AS-BUILT BASELINE MONITORING REPORT

Final

LITTLE PINE III STREAM AND WETLAND RESTORATION PROJECT

Alleghany County, NC
DEQ Contract D12010S
DMS Project Number 94903
DWR # 14-0041
USACE Action ID 2012-01299

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EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) completed design and construction management on a design--bid-build project at the Little Pine III Stream and Wetland Restoration Project (Site) for the North Carolina Division of Mitigation Services (DMS) to restore, enhance, and preserve a total of 13,112 linear feet (LF) of perennial and intermittent stream, and to enhance and preserve 2.9 acres of wetlands in Alleghany County, NC. The Site is expected to generate 6,973 stream mitigation units (SMUs), and 1.40 wetland mitigation units (WMUs), for the New River Basin (Table 1). The Site is located approximately eight miles east of the Town of Sparta, NC and approximately four miles south of the Virginia border in the New River Basin; eight-digit Cataloging Unit (CU) 05050001 and the 14-digit Hydrologic Unit Code (HUC) 05050001030030 (Figure 1). The 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) and four unnamed zero order tributaries to Little Pine Creek (UT1, UT2b, UT3, and UT4). (Figure 2). Little Pine Creek flows into Brush Creek at the downstream Site boundary. The land adjacent to the streams and wetlands is primarily maintained cattle pasture and forest.

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 LWP identified the following stressors to watershed function: unforested buffers that are heavily grazed, livestock access to the streams, heavily eroded stream banks, land-disturbing activities on steep slopes, and storm water runoff in and around the Town of Sparta. The Site was identified in the LWP as a stream and wetland restoration opportunity with the potential to improve water quality, habitat, and hydrology within the Brush Creek watershed (site identifiers LPC1-04, LPC1-W10). LPC1-04 is the second highest ranked stream project of sixty-five identified in the watershed. In addition to being a high priority site, the Site is located in close proximity to other established restoration projects with protected conservation easements.

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.

The Site construction and as-built survey were completed in 2016. Planting and baseline monitoring activities occurred between December 2015 and May 2016. Minimal adjustments made during construction are detailed in Section 4.1. Baseline (MY0) profiles and cross-section dimensions closely match the design parameters. Cross-section widths and pool depths occasionally exceed design parameters within a normal range of variability for natural streams. The Site has been built as designed and is expected to meet the upcoming monitoring year's success criteria.

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Section 1: PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Project Location and Setting

The Site is located in eastern Alleghany County, NC as shown in Figure 1. The Site is approximately eight miles east of the Town of Sparta, NC and approximately four miles south of the Virginia border. (Figure 1). The land required for construction, management, and stewardship of the mitigation project includeded portions of 5 parcels resulting in X acres of conservation easement

The Site is located in the New River Basin; eight-digit Cataloging Unit (CU) 05050001 and the 14-digit Hydrologic Unit Code (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.

The North Carolina Division of Water Resources (DWR) assigns best usage classifications to State Waters that reflect water quality conditions and potential resource usage. Little Pine Creek (DWR Index No. 10-9-10-5) is the main tributary of the project and is classified as Class C waters. Class C waters are protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, agriculture, and other uses. Little Pine Creek also has a supplemental classification as Trout Waters (Tr). Trout waters are protected to sustain and allow for trout propagation and survival and include tributaries to stocked trout streams. Trout are not currently stocked in Little Pine Creek. Brush Creek, which is located downstream of the Site, is hatchery supported.

The Site is located within a TLW in the New River RBRP plan (NCDENR, 2009), and is identified in the Little River and Brush Creek LWP Project Atlas (NCDENR, 2007). The Little River and Brush Creek LWP identified the following stressors in the watershed: unforested buffers that are heavily grazed, livestock access to streams, heavily eroded stream banks, land-disturbing activities on steep slopes, and storm water runoff in and around the town of Sparta. The LWP Project Atlas identified the Little Pine Creek III Stream and Wetland Restoration Project (LPC1-04, LPC1-W10) as a stream and wetland restoration opportunity with the potential to improve water quality, habitat, and hydrology within the Brush Creek watershed.

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 6 in Appendix 2 present the pre-restoration conditions in detail.

1.2 Project Goals and Objectives

This Site is intended to provide numerous ecological benefits within the New River Basin. While many of these benefits are limited to the Little Pine III project 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 project 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 LWP and 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 26.3 acres of forested riparian buffer;
- Fence off livestock from 57.32 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.

1.3 Project Structure, Restoration Type and Approach

The final mitigation plan was submitted and accepted by the DMS in March of 2014. Construction activities were completed in September 2015 by North State Environmental, Inc. Kee Surveying Inc. completed the as-built survey in April 2016 and Wildlands completed the baseline monitoring activities in May 2016. Planting was completed by Bruton Environmental, Inc. in December 2015. Final monitoring activities and close out will commence in December 2020. Minimal adjustments were made during construction and field adjustments made during construction are described in further detail in section 4.1. Please refer to Appendix 1 for detailed project activity, history, contact information, and watershed/site background information.

1.3.1 Project Structure

The Site is expected to provide 6,973 SMUs, and 1.40 WMUs. These Site components and mitigation credits reflect assets developed in the final Interagency Review Team (IRT)-approved project mitigation plan and subsequently permitted. Please refer to the Project Component Map (Figure 2) for the stream and wetland features and to Table 1 for the project component and mitigation credit information for the Site.

1.3.2 Restoration Type and Approach

The project includes stream restoration, enhancement I and II (EI and EII), and preservation as well as wetland enhancement and preservation. The specific proposed stream and wetland types are described below.

The stream restoration portion of the Site includes four reaches; three reaches on Little Pine Creek and one reach on UT2b. The restoration portion of Little Pine enters the Site from a farm field east of the site and flows southwest. The approach changes to EI 504 LF upstream of the Big Oak Road crossing, which marks the downstream Site boundary. UT2b originates in a wetland onsite and flows west until its confluence with UT2. The stream restoration design was developed based on reference conditions, representing streams within the Blue Ridge Belt region with similar drainage areas, valley slopes, morphology, and bed material. The restoration reaches were designed as threshold channels. This design approach was determined to be appropriate due to the low bedload supply, and sediment supply is not expected to change. The channels were not intended to be fully alluvial and are not expected to migrate laterally over time. Grade control structures and constructed riffles were used to address potential degradation and shear stress. The design streams were restored to the appropriate type based on the surrounding landscape, climate, and natural vegetation communities and with thorough consideration to the existing watershed conditions and their trajectory.

The EII portion of the Site includes several reaches; the downstream portion of Little Pine Creek Reach 2b, all of UT1, and portions of UT2a and UT2b. EII consisted of cattle exclusion, invasive species removal, planting supplemental riparian vegetation to encourage bank stabilization and establish a forested buffer, and occasional spot bank stabilization or grade control. EII activities also occurred in the buffer surrounding where an EI approach was used in the channel. In portions of UT2 Reach 1 upper and UT2 Reach 2 lower, localized bed and bank instabilities were sources of impairment prior to restoration activities. To address the impairment, an EI approach was used, which involved construction of a series of step-pools with logs, and short, steep, coarse riffles with grade control to allow UT2 to drop its channel elevation while maintaining stability. The EI approach was used in proportion to the level of impairment in existing conditions. Where UT2 Reach 1 enters the mature forest and exhibits good bed and bank stability, only cattle exclusion was implemented. Below the UT2a confluence, the existing condition of the UT2 was incised and laterally unstable. This is impairment was addressed by restoring proper dimension, pattern, and profile to the stream in the downstream portion of UT2 Reach 2.

The preservation portion of the Site includes portions of UT2a within the wood line, UT3, and UT4. The preservation reaches are preserved as is because they are stable and flow through mature forest. Fencing is installed to ensure livestock exclusion.

The wetland portion of the Site includes nine distinct wetland zones. The eight riparian wetland enhancement zones include Wetland AA, BB, CC, DD, EE, FF, GG, and HH. The enhancement activities included supplemental planting and fencing to remove livestock. Wetland JJ is preservation only.

1.4 Project History, Contacts, and Attribute Data

The Site was restored by Wildlands through a design-bid-build contract with DMS. Tables 2, 3, and 4 in Appendix 1 provide detailed information regarding the project schedule, project contacts, and project baseline information and attributes.

Section 2: PERFORMANCE STANDARDS

The stream and wetland performance criteria for the Site follow approved performance criteria presented in the Little Pine Creek III Stream and Wetland Restoration Project Mitigation Plan (2014). This Site is a post-instrument project (instituted after 7/28/2010), but instituted prior to the seven-year monitoring guidance. Therefore, the Site will be evaluated for five-years post-construction. Annual monitoring will be conducted to assess the condition of the finished Site. The stream restoration/EI reaches (Little Pine Creek Reaches 1, 2a, and 2b, UT2, and UT2b downstream) were assigned specific performance criteria for stream morphology, hydrology, and vegetation. Wetland enhancement areas were not assigned specific performance criteria for wetland hydrology. An outline of the performance criteria components follows. Performance criteria will be evaluated throughout the five-year post-construction monitoring.

2.1 Stream

2.1.1 Dimension

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. Per DMS guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored C and E channels to be considered stable. Riffle cross-sections should fall within the parameters defined for channels of the appropriate Rosgen stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability.

2.1.2 Pattern and Profile

Longitudinal profile data for the stream restoration reaches should show that the bedform features are remaining stable. The riffles should be steeper and shallower than the pools, while the pools should be deep with nearly flat water surface slopes. The relative percentage of riffles and pools should not change significantly from the design parameters. Adjustments in length and slope of run and glide features are expected and will not be considered a sign of instability. The longitudinal profile should show that the bank height ratio remains very near to 1.0 for the majority of the restoration reaches.

2.1.3 Photo Documentation

Photographs should illustrate the Site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent bars within the channel or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected.

2.1.4 Substrate

Substrate materials in the restoration and EI reaches should indicate a progression towards or the maintenance of coarser materials in the riffle features and smaller particles in the pool features.

2.1.5 Bankfull Documentation

Two bankfull flow events must be documented on the restoration and EI reaches within the five-year monitoring period. The two bankfull events must occur in separate years. Stream monitoring will continue until success criteria in the form of two bankfull events in separate years have been documented. Bankfull events will be documented using crest gages, photographs, and visual assessments such as debris lines.

2.1.6 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above.

2.2 Vegetation

The final vegetative success criteria will be the survival of 260 planted stems per acre in the planted riparian and wetland corridor at the end of the required monitoring period in monitoring year five (MY5). The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of the third monitoring year (MY3). The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

2.3 Wetlands

Performance standards are not defined for the wetland enhancement areas. Hydrologic data will be collected will not be used to evaluate success criteria for the Site.

2.4 Schedule and Reporting

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to DMS. Based on the DMS Annual Monitoring Template (April 2015), the monitoring reports will include the following:

- Project background which includes project objectives, project structure, restoration type and approach, location and setting, history and background;
- Project Asset Map of major project elements;
- Photographs showing views of the restored Site taken from fixed point stations;
- Current Condition Plan View Map with monitoring features and current problem areas noted such as stability and easement encroachment based on the cross-section surveys and annual visual assessments;
- Vegetative data as described above including the identification of any invasion by undesirable plant species;
- Groundwater gage plots;
- A description of damage by animals or vandalism;
- Maintenance issues and recommended remediation measures will be detailed and documented; and
- Wildlife observations.

Section 3: MONITORING PLAN

Annual monitoring will consist of collecting morphological, vegetative, and hydrological data to assess the project success based on the restoration goals and. Project success will be assessed by measuring channel dimension, substrate composition, vegetation, surface water hydrology, and groundwater hydrology and by analyzing photographs and performing visual assessments. Identified high priority problem areas, such as unstable stream banks, bed instability, aggradation/degradation, or poor vegetation establishment will be evaluated on a case-by-case basis. The problem areas will be visually noted and reported to DMS staff in the annual report. Refer to Table 5 in Appendix 1 for the monitoring component summary.

3.1 Stream

Geomorphic assessments follow guidelines outlined in the *Stream Channel Reference Sites: An Illustrated Guide to Field Techniques* (Harrelson et al., 1994), methodologies utilized in the Rosgen stream assessment and classification documents (Rosgen, 1994 and 1996), and in the *Stream Restoration: A Natural Channel Design Handbook* (Doll et al., 2003). Please refer to Figure 3 in Appendix 1 for monitoring locations discussed below.

3.1.1 Dimension

In order to monitor the channel dimension, 18 permanent cross-sections were installed along the stream restoration reach. Each cross-section is permanently marked with rebar installed in concrete and 1/2 inch PVC pipes. Cross-section surveys shall measure points at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg. Cross-sections will be surveyed annually for the five year monitoring period. Photographs will be taken annually of the cross-sections looking upstream and downstream.

3.1.2 Pattern and Profile

Longitudinal profile surveys will be conducted during the five-year monitoring period along (Little Pine Reaches 1, 2a, and 2b; UT2; and UT2b.). Stream pattern will be assessed visually as described below in Section 3.1.6.

3.1.3 Substrate

Reachwide pebble counts will be conducted for classification purposes on each of the restoration and EI reaches (Little Pine Reaches 1, 2a, and 2b; UT2; and UT2b.). Wetted riffle pebble counts were also conducted at permanent riffle cross-sections on Little Pine Reaches 1 (XS3), 2a (XS6), and 2b (XS9); UT2 (XS12, XS14, and XS17); and on UT2b (XS11). The pebble counts will be conducted annually for five years following construction and compared with data from previous years.

3.1.4 Photo Reference Points

Photographs will be used to monitor restoration and enhancement of stream and wetland areas as well as vegetation plots. A total of 42 permanent photographic reference points were established at the tail of riffles within the project stream and wetland areas after construction. Permanent markers were established so that the same locations and view directions on the site are monitored each year. Reference photos were also taken for each of the vegetation plots and cross-sections. Photographs will be taken annually during the annual stream and vegetation surveys to visually document stability for five years following construction. The photographer will make every effort to maintain the same area in each photo over time.

3.1.5 Hydrology Documentation

Bankfull events will be documented using crest gages, photographs, and visual assessments such as debris lines. Three crest gages were installed within surveyed riffle cross-sections; one on Little Pine Reach 2a (XS4), one on UT2 (XS17), and one on UT2b (XS11). The gages will be checked at each site visit to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition.

3.1.6 Visual Assessment

Visual assessments will be performed in the field along all stream areas on an annual basis during the five-year monitoring period. Problem areas will be noted such as channel instability (i.e. lateral and/or vertical instability, in-stream structure failure/instability and/or piping, headcuts), vegetated buffer health (i.e. low stem density, vegetation mortality, invasive species or encroachment), beaver activity, or livestock access. Areas of concern will be mapped, photographed, and described through a written description in the annual report. Problem areas will be re-evaluated during each subsequent visual assessment.

3.2 Vegetation

Planted woody vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2006) to monitor and assess the planted woody vegetation. A total of 21 vegetation plots were established on the Site. Vegetation plots were randomly established within the planted stream and wetland restoration areas to capture the heterogeneity of the designed vegetative communities. All of the plots were established as 10 meter by 10 meter squares or 5 meter by 20 meter rectangles. The vegetation plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs at the origin looking diagonally across the plot to the opposite corner were taken during the baseline monitoring in May 2016. Subsequent annual assessments following baseline survey will capture the same reference photograph locations.

Species composition, density and survival rates will be evaluated on an annual basis by plot and for the entire Site. Individual plot data will be provided and will include diameter, height, density, vigor, damage (if any), and percent survival. Planted woody stems will be marked annually as needed based off of a known origin so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems.

Please refer to Figure 3 in Appendix 1 for the vegetation monitoring locations.

3.3 Wetlands

One groundwater monitoring gage was established within enhancement wetland FF using a logging hydrology pressure transducer. The gage was set to record the ground water level two times per day. The groundwater gage will be downloaded during annual site visits. Please refer to Figure 3 in Appendix 1 for the groundwater gage monitoring location.

Section 4: AS-BUILT CONDITION (BASELINE)

The Site construction and as-built surveys were completed in April 2016. The survey included developing an as-built topographic surface, locating the channel boundaries, and structures. For comparison purposes, during the baseline assessments, reaches were divided into assessment reaches in the same way that they were established for design parameters: Little Pine Creek Reaches 1, 2a and 2b, UT2, and UT2b.

4.1 Record Drawings

A sealed half-size record drawing is located in Appendix 4 that includes redlines for any significant field adjustments made during construction that were different from the design plans. Stream adjustments along Little Pine Creek Reaches 1 and 2a were associated with existing vegetation and erosion prevention. Stream adjustments made along Little Pine Creek Reach 2b during construction were minor profile adjustments and adding additional grade control structures. Repair work was conducted in March 2016 on Little Pine Creek Reach 1, Reach 2a, Reach 2b, and UT2 to stabilize erosion resulting from several large storm events. The approved planting plan was not followed; a separate planting contract was used. This report provides planted species observed in the vegetation plots. Specific changes are detailed below.

4.1.1 Little Pine Creek Reach 1

- Station 100+00 - 101+00 Armored head of riffle, stone toe geolift, and brush mattress;
- Station 111+50 Class I/B stone toe, left and right bank; and
- Station 113+00 Ephemeral pool outlet channel stabilized with rock, seed, mulch, and matting.

4.1.2 Little Pine Creek Reach 2a

- Station 116+25 Ephemeral pool outlet channel stabilized with stone;
- Station 118+00 Boulder toe added right bank; and
- Station 122+75 Swale tie in from gully down to Little Pine left floodplain, outlet stabilization on left bank.

4.1.3 Little Pine Creek Reach 2b

- Station 124+00 Boulder toe added to tail of riffle;
- Station 124+75 Log sill and one boulder added;
- Station 126+00-126+50 Three boulders added below log sills in riffle;
- Station 127+20-127+75 Right bank protection changed from rootwads to brush toe;
- Station 128+00 Boulder sill replaced log sill; and
- Station 129+00 Log sill removed.

4.1.4 UT1

- Station 202+30 Rock “A” vane replaced with two boulder sills.

4.1.5 UT2

- Station 301+00 Angled log drop eliminated (3 log sills), bank grading removed;
- Station 327+00 log sill added;
- Station 337+75 and 338+25 Two boulder sills added;
- Station 342+00 boulder added below log sill; and
- Station 342+50-342+61 Tie in angle adjusted.

4.1.6 UT2a

- Station 401+80 Log sill removed.

4.1.7 UT2b

- Station 502+00 and 502+25 Log sills relocated; and
- Station 504+75 Log sill added.

4.2 Baseline Data Assessment

Baseline monitoring (MY0) was conducted between April and May 2016. The first annual monitoring assessment (MY1) will be completed in the fall of 2016. The streams and wetlands will be monitored for a total of five years, with the final monitoring activities to be conducted in 2020. The mitigation close-out for the Site is planned for 2021.

4.2.1 Morphological State of the Channel

Morphological data for the as-built profile was collected between April and May 2016. Please refer to Appendix 2 for summary data tables, morphological plots, and stream photographs.

Profile

The MY0 profiles closely match the profile design parameters. On the design profiles, riffles were depicted as straight lines with consistent slopes. However, at some locations the riffle profiles within the as-built survey are not consistent in slope due to the installation of structures and woody debris within the streambed. The water surface slope was used to calculate all riffle slopes. Maximum riffle slopes and bankfull slopes vary from design parameters due to a field adjustment during construction. Additionally, maximum pool depths typically exceed design parameters and are expected to trend towards the design depths as a result of natural deposition over time. These variations in riffle slope and pool depths do not constitute a problem or indicate a need for remedial actions and will be assessed visually during the annual assessments.

Dimension

The MY0 dimension numbers closely match the design parameters within acceptable ranges of variation. Variations in baseline parameters are reflected in the cross-sections as a larger maximum pool depth. We anticipate that over time pools may accumulate with sediment and organic matter. This accumulation of sediment within pools would not be seen as an indicator of instability. Maximum depth in riffles are occasionally exceeded due to micropools forming through lateral scour near boulders, but this is not expected to adversely impact the stability of the channel.

Pattern

The MY0 pattern metrics fell within acceptable ranges of the design parameters for all three reaches. Pattern data will be evaluated in MY5 if there are any indicators through the profile or dimension assessments that significant geomorphic adjustments have occurred.

Bankfull Events

Bankfull events recorded following completion of construction will be reported in the MY1 report.

4.2.2 Vegetation

The MY0 average planted density is 549 stems per acre, which exceeds the interim measure of vegetative success of at least 320 planted stems per acre at the end of the third monitoring year. Summary data and photographs of each plot can be found in Appendix 3.

4.2.3 Wetlands

Groundwater gage data will be reported in the annual monitoring report.

Section 5: REFERENCES

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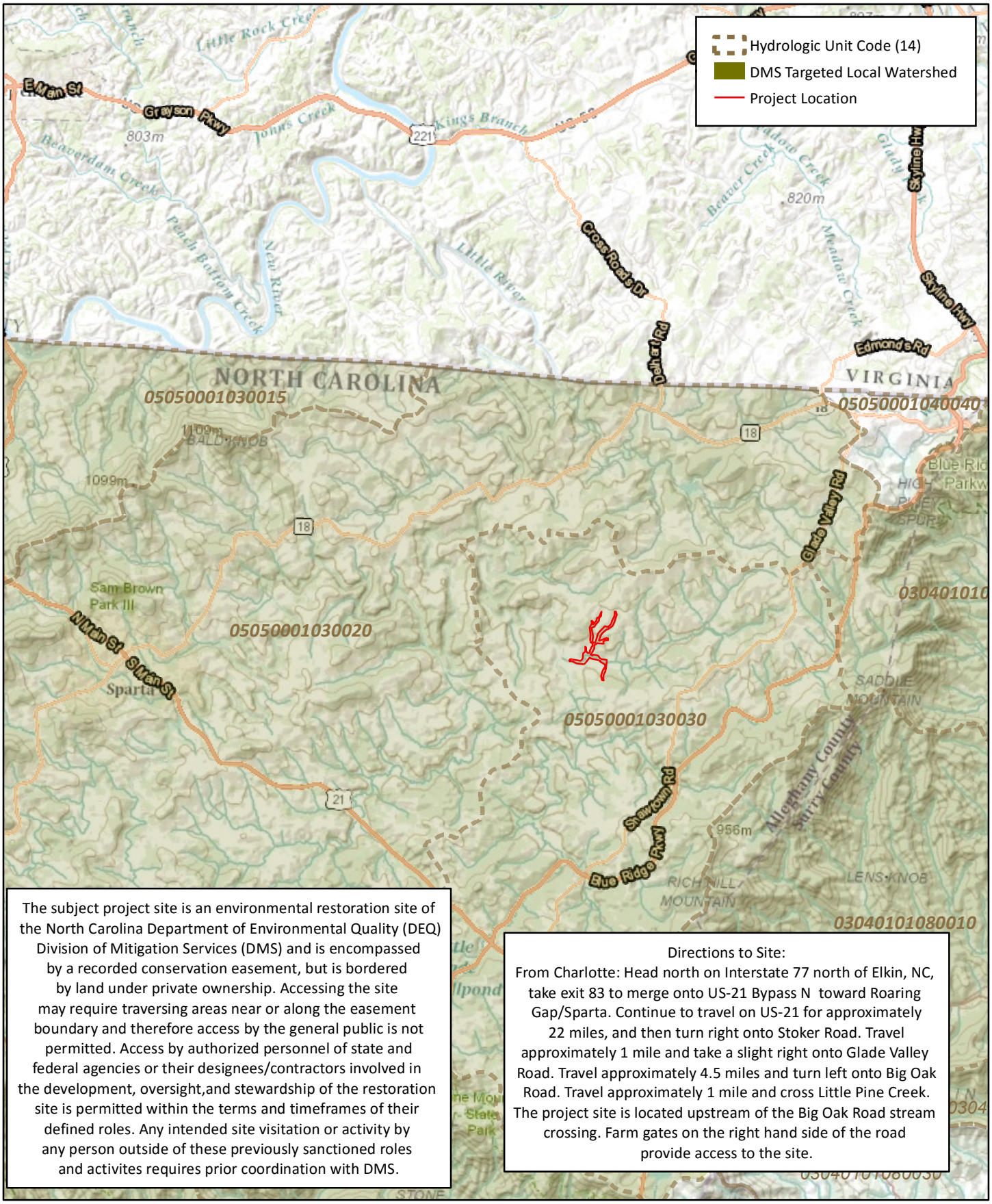
APPENDIX 1. General Tables and Figures



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

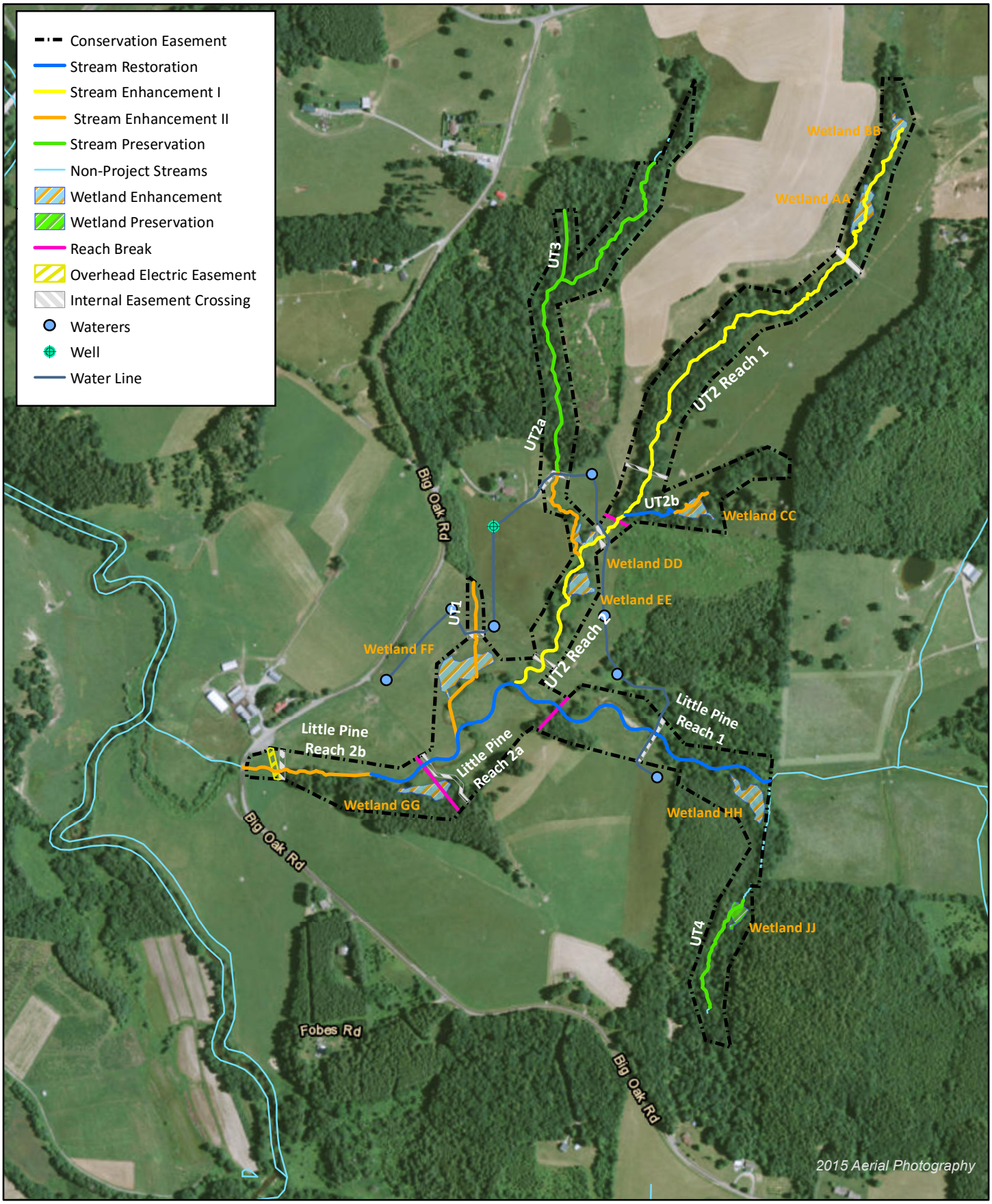
Directions to Site:
From Charlotte: Head north on Interstate 77 north of Elkin, NC, take exit 83 to merge onto US-21 Bypass N toward Roaring Gap/Sparta. Continue to travel on US-21 for approximately 22 miles, and then turn right onto Stoker Road. Travel approximately 1 mile and take a slight right onto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

WILDLANDS ENGINEERING

0 0.5 1 Mile

Figure 1 Project Vicinity Map
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 0 - 2016

Alleghany County, NC



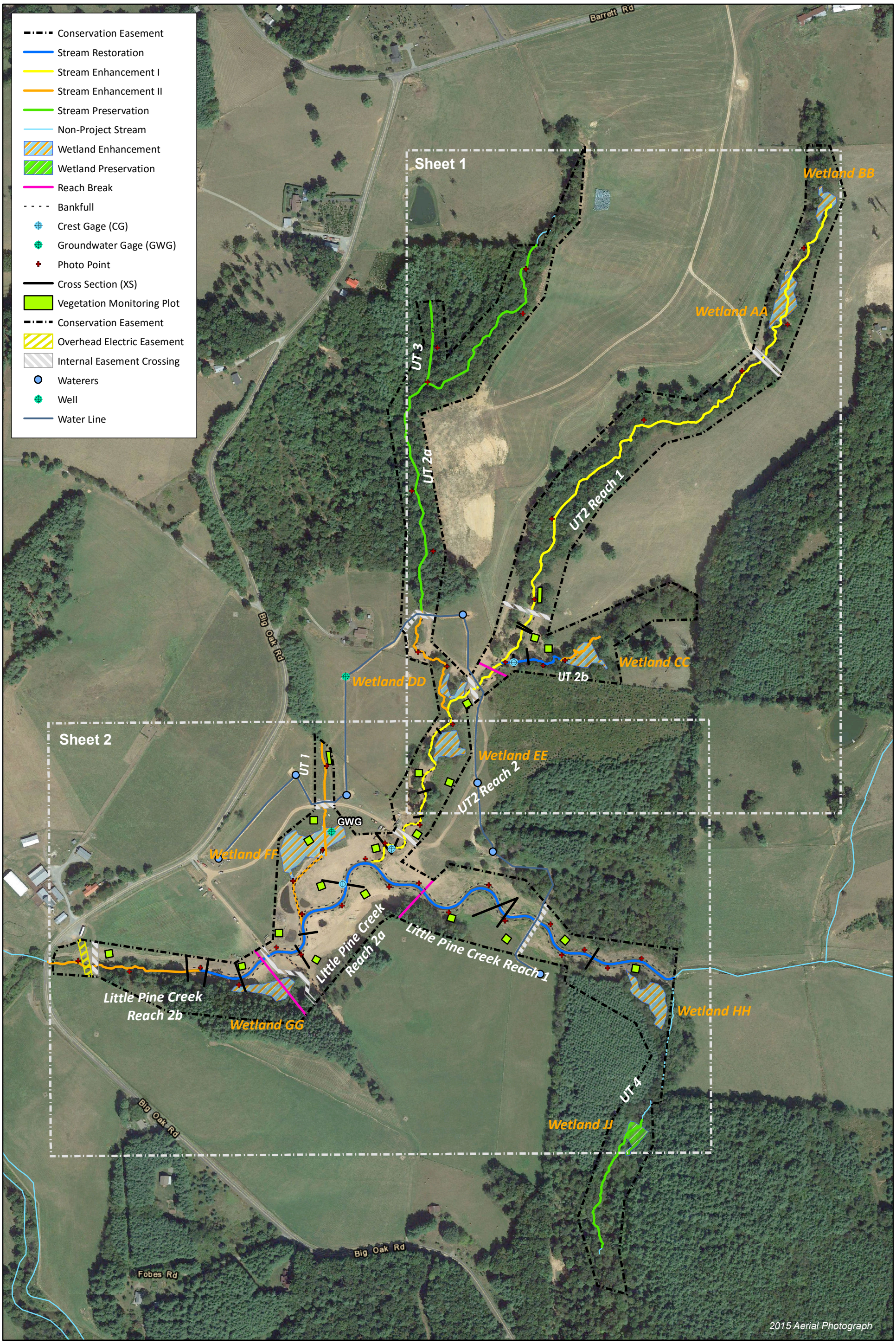
WILDLANDS ENGINEERING

0 700 Feet

N

Figure 2 Project Component/Asset Map
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 0 - 2016

Alleghany County, NC



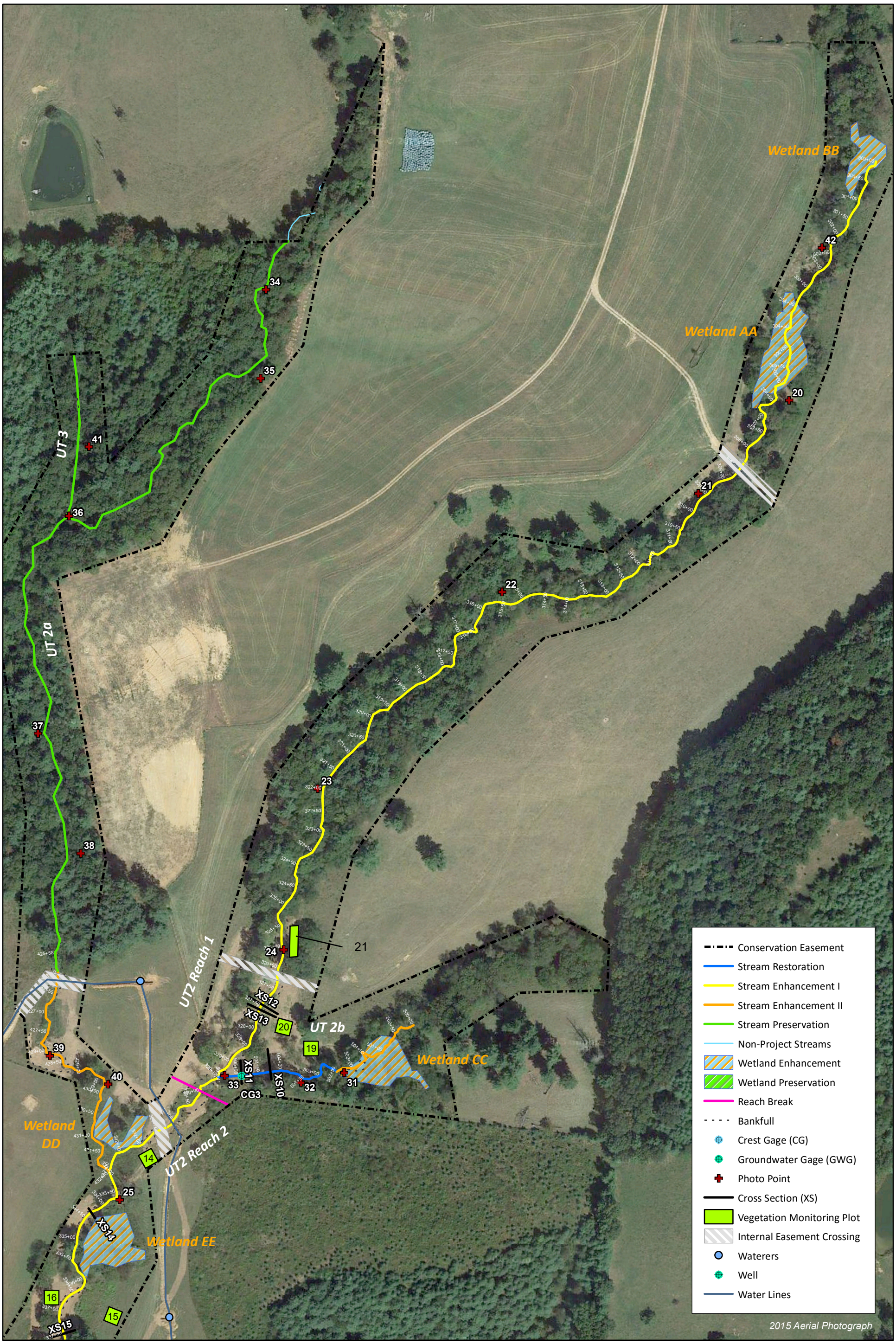
WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 3.0 Monitoring Plan View Map (Key)
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 0 - 2016

Alleghany County, NC



WILDLANDS ENGINEERING

Figure 3.1 Monitoring Plan View Map (Sheet 1 of 2)
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 0 - 2016

Alleghany County, NC

Conservation Easement
Stream Restoration
Stream Enhancement I
Stream Enhancement II
Stream Preservation
Non-Project Streams
Wetland Enhancement
Wetland Preservation
Reach Break
Bankfull
Crest Gage (CG)
Groundwater Gage (GWG)
Photo Point
Cross Section (XS)
Vegetation Monitoring Plot
Overhead Electric Easement
Internal Easement Crossing
Waterers
Well
Water Lines

UT 1
UT2 Reach 2
Wetland EE
Wetland FF
Wetland GG
Wetland HH
Little Pine Creek Reach 1
Little Pine Creek Reach 2a
Little Pine Creek Reach 2b
UT 4
Big Oak Rd
GWG
CG1
CG2
XS1
XS2
XS3
XS4
XS5
XS6
XS7
XS8
XS9
XS14
XS15
XS16
XS17
XS18

2015 Aerial Photograph

WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 3.2 Monitoring Plan View Map (Sheet 2 of 2)
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 0 - 2016

Alleghany County, NC

Table 1. Project Components and Mitigation Credits
Little Pine III Stream & Wetland Mitigation Project
DMS Project No.94903
Monitoring Year 0 - 2016

MITIGATION CREDITS									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	6,328.60	645	N/A	1.40	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[1]	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	1,417.00	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	1,058.00	Excludes one 25 foot wide ford crossing.
Little Pine Reach 2b		P1/P2	Restoration (R)	125+27 to 130+20	493	493	1:1	493.00	
		Planting, fencing	Enhancement II (R)	130+20 to 135+60	540	509	2.5:1	197.00	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	185.20	Excludes one 35 foot wide culvert crossing.
		Planting, fencing, channel creation	Enhancement II (R)	202+24 to 206+26	402	402	2.5:1	160.80	
UT2 Reach 1	5,270	P1/P2/P4, preservation	Enhancement I (R)	297+18-343+18	4,600	4,474	2:1	2,237.00	Excludes four constructed culvert crossings; 32, 24, 32, and 38 feet wide respectively.
UT2 Reach 2									
UT2a	2,921	Planting, fencing	Enhancement II (R)	401+78 to 403+34 & 403+75 to 404+34	215	215	n/a	n/a	Easement Break 403+34 - 403+75
		Preservation	Preservation (RE)	405+15 to 426+58	2,143	2,143	5:1	428.60	
		Planting, fencing	Enhancement II (R)	426+58 to 432+09	551	519	2.5:1	207.60	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	120.00	
		P2	Restoration (R)	503+00 to 505+53	253	253	1:1	253.00	
UT3	400	Preservation	Preservation (RE)	602+44 to 606+44	400	384	5:1	76.80	Excludes one 16 foot wide constructed ford crossing.
UT4	1,036	Preservation	Preservation (RE)	701+26 to 708+23	697	697	5:1	139.40	
WETLANDS									
Wetland AA	0.38	Planting, fencing	Enhancement (RE)	UT2 floodplain	0.38		2:1	0.19	
Wetland BB	0.16	Planting, fencing	Enhancement (RE)	UT2 floodplain	0.16		2:1	0.08	
Wetland CC	0.26	Grade control, planting, fencing	Enhancement (RE)	UT2b headwaters	0.26		2:1	0.13	
Wetland DD	0.12	Planting, fencing	Enhancement (RE)	North of UT2/UT2a	0.12		2:1	0.06	
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	0.38	
Wetland GG	0.33	Planting fencing	Enhancement (RE)	Little Pine	0.33		2:1	0.17	
Wetland HH	0.42	Planting, grade control	Enhancement (RE)	South of UT4/ Little Pine	0.42		2:1	0.21	
Wetland JJ	0.19	Preservation	Preservation (RE)	UT4 floodplain	0.19		5:1	0.04	

COMPONENT SUMMATION					
Restoration Level	Stream (LF)	Riparian Wetland (acres)	Non-Riparian	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.

