MONITORING YEAR 6 ANNUAL REPORT

Final

LITTLE PINE III STREAM AND WETLAND RESTORATION PROJECT

Alleghany County, NC
NCDEQ Contract 6844
DMS Project Number 94903
DWR # 14-0041
USACE Action ID 2012-01299

Data Collection Period: June - November 2021
Draft Submission Date: November 23, 2021
Final Submission Date: January 13, 2022

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
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January 13, 2022

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

RE: Monitoring Year 6 (MY6) Report – Draft Submittal
Little Pine III Stream and Wetland Restoration Project
DMS Project Number 94903
Contract Number 6844
New River Basin - CU# 05050001 - Alleghany County, North Carolina

Dear Mr. Tsomides:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments from the Draft Monitoring Year 6 report for the Little Pine III Stream and Wetland Restoration Project. DMS' comments are noted below in **bold**. Wildlands' responses to those comments are noted in *italics*.

DMS comment: Aerial photos appear washed out/yellow on the hard copies. Please remove any opaque filtering and/or improve the print quality

Wildlands response: The transparency for the aerial imagery has been reduced to 0% to improve the image quality in Figures 2 & 3.

DMS comment: Can Wildlands approximate dates on one or two of the more severe storm events which may have caused riparian tree damage, and one new plot failure, along Little Pine Creek? Since there are no dates given for the bank full events (crest gage data and wrack lines as the indicators on this particular project) it is hard to tell when the impacts may have occurred.

Wildlands response: Per the data from a nearby precipitation station (NC CRONOS Sparta 3.5 SSW), several large storm events occurred in the summer of 2021 that may have caused the riparian tree damage along Little Pine Creek. Single day rainfall totals greater than 2 inches were recorded on July 2, 2021, and greater than 3 inches on August 18, 2021. Single day rainfall totals are plotted on the groundwater gage and stream gage plots in Appendix 5.

DMS comment: It is noted that "*In MY2, sediment aggradation was observed on approximately 192 linear feet of UT1 downstream of the culvert crossing (STA 200+36) and beyond the two installed boulder sills (STA 202+28).*" Please update this to be the MY6 observation, including updated LF of aggraded channel, and note the LF excessive aggradation in the "Notes" column of Table 1. This can be updated annually.

Wildlands response: This was updated in section 1.2.5 to be the MY6 observation and the LF of excessive aggradation was added to the "Notes" column of Table 1. This will be updated annually.

Digital Support Files:

DMS comment: For clarity, please update the stream and vegetation areas of concern feature classes to include a field that specifies the years when specific lines/polygons were present (e.g. MY2, MY3, MY4, etc.).

Wildlands response: A field called "Year_present" was added to the stream and vegetation areas of concern feature classes to indicate the years when they were present. The digital support CCPV files have been updated.

DMS comment: If available, please submit features characterizing the low stem density area.

Wildlands response: Features characterizing the low stem density areas are calculated from the permanent vegetation plots not meeting density criteria. These are included the digital support CCPV files.

DMS comment: Please review cross section calculations. Based on the submitted data, XS-11 should have a BHR of 0.5. This difference could be caused by not excluding areas outside of the main channel before the bankfull elevation that achieves the as-built bankfull area is determined.

Wildlands response: The MY0 bankfull area elevation for XS11 was recalculated to exclude the areas outside the bankfull channel. This resulted in a recalculated BHR of 0.5. The cross-section plots and morphology tables have been updated in Appendix 4.

Enclosed please find two (2) hard copies (one spiral bound, one binder clipped) and one (1) electronic copy on CD of the Final Monitoring Report and all digital support files. Please contact me at 704-941-9093 if you have any questions.

Sincerely,

Kirsten Y. Gimbert

Kirsten Y. Gimbert
Project Manager
kgimbert@wildlandseng.com

EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) completed design and construction management for the North Carolina Division of Mitigation Services (DMS) as part of a design-bid-build contract at the Little Pine III Stream and Wetland Restoration Project (Site). The Site is in Alleghany County approximately eight miles east of the Town of Sparta, NC and approximately four miles south of the Virginia border. The Site lies within the New River Basin; eight-digit Cataloging Unit (CU) 05050001 and the 14-digit Hydrologic Unit Code (HUC) 05050001030030 (Figure 1). Site streams consist of Little Pine Creek, a third order stream, as well as an unnamed second order tributary to Little Pine Creek (UT2), an unnamed first order tributary to Little Pine Creek (UT2a), four unnamed zero order tributaries to Little Pine Creek (UT1, UT2b, UT3, and UT4), and 2.9 acres of wetlands (Figure 2). The project design and construction restored, enhanced, and preserved a total of 13,112 linear feet (LF) of perennial and intermittent stream, and enhanced and preserved 2.9 acres of wetlands. The Site is expected to generate 6,973.4 stream mitigation units (SMUs), and 1.393 wetland mitigation units (WMUs) for the New River Basin (Table 1).

The Site is within a Targeted Local Watershed (TLW) identified in the New River Basin Restoration Priority (RBRP) plan (NCDENR, 2009). The Site is also located within the Little River & Brush Creek Local Watershed Plan (LWP). The project goals from the mitigation plan (Wildlands, 2014) were established with careful consideration of RBRP goals and objectives to address stressors identified in the LWP. The established project goals include:

- Restore unforested buffers;
- Remove livestock from buffers;
- Remove livestock from streams;
- Repair heavily eroded stream banks and improve stream bank stability;
- Reforest steep landscape around streams; and
- Enhance wetland vegetation.

Site construction and as-built survey were completed in 2016 with planting and baseline monitoring activities occurring between December 2015 and May 2016. Annual monitoring has been completed for six years since as-built/construction. This following report summarizes the Monitoring Year (MY) 6 status of the Site.

Overall, the Site is meeting MY6 monitoring success criteria for vegetation, geomorphology, and hydrology performance standards. The MY6 vegetation survey resulted in an average of 383 planted stems per acre, which is meeting the final MY5 monitoring requirement of 260 stems per acre with 18 of the 21 plots (86%) individually meeting this requirement. Previously observed areas of invasive plant populations have significantly been reduced by supplemental treatments throughout the monitoring period. Morphological surveys and visual assessment indicate that the channel dimensions are stable and functioning as designed, with the exception of minor areas of scour, sediment deposition, and structure piping. DMS has implemented two phases of stream repairs in 2019 and 2020 along Little Pine Creek, UT1, UT2, and UT2a and repairs appear stable and functioning as designed. DMS has contracted with a design firm to develop a repair plan to address additional stream areas of concern on the Site with construction activities expected to occur in early spring 2022. At least one bankfull event occurred during MY6 data collection which was recorded by crest gages and by visual indicators. The performance standard of two recorded bankfull events in separate monitoring years has been met for Little Pine Creek, UT2, and UT2b. No target performance standard was established for wetland hydrology success; however, the groundwater gage in Wetland FF recorded 169 consecutive days of the groundwater levels at or within 12 inches of the ground surface, consisting of 100% of the growing season.

LITTLE PINE III STREAM AND WETLAND RESTORATION PROJECT

Monitoring Year 6 Report

TABLE OF CONTENTS

APPENDICES

Section 1: PROJECT OVERVIEW

The Site is a DMS design-bid-build project in Alleghany County, NC, located in the New River Basin; eight-digit CU 05050001 and the 14-digit HUC 05050001030030 (Figure 1). Located in the Blue Ridge belt of the Blue Ridge province (USGS, 1998), the project watershed includes primarily managed herbaceous, mixed upland hardwoods, and other forested land. The drainage area for the Site is 2,784 acres. Little Pine Creek flows into Brush Creek several hundred feet downstream of the Site boundary. The land adjacent to the streams and wetlands is primarily maintained cattle pasture and forest.

The project streams consist of Little Pine Creek, a third order stream, as well as an unnamed second order tributary to Little Pine Creek (UT2), an unnamed first order tributary to Little Pine Creek (UT2a) and four unnamed zero order tributaries to Little Pine Creek (UT1, UT2b, UT3, and UT4) (Figure 2). Mitigation work within the Site included restoring and enhancing 9,888 linear feet (LF) and preserving 3,224 LF of perennial stream, enhancing 2.71 acres of wetlands and preserving a 0.19 acres existing wetland. The Site is expected to provide 6,973.4 SMUs, and 1.393 WMUs.

A conservation easement protecting 57.3 acres in perpetuity was purchased by the State of North Carolina and recorded with Alleghany County Register of Deeds in 2012. The final mitigation plan was submitted and accepted by DMS in March 2014. Construction activities were completed in September 2015 by North State Environmental, Inc. Planting was completed in December 2015 by Bruton Environmental, Inc. Kee Surveying, Inc. completed the as-built survey in April 2016. Wildlands completed the baseline monitoring activities in May 2016 and subsequent monitoring has been conducted annually with closeout expected in 2021. Repairs were completed in March and December 2016. Appendix 1 includes detailed project activity, history, contact information, and background information. Directions and a map of the Site are provided in Figure 1. Site components are discussed in Table 1 and illustrated in Figure 2.

1.1 Project Goals and Objectives

Prior to construction activities, livestock had full access to most of the Site streams and used them as a water source. The riparian buffers in areas proposed for restoration were primarily herbaceous with a few sparse trees. Deposition of fine sediment, severe bank erosion, and trampling of banks impacted the in-stream habitat. Channel widening and incision indicated instability. Table 4 in Appendix 1 and Table 11 in Appendix 4 provide pre-restoration condition details.

The Site is intended to provide numerous ecological benefits within the New River Basin. While many of these benefits are limited to the Site area, others, such as pollutant removal, reduced sediment loading, and improved aquatic and terrestrial habitat, have farther-reaching effects. Expected improvements to water quality and ecological processes are outlined below as secondary goals and objectives. These project goals were established with careful consideration of goals and objectives that were described in the RBRP and to address stressors identified in the LWP.

The project specific goals of the Site address stressors identified in the Mitigation Plan (Wildlands, 2014) include the following:

- Restore unforested buffers;
- Remove livestock from buffers;
- Remove livestock from streams;
- Repair heavily eroded stream banks and improve stream bank stability;
- Reforest steep landscape around streams; and
- Enhance wetland vegetation.

Secondary goals include the following:

- Remove harmful nutrients from creek flow;
- Reduce pollution of creek by excess sediment;
- Improve in-stream habitat; and
- Improve aesthetics.

The project objectives have been defined as follows:

- Restore 27.8 acres of forested riparian buffer;
- Fence off livestock from 57.3 acres of buffer and 14,736 LF of existing streams;
- Stream bank erosion which contributes sediment load to the creek will be greatly reduced, if not eliminated, in the project area. Eroding stream banks will be stabilized by increased woody root mass in banks, reducing channel incision, and by using natural channel design techniques, grading, and planting to reduce bank angles and bank height;
- Steep, unforested landscape within the conservation easement will be reforested;
- Eight of the nine onsite wetlands will be enhanced with supplemental plantings;
- Flood flows will be filtered through restored floodplain areas, where flood flow will spread through native vegetation. Vegetation takes up excess nutrients;
- Storm flow containing grit and fine sediment will be filtered through restored floodplain areas, where flow will spread through native vegetation. The spreading of flood flows will reduce velocity allowing sediment to settle out;
- In-stream structures will promote aeration of water;
- In-stream structures will be constructed to improve habitat diversity and trap detritus. Wood structures will be incorporated into the stream as part of the restoration design. Such structures may include log drops and rock structures that incorporate woody debris; and
- Site aesthetics will be enhanced by planting native plant species, treating invasive species, and stabilizing eroding and unstable areas throughout the project.

1.2 Monitoring Year 6 Data Assessment

Annual monitoring was conducted during MY6 (June to November 2021) to assess the condition of the project. The stream restoration success criteria for the Site follows the approved performance standards presented in the Little Pine III Stream & Wetland Restoration Project Final Mitigation Plan (Wildlands, 2014).

1.2.1 Vegetation Assessment

A total of 21 vegetation monitoring plots (VP) were established during baseline monitoring within the project easement areas using a standard 10 by 10 meter plot. Please refer to Figures 3.0-3.2 in Appendix 2 for the vegetation monitoring locations. The final vegetation success criterion is the survival of 260 planted stems per acre in the riparian corridor along restored and enhanced reaches at the end of year five of the monitoring period.

The MY6 vegetation survey was completed in September 2021, resulting in an average planted stem density of 383 stems per acre. The Site has met the final MY5 requirement of 260 planted stems per acre, with 18 of the 21 plots (86%) individually meeting this requirement. The planted stem mortality was approximately 6% of the MY5 stem count (408 stems per acre). In addition, there is an average of 9 planted stems per plot.

Located in Wetland FF, VP13 continues to not meet the stem density requirement because the planted species are not suited for areas with saturated soils. There has also been a high planted stem mortality in VP11 due to competition with tall herbaceous vegetation. Along the floodplain of Little Pine Creek,

stems were damaged from large storm events as represented by some stem mortality present in VP1. Approximately 27% of the monitored stems were documented with a vigor of 1 or 2, indicating more than minor damage to leaf material and/or bark tissue exists. This lower vigor rating is due to damage from deer herbivory, storm damage, insects, and too wet or dry conditions. Approximately 61% of the planted stems are thriving with a vigor of 3 or greater indicating plant health ranging from good to excellent and damage is rare. Natural volunteer tree species that were observed on the Site include red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), spicebush (*Lindera benzoin*), tulip poplar (*Liriodendron tulipifera*), and sycamore (*Platanus occidentalis*). Please refer to Appendix 2 for vegetation plot photographs and Appendix 3 for vegetation data tables.

1.2.2 Vegetation Areas of Concern and Management Activity

MY6 visual assessments reveal that over 99% of the conservation easement is unaffected by invasive plant populations. Invasive species found on the Site include Japanese barberry (*Berberis thunvergii*), multiflora rose (*Rosa multiflora*), and tree of heaven (*Ailanthus altissima*). The treatments that have occurred throughout the monitoring period have kept the total acreages and densities of invasive plant populations very low.

The floodplain vegetation along Little Pine Creek Reach 1 is naturally recovering where out of bank storm events had previously deposited sandy sediment, burying planted stems and herbaceous cover. These vegetation areas of concern will continue to be monitored and addressed as necessary. Please refer to the current condition plan view (CCPV) Figures 3.0-3.2 in Appendix 2 for vegetation areas of concern.

1.2.3 Stream Assessment

Morphological surveys for MY6 were conducted in June, September, and November 2021. Overall, results indicate that channel dimensions are stable and functioning as designed, with the exception of the remaining stream areas of concern identified in section 1.2.4.

The surveyed longitudinal profile data for the project streams illustrates that bedform features have maintained lateral and vertical stability between MY5 and MY6. The longitudinal profile parameters on Little Pine Creek, UT2, and UT2b showed little change from baseline in slope (riffle, water surface, bankfull) with minor differences in pool-to-pool spacing and pool length. Max pool depths increased in most reaches due to scour from log structures, which is a desired outcome, enhancing aquatic habitat. Localized instances of structure piping and aggradation continue to be noted during the MY6 survey and are further discussed in section 1.2.4.

In general, the cross-sections on Little Pine Creek, UT2, and UT2b show little to moderate change in the bankfull dimensions compared to the baseline survey. Along Little Pine Creek Reach 1, floodplain sediment deposition continues to be evident along both banks, thus increasing bankfull depths and decreasing width-to-depth ratios slightly, but is not indicating reachwide instability. Riffle cross-sections 3, 4, and 8 along Little Pine Creek Reaches 2a and 2b have higher bank height ratios due to increased bankfull cross-sectional area and depths compared to baseline from minor bed and/or bank scour. Cross-section 5 is located where bank repair work was completed in 2020 and although the cross-sectional area is larger than at baseline, the stream conditions appear stable and shows little change compared to MY5. Along UT2, a scour pool has formed within riffle cross-section 14 due to a log grade control structure located upstream. In addition, cross-sections 17 and 18 are representative of sediment deposition occurring downstream of the culvert crossing on UT2 as the valley flattens before the confluence with Little Pine Creek (originally noted in MY5 report). Alluvial deposits in cross-sections 17 and 18 have caused the bed and bank elevations to rise, but similar width-to-depth ratios and bankfull depths have been maintained compared to baseline. Along UT2b, riffle cross-section 11 experienced

narrowing of the channel due to alluvial deposition that started in MY4 but has since stabilized in MY6. Stream areas of concern causing changes in cross-section dimensions are discussed further in section 1.2.4.

In general, pebble counts within the restoration reaches indicate maintenance of coarser materials in the riffles and finer particles in the pools. The particle size distributions along most restoration reaches for MY6 are similar to the as-built data in coarseness and distribution. Refer to Appendix 2 for the visual stability assessment table, CCPV maps, and reference photographs. Refer to Appendix 4 for the morphological summary data and plots.

1.2.4 Stream Areas of Concern and Management Activity

Two phases of stream repairs that were completed in the fall 2019 and fall 2020 have significantly reduced major areas of concern and improved the overall stability of project streams. In the fall 2019, DMS completed a plan to complete repairs along UT2 Reach 2 (STA 332+25 to 339+15) and UT2a (STA 427+00 to 432+00) which included spot bank grading, geolift, grade control installation, and structure repairs. Overall, the 2019 repair areas appear to be performing well. Along Little Pine Creek, DMS completed a repair plan in fall 2020 for Reach 1 (STA 100+43 to 101+75) and Reach 2a (STA 121+25 to 122+50) to address areas of stream instability. Repair activities included installing constructed riffles, geolifts, and repairing rock vane structures. The 2020 repair plan also addressed the formation of headcuts and bank erosion along UT1 (STA 10+00 to 12+28) by regrading banks and installing structures to improve grade control in the stream. Stream and visual assessments reveal that the 2020 repairs appear to be stable and functioning as designed with herbaceous cover and live stakes becoming well established along banks and rock structures maintaining vertical stability.

Outside of the previously repaired areas, there remain a few isolated instances of structure piping, bank scour, sediment deposition, and clogged culverts at internal easement crossings on the Site. Along Little Pine Creek, the remaining areas of banks scour along the restored reaches (STA 108+00, 118+00, 123+00, 124+75, 125+50, and 128+00) continue to be noted where woody vegetation has failed to take hold along the banks. In MY6, sediment aggradation was observed on approximately 192 linear feet of UT1 downstream of the culvert crossing (STA 200+36) and beyond the two installed boulder sills (STA 202+28). Currently, a defined baseflow channel is still present downstream of the two installed boulder sills and woody vegetation established along the banks is helping shade out the herbaceous cover, thus transporting more accumulated fine sediment in the reach. Some structure piping and stream downcutting that was previously noted along UT2 Reach 1 Upper persists into MY6. Furthermore, sediment deposition persists into MY6 above both culvert crossings on UT2 Reach 1 (Upper and Lower). A few areas of bank scour and sediment deposition persist along UT2 but are isolated and not widespread. DMS has contracted with a design firm to develop a repair plan to address stream areas of concern on the Site with construction activities expected to occur in early spring 2022. Please refer to Appendix 2 for stream stability tables and CCPV Figures 3.0-3.2 and Appendix 6 for conceptual repair plans.

1.2.5 Hydrology Assessment

At least one bankfull event occurred on Little Pine Creek, UT2, and UT2b reaches during the MY6 data collection, which was recorded using crest gages and visual indicators. Two bankfull flow events occurring in separate years must be documented on the restoration reaches within the five year monitoring period. The performance standard was met in MY3 for Little Pine, UT2, and UT2b.

At the end of MY3, a stream gage using a pressure transducer was installed to monitor flow on UT1, approximately 50 LF downstream of the two installed boulder sills. A total of 270 consecutive days of flow were documented in MY6 with multiple bankfull events correlating with peaks in rainfall. At the time of each gage download, flow was also visually observed along this section of UT1 validating the

gage data that a baseflow channel is still present downstream of the two installed boulder sills. Please refer to Appendix 5 for hydrologic data and graphs.

1.2.6 Wetland Assessment

One groundwater monitoring gage (GWG 1) was established during the baseline monitoring within the Wetland FF area using logging hydrology pressure transducers. The gage was installed at an appropriate location so that the data collected will provide an indication of groundwater levels throughout the wetland enhancement area. No target performance standard for wetland hydrology success was established within the mitigation plan (Wildlands, 2014). Wetland hydrology attainment typically consists of recorded groundwater levels within 12 inches of the ground surface for a consecutive period consisting of a pre-defined percentage of the growing season. Under typical precipitation conditions, Alleghany County's growing season extends 169 days from April 26th to October 11th. No onsite rainfall data is available; however, daily precipitation data for MY6 was collected from closest NC CRONOS Station, Sparta 3.5 SSW. GWG 1 recorded 169 consecutive days of the groundwater levels at or within 12 inches of the ground surface, consisting of 100% of the growing season. Monthly rainfall data in 2021 indicated higher than normal rainfall amounts occurred during the months of August and October, and lower than normal rainfall amounts occurred during January and February. Please refer to Appendix 2 for the groundwater gage location and Appendix 5 for groundwater hydrology data and plots.

1.3 Monitoring Year 6 Summary

Overall, the Site is meeting MY6 monitoring success criteria for vegetation, geomorphology, and hydrology performance standards. The MY6 vegetation survey resulted in an average of 383 planted stems per acre, which is meeting the final MY5 monitoring requirement of 260 stems per acre with 18 of the 21 plots (86%) individually meeting this requirement. Previously observed areas of invasive plant populations have significantly been reduced by supplemental treatments throughout the monitoring period. Morphological surveys and visual assessment indicate that the channel dimensions are stable and functioning as designed, with the exception of minor areas of scour, sediment deposition, and structure piping. DMS implemented two phases of stream repairs in 2019 and 2020 along Little Pine Creek, UT1, UT2, and UT2a and repairs appear stable and functioning as designed. DMS has contracted with a design firm to develop a repair plan to address additional stream areas of concern on the Site with construction activities expected to occur in early spring 2022. At least one bankfull event occurred during MY6 data collection which was recorded by crest gages and by visual indicators. The performance standard of two recorded bankfull events in separate monitoring years has been met for Little Pine Creek, UT2, and UT2b. No target performance standard was established for wetland hydrology success; however, the groundwater gage in Wetland FF recorded 169 consecutive days of the groundwater levels at or within 12 inches of the ground surface, consisting of 100% of the growing season.

Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these annual monitoring reports can be found in the mitigation plan 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 was 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). Longitudinal and cross-sectional data were collected using a total station and were georeferenced. All Current Condition Plan View mapping was recorded using a Trimble handheld GPS with sub-meter accuracy and processed using was Pathfinder and ArcView. Crest gages were installed in surveyed riffle cross-sections and monitored annually. Hydrology attainment installation and monitoring methods are in accordance with the standards published in the United States Army Corps of Engineers Stream Mitigation Guidelines (2003). Vegetation monitoring protocols followed the Carolina Vegetation Survey-NCEEP Level 2 Protocol (Lee et al., 2008).

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.

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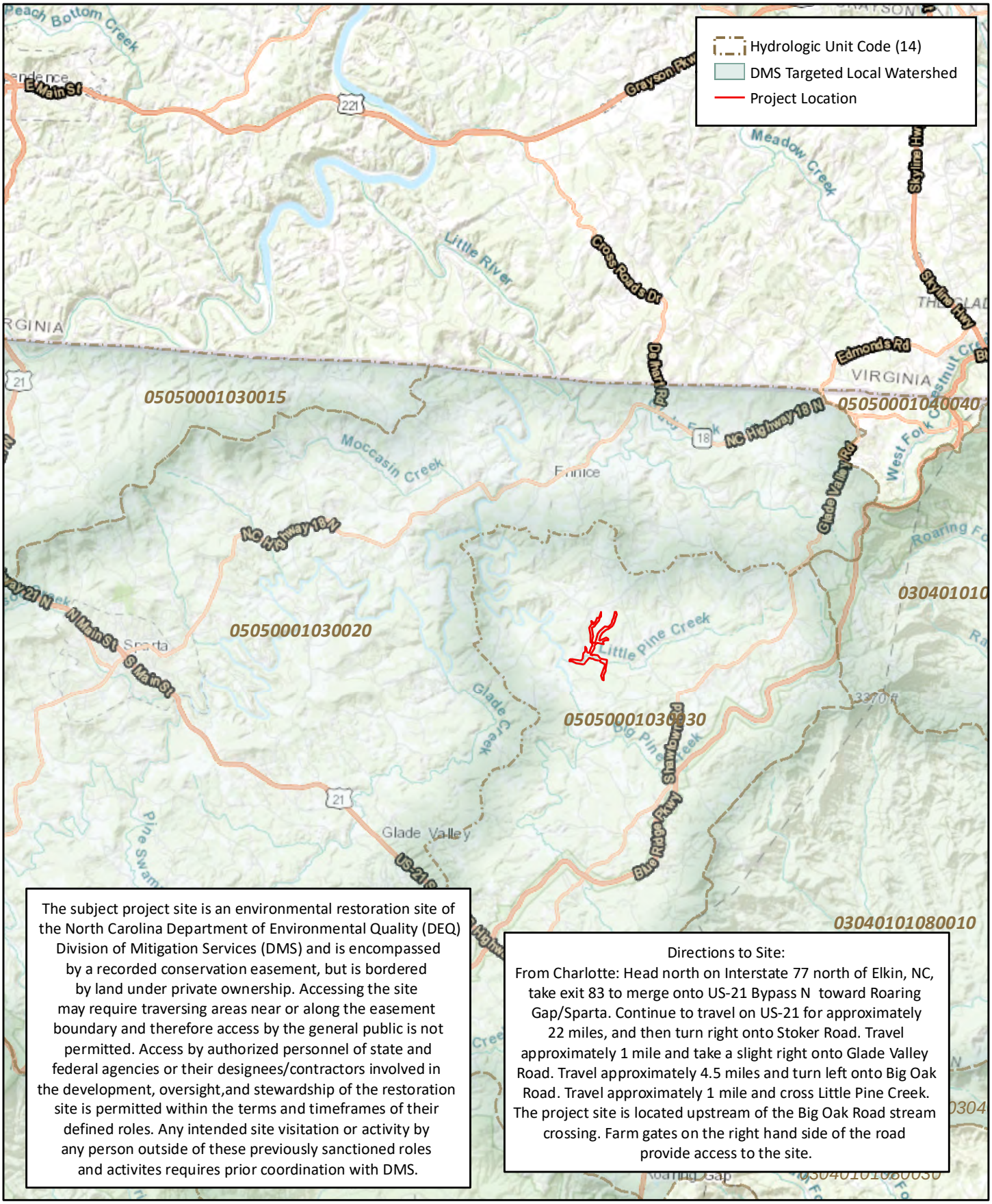
Wildlands Engineering, Inc. 2014. Little Pine III Stream & Wetland Restoration Project Final Mitigation Plan. NCEEP, Raleigh, NC.

Wildlands Engineering, Inc. 2016. Little Pine III Stream & Wetland Restoration Project As-Built Baseline Monitoring Report. NCDEQ-DMS, Raleigh, NC.

APPENDIX 1. General Tables and Figures



The subject project site is an environmental restoration site of the North Carolina 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.

Directions to Site:
From Charlotte: Head north on Interstate 77 north of Elkin, NC, take exit 83 to merge onto US-21 Bypass N toward Roaring Gap/Sparta. Continue to travel on US-21 for approximately 22 miles, and then turn right onto Stoker Road. Travel approximately 1 mile and take a slight right onto Glade Valley Road. Travel approximately 4.5 miles and turn left onto Big Oak Road. Travel approximately 1 mile and cross Little Pine Creek. The project site is located upstream of the Big Oak Road stream crossing. Farm gates on the right hand side of the road provide access to the site.

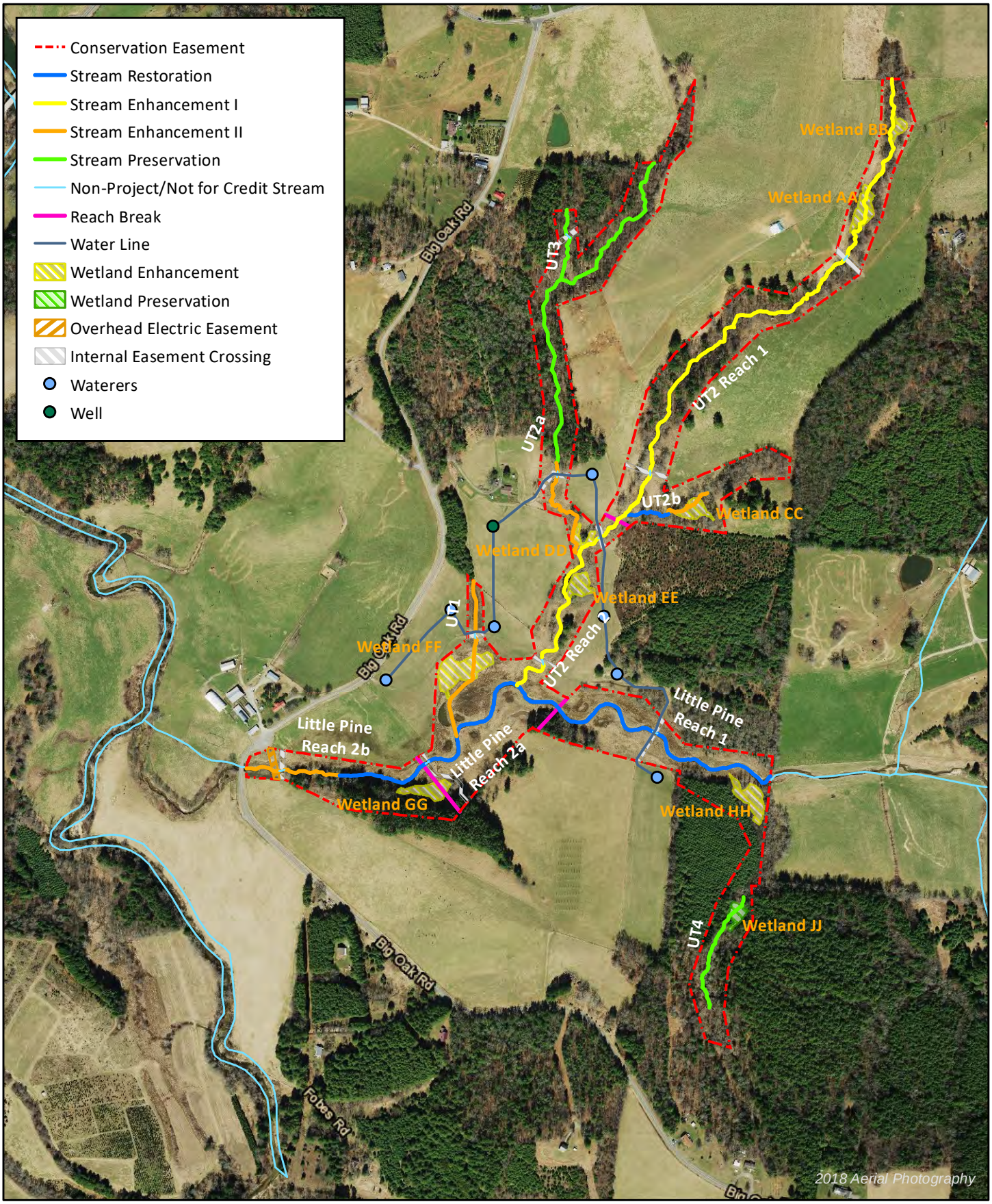
WILDLANDS ENGINEERING

0 0.5 1 Mile

N

Figure 1 Project Vicinity Map
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Alleghany County, NC



WILDLANDS ENGINEERING

0 700 Feet

N

Figure 2 Project Component/Asset Map
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Alleghany County, NC

Table 1. Project Components and Mitigation Credits

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	6,328.6	644.8	N/A	1.393	N/A	N/A	N/A	N/A	N/A

Project Components									
Reach ID	Existing Footage/ Acreage	Approach	Restoration (R) or Restoration Equivalent (RE)	As-Built Stationing/ Location	As-Built Footage/ Acreage	Restoration Footage/ Acreage[1]	Mitigation Ratio[2]	Credits[1] (SMU/WMU)	Notes[1]
STREAMS									
Little Pine Reach 1	4,016	P1/P2	Restoration (R)	100+00 to 114+44	1,444	1,417	1:1	1,417.0	Excludes one 27 foot wide ford crossing.
Little Pine Reach 2a		P1	Restoration (R)	114+44 to 125+27	1,083	1,058	1:1	1,058.0	Excludes one 25 foot wide ford crossing.
Little Pine Reach 2b		P1/P2	Restoration (R)	125+27 to 130+20	493	493	1:1	493.0	
		Planting, fencing	Enhancement II (R)	130+20 to 135+60	540	509	2.5:1	197.0	Excludes one 31 foot wide ford crossing, Includes 50% reduction for 33 ft overhead electric easement crossing.
UT1	540	Planting, fencing	Enhancement II (R)	197+26 to 202+24	498	463	2.5:1	185.2	Excludes one 35 foot wide culvert crossing. 192 LF of excessive aggradation.
		Planting, fencing, channel creation	Enhancement II (R)	202+24 to 206+26	402	402	2.5:1	160.8	
UT2 Reach 1	5,270	P1/P2/P4, preservation	Enhancement I (R)	297+18-343+18	4,600	4,474	2:1	2,237.0	Excludes four constructed culvert crossings; 32, 24, 32, and 38 feet wide respectively.
UT2 Reach 2									
UT2a	2,921	Planting, fencing	Enhancement II (R)[3]	401+78 to 403+34 & 403+75 to 404+34	215[3]	215[3]	n/a	n/a	Easement Break 403+34 - 403+75
		Preservation	Preservation (RE)	405+15 to 426+58	2,143	2,143	5:1	428.6	
		Planting, fencing	Enhancement II (R)	426+58 to 432+09	551	519	2.5:1	207.6	Excludes one 32 foot wide constructed culvert crossing.
UT2b	553	Planting, fencing	Enhancement II (R)	500+00 to 503+00	300	300	2.5:1	120.0	
		P2	Restoration (R)	503+00 to 505+53	253	253	1:1	253.0	
UT3	400	Preservation	Preservation (RE)	602+44 to 606+44	400	384	5:1	76.8	Excludes one 16 foot wide constructed ford crossing.
UT4	1,036	Preservation	Preservation (RE)	701+26 to 708+23	697	697	5:1	139.4	
WETLANDS									
Wetland AA	0.38	Planting, fencing	Enhancement (RE)	UT2 floodplain	0.38		2:1	0.190	
Wetland BB	0.16	Planting, fencing	Enhancement (RE)	UT2 floodplain	0.16		2:1	0.080	
Wetland CC	0.26	Grade control, planting, fencing	Enhancement (RE)	UT2b headwaters	0.26		2:1	0.130	
Wetland DD	0.12	Planting, fencing	Enhancement (RE)	North of UT2/UT2a	0.12		2:1	0.060	
Wetland EE	0.28	Planting fencing	Enhancement (RE)	UT2 floodplain	0.28		2:1	0.140	
Wetland FF	0.76	Outlet stabilization, planting, fencing	Enhancement (RE)	North of UT1/Little Pine	0.76		2:1	0.380	
Wetland GG	0.33	Planting, fencing	Enhancement (RE)	Little Pine	0.33		2:1	0.165	
Wetland HH	0.42	Planting, grade control	Enhancement (RE)	South of UT4/ Little Pine	0.42		2:1	0.210	
Wetland JJ	0.19	Preservation	Preservation (RE)	UT4 floodplain	0.19		5:1	0.038	

Component Summation					
Restoration Level	Stream (LF)	Riparian Wetland (acres)	Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
Restoration	3221				
Enhancement I	4474				
Enhancement II	2193				
Enhancement		2.71			
Preservation	3224	0.19			

[1]Restoration footage based off of the surveyed as-built thalweg alignment is greater than design centerline alignment, resulting in credited length greater than that reported in the Mitigation Plan.

