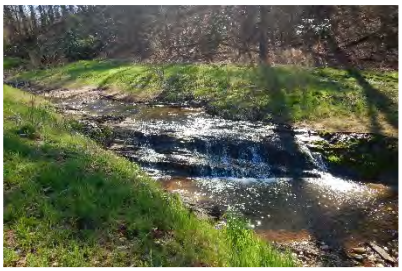

BASELINE MONITORING DOCUMENT AND AS-BUILT BASELINE REPORT

Final

LYON HILLS MITIGATION SITE

Wilkes County, NC
NCDEQ Contract No. 7620
DMS Project Number 100085
USACE Action ID Number SAW-2018-01784
NCDWR Project Number 2018-1274 v1

Yadkin River Basin
HUC 03040101

RFP Number 16-007406
June 19, 2018

Data Collection Period: January - March 2021
Draft Submission Date: June 11, 2021
Final Submission Date: July 28, 2021

PREPARED FOR:

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

PREPARED BY:

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

Jason Lorch
jlorch@wildlandseng.com
Phone: (919) 851-9986

July 28, 2021

Mr. Kelly Phillips
Project Manager
NCDEQ- Division of Mitigation Services
610 East Center Avenue, Suite 301
Mooresville, NC 28115

Subject: Draft As-Built Baseline Monitoring Report (MY0) for the
Lyon Hills Mitigation Site
Yadkin River Basin – CU# 03040101
Wilkes County
DMS Project ID No. 100085
Contract #. 7620

Dear Mr. Phillips:

On July 16, 2021, Wildlands Engineering received comments from the North Carolina Division of Mitigation Services (DMS) regarding the Draft As-Built Baseline Report dated June 11, 2021. The following letter documents DMS feedback and Wildlands' corresponding responses and revisions to the As-Built Report.

Report Cover: Add the river basin with CU#, RFP number and issuance date.

Response: River basin with CU# along with RFP and issuance date has been added.

1.3.1 Project Structure: Please check the SMU consistence between the As-Built and the Mitigation Plan to verify the correct number of SMUs.

Response: SMUs have been updated to reflect the Mitigation Plan total of 5,304.783 stream credits.

Section 5 As-Built Condition – Fencing: Please indicate the Sheets where the revised fencing layout is shown.

Response: Sheet numbers indicating fencing relocation has been added to Section 5: As-Built Condition.

Section 5.1 As-Built/Record Drawings: Log sills were substituted for boulder sills at several locations during construction. Please discuss the overall benefits/risks associated with this change.

Response: Due to more availability of material, the boulder sills were switched out for log sills depending on location. Log sills are able to be keyed into the banks further than boulder sills. However, log sills may decay over a long period of time. In our experience, log sills tend to be more stable overall than boulder sills. Based on best professional judgement, the overall benefit outweighs the negative impact logs sills may have.

Table 1 Project Credits: Project credits are established in the Mitigation Plan. The EII credits showing in the As-Built have been increase from 2,100.450 to 2,115.650 SMU. Please review the credits presented

in the two documents and insure they are consistent, utilize the appropriate credit determination and describe any deviations.

Response: SMUs have been updated to reflect the Mitigation Plan for a total of 5,304.783 stream credits. This change has also been reflected in Figure 2, Figure 3, and Figure 3b.

Appendix 2 Visual Assessment Data – Figures 3 (a through c): Please isolate the aerial base map on its own layer so it can be turned off in Adobe during review.

Response: Wildlands was not able to find a way to isolate the aerial base map in GIS. Turning off the aerial imagery.

Appendix 2 Visual Assessment Data – Site Photographs: Please include a photograph of the perched culvert along Hanks Branch.

Response: The perched culvert along Hanks Branch is included in the Culvert Crossing Photographs. There is now a callout indicating the perched culvert and a reference in the report to Appendix 2.

Digital Deliverable:

Support Files/Stream/Photos: Please add photos of the perched culvert along Hanks Branch.

Response: A photograph of the perched culvert was submitted in the Draft Digital Deliverables. It is now labeled Hanks Branch US – Perched.

Thank you for your review and providing comments on this submittal. If you have any further questions, please contact me at (919) 851-9986, or by email (jlorch@wildlandseng.com).

Sincerely,

Jason Lorch, *Monitoring Coordinator*

EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a full delivery project at the Lyon Hills Mitigation Site (Site) for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) to restore and enhance a total of 9,363 linear feet (LF) of perennial and intermittent streams in Wilkes County, NC. The Site will generate 5,304.783 stream credits. All stream lengths were measured along the stream centerline for stream credit calculations. The Site is located approximately 11 miles northwest of the Town of Elkin (Figure 1) in the Yadkin Basin 8-Digit Hydrologic Unit Code (HUC) 03040101. The Site is located within a Targeted Local Watershed (TLW) as presented in the 2009 Upper Yadkin Pee-Dee River Basin Restoration Priorities (RBRP) which highlights the importance of riparian buffers for stream restoration projects (NC EEP, 2009). The Site is located in the East Prong Roaring River 12-digit HUC (030401010600) and NC Division of Water Resources (DWR) Subbasin 03-07-01. Sparks Creek, Hanks Branch, and seven unnamed tributaries (UT1-UT5; UT3A; UT5A) are located on the Site. The downstream drainage area of the Site is 6,131 acres.

The project goals established in the Mitigation Plan (July, 2020) were completed with careful consideration of goals and objectives described in the Upper Yadkin Pee-Dee RBRP plan. The project goals include:

- Exclude cattle from project streams;
- Reconnect channels with floodplains and riparian wetlands;
- Improve water quality;
- Restore/improve riparian buffers;
- Improve instream habitat; and
- Permanently protect the Site from harmful land uses.

The project will contribute to achieving the goals for the watershed listed in the Upper Yadkin Pee-Dee RBRP and provide ecological benefits within the Yadkin Basin. While benefits such as habitat improvement and geomorphic stability are limited to the Site, others, such as reduced pollutant and sediment loading, have farther reaching effects.

Site construction and planting were completed in January and March 2021, respectively. As-built surveys for stream and vegetation were conducted between January and March 2021. No major adjustments were made during construction. Baseline (MY0) profiles and cross-section dimensions closely match the design parameters. Cross-section widths and pool depths occasionally deviate from the design parameters but fall within a normal range of variability for natural streams. The Site has been built as designed and is expected to meet the upcoming monitoring year's performance criteria.

The 20.720 acre Site is protected by a permanent conservation easement with six internal easement breaks for landowner access across the stream channels. The culvert crossing along Hanks Branch was installed on bedrock, and material below the downstream invert washed away during a major storm event after construction. The culvert is now perched but will be fixed by installing a log sill downstream to back up water into the pipe. Fencing was installed at a one-foot offset from the conservation easement and along roads within the internal easement breaks. In three specific areas noted on the as-built plan set fencing was installed just within the easement boundary. In all three locations, the fence has been moved outside the easement at the appropriate offset since the survey was completed.

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Section 1: PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Project Location and Setting

The Lyon Hills Mitigation Site (Site) is in a rural area of the Yadkin River Basin (Cataloging Unit 03040101) in Northeast Wilkes County approximately 11 miles northwest of the Town of Elkin at coordinates 36.32924 degrees N and 81.01018 degrees W (Figure 1). The Site is on an active cattle farm in the Piedmont, at the foothills of the Blue Ridge Mountains and near the break between the Piedmont and mountain physiographic regions.

The Site contains a network of streams that range in drainage area from five acres to 9.58 square miles. These include a portion of Sparks Creek, Hanks Branch (tributary to Sparks Creek), five unnamed tributaries to Hanks Branch; four of which originate within the project limits, and two unnamed tributaries to Sparks Creek. Sparks Creek and its tributaries are located within the East Prong Roaring River 12-digit HUC (030401010600). The site is within a targeted local watershed (TLW) but is not in a local watershed planning (LWP) area. The HUC is described in the 2009 Upper Yadkin Pee-Dee River Basin Restoration Priorities (RBRP) document (NC EEP, 2009). According to the RBRP, agricultural land use, including 30 animal operations, is a major stressor to aquatic resources in the lower portion of the HUC. Degraded riparian buffers are also noted as a significant stressor. Stressors described for the 8-digit CU include erosion and sedimentation (including erosion from pasture lands), which lead to aquatic habitat degradation. Turbidity and fecal coliform bacteria violations have been documented across the CU. The Site is located in DWR Subbasin 03-07-01. The 2008 Yadkin Pee-Dee River Basinwide Water Quality Plan (NC DWR, 2008) indicates that fecal coliform concentrations often exceeded the maximum regulatory limit in the CU which creates a potential health risk. The plan also notes major stressors in the Yadkin River Basin include excessive sedimentation and changes in hydrology and geomorphology due to urban development and agriculture. Agriculture was identified in the plan as the most significant stressor leading to water quality degradation in the Yadkin River basin.

The Site is located in the Blue Ridge Belt of the Piedmont physiographic province. The Blue Ridge Belt is composed of sedimentary and metamorphic rocks. The underlying geology of the Site and most of the watersheds is the Alligator Back Formation, which are Late Proterozoic aged rocks primarily consisting of gneiss and secondary geology consisting of conglomerate (NCGS, 1985). Gneiss geologic units are foliated rock formed by regional metamorphism and conglomerate geologic units are coarse-grained clastic sedimentary rock. A portion of the Sparks Creek watershed is underlain by quartz diorite to granodiorite formation of Devonian age. These rocks are igneous intrusive rocks of felsic composition.

Prior to construction activities, cattle had full access to all streams at the Site. The continual cattle access led to bank erosion, trampling of bed features, fining of substrate material, animal waste in the streams, and reduced habitat quality. Additionally, several of the tributaries to Hanks Branch had active head cuts or nick points arrested by tree roots or bedrock features indicating that vertical incision was occurring, leading to deeply entrenched channels. Hanks Branch itself had been impacted by recent high flow events, including large storms in 2018. A culvert crossing was destroyed, and bank erosion became more severe in a few isolated locations. Table 4 in Appendix 1 and Tables 7a-d in Appendix 4 present additional information on pre-restoration conditions.

1.2 Project Goals and Objectives

The project is intended to provide numerous ecological benefits within the Yadkin River Basin. While benefits such as habitat improvement and geomorphic stability are limited to the Site, reduced nutrient

and sediment loading have farther reaching effects. Table 1 below describes expected outcomes to water quality and ecological processes associated with the project goals and objectives. These goals were established and completed with careful consideration of goals and objectives described in the RBRP and to meet the DMS mitigation needs while maximizing the ecological and water quality uplift within the watershed.

Table 1: Mitigation Goals and Objectives – *Lyon Hills Mitigation Site*

Goal	Objectives	Expected Outcomes
Improve the stability of stream channels	Construct stream channels that will maintain a stable pattern and profile considering hydrologic and sediment inputs to the system; install bank revetments and grade control; install bank vegetation.	Reduce erosion and sediment inputs; maintain appropriate bed forms and sediment size distribution; support water quality and habitat goals.
Reconnect channels with floodplains and riparian wetlands	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Reduce shear stress on channel; hydrate adjacent wetland areas and vernal pools; filter pollutants out of overbank flows; provide surface storage of water on floodplain; increase groundwater recharge while reducing outflow of stormwater; support water quality and habitat goals.
Improve instream habitat	Install habitat features such as cover logs, log sills, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct a variety of riffle features and pools of varying depth. Fence out livestock.	Support biological communities and processes. Provide aquatic habitats for diverse populations of aquatic organisms.
Improve water quality	Stabilize stream banks. Plant riparian buffers with native trees. Construct BMPs to treat pasture runoff. Fence out livestock.	Reduce sediment and nutrient inputs from stream banks; reduce sediment, nutrient, and bacteria inputs from pasture runoff; keep livestock out of streams, further reducing pollutants in project streams.
Restore/improve riparian buffers	Plant native tree species in riparian zone where currently insufficient.	Provide a canopy to shade streams and reduce thermal loadings; stabilize stream banks and floodplain; support water quality and habitat goals.
Permanently protect the project site from harmful uses	Establish conservation easements on the Site.	Ensure that development and agricultural uses that would damage the site or reduce the benefits of the project are prevented.

1.3 Project Structure, Restoration Type, and Approach

The final Mitigation Plan was approved in July 2020. Construction activities were completed by Wildlands Construction in January 2021. The baseline as-built survey was completed by Kee Mapping and Surveying in February 2021. The planting was completed by Bruton Natural Systems, Inc. in March 2021. Refer to Appendix 1 for detailed Project Activity, History, Contact Information, and Watershed/Site Background Information.

1.3.1 Project Structure

The project provides 5,304.783 stream credits. Refer to Figure 2 for the Project Component / Asset Map for the stream restoration feature exhibits and Table 1 in Appendix 1 for the Project Components and Mitigation Credits for the Site.

1.3.2 Restoration Type and Approach

The design streams were restored to the appropriate type based on the surrounding landscape, climate, and natural vegetation communities but also with strong consideration to existing watershed conditions. The project consists of the stream restoration and enhancement activities as described below (Table 2) and illustrated in Figure 2.

Table 2: Restoration Type and Approach Per Reach – *Lyon Hills Mitigation Site*

Stream	Reach	Primary Stressors/Impairments	Treatment Approach	Restoration Activities
Sparks Creek	---	Cattle access	Enhancement II	Fencing out cattle, replanting buffers
Hanks Branch	Reach 1	Cattle access	Enhancement II	Localized bank repairs, creating floodplain bench at upstream end, fencing out cattle
	Reach 2	Cattle access, areas of lateral instability, lack of buffer on right floodplain	Enhancement II	Fencing out cattle, bank repairs where needed, add wood to channel, replanting buffers
	Reach 3	Channelization, incision, sparse/narrow buffers	Enhancement I	Fencing out cattle, creating floodplain bench, replanting buffers
UT1	---	Severe erosion and cattle trampling, poor buffer quality/lack of buffer	Restoration – Priority 1	Restoring dimension, pattern, and profile, replanting buffers
UT2	---	Cattle access	Enhancement II	Fencing out cattle
UT3	Reach 1	Cattle access, active head cutting and incision, bank erosion, poor buffers	Restoration – Priority 1	Restoring dimension, pattern, and profile, replanting buffers
	Reach 2	Cattle access, some incision, poor buffers	Enhancement II	Fencing out cattle, replanting buffers, localized bank repairs
	Reach 3	Cattle access, incision, bank erosion, poor buffers	Restoration – Priority 1	Restoring dimension, pattern, and profile, replanting buffers
	Reach 4	Cattle access, poor buffers	Enhancement II	Fencing out cattle, replanting buffers
UT3A	---	Cattle access, some incision, poor buffers	Enhancement II	Fencing out cattle, replanting buffers
UT4	Reach 1	Cattle access, incision, bank erosion, poor buffers	Restoration – Priority 1	Restoring dimension, pattern, and profile, replanting buffers
	Reach 2	Cattle access, some incision, poor buffers	Enhancement II	Fencing out cattle, stabilizing head cuts, replanting buffers
	Reach 3	Severe erosion and cattle trampling, poor buffer quality/lack of buffer	Restoration – Priority 1	Restoring dimension, pattern, and profile, replanting buffers
UT5	Reach 1	Cattle access, incision	Enhancement II	Fencing out cattle

Stream	Reach	Primary Stressors/Impairments	Treatment Approach	Restoration Activities
	Reach 2	Severe erosion and cattle trampling, poor buffer quality/lack of buffer, impoundment	Restoration – Priority 1	Restoring dimension, pattern, and profile, replanting buffers, removing impoundment
UT5A	---	Cattle access, incision	Enhancement II	Fencing out cattle

The design approach for this Site utilized a combination of analog and analytical approaches for stream restoration. Reference reaches were identified to serve as the basis for design parameters. Channels were sized based on design discharge hydrologic analysis. Designs were then verified and/or modified based on a sediment transport analysis. This approach has been used on many successful Piedmont restoration projects (Underwood, Foust, Holman Mill, Maney Farm, and Agony Acres Mitigation Sites) and is appropriate for the goals and objectives for this Site.

The morphologic design parameters are shown in Appendix 4, Tables 7a - 7d for the restoration reaches, and fall within the ranges specified for B4/C4b/C4 streams (Rosgen, 1996). The specific values for the design parameters were selected based on designer experience and judgment and were verified with morphologic data form reference reach data sets.

1.4 Project History, Contacts, and Attribute Data

The Site was restored by Wildlands Engineering 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 Information and Attributes.

Section 2: PERFORMANCE STANDARDS

The stream performance standards for the project will follow approved standards presented in the Wilmington District Stream and Wetland Compensatory Mitigation Updated in October 2016 by the North Carolina Interagency Review Team (NCIRT). Annual monitoring and semi-annual site visits will be conducted by qualified personnel to assess the condition of the project. Specific performance standard components are proposed for stream morphology, hydrology, and vegetation. Performance standards will be evaluated throughout the seven-year post-construction monitoring period.

2.1 Streams

2.1.1 Dimension

Riffle cross-sections on the restoration reaches should be largely stable and should only show minor changes in bankfull area, maximum depth ratio, and width-to-depth ratio. Per guidance, bank height ratios shall not exceed 1.2 for all restored streams, and entrenchment ratios shall be at least 1.4 (B channels) and 2.2 (C channels) to be considered stable. Riffle cross-sections should largely fall within the parameters defined for channels of that stream classification. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability.

2.1.2 Pattern and Profile

Visual assessments and photo documentation should indicate that streams are remaining stable and do not indicate a trend toward vertical or lateral instability.

2.1.3 Substrate

Channel substrate materials will be sampled in restoration and enhancement I reaches using the reach-wide pebble count method. Reaches should show maintenance of coarser substrate in the riffles than in the pools. Riffle cross-section pebble counts were conducted during as-built baseline monitoring and will not be conducted during annual monitoring unless observations indicate a trend toward finer substrate and a comparison is needed.

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 bars within the channel or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected.

2.1.5 Hydrology Documentation

The occurrence of bankfull events will be documented throughout the monitoring period. Four bankfull flow events must be documented within the seven-year monitoring period and individual 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.

All intermittent streams must demonstrate a minimum of 30 days of continuous flow on an annual basis during the monitoring period. A minimum of 30 days of continuous flow is targeted for UT4 Reach 1.

2.2 Vegetation

Vegetative performance for riparian buffers associated with the stream restoration component of the project (buffer widths 0 – 30ft) will be in accordance with the Stream Mitigation Guidelines issued October 2016 by the USACE and NCIRT. The success criteria is an interim survival rate of 320 planted stems per acre at the end of monitoring year three (MY3), 260 stems per acre at the end of MY5, and a final vegetation survival rate of 210 stems per acre at the end of MY7. Planted vegetation must average 10 feet in height in each plot at the end of the seventh year of monitoring. Vegetation monitoring will be conducted between July 1st and the end of the of the growing season. Individual plot data will be provided and will include height, density, vigor, damage (if any), and survival. In fixed vegetation plots, planted woody stems will be marked annually as needed and given a coordinate, based off a known origin so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living planted stems and the current year's living planted stems.

The extent of invasive species coverage will be monitored and controlled as necessary throughout the required monitoring period (MY7).

2.3 Visual Assessment

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

2.4 Schedule and Reporting

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to DMS. Based on the DMS Annual Monitoring Report Template (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;
- Monitoring Current Condition Plan View (CCPV) maps with major project elements noted such as grade control structures, vegetation plots, permanent cross-sections, and crest/flow gages;
- Photographs showing views of the restored Site taken from fixed point stations;
- Assessment of the stability of the Site based on the cross-sections;
- Vegetative data as described above including the establishment of any undesirable plant species;
- A description of damage by animals or vandalism; and
- Maintenance issues and recommended remediation measures will be detailed and documented.

Section 3: MONITORING PLAN

Monitoring will consist of collecting morphological, hydrologic, and vegetative data to assess the project performance based on the restoration goals and objectives on an annual basis until performance criteria have been met. The performance of the project will be assessed using measurements of the stream channel's dimension, substrate composition, permanent photographs, surface water hydrology, and vegetation. Any areas identified as high priority problems, such as streambank instability, aggradation/degradation, or lack of vegetation establishment will be evaluated on a case-by-case basis. The problem areas will be visually noted, and remedial actions will be discussed to determine a plan of action. A remedial action plan will be submitted if maintenance is required. The monitoring period will extend seven years beyond completion of construction or until performance criteria have been met.

3.1 Stream

Geomorphic assessments will 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 document (Rosgen, 1994 and 1996), and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al, 2003). Refer to Figure 3 in Appendix 2 and Record Drawings in Appendix 5 for monitoring locations discussed below.

3.1.1 Dimension

A total of eleven cross-sections were installed along the stream restoration and enhancement I reaches. Two cross-sections were installed per 1,000 linear feet of stream restoration work, with riffle and pool sections in proportion to IRT guidance. Each cross-section was permanently marked with pins to establish its location. Cross-section surveys include points measured at all breaks in slope; including top of bank, bankfull, edge of water, and thalweg to monitor any deviations in dimension. Annual cross-section surveys will be conducted in monitoring years MY1, MY2, MY3, MY5, and MY7. Photographs will be taken annually of the cross-sections looking upstream and downstream.

3.1.2 Pattern and Profile

Longitudinal profile surveys will not be conducted during the seven-year monitoring period unless other indicators during the annual monitoring show a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the DMS Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation (DMS, 2011) and the 2003 USACE and NCDWR Stream Mitigation Guidance for the necessary reaches. Stream pattern and profile will be assessed visually as described below in section 3.1.6.

3.1.3 Substrate

A reach-wide pebble count will be performed in seven reaches (Hanks Branch Reach 3, UT1, UT3 Reach 1 and 2, UT4 Reach 1 and 3, and UT5 Reach 2) during monitoring years 1, 2, 3, 5, and 7 for classification purposes and to show that riffles remain coarser than pools. Riffle cross-section pebble counts will only be conducted during as-built baseline monitoring unless observations indicate a trend toward finer substrate and a comparison is needed in future monitoring years.

3.1.4 Photo Reference Points

A total of 34 permanent photograph reference points were established along the stream reaches after construction. Permanent markers were established so that the same locations and view directions on the Site are photographed each year. Longitudinal stream photographs will be taken looking upstream and downstream once a year to visually document stability. Cross-sectional photos will be taken at each

permanent cross-section looking upstream and downstream. Representative digital photos of each permanent photo point will be taken on the same day the stream assessments are conducted.

3.1.5 Hydrology Documentation

Five automated crest gages were installed on Site. Crest gages were installed in or near surveyed riffle cross-sections (Hanks Branch, UT3, UT4 and UT5) or survey control points (UT1). Crest gage data will be downloaded during site visits to determine if a bankfull event has occurred since the last visit. Additionally, photographs will be collected to document the occurrence of debris lines and sediment deposition as evidence of bankfull events.

One automated flow gage was installed on UT4 Reach 1. Flow gage data will be downloaded during site visits to determine if the reach has 30 days of continuous flow.

3.1.6 Visual Assessment

Visual assessments will be performed at the Site on a semi-annual basis during the seven-year monitoring period. Problem areas will be noted such as channel instability (i.e., lateral and/or vertical instability, in-stream structure failure/instability and/or piping, or headcuts), vegetated health (i.e., low stem density, vegetation mortality, invasive species or encroachment), beaver activity, or livestock access. Areas of concern will be mapped and accompanied by a written description in the annual report. 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

Planted woody vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2006) to monitor and assess the planted woody vegetation. A total of nine standard 10 meter by 10 meter and 5 meter by 20 meter vegetation plots were established within the project easement area to monitor vegetation health across the Site.

Vegetation plots were randomly established between the conservation easement boundaries and five feet from the top of stream banks. Fixed 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 baseline monitoring in March 2021. Subsequent annual assessments following the baseline survey will capture the same reference photograph locations. Planted woody stems will be marked annually, as needed, based off a known origin so they can be found in subsequent monitoring years.

Species composition, density, and survival rates will be evaluated on an annual basis by plot and for the entire Site. Individual plot data will be provided and will include height, density, vigor, damage (if any), and survival. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems. Vegetation surveys will be conducted during monitoring years 1, 2, 3, 5, and 7.

Section 4: LAND MANAGEMENT AND CONTINGENCY PLAN

Wildlands will perform maintenance as needed at the Site. A physical inspection of the Site shall be conducted a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following construction and may include one or more of the following components.

4.1 Stream

Stream problem areas will be mapped and included in the CCPV as part of the annual stream assessment. Stream problems areas may include bank erosion, structure failure, beaver dams, aggradation/degradation, etc. Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where storm water runoff flows into the channel may also require maintenance to prevent bank failures and head-cutting.

4.2 Vegetation

Vegetation shall be maintained to ensure the health and vigor of the targeted community. Vegetative problem areas will be mapped and included in the CCPV as part of the annual vegetation assessment. Vegetation problem areas may include planted vegetation not meeting performance criteria, persistent invasive species, barren areas with little to no herbaceous cover, or grass suffocation/crowding of planted stems. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture rules and regulations.

4.3 Site Boundary

Site boundary issues will be mapped and included in the CCPV as part of the annual visual assessment. Site boundaries shall be identified in the field to ensure clear distinction between the Site and adjacent properties. Boundaries are marked with conservation easement signs. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.

Section 5: AS-BUILT CONDITION (BASELINE)

The Site construction and as-built surveys were completed in January and February 2021, respectively. The survey included developing an as-built topographic surface; as well as, surveying the as-built channel centerlines, top of banks, structures, and cross-sections.

Out of the six internal easement breaks, one culvert crossing became perched (Appendix 2 Culvert Crossing Photographs) after a major storm event. The culvert crossing along Hanks Branch was installed on bedrock, and material below the downstream invert washed away, thus creating a perched culvert. To amend the perched culvert, one log sill will be installed downstream to create backwater into the culvert.

Fencing was completed in March 2021. During survey, three areas were discovered to be installed slightly inside the conservation easement. These included a 185 linear foot section at the top of Sparks Creek, a 135 linear foot section at the top of UT5, and a 98 linear foot section along the top of UT5A. These locations can be found in Appendix 5 As-Built and Record Drawings: Sheet 4.07 and Sheet 4.17. In each of these areas, the fence has been moved to the appropriate one-foot offset outside the easement since the survey was completed. Two 95 linear foot sections of fencing along the stream crossing on Sparks Creek were not installed to comply with the landowner's request. Sparks Creek has a drainage area of 9.5 square miles and frequently floods. Fencing across Sparks Creek would catch debris and most likely fail during storm events. To avoid frequent repairs this section of fencing was not installed. Based on discussions with the landowner, gates on both sides of the Sparks Creek crossing will remain closed when not actively moving cattle. Cattle will actively be supervised when crossing Sparks Creek to prevent them from accessing the easement.

5.1 As-Built/Record Drawings

A sealed, half-size set of record drawings are located in Appendix 5 which includes the post-construction survey, alignments, structures, and monitoring features. No significant field adjustments were made during construction that differ from the design plans. Minimal adjustments were made during construction, where needed, based on field evaluation and are listed below. No deviations were made to the planting list.

5.1.1 Sparks Creek

- STA 100+98 - 101+07 – brush toe installed to increase bank stability.

5.1.2 Hanks Branch Reach 1

- STA 200+56 – rock floodplain outlet added to stabilize streambank where flow enters channel from floodplain;
- STA 201+97 - 202+44 – 40 LF realigned to stabilize channel;
- STA 202+47 rock floodplain outlet added to stabilize streambank where flow enters channel from floodplain; and
- STA 210+14 – rock floodplain outlet added to stabilize streambank where flow enters channel from floodplain.

5.1.3 Hanks Branch Reach 2

- STA 219+54 – rock vane replaced with log J-hook due to need for in-stream stability;
- STA 219+38 - 221+84 – 193 LF realigned to stabilize channel;
- STA 221+30 - 221+70 – boulder toe replaced with brush toe due to extra brush available at this location;

- STA 225+82 – floodplain outlet not installed due to adequate stability on bank; and

5.1.4 Hanks Branch Reach 3

- No deviations from design.

5.1.5 UT1

- STA 303+09 – boulder sill substituted with log sill due to extra log available;
- STA 306+40 - 306+60 – boulder toe extended to provide additional bank stability;
- STA 307+26 - 307+36 – brush toe not installed due to adequate stability; and
- STA 307+98 - 308+05 – log sill and brush toe not installed due to adequate stability.

5.1.6 UT2

- No deviations from design.

5.1.7 UT3 Reach 1

- STA 500+00 - 500+12 – sod mats installed on both banks to increase bank stability downstream of UT3 BMP;
- STA 502+05 – rock floodplain outlet added to stabilize flow from wetland; and
- STA 504+95 – rock floodplain outlet added to stabilize streambank where flow enters channel from floodplain.

5.1.8 UT3 Reach 2

- STA 506+53 - 506+77 – 21 LF realigned to stabilize channel; and
- STA 509+36 – log sill installed as grade control to increase depth of downstream pool.

5.1.9 UT3 Reach 3

- STA 511+58 and 511+66 – boulder sills substituted with log sills due to extra logs available; and
- STA 517+28 - 517+52 – 23 LF realigned to stabilize channel.

5.1.10 UT3 Reach 4

- No deviations from design.

5.1.11 UT3A

- No deviations from design.

5.1.12 UT4 Reach 1

- No deviations from design.

5.1.13 UT4 Reach 2

- No deviations from design.

5.1.14 UT4 Reach 3

- STA 607+74 – boulder sill substituted with log sill due to extra logs available; and
- STA 607+99 – boulder sill substituted with log sill due to extra logs available.

5.1.15 UT5 Reach 1

- No deviations from design.

5.1.16 UT5 Reach 2

- STA 805+90 – log sill substituted with boulder sill due to extra rock available;
- STA 806+43 – 806+53 – boulder toe substituted with brush toe due to extra brush at this location and adequate stability; and
- STA 807+51 – boulder sill substituted with log sill due to extra logs available.

5.1.17 UT5A

- No deviations from design.

5.2 Baseline Data Assessment

Baseline monitoring (MY0) was conducted between February and March 2021. The first annual monitoring assessment (MY1) will be completed in late 2021. The streams will be monitored for a total of seven years, with the final monitoring activities concluding in 2027. The close-out for the Site will be conducted in 2028 given the performance criteria have been met.

5.2.1 Morphological State of the Channel

Refer to Appendix 2 for stream photographs and Appendix 4 for summary data tables and morphological plots.

Profile

The MY0 longitudinal profiles closely match the design profile. On the design profiles, pools and riffles were depicted as straight lines with consistent slopes. The as-built surveyed profiles are not as consistent in slope due to natural deposition and scour. Pool and riffle depths and slopes are expected to be maintained near design parameter values. The variations in slope and depth do not constitute a problem or indicate a need for remedial actions and will be assessed visually during the site walks.

Dimension

The MY0 channel dimensions fall within the tolerance of specified design parameter ranges. The channels are expected to maintain dimensions of the designed Rosgen type channel (B4/C4b/C4). Summary data and cross-section plots of each project reach are included in Appendix 4.

Pattern

The MY0 pattern metrics fall within the design parameter ranges for all reaches. No major changes to design alignments were made during construction. Pattern data will be evaluated in MY5 if channel dimensions or profile indicate that significant geomorphic changes have occurred.

Sediment Transport

As-built shear stress and velocities are similar to design calculations and should reduce the risk of further erosion along the reaches. The as-built condition for each of these reaches indicates an overall increase in substrate particle size (Appendix 4). The substrate data for each constructed reach was compared to the design shear stress parameters from the mitigation plan to assess the potential for bed degradation. The shear stresses calculated for the constructed channels are within the stable range, which indicates the channel is not at risk to trend toward channel degradation.

5.2.2 Hydrology

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

5.2.3 Vegetation

The MY0 vegetation survey was completed in March 2021. The MY0 planted density is 571 stems per acre which exceeds the MY3 interim stem density requirement of 320 planted stems per acre.

Vegetation Plot photographs are included in Appendix 2 and summary data for each plot are included in Tables 6 in Appendix 3.

Section 6: REFERENCES

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

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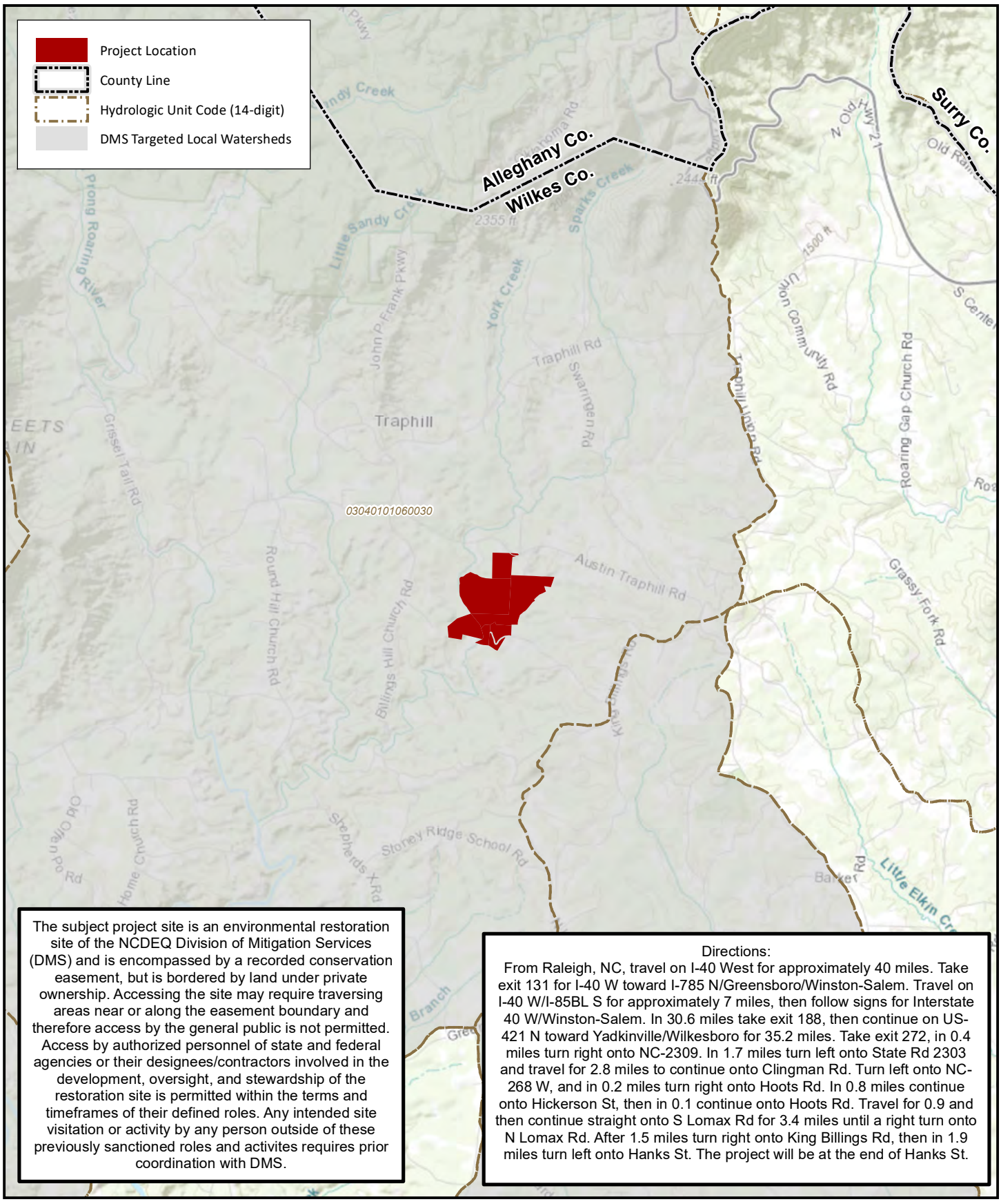
APPENDIX 1. General Figures and Tables



The subject project site is an environmental restoration site of the NCDEQ 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:
From Raleigh, NC, travel on I-40 West for approximately 40 miles. Take exit 131 for I-40 W toward I-785 N/Greensboro/Winston-Salem. Travel on I-40 W/I-85BL S for approximately 7 miles, then follow signs for Interstate 40 W/Winston-Salem. In 30.6 miles take exit 188, then continue on US-421 N toward Yadkinville/Wilkesboro for 35.2 miles. Take exit 272, in 0.4 miles turn right onto NC-2309. In 1.7 miles turn left onto State Rd 2303 and travel for 2.8 miles to continue onto Clingman Rd. Turn left onto NC-268 W, and in 0.2 miles turn right onto Hoots Rd. In 0.8 miles continue onto Hickerson St, then in 0.1 continue onto Hoots Rd. Travel for 0.9 and then continue straight onto S Lomax Rd for 3.4 miles until a right turn onto N Lomax Rd. After 1.5 miles turn right onto King Billings Rd, then in 1.9 miles turn left onto Hanks St. The project will be at the end of Hanks St.