Table 2. Project Activity and Reporting History
Little Pine III Stream & Wetland Mitigation Project
DMS Project No.94903
Monitoring Year 0 - 2016

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
Baseline Monitoring Document (Year 0)	May 2016	July 2016
Year 1 Monitoring	Fall 2016	December 2016
Year 2 Monitoring	2017	November 2017
Year 3 Monitoring	2018	November 2018
Year 4 Monitoring	2019	November 2019
Year 5 Monitoring	2020	November 2020

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

Table 3. Project Contact Table
Little Pine III Stream & Wetland Mitigation Site
DMS Project No.94903
Monitoring Year 0 - 2016

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 704.332.7754, ext. 110

Table 4. Project Information and Attributes
Little Pine III Stream & Wetland Mitigation Project
DMS Project No.94903
Monitoring Year 0 - 2016

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	LP2 Reach b	UT1	UT2 Reach 1	UT2 Reach 2	UT2 Reach 3	UT2a	UT2b	UT3	UT4
Length of Reach (linear feet) - Post-Restoration[1]	1,350	1,025	969	892	4,447			2,888	541	384	1,036
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 complex);										
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-Restoration	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 Categorical Exclusion (CE) Approved 7/6/2012
Essential Fisheries Habitat	Yes	Yes	LPIII Final Mitigation Plan (3/4/2014) and LPIII Categorical Exclusion (CE) Approved 7/6/2012

1: Restored length includes only streams within the conservation easement and excludes constructed ford and culvert crossing lengths within the easement.
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 Mitigation Project
DMS Project No.94903
Monitoring Year 0 - 2016

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	
	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

APPENDIX 2. Morphological Summary Data and Plots

Table 6a. Baseline Stream Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No.94903
Monitoring Year 0 - 2016

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

		PRE-RESTORATION CONDITION						REFERENCE REACH DATA		DESIGN						AS-BUILT/BASELINE					
Parameter	Gage	Little Pine Reach 1		Little Pine Reach 2a		Little Pine Reach 2b		Meadow Fork		Little Pine Reach 1		Little Pine Reach 2a		Little Pine Reach 2b		Little Pine Reach 1		Little Pine Reach 2a		Little Pine Reach 2b[2]	
		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)		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)	N/A	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	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)								---		---		---		---		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	0.2752	0.0101	0.0274	0.0055	0.0236
Pool Length (ft)	N/A							---		---		---		---		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)		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)	N/A	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%																					
SC%/Sa%/G%/C%/B%/Be%																					
d16/d35/d50/d84/d95/d100	N/A	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)		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)	N/A	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]		1,350[1]		1,025[1]		481	
Sinuosity		1.2		1.7		1.1		---		1.14		1.17		1.01		1.14		1.17		1.01	
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] Excludes 16 ft wide ford crossing
[2] Little Pine Reach 2b: Calculations only include reaches with a P1 or P2 approach

Table 6b. Baseline Stream Data Summary
Little Pine III Stream & Wetland Restoration Project
DMS Project No.94903
Monitoring Year 0 - 2016

UT2, UT2b

		PRE-RESTORATION CONDITION						REFERENCE REACH DATA		DESIGN						AS-BUILT/BASELINE					
Parameter	**Gage**	**UT2 Reach 1**		**UT2 Reach 2/3**		**UT2b**		**UT2a Reference**		**UT2 Reach 1 Lower**		**UT2 Reach 2**		**UT2b**		**UT2 Reach 1 Lower**		**UT2 Reach 2**		**UT2b[2]**	
		Min	**Max**	**Reach 2**	**Reach 3**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																					
Bankfull Width (ft)		4.9	9.7	6.1	7.0	8.3		12.6		9.0		11.6		5.9		8.1		8.9	12.8	6.7	
Floodprone Width (ft)		5.4	29.9	49.3	41.0	10.6		31.0		98		17	195	15	30	28.4		21.5	>200	15.9	
Bankfull Mean Depth		0.9	1.2	1.4	1.2	0.4		1.4		0.49		0.65		0.35		0.6		0.5	0.9	0.5	
Bankfull Max Depth		1.4		2.3	1.9	0.6		2.0		0.7		0.95		0.55		1.0		1.10	2.10	0.9	
Bankfull Cross-sectional Area (ft^2)	N/A	5.9	8.6	8.7	8.5	3.1		18.1		4.4		7.6		2.1		5.1		4.2	12.0	3.7	
Width/Depth Ratio		4.1	11.0	4.2	5.7	22.6		8.7		18.5		17.7		16.8		13.0		13.6	20.1	12.2	
Entrenchment Ratio		1.1	3.1	8.1	5.9	1.3		2.4		10.9		1.5	16.8	2.5	5.1	3.5		2.0	22.4	2.4	
Bank Height Ratio		2.6	3.2	1.0	1.2	5.8		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
D50 (mm)		10.7		15		16.0		---		---		---		---		56.9		44	53	43	
Profile																					
Riffle Length (ft)								---		---		---		---		10.7	25.0	16.8	29.3	4.4	23.0
Riffle Slope (ft/ft)		0.012	0.083	0.0327-0.063	0.0092-0.068	0.0178	0.081	0.0404	0.0517	0.0512	0.0681	0.026	0.046	0.0436	0.0750	0.0360	0.0853	0.0262	0.0575	0.0448	0.0659
Pool Length (ft)								---		---		---		---		5.0	22.3	13.3	46.3	3.1	14.3
Pool Max Depth (ft)	N/A	---		---		---		2.2	2.5	---		---		---		1.9	5.0	1.6	3.2	0.6	2.1
Pool Spacing (ft)		11.6	40.5	14-68	22-63	8	34	78		6.5	41.5	19	95	5	21	7	34	24	98	3	33
Pool Volume (ft^3)								---													
Pattern																					
Channel Beltwidth (ft)		---		49-52	120	N/A		---		---		45	68	---		---		61	66	---	
Radius of Curvature (ft)		---		10-48	8-27	N/A		---		---		29	39	---		---		19	63	---	
Rc:Bankfull Width (ft/ft)	N/A	---		1.6-7.9	1.1-3.9	N/A		---		---		2.5	3.4	---		---		2.1	4.9	---	
Meander Length (ft)		---		64-188	43-141	N/A		---		---		88	135	---		---		105	135	---	
Meander Width Ratio		---		8.0-8.5	17.1	N/A		---		---		3.9	5.9	---		---		7	5	---	
Substrate, Bed and Transport Parameters																					
Ri%/Ru%/P%/G%/S%																					
SC%/Sa%/G%/C%/B%/Be%																					
d16/d35/d50/d84/d95/d100	N/A	SC/5.9/10.7/21.5/36.7/90.0		SC/8.0/15/55.6/84.6/180.0		SC/11/16/52.6/128/180		---								0.25/11.0/27.6/96.0/143.4/256.0				0.78/28.5/41.6/85.0/123.3/180.0	
Reach Shear Stress (Competency) lb/ft^2		1.53		0.73		0.75				1.49		0.96		1.38		1.95		0.83	1.69	1.98	
Max part size (mm) mobilized at bankfull		208		121		123				208		148		193							
Stream Power (Capacity) W/m^2																					
Additional Reach Parameters																					
Drainage Area (SM)		0.12		0.29	0.31	0.030		0.12		0.12		0.31		0.03		0.12		0.31		0.03	
Watershed Impervious Cover Estimate (%)		<1%		<1%		<1%		<1%		<1%		<1%		<1%		<1%		<1%		<1%	
Rosgen Classification		A4		E4b	E4	F4b		A/B4/1		B4a		C4b		B4a		B4a		C4b		B4a	
Bankfull Velocity (fps)		2.3	3.4	4.0	4.1	3.2		---		4.5		4.6		4.7		4.1		2.7	4.3	5.1	
Bankfull Discharge (cfs)		20		35		10		20		20		35		10		20		35		10	
Q-NFF regression (2-yr)		---		---		---															
Q- NC Mountain Regional Curve (cfs)		21		44		7															
Q-USGS extrapolation (1.2-yr)	N/A	10		21		3															
Q-Mannings		35		43		8				---		---		---		21		11.2	51.0	18.7	
Valley Length (ft)		---		---		---		---		---		---		---		3,988				206	
Channel Thalweg Length (ft)		5,270				553		---		4,447[1]				241[2]		4,447[1]				241	
Sinuosity		1.1		1.3	2.1	1.1		---		1.05		1.20		1.04		1.05		1.2		1.04	
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 7a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Little Pine III Stream & Wetland Restoration Project

DMS Project No.94903

Monitoring Year 0 - 2016

	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 and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																		
Bankfull Width (ft)	30.3						30.6						33.5					
Floodprone Width (ft)	132.9						---						>200					
Bankfull Mean Depth (ft)	1.8						2.2						1.6					
Bankfull Max Depth (ft)	2.7						4.3						3.2					
Bankfull Cross-Sectional Area (ft^2)	53.5						68.0						52.2					
Bankfull Width/Depth Ratio	17.1						---						21.4					
Bankfull Entrenchment Ratio	4.4						---						6.0					
Bankfull Bank Height Ratio	1.0						---						0.8					
	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 and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																		
Bankfull Width (ft)	29.1						30.7						35.4					
Floodprone Width (ft)	>200						>200						---					
Bankfull Mean Depth (ft)	1.6						1.9						2.6					
Bankfull Max Depth (ft)	2.6						3.9						5.7					
Bankfull Cross-Sectional Area (ft^2)	46.6						56.9						93.4					
Bankfull Width/Depth Ratio	18.1						16.6						---					
Bankfull Entrenchment Ratio	6.9						6.5						---					
Bankfull Bank Height Ratio	1.0						1.0						---					
	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 and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																		
Bankfull Width (ft)	35.3						28.7						31.9					
Floodprone Width (ft)	---						>200						>200					
Bankfull Mean Depth (ft)	2.9						2.1						2.0					
Bankfull Max Depth (ft)	5.4						3.4						3.1					
Bankfull Cross-Sectional Area (ft^2)	103.7						58.8						64.2					
Bankfull Width/Depth Ratio	---						14.0						15.9					
Bankfull Entrenchment Ratio	---						7.0						6.3					
Bankfull Bank Height Ratio	---						1.0						1.0					

Table 7b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Little Pine III Stream & Wetland Restoration Project

DMS Project No.94903

Monitoring Year 0 - 2016

	Cross-Section 10, UT2b (Pool)						Cross-Section 11, UT2b (Riffle)						Cross-Section 12, UT2 Reach 1 Lower (Riffle					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																		
Bankfull Width (ft)	5.9						6.7						8.1					
Floodprone Width (ft)	---						15.9						28.4					
Bankfull Mean Depth (ft)	1.0						0.5						0.6					
Bankfull Max Depth (ft)	1.7						0.9						1.0					
Bankfull Cross-Sectional Area (ft^2)	5.7						3.7						5.1					
Bankfull Width/Depth Ratio	---						12.2						13.0					
Bankfull Entrenchment Ratio	---						2.4						3.5					
Bankfull Bank Height Ratio	---						1.0						1.0					
	Cross-Section 13, UT2 Reach 1 Lower (Pool)						**Cross-Section 14, UT2 Reach 2 (Riffle)**						**Cross-Section 15, UT2 Reach 2 (Pool)**					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																		
Bankfull Width (ft)	9.8						10.8						12.2					
Floodprone Width (ft)	---						21.5						---					
Bankfull Mean Depth (ft)	1.3						0.5						1.5					
Bankfull Max Depth (ft)	2.2						1.1						3.1					
Bankfull Cross-Sectional Area (ft^2)	12.8						5.9						18.7					
Bankfull Width/Depth Ratio	---						20.1						---					
Bankfull Entrenchment Ratio	---						2.0						---					
Bankfull Bank Height Ratio	---						1.0						---					
	Cross-Section 16, UT2 Reach 2 (Riffle)						**Cross-Section 17, UT2 Reach 2 (Riffle)**						**Cross-Section 18, UT2 Reach 2 (Pool)**					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																		
Bankfull Width (ft)	8.9						12.8						19.3					
Floodprone Width (ft)	>200						>200						---					
Bankfull Mean Depth (ft)	0.5						0.9						0.8					
Bankfull Max Depth (ft)	1.1						2.1						2.0					
Bankfull Cross-Sectional Area (ft^2)	4.2						12.0						15.8					
Bankfull Width/Depth Ratio	19.2						13.6						---					
Bankfull Entrenchment Ratio	22.4						15.7						---					
Bankfull Bank Height Ratio	1.0						1.0						---					

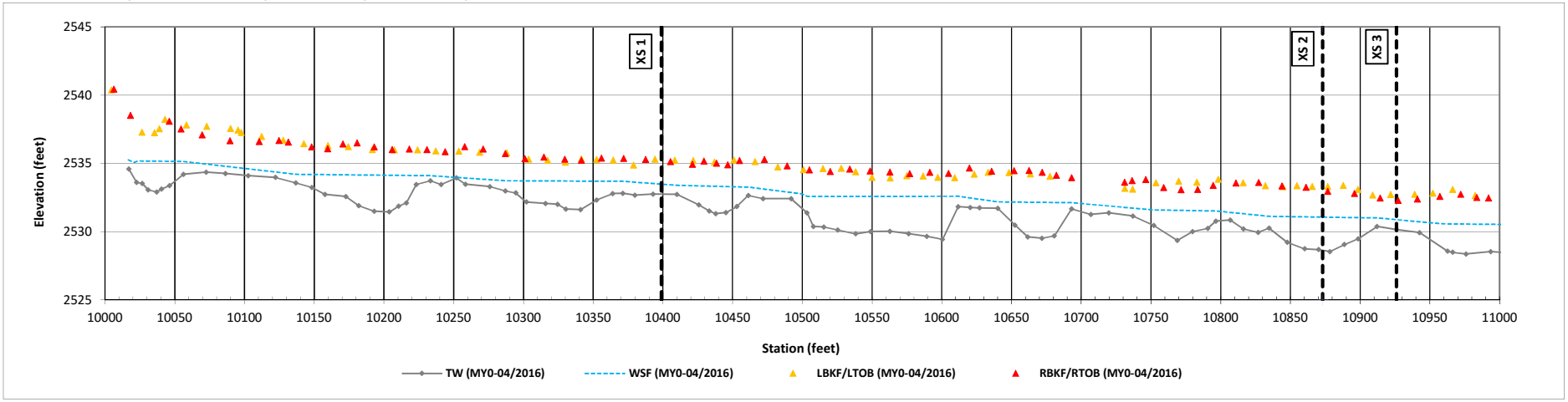
Longitudinal Profile Plots

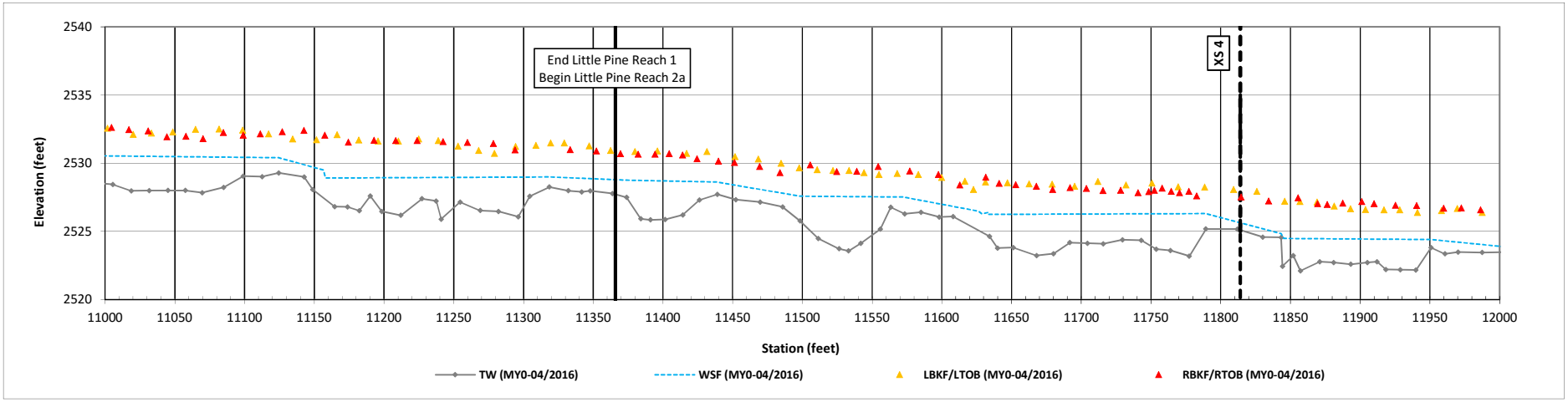
Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Little Pine Reach 1 (STA 100+00 - 113+66) and Reach 2a (113+66-124+07)





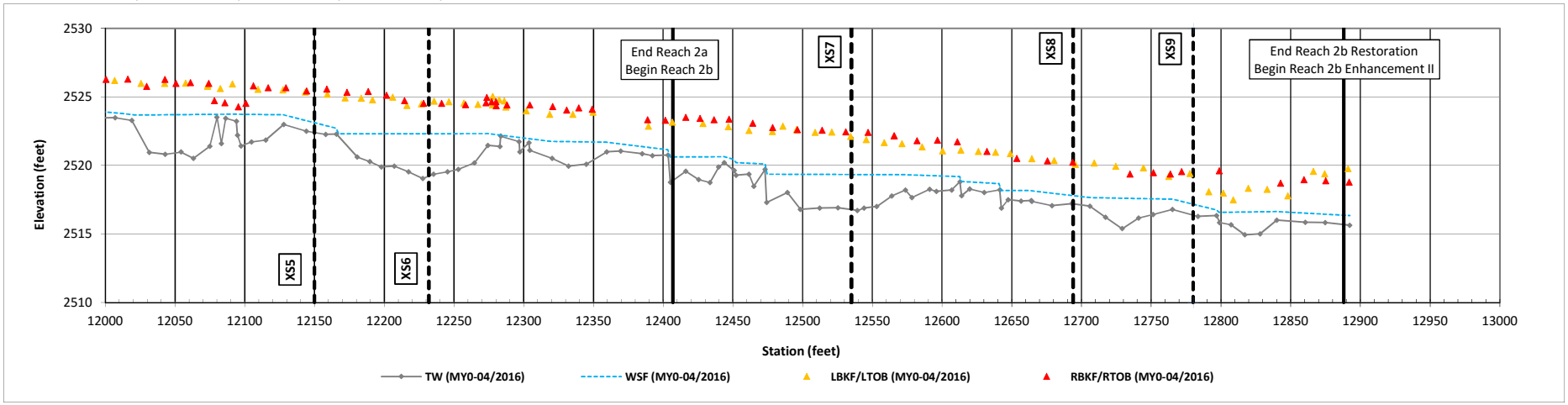
Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Little Pine Reach 2a (113+66-124+07) and Reach 2b (124+07-128+88)



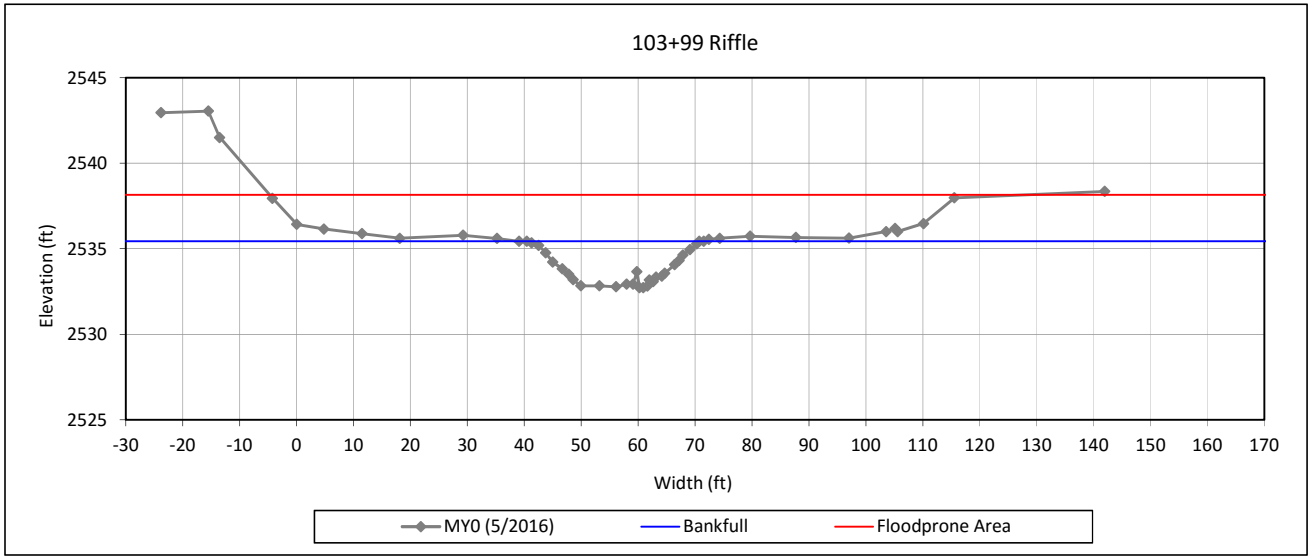
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 1- Little Pine Reach 1



Bankfull Dimensions	
53.5	x-section area (ft.sq.)
30.3	width (ft)
1.8	mean depth (ft)
2.7	max depth (ft)
32.1	wetted perimeter (ft)
1.7	hydraulic radius (ft)
17.1	width-depth ratio
132.9	W flood prone area (ft)
4.4	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

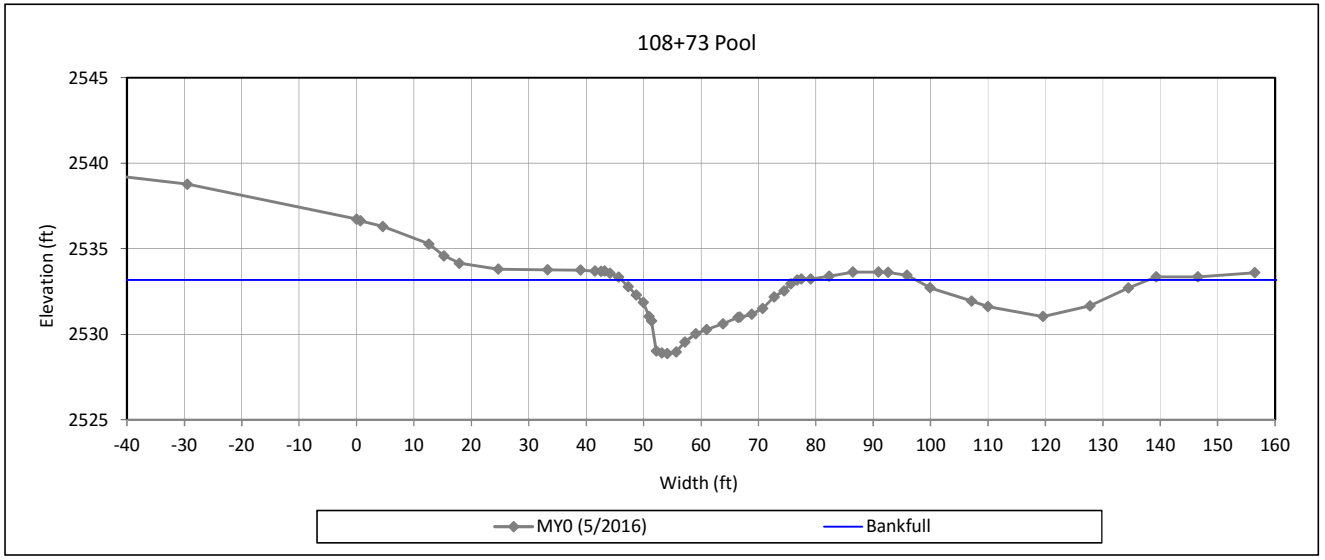
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 2- Little Pine Reach 1



Bankfull Dimensions	
68.0	x-section area (ft.sq.)
30.6	width (ft)
2.2	mean depth (ft)
4.3	max depth (ft)
32.8	wetted perimeter (ft)
2.1	hydraulic radius (ft)

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

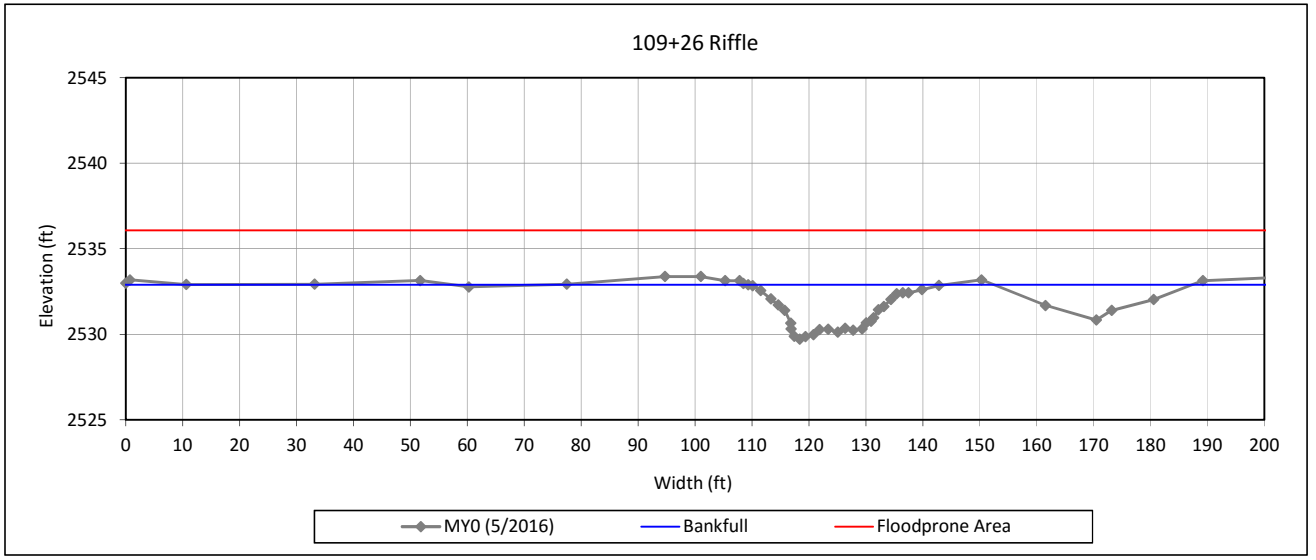
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 3- Little Pine Reach 1



Bankfull Dimensions	
52.2	x-section area (ft.sq.)
33.5	width (ft)
1.6	mean depth (ft)
3.2	max depth (ft)
34.9	wetted perimeter (ft)
1.5	hydraulic radius (ft)
21.4	width-depth ratio
>200	W flood prone area (ft)
6.0	entrenchment ratio
0.8	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

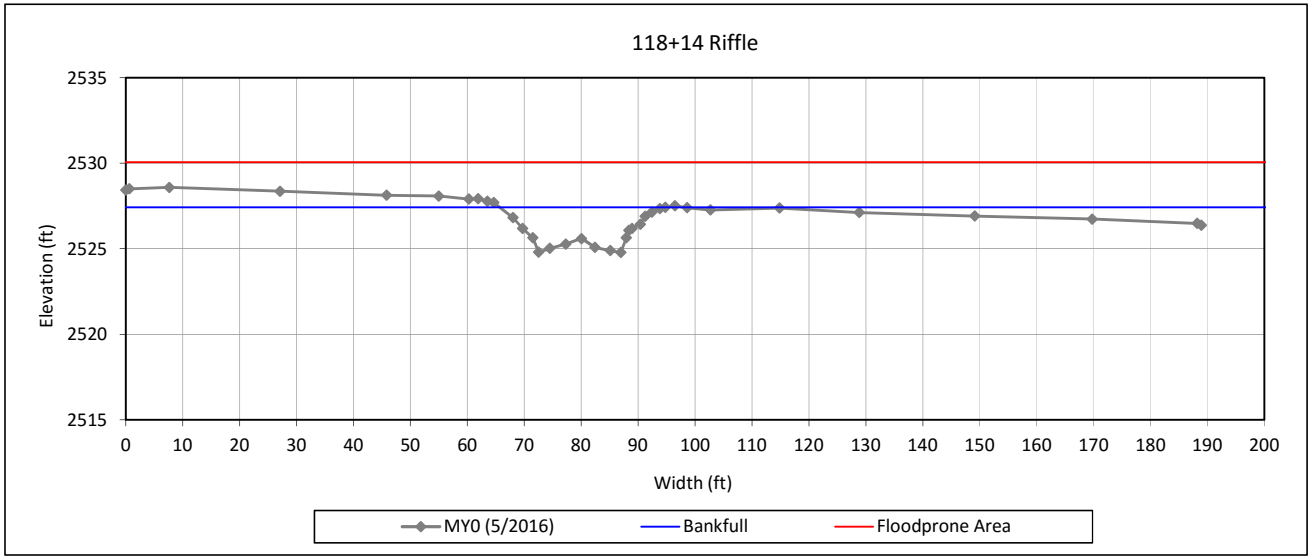
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 4 - Little Pine Reach 2a



Bankfull Dimensions	
46.6	x-section area (ft.sq.)
29.1	width (ft)
1.6	mean depth (ft)
2.6	max depth (ft)
30.4	wetted perimeter (ft)
1.5	hydraulic radius (ft)
18.1	width-depth ratio
>200	W flood prone area (ft)
6.9	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

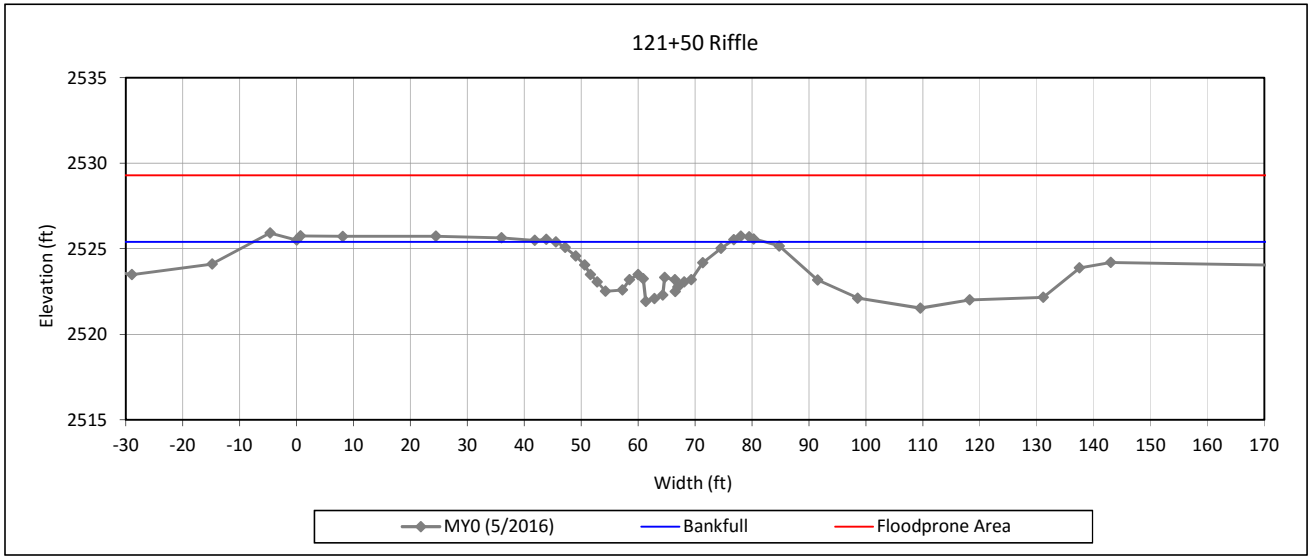
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 5- Little Pine Reach 2a



Bankfull Dimensions	
56.9	x-section area (ft.sq.)
30.7	width (ft)
1.9	mean depth (ft)
3.9	max depth (ft)
34.3	wetted perimeter (ft)
1.7	hydraulic radius (ft)
16.6	width-depth ratio
>200	W flood prone area (ft)
6.5	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

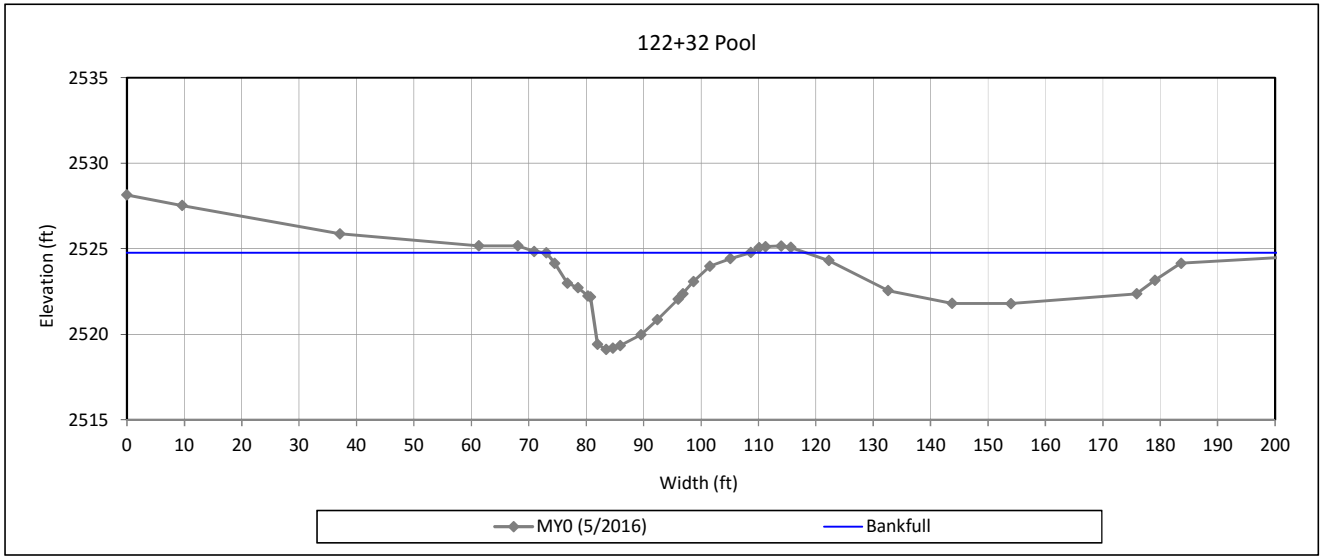
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 6- Little Pine Reach 2a



Bankfull Dimensions	
93.4	x-section area (ft.sq.)
35.4	width (ft)
2.6	mean depth (ft)
5.7	max depth (ft)
38.5	wetted perimeter (ft)
2.4	hydraulic radius (ft)

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

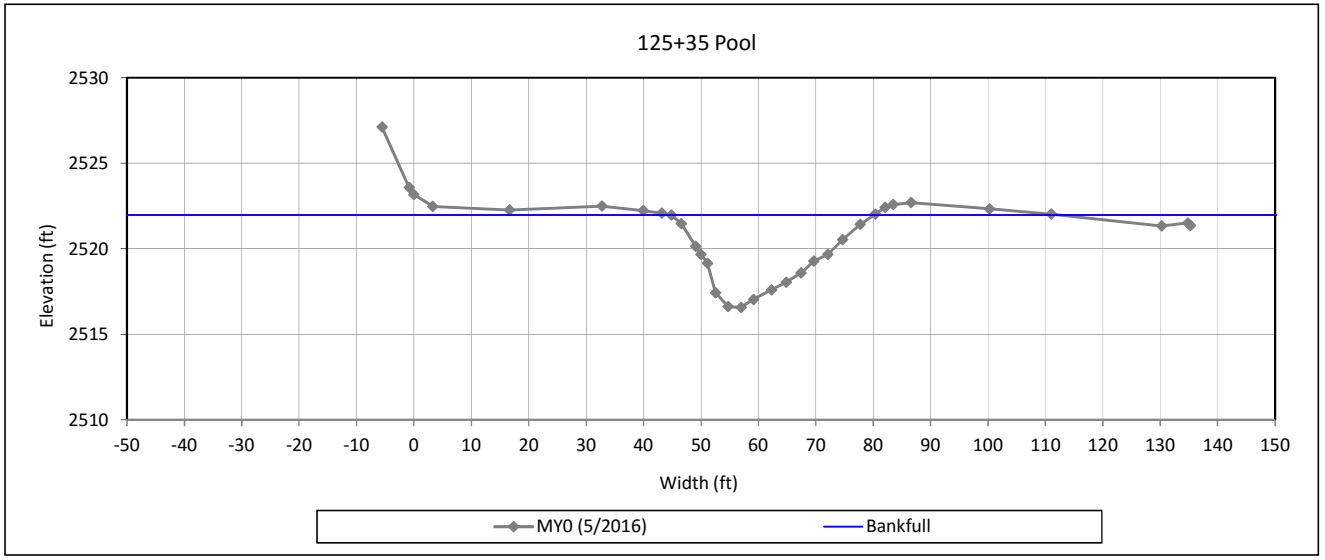
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 7 - Little Pine Reach 2b



Bankfull Dimensions	
103.7	x-section area (ft.sq.)
35.3	width (ft)
2.9	mean depth (ft)
5.4	max depth (ft)
37.6	wetted perimeter (ft)
2.8	hydraulic radius (ft)

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

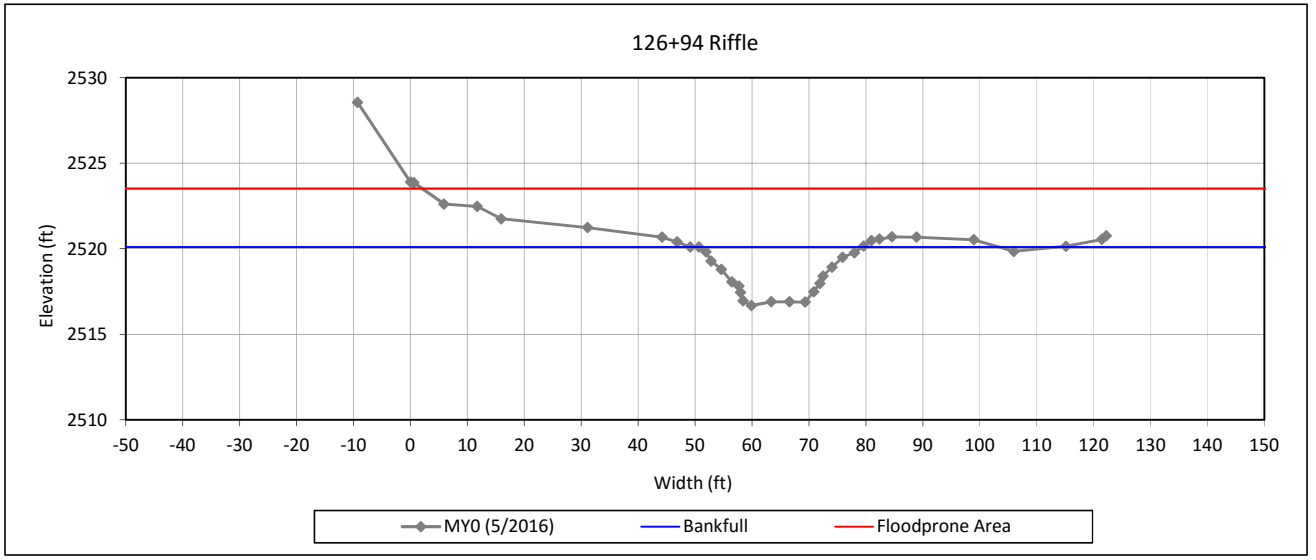
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 8 - Little Pine Reach 2b



Bankfull Dimensions	
58.8	x-section area (ft.sq.)
28.7	width (ft)
2.1	mean depth (ft)
3.4	max depth (ft)
30.1	wetted perimeter (ft)
2.0	hydraulic radius (ft)
14.0	width-depth ratio
>200	W flood prone area (ft)
7.0	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

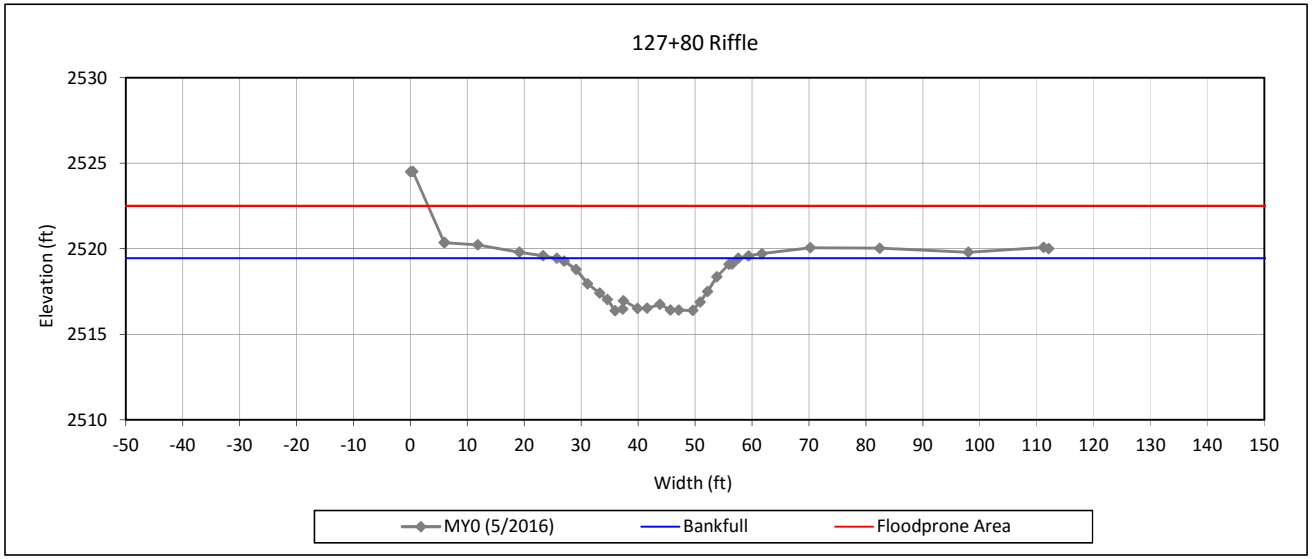
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 9 - Little Pine Reach 2b



Bankfull Dimensions	
64.2	x-section area (ft.sq.)
31.9	width (ft)
2.0	mean depth (ft)
3.1	max depth (ft)
33.5	wetted perimeter (ft)
1.9	hydraulic radius (ft)
15.9	width-depth ratio
>200	W flood prone area (ft)
6.3	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

