MONITORING YEAR 4 ANNUAL REPORT

Final

LITTLE PINE III STREAM AND WETLAND RESTORATION PROJECT

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

Data Collection Period: March - December 2019
Draft Submission Date: January 6, 2020
Final Submission Date: February 4, 2020

PREPARED FOR:

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

PREPARED BY:

Wildlands Engineering, Inc.
1430 South Mint Street, Suite 104
Charlotte, NC 28203
Phone: 704.332.7754
Fax: 704.332.3306

February 4, 2020

Mr. Harry Tsomides
Project Manager
Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

RE: Monitoring Year 4 (MY4) Report – Final Submittal
Little Pine Creek III Mitigation Site
DMS ID 94903
DEQ 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 4 report for the Little Pine Creek III Mitigation Project. The following Wildlands responses to DMS's report comments are noted in italics lettering.

DMS comment; Can the two boulder sills (referenced in regard to upstream sediment deposition and the stream gage location) on UT1 be mapped or called out on the CCPV?

Wildlands response; A callout has been added to the CCPV to note the location of the two boulder sills on UT1.

DMS comment; The report accurately captures current conditions and activities, including recent repairs, invasive treatments, and upcoming repairs. Please include, in an Appendix, the repair plan sheets for UT2/2a (completed) and the draft repair plan (upcoming) for LPC and UT1 (both emailed to you with this letter). Once record drawings become available for these repairs they can be included in the Appendix in future reports.

Wildlands response; The repair plan sheets for UT2/2a and LPC/UT1 have been added to the report appendix. Additional record drawings will be included in future reports as they are available.

DMS comment; Please check with me regarding digital support files prior to finalizing the report. Everything looks fine overall but the minor comments I emailed to you should be addressed.

Wildlands response; An additional review of the digital support files has been completed. Minor comments regarding the digital support files have been resolved.

Two (2) hard copies of the Final Monitoring Report and a full electronic submittal has been mailed to the DMS western field office. 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. The monitoring year (MY) 4 activities occurred in March through December 2019.

Overall, the Site is on track to meet the MY5 monitoring success criteria for vegetation, geomorphology, and hydrology performance standards. The MY4 vegetation survey resulted in an average of 447 planted stems per acre, which is on track to meet the final MY5 monitoring requirement of 260 stems per acre with 19 of the 21 plots (90%) individually meeting this requirement. Previously observed areas of invasive plant populations have significantly been reduced by supplemental treatments that occurred in summer and fall 2019. Morphological surveys and visual assessment indicate that the channel dimensions are stable and functioning as designed, except for isolated areas on UT1 and Little Pine Creek. DMS has a repair plan scheduled in 2020 to address formation of headcuts and excessive streambank erosion on UT1 and Little Pine Creek. Along UT2a and UT2, stream repairs were completed in the fall 2019 to address areas of stream instability including the formation of head-cuts, lateral stream migration, and excessive streambank erosion that were amplified by the large storm events in September and October 2018. At least one bankfull event occurred during MY4 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 4 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 4 Data Assessment

Annual monitoring was conducted during MY4 (March to December 2019) 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 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 MY4 vegetation survey was completed in September 2019, resulting in an average planted stem density of 447 stems per acre. The Site is on track to meet the final MY5 requirement of 260 planted stems per acre, with 19 of the 21 plots (90%) individually meeting this requirement. The planted stem mortality was approximately 8% of the MY3 stem count (486 stems per acre). In addition, there is an average of 11 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 was a high planted stem mortality in VP11 due to competition with tall herbaceous vegetation. Along the floodplain of Little Pine Creek, some

stems were damaged from the large storms event of 2018. Approximately 1% of the remaining planted stems scored a vigor of 1, indicating that they are unlikely to survive. In addition, approximately 19% of the remaining planted stems scored a vigor of 2, indicating more than minor damage to leaf material and/or bark tissue exists. This is most likely due to stress on planted stems included storm damage, animal herbivory, insects, and too wet or dry conditions. Please refer to Appendix 2 for vegetation plot photographs and Appendix 3 for vegetation data tables.

1.2.2 Vegetation Areas of Concern

Some invasive plant populations were identified and treated within the Site boundary in MY4 with predominant species including: Japanese barberry (*Berberis thunvergii*), multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), and oriental bittersweet (*Celastrus orbiculatus*). Invasive species treatment occurred in July, August, September, and October 2019. This has significantly reduced the areas of invasive species from approximately 4% of the easement acreage in MY3 down to less than 1% in MY4.

Areas noted at the beginning of the MY4 monitoring year with poor herbaceous cover and sandy deposition on the floodplain of Little Pine Creek have naturally recovered with vegetation becoming well established. These vegetation areas of concern will continue to be monitored and addressed by DMS 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 MY4 were conducted in April and May 2019 along Little Pine Creek, UT2 Reach 1 upper, and UT2b. The remaining survey along UT2 occurred in December 2019 to capture the stream repair work that was completed in the fall 2019. 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 MY3 and MY4. 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 enhances aquatic habitat. Several instances of structure piping and sediment deposition were noted during the MY4 survey and are 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 width, maximum depth ratio, or width-to-depth ratio compared to baseline. Surveyed riffle cross-sections fell within the parameters defined for channels of the appropriate Rosgen stream type (Rosgen, 1996). Along Little Pine Creek Reach 1, floodplain sediment deposition is evident along both banks, thus increasing bankfull depths and decreasing width-to-depth ratios slightly. Riffle cross-sections along Little Pine Creek Reaches 2a and 2b have bank height ratios of 1.2 due to increased bankfull cross-sectional area and depths compared to baseline from bed and bank scour. Along UT2b, cross-section 10 plots show little change between MY3 and MY4, indicating that the deepening displayed in MY1 has stabilized. Along UT2, the most significant change in cross-section dimensions occurred at cross-section 16 where repairs in MY4 have stabilized stream banks. Stream areas of concern causing changes in cross-section dimensions are discussed further in section 1.2.4.

In general, substrate within the restoration reaches are maintaining coarser materials in the riffle reaches and finer particles in the pools. The particle size distributions for MY4 are similar to the as-built data in coarseness and distribution. Refer to Appendix 2 for the visual stability assessment table, Current

Condition Plan View (CCPV) maps, and reference photographs. Refer to Appendix 4 for the morphological summary data and plots.

1.2.4 Stream Areas of Concern

Stream areas of concern included instances of structure piping, bank scour, sediment deposition, and clogged culverts at internal easement crossings. On Little Pine Creek, stream areas of concern noted in MY3 persist into MY4 with new or expanded areas of bank scour (STA 100+80, 121+50, 131+20, 131+60, and 132+50) observed after the storm events of fall 2018. DMS has a repair plan scheduled in 2020 for Little Pine Creek Reach 1 (STA 100+43 to 101+75) and Reach 2a (STA 121+25 to 122+50) to address areas of bank instability.

Along UT1, several headcuts have formed as the channel slope increases above the culvert crossing. DMS has a repair plan to address headcuts upstream of the culvert crossing also in 2020. 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). In future years, as woody vegetation becomes more established and shades out the herbaceous cover, the baseflow is expected to become stronger and transport the accumulated fine sediment in the reach. Currently, a defined baseflow channel is still present downstream of the two installed boulder sills and this area will continue to be monitored for additional sediment aggradation in future years.

Structure piping that was first noted on UT2 Reach 1 Upper in MY2 persists into MY4 with an additional structure failure. Furthermore, sediment deposition is noted in MY4 above both of the culvert crossings on UT2 Reach 1 (Upper and Lower). Several areas of concern previously noted along UT2a and UT2 Reach 2 included formation of headcuts, lateral stream migration, and excessive streambank erosion. DMS contracted with a provider 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. The repairs were completed in the fall 2019. Please refer to Appendix 2 for stream stability tables and CCPV Figures 3.0-3.2.

1.2.5 Hydrology Assessment

At least one bankfull event occurred on Little Pine, UT2, and UT2b reaches during the MY4 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 on UT1, approximately 50 LF downstream of the two installed boulder sills. A total of 335 consecutive days of flow were documented in MY4 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 MY4 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 2019 indicated higher than normal rainfall amounts occurred during the months of February, April, June, and October and lower than normal rainfall amounts occurred during March and September 2019. Please refer to Appendix 2 for the groundwater gage location and Appendix 5 for groundwater hydrology data and plots.

1.3 Monitoring Year 4 Summary

Overall, the Site is on track to meet the MY5 monitoring success criteria for vegetation, geomorphology, and hydrology performance standards. The MY4 vegetation survey resulted in an average of 447 planted stems per acre, which is on track to meet the final MY5 monitoring requirement of 260 stems per acre with 19 of the 21 plots (90%) individually meeting this requirement. Previously observed areas of invasive plant populations have significantly been reduced by supplemental treatments that occurred in summer and fall 2019. Morphological surveys and visual assessment indicate that the channel dimensions are stable and functioning as designed, except for isolated areas on UT1 and Little Pine Creek. DMS has a repair plan scheduled in 2020 to address formation of headcuts and excessive streambank erosion on UT1 and Little Pine Creek. Along UT2a and UT2, stream repairs were completed in the fall 2019 to address areas of stream instability including the formation of head-cuts, lateral stream migration, and excessive streambank erosion that were amplified by the large storm events in September and October 2018. At least one bankfull event occurred during MY4 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 DMS's 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.

Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2008. CVS-EEP Protocol for Recording Vegetation Version 4.2. Retrieved from: http://cvs.bio.unc.edu/protocol/cvs-eep-protocol-v4.2-lev1-2.pdf

North Carolina Climate Retrieval and Observations Network of the Southeast Database (NCCRONOS). 2019. State Climate Office of North Carolina. Version 2.7.2. Station ID Sparta 3.5 SSW. Accessed October 2019.

North Carolina Division of Mitigation Services and Interagency Review Team Technical Workgroup. 2018. Standard Measurement of the BHR Monitoring Parameter. Raleigh, NC.

North Carolina Division of Water Resources (NCDWR). 2016. Surface Water Classifications. Retrieved from http://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications

NCDENR. 2009. New River Basin Restoration Priorities. Retrieved from http://deq.nc.gov/about/divisions/mitigation-services/dms-planning/watershed-planning-documents/new-river-basin

NCDENR. 2007. Little River & Brush Creek Local Watershed Plan (LWP) Project Atlas. Retrieved from http://deq.nc.gov/about/divisions/mitigation-services/dms-planning/watershed-planning-documents/new-river-basin

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

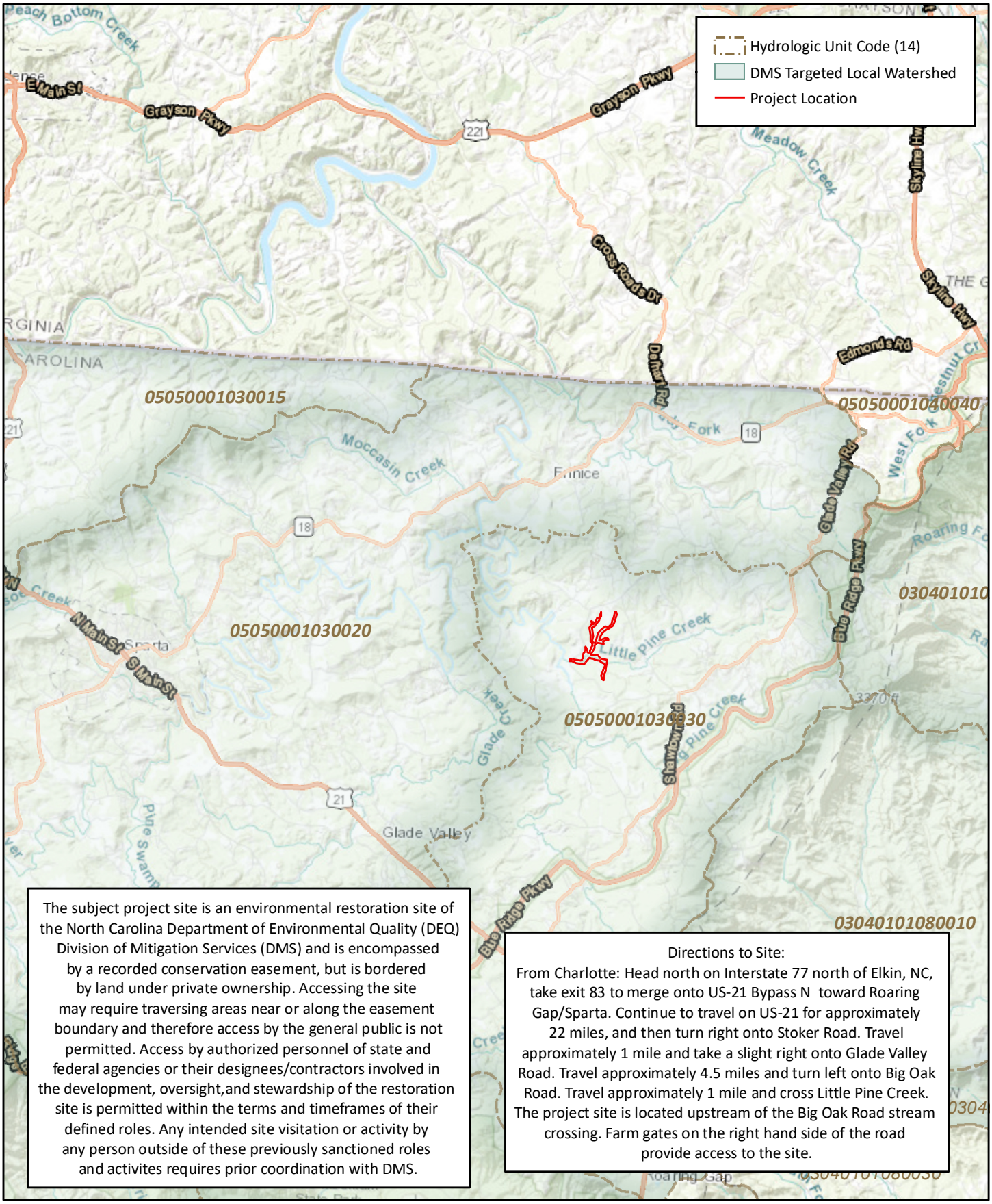
United States Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

United States Geological Survey (USGS), 1998. North Carolina Geology. https://deq.nc.gov/about/divisions/energy-mineral-land-resources/north-carolina-geological-survey/

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

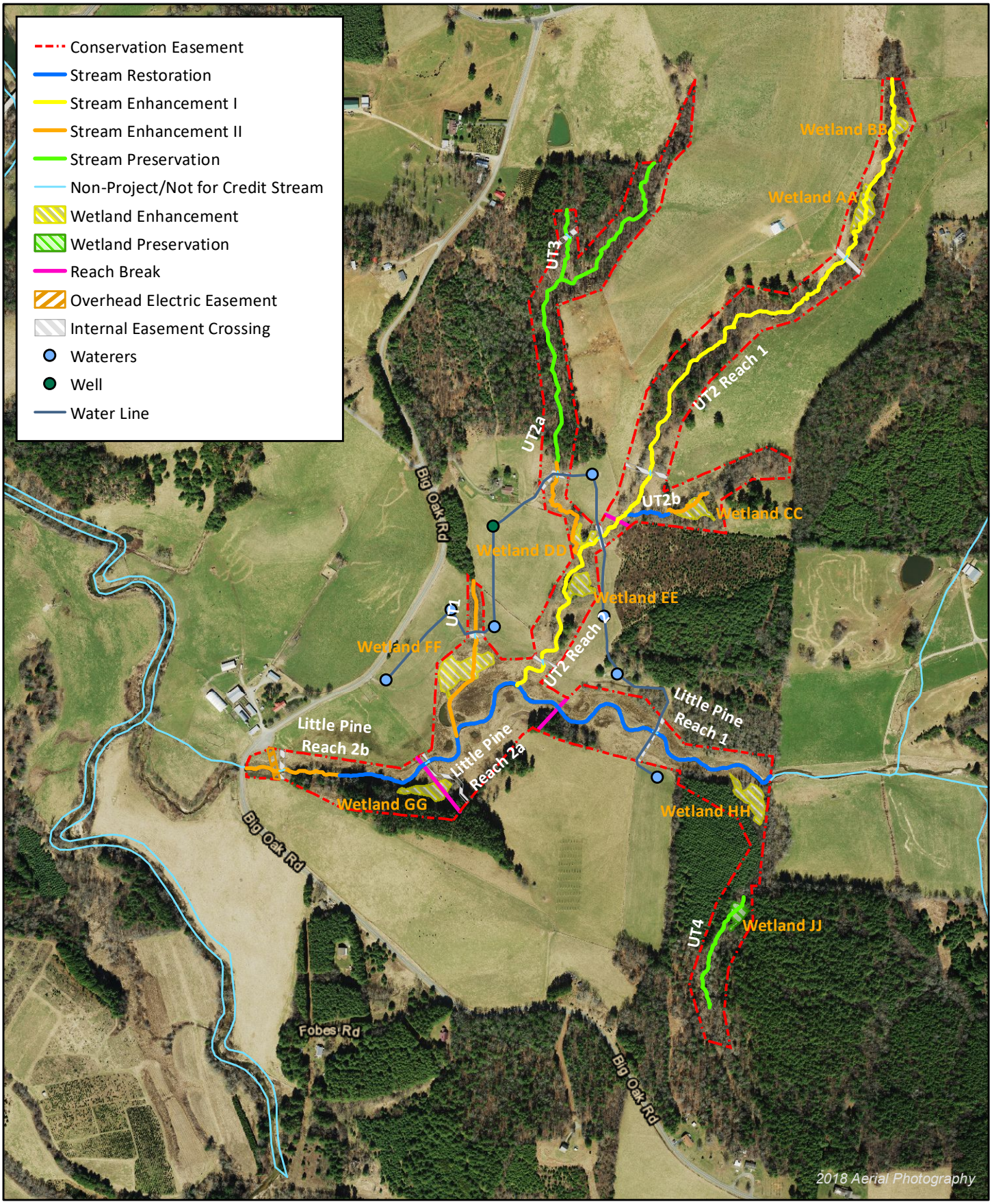


WILDLANDS ENGINEERING

0 0.5 1 Mile

Figure 1 Project Vicinity Map
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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 4 - 2019

Alleghany County, NC

Table 1. Project Components and Mitigation Credits
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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.
		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 4 - 2019

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	Vegetation Survey	2020	November 2020
	Stream Survey	2020	

[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 4 - 2019

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 4 - 2019

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 4 - 2019

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	N/A
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	N/A
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

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

Permanent Vegetation Plot (VP) - MY4

- Criteria Met
- Criteria Not Met

Vegetation Areas of Concern - MY4

- Barberry
- Multiflora Rose
- Oriental Bittersweet
- Bare/Poor Herbaceous Cover

Stream Areas of Concern - MY4

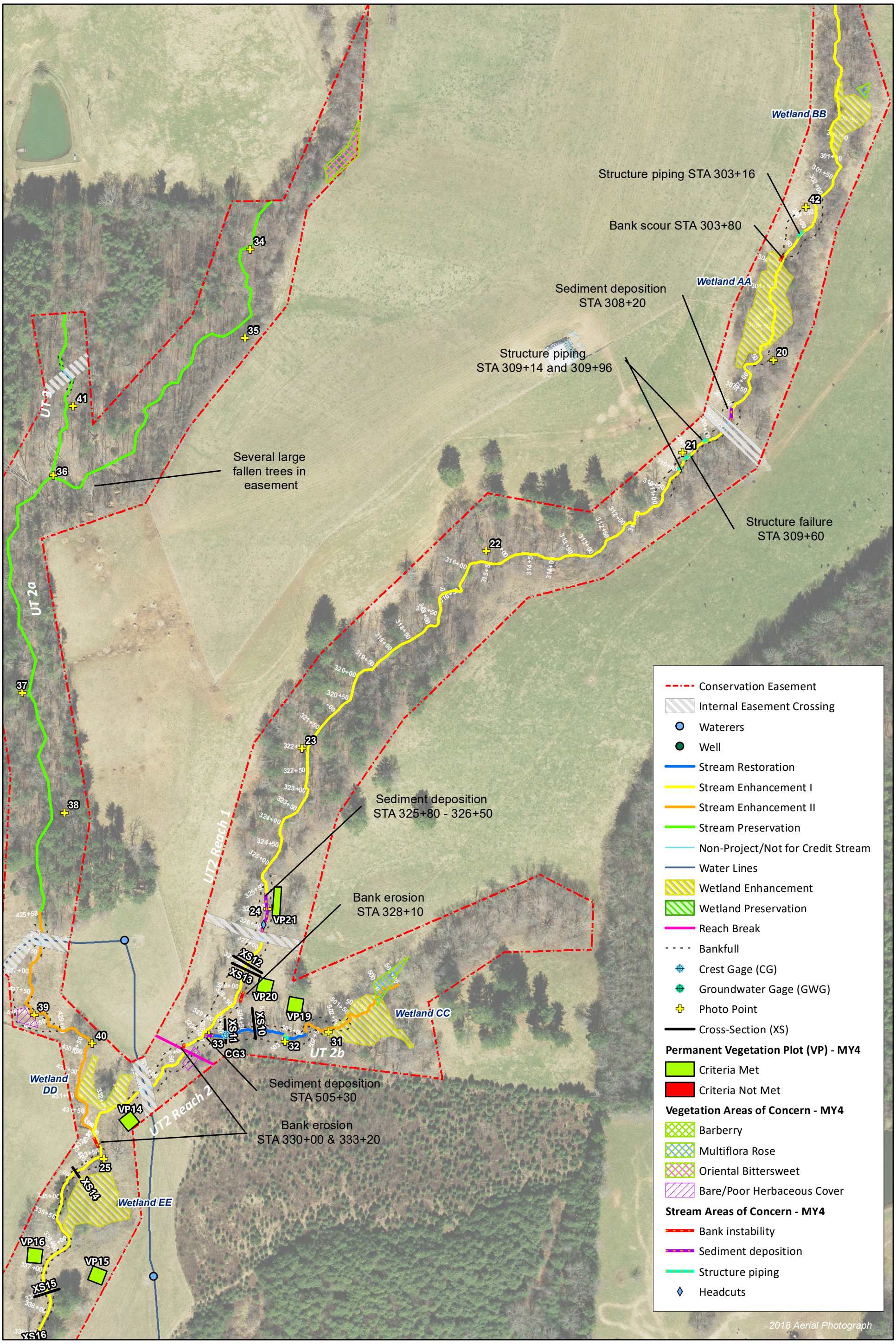
- Bank instability
- Sediment deposition
- Structure piping
- Headcuts

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
Big Oak Rd
2018 Aerial Photograph

WILDLANDS ENGINEERING

0 200 400 Feet

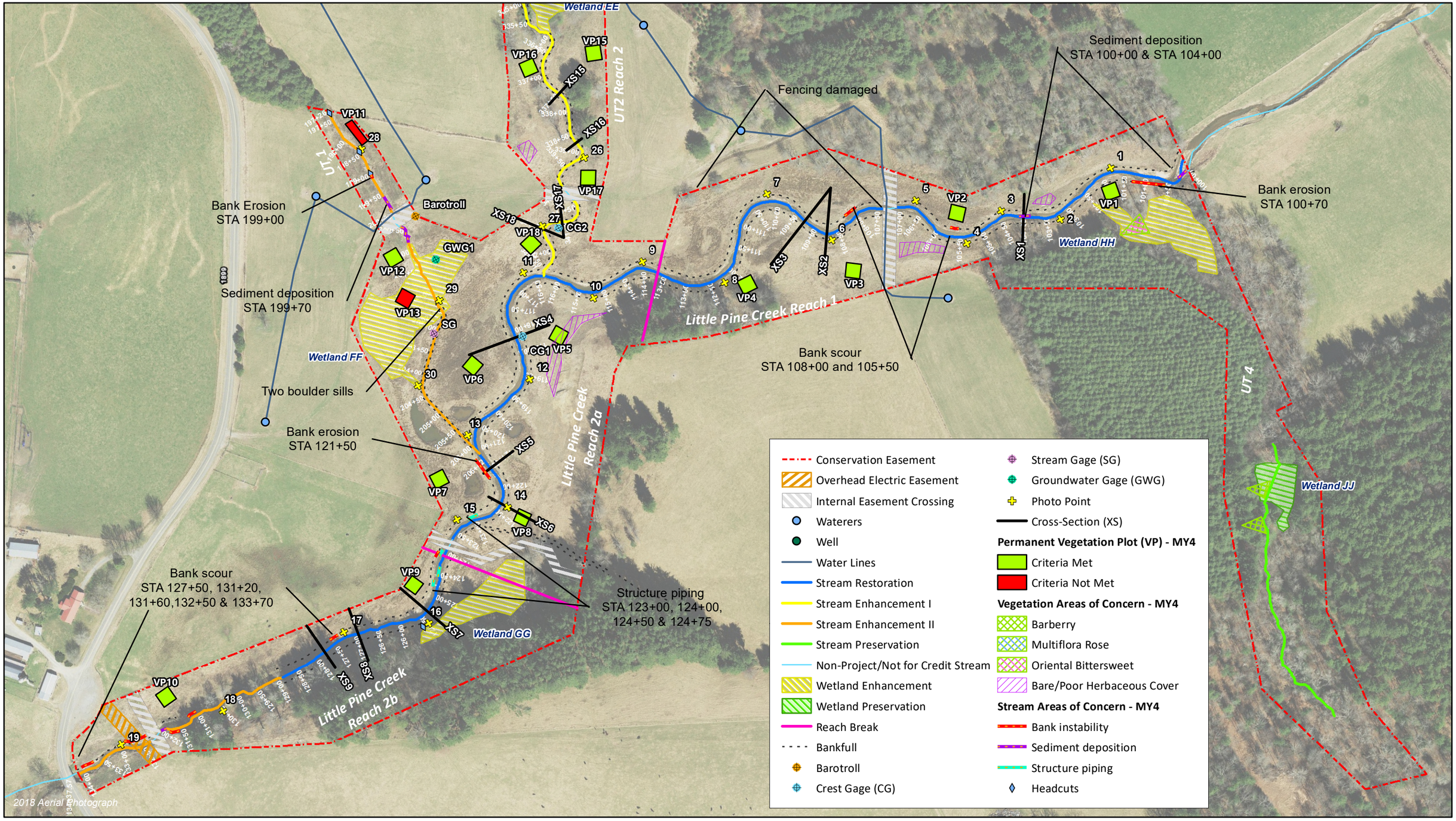
Figure 3.0 - Current Condition Plan View Map (Key)
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019
Alleghany County, NC



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 4 - 2019
Alleghany County, NC



WILDLANDS ENGINEERING

Figure 3.2 - Current Condition Plan View Map (Sheet 2)
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019
Alleghany County, NC

Table 6a. Visual Stream Morphology Stability Assessment Table

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 4 - 2019

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			2	50	97%			
		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			3	125	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	3	125	96%	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 4 - 2019

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			1	50	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	50	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 4 - 2019

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			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.	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 4 - 2019

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	40	97%			
		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			1	15	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	15	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 4 - 2019

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	80	82%			
		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.	15	20			75%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	15	20			75%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	15	20			75%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	15	20			75%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	15	20			75%			

[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 4 - 2019

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			1	100	92%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	14	15			93%			
	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			1	25	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	25	99%	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 4 - 2019

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			0	0	100%	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	0	0	100%	n/a	n/a	n/a
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	21	23			91%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	21	23			91%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	21	23			91%			
	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 4 - 2019

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	6	0.26	0.9%
Low Stem Density Areas[1]	Woody stem densities clearly below target levels based on MY3, 4, 5, or 7 stem count criteria.	0.1	2	0.05	0.2%
		Total	**8**	**0.30**	**1.1%**
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	**8**	**0.3**	**1.1%**

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	6	0.2	0.4%
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 *(04/30/2019)*	**Photo Point 1** – Little Pine Reach 1, looking downstream *(04/30/2019)*
	
Photo Point 2 – Little Pine Reach 1, looking upstream *(04/30/2019)*	**Photo Point 2** – Little Pine Reach 1, looking downstream *(04/30/2019)*
	
Photo Point 3 – Little Pine Reach 1, looking upstream *(04/30/2019)*	**Photo Point 3** – Little Pine Reach 1, looking downstream *(04/30/2019)*

	
Photo Point 4 – Little Pine Reach 1, looking upstream *(04/30/2019)*	**Photo Point 4** – Little Pine Reach 1, looking downstream *(04/30/2019)*
	
Photo Point 5 – Little Pine Reach 1, looking upstream *(04/30/2019)*	**Photo Point 5** – Little Pine Reach 1, looking downstream *(04/30/2019)*
	
Photo Point 6 – Little Pine Reach 1, looking upstream *(04/30/2019)*	**Photo Point 6** – Little Pine Reach 1, looking downstream *(04/30/2019)*

	
Photo Point 7 – Little Pine Reach 1, looking upstream *(04/30/2019)*	**Photo Point 7** – Little Pine Reach 1, looking downstream (04*/30/2019)*
	
Photo Point 8 – Little Pine Reach 1, looking upstream *(04/30/2019)*	**Photo Point 8** – Little Pine Reach 1, looking downstream *(04/30/2019)*
	
Photo Point 9 – Little Pine Reach 2a, looking upstream *(04/30/2019)*	**Photo Point 9** – Little Pine Reach 2a, looking downstream *(04/30/2019)*

	
Photo Point 10 – Little Pine Reach 2a, looking upstream *(04/30/2019)*	**Photo Point 10** – Little Pine Reach 2a, looking downstream *(04/30/2019)*
	
Photo Point 11 – Little Pine Reach 2a, looking upstream *(04/30/2019)*	**Photo Point 11** – Little Pine Reach 2a, looking downstream *(04/30/2019)*
	
Photo Point 12 – Little Pine Reach 2a, looking upstream *(05/01/2019)*	**Photo Point 12** – Little Pine Reach 2a, looking downstream *(05/01/2019)*

	
Photo Point 13 – Little Pine Reach 2a, looking upstream *(05/01/2019)*	**Photo Point 13** – Little Pine Reach 2a, looking downstream *(05/01/2019)*
	
Photo Point 14 – Little Pine Reach 2a, looking upstream *(05/01/2019)*	**Photo Point 14** – Little Pine Reach 2a, looking downstream *(05/01/2019)*
	
Photo Point 15 – Little Pine Reach 2a, looking upstream *(05/01/2019)*	**Photo Point 15** – Little Pine Reach 2a, looking downstream *(05/01/2019)*

	
Photo Point 16 – Little Pine Reach 2b, looking upstream *(05/01/2019)*	**Photo Point 16** – Little Pine Reach 2b, looking downstream *(05/01/2019)*
	
Photo Point 17 – Little Pine Reach 2b, looking upstream *(05/01/2019)*	**Photo Point 17** – Little Pine Reach 2b, looking downstream *(05/01/2019)*
	
Photo Point 18 – Little Pine Reach 2b, looking upstream *(05/01/2019)*	**Photo Point 18** – Little Pine Reach 2b, looking downstream *(05/01/2019)*

	
Photo Point 19 – Little Pine Reach 2b, looking upstream *(05/01/2019)*	**Photo Point 19** – Little Pine Reach 2b, looking downstream *(05/01/2019)*
	
Photo Point 20 – UT2 Reach 1, looking upstream *(04/30/2019)*	**Photo Point 20** – UT2 Reach 1, looking downstream *(04/30/2019)*
	
Photo Point 21 – UT2 Reach 1, looking upstream *(04/30/2019)*	**Photo Point 21** – UT2 Reach 1, looking downstream *(04/30/2019)*

	
Photo Point 22 – UT2 Reach 1, looking upstream *(04/30/2019)*	**Photo Point 22** – UT2 Reach 1, looking downstream *(04/30/2019)*
	
Photo Point 23 – UT2 Reach 1, looking upstream *(04/30/2019)*	**Photo Point 23** – UT2 Reach 1, looking downstream *(04/30/2019)*
	
Photo Point 24 – UT2 Reach 1, looking upstream *(04/30/2019)*	**Photo Point 24** – UT2 Reach 1, looking downstream *(04/30/2019)*

	
Photo Point 25 – UT2 Reach 2, looking upstream *(04/30/2019)*	**Photo Point 25** – UT2 Reach 2, looking downstream *(04/30/2019)*
	
Photo Point 26 – UT2 Reach 2, looking upstream *(04/30/2019)*	**Photo Point 26** – UT2 Reach 2, looking downstream *(04/30/2019)*
	
Photo Point 27 – UT2 Reach 2, looking upstream *(04/30/2019)*	**Photo Point 27** – UT2 Reach 2, looking downstream *(04/30/2019)*

	
Photo Point 28 – UT1, looking upstream *(05/01/2019)*	**Photo Point 28** – UT1, looking downstream *(05/01/2019)*
	
Photo Point 29 – UT1, looking upstream *(05/01/2019)*	**Photo Point 29** – UT1, looking downstream *(05/01/2019)*
	
Photo Point 30 – UT1, looking upstream *(05/01/2019)*	**Photo Point 30** – UT1, looking downstream *(05/01/2019)*

	
Photo Point 31 – UT2b, looking upstream *(04/30/2019)*	**Photo Point 31** – UT2b, looking downstream *(04/30/2019)*
	
Photo Point 32 – UT2b, looking upstream *(04/30/2019)*	**Photo Point 32** – UT2b, looking downstream *(04/30/2019)*
	
Photo Point 33 – UT2b, looking upstream *(04/30/2019)*	**Photo Point 33** – UT2b, looking upstream *(04/30/2019)*

Photo Point 33 – UT2, looking downstream *(04/30/2019)*

Photo Point 34 – UT2a, looking upstream *(04/30/2019)*

Photo Point 34 – UT2a, looking downstream *(04/30/2019)*

Photo Point 35 – UT2a, looking upstream *(04/30/2019)*

Photo Point 35 – UT2a, looking downstream *(04/30/2019)*

Photo Point 36 – UT2a, looking upstream *(04/30/2019)*

Photo Point 36 – looking upstream UT3 *(04/30/2019)*

Photo Point 36 – UT2a, looking downstream *(04/30/2019)*

Photo Point 37 – UT2a, looking upstream *(04/30/2019)*

Photo Point 37 – UT2a, looking downstream *(04/30/2019)*

	
Photo Point 38 – UT2a, looking upstream *(04/30/2019)*	**Photo Point 38** – UT2a, looking downstream *(04/30/2019)*
	
Photo Point 39 – UT2a, looking upstream *(04/30/2019)*	**Photo Point 39** – UT2a, looking downstream *(04/30/2019)*
	
Photo Point 40 – UT2a, looking upstream *(04/30/2019)*	**Photo Point 40** – UT2a, looking downstream *(04/30/2019)*

	
Photo Point 41 – UT3, looking upstream *(04/30/2019)*	**Photo Point 41** – UT3, looking downstream *(04/30/2019)*
	
Photo Point 42 – UT2 Reach 1, looking upstream *(04/30/2019)*	**Photo Point 42** – UT2 Reach 1, looking downstream *(04/30/2019)*

Vegetation Photographs

Vegetation Plot 1 – *(09/16/2019)*

Vegetation Plot 2 – *(09/16/2019)*

Vegetation Plot 3 – *(09/16/2019)*

Vegetation Plot 4 – *(09/17/2019)*

Vegetation Plot 5 – *(09/17/2019)*

Vegetation Plot 6 – *(09/17/2019)*

	
Vegetation Plot 7 – *(09/17/2019)*	**Vegetation Plot 8** – *(09/17/2019)*
	
Vegetation Plot 9 – *(09/17/2019)*	**Vegetation Plot 10** – *(09/17/2019)*
	
Vegetation Plot 11 – *(09/17/2019)*	**Vegetation Plot 12** – *(09/17/2019)*

Vegetation Plot 13 – *(09/17/2019)*

Vegetation Plot 14 – *(09/18/2019)*

Vegetation Plot 15 – *(09/17/2019)*

Vegetation Plot 16 – *(09/17/2019)*

Vegetation Plot 17 – *(09/17/2019)*

Vegetation Plot 18 – *(09/17/2019)*

Vegetation Plot 19 – *(09/18/2019)*

Vegetation Plot 20 – *(09/18/2019)*

Vegetation Plot 21 – *(09/18/2019)*

APPENDIX 3. Vegetation Plot Data

Table 8. Vegetation Plot Criteria Attainment

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Plot	MY4 Success Criteria Met (Y/N)	Tract Mean
1	Y	
2	Y	
3	Y	
4	Y	
5	Y	
6	Y	
7	Y	
8	Y	
9	Y	
10	Y	
11	N	90%
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 4 - 2019

Database Name	cvs-eep-entrytool-v2.5.0 LP III MY4.mdb
Database Location	L:\ActiveProjects\005-02160 Little Pine III Monitoring\Monitoring\Monitoring Year 4\Vegetation Assessment
Computer Name	MIMI-PC
File Size	49389568
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
River Basin	
Length(ft)	
Stream-to-edge Width (ft)	
Area (sq m)	
Required Plots (calculated)	
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 4 - 2019

Current Plot Data (MY4 2019)																								
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			15	1	1	1	2	2	2	5	5	5	4	4	4				1	1	5
Alnus serrulata	Tag Alder	Shrub Tree																		1			
Betula nigra	River Birch	Tree	1	1	1	3	3	3	3	3	3	2	2	2				5	5	5	1	1	1
Cercis canadensis	Redbud	Shrub Tree	1	1	1							3	3	3	4	4	4				2	2	2
Cornus	Dogwood	Shrub Tree																					1
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	6	2	2	2				8	8	8
Liriodendron tulipifera	Tulip Poplar	Tree																					
Platanus occidentalis	Sycamore	Tree	1	1	1	1	1	1				1	1	1	1	1	1	3	3	3	3	3	3
Salix sericea	Silky Willow	Shrub Tree						2															
Sambucus canadensis	Common Elderberry	Shrub Tree												1									
Ulmus americana	American Elm	Tree	3	3	3	2	2	2	8	8	8				3	3	3						
Stem count			7	7	22	9	9	11	15	15	15	16	16	18	14	14	14	8	8	9	15	15	20
size (ares)			1			1			1			1			1			1			1		
size (ACRES)			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247		
Species count			5	5	6	5	5	6	4	4	4	5	5	6	5	5	5	2	2	3	5	5	6
Stems per ACRE			283	283	890	364	364	445	607	607	607	647	647	728	567	567	567	324	324	364	607	607	809

Current Plot Data (MY4 2019)																								
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	7	7	7	4	4	4	2	2	2				1	1	1						
Alnus serrulata	Tag Alder	Shrub Tree																					
Betula nigra	River Birch	Tree				1	1	1	1	1	1				4	4	5				2	2	2
Cercis canadensis	Redbud	Shrub Tree	3	3	3	1	1	2	1	1	1				1	1	1				1	1	1
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	5	5	6	1	1	1	2	2	2
Liriodendron tulipifera	Tulip Poplar	Tree																					
Platanus occidentalis	Sycamore	Tree	1	1	1				2	2	2				1	1	2	1	1	1	2	2	3
Salix sericea	Silky Willow	Shrub Tree																					
Sambucus canadensis	Common Elderberry	Shrub Tree						2			1												
Ulmus americana	American Elm	Tree				4	4	4							2	2	2				5	5	5
Stem count			15	15	15	13	13	16	10	10	14	3	3	3	14	14	17	2	2	2	12	12	13
size (ares)			1			1			1			1			1			1			1		
size (ACRES)			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247		
Species count			4	4	4	5	5	6	5	5	6	1	1	1	6	6	6	2	2	2	5	5	5
Stems per ACRE			607	607	607	526	526	647	405	405	567	121	121	121	567	567	688	81	81	81	486	486	526

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 4 - 2019

Current Plot Data (MY4 2019)																							
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			15	5	5	5							1	1	36			20	2	2	22
Alnus serrulata	Tag Alder	Shrub Tree																					
Betula nigra	River Birch	Tree	3	3	3				3	3	3	3	3	3	1	1	1	1	1	1	3	3	3
Cercis canadensis	Redbud	Shrub Tree										5	5	5	1	1	1	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
Liriodendron tulipifera	Tulip Poplar	Tree																		1			1
Platanus occidentalis	Sycamore	Tree	8	8	8	1	1	1				5	5	5							2	2	2
Salix sericea	Silky Willow	Shrub Tree																					
Sambucus canadensis	Common Elderberry	Shrub Tree																					
Ulmus americana	American Elm	Tree							3	3	3	1	1	1	2	2	2	5	5	5			
Stem count			13	13	28	10	10	10	10	10	10	16	16	16	9	9	44	11	11	32	10	10	31
size (ares)			1			1			1			1			1			1			1		
size (ACRES)			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247			0.0247		
Species count			3	3	4	3	3	3	3	3	3	5	5	5	5	5	5	4	4	6	4	4	5
Stems per ACRE			526	526	1133	405	405	405	405	405	405	647	647	647	364	364	1781	445	445	1295	405	405	1255

Annual Means																	
Scientific Name	**Common Name**	**Species Type**	**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**
Acer rubrum	Red Maple	Tree	35	35	144	34	34	99	41	41	45	45	45	45	50	50	50
Alnus serrulata	Tag Alder	Shrub Tree			1			3			1			1			
Betula nigra	River Birch	Tree	37	37	38	39	39	39	39	39	41	41	41	41	49	49	49
Cercis canadensis	Redbud	Shrub Tree	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						5									
Fraxinus pennsylvanica	Green Ash	Tree	63	63	68	67	67	68	61	61	67	58	58	58	58	58	58
Liriodendron tulipifera	Tulip Poplar	Tree			2			4			1						
Platanus occidentalis	Sycamore	Tree	33	33	35	33	33	35	33	33	33	33	33	33	30	30	30
Salix sericea	Silky Willow	Shrub Tree			2												
Sambucus canadensis	Common Elderberry	Shrub Tree			4												
Ulmus americana	American Elm	Tree	38	38	38	44	44	44	47	47	47	50	50	50	52	52	52
Stem count			232	232	360	252	252	337	256	256	272	271	271	272	285	285	285
size (ares)			21			21			21			21			21		
size (ACRES)			0.52			0.52			0.52			0.52			0.52		
Species count			6	6	11	6	6	10	6	6	8	6	6	7	6	6	6
Stems per ACRE			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 4 - 2019

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

Parameter	Gage	Pre-Restoration Condition						Reference Reach Data		Design						As-Built/Baseline					
		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 4 - 2019

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)	N/A	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)		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)	N/A							---		---		---		---		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)								---		---		---		---		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)	N/A	---		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)		---		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%	N/A																				
SC%/Sa%/G%/C%/B%/Be%																					
d16/d35/d50/d84/d95/d100		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)	N/A	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)		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 4 - 2019

	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**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft)	2,535.4	2,535.4	2,535.4	2,535.7	2535.9		2,533.2	2,533.2	2,533.2	2,533.5	2,534.0		2,532.9	2,532.9	2,532.9	2,533.2	2,533.5	
Low Bank Elevation (ft)	2,535.4	2,535.4	2,535.5	2,535.7	2535.9		2,533.2	2,533.2	2,533.1	2,533.5	2,534.0		2,532.4	2,532.2	2,532.5	2,533.2	2,533.5	
Bankfull Width (ft)	30.3	29.9	30.8	29.5	29.1		30.6	30.9	30.9	29.8	29.5		33.5	32.9	32.3	29.5	23.7	
Floodprone Width (ft)	132.9	135.1	135.1	>106	>106		---	---	---	---	---	---	>200	>200	>200	>215	>215	
Bankfull Mean Depth (ft)	1.8	1.7	1.7	1.9	1.9		2.2	2.1	2.2	2.3	2.6		1.6	1.6	1.6	1.8	2.3	
Bankfull Max Depth (ft)	2.7	2.8	3.2	3.1	3.1		4.3	3.9	4.4	4.8	5.2		3.2	3.1	3.0	3.5	3.5	
Bankfull Cross Sectional Area (ft^2)	53.5	49.8	52.8	55.9	55.6		68.0	65.9	66.9	69.4	76.0		52.2	51.8	52.2	53.6	54.7	
Bankfull Width/Depth Ratio	17.1	18.0	18.0	15.6	15.3		---	---	---	---	---	---	21.4	20.9	20.0	16.3	10.3	
Bankfull Entrenchment Ratio	4.4	4.5	4.4	>3.6	>3.6		---	---	---	---	---	---	>6.0	>6.1	>6.2	>7.3	>9.1	
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		---	---	---	---	---	---	<1.0	<1.0	<1.0	1.0	1.0	
	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**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft)	2,527.4	2,527.4	2,527.4	2,527.7	2,527.8		2,525.4	2,525.4	2,525.4	2,525.4	2,525.8		2,524.8	2,524.8	2,524.8	2,524.4	2,525.2	
Low Bank Elevation (ft)	2,527.4	2,527.5	2,527.5	2,527.7	2,527.8		2,525.4	2,525.3	2,525.4	2,525.4	2,525.8		2,524.8	2,524.5	2,524.7	2,524.4	2,525.2	
Bankfull Width (ft)	29.1	29.3	28.5	31.0	27.9		30.7	31.3	31.0	31.4	31.5		35.4	35.5	35.4	27.7	32.7	
Floodprone Width (ft)	>200	>200	>200	>189	>189		>200	>200	>200	>90	>79.5		---	---	---	---	---	
Bankfull Mean Depth (ft)	1.6	1.6	1.8	1.9	2.2		1.9	1.8	1.9	2.0	2.6		2.6	2.4	2.4	2.4	3.0	
Bankfull Max Depth (ft)	2.6	2.6	2.9	3.9	4.1		3.9	3.6	3.5	3.6	5.4		5.7	5.1	5.3	4.6	5.5	
Bankfull Cross Sectional Area (ft^2)	46.6	46.4	49.8	57.8	62.6		56.9	56.7	58.2	63.1	82.3		93.4	83.6	86.5	67.4	98.7	
Bankfull Width/Depth Ratio	18.1	18.5	16.2	16.6	12.5		16.6	17.2	16.5	15.6	12.0		---	---	---	---	---	
Bankfull Entrenchment Ratio	>6.9	>6.8	>7.0	>6.1	>6.8		>6.5	>6.4	>6.5	>2.9	>2.5		---	---	---	---	---	
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.1	1.2		1.0	1.0	1.0	1.1	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**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft)	2,522.0	2,522.0	2,522.0	2,522.2	2,522.5		2,520.1	2,520.1	2,520.1	2,520.3	2,520.4		2,519.5	2,519.5	2,519.5	2,519.5	2,519.6	
Low Bank Elevation (ft)	2,522.0	2,522.0	2,522.2	2,522.2	2,522.5		2,520.1	2,520.1	2,520.2	2,520.3	2,520.4		2,519.5	2,519.5	2,519.4	2,519.5	2,519.6	
Bankfull Width (ft)	35.3	35.5	35.2	39.4	40.3		28.7	29.8	29.4	30.3	31.8		31.9	30.7	29.3	31.2	32.7	
Floodprone Width (ft)	---	---	---	---	---		>200	>200	>200	>121	>121		>200	>200	>200	>110	>110	
Bankfull Mean Depth (ft)	2.9	2.8	2.8	2.5	2.6		2.1	2.1	2.0	2.3	2.4		2.0	2.0	2.1	2.2	2.3	
Bankfull Max Depth (ft)	5.4	5.6	5.4	5.4	5.5		3.4	3.6	3.4	4.2	4.5		3.1	3.2	3.0	3.7	3.9	
Bankfull Cross Sectional Area (ft^2)	103.7	100.0	97.2	96.9	104.8		58.8	61.2	59.8	68.3	77.5		64.2	62.3	60.2	67.4	74.3	
Bankfull Width/Depth Ratio	---	---	---	---	---		14.0	14.5	14.4	13.5	13.1		15.9	15.2	14.2	14.4	14.3	
Bankfull Entrenchment Ratio	---	---	---	---	---		>7.0	>6.7	>6.8	>4.0	>3.8		>6.3	>6.5	>6.9	>3.5	>3.4	
Bankfull Bank Height Ratio	---	---	---	---	---		1.0	1.0	1.0	1.1	1.2		1.0	1.0	1.0	1.0	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 4 - 2019