[2]Unique ratio for UT2 was discussed in field with IRT members and recorded 8/15/2012 in meeting notes.

[3] Length not included in component summation since no credit is sought

Table 2. Project Activity and Reporting History
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Activity or Report		Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan		March 2013	March 2014
Final Design - Construction Plans		N/A	September 2014
Construction		N/A	September 2015
Temporary S&E mix applied to entire project area[1]		N/A	July - September 2015
Permanent seed mix applied to reach/segments[1]		N/A	July - September 2015
Bare root and live stake plantings for reach/segments		N/A	December 2015
Repair Work		N/A	March 2016 / December 2016
Baseline Monitoring Document (Year 0)	Vegetation Survey	May 2016	July 2016
	Stream Survey	April 2016	
Year 1 Monitoring	Vegetation Survey	October 2016	December 2016
	Stream Survey	October 2016	
Year 2 Monitoring	Vegetation Survey	September 2017	November 2017
	Stream Survey	May 2017	
Year 3 Monitoring	Invasive Treatment	N/A	July 2018
	Vegetation Survey	September 2018	November 2018
	Stream Survey	June 2018	
Year 4 Monitoring	Invasive Treatment	N/A	July, Aug, Sept, & Oct 2019
	Stream Repair	N/A	September 2019
	Vegetation Survey	September 2019	December 2019
	Stream Survey	April, May, & December 2019	
Year 5 Monitoring	Stream Repair	N/A	November 2020
	Vegetation Survey	August 2020	January 2021
	Stream Survey	December 2020	
Year 6 Monitoring	Vegetation Survey	September 2021	November 2021
	Stream Survey	June, September, & November 2021	

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

Table 3. Project Contact Table
Little Pine III Stream & Wetland Restoration Project
DMS Project No.94903
Monitoring Year 6 - 2021

Designer Aaron Early, PE, CFM	**Wildlands Engineering, Inc.** 1430 South Mint Street, Ste 104 Charlotte, NC 28205 704.332.7754
Construction Contractor	**North State Environmental, Inc.** 2889 Lowery Street Winston-Salem, NC 27101
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**North State Environmental, Inc.** 2889 Lowery Street Winston-Salem, NC 27101
Seed Mix Sources	**Green Resource, LLC**
Nursery Stock Suppliers **Bare Roots** **Live Stakes** **Plugs**	 **Bruton Natural Systems, Inc** **Foggy Mountain Nursery** **Mellow Marsh Farms**
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Kirsten Gimbert 704.941.9093

Table 4. Project Information and Attributes

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Project Information	
Project Name	Little Pine Creek III Stream & Wetland Restoration
County	Alleghany County
Project Area (acres)	57.32
Project Coordinates (latitude and longitude)	36° 30′ 29.16′′ N, 81° 0′ 6.12′′W
Project Watershed Summary Information	
Physiographic Province	Blue Ridge Belt of the Blue Ridge Province
River Basin	New
USGS Hydrologic Unit 8-digit	05050001
USGS Hydrologic Unit 14-digit	05050001030030
DWR Sub-basin	05-07-03
Project Drainiage Area (acres)	2,784
Project Drainage Area Percentage of Impervious Area	<1%
CGIA Land Use Classification	Managed Herbaceous (74%), Mixed Upland Hardwoods (20%), Mixed Hardwoods/Conifers (5%), Southern Yellow Pine (<1%), Mountain Conifers (<1%)

Reach Summary Information

Parameters	LP Reach 1	LP Reach 2a	LP Reach 2b	UT1	UT2 Reach 1	UT2 Reach 2	UT2 Reach 3	UT2a	UT2b	UT3	UT4
Length of Reach (linear feet) - Post-Restoration[1]	1,444	1,083	1,033	900	4,600			2,909	553	400	697
Drainage Area (acres)	2,496	2,752	2,784	28	75	185	196	89	19	23	33
NCDWR Stream Identification Score - Pre-Restoration	45.5	45.5	45.5	22.25	36	36	41.5	42	28/37.5	38.5	31.5
NCDWR Water Quality Classification	C, Tr										
Morphological Desription (stream type) - Pre-Restoration	C4	C/E4	C4	N/A	A4	E4b	E4	C4b	F4b	N/A	N/A
Evolutionary Trend (Simon's Model) - Pre-Restoration	IV/V	III/IV	IV/V	N/A[2]	N/A[4]	N/A[4]	N/A[4]	V	N/A[4]	N/A[2]	N/A[2]
Underlying Mapped Soils	Alluvial land, wet (Nikwasi); Ashe stony fine sandy loam (25-45% slopes); Chester loam (10-25% slopes); Chester clay loam (25-45% slopes), eroded (Evard); Codorus complex (Arkaqua); Tate loam (6-10% slopes); Watauga loam (6-45% slopes).										
Drainage Class	Well-drained										
Soil Hydric Status	A/D (Nikwasi); B (Ashe stony fine sandy loam, Chester loam, Tate loam, Watauga loam); B/D (Codorus										
Slope - Pre-Restoration	0.0043	0.0059	0.0087	N/A[2]	0.047	0.036	0.028	0.044	0.064	N/A[2]	N/A[2]
FEMA Classification	AE[3]										
Native Vegetation Community	Piedmont/Mountain Bottomland Forest, Rich Cove										
Percent Composition Exotic Invasive Vegetation -Post-	0%										

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. 3885. Action ID# 14-0041
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Dam Safety)	N/A	N/A	N/A
Endangered Species Act	Yes	Yes	LPIII Categorical Exclusion (CE) Approved 7/6/2012
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 5/3/2012)
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes[3]	No impact application was prepared for local review. No post-project activities required.	LPIII Final Mitigation Plan (3/4/2014) and LPIII CE Approved 7/6/2012
Essential Fisheries Habitat	Yes	Yes	LPIII Final Mitigation Plan (3/4/2014) and LPIII CE Approved 7/6/2012

1: Length includes internal easment crossings.

2: UT1 is enhancement II only, and UT3 and UT4 are preservation only. Geomorphic surveys were not performed for these streams in existing conditions.

3: The downstream 400 LF of Little Pine Creek near Big Oak Road is within a FEMA Zone AE floodplain on Firm panel 4010. The Zone AE floodplain is due to the backwater of Brush Creek; Little Pine Creek is not a FEMA studied stream.

4: Streams do not fit into Simon Evolutionary Sequence.

Table 5. Monitoring Component Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Parameter	Monitoring Feature	Quantity/ Length by Reach										Frequency
		Little Pine Reach 1	Little Pine Reach 2a	Little Pine Reach 2b	UT1	UT2	UT2a	UT2b	UT3	UT4	Wetlands	
Dimension	Riffle Cross Section	2	2	2	N/A	4	N/A	1	N/A	N/A	N/A	Annual
	Pool Cross Section	1	1	1	N/A	3	N/A	1	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	N/A
Profile	Longitudinal Profile	Y			N/A	Y	N/A	Y	N/A	N/A	N/A	Annual
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	RW-1, RF-1	RW-1, RF-1	RW-1, RF-1	N/A	RW-1, RF-3	N/A	RW-1, RF-1	N/A	N/A	N/A	Annual
Stream Hydrology	Crest Gage	1			N/A	1	N/A	1	N/A	N/A	N/A	Annual
Wetland Hydrology	Groundwater Gages	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	Annual
Vegetation[1]	CVS Level 2	21										Annual
Visual Assessment	All Streams	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Annual
Exotic and nuisance vegetation												
Project Boundary												
Reference Photos	Photographs	42										Annual

[1]A deviation from the vegetation plot quantity indicated in the Mitigation Plan is due to a smaller than expected planted area.

APPENDIX 2. Visual Assessment Data

Overhead Electric Easement
Internal Easement Crossing
Wetland Enhancement
Wetland Preservation
Conservation Easement
Water Line
Stream Restoration
Stream Enhancement I
Stream Enhancement II
Stream Preservation
Non-Project/Not for Credit Stream
Reach Break
Cross-Section (XS)
Waterers
Well
Barotroll
Crest Gage (CG)
Stream Gage (SG)
Groundwater Gage (GWG)

Permanent Vegetation Plot (VP) - MY6

Criteria Met
Criteria Not Met

Vegetation Areas of Concern - MY6

Tree of Heaven
Barberry
Multiflora Rose
Bare/Poor Herbaceous Cover

Stream Areas of Concern - MY6

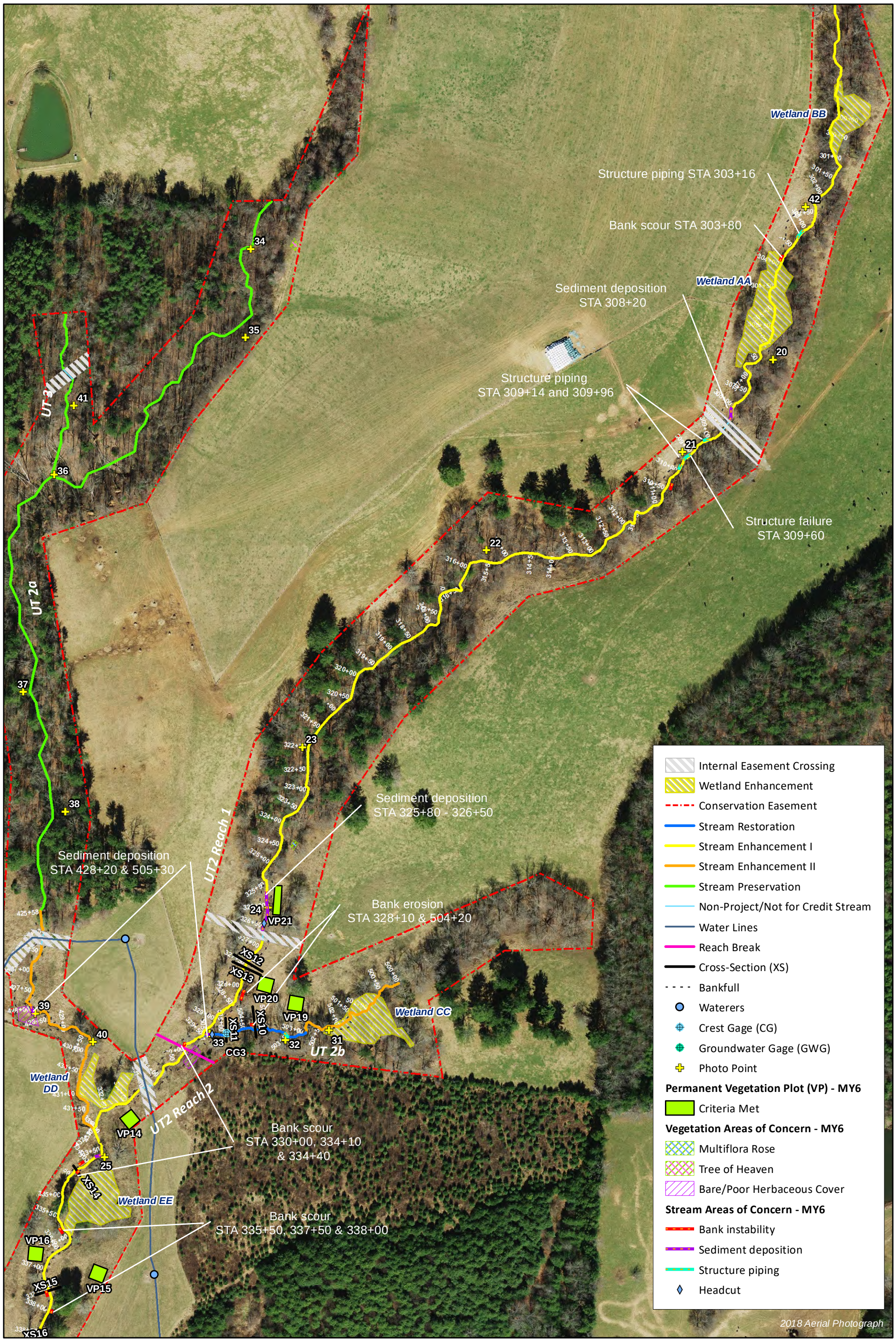
Bank instability
Sediment deposition
Structure piping
Headcut

Barrett Rd
Sheet 1
Wetland BB
Wetland AA
UT 3
UT 2a
UT2 Reach 1
Big Oak Rd
Wetland CC
UT 2b
Wetland DD
UT2 Reach 2
Wetland EE
UT 1
Wetland FF
Little Pine Creek Reach 2a
Little Pine Creek Reach 1
Sheet 2
Little Pine Creek Reach 2b
Wetland GG
Wetland HH
UT 4
Wetland JJ
Big Oak Rd
Fobes Rd
2018 Aerial Photograph

WILDLANDS ENGINEERING

0 200 400 Feet

Figure 3.0 Current Condition Plan View Map (Key)
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021
Alleghany County, NC



WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.1 Current Condition Plan View Map (Sheet 1)
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021
Alleghany County, NC

Wetland EE
VP15
VP16
XS15
UT2 Reach 2
Fencing damaged
Sediment deposition
STA 100+00 & STA 104+00
VP11
28
Bank scour
STA 337+50 &
338+00
UT 1
XS16
26
Sediment deposition
STA 341+00
VP17
XS17
Barotroll
XS18
27
CG2
VP18
GWG1
VP12
11
7
1
VP1
5
VP2
3
2
Wetland HH
4
XS1
9
6
XS3
XS2
VP3
Sediment deposition
STA 199+70
29
VP13
10
8
VP4
Little Pine Creek Reach 1
SG
XS4
CG1
VP5
Wetland FF
12
30
VP6
Two boulder sills
Bank scour
STA 108+00
Little Pine Creek
Reach 2a
13
XS5
Bank scour
STA 118+00
VP7
14
15
XS6
VP8
Structure Piping
STA 123+00, 124+00,
124+50 & 124+75
Bank scour
STA 123+00,124+75, &
125+50
Bank scour
STA 128+00, 131+20,
131+60,132+50 & 133+70
VP9
16
17
XS7
Wetland GG
XS8
XS9
VP10
18
Little Pine Creek
Reach 2b
19
Wetland JJ
UT 4
Debris piled in
easement

Overhead Electric Easement
Internal Easement Crossing
Wetland Enhancement
Wetland Preservation
Conservation Easement
Water Lines
Stream Restoration
Stream Enhancement I
Stream Enhancement II
Stream Preservation
Non-Project/Not for Credit Stream
Reach Break
Bankfull
Cross-Section (XS)
Waterers

Barotroll
Crest Gage (CG)
Stream Gage (SG)
Groundwater Gage (GWG)
Photo Point

Permanent Vegetation Plot (VP) - MY6
Criteria Met
Criteria Not Met

Vegetation Areas of Concern - MY6
Barberry
Multiflora Rose
Bare/Poor Herbaceous Cover

Stream Areas of Concern - MY6
Bank instability
Sediment deposition
Structure piping
Headcut

2018 Aerial Photograph

WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.2 Current Condition Plan View Map (Sheet 2)
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021
Alleghany County, NC

Table 6a. Visual Stream Morphology Stability Assessment Table

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Date of Visual Assessments: June 2021, September 2021

Little Pine Reach 1 (STA 100+00 - 114+44) 1,444 LF assessed

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			3	65	95%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	10	10			100%			
	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)	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			1	30	99%	n/a	n/a	n/a
	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%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	1	30	99%	n/a	n/a	n/a
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	3	3			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%.	3	3			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 6b. Visual Stream Morphology Stability Assessment Table
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Date of Visual Assessments: June 2021, September 2021
Little Pine Reach 2a (114+44-125+27) 1,083 LF assessed

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	7	7			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)	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			2	35	98%	n/a	n/a	n/a
	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%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	2	35	98%	n/a	n/a	n/a
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	4	5			80%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	4	5			80%			
	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 6c. Visual Stream Morphology Stability Assessment Table

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Date of Visual Assessments: June 2021, September 2021

Little Pine Reach 2b (125+27-130+20) 493 LF assessed

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			3	50	95%	n/a	n/a	n/a
	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%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	3	50	95%	n/a	n/a	n/a
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	3	5			60%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	3	5			60%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	5			60%			
	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 6d. Visual Stream Morphology Stability Assessment Table
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Date of Visual Assessments: June 2021, September 2021
UT2 Reach 1 Upper (STA 297+18 - 310+50) 1,332 LF assessed

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	30	98%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	9	10			90%			
	3. Meander Pool Condition	Depth Sufficient	n/a	n/a			n/a			
		Length Appropriate	n/a	n/a			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	n/a	n/a			n/a			
		Thalweg centering at downstream of meander bend (Glide)	n/a	n/a			n/a			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	30	99%	n/a	n/a	n/a
	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%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	2	30	99%	n/a	n/a	n/a
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	16	21			76%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	16	21			76%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	16	21			76%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	21	21			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	21	21			100%			

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

Table 6e. Visual Stream Morphology Stability Assessment Table
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Date of Visual Assessments: June 2021, September 2021
UT2 Reach 1 Lower (STA 325+67 - 330+00) 433 LF assessed

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	90	79%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	9	12			75%			
	3. Meander Pool Condition	Depth Sufficient	n/a	n/a			n/a			
		Length Appropriate	n/a	n/a			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	n/a	n/a			n/a			
		Thalweg centering at downstream of meander bend (Glide)	n/a	n/a			n/a			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	35	96%	n/a	n/a	n/a
	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%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	2	35	96%	n/a	n/a	n/a
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	20	20			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	20	20			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	20	20			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	20	20			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	16	20			80%			

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

Table 6f. Visual Stream Morphology Stability Assessment Table

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Date of Visual Assessments: June 2021, September 2021

UT2 Reach 2 (STA 330+00 - 343+18) 1,318 LF assessed

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			2	45	97%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	13	15			87%			
	3. Meander Pool Condition	Depth Sufficient	4	5			80%			
		Length Appropriate	4	5			80%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	4	5			80%			
		Thalweg centering at downstream of meander bend (Glide)	4	5			80%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			5	65	98%	n/a	n/a	n/a
	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%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	5	65	98%	n/a	n/a	n/a
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	19	19			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.	17	19			89%			

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

Table 6g. Visual Stream Morphology Stability Assessment Table
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Date of Visual Assessments: June 2021, September 2021
UT2b (STA 503+00 - 505+53) 253 LF assessed

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	92%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	7	9			78%			
	3. Meander Pool Condition	Depth Sufficient	n/a	n/a			n/a			
		Length Appropriate	n/a	n/a			n/a			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	n/a	n/a			n/a			
		Thalweg centering at downstream of meander bend (Glide)	n/a	n/a			n/a			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			1	10	98%	n/a	n/a	n/a
	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%	n/a	n/a	n/a
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	n/a	n/a	n/a
				Totals	1	10	98%	n/a	n/a	n/a
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	22	23			96%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	22	23			96%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	22	23			96%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	23	23			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	23	23			100%			

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

Table 7. Vegetation Condition Assessment Table

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Date of Visual Assessments: June 2021, September 2021

Planted Acreage **27.8**

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	3	0.11	0.40%
Low Stem Density Areas[1]	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	3	0.07	0.27%
		Total	**6**	**0.18**	**0.66%**
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0	0	0.0	0.0%
		Cumulative Total	**6**	**0.18**	**0.66%**

Easement Acreage **57.3**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Acreage
Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000	5	0.06	0.10%
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	0	0	0.0%

[1]Acreage calculated from permanent vegetation monitoring plots.

Stream Photographs

	
Photo Point 1 – Little Pine Reach 1, looking upstream *(9/13/2021)*	**Photo Point 1** – Little Pine Reach 1, looking downstream *(9/13/2021)*
	
Photo Point 2 – Little Pine Reach 1, looking upstream *(9/13/2021)*	**Photo Point 2** – Little Pine Reach 1, looking downstream *(9/13/2021)*
	
Photo Point 3 – Little Pine Reach 1, looking upstream *(9/13/2021)*	**Photo Point 3** – Little Pine Reach 1, looking downstream *(9/13/2021)*

	
Photo Point 4 – Little Pine Reach 1, looking upstream *(9/13/2021)*	**Photo Point 4** – Little Pine Reach 1, looking downstream *(9/13/2021)*
	
Photo Point 5 – Little Pine Reach 1, looking upstream *(9/13/2021)*	**Photo Point 5** – Little Pine Reach 1, looking downstream *(9/13/2021)*
	
Photo Point 6 – Little Pine Reach 1, looking upstream *(9/13/2021)*	**Photo Point 6** – Little Pine Reach 1, looking downstream *(9/13/2021)*

	
Photo Point 7 – Little Pine Reach 1, looking upstream *(9/13/2021)*	**Photo Point 7** – Little Pine Reach 1, looking downstream *(9/13/2021)*
	
Photo Point 8 – Little Pine Reach 1, looking upstream *(9/13/2021)*	**Photo Point 8** – Little Pine Reach 1, looking downstream *(9/13/2021)*
	
Photo Point 9 – Little Pine Reach 2a, looking upstream *(9/13/2021)*	**Photo Point 9** – Little Pine Reach 2a, looking downstream *(9/13/2021)*

	
Photo Point 10 – Little Pine Reach 2a, looking upstream *(9/13/2021)*	**Photo Point 10** – Little Pine Reach 2a, looking downstream *(9/13/2021)*
	
Photo Point 11 – Little Pine Reach 2a, looking upstream *(9/13/2021)*	**Photo Point 11** – Little Pine Reach 2a, looking downstream *(9/13/2021)*
	
Photo Point 12 – Little Pine Reach 2a, looking upstream *(9/13/2021)*	**Photo Point 12** – Little Pine Reach 2a, looking downstream *(9/13/2021)*

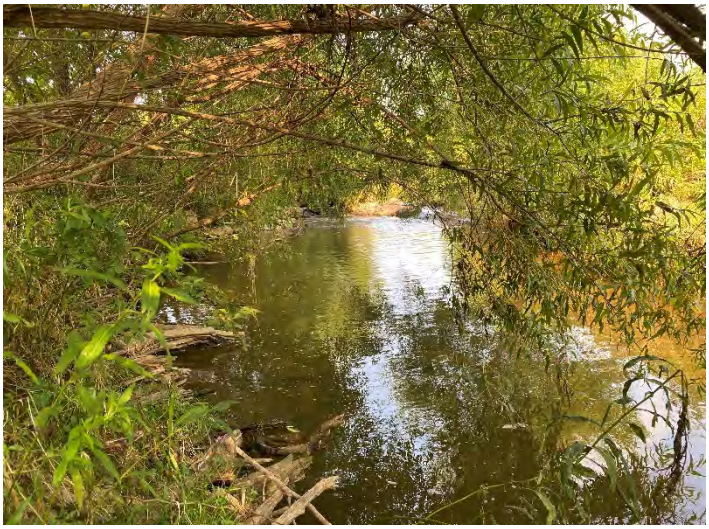


Photo Point 13 – Little Pine Reach 2a, looking upstream *(9/13/2021)*	**Photo Point 13** – Little Pine Reach 2a, looking downstream *(9/13/2021)*
	
Photo Point 14 – Little Pine Reach 2a, looking upstream *(9/13/2021)*	**Photo Point 14** – Little Pine Reach 2a, looking downstream *(9/13/2021)*
	
Photo Point 15 – Little Pine Reach 2a, looking upstream *(9/13/2021)*	**Photo Point 15** – Little Pine Reach 2a, looking downstream *(9/13/2021)*

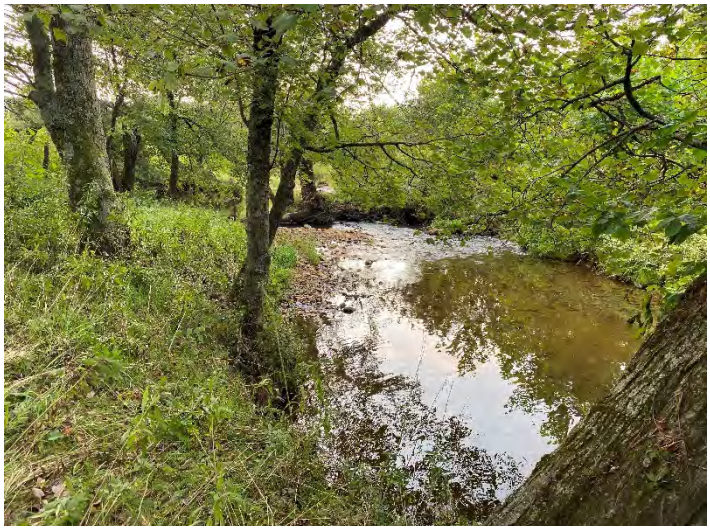
	
Photo Point 16 – Little Pine Reach 2b, looking upstream *(9/13/2021)*	**Photo Point 16** – Little Pine Reach 2b, looking downstream *(9/13/2021)*
	
Photo Point 17 – Little Pine Reach 2b, looking upstream *(9/13/2021)*	**Photo Point 17** – Little Pine Reach 2b, looking downstream *(9/13/2021)*
	
Photo Point 18 – Little Pine Reach 2b, looking upstream *(9/13/2021)*	**Photo Point 18** – Little Pine Reach 2b, looking downstream *(9/13/2021)*

	
Photo Point 19 – Little Pine Reach 2b, looking upstream *(9/13/2021)*	**Photo Point 19** – Little Pine Reach 2b, looking downstream *(9/13/2021)*
	
Photo Point 20 – UT2 Reach 1, looking upstream *(06/10/2021)*	**Photo Point 20** – UT2 Reach 1, looking downstream *(06/10/2021)*
	
Photo Point 21 – UT2 Reach 1, looking upstream *(06/10/2021)*	**Photo Point 21** – UT2 Reach 1, looking downstream *(06/10/2021)*

	
Photo Point 22 – UT2 Reach 1, looking upstream *(06/10/2021)*	**Photo Point 22** – UT2 Reach 1, looking downstream *(06/10/2021)*
	
Photo Point 23 – UT2 Reach 1, looking upstream *(06/10/2021)*	**Photo Point 23** – UT2 Reach 1, looking downstream *(06/10/2021)*
	
Photo Point 24 – UT2 Reach 1, looking upstream *(06/10/2021)*	**Photo Point 24** – UT2 Reach 1, looking downstream *(06/10/2021)*

	
Photo Point 25 – UT2 Reach 2, looking upstream *(06/10/2021)*	**Photo Point 25** – UT2 Reach 2, looking downstream *(06/10/2021)*
	
Photo Point 26 – UT2 Reach 2, looking upstream *(06/10/2021)*	**Photo Point 26** – UT2 Reach 2, looking downstream *(06/10/2021)*
	
Photo Point 27 – UT2 Reach 2, looking upstream *(06/10/2021)*	**Photo Point 27** – UT2 Reach 2, looking downstream *(06/10/2021)*

	
Photo Point 28 – UT1, looking upstream *(06/10/2021)*	**Photo Point 28** – UT1, looking downstream *(06/10/2021)*
	
Photo Point 29 – UT1, looking upstream *(06/10/2021)*	**Photo Point 29** – UT1, looking downstream *(06/10/2021)*
	
Photo Point 30 – UT1, looking upstream *(06/10/2021)*	**Photo Point 30** – UT1, looking downstream *(06/10/2021)*

	
Photo Point 31 – UT2b, looking upstream *(06/10/2021)*	**Photo Point 31** – UT2b, looking downstream *(06/10/2021)*
	
Photo Point 32 – UT2b, looking upstream *(06/10/2021)*	**Photo Point 32** – UT2b, looking downstream *(06/10/2021)*
	
Photo Point 33 – UT2b, looking upstream *(06/10/2021)*	**Photo Point 33** – UT2b, looking downstream *(06/10/2021)*

Photo Point 33 – UT2, looking downstream *(06/10/2021)*

Photo Point 34 – UT2a, looking upstream *(06/10/2021)*

Photo Point 34 – UT2a, looking downstream *(06/10/2021)*

Photo Point 35 – UT2a, looking upstream *(06/10/2021)*

Photo Point 35 – UT2a, looking downstream *(06/10/2021)*

Photo Point 36 – UT2a, looking upstream *(06/10/2021)*

Photo Point 36 – looking upstream UT3 *(06/10/2021)*

Photo Point 36 – UT2a, looking downstream *(06/10/2021)*

Photo Point 37 – UT2a, looking upstream *062/10/2021)*

Photo Point 37 – UT2a, looking downstream *(06/10/2021)*

	
Photo Point 38 – UT2a, looking upstream *(06/10/2021)*	**Photo Point 38** – UT2a, looking downstream *(06/10/2021)*
	
Photo Point 39 – UT2a, looking upstream *(06/10/2021)*	**Photo Point 39** – UT2a, looking downstream *(06/10/2021)*
	
Photo Point 40 – UT2a, looking upstream *(06/10/2021)*	**Photo Point 40** – UT2a, looking downstream *(06/10/2021)*

	
Photo Point 41 – UT3, looking upstream *(06/10/2021)*	**Photo Point 41** – UT3, looking downstream *(06/10/2021)*
	
Photo Point 42 – UT2 Reach 1, looking upstream *(06/10/2021)*	**Photo Point 42** – UT2 Reach 1, looking downstream *(06/10/2021)*

Vegetation Photographs

Vegetation Plot 1 – *(09/14/2021)*

Vegetation Plot 2 – *(09/14/2021)*

Vegetation Plot 3 – *(09/14/2021)*

Vegetation Plot 4 – *(09/14/2021)*

Vegetation Plot 5 – *(09/14/2021)*

Vegetation Plot 6 – *(09/14/2021)*

Vegetation Plot 7 – *(09/14/2021)*

Vegetation Plot 8 – *(09/14/2021)*

Vegetation Plot 9 – *(09/14/2021)*

Vegetation Plot 10 – *(09/14/2021)*

Vegetation Plot 11 – *(09/14/2021)*

Vegetation Plot 12 – *(09/14/2021)*

Vegetation Plot 13 – *(09/14/2021)*

Vegetation Plot 14 – *(09/15/2021)*

Vegetation Plot 15 – *(09/15/2021)*

Vegetation Plot 16 – *(09/15/2021)*

Vegetation Plot 17 – *(09/14/2021)*

Vegetation Plot 18 – *(09/14/2021)*

Vegetation Plot 19 – *(09/15/2021)*

Vegetation Plot 20 – *(09/14/2021)*

Vegetation Plot 21 – *(09/15/2021)*

APPENDIX 3. Vegetation Plot Data

Table 8. Vegetation Plot Criteria Attainment
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Plot	MY5 Success Criteria Met (Y/N)	Tract Mean
1	N	86%
2	Y	
3	Y	
4	Y	
5	Y	
6	Y	
7	Y	
8	Y	
9	Y	
10	Y	
11	N	
12	Y	
13	N	
14	Y	
15	Y	
16	Y	
17	Y	
18	Y	
19	Y	
20	Y	
21	Y	

Table 9. CVS Vegetation Plot Metadata
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Database Name	cvs-eep-entrytool-v2.5.0 LP III MY6.mdb
Database Location	L:\ActiveProjects\005-02160 Little Pine III Monitoring\Monitoring\Monitoring Year 6\Vegetation Assessment
Computer Name	MIMI-PC
File Size	53932032
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, 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	94903
Project Name	Little Pine Creek III Stream & Wetland Restoration Project
Description	Little Pine Creek III Stream & Wetland Restoration Project
Sampled Plots	21
Required Plots (calculated)	21
Sampled Plots	21

Table 10a. Planted and Total Stem Counts
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Current Plot Data (MY6 2021)																							
Scientific Name	**Common Name**	**Species Type**	**94903-WEI-0001**			**94903-WEI-0002**			**94903-WEI-0003**			**94903-WEI-0004**			**94903-WEI-0005**			**94903-WEI-0006**			**94903-WEI-0007**		
			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 rubrum	Red Maple	Tree			40	1	1	1	1	1	1	4	4	4	4	4	9				1	1	1
Alnus serrulata	Tag Alder	Shrub Tree																					
Betula nigra	River Birch	Tree	1	1	1	3	3	3	2	2	2	2	2	2				5	5	5	1	1	1
Cercis canadensis	Redbud	Shrub Tree	2	2	2							1	1	1	4	4	4				1	1	1
Cornus	Dogwood	Shrub Tree																					
Cornus amomum	Silky Dogwood	Shrub Tree																					
Cornus florida	Flowering Dogwood	Shrub Tree																					
Fraxinus pennsylvanica	Green Ash	Tree	1	1	1	2	2	2	2	2	2	5	5	5	2	2	2				8	8	8
Juglans nigra	Black Walnut	Tree																					
Lindera benzoin	Northern Spicebush	Shrub Tree																					
Liriodendron tulipifera	Tulip Poplar	Tree																					
Pinus taeda	Loblolly Pine	Tree																					
Platanus occidentalis	Sycamore	Tree	1	1	1	1	1	1				1	1	1	1	1	1	2	2	2	3	3	4
Salix nigra	Black Willow	Tree						25												2			
Salix sericea	Silky Willow	Shrub Tree																					
Sambucus canadensis	Common Elderberry	Shrub Tree																					
Ulmus americana	American Elm	Tree	1	1	1	2	2	2	8	8	8				2	2	2						
		Stem count	6	6	46	9	9	34	13	13	13	13	13	13	13	13	18	7	7	9	14	14	15
		size (ares)		1			1			1			1			1			1			1	
		size (ACRES)		0.02471			0.02471			0.02471			0.02471			0.02471			0.02471			0.02471	
		Species count	5	5	6	5	5	6	4	4	4	5	5	5	5	5	5	2	2	3	5	5	5
		Stems per ACRE	242.8	243	1862	364	364	1376	526	526	526	526	526	526	526	526	728	283	283	364	567	567	607

Current Plot Data (MY6 2021)																							
Scientific Name	**Common Name**	**Species Type**	**94903-WEI-0008**			**94903-WEI-0009**			**94903-WEI-0010**			**94903-WEI-0011**			**94903-WEI-0012**			**94903-WEI-0013**			**94903-WEI-0014**		
			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 rubrum	Red Maple	Tree	3	3	3	1	1	1	2	2	2				1	1	1						5
Alnus serrulata	Tag Alder	Shrub Tree																					
Betula nigra	River Birch	Tree				1	1	1	1	1	1				3	3	3				2	2	2
Cercis canadensis	Redbud	Shrub Tree	2	2	2	1	1	1	1	1	1										2	2	2
Cornus	Dogwood	Shrub Tree																					
Cornus amomum	Silky Dogwood	Shrub Tree																					
Cornus florida	Flowering Dogwood	Shrub Tree																					
Fraxinus pennsylvanica	Green Ash	Tree	4	4	4	3	3	3	4	4	7	3	3	3	3	3	3				2	2	2
Juglans nigra	Black Walnut	Tree																					
Lindera benzoin	Northern Spicebush	Shrub Tree																					1
Liriodendron tulipifera	Tulip Poplar	Tree																					
Pinus taeda	Loblolly Pine	Tree																					
Platanus occidentalis	Sycamore	Tree	1	1	1				2	2	2				1	1	2				2	2	2
Salix nigra	Black Willow	Tree																					
Salix sericea	Silky Willow	Shrub Tree																					
Sambucus canadensis	Common Elderberry	Shrub Tree																					
Ulmus americana	American Elm	Tree				4	4	4													3	3	3
		Stem count	10	10	10	10	10	10	10	10	13	3	3	3	8	8	9	0	0	0	11	11	17
		size (ares)		1			1			1			1			1			1			1	
		size (ACRES)		0.02471			0.02471			0.02471			0.02471			0.02471			0.02471			0.02471	
		Species count	4	4	4	5	5	5	5	5	5	1	1	1	4	4	4	0	0	0	5	5	7
		Stems per ACRE	405	405	405	405	405	405	405	405	526	121	121	121	324	324	364	0	0	0	445	445	688

