AS-BUILT BASELINE MONITORING REPORT

FINAL

ALEXANDER FARM MITIGATION SITE
Alexander County, NC
DEQ Contract No. 7416
DMS Project No. 100048

Catawba River Basin HUC 03050101
USACE Action ID No. SAW-2018-00451
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PREPARED FOR:

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EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a full-delivery stream mitigation project at the Alexander Farm Mitigation Site (Site) for the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS). The project restored, enhanced, and preserved a total of 6,722 linear feet (LF) of perennial stream in Alexander County, NC. The Site is located within the DMS targeted local watershed (TWL) for the Catawba River Basin HUC 03050101 and the NC Division of Water Resources (DWR) Subbasin 03-08-32. The project is providing 4,258.100 stream mitigation units (SMUs) for the Catawba River Basin Hydrologic Unit Code (HUC) 03050101130010 (Catawba 01).

The Site's immediate drainage area as well as the surrounding watershed has a long history of agricultural activity. Stream and wetland functional stressors for the Site were related to both historic and current land use practices. Major stream stressors for the Site included channel incision and widening, a lack of stabilizing riparian vegetation, a lack of bedform diversity and aquatic habitat, and agricultural related impacts such as channel manipulation or straightening and concentrated run-off inputs from agricultural fields. The effects of these stressors resulted in channel instability, loss of floodplain connection, degraded water quality, and the loss of both aquatic and riparian habitat throughout the Site's watershed when compared to reference conditions. The project approach for the Site focused on evaluating the Site's existing functional condition and evaluating its potential for recovery and need for intervention.

The project goals defined in the mitigation plan (Wildlands, 2019) were established with careful consideration of 2009 Upper Catawba River Basin Restoration Priorities (RBRP) goals and objectives to address stressors identified in the watershed through the implementation of stream restoration and enhancement activities and wetland re-establishment and rehabilitation activities, as well as riparian buffer re-vegetation. The established project goals include:

- Improve stream channel stability,
- Reconnect channels with historic floodplains,
- Improve in-stream habitat,
- Reduce sediment and nutrient inputs from adjacent farm fields,
- Restore and enhance native floodplain and wetland vegetation,
- Exclude livestock, and
- Permanently protect the project site from harmful uses.

The Site construction and as-built surveys were completed April - May 2020. Planting and baseline vegetation data collection occurred in April 2020. Vegetative plot species were confirmed in early June 2020 after leaf-out. Installation of monitoring features and sediment data collection was completed in April 2020. Fencing installation was completed in July 2020. Minimal adjustments were made during construction and specific changes are detailed in Section 5.1. Baseline (MY0) profiles and cross-section dimensions closely match the design parameters with little variation. The Site has been built as designed and is expected to meet the upcoming monitoring year's success criteria.

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Department of Environmental Quality (DEQ)
Division of Mitigation Services (DMS)
Division of Water Resources (DWR)
Hydrologic Unit Code (HUC)
Interagency Review Team (IRT)
Monitoring Year (MY)
National Resource Conservation Service (NRCS)
Stream Mitigation Unit (SMU)
Targeted Local Watershed (TLW)
United States Army Corps of Engineers (USACE)
Unnamed Tributary (UT)
Wetland Mitigation Unit (WMU)
Yadkin Pee Dee River Basin Priorities (RBRP)

Section 1.0 PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Project Location and Setting

The Alexander Farm Mitigation Site (Site) is in Alexander County approximately 6 miles west of Statesville and 15 miles northeast of Hickory (Figure 1). Unnamed tributaries to Elk Shoals Creek originate within the project limits, and were restored, enhanced, and preserved as part of this project. Elk Shoals Creek drains to Lookout Shoals Lake on the Catawba River, the primary water supply for the City of Statesville. The Site is located within the Elk Shoals Creek targeted local watershed (TLW) Hydrologic Unit Code (HUC) 03050101130010 and is being submitted for mitigation credit in the Upper Catawba River Basin 03050101. Located in the Northern Inner Piedmont belt within the Piedmont physiographic province (NCGS, 1985), the project watershed is dominated by agricultural and forested land.

The Site contains two unnamed tributaries, UT1 and UT1A, and eighteen riparian wetlands; however, no credit is being sought for project wetlands. For this project UT1 was broken into six reaches (Reach 1A, Reach 1B, Reach 2, Reach 3, Reach 4A, and Reach 4B). The project Site is bisected by Elk Shoals Church Loop Road between Reach 2 and Reach 3.

The overall Site topography consists of a gradually sloped valley running through the center of the project. Upstream of Elk Shoals Church Loop Road, the Site is characterized by a moderate slope. UT1 Reach 1 originates within the Site limits at a spring head and flows downslope through a moderately confined valley surrounded by open pasture. Approximately 600 feet downstream of the headwaters, the valley widens and continues downstream as a broad gently sloping floodplain to Elk Shoals Church Loop Road. Downstream of the road crossing, UT1 continues flowing south within a broad gently sloping floodplain to its confluence with UT1A from the left floodplain, where it originates as a wetland seep. At the confluence, UT1A and joins UT1 and continues south to its confluence with to Elk Shoals Creek within a broad alluvial floodplain. The site drains approximately 256 acres of rural land.

Prior to construction activities, the streams throughout the Site were in various stages of impairment related to the current and historical agricultural uses. UT1 Reach 1 was mostly incised and disconnected from the floodplain, with short segments of floodplain connectivity. The bed was trampled and severely impacted by cattle. Bedform diversity and habitat was very poor, primarily due to sedimentation and incision.

UT1 Reach 2 was overwide and trampled but well vegetated with herbaceous species from abutting wetlands. As it approached the Elk Shoals Church Loop Road, the creek alternated between areas of incision and floodplain connection. The bed was choked with fine sediments and trampled, with several active cattle wallow areas.

UT1 Reach 3 begins just downstream of the Elk Shoals Church Loop 48-inch culvert. It is wooded and cattle have been excluded from this section of the farm. The majority of the reach consisted of low, stable stream banks with a few scour pockets located near ATV crossings.

Within the wooded valley, UT1 Reach 4 was extensively eroded, incised, and laterally unstable with erosion present on both banks, transverse bars, and sharp meander bends. As the stream exited the wood line, bank heights decreased, the channel narrowed, and the stream banks became well vegetated with annual herbaceous species; however, the channel was still deeply incised and disconnected from its historic floodplain.

Pre-construction conditions are outlined in Table 4 of Appendix 1 and Table 6 of Appendix 2.

1.2 Project Goals and Objectives

The Site is providing numerous ecological benefits within the Upper Catawba Basin. The project goals were established with careful consideration to address stressors that were identified in the 2009 Upper Catawba

River Basin Restoration Priorities (RBRP) report. The project has improved stream functions through stream restoration and the conversion of maintained agricultural fields into riparian buffer within the Upper Catawba River Basin, while creating a functional riparian corridor at the site level. Improvements are outlined below as project goals and objectives.

Goals	Objectives
Improve stream channel stability.	Restore stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions. Create stable tie-ins for tributaries joining restored channels. Add bank revetments and in-stream structures to protect restored streams.
Reconnect channels with historic floodplains.	Reconstruct stream channels with bankfull dimensions relative to the floodplain.
Improve instream habitat.	Install habitat features such as constructed riffles, cover logs, and brush toes into restored streams. Add woody materials to channel beds. Construct pools of varying depth.
Reduce sediment and fecal coliform and nutrient input from adjacent farm fields.	Construct a step pool stormwater conveyance system to slow and treat runoff from farm field before entering Site streams.
Restore and enhance native floodplain and wetland vegetation.	Plant native tree and understory species in riparian zone where currently insufficient. Remove invasive species within the riparian corridor.
Exclude livestock from stream channels.	Exclude livestock from stream channels and riparian areas.
Permanently protect the project site from harmful uses.	Establish a conservation easement on the Site.

1.3 Project Structure, Restoration Type and Approach

The final mitigation plan was approved in October of 2019. Construction activities were completed in April 2020 by Baker Grading & Landscaping, Inc. Turner Land Surveying completed the as-built survey in May 2020. Following construction, Bruton Natural Systems, Inc. completed riparian planting in April 2020 and wetland planting in May 2020.

A copy of the final sealed survey is included in Appendix 4. Field adjustments made during construction are described in further detail in section 5.1 and depicted in the record drawings in Appendix 4. Please refer to Appendix 1 for detailed project activity, history, contact information, and watershed/site background information.

1.3.1 Project Structure

Project mitigation components are outlined in the Mitigation Assets and Components Table (Table 1) and depicted in the As-built Monitoring Plan View Maps (Figures 3.0 - 3.3) that are located in Appendix 1.

1.3.2 Restoration Type and Approach

The mitigation approaches proposed for the streams on the Site were developed to achieve the potential for functional uplift relative to the existing conditions on the site. The site plan includes elements of stream restoration, enhancement II, and preservation.

Restoration reaches were constructed as Priority 1 except where Priority 2 grading was needed to transition with existing grade elevations. Restoration reaches were designed to create stable, functional stream channels with improved dimension, pattern, and profile. Cross-sectional areas were sized for frequent overbank flows. Bedforms were stabilized and varied with the use of in-stream structures to reduce channel erosion and improve aquatic habitat.

Enhancement II reaches retained their existing dimension, pattern, and profile. Mitigation activities included localized bank stabilization and repairs in areas where damage was more significant. Mid-channel bars were excavated, and the existing alignment was stabilized. Invasive vegetation was treated by either excavation or herbicide.

Reaches that were stable and functioning were preserved to protect them from future impacts from cattle, agricultural production, timbering and/or site development. Timber limits were established approximately 30-ft – 50-ft outside of the conservation easement to provide additional wooded buffer. Vernal pools were placed at discrete runoff locations within the conservation easement to provide additional protection from timbering practices.

All the project reaches are protected in perpetuity with the implementation of a conservation easement. Fencing was installed outside of the easement to exclude cattle from the project area. Invasive vegetation such as Chinese Privet, multi-flora rose, and alligator weed were treated by either excavation or herbicide, as needed throughout the Site. The streambanks and floodplains were planted with native woody and herbaceous species as depicted in the planting plan of the record drawings located in Appendix 4.

UT1 Reach 1A and 1B

UT1 Reach 1A begins as a perennial stream located at Station 100+00 just downstream of a spring head stabilized by a series of rock sills. UT1 Reach 1A flows southward and receives drainage from multiple small swales that were stabilized to prevent erosion. UT1 Reach 1B begins at Station 107+70 and continues flowing southward and receives drainage from multiple stabilized wetland seeps and drainage swales. Reach 1B ends at an easement break at Station 117+39 for an existing permanent culverted farm road crossing.

UT1 Reach 1A and 1B were designed as Rosgen B-type channels and were improved through Priority 1 restoration. The channel beds were raised to reconnect to the existing floodplain. In-stream structures such as rock sills, log sills, constructed riffles, and brush toes were added for stream stability, grade control and habitat variability. The downstream extent of UT1 Reach 1B was slightly realigned to improve hydraulics and add additional stability to the channel before reconnecting with an existing 48-in arched CMP just downstream of the easement break.

UT1 Reach 2

UT1 Reach 2 begins downstream of the easement break at the culverted farm road crossing at Station 117+90. Enhancement level II activities were implemented along the reach. Construction activities were confined mostly to the upper portion of the reach and consisted of areas of bank grading, structure placement, and stream realignment to improve channel hydraulics and address areas of instability. The downstream section of Reach 2 flows through a series of abutting riparian wetlands was already mostly stable. Reach 2 ends at the easement break for the Elk Shoals Church Loop Road crossing at Station 130+46.

UT1 Reach 3

Reach 3 begins just downstream of the Elk Shoals Church Loop Road crossing at Station 131+27. The reach is currently stable and exhibits mature vegetation; therefore, the channel was left undisturbed as a preservation reach. Desirable aquatic habitat is present throughout the reach and includes undercut banks, root mats, leaf packs, and small debris jams. Stabilizing the upstream reaches will allow for this reach to remain stable and reduce the sediment load.

UT1 Reach 4A and 4B

UT1 Reach 4A and 4B were designed as Rosgen C-type channels and improved through a combination of Priority 1 and Priority 2 restoration. Reach 4A begins at Station 138+28. Priority 2 restoration was implemented along the first 200 linear feet of reach to tie the channel with Reach 3, while Priority 1 was implemented along the remainder of the reach. Reach 4B begins at Station 152+59 where a step-pool conveyance best management practice (BMP) joins UT1 from the left floodplain. Priority 1 was also implemented along the majority of Reach 4B; however, the restoration type was changed to Priority 2 along the last 100 feet of channel to its tie-in with the existing channel at Station 166+66. In-stream structures such as rock sills, log sills, constructed riffles, log j-hooks, brush toe, and cover logs were added for grade control, bank stability, and habitat creation.

UT1A

UT1A begins at Station 200+00 as an intermittent channel from a wetland seep. Enhancement II was implemented along the reach. While the channel will be raised to be connected to the existing floodplain, the stream alignment will not be changed. In-stream structures such as rock sills and constructed riffles were added for grade control and a variety of pool depths were incorporated for bedform diversity, energy dissipation, and aquatic habitat. A rock outlet enters the channel from a vernal pool located in the right floodplain. UT1A ends at Station 202+03 at its confluence with UT1 Reach 4A. No credit is being sought for this feature.

Step-pool Conveyance (SPSC) BMP

A step pool stormwater conveyance system was constructed within an ephemeral channel that flows into UT1 Reach 4B. The step pool system begins at Station 300+00 and conveys runoff from the adjacent pasture through a series of constructed riffles held by a rock sill and into a downstream pool. The reach acts as a stable conveyance to treat storm flows and dissipate storm velocities before its outlet into the main channel at Station 302+62. As with the other stream reaches throughout the Site, the riparian corridor of the BMP was planted with native vegetation, lies within the conservation easement, and was fenced to exclude cattle. No credit is being sought for this feature.

1.4 Project History, Contacts and Attribute Data

The Site was restored by Wildlands through a Full Delivery contract with DMS. Tables 2, 3, and 4 in Appendix 1 provide detailed information regarding the project activity and reporting history, project contacts, and project baseline information and attributes.

Section 2.0 PERFORMANCE STANDARDS

The stream performance criteria for the Site will follow approved performance criteria presented in the Alexander Farm Mitigation Site Mitigation Plan (2019) and is based on the performance criteria presented in the DMS Stream and Wetland Mitigation Plan Template and Guidance (June 2017) and the NC IRT Wilmington District Stream and Wetland Compensatory Mitigation Update (10/24/2016). Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. Specific performance standard components are proposed for stream morphology, hydrology, and vegetation. Performance standards will be evaluated throughout the seven-year postconstruction monitoring period. The monitoring program designed to verify that performance standards are met is described in Section 3.

2.1 Streams

2.1.1 Dimension

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, bank height ratio, and width-to-depth ratio. All riffle cross-sections should fall within the parameters defined for the designated stream type. Bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 1.4 for B-type channels and 2.2 for restored C-type channels. 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. Remedial action will not be taken if channel changes indicate a movement toward stability. 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

A longitudinal profile was conducted as part of the as-built survey to provide a baseline for comparison should it become necessary to perform longitudinal profile surveys later during monitoring and to insure accordance with design plans. Annual longitudinal profile surveys are not required during the seven-year monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the 2016 USACE Stream and Wetland Mitigation Guidance for the necessary reaches.

Restoration reaches must remain vertically stable throughout the monitoring period with little indication of downcutting or significant aggradation. Deposition of sediments at certain locations (such as the inside of meander bends) is expected and acceptable. Changes in pool depth are not an indication of vertical instability. Restoration reaches must remain laterally stable and major changes planform pattern dimensions and sinuosity should not occur. However, migration of meanders on alluvial channels is not an indication of instability if cross sectional dimensions continue to meet the requirements.

2.1.3 Substrate

A pebble count was conducted at each surveyed riffle to characterize the pavement during the baseline monitoring only. A reach-wide pebble count will be performed in each restoration reach for monitoring years 1, 2, 3, 5 and 7. Reach-wide counts will be conducted for classification purposes. Restoration reaches should show maintenance of coarser materials in the riffle features and finer particles in the pool features. Riffles may fine over the course of monitoring due to the stabilization of contributing watershed sediment sources.

2.1.4 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 mid-channel bars 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.

2.1.5 Hydrology Documentation

The occurrence of bankfull events will be documented on restoration reaches throughout the monitoring period. Four bankfull flow events must be documented within the seven-year monitoring period. The four bankfull events must occur in separate years. Stream monitoring will continue until performance standards in the form of four bankfull events in separate years have been documented.

2.2 Vegetation

The final vegetative success criteria will be the survival of 210 planted stems per acre in the riparian corridors at the end of the required monitoring period (MY7). The interim measure of vegetative success for the site will be the survival of at least 320 native species stems per acre at the end of the third monitoring year (MY3) and at least 260 stems per acre at the end of the fifth year of monitoring (MY5). In NC piedmont counties, planted trees must average 7 feet in height in each plot at the end of MY5 and 10 feet in height at Year 7. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

2.3 Wetlands

Wetland gages were installed within existing wetlands in areas along priority 1 restoration reaches to monitor groundwater hydrology, solely to verify the continuation of hydrologic wetland functions during the growing season. No wetland credits are being sought for this project and no performance criteria have been established. The NRCS Climate Analysis for Wetlands Tables (WETS) does not list a defined growing season for Alexander County due to insufficient data; therefore, the nearest WETS Station is Statesville 2 NNE (USDA, 2020) in Iredell County which is approximately 13.5 miles from the project site. The growing season based on data compiled from this WETS Station (1980 – 2020) is from April 4 through November 2 under typical precipitation conditions.

2.4 Visual Assessments

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

2.5 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 Report Format, Data Requirements, and Content Guidance (June 2017), 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,
- CCPV 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,
- Assessment of the stability of the stream based on the cross-sections,
- Vegetative data as described above including the identification of any invasion by undesirable plant species,

- A description of damage by animals or vandalism,
- Maintenance issues and recommended remediation measures will be detailed and documented, and
- Wildlife observations.

Section 3.0 MONITORING PLAN & METHODOLOGY

Annual monitoring will consist of collecting morphologic, vegetative, and hydrologic data to assess the project success based on the restoration goals, as outlined in the Alexander Farm Site Mitigation Plan (2019). Monitoring requirements will follow guidelines outlined in the DMS Annual Monitoring Report Format, Data Requirements, and Content Guidance (June 2017) and the USACE Stream and Wetland Mitigation Guidance (October 2016). Installed monitoring device and plot locations closely mimic the locations of those proposed in the Site's Mitigation Plan. Deviations from these locations were made when professional judgement deemed them necessary to better represent as-built field conditions or when installation of the device in the proposed location was not physically feasible.

Project success will be assessed by measuring channel dimension, substrate composition, vegetation, surface water hydrology, groundwater hydrology and by analyzing photographs and performing visual assessments. Any high priority problem areas identified, such as unstable stream banks, bed instability, aggradation/degradation, and/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. Standard DMS monitoring reports will be submitted in monitoring years 1, 2, 3, 5, and 7. Monitoring activities in years 4 and 6 will be documented in a memorandum to include a project summary update, annual photos, and updated monitoring plan map. Closeout will occur seven years beyond completion of construction or once performance standards are met. All survey data will be georeferenced to North Carolina State Plane coordinates. Refer to Table 5 in Appendix 1 for the monitoring component summary.

3.1 Streams

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 Figures 3.0 through 3.3 in Appendix 1 for monitoring locations discussed below.

3.1.1 Dimension

To assess channel dimension performance, 14 permanent cross-sections were installed along stream restoration reaches to represent approximately 50% riffles and 50% pools as defined in Table 15 of the Mitigation Plan. Cross-section locations were chosen in the field to be representative of the typical dimensions for each project reach. Each cross-section is permanently marked with rebar installed in concrete and ½ inch PVC pipes. Cross-section surveys will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg. Cross-section surveys will be conducted in monitoring years one, two, three, five, and seven. Photographs will be taken of the cross-sections looking upstream and downstream during the survey assessment.

3.1.2 Pattern and Profile

Longitudinal profile surveys will not be conducted during the seven-year post-construction monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the Stream Mitigation Guidelines issued in October 2016 by the NC IRT for the necessary reaches. Stream pattern and profile will be assessed visually as described below in Section 3.1.6.

3.1.3 Substrate

Reach-wide pebble counts will be performed on each restoration reach for classification purposes only and will be conducted in monitoring years one, two, three, five, and seven. Riffle 100-count substrate sampling was collected in each surveyed riffle cross-section during the baseline monitoring only to characterize pavement at as-built.

3.1.4 Photo Reference Points

A total of 20 permanent photograph reference points were established along the stream reaches and the floodplain area after construction. Photographs will be taken once a year to visually document stability for the seven-year monitoring period. Permanent markers were established and located with GPS equipment so that the same locations and view directions on the site are photographed each year. Photos will be used to monitor all stream reaches.

Longitudinal reference photos were established along the channel by taking a photo looking upstream and downstream. Cross-sectional photos will be taken of each permanent cross-section looking upstream and downstream.

3.1.5 Hydrology Documentation

The occurrence of bankfull events will be documented throughout the seven-year monitoring period using pressure transducers, photographs, and visual assessments such as debris lines. Streamflow stage will be monitored using a continuous stage recorder (pressure transducer), referred to as a "crest gage" (CG). CGs were set to record bankfull events every three hours. One CG was installed along restoration reaches. The gage will be downloaded semi-annually to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition observed during field visits. The transducer data will be plotted and included in the annual monitoring reports.

3.1.6 Visual Assessment

Visual assessments will be performed along stream reaches on a semi-annual basis during the seven-year monitoring period. Areas of concern, such as channel instability (i.e. lateral and/or vertical instability and in-stream structure failure, instability, and/or piping), poor vegetation health and/or establishment (i.e. low stem density, bare areas, high mortality rates, and/or invasive species), easement encroachment, beaver activity, and/or livestock trespass will be mapped, photographed, and described in the annual monitoring reports. Problem areas will be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

3.2 Vegetation

Vegetation monitoring quadrants (9 permanent and 3 mobile) were installed across the Site to measure the survival of the planted trees. Vegetative plot monitoring will occur between July 1st and leaf drop during post-construction monitoring years 1, 2, 3, 5, and 7. Permanent plots will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008) and the 2016 USACE Stream and Wetland Mitigation Guidance to assess vegetative success. For both permanent and mobile plots, all woody stems, including exotic and invasive species, should be counted. Supplemental plantings and volunteer plants must be present for at least two growing seasons before counting toward performance standards for monitoring years five and seven. Exotic/invasive species will not count toward success of performance standards

A total of 9 permanent vegetation plots were established within the project easement area. Permanent vegetation plots were randomly established within the planted stream riparian buffer areas to capture the heterogeneity of the designed vegetative communities. The locations of permanent vegetation plots were chosen using the same distribution throughout the planting areas, as shown in the Site's Mitigation Plan, and to best represent the planted areas within the easement.

All of the permanent vegetative plots were established either as a standard 10-meter by 10-meter square plot or an optional 5-meter by 20-meter rectangular plot. The vegetation plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs were taken at the origin looking diagonally across the plot to the opposite corner during the MY0 in April

2020. Subsequent assessments in monitoring years one, two, three, five, and seven following baseline survey will capture the same reference photograph locations.

Beginning in MY1, individual permanent plot data will include diameter, height, density, vigor, damage (if any), and percent survival. Planted woody stems were marked and mapped in MY0 and will be re-marked, if needed, during subsequent monitoring year assessments using a known origin so they can be found. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems.

To evaluate random vegetation performance for the Site, 3 mobile vegetation plots were established in MY0, for use in MY1, using a circular or 100 m^2 square/rectangular plot. Mobile plots will be re-established in different and random locations throughout the planted conservation easement in monitoring years 2, 3, 5, and 7. These locations will be geographically recorded and depicted in the CCPV maps for the corresponding monitoring assessment year. Mobile vegetation plot assessments will document the number of stems, number and type of species, and stem height within the plot.

Please refer to Figures 3.0 through 3.3 in Appendix 1 for the permanent and mobile MY0/1 vegetation monitoring plot locations.

3.3 Wetlands

To monitor the existing wetlands during post-construction monitoring, two groundwater monitoring gages were installed in April 2020 per USACE recommended procedures within the wetland areas using In- situ Level TROLL® 100 pressure transducers. The locations of the installed gages closely mimic those of the Site's Mitigation Plan. Minor adjustments in these locations were made to best represent wetland topography as needed. The groundwater gages are set to record the groundwater level four times per day and will be downloaded during site visits. The locations of the groundwater gages are denoted in Figures 3.0 through 3.3 in Appendix 1.

Section 4.0 ADAPTIVE MANAGEMENT AND CONTINGENCY PLAN

4.1 Adaptive Management Plan

Wildlands will perform maintenance as needed on the mitigation project. A physical inspection of the Site shall be conducted a minimum of once per year throughout the post-construction monitoring period or until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance for stream features should be most often expected in the first two years following site construction. The need for maintenance will be evaluated annually during monitoring activities. Maintenance may include the following activities.

Component/ Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel – these shall be conducted where success criteria are threatened or at the discretion of the Designer. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting. Beaver activity will be monitored and beaver dams on project streams will typically be removed, at the discretion of the Designer, during the monitoring period to allow for bank stabilization and stream development outside of this type of influence.
BMP	Routine BMP Maintenance and repair activities may include chinking of BMP structures to prevent piping and securing of loose coir fiber matting.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species treatment will be conducted per the Invasive Species Treatment Plan, outlined in Appendix 6 of the Alexander Farms Mitigation Plan (2019), and in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis.

The Wildlands Team will develop necessary adaptive measures or implement appropriate remedial actions in the event that the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase identifies an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria. If, during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the members of the DMS and work with them to develop contingency plans and remedial actions.

Section 5.0 AS-BUILT CONDITION (BASELINE)

The Site construction and planting were completed by April 17, 2020. The as-built survey, which included developing an as-built topographic surface and locating the channel boundaries, structures, and cross-sections were completed by May 16, 2020. Installation of monitoring features and the collection of sediment and vegetative data were completed by April 29th, 2020. However due to the lack of leaf-out on some of the bare roots within the vegetative plots, it was determined during data processing that some of the planted species were mis-identified. Therefore, vegetation plots species were verified on June 8, 2020. Fencing installation was completed and surveyed in July 2020.

5.1 Record Drawings

A sealed half-size record drawing is located in Appendix 4 and includes redlines for any significant field adjustments made during construction that were different from the design plans. Specific changes by each project area are detailed below:

5.1.1 All Reaches:

- Rock and roll riffle profile surveyed in detail showing intermediate micropool habitat and log sills.

5.1.2 UT1 Reach 1A

- Station 100+00: Rock sills and additional rock added to stabilize inlet.
- Station 101+00: Rock outlet added to prevent erosion from drainage swale.
- Station 107+00: Swale armored with rock and 2 log sills to prevent erosion.
- Station 107+30: Swale armored with rock to prevent erosion.

5.1.3 UT1 Reach 1B

- Station 109+85: Matting added for stabilization.
- Station 111+60: Wetland outlet added and armored with rock to prevent erosion.
- Station 112+00: Wetland outlet added and armored with rock to prevent erosion.
- Station 113+15: Wetland outlet stabilized with rock to prevent erosion.
- Station 115+05: Wetland outlet shifted due to field conditions.
- Station 115+50: Log sill added at tail of riffle for additional stability.
- Station 116+50 – 117+44: The channel design was altered and realigned to stabilize banks and improve hydraulics.

5.1.4 UT1 Reach 2

- Station 118+00: Vegetated geo-lift and rock sill were removed. Stream channel was realigned to address stability.
- Station 117+80 – 118+35: The channel design was altered and realigned to stabilize banks and improve hydraulics.
- Station 120+27 – 120+84: The channel design was altered and realigned to stabilize banks and improve hydraulics.
- Station 120+40: Log sill shifted due to stream realignment.
- Station 120+60: Log sill added to stabilize stream realignment.
- Station 120+75: Log sill length was shortened to preserve existing trees on right bank.

5.1.5 UT1 Reach 3

- No changes.

5.1.6 UT1 Reach 4A

- Station 143+90: Wetland outlet stabilized with rock to prevent erosion.
- Station 144+30: Wetland outlet stabilized with rock to prevent erosion.
- Station 145+80: Wetland outlet stabilized with rock to prevent erosion.

5.1.7 UT1 Reach 4B

- Station 150+90: Log sill added at tail of riffle for additional stability.
- Station 152+30: Log sill added at tail of riffle for additional stability.
- Station 152+40: Grading and debris removed in right floodplain at engineer's discretion due to field conditions.
- Station 159+00: Rock outlet added from vernal pool to prevent erosion.
- Station 163+00: Rock Outlet added from vernal pool to prevent erosion.
- Station 164+80: Vernal pool added to collect toe of slope drainage with rock outlet to prevent erosion.
- Station 166+25: Wetland outlet added and armored with rock to prevent erosion.
- Station 166+60: A rock vane was replaced with a log vane due to local material availability and similar functionality.

5.1.8 UT1A

- Station 201+70: Vegetated soil lift removed due to onsite conditions.
- Station 201+75: Rock Outlet was added from vernal pool to prevent erosion.

5.1.9 BMP

- No changes.

5.1.10 Vegetation Planting Plan

As previously stated, bare root planting was completed by April 17, 2020. Changes to the as-built planting list were made to account for the species availability at the time of planting. Changes in the location of bare root plantings were adjusted as needed along the top of bank in the areas where channel realignment was conducted. Specific changes to the plant species lists are outlined below.

<u>Open/Graded Buffer Planting Zone –</u>

- The following bareroot species were removed from the planting list due to the lack of available species at the time of planting: Swamp chestnut oak (*Quercus michauxii*).
- The following species were added to the planting list to increase species diversity at the direction of the engineer: White Oak (*Quercus alba*) and Northern Red Oak (*Quercus rubra*).
- The remaining species' "Percent of Stems" were adjusted accordingly.

<u>Shaded Area Buffer Planting Zone –</u>

- The following bareroot species were removed from the planting list due to the lack of available species at the time of planting: Swamp chestnut oak (*Quercus michauxii*), beautyberry (*Callicarpa americana*), American strawberry bush (*Euonymus americanus*), and sweetshrub (*Calycanthus floridus*).

- The following species were added to the planting list to increase species diversity at the direction of the engineer: White Oak (*Quercus alba*).
- The remaining species' "Percent of Stems" were adjusted accordingly.

Streambank Planting Zone –

- Percent planting for silky dogwood (*Cornus amomum*) and silky willow (*Salix sericea*) were adjusted from 40% to 36% and from 40% to 44%, respectively.

Vernal Pool and Wetland Planting Zone –

- The following herbaceous species were removed from the planting list due to the lack of available species at the time of planting: Broadwing sedge (*Carex alata*) and Bluejoint grass (*Calamagrostis canadensis*).
- The following species were added to the herbaceous planting list to increase species diversity at the direction of the engineer: Fringed sedge (*Caryx crinata*) and bushy beardgrass (*Andropogon glomeratus*).
- The remaining species' "Percent of Stems" were adjusted accordingly.

5.2 Baseline Data Assessment

MY0 was conducted between April and June 2020. Cross-section and longitudinal profile data collection were completed by May 16, 2020. The collection of sediment and vegetative data were completed by April 29th, 2020, and vegetative species identification was verified in early June 2020. Locations of the monitoring features are depicted in Figures 3.0 through 3.3 in Appendix 1. The first annual monitoring assessment (MY1) will be completed in the fall of 2020. The streams will be monitored for a total of seven years, with the final monitoring activities scheduled for 2026.

5.2.1 Morphological State of the Channel

Please refer to Appendix 2 for summary data tables, morphological plots, and stream photographs.

Profile

The MY0 profiles generally match the profile design parameters. As-built riffle slopes calculated for UT1 R1B resulted in a greater variation in range than those of design; however, the overall channel slope was similar to design parameters and on-site as-built reviews showed no visual indicators of vertically instability. Variations from the design profile often reflect field changes during construction as a result of field conditions and do not constitute a problem or indicate a need for remedial actions. Channels profiles will continue to be assessed visually during the CCPV Site walks.

Dimension

The MY0 dimension numbers closely match the design parameters with minor variations. The maximum bankfull width for UT1 Reach 4A slightly exceeds design parameters; however, channels are likely to narrow over time as vegetation is established. This narrowing over time would not be an indicator of instability in and of itself. On-site as-built reviews showed no visual indicators of lateral instability.

Pattern

The MY0 pattern metrics fell within acceptable ranges of the design parameters.

Substrate

Reach-wide pebble counts were performed on each restoration reach to establish stream classification at baseline conditions, and riffle 100-count substrate sampling was collected at each surveyed riffle cross-section to characterize pavement at as-built. Sediment analysis results were similar to design parameters; however, some reaches and cross-sections exhibited slightly coarser substrate than designed. These variations immediately after construction are normal because coarser materials are

used to provide immediate grade control on the newly constructed channel. Over time, the channel will continue to move gravels and finer sediments into the system creating a mix of coarse substrate in the riffles and fine sediments in the pools. On-site as-built reviews showed no visual indicators of instability within riffle or pools.

Bankfull Events

Bankfull events recorded following completion of construction will be reported in the Year 1 monitoring report.

5.2.2 Vegetation

The overall MY0 planted density is 499 stems/acre for permanent vegetation plots and 526 stems/acre for mobile vegetation plots. The total overall planted Site mean density is 506 stems/acre, which exceeds the interim measure of vegetative success of at least 320 planted stems per acre required atthe end of the third monitoring year. Summary data and photographs of each plot can be found in Appendix 3.

5.2.3 Wetlands

Groundwater gage data will be reported in the annual MY1 report.

Section 6.0 CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary Department of the Army (DA) authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Table A: Credit Release Schedule – Stream Credits – *Alexander Farms Mitigation Site*

Credit Release Milestone	Release Activity	ILF/NCDMS	
		Interim Release	Total Released
2*	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan.	30%	30%
3	First year monitoring report demonstrates that channels are stable interim performance standards are being met.	10%	40%
4	Second year monitoring report demonstrates that channels are stable interim performance standards are being met.	10%	50%
5	Third year monitoring report demonstrates that channels are stable interim performance standards are being met.	10%	60%
6**	Fourth year monitoring report demonstrates that channels are stable interim performance standards are being met.	5%	65% (75%***)
7	Fifth year monitoring report demonstrates that channels are stable interim performance standards are being met.	10%	75% (85%***)
8**	Sixth year monitoring report demonstrates that channels are stable interim performance standards are being met.	5%	80% (90%***)
9	Seventh year monitoring report demonstrates that channels are stable performance standards have been met and project has received closeout approval.	10%	90% (100%***)

*For ILF sites (including all NCDMS projects), no initial release of credits (Milestone 1) is provided because ILF programs utilized advance credits, so no initial release is necessary to help fund site construction. To account for this, the 15% credit release associated with the first milestone (bank establishment) is held until the second milestone, so that the total credits release at the second milestone is 30%. In order for NCDMS to receive the 30% release (shown in the schedules as Milestone 2), they must comply with the credit release requirements stated in Section IV(I)(3) of the approved NCDMS Instrument.

**Please note that vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

***10% reserve of credits to be held back until the bankfull event performance standard has been met.

Section 7.0 REFERENCES

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

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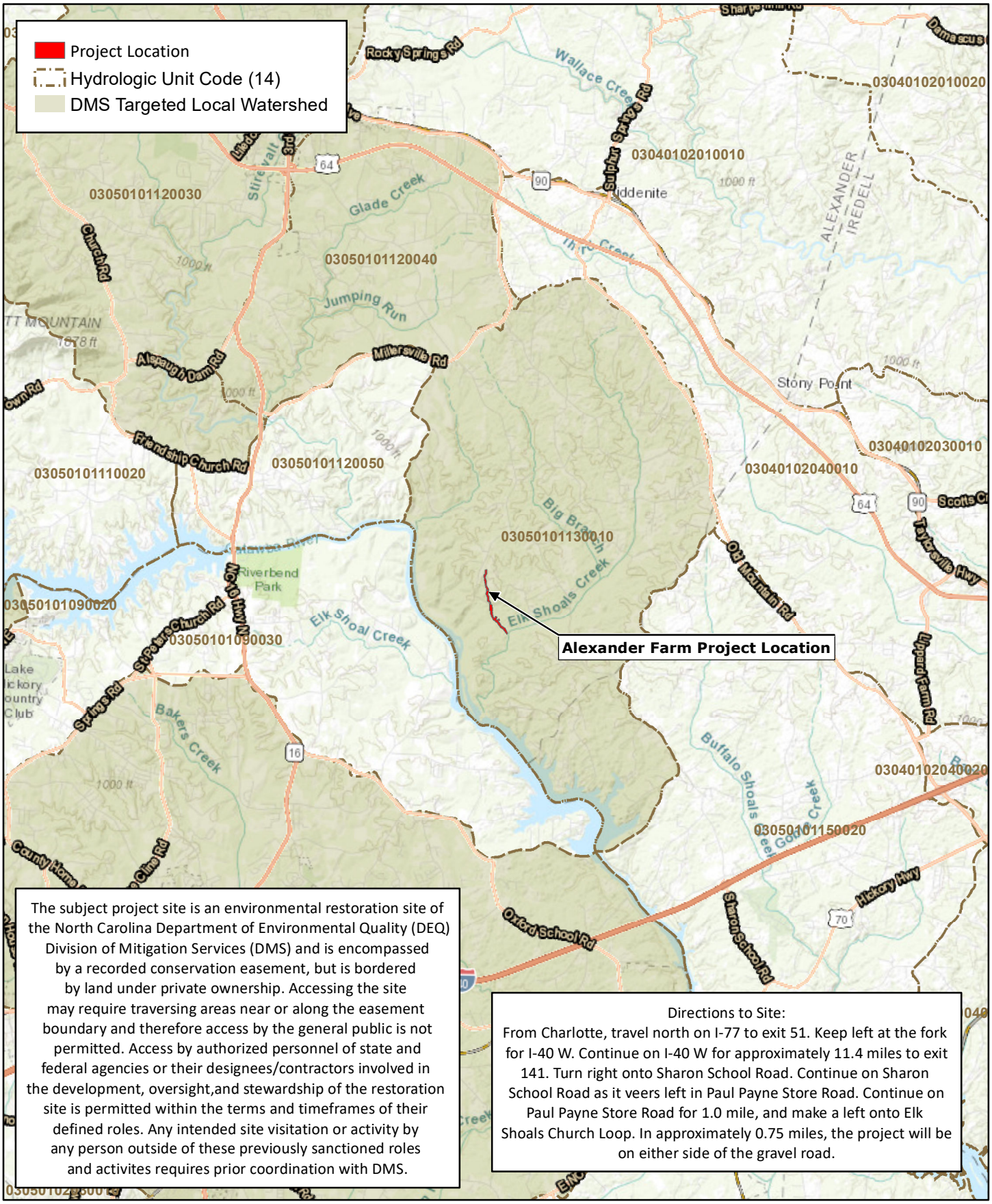
APPENDIX 1. General Figures, Tables, and Documentation

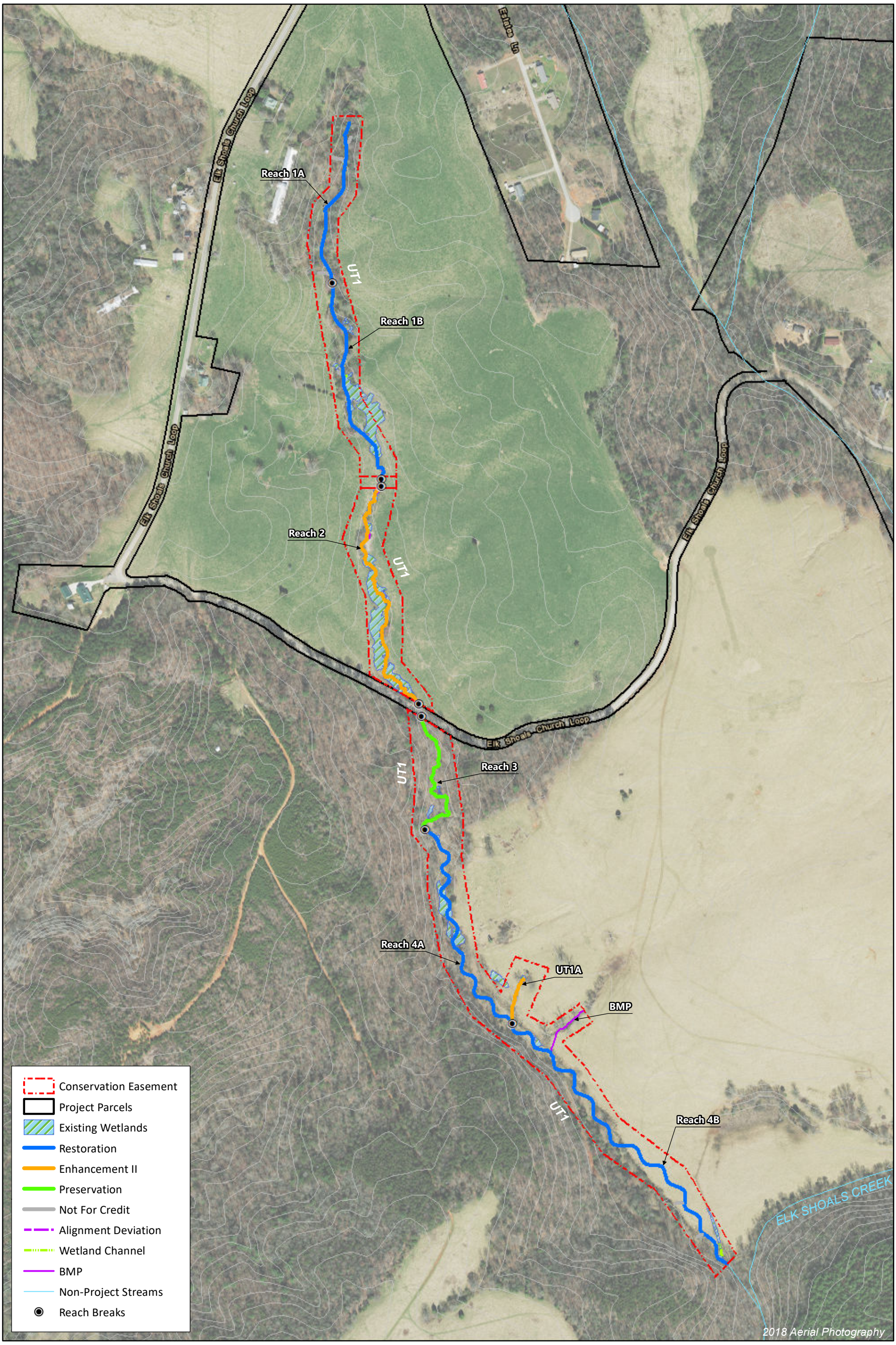


The subject project site is an environmental restoration site of the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing 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, travel north on I-77 to exit 51. Keep left at the fork for I-40 W. Continue on I-40 W for approximately 11.4 miles to exit 141. Turn right onto Sharon School Road. Continue on Sharon School Road as it veers left in Paul Payne Store Road. Continue on Paul Payne Store Road for 1.0 mile, and make a left onto Elk Shoals Church Loop. In approximately 0.75 miles, the project will be on either side of the gravel road.