	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**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft)	2,570.0	2,570.0	2,570.0	2,570.1	2,570.2		2,566.4	2,566.4	2,566.4	2,566.3	2,566.3		2,573.8	2,573.8	2,573.8	2,573.9	2,573.8	
Low Bank Elevation (ft)	2,570.0	2,569.7	2,570.0	2,570.1	2,570.2		2,566.4	2,566.4	2,566.2	2,566.3	2,566.3		2,573.8	2,573.7	2,573.7	2,573.9	2,573.8	
Bankfull Width (ft)	5.9	6.0	6.1	7.3	7.6		6.7	6.3	6.6	6.3	6.4		8.1	8.4	8.6	8.9	7.1	
Floodprone Width (ft)	---	---	---	---	---		15.9	17.7	17.9	14.3	14.1		28.4	30.0	30.0	31.4	29.5	
Bankfull Mean Depth (ft)	1.0	2.3	2.4	2.3	2.3		0.5	0.7	0.7	0.5	0.4		0.6	0.7	0.6	0.7	0.6	
Bankfull Max Depth (ft)	1.7	3.4	3.3	3.4	3.3		0.9	1.1	1.1	0.8	0.8		1.0	1.3	1.2	1.4	1.2	
Bankfull Cross Sectional Area (ft^2)	5.7	14.0	14.9	16.6	17.3		3.7	4.3	4.5	3.0	2.3		5.1	5.7	5.4	5.9	4.4	
Bankfull Width/Depth Ratio	---	---	---	---	---		12.2	9.1	9.6	13.2	17.9		13.0	12.5	13.9	13.4	11.5	
Bankfull Entrenchment Ratio	---	---	---	---	---		2.4	2.8	2.7	2.3	2.2		3.5	3.6	3.5	3.5	4.2	
Bankfull Bank Height Ratio	---	---	---	---	---		1.0	1.0	<1.0	0.9	0.8		1.0	<1.0	<1.0	1.1	0.9	
	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**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft)	2,573.3	2,573.3	2,573.3	2,573.4	2,573.3		2,547.2	2,547.2	2,547.2	2,547.4	2,547.7		2,539.1	2,539.1	2,539.1	2,539.1	2,539.2	
Low Bank Elevation (ft)	2,573.3	2,573.3	2,573.3	2,573.4	2,573.3		2,547.2	2,547.2	2,547.1	2,547.4	2,547.7		2,539.1	2,539.0	2,539.2	2,539.1	2,539.2	
Bankfull Width (ft)	9.8	10.1	10.4	10.2	10.0		10.8	8.0	9.2	6.9	7.6		12.2	11.6	12.0	11.4	11.4	
Floodprone Width (ft)	---	---	---	---	---		21.5	23.2	23.5	25.0	25.0		---	---	---	---	---	
Bankfull Mean Depth (ft)	1.3	1.2	1.4	1.6	1.5		0.5	0.8	0.7	0.7	0.8		1.5	1.0	1.2	1.2	1.0	
Bankfull Max Depth (ft)	2.2	1.9	2.5	3.0	2.8		1.1	1.2	1.2	1.2	1.3		3.1	1.7	2.2	1.9	1.7	
Bankfull Cross Sectional Area (ft^2)	12.8	12.5	15.0	16.6	15.0		5.9	6.6	6.6	4.6	6.3		18.7	11.9	14.4	13.9	11.4	
Bankfull Width/Depth Ratio	---	---	---	---	---		20.1	9.7	13.0	10.5	9.3		---	---	---	---	---	
Bankfull Entrenchment Ratio	---	---	---	---	---		2.0	2.9	2.5	3.6	3.3		---	---	---	---	---	
Bankfull Bank Height Ratio	---	---	---	---	---		1.0	1.0	<1.0	0.9	1.0		---	---	---	---	---	
	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**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
Bankfull Elevation (ft)	2,535.0	2,535.0	2,535.0	2,535.5	2,535.6		2,531.2	2,531.2	2,531.2	2,531.2	2,531.3		2,530.4	2,530.4	2,530.4	2,530.0	2,530.4	
Low Bank Elevation (ft)	2,535.0	2,535.0	2,535.1	2,535.5	2,535.6		2,531.2	2,531.2	2,531.2	2,531.2	2,531.3		2,530.4	2,579.7	2,530.1	2,530.0	2,530.4	
Bankfull Width (ft)	8.9	10.0	6.9	8.7	6.4		12.8	12.9	13.6	12.6	11.2		19.3	19.5	21.4	8.5	8.8	
Floodprone Width (ft)	>200	>200	>200	>39.5	>40.6		>200	>200	>200	>71.0	>71.0		---	---	---	---	---	
Bankfull Mean Depth (ft)	0.5	0.5	0.4	0.6	0.8		0.9	0.9	0.9	1.0	1.0		0.8	0.8	0.8	1.0	1.0	
Bankfull Max Depth (ft)	1.1	0.8	0.6	0.9	1.2		2.1	1.8	1.9	2.1	1.9		2.0	2.3	2.1	2.4	2.0	
Bankfull Cross Sectional Area (ft^2)	4.2	5.0	2.8	4.9	4.8		12.0	12.0	12.0	12.0	11.4		15.8	16.3	16.9	8.9	8.5	
Bankfull Width/Depth Ratio	19.2	19.9	17.1	15.6	8.5		13.6	13.8	15.4	13.2	11.0		---	---	---	---	---	
Bankfull Entrenchment Ratio	>22.4	>20.0	>28.9	>4.5	>6.3		>15.7	>15.5	>14.7	>5.6	>6.3		---	---	---	---	---	
Bankfull Bank Height Ratio	1.0	1.1	1.2	1.1	1.1		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 4 - 2019

Little Pine Reach 1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5	
	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		
Floodprone Width (ft)	133	>200	135	>200	135	>200	>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		
Bankfull Max Depth	2.7	3.2	2.8	3.1	3.0	3.2	3.1	3.5	3.1	3.5		
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		
Width/Depth Ratio	17.1	21.4	18	20.9	18	20	15.6	16.3	10.3	15.3		
Entrenchment Ratio	4.4	>6.0	4.5	>6.1	4.4	>6.2	>3.6	>6.9	>3.6	>9.1		
Bank Height Ratio	0.8	1.0	0.8	1.0	0.9	1.0	1.0		1.0			
D50 (mm)	50.7		56.9		45.0		48.5		26.9			
Profile												
Riffle Length (ft)	28	81	21	47	32	76	12	50	20	96		
Riffle Slope (ft/ft)	0.0040	0.0275	0.0064	0.0283	0.0052	0.0183	0.0029	0.0191	0.0067	0.0280		
Pool Length (ft)	44	96	66	176	49	177	58	176	63	166		
Pool Max Depth (ft)	3.5	5.8	3.0	4.7	3.9	6.2	4.2	5.8	4.1	6.4		
Pool Spacing (ft)	71	191	77	224	94	210	81	225	73	223		
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			
Channel Thalweg Length (ft)	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			
Bankfull Slope (ft/ft)	0.0051		0.0043		0.0045		0.0048		0.0059			
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			
% of Reach with Eroding Banks	0%		0%		1%		3%		6%			

Table 13b. Monitoring Data - Stream Reach Data Summary

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 4 - 2019

Little Pine Reach 2a

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5	
	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		
Floodprone Width (ft)	>200		>200		>200		>90	>189	>79.5	>189		
Bankfull Mean Depth	1.6	1.9	1.6	1.8	1.8	1.9	1.9	2.0	2.2	2.6		
Bankfull Max Depth	2.6	3.9	2.6	3.6	2.9	3.5	3.6	3.9	4.1	5.4		
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		
Width/Depth Ratio	16.6	18.1	17.2	18.5	16.2	16.5	15.6	16.6	12.0	12.5		
Entrenchment Ratio	>6.5	>6.9	>6.4	>6.8	>6.5	>7.0	>2.9	>6.1	>2.5	>6.8		
Bank Height Ratio	1.0		1.0		1.0		1.1		1.2			
D50 (mm)	87.6		72.4		75.9		85.0		72.1			
Profile												
Riffle Length (ft)	38	68	19	49	27	55	26	54	29	60		
Riffle Slope (ft/ft)	0.0101	0.0274	0.0112	0.0471	0.0143	0.0280	0.0139	0.0300	0.0065	0.0316		
Pool Length (ft)	39	109	39	145	66	186	84	178	77	218		
Pool Max Depth (ft)	4.7	5.8	4.3	6.6	4.0	6.7	4.3	6.0	4.2	6.7		
Pool Spacing (ft)	132	206	78	206	121	279	57	263	96	268		
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			
Channel Thalweg Length (ft)	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			
Bankfull Slope (ft/ft)	0.0074		0.0059		0.0067		0.0070		0.0070			
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			
% of Reach with Eroding Banks	0%		0%		2%		3%		5%			

Table 13c. Monitoring Data - Stream Reach Data Summary

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 4 - 2019

Little Pine Reach 2b

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5	
	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		
Floodprone Width (ft)	>200		>200		>200		>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		
Bankfull Max Depth	3.1	3.4	3.2	3.6	3.0	3.4	3.7	4.2	3.9	4.5		
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		
Width/Depth Ratio	14.0	15.9	14.5	15.2	14.2	14.4	13.5	14.4	13.1	14.3		
Entrenchment Ratio	>6.3	>7	>6.5	>6.7	>6.8	>6.9	>3.5	>4.0	>3.4	>3.8		
Bank Height Ratio	1.0		1.0		1.0		1.0	1.1	1.1	1.2		
D50 (mm)	47.4		72.0		70.2		62.1		65.7			
Profile												
Riffle Length (ft)	30	132	26	102	26	44	35	59	28	85		
Riffle Slope (ft/ft)	0.0055	0.0236	0.0169	0.0254	0.0116	0.0177	0.0040	0.0133	0.0070	0.0242		
Pool Length (ft)	41	99	55	153	26	149	24	152	76	140		
Pool Max Depth (ft)	2.6	5.4	3.8	6.3	3.7	5.0	3.6	5.5	4.3	6.8		
Pool Spacing (ft)	88	190	12	129	8	175	69	162	80	287		
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			
Channel Thalweg Length (ft)	493		493		493		493		493			
Sinuosity (ft)	1.04											
Water Surface Slope (ft/ft)	0.0118		0.0101		0.0082		0.0105		0.0121			
Bankfull Slope (ft/ft)	0.0101		0.0107		0.0103		0.0102		0.0101			
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			
% of Reach with Eroding Banks	0%		0%		0%		3%		6%			

Table 13d. Monitoring Data - Stream Reach Data Summary

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 4 - 2019

UT2 Reach 1 Lower

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5	
	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			
Floodprone Width (ft)	28.4		30.0		30.0		31		30			
Bankfull Mean Depth	0.6		0.7		0.6		0.7		0.6			
Bankfull Max Depth	1.0		1.3		1.2		1.4		1.2			
Bankfull Cross-sectional Area (ft^2)	5.1		5.7		5.4		5.9		4.4			
Width/Depth Ratio	13.0		12.5		13.9		13.4		11.5			
Entrenchment Ratio	3.5		3.6		3.5		3.5		4.2			
Bank Height Ratio	1.0		1.0		0.9		1.1		0.9			
D50 (mm)	56.9		39.8		38.7		43.8		42.9			
Profile												
Riffle Length (ft)	11	25	13	39	5	24	6	20	10	22		
Riffle Slope (ft/ft)	0.0360	0.0853	0.0136	0.0730	0.0253	0.0793	0.0109	0.0624	0.0234	0.0884		
Pool Length (ft)	5	22	2	15	4	17	5	21	2	25		
Pool Max Depth (ft)	1.9	5.0	1.0	2.9	2.0	3.8	1.1	3.5	1.4	2.6		
Pool Spacing (ft)	7	34	8	52	6	53	6	34	7	140		
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			
Channel Thalweg Length (ft)	433		433		433		433		433			
Sinuosity (ft)	1.05											
Water Surface Slope (ft/ft)	0.0560		0.0477		0.0481		0.0475		0.0502			
Bankfull Slope (ft/ft)	0.0563		0.0483		0.0485		0.0455		0.0451			
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			
% of Reach with Eroding Banks	0%		6%		2%		1%		6%			

Table 13e. Monitoring Data - Stream Reach Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

UT2 Reach 2

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5	
	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		
Floodprone Width (ft)	21.5	>200	23.2	>200	23.5	>200	25	>71	25	>71		
Bankfull Mean Depth	0.5	0.9	0.5	0.9	0.4	0.9	0.6	1.0	0.8	1.0		
Bankfull Max Depth	1.1	2.1	0.8	1.8	0.6	1.9	0.9	2.1	1.2	1.9		
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		
Width/Depth Ratio	13.6	20.1	9.7	19.9	13.0	17.1	10.5	15.6	8.5	11.0		
Entrenchment Ratio	2.0	>22.4	2.9	>20.0	2.5	>28.9	3.6	>5.6	3.3	>6.3		
Bank Height Ratio	1.0		1.0		0.9	1.2	0.9	1.1	1.0	1.1		
D50 (mm)	44	53	15	90	34.5	34.8	45.0	48.2	32.0	39.3		
Profile												
Riffle Length (ft)	17	29	10	36	5	62	4	68	6	36		
Riffle Slope (ft/ft)	0.0262	0.0575	0.0141	0.0658	0.0093	0.0773	0.0122	0.1161	0.0111	0.0725		
Pool Length (ft)	13	46	4	40	6	35	4	39	6	67		
Pool Max Depth (ft)	1.6	3.2	1.5	3.8	1.1	4.6	1.9	4.8	1.5	3.2		
Pool Spacing (ft)	24	98	8	113	10	207	7	156	3	162		
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			
Channel Thalweg Length (ft)	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			
Bankfull Slope (ft/ft)	0.0237		0.0214		0.0245		0.0247		0.0241			
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			
% of Reach with Eroding Banks	0%		0%		4%		7%		2%			

Table 13f. Monitoring Data - Stream Reach Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

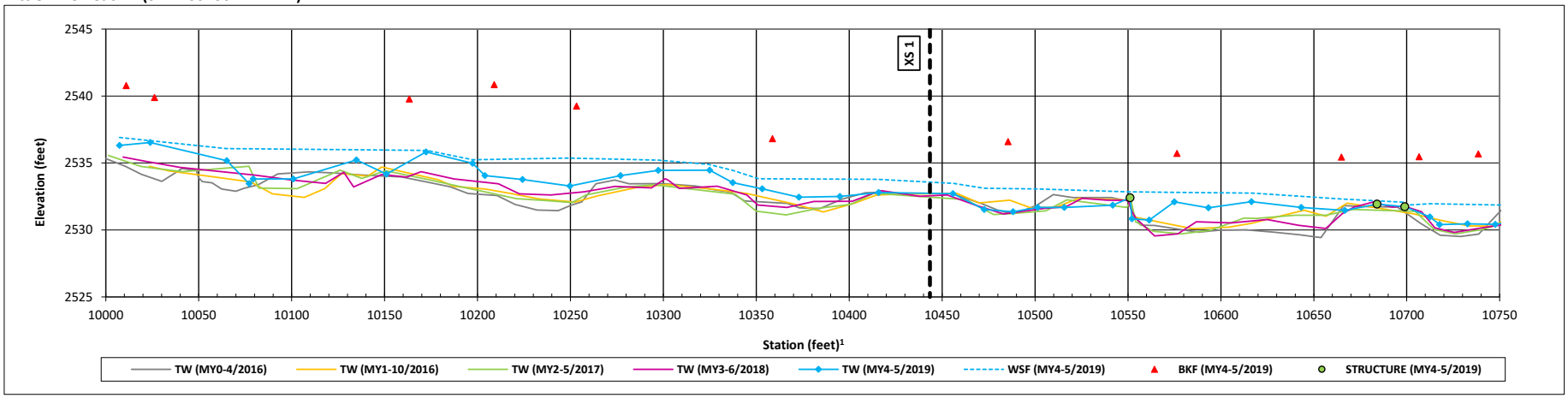
UT2b

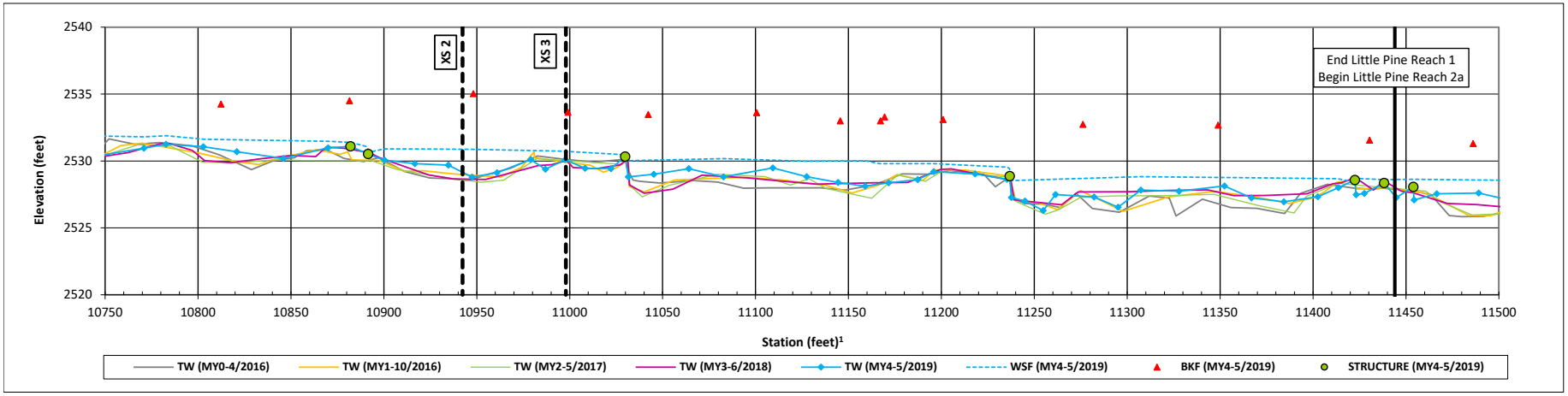
Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle												
Bankfull Width (ft)	6.7		6.3		6.6		6.3		6.4			
Floodprone Width (ft)	15.9		17.7		17.9		14.3		14.1			
Bankfull Mean Depth	0.5		0.7		0.7		0.5		0.4			
Bankfull Max Depth	0.9		1.1		1.1		0.8		0.8			
Bankfull Cross-sectional Area (ft^2)	3.7		4.3		4.5		3.0		2.3			
Width/Depth Ratio	12.2		9.1		9.6		13.2		17.9			
Entrenchment Ratio	2.4		2.8		2.7		2.3		2.2			
Bank Height Ratio	1.0		1.0		0.9		0.9		0.8			
D50 (mm)	43.0		35.9		32.0		23.5		24.4			
Profile												
Riffle Length (ft)	4	23	7	24	7	25	6	32	5	21		
Riffle Slope (ft/ft)	0.0448	0.0659	0.0276	0.0451	0.0127	0.0702	0.0125	0.0494	0.0117	0.0394		
Pool Length (ft)	3	14	3	8	4	15	3	11	3	9		
Pool Max Depth (ft)	0.6	2.1	2.0	3.9	0.8	3.8	0.9	4.0	0.7	3.5		
Pool Spacing (ft)	3	33	4	30	3	30	2	32	3	30		
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			
Channel Thalweg Length (ft)	253		253		253		253		253			
Sinuosity (ft)	1.10											
Water Surface Slope (ft/ft)	0.0616		0.0614		0.0557		0.0608		0.0610			
Bankfull Slope (ft/ft)	0.0536		0.0608		0.0612		0.0612		0.0602			
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			
% of Reach with Eroding Banks	0%		0%		0%		0%		0%			

Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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



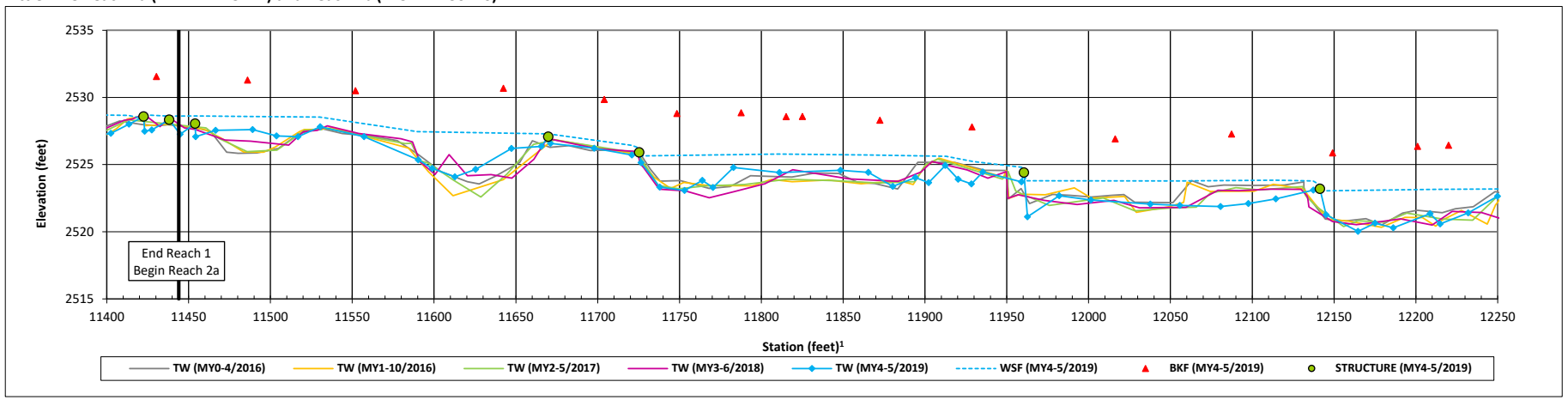


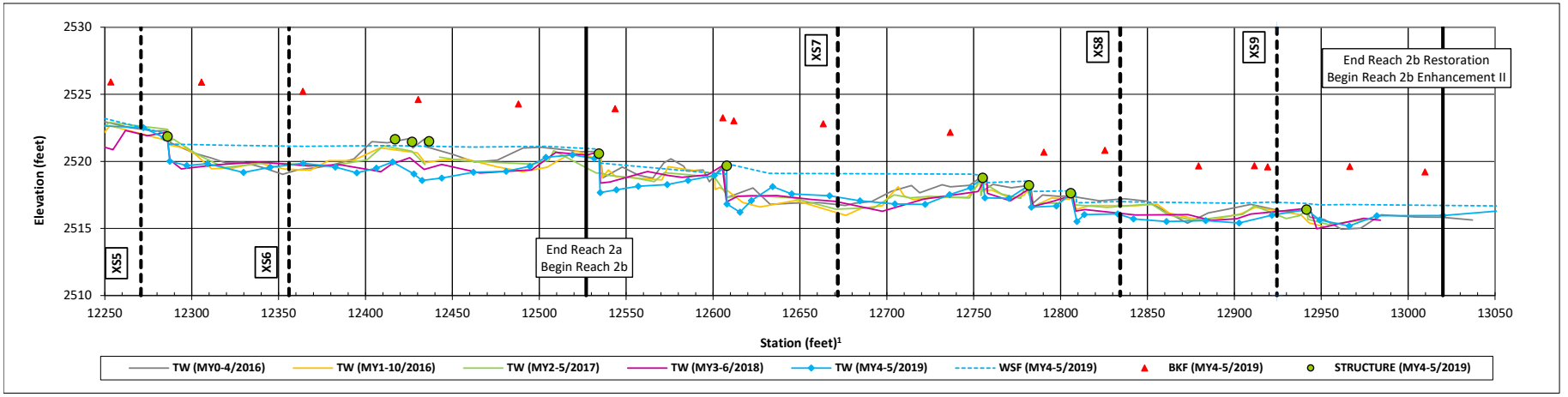
[1] Profile stationing derived from as-built thalweg alignment.

Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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





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

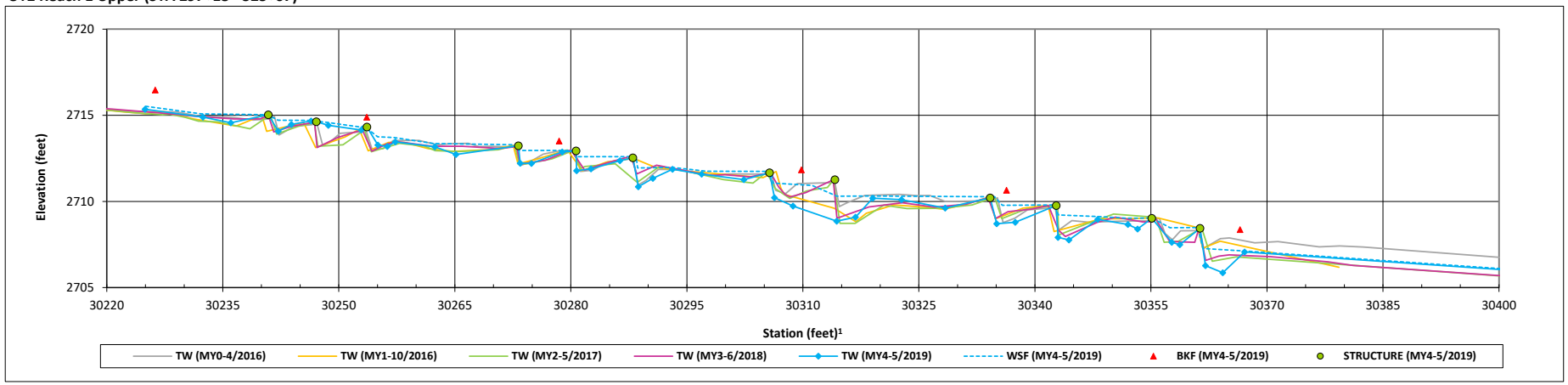
Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No.94903

Monitoring Year 4 - 2019

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



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

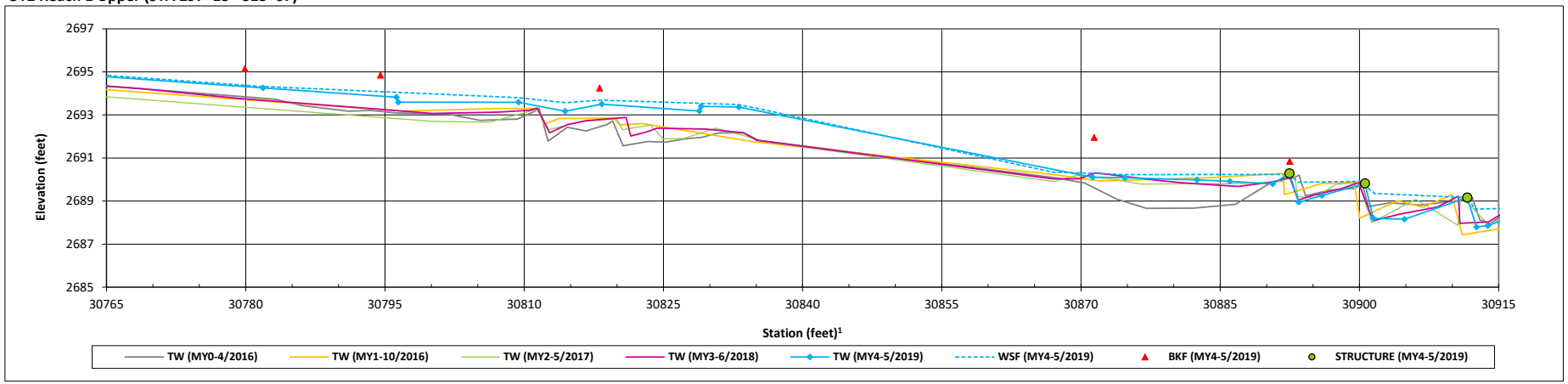
Longitudinal Profile Plots

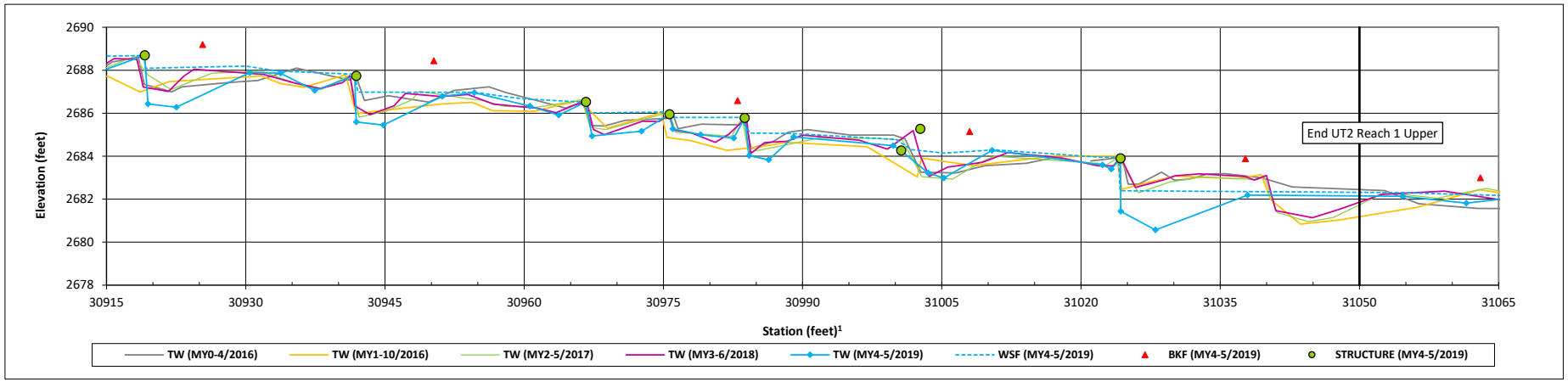
Little Pine III Stream & Wetland Restoration Project

DMS Project No.94903

Monitoring Year 4 - 2019

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





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

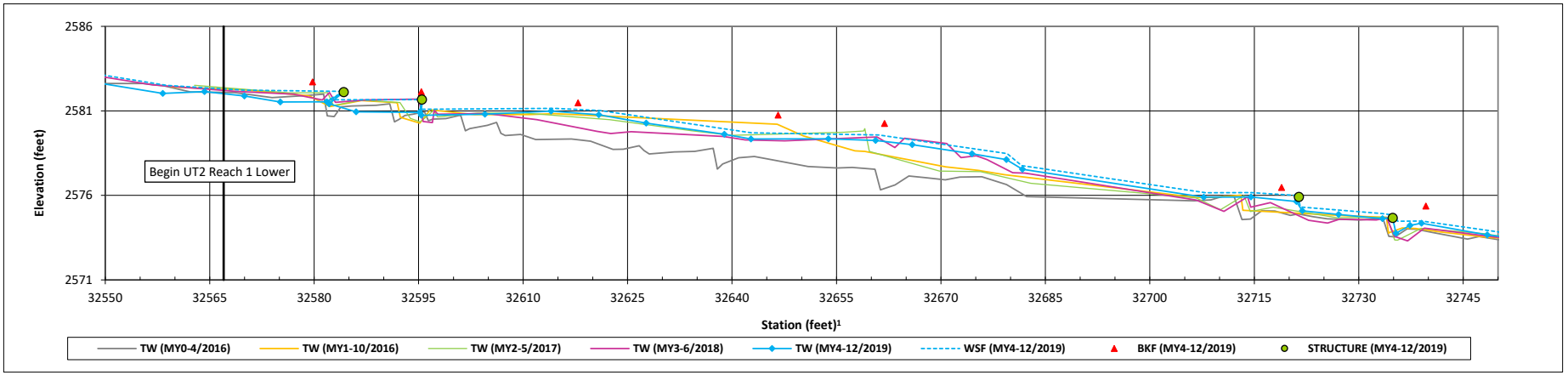
Longitudinal Profile Plots

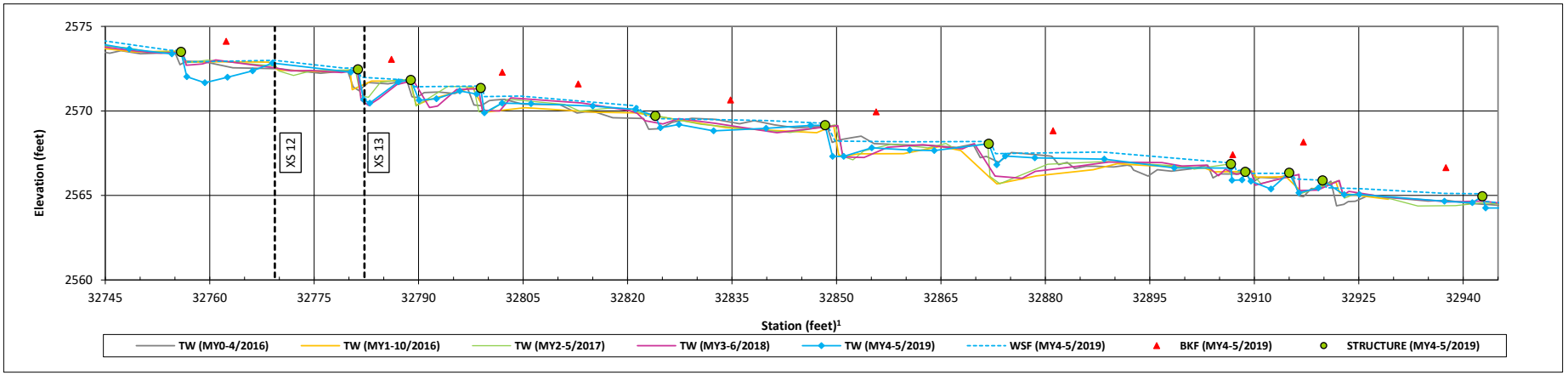
Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 4 - 2019

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





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

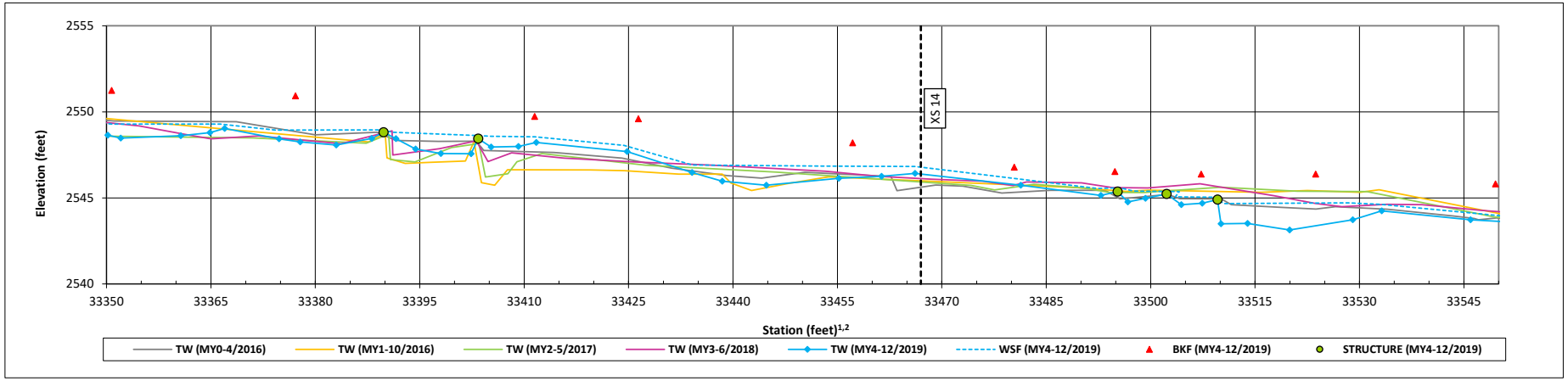
Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 4 - 2019

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.

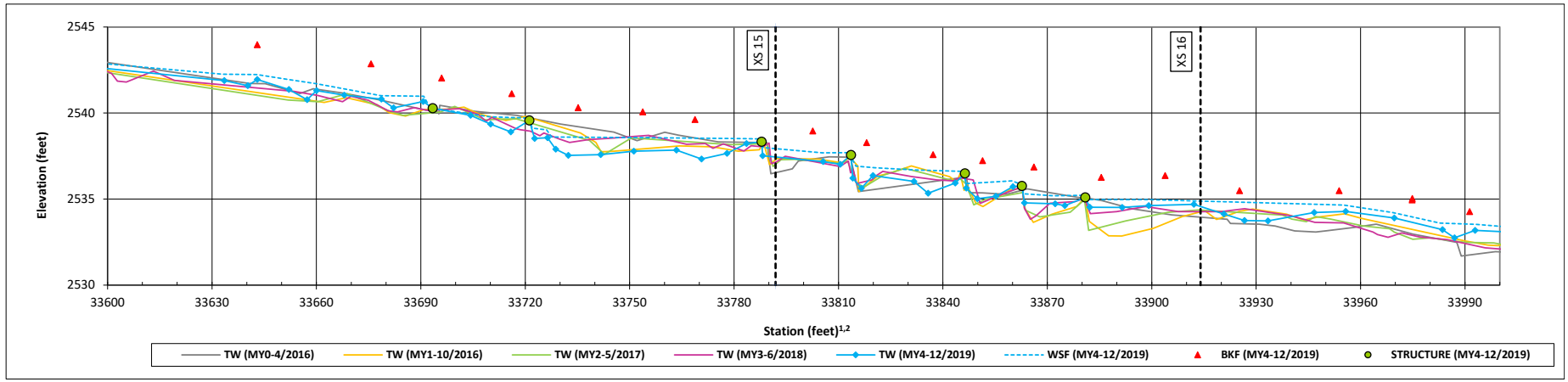
Longitudinal Profile Plots

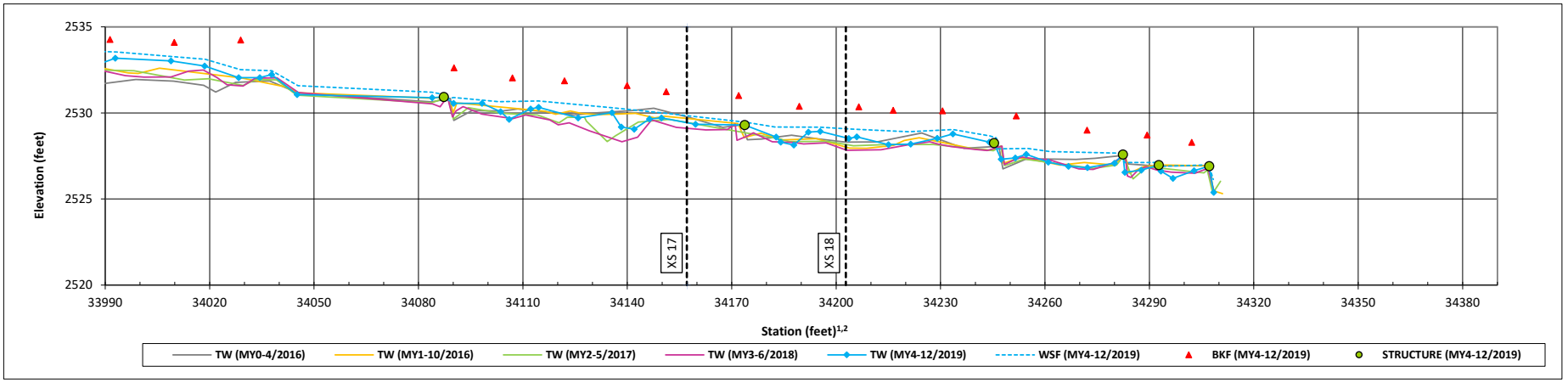
Little Pine III Stream & Wetland Restoration Project

DMS Project No.94903

Monitoring Year 4 - 2019

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





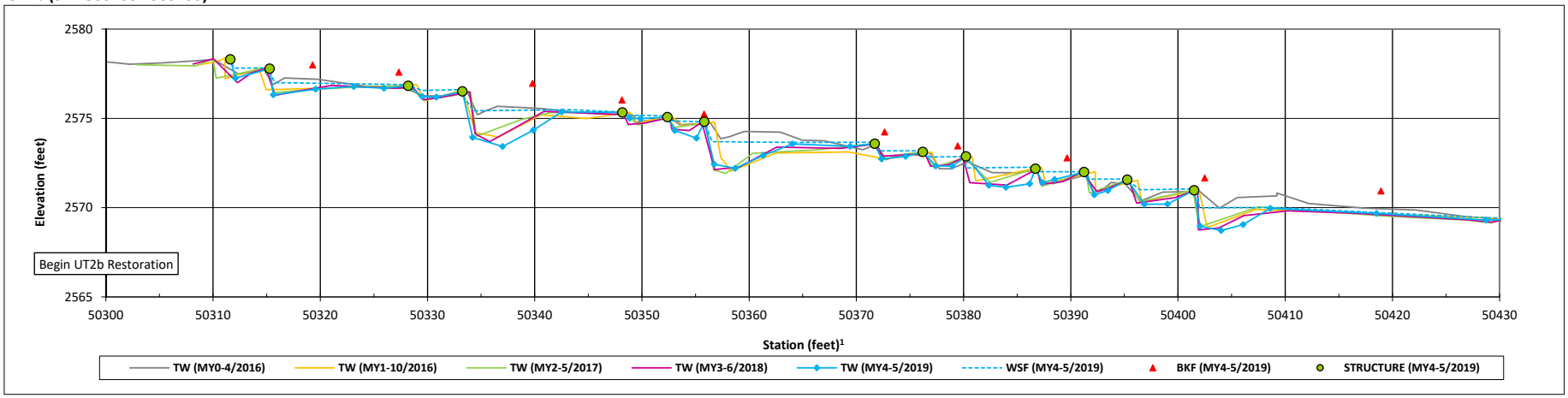
[1] Profile stationing derived from as-built thalweg alignment.

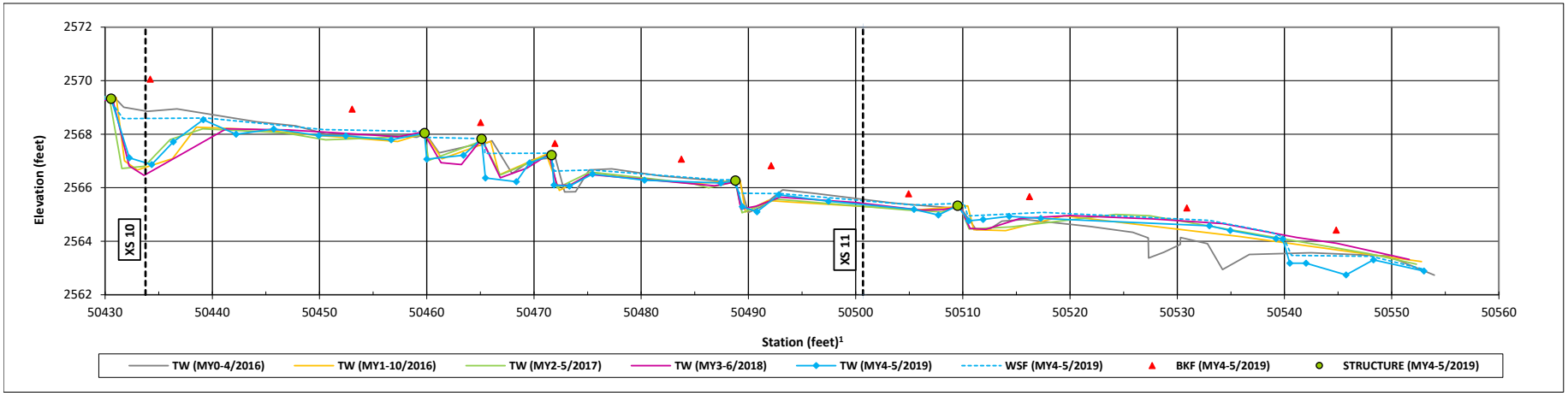
[2] Stream repairs completed in September 2019 on UT2 Reach 2 STA 332+25 to 339+15.

Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

UT2b (STA 503+00 - 505+53)





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

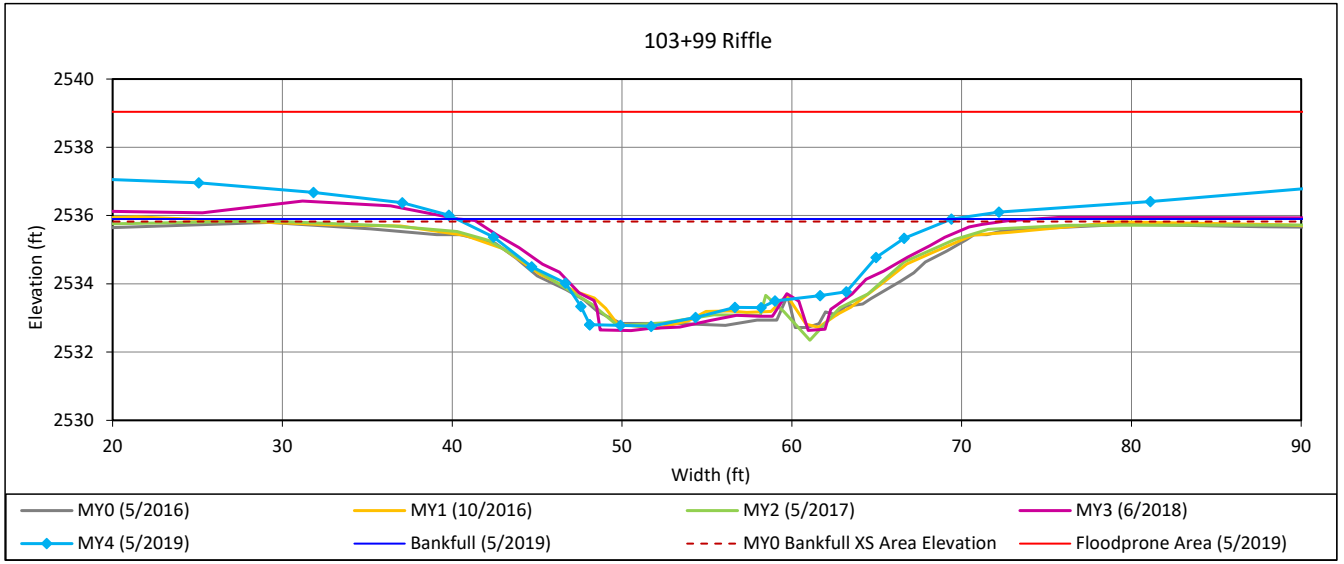
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 4 - 2019

Cross-Section 1- Little Pine Reach 1



Bankfull Dimensions	
55.6	x-section area (ft.sq.)
29.1	width (ft)
1.9	mean depth (ft)
3.1	max depth (ft)
30.4	wetted perimeter (ft)
1.8	hydraulic radius (ft)
15.3	width-depth ratio
106.0	W flood prone area (ft)
3.6	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2019

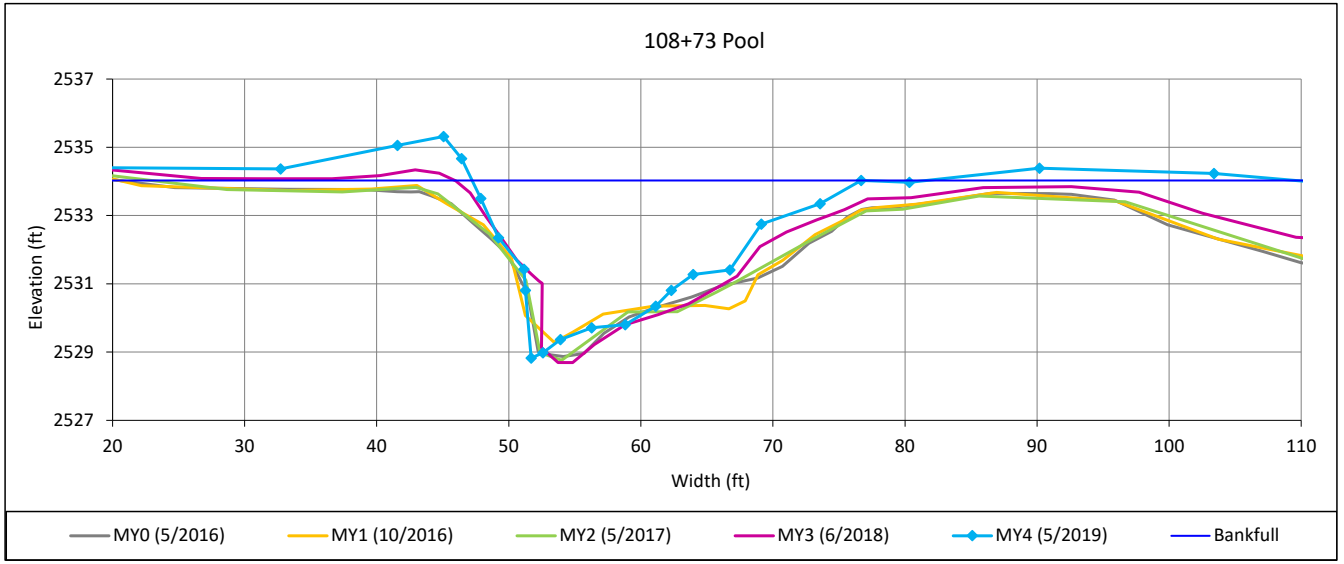
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 2- Little Pine Reach 1



Bankfull Dimensions	
76.0	x-section area (ft.sq.)
29.5	width (ft)
2.6	mean depth (ft)
5.2	max depth (ft)
33.2	wetted perimeter (ft)
2.3	hydraulic radius (ft)
11.4	width-depth ratio

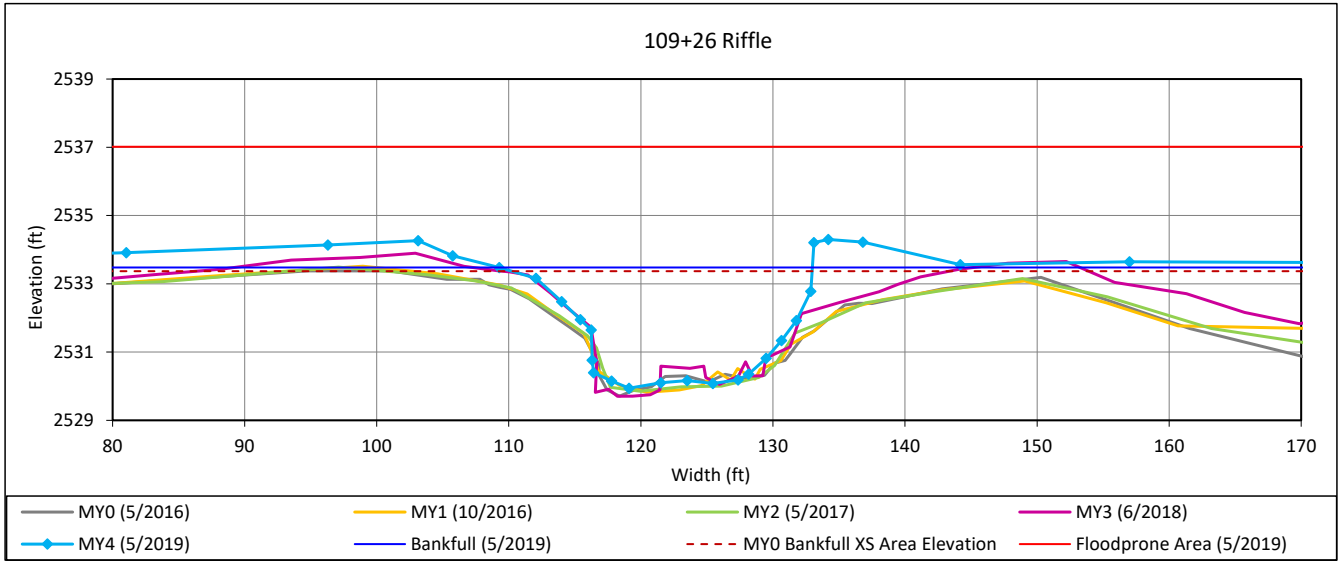
Survey Date: 5/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 3- Little Pine Reach 1



Bankfull Dimensions	
54.7	x-section area (ft.sq.)
23.7	width (ft)
2.3	mean depth (ft)
3.5	max depth (ft)
26.4	wetted perimeter (ft)
2.1	hydraulic radius (ft)
10.3	width-depth ratio
215.0	W flood prone area (ft)
9.1	entrenchment ratio
1.0	low bank height ratio

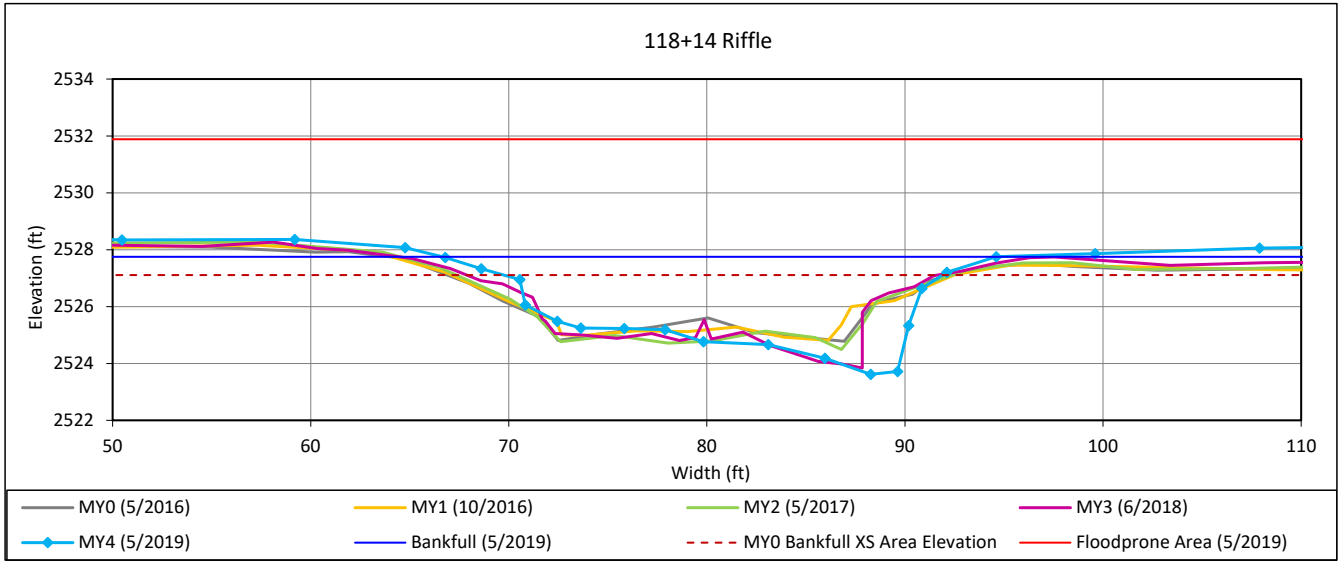
Survey Date: 5/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 4 - Little Pine Reach 2a



Bankfull Dimensions	
62.6	x-section area (ft.sq.)
27.9	width (ft)
2.2	mean depth (ft)
4.1	max depth (ft)
31.1	wetted perimeter (ft)
2.0	hydraulic radius (ft)
12.5	width-depth ratio
189.0	W flood prone area (ft)
6.8	entrenchment ratio
1.2	low bank height ratio

Survey Date: 5/2019
Field Crew: Wildlands Engineering

View Downstream

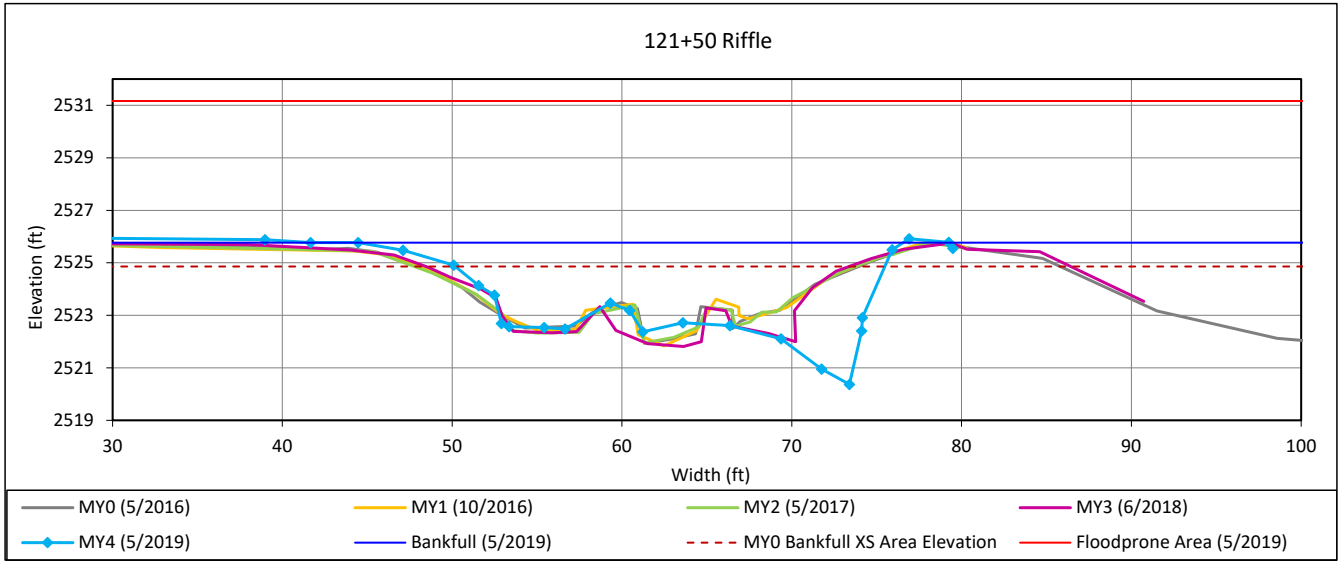
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 4 - 2019

Cross-Section 5- Little Pine Reach 2a



Bankfull Dimensions	
82.3	x-section area (ft.sq.)
31.5	width (ft)
2.6	mean depth (ft)
5.4	max depth (ft)
36.8	wetted perimeter (ft)
2.2	hydraulic radius (ft)
12.0	width-depth ratio
79.5	W flood prone area (ft)
2.5	entrenchment ratio
1.2	low bank height ratio

Survey Date: 5/2019

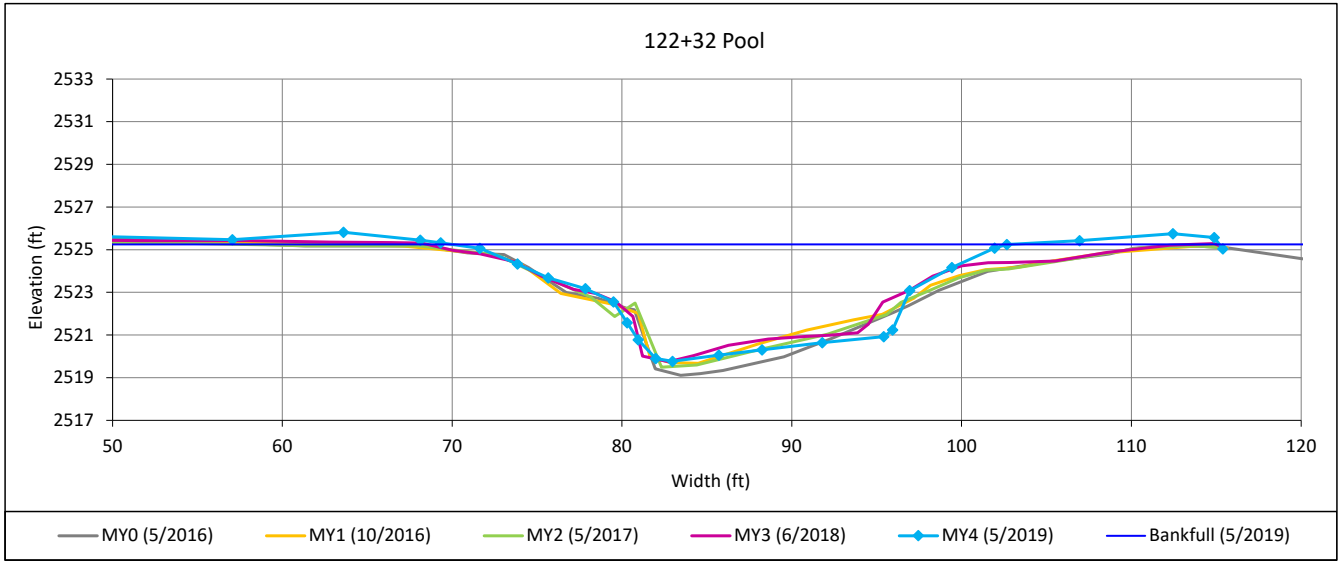
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 6- Little Pine Reach 2a



Bankfull Dimensions	
98.7	x-section area (ft.sq.)
32.7	width (ft)
3.0	mean depth (ft)
5.5	max depth (ft)
35.9	wetted perimeter (ft)
2.7	hydraulic radius (ft)
10.8	width-depth ratio

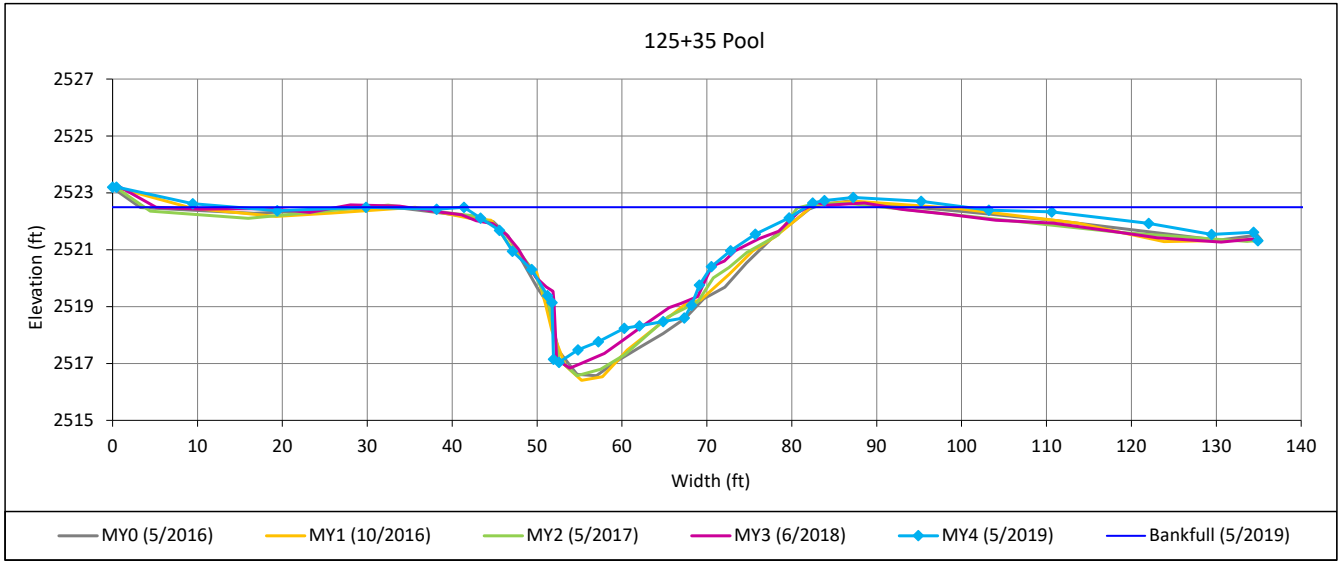
Survey Date: 5/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 7 - Little Pine Reach 2b



Bankfull Dimensions	
104.8	x-section area (ft.sq.)
40.3	width (ft)
2.6	mean depth (ft)
5.5	max depth (ft)
43.5	wetted perimeter (ft)
2.4	hydraulic radius (ft)
15.5	width-depth ratio

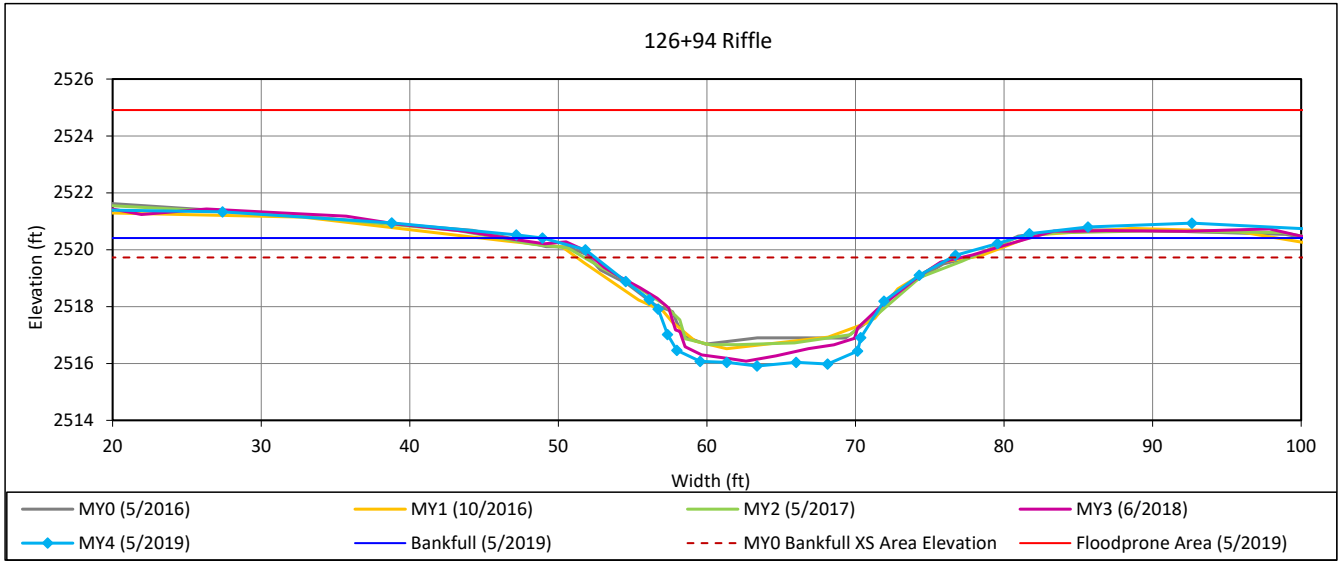
Survey Date: 5/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 8 - Little Pine Reach 2b



Bankfull Dimensions	
77.5	x-section area (ft.sq.)
31.8	width (ft)
2.4	mean depth (ft)
4.5	max depth (ft)
34.2	wetted perimeter (ft)
2.3	hydraulic radius (ft)
13.1	width-depth ratio
121.0	W flood prone area (ft)
3.8	entrenchment ratio
1.2	low bank height ratio

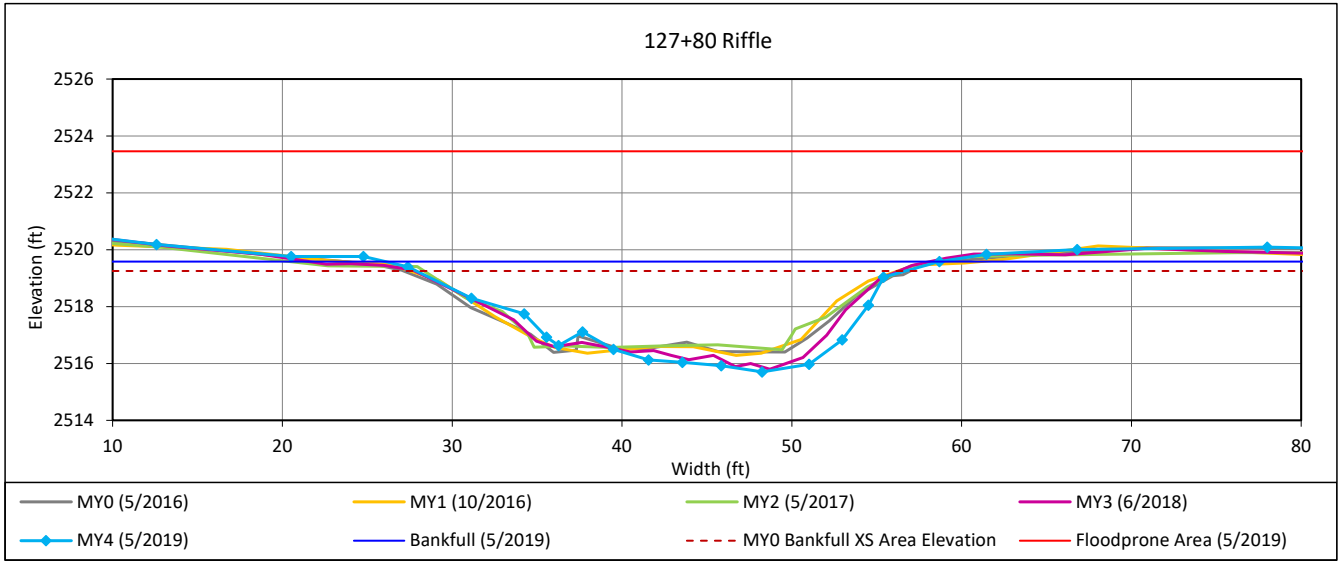
Survey Date: 5/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 9 - Little Pine Reach 2b



Bankfull Dimensions	
74.3	x-section area (ft.sq.)
32.7	width (ft)
2.3	mean depth (ft)
3.9	max depth (ft)
34.5	wetted perimeter (ft)
2.2	hydraulic radius (ft)
14.3	width-depth ratio
110.0	W flood prone area (ft)
3.4	entrenchment ratio
1.1	low bank height ratio

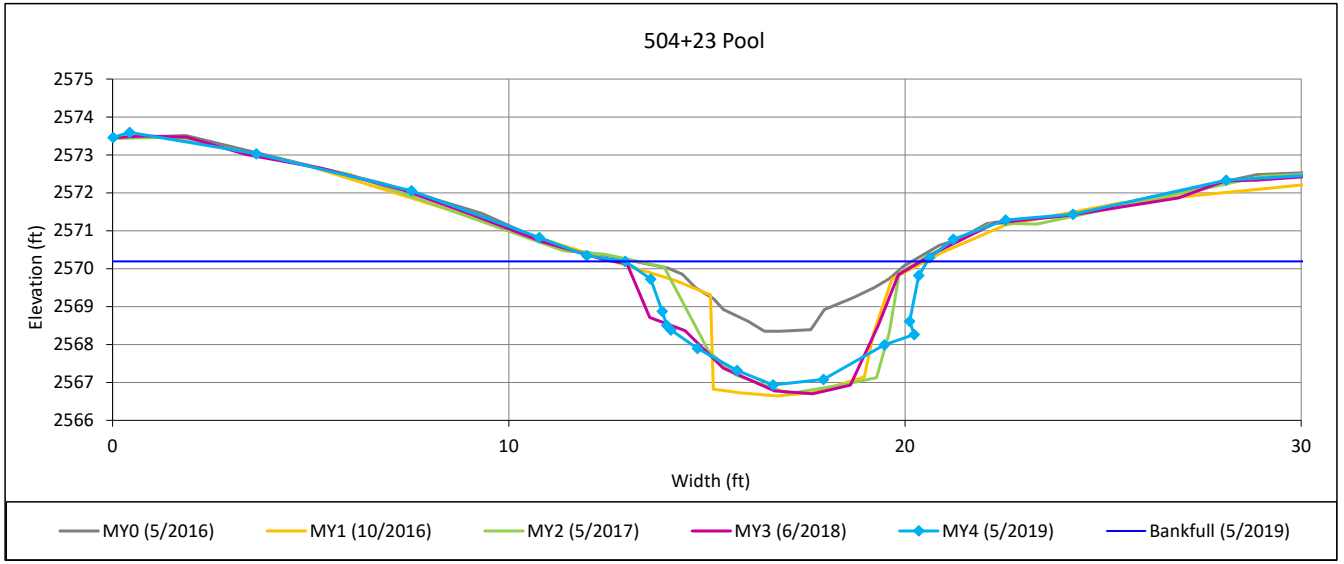
Survey Date: 5/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 10 - UT2b



Bankfull Dimensions	
17.3	x-section area (ft.sq.)
7.6	width (ft)
2.3	mean depth (ft)
3.3	max depth (ft)
11.1	wetted perimeter (ft)
1.6	hydraulic radius (ft)
3.4	width-depth ratio

Survey Date: 5/2019
Field Crew: Wildlands Engineering

View Downstream

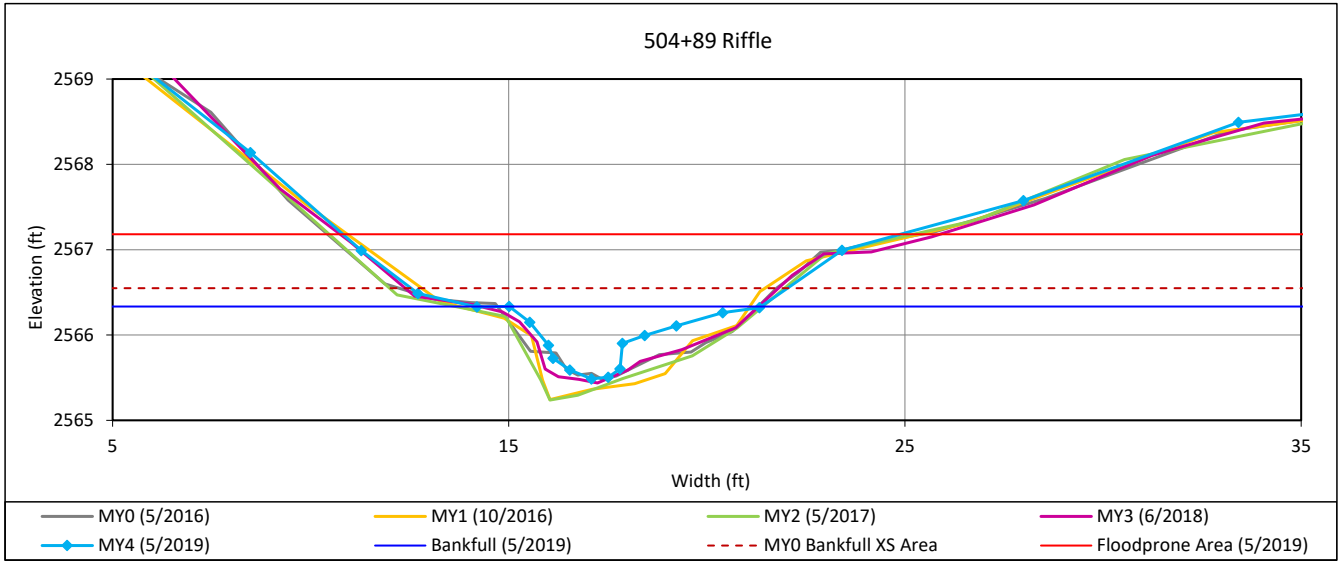
Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 4 - 2019

Cross-Section 11 - UT2b



Bankfull Dimensions	
2.3	x-section area (ft.sq.)
6.4	width (ft)
0.4	mean depth (ft)
0.8	max depth (ft)
6.9	wetted perimeter (ft)
0.3	hydraulic radius (ft)
17.9	width-depth ratio
14.1	W flood prone area (ft)
2.2	entrenchment ratio
0.8	low bank height ratio

Survey Date: 5/2019

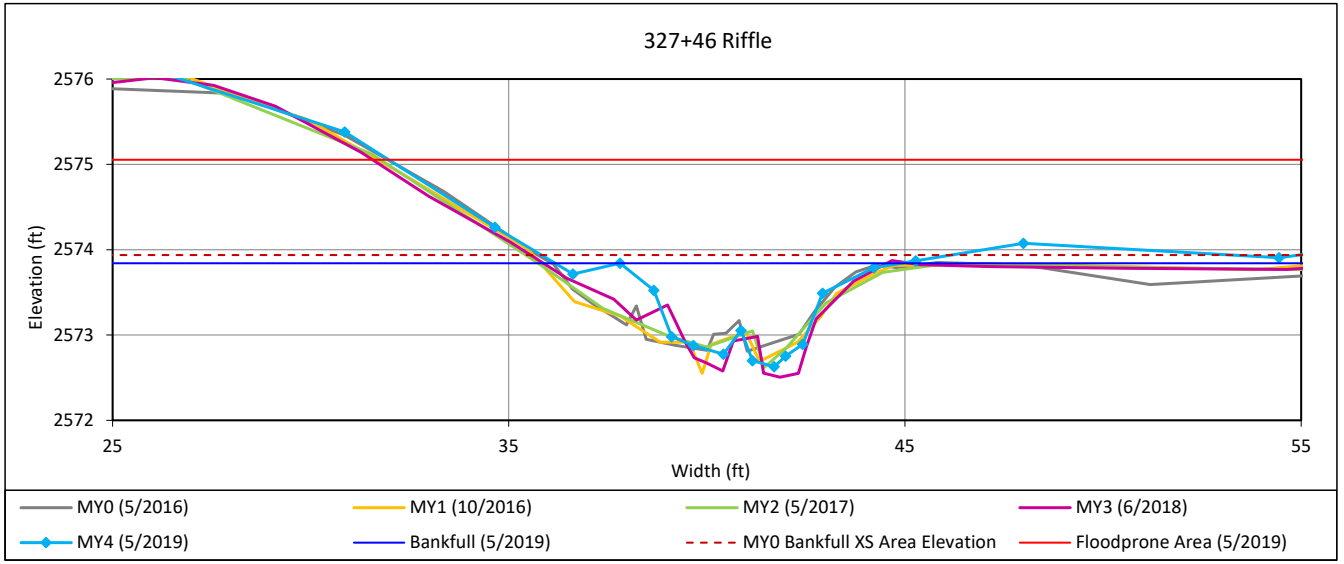
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 12 - UT2



Bankfull Dimensions	
4.4	x-section area (ft.sq.)
7.1	width (ft)
0.6	mean depth (ft)
1.2	max depth (ft)
8.0	wetted perimeter (ft)
0.5	hydraulic radius (ft)
11.5	width-depth ratio
29.5	W flood prone area (ft)
4.2	entrenchment ratio
0.9	low bank height ratio

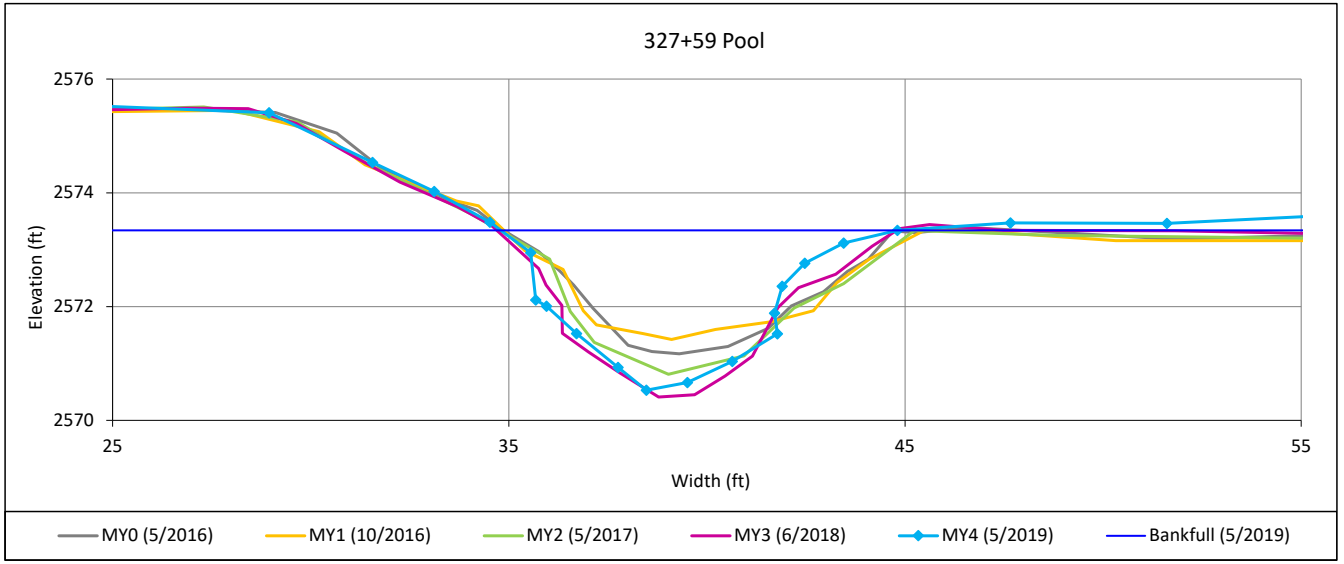
Survey Date: 5/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 13 - UT2



Bankfull Dimensions	
15.0	x-section area (ft.sq.)
10.0	width (ft)
1.5	mean depth (ft)
2.8	max depth (ft)
12.4	wetted perimeter (ft)
1.2	hydraulic radius (ft)
6.7	width-depth ratio

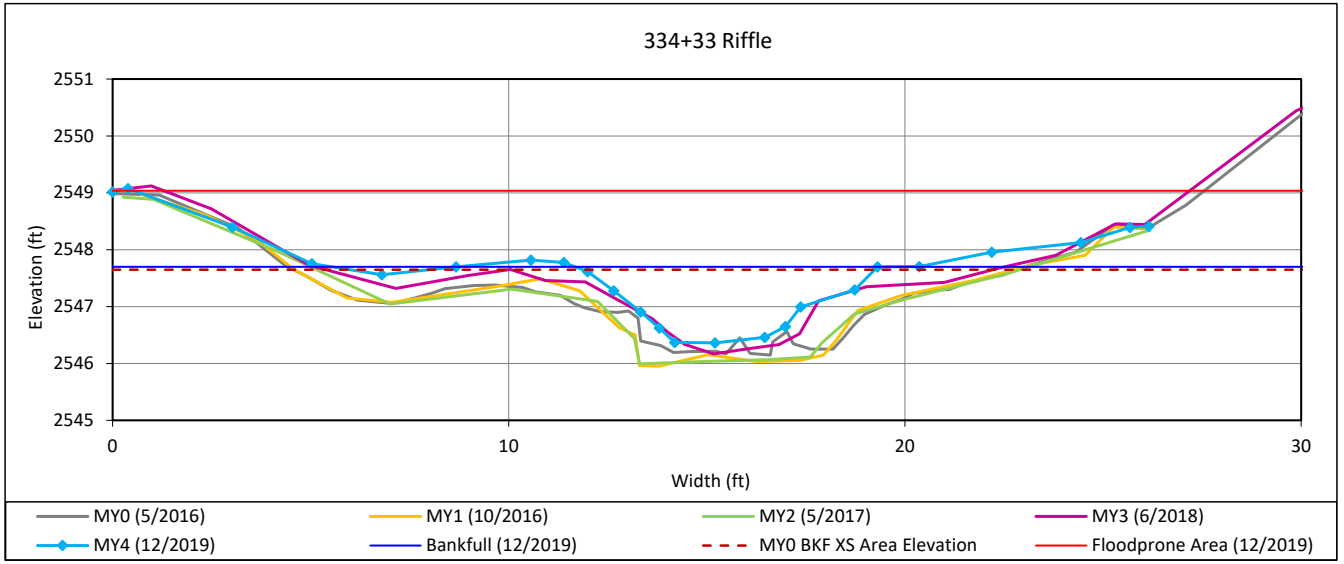
Survey Date: 5/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 14 - UT2



Bankfull Dimensions	
6.3	x-section area (ft.sq.)
7.6	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
8.3	wetted perimeter (ft)
0.8	hydraulic radius (ft)
9.3	width-depth ratio
25.0	W flood prone area (ft)
3.3	entrenchment ratio
1.0	low bank height ratio

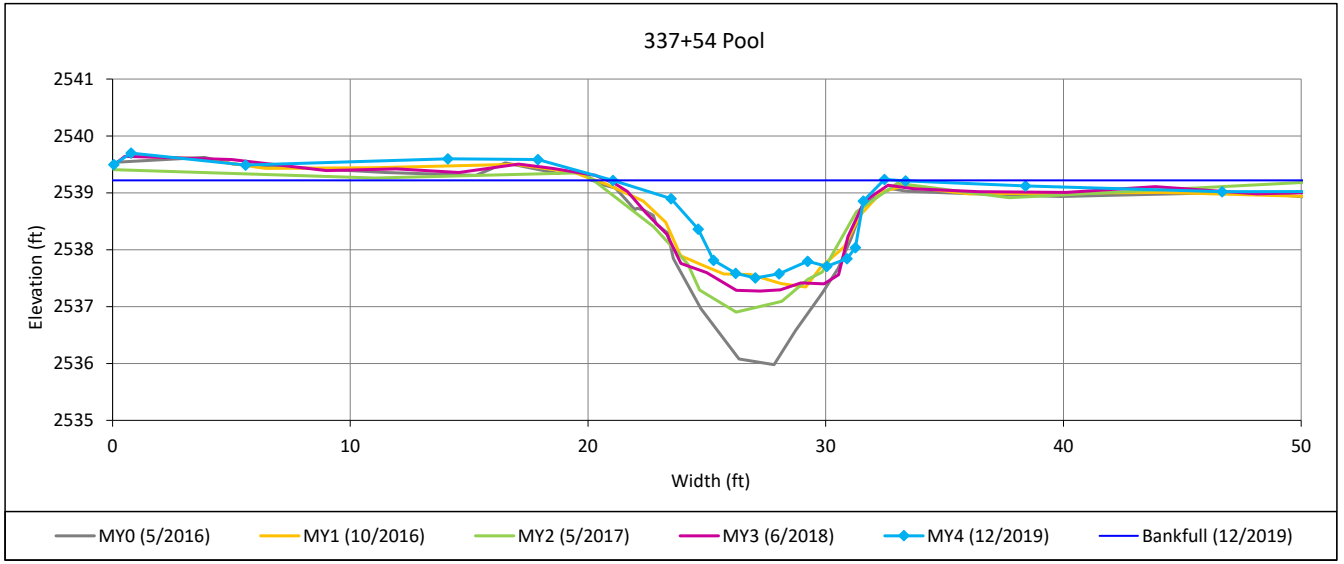
Survey Date: 12/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 15 - UT2



Bankfull Dimensions	
11.4	x-section area (ft.sq.)
11.4	width (ft)
1.0	mean depth (ft)
1.7	max depth (ft)
12.5	wetted perimeter (ft)
0.9	hydraulic radius (ft)
11.4	width-depth ratio

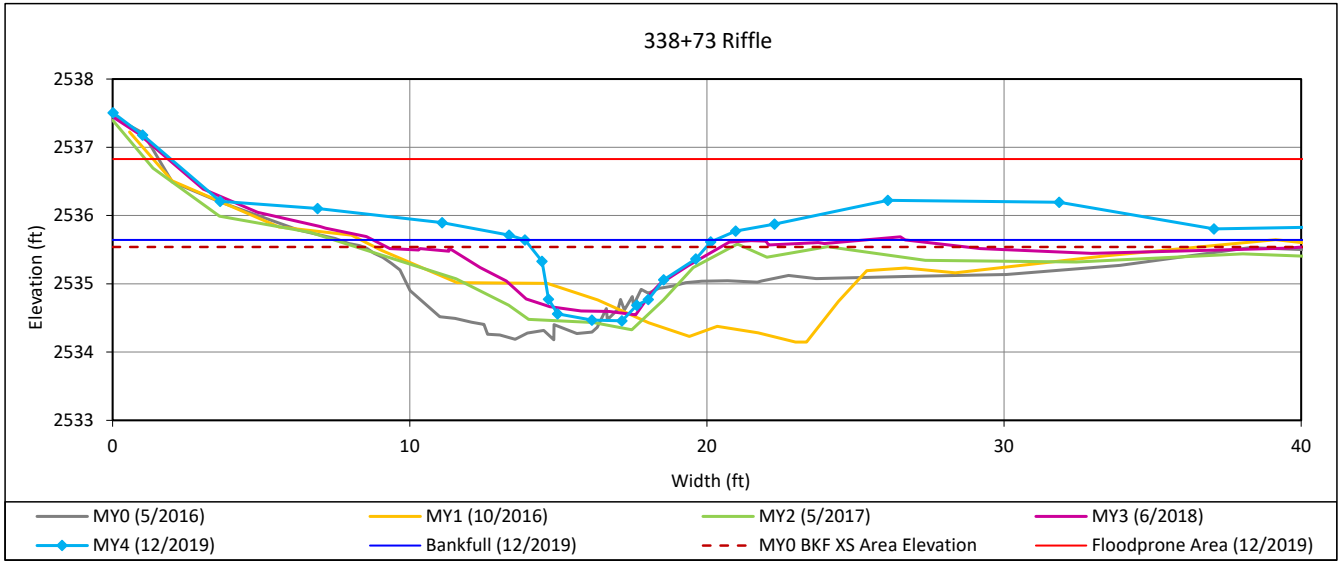
Survey Date: 12/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 16 - UT2



