

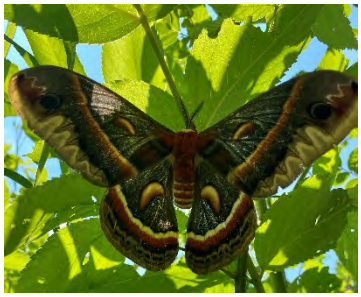

MONITORING YEAR 4 ANNUAL REPORT

Final

BIG HARRIS CREEK MITIGATION SITE

Cleveland County, NC
DMS Project No. 739
DEQ Contract 006256
DWR 401 Project No. 10-0811
USACE Action ID No. SAW-2009-0475
Broad River Basin
HUC 03050105

Data Collection Period: May – November 2021
Final Submission Date: February 17, 2022

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

February 17, 2022

Mr. Paul Wiesner
NC Department of Environmental Quality
Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

RE: Big Harris Creek Mitigation Site – Monitoring Year 4 Report
Final Submittal for DMS
Contract Number 006256, RFP Number 16-006119, DMS# 739
Broad River Basin – CU# 03050105; Cleveland County, NC

Dear Mr. Wiesner:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments and observations from the Big Harris Creek Mitigation Site Draft Monitoring Year 4 Report and included them below in **bold**. Wildlands' responses to your comments from the report noted in *italics*.

DMS' Comment: General – Janet Whisnant Property: Please provide a brief update in the response letter (not the MY4 report). If Mrs. Whisnant is unwilling to sign the revised conservation easement and associated plat prior to project closeout, mitigation assets and the associated contract invoices will need to be revised accordingly.

Wildlands' Response: Wildlands will reach out one last time to Ms. Whisnant and understands that the mitigation assets and associated contract invoices will need to be revised prior to closeout if an updated conservation easement and plat is not signed.

DMS' Comment: Section 1.1 – Project Goals and Objectives Page 1-6, 2nd paragraph – Please make the distinction that the proportion of the project drainage network protected and treated by the project is 70% at the 4 square mile project terminus. The 11 square mile figure at the confluence with First Broad may be confusing to the reader.

Wildlands' Response: The text has been updated to reflect protection and treatment of 70% of the 4 square mile watershed at the downstream terminus of the project.

DMS' Comment: Section 1.2.1 – Stream Assessment – When referencing the hurricanes from MY1 please provide actual precipitation or the recurrence interval associated with these storms. Simply indicating they were in excess of 2 inches does not provide adequate context or support for the resulting damage to the project.

Wildlands' Response: The text has been updated with dates and rainfall totals for Hurricanes Florence and Michael.

DMS' Comment: Section 1.2.1 – Stream Assessment – Deepening at XS44 was evident between MY3 and MY4 in the cross section plot as cited, but it is recommended to include that this was a pool cross section for the benefit of the reader. Evidence of bank repair was not discernable in the cross section plot. Was this the actual location of the repair? The banks or channel width did not demonstrate any change from the last 2 years. Please reply or revise as appropriate.

Wildlands' Response: Text updated to indicate XS44 is a pool and discussion of repair work was removed because the work was not completed at XS44 but in the immediate vicinity.

DMS' Comment: Section 1.2.1 – Stream Assessment – There was likely a large change in the entrenchment ratio at cross section 11 given the plots. How localized was this adjustment to the cross section? Is this condition representative of any significant footage on Scott Creek?

Wildlands' Response: The entrenchment ratio has decreased because of the channel adjustment however the current entrenchment ratio (2.5) is close to the design entrenchment range of 1.4 to 2.2. XS11 appears to have stabilized with the establishment of a bankfull bench. The adjustment is isolated to approximately 20-30 feet in the immediate vicinity of XS11 and is not representative of any significant footage on Scott Creek.

DMS' Comment: Section 1.2.1 – Stream Assessment – Contrary to the last sentence of the second paragraph, pool cross sections 32 and 33 actually appeared to narrow and deepen, which would be a welcome progression. Please reply or revise as appropriate.

Wildlands' Response: The last sentence has been revised to reflect the narrowing and deepening exhibited at these two pool cross sections during MY4. The draft cross-section 32 plot inadvertently captured a small area outside of the bankfull channel. The cross-section plot and corresponding Table 12c values in Appendix 4 have been updated.

DMS' Comment: Section 1.2.1 – Stream Assessment – Third paragraph, first sentence. Pools were not measured for substrate. Please reply or revise as appropriate.

Wildlands' Response: The sentence has been updated to clarify that finer particles documented in pools were part of reachwide pebble counts.

DMS' Comment: Section 1.2.1 – Stream Assessment – Third paragraph. Contrary to some assertions here, some reaches (UBHC Reach 2B, Scott Creek, Elliott, Elliott UT1, USEC UT2) all appear to have fined relative to the Baseline even to the point of changing the substrate class. LBHC seems to have maintained its D50, however, all but the coarsest cobble seems to have downsized to a gravel class. Please reply or revise as appropriate.

Wildlands' Response: The paragraph has been revised to discuss fining.

DMS' Comment: Section 1.2.1 – Stream Assessment – 4th paragraph. Was the measurement of sample water slopes required in the mitigation plan? It doesn't appear in Tables 5a-c in this MY4 draft. Changes in WS slope for Scott, USEC R1, and Elliot seem substantial. Were these to be compared to baseline water surface slopes in any way? Please reply or revise as appropriate.

Wildlands' Response: The collection of water surface slopes after geomorphically significant events is discussed in the second paragraph of Section 12.2.1 of the mitigation plan however reporting is not detailed. Footnote 1 in Tables 5a, 5c, and 5e have been updated to include this data collection. Water surface slopes were collected within one meander wavelength per select reach. No specific reporting or comparison guidance is provided in the mitigation plan or DMS Stream and Wetland Mitigation Monitoring Guidelines (February 2014). Water surface slopes in MY3 and MY4 are compared to baseline bankfull slopes because no water surface slopes were previous reported. Water surface slopes on Scott are very similar to baseline bankfull slope with minimal differences between MY3 and MY4 values. MY3/MY4 water surface slopes on USEC R1 were collected only within the flatter, downstream portion of the reach while the baseline slope reflects the entire reach including the steeper upstream section of channel. The report text was updated to explain the discrepancy between baseline and MY3/MY4 slopes

on USEC R1. The difference between baseline bankfull slope and MY3 water surface slope on Elliott may reflect a coarser level of data collection (fewer survey points) over the short profile. The MY4 water surface slope is very similar to the baseline bankfull slope.

DMS' Comment: Section 1.2.2 – Stream Areas of Concern – If available, please include the repair plans from MY4 (2021) repairs in the appendices and reference them in the report text.

Wildlands' Response: No plans were prepared as these minor repairs were done on site by designer and contractor.

DMS' Comment: Section 1.2.6 – Additional Monitoring – Please indicate that the sampling due to start in January 2020 was delayed until June of 2020 due to pandemic related restrictions for Western Carolina and therefore water quality data will be collected through June of 2023.

Wildlands' Response: Report text updated per comment.

DMS' Comment: CCPV Figure 3.2 & Section 1.2.2 Stream Areas of Concern – The density of beaver dams on UBHC Reach 2 appears very high. How long were they in place? Have they been removed now? Are they explanatory for any of the fining observed? Please update the report text accordingly. If the beaver and dams have been removed prior to the issuance of the final MY4 report, please note the removal dates in the text as well.

Wildlands' Response: The beaver dams appeared between August and November 2021. Wildlands is coordinating with a USDA trapper to remove the beaver in early 2022. The report text has been updated. The beaver dams appeared after annual pebble counts were completed and do not explain the fining.

DMS' Comment: CCPV Figure 3.2 – Is any Loblolly Pine maintenance/ treatment proposed along these reaches in MY5 (2022)?

Wildlands' Response: Loblolly pines mapped on CCPV Figure 3.2 will be cut down in 2022.

DMS' Comment: Section 1.2.4 Vegetative Assessment / Appendix 3. Vegetation Plot Data – The failing vegetation plots appear to be primarily in areas surrounding the headwater BMPSs. Are the stems being suppressed by field fescue? If so, is treatment and supplemental planting needed/ planned? Please reply or revise as appropriate.

Wildlands' Response: Three vegetation plots (27, 29, and 31) are located along headwater BMPs with greater amounts of fescue. The lower stem densities of these plots may be a result of competition with fescue. Surviving stems are tall enough that they are no longer threatened to be crowded out or suffocated by the fescue. Wildlands will perform ring sprays and apply fertilizer in early 2022 to existing woody stems within these plots and surrounding areas with heavier fescue. Section 1.2.5 (Vegetation Areas of Concern/Adaptative Management Plan) has been updated to include these activities. No supplemental planting is proposed.

DMS' Comment: Table 6a-6u & Table 7: Please include the date/s that the project was assessed at the top of each table.

Wildlands' Response: Dates of visual assessment have been added to the top of each table.

DMS' Comment: Appendix 5. Hydrology Summary Data and Plots – Please specify the source of precipitation data.

Wildlands' Response: The source of the precipitation data is USGS Station 02150495 located along the Second Broad River near Logan, NC. A reference has been added in the report and included on the newly created Monthly Rainfall Plot in Appendix 5.

DMS' Comment: Appendix 7. Water Quality and Biological Monitoring Data (MY4) & Updated Water Quality Monitoring Sampling Schedule Correspondence (Tables 15-17) – Table 15 – Please indicate that the data from 2020 can be found in the MY3 (2020) report and that water quality data collection will be complete in June 2023 and a complete analysis in keeping with the technical memo will be completed at that time.

Wildlands' Response: Footnotes were added to Table 15 with the recommended information.

DMS' Comment: Appendix 7. Water Quality and Biological Monitoring Data (MY4) & Updated Water Quality Monitoring Sampling Schedule Correspondence (Tables 15-17) – Table 16-17 – Please reiterate in a footnote that these analyses will be rerun at the end of MY5 and the biological data will be consolidated for MY4 and MY5 for a final analysis.

Wildlands' Response: Footnotes were added to Tables 16 and 17.

DMS' Comment: Digital Support Files –Please review the S_AOCs feature class and ensure that the number of features and their lengths reflect the reported segments and lengths in Table 6. For example, there are 6 segments with "type" described as scour in the feature class, but only 4 segments are reported in Table 6.

Wildlands' Response: Two of the scour segments are along Enhancement II or Headwater Protection reaches that are not reported on Table 6.

DMS' Comment: Digital Support Files – Please submit a feature that characterizes the low stem density area reported in Table 7.

Wildlands' Response: The seven polygons referenced in Table 7 as areas with low stem density are the seven vegetation plots not meeting density criteria. GIS files entitled "Low Stem Density Areas" for the failing vegetation plots have been added to the digital support files.

DMS' Comment: Digital Support Files – Neither the Table 7 or simple export from CVS mdb are able to replicate Table 10 in the report. Please review the CVS mdb and ensure the data reflect the table in the report.

Wildlands' Response: The CVS mdb has been updated and the simple export is now able to replicate Table 10. The Table 7 export from CVS does not recognize select volunteer species added to the planted stem inventory after two consecutive years of documentation and will not match report Table 10.

DMS' Comment: Digital Support Files – Please ensure BHR calculations exclude the area outside of the main channel before determining the bankfull elevation that achieves the MY0 bankfull area (BKF-ab). For example, cross section 9 has a reported BHR of 0.8, but this would only be the case if the areas outside of the main channel were included when determining BKF-ab.

Wildlands' Response: BHR calculations were reviewed to ensure areas outside of the active channel were excluded. After review BHR values have been updated at four cross-sections (XS 1, 9, 17, & 35).

DMS' Comment: Digital Support Files – In the report and support files, please include a figure with the 30th and 70th percentiles of monthly precipitation relative to observed precipitation.

Wildlands' Response: A chart with the 30th and 70th percentiles of monthly precipitation relative to observed precipitation has been added to Appendix 5.

Enclosed please find two (2) hard copies of the Final Monitoring Year 4 Report and one (1) USB with the final corrected electronic files for DMS distribution. Please contact me at 704-332-7754 x110 if you have any questions.

Sincerely,

Kristi Suggs
Senior Environmental Scientist
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PREPARED BY:

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EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a design-build project for the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) to restore 10,071 linear feet (LF) of streams, enhance 23,421 LF of streams, preserve 669 LF of streams, and provide water quality treatment for 171 acres of drainage area in Cleveland County, NC. The streams proposed for mitigation credit include Big Harris Creek and 25 tributaries. Buffer restoration also occurred but is not proposed for buffer mitigation credit. The project is expected to provide 25,329.916 stream mitigation units (SMUs) in the Broad River Basin. An additional 507.000 SMUs are proposed for statistical improvement in water quality parameters per revised post-construction water quality sampling approved by the Interagency Review Team (IRT) in 2019.

The Big Harris Creek Mitigation Site (Site) is located within the DMS targeted watershed for the Broad River Basin Hydrologic Unit Code (HUC) 03050105080060 and the North Carolina Division of Water Resources (NCDWR) Subbasin 03-08-04. The Big Harris Creek and Magness Creek HUC 03050105080060 was identified as a Targeted Local Watershed (TLW) in DMS's 2009 Broad River Basin Restoration Priority (RBRP) Plan (DMS, 2009). The Cleveland County Natural Resources Conservation Service has also identified this watershed as a priority area.

The watershed has a long history of agricultural activity and most of the stressors to stream functions are related to historic and current land use practices. Prior to restoration, the major stream stressors for the Site were cattle access, erosion from lateral instability, and gully headcutting in the headwater ephemeral reaches. The effects of these stressors resulted in degraded water quality and habitat throughout the watershed when compared to reference conditions. The design approach for the Site focused on evaluating the existing functional condition, potential for recovery, and need for intervention.

The major goals established for the project align with the overall goals of the Broad River Basin RBRP and aim to reduce sediment and nutrient inputs, reduce fecal coliform inputs through cattle exclusion, and reestablish native riparian corridors while preserving existing headwater aquatic habitats and riparian corridors.

The following specific project goals were established in the Mitigation Plan (Wildlands, 2016).

- Improve stream stability and reduce stream bed and bank erosion;
- Restore hydrologic connection between bankfull channels and floodplains, wetlands, and vernal pools;
- Improve instream habitat and instream habitat connectivity;
- Reduce agricultural pollutant loading to project streams; and
- Create and improve forested riparian buffers.

The Site construction and as-built surveys were completed between April 2017 and May 2018. Post-construction monitoring will be conducted for five years to evaluate project success. Planting and baseline vegetation data collection occurred between March and May 2018. Monitoring Year (MY) 1 assessments were completed between September and December 2018.

MY4 assessments and site visits were completed between May and November of 2021. The Site has met the required stream, vegetation, and hydrology success criteria for MY4. Overall, restored streams are stable and functioning as designed with minor fluctuations in channel dimensions related to bed/bank scour and/or deposition documented in some of the annual cross-sections. Isolated pockets of instability were observed across the Site during visual assessment. Stream repairs were completed in June 2021 to areas of bank erosion noted during MY3 on Lower Big Harris Creek Reach 2 and Upper Stick Elliott Creek

Reaches 1 and 3. The average planted stem density for the Site is 427 stems per acre, which exceeds the final (MY5) criteria of 260 stems per acre. Seven of the 56 vegetation plots do not independently meet the MY5 stem density criteria; however, with the inclusion of desirable volunteers, only four do not meet final stem density success criteria. Bankfull and geomorphically significant events were recorded on most of the restoration and enhancement I reaches during MY4.

TABLE OF CONTENTS

APPENDICES

Section 1: PROJECT OVERVIEW

The Site is located in western Cleveland County, approximately 2.5 miles west of the Town of Lawndale in the Broad River Basin Hydrologic Unit Code (HUC) 03050105080060 and North Carolina Division of Water Resources (NCDWR) Subbasin 03-08-04 and is being submitted for mitigation credit in the Broad River Basin HUC 03050105. (Figure 1). Located in the Inner Piedmont geologic belt within the Piedmont physiographic province (NCGS, 1985), the project watershed is dominated by agricultural and forested land. Big Harris Creek drains 3.9 square miles of rural land.

The development of the mitigation project for this Site has a long history. The Site was first identified in 2008 by DMS staff as a watershed-scale mitigation opportunity. The Site is located in a HUC that was designated as a high priority agricultural Targeted Local Watershed (TLW) and as a "focus area" for the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) in the 2009 Broad River Basin Restoration Priority (RBRP) Plan. The initial Environmental Resources Technical Report (ERTR) for the Site was completed in March 2009. Easement acquisition on 12 parcels, totaling 144.7 acres, was completed on the project area by the end of 2009. The Interagency (IRT) originally walked the Site in 2010 and requested a "light touch" approach to much of the Site. Water quality, benthic, fish, and storm water sampling has been collected for the project by multiple agencies and organizations between 2009 and 2013.

The availability of the pre-construction monitoring led to more precise management recommendations for the Site. The project approach incorporated previous and recent IRT feedback and minimized construction phase impacts to existing channels and riparian areas while providing the targeted uplifts to the system. Project components include intermittent and perennial stream restoration, enhancement, and preservation, as well as water quality treatment on ephemeral drainages. Stream restoration, enhancement, and preservation components include Big Harris Creek and 25 unnamed tributaries.

The watershed has a long history of agricultural activity and most of the stressors to stream functions are related to this historic and current land use. Prior to restoration, the major stream stressors for the project were cattle access, erosion from lateral instability, and gully headcutting in the headwater ephemeral reaches. The effects of these stressors resulted in degraded water quality and habitat throughout the watershed when compared to reference conditions.

Table 4 in Appendix 1 and Tables 6 in Appendix 2 present the pre-restoration conditions in more detail.

1.1 Project Goals and Objectives

The Site was identified by DMS to address major agricultural stressors within the watershed with specific focus on gully erosion, streambank erosion, and livestock access to streams. Restoration and enhancement of streams and buffers on the Site addressed those identified stressors and thereby improving water quality in the Big Harris Creek watershed.

The major goals of this stream mitigation project were to reduce sediment and nutrient sources, reduce fecal coliform sources through cattle exclusion, and reestablish healthy riparian corridors while preserving existing, high quality headwater aquatic habitats. These goals were primarily achieved by creating functional and stable stream channels by: 1) increasing and improving the interaction of stream hydrology with the riparian zone, 2) improving in-stream habitat and bed form diversity, 3) introducing large woody debris, and 4.) beginning the establishment of a native, forested riparian corridor along the stream reaches. These activities are known to support higher order functions including the processing of organic matter, nutrient cycling, and temperature regulation.

The project protects and treats 70% of the 4-square mile Big Harris Creek watershed at the downstream terminus of the Site. Within the project limits, approximately 34,161 LF of stream channel were restored, enhanced, or preserved. Water quality Best Management Practices (BMPs) were also implemented to stabilize eroding ephemeral channels and provide water quality treatment on 171 acres of headwater drainage systems during the period after construction until the riparian buffer vegetation becomes established. A total of 5,536 LF of ephemeral drainages were buffered and conserved, enhancing the overall watershed water quality and function.

The following specific goals and objectives established in the Mitigation Plan (Wildlands, 2016) address the identified stressors in the Big Harris Creek and Magness Creek TLW.

Goals	Objectives
Improve stream stability and reduce stream bed and bank erosion.	Grade back eroding stream and headwater gully slopes and/or install bioengineering. Add bank revetments and in-stream structures to protect enhanced streams.
	Construct new stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions.
Restore hydrologic connection between bankfull channels and floodplains, wetlands, and vernal pools.	Construct new stream channels with appropriate dimension and depth relative to their functioning floodplain elevation.
Improve instream habitat and instream habitat connectivity.	Install habitat features such as constructed riffles and brush toes into restored/enhanced streams, adding woody materials to channel beds and constructing pools of varying depth.
	Replace existing culverts with bottomless arch culverts, partially buried culverts, or ford crossings and enhance profile by removing vertical steps at culvert outlets.
Reduce agricultural pollutant loading to project streams.	Install BMPs at concentrated flow locations in the watershed headwaters to treat agricultural runoff until riparian buffer vegetation becomes established and reduce gully erosion. Plant riparian buffers that will uptake runoff and reduce pollutants once established.
	Construct new stream channels with floodplain connectivity, allowing flood flows to filter through a vegetated floodplain.
	Install fencing around conservation easements adjacent to cattle pastures to exclude cattle from the easement.
Create and improve forested riparian buffers.	Plant native tree and understory species in riparian zone.

1.2 Monitoring Year 4 Data Assessment

Annual monitoring and quarterly site visits were conducted during MY4 to assess the condition of the project. The stream, vegetation, and hydrologic success criteria for the Site follows the approved success criteria presented in the Big Harris Creek Mitigation Plan (Wildlands, 2016).

1.2.1 Stream Assessment

Project streams appear stable with most cross-sections showing minimal change in bankfull width, maximum depth ratio, and width-to-depth ratio. Cross-section dimensions generally fell within the parameters defined for channels of the designed stream type (Rosgen, 1994 & 1996). During the fall of MY1, significant adjustments in channel dimension related to bed and/or bank scour were documented at cross-sections 3, 4, 43 and 44 because of multiple large storm events that included the remnants of Hurricane Florence (September 15 – 18, 2018) and Hurricane Michael (October 10 – 11, 2018) with rainfall totals of 2.74 and 4.60 inches, respectively. Cross-section 3 and 43 have stabilized since MY1 with minimal adjustments. Cross-section 4 has remained stable in MY4 after significant bed and right bank scour during MY3 likely in part to vegetation re-establishment. Slight bed deepening was documented at pool cross-section 44 in MY4. During MY2, bed and bank erosion were documented at cross-section 11 on Scott Creek, resulting in a wider and deeper channel. Since MY2, cross-section 11 has stabilized with little to no change in channel dimension. A bankfull bench feature has developed within the adjusted cross-section. Bankfull elevation and dimension calculations were revised in MY4 and retroactively in MY3 to reflect the bankfull elevation after consecutive years of stability.

A few cross-sections showed small fluctuations in channel dimension related to minor scour or deposition, which are normal and not indicative of instability. Riffle cross-sections 9, 13, 29, and 31 exhibited channel narrowing because of deposition coupled with the continued establishment of streambank vegetation which is a common adjustment and not suggestive of instability. During MY3, aggradation was documented at pool cross-section 32 and 33 on Upper Fletcher Creek Reach 2. The source of in-stream sediment may be offsite since no erosion was noted along Upper Fletcher Reaches 1 or 2. These cross-sections exhibit narrowing and deepening in MY4.

Reachwide pebble counts conducted in the restoration and enhancement I reaches indicate maintenance of coarser substrate in the riffle features and finer particles in the pool features. Fluctuations in grain size distribution were documented with MY4 pebble counts; however, distributions on many reaches generally fell within previous ranges indicative of cyclic changes in sediment transport. An increase in finer particles was documented on Upper Big Harris Reach 2A and 2B, Scott, Elliott, Elliott UT1, Upper Stick Elliott UT2, and Lower Big Harris Creek. Due to the lack of erosion and instability within project reaches the increase of fines likely reflects offsite sediment moving through the Site. Fluctuations in grain size distributions are expected and at this time do not indicate instability. Refer to Appendix 2 for the visual stability assessment table, Current Condition Plan View (CCPV) map, and reference photographs. Refer to Appendix 4 for the morphological data and plots.

In addition to annual geomorphic cross-sections, at least three sets of hydraulic geometry measurements (water surface slopes) are to be collected within distinct restoration and enhancement I design reaches following a geomorphically significant discharge (Qgs) event as described in the DMS Stream and Wetland Mitigation Monitoring Guidelines (February 2014). During MY3 and MY4, water surface slopes were collected on representative wavelengths within Upper Big Harris Reach 2A, Scott Creek, Upper Stick Elliott Creek Reach 1, Elliott Creek, UT1 to Elliott Creek, Bridges Creek, and Lower Big Harris Creek. Minor fluctuations were observed in MY3 and MY4 water surface slopes. Slopes were also similar to most baseline (MY0) bankfull slopes with the exception of Upper Stick Elliott Creek Reach 1

because MY3 and MY4 data collection did not include the steeper, upstream portion of the reach. Refer to Tables 13a-13s in Appendix 4 for water surface slope data.

1.2.2 Stream Areas of Concern

Repairs were completed along Upper Stick Elliott (Reaches 1 and 3) and Lower Big Harris Creek Reach 2 in June 2021. The repairs included regrading banks, resetting log sills, and removing one log sill. All repairs were stable during November 2021 site visits. Isolated erosion was documented at a handful of spots across the Site in late 2021. One failed boulder sill at Station 806+75 of Royster Creek and a dislodged boulder within a sill at Station 1214+30 on Scott Creek are isolated structure issues. Several small beaver dams were present along Upper Big Harris Reaches 1 – 2B and at the bottom of Cornwell Creek in November 2021. Wildlands is coordinating with a trapper from the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Services (APHIS) to remove beaver in these locations by early 2022. Refer to the CCPV maps in Appendix 2 for the locations of stream areas of concern.

1.2.3 Stream Hydrology Assessment

At the end of the five-year monitoring period, two or more bankfull events and geomorphically significant (≥ 60% of bankfull flow) events must have occurred in separate years within the restoration and enhancement I reaches. During MY4, 11 of 14 automated stream gages documented at least one bankfull event and one geomorphically significant event. Refer to Table 14 in Appendix 5 for specific reaches. At the end of MY4, all 14 stream gages have recorded at least two bankfull events and geomorphically significant events in separate years.

In addition to monitoring bankfull events, the presence of baseflow must be documented along intermittent reaches (Royster Creek Reach 1, Scott Creek, and Bridges Creek) constructed with a Priority 1 Restoration approach. Flow must be present for at least 30 consecutive days of the year with normal rainfall conditions. During MY4, all three reaches exceeded the 30 days of baseflow. Royster Creek Reach 1, Scott Creek, and Bridges Creek stream flow gages recorded 32, 77, and 208 days of consecutive flow, respectively.

The Site does not contain a rainfall gage; therefore, the daily precipitation data was collected from the closest United States Geological Survey (USGS) gage, 02150495, located on the Second Broad River near Logan, NC (USGS, 2021). Refer to Appendix 5 for hydrology summary data and plots.

1.2.4 Vegetative Assessment

A total of 56 vegetation plots were established during the baseline monitoring within the project easement area. The vegetation plots were installed using a 100 square meter quadrant (10m x 10m or 5m x 20m). The final vegetative success criteria will be the survival of 260 planted stems per acre in the planted riparian corridor at the end of the required monitoring period (MY5).

The MY4 planted stem densities in vegetation plots ranged from 121 stems per acre to 688 stems per acre with an overall average stem density of 427 planted stems per acre, which exceeds the final success criteria of 260 planted stems per acre required at MY5. Most vegetation plots (49 of 56 plots) met the final stem density success criteria for planted stems in MY5. Seven plots (12, 25, 27, 29, 31, 42, and 51) did not meet the final planted stem density success criteria; however, only plots 12, 25, 29, and 31 do not meet the final density success criteria with the inclusion of desired volunteers. Planted stem counts within individual plots ranged from 3 to 17 stems with an average of 11 planted stems per plot. During MY4, select volunteers were added to the planted stem density of certain plots. Additional stems only include species listed on the approved planted plan (See Sheet 4.0 of construction plans) that have been observed for two consecutive years and assigned X/Y coordinates. Added species include American

persimmon (*Diospryos virginiana*), cherrybark oak (*Quercus pagoda*), green ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), and tulip poplar (*Liriodendron tulipifera*). A majority of planted woody stems (78%) had a vigor rating of 3 or greater. Refer to Appendix 2 for vegetation plot photographs and the vegetation condition assessment table and Appendix 3 for vegetation data tables.

1.2.5 Vegetation Areas of Concern/Adaptive Management Plan

Invasive species were treated between February and October 2021. Treatments focused on populations of Chinaberry (*Melia azedarach*), Chinese privet (*Ligustrum sinense*), hardy orange (*Poncirus trifolata*), kudzu (*Pueraria lobata*), and tree-of-heaven (*Ailanthus altissima*). Areas of heavy fescue (*Festuca* sp.) were documented within headwater BMPs on Eaker and Royster Creeks during MY3. Several of the fescue areas were removed or reduced on MY4 CCPV maps as woody species continue to establish. Wildlands will perform ring sprays and apply fertilizer in areas of heavy fescue still present within some headwater BMPs on Royster Creek and Scott Creek in early 2022 to promote woody stem health. At the end of MY4, approximately 97 percent or 141 of 145 acres of overall easement is unaffected by invasive species. Remaining areas of invasive species are shown on CCPV maps in Appendix 2. Future treatments will be performed as needed.

During MY4, minor easement encroachment (mowing) impacted less than 0.1 acres in the right floodplain and hillside of Lower Big Harris Reach 1A. The encroachment appears to be related to maintenance of an overhead utility line that parallels Harris Creek Road. Additional conservation easement markers will be installed in the vicinity of the encroachment. Refer to Appendix 2 for the vegetation condition assessment table and the CCPV maps.

1.2.6 Additional Monitoring

A post-construction water quality monitoring plan was approved by the IRT during MY2. Components of the plan include water quality sampling in MY3 – MY5 with benthic macroinvertebrate and fish assessments being conducted during MY4 – MY5. Water quality sampling was originally scheduled to begin in January 2020 and last for three years; however, due to pandemic related restrictions for Western Carolina University (WCU), it was not initiated until June 2020. Based on the adjusted start date, water quality sampling will be collected through June 2023. Benthic macroinvertebrates were sampled by staff from Penrose Environmental and Wildlands in May 2021 at the same six sites that were sampled prior to construction in 2013 (Sites 0, 1, 4, 6, 8, and 14). MY4 benthic data from most sampling sites indicated similar biotic integrity and bioclassifications to pre-construction samples. Two exceptions (Sites 8 and 14) exhibited a decline in these metrics during MY4. Fish surveys were performed by Wildlands in June 2021 at four locations (Site 4, 5a, 9, and 13). Results from the MY4 fish data collection show an overall improvement in the index of biotic integrity (IBI) in the fish community at the Site. All reaches except for Site 4 (Lower Fletcher Creek/Upper Stick Elliott Creek) resulted in an integrity class improvement. Biological sampling (benthic macroinvertebrates and fish) will be sampled again in MY5, and the results will be pooled to generate one-bioclassification to represent post-construction communities. Refer to Appendices 6 and 7 for the Revised Water Quality Monitoring Technical Memo, associated IRT correspondence, MY4 water quality data provided by WCU, updated sampling schedule correspondence with WCU, and MY4 biological sampling results.

1.3 Monitoring Year 4 Summary

Overall, streams within the Site appear to be stable and functioning as designed except for minor areas of erosion and aggradation. Bankfull events and additional geomorphically significant events were documented on 11 of 14 gaged streams. At the end of MY4, all 14 stream gages have recorded at least two bankfull events and geomorphically significant events in separate years. With an average planted

stem density of 427 stems per acre for the Site, the project is on track to meet the MY5 success criteria. Seven plots do not meet the final planted stem density success criteria; however, with the inclusion of desirable volunteers only four plots do not meet the final density success criteria. Adaptive management will be implemented as necessary to address areas of stream and vegetation areas of concern.

Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures of the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Mitigation Plan (Wildlands, 2016) documents available on the DMS website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

Section 2: METHODOLOGY

Geomorphic data were collected following the standards outlined in The Stream Channel Reference Site: An Illustrated Guide to Field Techniques (Harrelson et al., 1994) and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al., 2003). All Integrated Current Condition Mapping was recorded using either a Trimble or Topcon handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcGIS. Crest gages were installed in surveyed riffle cross sections and monitored quarterly. Hydrologic monitoring instrument installation and monitoring methods are in accordance with the United States Army Corps of Engineers (USACE, 2003) standards. Planted woody vegetation is being monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2006).

Section 3: REFERENCES

Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E. 2003. Stream Restoration A Natural Channel Design Handbook.

Harrelson, Cheryl C; Rawlins, C.L.; Potyondy, John P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique.* Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved from http://deq.nc.gov/document/cvs-eep-protocol-v42-lev1-2

North Carolina Division of Water Resources (NCDWR), 2015. Surface Water Classifications. http://portal.ncdenr.org/web/wq/ps/csu/classifications

North Carolina Division of Mitigation Services (DMS), 2009. Broad River Basin Restoration Priorities. https://files.nc.gov/ncdeq/Mitigation%20Services/Watershed_Planning/Broad_River_Basin/Broad_RBRP_2009_final.pdf

North Carolina Division of Mitigation Services (DMS), February 2014. DMS Annual Monitoring and Closeout Reporting Template.

North Carolina Geological Survey (NCGS), 1985. Geologic Map of North Carolina: North Carolina Survey, General Geologic Map, scale 1:500,000. https://deq.nc.gov/about/divisions/energy-mineral-land-resources/north-carolina-geological-survey/ncgs-maps/1985-geologic-map-of-nc4

Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.

Rosgen, D.L. 1996. Applied River Morphology. Pagosa Springs, CO: Wildland Hydrology Books.

United States Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

United States Geological Survey (USGS), 2021. USGS Station 02150495, Second Broad River near Logan, NC. https://waterdata.usgs.gov/nwis/uv?site_no=02150495

Wildlands Engineering, Inc (Wildlands), 2016. Big Harris Creek Mitigation Site Mitigation Plan. DMS, Raleigh, NC.

Wildlands Engineering, Inc (Wildlands), 2018. Big Harris Creek Mitigation Site Baseline Monitoring Document and As-Built Baseline Report, DMS, Raleigh, NC.

APPENDIX 1. General Figures and Tables

Hydrologic Unit Code (14 Digit)
DMS Targeted Local Watersheds
Project Locations

Project Location

03050105080030
03050105080050
03050105080060
03050105080070
03050105070070
03050105080110
03050105100020

Area A
Area B
Area C

The subject project site is an environmental restoration site of the Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight,and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activites requires prior coordination with DMS.

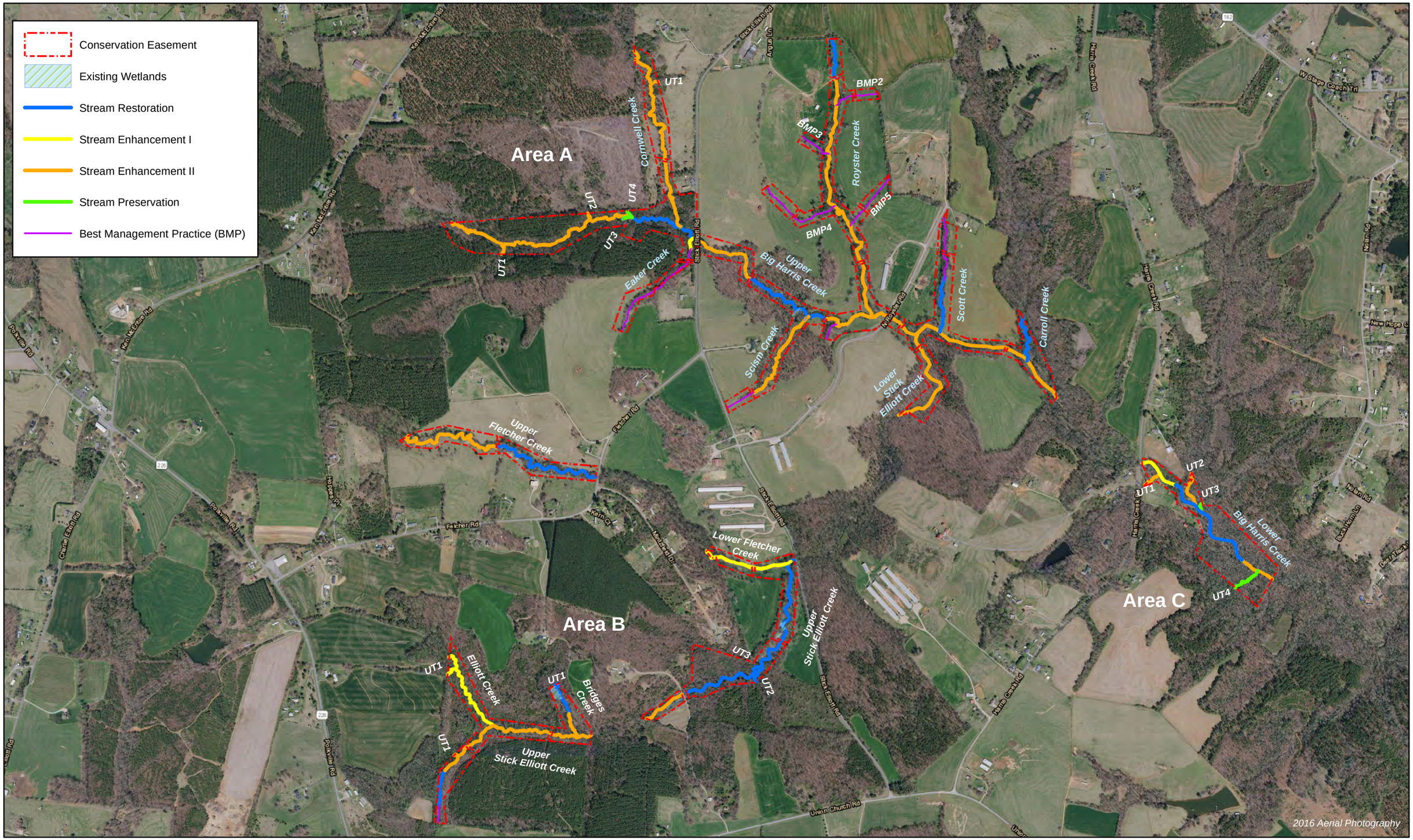
Directons to Site:
The site is located in western Cleveland County, NC, The site is approximately 2.5 miles west of the Town of Lawndale. From Asheville, NC, take Interstate 40 east approximately 33 miles to Exit 86 (NC-226). Take NC-226 south towards Shelby for approximately 31 miles before taking a left onto Union Church Road. Portions of the site are accessible from Union Church Road, Stick Elliott Road, Harris Creek Road, and Fletcher Road.

WILDLANDS ENGINEERING

0 1 2 Miles

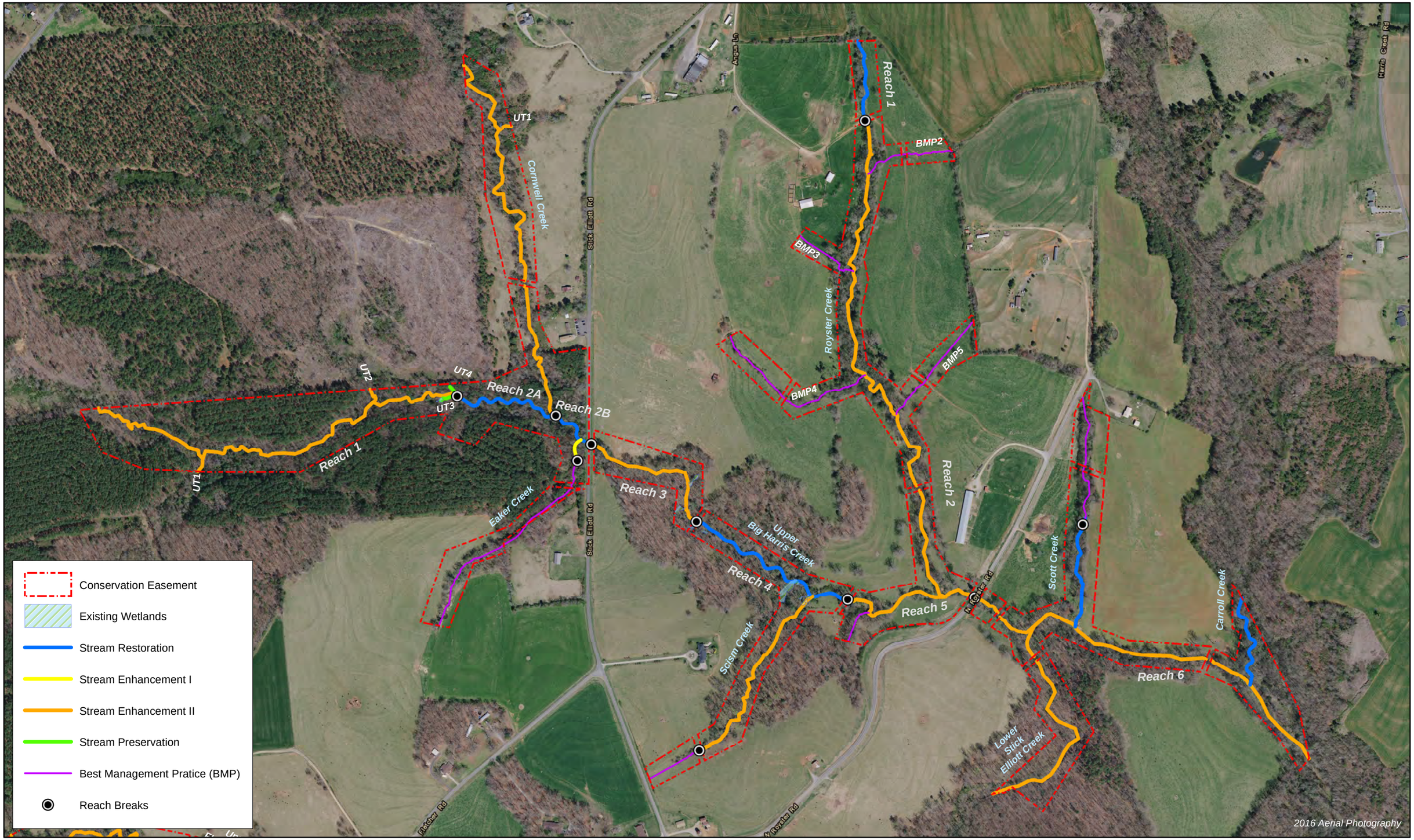
N

Figure 1 Project Vicinity Map
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC



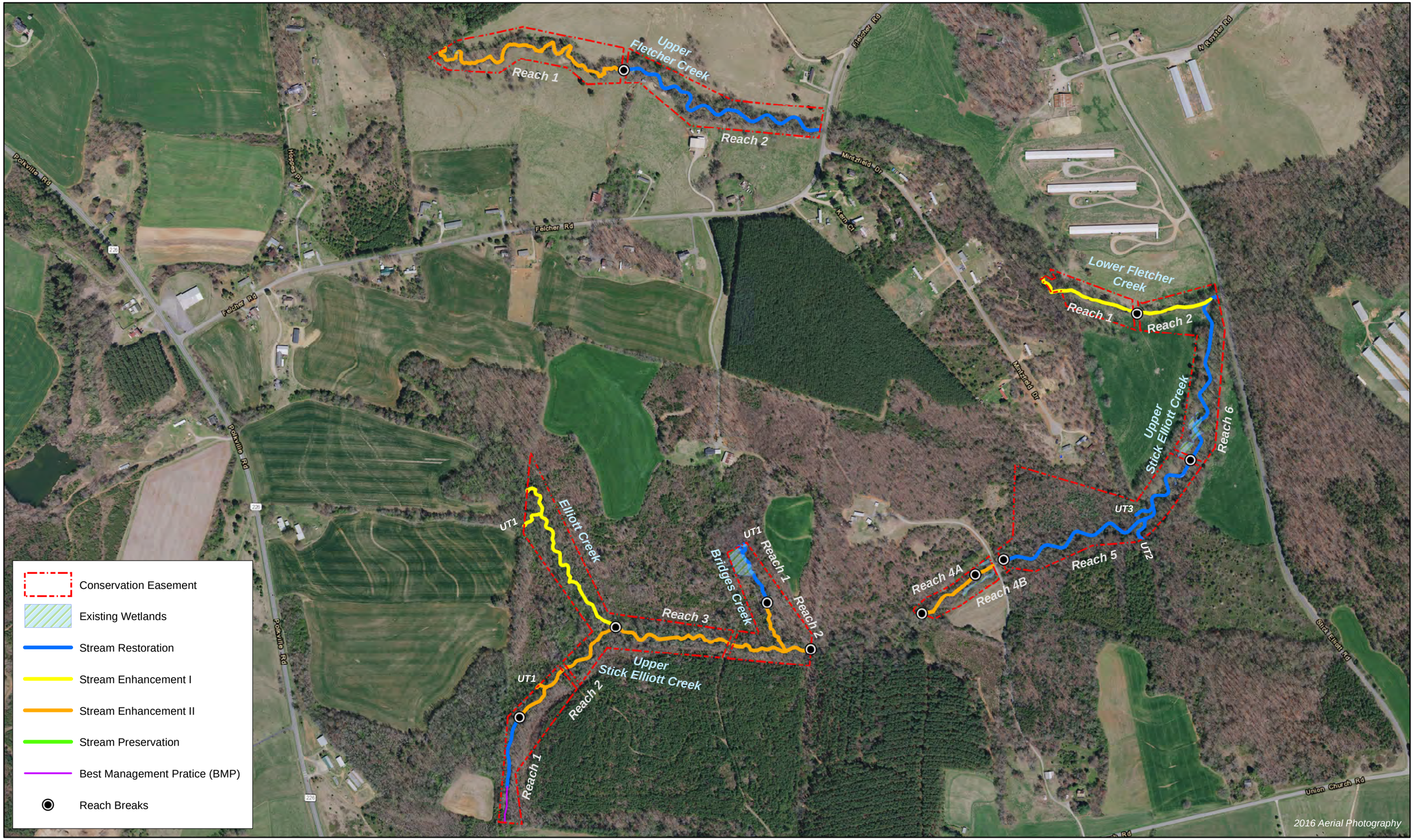
WILDLANDS ENGINEERING

Figure 2.0 Project Component/Asset Map
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC



WILDLANDS ENGINEERING

Figure 2.1 Project Component/Asset Map
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC



WILDLANDS ENGINEERING

Figure 2.2 Project Component/Asset Map
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC

WILDLANDS ENGINEERING

0 150 300 Feet

Figure 2.3 Project Component/Asset Map
Big Harris Creek Mitigation Site - Area C
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC

Table 1a. Project Components and Mitigation Credits

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Mitigation Credits										
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset	
Type	R	RE	R	RE	R	RE				
Totals	25,228.121	101.795	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Project Components										
Project Area	Project Reach	Existing Footage (LF) [1]	Stationing/Location		Approach (P1, P2, etc.)	Restoration (R) or Restoration Equivalent (RE)	Restoration Footage (LF) [1]	Mitigation Ratio	Total Buffer Width Adjustments	Proposed Credit [2, 3, 4]
A	Cornwell Creek R1	2,144	403+44	425+20	cattle fencing; buffer planting	EII	2,144	2.5	25	883.000
	Cornwell Creek R2	286	425+20	428+27	Full restoration with structures	EII	307	2.5	0	123.000
	UT1 to Cornwell Creek	78	430+27	431+05	cattle fencing; buffer planting	EII	78	2.5	0	31.000
	Eaker Creek	135	513+11	514+45	cattle fencing, bank grading and in-stream structures	EI	134	1	0	134.000
	Eaker Creek SPSC BMP	N/A	N/A	N/A	headwater BMP	N/A	1309	N/A	N/A	N/A
	Scism Creek	1,189	606+92	618+81	BMP, bank grading and in-stream structures	EII	1,189	1.5	12	805.000
	Scism Creek EC	N/A	N/A	N/A	headwater BMP	N/A	358	N/A	N/A	N/A
	Royster Creek R1	438	802+54	807+13	Priority 2 Restoration	R	459	1	-5	454.000
	Royster Creek R2	3,185	807+40	839+40	cattle fencing; buffer planting	EII	3,170	2	21	1606.000
	Royster BMP2	N/A	N/A	N/A	headwater BMP	N/A	539	N/A	N/A	N/A
	Royster BMP3	N/A	N/A	N/A	headwater BMP	N/A	399	N/A	N/A	N/A
	Royster BMP4	N/A	N/A	N/A	headwater BMP	N/A	1022	N/A	N/A	N/A
	Royster BMP5	N/A	N/A	N/A	headwater BMP	N/A	669	N/A	N/A	N/A
	Lower Stick Elliott Creek	1,422	1101+13	1115+34	cattle fencing; buffer planting	EII	1,389	2.5	-29	527.000
	Scott Creek	630	1210+12	1216+74	Priority 1 Restoration	R	662	1	19	681.000
	Scott Creek SPSC BMP	N/A	N/A	N/A	headwater BMP	N/A	734	N/A	N/A	N/A
	Carroll Creek	553	1301+68	1307+63	Priority 2 Restoration	R	595	1	-56	539.000
	Upper Big Harris Creek R1	2,615	104+25	129+81	bank grading and in-stream structures; pine removal and buffer planting	EII	2,556	2.5	119	1141.000
	Upper Big Harris Creek R2	990	129+81	139+15	Priority 2 Restoration	R	934	1	126	1060.000

Table 1b. Project Components and Mitigation Credits
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Mitigation Credits										
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset	
Type	R	RE	R	RE	R	RE				
Totals	25,228.121	101.795	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Project Components										
Project Area	Project Reach	Existing Footage (LF) [1]	Stationing/Location		Approach (P1, P2, etc.)	Restoration (R) or Restoration Equivalent (RE)	Restoration Footage (LF) [1]	Mitigation Ratio	Total Buffer Width Adjustments	Proposed Credit [2, 3, 4]
A	Upper Big Harris Creek R3	880	139+75	148+45	cattle fencing; bank grading and in-stream structures	EII	870	2	75	510.000
	Upper Big Harris Creek R4	1,203	148+76	159+15	Priority 2 Restoration	R	1,039	1	11	1050.000
	Upper Big Harris Creek R5	845	159+58	168+03	cattle fencing; bank grading and in-stream structures	EII	845	1.5	41	604.000
	Upper Big Harris Creek R6A	824	168+63	177+50	cattle fencing; benching; bank grading and in-stream structures	EII	855	1.5	1	571.000
	Upper Big Harris Creek R6B	1,434	177+50	191+84	cattle fencing; benching; bank grading and bank structures	EII	1,403	1.5	-10	925.000
	Upper Big Harris BMP	N/A	N/A	N/A	headwater BMP into Upper Big Harris Reach 5	N/A	166	N/A	N/A	N/A
	UT1 to Upper Big Harris Creek	84	197+13	197+97	bank grading and in-stream structures; pine removal and buffer planting	EII	84	2.5	-8	26.000
	UT2 to Upper Big Harris Creek	97	200+42	201+39	bank grading and in-stream structures; pine removal and buffer planting	EII	97	2.5	-4	35.000
	UT3 to Upper Big Harris Creek	105	202+00	203+05	preservation	P	105	10	0	11.000
	UT4 to Upper Big Harris Creek	84	204+00	204+84	preservation	P	84	10	-1	7.000
B	Elliott Creek	1,389	1400+85	1412+06	bank grading, segments of profile and bench restoration, in-stream structures	EI	1,121	1	42	1163.000
	UT1 to Elliott Creek	141	1415+87	1417+28	bank grading, segments of profile and bench restoration, in-stream structures	EI	141	1	-19	122.000
	Bridges Creek R1	445	1500+91	1504+67	Priority 1 Restoration	R	376	1	15	391.000
	Bridges Creek R2	366	1504+67	1507+84	bank grading and in-stream structures	EII	317	2	9	168.000
	UT1 to Bridges Creek	58	1510+46	1511+01	Priority 1 Restoration	R	55	1	-28	27.000
	Upper Stick Elliott Creek SPSC BMP	N/A	N/A	N/A	headwater BMP into USEC	N/A	206	N/A	N/A	N/A
	Upper Stick Elliott Creek R1	352	1002+89	1006+98	Priority 1 Restoration	R	409	1	-55	354.000
	Upper Stick Elliott Creek R2A	535	1006+98	1012+00	bank grading and in-stream structures	EII	471	2	4	240.000
	Upper Stick Elliott Creek R2B	334	1012+00	1015+10	bank grading and in-stream structures	EII	310	2	0	155.000
	Upper Stick Elliott Creek R3A	209	1015+10	1018+25	bank grading and benching	EII	315	2	17	175.000
	Upper Stick Elliott Creek R3B	1,336	1018+25	1027+44	bank grading, benching, and in-stream structures	EII	889	2	21	465.000

Table 1c. Project Components and Mitigation Credits

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Mitigation Credits										
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset	
Type	R	RE	R	RE	R	RE				
Totals	25,228.121	101.795	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Project Components										
Project Area	Project Reach	Existing Footage (LF) [1]	Stationing/Location		Approach (P1, P2, etc.)	Restoration (R) or Restoration Equivalent (RE)	Restoration Footage (LF) [1]	Mitigation Ratio	Total Buffer Width Adjustments	Proposed Credit [2, 3, 4]
B	Upper Stick Elliott Creek R4A	428	1038+11	1042+08	attle fencing, bank grading and in-stream structure	EII	397	2	-17	182.000
	Upper Stick Elliott Creek R4B	113	1042+28	1043+21	in-stream structures	EII	113	1.5	-6	69.000
	Upper Stick Elliott Creek R5	1,909	1043+77	1058+84	Priority 2 -> Priority 1 Restoration	R	1,507	1	89	1596.000
	Upper Stick Elliott Creek R6	1,036	1059+14	1069+83	Priority 1 -> Priority 2 Restoration	R	1,069	1	0	1069.000
	UT1 to Upper Stick Elliott Creek	50	1078+08	1078+80	bank grading and in-stream structures	EII	72	1.5	-9	39.000
	UT2 to Upper Stick Elliott Creek	56	1080+00	1081+54	reconnection; Priority 1 Restoration	R	154	1	-10	144.000
	UT3 to Upper Stick Elliott Creek	107	1082+00	1083+18	reconnection; Priority 1 Restoration	R	118	1	0	118.000
	Upper Fletcher Creek R1	1,493	1600+00	1615+71	isolated bank grading and in-stream structures, livestock fencing, invasives treatment	EII	1,571	2.5	16	644.000
	Upper Fletcher Creek R2	1,465	1616+02	1630+09	Priority 2 Restoration	R	1,407	1	33	1440.000
	Lower Fletcher Creek R1	574	1641+28	1647+02	bank grading, benching, and in-stream structures	EI	574	1	-81	493.000
	Lower Fletcher Creek R2	467	1647+33	1651+60	bank grading, benching, and in-stream structures	EI	427	1	37	464.000

Table 1d. Project Components and Mitigation Credits

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Mitigation Credits										
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset	
Type	R	RE	R	RE	R	RE				
Totals	25,228.121	101.795	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Project Components										
Project Area	Project Reach	Existing Footage (LF) [1]	Stationing/Location		Approach (P1, P2, etc.)	Restoration (R) or Restoration Equivalent (RE)	Restoration Footage (LF) [1]	Mitigation Ratio	Total Buffer Width Adjustments	Proposed Credit [2, 3, 4]
C	Lower Big Harris Creek R1A	509	300+13	305+13	bank grading, segments of profile and bench restoration, in-stream structures	EI	500	1.5	-29	304.000
	Lower Big Harris Creek R1B	385	305+13	308+33	Priority 2 Restoration	R	320	1	13	333.000
	Lower Big Harris Creek R2	987	308+33	318+00	Priority 2 Restoration	R	967	1	125	1092.000
	Lower Big Harris Creek R3	414	318+00	322+14	isolated bank grading and in-stream structures, invasives treatment	EII	414	2.5	32	198.000
	UT1 to Lower Big Harris Creek	229	330+68	332+96	isolated bank grading and in-stream structures, invasives treatment	EII	228	2.5	-39	53.000
	UT2 to Lower Big Harris Creek	511	334+20	338+60	heavy enhancement with in-stream structures, invasives treatment	EII	440	2	-37	183.000
	UT3 to Lower Big Harris Creek	99	341+69	342+87	preservation	P	118	10	-1	11.000
	UT4 to Lower Big Harris Creek	362	343+12	346+74	preservation	P	362	10	0	36.000
						Total Intermittent/Perennial (I/P) Streams	3,349			23,451.000
						Additional 4% Credit Based on I/P Stream Length for Extra Project Monitoring				1,366.000
						Additional 1.5% Credit Based on I/P Stream Length for Watershed Nature of Project				512.000
						Additional 2% Credit Based on Total SMUs for Statistical Improvement in Water Quality[5]				507.000
						Potential Total Credits[5]				25,329.916

Component Summation					
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)	Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
Restoration	10,071				
Enhancement	N/A				
Enhancement I	2,897				
Enhancement II	20,524				
Creation	N/A				
Wetland Rehabilitation	N/A				
Wetland Re-Establishment	N/A				
Preservation	669				
High Quality Preservation	N/A				

Notes:

1. Existing and proposed lengths include only reach length located within the conservation easement. No direct credit for BMPs. BMP lengths not included in proposed footage.
2. Credits reported have been adjusted based on buffer width deviations from standard 50-foot buffer width. Detailed calculations included in Appendix I of the Mitigation Plan (Wildlands, 2016).
3. The lengths of Royster Reach 2 and Scott Creek that are located underneath the existing overhead electric power line corridor have credits reduced by 100%.
4. The SMUs reported in this table were determined in the mitigation plan utilizing the design center line.
5. The potential SMU total does not inlclude the 2% increase for statistical improvement in water quality. If revised monitoring plan is approved, an addendum will be prepared and submitted.

Table 2. Project Activity and Reporting History
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Activity or Report		Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan		February - July 2015	November 2016
Final Design - Construction Plans		May 2018	June 2018
Construction		April 2017 - May 2018	April 2017 - May 2018
Temporary S&E mix applied to entire project area[1]		April 2017 - May 2018	April 2017 - May 2018
Permanent seed mix applied to reach/segments		April 2017 - May 2018	April 2017 - May 2018
Bare root and live stake plantings for reach/segments		February 2018 - March 2018	February 2018 - March 2018
Baseline Monitoring Document (Year 0)	Stream Assessment	April 2018	June 2018
	Vegetation Assessment	May 2018	
Invasive Treatment		N/A	Summer 2018
Year 1 Monitoring	Stream Assessment	November 2018	December 2018
	Vegetation Assessment	November 2018	
Year 2 Monitoring	Stream Assessment	March - October 2019	December 2019
	Vegetation Assessment	August 2019	
Stream Repairs (UBHC R2B & R6, USEC R2 & R3, and LSEC)		August 2019	August 2019
Invasive Treatments		October & December 2019	October & December 2019
Isolated bank rematting & live stakes (UBHC R6 and LBHC R2)		November 2019	November 2019
Invasive Treatments		January & September 2020	January & September 2020
Stream Repairs (UBHC R5 & R6, and LSEC)		April 2020	April 2020
Year 3 Monitoring	Stream Assessment	February - November 2020	November 2020
	Vegetation Assessment	July - August 2020	
Invasive Treatments		February - October 2021	February - October 2021
Stream Repairs (USEC R1 & R3 and LBHC R2)		June 2021	June 2021
Year 4 Monitoring	Stream Assessment	May- September 2021	November 2021
	Vegetation Assessment	August - September 2021	
Year 5 Monitoring		2022	December 2022

[1]Seed and mulch is added as each section of construction is completed.

Table 3. Project Contact Table
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Designers Emily Reinicker, PE, CFM Angela Allen, PE - Area A Jake McLean, PE, CFM - Area C	**Wildlands Engineering, Inc.** 1430 South Mint Street, Suite 104 Charlotte, NC 28203 704.332.7754
Kevin Tweedy, PE - Area B	**Ecosystem Planning & Restoration** 559 Jones Franklin Road, Suite 150 Raleigh, NC 27606
Construction Contractors	**Land Mechanics Designs Incorporated** 780 Landmark Road Willow Springs, NC 27611
	Fluvial Solutions Incorporated P.O. Box 28749 Raleigh, NC 27611
Planting Contractor	**Bruton Natural Systems, Inc.** 150 Old Black Creek Rd Freemont, NC 27830
Seeding Contractor	**Land Mechanics Designs Incorporated**
	Fluvial Solutions Incorporated
Seed Mix Sources	**Green Resource, LLC** 5204 Highgreen Court Colfax, NC 27235
	ACF Environmental 3313 Durham Drive Raleigh, NC 27603
Nursery Stock Suppliers **Bare Roots**	**Dykes & Son Nursery** 825 Maude Etter Rd. McMinnville, TN 37110
Live Stakes	**Foggy Mountain Nursery** 797 Helton Creek Road Lansing, NC 28643
	Bruton Natural Systems, Inc.
Herbaceous Plugs	**Wetland Plants Incorporated** 812 Drummonds Point Road Edenton, NC 27932
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Kristi Suggs 704.332.7754, ext. 110

Table 4a. Project Information and Attributes
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

AREA A

Project Information	
Project Name	Big Harris Creek Mitigation Site
County	Cleveland County
Project Area (acres)	145
Project Coordinates (latitude and longitude)	34° 24' 32.70"N, 81° 36' 41.55"W

Project Watershed Summary Information	
Physiographic Province	Piedmont Physiographic Province
River Basin	Broad
Temperature Regime	Warm
USGS Hydrologic Unit 8-digit	03050105
USGS Hydrologic Unit 14-digit	03050105080060
DWR Sub-basin	03-08-04
Project Drainage Area (acres)	2,509
Project Drainage Area Percentage of Impervious Area	<10%
CGIA Land Use Classification	Pasture (46%); Deciduous Forest (22%); Evergreen Forest (14%); Developed (10%); Herbaceous (2%); Shrub/Scrub (2%); Cultivated Crops (2%); Mixed Forest (1%); and Woody Wetlands (1%)

Reach Summary Information

Parameters	Area A																			
	Carroll Creek	Cornwell Creek	Cornwell Creek UT1	Eaker Creek	LSEC	Royster Creek		Scism Creek	Scott Creek	UBHC							UBHC UT1	UBHC UT2	UBHC UT3	UBHC UT4
		R 1 & 2		R1	R1	R1	R2			R1	R2a	R2b	R3	R4	R5	R6				
Length of reach (linear feet) - Post-Restoration	595	2,451	78	134	1,389	459	3,170	1,189	662	2,556	934		870	1,039	845	2,258	84	97	105	84
Drainage area (acres)	203	211		27	943	149		40	42	1,969										
NCDWR stream identification score	38	-	30	31.5/20.5	-	22.5	32	34/22.5	28.5	25 (I only)	-	-	-	-	-	-	-	-	-	24
NCDWR Water Quality Classification	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV
Morphological Description (stream type)	P	P	P	P/I	P	I	P	P/I	I	P/I	P	P	P	P	P	P	P	I	I	P
Evolutionary trend (Simon's Model) - Pre- Restoration	IV/V	VI		IIIa	V	III/IV	V/VI	III, IV, V	III	III	III		IV	IV	III	III	III	III	III	III
Underlying mapped soils	Pacolet-Saw complex (PtD)	Chewacla loam (ChA)		Pacolet-Bethlehem complex (PbC2)	Toccoa loam (ToA)	Chewacla loam (ChA)		Pacolet-Saw complex (PtD)		Chewacla loam (ChA)										
Drainage class	Well drained	Somewhat poorly drained		Well drained	Well drained and moderately well drained	Somewhat poorly drained		Well drained		Somewhat poorly drained										
Soil hydric status	No	Yes		No	No	Yes		No		Yes										
Slope	15-25%	0-2%		8-15%	0-2%	0-2%		15-25%		0-2%										
FEMA classification	LBHC Reaches 1a, 1b, and 2 are a mapped Zone AE floodplain with defined base flood elevations.																			
Native vegetation community	Piedmont Alluvial Forest, Mesic Mixed Hardwood Forest, and Timber Forest (applies to UBHC - Reach 1, Reach 2, UT1, UT2, UT3 only)																			
Percent composition exotic invasive vegetation -Post-Restoration	0%																			

Table 4b. Project Information and Attributes
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

AREA A

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 4087. USACE Action ID #SAW-2009-0045
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Erosion and Sediment Contro	Yes	Yes	NPDES Construction Stormwater General Permit NCG010000
Endangered Species Act	Yes	Yes	Big Harris Creek Mitigation Plan; Wildlands determined "no effect" on Cleveland County listed endangered species. USFWS indicates project will have no impact on possible endangered plants and the possibility of incidental take of the northern long-eared bat is exempt under the 4(d) rule at this location (email correspondence from 12/18/2008 and 05/09/2016).
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 6/25/2008).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	LBHC Reaches 1a, 1b, and 2 are a mapped Zone AE floodplain with defined base flood elevations. (FEMA Zone AE, FIRM panels 2620 and 2621). Cleveland County Floodplain Development Permit #153715.
Essential Fisheries Habitat	No	N/A	N/A

Table 4c. Project Information and Attributes
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

AREA B

Project Information	
Project Name	Big Harris Creek Mitigation Site
County	Cleveland County
Project Area (acres)	145.00
Project Coordinates (latitude and longitude)	34° 24' 32.70"N, 81° 36' 41.55"W
Project Watershed Summary Information	
Physiographic Province	Piedmont Physiographic Province
River Basin	Broad
Temperature Regime	Warm
USGS Hydrologic Unit 8-digit	03050105
USGS Hydrologic Unit 14-digit	03050105080060
DWR Sub-basin	03-08-04
Project Drainage Area (acres)	2509
Project Drainage Area Percentage of Impervious Area	<10%
CGIA Land Use Classification	Pasture (46%); Deciduous Forest (22%); Evergreen Forest (14%); Developed (10%); Herbaceous (2%); Shrub/Scrub (2%); Cultivated Crops (2%); Mixed Forest (1%); and Woody Wetlands (1%)

Reach Summary Information

Parameters	Area B																		
	Elliott Creek	Elliott Creek UT1	Bridges Creek		Bridges Creek UT1	LFC		USEC							USEC UT1	USEC UT2	USEC UT3	UFC	
	R1		R1	R2		R1	R2	R1	R2	R3	R4a	R4b	R5	R6				R1	R2
Length of reach (linear feet) - Post-Restoration	1,121	141	376	317	55	574	427	409	781	1,204	397	113	1,507	1,069	72	154	118	1,571	1,407
Drainage area (acres)	82		38			266		487										185	
NCDWR stream identification score	33.5	33.5	33/25.5	-	24	38	-	33.5	-	-	-	-	-	-	25.5	33	25.5	-	-
NCDWR Water Quality Classification	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV
Morphological Description (stream type)	P	P	P/I	P	I	P	P	P	P	P	P	P	P	P	I	P	I	P	P
Evolutionary trend (Simon's Model) - Pre- Restoration	IV/V	III	III/IV/V/VI			IV/V	III/IV	III/IV	IV/V	V	III/V/VI		IV	IV/V	-	-	-	VI	
Underlying mapped soils	Chewacla loam (ChA)		Pacolet sandy clay loam (PaC2)			Chewacla loam (ChA)													
Drainage class	Somewhat poorly drained		Well drained			Somewhat poorly drained													
Soil hydric status	Yes		No			Yes													
Slope	0-2%		8-15%			0-2%													
FEMA classification	no regulated floodplain																		
Native vegetation community	Piedmont Alluvial Forest and Mesic Mixed Hardwood Forest																		
Percent composition exotic invasive vegetation -Post-Restoration	0%																		

Table 4d. Project Information and Attributes
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

AREA B

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 4087. USACE Action ID #SAW-2009-0045
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	NPDES Construction Stormwater General Permit NCG010000
Endangered Species Act	Yes	Yes	Big Harris Creek Mitigation Plan; Wildlands determined "no effect" on Cleveland County listed endangered species. USFWS indicates project will have no impact on possible endangered plants and the possibility of incidental take of the northern long-eared bat is exempt under the 4(d) rule at this location (email correspondence from 12/18/2008 and 05/09/2016).
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 6/25/2008).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	LBHC Reaches 1a, 1b, and 2 are a mapped Zone AE floodplain with defined base flood elevations. (FEMA Zone AE, FIRM panels 2620 and 2621). Cleveland County Floodplain Development Permit #153715.
Essential Fisheries Habitat	No	N/A	N/A

Table 4e. Project Information and Attributes

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

AREA C

Project Information	
Project Name	Big Harris Creek Mitigation Site
County	Cleveland County
Project Area (acres)	145.00
Project Coordinates (latitude and longitude)	34° 24' 32.70"N, 81° 36' 41.55"W
Project Watershed Summary Information	
Physiographic Province	Piedmont Physiographic Province
River Basin	Broad
Temperature Regime	Warm
USGS Hydrologic Unit 8-digit	03050105
USGS Hydrologic Unit 14-digit	03050105080060
DWR Sub-basin	03-08-04
Project Drainage Area (acres)	2509
Project Drainage Area Percentage of Impervious Area	<10%
CGIA Land Use Classification	Pasture (46%); Deciduous Forest (22%); Evergreen Forest (14%); Developed (10%); Herbaceous (2%); Shrub/Scrub (2%); Cultivated Crops (2%); Mixed Forest

Reach Summary Information								
Parameters	**Area C**							
	LBHC				**LBHC UT1**	**LBHC UT2**	**LBHC UT3**	**LBHC UT4**
	R1a	**R1b**	**R2**	**R3**				
Length of reach (linear feet) - Post-Restoration	500	320	967	414	228	440	118	362
Drainage area (acres)	2,509							
NCDWR stream identification score	-	-	-	-	-	35.5	32	35.5
NCDWR Water Quality Classification	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV
Morphological Description (stream type)	P	P	P	P	P	P	P	P
Evolutionary trend (Simon's Model) - Pre- Restoration	IV/V							VI
Underlying mapped soils	Toccoa loam (ToA)							
Drainage class	Well drained and moderately well drained							
Soil hydric status	No							
Slope	0-2%							
FEMA classification	Zone AE				no regulated floodplain			
Native vegetation community	Piedmont Alluvial Forest and Mesic Mixed Hardwood Forest							
Percent composition exotic invasive vegetation -Post-Restoration	0%							

Table 4f. Project Information and Attributes
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

AREA C

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 4087. USACE Action ID #SAW-2009-0045.
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	NPDES Construction Stormwater General Permit NCG010000
Endangered Species Act	Yes	Yes	Big Harris Creek Mitigation Plan; Wildlands determined "no effect" on Cleveland County listed endangered species. USFWS indicates project will have no impact on possible endangered plants and the possibility of incidental take of the northern long-eared bat is exempt under the 4(d) rule at this location (email correspondence from 12/18/2008 and 05/09/2016).
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 6/25/2008).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	LBHC Reaches 1a, 1b, and 2 are a mapped Zone AE floodplain with defined base flood elevations. (FEMA Zone AE, FIRM panels 2620 and 2621). Cleveland County Floodplain Development Permit #153715.
Essential Fisheries Habitat	No	N/A	N/A

Table 5a. Monitoring Component Summary
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area A - Restoration and Enhancement I Reaches

Parameter	Monitoring Feature	Quantity / Length by Reach						Frequency	Notes
		Carroll Creek	Royster Creek R1	Scott Creek	UBHC R2	UBHC R4	Eaker Creek		
Dimension	Riffle Cross-Section	1	1	1	2	2	N/A	Annual	
	Pool Cross-Section	1	1	1	2	2	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	1 RW, 1 RF	1 RW, 1 RF	1 RW, 1 RF	1 RW, 2RF	1 RW, 2RF	N/A	Annual	
Hydrology	Crest Gage/Transducer	1	1	1	1		N/A	Quarterly	2
Vegetation	CVS Level 2	16					N/A	Annual	3
Water Quality	4 baseflow, 4 stormflow grab samples	up to 10 locations throughout project areas A, B, & C and 1 reference location					N/A	Years 3, 4, and 5	
Benthic Macroinvertebrates	NCDWR Qual 4						N/A	Years 3, 4, and 5	
Fisheries	NCDWR SOP						N/A	Year 5	
Exotic and Nuisance Vegetation								Semi-Annual	4
Project Boundary								Semi-Annual	5
Reference Photos	Photographs	18						Annual	

Notes:
1. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring only, unless observations indicate a lack of stability and a profile survey is warranted in additional years. Water surface slope will be measured on representative restoration and enhancement I reaches after three geomorphically significant events in separate monitoring years.
2. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers will be set to record stage once every hour. Devices will be inspected and downloaded semi-annually. In addition, Scott Creek and Royster Creek Reach 1 will be monitored for the presence of baseflow (minimun of 30 consecutives days).
3. The total number of vegetation monitoring plots represents 2% of the open planted area. This is a reduction from the number of vegetation plots proposed in the Mitigation Plan, which was based on 2% of the entire conservation easement. IRT and DMS approved the change in January 2018.
4. Locations of exotic and nuisance vegetation will be mapped.
5. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

Table 5b. Monitoring Component Summary

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area A - Enhancement II Reaches

Parameter	Monitoring Feature	Quantity / Length by Reach										Frequency	Notes
		Cornwell Creek	Cornwell Creek UT1	LSEC	Royster Creek R2	Scism Creek	UBHC R1	UBHC R3	UBHC R5	UBHC R6	UBHC UT1 & UT2		
Dimension	Riffle Cross-Section	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
	Pool Cross-Section	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Hydrology	Crest Gage/Transducer	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Quarterly	
Vegetation	CVS Level 2	18										Annual	1
Exotic and Nuisance Vegetation												Semi-Annual	2
Project Boundary												Semi-Annual	3
Reference Photos	Photographs	38										Annual	4

Notes:

1. The total number of vegetation monitoring plots represents 2% of the open planted area. This is a reduction from the number of vegetation plots proposed in the Mitigation Plan, which was based on 2% of the entire conservation easement. IRT and DMS approved this change in January 2018.
2. Locations of exotic and nuisance vegetation will be mapped.
3. Locations of vegetation damage, boundary encroachments, etc. will be mapped.
4. Photographs will be taken along preservation reaches not noted above (3 photographs total).

Table 5c. Monitoring Component Summary
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area B - Restoration and Enhancement I Reaches

Parameter	Monitoring Feature	Quantity / Length by Reach												Frequency	Notes
		Elliott Creek	Elliott Creek UT1	Bridges Creek R1	Bridges Creek UT1	LFC R1	LFC R2	Upper Stick Elliott Creek R1	USEC R5	USEC R6	USEC UT2	USEC UT3	UFC R2		
Dimension	Riffle Cross-Section	2	1	1	N/A	1	1	1	3	2	1	1	3	Annual	
	Pool Cross-Section	1	0	0	N/A	1	1	0	2	1	0	0	3		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	1
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	1 RW, 2 RF	1 RW, 1 RF	1 RW, 1 RF	N/A	1 RW, 1 RF	1 RW, 1 RF	1 RW, 1 RF	1 RW, 3 RF	1 RW, 2 RF	1 RW, 1 RF	1 RW, 1 RF	1 RW, 3RF	Annual	
Hydrology	Crest Gage/Transducer	1	1	1	N/A	1		1	1		1	1	1	Quarterly	2
Vegetation	CVS Level 2	13												Annual	3
Water Quality	4 baseflow, 4 stormflow grab samples	up to 10 locations throughout project areas A, B, & C and 1 reference location												Years 3, 4, and 5	
Benthic Macroinvertebrates	NCDWR Qual 4													Years 3, 4, and 5	
Fisheries	NCDWR SOP													Year 5	
Exotic and Nuisance Vegetation														Semi-Annual	4
Project Boundary														Semi-Annual	5
Reference Photos	Photographs	27												Annual	

Notes:

1. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only, unless observations indicate a lack of stability and a profile survey is warranted in additional years. Water surface slope will be measured on representative restoration and enhancement I reaches after three geomorphically significant events in separate monitoring years.

2. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers will be set to record stage once every hour. Device will be inspected and downloaded semi-annually. In addition, Bridges Creek will be monitored for the presence of baseflow (minimun of 30 consecutives days).
3. The total number of vegetation monitoring plots represents 2% of the open planted area. This is a reduction from the number of vegetation plots proposed in the Mitigation Plan, which was based on 2% of the entire conservation easement. IRT and DMS approved this change in January 2018.
4. Locations of exotic and nuisance vegetation will be mapped.
5. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

Table 5d. Monitoring Component Summary
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area B - Enhancement II Reaches

Parameter	Monitoring Feature	Quantity / Length by Reach						Frequency	Notes
		Bridges Creek R2	USEC R2	USEC R3	USEC R4a/4b	USEC UT1	UFC R1		
Dimension	Riffle Cross-Section	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
	Pool Cross-Section	N/A	N/A	N/A	N/A	N/A	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	N/A	N/A	N/A	N/A	N/A	N/A	Annual	
Hydrology	Crest Gage/Transducer	N/A	N/A	N/A	N/A	N/A	N/A	Quarterly	
Vegetation	CVS Level 2	5						Annual	1
Exotic and Nuisance Vegetation								Semi-Annual	2
Project Boundary								Semi-Annual	3
Reference Photos	Photographs	12						Annual	

Notes:
1. The total number of vegetation monitoring plots represents 2% of the open planted area. This is a reduction from the number of vegetation plots proposed in the Mitigation Plan, whicl was based on 2% of the entire conservation easement that included supplemental planting areas. IRT and DMS approved this change in January 2018.
2. Locations of exotic and nuisance vegetation will be mapped
3. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

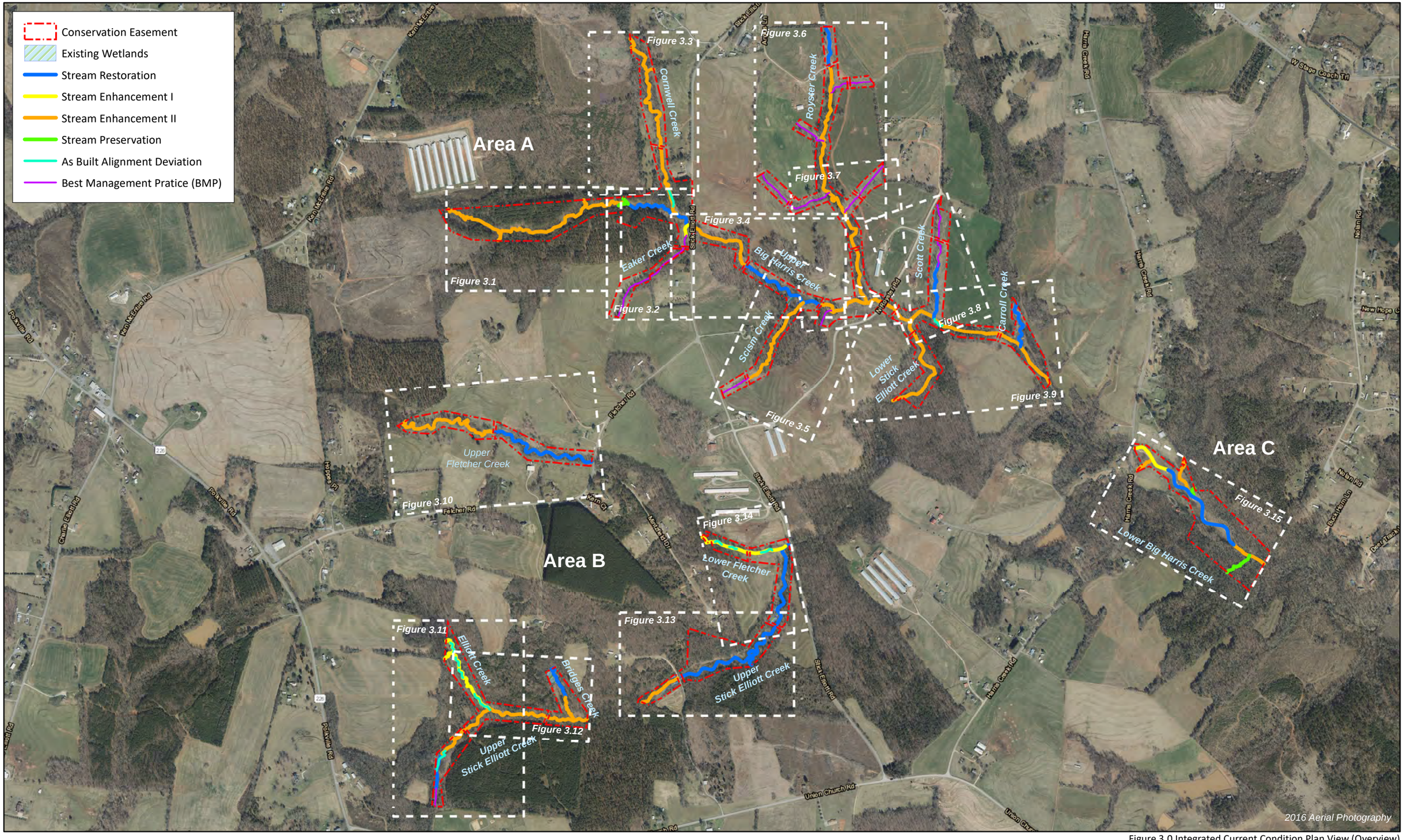
Table 5e. Monitoring Component Summary
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area C - Restoration, Enhancement I, and II Reaches

Parameter	Monitoring Feature	Quantity / Length by Reach				Frequency	Notes
		LBHC Reach 1a	LBHC Reaches 1b & 2	LBHC UT1	LBHC UT2		
Dimension	Riffle Cross-Section	1	1	N/A	N/A	Annual	
	Pool Cross-Section	1	1	N/A	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	Annual	1
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	Annual	
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	1 RW, 1 RF	1 RW, 1 RF	N/A	N/A	Annual	
Hydrology	Crest Gage/Transducer	1	1	N/A	N/A	Quarterly	2
Vegetation	CVS Level 2	4				Annual	3
Water Quality	4 baseflow, 4 stormflow grab samples	up to 10 locations throughout project areas A, B, & C and 1 reference location				Years 3, 4, and 5	
Benthic Macroinvertebrates	NCDWR Qual 4					Years 3, 4, and 5	
Fisheries	NCDWR SOP					Year 5	
Exotic and Nuisance Vegetation						Semi-Annual	4
Project Boundary						Semi-Annual	5
Reference Photos	Photographs	12				Annual	6

Notes:
1. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only, unless observations indicate a lack of stability and a profile survey is warranted in additional years.
2. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers will be set to record stage once every hour. Device will be inspected and downloaded semi-annually.
3. The total number of vegetation monitoring plots represents 2% of the open planted area. This is a reduction from the number of vegetation plots proposed in the Mitigation Plan, which was based on 2% of the entire conservation easement. IRT and DMS approved this change in January 2018.
4. Locations of exotic and nuisance vegetation will be mapped.
5. Locations of vegetation damage, boundary encroachments, etc. will be mapped.
6. Photographs will be taken along preservation reaches not noted above (2 photographs total).