WILDLANDS ENGINEERING

Figure 1 Project Vicinity Map
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020
Alexander County, NC

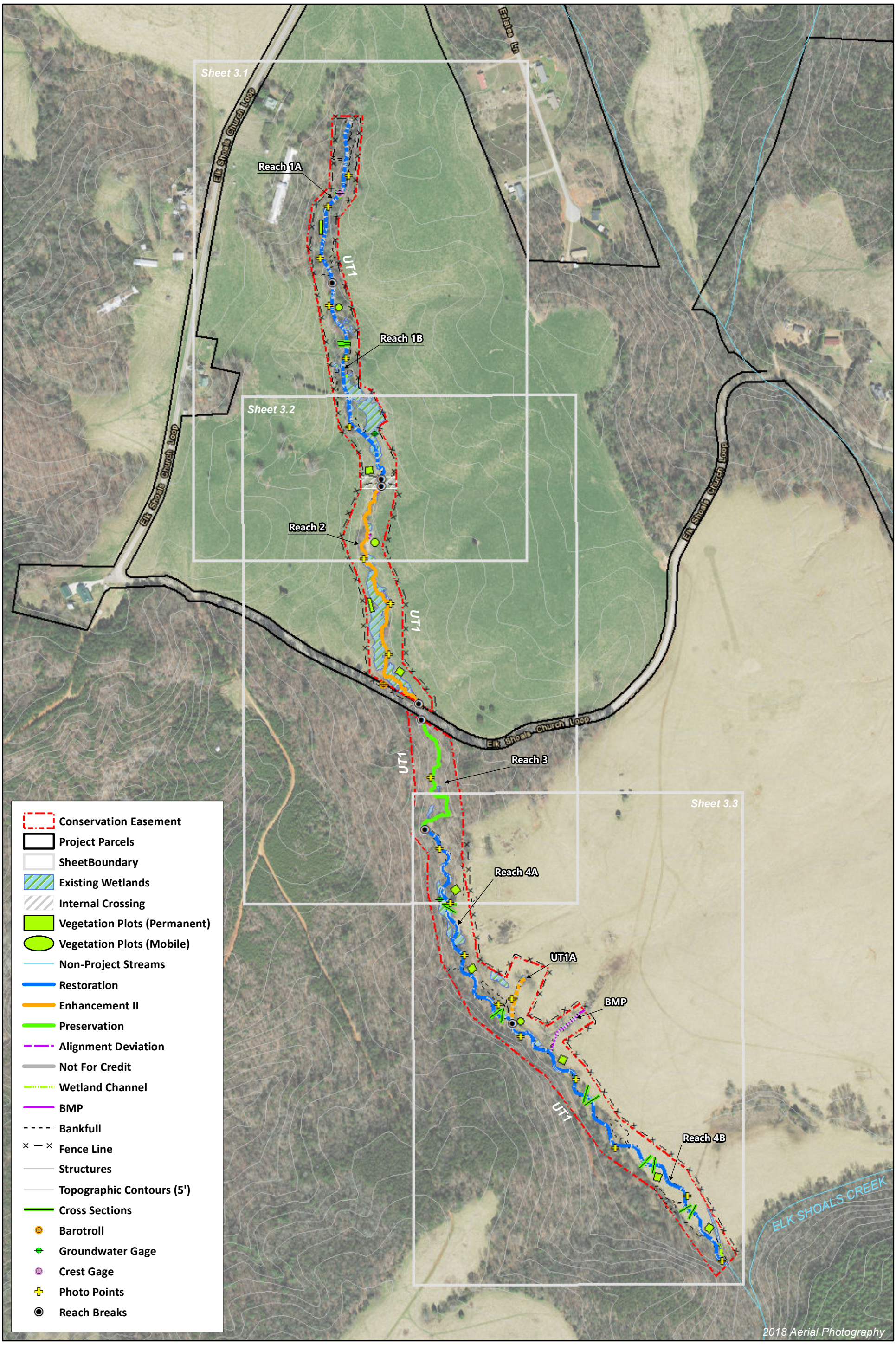


WILDLANDS ENGINEERING

0 400 800 Feet

N

Figure 2 Project Component/ Asset Map
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020
Alexander County, NC

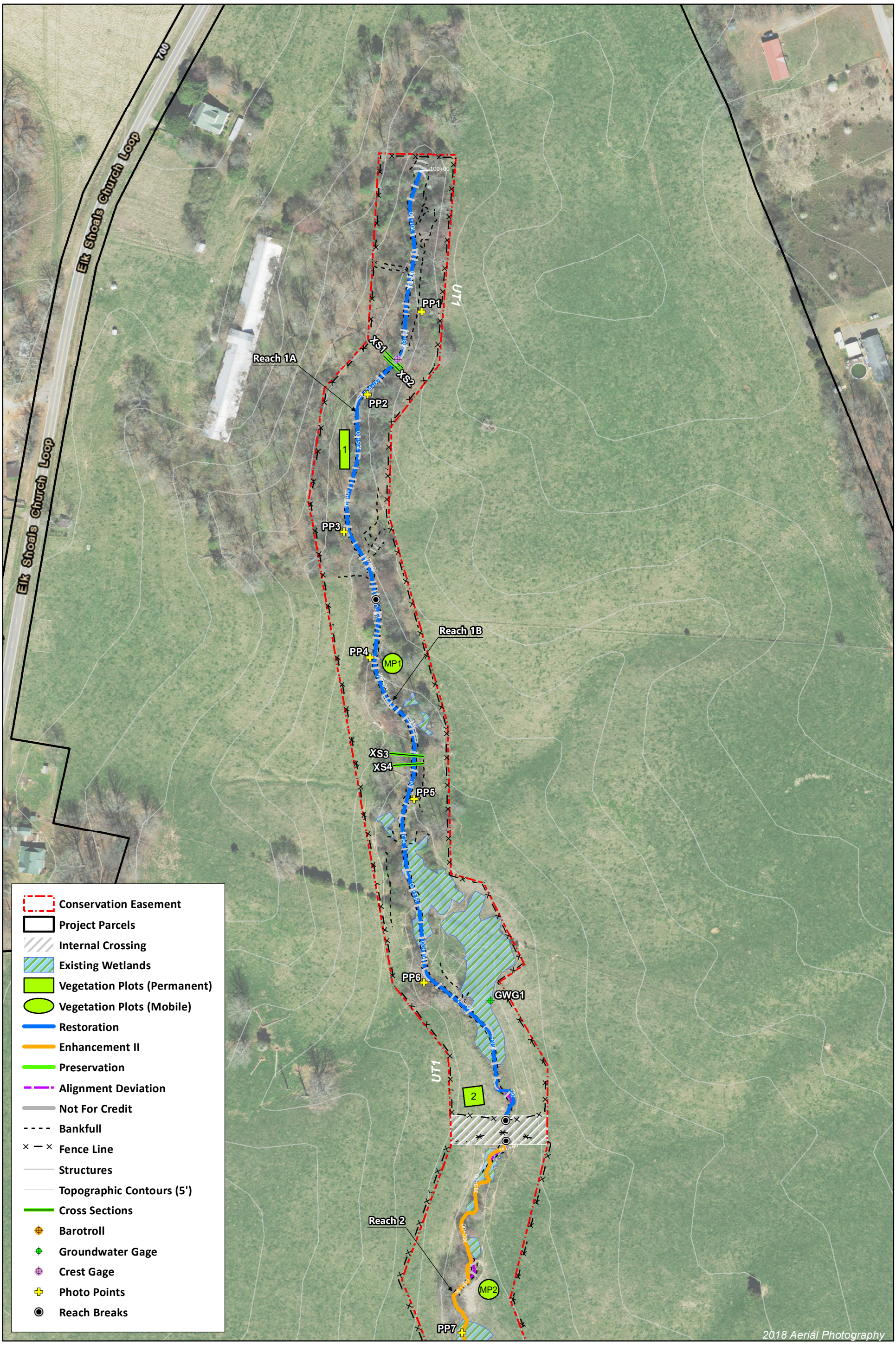


WILDLANDS ENGINEERING

0 400 800 Feet

N

Figure 3.0 As-Built Monitoring Plan View (Key)
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020
Alexander County, NC

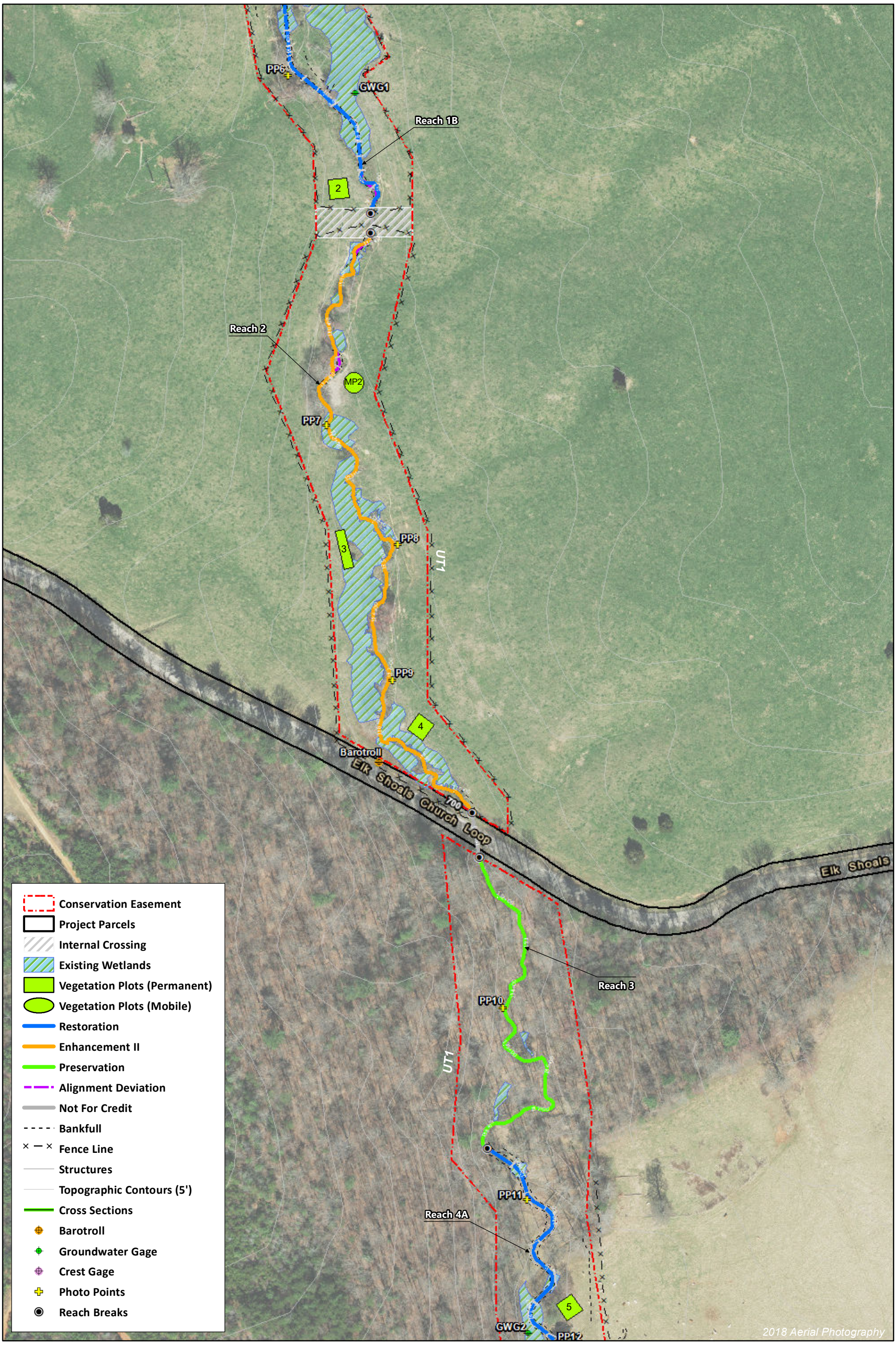


WILDLANDS ENGINEERING

0 150 300 Feet

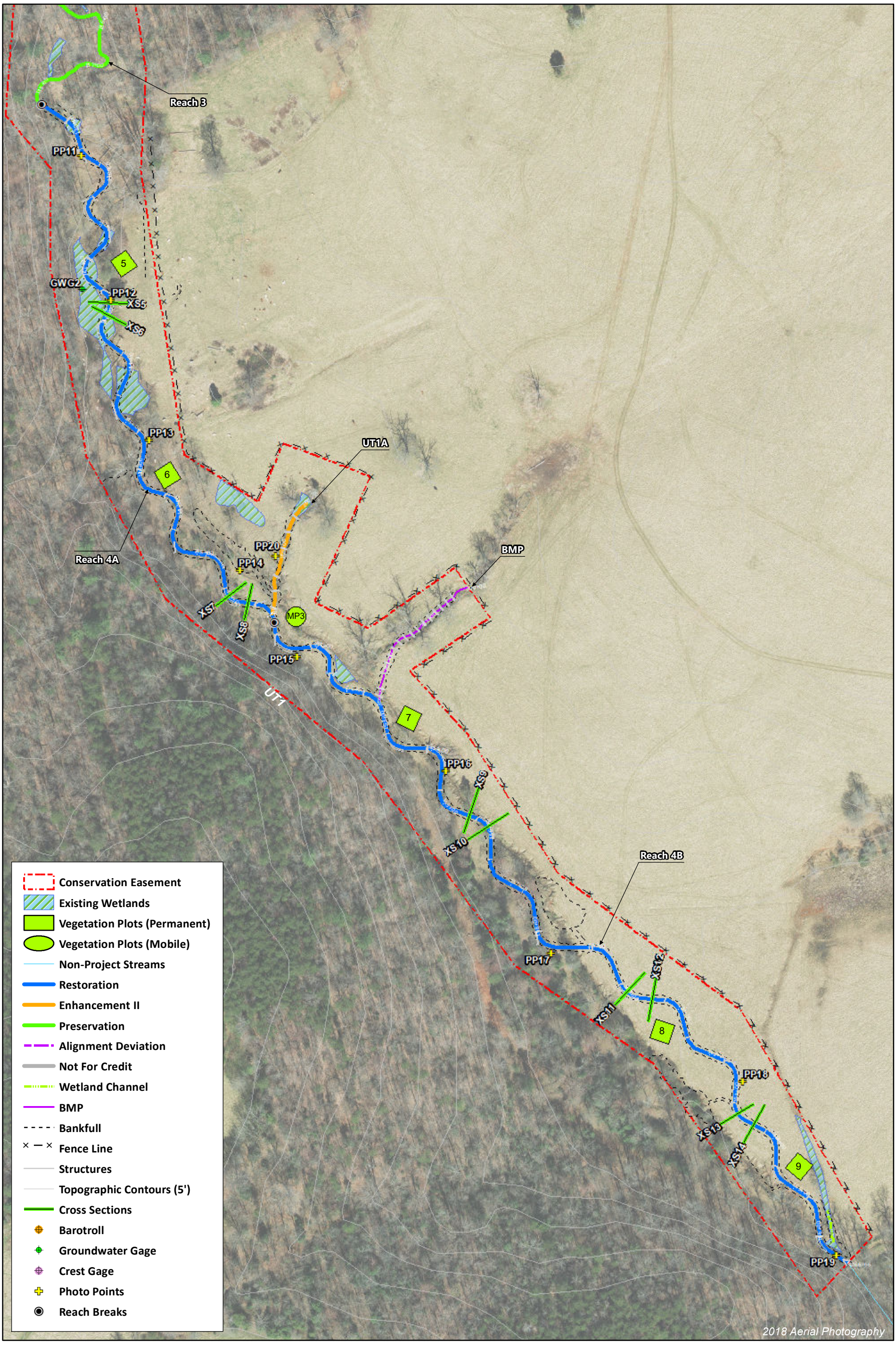
N

Figure 3.1 As-Built Monitoring Plan View
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020
Alexander County, NC



WILDLANDS ENGINEERING

Figure 3.2 As-Built Monitoring Plan View
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020
Alexander County, NC



WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3.3 As-Built Monitoring Plan View
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020
Alexander County, NC

Table 1. Mitigation Assets and Components

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Project Components									
Project Area /Reach	**Existing Footage (LF) or Acreage**	**Mitigation Plan Footage/ Acreage**	**Mitigation Category**	**Restoration Level**	**Priority Level**	**Mitigation Ratio (X:1)[1]**	**As-Built Footage/Acreage[2]**	**Project Credit**	**Notes/Comments**
UT1 Reach 1A	1,901	770	Warm	Restoration	P1, P2	2.000	770.000	385.000	Full channel restoration with planted buffer. Livestock excluded, and invasive species treated.
UT1 Reach 1B*		969	Warm	Restoration	P1, P2	2.000	957.000	478.500	Full channel restoration with planted buffer. Livestock excluded, and invasive species treated.
UT1 Reach 2*	1,324	1260	Warm	Enhancement II	N/A	2.000	1,253.000	626.500	Channel stabilization with planted buffer. Livestock excluded, and invasive species treated.
UT1 Reach 3*	732	718	Warm	Preservation	N/A	10.000	701.000	70.100	Invasive species treated.
UT1 Reach 4A	2,825	252	Warm	Restoration	P2	2.500	252.000	100.800	Channel stablized. Floodplain bench cut to reconnect channel with floodplain and transition preservation reach to Priority 1 restoration. Planted buffer, livestock exclusion, and invasive species treated.
UT1 Reach 4A		920	Warm	Restoration	P1	1.000	920.000	920.000	Full channel restoration with planted buffer. Livestock excluded, and invasive species treated.
UT1 Reach 4B		1666	Warm	Restoration	P1, P2	1.000	1,666.000	1,666.000	Full channel restoration with planted buffer. Livestock excluded, and invasive species treated.
UT1A	158.00	203	Warm	Enhancement II	N/A	-	203.000	0.000	Channel reconnected with floodplain. Livestock excluded, invasive species treated, and planted buffer.
BMP	N/A	262	N/A	N/A	N/A	-	262.000	N/A	Step-pool conveyance system implemented to treat pasture stormwater run-off. Livestock excluded, and invasive species treated.

Notes:

* UT1 R1B's as-built footage is short by 12 LF, with a restoration credit ratio of 2:1, there is a loss of 6.000 restoration SMUs. UT1 R2's as-built footage is short 7 LF, with an EII credit ratio of 2:1, there is a loss of 3.500 EII SMUs. UT1 R3's as-built footage is short 17 LF, with a preservation credit ratio of 10:1, there is a loss of 1.700 preservation SMUs. This results in net loss of 11.200 SMUs. These numbers are not reflected in the Project Credits table below, in order for the credit totals to match the Site's Mitigation Plan.

1. No direct credit for BMP or UT1A.

2. Internal culvert crossing and external break excluded from stationing listed.

Project Credits							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Riparian Wetland**	**Coastal Marsh**
	Warm	**Cool**	**Cold**	**Riverine**	**Non-Riv**		
Restoration	3,556.300	N/A	N/A	N/A	N/A	N/A	N/A
Re-establishment				N/A	N/A	N/A	N/A
Rehabilitation				N/A	N/A	N/A	N/A
Enhancement				N/A	N/A	N/A	N/A
Enhancement I	-	N/A	N/A				
Enhancement II	630.000	N/A	N/A				
Creation				N/A	N/A	N/A	N/A
Preservation	71.800	N/A	N/A	N/A	N/A	N/A	
Totals	**4,258.100**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

Table 2. Project Activity and Reporting History

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Activity or Report		Data Collection Complete	Completion or Delivery
404 Permit		October 2019	November 2019
Mitigation Plan		March 2018 - October 2019	October 2019
Final Design - Construction Plans		September 2019	September 2019
Construction		December 2019 - April 2020	April 2020
Temporary S&E mix applied to entire project area[1]		April 2020	April 2020
Permanent seed mix applied to reach/segments[1]		April 2020	April 2020
Bare root and live stake plantings for reach/segments		April 2020	April 2020
Baseline Monitoring (Year 0)	Stream Survey	April - May 2020	September 2020
	Vegetation Survey	Collected - April 2020 Verified - June 2020	
Year 1 Monitoring	Stream Survey		
	Vegetation Survey		
Year 2 Monitoring	Stream Survey		
	Vegetation Survey		
Year 3 Monitoring	Stream Survey		
	Vegetation Survey		
Year 4 Monitoring	Stream Survey		
	Vegetation Survey		
Year 5 Monitoring	Stream Survey		
	Vegetation Survey		
Year 6 Monitoring	Stream Survey		
	Vegetation Survey		
Year 7 Monitoring	Stream Survey		
	Vegetation Survey		

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

Table 3. Project Contact Table

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Designers Aaron Earley, PE, CFM	**Wildlands Engineering, Inc.** 1430 South Mint Street, Suite 104 Charlotte, NC 28203 704.332.7754
Construction Contractors	**Baker Grading & Landscaping, Inc** 970 Bat Cave Road Old Fort, NC 28762
Planting Contractor	**Bruton Natural Systems, Inc.** PO Box 1197 Fremont, NC 27830
Seeding Contractor	**Baker Grading & Landscaping, Inc.** 970 Bat Cave Road Old Fort, NC 28762
Seed Mix Sources	**Baker Grading & Landscaping, Inc.**
Nursery Stock Suppliers	
Bare Roots Live Stakes	**Bruton Natural Systems, Inc.**
Herbaceous Plugs	**Wetland Plants Inc.**
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Kristi Suggs (704) 332.7754 x.110

Table 4. Project Information and Attributes

Alexander Farm Mitigation Site

DMS Project No. 100048

Monitoring Year 0 - 2020

Project Information					
Project Name	Alexander Farm Mitigation Site Alexander County				
Project Area (acres)	21.7				
Project Coordinates (latitude and longitude)	35° 48' 42.36"N 81° 7' 14.46"W				
Planted Acreage (Acre of Woody Stems Planted)	17.5				
Project Watershed Summary Information					
Physiographic Province	Piedmont Physiographic Province				
River Basin	Catawba River				
USGS Hydrologic Unit 8-digit	3050101				
USGS Hydrologic Unit 14-digit	3050101130010				
DWR Sub-basin	03-08-32				
Project Drainage Area (acres)	UT1 - 256, UT1A - 7.4				
Project Drainage Area Percentage of Impervious Area	1%				
2011 NLCD Land Use Classification	Forest (20%), Cultivated (73%), Grassland (1%), Shrubland (1%), Urban (5%), Open Water (0%)				
Reach Summary Information					
Parameters	**UT1 Reach 1A and 1B**	**UT1 Reach 2**	**UT1 Reach 3**	**UT1 Reach 4A and 4B**	**UT1A**
Length of reach (linear feet) - Post-Restoration	1,727	1,253	701	2,838	203
Valley confinement (Confined, moderately confined, unconfined)	Confined	Unconfined	Moderately Confined	Unconfined	Unconfined
Drainage area (acres)	71	117	141	256	7
Perennial, Intermittent, Ephemeral	P	P	P	P	I
NCDWR Water Quality Classification	WS-IV				
Morphological Description (stream type) - Pre-Restoration	B4	B4	N/A	C4c/G4c	N/A
Morphological Description (stream type) - Post-Restoration	B4	B4	N/A	C4	N/A
Evolutionary trend (Simon's Model) - Pre- Restoration	III	V	I/II	IV	III
FEMA classification	N/A	N/A	N/A	Zone AE	N/A

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	Yes	Yes	USACE Action ID #SAW-2018-00451
Waters of the United States - Section 401	Yes	Yes	DWR# 18-0665
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	NPDES Construction Stormwater General Permit NCG010000
Endangered Species Act	Yes	Yes	Categorical Exclusion Document in Mitigation Plan
Historic Preservation Act	Yes	Yes	Categorical Exclusion Document in Mitigation Plan
Coastal Zone Management Act (CZMA)/Coastal Area Management Act	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	Alexander County Floodplain Development Permit #01-2019
Essential Fisheries Habitat	No	N/A	N/A

Table 5. Monitoring Component Summary

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Parameter	Monitoring Feature	Quantity / Length by Reach							Wetlands	Frequency	Notes
		UT1 Reach 1A	UT1 Reach 1B	UT1 Reach 2	UT1 Reach 3	UT1 Reach 4A	UT1 Reach 4B	UT1A			
Dimension	Riffle Cross-Section	1	warm	N/A	N/A	2	3	N/A		Year 1, 2, 3, 5, and 7	1
	Pool Cross-Section	1	warm	N/A	N/A	2	3	N/A			
Pattern	Pattern	N/A	warm	N/A	N/A	N/A	N/A	N/A		N/A	2
Profile	Longitudinal Profile	N/A	warm	N/A	N/A	N/A	N/A	N/A		N/A	
Substrate	Reach Wide (RW) Pebble Count	1 RW	warm	N/A	N/A	1 RW	1 RW	N/A		Year 1, 2, 3, 5, and 7	3
Hydrology	Crest Gage (CG) and or/Transducer (SG)	1 CG						N/A		Semi-Annual	4
Wetland Hydrology	Groundwater Gages (GWG)								2	Semi-Annual	8
Vegetation	CVS Level 2/Mobile plots	12 (9 permanent, 3 mobile)								Year 1, 2, 3, 5, and 7	5
Visual Assessment		Yes								Semi-Annual	
Exotic and Nuisance Vegetation										Semi-Annual	6
Project Boundary										Semi-Annual	7
Reference Photos	Photographs	20								Annual	

Notes:

1. Cross-sections were permanently marked with rebar to establish location. Surveys include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.
2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile was collected during the as-built baseline monitoring survey only, unless observations indicate widespread lack of vertical stability (greater than 10% of reach is affected) and profile survey is warranted in additional years to monitor adjustments or survey repair work.
3. Riffle 100-count substrate sampling were collected during the baseline monitoring only. A reach-wide pebble count will be performed on each restoration or enhancement I reach each year for classification purposes.
4. Crest gages and/or transducers will be inspected and downloaded quarterly or semi-annually. Evidence of bankfull events such as rack lines or floodplain deposition will be documented with a photo when possible. Transducers, if used, will be set to record stage once every three hours.
5. Permanent vegetation monitoring plot assessments will follow CVS Level 2 protocols. Mobile vegetation monitoring plot assessments will document number of planted stems, height, and species using a circular or 100 m2 square/rectangular plot.
6. Locations of exotic and nuisance vegetation will be mapped.
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.
8. Wetland gages were installed within existing wetlands located where Priority 1 restoration was conducted to monitor groundwater hydrology. No wetland credits are being sought for this project and no performance criteria have been established.

WILDLANDS
ENGINEERING

MEETING NOTES

MEETING: Post-Contract IRT Site Walk
ALEXANDER FARM Mitigation Site
Catawba 03050101; Alexander County, NC
DEQ Contract No. 7416
DMS Project No. 100048
Wildlands Project No. 005-02169

DATE: Thursday, March 29, 2018

LOCATION: Elk Shoals Church Loop
Stony Point, NC

Attendees

Steve Kichefski, USACE
Olivia Munzer, WRC
Todd Bowers, EPA
Paul Wiesner, DMS
Harry Tsomides, DMS
Kirsten Ullman, DMS
Alan Johnson, DWR
Ori Tuvia, DWR
Mac Haupt, DWR
Shawn Wilkerson, Wildlands
Christine Blackwelder, Wildlands

Materials

- Wildlands Engineering Technical Proposal dated 9/21/2017 in response to DMS RFP 16-007277

Meeting Notes

The meeting began at 1 pm. Shawn presented an overview of the project at the parking location. From there, the group walked upstream to the headwaters of UT1, retraced steps and reviewed UT1 downstream of the road, UT1A, and the potential wetland area in the left floodplain at the downstream site extents. The meeting concluded at 3:30 PM.

1. **Overall project comments**
   - Bald eagle is listed for Alexander County. No bald eagle nest noticed in vicinity, nor is there a record adjacent to the site.
   - Alexander family house (historical) located near the site.
   - Olivia recommends that no trees are cleared during bat maternity roosting period (June/July).
2. **Potential Wetland Credit Areas**

   Steve noted that if wetlands are included in the project, he or William Elliott (USACE) will do a more thorough review of the site when they return for the jurisdictional determination.

- **Upstream of road**
  - There are a few wetland pockets in the right floodplain just upstream of the road, and several more in the left floodplain upstream of the proposed stream crossing.
  - Steve asked that wetland pockets be encompassed by the easement, even if not for credit.
- **Downstream of road**
  - If needed, the area in the left floodplain that is currently ditched has potential for wetland credits.
  - Discussion about the need to drop a well into any wetland proposed for restoration credit to begin pre-construction data collection asap.

3. **Stream Restoration**

- **Upstream of the road**
  - The group walked up to the head of UT1. Cattle have been rotated out of this pasture and are in the pasture downstream of the road.
  - The start of UT1 is a large cattle wallow area. Shawn discussed that Wildlands may install a BMP to treat concentrated agricultural runoff above the reach.
  - Mac noted the soils at the head of UT1 and that this area may have been a wetland before the headcut advanced through and formed a stream channel.
  - Several members of the group noted that UT1 here has a lot of side seeps and noted areas of channel recovery from the absence of cattle over the last few months. One area of UT1 here just upstream of a headcut has very low banks and the group discussed tying design into this area. Shawn noted the planar bed and lack of habitat but did agree that Wildlands may utilize good areas of existing channel in the restoration design.
  - Continuing downstream, Olivia expressed concern over how close the proposed crossing is to the existing left floodplain wetland. The valley walls are relatively steep near the proposed crossing, and Wildlands will likely shift this crossing further downstream to where crossing will be easier for the farmer, which should also address any wetland concerns.
  - The crossing shown in the proposal marks a transition from restoration upstream to enhancement 2 downstream, although the group agreed that there isn't a clearly defined transition point in the field. The proposed enhancement 2 section will require some areas of restoration or enhancement I, and some of the restoration area may be fine with a lighter touch.
  - Overall, upstream of the road, the group discussed restoration at 1:1 credit from the head of the channel down to the existing fence line, and enhancement 2 at 2:1 credit from the fence line to the road. This would shorten the proposed restoration footage in this area by approximately 400 feet.
- **Downstream of the road**
  - Within the woods, the group generally agreed with a preservation approach. At the headcut which marked the proposed transition from preservation to restoration, the group agreed that a transitional length of enhancement 2 was appropriate. This transitional length will continue until the stream enters the active cattle pasture, where the approach will switch to restoration down to the end of the project.

- The restoration downstream of the road was presented in the proposal at 1.5:1 credit due to the amount of floodplain vegetation which had established in absence of the cattle over the last two years. The group noted the extreme difference in the floodplain vegetation and channel condition since the cattle have been rotated back into the field, and that the reach is worthy of traditional 1:1 crediting.
- Olivia noted underground flow from the left floodplain near the downstream project extent. These may be drain tiles from the field. Wildlands will review this more carefully during the existing conditions assessment.

These meeting minutes were prepared by Christine Blackwelder and reviewed by Shawn Wilkerson on April 13, 2018, and represent the authors' interpretation of events. Olivia Munzer comments (May 7, 2018) were incorporated on May 15, 2018. These minutes are now final.

WILDLANDS
ENGINEERING

MEMO

REGARDING: Credit Ratios
ALEXANDER FARM Mitigation Site
Catawba 03050101; Alexander County, NC
DEQ Contract No. 7416
DMS Project No. 100048
Wildlands Project No. 005-02169

DATE: Monday, April 16, 2018

In the September 26, 2017, Technical Proposal for the Alexander Farm Mitigation Site, Wildlands presented various credit ratios for UT1 upstream and downstream of Elk Shoals Church Loop road based on the channel conditions at the time of the proposal. This memo reflects changes to the proposed credit ratios in response to discussion during the IRT field walk of the site on March 29, 2018.

Upstream of the road

The stream crossing shown in the proposal marked the proposed transition from restoration at 1:1 credit to enhancement 2 at 2.5:1 credit; however, during the IRT field walk, the group agreed that there isn't a clearly defined transition point in the field. The proposed enhancement 2 section will require some areas of restoration or enhancement I, and some of the restoration area may be fine with a lighter touch.

The IRT group discussed restoration at 1:1 credit from the head of the channel down to the existing fence line (which crosses the channel upstream of the stream crossing), and enhancement 2 at 2:1 credit from the fence line to the road. This would shorten the restoration footage presented in the proposal in this area by approximately 400 feet.

After the meeting, Wildlands reviewed the contracted credit requirements, and given the large area of transition from restoration to enhancement 2 upstream of the road, Wildlands will likely propose the entire area upstream of the road as enhancement 2 at 2:1 credit in the mitigation plan and apply the appropriate level of intervention needed throughout the reach.

Downstream of the road

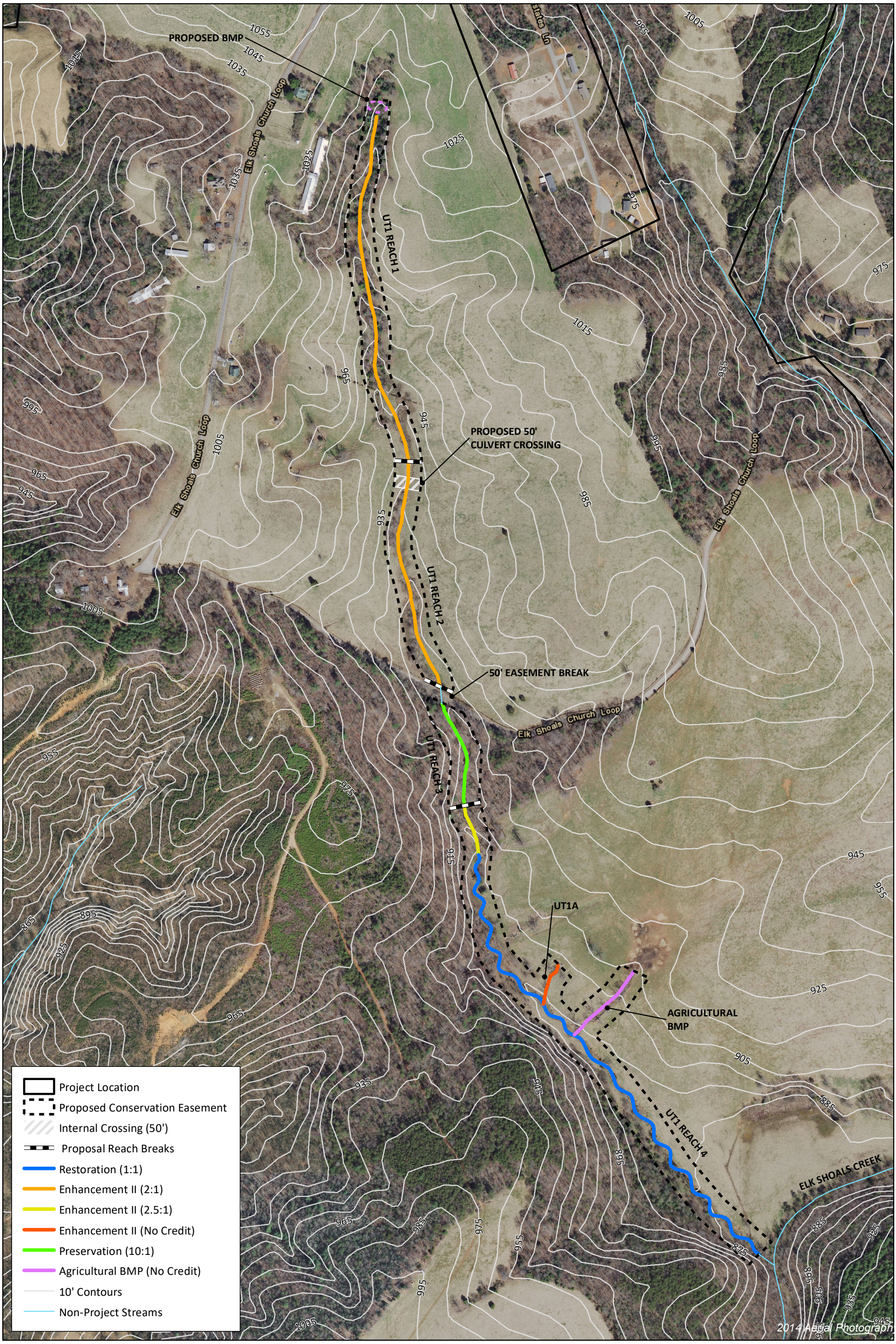
Within the woods, the IRT group generally agreed with the preservation approach presented in the proposal. At the headcut which marked the proposed transition from preservation to restoration, the group agreed that a transitional length of enhancement 2 was appropriate. This transitional length will continue until the stream enters the active cattle pasture, where the approach will switch to restoration down to the end of the project.

The Alexander Farm tenant farmer rotates his 175-head herd between the pasture upstream of the road in spring and summer and the downstream of the road in fall and winter. Wildlands visited the Site several times between 2010 and 2015 and confirmed this land management practice. Over the 2 years prior to submittal of the proposal, however, the tenant farmer kept the herd upstream of the road to allow for fencing repair and

replacement downstream of the road. During this time, he cut hay downstream of the road, but allowed the riparian area to grow with annuals. During the proposal process, the farmer told Wildlands that his repairs would soon be complete and he would then move the herd downstream of the road. Despite incision throughout the channel length, Wildlands proposed a lower credit ratio of 1.5:1 for restoration downstream of the road to acknowledge the reach's heavy herbaceous cover due to the absence of recent cattle activity.

The farmer completed his fencing repairs after the proposal was submitted and moved his herd downstream of the road. During the IRT site walk on March 29, 2018, the IRT group noted that all the riparian vegetation was gone and impacted by cattle. IRT members, Wildlands, and DMS all felt that the restoration activities proposed downstream of the road were now creditable at a 1:1 ratio. Wildlands proposes this section of restoration at 1:1 credit.

Please see the attached figure which illustrates the proposed shift in credit ratios. All proposed credit ratios will be fully justified in the mitigation plan.



WILDLANDS ENGINEERING

0 200 400 Feet

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IRT Credit Memo
Alexander Farm Mitigation Site
Catawba River Basin (03050101)

Alexander County, NC

APPENDIX 2. Morphological Summary Data and Plots

Table 6. Baseline Stream Data Summary
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

		Pre-Restoration Condition								Design								As-Built/Baseline							
Parameter	**Gage**	**UT1 R1A**		**UT1 R1B**		**UT1 R4A**		**UT1 R4B**		**UT1 R1A**		**UT1 R1B**		**UT1 R4A**		**UT1 R4B**		**UT1 R1A**		**UT1 R1B**		**UT1 R4A**		**UT1 R4B**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																									
Bankfull Width (ft)	N/A	5.8	7.2	5.8	7.2	6.0	9.1	8.2	8.6	6.5		8.0		11.5		12.0		6.6		7.9		11.6	12.9	11.4	12.5
Floodprone Width (ft)		7	9	7	9	24	54	8	10	9	14	11	18	25	58	26	60	23		25		64	68	75	83
Bankfull Mean Depth (ft)		0.6	0.7	0.6	0.7	1.0	1.4	1.2		0.5		0.5		0.9		0.9		0.4		0.7		0.8	1.0	1.0	1.1
Bankfull Max Depth (ft)		0.8	0.9	0.8	0.9	1.9	2.0	2.0	2.1	0.6	0.7	0.6	0.8	1.1	1.3	1.1	1.4	0.9		0.9		1.3	1.4	1.3	1.6
Bankfull Cross-sectional Area (ft^2)[1]		4.0	4.4	4.0	4.4	8.6	8.8	10.1	10.3	3.0		4.3		10.1		11.3		2.7		5.5		10.6	12.0	11.9	12.6
Width/Depth Ratio		8.5	12.0	8.5	12.0	8.0	14.1	6.6	7.2	14.0		15.0		13.0		13.0		16.3		11.4		11.3	15.8	10.3	13.1
Entrenchment Ratio[3]		1.2		1.2		3.0	9.1	1.0	1.1	1.4	2.2	1.4	2.2	2.2	5.0	2.2	5.0	3.5		3.2		5.3	5.5	6.0	6.6
Bank Height Ratio		5.9	6.4	5.9	6.4	1.0	2.1	2.0	2.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.0		1.0		1.0		1.0	
D_{50} (mm)		13.6	22.6	13.6	22.6	17.7	22.6	17.7	22.6	---		---		---		---		49.6		65.3		59.4	71.0	55.6	69.1
Profile																									
Riffle Length (ft)	N/A																								
Riffle Slope (ft/ft)		---		---		---		---		0.009	0.052	0.018	0.049	0.002	0.024	0.002	0.026	0.006	0.052	0.002	0.063	0.001	0.037	0.004	0.021
Pool Length (ft)																									
Pool Max Depth (ft)		1.0		1.0		2.1		N/A		0.9	1.4	1.1	1.6	1.8	2.6	1.9	2.8	0.9	2.1	1.2	2.4	1.9	2.8	1.8	3.9
Pool Spacing (ft)		8	24	8	24	11	19	N/A		7.0	33.0	8.0	40.0	26.0	81.0	28.0	84.0	7.8	49.9	7.8	49.7	28.0	97.5	47.2	115.3
Pool Volume (ft^3)																									
Pattern																									
Channel Beltwidth (ft)	N/A	N/A		N/A		9.0	99.0	9.0	99.0	N/A		N/A		23.0	92.0	24.0	96.0	N/A		N/A		23.0	92.0	24.0	96.0
Radius of Curvature (ft)		N/A		N/A		27.0	65.0	27.0	65.0	N/A		N/A		23.0	35.0	24.0	36.0	N/A		N/A		23.0	35.0	24.0	36.0
Rc/Bankfull Width		N/A		N/A		4.5	7.1	3.3	7.6	N/A		N/A		2.0	3.0	2.0	3.0	N/A		N/A		2.0	3.0	2.0	3.0
Meander Length (ft)		N/A		N/A		58.0	201.0	58.0	201.0	N/A		N/A		58.0	161.0	60.0	168.0	N/A		N/A		58.0	161.0	60.0	168.0
Meander Width Ratio		N/A		N/A		1.5	10.9	1.1	11.5	N/A		N/A		2.0	8.0	2.0	8.0	N/A		N/A		2.0	8.0	2.0	8.0
Substrate, Bed and Transport Parameters																									
Ri%/Ru%/P%/G%/S%	N/A																								
SC%/Sa%/G%/C%/B%/Be%																									
$D_{16}/D_{35}/D_{50}/D_{84}/D_{95}$/dip/disp		0.4/0.7/1.3/23.6/42.0/90.0				0.3/0.5/0.9/33.7/45.0/90.0				---		---		---		---		0.2/0.8/7.7/102.0/156.8/256.0		SC/0.2/2.0/86.5/128.0/512.0		SC/0.3/1.7/76.7/128.0/256.0		SC/SC/0.7/75.9/128.0/256.0	
Reach Shear Stress (Competency) lb/ft[1]		---		---		---		---		---		---		---		---		---		---		---		---		---	
Max part size (mm) mobilized at bankfull		---		---		---		---		---		---		---		---		---		---		---		---	
Stream Power (Capacity) W/m[1]																									
Additional Reach Parameters																									
Drainage Area (SM)	N/A	0.05		0.11		0.29		0.40		0.05		0.11		0.29		0.40		0.05		0.11		0.29		0.40	
Watershed Impervious Cover Estimate (%)		1%								1%								1%							
Rosgen Classification		B4		B4		C4c		G4c		B4		B4		C4		C4		B4		B4		C4		C4	
Bankfull Velocity (fps)		5.5	5.8	5.5	5.8	3.4	3.8	3.9	4.0	4.1		4.5		3.50		3.9		---		---		---		---	
Bankfull Discharge (cfs)		---		23.0		31.0	54.6	40.1		12		20		32		40		---		---		---		---	
Q-NFF regression (2-yr)																									
Q-USGS extrapolation (1.2-yr)		---		---		---		---		---		---		---		---		---		---		---		---	
Max Q-Mannings		---		---		---		---		---		---		---		---		---		---		---		---	
Valley Slope (ft/ft)		0.0370		0.0370		0.0130		0.0130		0.0370		0.0370		0.0130		0.0130		0.0370		0.0370		0.0130		0.0130	
Channel Thalweg Length (ft)		1,901				2,825				770		969		1,172		1,666		770		957		1,172		1,666	
Sinuosity		1.14		1.14		1.13		1.13		1.03		1.03		1.11		1.11		1.02		0.96		1.23		1.15	
Bankfull/Channel Slope (ft/ft)		0.0340		0.0340		0.0080		0.0080		0.0362		0.0362		0.0093		0.0093		0.0370		0.0375		0.0088		0.0085	

1. Pattern data is not applicable for A-type and B-type channels
2. ER for the baseline/monitoring parameters are based on the width of the cross-section, in lieu of assuming the width across the floodplain.
SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 7. Reference Reach Data Summary
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Reference Reach Data																			
Parameter	**Gage**	**Agony Acres UT1**		**UT to Kelly Creek**		**UT to Austin Branch**		**Timber Trib**		**UT to Lyle Creek**		**UT to Varnals Creek**		**Walker Branch**		**Box Creek**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																			
Bankfull Width (ft)	N/A	11.1		7.91		6.2		8.9		7.0		9.3	10.5	11.5	12.3	23.5	
Floodprone Width (ft)		25		9		27		14		45	49	60	100	31		76	
Bankfull Mean Depth		0.7		0.73		0.7		0.5		0.47		1.1	1.2	0.8	1.0	1.2	
Bankfull Max Depth		1.0		1.1		1.2		0.7		1.0	1.1	1.5	1.7	1.2	1.6	1.9	
Bankfull Cross-sectional Area (ft^2)		7.4		5.7		4.4		4.6		3.5	4.1	10.3	12.3	8.9	12.2	28.9	
Width/Depth Ratio		16.6		10.9		8.8		17.0		14.9	18.3	8.1	9.3	12.3	14.4	19.1	
Entrenchment Ratio		2.3		1.2		4.3		1.5		6.0	6.0	5.7	10.0	2.5	2.7	3.3	
Bank Height Ratio		1.0		2.5		1.0		1.0		1.0		1.0		---		1.5	
D50 (mm)		50.6		---		59		6.5		0.5		15		27.8		22	
Profile																			
Riffle Length (ft)	N/A																		
Riffle Slope (ft/ft)		---		---		0.025	0.730	0.020	0.150	0.006	0.060	0.024	0.057	0.000	0.100	0.600	
Pool Length (ft)																			
Pool Max Depth (ft)		1.6		---		1.7		---		1.3		2.5	2.6	1.8	2.3	4.4	
Pool Spacing (ft)		---		---		2.0	5.0	1.0	6.0	2.0	4.0	0.5	5.6	2.3	6.1	1.2	
Pool Volume (ft^3)																			
Pattern																			
Channel Beltwidth (ft)	N/A	---		18.0	34.0	---		---		21.0		15.0	45.0	102.0		62.0	87.8
Radius of Curvature (ft)		---		8	26	---		---		19	32	8	47	23	38	8	38
Rc/Bankfull Width		---		---		---		---		2.7	3.7	0.6	3.2	2.0	3.1	0.3	1.6
Meander Length (ft)		---		---		---		---		---		---		---		---	
Meander Width Ratio		---		---		---		---		---		---		---		---	
Substrate, Bed and Transport Parameters																			
Ri%/Ru%/P%/G%/S%	N/A																		
SC%/Sa%/G%/C%/B%/Be%																			
d16/d35/d50/d84/d95/d100		2.0/12.9/50.6/168.1/2048.0/>2048		---		11.0/42.0/59.0/170.0/256.0		0.49/3.5/6.5/48.0/83.0/128.0		SC/0.1/0.2/0.5/4.0/8.0		2.9/9.2/15.0/56.0/88.0/256.0		0.6/12.2/27.8/74.5/128.0/>2048		4.1/11.0/22.0/50.0 /78.0	
Reach Shear Stress (Competency) lb/ft^2																			
Max part size (mm) mobilized at bankfull																			
Stream Power (Capacity) W/m^2																			
Additional Reach Parameters																			
Drainage Area (SM)	N/A	0.15		0.08		0.12		0.04		0.25		0.41		0.29		2.13	
Watershed Impervious Cover Estimate (%)		---		---		---		---		---		---					
Rosgen Classification		B3		B4/B4a		B4a/A4		B4		C5		C4/E4		E4		C4	
Bankfull Velocity (fps)		4.9		5.9		6.2		3.7		4.7		4.4	5.2	3.8		3.4	
Bankfull Discharge (cfs)		37		23		27		17		18		54		40		99	
Q-NFF regression (2-yr)																			
Q-USGS extrapolation (1.2-yr)																			
Q-Mannings																			
Valley Slope (ft/ft)		0.050		0.049		0.048		0.041		0.009		0.020		0.030		0.250	
Channel Thalweg Length (ft)		---		---		---		---		---		---		---		---	
Sinuosity		1.0		1.0		1.2		1.1		1.1		1.2		1.4		1.3	
Water Surface Slope (ft/ft)		---		---		---		---		---		---		---		---	
Bankfull/Channel Slope (ft/ft)		0.049		0.030	0.065	0.040		0.033		0.004		0.017		0.010		0.840	