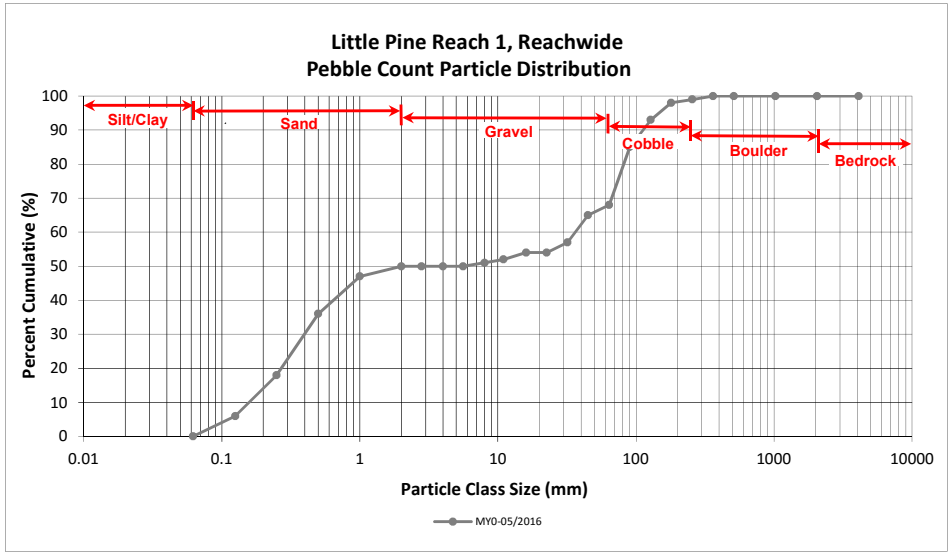
DMS Project No. 94903

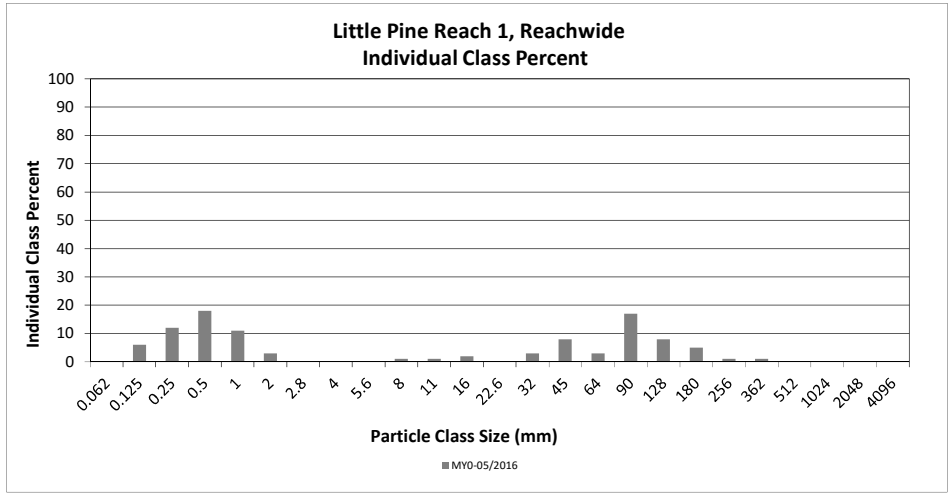
Monitoring Year 0 - 2016

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		6	6	6	6
	Fine	0.125	0.250	3	9	12	12	18
	Medium	0.25	0.50	1	17	18	18	36
	Coarse	0.5	1.0	2	9	11	11	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		1	1	1	51
	Medium	8.0	11.0		1	1	1	52
	Medium	11.0	16.0	1	1	2	2	54
	Coarse	16.0	22.6					54
	Coarse	22.6	32	3		3	3	57
	Very Coarse	32	45	8		8	8	65
	Very Coarse	45	64	3		3	3	68
COBBLE	Small	64	90	14	3	17	17	85
	Small	90	128	8		8	8	93
	Large	128	180	5		5	5	98
	Large	180	256	1		1	1	99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.22
D_{35} =	0.48
D_{50} =	2.0
D_{84} =	88.2
D_{95} =	146.7
D_{100} =	362.0





Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

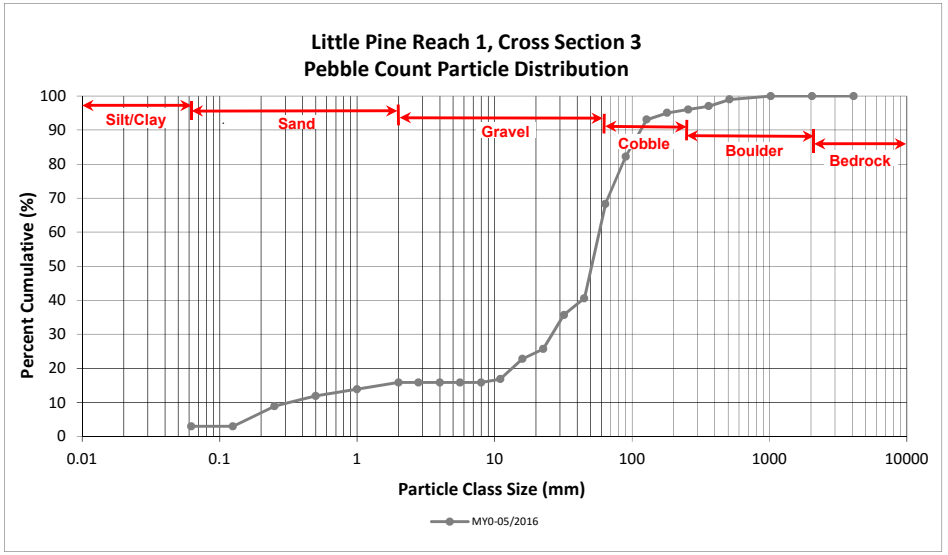
DMS Project No. 94903

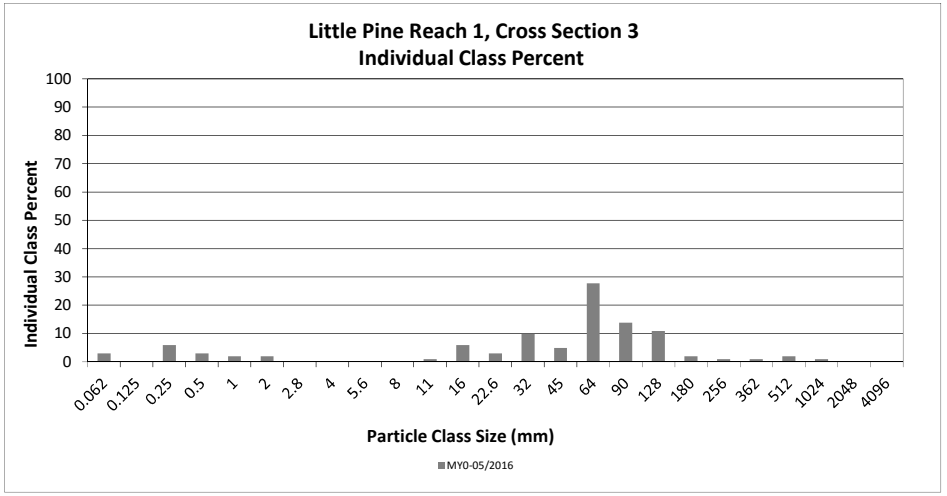
Monitoring Year 0 - 2016

Little Pine Reach 1, Cross Section 3

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	3	3
SAND	Very fine	0.062	0.125			3
	Fine	0.125	0.250	6	6	9
	Medium	0.25	0.50	3	3	12
	Coarse	0.5	1.0	2	2	14
	Very Coarse	1.0	2.0	2	2	16
GRAVEL	Very Fine	2.0	2.8			16
	Very Fine	2.8	4.0			16
	Fine	4.0	5.6			16
	Fine	5.6	8.0			16
	Medium	8.0	11.0	1	1	17
	Medium	11.0	16.0	6	6	23
	Coarse	16.0	22.6	3	3	26
	Coarse	22.6	32	10	10	36
	Very Coarse	32	45	5	5	41
	Very Coarse	45	64	28	28	68
COBBLE	Small	64	90	14	14	82
	Small	90	128	11	11	93
	Large	128	180	2	2	95
	Large	180	256	1	1	96
BOULDER	Small	256	362	1	1	97
	Small	362	512	2	2	99
	Medium	512	1024	1	1	100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**101**	**100**	**100**

Cross Section 3	
Channel materials (mm)	
D_{16} =	8.42
D_{35} =	31.28
D_{50} =	50.7
D_{84} =	95.5
D_{95} =	178.5
D_{100} =	1024.0





Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

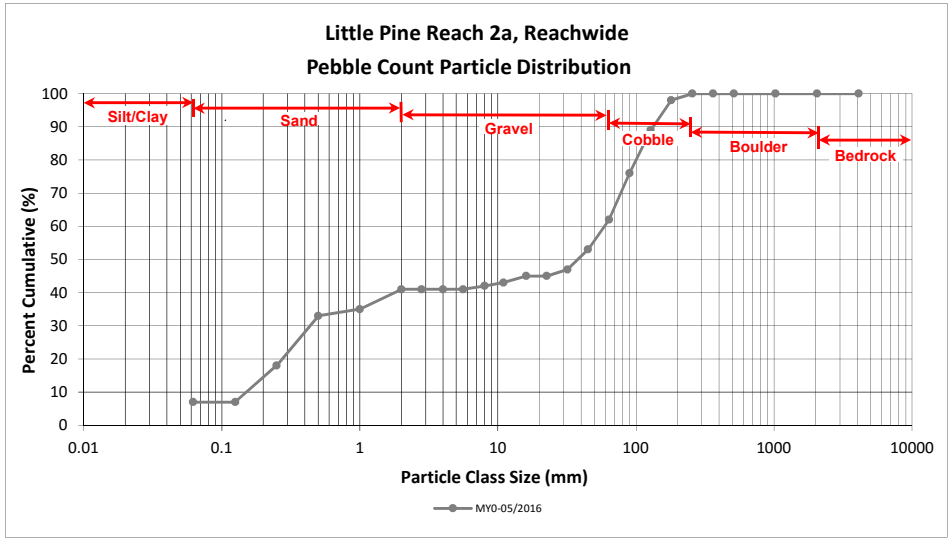
DMS Project No. 94903

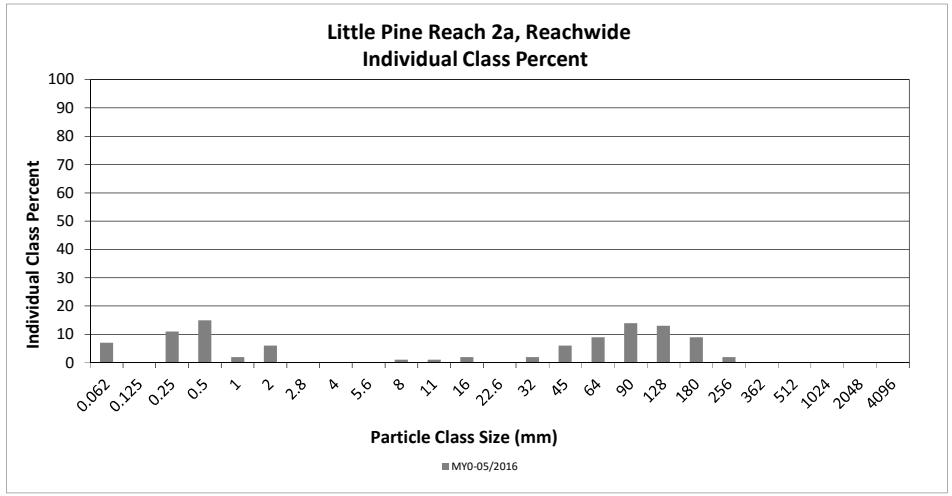
Monitoring Year 0 - 2016

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	5	7	7	7
SAND	Very fine	0.062	0.125					7
	Fine	0.125	0.250	3	8	11	11	18
	Medium	0.25	0.50	6	9	15	15	33
	Coarse	0.5	1.0	1	1	2	2	35
	Very Coarse	1.0	2.0	1	5	6	6	41
GRAVEL	Very Fine	2.0	2.8					41
	Very Fine	2.8	4.0					41
	Fine	4.0	5.6					41
	Fine	5.6	8.0		1	1	1	42
	Medium	8.0	11.0		1	1	1	43
	Medium	11.0	16.0		2	2	2	45
	Coarse	16.0	22.6					45
	Coarse	22.6	32	1	1	2	2	47
	Very Coarse	32	45	5	1	6	6	53
	Very Coarse	45	64	4	5	9	9	62
COBBLE	Small	64	90	11	3	14	14	76
	Small	90	128	8	5	13	13	89
	Large	128	180	7	2	9	9	98
	Large	180	256	1	1	2	2	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.22
D_{35} =	1.00
D_{50} =	37.9
D_{84} =	111.8
D_{95} =	160.7
D_{100} =	256.0





Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

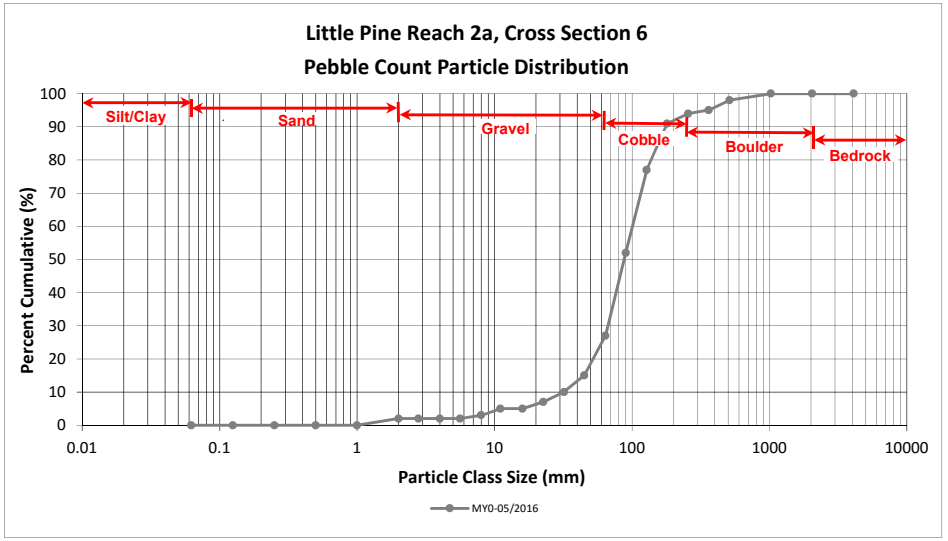
DMS Project No. 94903

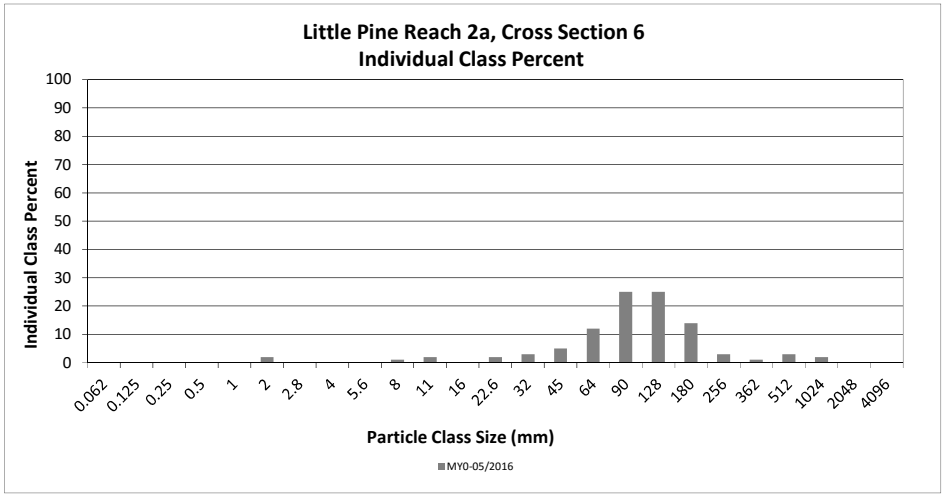
Monitoring Year 0 - 2016

Little Pine Reach 2a, Cross Section 6

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	2	2	2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6			2
	Fine	5.6	8.0	1	1	3
	Medium	8.0	11.0	2	2	5
	Medium	11.0	16.0			5
	Coarse	16.0	22.6	2	2	7
	Coarse	22.6	32	3	3	10
	Very Coarse	32	45	5	5	15
	Very Coarse	45	64	12	12	27
COBBLE	Small	64	90	25	25	52
	Small	90	128	25	25	77
	Large	128	180	14	14	91
	Large	180	256	3	3	94
BOULDER	Small	256	362	1	1	95
	Small	362	512	3	3	98
	Medium	512	1024	2	2	100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 6	
Channel materials (mm)	
D_{16} =	46.34
D_{35} =	71.38
D_{50} =	87.6
D_{84} =	151.8
D_{95} =	362.0
D_{100} =	1024.0





Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

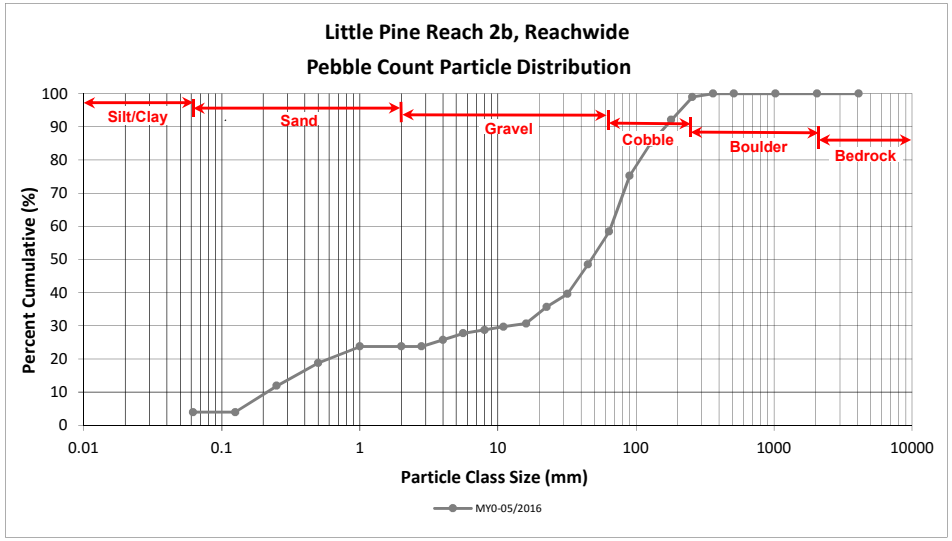
DMS Project No. 94903

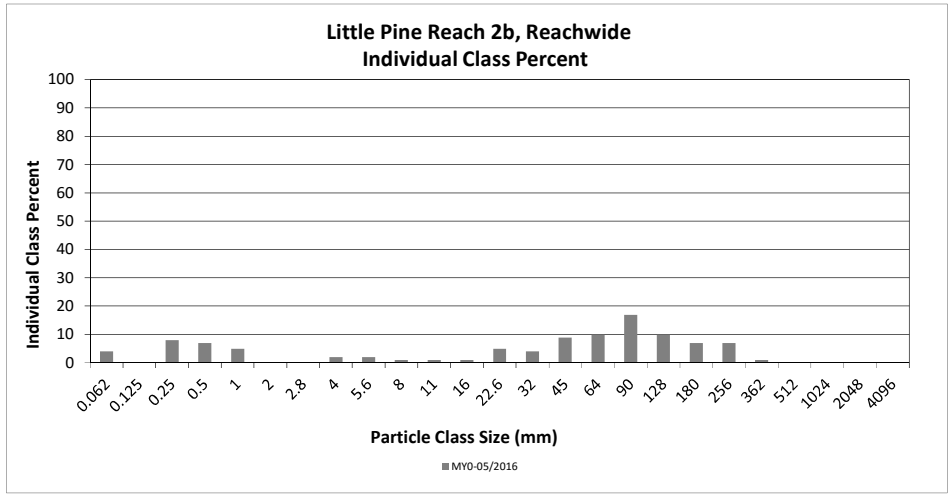
Monitoring Year 0 - 2016

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	1	3	4	4	4
SAND	Very fine	0.062	0.125					4
	Fine	0.125	0.250		8	8	8	12
	Medium	0.25	0.50	2	5	7	7	19
	Coarse	0.5	1.0		5	5	5	24
	Very Coarse	1.0	2.0					24
GRAVEL	Very Fine	2.0	2.8					24
	Very Fine	2.8	4.0	1	1	2	2	26
	Fine	4.0	5.6	1	1	2	2	28
	Fine	5.6	8.0		1	1	1	29
	Medium	8.0	11.0		1	1	1	30
	Medium	11.0	16.0		1	1	1	31
	Coarse	16.0	22.6	2	3	5	5	36
	Coarse	22.6	32	1	3	4	4	40
	Very Coarse	32	45	3	6	9	9	49
	Very Coarse	45	64	6	4	10	10	58
COBBLE	Small	64	90	8	9	17	17	75
	Small	90	128	5	5	10	10	85
	Large	128	180	4	3	7	7	92
	Large	180	256	5	2	7	7	99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**40**	**61**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.38
D_{35} =	21.61
D_{50} =	47.4
D_{84} =	122.9
D_{95} =	208.8
D_{100} =	362.0





Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

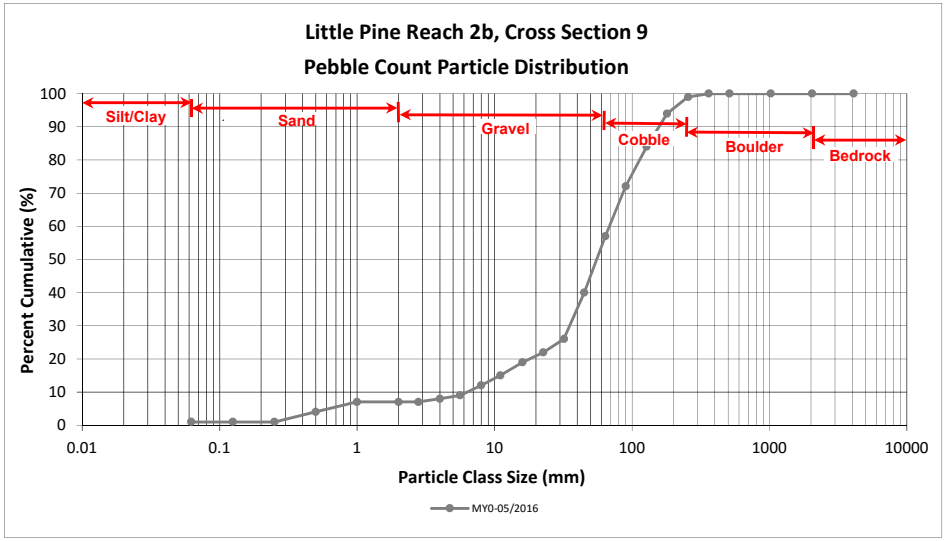
DMS Project No. 94903

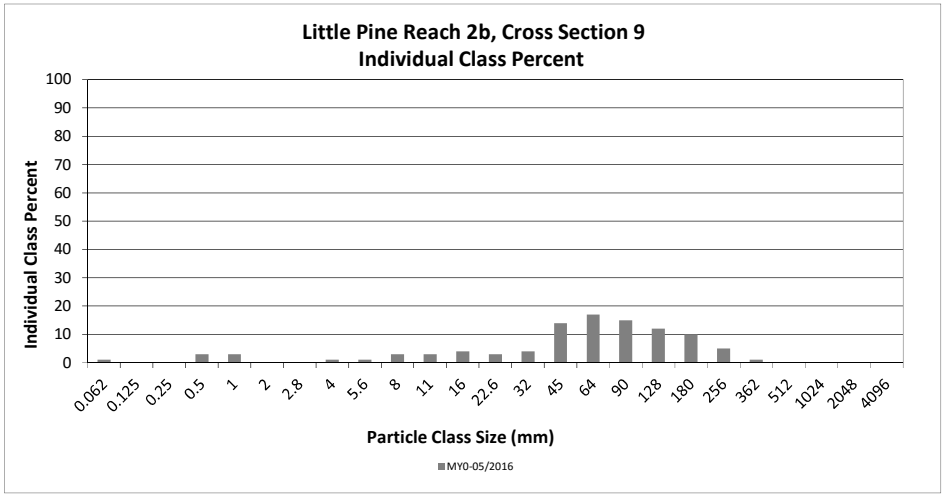
Monitoring Year 0 - 2016

Little Pine Reach 2b, Cross Section 9

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125			1
	Fine	0.125	0.250			1
	Medium	0.25	0.50	3	3	4
	Coarse	0.5	1.0	3	3	7
	Very Coarse	1.0	2.0			7
GRAVEL	Very Fine	2.0	2.8			7
	Very Fine	2.8	4.0	1	1	8
	Fine	4.0	5.6	1	1	9
	Fine	5.6	8.0	3	3	12
	Medium	8.0	11.0	3	3	15
	Medium	11.0	16.0	4	4	19
	Coarse	16.0	22.6	3	3	22
	Coarse	22.6	32	4	4	26
	Very Coarse	32	45	14	14	40
	Very Coarse	45	64	17	17	57
COBBLE	Small	64	90	15	15	72
	Small	90	128	12	12	84
	Large	128	180	10	10	94
	Large	180	256	5	5	99
BOULDER	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 9	
Channel materials (mm)	
D_{16} =	12.08
D_{35} =	39.84
D_{50} =	55.4
D_{84} =	128.0
D_{95} =	193.1
D_{100} =	362.0





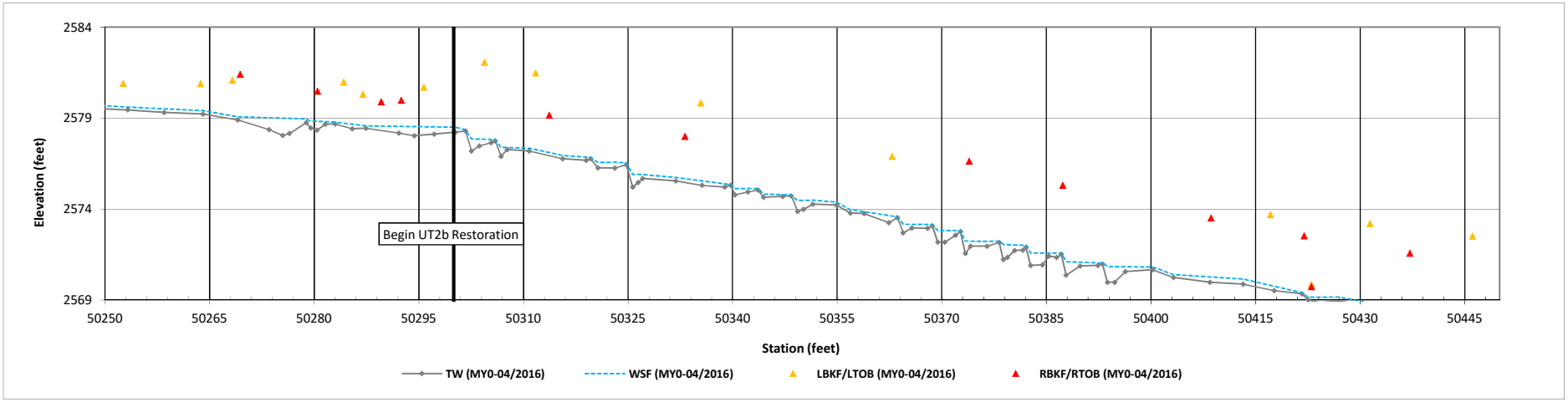
Longitudinal Profile Plots

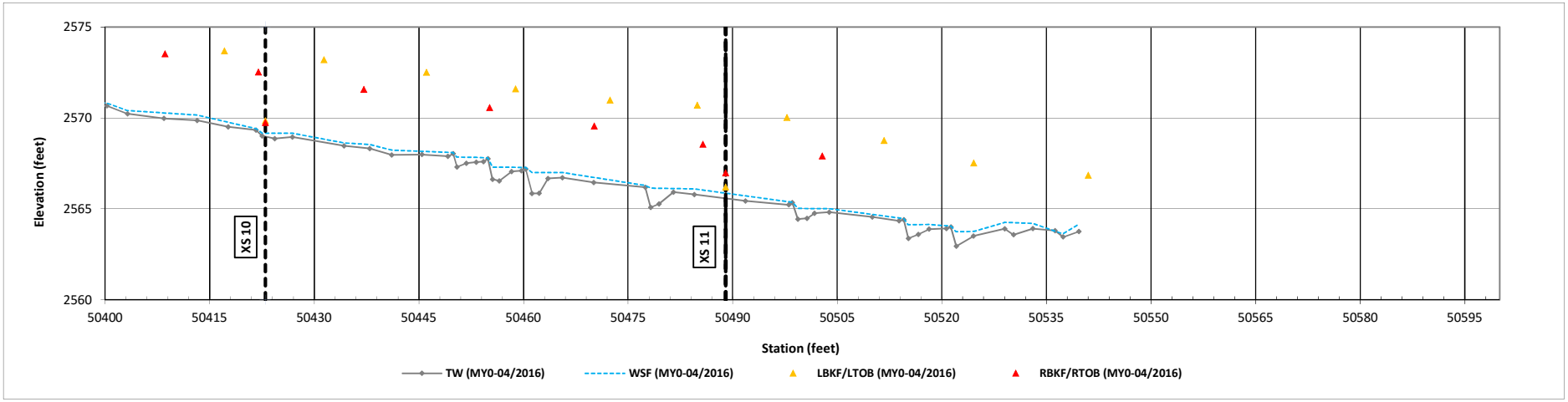
Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

UT2b (STA 503+00 - 505+41)





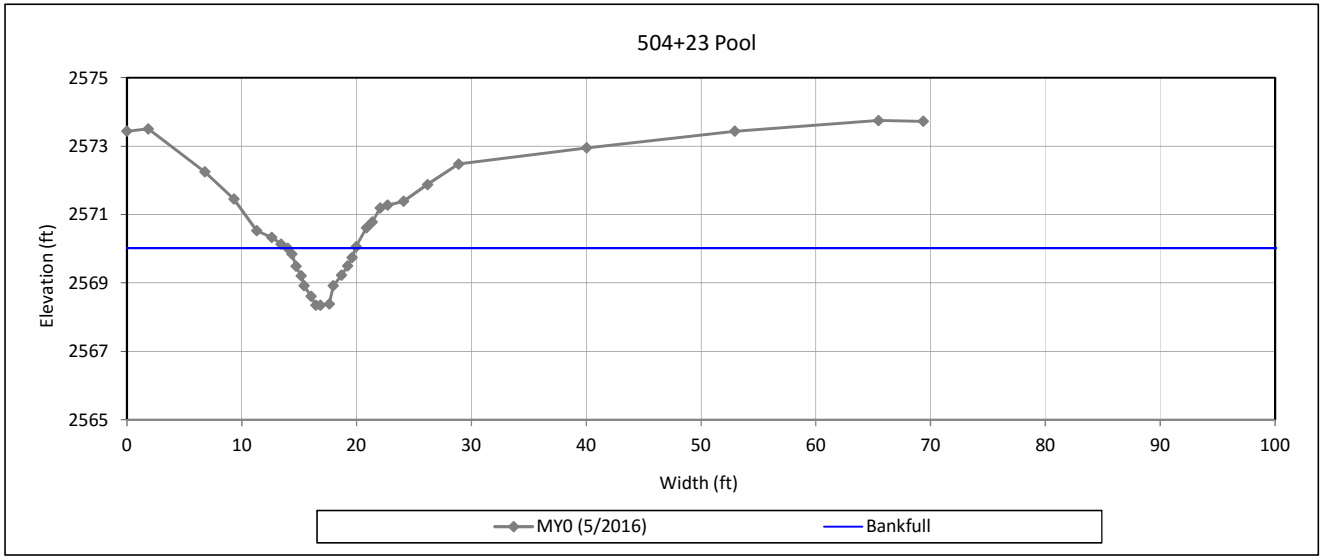
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 10 - UT2b



Bankfull Dimensions	
5.7	x-section area (ft.sq.)
5.9	width (ft)
1.0	mean depth (ft)
1.7	max depth (ft)
7.1	wetted perimeter (ft)
0.8	hydraulic radius (ft)
6.1	width-depth ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

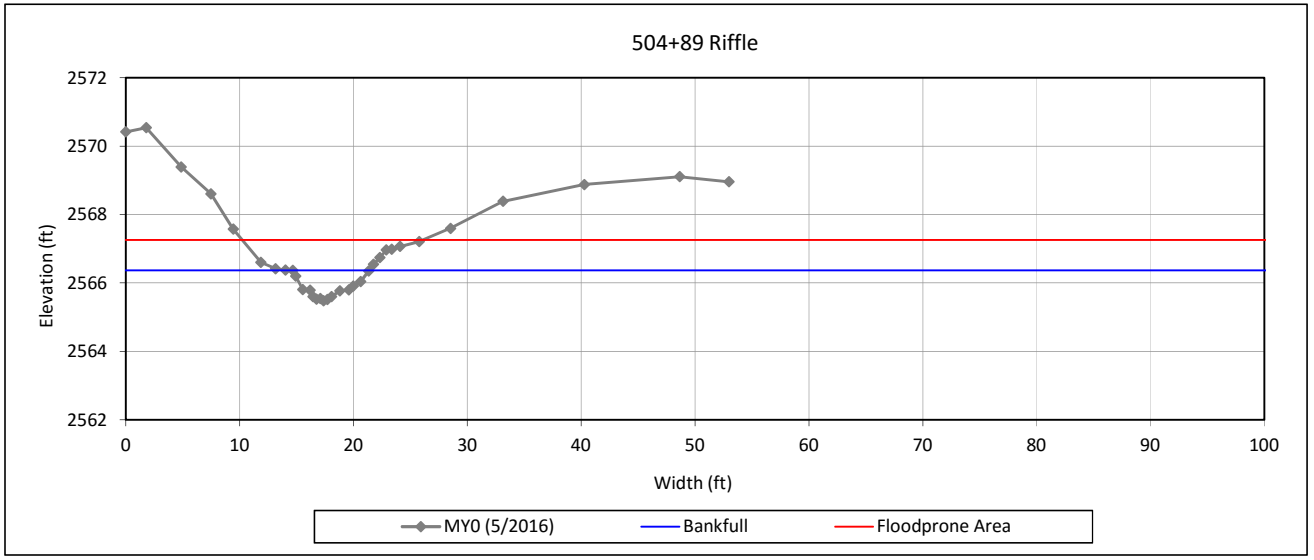
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 11 - UT2b



Bankfull Dimensions	
3.7	x-section area (ft.sq.)
6.7	width (ft)
0.5	mean depth (ft)
0.9	max depth (ft)
7.1	wetted perimeter (ft)
0.5	hydraulic radius (ft)
12.2	width-depth ratio
15.9	W flood prone area (ft)
2.4	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

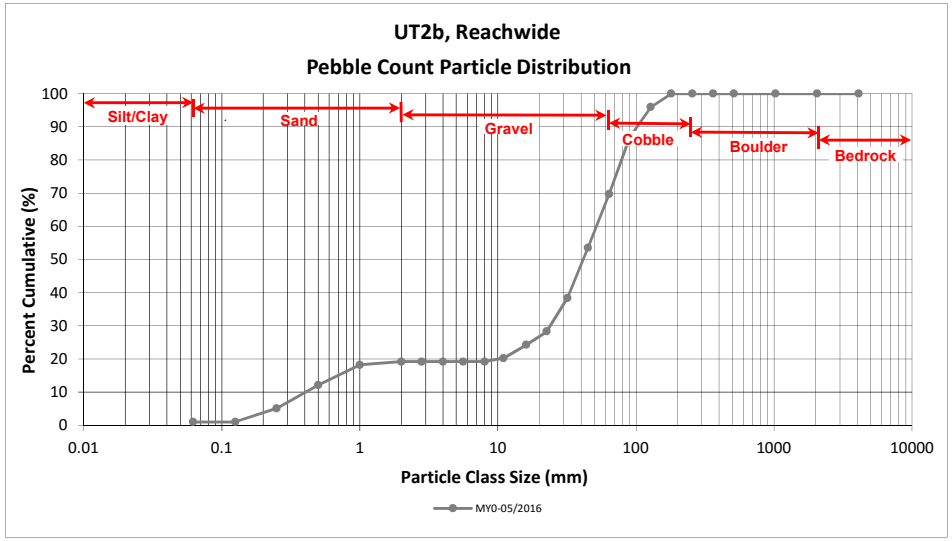
DMS Project No. 94903

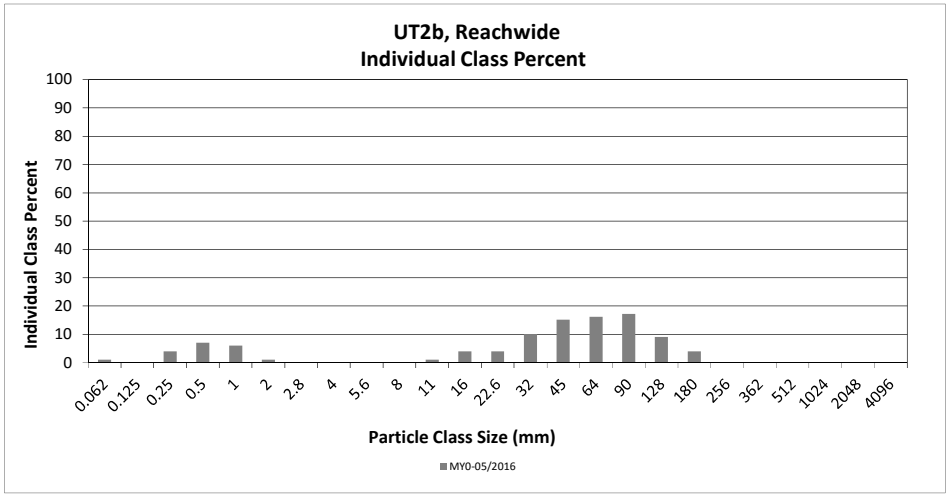
Monitoring Year 0 - 2016

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	1		1	1	1
SAND	Very fine	0.062	0.125					1
	Fine	0.125	0.250		4	4	4	5
	Medium	0.25	0.50	2	5	7	7	12
	Coarse	0.5	1.0	2	4	6	6	18
	Very Coarse	1.0	2.0	1		1	1	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					19
	Medium	8.0	11.0		1	1	1	20
	Medium	11.0	16.0	2	2	4	4	24
	Coarse	16.0	22.6	4		4	4	28
	Coarse	22.6	32	7	3	10	10	38
	Very Coarse	32	45	13	2	15	15	54
	Very Coarse	45	64	15	1	16	16	70
COBBLE	Small	64	90	13	4	17	17	87
	Small	90	128	5	4	9	9	96
	Large	128	180	4		4	4	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**69**	**30**	**99**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.78
D_{35} =	28.48
D_{50} =	41.6
D_{84} =	85.0
D_{95} =	123.3
D_{100} =	180.0





Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

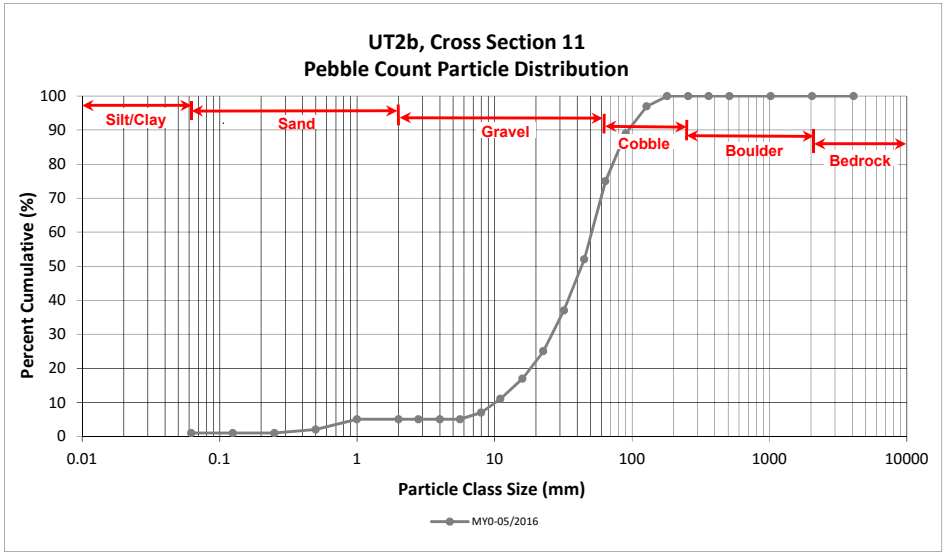
DMS Project No. 94903

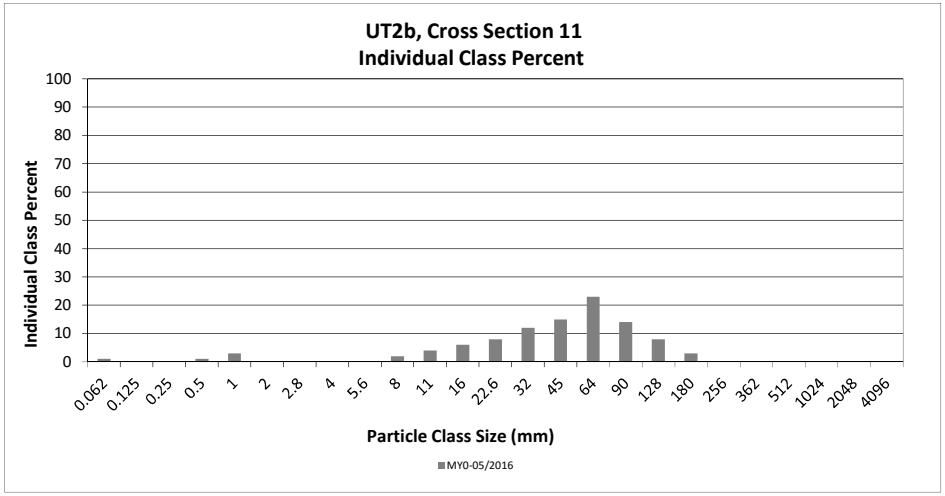
Monitoring Year 0 - 2016

UT2b, Cross Section 11

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	1
SAND	Very fine	0.062	0.125			1
	Fine	0.125	0.250			1
	Medium	0.25	0.50	1	1	2
	Coarse	0.5	1.0	3	3	5
	Very Coarse	1.0	2.0			5
GRAVEL	Very Fine	2.0	2.8			5
	Very Fine	2.8	4.0			5
	Fine	4.0	5.6			5
	Fine	5.6	8.0	2	2	7
	Medium	8.0	11.0	4	4	11
	Medium	11.0	16.0	6	6	17
	Coarse	16.0	22.6	8	8	25
	Coarse	22.6	32	12	12	37
	Very Coarse	32	45	15	15	52
	Very Coarse	45	64	23	23	75
COBBLE	Small	64	90	14	14	89
	Small	90	128	8	8	97
	Large	128	180	3	3	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 11	
Channel materials (mm)	
D_{16} =	15.03
D_{35} =	30.20
D_{50} =	43.0
D_{84} =	79.7
D_{95} =	117.2
D_{100} =	180.0