Color for Density

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%
Volunteer species included in total

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 Stem Counts
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Current Plot Data (MY6 2021)																							
Scientific Name	**Common Name**	**Species Type**	**94903-WEI-0015**			**94903-WEI-0016**			**94903-WEI-0017**			**94903-WEI-0018**			**94903-WEI-0019**			**94903-WEI-0020**			**94903-WEI-0021**		
			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 rubrum	Red Maple	Tree			150	3	3	3							1	1	26			200	1	1	201
Alnus serrulata	Tag Alder	Shrub Tree																					
Betula nigra	River Birch	Tree	2	2	2				3	3	3	3	3	3	1	1	1				3	3	3
Cercis canadensis	Redbud	Shrub Tree										5	5	5	2	2	2	3	3	3			
Cornus	Dogwood	Shrub Tree																					
Cornus amomum	Silky Dogwood	Shrub Tree																					
Cornus florida	Flowering Dogwood	Shrub Tree																					
Fraxinus pennsylvanica	Green Ash	Tree	2	2	2	4	4	4	4	4	4	2	2	2	4	4	4	2	2	2	3	3	3
Juglans nigra	Black Walnut	Tree																					
Lindera benzoin	Northern Spicebush	Shrub Tree																					2
Liriodendron tulipifera	Tulip Poplar	Tree																		4			
Pinus taeda	Loblolly Pine	Tree																					
Platanus occidentalis	Sycamore	Tree	8	8	8	1	1	1				5	5	5							2	2	2
Salix nigra	Black Willow	Tree																					
Salix sericea	Silky Willow	Shrub Tree																					
Sambucus canadensis	Common Elderberry	Shrub Tree																					
Ulmus americana	American Elm	Tree							4	4	4	1	1	1	1	1	1	2	2	2			
		Stem count	12	12	162	8	8	8	11	11	11	16	16	16	9	9	34	7	7	211	9	9	211
		size (ares)	1			1			1			1			1			1			1		
		size (ACRES)	0.02471			0.02471			0.02471			0.02471			0.02471			0.02471			0.02471		
		Species count	3	3	4	3	3	3	3	3	3	5	5	5	5	5	5	3	3	5	4	4	5
		Stems per ACRE	486	486	6556	324	324	324	445	445	445	647	647	647	364	364	1376	283.3	283	8539	364	364	8539

Annual Means																							
Scientific Name	**Common Name**	**Species Type**	**MY6 (9/2021)**			**MY5 (8/2020)**			**MY4 (9/2019)**			**MY3 (9/2018)**			**MY2 (9/2017)**			**MY1 (10/2016)**			**MY0 (05/2016)**		
			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 rubrum	Red Maple	Tree	23	23	648	26	26	168	35	35	144	34	34	99	41	41	45	45	45	45	50	50	50
Alnus serrulata	Tag Alder	Shrub Tree						2			1			3			1			1			
Betula nigra	River Birch	Tree	33	33	33	34	34	37	37	37	38	39	39	39	39	39	41	41	41	41	49	49	49
Cercis canadensis	Redbud	Shrub Tree	24	24	24	25	25	25	26	26	27	35	35	35	35	35	37	44	44	44	46	46	46
Cornus	Dogwood	Shrub Tree									1												
Cornus amomum	Silky Dogwood	Shrub Tree												5									
Cornus florida	Flowering Dogwood	Shrub Tree						1						5									
Fraxinus pennsylvanica	Green Ash	Tree	60	60	63	60	60	63	63	63	68	67	67	68	61	61	67	58	58	58	58	58	58
Juglans nigra	Black Walnut	Tree						2															
Lindera benzoin	Northern Spicebush	Shrub Tree			3			3															
Liriodendron tulipifera	Tulip Poplar	Tree			4			3			2			4			1						
Pinus taeda	Loblolly Pine	Tree						1															
Platanus occidentalis	Sycamore	Tree	31	31	33	32	32	33	33	33	35	33	33	35	33	33	33	33	33	33	30	30	30
Salix nigra	Black Willow	Tree			27																		
Salix sericea	Silky Willow	Shrub Tree						5			2												
Sambucus canadensis	Common Elderberry	Shrub Tree									4												
Ulmus americana	American Elm	Tree	28	28	28	35	35	37	38	38	38	44	44	44	47	47	47	50	50	50	52	52	52
		Stem count	199	199	863	212	212	380	232	232	360	252	252	337	256	256	272	271	271	272	285	285	285
		size (ares)	21			21			21			21			21			21			21		
		size (ACRES)	0.5189			0.5189			0.5189			0.5189			0.5189			0.5189			0.5189		
		Species count	6	6	9	6	6	13	6	6	11	6	6	10	6	6	8	6	6	7	6	6	6
		Stems per ACRE	383	383	1663	409	409	732	447	447	694	486	486	649	493	493	524	522	522	524	549	549	549

Color for Density
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%
Volunteer species included in total

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
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 1, Reach 2a, Reach 2b

		Pre-Restoration Condition						Reference Reach Data		Design						As-Built/Baseline					
Parameter	Gage	Little Pine Reach 1		Little Pine Reach 2a		Little Pine Reach 2b		Meadow Fork		Little Pine Reach 1		Little Pine Reach 2a		Little Pine Reach 2b		Little Pine Reach 1		Little Pine Reach 2a		Little Pine Reach 2b[1]	
		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	25.8	33.4	24.9		29.0		21.4		30.0		30.0		31.0		30.3	33.5	29.1	30.7	28.7	31.9
Floodprone Width (ft)		>200		>200		>200		>200		>200		>200		>200		133	>200	>200		>200	
Bankfull Mean Depth		1.7	1.8	2.1		1.8		2.1		1.8		1.8		1.8		1.6	1.8	1.6	1.9	2.0	2.1
Bankfull Max Depth		3.3	3.3	3.7		2.2		3.1		2.5		2.5		2.5		2.7	3.2	2.6	3.9	3.1	3.4
Bankfull Cross-sectional Area (ft^2)		45.5	47.5	53.3		53.3		44.0		54.5		53.0		54.9		52.2	53.5	46.6	56.9	58.8	64.2
Width/Depth Ratio		1.4	23.9	11.6		16.1		10.2		16.5		17.0		17.5		17.1	21.4	16.6	18.1	14.0	15.9
Entrenchment Ratio		>2.2		>2.2		>2.2		>2.2		>2.2		>2.2		>2.2		4.4	>6.0	>6.5	>6.9	>6.3	>7
Bank Height Ratio		1.2	1.4	1.6		1.0		1.1		1.0		1.0		1.0		0.8	1.0	1.0		1.0	
D50 (mm)		10.2		1.3		18.4		---		---		---		---		50.7		87.6		47.4	
Riffle Length (ft)	N/A							---		---		---		---		28.4	80.5	37.8	68.3	30.44	132.29
Riffle Slope (ft/ft)		0.012	0.019	0.0095	0.031	0.028	0.045	0.0239		0.007	0.0125	0.0098	0.0175	0.0155	0.0278	0.0040	0.0275	0.0101	0.0274	0.0055	0.0236
Pool Length (ft)								---		---		---		---		44.5	96.5	38.7	108.9	40.92	99.41
Pool Max Depth (ft)		---		---		---		---		---		---		---		3.5	5.8	4.7	5.8	2.6	5.4
Pool Spacing (ft)		38	85	55	227	65	229	---		75	270	75	270	78	279	71	191	132	206	88	190
Pool Volume (ft^3)								---													
Pattern																					
Channel Beltwidth (ft)	N/A	63	82	77	94	57		---		45	210	45	210	47	217	45	154	48	108	89	
Radius of Curvature (ft)		25	59	39	58	34	70	---		60	210	60	120	62	124	60	96	63	77	82	124
Rc:Bankfull Width (ft/ft)		1.0	1.8	1.6	2.3	1.3	2.4	---		2.0	4.0	2.0	4.0	2.0	4.0	2.0	2.9	2.2	2.5	2.9	3.9
Meander Length (ft)		86	140	110	186	100	134	---		210	360	210	360	217	372	207	313	288	337	334	329
Meander Width Ratio		2.4	2.5	3.1	3.8	2.0		---		1.5	7.0	1.5	7.0	1.5	7.0	1.5	4.6	1.6	3.5	3.1	
Substrate, Bed and Transport Parameters																					
Ri%/Ru%/P%/G%/S%	N/A																				
SC%/Sa%/G%/C%/B%/Be%																					
d16/d35/d50/d84/d95/d100		SC/4.5/10.2/61.2/143.4/>2048		SC/0.4/1.3/77.8/180.0/362		SC/0.5/18.4/79.2/143.4/256		---								0.22/0.48/2.0/88.2/146.7/362		0.22/1.0/37.9/111.8/160.7/256		0.38/21.6/47.4/122.3/208.8/362	
Reach Shear Stress (Competency) lb/ft^2		0.85		0.66		2.43				0.56		0.75		1.20		0.46	0.51	0.69	0.74	1.21	1.23
Max part size (mm) mobilized at bankfull		134		122		289				99		123		174							
Stream Power (Capacity) W/m^2																					
Additional Reach Parameters																					
Drainage Area (SM)	N/A	3.9		4.3		4.4		4.4		3.9		4.3		4.4		3.9		4.3		4.4	
Watershed Impervious Cover Estimate (%)		<1%		<1%		<1%		<1%		<1%		<1%		<1%		<1%		<1%		<1%	
Rosgen Classification		C4		E/C5		C4		E4		C4		C5		C4		C4		C4		C4	
Bankfull Velocity (fps)		4.2	4.6	4.0		4.4		5.1		3.8		4.0		4.1		3.6	3.8	4.1	4.3	3.6	3.7
Bankfull Discharge (cfs)		205		215		225		224		205		215		225		205		215		225	
Q-NFF regression (2-yr)		---		---		---															
Q- NC Mountain Regional Curve (cfs)		284		306		308															
Q-USGS extrapolation (1.2-yr)		177		191		193															
Q-Mannings		199	211	213		235				---		---		---		188	204	199	231	219	232
Valley Length (ft)		---		---		---		---		---		---		---		1,184		876		476	
Channel Thalweg Length (ft)		4,016						---		1,350[1]		1,025[1]		481[2]		1,444		1,083		493	
Sinuosity		1.2		1.7		1.1		---		1.14		1.17		1.01		1.22		1.24		1.04	
Water Surface Slope (ft/ft)		0.0048	0.0058	0.0033	0.0057	0.0049	0.0058	0.0100		0.0050		0.0070		0.0111		0.0049		0.0072		0.0118	
Bankfull Slope (ft/ft)		0.0057		0.0087		0.0089		---		0.0057		0.0082		0.0089		0.0051		0.0074		0.0101	

SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable
[1] Little Pine Reach 2b: Calculations only include reaches with a P1 or P2 approach

Table 11b. Baseline Stream Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

UT2, UT2b

Parameter	Gage	Pre-Restoration Condition						Reference Reach Data		Design						As-Built/Baseline					
		UT2 Reach 1		UT2 Reach 2/3		UT2b		UT2a Reference		UT2 Reach 1 Lower		UT2 Reach 2		UT2b[2]		UT2 Reach 1 Lower		UT2 Reach 2		UT2b[2]	
		Min	Max	Reach 2	Reach 3	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																					
Bankfull Width (ft)		4.9	9.7	6.1	7.0	8.3		12.6		9.0		11.6		5.9		8.1		8.9	12.8	6.7	
Floodprone Width (ft)		5.4	29.9	49.3	41.0	10.6		31.0		98		17	195	15	30	28.4		21.5	>200	15.9	
Bankfull Mean Depth		0.9	1.2	1.4	1.2	0.4		1.4		0.49		0.65		0.35		0.6		0.5	0.9	0.5	
Bankfull Max Depth		1.4		2.3	1.9	0.6		2.0		0.7		0.95		0.55		1.0		1.10	2.10	0.9	
Bankfull Cross-sectional Area (ft^2)	N/A	5.9	8.6	8.7	8.5	3.1		18.1		4.4		7.6		2.1		5.1		4.2	12.0	3.7	
Width/Depth Ratio		4.1	11.0	4.2	5.7	22.6		8.7		18.5		17.7		16.8		13.0		13.6	20.1	12.2	
Entrenchment Ratio		1.1	3.1	8.1	5.9	1.3		2.4		10.9		1.5	16.8	2.5	5.1	3.5		2.0	>22.4	2.4	
Bank Height Ratio		2.6	3.2	1.0	1.2	5.8		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
D50 (mm)		10.7		15		16.0		---		---		---		---		56.9		44	53	43	
Profile																					
Riffle Length (ft)								---		---		---		---		10.7	25.0	16.8	29.3	4.4	23.0
Riffle Slope (ft/ft)		0.012	0.083	0.0327-0.063	0.0092-0.068	0.0178	0.081	0.0404	0.0517	0.0512	0.0681	0.026	0.046	0.0436	0.0750	0.0360	0.0853	0.0262	0.0575	0.0448	0.0659
Pool Length (ft)	N/A							---		---		---		---		5.0	22.3	13.3	46.3	3.1	14.3
Pool Max Depth (ft)		---		---		---		2.2	2.5	---		---		---		1.9	5.0	1.6	3.2	0.6	2.1
Pool Spacing (ft)		11.6	40.5	14-68	22-63	8	34	78		6.5	41.5	19	95	5	21	7	34	24	98	3	33
Pool Volume (ft^3)								---													
Pattern																					
Channel Beltwidth (ft)		---		49-52	120	N/A		---		---		45	68	---		---		61	66	---	
Radius of Curvature (ft)		---		10-48	8-27	N/A		---		---		29	39	---		---		19	63	---	
Rc:Bankfull Width (ft/ft)	N/A	---		1.6-7.9	1.1-3.9	N/A		---		---		2.5	3.4	---		---		2.1	4.9	---	
Meander Length (ft)		---		64-188	43-141	N/A		---		---		88	135	---		---		105	135	---	
Meander Width Ratio		---		8.0-8.5	17.1	N/A		---		---		3.9	5.9	---		---		7	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	SC/5.9/10.7/21.5/36.7/90.0		SC/8.0/15/55.6/84.6/180.0		SC/11/16/52.6/128/180		---								0.25/11.0/27.6/96.0/143.4/256.0				0.78/28.5/41.6/85.0/123.3/180.0	
Reach Shear Stress (Competency) lb/ft^2		1.53		0.73		0.75				1.49		0.96		1.38		1.95		0.83	1.69	1.98	
Max part size (mm) mobilized at bankfull		208		121		123				208		148		193							
Stream Power (Capacity) W/m^2																					
Additional Reach Parameters																					
Drainage Area (SM)		0.12		0.29	0.31	0.030		0.12		0.12		0.31		0.03		0.12		0.31		0.03	
Watershed Impervious Cover Estimate (%)		<1%		<1%		<1%		<1%		<1%		<1%		<1%		<1%		<1%		<1%	
Rosgen Classification		A4		E4b	E4	F4b		A/B4/1		B4a		C4b		B4a		B4a		C4b		B4a	
Bankfull Velocity (fps)		2.3	3.4	4.0	4.1	3.2		---		4.5		4.6		4.7		4.1		2.7	4.3	5.1	
Bankfull Discharge (cfs)		20		35		10		20		20		35		10		20		35		10	
Q-NFF regression (2-yr)		---		---		---															
Q- NC Mountain Regional Curve (cfs)	N/A	21		44		7															
Q-USGS extrapolation (1.2-yr)		10		21		3															
Q-Mannings		35		43		8				---		---		---		21		11.2	51.0	18.7	
Valley Length (ft)		---		---		---		---		---		---		---		3,988				231	
Channel Thalweg Length (ft)		5270[1]				553		---		433		1264		241		433		1318		253	
Sinuosity		1.1		1.3	2.1	1.1		---		1.05		1.20		1.04		1.05		1.2		1.1	
Water Surface Slope (ft/ft)[2]		0.0436		0.0290	0.0136	0.0406		0.0433		0.0501		0.0239		0.0639		0.0560		0.0231		0.0616	
Bankfull Slope (ft/ft)		0.0476		0.0363	0.028	0.0667		---		0.0525		0.0280		0.0667		0.0563		0.0237		0.0536	

SC: Silt/Clay <0.062 mm diameter particles
FS: Fine Sand 0.125-0.250mm diameter particles
(---): Data was not provided
N/A: Not Applicable
[1]entire length of UT2
[2] UT2b: Calculations only include reach with a P2 approach

Table 12a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

	Cross-Section 1, Little Pine Reach 1 (Riffle)							Cross-Section 2, Little Pine Reach 1 (Pool)							Cross-Section 3, Little Pine Reach 1 (Riffle)						
Dimension[1,2]	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**
Bankfull Elevation (ft)	2,535.4	2,535.4	2,535.4	2,535.7	2535.8	2536.1	2536.2	2,533.2	2,533.2	2,533.2	2,533.5	2,534.0	2,534.4	2534.6	2,532.9	2,532.9	2,532.9	2,533.2	2,533.4	2,533.5	2533.0
Low Bank Elevation (ft)	2,535.4	2,535.4	2,535.5	2,535.7	2535.9	2536.1	2535.8	2,533.2	2,533.2	2,533.1	2,533.5	2,534.0	2,534.4	2534.6	2,532.4	2,532.2	2,532.5	2,533.2	2,533.5	2,533.9	2533.7
Bankfull Width (ft)	30.3	29.9	30.8	29.5	29.1	25.3	25.0	30.6	30.9	30.9	29.8	29.5	29.8	24.6	33.5	32.9	32.3	29.5	23.7	25.5	22.5
Floodprone Width (ft)	132.9	135.1	135.1	>106	>106	>106	>106	---	---	---	---	---	---	---	>200	>200	>200	>215	>215	>214	>214
Bankfull Mean Depth (ft)	1.8	1.7	1.7	1.9	1.9	2.1	1.8	2.2	2.1	2.2	2.3	2.6	3.3	4.2	1.6	1.6	1.6	1.8	2.3	2.4	3.0
Bankfull Max Depth (ft)	2.7	2.8	3.2	3.1	3.1	3.7	3.5	4.3	3.9	4.4	4.8	5.2	5.6	6.3	3.2	3.1	3.0	3.5	3.5	4.4	4.5
Bankfull Cross Sectional Area (ft^2)	53.5	49.8	52.8	55.9	55.6	54.2	44.3	68.0	65.9	66.9	69.4	76.0	97.0	103.2	52.2	51.8	52.2	53.6	54.7	61.8	67.0
Bankfull Width/Depth Ratio	17.1	18.0	18.0	15.6	15.3	11.8	14.1	---	---	---	---	---	---	---	21.4	20.9	20.0	16.3	10.3	10.5	7.6
Bankfull Entrenchment Ratio	4.4	4.5	4.4	>3.6	>3.6	>4.2	>4.2	---	---	---	---	---	---	---	>6.0	>6.1	>6.2	>7.3	>9.1	>8.4	>9.5
Bankfull 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	1.0	1.1	1.2
	Cross-Section 4, Little Pine Reach 2a (Riffle)							**Cross-Section 5, Little Pine Reach 2a (Riffle)**							**Cross-Section 6, Little Pine Reach 2a (Pool)**						
Dimension[1,2]	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**
Bankfull Elevation (ft)	2,527.4	2,527.4	2,527.4	2,527.3	2,527.1	2526.6	2,526.7	2,525.4	2,525.4	2,525.4	2,525.2	2,524.9	2,524.4	2524.5	2,524.8	2,524.8	2,524.8	2,524.4	2,525.2	2,524.8	2524.7
Low Bank Elevation (ft)	2,527.4	2,527.5	2,527.5	2,527.7	2,527.8	2527.6	2,527.5	2,525.4	2,525.3	2,525.4	2,525.4	2,525.8	2,524.9	2525.1	2,524.8	2,524.5	2,524.7	2,524.4	2,525.2	2,524.8	2524.7
Bankfull Width (ft)	29.1	29.3	28.5	31.0	27.9	25.4	24.4	30.7	31.3	31.0	31.4	31.5	29.2	31.2	35.4	35.5	35.4	27.7	32.7	26.9	26.2
Floodprone Width (ft)	>200	>200	>200	>189	>189	>189	>189	>200	>200	>200	>90	>79.5	>93	>93	---	---	---	---	---	---	---
Bankfull Mean Depth (ft)	1.6	1.6	1.8	1.9	2.2	2.8	2.7	1.9	1.8	1.9	2.0	2.6	2.5	2.3	2.6	2.4	2.4	2.4	3.0	3.6	3.3
Bankfull Max Depth (ft)	2.6	2.6	2.9	3.9	4.1	4.4	4.3	3.9	3.6	3.5	3.6	5.4	3.6	3.6	5.7	5.1	5.3	4.6	5.5	6.2	6.6
Bankfull Cross Sectional Area (ft^2)	46.6	46.4	49.8	57.8	62.6	71.1	66.8	56.9	56.7	58.2	63.1	82.3	72.2	73.1	93.4	83.6	86.5	67.4	98.7	97.4	86.8
Bankfull Width/Depth Ratio	18.1	18.5	16.2	16.6	12.5	9.1	8.9	16.6	17.2	16.5	15.6	12.0	11.8	13.3	---	---	---	---	---	---	---
Bankfull Entrenchment Ratio	>6.9	>6.8	>7.0	>6.1	>6.8	>7.4	>7.7	>6.5	>6.4	>6.5	>2.9	>2.5	>3.2	>3.0	---	---	---	---	---	---	---
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.1	1.2	1.3	1.2	1.0	1.0	1.0	1.1	1.2	1.2	1.2	---	---	---	---	---	---	---
	Cross-Section 7, Little Pine Reach 2b (Pool)							**Cross-Section 8, Little Pine Reach 2b (Riffle)**							**Cross-Section 9, Little Pine Reach 2b (Riffle)**						
Dimension[1,2]	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**
Bankfull Elevation (ft)	2,522.0	2,522.0	2,522.0	2,522.2	2,522.5	2,522.4	2522.3	2,520.1	2,520.1	2,520.1	2,519.9	2,519.7	2,519.5	2519.6	2,519.5	2,519.5	2,519.5	2,519.3	2,519.3	2,519.0	2519.0
Low Bank Elevation (ft)	2,522.0	2,522.0	2,522.2	2,522.2	2,522.5	2,522.4	2522.3	2,520.1	2,520.1	2,520.2	2,520.3	2,520.4	2,520.3	2520.4	2,519.5	2,519.5	2,519.4	2,519.5	2,519.6	2,519.4	2519.4
Bankfull Width (ft)	35.3	35.5	35.2	39.4	40.3	38.1	29.5	28.7	29.8	29.4	30.3	31.8	29.8	26.8	31.9	30.7	29.3	31.2	32.7	28.8	29.2
Floodprone Width (ft)	---	---	---	---	---	---	---	>200	>200	>200	>121	>121	>121	>121	>200	>200	>200	>110	>110	>110	>110
Bankfull Mean Depth (ft)	2.9	2.8	2.8	2.5	2.6	2.6	3.2	2.1	2.1	2.0	2.3	2.4	2.6	2.9	2.0	2.0	2.1	2.2	2.3	2.7	2.5
Bankfull Max Depth (ft)	5.4	5.6	5.4	5.4	5.5	5.5	5.5	3.4	3.6	3.4	4.2	4.5	4.7	4.6	3.1	3.2	3.0	3.7	3.9	4.2	4.0
Bankfull Cross Sectional Area (ft^2)	103.7	100.0	97.2	96.9	104.8	98.1	94.0	58.8	61.2	59.8	68.3	77.5	77.4	77.7	64.2	62.3	60.2	67.4	74.3	76.6	73.9
Bankfull Width/Depth Ratio	---	---	---	---	---	---	---	14.0	14.5	14.4	13.5	13.1	11.5	9.3	15.9	15.2	14.2	14.4	14.3	10.9	11.5
Bankfull Entrenchment Ratio	---	---	---	---	---	---	---	>7.0	>6.7	>6.8	>4.0	>3.8	>4.1	>4.5	>6.3	>6.5	>6.9	>3.5	>3.4	>3.8	>3.8
Bankfull Bank Height Ratio	---	---	---	---	---	---	---	1.0	1.0	1.0	1.1	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.1	1.1	1.1

---: not applicable

[1]Prior to MY3, bankfull dimensions were calculated using a fixed bankfull elevation.

[2]MY3-MY5 Bank Height Ratio is 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 (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height. MY3 dimensions were updated in MY4.

Table 12b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

	Cross-Section 10, UT2b (Pool)							Cross-Section 11, UT2b (Riffle)							Cross-Section 12, UT2 Reach 1 Lower (Riffle)						
Dimension[1,2]	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**
Bankfull Elevation (ft)	2,570.0	2,570.0	2,570.0	2,570.1	2,570.2	2,570.0	2,570.0	2,566.4	2,566.4	2,566.4	2,566.4	2,566.5	2,566.7	2,567.0	2,573.8	2,573.8	2,573.8	2,573.8	2,573.9	2,574.0	2,573.9
Low Bank Elevation (ft)	2,570.0	2,569.7	2,570.0	2,570.1	2,570.2	2,570.0	2,570.0	2,566.4	2,566.4	2,566.2	2,566.3	2,566.3	2,566.4	2,566.3	2,573.8	2,573.7	2,573.7	2,573.9	2,573.8	2,573.9	2,574.0
Bankfull Width (ft)	5.9	6.0	6.1	7.3	7.6	6.4	7.4	6.7	6.3	6.6	6.3	6.4	3.2	3.4	8.1	8.4	8.6	8.9	7.1	4.9	5.8
Floodprone Width (ft)	---	---	---	---	---	---	---	15.9	17.7	17.9	14.3	14.1	14.9	14.2	28.4	30.0	30.0	31.4	29.5	32.7	34.1
Bankfull Mean Depth (ft)	1.0	2.3	2.4	2.3	2.3	2.3	2.1	0.5	0.7	0.7	0.5	0.4	0.5	0.4	0.6	0.7	0.6	0.7	0.6	1.0	0.9
Bankfull Max Depth (ft)	1.7	3.4	3.3	3.4	3.3	2.9	3.0	0.9	1.1	1.1	0.8	0.8	0.8	0.8	1.0	1.3	1.2	1.4	1.2	1.5	1.8
Bankfull Cross Sectional Area (ft^2)	5.7	14.0	14.9	16.6	17.3	14.9	15.6	3.7	4.3	4.5	3.0	2.3	1.5	1.4	5.1	5.7	5.4	5.9	4.4	4.9	5.4
Bankfull Width/Depth Ratio	---	---	---	---	---	---	---	12.2	9.1	9.6	13.2	17.9	6.7	7.8	13.0	12.5	13.9	13.4	11.5	4.8	6.2
Bankfull Entrenchment Ratio	---	---	---	---	---	---	---	2.4	2.8	2.7	2.3	2.2	4.7	4.2	3.5	3.6	3.5	3.5	4.2	6.7	5.9
Bankfull Bank Height Ratio	---	---	---	---	---	---	---	1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	1.1	<1.0	1.0	1.0
	Cross-Section 13, UT2 Reach 1 Lower (Pool)							**Cross-Section 14, UT2 Reach 2 (Riffle)**							**Cross-Section 15, UT2 Reach 2 (Pool)**						
Dimension[1,2]	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**
Bankfull Elevation (ft)	2,573.3	2,573.3	2,573.3	2,573.4	2,573.3	2,573.4	2,573.4	2,547.2	2,547.2	2,547.2	2,547.5	2,547.6	2,546.8	2,546.0	2,539.1	2,539.1	2,539.1	2,539.1	2,539.2	2,539.2	2,539.3
Low Bank Elevation (ft)	2,573.3	2,573.3	2,573.3	2,573.4	2,573.3	2,573.4	2,573.4	2,547.2	2,547.2	2,547.1	2,547.4	2,547.7	2,547.4	2,547.8	2,539.1	2,539.0	2,539.2	2,539.1	2,539.2	2,539.2	2,539.3
Bankfull Width (ft)	9.8	10.1	10.4	10.2	10.0	9.9	9.4	10.8	8.0	9.2	6.9	7.6	5.9	7.8	12.2	11.6	12.0	11.4	11.4	9.7	10.3
Floodprone Width (ft)	---	---	---	---	---	---	---	21.5	23.2	23.5	25.0	25.0	26.0	26.0	---	---	---	---	---	---	---
Bankfull Mean Depth (ft)	1.3	1.2	1.4	1.6	1.5	1.7	1.6	0.5	0.8	0.7	0.7	0.8	1.5	2.3	1.5	1.0	1.2	1.2	1.0	1.9	2.1
Bankfull Max Depth (ft)	2.2	1.9	2.5	3.0	2.8	2.9	2.6	1.1	1.2	1.2	1.2	1.3	2.6	3.4	3.1	1.7	2.2	1.9	1.7	2.7	3.5
Bankfull Cross Sectional Area (ft^2)	12.8	12.5	15.0	16.6	15.0	17.3	15.4	5.9	6.6	6.6	4.6	6.3	8.8	17.6	18.7	11.9	14.4	13.9	11.4	18.8	21.6
Bankfull Width/Depth Ratio	---	---	---	---	---	---	---	20.1	9.7	13.0	10.5	9.3	3.9	3.5	---	---	---	---	---	---	---
Bankfull Entrenchment Ratio	---	---	---	---	---	---	---	2.0	2.9	2.5	3.6	3.3	4.4	3.3	---	---	---	---	---	---	---
Bankfull Bank Height Ratio	---	---	---	---	---	---	---	1.0	1.0	<1.0	<1.0	1.0	1.3	2.1	---	---	---	---	---	---	---
	Cross-Section 16, UT2 Reach 2 (Riffle)							**Cross-Section 17, UT2 Reach 2 (Riffle)**							**Cross-Section 18, UT2 Reach 2 (Pool)**						
Dimension[1,2]	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**
Bankfull Elevation (ft)	2,535.0	2,535.0	2,535.0	2,535.4	2,535.5	2,535.3	2,535.6	2,531.2	2,531.2	2,531.2	2,531.2	2,531.3	2,532.0	2,531.9	2,530.4	2,530.4	2,530.4	2,530.0	2,530.4	2,530.5	2,530.6
Low Bank Elevation (ft)	2,535.0	2,535.0	2,535.1	2,535.5	2,535.6	2,535.7	2,535.7	2,531.2	2,531.2	2,531.2	2,531.2	2,531.3	2,531.7	2,531.6	2,530.4	2,579.7	2,530.1	2,530.0	2,530.4	2,530.5	2,530.6
Bankfull Width (ft)	8.9	10.0	6.9	8.7	6.4	7.1	6.9	12.8	12.9	13.6	12.6	11.2	10.4	10.9	19.3	19.5	21.4	8.5	8.8	7.3	9.6
Floodprone Width (ft)	>200	>200	>200	>39.5	>40.6	>42	>41	>200	>200	>200	>71.0	>71.0	>71.0	>71	---	---	---	---	---	---	---
Bankfull Mean Depth (ft)	0.5	0.5	0.4	0.6	0.8	1.0	0.7	0.9	0.9	0.9	1.0	1.0	0.8	0.8	0.8	0.8	0.8	1.0	1.0	1.1	1.0
Bankfull Max Depth (ft)	1.1	0.8	0.6	0.9	1.2	1.5	1.1	2.1	1.8	1.9	2.1	1.9	1.2	1.3	2.0	2.3	2.1	2.4	2.0	1.5	1.6
Bankfull Cross Sectional Area (ft^2)	4.2	5.0	2.8	4.9	4.8	6.7	4.6	12.0	12.0	12.0	12.0	11.4	8.3	8.8	15.8	16.3	16.9	8.9	8.5	8.4	9.5
Bankfull Width/Depth Ratio	19.2	19.9	17.1	15.6	8.5	7.4	10.5	13.6	13.8	15.4	13.2	11.0	13.0	13.5	---	---	---	---	---	---	---
Bankfull Entrenchment Ratio	>22.4	>20.0	>28.9	>4.5	>6.3	>6.0	>5.9	>15.7	>15.5	>14.7	>5.6	>6.3	>6.8	>6.5	---	---	---	---	---	---	---
Bankfull Bank Height Ratio	1.0	1.1	1.2	1.1	1.1	1.4	1.1	1.0	1.0	1.0	1.0	1.0	<1.0	<1.0	---	---	---	---	---	---	---

---: not applicable

[1]Prior to MY3, bankfull dimensions were calculated using a fixed bankfull elevation.

[2]MY3-MY5 Bank Height Ratio is 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 (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height. MY3 dimensions were updated in MY4.