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

Table 8. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

	UT1 R1A Cross-Section 1								UT1 R1A Cross-Section 2								UT1 R1B Cross-Section 3								UT1 R1B Cross-Section 4							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	976.6								976.2								945.7								945.3							
Bankfull Width (ft)	6.6								7.0								8.3								7.9							
Floodprone Width (ft)	23.3								-								-								25.2							
Bankfull Mean Depth (ft)	0.4								1.2								1.4								0.7							
Bankfull Max Depth (ft)	0.9								1.9								2.1								0.9							
Bankfull Cross-Sectional Area (ft^2)	2.7								8.2								11.7								5.5							
Bankfull Width/Depth Ratio	16.3								6.0								5.9								11.4							
Bankfull Entrenchment Ratio[1]	3.5								-								-								3.2							
Bankfull Bank Height Ratio	1.0								-								-								1.0							

	UT1 R4A Cross-Section 5								UT1 R4A Cross-Section 6								UT1 R4A Cross-Section 7								UT1 R4A Cross-Section 8							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	891.5								891.8								885.5								885.1							
Bankfull Width (ft)	8.9								12.9								16.2								11.6							
Floodprone Width (ft)	-								68.0								-								64.2							
Bankfull Mean Depth (ft)	1.4								0.8								1.0								1.0							
Bankfull Max Depth (ft)	2.1								1.3								2.3								1.4							
Bankfull Cross-Sectional Area (ft^2)	12.9								10.6								15.7								12.0							
Bankfull Width/Depth Ratio	6.2								15.8								16.7								11.3							
Bankfull Entrenchment Ratio[1]	-								5.3								-								5.5							
Bankfull Bank Height Ratio	-								1.0								-								1.0							

	UT1 R4B Cross Section 9								UT1 R4B Cross Section 10								UT1 R4B Cross-Section 11								UT1 R4B Cross-Section 12							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	879.8								879.5								875.5								875.1							
Bankfull Width (ft)	12.5								13.3								13.2								12.5							
Floodprone Width (ft)	82.5								-								-								74.7							
Bankfull Mean Depth (ft)	1.0								2.5								1.6								1.0							
Bankfull Max Depth (ft)	1.3								3.7								3.0								1.6							
Bankfull Cross-Sectional Area (ft^2)	11.9								32.7								21.0								12.5							
Bankfull Width/Depth Ratio	13.1								5.4								8.3								12.5							
Bankfull Entrenchment Ratio[1]	6.6								-								-								6.0							
Bankfull Bank Height Ratio	1.0								-								-								1.0							

	UT1 R4B Cross Section 13								UT1 R4B Cross Section 14							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
bankfull elevation	873.3								873.2							
Bankfull Width (ft)	13.0								11.4							
Floodprone Width (ft)	-								75.2							
Bankfull Mean Depth (ft)	1.4								1.1							
Bankfull Max Depth (ft)	2.6								1.5							
Bankfull Cross-Sectional Area (ft^2)	18.0								12.6							
Bankfull Width/Depth Ratio	9.4								10.3							
Bankfull Entrenchment Ratio[1]	-								6.6							
Bankfull Bank Height Ratio	-								1.0							

1. ER for the baseline/monitoring parameters are based on the width of the cross-section, in lieu of assuming the width across the floodplain.
N/A: Not Applicable

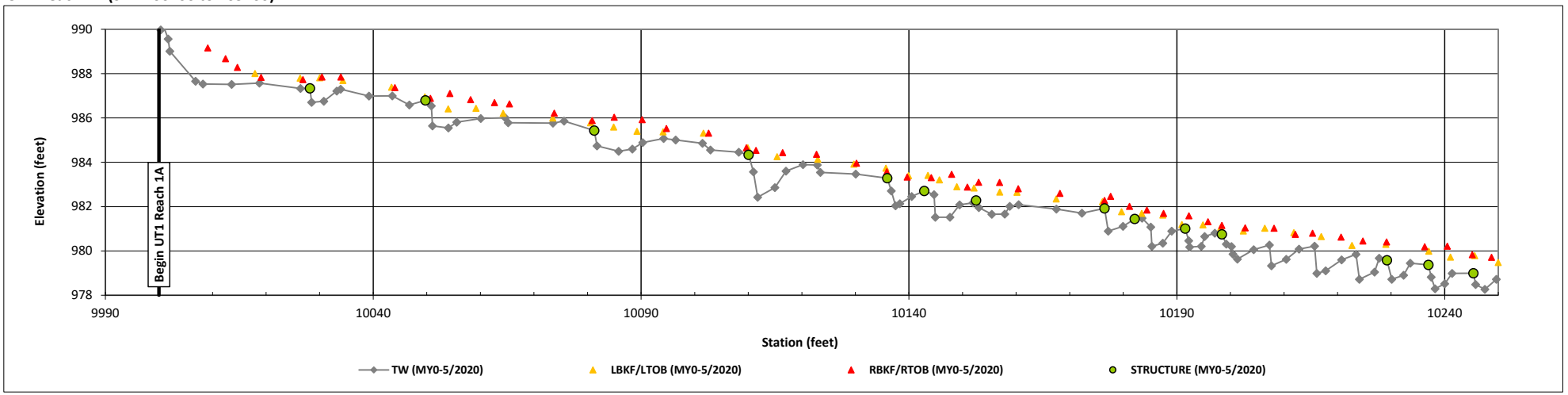
Longitudinal Profile Plots

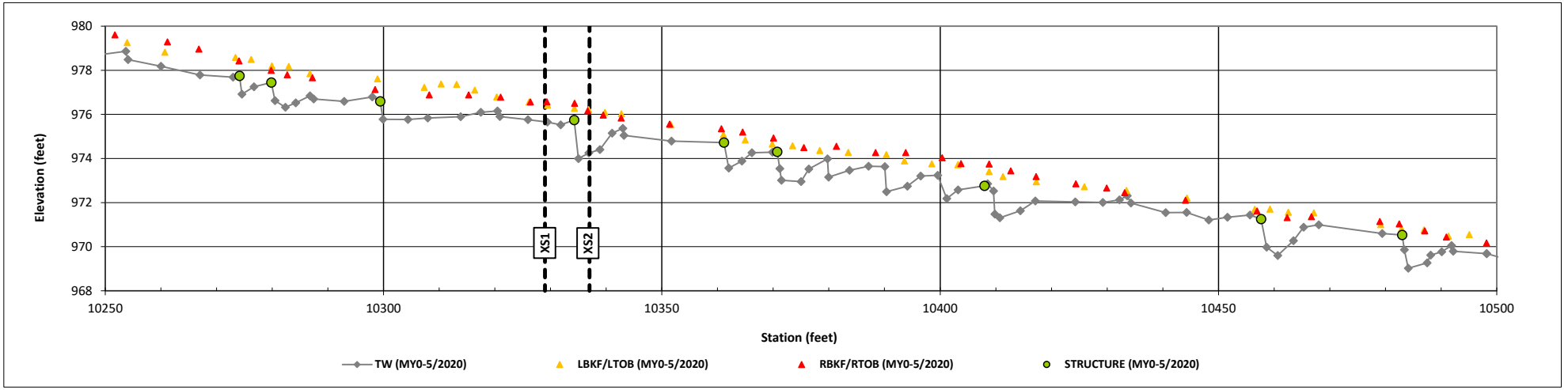
Alexander Farm Mitigation Site

DMS Project No. 100048

Monitoring Year 0 - 2020

UT1 Reach 1A (STA 100+00 to 105+00)





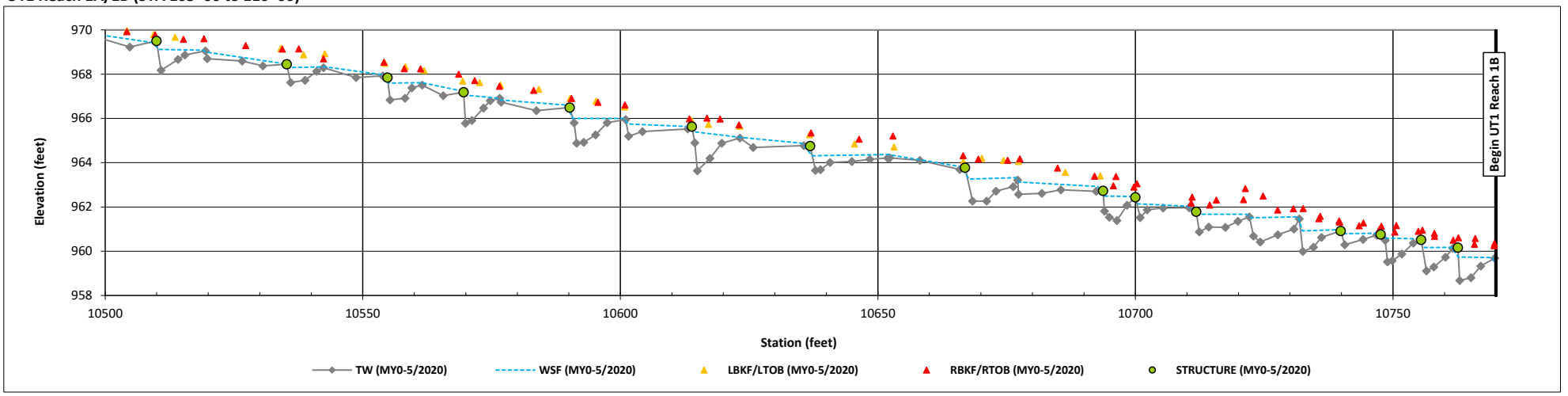
Longitudinal Profile Plots

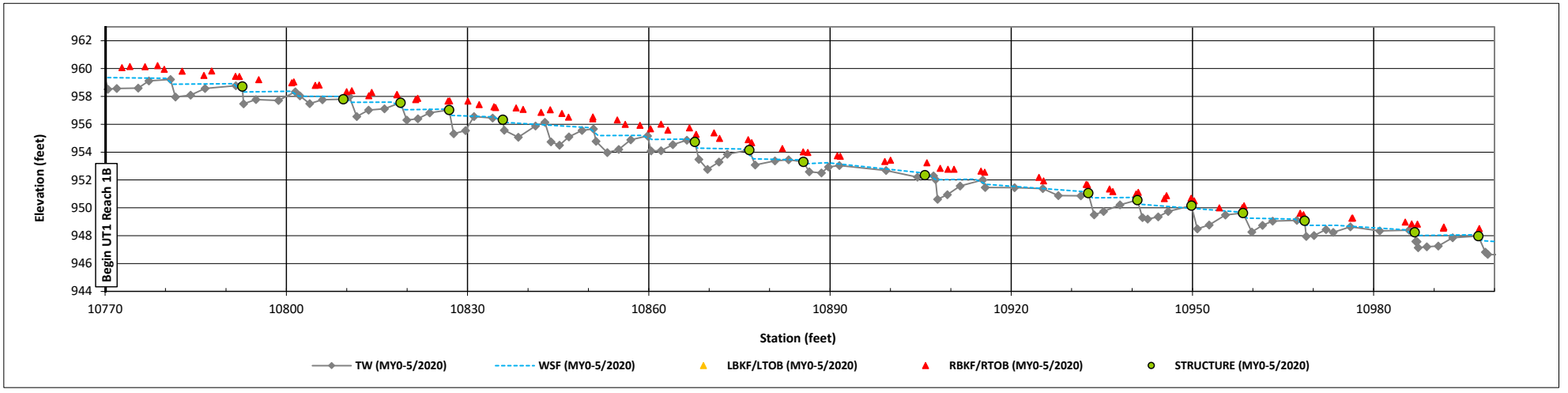
Alexander Farm Mitigation Site

DMS Project No. 100048

Monitoring Year 0 - 2020

UT1 Reach 1A/1B (STA 105+00 to 110+00)

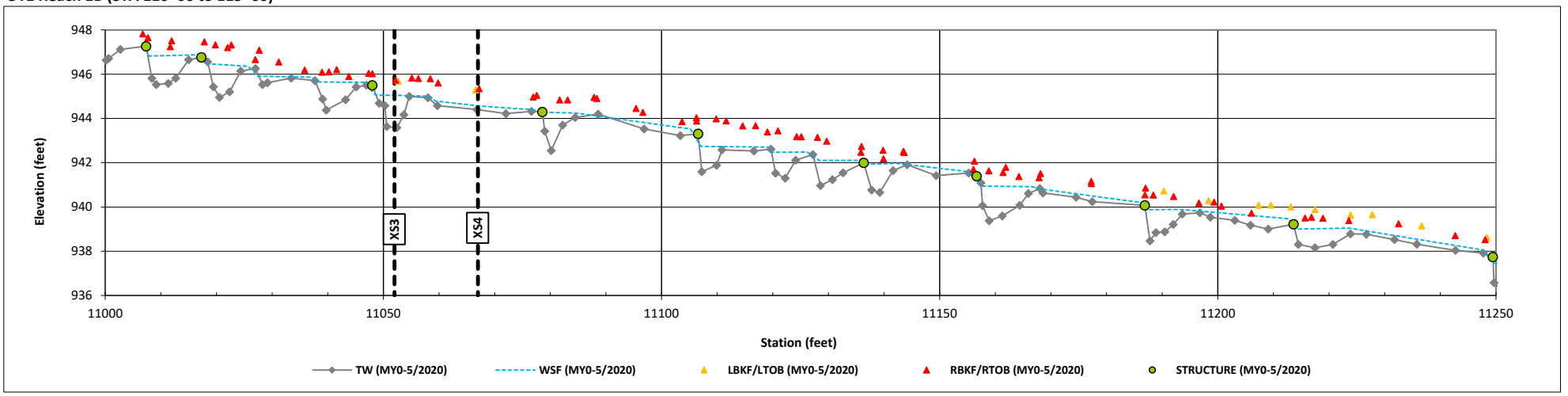


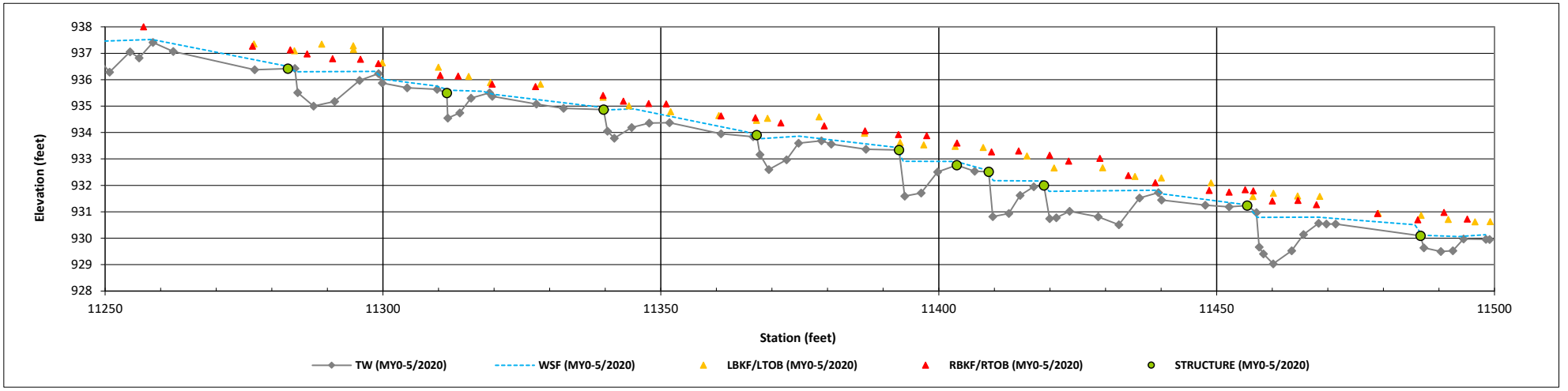


Longitudinal Profile Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 1B (STA 110+00 to 115+00)

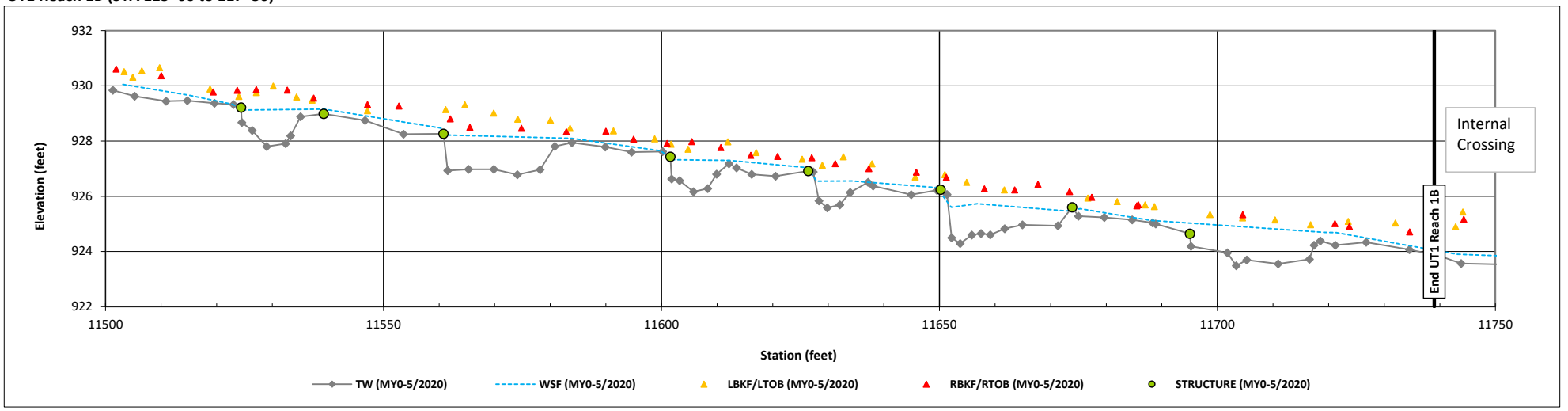




Longitudinal Profile Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

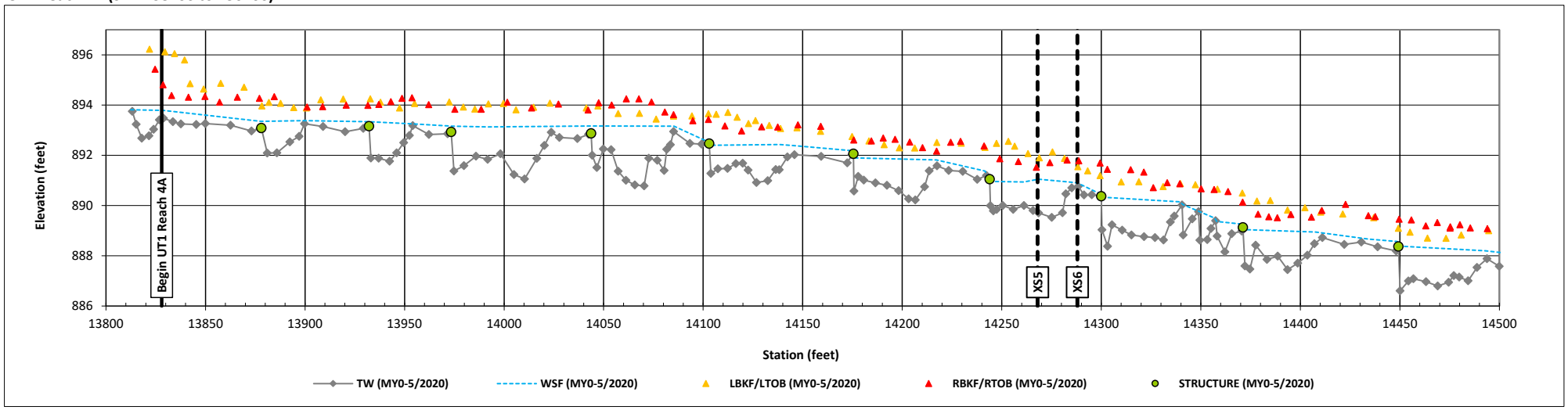
UT1 Reach 1B (STA 115+00 to 117+50)

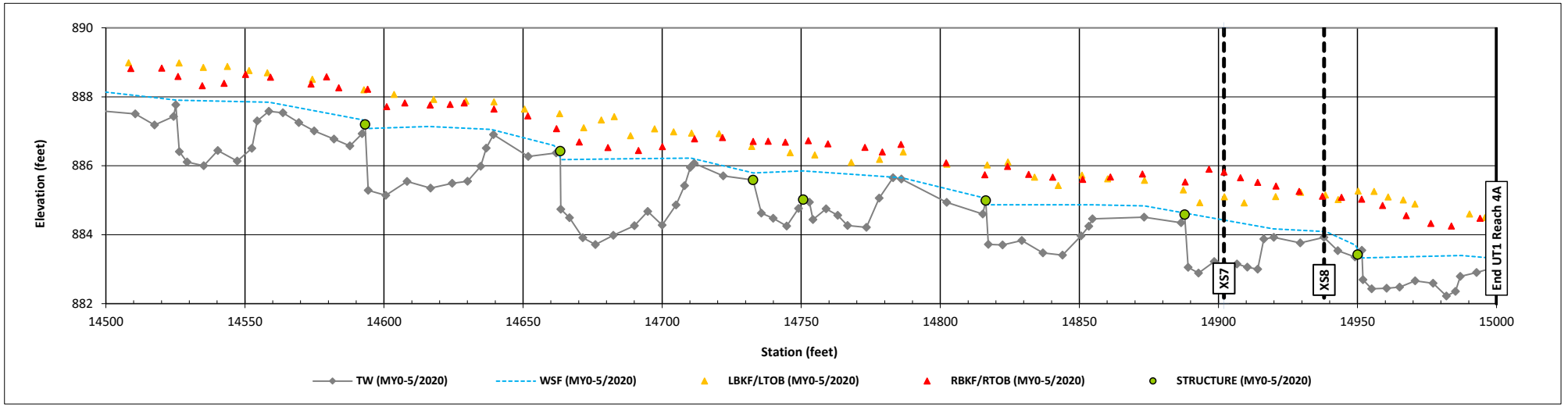


Longitudinal Profile Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 4A (STA 138+00 to 150+00)

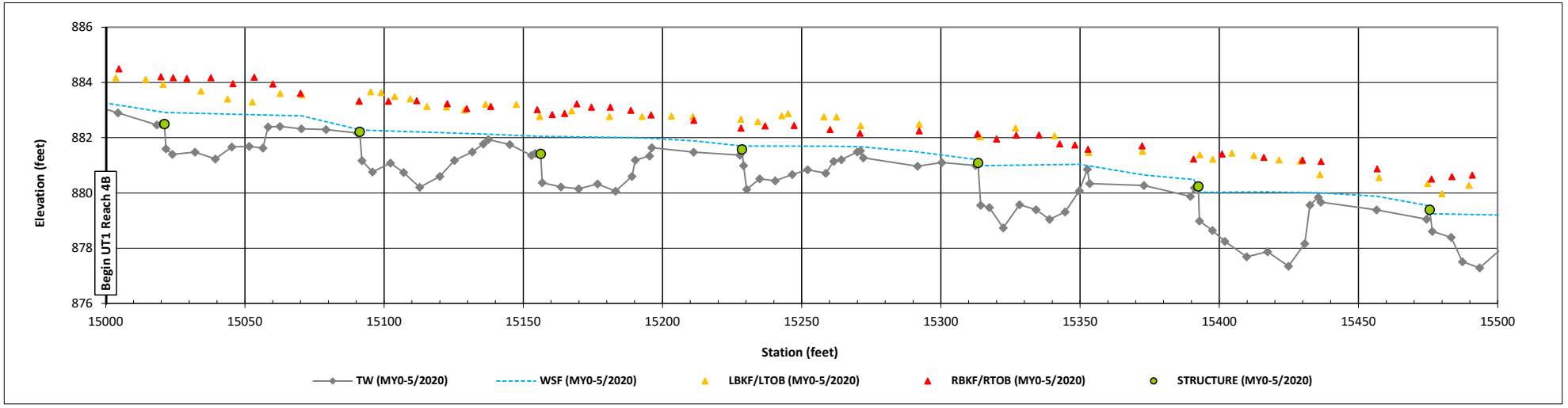


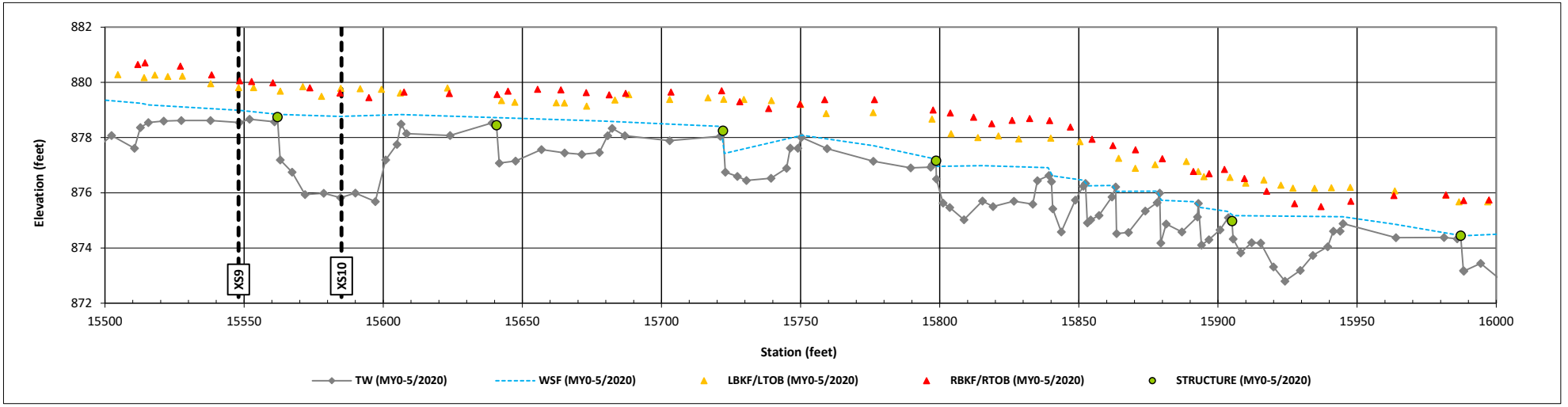


Longitudinal Profile Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 4B (STA 150+00 to 160+00)

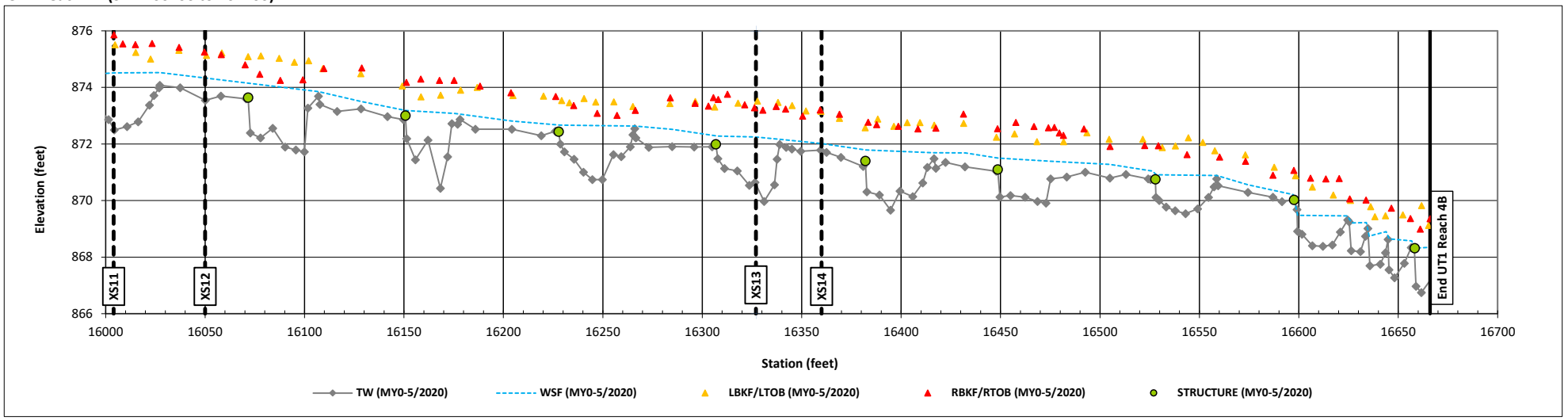




Longitudinal Profile Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

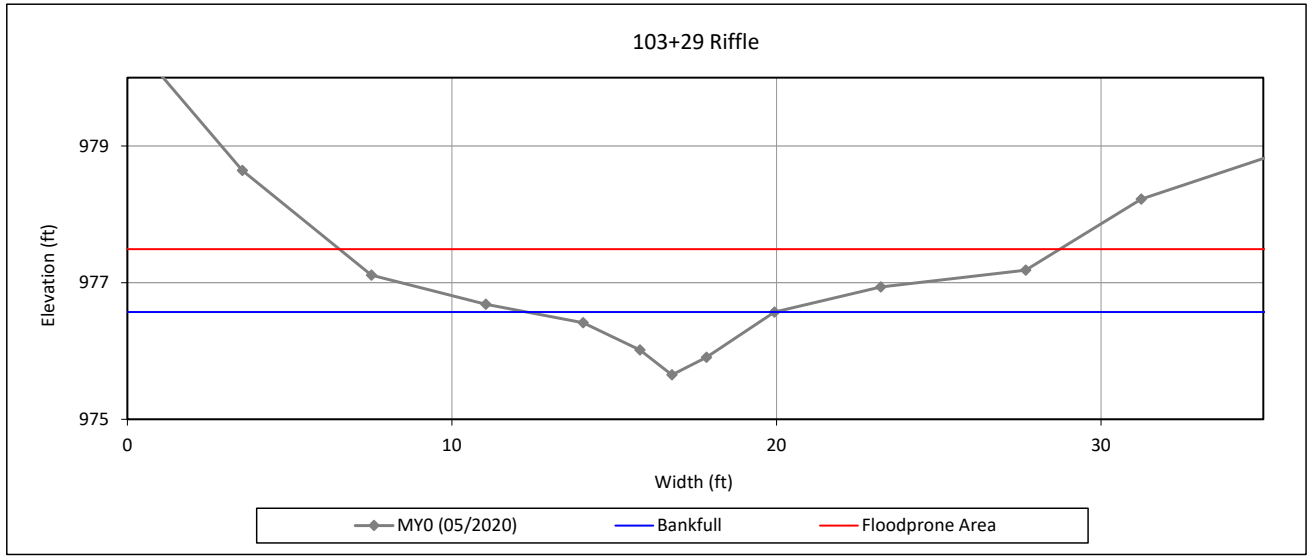
UT1 Reach 4B (STA 160+00 to 167+00)



Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 1-UT1 Reach 1A



Bankfull Dimensions

2.7	x-section area (ft.sq.)
6.6	width (ft)
0.4	mean depth (ft)
0.9	max depth (ft)
7.0	wetted perimeter (ft)
0.4	hydraulic radius (ft)
16.3	width-depth ratio
23.3	W flood prone area (ft)
3.5	entrenchment ratio
1.0	low bank height ratio

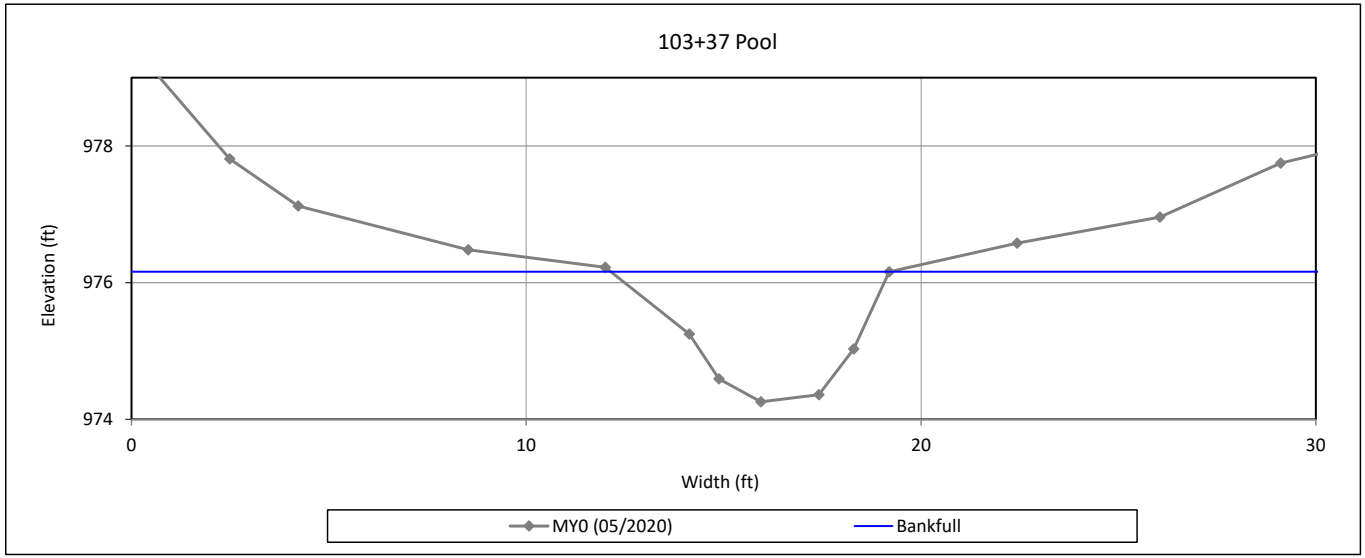
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 2-UT1 Reach 1A



Bankfull Dimensions	
8.2	x-section area (ft.sq.)
7.0	width (ft)
1.2	mean depth (ft)
1.9	max depth (ft)
8.3	wetted perimeter (ft)
1.0	hydraulic radius (ft)
6.0	width-depth ratio

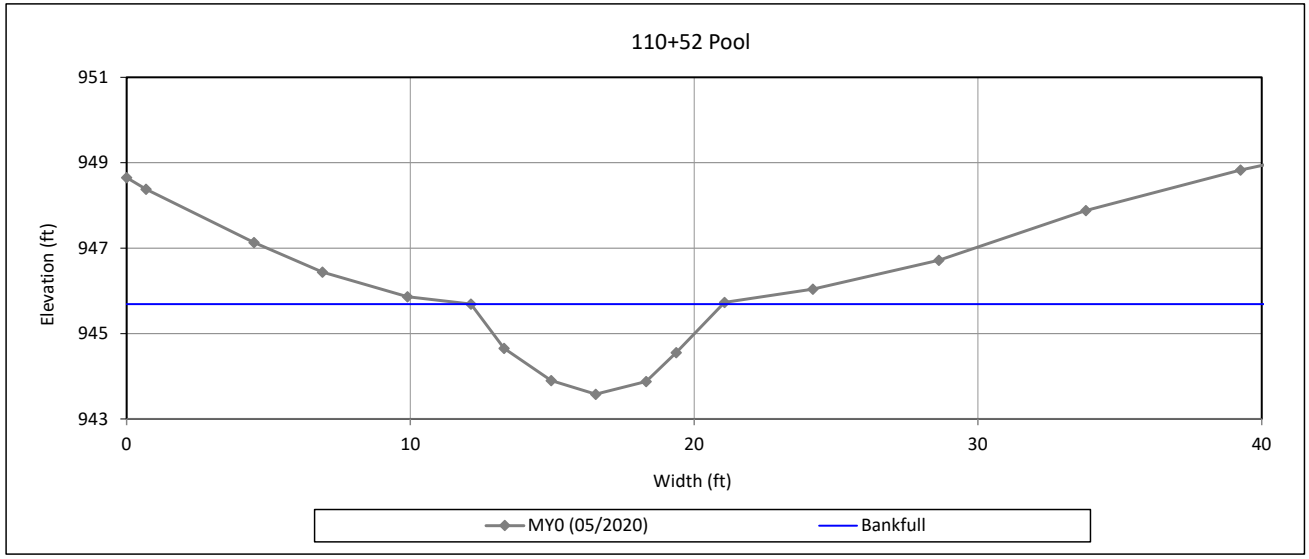
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 3-UT1 Reach 1B



Bankfull Dimensions	
11.7	x-section area (ft.sq.)
8.3	width (ft)
1.4	mean depth (ft)
2.1	max depth (ft)
9.3	wetted perimeter (ft)
1.3	hydraulic radius (ft)
5.9	width-depth ratio

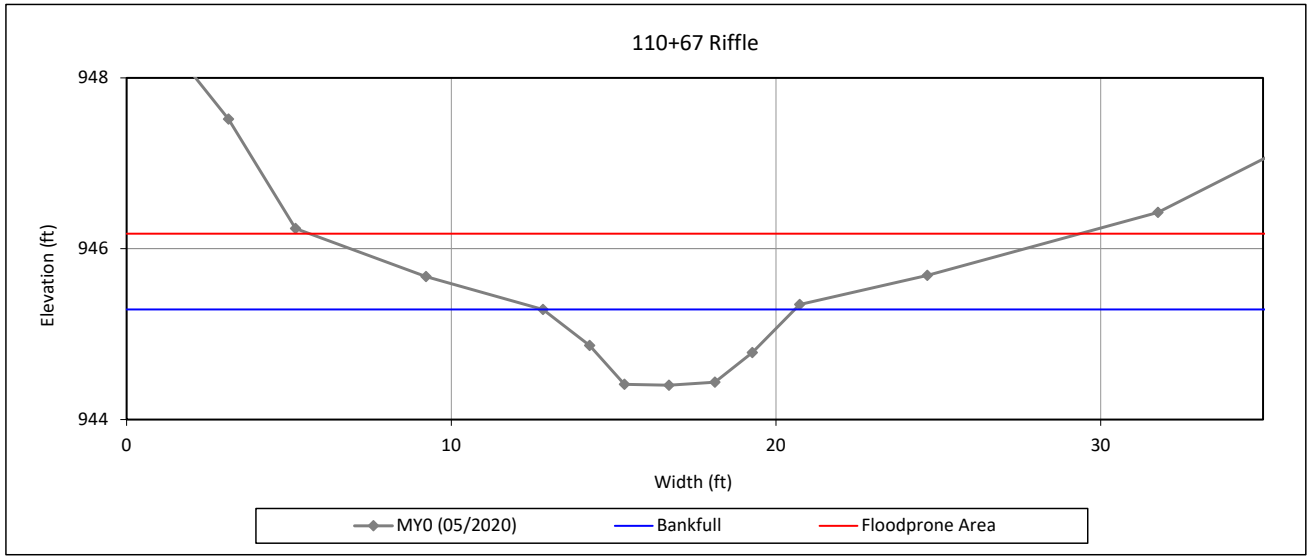
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 4-UT1 Reach 1B



Bankfull Dimensions

5.5	x-section area (ft.sq.)
7.9	width (ft)
0.7	mean depth (ft)
0.9	max depth (ft)
8.1	wetted perimeter (ft)
0.7	hydraulic radius (ft)
11.4	width-depth ratio
25.2	W flood prone area (ft)
3.2	entrenchment ratio
1.0	low bank height ratio

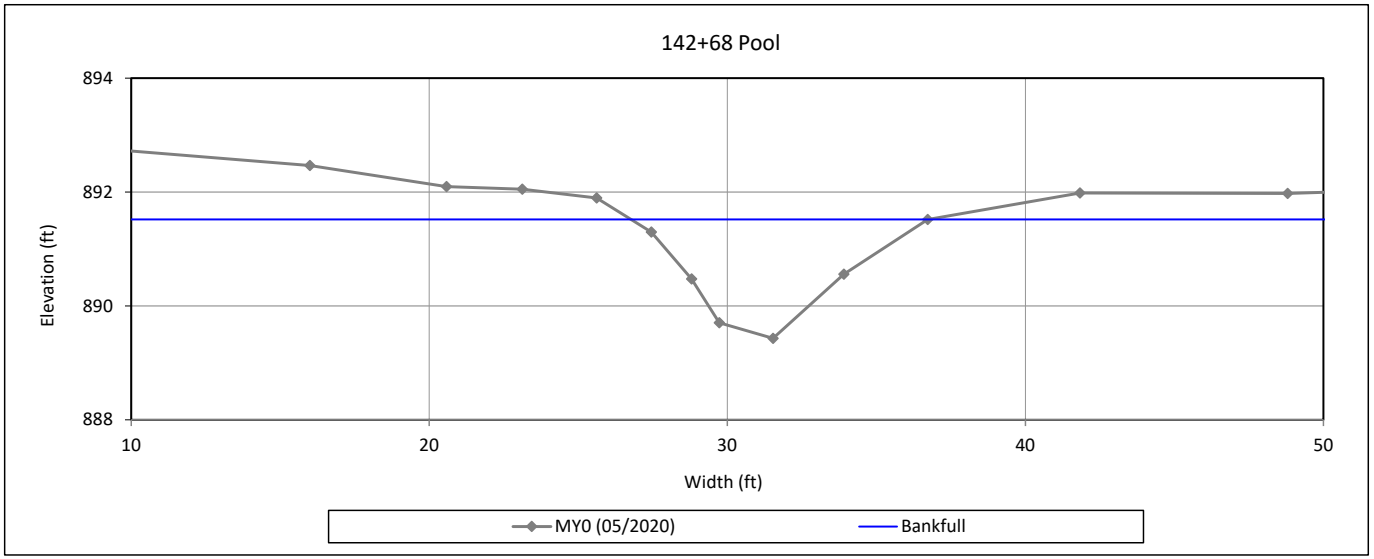
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 5-UT1 Reach 4A



Bankfull Dimensions	
12.9	x-section area (ft.sq.)
8.9	width (ft)
1.4	mean depth (ft)
2.1	max depth (ft)
9.8	wetted perimeter (ft)
1.3	hydraulic radius (ft)
6.2	width-depth ratio

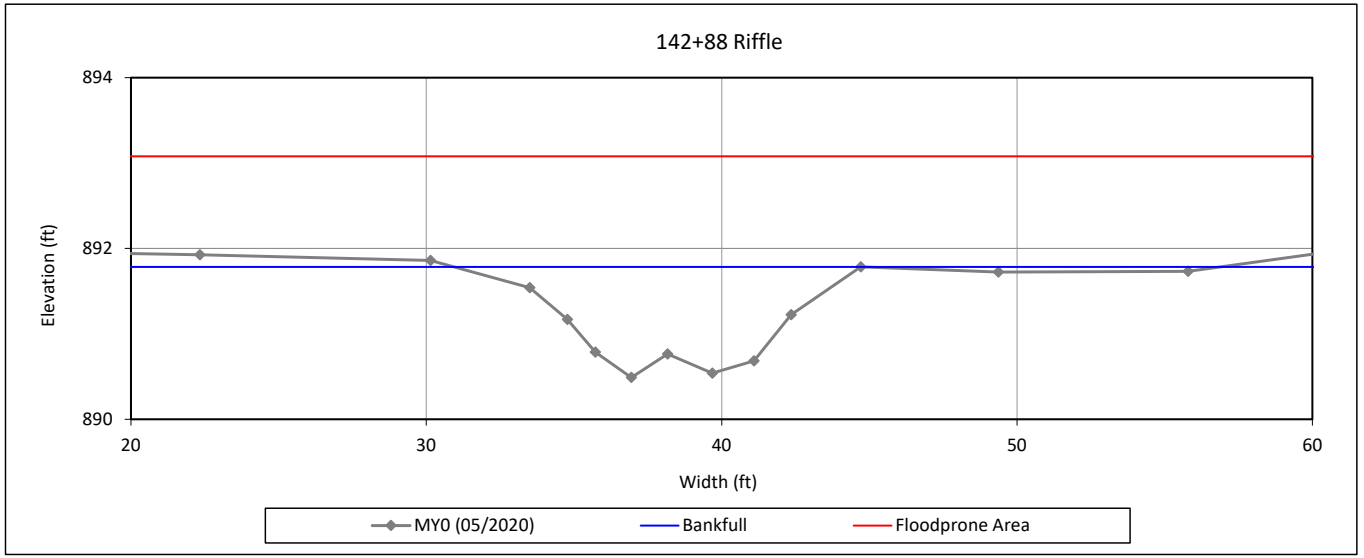
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 6-UT1 Reach 4A



Bankfull Dimensions

10.6	x-section area (ft.sq.)
12.9	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
13.3	wetted perimeter (ft)
0.8	hydraulic radius (ft)
15.8	width-depth ratio
68.0	W flood prone area (ft)
5.3	entrenchment ratio
1.0	low bank height ratio