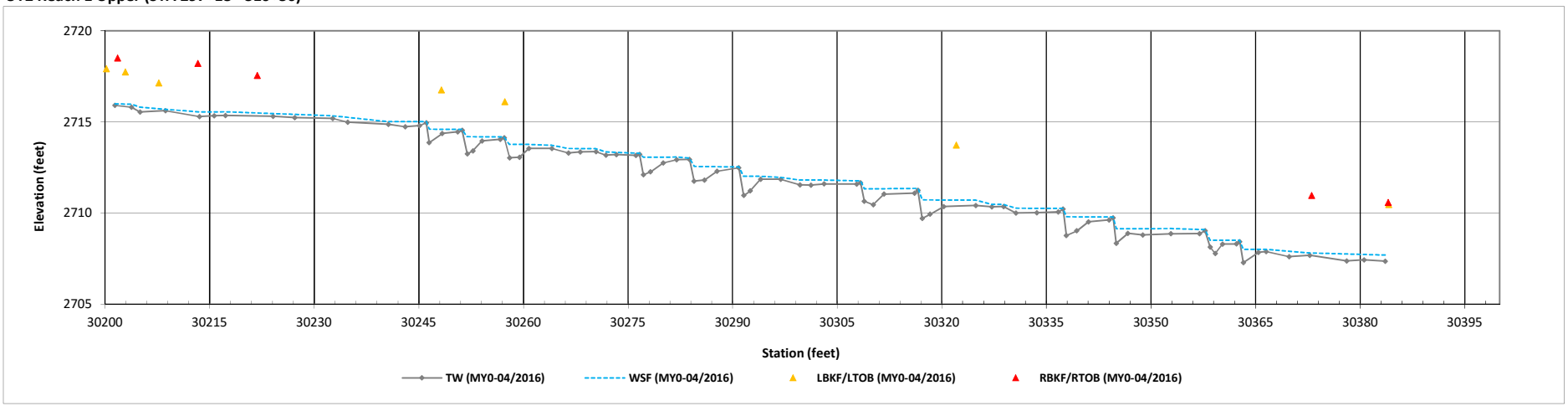
Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No.94903

Monitoring Year 0 - 2016

UT2 Reach 1 Upper (STA 297+18 - 310+50)



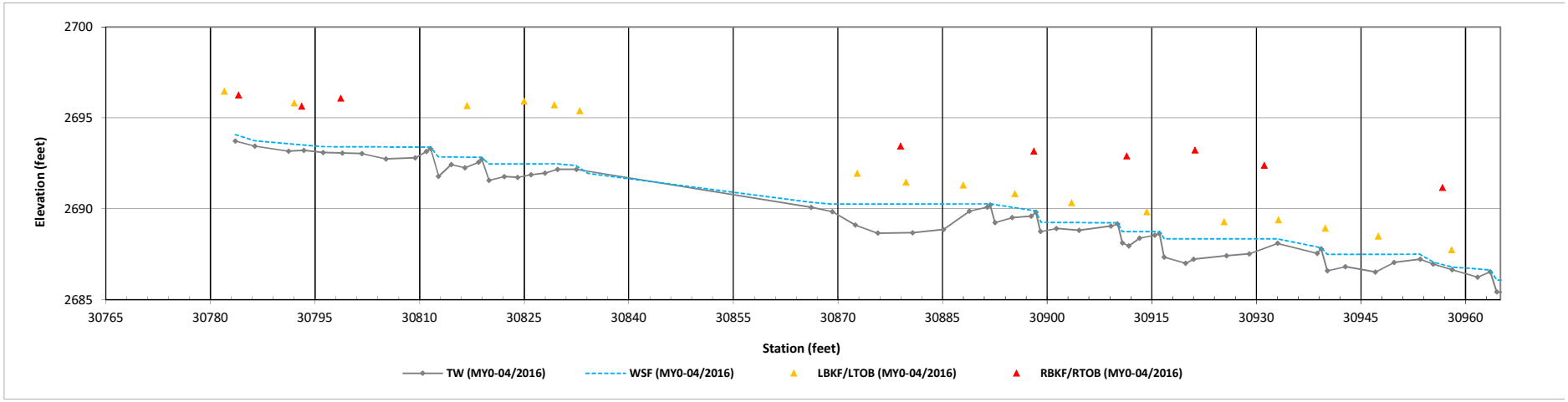
Longitudinal Profile Plots

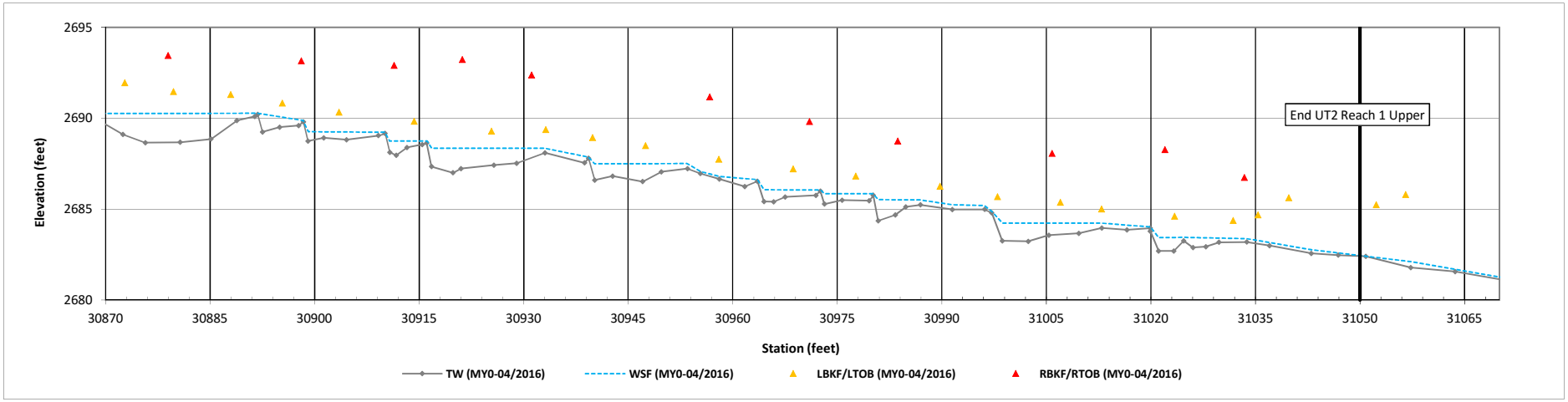
Little Pine III Stream & Wetland Restoration Project

DMS Project No.94903

Monitoring Year 0 - 2016

UT2 Reach 1 Upper (STA 297+18 - 310+50)





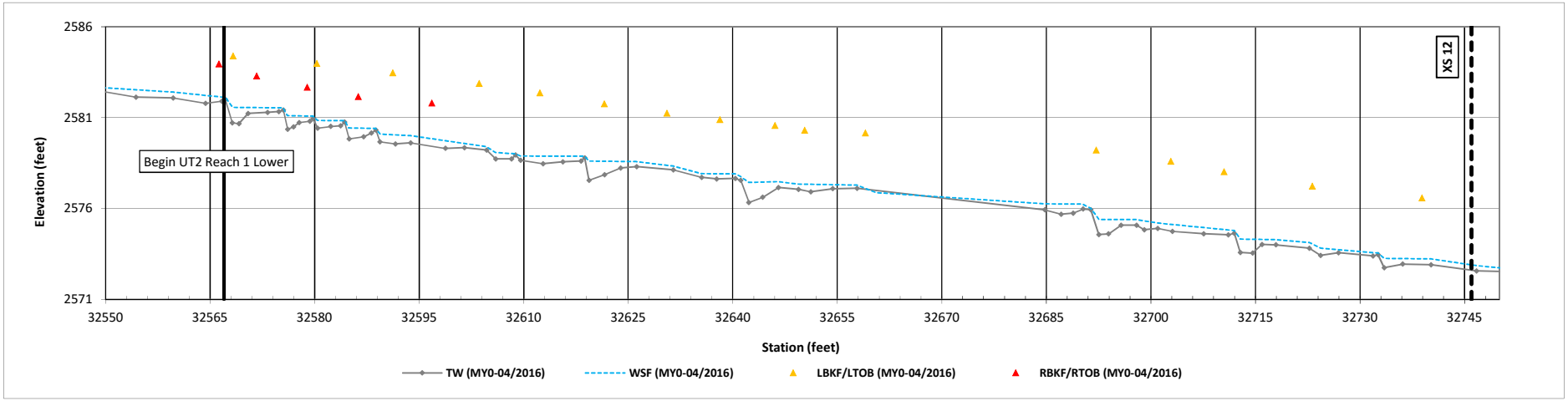
Longitudinal Profile Plots

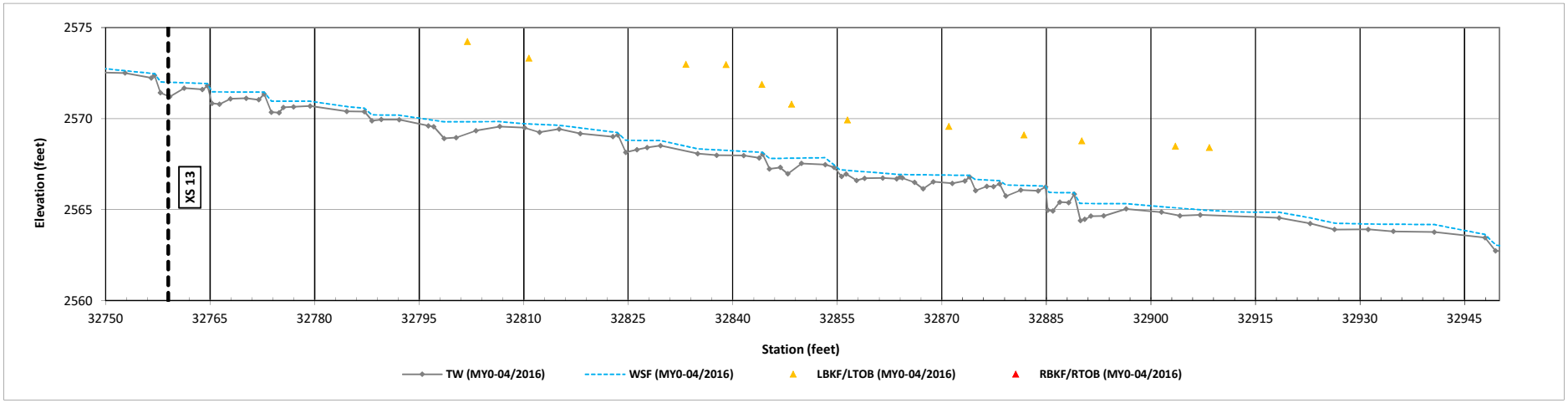
Little Pine III Stream & Wetland Restoration Project

DMS Project No.94903

Monitoring Year 0 - 2016

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





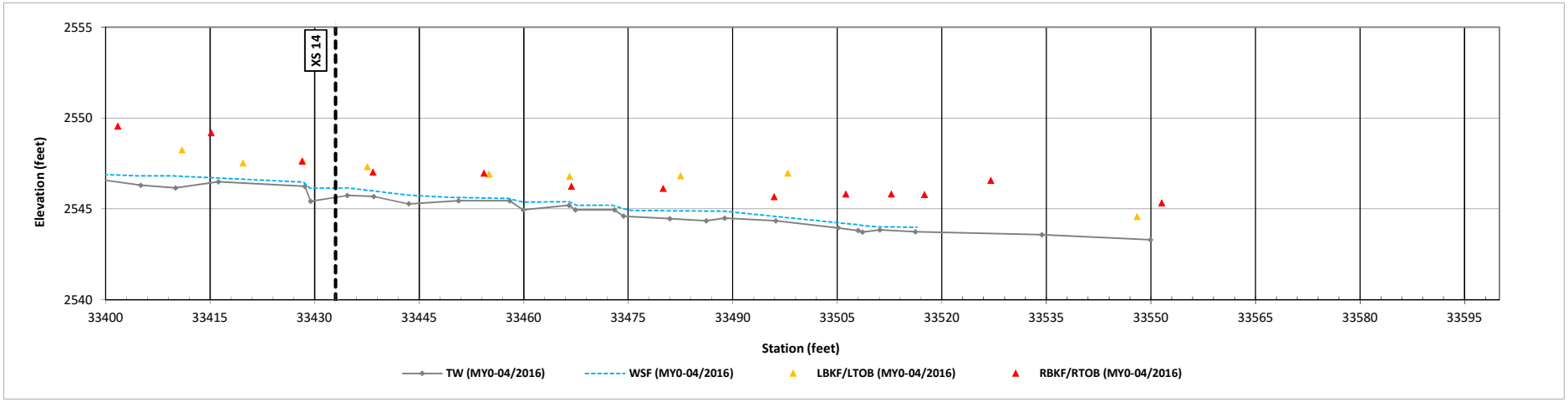
Longitudinal Profile Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No.94903

Monitoring Year 0 - 2016

UT2 Reach 2 (STA 330+00 - 342+61)



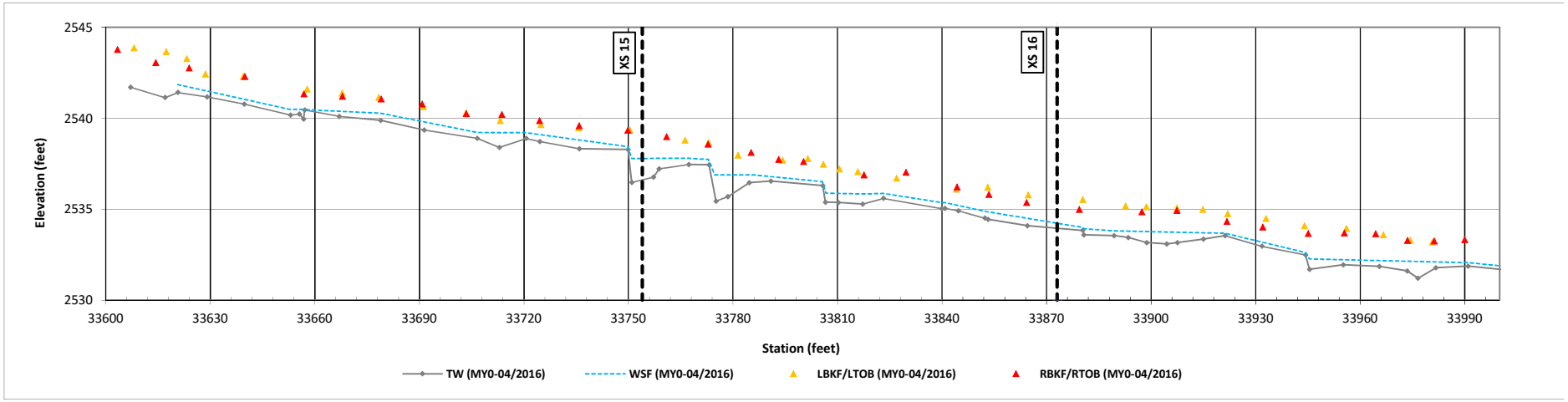
Longitudinal Profile Plots

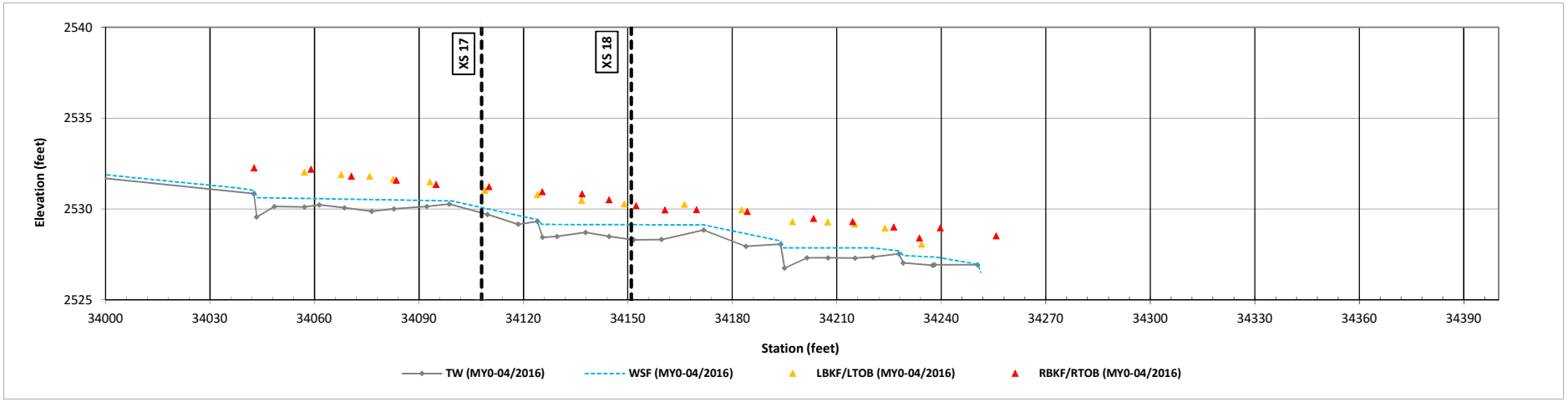
Little Pine III Stream & Wetland Restoration Project

DMS Project No.94903

Monitoring Year 0 - 2016

UT2 Reach 2 (STA 330+00 - 342+61)





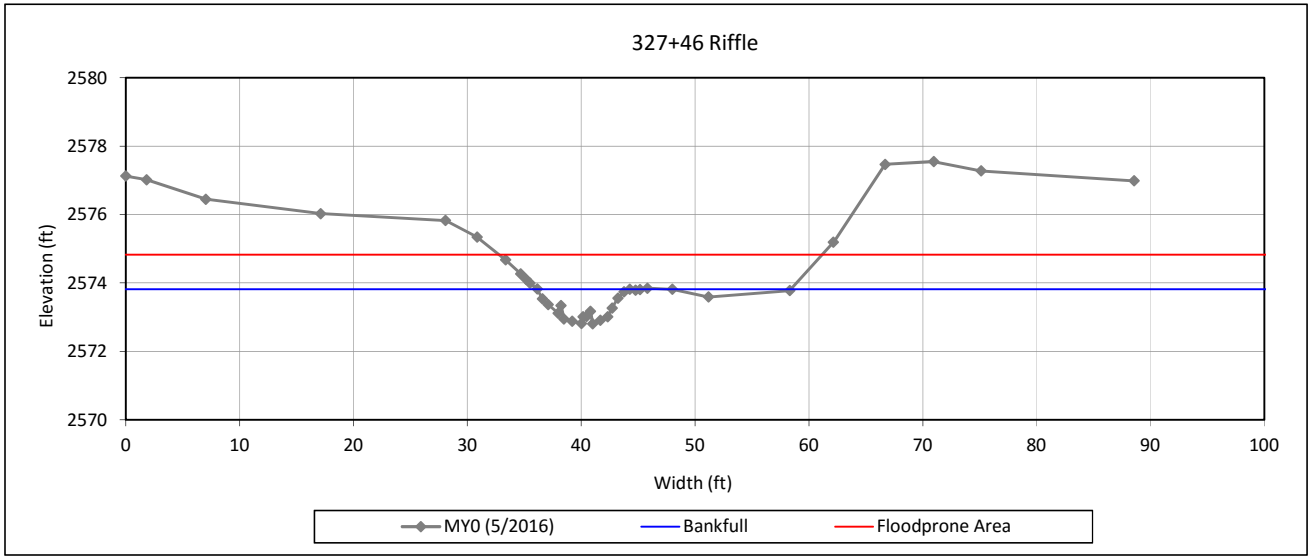
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 12 - UT2



Bankfull Dimensions	
5.1	x-section area (ft.sq.)
8.1	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
9.1	wetted perimeter (ft)
0.6	hydraulic radius (ft)
13.0	width-depth ratio
28.4	W flood prone area (ft)
3.5	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

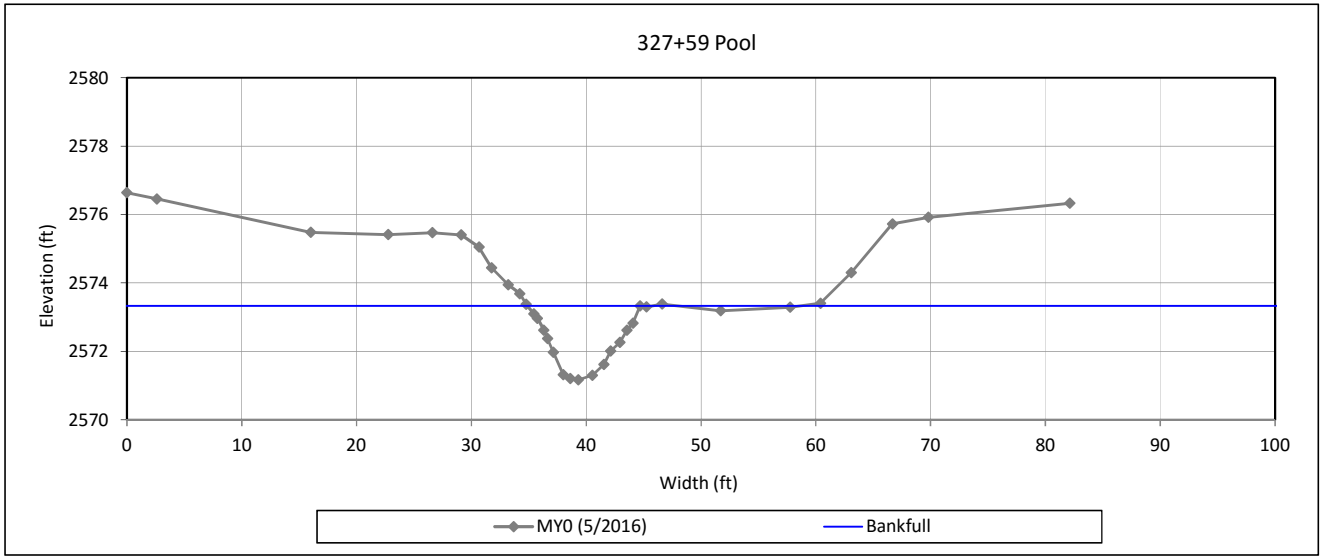
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 13 - UT2



Bankfull Dimensions	
12.8	x-section area (ft.sq.)
9.8	width (ft)
1.3	mean depth (ft)
2.2	max depth (ft)
11.0	wetted perimeter (ft)
1.2	hydraulic radius (ft)
7.5	width-depth ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

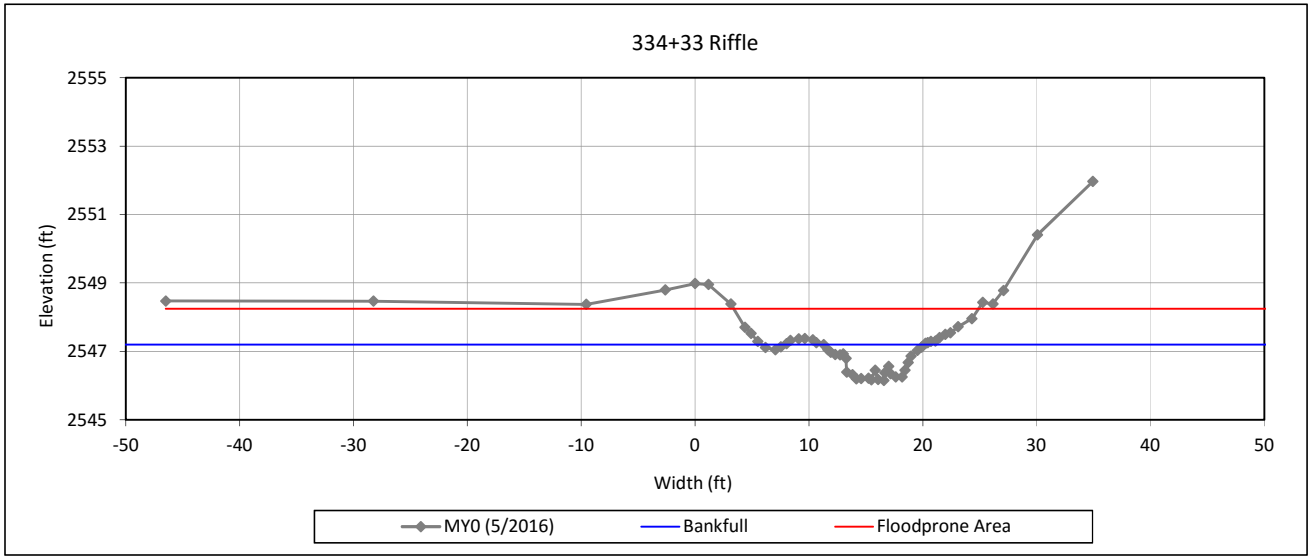
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 14 - UT2



Bankfull Dimensions	
5.9	x-section area (ft.sq.)
10.8	width (ft)
0.5	mean depth (ft)
1.1	max depth (ft)
12.1	wetted perimeter (ft)
0.5	hydraulic radius (ft)
20.1	width-depth ratio
21.5	W flood prone area (ft)
2.0	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

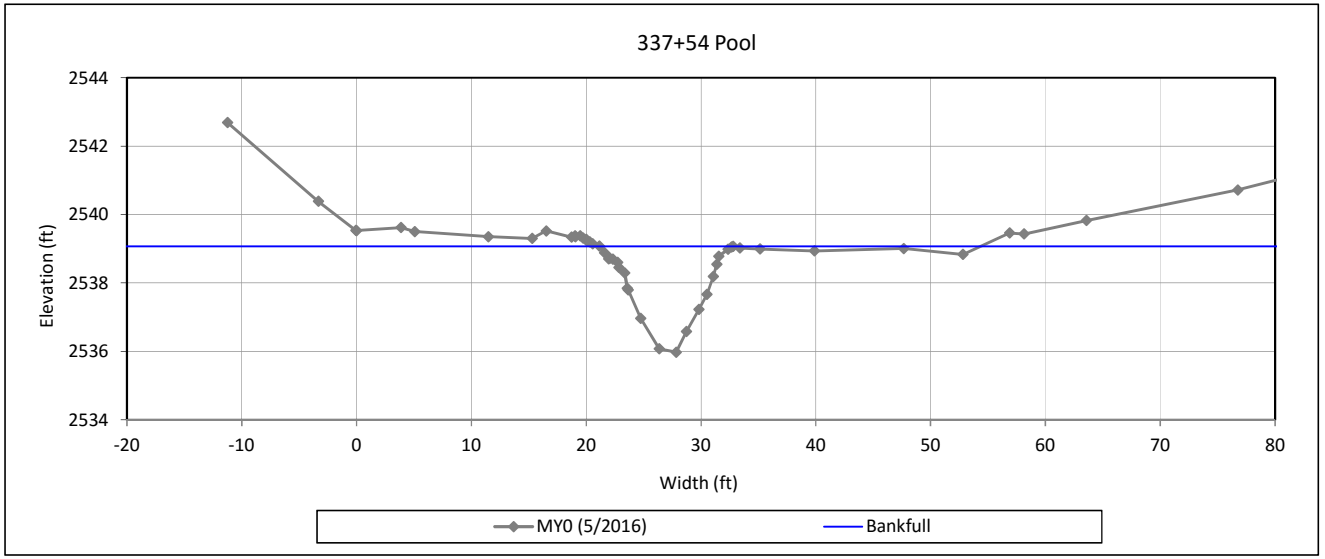
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 15 - UT2



Bankfull Dimensions	
18.7	x-section area (ft.sq.)
12.2	width (ft)
1.5	mean depth (ft)
3.1	max depth (ft)
14.2	wetted perimeter (ft)
1.3	hydraulic radius (ft)
8.0	width-depth ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

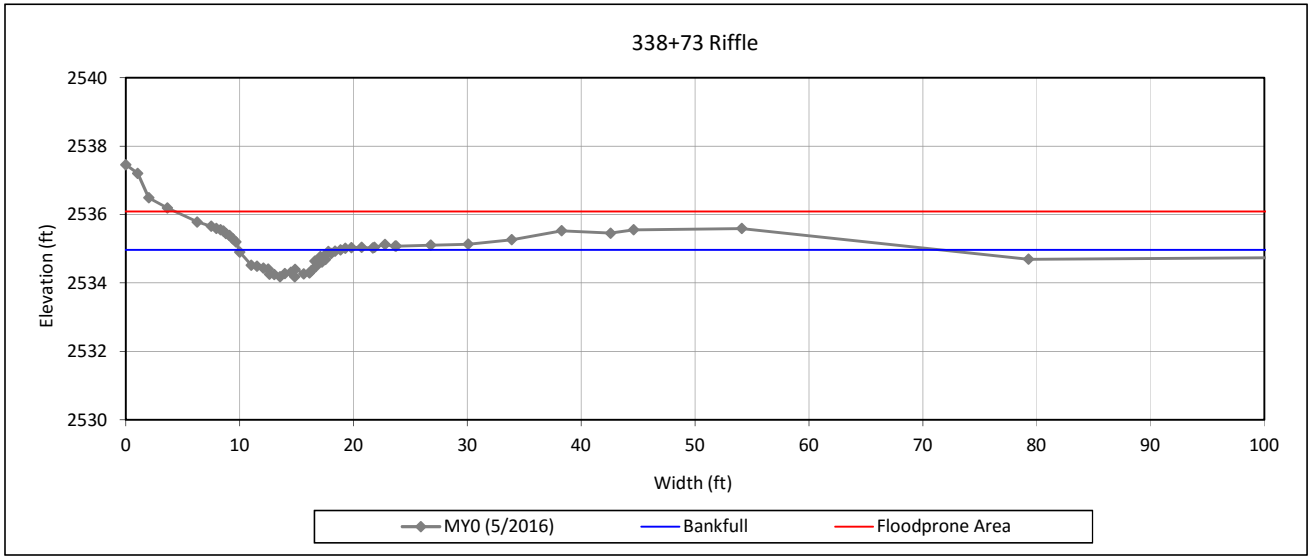
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 16 - UT2



Bankfull Dimensions	
4.2	x-section area (ft.sq.)
8.9	width (ft)
0.5	mean depth (ft)
1.1	max depth (ft)
10.1	wetted perimeter (ft)
0.4	hydraulic radius (ft)
19.2	width-depth ratio
>200	W flood prone area (ft)
22.4	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

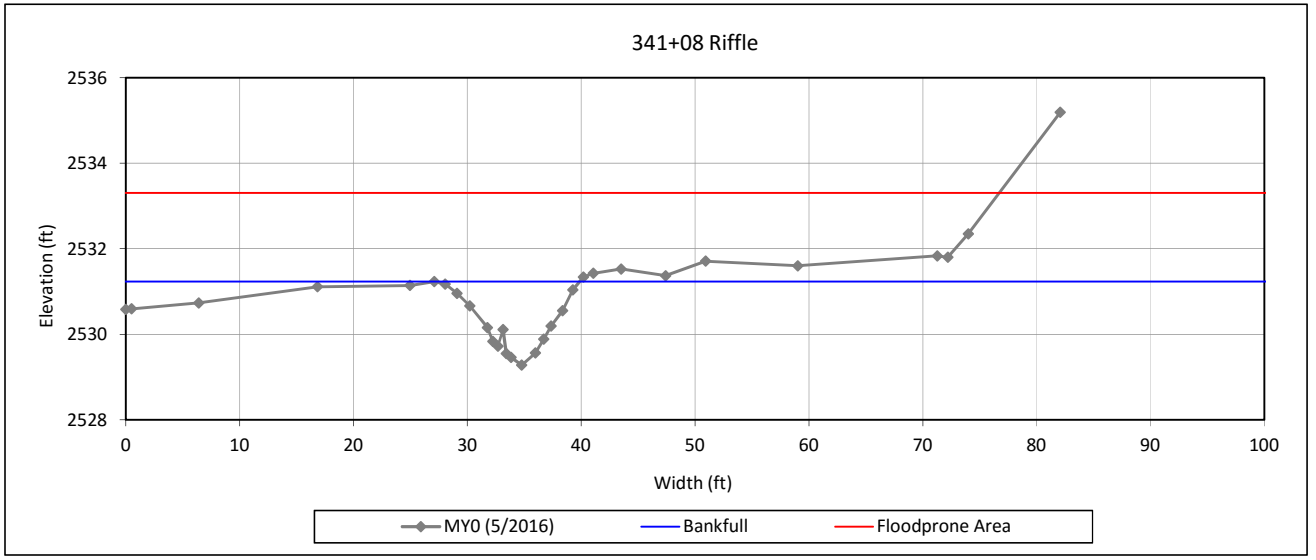
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 17 - UT2



Bankfull Dimensions	
12.0	x-section area (ft.sq.)
12.8	width (ft)
0.9	mean depth (ft)
2.1	max depth (ft)
13.9	wetted perimeter (ft)
0.9	hydraulic radius (ft)
13.6	width-depth ratio
>200	W flood prone area (ft)
15.7	entrenchment ratio
1.0	low bank height ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

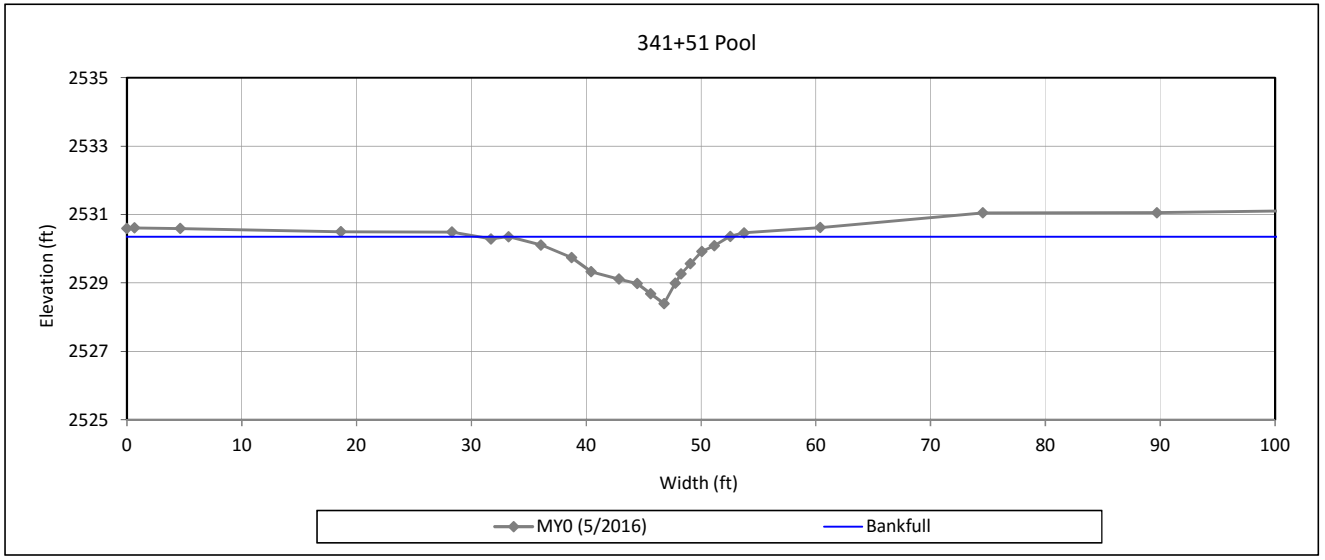
Cross Section Plots

Little Pine III Stream & Wetland Restoration Project

DMS Project No. 94903

Monitoring Year 0 - 2016

Cross Section 18 - UT2



Bankfull Dimensions	
15.8	x-section area (ft.sq.)
19.3	width (ft)
0.8	mean depth (ft)
2.0	max depth (ft)
19.8	wetted perimeter (ft)
0.8	hydraulic radius (ft)
23.6	width-depth ratio

Survey Date: 5/2016

Field Crew: Wildlands Engineering

View Downstream

Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

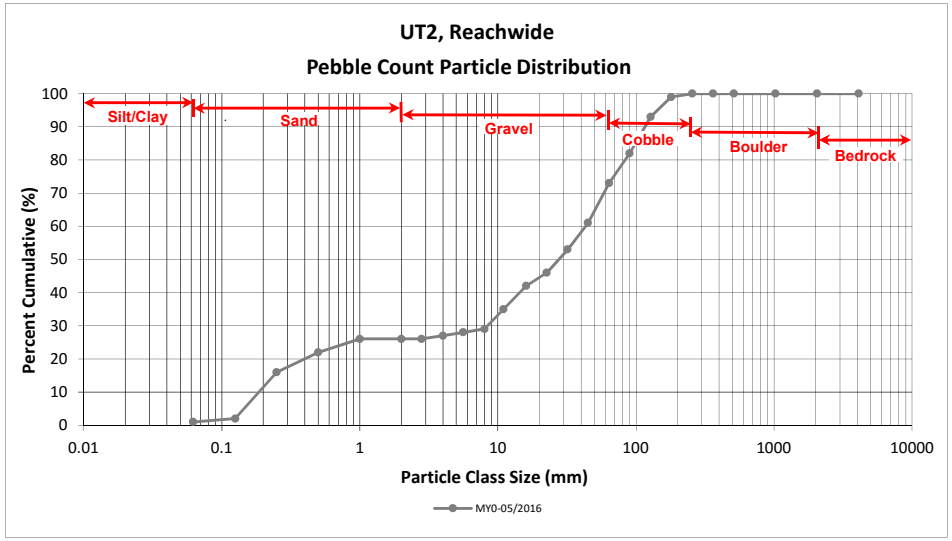
DMS Project No. 94903

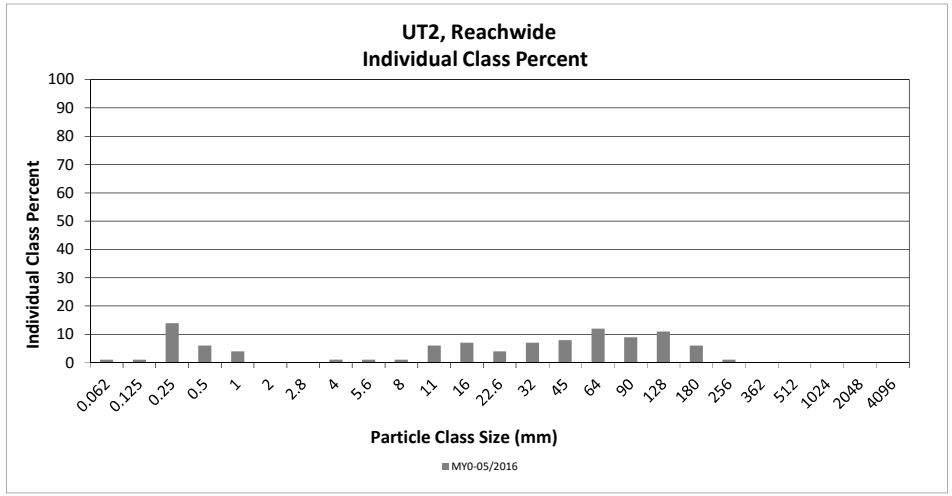
Monitoring Year 0 - 2016

UT2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1		1	1	1
SAND	Very fine	0.062	0.125		1	1	1	2
	Fine	0.125	0.250	4	10	14	14	16
	Medium	0.25	0.50	2	4	6	6	22
	Coarse	0.5	1.0	2	2	4	4	26
	Very Coarse	1.0	2.0					26
GRAVEL	Very Fine	2.0	2.8					26
	Very Fine	2.8	4.0	1		1	1	27
	Fine	4.0	5.6	1		1	1	28
	Fine	5.6	8.0		1	1	1	29
	Medium	8.0	11.0	3	3	6	6	35
	Medium	11.0	16.0	5	2	7	7	42
	Coarse	16.0	22.6	3	1	4	4	46
	Coarse	22.6	32	6	1	7	7	53
	Very Coarse	32	45	7	1	8	8	61
	Very Coarse	45	64	10	2	12	12	73
COBBLE	Small	64	90	8	1	9	9	82
	Small	90	128	11		11	11	93
	Large	128	180	5	1	6	6	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} =	0.25
D_{35} =	11.00
D_{50} =	27.6
D_{84} =	96.0
D_{95} =	143.4
D_{100} =	256.0





Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

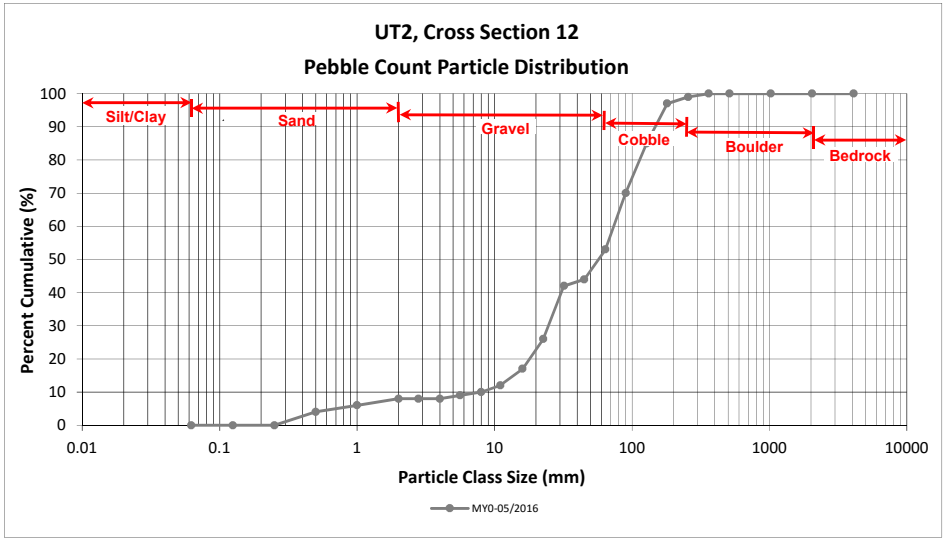
DMS Project No. 94903

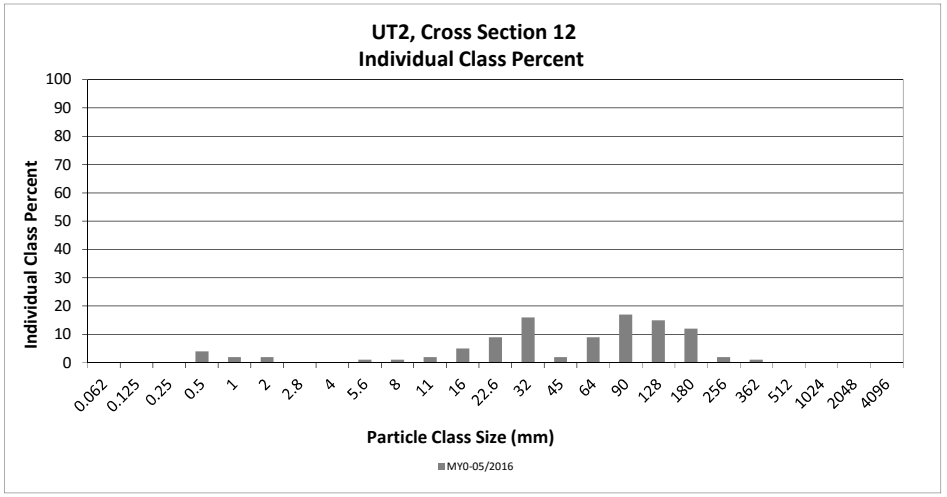
Monitoring Year 0 - 2016

UT2, Cross Section 12

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	4	4	4
	Coarse	0.5	1.0	2	2	6
	Very Coarse	1.0	2.0	2	2	8
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0			8
	Fine	4.0	5.6	1	1	9
	Fine	5.6	8.0	1	1	10
	Medium	8.0	11.0	2	2	12
	Medium	11.0	16.0	5	5	17
	Coarse	16.0	22.6	9	9	26
	Coarse	22.6	32	16	16	42
	Very Coarse	32	45	2	2	44
	Very Coarse	45	64	9	9	53
COBBLE	Small	64	90	17	17	70
	Small	90	128	15	15	85
	Large	128	180	12	12	97
	Large	180	256	2	2	99
BOULDER	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 12	
Channel materials (mm)	
D_{16} =	14.84
D_{35} =	27.48
D_{50} =	56.9
D_{84} =	125.0
D_{95} =	170.1
D_{100} =	362.0





Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

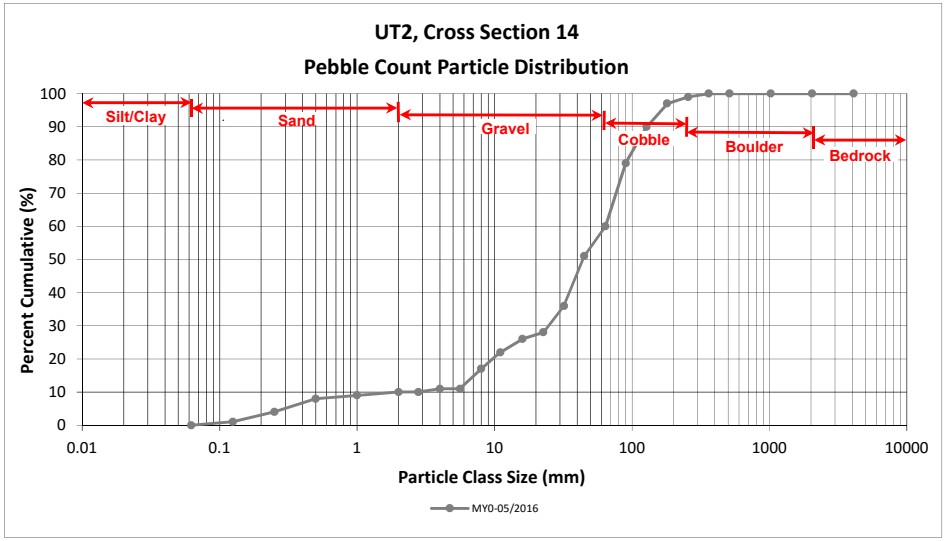
DMS Project No. 94903

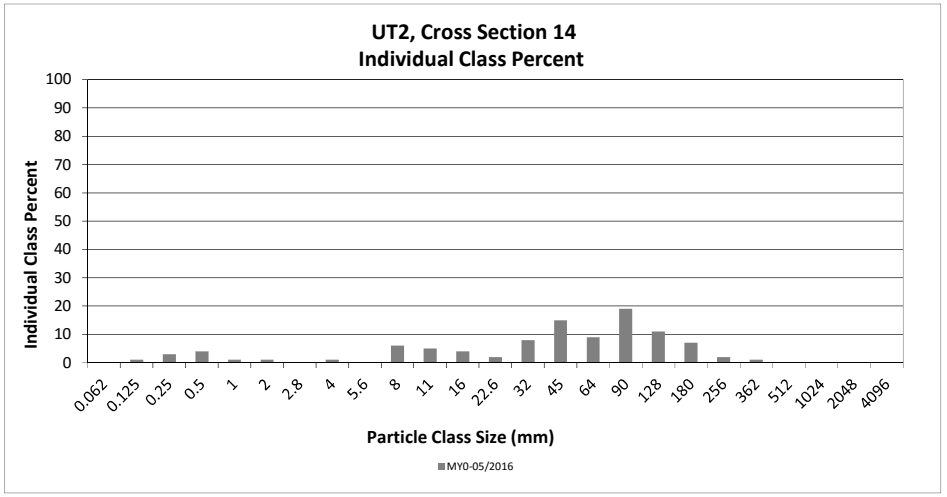
Monitoring Year 0 - 2016

UT2, Cross Section 14

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125	1	1	1
	Fine	0.125	0.250	3	3	4
	Medium	0.25	0.50	4	4	8
	Coarse	0.5	1.0	1	1	9
	Very Coarse	1.0	2.0	1	1	10
GRAVEL	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0	1	1	11
	Fine	4.0	5.6			11
	Fine	5.6	8.0	6	6	17
	Medium	8.0	11.0	5	5	22
	Medium	11.0	16.0	4	4	26
	Coarse	16.0	22.6	2	2	28
	Coarse	22.6	32	8	8	36
	Very Coarse	32	45	15	15	51
	Very Coarse	45	64	9	9	60
COBBLE	Small	64	90	19	19	79
	Small	90	128	11	11	90
	Large	128	180	7	7	97
	Large	180	256	2	2	99
BOULDER	Small	256	362	1	1	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross Section 14	
Channel materials (mm)	
D_{16} =	7.54
D_{35} =	30.64
D_{50} =	44.0
D_{84} =	105.6
D_{95} =	163.3
D_{100} =	362.0





Reachwide and Cross Section Pebble Count Plots

Little Pine Creek III Stream & Wetland Restoration Project

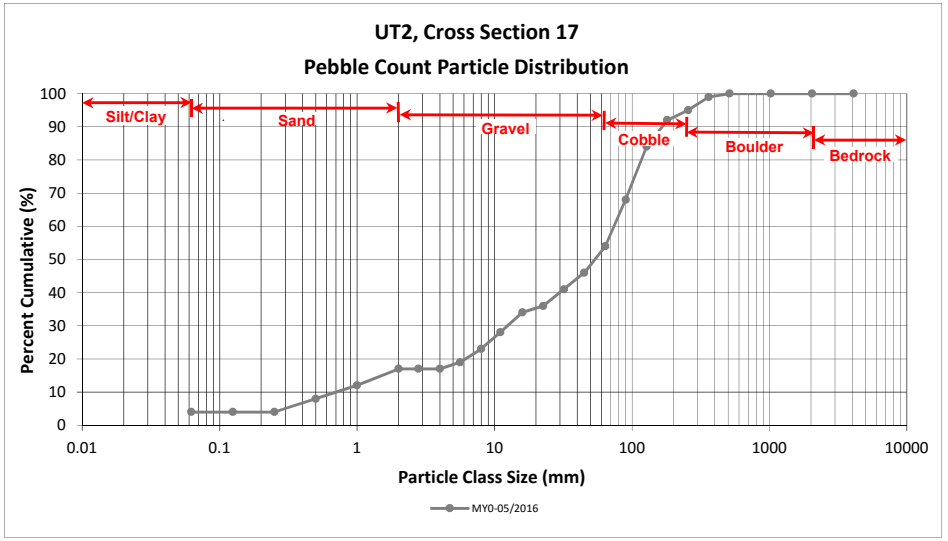
DMS Project No. 94903

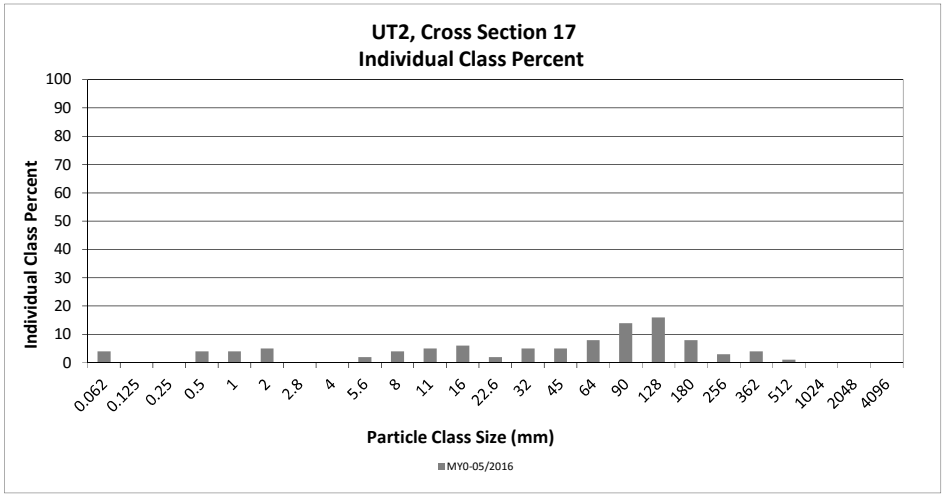
Monitoring Year 0 - 2016

UT2, Cross Section 17

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250			4
	Medium	0.25	0.50	4	4	8
	Coarse	0.5	1.0	4	4	12
	Very Coarse	1.0	2.0	5	5	17
GRAVEL	Very Fine	2.0	2.8			17
	Very Fine	2.8	4.0			17
	Fine	4.0	5.6	2	2	19
	Fine	5.6	8.0	4	4	23
	Medium	8.0	11.0	5	5	28
	Medium	11.0	16.0	6	6	34
	Coarse	16.0	22.6	2	2	36
	Coarse	22.6	32	5	5	41
	Very Coarse	32	45	5	5	46
	Very Coarse	45	64	8	8	54
COBBLE	Small	64	90	14	14	68
	Small	90	128	16	16	84
	Large	128	180	8	8	92
	Large	180	256	3	3	95
BOULDER	Small	256	362	4	4	99
	Small	362	512	1	1	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} =	1.74
D_{35} =	19.02
D_{50} =	53.7
D_{84} =	128.0
D_{95} =	256.0
D_{100} =	512.0





Stream Photographs

	
Photo Point 1 – looking upstream (05/16/2016)	Photo Point 1 – looking downstream (05/16/2016)
	
Photo Point 2 – looking upstream (05/16/2016)	Photo Point 2 – looking downstream (05/16/2016)
	
Photo Point 3 – looking upstream (05/16/2016)	Photo Point 3 – looking downstream (05/16/2016)

	
Photo Point 4 – looking upstream (05/16/2016)	Photo Point 4 – looking downstream (05/16/2016)
	
Photo Point 5 – looking upstream (05/16/2016)	Photo Point 5 – looking downstream (05/16/2016)
	
Photo Point 6 – looking upstream (05/16/2016)	Photo Point 6 – looking downstream (05/16/2016)

	
Photo Point 7 – looking upstream (05/16/2016)	Photo Point 7 – looking downstream (05/16/2016)
	
Photo Point 8 – looking upstream (05/16/2016)	Photo Point 8 – looking downstream (05/16/2016)
	
Photo Point 9 – looking upstream (05/16/2016)	Photo Point 9 – looking downstream (05/16/2016)

	
Photo Point 10 – looking upstream (05/16/2016)	Photo Point 10 – looking downstream (05/16/2016)
	
Photo Point 11 – looking upstream (05/16/2016)	Photo Point 11 – looking downstream (05/16/2016)
	
Photo Point 12 – looking upstream (05/16/2016)	Photo Point 12 – looking downstream (05/16/2016)

	
Photo Point 13 – looking upstream (05/16/2016)	Photo Point 13 – looking downstream (05/16/2016)
	
Photo Point 14 – looking upstream (05/16/2016)	Photo Point 14 – looking downstream (05/16/2016)
	
Photo Point 15 – looking upstream (05/16/2016)	Photo Point 15 – looking downstream (05/16/2016)

	
Photo Point 16 – looking upstream (05/16/2016)	Photo Point 16 – looking downstream (05/16/2016)
	
Photo Point 17 – looking upstream (05/16/2016)	Photo Point 17 – looking downstream (05/16/2016)
	
Photo Point 18 – looking upstream (05/16/2016)	Photo Point 18 – looking downstream (05/16/2016)

	
Photo Point 19 – looking upstream (05/16/2016)	Photo Point 19 – looking downstream (05/16/2016)
	
Photo Point 20 – looking upstream (05/31/2016)	Photo Point 20 – looking downstream (05/31/2016)
	
Photo Point 21 – looking upstream (05/31/2016)	Photo Point 21 – looking downstream (05/31/2016)

	
Photo Point 22 – looking upstream (05/31/2016)	Photo Point 22 – looking downstream (05/31/2016)
	
Photo Point 23 – looking upstream (05/31/2016)	Photo Point 23 – looking downstream (05/31/2016)
	
Photo Point 24 – looking upstream (05/31/2016)	Photo Point 24 – looking downstream (05/31/2016)

	
Photo Point 25 – looking upstream (05/31/2016)	Photo Point 25 – looking downstream (05/31/2016)
	
Photo Point 26 – looking upstream (05/31/2016)	Photo Point 26 – looking downstream (05/31/2016)
	
Photo Point 27 – looking upstream (05/16/2016)	Photo Point 27 – looking downstream (05/16/2016)

	
Photo Point 28 – looking upstream (05/16/2016)	Photo Point 28 – looking downstream (05/16/2016)
	
Photo Point 29 – looking upstream (05/16/2016)	Photo Point 29 – looking downstream (05/16/2016)
	
Photo Point 30 – looking upstream (05/16/2016)	Photo Point 30 – looking downstream (05/16/2016)

	
Photo Point 31 – looking upstream (05/31/2016)	Photo Point 31 – looking downstream (05/31/2016)
	
Photo Point 32 – looking upstream (05/31/2016)	Photo Point 32 – looking downstream (05/31/2016)
	
Photo Point 33 – looking upstream UT2 (05/31/2016)	Photo Point 33 – looking upstream UT2b (05/31/2016)

Photo Point 33 – looking downstream UT2 (05/31/2016)

Photo Point 34 – looking upstream (05/31/2016)

Photo Point 34 – looking downstream (05/31/2016)

Photo Point 35 – looking upstream (05/31/2016)

Photo Point 35 – looking downstream (05/31/2016)

Photo Point 36 – looking upstream UT2a (05/31/2016)

Photo Point 36 – looking upstream UT3 (05/31/2016)

Photo Point 36 – looking downstream UT3 (05/31/2016)

Photo Point 37 – looking upstream (05/31/2016)

Photo Point 37 – looking downstream (05/31/2016)

	
Photo Point 38 – looking upstream (05/31/2016)	Photo Point 38 – looking downstream (05/31/2016)
	
Photo Point 39 – looking upstream (05/31/2016)	Photo Point 39 – looking downstream (05/31/2016)
	
Photo Point 40 – looking upstream (05/31/2016)	Photo Point 40 – looking downstream (05/31/2016)

	
Photo Point 41 – looking upstream (05/31/2016)	Photo Point 41 – looking downstream (05/31/2016)
	
Photo Point 42 – looking upstream (05/31/2016)	Photo Point 42 – looking downstream (05/31/2016)

APPENDIX 3. Vegetation Plot Data

Table 8. Planted and Total Stem Counts
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 0 - 2016

			Current Plot Data (MY0 2016)																				
			Vegetation Plot 1			Vegetation Plot 2			Vegetation Plot 3			Vegetation Plot 4			Vegetation Plot 5			Vegetation Plot 6			Vegetation Plot 7		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	Red maple	Tree				1	1	1	3	3	3	5	5	5	4	4	4	4	4	4			
Betula nigra	River birch	Tree	1	1	1	5	5	5	3	3	3	3	3	3				5	5	5			
Cercis canadensis	Eastern redbud	Shrub Tree	2	2	2	1	1	1	1	1	1	4	4	4	5	5	5				8	8	8
Fraxinus pennsylvanica	Green ash	Tree	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2				4	4	4
Platanus occidentalis	Sycamore	Tree	1	1	1	1	1	1				1	1	1				3	3	3	3	3	3
Quercus rubra	Red oak	Tree																					
Ulmus americana	American elm	Tree	10	10	10	4	4	4	8	8	8				3	3	3	2	2	2			
Stem count			15	15	15	14	14	14	17	17	17	15	15	15	14	14	14	14	14	14	15	15	15
size (ares)			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			5	5	5	6	6	6	5	5	5	5	5	5	4	4	4	4	4	4	3	3	3
Stems per ACRE			607	607	607	567	567	567	688	688	688	607	607	607	567	567	567	567	567	567	607	607	607

Color For Density

Exceeds requirements by 10% or greater
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 8. Planted and Total Stem Counts
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 0 - 2016

			Current Plot Data (MY0 2016)																				
			Vegetation Plot 8			Vegetation Plot 9			Vegetation Plot 10			Vegetation Plot 11			Vegetation Plot 12			Vegetation Plot 13			Vegetation Plot 14		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	Red maple	Tree	7	7	7	3	3	3	2	2	2	4	4	4	1	1	1	7	7	7			
Betula nigra	River birch	Tree				1	1	1	1	1	1	2	2	2	5	5	5				4	4	4
Cercis canadensis	Eastern redbud	Shrub Tree	3	3	3	2	2	2	3	3	3	2	2	2	2	2	2				1	1	1
Fraxinus pennsylvanica	Green ash	Tree	4	4	4	3	3	3	4	4	4	5	5	5	1	1	1	1	1	1	2	2	2
Platanus occidentalis	Sycamore	Tree	1	1	1				2	2	2				1	1	1	1	1	1	2	2	2
Quercus rubra	Red oak	Tree				1	1	1															
Ulmus americana	American elm	Tree				3	3	3				1	1	1	3	3	3	1	1	1	5	5	5
		Stem count	15	15	15	13	13	13	12	12	12	14	14	14	13	13	13	10	10	10	14	14	14
		size (ares)	1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	4	4	4	6	6	6	5	5	5	5	5	5	6	6	6	4	4	4	5	5	5
		Stems per ACRE	607	607	607	526	526	526	486	486	486	567	567	567	526	526	526	405	405	405	567	567	567

Color For Density

Exceeds requirements by 10% or greater
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
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T: Total Stems

Table 8. Planted and Total Stem Counts
Little Pine Creek III Stream & Wetland Restoration Project
DMS Project No. 94903
Monitoring Year 0 - 2016

			Current Plot Data (MY0 2016)																						Annual Summary		
			Vegetation Plot 15			Vegetation Plot 16			Vegetation Plot 17			Vegetation Plot 18			Vegetation Plot 19			Vegetation Plot 20			Vegetation Plot 21			MY0 (2016)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	Red maple	Tree				5	5	5													4	4	4	50	50	50
Betula nigra	River birch	Tree	2	2	2	1	1	1	5	5	5	3	3	3	2	2	2	1	1	1	3	3	3	47	47	47
Cercis canadensis	Eastern redbud	Shrub Tree				1	1	1				5	5	5	2	2	2	3	3	3	1	1	1	46	46	46
Fraxinus pennsylvanica	Green ash	Tree	3	3	3	4	4	4	4	4	4	1	1	1	4	4	4	6	6	6	3	3	3	58	58	58
Platanus occidentalis	Sycamore	Tree	8	8	8	1	1	1				3	3	3							2	2	2	30	30	30
Quercus rubra	Red oak	Tree																						1	1	1
Ulmus americana	American elm	Tree	1	1	1				4	4	4	1	1	1	1	1	1	5	5	5	1	1	1	53	53	53
Stem count			14	14	14	12	12	12	13	13	13	13	13	13	9	9	9	15	15	15	14	14	14	285	285	285
size (ares)			1			1			1			1			1			1			1			21		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.52		
Species count			4	4	4	5	5	5	3	3	3	5	5	5	4	4	4	4	4	4	6	6	6	7	7	7
Stems per ACRE			567	567	567	486	486	486	526	526	526	526	526	526	364	364	364	607	607	607	567	567	567	549	549	549

Color For Density

Exceeds requirements by 10% or greater
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

Vegetation Photographs

Vegetation Plot 1 – *(05/03/2016)*

Vegetation Plot 2 – *(05/03/2016)*

Vegetation Plot 3 – *(05/03/2016)*

Vegetation Plot 4 – *(05/03/2016)*

Vegetation Plot 5 – *(05/03/2016)*

Vegetation Plot 6 – *(05/03/2016)*

	
Vegetation Plot 7 – (05/03/2016)	**Vegetation Plot 8** – (05/03/2016)
	
Vegetation Plot 9 – (05/03/2016)	**Vegetation Plot 10** – (05/03/2016)
	
Vegetation Plot 11 – (05/03/2016)	**Vegetation Plot 12** – (05/03/2016)

Vegetation Plot 13 – *(05/16/2016)*

Vegetation Plot 14 – *(05/16/2016)*

Vegetation Plot 15 – *(05/16/2016)*

Vegetation Plot 16 – *(05/16/2016)*

Vegetation Plot 17 – *(05/03/2016)*

Vegetation Plot 18 – *(05/03/2016)*

Vegetation Plot 19 – *(05/16/2016)*

Vegetation Plot 20 – *(05/16/2016)*

Vegetation Plot 21 – *(05/16/2016)*

APPENDIX 4. Record Drawings

August 11, 2016

Little Pine Creek III Stream & Wetland As-Built

Alleghany County, North Carolina

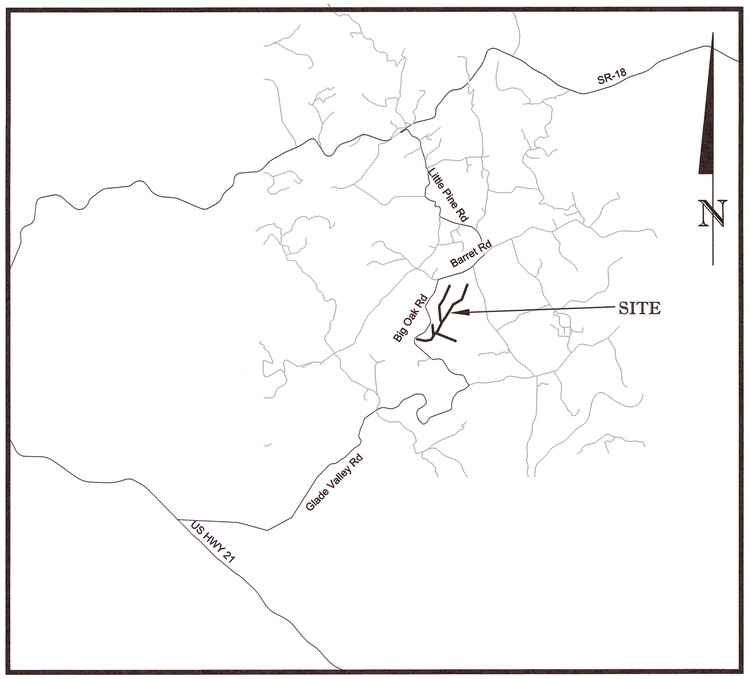
for

NCDEQ Division of Mitigation Services

Id No: 94903

SCO Project No:

07-07088-03



Vicinity Map
Not to Scale

BEFORE YOU DIG!
CALL 1-800-632-4949
N.C. ONE-CALL CENTER
IT'S THE LAW!

RECORD DRAWINGS
ISSUED AUGUST 5, 2016

CERTIFICATE OF SURVEY
AND
ACCURACY

I, PHILLIP B. KEE, CERTIFY THAT THE GROUND TOPOGRAPHIC SURVEY PORTION OF THIS PROJECT WAS COMPLETED UNDER MY DIRECT SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY DIRECT SUPERVISION, THAT THE RECORD DRAWINGS WERE PREPARED BY WILDLANDS ENGINEERING, INC FROM DIGITAL FILES PROVIDED BY KEE MAPPING AND SURVEYING, PA AS SHOWN ON AN AS-BUILT SURVEY FOR "THE STATE OF NC, DIVISION OF MITIGATION SERVICES", JOB #1509144-AB, DATED APRIL 11, 2016; THAT THIS SURVEY WAS PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET THE FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS; THAT THIS SURVEY WAS PERFORMED TO MEET THE REQUIREMENTS FOR A TOPOGRAPHIC SURVEY TO THE ACCURACY OF CLASS A HORIZONTAL AND CLASS C VERTICAL WHERE APPLICABLE; THAT THE ORIGINAL DATA WAS OBTAIN BETWEEN THE DATES OF 10/28/15 - 11/06/15, 03/29/16 ; THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD AND ALL COORDINATES ARE BASE ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASE ON NAVD 88; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION .1606; THAT THIS MAP WAS NOT PREPARED IN ACCORDANCE WITH G.S. 47-30, AS AMENDED AND DOES NOT REPRESENT AN OFFICIAL BOUNDARY SURVEY.

WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS THE 11TH DAY OF August, 2016.

OFFICIAL SEAL

NORTH CAROLINA PROFESSIONAL SEAL L-4647 LAND SURVEYOR PHILLIP B. KEE

Phillip B. Kee
PHILLIP B. KEE, PLS L-4647

Sheet Index

Project Directory

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Brad Kee, PLS
828-645-8275

Engineering:
Wildlands Engineering, Inc
License No. F-0831
1430 South Mint Street
Suite 104
Charlotte, NC 28203
Aaron Earley, PE
704-332-7754

Owner:
NCDEQ
Division of Mitigation Services
5 Ravenscroft Dr, Suite 102
Asheville, NC 28801
DMS Project Manager:
Harry Tsomides
828-545-7057

Disturbed Area:
20 Acres

Lat: N36°30'26.73"
Long: W81°00'18.47"

WILDLANDS
Wildlands Engineering, Inc
1430 South Mint Street, Ste 104
Charlotte, NC 28203
Tel: 704.332.7754
Fax: 704.332.3306
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL 029340 ENGINEER AARON S. EARLEY

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina
Title Sheet

Revisions:

Date: August 5, 2016
Job Number: 005-02123
Designed By: CDM
Drawn By: JCK
Checked By: EGR
SCO Project No.: 07-07088-03

Sheet 0.1

Q:\Active Projects\005-02123 Little Pine III\Monitoring\Baseline Monitoring\Plans\As-Built Set\02123-CoverNotes.dwg

Channel Construction Notes for all Reaches

1) Contractor shall not disturb more active stream channel than can be stabilized by the end of the day. A 24-hour pump-around is required if in-stream construction is not completed and stabilized by the end of the work day.
2) No material from the off-line Design stream channel excavation many be backfilled into the adjacent existing stream channel until the newly-constructed Design stream section is completed, stabilized, and the stream flow has been diverted into it, not even if that section of old/ existing stream is being pumped.
3) Clearing and grubbing activities shall not extend more than 150 linear feet ahead of in-stream work.

The Little Pine Creek III Restoration construction will follow the construction sequence protocol as described below, unless otherwise noted.

Initial Site Preparation

1) Contact North Carolina "ONE CALL" Center (1.800.632.4949) before any excavation.
2) Contact Land Quality (336-771-5000) before any work begins on the project and notify them of the start date.
3) Install temporary cattle exclusion fencing as outlined in the specifications.
4) Prepare stabilized construction entrances and temporary construction easement areas as indicated on the Plan Set.
5) Mobilize equipment, materials, prepare staging, disposal, and material stockpile area(s) as shown on plans.
6) Set-up erosion control measures as outlined in the Plan Set. Erosion and sediment control measures shall be installed by the Contractor to protect the Design stream channel from significant runoff prior to permanent stabilization. Silt fence should be installed where appropriate at the designated disposal area as well. Contractor is responsible for inspection and maintenance of erosion control measures through the duration of construction.
7) Install temporary stream crossings.
8) Install and maintain an onsite rain gauge and log book to record the rainfall amounts and dates. Complete the self-inspection as required by DENR permit.

Little Pine Creek Channel Construction Notes

9) Construction shall generally begin at the upstream extent of the project (Little Pine Creek, Reach 1, Station 100+00) and progress downstream to Sta. 124+07.
10) As work progresses, remove and stockpile the top 3 inches of soil from the active grading area. Stockpiled topsoil shall be kept separate for onsite replacement prior to floodplain seeding.
11) Install the pump around system prior to beginning excavation within the existing live channel bed. The pump around system needs to be employed only when work is being conducted within the active channel. Contractor shall stage his work to minimize the duration of pump around operations.
12) Install impervious dikes at upstream and downstream ends of pump around locations. The pump around operation shall be performed between these locations as described in plan details.
13) Remove all non-native and invasive vegetation prior to beginning the channel construction.
14) Contractor should attempt to construct the channel offline where feasible. If site conditions permit, more than one offline section may be constructed concurrently, however offline sections shall be tied online sequentially from downstream to upstream.
15) The Contractor shall not disturb more active stream channel than can be stabilized with seed, mulch, and matting by the end of the day. Excess cut material may be stockpiled within the established stockpile area or hauled directly to the appropriately permitted disposal site.
16) Construct the Design stream channel to the grade specified in the cross sections and profile. Transfer coarse material from abandoned channel riffles to new channel riffles. Backfill abandoned channel sections with stockpiled soil. Non-native and invasive vegetation (e.g. privet, multiflora rose, and Japanese honeysuckle) shall be removed from the existing channel prior to backfilling.
17) Install structures (log vane, j hook rock vane, j hook log vane, riffles, etc.) and in-bank bioengineering such as brush mattress or brush toe after channel grading is completed.
18) Seed (with appropriate seed mix) and straw mulch areas where the coir fiber matting is to be installed.
19) Install coir fiber matting.
20) Gully work shall be constructed and stabilized prior to work on Little Pine Reach 2B to protect downstream work, unless otherwise approved by the Designer.
21) When channel construction is completed remove the temporary stream crossing structures and install the permanent ford crossings per the plans and specifications.
22) Prepare floodplain for seeding by applying stockpiled topsoil to the floodplain between bankfull elevation and the grading limits, ripping, and raking/ smoothing. Seed and mulch. Any areas within the conservation easement that have not been graded shall have fescue herbicide treatment and will not be ripped or seeded.
23) Plant live stakes and herbaceous plugs on stream banks according to planting details and specifications.

UT2 Channel Construction Notes

24) Construction shall generally begin at the upstream project boundary (UT2 Station 297+18) and progress downstream towards the Little Pine confluence. UT2B shall be constructed before work begins on UT2 below Station 330+00. UT2A shall be constructed prior to work beginning below UT2 Station 333+00. Little Pine Creek construction shall be complete up to Station 117+88 and the log vane at station 116+25 so that the confluence may be constructed appropriately.
25) Establish Pump System for areas of construction where Design channel intersects existing channel frequently. Contractor shall stage his work to minimize the duration of pump around operations.
26) Install impervious dikes at upstream and downstream ends of pump around locations. The pump around operation shall be performed between these locations as described in plan details.
27) UT2 will be constructed from the upstream end, working downstream, along the existing stream channel. As work progresses, remove and stockpile the top 3 inches of soil from the active grading area. Stockpiled topsoil shall be kept separate for onsite replacement prior to floodplain seeding.
28) Remove all non-native and invasive vegetation prior to beginning the channel construction.
29) Clear and grub only the portion of stream channel that can be completed, stabilized, and matted within the same day.
30) Construct the Design stream channel to the grade specified in the cross sections and profile. Stockpile any material suitable for fill or topsoil where indicated on the plan sheets.
31) Excavate and stockpile any remaining coarse bed material found in the old channel separately from the excavated soil. Bed material shall be incorporated into the riffles of the newly constructed channel.
32) Install structures (log vane, j hook rock vane, j hook log vane, riffles, etc.) and in-bank bioengineering such as brush mattress or brush toe in the dry after grading is completed.
33) Seed (with appropriate seed mix) and straw mulch areas where the coir fiber matting is to be installed.
34) Install coir fiber matting.
35) Once disturbed areas and exposed slopes area stabilized; remove impervious dikes, install channel plug, and turn water into the new channel.
36) Backfill abandoned channel sections with stockpiled soil. Non-native and invasive vegetation (i.e. privet, multiflora rose, and Japanese honeysuckle) shall be removed from the existing channel prior to backfilling.
37) Seed, mat, and mulch backfill sections before proceeding to the next area.
38) Install permanent culvert crossings as shown on plans before moving to the next construction area.
39) Prepare floodplain for seeding by applying stockpiled topsoil between bankfull elevation and the grading limits, ripping, and raking/ smoothing. Seed and mulch. Any areas within the conservation easement that have remaining ground cover of fescue that has not been graded shall have fescue herbicide treatment and will not be ripped or seeded.
40) Plant live stakes and herbaceous plugs on stream banks according to planting details and specifications.

UT2A Channel Construction Notes

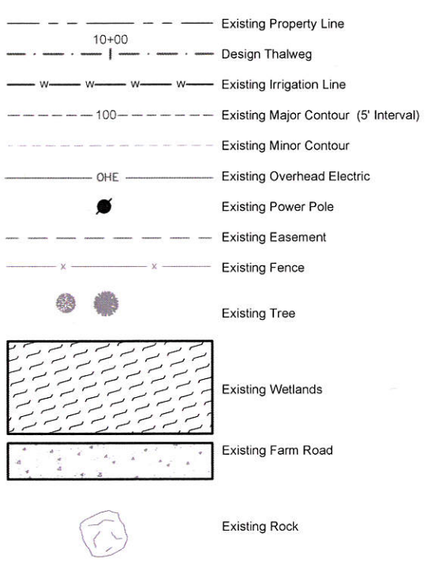
41) Construction at the upstream most end (Sta, 401+78 to Sta. 404+34) can occur concurrently with downstream work (Sta. 425+58 to Sta. 432+09) if needed; however, construction shall generally begin at the upstream boundary of each work area and progress downstream.
42) Establish Pump System for areas of construction in the active channel. Contractor shall stage his work to minimize the duration of pump around operations.
43) Install impervious dikes at upstream and downstream ends of pump around locations. The pump around operation shall be performed between these locations as described in plan details.
44) As work progresses, remove and stockpile the top 3 inches of soil from the active grading area. Stockpiled topsoil shall be kept separate for onsite replacement prior to floodplain seeding.
45) Remove all non-native and invasive vegetation prior to beginning the channel construction.
46) Clear and grub only the portion of stream channel that can be completed, stabilized, and matted within the same day.
47) Construct the Design stream channel to the grade specified in the cross sections and profile. Stockpile any material suitable for fill or topsoil where indicated on the plan sheets.
48) Excavate and stockpile any remaining coarse bed material found in the old channel separately from the excavated soil. Bed material shall be incorporated into the riffles of the newly constructed channel.
49) Install structures (log vane, j hook rock vane, j hook log vane, riffles, etc.) and in-bank bioengineering such as brush mattress or brush toe in the dry after grading is completed.
50) Seed (with appropriate seed mix) and straw mulch areas where the coir fiber matting is to be installed.
51) Install coir fiber matting.
52) Once disturbed areas and exposed slopes area stabilized; remove impervious dikes and turn water into the new channel.
53) Backfill any abandoned channel sections with stockpiled soil. Non-native and invasive vegetation (i.e. privet, multiflora rose, and Japanese honeysuckle) shall be removed from the existing channel prior to backfilling.
54) Seed, mat, and mulch backfill sections before proceeding to the next area.
55) Install permanent culvert crossing as shown on plans.
56) Prepare floodplain for seeding by applying stockpiled topsoil between bankfull elevation and the grading limits, ripping, and raking/ smoothing. Seed and mulch. Any areas within the conservation easement that have remaining ground cover of fescue that has not been graded shall have fescue herbicide treatment and will not be ripped or seeded.
57) Plant live stakes and herbaceous plugs on stream banks according to planting details and specifications.

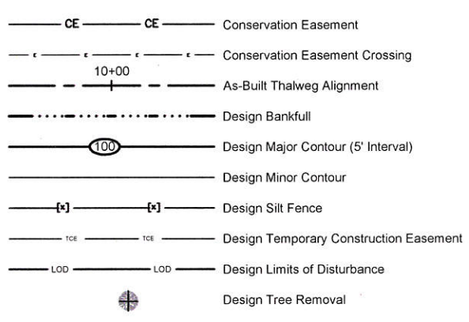
UT2B Channel Construction Notes

58) Begin construction on UT2B by installing the two log sills at the wetland headcuts near Sta. 502+00. Care should be taken to avoid disturbance in the existing wetland to the greatest extent possible. After sills are installed, immediately stabilize the wetland area as specified in the planting plans and these specifications.
59) Construction shall generally progress at the upstream end of active channel work (Sta. 502+95) and progress downstream towards the UT2 confluence (Sta. 505+41).
60) Establish Pump System for areas of construction in the active channel. Contractor shall stage his work to minimize the duration of pump around operations.
61) Install impervious dikes at upstream and downstream ends of pump around locations. The pump around operation shall be performed between these locations as described in plan details.
62) As work progresses, remove and stockpile the top 3 inches of soil from the active grading area. Stockpiled topsoil shall be kept separate for onsite replacement prior to floodplain seeding.
63) Remove all non-native and invasive vegetation prior to beginning the channel construction.
64) Clear and grub only the portion of stream channel that can be completed, stabilized, and matted within the same day.
65) Construct the Design stream channel to the grade specified in the cross sections and profile. Stockpile any material suitable for fill or topsoil where indicated on the plan sheets.
66) Excavate and stockpile any remaining coarse bed material found in the old channel separately from the excavated soil. Bed material shall be incorporated into the riffles of the newly constructed channel.
67) Install structures (log vane, j hook rock vane, j hook log vane, riffles, etc.) and in-bank bioengineering such as brush mattress or brush toe in the dry after grading is completed.
68) Seed (with appropriate seed mix) and straw mulch areas where the coir fiber matting is to be installed.
69) Install coir fiber matting.
70) Once disturbed areas and exposed slopes area stabilized; remove impervious dikes and turn water into the new channel.
71) Backfill any abandoned channel sections with stockpiled soil. Non-native and invasive vegetation (i.e. privet, multiflora rose, and Japanese honeysuckle) shall be removed from the existing channel prior to backfilling.
72) Seed, mat, and mulch backfill sections before proceeding to the next area.
73) Install permanent culvert crossing as shown on plans.
74) Prepare floodplain for seeding by applying stockpiled topsoil between bankfull elevation and the grading limits, ripping, and raking/ smoothing. Seed and mulch. Any areas within the conservation easement that have remaining ground cover of fescue that has not been graded shall have fescue herbicide treatment and will not be ripped or seeded.
75) Plant live stakes and herbaceous plugs on stream banks according to planting details and specifications.

Construction Demobilization

76) Remove temporary stream crossings.
77) The Contractor shall ensure that the site is free of trash and leftover materials prior to demobilization of equipment from the site.
78) Complete the removal of any additional stockpiled material from the site.
79) Demobilize grading equipment from the site.
80) All rock and other stockpiled materials must be removed from the limits of disturbance and conservation easement. All areas outside the conservation easement shall be returned to pre-project conditions or better.
81) Seed, mulch, and stabilize staging areas, stockpile areas, haul roads, and construction entrances. Pasture seed mix is to be applied to areas of disturbance outside of the conservation easement.
82) Coordinate removal of any remaining temporary cattle exclusion fencing with the Designer.