APPENDIX 2. Visual Assessment Data



WILDLANDS ENGINEERING

0 500 1,000 Feet

N

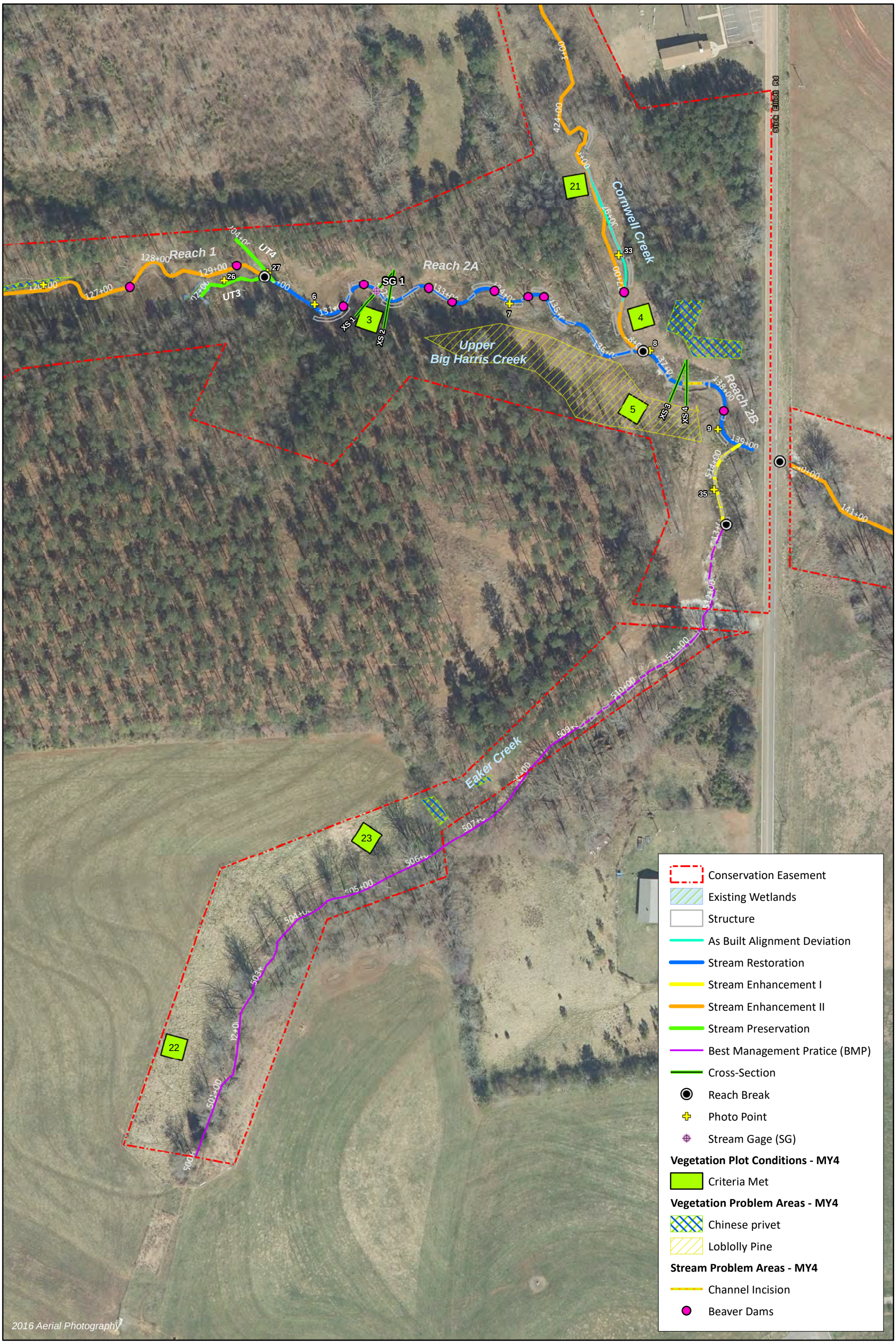
Figure 3.0 Integrated Current Condition Plan View (Overview)
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC

WILDLANDS ENGINEERING

0 125 250 Feet

N

Figure 3.1 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC



WILDLANDS ENGINEERING

0 100 200 Feet

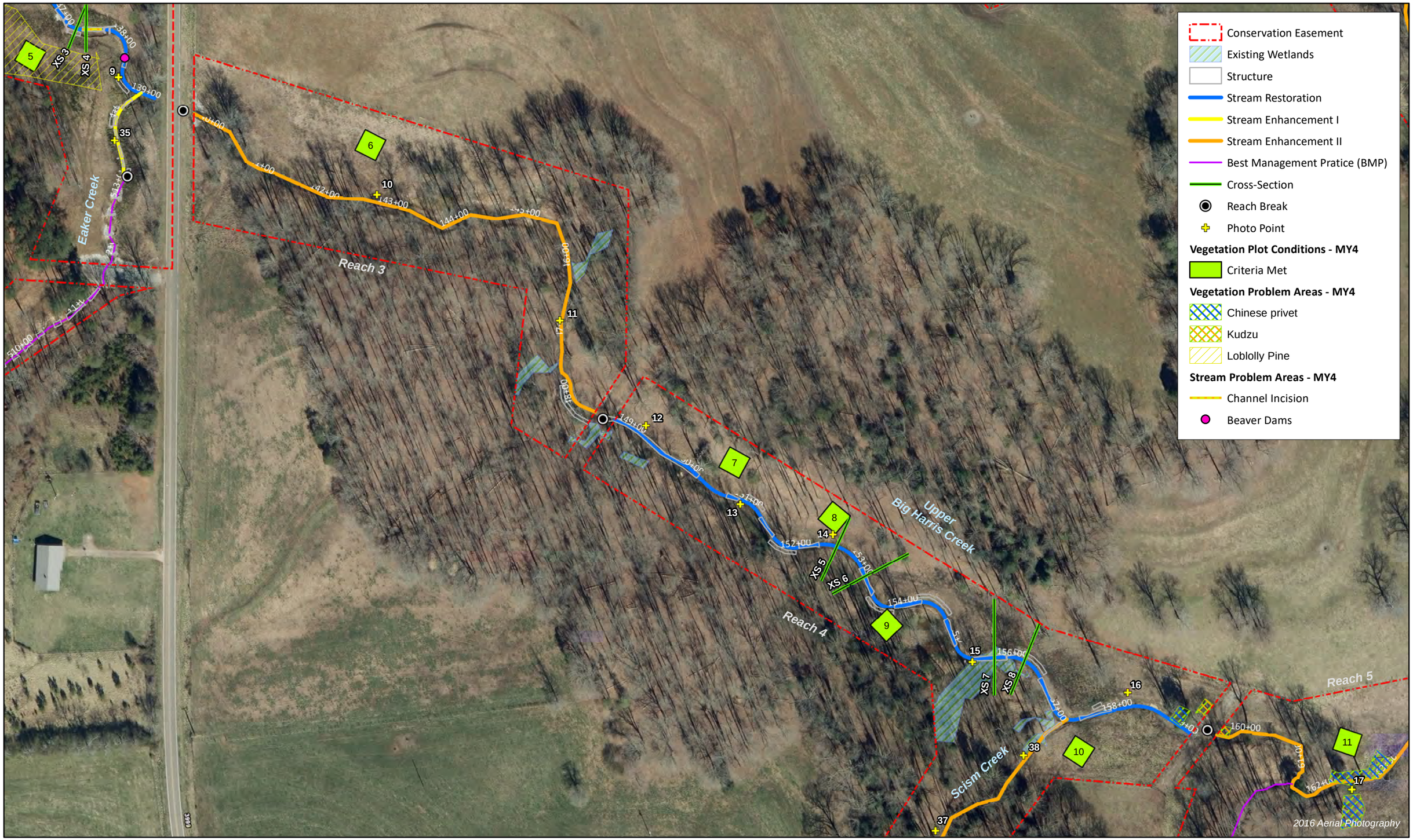
N

Figure 3.2 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

Cleveland County, NC

Figure 3.3 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

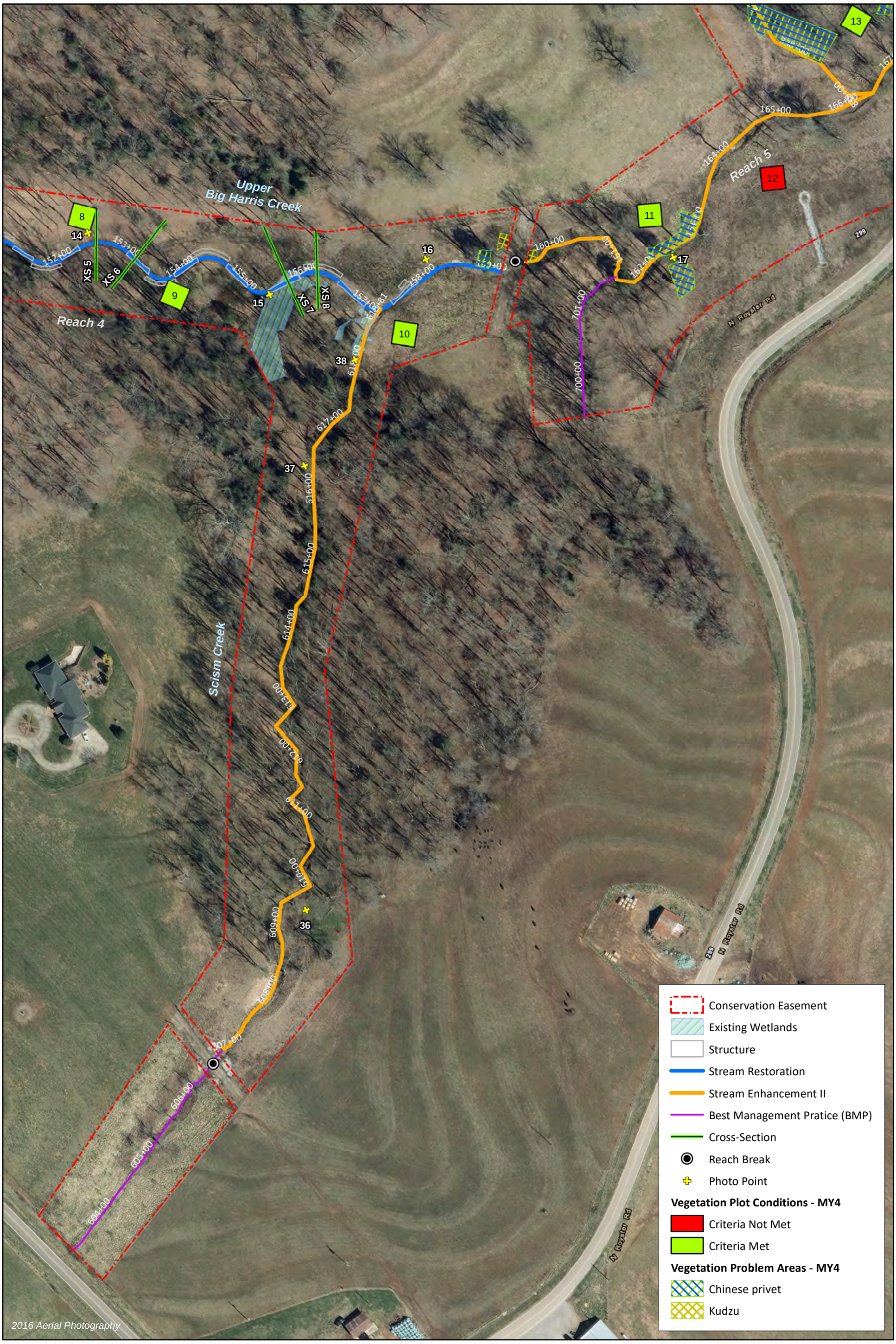
Cleveland County, NC



WILDLANDS ENGINEERING

0 125 250 Feet

Figure 3.4 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC



WILDLANDS ENGINEERING

0 125 250 Feet

Figure 3.5 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site -- Area A
DMS Project No. 739
Monitoring Year 4 - 2021

Cleveland County, NC

Conservation Easement
Structure
Stream Restoration
Stream Enhancement II
Best Management Pratice (BMP)
Cross-Section
Reach Break
Photo Point
Stream Gage (SG)

Vegetation Plot Conditions - MY4

Criteria Not Met
Criteria Met

Vegetation Problem Areas - MY4

Chinaberry
Chinese privet
Chinese privet, Hardy orange, Tree of Heaven
Fescue

Stream Problem Areas - MY4

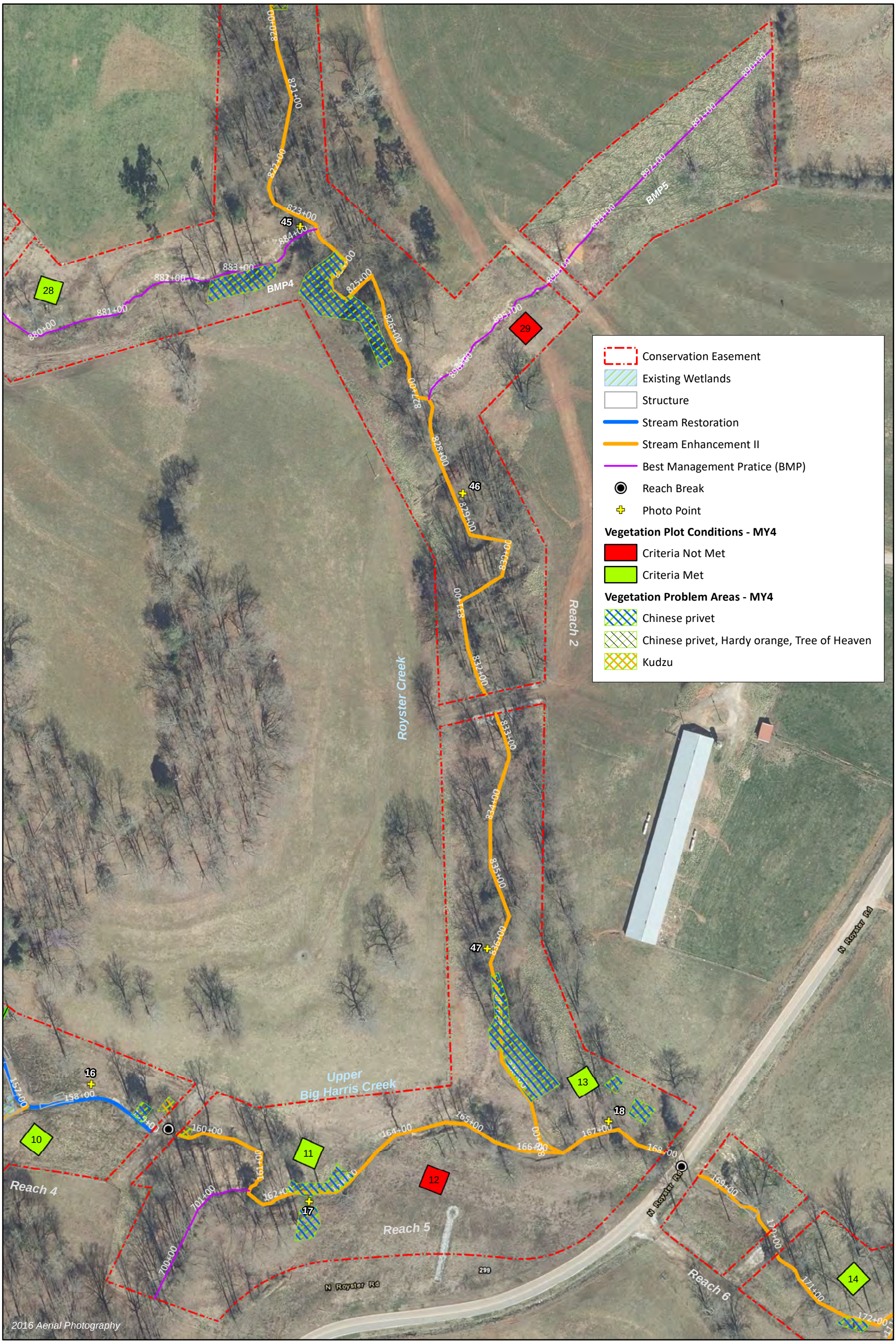
Aggradation
Bank Scour/Eroded
Structure Issue

WILDLANDS ENGINEERING

0 150 300 Feet

Figure 3.6 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

Cleveland County, NC

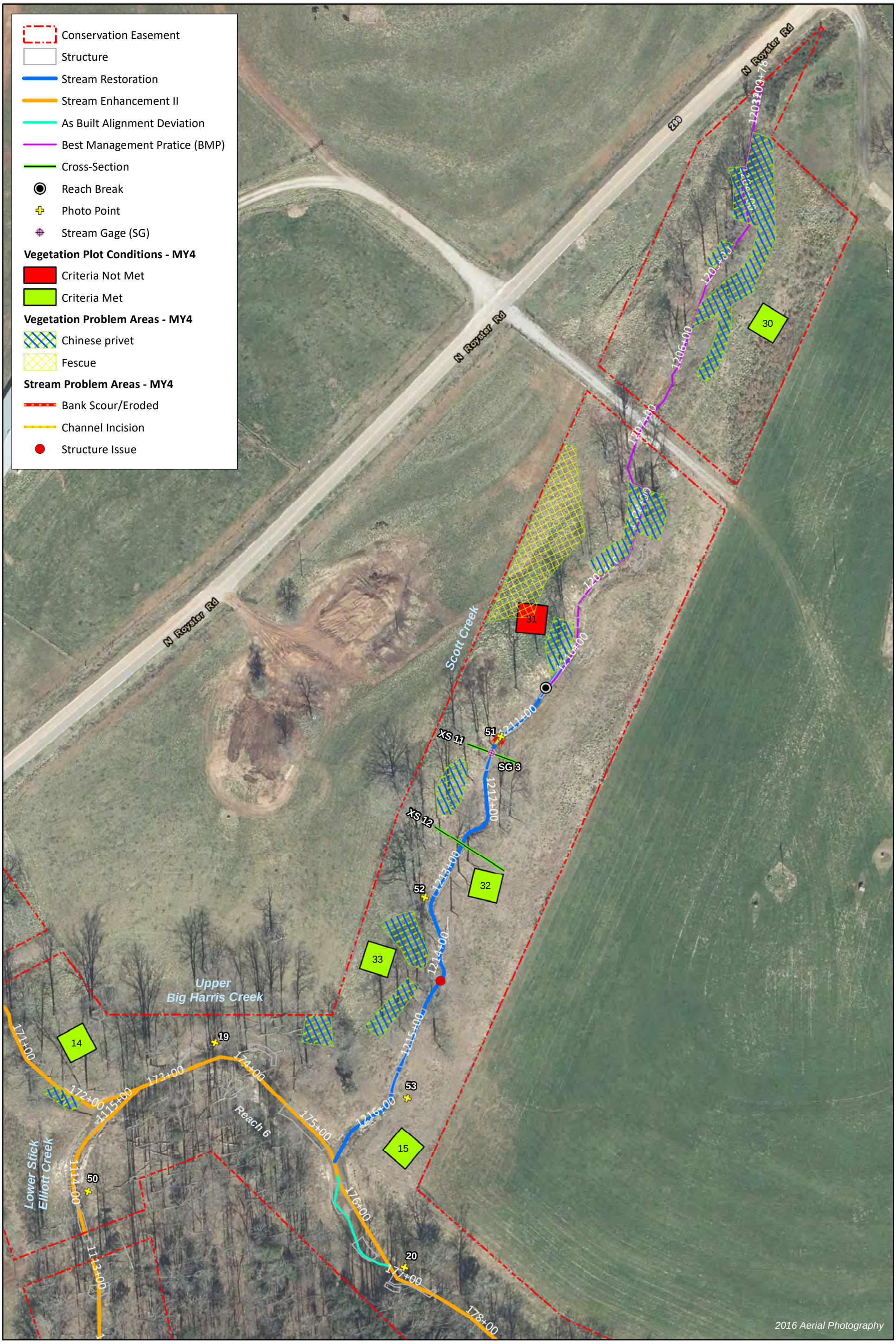


WILDLANDS ENGINEERING

0 125 250 Feet

Figure 3.7 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

Cleveland County, NC

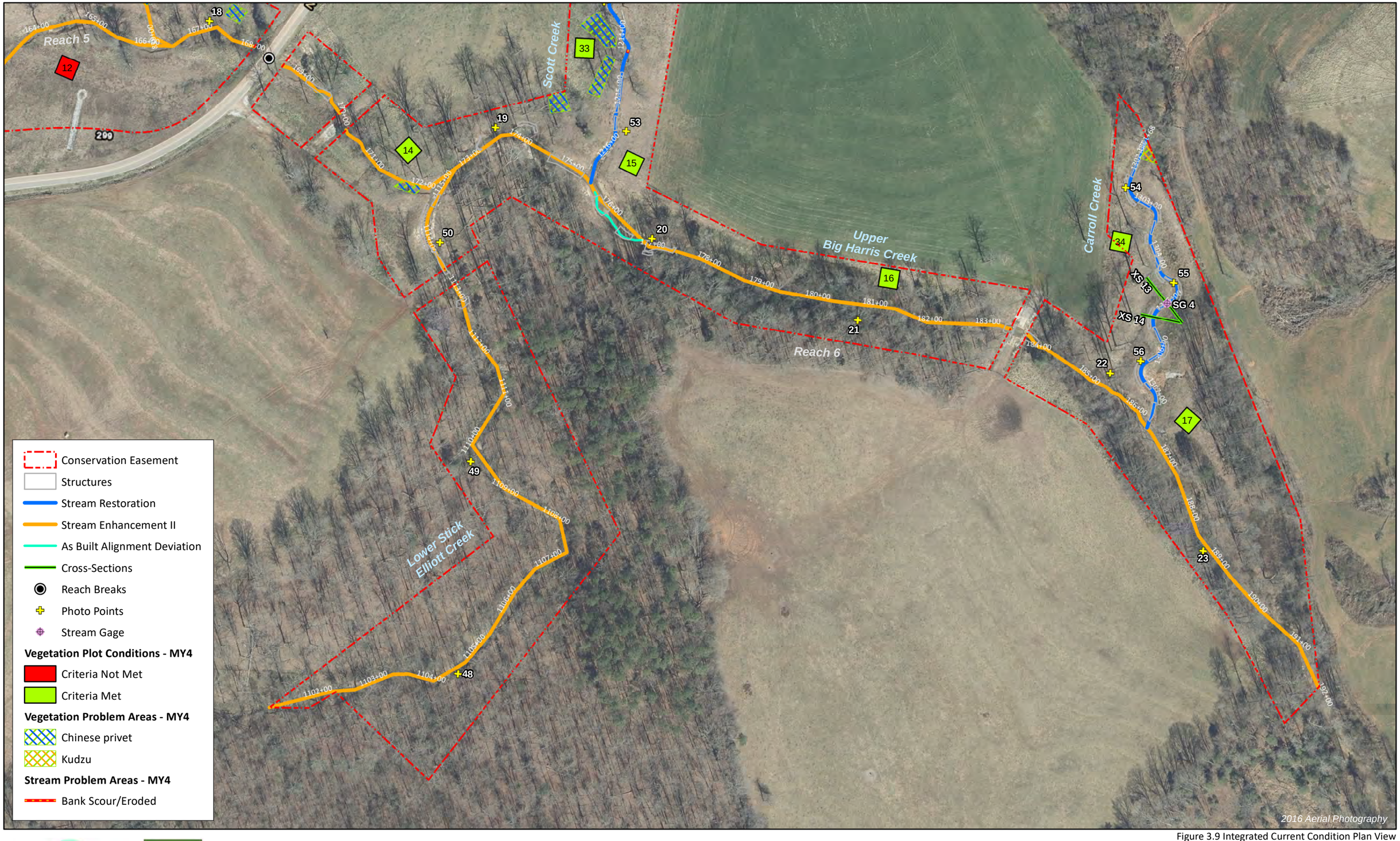


WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.8 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

Cleveland County, NC



WILDLANDS ENGINEERING

0 150 300 Feet

Figure 3.9 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC

WILDLANDS ENGINEERING

0 150 300 Feet

Figure 3.10 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC

Conservation Easement
Structure
Stream Restoration
Stream Enhancement I
Stream Enhancement II
As Built Alignment Deviation
Best Management Pratice (BMP)
Cross-Section
Reach Break
Photo Point
Stream Gage (SG)

Vegetation Plot Conditions - MY4

Criteria Not Met
Criteria Met

Vegetation Problem Areas - MY4

Kudzu

Stream Problem Areas - MY4

Bank Scour/Eroded

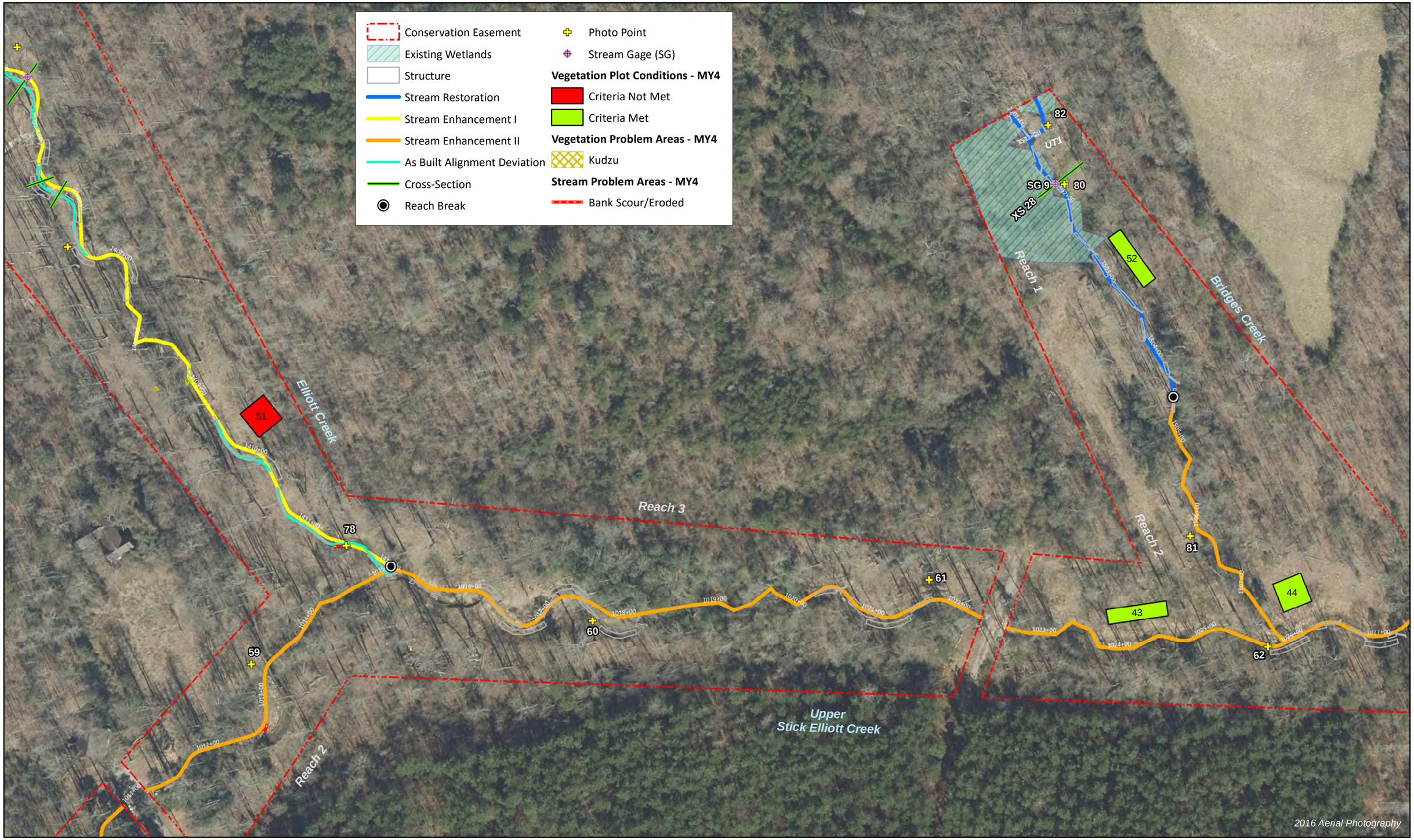
75
50
79
SG 8
XS 27
76
SG 7
XS 24
UT1
Elliott Creek
XS 25
XS 26
77
51
78
Reach 3
59
60
Upper
Stick Elliott Creek
74
UT1
58
Reach 2
57
42
XS 15
SG 5
Reach 1

2016 Aerial Photography

0 150 300 Feet

WILDLANDS ENGINEERING

Figure 3.11 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC



WILDLANDS ENGINEERING

0 100 200 Feet

N

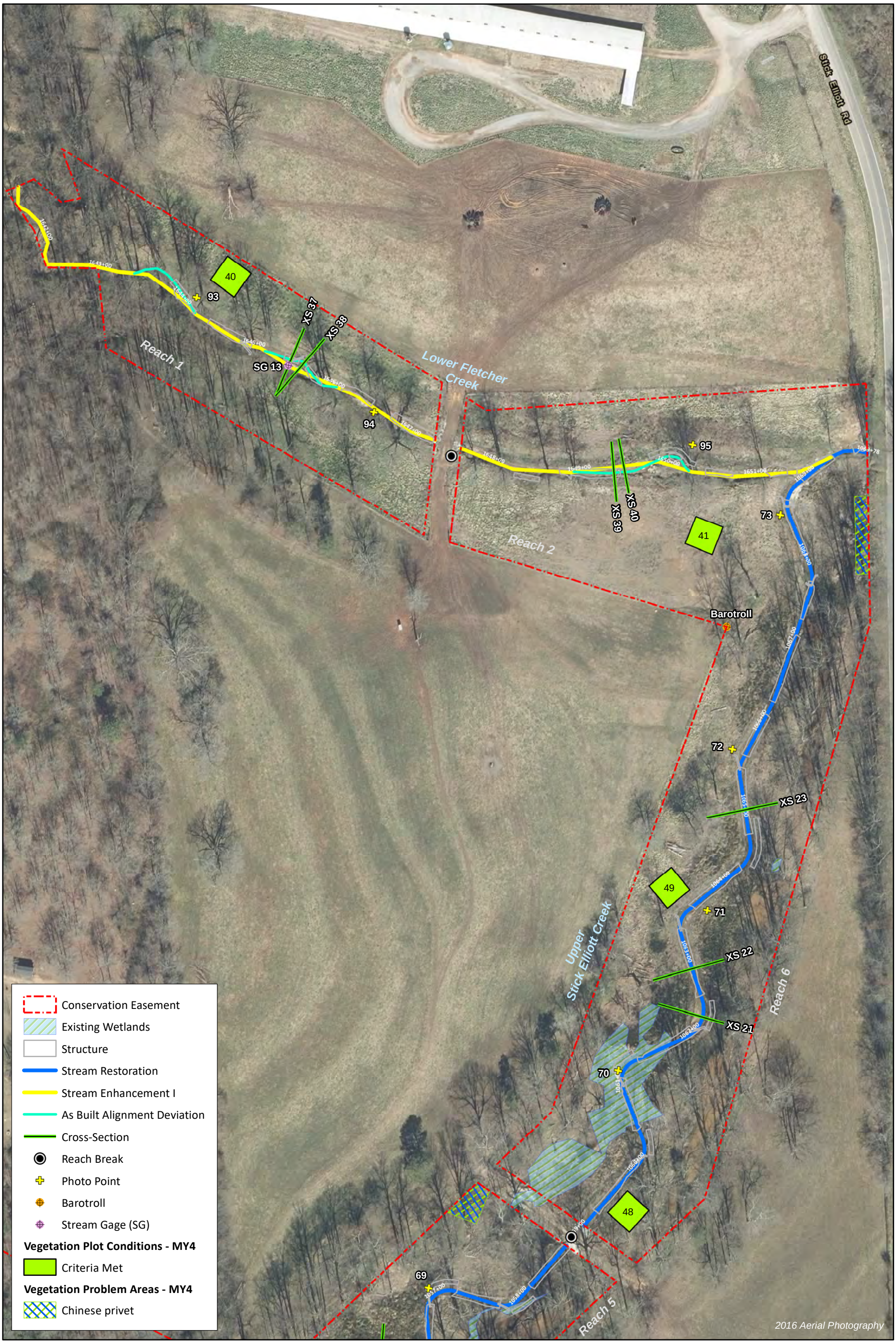
Figure 3.12 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC

WILDLANDS ENGINEERING

0 125 250 Feet

N

Figure 3.13 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC

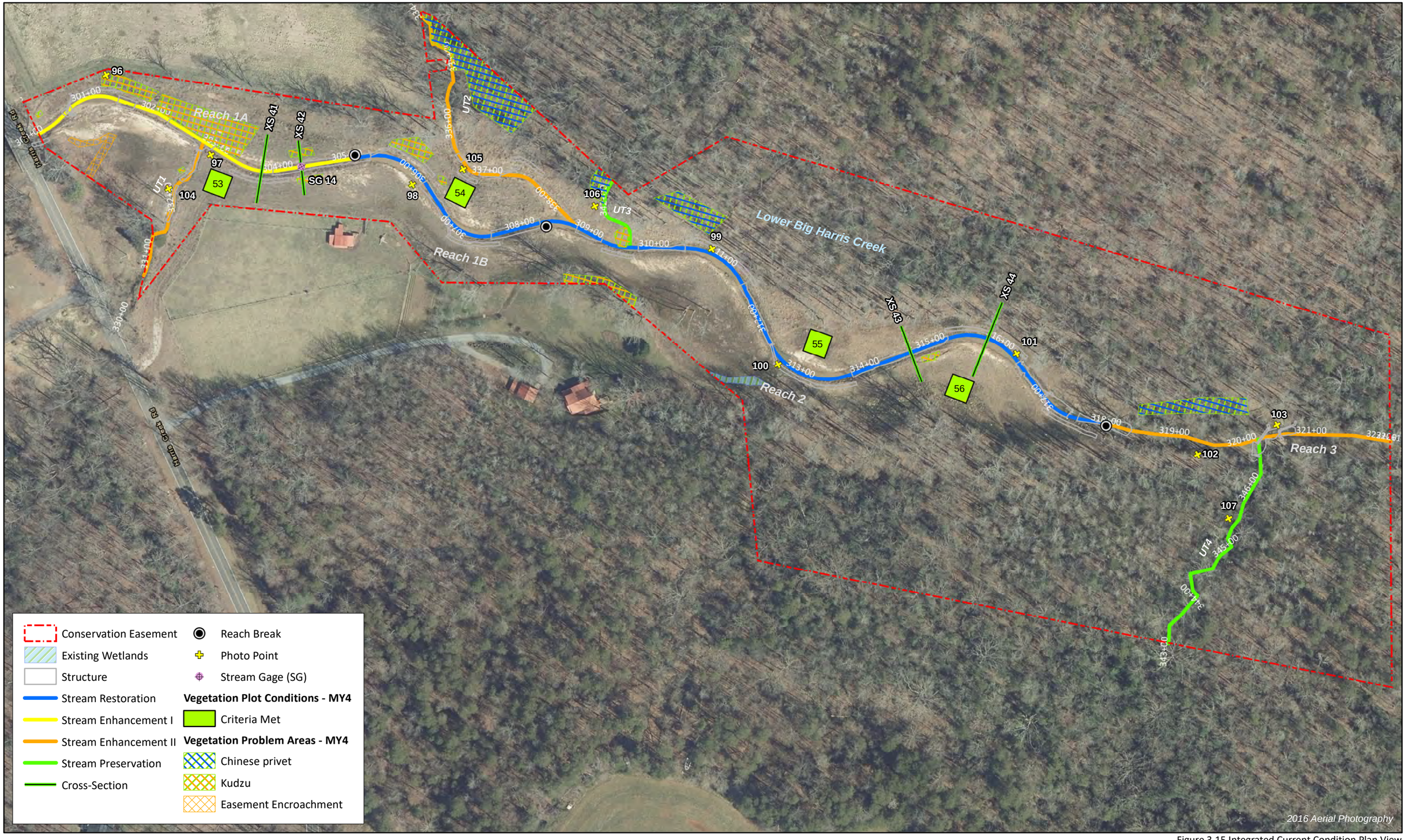


WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.14 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

Cleveland County, NC



WILDLANDS ENGINEERING

0 125 250 Feet

Figure 3.15 Integrated Current Condition Plan View
Big Harris Creek Mitigation Site - Area C
DMS Project No. 739
Monitoring Year 4 - 2021
Cleveland County, NC

Table 6a. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area A- Eaker Creek - 134 LF			**Date of Assessment: 11/2/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	1	1			100%			
	3. Meander Pool Condition	Depth Sufficient	1	1			100%			
		Length Appropriate	1	1			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	1	1			100%			
		Thalweg centering at downstream of meander bend (Glide)	1	1			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	n/a	n/a			n/a			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	n/a	n/a			n/a			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	n/a	n/a			n/a			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6b. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area A- Royster Creek R1 - 459 LF			**Date of Assessment: 11/3/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			1	43	91%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	8	9			89%			
	3. Meander Pool Condition	Depth Sufficient	7	7			100%			
		Length Appropriate	7	7			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	7	7			100%			
		Thalweg centering at downstream of meander bend (Glide)	7	7			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	13	14			93%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	11	12			92%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	12	12			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	3	3			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	12	12			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6c. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area A- Scott Creek - 662 LF			**Date of Assessment: 10/27/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			1	11	98%			
	2. Riffle Condition	Texture/Substrate	10	10			100%			
	3. Meander Pool Condition	Depth Sufficient	5	5			100%			
		Length Appropriate	5	5			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	5	5			100%			
		Thalweg centering at downstream of meander bend (Glide)	5	5			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	21	98%	0	0	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	2	21	98%	0	0	99%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	18	19			95%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	18	19			95%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	18	19			95%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	19	19			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6d. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area A- Carroll Creek - 595 LF			Date of Assessment: 10/27/2021							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	10	10			100%			
	3. Meander Pool Condition	Depth Sufficient	9	9			100%			
		Length Appropriate	9	9			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	9	9			100%			
		Thalweg centering at downstream of meander bend (Glide)	9	9			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	1	1			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6e. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area A- UBHC R2 - 934 LF			**Date of Assessment: 11/2/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			1	28	97%			
	2. Riffle Condition	Texture/Substrate	16	17			94%			
	3. Meander Pool Condition	Depth Sufficient	15	15			100%			
		Length Appropriate	15	15			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	15	15			100%			
		Thalweg centering at downstream of meander bend (Glide)	15	15			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	98%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	98%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	7	7			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	7	7			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	7	7			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	7	7			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	9	9			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6f. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area A- UBHC R4 - 1,039 LF			**Date of Assessment: 10/27/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	10	10			100%			
	3. Meander Pool Condition	Depth Sufficient	10	10			100%			
		Length Appropriate	10	10			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	10	10			100%			
		Thalweg centering at downstream of meander bend (Glide)	10	10			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	98%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	98%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	n/a	n/a			n/a			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	1	1			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6g. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- Elliot Creek - 1,121 LF			**Date of Assessment: 11/5/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	19	19			100%			
	3. Meander Pool Condition	Depth Sufficient	17	17			100%			
		Length Appropriate	17	17			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	17	17			100%			
		Thalweg centering at downstream of meander bend (Glide)	17	17			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	18	99%	0	0	98%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	2	18	99%	0	0	98%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	4	4			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	4	4			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	11	11			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	11	11			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6h. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- UT1 to Elliot Creek - 141 LF			**Date of Assessment: 11/5/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	5	5			100%			
	3. Meander Pool Condition	Depth Sufficient	4	4			100%			
		Length Appropriate	4	4			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	4	4			100%			
		Thalweg centering at downstream of meander bend (Glide)	4	4			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6i. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area B- Bridges Creek R1 - 376 LF			Date of Assessment: 11/5/2021							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	10	10			100%			
	3. Meander Pool Condition	Depth Sufficient	10	10			100%			
		Length Appropriate	10	10			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	10	10			100%			
		Thalweg centering at downstream of meander bend (Glide)	10	10			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	7	7			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	7	7			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	7	7			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	7	7			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6j. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- UT1 to Bridges Creek - 55 LF			**Date of Assessment: 11/5/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	2	2			100%			
	3. Meander Pool Condition	Depth Sufficient	1	1			100%			
		Length Appropriate	1	1			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	1	1			100%			
		Thalweg centering at downstream of meander bend (Glide)	1	1			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6k. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- USEC R1 - 409 LF			**Date of Assessment: 11/5/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	15	15			100%			
	3. Meander Pool Condition	Depth Sufficient	2	2			100%			
		Length Appropriate	2	2			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	2	2			100%			
		Thalweg centering at downstream of meander bend (Glide)	2	2			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	93%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	93%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6l. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- USEC R5 - 1,507 LF			**Date of Assessment: 10/26/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	15	15			100%			
	3. Meander Pool Condition	Depth Sufficient	13	13			100%			
		Length Appropriate	13	13			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	13	13			100%			
		Thalweg centering at downstream of meander bend (Glide)	13	13			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	19	19			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	3			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	19	19			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	3	3			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6m. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- USEC R6 - 1,069 LF			**Date of Assessment: 10/26/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	12	12			100%			
	3. Meander Pool Condition	Depth Sufficient	9	9			100%			
		Length Appropriate	9	9			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	9	9			100%			
		Thalweg centering at downstream of meander bend (Glide)	9	9			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0`	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	12	12			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	12	12			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	12	12			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	7	7			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6n. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- UT2 to USEC - 154 LF			**Date of Assessment: 10/26/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			1	20	87%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	2	3			67%			
	3. Meander Pool Condition	Depth Sufficient	2	2			100%			
		Length Appropriate	2	2			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	2	2			100%			
		Thalweg centering at downstream of meander bend (Glide)	2	2			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	n/a	n/a			n/a			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	n/a	n/a			n/a			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	n/a	n/a			n/a			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6o. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- UT3 to USEC - 118 LF			Date of Assessment: 10/26/2021							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	4	4			100%			
	3. Meander Pool Condition	Depth Sufficient	2	2			100%			
		Length Appropriate	2	2			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	2	2			100%			
		Thalweg centering at downstream of meander bend (Glide)	2	2			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	n/a	n/a			n/a			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	n/a	n/a			n/a			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	n/a	n/a			n/a			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	n/a	n/a			n/a			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6p. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- UFC R2 - 1,407 LF			**Date of Assessment: 10/26/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	18	18			100%			
	3. Meander Pool Condition	Depth Sufficient	14	16			88%			
		Length Appropriate	16	16			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	16	16			100%			
		Thalweg centering at downstream of meander bend (Glide)	16	16			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	19	19			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	19	19			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	19	19			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6q. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- LFC R1 - 574 LF			**Date of Assessment: 10/26/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	6	6			100%			
	3. Meander Pool Condition	Depth Sufficient	5	5			100%			
		Length Appropriate	5	5			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	5	5			100%			
		Thalweg centering at downstream of meander bend (Glide)	5	5			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	5	5			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	5	5			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	5	5			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	5	5			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6r. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area B- LFC R2 - 427 LF			**Date of Assessment: 10/26/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	3	3			100%			
	3. Meander Pool Condition	Depth Sufficient	2	2			100%			
		Length Appropriate	2	2			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	2	2			100%			
		Thalweg centering at downstream of meander bend (Glide)	2	2			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	n/a	n/a			n/a			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6s. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area C- LBHC R1A - 500 LF			**Date of Assessment: 11/2/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	4	4			100%			
	3. Meander Pool Condition	Depth Sufficient	4	4			100%			
		Length Appropriate	4	4			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	4	4			100%			
		Thalweg centering at downstream of meander bend (Glide)	4	4			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	1	1			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6t. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area C- LBHC R1B - 320 LF			**Date of Assessment: 11/2/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	3	3			100%			
	3. Meander Pool Condition	Depth Sufficient	2	2			100%			
		Length Appropriate	2	2			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	2	2			100%			
		Thalweg centering at downstream of meander bend (Glide)	2	2			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures[1]	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 6u. Visual Stream Morphology Stability Assessment Table

Big Harris Creek Stream Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Area C- LBHC R2 - 967 LF			**Date of Assessment: 11/2/2021**							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-Built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**	**Number with Stabilizing Woody Vegetation**	**Footage with Stabilizing Woody Vegetation**	**Adjust % for Stabilizing Woody Vegetation**
1. Bed	**1. Vertical Stability (Riffle and Run units)**	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	6	6			100%			
	3. Meander Pool Condition	Depth Sufficient	6	6			100%			
		Length Appropriate	6	6			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	6	6			100%			
		Thalweg centering at downstream of meander bend (Glide)	6	6			100%			
2. Bank	**1. Scoured/Eroded**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	94%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	94%
3. Engineered Structures[1]	**1. Overall Integrity[2]**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control[2]	Grade control structures exhibiting maintenance of grade across the sill	n/a	n/a			n/a			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

[2]One log sill was removed during MY4 repairs.

Table 7. Vegetation Condition Assessment Table

Big Harris Creek Mitigation Site

DMS Project No. 739

DMS Project No.

Planted Acreage	**61.5**	**Date of Assessment: 10/26/2021 - 11/5/2021**			
Vegetation Category	**Definitions**	**Mapping Threshold (acres)**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	0	0.00	0.0%
Low Stem Density Areas[1]	Woody stem densities clearly below target levels based on MY3, 4, 5, or 7 stem count criteria.	0.1	7	0.18	0.3%
		Total	**7**	**0.18**	**0.3%**
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25	0	0.00	0.0%
		Cumulative Total	**7**	**0.18**	**0.3%**

Easement Acreage	**144.7**				
Vegetation Category	**Definitions**	**Mapping Threshold (SF)**	**Number of Polygons**	**Combined Acreage**	**% of Easement Acreage**
Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000	65	4.03	2.8%
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	1	0.03	0.0%

[1]Acreage calculated from vegetation plots monitored for site.

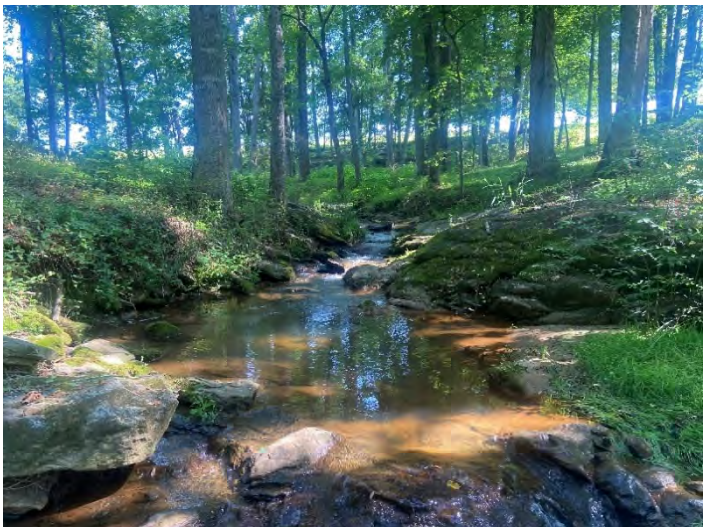
STREAM PHOTOGRAPHS

Big Harris Creek - Area A
Monitoring Year 4

	
UBHC R1 Photo Point 1 – view upstream (6*/17/2021)*	**UBHC R1 Photo Point 1** – view downstream (6*/17/2021)*
	
UBHC R1 Photo Point 2 – view upstream (6*/17/2021)*	**UBHC R1 Photo Point 2** – view downstream (6*/17/2021)*
	
UBHC R1 Photo Point 3 – view upstream (6*/17/2021)*	**UBHC R1 Photo Point 3** – view downstream (6*/17/2021)*

	
UBHC R1 Photo Point 4 – view upstream (6*/17/2021)*	**UBHC R1 Photo Point 4** – view downstream (6*/17/2021)*
	
UBHC R1 Photo Point 5 – view upstream (6*/17/2021)*	**UBHC R1 Photo Point 5** – view downstream (6*/17/2021)*
	
UBHC R2A Photo Point 6 – view upstream (5*/27/2021)*	**UBHC R2A Photo Point 6** – view downstream (5*/27/2021)*

	
UBHC R2A Photo Point 7 – view upstream (5*/27/2021)*	**UBHC R2A Photo Point 7** – view downstream (5*/27/2021)*
	
UBHC R2B Photo Point 8 – view upstream (5*/27/2021)*	**UBHC R2B Photo Point 8** – view downstream (5*/27/2021)*
	
UBHC R2B Photo Point 9 – view upstream (5*/27/2021)*	**UBHC R2B Photo Point 9** – view downstream (5*/27/2021)*

	
UBHC R3 Photo Point 10 – view upstream *(5/27/2021)*	**UBHC R3 Photo Point 10** – view downstream *(5/27/2021)*
	
UBHC R3 Photo Point 11 – view upstream *(5/27/2021)*	**UBHC R3 Photo Point 11** – view downstream *(5/27/2021)*
	
UBHC R4 Photo Point 12 – view upstream *(5/27/2021)*	**UBHC R4 Photo Point 12** – view downstream *(5/27/2021)*

	
UBHC R4 Photo Point 13 – view upstream *(5/27/2021)*	**UBHC R4 Photo Point 13** – view downstream *(5/27/2021)*
	
UBHC R4 Photo Point 14 – view upstream *(5/27/2021)*	**UBHC R4 Photo Point 14** – view downstream (*5/27/2021)*
	
UBHC R4 Photo Point 15 – view upstream *(5/27/2021)*	**UBHC R4 Photo Point 15** – view downstream *(5/27/2021)*

	
UBHC R4 Photo Point 16 – view upstream (5*/27/2021)*	**UBHC R4 Photo Point 16** – view downstream *(5/27/2021)*
	
UBHC R5 Photo Point 17 – view upstream *(5/27/2021)*	**UBHC R5 Photo Point 17** – view downstream *(5/27/2021)*
	
UBHC R5 Photo Point 18 – view upstream *(5/27/2021)*	**UBHC R5 Photo Point 18** – view downstream *(5/27/2021)*

	
UBHC R6 Photo Point 19 – view upstream *(5/26/2021)*	**UBHC R6 Photo Point 19** – view downstream *(5/26/2021)*
	
UBHC R6 Photo Point 20 – view upstream *(5/26/2021)*	**UBHC R6 Photo Point 20** – view downstream *(5/26/2021)*
	
UBHC R6 Photo Point 21 – view upstream *(5/26/2021)*	**UBHC R6 Photo Point 21** – view downstream *(5/26/2021)*

	
UBHC R6 Photo Point 22 – view upstream *(5/26/2021)*	**UBHC R6 Photo Point 22** – view downstream *(5/26/2021)*
	
UBHC R6 Photo Point 23 – view upstream *(5/26/2021)*	**UBHC R6 Photo Point 23** – view downstream *(5/26/2021)*
	
UBHC UT1 Photo Point 24 – view upstream (6*/17/2021)*	**UBHC UT1 Photo Point 24** – view downstream (6*/17/2021)*

	
UBHC UT2 Photo Point 25 – view upstream (6*/17/2021)*	**UBHC UT2 Photo Point 25** – view downstream (6*/17/2021)*
	
UBHC UT3 Photo Point 26 – view upstream (5*/27/2021)*	**UBHC UT3 Photo Point 26** – view downstream (5*/27/2021)*
	
UBHC UT4 Photo Point 27 – view upstream (5*/27/2021)*	**UBHC UT4 Photo Point 27** – view downstream (5*/27/2021)*

	
Cornwell Creek Photo Point 28 – view upstream (5*/27/2021)*	**Cornwell Creek Photo Point 28** – view downstream (5*/27/2021)*
	
Cornwell Creek Photo Point 29 – view upstream (5*/27/2021)*	**Cornwell Creek Photo Point 29** – view downstream (5*/27/2021)*
	
Cornwell Creek Photo Point 30 – view upstream (5*/27/2021)*	**Cornwell Creek Photo Point 30** – view downstream (5*/27/2021)*

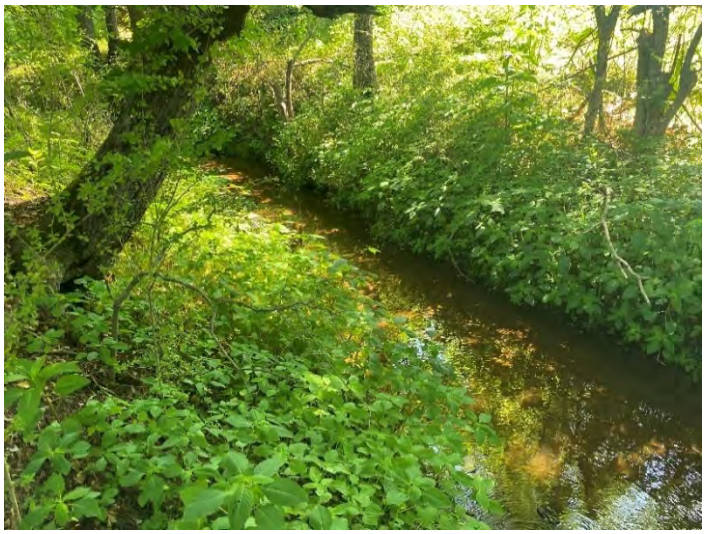
	
Cornwell Creek Photo Point 31 – view upstream (5*/27/2021)*	**Cornwell Creek Photo Point 31** – view downstream (5*/27/2021)*
	
Cornwell Creek Photo Point 32 – view upstream (5*/27/2021)*	**Cornwell Creek Photo Point 32** – view downstream (5*/27/2021)*
	
Cornwell Creek Photo Point 33 – view upstream (5*/27/2021)*	**Cornwell Creek Photo Point 33** – view downstream (5*/27/2021)*

	
Cornwell Creek UT1 Photo Point 34 – view upstream *(5/27/2021)*	**Cornwell Creek UT1 Photo Point 34** – view downstream (5*/27/2021)*
	
Eaker Creek Photo Point 35 – view upstream (5*/27/2021)*	**Eaker Creek Photo Point 35** – view downstream (5*/27/2021)*
	
Scism Creek Photo Point 36 – view upstream *(5/27/2021)*	**Scism Creek Photo Point 36** – view downstream *(5/27/2021)*

	
Scism Creek Photo Point 37 – view upstream *(5/27/2021)*	**Scism Creek Photo Point 37** – view downstream *5/27/2021)*
	
Scism Creek Photo Point 38 – view upstream *(5/27/2021)*	**Scism Creek Photo Point 38** – view downstream *(5/27/2021)*
	
Royster Creek Photo Point 39 – view upstream *(5/27/2021)*	**Royster Creek Photo Point 39** – view downstream *(5/27/2021)*

	
Royster Creek Photo Point 40 – view upstream *(5/27/2021)*	**Royster Creek Photo Point 40** – view downstream *(5/27/2021)*
	
Royster Creek Photo Point 41 – view upstream *(5/27/2021)*	**Royster Creek Photo Point 41** – view downstream *(5/27/2021)*
	
Royster Creek Photo Point 42 – view upstream *(5/27/2021)*	**Royster Creek Photo Point 42** – view downstream *(5/27/2021)*

	
Royster Creek Photo Point 43 – view upstream *(5/27/2021)*	**Royster Creek Photo Point 43** – view downstream *(5/27/2021)*
	
Royster Creek Photo Point 44 – view upstream *(5/27/2021)*	**Royster Creek Photo Point 44** – view downstream *(5/27/2021)*
	
Royster Creek Photo Point 45 – view upstream *(5/27/2021)*	**Royster Creek Photo Point 45** – view downstream *(5/27/2021)*

	
Royster Creek Photo Point 46 – view upstream *(5/27/2021)*	**Royster Creek Photo Point 46** – view downstream *(5/27/2021)*
	
Royster Creek Photo Point 47 – view upstream *(5/27/2021)*	**Royster Creek Photo Point 47** – view downstream *(5/27/2021)*
	
LSEC Photo Point 48 – view upstream *(5/26/2021)*	**LSEC Photo Point 48** – view downstream *(5/26/2021)*

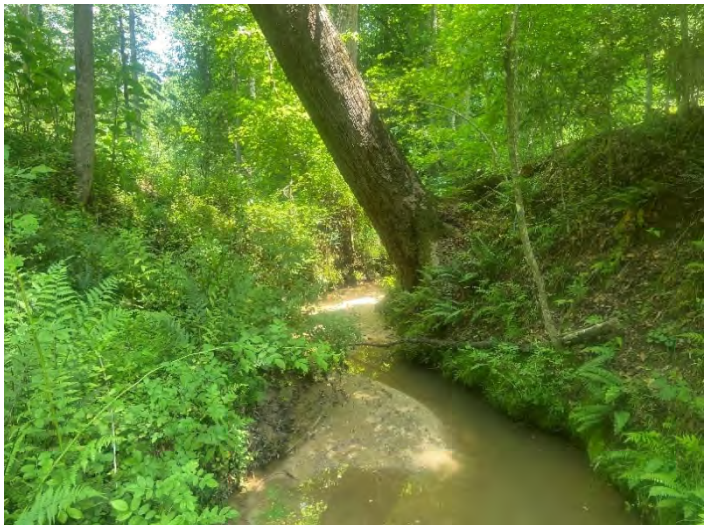
	
LSEC Photo Point 49 – view upstream *(5/26/2021)*	**LSEC Photo Point 49** – view downstream *(5/26/2021)*
	
LSEC Photo Point 50 – view upstream *(5/26/2021)*	**LSEC Photo Point 50** – view downstream *(5/26/2021)*
	
Scott Creek Photo Point 51 – view upstream *(5/26/2021)*	**Scott Creek Photo Point 51** – view downstream *(5/26/2021)*

	
Scott Creek Photo Point 52 – view upstream *(5/26/2021)*	**Scott Creek Photo Point 52** – view downstream *(5/26/2021)*
	
Scott Creek Photo Point 53 – view upstream *(5/26/2021)*	**Scott Creek Photo Point 53** – view downstream *(5/26/2021)*
	
Carroll Creek Photo Point 54 – view upstream *(5/26/2021)*	**Carroll Creek Photo Point 54** – view downstream *(5/26/2021)*

	
Carroll Creek Photo Point 55 – view upstream *(5/26/2021)*	**Carroll Creek Photo Point 55** – view downstream *(5/26/2021)*
	
Carroll Creek Photo Point 56 – view upstream *(5/26/2021)*	**Carroll Creek Photo Point 56** – view downstream *(5/26/2021)*

STREAM PHOTOGRAPHS

Big Harris Creek - Area B
Monitoring Year 4

	
USEC R1 Photo Point 57 – view upstream (5*/27/2021)*	**USEC R1 Photo Point 57** – view downstream (5*/27/2021)*
	
USEC R2 Photo Point 58 – view upstream *(5/27/2021)*	**USEC R2 Photo Point 58** – view downstream *(5/27/2021)*
	
USEC R2 Photo Point 59 – view upstream *(5/27/2021)*	**USEC R2 Photo Point 59** – view downstream *(5/27/2021)*

	
USEC R3 Photo Point 60 – view upstream *(5/27/2021)*	**USEC R3 Photo Point 60** – view downstream *(5/27/2021)*
	
USEC R3 Photo Point 61 – view upstream (5*/27/2021)*	**USEC R3 Photo Point 61** – view downstream (5*/27/2021)*
	
USEC R3 Photo Point 62 – view upstream (5*/27/2021)*	**USEC R3 Photo Point 62** – view downstream (5*/27/2021)*

	
USEC R4A Photo Point 63 – view upstream *(5/26/2021)*	**USEC R4A Photo Point 63** – view downstream *(5/26/2021)*
	
USEC R4B Photo Point 64 – view upstream *(5/26/2021)*	**USEC R4B Photo Point 64** – view downstream *(5/26/2021)*
	
USEC R5 Photo Point 65 – view upstream *(5/26/2021)*	**USEC R5 Photo Point 65** – view downstream *(5/26/2021)*

	
USEC R5 Photo Point 66 – view upstream *(5/26/2021)*	**USEC R5 Photo Point 66** – view downstream *(5/26/2021)*
	
USEC R5 Photo Point 67 – view upstream *(5/26/2021)*	**USEC R5 Photo Point 67** – view downstream *(5/26/2021)*
	
USEC R5 Photo Point 68 – view upstream *(5/26/2021)*	**USEC R5 Photo Point 68** – view downstream *(5/26/2021)*

	
USEC R5 Photo Point 69 – view upstream *(5/26/2021)*	**USEC R5 Photo Point 69** – view downstream *(5/26/2021)*
	
USEC R6 Photo Point 70 – view upstream *(5/26/2021)*	**USEC R6 Photo Point 70** – view downstream *(5/26/2021)*
	
USEC R6 Photo Point 71 – view upstream *(5/26/2021)*	**USEC R6 Photo Point 71** – view downstream *(5/26/2021)*

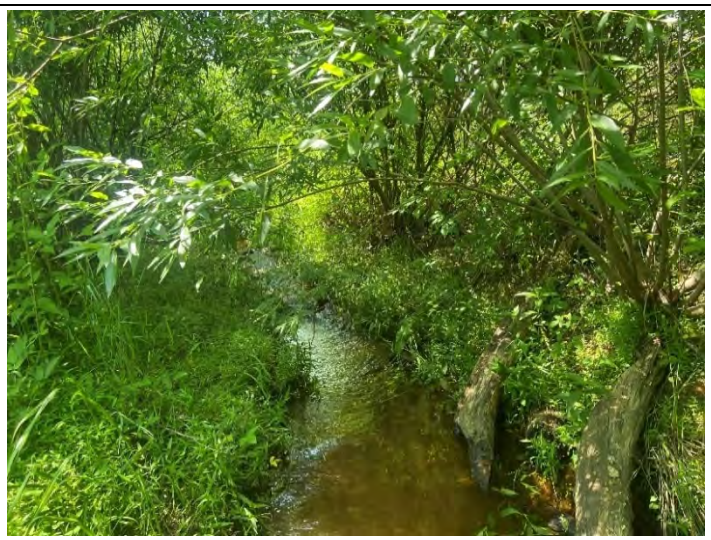
	
USEC R6 Photo Point 72 – view upstream *(5/26/2021)*	**USEC R6 Photo Point 72** – view downstream *(5/26/2021)*
	
USEC R6 Photo Point 73 – view upstream *(5/26/2021)*	**USEC R6 Photo Point 73** – view downstream *(5/26/2021)*
	
USEC UT1 Photo Point 74 – view upstream (5*/27/2021)*	**USEC UT1 Photo Point 74** – view downstream *(5/27/2021)*

	
Elliott Creek Photo Point 75 – view upstream (5*/27/2021)*	**Elliott Creek Photo Point 75** – view downstream (5*/27/2021)*
	
Elliott Creek Photo Point 76 – view upstream (5*/27/2021)*	**Elliott Creek Photo Point 76** – view downstream (5*/27/2021)*
	
Elliott Creek Photo Point 77 – view upstream *(5/27/2021)*	**Elliott Creek Photo Point 77** – view downstream *(5/27/2021)*

	
Elliott Creek Photo Point 78 – view upstream *(5/27/2021)*	**Elliott Creek Photo Point 78** – view downstream *(5/27/2021)*
	
Elliott Creek UT1 Photo Point 79 – view upstream (5*/27/2021)*	**Elliott Creek UT1 Photo Point 79** – view downstream (5*/27/2021)*
	
Bridges Creek R1 Photo Point 80 – view upstream (5*/27/2021)*	**Bridges Creek R1 Photo Point 80** – view downstream (5*/27/2021)*

	
Bridges Creek R2 Photo Point 81 – view upstream (5*/27/2021)*	**Bridges Creek R2 Photo Point 81** – view downstream (5*/27/2021)*
	
Bridges Creek UT1 Photo Point 82 – view upstream (5*/27/2021)*	**Bridges Crk UT1 Photo Point 82** – view downstream (5*/27/2021)*
	
USEC UT2 Photo Point 83 – view upstream *(5/26/2021)*	**USEC UT2 Photo Point 83** – view downstream *(5/26/2021)*

	
USEC UT3 Photo Point 84 – view upstream *(5/26/2021)*	**USEC UT3 Photo Point 84** – view downstream *(5/26/2021)*
	
UFC R1 Photo Point 85 – view upstream *(5/27/2021)*	**UFC R1 Photo Point 85** – view downstream *(5/27/2021)*
	
UFC R1 Photo Point 86 – view upstream *(5/27/2021)*	**UFC R1 Photo Point 86** – view downstream *(5/27/2021)*

	
UFC R1 Photo Point 87 – view upstream *(5/27/2021)*	**UFC R1 Photo Point 87** – view downstream *(5/27/2021)*
	
UFC R2 Photo Point 88 – view upstream *(5/27/2021)*	**UFC R2 Photo Point 88** – view downstream *(5/27/2021)*
	
UFC R2 Photo Point 89 – view upstream *(5/27/2021)*	**UFC R2 Photo Point 89** – view downstream *(5/27/2021)*

	
UFC R2 Photo Point 90 – view upstream *(5/27/2021)*	**UFC R2 Photo Point 90** – view downstream *(5/27/2021)*
	
UFC R2 Photo Point 91 – view upstream *(5/27/2021)*	**UFC R2 Photo Point 91** – view downstream *(5/27/2021)*
	
UFC R2 Photo Point 92 – view upstream *(5/27/2021)*	**UFC R2 Photo Point 92** – view downstream *(5/27/2021)*

	
LFC R1 Photo Point 93 – view upstream *(5/26/2021)*	**LFC R1 Photo Point 93** – view downstream *(5/26/2021)*
	
LFC R1 Photo Point 94 – view upstream *(5/26/2021)*	**LFC R1 Photo Point 94** – view downstream *(5/26/2021)*
	
LFC R2 Photo Point 95 – view upstream *(5/26/2021)*	**LFC R2 Photo Point 95** – view downstream *(5/26/2021)*

STREAM PHOTOGRAPHS

Big Harris Creek - Area C
Monitoring Year 4

	
LBHC R1A Photo Point 96 – view upstream *(5/26/2021)*	**LBHC R1A Photo Point 96** – view downstream *(5/26/2021)*
	
LBHC R1A Photo Point 97 – view upstream *(5/26/2021)*	**LBHC R1A Photo Point 97** – view downstream *(5/26/2021)*
	
LBHC R1B Photo Point 98 – view upstream *(5/26/2021)*	**LBHC R1B Photo Point 98** – view downstream *(5/26/2021)*

	
LBHC R2 Photo Point 99 – view upstream *(5/26/2021)*	**LBHC R2 Photo Point 99** – view downstream *(5/26/2021)*
	
LBHC R2 Photo Point 100 – view upstream *(5/26/2021)*	**LBHC R2 Photo Point 100** – view downstream *(5/26/2021)*
	
LBHC R2 Photo Point 101 – view upstream *(5/26/2021)*	**LBHC R2 Photo Point 101** – view downstream *(5/26/2021)*

	
LBHC R3 Photo Point 102 – view upstream *(5/26/2021)*	**LBHC R3 Photo Point 102** – view downstream *(5/26/2021)*
	
LBHC R3 Photo Point 103 – view upstream *(5/26/2021)*	**LBHC R3 Photo Point 103** – view downstream *(5/26/2021)*
	
LBHC UT1 Photo Point 104 – view upstream *(5/26/2021)*	**LBHC UT1 Photo Point 104** – view downstream *(5/26/2021)*

	
LBHC UT2 Photo Point 105 – view upstream *(5/26/2021)*	**LBHC UT2 Photo Point 105** – view downstream *(5/26/2021)*
	
LBHC UT3 Photo Point 106 – view upstream *(5/26/2021)*	**LBHC UT3 Photo Point 106** – view downstream *(5/26/2021)*
	
LBHC UT4 Photo Point 107 – view upstream *(5/26/2021)*	**LBHC UT4 Photo Point 107** – view downstream *(5/26/2021)*

VEGETATION PHOTOGRAPHS

Monitoring Year 4

Vegetation Plot 1 *(08/19/2021)*

Vegetation Plot 2 *(08/19/2021)*

Vegetation Plot 3 *(08/19/2021)*

Vegetation Plot 4 *(08/20/2021)*

Vegetation Plot 5 *(08/19/2021)*

Vegetation Plot 6 *(08/24/2021)*

Vegetation Plot 7 *(08/24/2021)*

Vegetation Plot 8 *(08/24/2021)*

Vegetation Plot 9 *(08/24/2021)*

Vegetation Plot 10 *(08/31/2021)*

Vegetation Plot 11 *(08/31/2021)*

Vegetation Plot 12 *(08/31/2021)*

Vegetation Plot 13 *(08/31/2021)*

Vegetation Plot 14 *(08/25/2021)*

Vegetation Plot 15 *(08/25/2021)*

Vegetation Plot 16 *(08/31/2021)*

Vegetation Plot 17 *(08/31/2021)*

Vegetation Plot 18 *(08/20/2021)*

Vegetation Plot 19 *(08/20/2021)*

Vegetation Plot 20 *(08/20/2021)*

Vegetation Plot 21 *(08/20/2021)*

Vegetation Plot 22 *(08/19/2021)*

Vegetation Plot 23 *(08/19/2021)*

Vegetation Plot 24 *(08/31/2021)*

Vegetation Plot 25 *(08/31/2021)*

Vegetation Plot 26 *(08/31/2021)*

Vegetation Plot 27 *(09/01/2021)*

Vegetation Plot 28 *(09/01/2021)*

Vegetation Plot 29 *(09/01/2021)*

Vegetation Plot 30 *(08/31/2021)*

Vegetation Plot 31 *(8/25/2021)*

Vegetation Plot 32 *(08/25/2021)*

Vegetation Plot 33 *(08/25/2021)*

Vegetation Plot 34 *(08/31/2021)*

Vegetation Plot 35 *(09/01/2021)*

Vegetation Plot 36 *(09/01/2021)*

Vegetation Plot 37 *(09/01/2021)*

Vegetation Plot 38 *(09/01/2021)*

Vegetation Plot 39 *(08/31/2021)*

Vegetation Plot 40 *(8/23/2021)*

Vegetation Plot 41 *(08/23/2021)*

Vegetation Plot 42 *(08/19/2021)*

Vegetation Plot 43 *(08/23/2021)*

Vegetation Plot 44 *(08/23/2021)*

Vegetation Plot 45 *(08/24/2021)*

Vegetation Plot 46 *(08/24/2021)*

Vegetation Plot 47 *(08/24/2021)*

Vegetation Plot 48 *(08/24/2021)*

Vegetation Plot 49 *(8/23/2021)*

Vegetation Plot 50 *(8/23/2021)*

Vegetation Plot 51 *(08/23/2021)*

Vegetation Plot 52 *(08/23/2021)*

Vegetation Plot 53 *(08/25/2021)*

Vegetation Plot 54 *(08/25/2021)*

	
Vegetation Plot 55 *(08/25/2021)*	**Vegetation Plot 56** *(08/25/2021)*

AREAS OF CONCERN PHOTOGRAPHS

Monitoring Year 4

Elliott Creek Bank Scour (STA 141+30) – view downstream *(11/5/2021)*

Scott Creek Channel Incision (STA 1211+25 – 1211+36) – view upstream *(10/27/2021)*

Royster Creek R1 Rock Sill Failed (STA 806+74) – view upstream (11/3/2021)

LBHC R1A Easement Encroachment (Mowing) (11/2/2021)

Royster Creek Reach 2 Chinese Privet (11/3/2021)

LBHC R1A Kudzu (10/27/2020)

APPENDIX 3. Vegetation Plot Data

Table 8. Vegetation Plot Criteria Attainment Table
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Plot	MY5 Success Criteria Met (Y/N)	Tract Mean
1	Y	88%
2	Y	
3	Y	
4	Y	
5	Y	
6	Y	
7	Y	
8	Y	
9	Y	
10	Y	
11	Y	
12	N	
13	Y	
14	Y	
15	Y	
16	Y	
17	Y	
18	Y	
19	Y	
20	Y	
21	Y	
22	Y	
23	Y	
24	Y	
25	N	
26	Y	
27	N	
28	Y	
29	N	
30	Y	
31	N	
32	Y	
33	Y	
34	Y	
35	Y	
36	Y	
37	Y	
38	Y	
39	Y	
40	Y	
41	Y	
42	N	
43	Y	
44	Y	
45	Y	
46	Y	
47	Y	
48	Y	
49	Y	
50	Y	
51	N	
52	Y	
53	Y	
54	Y	
55	Y	
56	Y	

Table 9. CVS Vegetation Tables - Metadata
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Report Prepared By	Ian Eckardt
Date Prepared	2/4/2022 15:16
Database Name	BHC MY4 cvs-eep-entrytool-v2.5.0.mdb
Database Location	Q:\ActiveProjects\005-02149 Big Harris Creek\Monitoring\Monitoring Year 4 (2021)\Vegetation Assessment
Computer Name	IAN
File Size	96366592
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and Spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	739
Project Name	Big Harris Creek Mitigation Site
Sampled Plots	56

Table 10a. Planted and Total Stems
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

			Current Plot Data (MY4 2021) - Area A																				
			Vegetation Plot 1			Vegetation Plot 2			Vegetation Plot 3			Vegetation Plot 4			Vegetation Plot 5			Vegetation Plot 6			Vegetation Plot 7		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder maple	Tree																		2			
Acer rubrum	Red maple	Tree	3	3	3	1	1	2	3	3	3	3	3	4	4	4	4	2	2	2	2	2	2
Alnus incana	Grey alder	Shrub Tree																					
Betula nigra	River birch	Tree							1	1	1	1	1	1	2	2	2	1	1	1	1	1	1
Diospyros virginiana	American Persimmon	Tree																1	1	2			5
Fagus	Beech	Tree																					
Fraxinus pennsylvanica	Green ash	Tree	2	2	2	1	1	1	4	4	4	2	2	2	3	3	3	5	5	5	1	1	1
Ilex opaca	American Holly	Shrub Tree																					
Juglans nigra	Black Walnut	Tree																					
Ligustrum sinense	Chinese Privet	Shrub Tree																					
Liquidambar styraiflua	Sweet Gum	Tree			100			200			30			60			35			80			7
Liriodendron tulipifera	Tulip Poplar	Tree			40			10			25						15			6			
Nyssa sylvatica	Blackgum	Tree	1	1	1				2	2	2	2	2	2				1	1	1	2	2	2
Pinus rigida	Pitch pine	Tree																					
Pinus taeda	Loblolly pine	Tree									15			20			30						
Pinus Virginiana	Virginia Pine	Tree																					
Platanus occidentalis	American sycamore	Tree	4	4	4	5	5	5	1	1	1	2	2	2	5	5	5				4	4	4
Quercus sp.	Oak	Tree																					
Quercus alba	White Oak	Tree																					
Quercus falcata	Spanish Oak	Tree																					
Quercus nigra	Water Oak	Tree																					
Quercus pagoda	Cherrybark oak	Tree	1	1	1							1	1	1				1	1	1			
Quercus phellos	Willow oak	Tree							1	1	1												
Quercus rubra	Red oak	Tree	1	1	1				2	2	2												
Rhus copallinum	Shining sumac	Shrub Tree															3						
Rhus typhina	Staghorn Sumac	Shrub																					
Salix nigra	Black willow	Tree																					
Sambucus Canadensis	Common Elderberry	Shrub Tree			3									1									
		Stem count	12	12	155	7	7	218	14	14	84	11	11	93	14	14	97	11	11	100	10	10	22
		Size (ares)		1			1			1			1			1		1			1		
		Size (acres)		0.0247			0.0247			0.0247			0.0247			0.0247		0.0247			0.0247		
		Species count	6	6	9	3	3	5	7	7	10	6	6	9	4	4	8	6	6	9	5	5	7
		Stems per acre	486	486	6,275	283	283	8,826	567	567	3,401	445	445	3,765	567	567	3,927	445	445	4,049	405	405	891

			Current Plot Data (MY4 2021) - Area A																				
			Vegetation Plot 8			Vegetation Plot 9			Vegetation Plot 10			Vegetation Plot 11			Vegetation Plot 12			Vegetation Plot 13			Vegetation Plot 14		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder maple	Tree																					
Acer rubrum	Red maple	Tree	3	3	33	3	3	6	5	5	5	3	3	3	1	1	1	3	3	3	2	2	2
Alnus incana	Grey alder	Shrub Tree																					
Betula nigra	River birch	Tree	1	1	1																1	1	1
Diospyros virginiana	American Persimmon	Tree									4												
Fagus	Beech	Tree																					
Fraxinus pennsylvanica	Green ash	Tree	5	5	5	4	4	4	3	3	3	4	4	4	1	1	1	2	2	2	3	3	3
Ilex opaca	American Holly	Shrub Tree																					
Juglans nigra	Black Walnut	Tree																					
Ligustrum sinense	Chinese Privet	Shrub Tree																					
Liquidambar styraiflua	Sweet Gum	Tree			55												4						80
Liriodendron tulipifera	Tulip Poplar	Tree			50			10												3			4
Nyssa sylvatica	Blackgum	Tree				1	1	1										1	1	1	1	1	1
Pinus rigida	Pitch pine	Tree																					
Pinus taeda	Loblolly pine	Tree																					
Pinus Virginiana	Virginia Pine	Tree																					
Platanus occidentalis	American sycamore	Tree	4	4	4	7	7	7	5	5	5	5	5	5	1	1	1				5	5	5
Quercus sp.	Oak	Tree																					
Quercus alba	White Oak	Tree																					
Quercus falcata	Spanish Oak	Tree																					
Quercus nigra	Water Oak	Tree																					
Quercus pagoda	Cherrybark oak	Tree	1	1	1				1	1	1										1	1	1
Quercus phellos	Willow oak	Tree																1	1	1	1	1	1
Quercus rubra	Red oak	Tree										1	1	1				2	2	2			
Rhus copallinum	Shining sumac	Shrub Tree																					
Rhus typhina	Staghorn Sumac	Shrub																					
Salix nigra	Black willow	Tree																					
Sambucus Canadensis	Common Elderberry	Shrub Tree																					
		Stem count	14	14	149	15	15	28	14	14	18	13	13	13	3	3	7	9	9	12	14	14	98
		Size (ares)		1			1			1			1			1		1			1		
		Size (acres)		0.0247			0.0247			0.0247			0.0247			0.0247		0.0247			0.0247		
		Species count	5	5	7	4	4	5	4	4	5	4	4	4	3	3	4	5	5	6	7	7	9
		Stems per acre	567	567	6,032	607	607	1,134	567	567	729	526	526	526	121	121	283	364	364	486	567	567	3,968

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteers included

PnoLS: Number of planted stems excluding live stakes
P-All: Number of planted stems including live stakes
T: Total stems

Table 10b. Planted and Total Stems
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

			Current Plot Data (MY4 2021) - Area A																				
			Vegetation Plot 15			Vegetation Plot 16			Vegetation Plot 17			Vegetation Plot 18			Vegetation Plot 19			Vegetation Plot 20			Vegetation Plot 21		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder maple	Tree																					
Acer rubrum	Red maple	Tree	1	1	4	1	1	1	2	2	152				3	3	3	1	1	1	1	1	1
Alnus incana	Grey alder	Shrub Tree																					
Betula nigra	River birch	Tree	1	1	1				1	1	71	2	2	2				1	1	1	2	2	2
Diospyros virginiana	American Persimmon	Tree												2	2	2	3						
Fagus	Beech	Tree																					
Fraxinus pennsylvanica	Green ash	Tree	2	2	2	6	6	6	3	3	3	6	6	6	1	1	2	2	2	32	1	1	1
Ilex opaca	American Holly	Shrub Tree																					
Juglans nigra	Black Walnut	Tree																					
Ligustrum sinense	Chinese Privet	Shrub Tree												10									
Liquidambar styraiflua	Sweet Gum	Tree						20			300												40
Liriodendron tulipifera	Tulip Poplar	Tree						3			100			40			2						2
Nyssa sylvatica	Blackgum	Tree							1	1	1										1	1	1
Pinus rigida	Pitch pine	Tree																					
Pinus taeda	Loblolly pine	Tree																					
Pinus Virginiana	Virginia Pine	Tree																					
Platanus occidentalis	American sycamore	Tree	1	1	1	4	4	4	3	3	3				3	3	3	5	5	5	2	2	3
Quercus sp.	Oak	Tree																					
Quercus alba	White Oak	Tree																					
Quercus falcata	Spanish Oak	Tree																					
Quercus nigra	Water Oak	Tree																					
Quercus pagoda	Cherrybark oak	Tree	2	2	2							1	1	1									
Quercus phellos	Willow oak	Tree										1	1	1							1	1	1
Quercus rubra	Red oak	Tree							1	1	1	1	1	1				1	1	1			
Rhus copallinum	Shining sumac	Shrub Tree																					
Rhus typhina	Staghorn Sumac	Shrub																					
Salix nigra	Black willow	Tree																					
Sambucus Canadensis	Common Elderberry	Shrub Tree																					
		Stem count	7	7	10	11	11	34	11	11	631	11	11	63	9	9	13	10	10	40	8	8	51
		Size (ares)		1			1			1			1			1			1			1	
		Size (acres)		0.0247			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247	
		Species count	5	5	5	3	3	5	6	6	8	5	5	8	4	4	5	5	5	5	6	6	8
		Stems per acre	283	283	405	445	445	1,377	445	445	25,547	445	445	2,551	364	364	526	405	405	1,619	324	324	2,065

			Current Plot Data (MY4 2021) - Area A																				
			Vegetation Plot 22			Vegetation Plot 23			Vegetation Plot 24			Vegetation Plot 25			Vegetation Plot 26			Vegetation Plot 27			Vegetation Plot 28		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder maple	Tree									3									1			1
Acer rubrum	Red maple	Tree	3	3	3	5	5	5	2	2	2	1	1	1	1	1	1						
Alnus incana	Grey alder	Shrub Tree																					
Betula nigra	River birch	Tree				2	2	2										1	1	2	1	1	2
Diospyros virginiana	American Persimmon	Tree							3	3	8						10			1			
Fagus	Beech	Tree																					
Fraxinus pennsylvanica	Green ash	Tree	3	3	3	2	2	2	1	1	1	1	1	1	4	4	4	2	2	2	3	3	3
Ilex opaca	American Holly	Shrub Tree																					
Juglans nigra	Black Walnut	Tree									4												
Ligustrum sinense	Chinese Privet	Shrub Tree																					
Liquidambar styraiflua	Sweet Gum	Tree			2															2			
Liriodendron tulipifera	Tulip Poplar	Tree															2				1	1	1
Nyssa sylvatica	Blackgum	Tree							2	2	2												
Pinus rigida	Pitch pine	Tree																					
Pinus taeda	Loblolly pine	Tree																					
Pinus Virginiana	Virginia Pine	Tree																					
Platanus occidentalis	American sycamore	Tree	3	3	3	2	2	2				1	1	1	7	7	7				3	3	3
Quercus sp.	Oak	Tree																					
Quercus alba	White Oak	Tree																					
Quercus falcata	Spanish Oak	Tree																					
Quercus nigra	Water Oak	Tree																					
Quercus pagoda	Cherrybark oak	Tree				1	1	1	1	1	1	1	1	1				1	1	1			
Quercus phellos	Willow oak	Tree													1	1	1						
Quercus rubra	Red oak	Tree				1	1	1				1	1	1	1	1	1	2	2	2			
Rhus copallinum	Shining sumac	Shrub Tree																					
Rhus typhina	Staghorn Sumac	Shrub																					
Salix nigra	Black willow	Tree																					
Sambucus Canadensis	Common Elderberry	Shrub Tree																					
		Stem count	9	9	11	13	13	13	9	9	21	5	5	5	14	14	26	6	6	11	8	8	10
		Size (ares)		1			1			1			1			1			1			1	
		Size (acres)		0.0247			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247	
		Species count	3	3	4	6	6	6	5	5	7	5	5	5	5	5	7	4	4	7	4	4	5
		Stems per acres	364	364	445	526	526	526	364	364	850	202	202	202	567	567	1,053	243	243	445	324	324	405

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteers included

PnoLS: Number of planted stems excluding live stakes
P-All: Number of planted stems including live stakes
T: Total stems

Table 10c. Planted and Total Stems
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

			Current Plot Data (MY4 2021) - Area A																	
			Vegetation Plot 29			Vegetation Plot 30			Vegetation Plot 31			Vegetation Plot 32			Vegetation Plot 33			Vegetation Plot 34		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder maple	Tree																		
Acer rubrum	Red maple	Tree				3	3	3				1	1	1	3	3	3	1	1	1
Alnus incana	Grey alder	Shrub Tree																		
Betula nigra	River birch	Tree										1	1	1						
Diospyros virginiana	American Persimmon	Tree																		1
Fagus	Beech	Tree																		
Fraxinus pennsylvanica	Green ash	Tree			1	3	3	3	2	2	2	2	2	5	3	3	3	2	2	3
Ilex opaca	American Holly	Shrub Tree																		
Juglans nigra	Black Walnut	Tree																		
Ligustrum sinense	Chinese Privet	Shrub Tree																		
Liquidambar styraiflua	Sweet Gum	Tree												50			90			
Liriodendron tulipifera	Tulip Poplar	Tree												4			10			3
Nyssa sylvatica	Blackgum	Tree										2	2	2				2	2	2
Pinus rigida	Pitch pine	Tree																		
Pinus taeda	Loblolly pine	Tree																		1
Pinus Virginiana	Virginia Pine	Tree																		
Platanus occidentalis	American sycamore	Tree	2	2	2	5	5	5				3	3	3	2	2	2	2	2	6
Quercus sp.	Oak	Tree																		
Quercus alba	White Oak	Tree																		
Quercus falcata	Spanish Oak	Tree																		
Quercus nigra	Water Oak	Tree																		
Quercus pagoda	Cherrybark oak	Tree				1	1	1				1	1	1	1	1	1	1	1	1
Quercus phellos	Willow oak	Tree	1	1	1							1	1	1						
Quercus rubra	Red oak	Tree	1	1	1				1	1	1	1	1	1	1	1	1	2	2	2
Rhus copallinum	Shining sumac	Shrub Tree																		
Rhus typhina	Staghorn Sumac	Shrub																		
Salix nigra	Black willow	Tree																		
Sambucus canadensis	Common Elderberry	Shrub Tree																		
		Stem count	4	4	5	12	12	12	3	3	3	12	12	69	10	10	110	10	10	20
		Size (ares)		1			1			1			1			1			1	
		Size (acres)		0.0247			0.0247			0.0247			0.0247			0.0247			0.0247	
		Species count	3	3	4	4	4	4	2	2	2	8	8	10	5	5	7	6	6	9
		Stems per acre	162	162	202	486	486	486	121	121	121	486	486	2,794	405	405	4,453	405	405	810

			Current Plot Data (MY4 2021) - Area B																			
			Vegetation Plot 35			Vegetation Plot 36			Vegetation Plot 37			Vegetation Plot 38			Vegetation Plot 39			Vegetation Plot 40			Vegetation Plot 41		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder maple	Tree																				
Acer rubrum	Red maple	Tree				1	1	1	1	1	4	2	2	2	3	3	6	1	1	1	4	4	4
Alnus incana	Grey alder	Shrub Tree																				
Betula nigra	River birch	Tree	2	2	2				1	1	1	1	1	1								
Diospyros virginiana	American Persimmon	Tree									1											
Fagus	Beech	Tree																				
Fraxinus pennsylvanica	Green ash	Tree	1	1	2	3	3	5	3	3	3	5	5	8	3	3	5	2	2	2	4	4	4
Ilex opaca	American Holly	Shrub Tree																				
Juglans nigra	Black Walnut	Tree																				
Ligustrum sinense	Chinese Privet	Shrub Tree																				
Liquidambar styraiflua	Sweet Gum	Tree																				450
Liriodendron tulipifera	Tulip Poplar	Tree			3									6								14
Nyssa sylvatica	Blackgum	Tree	3	3	3													1	1	1	2	2	2
Pinus rigida	Pitch pine	Tree																				
Pinus taeda	Loblolly pine	Tree									1						2					
Pinus Virginiana	Virginia Pine	Tree																				
Platanus occidentalis	American sycamore	Tree	3	3	3	4	4	4	3	3	3	5	5	5	5	5	5	6	6	6	1	1	1
Quercus sp.	Oak	Tree																				
Quercus alba	White Oak	Tree									1											
Quercus falcata	Spanish Oak	Tree																				
Quercus nigra	Water Oak	Tree																				
Quercus pagoda	Cherrybark oak	Tree							1	1	1				2	2	2	1	1	1			
Quercus phellos	Willow oak	Tree										1	1	1							2	2	2
Quercus rubra	Red oak	Tree	3	3	3										1	1	1				1	1	1
Rhus copallinum	Shining sumac	Shrub Tree																				
Rhus typhina	Staghorn Sumac	Shrub																				
Salix nigra	Black willow	Tree																				
Sambucus canadensis	Common Elderberry	Shrub Tree																				
		Stem count	12	12	16	8	8	10	9	9	15	14	14	23	14	14	21	11	11	11	14	14	478
		Size (ares)		1			1			1			1			1			1			1	
		Size (acres)		0.0247			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247	
		Species count	5	5	6	3	3	3	5	5	8	5	5	6	5	5	6	5	5	5	6	6	8
		Stems per acre	486	486	648	324	324	405	364	364	607	567	567	931	567	567	850	445	445	445	567	567	19,352