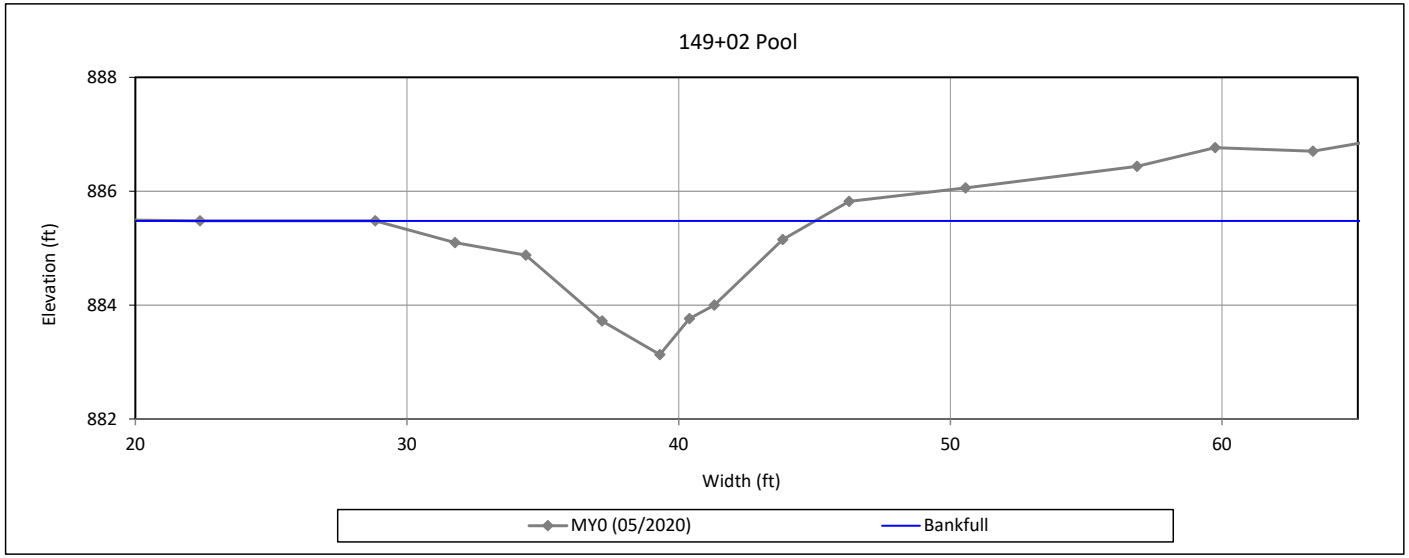
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 7-UT1 Reach 4A



Bankfull Dimensions	
15.7	x-section area (ft.sq.)
16.2	width (ft)
1.0	mean depth (ft)
2.3	max depth (ft)
17.4	wetted perimeter (ft)
0.9	hydraulic radius (ft)
16.7	width-depth ratio

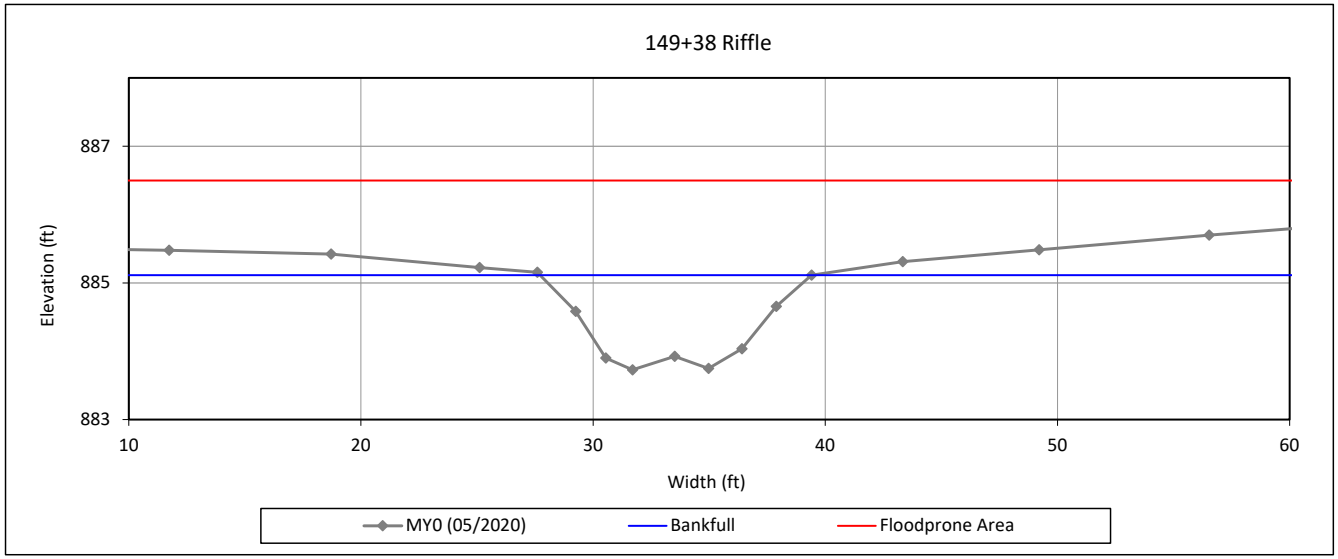
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 8-UT1 Reach 4A



Bankfull Dimensions

12.0	x-section area (ft.sq.)
11.6	width (ft)
1.0	mean depth (ft)
1.4	max depth (ft)
12.1	wetted perimeter (ft)
1.0	hydraulic radius (ft)
11.3	width-depth ratio
64.2	W flood prone area (ft)
5.5	entrenchment ratio
1.0	low bank height ratio

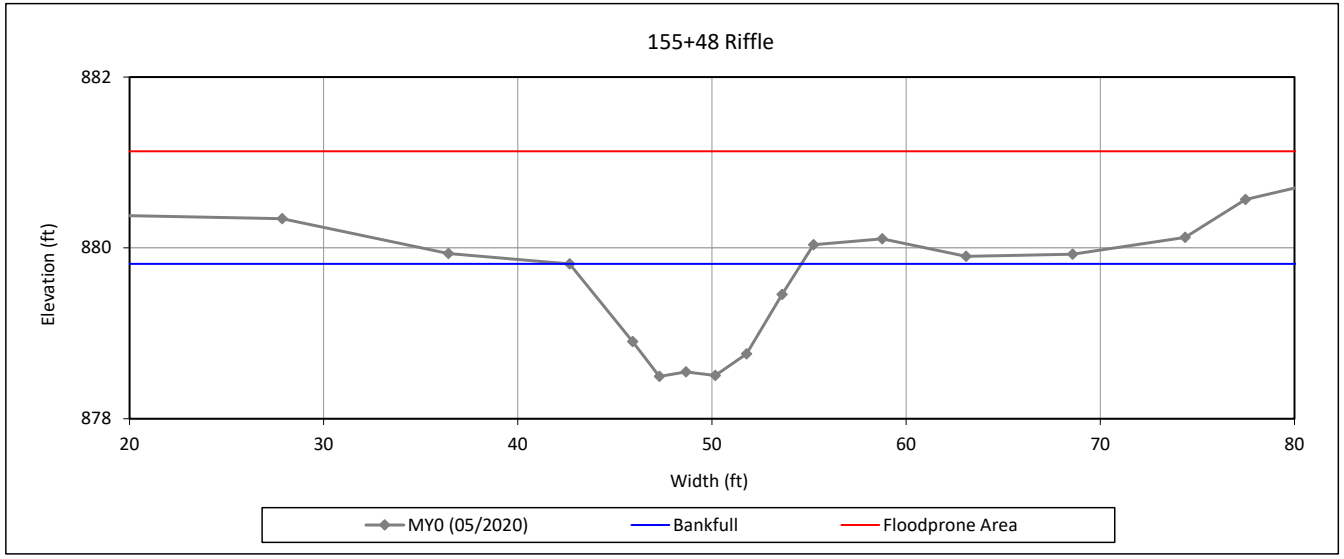
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 9-UT1 Reach 4B



Bankfull Dimensions

11.9	x-section area (ft.sq.)
12.5	width (ft)
1.0	mean depth (ft)
1.3	max depth (ft)
12.8	wetted perimeter (ft)
0.9	hydraulic radius (ft)
13.1	width-depth ratio
82.5	W flood prone area (ft)
6.6	entrenchment ratio
1.0	low bank height ratio

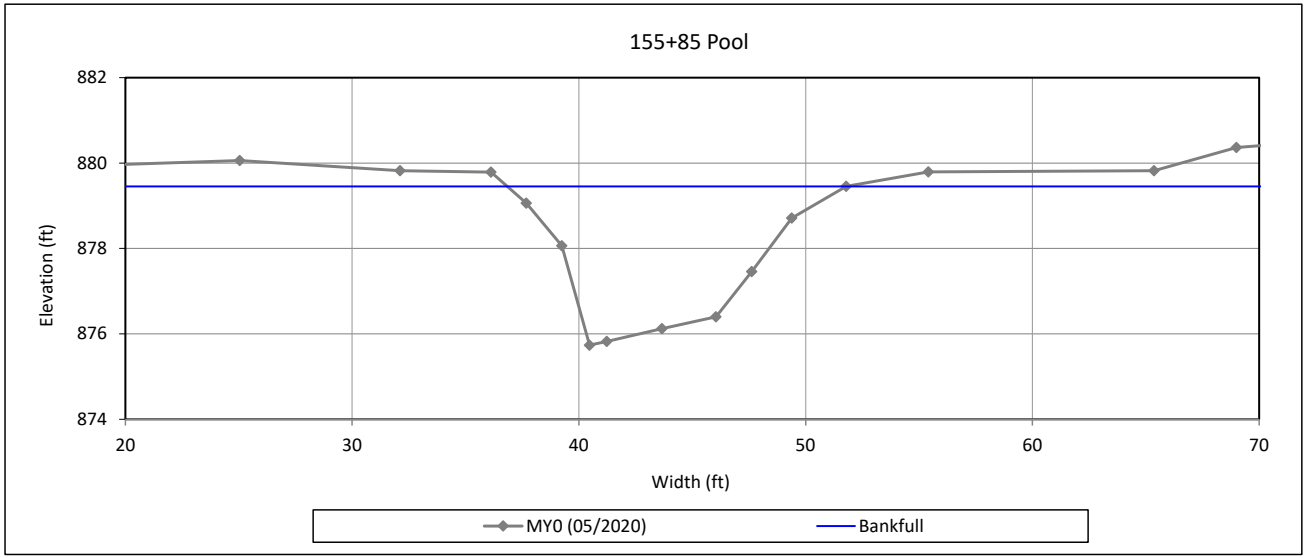
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 10-UT1 Reach 4B



Bankfull Dimensions	
32.7	x-section area (ft.sq.)
13.3	width (ft)
2.5	mean depth (ft)
3.7	max depth (ft)
15.9	wetted perimeter (ft)
2.1	hydraulic radius (ft)
5.4	width-depth ratio

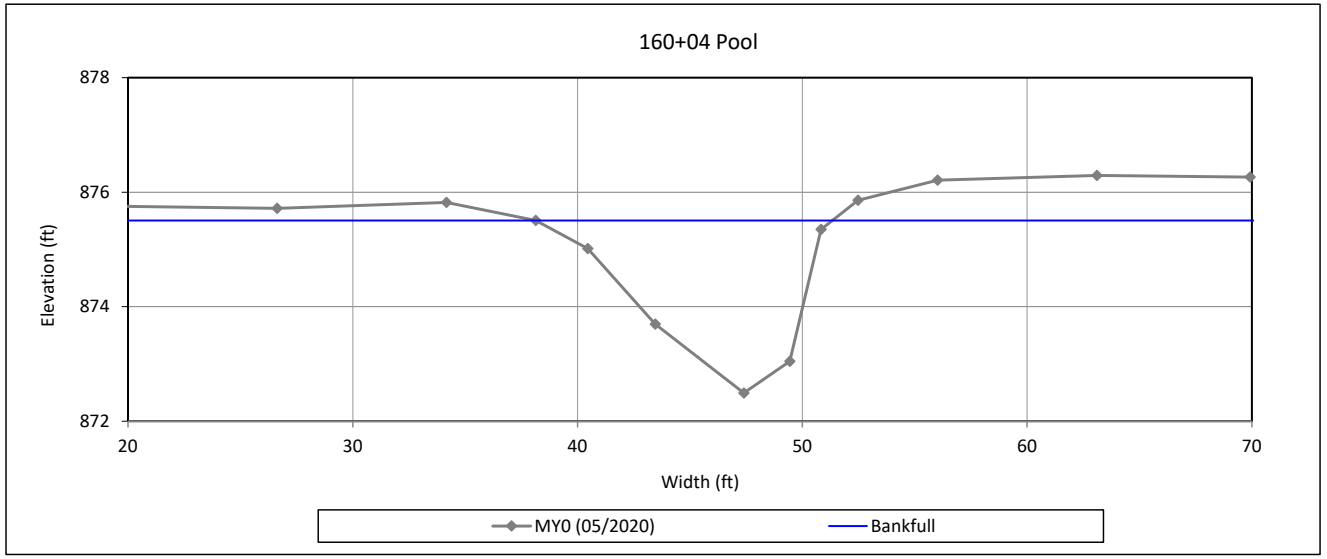
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 11-UT1 Reach 4B



Bankfull Dimensions	
21.0	x-section area (ft.sq.)
13.2	width (ft)
1.6	mean depth (ft)
3.0	max depth (ft)
15.1	wetted perimeter (ft)
1.4	hydraulic radius (ft)
8.3	width-depth ratio

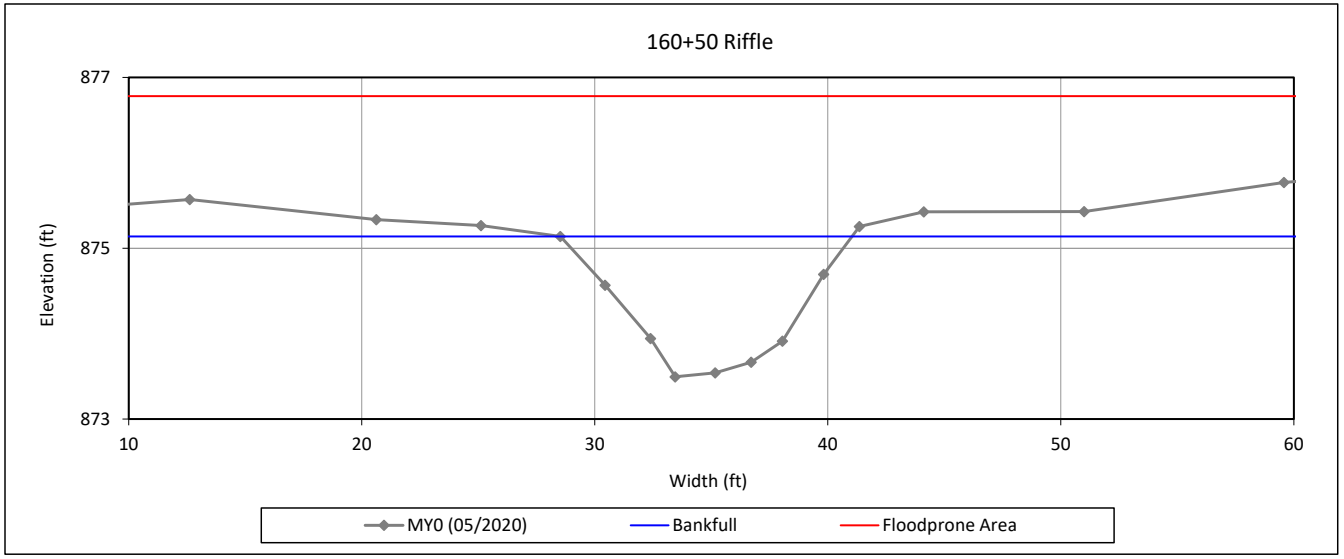
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 12-UT1 Reach 4B



Bankfull Dimensions

12.5	x-section area (ft.sq.)
12.5	width (ft)
1.0	mean depth (ft)
1.6	max depth (ft)
13.1	wetted perimeter (ft)
1.0	hydraulic radius (ft)
12.5	width-depth ratio
74.7	W flood prone area (ft)
6.0	entrenchment ratio
1.0	low bank height ratio

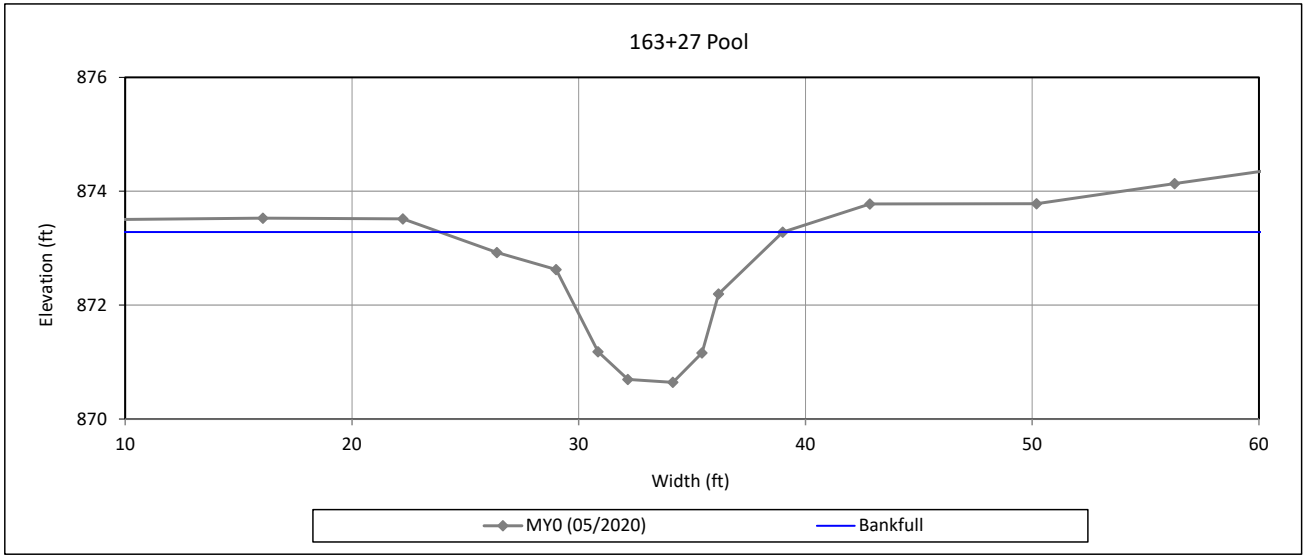
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 13-UT1 Reach 4B



Bankfull Dimensions	
18.0	x-section area (ft.sq.)
13.0	width (ft)
1.4	mean depth (ft)
2.6	max depth (ft)
14.8	wetted perimeter (ft)
1.2	hydraulic radius (ft)
9.4	width-depth ratio

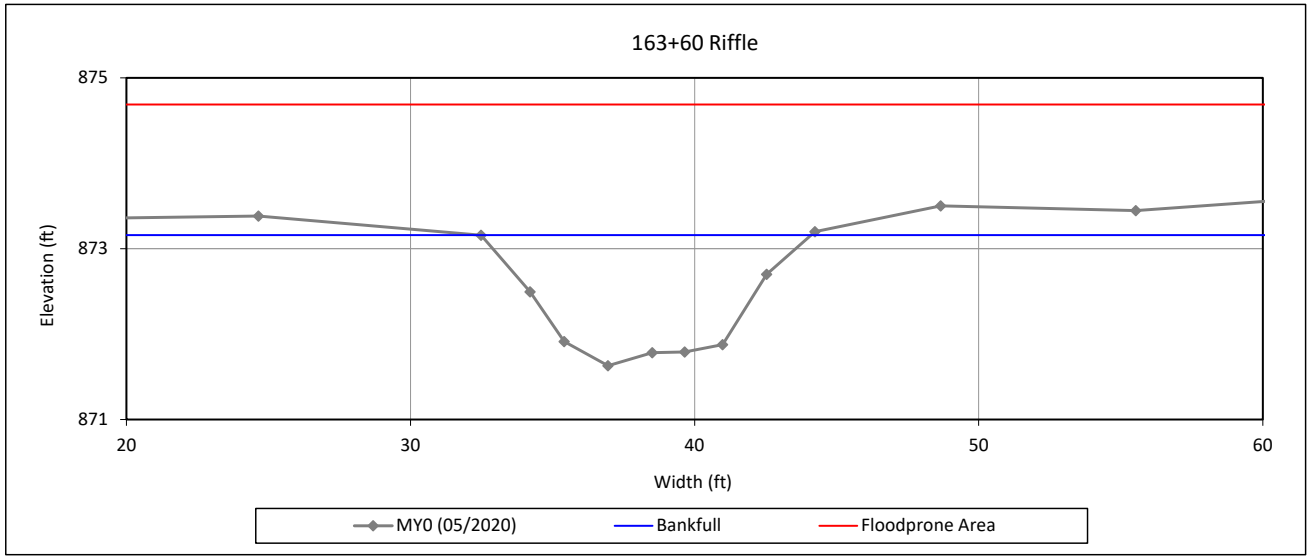
Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

Cross-Section Plots

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Cross-Section 14-UT1 Reach 4B



Bankfull Dimensions

12.6	x-section area (ft.sq.)
11.4	width (ft)
1.1	mean depth (ft)
1.5	max depth (ft)
11.9	wetted perimeter (ft)
1.1	hydraulic radius (ft)
10.3	width-depth ratio
75.2	W flood prone area (ft)
6.6	entrenchment ratio
1.0	low bank height ratio

Survey Date: 05/2020
Field Crew: Turner Land Surveying

View Downstream

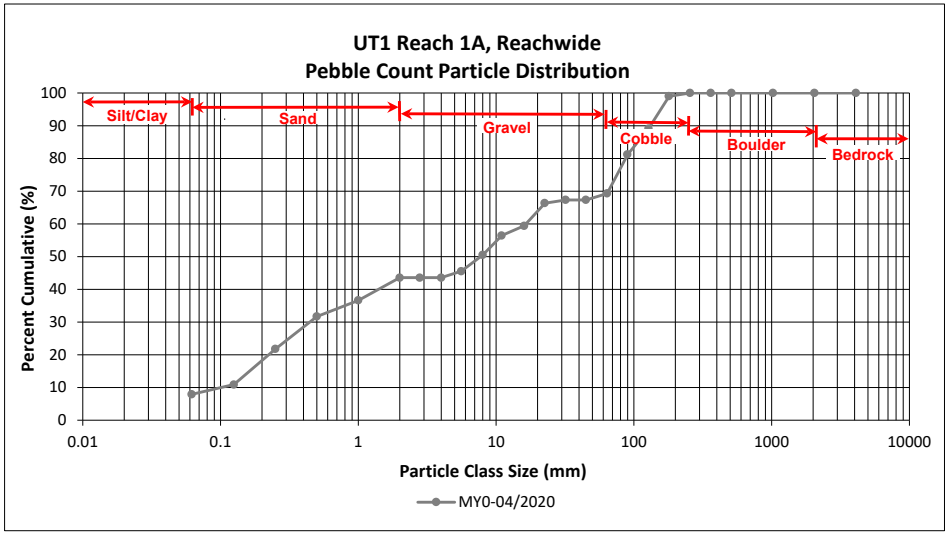
Reachwide and Cross-Section Pebble Count Plots

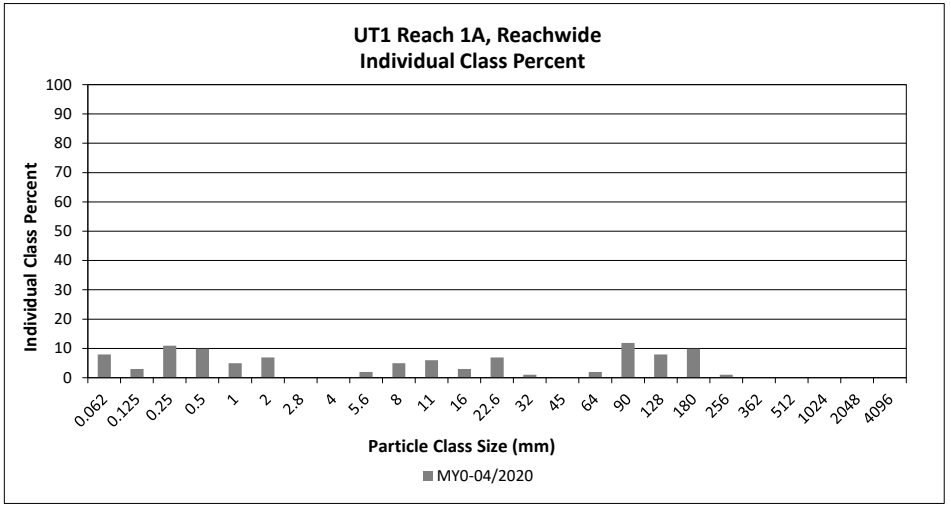
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 1A, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		8	8	8	8
SAND	Very fine	0.062	0.125		3	3	3	11
	Fine	0.125	0.250		11	11	11	22
	Medium	0.25	0.50		10	10	10	32
	Coarse	0.5	1.0		5	5	5	37
	Very Coarse	1.0	2.0	5	2	7	7	44
GRAVEL	Very Fine	2.0	2.8					44
	Very Fine	2.8	4.0					44
	Fine	4.0	5.6	1	1	2	2	46
	Fine	5.6	8.0	2	3	5	5	50
	Medium	8.0	11.0	3	3	6	6	56
	Medium	11.0	16.0	1	2	3	3	59
	Coarse	16.0	22.6	4	3	7	7	66
	Coarse	22.6	32	1		1	1	67
	Very Coarse	32	45					67
	Very Coarse	45	64	2		2	2	69
COBBLE	Small	64	90	12		12	12	81
	Small	90	128	8		8	8	89
	Large	128	180	10		10	10	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**51**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	0.8
D_{50} =	7.7
D_{84} =	102.0
D_{95} =	156.8
D_{100} =	256.0





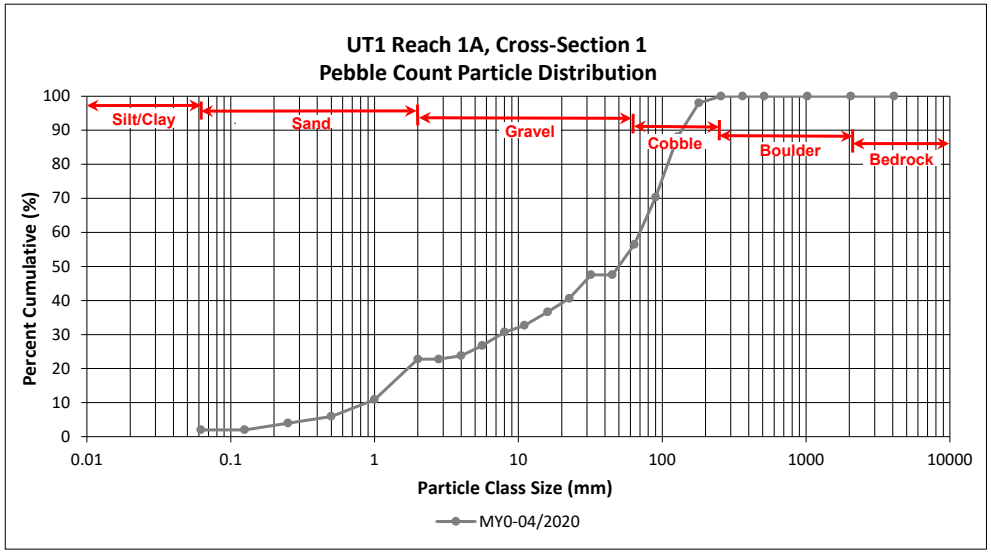
Reachwide and Cross-Section Pebble Count Plots

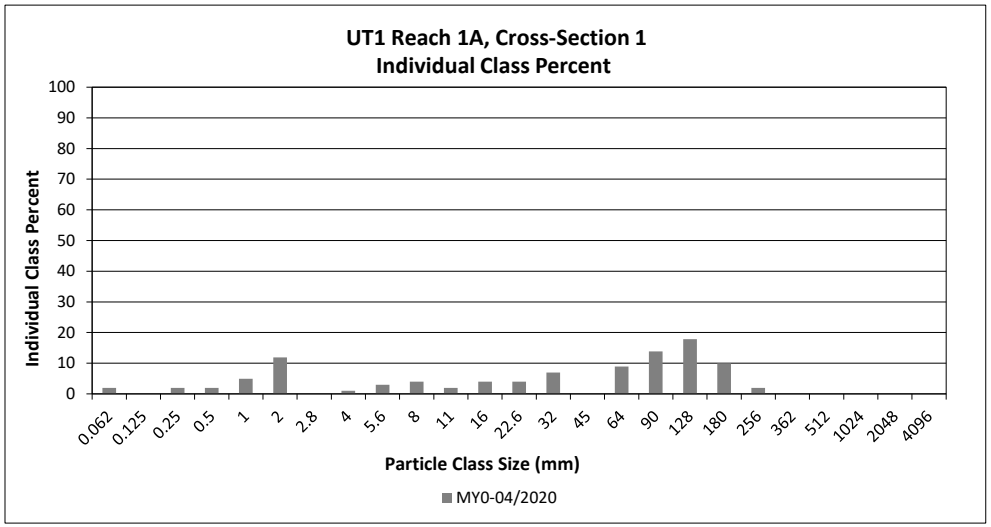
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 1A, Cross-Section 1

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250	2	2	4
	Medium	0.25	0.50	2	2	6
	Coarse	0.5	1.0	5	5	11
	Very Coarse	1.0	2.0	12	12	23
GRAVEL	Very Fine	2.0	2.8			23
	Very Fine	2.8	4.0	1	1	24
	Fine	4.0	5.6	3	3	27
	Fine	5.6	8.0	4	4	31
	Medium	8.0	11.0	2	2	33
	Medium	11.0	16.0	4	4	37
	Coarse	16.0	22.6	4	4	41
	Coarse	22.6	32	7	7	48
	Very Coarse	32	45			48
	Very Coarse	45	64	9	9	56
COBBLE	Small	64	90	14	14	70
	Small	90	128	18	18	88
	Large	128	180	10	10	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**101**	**100**	**100**

Cross-Section 1	
Channel materials (mm)	
D_{16} =	1.3
D_{35} =	13.7
D_{50} =	49.6
D_{84} =	118.0
D_{95} =	162.2
D_{100} =	256.0





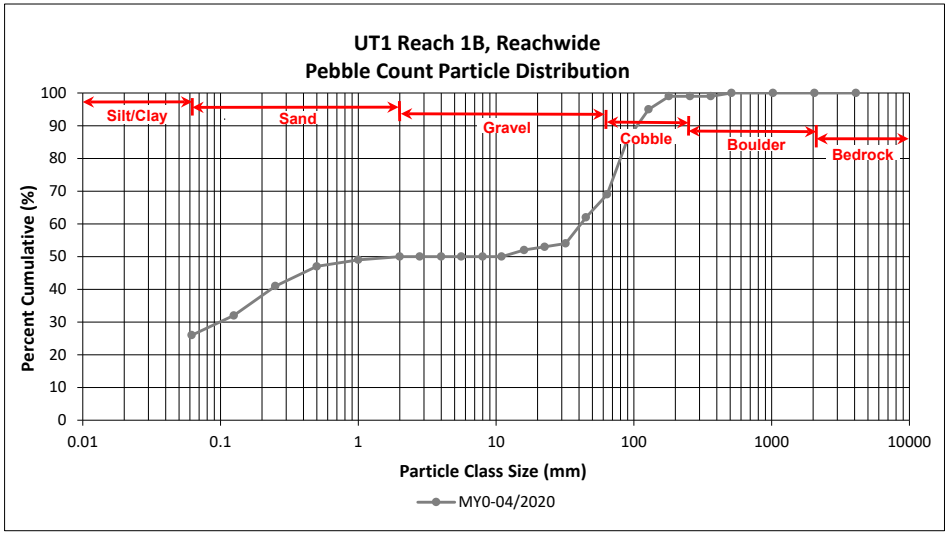
Reachwide and Cross-Section Pebble Count Plots

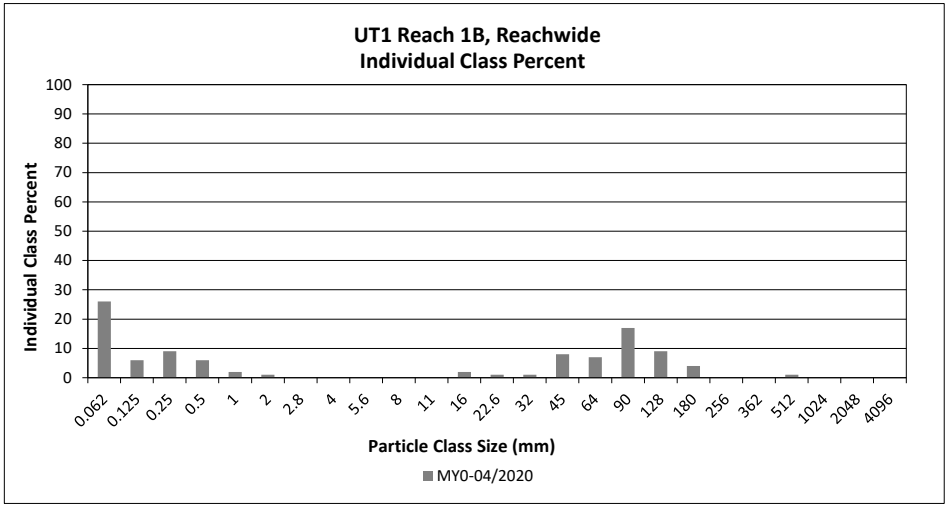
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 1B, 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	3	23	26	26	26
SAND	Very fine	0.062	0.125	1	5	6	6	32
	Fine	0.125	0.250		9	9	9	41
	Medium	0.25	0.50		6	6	6	47
	Coarse	0.5	1.0		2	2	2	49
	Very Coarse	1.0	2.0		1	1	1	50
GRAVEL	Very Fine	2.0	2.8					50
	Very Fine	2.8	4.0					50
	Fine	4.0	5.6					50
	Fine	5.6	8.0					50
	Medium	8.0	11.0					50
	Medium	11.0	16.0	1	1	2	2	52
	Coarse	16.0	22.6	1		1	1	53
	Coarse	22.6	32	1		1	1	54
	Very Coarse	32	45	8		8	8	62
	Very Coarse	45	64	5	2	7	7	69
COBBLE	Small	64	90	16	1	17	17	86
	Small	90	128	9		9	9	95
	Large	128	180	4		4	4	99
	Large	180	256					99
BOULDER	Small	256	362					99
	Small	362	512	1		1	1	100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	50	50	100	100	100

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.2
D_{50} =	2.0
D_{84} =	86.5
D_{95} =	128.0
D_{100} =	512.0





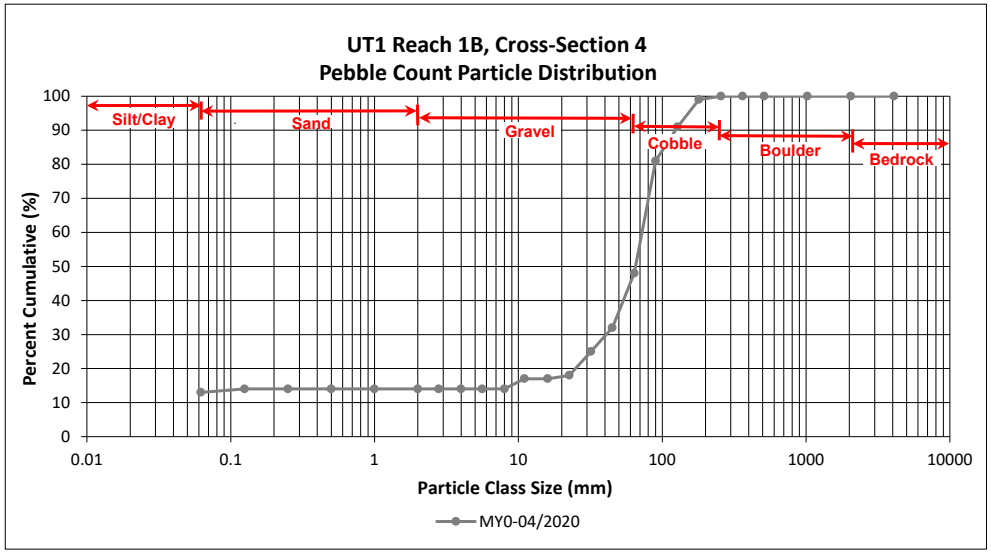
Reachwide and Cross-Section Pebble Count Plots

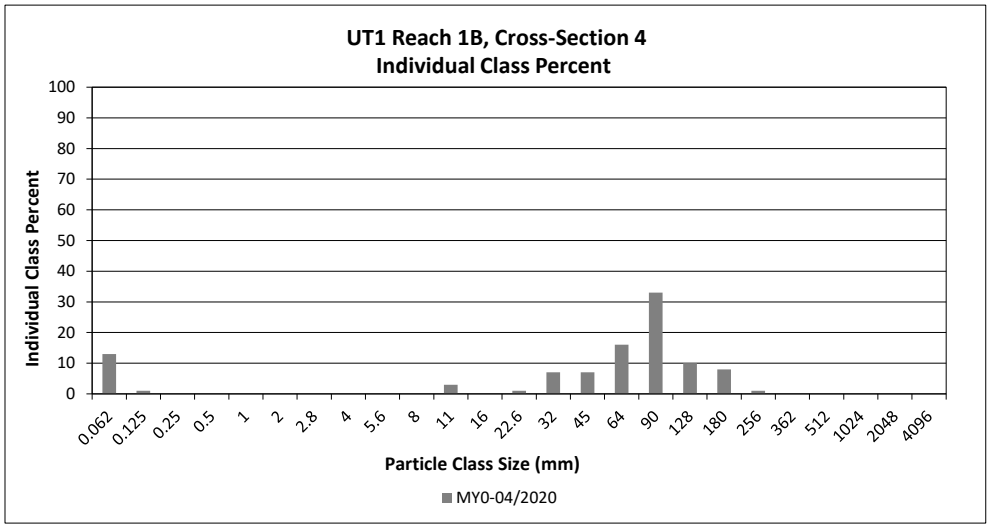
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 1B, Cross-Section 4

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	13	13	13
SAND	Very fine	0.062	0.125	1	1	14
	Fine	0.125	0.250			14
	Medium	0.25	0.50			14
	Coarse	0.5	1.0			14
	Very Coarse	1.0	2.0			14
GRAVEL	Very Fine	2.0	2.8			14
	Very Fine	2.8	4.0			14
	Fine	4.0	5.6			14
	Fine	5.6	8.0			14
	Medium	8.0	11.0	3	3	17
	Medium	11.0	16.0			17
	Coarse	16.0	22.6	1	1	18
	Coarse	22.6	32	7	7	25
	Very Coarse	32	45	7	7	32
	Very Coarse	45	64	16	16	48
COBBLE	Small	64	90	33	33	81
	Small	90	128	10	10	91
	Large	128	180	8	8	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 4	
Channel materials (mm)	
D_{16} =	9.9
D_{35} =	48.1
D_{50} =	65.3
D_{84} =	100.0
D_{95} =	151.8
D_{100} =	256.0





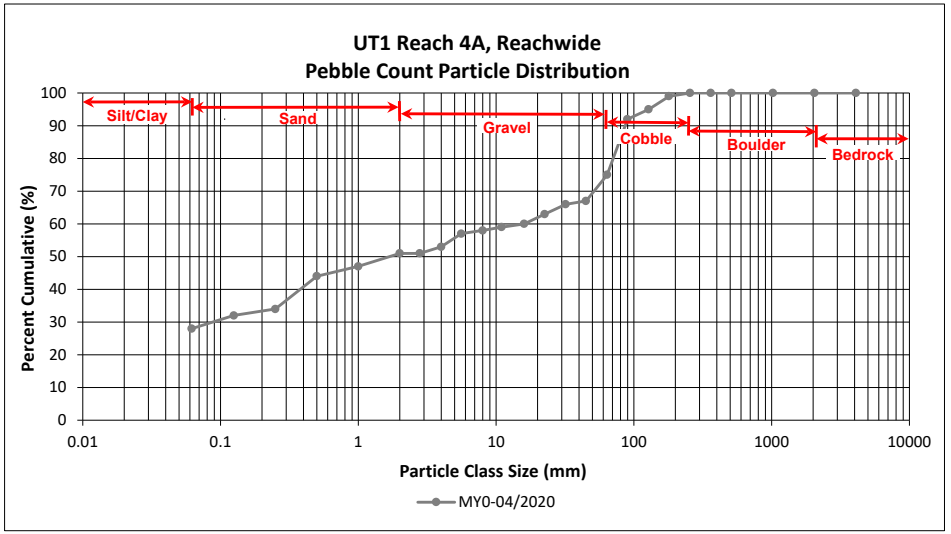
Reachwide and Cross-Section Pebble Count Plots

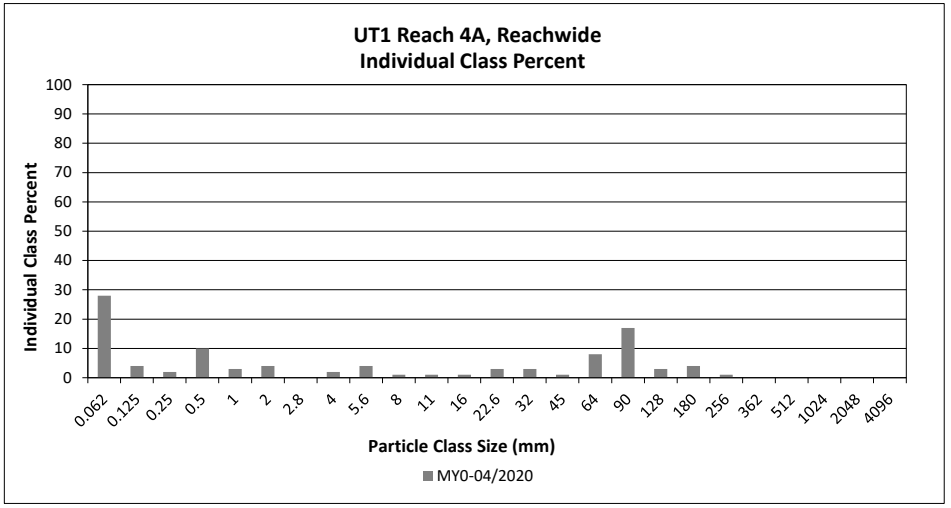
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 4A, 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	6	22	28	28	28
SAND	Very fine	0.062	0.125		4	4	4	32
	Fine	0.125	0.250		2	2	2	34
	Medium	0.25	0.50		10	10	10	44
	Coarse	0.5	1.0		3	3	3	47
	Very Coarse	1.0	2.0	2	2	4	4	51
GRAVEL	Very Fine	2.0	2.8					51
	Very Fine	2.8	4.0		2	2	2	53
	Fine	4.0	5.6	2	2	4	4	57
	Fine	5.6	8.0	1		1	1	58
	Medium	8.0	11.0		1	1	1	59
	Medium	11.0	16.0	1		1	1	60
	Coarse	16.0	22.6	2	1	3	3	63
	Coarse	22.6	32	2	1	3	3	66
	Very Coarse	32	45	1		1	1	67
	Very Coarse	45	64	8		8	8	75
COBBLE	Small	64	90	17		17	17	92
	Small	90	128	3		3	3	95
	Large	128	180	4		4	4	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.3
D_{50} =	1.7
D_{84} =	76.7
D_{95} =	128.0
D_{100} =	256.0





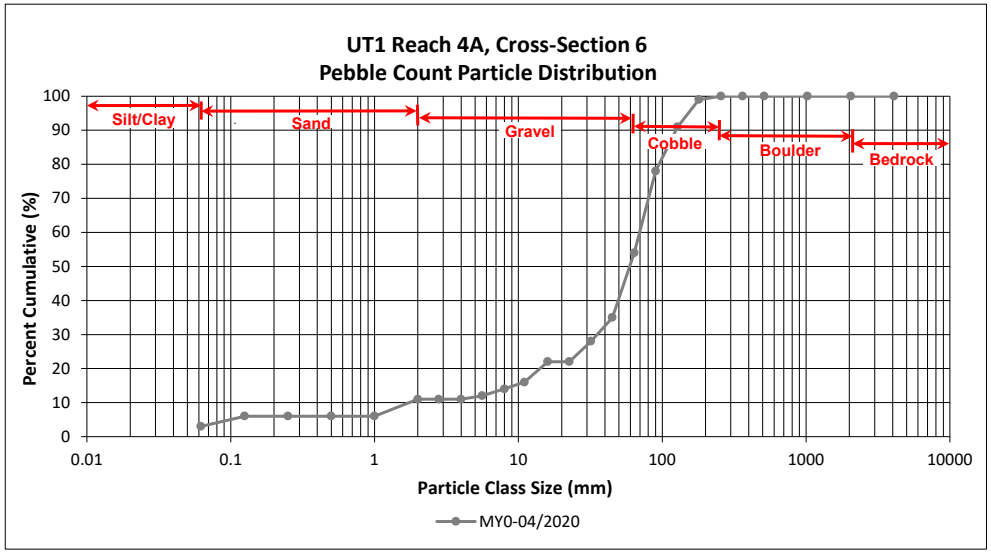
Reachwide and Cross-Section Pebble Count Plots