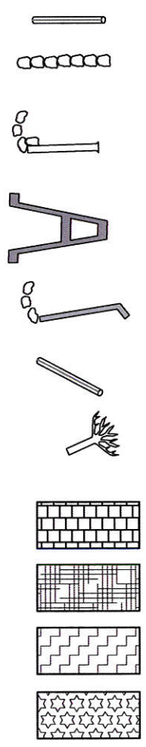


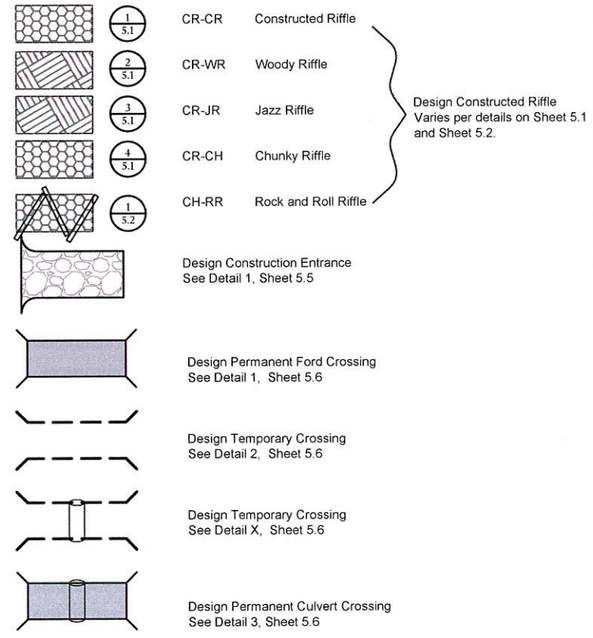
PROJECT NOTES:

Topographic survey was performed by Kee Mapping and Survey on June 11, 2012. Additional survey completed February 22, 2013. Datum is NAD 83/NSR2007 & NAVD 1988.

Deviations from the design are shown in red

GROUND STABILIZATION REQUIREMENTS OF DWQ CONSTRUCITON GENERAL PERMIT		
SITE AREA DESCRIPTION	**STABILIZATION TIME FRAME**	**STABILIZATION TIME FRAME EXCEPTIONS**
PERIMETER DIKES, SWALES, DITCHES AND SLOPES	7 DAYS	NONE
HIGH QUALITY WATER (HQW) ZONES	7 DAYS	NONE
SLOPES STEEPER THAN 3:1	7 DAYS	FOR SLOPES <10' IN LENGTH AND NOT STEEPER THAN 2:1, 14 DAYS ALLOWED
SLOPES 3:1 OR FLATTER	14 DAYS	7 DAYS FOR SLOPES > 50' IN LENGTH
ALL OTHER AREAS WITH SLOPES FLATTER THAN 4:1	14 DAYS	NONE (EXCEPT FOR PERIMETERS AND HQW ZONES)





WILDLANDS
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Fax: 704.332.3306
Firm License No. F-0831

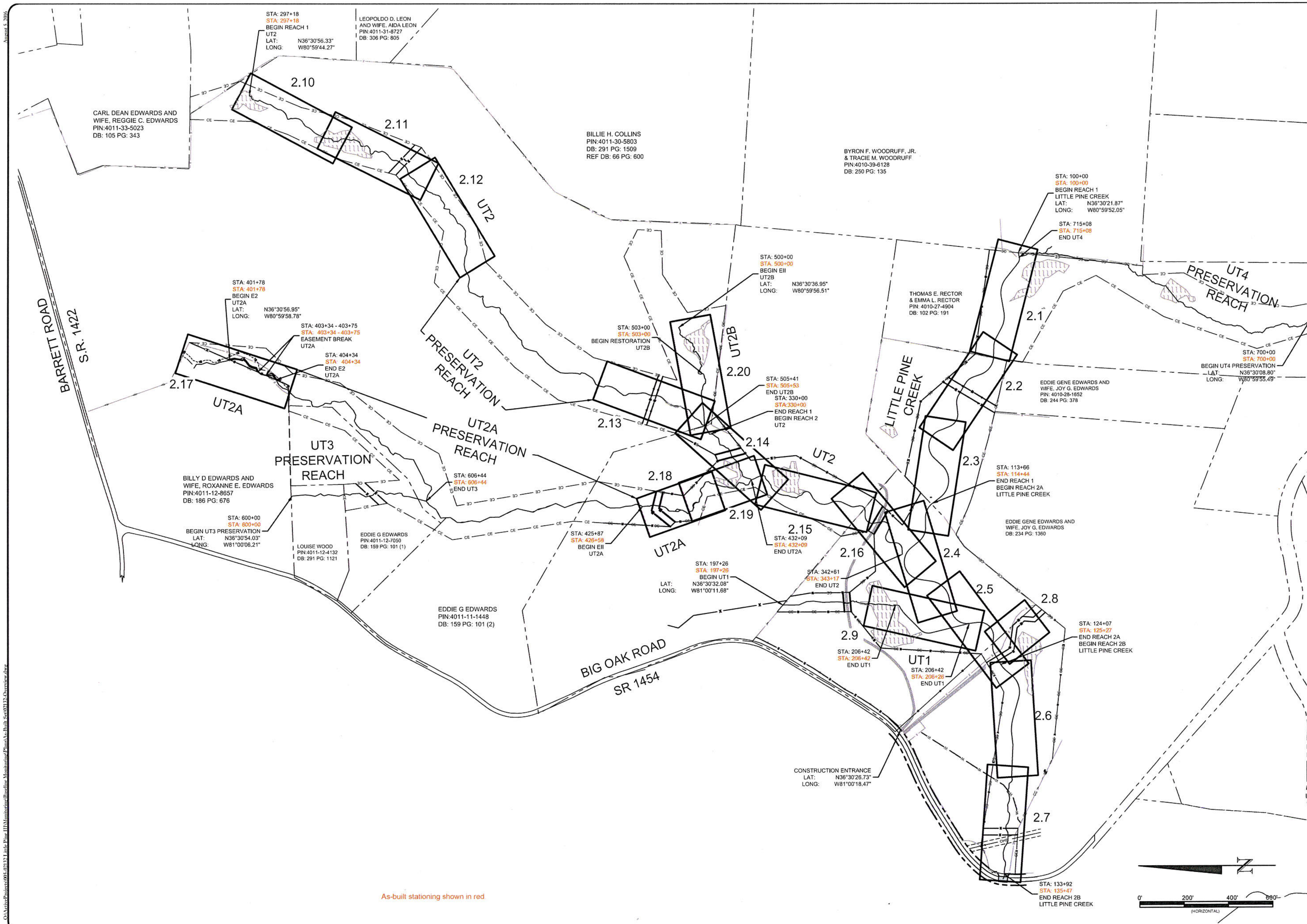
NORTH CAROLINA PROFESSIONAL SEAL 029346 ENGINEER EGR 8-5-16

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina
General Notes and Symbols

Revisions:
08/07/2001 Revised phone number on note 2.

Date: August 5, 2016
Job Number: 905-48123
Designed By: CDM
Drawn By: JCK
Checked By: EGR
SCO Project No.: 07-07088-03

Sheet 0.2



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Little Pine Creek III Stream & Wetland As-Built

Alleghany County, North Carolina

Project Overview

Revisions:

Date:	August 5, 2016
Job Number:	005-02123
Designed By:	CDM
Drawn By:	JCK
Checked By:	EGR
SCO Project No.:	07-07088-03

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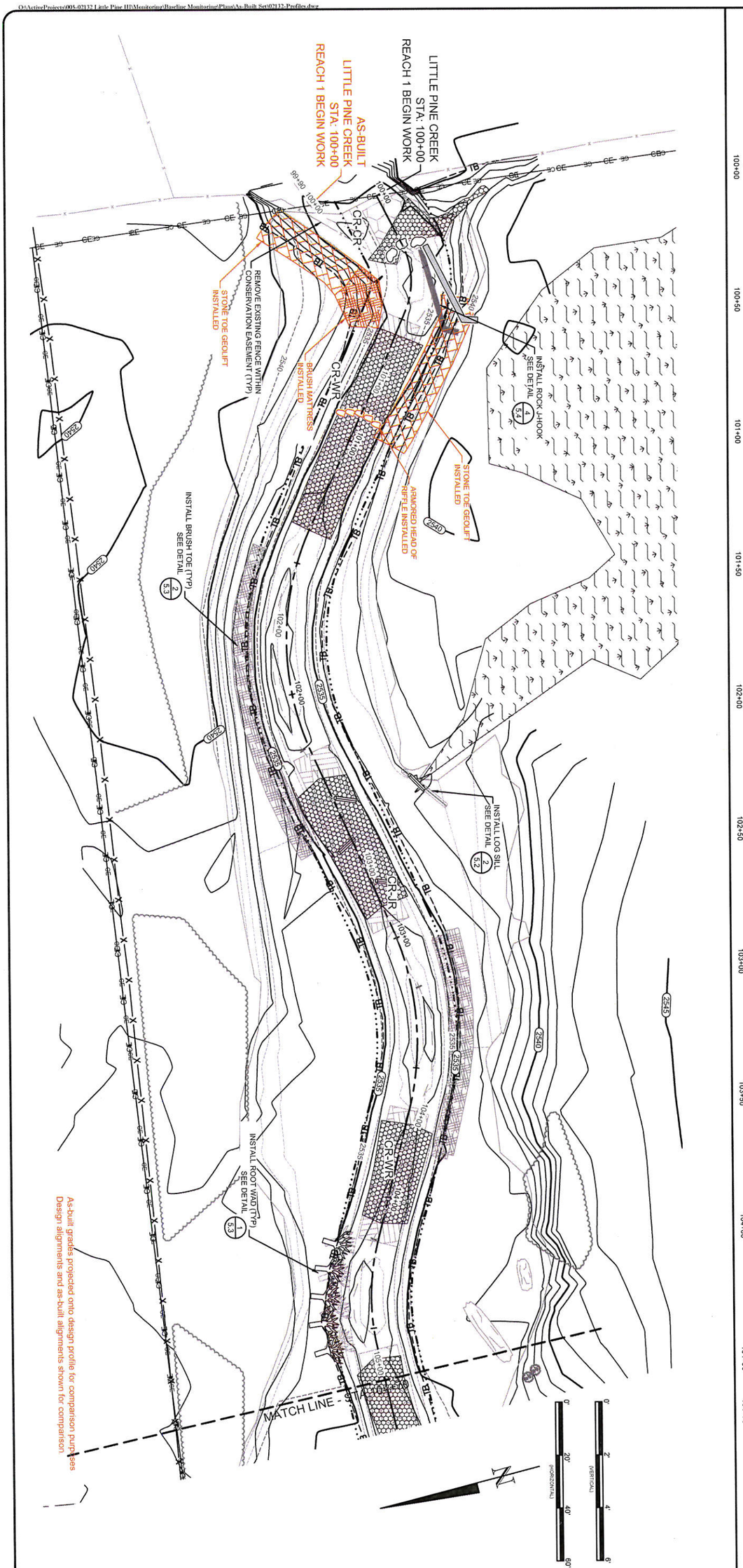

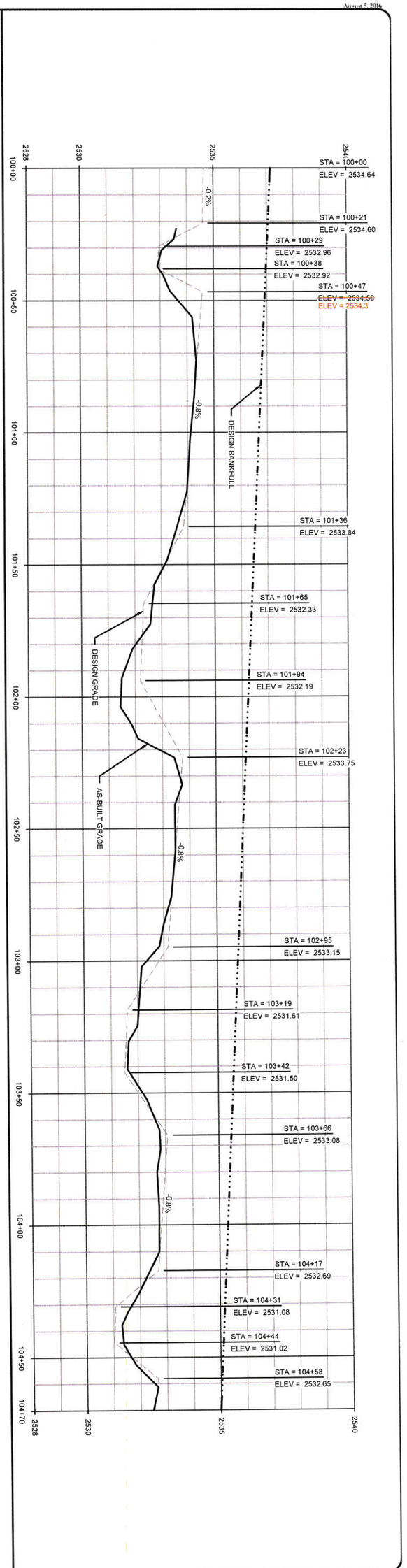

Date:	August 5, 2016
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Drawn By:	JCK
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SCO Project No.:	07-07088-03

Revisions:

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Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

Little Pine Creek
Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 029348 ENGINEER AARON S. EARLEY
8-5-16

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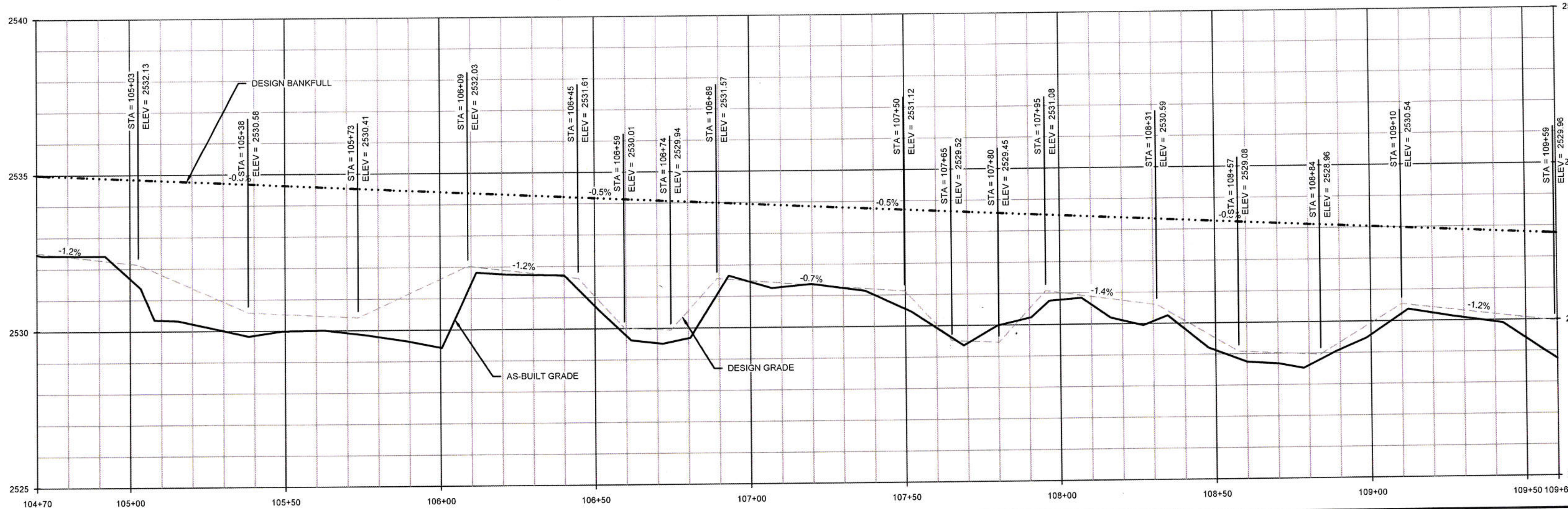

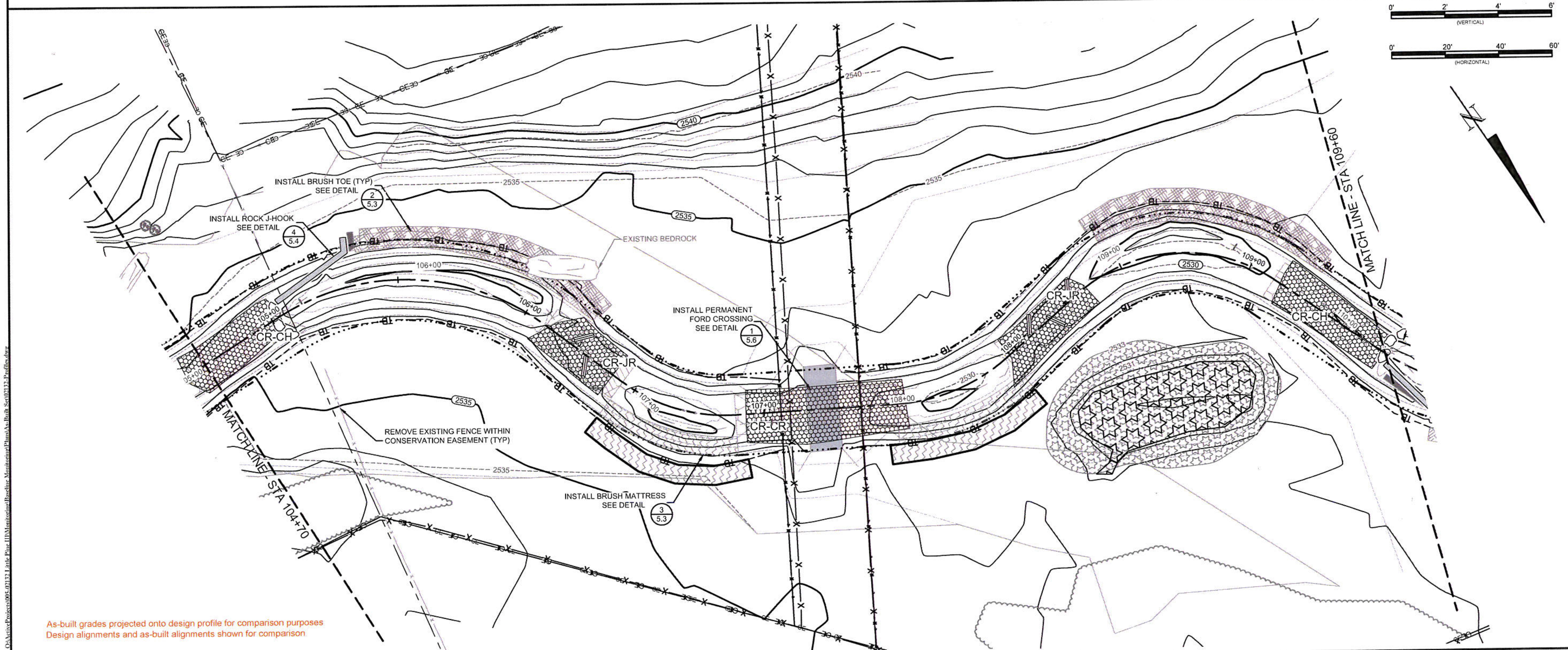

As-built grades projected onto design profile for comparison purposes
Design alignments and as-built alignments shown for comparison

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Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

Little Pine Creek
Plan and Profile

Revisions:

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Designed By:	CDM
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SCO Project No.:	07-07088-03

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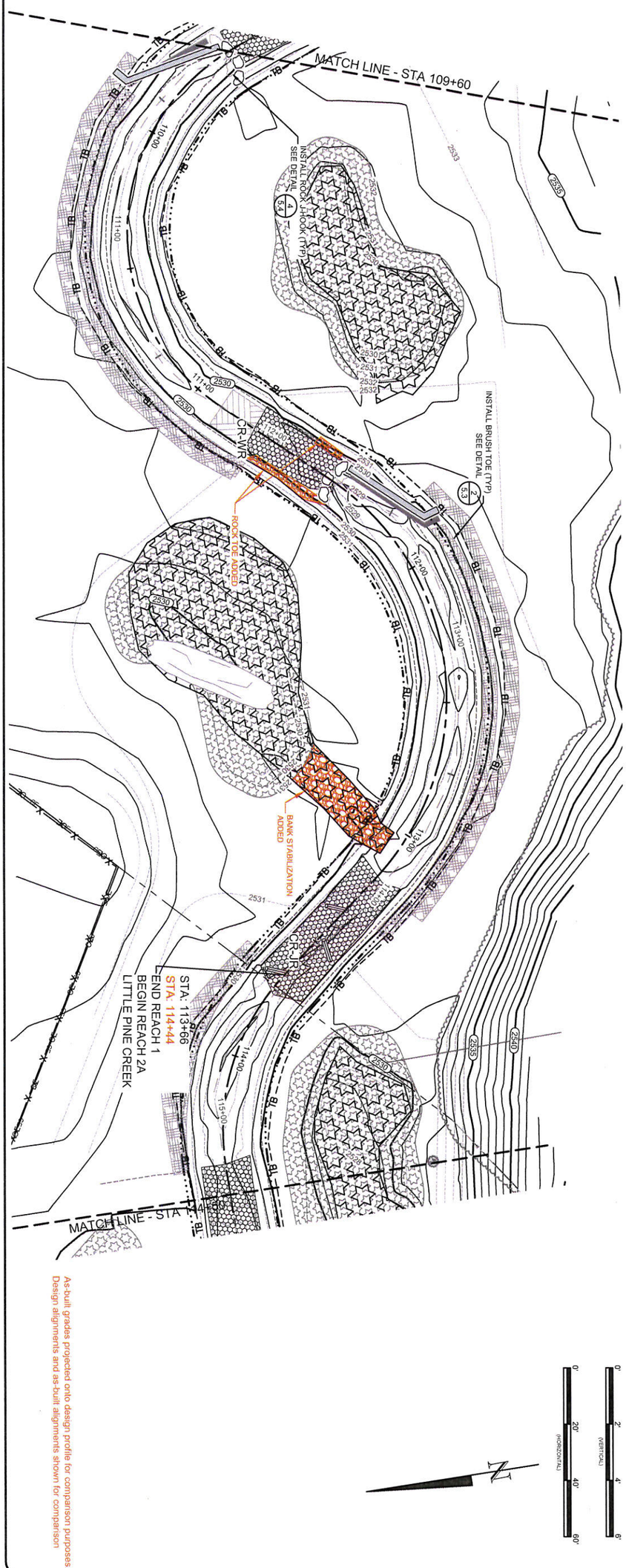

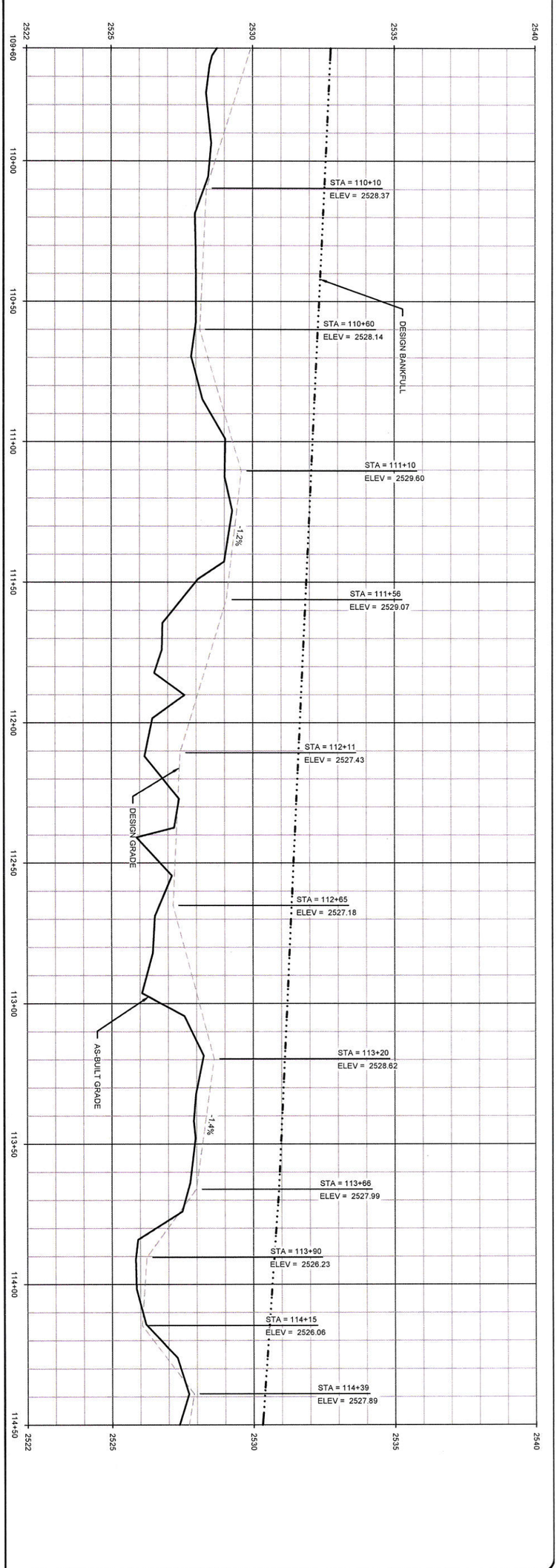

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SCO Project No.: 07-07088-03	

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Revisions:

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

Little Pine Creek
Plan and Profile

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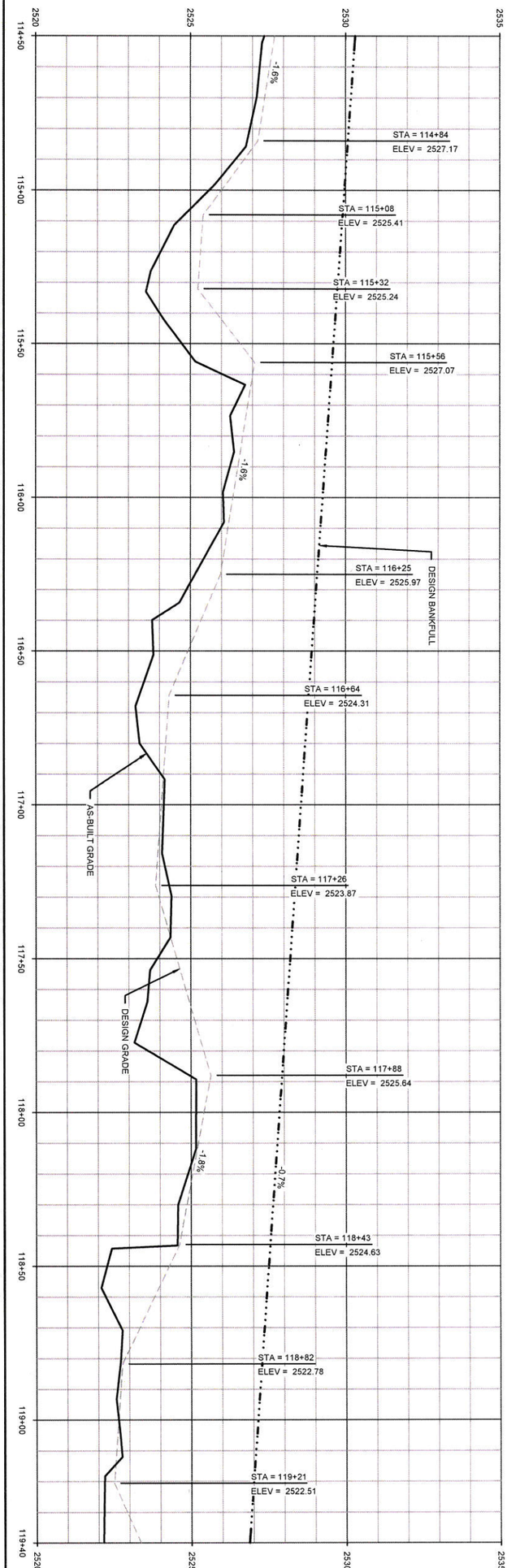

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Date:	August 5, 2016
Job Number:	005-02123
Designed By:	CDM
Drawn By:	JCK
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SCO Project No.:	07-070888-03

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Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

Little Pine Creek
Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 039340 ENGINEER JASON S. EARLEY
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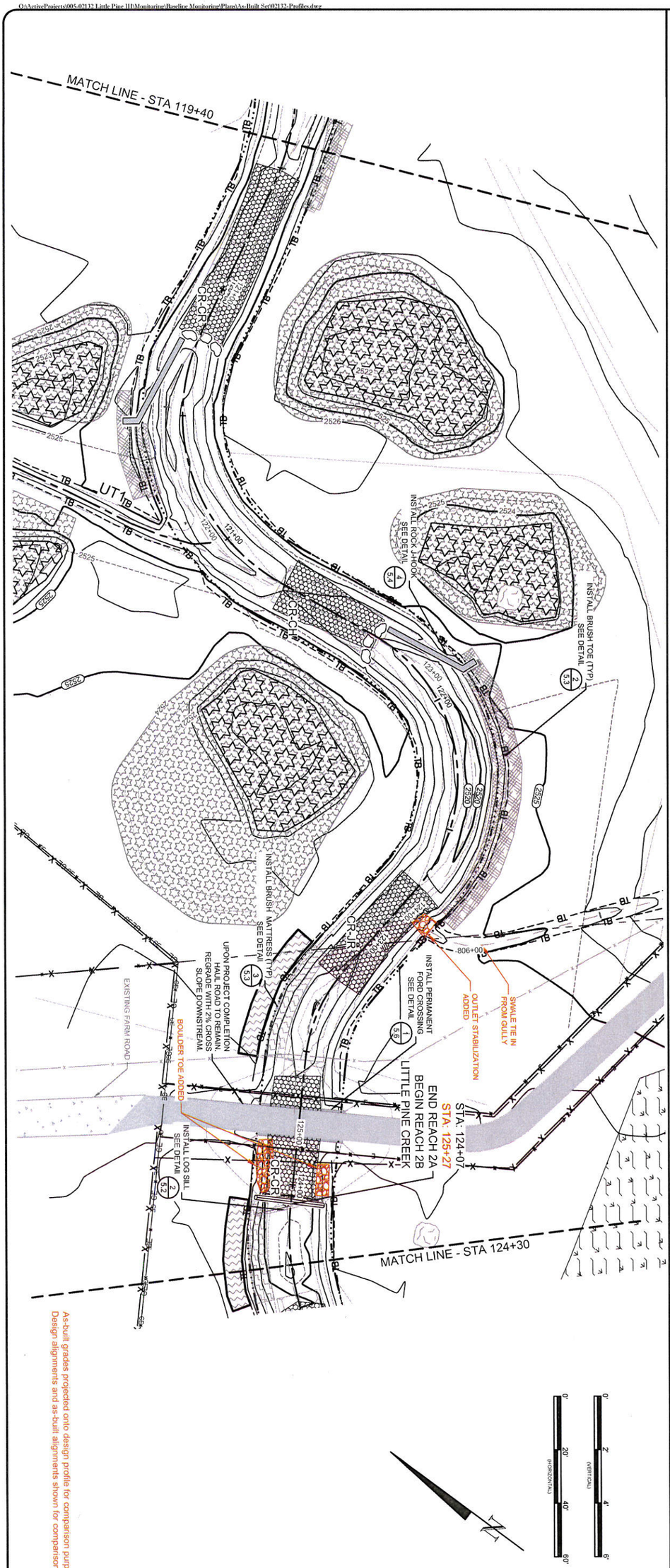

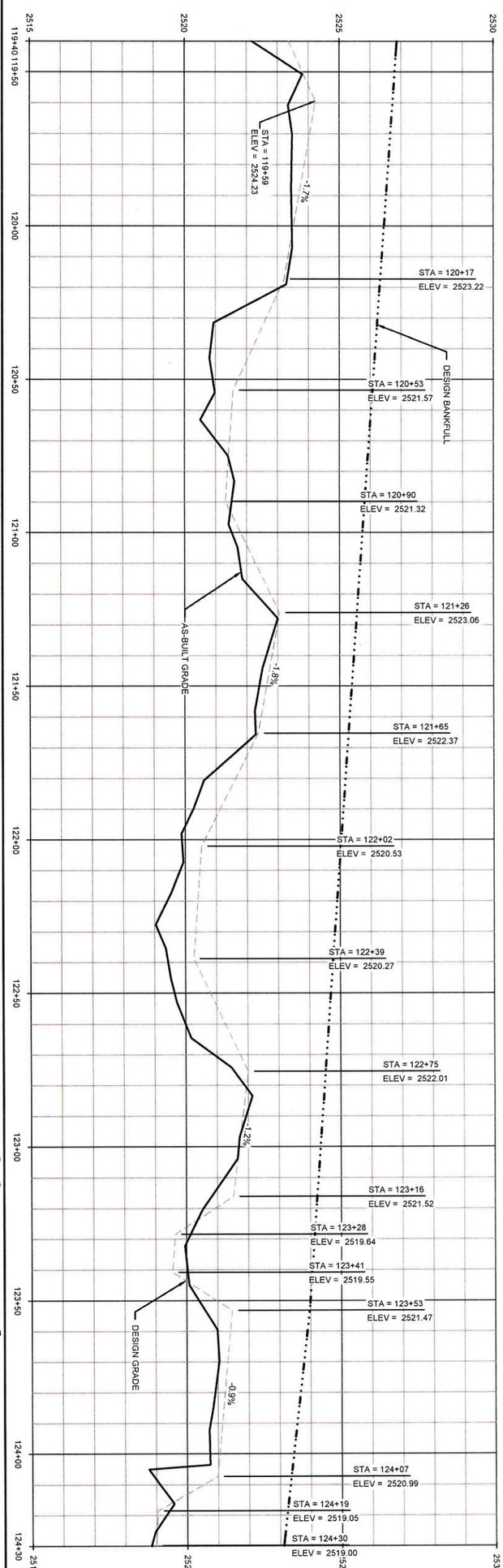

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Date:	August 5, 2016
Job Number:	005-02123
Designed By:	CDM
Drawn By:	JCK
Checked By:	EGR
SCO Project No.: 07-07088-03	

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Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

Little Pine Creek
Plan and Profile

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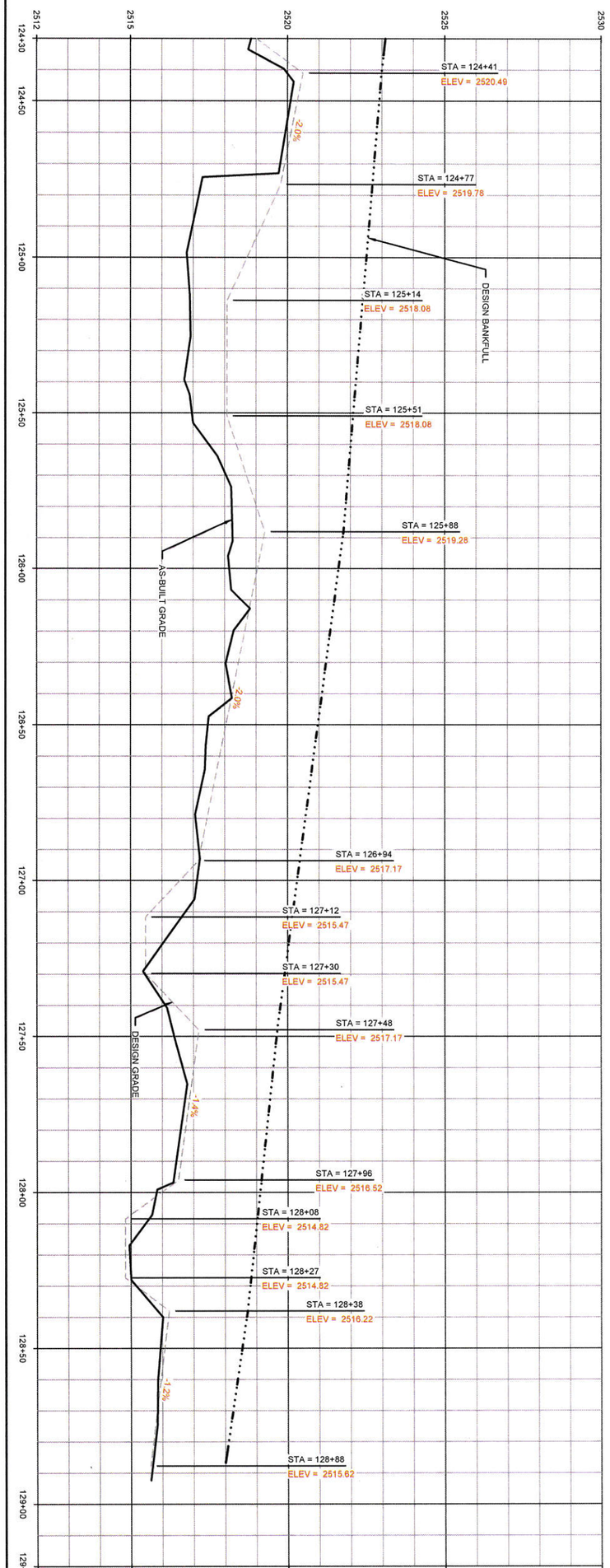

As-built grades projected onto design profile for comparison purposes. Design alignments and as-built alignments shown for comparison.