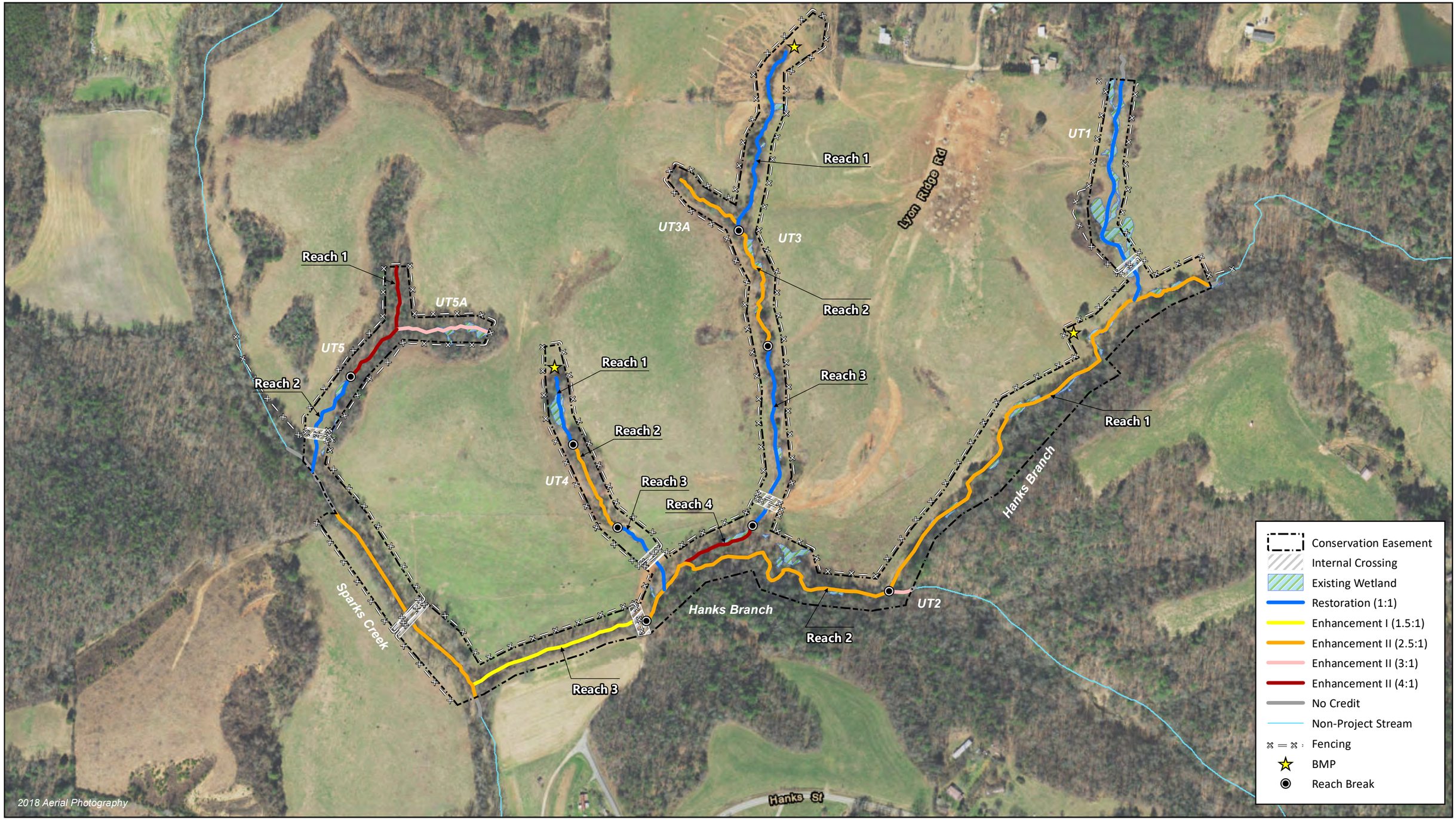
WILDLANDS ENGINEERING

0 0.5 1 Miles

N

Figure 1. Project Vicinity Map
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Wilkes County, NC



WILDLANDS ENGINEERING

0 300 600 Feet

N

Figure 2. Project Component/Asset Map
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Wilkes County, NC

Table 1. Project Components and Mitigation Credits
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

PROJECT COMPONENTS									
Reach ID	**Existing Footage**	**Mitigation Plan Footage**	**Mitigation Category**	**Restoration Level**	**Priority Level**	**Mitigation Ratio (X:1)**	**Project Credits**	**As-Built Footage**	**Comments**
STREAMS									
Spark Creek - Not For Credit	215	215	Cool	EII	N/A	2.5	0	215	No buffer on right side
Sparks Creek	405	405	Cool	EII	N/A	2.5	162.000	405	Fenced Out Cattle, Planted Buffer
Sparks Creek - Not For Credit	42	42	Cool	EII	N/A	2.5	0	42	Ford Crossing
Sparks Creek	332	332	Cool	EII	N/A	2.5	132.800	332	Fenced Out Cattle, Planted Buffer
Hanks Branch Reach 1	1,678	1,678	Cool	EII	N/A	2.5	671.200	1,659	Localized Bank Repairs, Floodplain Bench at Upstream End, Fenced Out Cattle
Hanks Branch Reach 2	1,083	1,065	Cool	EII	N/A	2.5	426.000	1,012	Fenced Out Cattle, Localized Bank Repairs, Planted Buffer, Add Wood to Channel
Hanks Branch Reach 2 - Not for Credit	42	42	Cool	EII	N/A	2.5	0	42	Culvert Crossing
Hanks Branch Reach 3	581	581	Cool	EI	PII	1.5	387.333	585	Fenced Out Cattle, Floodplain Bench, Planted Buffer
UT1 - Not for Credit	60	60	Cool	R	PI	1	0	57	TCE to work above property line
UT1	717	659	Cool	R	PI	1	659.000	657	Restored Dimension, Pattern, and Profile, Planted Buffer
UT1 - Not for Credit	42	40	Cool	R	PI	1	0	40	Culvert Crossing
UT1	110	106	Cool	R	PI	1	106.000	105	Restored Dimension, Pattern, and Profile, Planted Buffer
UT2	78	78	Cool	EII	N/A	3	26.000	78	Fenced Out Cattle
UT3 Reach 1	702	655	Cool	R	PI	1	655.000	652	Restored Dimension, Pattern, and Profile, Planted Buffer
UT3 Reach 2	447	447	Cool	EII	N/A	2.5	178.800	436	Fenced Out Cattle, Localized Bank Repairs, Planted Buffer
UT3 Reach 3	560	513	Cool	R	PI	1	513.000	512	Restored Dimension, Pattern, and Profile, Planted Buffer
UT3 Reach 3 - Not for Credit	47	45	Cool	R	PI	1	0	45	Culvert Crossing
UT3 Reach 3	84	74	Cool	R	PI	1	74.000	74	Restored Dimension, Pattern, and Profile, Planted Buffer
UT3 Reach 4	272	272	Cool	EII	N/A	4	68.000	271	Fenced Out Cattle, Planted Buffer
UT3A	253	253	Cool	EII	N/A	2.5	101.200	252	Fenced Out Cattle, Planted Buffer
UT4 Reach 1	237	233	Cool	R	PI	1	233.000	233	Restored Dimension, Pattern, and Profile, Planted Buffer
UT4 Reach 2	323	323	Cool	EII	N/A	2.5	129.200	319	Fenced Out Cattle, Stabilize Headcuts, Planted Buffer
UT4 Reach 3	138	140	Cool	R	PI	1	140.000	139	Restored Dimension, Pattern, and Profile, Planted Buffer
UT4 Reach 3 - Not for Credit	42	40	Cool	R	PI	1	0	40	Culvert Crossing
UT4 Reach 3	96	100	Cool	R	PI	1	100.000	100	Restored Dimension, Pattern, and Profile, Planted Buffer
UT5 Reach 1	437	437	Cool	EII	N/A	4	109.250	437	Fenced Out Cattle
UT5 Reach 2	207	220	Cool	R	PI	1	220.000	221	Restored Dimension, Pattern, and Profile, Planted Buffer, Removed Impoundment
UT5 Reach 2 - Not For Credit	36	35	Cool	R	PI	1	0	35	Culvert Crossing
UT5 Reach 2	113	107	Cool	R	PI	1	107.000	107	Restored Dimension, Pattern, and Profile, Planted Buffer
UT5A	318	318	Cool	EII	N/A	3	106.000	318	Fenced Out Cattle

PROJECT CREDITS							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Riparian Wetland**	**Coastal Marsh**
	Warm	**Cool**	**Cold**	**Riverine**	**Non-Riverine**		
Restoration		2,807.000					
Enhancement I		387.333					
Enhancement II		2,110.450					
Preservation							
Re-Establishment							
Rehabilitation							
Enhancement							
Creation							
Totals		**5,304.783**					

Table 2. Project Activity and Reporting History

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Activity or Report		Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan		July 2020	July 2020
Final Design - Construction Plans		August 2020	August 2020
Construction		January 2021	January 2021
Temporary S&E mix applied to entire project area [1]		February 2021	February 2021
Permanent seed mix applied to reach/segments [1]		February 2021	February 2021
Bare root and live stake plantings for reach/segments		March 2021	March 2021
Baseline Monitoring Document (Year 0)	Stream Survey	February 2021	June 2021
	Vegetation Survey	March 2021	
Year 1 Monitoring	Stream Survey	2021	December 2021
	Vegetation Survey	2021	
Year 2 Monitoring	Stream Survey	2022	December 2022
	Vegetation Survey	2022	
Year 3 Monitoring	Stream Survey	2023	December 2023
	Vegetation Survey	2023	
Year 4 Monitoring			December 2024
Year 5 Monitoring	Stream Survey	2025	December 2025
	Vegetation Survey	2025	
Year 6 Monitoring			December 2026
Year 7 Monitoring	Stream Survey	2027	December 2027
	Vegetation Survey	2027	

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

Table 3. Project Contact Table

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Designer Nicole Macaluso Millns, PE	**Wildlands Engineering, Inc.** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986
Construction Contractor	**Wildlands Construction** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**Wildlands Contruction** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609
Seed Mix Sources	**Garrett Wildflower Seed Company**
Nursery Stock Suppliers Bare Roots	**Dykes and Sons Nursery and Greenhouse**
Live Stakes	**Bruton Natural Systems, Inc**
Monitoring Performers Monitoring, POC	**Wildlands Engineering, Inc.** Jason Lorch 919.851.9986

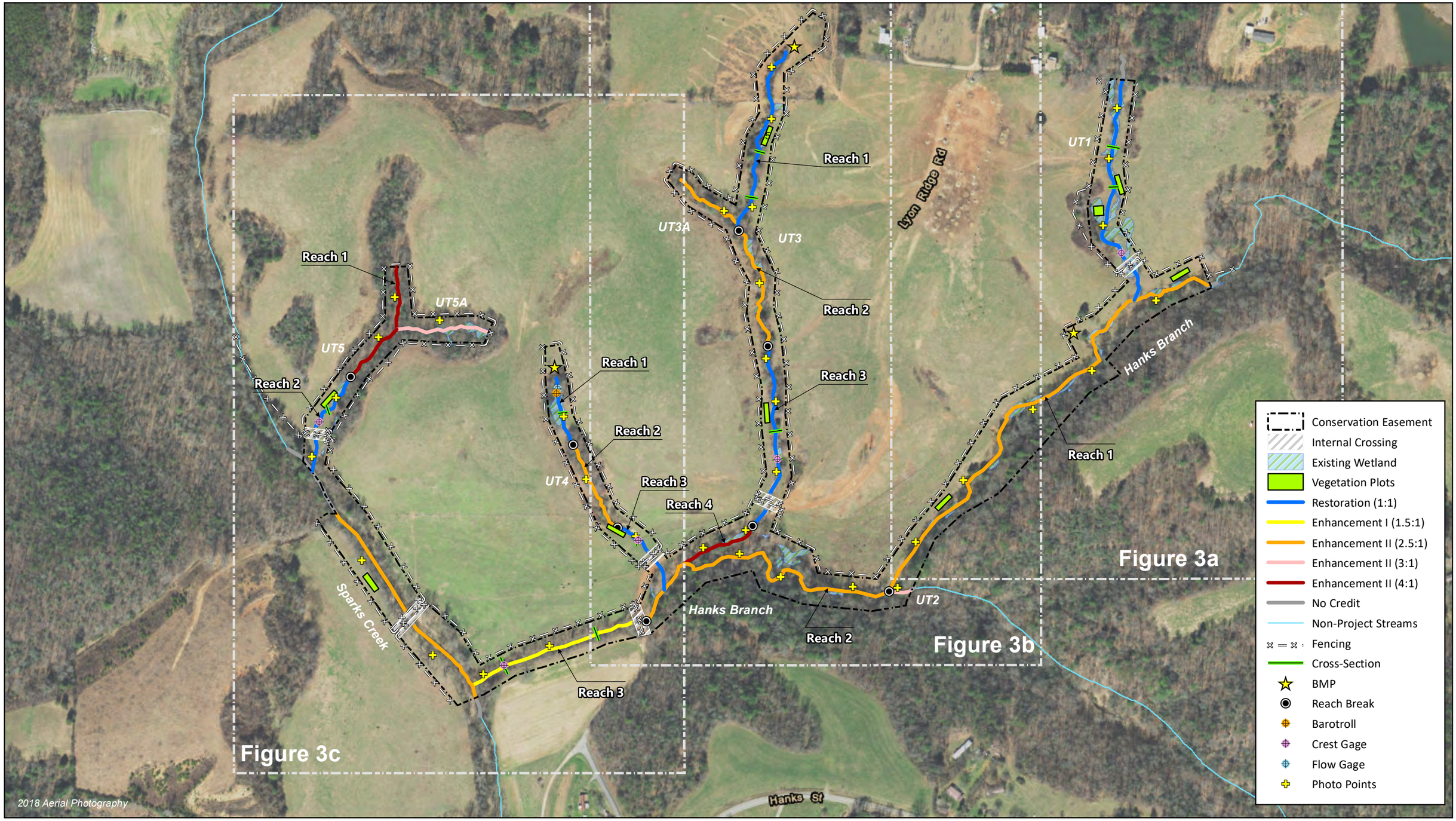
Table 4. Project Information and Attributes
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

PROJECT INFORMATION									
Project Name	Lyon Hills Mitigation Site								
County	Wilkes County								
Project Area (acres)	20.720								
Planted (acres)	10.800								
Project Coordinates (latitude and longitude)	36.32924° N, 81.01018° W								
PROJECT WATERSHED SUMMARY INFORMATION									
Physiographic Province	Piedmont								
River Basin	Yadkin								
USGS Hydrologic Unit 8-digit	03040101								
USGS Hydrologic Unit 14-digit	03040101060030								
DWR Sub-basin	03-07-01								
Project Drainiage Area (acres)	6,131								
Project Drainage Area Percentage of Impervious Area	<1%								
CGIA Land Use Classification	66% forested, 22% agriculture, 2% herbaceous/grassland, 6%developed, 4%shrub/scrub								
REACH SUMMARY INFORMATION									
Parameters	**Sparks Creek**	**Hanks Branch**	**UT1**	**UT2**	**UT3**	**UT3A**	**UT4**	**UT5**	**UT5A**
Length of Reach (linear feet) - Post-Restoration	994	3,298	802	78	1,990	252	831	800	318
Drainage Area (acres)	6,131	669	37	231	46	5	12	13	5
NCDWR Stream Identification Score	42.5	41.5	40.75	34.5	36	31.5	30.5	35.5	30.5
NCDWR Water Quality Classification	C								
Morphological Desription (stream type)	Perennial								
Evolutionary Trend (Simon's Model) - Pre-Restoration	I Premodified				IV Degradation and Widening				
Underlying Mapped Soils	Codorus loam, Dan River Comus Soils, Danripple sandy clay loam, Fairview sand loam and Fairview sandy clay loam, Rhodhiss fine sand loam								
Drainage Class	-								
Soil Hydric Status	-								
Slope	-								
FEMA Classification	AE	X							
Native Vegetation Community	Piedmont/Low Mountain Alluvial Forest								
Percent Composition Exotic Invasive Vegetation - Post-Restoration	0%								
REGULATORY CONSIDERATIONS									
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**						
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No. 27 and DWQ 401 Water Quality Certification No. 4134.						
Waters of the United States - Section 401	Yes	Yes							
Division of Land Quality (Dam Safety)	N/A	N/A	N/A						
Endangered Species Act	Yes	Yes	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 (CAMA)	N/A	N/A	N/A						
FEMA Floodplain Compliance	Yes	Yes	Floodplain Development Permit was obtained from Wilkes County						
Essential Fisheries Habitat	N/A	N/A	N/A						

Table 5. Monitoring Component Summary
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Parameter	Monitoring Feature	Quantity / Length by Reach					Frequency
		Hanks Branch Reach 3	UT1	UT3 Reach 1 & 3	UT4 Reach 1 & 3	UT5 Reach 2	
Dimension	Riffle Cross-Sections	1	1	2	2	1	Year 1, 2, 3, 5, and 7
	Pool Cross-Sections	1	1	2	N/A	N/A	Year 1, 2, 3, 5, and 7
Pattern	Pattern	N/A					Year 0 (Unless Required)
Profile	Longitudinal Profile						
Substrate	Reach Wide Pebble Count	1	1	2	2	1	Year 1, 2, 3, 5, and 7
Hydrology	Transducer: Crest Gauge (CG) or Flow Gauge (FG)	1 CG	1 CG	1 CG	1 CG, 1 FG	1 CG	Semi- Annual
Vegetation	CVS Level 2 Vegetation Plots	9					Year 1, 2, 3, 5, and 7
Visual Assessment		Yes					Semi-Annual
Exotic and Nuisance Vegetation							Semi-Annual
Project Boundary							Semi- Annual
Reference Photos	Photographs	34					Annual

APPENDIX 2. Visual Assessment Data



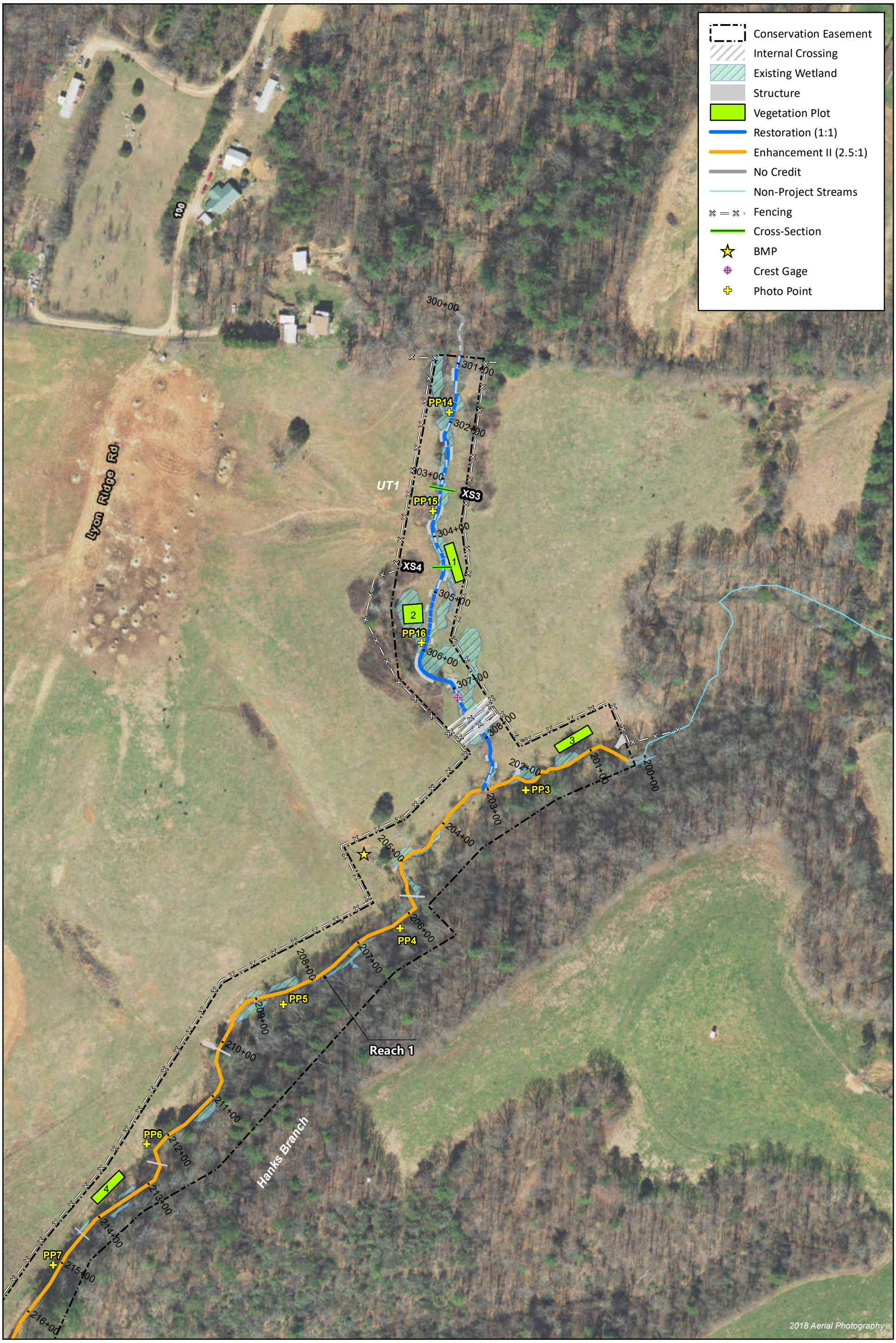
WILDLANDS ENGINEERING

0 300 600 Feet

N

Figure 3. Monitoring Plan View Key
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 -2021

Wilkes County, NC



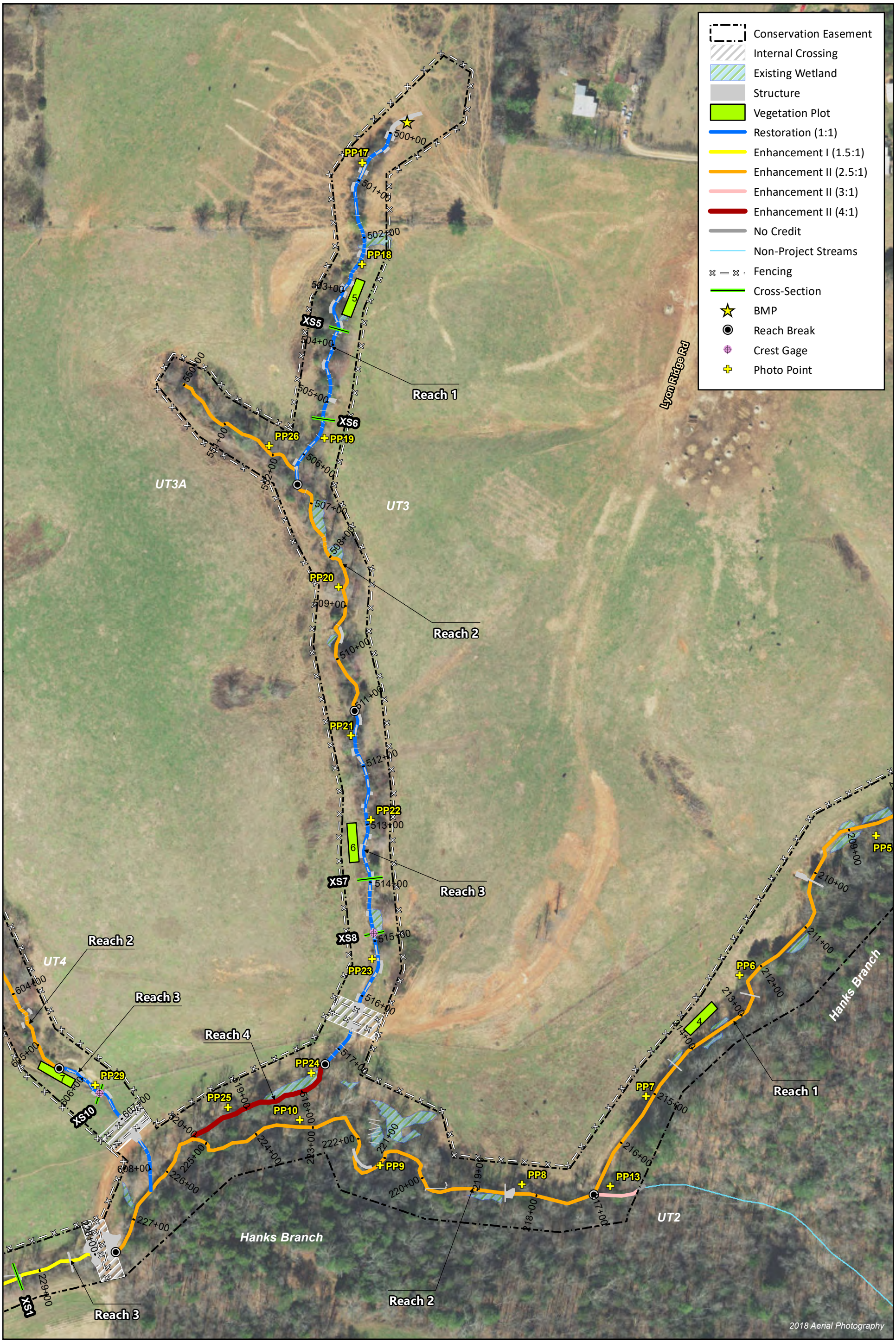
WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3a. Monitoring Plan View
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Wilkes County, NC



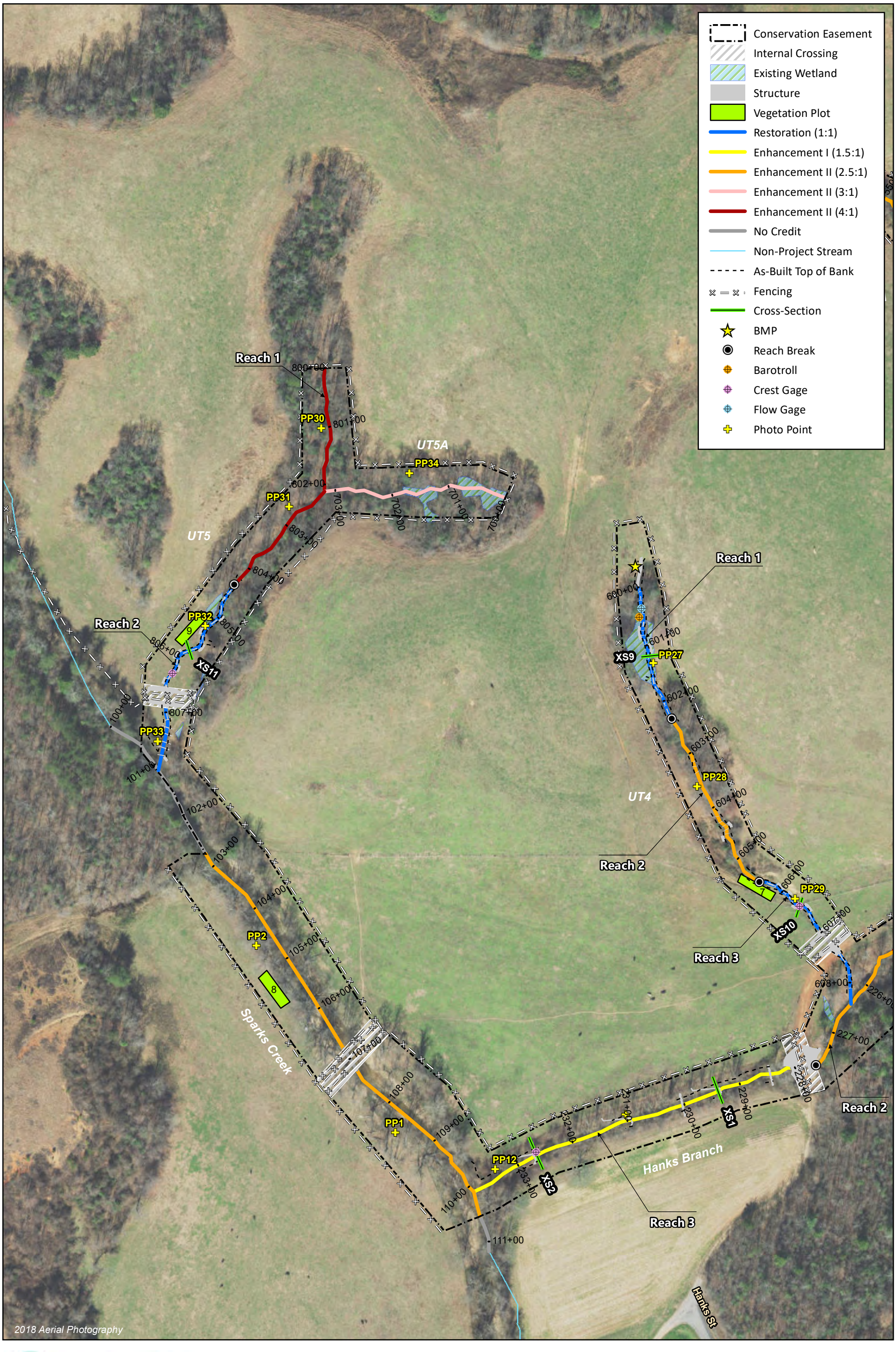
WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3b. Monitoring Plan View
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Wilkes County, NC



WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3c. Monitoring Plan View
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Wilkes County, NC

STREAM PHOTOGRAPHS

PHOTO POINT 1 Spark's Creek – upstream *(01/25/2021)*

PHOTO POINT 1 Spark's Creek – downstream *(01/25/2021)*

PHOTO POINT 2 Spark's Creek – upstream *(01/25/2021)*

PHOTO POINT 2 Spark's Creek – downstream *(01/25/2021)*

PHOTO POINT 3 Hank's Branch R1 – upstream *(01/25/2021)*

PHOTO POINT 3 Hank's Branch R1 – downstream *(01/25/2021)*

PHOTO POINT 4 Hank's Branch R1 – upstream *(01/25/2021)*

PHOTO POINT 4 Hank's Branch R1 – downstream *(01/25/2021)*

PHOTO POINT 5 Hank's Branch R1 – upstream *(01/25/2021)*

PHOTO POINT 5 Hank's Branch R1 – downstream *(01/25/2021)*

PHOTO POINT 6 Hank's Branch R1 – upstream *(01/25/2021)*

PHOTO POINT 6 Hank's Branch R1 – downstream *(01/25/2021)*

PHOTO POINT 7 Hank's Branch R1 – upstream *(01/25/2021)*

PHOTO POINT 7 Hank's Branch R1 – downstream *(01/25/2021)*

PHOTO POINT 8 Hank's Branch R2 – upstream *(01/25/2021)*

PHOTO POINT 8 Hank's Branch R2 – downstream *(01/25/2021)*

PHOTO POINT 9 Hank's Branch R2 – upstream *(01/25/2021)*

PHOTO POINT 9 Hank's Branch R2 – downstream *(01/25/2021)*

PHOTO POINT 10 Hank's Branch R2 – upstream *(01/25/2021)*

PHOTO POINT 10 Hank's Branch R2 – downstream *(01/25/2021)*

PHOTO POINT 11 Hank's Branch R3 – upstream *(02/02/2021)*

PHOTO POINT 11 Hank's Branch R3 – downstream *(02/02/2021)*

PHOTO POINT 12 Hank's Branch R3 – upstream *(02/02/2021)*

PHOTO POINT 12 Hank's Branch R3 – downstream *(02/02/2021)*

PHOTO POINT 13 UT2 – upstream *(01/25/2021)*

PHOTO POINT 13 UT2 – downstream *(01/25/2021)*

PHOTO POINT 14 UT1 – upstream *(01/25/2021)*

PHOTO POINT 14 UT1 – downstream *(01/25/2021)*

PHOTO POINT 15 UT1 – upstream *(01/25/2021)*

PHOTO POINT 15 UT1 – downstream *(01/25/2021)*

PHOTO POINT 16 UT1 – upstream *(01/25/2021)*

PHOTO POINT 16 UT1 – downstream *(01/25/2021)*

PHOTO POINT 17 UT3 R1 – upstream *(01/25/2021)*

PHOTO POINT 17 UT3 R1 – downstream *(01/25/2021)*

PHOTO POINT 18 UT3 R1 – upstream *(01/25/2021)*

PHOTO POINT 18 UT3 R1 – downstream *(01/25/2021)*

	
PHOTO POINT 19 UT3 R1 – upstream *(01/25/2021)*	**PHOTO POINT 19 UT3 R1 – downstream *(01/25/2021)***
	
PHOTO POINT 20 UT3 R2 – upstream *(01/25/2021)*	**PHOTO POINT 20 UT3 R2 – downstream *(01/25/2021)***
	
PHOTO POINT 21 UT3 R3 – upstream *(01/25/2021)*	**PHOTO POINT 21 UT3 R3 – downstream *(01/25/2021)***

PHOTO POINT 22 UT3 R3 – upstream *(01/25/2021)*

PHOTO POINT 22 UT3 R3 – downstream *(01/25/2021)*

PHOTO POINT 23 UT3 R3 – upstream *(01/25/2021)*

PHOTO POINT 23 UT3 R3 – downstream *(01/25/2021)*

PHOTO POINT 24 UT3 R3 – upstream *(02/02/2021)*

PHOTO POINT 24 UT3 R3 – downstream *(02/02/2021)*

PHOTO POINT 25 UT3 R4 – upstream *(02/02/2021)*

PHOTO POINT 25 UT3 R4 – downstream *(02/02/2021)*

PHOTO POINT 26 UT3A – upstream *(01/25/2021)*

PHOTO POINT 26 UT3A – downstream *(01/25/2021)*

PHOTO POINT 27 UT4 R1 – upstream *(01/25/2021)*

PHOTO POINT 27 UT4 R1 – downstream *(01/25/2021)*

	
PHOTO POINT 28 UT4 R2 – upstream *(01/25/2021)*	**PHOTO POINT 28 UT4 R2 – downstream *(01/25/2021)***
	
PHOTO POINT 29 UT4 R3 – upstream *(01/25/2021)*	**PHOTO POINT 29 UT4 R3 – downstream *(01/25/2021)***
	
PHOTO POINT 30 UT5 R1 – upstream *(01/25/2021)*	**PHOTO POINT 30 UT5 R1 – downstream *(01/25/2021)***

	
PHOTO POINT 31 UT5 R1 – upstream *(01/25/2021)*	**PHOTO POINT 31 UT5 R1 – downstream *(01/25/2021)***
	
PHOTO POINT 32 UT5 R2 – upstream *(01/25/2021)*	**PHOTO POINT 32 UT5 R2 – downstream *(01/25/2021)***
	
PHOTO POINT 33 UT5 R2 – upstream *(01/25/2021)*	**PHOTO POINT 33 UT5 R2 – downstream *(01/25/2021)***

	SSSSS 
PHOTO POINT 34 UT5A – upstream *(01/25/2021)*	**PHOTO POINT 34 UT5A – downstream *(01/25/2021)***

VEGETATION PLOT PHOTOGRAPHS

VEG PLOT 1 ***(03/29/2021)***

VEG PLOT 2 ***(03/29/2021)***

VEG PLOT 3 ***(03/29/2021)***

VEG PLOT 4 ***(03/29/2021)***

VEG PLOT 5 ***(03/29/2021)***

VEG PLOT 6 ***(03/29/2021)***

VEG PLOT 7 *(03/29/2021)*

VEG PLOT 8 *(03/29/2021)*

VEG PLOT 9 *(03/29/2021)*

CULVERT CROSSING PHOTOGRAPHS

	
Hanks Branch R3 - Perched - Looking Upstream *(03/29/2021)*	**Hanks Branch R3 - Looking Downstream (*03/29/2021)***
	
UT1 - Looking Upstream *(03/29/2021)*	**UT1 - Looking Downstream (*03/29/2021)***
	
UT3 R3 - Looking Upstream *(03/29/2021)*	**UT3 R3 - Looking Downstream (*03/29/2021)***

	
UT4 R3 - Looking Upstream *(03/29/2021)*	**UT4 R3 - Looking Downstream (*03/29/2021)***
	
UT5 R2 - Looking Upstream *(03/29/2021)*	**UT5 R2 - Looking Downstream (*03/29/2021)***

APPENDIX 3. Vegetation Plot Data

Table 6. Planted and Total Stem Counts

Lyon Hills Mitigation Site

DMS Project No. 100085

Monitoring Year 0 - 2021

			Current Plot Data (MY0 2021)														
			VP 1			VP 2			VP 3			VP 4			VP 5		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Box Elder	Tree				2	2	2									
Betula nigra	River Birch	Tree	3	3	3	2	2	2	3	3	3	1	1	1	1	1	1
Diospyros virginiana	American Persimmon	Tree	1	1	1				1	1	1	1	1	1	1	1	1
Liriodendron tulipifera	Tulip Poplar	Tree										1	1	1	2	2	2
Morus rubra	Red Mulberry	Tree	1	1	1												
Nyssa sylvatica	Black Gum	Tree	3	3	3	4	4	4	1	1	1	3	3	3	1	1	1
Platanus occidentalis	Sycamore	Tree	1	1	1	3	3	3	5	5	5	3	3	3	2	2	2
Prunus serotina	Black Cherry	Shrub Tree							1	1	1						
Quercus phellos	Willow Oak	Tree	3	3	3	2	2	2	1	1	1	3	3	3	3	3	3
Quercus rubra	Northern Red Oak	Tree	2	2	2				2	2	2	1	1	1	1	1	1
Ulmus americana	American Elm	Tree	1	1	1	2	2	2	1	1	1	2	2	2	2	2	2
		Stem count	15	15	15	15	15	15	15	15	15	15	15	15	13	13	13
		size (ares)		1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02			0.02	
		Species count	8	8	8	6	6	6	8	8	8	8	8	8	8	8	8
		Stems per ACRE	607	607	607	607	607	607	607	607	607	607	607	607	526	526	526

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Volunteer species included in total

PnoLS: Number of planted stems excluding live stakes

P-all: Number of planted stems including live stakes

T: Total stems

Table 6. Planted and Total Stem Counts

Lyon Hills Mitigation Site

DMS Project No. 100085

Monitoring Year 0 - 2021

			Current Plot Data (MY0 2021)												Annual Means		
			VP 6			VP 7			VP 8			VP 9			MY0 (2021)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Box Elder	Tree				2	2	2							4	4	4
Betula nigra	River Birch	Tree	4	4	4	1	1	1	2	2	2	3	3	3	20	20	20
Diospyros virginiana	American Persimmon	Tree	1	1	1	1	1	1	1	1	1	1	1	1	8	8	8
Liriodendron tulipifera	Tulip Poplar	Tree				1	1	1							4	4	4
Morus rubra	Red Mulberry	Tree	1	1	1	1	1	1							3	3	3
Nyssa sylvatica	Black Gum	Tree	2	2	2				1	1	1	2	2	2	17	17	17
Platanus occidentalis	Sycamore	Tree	2	2	2	1	1	1	4	4	4	2	2	2	23	23	23
Prunus serotina	Black Cherry	Shrub Tree	1	1	1	1	1	1							3	3	3
Quercus phellos	Willow Oak	Tree	2	2	2	1	1	1	3	3	3	3	3	3	21	21	21
Quercus rubra	Northern Red Oak	Tree	1	1	1				2	2	2	2	2	2	11	11	11
Ulmus americana	American Elm	Tree	1	1	1	2	2	2	2	2	2				13	13	13
		Stem count	15	15	15	11	11	11	15	15	15	13	13	13	127	127	127
		size (ares)	1			1			1			1			9		
		size (ACRES)	0.02			0.02			0.02			0.02			0.22		
		Species count	9	9	9	9	9	9	7	7	7	6	6	6	11	11	11
		Stems per ACRE	607	607	607	445	445	445	607	607	607	526	526	526	571	571	571

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Volunteer species included in total

PnoLS: Number of planted stems excluding live stakes

P-all: Number of planted stems including live stakes

T: Total stems

APPENDIX 4. Morphological Summary Data and Plots

Table 7a. Baseline Stream Data Summary

Lyon Hills Mitigation Site

DMS Project No. 100085

Monitoring Year 0 - 2021

	PRE-EXISTING CONDITIONS			DESIGN			MONITORING BASELINE (MY0)		
Parameter	**Hanks Branch Reach 3**								
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**n**	**Min**	**Max**	**n**
Bankfull Width (ft)	13		1	15.5			16		1
Floodprone Width (ft)	---		1	34	78		38		1
Bankfull Mean Depth	1		1	1.1			1.9		1
Bankfull Max Depth	1.2		1	1.7			2.7		1
Bankfull Cross Sectional Area (ft^2)	13.4		1	17.7			30.7		1
Width/Depth Ratio	12.6		1	14.0			8.4		1
Entrenchment Ratio	1.2		1	2.2	5.0		2.3		1
Bank Height Ratio	4.8		1	14.0			1.0		1
Max part size (mm) mobilized at bankfull	95			79			93		
Rosgen Classification	C4			C4			C4		
Bankfull Discharge (cfs)	68.8			85.0			145.0		1
Sinuosity	1.06			---			---		
Water Surface Slope ($ft/ft)^2$	0.0210		1	0.017	0.020		0.012		1
Other	---			---			---		
Parameter	**UT1**								
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**n**	**Min**	**Max**	**n**
Bankfull Width (ft)	7		1	6.6			4.3		1
Floodprone Width (ft)	---		1	9	15		12		1
Bankfull Mean Depth	0.5		1	0.5			0.5		1
Bankfull Max Depth	1.2		1	0.6	0.7		0.9		1
Bankfull Cross Sectional Area (ft^2)	3.3		1	3.2			2.2		1
Width/Depth Ratio	13.5		1	14.0			8.4		1
Entrenchment Ratio	6.7		1	>1.4			2.9		1
Bank Height Ratio	1.7		1	1.0			1.0		1
Max part size (mm) mobilized at bankfull	54			99			117		
Rosgen Classification	B4			B4			B4		
Bankfull Discharge (cfs)	13.2			13.0			10.0		1
Sinuosity	1.10			1.05			1.05		
Water Surface Slope ($ft/ft)^2$	0.051		1	0.051	0.056		0.052		1
Other	---			---			---		