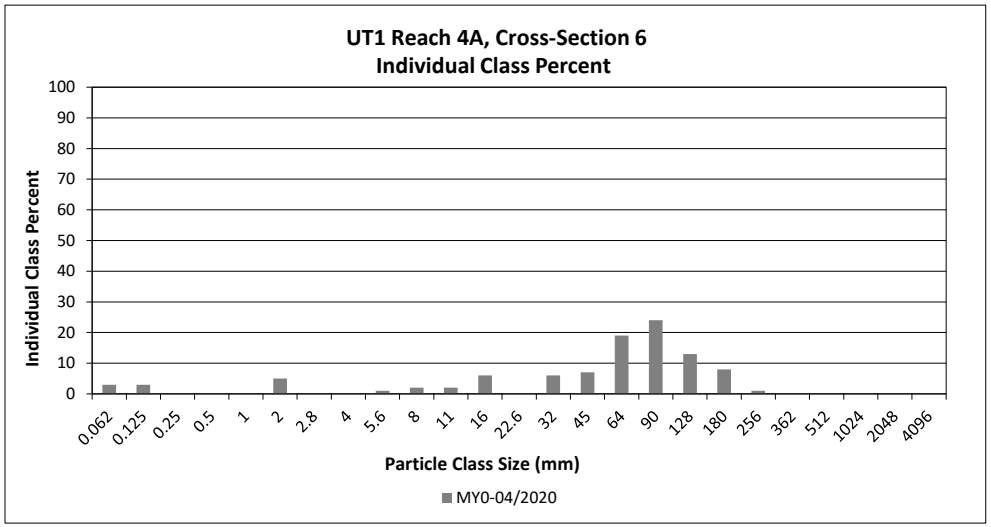
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 4A, 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	3	3	3
SAND	Very fine	0.062	0.125	3	3	6
	Fine	0.125	0.250			6
	Medium	0.25	0.50			6
	Coarse	0.5	1.0			6
	Very Coarse	1.0	2.0	5	5	11
GRAVEL	Very Fine	2.0	2.8			11
	Very Fine	2.8	4.0			11
	Fine	4.0	5.6	1	1	12
	Fine	5.6	8.0	2	2	14
	Medium	8.0	11.0	2	2	16
	Medium	11.0	16.0	6	6	22
	Coarse	16.0	22.6			22
	Coarse	22.6	32	6	6	28
	Very Coarse	32	45	7	7	35
	Very Coarse	45	64	19	19	54
COBBLE	Small	64	90	24	24	78
	Small	90	128	13	13	91
	Large	128	180	8	8	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 6	
Channel materials (mm)	
D_{16} =	11.0
D_{35} =	45.0
D_{50} =	59.4
D_{84} =	105.9
D_{95} =	151.8
D_{100} =	256.0





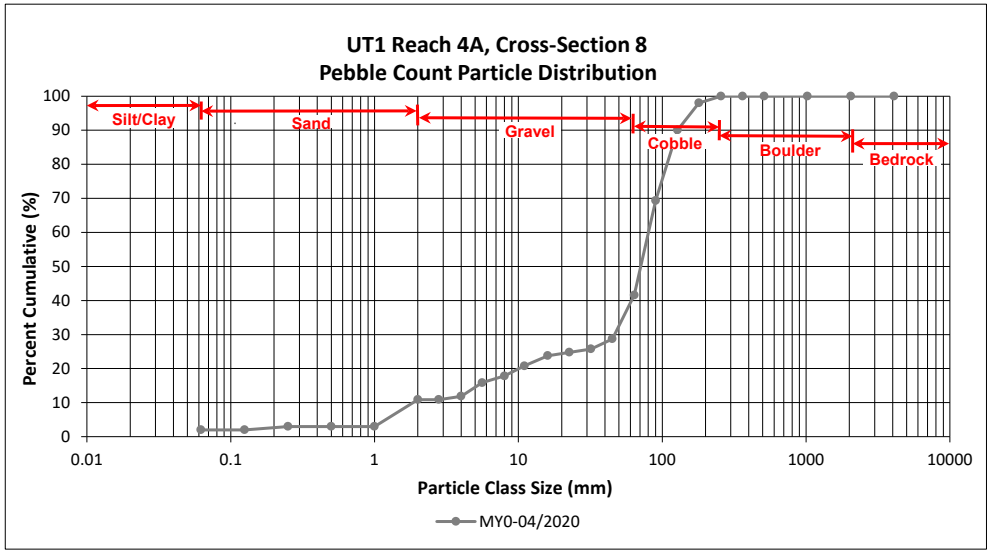
Reachwide and Cross-Section Pebble Count Plots

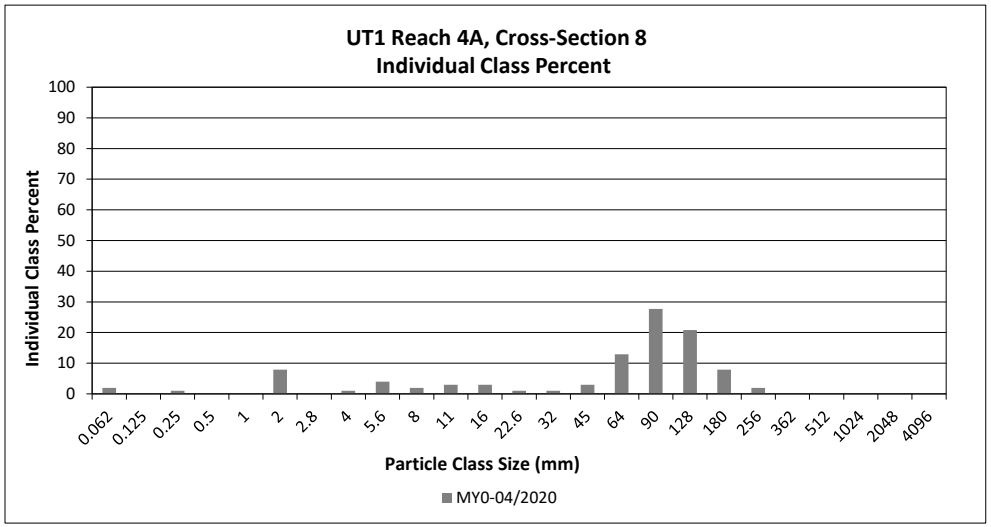
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 4A, Cross-Section 8

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250	1	1	3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0	8	8	11
GRAVEL	Very Fine	2.0	2.8			11
	Very Fine	2.8	4.0	1	1	12
	Fine	4.0	5.6	4	4	16
	Fine	5.6	8.0	2	2	18
	Medium	8.0	11.0	3	3	21
	Medium	11.0	16.0	3	3	24
	Coarse	16.0	22.6	1	1	25
	Coarse	22.6	32	1	1	26
	Very Coarse	32	45	3	3	29
	Very Coarse	45	64	13	13	42
COBBLE	Small	64	90	28	28	69
	Small	90	128	21	21	90
	Large	128	180	8	8	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**101**	**100**	**100**

Cross-Section 8	
Channel materials (mm)	
D_{16} =	5.8
D_{35} =	53.4
D_{50} =	71.0
D_{84} =	115.4
D_{95} =	158.1
D_{100} =	256.0





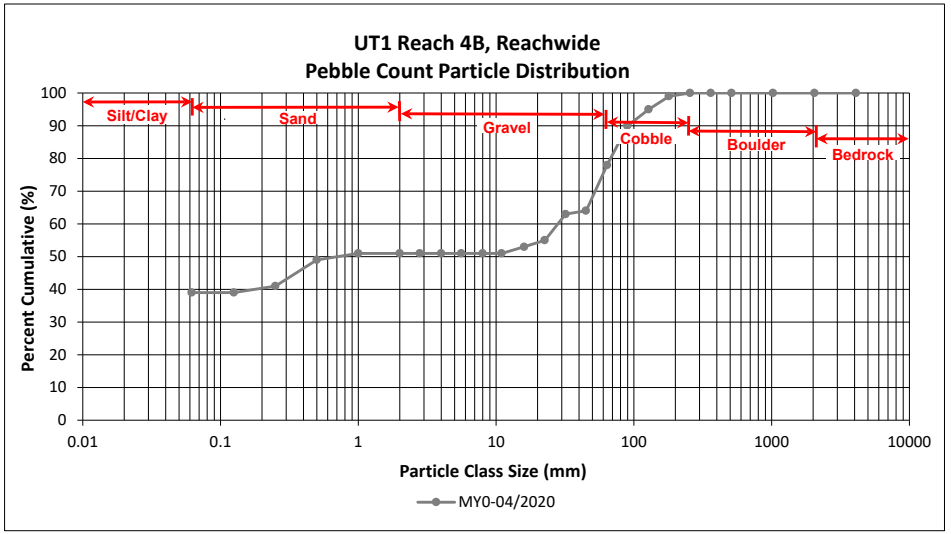
Reachwide and Cross-Section Pebble Count Plots

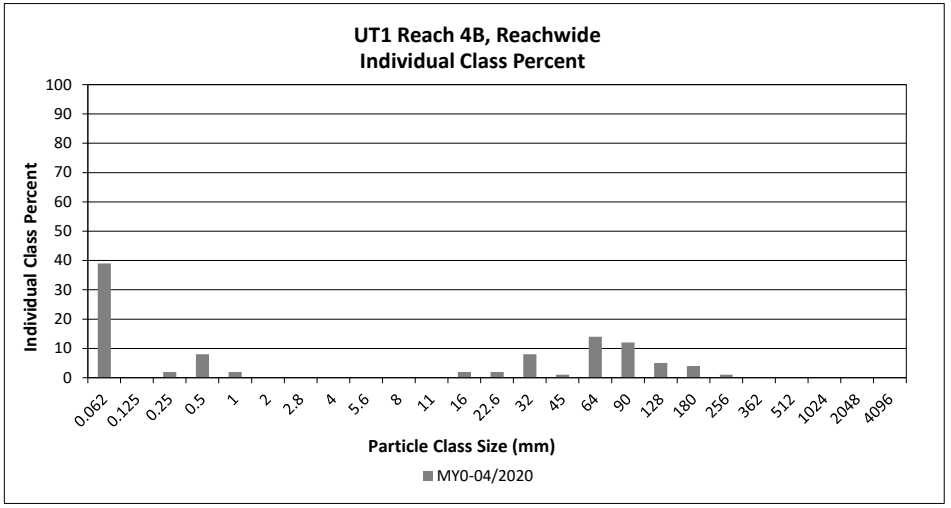
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 4B, 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	38	39	39	39
SAND	Very fine	0.062	0.125					39
	Fine	0.125	0.250		2	2	2	41
	Medium	0.25	0.50		8	8	8	49
	Coarse	0.5	1.0		2	2	2	51
	Very Coarse	1.0	2.0					51
GRAVEL	Very Fine	2.0	2.8					51
	Very Fine	2.8	4.0					51
	Fine	4.0	5.6					51
	Fine	5.6	8.0					51
	Medium	8.0	11.0					51
	Medium	11.0	16.0	2		2	2	53
	Coarse	16.0	22.6	2		2	2	55
	Coarse	22.6	32	8		8	8	63
	Very Coarse	32	45	1		1	1	64
	Very Coarse	45	64	14		14	14	78
COBBLE	Small	64	90	12		12	12	90
	Small	90	128	5		5	5	95
	Large	128	180	4		4	4	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	Silt/Clay
D_{50} =	0.7
D_{84} =	75.9
D_{95} =	128.0
D_{100} =	256.0





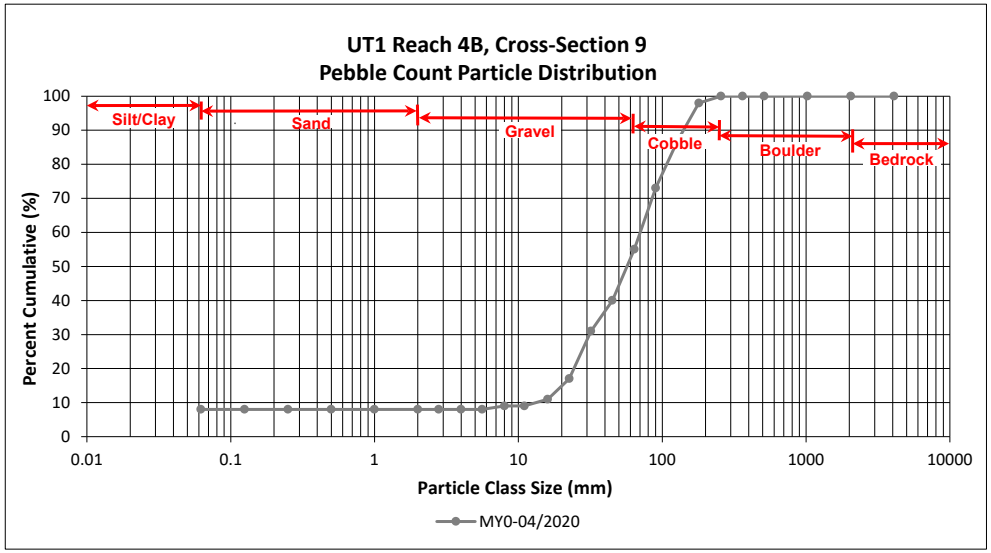
Reachwide and Cross-Section Pebble Count Plots

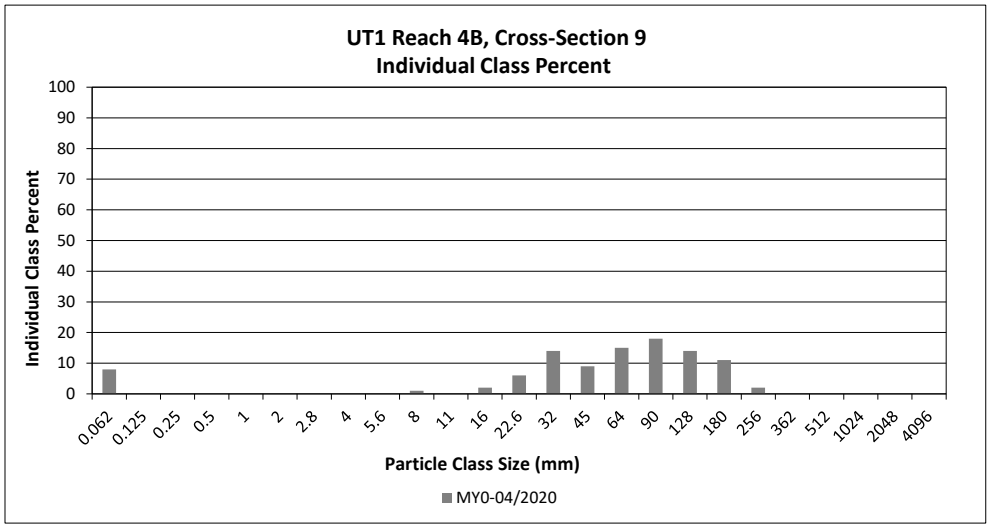
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 4B, 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	8	8	8
SAND	Very fine	0.062	0.125			8
	Fine	0.125	0.250			8
	Medium	0.25	0.50			8
	Coarse	0.5	1.0			8
	Very Coarse	1.0	2.0			8
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0			8
	Fine	4.0	5.6			8
	Fine	5.6	8.0	1	1	9
	Medium	8.0	11.0			9
	Medium	11.0	16.0	2	2	11
	Coarse	16.0	22.6	6	6	17
	Coarse	22.6	32	14	14	31
	Very Coarse	32	45	9	9	40
	Very Coarse	45	64	15	15	55
COBBLE	Small	64	90	18	18	73
	Small	90	128	14	14	87
	Large	128	180	11	11	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 9	
Channel materials (mm)	
D_{16} =	21.3
D_{35} =	37.2
D_{50} =	56.9
D_{84} =	118.7
D_{95} =	164.0
D_{100} =	256.0





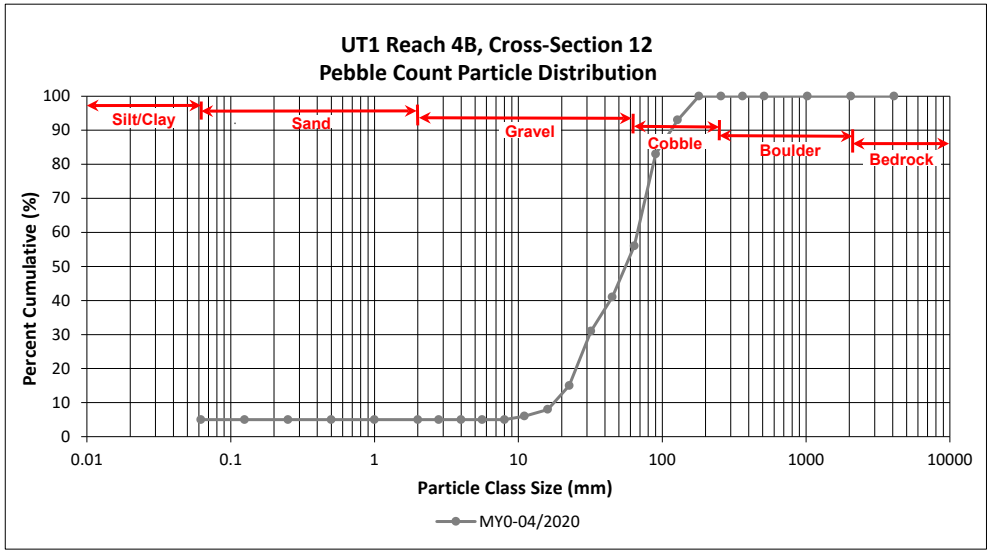
Reachwide and Cross-Section Pebble Count Plots

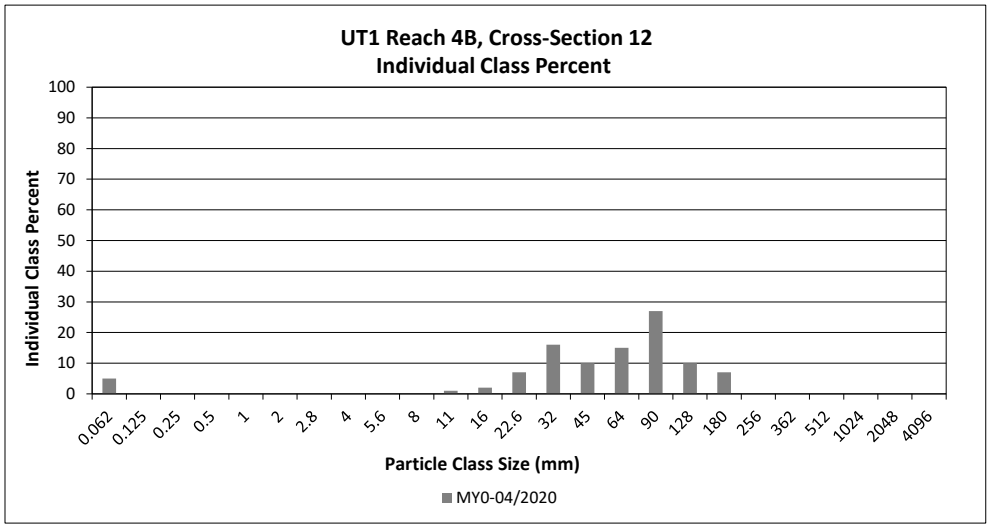
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 4B, 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	5	5	5
SAND	Very fine	0.062	0.125			5
	Fine	0.125	0.250			5
	Medium	0.25	0.50			5
	Coarse	0.5	1.0			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			5
	Medium	8.0	11.0	1	1	6
	Medium	11.0	16.0	2	2	8
	Coarse	16.0	22.6	7	7	15
	Coarse	22.6	32	16	16	31
	Very Coarse	32	45	10	10	41
	Very Coarse	45	64	15	15	56
COBBLE	Small	64	90	27	27	83
	Small	90	128	10	10	93
	Large	128	180	7	7	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 12	
Channel materials (mm)	
D_{16} =	23.1
D_{35} =	36.7
D_{50} =	55.6
D_{84} =	93.2
D_{95} =	141.1
D_{100} =	180.0





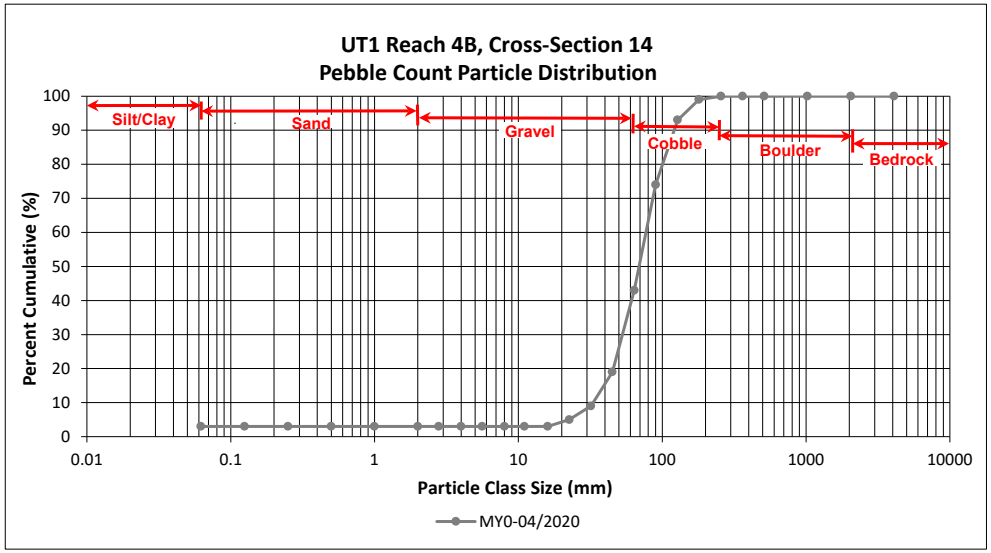
Reachwide and Cross-Section Pebble Count Plots

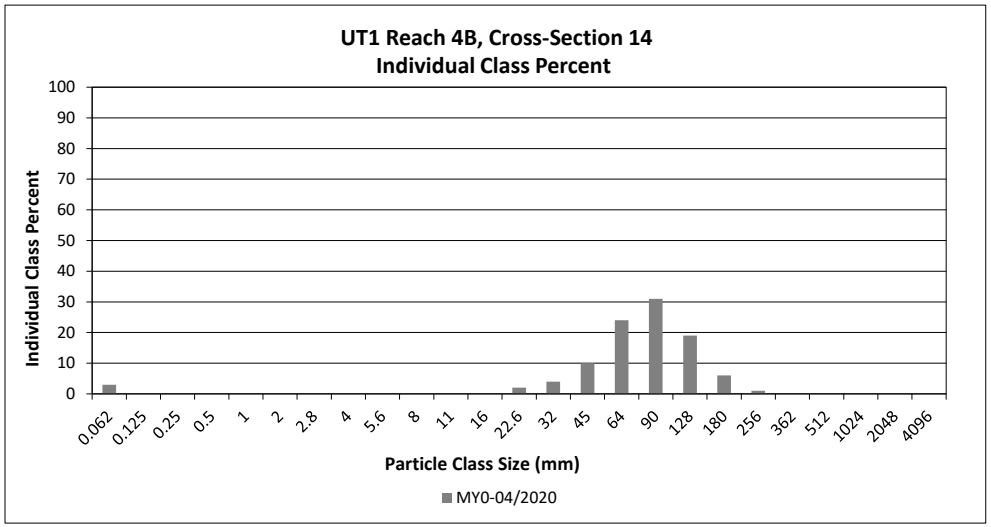
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

UT1 Reach 4B, 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	3	3	3
SAND	Very fine	0.062	0.125			3
	Fine	0.125	0.250			3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0			3
GRAVEL	Very Fine	2.0	2.8			3
	Very Fine	2.8	4.0			3
	Fine	4.0	5.6			3
	Fine	5.6	8.0			3
	Medium	8.0	11.0			3
	Medium	11.0	16.0			3
	Coarse	16.0	22.6	2	2	5
	Coarse	22.6	32	4	4	9
	Very Coarse	32	45	10	10	19
	Very Coarse	45	64	24	24	43
COBBLE	Small	64	90	31	31	74
	Small	90	128	19	19	93
	Large	128	180	6	6	99
	Large	180	256	1	1	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 14	
Channel materials (mm)	
D_{16} =	40.6
D_{35} =	56.9
D_{50} =	69.1
D_{84} =	108.3
D_{95} =	143.4
D_{100} =	256.0





Stream Photographs
Monitoring Year 0

	
PP1 – view upstream—UT1 Reach 1A (04/22/2020)	**PP1** – view downstream—UT1 Reach 1A (04/22/2020)
	
PP2 – view upstream—UT1 Reach 1A (04/22/2020)	**PP2** – view downstream—UT1 Reach 1A (04/22/2020)
	
PP3 – view upstream—UT1 Reach 1A (04/22/2020)	**PP3** – view downstream—UT1 Reach 1A (04/22/2020)

	
PP4 – view upstream- UT1 Reach 1B (04/22/2020)	**PP4** – view downstream— UT1 Reach 1B (04/22/2020)
	
PP5 – view upstream- UT1 Reach 1B (04/22/2020)	**PP5** – view downstream—UT1 Reach 1B (04/22/2020)
	
PP6- view upstream—UT1 Reach 1B (04/22/2020)	**PP6** – view downstream—UT1 Reach 1B (04/22/2020)

	
PP7 – view upstream—UT1 Reach 2 (04/22/2020)	**PP7** – view downstream-UT1 Reach 2 (04/22/2020)
	
PP8 – view upstream—UT1 Reach 2 (04/22/2020)	**PP8** – view downstream—UT1 Reach 2 (04/22/2020)
	
PP9 – view upstream---UT1 Reach 2 (04/22/2020)	**PP9** – view downstream—UT1 Reach 2 (04/22/2020)

	
PP10 – view upstream—UT1 Reach 3 (04/22/2020)	**PP10** – view downstream—UT1 Reach 3 (04/22/2020)
	
PP11 – view upstream—UT1 Reach 4A (04/22/2020)	**PP11** – view downstream—UT1 Reach 4A (04/22/2020)
	
PP12 – view upstream— UT1 Reach 4A (04/22/2020)	**PP12** – view downstream—UT1 Reach 4A (04/22/2020)

	
PP13 – view upstream—UT1 Reach 4A (04/22/2020)	**PP13** – view downstream— UT1 Reach 4A (04/22/2020)
	
PP14 – view upstream— UT1 Reach 4A (04/22/2020)	**PP14** – view downstream— UT1 Reach 4A (04/22/2020)
	
PP15 – view upstream— UT1 Reach 4B (04/22/2020)	**PP15** – view downstream— UT1 Reach 4B (04/22/2020)

	
PP16 – view upstream— UT1 Reach 4B (04/22/2020)	**PP16** – view downstream— UT1 Reach 4B (04/22/2020)
	
PP17 – view upstream— UT1 Reach 4B (04/22/2020)	**PP17** – view downstream— UT1 Reach 4B (04/22/2020)
	
PP18 – view upstream— UT1 Reach 4B (04/22/2020)	**PP18** – view downstream— UT1 Reach 4B (04/22/2020)

	
PP19 – view upstream— UT1 Reach 4B (04/22/2020)	**PP19** – view downstream— UT1 Reach 4B (04/22/2020)
	
PP20 – view upstream— UT1A (04/22/2020)	**PP20** – view downstream— UT1A (04/22/2020)

APPENDIX 3. Vegetation Plot Data

Table 9. Vegetation Plot Criteria Attainment

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Permanent Vegetation Plot	MY0 Success Criteria Met (Y/N)	Tract Mean (MY0 - 2020)	
1	Y	100%	100%
2	Y		
3	Y		
4	Y		
5	Y		
6	Y		
7	Y		
8	Y		
9	Y		
Mobile Vegetation Plot	**MY0 Success Criteria Met (Y/N)**		
1	Y	100%	
2	y		
3	Y		

Table 10. CVS Vegetation Plot Metadata

Alexander Farm Mitigation Site

DMS Project No. 100048

Monitoring Year 0 - 2020

Report Prepared By	Henry Reed
Date Prepared	6/26/2020 13:23
Database Name	cvs-eep-entrytool-v2.5.0.mdb
Database Location	Q:\ActiveProjects\005-02169 Alexander Farm\Monitoring\Baseline Monitoring\Vegetation Assessment
Computer Name	HENRY
File Size	73809920
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	100048
Project Name	Alexander Farm Mitigation Site
Description	The Alexander Farm Mitigation Site (Site) is in Alexander County approximately 6 miles west of Statesville and 15 miles northeast of Hickory.
Sampled Plots	12

Table 11a. Planted and Total Stem Counts
Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Current Permanent Vegetation Plot Data (MY0 2020)																	
Scientific Name	**Common Name**	**Species Type**	**Permanent Plot 1**			**Permanent Plot 2**			**Permanent Plot 3**			**Permanent Plot 4**			**Permanent Plot 5**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Box elder	Tree	1	1	1							1	1	1	2	2	2
Betula nigra	River birch	Tree	1	1	1	1	1	1	5	5	5	4	4	4	1	1	1
Platanus occidentalis	Sycamore	Tree				3	3	3	1	1	1				2	2	2
Quercus sp. (unknown)	Oak species (unknown)	Tree	1	1	1							1	1	1	1	1	1
Quercus pagoda	Cherrybark oak	Tree	5	5	5	6	6	6	3	3	3	3	3	3	2	2	2
Quercus phellos	Willow oak	Tree	2	2	2	2	2	2	3	3	3	4	4	4	3	3	3
Quercus rubra	Northern Red oak	Tree				1	1	1	1	1	1						
		Stem count	10	10	10	13	13	13	13	13	13	13	13	13	11	11	11
		size (ares)		1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02			0.02	
		Species count	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6
		Stems per ACRE	405	405	405	526	526	526	526	526	526	526	526	526	445	445	445

Current Permanent Vegetation Plot Data (MY0 2020)																	
Scientific Name	**Common Name**	**Species Type**	**Permanent Plot 6**			**Permanent Plot 7**			**Permanent Plot 8**			**Permanent Plot 9**			**MY0 (2020)**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Box elder	Tree	5	5	5				2	2	2	4	4	4	15	15	15
Betula nigra	River birch	Tree				1	1	1	3	3	3	1	1	1	17	17	17
Platanus occidentalis	Sycamore	Tree										3	3	3	9	9	9
Quercus sp. (unknown)	Oak species (unknown)	Tree				2	2	2	2	2	2				7	7	7
Quercus pagoda	Cherrybark oak	Tree	4	4	4	5	5	5	1	1	1	4	4	4	33	33	33
Quercus phellos	Willow oak	Tree	3	3	3	4	4	4	4	4	4	3	3	3	28	28	28
Quercus rubra	Northern Red oak	Tree													2	2	2
		Stem count	12	12	12	12	12	12	12	12	12	15	15	15	111	111	111
		size (ares)		1			1			1			1			9	
		size (ACRES)		0.02			0.02			0.02			0.02			0.22	
		Species count	3	3	3	4	4	4	5	5	5	5	5	5	7	7	7
		Stems per ACRE	486	486	486	486	486	486	486	486	486	607	607	607	499	499	499

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteer species included in total

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

Table 11b. Planted and Total Stem Counts

Alexander Farm Mitigation Site
DMS Project No. 100048
Monitoring Year 0 - 2020

Current Mobile Vegetation Plot (MP) Data (MY0 2020)						Annual Mean
Scientific Name	**Common Name**	**Species Type**	**MP1**	**MP2**	**MP3**	**MY0 (2020)**
			PnoLS	**PnoLS**	**PnoLS**	**PnoLS**
Acer negundo	Box elder	Tree	1	3	2	6
Betula nigra	River birch	Tree	7	1	4	12
Platanus occidentalis	Sycamore	Tree	3	1		4
Quercus sp. (unknown)	Oak species (unknown)	Tree		3	1	4
Quercus pagoda	Cherrybark oak	Tree	1	4	3	8
Quercus phellos	Willow oak	Tree		1	2	3
Quercus rubra	Northern Red oak	Tree		1	1	2
		Stem count	12	14	13	39
		size (ares)	1	1	1	3
		size (ACRES)	0.02	0.02	0.02	0.07
		Species count	4	7	6	7
		Stems per ACRE	486	567	526	526

Overall Site Annual Mean			
Scientific Name	**Common Name**	**Species Type**	**MY0 (2020)**
			PnoLS
Acer negundo	Box elder	Tree	21
Betula nigra	River birch	Tree	29
Platanus occidentalis	Sycamore	Tree	13
Quercus sp. (unknown)	Oak species (unknown)	Tree	11
Quercus pagoda	Cherrybark oak	Tree	41
Quercus phellos	Willow oak	Tree	31
Quercus rubra	Northern Red oak	Tree	4
		Stem count	150
		size (ares)	12
		size (ACRES)	0.30
		Species count	7
		Stems per ACRE	506

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%
- Volunteer species included in total

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

Vegetation Plot Photographs
Monitoring Year 0

Permanent Vegetation Plot 1 *(4/27/2020)*

Permanent Vegetation Plot 2 *(4/27/2020)*

Permanent Vegetation Plot 3 *(4/27/2020)*

Permanent Vegetation Plot 4 *(4/27/2020)*

Permanent Vegetation Plot 5 *(4/27/2020)*

Permanent Vegetation Plot 6 *(4/27/2020)*

Permanent Vegetation Plot 7 *(4/27/2020)*

Permanent Vegetation Plot 8 *(4/27/2020)*

Permanent Vegetation Plot 9 *(4/27/2020)*

Mobile Vegetation Plot 1 *(4/27/2020)*

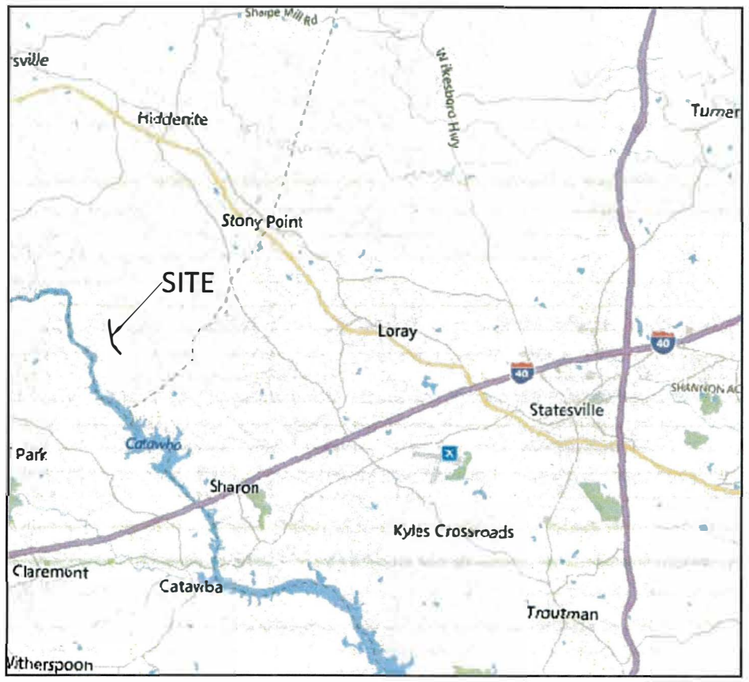
Mobile Vegetation Plot 2 *(4/27/2020)*

Mobile Vegetation Plot 3 *(4/27/2020)*

APPENDIX 4. Record Drawings

Alexander Farm Mitigation Site - Record Drawings

Alexander County, North Carolina
Catawba River Basin 03050101
for
NCDEQ
Division of Mitigation Services



Vicinity Map
Not to Scale

Environmental Quality

RECORD DRAWINGS ISSUED
AUGUST 21, 2020

CERTIFICATE OF SURVEY AND ACCURACY

I, ELISABETH G. TURNER, 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 TURNER LAND SURVEYING, PPLC AS SHOWN ON AN AS-BUILT SURVEY FOR "WILDLANDS ENGINEERING, INC.", JOB # 18-023, DATED MAY 19, 2020; THAT THIS SURVEY WAS PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET THE FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS AND TO MEET THE REQUIREMENTS OF A TOPOGRAPHIC SURVEY TO THE ACCURACY OF CLASS A HORIZONTAL AND CLASS C VERTICAL WHERE APPLICABLE; THAT THE ORIGINAL DATA WAS OBTAINED BETWEEN THE DATES OF MAY 9-16, 2020, THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD AND ALL COORDINATES ARE BASED ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASED ON NAVD 88 AND COORDINATE VALUES WERE TAKEN FROM AN EXISTING CONDITIONS TOPOGRAPHIC SURVEY PREPARED BY TURNER LAND SURVEYING, SIGNED, SEALED AND DATED ON 9/23/2020 BY ELISABETH G. TURNER, NC PLS LICENSE#4440; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION .1606.

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 24th DAY OF SEPTEMBER, 2020, A.D.

NORTH CAROLINA PROFESSIONAL SEAL L-4440 LAND SURVEYOR ELISABETH G. TURNER

ELISABETH G. TURNER, PLS L-4440

Sheet Index

Title Sheet	0.1
Project Overview	0.2
General Notes and Symbols	0.3
Stream Plan and Profile	
UT1	1.1.1.-1.1.15
UT1A	1.2.1
BMP	1.3.1
Planting Plan	2.0-2.6

Project Directory

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

Pre-Construction Conditions and As-Built Surveying:
Turner Land Surveying, PLLC
P.O. Box 148
Swannanoa, NC 28778
Lissa Turner, PLS
919-827-0745

Owner:
NC DEQ - Division of Mitigation Services
5 Ravenscroft Dr, Ste. 102
Asheville, NC 28801
Harry Tsomides
828-545-7057

NC DEQ Contract No. 7416
DMS Project No. 100048
USACE ID No. SAW-2018-00451

WILDLANDS ENGINEERING
1430 S. Mint Street, Ste 104
Charlotte, NC 28203
Tel: 704.332.7754
Fax: 704.332.3306
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL 23906 ENGINEER AARON S. EARLEY 9-21-20

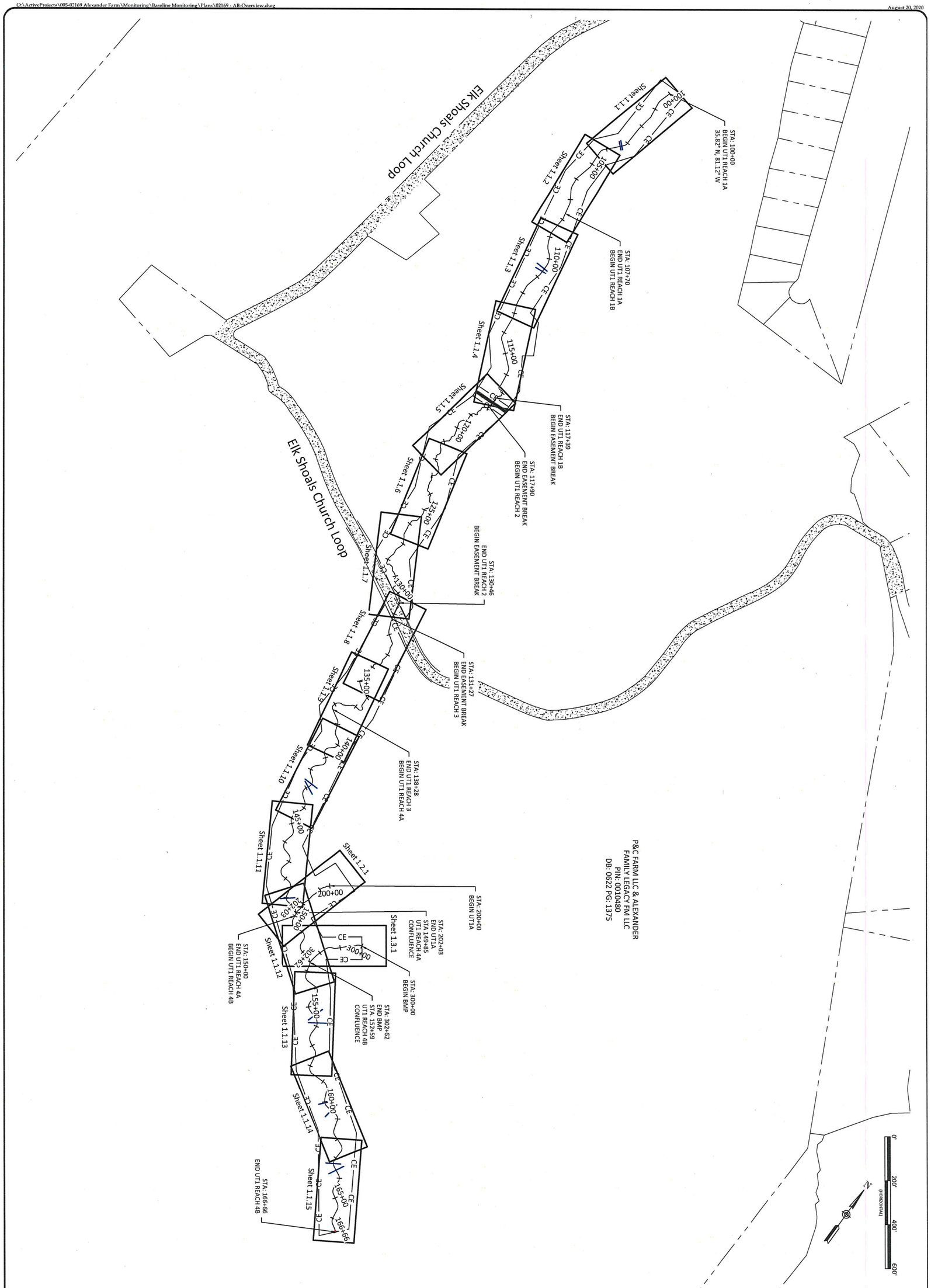
Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina
Title Sheet

Revisions:

Date: 08/13/2020
Job Number: 1005-02169
Project Engineer: ASE
Drawn By: HCB
Checked By: JCK

Sheet 0.1

O:\Active Projects\1005-02169 Alexander Farm\Monitoring\Baseline Monitoring\Plans\02169 - Alt Cover Sheet.dgn



Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

0.2
Sheet

Revisions:

Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

Project Overview

NORTH CAROLINA PROFESSIONAL SEAL 032340 ENGINEER AARON S. EARLES
8-21-20

WILDLANDS
ENGINEERING
1430 S. Mint Street, Ste 104
Charlotte, NC 28203
Tel: 704.332.7754
Fax: 704.332.3306
Firm License No. F-0831

As-Built Features

- CE — As-Built Conservation Easement
- CE-XS — As-Built Stream Crossing
- As-Built Thalweg Alignment
- As-Built Bankfull
- 100 — As-Built Major Contour
- As-Built Minor Contour
- As-Built Cross Section
- VEG / VP# — Permanent Vegetation Monitoring Plots
- GWG# — Groundwater Gage
- CG# — Crest Gauge
- PP# — Photo Point
- Survey Control Point
- BT# — Barotroll

AS-BUILT DRAWINGS:
Deviations from the design will be shown in red.

As-Built Structures

- As-Built Various Constructed Riffles
- As-Built Brush Toe
- As-Built Vernal Pool
- As-Built Vegetated Soil Lift
- As-Built Armored Rock Stabilization/Permanent Crossing

As-Built Structures

- As-Built Log Sill
- As-Built Lunker Log
- As-Built Log J-Hook
- As-Built Log Vane
- As-Built Rock Sill
- As-Built Permanent Crossing
- As-Built Coarse Woody Debris
- As-Built Culvert

Pre-Construction Features

- Pre-Construction Property Line
- X — Pre-Construction Fence
- FEMA FP — Pre-Construction FEMA Floodplain
- Pre-Construction Storm Pipe
- Pre-Construction Bridge
- Pre-Construction Wetland
- Pre-Construction Road
- Pre-Construction Treeline

Design Features

- 10+00 — Designed Centerline Alignment
- Designed Bankfull
- 100 — Designed Major Contour (5' Interval)
- Designed Minor Contour

Design Structures

- Designed Various Constructed Riffles
- Designed Brush Toe
- Designed Vernal Pool
- Designed Vegetated Soil Lift

Design Structures

- Designed Angled Log Sill
- Designed Lunker Log
- Designed Log J-Hook
- Designed Log Vane
- Designed Rock Sill
- Designed Permanent Crossing
- Designed Coarse Woody Debris

Project Notes:

Topographic survey was completed by Turner Land Surveying in October 2018.
Parcel boundary survey was completed by Turner Land Surveying in January 2019.
Record Drawing survey was completed by Turner Land Surveying in May 2020.

Topographic data outside Designed conservation easement supplemented with Lidar data from 2016.