Table 13a. Monitoring Data - Stream Reach Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle														
Bankfull Width (ft)	30.3	33.5	29.9	32.9	30.8	32.3	29.5	29.5	23.7	29.1	25.3	25.5	22.5	25.0
Floodprone Width (ft)	133	>200	135	>200	135	>200	>106	>215	>106	>215	>106	>215	>106	>215
Bankfull Mean Depth	1.6	1.8	1.6	1.7	1.6	1.7	1.8	1.9	1.9	2.3	2.1	2.4	1.8	3.0
Bankfull Max Depth	2.7	3.2	2.8	3.1	3.0	3.2	3.1	3.5	3.1	3.5	3.7	4.4	3.5	4.5
Bankfull Cross-sectional Area (ft^2)	52.2	53.5	49.8	51.8	52.2	52.8	53.6	55.9	54.7	55.6	54.2	61.8	44.3	67.0
Width/Depth Ratio	17.1	21.4	18	20.9	18	20	15.6	16.3	10.3	15.3	10.5	11.8	7.6	14.1
Entrenchment Ratio	4.4	>6.0	4.5	>6.1	4.4	>6.2	>3.6	>6.9	>3.6	>9.1	>4.2	>8.4	>4.2	>9.5
Bank Height Ratio	0.8	1.0	0.8	1.0	0.9	1.0	1.0		1.0		1.0	1.1	<1.0	1.2
D50 (mm)	50.7		56.9		45.0		48.5		26.9		45.0		42.5	
Profile														
Riffle Length (ft)	28	81	21	47	32	76	12	50	20	96	33	70	28	65
Riffle Slope (ft/ft)	0.0040	0.0275	0.0064	0.0283	0.0052	0.0183	0.0029	0.0191	0.0067	0.0280	0.0013	0.0205	0.0032	0.0248
Pool Length (ft)	44	96	66	176	49	177	58	176	63	166	36	182	42	216
Pool Max Depth (ft)	3.5	5.8	3.0	4.7	3.9	6.2	4.2	5.8	4.1	6.4	3.9	6.5	3.6	6.5
Pool Spacing (ft)	71	191	77	224	94	210	81	225	73	223	83	213	82	226
Pool Volume (ft^3)														
Pattern														
Channel Beltwidth (ft)	45	154												
Radius of Curvature (ft)	60	96												
Rc:Bankfull Width (ft/ft)	2.0	2.9												
Meander Wave Length (ft)	207	313												
Meander Width Ratio	1.5	4.6												
Additional Reach Parameters														
Rosgen Classification	C4		C4		C4		C4		C4		C4		C4	
Channel Thalweg Length (ft)	1,444		1,444		1,444		1,444		1,444		1,444		1,444	
Sinuosity (ft)	1.22													
Water Surface Slope (ft/ft)	0.0049		0.0049		0.0050		0.0049		0.0060		0.0054		0.0057	
Bankfull Slope (ft/ft)	0.0051		0.0043		0.0045		0.0048		0.0059		0.0054		0.0044	
Ri%/Ru%/P%/G%/S%														
SC%/Sa%/G%/C%/B%/Be%														
d16/d35/d50/d84/d95/d100	0.22/0.48/2.0/88/147/362		0.22/3.4/22/81/123/362		0.13/0.38/11/789/180/1024		0.35/7.45/16/90/128/180		0.1/0.2/8.7/77.7/113.6/180		0.4/1.8/23.8/87.8/151.8/1024		0.9/6.6/19.0/90.6/152.4/512	
% of Reach with Eroding Banks	0%		0%		1%		3%		6%		2%		2%	

Table 13b. Monitoring Data - Stream Reach Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 2a

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle														
Bankfull Width (ft)	29.1	30.7	29.3	31.3	28.5	31.0	31.0	31.4	27.9	31.5	25.4	29.2	24.4	31.2
Floodprone Width (ft)	>200		>200		>200		>90	>189	>79.5	>189	>93	>189	>93	>189
Bankfull Mean Depth	1.6	1.9	1.6	1.8	1.8	1.9	1.9	2.0	2.2	2.6	2.5	2.8	2.3	2.7
Bankfull Max Depth	2.6	3.9	2.6	3.6	2.9	3.5	3.6	3.9	4.1	5.4	3.6	4.4	3.6	4.3
Bankfull Cross-sectional Area (ft^2)	46.6	56.9	46.4	56.7	49.8	58.2	57.8	63.1	62.6	82.3	71.1	72.2	66.8	73.1
Width/Depth Ratio	16.6	18.1	17.2	18.5	16.2	16.5	15.6	16.6	12.0	12.5	9.1	11.8	8.9	13.3
Entrenchment Ratio	>6.5	>6.9	>6.4	>6.8	>6.5	>7.0	>2.9	>6.1	>2.5	>6.8	>3.2	>7.4	>3.0	>7.0
Bank Height Ratio	1.0		1.0		1.0		1.1		1.2		1.2	1.3	1.2	
D50 (mm)	87.6		72.4		75.9		85.0		72.1		64.0		74.8	
Profile														
Riffle Length (ft)	38	68	19	49	27	55	26	54	29	60	22	55	14	62
Riffle Slope (ft/ft)	0.0101	0.0274	0.0112	0.0471	0.0143	0.0280	0.0139	0.0300	0.0065	0.0316	0.0015	0.0247	0.0177	0.0238
Pool Length (ft)	39	109	39	145	66	186	84	178	77	218	69	185	87	214
Pool Max Depth (ft)	4.7	5.8	4.3	6.6	4.0	6.7	4.3	6.0	4.2	6.7	4.7	7.5	4.3	8.5
Pool Spacing (ft)	132	206	78	206	121	279	57	263	96	268	74	252	89	303
Pool Volume (ft^3)														
Pattern														
Channel Beltwidth (ft)	48	108												
Radius of Curvature (ft)	63	77												
Rc:Bankfull Width (ft/ft)	2.2	2.5												
Meander Wave Length (ft)	288	337												
Meander Width Ratio	1.6	3.5												
Additional Reach Parameters														
Rosgen Classification	C4		C4		C4		C4		C4		C4		C4	
Channel Thalweg Length (ft)	1,083		1,083		1,083		1,083		1,083		1,083		1,083	
Sinuosity (ft)	1.24													
Water Surface Slope (ft/ft)	0.0072		0.0073		0.0075		0.0074		0.0076		0.0076		0.0082	
Bankfull Slope (ft/ft)	0.0074		0.0059		0.0067		0.0070		0.0070		0.0073		0.0073	
Ri%/Ru%/P%/G%/S%														
SC%/Sa%/G%/C%/B%/Be%														
d16/d35/d50/d84/d95/d100	0.22/1.0/38/112/161/256		0.29/11/36/90/157/1024		0.21/12.5/523/121/168/1024		0.32/6.7/49.8/136/274/512		0.2/0.6/24.7/103.6/161.1/256		0.3/12.8/45/153.5/227.6/362		0.4/8.2/24.2/116.6/203.6/512	
% of Reach with Eroding Banks	0%		0%		2%		3%		5%		3%		3%	

Table 13c. Monitoring Data - Stream Reach Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 2b

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle														
Bankfull Width (ft)	28.7	31.9	29.8	30.7	29.3	29.4	30.3	31.2	31.8	32.7	28.8	29.8	26.8	29.2
Floodprone Width (ft)	>200		>200		>200		>110	>121	>110	>121	>110	>121	>110	>121
Bankfull Mean Depth	2.0	2.1	2.0	2.1	2.0	2.1	2.2	2.3	2.3	2.4	2.6	2.7	2.5	2.9
Bankfull Max Depth	3.1	3.4	3.2	3.6	3.0	3.4	3.7	4.2	3.9	4.5	4.2	4.7	4.0	4.6
Bankfull Cross-sectional Area (ft^2)	58.8	64.2	61.2	62.3	59.8	60.2	67.4	68.3	74.3	77.5	76.6	77.4	73.9	77.7
Width/Depth Ratio	14.0	15.9	14.5	15.2	14.2	14.4	13.5	14.4	13.1	14.3	10.9	11.5	9.3	11.5
Entrenchment Ratio	>6.3	>7	>6.5	>6.7	>6.8	>6.9	>3.5	>4.0	>3.4	>3.8	>3.8	>4.1	>3.8	>4.5
Bank Height Ratio	1.0		1.0		1.0		1.0	1.1	1.1	1.2	1.1	1.2	1.1	1.2
D50 (mm)	47.4		72.0		70.2		62.1		65.7		56.1		47.7	
Profile														
Riffle Length (ft)	30	132	26	102	26	44	35	59	28	85	20	52	49	55
Riffle Slope (ft/ft)	0.0055	0.0236	0.0169	0.0254	0.0116	0.0177	0.0040	0.0133	0.0070	0.0242	0.0062	0.0218	0.0024	0.0227
Pool Length (ft)	41	99	55	153	26	149	24	152	76	140	55	152	71	151
Pool Max Depth (ft)	2.6	5.4	3.8	6.3	3.7	5.0	3.6	5.5	4.3	6.8	4.4	6.6	5.1	5.9
Pool Spacing (ft)	88	190	12	129	8	175	69	162	80	287	52	191	51	196
Pool Volume (ft^3)														
Pattern														
Channel Beltwidth (ft)	89													
Radius of Curvature (ft)	82	124												
Rc:Bankfull Width (ft/ft)	2.9	3.9												
Meander Wave Length (ft)	334	329												
Meander Width Ratio	3.1													
Additional Reach Parameters														
Rosgen Classification	C4		C4		C4		C4		C4		C4		C4	
Channel Thalweg Length (ft)	493		493		493		493		493		493		493	
Sinuosity (ft)	1.04													
Water Surface Slope (ft/ft)	0.0118		0.0101		0.0082		0.0105		0.0121		0.0118		0.0123	
Bankfull Slope (ft/ft)	0.0101		0.0107		0.0103		0.0102		0.0101		0.0096		0.0114	
Ri%/Ru%/P%/G%/S%														
SC%/Sa%/G%/C%/B%/Be%														
d16/d35/d50/d84/d95/d100	0.38/22/47/122/209/362		0.22/10/29/111/171/362		0.3/8.0/29.0/107.3/180/362		0.71/5.6/28/93/152/512		0.2/1.0/8.9/94.5/136.1/256		0.4/2.0/22.6/107.3/168.1/362		1.3/6.4/14.4/132.1/208.8/362	
% of Reach with Eroding Banks	0%		0%		0%		3%		6%		7%		10%	

Table 13d. Monitoring Data - Stream Reach Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

UT2 Reach 1 Lower

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle														
Bankfull Width (ft)	8.1		8.4		8.6		8.9		7.1		4.9		5.8	
Floodprone Width (ft)	28.4		30.0		30.0		31.4		29.5		32.7		34.1	
Bankfull Mean Depth	0.6		0.7		0.6		0.7		0.6		1.0		0.9	
Bankfull Max Depth	1.0		1.3		1.2		1.4		1.2		1.5		1.8	
Bankfull Cross-sectional Area (ft^2)	5.1		5.7		5.4		5.9		4.4		4.9		5.4	
Width/Depth Ratio	13.0		12.5		13.9		13.4		11.5		4.8		6.2	
Entrenchment Ratio	3.5		3.6		3.5		3.5		4.2		6.7		5.9	
Bank Height Ratio	1.0		1.0		0.9		1.1		<1.0		1.0		1.0	
D50 (mm)	56.9		39.8		38.7		43.8		42.9		26.3		35.6	
Profile														
Riffle Length (ft)	11	25	13	39	5	24	6	20	10	22	6	38	7	53
Riffle Slope (ft/ft)	0.0360	0.0853	0.0136	0.0730	0.0253	0.0793	0.0109	0.0624	0.0234	0.0884	0.0255	0.1066	0.0081	0.1588
Pool Length (ft)	5	22	2	15	4	17	5	21	2	25	3	18	5	37
Pool Max Depth (ft)	1.9	5.0	1.0	2.9	2.0	3.8	1.1	3.5	1.4	2.6	0.9	2.5	1.1	3.2
Pool Spacing (ft)	7	34	8	52	6	53	6	34	7	140	5	69	5	117
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	B4a		B4a		B4a		B4a		B4a		B4a		B4a	
Channel Thalweg Length (ft)	433		433		433		433		433		433		433	
Sinuosity (ft)	1.05													
Water Surface Slope (ft/ft)	0.0560		0.0477		0.0481		0.0475		0.0502		0.0509		0.0455	
Bankfull Slope (ft/ft)	0.0563		0.0483		0.0485		0.0455		0.0451		0.0484		0.0461	
Ri%/Ru%/P%/G%/S%														
SC%/Sa%/G%/C%/B%/Be%														
d16/d35/d50/d84/d95/d100	0.25/11/28/96/143/256		6.1/14/23/75/153/256		0.7/11/28/76/118/256		1.2/18/37/113/180/362		1.6/23.8/35.1/94.3/122.1/256		17.7/34.1/47.3/123/175/362		6.3/17.7/29.8/131.7/180/256	
% of Reach with Eroding Banks	0%		6%		2%		1%		6%		6%		8%	

Table 13e. Monitoring Data - Stream Reach Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

UT2 Reach 2

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle														
Bankfull Width (ft)	8.9	12.8	8.0	12.9	6.9	13.6	6.9	12.6	6.4	11.2	5.9	10.4	6.9	10.9
Floodprone Width (ft)	22	>200	23	>200	24	>200	25	>71	25	>71	26	>71	26	26
Bankfull Mean Depth	0.5	0.9	0.5	0.9	0.4	0.9	0.6	1.0	0.8	1.0	0.8	1.5	0.7	2.3
Bankfull Max Depth	1.1	2.1	0.8	1.8	0.6	1.9	0.9	2.1	1.2	1.9	1.2	2.6	1.1	3.4
Bankfull Cross-sectional Area (ft^2)	4.2	12.0	5.0	12.0	2.8	12.0	4.6	12.0	4.8	11.4	6.7	8.8	4.6	17.6
Width/Depth Ratio	13.6	20.1	9.7	19.9	13.0	17.1	10.5	15.6	8.5	11.0	3.9	13.0	3.5	13.5
Entrenchment Ratio	2.0	>22.4	2.9	>20.0	2.5	>28.9	3.6	>5.6	3.3	>6.3	4.4	>6.8	3.3	>6.5
Bank Height Ratio	1.0		1.0		0.9	1.2	<1.0	1.1	1.0	1.1	1.3	1.4	<1.0	2.1
D50 (mm)	44	53	15	90	34.5	34.8	45.0	48.2	32.0	39.3	29.8	36.4	22.0	27.9
Profile														
Riffle Length (ft)	17	29	10	36	5	62	4	68	6	36	6	56	4	31
Riffle Slope (ft/ft)	0.0262	0.0575	0.0141	0.0658	0.0093	0.0773	0.0122	0.1161	0.0111	0.0725	0.0046	0.0811	0.0063	0.0895
Pool Length (ft)	13	46	4	40	6	35	4	39	6	67	6	41	4	52
Pool Max Depth (ft)	1.6	3.2	1.5	3.8	1.1	4.6	1.9	4.8	1.5	3.2	1.6	3.7	1.5	3.7
Pool Spacing (ft)	24	98	8	113	10	207	7	156	3	162	15	160	4	156
Pool Volume (ft^3)														
Pattern														
Channel Beltwidth (ft)	61	66												
Radius of Curvature (ft)	19	63												
Rc:Bankfull Width (ft/ft)	2.1	4.9												
Meander Wave Length (ft)	105	135												
Meander Width Ratio	7	5												
Additional Reach Parameters														
Rosgen Classification	C4b		C4b		C4b		C4b		C4b		C4b		C4b	
Channel Thalweg Length (ft)	1,318		1,318		1,318		1,318		1,318		1,318		1,318	
Sinuosity (ft)	1.2													
Water Surface Slope (ft/ft)	0.0231		0.0225		0.0235		0.0237		0.0240		0.0249		0.0248	
Bankfull Slope (ft/ft)	0.0237		0.0214		0.0245		0.0247		0.0241		0.0232		0.0235	
Ri%/Ru%/P%/G%/S%														
SC%/Sa%/G%/C%/B%/Be%														
d16/d35/d50/d84/d95/d100	0.25/11/28/96/143/256		6.1/14/23/75/153/256		0.7/11/28/76/118/256		1.2/18/37/113/180/362		1.6/23.8/35.1/94.3/122.1/256		17.7/34.1/47.3/123/175/362		6.3/17.7/29.8/131.7/180/256	
% of Reach with Eroding Banks	0%		0%		4%		7%		2%		4%		5%	

Table 13f. Monitoring Data - Stream Reach Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

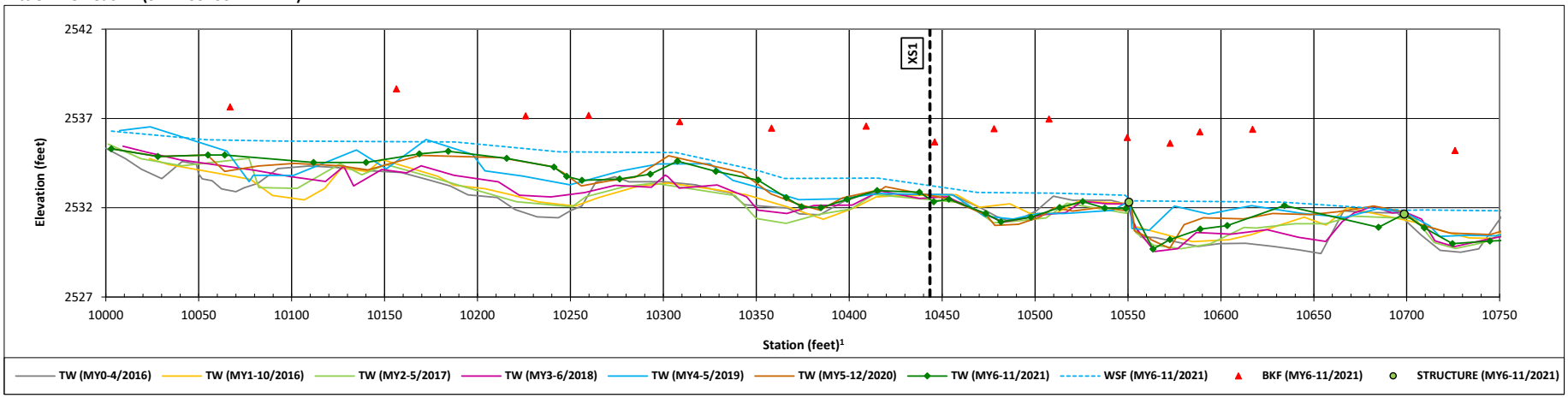
UT2b

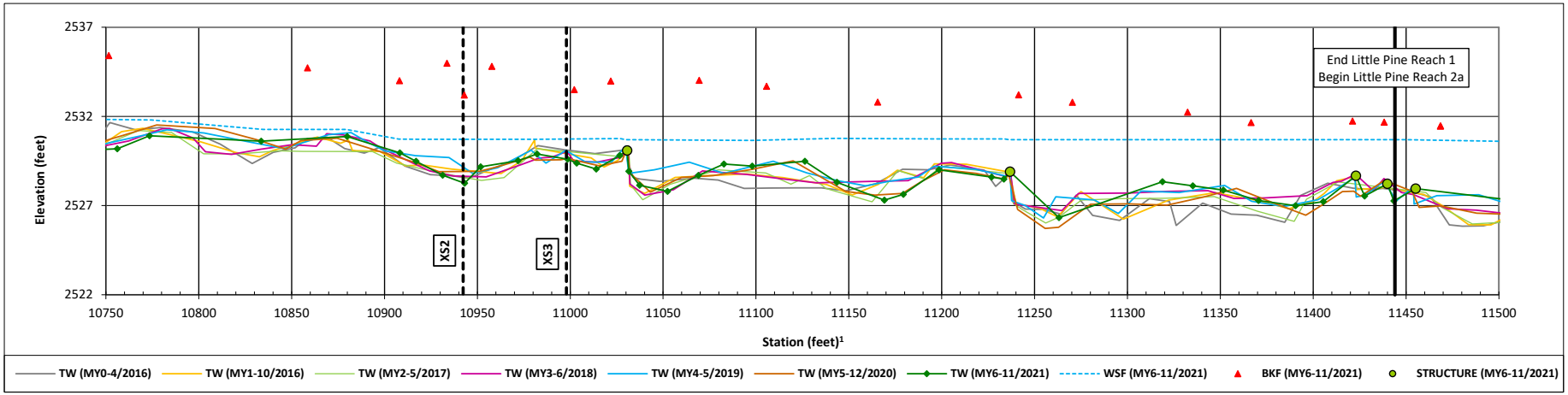
Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle														
Bankfull Width (ft)	6.7		6.3		6.6		6.3		6.4		3.2		3.4	
Floodprone Width (ft)	15.9		17.7		17.9		14.3		14.1		14.9		14.2	
Bankfull Mean Depth	0.5		0.7		0.7		0.5		0.4		0.5		0.4	
Bankfull Max Depth	0.9		1.1		1.1		0.8		0.8		0.8		0.8	
Bankfull Cross-sectional Area (ft^2)	3.7		4.3		4.5		3.0		2.3		1.5		1.4	
Width/Depth Ratio	12.2		9.1		9.6		13.2		17.9		6.7		7.8	
Entrenchment Ratio	2.4		2.8		2.7		2.3		2.2		4.7		4.2	
Bank Height Ratio	1.0		1.0		0.9		<1.0		<1.0		<1.0		<1.0	
D50 (mm)	43.0		35.9		32.0		23.5		24.4		10.5		20.7	
Profile														
Riffle Length (ft)	4	23	7	24	7	25	6	32	5	21	4	45	5	46
Riffle Slope (ft/ft)	0.0448	0.0659	0.0276	0.0451	0.0127	0.0702	0.0125	0.0494	0.0117	0.0394	0.0160	0.0499	0.0007	0.0422
Pool Length (ft)	3	14	3	8	4	15	3	11	3	9	3	12	4	11
Pool Max Depth (ft)	0.6	2.1	2.0	3.9	0.8	3.8	0.9	4.0	0.7	3.5	1.0	3.3	1.0	3.2
Pool Spacing (ft)	3	33	4	30	3	30	2	32	3	30	2	30	5	52
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	B4a		B4a		B4a		B4a		B4a		B4a		B4a	
Channel Thalweg Length (ft)	253		253		253		253		253		253		253	
Sinuosity (ft)	1.10													
Water Surface Slope (ft/ft)	0.0616		0.0614		0.0557		0.0608		0.0610		0.0591		0.0621	
Bankfull Slope (ft/ft)	0.0536		0.0608		0.0612		0.0612		0.0602		0.0599		0.0604	
Ri%/Ru%/P%/G%/S%														
SC%/Sa%/G%/C%/B%/Be%														
d16/d35/d50/d84/d95/d100	0.78/29/42/85/123/180		0.28/7.4/23/82/128/362		0.5/13/26/87/143/256		0.50/6.7/14/100/161/256		8.9/20.6/29.8/81.3/119.3/180		5.3/17.5/32.4/101.8/158.7/256		11/11.6/18.2/76.6/135.9/180	
% of Reach with Eroding Banks	0%		0%		0%		0%		0%		4%		4%	

Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 1 (STA 100+00 - 114+44)





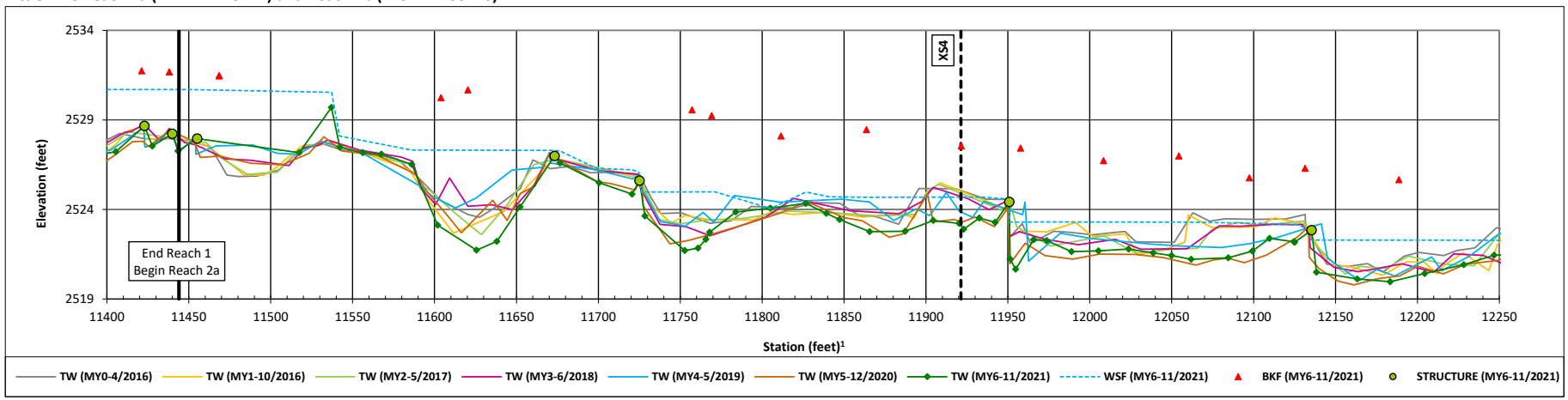
[1] Profile stationing derived from as-built thalweg alignment.

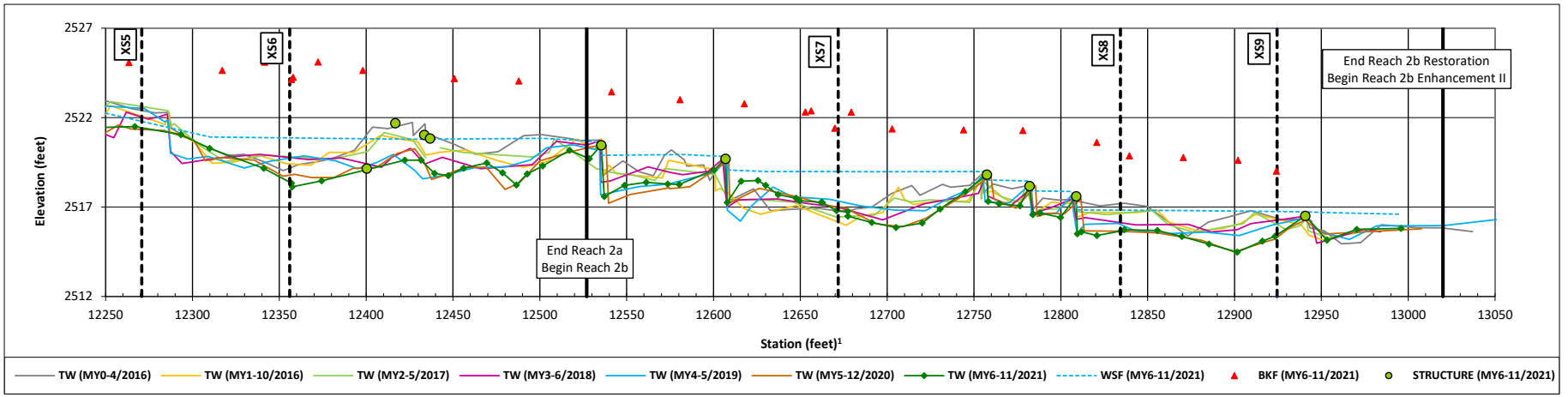
[2] Stream repairs completed in fall 2020 on Little Pine Creek Reach 1 (STA 100+43 to 101+75) and Reach 2a (STA 121+25 to 122+50).

Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 2a (114+44-125+27) and Reach 2b (125+27-130+20)





[1] Profile stationing derived from as-built thalweg alignment.

[2] Stream repairs completed in fall 2020 on Little Pine Creek Reach 1 (STA 100+43 to 101+75) and Reach 2a (STA 121+25 to 122+50).

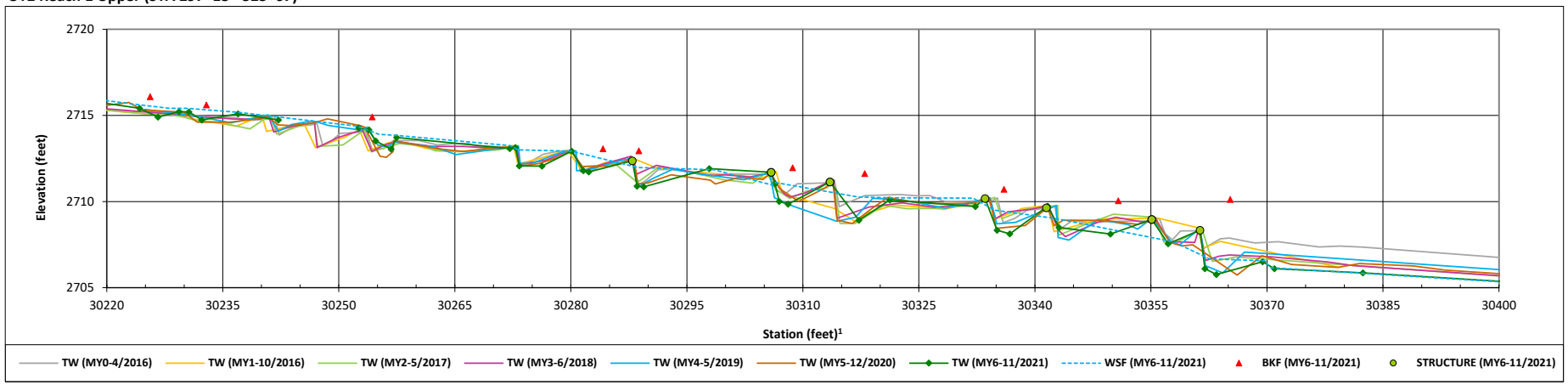
Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

UT2 Reach 1 Upper (STA 297+18 - 325+67)



[1] Profile stationing derived from as-built thalweg alignment.

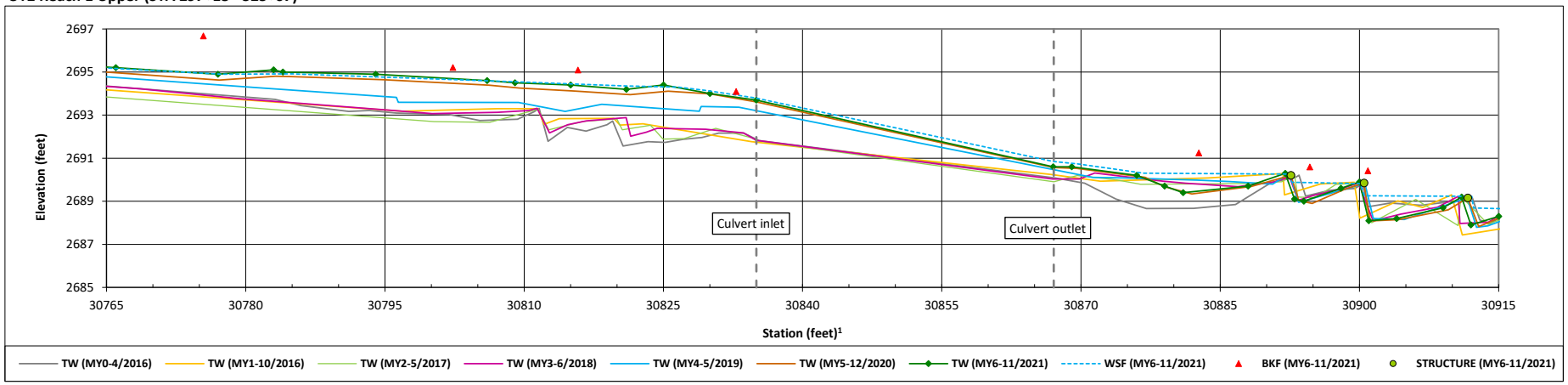
Longitudinal Profile Plots

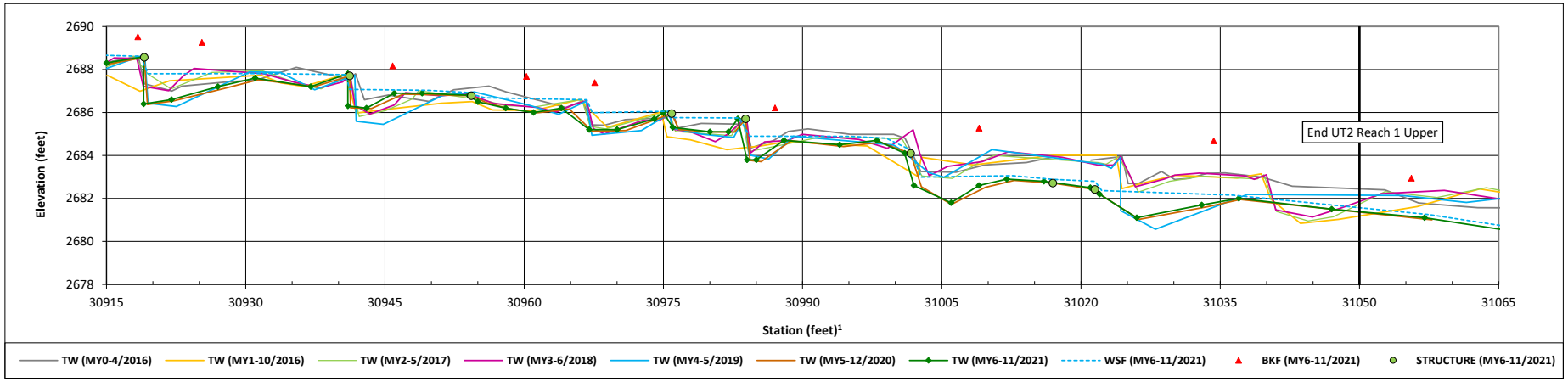
Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

UT2 Reach 1 Upper (STA 297+18 - 325+67)





[1] Profile stationing derived from as-built thalweg alignment.

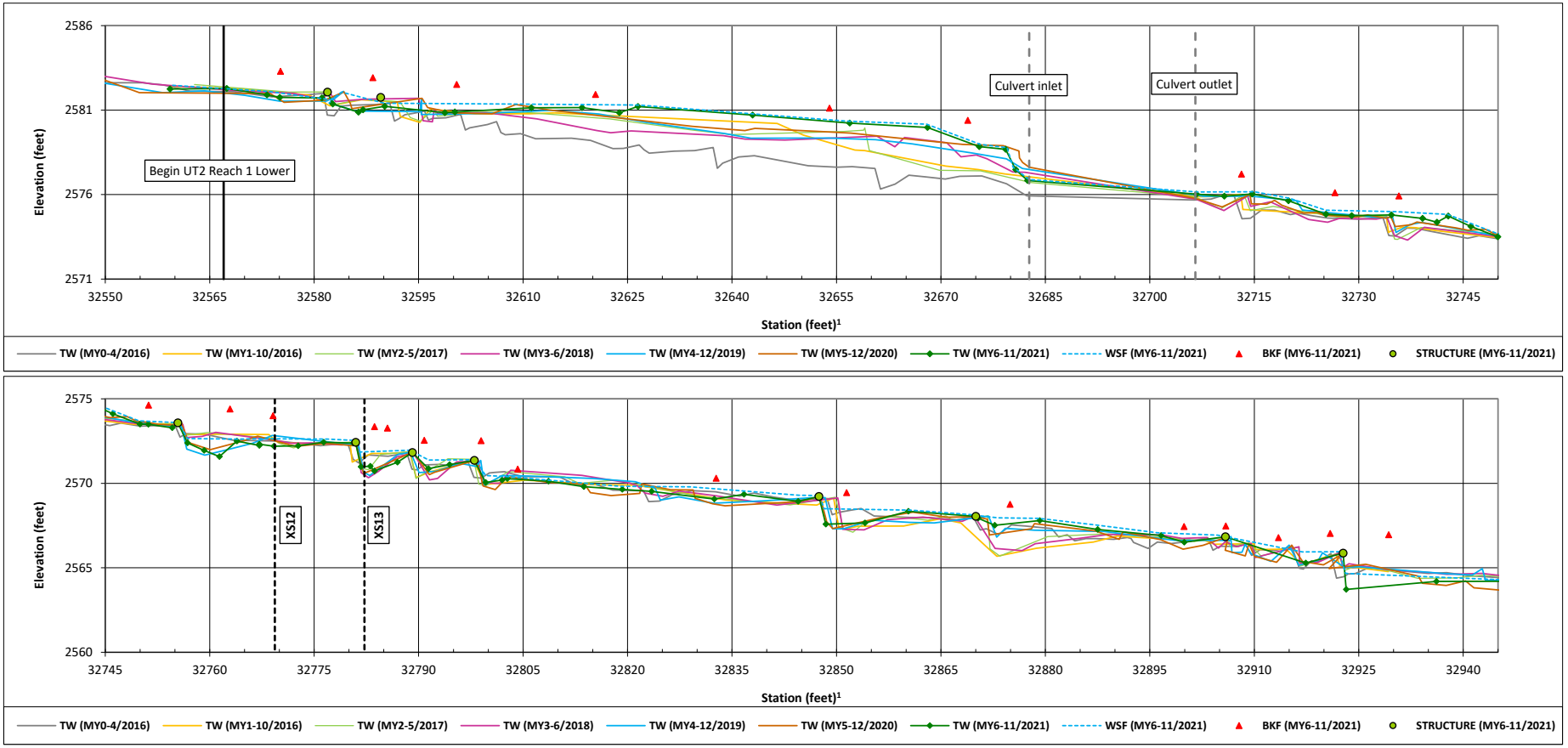
Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

UT2 Reach 1 Lower (STA 325+67 - 330+00)



[1] Profile stationing derived from as-built thalweg alignment.

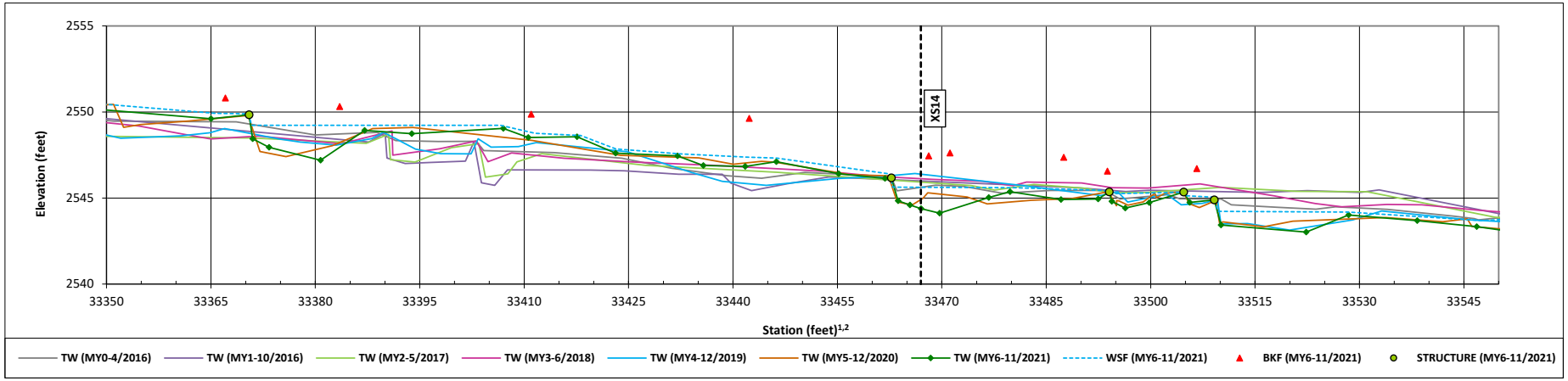
Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

UT2 Reach 2 (STA 330+00 - 343+18)



[1] Profile stationing derived from as-built thalweg alignment.