Table 7b. Baseline Stream Data Summary

Lyon Hills Mitigation Site

DMS Project No. 100085

Monitoring Year 0 - 2021

	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
Parameter	**UT3 Reach 1**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	7.3		1	5.9		4.9		1
Floodprone Width (ft)	10.4		1	8	13	8		1
Bankfull Mean Depth	0.4		1	0.5		0.4		1
Bankfull Max Depth	0.6		1	0.7		0.6		1
Bankfull Cross Sectional Area (ft^2)	3.1		1	2.7		1.9		1
Width/Depth Ratio	17.5		1	13.0		12.5		1
Entrenchment Ratio	1.4		1	>1.4		1.7		1
Bank Height Ratio	2.7		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	114			87		75		
Rosgen Classification	B4			B4		B4		
Bankfull Discharge (cfs)	15.0			10.0		6.6		1
Sinuosity	1.02			1.10		1.10		
Water Surface Slope ($ft/ft)^2$	0.056		1	0.036	0.040	0.042		1
Other	---			---		---		
Parameter	**UT3 Reach 3**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	6.0		1	6.8		4.7		1
Floodprone Width (ft)	8.7		1	10	15	15		1
Bankfull Mean Depth	0.8		1	0.5		0.3		1
Bankfull Max Depth	1.0		1	0.8		0.6		1
Bankfull Cross Sectional Area (ft^2)	4.8		1	3.5		1.5		1
Width/Depth Ratio	7.5		1	13.0		14.4		1
Entrenchment Ratio	1.4		1	>1.4		3.2		1
Bank Height Ratio	2.6		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	128			102		64		
Rosgen Classification	B4			B4		B4		
Bankfull Discharge (cfs)	27.5			15.0		4.8		1
Sinuosity	1.03			1.05		1.05		
Water Surface Slope ($ft/ft)^2$	0.039		1	0.042	0.053	0.044		1
Other	---			---		---		

Table 7c. Baseline Stream Data Summary

Lyon Hills Mitigation Site

DMS Project No. 100085

Monitoring Year 0 - 2021

	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
Parameter	**UT4 Reach 1**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	6.2		1	4.0		4.7		1
Floodprone Width (ft)	7.4		1	6	9	35		1
Bankfull Mean Depth	0.5		1	0.3		0.5		1
Bankfull Max Depth	0.7		1	0.5		0.8		1
Bankfull Cross Sectional Area (ft^2)	3.1		1	1.3		2.2		1
Width/Depth Ratio	12.5		1	13.0		10.2		1
Entrenchment Ratio	1.2		1	>1.4		7.4		1
Bank Height Ratio	1.7		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	122			74		159		
Rosgen Classification	B4			B4		B4		
Bankfull Discharge (cfs)	15.5			4.0		11.3		1
Sinuosity	1.10			1.05		1.05		
Water Surface Slope ($ft/ft)^2$	0.053		1	0.054	0.059	0.073		1
Other	---			---		---		
Parameter	**UT4 Reach 3**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	7.3		1	4.9		4.5		1
Floodprone Width (ft)	9.0		1	7	11	35		1
Bankfull Mean Depth	0.3		1	0.4		0.4		1
Bankfull Max Depth	0.4		1	0.6		0.9		1
Bankfull Cross Sectional Area (ft^2)	1.8		1	1.9		1.9		1
Width/Depth Ratio	29.1		1	13.0		11.0		1
Entrenchment Ratio	1.2		1	>1.4		7.7		1
Bank Height Ratio	2.3		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	140			67		86		
Rosgen Classification	B4			B4		B4		
Bankfull Discharge (cfs)	5.6			6.0		7.0		1
Sinuosity	1.00			1.05		1.05		
Water Surface Slope ($ft/ft)^2$	0.044		1	0.045	0.049	0.046		1
Other	---			---		---		

Table 7d. Baseline Stream Data Summary

Lyon Hills Mitigation Site

DMS Project No. 100085

Monitoring Year 0 - 2021

	PRE-EXISTING CONDITIONS			DESIGN			MONITORING BASELINE (MY0)		
Parameter	**UT5 Reach 2**								
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**n**	**Min**	**Max**	**n**
Bankfull Width (ft)	5.4		1	5.0			5.4		1
Floodprone Width (ft)	11.0		1	11	25		35		1
Bankfull Mean Depth	0.4		1	0.4			0.2		1
Bankfull Max Depth	0.6		1	0.6			0.5		1
Bankfull Cross Sectional Area (ft^2)	2.2		1	1.9			1.3		1
Width/Depth Ratio	13.0		1	13.0			21.6		1
Entrenchment Ratio	2.1		1	2.2	5.0		6.5		1
Bank Height Ratio	1.7		1	1.0			1.0		1
Max part size (mm) mobilized at bankfull	79			49			39		
Rosgen Classification	C4b			C4b			C4b		
Bankfull Discharge (cfs)	9.0			6.0			4.9		1
Sinuosity	1.10			1.20			1.20		
Water Surface Slope ($ft/ft)^2$	0.051		1	0.028	0.033		0.035		1
Other	---								

Table 8. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Lyon Hills Mitigation Site

DMS Project No. 100085

Monitoring Year 0 - 2021

	Hanks Branch Reach 3												UT1											
	Cross-Section 1 (Pool)						Cross-Section 2 (Riffle)						Cross-Section 3 (Pool)						Cross-Section 4 (Riffle)					
Dimension	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull [1] Area	1,157.57						1,153.89						1,228.70						1,224.06					
Bank Height Ratio - Based on AB Bankfull [1] Area	N/A						1.00						N/A						1.00					
Thalweg Elevation	1,153.44						1,151.24						1,227.74						1,223.19					
LTOB[2] Elevation	1,157.57						1,153.89						1,228.70						1,224.06					
LTOB[2] Max Depth (ft)	4.13						2.65						1.00						0.90					
LTOB[2] Cross Sectional Area (ft^2)	44.10						30.70						3.20						2.20					
	UT3 Reach 1												UT3 Reach 3											
	Cross-Section 5 (Pool)						Cross-Section 6 (Riffle)						Cross-Section 7 (Pool)						Cross-Section 8 (Riffle)					
Dimension	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull [1] Area	1,230.54						1,222.82						1,185.20						1,180.95					
Bank Height Ratio - Based on AB Bankfull [1] Area	N/A						1.00						N/A						1.00					
Thalweg Elevation	1,228.40						1,222.18						1,183.59						1,180.36					
LTOB[2] Elevation	1,230.54						1,222.82						1,185.20						1,180.95					
LTOB[2] Max Depth (ft)	2.10						0.60						1.60						0.60					
LTOB[2] Cross Sectional Area (ft^2)	10.20						1.90						4.90						1.50					
	UT4 Reach 1						UT4 Reach 3						UT5 Reach 2											
	Cross-Section 9 (Riffle)						Cross-Section 10 (Riffle)						Cross-Section 11 (Riffle)											
Dimension	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7						
Bankfull Elevation (ft) - Based on AB-Bankfull [1] Area	1,204.05						1,170.57						1,163.95											
Bank Height Ratio - Based on AB Bankfull [1] Area	1.00						1.00						1.00											
Thalweg Elevation	1,203.22						1,169.68						1,163.47											
LTOB[2] Elevation	1,204.05						1,170.57						1,163.95											
LTOB[2] Max Depth (ft)	0.80						0.90						0.50											
LTOB[2] Cross Sectional Area (ft^2)	2.20						1.90						1.30											

[1]Bank Height Ratio (BHR) takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation.

[2]LTOB Area and Max depth - These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

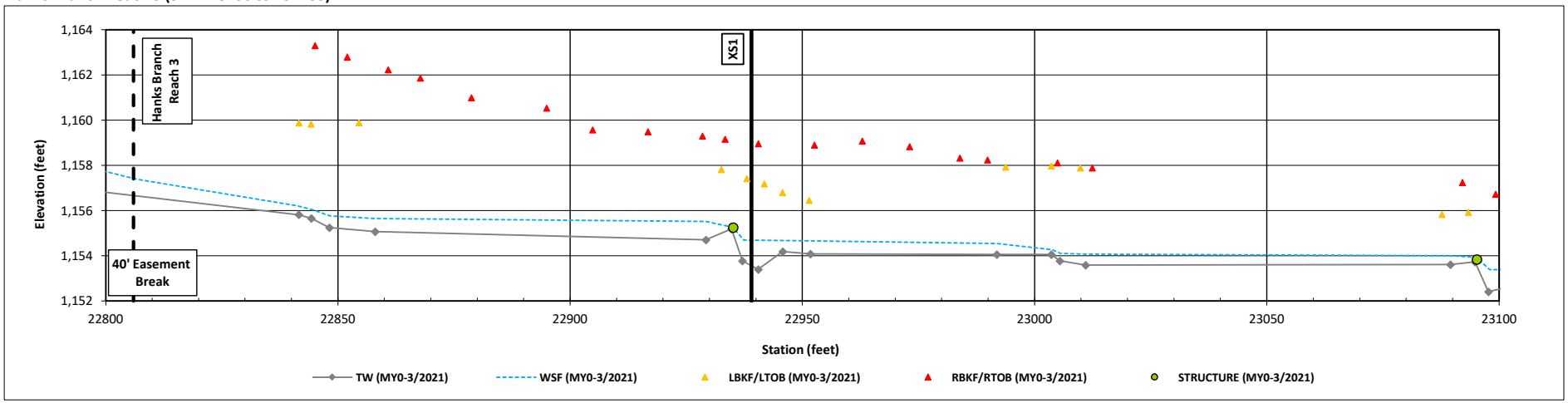
Longitudinal Profile Plots

Lyon Hills Mitigation Site

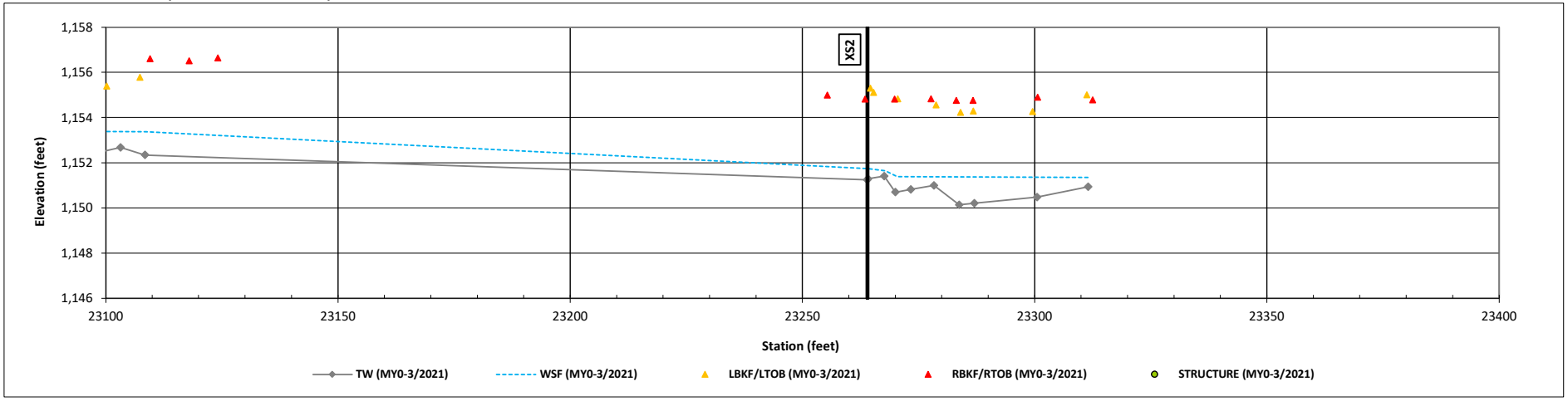
DMS Project No. 100085

Monitoring Year 0 - 2021

Hanks Branch Reach 3 (STA 228+06 to 231+00)



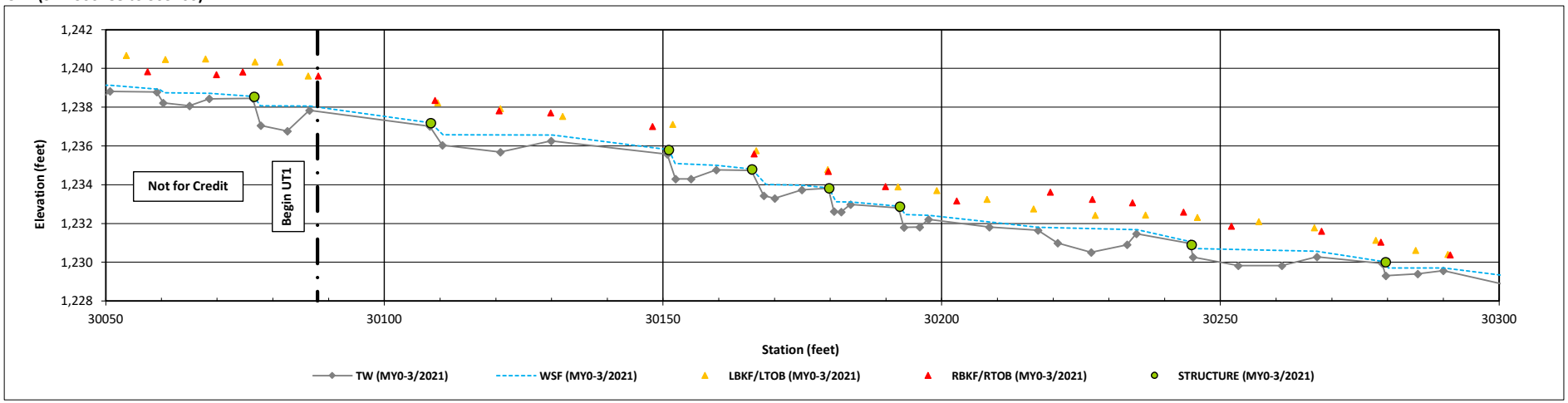
Hanks Branch Reach 3 (STA 231+00 to 233+11)



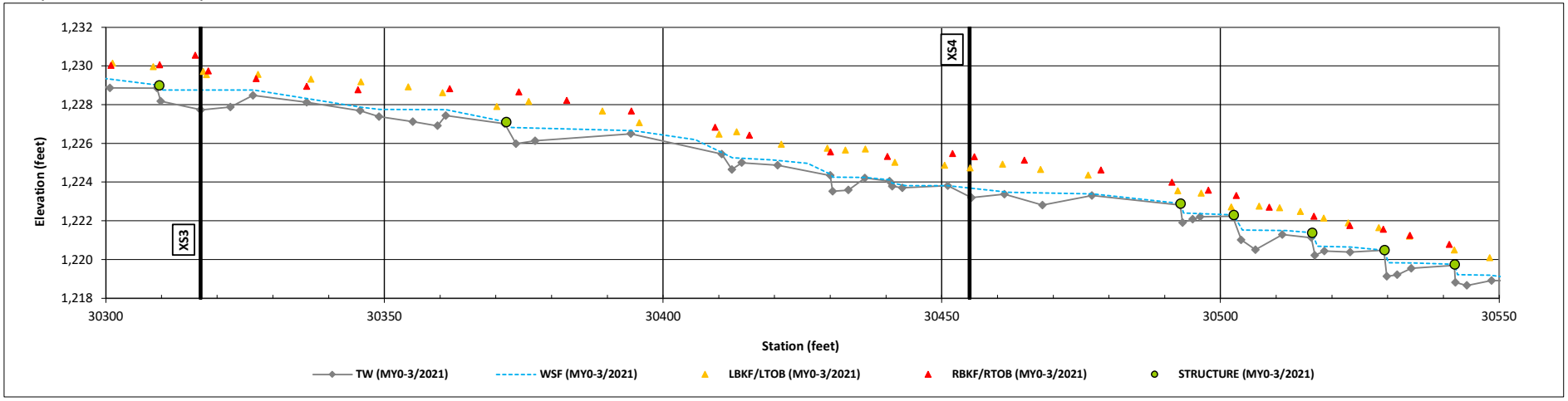
Longitudinal Profile Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT1 (STA 300+88 to 303+00)



UT1 (STA 303+00 to 305+50)



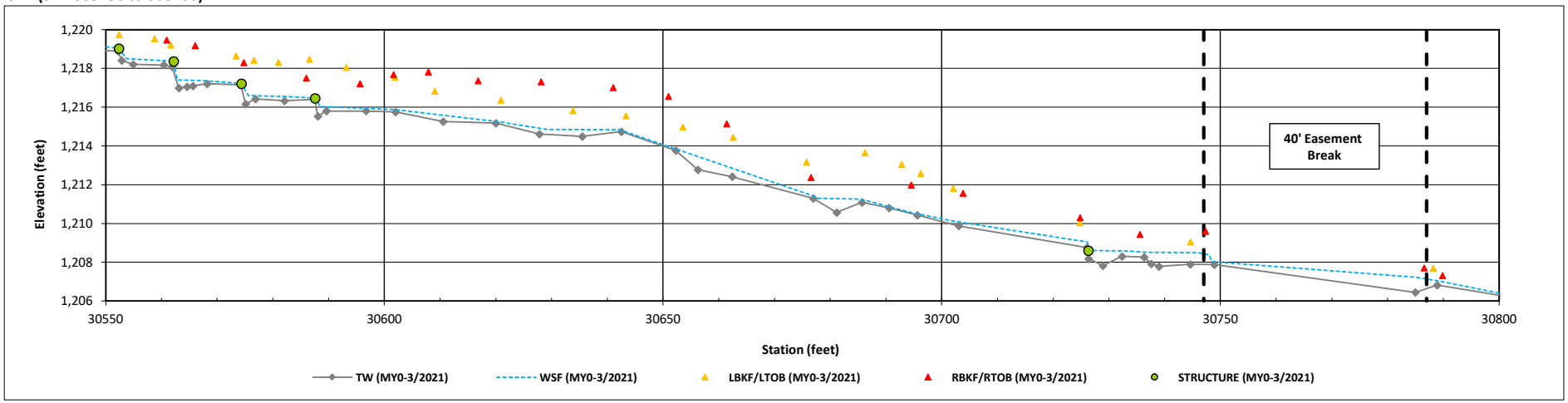
Longitudinal Profile Plots

Lyon Hills Mitigation Site

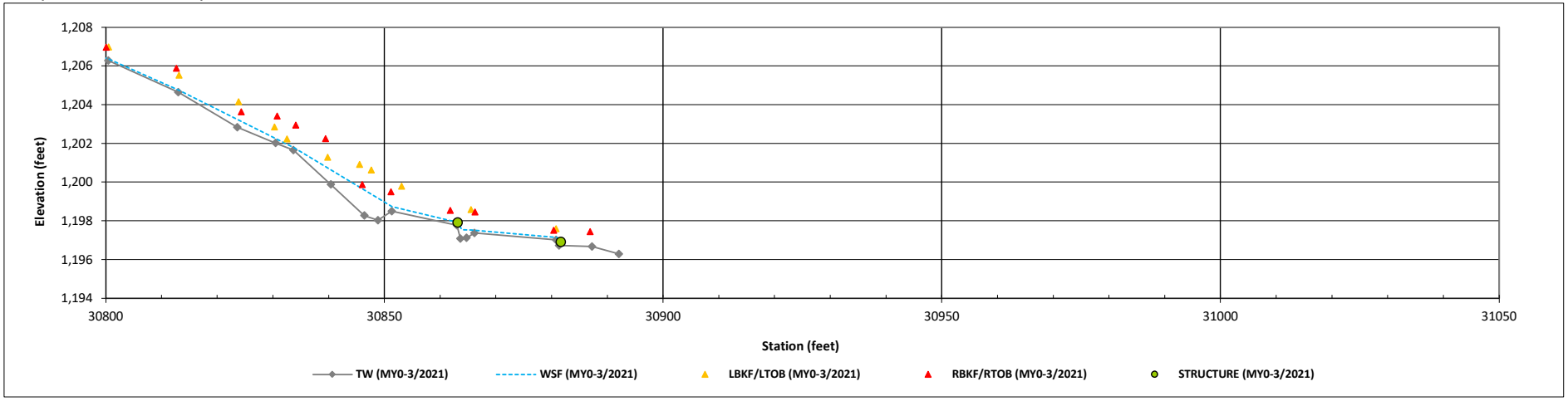
DMS Project No. 100085

Monitoring Year 0 - 2021

UT1 (STA 305+50 to 308+00)



UT1 (STA 308+00 to 308+93)



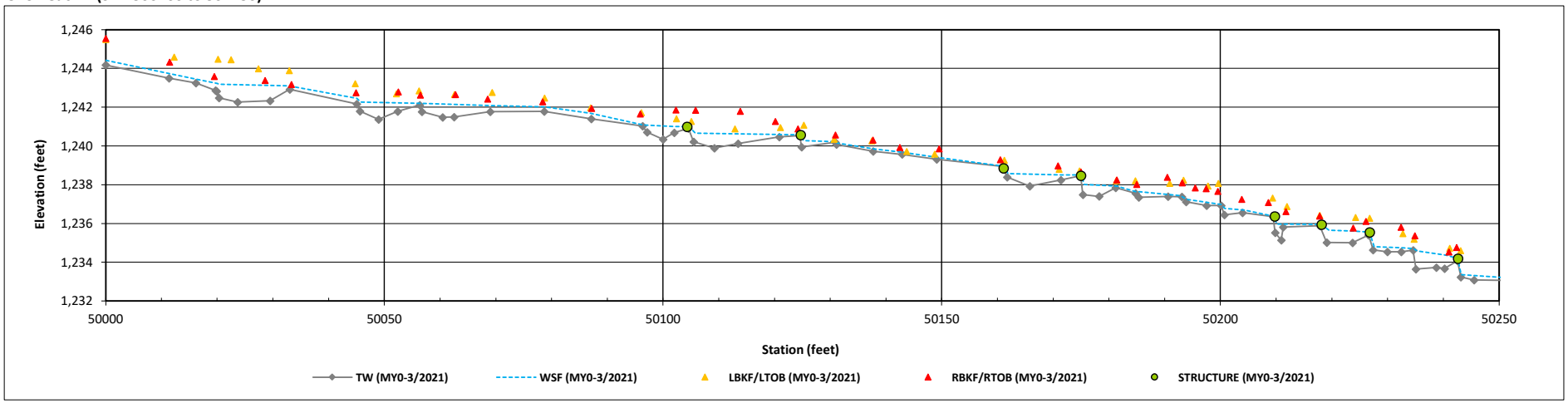
Longitudinal Profile Plots

Lyon Hills Mitigation Site

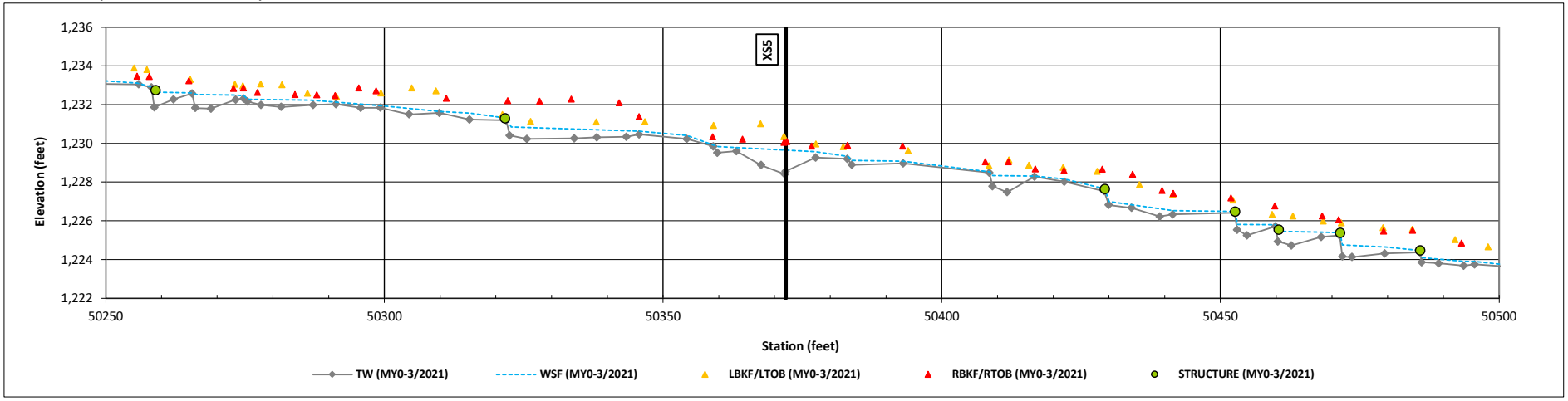
DMS Project No. 100085

Monitoring Year 0 - 2021

UT3 Reach 1 (STA 500+00 to 502+50)



UT3 Reach 1 (STA 502+50 to 505+00)



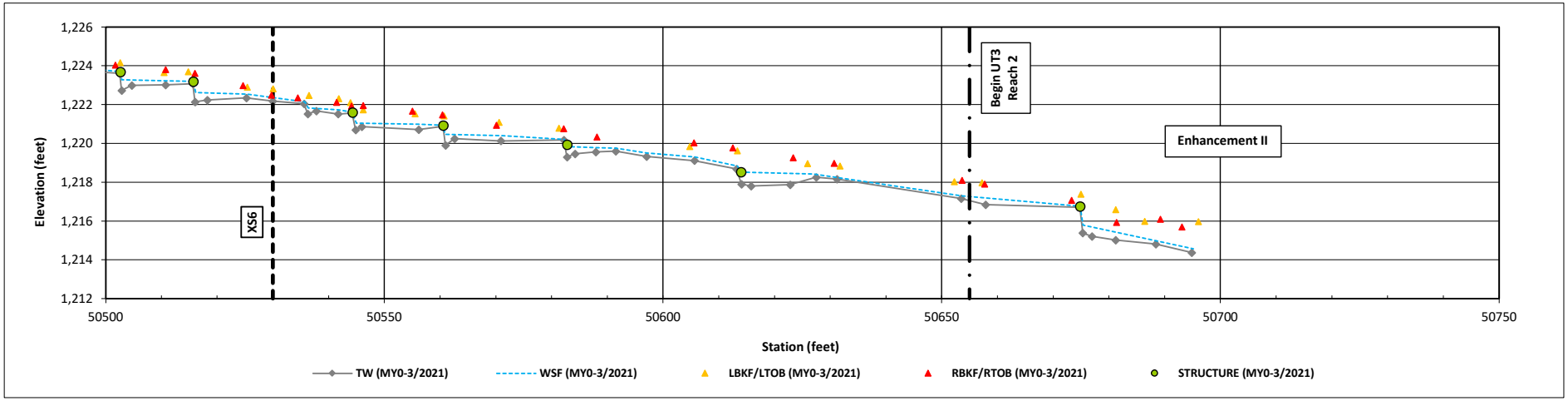
Longitudinal Profile Plots

Lyon Hills Mitigation Site

DMS Project No. 100085

Monitoring Year 0 - 2021

UT3 Reach 1 (STA 505+00 to 506+55)



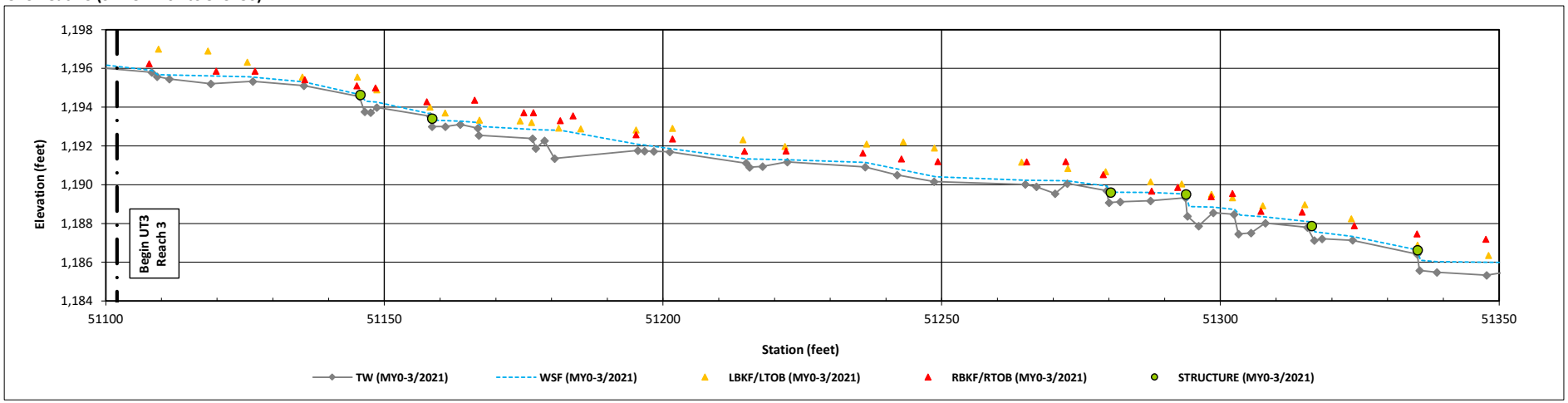
Longitudinal Profile Plots

Lyon Hills Mitigation Site

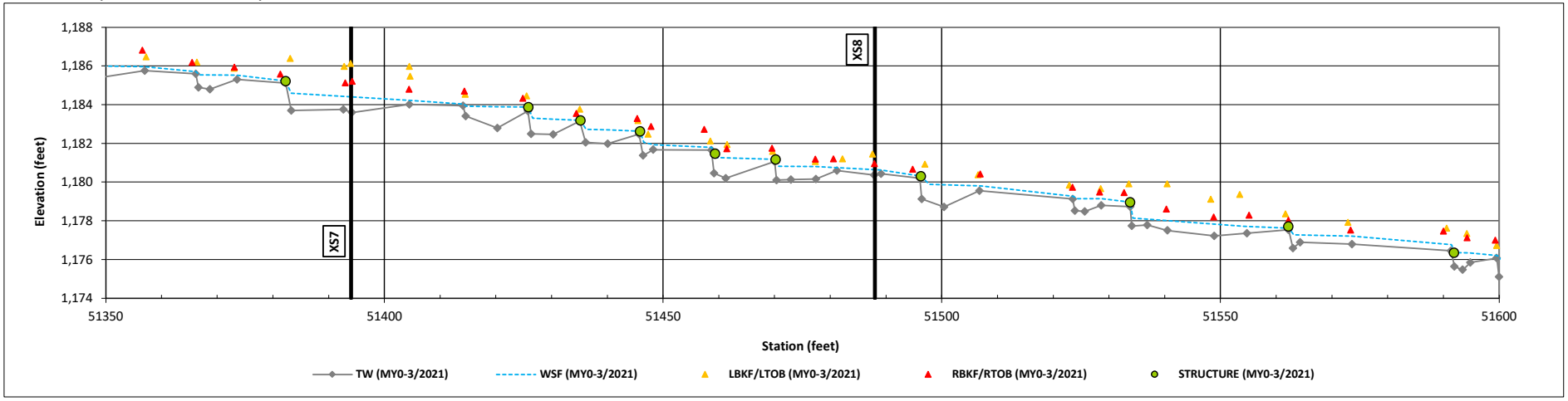
DMS Project No. 100085

Monitoring Year 0 - 2021

UT3 Reach 3 (STA 511+02 to 513+50)



UT3 Reach 3 (STA 513+50 to 516+00)



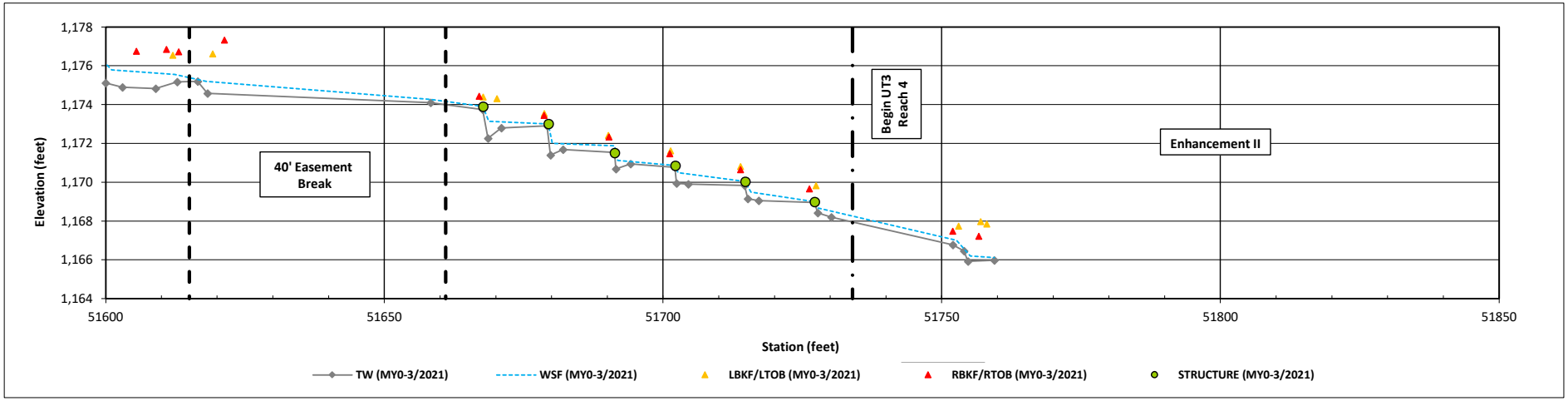
Longitudinal Profile Plots

Lyon Hills Mitigation Site

DMS Project No. 100085

Monitoring Year 0 - 2021

UT3 Reach 3 (STA 516+00 to 517+34)



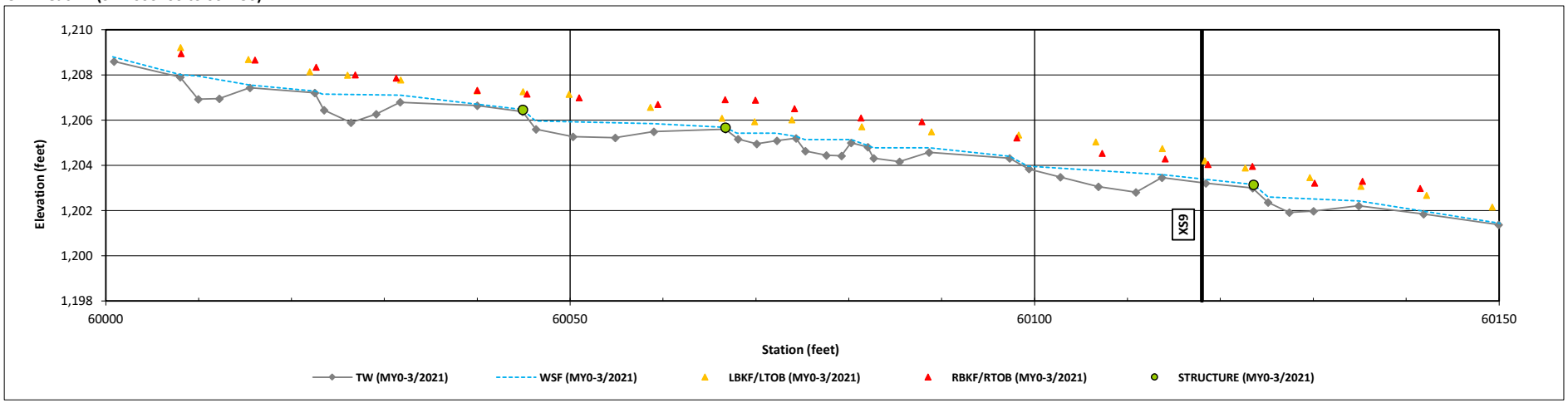
Longitudinal Profile Plots

Lyon Hills Mitigation Site

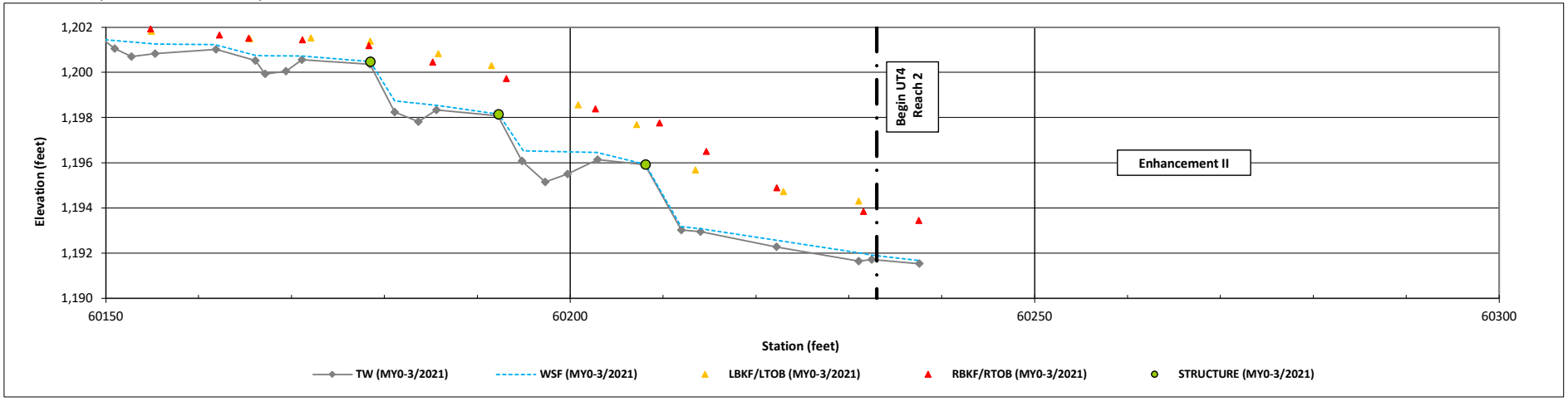
DMS Project No. 100085

Monitoring Year 0 - 2021

UT4 Reach 1 (STA 600+00 to 601+50)



UT4 Reach 1 (STA 601+50 to 602+33)