Bankfull Dimensions	
4.8	x-section area (ft.sq.)
6.4	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
7.2	wetted perimeter (ft)
0.7	hydraulic radius (ft)
8.5	width-depth ratio
40.6	W flood prone area (ft)
6.3	entrenchment ratio
1.1	low bank height ratio

Survey Date: 12/2019
Field Crew: Wildlands Engineering

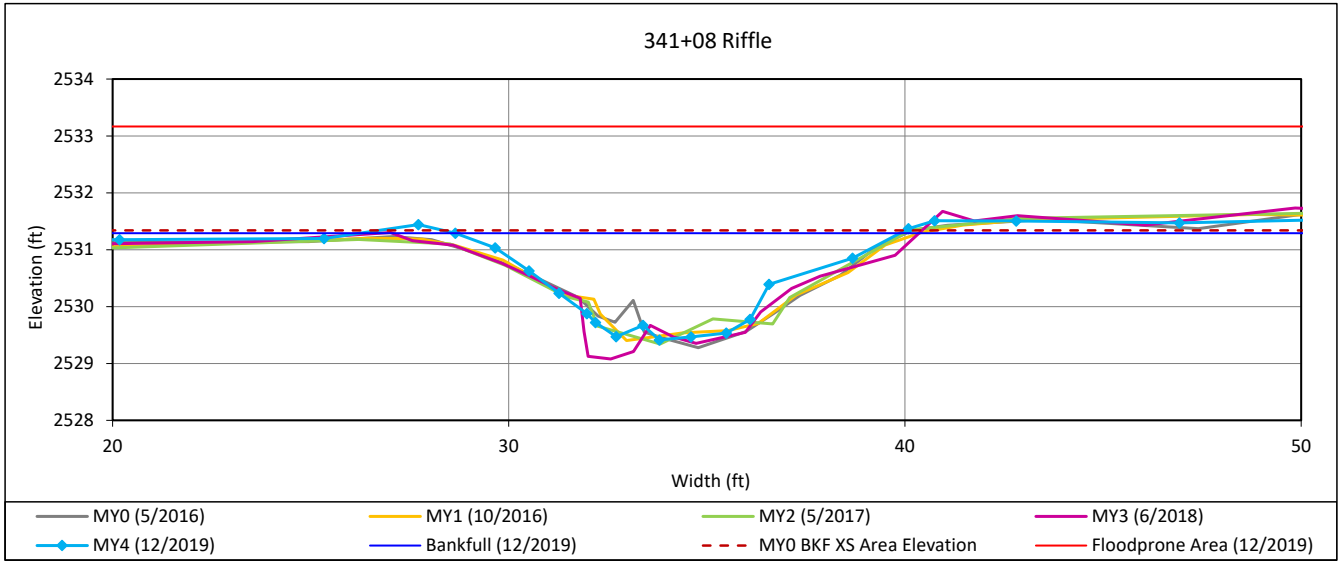
View Downstream

Stream repairs completed in September 2019

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 17 - UT2



Bankfull Dimensions	
11.4	x-section area (ft.sq.)
11.2	width (ft)
1.0	mean depth (ft)
1.9	max depth (ft)
12.2	wetted perimeter (ft)
0.9	hydraulic radius (ft)
11.0	width-depth ratio
71.0	W flood prone area (ft)
6.3	entrenchment ratio
1.0	low bank height ratio

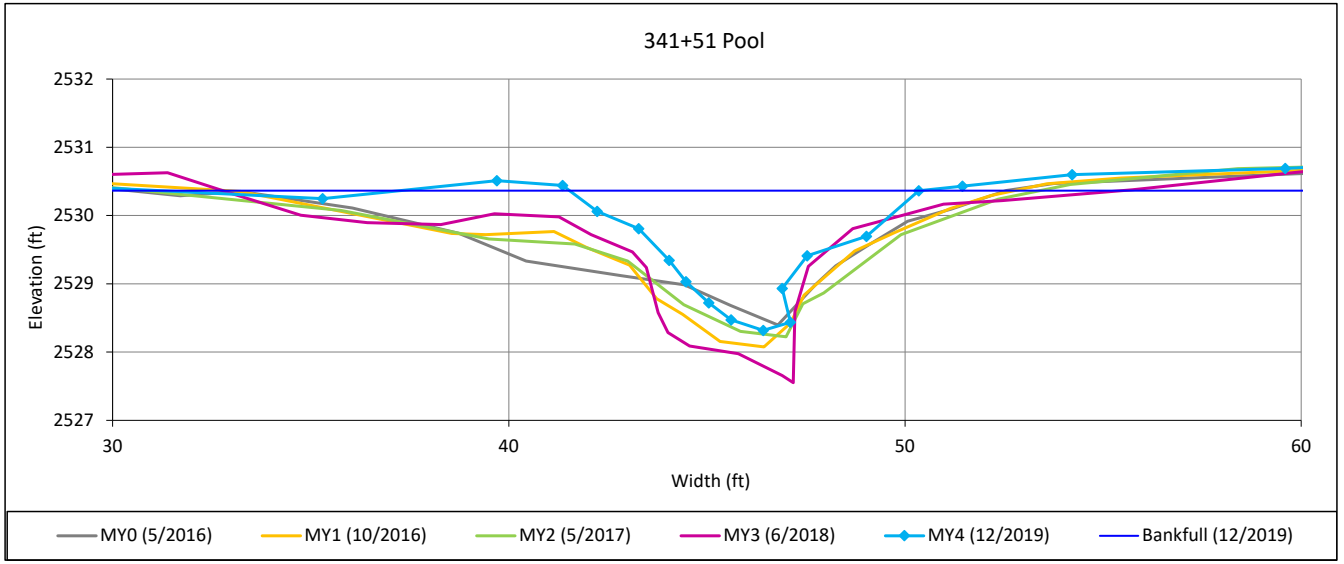
Survey Date: 12/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Cross-Section 18 - UT2



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

Survey Date: 12/2019
Field Crew: Wildlands Engineering

View Downstream

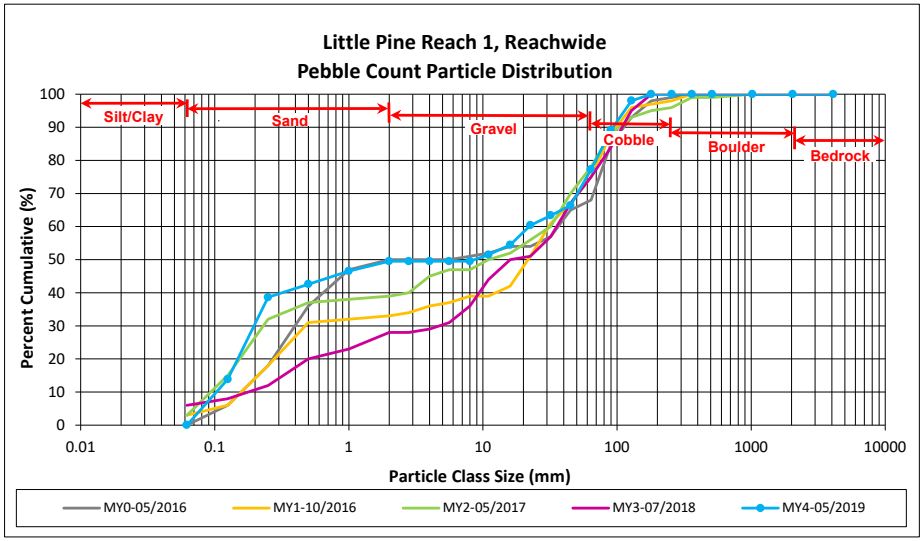
Reachwide and Cross-Section Pebble Count Plots

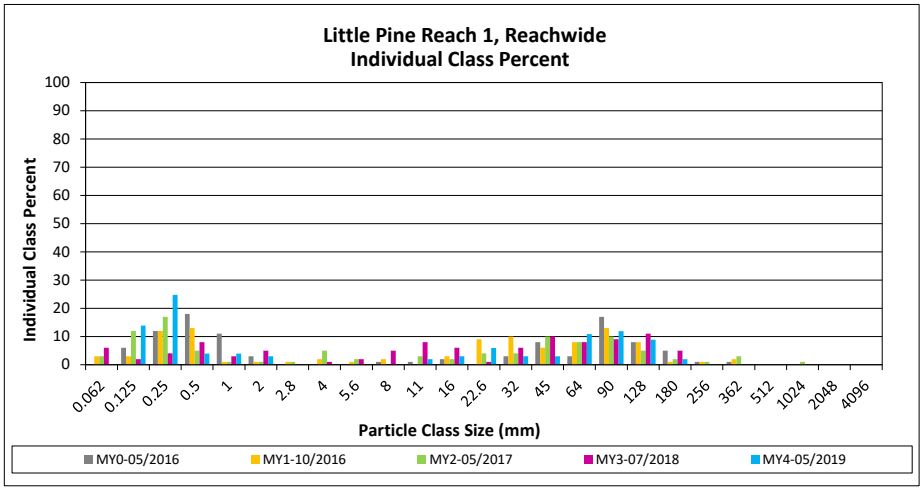
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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		14	14	14	14
	Fine	0.125	0.250	1	24	25	25	39
	Medium	0.25	0.50		4	4	4	43
	Coarse	0.5	1.0		4	4	4	47
	Very Coarse	1.0	2.0		3	3	3	50
GRAVEL	Very Fine	2.0	2.8					50
	Very Fine	2.8	4.0					50
	Fine	4.0	5.6					50
	Fine	5.6	8.0					50
	Medium	8.0	11.0	2		2	2	51
	Medium	11.0	16.0	3		3	3	54
	Coarse	16.0	22.6	6		6	6	60
	Coarse	22.6	32	3		3	3	63
	Very Coarse	32	45	3		3	3	66
	Very Coarse	45	64	10	1	11	11	77
COBBLE	Small	64	90	11	1	12	12	89
	Small	90	128	9		9	9	98
	Large	128	180	2		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	50	51	101	100	100

Reachwide	
Channel materials (mm)	
D_{16} =	0.1
D_{35} =	0.2
D_{50} =	8.7
D_{84} =	77.7
D_{95} =	113.6
D_{100} =	180.0





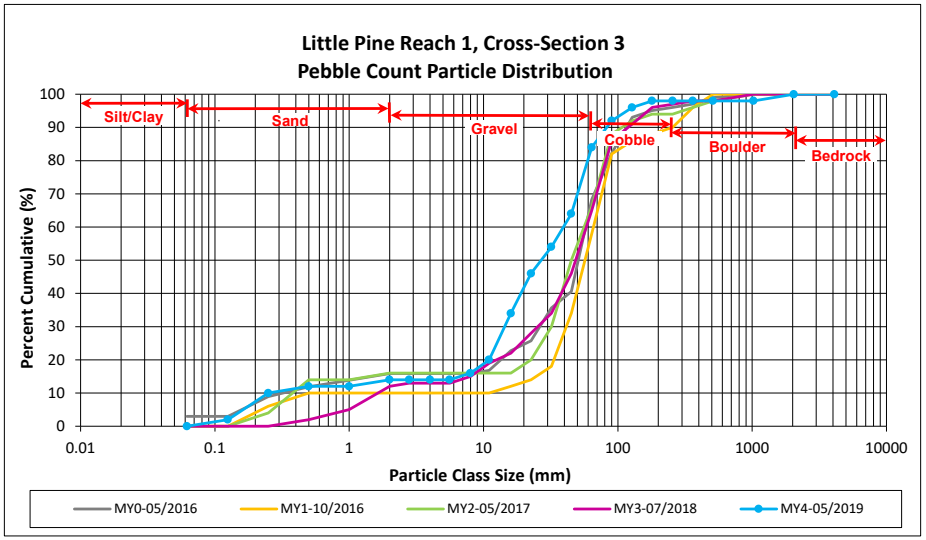
Reachwide and Cross-Section Pebble Count Plots

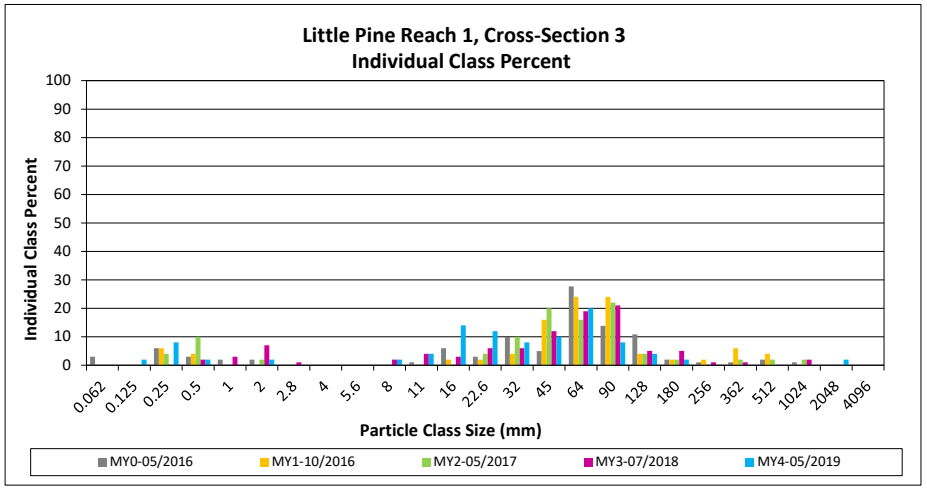
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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	2	2	2
	Fine	0.125	0.250	8	8	10
	Medium	0.25	0.50	2	2	12
	Coarse	0.5	1.0			12
	Very Coarse	1.0	2.0	2	2	14
GRAVEL	Very Fine	2.0	2.8			14
	Very Fine	2.8	4.0			14
	Fine	4.0	5.6			14
	Fine	5.6	8.0	2	2	16
	Medium	8.0	11.0	4	4	20
	Medium	11.0	16.0	14	14	34
	Coarse	16.0	22.6	12	12	46
	Coarse	22.6	32	8	8	54
	Very Coarse	32	45	10	10	64
	Very Coarse	45	64	20	20	84
COBBLE	Small	64	90	8	8	92
	Small	90	128	4	4	96
	Large	128	180	2	2	98
	Large	180	256			98
BOULDER	Small	256	362			98
	Small	362	512			98
	Medium	512	1024			98
	Large/Very Large	1024	2048	2	2	100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 3	
Channel materials (mm)	
D_{16} =	8.0
D_{35} =	16.5
D_{50} =	26.9
D_{84} =	64.0
D_{95} =	117.2
D_{100} =	2048.0





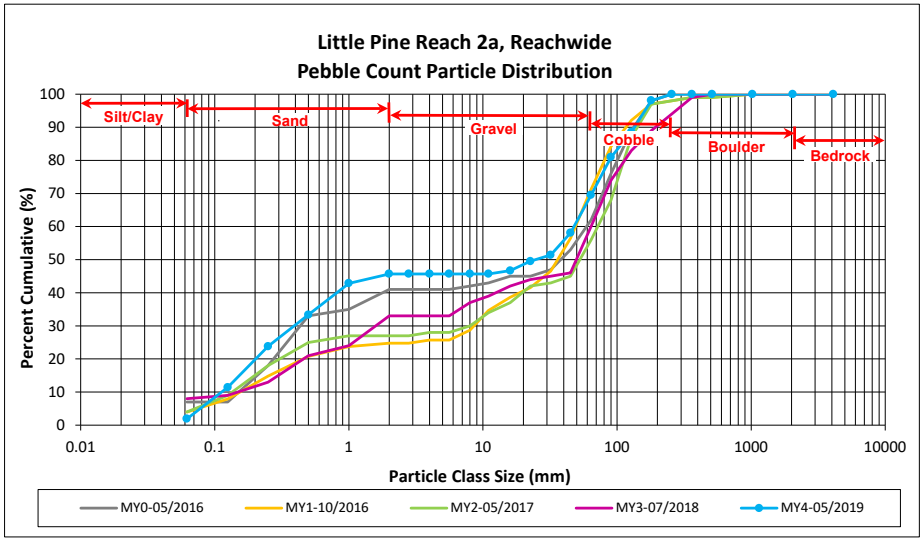
Reachwide and Cross-Section Pebble Count Plots

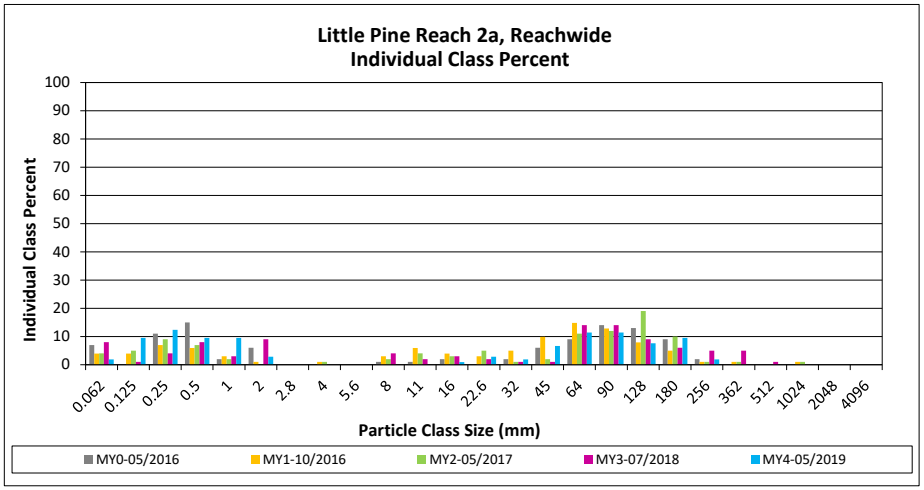
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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		2	2	2	2
SAND	Very fine	0.062	0.125		10	10	10	11
	Fine	0.125	0.250		13	13	12	24
	Medium	0.25	0.50		10	10	10	33
	Coarse	0.5	1.0		10	10	10	43
	Very Coarse	1.0	2.0	2	1	3	3	46
GRAVEL	Very Fine	2.0	2.8					46
	Very Fine	2.8	4.0					46
	Fine	4.0	5.6					46
	Fine	5.6	8.0					46
	Medium	8.0	11.0					46
	Medium	11.0	16.0	1		1	1	47
	Coarse	16.0	22.6	1	2	3	3	50
	Coarse	22.6	32	2		2	2	51
	Very Coarse	32	45	5	2	7	7	58
	Very Coarse	45	64	9	3	12	11	70
COBBLE	Small	64	90	12		12	11	81
	Small	90	128	7	1	8	8	89
	Large	128	180	10		10	10	98
	Large	180	256	2		2	2	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**51**	**54**	**105**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	0.6
D_{50} =	24.7
D_{84} =	103.6
D_{95} =	161.1
D_{100} =	256.0





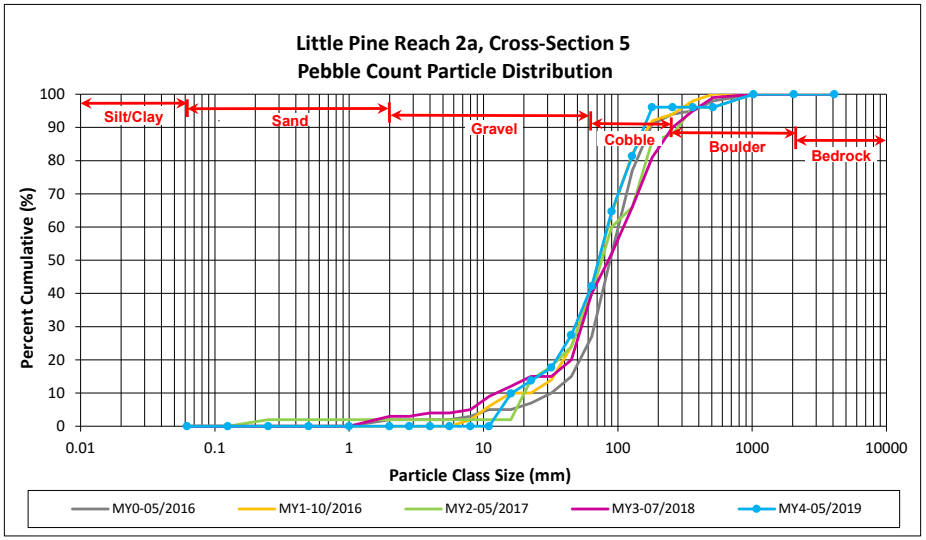
Reachwide and Cross-Section Pebble Count Plots

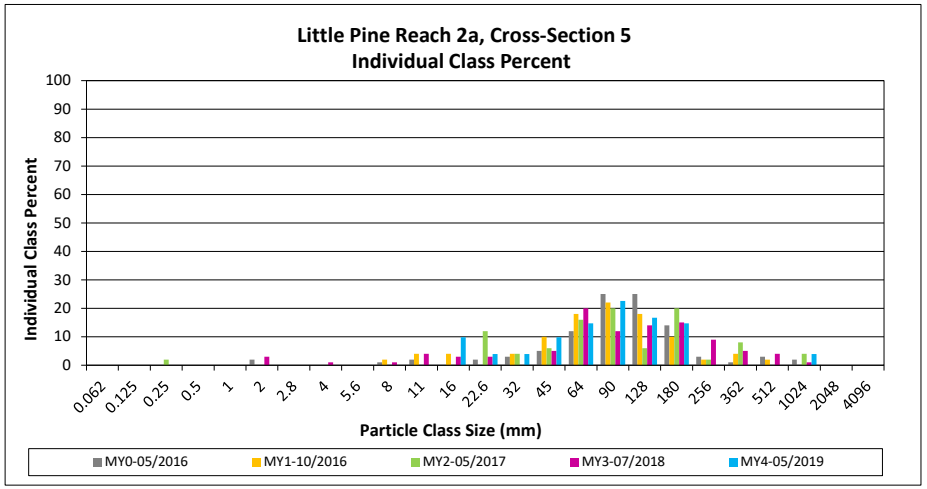
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.6			0
	Fine	5.6	8.0			0
	Medium	8.0	11.0			0
	Medium	11.0	16.0	10	10	10
	Coarse	16.0	22.6	4	4	14
	Coarse	22.6	32	4	4	18
	Very Coarse	32	45	10	10	27
	Very Coarse	45	64	15	15	42
COBBLE	Small	64	90	23	23	65
	Small	90	128	17	17	81
	Large	128	180	15	15	96
	Large	180	256			96
BOULDER	Small	256	362			96
	Small	362	512			96
	Medium	512	1024	4	4	100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**102**	**100**	**100**

Cross-Section 5	
Channel materials (mm)	
D_{16} =	27.7
D_{35} =	53.9
D_{50} =	72.1
D_{84} =	136.0
D_{95} =	175.6
D_{100} =	1024.0





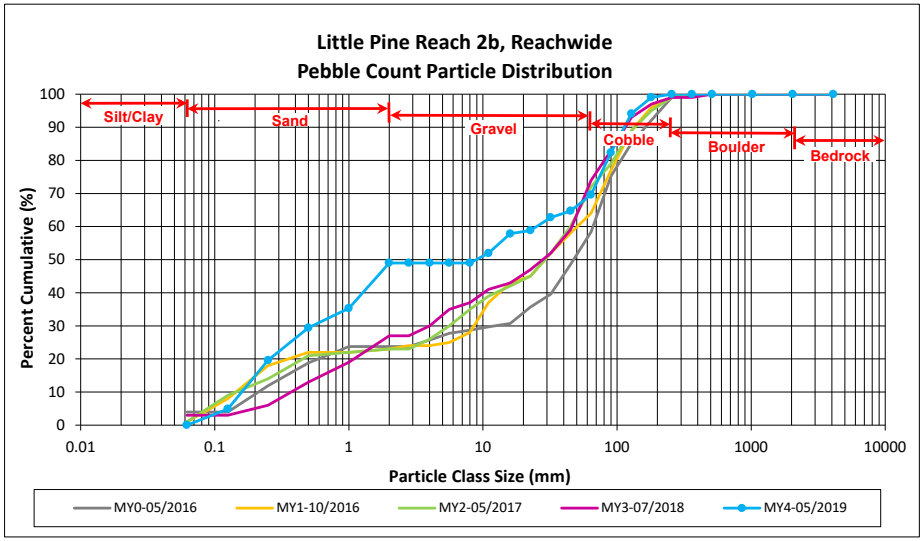
Reachwide and Cross-Section Pebble Count Plots

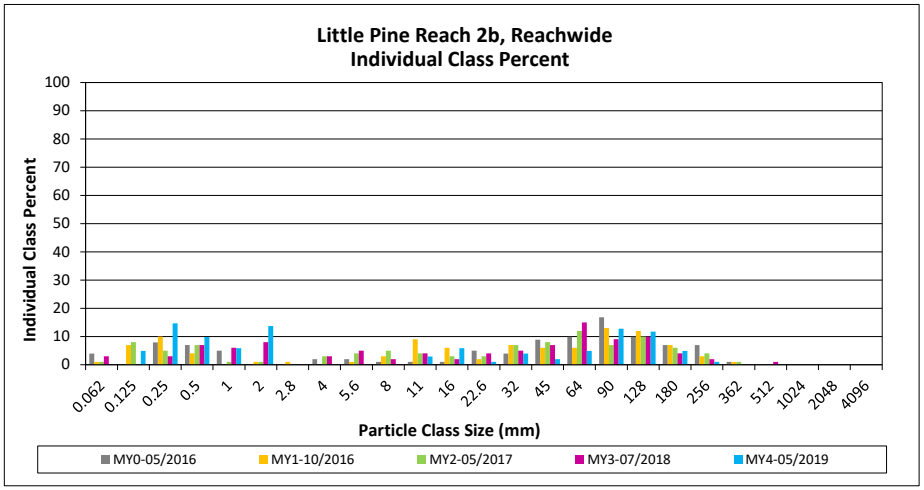
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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		5	5	5	5
	Fine	0.125	0.250		15	15	15	20
	Medium	0.25	0.50		10	10	10	29
	Coarse	0.5	1.0	1	5	6	6	35
	Very Coarse	1.0	2.0	3	11	14	14	49
GRAVEL	Very Fine	2.0	2.8					49
	Very Fine	2.8	4.0					49
	Fine	4.0	5.6					49
	Fine	5.6	8.0					49
	Medium	8.0	11.0		3	3	3	52
	Medium	11.0	16.0	1	5	6	6	58
	Coarse	16.0	22.6		1	1	1	59
	Coarse	22.6	32	3	1	4	4	63
	Very Coarse	32	45	2		2	2	65
	Very Coarse	45	64	4	1	5	5	70
COBBLE	Small	64	90	12	1	13	13	82
	Small	90	128	10	2	12	12	94
	Large	128	180	4	1	5	5	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	41	61	102	100	100

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	1.0
D_{50} =	8.9
D_{84} =	94.5
D_{95} =	136.1
D_{100} =	256.0





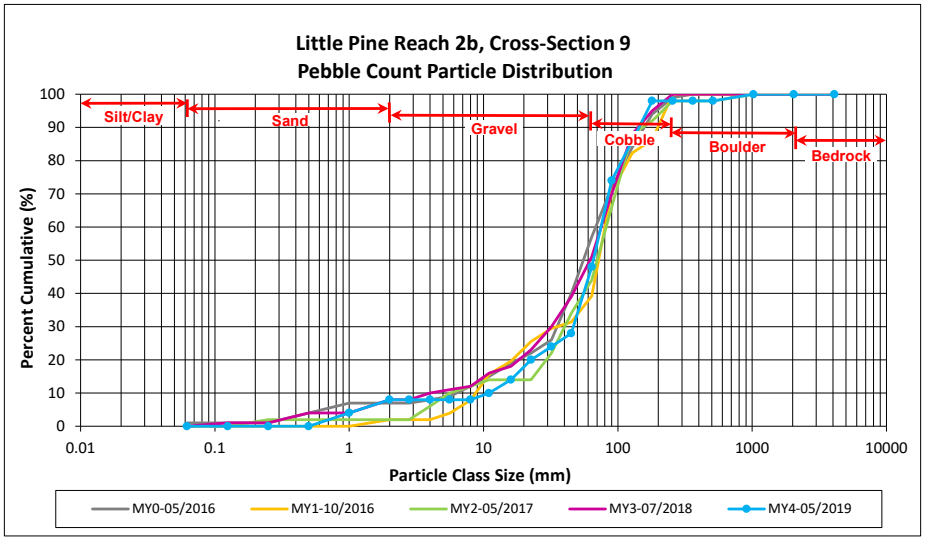
Reachwide and Cross-Section Pebble Count Plots

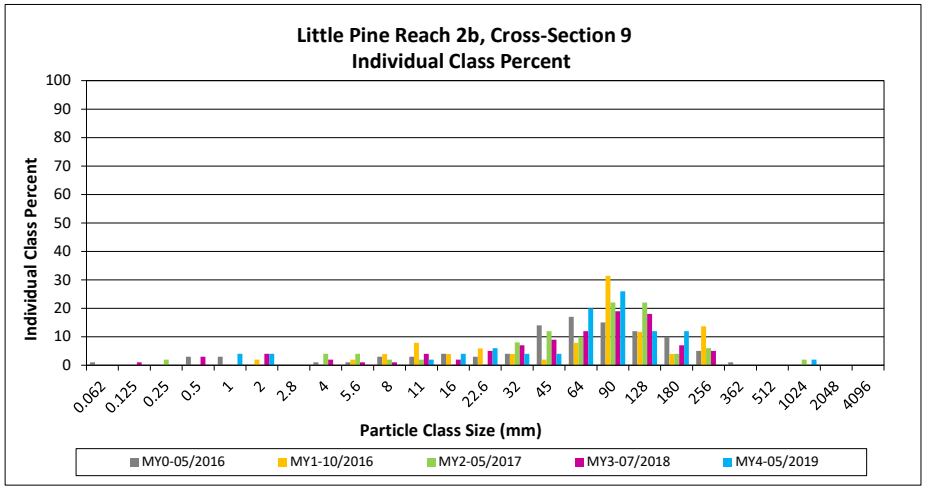
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0	4	4	4
	Very Coarse	1.0	2.0	4	4	8
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0			8
	Fine	4.0	5.6			8
	Fine	5.6	8.0			8
	Medium	8.0	11.0	2	2	10
	Medium	11.0	16.0	4	4	14
	Coarse	16.0	22.6	6	6	20
	Coarse	22.6	32	4	4	24
	Very Coarse	32	45	4	4	28
	Very Coarse	45	64	20	20	48
COBBLE	Small	64	90	26	26	74
	Small	90	128	12	12	86
	Large	128	180	12	12	98
	Large	180	256			98
BOULDER	Small	256	362			98
	Small	362	512			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} =	18.0
D_{35} =	50.9
D_{50} =	65.7
D_{84} =	120.7
D_{95} =	165.3
D_{100} =	1024.0





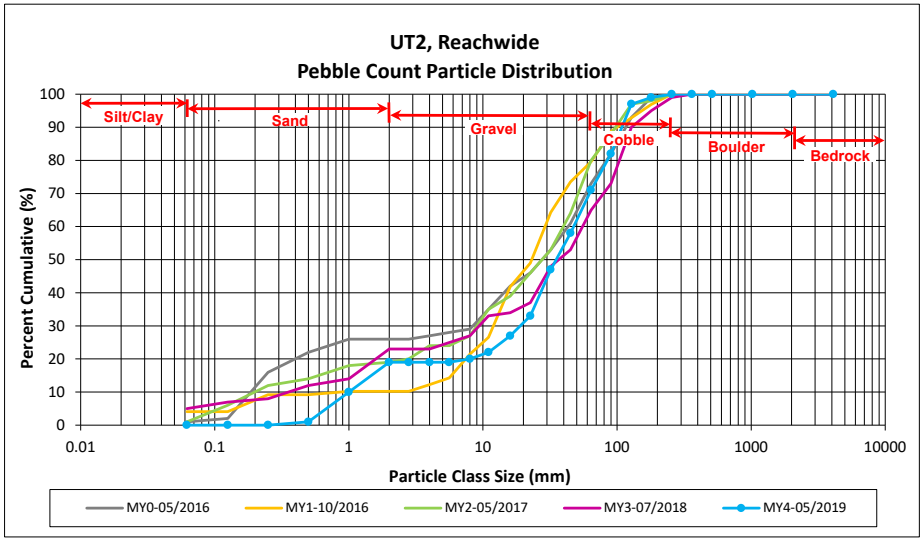
Reachwide and Cross-Section Pebble Count Plots

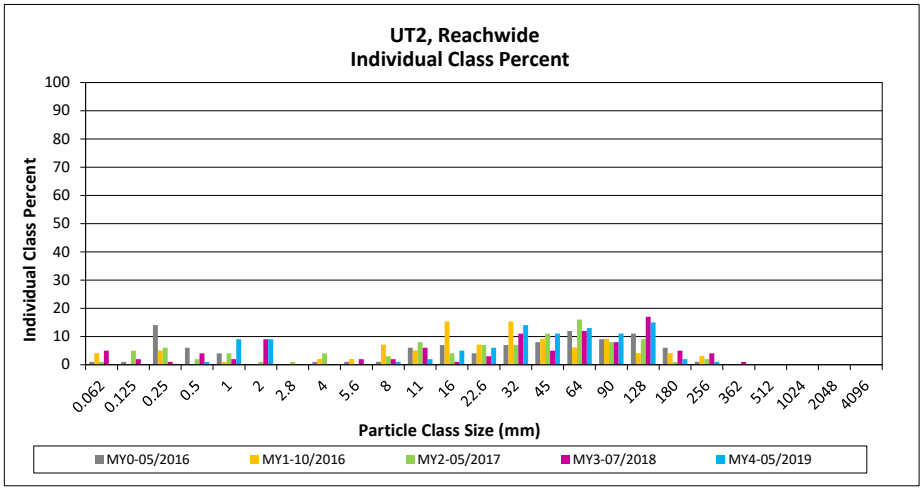
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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					0
SAND	Very fine	0.062	0.125					0
	Fine	0.125	0.250					0
	Medium	0.25	0.50		1	1	1	1
	Coarse	0.5	1.0	3	6	9	9	10
	Very Coarse	1.0	2.0	1	8	9	9	19
GRAVEL	Very Fine	2.0	2.8					19
	Very Fine	2.8	4.0					19
	Fine	4.0	5.6					19
	Fine	5.6	8.0		1	1	1	20
	Medium	8.0	11.0	1	1	2	2	22
	Medium	11.0	16.0	3	2	5	5	27
	Coarse	16.0	22.6	2	4	6	6	33
	Coarse	22.6	32	10	4	14	14	47
	Very Coarse	32	45	10	1	11	11	58
	Very Coarse	45	64	11	2	13	13	71
COBBLE	Small	64	90	11		11	11	82
	Small	90	128	15		15	15	97
	Large	128	180	2		2	2	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**70**	**30**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	1.6
D_{35} =	23.8
D_{50} =	35.1
D_{84} =	94.3
D_{95} =	122.1
D_{100} =	256.0





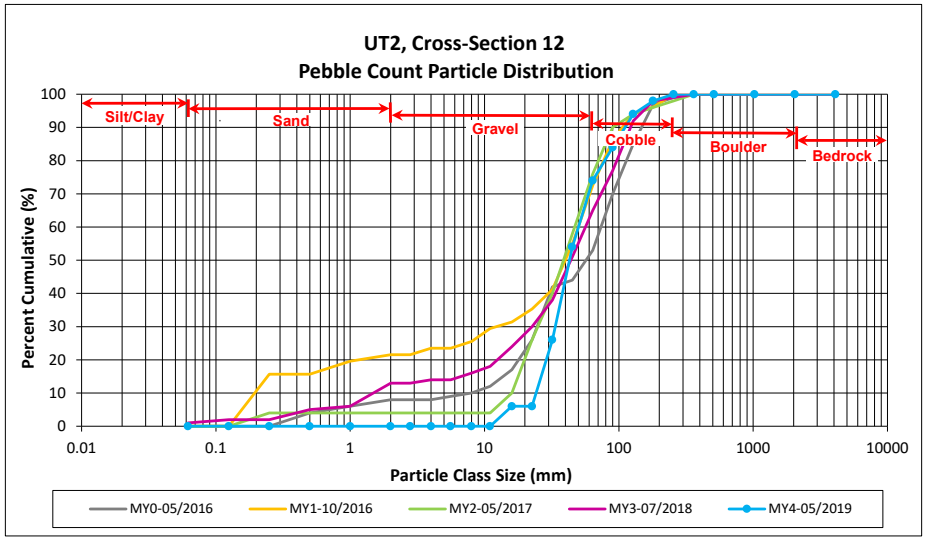
Reachwide and Cross-Section Pebble Count Plots

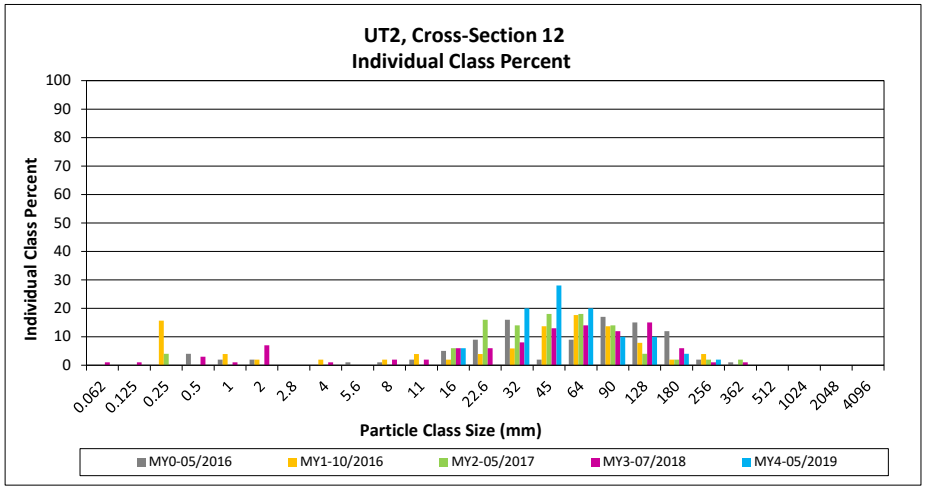
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.6			0
	Fine	5.6	8.0			0
	Medium	8.0	11.0			0
	Medium	11.0	16.0	6	6	6
	Coarse	16.0	22.6			6
	Coarse	22.6	32	20	20	26
	Very Coarse	32	45	28	28	54
	Very Coarse	45	64	20	20	74
COBBLE	Small	64	90	10	10	84
	Small	90	128	10	10	94
	Large	128	180	4	4	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	100	100	100

Cross-Section 12	
Channel materials (mm)	
D_{16} =	26.9
D_{35} =	35.7
D_{50} =	42.9
D_{84} =	90.0
D_{95} =	139.4
D_{100} =	256.0





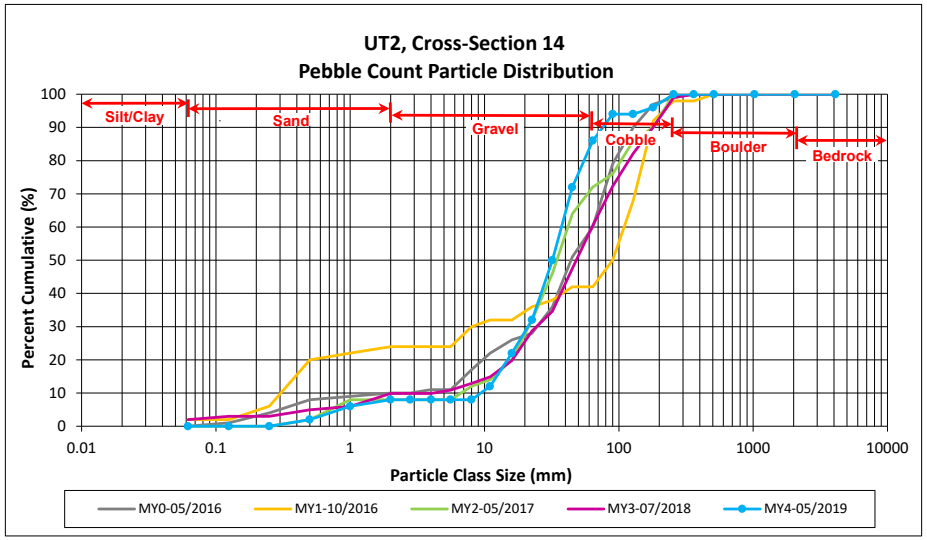
Reachwide and Cross-Section Pebble Count Plots

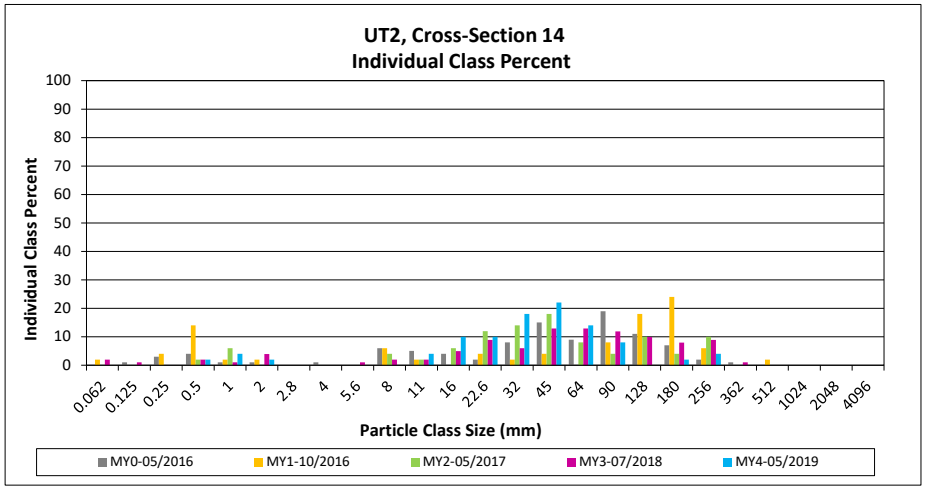
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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	2	2	2
	Coarse	0.5	1.0	4	4	6
	Very Coarse	1.0	2.0	2	2	8
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0			8
	Fine	4.0	5.6			8
	Fine	5.6	8.0			8
	Medium	8.0	11.0	4	4	12
	Medium	11.0	16.0	10	10	22
	Coarse	16.0	22.6	10	10	32
	Coarse	22.6	32	18	18	50
	Very Coarse	32	45	22	22	72
	Very Coarse	45	64	14	14	86
COBBLE	Small	64	90	8	8	94
	Small	90	128			94
	Large	128	180	2	2	96
	Large	180	256	4	4	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 14	
Channel materials (mm)	
D_{16} =	12.8
D_{35} =	23.9
D_{50} =	32.0
D_{84} =	60.9
D_{95} =	151.8
D_{100} =	256.0





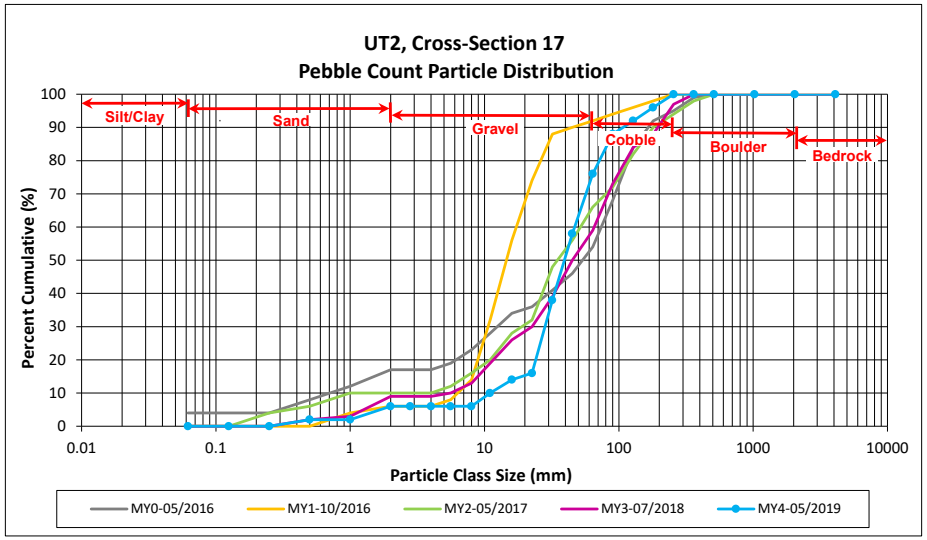
Reachwide and Cross-Section Pebble Count Plots

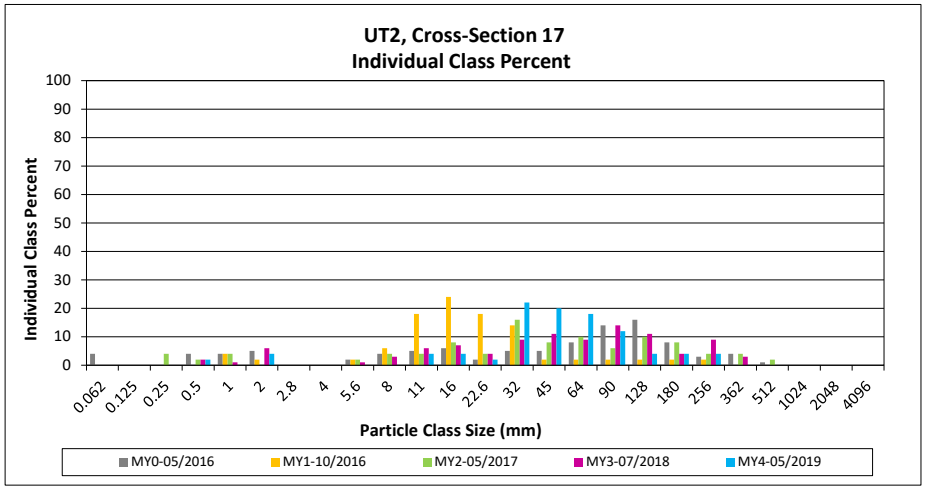
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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	2	2	2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	4	4	6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0			6
	Fine	4.0	5.6			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	2	2	16
	Coarse	22.6	32	22	22	38
	Very Coarse	32	45	20	20	58
	Very Coarse	45	64	18	18	76
COBBLE	Small	64	90	12	12	88
	Small	90	128	4	4	92
	Large	128	180	4	4	96
	Large	180	256	4	4	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 17	
Channel materials (mm)	
D_{16} =	22.6
D_{35} =	30.5
D_{50} =	39.3
D_{84} =	80.3
D_{95} =	165.3
D_{100} =	256.0