WILDLANDS ENGINEERING
1430 S. Mint Street, Ste 104
Charlotte, NC 28203
Tel: 704.332.7754
Fax: 704.332.3306
Firm License No. F-0831

Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina
General Notes and Symbols

Revisions:

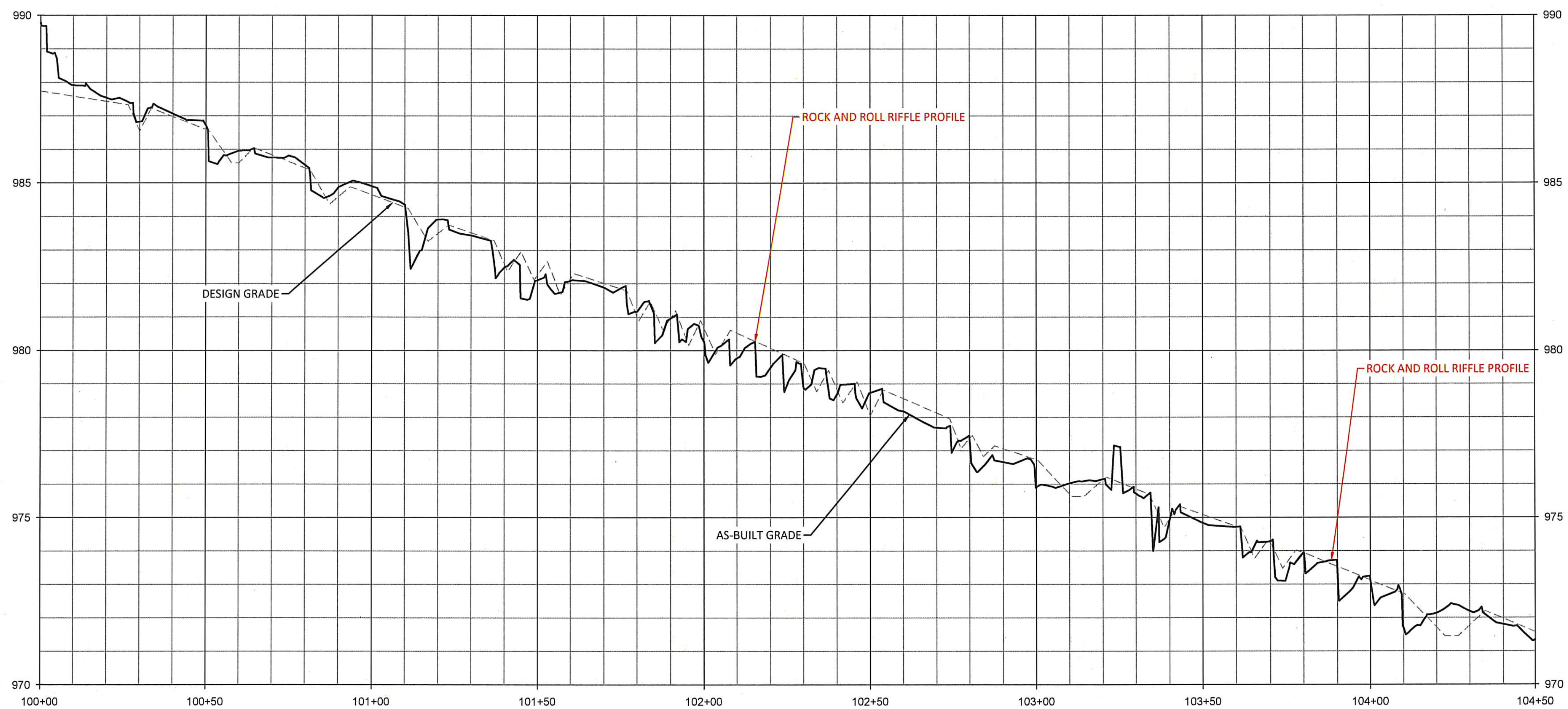
Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

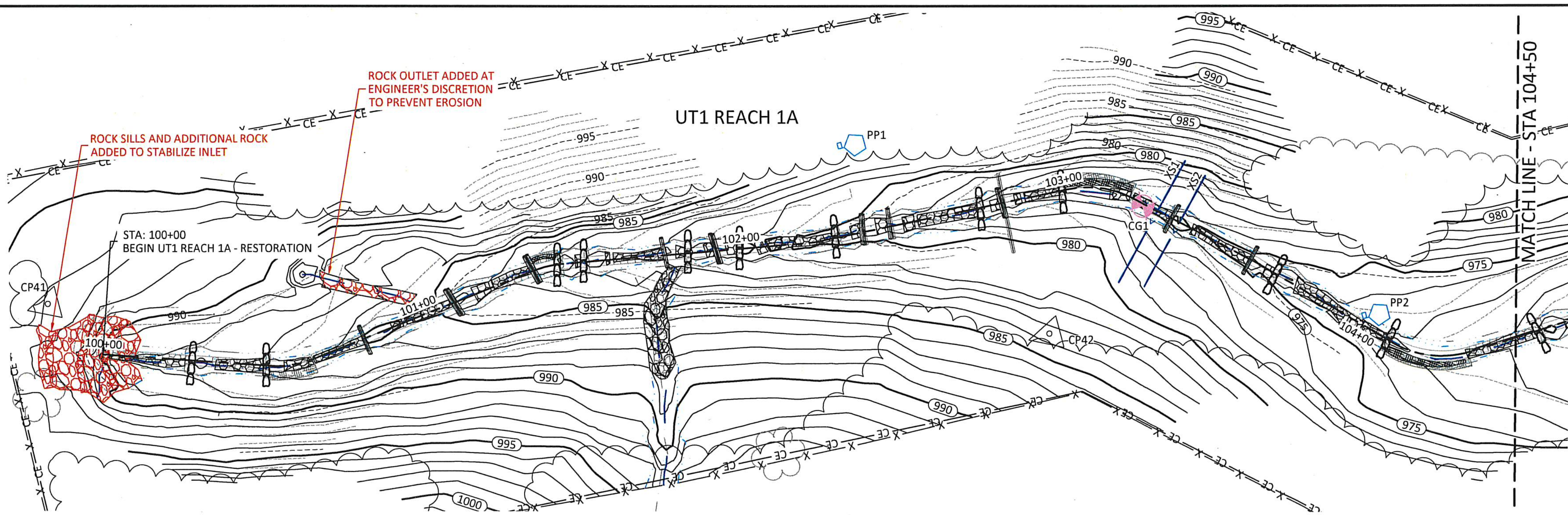
Sheet 0.3

August 20, 2020

0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)





*Rock and Roll Riffles contain log sills as shown in profiles.

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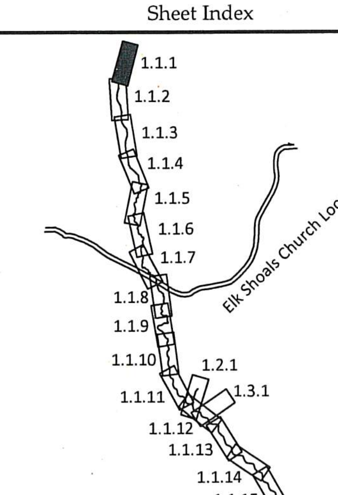

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NORTH CAROLINA PROFESSIONAL SEAL ENGINEER AARON S. EARLEY 8-21-20

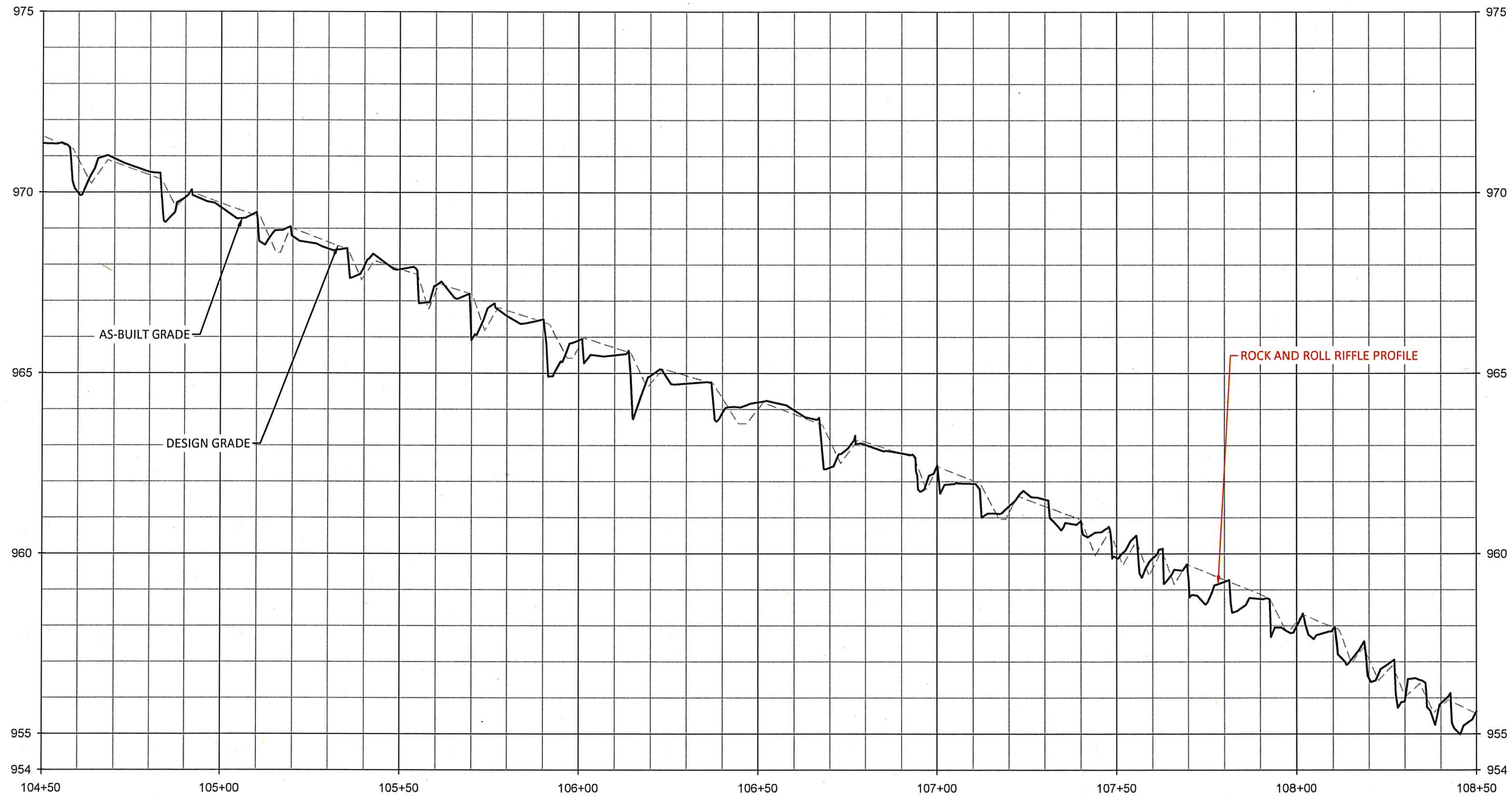
Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

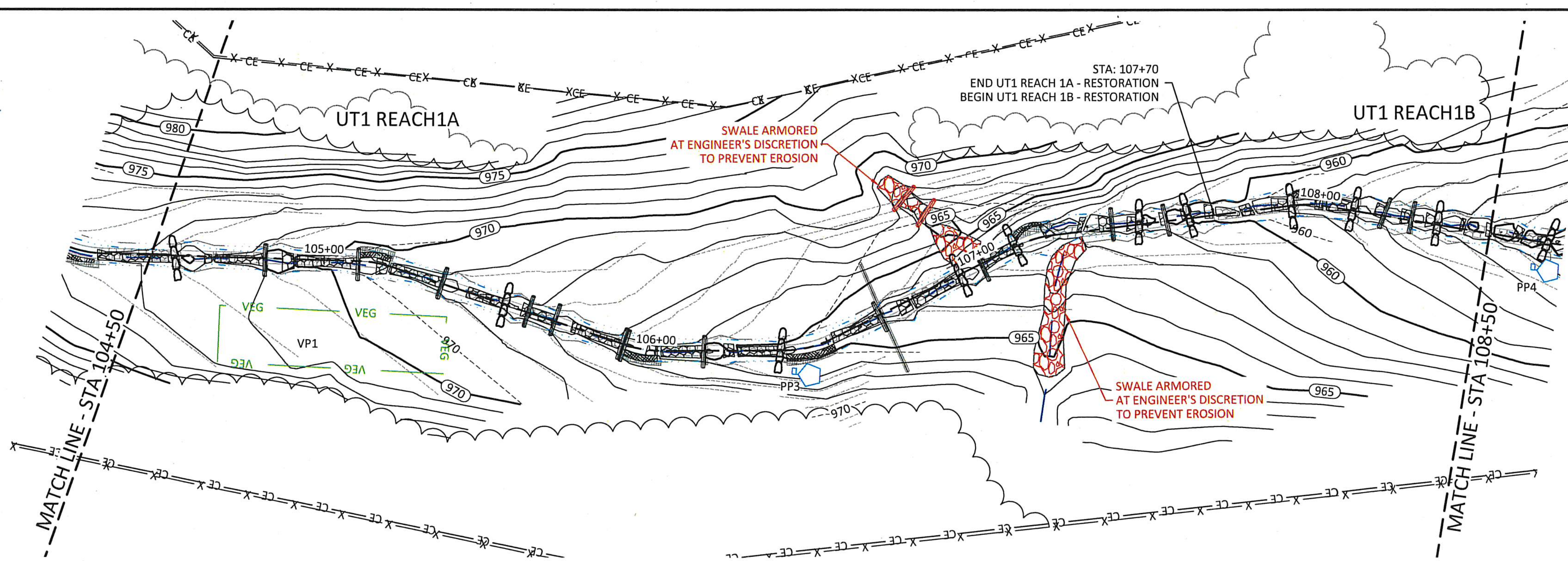
UT1 Reach 1A
Stream Plan and Profile

Revisions:

Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

Sheet 1.1.1

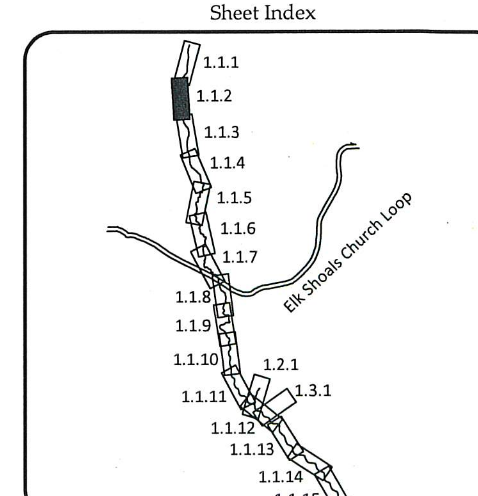




UT1 REACH1A
UT1 REACH1B
STA: 107+70
END UT1 REACH 1A - RESTORATION
BEGIN UT1 REACH 1B - RESTORATION
SWALE ARMORED
AT ENGINEER'S DISCRETION
TO PREVENT EROSION
SWALE ARMORED
AT ENGINEER'S DISCRETION
TO PREVENT EROSION
MATCH LINE - STA 104+50
MATCH LINE - STA 108+50
105+00
106+00
107+00
108+00
VEG
VP1
PP3
PP4
980
975
970
965
960

*Rock and Roll Riffles contain log sills as shown in profiles.

Sheet Index



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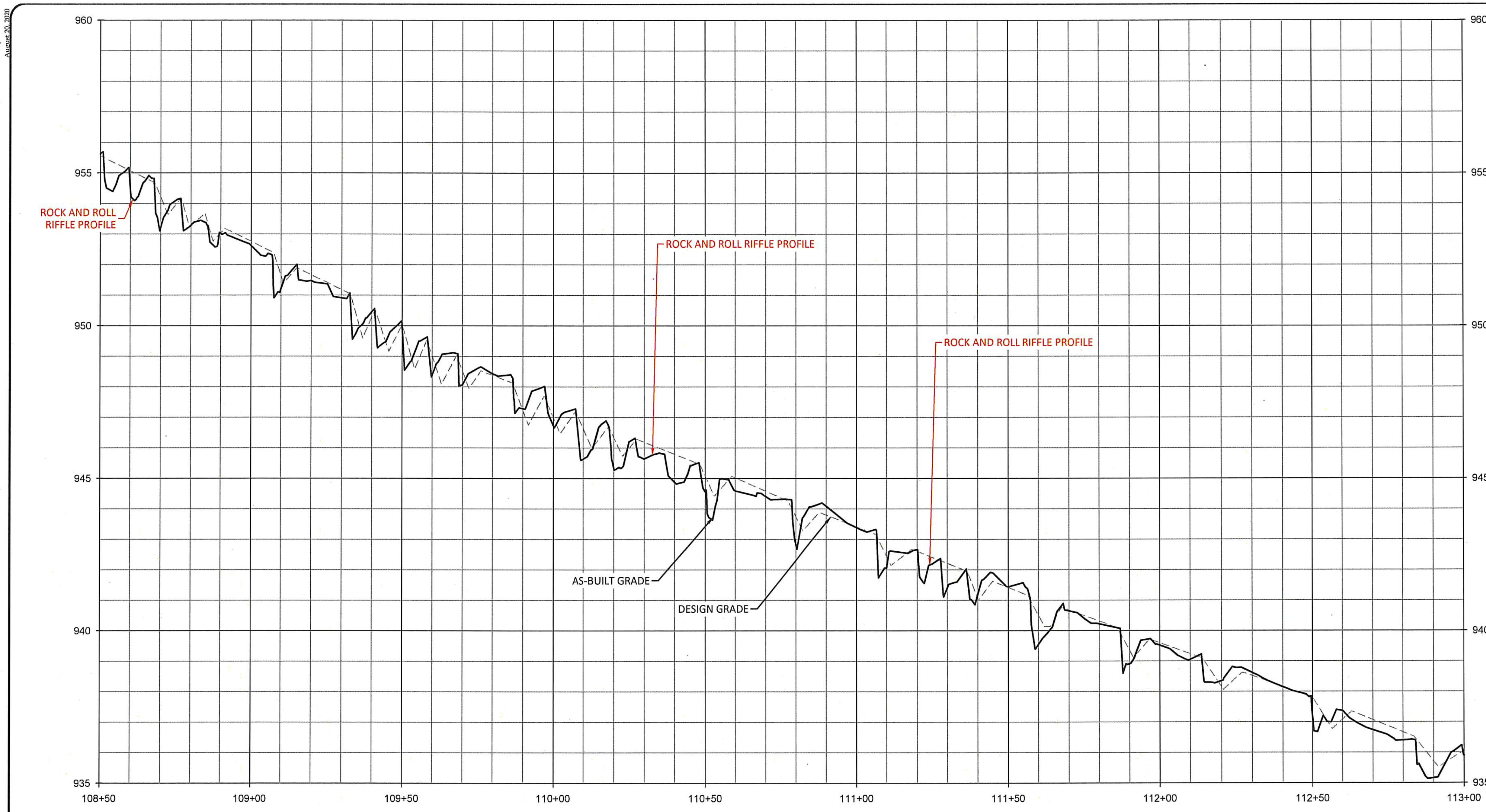
Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

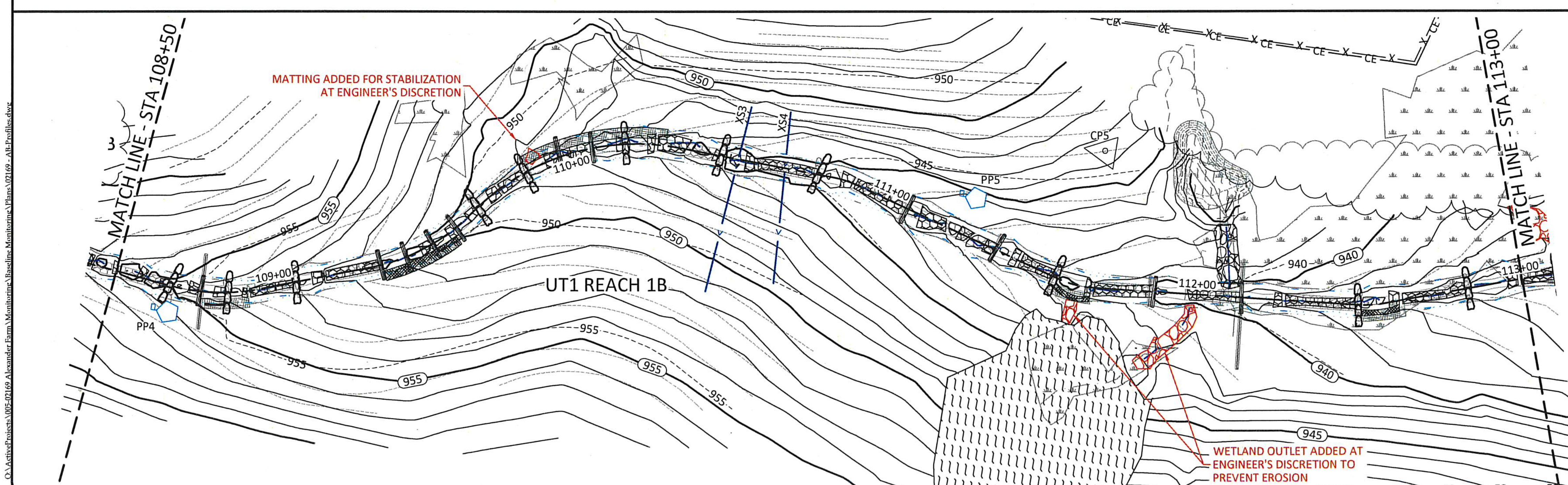
UT1 Reach 1A & 1B
Stream Plan and Profile

Revisions:

Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

Sheet 1.1.2





*Rock and Roll Riffles contain log sills as shown in profiles.

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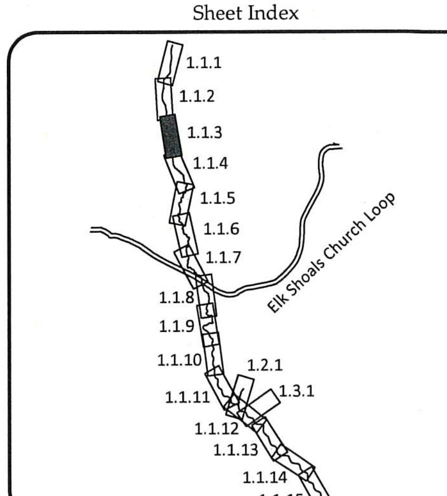

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Alexander Farm Mitigation Site - Record Drawings

Alexander County, North Carolina

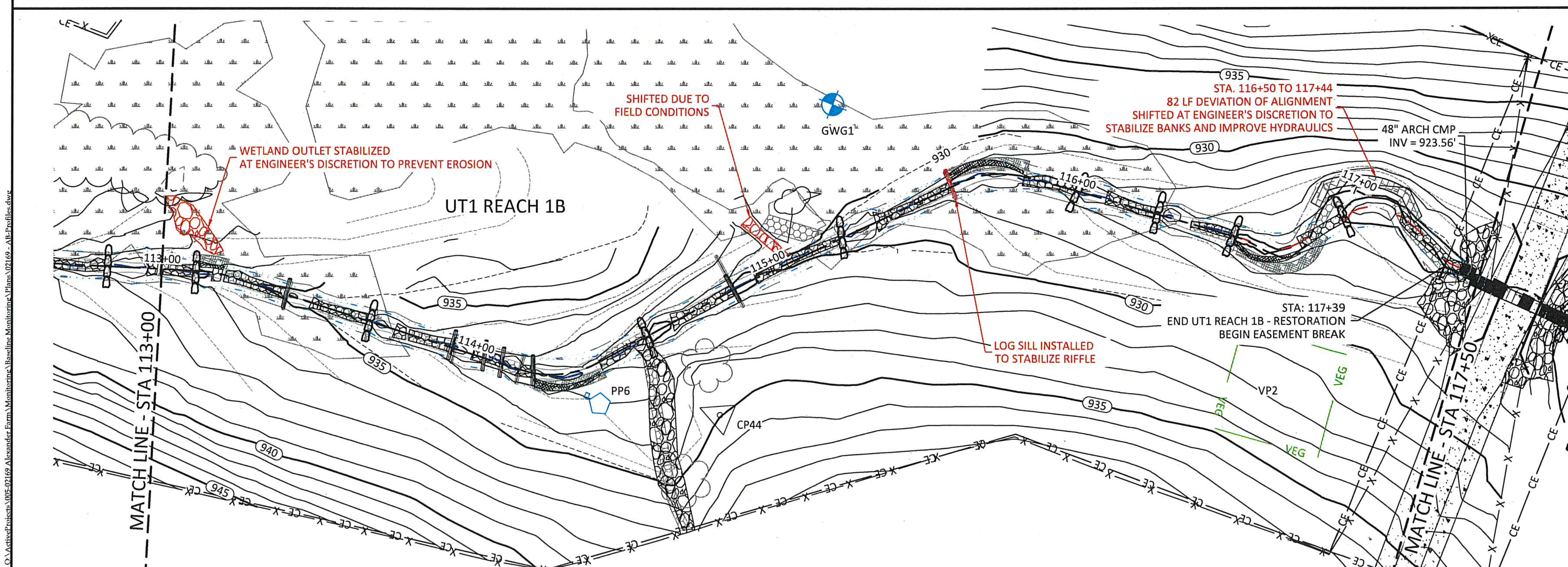
UT1 Reach 1B

Stream Plan and Profile

Revisions:

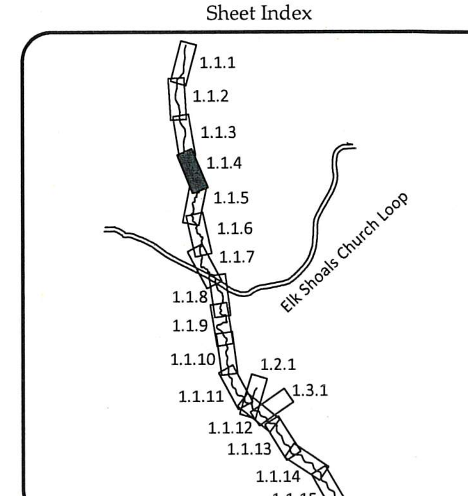
Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

Sheet 1.1.3



*Rock and Roll Riffles contain log sills as shown in profiles.

Sheet Index



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Alexander Farm Mitigation Site - Record Drawings

Alexander County, North Carolina

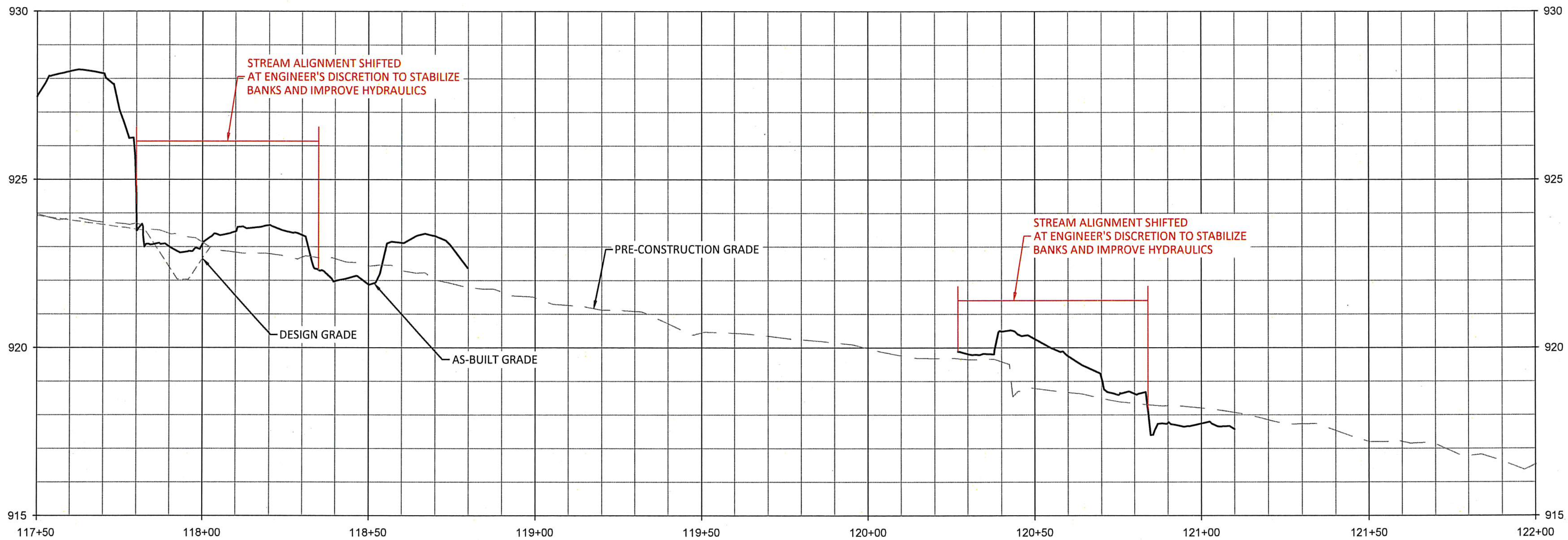
UT1 Reach 1B

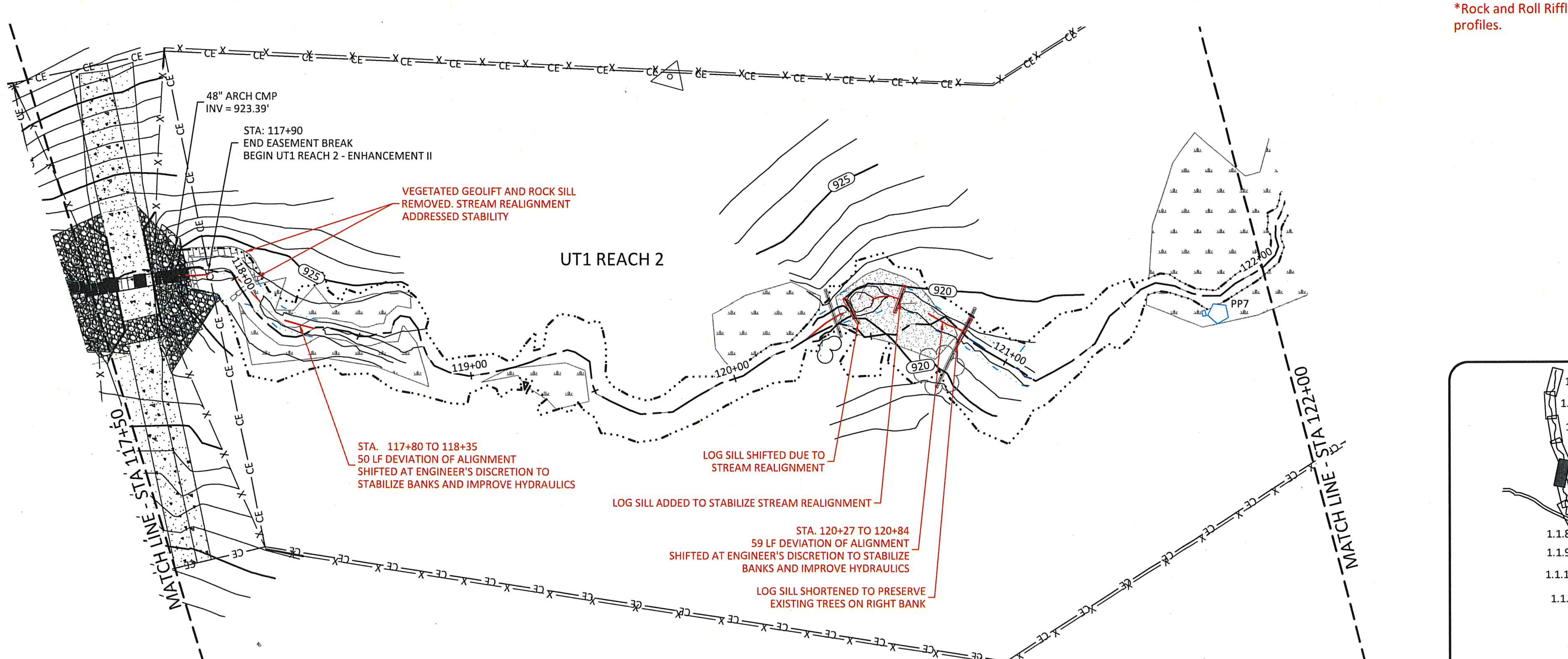
Stream Plan and Profile

Revisions:

Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

Sheet 1.1.4





*Rock and Roll Riffles contain log sills as shown in profiles.

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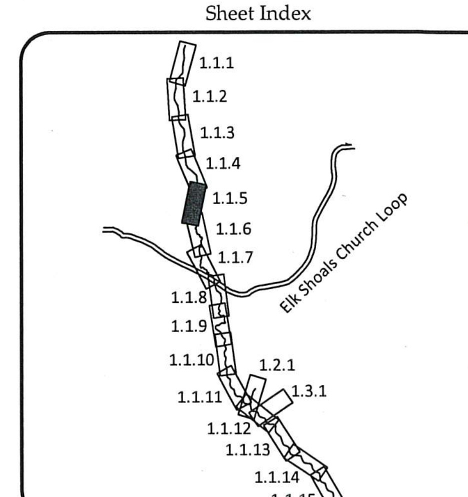

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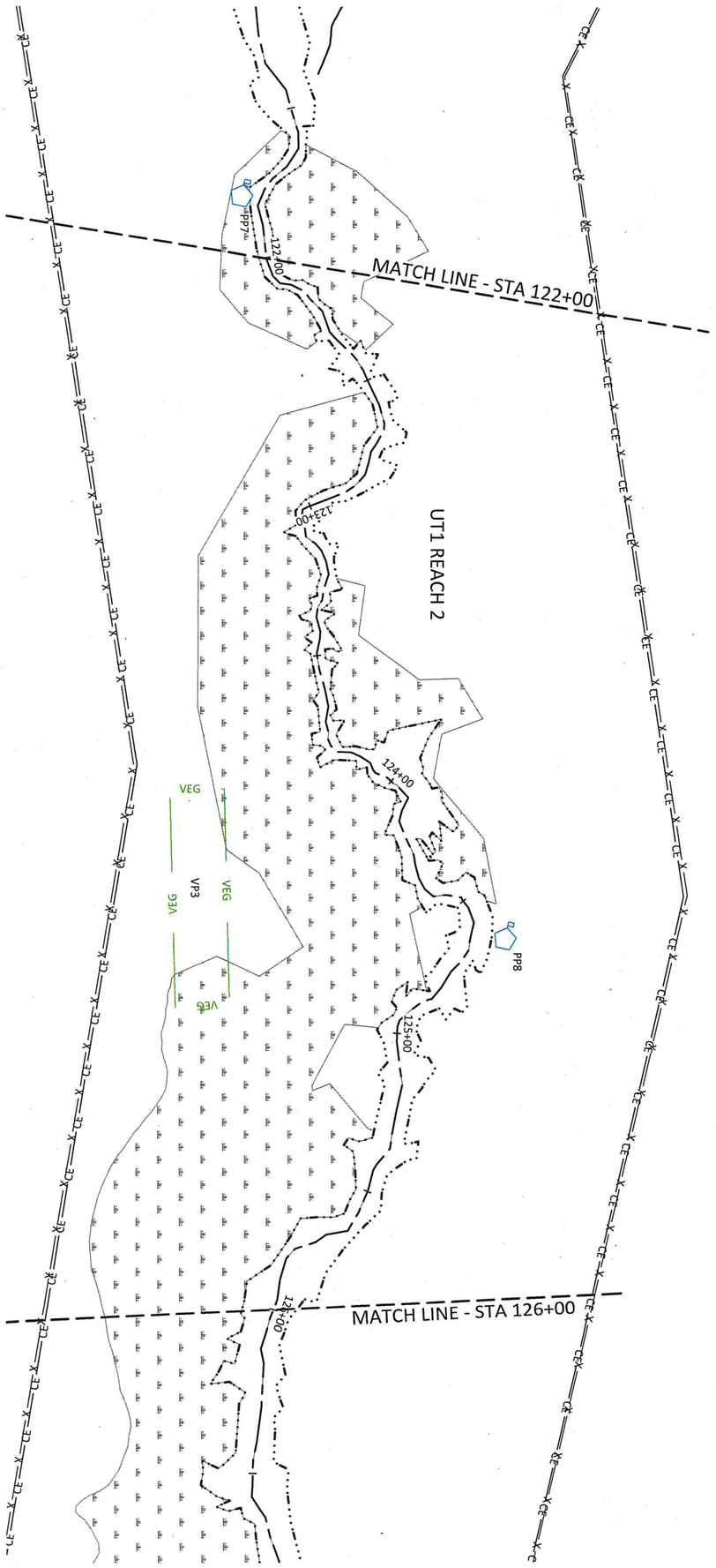
Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

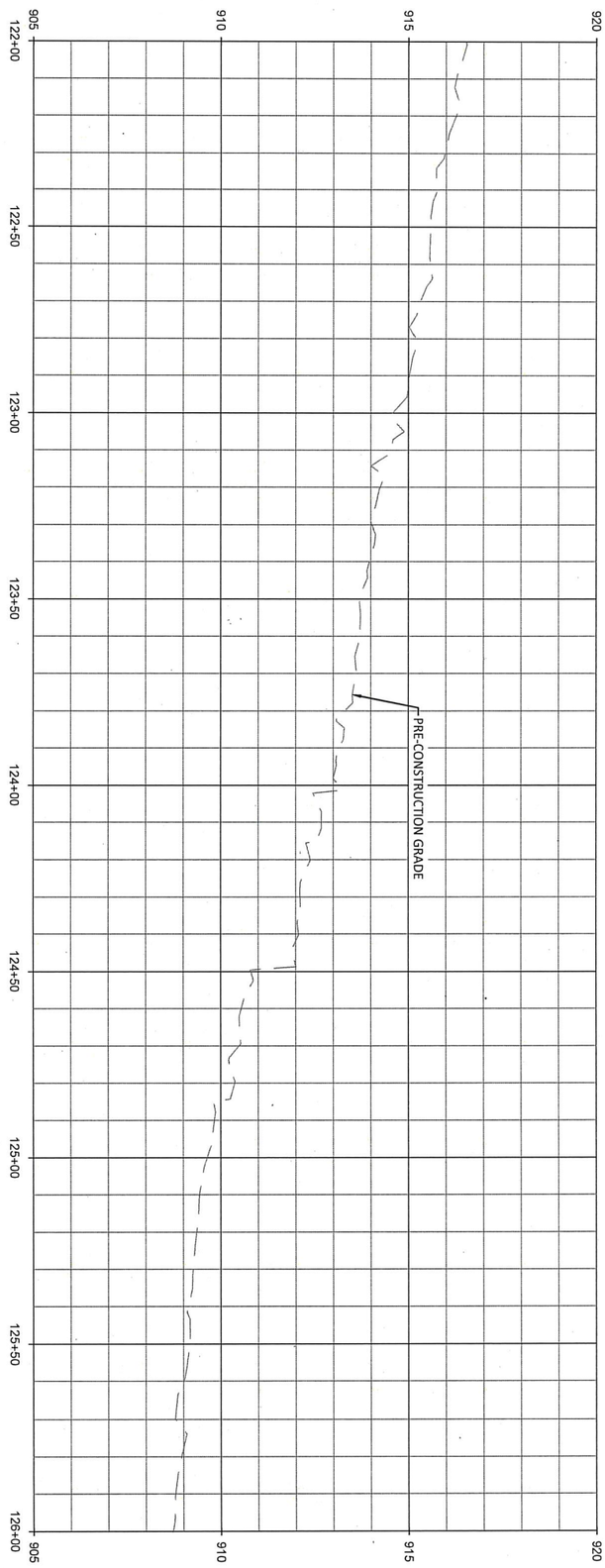
UT1 Reach 2
Stream Plan and Profile

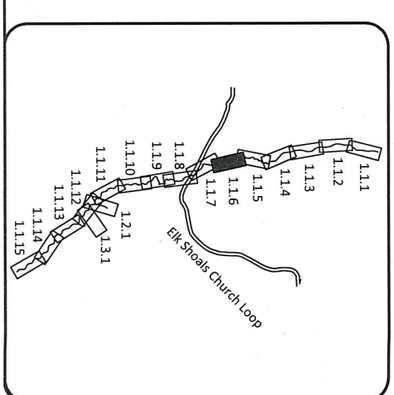
Date: 08/13/2020
Job Number: 005-02169
Project Engineer: ASE
Drawn By: HCB
Checked By: JCK

Revisions:

Sheet 1.1.5







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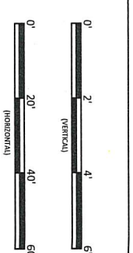

Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

Revisions:

1.1.6
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Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 2
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 038415 ENGINEER AARON S. EARLEY
8-21-20

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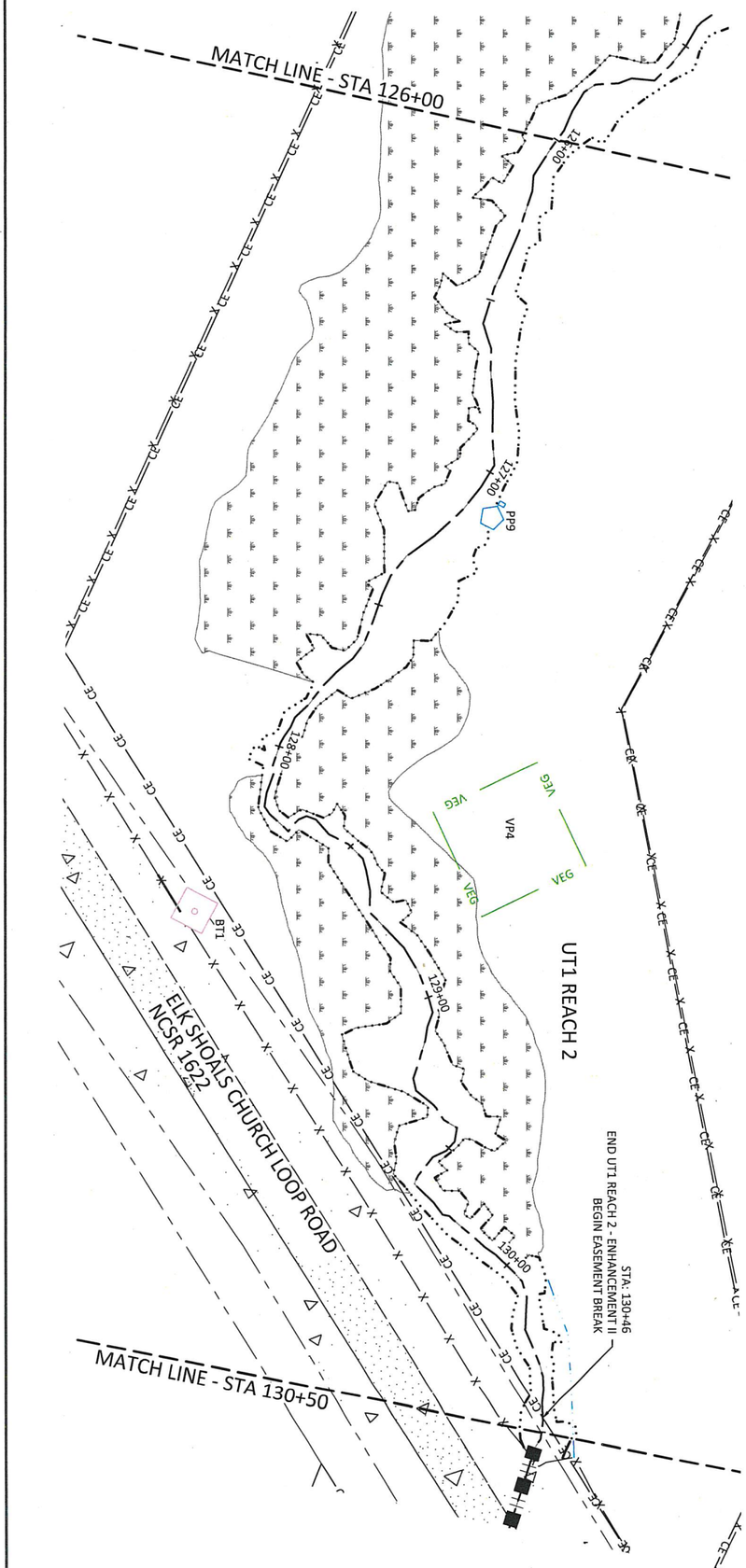

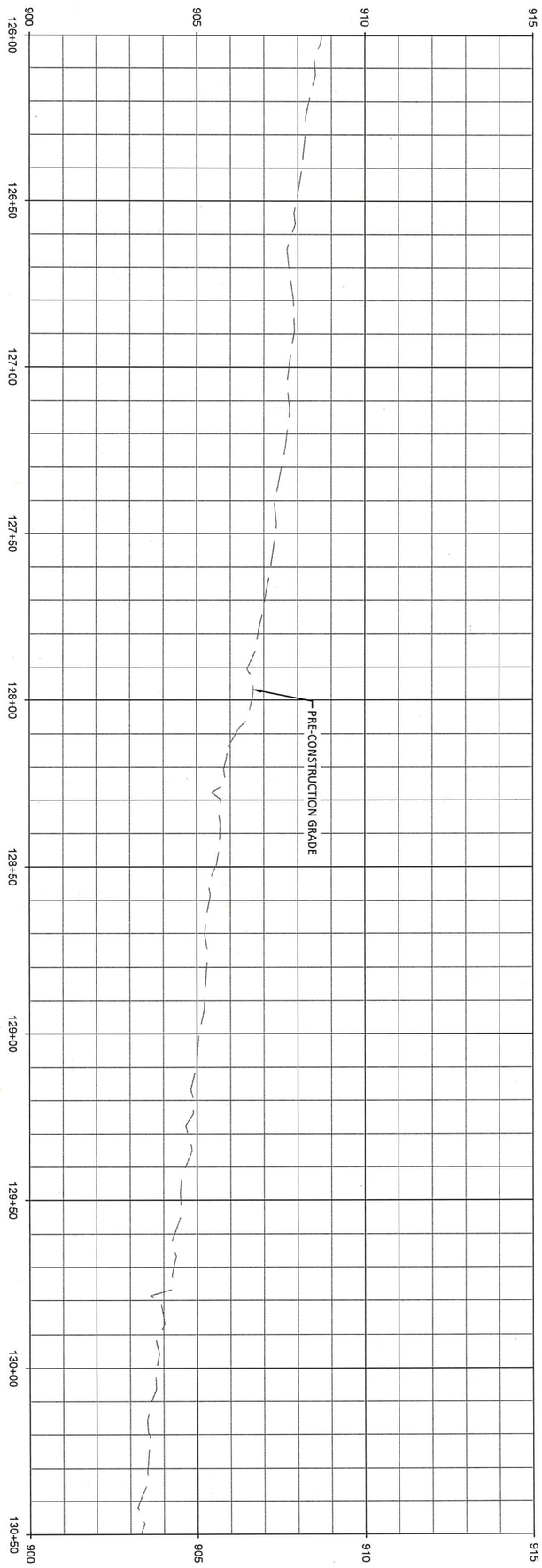

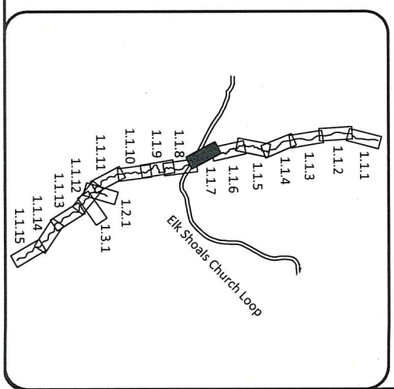

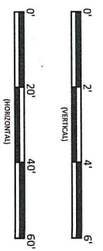

Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

Revisions:

1.1.7
Sheet

Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 2
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 039340 ENGINEER AARON S. CARPENTER
8-21-20

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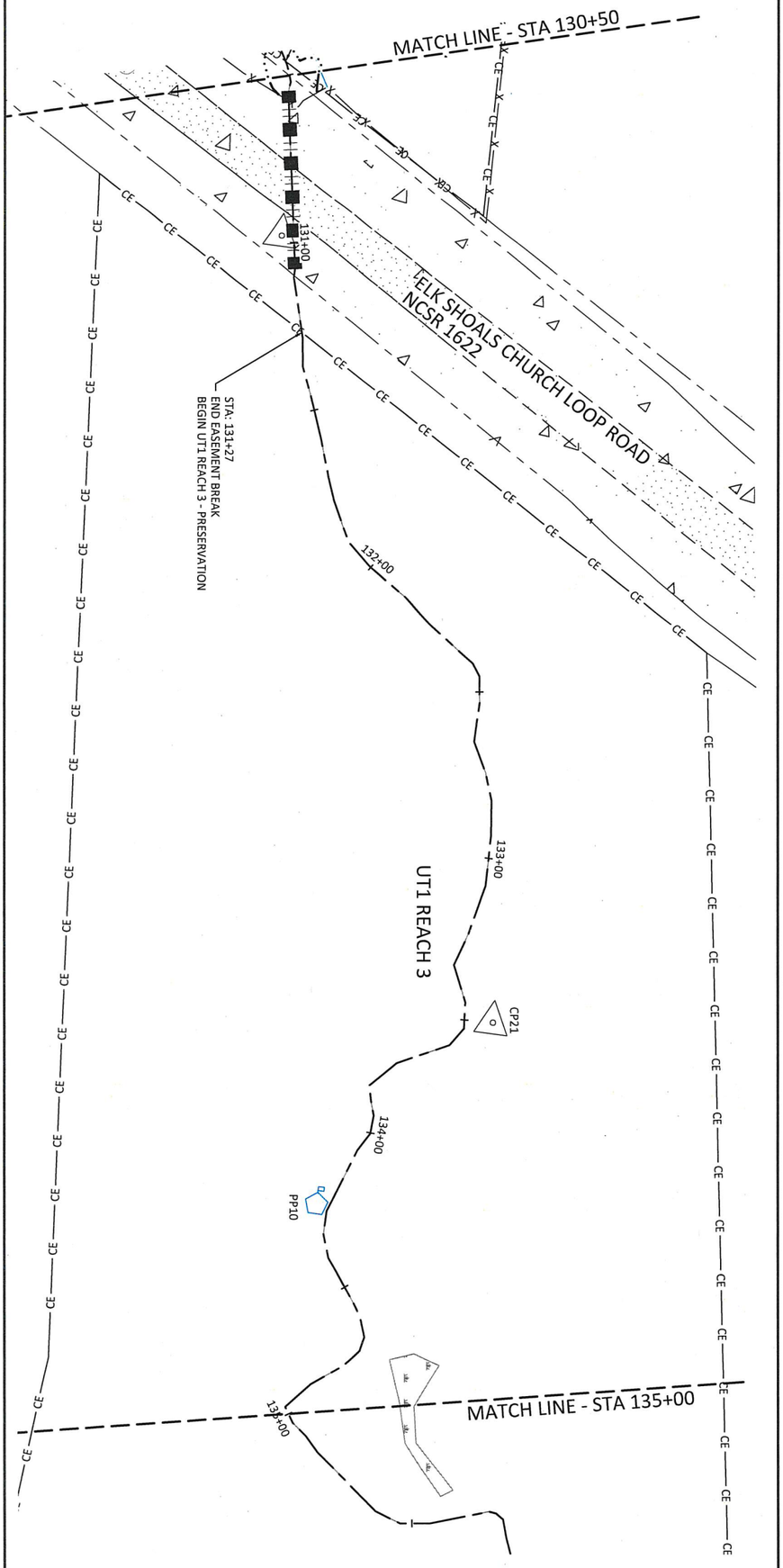
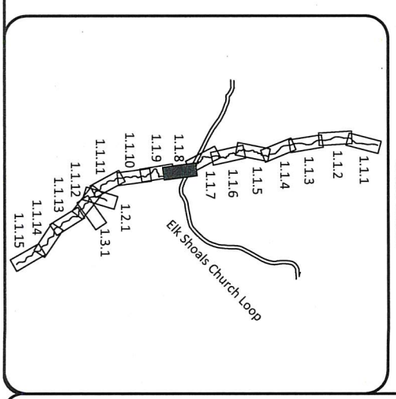
August 20, 2020





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0' 20' 40' 60' (HORIZONTAL)

0' 2' 4' 6' (VERTICAL)

Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

Revisions:

1.1.8

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Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 3
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 038361 ENGINEER ANDREW S. EARLES

8-21-20

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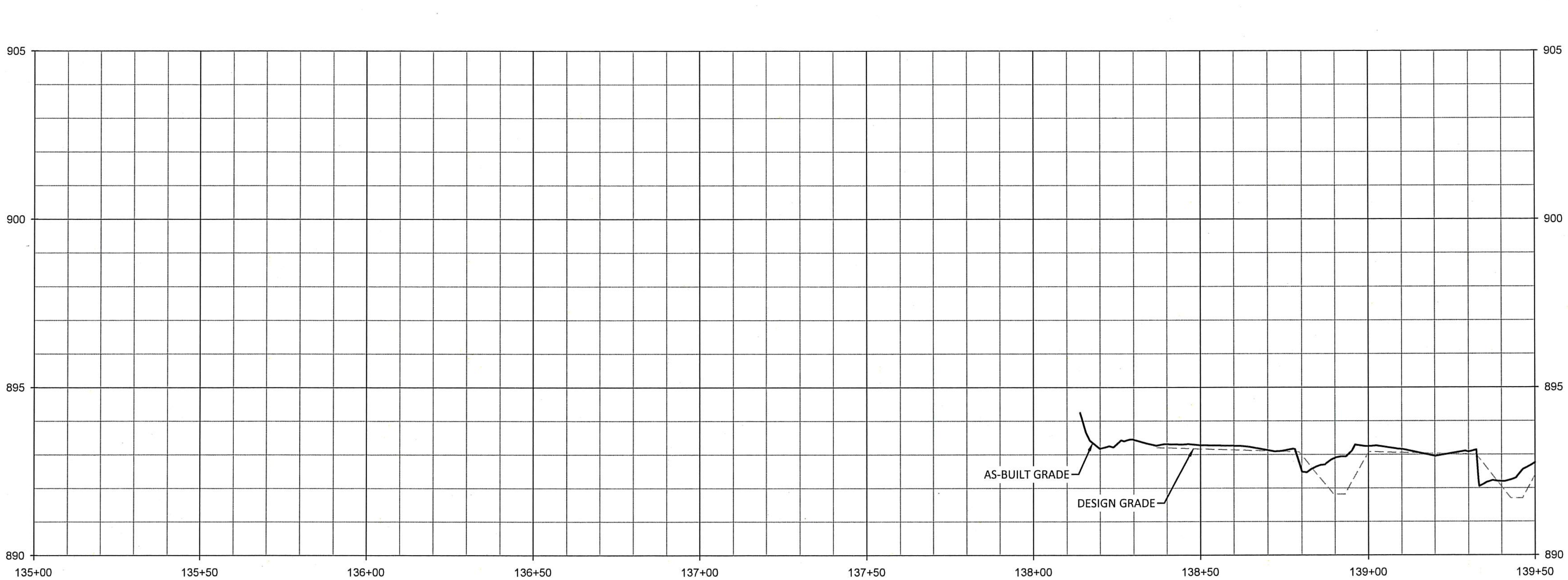

*Rock and Roll Riffles contain log sills as shown in profiles.

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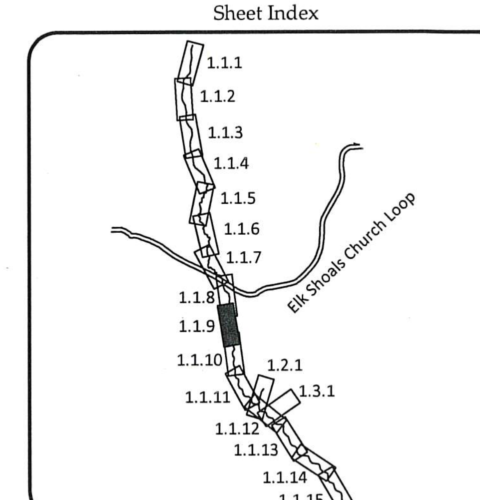

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Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

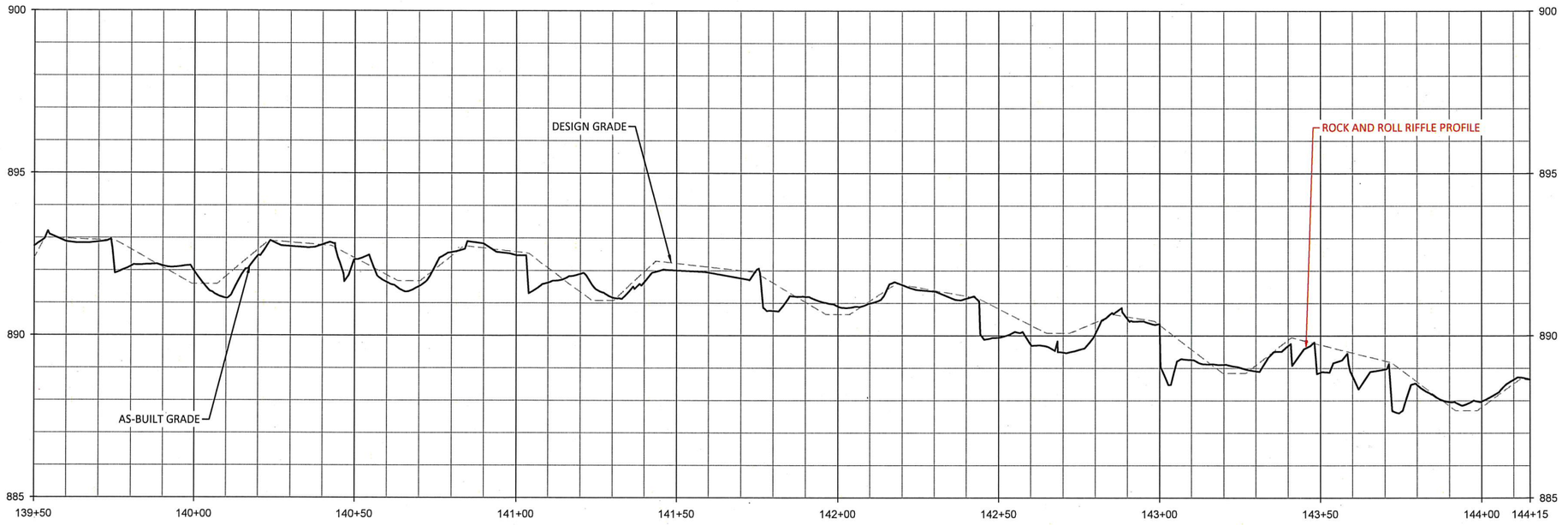
UT1 Reach 3 & 4A
Stream Plan and Profile

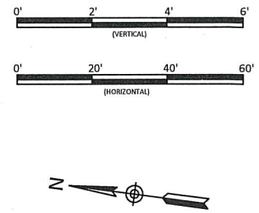
Revisions:

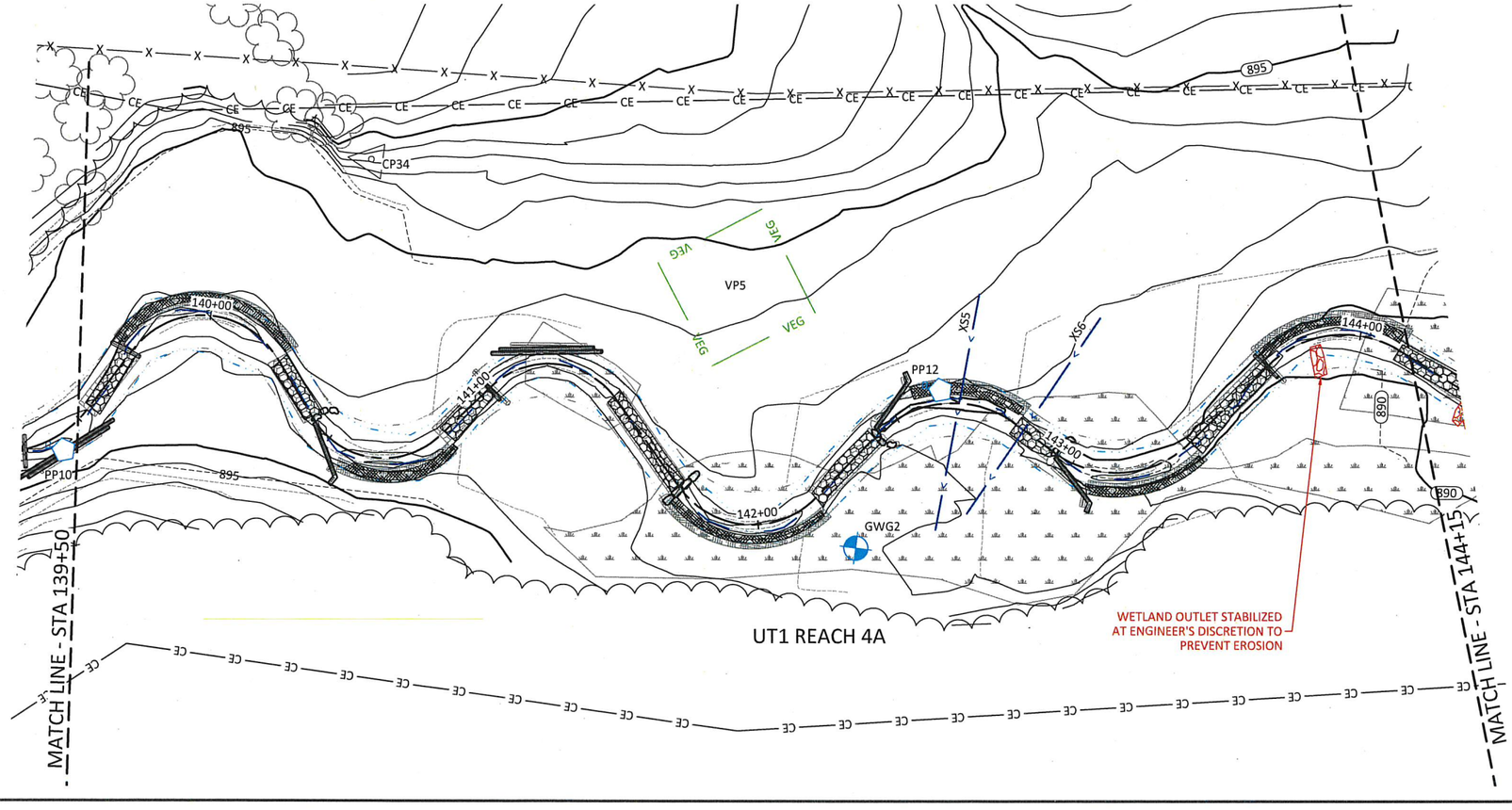
Date: 08/13/2020
Job Number: 005-02169
Project Engineer: ASE
Drawn By: HCB
Checked By: JCK

Sheet 1.1.9

August 20, 2020

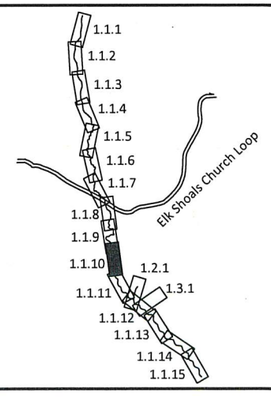






*Rock and Roll Riffles contain log sills as shown in profiles.

Sheet Index



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NORTH CAROLINA PROFESSIONAL SEAL 036442 ENGINEER AARON S. ELLIS
9-21-20

Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 4A
Stream Plan and Profile

Revisions:

Date: 08/13/2020
Job Number: 005-02169
Project Engineer: ASE
Drawn By: HCB
Checked By: JCK

Sheet 1.1.10

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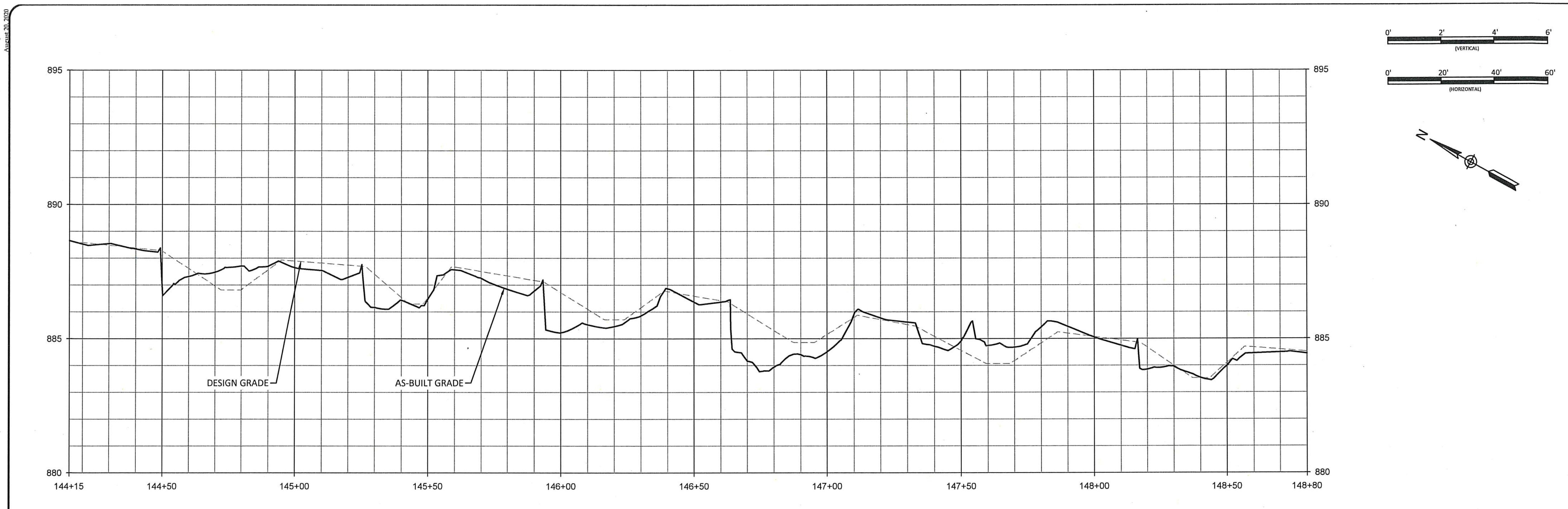

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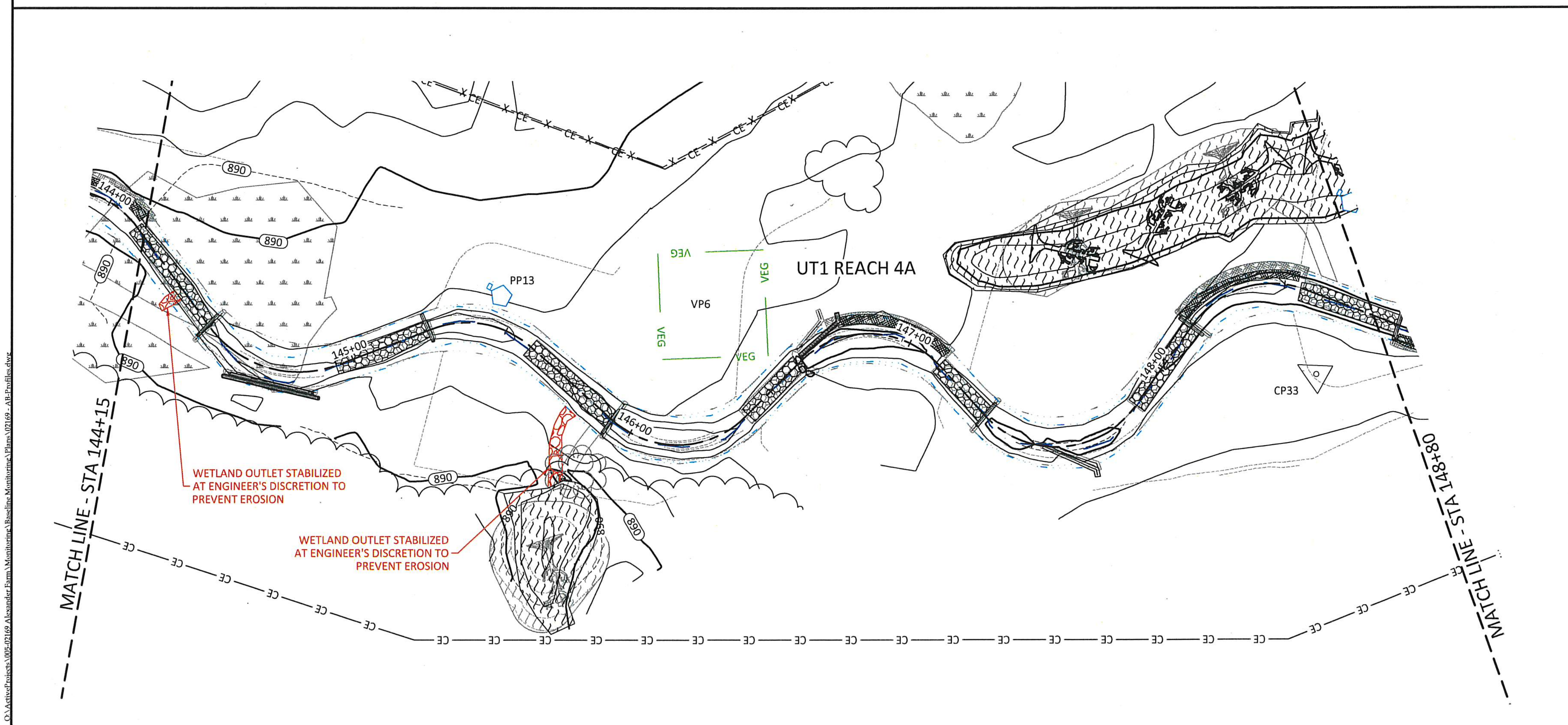

*Rock and Roll Riffles contain log sills as shown in profiles.

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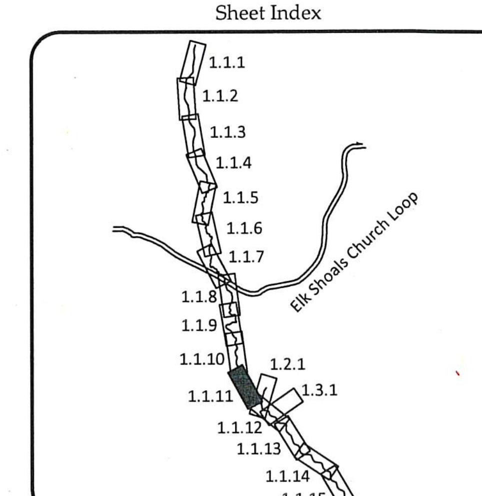

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NORTH CAROLINA PROFESSIONAL SEAL ENGINEER AARON S. EARLEY 8-21-20

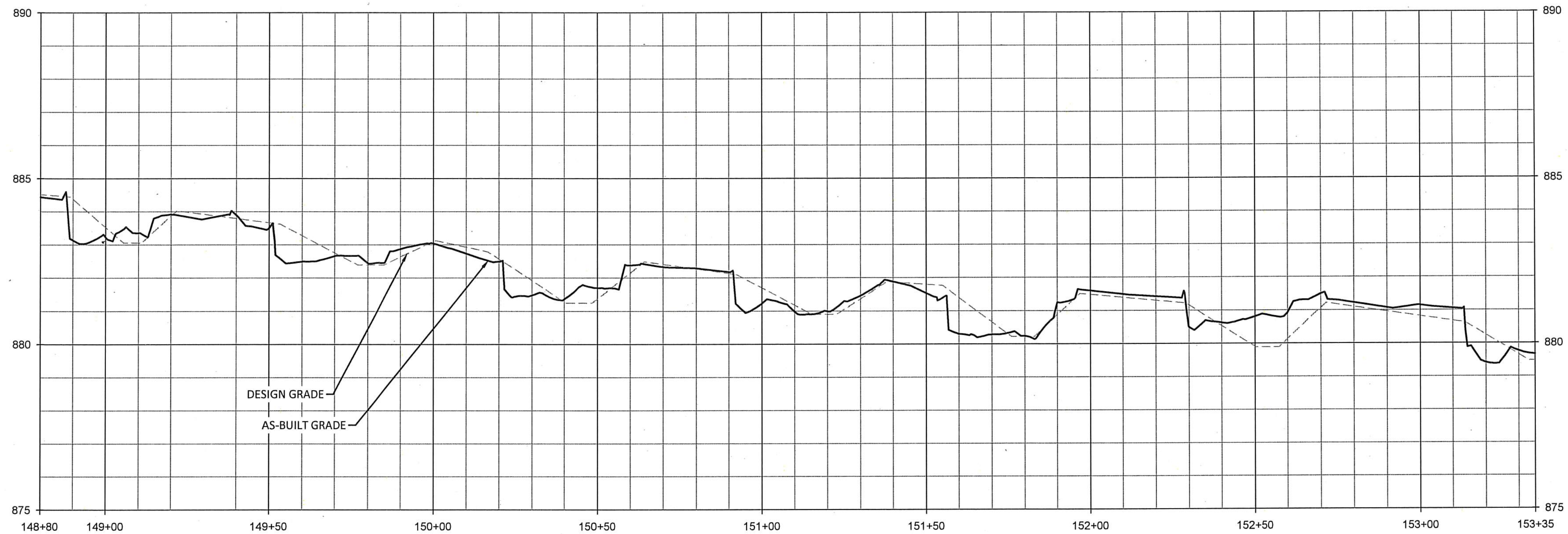
Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

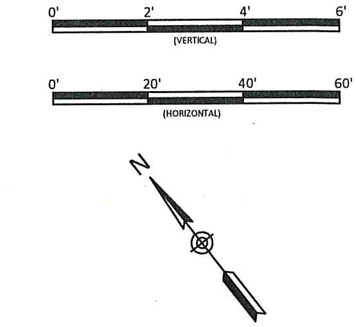
UT1 Reach 4A
Stream Plan and Profile

Revisions:

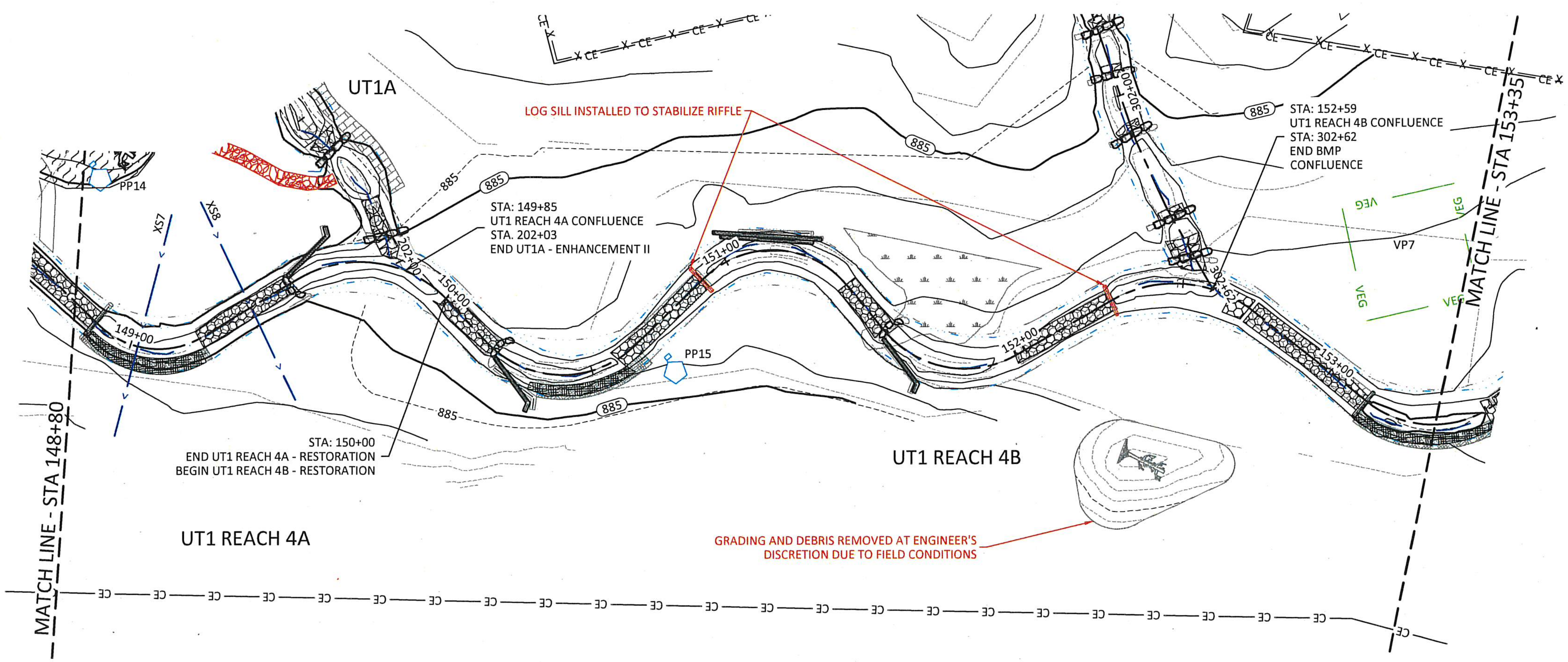
Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

Sheet 1.1.11





*Rock and Roll Riffles contain log sills as shown in profiles.



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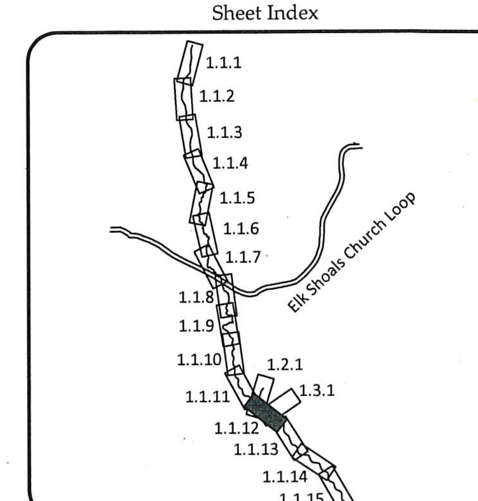

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 029350 AARON S. EARLEY
8-21-20

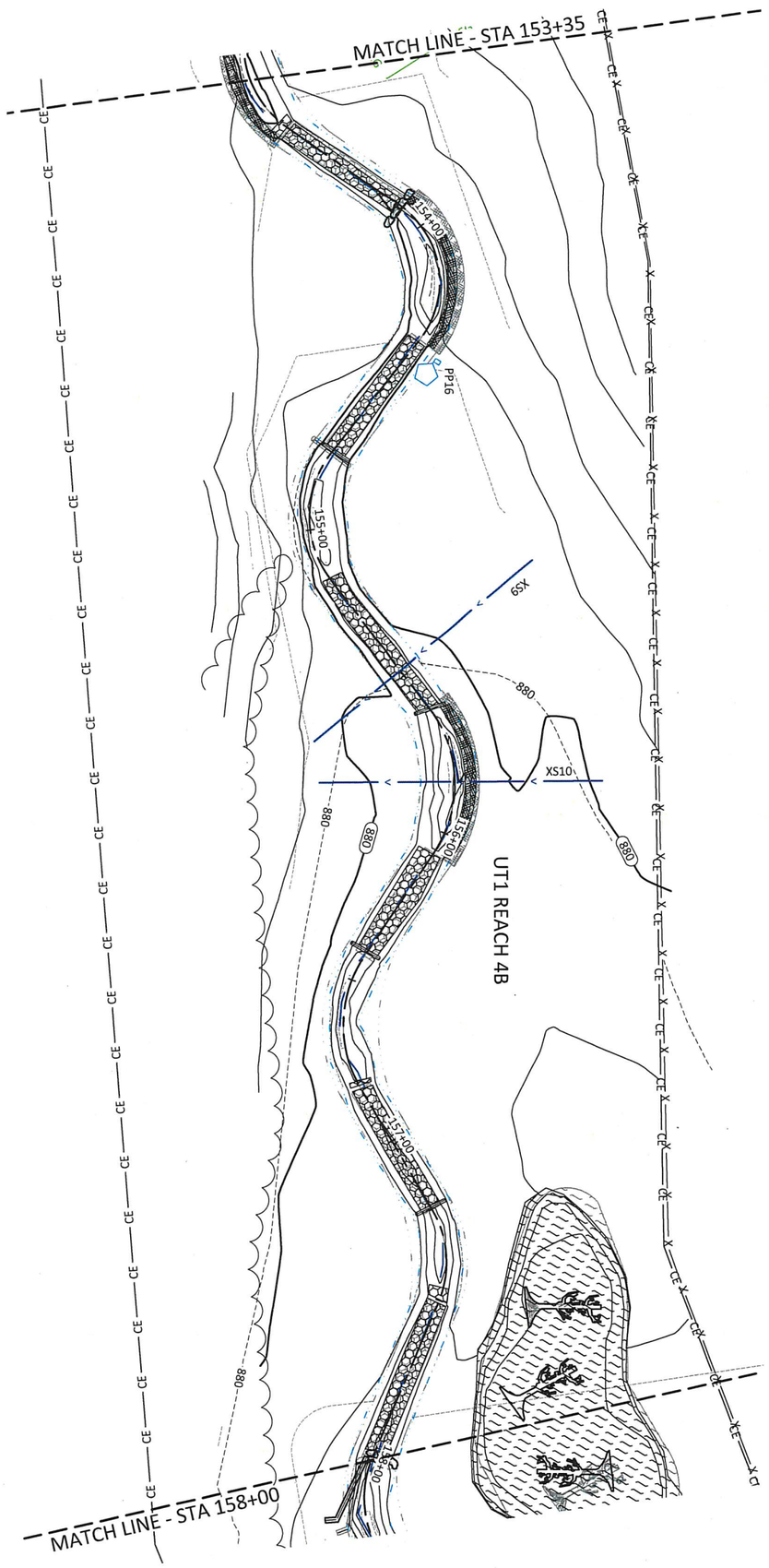
Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

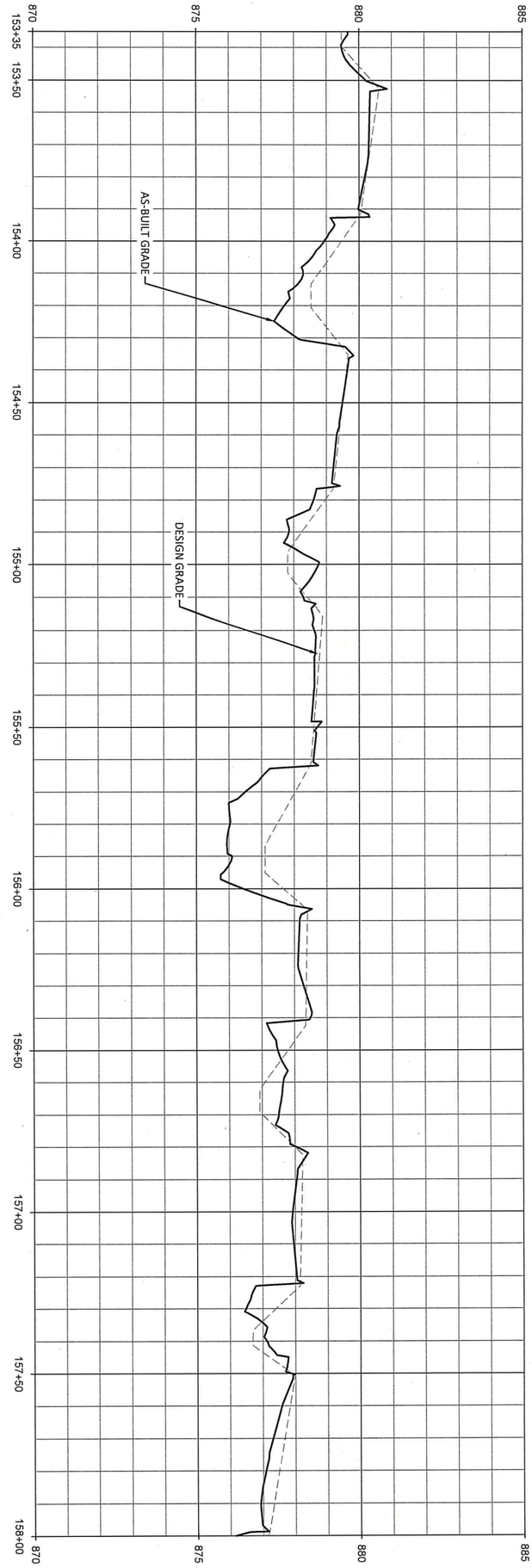
UT1 Reach 4A & 4B
Stream Plan and Profile

Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

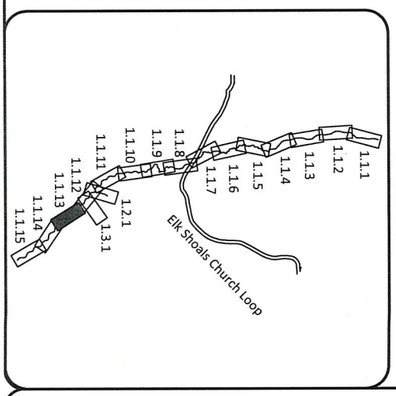
Revisions:

Sheet 1.1.12





*Rock and Roll Riffles contain log sills as shown in profiles.



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Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

Revisions:

1.1.13
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Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 4B
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 029340 ENGINEER AARON S. EARLY
4-21-20

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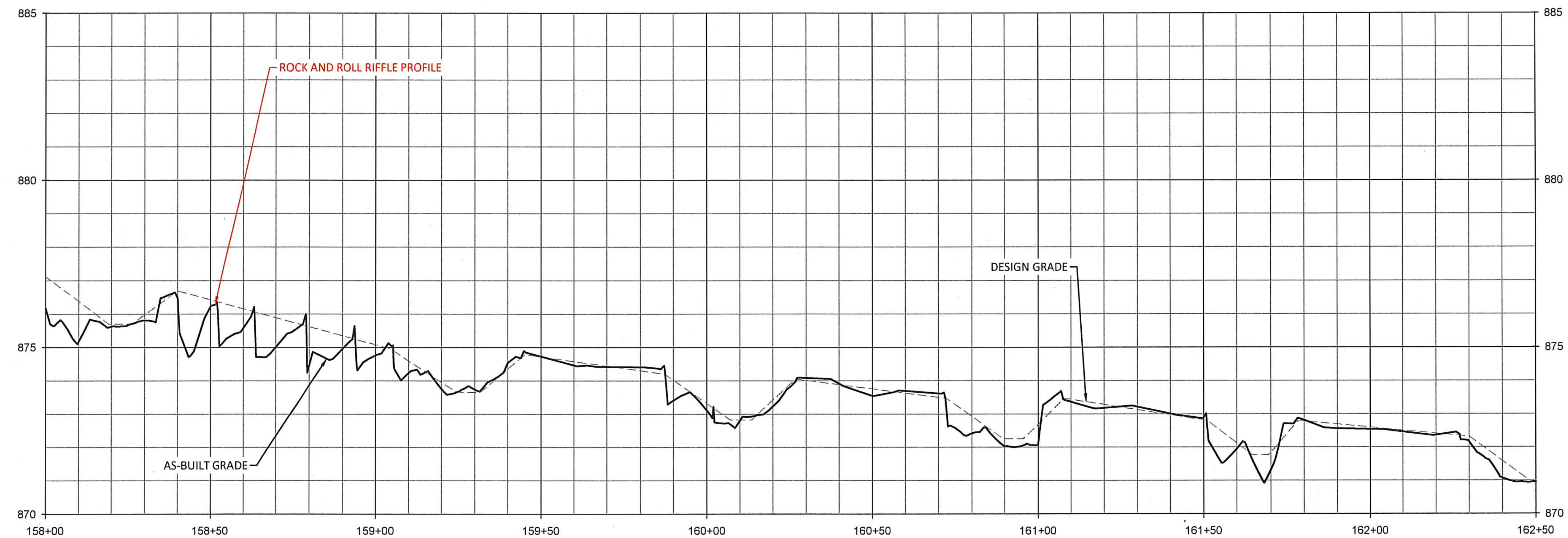

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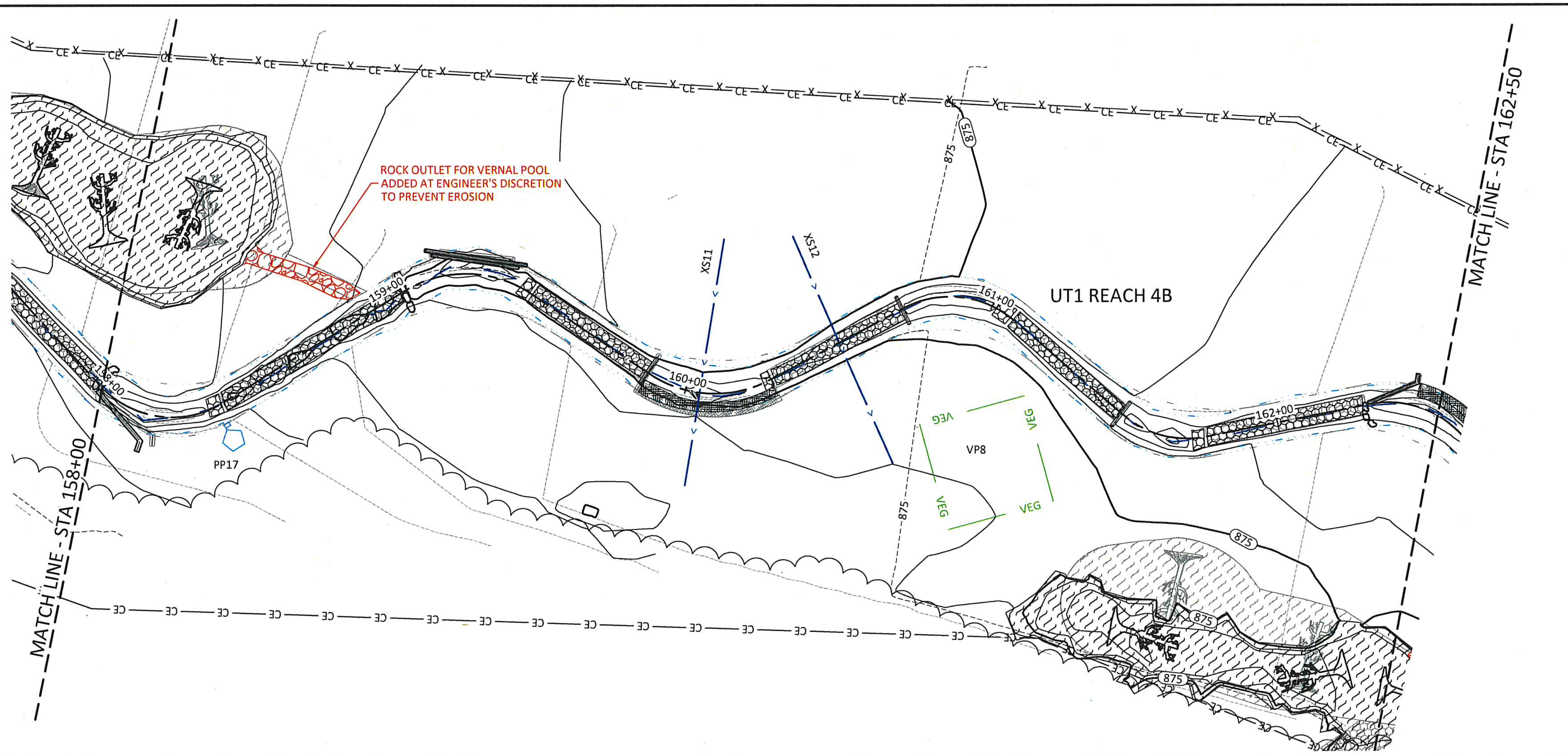
0' 20' 40' 60' (HORIZONTAL)



*Rock and Roll Riffles contain log sills as shown in profiles.