Date:	August 5, 2016
Job Number:	005-02123
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SCO Project No.: 07-07088-03	

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Sheet

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

Little Pine Creek
Plan and Profile

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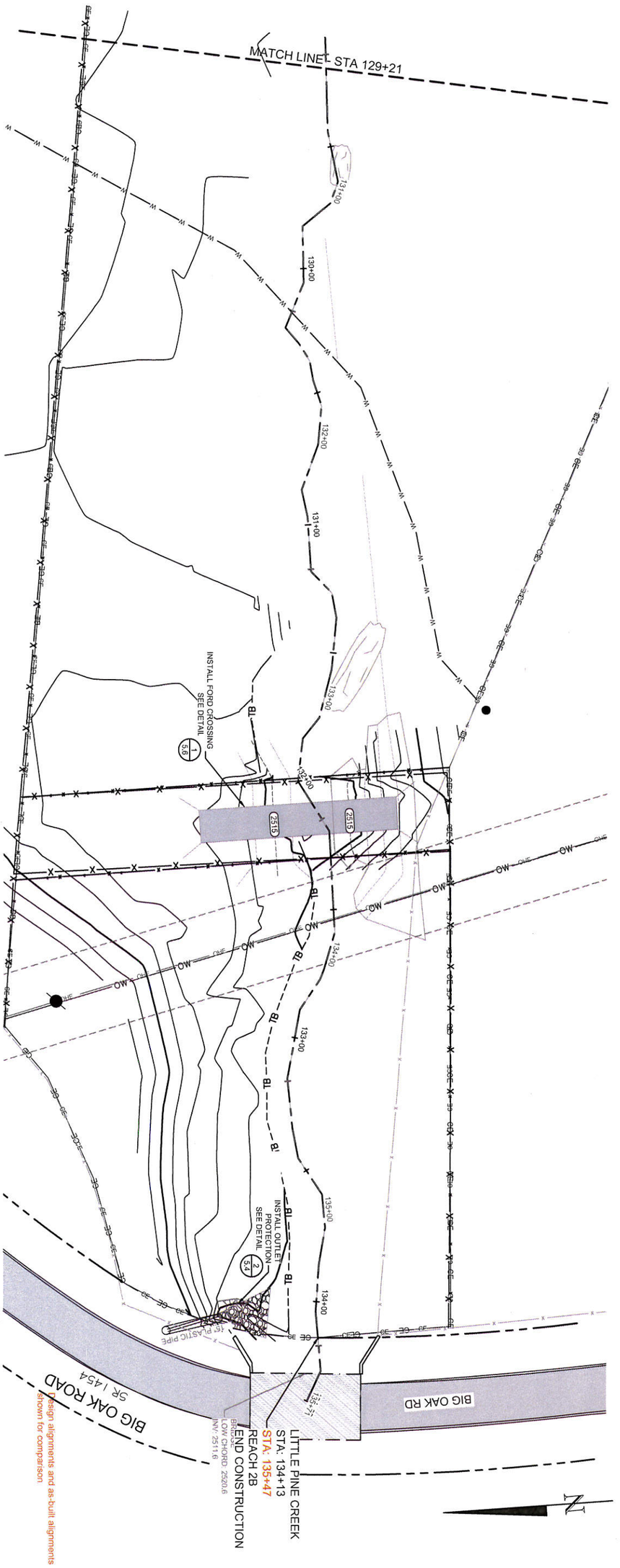

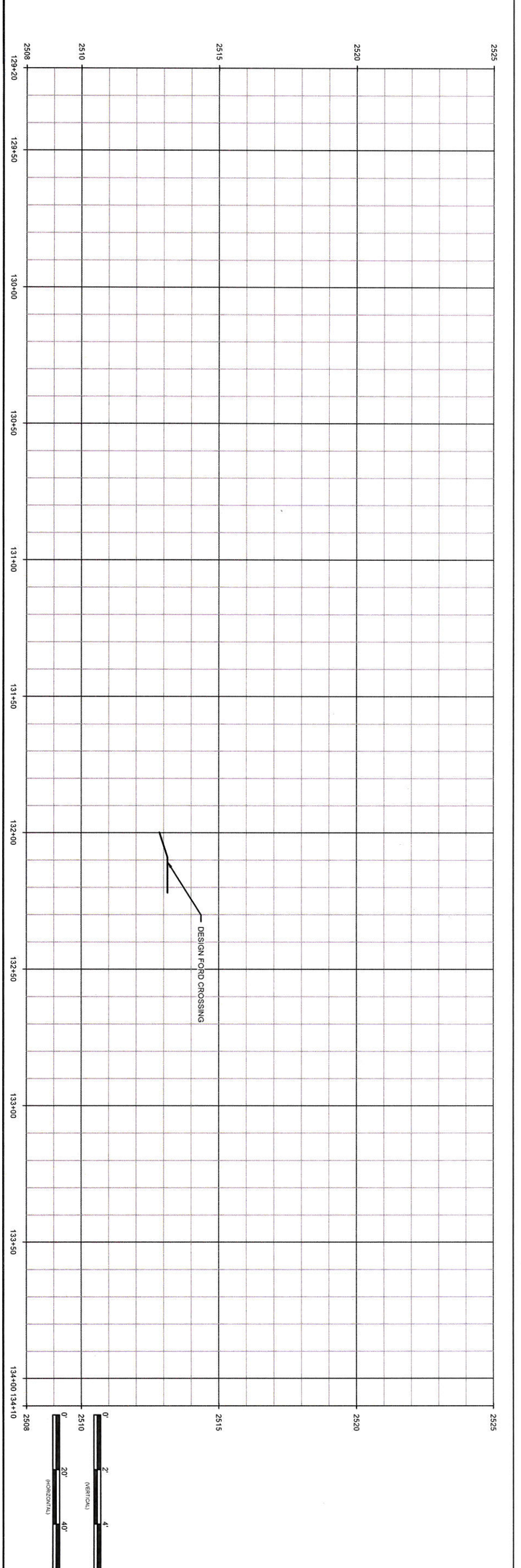

Date:	August 5, 2016
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Designed By:	CDM
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Checked By:	EGR
SCO Project No.: 07-07088-03	

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Revisions:

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

Little Pine Creek
Plan and Profile

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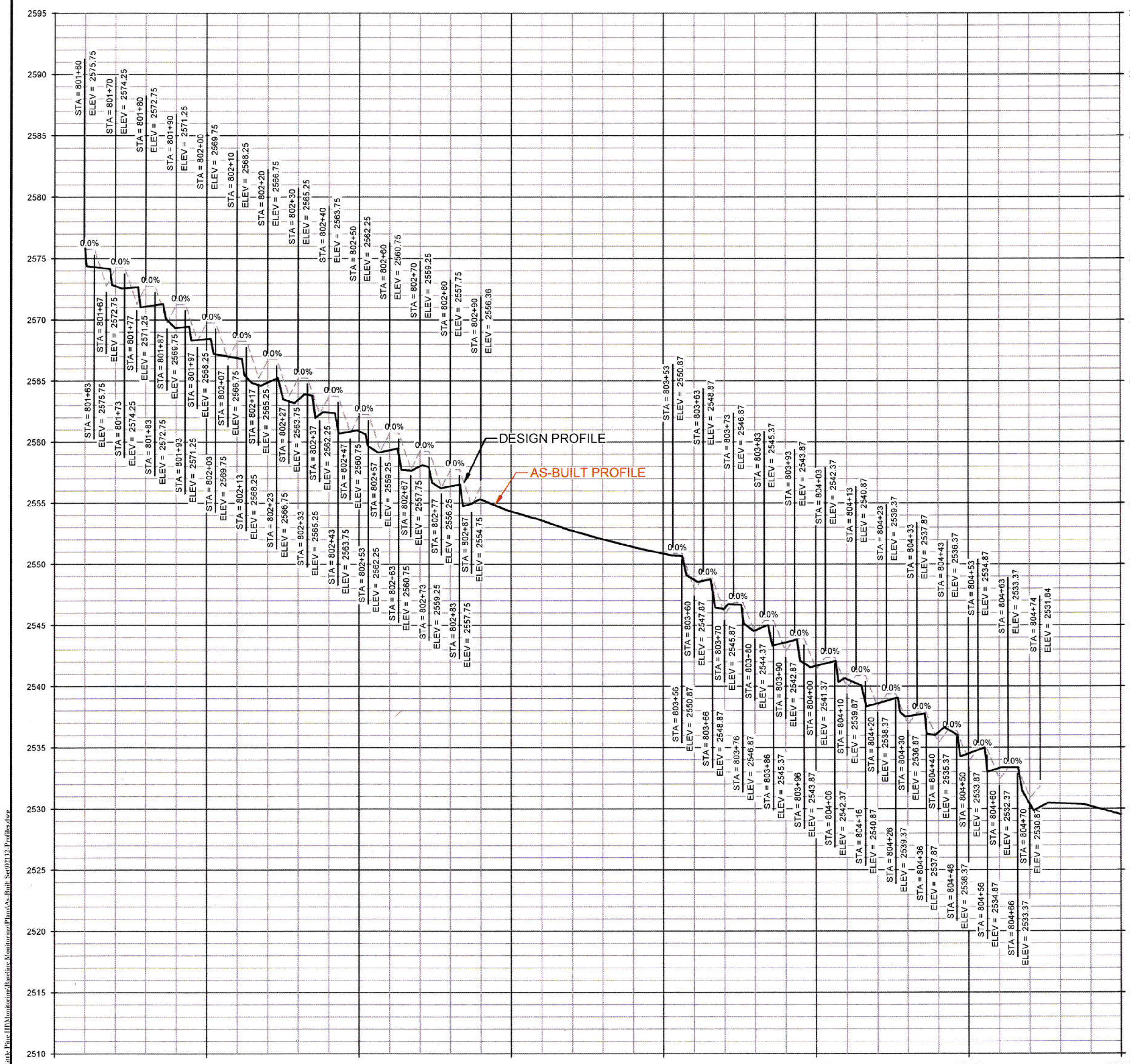

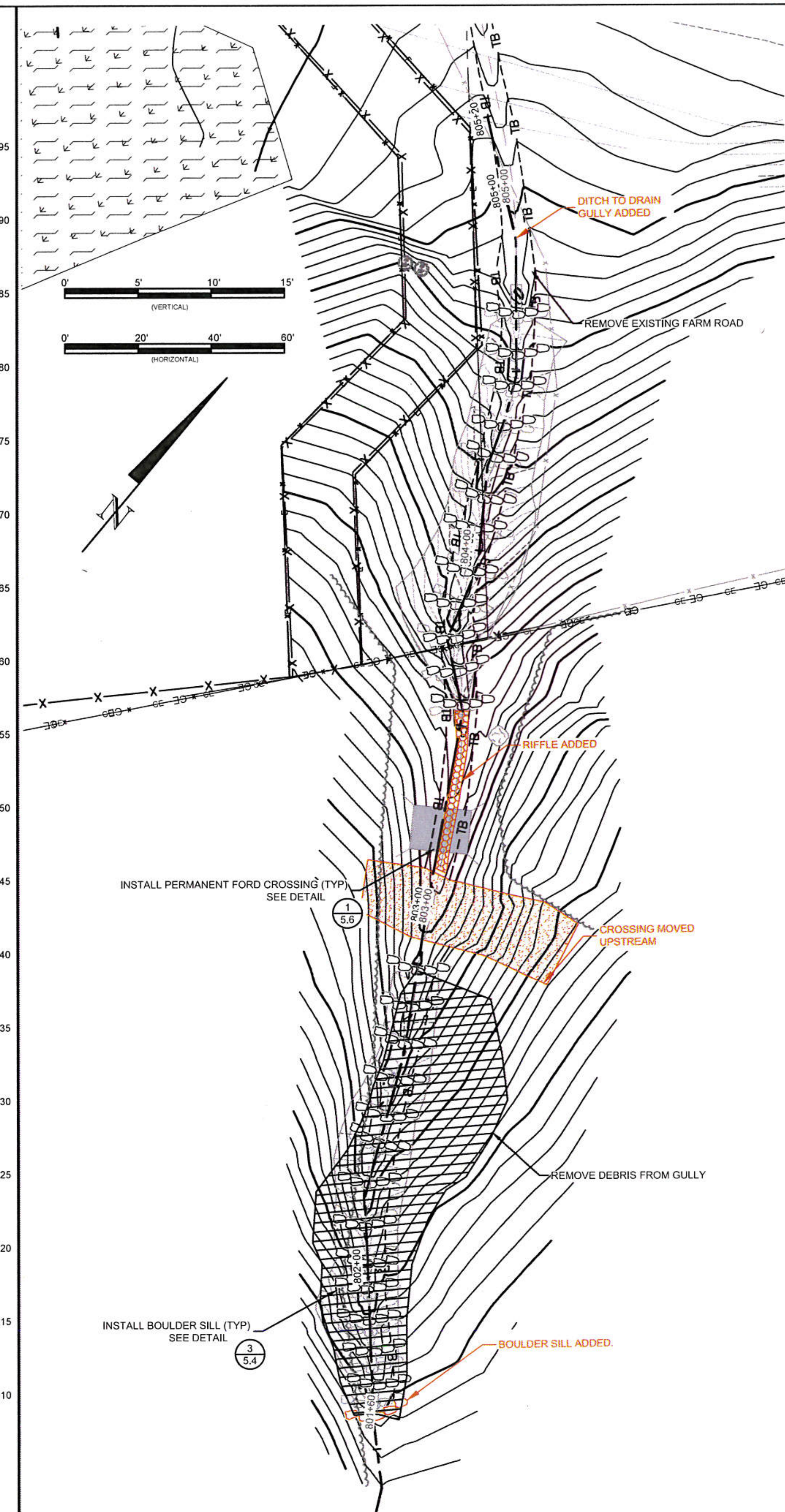

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Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

Gully Adjacent to Little Pine Creek
Plan and Profile

Date:	August 5, 2016
Job Number:	005-02123
Designed By:	CDM
Drawn By:	JCK
Checked By:	EGR
SCO Project No:	07-07088-03

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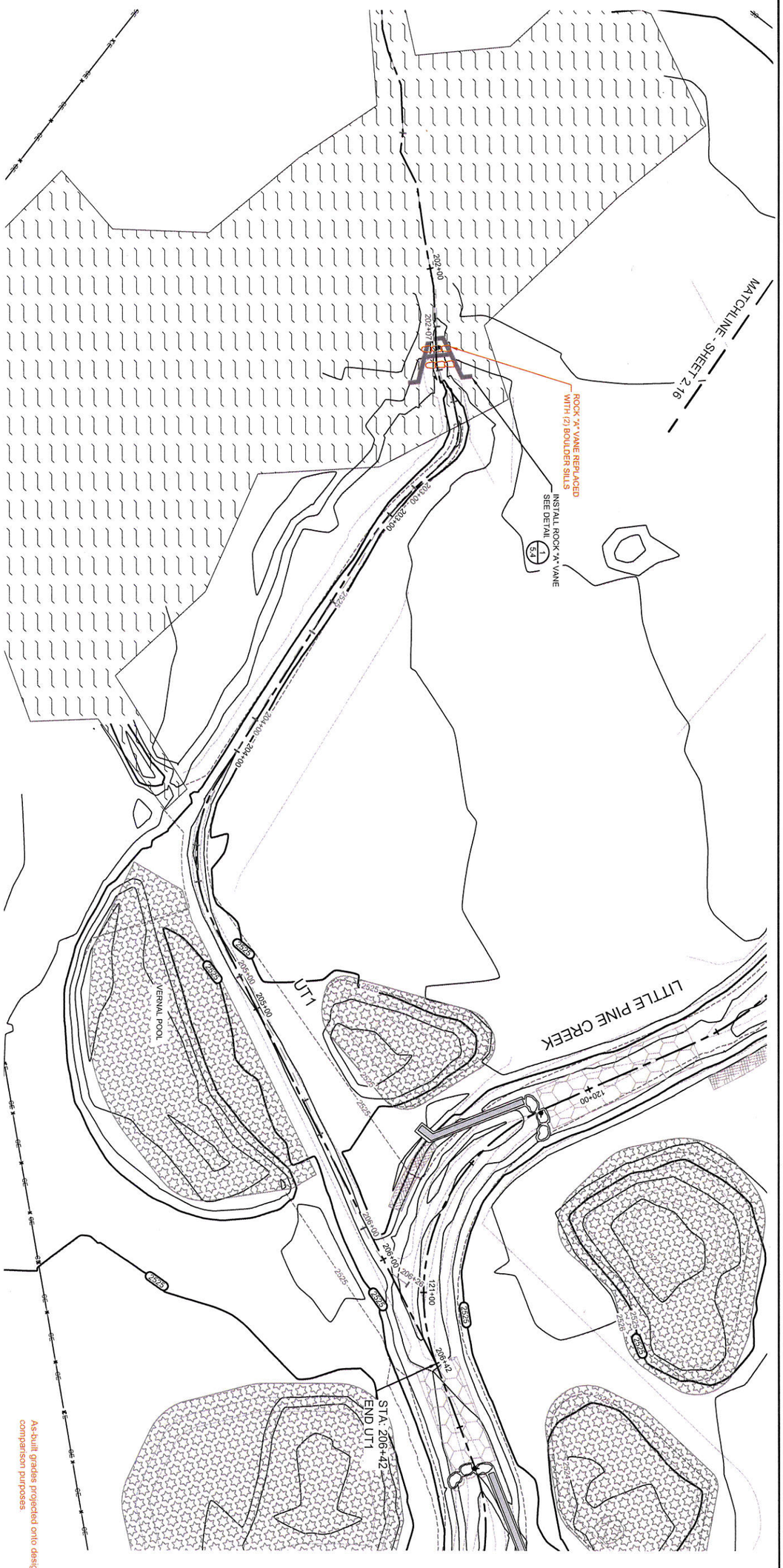

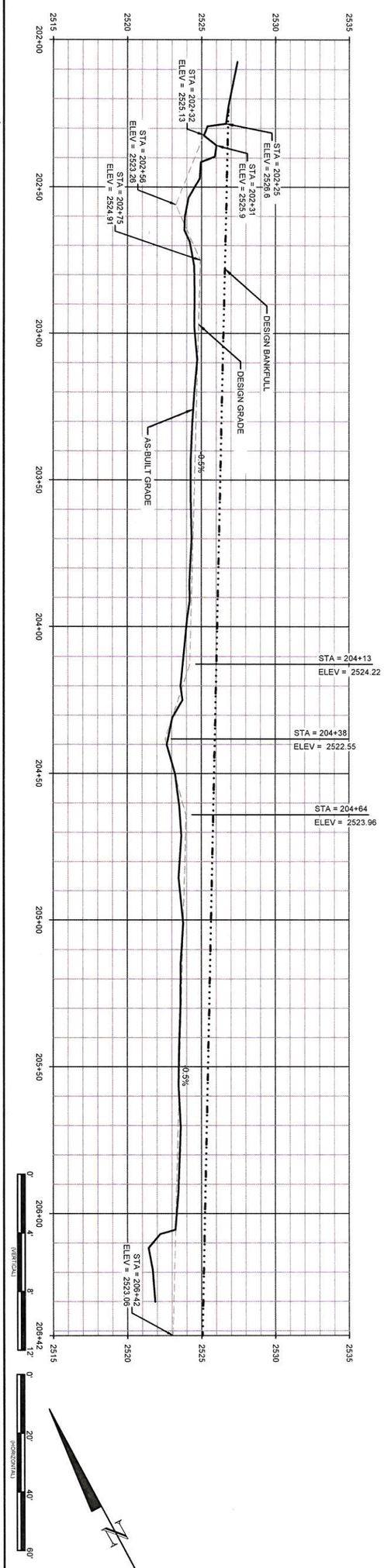

Date:	August 5, 2016
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Designed By:	CDM
Drawn By:	JCK
Checked By:	EGR
SCO Project No.: 07-07088-03	

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Revisions:

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT1
Plan and Profile

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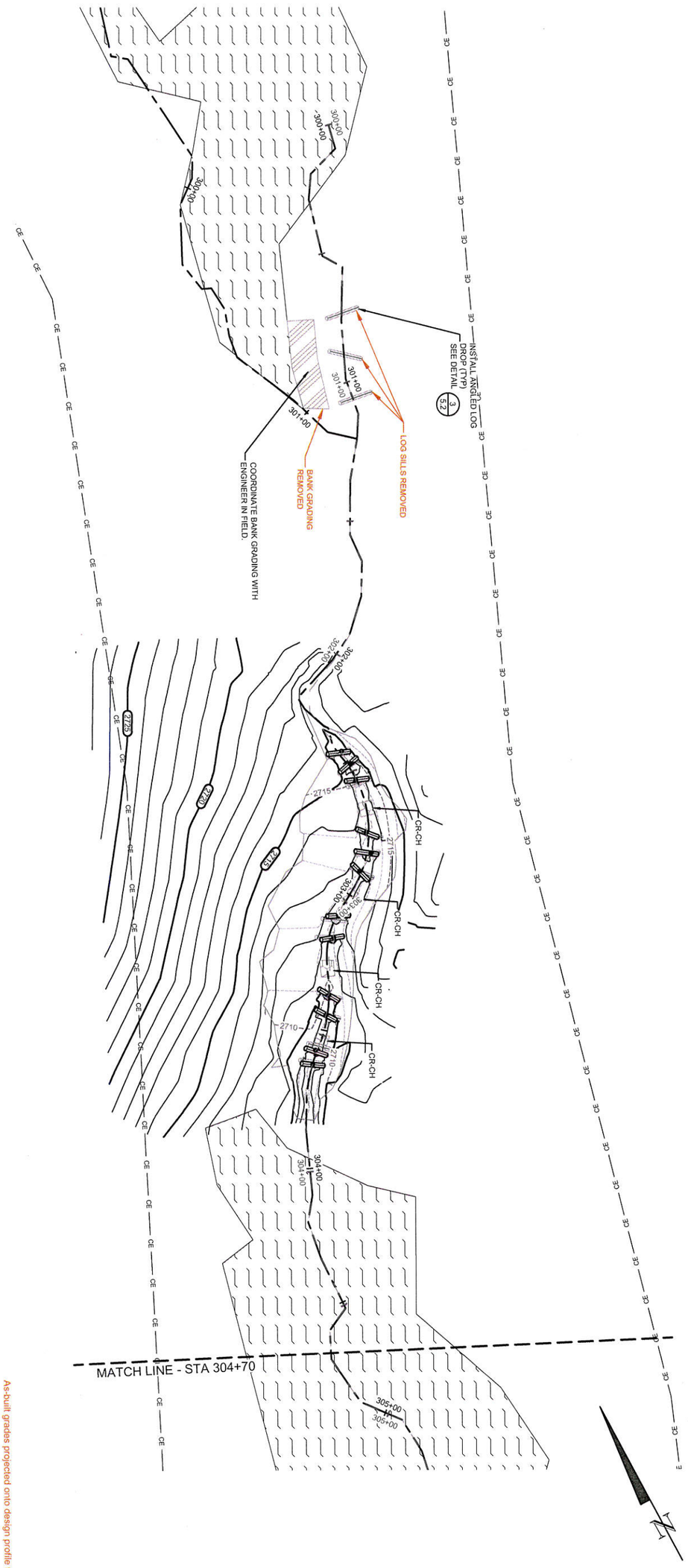

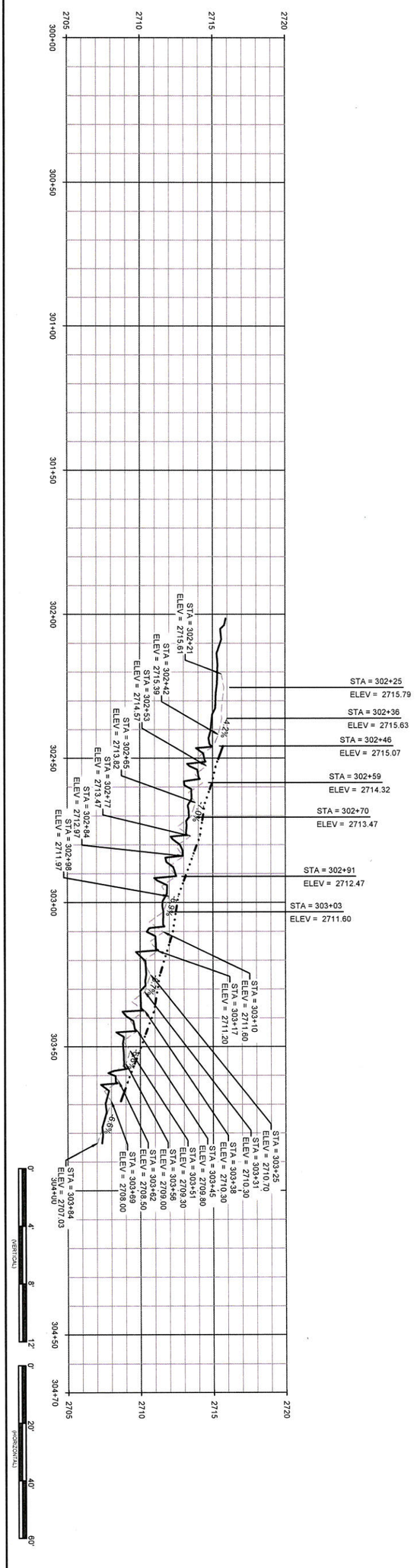

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SCO Project No.: 07-07088-03	

Revisions:

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Sheet

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT2
Plan and Profile

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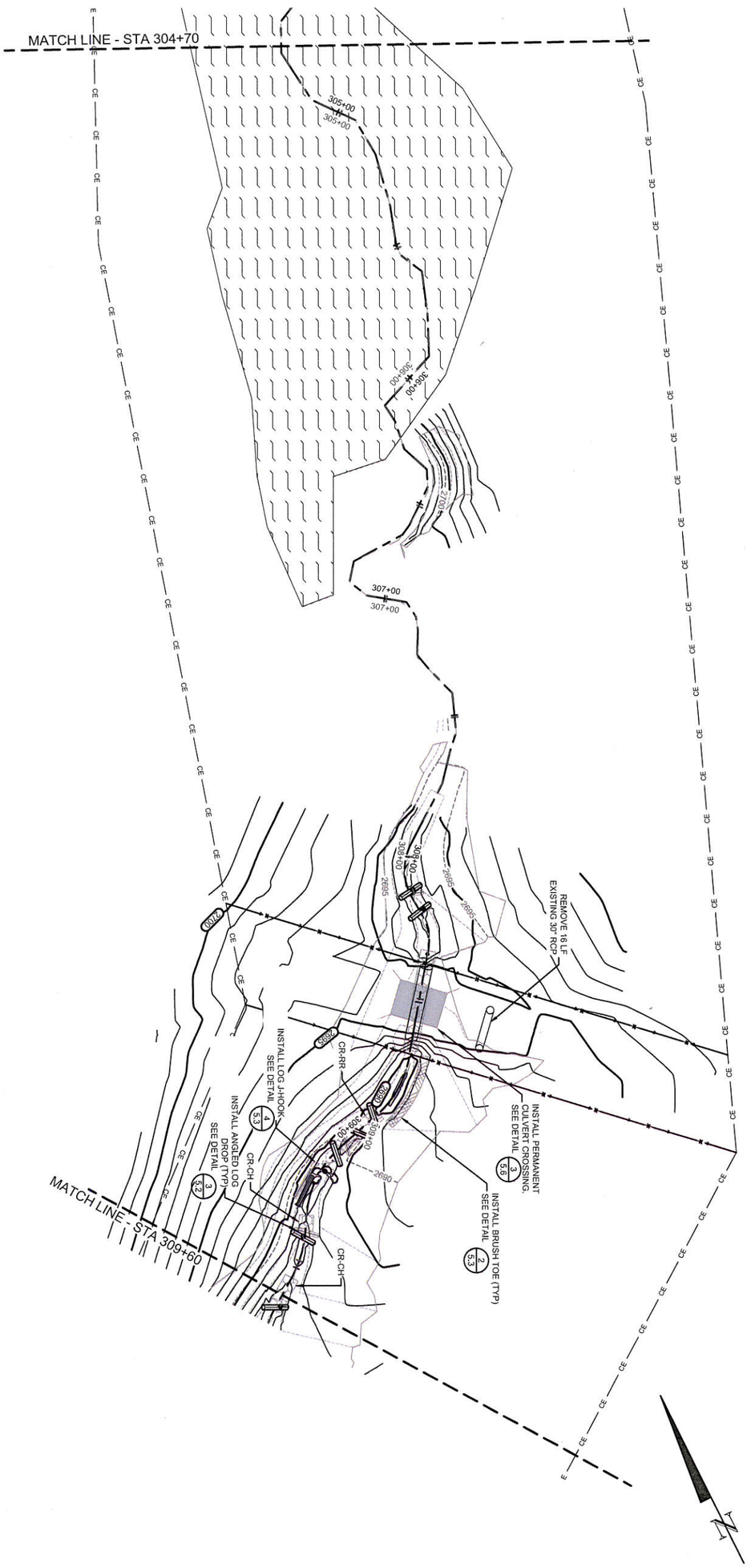

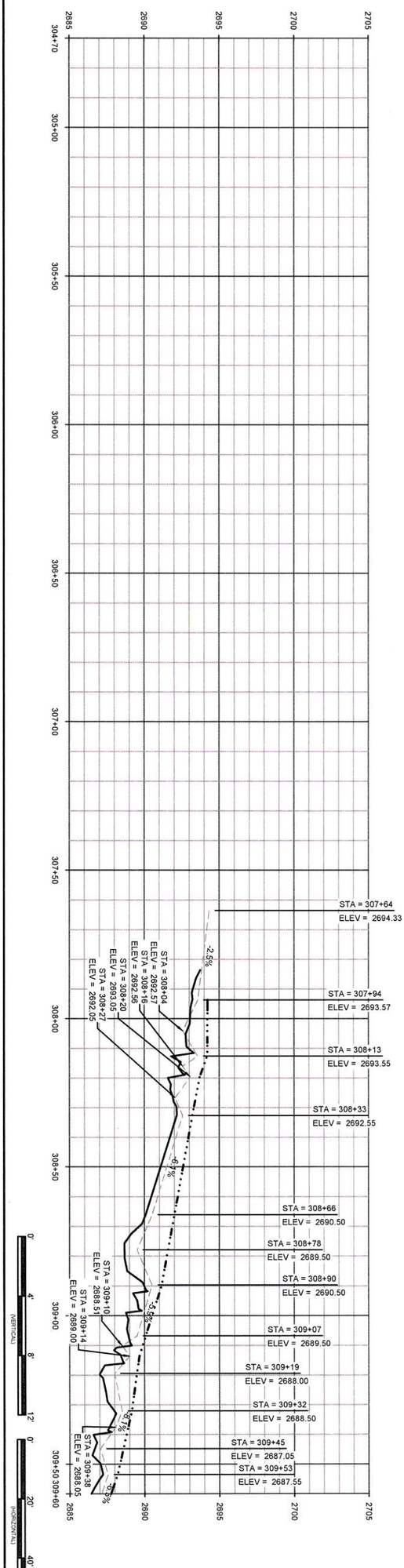

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Design alignments and as-built alignments shown for comparison

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SCO Project No.:	07-07088-03

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Revisions:

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT2
Plan and Profile

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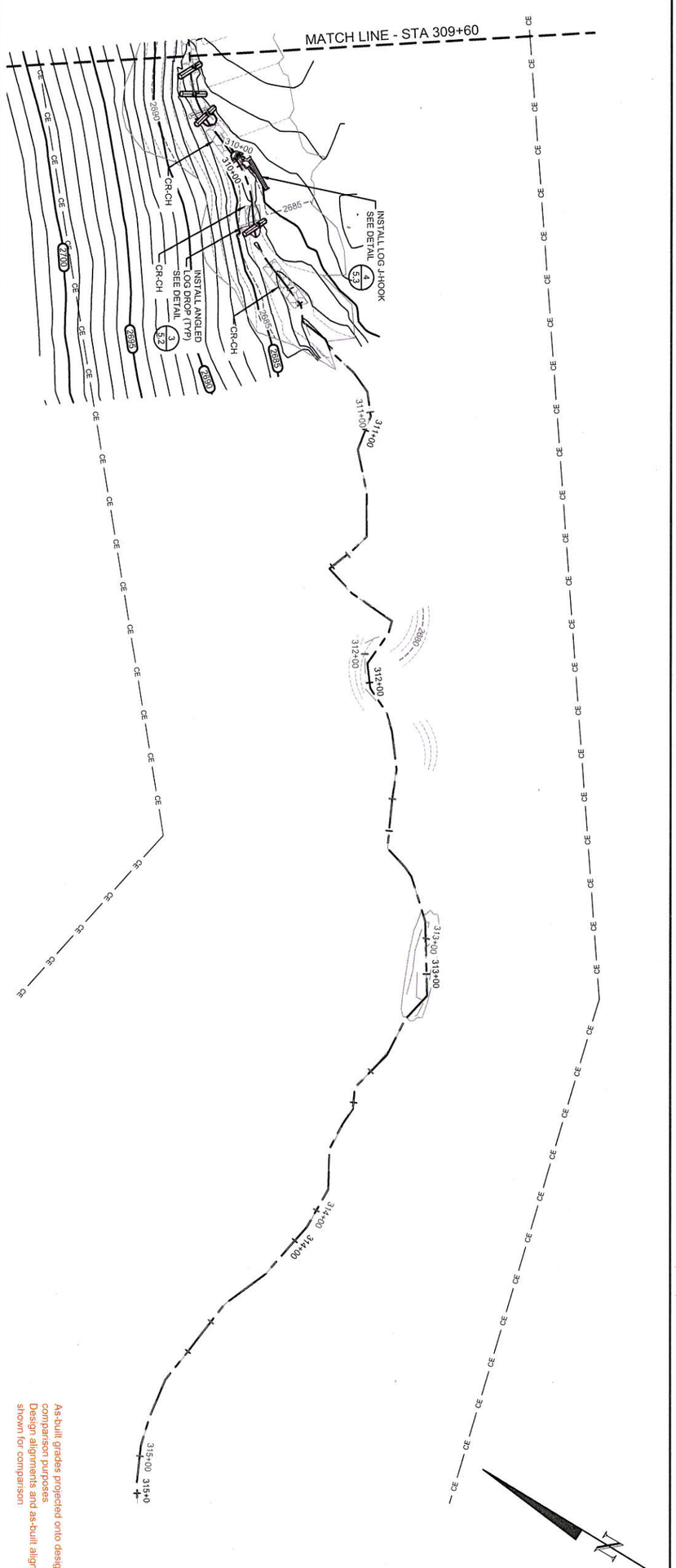

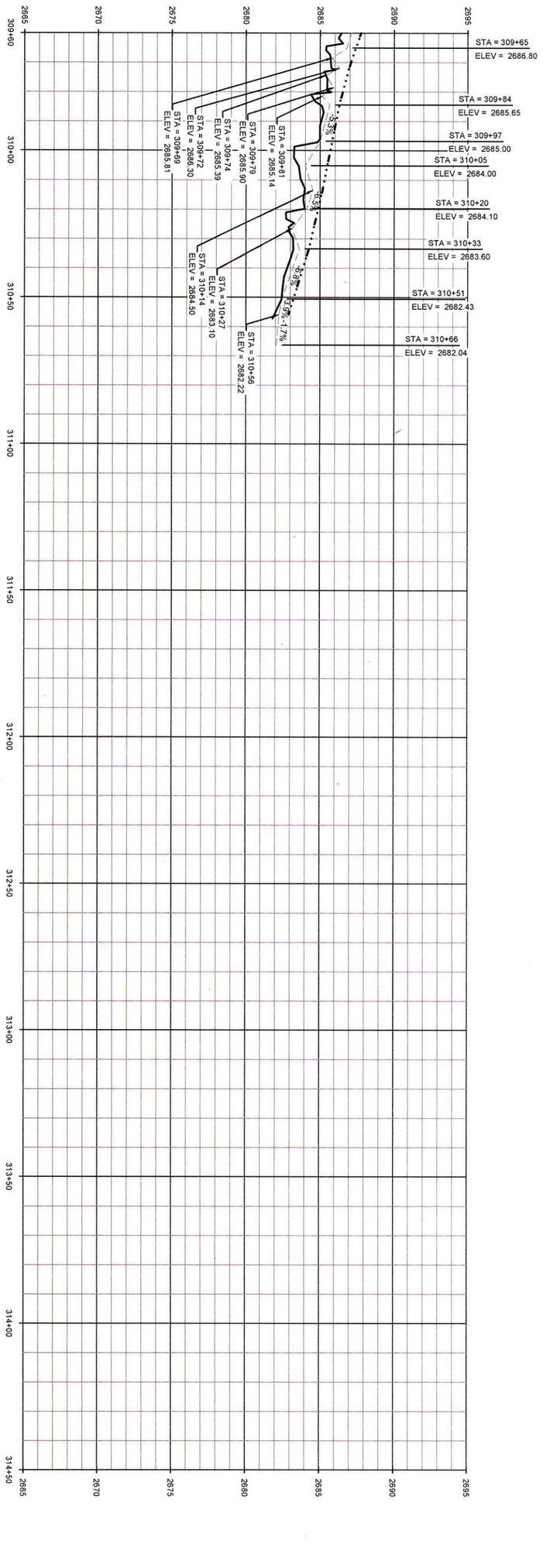

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SCO Project No.: 07-07088-03	

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Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT2
Plan and Profile

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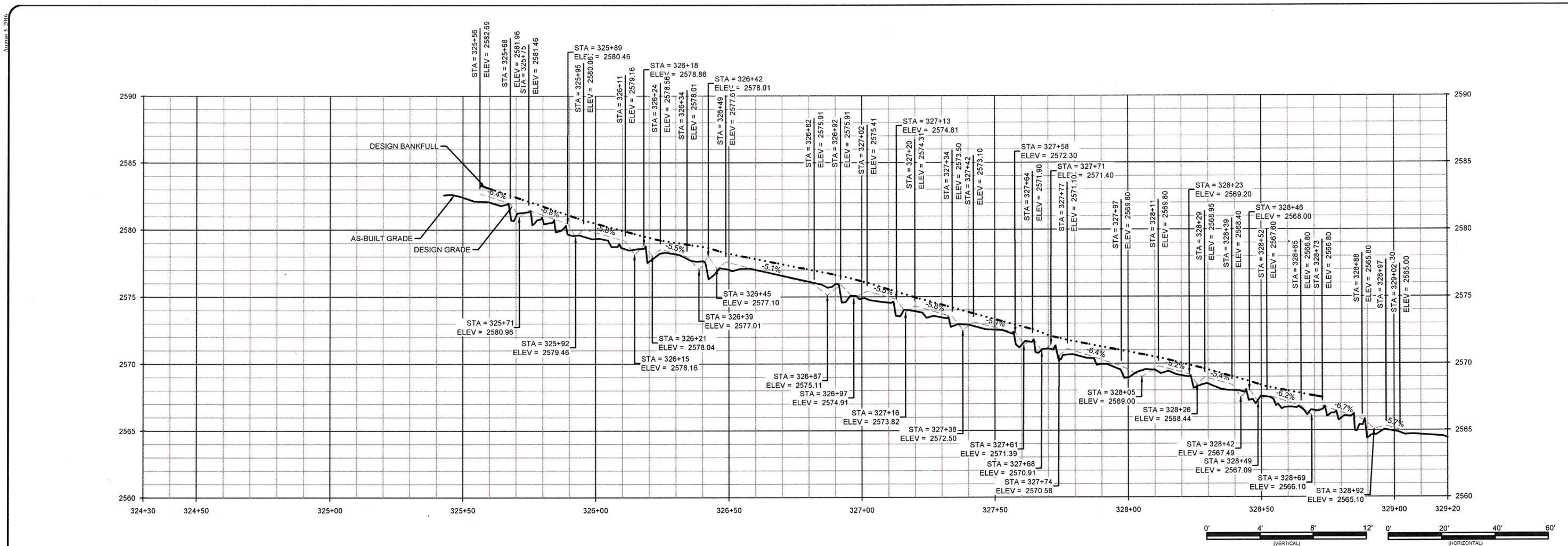

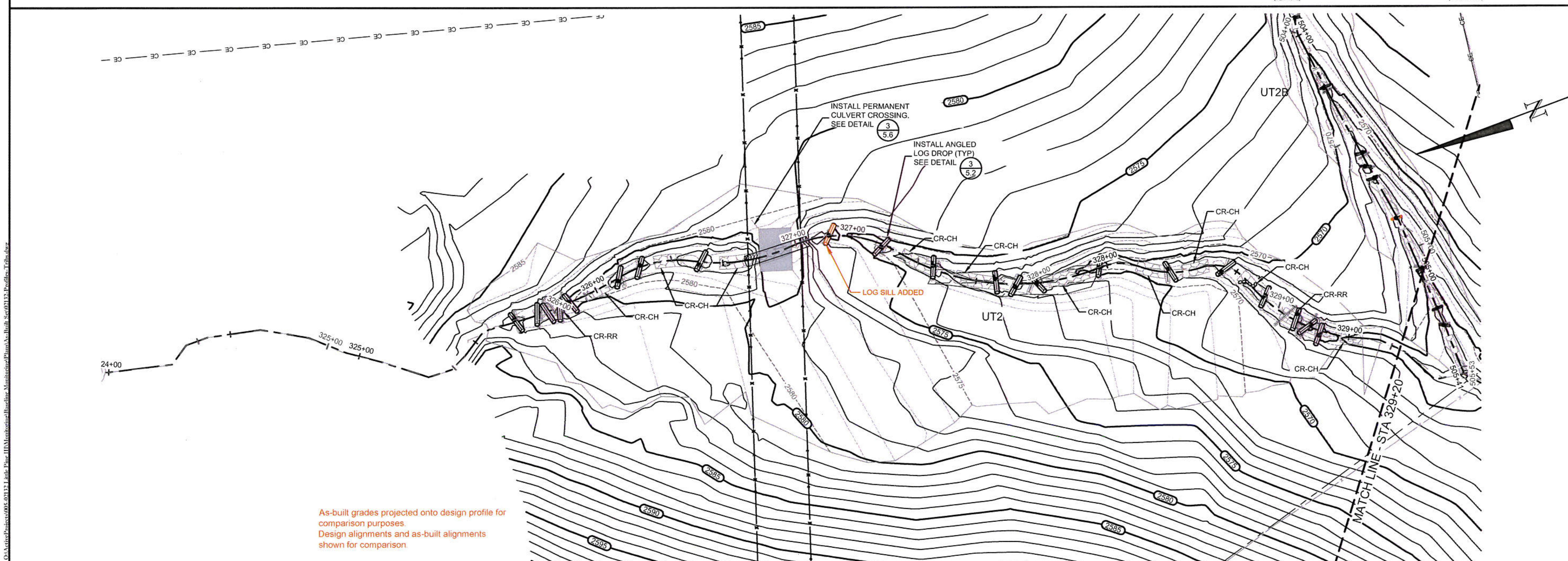

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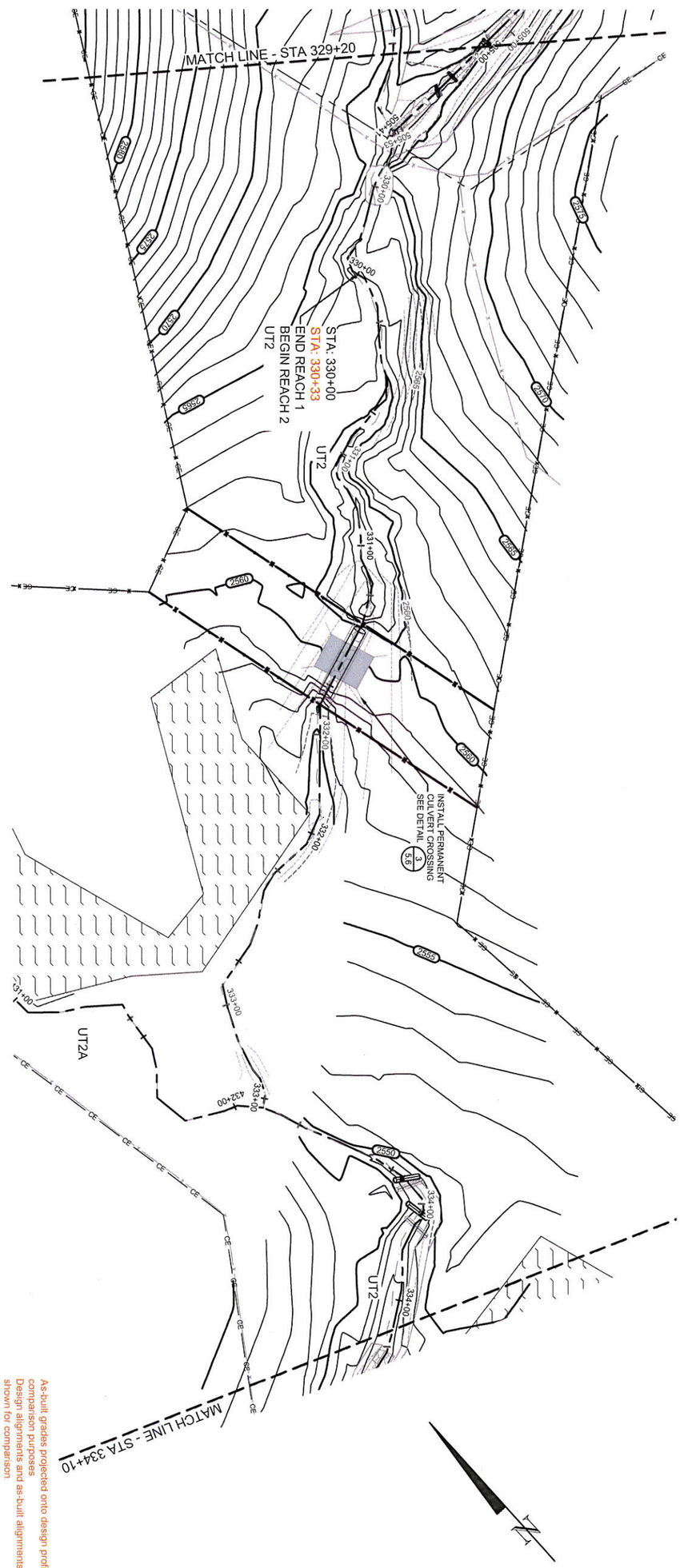
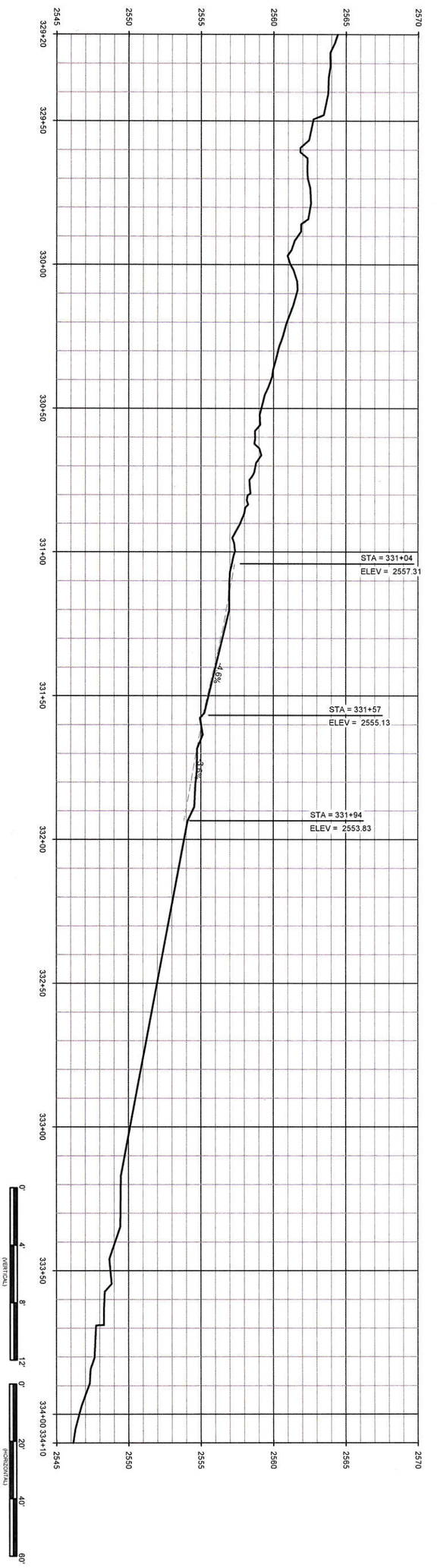
Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT2
Plan and Profile