[2] Stream repairs completed in September 2019 on UT2 Reach 2 STA 332+25 to 339+15.

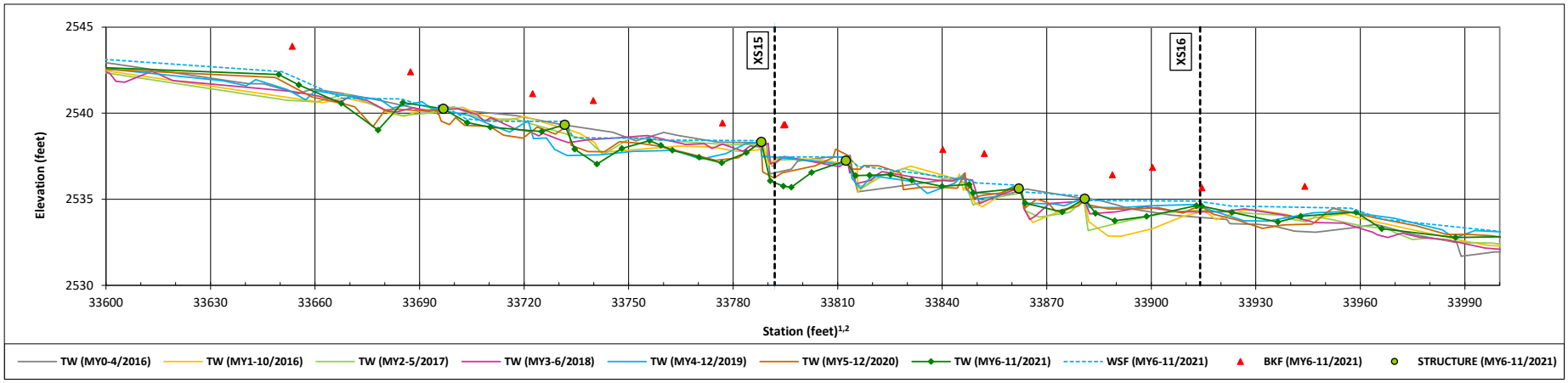
Longitudinal Profile Plots

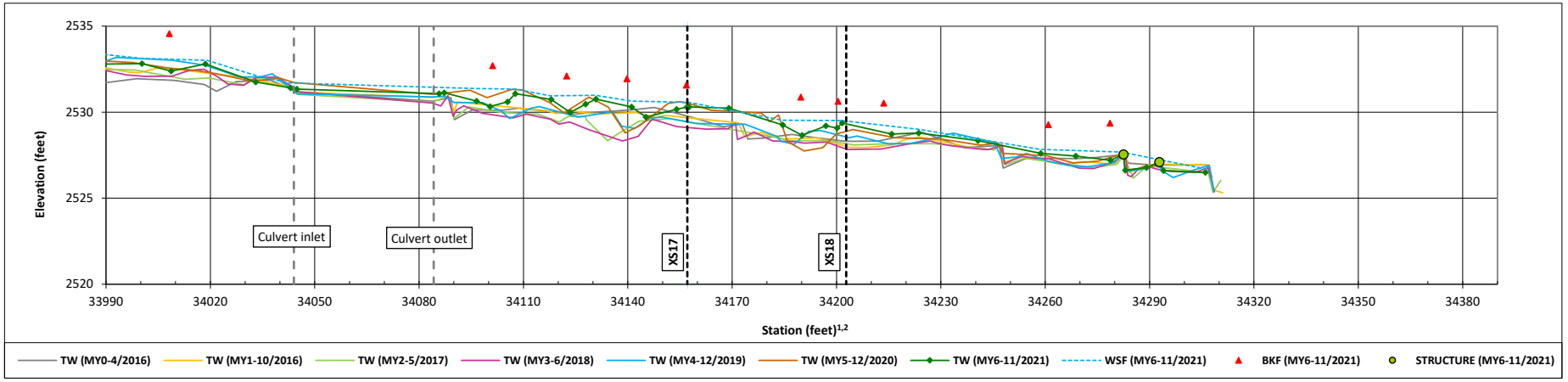
Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

UT2 Reach 2 (STA 330+00 - 343+18)





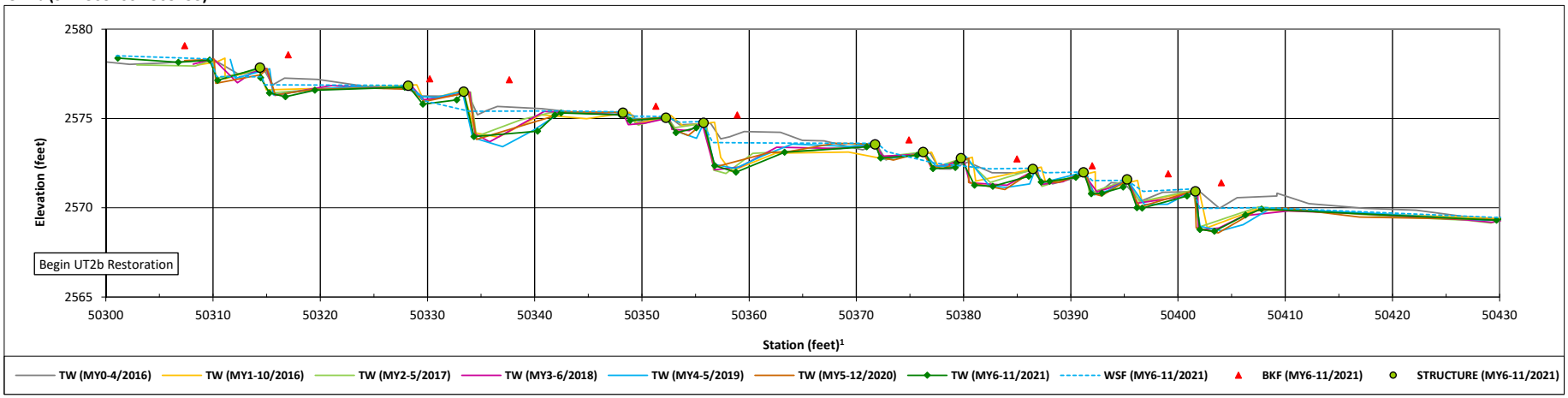
[1] Profile stationing derived from as-built thalweg alignment.

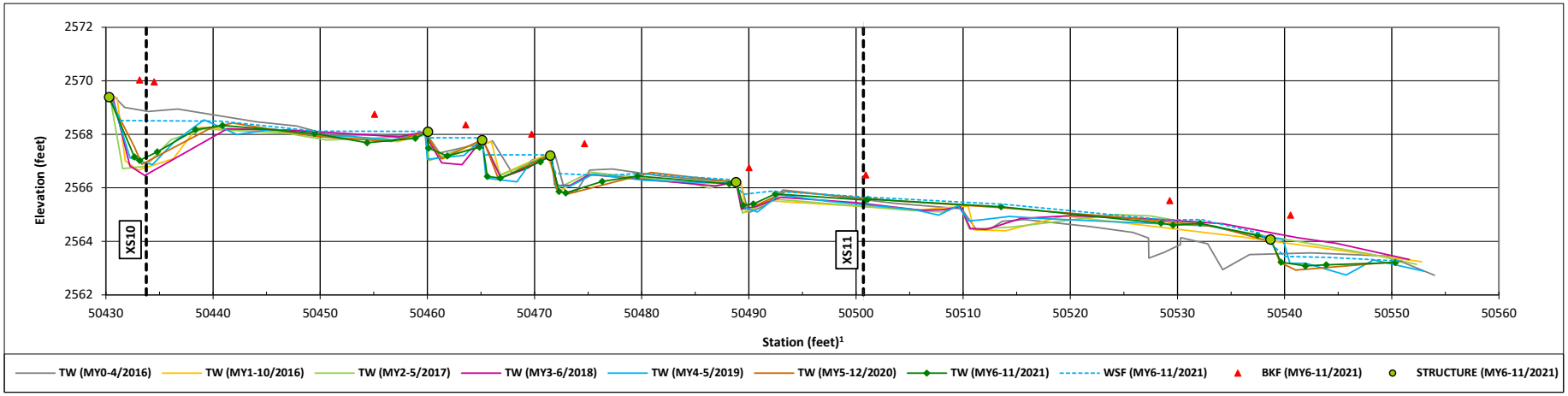
[2] Stream repairs completed in September 2019 on UT2 Reach 2 STA 332+25 to 339+15.

Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

UT2b (STA 503+00 - 505+53)





[1] Profile stationing derived from as-built thalweg alignment.

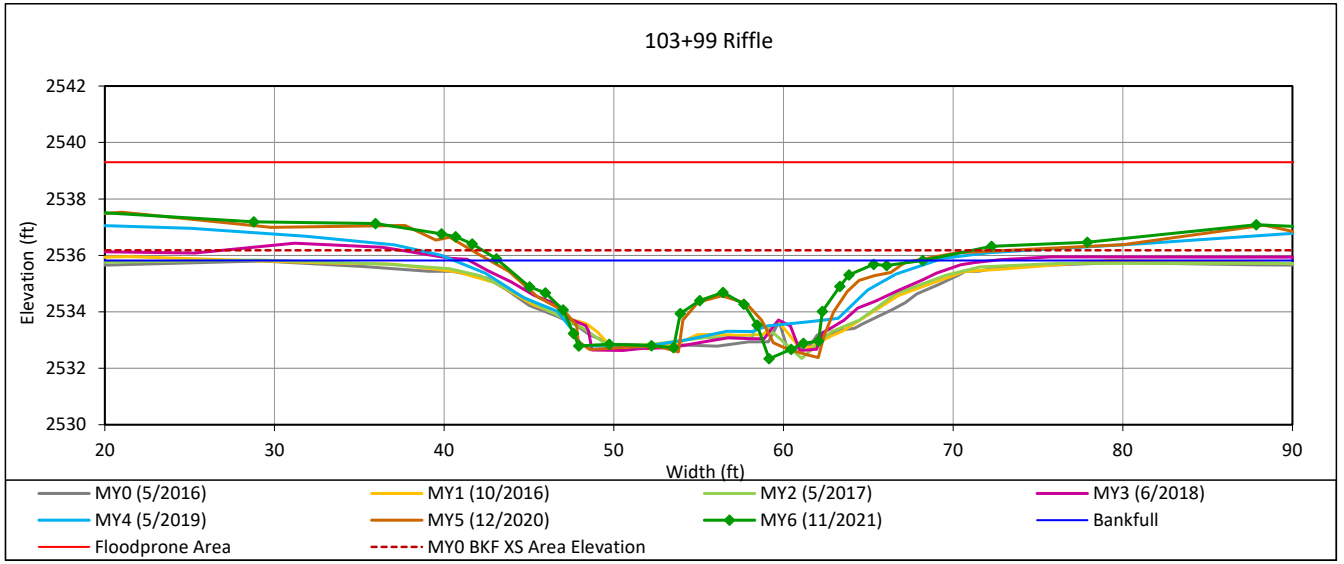
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 1- Little Pine Reach 1



Bankfull Dimensions	
44.3	x-section area (ft.sq.)
25.0	width (ft)
1.8	mean depth (ft)
3.5	max depth (ft)
29.5	wetted perimeter (ft)
1.5	hydraulic radius (ft)
14.1	width-depth ratio
105.5	W flood prone area (ft)
4.2	entrenchment ratio
0.9	low bank height ratio

Survey Date: 11/2021

Field Crew: Wildlands Engineering

View Downstream

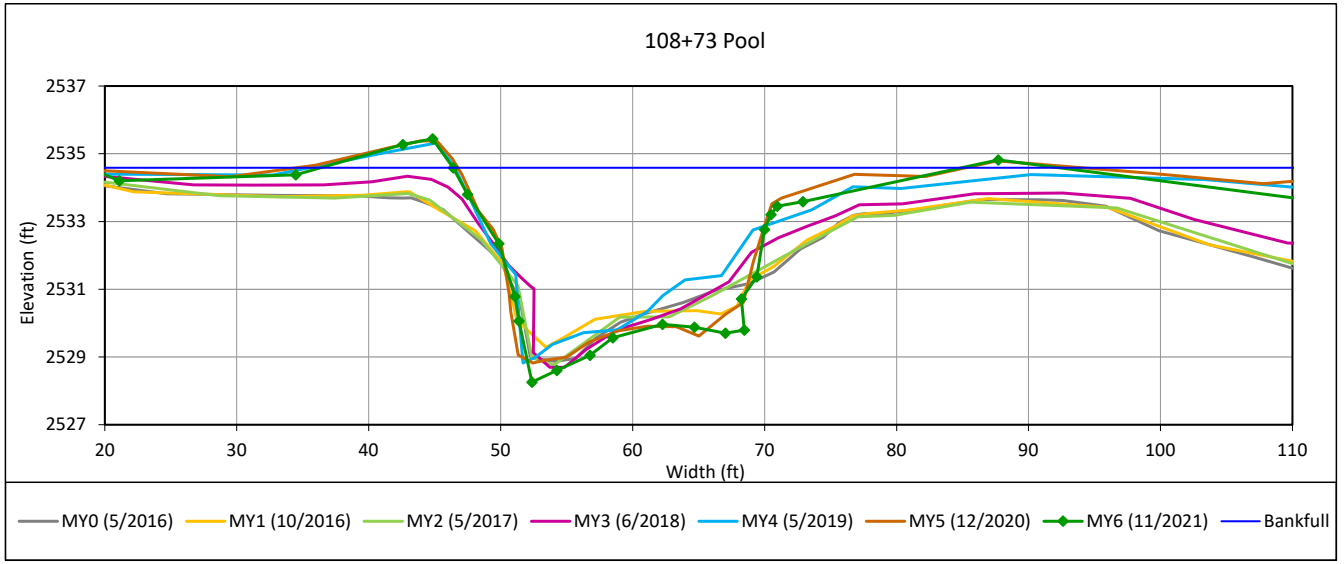
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 2- Little Pine Reach 1



Bankfull Dimensions	
103.2	x-section area (ft.sq.)
24.6	width (ft)
4.2	mean depth (ft)
6.3	max depth (ft)
30.2	wetted perimeter (ft)
3.4	hydraulic radius (ft)
5.8	width-depth ratio

Survey Date: 11/2021

Field Crew: Wildlands Engineering

View Downstream

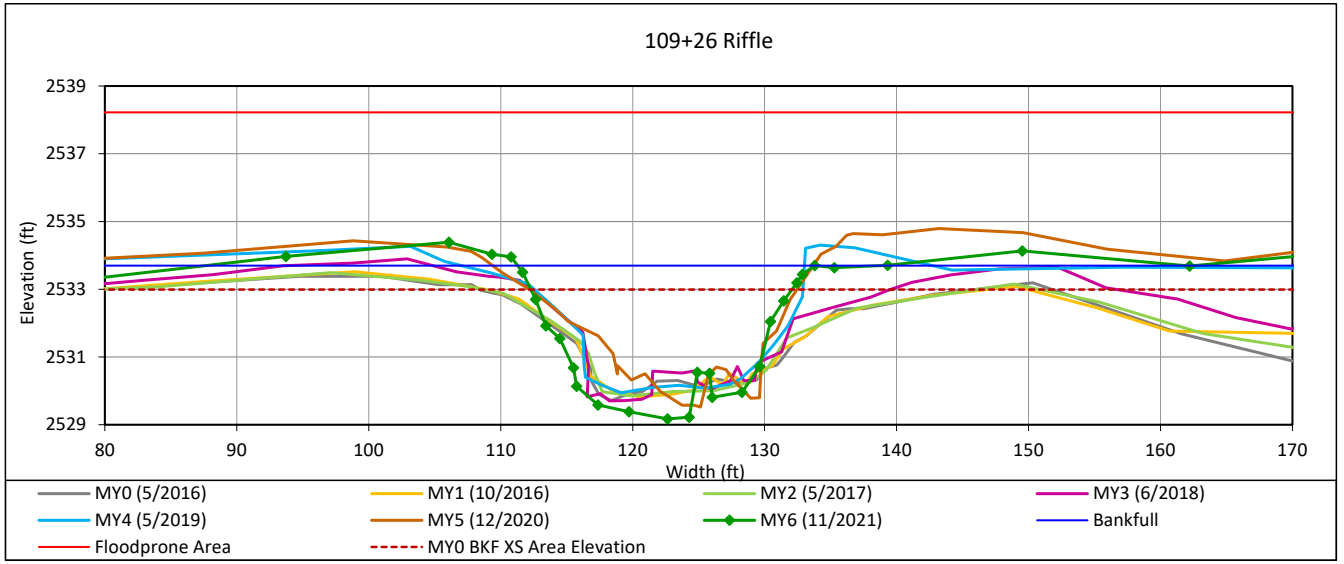
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 3- Little Pine Reach 1



Bankfull Dimensions	
67.0	x-section area (ft.sq.)
22.5	width (ft)
3.0	mean depth (ft)
4.5	max depth (ft)
26.7	wetted perimeter (ft)
2.5	hydraulic radius (ft)
7.6	width-depth ratio
214.1	W flood prone area (ft)
9.5	entrenchment ratio
1.2	low bank height ratio

Survey Date: 11/2021

Field Crew: Wildlands Engineering

View Downstream

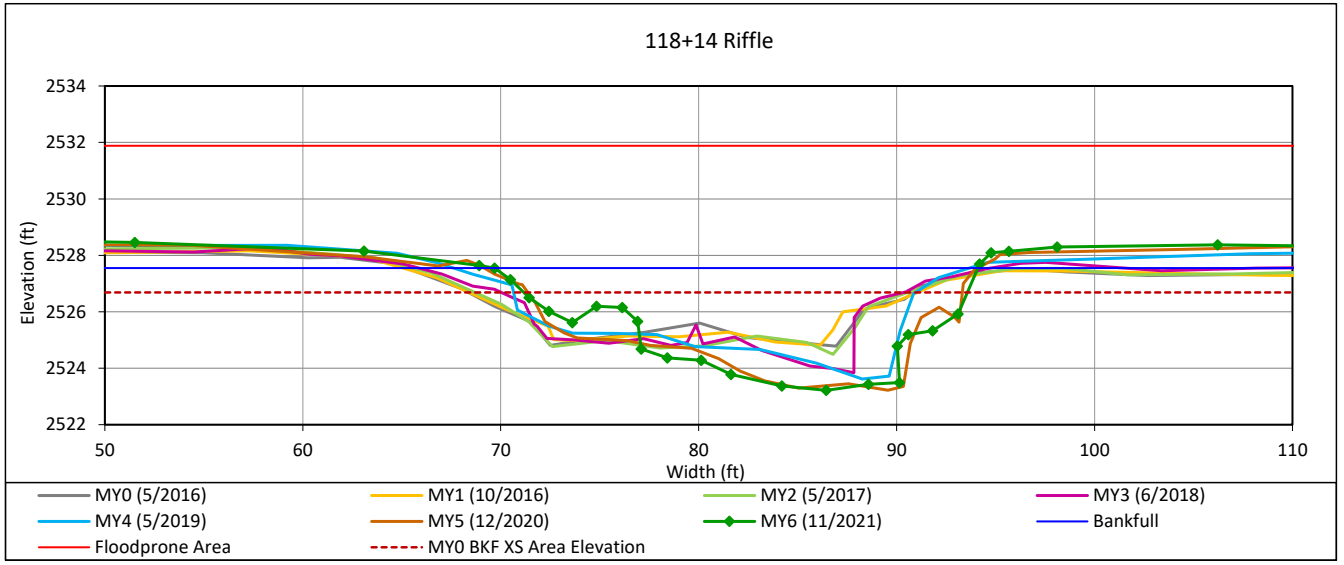
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 4 - Little Pine Reach 2a



Bankfull Dimensions	
66.8	x-section area (ft.sq.)
24.4	width (ft)
2.7	mean depth (ft)
4.3	max depth (ft)
28.7	wetted perimeter (ft)
2.3	hydraulic radius (ft)
8.9	width-depth ratio
188.7	W flood prone area (ft)
7.7	entrenchment ratio
1.2	low bank height ratio

Survey Date: 11/2021

Field Crew: Wildlands Engineering

View Downstream

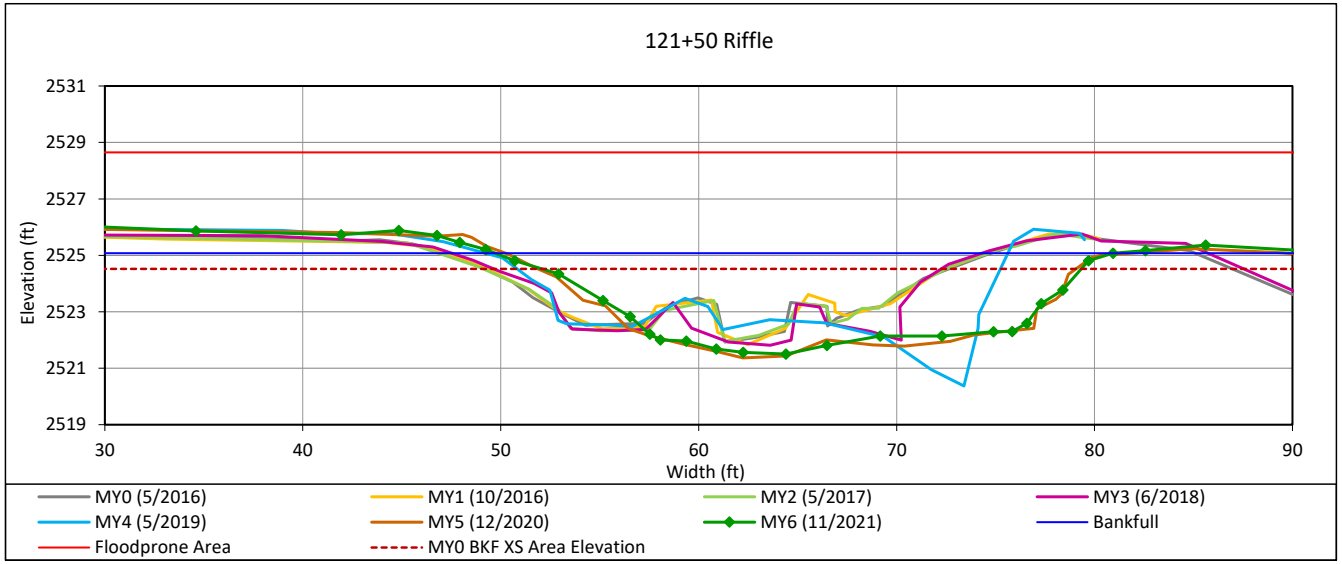
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 5- Little Pine Reach 2a



Bankfull Dimensions	
73.1	x-section area (ft.sq.)
31.2	width (ft)
2.3	mean depth (ft)
3.6	max depth (ft)
32.7	wetted perimeter (ft)
2.2	hydraulic radius (ft)
13.3	width-depth ratio
93.1	W flood prone area (ft)
3.0	entrenchment ratio
1.2	low bank height ratio

Survey Date: 11/2021

Field Crew: Wildlands Engineering

View Downstream

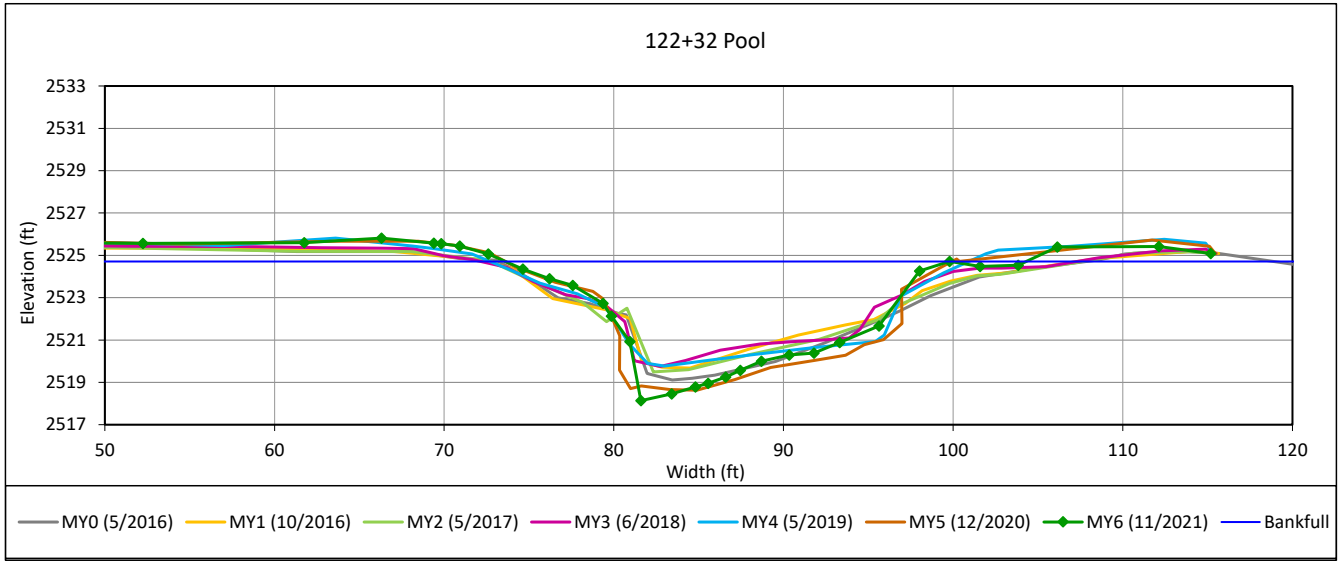
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 6- Little Pine Reach 2a



Bankfull Dimensions	
86.8	x-section area (ft.sq.)
26.2	width (ft)
3.3	mean depth (ft)
6.6	max depth (ft)
31.2	wetted perimeter (ft)
2.8	hydraulic radius (ft)
7.9	width-depth ratio

Survey Date: 11/2021

Field Crew: Wildlands Engineering

View Downstream

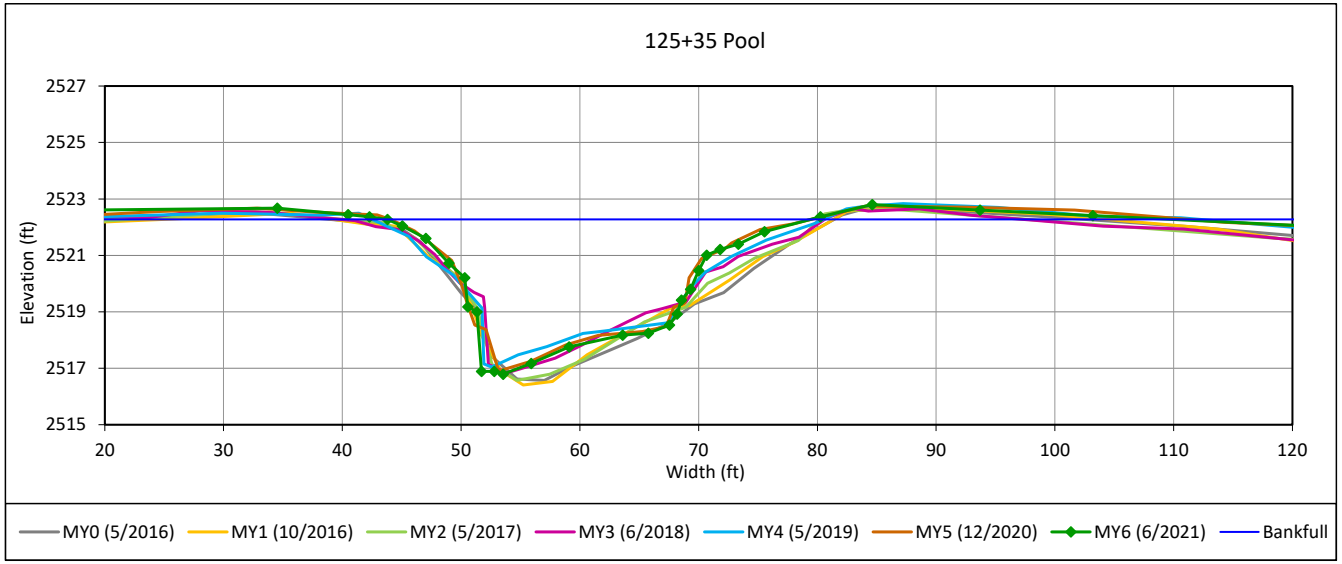
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 7 - Little Pine Reach 2b



Bankfull Dimensions	
94.0	x-section area (ft.sq.)
29.5	width (ft)
3.2	mean depth (ft)
5.5	max depth (ft)
33.6	wetted perimeter (ft)
2.8	hydraulic radius (ft)
9.3	width-depth ratio

Survey Date: 6/2021

Field Crew: Wildlands Engineering

View Downstream

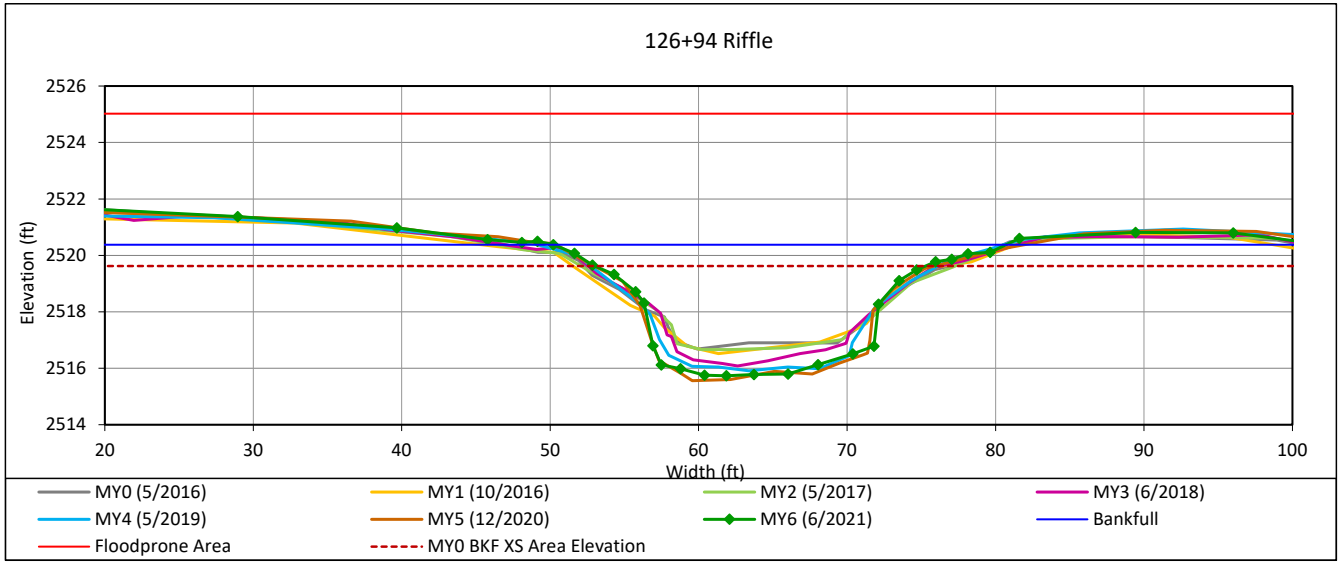
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 8 - Little Pine Reach 2b



Bankfull Dimensions	
77.7	x-section area (ft.sq.)
26.8	width (ft)
2.9	mean depth (ft)
4.6	max depth (ft)
30.2	wetted perimeter (ft)
2.6	hydraulic radius (ft)
9.3	width-depth ratio
121.4	W flood prone area (ft)
4.5	entrenchment ratio
1.2	low bank height ratio

Survey Date: 6/2021

Field Crew: Wildlands Engineering

View Downstream

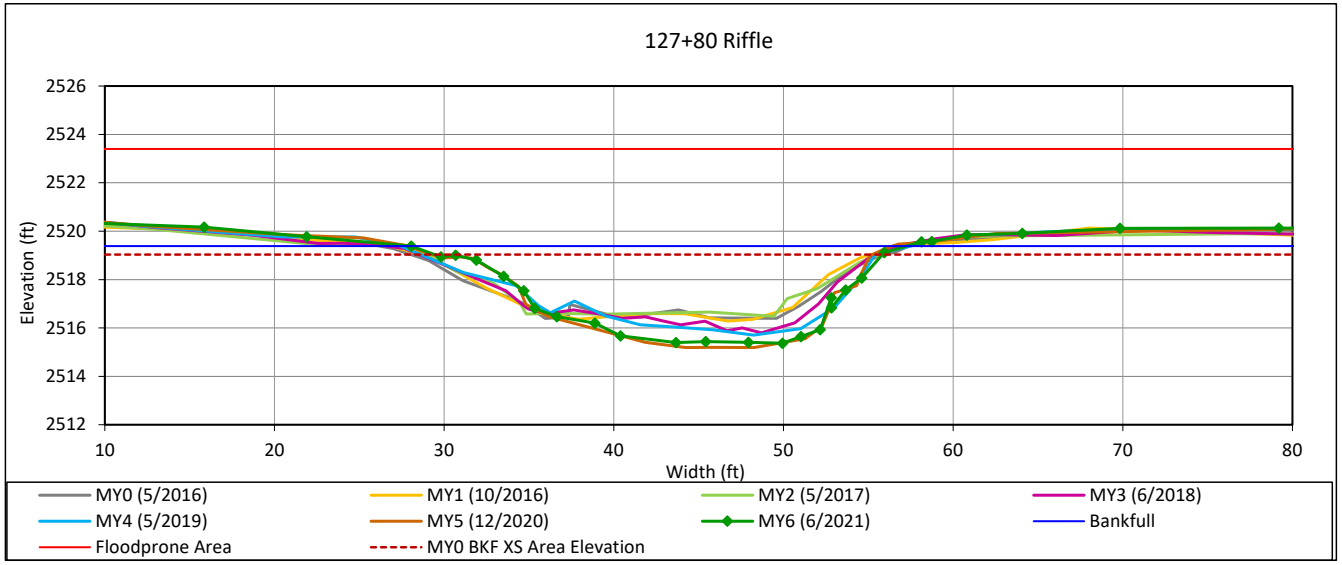
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 9 - Little Pine Reach 2b



Bankfull Dimensions	
73.9	x-section area (ft.sq.)
29.2	width (ft)
2.5	mean depth (ft)
4.0	max depth (ft)
32.1	wetted perimeter (ft)
2.3	hydraulic radius (ft)
11.5	width-depth ratio
110.0	W flood prone area (ft)
3.8	entrenchment ratio
1.1	low bank height ratio