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteers included

PnoLS: Number of planted stems excluding live stakes
P-All: Number of planted stems including live stakes
T: Total stems

Table 10d. Planted and Total Stems
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

			Current Plot Data (MY4 2021) - Area B																				
			Vegetation Plot 42			Vegetation Plot 43			Vegetation Plot 44			Vegetation Plot 45			Vegetation Plot 46			Vegetation Plot 47			Vegetation Plot 48		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder maple	Tree	1	1	1																		
Acer rubrum	Red maple	Tree	1	1	1				2	2	2	1	1	6	2	2	12	3	3	3	3	3	23
Alnus incana	Grey alder	Shrub Tree																					
Betula nigra	River birch	Tree				2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1
Diospyros virginiana	American Persimmon	Tree												6						4			
Fagus	Beech	Tree																					
Fraxinus pennsylvanica	Green ash	Tree	2	2	2	4	4	4	2	2	2	2	2	2	6	6	6	3	3	3	3	3	3
Ilex opaca	American Holly	Shrub Tree																					
Juglans nigra	Black Walnut	Tree																					
Ligustrum sinense	Chinese Privet	Shrub Tree																					
Liquidambar styraiflua	Sweet Gum	Tree			5			35			55			15			15			2			
Liriodendron tulipifera	Tulip Poplar	Tree			60			15			25			15						15			27
Nyssa sylvatica	Blackgum	Tree			1				1	1	1	1	1	1	1	1	1						
Pinus rigida	Pitch pine	Tree																					
Pinus taeda	Loblolly pine	Tree																					
Pinus Virginiana	Virginia Pine	Tree																					
Platanus occidentalis	American sycamore	Tree	1	1	1	2	2	2	4	4	11	5	5	5	4	4	4	6	6	6	3	3	3
Quercus sp.	Oak	Tree																					
Quercus alba	White Oak	Tree			4																		
Quercus falcata	Spanish Oak	Tree																					
Quercus nigra	Water Oak	Tree																					
Quercus pagoda	Cherrybark oak	Tree	1	1	1				1	1	1	1	1	1	1	1	1				2	2	2
Quercus phellos	Willow oak	Tree													1	1	1						
Quercus rubra	Red oak	Tree				1	1	1	2	2	2										1	1	1
Rhus copallinum	Shining sumac	Shrub Tree																					
Rhus typhina	Staghorn Sumac	Shrub																					
Salix nigra	Black willow	Tree															6						
Sambucus canadensis	Common Elderberry	Shrub Tree																					
		Stem count	6	6	76	9	9	59	14	14	101	12	12	53	17	17	48	13	13	34	13	13	60
		Size (ares)		1			1			1			1			1			1			1	
		Size (acres)		0.0247			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247	
		Species count	5	5	9	4	4	6	7	7	9	6	6	9	7	7	9	4	4	7	6	6	7
		Stems per acre	243	243	3,077	364	364	2,389	567	567	4,089	486	486	2,146	688	688	1,943	526	526	1,377	526	526	2,429

			Current Plot Data (MY4 2021) - Area B											
			Vegetation Plot 49			Vegetation Plot 50			Vegetation Plot 51			Vegetation Plot 52		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder maple	Tree												
Acer rubrum	Red maple	Tree	1	1	1				1	1	1			
Alnus incana	Grey alder	Shrub Tree									1			
Betula nigra	River birch	Tree	3	3	3							2	2	2
Diospyros virginiana	American Persimmon	Tree				1	1	1	1	1	1			1
Fagus	Beech	Tree												
Fraxinus pennsylvanica	Green ash	Tree	2	2	2	4	4	4	1	1	1	5	5	5
Ilex opaca	American Holly	Shrub Tree												
Juglans nigra	Black Walnut	Tree			1									
Ligustrum sinense	Chinese Privet	Shrub Tree						3			10			
Liquidambar styraiflua	Sweet Gum	Tree			5						38			25
Liriodendron tulipifera	Tulip Poplar	Tree			10	1	1	11			5			13
Nyssa sylvatica	Blackgum	Tree	1	1	1									
Pinus rigida	Pitch pine	Tree												
Pinus taeda	Loblolly pine	Tree												
Pinus Virginiana	Virginia Pine	Tree												
Platanus occidentalis	American sycamore	Tree	2	2	3							4	4	4
Quercus sp.	Oak	Tree												
Quercus alba	White Oak	Tree												
Quercus falcata	Spanish Oak	Tree												
Quercus nigra	Water Oak	Tree												
Quercus pagoda	Cherrybark oak	Tree	1	1	1	2	2	2				1	1	1
Quercus phellos	Willow oak	Tree												
Quercus rubra	Red oak	Tree	1	1	1							1	1	1
Rhus copallinum	Shining sumac	Shrub Tree												
Rhus typhina	Staghorn Sumac	Shrub												
Salix nigra	Black willow	Tree												
Sambucus canadensis	Common Elderberry	Shrub Tree												
		Stem count	11	11	28	8	8	21	3	3	57	13	13	52
		Size (ares)		1			1			1			1	
		Size (acres)		0.0247			0.0247			0.0247			0.0247	
		Species count	7	7	10	4	4	5	3	3	7	5	5	8
		Stems per acre	445	445	1,134	324	324	850	121	121	2,308	526	526	2,105

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteers included

PnoLS: Number of planted stems excluding live stakes
P-All: Number of planted stems including live stakes
T: Total stems

Table 10e. Planted and Total Stems
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

			Current Plot Data (MY4 2021) - Area C												Annual Summaries													
			Vegetation Plot 53			Vegetation Plot 54			Vegetation Plot 55			Vegetation Plot 56			MY4 (2021)			MY3 (2020)			MY2 (2019)			MY1 (9/2018 thru 11/2018)			MY0 (3/2018 thru 5/2018)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	Boxelder maple	Tree													1	1	7			3			6						
Acer rubrum	Red maple	Tree							3	3	3	3	3	3	99	99	328	95	95	200	108	108	307	143	143	432	171	171	171
Alnus incana	Grey alder	Shrub Tree															1												
Betula nigra	River birch	Tree	2	2	2	1	1	1	4	4	4			1	46	46	119	47	47	83	52	52	89	61	61	62	99	99	99
Diospyros virginiana	American Persimmon	Tree													8	8	50	1	1	38			50			11			
Fagus	Beech	Tree																								1			
Fraxinus pennsylvanica	Green ash	Tree	4	4	4				3	3	3	2	2	2	153	153	197	153	153	213	153	153	186	159	159	160	167	167	167
Ilex opaca	American Holly	Shrub Tree																								1			
Juglans nigra	Black Walnut	Tree															5						1						
Ligustrum sinense	Chinese Privet	Shrub Tree															23												
Liquidambar styraiflua	Sweet Gum	Tree			3			100			95			50			2048			1732			2045			456			
Liriodendron tulipifera	Tulip Poplar	Tree			6									5	2	2	560			899			762			366			
Nyssa sylvatica	Blackgum	Tree				1	1	1				1	1	1	31	31	32	31	31	32	38	38	49	48	48	48	59	59	60
Pinus rigida	Pitch pine	Tree																		65									
Pinus taeda	Loblolly pine	Tree															69												
Pinus Virginiana	Virginia Pine	Tree																					23						
Platanus occidentalis	American sycamore	Tree	3	3	23	4	4	4	3	3	73	2	2	17	166	166	284	169	169	418	175	175	716	186	186	265	212	212	212
Quercus sp.	Oak	Tree	1	1	1										1	1	1	2	2	2	2	2	2	4	4	4	3	3	3
Quercus alba	White Oak	Tree															5									2			
Quercus falcata	Spanish Oak	Tree																					1						
Quercus nigra	Water Oak	Tree																											
Quercus pagoda	Cherrybark oak	Tree	2	2	2				2	2	2	1	1	1	36	36	36	39	39	43	39	39	39	49	49	49	55	55	55
Quercus phellos	Willow oak	Tree				3	3	3							15	15	15	18	18	19	17	17	17	25	25	28	46	46	46
Quercus rubra	Red oak	Tree										1	1	1	32	32	32	35	35	35	37	37	43	51	51	51	57	57	57
Rhus copallinum	Shining sumac	Shrub Tree															3						2						
Rhus typhina	Staghorn Sumac	Shrub																					3						
Salix nigra	Black willow	Tree												1			7			2									
Sambucus canadensis	Common Elderberry	Shrub Tree															4						1						
		Stem count	12	12	41	9	9	109	15	15	180	10	10	82	590	590	3,826	590	590	3784	621	621	4,342	726	726	1,936	869	869	870
		Size (ares)		1			1			1			1			56			56			56			56			56	
		Size (acres)		0.0247			0.0247			0.0247			0.0247			1.38			1.38			1.38			1.38			1.38	
		Species count	5	5	7	4	4	5	5	5	6	6	6	10	12	12	21	10	10	15	9	9	19	9	9	15	9	9	9
		Stems per acre	486	486	1,660	364	364	4,413	607	607	7,287	405	405	3,320	427	427	2,766	427	427	2,736	449	449	3,139	525	525	1,399	628	628	629

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteers included

PnoLS: Number of planted stems excluding live stakes
P-All: Number of planted stems including live stakes
T: Total stems

APPENDIX 4. Morphological Summary Data and Plots

Table 11a. Baseline Stream Data Summary
Area A
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area A

Parameter	Gage	Pre-Restoration Condition																Design												As-Built/Baseline											
		Carroll Creek Reach 1		Eaker Creek Reach 1		Royster Creek Reach 1		Scott Creek		UBHC Reach 2A		UBHC Reach 2B		UBHC Reach 4		Carroll Creek Reach 1		Royster Creek Reach 1		Scott Creek		UBHC Reach 2A		UBHC Reach 2B		UBHC Reach 4		Carroll Creek Reach 1		Eaker Creek Reach 1		Royster Creek Reach 1		Scott Creek		UBHC Reach 2A		UBHC Reach 2B		UBHC Reach 4	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																																									
Bankfull Width (ft)	N/A	9.4	10.8	3.5	3.6	3.6	6.1	4.4	10.3	7.0	8.2	11.3	12.0	18.7	26.8	10.40		8.30		6.50		10.20		12.80		13.80		11.4		N/A		10.0		6.8		16.0		11.3		15.5	16.0
Floodprone Width (ft)		13.1	14.2	6.7	7.1	6.0	7.0	5.2	12.4	9.5	10.0	15.5	16.5	22.0	34.6	---		---		---		---		---		---		82.0		N/A		46.7		67.1		108.7		170.3		118.0	190.0
Bankfull Mean Depth		0.9	1.4	0.5	0.5	0.6		0.3	0.6	0.7	0.8	0.9	1.0	0.8	1.1	0.8		0.6		0.5		0.8		1.0		1.0		0.7		N/A		0.4		0.5		0.7		1.6		0.8	1.1
Bankfull Max Depth		1.0	1.8	1.0	1.1	0.8	1.4	0.8	0.9	0.8	1.0	1.3	1.7	1.3	1.7	1.2		1.0		0.7		1.2		1.5		1.6		1.3		N/A		0.8		0.9		1.5		3.0		1.4	2.0
Bankfull Cross-sectional Area (ft^2)		11.4		1.9		3.7		2.9		5.6		11.3		20.4		8.2		5.3		3.1		7.9		12.5		14.4		7.9		N/A		3.6		3.6		11.6		17.7		13.1	17.6
Width/Depth Ratio		6.6	12.5	6.6	6.9	6.1	10.2	7.4	30.8	9.1	11.5	11.4	12.7	17.6	30.3	13.2		13.0		13.6		13.2		13.1		13.2		16.4		N/A		27.6		12.7		22.0		7.3		14.5	18.3
Entrenchment Ratio		1.2	1.5	1.9	2.0	1.2	1.5	1.2	1.4	1.2	1.4	1.3	1.5	1.1	1.8	2.2+		2.2+		1.4	2.2	2.2+		2.2+		2.2+		7.2		N/A		4.7		9.9		6.8		15.0		7.6	11.9
Bank Height Ratio		3.4	5.0	3.1	3.5	6.6	7.3	3.8	10.6	3.1	4.6	3.4	4.4	1.6	2.9	1.0	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0	1.2	1.0		N/A		1.0		1.0		1.0		1.0		1.0	1.0
D_{50} (mm)		---		---		---		---		---		---		---		N/A		N/A		N/A		N/A		N/A		N/A		51.00		N/A		43.50		51.60		44.20		83.80		46.20	85.60
Profile																																									
Riffle Length (ft)	N/A															---		---		---		---		---		---		14	65	10	19	7	42	22	47	11	40	8	39	19	56
Riffle Slope (ft/ft)																0.016	0.0500	0.033	0.0500	0.045	0.0530	0.016	0.0490	0.017	0.0500	0.017	0.0470	0.0084	0.0359	0.0093	0.0406	0.0068	0.0569	0.0164	0.0416	0.0006	0.0515	0.0215	0.0627	0.0119	0.0521
Pool Length (ft)																---		---		---		---		---		---		18	50	4	13	7	71	6	138	10	59	10	47	33	73
Pool Max Depth (ft)		---		---	---			0.9	1.2	2.2	2.2	1.9	1.9	2.9	3.2	1.3	2.4	1.1	2.0	1.0	1.7	1.2	2.3	1.5	2.9	1.6	3.1	1.9	2.8	1.3	2.1	1.6	2.5	1.9	5.2	1.9	3.3	2.6	3.4	2.4	3.8
Pool Spacing (ft)																17	73	13	58	8	42	23	66	29	83	30	110	45	67	20	22	38	70	17	69	29	75	21	79	62	125
Pool Volume (ft^3)																																									
Pattern																																									
Channel Beltwidth (ft)	N/A	---		---		---		---		---		---		---		31	47	25	37	7	26	26	51	28	64	41	69	26	45	N/A		9	18	25	45	13	31	20	35	19	67
Radius of Curvature (ft)		---		---		---		---		---		---		---		19	47	15	37	16	29	18	41	23	51	25	62	15	29	46	62	21	41	11	28	18	26	30	34	27	60
Rc:Bankfull Width (ft/ft)		---		---		---		---		---		---		---		1.8	4.5	1.8	4.5	2.5	4.5	1.8	4.0	1.8	4.0	1.8	4.5	1.3	2.5	N/A		2.1	4.1	1.6	4.1	1.1	1.6	2.7	3.0	1.7	3.8
Meander Length (ft)		---		---		---		---		---		---		---		31	104	25	83	20	52	36	97	45	122	48	193	89	139	N/A		95	125	30	59	74	102	108	125	122	178
Meander Width Ratio		---		---		---		---		---		---		---		3.0	4.5	3.0	4.5	3.0	8.0	3.5	9.5	3.5	9.5	3.5	14.0	2.2	3.9	N/A		0.9	1.8	3.7	6.6	0.8	1.9	1.8	3.1	1.2	4.2
Ri%/Ru%/P%/G%/S%	N/A																																								
SC%/Sa%/G%/C%/B%/Be%																																									
$D_{16}/D_{35}/D_{50}/D_{84}/D_{95}/D_{100}$		0.16/0.39/ 4.0/98.3/2		---		---		SC/0.19/2. 0/90.0/19		5.2/9.5/17/		---		SC/0.36/1. 0/129.8/61																0.28/2/10.2/5 9.6/		N/A		SC/2/11/71.7/ 98.3/256		0.21/24.23/39 .8/		0.66/2.37/16.6/79.2/146.7/362				0.3/6.69/29.8/ 87/ 202.4/512	
Reach Shear Stress (Competency) lb/ft^2		---		---		---		---		---		---		---		0.94		---		1.37		0.61		1.30		1.39		0.75		N/A		---		1.19		0.64		1.18		0.63	0.86
Max part size (mm) mobilized at bankfull																																									
Stream Power (Capacity) W/m^2																																									
Additional Reach Parameters																																									
Drainage Area (SM)	N/A	0.32		0.04		0.23		0.07		0.36		0.74		0.83		0.32		0.23		0.07		0.36		0.74		0.83		0.32		0.04		0.23		0.07		0.36		0.74		0.83	
Watershed Impervious Cover Estimate (%)		<10%														<10%												<10%													
Rosgen Classification		E4-G4c		A4		B4		A4		G4c		F4		F4		C4		B4		B4a		C4		C4		C4		C4		N/A		B/C4		B/C4		C4		C4		C4	
Bankfull Velocity (fps)		5.4		4.9		3.8		4.5		4.1		4.4		3.7		3.9		4.4		3.9		4.2		4.2		3.8		3.8		N/A		4.0		4.6		3.5		5.4		3.6	4.5
Bankfull Discharge (cfs)		30		9.5		14		9		32		47		53		32		23		12		33		53		55		30.3		N/A		14.5		16.5		41.2		94.9		47.2	78.4
Q-NFF regression (2-yr)		---		---		---		---		---		---		---																													
Q-USGS extrapolation (1.2-yr)		18.0		---		26.0		6.6		24.8		44.0		51.0																													
Q-Mannings		---		---		---	---	12	13	22	23	49	51	68																													
Valley Slope (ft/ft)		0.0150		N/A		0.0325		0.0444		0.0152		0.0163		0.0129		0.0150		0.0325		0.0444		0.0152		0.0163		0.0129		0.0150		N/A		0.0325		0.0444		0.0152		0.0163		0.0129	
Channel Thalweg Length (ft)		553		135		438		630		990				1,203		595		459		662		934				1,039		590		135		459		644		930				1,296	
Sinuosity		1.16		1.01		1.01		1.08		1.22		1.22		1.28		1.15		1.10		1.05	1.10	1.18		1.15		1.10		1.2		N/A		1.1		1.1		1.1				1.4	
Bankfull/Channel Slope (ft/ft)		0.0180		0.0482		0.0153		0.0405		0.0163		0.0186		0.0118		0.0131		0.0295		0.0411		0.0130		0.0140		0.0105		0.0171		0.0555		0.0395		0.0382		0.0146				0.0126	

SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 11b. Baseline Stream Data Summary
Area B - Pre-Restoration Condition
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area B

		Pre-Restoration Condition																					
Parameter	**Gage**	**Elliott Creek Reach 1**		**Elliott Creek UT1**		**Bridges Creek Reach 1**		**UT1 to Bridges Creek**		**Lower Fletcher Creek Reach 1**		**Lower Fletcher Creek Reach 2**		**Upper Stick Elliot Creek Reach 1**		**Upper Stick Elliott Creek Reach 5**		**Upper Stick Elliott Creek Reach 6**		**Upper Stick Elliott Creek UT2**		**Upper Stick Elliott Creek UT3**		**Upper Fletcher Creek Reach 2**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Shallow																									
Bankfull Width (ft)		7.7		3.4		2.9	5.3	3.4		16.4		9.2		4.9		15.2		15.7	24.7	4.4		4.2		9.2	
Floodprone Width (ft)		18.0		6.0		6.0	17.0	4.0		21.0		11.0		6.0		14.0		19.0	58.0	7.0		5.0		19.0	
Bankfull Mean Depth		0.5		0.4		0.4	1.0	0.2		0.8		1.0		0.4		1.2		0.7	1.2	0.7		0.8		1.1	
Bankfull Max Depth		0.9		0.2		0.7	1.2	0.3		1.1		1.3		0.6		1.7		1.5	1.7	0.9		1.1		1.7	
Bankfull Cross-sectional Area (ft^2)	N/A	4.0		3.9		3.8		0.6		12.4		9.1		1.9		18.4		18.4		2.9		3.6		10.3	
Width/Depth Ratio		14.9		26.3		3.0	9.8	18.6		21.6		9.2		12.3		12.6		13.5	34.4	6.8		5.0		8.3	
Entrenchment Ratio		2.3		1.1		2.2	4.7	1.2		1.3		1.2		1.3		1.5		1.2	2.3	1.6		1.3		2.0	
Bank Height Ratio		1.9		17.3		1.9	2.3	6.2		5.1		2.3		20.7		1.7		1.4	3.5	4.0		4.1		3.2	
D_{50} (mm)		---		---		---		---		---		---		---		---		---		---		---		---	
Profile																									
Riffle Length (ft)																									
Riffle Slope (ft/ft)		0.0179		0.0250		0.0208		0.0812		0.0204		0.0198		0.0320		0.0150		0.0175		0.0200		---		0.0270	0.0458
Pool Length (ft)	N/A																								
Pool Max Depth (ft)		1.0	1.4	0.5	0.5	1.2	1.5	0.5	0.5	1.1	1.4	1.3	1.7	1.3	2.0	1.7	2.1	0.8	1.0	1.0	1.2	1.3	1.4	2.2	
Pool Spacing (ft)		15.0	100.0	22.5	27.9	22.1	51.2	3.8	4.1	65.0	80.0	6.0	80.0	14.1	68.1	15.0	90.0	15.0	90.0	29.5	49.3	21.5	21.5	77.0	259.0
Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)		3	40	4	20	11	26	9	13	21	43	39	43	4	37	21	97	20	49	7	38	17	17	48	143
Radius of Curvature (ft)		7	74	5	23	6	25	6	25	53	98	100	130	2	23	11	76	15	69	12	26	21	33	10	90
Rc:Bankfull Width (ft/ft)	N/A	0.9	9.6	1.4	6.9	2.0	4.8	1.7	7.5	3.2	6.0	10.9	14.1	0.5	4.6	0.8	5.0	0.9	2.8	2.8	6.0	5.0	7.9	1.1	9.8
Meander Length (ft)		54	166	45	56	44	102	44	102	249	336	318	336	28	136	72	134	142	304	59	99	43	43	200	295
Meander Width Ratio		0.3	5.1	0.7	3.6	3.8	8.9	3.8	8.9	4.2	4.7	4.2	4.7	5.8	27.8	1.4	6.4	0.8	2.0	1.5	8.7	4.0	4.0	5.2	15.5
Substrate, Bed and Transport Parameters																									
Ri%/Ru%/P%/G%/S%																									
SC%/Sa%/G%/C%/B%/Be%																									
d16/d35/d50/d84/d95/d100	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Reach Shear Stress (Competency) lb/ft^2		---		---		---		---		---		---		---		---		---		---		---		---	
Max part size (mm) mobilized at bankfull																									
Stream Power (Capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)		0.13		0.02		0.07		0..01		0.41		0.42		0.05		0.72		0.76		0.07		0.10		0.42	
Watershed Impervious Cover Estimate (%)		<10%																							
Rosgen Classification		Incised C5		F4		Incised E4		F5b		F4		F4		F4		B4c		Incised C4 / F4		G4		G4		F4	
Bankfull Velocity (fps)		4.2		5.2		3.8		3.9		4.8		4.1		4.8		2.8		2.9		4.2		4.2		3.6	
Bankfull Discharge (cfs)		17		3		12		3		35		37		9		52		54		12		15		21	
Q-NFF regression (2-yr)		---		---		---		---		---		---		---		---		---		---		---		---	
Q-USGS extrapolation (1.2-yr)	N/A	11		2		7		1		144		162		---		43		45		7		9		21	
Q-Mannings		15		9		12		2.4		46		44		---		73		53		11		20		40	60
Valley Slope (ft/ft)		0.0179		0.0135		0.0208		0.0812		0.0125		0.0198		0.0638		0.0143		0.0087		0.0208		0.0353		0.0160	
Channel Thalweg Length (ft)		1,389		141		445		58		574		467		352		1,909		1,036		56		107		1,465	
Sinuosity		1.30		1.17		1.06		1.16		1.10		1.03		1.04		1.53		1.09		1.22		1.22		1.23	
Bankfull/Channel Slope (ft/ft)		0.0138		0.0113		0.0196		0.0700		0.0113		0.0192		0.0613		0.0093		0.0080		0.0200		0.0289		0.0130	

SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 11c. Baseline Stream Data Summary
Area B - Design Parameters
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area B

	Design																			
Parameter	**Elliott Creek Reach 1**		**Elliott Creek UT1**		**Bridges Creek Reach 1**		**UT1 to Bridges Creek**		**Lower Fletcher Creek Reach 1**		**Lower Fletcher Creek Reach 2**		**Upper Stick Elliott Creek Reach 5**		**Upper Stick Elliott Creek Reach 6**		**Upper Stick Elliott Creek UT2**		**Upper Stick Elliott Creek UT3**		**Upper Fletcher Creek Reach 2**	
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Shallow																						
Bankfull Width (ft)	7.5		4.9		6.9		4.9		11.8		12.4		16.0		16.0		6.7		7.2		10.5	
Floodprone Width (ft)	16.5	---	10.8	---	9.7	15.3	10.8	---	26.0	---	27.3	---	22.5	35.3	35.3	---	14.8	---	15.9	---	50.0	100.0
Bankfull Mean Depth	0.5		0.4		0.5		0.4		0.8		0.9		1.1		1.1		0.5		0.6		0.9	
Bankfull Max Depth	1.1	1.9	0.8	1.4	1.1	1.9	0.8	1.4	1.7	3.0	1.8	3.1	2.3	4.0	2.3	4.0	1.0	1.8	1.1	1.9	2.2+	
Bankfull Cross-sectional Area (ft^2)	4.0		2.0		3.7		2.0		10.0		11.0		18.4		18.4		3.5		4.0		9.0	
Width/Depth Ratio	14.0		12.0		13.0		12.0		14.0		14.0		14.0		14.0		13.0		13.0		12.2	
Entrenchment Ratio	2.2+		2.2+		1.4	2.2	2.2+		2.2+		2.2+		1.4	2.2	2.2+		2.2+		2.2+		4.8	9.5
Bank Height Ratio	1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
D_{50} (mm)	---		---		---		---		---		---		---		---		---		---		---	
Profile																						
Riffle Length (ft)	---		---		---		---		---		---		---		---		---		---		---	
Riffle Slope (ft/ft)	0.020	0.030	0.030	0.050	0.025	0.047	0.074	0.098	0.013	0.018	0.022	0.029	0.009	0.014	0.015	0.020	0.005	0.007	0.020	0.026	0.021	0.032
Pool Length (ft)	---		---		---		---		---		---		---		---		---		---		---	
Pool Max Depth (ft)	1.1	1.9	0.8	1.4	1.1	1.9	0.8	1.4	1.7	3.0	1.8	3.1	2.3	4.0	2.3	4.0	1.0	1.8	1.1	1.9	2.2+	
Pool Spacing (ft)	26	45	17	29	24	55	17	29	41	71	43	74	88	119	63	109	24	45	25	43	40	100
Pool Volume (ft^3)																						
Pattern																						
Channel Beltwidth (ft)	19	60	17	39	---	---	17	39	41	95	43	99	61	81	62	78	24	54	25	58	25	95
Radius of Curvature (ft)	15	26	10	17	---	---	10	17	24	41	25	43	33	56	32	43	13	24	14	25	23	50
Rc:Bankfull Width (ft/ft)	2.0	3.5	2.0	3.5	---	---	2.0	3.5	2.0	3.5	2.0	3.5	2.1	3.5	2.0	2.7	1.9	3.6	1.9	3.5	2.2	4.8
Meander Length (ft)	52	90	34	59	---	---	34	59	83	142	87	149	139	192	166	191	47	81	50	87	100	200
Meander Width Ratio	2.5	8.0	3.5	8.0	---	---	3.5	8.0	3.5	8.0	3.5	8.0	3.8	5.0	3.8	4.8	3.5	8.0	3.5	8.0	2.4	9.0
Substrate, Bed and Transport Parameters																						
Ri%/Ru%/P%/G%/S%																						
SC%/Sa%/G%/C%/B%/Be%																						
d16/d35/d50/d84/d95/d100																						
Reach Shear Stress (Competency) lb/ft^2	0.47		---		0.65		---		0.73		0.45		0.55		0.69		---		---		---	
Max part size (mm) mobilized at bankfull																						
Stream Power (Capacity) W/m^2																						
Additional Reach Parameters																						
Drainage Area (SM)	0.13		0.02		0.07		0.01		0.41		0.42		0.72		0.76		0.07		0.10		0.29	
Watershed Impervious Cover Estimate (%)	<10%																					
Rosgen Classification	C5		C4		B4		C4		C4		C4		C4		C4		C4		C4		C	
Bankfull Velocity (fps)	4.3		3		3.2		1.5		3.5		3.4		2.8		2.9		3.4		3.8		3.3	
Bankfull Discharge (cfs)	17		6		12		3		35		37		52		54		12		15		30	
Q-NFF regression (2-yr)																						
Q-USGS extrapolation (1.2-yr)																						
Q-Mannings																						
Valley Slope (ft/ft)	0.0174		0.0302		0.0290		0.0580		0.0089		0.0150		0.0110		0.0115		0.0045		0.0150		0.0158	
Channel Thalweg Length (ft)	1,121		141		376		55		574		427		1,507		1,069		154		118		1,407	
Sinuosity	1.19		1.19		1.03		1.20		1.02		1.03		1.34		1.13		1.27		1.09		1.21	
Bankfull/Channel Slope (ft/ft)	0.0149		0.0255		0.028		0.049		0.0088		0.0088		0.0080		0.0101		0.0035		0.0130		0.0128	0.0263

SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 11d. Baseline Stream Data Summary
Area B - As-Built/Baseline Parameters
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area B

Parameter	As-Built/Baseline																							
	Elliott Creek Reach 1		Elliott Creek UT1		Bridges Creek Reach 1		UT1 to Bridges Creek		Lower Fletcher Creek Reach 1		Lower Fletcher Creek Reach 2		Upper Stick Elliot Creek Reach 1		Upper Stick Elliott Creek Reach 5		Upper Stick Elliott Creek Reach 6		Upper Stick Elliott Creek UT2		Upper Stick Elliott Creek UT3		Upper Fletcher Creek Reach 2	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Shallow																								
Bankfull Width (ft)	6.4	8.2	5.2		9.3		N/A		12.3		9.9		6.7		15.9	18.4	16.7	18.3	7.9		7.2		11.5	12.0
Floodprone Width (ft)	19.0	19.6	14.0		23.6		N/A		26.4		28.4		37.2		169.2	178.4	148.5	192.7	25.0		63.8		72.0	99.5
Bankfull Mean Depth	0.6	0.7	0.5		0.4		N/A		0.8		0.6		0.7		1.0	1.2	1.1	1.2	0.5		0.5		0.8	0.8
Bankfull Max Depth	0.9	0.9	0.8		0.7		N/A		1.1		0.8		0.9		1.7	1.8	2.0	2.2	0.9		0.8		1.4	1.4
Bankfull Cross-sectional Area (ft^2)	4.1	5.6	2.5		3.3		N/A		9.7		6.3		4.7		18.9	19.2	19.1	22.4	3.8		3.7		9.2	9.5
Width/Depth Ratio	10.1	11.9	10.7		26.5		N/A		15.7		15.4		9.6		13.3	17.8	14.6	14.9	16.5		14.0		14.0	15.6
Entrenchment Ratio	2.4	2.9	2.7		2.5		N/A		2.1		2.9		5.5		9.2	10.9	8.9	10.5	3.2		8.8		6.0	8.6
Bank Height Ratio	1.0	1.0	1.0		1.0		N/A		1.0		1.0		1.0		1.0	1.0	1.0	1.0	1.0		1.0		1.0	1.0
D_{50} (mm)	32	42	31		53.7		N/A		35.3		11.0		32.0		35.0	39.8	41.1	46.1	14.9		14.4		39.1	54.8
Profile																								
Riffle Length (ft)	7	64	11	21	11	32	6	6	11	55	14	36	6	18	39	74	13	80	14	37	18	19	16	69
Riffle Slope (ft/ft)	0.0076	0.0712	0.0018	0.0429	0.0129	0.0576	0.0686	0.0862	0.0008	0.0466	0.0050	0.0396	0.0028	0.1323	0.0068	0.0218	0.0038	0.0653	0.0065	0.0167	0.0092	0.0257	0.0078	0.0631
Pool Length (ft)	10.98	73.26	12.42	18.46	6.36	34.19	8.56	8.56	10.61	44	17.92	53.39	3.72	55.52	14.68	66.89	14.35	79.03	18.84	51.34	8.77	14.02	13.89	63.47
Pool Max Depth (ft)	1.1	2.3	1.1	1.4	1.6	2.4	1.0	2.0	1.4	1.6	1.8	2.2	1.7	2.2	1.9	4.1	2.0	4.6	1.0	1.7	1.5	1.7	2.5	4.5
Pool Spacing (ft)	20	132	18	45	29	49	11	11	36	92	42	90	22	102	48	128	43	127	62	62	26	34	45	162
Pool Volume (ft^3)																								
Pattern																								
Channel Beltwidth (ft)	14	38	8	17	9	15	23	23	20	73	44		N/A	N/A	37	64	27	57	24	24	16	16	8	71
Radius of Curvature (ft)	8	42	15	20	10	19	19	19	12	50	53	79	N/A	N/A	25	48	24	39	20	17	9	12	23	50
Rc:Bankfull Width (ft/ft)	1.3	5.1	2.9	3.8	1.1	2.0	N/A		1.0	4.1	5.4	8.0	N/A	N/A	1.6	2.6	1.4	2.2	2.5	2.2	1.3	1.7	2.0	4.2
Meander Length (ft)	46	156	48	69	68	80	51	51	73	138	201	201	N/A	N/A	128	200	160	193	54	54	32	32	92	195
Meander Width Ratio	2.2	4.6	1.4	3.3	1.0	1.6	N/A		1.6	5.9	4.4	0.0	N/A	N/A	2.3	3.5	1.6	3.1	3.1	3.1	2.2	2.2	0.7	5.9
Substrate, Bed and Transport Parameters																								
Ri%/Ru%/P%/G%/S%																								
SC%/Sa%/G%/C%/B%/Be%																								
d16/d35/d50/d84/d95/d100	0.59/1.78/6/101.2/ 151.8/180		SC/1/5.9/47/101.2/180		SC/0.16/1/90/135.5/180		N/A		0.36/0.69/1.8/57.9/ 110.1/180		0.27/0.69/4.4/40.5/ 128.7/362		SC/3.15/20.7/68.5/ 137/256		0.15/2.18/23.6/64/ 103.6/10		SC/0.61/3.3/60.4/ 113.8/180		SC/0.14/0.2/26.1/48/64		SC/SC/0.2/20.5/35.9/ 180		SC/0.63/10.4/55.9/ 104/180	
Reach Shear Stress (Competency) lb/ft^2	0.66		1.08		1.35		N/A		0.40		0.71		3.66		0.35		0.41		0.44		0.46		0.55	
Max part size (mm) mobilized at bankfull																								
Stream Power (Capacity) W/m^2																								
Additional Reach Parameters																								
Drainage Area (SM)	0.13		0.02		0.07		0.01		0.41		0.42		0.05		0.72		0.76		0.07		0.10		0.29	
Watershed Impervious Cover Estimate (%)	<10%																							
Rosgen Classification	C/E4		C/E4		C5		N/A		C5		C4		E4		C4		C4		C5		C5		C4	
Bankfull Velocity (fps)	3.2		3.7		2.9		N/A		3.1		3.4		8.5		3.4	3.8	3.8	4.1	2.4		2.1		3.3	3.6
Bankfull Discharge (cfs)	13.3		9.2		9.7		N/A		29.9		21.3		39.9		63.4	72.8	73.1	90.9	9.0		7.7		30.2	34.1
Q-NFF regression (2-yr)																								
Q-USGS extrapolation (1.2-yr)																								
Q-Mannings																								
Valley Slope (ft/ft)	0.0174		0.0302		0.0290		0.0580		0.0089		0.0150		N/A		0.0110		0.0115		0.0045		0.0150		N/A	
Channel Thalweg Length (ft)	1,121		141		376		55		574		427		409		1,228		1,070		154		118		1,407	
Sinuosity	1.1		1.1		1.0		1.0		1.1		1.0		1.0		1.2		1.1		1.4		1.3		1.2	
Bankfull/Channel Slope (ft/ft)	0.0150		0.0247		0.0308		0.0598		0.0092		0.0162		0.0837		0.0081		0.0093		0.0101		0.0105		0.0125	

SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 11e. Baseline Stream Data Summary
Area C
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Area C

Parameter	Gage	Pre-Restoration Condition				Design				As-Built/Baseline			
		Lower Big Harris Creek Reach 1a/1b		Lower Big Harris Creek Reach 2		Lower Big Harris Creek Reach 1a/1b		Lower Big Harris Creek Reach 2		Lower Big Harris Creek Reach 1a/1b		Lower Big Harris Creek Reach 2	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Shallow													
Bankfull Width (ft)	N/A	25.2		25.2		26.0		27.0		26.20		26.70	
Floodprone Width (ft)		120.0		120.0		75.0	115.0	100.0	200.0	158		300	
Bankfull Mean Depth		2.4		2.4		2.1		2.2		1.9		1.7	
Bankfull Max Depth		3.6		3.6		2.9		3.0		3.0		2.8	
Bankfull Cross-sectional Area (ft^2)		60.5		60.5		54.4		58.5		49.4		46.0	
Width/Depth Ratio		10.5		10.5		12.4		12.5		13.9		15.5	
Entrenchment Ratio		4.8		4.8		2.9	4.4	3.7	7.4	6.0		11.2	
Bank Height Ratio		2.0		2.0		1.0		1.0		1.0		1.0	
D_{50} (mm)		---		---		---		---		32.0		87.4	
Profile													
Riffle Length (ft)	N/A					---		---		15	142	21	146
Riffle Slope (ft/ft)		0.0133	0.0512	0.0063	0.0177	---	0.0054	0.0054	0.0086	0.0055	0.0792	0.0019	0.0651
Pool Length (ft)						---		---		54.2	94.3	14.2	134.9
Pool Max Depth (ft)		4.1		3.2		6.0		6.2		3.9	6.2	4.6	6.0
Pool Spacing (ft)		200.0	250.0	410.0	480.0	185	240	150	250	116	218	37	291
Pool Volume (ft^3)													
Pattern													
Channel Beltwidth (ft)	N/A	75	120	85	125	53	112	110	145	58	105	80	117
Radius of Curvature (ft)		70	165	120	190	60	80	75	90	60	80	65	90
Rc:Bankfull Width (ft/ft)		2.8	6.5	4.8	7.5	2.3	3.1	2.8	3.3	2.3	3.1	2.4	3.4
Meander Length (ft)		350	450	250	300	290	440	344	420	157	419	236	396
Meander Width Ratio		3.0	4.8	3.4	5.0	2.0	4.3	4.1	5.4	2.2	4.0	3.0	4.4
Substrate, Bed and Transport Parameters													
Ri%/Ru%/P%/G%/S%	N/A												
SC%/Sa%/G%/C%/B%/Be%													
d16/d35/d50/d84/d95/d100		1.9/16/29/83/130/2048		1.9/16/29/83/130/2048						0.4/0.8/1.7/94/256/2048		0.2/0.3/5.6/94/256/2048	
Reach Shear Stress (Competency) lb/ft^2		---		---		---		---		---		---	
Max part size (mm) mobilized at bankfull													
Stream Power (Capacity) W/m^2													
Additional Reach Parameters													
Drainage Area (SM)	N/A	3.19	3.36	3.50	3.88	3.36		3.88		3.36		3.88	
Watershed Impervious Cover Estimate (%)		<10%											
Rosgen Classification		E4	G4c	E4	G4c	C		C		C5		C4	
Bankfull Velocity (fps)		2.9		3.2		3.3		3.4		3.6		3.0	
Bankfull Discharge (cfs)		176		194		176		194		176		137	
Q-NFF regression (2-yr)		---		---									
Q-USGS extrapolation (1.2-yr)		190		211									
Q-Mannings		182	255	205	350								
Valley Slope (ft/ft)		0.0053		0.0053		0.0053		0.0053		0.0053		0.0053	
Channel Thalweg Length (ft)		894		987		820		967		820		967	
Sinuosity		1.0		1.0		1.1		1.1		1.1		1.1	
Bankfull/Channel Slope (ft/ft)		0.0050		0.0050		0.0048		0.0048		0.0039		0.0032	

SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 11f. Baseline Stream Data Summary
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

		Reference Reach Data																							
Parameter	**Gage**	**Group Camp Tributary**		**UT to South Crowders**		**UT to Cane Creek**		**Boyd Branch**		**Spencer Creek**		**Box Creek**		**Hall Creek**		**Meadow Fork**		**UT to Gap Branch**		**UT to Kelly Branch**		**UT to Sandy Run**		**UT to Little Pine Trib 1**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Shallow																									
Bankfull Width (ft)	N/A	4.2	4.4	6.1	8.4	11.5	12.3	13.5		10.7	11.2	23.5		20.7	27.0	21.4		6.2		7.9		7.3	7.8	12.2	
Floodprone Width (ft)		8.6	10.6	26.0	31.0	31.0		37.0		60.0	114.0	76.0		34.0	39.0	---		20.9		9.1		12.2	15.6	72.0	
Bankfull Mean Depth		0.8	0.8	1.0	1.1	0.8	1.0	1.1		1.6	1.8	1.2		1.4	1.8	2.1		0.6		0.7		0.7	0.8	1.3	
Bankfull Max Depth		1.0	1.2	1.4		1.2	1.6	1.9		2.1	2.6	1.9		3.1		3.1		1.0		1.1		1.1	1.4	1.8	
Bankfull Cross-sectional Area (ft^2)		3.4	3.6	6.4	8.7	8.9	12.2	15.4		17.8	19.7	28.9		36.9		44.0		3.8		5.7		5.7	6.2	16.3	
Width/Depth Ratio		5.2	55.0	5.8	8.0	12.3	14.4	11.8		5.8	7.1	19.1		11.6	19.7	10.4		10.1		10.9		6.6	9.8	9.1	
Entrenchment Ratio		1.9	2.5	3.7	4.3	2.5	2.7	2.8		5.5	10.2+	3.3		1.4	1.6	>2.2		3.4		1.2		1.6	2.1	6.0	
Bank Height Ratio		1.0	1.0	1.4	2.1	---	---	1.0		1.0		1.5		2.1	2.2	1.1		1.0		2.5		1.7	2.6	1.0	
D50 (mm)																									
Riffle Length (ft)	N/A	---		---		---		---		---		---		---		---		---		---		---		---	
Riffle Slope (ft/ft)		0.0105	0.1218	0.0202	0.0664	0.0188	0.0704	0.015	0.028	0.013		0.0100	0.0770	0.008	0.02	0.2390		0.01	0.14	---		0.004	0.04	0.0600	0.0892
Pool Length (ft)		---		---		---		---		---		---		---		---		---		---		---		---	
Pool Max Depth (ft)		1.8	2.8	1.3	3	1.8	2.3	2.6		3.3		4.4		2.7	3.5	---		15.0		---		1.3	1.5	2.2	
Pool Spacing (ft)		9	58	28	63	27	73	260	345	71		29	88	35	108	---		3	4	---		9	55	26	81
Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)	N/A	16	17	81		102		230.0		38	41	62	88	35	41	---		---		18	34	24	60	---	
Radius of Curvature (ft)		8	12	9	20	23	38	50	180	1.3	1.4	1	2	1	4	---		---		8	26	14	29	---	
Rc:Bankfull Width (ft/ft)		---		---		---		---		---		---		---		---		---		---		---		---	
Meander Length (ft)		31	34	45	72	45	81	600	623	46	48	39	76	78	200	---		---		27	94	63	72	---	
Meander Width Ratio		3.6	3.8	9.6	13.3	8.3	8.9	17.0		3.4	3.6	2.6	3.7	1.5	1.7	---		---		2.3	4.3	3.3	7.6	---	
Substrate, Bed and Transport Parameters																									
Ri%/Ru%/P%/G%/S%	N/A																								
SC%/Sa%/G%/C%/B%/Be%																									
d16/d35/d50/d84/d95/d100		0.1/0.3/16/55.6/---		0.8/12.1/19.7/49.5/75.9/---		0.6/12.2/27.8/74.5/128/---		---		<0.063/3/8.8/42/90/---		41/11/22/50/78/---		<0.063/1/13/70/110/---		69/16/31/120/230/ ---		0.4/8/19/102.3/256/---		---		0.062/1/19/76/150/---		<0.063/2.4/22.6/120/256	
Reach Shear Stress (Competency) lb/ft^2																									
Max part size (mm) mobilized at bankfull																									
Stream Power (Capacity) W/m^2																									
Additional Reach Parameters																									
Drainage Area (SM)	N/A	0.10		0.22		0.29		0.90		0.96		2.13		4.09		4.37		0.04		0.08		0.15		1.10	
Watershed Impervious Cover Estimate (%)		---		---		---		---		---		---		---		---		---		---		---		---	
Rosgen Classification		E5b		E4		E4		E4		E4		C4		B4c		E4		B4a		A4		E4		E4b	
Bankfull Velocity (fps)		3.4	3.6	4		3.8		3.2		4.9	5.4	3.3		4.3		5.1		5		6.2		3.2		5.5	
Bankfull Discharge (cfs)		12		30		40		51		97		94.9		159		224		18.7		23.2		19		85	
Q-NFF regression (2-yr)		---				---				---				---				---				---			
Q-USGS extrapolation (1.2-yr)		---				---				---				---				---				---			
Q-Mannings		---				---				---				---				---				---			
Valley Length (ft)		---		---		---		---		---		---		---		---		---		---		---		---	
Channel Thalweg Length (ft)		---		---		---		---		---		---		---		---		---		---		---		---	
Sinuosity		1.60		2.20		1.40		1.40		1.30		1.30		1.04		---		1.12		1.19		1.60		1.10	
Water Surface Slope $(ft/ft)^2$		---		---		---		---		---		---		---		---		---		---		---		---	
Bankfull Slope (ft/ft)		---		---		---		---		---		---		---		---		---		---		---		---	

SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 12a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

AREA A

	Cross-Section 1, UBHC R2A (Riffle)						Cross-Section 2, UBHC R2A (Pool)						Cross-Section 3, UBHC R2B (Pool)						Cross-Section 4, UBHC R2B (Riffle)						Cross-Section 5, UBHC R4 (Pool)[2]					
Dimension[1] and Substrate	Base (3/2018)	MY1 (11/2018)	MY2 (06/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (11/2018)	MY2 (06/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (11/2018)	MY2 (09/2019)	MY3 (10/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (11/2018)	MY2 (09/2019)	MY3 (10/2020)	MY4 (06/2021)	MY5	Base (4/2018)	MY1 (10/2018)	MY2 (07/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5
Bankfull Elevation (ft)	929.2	929.0	929.2	929.5	929.6		928.7	928.7	928.7	928.9	929.1		921.0	921.2	921.1	921.1	921.3		920.8	921.0	920.5	919.1	919.3		900.1	900.2	899.9	899.8	899.9	
Low Bank Elevation (ft)	929.2	929.0	929.2	929.2	929.2		928.7	928.7	928.7	928.9	929.1		921.0	921.2	921.1	921.1	921.3		920.8	921.0	920.5	920.9	920.8		900.1	900.2	899.9	899.8	899.9	
Bankfull Width (ft)	16.0	10.4	13.4	10.4	9.2		13.5	12.2	13.3	11.4	14.0		12.0	16.1	15.2	15.4	16.2		11.3	18.2	13.8	18.9	18.6		17.0	19.2	11.9	10.9	12.3	
Floodprone Width (ft)	108.7	104.1	89.3	89.2	89.2		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		170.3	118.6	63.4	67.5	67.6		N/A	N/A	N/A	N/A	N/A	
Bankfull Mean Depth (ft)	0.7	0.6	0.6	0.8	0.9		1.4	0.9	1.2	1.5	1.0		1.2	1.7	1.8	2.1	2.0		1.6	2.4	1.3	2.3	2.1		1.4	1.1	1.4	1.2	1.2	
Bankfull Max Depth (ft)	1.5	1.4	1.9	2.0	1.8		3.1	1.7	2.8	2.9	2.3		1.9	4.0	3.7	4.3	4.2		3.0	4.2	2.4	4.0	3.7		2.7	2.7	2.7	2.3	2.4	
Bankfull Cross-Sectional Area (ft)	11.6	6.6	8.2	8.3	8.1		19.3	11.0	16.5	16.5	14.2		14.0	27.0	27.2	33.1	33.0		17.7	44.1	18.4	44.0	39.2		23.5	20.6	17.2	12.9	14.5	
Bankfull Width/Depth Ratio	22.0	16.5	21.7	13.1	10.5		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		7.3	7.5	10.4	8.1	8.8		N/A	N/A	N/A	N/A	N/A	
Bankfull Entrenchment Ratio[3]	6.8	10.0	6.7	8.6	9.7		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		15.0	6.5	4.6	3.6	3.6		N/A	N/A	N/A	N/A	N/A	
Bankfull Bank Height Ratio	1.0	0.8	0.9	0.9	0.8		N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A		1.0	1.8	1.0	1.8	1.6		N/A	N/A	N/A	N/A	N/A	

	Cross-Section 6, UBHC R4 (Riffle)						Cross-Section 7, UBHC R4 (Riffle)						Cross-Section 8, UBHC R4 (Pool)						Cross-Section 9, Royster Cr R1 (Riffle)						Cross-Section 10, Royster Cr R1 (Pool)					
Dimension[1] and Substrate	Base (4/2018)	MY1 (10/2018)	MY2 (07/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (4/2018)	MY1 (10/2018)	MY2 (07/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (4/2018)	MY1 (10/2018)	MY2 (07/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (4/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (4/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5
Bankfull Elevation (ft)	899.7	899.7	899.7	899.8	899.9		896.5	896.5	896.6	896.6	896.4		896.0	895.9	895.8	896.0	895.9		965.0	965.0	965.0	965.3	965.6		961.5	961.4	961.3	961.4	961.5	
Low Bank Elevation (ft)	899.7	899.7	899.7	899.7	899.8		896.5	896.5	896.6	896.6	896.5		896.0	895.9	895.8	896.0	895.9		965.0	965.0	965.0	964.9	965.0		961.5	961.4	961.3	961.4	961.5	
Bankfull Width (ft)	15.5	16.2	14.9	14.9	13.1		16.0	15.7	15.4	16.2	14.7		20.9	16.9	15.6	18.2	16.4		10.0	9.4	8.3	4.1	3.7		12.3	11.2	8.8	11.0	11.5	
Floodprone Width (ft)	118.0	110.8	119.2	121.7	120.1		190.0	167.4	137.2	137.3	137.3		N/A	N/A	N/A	N/A	N/A		46.7	46.1	39.5	39.6	44.9		N/A	N/A	N/A	N/A	N/A	
Bankfull Mean Depth (ft)	0.8	0.6	0.8	0.8	0.8		1.1	0.9	1.1	1.1	1.3		1.5	1.8	1.5	1.7	2.0		0.4	0.4	0.2	0.2	0.4		0.9	0.9	0.8	0.9	0.8	
Bankfull Max Depth (ft)	1.4	1.3	1.5	1.6	1.4		2.0	2.0	2.0	2.3	2.2		3.3	3.7	3.0	3.8	4.0		0.8	0.8	0.4	0.4	0.6		1.9	1.8	1.7	1.9	1.9	
Bankfull Cross-Sectional Area (ft)	13.1	10.5	12.0	12.1	10.7		17.6	14.7	17.7	17.1	18.7		31.6	31.0	22.8	30.9	32.6		3.6	3.7	1.8	1.0	1.4		11.0	9.7	7.4	9.5	9.2	
Bankfull Width/Depth Ratio	18.3	25.1	18.4	18.5	16.2		14.5	16.6	13.4	15.3	11.6		N/A	N/A	N/A	N/A	N/A		27.6	24.1	39.0	16.7	9.8		N/A	N/A	N/A	N/A	N/A	
Bankfull Entrenchment Ratio[3]	7.6	6.8	8.0	8.1	9.1		11.9	10.7	8.9	8.5	9.3		N/A	N/A	N/A	N/A	N/A		4.7	4.9	4.8	9.6	12.2		N/A	N/A	N/A	N/A	N/A	
Bankfull Bank Height Ratio	1.0	0.9	1.0	1.0	0.9		1.0	0.9	1.0	1.0	1.0		N/A	N/A	N/A	N/A	N/A		1.0	1.0	0.7	0.5	0.5		N/A	N/A	N/A	N/A	N/A	

	Cross-Section 11, Scott Cr (Riffle)						Cross-Section 12, Scott Cr (Pool)						Cross-Section 13, Carroll Cr R1 (Riffle)						Cross-Section 14, Carroll Cr R1 (Pool)					
Dimension[1] and Substrate	Base (4/2018)	MY1 (10/2018)	MY2 (08/2019)	MY3 (06/2020)[4]	MY4 (06/2021)[4]	MY5	Base (4/2018)	MY1 (10/2018)	MY2 (08/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (4/2018)	MY1 (10/2018)	MY2 (07/2019)	MY3 (06/2020)	MY4 (09/2021)	MY5	Base (4/2018)	MY1 (10/2018)	MY2 (07/2019)	MY3 (06/2020)	MY4 (09/2021)	MY5
Bankfull Elevation (ft)	894.8	894.7	894.8	893.7	893.6		890.1	890.2	890.0	889.8	890.0		862.2	862.2	862.2	862.7	862.7		861.6	861.4	861.9	861.9	862.0	
Low Bank Elevation (ft)	894.8	894.7	894.8	893.7	893.7		890.1	890.2	890.0	889.8	890.0		862.2	862.2	862.2	862.3	863.0		861.6	861.4	861.9	861.9	862.0	
Bankfull Width (ft)	6.8	8.7	13.6	6.6	6.4		13.7	13.9	12.5	11.4	14.8		11.4	11.3	8.6	7.0	10.2		12.7	10.2	11.5	8.7	8.5	
Floodprone Width (ft)	67.1	44.8	45.2	44.5	15.9		N/A	N/A	N/A	N/A	N/A		82.0	82.1	71.2	79.2	97.3		N/A	N/A	N/A	N/A	N/A	
Bankfull Mean Depth (ft)	0.5	0.6	1.3	0.7	0.6		1.1	0.9	1.1	1.0	0.9		0.7	0.6	0.6	0.7	1.1		1.1	0.9	0.8	1.0	1.0	
Bankfull Max Depth (ft)	0.9	1.2	2.2	1.1	1.1		2.1	1.7	2.1	1.9	2.1		1.3	1.2	1.1	1.2	2.1		2.0	1.8	1.9	2.0	2.0	
Bankfull Cross-Sectional Area (ft)	3.6	5.1	18.1	4.9	4.0		14.9	12.2	13.4	10.9	13.7		7.9	7.0	4.9	4.7	10.8		13.4	9.4	9.4	8.5	8.4	
Bankfull Width/Depth Ratio	12.7	15.0	10.2	8.9	10.2		N/A	N/A	N/A	N/A	N/A		16.4	18.2	15.0	10.3	9.6		N/A	N/A	N/A	N/A	N/A	
Bankfull Entrenchment Ratio[3]	9.9	5.1	3.3	6.7	2.5		N/A	N/A	N/A	N/A	N/A		7.2	7.3	8.3	11.3	9.6		N/A	N/A	N/A	N/A	N/A	
Bankfull Bank Height Ratio	1.0	1.2	2.6	1.3	1.1		N/A	N/A	N/A	N/A	N/A		1.0	0.9	0.8	0.7	1.2		N/A	N/A	N/A	N/A	N/A	

[1] MY0 bankfull dimensions were calculated using a fixed bankfull elevation. Beginning in MY1 Bank Height Ratios are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by NCIRT and NCDMS (2018).
[2] The bankfull elevation at cross-section 5 was set too high in the baseline report. The baseline bankfull elevation was updated in MY1.
[3] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.
[4]Bankfull dimension calculations were adjusted at cross-section 11 in MY4 and retroactively to MY3 to reflect a revised bankfull elevation with the development of a bankfull bench and consecutive years of stability.

Table 12b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

AREA B

	Cross-Section 15, USEC R1 (Riffle)						Cross-Section 16, USEC R5 (Pool)						Cross-Section 17, USEC R5 (Riffle)						Cross-Section 18, USEC R5 (Riffle)						Cross-Section 19, USEC R5 (Pool)						Cross-Section 20, USEC R5 (Riffle)					
Dimension[1] and Substrate	Base (4/2018)	MY1 (11/2018)[1]	MY2 (06/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (04/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (04/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (04/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5
Bankfull Elevation (ft)	979.1	979.1	979.1	979.2	979.1		934.0	934.0	933.9	934.1	934.3		932.1	932.1	932.0	932.3	932.6		930.9	930.7	931.0	931.3	931.3		928.9	928.7	928.8	928.9	929.1		925.7	925.6	925.5	925.9	925.8	
Low Bank Elevation (ft)	979.1	979.1	979.1	979.0	979.1		934.0	934.0	933.9	934.1	934.3		932.1	932.1	932.0	932.2	932.2		930.9	930.7	931.0	931.0	931.0		928.9	928.7	928.8	928.9	929.1		925.7	925.6	925.5	925.6	925.8	
Bankfull Width (ft)	6.7	7.7	7.8	6.3	7.4		17.4	18.0	17.2	17.6	23.2		18.4	18.3	15.6	18.6	13.4		18.1	16.4	17.2	17.7	16.5		20.8	20.9	20.1	21.4	17.3		15.9	16.6	14.6	15.4	17.2	
Floodprone Width (ft)	37.2	37.0	35.8	35.8	36.0		N/A	N/A	N/A	N/A	N/A		169.2	167.8	93.6	93.6	89.1		172.1	166.3	86.0	86.0	80.7		N/A	N/A	N/A	N/A	N/A		173.2	191.0	108.0	108.1	102.9	
Bankfull Mean Depth (ft)	0.7	0.6	0.6	0.6	0.6		1.5	1.2	1.1	1.0	0.9		1.0	1.0	0.9	0.9	1.0		1.1	1.0	1.0	0.8	0.8		1.9	1.6	1.1	1.0	1.3		1.2	1.1	1.0	0.9	1.1	
Bankfull Max Depth (ft)	0.9	0.9	1.0	1.0	1.0		2.3	2.1	1.7	1.7	1.9		1.7	1.7	1.6	1.7	1.6		1.7	1.5	1.8	1.9	1.9		3.5	3.9	2.4	2.6	2.7		1.8	1.8	1.8	1.7	2.0	
Bankfull Cross-Sectional Area (ft)	4.7	4.8	4.7	3.6	4.6		26.3	22.0	18.5	17.6	20.1		19.2	18.4	14.0	17.5	13.6		19.1	16.1	17.5	14.8	13.9		39.3	34.3	21.5	21.8	22.7		18.9	18.2	13.9	14.5	18.2	
Bankfull Width/Depth Ratio	9.6	12.3	12.7	11.2	11.9		N/A	N/A	N/A	N/A	N/A		17.8	18.1	17.5	19.9	13.3		17.2	16.7	17.0	21.2	19.6		N/A	N/A	N/A	N/A	N/A		13.3	15.1	15.2	16.4	16.3	
Bankfull Entrenchment Ratio[2]	5.5	4.8	4.6	5.7	4.8		N/A	N/A	N/A	N/A	N/A		9.2	9.2	6.0	5.0	6.6		9.5	10.2	5.0	4.9	4.9		N/A	N/A	N/A	N/A	N/A		10.9	11.5	7.4	7.0	6.0	
Bankfull Bank Height Ratio	1.0	1.0	1.0	0.9	0.9		N/A	N/A	N/A	N/A	N/A		1.0	1.0	0.8	0.9	0.9		1.0	0.9	0.9	0.9	0.9		N/A	N/A	N/A	N/A	N/A		1.0	1.0	0.8	0.9	1.0	
	Cross-Section 21, USEC R6 (Pool)						Cross-Section 22, USEC R6 (Riffle)						Cross-Section 23, USEC R6 (Riffle)						Cross-Section 24, Elliott Cr (Riffle)						Cross-Section 25, Elliott Cr (Pool)						Cross-Section 26, Elliott Cr (Riffle)					
Dimension[1] and Substrate	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (4/2018)	MY1 (11/2018)	MY2 (06/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (4/2018)	MY1 (11/2018)	MY2 (06/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (4/2018)	MY1 (11/2018)	MY2 (06/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5
Bankfull Elevation (ft)	919.8	919.8	919.9	919.8	919.9		919.4	919.3	919.4	919.4	919.4		917.5	917.6	917.5	917.3	917.2		972.1	972.2	972.2	972.2	972.3		970.5	970.5	970.6	970.7	970.8		970.1	970.1	970.1	970.2	970.2	
Low Bank Elevation (ft)	919.8	919.8	919.9	919.8	919.9		919.4	919.3	919.4	919.3	919.4		917.5	917.6	917.5	917.6	917.5		972.1	972.2	972.2	972.3	972.3		970.5	970.5	970.6	970.7	970.8		970.1	970.1	970.1	970.3	970.1	
Bankfull Width (ft)	21.8	22.3	21.9	21.6	24.1		18.3	16.3	19.8	18.2	19.4		16.7	16.2	16.3	17.1	15.4		6.4	7.1	7.9	7.3	5.9		7.6	8.9	10.6	9.7	10.4		8.2	8.6	8.8	8.5	7.1	
Floodprone Width (ft)	N/A	N/A	N/A	N/A	N/A		192.7	221.2	83.2	83.2	81.8		148.5	130.5	81.6	81.8	81.2		19.0	21.6	19.8	17.6	23.3		N/A	N/A	N/A	N/A	N/A		19.6	18.3	18.2	20.5	19.1	
Bankfull Mean Depth (ft)	2.1	1.7	1.9	1.7	1.7		1.2	1.2	1.2	1.2	1.1		1.1	1.2	1.2	1.3	1.5		0.6	0.6	0.5	0.6	0.8		1.5	0.9	1.2	1.0	1.0		0.7	0.6	0.6	0.8	0.7	
Bankfull Max Depth (ft)	5.2	3.8	4.2	3.7	4.6		2.2	2.6	2.5	2.7	2.7		2.0	2.2	2.5	2.9	2.6		0.9	1.0	0.9	1.1	1.1		1.9	1.5	2.0	1.5	1.7		0.9	0.9	1.1	1.3	1.2	
Bankfull Cross-Sectional Area (ft)	45.1	38.4	42.1	36.8	40.3		22.4	19.4	22.9	21.5	22.0		19.1	20.0	18.8	22.9	23.3		4.1	4.1	4.2	4.7	4.5		11.2	8.0	12.2	9.4	10.2		5.6	5.1	5.0	6.8	5.0	
Bankfull Width/Depth Ratio	N/A	N/A	N/A	N/A	N/A		14.9	13.7	17.1	15.4	17.0		14.6	13.1	14.1	12.7	10.2		10.1	12.3	14.9	11.3	7.6		N/A	N/A	N/A	N/A	N/A		11.9	14.5	15.6	10.6	10.2	
Bankfull Entrenchment Ratio[2]	N/A	N/A	N/A	N/A	N/A		10.5	13.6	4.2	4.6	4.2		8.9	8.1	5.0	4.8	5.3		2.9	3.0	2.5	2.4	4.0		N/A	N/A	N/A	N/A	N/A		2.4	2.1	2.1	2.4	2.7	
Bankfull Bank Height Ratio	N/A	N/A	N/A	N/A	N/A		1.0	0.9	1.0	1.0	1.0		1.0	1.0	1.0	1.1	1.1		1.0	1.0	1.0	1.2	1.1		N/A	N/A	N/A	N/A	N/A		1.0	1.0	0.9	1.1	0.9	

[1] MY0 bankfull dimensions were calculated using a fixed bankfull elevation. Beginning in MY1 Bank Height Ratios are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by NCIRT and NCDMS (2018).

[2] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

Table 12c. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

AREA B

	Cross-Section 27, UT1 to Elliott Cr (Riffle)						Cross-Section 28, Bridges Cr (Riffle)						Cross-Section 29, USEC UT2 (Riffle)						Cross-Section 30, USEC UT3 (Riffle)[3]						Cross-Section 31, UFC R2 (Riffle)						Cross-Section 32, UFC R2 (Pool)					
Dimension[1] and Substrate	Base (4/2018)	MY1 (11/2018)	MY2 (06/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (4/2018)	MY1 (11/2018)	MY2 (06/2019)	MY3 (06/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (10/2017)	MY1 (10/2018)	MY2 (08/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (10/2017)	MY1	MY2 (08/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5
Bankfull Elevation (ft)	976.8	976.7	976.7	976.8	976.7		966.8	966.7	966.7	966.9	966.9		926.9	926.9	927.1	927.5	927.6		926.9	926.9	926.9	927.0	927.0		969.5	969.5	969.6	969.6	969.8		969.1	969.2	969.0	969.0	969.2	
Low Bank Elevation (ft)	976.8	976.7	976.7	976.7	976.7		966.8	966.7	966.7	966.7	966.8		926.9	926.9	927.1	927.4	927.6		926.9	926.9	926.9	926.9	926.9		969.5	969.5	969.6	969.6	969.7		969.1	969.2	969.0	969.0	969.2	
Bankfull Width (ft)	5.2	4.9	5.5	5.4	5.4		9.3	6.4	6.5	6.6	7.9		7.9	8.1	6.7	5.5	8.2		7.2	7.4	7.9	7.6	7.1		11.4	11.2	11.5	11.6	11.3		12.3	13.6	11.8	9.2	8.6	
Floodprone Width (ft)	14.0	14.2	13.3	14.3	14.0		23.6	21.1	20.4	20.1	22.7		25.0	26.0	23.0	43.5	40.9		63.8	62.8	45.3	45.2	42.6		91.8	91.7	77.7	77.8	77.6		N/A	N/A	N/A	N/A	N/A	
Bankfull Mean Depth (ft)	0.5	0.5	0.4	0.4	0.4		0.4	0.4	0.3	0.3	0.3		0.5	0.4	0.3	0.6	0.5		0.5	0.5	0.4	0.4	0.4		0.7	0.7	0.7	0.7	0.7		1.4	1.3	1.0	0.9	1.1	
Bankfull Max Depth (ft)	0.8	0.9	0.8	0.9	0.9		0.7	0.6	0.6	0.6	0.7		0.9	0.9	0.6	1.1	1.0		0.8	0.8	0.7	0.8	0.7		1.1	1.1	1.1	1.2	1.3		2.6	2.7	1.8	1.1	1.7	
Bankfull Cross-Sectional Area (ft^2)	2.5	2.5	2.5	2.2	2.4		3.3	2.4	2.2	2.2	2.7		3.8	3.5	2.0	3.0	3.9		3.7	3.6	3.3	2.9	2.8		8.2	7.8	7.9	7.8	7.8		17.1	18.0	11.8	7.9	9.3	
Bankfull Width/Depth Ratio	10.7	9.7	12.4	13.2	12.4		26.5	17.2	19.3	19.8	22.8		16.5	18.6	22.5	9.9	16.9		14.0	15.5	18.6	19.4	17.9		15.7	16.0	16.8	17.2	16.5		N/A	N/A	N/A	N/A	N/A	
Bankfull Entrenchment Ratio[5]	2.7	2.9	2.4	2.6	2.6		2.5	3.3	3.1	3.0	2.9		3.2	3.2	3.4	8.0	5.0		8.8	8.4	5.8	6.0	6.0		8.1	8.2	6.7	6.7	6.9		N/A	N/A	N/A	N/A	N/A	
Bankfull Bank Height Ratio	1.0	1.0	1.0	0.9	1.0		1.0	0.8	0.8	0.8	0.9		1.0	1.0	0.7	1.0	1.0		1.0	1.0	0.9	0.9	0.9		1.0	1.0	1.0	1.0	1.0		N/A	N/A	N/A	N/A	N/A	

	Cross-Section 33, UFC R2 (Pool)						Cross-Section 34, UFC R2 (Riffle)						Cross-Section 35, UFC R2 (Riffle)[3]						Cross-Section 36, UFC R2 (Pool)						Cross-Section 37, LFC R1 (Riffle)[2]						Cross-Section 38, LFC R1 (Pool)[3]					
Dimension[1] and Substrate	Base (10/2017)	MY1 (10/2018)	MY2 (08/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (10/2017)	MY1 (10/2018)	MY2 (08/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (10/2017)	MY1 (10/2018)	MY2 (08/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (10/2017)	MY1 (10/2018)	MY2 (08/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5
Bankfull Elevation (ft)	965.9	966.0	965.9	966.1	965.9		965.5	965.5	965.5	965.6	965.7		960.5	960.4	960.5	960.5	960.6		960.1	960.1	960.1	960.4	960.1		919.4	919.3	919.5	919.5	919.3		918.9	918.8	919.3	919.4	919.2	
Low Bank Elevation (ft)	965.9	966.0	965.9	966.1	965.9		965.5	965.5	965.5	965.6	965.6		960.5	960.4	960.5	960.5	960.4		960.1	960.1	960.1	960.4	960.1		919.4	919.3	919.5	919.4	919.3		918.9	918.8	919.3	919.4	919.2	
Bankfull Width (ft)	13.2	13.4	13.2	14.0	12.7		12.0	12.3	12.5	12.1	12.5		11.5	11.7	12.6	12.1	10.4		14.7	14.2	14.2	15.5	15.2		12.3	12.8	13.3	10.4	11.5		11.2	10.5	12.4	11.5	11.2	
Floodprone Width (ft)	N/A	N/A	N/A	N/A	N/A		72.0	69.1	70.6	69.8	70.1		99.5	96.4	85.5	85.7	84.3		N/A	N/A	N/A	N/A	N/A		26.4	25.3	27.3	26.9	20.0		N/A	N/A	N/A	N/A	N/A	
Bankfull Mean Depth (ft)	1.2	1.2	1.0	1.0	0.9		0.8	0.7	0.7	0.7	0.6		0.8	0.8	0.7	0.7	0.7		1.5	1.3	1.3	1.5	1.3		0.8	0.7	1.0	0.9	0.8		0.7	0.6	1.0	1.0	1.1	
Bankfull Max Depth (ft)	2.3	2.3	1.9	1.8	1.8		1.4	1.2	1.4	1.4	1.3		1.4	1.4	1.4	1.5	1.2		2.8	2.8	2.7	3.1	2.8		1.1	1.0	1.3	1.2	1.0		1.1	1.0	1.5	1.5	1.5	
Bankfull Cross-Sectional Area (ft^2)	16.1	15.7	13.2	13.3	11.1		9.2	8.1	8.3	8.5	8.0		9.5	9.4	9.1	8.8	7.0		21.5	18.5	17.7	22.7	19.5		9.7	9.6	12.8	9.3	9.7		7.7	6.5	12.4	11.3	12.0	
Bankfull Width/Depth Ratio	N/A	N/A	N/A	N/A	N/A		15.6	18.7	18.9	17.1	19.7		14.0	14.7	17.3	16.7	15.6		N/A	N/A	N/A	N/A	N/A		15.7	17.1	13.8	11.7	13.5		N/A	N/A	N/A	N/A	N/A	
Bankfull Entrenchment Ratio[5]	N/A	N/A	N/A	N/A	N/A		6.0	5.6	5.6	5.8	5.6		8.6	8.2	6.8	7.1	8.1		N/A	N/A	N/A	N/A	N/A		2.1	2.0	2.1	2.6	1.7		N/A	N/A	N/A	N/A	N/A	
Bankfull Bank Height Ratio	N/A	N/A	N/A	N/A	N/A		1.0	0.9	1.0	1.0	0.8		1.0	1.0	1.0	1.0	0.8		N/A	N/A	N/A	N/A	N/A		1.0	1.0	1.2	1.0	1.0		N/A	N/A	N/A	N/A	N/A	

	Cross-Section 39, LFC R2 (Riffle)[4]						Cross-Section 40, LFC R2 (Pool)					
Dimension[1] and Substrate	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5	Base (3/2018)	MY1 (10/2018)	MY2 (06/2019)	MY3 (03/2020)	MY4 (06/2021)	MY5
Bankfull Elevation (ft)	915.9	915.9	915.9	916.0	915.9		916.0	915.9	915.9	915.9	915.9	
Low Bank Elevation (ft)	915.9	915.9	915.9	916.1	915.8		916.0	915.9	915.9	915.9	915.9	
Bankfull Width (ft)	9.9	9.8	9.1	10.1	8.5		11.5	10.9	10.4	10.0	11.8	
Floodprone Width (ft)	28.4	28.6	29.6	30.5	27.3		N/A	N/A	N/A	N/A	N/A	
Bankfull Mean Depth (ft)	0.6	0.5	0.6	0.8	0.6		1.0	0.9	1.2	1.2	1.0	
Bankfull Max Depth (ft)	0.8	0.9	1.2	1.1	1.0		1.5	1.3	1.8	1.6	1.7	
Bankfull Cross-Sectional Area (ft^2)	6.3	4.6	5.9	7.6	5.4		11.8	9.6	12.1	11.9	11.6	
Bankfull Width/Depth Ratio	15.4	20.5	14.2	13.4	13.5		N/A	N/A	N/A	N/A	N/A	
Bankfull Entrenchment Ratio[5]	2.9	2.9	3.2	3.0	3.2		N/A	N/A	N/A	N/A	N/A	
Bankfull Bank Height Ratio	1.0	0.8	1.0	1.1	0.9		N/A	N/A	N/A	N/A	N/A	

AREA C

	Cross-Section 41, LBHC R1A (Pool)						Cross-Section 42, LBHC R1A (Riffle)[3]						Cross-Section 43, LBHC R1B/2 (Riffle)[2]						Cross-Section 44, LBHC R1B/2 (Pool)					
Dimension[1] and Substrate	Base (9/2017)	MY1 (10/2018)	MY2 (08/2019)	MY3 (05/2020)	MY4 (06/2021)	MY5	Base (9/2017)	MY1 (10/2018)	MY2 (08/2019)	MY3 (05/2020)	MY4 (06/2021)	MY5	Base (9/2017)	MY1 (10/2018)	MY2 (08/2019)	MY3 (05/2020)	MY4 (06/2021)	MY5	Base (9/2017)	MY1 (10/2018)	MY2 (08/2019)	MY3 (05/2020)	MY4 (06/2021)	MY5
Bankfull Elevation (ft)	848.0	847.5	847.9	848.2	848.4		847.6	847.5	847.8	848.0	848.1		844.2	844.2	844.2	843.6	843.7		843.5	843.7	843.5	842.9	843.3	
Low Bank Elevation (ft)	848.0	847.5	847.9	848.2	848.4		847.6	847.5	847.8	848.3	848.1		844.2	844.2	844.2	844.2	844.3		843.5	843.7	843.5	842.9	843.3	
Bankfull Width (ft)	41.6	24.0	24.7	24.6	24.2		26.2	25.7	28.3	30.7	26.4		26.7	27.2	29.4	30.4	31.0		26.8	27.2	30.8	22.8	22.3	
Floodprone Width (ft)	N/A	N/A	N/A	N/A	N/A		158.0	155.7	77.9	78.0	77.9		299.6	171.0	84.9	84.9	84.9		N/A	N/A	N/A	N/A	N/A	
Bankfull Mean Depth (ft)	2.5	1.4	1.7	2.0	2.0		1.9	1.5	1.7	1.8	1.8		1.7	1.9	2.1	2.0	2.0		2.8	3.3	2.4	2.5	3.8	
Bankfull Max Depth (ft)	5.8	2.6	3.2	3.7	3.3		3.0	2.9	3.3	3.6	3.4		2.8	3.3	3.6	3.5	3.4		5.5	7.8	4.2	3.7	5.3	
Bankfull Cross-Sectional Area (ft^2)	104.7	33.5	42.8	50.2	47.7		49.4	38.7	49.3	55.6	48.8		46.0	51.5	60.8	62.1	62.9		75.4	91.0	75.2	57.7	84.1	
Bankfull Width/Depth Ratio	N/A	N/A	N/A	N/A	N/A		13.9	17.1	16.2	16.9	14.3		15.5	14.3	14.2	14.9	15.2		N/A	N/A	N/A	N/A	N/A	
Bankfull Entrenchment Ratio[5]	N/A	N/A	N/A	N/A	N/A		6.0	6.1	2.8	2.5	3.0		11.2	6.3	2.9	2.8	2.7		N/A	N/A	N/A	N/A	N/A	
Bankfull Bank Height Ratio	N/A	N/A	N/A	N/A	N/A		1.0	0.9	1.0	1.1	1.0		1.0	1.1	1.2	1.2	1.2		N/A	N/A	N/A	N/A	N/A	

[1] MY0 bankfull dimensions were calculated using a fixed bankfull elevation. Beginning in MY1 Bank Height Ratios are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by NCIRT and NCDMS (2018).

[2] The floodprone width and entrenchment ratio at cross-section 37 and 43 were miscalculated during MY0. Both measurements were updated in MY1.

[3] The bankfull (low bank) elevations were recorded incorrectly at cross-section 30, 35, 38, and 42 during MY0; therefore, subsequent cross-sectional data calculations were incorrect. MY0 data was updated in MY1.

[4] The Floodprone width for Cross-section 39 was incorrectly recorded MY0 and was updated in MY1.

[5] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

Table 13a. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

UBHC R2A (STA. 129+81 - 136+66)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	16.0		10.4		13.4		10.4		9.2			
Floodprone Width (ft)	108.7		104.1		89.3		89.2		89.2			
Bankfull Mean Depth	0.7		0.6		0.6		0.8		0.9			
Bankfull Max Depth	1.5		1.4		1.9		2.0		1.8			
Bankfull Cross-Sectional Area (ft2)	11.6		6.6		8.2		8.3		8.1			
Width/Depth Ratio	22.0		16.5		21.7		13.1		10.5			
Entrenchment Ratio[1]	6.8		10		6.7		8.6		9.7			
Bank Height Ratio[2]	1.0		0.8		0.9		0.9		0.8			
D50 (mm)	44.2		30.6		52.4		9.9		15.2			
Profile												
Riffle Length (ft)	11	40										
Riffle Slope (ft/ft)	0.001	0.052										
Pool Length (ft)	10	59										
Pool Max Depth (ft)	1.9	3.3										
Pool Spacing (ft)	29	75										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	13	31										
Radius of Curvature (ft)	18	26										
Rc:Bankfull Width (ft/ft)	1.1	1.6										
Meander Wave Length (ft)	74	102										
Meander Width Ratio	0.8	1.9										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	685											
Sinuosity (ft)	1.14											
Water Surface Slope (ft/ft)[4]	---						0.011		0.011			
Bankfull Slope (ft/ft)	0.015											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.66/2.37/16.6/79.2/146.7/362											
% of Reach with Eroding Banks	0%		3%		1%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

[4] Water surface slopes are based on abbreviated longitudinal profiles of one meander length collected in MY3 and MY4 after geomorphically significant events.

Table 13b. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

UBHC R2B (STA. 136+66 - 139+15)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	11.3		18.2		13.8		18.9		18.6			
Floodprone Width (ft)	170.3		118.6		63.4		67.5		67.6			
Bankfull Mean Depth	1.6		2.4		1.3		2.3		2.1			
Bankfull Max Depth	3.0		4.2		2.4		4.0		3.7			
Bankfull Cross-Sectional Area (ft2)	17.7		44.1		18.4		44.0		39.2			
Width/Depth Ratio	7.3		7.5		10.4		8.1		8.8			
Entrenchment Ratio[1]	15.0		6.5		4.6		3.6		3.6			
Bank Height Ratio[2]	1.0		1.8		1.0		1.8		1.6			
D50 (mm)	83.8		1.4		0.8		1.6		29.0			
Profile												
Riffle Length (ft)	8	39										
Riffle Slope (ft/ft)	0.022	0.063										
Pool Length (ft)	10	47										
Pool Max Depth (ft)	2.6	3.4										
Pool Spacing (ft)	21	79										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	20	35										
Radius of Curvature (ft)	30	34										
Rc:Bankfull Width (ft/ft)	2.7	3.0										
Meander Wave Length (ft)	108	125										
Meander Width Ratio	1.8	3.1										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	249											
Sinuosity (ft)	1.14											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.015											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.66/2.37/16.6/79.2/146.7/362											
% of Reach with Eroding Banks	0%		14%		3%		7%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13c. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

UBHC R4 (STA. 148+76 - 159+15)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	15.5	16.0	15.7	16.2	14.9	15.4	14.9	16.2	13.1	14.7		
Floodprone Width (ft)	118.0	190.0	110.8	167.4	119.2	137.2	121.7	137.3	120.1	137.3		
Bankfull Mean Depth	0.8	1.1	0.6	0.9	0.8	1.1	0.8	1.1	0.8	1.3		
Bankfull Max Depth	1.4	2.0	1.3	2.0	1.5	2.0	1.6	2.3	1.4	2.2		
Bankfull Cross-Sectional Area (ft2)	13.1	17.6	10.5	14.7	12.0	17.7	12.1	17.1	10.7	18.7		
Width/Depth Ratio	14.5	18.3	16.6	25.1	13.4	18.4	15.3	18.5	11.6	16.2		
Entrenchment Ratio[1]	7.6	11.9	6.8	10.7	8.0	8.9	8.1	8.5	9.1	9.3		
Bank Height Ratio[2]	1.0	1.0	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0		
D50 (mm)	46.2	85.6	26.9	32	50.6	69.7	43.6	75.2	45.0	65.6		
Profile												
Riffle Length (ft)	19	56										
Riffle Slope (ft/ft)	0.012	0.052										
Pool Length (ft)	33	73										
Pool Max Depth (ft)	2.4	3.8										
Pool Spacing (ft)	62	125										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	19	67										
Radius of Curvature (ft)	27	60										
Rc:Bankfull Width (ft/ft)	1.7	3.8										
Meander Wave Length (ft)	122	178										
Meander Width Ratio	1.2	4.2										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	1,296											
Sinuosity (ft)	1.36											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.013											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.3/6.69/29.8/87/ 202.4/512											
% of Reach with Eroding Banks	0%		5%		0%		2%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13d. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Royster Creek R1 (STA. 802+54 - 807+13)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	10.0		9.4		8.3		4.1		3.7			
Floodprone Width (ft)	46.7		46.1		39.5		39.6		44.9			
Bankfull Mean Depth	0.4		0.4		0.2		0.2		0.4			
Bankfull Max Depth	0.8		0.8		0.4		0.4		0.6			
Bankfull Cross-Sectional Area (ft2)	3.6		3.7		1.8		1.0		1.4			
Width/Depth Ratio	27.6		24.1		39.0		16.7		9.8			
Entrenchment Ratio[1]	4.7		4.9		4.8		9.6		12.2			
Bank Height Ratio[2]	1.0		1.0		0.7		0.5		0.5			
D50 (mm)	43.5		35.4		44.4		1.0		9.8			
Profile												
Riffle Length (ft)	7	42										
Riffle Slope (ft/ft)	0.007	0.057										
Pool Length (ft)	7	71										
Pool Max Depth (ft)	1.6	2.5										
Pool Spacing (ft)	38	70										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	9	18										
Radius of Curvature (ft)	21	41										
Rc:Bankfull Width (ft/ft)	2.1	4.1										
Meander Wave Length (ft)	95	125										
Meander Width Ratio	0.9	1.8										
Additional Reach Parameters												
Rosgen Classification	B/C4											
Channel Thalweg Length (ft)	459											
Sinuosity (ft)	1.05											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.040											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	SC/2/11/71.7/98.3/256											
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13e. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Scott Creek (STA. 1210+12 - 1216+74)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020[5]		MY4 2021[5]		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	6.8		8.7		13.6		6.6		6.4			
Floodprone Width (ft)	67.1		44.8		45.2		44.5		15.9			
Bankfull Mean Depth	0.5		0.6		1.3		0.7		0.6			
Bankfull Max Depth	0.9		1.2		2.2		1.1		1.1			
Bankfull Cross-Sectional Area (ft2)	3.6		5.1		18.1		4.9		4.0			
Width/Depth Ratio	12.7		15.0		10.2		8.9		10.2			
Entrenchment Ratio[1]	9.9		5.1		3.3		6.7		2.5			
Bank Height Ratio[2]	1.0		1.2		2.6		1.3		1.1			
D50 (mm)	51.6		33.3		49.5		38.7		16.0			
Profile												
Riffle Length (ft)	22	47										
Riffle Slope (ft/ft)	0.016	0.042										
Pool Length (ft)	6	138										
Pool Max Depth (ft)	1.9	5.2										
Pool Spacing (ft)	17	69										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	25	45										
Radius of Curvature (ft)	11	28										
Rc:Bankfull Width (ft/ft)	1.6	4.1										
Meander Wave Length (ft)	30	59										
Meander Width Ratio	3.7	6.6										
Additional Reach Parameters												
Rosgen Classification	B/C4											
Channel Thalweg Length (ft)	644											
Sinuosity (ft)	1.10											
Water Surface Slope (ft/ft)[4]	---						0.041		0.036			
Bankfull Slope (ft/ft)	0.038											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.21/24.23/39.8/ 99.5/160.7/512											
% of Reach with Eroding Banks	0%		4%		2%		1%		2%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

[4] Water surface slopes are based on abbreviated longitudinal profiles of one meander length collected in MY3 and MY4 after geomorphically significant events.