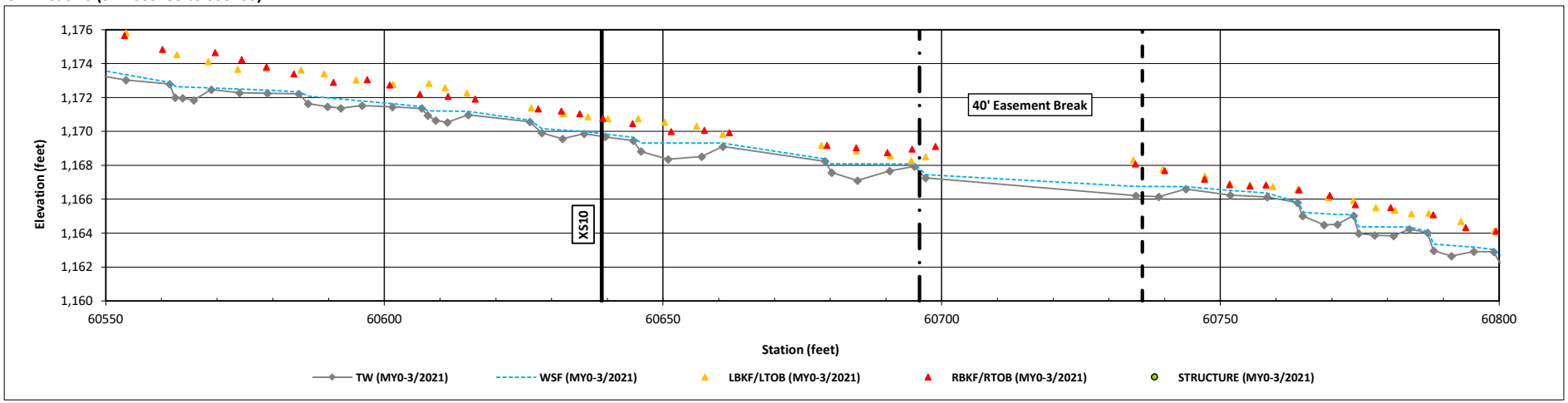
Longitudinal Profile Plots

Lyon Hills Mitigation Site

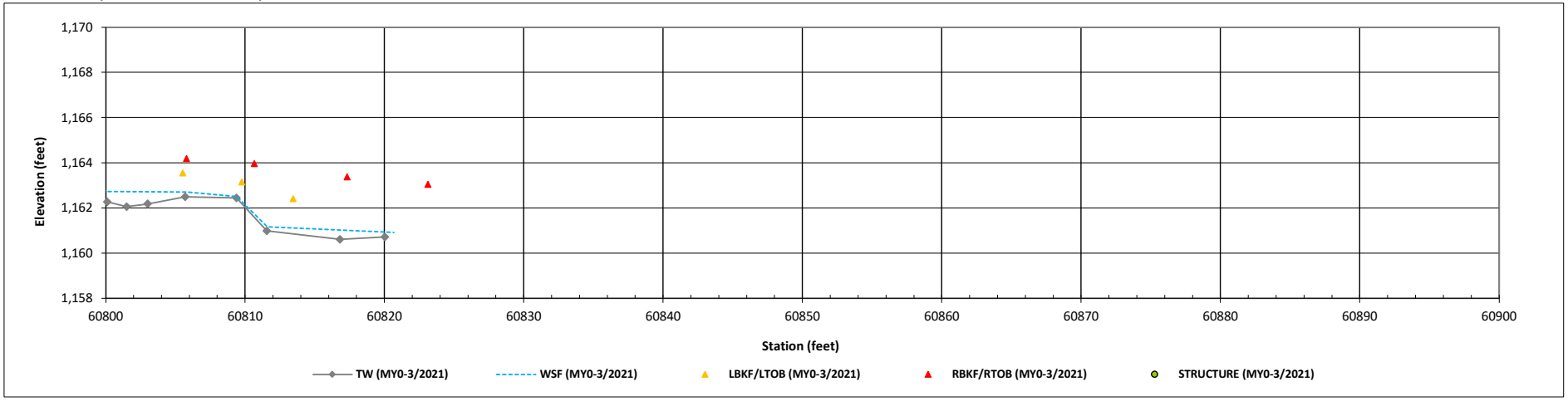
DMS Project No. 100085

Monitoring Year 0 - 2021

UT4 Reach 3 (STA 605+55 to 608+00)



UT4 Reach 3 (STA 608+00 to 608+36)



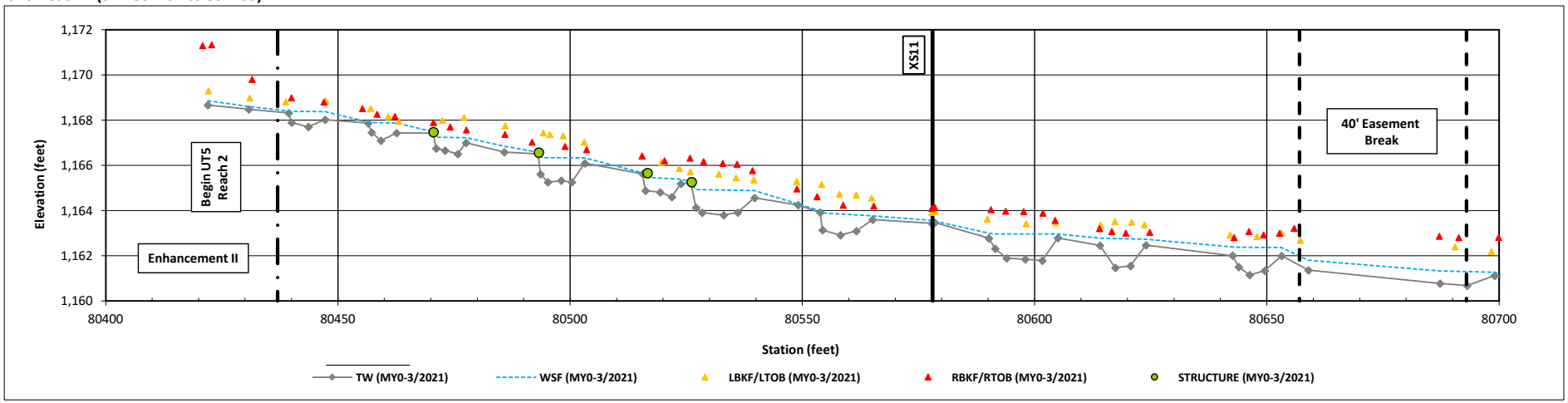
Longitudinal Profile Plots

Lyon Hills Mitigation Site

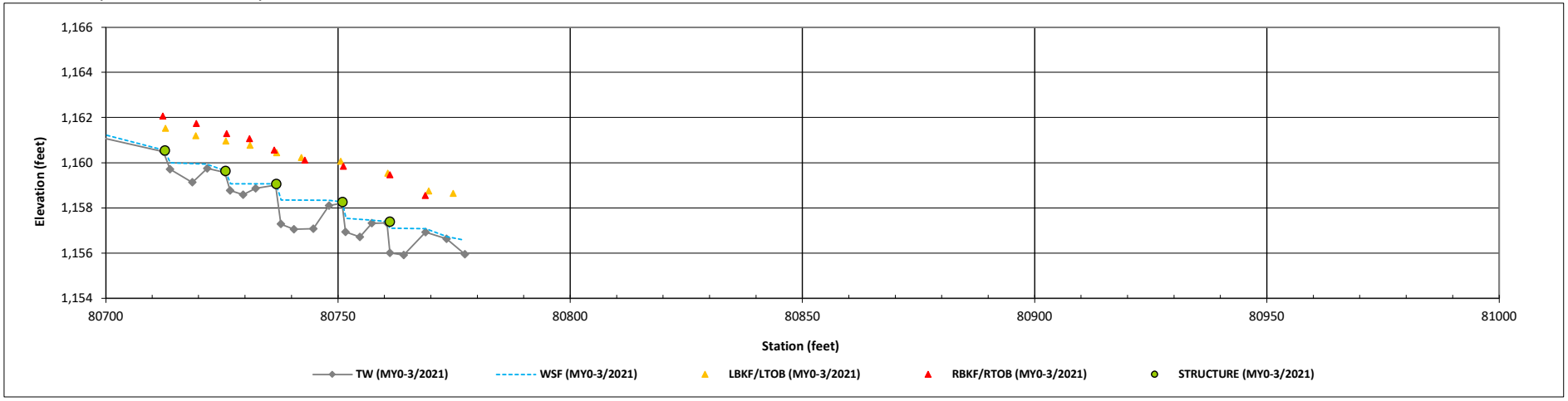
DMS Project No. 100085

Monitoring Year 0 - 2021

UT5 Reach 2 (STA 804+37 to 807+00)



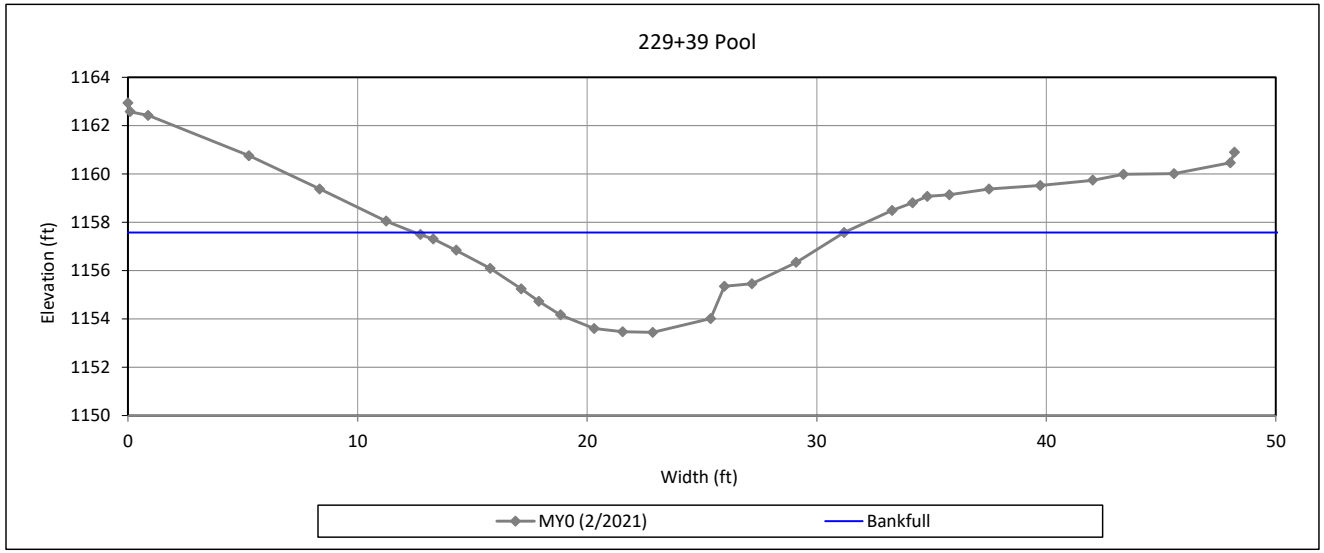
UT5 Reach 2 (STA 807+00 to 807+77)



Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 1-Hanks Branch Reach 3



Bankfull Dimensions	
44.1	x-section area (ft.sq.)
18.7	width (ft)
2.4	mean depth (ft)
4.1	max depth (ft)
21.1	wetted perimeter (ft)
2.1	hydraulic radius (ft)
7.9	width-depth ratio

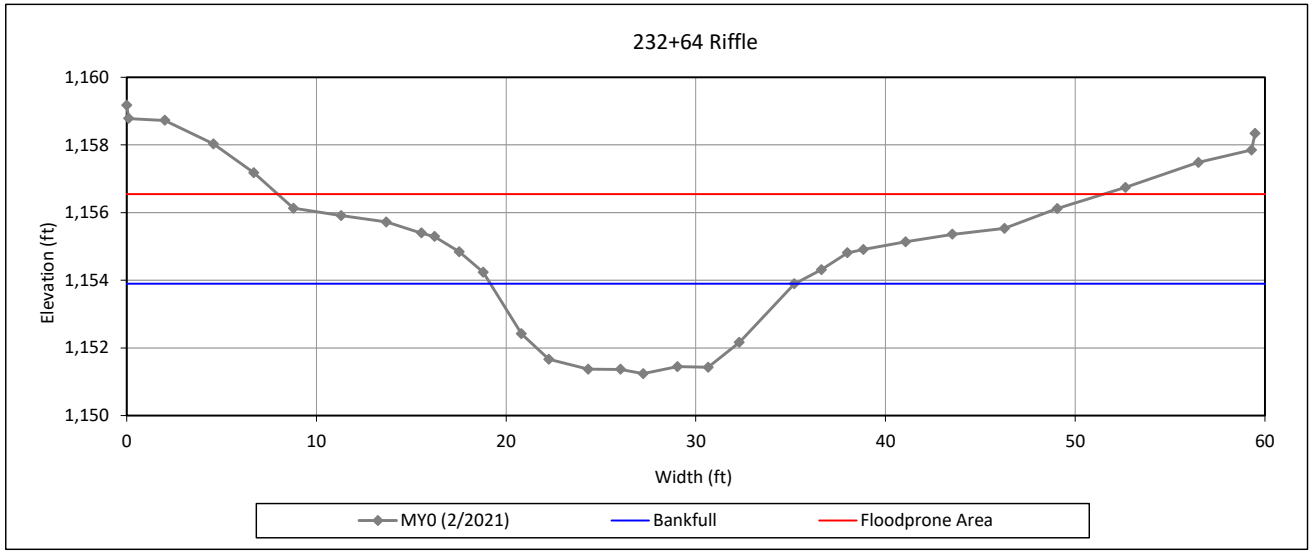
Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 2-Hanks Branch Reach 3



Bankfull Dimensions

30.7	x-section area (ft.sq.)
16.0	width (ft)
1.9	mean depth (ft)
2.7	max depth (ft)
17.4	wetted perimeter (ft)
1.8	hydraulic radius (ft)
8.4	width-depth ratio
37.6	W flood prone area (ft)
2.3	entrenchment ratio
1.0	low bank height ratio

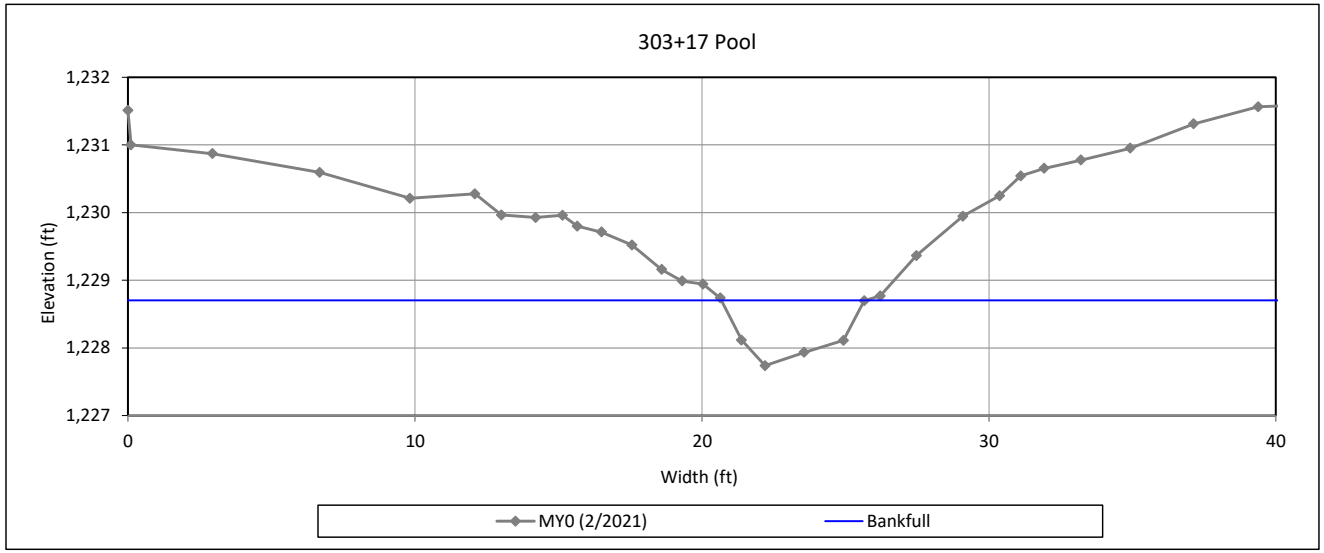
Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 3-UT1



Bankfull Dimensions	
3.2	x-section area (ft.sq.)
5.0	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
5.5	wetted perimeter (ft)
0.6	hydraulic radius (ft)
7.9	width-depth ratio

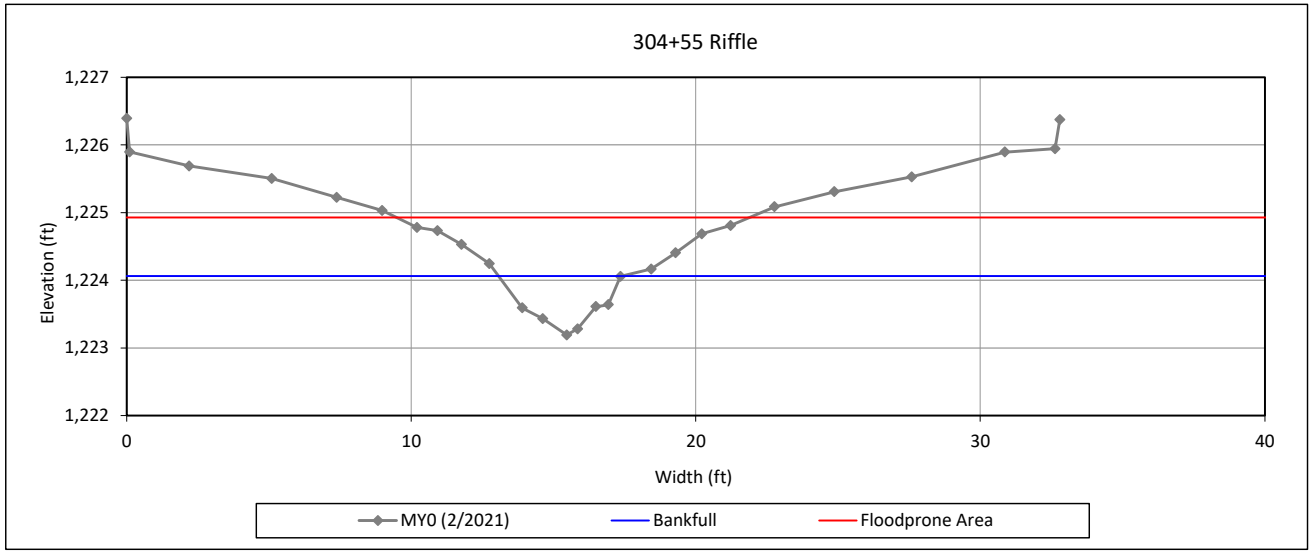
Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 4-UT1



Bankfull Dimensions

2.2	x-section area (ft.sq.)
4.3	width (ft)
0.5	mean depth (ft)
0.9	max depth (ft)
4.8	wetted perimeter (ft)
0.5	hydraulic radius (ft)
8.4	width-depth ratio
12.4	W flood prone area (ft)
2.9	entrenchment ratio
1.0	low bank height ratio

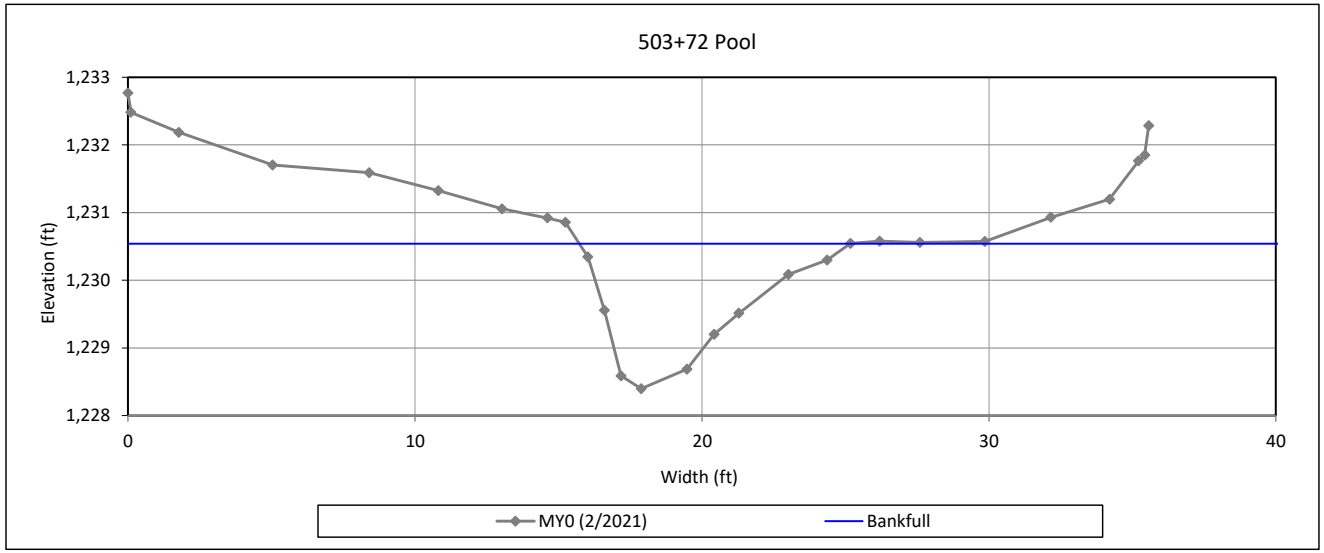
Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 5-UT3 Reach 1



Bankfull Dimensions	
10.2	x-section area (ft.sq.)
9.4	width (ft)
1.1	mean depth (ft)
2.1	max depth (ft)
10.8	wetted perimeter (ft)
0.9	hydraulic radius (ft)
8.7	width-depth ratio

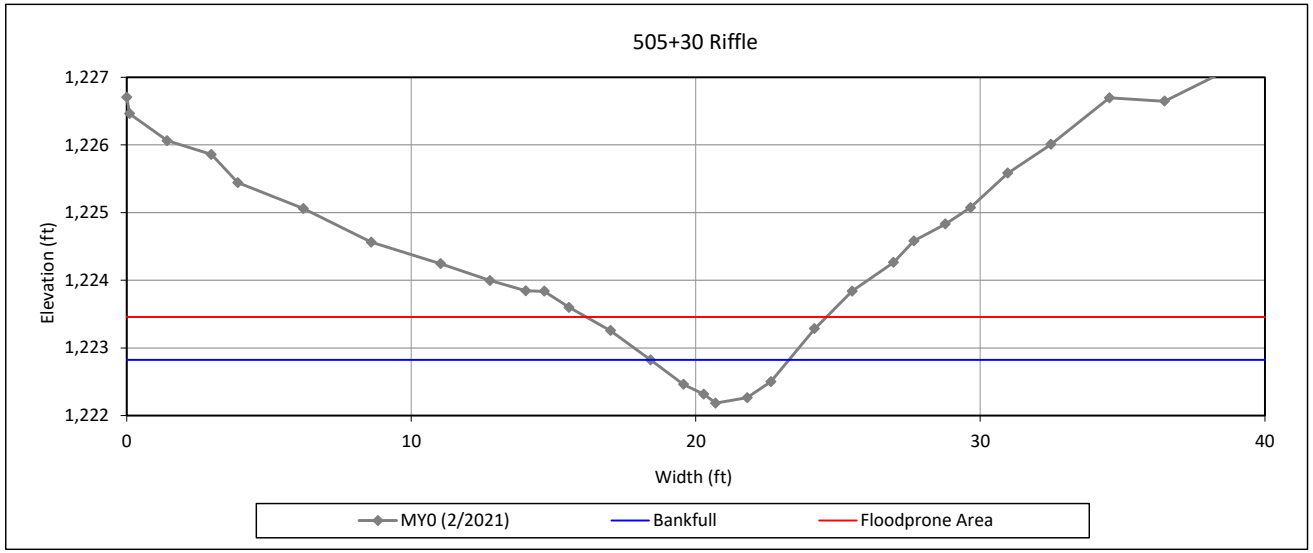
Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 6-UT3 Reach 1



Bankfull Dimensions

1.9	x-section area (ft.sq.)
4.9	width (ft)
0.4	mean depth (ft)
0.6	max depth (ft)
5.1	wetted perimeter (ft)
0.4	hydraulic radius (ft)
12.5	width-depth ratio
8.4	W flood prone area (ft)
1.7	entrenchment ratio
1.0	low bank height ratio

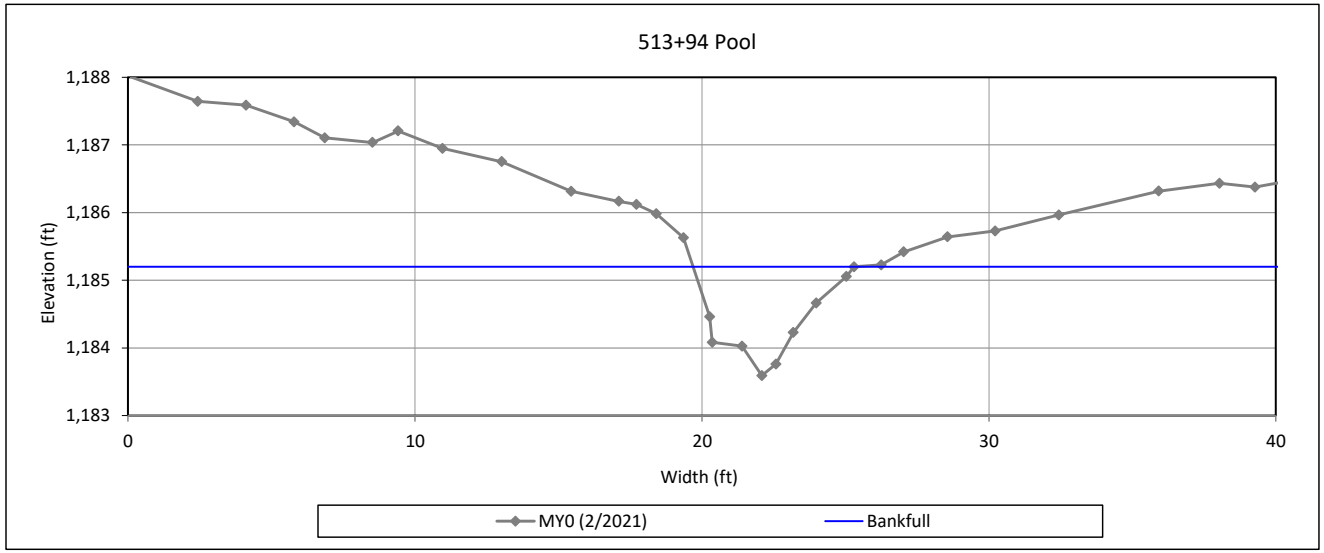
Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 7-UT3 Reach 3



Bankfull Dimensions	
4.9	x-section area (ft.sq.)
5.6	width (ft)
0.9	mean depth (ft)
1.6	max depth (ft)
6.8	wetted perimeter (ft)
0.7	hydraulic radius (ft)
6.4	width-depth ratio

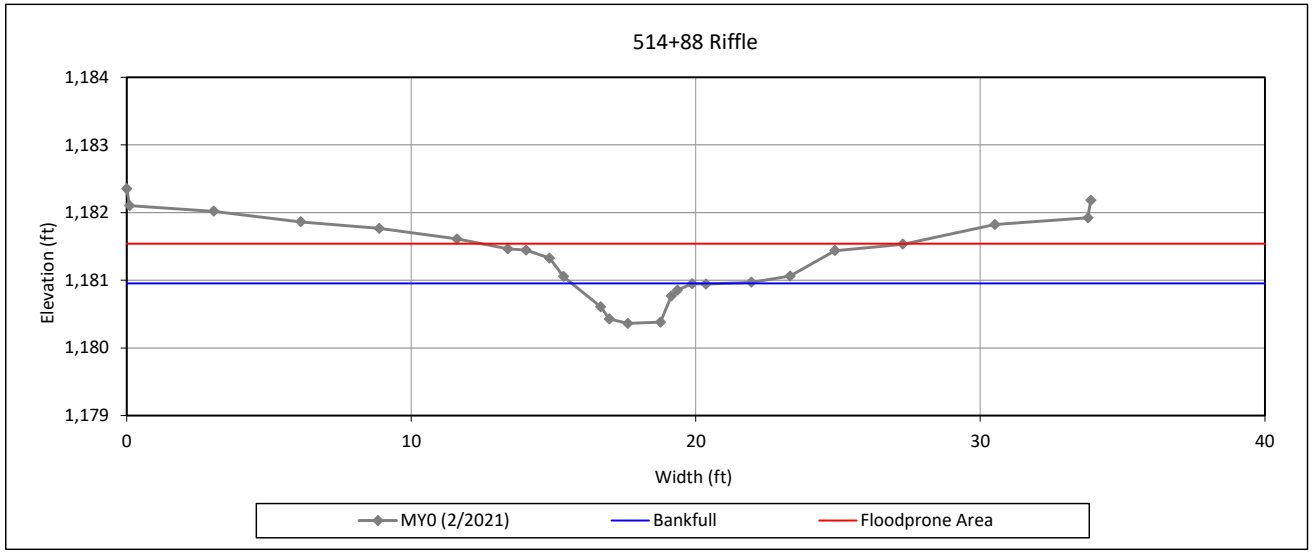
Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 8-UT3 Reach 3



Bankfull Dimensions

1.5	x-section area (ft.sq.)
4.7	width (ft)
0.3	mean depth (ft)
0.6	max depth (ft)
5.0	wetted perimeter (ft)
0.3	hydraulic radius (ft)
14.4	width-depth ratio
14.9	W flood prone area (ft)
3.2	entrenchment ratio
1.0	low bank height ratio

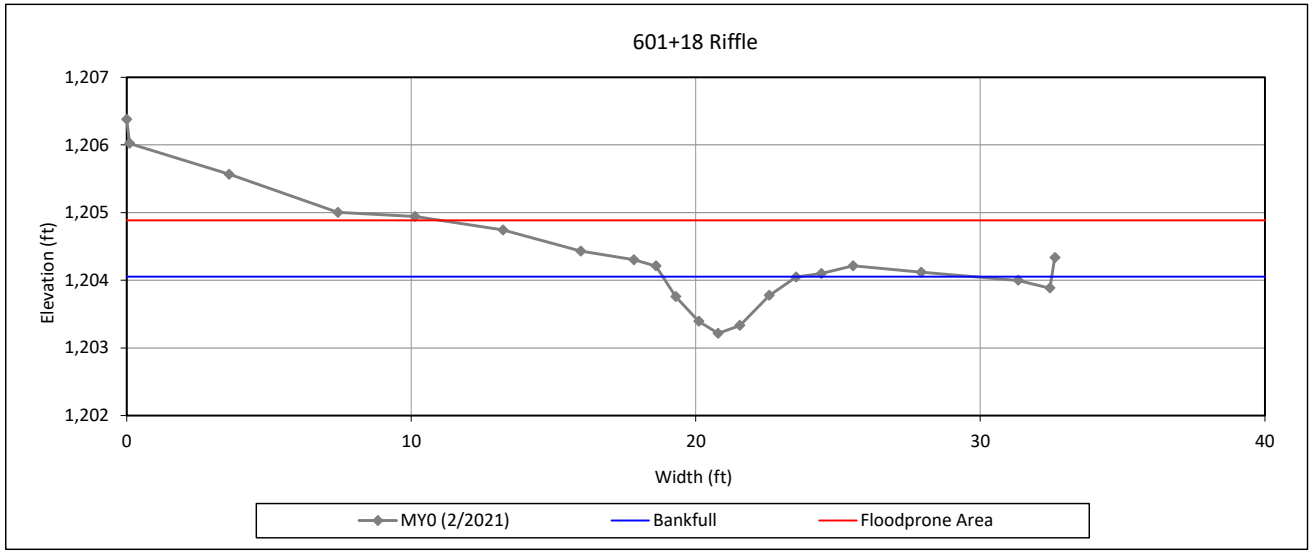
Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 9-UT4 Reach 1



Bankfull Dimensions

2.2	x-section area (ft.sq.)
4.7	width (ft)
0.5	mean depth (ft)
0.8	max depth (ft)
5.1	wetted perimeter (ft)
0.4	hydraulic radius (ft)
10.2	width-depth ratio
35.0	W flood prone area (ft)
7.4	entrenchment ratio
1.0	low bank height ratio

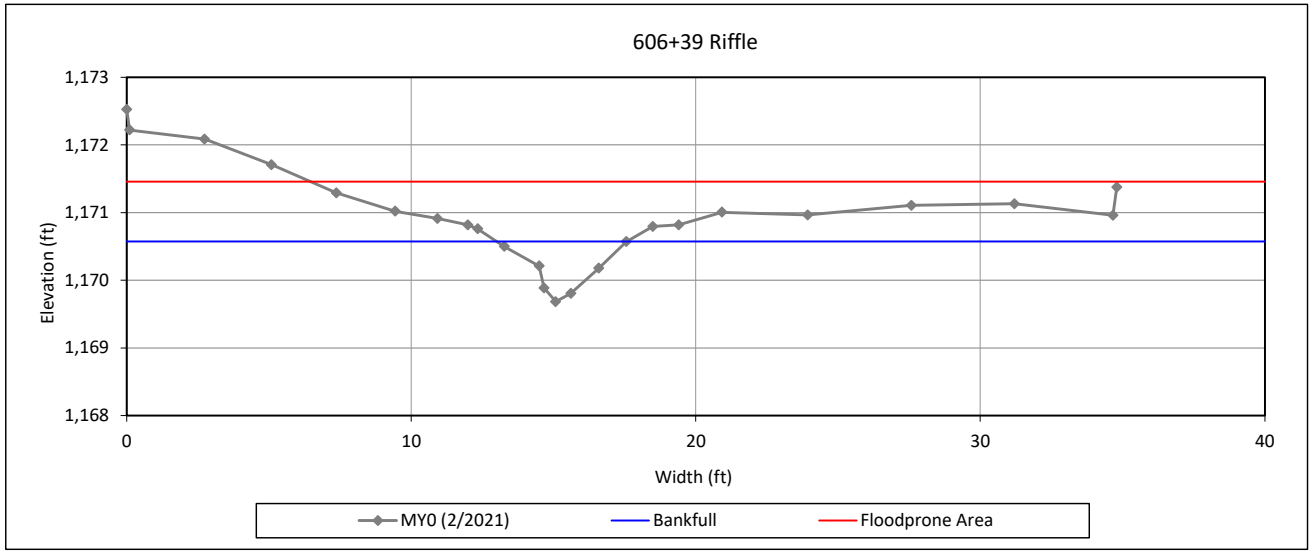
Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 10-UT4 Reach 3



Bankfull Dimensions

1.9	x-section area (ft.sq.)
4.5	width (ft)
0.4	mean depth (ft)
0.9	max depth (ft)
5.0	wetted perimeter (ft)
0.4	hydraulic radius (ft)
11.0	width-depth ratio
35.0	W flood prone area (ft)
7.7	entrenchment ratio
1.0	low bank height ratio

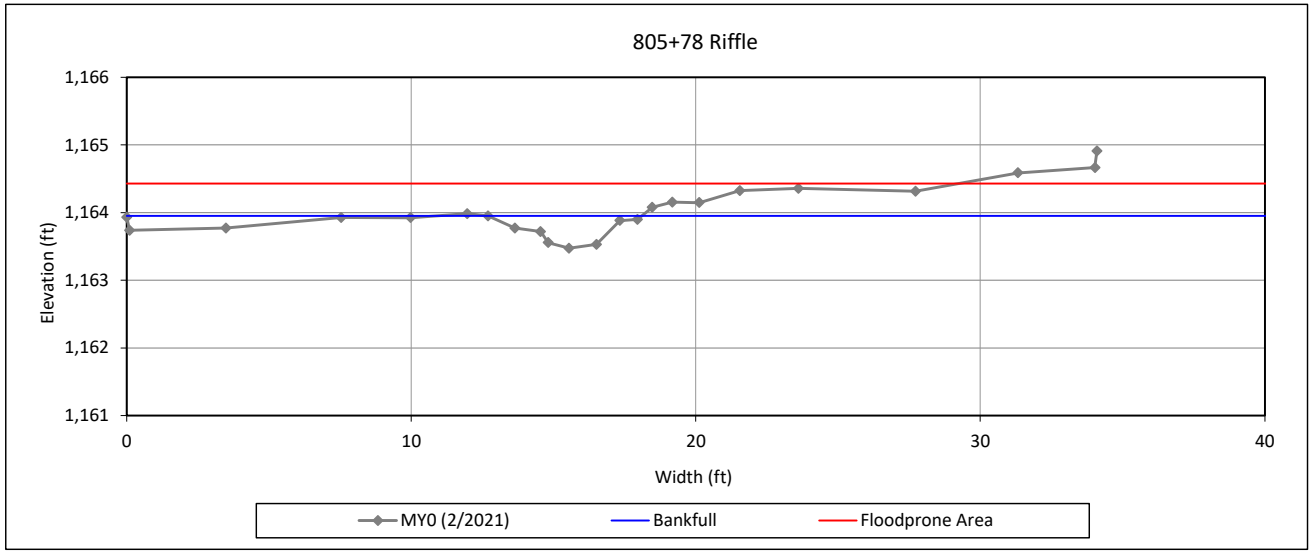
Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

Cross-Section Plots

Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Cross-Section 11-UT5 Reach 2



Bankfull Dimensions

1.3	x-section area (ft.sq.)
5.4	width (ft)
0.2	mean depth (ft)
0.5	max depth (ft)
5.5	wetted perimeter (ft)
0.2	hydraulic radius (ft)
21.6	width-depth ratio
35.0	W flood prone area (ft)
6.5	entrenchment ratio
1.0	low bank height ratio

Survey Date: 2/2021
Field Crew: Kee Mapping and Surveying

View Downstream

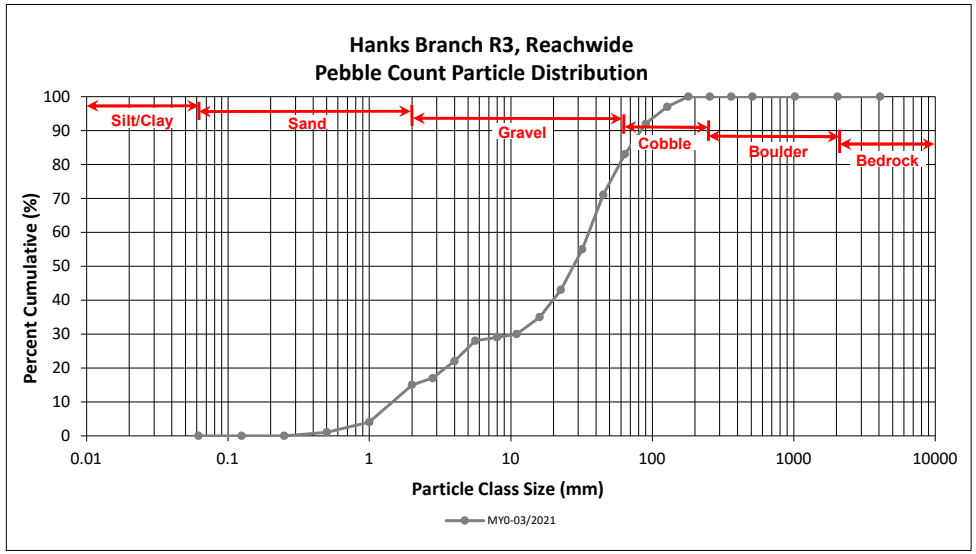
Reachwide Pebble Count Plots

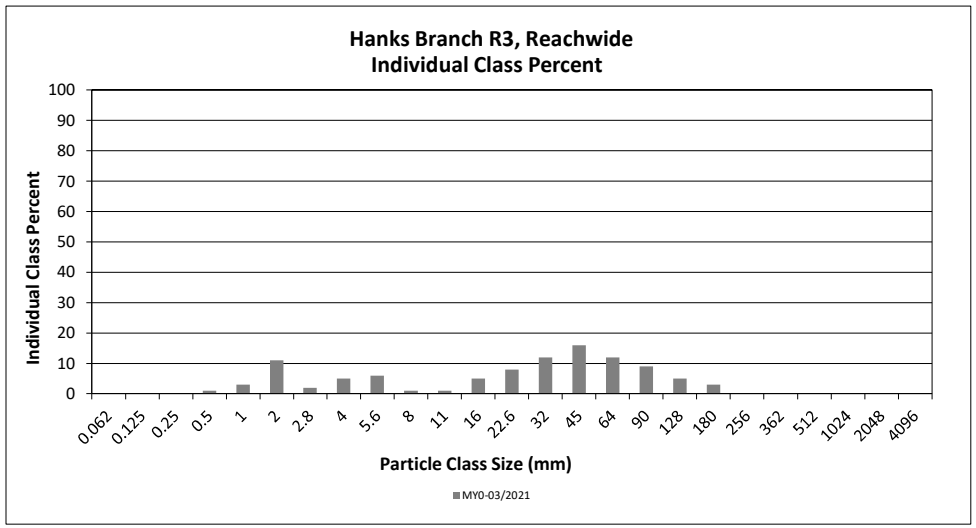
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Hanks Branch R3, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062					0
SAND	Very fine	0.062	0.125					0
	Fine	0.125	0.250					0
	Medium	0.25	0.50		1	1	1	1
	Coarse	0.5	1.0		3	3	3	4
	Very Coarse	1.0	2.0		11	11	11	15
GRAVEL	Very Fine	2.0	2.8	1	1	2	2	17
	Very Fine	2.8	4.0		5	5	5	22
	Fine	4.0	5.6	2	4	6	6	28
	Fine	5.6	8.0	1		1	1	29
	Medium	8.0	11.0	1		1	1	30
	Medium	11.0	16.0	4	1	5	5	35
	Coarse	16.0	22.6	7	1	8	8	43
	Coarse	22.6	32	11	1	12	12	55
	Very Coarse	32	45	15	1	16	16	71
	Very Coarse	45	64	11	1	12	12	83
COBBLE	Small	64	90	9		9	9	92
	Small	90	128	5		5	5	97
	Large	128	180	3		3	3	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**70**	**30**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	2.37
D_{35} =	16.00
D_{50} =	27.7
D_{84} =	66.5
D_{95} =	111.2
D_{100} =	180.0