Survey Date: 6/2021

Field Crew: Wildlands Engineering

View Downstream

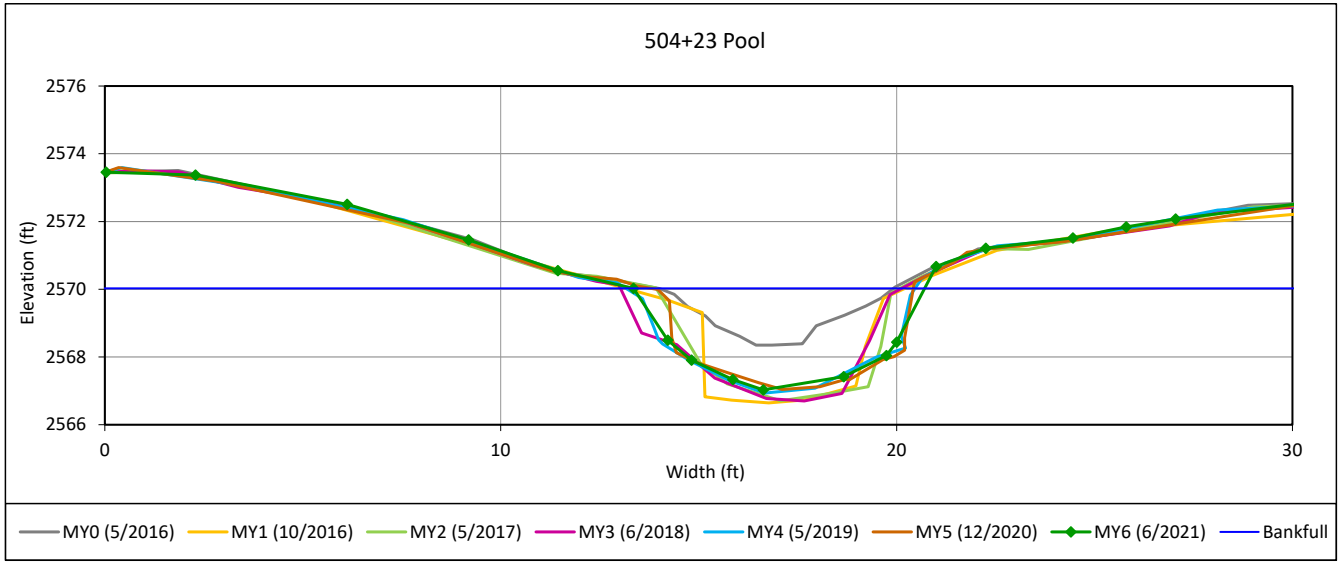
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2020

Cross Section 10 - UT2b



Bankfull Dimensions	
15.6	x-section area (ft.sq.)
7.4	width (ft)
2.1	mean depth (ft)
3.0	max depth (ft)
10.1	wetted perimeter (ft)
1.5	hydraulic radius (ft)
3.5	width-depth ratio

Survey Date: 6/2021

Field Crew: Wildlands Engineering

View Downstream

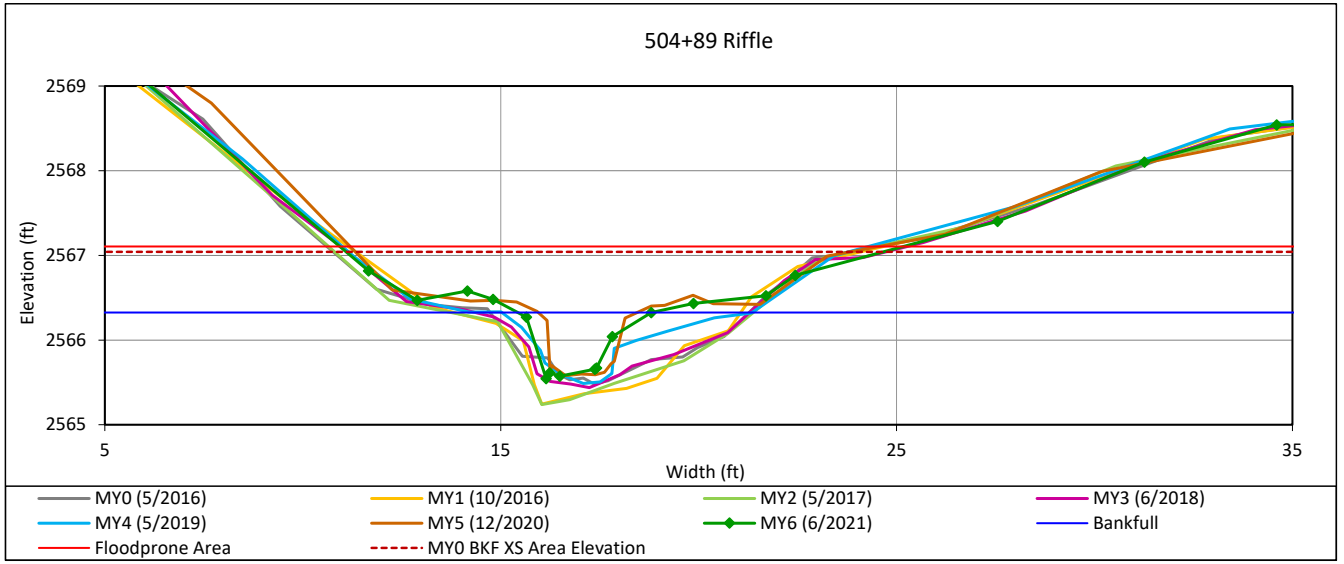
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2020

Cross Section 11 - UT2b



Bankfull Dimensions	
1.4	x-section area (ft.sq.)
3.4	width (ft)
0.4	mean depth (ft)
0.8	max depth (ft)
4.0	wetted perimeter (ft)
0.4	hydraulic radius (ft)
7.8	width-depth ratio
14.2	W flood prone area (ft)
4.2	entrenchment ratio
0.5	low bank height ratio

Survey Date: 6/2021

Field Crew: Wildlands Engineering

View Downstream

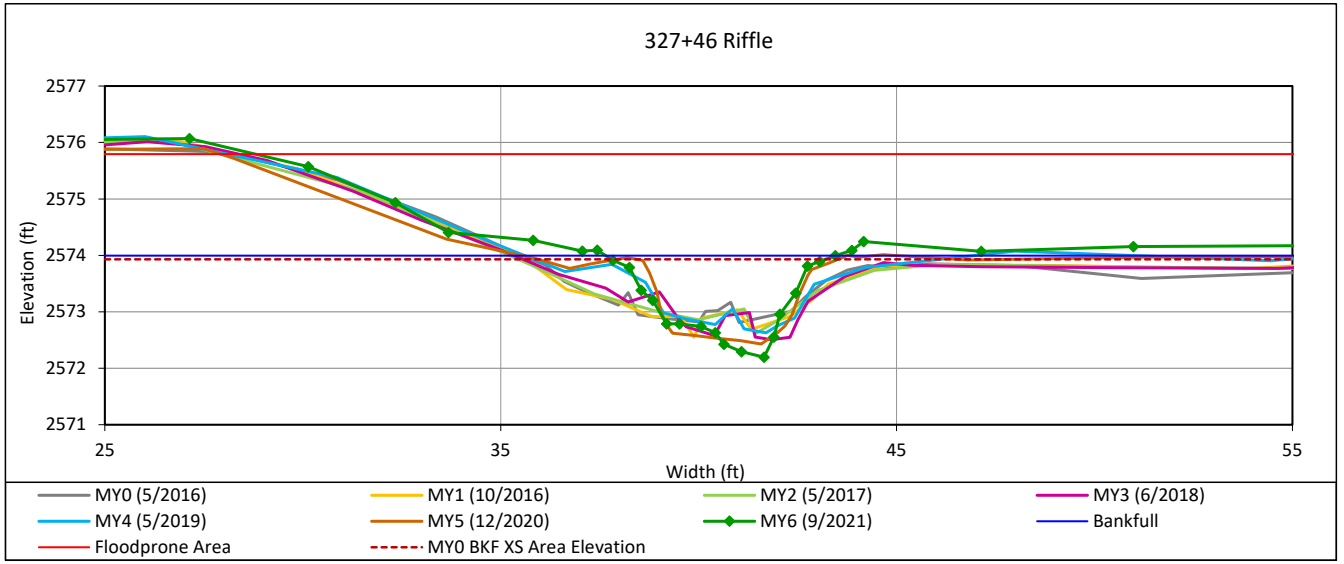
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 12 - UT2



Bankfull Dimensions	
5.4	x-section area (ft.sq.)
5.8	width (ft)
0.9	mean depth (ft)
1.8	max depth (ft)
7.3	wetted perimeter (ft)
0.7	hydraulic radius (ft)
6.2	width-depth ratio
34.1	W flood prone area (ft)
5.9	entrenchment ratio
1.0	low bank height ratio

Survey Date: 9/2021

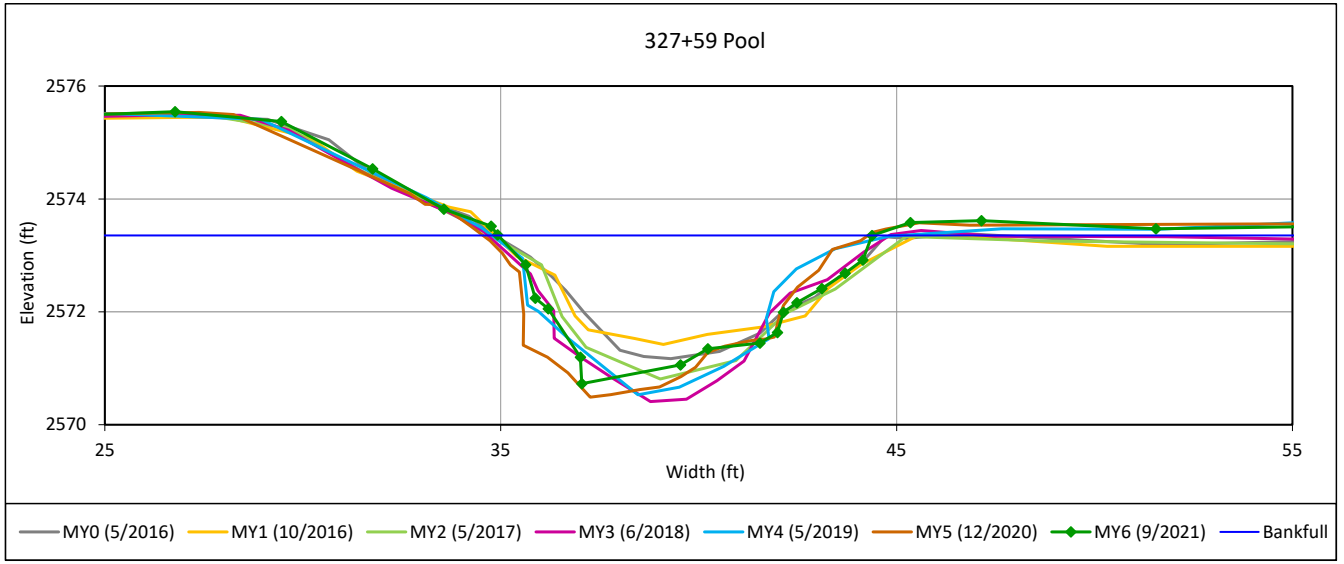
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Cross Section 13 - UT2



Bankfull Dimensions	
15.4	x-section area (ft.sq.)
9.4	width (ft)
1.6	mean depth (ft)
2.6	max depth (ft)
11.7	wetted perimeter (ft)
1.3	hydraulic radius (ft)
5.8	width-depth ratio

Survey Date: 9/2021
Field Crew: Wildlands Engineering

View Downstream

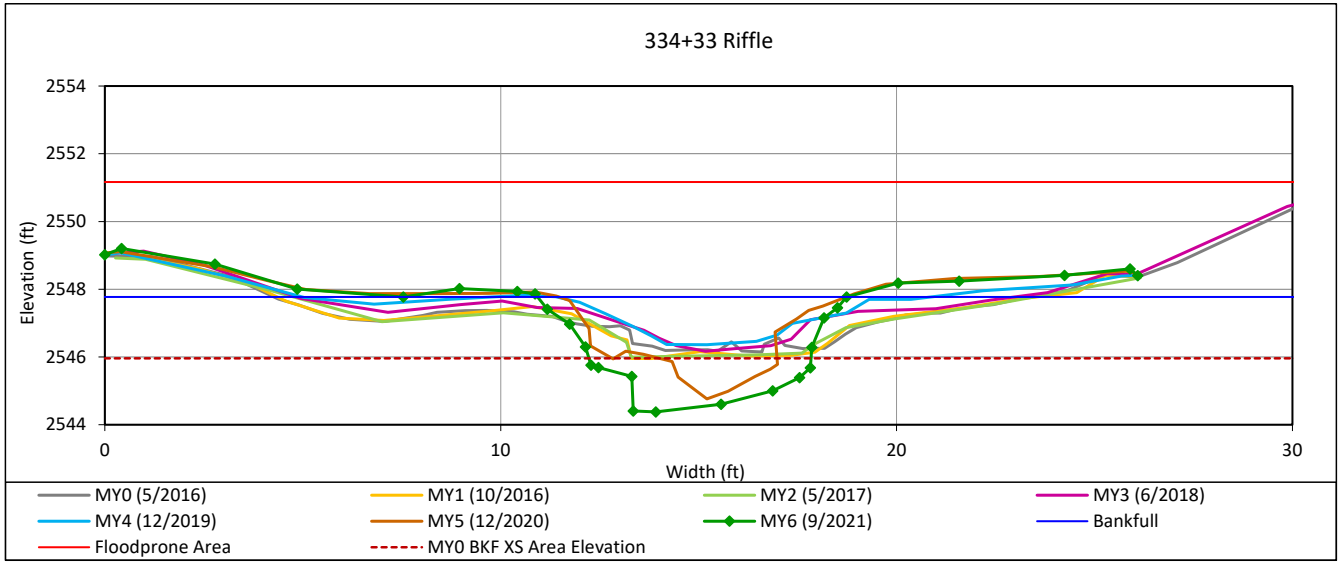
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 14 - UT2



Bankfull Dimensions	
17.6	x-section area (ft.sq.)
7.8	width (ft)
2.3	mean depth (ft)
3.4	max depth (ft)
11.7	wetted perimeter (ft)
1.5	hydraulic radius (ft)
3.5	width-depth ratio
26.0	W flood prone area (ft)
3.3	entrenchment ratio
2.1	low bank height ratio

Survey Date: 9/2021

Field Crew: Wildlands Engineering

View Downstream

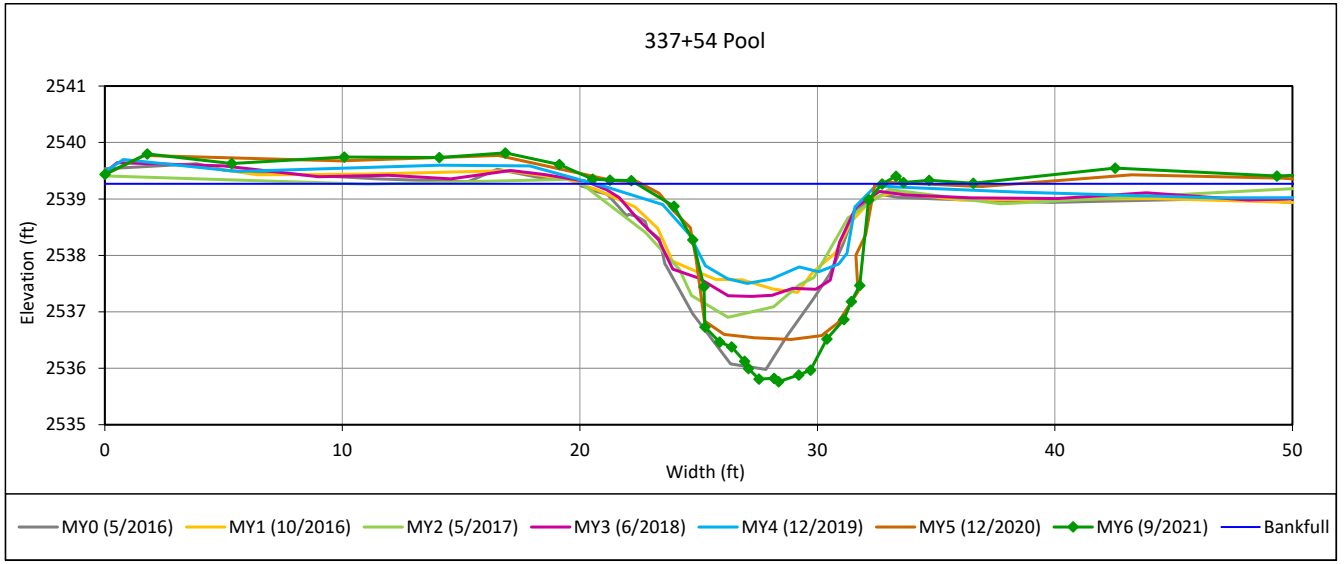
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 15 - UT2



Bankfull Dimensions	
21.6	x-section area (ft.sq.)
10.3	width (ft)
2.1	mean depth (ft)
3.5	max depth (ft)
13.7	wetted perimeter (ft)
1.6	hydraulic radius (ft)
4.9	width-depth ratio

Survey Date: 9/2021

Field Crew: Wildlands Engineering

View Downstream

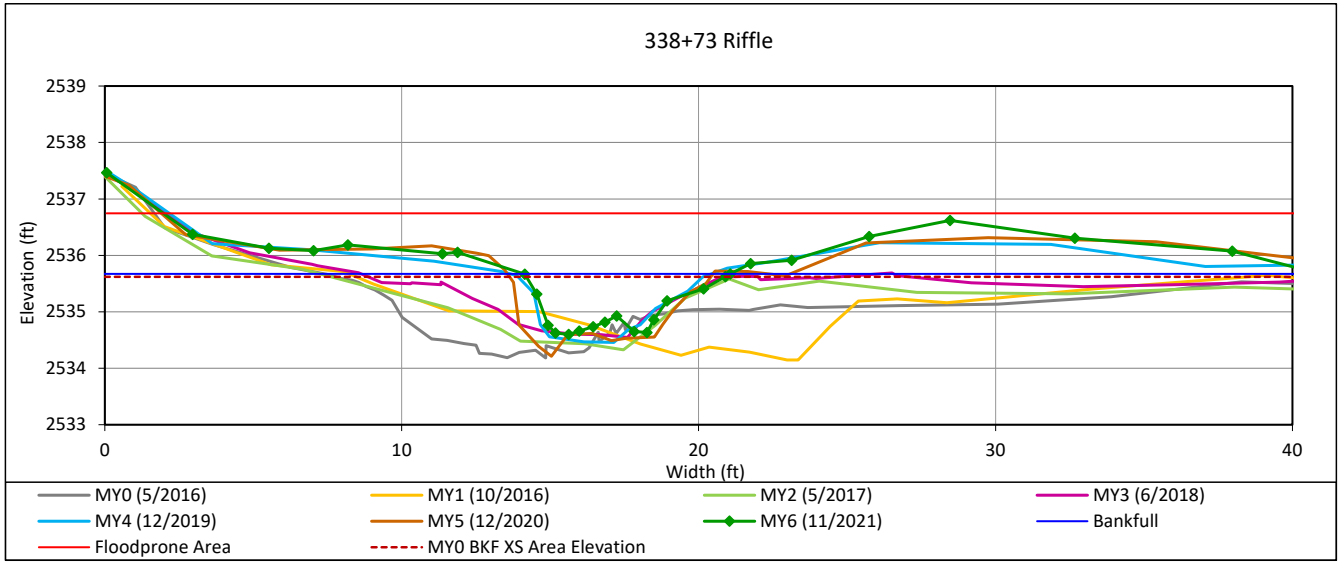
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 16 - UT2



Bankfull Dimensions	
4.6	x-section area (ft.sq.)
6.9	width (ft)
0.7	mean depth (ft)
1.1	max depth (ft)
7.8	wetted perimeter (ft)
0.6	hydraulic radius (ft)
10.5	width-depth ratio
40.6	W flood prone area (ft)
5.9	entrenchment ratio
1.1	low bank height ratio

Survey Date: 11/2021

Field Crew: Wildlands Engineering

View Downstream

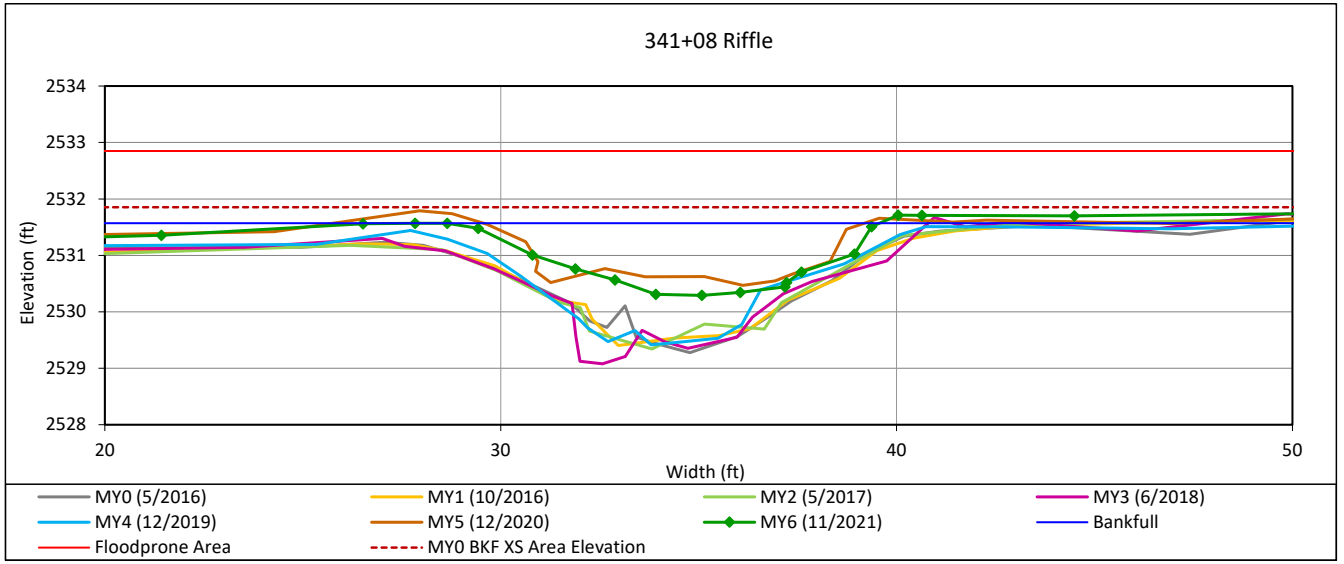
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 17 - UT2



Bankfull Dimensions	
8.8	x-section area (ft.sq.)
10.9	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
11.4	wetted perimeter (ft)
0.8	hydraulic radius (ft)
13.5	width-depth ratio
71.0	W flood prone area (ft)
6.5	entrenchment ratio
0.8	low bank height ratio

Survey Date: 11/2021

Field Crew: Wildlands Engineering

View Downstream

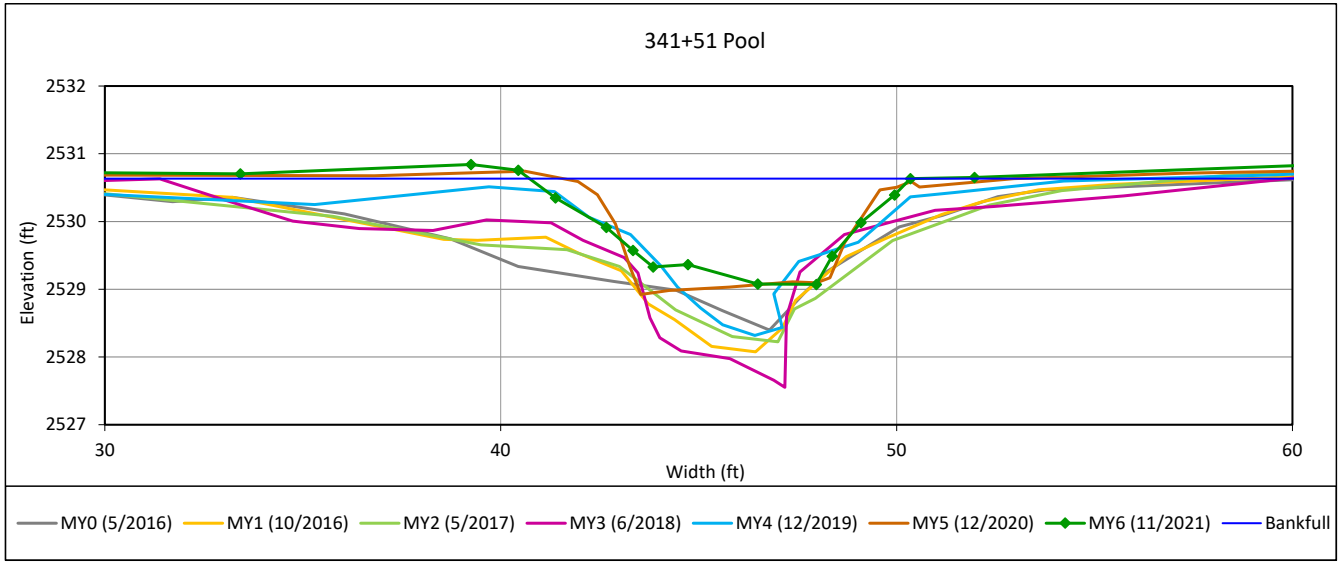
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021

Cross Section 18 - UT2



Bankfull Dimensions	
9.5	x-section area (ft.sq.)
9.6	width (ft)
1.0	mean depth (ft)
1.6	max depth (ft)
10.4	wetted perimeter (ft)
0.9	hydraulic radius (ft)
9.8	width-depth ratio

Survey Date: 11/2021

Field Crew: Wildlands Engineering

View Downstream

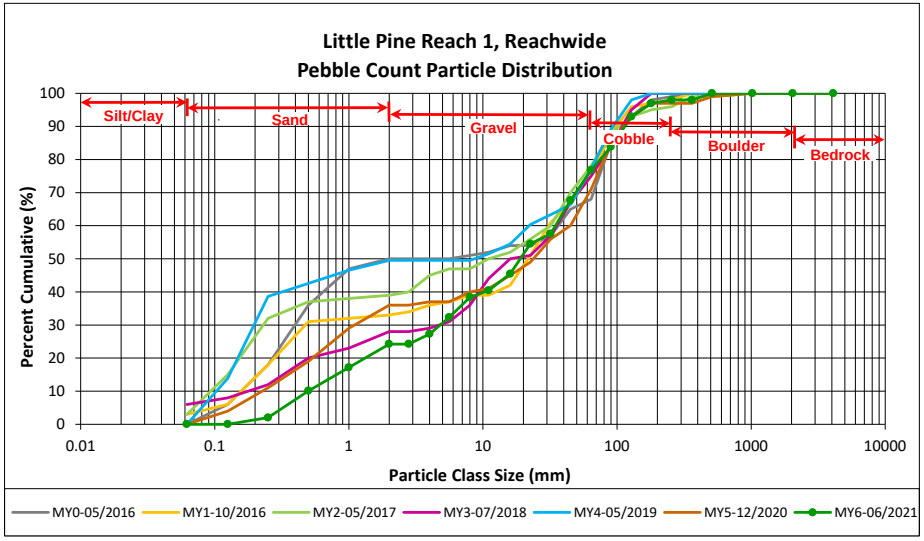
Reachwide and Cross-Section Pebble Count Plots

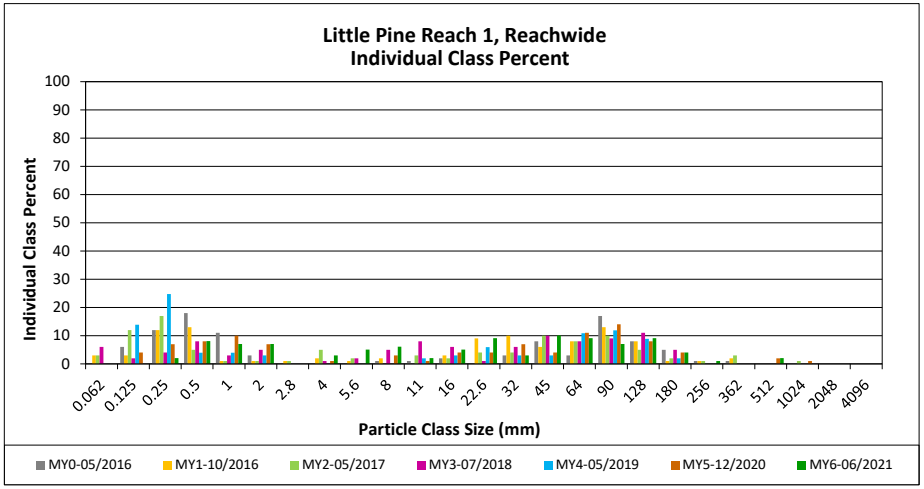
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine 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					0
SAND	Very fine	0.062	0.125					0
	Fine	0.125	0.250		2	2	2	2
	Medium	0.25	0.50	3	5	8	8	10
	Coarse	0.5	1.0		7	7	7	17
	Very Coarse	1.0	2.0		7	7	7	24
GRAVEL	Very Fine	2.0	2.8					24
	Very Fine	2.8	4.0	1	2	3	3	27
	Fine	4.0	5.6	1	4	5	5	32
	Fine	5.6	8.0	1	5	6	6	38
	Medium	8.0	11.0	1	1	2	2	40
	Medium	11.0	16.0	3	2	5	5	45
	Coarse	16.0	22.6	3	6	9	9	55
	Coarse	22.6	32	3		3	3	58
	Very Coarse	32	45	8	2	10	10	68
	Very Coarse	45	64	7	2	9	9	77
COBBLE	Small	64	90	5	2	7	7	84
	Small	90	128	7	2	9	9	93
	Large	128	180	4		4	4	97
	Large	180	256	1		1	1	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	**50**	**49**	**99**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.9
D_{35} =	6.6
D_{50} =	19.0
D_{84} =	90.6
D_{95} =	152.4
D_{100} =	512.0





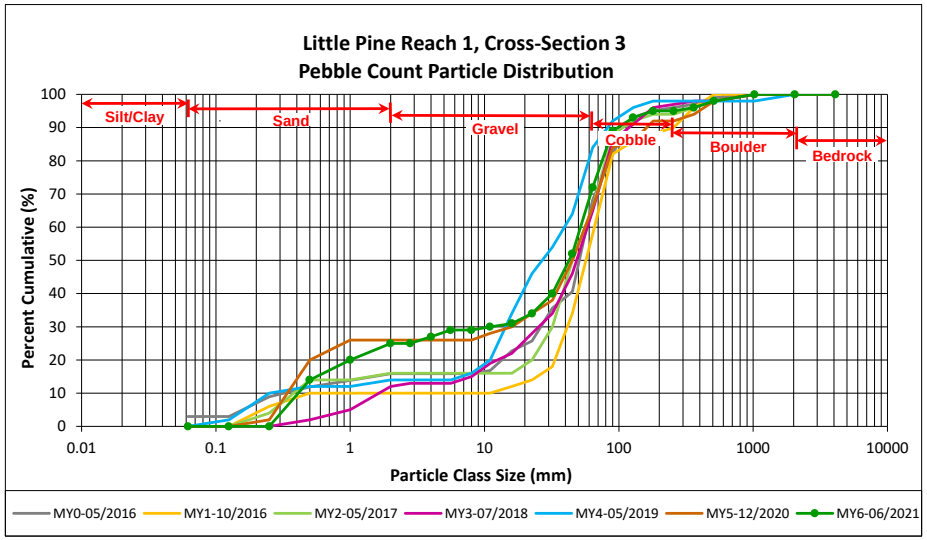
Reachwide and Cross-Section Pebble Count Plots

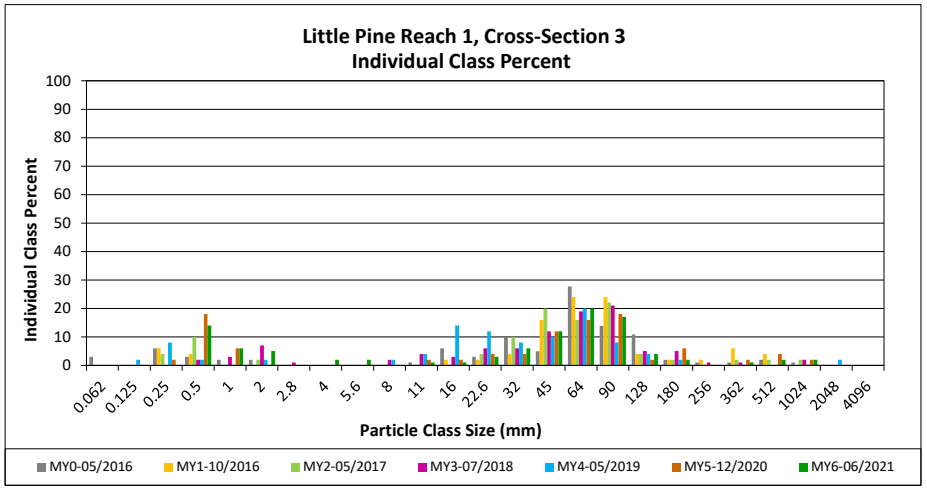
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 1, Cross-Section 3

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	14	14	14
	Coarse	0.5	1.0	6	6	20
	Very Coarse	1.0	2.0	5	5	25
GRAVEL	Very Fine	2.0	2.8			25
	Very Fine	2.8	4.0	2	2	27
	Fine	4.0	5.6	2	2	29
	Fine	5.6	8.0			29
	Medium	8.0	11.0	1	1	30
	Medium	11.0	16.0	1	1	31
	Coarse	16.0	22.6	3	3	34
	Coarse	22.6	32	6	6	40
	Very Coarse	32	45	12	12	52
	Very Coarse	45	64	20	20	72
COBBLE	Small	64	90	17	17	89
	Small	90	128	4	4	93
	Large	128	180	2	2	95
	Large	180	256			95
BOULDER	Small	256	362	1	1	96
	Small	362	512	2	2	98
	Medium	512	1024	2	2	100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 3	
Channel materials (mm)	
D_{16} =	0.6
D_{35} =	23.9
D_{50} =	42.5
D_{84} =	81.4
D_{95} =	180.0
D_{100} =	1024.0





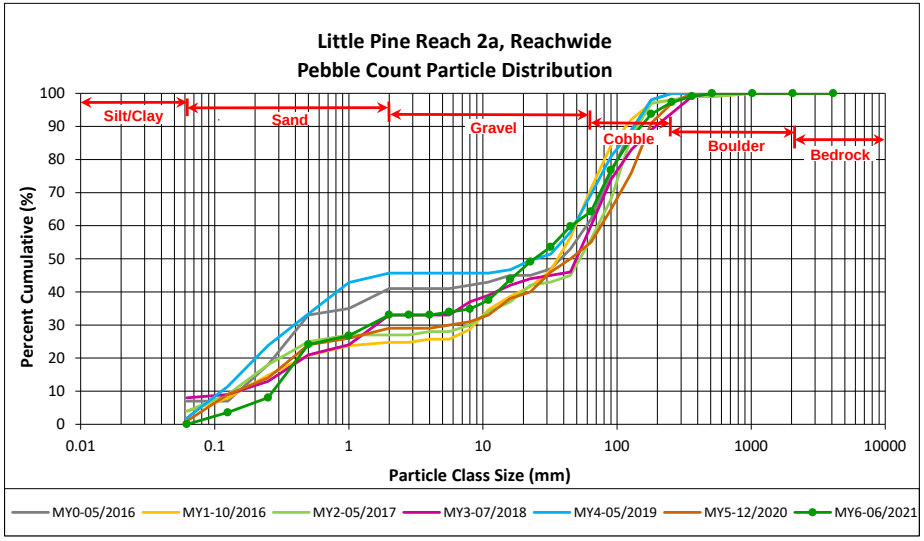
Reachwide and Cross-Section Pebble Count Plots