Table 13f. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Carroll Creek (STA. 1301+68 - 1307+63)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	11.4		11.3		8.6		7.0		10.2			
Floodprone Width (ft)	82.0		82.1		71.2		79.2		97.3			
Bankfull Mean Depth	0.7		0.6		0.6		0.7		1.1			
Bankfull Max Depth	1.3		1.2		1.1		1.2		2.1			
Bankfull Cross-Sectional Area (ft2)	7.9		7.0		4.9		4.7		10.8			
Width/Depth Ratio	16.4		18.2		15.0		10.3		9.6			
Entrenchment Ratio[1]	7.2		7.3		8.3		11.3		9.6			
Bank Height Ratio[2]	1.0		0.9		0.8		0.7		1.2			
D50 (mm)	51		41.3		42.6		36.0		49.1			
Profile												
Riffle Length (ft)	14	65										
Riffle Slope (ft/ft)	0.008	0.036										
Pool Length (ft)	18	50										
Pool Max Depth (ft)	1.9	2.8										
Pool Spacing (ft)	45	67										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	26	45										
Radius of Curvature (ft)	15	29										
Rc:Bankfull Width (ft/ft)	1.3	2.5										
Meander Wave Length (ft)	89	139										
Meander Width Ratio	2.2	3.9										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	590											
Sinuosity (ft)	1.15											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.017											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.28/2/10.2/59.6/ 101.2/180											
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13g. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

USEC R1 (STA. 1002+89 - 1006+98)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	6.7		7.7		7.8		6.3		7.4			
Floodprone Width (ft)	37.2		37.0		35.8		35.8		36.0			
Bankfull Mean Depth	0.7		0.6		0.6		0.6		0.6			
Bankfull Max Depth	0.9		0.9		1.0		1.0		1.0			
Bankfull Cross-Sectional Area (ft2)	4.7		4.8		4.7		3.6		4.6			
Width/Depth Ratio	9.6		12.3		12.7		11.2		11.9			
Entrenchment Ratio[1]	5.5		4.8		4.6		5.7		4.8			
Bank Height Ratio[2]	1.0		1.0		1.0		0.9		0.9			
D50 (mm)	32.0		36.5		33.6		64.0		48.7			
Profile												
Riffle Length (ft)	6	18										
Riffle Slope (ft/ft)	0.003	0.132										
Pool Length (ft)	4	56										
Pool Max Depth (ft)	1.7	2.2										
Pool Spacing (ft)	22	102										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	---	---										
Radius of Curvature (ft)	---	---										
Rc:Bankfull Width (ft/ft)	---	---										
Meander Wave Length (ft)	---	---										
Meander Width Ratio	---	---										
Additional Reach Parameters												
Rosgen Classification	E4											
Channel Thalweg Length (ft)	409											
Sinuosity (ft)	1.00											
Water Surface Slope (ft/ft)[4]	---						0.015		0.030			
Bankfull Slope (ft/ft)	0.084											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	SC/3.15/20.7/68.5/ 137/256											
% of Reach with Eroding Banks	0%		8%		4%		7%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

[4] Water surface slopes are based on abbreviated longitudinal profiles of one meander length collected in MY3 and MY4 after geomorphically significant events.

Table 13h. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

USEC R5 (STA. 1043+77 - 1058+84)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	15.9	18.4	16.4	18.3	14.6	17.2	15.4	18.6	13.4	17.2		
Floodprone Width (ft)	169.2	173.2	166.3	191.0	86.0	108.0	86.0	108.1	80.7	102.9		
Bankfull Mean Depth	1.0	1.2	1.0	1.1	0.9	1.0	0.8	0.9	0.8	1.1		
Bankfull Max Depth	1.7	1.8	1.5	1.8	1.6	1.8	1.7	1.9	1.6	2.0		
Bankfull Cross-Sectional Area (ft2)	18.9	19.2	16.1	18.4	13.9	17.5	14.5	17.5	13.6	18.2		
Width/Depth Ratio	13.3	17.8	15.1	18.1	15.2	17.5	16.4	21.2	13.3	19.6		
Entrenchment Ratio[1]	9.2	10.9	9.2	11.5	5.0	7.4	4.9	7.0	4.9	6.6		
Bank Height Ratio[2]	1.0	1.0	0.8	1.0	0.8	0.9	0.9	0.9	0.9	1.0		
D50 (mm)	35.0	39.8	32.0	35.3	30.4	43.1	24.7	56.9	35.1	43.6		
Profile												
Riffle Length (ft)	39	74										
Riffle Slope (ft/ft)	0.007	0.022										
Pool Length (ft)	15	67										
Pool Max Depth (ft)	1.9	4.1										
Pool Spacing (ft)	48	128										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	37	64										
Radius of Curvature (ft)	25	48										
Rc:Bankfull Width (ft/ft)	1.6	2.6										
Meander Wave Length (ft)	128	200										
Meander Width Ratio	2.3	3.5										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	1,228											
Sinuosity (ft)	1.23											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.008											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.15/2.18/23.6/64/ 103.6/10											
% of Reach with Eroding Banks	0%		1%		0%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13i. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

USEC R6 (STA. 1059+14 - 1069+83)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	16.7	18.3	16.2	16.3	16.3	19.8	17.1	18.2	15.4	19.4		
Floodprone Width (ft)	148.5	192.7	130.5	221.2	81.6	83.2	81.8	83.2	81.2	81.8		
Bankfull Mean Depth	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.1	1.5		
Bankfull Max Depth	2.0	2.2	2.2	2.6	2.5	2.5	2.7	2.9	2.6	2.7		
Bankfull Cross-Sectional Area (ft)	19.1	22.4	19.4	20.0	18.8	22.9	21.5	22.9	22.0	23.3		
Width/Depth Ratio	14.6	14.9	13.1	13.7	14.1	17.1	12.7	15.4	10.2	17.0		
Entrenchment Ratio[1]	8.9	10.5	8.1	13.6	4.2	5.0	4.6	4.8	4.2	5.3		
Bank Height Ratio[2]	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.1	1.0	1.1		
D50 (mm)	41.1	46.1	26.9	34	27.3	50.9	42.9	44.2	26.3	38.5		
Profile												
Riffle Length (ft)	13	80										
Riffle Slope (ft/ft)	0.004	0.065										
Pool Length (ft)	14	79										
Pool Max Depth (ft)	2.0	4.6										
Pool Spacing (ft)	43	127										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	27	57										
Radius of Curvature (ft)	24	39										
Rc:Bankfull Width (ft/ft)	1.4	2.2										
Meander Wave Length (ft)	160	193										
Meander Width Ratio	1.6	3.1										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	1,070											
Sinuosity (ft)	1.13											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.009											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	SC/0.61/3.3/60.4/ 113.8/180											
% of Reach with Eroding Banks	0%		4%		1%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13j. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Elliott Creek (STA. 1400+85 - 1412+06)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	6.4	8.2	7.1	8.6	7.9	8.8	7.3	8.5	5.9	7.1		
Floodprone Width (ft)	19.0	19.6	18.3	21.6	18.2	19.8	17.6	20.5	19.1	23.3		
Bankfull Mean Depth	0.6	0.7	0.6	0.6	0.5	0.6	0.6	0.8	0.7	0.8		
Bankfull Max Depth	0.9	0.9	0.9	1.0	0.9	1.1	1.1	1.3	1.1	1.2		
Bankfull Cross-Sectional Area (ft)	4.1	5.6	4.1	5.1	4.2	5.0	4.7	6.8	4.5	5.0		
Width/Depth Ratio	10.1	11.9	12.3	14.5	14.9	15.6	10.6	11.3	7.6	10.2		
Entrenchment Ratio[1]	2.4	2.9	2.1	3.0	2.1	2.5	2.4	2.4	2.7	4.0		
Bank Height Ratio[2]	1.0	1.0	1.0	1.0	0.9	1.0	1.1	1.2	0.9	1.1		
D50 (mm)	32.0	41.7	23.9	49.1	46.9	75.9	11.0	14.1	11.2	24.2		
Profile												
Riffle Length (ft)	7	64										
Riffle Slope (ft/ft)	0.008	0.071										
Pool Length (ft)	11	73										
Pool Max Depth (ft)	1.1	2.3										
Pool Spacing (ft)	20	132										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	14	38										
Radius of Curvature (ft)	8	42										
Rc:Bankfull Width (ft/ft)	1.3	5.1										
Meander Wave Length (ft)	46	156										
Meander Width Ratio	2.2	4.6										
Additional Reach Parameters												
Rosgen Classification	C/E4											
Channel Thalweg Length (ft)	1,121											
Sinuosity (ft)	1.13											
Water Surface Slope (ft/ft)[4]	---						0.007		0.016			
Bankfull Slope (ft/ft)	0.015											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.59/1.78/6/101.2/ 151.8/180											
% of Reach with Eroding Banks	0%		2%		0%		2%		2%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

[4] Water surface slopes are based on abbreviated longitudinal profiles of one meander length collected during MY3 after geomorphically significant events.

Table 13k. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Elliott Creek UT1 (STA. 1415+87 - 1417+28)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	5.2		4.9		5.5		5.4		5.4			
Floodprone Width (ft)	14.0		14.2		13.3		14.3		14.0			
Bankfull Mean Depth	0.5		0.5		0.4		0.4		0.4			
Bankfull Max Depth	0.8		0.9		0.8		0.9		0.9			
Bankfull Cross-Sectional Area (ft)	2.5		2.5		2.5		2.2		2.4			
Width/Depth Ratio	10.7		9.7		12.4		13.2		12.4			
Entrenchment Ratio[1]	2.7		2.9		2.4		2.6		2.6			
Bank Height Ratio[2]	1.0		1.0		1.0		0.9		1.0			
D50 (mm)	31.0		36.8		26.4		3.1		0.4			
Profile												
Riffle Length (ft)	11	21										
Riffle Slope (ft/ft)	0.002	0.043										
Pool Length (ft)	12	18										
Pool Max Depth (ft)	1.1	1.4										
Pool Spacing (ft)	18	45										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	8	17										
Radius of Curvature (ft)	15	20										
Rc:Bankfull Width (ft/ft)	2.9	3.8										
Meander Wave Length (ft)	48	69										
Meander Width Ratio	1.4	3.3										
Additional Reach Parameters												
Rosgen Classification	C/E4											
Channel Thalweg Length (ft)	141											
Sinuosity (ft)	1.07											
Water Surface Slope (ft/ft)[4]	---						0.025		0.028			
Bankfull Slope (ft/ft)	0.025											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	SC/1/5.9/47/101.2/180											
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

[4] Water surface slopes are based on abbreviated longitudinal profiles of one meander length collected during MY3 after geomorphically significant events.

Table 13l. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

Bridges Creek R1 (STA. 1500+91 - 1504+67)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	9.3		6.4		6.5		6.6		7.9			
Floodprone Width (ft)	23.6		21.1		20.4		20.1		22.7			
Bankfull Mean Depth	0.4		0.4		0.3		0.3		0.3			
Bankfull Max Depth	0.7		0.6		0.6		0.6		0.7			
Bankfull Cross-Sectional Area (ft)	3.3		2.4		2.2		2.2		2.7			
Width/Depth Ratio	26.5		17.2		19.3		19.8		22.8			
Entrenchment Ratio[1]	2.5		3.3		3.1		3.0		2.9			
Bank Height Ratio[2]	1.0		0.8		0.8		0.8		0.9			
D50 (mm)	53.7		29.0		44.2		13.9		48.3			
Profile												
Riffle Length (ft)	11	32										
Riffle Slope (ft/ft)	0.013	0.058										
Pool Length (ft)	6	34										
Pool Max Depth (ft)	1.6	2.4										
Pool Spacing (ft)	29	49										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	9	15										
Radius of Curvature (ft)	10	19										
Rc:Bankfull Width (ft/ft)	1.1	2.0										
Meander Wave Length (ft)	68	80										
Meander Width Ratio	1.0	1.6										
Additional Reach Parameters												
Rosgen Classification	C5											
Channel Thalweg Length (ft)	376											
Sinuosity (ft)	1.00											
Water Surface Slope (ft/ft)[4]	---						0.023		0.025			
Bankfull Slope (ft/ft)	0.031											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	SC/0.16/1/90/135.5/180											
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

[4] Water surface slopes are based on abbreviated longitudinal profiles of one meander length collected during MY3 after geomorphically significant events.

Table 13m. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

USEC UT2 (STA. 1080+00 - 1081+54)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	7.9		8.1		6.7		5.5		8.2			
Floodprone Width (ft)	25.0		26.0		23.0		43.5		40.9			
Bankfull Mean Depth	0.5		0.4		0.3		0.6		0.5			
Bankfull Max Depth	0.9		0.9		0.6		1.1		1.0			
Bankfull Cross-Sectional Area (ft)	3.8		3.5		2.0		3.0		3.9			
Width/Depth Ratio	16.5		18.6		22.5		9.9		16.9			
Entrenchment Ratio[1]	3.2		3.2		3.4		8.0		5.0			
Bank Height Ratio[2]	1.0		1.0		0.7		1		1.0			
D50 (mm)	14.9		0.5		1.3		0.7		0.4			
Profile												
Riffle Length (ft)	14	37										
Riffle Slope (ft/ft)	0.007	0.017										
Pool Length (ft)	19	51										
Pool Max Depth (ft)	1.0	1.7										
Pool Spacing (ft)	62	62										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	24	24										
Radius of Curvature (ft)	20	17										
Rc:Bankfull Width (ft/ft)	2.5	2.2										
Meander Wave Length (ft)	54	54										
Meander Width Ratio	3.1	3.1										
Additional Reach Parameters												
Rosgen Classification	C5											
Channel Thalweg Length (ft)	154											
Sinuosity (ft)	1.41											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.010											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	SC/0.14/0.2/26.1/48/64											
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13n. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

USEC UT3 (STA. 1082+00 - 1083+18)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	7.2		7.4		7.9		7.6		7.1			
Floodprone Width (ft)	63.8		62.8		45.3		45.2		42.6			
Bankfull Mean Depth	0.5		0.5		0.4		0.4		0.4			
Bankfull Max Depth	0.8		0.8		0.7		0.8		0.7			
Bankfull Cross-Sectional Area (ft)	3.7		3.6		3.3		2.9		2.8			
Width/Depth Ratio	14.0		15.5		18.6		19.4		17.9			
Entrenchment Ratio[1]	8.8		8.4		5.8		6.0		6.0			
Bank Height Ratio[2]	1.0		1.0		0.9		0.9		0.9			
D50 (mm)	14.4		18.9		S/C		19.6		17.8			
Profile												
Riffle Length (ft)	18	19										
Riffle Slope (ft/ft)	0.009	0.026										
Pool Length (ft)	9	14										
Pool Max Depth (ft)	1.5	1.7										
Pool Spacing (ft)	26	34										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	16	16										
Radius of Curvature (ft)	9	12										
Rc:Bankfull Width (ft/ft)	0.7	1.0										
Meander Wave Length (ft)	32	32										
Meander Width Ratio	1.3	1.3										
Additional Reach Parameters												
Rosgen Classification	C5											
Channel Thalweg Length (ft)	118											
Sinuosity (ft)	1.28											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.011											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	SC/SC/0.2/20.5/35.9/ 180											
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13o. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

UFC R2 (STA. 1616+02 - 1630+09)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	11.4	12.0	11.2	12.3	11.5	12.6	11.6	12.1	10.4	12.5		
Floodprone Width (ft)	72.0	99.5	69.1	96.4	70.2	85.5	69.8	85.7	70.1	84.3		
Bankfull Mean Depth	0.7	0.8	0.7	0.8	0.7	0.7	0.7	0.7	0.6	0.7		
Bankfull Max Depth	1.1	1.4	1.1	1.4	1.1	1.4	1.2	1.5	1.2	1.3		
Bankfull Cross-Sectional Area (ft)	8.2	9.5	7.8	9.4	7.9	9.1	7.8	8.8	7.0	8.0		
Width/Depth Ratio	14.0	15.7	14.7	18.7	16.8	18.9	16.7	17.2	15.6	19.7		
Entrenchment Ratio[1]	6.0	8.6	5.6	8.2	5.6	6.8	5.8	7.1	5.6	8.1		
Bank Height Ratio[2]	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	0.8	1.0		
D50 (mm)	39.1	54.8	33.4	39.5	39.5	58.3	37.1	67.0	5.9	69.7		
Profile												
Riffle Length (ft)	16	69										
Riffle Slope (ft/ft)	0.008	0.063										
Pool Length (ft)	14	63										
Pool Max Depth (ft)	2.5	4.5										
Pool Spacing (ft)	45	162										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	8	71										
Radius of Curvature (ft)	23	50										
Rc:Bankfull Width (ft/ft)	2.0	3.8										
Meander Wave Length (ft)	92	195										
Meander Width Ratio	0.7	5.4										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	1,407											
Sinuosity (ft)	1.20											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.013											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	SC/0.63/10.4/55.9/ 104/180											
% of Reach with Eroding Banks	0%		1%		0%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13p. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

LFC R1 (STA. 1641+28 - 1647+02)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	12.3		12.8		13.3		10.4		11.5			
Floodprone Width (ft)	26.4		25.3		27.3		26.9		20.0			
Bankfull Mean Depth	0.8		0.7		1.0		0.9		0.8			
Bankfull Max Depth	1.1		1.0		1.3		1.2		1.0			
Bankfull Cross-Sectional Area (ft)	9.7		9.6		12.8		9.3		9.7			
Width/Depth Ratio	15.7		17.1		13.8		11.7		13.5			
Entrenchment Ratio[1]	2.1		2.0		2.1		2.6		1.7			
Bank Height Ratio[2]	1.0		1.0		1.2		1		1.0			
D50 (mm)	35.3		10.4		50.6		32.7		57.4			
Profile												
Riffle Length (ft)	11	55										
Riffle Slope (ft/ft)	0.001	0.047										
Pool Length (ft)	11	44										
Pool Max Depth (ft)	1.4	1.6										
Pool Spacing (ft)	36	92										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	20	73										
Radius of Curvature (ft)	12	50										
Rc:Bankfull Width (ft/ft)	1.0	4.1										
Meander Wave Length (ft)	73	138										
Meander Width Ratio	1.6	5.9										
Additional Reach Parameters												
Rosgen Classification	C5											
Channel Thalweg Length (ft)	574											
Sinuosity (ft)	1.07											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.009											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.36/0.69/1.8/57.9/ 110.1/180											
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13q. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

LFC R2 (STA. 1647+33 - 1651+60)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	9.9		9.8		9.1		10.1		8.5			
Floodprone Width (ft)	28.4		28.6		29.6		30.5		27.3			
Bankfull Mean Depth	0.6		0.5		0.6		0.8		0.6			
Bankfull Max Depth	0.8		0.9		1.2		1.1		1.0			
Bankfull Cross-Sectional Area (ft)	6.3		4.6		5.9		7.6		5.4			
Width/Depth Ratio	15.4		20.5		14.2		13.4		13.5			
Entrenchment Ratio[1]	2.9		2.9		3.2		3.0		3.2			
Bank Height Ratio[2]	1.0		0.8		1.0		1.1		0.9			
D50 (mm)	11.0		8.4		43.9		40.2		12.6			
Profile												
Riffle Length (ft)	14	36										
Riffle Slope (ft/ft)	0.005	0.040										
Pool Length (ft)	18	53										
Pool Max Depth (ft)	1.8	2.2										
Pool Spacing (ft)	42	90										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	44											
Radius of Curvature (ft)	53	79										
Rc:Bankfull Width (ft/ft)	5.4	8.0										
Meander Wave Length (ft)	201	201										
Meander Width Ratio	4.4	0.0										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	427											
Sinuosity (ft)	1.00											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.016											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.27/0.69/4.4/40.5/ 128.7/362											
% of Reach with Eroding Banks	0%		4%		2%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13r. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

LBHC R1a (STA. 300+13 - 305+13)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	26.2		25.7		28.3		30.7		26.4			
Floodprone Width (ft)	158.0		155.7		77.9		78.0		77.9			
Bankfull Mean Depth	1.9		1.5		1.7		1.8		1.8			
Bankfull Max Depth	3.0		2.9		3.3		3.6		3.4			
Bankfull Cross-Sectional Area (ft)	49.4		38.7		49.3		55.6		48.8			
Width/Depth Ratio	13.9		17.1		16.2		16.9		14.3			
Entrenchment Ratio[1]	6.0		6.1		2.8		2.5		3.0			
Bank Height Ratio[2]	1.0		0.9		1.0		1.1		1.0			
D50 (mm)	32.0		20.3		51.2		39.6		8.6			
Profile												
Riffle Length (ft)	15	142										
Riffle Slope (ft/ft)	0.005	0.079										
Pool Length (ft)	54	94										
Pool Max Depth (ft)	3.9	6.2										
Pool Spacing (ft)	116	218										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	58	105										
Radius of Curvature (ft)	60	80										
Rc:Bankfull Width (ft/ft)	2.0	2.6										
Meander Wave Length (ft)	157	419										
Meander Width Ratio	1.9	3.5										
Additional Reach Parameters												
Rosgen Classification	C5											
Channel Thalweg Length (ft)	500											
Sinuosity (ft)	1.10											
Water Surface Slope (ft/ft)	---											
Bankfull Slope (ft/ft)	0.004											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.4/0.8/1.7/94/256/2048											
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

Table 13s. Monitoring Data - Stream Reach Data Summary

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

LBHC R1b/2 (STA. 305+13 - 318+00)

Parameter	As-Built/Baseline 2018		MY1 2018		MY2 2019		MY3 2020		MY4 2021		MY5 2022	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate[3]												
Bankfull Width (ft)	26.7		27.2		29.4		30.4		31.0			
Floodprone Width (ft)	299.6		171.0		84.9		84.9		84.9			
Bankfull Mean Depth	1.7		1.9		2.1		2.0		2.0			
Bankfull Max Depth	2.8		3.3		3.6		3.5		3.4			
Bankfull Cross-Sectional Area (ft)	46.0		51.5		60.8		62.1		62.9			
Width/Depth Ratio	15.5		14.3		14.2		14.9		15.2			
Entrenchment Ratio[1]	11.2		6.3		2.9		2.8		2.7			
Bank Height Ratio[2]	1.0		1.1		1.2		1.2		1.2			
D50 (mm)	87.4		47.7		61.5		85.4		36.2			
Profile												
Riffle Length (ft)	21	146										
Riffle Slope (ft/ft)	0.002	0.065										
Pool Length (ft)	14	135										
Pool Max Depth (ft)	4.6	6.0										
Pool Spacing (ft)	37	291										
Pool Volume (ft^3)												
Pattern												
Channel Beltwidth (ft)	80	117										
Radius of Curvature (ft)	65	90										
Rc:Bankfull Width (ft/ft)	2.4	3.4										
Meander Wave Length (ft)	236	396										
Meander Width Ratio	3.0	4.4										
Additional Reach Parameters												
Rosgen Classification	C4											
Channel Thalweg Length (ft)	1,287											
Sinuosity (ft)	1.09											
Water Surface Slope (ft/ft)[4]	---						0.007		0.005			
Bankfull Slope (ft/ft)	0.003											
Ri%/Ru%/P%/G%/S%	---											
SC%/Sa%/G%/C%/B%/Be%	---											
d16/d35/d50/d84/d95/d100	0.2/0.3/5.6/94/256/2048											
% of Reach with Eroding Banks	0%		11%		6%		6%		0%			

(---): Data was not provided

[1] Entrenchment Ratio (ER) is the flood prone width divided by the bankfull width. ER in MY2 and forward will be based on the width between monumented cross-section pins. ER in MY0 and MY1 are based on surveyed widths beyond cross-section pins.

[2] Bank Height Ratio is the bank height divided by the max depth of the bankfull channel.

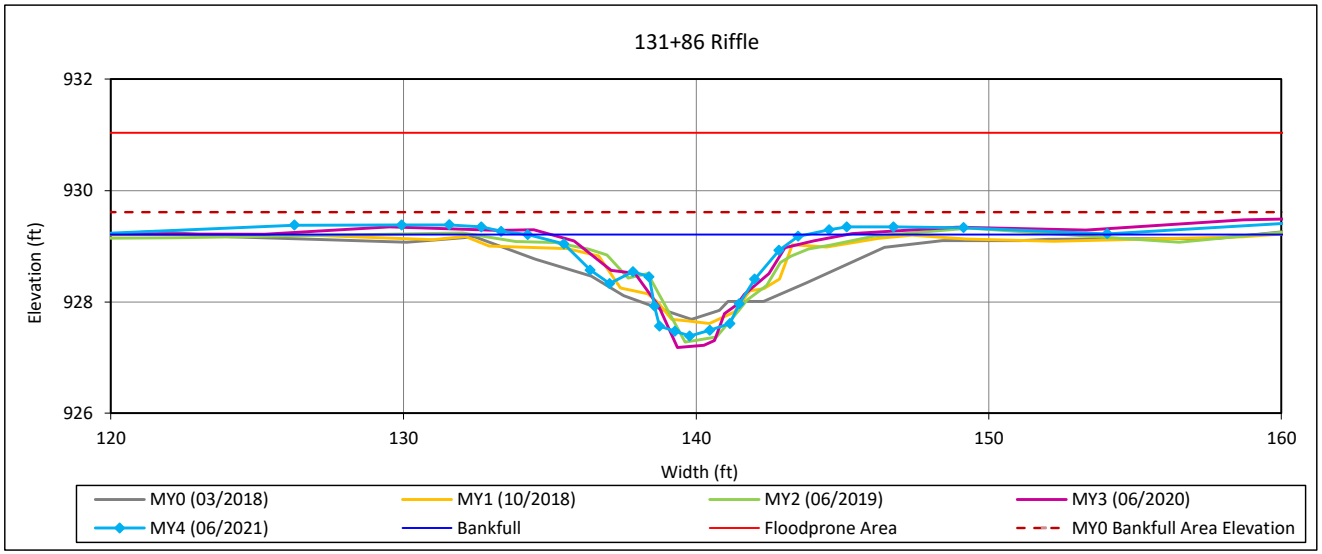
[3] Starting in MY2, bankfull elevation is calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (2018).

[4] Water surface slopes are based on abbreviated longitudinal profiles of one meander length collected during MY3 after geomorphically significant events.

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 2A: Cross-Section 1



Bankfull Dimensions	
8.1	x-section area (ft.sq.)
9.2	width (ft)
0.9	mean depth (ft)
1.8	max depth (ft)
10.6	wetted perimeter (ft)
0.8	hydraulic radius (ft)
10.5	width-depth ratio
89.2	W flood prone area (ft)
9.7	entrenchment ratio
0.8	low bank height ratio

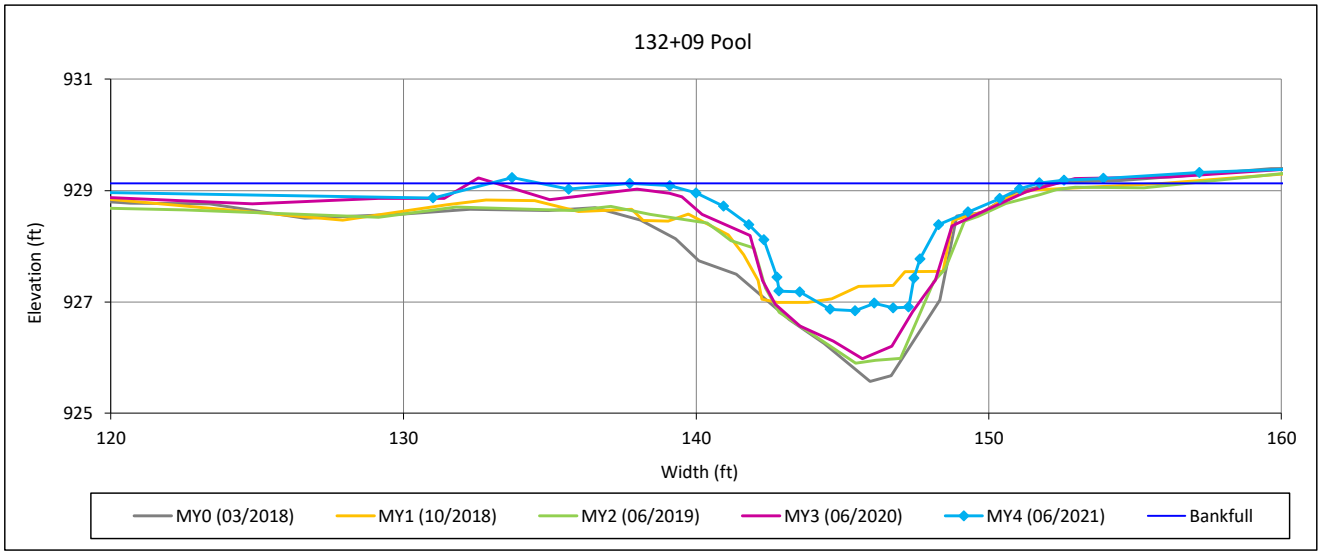
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 2A: Cross-Section 2



Bankfull Dimensions	
14.2	x-section area (ft.sq.)
14.0	width (ft)
1.0	mean depth (ft)
2.3	max depth (ft)
15.6	wetted perimeter (ft)
0.9	hydraulic radius (ft)
13.7	width-depth ratio

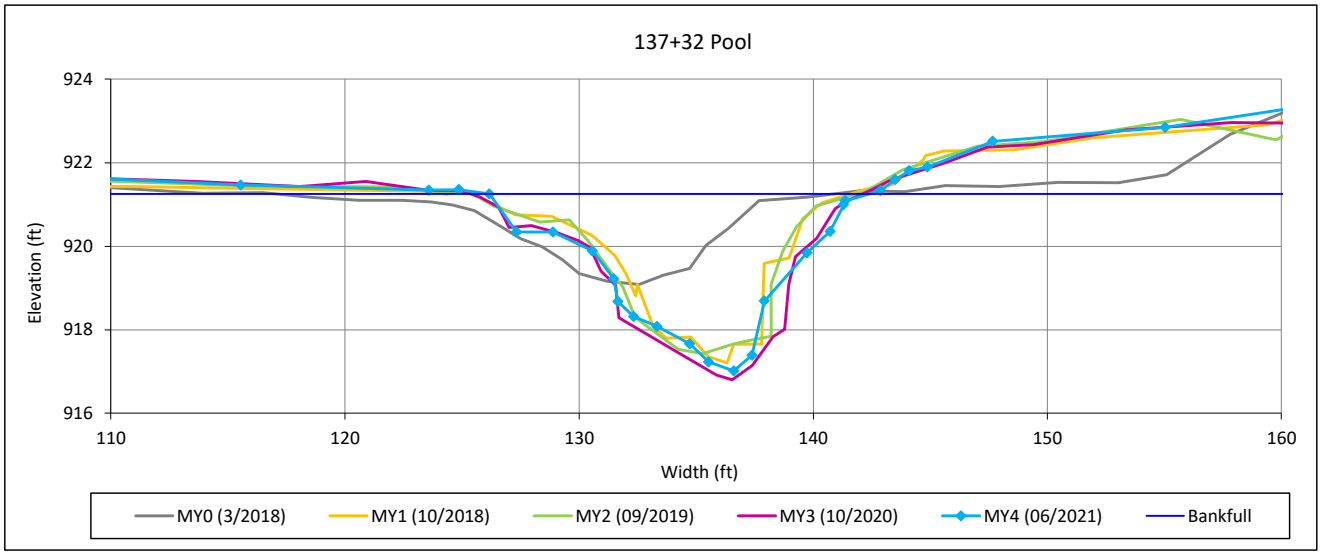
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 2B: Cross-Section 3



Bankfull Dimensions	
33.0	x-section area (ft.sq.)
16.2	width (ft)
2.0	mean depth (ft)
4.2	max depth (ft)
19.3	wetted perimeter (ft)
1.7	hydraulic radius (ft)
8.0	width-depth ratio

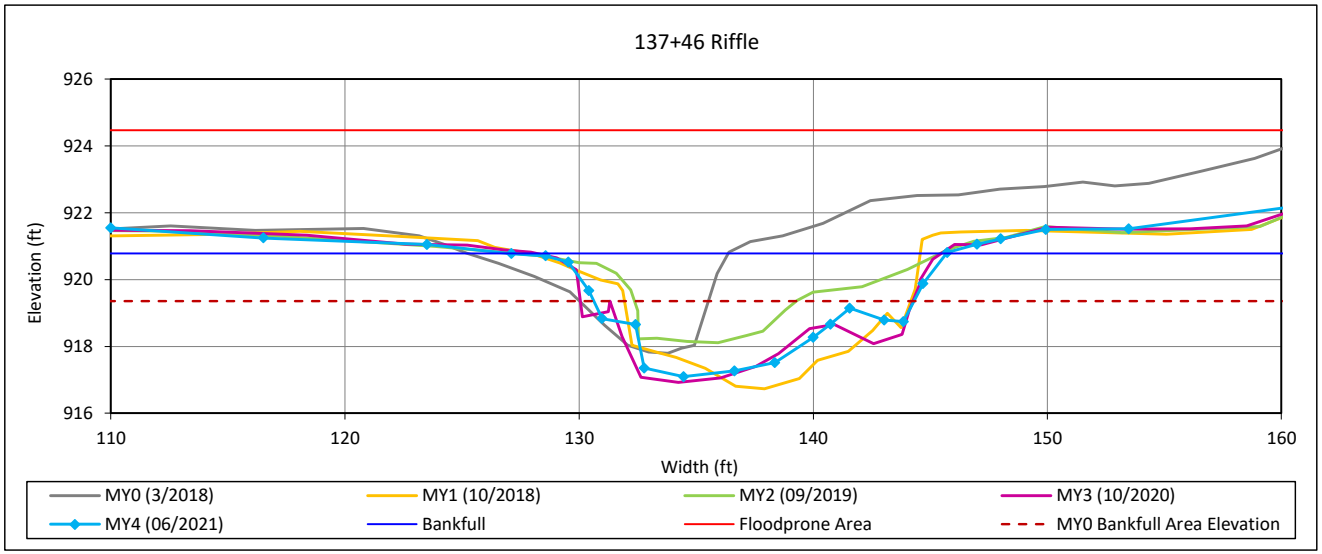
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 2B: Cross-Section 4



Bankfull Dimensions	
39.1	x-section area (ft.sq.)
17.1	width (ft)
2.3	mean depth (ft)
3.7	max depth (ft)
20.3	wetted perimeter (ft)
1.9	hydraulic radius (ft)
7.5	width-depth ratio
67.6	W flood prone area (ft)
4.0	entrenchment ratio
1.6	low bank height ratio

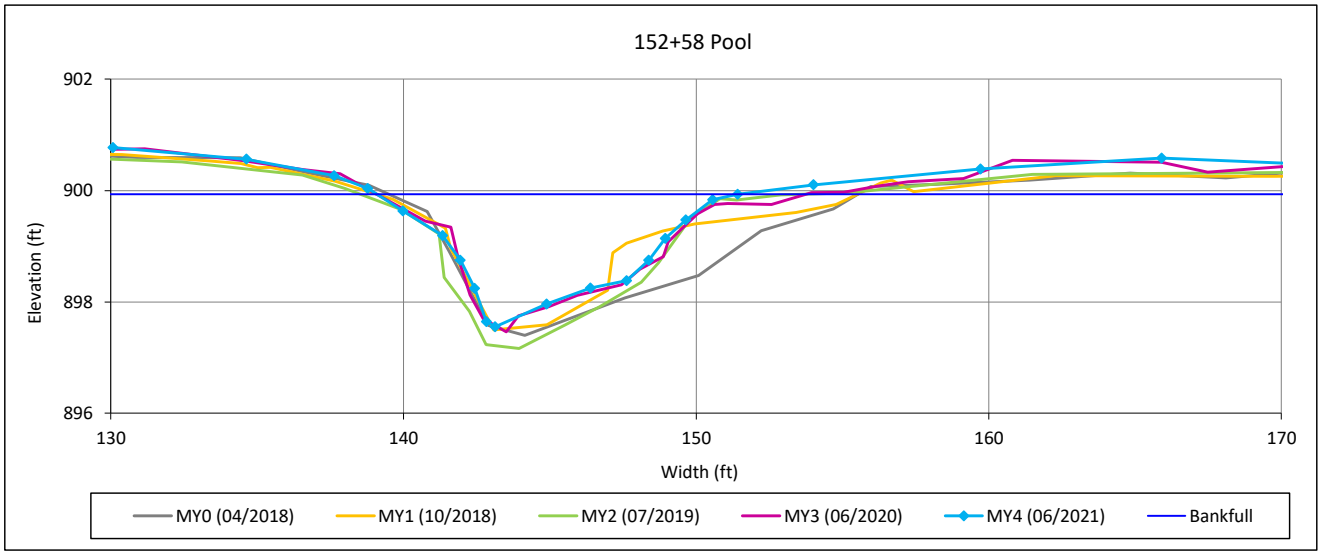
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 4: Cross-Section 5



Bankfull Dimensions	
14.5	x-section area (ft.sq.)
12.3	width (ft)
1.2	mean depth (ft)
2.4	max depth (ft)
13.6	wetted perimeter (ft)
1.1	hydraulic radius (ft)
10.5	width-depth ratio

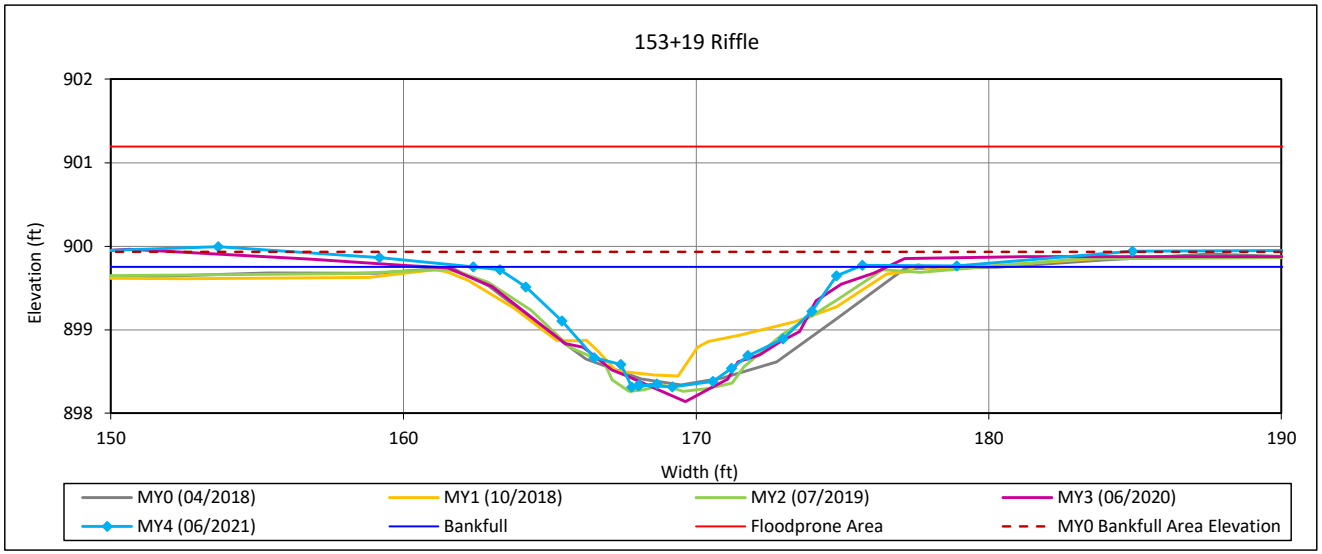
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 4: Cross-Section 6



Bankfull Dimensions	
10.7	x-section area (ft.sq.)
13.1	width (ft)
0.8	mean depth (ft)
1.4	max depth (ft)
14.9	wetted perimeter (ft)
0.7	hydraulic radius (ft)
16.2	width-depth ratio
120.1	W flood prone area (ft)
9.1	entrenchment ratio
0.9	low bank height ratio

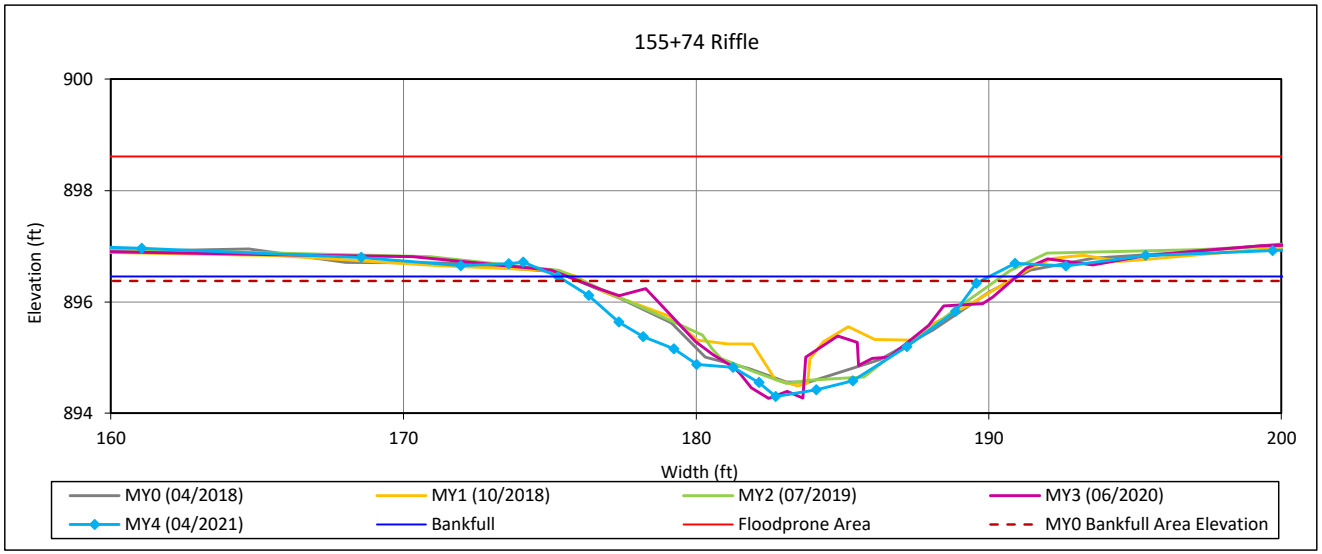
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 4: Cross-Section 7



Bankfull Dimensions	
18.7	x-section area (ft.sq.)
14.7	width (ft)
1.3	mean depth (ft)
2.2	max depth (ft)
15.5	wetted perimeter (ft)
1.2	hydraulic radius (ft)
11.6	width-depth ratio
137.3	W flood prone area (ft)
9.3	entrenchment ratio
1.0	low bank height ratio

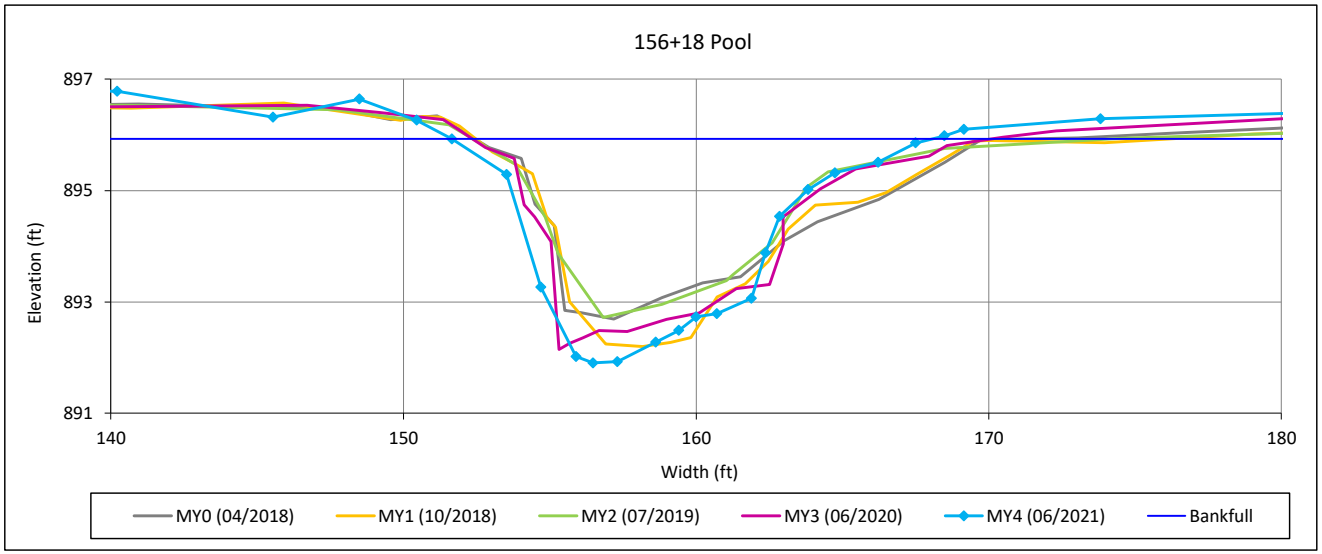
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 4: Cross-Section 8



Bankfull Dimensions	
32.6	x-section area (ft.sq.)
16.4	width (ft)
2.0	mean depth (ft)
4.0	max depth (ft)
19.4	wetted perimeter (ft)
1.7	hydraulic radius (ft)
8.3	width-depth ratio

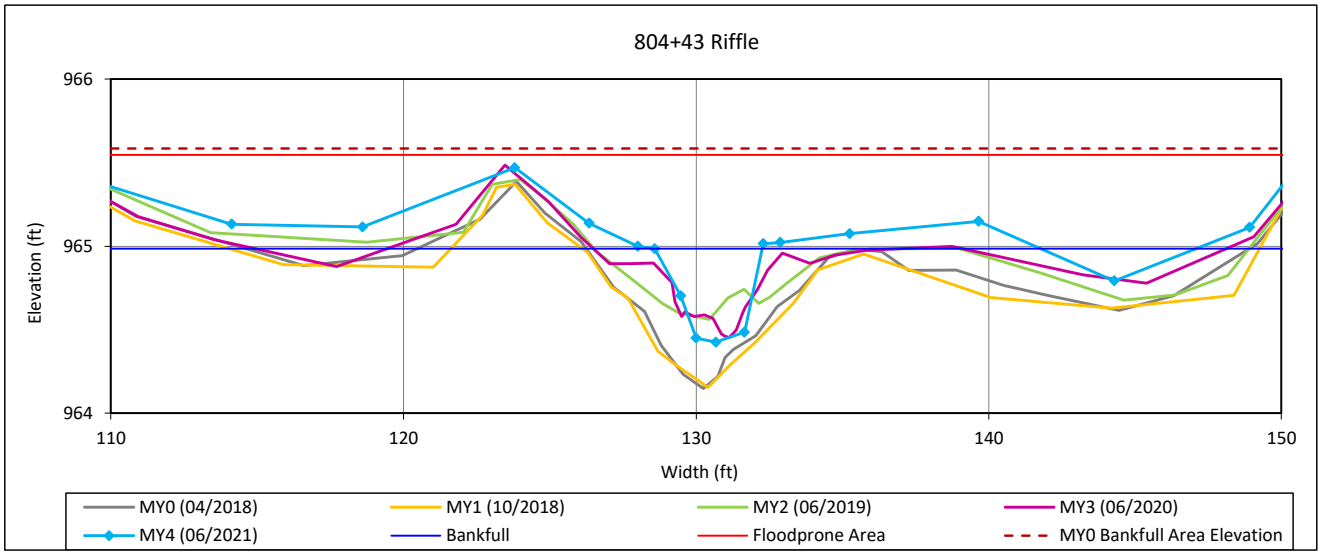
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

Royster Creek Reach 1: Cross-Section 9



Bankfull Dimensions	
1.4	x-section area (ft.sq.)
3.7	width (ft)
0.4	mean depth (ft)
0.6	max depth (ft)
4.0	wetted perimeter (ft)
0.3	hydraulic radius (ft)
9.8	width-depth ratio
44.9	W flood prone area (ft)
12.2	entrenchment ratio
0.5	low bank height ratio

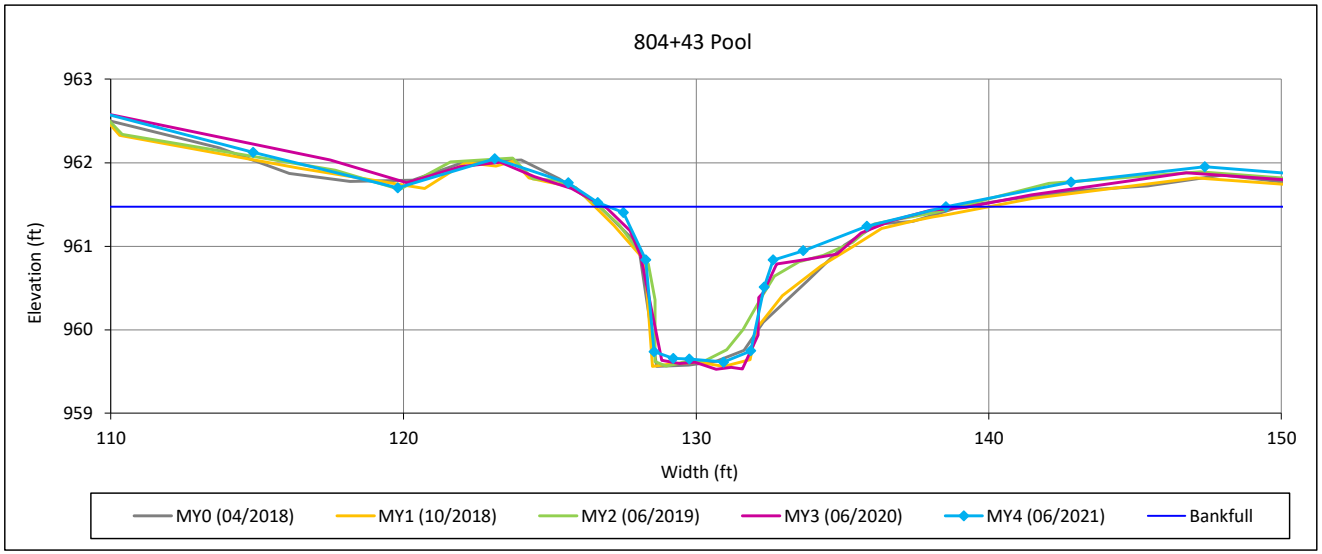
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

Royster Creek Reach 1: Cross-Section 10



Bankfull Dimensions	
9.2	x-section area (ft.sq.)
11.5	width (ft)
0.8	mean depth (ft)
1.9	max depth (ft)
13.2	wetted perimeter (ft)
0.7	hydraulic radius (ft)
14.4	width-depth ratio

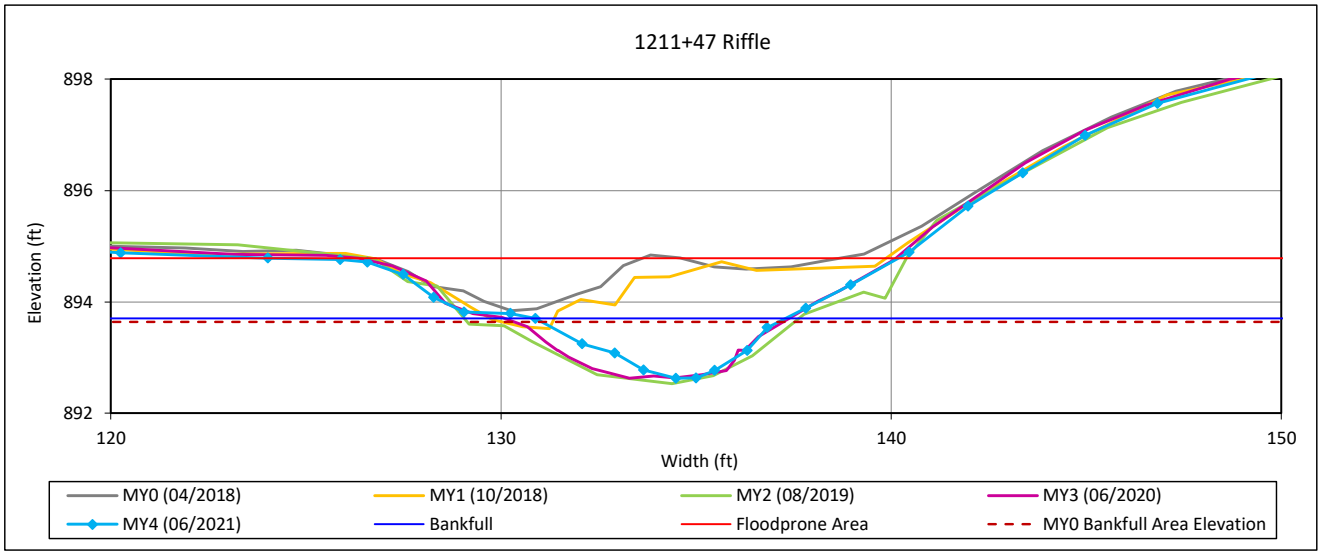
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

Scott Creek: Cross-Section 11



Bankfull Dimensions	
4.0	x-section area (ft.sq.)
6.4	width (ft)
0.6	mean depth (ft)
1.1	max depth (ft)
6.8	wetted perimeter (ft)
0.6	hydraulic radius (ft)
10.2	width-depth ratio
15.9	W flood prone area (ft)
2.5	entrenchment ratio
1.1	low bank height ratio

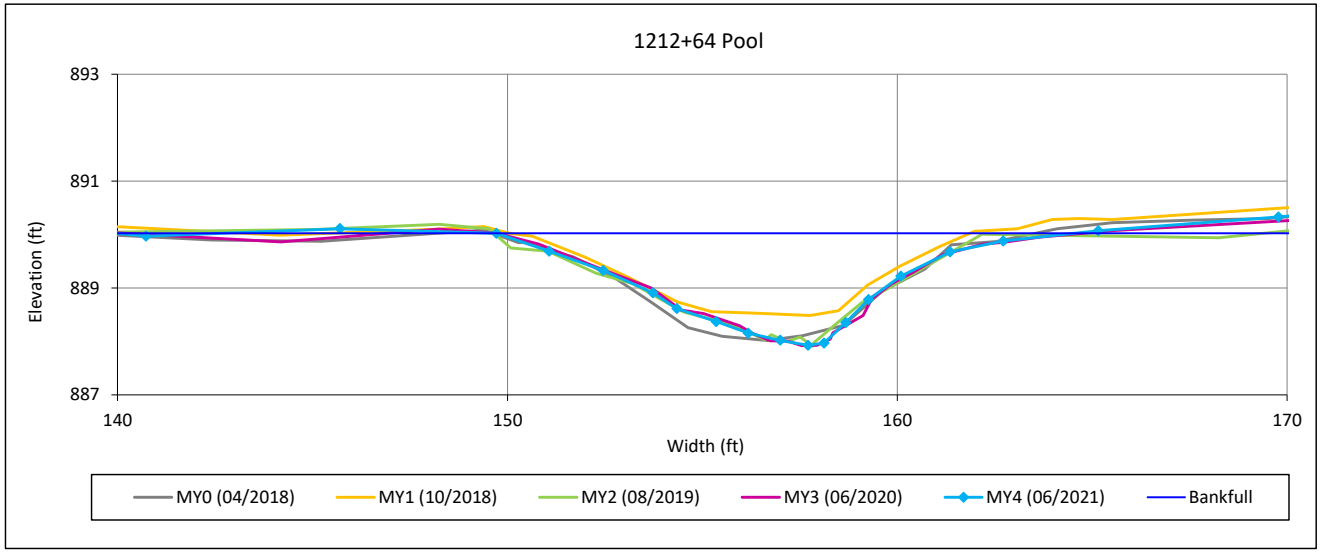
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

Scott Creek: Cross-Section 12



Bankfull Dimensions	
13.7	x-section area (ft.sq.)
14.8	width (ft)
0.9	mean depth (ft)
2.1	max depth (ft)
15.6	wetted perimeter (ft)
0.9	hydraulic radius (ft)
16.1	width-depth ratio

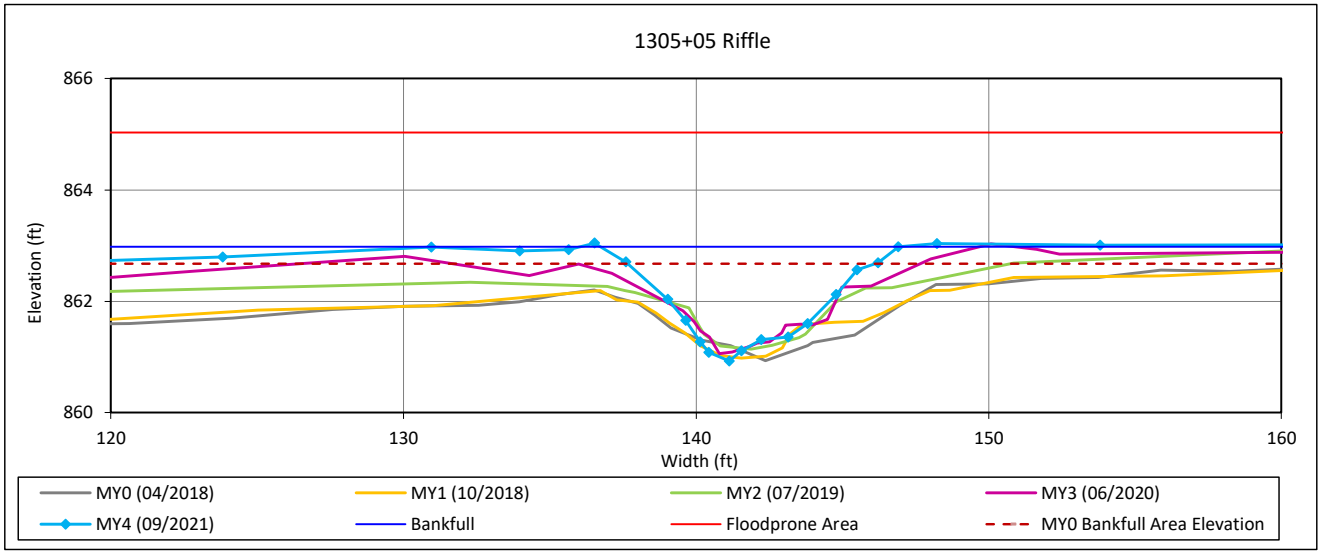
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

Carroll Creek Reach 1: Cross-Section 13



Bankfull Dimensions	
10.8	x-section area (ft.sq.)
10.2	width (ft)
1.1	mean depth (ft)
2.1	max depth (ft)
11.1	wetted perimeter (ft)
1.0	hydraulic radius (ft)
9.6	width-depth ratio
97.3	W flood prone area (ft)
9.6	entrenchment ratio
1.2	low bank height ratio

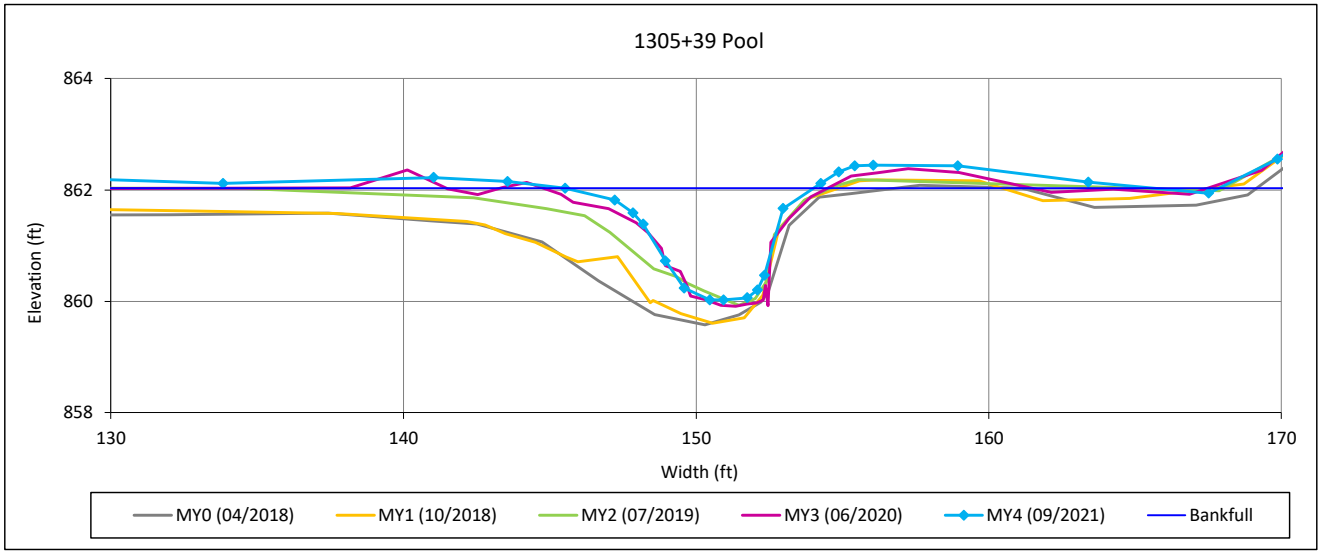
Survey Date: 09/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area A
NCDMS Project No. 739
Monitoring Year 4 - 2021

Carroll Creek Reach 1: Cross-Section 14



Bankfull Dimensions	
8.4	x-section area (ft.sq.)
8.5	width (ft)
1.0	mean depth (ft)
2.0	max depth (ft)
10.0	wetted perimeter (ft)
0.8	hydraulic radius (ft)
8.6	width-depth ratio

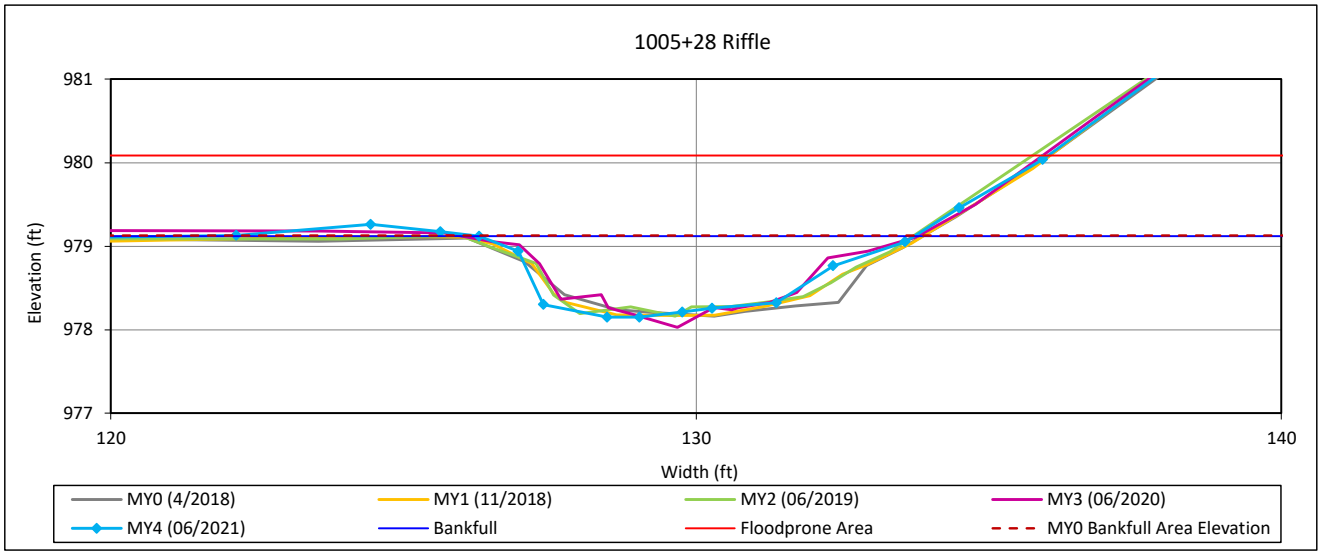
Survey Date: 09/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 1: Cross-Section 15



Bankfull Dimensions	
4.6	x-section area (ft.sq.)
7.4	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
8.0	wetted perimeter (ft)
0.6	hydraulic radius (ft)
11.9	width-depth ratio
36.0	W flood prone area (ft)
4.8	entrenchment ratio
0.9	low bank height ratio

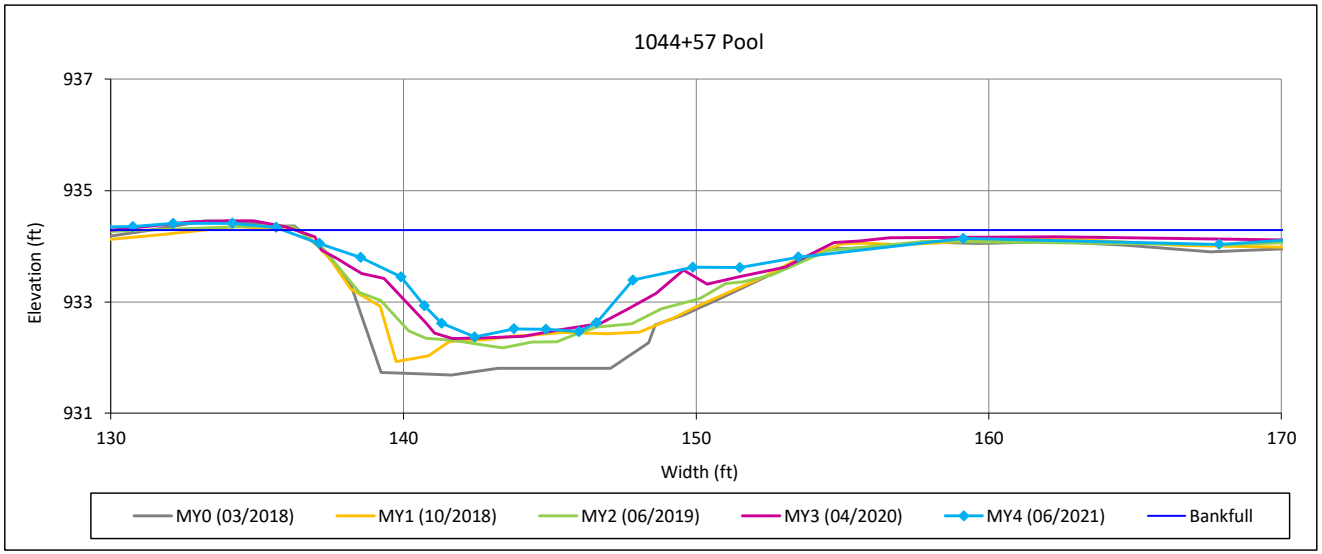
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 5: Cross-Section 16



Bankfull Dimensions	
20.1	x-section area (ft.sq.)
23.2	width (ft)
0.9	mean depth (ft)
1.9	max depth (ft)
23.8	wetted perimeter (ft)
0.8	hydraulic radius (ft)
26.8	width-depth ratio

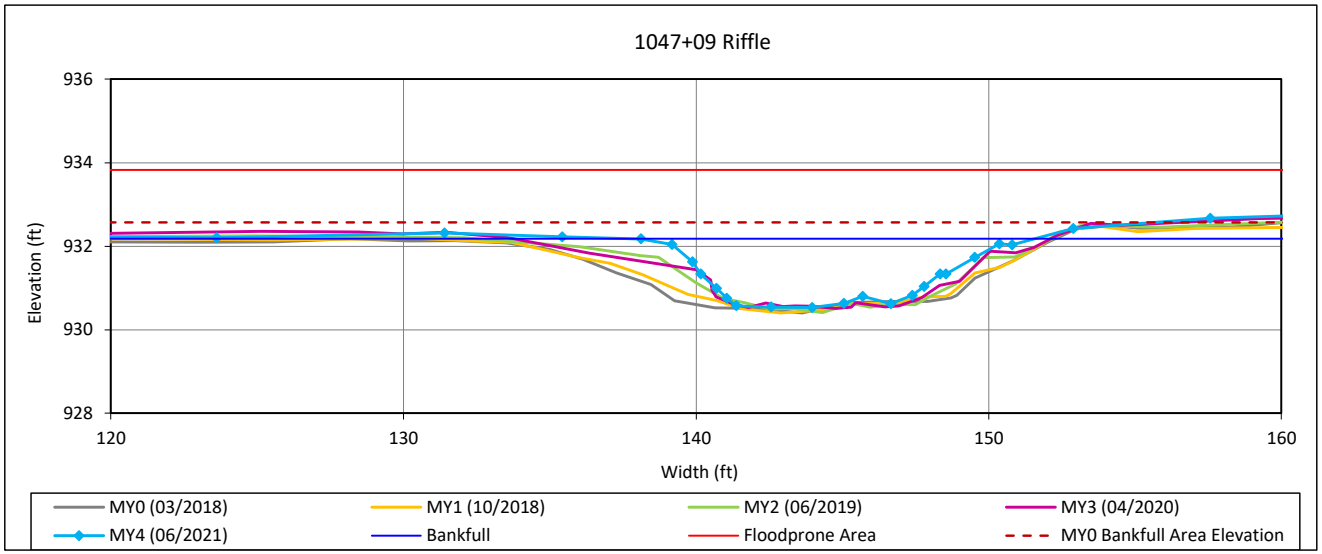
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 5: Cross-Section 17



Bankfull Dimensions	
13.6	x-section area (ft.sq.)
13.4	width (ft)
1.0	mean depth (ft)
1.6	max depth (ft)
14.3	wetted perimeter (ft)
1.0	hydraulic radius (ft)
13.3	width-depth ratio
89.1	W flood prone area (ft)
6.6	entrenchment ratio
0.9	low bank height ratio

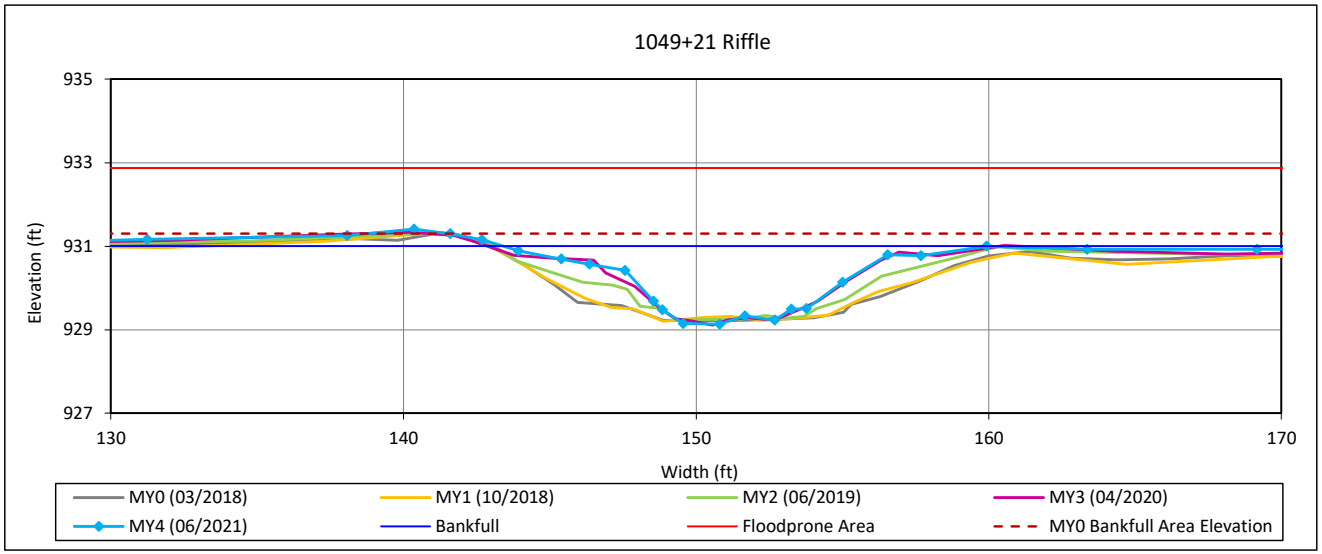
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 5: Cross-Section 18



Bankfull Dimensions	
13.9	x-section area (ft.sq.)
16.5	width (ft)
0.8	mean depth (ft)
1.9	max depth (ft)
17.3	wetted perimeter (ft)
0.8	hydraulic radius (ft)
19.6	width-depth ratio
80.7	W flood prone area (ft)
4.9	entrenchment ratio
0.9	low bank height ratio

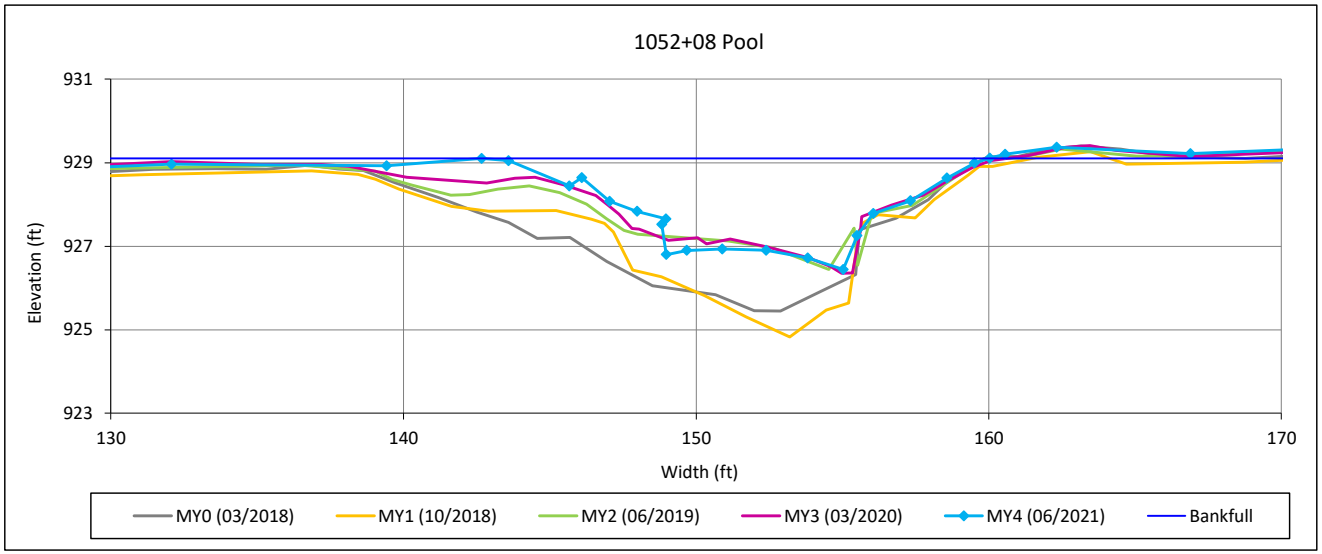
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 5: Cross-Section 19



Bankfull Dimensions	
22.7	x-section area (ft.sq.)
17.3	width (ft)
1.3	mean depth (ft)
2.7	max depth (ft)
19.6	wetted perimeter (ft)
1.2	hydraulic radius (ft)
13.2	width-depth ratio

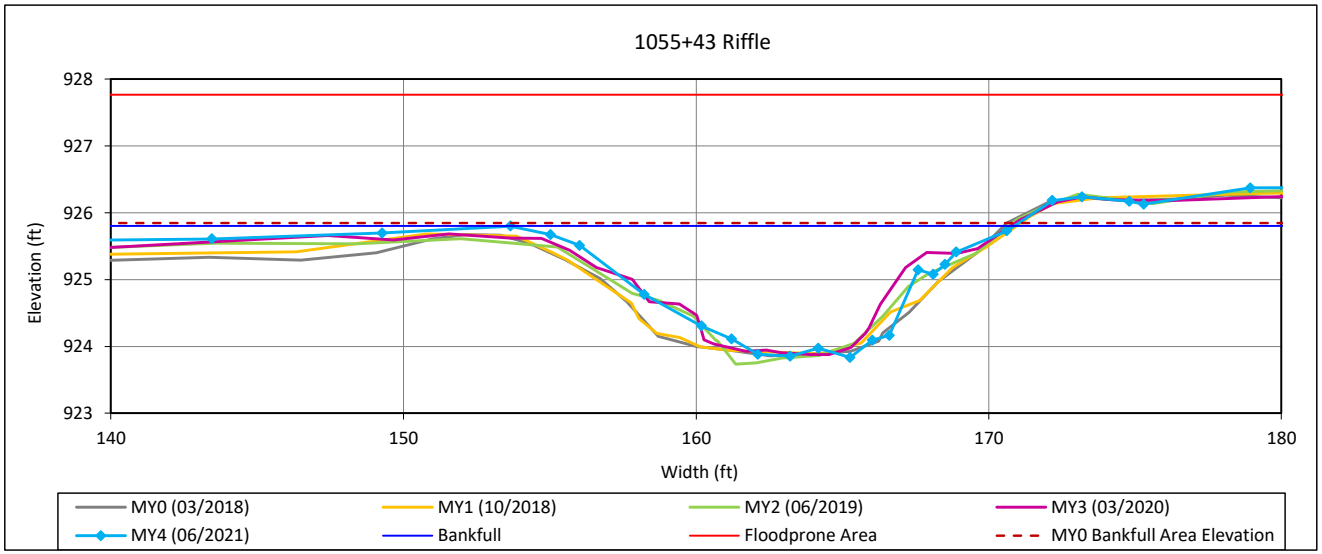
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 5: Cross-Section 20



Bankfull Dimensions	
18.2	x-section area (ft.sq.)
17.2	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
18.0	wetted perimeter (ft)
1.0	hydraulic radius (ft)
16.3	width-depth ratio
102.9	W flood prone area (ft)
6.0	entrenchment ratio
1.0	low bank height ratio

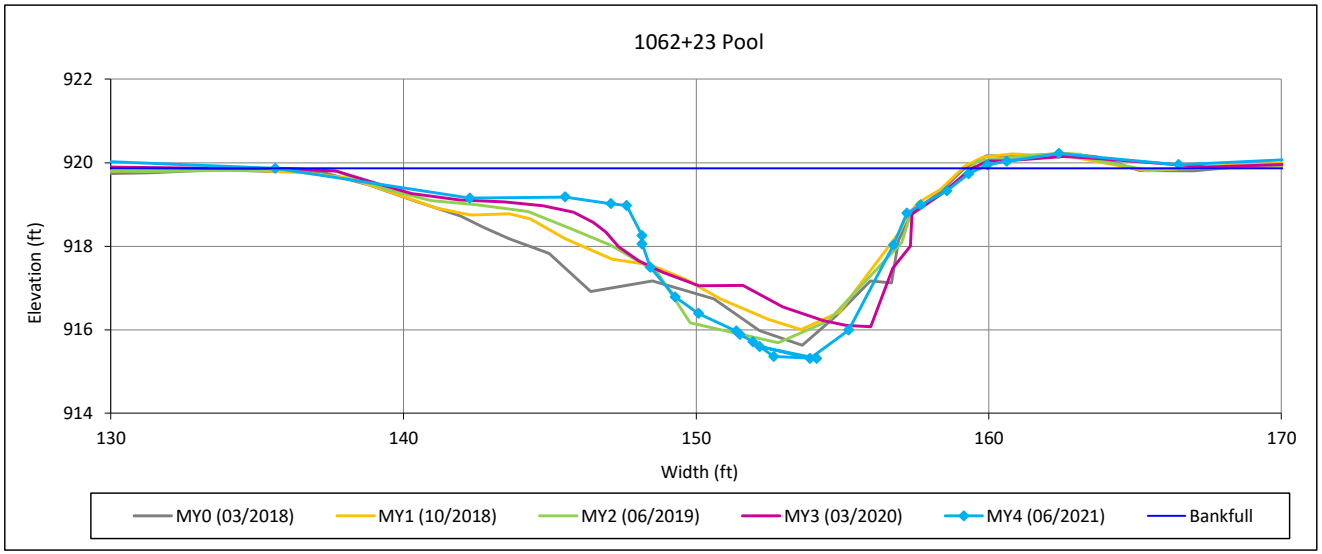
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 6: Cross-Section 21



Bankfull Dimensions	
40.3	x-section area (ft.sq.)
24.1	width (ft)
1.7	mean depth (ft)
4.6	max depth (ft)
31.4	wetted perimeter (ft)
1.3	hydraulic radius (ft)
14.4	width-depth ratio

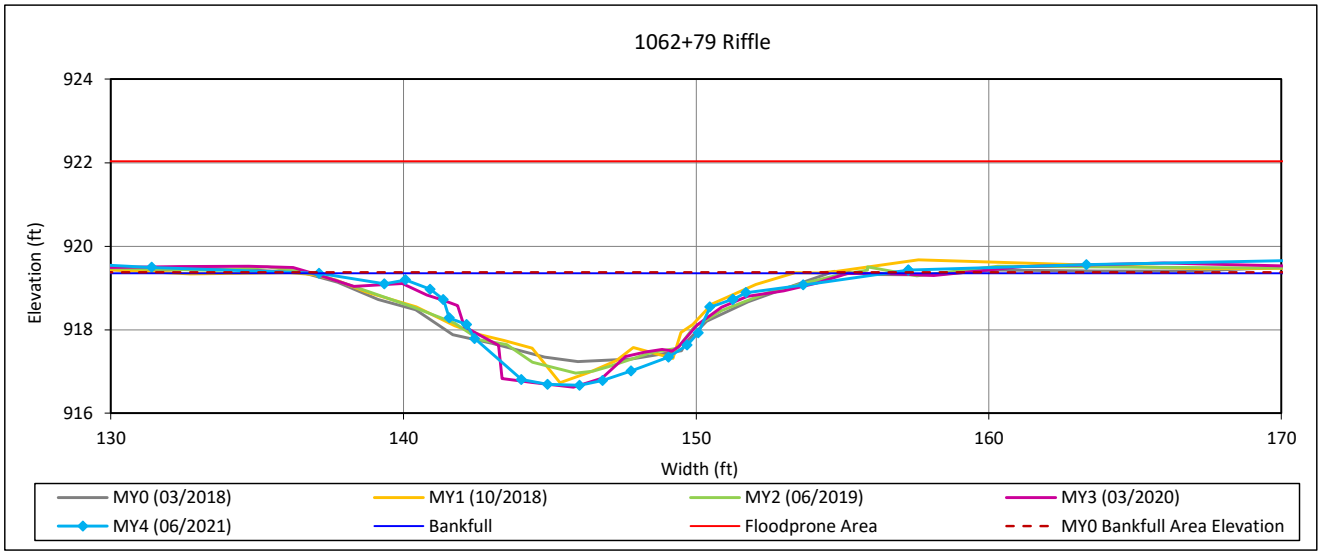
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

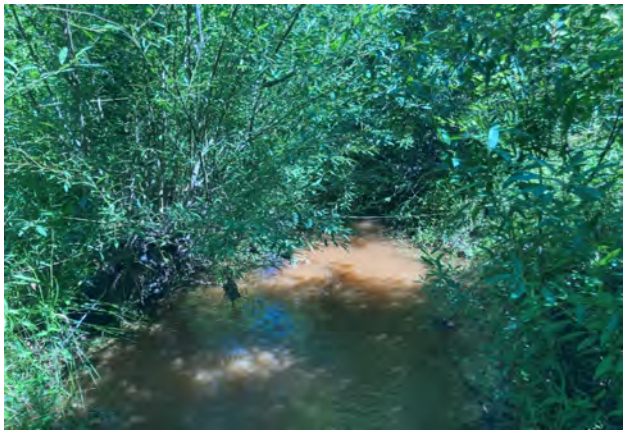
Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 6: Cross-Section 22



Bankfull Dimensions	
22.0	x-section area (ft.sq.)
19.4	width (ft)
1.1	mean depth (ft)
2.7	max depth (ft)
20.9	wetted perimeter (ft)
1.1	hydraulic radius (ft)
17.0	width-depth ratio
81.8	W flood prone area (ft)
4.2	entrenchment ratio
1.0	low bank height ratio