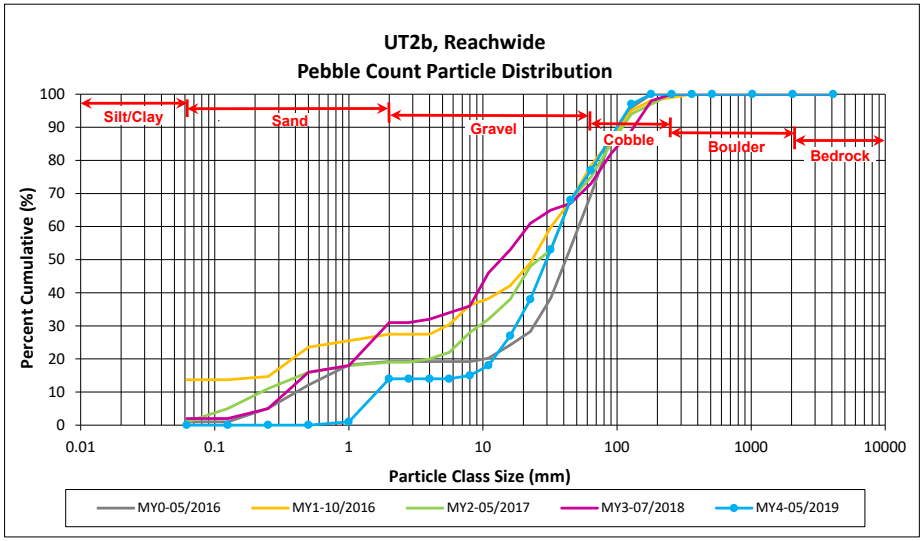
Reachwide and Cross-Section Pebble Count Plots

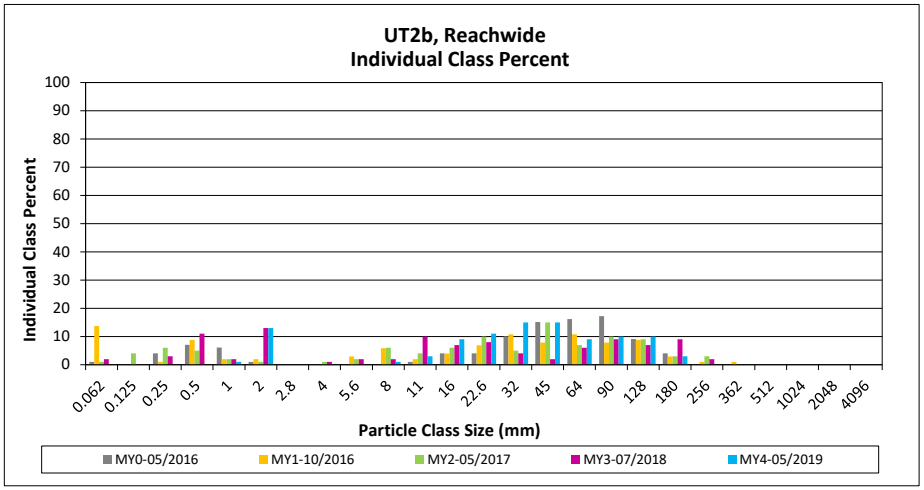
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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					0
	Coarse	0.5	1.0		1	1	1	1
	Very Coarse	1.0	2.0		13	13	13	14
GRAVEL	Very Fine	2.0	2.8					14
	Very Fine	2.8	4.0					14
	Fine	4.0	5.6					14
	Fine	5.6	8.0	1		1	1	15
	Medium	8.0	11.0	2	1	3	3	18
	Medium	11.0	16.0	5	4	9	9	27
	Coarse	16.0	22.6	7	4	11	11	38
	Coarse	22.6	32	12	3	15	15	53
	Very Coarse	32	45	13	2	15	15	68
	Very Coarse	45	64	9		9	9	77
COBBLE	Small	64	90	10		10	10	87
	Small	90	128	9	1	10	10	97
	Large	128	180	2	1	3	3	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**70**	**30**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	8.9
D_{35} =	20.6
D_{50} =	29.8
D_{84} =	81.3
D_{95} =	119.3
D_{100} =	180.0





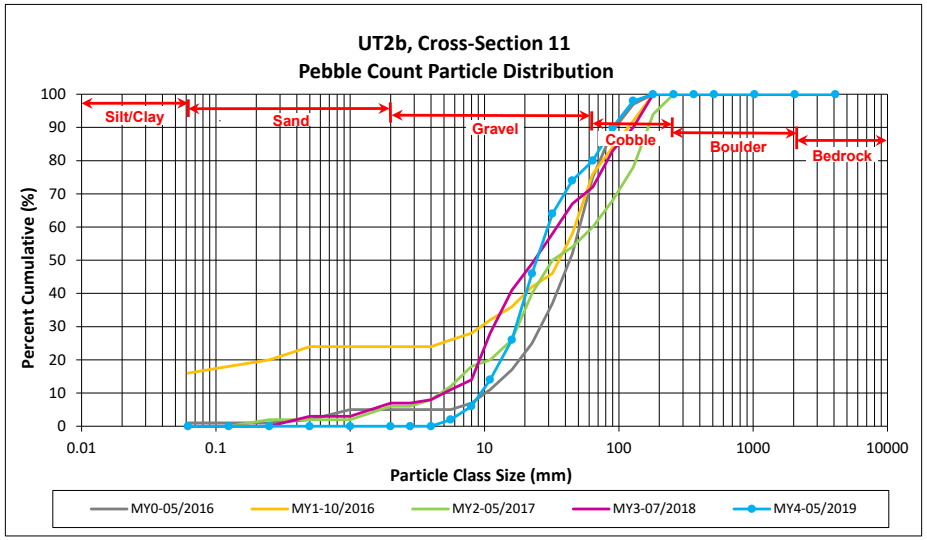
Reachwide and Cross-Section Pebble Count Plots

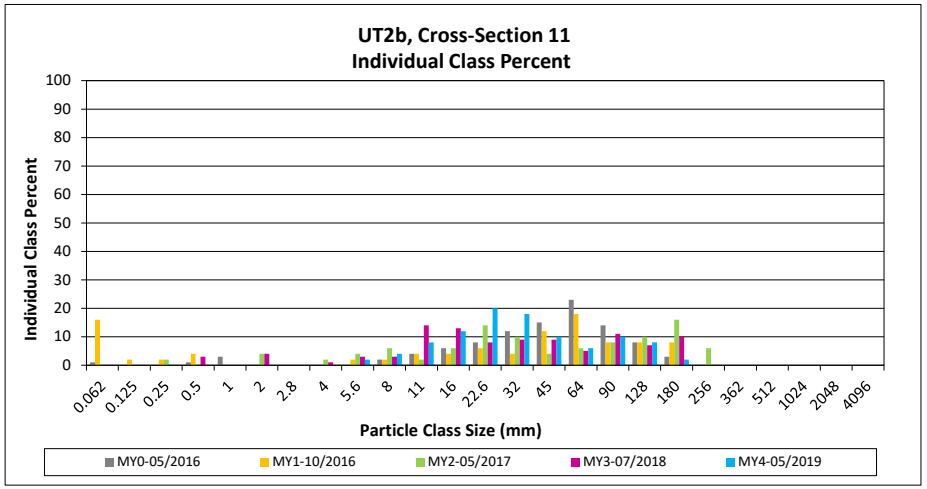
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

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			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.6	2	2	2
	Fine	5.6	8.0	4	4	6
	Medium	8.0	11.0	8	8	14
	Medium	11.0	16.0	12	12	26
	Coarse	16.0	22.6	20	20	46
	Coarse	22.6	32	18	18	64
	Very Coarse	32	45	10	10	74
	Very Coarse	45	64	6	6	80
COBBLE	Small	64	90	10	10	90
	Small	90	128	8	8	98
	Large	128	180	2	2	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 11	
Channel materials (mm)	
D_{16} =	11.7
D_{35} =	18.7
D_{50} =	24.4
D_{84} =	73.4
D_{95} =	112.2
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 4 - 2019

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
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
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

Table 15. Wetland Gage Attainment Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

Summary of Groundwater Gage Results for MY4					
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)
Wetland FF	Yes/112 Days (66.6%)	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)	

No wetland success criteria established

[1]Growing season starts April 26, 2019 and ends October 11, 2019.

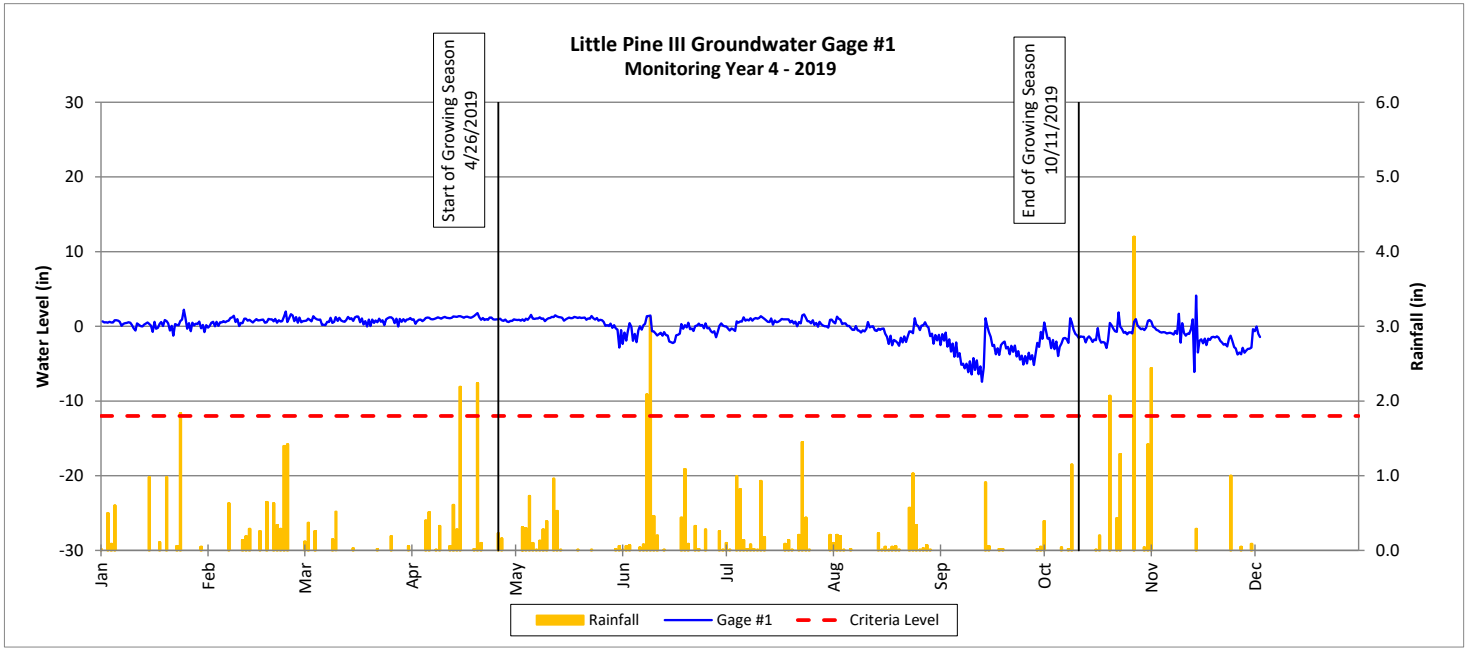
Groundwater Gage Plots

Little Pine III Stream & Wetland Mitigation Project

DMS Project No. 94903

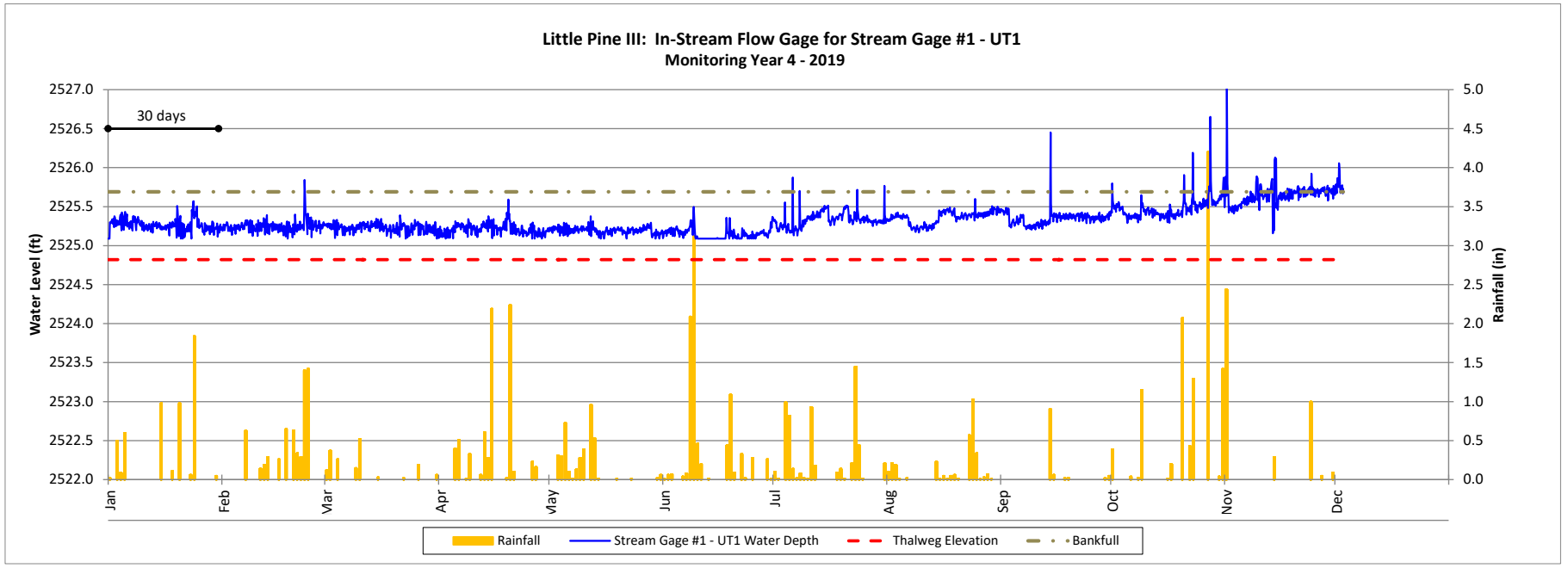
Monitoring Year 4 - 2019

Wetland FF



Recorded In-stream Flow Events

Little Pine III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 4 - 2019

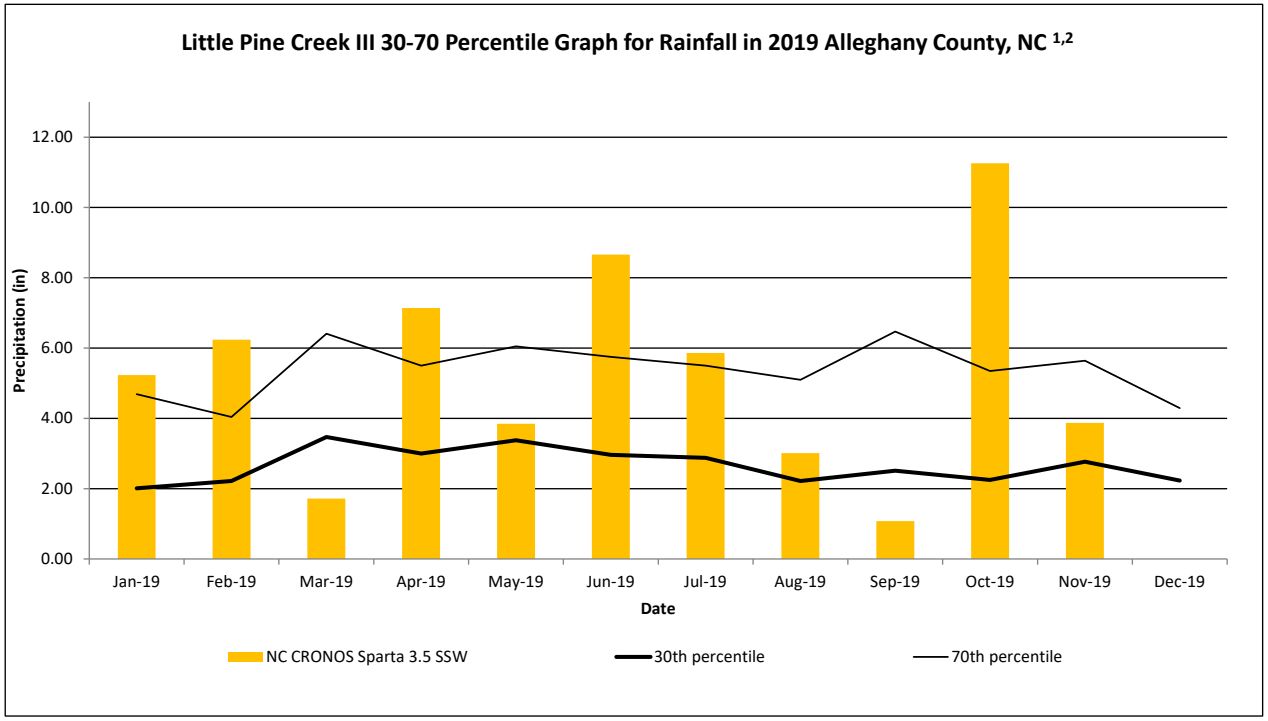


Monthly Rainfall Data

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 4 - 2019



[1] 2019 rainfall collected from NC CRONOS Station Name: Sparta 3.5 SSW (NCSU, 2019)

[2] 30th and 70th percentile rainfall data collected from weather station Sparta, NC8158 (USDA, 2019)

APPENDIX 6. Repair Plans

NC DEPARTMENT OF ENVIRONMENTAL QUALITY - DIVISION OF MITIGATION SERVICES

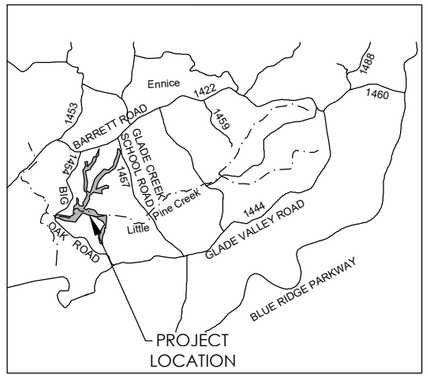
LITTLE PINE CREEK III

STREAM AND WETLAND RESTORATION PROJECT - REPAIR

ALLEGHANY COUNTY, NORTH CAROLINA

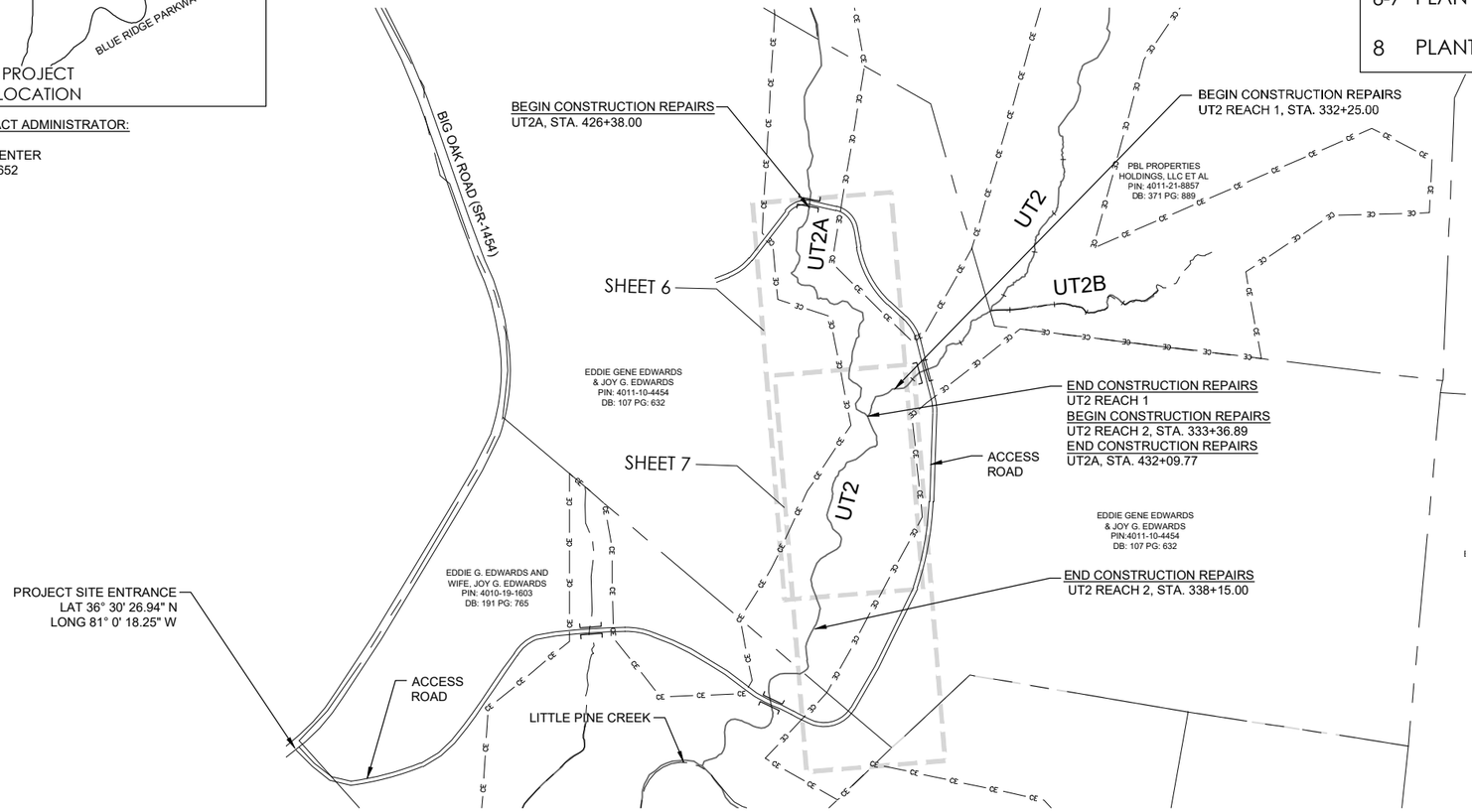
NCDEQ - DMS PROJECT ID # 94903
NC SCO PROJECT ID #18-18332-01
NEW RIVER BASIN (CU 05050001)
USACE ACTION ID # 2012-01299
TYPE OF WORK : STREAM REPAIR DESIGN SERVICES PROJECT

VICINITY MAP
N.T.S.



NCDEQ-DMS CONTRACT ADMINISTRATOR:
KRISTIE CORSON
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652
PH: 919-707-8935

SHEET INDEX



WLS ENGINEERING, PLLC
81 Chickwood Trail
Weaverville, NC 28787
(919)614-5111

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A. TOMSIC
4/12/19

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC
FIRM LICENSE NO. P-1480

REVISIONS		
A	DRAFT CONCEPT PLAN	05-01-18
B	FINAL CONCEPT PLAN	06-01-18
C	FINAL CONCEPT PLAN	06-11-18
D	DRAFT FINAL PLAN	08-17-18
E	FINAL PLAN	10-02-18
NO.	DESCRIPTION	DATE

PROJECT NAME

LITTLE PINE CREEK III STREAM AND WETLAND RESTORATION PROJECT - REPAIR

ALLEGHANY COUNTY, NC

DRAWING INFORMATION	
PROJECT NO. :	94903
FILENAME : 01_LITTLE PINE III__COVER.DWG	
DESIGNED BY :	KMV/WSH
DRAWN BY :	APL
DATE :	10-02-18
HORIZ. SCALE :	1" = 300'
VERT. SCALE :	N/A

NORTH

150 75 0 150 300
GRAPHIC SCALE

SHEET NAME

COVER SHEET

SHEET NUMBER

1

LEGEND

- STONE AND LOG STEP-POOL
- CONSTRUCTED STONE RIFFLE
- GRADE CONTROL LOG J-HOOK VANE
- GEOLIFT WITH TOE WOOD
- CE ——— CE — EXISTING CONSERVATION EASEMENT BOUNDARY
- 100 — EXISTING MAJOR CONTOUR
- 101 — EXISTING MINOR CONTOUR
- 100 — PROPOSED MAJOR CONTOUR
- 101 — PROPOSED MINOR CONTOUR
- LOD ——— LOD — LIMITS OF DISTURBANCE
- C/F ——— C/F — CUT/FILL LIMITS
- WLB ——— WLB — EXISTING WETLAND BOUNDARY
- EXISTING WOODLINE
- PROPOSED TOP OF STREAM BANK
- EXISTING PROPERTY BOUNDARY
- EXISTING FENCE
- 15+00 — PROPOSED CENTERLINE (THALWEG)
- TP ——— TP — PROPOSED TEMPORARY PROTECTION FENCE
- EXISTING TREE
- CHANNEL BLOCK
- CHANNEL FILL
- EXISTING WETLAND AREA

GENERAL NOTES

1. CONSTRUCTION ACTIVITIES ARE BEING PERFORMED AS A RESTORATION DESIGN REPAIR PLAN ON PRIVATE PROPERTY. THE CONTRACTOR SHALL MAKE ALL REASONABLE EFFORTS TO REDUCE SEDIMENT LOSS, PROTECT PUBLIC SAFETY, AND MINIMIZE DISTURBANCE OF THE SITE WHILE PERFORMING THE CONSTRUCTION WORK. ALL AREAS SHALL BE KEPT NEAT, CLEAN, AND FREE OF ALL TRASH AND DEBRIS, AND ALL REASONABLE PRECAUTIONS SHALL BE TAKEN TO AVOID DAMAGE TO EXISTING ROADS, VEGETATION, TURF, STRUCTURES, AND PRIVATE PROPERTY.
2. THE PROJECT SITE BOUNDARIES ARE SHOWN ON THE DESIGN PLANS AS THE PROPOSED CONSERVATION EASEMENT. THE CONTRACTOR SHALL PERFORM ALL RELATED WORK ACTIVITIES WITHIN THE PROJECT SITE BOUNDARIES AND/OR WITHIN THE LIMITS OF DISTURBANCE (LOD). THE PROJECT SITE SHALL BE ACCESSED THROUGH THE DESIGNATED ACCESS POINTS SHOWN ON THE PLANS. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING PERMITTED ACCESS THROUGHOUT ALL CONSTRUCTION ACTIVITIES.
3. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS AND MEASURES TO PROTECT ALL PROPERTIES, RESTORED AREAS AND SITE FEATURES FROM DAMAGE. THE CONTRACTOR SHALL REPAIR ALL DAMAGE OUTSIDE DESIGNATED AREAS AND UPON COMPLETION OF ALL CONSTRUCTION REPAIR ACTIVITIES, THE AREAS ARE TO BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN FOUND PRIOR TO CONSTRUCTION.
4. THE ORIGINAL TOPOGRAPHIC SURVEY USED FOR THE RESTORATION DESIGN PLANS AND CONSTRUCTION WORK WAS DEVELOPED USING SURVEY DATA COLLECTED BY KEE MAPPING AND SURVEY (KEE) IN JUNE 2012 AND FEBRUARY 2013. THE AS-BUILT SURVEY AND RECORD DRAWINGS WERE PREPARED BY WILDLANDS ENGINEERING IN AUGUST 2016 FROM DIGITAL FILES PROVIDED BY KEE IN APRIL 2016. THE HORIZONTAL AND VERTICAL DATUM SHOWN ON THE DESIGN REPAIR PLANS REPRESENT THE AS-BUILT CONDITIONS AND WERE TIED TO NAD83 NC STATE PLANE COORDINATE SYSTEM (US SURVEY FEET) AND NAVD88 VERTICAL DATUM. SUPPLEMENTAL GPS SURVEY DESIGN LEVEL DATA WAS COLLECTED IN MARCH 2018 BY WLS, HOWEVER, EXISTING ELEVATIONS AND SITE CONDITIONS MAY HAVE CHANGED SINCE THE ORIGINAL DESIGN SURVEY AND AS-BUILT SURVEY WAS COMPLETED.
5. THE CONTRACTOR SHALL VISIT THE CONSTRUCTION SITE AND THOROUGHLY FAMILIARIZE HIM/HERSELF WITH ALL EXISTING SITE CONDITIONS PRIOR TO BEGINNING CONSTRUCTION ACTIVITIES. THE CONTRACTOR SHALL VERIFY THE ACCURACY AND COMPLETENESS OF THE CONSTRUCTION SPECIFICATIONS AND DESIGN PLANS REGARDING THE NATURE AND EXTENT OF THE REPAIR WORK DESCRIBED.
6. THE CONTRACTOR SHALL BRING ANY DISCREPANCIES BETWEEN THE CONSTRUCTION PLANS AND SPECIFICATIONS AND/OR FIELD CONDITIONS TO THE ATTENTION OF THE ENGINEER BEFORE CONSTRUCTION BEGINS.
7. THERE SHALL BE NO CLEARING OR REMOVAL OF ANY NATIVE SPECIES, PLANTED VEGETATION OR TREES OF SIGNIFICANCE, OTHER THAN THOSE INDICATED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
8. THE CONTRACTOR SHALL EXERCISE CARE DURING GRADING ACTIVITIES IN THE VICINITY OF ANY NATIVE/PLANTED VEGETATION AND TREES OF SIGNIFICANCE AT THE CONSTRUCTION SITE. ALL GRADING IN THE VICINITY OF TREES NOT IDENTIFIED FOR REMOVAL SHALL BE MADE IN A MANNER THAT DOES NOT DISTURB THE ROOT SYSTEM WITHIN THE DRIP LINE OF THE TREE. TREES COMPROMISED OR DAMAGED DURING CONSTRUCTION MUST BE REMOVED. TREE DISPOSAL MUST BE CONDUCTED IN A MANNER AS TO NOT INTERFERE WITH STREAM FLOW OR OTHER PROJECT FUNCTIONS AND AS DIRECTED BY THE ENGINEER.
9. PRIOR TO START OF WORK, THE CONTRACTOR SHALL SUBMIT THE SOURCE OF MATERIALS, INCLUDING AGGREGATES, EROSION CONTROL MATTING, WOOD AND NATIVE PLANTING MATERIAL TO THE ENGINEER FOR REVIEW AND APPROVAL. NO WORK SHALL BE PERFORMED UNTIL THE SOURCE OF MATERIAL IS APPROVED BY THE ENGINEER.
10. THE CONTRACTOR SHALL BE HELD SOLELY RESPONSIBLE FOR ANY NECESSARY COORDINATION BETWEEN THE VARIOUS COUNTY, STATE OR FEDERAL AGENCIES, UTILITY COMPANIES, HIS/HER SUB-CONTRACTORS, AND THE ENGINEER FOR THE DURATION OF THE PROJECT.
11. PRIOR TO START OF WORK, THE CONTRACTOR SHALL SUBMIT THEIR DETAILED PLANTING SCHEDULE TO THE ENGINEER FOR REVIEW. NO WORK SHALL BE PERFORMED UNTIL THIS SCHEDULE IS APPROVED BY THE ENGINEER. THE DETAILED PLANTING SCHEDULE SHALL CONFORM TO THE PLANTING REVEGETATION PLAN AND SHALL INCLUDE A SPECIES LIST AND TIMING SEQUENCE.
12. THE CONTRACTOR IS REQUIRED TO INSTALL IN-STREAM STRUCTURES USING A BACKHOE/EXCAVATOR WITH A HYDRAULIC THUMB OF SUFFICIENT SIZE TO PLACE STRUCTURES INCLUDING LOGS, STONE, BOULDERS, ROOT WADS, AND TEMPORARY WOOD MAT STREAM CROSSINGS.
13. NO GRADING ACTIVITIES SHALL OCCUR BEYOND THE PROJECT LIMITS OF DISTURBANCE (LOD) AS SHOWN ON THE DESIGN PLANS. THE TOTAL AREA OF DISTURBANCE IS 5.0 ACRES. PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL INSTALL TEMPORARY ORANGE FENCING TO DELIMIT AND PROTECT THE EXISTING JURISDICTIONAL WETLANDS WITHIN THE LOD. THE CONTRACTOR SHALL REMOVE SAID FENCING IMMEDIATELY FOLLOWING THE COMPLETION OF CONSTRUCTION.
14. ONCE PROPOSED GRADES ARE ACHIEVED ALONG THE CONSTRUCTED STREAM CHANNEL, BANKFULL BENCHES AND FLOODPLAIN AREAS AS SHOWN ON THE PLANS, GRADED AREAS SHALL BE ROUGHENED USING TECHNIQUES DESCRIBED IN THE CONSTRUCTION SPECIFICATIONS.
15. ALL SUITABLE SOIL MATERIAL REQUIRED TO FILL AND/OR PLUG EXISTING DITCHES AND/OR STREAM CHANNEL SHALL BE GENERATED ON-SITE AS DESCRIBED IN THE CONSTRUCTION SPECIFICATIONS. IF SUITABLE SOIL MATERIAL CAN NOT BE GENERATED ON-SITE, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING SUITABLE MATERIAL FROM OFF-SITE. IF NECESSARY, ANY EXCESS SPOIL MATERIAL SHALL BE STOCKPILED IN DESIGNATED AREAS OR HAULED OFF-SITE AS APPROVED BY THE ENGINEER.
16. ANY EXISTING FENCE DAMAGED DURING CONSTRUCTION OR FENCE BREAKS NEEDED FOR ACCESS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RESTORE TO PRE-DISTURBED CONDITIONS.

CONSTRUCTION SEQUENCE

THE ENGINEER WILL PROVIDE CONSTRUCTION OBSERVATION DURING THE CONSTRUCTION REPAIRS FOR THIS PROJECT. THE FOLLOWING CONSTRUCTION SEQUENCE SHALL BE USED DURING PROJECT CONSTRUCTION IMPLEMENTATION. PRIOR TO BEGINNING ANY LAND DISTURBING ACTIVITIES, NOTIFICATION OF AND RECEIPT OF THE CERTIFICATE OF APPROVAL MUST BE RECEIVED FROM NCDEQ - LAND QUALITY SECTION. THE CONTRACTOR SHALL CALL NC DEQ LQS AT 919-791-4200 TO SCHEDULE A PRE-CONSTRUCTION MEETING AT LEAST 72 HOURS PRIOR TO PROJECT ACTIVATION. THE CONTRACTOR SHALL REFER TO THE APPROVED EROSION AND SEDIMENTATION CONTROL PERMIT AND CORRESPONDING PLANS AND TECHNICAL SPECIFICATIONS FOR SPECIFIC CONSTRUCTION SEQUENCING ITEMS AND SHALL BE RESPONSIBLE FOR FOLLOWING THE APPROVED PLANS AND PERMIT CONDITIONS.

1. THE CONTRACTOR SHALL NOTIFY "NC 811" (1-800-632-4949) BEFORE ANY EXCAVATION BEGINS. ANY UTILITIES AND RESPECTIVE EASEMENTS SHOWN ON THE PLANS ARE CONSIDERED APPROXIMATE AND THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES AND ADJOINING EASEMENTS AND SHALL REPAIR OR REPLACE ANY DAMAGED UTILITIES AT HIS/HER OWN EXPENSE.
2. THE CONTRACTOR SHALL PREPARE STABILIZED CONSTRUCTION ENTRANCES, HAUL ROADS AND SHALL MOBILIZE EQUIPMENT, MATERIALS, PREPARE STAGING AREA(S) AND STOCKPILE AREA(S) AS SHOWN ON THE PLANS. HAUL ROADS SHALL BE PROPERLY MAINTAINED AT ALL TIMES DURING CONSTRUCTION.
3. CONSTRUCTION TRAFFIC SHALL BE RESTRICTED TO THE AREA DENOTED AS "LIMITS OF DISTURBANCE" OR "HAUL ROADS" AS SHOWN ON THE PLANS.
4. THE CONTRACTOR SHALL INSTALL TEMPORARY ROCK DAMS AT LOCATIONS INDICATED ON THE PLANS.
5. THE CONTRACTOR SHALL INSTALL TEMPORARY SILT FENCE AROUND THE STAGING AREA(S). TEMPORARY SILT FENCING WILL ALSO BE PLACED AROUND THE TEMPORARY STOCKPILE AREAS AS MATERIAL IS STOCKPILED THROUGHOUT THE CONSTRUCTION PERIOD.
6. THE CONTRACTOR SHALL INSTALL ALL TEMPORARY STREAM CROSSINGS AS SHOWN ON THE PLANS IN ACCORDANCE WITH THE APPROVED SEDIMENTATION AND EROSION CONTROL PERMIT. THE EXISTING CHANNEL AND DITCHES ON SITE WILL REMAIN OPEN DURING THE INITIAL STAGES OF CONSTRUCTION TO ALLOW FOR DRAINAGE AND TO MAINTAIN SITE ACCESSIBILITY.
7. THE CONTRACTOR SHALL CONSTRUCT ONLY THE PORTION OF CHANNEL AND/OR AREAS THAT CAN BE COMPLETED AND STABILIZED WITHIN THE SAME DAY. THE CONTRACTOR SHALL APPLY TEMPORARY AND PERMANENT SEED AND MULCH TO ALL DISTURBED AREAS AT THE END OF EACH WORK DAY, WITH THE REQUIREMENT OF ESTABLISHING TEMPORARY AND PERMANENT GROUND COVER THROUGH VEGETATION ESTABLISHMENT.
8. THE CONTRACTOR SHALL CLEAR AND GRUB AN AREA ADEQUATE TO CONTRUCT AND/OR REPAIR THE STREAM CHANNEL AND GRADING OPERATIONS AFTER ALL EROSION AND SEDIMENTATION MEASURES HAVE BEEN INSTALLED AND APPROVED. IN GENERAL, THE CONTRACTOR SHALL WORK FROM UPSTREAM TO DOWNSTREAM AND IN-STREAM STRUCTURES AND CHANNEL FILL MATERIAL SHALL BE INSTALLED USING A PUMP-AROUND OR FLOW DIVERSION MEASURE AS SHOWN ON THE PLANS.
9. CONTRACTOR SHALL BEGIN CONSTRUCTION REPAIR WORK ON REACH UT2A AT APPROXIMATE STATION 426+75 AND PROCEED IN A DOWNSTREAM DIRECTION. ANY NEW DESIGN CHANNEL SHOULD BE CONSTRUCTED OFFLINE AND/OR IN THE DRY WHENEVER POSSIBLE. THE CONTRACTOR SHALL EXCAVATE AND CONSTRUCT THE NEW DESIGN CHANNEL TO PROPOSED DESIGN GRADES AND, IF POSSIBLE, SHALL NOT EXTEND EXCAVATION ACTIVITIES ANY CLOSER THAN WITHIN 10 FEET (HORIZONTALLY) OF THE TOP OF EXISTING STREAM BANKS IN ORDER TO PROTECT THE INTEGRITY OF THE EXISTING STREAM CHANNEL UNTIL ABANDONMENT.
10. THE CONTRACTOR SHALL CONTINUE CONSTRUCTION BY EXCAVATING CHANNEL FILL MATERIAL AS SHOWN ON THE PLANS. ANY EXCAVATED MATERIAL SHOULD BE STOCKPILED IN AREAS SHOWN ON THE PLANS. IN ANY AREAS WHERE EXCAVATION DEPTHS WILL EXCEED 10 INCHES, TOPSOIL SHALL BE HARVESTED, STOCKPILED AND PLACED BACK OVER THESE AREAS TO A MINIMUM DEPTH OF 8 INCHES TO ACHIEVE DESIGN GRADES AND CREATE A SOIL BASE FOR VEGETATION PLANTING ACCORDING TO THE DESIGN PLANS AND CONSTRUCTION SPECIFICATIONS.
11. AFTER EXCAVATING AND CONSTRUCTING THE NEW CHANNEL, THE CONTRACTOR SHALL INSTALL IN-STREAM STRUCTURES, BIOENGINEERING MEASURES, PERMANENT AND TEMPORARY SEEDING AND ALL REQUIRED AMENDMENTS, MULCHING, VEGETATION TRANSPLANTS, TO COMPLETE CHANNEL CONSTRUCTION AND READY THE CHANNEL TO ACCEPT FLOW PER APPROVAL BY THE ENGINEER.
12. LIVE STREAM FLOW WILL BE DIVERTED BACK INTO THE CONSTRUCTED CHANNEL ONCE THE RESTORED STREAM CHANNEL AND ASSOCIATED RIPARIAN AREA HAS BEEN STABILIZED, AS DETERMINED BY THE ENGINEER AND IN COMPLIANCE WITH APPROVED PERMIT REQUIREMENTS. ONCE STREAM FLOW IS RETURNED TO A RESTORED STREAM CHANNEL REACH, THE CONTRACTOR SHALL IMMEDIATELY BEGIN PLUGGING, FILLING, AND GRADING THE ASSOCIATED ABANDONED REACH OF STREAM CHANNEL, AS INDICATED ON PLANS, MOVING IN A DOWNSTREAM DIRECTION TO ALLOW FOR POSITIVE AND ADEQUATE DRAINAGE OF THE ABANDONED CHANNEL REACH. STREAM FLOW SHALL NOT BE DIVERTED INTO ANY SECTION OF RESTORED STREAM CHANNEL PRIOR TO THE COMPLETION OF THE CONSTRUCTION OF THAT REACH OF PROPOSED CHANNEL, INCLUDING, BUT NOT LIMITED TO FINAL GRADING, STABILIZATION WITH TEMPORARY AND PERMANENT SEEDING AND ALL REQUIRED AMENDMENTS, MULCHING, VEGETATION TRANSPLANT INSTALLATION, INSTREAM STRUCTURE INSTALLATION, BIOENGINEERING INSTALLATION, AND COIR FIBER MATTING INSTALLATION.
13. THE RESTORED CHANNEL SECTIONS SHALL REMAIN OPEN AT THEIR DOWNSTREAM END TO ALLOW FOR DRAINAGE DURING RAIN EVENTS.
14. ALL GRADING ACTIVITIES ADJACENT TO THE STREAM CHANNEL AND RIPARIAN AREAS SHALL BE COMPLETED PRIOR TO DIVERTING STREAM FLOW INTO THE RESTORED STREAM CHANNEL REACHES. ONCE CONSTRUCTION IS COMPLETED ON A REACH OF PROPOSED STREAM CHANNEL, ADDITIONAL GRADING ACTIVITIES SHALL NOT BE CONDUCTED WITHIN 10 FEET (HORIZONTALLY) OF THE NEWLY RESTORED STREAM CHANNEL BANKS. THE CONTRACTOR SHALL NOT ROUGHEN AREAS WHERE REQUIRED EXCAVATION ACTIVITIES HAVE NOT BEEN COMPLETED.
15. ONCE CONSTRUCTION IS COMPLETE WITHIN A PUMP-AROUND WORK AREA OR CONSTRUCTION WORK PHASE LIMIT, THE CONTRACTOR SHALL APPLY TEMPORARY AND PERMANENT SEEDING, MULCH AND AMENDMENTS TO ANY AREAS DISTURBED DURING CONSTRUCTION WITHIN HOURS. ALL SLOPES STEEPER THAN 3:1 SHALL BE STABILIZED WITH GROUND COVER AS SOON AS PRACTICABLE WITHIN 7 CALENDAR DAYS. ALL OTHER DISTURBED AREAS AND SLOPES FLATTER THAN 3:1 SHALL BE STABILIZED WITHIN 14 CALENDAR DAYS FROM THE LAST LAND-DISTURBING ACTIVITY.
16. PERMANENT GROUND COVER SHALL BE ESTABLISHED FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS OR 90 CALENDAR DAYS (WHICHEVER IS SHORTER) FOLLOWING COMPLETION OF CONSTRUCTION. ALL DISTURBED AREAS SHOULD HAVE ESTABLISHED GROUND COVER PRIOR TO DEMOBILIZATION. REMOVE ANY TEMPORARY STREAM CROSSINGS AND TEMPORARY EROSION CONTROL MEASURES. HAUL ROADS TO BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN FOUND PRIOR TO CONSTRUCTION.
17. ALL REMAINING DISTURBED AREAS SHALL BE STABILIZED BY TEMPORARY AND PERMANENT SEEDING AND MULCHING BEFORE CONSTRUCTION CLOSEOUT IS REQUESTED AND DEMOBILIZATION CAN OCCUR. ANY EXCESS SPOIL MATERIAL SHALL BE STOCKPILED IN DESIGNATED AREAS AND OR HAULED OFF-SITE AS APPROVED BY THE ENGINEER.
18. THE CONTRACTOR COMPLETE ALL REMAINING PLANTING ACTIVITIES, INCLUDING SHRUB AND TREE PLANTING, REMAINING TRANSPLANT INSTALLATION, INSTALLATION OF REMAINING BIOENGINEERING MEASURES, AND LIVE STAKE INSTALLATION, ACCORDING TO THE CONSTRUCTION CONTRACT DOCUMENTS, INCLUDING THE APPROVED PERMIT, PLANS AND TECHNICAL SPECIFICATIONS. THE CONTRACTOR SHALL COMPLETE THE RE-FORESTATION PHASE OF THE PROJECT AND CONDUCT REMAINING PERMANENT SEEDING IN ACCORDANCE WITH THE CONSTRUCTION CONTRACT DOCUMENTS, INCLUDING THE APPROVED PERMIT, PLANS AND TECHNICAL SPECIFICATIONS.
19. THE CONTRACTOR SHALL ENSURE THAT THE SITE IS FREE OF TRASH AND LEFTOVER CONSTRUCTION MATERIALS PRIOR TO DEMOBILIZATION FROM THE SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OFF-SITE REMOVAL OF ALL TRASH AND ANY OTHER INCIDENTAL MATERIALS PRIOR TO DEMOBILIZATION OF EQUIPMENT FROM THE SITE. ANY EXCESS SPOIL MATERIAL SHALL BE STOCKPILED IN DESIGNATED AREAS AND OR HAULED OFF-SITE AS APPROVED BY THE ENGINEER.