Date: August 5, 2016
Job Number: 005-02123
Designed By: CDM
Drawn By: JCK
Checked By: EGR
SCO Project No.: 07-07088-03
Revisions:

Sheet 2.13





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Revisions:

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT2
Plan and Profile

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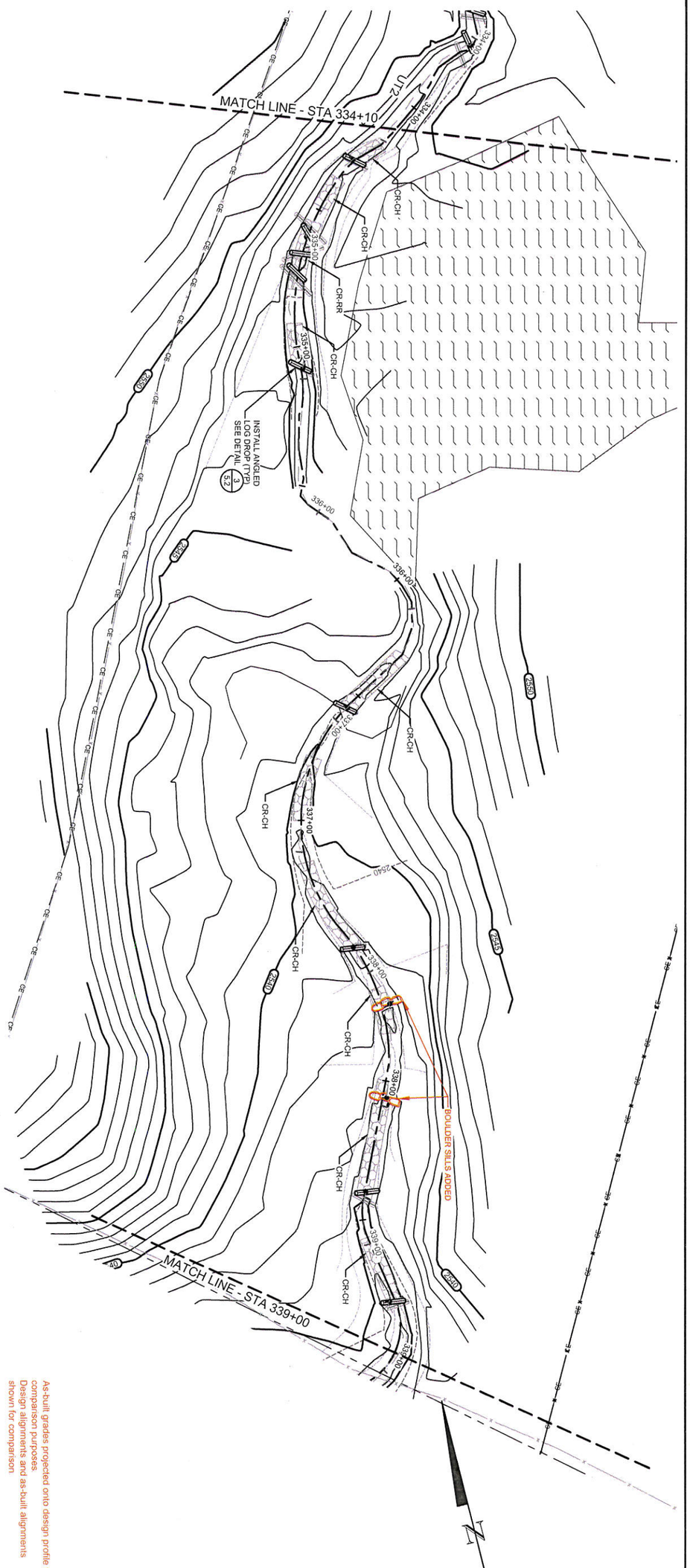

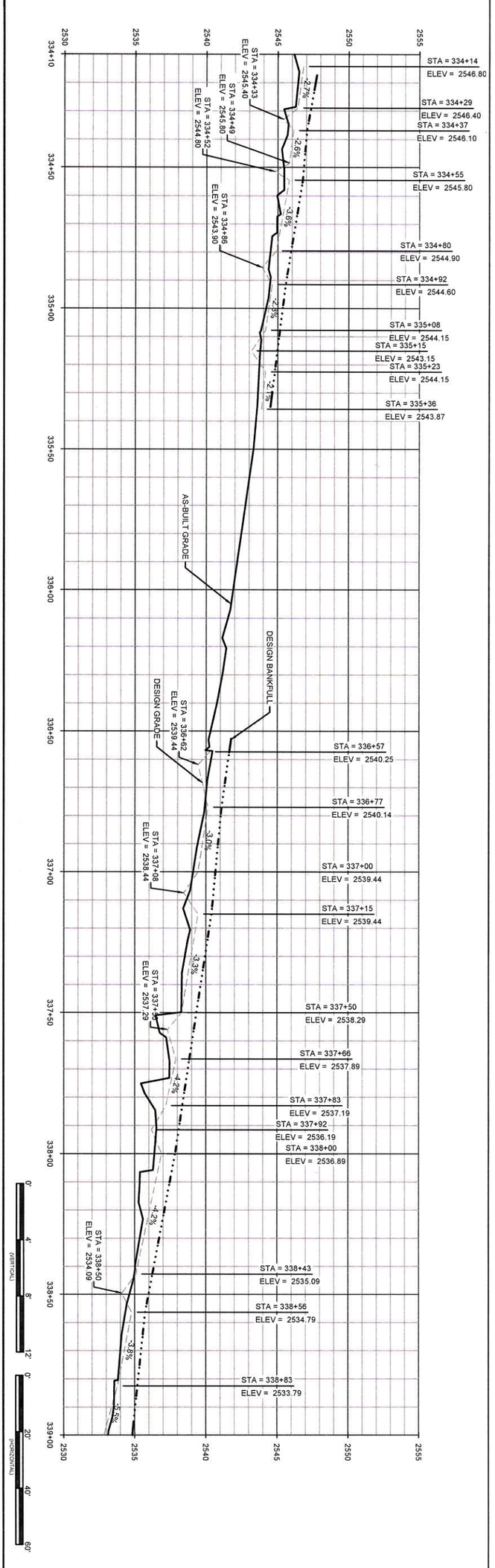

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Revisions:

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT2
Plan and Profile

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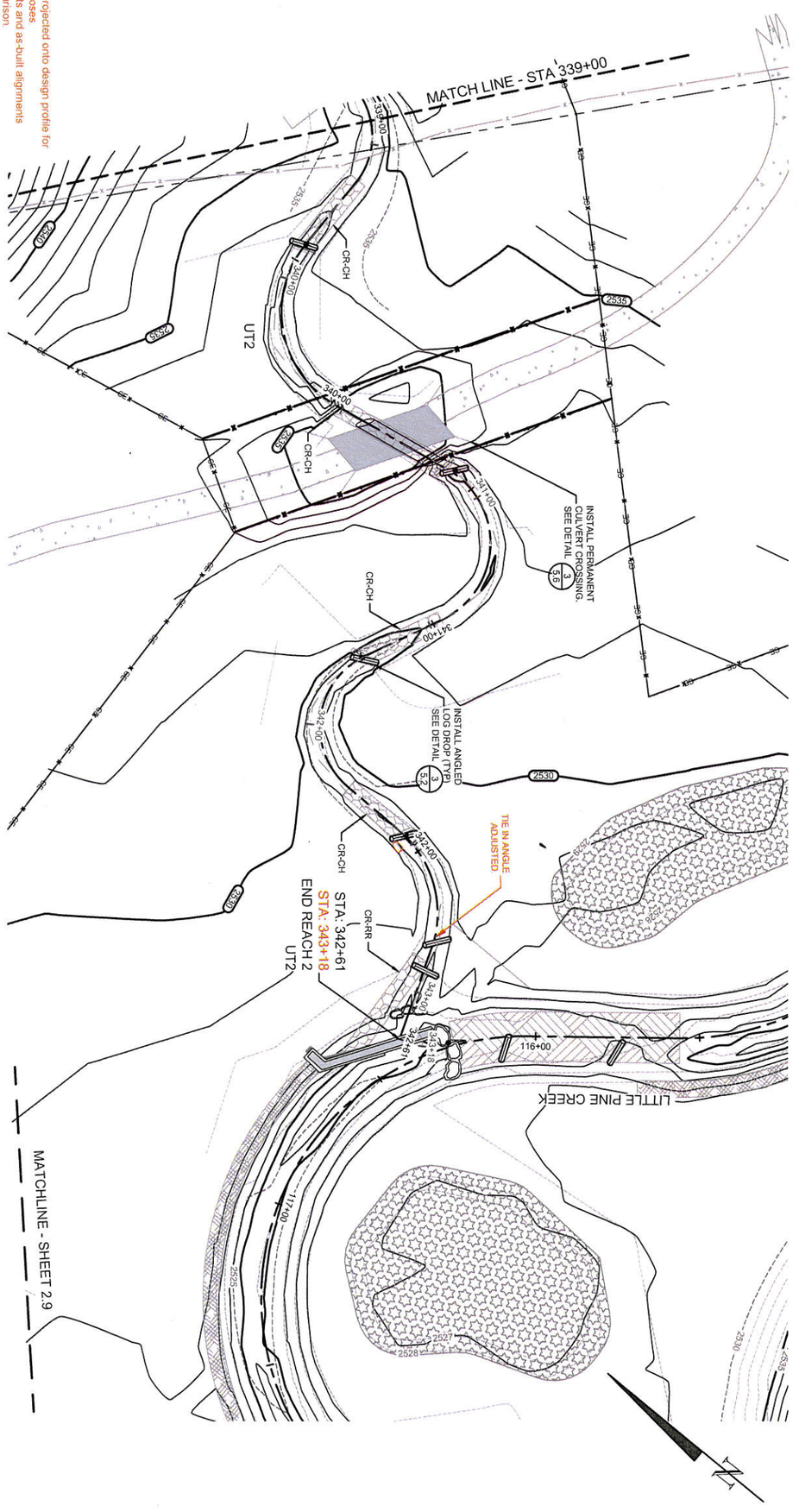

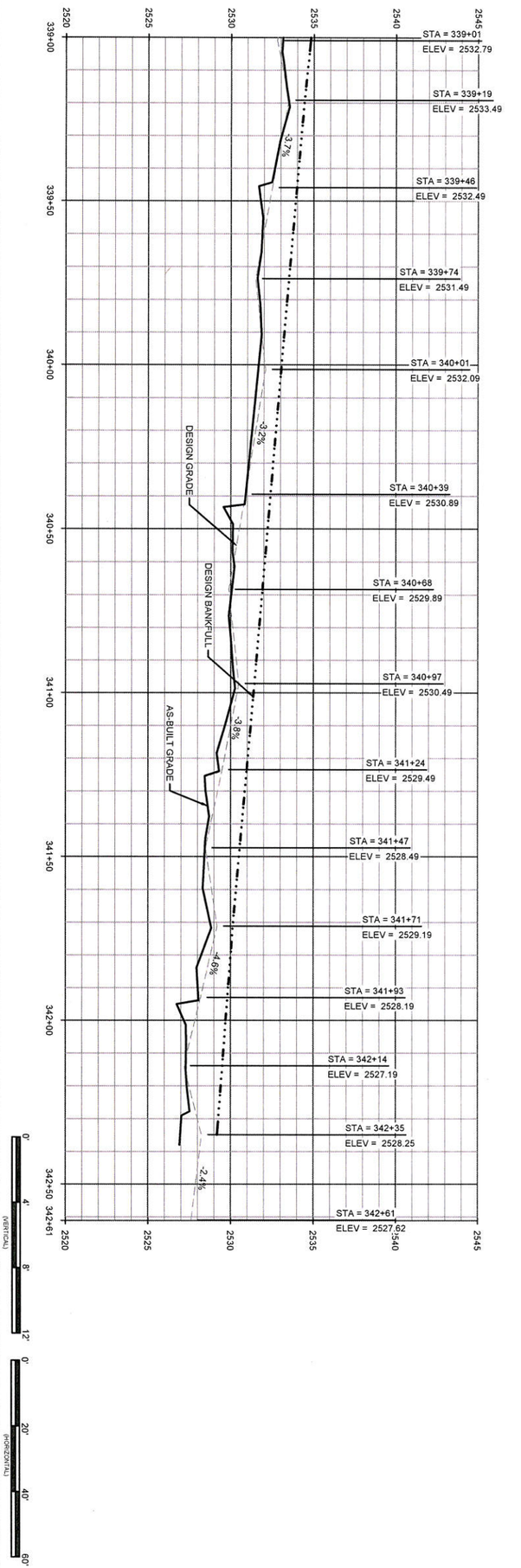

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Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT2
Plan and Profile

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8-5-16

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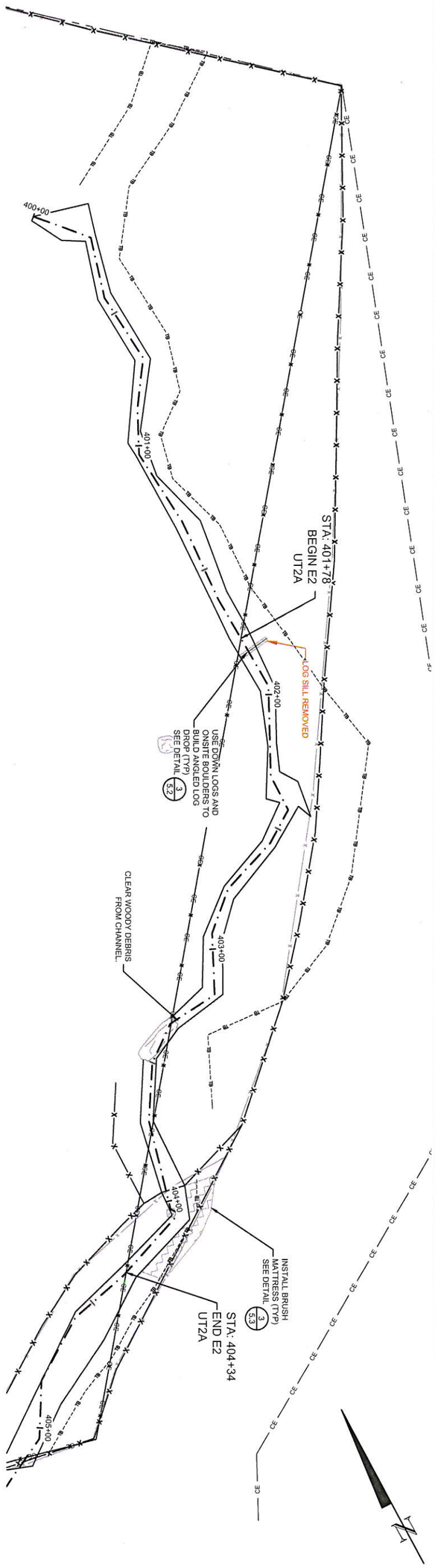

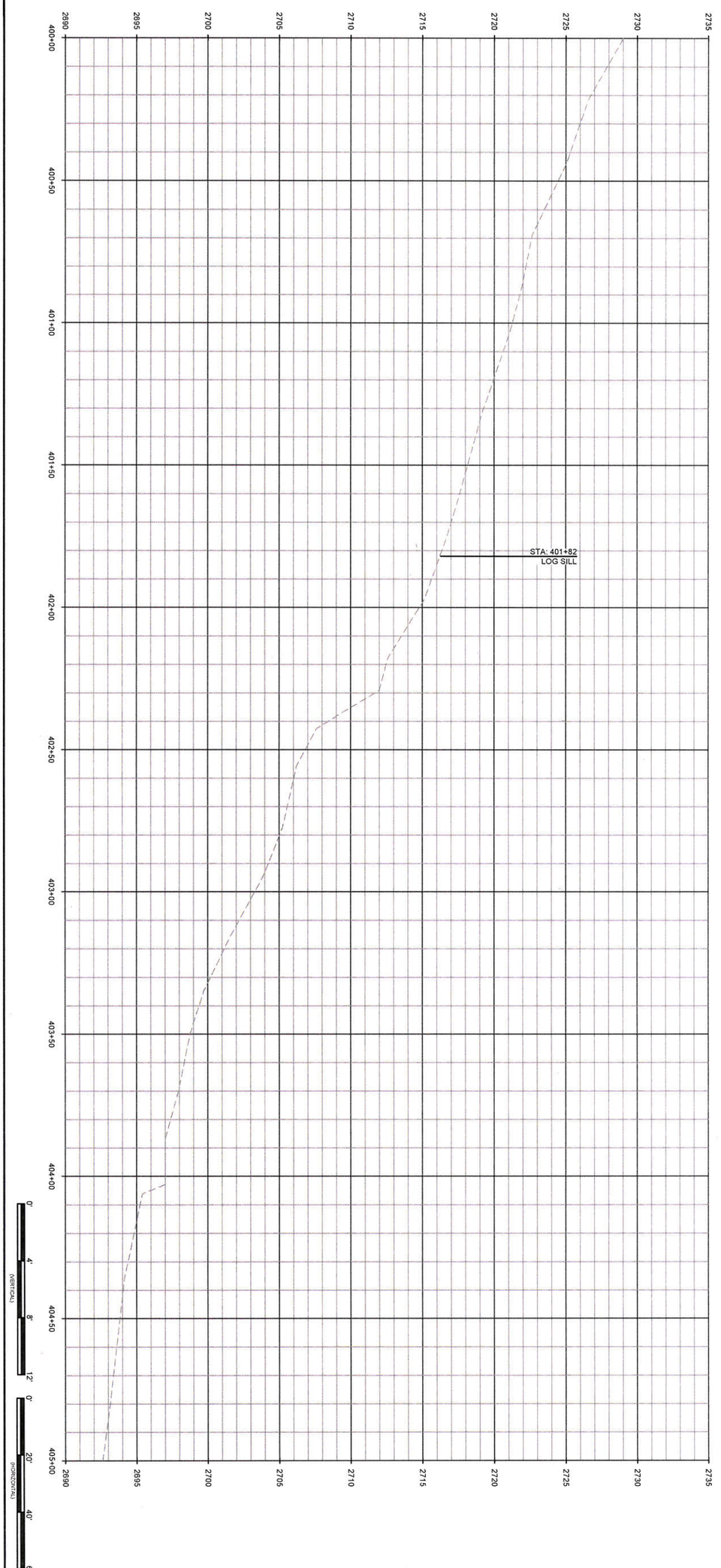

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Revisions:

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT2A
Plan and Profile

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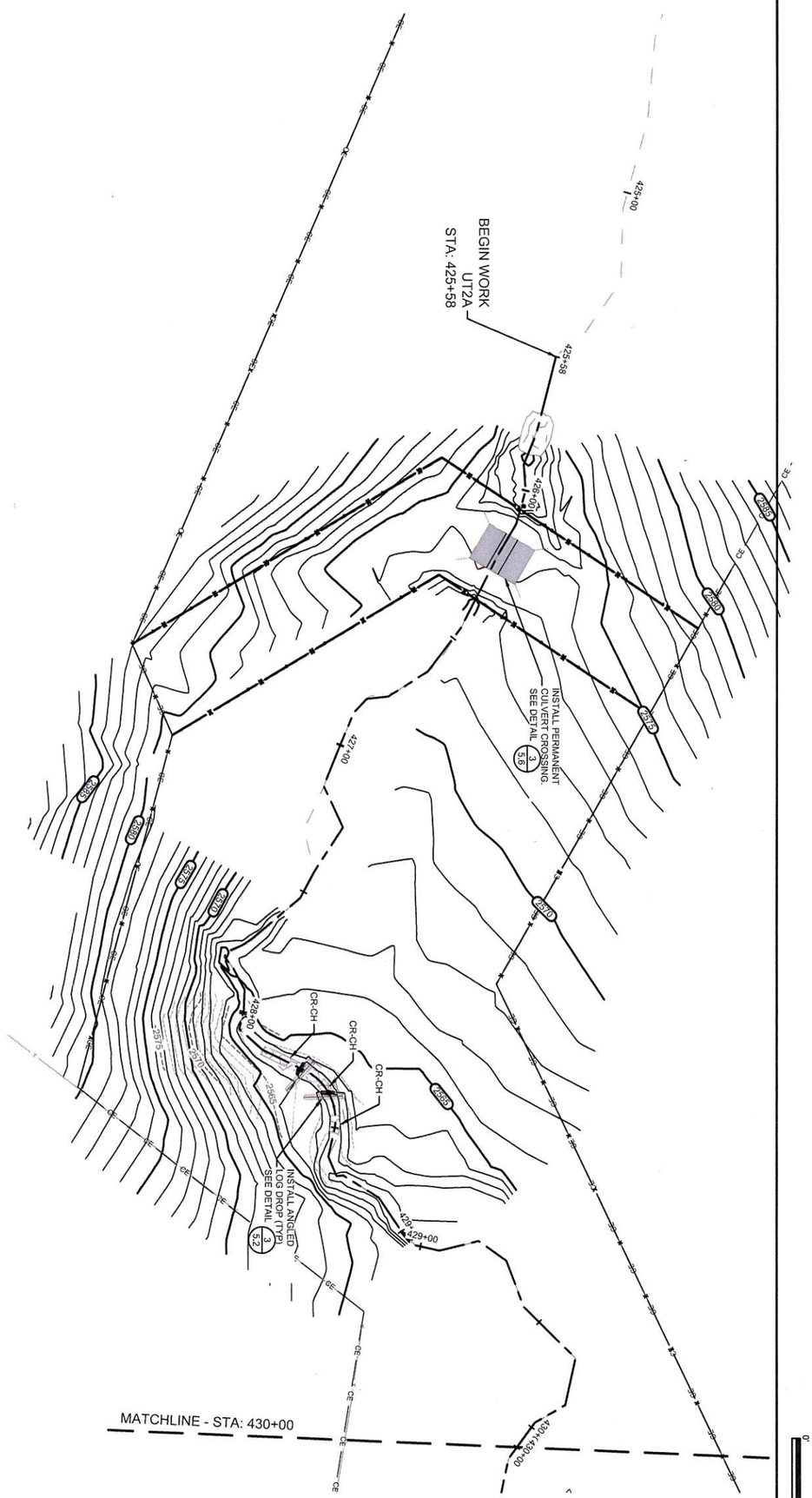

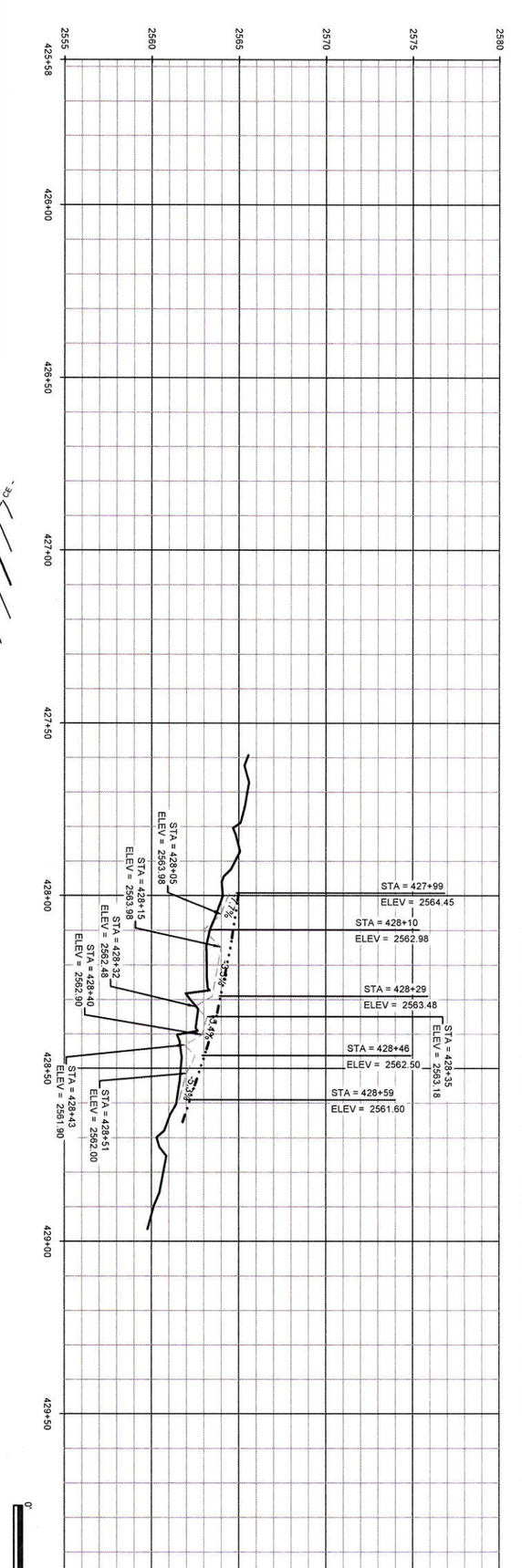

As-built grades projected onto design profile for comparison purposes. Design alignments and as-built alignments shown for comparison.

Date:	August 5, 2016
Job Number:	005-02123
Designed By:	CDM
Drawn By:	JCK
Checked By:	EGR
SCO Project No.:	07-07088-03

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Revisions:

Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT2A
Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 029340 ENGINEER AARON S. EARLEY
8-5-16

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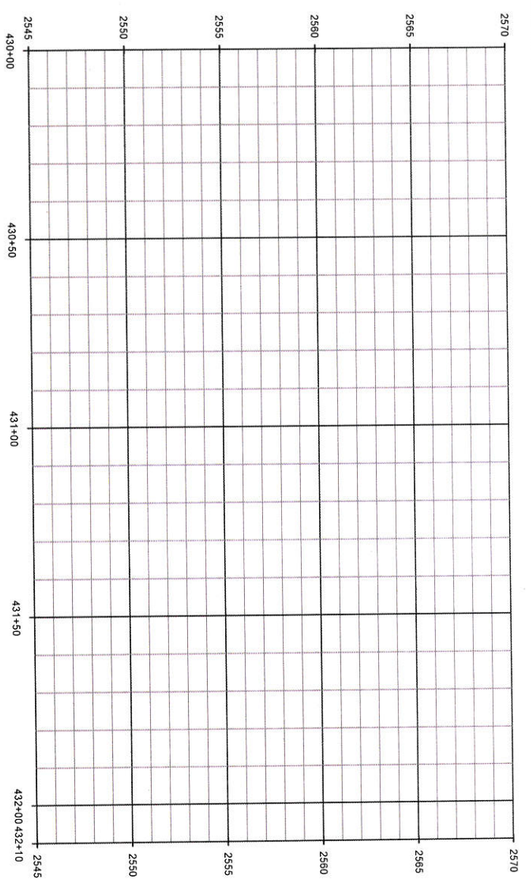

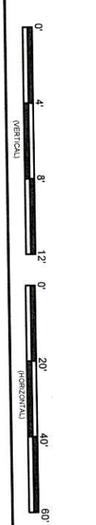

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Alleghany County, North Carolina

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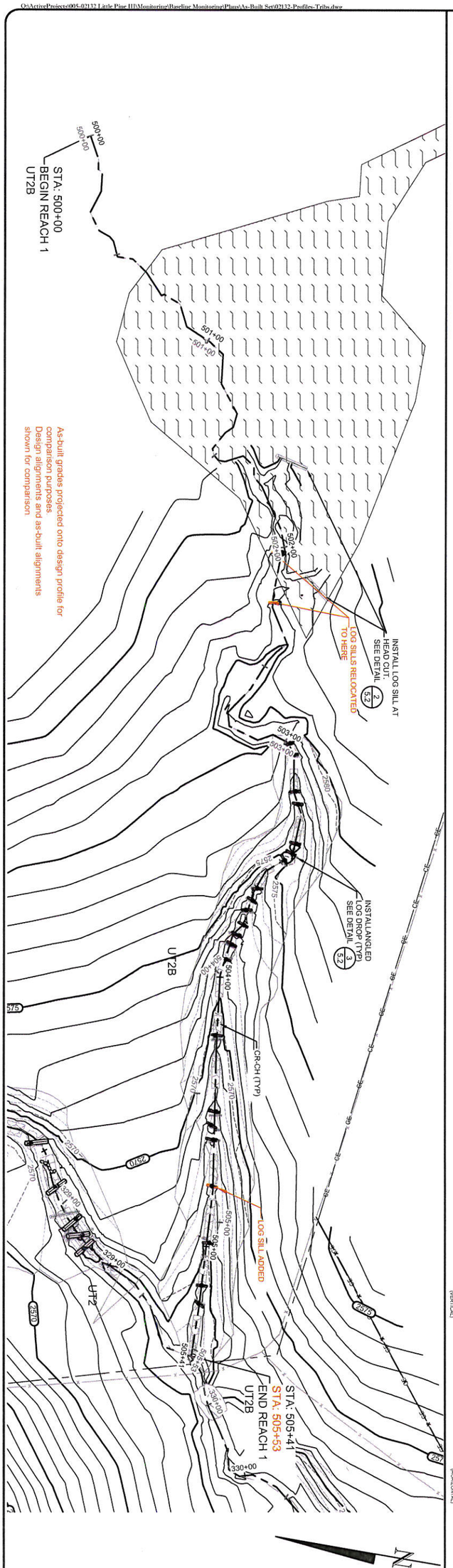

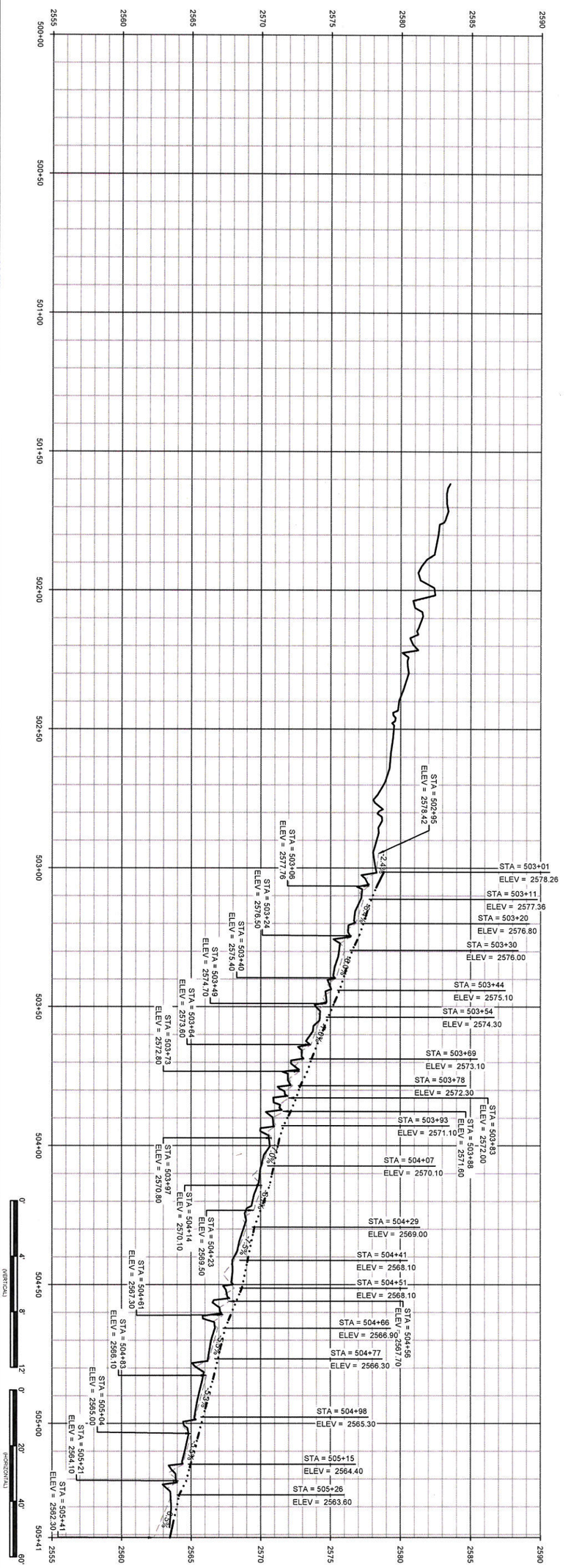

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Job Number:	005-02123
Designed By:	CDM
Drawn By:	JCK
Checked By:	EGR
SCO Project No.:	07-07088-03

Revisions:

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Little Pine Creek III Stream & Wetland As-Built
Alleghany County, North Carolina

UT2B
Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 029340 ENGINEER AARON E. EARLES
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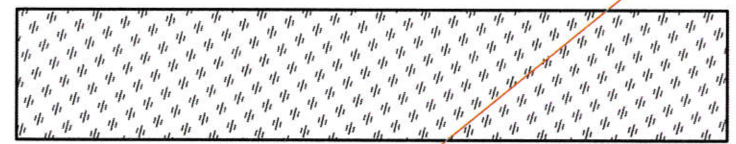
August 5, 2016

RIPARIAN BUFFER PLANTING ZONE

Species	Common Name	Max. Spacing	Indiv. Spacing	Min. Caliper	Stratum	#
Sassafras albidum	Sassafras	12 ft	6-12 ft	0.25"-1.0"		5%
Liriodendron tulipifera	Tulip Poplar	12 ft	6-12 ft	0.25"-1.0"		15%
Quercus prinus	Chestnut Oak	12 ft	6-12 ft	0.25"-1.0"		5%
Platanus occidentalis	Sycamore	12 ft	6-12 ft	0.25"-1.0"		20%
Betula nigra	River Birch	12 ft	6-12 ft	0.25"-1.0"		10%
Cornus florida	Flowering Dogwood	12 ft	6-12 ft	0.25"-1.0"		10%
Aesculus octandra	Yellow Buckeye	12 ft	6-12 ft	0.25"-1.0"		5%
Fraxinus americana	White Ash	12 ft	6-12 ft	0.25"-1.0"		20%
Quercus rubra	Northern Red Oak	12 ft	6-12 ft	0.25"-1.0"		10%

SLOPE BUFFER PLANTING ZONE

Species	Common Name	Max. Spacing	Indiv. Spacing	Min. Caliper	Stratum	#
Prunus serotina	Black Cherry	12 ft	6-12 ft	0.25"-1.0"		10%
Liriodendron tulipifera	Tulip Poplar	12 ft	6-12 ft	0.25"-1.0"		20%
Quercus prinus	Chestnut Oak	12 ft	6-12 ft	0.25"-1.0"		10%
Quercus coccinea	Scarlet Oak	12 ft	6-12 ft	0.25"-1.0"		10%
Carya glabra	Pignut Hickory	12 ft	6-12 ft	0.25"-1.0"		15%
Cornus florida	Flowering Dogwood	12 ft	6-12 ft	0.25"-1.0"		10%
Aesculus octandra	Yellow Buckeye	12 ft	6-12 ft	0.25"-1.0"		5%
Fraxinus americana	White Ash	12 ft	6-12 ft	0.25"-1.0"		10%
Quercus rubra	Northern Red Oak	12 ft	6-12 ft	0.25"-1.0"		10%



WETLAND PLANTING ZONE A

Species	Common Name	Max. Spacing	Indiv. Spacing	Min. Caliper	Stratum	#
Nyssa sylvatica	Black Gum	12 ft	6-12 ft	0.25"-1.0"		10%
Platanus occidentalis	Sycamore	12 ft	6-12 ft	0.25"-1.0"		30%
Betula nigra	River Birch	12 ft	6-12 ft	0.25"-1.0"		20%
Cornus amomum	Silky Dogwood	12 ft	6-12 ft	0.25"-1.0"		15%
Alnus serrulata	Tag Alder	12 ft	6-12 ft	0.25"-1.0"		5%
Acer negundo	Box Elder	12 ft	6-12 ft	0.25"-1.0"		10%
Lindera benzoin	Spicebush	12 ft	6-12 ft	0.25"-1.0"		10%
						100%

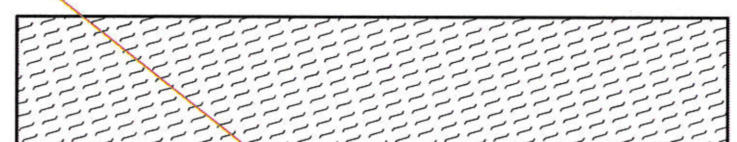
WETLAND PLANTING ZONE B

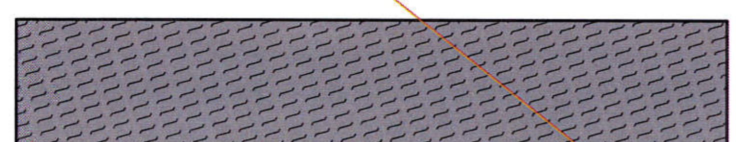
Live Stakes or Plugs

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.		10%
Salix sericea	Silky Willow	3 ft	3ft	0.5"-1.0" cal.		40%
Sambucus nigra ssp canadensis	Elderberry	3 ft	3ft	0.5"-1.0" cal.		5%
Juncus effusus	Common Rush	5 ft	5ft	1"-2" plug		NA

Transplants or Tublings

Species	Common Name	Max. Spacing	Indiv. Spacing	Min. Size	Stratum	# Plants
Alnus serrulata	Tag Alder	12 ft	6-12 ft	0.25"-1.0"		20%





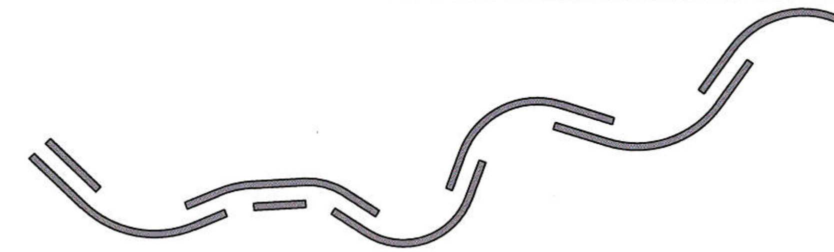
TEMPORARY SEEDING

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

STREAMBANK PLANTING ZONE

Live Stakes and Herbacous Plugs

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%
Juncus effusus	Common Rush	5 ft	5ft	1"-2" plug		See Specs



PERMANENT RIPARIAN SEED PLANTING ZONE *

Pure Live Seed (20 lbs/acre)

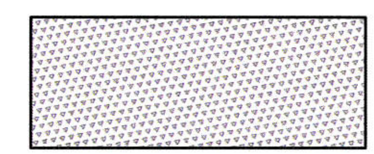
Species Name	Common Name	lbs/acre
Panicum rigidulum	Redtop Panicgrass	3
Agrostis hyemalis	Winter Bentgrass	3
Chasmanthium latifolium	River Oats	2
Rudbeckia hirta	Blackeyed Susan	1
Coreopsis lanceolata	Lanceleaf Coreopsis	1
Carex vulpinoidea	Fox Sedge	3
Panicum clandestinum	Deertongue	3
Elymus virginicus	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.

PASTURE SEEDING

Pure Live Seed (42 lbs/acre)

Species Name	Common Name	lbs/acre
Dactylis qlomerata	Orchard Grass	40
Trifolium repens	White Ladino Clover	2



RIPARIAN BUFFER ZONE, SLOPE BUFFER ZONE, AND WETLAND PLANTING ZONE "A" PLANTS WILL BE INSTALLED BY A THIRD PARTY CONTRACTOR. SEEDING OF THESE ZONES WITH PERMANENT RIPARIAN SEED MIX, STREAM BANK PLANTING, AND PASTURE SEEDING IS THE RESPONSIBILITY OF THE CONTRACTOR RESPONSIBLE FOR STREAM AND FLOODPLAIN GRADING. ALL SEEDED AND PLANTED AREAS SHALL ALSO BE PLANTED WITH TEMPORARY SEED AND NOTED SOIL AMENDMENTS SHALL BE USED.

STREAM BANK PLANTING, PASTURE SEEDING, TEMPORARY SEEDING, AND PERMANENT SEEDING WERE INSTALLED PER ORIGINAL PLAN DURING CONSTRUCTION. SEPARATE PLANTING CONTRACT USED FOR RIPARIAN, SLOPE, AND WETLAND BARE ROOT PLATING - SPECIES VARY FROM DESIGN PLAN.

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NORTH CAROLINA PROFESSIONAL SEAL 029340 ENGINEER AARON S. EARLEY 8-5-16

Little Pine Creek III Stream & Wetland As-Built
Allegheny County, North Carolina

Plant List

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Revisions:
08/07/2014 Revised seeding mix

Date:	August 5, 2016
Job Number:	005-02123
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Sheet 3.0