Survey Date: 06/2021
Field Crew: Wildlands Engineering

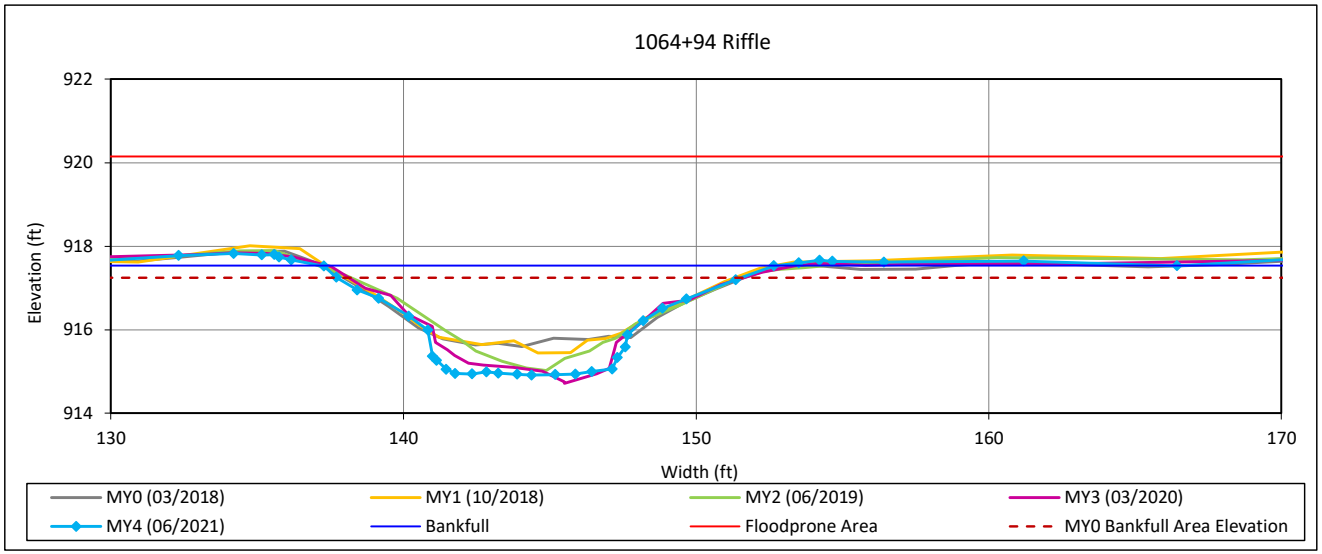


View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 6: Cross-Section 23



Bankfull Dimensions	
23.3	x-section area (ft.sq.)
15.4	width (ft)
1.5	mean depth (ft)
2.6	max depth (ft)
17.1	wetted perimeter (ft)
1.4	hydraulic radius (ft)
10.2	width-depth ratio
81.2	W flood prone area (ft)
5.3	entrenchment ratio
1.1	low bank height ratio

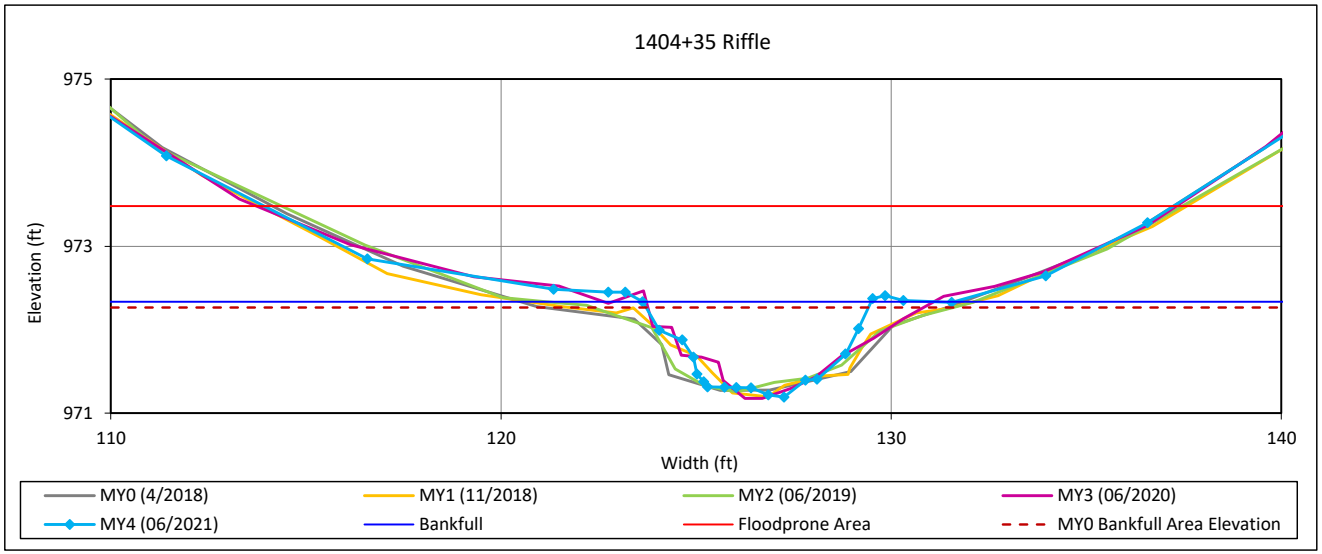
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

Elliott Creek: Cross-Section 24



Bankfull Dimensions	
4.5	x-section area (ft.sq.)
5.9	width (ft)
0.8	mean depth (ft)
1.1	max depth (ft)
6.6	wetted perimeter (ft)
0.7	hydraulic radius (ft)
7.6	width-depth ratio
23.3	W flood prone area (ft)
4.0	entrenchment ratio
1.1	low bank height ratio

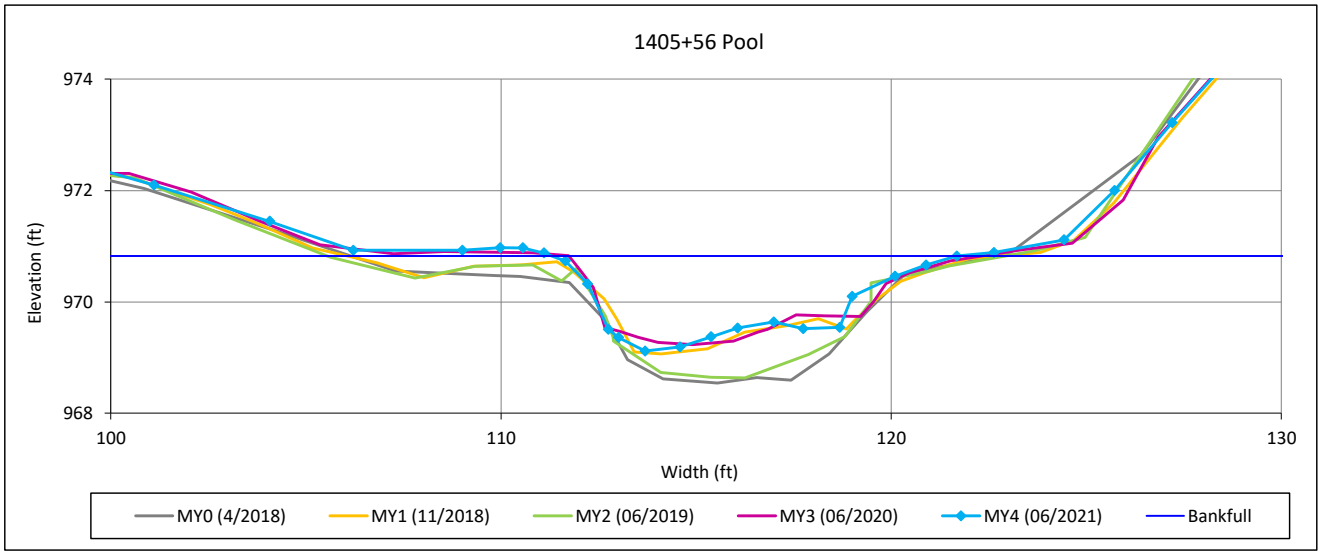
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

Elliott Creek: Cross-Section 25



Bankfull Dimensions	
10.2	x-section area (ft.sq.)
10.4	width (ft)
1.0	mean depth (ft)
1.7	max depth (ft)
11.5	wetted perimeter (ft)
0.9	hydraulic radius (ft)
10.5	width-depth ratio

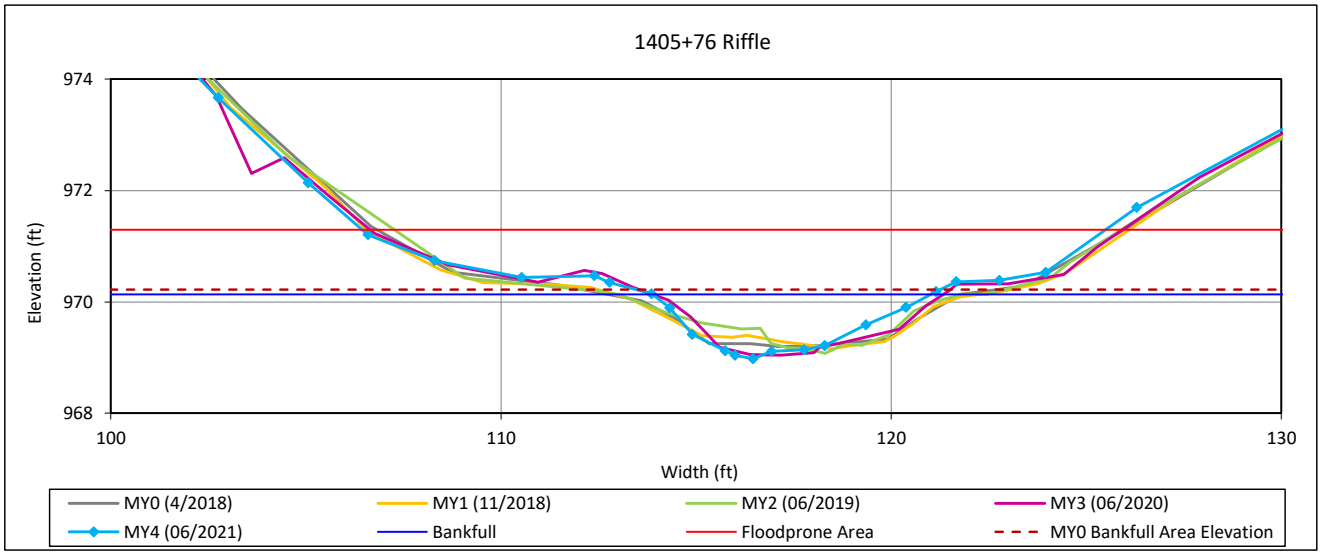
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

Elliott Creek: Cross-Section 26



Bankfull Dimensions	
5.0	x-section area (ft.sq.)
7.1	width (ft)
0.7	mean depth (ft)
1.2	max depth (ft)
7.6	wetted perimeter (ft)
0.7	hydraulic radius (ft)
10.2	width-depth ratio
19.1	W flood prone area (ft)
2.7	entrenchment ratio
0.9	low bank height ratio

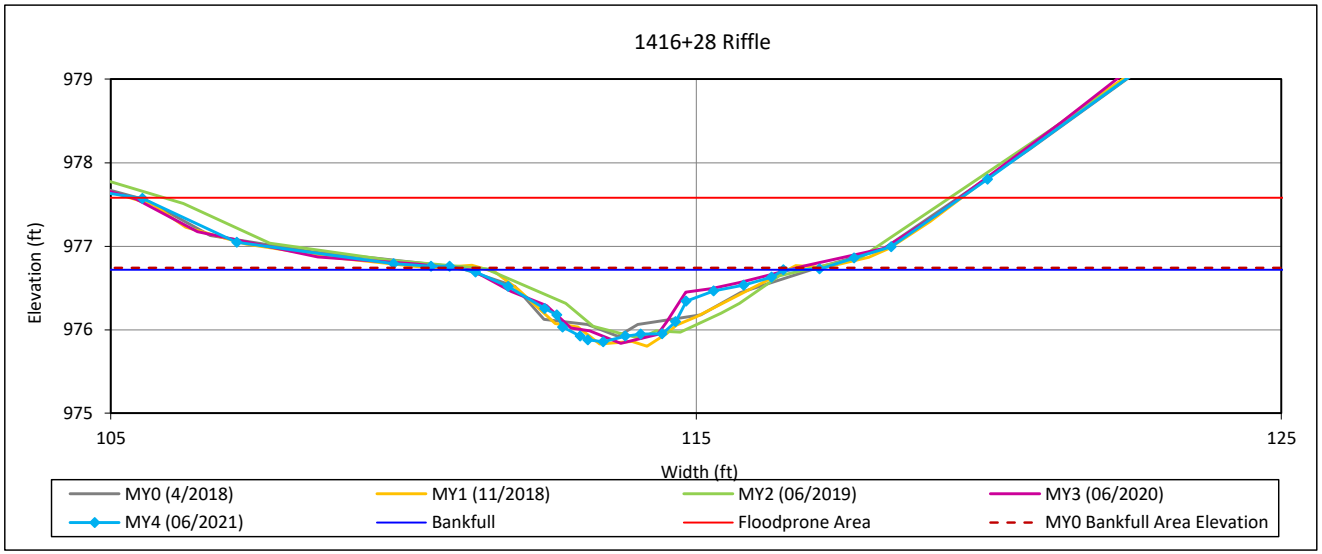
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

UT1 to Elliott Creek: Cross-Section 27



Bankfull Dimensions	
2.4	x-section area (ft.sq.)
5.4	width (ft)
0.4	mean depth (ft)
0.9	max depth (ft)
5.8	wetted perimeter (ft)
0.4	hydraulic radius (ft)
12.4	width-depth ratio
14.0	W flood prone area (ft)
2.6	entrenchment ratio
1.0	low bank height ratio

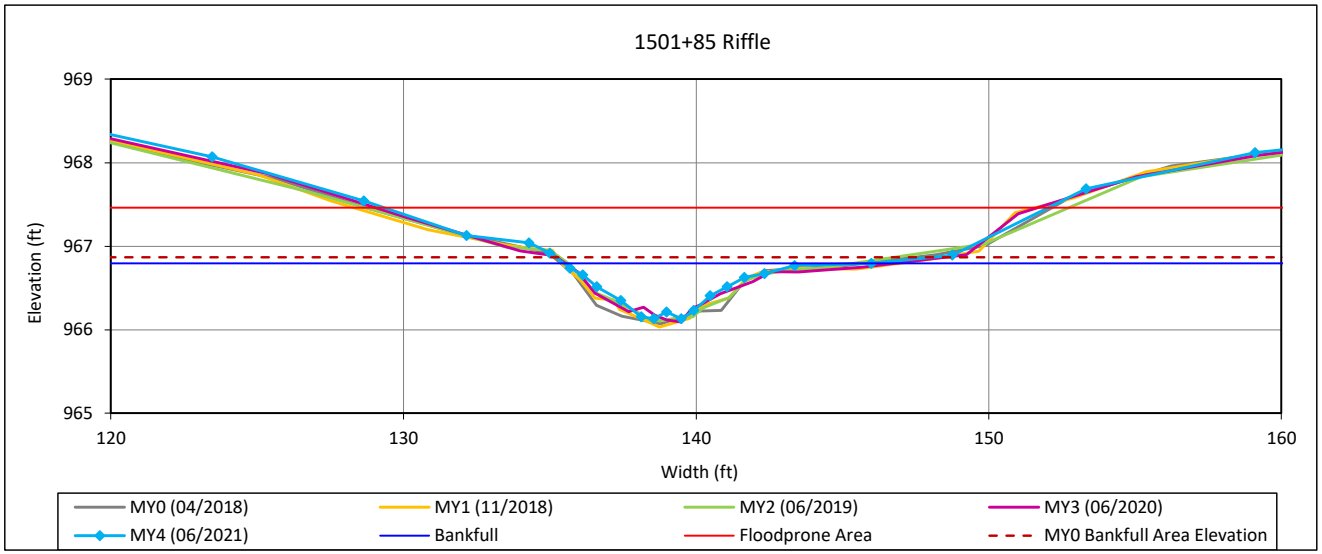
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

Bridges Creek: Cross-Section 28



Bankfull Dimensions	
2.7	x-section area (ft.sq.)
7.9	width (ft)
0.3	mean depth (ft)
0.7	max depth (ft)
8.0	wetted perimeter (ft)
0.3	hydraulic radius (ft)
22.8	width-depth ratio
22.7	W flood prone area (ft)
2.9	entrenchment ratio
0.9	low bank height ratio

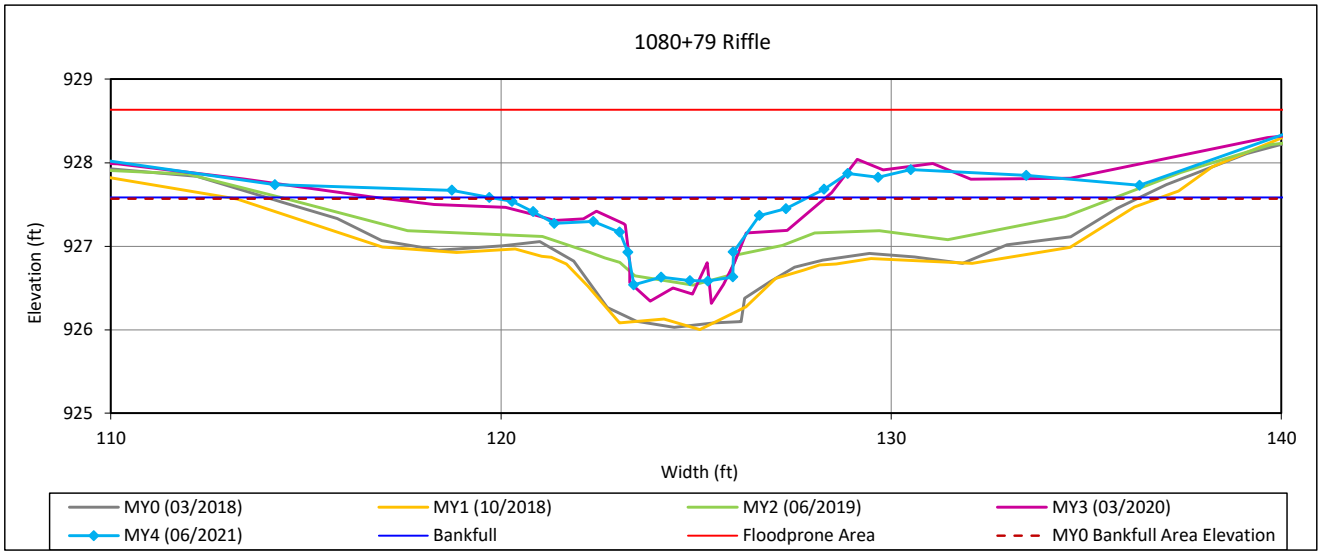
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC UT2: Cross-Section 29



Bankfull Dimensions	
3.9	x-section area (ft.sq.)
8.2	width (ft)
0.5	mean depth (ft)
1.0	max depth (ft)
9.0	wetted perimeter (ft)
0.4	hydraulic radius (ft)
16.9	width-depth ratio
40.9	W flood prone area (ft)
5.0	entrenchment ratio
1.0	low bank height ratio

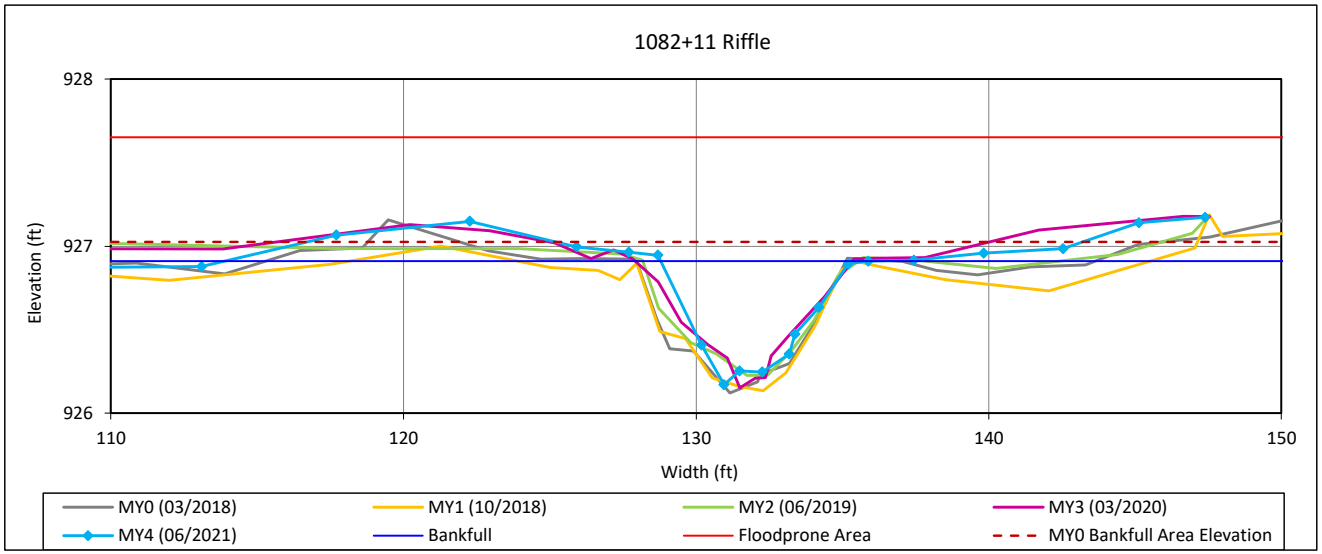
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach UT3: Cross-Section 30



Bankfull Dimensions	
2.8	x-section area (ft.sq.)
7.1	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
7.3	wetted perimeter (ft)
0.4	hydraulic radius (ft)
17.9	width-depth ratio
42.6	W flood prone area (ft)
6.0	entrenchment ratio
0.9	low bank height ratio

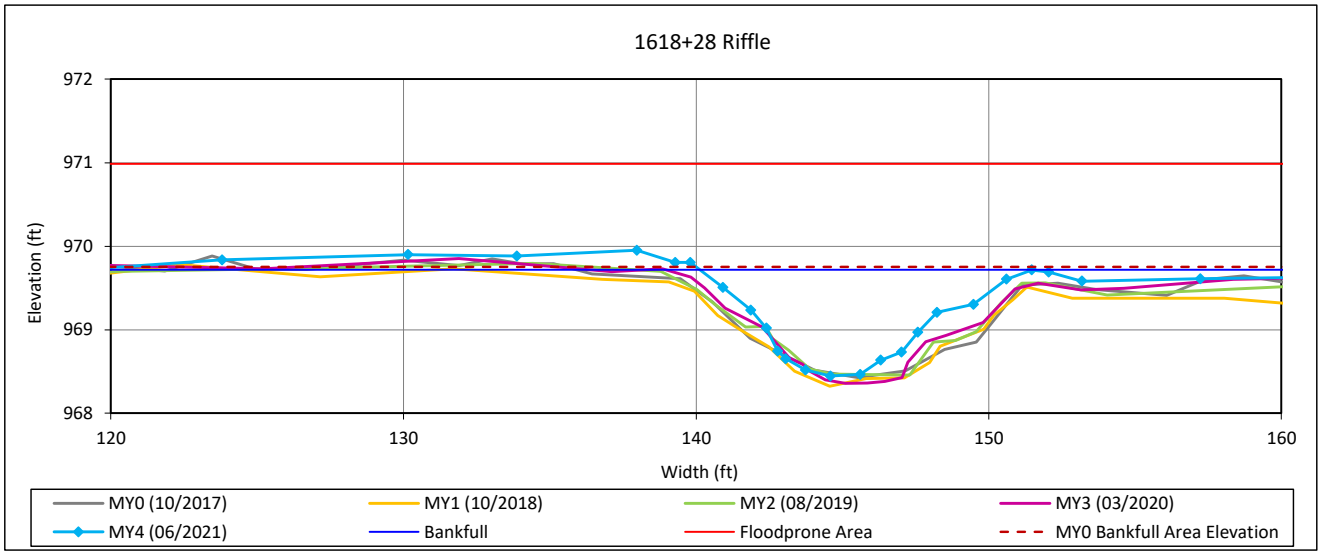
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

UFC Reach 2: Cross-Section 31



Bankfull Dimensions	
7.8	x-section area (ft.sq.)
11.3	width (ft)
0.7	mean depth (ft)
1.3	max depth (ft)
11.7	wetted perimeter (ft)
0.7	hydraulic radius (ft)
16.5	width-depth ratio
77.6	W flood prone area (ft)
6.9	entrenchment ratio
1.0	low bank height ratio

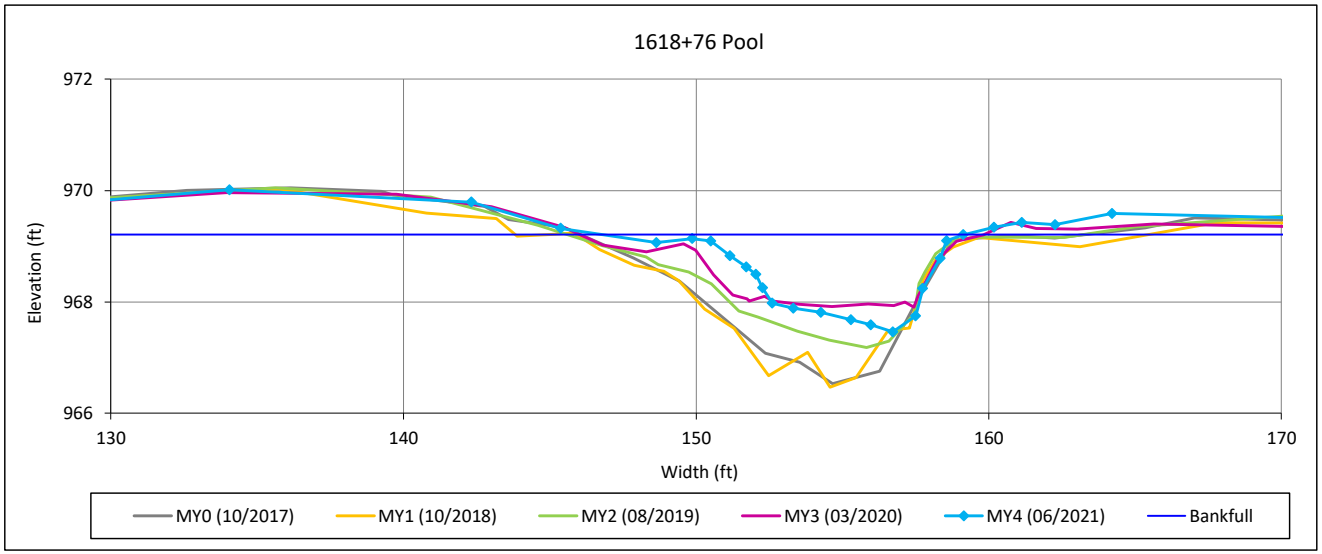
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

UFC Reach 2: Cross-Section 32



Bankfull Dimensions	
9.3	x-section area (ft.sq.)
8.6	width (ft)
1.1	mean depth (ft)
1.7	max depth (ft)
9.7	wetted perimeter (ft)
1.0	hydraulic radius (ft)
8.0	width-depth ratio

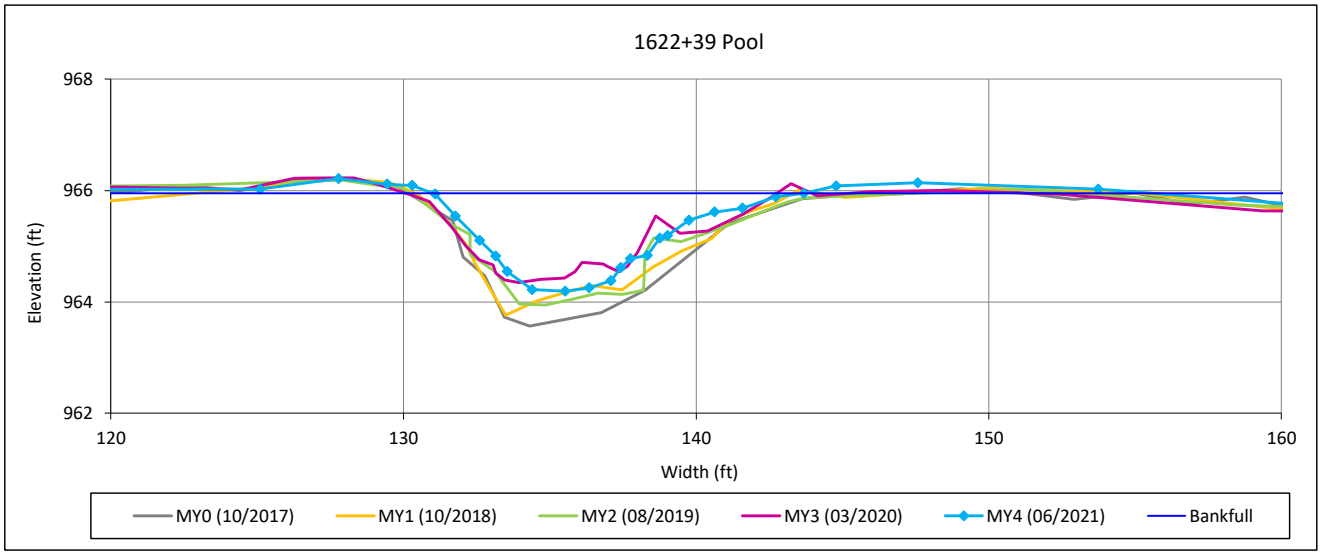
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

UFC Reach 2: Cross-Section 33



Bankfull Dimensions	
11.1	x-section area (ft.sq.)
12.7	width (ft)
0.9	mean depth (ft)
1.8	max depth (ft)
13.4	wetted perimeter (ft)
0.8	hydraulic radius (ft)
14.4	width-depth ratio

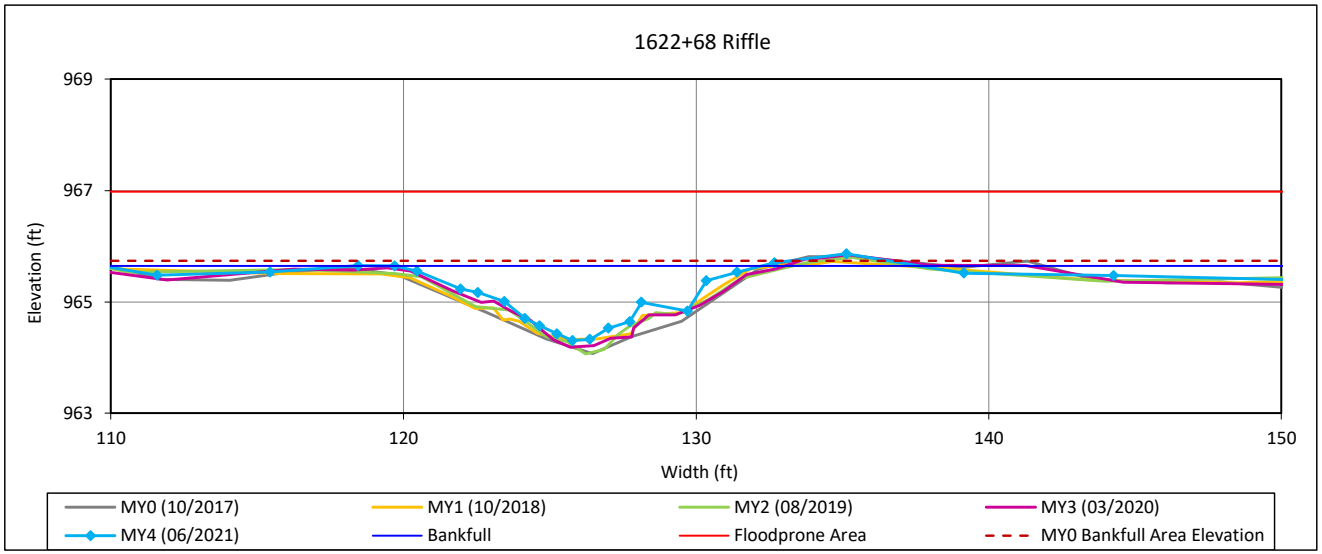
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

UFC Reach 2: Cross-Section 34



Bankfull Dimensions	
8.0	x-section area (ft.sq.)
12.5	width (ft)
0.6	mean depth (ft)
1.3	max depth (ft)
13.1	wetted perimeter (ft)
0.6	hydraulic radius (ft)
19.7	width-depth ratio
70.1	W flood prone area (ft)
5.6	entrenchment ratio
0.8	low bank height ratio

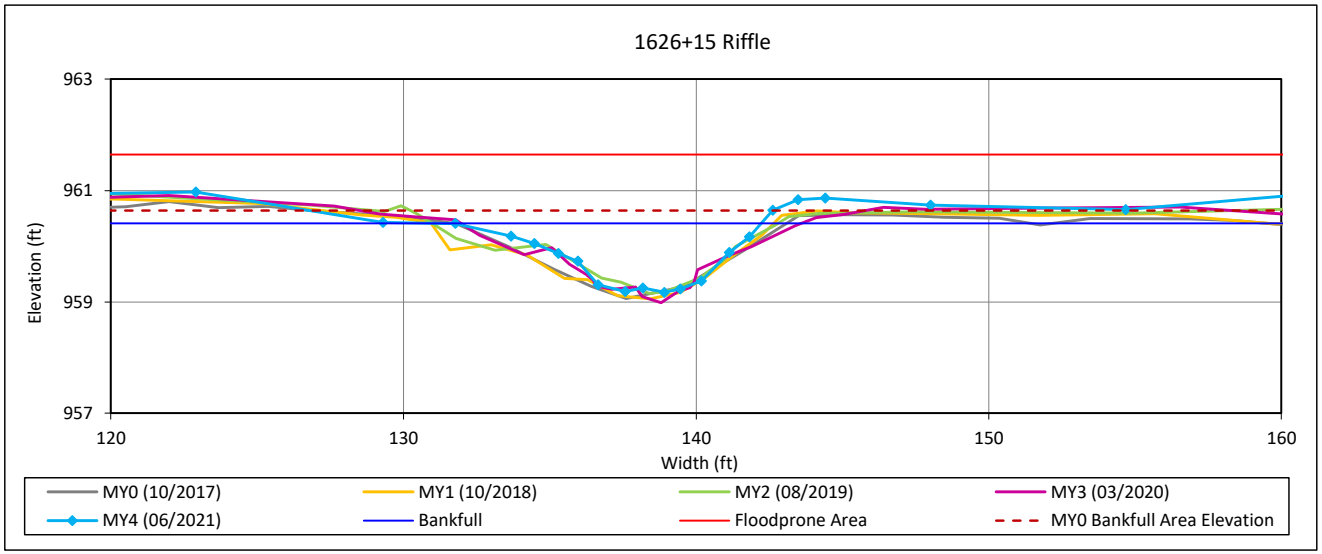
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

UFC Reach 2: Cross-Section 35



Bankfull Dimensions	
7.0	x-section area (ft.sq.)
10.4	width (ft)
0.7	mean depth (ft)
1.2	max depth (ft)
10.9	wetted perimeter (ft)
0.6	hydraulic radius (ft)
15.6	width-depth ratio
84.3	W flood prone area (ft)
8.1	entrenchment ratio
0.8	low bank height ratio

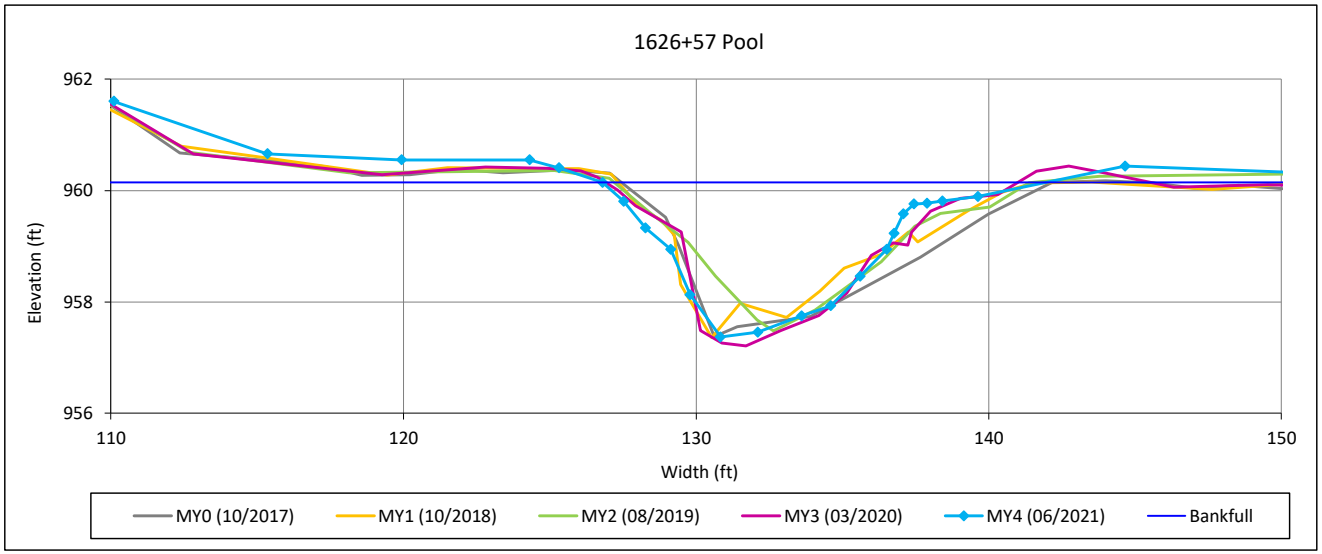
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

UFC Reach 2: Cross-Section 36



Bankfull Dimensions	
19.5	x-section area (ft.sq.)
15.2	width (ft)
1.3	mean depth (ft)
2.8	max depth (ft)
16.8	wetted perimeter (ft)
1.2	hydraulic radius (ft)
11.8	width-depth ratio

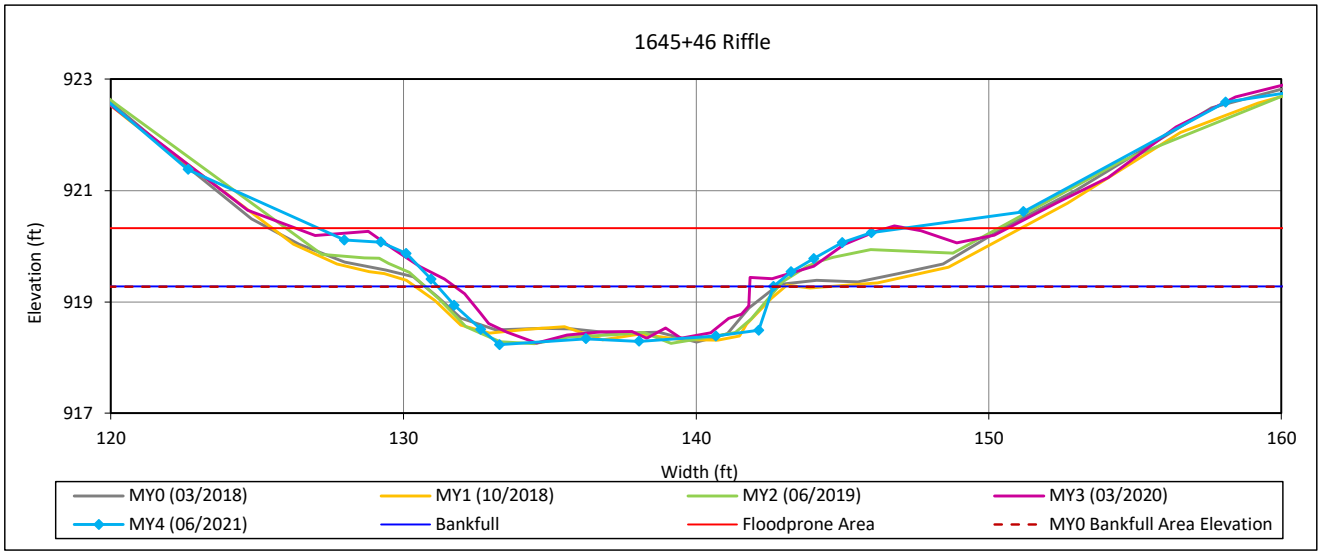
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

LFC Reach 1: Cross-Section 37



Bankfull Dimensions	
9.7	x-section area (ft.sq.)
11.5	width (ft)
0.8	mean depth (ft)
1.0	max depth (ft)
12.2	wetted perimeter (ft)
0.8	hydraulic radius (ft)
13.5	width-depth ratio
20.0	W flood prone area (ft)
1.7	entrenchment ratio
1.0	low bank height ratio

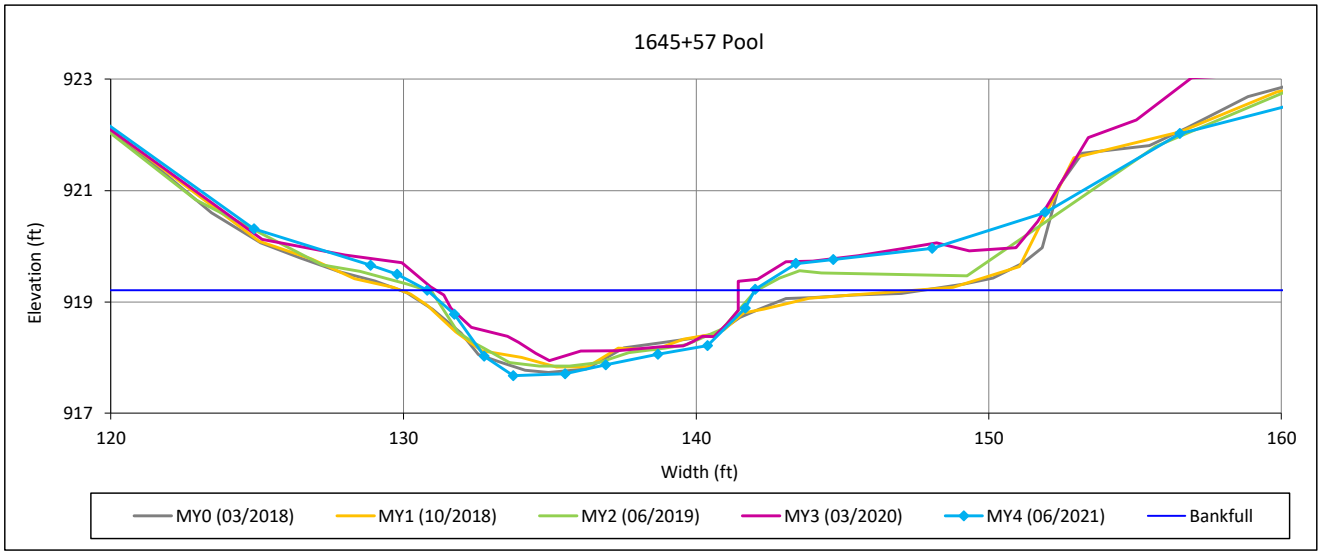
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

LFC Reach 1: Cross-Section 38



Bankfull Dimensions	
12.0	x-section area (ft.sq.)
11.2	width (ft)
1.1	mean depth (ft)
1.5	max depth (ft)
11.9	wetted perimeter (ft)
1.0	hydraulic radius (ft)
10.5	width-depth ratio

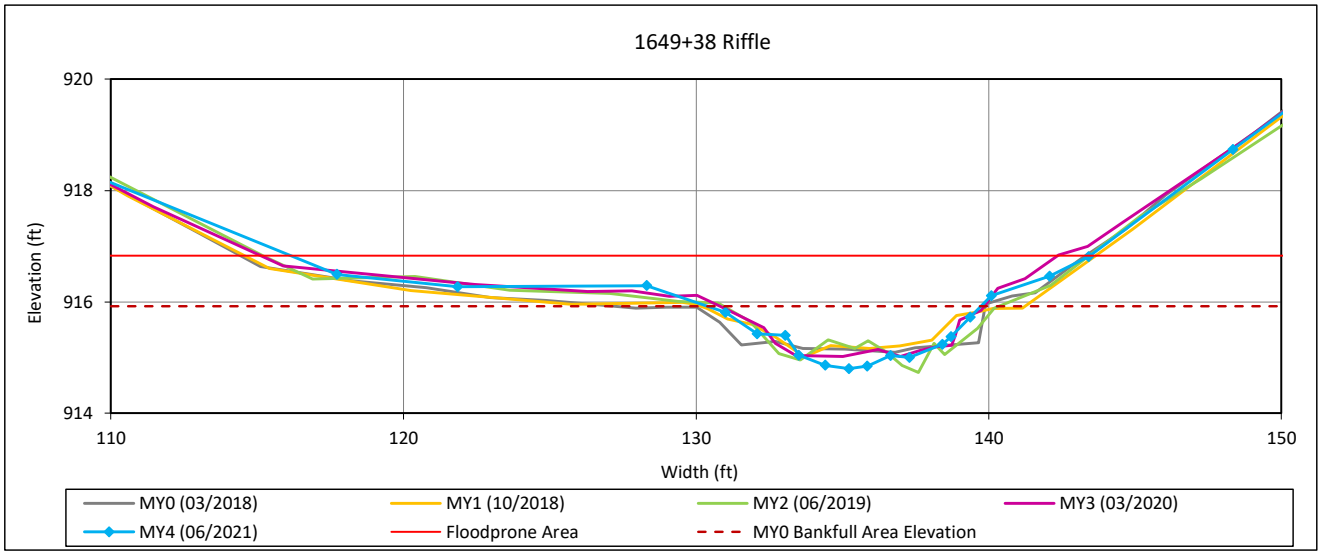
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

LFC Reach 2: Cross-Section 39



Bankfull Dimensions	
5.4	x-section area (ft.sq.)
8.5	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
8.9	wetted perimeter (ft)
0.6	hydraulic radius (ft)
13.5	width-depth ratio
27.3	W flood prone area (ft)
3.2	entrenchment ratio
0.9	low bank height ratio

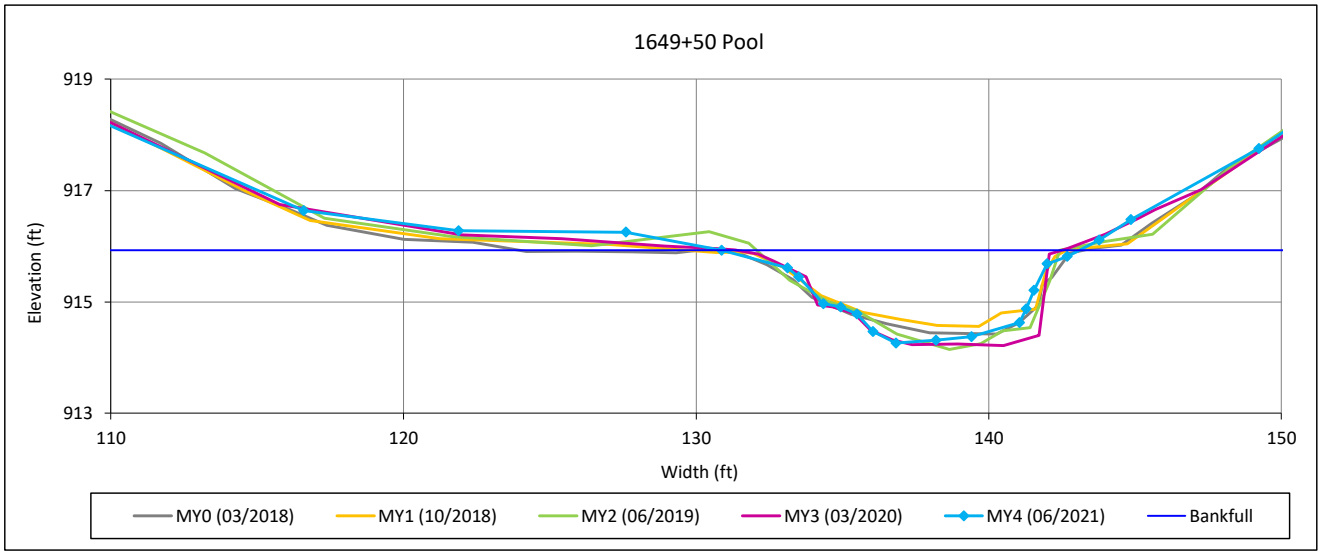
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area B
NCDMS Project No. 739
Monitoring Year 4 - 2021

LFC Reach 2: Cross-Section 40



Bankfull Dimensions	
11.6	x-section area (ft.sq.)
11.8	width (ft)
1.0	mean depth (ft)
1.7	max depth (ft)
12.6	wetted perimeter (ft)
0.9	hydraulic radius (ft)
12.0	width-depth ratio

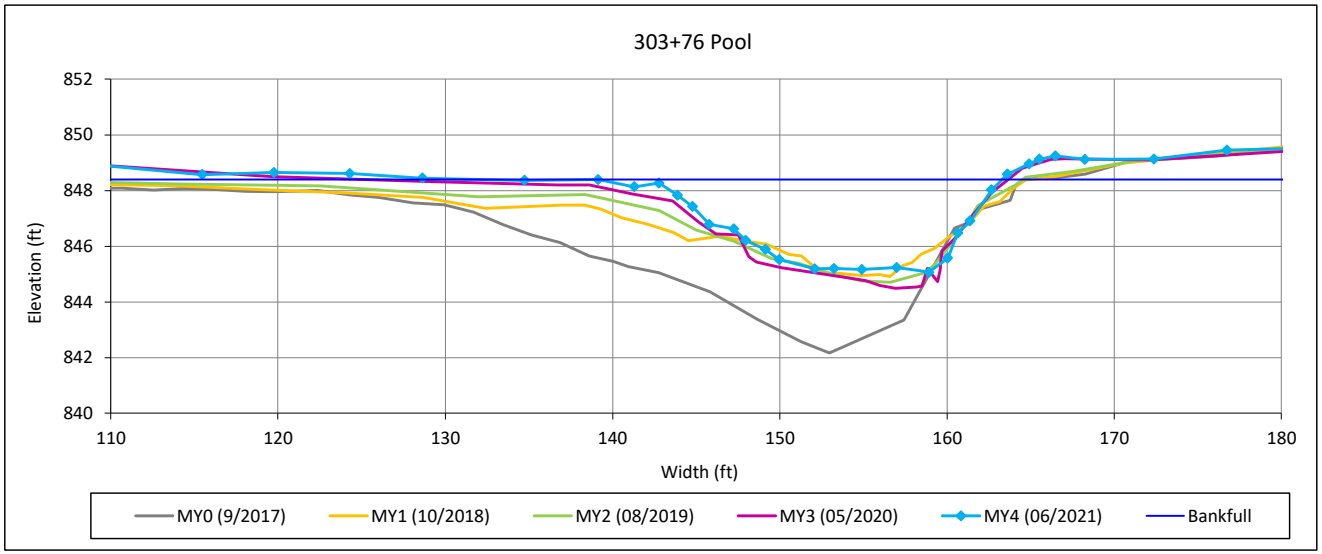
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area C
NCDMS Project No. 739
Monitoring Year 4 - 2021

LBHC Reach 1A: Cross-Section 41



Bankfull Dimensions	
47.7	x-section area (ft.sq.)
24.2	width (ft)
2.0	mean depth (ft)
3.3	max depth (ft)
26.0	wetted perimeter (ft)
1.8	hydraulic radius (ft)
12.2	width-depth ratio

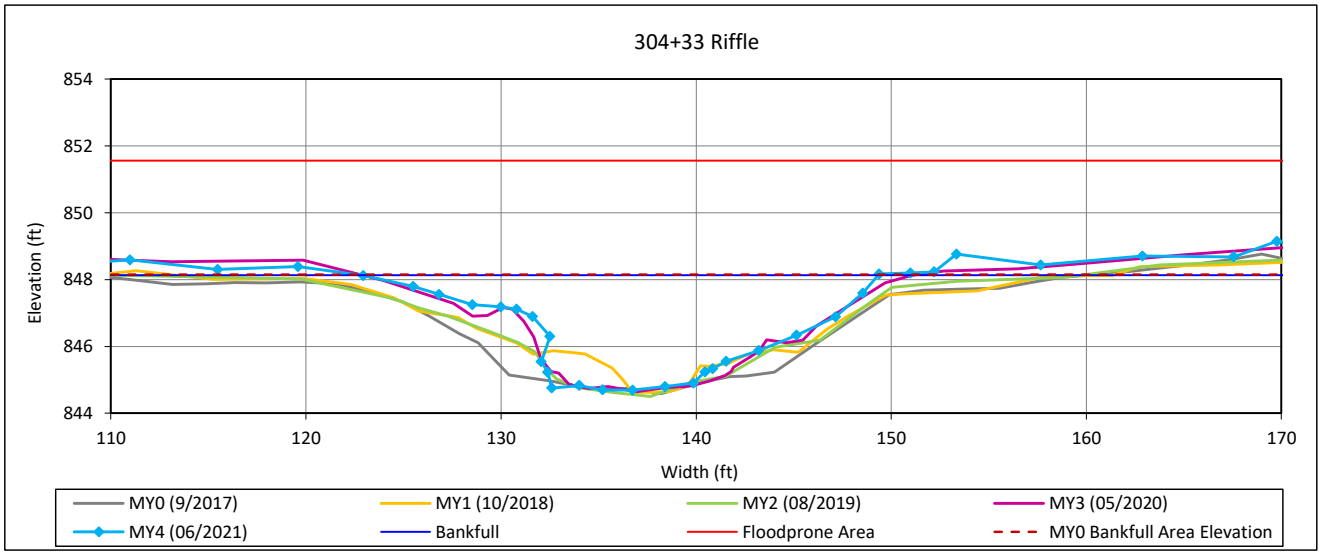
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area C
NCDMS Project No. 739
Monitoring Year 4 - 2021

LBHC Reach 1A: Cross-Section 42



Bankfull Dimensions	
48.8	x-section area (ft.sq.)
26.4	width (ft)
1.8	mean depth (ft)
3.4	max depth (ft)
29.1	wetted perimeter (ft)
1.7	hydraulic radius (ft)
14.3	width-depth ratio
77.9	W flood prone area (ft)
3.0	entrenchment ratio
1.0	low bank height ratio

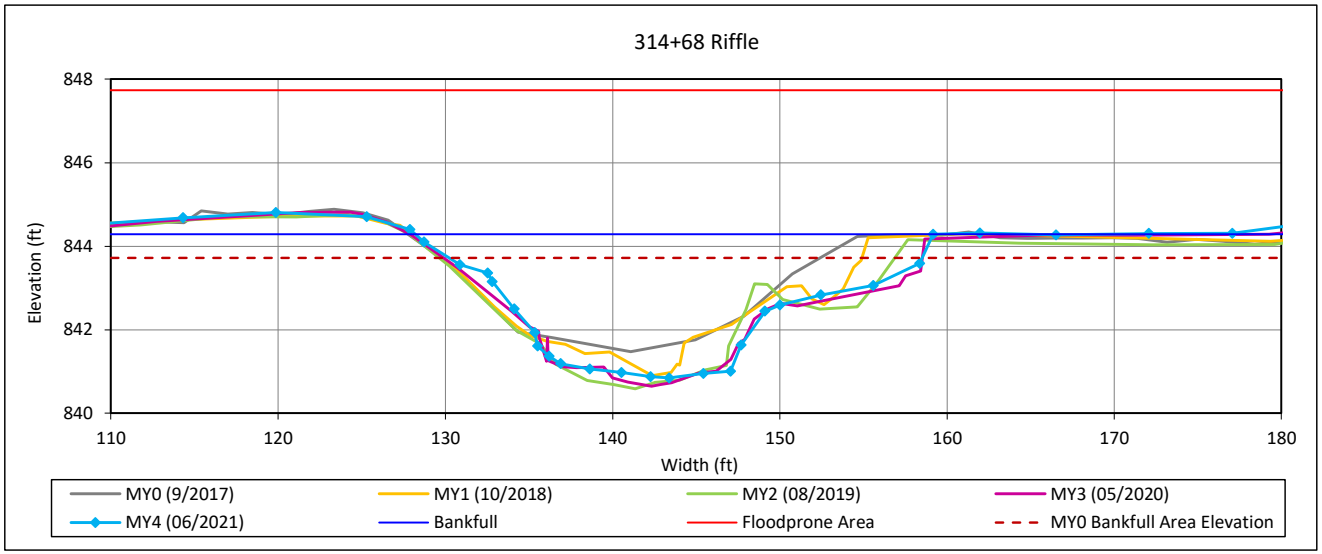
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area C
NCDMS Project No. 739
Monitoring Year 4 - 2021

LBHC Reach 1B/2: Cross-Section 43



Bankfull Dimensions	
62.9	x-section area (ft.sq.)
31.0	width (ft)
2.0	mean depth (ft)
3.4	max depth (ft)
32.5	wetted perimeter (ft)
1.9	hydraulic radius (ft)
15.2	width-depth ratio
84.9	W flood prone area (ft)
2.7	entrenchment ratio
1.2	low bank height ratio

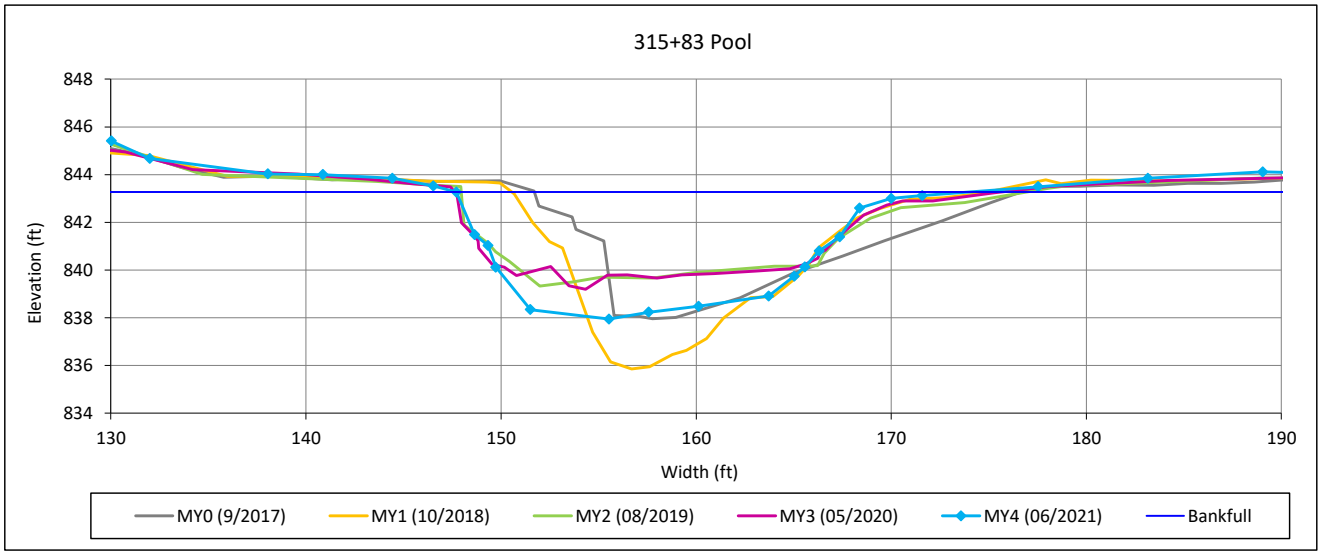
Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Big Harris Creek Mitigation Site - Area C
NCDMS Project No. 739
Monitoring Year 4 - 2021

LBHC Reach 1B/2: Cross-Section 44



Bankfull Dimensions	
84.1	x-section area (ft.sq.)
22.3	width (ft)
3.8	mean depth (ft)
5.3	max depth (ft)
26.3	wetted perimeter (ft)
3.2	hydraulic radius (ft)
5.9	width-depth ratio

Survey Date: 06/2021
Field Crew: Wildlands Engineering

View Downstream

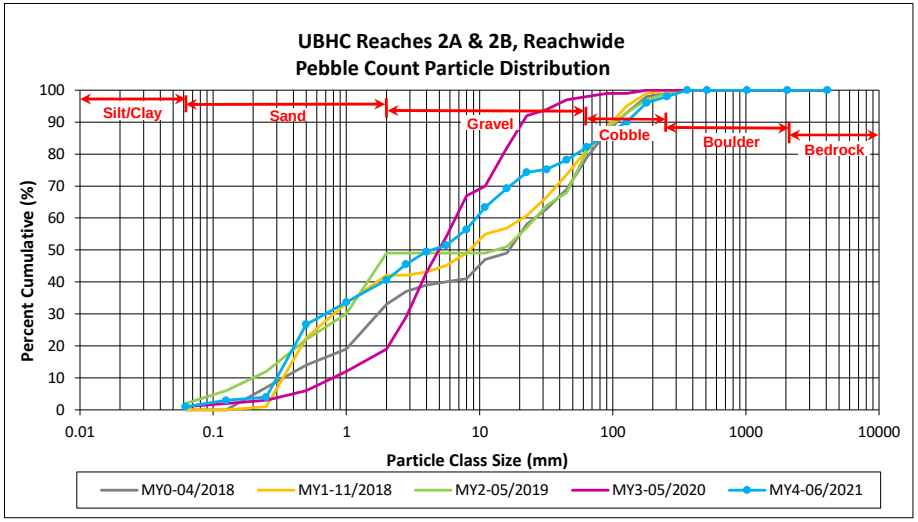
Reachwide and Cross-Section Pebble Count Plots

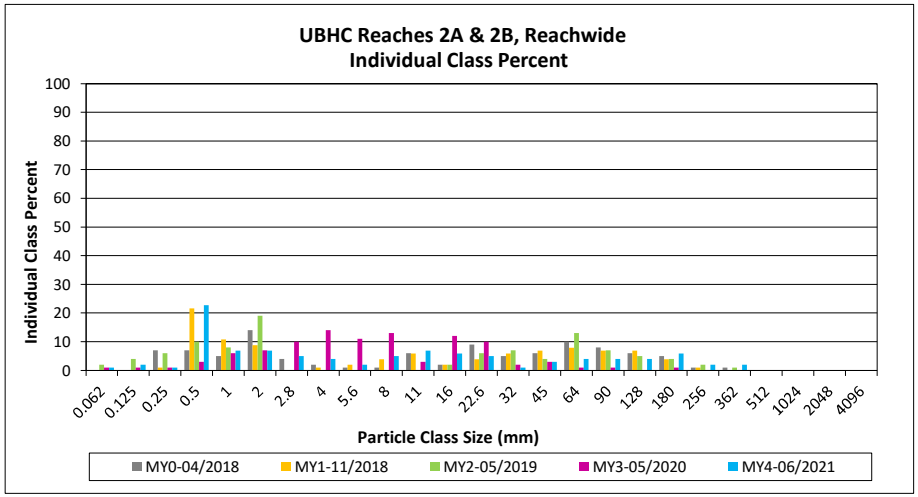
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reaches 2A & 2B, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1		1	1	1
SAND	Very fine	0.062	0.125	1	1	2	2	3
	Fine	0.125	0.250		1	1	1	4
	Medium	0.25	0.50	5	18	23	23	27
	Coarse	0.5	1.0		7	7	7	34
	Very Coarse	1.0	2.0	1	6	7	7	41
GRAVEL	Very Fine	2.0	2.8	3	2	5	5	46
	Very Fine	2.8	4.0	2	2	4	4	50
	Fine	4.0	5.6	1	1	2	2	51
	Fine	5.6	8.0	1	4	5	5	56
	Medium	8.0	11.0	2	5	7	7	63
	Medium	11.0	16.0	4	2	6	6	69
	Coarse	16.0	22.6	5		5	5	74
	Coarse	22.6	32	1		1	1	75
	Very Coarse	32	45	2	1	3	3	78
	Very Coarse	45	64	4		4	4	82
COBBLE	Small	64	90	4		4	4	86
	Small	90	128	4		4	4	90
	Large	128	180	6		6	6	96
	Large	180	256	2		2	2	98
BOULDER	Small	256	362	2		2	2	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**51**	**50**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	1.1
D_{50} =	4.4
D_{84} =	74.9
D_{95} =	169.6
D_{100} =	362.0





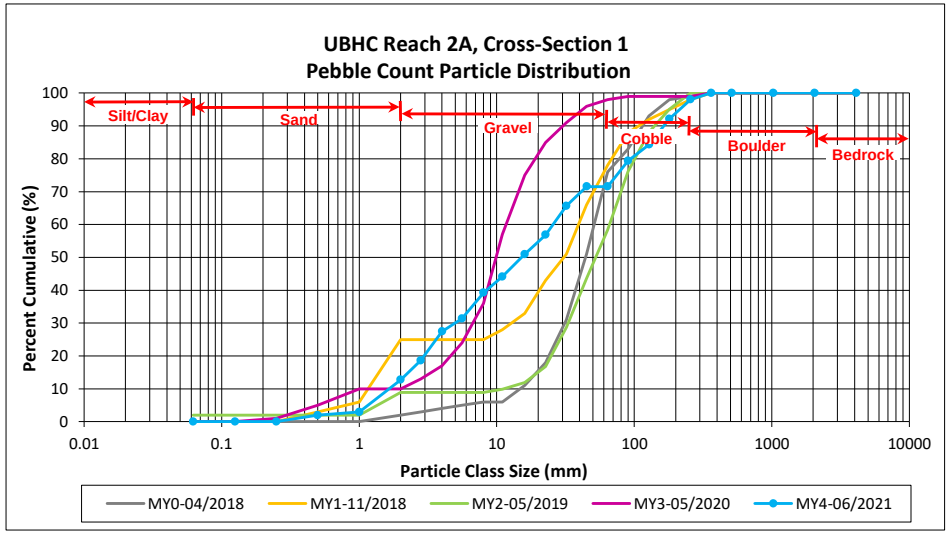
Reachwide and Cross-Section Pebble Count Plots

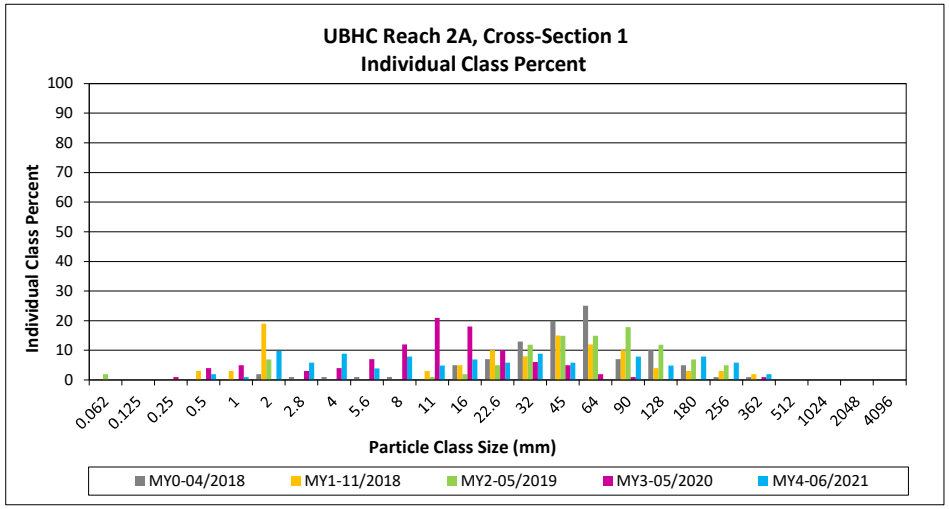
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 2A, Cross-Section 1

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	2	2	2
	Coarse	0.5	1.0	1	1	3
	Very Coarse	1.0	2.0	10	10	13
GRAVEL	Very Fine	2.0	2.8	6	6	19
	Very Fine	2.8	4.0	9	9	27
	Fine	4.0	5.6	4	4	31
	Fine	5.6	8.0	8	8	39
	Medium	8.0	11.0	5	5	44
	Medium	11.0	16.0	7	7	51
	Coarse	16.0	22.6	6	6	57
	Coarse	22.6	32	9	9	66
	Very Coarse	32	45	6	6	72
	Very Coarse	45	64			72
COBBLE	Small	64	90	8	8	79
	Small	90	128	5	5	84
	Large	128	180	8	8	92
	Large	180	256	6	6	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**102**	**100**	**100**

Cross-Section 1	
Channel materials (mm)	
D_{16} =	2.4
D_{35} =	6.6
D_{50} =	15.2
D_{84} =	125.1
D_{95} =	213.4
D_{100} =	362.0





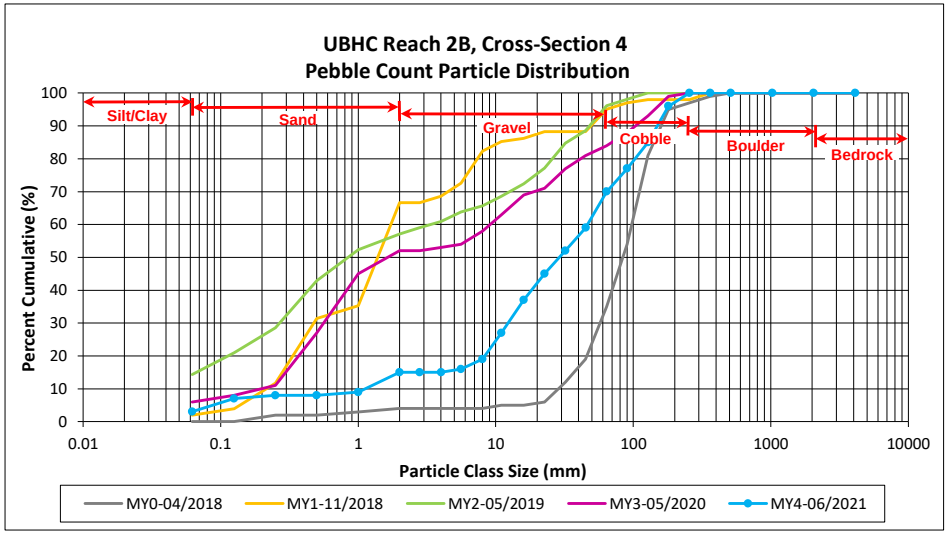
Reachwide and Cross-Section Pebble Count Plots

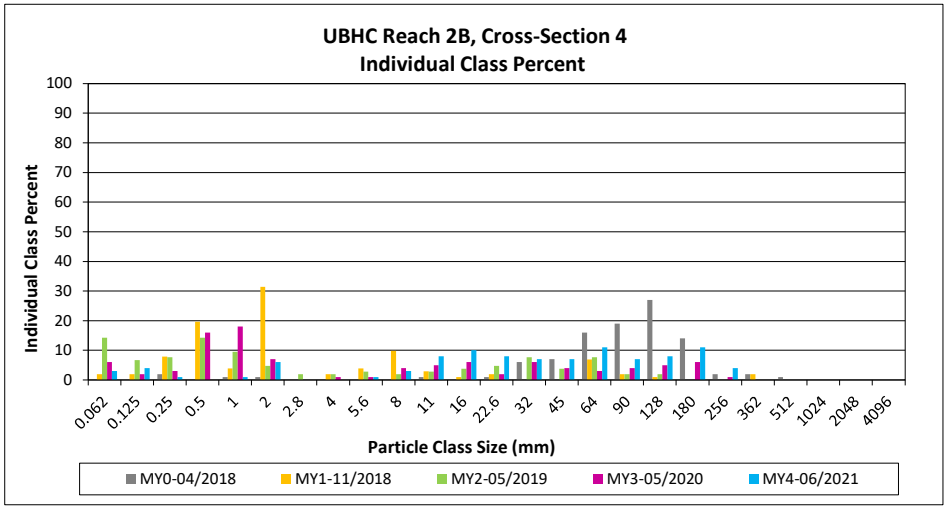
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 2B, Cross-Section 4

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	3	3
SAND	Very fine	0.062	0.125	4	4	7
	Fine	0.125	0.250	1	1	8
	Medium	0.25	0.50			8
	Coarse	0.5	1.0	1	1	9
	Very Coarse	1.0	2.0	6	6	15
GRAVEL	Very Fine	2.0	2.8			15
	Very Fine	2.8	4.0			15
	Fine	4.0	5.6	1	1	16
	Fine	5.6	8.0	3	3	19
	Medium	8.0	11.0	8	8	27
	Medium	11.0	16.0	10	10	37
	Coarse	16.0	22.6	8	8	45
	Coarse	22.6	32	7	7	52
	Very Coarse	32	45	7	7	59
	Very Coarse	45	64	11	11	70
COBBLE	Small	64	90	7	7	77
	Small	90	128	8	8	85
	Large	128	180	11	11	96
	Large	180	256	4	4	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 4	
Channel materials (mm)	
D_{16} =	5.6
D_{35} =	14.8
D_{50} =	29.0
D_{84} =	122.5
D_{95} =	174.5
D_{100} =	256.0





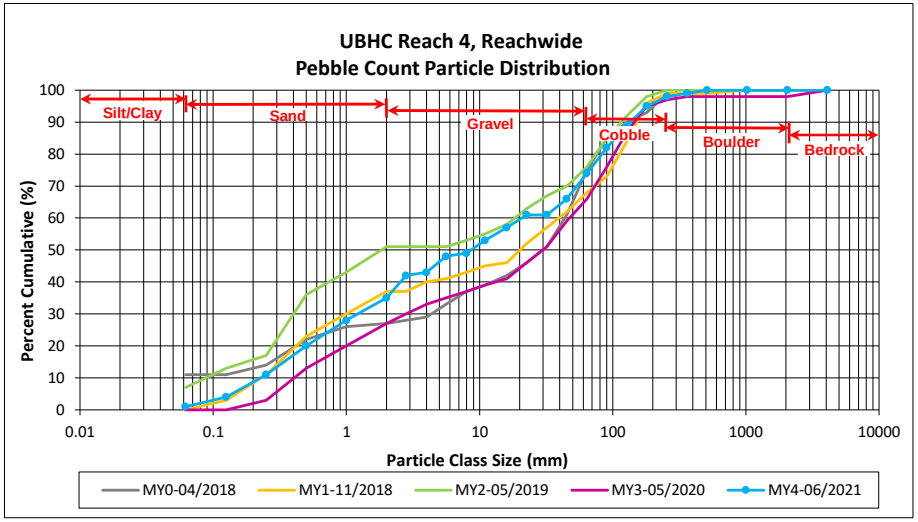
Reachwide and Cross-Section Pebble Count Plots

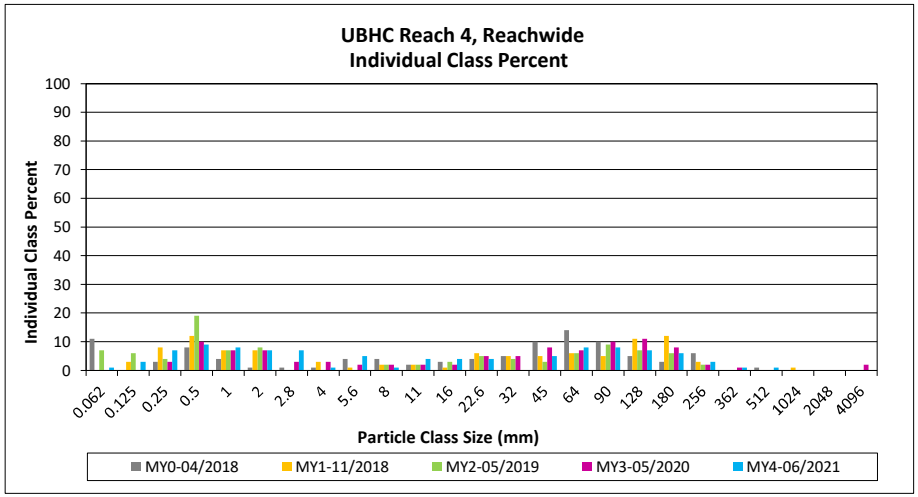
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 4, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		1	1	1	1
SAND	Very fine	0.062	0.125		3	3	3	4
	Fine	0.125	0.250		7	7	7	11
	Medium	0.25	0.50		9	9	9	20
	Coarse	0.5	1.0	1	7	8	8	28
	Very Coarse	1.0	2.0	1	6	7	7	35
GRAVEL	Very Fine	2.0	2.8		7	7	7	42
	Very Fine	2.8	4.0		1	1	1	43
	Fine	4.0	5.6	2	3	5	5	48
	Fine	5.6	8.0		1	1	1	49
	Medium	8.0	11.0	2	2	4	4	53
	Medium	11.0	16.0	2	2	4	4	57
	Coarse	16.0	22.6	4		4	4	61
	Coarse	22.6	32					61
	Very Coarse	32	45	4	1	5	5	66
	Very Coarse	45	64	8		8	8	74
COBBLE	Small	64	90	8		8	8	82
	Small	90	128	7		7	7	89
	Large	128	180	6		6	6	95
	Large	180	256	3		3	3	98
BOULDER	Small	256	362	1		1	1	99
	Small	362	512	1		1	1	100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	2.0
D_{50} =	8.7
D_{84} =	99.5
D_{95} =	180.0
D_{100} =	512.0





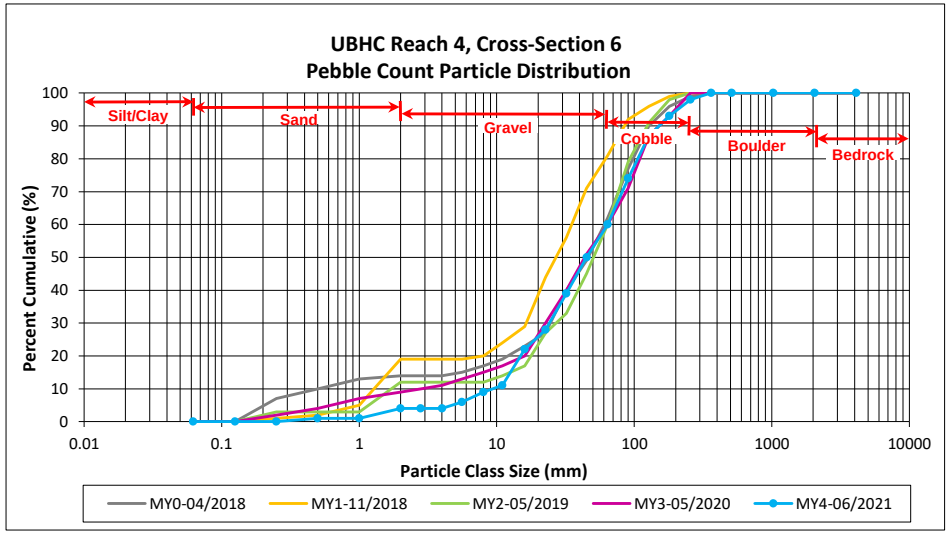
Reachwide and Cross-Section Pebble Count Plots

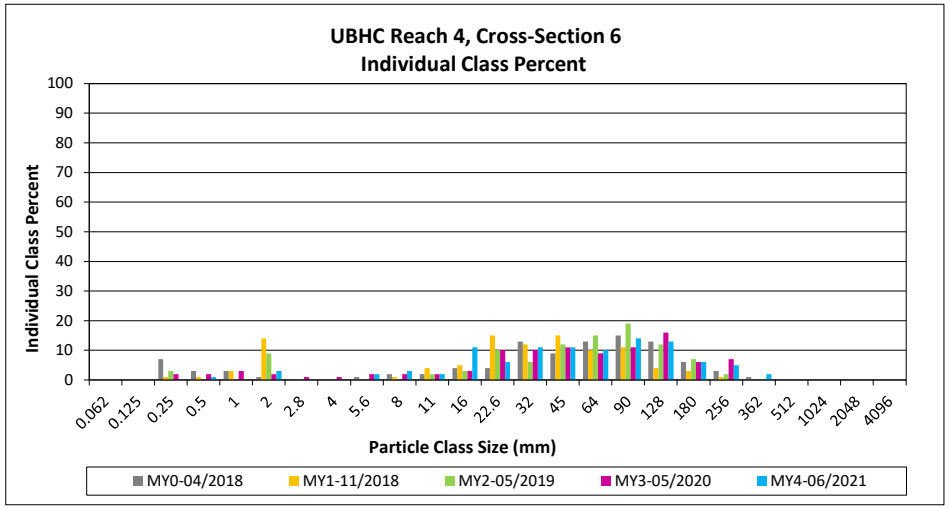
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 4, Cross-Section 6

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	1	1	1
	Coarse	0.5	1.0			1
	Very Coarse	1.0	2.0	3	3	4
GRAVEL	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0			4
	Fine	4.0	5.6	2	2	6
	Fine	5.6	8.0	3	3	9
	Medium	8.0	11.0	2	2	11
	Medium	11.0	16.0	11	11	22
	Coarse	16.0	22.6	6	6	28
	Coarse	22.6	32	11	11	39
	Very Coarse	32	45	11	11	50
	Very Coarse	45	64	10	10	60
COBBLE	Small	64	90	14	14	74
	Small	90	128	13	13	87
	Large	128	180	6	6	93
	Large	180	256	5	5	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 6	
Channel materials (mm)	
D_{16} =	13.0
D_{35} =	28.2
D_{50} =	45.0
D_{84} =	118.0
D_{95} =	207.2
D_{100} =	362.0





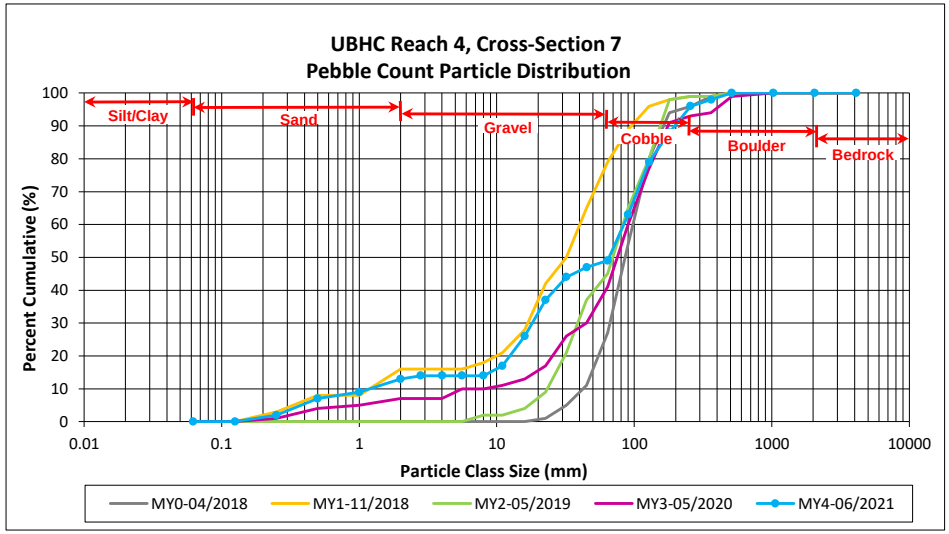
Reachwide and Cross-Section Pebble Count Plots

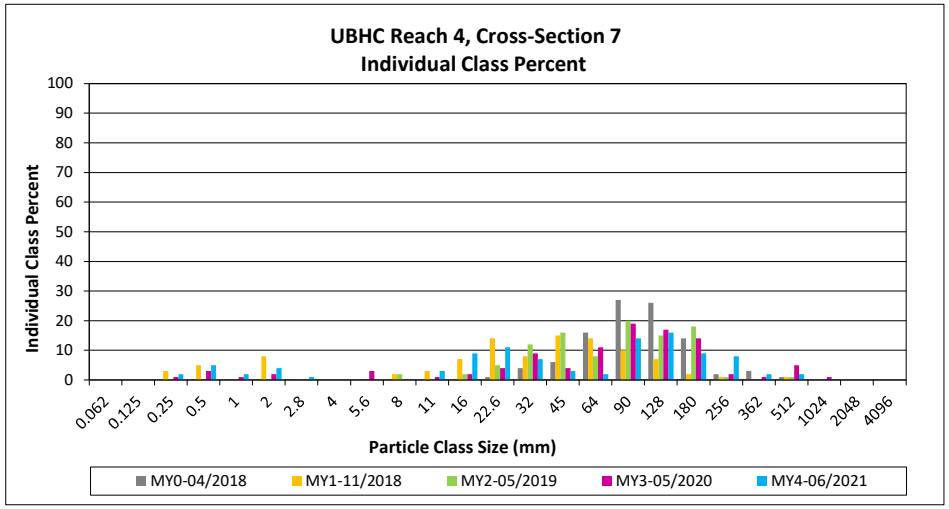
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

UBHC Reach 4, Cross-Section 7

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250	2	2	2
	Medium	0.25	0.50	5	5	7
	Coarse	0.5	1.0	2	2	9
	Very Coarse	1.0	2.0	4	4	13
GRAVEL	Very Fine	2.0	2.8	1	1	14
	Very Fine	2.8	4.0			14
	Fine	4.0	5.6			14
	Fine	5.6	8.0			14
	Medium	8.0	11.0	3	3	17
	Medium	11.0	16.0	9	9	26
	Coarse	16.0	22.6	11	11	37
	Coarse	22.6	32	7	7	44
	Very Coarse	32	45	3	3	47
	Very Coarse	45	64	2	2	49
COBBLE	Small	64	90	14	14	63
	Small	90	128	16	16	79
	Large	128	180	9	9	88
	Large	180	256	8	8	96
BOULDER	Small	256	362	2	2	98
	Small	362	512	2	2	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 7	
Channel materials (mm)	
D_{16} =	9.9
D_{35} =	21.2
D_{50} =	65.6
D_{84} =	154.7
D_{95} =	245.0
D_{100} =	512.0