WLS ENGINEERING, PLLC

81 Chickwood Trail
Weaverville, NC 28787
(919)614-5111

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A. TOMSIC 11/12/19

ENGINEERING SERVICES BY
WLS ENGINEERING, PLLC
FIRM LICENSE NO. P-1480

REVISIONS

NO.	DESCRIPTION	DATE
A	DRAFT CONCEPT PLAN	05-01-18
B	FINAL CONCEPT PLAN	06-01-18
C	FINAL CONCEPT PLAN	06-11-18
D	DRAFT FINAL PLAN	08-17-18
E	FINAL PLAN	10-02-18

PROJECT NAME

LITTLE PINE CREEK III STREAM AND WETLAND RESTORATION PROJECT - REPAIR

ALLEGHANY COUNTY, NC

DRAWING INFORMATION

PROJECT NO. :	94903
FILENAME :	02_LITTLE PINE III_GENERAL NOTES - SYMBOL_SHEET.DWG
DESIGNED BY :	KMV/WSH
DRAWN BY :	APL
DATE :	10-02-18
HORIZ. SCALE :	N.T.S.
VERT. SCALE :	N/A

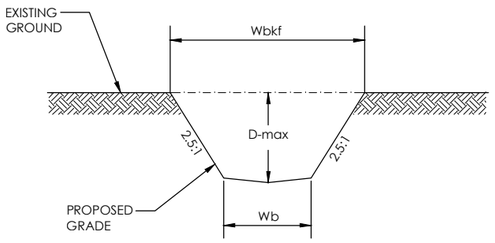
SHEET NAME

LEGEND/ GENERAL NOTES/ CONSTRUCTION SEQUENCE

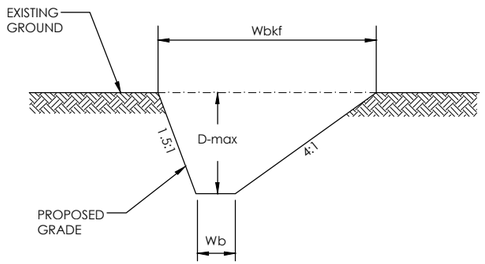
SHEET NUMBER

2

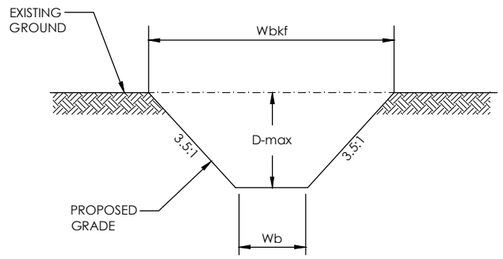
TYPICAL SECTIONS



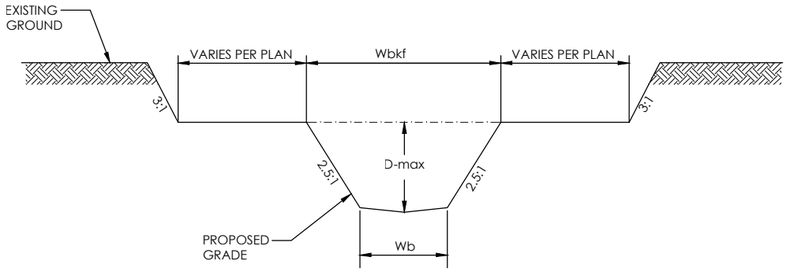
RIFFLE
N.T.S



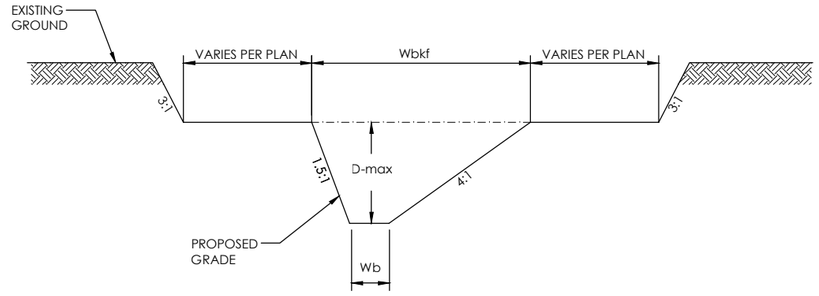
POOL (MEANDER)
N.T.S



POOL (STEP)
N.T.S



RIFFLE WITH BANKFULL BENCH
N.T.S



POOL WITH BANKFULL BENCH
N.T.S

Reach Name	UT2A		UT2 Reach 1		UT2 Reach 2	
Feature	**Riffle**	**Pool**	**Riffle**	**Pool**	**Riffle**	**Pool**
Width of Bankfull, Wbkf (ft)	7.4	10.2	8.9	10.8	11.5	14.8
Mean Depth, Dbkf (ft)	0.5	0.7	0.5	0.7	0.7	0.9
Maximum Depth, D-Max (ft)	0.7	1.2	0.7	1.1	0.8	1.3
Width to Depth Ratio, bkf W/D	15.7	14.5	18.0	15.3	17.5	16.4
Bankfull Area, Abkf (sq ft)	3.4	7.2	4.4	7.6	7.6	13.3
Bottom Width, Wb (ft)	4.4	1.8	5.9	3.1	7.5	5.7

WLS ENGINEERING, PLLC

81 Chickwood Trail
Weaverville, NC 28787
(919)614-5111

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A. TOMSIC 4/12/19

ENGINEERING SERVICES BY
WLS ENGINEERING, PLLC
FIRM LICENSE NO. P-1480

REVISIONS

NO.	DESCRIPTION	DATE
A	DRAFT CONCEPT PLAN	05-01-18
B	FINAL CONCEPT PLAN	06-01-18
C	FINAL CONCEPT PLAN	06-11-18
D	DRAFT FINAL PLAN	08-17-18
E	FINAL PLAN	10-02-18

PROJECT NAME

LITTLE PINE CREEK III STREAM AND WETLAND RESTORATION PROJECT - REPAIR

ALLEGHANY COUNTY, NC

DRAWING INFORMATION

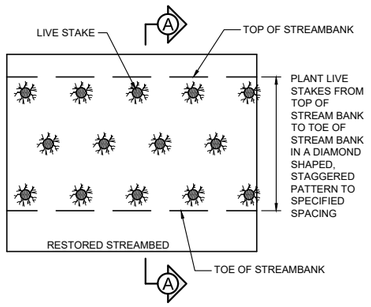
PROJECT NO. :	94903
FILENAME :	03_LITTLE PINE III_TYPICAL SECTIONS.DWG
DESIGNED BY :	KMV/WSH
DRAWN BY :	APL
DATE :	10-02-18
HORIZ. SCALE :	N.T.S.
VERT. SCALE :	N/A

SHEET NAME

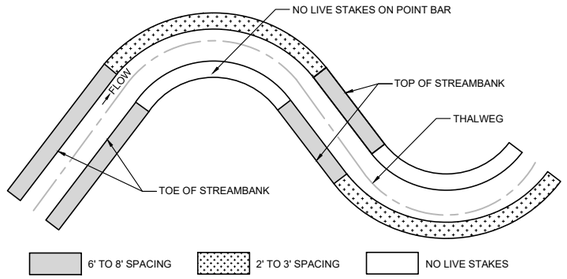
TYPICAL SECTIONS

SHEET NUMBER

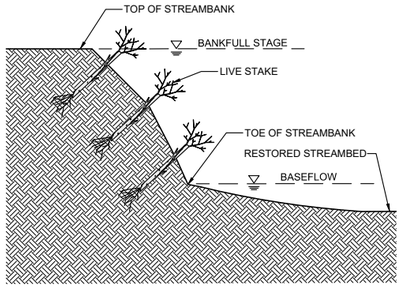
3



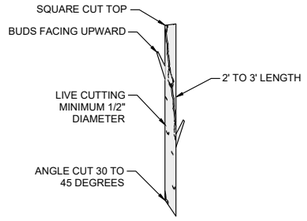
PLAN VIEW OF STREAM BANK



LIVE STAKE SPACING PLAN VIEW



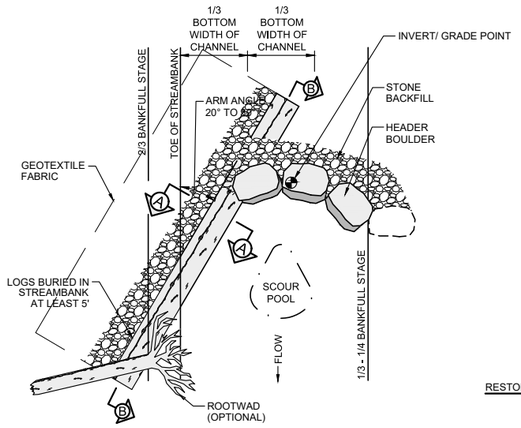
SECTION A - A



LIVE STAKE DETAIL

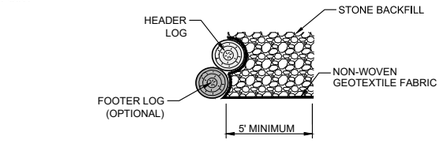
NOTES:
1. LIVE STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY.
2. DO NOT INSTALL LIVE STAKES THAT HAVE BEEN SPLIT.
3. LIVE STAKES MUST BE INSTALLED WITH BUDS POINTING UPWARDS.
4. LIVE STAKES SHOULD BE INSTALLED PERPENDICULAR TO BANK.
5. LIVE STAKES SHOULD BE 1/2 TO 2 INCHES IN DIAMETER AND 2 TO 3 FEET LONG.
6. LIVE STAKES SHOULD BE INSTALLED LEAVING 1/5 OF THE LENGTH OF THE LIVE STAKE ABOVE GROUND.

LIVE STAKING
NOT TO SCALE

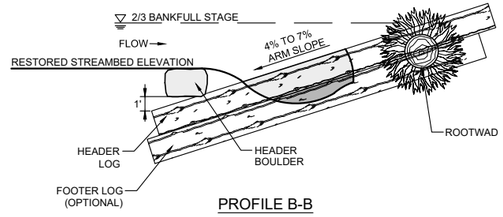


PLAN VIEW

NOTES:
1. LOGS SHOULD BE 12" TO 18" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. LOGS SHOULD BE BURIED INTO THE STREAM BED AND BANKS AT LEAST 5 FEET.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOGS.
4. INSTALL GEOTEXTILE FABRIC BEGINNING AT THE TOP OF THE HEADER LOG AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER LOG AND THEN UPSTREAM TO A MINIMUM OF FIVE FEET. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
5. EXCAVATE A TRENCH BELOW THE BED FOR FOOTER LOG AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
6. START AT BANK AND PLACE FOOTER BOULDERS FIRST AND THEN HEADER BOULDERS.
7. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
8. AN OPTIONAL COVER LOG CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT AT DIRECTION OF ENGINEER.
9. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER BOULDERS.
10. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER BOULDER AND LOG.
11. VEGETATION TRANSPLANTS CAN BE USED INSTEAD OF ROOTWADS, PER DIRECTION OF ENGINEER.

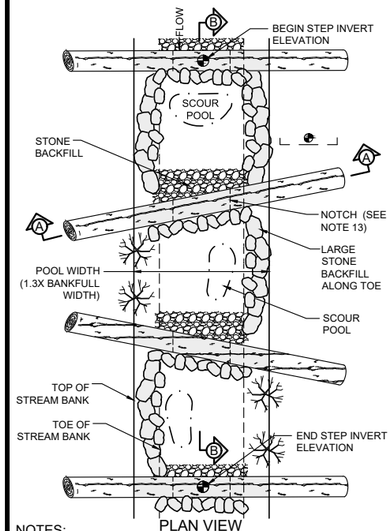


SECTION A-A

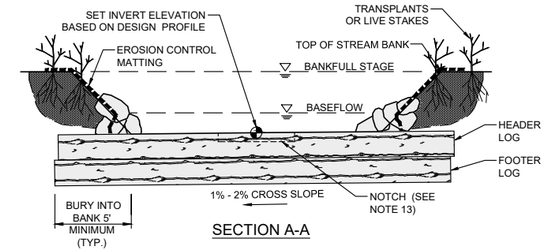


PROFILE B-B

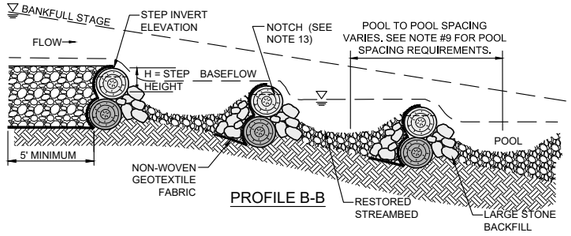
GRADE CONTROL LOG J-HOOK VANE
NOT TO SCALE



PLAN VIEW



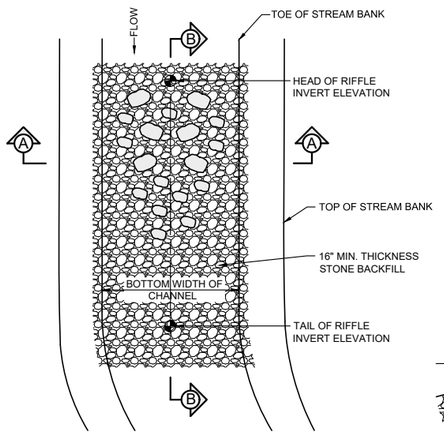
SECTION A-A



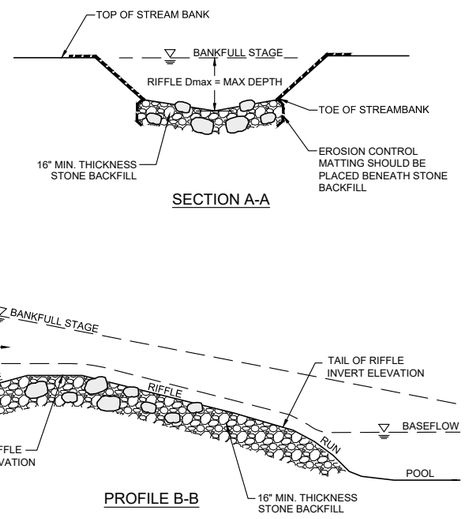
PROFILE B-B

NOTES:
1. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER, RELATIVELY STRAIGHT HARDWOOD AND RECENTLY HARVESTED.
2. LOGS ≥24 INCHES IN DIAMETER MAY BE USED ALONE WITHOUT AN ADDITIONAL LOG FILTER FABRIC SHOULD STILL BE USED TO SEAL AROUND LOG. LOGS SHOULD EXTEND INTO THE BANKS 5' ON EACH SIDE.
3. SOIL SHALL BE WELL COMPACTED AROUND BURIED PORTION OF FOOTER LOGS WITH BUCKET OF TRACK HOE.
4. INSTALL GEOTEXTILE FILTER FABRIC UNDERNEATH LOGS.
5. UNDERCUT POOL BED ELEVATION 8 INCHES TO ALLOW FOR LAYER OF STONE. INSTALL LARGE STONE BACKFILL ALONG SIDE SLOPES.
6. INSTALL EROSION CONTROL MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
7. INSTALL LARGE STONE BACKFILL ALONG SIDE SLOPES.
8. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, COMPACTED, AND CONCAVE, WITH THE ELEVATION OF THE BED APPROXIMATELY 0.5 FT DEEPER IN THE CENTER THAN AT THE EDGES.
9. AVERAGE POOL TO POOL SPACING SHALL BE SHOWN ON THE PROFILE OR SPECIFIED BY ENGINEER BASED ON EXISTING CONDITIONS SUCH AS SLOPE AND SUITABLE FILL MATERIAL. RIFFLE STEP-POOLS OR CASCADE POOLS MAY BE SUBSTITUTED IN AREAS WHERE EXISTING SLOPES EXCEED 10□ AS DETERMINED BY THE ENGINEER.
10. INTERIOR LOGS SHOULD BE AT A SLIGHT ANGLE (□70 DEGREES) FROM THE STREAMBANK AND CROSS SLOPES SHOULD BE 1-2□.
11. PLACE FOOTER LOGS FIRST AND THEN HEADER (TOP) LOG. SET HEADER LOG AT A MAXIMUM OF 3 INCHES ABOVE THE INVERT ELEVATION.
12. AVERAGE STEP HEIGHTS/DROPS SHALL NOT EXCEED 0.5 UNLESS SHOWN OTHERWISE.
13. CUT A NOTCH IN THE HEADER LOG APPROXIMATELY 30□ OF THE CHANNEL BOTTOM WIDTH AND EXTENDING DOWN TO THE INVERT ELEVATION. NOTCH SHALL BE USED TO CENTER FLOW AND NOT EXCEED 3 INCHES IN DEPTH.
14. THE NUMBER OF STEPS MAY VARY BETWEEN BEGINNING AND END STATIONING. SEE LONGITUDINAL PROFILE FOR STATION AND ELEVATION.
15. USE GEOTEXTILE FABRIC FOR DRAINAGE TO SEAL GAPS BETWEEN LOGS.
16. PLACE VEGETATION TRANSPLANTS FROM TOE OF STREAMBANK TO TOP OF STREAMBANK.
17. SEE TYPICAL SECTION FOR CHANNEL DIMENSIONS.

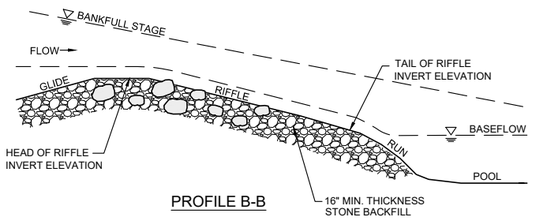
STONE AND LOG STEP POOL
NOT TO SCALE



PLAN VIEW



SECTION A-A



PROFILE B-B

NOTES:
1. DIG A TRENCH BELOW THE RESTORED STREAMBED FOR THE STONE BACKFILL.
2. FILL TRENCH WITH STONE BACKFILL.

CONSTRUCTED STONE RIFFLE
NOT TO SCALE

WLS ENGINEERING, PLLC
81 Chickwood Trail
Weaverville, NC 28787
(919)614-5111

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A TOMSIC 4/12/19

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC FIRM LICENSE NO. P-1480

REVISIONS

NO.	DESCRIPTION	DATE
A	DRAFT CONCEPT PLAN	05-01-18
B	FINAL CONCEPT PLAN	06-01-18
C	FINAL CONCEPT PLAN	06-11-18
D	DRAFT FINAL PLAN	08-17-18
E	FINAL PLAN	10-02-18

PROJECT NAME

LITTLE PINE CREEK III STREAM AND WETLAND RESTORATION PROJECT - REPAIR

ALLEGHANY COUNTY, NC

DRAWING INFORMATION

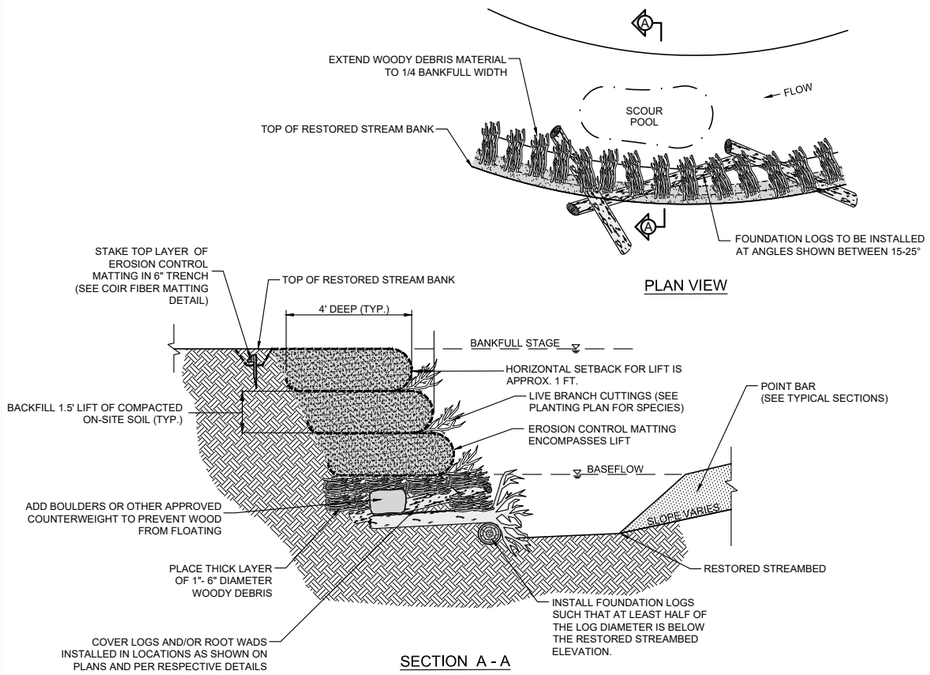
PROJECT NO. :	94903
FILENAME :	04_05_LITTLE PINE III_DETAIL_SHEET.DWG
DESIGNED BY :	KMV/WSH
DRAWN BY :	APL
DATE :	10-02-18
HORIZ. SCALE :	N.T.S.
VERT. SCALE :	N.T.S.

SHEET NAME

DETAILS

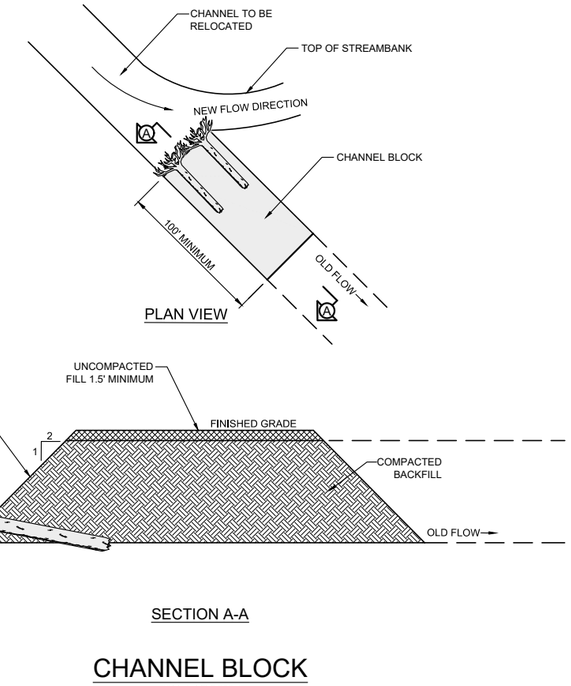
SHEET NUMBER

4



GEOLIFT W/ TOE WOOD

NOT TO SCALE

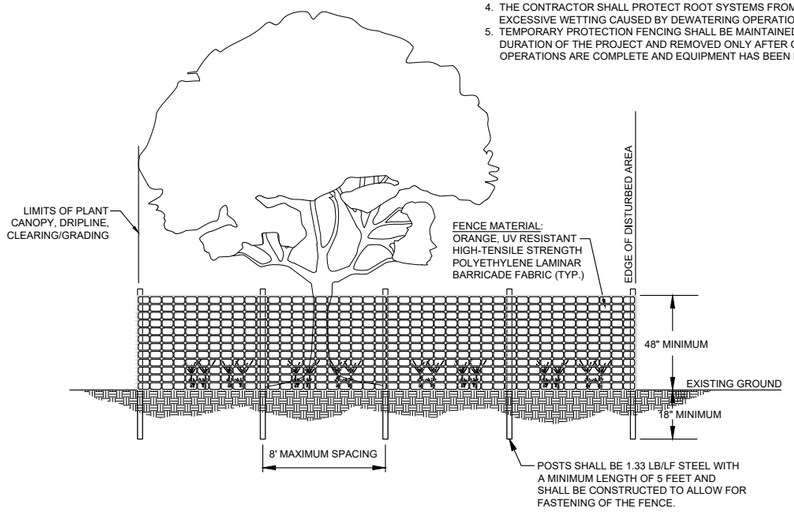


NOTES:
1. COMPACT BACKFILL USING ON-SITE HEAVY EQUIPMENT IN 10 INCH LIFTS.
2. FILL DITCH PLUG TO TOP OF BANKS OR AS DIRECTED BY ENGINEER.

CHANNEL BLOCK

NOT TO SCALE

NOTES:
1. ALL TREES, PLANTS, VEGETATION OR WETLANDS DESIGNATED TO BE PROTECTED SHALL BE INSTALLED IN AREAS AS SHOWN ON PLANS.
2. INSTALL TEMPORARY PROTECTION FENCE AT TREE DRIP LINE, AT EDGE OF WETLANDS, OR PROPOSED DISTURBED AREA AS SHOWN ON PLANS, PRIOR TO CONSTRUCTION ACTIVITIES.
3. THERE SHALL BE NO STORAGE OF CONSTRUCTION MATERIALS WITHIN THE BOUNDARIES OF THE TEMPORARY PROTECTION FENCING.
4. THE CONTRACTOR SHALL PROTECT ROOT SYSTEMS FROM PONDING, ERODING, OR EXCESSIVE WETTING CAUSED BY DEWATERING OPERATIONS.
5. TEMPORARY PROTECTION FENCING SHALL BE MAINTAINED THROUGHOUT THE DURATION OF THE PROJECT AND REMOVED ONLY AFTER CONSTRUCTION OPERATIONS ARE COMPLETE AND EQUIPMENT HAS BEEN REMOVED FROM THE SITE.



TEMPORARY PROTECTION FENCE

NOT TO SCALE

WLS ENGINEERING, PLLC
81 Chickwood Trail
Weaverville, NC 28787
(919)614-5111

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A TOMSIC 4/12/19

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC
FIRM LICENSE NO. P-1480

REVISIONS

NO.	DESCRIPTION	DATE
A	DRAFT CONCEPT PLAN	05-01-18
B	FINAL CONCEPT PLAN	06-01-18
C	FINAL CONCEPT PLAN	06-11-18
D	DRAFT FINAL PLAN	08-17-18
E	FINAL PLAN	10-02-18

PROJECT NAME

LITTLE PINE CREEK III STREAM AND WETLAND RESTORATION PROJECT - REPAIR

ALLEGHANY COUNTY, NC

DRAWING INFORMATION

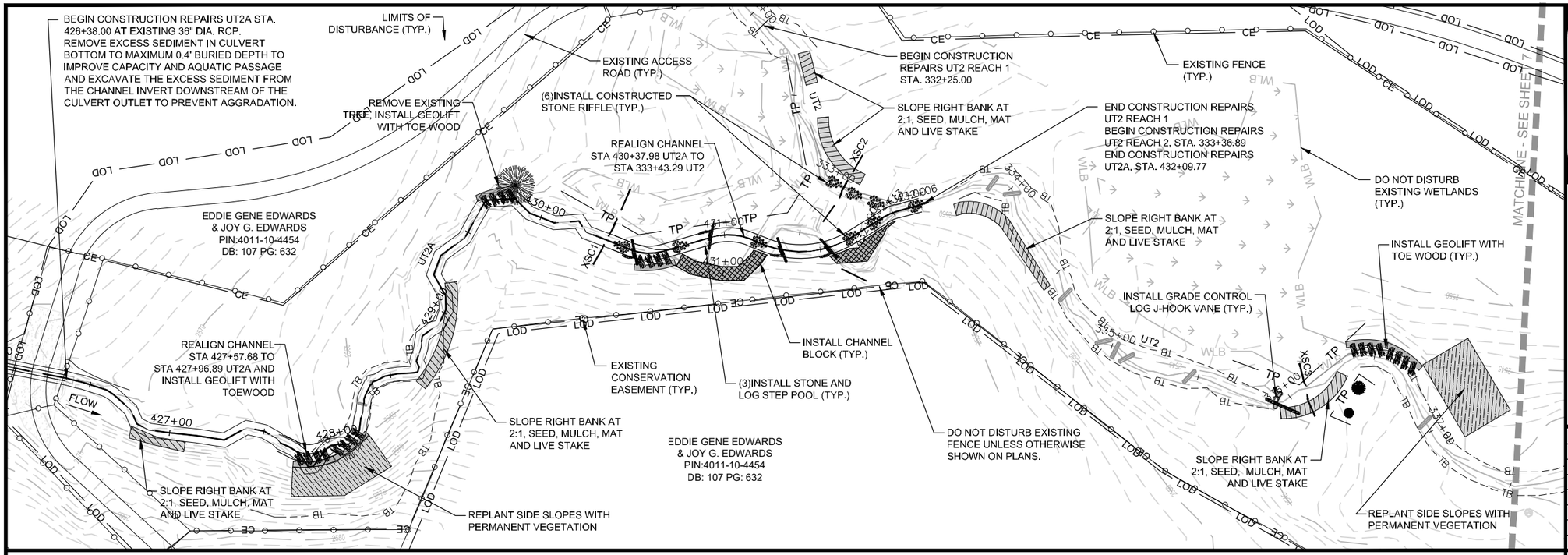
PROJECT NO. :	94903
FILENAME :	04_05_LITTLE PINE III_DETAIL_SHEET.DWG
DESIGNED BY :	KMV/WSH
DRAWN BY :	APL
DATE :	10-02-18
HORIZ. SCALE :	N.T.S.
VERT. SCALE :	N.T.S.

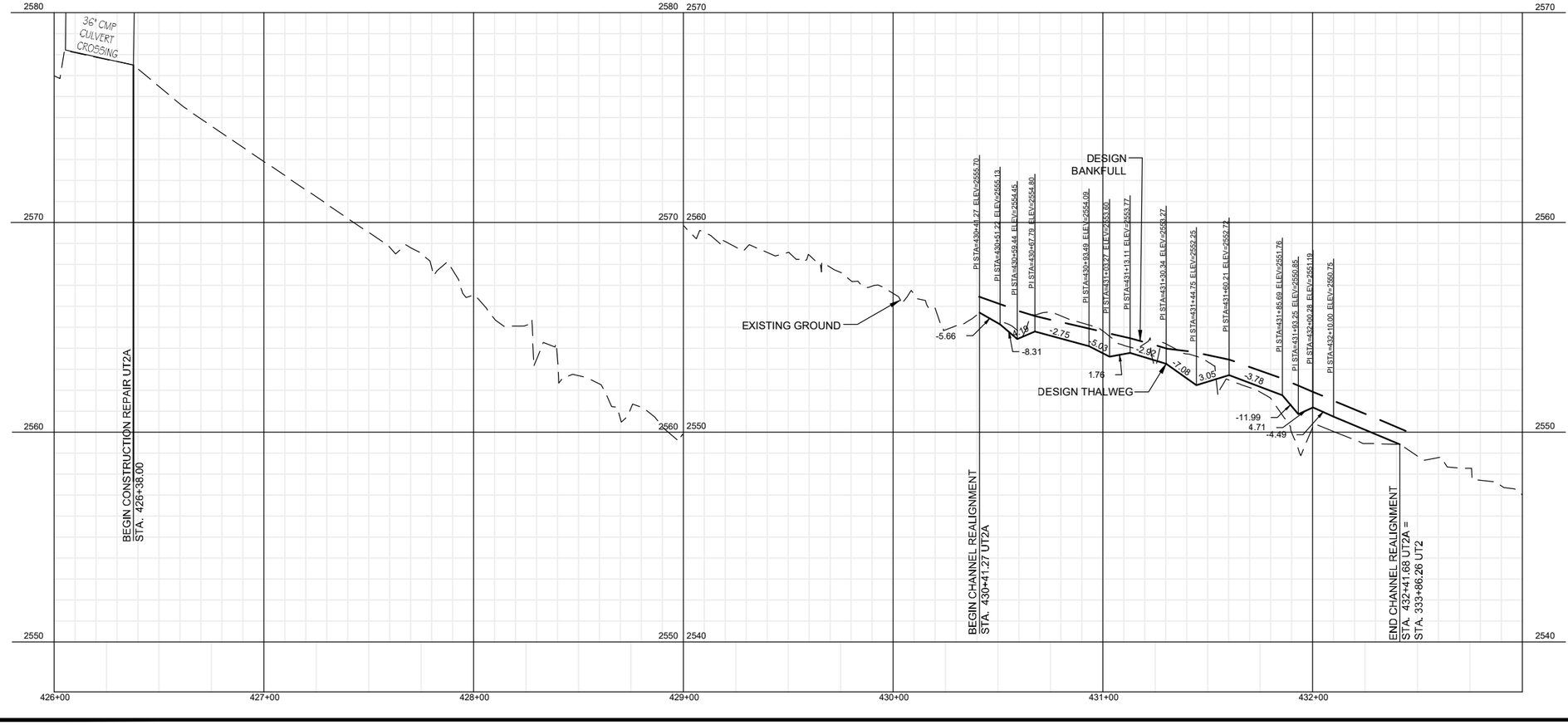
SHEET NAME

DETAILS

SHEET NUMBER

5





WLS ENGINEERING, PLLC
81 Chickwood Trail
Weaverville, NC 28787
(919)614-5111

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A. TOMSIC 4/12/19

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC FIRM LICENSE NO. P-1480

REVISIONS		
A	DRAFT CONCEPT PLAN	05-01-18
B	FINAL CONCEPT PLAN	06-01-18
C	FINAL CONCEPT PLAN	06-11-18
D	DRAFT FINAL PLAN	08-17-18
E	FINAL PLAN	10-02-18
NO.	DESCRIPTION	DATE

PROJECT NAME

LITTLE PINE CREEK III STREAM AND WETLAND RESTORATION PROJECT - REPAIR

ALLEGHANY COUNTY, NC

DRAWING INFORMATION	
PROJECT NO. :	94903
FILENAME : 06-07_LITTLE PINE III_PP_SHEETS.DWG	
DESIGNED BY :	KVS/WSH
DRAWN BY :	APL
DATE :	10-02-18
HORIZ. SCALE :	1" = 60'
VERT. SCALE :	1" = 6'

NORTH

30 15 0 30 60

GRAPHIC SCALE

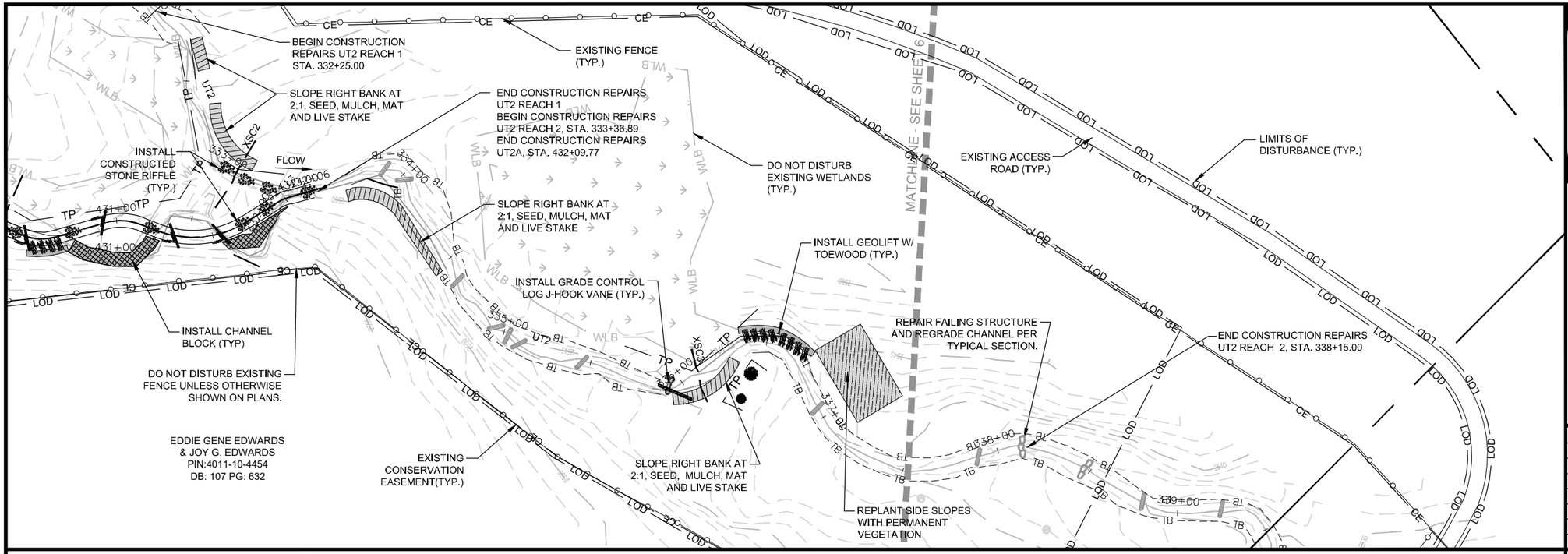
SHEET NAME

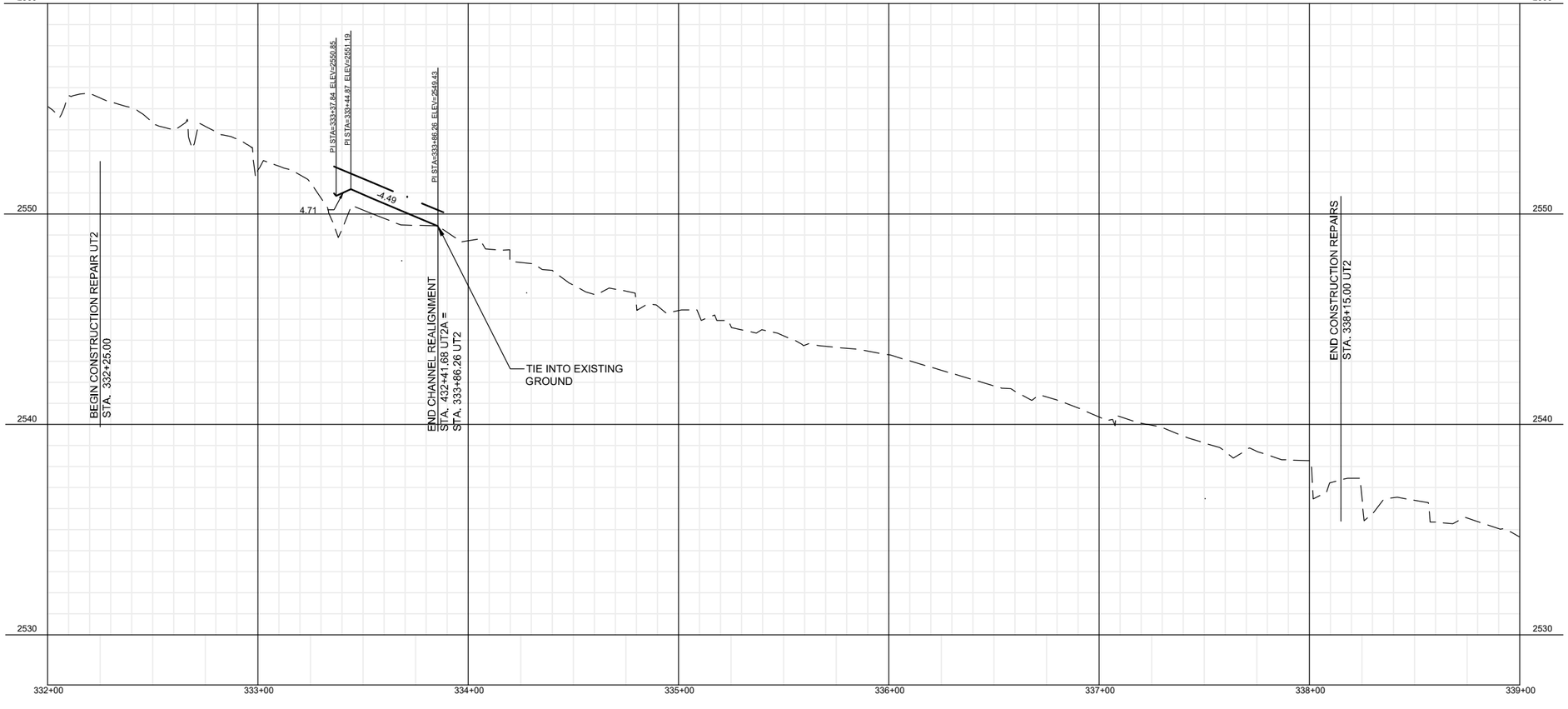
UT2A

PLAN AND PROFILE

SHEET NUMBER

6





WLS ENGINEERING, PLLC
81 Chickwood Trail
Weaverville, NC 28787
(919)614-5111

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A. TOMSIC 4/12/19

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC FIRM LICENSE NO. P-1480

REVISIONS		
A	DRAFT CONCEPT PLAN	05-01-18
B	FINAL CONCEPT PLAN	06-01-18
C	FINAL CONCEPT PLAN	06-11-18
D	DRAFT FINAL PLAN	08-17-18
E	FINAL PLAN	10-02-18
NO.	DESCRIPTION	DATE

PROJECT NAME

LITTLE PINE CREEK III STREAM AND WETLAND RESTORATION PROJECT - REPAIR

ALLEGHANY COUNTY, NC

DRAWING INFORMATION	
PROJECT NO. :	94903
FILENAME : 06-07_LITTLE PINE III_PP_SHEETS.DWG	
DESIGNED BY :	KVS/WSH
DRAWN BY :	APL
DATE :	10-02-18
HORIZ. SCALE :	1" = 60'
VERT. SCALE :	1" = 6'

NORTH

30 15 0 30 60

GRAPHIC SCALE

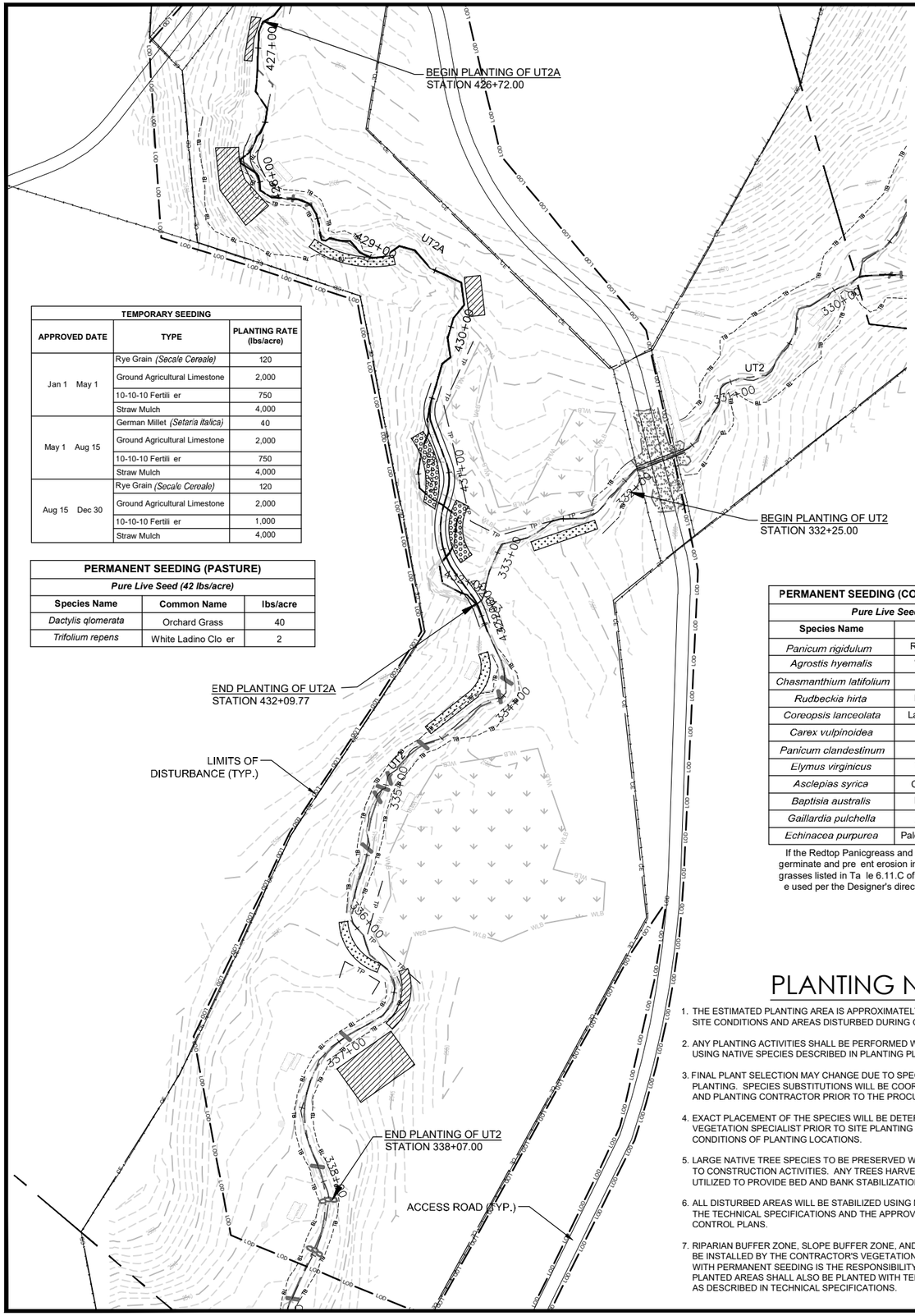
SHEET NAME

UT2

PLAN AND PROFILE

SHEET NUMBER

7



PLANTING ZONES

RIPARIAN BUFFER

SLOPE BUFFER

WETLAND

NPDES Groundcover Stabilization Requirements		
Site Area Description	**Stabilization**	**Timeframe Exceptions**
Perimeter dikes, sw ales, ditches and slopes	7 days	None
High Quality Water (HQW) Zones	7 days	None
Slopes steeper than 3:1	7 days	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allow ed.
Slopes 3:1 or flatter	14 days	7 days for slopes greater than 50' in length.
All other areas w ith slopes flatter than 4:1	14 days	None, except for perimeters and HQW Zones.