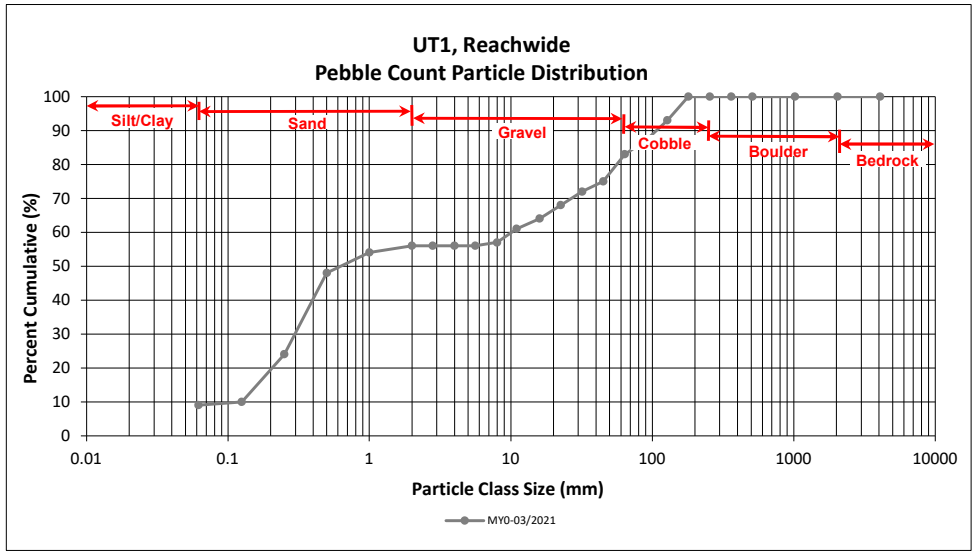
Reachwide Pebble Count Plots

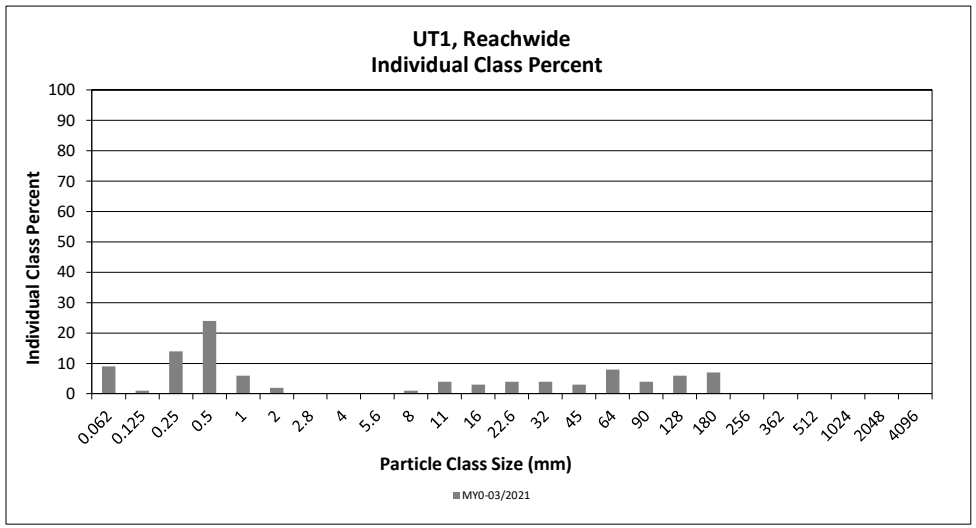
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	5	9	9	9
SAND	Very fine	0.062	0.125	1		1	1	10
	Fine	0.125	0.250	5	9	14	14	24
	Medium	0.25	0.50	10	14	24	24	48
	Coarse	0.5	1.0		6	6	6	54
	Very Coarse	1.0	2.0		2	2	2	56
GRAVEL	Very Fine	2.0	2.8					56
	Very Fine	2.8	4.0					56
	Fine	4.0	5.6					56
	Fine	5.6	8.0		1	1	1	57
	Medium	8.0	11.0	4		4	4	61
	Medium	11.0	16.0	1	2	3	3	64
	Coarse	16.0	22.6	4		4	4	68
	Coarse	22.6	32	4		4	4	72
	Very Coarse	32	45	3		3	3	75
	Very Coarse	45	64	8		8	8	83
COBBLE	Small	64	90	4		4	4	87
	Small	90	128	6		6	6	93
	Large	128	180	6	1	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	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.17
D_{35} =	0.34
D_{50} =	0.6
D_{84} =	69.7
D_{95} =	141.1
D_{100} =	180.0





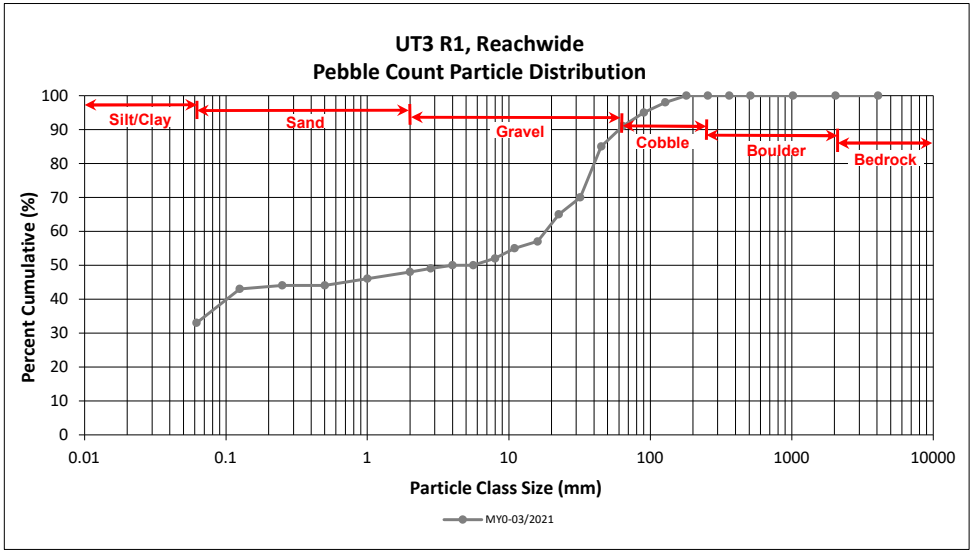
Reachwide Pebble Count Plots

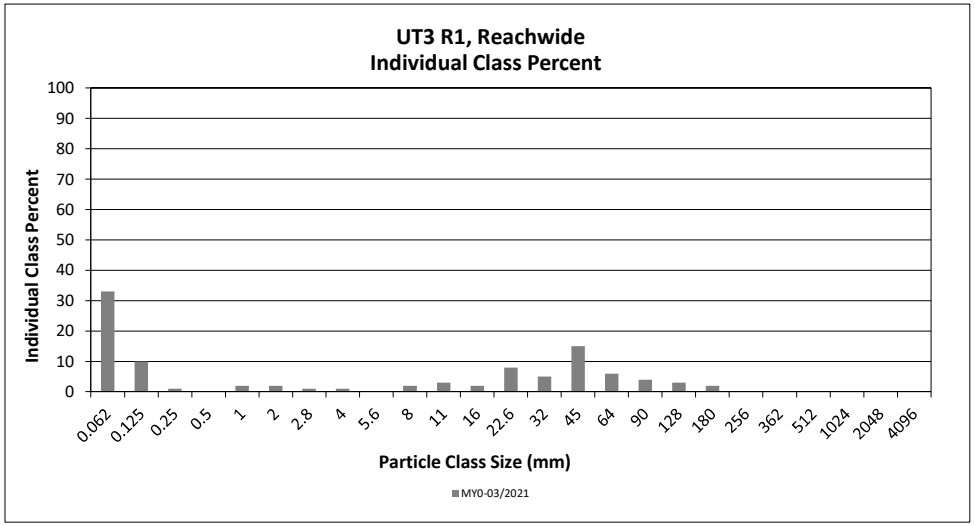
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT3 R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	10	23	33	33	33
SAND	Very fine	0.062	0.125		10	10	10	43
	Fine	0.125	0.250	1		1	1	44
	Medium	0.25	0.50					44
	Coarse	0.5	1.0		2	2	2	46
	Very Coarse	1.0	2.0		2	2	2	48
GRAVEL	Very Fine	2.0	2.8		1	1	1	49
	Very Fine	2.8	4.0		1	1	1	50
	Fine	4.0	5.6					50
	Fine	5.6	8.0		2	2	2	52
	Medium	8.0	11.0	2	1	3	3	55
	Medium	11.0	16.0	1	1	2	2	57
	Coarse	16.0	22.6	7	1	8	8	65
	Coarse	22.6	32	4	1	5	5	70
	Very Coarse	32	45	11	4	15	15	85
	Very Coarse	45	64	5	1	6	6	91
COBBLE	Small	64	90	4		4	4	95
	Small	90	128	3		3	3	98
	Large	128	180	2		2	2	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.07
D_{50} =	4.0
D_{84} =	44.0
D_{95} =	90.0
D_{100} =	180.0





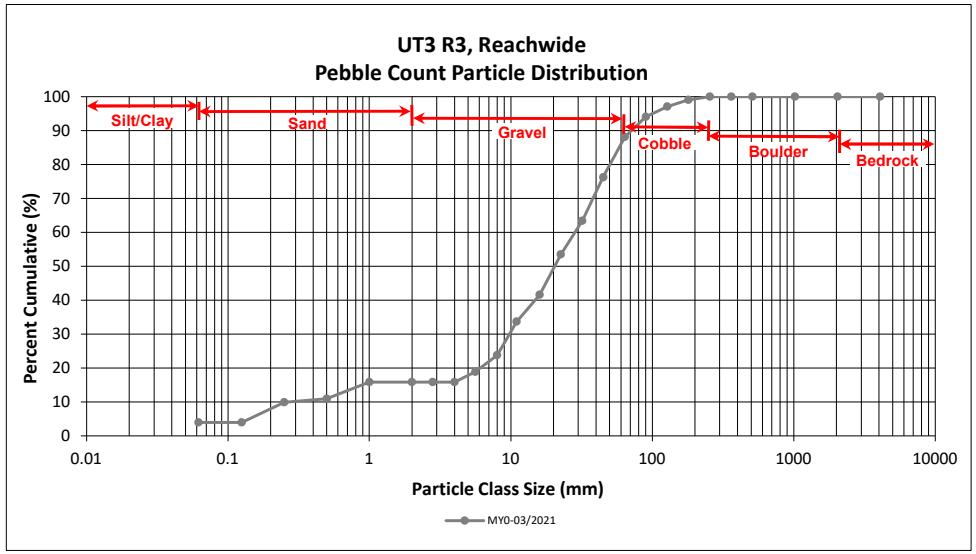
Reachwide Pebble Count Plots

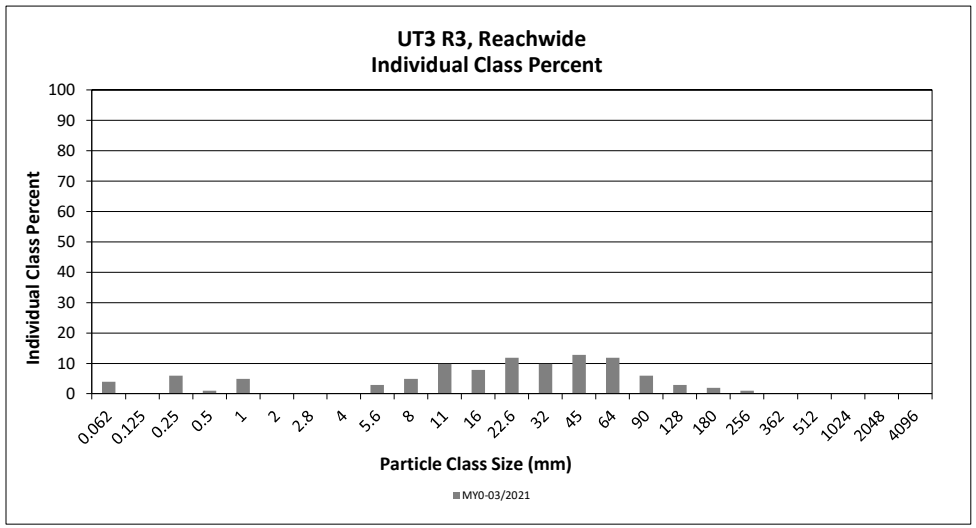
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT3 R3, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	3	4	4	4
SAND	Very fine	0.062	0.125					4
	Fine	0.125	0.250	4	2	6	6	10
	Medium	0.25	0.50		1	1	1	11
	Coarse	0.5	1.0	2	3	5	5	16
	Very Coarse	1.0	2.0					16
GRAVEL	Very Fine	2.0	2.8					16
	Very Fine	2.8	4.0					16
	Fine	4.0	5.6		3	3	3	19
	Fine	5.6	8.0	3	2	5	5	24
	Medium	8.0	11.0	6	4	10	10	34
	Medium	11.0	16.0	6	2	8	8	42
	Coarse	16.0	22.6	9	3	12	12	54
	Coarse	22.6	32	8	2	10	10	64
	Very Coarse	32	45	10	3	13	13	77
	Very Coarse	45	64	9	2	11	11	88
COBBLE	Small	64	90	6		6	6	94
	Small	90	128	3		3	3	97
	Large	128	180	2		2	2	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**70**	**30**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	1.00
D_{35} =	11.53
D_{50} =	20.1
D_{84} =	56.3
D_{95} =	101.2
D_{100} =	256.0





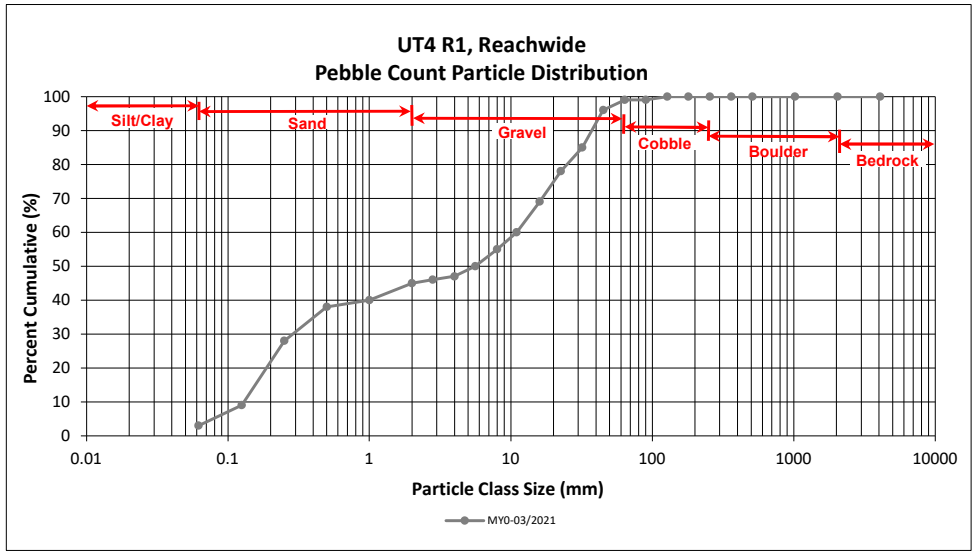
Reachwide Pebble Count Plots

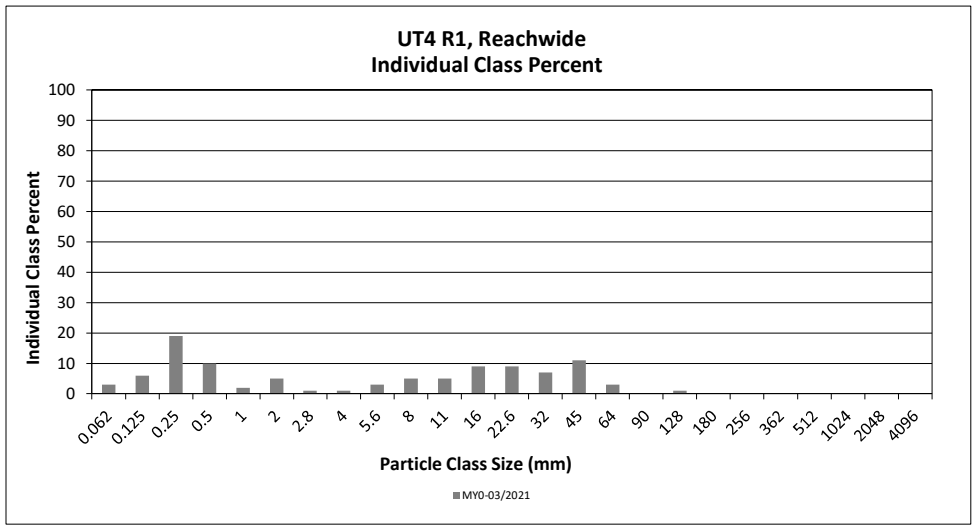
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT4 R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	1	3	3	3
SAND	Very fine	0.062	0.125	1	5	6	6	9
	Fine	0.125	0.250	13	6	19	19	28
	Medium	0.25	0.50	5	5	10	10	38
	Coarse	0.5	1.0	1	1	2	2	40
	Very Coarse	1.0	2.0		5	5	5	45
GRAVEL	Very Fine	2.0	2.8		1	1	1	46
	Very Fine	2.8	4.0	1		1	1	47
	Fine	4.0	5.6	2	1	3	3	50
	Fine	5.6	8.0	4	1	5	5	55
	Medium	8.0	11.0	4	1	5	5	60
	Medium	11.0	16.0	6	3	9	9	69
	Coarse	16.0	22.6	9		9	9	78
	Coarse	22.6	32	7		7	7	85
	Very Coarse	32	45	11		11	11	96
	Very Coarse	45	64	3		3	3	99
COBBLE	Small	64	90					99
	Small	90	128	1		1	1	100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**70**	**30**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.16
D_{35} =	0.41
D_{50} =	5.6
D_{84} =	30.4
D_{95} =	43.6
D_{100} =	128.0





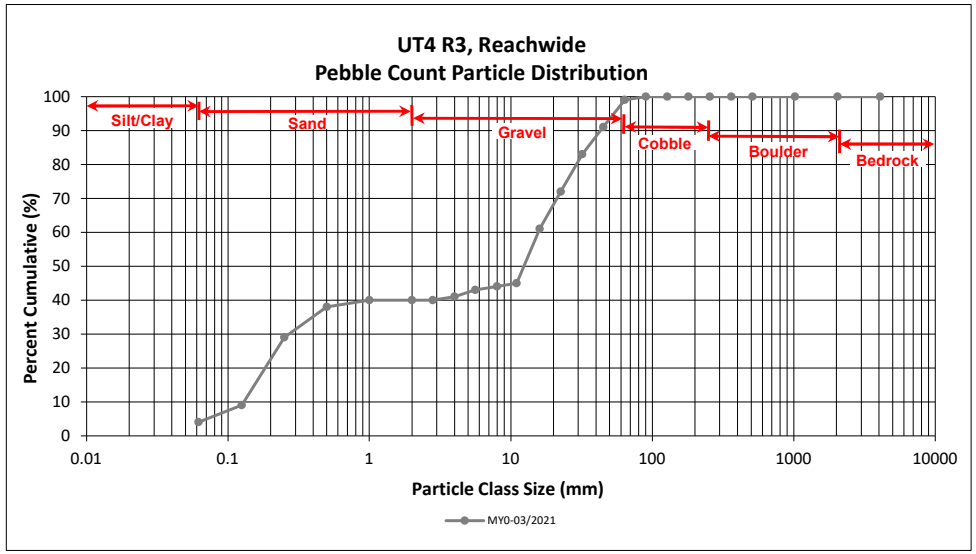
Reachwide Pebble Count Plots

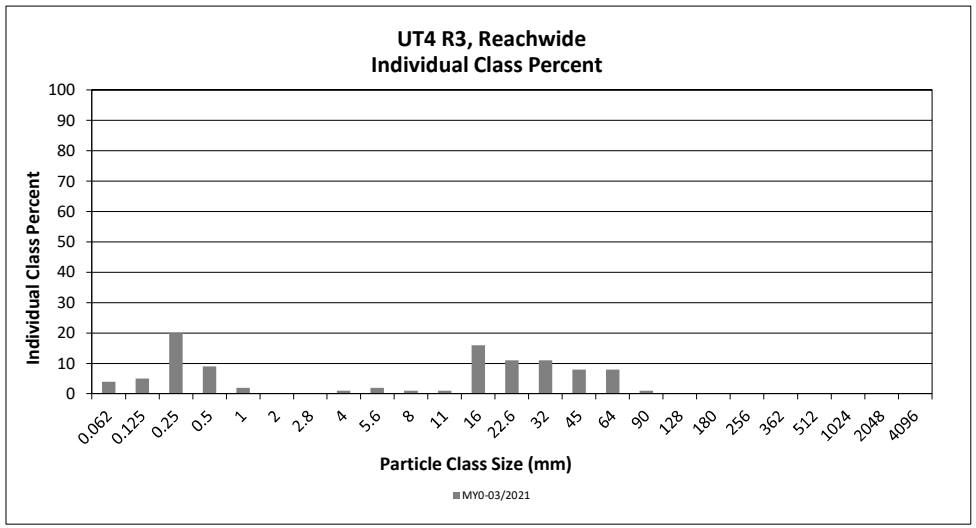
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT4 R3, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	3	4	4	4
SAND	Very fine	0.062	0.125		5	5	5	9
	Fine	0.125	0.250		20	20	20	29
	Medium	0.25	0.50	2	7	9	9	38
	Coarse	0.5	1.0	1	1	2	2	40
	Very Coarse	1.0	2.0					40
GRAVEL	Very Fine	2.0	2.8					40
	Very Fine	2.8	4.0		1	1	1	41
	Fine	4.0	5.6	2		2	2	43
	Fine	5.6	8.0	1		1	1	44
	Medium	8.0	11.0	1		1	1	45
	Medium	11.0	16.0	14	2	16	16	61
	Coarse	16.0	22.6	10	1	11	11	72
	Coarse	22.6	32	11		11	11	83
	Very Coarse	32	45	8		8	8	91
	Very Coarse	45	64	8		8	8	99
COBBLE	Small	64	90	1		1	1	100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.16
D_{35} =	0.40
D_{50} =	12.4
D_{84} =	33.4
D_{95} =	53.7
D_{100} =	90.0





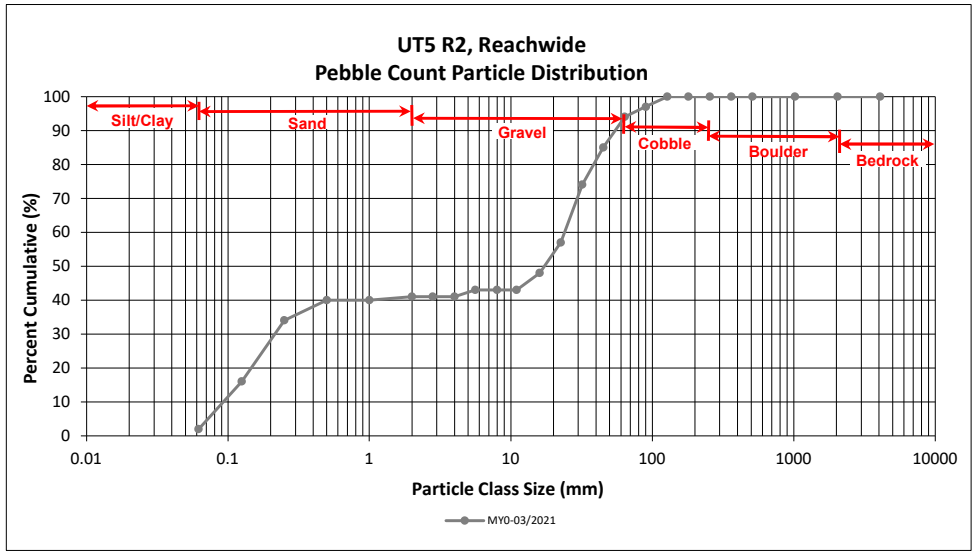
Reachwide Pebble Count Plots

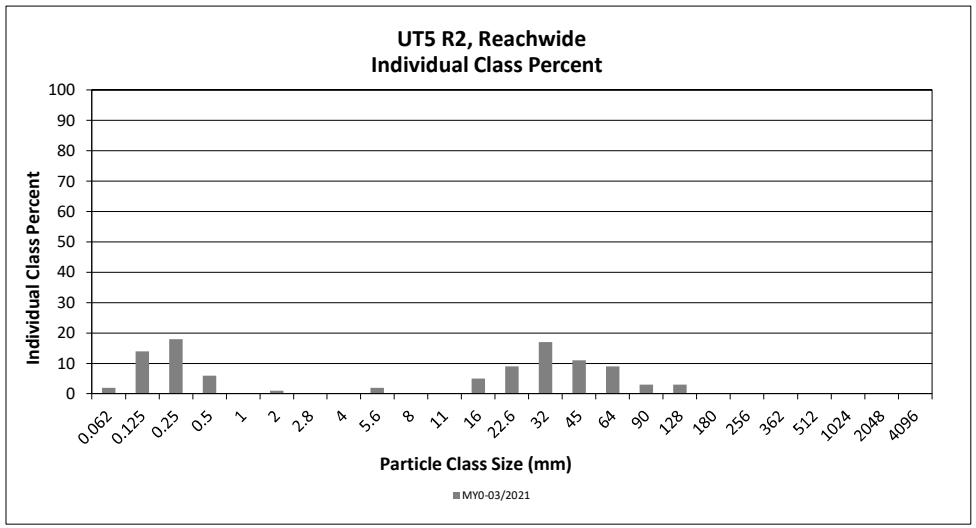
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT5 R2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		2	2	2	2
SAND	Very fine	0.062	0.125		14	14	14	16
	Fine	0.125	0.250		18	18	18	34
	Medium	0.25	0.50		6	6	6	40
	Coarse	0.5	1.0					40
	Very Coarse	1.0	2.0	1		1	1	41
GRAVEL	Very Fine	2.0	2.8					41
	Very Fine	2.8	4.0					41
	Fine	4.0	5.6	2		2	2	43
	Fine	5.6	8.0					43
	Medium	8.0	11.0					43
	Medium	11.0	16.0	5		5	5	48
	Coarse	16.0	22.6	9		9	9	57
	Coarse	22.6	32	17		17	17	74
	Very Coarse	32	45	11		11	11	85
	Very Coarse	45	64	9		9	9	94
COBBLE	Small	64	90	3		3	3	97
	Small	90	128	3		3	3	100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.13
D_{35} =	0.28
D_{50} =	17.3
D_{84} =	43.6
D_{95} =	71.7
D_{100} =	128.0





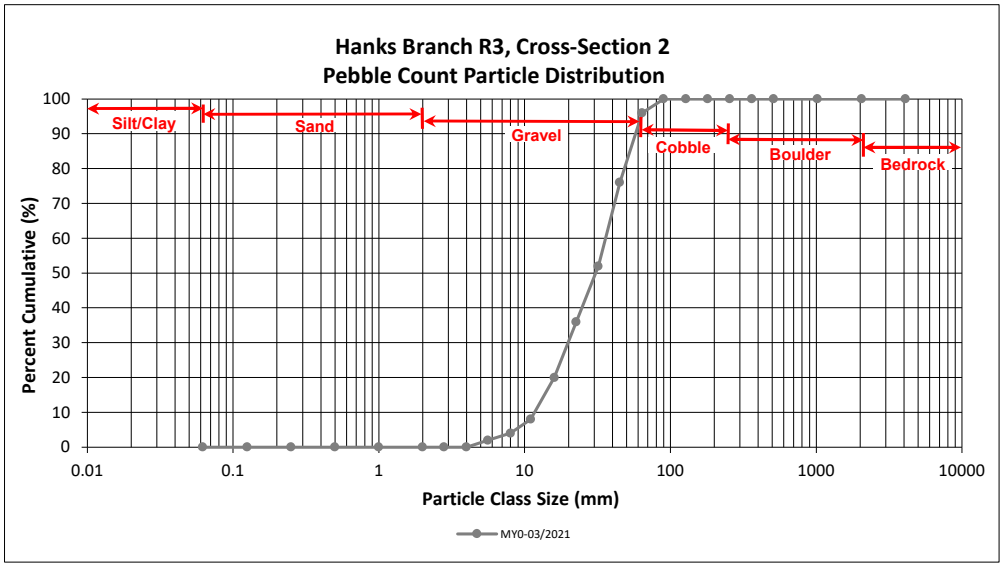
Cross-Section Pebble Count Plots

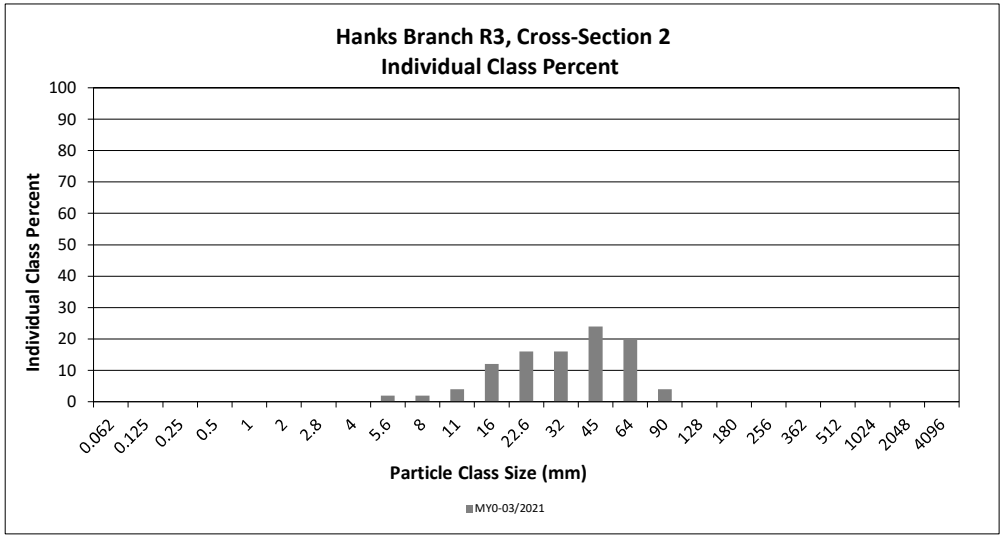
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

Hanks Branch R3, Cross-Section 2

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.6	2	2	2
	Fine	5.6	8.0	2	2	4
	Medium	8.0	11.0	4	4	8
	Medium	11.0	16.0	12	12	20
	Coarse	16.0	22.6	16	16	36
	Coarse	22.6	32	16	16	52
	Very Coarse	32	45	24	24	76
	Very Coarse	45	64	20	20	96
COBBLE	Small	64	90	4	4	100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 2	
Channel materials (mm)	
D_{16} =	14.12
D_{35} =	22.12
D_{50} =	30.6
D_{84} =	51.8
D_{95} =	62.9
D_{100} =	90.0





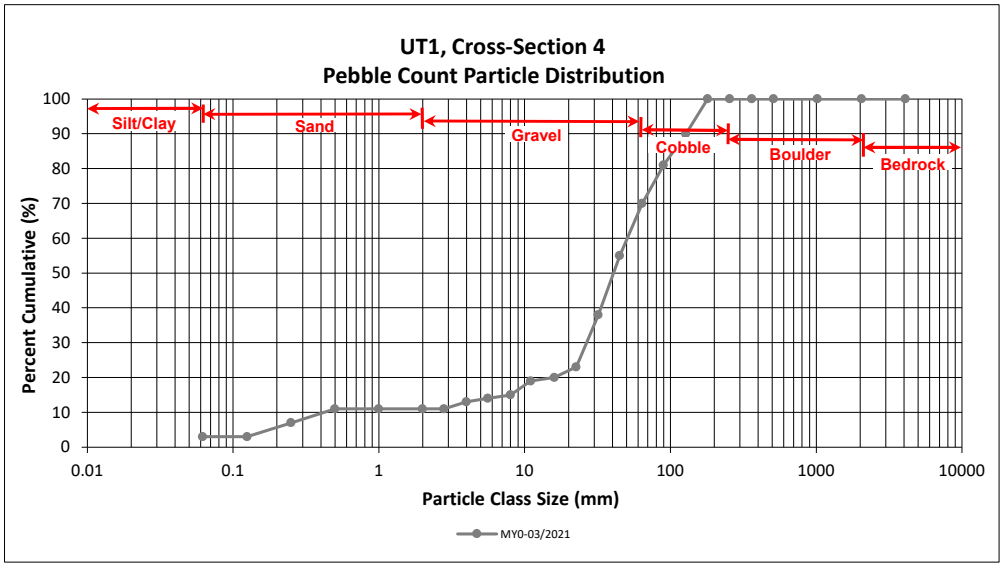
Cross-Section Pebble Count Plots

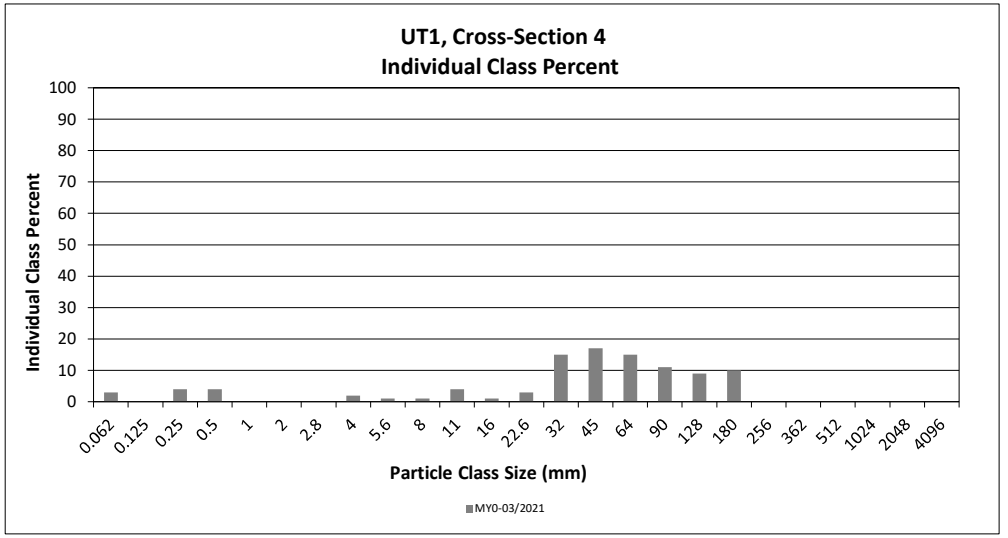
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT1, 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	3	3	3
SAND	Very fine	0.062	0.125			3
	Fine	0.125	0.250	4	4	7
	Medium	0.25	0.50	4	4	11
	Coarse	0.5	1.0			11
	Very Coarse	1.0	2.0			11
GRAVEL	Very Fine	2.0	2.8			11
	Very Fine	2.8	4.0	2	2	13
	Fine	4.0	5.6	1	1	14
	Fine	5.6	8.0	1	1	15
	Medium	8.0	11.0	4	4	19
	Medium	11.0	16.0	1	1	20
	Coarse	16.0	22.6	3	3	23
	Coarse	22.6	32	15	15	38
	Very Coarse	32	45	17	17	55
	Very Coarse	45	64	15	15	70
COBBLE	Small	64	90	11	11	81
	Small	90	128	9	9	90
	Large	128	180	10	10	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 4	
Channel materials (mm)	
D_{16} =	8.66
D_{35} =	29.85
D_{50} =	40.7
D_{84} =	101.2
D_{95} =	151.8
D_{100} =	180.0





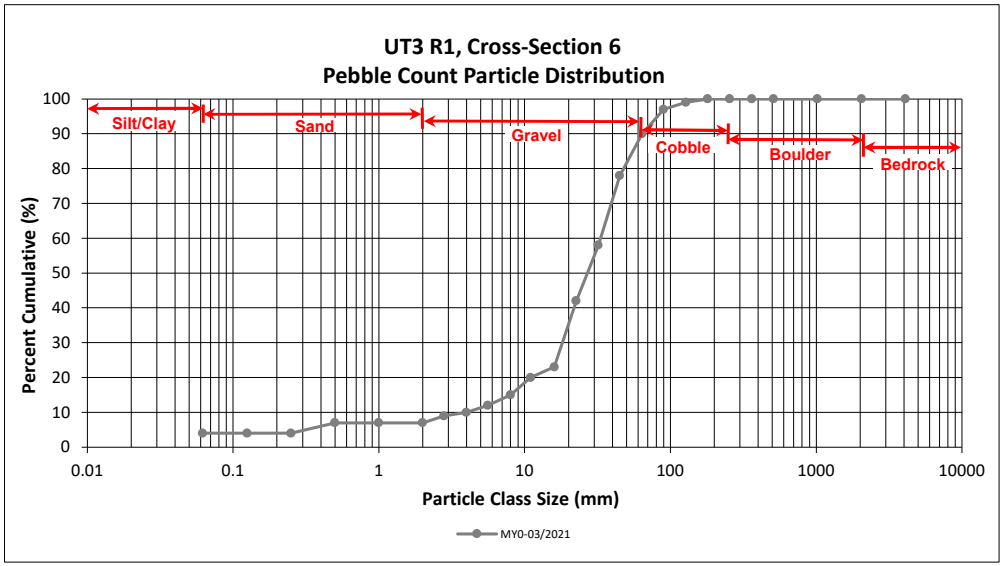
Cross-Section Pebble Count Plots

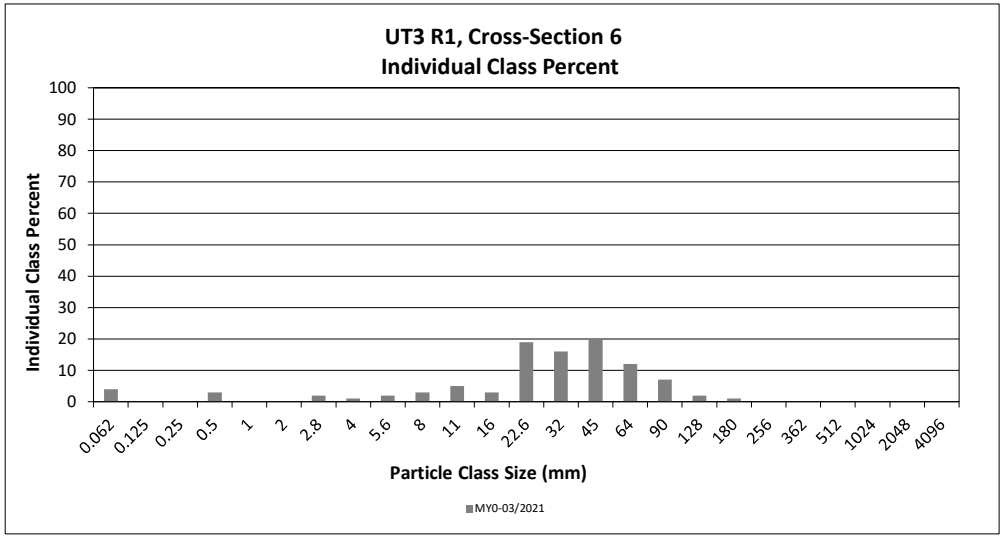
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT3 R1, 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	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250			4
	Medium	0.25	0.50	3	3	7
	Coarse	0.5	1.0			7
	Very Coarse	1.0	2.0			7
GRAVEL	Very Fine	2.0	2.8	2	2	9
	Very Fine	2.8	4.0	1	1	10
	Fine	4.0	5.6	2	2	12
	Fine	5.6	8.0	3	3	15
	Medium	8.0	11.0	5	5	20
	Medium	11.0	16.0	3	3	23
	Coarse	16.0	22.6	19	19	42
	Coarse	22.6	32	16	16	58
	Very Coarse	32	45	20	20	78
	Very Coarse	45	64	12	12	90
COBBLE	Small	64	90	7	7	97
	Small	90	128	2	2	99
	Large	128	180	1	1	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 5	
Channel materials (mm)	
D_{16} =	8.53
D_{35} =	19.90
D_{50} =	26.9
D_{84} =	53.7
D_{95} =	81.6
D_{100} =	180.0