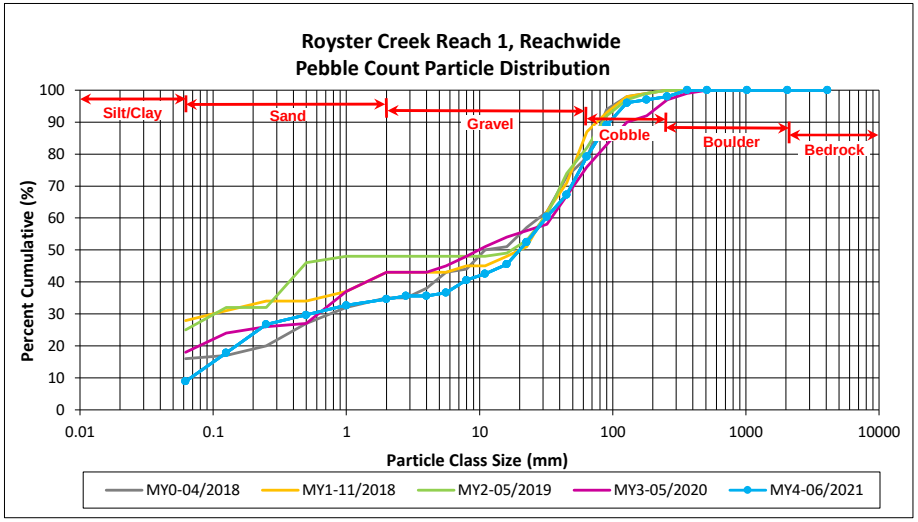
Reachwide and Cross-Section Pebble Count Plots

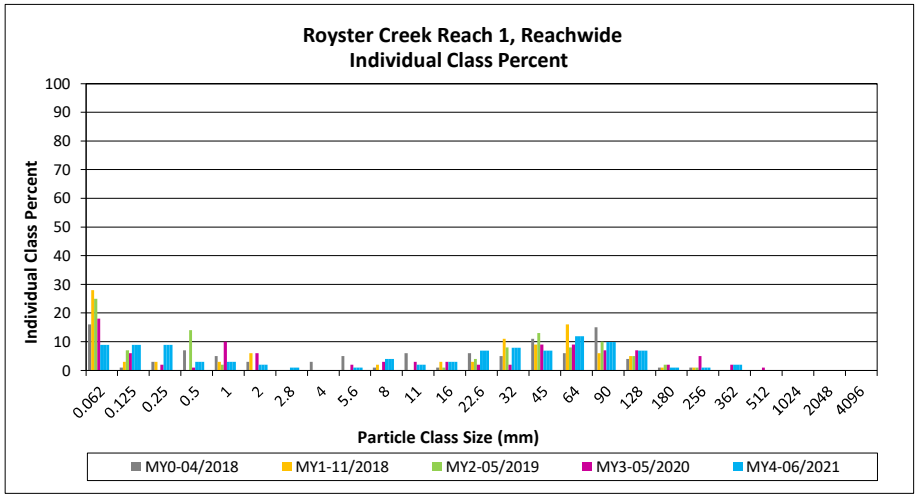
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

Royster Creek Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		9	9	9	9
SAND	Very fine	0.062	0.125	1	8	9	9	18
	Fine	0.125	0.250	2	7	9	9	27
	Medium	0.25	0.50		3	3	3	30
	Coarse	0.5	1.0	1	2	3	3	33
	Very Coarse	1.0	2.0	1	1	2	2	35
GRAVEL	Very Fine	2.0	2.8		1	1	1	36
	Very Fine	2.8	4.0					36
	Fine	4.0	5.6		1	1	1	37
	Fine	5.6	8.0	1	3	4	4	41
	Medium	8.0	11.0		2	2	2	43
	Medium	11.0	16.0	2	1	3	3	46
	Coarse	16.0	22.6	5	2	7	7	52
	Coarse	22.6	32	6	2	8	8	60
	Very Coarse	32	45	6	1	7	7	67
	Very Coarse	45	64	10	2	12	12	79
COBBLE	Small	64	90	9	1	10	10	89
	Small	90	128	4	3	7	7	96
	Large	128	180	1		1	1	97
	Large	180	256	1		1	1	98
BOULDER	Small	256	362	2		2	2	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**52**	**49**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.11
D_{35} =	2.2
D_{50} =	20.0
D_{84} =	75.5
D_{95} =	121.4
D_{100} =	362.0





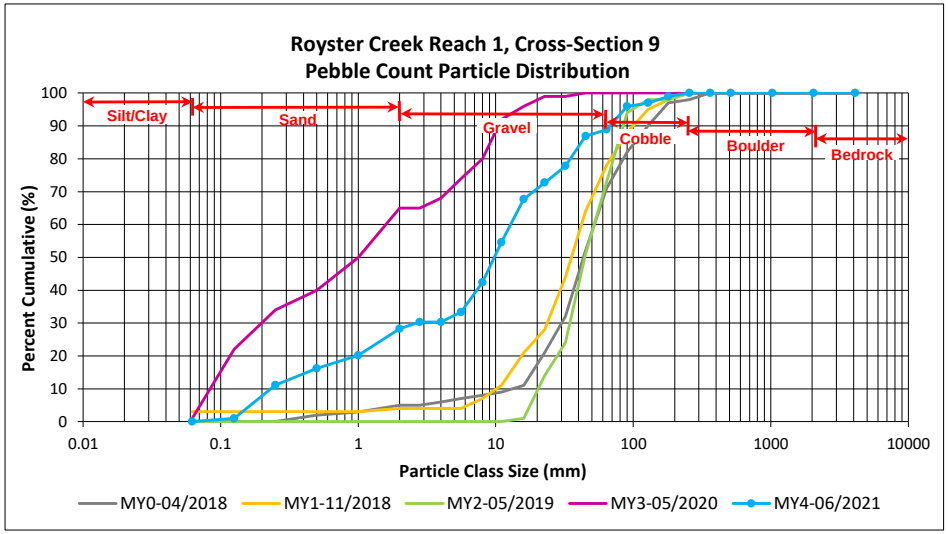
Reachwide and Cross-Section Pebble Count Plots

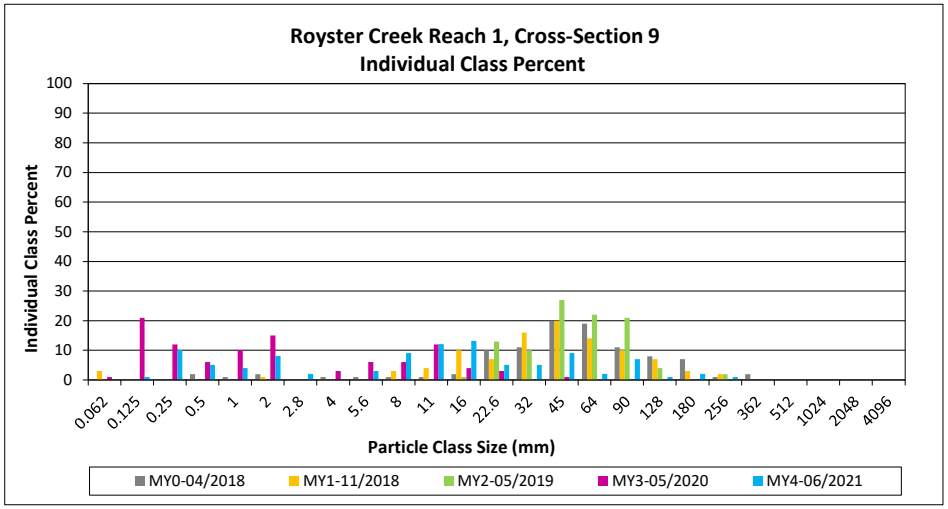
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

Royster Creek Reach 1, Cross-Section 9

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125	1	1	1
	Fine	0.125	0.250	10	10	11
	Medium	0.25	0.50	5	5	16
	Coarse	0.5	1.0	4	4	20
	Very Coarse	1.0	2.0	8	8	28
GRAVEL	Very Fine	2.0	2.8	2	2	30
	Very Fine	2.8	4.0			30
	Fine	4.0	5.6	3	3	33
	Fine	5.6	8.0	9	9	42
	Medium	8.0	11.0	12	12	55
	Medium	11.0	16.0	13	13	68
	Coarse	16.0	22.6	5	5	73
	Coarse	22.6	32	5	5	78
	Very Coarse	32	45	9	9	87
	Very Coarse	45	64	2	2	89
COBBLE	Small	64	90	7	7	96
	Small	90	128	1	1	97
	Large	128	180	2	2	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**99**	**100**	**100**

Cross-Section 9	
Channel materials (mm)	
D_{16} =	0.5
D_{35} =	6.0
D_{50} =	9.8
D_{84} =	40.4
D_{95} =	85.9
D_{100} =	256.0





Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area A

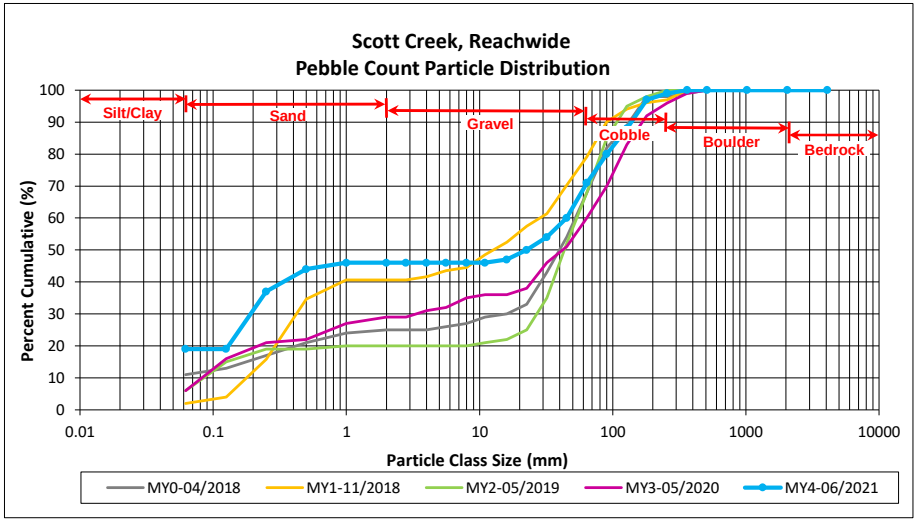
DMS Project No. 739

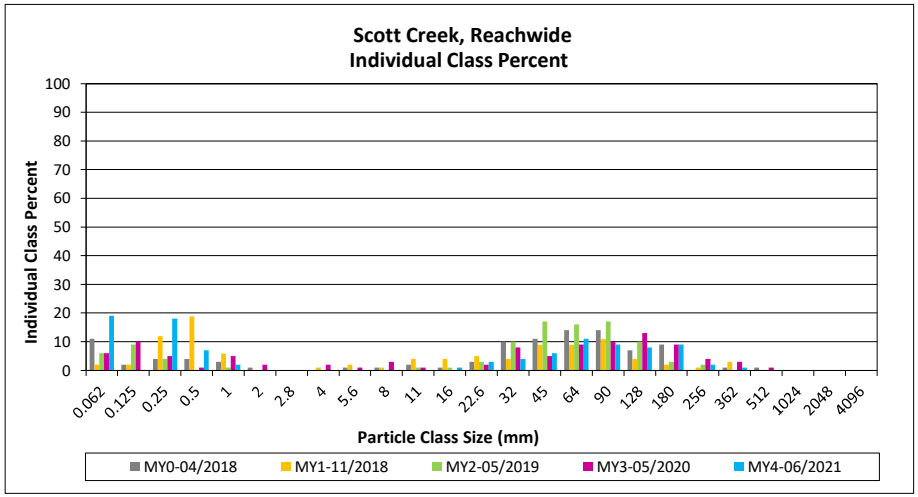
Monitoring Year 4 - 2021

Scott Creek, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	7	12	19	19	19
SAND	Very fine	0.062	0.125					19
	Fine	0.125	0.250	7	11	18	18	37
	Medium	0.25	0.50		7	7	7	44
	Coarse	0.5	1.0		2	2	2	46
	Very Coarse	1.0	2.0					46
GRAVEL	Very Fine	2.0	2.8					46
	Very Fine	2.8	4.0					46
	Fine	4.0	5.6					46
	Fine	5.6	8.0					46
	Medium	8.0	11.0					46
	Medium	11.0	16.0		1	1	1	47
	Coarse	16.0	22.6	1	2	3	3	50
	Coarse	22.6	32	2	2	4	4	54
	Very Coarse	32	45	3	3	6	6	60
	Very Coarse	45	64	8	3	11	11	71
COBBLE	Small	64	90	7	2	9	9	80
	Small	90	128	6	2	8	8	88
	Large	128	180	8	1	9	9	97
	Large	180	256	1	1	2	2	99
BOULDER	Small	256	362		1	1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.2
D_{50} =	22.6
D_{84} =	107.3
D_{95} =	166.9
D_{100} =	362.0





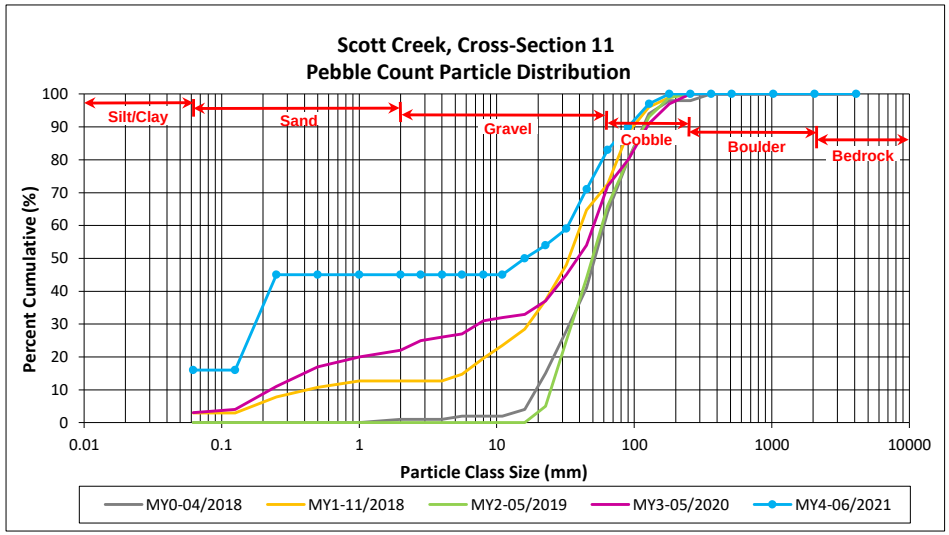
Reachwide and Cross-Section Pebble Count Plots

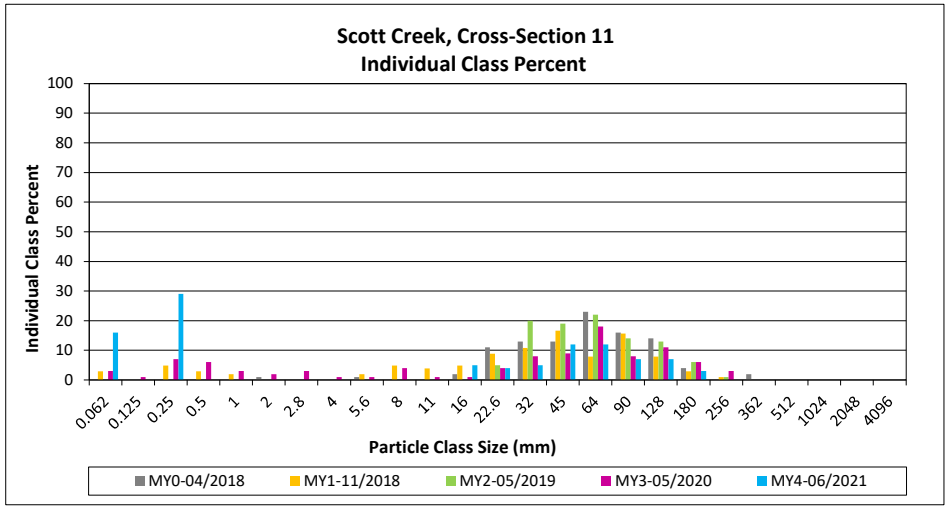
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

Scott Creek, Cross-Section 11

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	16	16	16
SAND	Very fine	0.062	0.125			16
	Fine	0.125	0.250	29	29	45
	Medium	0.25	0.50			45
	Coarse	0.5	1.0			45
	Very Coarse	1.0	2.0			45
GRAVEL	Very Fine	2.0	2.8			45
	Very Fine	2.8	4.0			45
	Fine	4.0	5.6			45
	Fine	5.6	8.0			45
	Medium	8.0	11.0			45
	Medium	11.0	16.0	5	5	50
	Coarse	16.0	22.6	4	4	54
	Coarse	22.6	32	5	5	59
	Very Coarse	32	45	12	12	71
	Very Coarse	45	64	12	12	83
COBBLE	Small	64	90	7	7	90
	Small	90	128	7	7	97
	Large	128	180	3	3	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 11	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.2
D_{50} =	16.0
D_{84} =	67.2
D_{95} =	115.7
D_{100} =	180.0





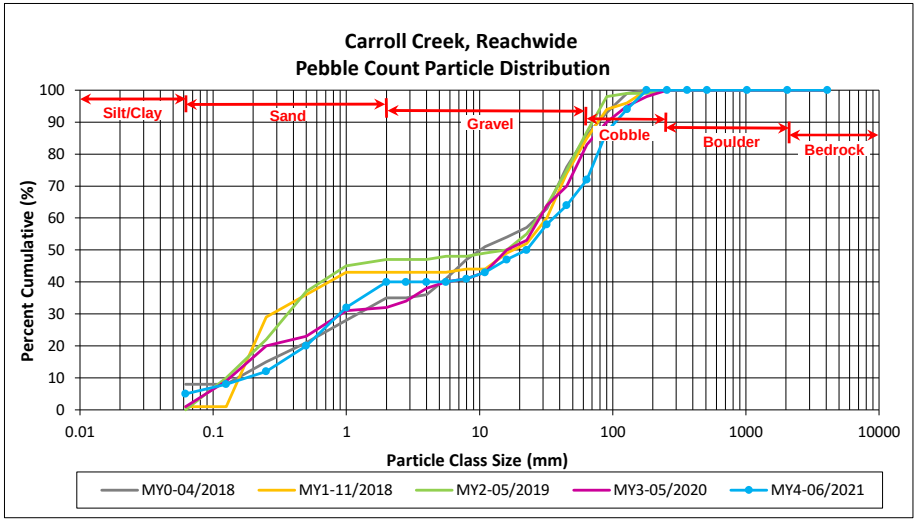
Reachwide and Cross-Section Pebble Count Plots

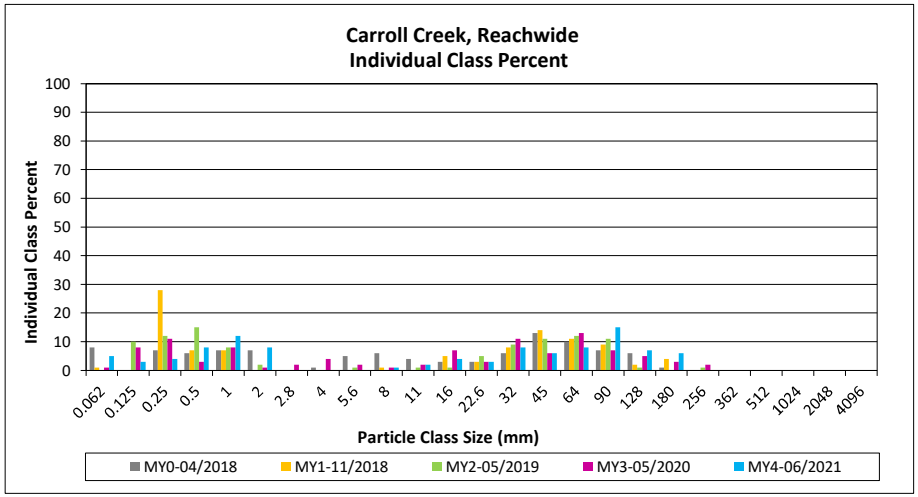
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

Carroll Creek, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		5	5	5	5
SAND	Very fine	0.062	0.125		3	3	3	8
	Fine	0.125	0.250	1	3	4	4	12
	Medium	0.25	0.50		8	8	8	20
	Coarse	0.5	1.0	1	11	12	12	32
	Very Coarse	1.0	2.0	2	6	8	8	40
GRAVEL	Very Fine	2.0	2.8					40
	Very Fine	2.8	4.0					40
	Fine	4.0	5.6					40
	Fine	5.6	8.0		1	1	1	41
	Medium	8.0	11.0		2	2	2	43
	Medium	11.0	16.0	2	2	4	4	47
	Coarse	16.0	22.6	2	1	3	3	50
	Coarse	22.6	32	5	3	8	8	58
	Very Coarse	32	45	4	2	6	6	64
	Very Coarse	45	64	6	2	8	8	72
COBBLE	Small	64	90	14	1	15	15	87
	Small	90	128	7		7	7	94
	Large	128	180	6		6	6	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	1.3
D_{50} =	22.6
D_{84} =	84.1
D_{95} =	135.5
D_{100} =	180.0





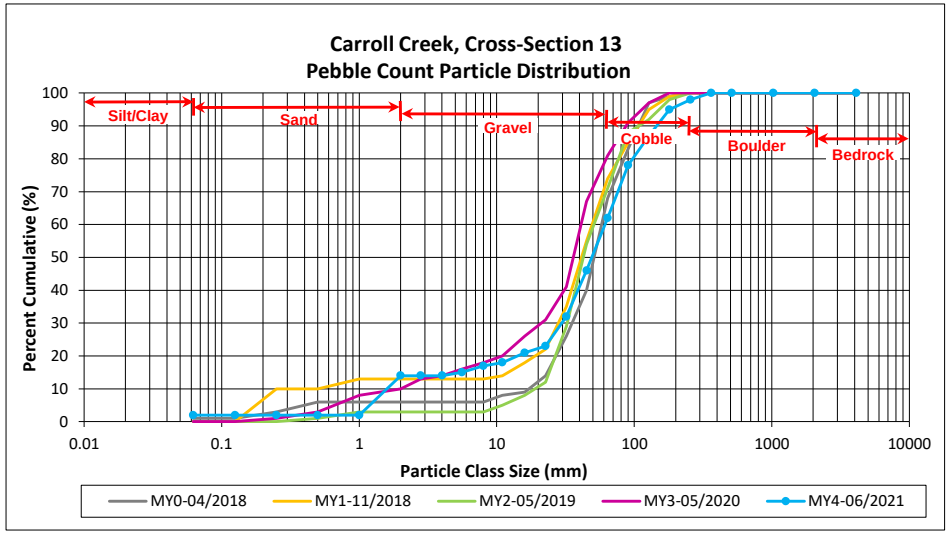
Reachwide and Cross-Section Pebble Count Plots

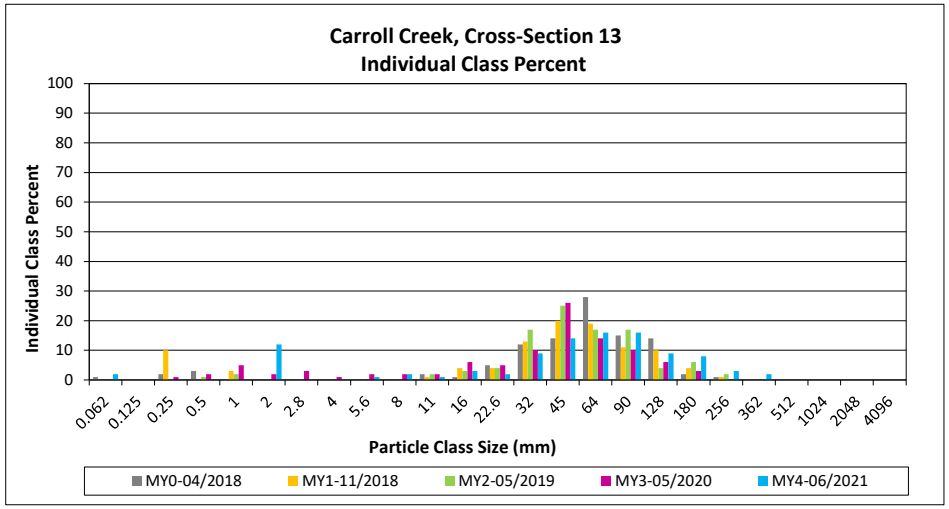
Big Harris Creek Mitigation Site - Area A
DMS Project No. 739
Monitoring Year 4 - 2021

Carroll Creek, Cross-Section 13

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	12	12	14
GRAVEL	Very Fine	2.0	2.8			14
	Very Fine	2.8	4.0			14
	Fine	4.0	5.6	1	1	15
	Fine	5.6	8.0	2	2	17
	Medium	8.0	11.0	1	1	18
	Medium	11.0	16.0	3	3	21
	Coarse	16.0	22.6	2	2	23
	Coarse	22.6	32	9	9	32
	Very Coarse	32	45	14	14	46
	Very Coarse	45	64	16	16	62
COBBLE	Small	64	90	16	16	78
	Small	90	128	9	9	87
	Large	128	180	8	8	95
	Large	180	256	3	3	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 13	
Channel materials (mm)	
D_{16} =	6.7
D_{35} =	34.4
D_{50} =	49.1
D_{84} =	113.8
D_{95} =	180.0
D_{100} =	362.0





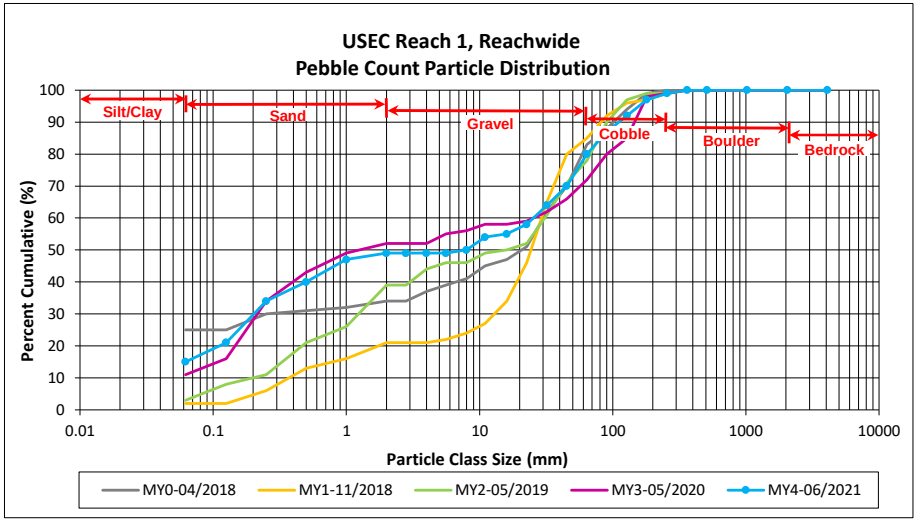
Reachwide and Cross-Section Pebble Count Plots

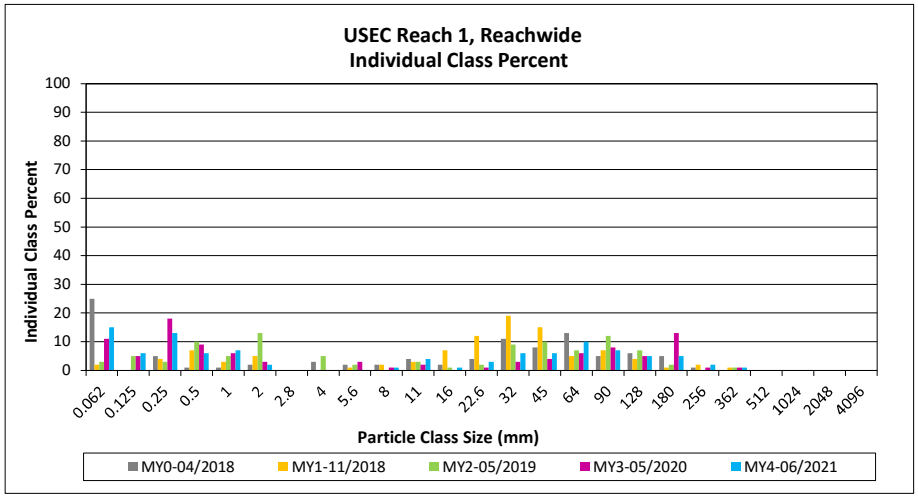
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	11	15	15	15
SAND	Very fine	0.062	0.125	1	5	6	6	21
	Fine	0.125	0.250	1	12	13	13	34
	Medium	0.25	0.50	1	5	6	6	40
	Coarse	0.5	1.0	3	4	7	7	47
	Very Coarse	1.0	2.0		2	2	2	49
GRAVEL	Very Fine	2.0	2.8					49
	Very Fine	2.8	4.0					49
	Fine	4.0	5.6					49
	Fine	5.6	8.0		1	1	1	50
	Medium	8.0	11.0	3	1	4	4	54
	Medium	11.0	16.0		1	1	1	55
	Coarse	16.0	22.6	3		3	3	58
	Coarse	22.6	32	5	1	6	6	64
	Very Coarse	32	45	5	1	6	6	70
	Very Coarse	45	64	7	3	10	10	80
COBBLE	Small	64	90	6	1	7	7	87
	Small	90	128	5		5	5	92
	Large	128	180	4	1	5	5	97
	Large	180	256	1	1	2	2	99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.1
D_{35} =	0.3
D_{50} =	8.0
D_{84} =	77.8
D_{95} =	157.1
D_{100} =	362.0





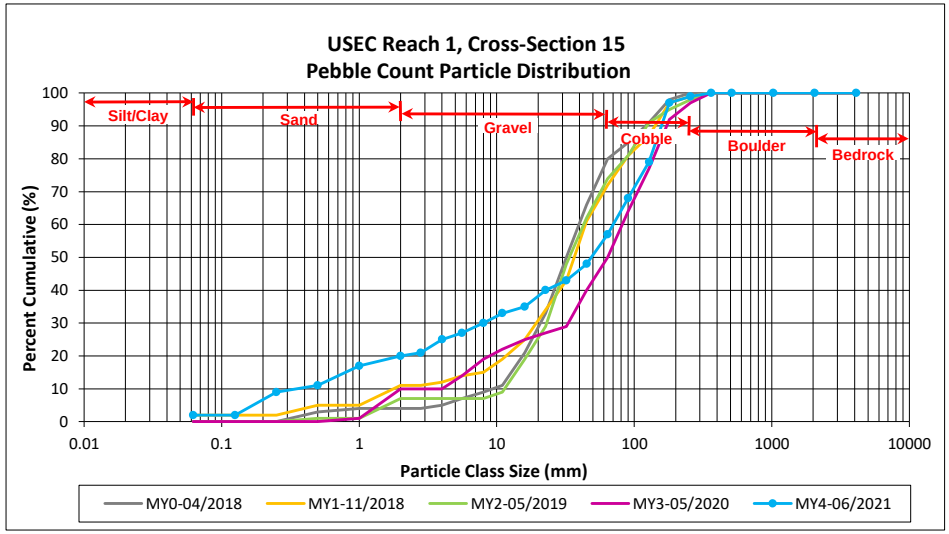
Reachwide and Cross-Section Pebble Count Plots

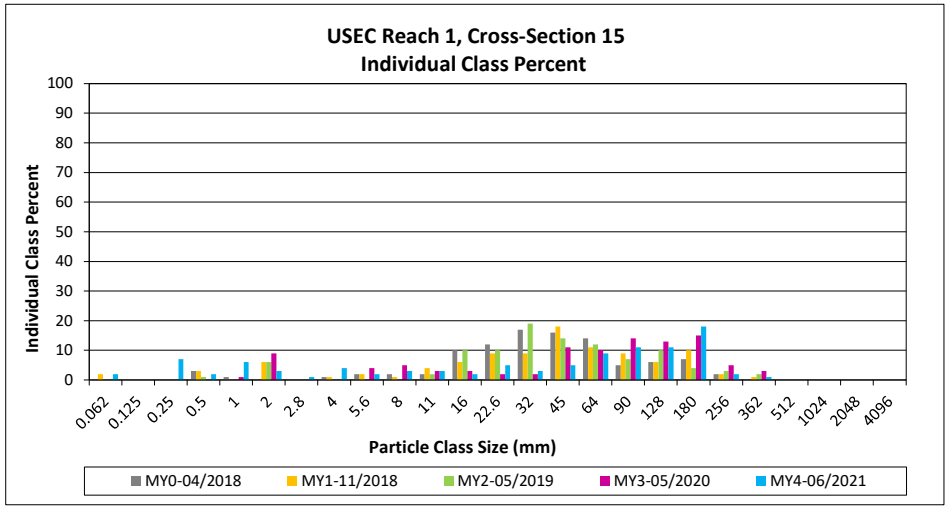
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 1, Cross-Section 15

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250	7	7	9
	Medium	0.25	0.50	2	2	11
	Coarse	0.5	1.0	6	6	17
	Very Coarse	1.0	2.0	3	3	20
GRAVEL	Very Fine	2.0	2.8	1	1	21
	Very Fine	2.8	4.0	4	4	25
	Fine	4.0	5.6	2	2	27
	Fine	5.6	8.0	3	3	30
	Medium	8.0	11.0	3	3	33
	Medium	11.0	16.0	2	2	35
	Coarse	16.0	22.6	5	5	40
	Coarse	22.6	32	3	3	43
	Very Coarse	32	45	5	5	48
	Very Coarse	45	64	9	9	57
COBBLE	Small	64	90	11	11	68
	Small	90	128	11	11	79
	Large	128	180	18	18	97
	Large	180	256	2	2	99
BOULDER	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 15	
Channel materials (mm)	
D_{16} =	0.9
D_{35} =	16.0
D_{50} =	48.7
D_{84} =	140.7
D_{95} =	173.3
D_{100} =	362.0





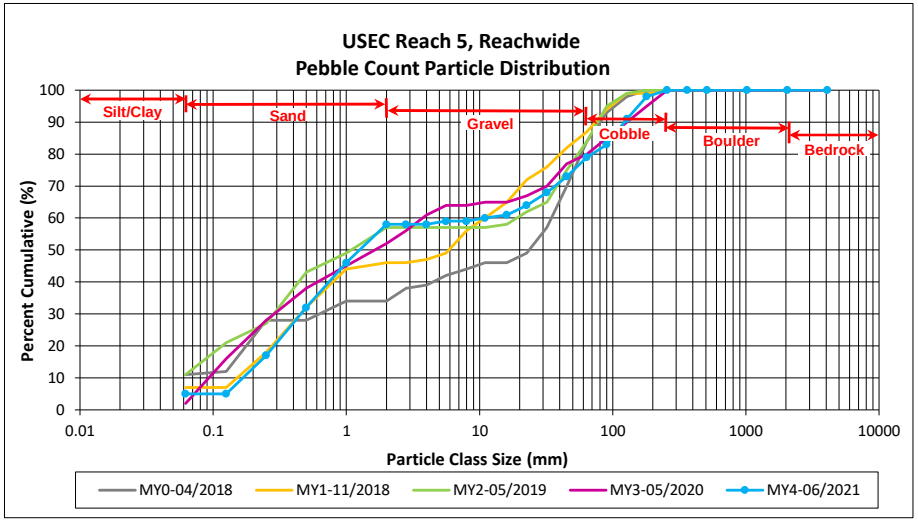
Reachwide and Cross-Section Pebble Count Plots

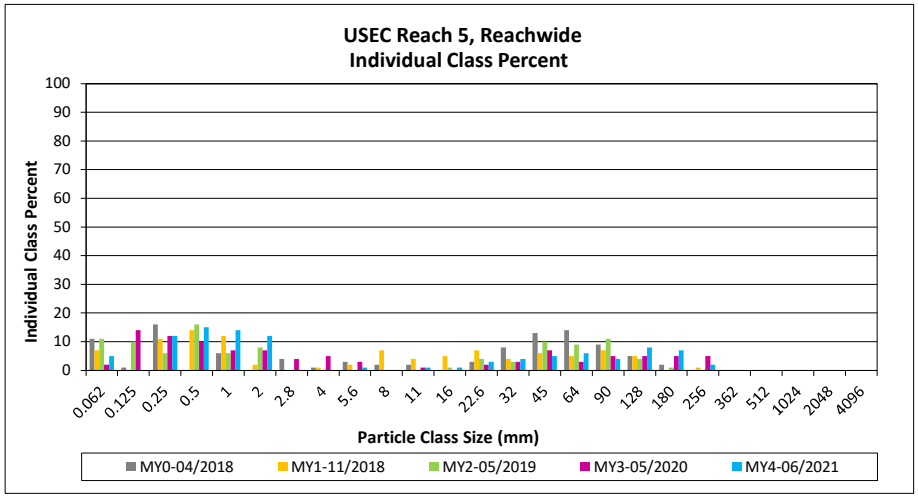
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 5, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	3	5	5	5
SAND	Very fine	0.062	0.125					5
	Fine	0.125	0.250		12	12	12	17
	Medium	0.25	0.50	2	13	15	15	32
	Coarse	0.5	1.0	4	10	14	14	46
	Very Coarse	1.0	2.0	1	11	12	12	58
GRAVEL	Very Fine	2.0	2.8					58
	Very Fine	2.8	4.0					58
	Fine	4.0	5.6		1	1	1	59
	Fine	5.6	8.0					59
	Medium	8.0	11.0	1		1	1	60
	Medium	11.0	16.0	1		1	1	61
	Coarse	16.0	22.6	3		3	3	64
	Coarse	22.6	32	4		4	4	68
	Very Coarse	32	45	5		5	5	73
	Very Coarse	45	64	6		6	6	79
COBBLE	Small	64	90	4		4	4	83
	Small	90	128	8		8	8	91
	Large	128	180	7		7	7	98
	Large	180	256	2		2	2	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	0.6
D_{50} =	1.3
D_{84} =	94.1
D_{95} =	155.5
D_{100} =	256.0





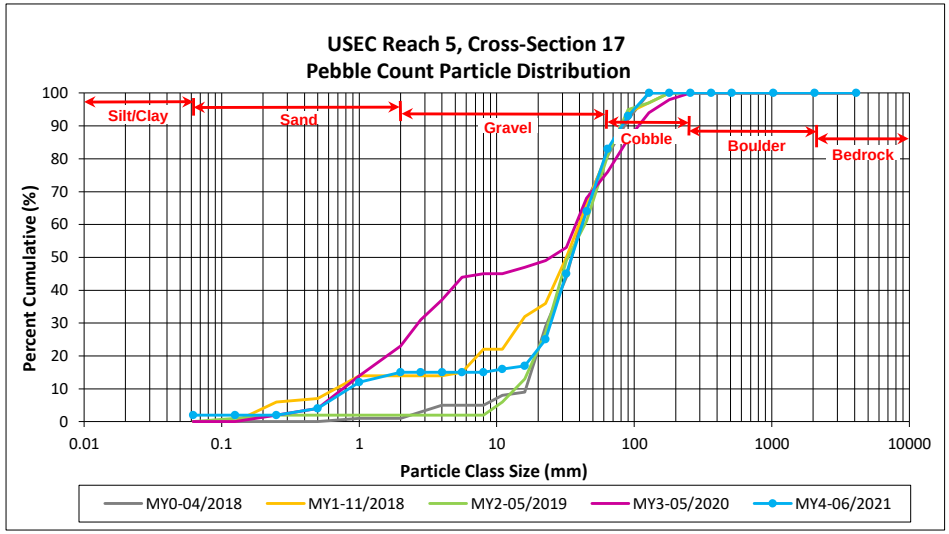
Reachwide and Cross-Section Pebble Count Plots

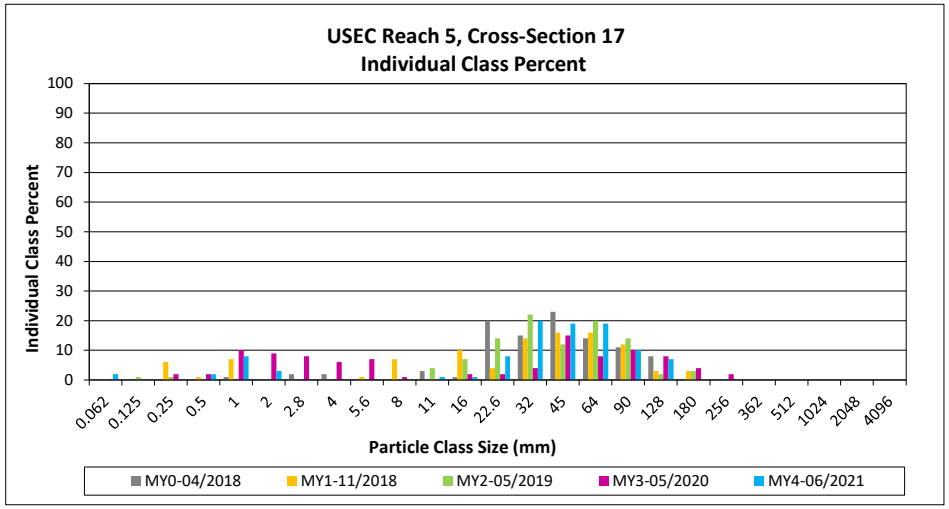
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 5, Cross-Section 17

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50	2	2	4
	Coarse	0.5	1.0	8	8	12
	Very Coarse	1.0	2.0	3	3	15
GRAVEL	Very Fine	2.0	2.8			15
	Very Fine	2.8	4.0			15
	Fine	4.0	5.6			15
	Fine	5.6	8.0			15
	Medium	8.0	11.0	1	1	16
	Medium	11.0	16.0	1	1	17
	Coarse	16.0	22.6	8	8	25
	Coarse	22.6	32	20	20	45
	Very Coarse	32	45	20	20	64
	Very Coarse	45	64	19	19	83
COBBLE	Small	64	90	10	10	93
	Small	90	128	7	7	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**101**	**100**	**100**

Cross-Section 17	
Channel materials (mm)	
D_{16} =	11.7
D_{35} =	27.1
D_{50} =	35.1
D_{84} =	65.9
D_{95} =	99.3
D_{100} =	128.0





Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

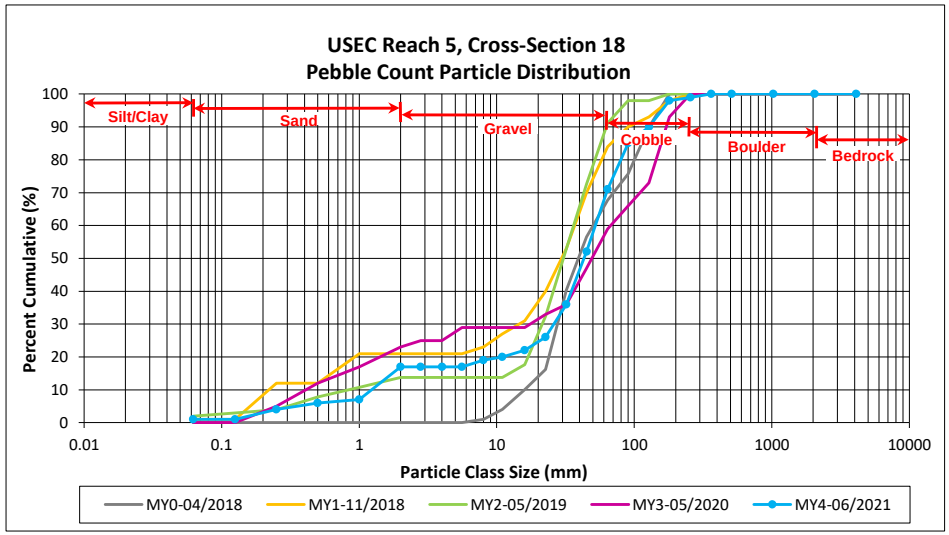
DMS Project No. 739

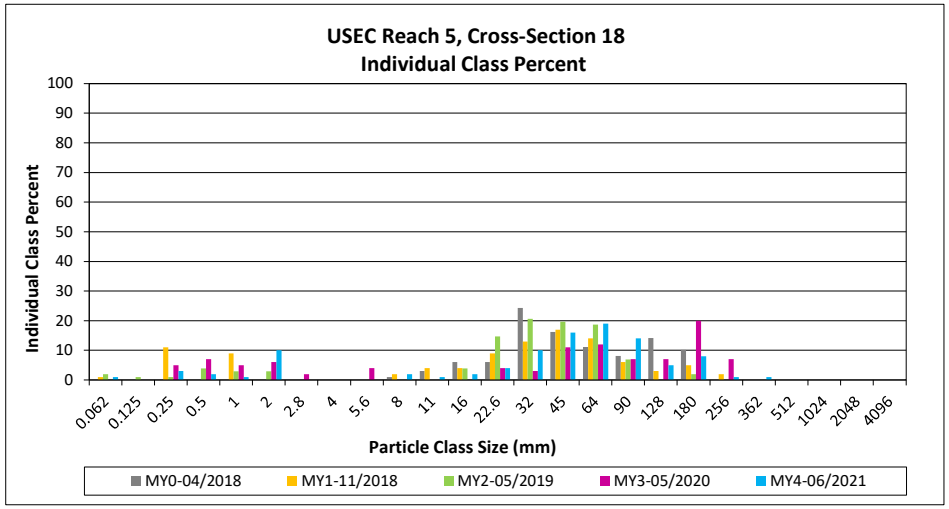
Monitoring Year 4 - 2021

USEC Reach 5, Cross-Section 18

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125			1
	Fine	0.125	0.250	3	3	4
	Medium	0.25	0.50	2	2	6
	Coarse	0.5	1.0	1	1	7
	Very Coarse	1.0	2.0	10	10	17
GRAVEL	Very Fine	2.0	2.8			17
	Very Fine	2.8	4.0			17
	Fine	4.0	5.6			17
	Fine	5.6	8.0	2	2	19
	Medium	8.0	11.0	1	1	20
	Medium	11.0	16.0	2	2	22
	Coarse	16.0	22.6	4	4	26
	Coarse	22.6	32	10	10	36
	Very Coarse	32	45	16	16	51
	Very Coarse	45	64	19	19	70
COBBLE	Small	64	90	14	14	84
	Small	90	128	5	5	89
	Large	128	180	9	9	98
	Large	180	256	1	1	99
BOULDER	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**101**	**100**	**100**

Cross-Section 18	
Channel materials (mm)	
D_{16} =	1.9
D_{35} =	31.3
D_{50} =	43.6
D_{84} =	89.7
D_{95} =	160.4
D_{100} =	362.0





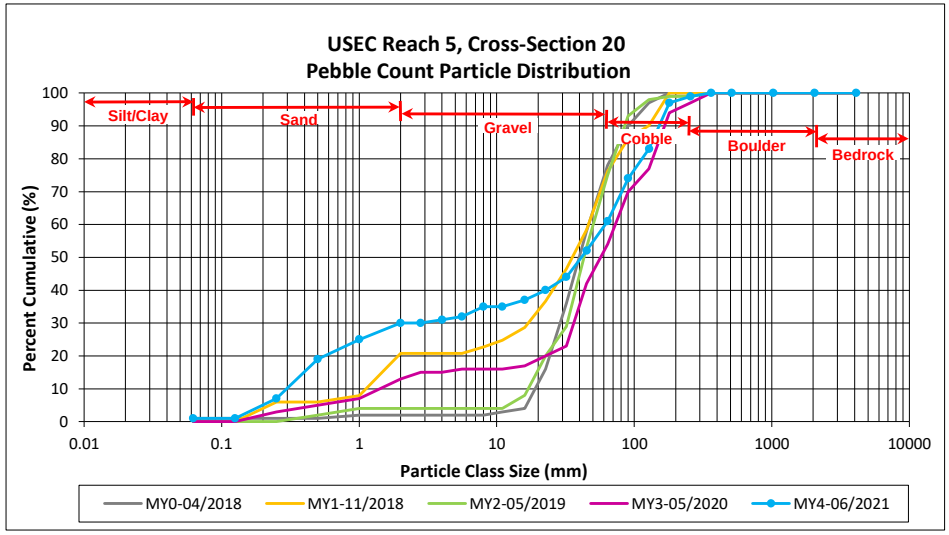
Reachwide and Cross-Section Pebble Count Plots

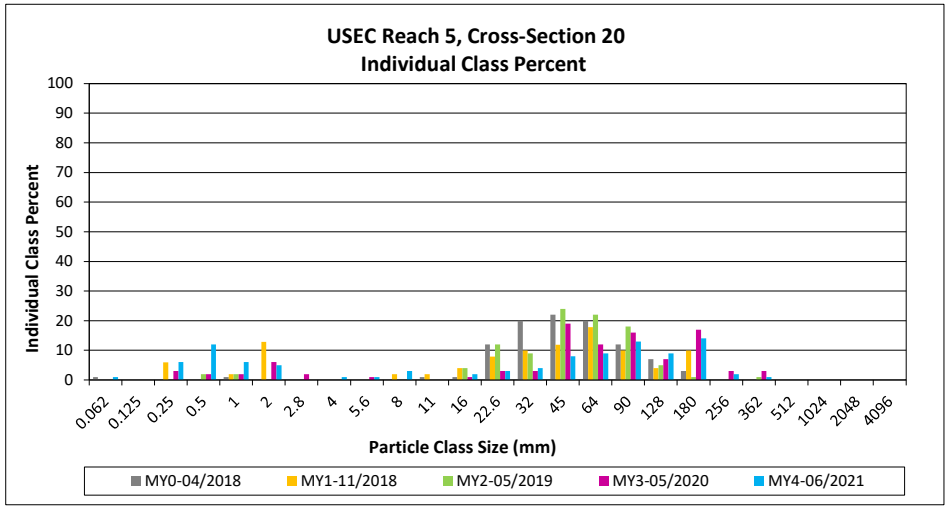
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 5, Cross-Section 20

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125			1
	Fine	0.125	0.250	6	6	7
	Medium	0.25	0.50	12	12	19
	Coarse	0.5	1.0	6	6	25
	Very Coarse	1.0	2.0	5	5	30
GRAVEL	Very Fine	2.0	2.8			30
	Very Fine	2.8	4.0	1	1	31
	Fine	4.0	5.6	1	1	32
	Fine	5.6	8.0	3	3	35
	Medium	8.0	11.0			35
	Medium	11.0	16.0	2	2	37
	Coarse	16.0	22.6	3	3	40
	Coarse	22.6	32	4	4	44
	Very Coarse	32	45	8	8	52
	Very Coarse	45	64	9	9	61
COBBLE	Small	64	90	13	13	74
	Small	90	128	9	9	83
	Large	128	180	14	14	97
	Large	180	256	2	2	99
BOULDER	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 20	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	8.0
D_{50} =	41.3
D_{84} =	131.2
D_{95} =	171.4
D_{100} =	362.0





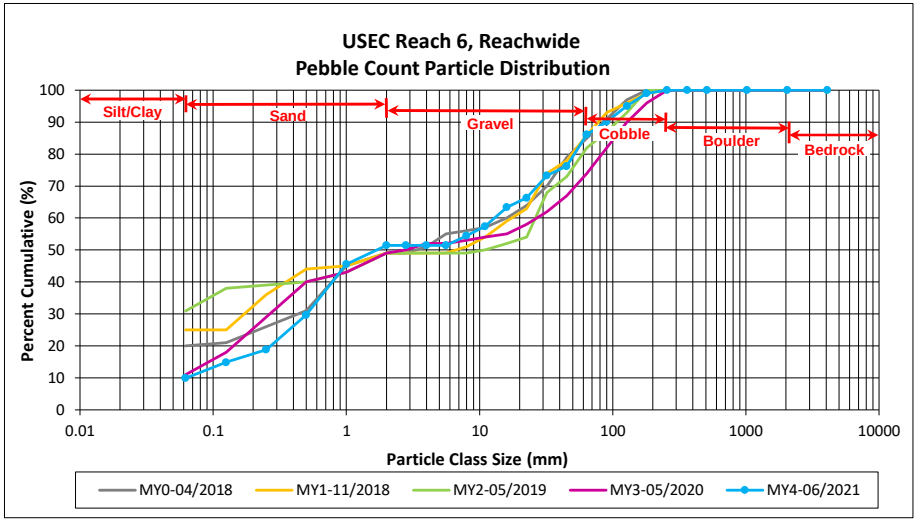
Reachwide and Cross-Section Pebble Count Plots

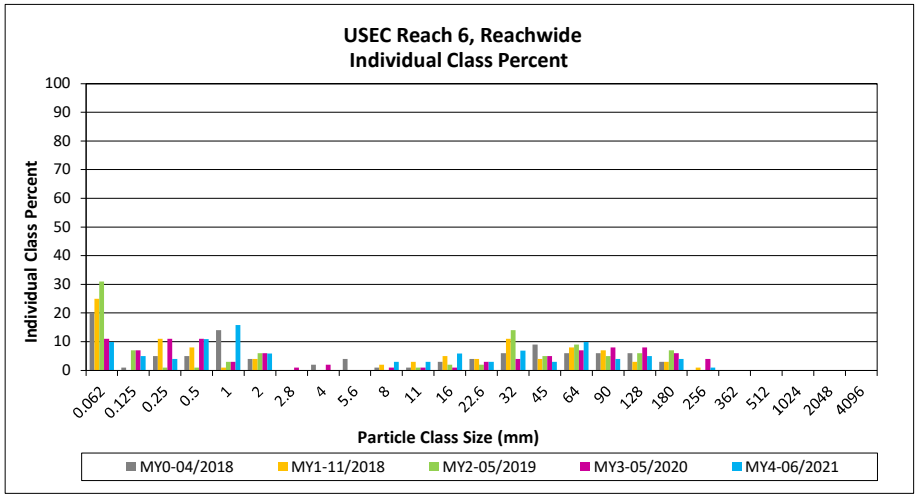
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 6, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	9	10	10	10
SAND	Very fine	0.062	0.125	1	4	5	5	15
	Fine	0.125	0.250	1	3	4	4	19
	Medium	0.25	0.50	3	8	11	11	30
	Coarse	0.5	1.0	3	13	16	16	46
	Very Coarse	1.0	2.0	3	3	6	6	51
GRAVEL	Very Fine	2.0	2.8					51
	Very Fine	2.8	4.0					51
	Fine	4.0	5.6					51
	Fine	5.6	8.0		3	3	3	54
	Medium	8.0	11.0	1	2	3	3	57
	Medium	11.0	16.0	4	2	6	6	63
	Coarse	16.0	22.6	3		3	3	66
	Coarse	22.6	32	6	1	7	7	73
	Very Coarse	32	45	1	2	3	3	76
	Very Coarse	45	64	10		10	10	86
COBBLE	Small	64	90	4		4	4	90
	Small	90	128	5		5	5	95
	Large	128	180	4		4	4	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**51**	**50**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	0.6
D_{50} =	1.7
D_{84} =	59.3
D_{95} =	127.5
D_{100} =	256.0





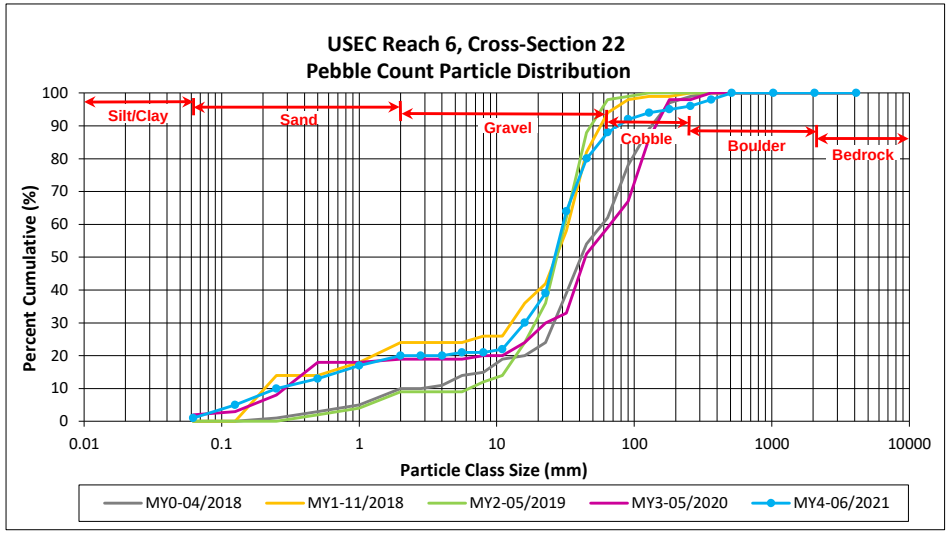
Reachwide and Cross-Section Pebble Count Plots

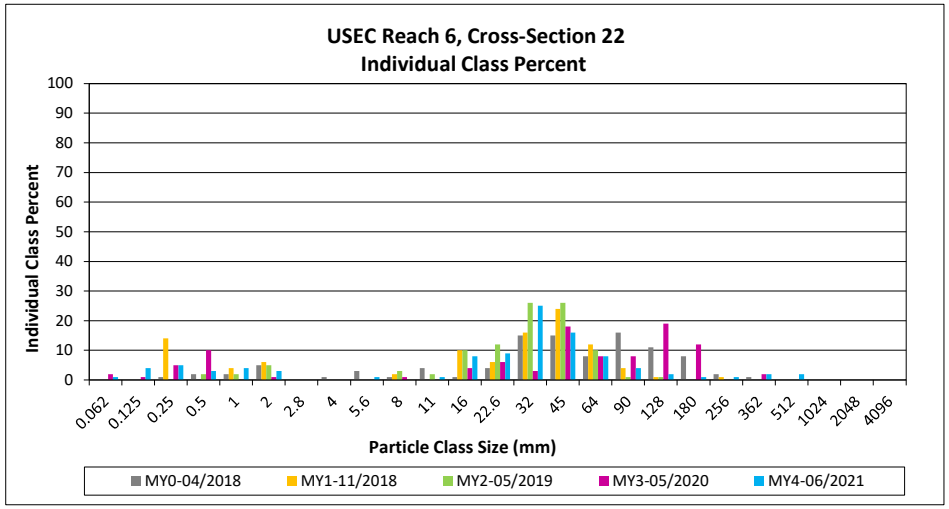
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

USEC Reach 6, Cross-Section 22

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125	4	4	5
	Fine	0.125	0.250	5	5	10
	Medium	0.25	0.50	3	3	13
	Coarse	0.5	1.0	4	4	17
	Very Coarse	1.0	2.0	3	3	20
GRAVEL	Very Fine	2.0	2.8			20
	Very Fine	2.8	4.0			20
	Fine	4.0	5.6	1	1	21
	Fine	5.6	8.0			21
	Medium	8.0	11.0	1	1	22
	Medium	11.0	16.0	8	8	30
	Coarse	16.0	22.6	9	9	39
	Coarse	22.6	32	25	25	64
	Very Coarse	32	45	16	16	80
	Very Coarse	45	64	8	8	88
COBBLE	Small	64	90	4	4	92
	Small	90	128	2	2	94
	Large	128	180	1	1	95
	Large	180	256	1	1	96
BOULDER	Small	256	362	2	2	98
	Small	362	512	2	2	100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 22	
Channel materials (mm)	
D_{16} =	0.8
D_{35} =	19.4
D_{50} =	26.3
D_{84} =	53.7
D_{95} =	180.0
D_{100} =	512.0





Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

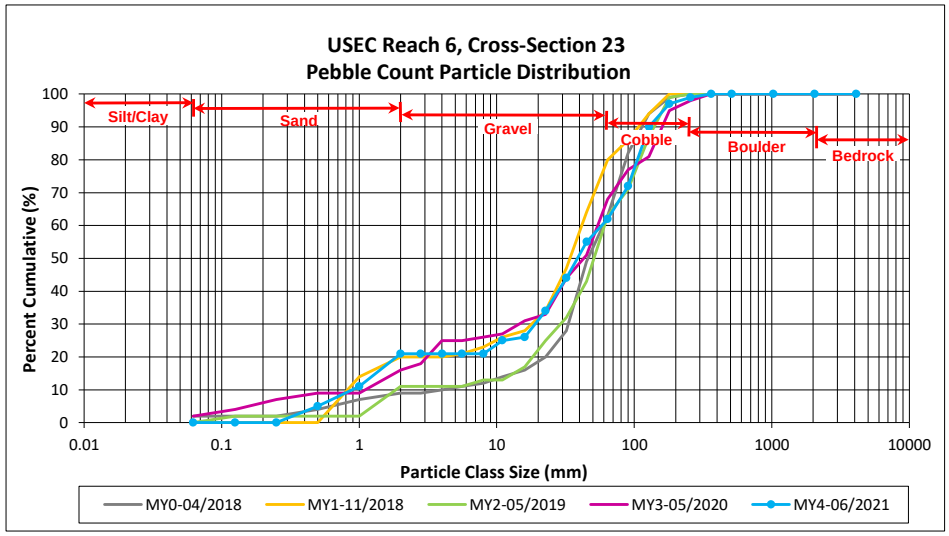
DMS Project No. 739

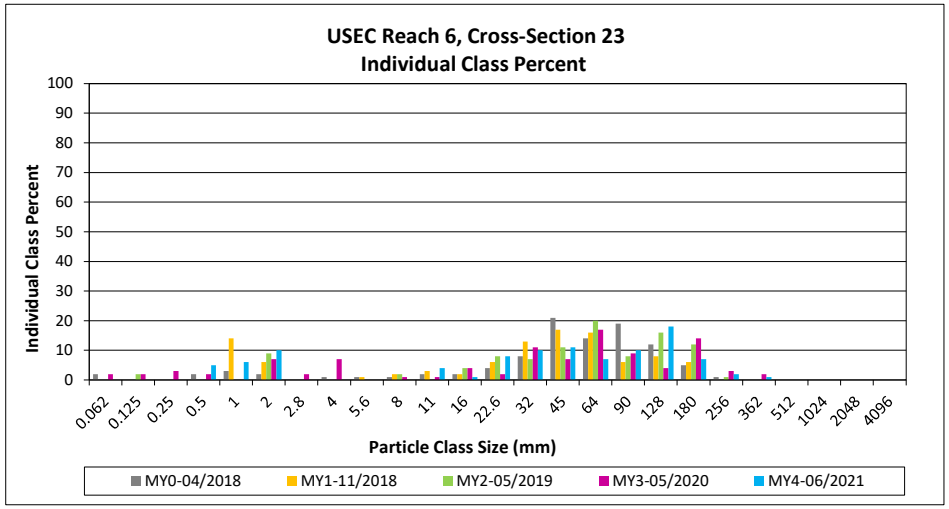
Monitoring Year 4 - 2021

USEC Reach 6, Cross-Section 23

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	5	5	5
	Coarse	0.5	1.0	6	6	11
	Very Coarse	1.0	2.0	10	10	21
GRAVEL	Very Fine	2.0	2.8			21
	Very Fine	2.8	4.0			21
	Fine	4.0	5.6			21
	Fine	5.6	8.0			21
	Medium	8.0	11.0	4	4	25
	Medium	11.0	16.0	1	1	26
	Coarse	16.0	22.6	8	8	34
	Coarse	22.6	32	10	10	44
	Very Coarse	32	45	11	11	55
	Very Coarse	45	64	7	7	62
COBBLE	Small	64	90	10	10	72
	Small	90	128	18	18	90
	Large	128	180	7	7	97
	Large	180	256	2	2	99
BOULDER	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 23	
Channel materials (mm)	
D_{16} =	1.4
D_{35} =	23.4
D_{50} =	38.5
D_{84} =	113.8
D_{95} =	163.3
D_{100} =	362.0





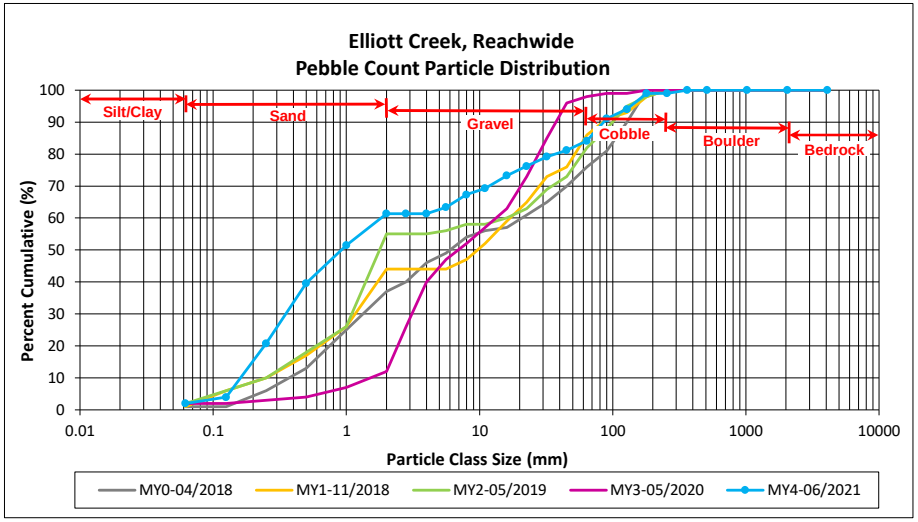
Reachwide and Cross-Section Pebble Count Plots

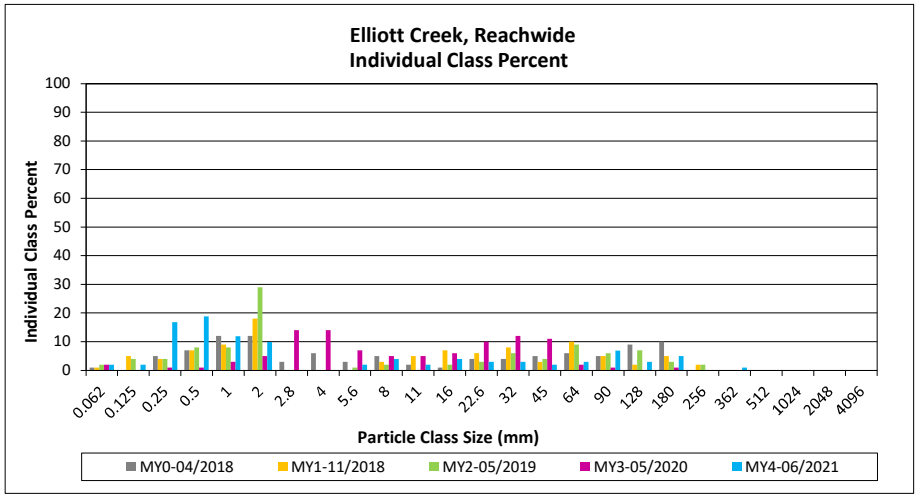
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

Elliott Creek, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2		2	2	2
SAND	Very fine	0.062	0.125	2		2	2	4
	Fine	0.125	0.250	8	9	17	17	21
	Medium	0.25	0.50	2	17	19	19	40
	Coarse	0.5	1.0	5	7	12	12	51
	Very Coarse	1.0	2.0	2	8	10	10	61
GRAVEL	Very Fine	2.0	2.8					61
	Very Fine	2.8	4.0					61
	Fine	4.0	5.6	1	1	2	2	63
	Fine	5.6	8.0	2	2	4	4	67
	Medium	8.0	11.0	2		2	2	69
	Medium	11.0	16.0	2	2	4	4	73
	Coarse	16.0	22.6	3		3	3	76
	Coarse	22.6	32	3		3	3	79
	Very Coarse	32	45	2		2	2	81
	Very Coarse	45	64	3		3	3	84
COBBLE	Small	64	90	4	3	7	7	91
	Small	90	128	3		3	3	94
	Large	128	180	4	1	5	5	99
	Large	180	256					99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**51**	**50**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	0.4
D_{50} =	0.9
D_{84} =	62.8
D_{95} =	136.6
D_{100} =	362.0





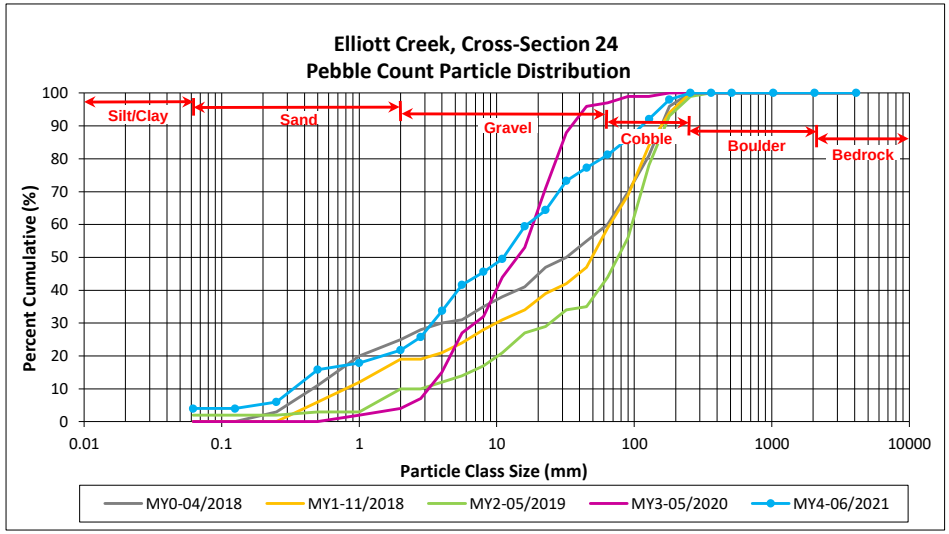
Reachwide and Cross-Section Pebble Count Plots

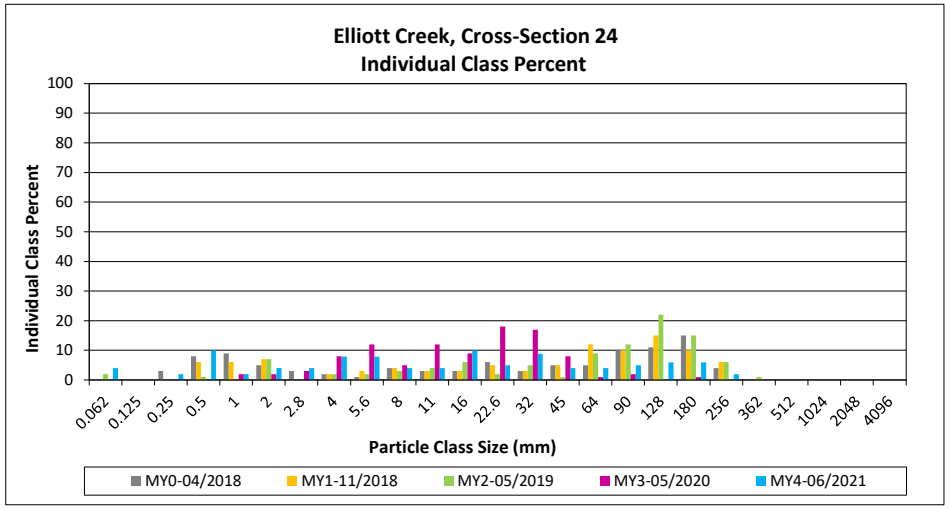
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

Elliott Creek, Cross-Section 24

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250	2	2	6
	Medium	0.25	0.50	10	10	16
	Coarse	0.5	1.0	2	2	18
	Very Coarse	1.0	2.0	4	4	22
GRAVEL	Very Fine	2.0	2.8	4	4	26
	Very Fine	2.8	4.0	8	8	34
	Fine	4.0	5.6	8	8	42
	Fine	5.6	8.0	4	4	46
	Medium	8.0	11.0	4	4	50
	Medium	11.0	16.0	10	10	59
	Coarse	16.0	22.6	5	5	64
	Coarse	22.6	32	9	9	73
	Very Coarse	32	45	4	4	77
	Very Coarse	45	64	4	4	81
COBBLE	Small	64	90	5	5	86
	Small	90	128	6	6	92
	Large	128	180	6	6	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**101**	**100**	**100**

Cross-Section 24	
Channel materials (mm)	
D_{16} =	0.5
D_{35} =	4.2
D_{50} =	11.2
D_{84} =	77.7
D_{95} =	151.4
D_{100} =	256.0





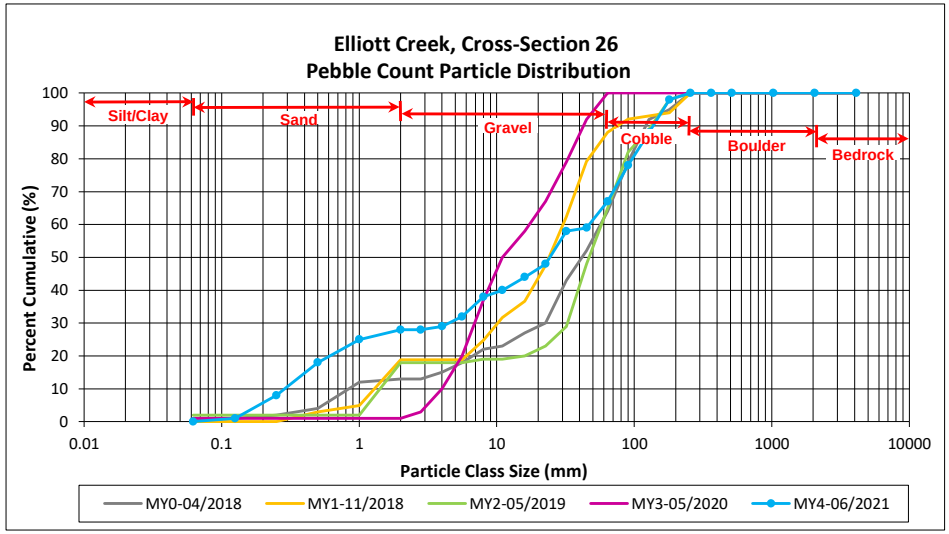
Reachwide and Cross-Section Pebble Count Plots

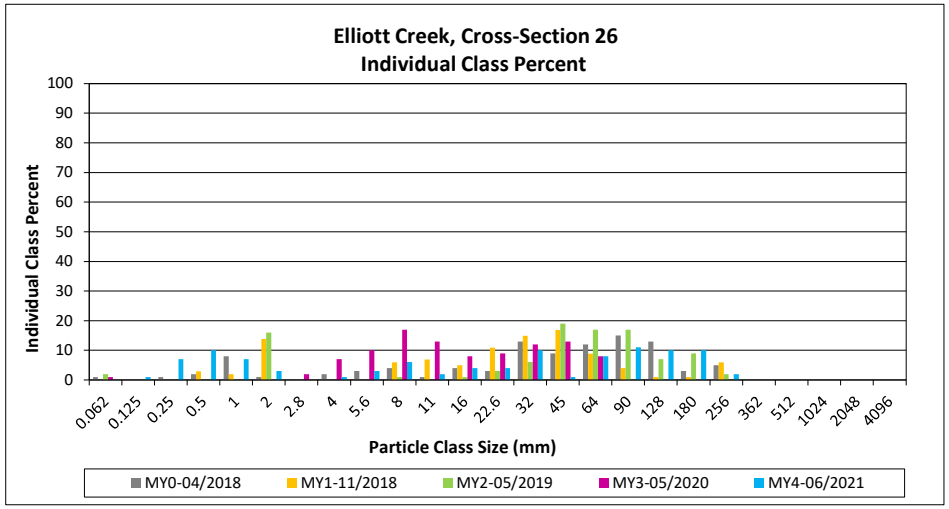
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

Elliott Creek, Cross-Section 26

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125	1	1	1
	Fine	0.125	0.250	7	7	8
	Medium	0.25	0.50	10	10	18
	Coarse	0.5	1.0	7	7	25
	Very Coarse	1.0	2.0	3	3	28
GRAVEL	Very Fine	2.0	2.8			28
	Very Fine	2.8	4.0	1	1	29
	Fine	4.0	5.6	3	3	32
	Fine	5.6	8.0	6	6	38
	Medium	8.0	11.0	2	2	40
	Medium	11.0	16.0	4	4	44
	Coarse	16.0	22.6	4	4	48
	Coarse	22.6	32	10	10	58
	Very Coarse	32	45	1	1	59
	Very Coarse	45	64	8	8	67
COBBLE	Small	64	90	11	11	78
	Small	90	128	10	10	88
	Large	128	180	10	10	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 26	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	6.7
D_{50} =	24.2
D_{84} =	111.2
D_{95} =	162.5
D_{100} =	256.0





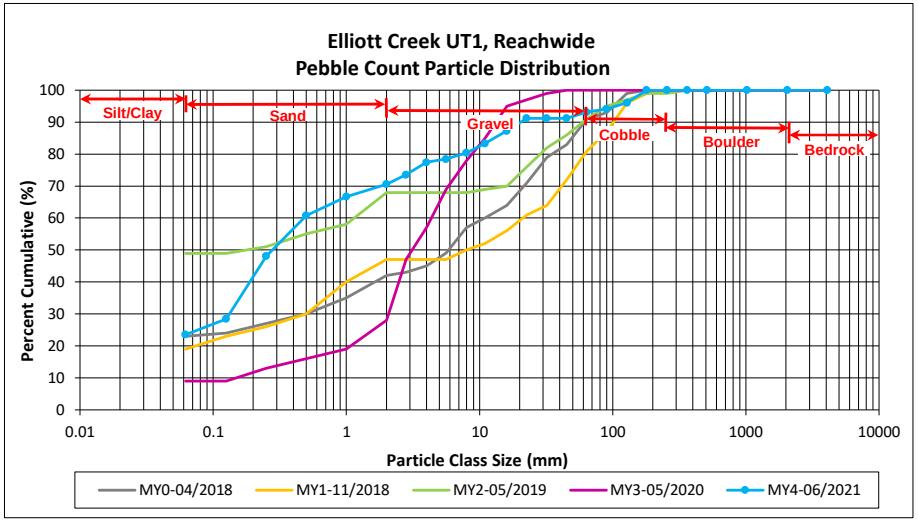
Reachwide and Cross-Section Pebble Count Plots

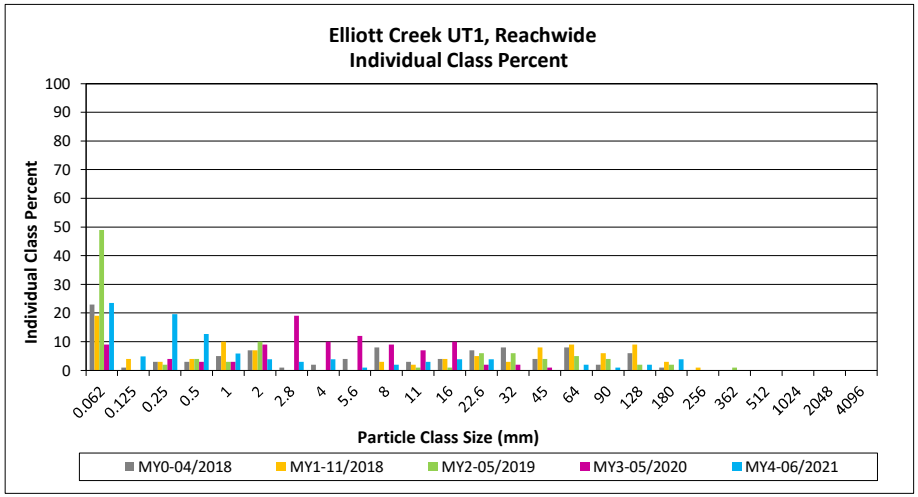
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

Elliott Creek UT1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	9	15	24	24	24
SAND	Very fine	0.062	0.125		5	5	5	28
	Fine	0.125	0.250	9	11	20	20	48
	Medium	0.25	0.50	4	9	13	13	61
	Coarse	0.5	1.0	3	3	6	6	67
	Very Coarse	1.0	2.0	3	1	4	4	71
GRAVEL	Very Fine	2.0	2.8	1	2	3	3	74
	Very Fine	2.8	4.0	2	2	4	4	77
	Fine	4.0	5.6	1		1	1	78
	Fine	5.6	8.0	1	1	2	2	80
	Medium	8.0	11.0	3		3	3	83
	Medium	11.0	16.0	3	1	4	4	87
	Coarse	16.0	22.6	3	1	4	4	91
	Coarse	22.6	32					91
	Very Coarse	32	45					91
	Very Coarse	45	64	2		2	2	93
COBBLE	Small	64	90	1		1	1	94
	Small	90	128	2		2	2	96
	Large	128	180	4		4	4	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**51**	**51**	**102**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.16
D_{50} =	0.3
D_{84} =	11.7
D_{95} =	105.5
D_{100} =	180.0





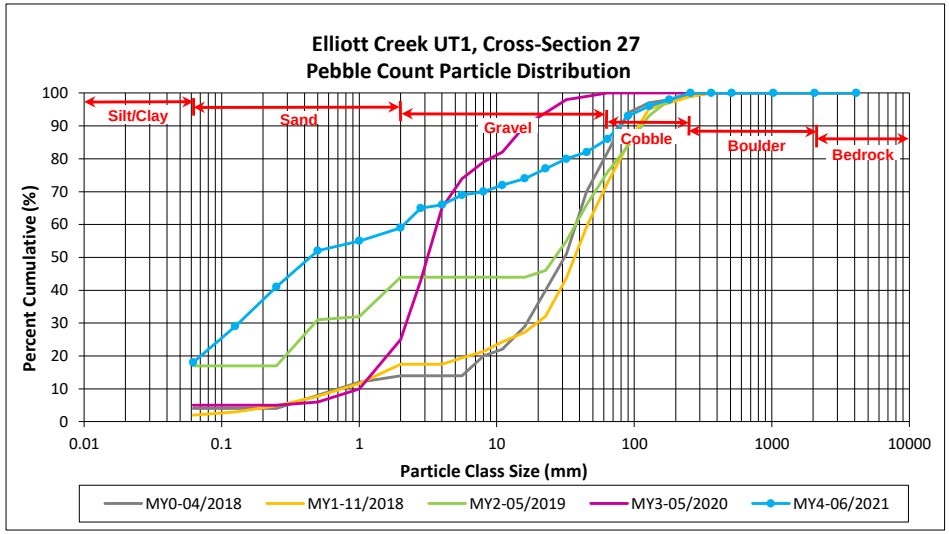
Reachwide and Cross-Section Pebble Count Plots

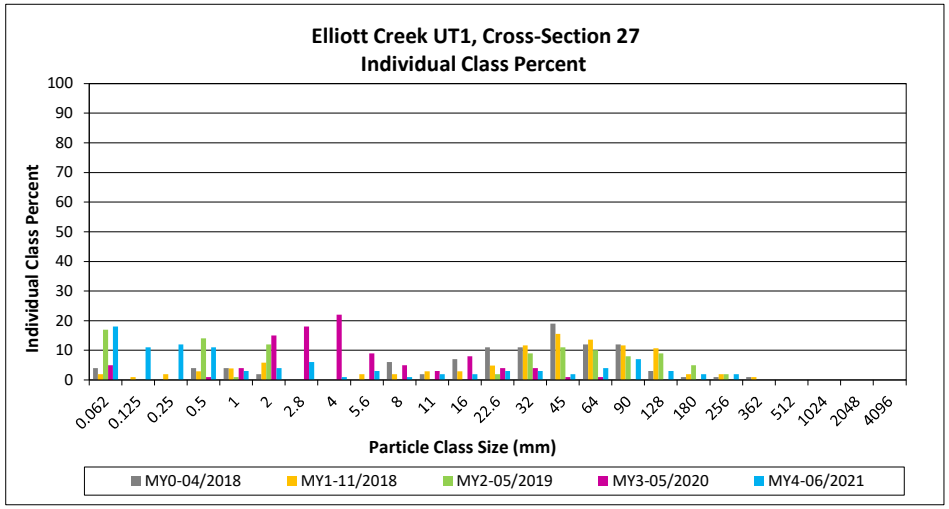
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

Elliott Creek UT1, Cross-Section 27

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	18	18	18
SAND	Very fine	0.062	0.125	11	11	29
	Fine	0.125	0.250	12	12	41
	Medium	0.25	0.50	11	11	52
	Coarse	0.5	1.0	3	3	55
	Very Coarse	1.0	2.0	4	4	59
GRAVEL	Very Fine	2.0	2.8	6	6	65
	Very Fine	2.8	4.0	1	1	66
	Fine	4.0	5.6	3	3	69
	Fine	5.6	8.0	1	1	70
	Medium	8.0	11.0	2	2	72
	Medium	11.0	16.0	2	2	74
	Coarse	16.0	22.6	3	3	77
	Coarse	22.6	32	3	3	80
	Very Coarse	32	45	2	2	82
	Very Coarse	45	64	4	4	86
COBBLE	Small	64	90	7	7	93
	Small	90	128	3	3	96
	Large	128	180	2	2	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 27	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.2
D_{50} =	0.4
D_{84} =	53.7
D_{95} =	113.8
D_{100} =	256.0





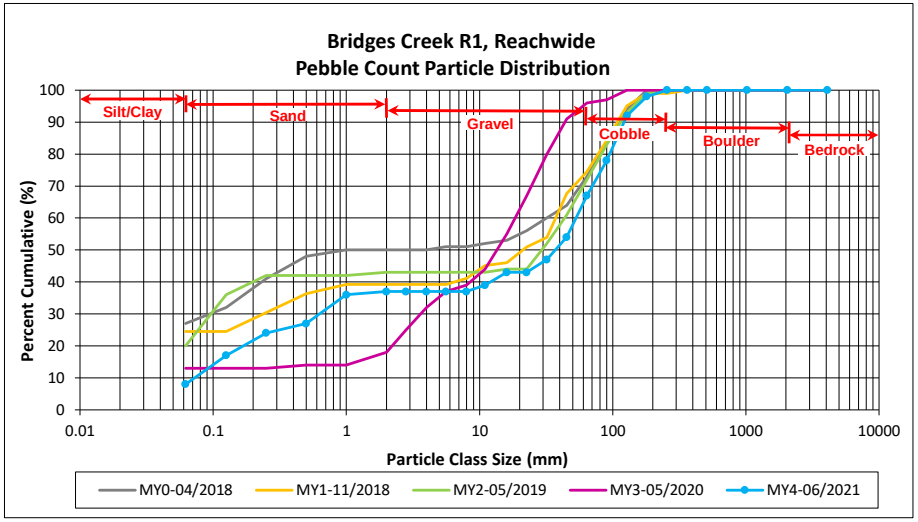
Reachwide and Cross-Section Pebble Count Plots