TEMPORARY SEEDING		
APPROVED DATE	**TYPE**	**PLANTING RATE (lbs/acre)**
Jan 1 May 1	Rye Grain *(Secale Cereale)*	120
	Ground Agricultural Limestone	2,000
	10-10-10 Fertili er	750
	Straw Mulch	4,000
May 1 Aug 15	German Millet *(Setaria italica)*	40
	Ground Agricultural Limestone	2,000
	10-10-10 Fertili er	750
	Straw Mulch	4,000
Aug 15 Dec 30	Rye Grain *(Secale Cereale)*	120
	Ground Agricultural Limestone	2,000
	10-10-10 Fertili er	1,000
	Straw Mulch	4,000

PERMANENT SEEDING (PASTURE)		
Pure Live Seed (42 lbs/acre)		
Species Name	**Common Name**	**lbs/acre**
Dactylis glomerata	Orchard Grass	40
Trifolium repens	White Ladino Clo er	2

PERMANENT SEEDING (CONSERVATION EASEMENT)		
Pure Live Seed (20 lbs/acre)		
Species Name	**Common Name**	**lbs/acre**
Panicum rigidulum	Redtop Panicgrass	3
Agrostis hyemalis	Winter Bentgrass	3
Chasmanthium latifolium	Ri er Oats	2
Rudbeckia hirta	Blackeyed Susan	1
Coreopsis lanceolata	Lanceleaf Coreopsis	1
Carex vulpinoidea	Fox Sedge	3
Panicum clandestinum	Deertongue	3
Elymus virginicus	Virginia Wild Rye	2
Asclepias syrica	Common Milkweed	0.2
Baptisia australis	Blue False Indigo	0.2
Gaillardia pulchella	Annual Gaillardia	1
Echinacea purpurea	Pale Purple Coneflower	0.6

If the Redtop Panicgreass and Winter Bentgrass fail to ade uately germinate and pre ent erosion in the Mountain Region, other types of grasses listed in Ta le 6.11.C of the NC E&SC Design Manual shall e used per the Designer's direction.

RIPARIAN BUFFER PLANTING ZONE						
Species	**Common Name**	**Max. Spacing**	**Indiv. Spacing**	**Min. Caliper**	**Stratum**	**#**
Sassafras albidum	Sassafras	8 ft	8 ft	0.25 -1.0		5
Liriodendron tulipifera	Tulip Poplar	8 ft	8 ft	0.25 -1.0		15
Quercus prinus	Chestnut Oak	8 ft	8 ft	0.25 -1.0		5
Platanus occidentalis	Sycamore	8 ft	8 ft	0.25 -1.0		20
Betula nigra	Ri er Birch	8 ft	8 ft	0.25 -1.0		10
Cornus florida	Flowering Dogwood	8 ft	8 ft	0.25 -1.0		10
Aesculus octrandra	Yellow Buckeye	8 ft	8 ft	0.25 -1.0		5
Fraxinus americana	White Ash	8 ft	8 ft	0.25 -1.0		20
Quercus rubra	Northern Red Oak	8 ft	8 ft	0.25 -1.0		10
SLOPE BUFFER PLANTING ZONE						
Species	**Common Name**	**Max. Spacing**	**Indiv. Spacing**	**Min. Caliper**	**Stratum**	**#**
Prunus serotina	Black Cherry	8 ft	8 ft	0.25 -1.0		10
Liriodendron tulipifera	Tulip Poplar	8 ft	8 ft	0.25 -1.0		20
Quercus prinus	Chestnut Oak	8 ft	8 ft	0.25 -1.0		10
Quercus coccinea	Scarlet Oak	8 ft	8 ft	0.25 -1.0		10
Carya glabra	Pignut Hickory	8 ft	8 ft	0.25 -1.0		15
Cornus florida	Flowering Dogwood	8 ft	8 ft	0.25 -1.0		10
Aesculus octrandra	Yellow Buckeye	8 ft	8 ft	0.25 -1.0		5
Fraxinus americana	White Ash	8 ft	8 ft	0.25 -1.0		10
Quercus rubra	Northern Red Oak	8 ft	8 ft	0.25 -1.0		10

WETLAND PLANTING ZONE						
Species	**Common Name**	**Max. Spacing**	**Indiv. Spacing**	**Min. Caliper**	**Stratum**	**#**
Nyssa sylvatica	Black Gum	8 ft	8 ft	0.25 -1.0		10
Platanus occidentalis	Sycamore	8 ft	8 ft	0.25 -1.0		30
Betula nigra	Ri er Birch	8 ft	8 ft	0.25 -1.0		20
Cornus amomum	Silky Dogwood	8 ft	8 ft	0.25 -1.0		15
Alnus serrulata	Tag Alder	8 ft	8 ft	0.25 -1.0		5
Fraxinus pennsylvanica	Green Ash	8 ft	8 ft	0.25 -1.0		10
Lindera benzoin	Spice ush	8 ft	8 ft	0.25 -1.0		10
						100
WETLAND PLANTING ZONE						
Live Stakes						
Species	**Common Name**	**Max. Spacing**	**Indiv. Spacing**	**Min. Size**	**Stratum**	**# Plants**
Cornus amomum	Silky Dogwood	3 ft	3ft	0.5 -1.0 cal.		25
Salix nigra	Black Willow	3 ft	3ft	0.5 -1.0 cal.		15
Salix sericea	Silky Willow	3 ft	3ft	0.5 -1.0 cal.		50
Sambucus nigra ssp canadensis	Elder erry	3 ft	3ft	0.5 -1.0 cal.		10

STREAMBANKS						
Live Stakes						
Species	**Common Name**	**Max. Spacing**	**Indiv. Spacing**	**Min. Size**	**Stratum**	**# Plants**
Cornus amomum	Silky Dogwood	3 ft	3ft	0.5 -1.0 cal.		25
Salix nigra	Black Willow	3 ft	3ft	0.5 -1.0 cal.		15
Salix sericea	Silky Willow	3 ft	3ft	0.5 -1.0 cal.		50
Sambucus nigra ssp canadensis	Elder erry	3 ft	3ft	0.5 -1.0 cal.		10

PLANTING NOTES

1. THE ESTIMATED PLANTING AREA IS APPROXIMATELY 0.5 ACRES AND WILL VARY BASED ON SITE CONDITIONS AND AREAS DISTURBED DURING CONSTRUCTION REPAIR WORK.
2. ANY PLANTING ACTIVITIES SHALL BE PERFORMED WITHIN THE CONSERVATION EASEMENT USING NATIVE SPECIES DESCRIBED IN PLANTING PLAN AND TECHNICAL SPECIFICATIONS.
3. FINAL PLANT SELECTION MAY CHANGE DUE TO SPECIES AVAILABILITY AT THE TIME OF PLANTING. SPECIES SUBSTITUTIONS WILL BE COORDINATED BETWEEN ENGINEER, OWNER, AND PLANTING CONTRACTOR PRIOR TO THE PROCUREMENT OF PLANT/SEED STOCK.
4. EXACT PLACEMENT OF THE SPECIES WILL BE DETERMINED BY THE CONTRACTOR'S VEGETATION SPECIALIST PRIOR TO SITE PLANTING AND BASED ON THE WETNESS CONDITIONS OF PLANTING LOCATIONS.
5. LARGE NATIVE TREE SPECIES TO BE PRESERVED WILL BE FLAGGED BY THE ENGINEER PRIOR TO CONSTRUCTION ACTIVITIES. ANY TREES HARVESTED FOR WOODY MATERIAL WILL BE UTILIZED TO PROVIDE BED AND BANK STABILIZATION, COVER AND/OR NESTING HABITAT.
6. ALL DISTURBED AREAS WILL BE STABILIZED USING MULCHING AND SEEDING AS DEFINED IN THE TECHNICAL SPECIFICATIONS AND THE APPROVED SEDIMENTATION AND EROSION CONTROL PLANS.
7. RIPARIAN BUFFER ZONE, SLOPE BUFFER ZONE, AND WETLAND PLANTING ZONE PLANTS WILL BE INSTALLED BY THE CONTRACTOR'S VEGETATION SPECIALIST. SEEDING OF THESE ZONES WITH PERMANENT SEEDING IS THE RESPONSIBILITY OF THE CONTRACTOR. ALL SEEDED AND PLANTED AREAS SHALL ALSO BE PLANTED WITH TEMPORARY SEED AND SOIL AMENDMENTS AS DESCRIBED IN TECHNICAL SPECIFICATIONS.

WLS ENGINEERING, PLLC
81 Chickwood Trail
Weaverville, NC 28787
(919)614-5111

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A. TOMSIC 4/12/19

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC FIRM LICENSE NO. P-1480

REVISIONS		
A	DRAFT CONCEPT PLAN	05-01-18
B	FINAL CONCEPT PLAN	06-01-18
C	FINAL CONCEPT PLAN	06-11-18
D	DRAFT FINAL PLAN	08-17-18
E	FINAL PLAN	10-02-18
NO.	DESCRIPTION	DATE

PROJECT NAME

LITTLE PINE CREEK III STREAM AND WETLAND RESTORATION PROJECT - REPAIR

ALLEGHANY COUNTY, NC

DRAWING INFORMATION	
PROJECT NO. :	94903
FILENAME :	08_LITTLE PINE III_PLANTING_PLAN.DWG
DESIGNED BY :	KMV/WSH
DRAWN BY :	APL
DATE :	10-02-18
HORIZ. SCALE :	1" = 80'
VERT. SCALE :	N/A

NORTH

40 20 0 40 80

GRAPHIC SCALE

SHEET NAME

PLANTING PLAN

SHEET NUMBER

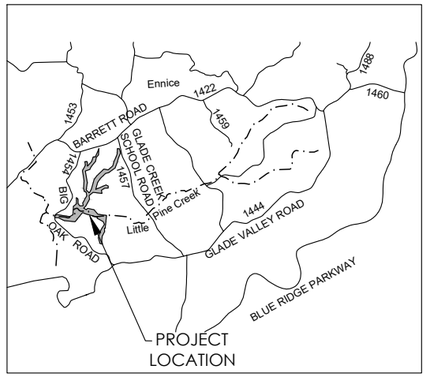
8

NC DEPARTMENT OF ENVIRONMENTAL QUALITY - DIVISION OF MITIGATION SERVICES

LITTLE PINE CREEK III

STREAM AND WETLAND RESTORATION PROJECT - REPAIR (PHASE 2)

VICINITY MAP
N.T.S.

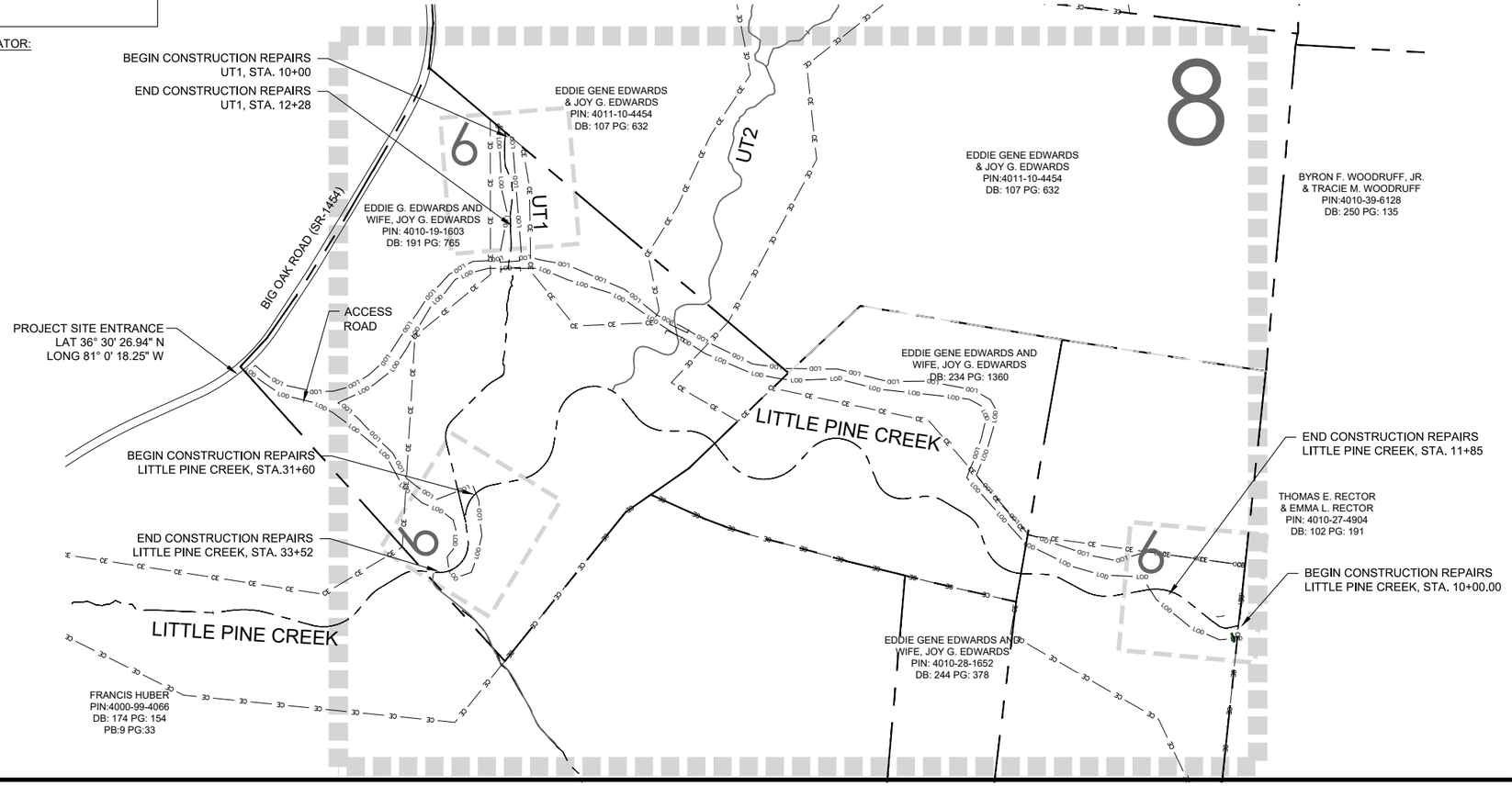


NCDEQ-DMS CONTRACT ADMINISTRATOR:
KRISTIE CORSON
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652
PH: 919-707-8935

ALLEGHANY COUNTY, NORTH CAROLINA

NCDEQ - DMS PROJECT ID # 94903
NC SCO PROJECT ID #18-18332-01
NEW RIVER BASIN (CU 05050001)
USACE ACTION ID # 2012-01299
TYPE OF WORK : STREAM REPAIR DESIGN SERVICES PROJECT

SHEET INDEX



WLS ENGINEERING, PLLC
6 Dula Springs Road
Weaverville, NC 28787
(828)493-3287

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36416 ENGINEER CHRISTOPHER A TOMISIC

PRELIMINARY PLANS NOT FOR CONSTRUCTION

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC
FIRM LICENSE NO. P-1480

REVISIONS

NO.	DESCRIPTION	DATE
A	DRAFT CONCEPT PLAN	1-7-20

PROJECT NAME

LITTLE PINE CREEK III
STREAM AND WETLAND RESTORATION PROJECT - REPAIR PHASE 2

ALLEGHANY COUNTY, NC

DRAWING INFORMATION

PROJECT NO.	18-001A
FILENAME	01_LP3_PH2__COVER.DWG
DESIGNED BY	CAT
DRAWN BY	APL
DATE	1-7-20
HORIZ. SCALE	1" = 300'
VERT. SCALE	N/A

NORTH

150 75 0 150 300
GRAPHIC SCALE

SHEET NAME

COVER SHEET

SHEET NUMBER

1

LEGEND

- LOG WEIR
- CONSTRUCTED STONE RIFFLE
- BOULDER VANE
- GEOLIFT W/ TOEWOOD
- FP — FP — 100 YEAR FLOOD PLAIN
- OHPL — EXISTING OVERHEAD ELECTRIC
- TEMPORARY STREAM CROSSING
- PERMANENT STREAM CROSSING
- CE — CE — PROPOSED CONSERVATION EASEMENT BOUNDARY
- 100 — EXISTING MAJOR CONTOUR
- 101 — EXISTING MINOR CONTOUR
- 100 — PROPOSED MAJOR CONTOUR
- 101 — PROPOSED MINOR CONTOUR
- LD — LD — LIMITS OF DISTURBANCE
- C/F — C/F — CUT/FILL LIMITS
- WLB — WLB — EXISTING WETLAND BOUNDARY
- EXISTING WOODLINE
- PROPOSED TOP OF STREAM BANK
- EXISTING PROPERTY BOUNDARY
- X — X — EXISTING FENCE
- 15+00 — PROPOSED CENTERLINE (THALWEG)
- X — X — PROPOSED FIELD FENCE
- TP — TP — PROPOSED TREE PROTECTION FENCE
- EXISTING FARM PATH
- PROPOSED FARM PATH
- EXISTING TREE
- PROPOSED WATER QUALITY TREATMENT FEATURE
- CHANNEL BLOCK
- CHANNEL FILL
- X — PROPOSED GATE
- EXISTING STRUCTURE

GENERAL NOTES

1. CONSTRUCTION ACTIVITIES ARE BEING PERFORMED AS A RESTORATION DESIGN REPAIR PLAN ON PRIVATE PROPERTY. THE CONTRACTOR SHALL MAKE ALL REASONABLE EFFORTS TO REDUCE SEDIMENT LOSS, PROTECT PUBLIC SAFETY, AND MINIMIZE DISTURBANCE OF THE SITE WHILE PERFORMING THE CONSTRUCTION WORK. ALL AREAS SHALL BE KEPT NEAT, CLEAN, AND FREE OF ALL TRASH AND DEBRIS, AND ALL REASONABLE PRECAUTIONS SHALL BE TAKEN TO AVOID DAMAGE TO EXISTING ROADS, VEGETATION, TURF, STRUCTURES, AND PRIVATE PROPERTY.
2. THE PROJECT SITE BOUNDARIES ARE SHOWN ON THE DESIGN PLANS AS THE PROPOSED CONSERVATION EASEMENT. THE CONTRACTOR SHALL PERFORM ALL RELATED WORK ACTIVITIES WITHIN THE PROJECT SITE BOUNDARIES AND/OR WITHIN THE LIMITS OF DISTURBANCE (LOD). THE PROJECT SITE SHALL BE ACCESSED THROUGH THE DESIGNATED ACCESS POINTS SHOWN ON THE PLANS. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING PERMITTED ACCESS THROUGHOUT ALL CONSTRUCTION ACTIVITIES.
3. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS AND MEASURES TO PROTECT ALL PROPERTIES, RESTORED AREAS AND SITE FEATURES FROM DAMAGE. THE CONTRACTOR SHALL REPAIR ALL DAMAGE OUTSIDE DESIGNATED AREAS AND UPON COMPLETION OF ALL CONSTRUCTION REPAIR ACTIVITIES, THE AREAS ARE TO BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN FOUND PRIOR TO CONSTRUCTION.
4. THE ORIGINAL TOPOGRAPHIC SURVEY USED FOR THE RESTORATION DESIGN PLANS AND CONSTRUCTION WORK WAS DEVELOPED USING SURVEY DATA COLLECTED BY KEE MAPPING AND SURVEY (KEE) IN JUNE 2012 AND FEBRUARY 2013. THE AS-BUILT SURVEY AND RECORD DRAWINGS WERE PREPARED BY WILDLANDS ENGINEERING IN AUGUST 2016 FROM DIGITAL FILES PROVIDED BY KEE IN APRIL 2016. THE HORIZONTAL AND VERTICAL DATUM SHOWN ON THE DESIGN REPAIR PLANS REPRESENT THE AS-BUILT CONDITIONS AND WERE TIED TO NAD83 NC STATE PLANE COORDINATE SYSTEM (US SURVEY FEET) AND NAVD88 VERTICAL DATUM. SUPPLEMENTAL GPS SURVEY DESIGN LEVEL DATA WAS COLLECTED IN MARCH 2018 BY WLS, HOWEVER, EXISTING ELEVATIONS AND SITE CONDITIONS MAY HAVE CHANGED SINCE THE ORIGINAL DESIGN SURVEY AND AS-BUILT SURVEY WAS COMPLETED.
5. THE CONTRACTOR SHALL VISIT THE CONSTRUCTION SITE AND THOROUGHLY FAMILIARIZE HIM/HERSELF WITH ALL EXISTING SITE CONDITIONS PRIOR TO BEGINNING CONSTRUCTION ACTIVITIES. THE CONTRACTOR SHALL VERIFY THE ACCURACY AND COMPLETENESS OF THE CONSTRUCTION SPECIFICATIONS AND DESIGN PLANS REGARDING THE NATURE AND EXTENT OF THE REPAIR WORK DESCRIBED.
6. THE CONTRACTOR SHALL BRING ANY DISCREPANCIES BETWEEN THE CONSTRUCTION PLANS AND SPECIFICATIONS AND/OR FIELD CONDITIONS TO THE ATTENTION OF THE ENGINEER BEFORE CONSTRUCTION BEGINS.
7. THERE SHALL BE NO CLEARING OR REMOVAL OF ANY NATIVE SPECIES, PLANTED VEGETATION OR TREES OF SIGNIFICANCE, OTHER THAN THOSE INDICATED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
8. THE CONTRACTOR SHALL EXERCISE CARE DURING GRADING ACTIVITIES IN THE VICINITY OF ANY NATIVE/PLANTED VEGETATION AND TREES OF SIGNIFICANCE AT THE CONSTRUCTION SITE. ALL GRADING IN THE VICINITY OF TREES NOT IDENTIFIED FOR REMOVAL SHALL BE MADE IN A MANNER THAT DOES NOT DISTURB THE ROOT SYSTEM WITHIN THE DRIP LINE OF THE TREE. TREES COMPROMISED OR DAMAGED DURING CONSTRUCTION MUST BE REMOVED. TREE DISPOSAL MUST BE CONDUCTED IN A MANNER AS TO NOT INTERFERE WITH STREAM FLOW OR OTHER PROJECT FUNCTIONS AND AS DIRECTED BY THE ENGINEER.
9. PRIOR TO START OF WORK, THE CONTRACTOR SHALL SUBMIT THE SOURCE OF MATERIALS, INCLUDING AGGREGATES, EROSION CONTROL MATTING, WOOD AND NATIVE PLANTING MATERIAL TO THE ENGINEER FOR REVIEW AND APPROVAL. NO WORK SHALL BE PERFORMED UNTIL THE SOURCE OF MATERIAL IS APPROVED BY THE ENGINEER.
10. THE CONTRACTOR SHALL BE HELD SOLELY RESPONSIBLE FOR ANY NECESSARY COORDINATION BETWEEN THE VARIOUS COUNTY, STATE OR FEDERAL AGENCIES, UTILITY COMPANIES, HIS/HER SUB-CONTRACTORS, AND THE ENGINEER FOR THE DURATION OF THE PROJECT.
11. PRIOR TO START OF WORK, THE CONTRACTOR SHALL SUBMIT THEIR DETAILED PLANTING SCHEDULE TO THE ENGINEER FOR REVIEW. NO WORK SHALL BE PERFORMED UNTIL THIS SCHEDULE IS APPROVED BY THE ENGINEER. THE DETAILED PLANTING SCHEDULE SHALL CONFORM TO THE PLANTING REVEGETATION PLAN AND SHALL INCLUDE A SPECIES LIST AND TIMING SEQUENCE.
12. THE CONTRACTOR IS REQUIRED TO INSTALL IN-STREAM STRUCTURES USING A BACKHOE/EXCAVATOR WITH A HYDRAULIC THUMB OF SUFFICIENT SIZE TO PLACE STRUCTURES INCLUDING LOGS, STONE, BOULDERS, ROOT WADS, AND TEMPORARY WOOD MAT STREAM CROSSINGS.
13. NO GRADING ACTIVITIES SHALL OCCUR BEYOND THE PROJECT LIMITS OF DISTURBANCE (LOD) AS SHOWN ON THE DESIGN PLANS. THE TOTAL AREA OF DISTURBANCE IS 5.0 ACRES. PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL INSTALL TEMPORARY ORANGE FENCING TO DELIMIT AND PROTECT THE EXISTING JURISDICTIONAL WETLANDS WITHIN THE LOD. THE CONTRACTOR SHALL REMOVE SAID FENCING IMMEDIATELY FOLLOWING THE COMPLETION OF CONSTRUCTION.
14. ONCE PROPOSED GRADES ARE ACHIEVED ALONG THE CONSTRUCTED STREAM CHANNEL, BANKFULL BENCHES AND FLOODPLAIN AREAS AS SHOWN ON THE PLANS, GRADED AREAS SHALL BE ROUGHENED USING TECHNIQUES DESCRIBED IN THE CONSTRUCTION SPECIFICATIONS.
15. ALL SUITABLE SOIL MATERIAL REQUIRED TO FILL AND/OR PLUG EXISTING DITCHES AND/OR STREAM CHANNEL SHALL BE GENERATED ON-SITE AS DESCRIBED IN THE CONSTRUCTION SPECIFICATIONS. IF SUITABLE SOIL MATERIAL CAN NOT BE GENERATED ON-SITE, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING SUITABLE MATERIAL FROM OFF-SITE. IF NECESSARY, ANY EXCESS SPOIL MATERIAL SHALL BE STOCKPILED IN DESIGNATED AREAS OR HAULED OFF-SITE AS APPROVED BY THE ENGINEER.
16. ANY EXISTING FENCE DAMAGED DURING CONSTRUCTION OR FENCE BREAKS NEEDED FOR ACCESS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RESTORE TO PRE-DISTURBED CONDITIONS.

CONSTRUCTION SEQUENCE

THE ENGINEER WILL PROVIDE CONSTRUCTION OBSERVATION DURING THE CONSTRUCTION REPAIRS FOR THIS PROJECT. THE FOLLOWING CONSTRUCTION SEQUENCE SHALL BE USED DURING PROJECT CONSTRUCTION IMPLEMENTATION. PRIOR TO BEGINNING ANY LAND DISTURBING ACTIVITIES, NOTIFICATION OF AND RECEIPT OF THE CERTIFICATE OF APPROVAL MUST BE RECEIVED FROM NCDEQ - LAND QUALITY SECTION. THE CONTRACTOR SHALL CALL NC DEQ LQS AT 919-791-4200 TO SCHEDULE A PRE-CONSTRUCTION MEETING AT LEAST 72 HOURS PRIOR TO PROJECT ACTIVATION. THE CONTRACTOR SHALL REFER TO THE APPROVED EROSION AND SEDIMENTATION CONTROL PERMIT AND CORRESPONDING PLANS AND TECHNICAL SPECIFICATIONS FOR SPECIFIC CONSTRUCTION SEQUENCING ITEMS AND SHALL BE RESPONSIBLE FOR FOLLOWING THE APPROVED PLANS AND PERMIT CONDITIONS.

1. THE CONTRACTOR SHALL NOTIFY "NC 811" (1-800-632-4949) BEFORE ANY EXCAVATION BEGINS. ANY UTILITIES AND RESPECTIVE EASEMENTS SHOWN ON THE PLANS ARE CONSIDERED APPROXIMATE AND THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES AND ADJOINING EASEMENTS AND SHALL REPAIR OR REPLACE ANY DAMAGED UTILITIES AT HIS/HER OWN EXPENSE.
2. THE CONTRACTOR SHALL PREPARE STABILIZED CONSTRUCTION ENTRANCES, HAUL ROADS AND SHALL MOBILIZE EQUIPMENT, MATERIALS, PREPARE STAGING AREA(S) AND STOCKPILE AREA(S) AS SHOWN ON THE PLANS. HAUL ROADS SHALL BE PROPERLY MAINTAINED AT ALL TIMES DURING CONSTRUCTION.
3. CONSTRUCTION TRAFFIC SHALL BE RESTRICTED TO THE AREA DENOTED AS "LIMITS OF DISTURBANCE" OR "HAUL ROADS" AS SHOWN ON THE PLANS.
4. THE CONTRACTOR SHALL INSTALL TEMPORARY ROCK DAMS AT LOCATIONS INDICATED ON THE PLANS.
5. THE CONTRACTOR SHALL INSTALL TEMPORARY SILT FENCE AROUND THE STAGING AREA(S). TEMPORARY SILT FENCING WILL ALSO BE PLACED AROUND THE TEMPORARY STOCKPILE AREAS AS MATERIAL IS STOCKPILED THROUGHOUT THE CONSTRUCTION PERIOD.
6. THE CONTRACTOR SHALL INSTALL ALL TEMPORARY STREAM CROSSINGS AS SHOWN ON THE PLANS IN ACCORDANCE WITH THE APPROVED SEDIMENTATION AND EROSION CONTROL PERMIT. THE EXISTING CHANNEL AND DITCHES ON SITE WILL REMAIN OPEN DURING THE INITIAL STAGES OF CONSTRUCTION TO ALLOW FOR DRAINAGE AND TO MAINTAIN SITE ACCESSIBILITY.
7. THE CONTRACTOR SHALL CONSTRUCT ONLY THE PORTION OF CHANNEL AND/OR AREAS THAT CAN BE COMPLETED AND STABILIZED WITHIN THE SAME DAY. THE CONTRACTOR SHALL APPLY TEMPORARY AND PERMANENT SEED AND MULCH TO ALL DISTURBED AREAS AT THE END OF EACH WORK DAY, WITH THE REQUIREMENT OF ESTABLISHING TEMPORARY AND PERMANENT GROUND COVER THROUGH VEGETATION ESTABLISHMENT.
8. THE CONTRACTOR SHALL CLEAR AND GRUB AN AREA ADEQUATE TO CONTRUCT AND/OR REPAIR THE STREAM CHANNEL AND GRADING OPERATIONS AFTER ALL EROSION AND SEDIMENTATION MEASURES HAVE BEEN INSTALLED AND APPROVED. IN GENERAL, THE CONTRACTOR SHALL WORK FROM UPSTREAM TO DOWNSTREAM AND IN-STREAM STRUCTURES AND CHANNEL FILL MATERIAL SHALL BE INSTALLED USING A PUMP-AROUND OR FLOW DIVERSION MEASURE AS SHOWN ON THE PLANS.
9. CONTRACTOR SHALL BEGIN CONSTRUCTION REPAIR WORK ON LITTLE PINE CREEK AT APPROXIMATE STATION 10+00 AND PROCEED IN A DOWNSTREAM DIRECTION. ANY NEW DESIGN CHANNEL SHOULD BE CONSTRUCTED OFFLINE AND/OR IN THE DRY WHENEVER POSSIBLE. THE CONTRACTOR SHALL EXCAVATE AND CONSTRUCT THE NEW DESIGN CHANNEL TO PROPOSED DESIGN GRADES AND, IF POSSIBLE, SHALL NOT EXTEND EXCAVATION ACTIVITIES ANY CLOSER THAN WITHIN 10 FEET (HORIZONTALLY) OF THE TOP OF EXISTING STREAM BANKS IN ORDER TO PROTECT THE INTEGRITY OF THE EXISTING STREAM CHANNEL UNTIL ABANDONMENT.
10. THE CONTRACTOR SHALL CONTINUE CONSTRUCTION BY EXCAVATING CHANNEL FILL MATERIAL AS SHOWN ON THE PLANS. ANY EXCAVATED MATERIAL SHOULD BE STOCKPILED IN AREAS SHOWN ON THE PLANS. IN ANY AREAS WHERE EXCAVATION DEPTHS WILL EXCEED 10 INCHES, TOPSOIL SHALL BE HARVESTED, STOCKPILED AND PLACED BACK OVER THESE AREAS TO A MINIMUM DEPTH OF 8 INCHES TO ACHIEVE DESIGN GRADES AND CREATE A SOIL BASE FOR VEGETATION PLANTING ACCORDING TO THE DESIGN PLANS AND CONSTRUCTION SPECIFICATIONS.
11. AFTER EXCAVATING AND CONSTRUCTING THE NEW CHANNEL, THE CONTRACTOR SHALL INSTALL IN-STREAM STRUCTURES, BIOENGINEERING MEASURES, PERMANENT AND TEMPORARY SEEDING AND ALL REQUIRED AMENDMENTS, MULCHING, VEGETATION TRANSPLANTS, TO COMPLETE CHANNEL CONSTRUCTION AND READY THE CHANNEL TO ACCEPT FLOW PER APPROVAL BY THE ENGINEER.
12. LIVE STREAM FLOW WILL BE DIVERTED BACK INTO THE CONSTRUCTED CHANNEL ONCE THE RESTORED STREAM CHANNEL AND ASSOCIATED RIPARIAN AREA HAS BEEN STABILIZED, AS DETERMINED BY THE ENGINEER AND IN COMPLIANCE WITH APPROVED PERMIT REQUIREMENTS. ONCE STREAM FLOW IS RETURNED TO A RESTORED STREAM CHANNEL REACH, THE CONTRACTOR SHALL IMMEDIATELY BEGIN PLUGGING, FILLING, AND GRADING THE ASSOCIATED ABANDONED REACH OF STREAM CHANNEL, AS INDICATED ON PLANS, MOVING IN A DOWNSTREAM DIRECTION TO ALLOW FOR POSITIVE AND ADEQUATE DRAINAGE OF THE ABANDONED CHANNEL REACH. STREAM FLOW SHALL NOT BE DIVERTED INTO ANY SECTION OF RESTORED STREAM CHANNEL PRIOR TO THE COMPLETION OF THE CONSTRUCTION OF THAT REACH OF PROPOSED CHANNEL, INCLUDING, BUT NOT LIMITED TO FINAL GRADING, STABILIZATION WITH TEMPORARY AND PERMANENT SEEDING AND ALL REQUIRED AMENDMENTS, MULCHING, VEGETATION TRANSPLANT INSTALLATION, INSTREAM STRUCTURE INSTALLATION, BIOENGINEERING INSTALLATION, AND COIR FIBER MATTING INSTALLATION.
13. THE RESTORED CHANNEL SECTIONS SHALL REMAIN OPEN AT THEIR DOWNSTREAM END TO ALLOW FOR DRAINAGE DURING RAIN EVENTS.
14. ALL GRADING ACTIVITIES ADJACENT TO THE STREAM CHANNEL AND RIPARIAN AREAS SHALL BE COMPLETED PRIOR TO DIVERTING STREAM FLOW INTO THE RESTORED STREAM CHANNEL REACHES. ONCE CONSTRUCTION IS COMPLETED ON A REACH OF PROPOSED STREAM CHANNEL, ADDITIONAL GRADING ACTIVITIES SHALL NOT BE CONDUCTED WITHIN 10 FEET (HORIZONTALLY) OF THE NEWLY RESTORED STREAM CHANNEL BANKS. THE CONTRACTOR SHALL NOT ROUGHEN AREAS WHERE REQUIRED EXCAVATION ACTIVITIES HAVE NOT BEEN COMPLETED.
15. ONCE CONSTRUCTION IS COMPLETE WITHIN A PUMP-AROUND WORK AREA OR CONSTRUCTION WORK PHASE LIMIT, THE CONTRACTOR SHALL APPLY TEMPORARY AND PERMANENT SEEDING, MULCH AND AMENDMENTS TO ANY AREAS DISTURBED DURING CONSTRUCTION WITHIN HOURS. ALL SLOPES STEEPER THAN 3:1 SHALL BE STABILIZED WITH GROUND COVER AS SOON AS PRACTICABLE WITHIN 7 CALENDAR DAYS. ALL OTHER DISTURBED AREAS AND SLOPES FLATTER THAN 3:1 SHALL BE STABILIZED WITHIN 14 CALENDAR DAYS FROM THE LAST LAND-DISTURBING ACTIVITY.
16. PERMANENT GROUND COVER SHALL BE ESTABLISHED FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS OR 90 CALENDAR DAYS (WHICHEVER IS SHORTER) FOLLOWING COMPLETION OF CONSTRUCTION. ALL DISTURBED AREAS SHOULD HAVE ESTABLISHED GROUND COVER PRIOR TO DEMOBILIZATION. REMOVE ANY TEMPORARY STREAM CROSSINGS AND TEMPORARY EROSION CONTROL MEASURES. HAUL ROADS TO BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN FOUND PRIOR TO CONSTRUCTION.
17. ALL REMAINING DISTURBED AREAS SHALL BE STABILIZED BY TEMPORARY AND PERMANENT SEEDING AND MULCHING BEFORE CONSTRUCTION CLOSEOUT IS REQUESTED AND DEMOBILIZATION CAN OCCUR. ANY EXCESS SPOIL MATERIAL SHALL BE STOCKPILED IN DESIGNATED AREAS AND OR HAULED OFF-SITE AS APPROVED BY THE ENGINEER.
18. THE CONTRACTOR COMPLETE ALL REMAINING PLANTING ACTIVITIES, INCLUDING SHRUB AND TREE PLANTING, REMAINING TRANSPLANT INSTALLATION, INSTALLATION OF REMAINING BIOENGINEERING MEASURES, AND LIVE STAKE INSTALLATION, ACCORDING TO THE CONSTRUCTION CONTRACT DOCUMENTS, INCLUDING THE APPROVED PERMIT, PLANS AND TECHNICAL SPECIFICATIONS. THE CONTRACTOR SHALL COMPLETE THE RE-FORESTATION PHASE OF THE PROJECT AND CONDUCT REMAINING PERMANENT SEEDING IN ACCORDANCE WITH THE CONSTRUCTION CONTRACT DOCUMENTS, INCLUDING THE APPROVED PERMIT, PLANS AND TECHNICAL SPECIFICATIONS.
19. THE CONTRACTOR SHALL ENSURE THAT THE SITE IS FREE OF TRASH AND LEFTOVER CONSTRUCTION MATERIALS PRIOR TO DEMOBILIZATION FROM THE SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OFF-SITE REMOVAL OF ALL TRASH AND ANY OTHER INCIDENTAL MATERIALS PRIOR TO DEMOBILIZATION OF EQUIPMENT FROM THE SITE. ANY EXCESS SPOIL MATERIAL SHALL BE STOCKPILED IN DESIGNATED AREAS AND OR HAULED OFF-SITE AS APPROVED BY THE ENGINEER.

WLS ENGINEERING, PLLC

6 Dula Springs Road
Weaverville, NC 28787
(828)493-3287

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A TOMSIC

PRELIMINARY PLANS NOT FOR CONSTRUCTION

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC FIRM LICENSE NO. P-1480

REVISIONS

NO.	DESCRIPTION	DATE
A	DRAFT CONCEPT PLAN	1-7-20

PROJECT NAME

LITTLE PINE CREEK III
STREAM AND WETLAND RESTORATION PROJECT - REPAIR PHASE 2

ALLEGHANY COUNTY, NC

DRAWING INFORMATION

PROJECT NO.	18-001A
FILENAME	02_LPI_PH2_GENERAL NOTES - SYMBOL_SHEET.DWG
DESIGNED BY	CAT
DRAWN BY	APL
DATE	1-7-20
HORIZ. SCALE	N.T.S.
VERT. SCALE	N/A

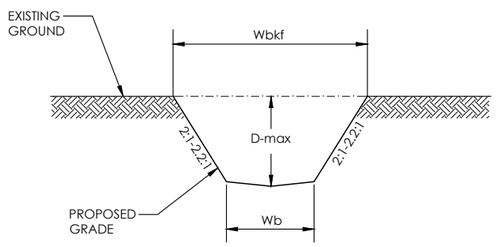
SHEET NAME

LEGEND/ GENERAL NOTES/ CONSTRUCTION SEQUENCE/TYPICAL SECTIONS

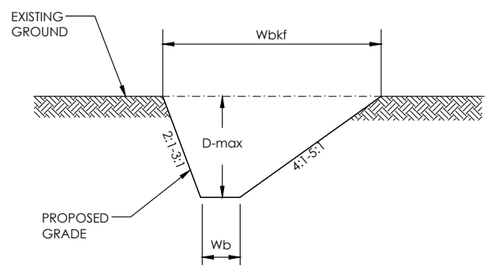
SHEET NUMBER

2

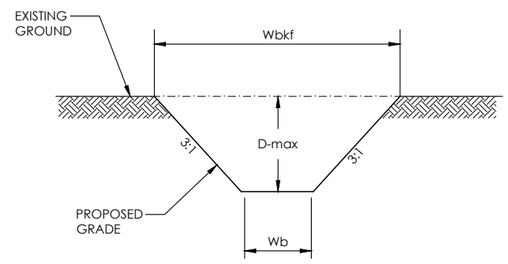
TYPICAL SECTIONS



RIFFLE
N.T.S



POOL (MEANDER)
N.T.S



POOL (STEP)
N.T.S

Reach Name	LITTLE PINE CR.		UT1	
Feature	Riffle	Pool	Riffle	Pool
Width of Bankfull, Wbkf (ft)	26.0	44.0	6.0	9.0
Average Depth, Dbkf (ft)	1.9	2.6	0.4	0.7
Maximum Depth, D-Max (ft)	2.4	4.0	0.5	1.0
Width to Depth Ratio, bkf W/D	13.4	17.3	16.0	13.5
Bankfull Area, Abkf (sq ft)	50.4	112.0	2.3	6.0
Bottom Width, Wb (ft)	16.0	12.0	4.0	3.0

WLS ENGINEERING, PLLC

6 Dula Springs Road
Weaverville, NC 28787
(828)493-3287

PROJECT ENGINEER

ENGINEERING SERVICES BY
WLS ENGINEERING, PLLC
FIRM LICENSE NO. P-1480

REVISIONS

NO.	DESCRIPTION	DATE
A	DRAFT CONCEPT PLAN	1-7-20

PROJECT NAME

LITTLE PINE CREEK III
STREAM AND WETLAND RESTORATION PROJECT - REPAIR PHASE 2

ALLEGHANY COUNTY, NC

DRAWING INFORMATION

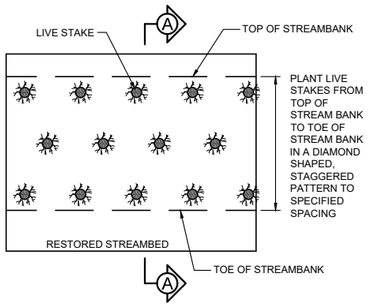
PROJECT NO.	18-001A
FILENAME	03_LP3_PH2_TYPICAL SECTIONS.DWG
DESIGNED BY	CAT
DRAWN BY	APL
DATE	1-7-20
HORIZ. SCALE	N.T.S.
VERT. SCALE	N/A

SHEET NAME

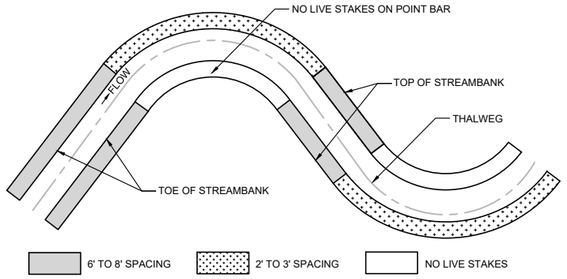
TYPICAL SECTIONS

SHEET NUMBER

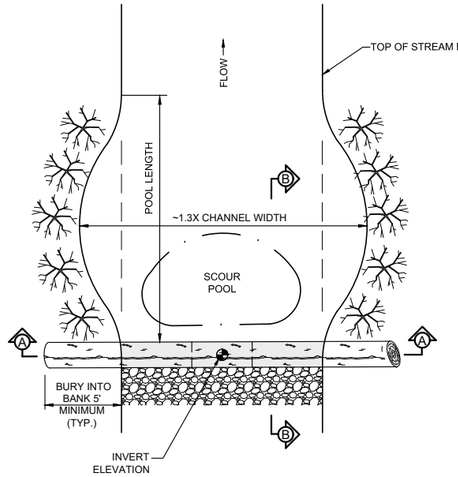
3



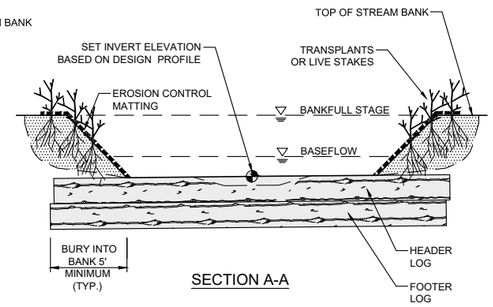
PLAN VIEW OF STREAM BANK



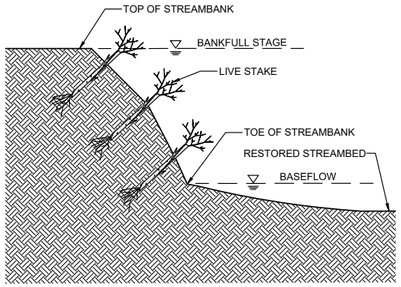
LIVE STAKE SPACING PLAN VIEW



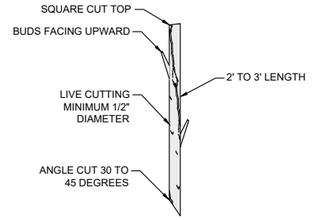
PLAN VIEW



SECTION A-A



SECTION A - A

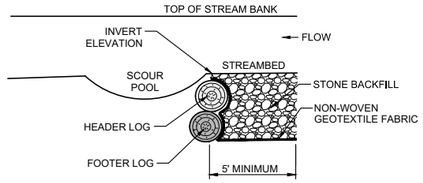


LIVE STAKE DETAIL

NOTES:
1. LIVE STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY.
2. DO NOT INSTALL LIVE STAKES THAT HAVE BEEN SPLIT.
3. LIVE STAKES MUST BE INSTALLED WITH BUDS POINTING UPWARDS.
4. LIVE STAKES SHOULD BE INSTALLED PERPENDICULAR TO BANK.
5. LIVE STAKES SHOULD BE 1/2 TO 2 INCHES IN DIAMETER AND 2 TO 3 FEET LONG.
6. LIVE STAKES SHOULD BE INSTALLED LEAVING 1/5 OF THE LENGTH OF THE LIVE STAKE ABOVE GROUND.