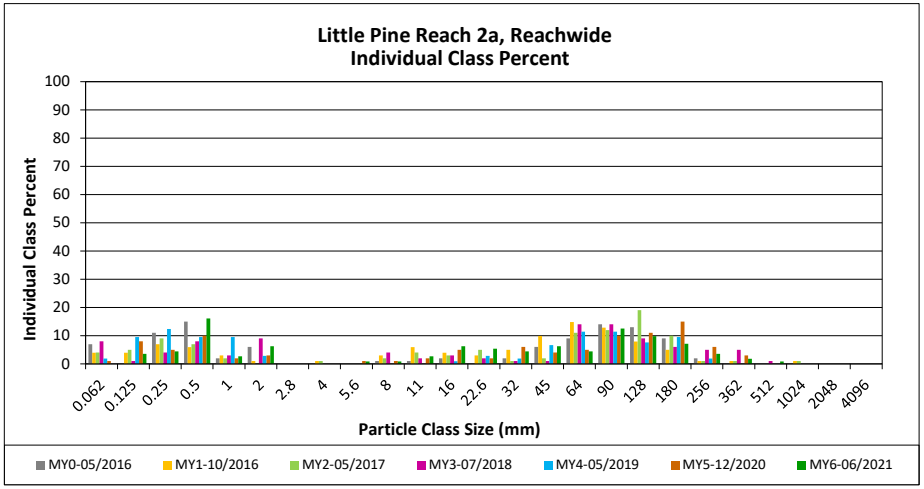
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 2a, 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					0
SAND	Very fine	0.062	0.125		4	4	4	4
	Fine	0.125	0.250		5	5	4	8
	Medium	0.25	0.50	2	16	18	16	24
	Coarse	0.5	1.0		3	3	3	27
	Very Coarse	1.0	2.0	1	6	7	6	33
GRAVEL	Very Fine	2.0	2.8					33
	Very Fine	2.8	4.0					33
	Fine	4.0	5.6		1	1	1	34
	Fine	5.6	8.0		1	1	1	35
	Medium	8.0	11.0	1	2	3	3	38
	Medium	11.0	16.0	5	2	7	6	44
	Coarse	16.0	22.6	2	4	6	5	49
	Coarse	22.6	32	3	2	5	4	54
	Very Coarse	32	45	5	2	7	6	60
	Very Coarse	45	64	5		5	4	64
COBBLE	Small	64	90	12	2	14	13	77
	Small	90	128	11		11	10	87
	Large	128	180	7	1	8	7	94
	Large	180	256	4		4	4	97
BOULDER	Small	256	362	2		2	2	99
	Small	362	512	1		1	1	100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	61	51	112	100	100

Reachwide	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	8.2
D_{50} =	24.2
D_{84} =	116.6
D_{95} =	203.6
D_{100} =	512.0





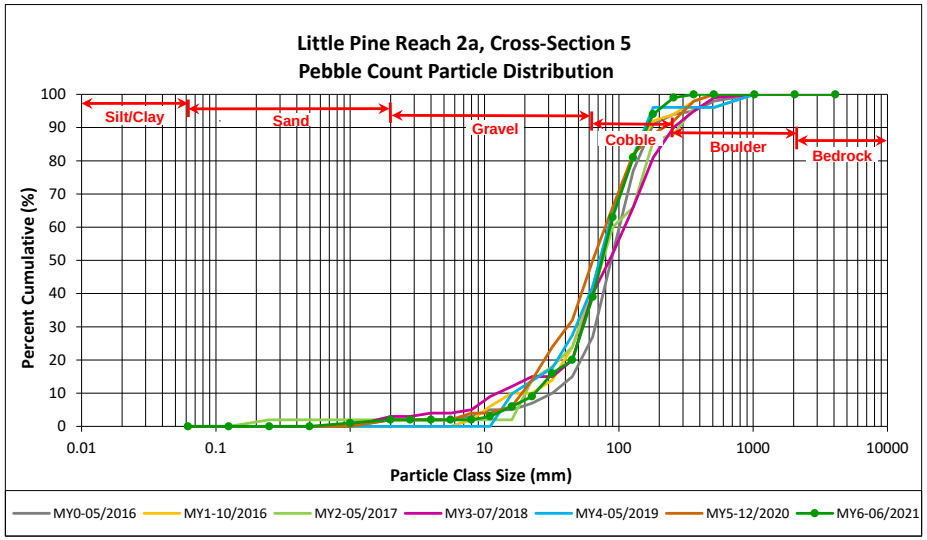
Reachwide and Cross-Section Pebble Count Plots

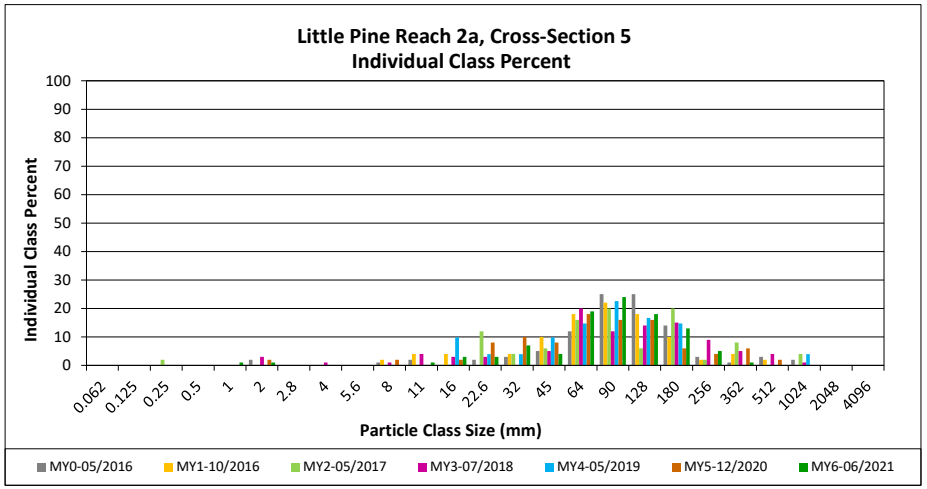
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 2a, Cross-Section 5

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			0
	Coarse	0.5	1.0	1	1	1
	Very Coarse	1.0	2.0	1	1	2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6			2
	Fine	5.6	8.0			2
	Medium	8.0	11.0	1	1	3
	Medium	11.0	16.0	3	3	6
	Coarse	16.0	22.6	3	3	9
	Coarse	22.6	32	7	7	16
	Very Coarse	32	45	4	4	20
	Very Coarse	45	64	19	19	39
COBBLE	Small	64	90	24	24	63
	Small	90	128	18	18	81
	Large	128	180	13	13	94
	Large	180	256	5	5	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 5	
Channel materials (mm)	
D_{16} =	32.0
D_{35} =	59.4
D_{50} =	74.8
D_{84} =	138.5
D_{95} =	193.1
D_{100} =	362.0





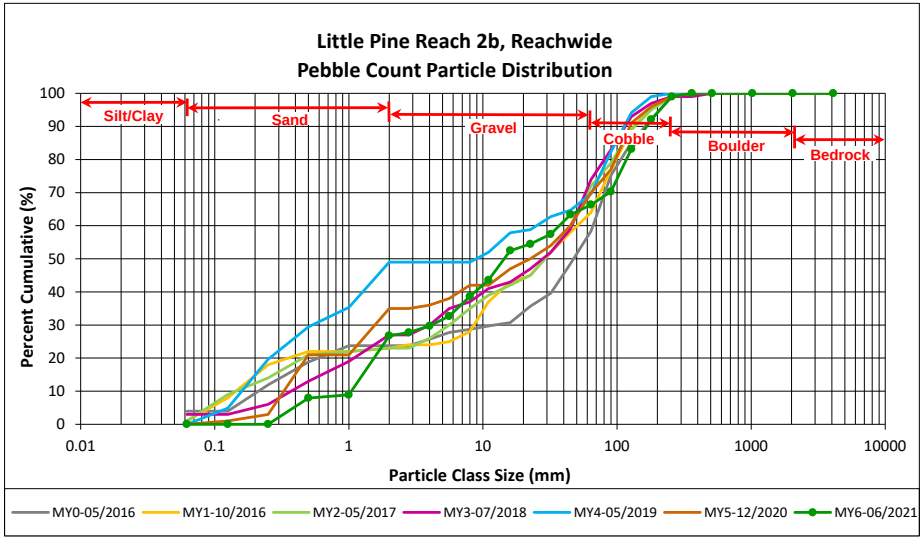
Reachwide and Cross-Section Pebble Count Plots

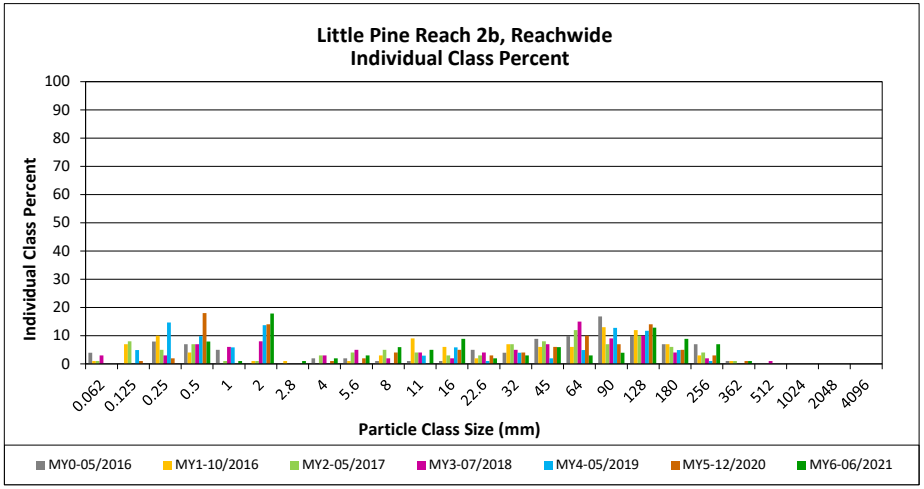
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 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					0
SAND	Very fine	0.062	0.125					0
	Fine	0.125	0.250					0
	Medium	0.25	0.50	1	7	8	8	8
	Coarse	0.5	1.0		1	1	1	9
	Very Coarse	1.0	2.0	4	14	18	18	27
GRAVEL	Very Fine	2.0	2.8		1	1	1	28
	Very Fine	2.8	4.0		2	2	2	30
	Fine	4.0	5.6		3	3	3	33
	Fine	5.6	8.0	1	5	6	6	39
	Medium	8.0	11.0	1	4	5	5	44
	Medium	11.0	16.0	1	8	9	9	52
	Coarse	16.0	22.6		2	2	2	54
	Coarse	22.6	32	1	2	3	3	57
	Very Coarse	32	45	2	4	6	6	63
	Very Coarse	45	64	1	2	3	3	66
COBBLE	Small	64	90	3	1	4	4	70
	Small	90	128	11	2	13	13	83
	Large	128	180	7	2	9	9	92
	Large	180	256	5	2	7	7	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	39	62	101	100	100

Reachwide	
Channel materials (mm)	
D_{16} =	1.3
D_{35} =	6.4
D_{50} =	14.4
D_{84} =	132.1
D_{95} =	208.8
D_{100} =	362.0





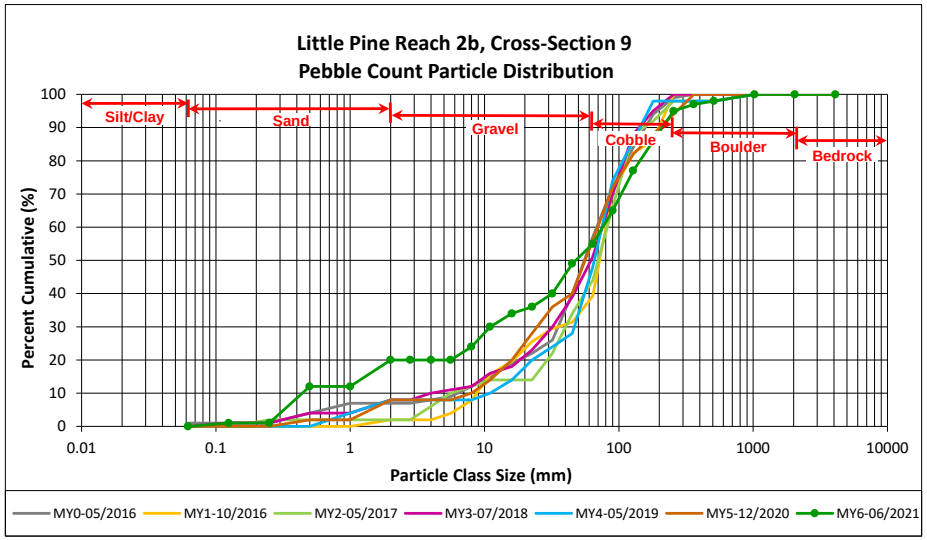
Reachwide and Cross-Section Pebble Count Plots

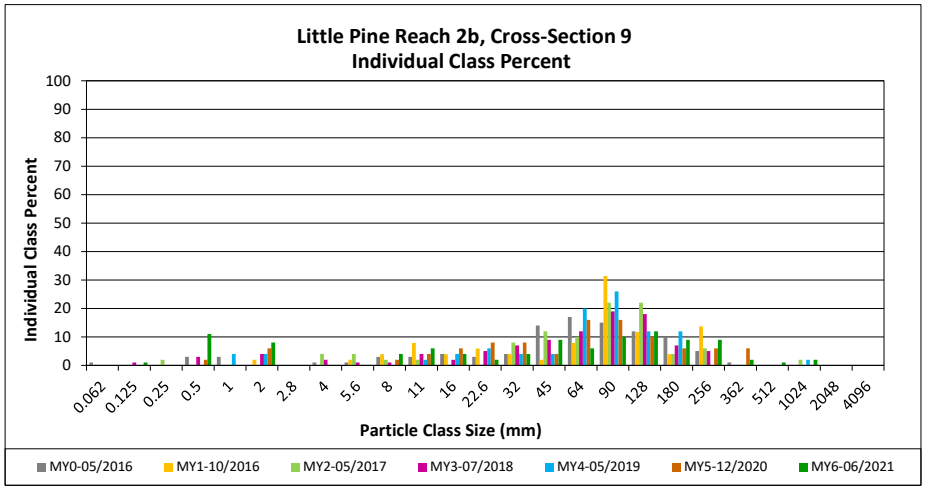
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Little Pine Reach 2b, 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			1
	Medium	0.25	0.50	11	11	12
	Coarse	0.5	1.0			12
	Very Coarse	1.0	2.0	8	8	20
GRAVEL	Very Fine	2.0	2.8			20
	Very Fine	2.8	4.0			20
	Fine	4.0	5.6			20
	Fine	5.6	8.0	4	4	24
	Medium	8.0	11.0	6	6	30
	Medium	11.0	16.0	4	4	34
	Coarse	16.0	22.6	2	2	36
	Coarse	22.6	32	4	4	40
	Very Coarse	32	45	9	9	49
	Very Coarse	45	64	6	6	55
COBBLE	Small	64	90	10	10	65
	Small	90	128	12	12	77
	Large	128	180	9	9	86
	Large	180	256	9	9	95
BOULDER	Small	256	362	2	2	97
	Small	362	512	1	1	98
	Medium	512	1024	2	2	100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 9	
Channel materials (mm)	
D_{16} =	1.4
D_{35} =	19.0
D_{50} =	47.7
D_{84} =	166.9
D_{95} =	256.0
D_{100} =	1024.0





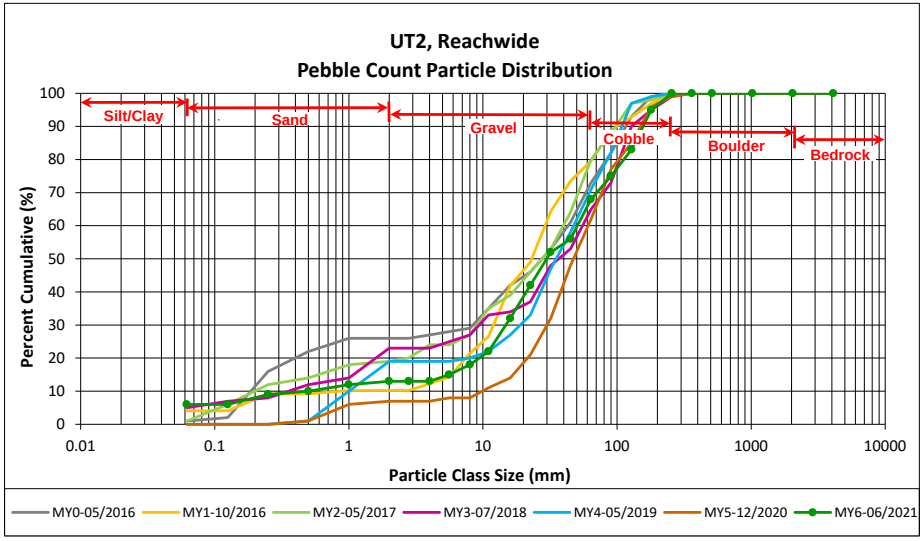
Reachwide and Cross-Section Pebble Count Plots

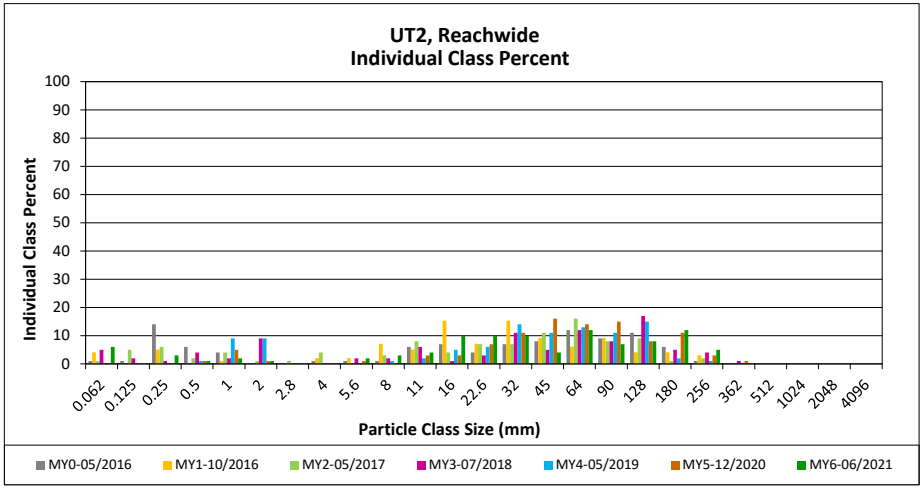
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

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					6
	Fine	0.125	0.250		3	3	3	9
	Medium	0.25	0.50	1		1	1	10
	Coarse	0.5	1.0		2	2	2	12
	Very Coarse	1.0	2.0		1	1	1	13
GRAVEL	Very Fine	2.0	2.8					13
	Very Fine	2.8	4.0					13
	Fine	4.0	5.6	1	1	2	2	15
	Fine	5.6	8.0	3		3	3	18
	Medium	8.0	11.0	1	3	4	4	22
	Medium	11.0	16.0	7	3	10	10	32
	Coarse	16.0	22.6	5	5	10	10	42
	Coarse	22.6	32	6	4	10	10	52
	Very Coarse	32	45	4		4	4	56
	Very Coarse	45	64	11	1	12	12	68
COBBLE	Small	64	90	7		7	7	75
	Small	90	128	7	1	8	8	83
	Large	128	180	11	1	12	12	95
	Large	180	256	5		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	**70**	**30**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	6.3
D_{35} =	17.7
D_{50} =	29.8
D_{84} =	131.7
D_{95} =	180.0
D_{100} =	256.0





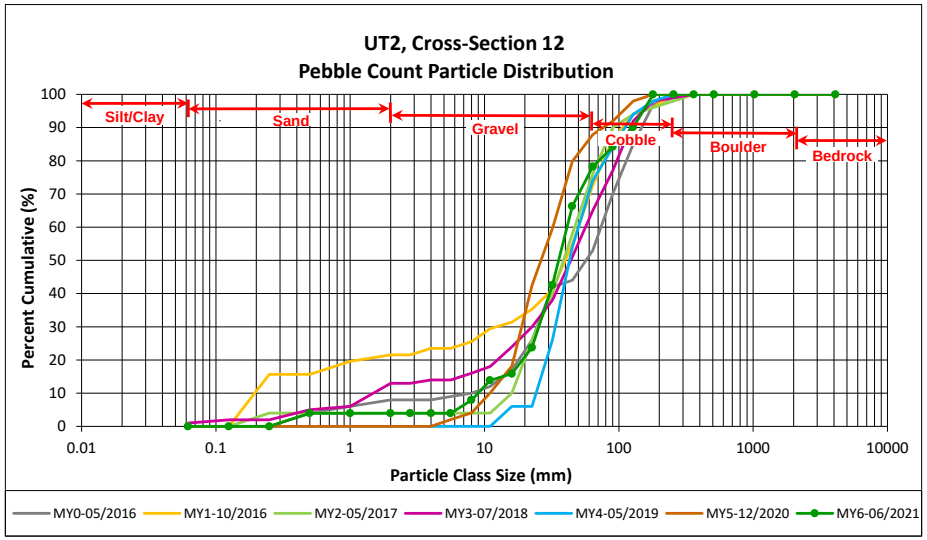
Reachwide and Cross-Section Pebble Count Plots

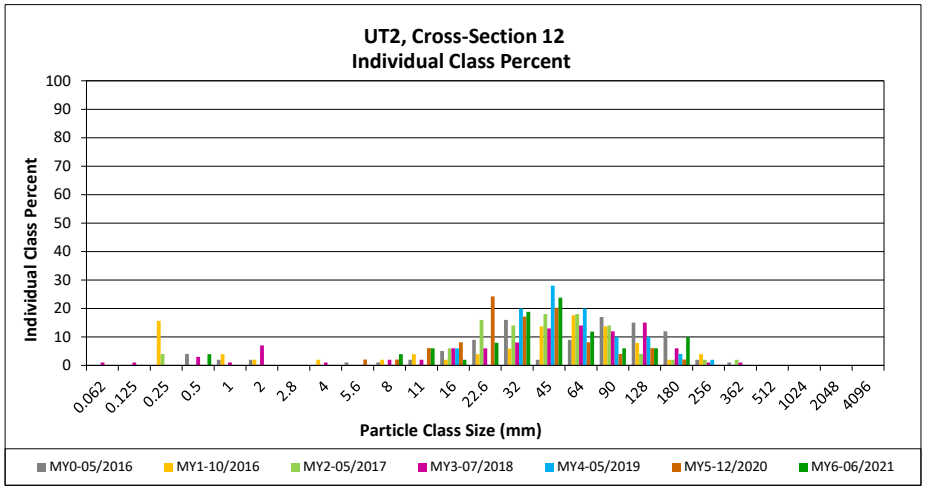
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

UT2, Cross-Section 12

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	4	4	4
	Coarse	0.5	1.0			4
	Very Coarse	1.0	2.0			4
GRAVEL	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0			4
	Fine	4.0	5.6			4
	Fine	5.6	8.0	4	4	8
	Medium	8.0	11.0	6	6	14
	Medium	11.0	16.0	2	2	16
	Coarse	16.0	22.6	8	8	24
	Coarse	22.6	32	19	19	43
	Very Coarse	32	45	24	24	66
	Very Coarse	45	64	12	12	78
COBBLE	Small	64	90	6	6	84
	Small	90	128	6	6	90
	Large	128	180	10	10	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 12	
Channel materials (mm)	
D_{16} =	16.1
D_{35} =	27.8
D_{50} =	35.6
D_{84} =	89.2
D_{95} =	151.5
D_{100} =	180.0





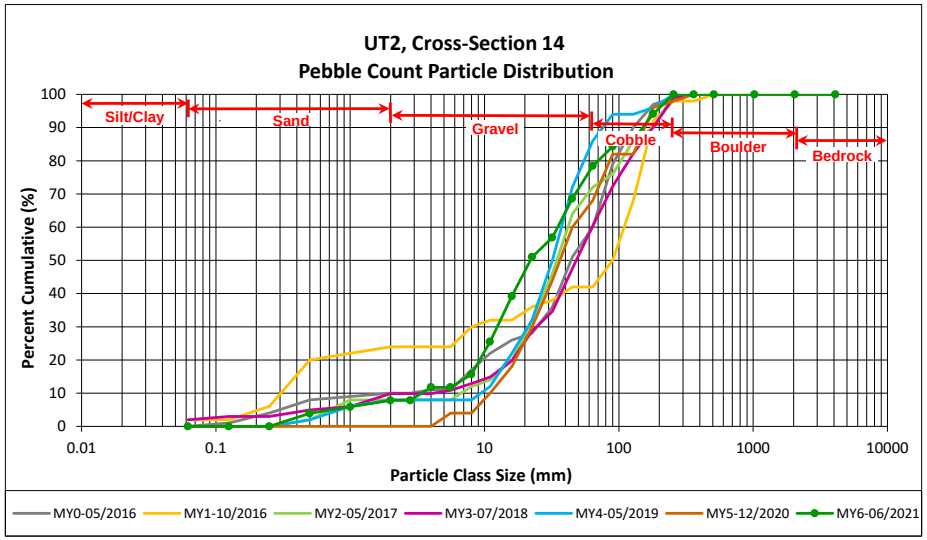
Reachwide and Cross-Section Pebble Count Plots

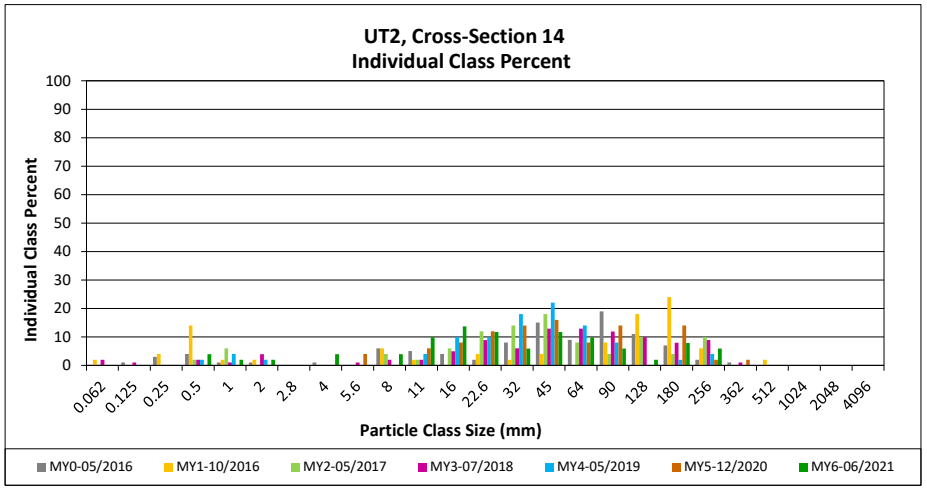
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

UT2, Cross-Section 14

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	4	4	4
	Coarse	0.5	1.0	2	2	6
	Very Coarse	1.0	2.0	2	2	8
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0	4	4	12
	Fine	4.0	5.6			12
	Fine	5.6	8.0	4	4	16
	Medium	8.0	11.0	10	10	25
	Medium	11.0	16.0	14	14	39
	Coarse	16.0	22.6	12	12	51
	Coarse	22.6	32	6	6	57
	Very Coarse	32	45	12	12	69
	Very Coarse	45	64	10	10	78
COBBLE	Small	64	90	6	6	84
	Small	90	128	2	2	86
	Large	128	180	8	8	94
	Large	180	256	6	6	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	**102**	**100**	**100**

Cross-Section 14	
Channel materials (mm)	
D_{16} =	8.1
D_{35} =	14.3
D_{50} =	22.0
D_{84} =	88.4
D_{95} =	189.8
D_{100} =	256.0





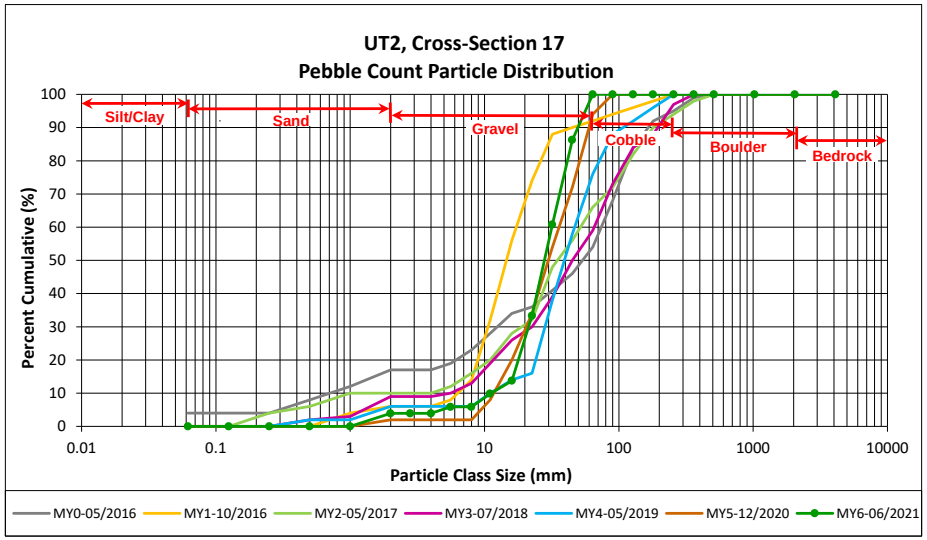
Reachwide and Cross-Section Pebble Count Plots

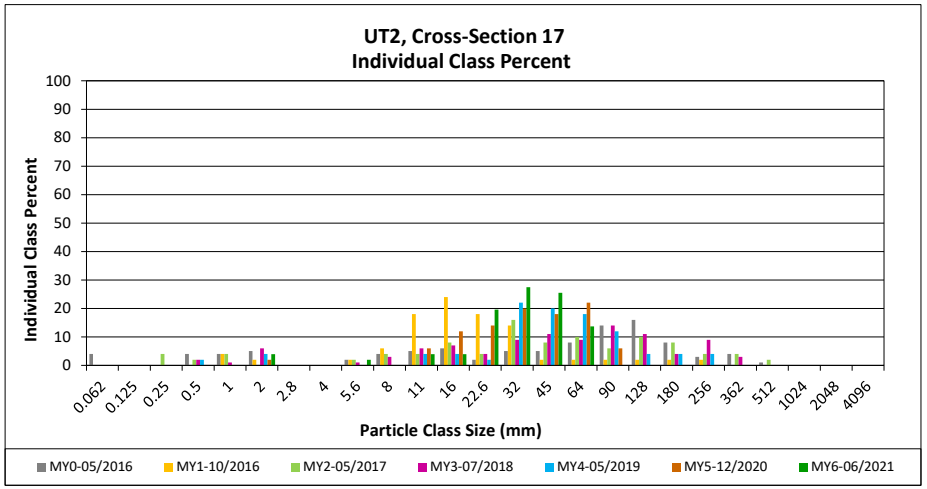
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

UT2, 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			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	4	4	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			6
	Medium	8.0	11.0	4	4	10
	Medium	11.0	16.0	4	4	14
	Coarse	16.0	22.6	20	20	33
	Coarse	22.6	32	28	27	61
	Very Coarse	32	45	26	25	86
	Very Coarse	45	64	14	14	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	**102**	**100**	**100**

Cross-Section 17	
Channel materials (mm)	
D_{16} =	16.7
D_{35} =	23.1
D_{50} =	27.9
D_{84} =	43.7
D_{95} =	56.3
D_{100} =	64.0





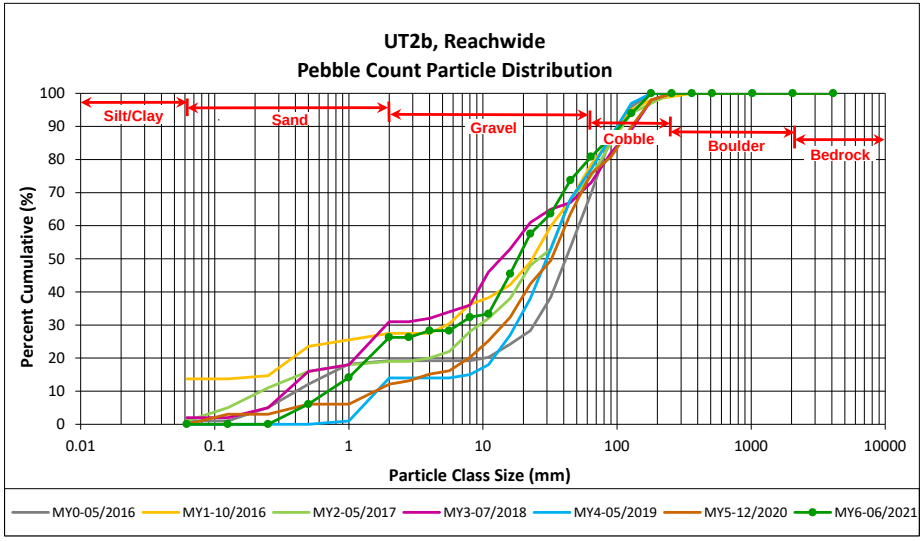
Reachwide and Cross-Section Pebble Count Plots

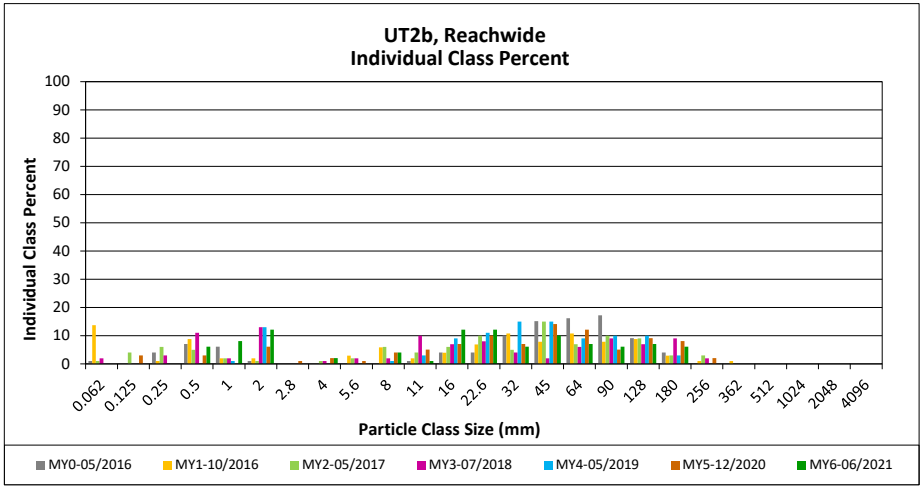
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

UT2b, 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					0
SAND	Very fine	0.062	0.125					0
	Fine	0.125	0.250					0
	Medium	0.25	0.50	3	3	6	6	6
	Coarse	0.5	1.0	4	4	8	8	14
	Very Coarse	1.0	2.0	4	8	12	12	26
GRAVEL	Very Fine	2.0	2.8					26
	Very Fine	2.8	4.0	1	1	2	2	28
	Fine	4.0	5.6					28
	Fine	5.6	8.0	3	1	4	4	32
	Medium	8.0	11.0	1		1	1	33
	Medium	11.0	16.0	12		12	12	45
	Coarse	16.0	22.6	9	3	12	12	58
	Coarse	22.6	32	4	2	6	6	64
	Very Coarse	32	45	10		10	10	74
	Very Coarse	45	64	7		7	7	81
COBBLE	Small	64	90	4	2	6	6	87
	Small	90	128	4	3	7	7	94
	Large	128	180	4	2	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	**70**	**29**	**99**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	1.1
D_{35} =	11.6
D_{50} =	18.2
D_{84} =	76.6
D_{95} =	135.9
D_{100} =	180.0