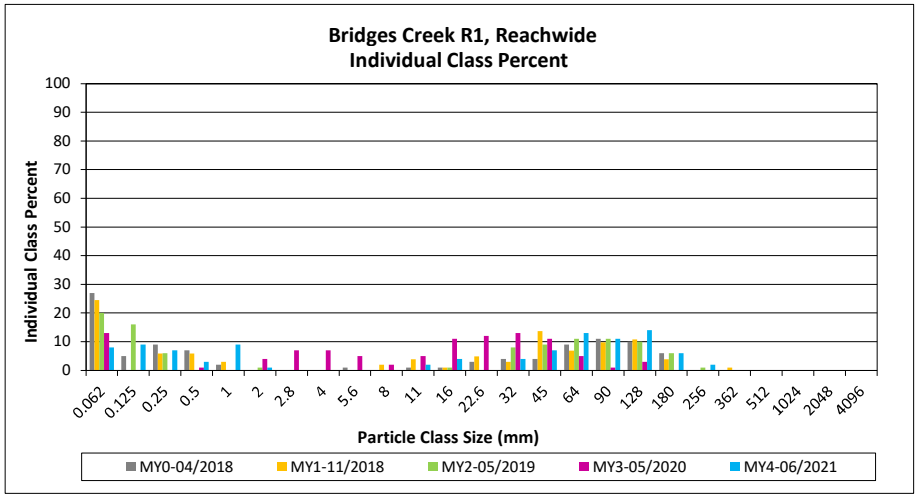
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

Bridges Creek R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		8	8	8	8
SAND	Very fine	0.062	0.125		9	9	9	17
	Fine	0.125	0.250		7	7	7	24
	Medium	0.25	0.50		3	3	3	27
	Coarse	0.5	1.0	1	8	9	9	36
	Very Coarse	1.0	2.0		1	1	1	37
GRAVEL	Very Fine	2.0	2.8					37
	Very Fine	2.8	4.0					37
	Fine	4.0	5.6					37
	Fine	5.6	8.0					37
	Medium	8.0	11.0	1	1	2	2	39
	Medium	11.0	16.0	4		4	4	43
	Coarse	16.0	22.6					43
	Coarse	22.6	32	4		4	4	47
	Very Coarse	32	45	5	2	7	7	54
	Very Coarse	45	64	12	1	13	13	67
COBBLE	Small	64	90	8	3	11	11	78
	Small	90	128	10	4	14	14	92
	Large	128	180	3	3	6	6	98
	Large	180	256	2		2	2	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.12
D_{35} =	0.9
D_{50} =	37.0
D_{84} =	104.7
D_{95} =	151.8
D_{100} =	256.0





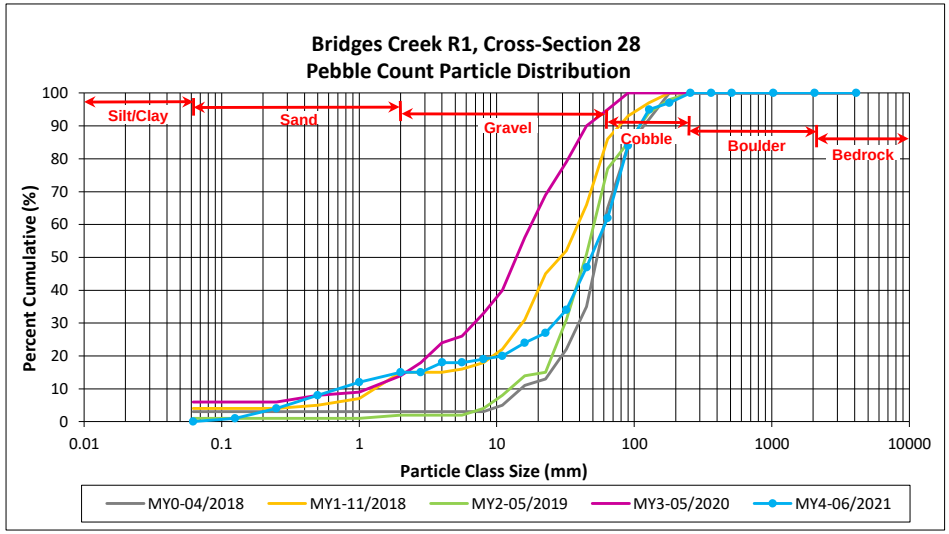
Reachwide and Cross-Section Pebble Count Plots

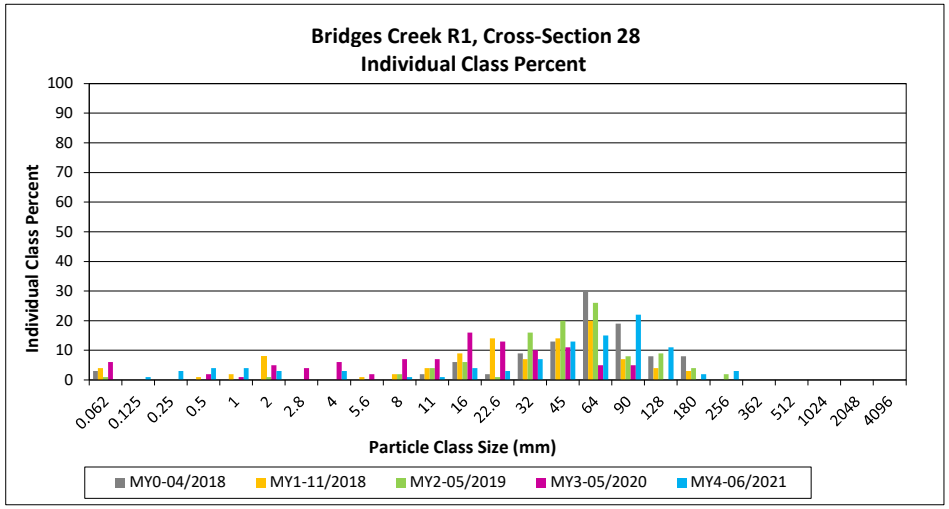
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

Bridges Creek R1, Cross-Section 28

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125	1	1	1
	Fine	0.125	0.250	3	3	4
	Medium	0.25	0.50	4	4	8
	Coarse	0.5	1.0	4	4	12
	Very Coarse	1.0	2.0	3	3	15
GRAVEL	Very Fine	2.0	2.8			15
	Very Fine	2.8	4.0	3	3	18
	Fine	4.0	5.6			18
	Fine	5.6	8.0	1	1	19
	Medium	8.0	11.0	1	1	20
	Medium	11.0	16.0	4	4	24
	Coarse	16.0	22.6	3	3	27
	Coarse	22.6	32	7	7	34
	Very Coarse	32	45	13	13	47
	Very Coarse	45	64	15	15	62
COBBLE	Small	64	90	22	22	84
	Small	90	128	11	11	95
	Large	128	180	2	2	97
	Large	180	256	3	3	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 28	
Channel materials (mm)	
D_{16} =	3.2
D_{35} =	32.9
D_{50} =	48.3
D_{84} =	90.0
D_{95} =	128.0
D_{100} =	256.0





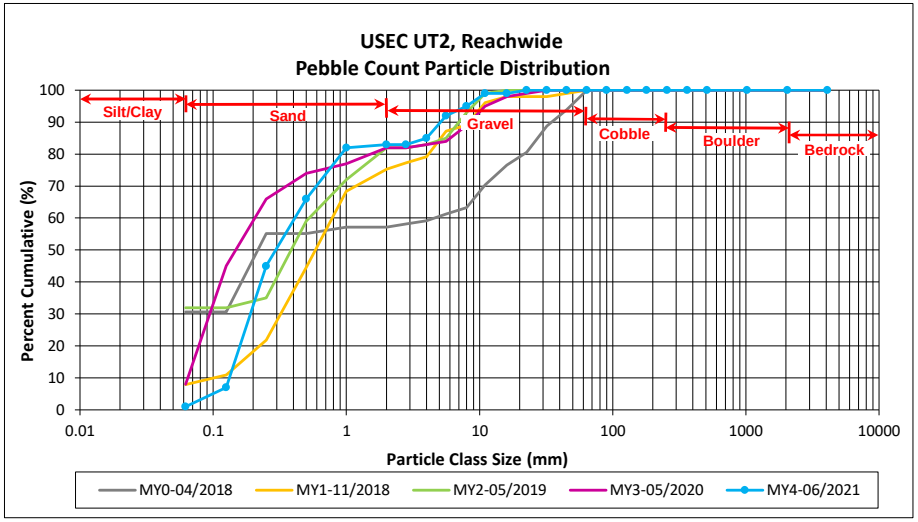
Reachwide and Cross-Section Pebble Count Plots

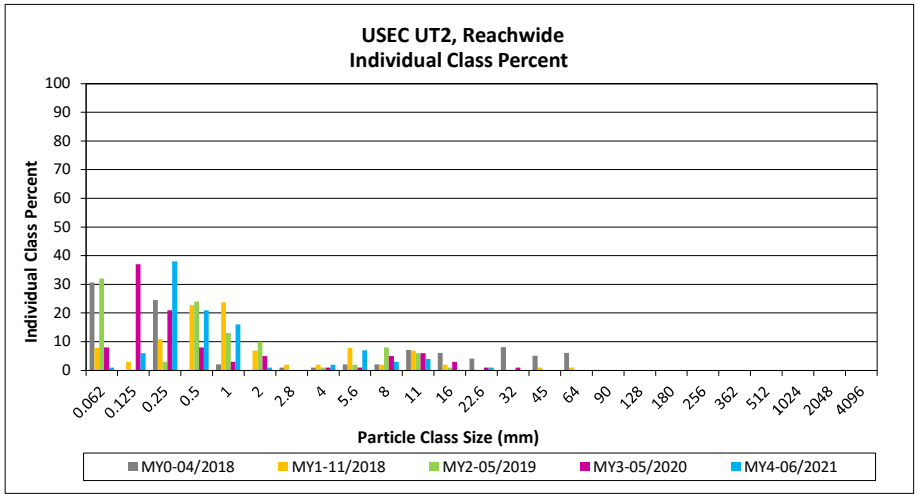
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

USEC UT2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	5	6	6	6
SAND	Very fine	0.062	0.125	1	22	23	23	29
	Fine	0.125	0.250	16	12	28	28	57
	Medium	0.25	0.50	9	7	16	16	73
	Coarse	0.5	1.0	9		9	9	82
	Very Coarse	1.0	2.0	1		1	1	83
GRAVEL	Very Fine	2.0	2.8					83
	Very Fine	2.8	4.0	2		2	2	85
	Fine	4.0	5.6	5	2	7	7	92
	Fine	5.6	8.0	3		3	3	95
	Medium	8.0	11.0	2	2	4	4	99
	Medium	11.0	16.0					99
	Coarse	16.0	22.6	1		1	1	100
	Coarse	22.6	32					100
	Very Coarse	32	45					100
	Very Coarse	45	64					100
COBBLE	Small	64	90					100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.1
D_{35} =	0.1
D_{50} =	0.2
D_{84} =	3.3
D_{95} =	8.0
D_{100} =	22.6





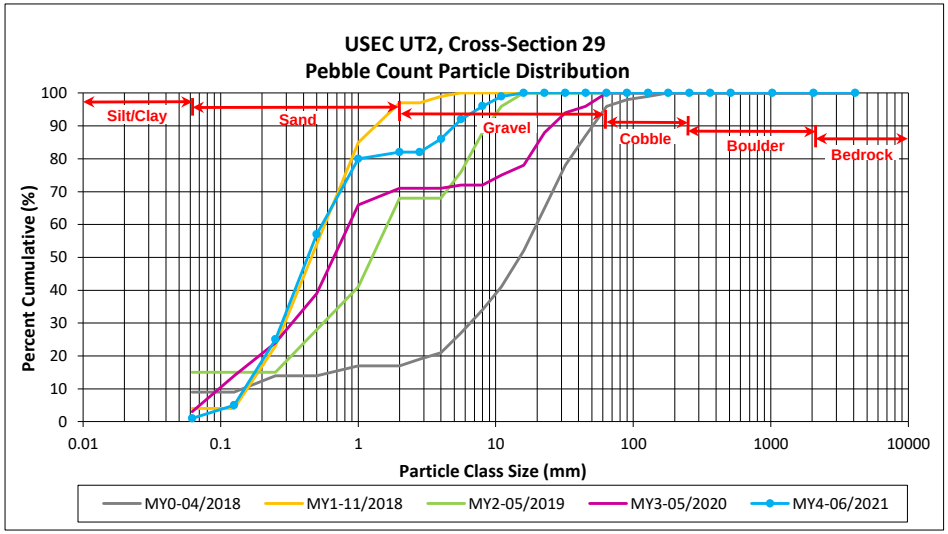
Reachwide and Cross-Section Pebble Count Plots

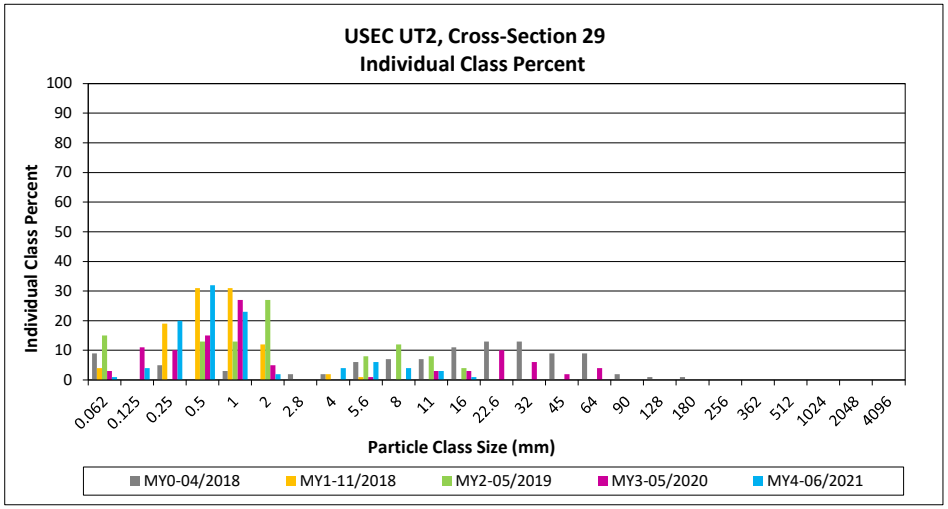
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

USEC UT2, Cross-Section 29

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125	4	4	5
	Fine	0.125	0.250	20	20	25
	Medium	0.25	0.50	32	32	57
	Coarse	0.5	1.0	23	23	80
	Very Coarse	1.0	2.0	2	2	82
GRAVEL	Very Fine	2.0	2.8			82
	Very Fine	2.8	4.0	4	4	86
	Fine	4.0	5.6	6	6	92
	Fine	5.6	8.0	4	4	96
	Medium	8.0	11.0	3	3	99
	Medium	11.0	16.0	1	1	100
	Coarse	16.0	22.6			100
	Coarse	22.6	32			100
	Very Coarse	32	45			100
	Very Coarse	45	64			100
COBBLE	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 29	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	0.3
D_{50} =	0.4
D_{84} =	3.3
D_{95} =	7.3
D_{100} =	16.0





Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area B

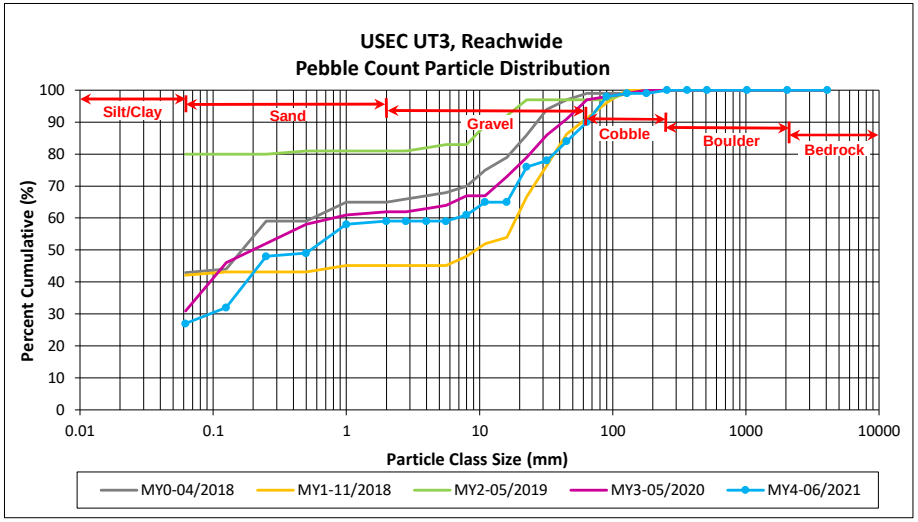
DMS Project No. 739

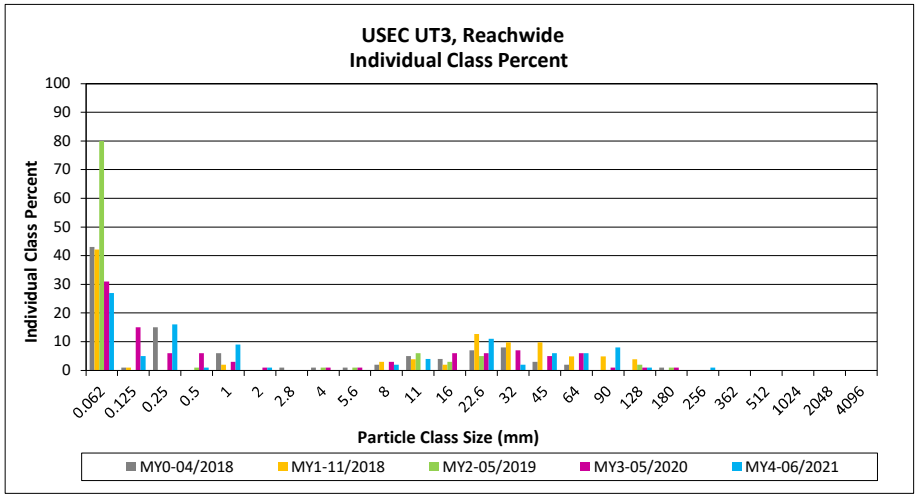
Monitoring Year 4 - 2021

USEC UT3, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	7	20	27	27	27
SAND	Very fine	0.062	0.125		5	5	5	32
	Fine	0.125	0.250	7	9	16	16	48
	Medium	0.25	0.50	1		1	1	49
	Coarse	0.5	1.0	5	4	9	9	58
	Very Coarse	1.0	2.0		1	1	1	59
GRAVEL	Very Fine	2.0	2.8					59
	Very Fine	2.8	4.0					59
	Fine	4.0	5.6					59
	Fine	5.6	8.0	1	1	2	2	61
	Medium	8.0	11.0	3	1	4	4	65
	Medium	11.0	16.0					65
	Coarse	16.0	22.6	9	2	11	11	76
	Coarse	22.6	32	1	1	2	2	78
	Very Coarse	32	45	5	1	6	6	84
	Very Coarse	45	64	5	1	6	6	90
COBBLE	Small	64	90	5	3	8	8	98
	Small	90	128		1	1	1	99
	Large	128	180					99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.1
D_{50} =	0.5
D_{84} =	45.0
D_{95} =	79.2
D_{100} =	256.0





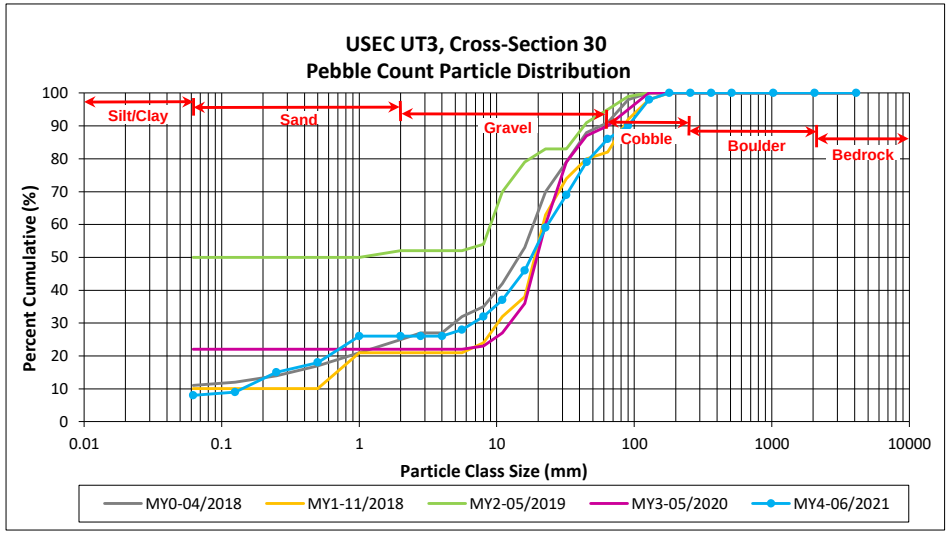
Reachwide and Cross-Section Pebble Count Plots

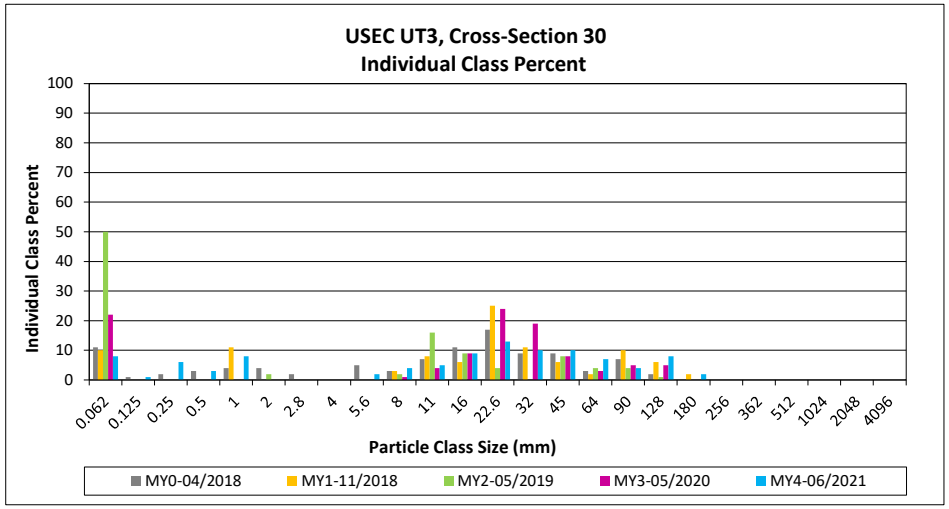
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

USEC UT3, Cross-Section 30

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	8	8	8
SAND	Very fine	0.062	0.125	1	1	9
	Fine	0.125	0.250	6	6	15
	Medium	0.25	0.50	3	3	18
	Coarse	0.5	1.0	8	8	26
	Very Coarse	1.0	2.0			26
GRAVEL	Very Fine	2.0	2.8			26
	Very Fine	2.8	4.0			26
	Fine	4.0	5.6	2	2	28
	Fine	5.6	8.0	4	4	32
	Medium	8.0	11.0	5	5	37
	Medium	11.0	16.0	9	9	46
	Coarse	16.0	22.6	13	13	59
	Coarse	22.6	32	10	10	69
	Very Coarse	32	45	10	10	79
	Very Coarse	45	64	7	7	86
COBBLE	Small	64	90	4	4	90
	Small	90	128	8	8	98
	Large	128	180	2	2	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 30	
Channel materials (mm)	
D_{16} =	0.31
D_{35} =	9.7
D_{50} =	17.8
D_{84} =	57.9
D_{95} =	112.2
D_{100} =	180.0





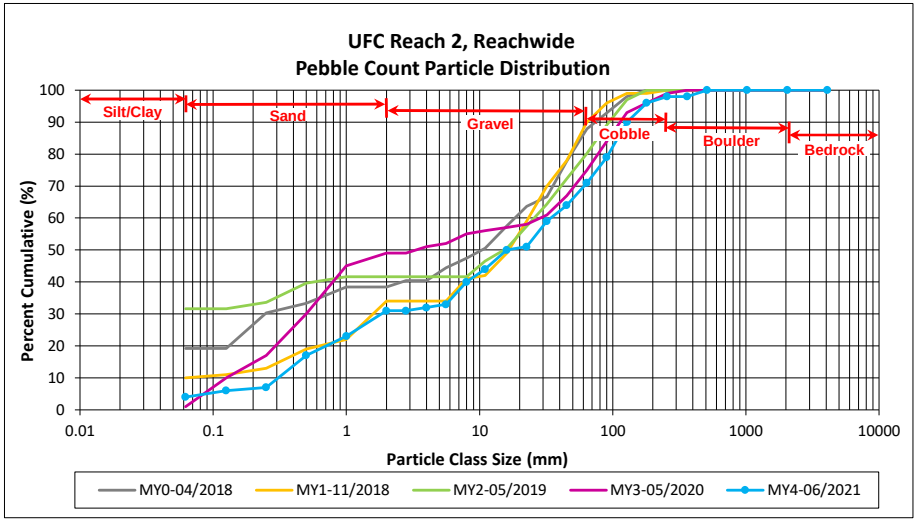
Reachwide and Cross-Section Pebble Count Plots

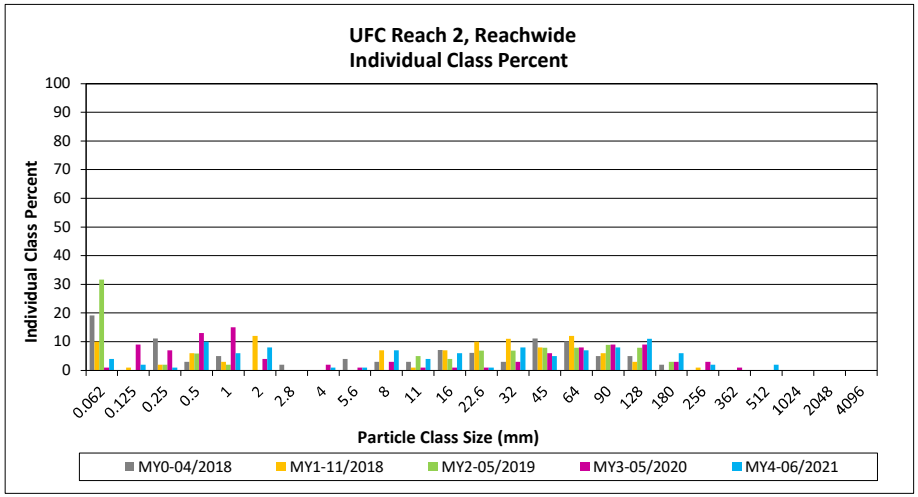
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

UFC Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	3	4	4	4
SAND	Very fine	0.062	0.125		2	2	2	6
	Fine	0.125	0.250		1	1	1	7
	Medium	0.25	0.50		10	10	10	17
	Coarse	0.5	1.0		6	6	6	23
	Very Coarse	1.0	2.0	6	2	8	8	31
GRAVEL	Very Fine	2.0	2.8					31
	Very Fine	2.8	4.0		1	1	1	32
	Fine	4.0	5.6		1	1	1	33
	Fine	5.6	8.0	1	6	7	7	40
	Medium	8.0	11.0	2	2	4	4	44
	Medium	11.0	16.0		6	6	6	51
	Coarse	16.0	22.6		1	1	1	52
	Coarse	22.6	32	3	5	8	8	60
	Very Coarse	32	45	3	2	5	5	65
	Very Coarse	45	64	6	1	7	7	72
COBBLE	Small	64	90	6	1	7	7	79
	Small	90	128	11		11	11	90
	Large	128	180	6		6	6	96
	Large	180	256	2		2	2	98
BOULDER	Small	256	362					98
	Small	362	512	2		2	2	100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**49**	**50**	**99**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.5
D_{35} =	6.1
D_{50} =	15.5
D_{84} =	106.2
D_{95} =	170.5
D_{100} =	512.0





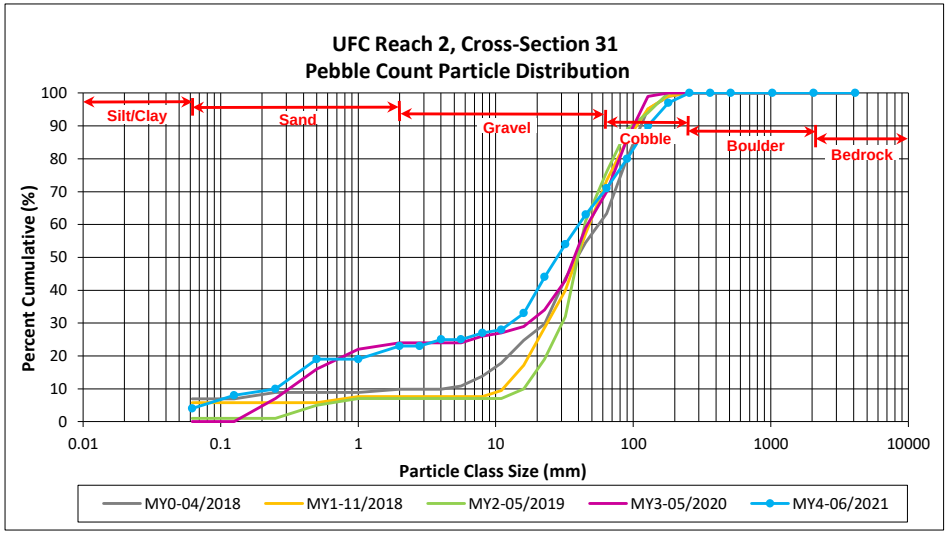
Reachwide and Cross-Section Pebble Count Plots

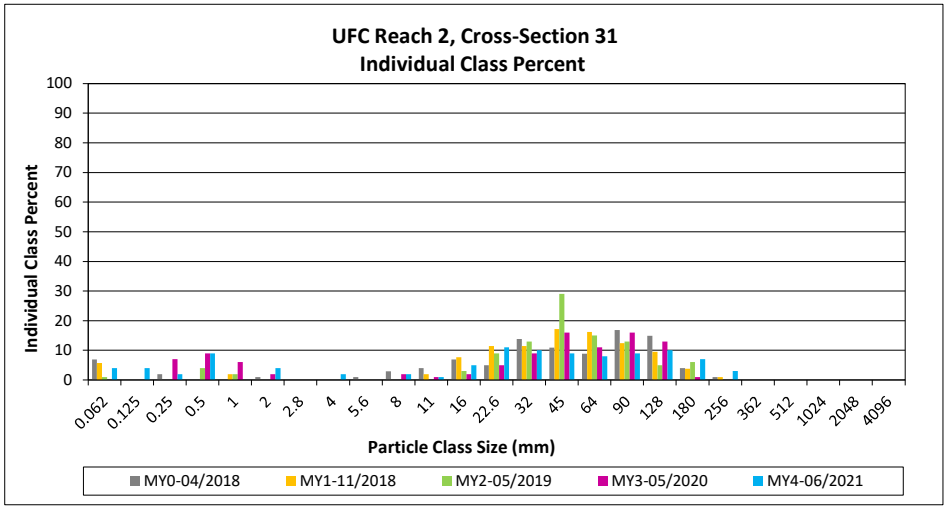
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

UFC Reach 2, Cross-Section 31

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125	4	4	8
	Fine	0.125	0.250	2	2	10
	Medium	0.25	0.50	9	9	19
	Coarse	0.5	1.0			19
	Very Coarse	1.0	2.0	4	4	23
GRAVEL	Very Fine	2.0	2.8			23
	Very Fine	2.8	4.0	2	2	25
	Fine	4.0	5.6			25
	Fine	5.6	8.0	2	2	27
	Medium	8.0	11.0	1	1	28
	Medium	11.0	16.0	5	5	33
	Coarse	16.0	22.6	11	11	44
	Coarse	22.6	32	10	10	54
	Very Coarse	32	45	9	9	63
	Very Coarse	45	64	8	8	71
COBBLE	Small	64	90	9	9	80
	Small	90	128	10	10	90
	Large	128	180	7	7	97
	Large	180	256	3	3	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 31	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	17.0
D_{50} =	27.8
D_{84} =	103.6
D_{95} =	163.3
D_{100} =	256.0





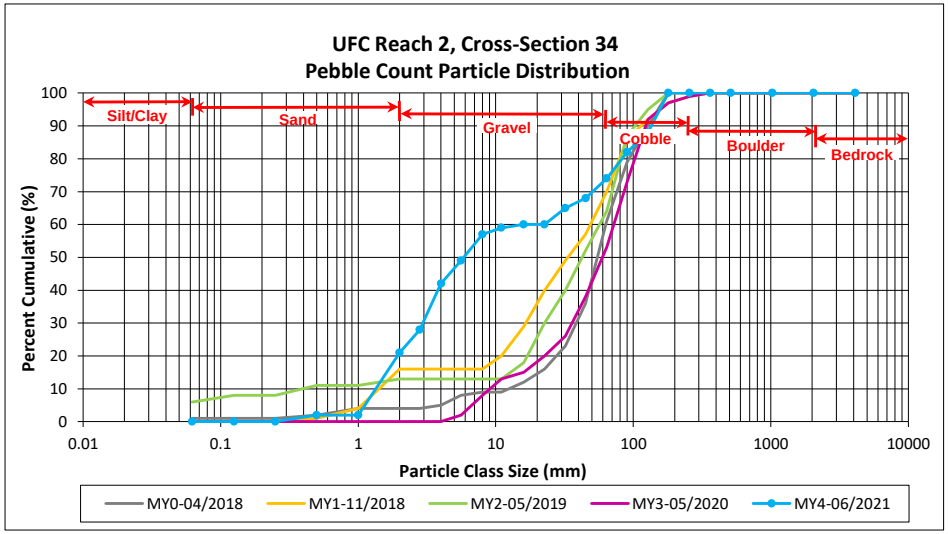
Reachwide and Cross-Section Pebble Count Plots

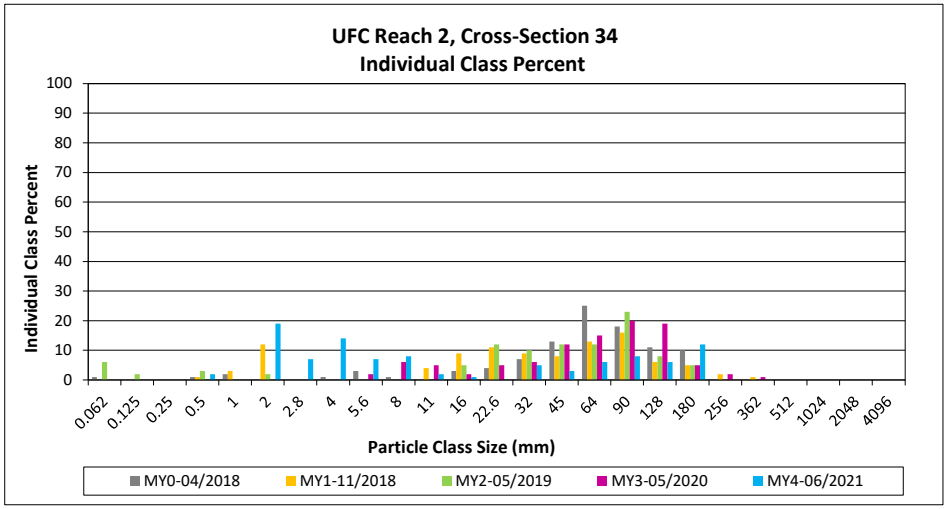
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

UFC Reach 2, Cross-Section 34

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	2	2	2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	19	19	21
GRAVEL	Very Fine	2.0	2.8	7	7	28
	Very Fine	2.8	4.0	14	14	42
	Fine	4.0	5.6	7	7	49
	Fine	5.6	8.0	8	8	57
	Medium	8.0	11.0	2	2	59
	Medium	11.0	16.0	1	1	60
	Coarse	16.0	22.6			60
	Coarse	22.6	32	5	5	65
	Very Coarse	32	45	3	3	68
	Very Coarse	45	64	6	6	74
COBBLE	Small	64	90	8	8	82
	Small	90	128	6	6	88
	Large	128	180	12	12	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 34	
Channel materials (mm)	
D_{16} =	1.7
D_{35} =	3.3
D_{50} =	5.9
D_{84} =	101.2
D_{95} =	156.2
D_{100} =	180.0





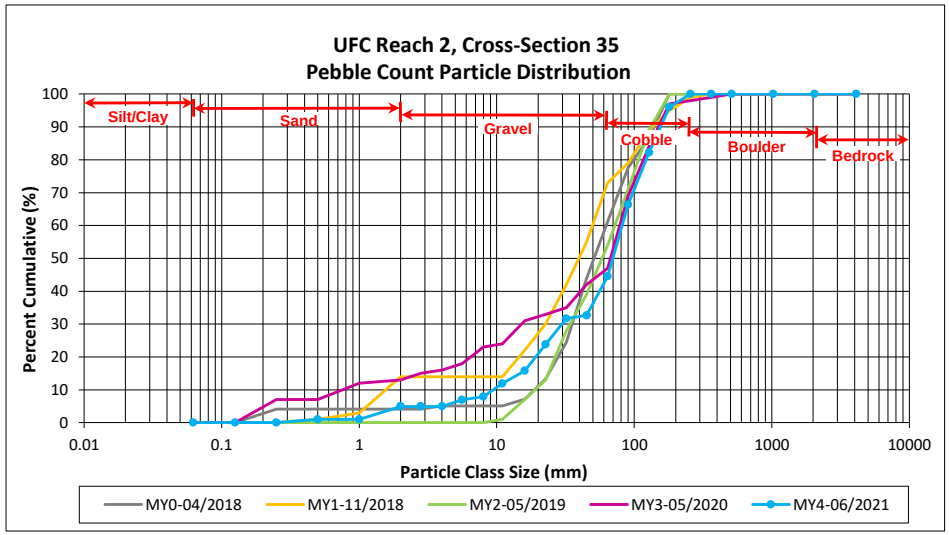
Reachwide and Cross-Section Pebble Count Plots

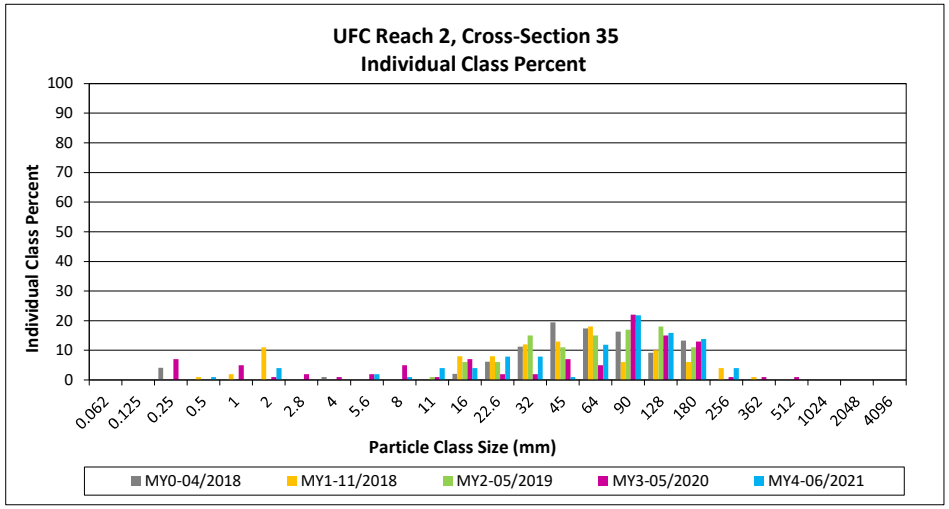
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

UFC Reach 2, Cross-Section 35

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	1	1	1
	Coarse	0.5	1.0			1
	Very Coarse	1.0	2.0	4	4	5
GRAVEL	Very Fine	2.0	2.8			5
	Very Fine	2.8	4.0			5
	Fine	4.0	5.6	2	2	7
	Fine	5.6	8.0	1	1	8
	Medium	8.0	11.0	4	4	12
	Medium	11.0	16.0	4	4	16
	Coarse	16.0	22.6	8	8	24
	Coarse	22.6	32	8	8	32
	Very Coarse	32	45	1	1	33
	Very Coarse	45	64	12	12	45
COBBLE	Small	64	90	22	22	66
	Small	90	128	16	16	82
	Large	128	180	14	14	96
	Large	180	256	4	4	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**101**	**100**	**100**

Cross-Section 35	
Channel materials (mm)	
D_{16} =	16.1
D_{35} =	48.2
D_{50} =	69.7
D_{84} =	133.9
D_{95} =	175.5
D_{100} =	256.0





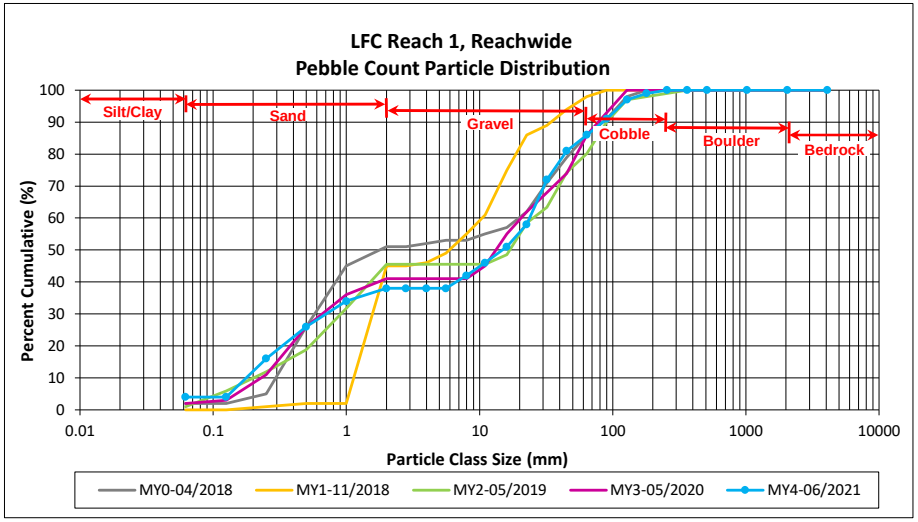
Reachwide and Cross-Section Pebble Count Plots

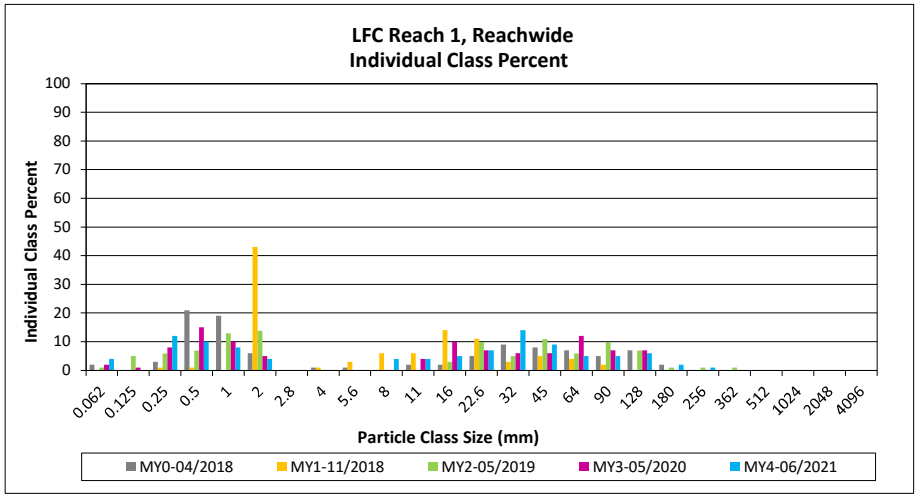
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

LFC Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	3	4	4	4
SAND	Very fine	0.062	0.125					4
	Fine	0.125	0.250	3	9	12	12	16
	Medium	0.25	0.50		10	10	10	26
	Coarse	0.5	1.0	1	7	8	8	34
	Very Coarse	1.0	2.0	3	1	4	4	38
GRAVEL	Very Fine	2.0	2.8					38
	Very Fine	2.8	4.0					38
	Fine	4.0	5.6					38
	Fine	5.6	8.0	1	3	4	4	42
	Medium	8.0	11.0	3	1	4	4	46
	Medium	11.0	16.0	2	3	5	5	51
	Coarse	16.0	22.6	5	2	7	7	58
	Coarse	22.6	32	7	7	14	14	72
	Very Coarse	32	45	7	2	9	9	81
	Very Coarse	45	64	4	1	5	5	86
COBBLE	Small	64	90	5		5	5	91
	Small	90	128	5	1	6	6	97
	Large	128	180	2		2	2	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.3
D_{35} =	1.2
D_{50} =	14.8
D_{84} =	55.6
D_{95} =	113.8
D_{100} =	256.0





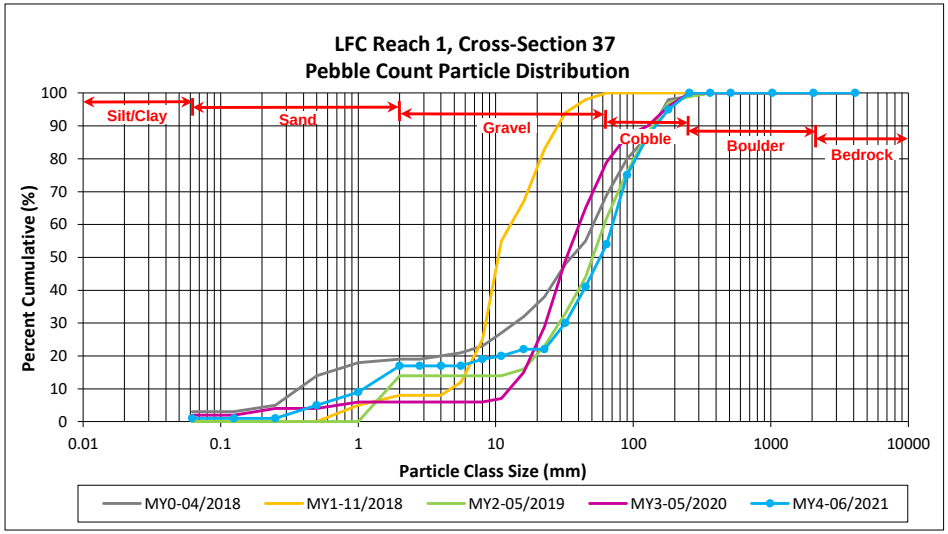
Reachwide and Cross-Section Pebble Count Plots

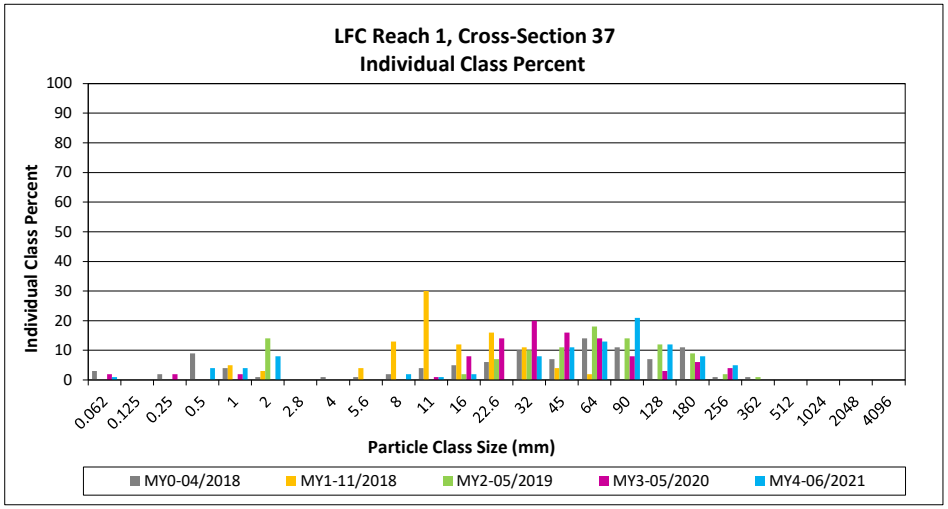
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

LFC Reach 1, Cross-Section 37

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125			1
	Fine	0.125	0.250			1
	Medium	0.25	0.50	4	4	5
	Coarse	0.5	1.0	4	4	9
	Very Coarse	1.0	2.0	8	8	17
GRAVEL	Very Fine	2.0	2.8			17
	Very Fine	2.8	4.0			17
	Fine	4.0	5.6			17
	Fine	5.6	8.0	2	2	19
	Medium	8.0	11.0	1	1	20
	Medium	11.0	16.0	2	2	22
	Coarse	16.0	22.6			22
	Coarse	22.6	32	8	8	30
	Very Coarse	32	45	11	11	41
	Very Coarse	45	64	13	13	54
COBBLE	Small	64	90	21	21	75
	Small	90	128	12	12	87
	Large	128	180	8	8	95
	Large	180	256	5	5	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 37	
Channel materials (mm)	
D_{16} =	1.8
D_{35} =	37.4
D_{50} =	57.4
D_{84} =	117.2
D_{95} =	180.0
D_{100} =	256.0





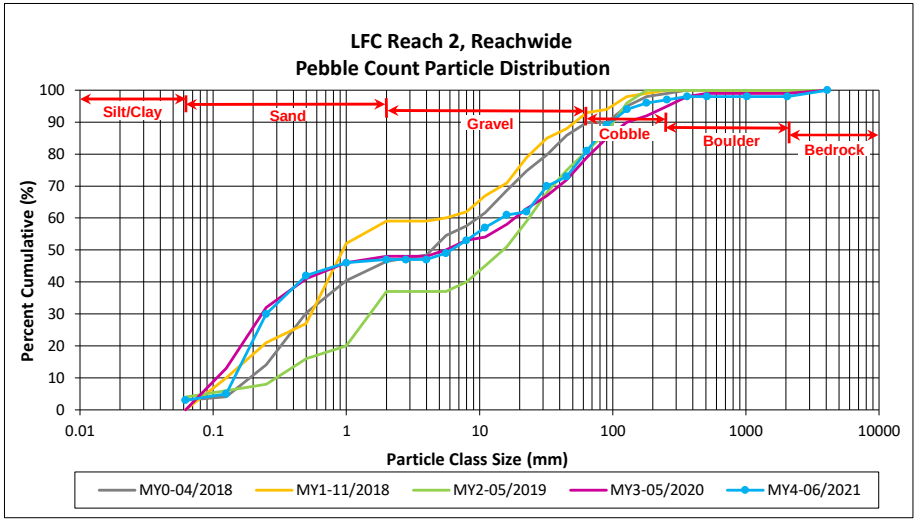
Reachwide and Cross-Section Pebble Count Plots

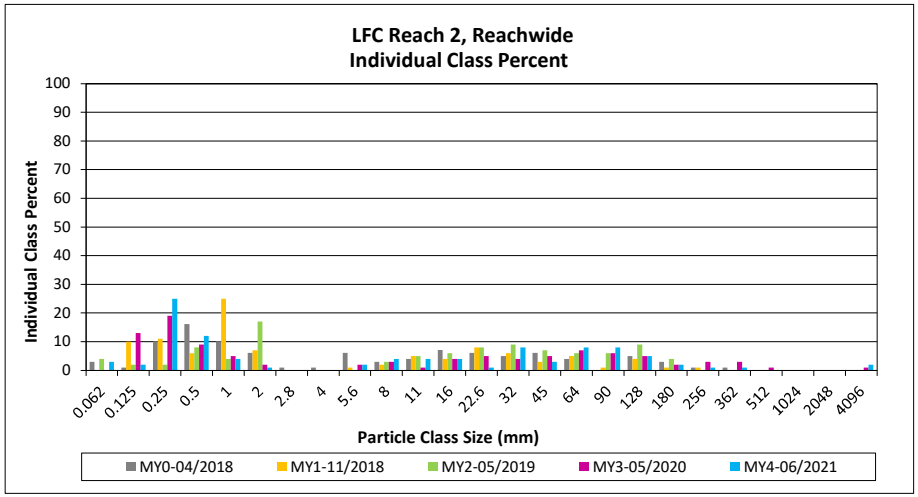
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

LFC Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	2	3	3	3
SAND	Very fine	0.062	0.125		2	2	2	5
	Fine	0.125	0.250	6	19	25	25	30
	Medium	0.25	0.50	3	9	12	12	42
	Coarse	0.5	1.0	2	2	4	4	46
	Very Coarse	1.0	2.0		1	1	1	47
GRAVEL	Very Fine	2.0	2.8					47
	Very Fine	2.8	4.0					47
	Fine	4.0	5.6	1	1	2	2	49
	Fine	5.6	8.0	1	3	4	4	54
	Medium	8.0	11.0	1	3	4	4	58
	Medium	11.0	16.0	4		4	4	62
	Coarse	16.0	22.6	1		1	1	63
	Coarse	22.6	32	6	1	7	7	70
	Very Coarse	32	45	3		3	3	73
	Very Coarse	45	64	6	2	8	8	81
COBBLE	Small	64	90	7	1	8	8	89
	Small	90	128	5		5	5	94
	Large	128	180	1	1	2	2	96
	Large	180	256		1	1	1	97
BOULDER	Small	256	362	1		1	1	98
	Small	362	512					98
	Medium	512	1024					98
	Large/Very Large	1024	2048					98
BEDROCK	Bedrock	2048	>2048		2	2	2	100
			Total	**49**	**50**	**99**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	0.3
D_{50} =	5.9
D_{84} =	73.2
D_{95} =	153.1
D_{100} =	>2048





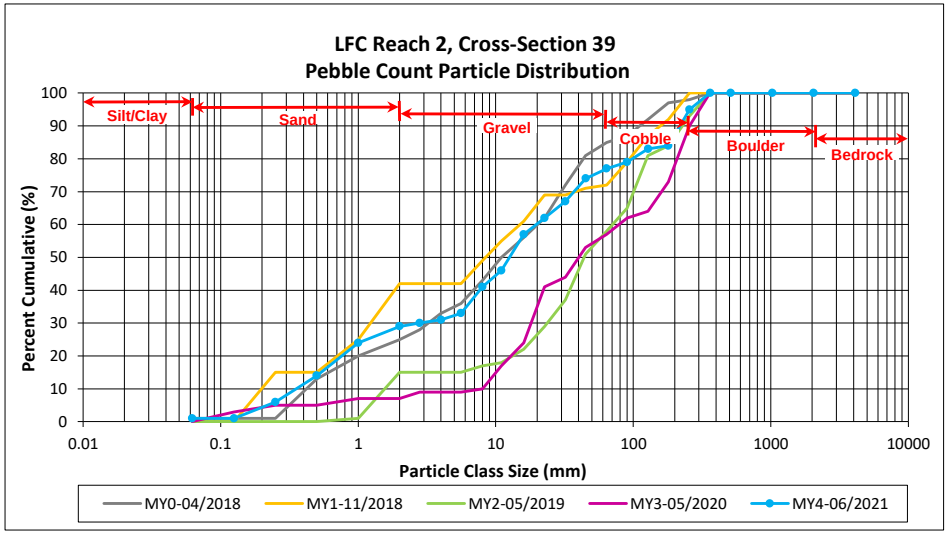
Reachwide and Cross-Section Pebble Count Plots

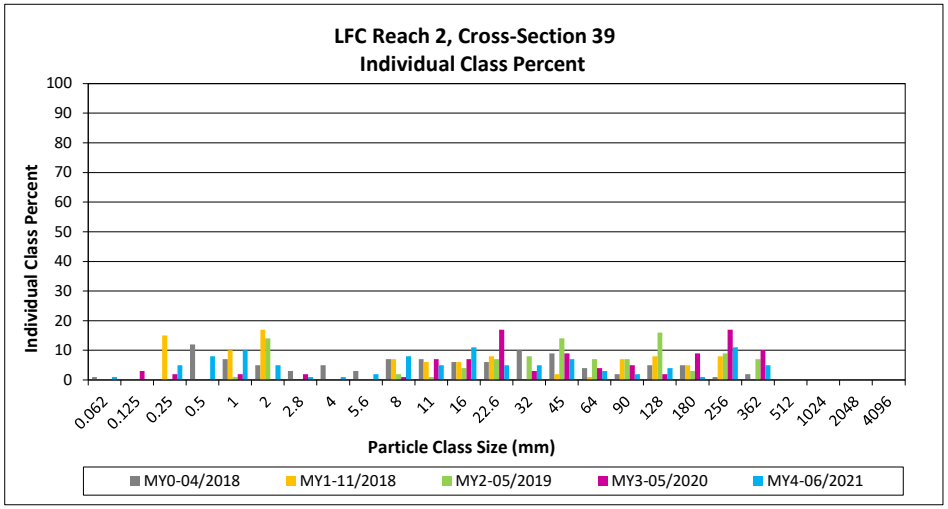
Big Harris Creek Mitigation Site - Area B
DMS Project No. 739
Monitoring Year 4 - 2021

LFC Reach 2, Cross-Section 39

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125			1
	Fine	0.125	0.250	5	5	6
	Medium	0.25	0.50	8	8	14
	Coarse	0.5	1.0	10	10	24
	Very Coarse	1.0	2.0	5	5	29
GRAVEL	Very Fine	2.0	2.8	1	1	30
	Very Fine	2.8	4.0	1	1	31
	Fine	4.0	5.6	2	2	33
	Fine	5.6	8.0	8	8	41
	Medium	8.0	11.0	5	5	46
	Medium	11.0	16.0	11	11	57
	Coarse	16.0	22.6	5	5	62
	Coarse	22.6	32	5	5	67
	Very Coarse	32	45	7	7	74
	Very Coarse	45	64	3	3	77
COBBLE	Small	64	90	2	2	79
	Small	90	128	4	4	83
	Large	128	180	1	1	84
	Large	180	256	11	11	95
BOULDER	Small	256	362	5	5	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 39	
Channel materials (mm)	
D_{16} =	0.6
D_{35} =	6.1
D_{50} =	12.6
D_{84} =	180.0
D_{95} =	256.0
D_{100} =	362.0





Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area C

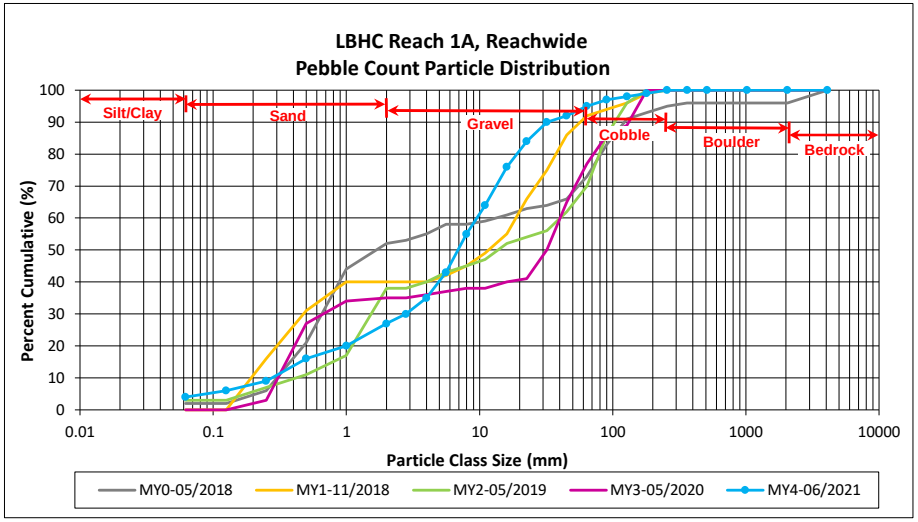
DMS Project No. 739

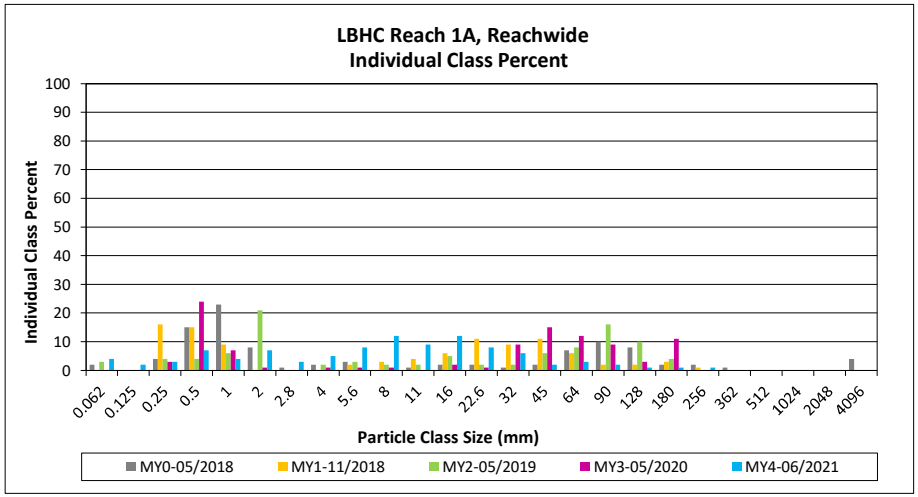
Monitoring Year 4 - 2021

LBHC Reach 1A, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	3	4	4	4
SAND	Very fine	0.062	0.125	1	1	2	2	6
	Fine	0.125	0.250	1	2	3	3	9
	Medium	0.25	0.50	4	3	7	7	16
	Coarse	0.5	1.0	1	3	4	4	20
	Very Coarse	1.0	2.0		7	7	7	27
GRAVEL	Very Fine	2.0	2.8	2	1	3	3	30
	Very Fine	2.8	4.0	1	4	5	5	35
	Fine	4.0	5.6	3	5	8	8	43
	Fine	5.6	8.0	8	4	12	12	55
	Medium	8.0	11.0	7	2	9	9	64
	Medium	11.0	16.0	6	6	12	12	76
	Coarse	16.0	22.6	5	3	8	8	84
	Coarse	22.6	32	4	2	6	6	90
	Very Coarse	32	45	1	1	2	2	92
	Very Coarse	45	64	2	1	3	3	95
COBBLE	Small	64	90	2		2	2	97
	Small	90	128	1		1	1	98
	Large	128	180		1	1	1	99
	Large	180	256		1	1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.5
D_{35} =	4.0
D_{50} =	6.9
D_{84} =	22.6
D_{95} =	64.0
D_{100} =	256.0





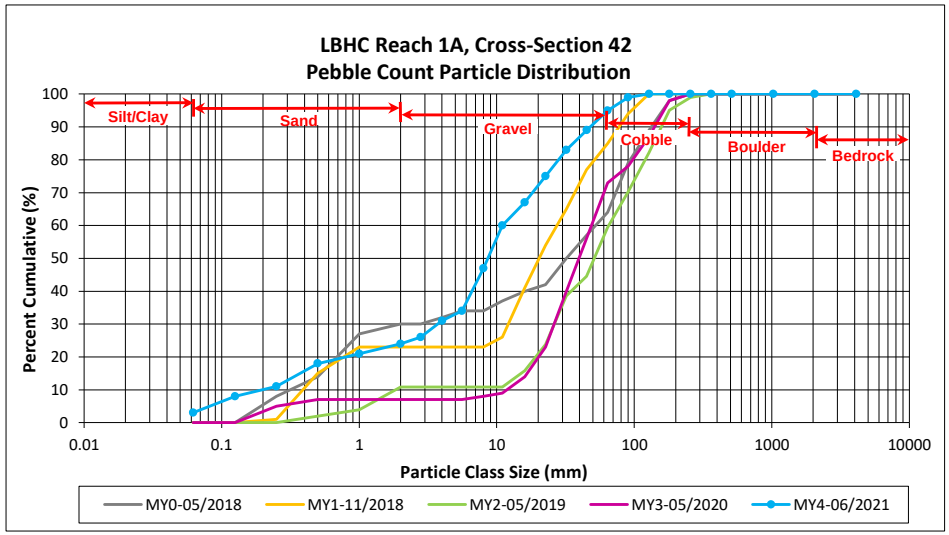
Reachwide and Cross-Section Pebble Count Plots

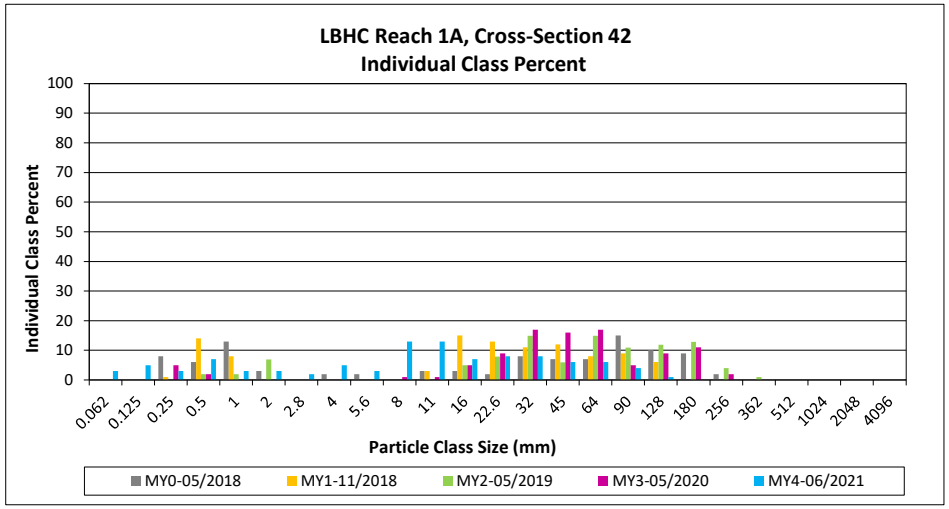
Big Harris Creek Mitigation Site - Area C
DMS Project No. 739
Monitoring Year 4 - 2021

LBHC Reach 1A, Cross-Section 42

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	3	3
SAND	Very fine	0.062	0.125	5	5	8
	Fine	0.125	0.250	3	3	11
	Medium	0.25	0.50	7	7	18
	Coarse	0.5	1.0	3	3	21
	Very Coarse	1.0	2.0	3	3	24
GRAVEL	Very Fine	2.0	2.8	2	2	26
	Very Fine	2.8	4.0	5	5	31
	Fine	4.0	5.6	3	3	34
	Fine	5.6	8.0	13	13	47
	Medium	8.0	11.0	13	13	60
	Medium	11.0	16.0	7	7	67
	Coarse	16.0	22.6	8	8	75
	Coarse	22.6	32	8	8	83
	Very Coarse	32	45	6	6	89
	Very Coarse	45	64	6	6	95
COBBLE	Small	64	90	4	4	99
	Small	90	128	1	1	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 42	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	5.8
D_{50} =	8.6
D_{84} =	33.9
D_{95} =	64.0
D_{100} =	128.0





Reachwide and Cross-Section Pebble Count Plots

Big Harris Creek Mitigation Site - Area C

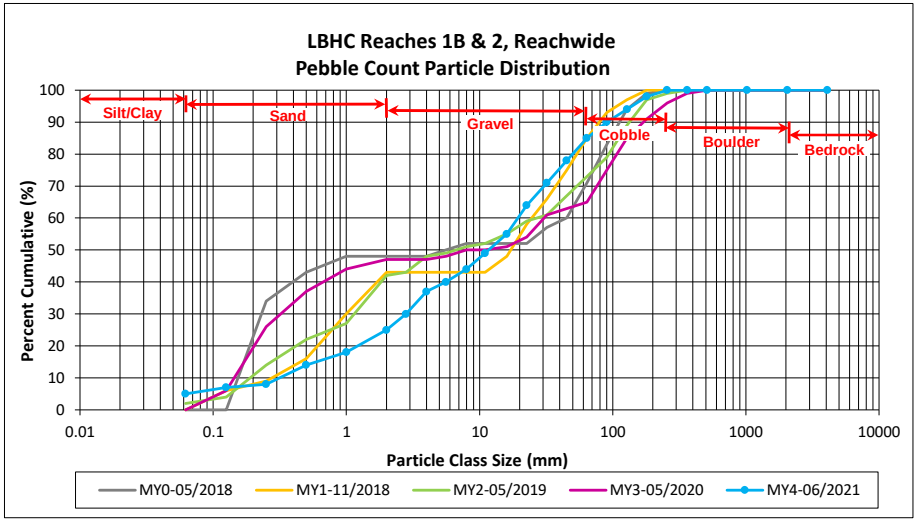
DMS Project No. 739

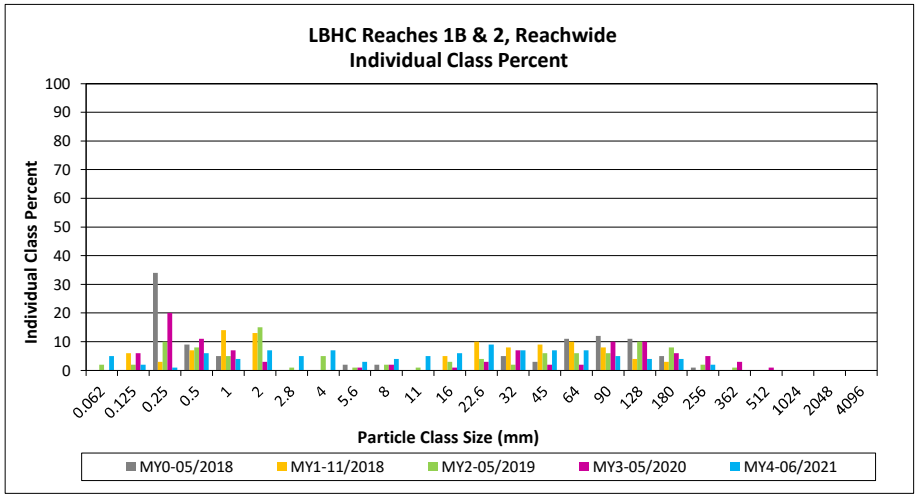
Monitoring Year 4 - 2021

LBHC Reaches 1B & 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	3	5	5	5
SAND	Very fine	0.062	0.125		2	2	2	7
	Fine	0.125	0.250		1	1	1	8
	Medium	0.25	0.50		6	6	6	14
	Coarse	0.5	1.0	1	3	4	4	18
	Very Coarse	1.0	2.0	3	4	7	7	25
GRAVEL	Very Fine	2.0	2.8	1	4	5	5	30
	Very Fine	2.8	4.0	1	6	7	7	37
	Fine	4.0	5.6		3	3	3	40
	Fine	5.6	8.0		4	4	4	44
	Medium	8.0	11.0	2	3	5	5	49
	Medium	11.0	16.0	3	3	6	6	55
	Coarse	16.0	22.6	8	1	9	9	64
	Coarse	22.6	32	5	2	7	7	71
	Very Coarse	32	45	6	1	7	7	78
	Very Coarse	45	64	5	2	7	7	85
COBBLE	Small	64	90	5		5	5	90
	Small	90	128	3	1	4	4	94
	Large	128	180	3	1	4	4	98
	Large	180	256	2		2	2	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.7
D_{35} =	3.6
D_{50} =	11.7
D_{84} =	60.9
D_{95} =	139.4
D_{100} =	256.0





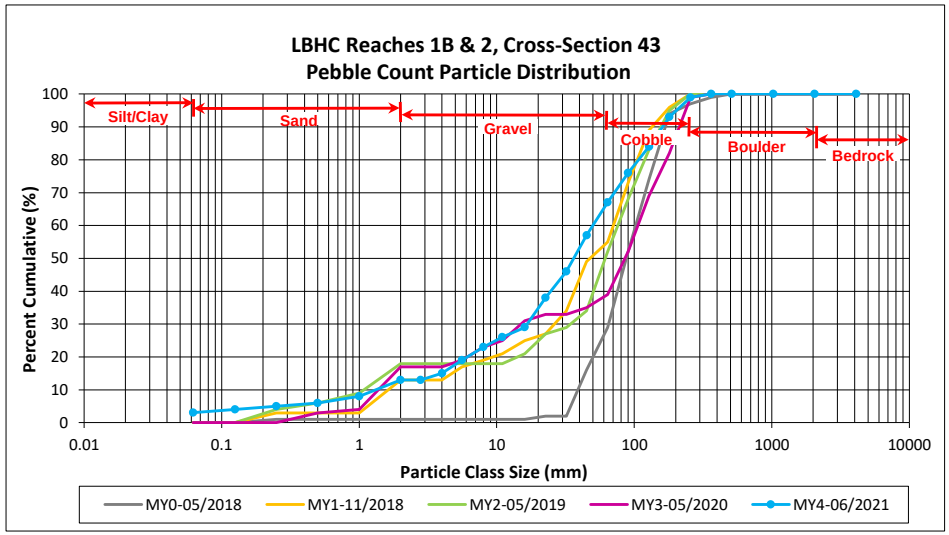
Reachwide and Cross-Section Pebble Count Plots

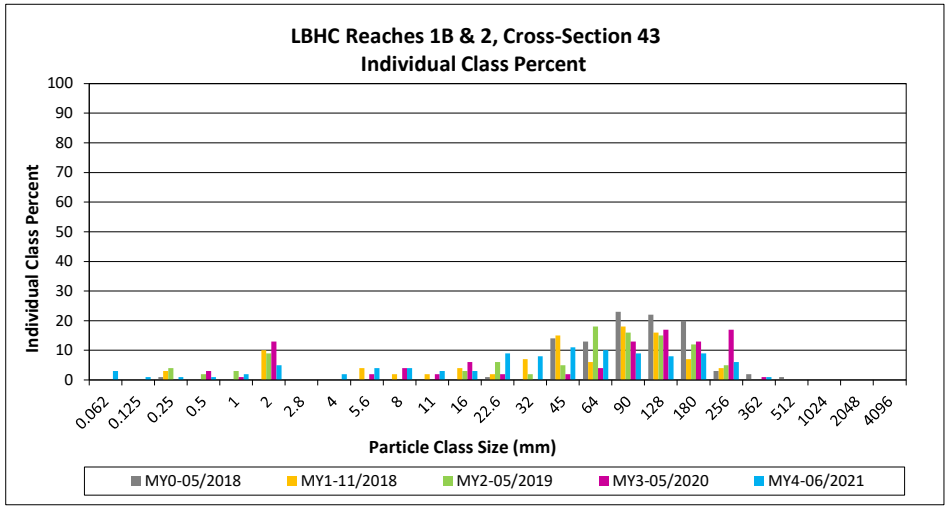
Big Harris Creek Mitigation Site - Area C
DMS Project No. 739
Monitoring Year 4 - 2021

LBHC Reaches 1B & 2, Cross-Section 43

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	3	3
SAND	Very fine	0.062	0.125	1	1	4
	Fine	0.125	0.250	1	1	5
	Medium	0.25	0.50	1	1	6
	Coarse	0.5	1.0	2	2	8
	Very Coarse	1.0	2.0	5	5	13
GRAVEL	Very Fine	2.0	2.8			13
	Very Fine	2.8	4.0	2	2	15
	Fine	4.0	5.6	4	4	19
	Fine	5.6	8.0	4	4	23
	Medium	8.0	11.0	3	3	26
	Medium	11.0	16.0	3	3	29
	Coarse	16.0	22.6	9	9	38
	Coarse	22.6	32	8	8	46
	Very Coarse	32	45	11	11	57
	Very Coarse	45	64	10	10	67
COBBLE	Small	64	90	9	9	76
	Small	90	128	8	8	84
	Large	128	180	9	9	93
	Large	180	256	6	6	99
BOULDER	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 43	
Channel materials (mm)	
D_{16} =	4.4
D_{35} =	20.1
D_{50} =	36.2
D_{84} =	128.0
D_{95} =	202.4
D_{100} =	362.0





APPENDIX 5. Hydrology Summary Data and Plots

Table 14a. Verification of Bankfull Events

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Reach	Monitoring Year	Date of Occurrence	Method
Upper Big Harris Creek Reach 2A (SG #1)	MY1	10/11/2018	Stream Gage
	MY2	6/7/2019	
		6/8/2019	
		8/4/2019	
	MY3	2/6/2020	
		4/30/2020	
		10/11/2020	
	MY4	3/25/2021-3/26/2021	
Royster Creek Reach 1 (SG #2)	MY1	5/30/2018	
		7/24/2018	
		10/11/2018	
		11/12/2018[1]	
		11/15/2018	
	MY2	1/22/2019	
		1/26/2019	
		1/30/2019[1]	
		1/31/2019	
		2/11/2019	
		6/7/2019	
		6/8/2019	
		6/9/2019	
	MY3	1/11/2020	
		2/6/2020	
		2/13/2020	
		3/25/2020	
		4/13/2020	
		4/29/2020 - 4/30/2020	
		5/19/2020	
		5/21/2020	
		8/15/2020	
		9/25/2020	
		10/11/2020	
	MY4	1/1/2021	
		1/27/2021	
		2/15/2021	
		3/25/2021-3/26/2021	
		7/26/2021	
		8/17/2021	

[1] Multiple bankfull events recorded on occurrence date.

--- No bankfull events reported.

Table 14b. Verification of Bankfull Events

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Reach	Monitoring Year	Date of Occurrence	Method
Scott Creek (SG #3)	MY1	---	Stream Gage
	MY2	---	
	MY3	2/6/2020	
		3/8/2020	
	MY4	1/24/2021	
Carroll Creek (SG #4)	MY1	10/11/2018	
		11/15/2018	
	MY2	6/7/2019	
		6/8/2019[1]	
		6/9/2019	
		8/4/2019	
	MY3	2/6/2020	
		2/13/2020	
		4/30/2020	
		5/19/2020	
		8/15/2020	
		10/11/2020	
	MY4	3/26/2021	
		8/17/2021	
Upper Stick Elliott Creek Reach 1 (SG #5)	MY1	10/11/2018	
	MY2	6/7/2019[1]	
		6/8/2019	
		8/4/2019	
	MY3	2/6/2020	
		2/13/2020	
		5/19/2020	
	MY4	---	
Upper Stick Elliott Creek Reach 5 (SG #6)	MY1	10/11/2018[1]	
		11/12/2018	
		11/15/2018	
	MY2	6/8/2019	
		8/4/2019	
	MY3	2/6/2020	
		4/30/2020	
		5/19/2020	
		10/11/2020	
	MY4	3/26/2021	

[1] Multiple bankfull events recorded on occurrence date.

--- No bankfull events reported.

Table 14c. Verification of Bankfull Events

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Reach	Monitoring Year	Date of Occurrence	Method
Elliott Creek (SG #7)	MY1	10/11/2018	Stream Gage
	MY2	6/7/2019	
		6/8/2019	
	MY3	2/6/2020	
		4/30/2020	
		5/19/2020	
		10/11/2020	
	MY4	---	
UT1 to Elliott Creek (SG #8)	MY1	---	
	MY2	6/8/2019	
	MY3	2/6/2020	
		3/25/2020	
		4/30/2020	
		5/19/2020	
		10/11/2020	
	MY4	---	
Bridges Creek (SG #9)	MY1	---	
	MY2	---	
	MY3	2/6/2020	
	MY4	3/26/2021	
UT2 to Upper Stick Elliott Creek (SG #10)	MY1	7/19/2018	
		8/2/2018	
		10/11/2018	
		11/12/2018	
		11/15/2018	
	MY2	1/4/2019	
		2/18/2019	
		2/21/2019	
		6/7/2019[1]	
		6/8/2019	
		8/2/2019	
		8/4/2019	
		8/14/2019	
	MY3	1/13/2020 - 1/14/2020	
		2/6/2020 - 2/7/2020	
		2/11/2020	
		2/13/2020	
		3/25/2020	

[1] Multiple bankfull events recorded on occurrence date.

--- No bankfull events reported.

Table 14d. Verification of Bankfull Events

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Reach	Monitoring Year	Date of Occurrence	Method
UT2 to Upper Stick Elliott Creek (SG #10) (cont.)	MY3 (cont.)	4/30/2020	Stream Gage
		5/19/2020	
		5/21/2020	
		8/3/2020	
		8/7/2020	
		8/15/2020	
		9/17/2020	
	MY4	1/27/2021-1/28/2021	
		2/15/2021-2/16/2021	
		3/25/2021-3/26/2021	
UT3 to Upper Stick Elliott Creek (SG #11)	MY1	10/11/2018	
	MY2	8/4/2019	
	MY3	2/6/2020	
		10/11/2020	
	MY4	3/26/2021	
Upper Fletcher Creek Reach 2 (SG #12)	MY1	7/24/2018	
		8/2/2018	
		10/11/2018	
		10/26/2018	
		11/12/2018	
		11/15/2018	
	MY2	6/7/2019	
		6/8/2019	
	MY3	2/6/2020	
		4/30/2020	
		5/19/2020	
		8/15/2020	
		10/11/2020	
	MY4	3/26/2021	
Lower Fletcher Creek Reach 1 (SG #13)	MY1	8/2/2018	
		10/11/2018	
		10/26/2018	
		11/12/2018	
		11/15/2018	
	MY2	1/30/2019	
		1/31/2019	
	MY3	2/6/2020 - 2/7/2020	
		2/11/2020	

[1] Multiple bankfull events recorded on occurrence date.

--- No bankfull events reported.

Table 14e. Verification of Bankfull Events

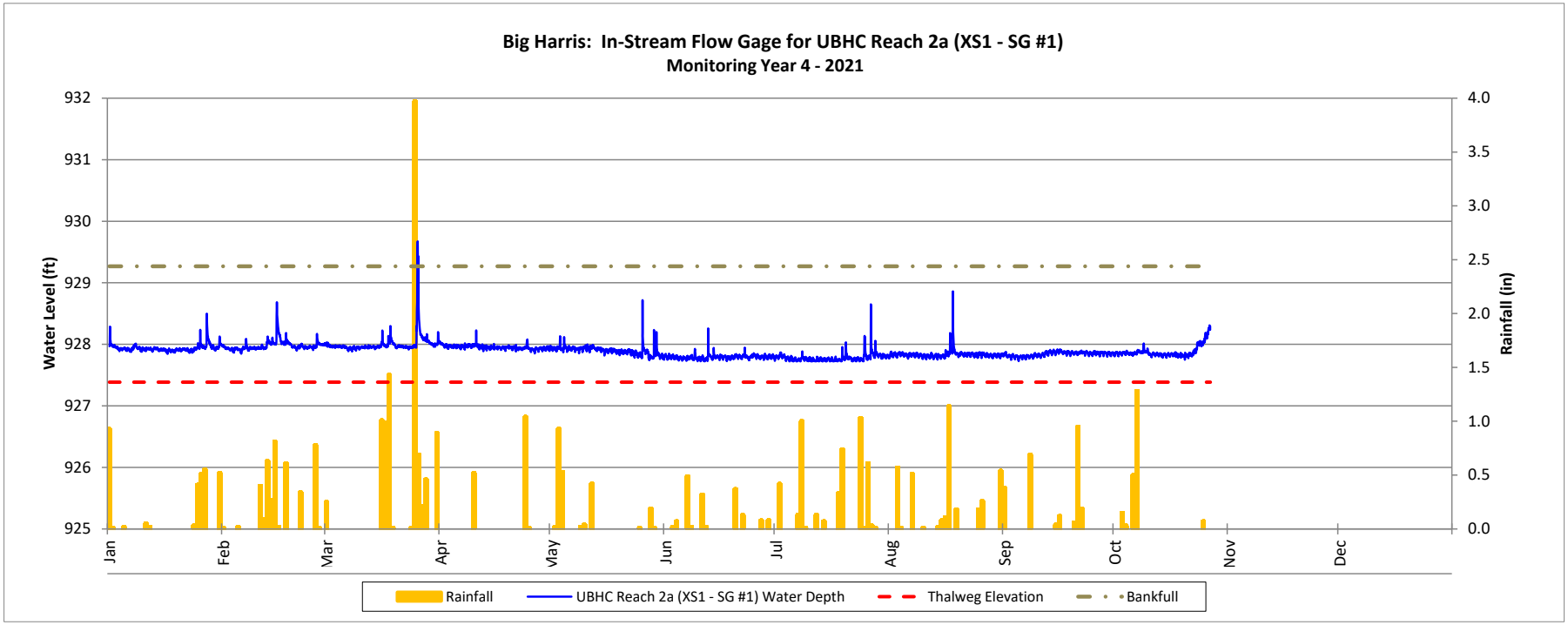
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Reach	Monitoring Year	Date of Occurrence	Method
Lower Fletcher Creek Reach 1 (SG #13) (cont.)	MY3 (cont.)	2/13/2020	Stream Gage
		10/11/2020 - 10/12/2020	
	MY4	3/25/2021-3/26/2021	
Lower Big Harris Creek Reach 1A (SG #14)	MY1	10/11/2018	
		10/26/2018	
		11/12/2018	
	MY2	6/7/2019	
		6/8/2019	
		6/9/2019	
	MY3	2/6/2020	
		2/13/2020	
		4/30/2020	
		5/19/2020	
		10/11/2020	
	MY4	1/27/2021	
		2/15/2021	
		3/25/2021-3/26/2021	

[1] Multiple bankfull events recorded on occurrence date.
--- No bankfull events reported.