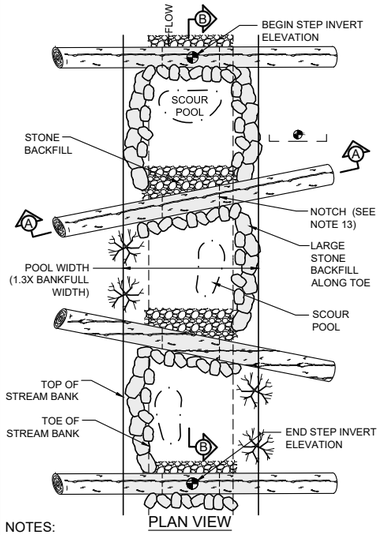
LIVE STAKING
NOT TO SCALE

NOTES:
1. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER, RELATIVELY STRAIGHT HARDWOOD AND RECENTLY HARVESTED.
2. LOGS >24 INCHES IN DIAMETER MAY BE USED ALONE WITHOUT AN ADDITIONAL LOG FILTER FABRIC SHOULD STILL BE USED TO SEAL AROUND LOG, AT THE DIRECTION OF THE ENGINEER.
3. PLACE FOOTER LOGS FIRST AND THEN HEADER (TOP) LOG. SET HEADER LOG AT A MAXIMUM OF 3 INCHES ABOVE THE INVERT ELEVATION.
4. CUT A NOTCH IN THE HEADER LOG APPROXIMATELY 30% OF THE CHANNEL BOTTOM WIDTH AND EXTENDING DOWN TO THE INVERT ELEVATION. NOTCH SHALL BE USED TO CENTER FLOW AND NOT EXCEED 3 INCHES IN DEPTH.
5. USE GEOTEXTILE FABRIC FOR DRAINAGE TO SEAL GAPS BETWEEN LOGS.
6. INSTALL VEGETATION TRANSPLANTS FROM TOE OF STREAM BANK TO TOP OF STREAM BANK.
7. SEE TYPICAL SECTION FOR CHANNEL DIMENSIONS.

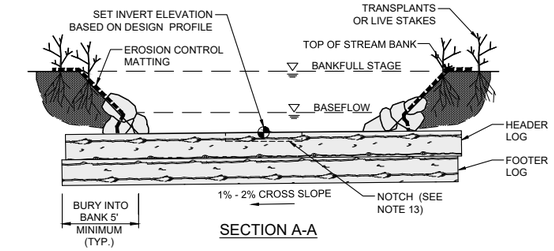


PROFILE B-B

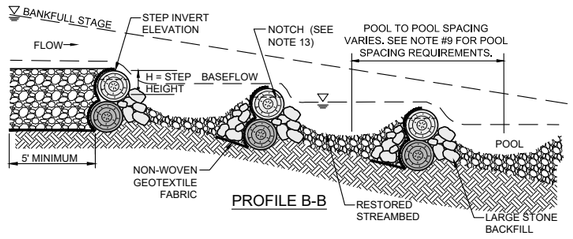
LOG WEIR
NOT TO SCALE



PLAN VIEW



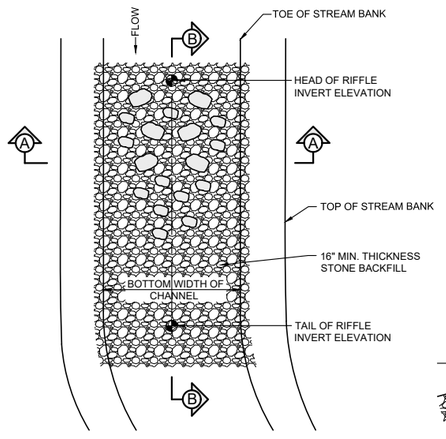
SECTION A-A



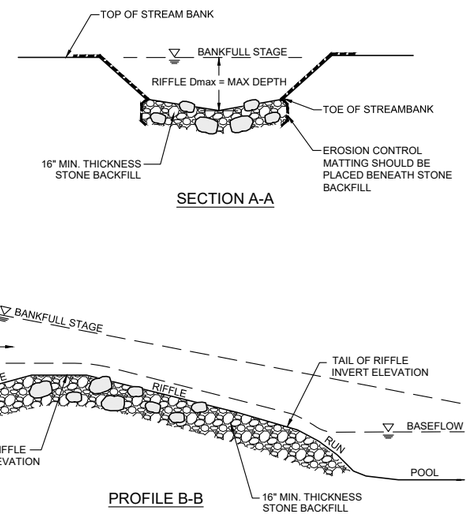
PROFILE B-B

NOTES:
1. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER, RELATIVELY STRAIGHT HARDWOOD AND RECENTLY HARVESTED.
2. LOGS >24 INCHES IN DIAMETER MAY BE USED ALONE WITHOUT AN ADDITIONAL LOG FILTER FABRIC SHOULD STILL BE USED TO SEAL AROUND LOG, AT THE DIRECTION OF THE ENGINEER.
3. SOIL SHALL BE WELL COMPACTED AROUND BURIED PORTION OF FOOTER LOGS WITH BUCKET OF TRACK HOE.
4. INSTALL GEOTEXTILE FILTER FABRIC UNDERNEATH LOGS.
5. UNDERCUT POOL BED ELEVATION 8 INCHES TO ALLOW FOR LAYER OF STONE. INSTALL LARGE STONE BACKFILL ALONG SIDE SLOPES.
6. INSTALL EROSION CONTROL MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
7. INSTALL LARGE STONE BACKFILL ALONG SIDE SLOPES.
8. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, COMPACTED, AND CONCAVE, WITH THE ELEVATION OF THE BED APPROXIMATELY 0.5 FT DEEPER IN THE CENTER THAN AT THE EDGES.
9. AVERAGE POOL TO POOL SPACING SHALL BE SHOWN ON THE PROFILE OR SPECIFIED BY ENGINEER BASED ON EXISTING CONDITIONS SUCH AS SLOPE AND SUITABLE FILL MATERIAL. RIFFLE STEP-POOLS OR CASCADE POOLS MAY BE SUBSTITUTED IN AREAS WHERE EXISTING SLOPES EXCEED 10% AS DETERMINED BY THE ENGINEER.
10. INTERIOR LOGS SHOULD BE AT A SLIGHT ANGLE (~70 DEGREES) FROM THE STREAMBANK AND CROSS SLOPES SHOULD BE 1-2%.
11. PLACE FOOTER LOGS FIRST AND THEN HEADER (TOP) LOG. SET HEADER LOG AT A MAXIMUM OF 3 INCHES ABOVE THE INVERT ELEVATION.
12. AVERAGE STEP HEIGHTS/DROPS SHALL NOT EXCEED 0.5 UNLESS SHOWN OTHERWISE.
13. CUT A NOTCH IN THE HEADER LOG APPROXIMATELY 30% OF THE CHANNEL BOTTOM WIDTH AND EXTENDING DOWN TO THE INVERT ELEVATION. NOTCH SHALL BE USED TO CENTER FLOW AND NOT EXCEED 3 INCHES IN DEPTH.
14. THE NUMBER OF STEPS MAY VARY BETWEEN BEGINNING AND END STATIONING. SEE LONGITUDINAL PROFILE FOR STATION AND ELEVATION.
15. USE GEOTEXTILE FABRIC FOR DRAINAGE TO SEAL GAPS BETWEEN LOGS.
16. PLACE VEGETATION TRANSPLANTS FROM TOE OF STREAMBANK TO TOP OF STREAMBANK.
17. SEE TYPICAL SECTION FOR CHANNEL DIMENSIONS.

STONE AND LOG STEP POOL
NOT TO SCALE



PLAN VIEW



SECTION A-A

PROFILE B-B

NOTES:
1. DIG A TRENCH BELOW THE RESTORED STREAMBED FOR THE STONE BACKFILL.
2. FILL TRENCH WITH CLASS "A" AND "B" STONE BACKFILL.

CONSTRUCTED STONE RIFFLE
NOT TO SCALE

WLS ENGINEERING, PLLC
6 Dula Springs Road
Weaverville, NC 28787
(828)493-3287

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A TOMSIC

PRELIMINARY PLANS NOT FOR CONSTRUCTION

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC FIRM LICENSE NO. P-1480

REVISIONS

NO.	DESCRIPTION	DATE
A	DRAFT CONCEPT PLAN	1-7-20

PROJECT NAME

LITTLE PINE CREEK III
STREAM AND WETLAND RESTORATION PROJECT - REPAIR PHASE 2

ALLEGHANY COUNTY, NC

DRAWING INFORMATION

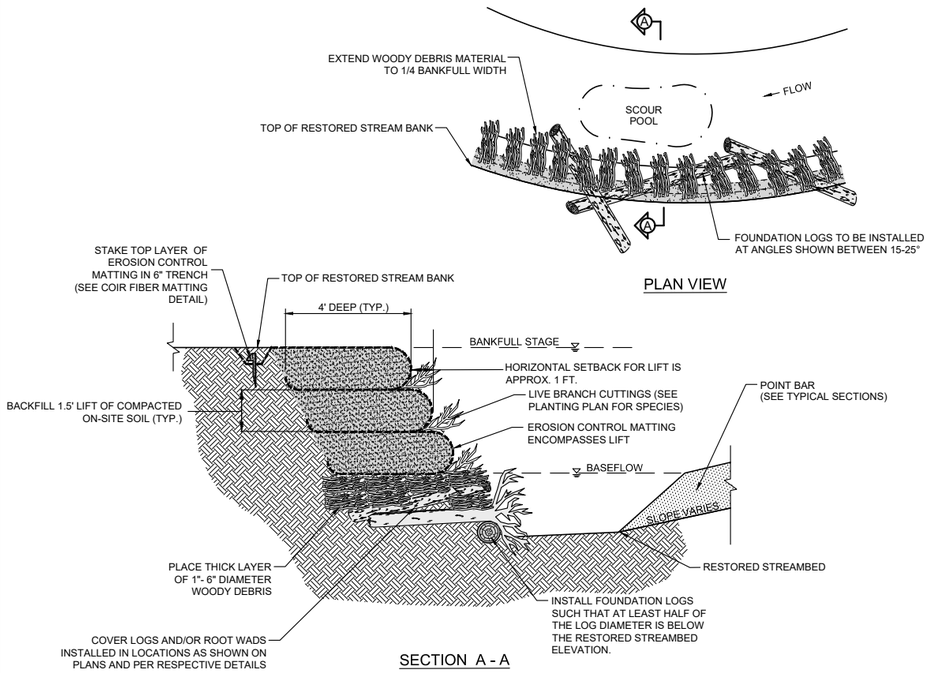
PROJECT NO.	18-001A
FILENAME	04_05_LP3_PH2_DETAIL_SHEET.DWG
DESIGNED BY	CAT
DRAWN BY	APL
DATE	1-7-20
HORIZ. SCALE	N.T.S.
VERT. SCALE	N/A

SHEET NAME

DETAILS

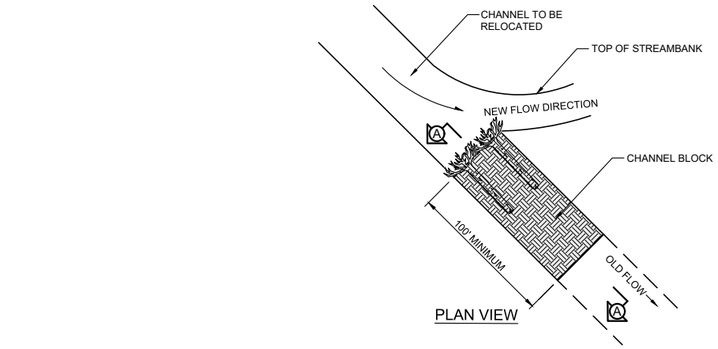
SHEET NUMBER

4



GEOLIFT W/ TOE WOOD

NOT TO SCALE

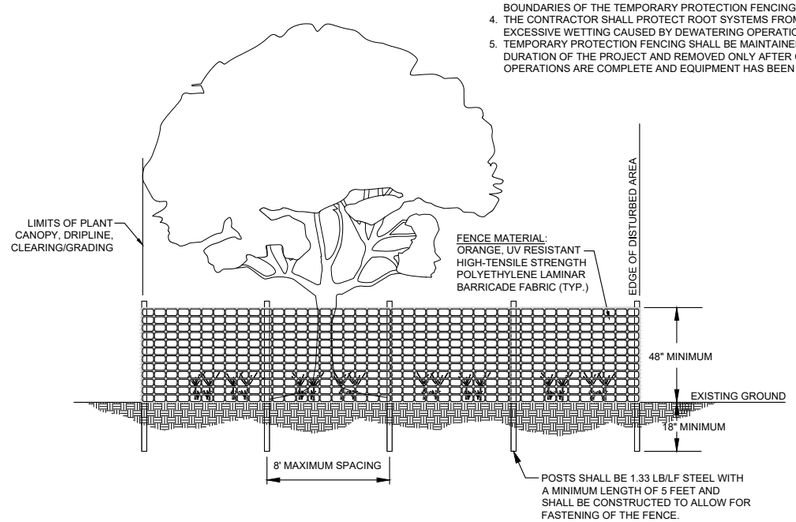


NOTES:
1. COMPACT DITCH PLUG MATERIAL FOR BACKFILL USING HEAVY EQUIPMENT IN 10 INCH LIFTS.
2. CONSTRUCT DITCH PLUG WITH COMPACTED SOIL USING SUITABLE MATERIAL IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
3. PLACE FILL MATERIAL IN LOCATIONS SHOWN ON PLANS OR AS DIRECTED BY ENGINEER TO ALLOW FOR SETTLING.

CHANNEL BLOCK

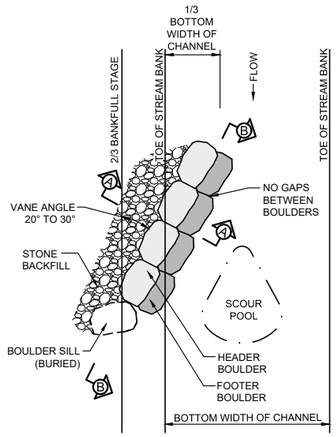
NOT TO SCALE

NOTES:
1. ALL TREES, PLANTS, VEGETATION OR WETLANDS DESIGNATED TO BE PROTECTED SHALL BE INSTALLED IN AREAS AS SHOWN ON PLANS.
2. INSTALL TEMPORARY PROTECTION FENCE AT TREE DRIP LINE, AT EDGE OF WETLANDS, OR PROPOSED DISTURBED AREA AS SHOWN ON PLANS, PRIOR TO CONSTRUCTION ACTIVITIES.
3. THERE SHALL BE NO STORAGE OF CONSTRUCTION MATERIALS WITHIN THE BOUNDARIES OF THE TEMPORARY PROTECTION FENCING.
4. THE CONTRACTOR SHALL PROTECT ROOT SYSTEMS FROM PONDING, ERODING, OR EXCESSIVE WETTING CAUSED BY DEWATERING OPERATIONS.
5. TEMPORARY PROTECTION FENCING SHALL BE MAINTAINED THROUGHOUT THE DURATION OF THE PROJECT AND REMOVED ONLY AFTER CONSTRUCTION OPERATIONS ARE COMPLETE AND EQUIPMENT HAS BEEN REMOVED FROM THE SITE.



TEMPORARY PROTECTION FENCE

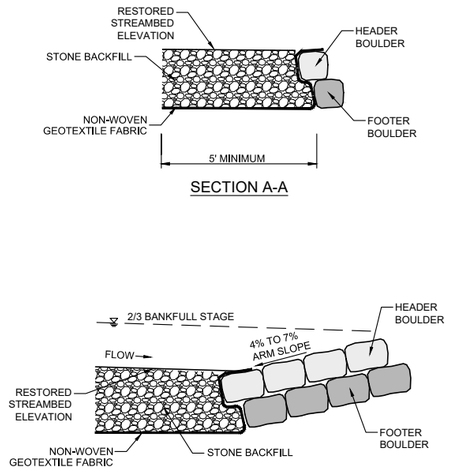
NOT TO SCALE



NOTES:
1. INSTALL GEOTEXTILE FABRIC BEGINNING AT THE TOP OF THE HEADER BOULDERS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER BOULDER, AND THEN UPSTREAM TO A MINIMUM OF FIVE FEET.
2. EXCAVATE A TRENCH BELOW THE STREAM BED FOR FOOTER BOULDERS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAM BANK.
3. START AT BANK AND PLACE FOOTER BOULDERS FIRST AND THEN HEADER BOULDERS. START SLOPE AT 2/3 THE BANKFULL STAGE.
4. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS. ACTUAL NUMBER OF BOULDERS MAY VARY.
5. AN EXTRA BOULDER CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT AT DIRECTION OF THE ENGINEER.
6. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER BOULDERS.
7. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER BOULDERS.

BOULDER VANE

NOT TO SCALE



WLS ENGINEERING, PLLC
6 Dula Springs Road
Weaverville, NC 28787
(828)493-3287

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A TOMISIC

PRELIMINARY PLANS NOT FOR CONSTRUCTION

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC FIRM LICENSE NO. P-1480

REVISIONS		
A	DRAFT CONCEPT PLAN	1-7-20
NO.	DESCRIPTION	DATE

PROJECT NAME

LITTLE PINE CREEK III
STREAM AND WETLAND RESTORATION PROJECT - REPAIR PHASE 2

ALLEGHANY COUNTY, NC

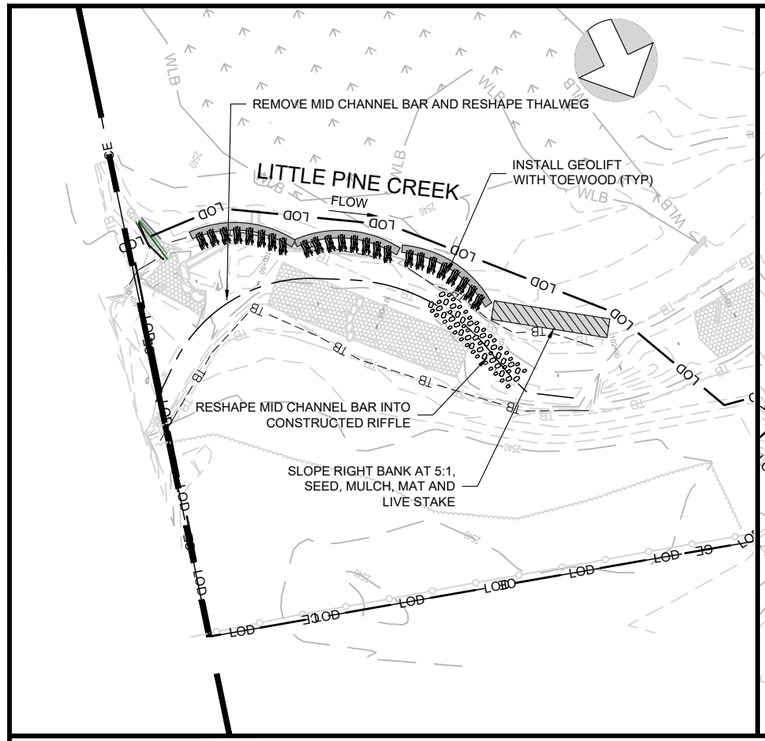
DRAWING INFORMATION	
PROJECT NO.	18-001A
FILENAME	04_05_LP3_PH2_DETAIL_SHEET.DWG
DESIGNED BY	CAT
DRAWN BY	APL
DATE	1-7-20
HORIZ. SCALE	N.T.S.
VERT. SCALE	N/A

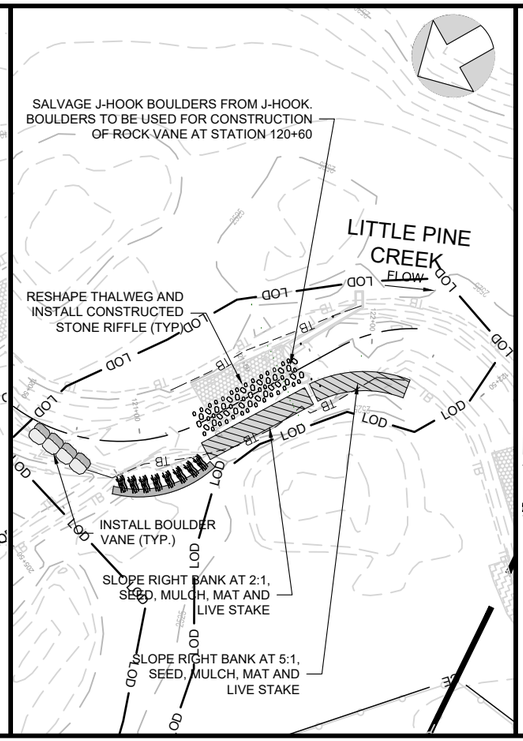
SHEET NAME

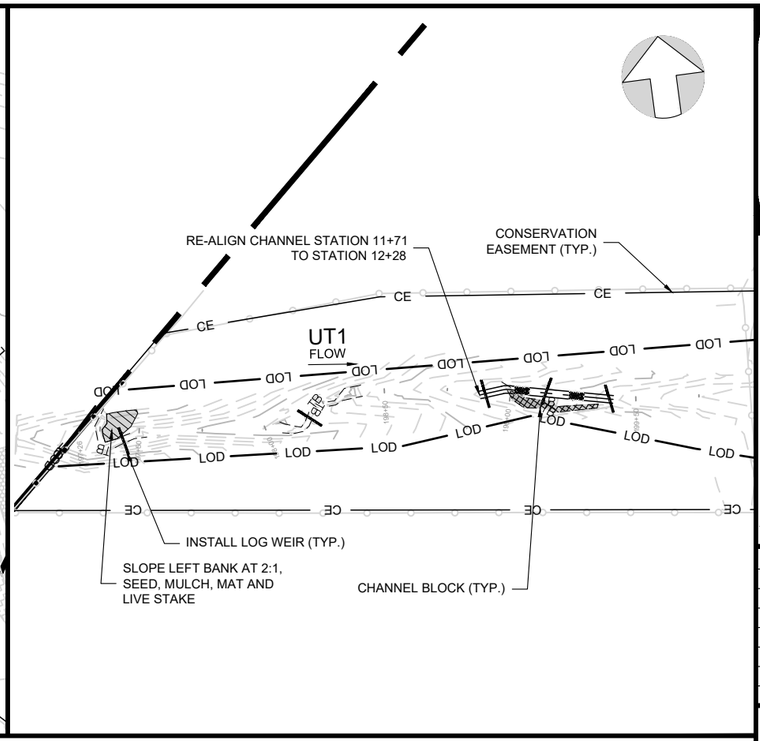
DETAILS

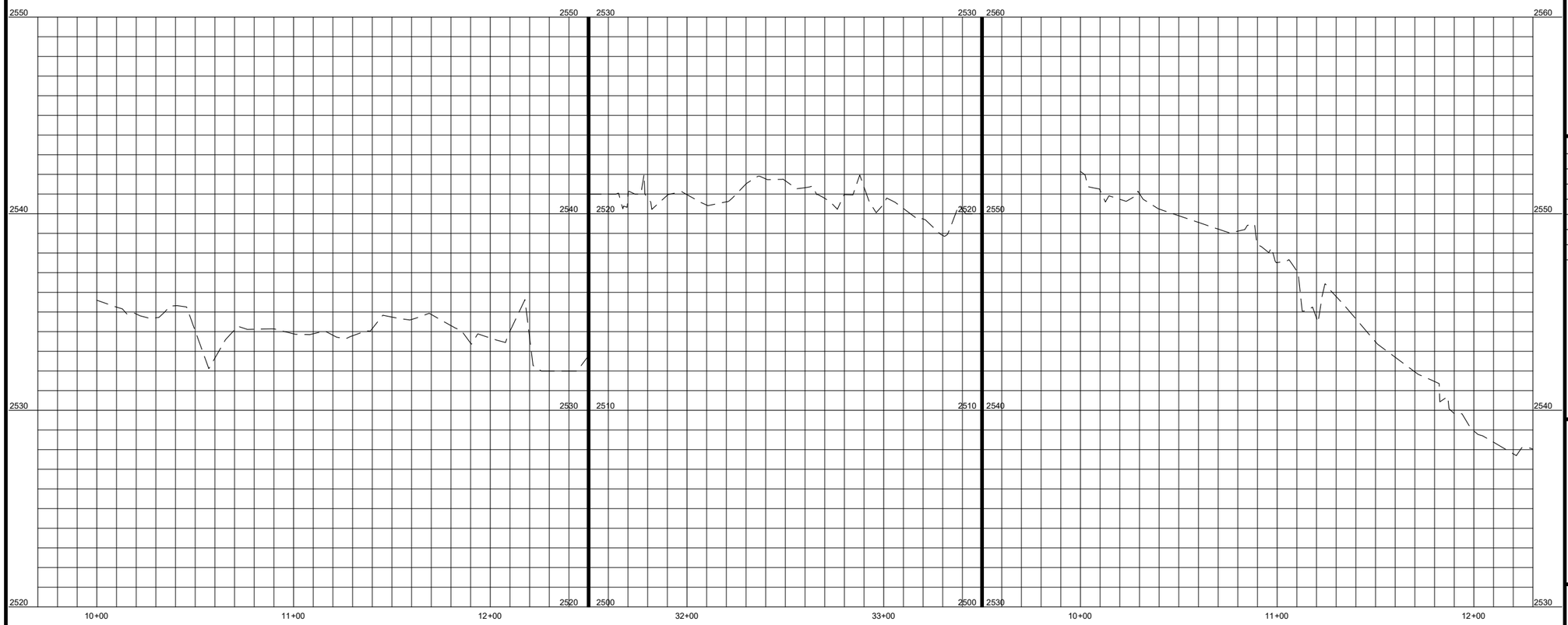
SHEET NUMBER

5









WLS ENGINEERING, PLLC

6 Dula Springs Road
Weaverville, NC 28787
(828)493-3287

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36016 ENGINEER CHRISTOPHER A TOMSIC

PRELIMINARY PLANS NOT FOR CONSTRUCTION

ENGINEERING SERVICES BY
WLS ENGINEERING, PLLC
FIRM LICENSE NO. P-1480

REVISIONS

NO.	DESCRIPTION	DATE
A	DRAFT CONCEPT PLAN	1-7-20

PROJECT NAME

LITTLE PINE CREEK III
STREAM AND WETLAND RESTORATION PROJECT - REPAIR PHASE 2

ALLEGHANY COUNTY, NC

DRAWING INFORMATION

PROJECT NO.	18-001A
FILENAME	06_LP3_PH2_PLAN AND PROFILE.DWG
DESIGNED BY	CAT
DRAWN BY	APL
DATE	1-7-20
HORIZ. SCALE	1" = 60'
VERT. SCALE	1" = 6'

30 15 0 30 60
GRAPHIC SCALE

SHEET NAME

UT1 &
LITTLE PINE CREEK

PLAN AND PROFILE

SHEET NUMBER

6

TEMPORARY SEEDING		
APPROVED DATE	**TYPE**	**PLANTING RATE (lbs/acre)**
Jan 1 – May 1	Rye Grain *(Secale Cereale)*	120
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	750
	Straw Mulch	4,000
May 1 – Aug 15	German Millet *(Setaria italica)*	40
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	750
	Straw Mulch	4,000
Aug 15 – Dec 30	Rye Grain *(Secale Cereale)*	120
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	1,000
	Straw Mulch	4,000

PERMANENT SEEDING (PASTURE)		
Pure Live Seed (42 lbs/acre)		
Species Name	**Common Name**	**lbs/acre**
Dactylis glomerata	Orchard Grass	40
Trifolium repens	White Ladino Clover	2

PERMANENT SEEDING (CONSERVATION EASEMENT)		
Pure Live Seed (20 lbs/acre)		
Species Name	**Common Name**	**lbs/acre**
Panicum rigidulum	Redtop Panicgrass	3
Agrostis hyemalis	Winter Bentgrass	3
Chasmanthium latifolium	River Oats	2
Rudbeckia hirta	Blackeyed Susan	1
Coreopsis lanceolata	Lanceleaf Coreopsis	1
Carex vulpinoidea	Fox Sedge	3
Panicum clandestinum	Deertongue	3
Elymus virginicus	Virginia Wild Rye	2
Asclepias syrica	Common Milkweed	0.2
Baptisia australis	Blue False Indigo	0.2
Gaillardia pulchella	Annual Gaillardia	1
Echinacea purpurea	Pale Purple Coneflower	0.6

* If the Redtop Panicgreass and Winter Bentgrass fail to adequately germinate and prevent erosion in the Mountain Region, other types of grasses listed in Table 6.11.C of the NC E&SC Design Manual shall be used per the Designer's direction.

PLANTING NOTES

1. THE ESTIMATED PLANTING AREA IS APPROXIMATELY 1.4 ACRES AND WILL VARY BASED ON SITE CONDITIONS AND AREAS DISTURBED DURING CONSTRUCTION REPAIR WORK.
2. ANY PLANTING ACTIVITIES SHALL BE PERFORMED WITHIN THE CONSERVATION EASEMENT USING NATIVE SPECIES DESCRIBED IN PLANTING PLAN AND TECHNICAL SPECIFICATIONS.
3. FINAL PLANT SELECTION MAY CHANGE DUE TO SPECIES AVAILABILITY AT THE TIME OF PLANTING. SPECIES SUBSTITUTIONS WILL BE COORDINATED BETWEEN ENGINEER, OWNER, AND PLANTING CONTRACTOR PRIOR TO THE PROCUREMENT OF PLANT/SEED STOCK.
4. EXACT PLACEMENT OF THE SPECIES WILL BE DETERMINED BY THE CONTRACTOR'S VEGETATION SPECIALIST PRIOR TO SITE PLANTING AND BASED ON THE WETNESS CONDITIONS OF PLANTING LOCATIONS.
5. LARGE NATIVE TREE SPECIES TO BE PRESERVED WILL BE FLAGGED BY THE ENGINEER PRIOR TO CONSTRUCTION ACTIVITIES. ANY TREES HARVESTED FOR WOODY MATERIAL WILL BE UTILIZED TO PROVIDE BED AND BANK STABILIZATION, COVER AND/OR NESTING HABITAT.
6. ALL DISTURBED AREAS WILL BE STABILIZED USING MULCHING AND SEEDING AS DEFINED IN THE TECHNICAL SPECIFICATIONS AND THE APPROVED SEDIMENTATION AND EROSION CONTROL PLANS.
7. RIPARIAN BUFFER ZONE, SLOPE BUFFER ZONE, AND WETLAND PLANTING ZONE PLANTS WILL BE INSTALLED BY THE CONTRACTOR'S VEGETATION SPECIALIST. SEEDING OF THESE ZONES WITH PERMANENT SEEDING IS THE RESPONSIBILITY OF THE CONTRACTOR. ALL SEEDED AND PLANTED AREAS SHALL ALSO BE PLANTED WITH TEMPORARY SEED AND SOIL AMENDMENTS AS DESCRIBED IN TECHNICAL SPECIFICATIONS.

NPDES Groundcover Stabilization Requirements		
Site Area Description	**Stabilization**	**Timeframe Exceptions**
Perimeter dikes, sw ales, ditches and slopes	7 days	None
High Quality Water (HQW) Zones	7 days	None
Slopes steeper than 3:1	7 days	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allow ed.
Slopes 3:1 or flatter	14 days	7 days for slopes greater than 50' in length.
All other areas w ith slopes flatter than 4:1	14 days	None, except for perimeters and HQW Zones.

RIPARIAN BUFFER PLANTING ZONE						
Species	**Common Name**	**Max. Spacing**	**Indiv. Spacing**	**Min. Caliper**	**Stratum**	**#**
Sassafras albidum	Sassafras	8 ft	8 ft	0.25"-1.0"		5%
Liriodendron tulipifera	Tulip Poplar	8 ft	8 ft	0.25"-1.0"		15%
Quercus prinus	Chestnut Oak	8 ft	8 ft	0.25"-1.0"		5%
Platanus occidentalis	Sycamore	8 ft	8 ft	0.25"-1.0"		20%
Betula nigra	River Birch	8 ft	8 ft	0.25"-1.0"		10%
Cornus florida	Flowering Dogwood	8 ft	8 ft	0.25"-1.0"		10%
Aesculus octrandra	Yellow Buckeye	8 ft	8 ft	0.25"-1.0"		5%
Fraxinus americana	White Ash	8 ft	8 ft	0.25"-1.0"		20%
Quercus rubra	Northern Red Oak	8 ft	8 ft	0.25"-1.0"		10%
SLOPE BUFFER PLANTING ZONE						
Species	**Common Name**	**Max. Spacing**	**Indiv. Spacing**	**Min. Caliper**	**Stratum**	**#**
Prunus serotina	Black Cherry	8 ft	8 ft	0.25"-1.0"		10%
Liriodendron tulipifera	Tulip Poplar	8 ft	8 ft	0.25"-1.0"		20%
Quercus prinus	Chestnut Oak	8 ft	8 ft	0.25"-1.0"		10%
Quercus coccinea	Scarlet Oak	8 ft	8 ft	0.25"-1.0"		10%
Carya glabra	Pignut Hickory	8 ft	8 ft	0.25"-1.0"		15%
Cornus florida	Flowering Dogwood	8 ft	8 ft	0.25"-1.0"		10%
Aesculus octrandra	Yellow Buckeye	8 ft	8 ft	0.25"-1.0"		5%
Fraxinus americana	White Ash	8 ft	8 ft	0.25"-1.0"		10%
Quercus rubra	Northern Red Oak	8 ft	8 ft	0.25"-1.0"		10%

WETLAND PLANTING ZONE						
Species	**Common Name**	**Max. Spacing**	**Indiv. Spacing**	**Min. Caliper**	**Stratum**	**#**
Nyssa sylvatica	Black Gum	8 ft	8 ft	0.25"-1.0"		10%
Platanus occidentalis	Sycamore	8 ft	8 ft	0.25"-1.0"		30%
Betula nigra	River Birch	8 ft	8 ft	0.25"-1.0"		20%
Cornus amomum	Silky Dogwood	8 ft	8 ft	0.25"-1.0"		15%
Alnus serrulata	Tag Alder	8 ft	8 ft	0.25"-1.0"		5%
Fraxinus pennsylvanica	Green Ash	8 ft	8 ft	0.25"-1.0"		10%
Lindera benzoin	Spicebush	8 ft	8 ft	0.25"-1.0"		10%
						100%
WETLAND PLANTING ZONE						
Live Stakes						
Species	**Common Name**	**Max. Spacing**	**Indiv. Spacing**	**Min. Size**	**Stratum**	**# Plants**
Cornus amomum	Silky Dogwood	3 ft	3ft	0.5"-1.0" cal.		25%
Salix nigra	Black Willow	3 ft	3ft	0.5"-1.0" cal.		15%
Salix sericea	Silky Willow	3 ft	3ft	0.5"-1.0" cal.		50%
Sambucus nigra ssp canadensis	Elderberry	3 ft	3ft	0.5"-1.0" cal.		10%

STREAMBANKS						
Live Stakes						
Species	**Common Name**	**Max. Spacing**	**Indiv. Spacing**	**Min. Size**	**Stratum**	**# Plants**
Cornus amomum	Silky Dogwood	3 ft	3ft	0.5"-1.0" cal.		25%
Salix nigra	Black Willow	3 ft	3ft	0.5"-1.0" cal.		15%
Salix sericea	Silky Willow	3 ft	3ft	0.5"-1.0" cal.		50%
Sambucus nigra ssp canadensis	Elderberry	3 ft	3ft	0.5"-1.0" cal.		10%

WLS ENGINEERING, PLLC

6 Dula Springs Road
Weaverville, NC 28787
(828)493-3287

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36316 ENGINEER CHRISTOPHER A. TOMSIC

PRELIMINARY PLANS NOT FOR CONSTRUCTION

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC FIRM LICENSE NO. P-1480

REVISIONS		
A	DRAFT CONCEPT PLAN	1-7-20
NO.	DESCRIPTION	DATE

PROJECT NAME

LITTLE PINE CREEK III
STREAM AND WETLAND RESTORATION PROJECT - REPAIR PHASE 2

ALLEGHANY COUNTY, NC

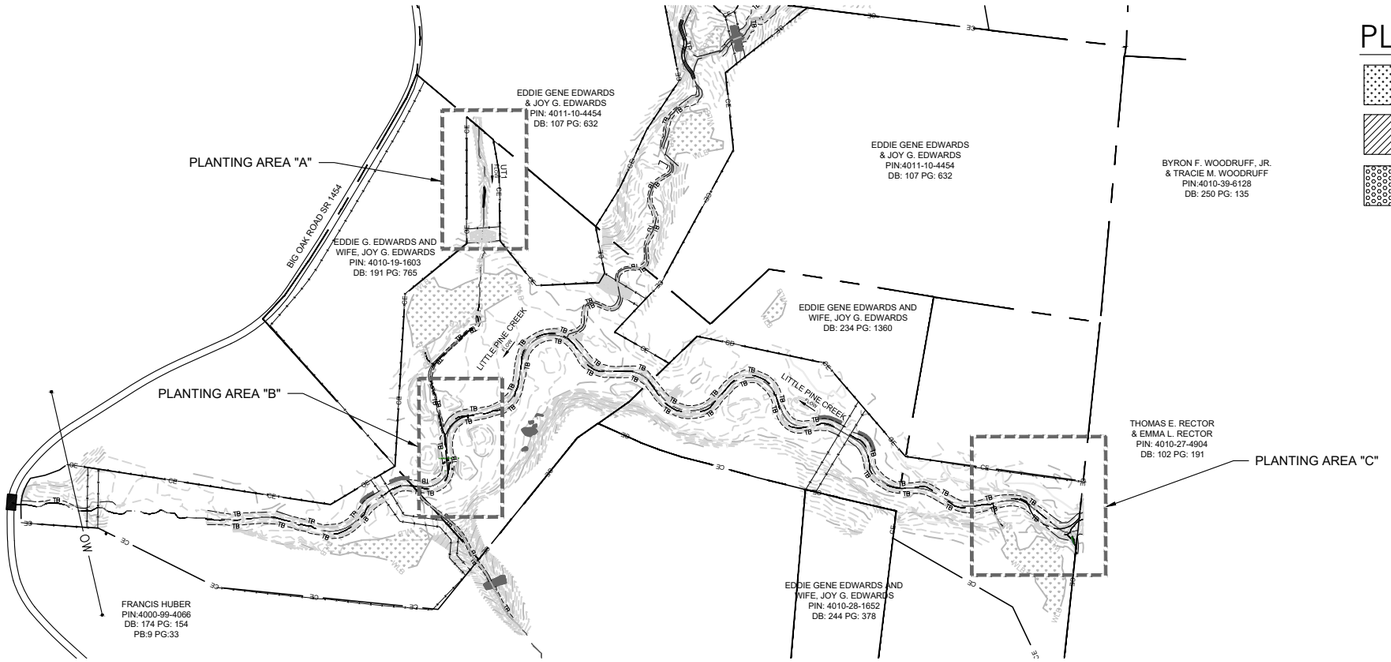
DRAWING INFORMATION	
PROJECT NO.	18-001A
FILENAME	07_08_LP3_PH2_PLANTING_PLAN.DWG
DESIGNED BY	CAT
DRAWN BY	APL
DATE	1-7-20
HORIZ. SCALE	N.T.S.
VERT. SCALE	N/A

SHEET NAME

PLANTING PLAN

SHEET NUMBER

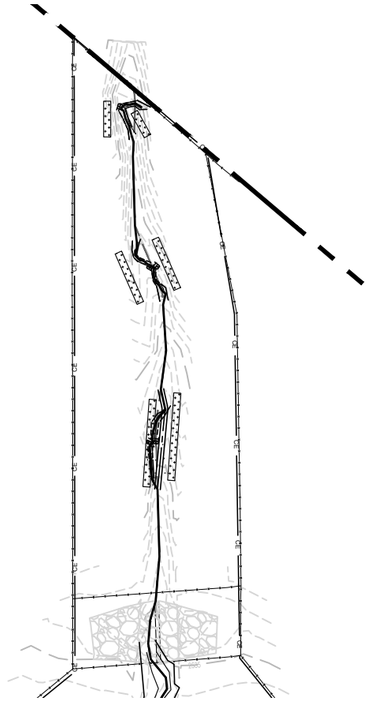
7



PLANTING INDEX PLAN

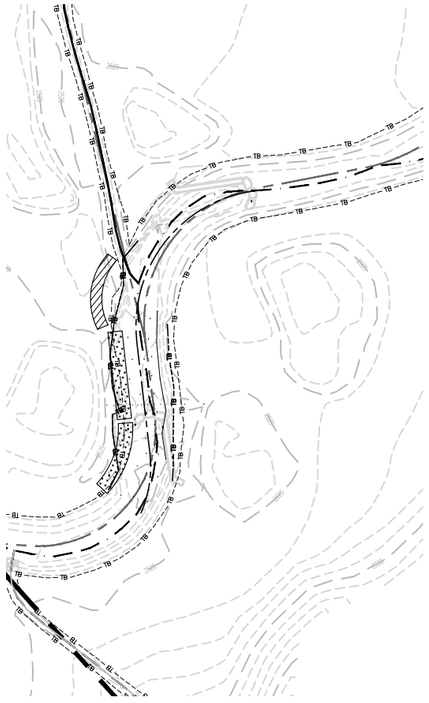
PLANTING ZONES

- RIPARIAN BUFFER
- SLOPE BUFFER
- WETLAND



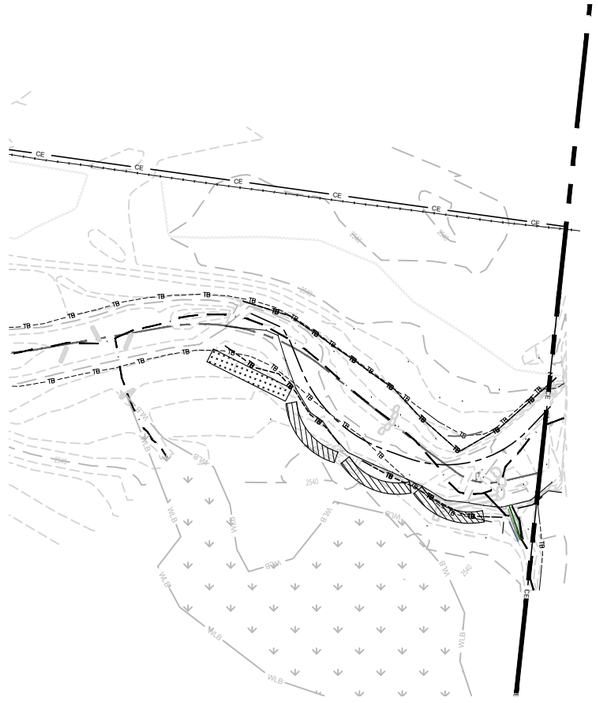
PLANTING AREA "A"

SCALE : 1" = 80'



PLANTING AREA "B"

SCALE : 1" = 80'



PLANTING AREA "C"

SCALE : 1" = 80'

WLS ENGINEERING, PLLC
6 Dula Springs Road
Weaverville, NC 28787
(828)493-3287

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 36316 ENGINEER CHRISTOPHER A. TOMSIC

PRELIMINARY PLANS NOT FOR CONSTRUCTION

ENGINEERING SERVICES BY WLS ENGINEERING, PLLC FIRM LICENSE NO. P-1480

REVISIONS		
A	DRAFT CONCEPT PLAN	1-7-20
NO.	DESCRIPTION	DATE

PROJECT NAME

LITTLE PINE CREEK III
STREAM AND WETLAND RESTORATION PROJECT - REPAIR PHASE 2

ALLEGHANY COUNTY, NC

DRAWING INFORMATION	
PROJECT NO.	18-001A
FILENAME	07_08_LP3_PH2_PLANTING_PLAN.DWG
DESIGNED BY	CAT
DRAWN BY	APL
DATE	1-7-20
HORIZ. SCALE	1" = 400'
VERT. SCALE	N/A

NORTH

200 100 0 200 400

GRAPHIC SCALE

SHEET NAME

PLANTING PLAN

SHEET NUMBER

8