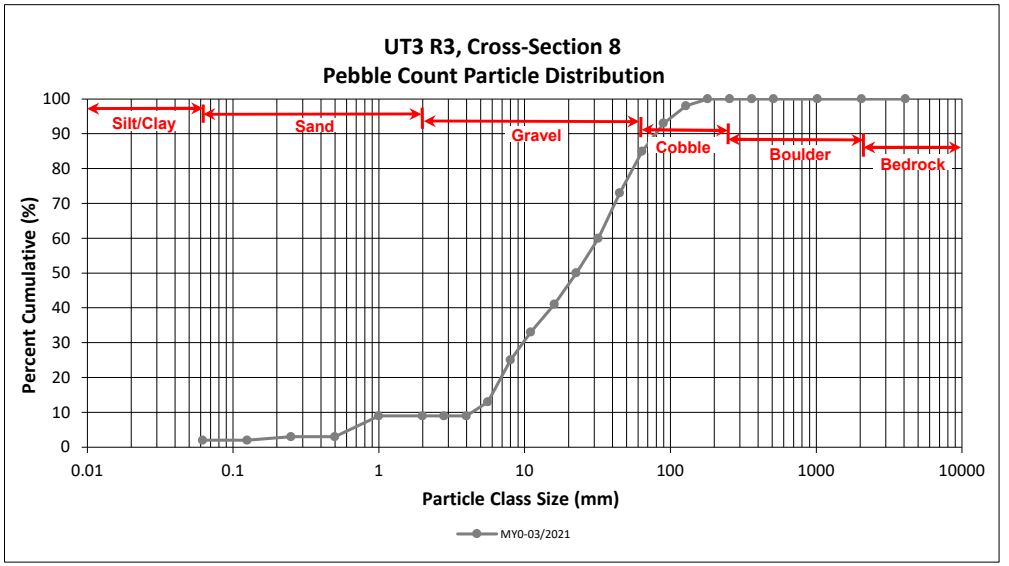
Cross-Section Pebble Count Plots

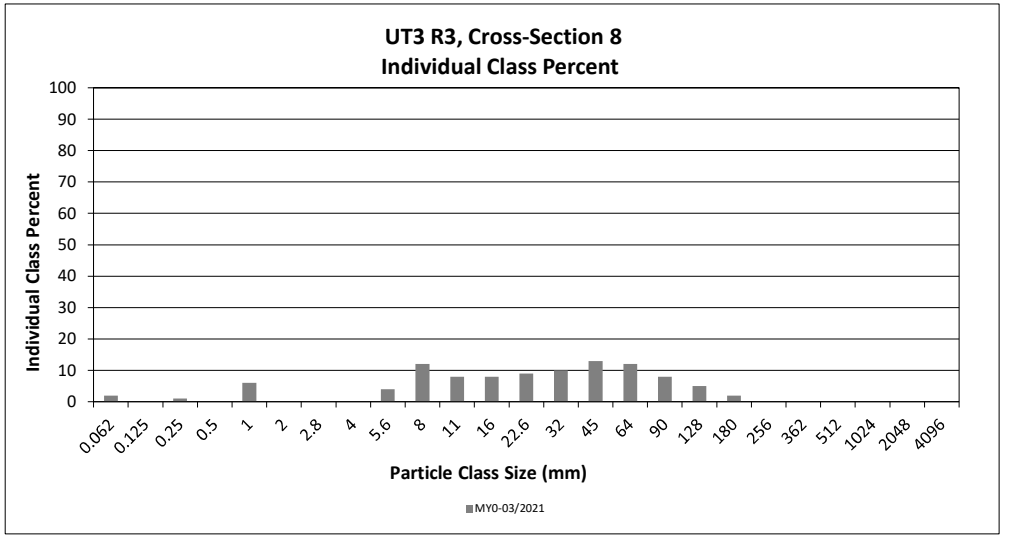
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT3 R3, Cross-Section 8

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250	1	1	3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0	6	6	9
	Very Coarse	1.0	2.0			9
GRAVEL	Very Fine	2.0	2.8			9
	Very Fine	2.8	4.0			9
	Fine	4.0	5.6	4	4	13
	Fine	5.6	8.0	12	12	25
	Medium	8.0	11.0	8	8	33
	Medium	11.0	16.0	8	8	41
	Coarse	16.0	22.6	9	9	50
	Coarse	22.6	32	10	10	60
	Very Coarse	32	45	13	13	73
	Very Coarse	45	64	12	12	85
COBBLE	Small	64	90	8	8	93
	Small	90	128	5	5	98
	Large	128	180	2	2	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 8	
Channel materials (mm)	
D_{16} =	6.12
D_{35} =	12.08
D_{50} =	22.6
D_{84} =	62.1
D_{95} =	103.6
D_{100} =	180.0





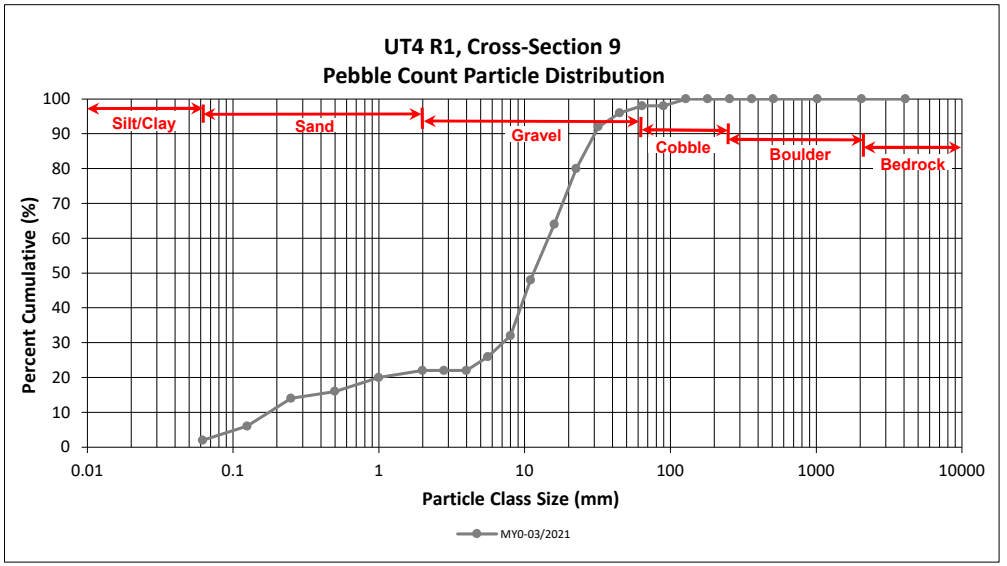
Cross-Section Pebble Count Plots

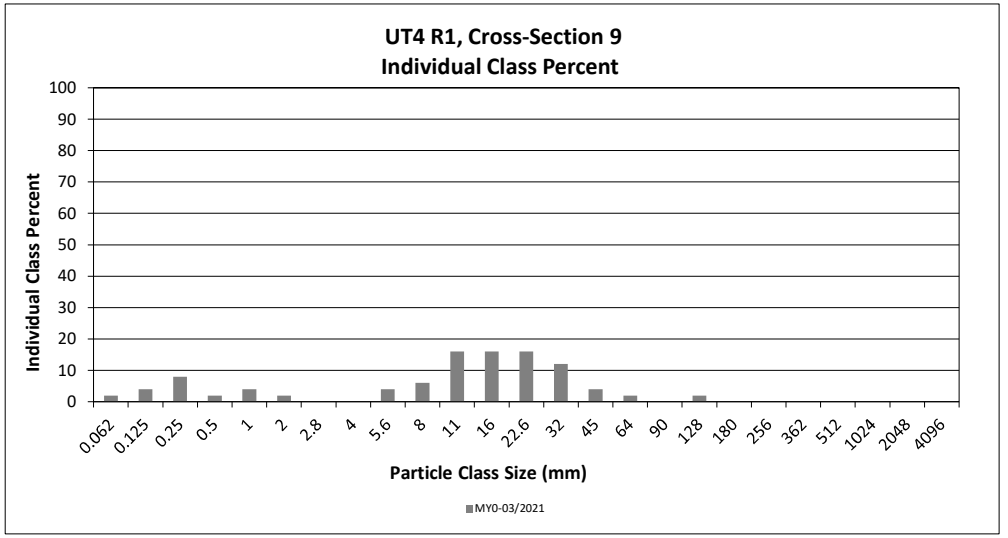
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT4 R1, 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	2	2	2
SAND	Very fine	0.062	0.125	4	4	6
	Fine	0.125	0.250	8	8	14
	Medium	0.25	0.50	2	2	16
	Coarse	0.5	1.0	4	4	20
	Very Coarse	1.0	2.0	2	2	22
GRAVEL	Very Fine	2.0	2.8			22
	Very Fine	2.8	4.0			22
	Fine	4.0	5.6	4	4	26
	Fine	5.6	8.0	6	6	32
	Medium	8.0	11.0	16	16	48
	Medium	11.0	16.0	16	16	64
	Coarse	16.0	22.6	16	16	80
	Coarse	22.6	32	12	12	92
	Very Coarse	32	45	4	4	96
	Very Coarse	45	64	2	2	98
COBBLE	Small	64	90			98
	Small	90	128	2	2	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 9	
Channel materials (mm)	
D_{16} =	0.50
D_{35} =	8.49
D_{50} =	11.5
D_{84} =	25.4
D_{95} =	41.3
D_{100} =	128.0





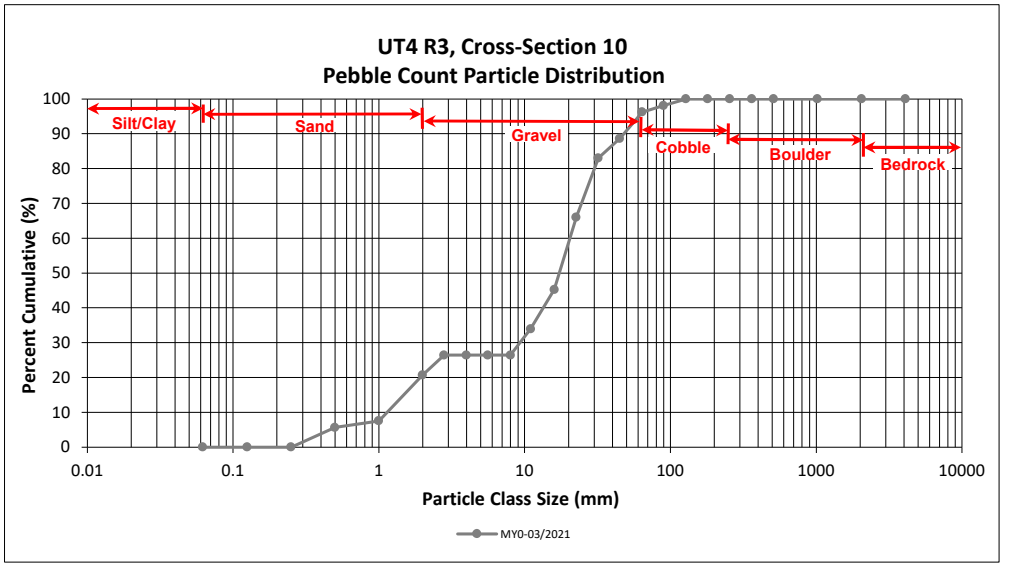
Cross-Section Pebble Count Plots

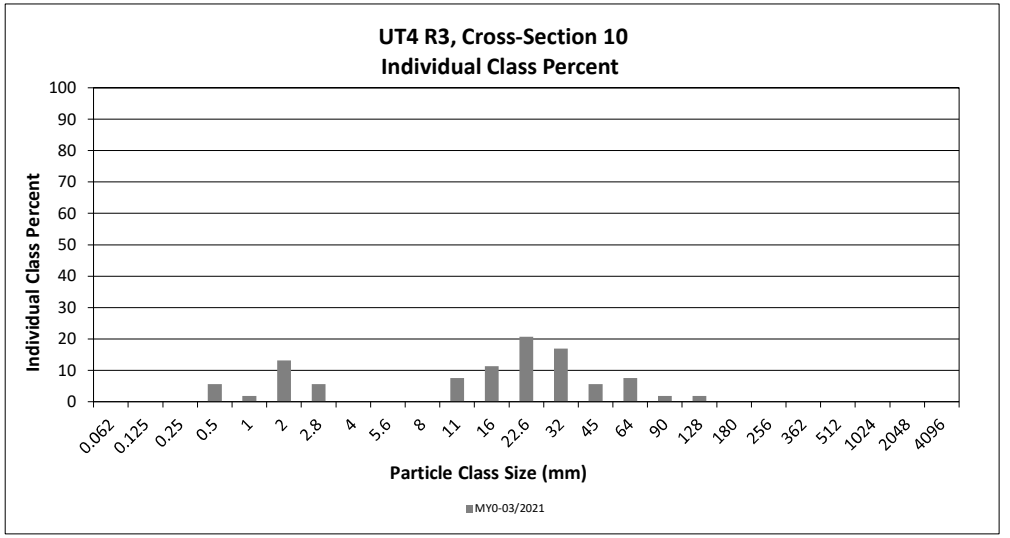
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT4 R3, Cross-Section 10

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	6	6	6
	Coarse	0.5	1.0	2	2	8
	Very Coarse	1.0	2.0	13	13	21
GRAVEL	Very Fine	2.0	2.8	6	6	27
	Very Fine	2.8	4.0			27
	Fine	4.0	5.6			27
	Fine	5.6	8.0			27
	Medium	8.0	11.0	8	8	35
	Medium	11.0	16.0	11	11	46
	Coarse	16.0	22.6	21	21	67
	Coarse	22.6	32	17	17	84
	Very Coarse	32	45	6	6	90
	Very Coarse	45	64	7	7	97
COBBLE	Small	64	90	2	2	99
	Small	90	128	1	1	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 10	
Channel materials (mm)	
D_{16} =	1.53
D_{35} =	11.00
D_{50} =	17.1
D_{84} =	32.0
D_{95} =	57.9
D_{100} =	128.0





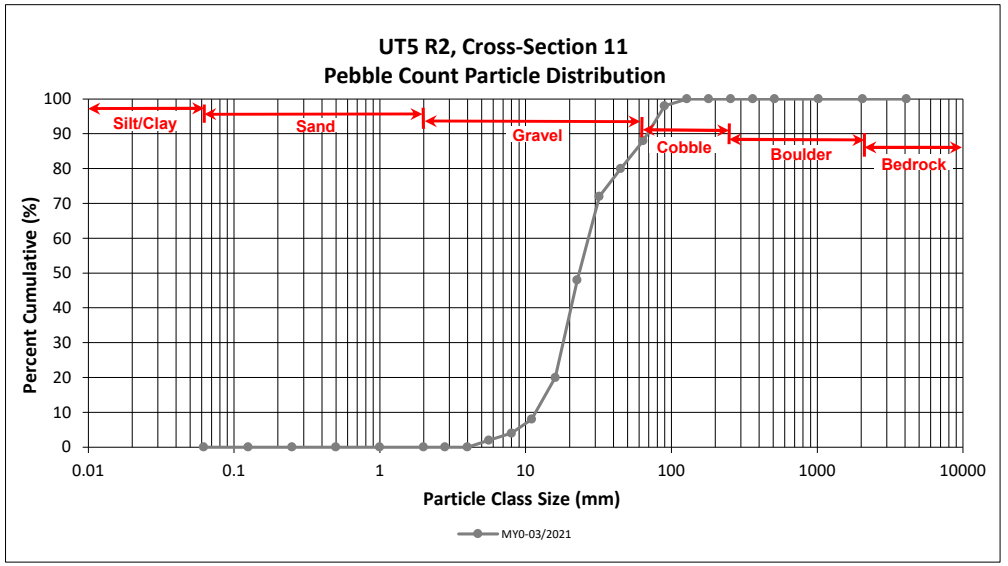
Cross-Section Pebble Count Plots

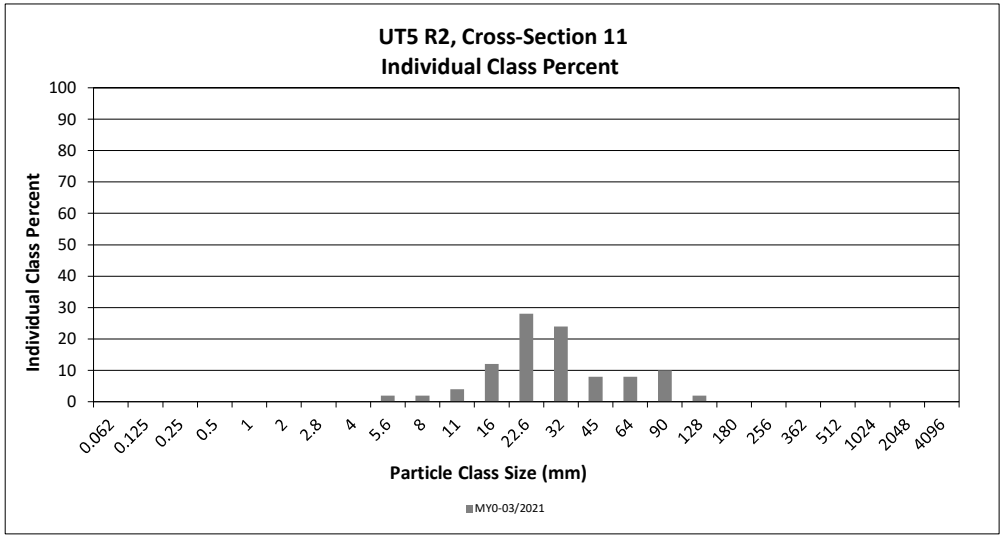
Lyon Hills Mitigation Site
DMS Project No. 100085
Monitoring Year 0 - 2021

UT5 R2, Cross-Section 11

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.6	2	2	2
	Fine	5.6	8.0	2	2	4
	Medium	8.0	11.0	4	4	8
	Medium	11.0	16.0	12	12	20
	Coarse	16.0	22.6	28	28	48
	Coarse	22.6	32	24	24	72
	Very Coarse	32	45	8	8	80
	Very Coarse	45	64	8	8	88
COBBLE	Small	64	90	10	10	98
	Small	90	128	2	2	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 11	
Channel materials (mm)	
D_{16} =	14.12
D_{35} =	19.25
D_{50} =	23.3
D_{84} =	53.7
D_{95} =	81.3
D_{100} =	128.0





APPENDIX 5. Record Drawings

June 10, 2021

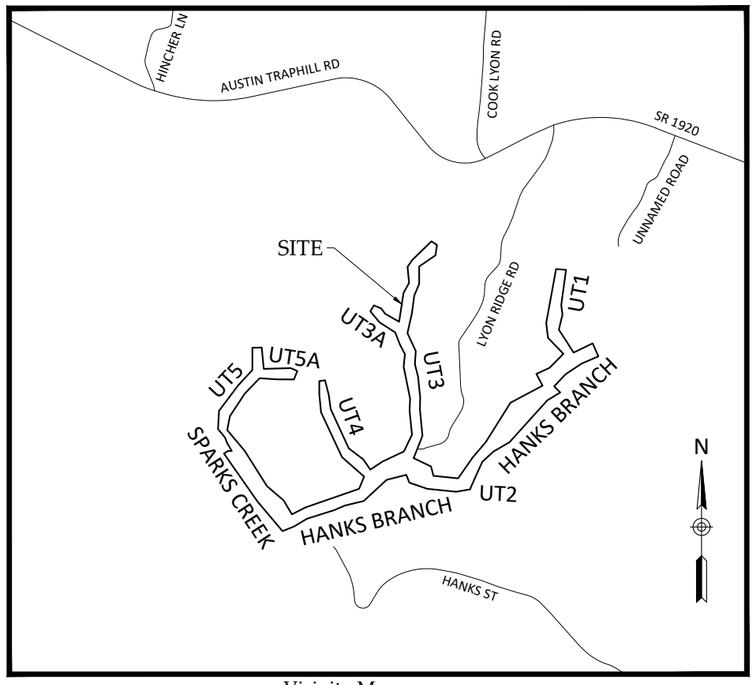
Lyon Hills Mitigation Site As-Built

Wilkes County, North Carolina

for

NCDEQ

Division of Mitigation Services



Vicinity Map
Not to Scale

CERTIFICATE OF SURVEY AND ACCURACY

I, PHILLIP B. KEE, CERTIFY THAT THE GROUND TOPOGRAPHIC SURVEY PORTION OF THIS PROJECT WAS COMPLETED UNDER MY DIRECT SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY DIRECT SUPERVISION; THAT THE RECORD DRAWINGS WERE PREPARED BY WILDLANDS ENGINEERING, INC. FROM DIGITAL FILES PROVIDED BY KEE MAPPING AND SURVEYING, PA AS SHOWN ON AN AS-BUILT SURVEY FOR "LYON HILLS MITIGATION SITE", JOB # 2101003-AB, DATED 04/30/21; 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 02/17/21 - 04/26/21; 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; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION .1606; THAT THIS MAP WAS NOT PREPARED IN ACCORDANCE WITH G.S. 47-30, AS AMENDED AND DOES NOT REPRESENT AN OFFICIAL BOUNDARY SURVEY.

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 10TH DAY OF JUNE, 2021, A.D.

DocuSigned by:
Phillip B. Kee
D965004A7692407...
PHILLIP B. KEE, PLS L-4647

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

AS-BUILT AND RECORD DRAWINGS
ISSUED MAY 28, 2021

Sheet Index

Title Sheet	0.1
Project Overview	0.2
General Notes and Symbols	0.3
Stream Plan & Profile	1.01-1.41
BMP Overview	2.00
BMP Plans	2.01-2.03
Planting Tables	3.00
Planting Overview	3.01
Planting Plans	3.02-3.10
Fencing Overview	4.00
Fencing Plan	4.01-4.18

Project Directory

Engineering:
Wildlands Engineering, Inc
License No. F-0831
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Jeff Keaton, PE, Project Manager
Nicole Millns, PE, Project Engineer
919-851-9986

Surveying:
Kee Mapping and Surveying, PA
88 Central Avenue
Asheville, NC 28801
Phillip B. Kee, PLS
828-645-8275

Owner:
DEQ NCDMS
1652 Mail Service Center
Raleigh, NC 27699-1652
Attention: Kelly Phillips
919-723-7365

NCDEQ Contract No. 7620
DMS ID No. 100085
USACE Action ID No. SAW-2018-01784
NCDWR Project No. 2018-1274 v1

WILDLANDS ENGINEERING
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Tel: 919-851-9986
License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE MACALUSO

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Title Sheet

Revisions:

Date: May 29, 2021
Job Number: 105-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 0.1

X:\Shared\Projects\105-02177 Lyon Hills\Monitoring\Baseline Monitoring\2021\Plans\02177-AB Cover.dwg

June 10, 2021

HORACE RANDLE WOOD
PIN: 4904-85-2899
DB: 1156 PG: 106 (EXHIBIT R, TRACT II & III)

RICKY C. CARROLL & WIFE
LISA B. CARROLL
PIN: 4904-76-4116
PORTION OF DB: 859 PG: 207
(FIRST TRACT)

BOBBY J. HOLBROOK & WIFE
RITA K. HOLBROOK
PIN: 4904-85-7507
DB: 849 PG: 279

BENJAMIN J. LYON & WIFE
LINDA LYON
PIN: 4904-95-0764
DB: 1051 PG: 212

MICKEY L. DURHAM & WIFE
LINDA M. DURHAM
PIN: 4914-05-0896
DB: 1249 PG: 99
PB: 11 PG: 569 (TRACT 4)

40' SURRY-YADKIN E.M.C.
UTILITY LINE EASEMENT

EDDIE D. BLACKBURN, JR. & WIFE
HEATHER BLACKBURN
PIN: 4904-95-3428
DB: 1199 PG: 210

RICHARD D. LYON & WIFE
TAMMY W. LYON
PIN: 4914-05-1582
DB: 731 PG: 267

STA. 500+00
BEGIN UT3
REACH 1 (RESTORATION)

STA. 300+28
BEGIN UT1
(RESTORATION)

STA. 300+88
UT1 (RESTORATION)
BEGIN CREDITS

TO S.R. 1749

LYON RIDGE ROAD
(FORMERLY T.W. LYON ROAD)
(PRIVATE)

HORACE RANDLE WOOD
PIN: 4904-74-6732
DB: 1156 PG: 106 (EXHIBIT R, TRACT I)

HORACE RANDLE WOOD
PIN: 4904-94-1831
DB: 1156 PG: 106 (EXHIBIT Q, TRACT III)

STA. 550+00
BEGIN UT3A
(ENHANCEMENT II)

STA. 552+53
END UT3A (ENHANCEMENT II)
STA. 506+30
UT3 REACH 1 (RESTORATION)

STA. 506+55
END UT3
REACH 1 (RESTORATION)
BEGIN UT3
REACH 2 (ENHANCEMENT II)

STA. 511+02
END UT3
REACH 2 (ENHANCEMENT II)
BEGIN UT3
REACH 3 (RESTORATION)

STA. 517+34
END UT3
REACH 3 (RESTORATION)
BEGIN UT3
REACH 4 (ENHANCEMENT II)

STA. 520+06
END UT3
REACH 4 (ENHANCEMENT II)
STA. 225+25
HANKS BRANCH
REACH 2 (ENHANCEMENT II)

STA. 216+99
END HANKS BRANCH
REACH 1 (ENHANCEMENT II)
BEGIN HANKS BRANCH
REACH 2 (ENHANCEMENT II)
STA. 400+90
END UT2 (ENHANCEMENT II)

STA. 400+12
BEGIN UT2
(ENHANCEMENT II)

STA. 200+21
BEGIN HANKS BRANCH
REACH 1 (ENHANCEMENT II)

STA. 308+93
END UT1 (RESTORATION)
STA. 203+08
HANKS BRANCH REACH 1
(ENHANCEMENT II)

N/F
LEFF J. BENGE
PIN: 4914-04-5444
DB: 819 PG: 474

LEFF J. BENGE
PIN: 4914-04-5444
DB: 819 PG: 474

STA. 800+00
BEGIN UT5
REACH 1 (ENHANCEMENT II)

STA. 703+18
END UT5A
(ENHANCEMENT II)
STA. 802+12
UT5 REACH 1
(ENHANCEMENT II)

STA. 700+00
BEGIN UT5A
(ENHANCEMENT II)

STA. 804+37
END UT5
REACH 1 (ENHANCEMENT II)
BEGIN UT5
REACH 2 (RESTORATION)

STA. 600+00
BEGIN UT4
REACH 1 (RESTORATION)

STA. 602+33
END UT4
REACH 1 (RESTORATION)
BEGIN UT4
REACH 2 (ENHANCEMENT II)

STA. 605+55
END UT4
REACH 2 (ENHANCEMENT II)
BEGIN UT4
REACH 3 (RESTORATION)

STA. 608+36
END UT4
REACH 3 (RESTORATION)
STA. 226+42
HANKS BRANCH
REACH 2 (ENHANCEMENT II)

STA. 100+61
BEGIN SPARKS CREEK
(ENHANCEMENT II)

STA. 102+75
SPARKS CREEK
(ENHANCEMENT II)
START CREDITS

STA. 808+00
END UT5
REACH 2 (RESTORATION)
STA. 101+12
SPARKS CREEK (ENHANCEMENT II)

STA. 228+06
END HANKS BRANCH
REACH 2 (ENHANCEMENT II)
BEGIN HANKS BRANCH
REACH 3 (ENHANCEMENT I)

STA. 233+87
END HANKS BRANCH
REACH 3 (ENHANCEMENT I)
STA. 110+12
SPARKS CREEK (ENHANCEMENT II)

STA. 110+54
END SPARKS CREEK
(ENHANCEMENT II)

JANIE W. CHEEK
PIN: 4904-55-7721
DB: 1068 PG: 452 (TRACTS 1, 2 & 3)
ESTATE FILE 11 E-574

JANIE W. CHEEK
PIN: 4904-54-8184
DB: 1068 PG: 452 (PORTION OF TRACT FOUR)
ESTATE FILE 11 E-574

HORACE RANDLE WOOD
PIN: 4904-63-7463
DB: 1156 PG: 106 (EXHIBIT Q, TRACT II)

JOHN E. LYON
PIN: 4904-82-0576
PORTION OF DB: 557 PG: 433

JOHN E. LYON
PIN: 4904-73-6035
PORTION OF DB: 557 PG: 437
ESTATE FILE 00E-173

RANDEL M. FENDER & WIFE
ETTA FENDER
PIN: 4904-82-1964
DB: 1270 PG: 163

RANDEL M. FENDER & WIFE
ETTA FENDER
PIN: 4904-83-4149
DB: 1254 PG: 205

RANDEL M. FENDER & WIFE
ETTA FENDER
PIN: 4904-83-7188
DB: 1216 PG: 280

JENNIFER A. LEONARD
& HUSBAND JIMMIE E. LEONARD
PIN: 4904-93-0182
DB: 766 PG: 199 &
DB: 1179 PG: 338

HANKS STREET
(S.R. 2078)
R/W
R/W

UT3A
UT5A
UT5
UT4
UT3
UT1
UT2
SPARKS CREEK
HANKS BRANCH

1.01 1.02 1.03 1.04 1.05 1.06 1.07 1.08 1.09 1.10 1.11 1.12 1.13 1.14 1.15 1.16 1.17 1.18 1.19 1.20 1.21 1.22 1.23 1.24 1.25 1.26 1.27 1.28 1.29 1.30 1.31 1.32 1.33 1.34 1.35 1.36 1.37 1.38 1.39 1.40 1.41

FEMA-XS
SFHA
CE
OU

N

0' 150' 300' 450'
(HORIZONTAL)

WILDLANDS ENGINEERING
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Tel: 919-851-9986
License No. F-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037415 NICOLE MACALUSO

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Project Overview

Revisions:

Date:	May 26, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 0.2

X:\Shared\Projects\005-02177 Lyon Hills Monitoring\Baseline Monitoring 2021\Plans\02177-AR General Overview.dwg

June 10, 2021

Pre-Construction Features

- EXISTING PROPERTY LINE
- EXISTING FENCING
- EXISTING STORM PIPE
- EXISTING BEDROCK
- EXISTING FARM ROAD
- EXISTING WETLAND
- EXISTING SPRING
- EXISTING ELECTRIC BOX

Design Features

- CONSERVATION EASEMENT
- CONSERVATION EASEMENT INTERNAL CROSSING
- NOT FOR CREDIT
- DESIGN ENHANCEMENT I REACH
- DESIGN ENHANCEMENT II REACH
- DESIGN RESTORATION REACH
- DESIGN BANKFULL
- DESIGN MAJOR CONTOUR
- DESIGN MINOR CONTOUR
- DESIGN CULVERT
- DESIGN 5 WIRE FENCE
- DESIGN WOVEN WIRE FENCE
- DESIGN LOG VANE
- DESIGN LOG SILL
- DESIGN BOULDER SILL
- DESIGN LOG J-HOOK
- DESIGN ROCK VANE
- DESIGN ROCK STEP POOLS
- DESIGN ROCK CASCADE
- DESIGN FLOODPLAIN OUTLET
- DESIGN RIFFLE
- DESIGN STREAM BANK GRADING
- DESIGN FORD CROSSING
- DESIGN FARM ROAD
- DESIGN BOULDER TOE
- DESIGN TRANSPLANTED SOD MAT
- DESIGN BRUSH TOE
- DESIGN 2" TUBE STEEL GATE
- DESIGN DOUBLE 2" TUBE STEEL GATE

As-Built Features

- AS-BUILT STREAM ALIGNMENT
- AS-BUILT STREAM ALIGNMENT DEVIATION
- AS-BUILT BANKFULL
- AS-BUILT MAJOR CONTOUR (5')
- AS-BUILT MINOR CONTOUR (1')
- LIMITS OF DISTURBANCE
- AS-BUILT CULVERT
- AS-BUILT 5 WIRE FENCE
- AS-BUILT WOVEN WIRE FENCE
- CROSS SECTION
- PHOTO POINT
- STREAM GAUGE - CREST/FLOW
- BAROTROLL
- VEGETATION PLOT
- AS-BUILT LOG VANE
- AS-BUILT LOG SILL
- AS-BUILT BOULDER SILL
- AS-BUILT LOG J-HOOK
- AS-BUILT FLOODPLAIN OUTLET/RIP RAP
- AS-BUILT FARM ROAD
- AS-BUILT FORD CROSSING
- AS-BUILT RIFFLE
- AS-BUILT BOULDER TOE
- AS-BUILT TRANSPLANTED SOD MAT
- AS-BUILT BRUSH TOE
- AS-BUILT TREE
- AS-BUILT 2" TUBE STEEL GATE
- AS-BUILT DOUBLE 2" TUBE STEEL GATE

NOTE:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

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312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Tel: 919.851.9986
License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE MACALUSO

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

General Notes and Symbols

Revisions:

Date:	May 26, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 0.3

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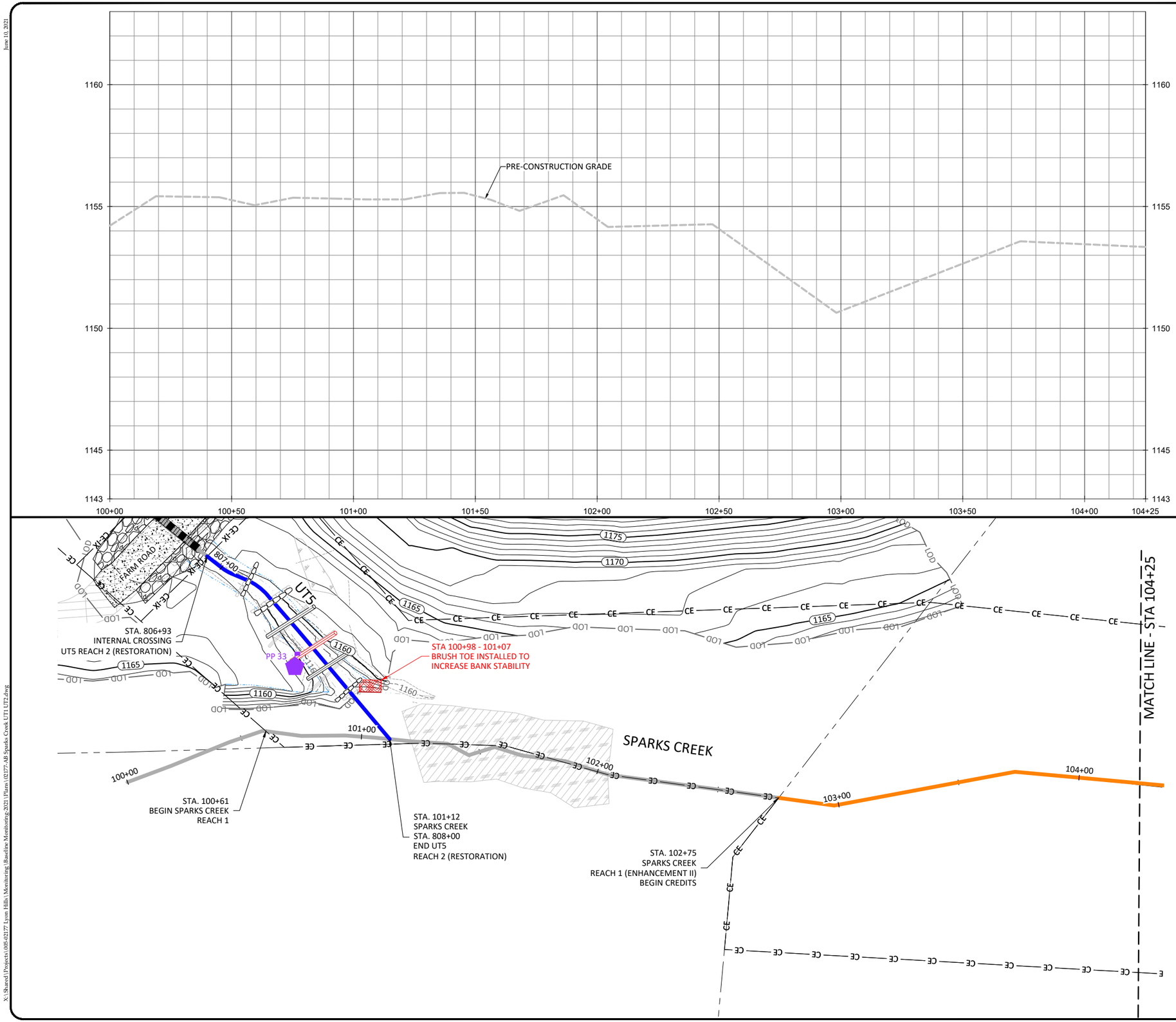
June 10, 2021



NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT5 IS ADDRESSED ON SHEETS 1.35 THROUGH 1.39.