Recorded In-stream Flow Events

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

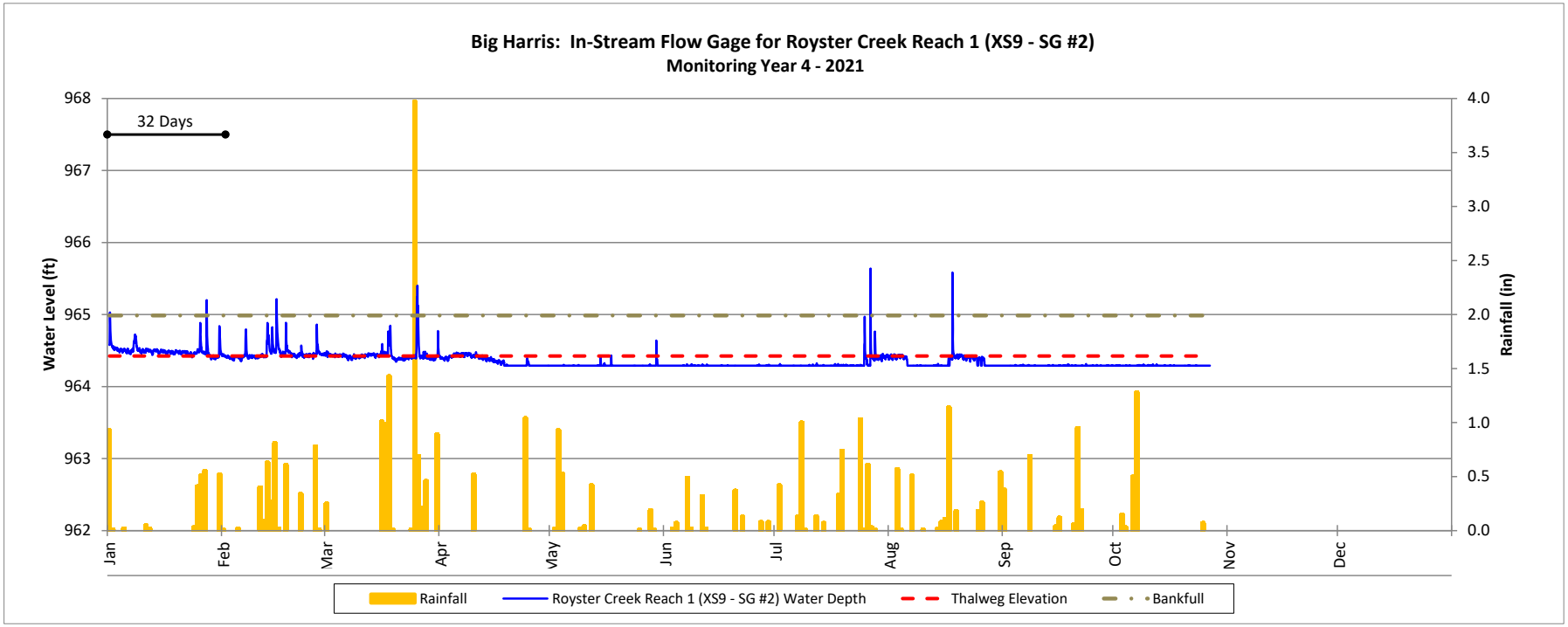


Recorded In-stream Flow Events

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

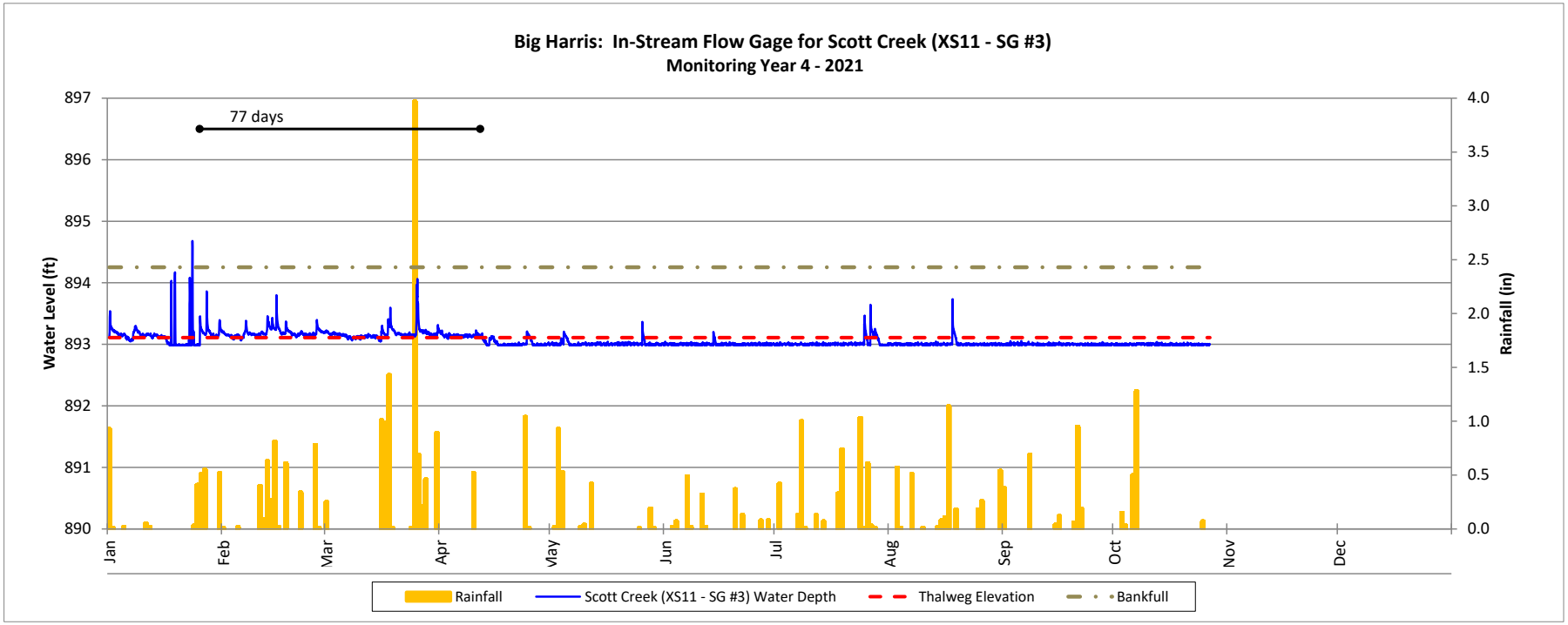


Recorded In-stream Flow Events

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

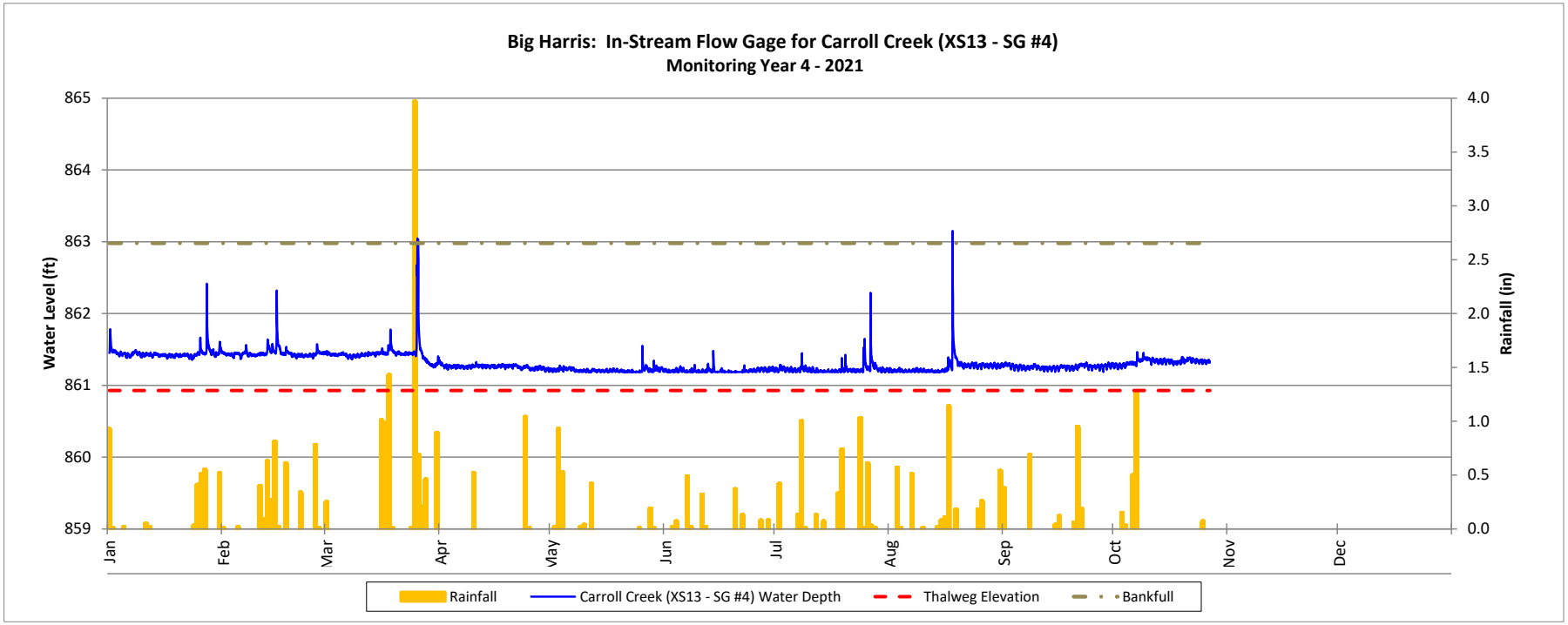


Recorded In-stream Flow Events

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

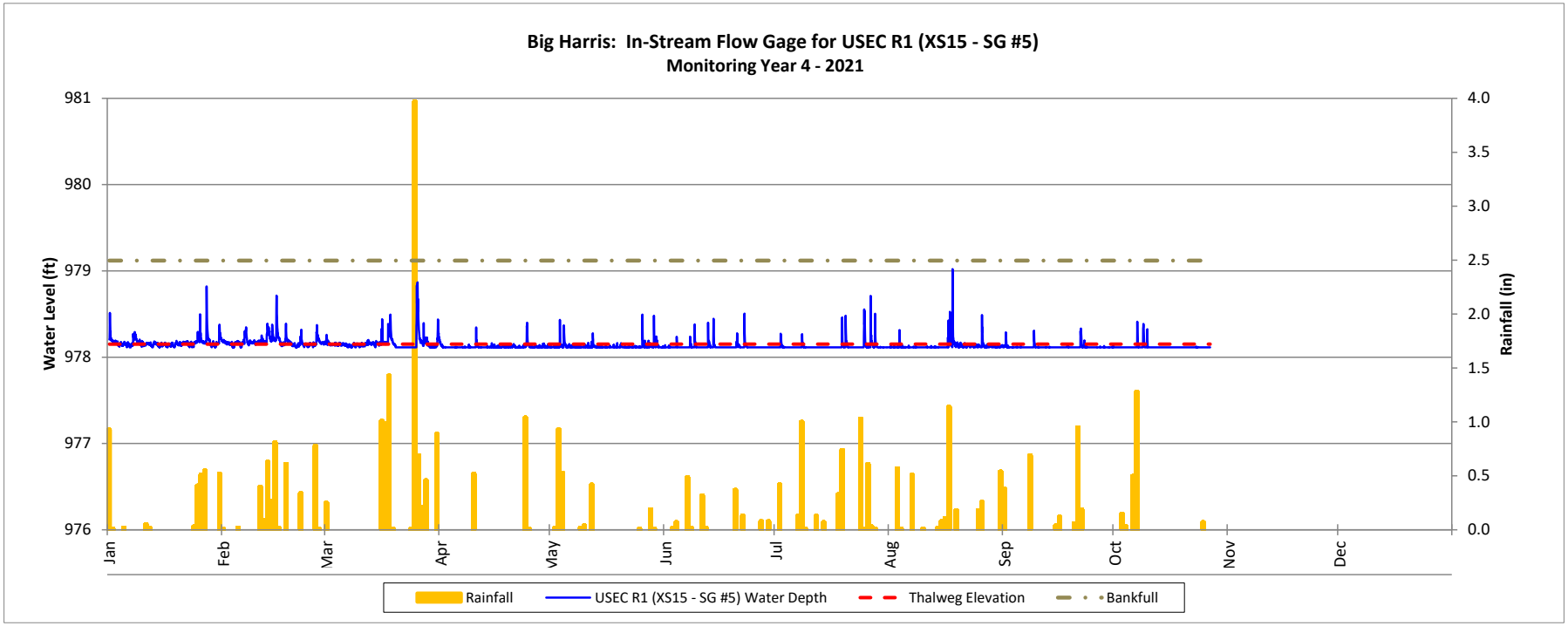


Recorded In-stream Flow Events

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

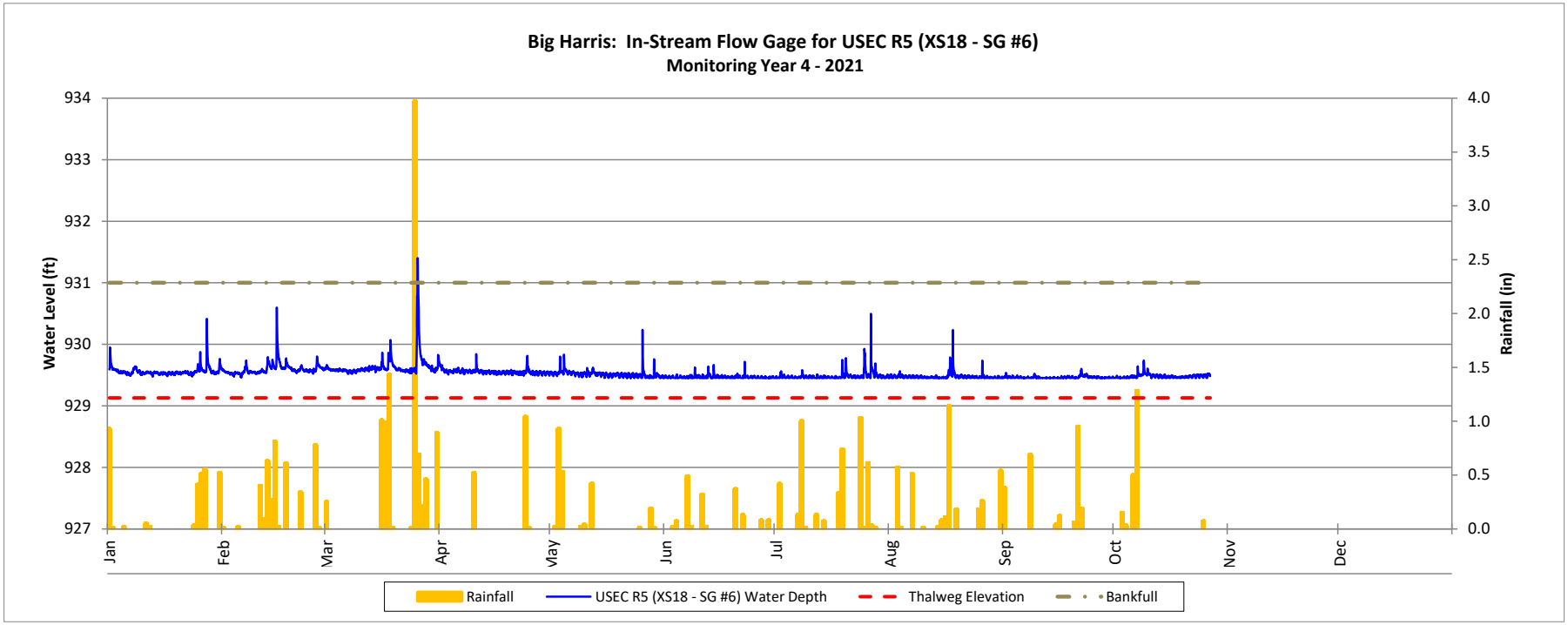


Recorded In-stream Flow Events

Big Harris Creek Mitigation Site

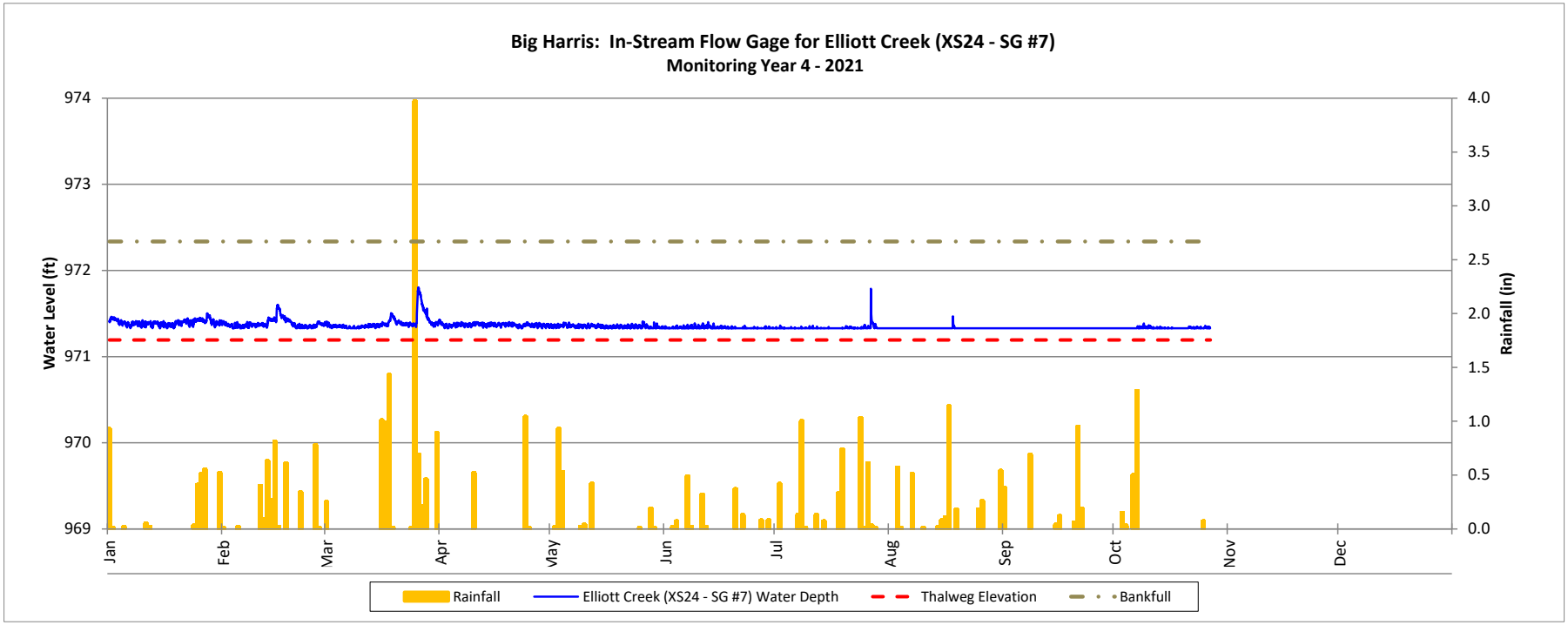
DMS Project No. 739

Monitoring Year 4 - 2021



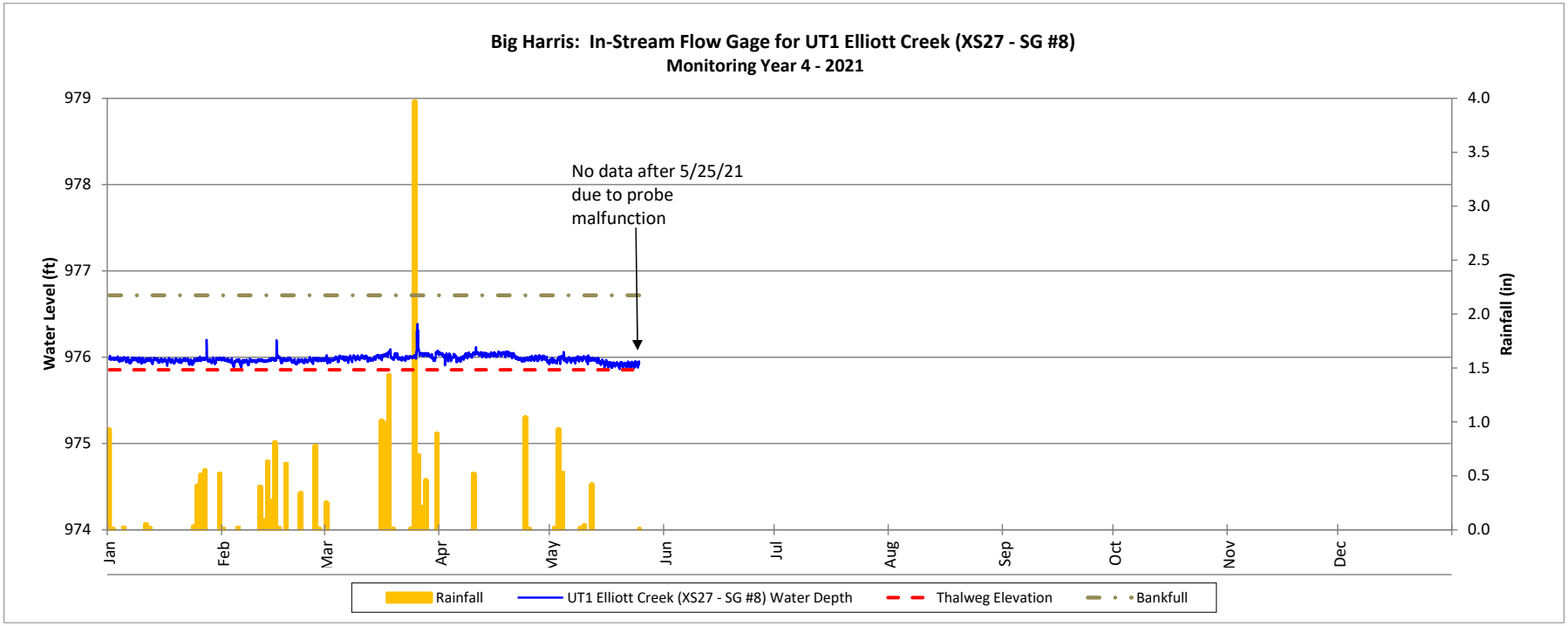
Recorded In-stream Flow Events

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021



Recorded In-stream Flow Events

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

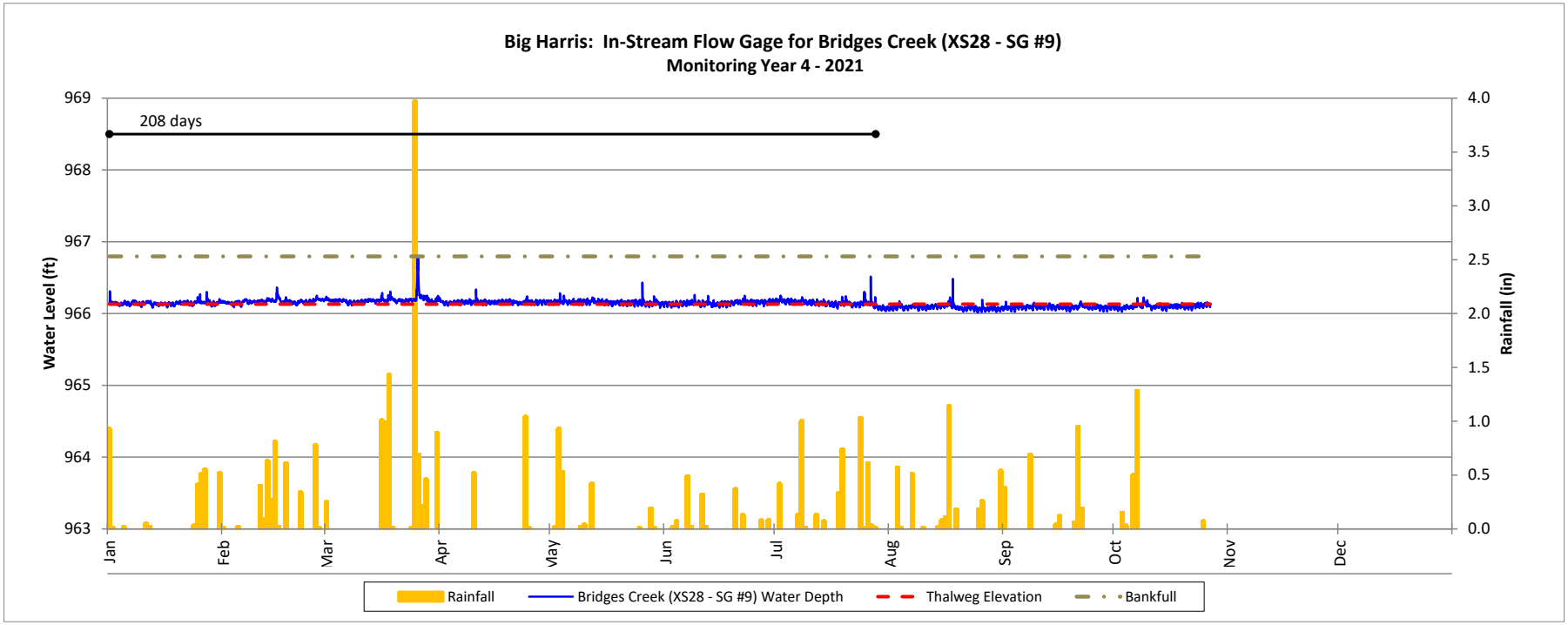


Recorded In-stream Flow Events

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

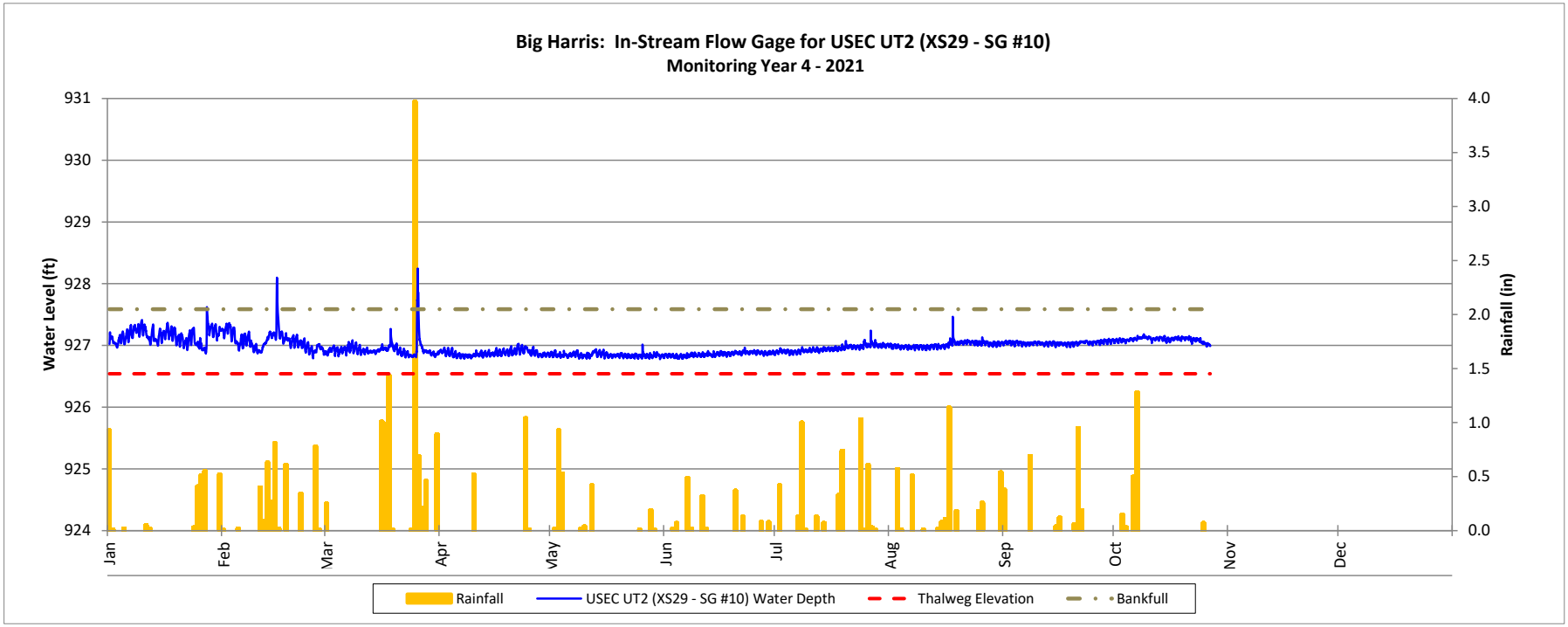


Recorded In-stream Flow Events

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

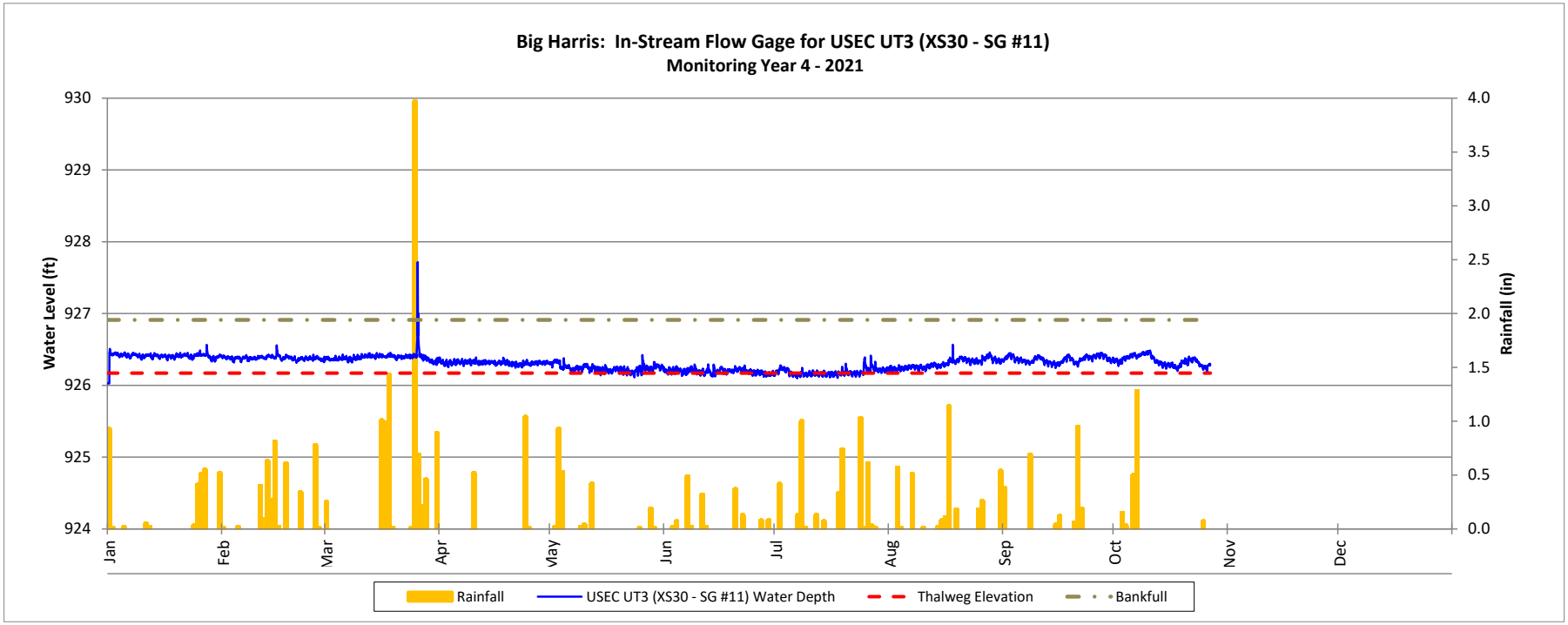


Recorded In-stream Flow Events

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

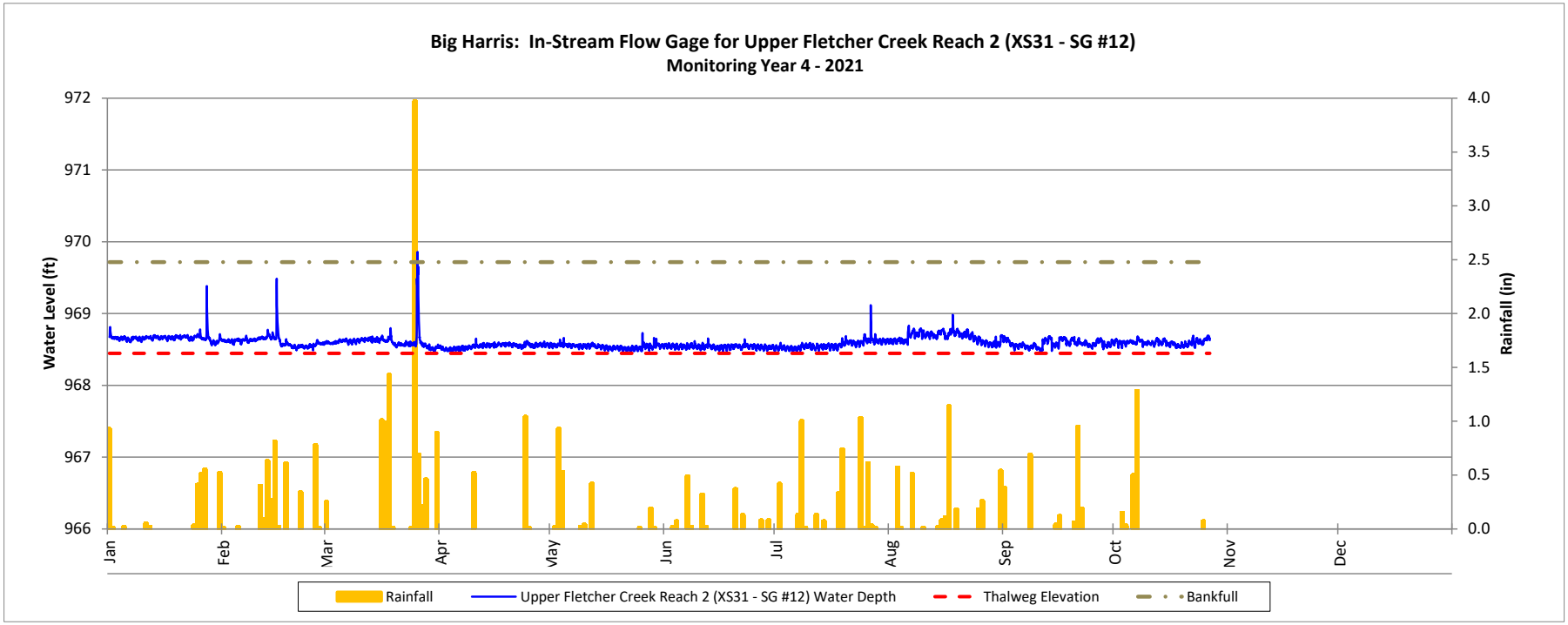


Recorded In-stream Flow Events

Big Harris Creek Mitigation Site

DMS Project No. 739

Monitoring Year 4 - 2021

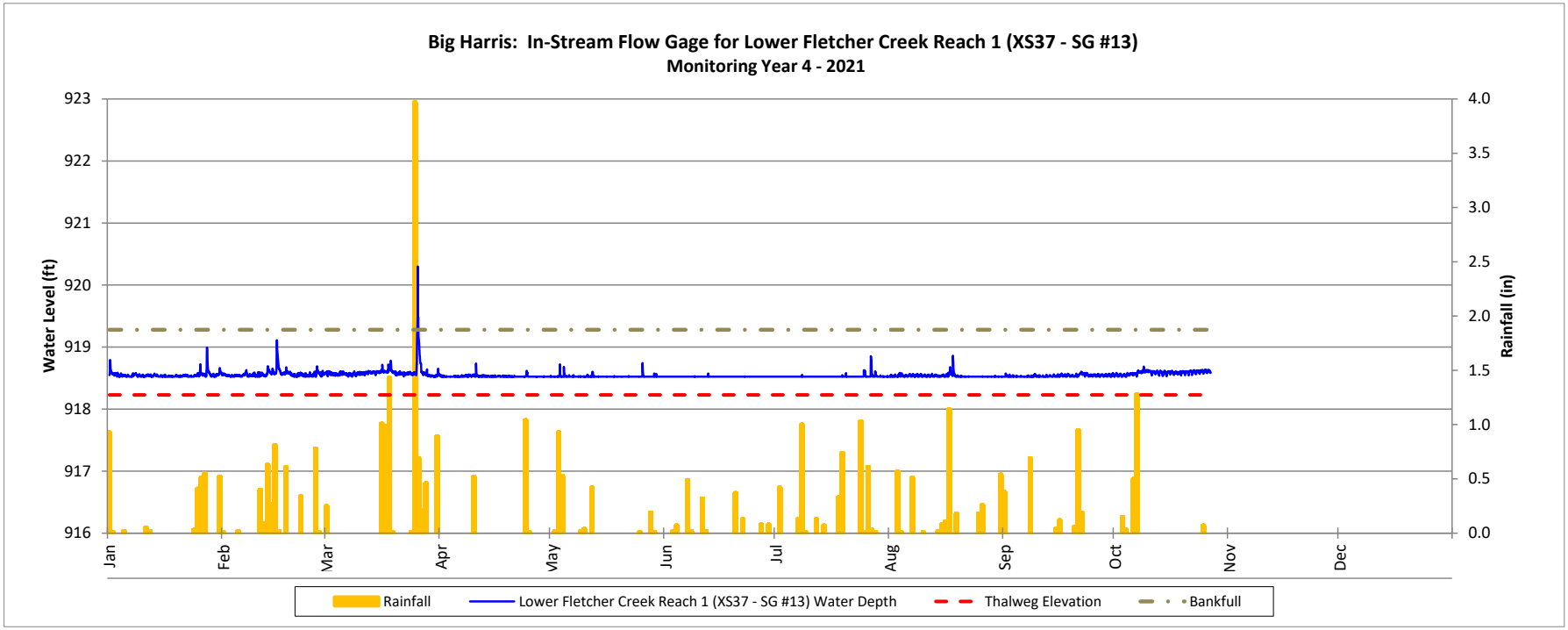


Recorded In-stream Flow Events

Big Harris Creek Mitigation Site

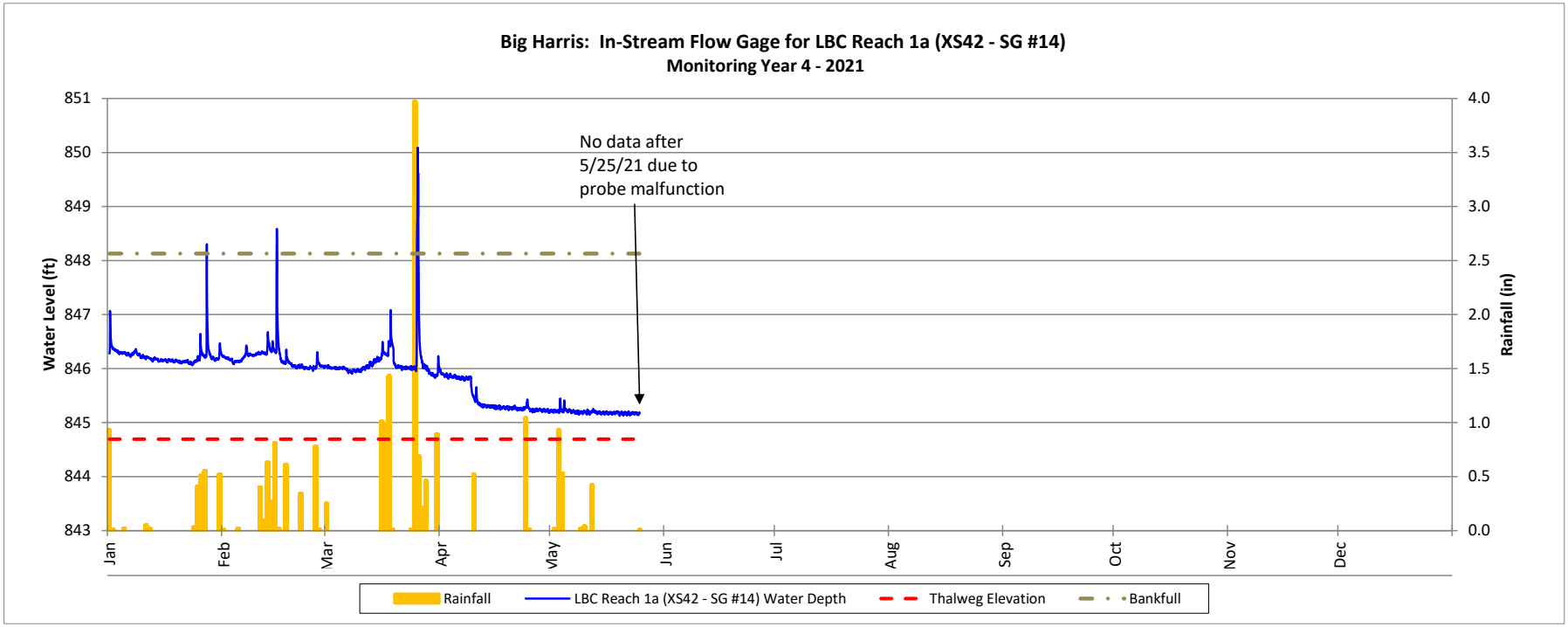
DMS Project No. 739

Monitoring Year 4 - 2021



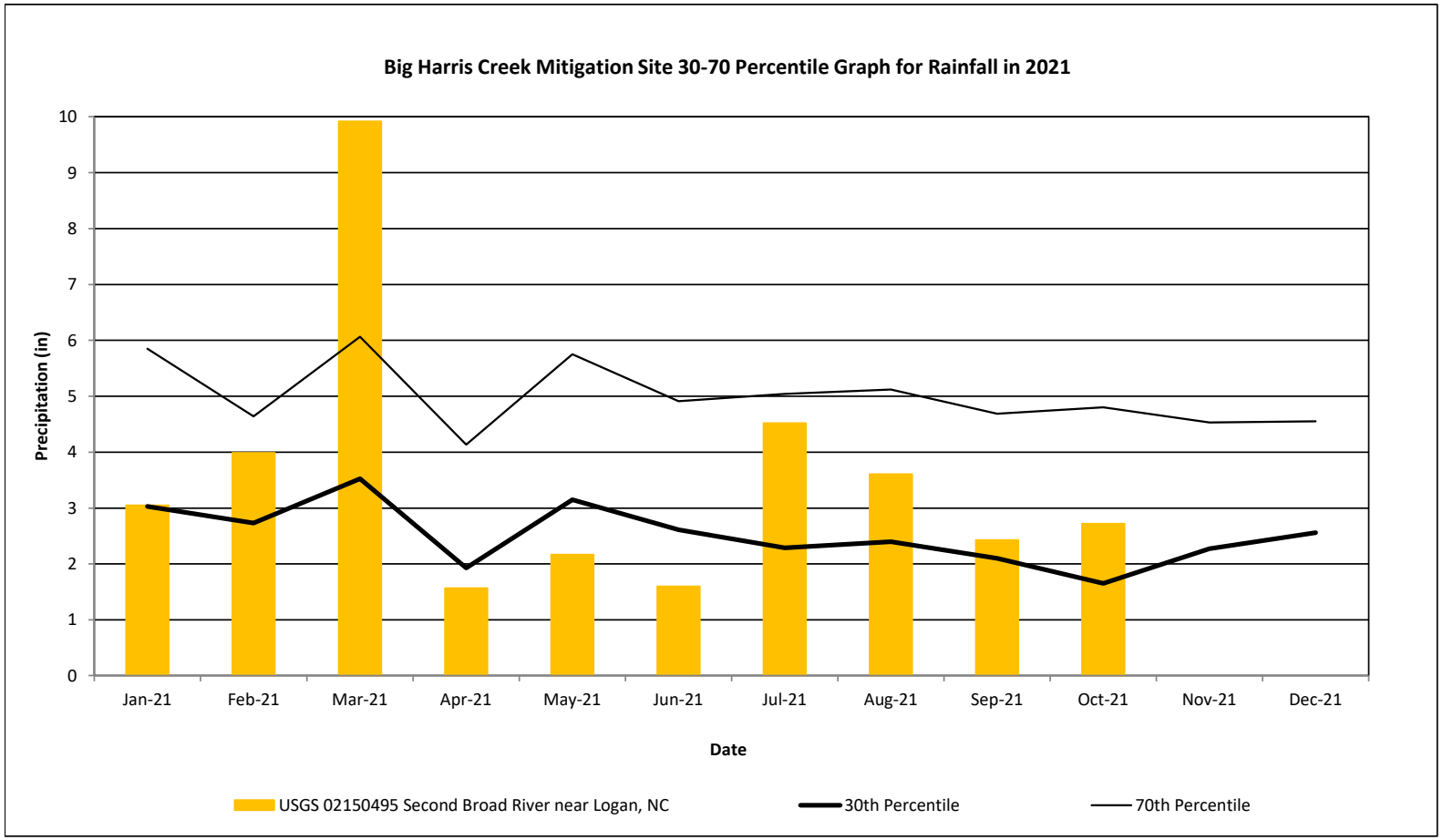
Recorded In-stream Flow Events

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021



Monthly Rainfall Plot

Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021



30th and 70th percentile rainfall data collected from WETS Station Shelby 2 NW in Shelby, NC (USDA, 2000).

APPENDIX 6. Revised Water Quality Monitoring Correspondence and Technical Memo

From:	Tugwell, Todd J CIV USARMY CESAW (US)
To:	Melia, Gregory; Wiesner, Paul; Kim Browning; Haupt, Mac; Davis, Erin B
Cc:	Jeff Keaton; Shawn Wilkerson
Subject:	[External] RE: Big Harris_DMS# 739_Technical Memo WQ Monitoring_6-6-2019
Date:	Thursday, August 22, 2019 11:55:46 AM

Greg,
We discussed the latest plan with the IRT yesterday, and we are fine with the responses. Please proceed and let me know if you have any other questions. I'm sure Mac will jump at the chance to go back out to Big Harris once we get some results.

Todd

-----Original Message-----
From: Melia, Gregory [mailto:gregory.melia@ncdenr.gov]
Sent: Tuesday, August 13, 2019 5:00 PM
To: Wiesner, Paul <paul.wiesner@ncdenr.gov>; Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>; Browning, Kimberly D CIV USARMY CESAW (US) <Kimberly.D.Browning@usace.army.mil>; Haupt, Mac <mac.haupt@ncdenr.gov>; Davis, Erin B <erin.davis@ncdenr.gov>
Cc: Jeff Keaton <jkeaton@wildlandseng.com>; Shawn Wilkerson <swilkerson@wildlandseng.com>
Subject: [Non-DoD Source] RE: Big Harris_DMS# 739_Technical Memo WQ Monitoring_6-6-2019

All,

Attached is the document I had brought to the meeting today. The first 3 pages include the e-mail that was sent by the IRT with questions about the memo as well as the responses I sent back (in blue). The rest of the pages are the final memo revised to address the questions. Paul sent that out on 6/12/19 (see below).

My responses (blue text) in the attached and the final memo have yellow highlighted sections that identify the salient part of my response and shows where in the memo document that we addressed the question/concern.

So, if you focus on those yellow highlighted part of the attached it should expedite things.

If there were other questions, just let us know.

WEI and Western Carolina are trying to complete their contracting for this.

Thanks,

Greg

From: Wiesner, Paul <paul.wiesner@ncdenr.gov>
Sent: Wednesday, June 12, 2019 4:35 PM
To: Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>; Kim Browning <Kimberly.D.Browning@usace.army.mil>; Haupt, Mac <mac.haupt@ncdenr.gov>; Davis, Erin B <erin.davis@ncdenr.gov>
Cc: Melia, Gregory <gregory.melia@ncdenr.gov>; Jeff Keaton <jkeaton@wildlandseng.com>; Shawn Wilkerson <swilkerson@wildlandseng.com>
Subject: Big Harris_DMS# 739_Technical Memo WQ Monitoring_6-6-2019

Erin, Kim, Mac and Todd;

Please find attached the final Big Harris water quality monitoring proposal. It incorporates all and the changes and updates we have discussed to date.

Let us know how you would like to proceed. The potential 507 credits was established in the mitigation plan so there is no increase in project credits. If possible, we would like to move forward with an email approval of the proposal rather than a full mitigation plan addendum.

Thanks

Paul Wiesner

Western Regional Supervisor

North Carolina Department of Environmental Quality

Division of Mitigation Services

828-273-1673 Mobile

paul.wiesner@ncdenr.gov <mailto:paul.wiesner@ncdenr.gov>

Western DMS Field Office

5 Ravenscroft Drive

Suite 102

Asheville, N.C. 28801

From:	Melia, Gregory
To:	Tugwell, Todd J CIV USARMY CESAW (US); Wiesner, Paul; Shawn Wilkerson; Haupt, Mac; Jeff Keaton; Kim Browning; Russell, Periann
Subject:	RE: [External] RE: Big Harris Creek - DMS# 739 - Revised Water Quality Monitoring Proposal Memo
Date:	Thursday, April 25, 2019 10:49:00 AM

Todd et al.,

Sorry everybody. I've been playing catchup from being out last week. See my responses to your comments below in Blue

-----Original Message-----

From: Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>

Sent: Tuesday, April 16, 2019 4:24 PM

To: Melia, Gregory <gregory.melia@ncdenr.gov>; Wiesner, Paul <paul.wiesner@ncdenr.gov>; Shawn Wilkerson <swilkerson@wildlandseng.com>; Haupt, Mac <mac.haupt@ncdenr.gov>; Jeff Keaton <jkeaton@wildlandseng.com>; Kim Browning <Kimberly.D.Browning@usace.army.mil>

Subject: RE: [External] RE: Big Harris Creek - DMS# 739 - Revised Water Quality Monitoring Proposal Memo

Greg,

I have had a chance to review the Big Harris WQ Monitoring proposal as discussed during our meeting last week. After looking over the mitigation plan and comments, I have the following comments and a few more questions:

1. With regard to credits, the IRT comments on the draft plan confirm your accounting of the credits with one minor error. I believe the total credit from the mitigation plan (not including the 507 credits from the additional 2%) was 25,330 (rounded up), not 25,331. While it is not clear to me if the additional 2% should have been based on the total credit before or after adding in the 1.5% watershed bonus and the initial 4% water quality bonus, I will agree to the 507 credits because Wildlands response to our comments makes reference to the 507 credits, and it is attached to our approval letter. Understood.

2. In the biological monitoring section, the memo indicates three macro-benthic sites will

be monitored on Upper Fletcher above station 1. I didn't see these stations on the map - are they in the restoration reach or the E2 reach? Also, why concentrate three sites on this reach? That is an error we didn't catch in the narrative. The only benthos stations on fletcher are stations 0 and 1. Station 0 is serving as a watershed control station and was assessed for Benthos and Conductivity pre-con. See note A on page 4.

3. In the success criteria, the physiochemical parameters are determined successful with a 15% reduction in the mean distribution, and the biological parameters are determined successful with an increase of at least one bio-classification, correct? And then all parameters (both physiochemical and biological) are used to determine the % of credit for that station? For the biological parameters, sampling will be done in year 3 and 5 - does success assume an increase in bio-classification in both year 3 and 5, or only once? Also does it matter if there is an improvement in year 3 but a loss of a bio-classification in year 5? Yes, I remember at one point that Wildlands and I were discussing this uncertainty and apparently we never circled back. As is evident there are a lot of moving parts here. We had 3 options we were discussing at the time as I recall (see below). I had meant to speak with Eric Fleek at the DWR lab to see if B is something they ever do or whether it is advisable. I will contact him about that. The rationale for C was that if the we relied on a single year we could have drought in post-con as compared to the pre-con for example. Let me circle back with Eric Fleek and/or Larry on their thoughts on that and I will get back to you. In addition, some of the habitat development might take longer to indicate a change related to the restoration efforts (e.g. LWD, Leaf Pack etc.). It may be advisable for us to have it for years 4 and 5 instead of 3 and 5 if we maintain 2 years of benthos sampling. If anyone has a compelling argument for one approach or another then chime in, but I would actually lean towards a pooled data set from year 4 and 5 if Eric and Larry bless that approach.

a. Simply measure in Year 5 and base the entire success/failure on that.

b. Pool the raw data from Year 3 and 5 to generate a single BI to represent the post-con condition for comparison to pre-con.

c. Sample both years and choose the year that is the closest in terms of the hydrologic condition (water year) that the site was exposed to in the pre-con sampling.

4. In the success criteria, there is a provision for "time series analysis" that I'd like to understand better. This seems to imply that if you don't meet the 15% reduction at the end of monitoring (year 5), but the trend indicates you will meet the 15% at the end of 10 years, you still consider this to be successful, correct? So does this mean you could meet success with as little as a 7.5% reduction at the end of monitoring? Am I reading this right? If so, I'm not sure I agree that such a low percentage is an appropriate standard for success.

Point taken. The intent here was to incorporate standard statistical practices used in assessment of change WQ , which are discussed in the Spooner paper and other literature to include parametric, non-parametric hypothesis testing (referred to as Step change in Spooner's paper) and time series in a tiered approach to investigate change, but I see the problem that the time series presents written as it is. I would say that we need to proceed and revise as follows:

a. If statistical assumptions of normality and homogeneity of variance are met we rely on parametric hypothesis testing or ANOVA ($P<0.05$)

b. If assumptions are not met we utilize non-parametric hypothesis testing ($P<0.05$) as per standard practice

c. If the variability of a particular parameter at a particular station does permit detection of significance at 0.05 in either hypothesis testing scheme (a or b) then we attempt to run the data as a time series trend. The variability in a pooled hypothesis test may present differently when subjected to multiple regression techniques plotted against time (time series) and you can may be able tease out changes you could not through a and b. The slope of the time series regression line would have to be significantly different from zero at ($P<0.05$).

Now, even though we would employ this tiered approach, the one basic minimum threshold that will apply in all cases (a,b,c) is that the difference in the means pre-post must be a minimum of 15%. If that minimum threshold of 15% is not met it doesn't matter if any of the three above are deemed significant, that parameter at that station will be deemed a failure for the purpose of attaining mitigation credit.

5. I haven't seen the as-built yet for this project - do you know if it's available and if there are projected changes to credit?

The As-built is posted on our documents spreadsheet and was sent to DWR and USACE in the Bulk transfer on 12/18/2018. It is my understanding that the credits from the Mit Plan are what WEI used in that report and are being used as the agreed upon credits for the duration. If I have this wrong anybody, just chime in.

I appreciate your bearing with me as I work through this. I know I am asking questions that may seem like I'm getting into the weeds, but the details really matter in this case and we all need to make sure to understand and agree on these points up front so we don't have disagreements on credit at closeout. I've had to learn that lesson the hard way. Understood and thanks for your review.

Thanks,

Technical Memorandum

Prepared for:	Interagency Review Team
Project Title:	Big Harris Creek Mitigation Site
Subject:	Revised Water Quality Monitoring Proposal
Date:	June 6, 2019
From:	Jeff Keaton

INTRODUCTION

The purpose of this Technical Memorandum is to provide the North Carolina Interagency Review Team (IRT) a summary of the proposed post-construction water quality and biological monitoring program for the Big Harris Creek Mitigation Site. As stated in the final mitigation plan (section 12.7), a 4% credit allowance based on the entire linear footage of the project will be granted for the inclusion of these parameters for a pre/post construction comparison. Also based on the mitigation plan, an additional 2% (507 SMUs) credit allowance will be granted if post-construction water quality monitoring demonstrates improvement as per the plan detailed below.

This memo describes a revised version of the water quality, benthic, and fish monitoring program that has been refined based on an analysis of the pre-construction data and a set of criteria to support statistically reliable detection of change. **This revised monitoring program will supersede the program described in the final mitigation plan.** The memo will also describe the proposed success criteria for the monitoring program.

ANALTICAL BASIS FOR POST-CON SAMPLING PLAN

Pre-con sampling was completed at 16 stations within the Big Harris watershed and at 4 reference stations in the Little Harris watershed by the Division of Water Resources Watershed Assessments Team (WAT) for nutrient and biological parameters using state certified procedures. Western Carolina University performed automated stormflow monitoring of suspended sediments and discharge at 4 key drainage locations. Selected reaches were also monitored for groundwater hydrology. These monitoring activities were funded by the Division of Mitigation Services (DMS). The pre-construction (baseline) data were analyzed and several criteria were used to determine whether post-construction monitoring of a parameter was warranted at a given station. The statistical analysis was performed by DMS staff member, Greg Melia, with consultation and review by Wildlands Engineering staff. The hierarchy of the criteria used to select post-construction monitoring parameters and stations are as follows:

1. The levels of the pre-con data for a given parameter at a given station had to demonstrate that they were elevated compared to regulatory standards, the Little Harris reference sites, or relevant regional data sets/literature. The main consideration here is whether there is meaningful room for improvement at a given station.

2. There exists a reasonable likelihood for improvement in the given parameter at the given location because the direct stressors can be largely addressed. Examples of where stressors might not be addressed include cases where land owner easement grants do not permit capture of the major lateral inputs.
3. The pre-construction data indicates that a given station can be adequately represented by one of the pre-construction sampling stations (to include consolidation, where sensible).
4. Statistical analysis of the pre-construction distributions using minimal detectable change (MDC) analysis (Spooner et al., 2011) was performed by DMS for each parameter at each station. Using the variance of the pre-construction distribution, the MDC provides an estimate of the minimum percent change in a pollutant concentration that will be required to support statistically reliable detection of that change (assuming and alpha of 0.05). The more variability in the distribution of the data, the greater the MDC must be for reliable change detection. MDC results $\geq$ 50% were generally considered too variable and resulted in exclusion of that parameter at that station for post-construction monitoring. However, in some case best professional judgement was applied. MDCs that were slightly over 50% may have been included if outliers in the raw data could be identified or the parameter distributions and/or site characteristics exhibited other qualities that made it sensible to override a slightly elevated MDC.
5. Statistical Assumptions – The use of the MDC in item 4 assumes the approximation of a normal distribution, however in many cases the MDC analysis is robust against the violation of this assumption after pooling the post-con data with the pre-data. Therefore, this criterion was used to assist in decision making, but was a lesser factor than the other criteria.

Wildlands Engineering will contract Western Carolina University (WCU) to collect the post-construction water quality data which will include both baseflow and stormflow monitoring. Table 1 provides the matrix of parameters to be collected at a given station based on the analysis and criteria described above. The locations of the monitoring stations are shown on the attached map (Figure 1). The station numbers in the matrix correspond to the stations listed on the map. The samples will be collected using protocols utilized by the NC Department of Environmental Quality (DEQ), which are consistent with the methods used to collect pre-construction water samples. All samples will be analyzed at the NC DEQ labs in Swannanoa and/or Raleigh.

The four water quality monitoring locations are the four previously monitored sites (Sites 2, 8, 9, 14). ISCO automated samplers will be used to collect the samples at each of these four sites. Samples at the automated ISCO stations listed in will be collected as flow-proportional composites. Samples at the non-automated sites will be collected as grab samples. Fecal coliform will be collected exclusively as grab samples in all cases. Conductivity will be measured directly in-situ with a water quality meter. Baseflow samples will be collected at the frequencies described below. Fifteen to twenty storm events will be targeted between years 2 and 5 to cover storm water samples.

Table 1. Parameter Matrix

Type	**NA**	**NA**	**A**	**NA**	**NA**	**NA**	**A**	**A**	**NA**	**A**	Baseflow	
Station	0	1	2	4	5a	6	8	9	13	14	Stormflow	
Fecal											Base and Storm	
Cond											ISCO Station	**A**
TSS											Not Automated	**NA**

NH3											Watershed Control	
TKN												
NO2-NO3												
TP												
Macrobenthos												
Fish												

Baseflow Monitoring

The base flow monitoring program proposed is as follows:

a. Fecal coliform – Once per month during years 3, 4, and 5 at Stations 2, 4 ,8, and 9.
b. Conductivity – Once per month during years 2, 3, and 5 at Stations 0, 1, 2, 8, 9, and 13, and 14 and at stations when benthos or fish are to be sampled.
c. TSS baseflow solids – Once per month during years 3, 4, 5 at Stations 2, 9, and 14.
d. Ammonia (NH_3) – Once per month during years 4 and 5 at Stations 8 and 9.
e. Total Kjeldahl nitrogen (TKN) – Once per month during years 4 and 5 at Station 9.
f. Nitrite (NO_2)-nitrate (NO_3) nitrogen – Once per month during years 4 and 5 at Stations 2, 8, 9, and 14.
g. Total phosphorous (TP) – Once per month during years 4 and 5 at Stations 2, 8, 9, and 14.

Stormflow Monitoring

The proposed stormflow monitoring program is as follows:

a. Fecal coliform – Sites 2 and 9.
b. Conductivity – Site 1
c. Ammonia (NH_3) –Sites 2, 8, 9, and 14.
d. Total Kjeldahl nitrogen (TKN) – Sites 2, 9, and 14.
e. Nitrite (NO_2)-nitrate (NO_3) nitrogen – Sites 2, 8, 9, and 14.
f. Total phosphorous (TP) – Sites 2, 8, 9, and 14.

Biological Monitoring

The proposed fish community and benthic macroinvertebrate monitoring program is as follows:

a. Fish community sampling will be conducted with a backpack electrofisher once per year during years 4 and 5 at stations 4, 5a, 9, and 13.
b. Benthic macroinvertebrate sampling will be conducted once per year during years 4 and 5 at stations 0, 1, 4, 6, 8, and 14. Two macro-benthic sites (stations 0 and 1) will be sampled on Upper Fletcher Creek. This is being done to demonstrate the extent of post-construction habitat improvement on this reach as compared to the pre-construction data. The increase in habitat brought about by the restoration treatments should demonstrate a greater extent and improved recruitment of the benthic community. The water quality results for Upper Fletcher Creek will be the result of the synthesis of the benthos data from these stations.

Biological sampling will be performed directly by Wildlands personnel. Approved Qual 4 DEQ Standard Operating Procedures will be followed for all biological sampling. The classification criteria for benthos will follow the NCBI thresholds - for small streams (NC DEQ, 2016).

Notes on Monitoring Plan

a. Site 0 will be used as watershed control point using conductivity and benthos as an indicator of incoming water quality. The drainage above this location indicated relatively high pollutant inputs possibly due to hay fields at the drainage headwaters on some very steep slopes. Monitoring station 0 for conductivity as a surrogate for overall water quality will provide comparison to pre-construction levels for any post-construction results below this point.
b. Site 13 will also serve as a watershed control. It had good water quality pre-construction, but during the design phase an upstream landowner created a large disturbance in this drainage and conductivity will be measured at this point to see how it compares to the pre-con conductivity distribution.
c. Sites 8 and 9 were only sampled at baseflow pre-construction, but site 7, which was immediately downstream of the confluence of sites 8 and 9 will serve as the stormflow baseline for sites 8 and 9. This was deemed appropriate because when pooled, the baseflow data at sites 8 and 9 closely represented the pre-con baseflow at site 7. The storm data for sites 8 and 9 will be synthesized to provide the post-construction stormflow comparison to Site 7 pre-construction stormflow baseline.
d. Site 14 was only sampled for baseflow pre-construction, but the distributions for the pre-construction water quality parameters were very similar for sites 10 and 14. Therefore, the storm data from site 10 will serve as the pre-construction storm baseline for the storm data collected at site 14 post-construction.
e. For all other sites, post-construction baseflow and stormflow data will be compared to pre-construction baseflow and stormflow data respectively for the same sites.

SUCCESS CRITERIA

Each year when sampling is complete, data will be evaluated for any changes or trends that may be developing. Any observations will be reported in annual monitoring reports. However, ultimate success or failure for each monitoring station will be determined after the final dataset is collected prior to close out. At this time, each parameter in the overall post-construction data set (years 3-5) will be compared to the same parameter in the pre-construction data set using hypothesis testing. Improvement for any given physicochemical parameter will require a minimum of a 15% reduction in the mean of the distribution and demonstrate statistical significance (alpha 0.05). If parametric tests of assumption are not met, non-parametric methods may be employed. If a particular physicochemical parameter at a given station does not demonstrate a 15% improvement while meeting these criteria using hypothesis testing, time series analysis will be applied to demonstrate whether a significant negative trend exists. That is, the trend line will have to demonstrate a negative slope that is significantly different than 0 at an alpha of 0.05. In all cases the reduction between the means of the pre- and post-distributions must meet the minimum threshold of 15% for that parameter to be successful for the purpose of obtaining credit. For biological parameters, success will be determined based on whether there is an improvement of at least one bio-classification level (i.e. fair to good). Data from years 4 and 5 will be pooled to generate one bio-classification outcome to represent the post-construction condition.

The number of parameters that demonstrate success as described above will determine the proportion of credit that would be generated. For example, if there are 4 parameters at a station then each parameter represents 25% of the total available station credits credit. The number of parameters at

station that will contribute to success will include both baseflow and stormflow samples. The following equation will be used to quantify the additional credits:

# of parameters meeting success criteria at station/total # of parameters at station x total available station credits = additional credit

Total available station credits refers to the total possible additional credit that would be given for the reaches of the project that are at or upstream of that station either to the project limits or to another station. The total available station credits to be assigned if complete success is demonstrated at each station are summarized in Table 2 below. Total available station credits for stations 2 and 4 and stations 10 and 14 have been combined to balance out the effort/cost of collecting data with the credit amounts that would be generated by showing success at these stations.

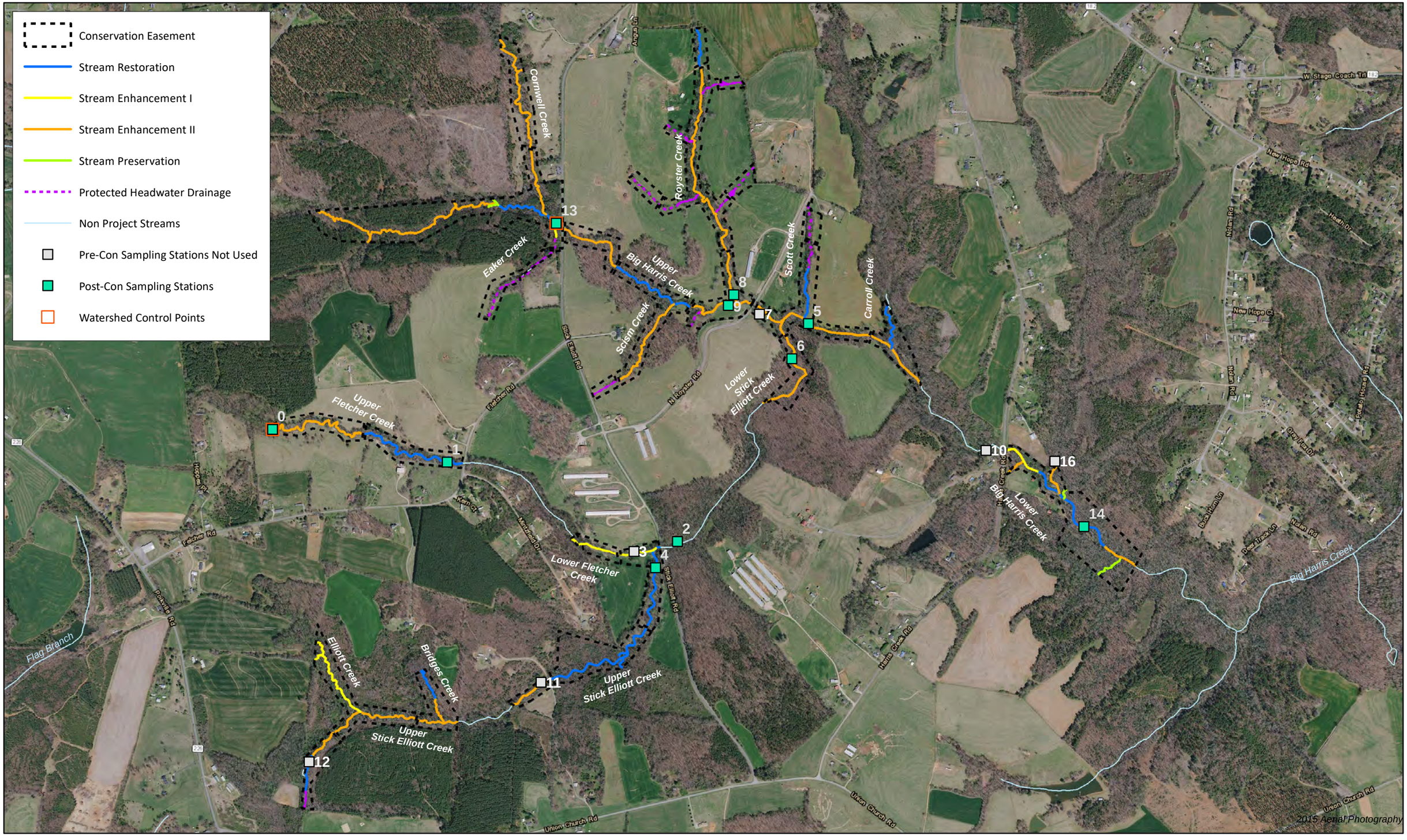
REFERENCES:

NC Department of Environmental Quality. 2016. Standard Operating Procedures for the Collection and Analysis of Benthic Macroinvertebrates. Division of Water Resources. Raleigh, North Carolina. February 2016

Spooner, Jean; Dressing, Stephen A.; and Meals, Donald W. 2011. Minimum Detectable Change Analysis. Tech Notes 7, December 2011. Developed for U.S. Environmental Protection Agency by Tetra Tech, Inc., Fairfax, VA, 21 p.

Table 2. Total Available Station Credits Assigned by Station

Station	Parameters	Reaches Represented	Credits for Reaches (from MP)	Credits * Multiplier	2% of Credits	2% of Credits * Multiplier
1	Cond, MB	Upper Fletcher Creek R1-R2	2084	2251	42	45
2 & 4	Site 2: FC, Cond, TSS, NH3, TKN, NO2-NO3, TP Site 4:MB, Fish	Lower Fletcher Creek R1-R2	7434	8030	149	161
5a	Fish, Cond	Scott Creek Upper Big Harris R6A	1252	1352	25	27
6	MB	Lower Stick Elliot Creek	527	569	11	11
8	MB, FC, Cond, NH3,NO2-NO3, TP	Royster Creek R1-R2	2060	2225	41	45
9	Fish, FC, Cond, TSS, NH3, TKN, NO2-NO3, TP	Upper Big Harris Creek R3-R5, Scism Creek	2969	3207	59	64
10 & 14	Site 10: Fish Site 14:MB, Cond, TSS, NH3, TKN, NO2-NO3, TP	Upper Big Harris R6B, Carrol Creek	3674	3969	73	79
13	Fish	Upper Big Harris Creek R1-R2, Cornwell Creek R1-R2, UT1 to Cornwell Creek, Eaker Creek	3451	3728	69	75
Total			23451	25331	469	507
TotalCredits from MP including additional credit for monitoring and watershed approach			25331			
Multiplier to get credits per reach (=25331/23451)			1.080167157050870			



WILDLANDS ENGINEERING

0 500 1,000 2,000 3,000 4,000 Feet

N

Proposed Water Quality Monitoring Locations
Big Harris Creek Mitigation Site
Broad River Basin (03050105)
Cleveland County, NC

APPENDIX 7. Water Quality and Biological Monitoring Data (MY4) & Updated Water Quality Monitoring Sampling Schedule Correspondence

Table 15. WCU Fecal & TSS Water Quality Data
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Station 0 - Upper Fletcher Creek Reach 1								
Date Sampled	**Flow Type**	**Conductivity (µS/cm)**	**Fecal (CFU/100mL)**	**TSS (mg/L)**	**NOx (mg/L)**	**NH3-4 (mg/L)**	**TKN (mg/L)**	**TP (mg/L)**
1/28/2021	Base	N/C	No other parameters collected at this station.					
2/25/2021	Base	59						
3/30/2021	Base	60						
4/27/2021	Base	59						
5/18/2021	Base	59						
6/29/2021	Base	60						
7/20/2021	Base	58						
8/19/2021	Base	59						
9/22/2021	Base	59						
10/27/2021	Base	59						
Station 1 - Upper Fletcher Creek Reach 2								
Date Sampled	**Flow Type**	**Conductivity (µS/cm)**	**Fecal (CFU/100mL)**	**TSS (mg/L)**	**NOx (mg/L)**	**NH3-4 (mg/L)**	**TKN (mg/L)**	**TP (mg/L)**
1/28/2021	Base	N/C	No other parameters collected at this station.					
2/25/2021	Base	53						
3/30/2021	Base	54						
4/27/2021	Base	53						
5/18/2021	Base	52						
6/29/2021	Base	53						
7/20/2021	Base	53						
8/19/2021	Base	54						
9/22/2021	Base	54						
10/27/2021	Base	54						
Station 2 - Lower Stick Elliot Creek (downstream of Stick Elliot Rd.)								
Date Sampled	**Flow Type**	**Conductivity (µS/cm)**	**Fecal (CFU/100mL)**	**TSS (mg/L)**	**NOx (mg/L)**	**NH3-4 (mg/L)**	**TKN (mg/L)**	**TP (mg/L)**
1/28/2021	Base	N/C	440	6.3	4.70	0.55	1.20	0.34
2/25/2021	Base	86	280	6.2	5.30	0.02	0.30	0.04
3/30/2021	Base	85	170	6.2	1.50	0.02	0.30	0.02
4/27/2021	Base	82	100	6.2	5.00	0.02	0.30	0.02
5/18/2021	Base	82	56	2.5	5.00	N/A	N/A	0.02
6/29/2021	Base	83	TBD	TBD	TBD	TBD	N/A	TBD
7/20/2021	Base	83	TBD	TBD	TBD	TBD	N/A	TBD
8/19/2021	Base	86	TBD	TBD	1.80	N/A	N/A	0.02
9/22/2021	Base	86	160	1.7	5.10	N/A	N/A	0.04
10/27/2021	Base	86	TBD	TBD	5.40	N/A	N/A	0.03
3/30/2021	Storm	N/A	N/A	N/A	0.44	0.04	2.40	0.97
7/29/2021	Storm	N/A	N/A	N/A	5.10	TBD	TBD	0.31
8/19/2021	Storm	N/A	N/A	N/A	5.20	TBD	TBD	0.09
Station 4 - Lower Stick Elliott Creek Reach 6								
Date Sampled	**Flow Type**	**Conductivity (µS/cm)**	**Fecal (CFU/100mL)**	**TSS (mg/L)**	**NOx (mg/L)**	**NH3-4 (mg/L)**	**TKN (mg/L)**	**TP (mg/L)**
1/28/2021	Base	N/C	76	No other parameters collected at this station.				
2/25/2021	Base	39	9					
3/30/2021	Base	39	88					
4/27/2021	Base	39	57					
5/18/2021	Base	41	88					
6/29/2021	Base	44	600					
7/20/2021	Base	47	250					
8/19/2021	Base	48	TBD					
9/22/2021	Base	48	92					
10/27/2021	Base	48	TBD					

N/A, Samples not scheduled for anaylsis according to technical memorandum.
N/C, No data recorded due to instrument or other problem.
TBD, Data results are pending. Currently waiting on data result from the lab.
Data from 2020 can be found in the MY3 (2020) report.
Per the technical memo a complete analysis of water quality data will be completed at the conclusion of sampling which runs through June 2023.

Table 15. WCU Fecal & TSS Water Quality Data
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Station 8 - Royster Creek Reach 2								
Date Sampled	**Flow Type**	**Conductivity (µS/cm)**	**Fecal (CFU/100mL)**	**TSS (mg/L)**	**NOx (mg/L)**	**NH3-4 (mg/L)**	**TKN (mg/L)**	**TP (mg/L)**
1/28/2021	Base	N/C	170	11.0	1.60	0.03	0.52	0.13
2/25/2021	Base	48	58	6.2	2.00	0.02	0.30	0.02
3/30/2021	Base	48	100	6.2	1.50	0.02	0.30	0.02
4/27/2021	Base	49	71	6.2	1.90	0.03	0.30	0.02
5/18/2021	Base	50	57	3.7	1.90	0.04	N/A	0.02
6/29/2021	Base	52	530	N/A	1.40	0.02	N/A	0.02
7/20/2021	Base	53	220	N/A	1.80	0.04	N/A	0.02
8/19/2021	Base	55	TBD	N/A	1.40	0.02	N/A	0.03
9/22/2021	Base	55	120	N/A	1.80	0.03	N/A	0.02
10/27/2021	Base	55	TBD	N/A	1.80	0.02	N/A	0.02
3/30/2021	Storm	N/A	N/A	N/A	0.67	0.30	1.80	0.84
7/29/2021	Storm	N/A	N/A	N/A	N/C	N/C	N/A	N/C
8/19/2021	Storm	N/A	N/A	N/A	1.00	0.11	N/A	0.61
Station 9 - Upper Big Harris Creek Reach 5								
Date Sampled	**Flow Type**	**Conductivity (µS/cm)**	**Fecal (CFU/100mL)**	**TSS (mg/L)**	**NOx (mg/L)**	**NH3-4 (mg/L)**	**TKN (mg/L)**	**TP (mg/L)**
1/28/2021	Base	N/C	150	6.2	1.60	0.03	0.43	0.05
2/25/2021	Base	40	49	6.2	1.60	0.02	0.30	0.20
3/30/2021	Base	41	130	6.2	0.61	0.26	2.20	0.87
4/27/2021	Base	40	88	6.2	1.40	0.02	0.30	0.02
5/18/2021	Base	40	42	3.4	1.40	0.03	0.30	0.02
6/29/2021	Base	42	TBD	TBD	TBD	TBD	TBD	TBD
7/20/2021	Base	44	TBD	TBD	1.40	0.02	LEP	0.02
8/19/2021	Base	46	470	2.7	0.35	0.03	LEP	0.03
9/22/2021	Base	46	120	3.4	TBD	TBD	TBD	TBD
10/27/2021	Base	46	TBD	TBD	TBD	TBD	TBD	TBD
3/30/2021	Storm	N/A	N/A	N/A	1.00	0.36	2.20	1.70
7/29/2021	Storm	N/A	N/A	N/A	1.20	0.06	0.30	0.97
8/19/2021	Storm	N/A	N/A	N/A	0.35	0.03	LEP	0.30
Station 13 - Upper Big Harris Creek Reach 2b								
Date Sampled	**Flow Type**	**Conductivity (µS/cm)**	**Fecal (CFU/100)**	**TSS (mg/L)**	**NOx (mg/L)**	**NH3-4 (mg/L)**	**TKN (mg/L)**	**TP (mg/L)**
1/28/2021	Base	N/C	No other parameters collected at this station.					
2/25/2021	Base	32						
3/30/2021	Base	33						
4/27/2021	Base	32						
5/18/2021	Base	32						
6/29/2021	Base	33						
7/20/2021	Base	35						
8/19/2021	Base	36						
9/22/2021	Base	36						
10/27/2021	Base	36						
Station 14 - Lower Big Harris Creek Reach 2								
Date Sampled	**Flow Type**	**Conductivity (µS/cm)**	**Fecal (CFU/100)**	**TSS (mg/L)**	**NOx (mg/L)**	**NH3-4 (mg/L)**	**TKN (mg/L)**	**TP (mg/L)**
1/28/2021	Base	N/C	N/A	13.0	1.70	0.07	0.48	0.14
2/25/2021	Base	50	N/A	6.8	2.10	0.02	0.30	0.02
3/30/2021	Base	49	N/A	6.2	2.00	0.02	0.30	0.02
4/27/2021	Base	50	N/A	7.3	1.90	0.02	0.30	0.02
5/18/2021	Base	47	N/A	6.2	1.90	N/A	N/A	0.02
6/29/2021	Base	52	N/A	TBD	TBD	N/A	N/A	TBD
7/20/2021	Base	53	N/A	TBD	1.00	N/A	N/A	1.30
8/19/2021	Base	55	N/A	3.9	1.80	N/A	N/A	0.03
9/22/2021	Base	55	N/A	2.5	1.80	N/A	N/A	0.02
10/27/2021	Base	55	N/A	TBD	1.80	N/A	N/A	0.02
3/30/2021	Storm	N/A	N/A	N/A	4.90	0.02	0.30	0.04
7/26/2021	Storm	N/A	N/A	N/A	1.80	LEP	LEP	0.04
8/17/2021	Storm	N/A	N/A	N/A	5.20	LEP	LEP	0.09

N/A, Samples not scheduled for anaylsis according to technical memorandum.
N/C, No data recorded due to instrument or other problem.
TBD, Data results are pending. Currently waiting on data result from the lab.
LEP, No data due to lab equipment problem.
Data from 2020 can be found in the MY3 (2020) report.
Per the technical memo a complete analysis of water quality data will be completed at the conclusion of sampling which runs through June 2023.

From: Ian Eckardt [mailto:ieckardt@wildlandseng.com]
Sent: Friday, February 12, 2021 1:20 PM
To: Jerry Miller <jmiller@email.wcu.edu>
Cc: Kristi Suggs <ksuggs@wildlandseng.com>; Melia, Gregory <gregory.melia@ncdenr.gov>; Wiesner, Paul <paul.wiesner@ncdenr.gov>
Subject: [External] RE: Big Harris Water Quality Monitoring Schedule

Jerry,

Thanks for the prompt response. I'll update the final annual monitoring report (MY3) with the adjusted water quality sampling schedule which will extend to June 2023. I'm copying Greg, Paul, and Kristi so that everyone's on the same page.

Ian Eckardt, PWS | *Environmental Scientist*
O: 704.332.7754 x108 **M**: 704.517-4988

Wildlands Engineering, Inc.
1430 S. Mint St, Suite 104
Charlotte, NC 28203

From: Jerry Miller <jmiller@email.wcu.edu>
Sent: Friday, February 12, 2021 11:03 AM
To: Ian Eckardt <ieckardt@wildlandseng.com>
Subject: Re: Big Harris Water Quality Monitoring Schedule

Hi Ian,

Yes, I agree. I think that continuing the sampling through June 2023 would be best.

Jerry

From: Ian Eckardt <ieckardt@wildlandseng.com>
Sent: Friday, February 12, 2021 10:32 AM
To: Jerry Miller <jmiller@email.wcu.edu>
Subject: Big Harris Water Quality Monitoring Schedule

Jerry,

I wanted to touch base about the end date for the water quality sampling Western Carolina is performing at Big Harris Creek Mitigation Site. Grab samples were originally expected to begin in January 2020 and last for three years; however, due to equipment issues and issues related to COVID,

the WCU sampling wasn't initiated until June 2020. Based on the adjusted start date, water quality sampling is now anticipated to run through June 2023. Please let me know if you concur or need to discuss further.

Thanks,

Ian Eckardt, PWS | *Environmental Scientist*
O: 704.332.7754 x108 **M**: 704.517-4988

Wildlands Engineering, Inc.
1430 S. Mint St, Suite 104
Charlotte, NC 28203

Table 16. Fish Sampling Summary Data
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Station ID	4		5a		9		13	
Date Sampled	June 2009	June 2021	June 2009	June 2021	June 2009	June 2021	June 2009	June 2021
Conductivity (µS/cm)	N/A	68.48	N/A	73.80		53.60		43.22
pH	N/A	6.38	N/A	5.81		6.87		6.66
Temperature (C)	18.6	19.0	22.5	19.0	19.0	21.7	18.1	16.6
Index of Biotic Intergrity	40	36	40	44	34	42	30	42
Index of Biotic Intergrity Summary Score Range	Fair	Fair	Fair	Good-Fair	Poor	Good-Fair	Poor	Good-Fair

Fish data is being sampled in MY4 and MY5. Final analysis will consolidate data from both years.

Table 17. Benthic Macroinvertebrate Sampling Summary Data
Big Harris Creek Mitigation Site
DMS Project No. 739
Monitoring Year 4 - 2021

Station ID	0		1		4	
Date Sampled	May 2013	May 2021	May 2013	May 2021	May 2013	May 2021
Total Taxa Richness	28	28	36	27	36	33
EPT Taxa Richness	6	10	6	7	9	10
EPT Abundance	8	59	8	9	22	25
Biotic Index	4.88	4.35	5.71	5.86	4.95	4.85
Bioclassification (Small Stream Criteria)	Good	Good	Good-Fair	Fair	Good	Good
Station ID	**6**		**8**		**14**	
Date Sampled	May 2013	May 2021	May 2013	May 2021	May 2013	May 2021
Total Taxa Richness	49	44	56	33	52	44
EPT Taxa Richness	16	19	18	9	21	15
EPT Abundance	30	86	35	22	61	58
Biotic Index	4.95	4.85	5.18	6.20	4.67	5.49
Bioclassification (Small Stream Criteria)	Good	Good	Good	Fair	Good	Good-Fair

Benthic data is being sampled in MY4 and MY5. Final analysis will consolidate data from both years.