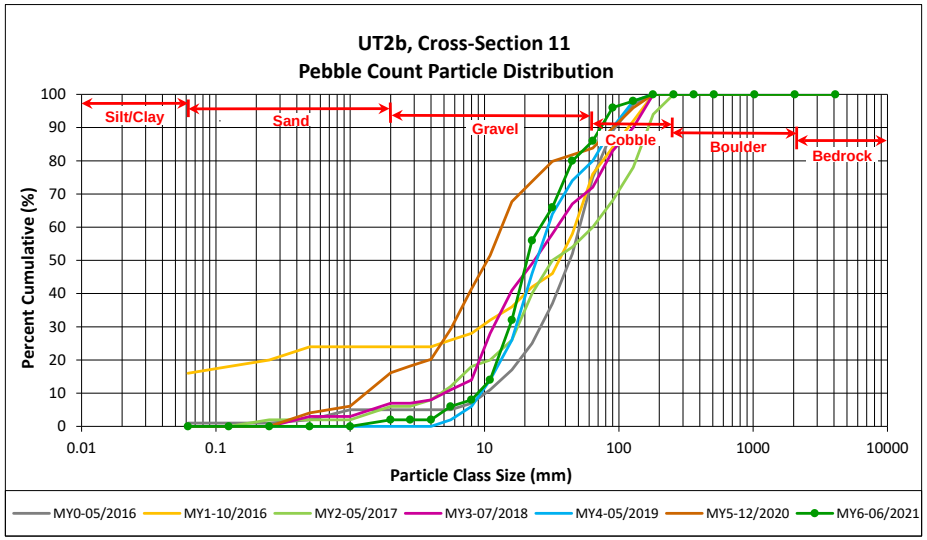
Reachwide and Cross-Section Pebble Count Plots

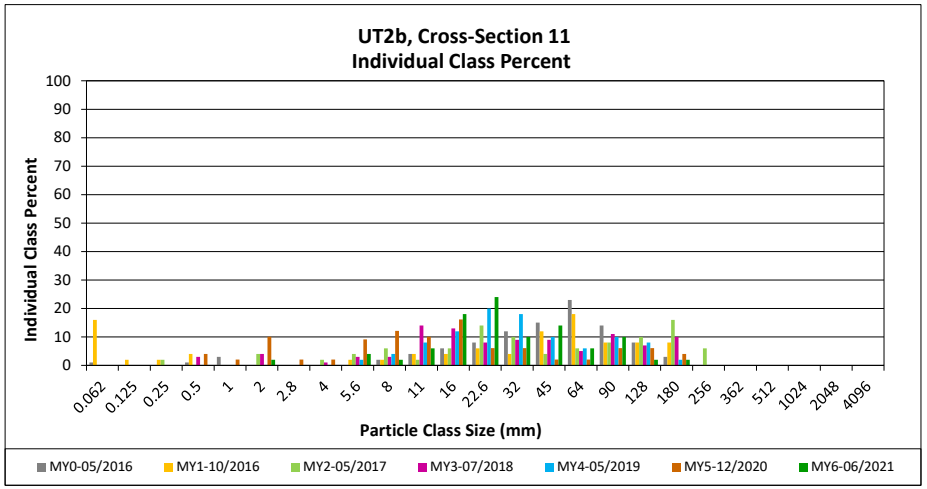
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

UT2b, Cross-Section 11

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			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	2	2	2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6	4	4	6
	Fine	5.6	8.0	2	2	8
	Medium	8.0	11.0	6	6	14
	Medium	11.0	16.0	18	18	32
	Coarse	16.0	22.6	24	24	56
	Coarse	22.6	32	10	10	66
	Very Coarse	32	45	14	14	80
	Very Coarse	45	64	6	6	86
COBBLE	Small	64	90	10	10	96
	Small	90	128	2	2	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 11 Channel materials (mm)	
D_{16} =	11.5
D_{35} =	16.7
D_{50} =	20.7
D_{84} =	56.9
D_{95} =	87.0
D_{100} =	180.0





APPENDIX 5. Hydrology Summary Data and Plots

Table 14. Verification of Bankfull Events
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Reach	Year of Occurrence	Date of Data Collection	Date of Occurrence	Method
Little Pine	MY1	9/25/2016	unknown	Crest Gage
	MY2	5/23/2017	unknown	Wrack Lines and alluvial sediment deposit
	MY3	4/2/2018	unknown	Wrack Lines and alluvial sediment deposit
	MY4	9/18/2019	unknown	Crest Gage
	MY5	8/20/2020	unknown	Wrack Lines and alluvial sediment deposit
	MY6	9/13/2021	unknown	Wrack Lines and alluvial sediment deposit
UT2	MY1	10/5/2016	unknown	Crest Gage
	MY2	5/23/2017	unknown	Crest Gage
	MY3	4/2/2018	unknown	Wrack Lines and alluvial sediment deposit
	MY4	12/3/2019	unknown	Wrack Lines and alluvial sediment deposit
	MY5	8/20/2020	unknown	Wrack Lines and alluvial sediment deposit
	MY6	6/7/2021	unknown	Wrack Lines and alluvial sediment deposit
UT2B	MY1	9/27/2016	unknown	Crest Gage
	MY3	4/2/2018	unknown	Wrack Lines and alluvial sediment deposit
	MY4	9/18/2019	unknown	Crest Gage
	MY5	8/20/2020	unknown	Crest Gage
	MY6	6/7/2021	unknown	Crest Gage

Table 15. Wetland Gage Attainment Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 6 - 2021

Summary of Groundwater Gage Results for MY6						
Gage	Success Criteria Achieved/Max Consecutive Days During Growing Season[1] (%)					
	Year 1 (2016)	Year 2 (2017)	Year 3 (2018)	Year 4 (2019)	Year 5 (2020)	Year 6 (2021)
Wetland FF	Yes/112 Days (66.6%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)

No wetland success criteria established

[1]Growing season starts April 26, 2020 and ends October 11, 2020.

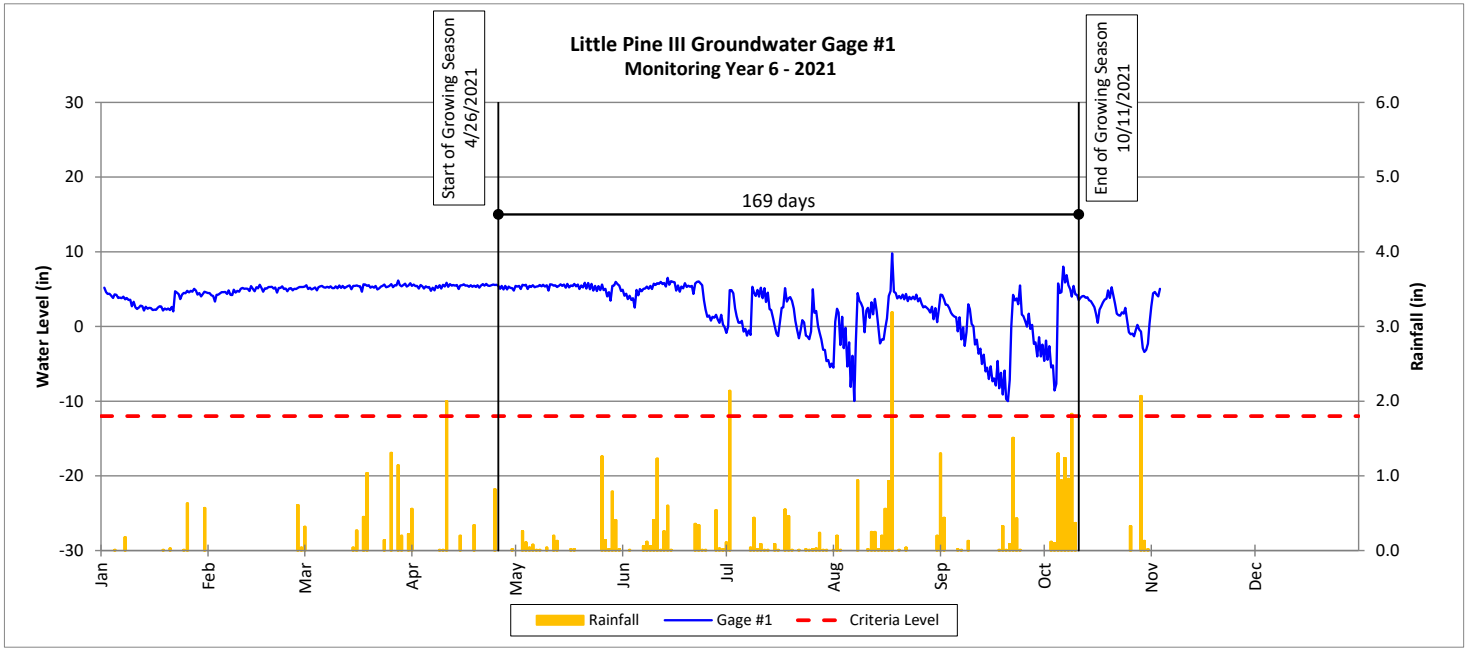
Groundwater Gage Plots

Little Pine III Stream & Wetland Mitigation Project

DMS Project No. 94903

Monitoring Year 6 - 2021

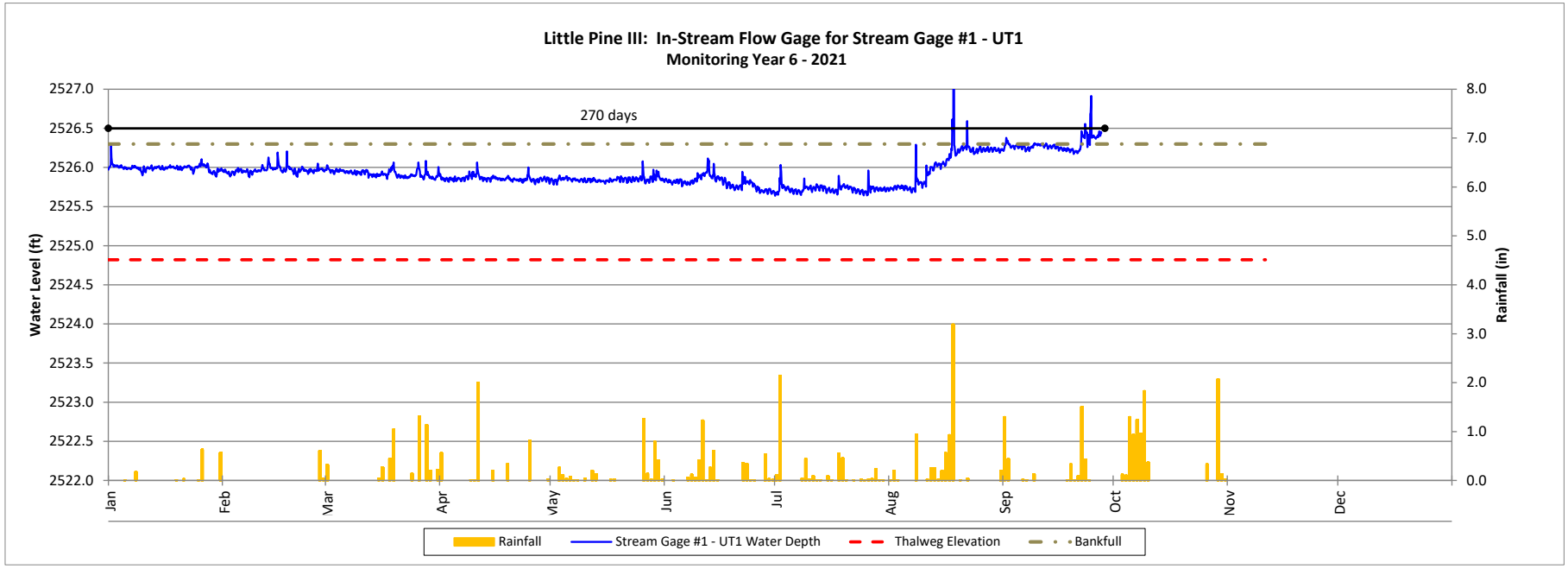
Wetland FF



Recorded In-stream Flow Events

Little Pine III Stream & Wetland Restoration Project (DMS Project No. 94903)

Monitoring Year 6 - 2021

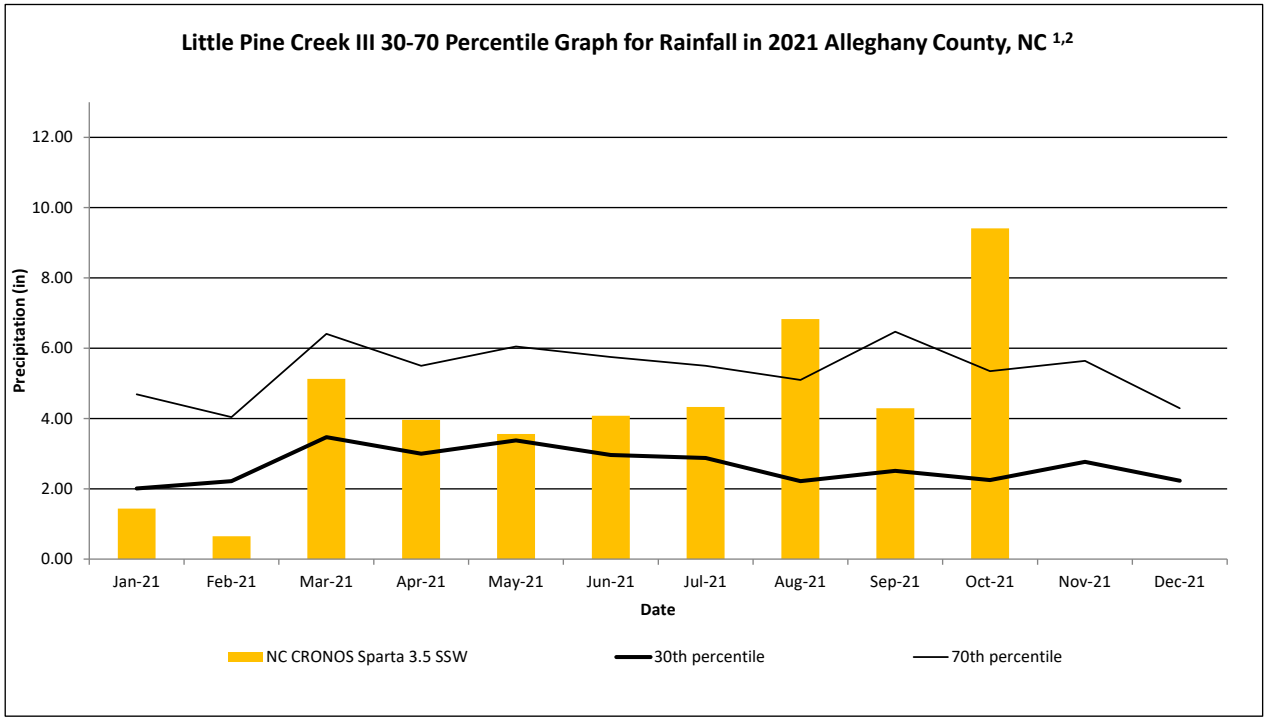


Monthly Rainfall Data

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 6 - 2021



[1] 2021 rainfall collected from NC CRONOS Station Name: Sparta 3.5 SSW (NCSU, 2021)

[2] 30th and 70th percentile rainfall data collected from weather station Sparta, NC8158 (USDA, 2021)

APPENDIX 6. Repair Plans

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
TIM BAUMGARTNER
Director

NORTH CAROLINA
Environmental Quality

3/1/2021

PROJECT SITE MEETING MINUTES
Little Pine Creek III Stream and Wetland Restoration Site, Alleghany County
Meeting Date: 2/23/2021

DMS Project ID 94903
DWR # 14-0041
USACE Action ID 2012-01299

In attendance:
Todd Tugwell (USACE), Erin Davis (NCDWR), Travis Wilson (NCWRC), Paul Wiesner (NCDMS), Harry Tsomides (NCDMS)

Meeting Summary
The field review meeting was held in order to **a)** review recent repairs and current conditions on this Design-Bid-Build site following submittal and IRT review of a repair memo ("Little Pine Creek III – Update on recent stream repairs", Dec 17, 2020); **b)** review other areas of the project as time allowed; and **c)** establish the framework for remaining monitoring reporting, credit releases and other items as appropriate. Further documented details on the recent repairs can be found in the December 2020 memo. The project MY5 asset map is attached below for reference.

The following is a summary of the field review and items discussed during the meeting:

- The areas of recent repair were all walked including: Phase 1 (2019) repair areas along UT2a and UT2; and Phase 2 (2020) repairs including the two repair areas along the Little Pine Creek main channel and head cut/stream repairs along UT1 (Repair Area 2). All recent repairs appeared to be intact and functioning as intended, and no major concerns were noted. There were other stressed spots in between the tributary repair areas on UT1, UT2 and UT2a that were noted and the group felt should be watched, including an area Todd noted along right bank of UT2 just below culvert pipe within the repair area that was starting to erode following recent heavy rains this past winter; Travis noted a boulder footer and structure along an outer bend of UT2 near STA 336+00 that was stabilized with soil lift and buried boulders that appeared to show minor stress signs and should be watched; and Todd noted the segment of stream along UT1 in between head cut repairs that was down cutting. Other isolated areas beginning show signs of stress

were noted but not discussed as a group. The two culverts at the upper ends of the repair areas along UT2 and 2a, and the one at the lower end of UT2, all appeared to be functioning well.

- All livestock exclusion fencing appeared to be intact and functioning effectively (with exception of culvert crossing on UT2 Reach 1-upper, further discussed below). There were a few areas of stream crossing fencing where livestock were not present (hay production areas) that had been impacted by culvert overtopping (UT2) or high water flows (Little Pine Creek) where fencing was loose or absent. Todd recommended that sections of dysfunctional fencing in these areas either be removed or fixed; it was discussed that this would be the landowner's responsibility to repair their own fence in the event livestock were reintroduced but DMS will further evaluate feasible options/costs, discuss with the landowner, and come to some resolution. Any fencing removed would have to be approved by the landowner since it is their fence now.

- It was noted that site vegetation is doing well overall. As the MY5 report points out, the Site has met the final MY5 requirement of 260 planted stems per acre, with 19 of the 21 plots (90%) individually meeting this requirement and an average planted stem density of 409 stems per acre. Wetland FF (VP13) continues to not meet the stem density requirement because the planted species are not suited for areas with saturated soils; this will be likely be supplemented with wetland plants prior to 2021 growing season. There has also been a high planted stem mortality in VP11 (Tributary 1 area) due to competition with tall herbaceous vegetation. This will be supplementally planted following the recent repairs, prior to growing season 2021.

- Project areas were observed outside of the repair areas including walking UT2 upstream direction to the UT2 Reach 1-upper culvert and just beyond, and a preservation portion of UT2a. The main concerns were the conditions and functionality of the culverts on UT2 Reach 1-upper (UT2R1-U), and UT2 Reach 1-lower (UT2R1-L)

  UT2R1-L showed recent impacts of overtopping that had scraped away the top dressing material for a large portion of the middle of the crossing. This loss of rock was not noted previously on field walks or in the MY5/2020 report and apparently the result of recent winter storms. The area just upstream from this culvert was a constructed pool that had filled in pretty quickly following project completion in 2015-2016 and well-known; while the culvert is allowing water passage, there is substantial deposition upstream from the culvert along the original pool that has caused incremental lateral migration of the stream towards the right side (facing downstream) over the monitoring period such that water flow is elbowing to the left at the culvert opening to get through.

  UT2R1-U appeared intact along the top, sides, and materials intact, etc; however there was significant sedimentation at the culvert opening that is affecting the culverts ability to pass water significantly beyond base flow. Site walk photos taken July 2019 indicate this was not a problem then so there has apparently been a recent impact and/or

movement downstream of sediments from farther above. A calf was observed in the easement corner at this crossing and fled through an opening underneath the wires up the rock façade right at the downstream end of the culvert. This loose fencing will be communicated to the landowner and rectified; in addition, the landowner will be requested to keep the gates closed in the future.

It was noted by IRT that both UT2R1-L and UT2R1-U seem undersized and not passing sediments effectively to the point where they are not functioning as intended, and need either maintenance/repair or replaced entirely. A conclusion on the solutions to the issues at these two culverts remains to be seen; further evaluation/ calculations would need to be performed. DMS is evaluating further, pursuing alternatives, and will communicate statuses in the next monitoring report.

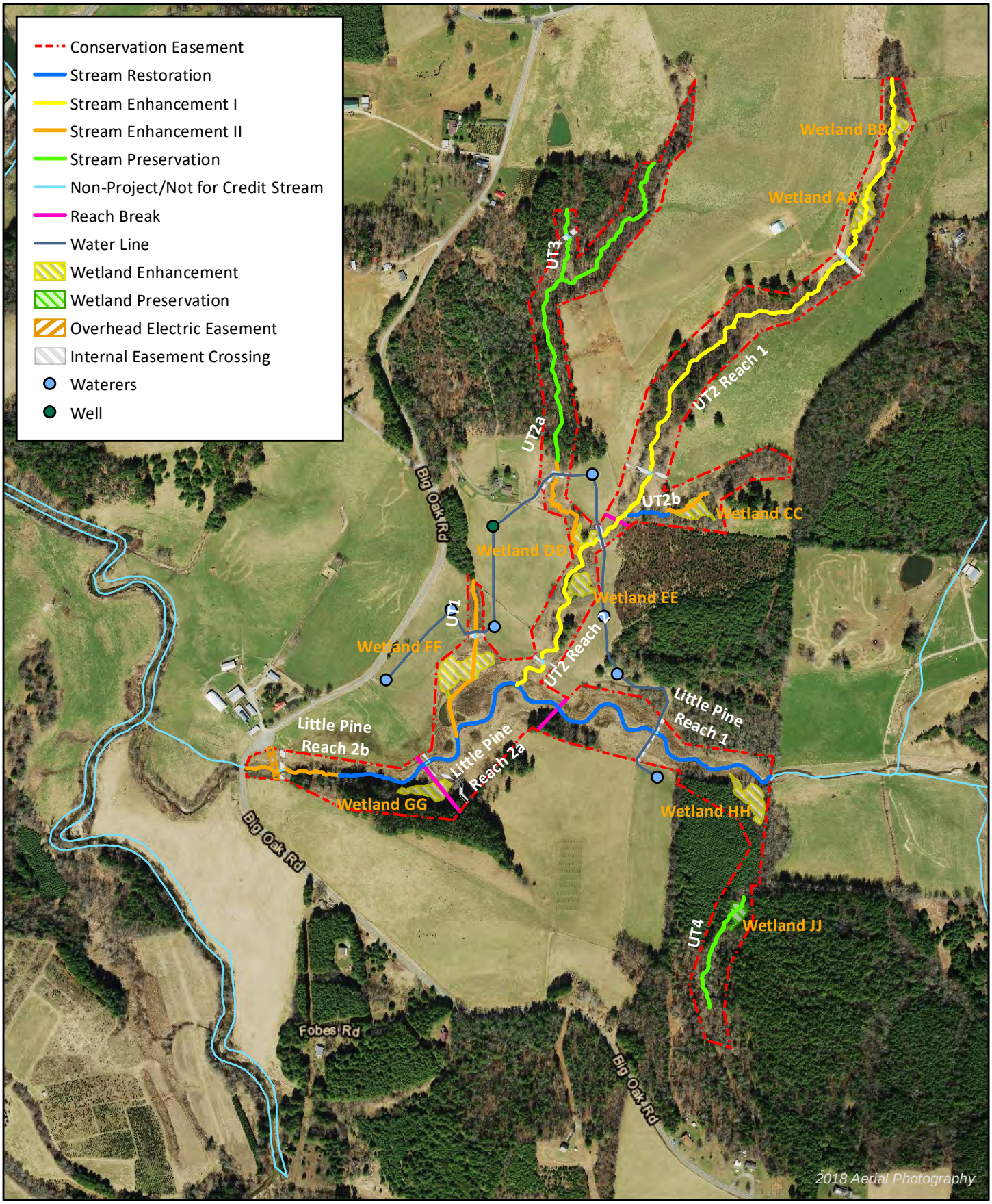
- Erin noted a head cut along UT2b the CCPV sheet that has appeared as a new feature on the MY5 (2019) CCPV that was not mapped in MY4. The group did not have time to observe but DMS agreed to evaluate and follow up appropriately.

- IRT recommended that DMS should photo-document selected areas that are starting to show signs of stress over the remaining monitoring period to help evaluate if and at what rate these areas may be trending downward, or stabilizing/ recovering. DMS intends to complete these assessments and provide as an appendix to the MY6/close out report.

- As far as credit release, Harry noted that stream credits are being proposed to release in 2021 up to 90% of the stream crediting across the project, leaving 10% (697.340 out of 6,973.40 credits total) being held for the remaining monitoring period following the 2021 proposed release. Todd asked about the proportional distribution of the repairs (length and credits) relative to the entire project and Harry noted that the quantities represented by the Phase 1 and 2 repair areas (and sections in between repairs along UT2/2a) were 7.5% of the total stream length and 9% of the total project stream credits. In general this approach seemed agreeable with the group although the project will be discussed further at the May 2021 credit release annual meeting.

- As far as remaining monitoring, the IRT requested that a full year of annual monitoring across the entire site (MY06/2021) should be added. Being originally a 5-year stream project, this will include all previously reported parameters (stream morphology, vegetation, and hydrology, etc.). Paul pointed out that DMS hopes to close out the project in 2022 following this additional year, if site criteria are being met. DMS has already been in scoping/contract discussions with Wildlands and will proceed with this contract action and activity.

Meeting notes compiled by:
Harry Tsomides, Project Manager
Division of Mitigation Services, NCDEQ
Tel. (828) 545-7057
Harry.Tsomides@ncdenr.gov



WILDLANDS ENGINEERING

0 700 Feet

N

Figure 2 Project Component/Asset Map
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 5 - 2020

Alleghany County, NC

Repair Conceptual Plan

Little Pine Creek III Repair

Alleghany County, North Carolina

DMS Project # 94903

USACE Action ID: 2012-01299

DWR # 20140041

Prepared by

Ecosystem Planning & Restoration
204 Stone Ridge Boulevard
Asheville, NC 28804

Prepared for

NCDEQ Division of Mitigation Services
217 West Jones St., Suite 3000A
Raleigh, N.C. 27603
(919)707-8976

August 23, 2021

PROJECT DESCRIPTION

The North Carolina Division of Mitigation Services (DMS) has requested that Ecosystem Planning and Restoration (EPR) provide site evaluation, design, construction administration and oversight services for repairs at the Little Pine Creek III Mitigation Project in the New River Basin, in Alleghany County, NC. The repairs will occur on UT1, UT2, UT2A, UT2B, and Little Pine Creek.

SITE ASSESSMENT

EPR conducted an initial site assessment to investigate each repair area on May 19, 2021. This assessment included visual inspections, measurements, and photo documentation at each repair location. These assessments also included investigations into the likely causes of the instability on each reach and potential solutions. From these assessments, EPR has developed an adaptive management plan that provides a general description of the repair site, potential causes of the instability, and provides a conceptual approach for the proposed repairs.

UT1 REPAIR AREA
DMS Location #5:

Existing conditions
The UT1 Repair Area consists of a section of UT1 where a headcut has formed and active downcutting is occurring. This headcut has developed upstream of previous headcut repairs. The cause of this headcut is likely due to lack of grade control designed into the original restoration plans and not addressing during previous repairs. Unless stabilization activities occur, the headcut is likely to continue migrating upstream.

Proposed approach
EPR proposes to stabilize this headcut a by using instream structures to provide adequate grade control. Structures will be placed in a way that dissipates energy during storm events and provides grade control. The vertical banks that currently exist due to the migrating headcut and any other disturbed or unstable areas adjacent to the existing headcut will be graded to 3:1 slopes or flatter and seeded, mulched, matted, and live staked.

UT 1 Repair Area

UT2 Repair Area
DMS Location #1 and Location #3

Existing conditions
This repair area consists of existing culverts at stream crossings at locations #1 and #3. Both culverts appear to be undersized and are frequently inundated with sediment. The crossings have also been overtopped on several occasions.

Proposed approach
Based on hydraulic analysis of the culverts, both culverts are undersized for the 25-year storm. Replacement of the 30-inch culverts with 48-inch culverts will convey the 25-year discharge without overtopping the road. EPR will work with DMS to determine if installing a larger culvert or replacing the culvert crossing with a ford crossing is the best course of action. Bed and bank stabilization upstream and downstream of both crossings will be incorporated as needed and include grade control structures to step down the channel if required. Cross fencing will be repaired. Upstream of location #1 at approximate station 310+10 the streambed will be stabilized using in-stream structures and the banks will be graded, matted, seeded, mulched, and live staked.

Culvert at Location #3

DMS Location #4 and Approximate Station 328+10

Existing conditions
These repair areas consist of bed and bank instability. Banks are eroding and several existing grade control structures are piping.

Proposed approach
EPR proposes to stabilize the bed instability by repairing or replacing the existing grade control structures. Structures will be repaired by excavating upstream and installing new filter fabric and bankfull to prevent piping or by re-building structures utilizing existing materials as much as possible. Banks will be graded to slopes of 3:1 or flatter, seeded, mulched, matted and live staked.


Piping structure and bank instability

UT2A Repair Area:
DMS Location #7

Existing conditions
Bank scour is occurring below UT2A culvert.

Proposed approach
EPR proposes to stabilize stream banks utilizing bank grading, bio-engineering and potentially an in-stream structure to help protect the stream bank.


Bank erosion along UT2A

UT2B Repair Area:
DMS Location #2

Existing conditions
Headcut in early stages of development is observed at location #2. Due to proximity to the repair work at location #1 this minor headcut will be stabilized while other repair work is being performed.

Proposed approach
EPR proposes to install a grade control structure such as a step or constructed riffle that will repair the head cut and prevent future degradation. Stream banks will be graded, seeded, mulched, matted and live staked.

Little Pine Creek Repair Area:
DMS Locations #9 and #11

Existing conditions
Locations #9 and #11 along Little Pine Creek are exhibiting bank slumping. Slumping is likely due to existing seeps and overland flow along with the lack of deep-rooted woody vegetation along banks.

Proposed approach
EPR proposes that areas suffering from bank erosion/slumping will be repaired and stabilized by a combination of grading and bioengineering with any seeps or overland flow being addressed with a stabilized outlet structure.

Bank slumping along Little Pine Creek
Little Pine Creek Repair Area:
DMS Locations #10

Existing conditions
Bank erosion near the log step at approximate station 124+50 is occurring. This is likely due to the structure being placed perpendicular to the flow. Other areas adjacent to log steps in the lower section of Little Pine Creek are also exhibiting this problem.

Proposed approach
These banks will be repaired and stabilized utilizing a combination of large stone and bioengineering. Geolifts utilizing live cuttings with a stone toe will be constructed in combination with the placement of some larger stone where needed.

Bank erosion below log step structure on Little Pine Creek
Little Pine Creek Repair Area:
DMS Locations #12

Existing conditions
Bank erosion near the log step is occurring. This is due to the structure being placed perpendicular to the flow and from consistent flow coming from an adjacent wetland seep.

Proposed approach
This seep will be stabilized utilizing boulder step structures. This will also provide bank protection and prevent further bank erosion caused by this structure in this location.

Bank erosion at log step on Little Pine Creek

Little Pine Creek Repair Area:
DMS Locations #13

Existing conditions
Existing streambanks from the approximate location of the existing farm crossing down to the bridge are exhibiting significant bank erosion. Poor woody vegetation growth was noted along this section. It was also noted that this section did not have very good floodplain access which likely is increasing bank shear stresses during flood events.

Proposed approach
A combination of bank grading and bioengineering will be utilized to stabilize these streambanks. Live stakes will be replanted along both banks in areas that do not receive any additional bioengineering such as soil lifts.


Little Pine Creek Repair Area: Bank erosion near station 131+00 (Location #13)

Little Pine Creek Repair Area:
Boulder J-Hook Structure at Approximate Station 120+50

Existing conditions
This structure is beginning to fail. The structure is piping, boulders have shifted, and flow is beginning to cut around the structure.

Proposed approach

EPR proposes to re-build the hook of this structure utilizing the existing boulders, new filter fabric and stone backfill and additional boulders for a longer sill. This will prevent future cutting around of this structure.

Failing J-hook structure along Little Pine Creek

Little Pine Creek Repair Area:
Planting and General Repairs

Existing conditions
Supplemental planting along previous repair haul road is required. This is along Phase 2, Area C.

Proposed approach

EPR proposes to plant 1 gallon tree species in this area.

Existing conditions
"Lunker logs" presumably installed originally for habitat improvements are causing stability issues in several areas.

Proposed approach

These logs will be removed where issues are occurring. Any disturbed areas will be stabilized using seeding, mulching, matting and live staking.

Existing conditions
Fencing near the farm crossing at station 107+00 has been damaged by storms.

Proposed approach

EPR proposes to repair this fencing.

Site Wide Notes:

All areas including access paths, staging areas, etc. that have been disturbed from construction/repair activities will be repaired and stabilized using seeding and mulching. Any disturbed areas outside the conservation easement will utilize tall fescue seed and areas inside the conservation easement will utilize a native riparian seed mix. All disturbed streambanks will be seeded, mulched, matted, and live staked unless another bioengineered approach is used such as soil lifts with live cuttings.

Little Pine III
Culvert and Stream Repairs (2021)
Little Pine Creek - Main

Legend

- STA_Point
- AB_PP
- AB_GWG
- AB_CG
- AB_barotroll
- nonprojectstreams
- AB_CE
- AB_XS_to_pins
- AB_Reach_Breaks
- OHE
- AB_VP
- OHE
- crossing_poly
- AB_Wetland
- <all other values>

RefName

- Enhancement I
- Enhancement II
- Preservation
- Restoration
- LP III Easement

5
Headcut/Incision

11a
Bank slumping

11a
Structure (J-hook)

10
Erosion

9
Bank slumping

13
Erosion

12
Erosion

Little Pine Reach 2a

Little Pine Reach 2b

Little Pine Reach 1

UT1

UT2

0 50 100 150 200 250 300 350 400 Feet

N
W E
S

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Little Pine III
Culvert and Stream Repairs (2021)
Tribs - Middle Section

Legend

- STA_Point
- AB_PP
- AB_GWG
- AB_CG
- AB_barotroll
- nonprojectstreams
- AB_CE
- AB_XS_to_pins
- AB_Reach_Breaks
- OHE
- AB_VP
- OHE
- crossing_poly
- AB_Wetland
- <all other values>

RefName

- Enhancement I
- Enhancement II
- Preservation
- Restoration
- LP III Easement

UT2A

Culvert D

7
Erosion

UT2A

21

1a
Filled in culvert

1b
Erosion

Culvert B

12

20

19

500+00

504+50

504+00

502+50

11

10

UT2B

Culvert C

2
Head cut

UT2

333+00

14

6
Erosion

197+26

11

5
Headcut/Incision

UT1

16

15

15

16

339+50

12

17

0 45 90 135 180 225 270 315 360 Feet

N E S

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Little Pine III
Culvert and Stream Repairs (2021)
UT2 - Upper Area

Legend

- STA_Point
- AB_PP
- AB_GWG
- AB_CG
- AB_barotroll
- nonprojectstreams
- AB_CE
- AB_XS_to_pins
- AB_Reach_Breaks
- OHE
- AB_VP
- OHE
- crossing_poly
- AB_Wetland
- <all other values>

RefName

- Enhancement I
- Enhancement II
- Preservation
- Restoration
- LP III Easement

0 30 60 90 120 150 180 210 240 Feet

 # 4a
structure piping/erosion

 # 3
filled in culvert

Culvert A

 # 4b
structure piping/erosion

UT2

302+00
302+50
303+00
303+50
304+00
304+50
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