0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)

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312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Tel: 919.851.9986
License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE INGALLS HUGHES 8/25/21

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Sparks Creek
Stream Plan and Profile

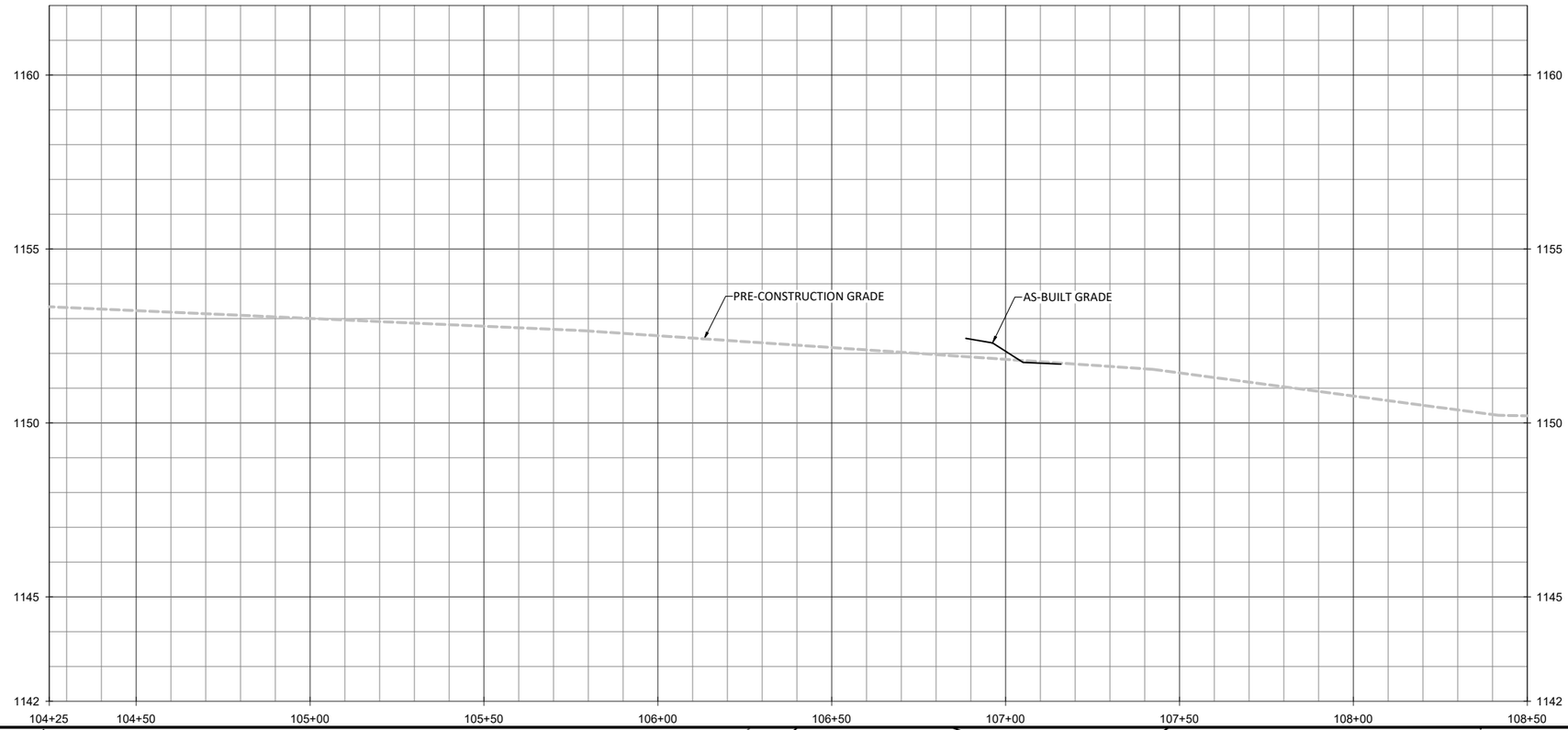
Revisions:

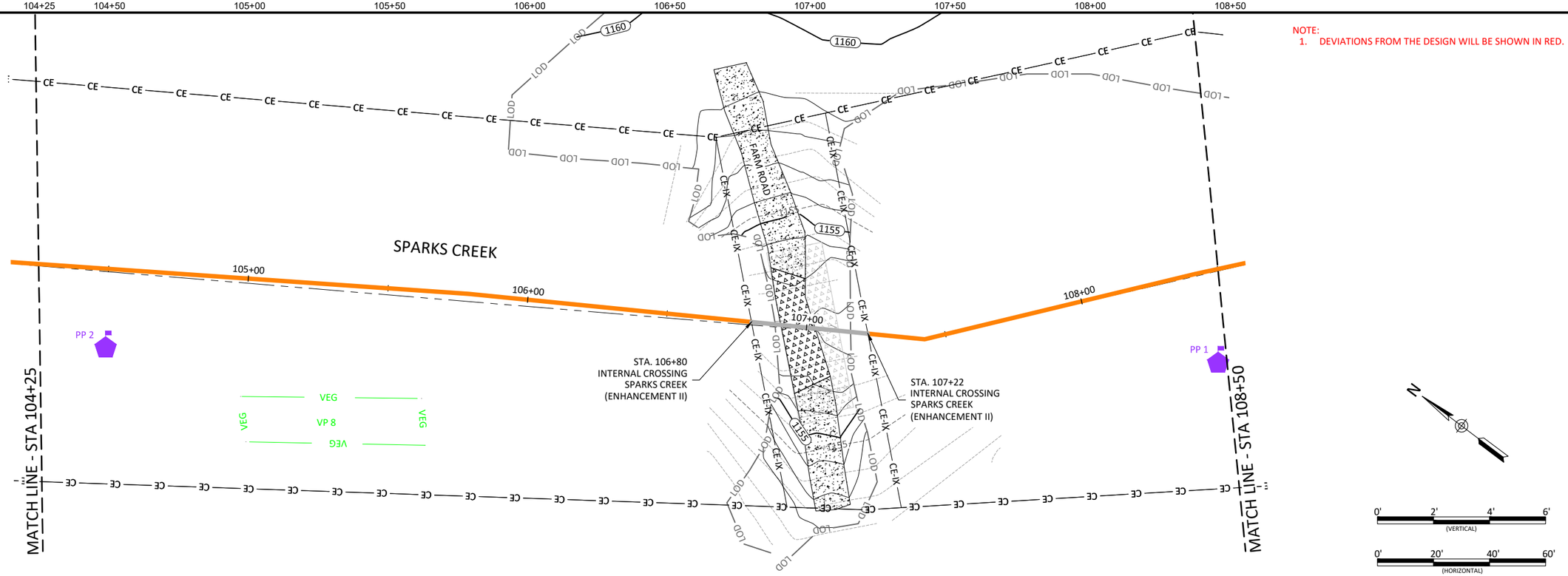
Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.01

X:\Shared\Projects\005-02177 Lyon Hills\Monitoring\Baseline Monitoring 2021\Plans\02177-AB Sparks Creek UT1 UT2.dwg

June 10, 2021





NOTE:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

WILDLANDS ENGINEERING
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Tel: 919-851-9986
License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE MACALUSO 8/25/21

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Sparks Creek
Stream Plan and Profile

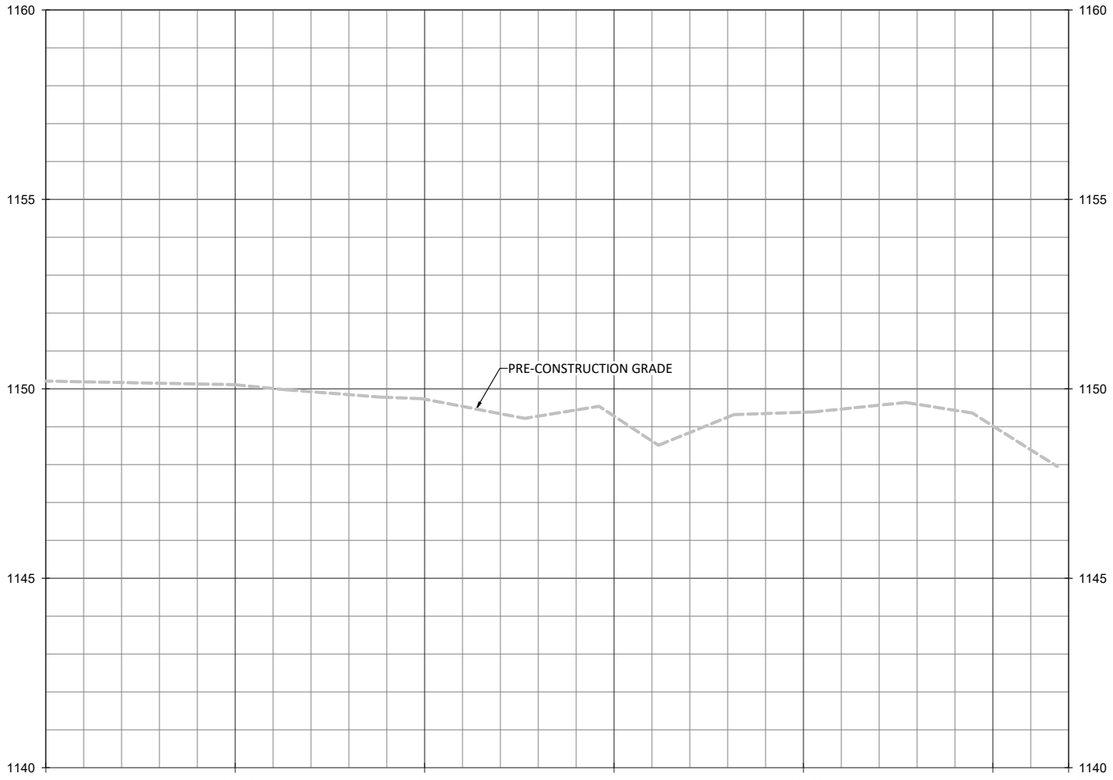
Revisions:

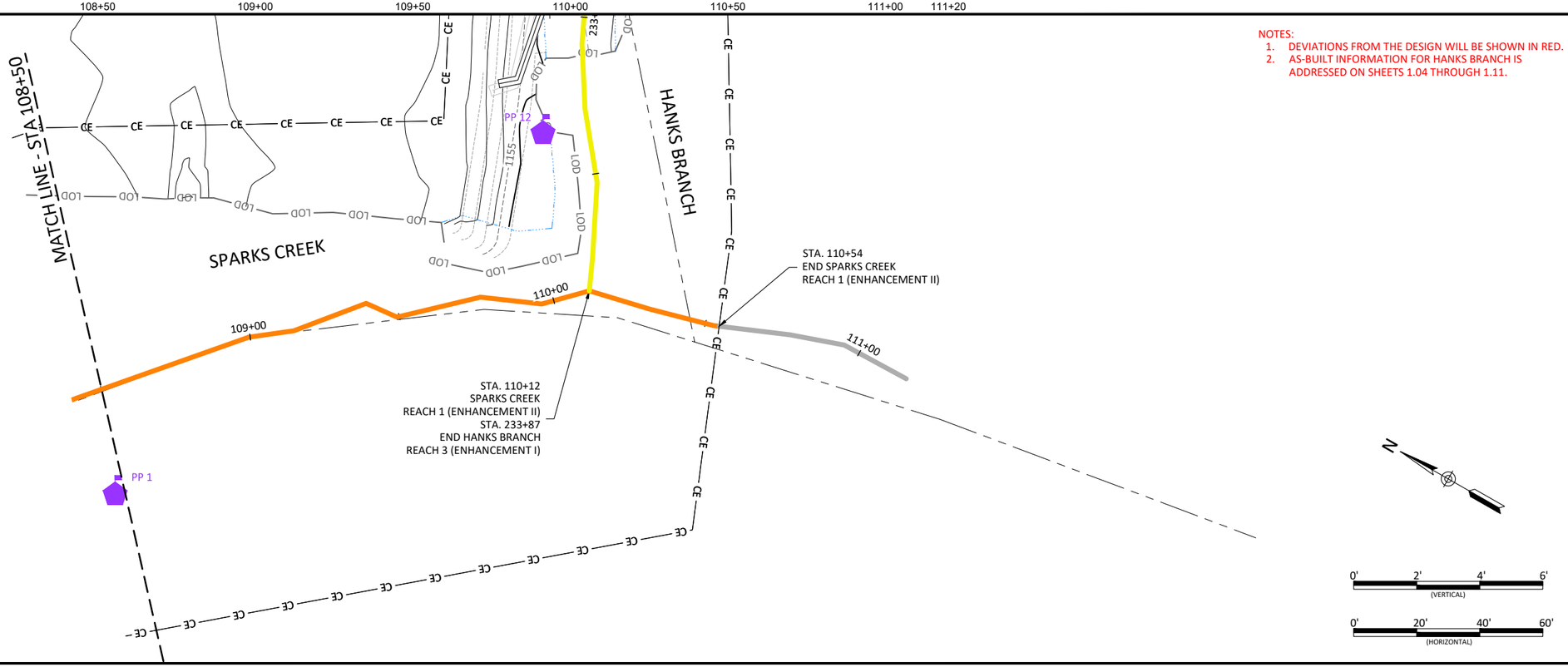
Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.02

X:\Shared\Projects\005-02177 Lyon Hills Monitoring\Baseline Monitoring-2021\Plans\02177-AR Sparks Creek LT1 LT2.dwg

June 10, 2021





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR HANKS BRANCH IS ADDRESSED ON SHEETS 1.04 THROUGH 1.11.

WILDLANDS ENGINEERING
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Tel: 919.851.9986
License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE MACALUSO 5/25/21

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Sparks Creek
Stream Plan and Profile

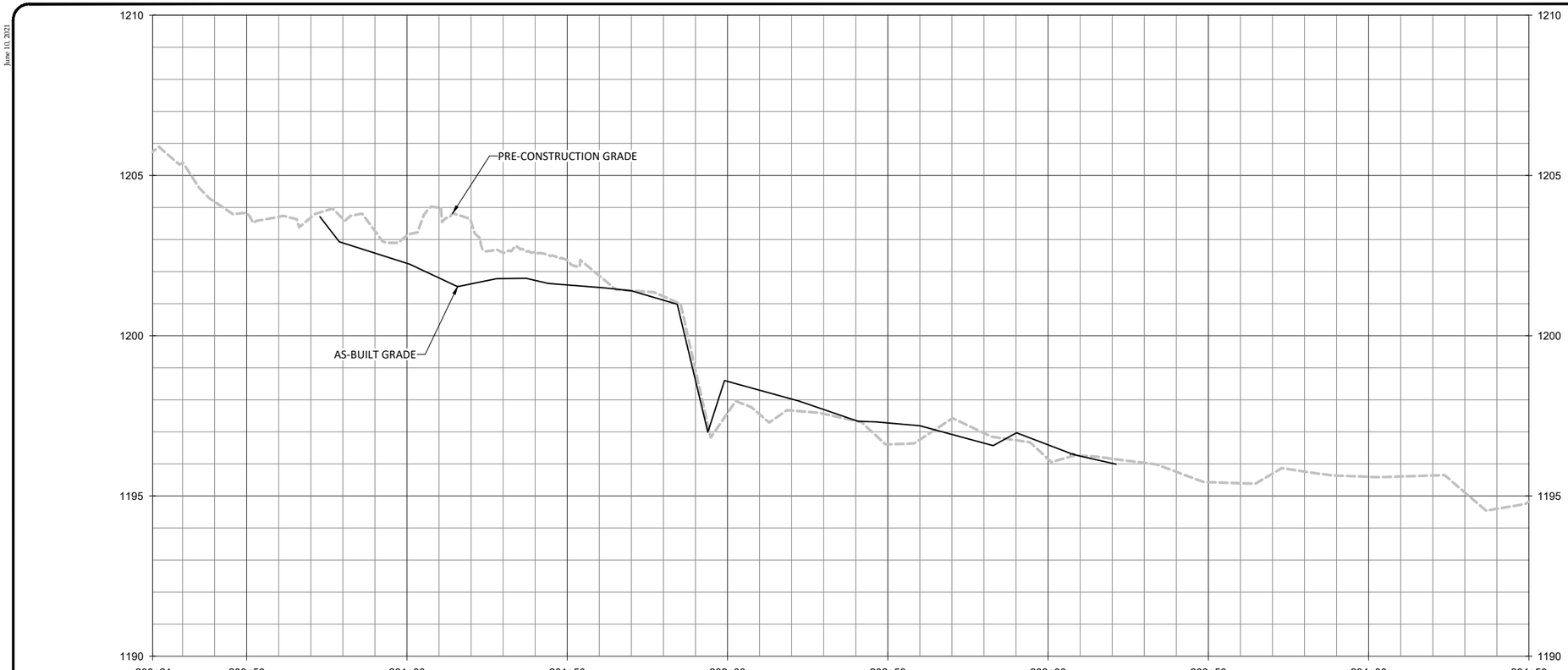
Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.03

X:\Shared\Projects\005-02177 Lyon Hills\Monitoring\Baseline Monitoring-2021\Plans\02177-AB Sparks Creek LT1 LT2.dwg

June 10, 2021



NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT1 IS ADDRESSED ON SHEETS 1.12 THROUGH 1.16

STA. 200+21
BEGIN HANKS BRANCH
REACH 1 (ENHANCEMENT II)

STA. 203+08
HANKS BRANCH
REACH 1 (ENHANCEMENT II)
STA. 308+93
END UT1
REACH 1 (RESTORATION)

HANKS BRANCH

STA 200+56
ROCK FLOODPLAIN OUTLET ADDED TO STABILIZE FLOW FROM FLOODPLAIN

STA 201+97 - 202+44
40 LF REALIGNED TO STABILIZE CHANNEL

STA 202+47
ROCK FLOODPLAIN OUTLET ADDED TO STABILIZE FLOW FROM FLOODPLAIN

PP 3
VP 3
UT1
MATCH LINE - STA 204+50

0' 2' 4' 6' (VERTICAL)
0' 20' 40' 60' (HORIZONTAL)

X:\Shared\Projects\005-02177 Lyon Hills\Monitoring\Baseline Monitoring 2021\Plans\02177-AB Hanks Branch.dwg

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License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE MACALUSO 8/25/21

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

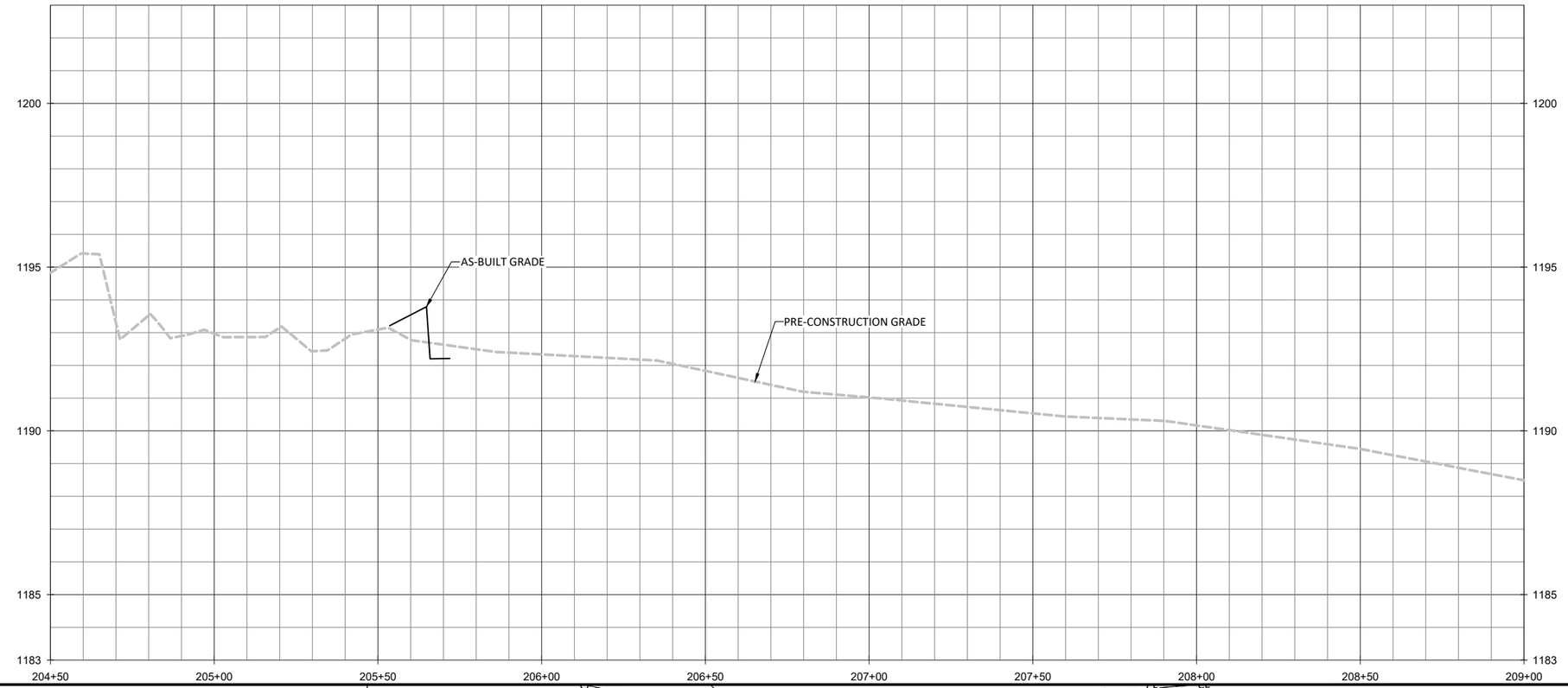
Hanks Branch
Stream Plan and Profile

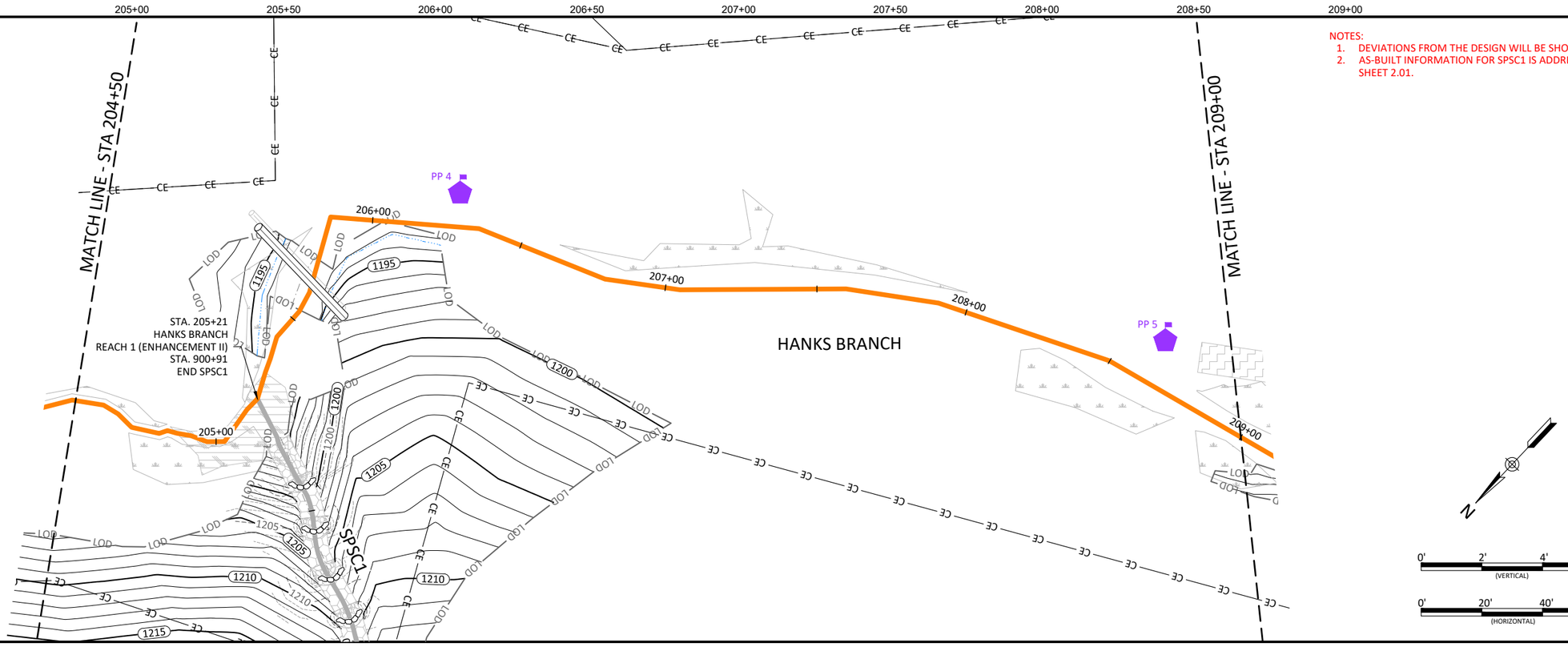
Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.04

June 10, 2021





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR SPSC1 IS ADDRESSED ON SHEET 2.01.

0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

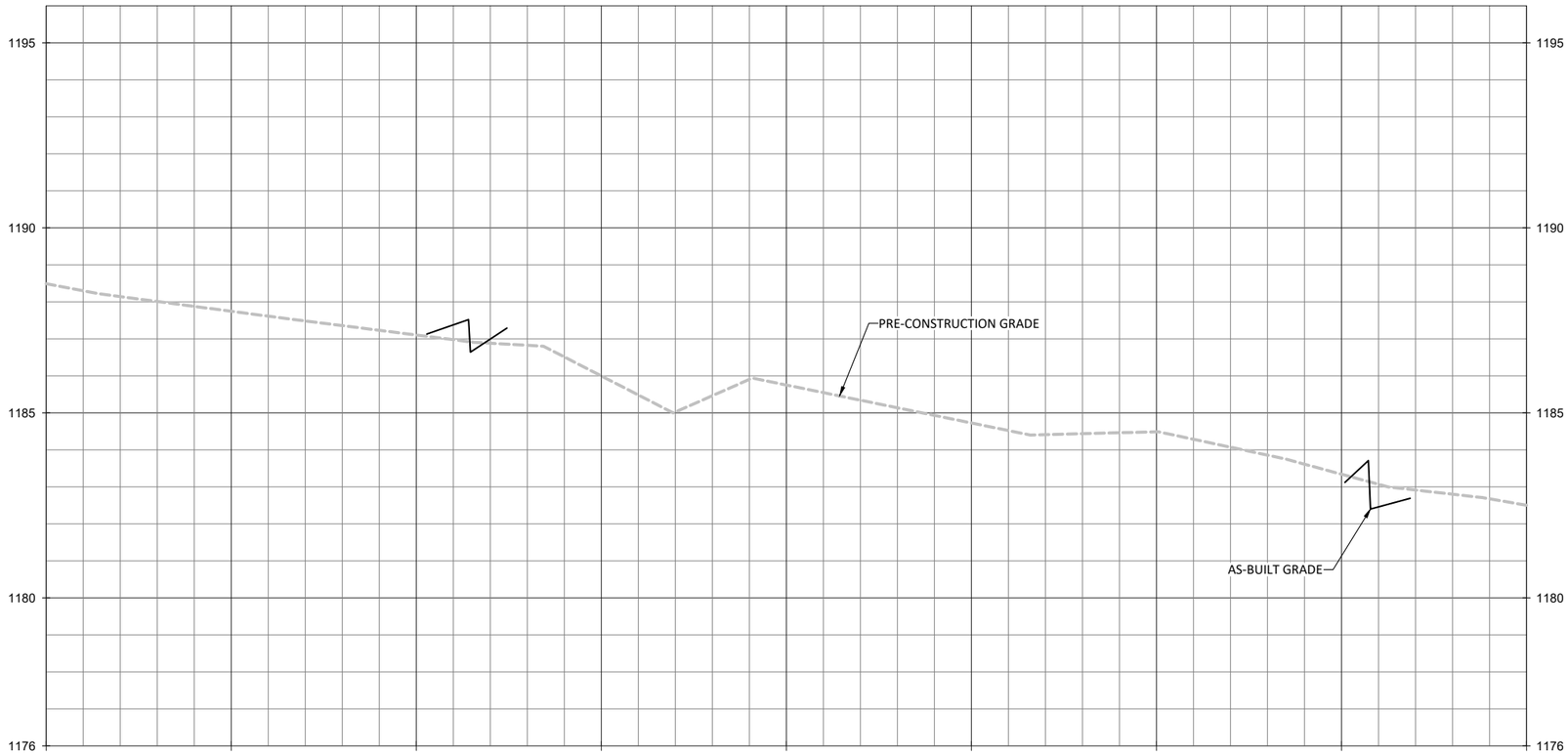
Hanks Branch
Stream Plan and Profile

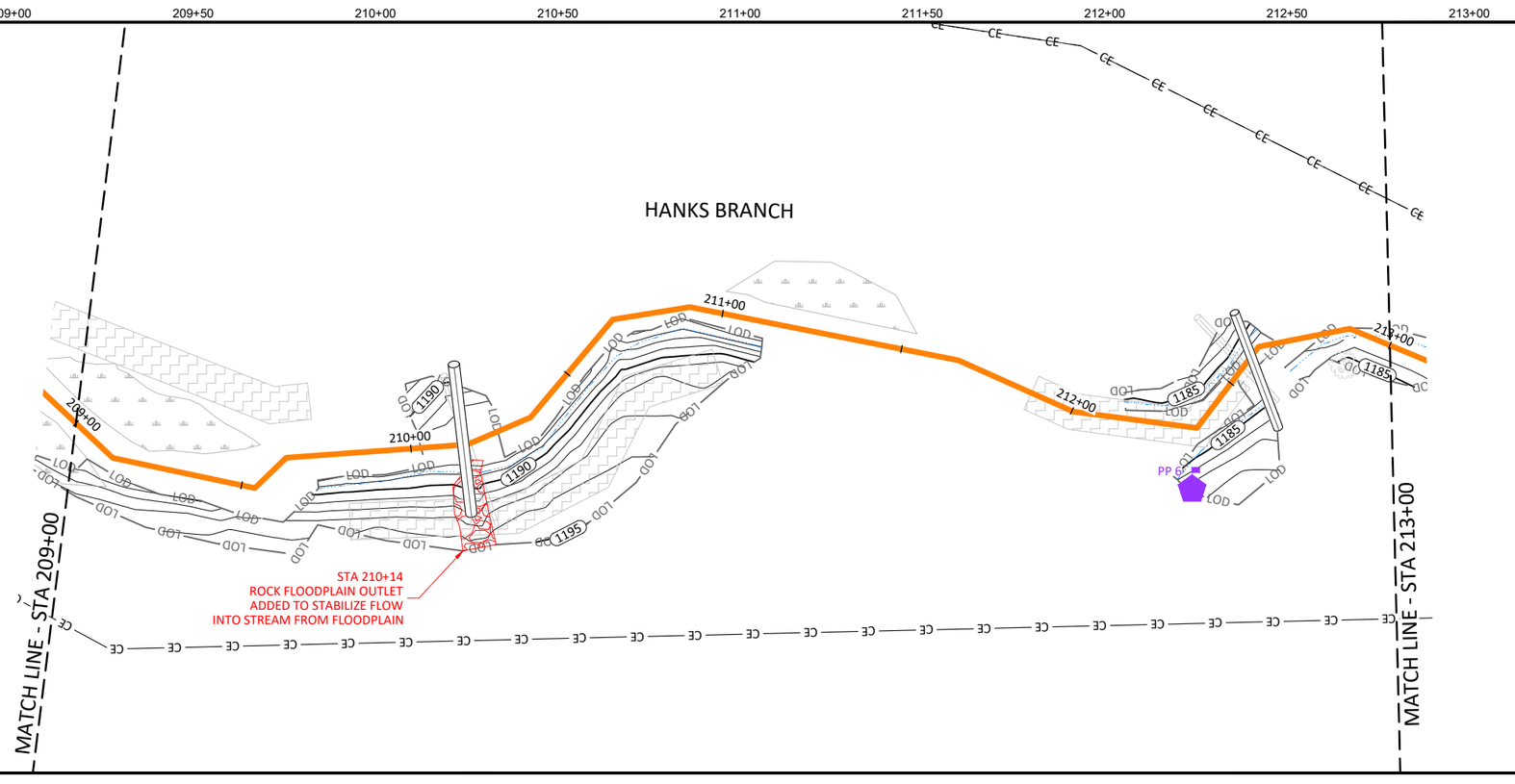
Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

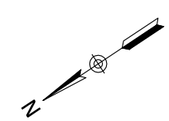
Sheet 1.05

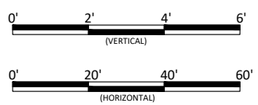
X:\Shared\Projects\005-02177 Lyon Hills\Monitoring\Baseline Monitoring-2021\Plans\02177-AB Hanks Branch.dwg





NOTE:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.





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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch
Stream Plan and Profile

Revisions:

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.06

June 10, 2021

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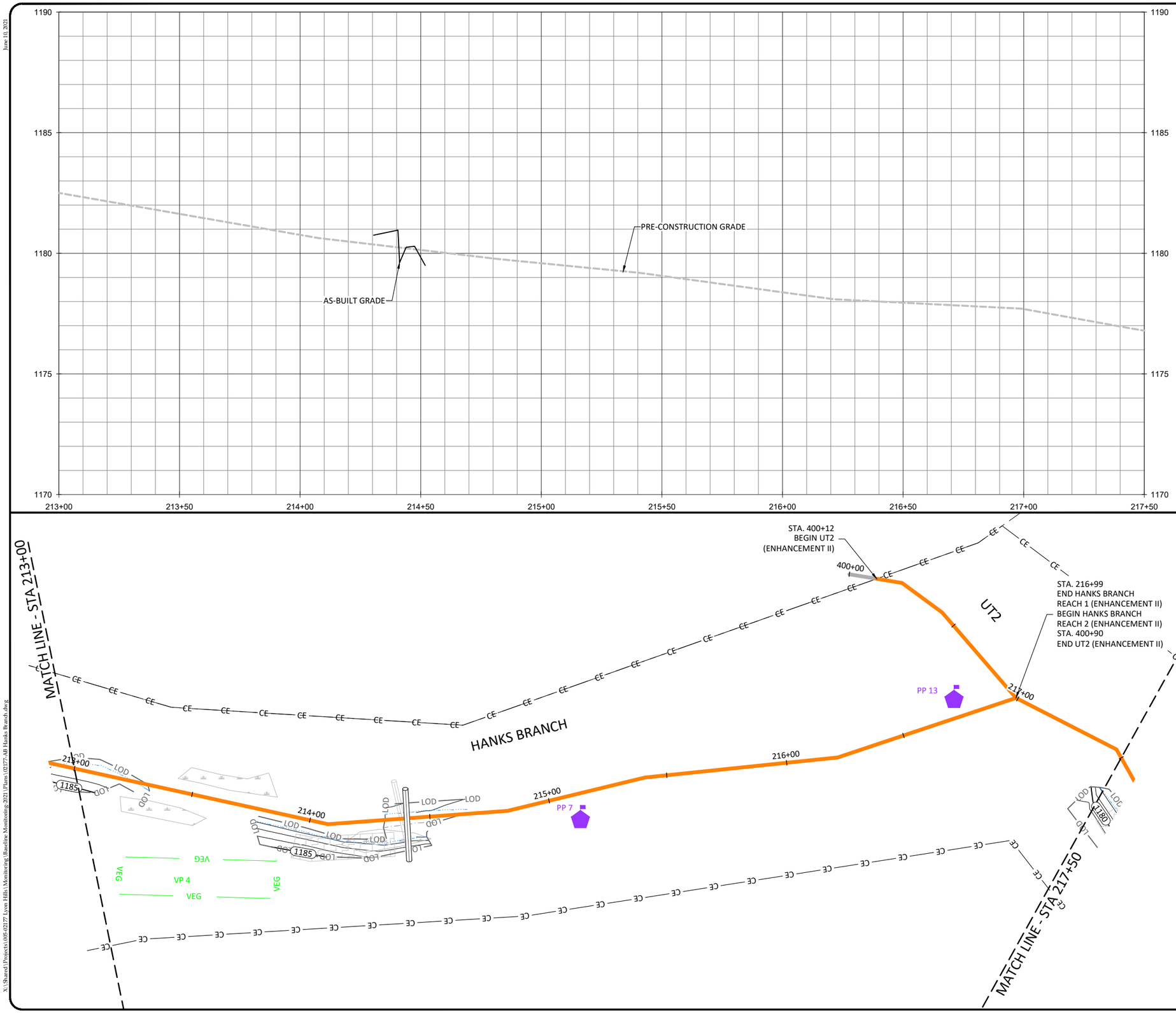

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT2 IS ADDRESSED ON SHEET 1.17.