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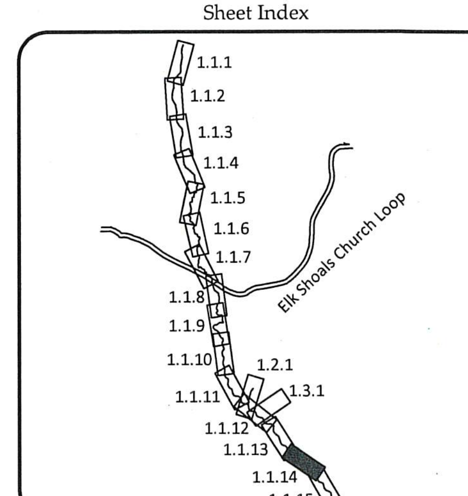

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL AARON S. EARLEY 8-21-20

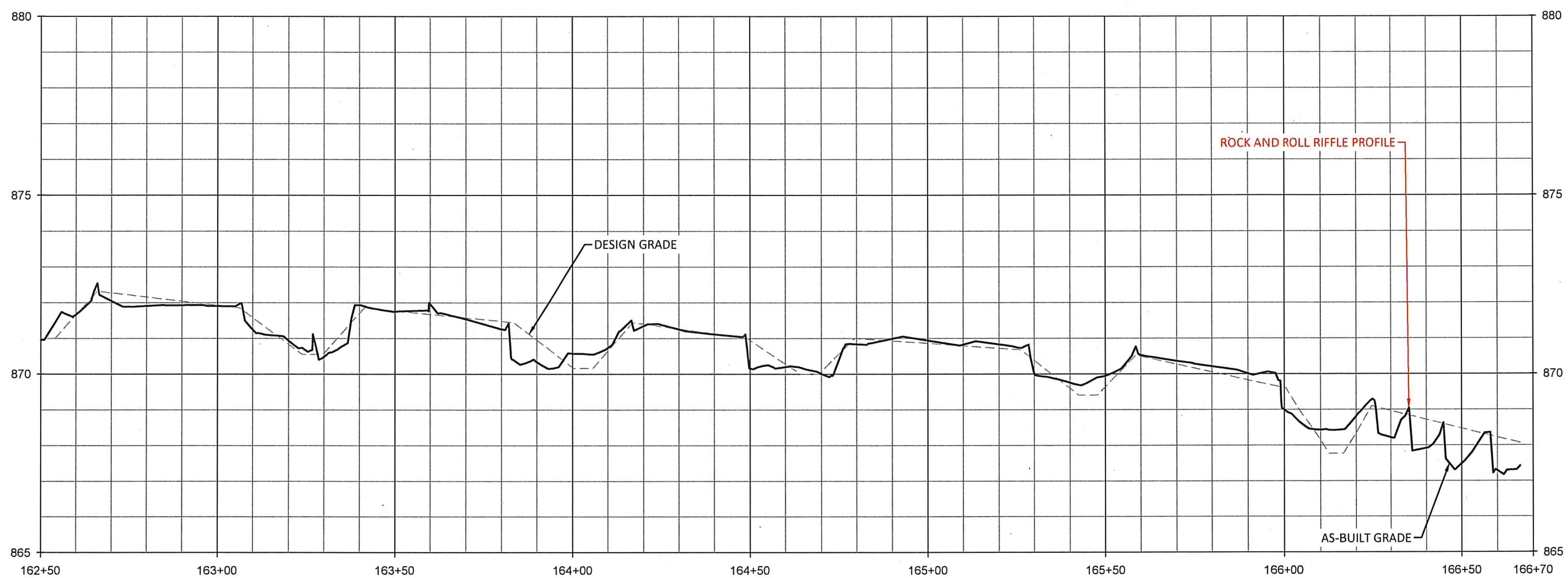
Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

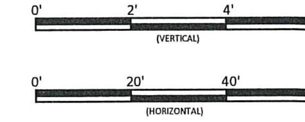
UT1 Reach 4B
Stream Plan and Profile

Revisions:

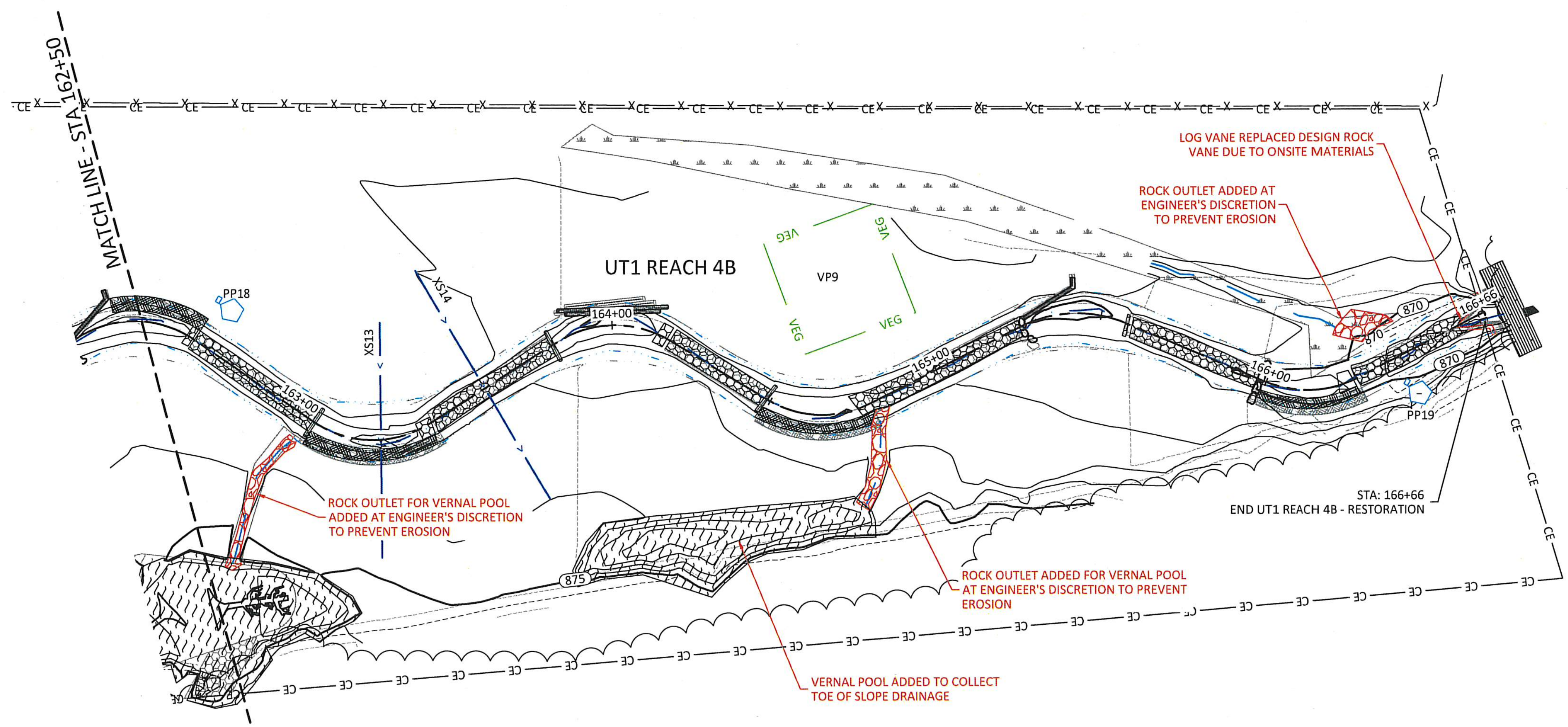
Date:	08/13/2020
Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

Sheet 1.1.14





*Rock and Roll Riffles contain log sills as shown in profiles.



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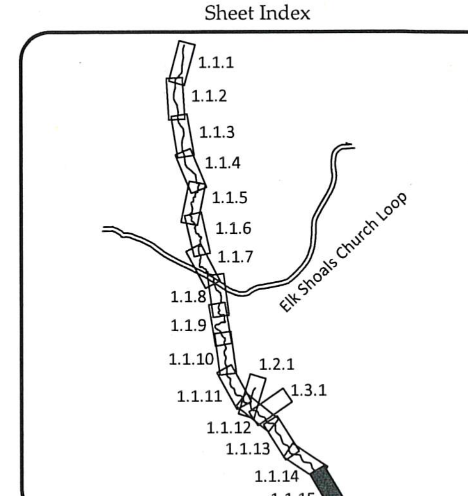

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 028340 AARON S. EARLEY
8-21-20

Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 4B
Stream Plan and Profile

Revisions:

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Job Number:	005-02169
Project Engineer:	ASE
Drawn By:	HCB
Checked By:	JCK

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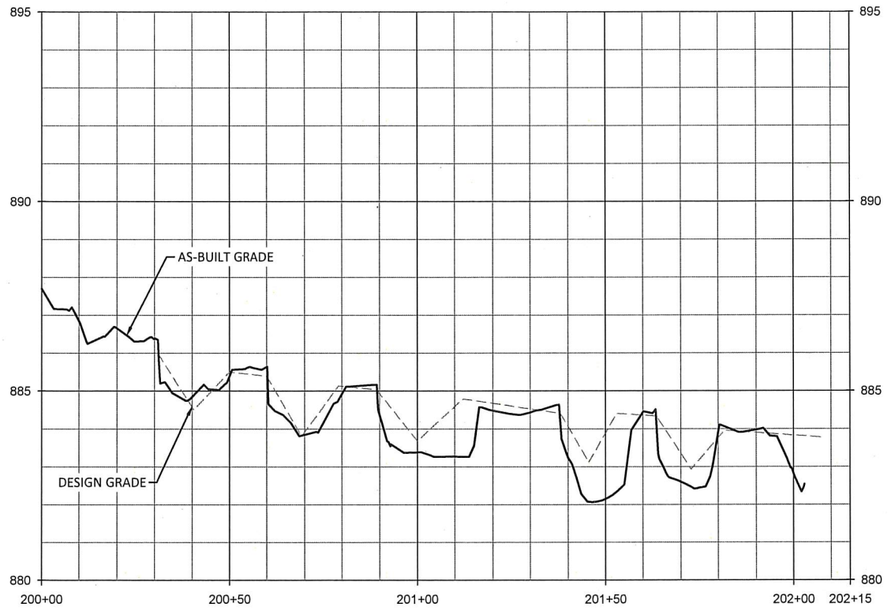
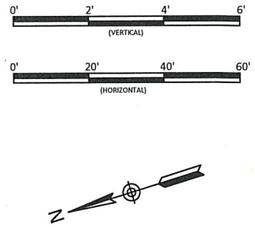
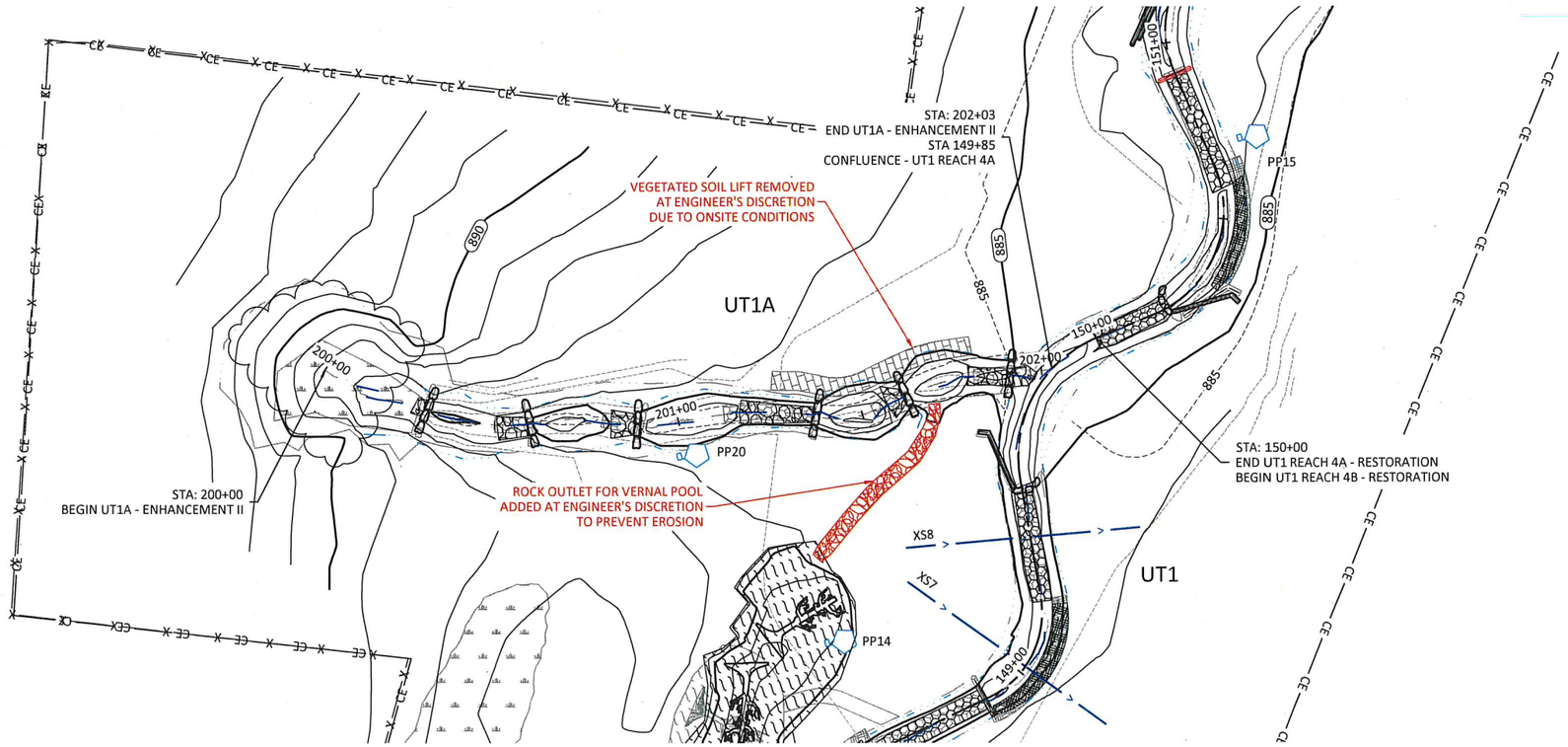
August 20, 2020







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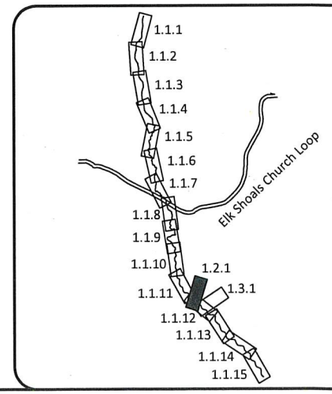

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NORTH CAROLINA PROFESSIONAL SEAL 036346 ENGINEER AARON J. ROWE
8-21-20

Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1A
Stream Plan and Profile

Revisions:

Date: 08/13/2020
Job Number: 005-02169
Project Engineer: ASE
Drawn By: HCB
Checked By: JCK

Sheet 1.2.1

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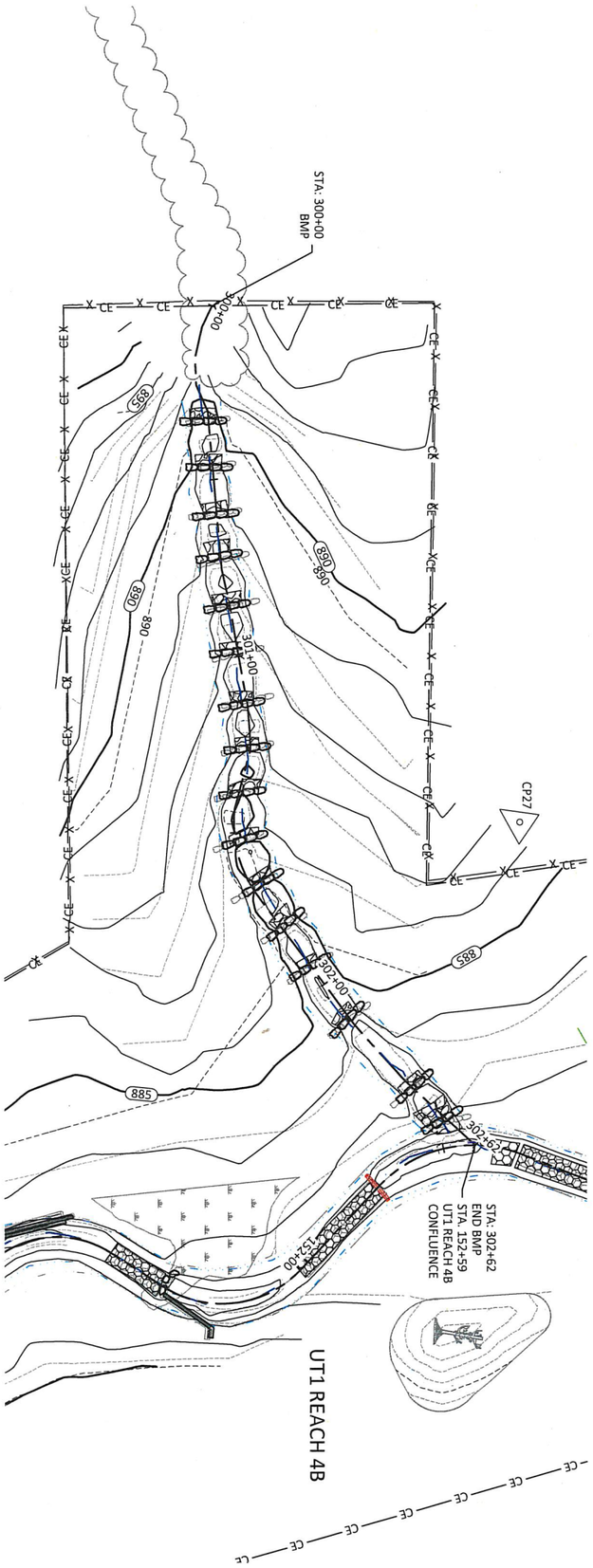

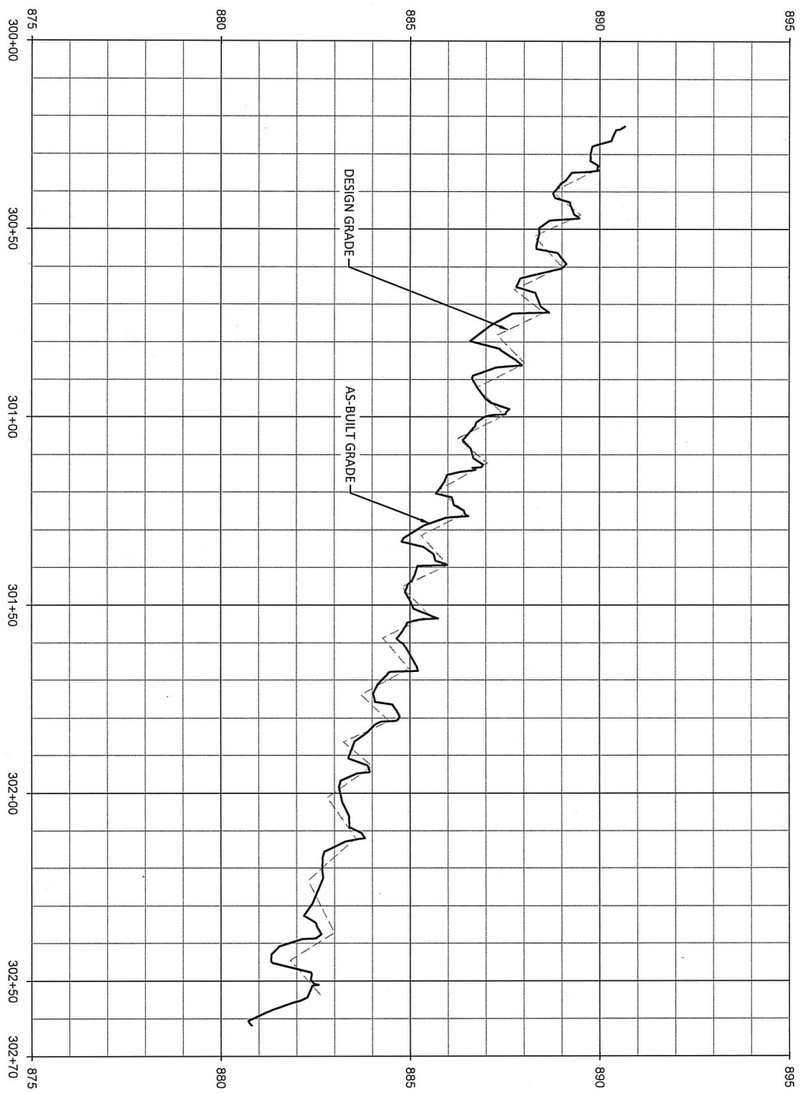

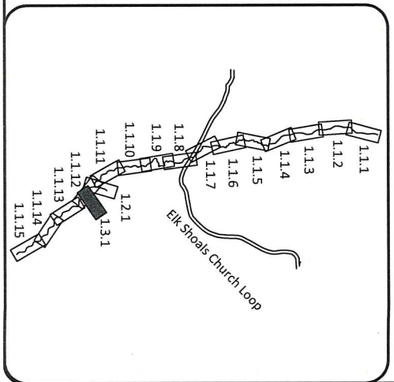

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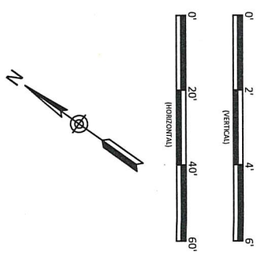

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Job Number:	005-02169
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Drawn By:	HCB
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Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

BMP
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 023402 ENGINEER AARON S. EARLY
8-21-20

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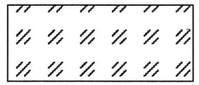
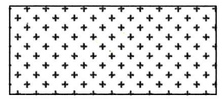
August 20, 2020

Streambank Planting Zone						
Live Stakes and Herbaceous Plugs						
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Size	Stratum	# of Stems
Physocarpus opulifolius	Ninebark	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	20%
Cornus amomum	Silky Dogwood	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	~~40%~~ 36%
Salix sericea	Silky Willow	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	~~40%~~ 44%
Juncus effusus	Common Rush	5 ft.	4-6 ft.	1.0"- 2.0" plug	Herb	N/A
Carex alata	Broadwing Sedge	5 ft.	4-6 ft.	1.0"- 2.0" plug	Herb	N/A
						100%

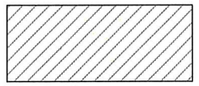
Open/Graded Buffer Planting Zone						
Bare Root						
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	# of Stems
Acer negundo	Box Elder	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
Quercus phellos	Willow Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	15%
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	15%
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	15%
Quercus pagoda	Cherrybark Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	15%
~~*Quercus michauxii*~~	~~Swamp Chestnut Oak~~	~~12 ft.~~	~~6-12 ft.~~	~~0.25"-1.0"~~	~~Canopy~~	~~20%~~
Quercus alba	White Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	13%
Quercus rubra	Northern Red Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	7%
						100%

Shaded Areas Bare Roots - Buffer Planting As Needed to Increase Density		
Species	Common name	# of stems
Platanus occidentalis	Sycamore	18%
Fraxinus pennsylvanicum	Green Ash	18%
Betula nigra	River Birch	10%
Liriodendron tulipifera	Tulip Poplar	10%
~~*Quercus michauxii*~~	~~Swamp Chestnut Oak~~	~~10%~~
Quercus alba	White Oak	10%
Carpinus caroliniana	Ironwood	~~5%~~ 6%
Diospyros virginiana	Persimmon	5%
Quercus pagoda	Cherrybark Oak	5%
Acer saccharinum	Silver Maple	5%
Nyssa sylvatica	Black Gum	~~5%~~ 7%
~~*Callicarpa americana*~~	~~Beautyberry~~	~~5%~~
~~*Euonymus americanus*~~	~~American Strawberry Bush~~	~~1%~~
~~*Calycanthus floridus*~~	~~Sweetshrub~~	~~1%~~
Magnolia virginiana	Sweetbay Magnolia	~~1%~~ 3%
Hamamelis virginiana	Witch-Hazel	~~1%~~ 3%
		100%

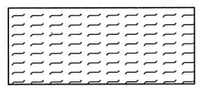




All streambank and buffer planting zones within easement.



All disturbed areas.



All disturbed pasture areas outside easement.

Permanent Riparian Seeding				
Pure Live Seed (20 lbs/ acre)				
Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	2.0
All Year	*Agrostis Hyemalis*	Winter Bentgrass	Herb	2.0
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	1.0
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	1.0
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	3.0
All Year	*Panicum clandestinum*	Deertongue	Herb	3.0
All Year	*Elymus virginicus*	Virginia Wildrye	Herb	3.0
All Year	*Bidens aristosa*	Bur-Marigold	Herb	1.2
All Year	*Helianthus angustifolius*	Swamp Sunflower	Herb	0.8
All Year	*Panicum virgatum*	Switchgrass	Herb	1.0
All Year	*Sorghastrum nutans*	Indiangrass	Herb	2.0

Temporary Seeding			
Scientific Name	Common Name	Application Dates	Application Rate
Secale cereale	*Rye Grain*	October 1 - March 31	120 lb/acre
Panicum ramosum	*Browntop Millet*	April 1 - June 30	45 lb/acre
Pennisetum glaucum	*Pearl Headed Millet*	July 1 - September 30	20 lb/acre

Pasture Seeding				
Approved Date	Species Name	Stratum	Common Name	Density (lbs/acre)
All Year	*Festuca arundinacea*	Herb	Tall Fescue	80
All Year	*Trifolium repens*	Herb	White Clover	8

Vernal Pool Planting Zone						
Herbaceous Plugs						
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Size	Stratum	# of Stems
~~Calamagrostis canadensis~~	~~*Bluejoint Grass*~~	~~5 ft.~~	~~3-5 ft.~~	~~1.0"- 2.0" plug~~	~~Herb~~	~~30%~~
~~Carex alata~~	~~*Broadwing Sedge*~~	~~5 ft.~~	~~3-5 ft.~~	~~1.0"- 2.0" plug~~	~~Herb~~	~~35%~~
Juncus effusus	*Common Rush*	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	35%
Caryx crinata	*Fringed Sedge*	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	35%
Andropogon glomeratus	*Bushy Beardgrass*	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	30%
						100%

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8-12-20

Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

Plant List
Planting Tables

Revisions:

Date: 08/13/2020
Job Number: 005-02169
Project Engineer: ASE
Drawn By: HCB
Checked By: JCK

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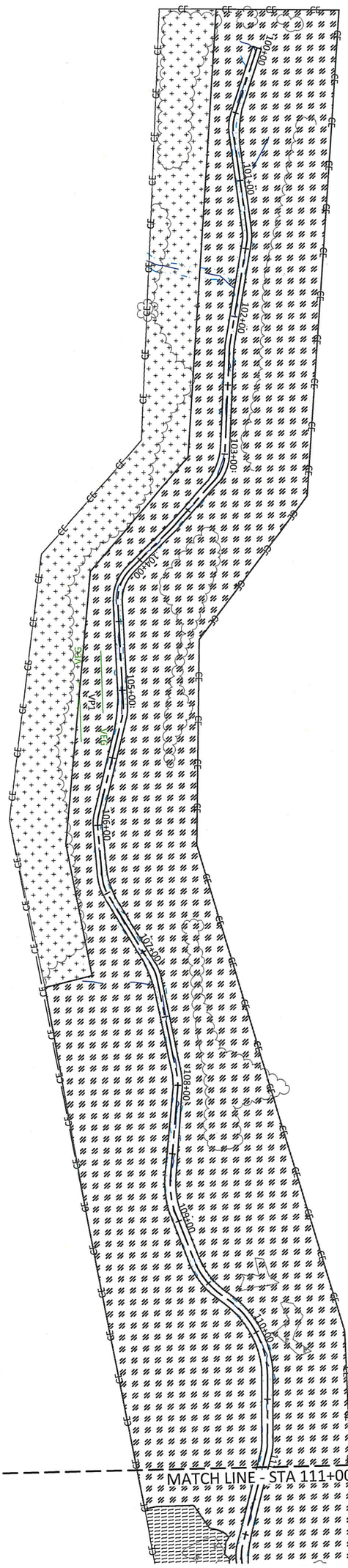

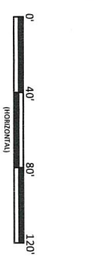

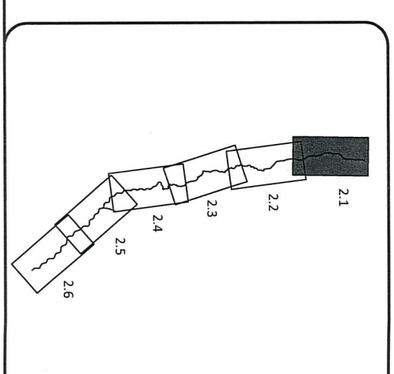

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Job Number:	005-02169
Project Engineer:	ASE
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Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 1A & 1B
Planting Plan

NORTH CAROLINA PROFESSIONAL SEAL 029348 ENGINEER JACKSON S. CARTER
8-21-20

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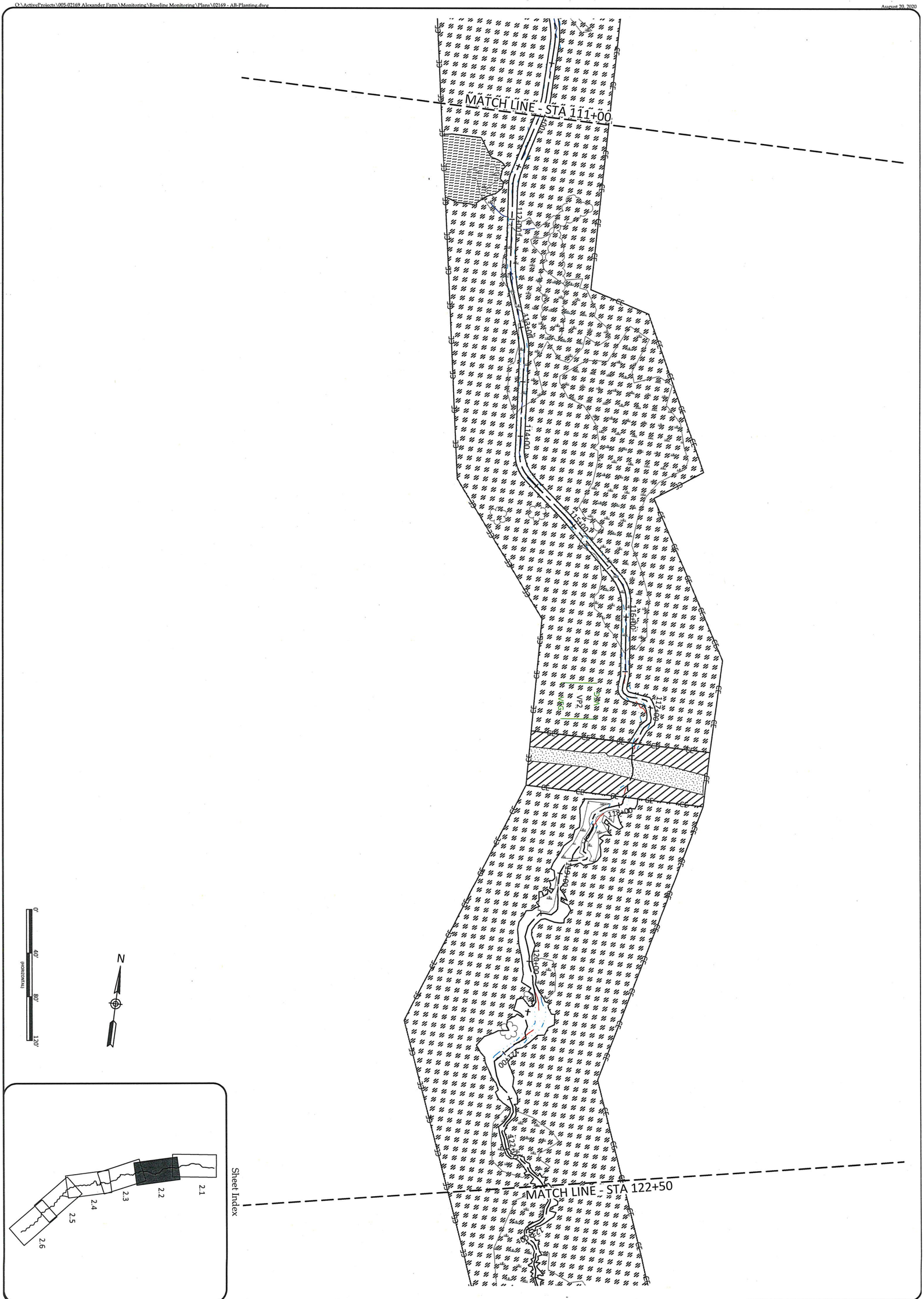

Date:	08/13/2020
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Project Engineer:	ASE
Drawn By:	HCB
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Revisions:

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Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 1B & 2
Planting Plan

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6-21-20

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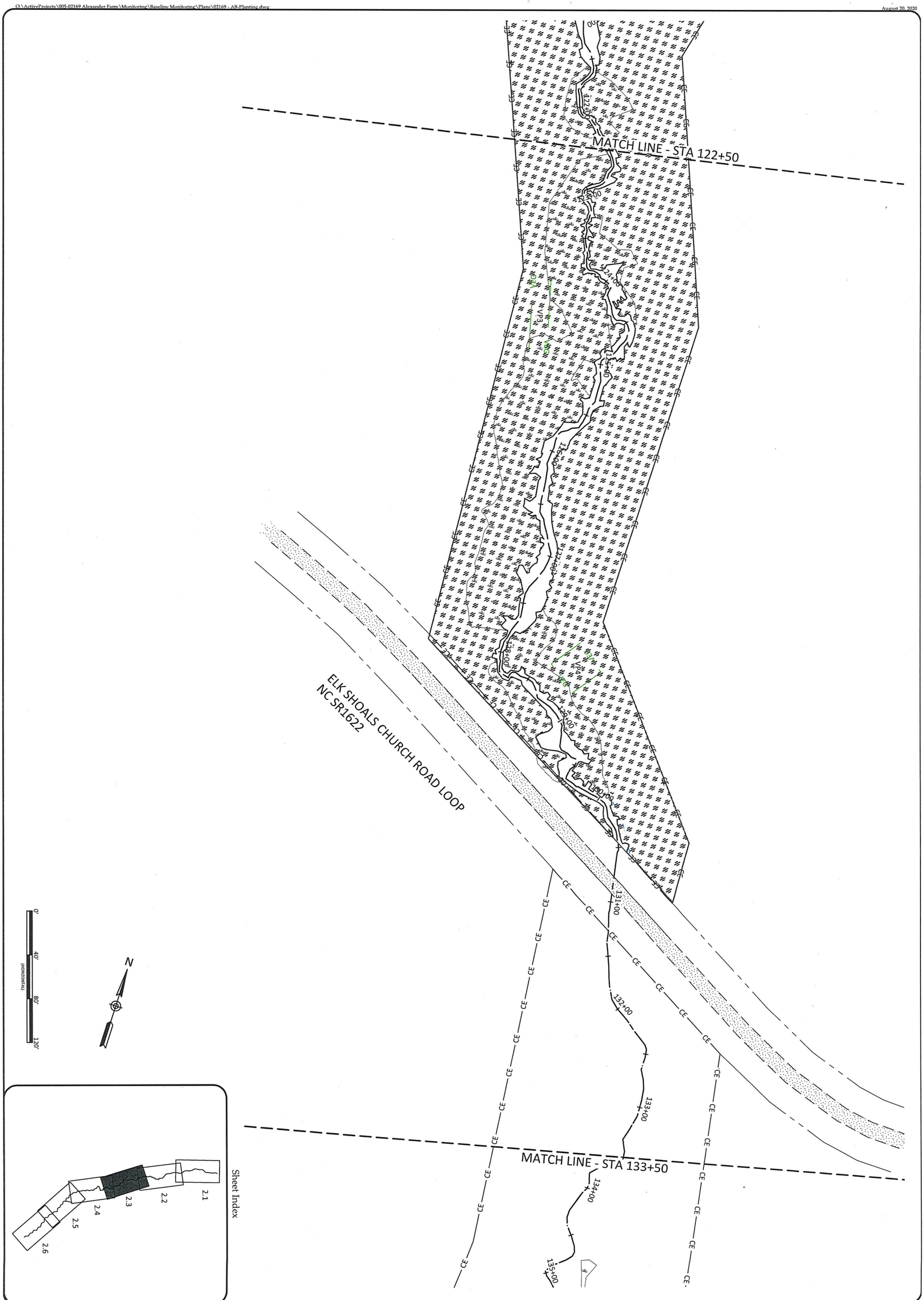

Date:	08/13/2020
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Revisions:

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Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 2 & 3
Planting Plan

NORTH CAROLINA PROFESSIONAL SEAL 029340 ENGINEER JARROW S. EARLES
8-21-20

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Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 3 & 4A
Planting Plan

NORTH CAROLINA PROFESSIONAL SEAL 042340 ENGINEER JARROW S. HARRIS
8-21-20

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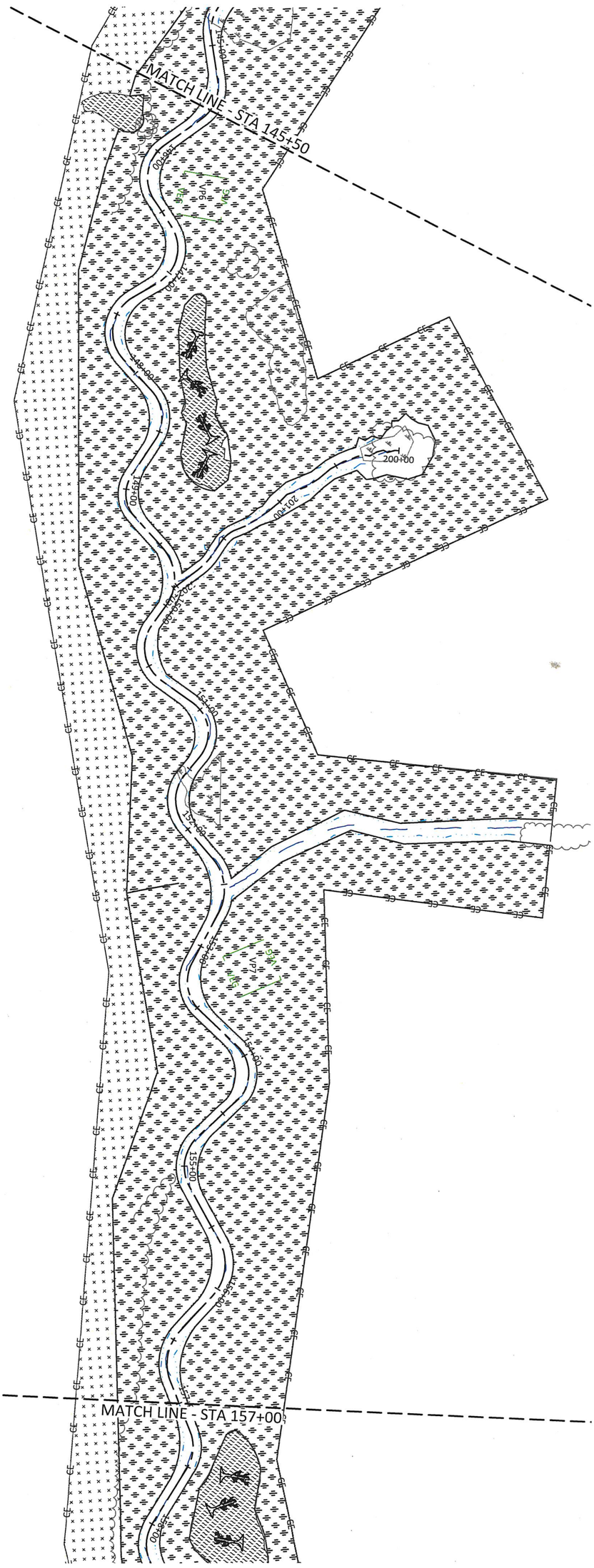

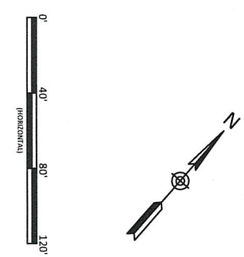

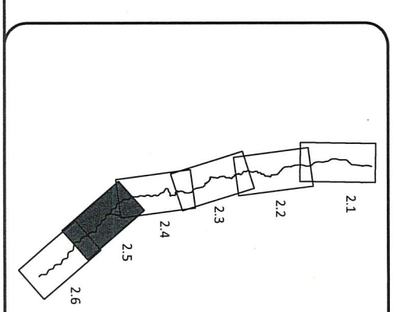

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Date:	08/13/2020
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Project Engineer:	ASE
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Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 4A 4B & UT1A
Planting Plan

NORTH CAROLINA PROFESSIONAL SEAL 009300 ENGINEER JOHN C. KLEIN
8-21-20

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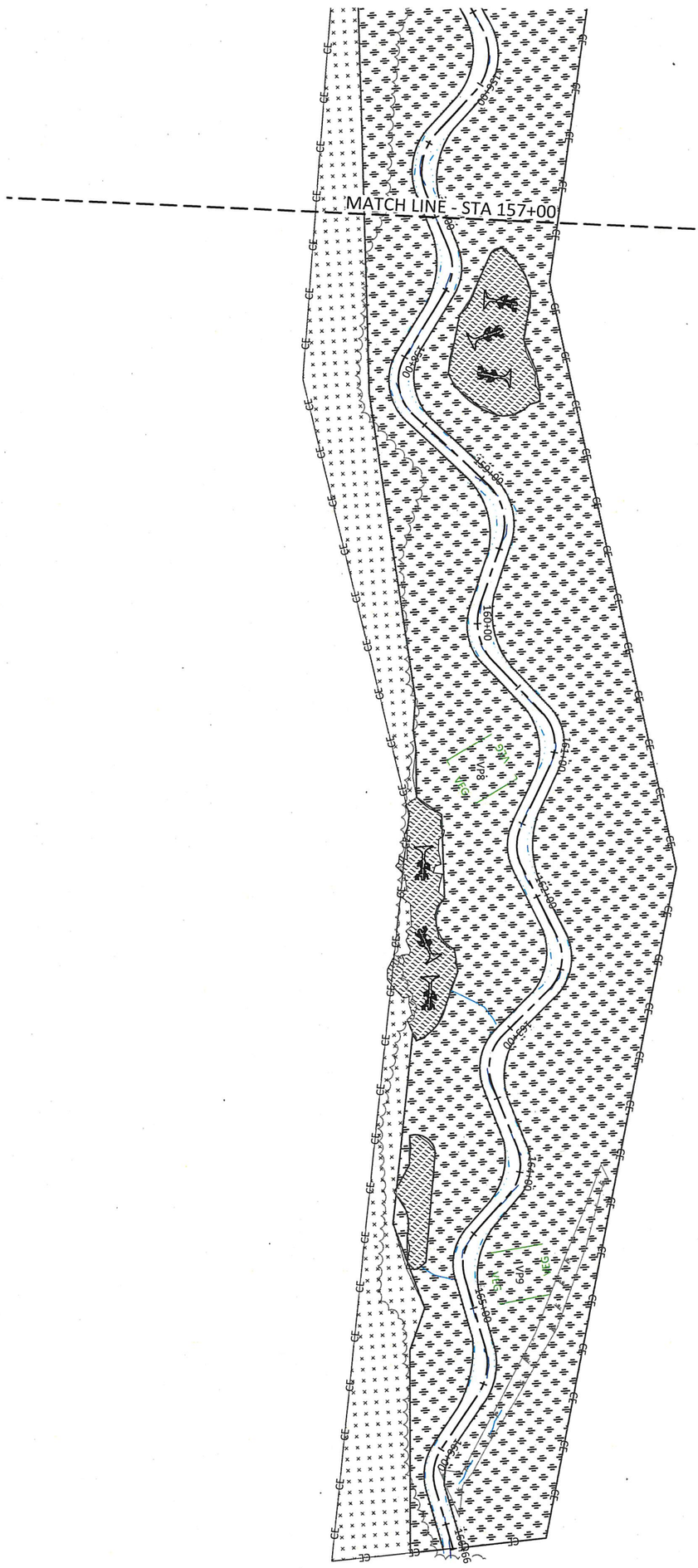
August 20, 2020



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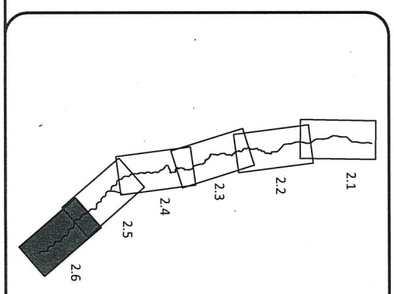

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Date: 08/13/2020
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Project Engineer: ASE
Drawn By: HCB
Checked By: JCK

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Revisions:

Alexander Farm Mitigation Site - Record Drawings
Alexander County, North Carolina

UT1 Reach 4B
Planting Plan

NORTH CAROLINA PROFESSIONAL SEAL 023340 ENGINEER JASON S. KERR
8-21-20

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