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch
Stream Plan and Profile

Revisions:

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.07

June 10, 2021

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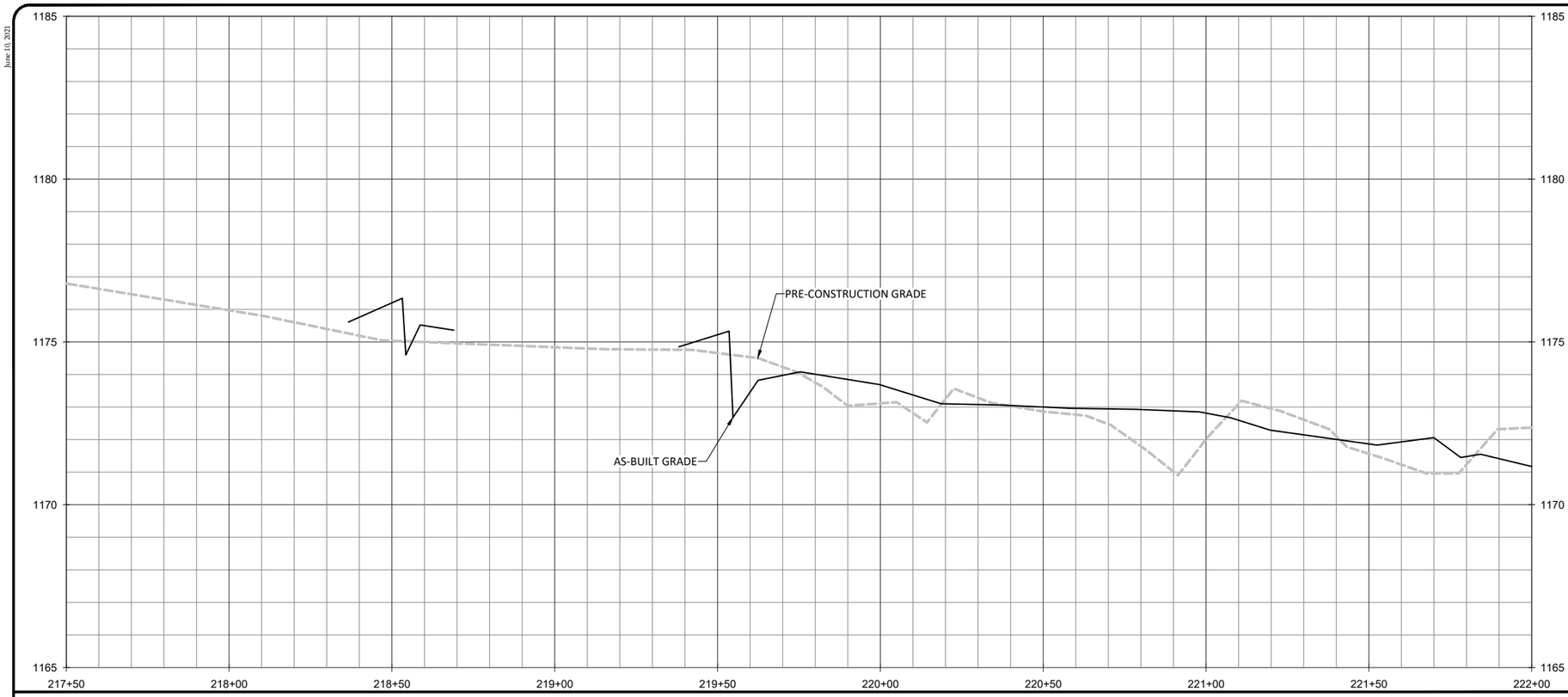

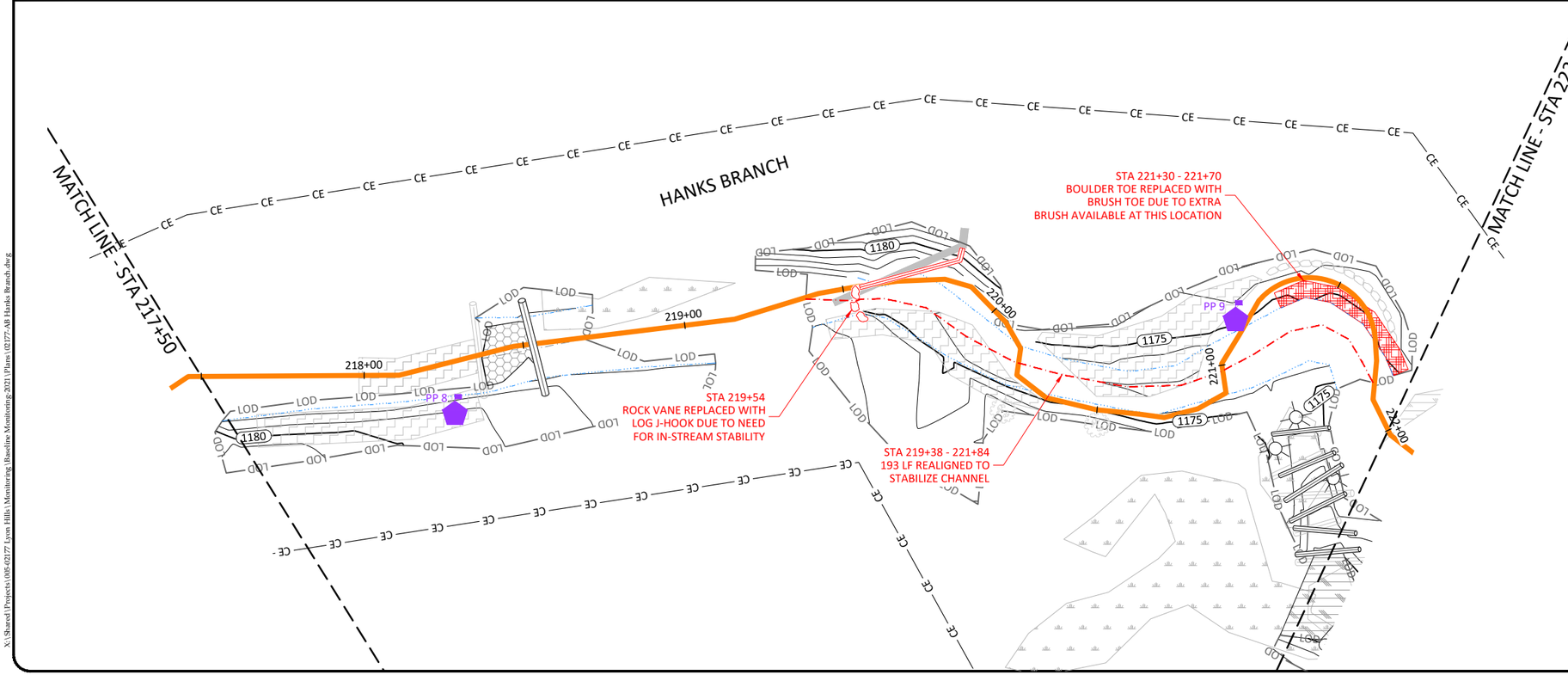

NOTE:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch
Stream Plan and Profile

Revisions:

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.08

June 10, 2021

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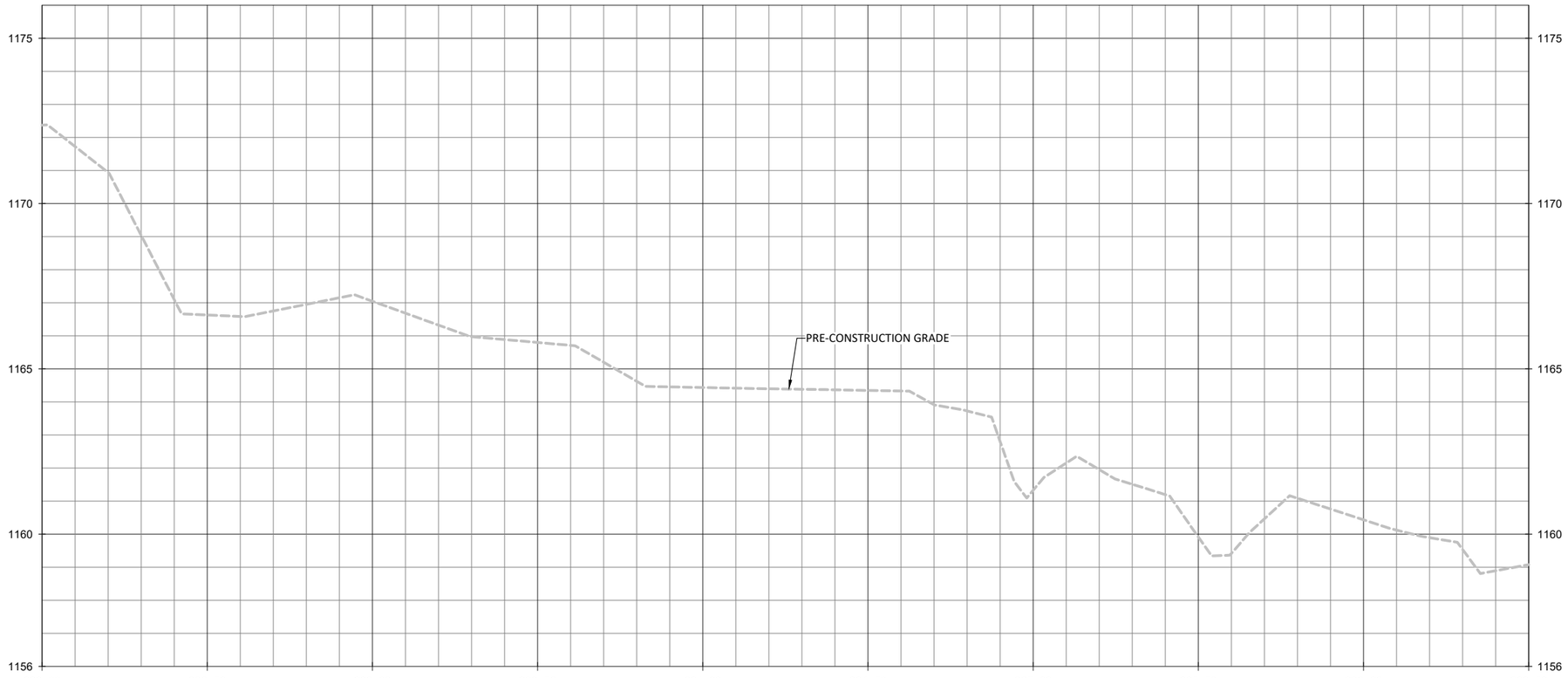
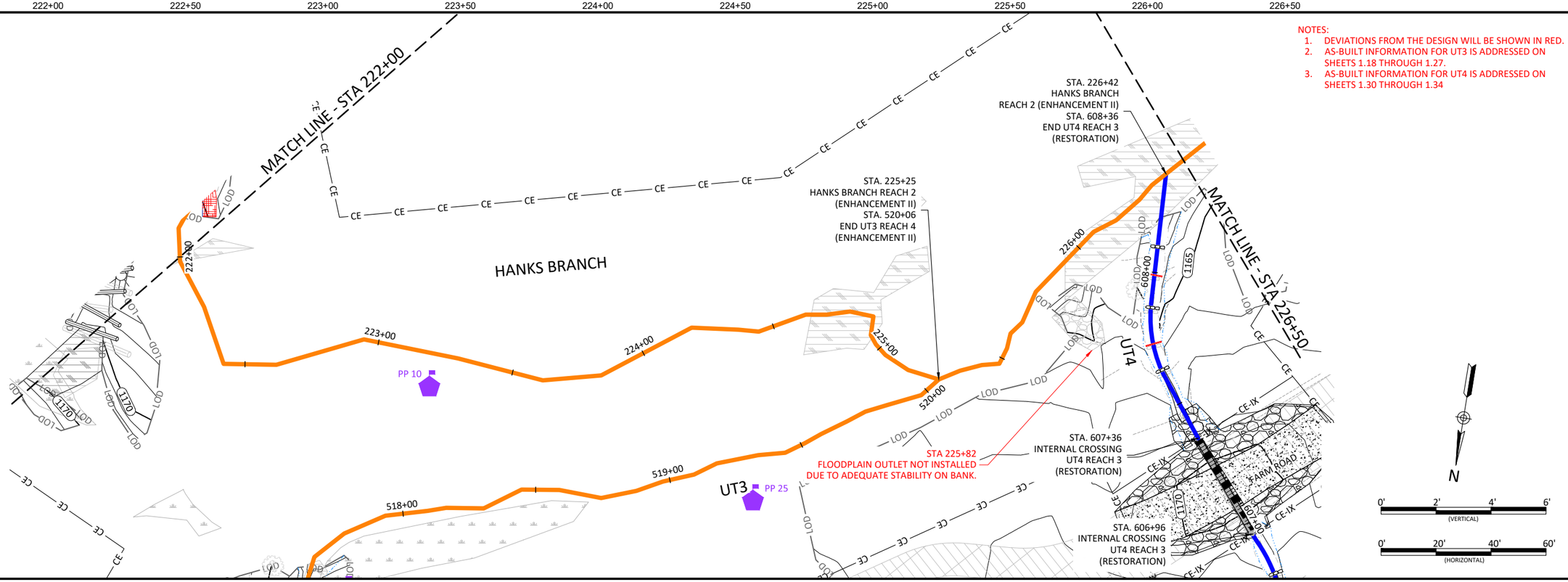
June 10, 2021





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT3 IS ADDRESSED ON SHEETS 1.18 THROUGH 1.27.
3. AS-BUILT INFORMATION FOR UT4 IS ADDRESSED ON SHEETS 1.30 THROUGH 1.34

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch
Stream Plan and Profile

Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.09

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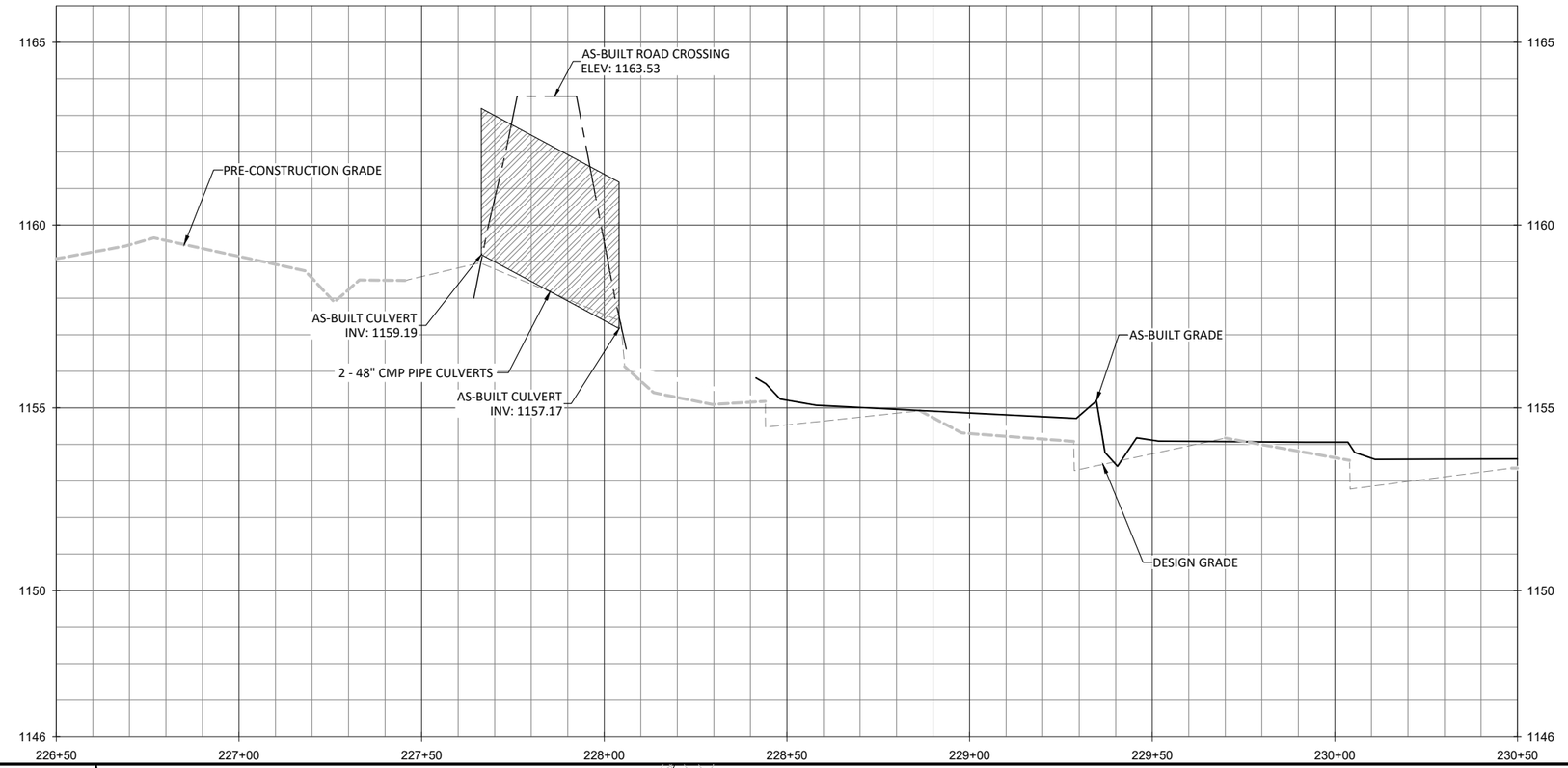

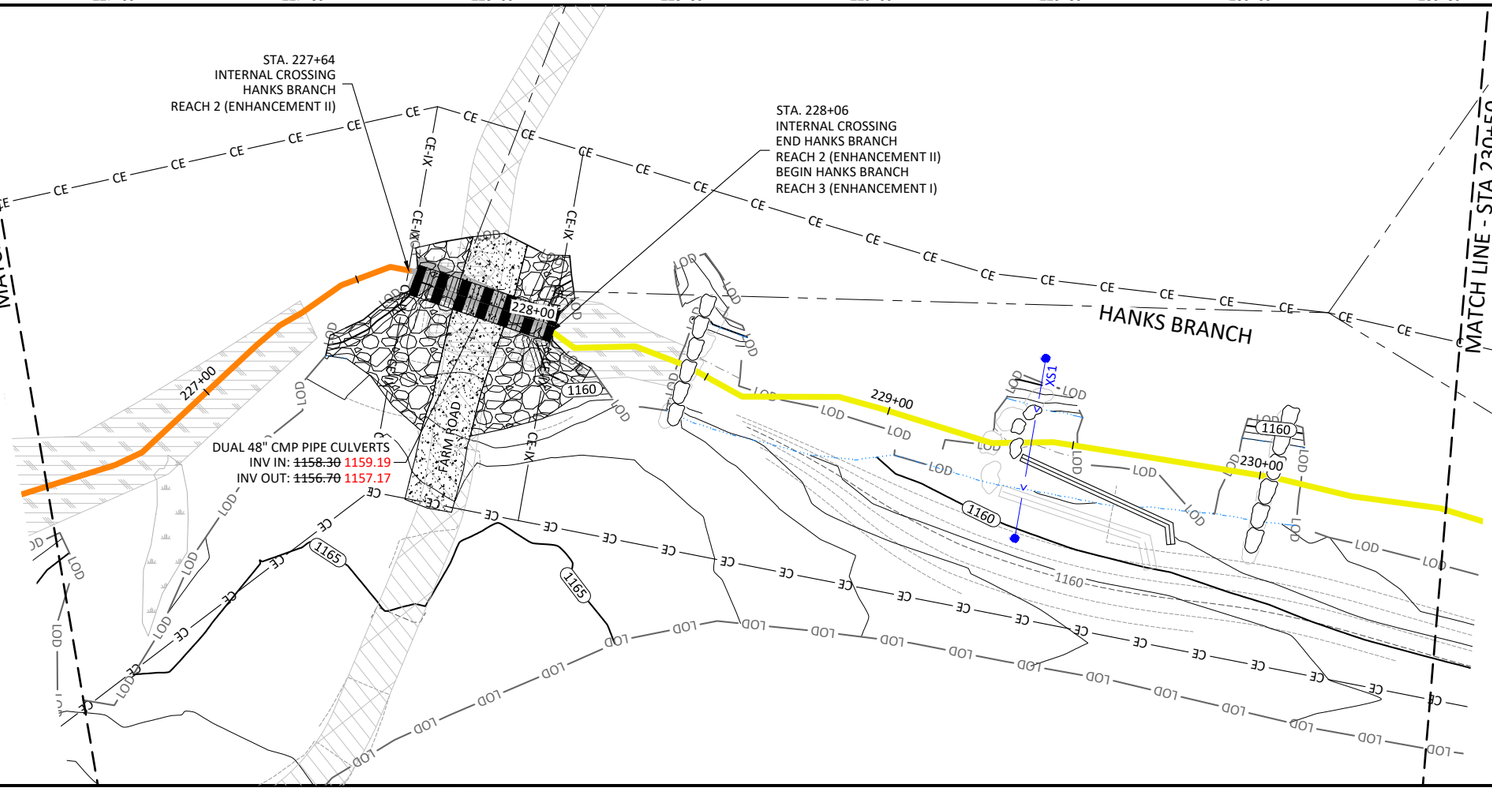

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch
Stream Plan and Profile

Revisions:
9-21-2020 Culvert Crossing Added

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.10

June 10, 2021

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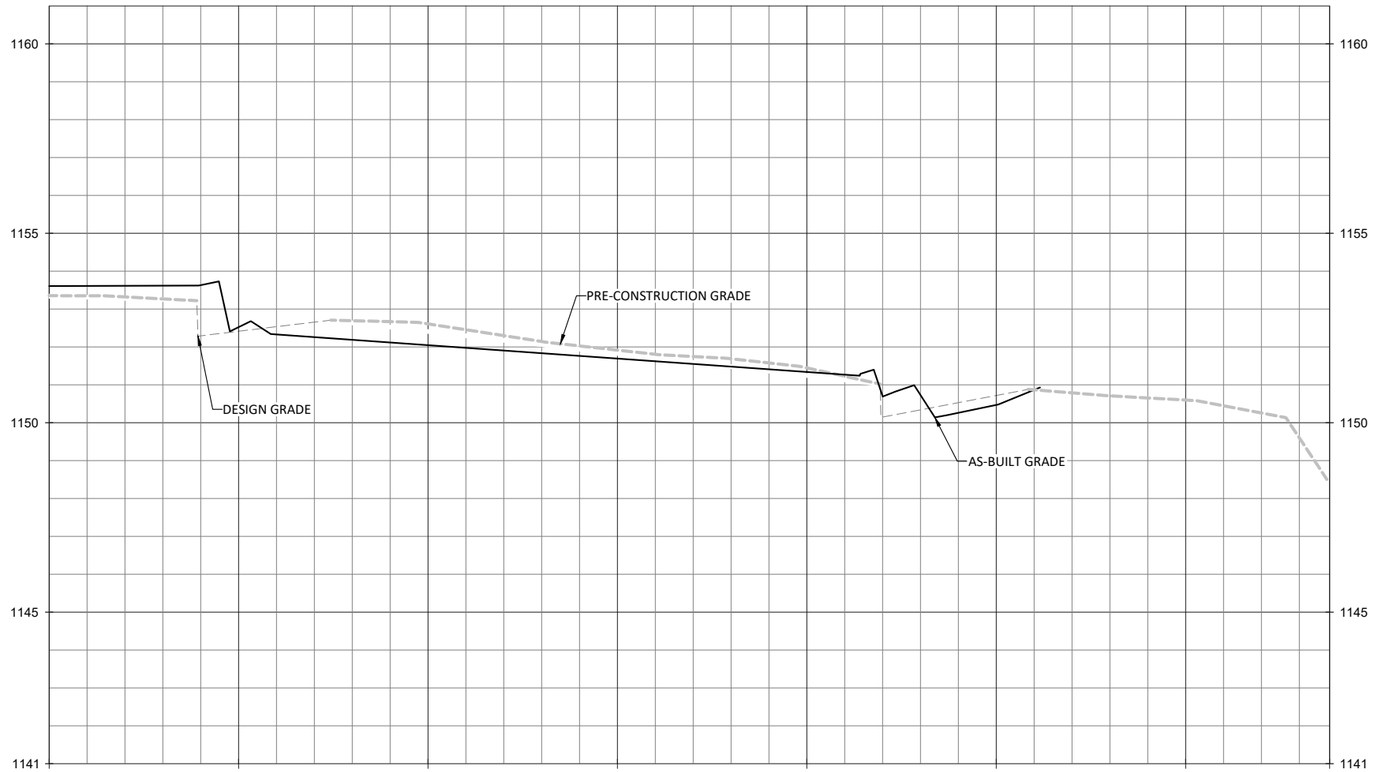
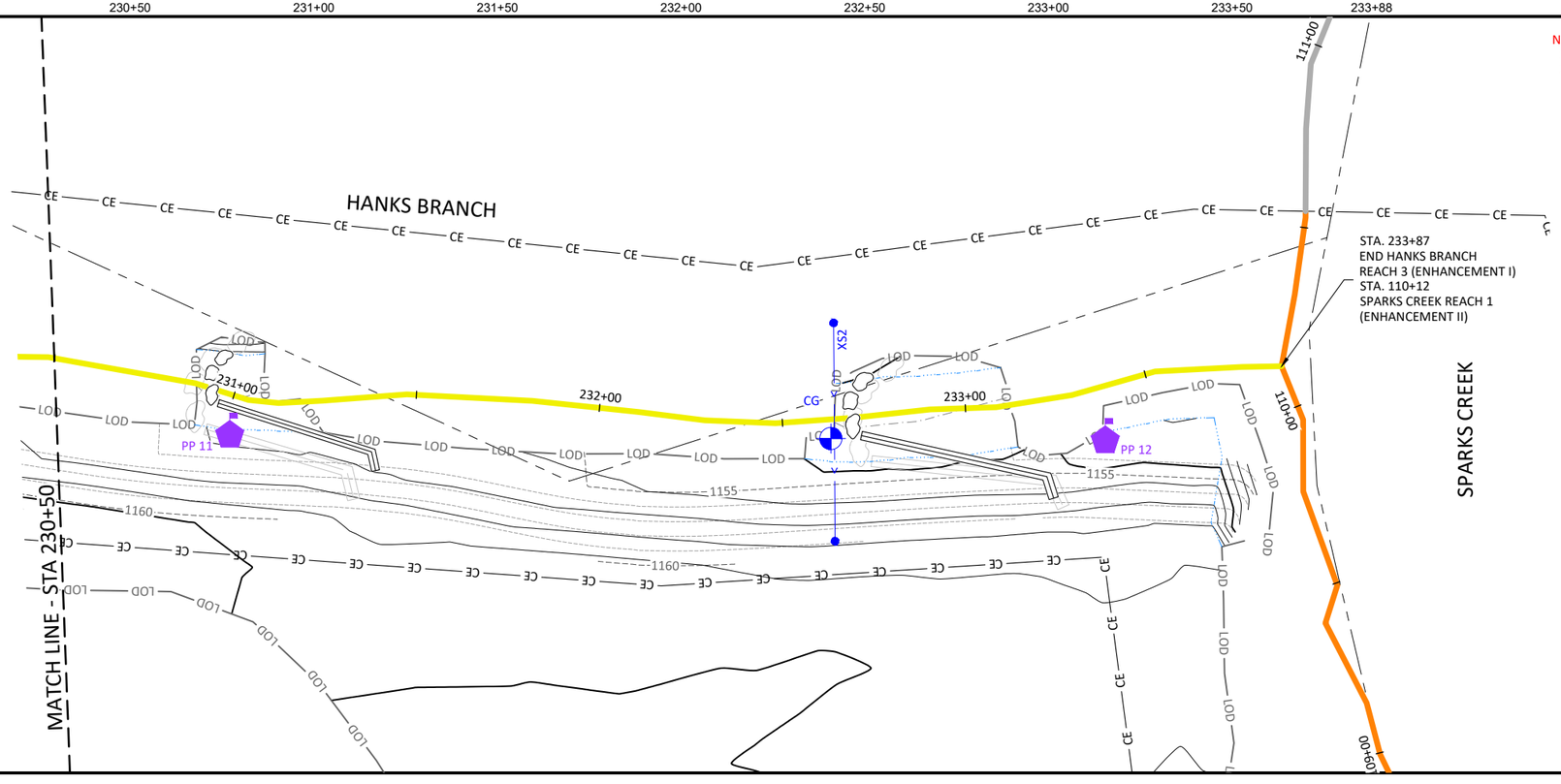
June 10, 2021





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR SPARKS CREEK IS ADDRESSED ON SHEETS 1.01 THROUGH 1.03.

0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch
Stream Plan and Profile

Revisions:

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.11

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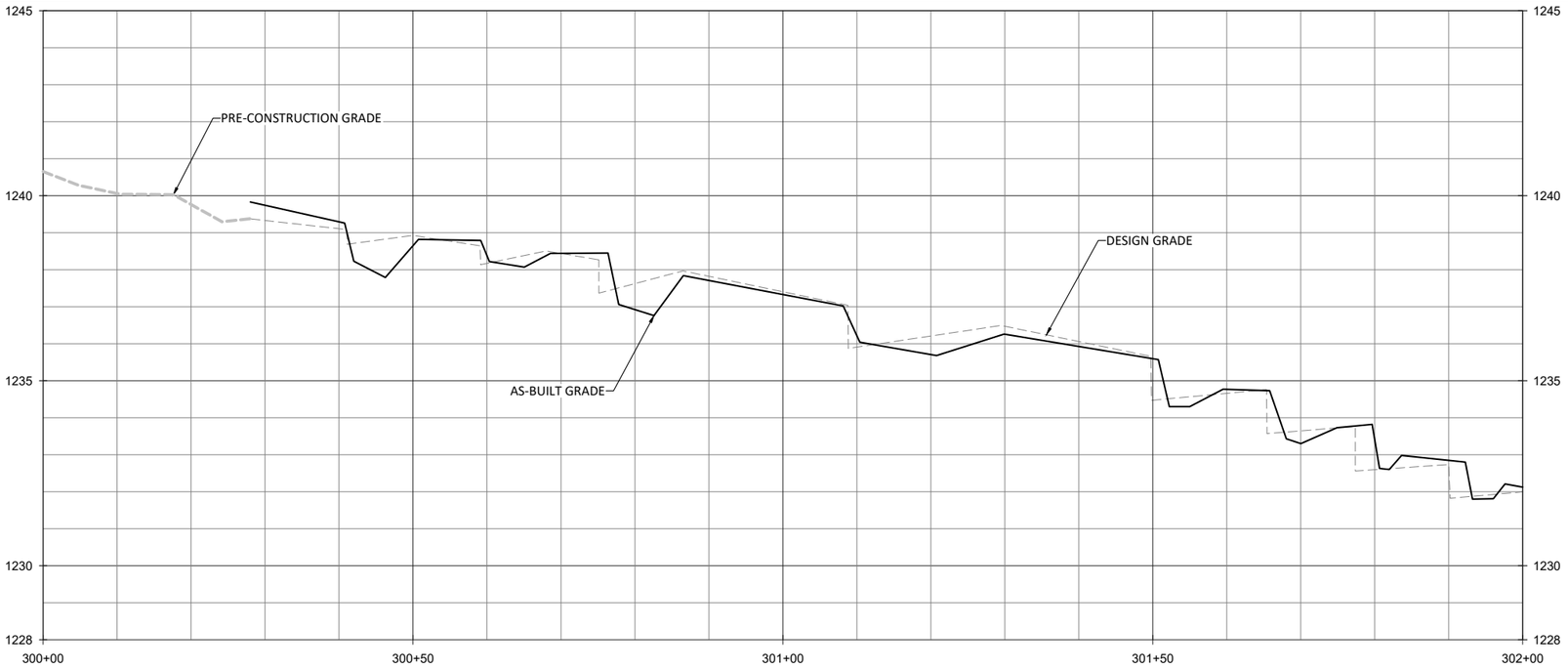
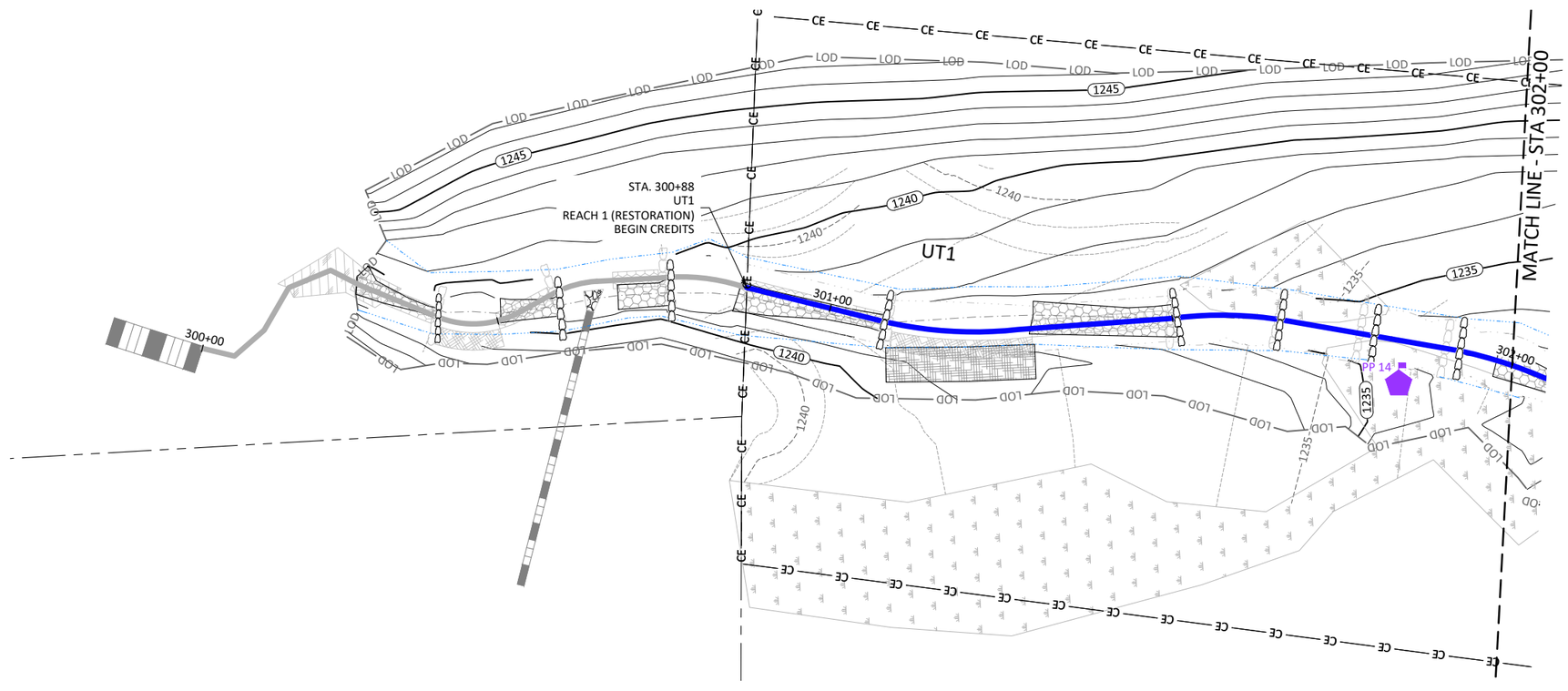
June 10, 2021





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

N

0' 2' 4' 6' (VERTICAL)

0' 10' 20' 30' (HORIZONTAL)

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NICOLE MACALUSO — NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER — 8/25/21

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

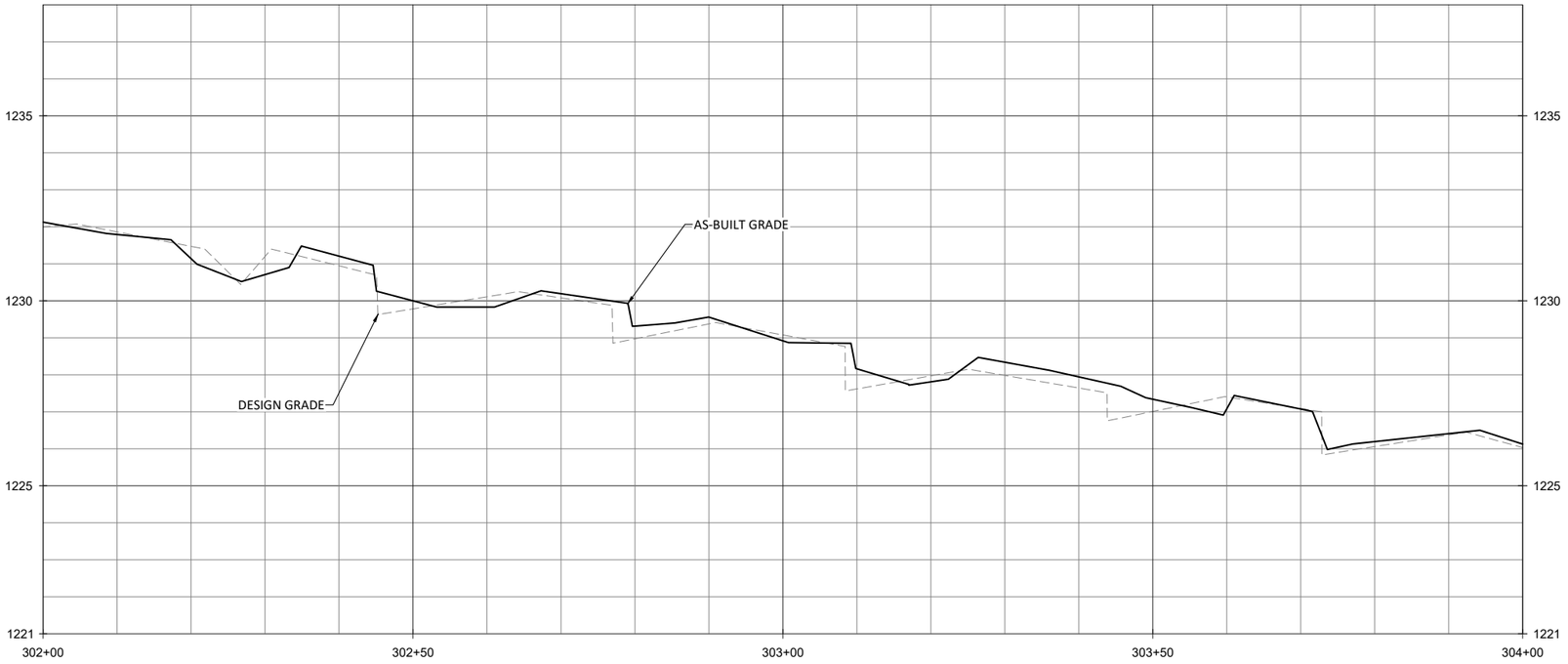
UT1
Stream Plan and Profile

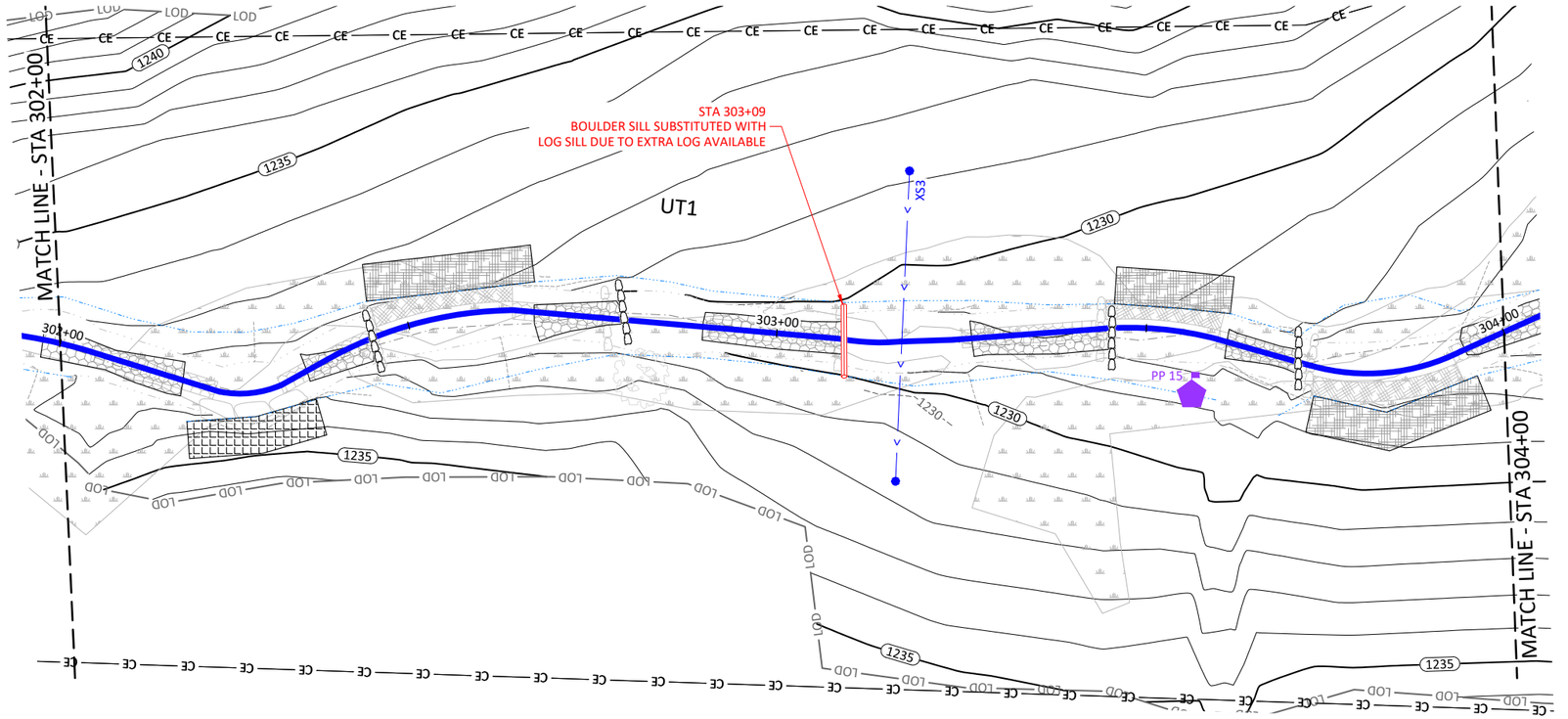
Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.12

X:\Shared\Projects\005-02177 Lyon Hills Monitoring\Baseline Monitoring-2021\Plans\02177-AR Sparks Creek UT1 UT2.dwg





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

N

0' 2' 4' 6' (VERTICAL)

0' 10' 20' 30' (HORIZONTAL)

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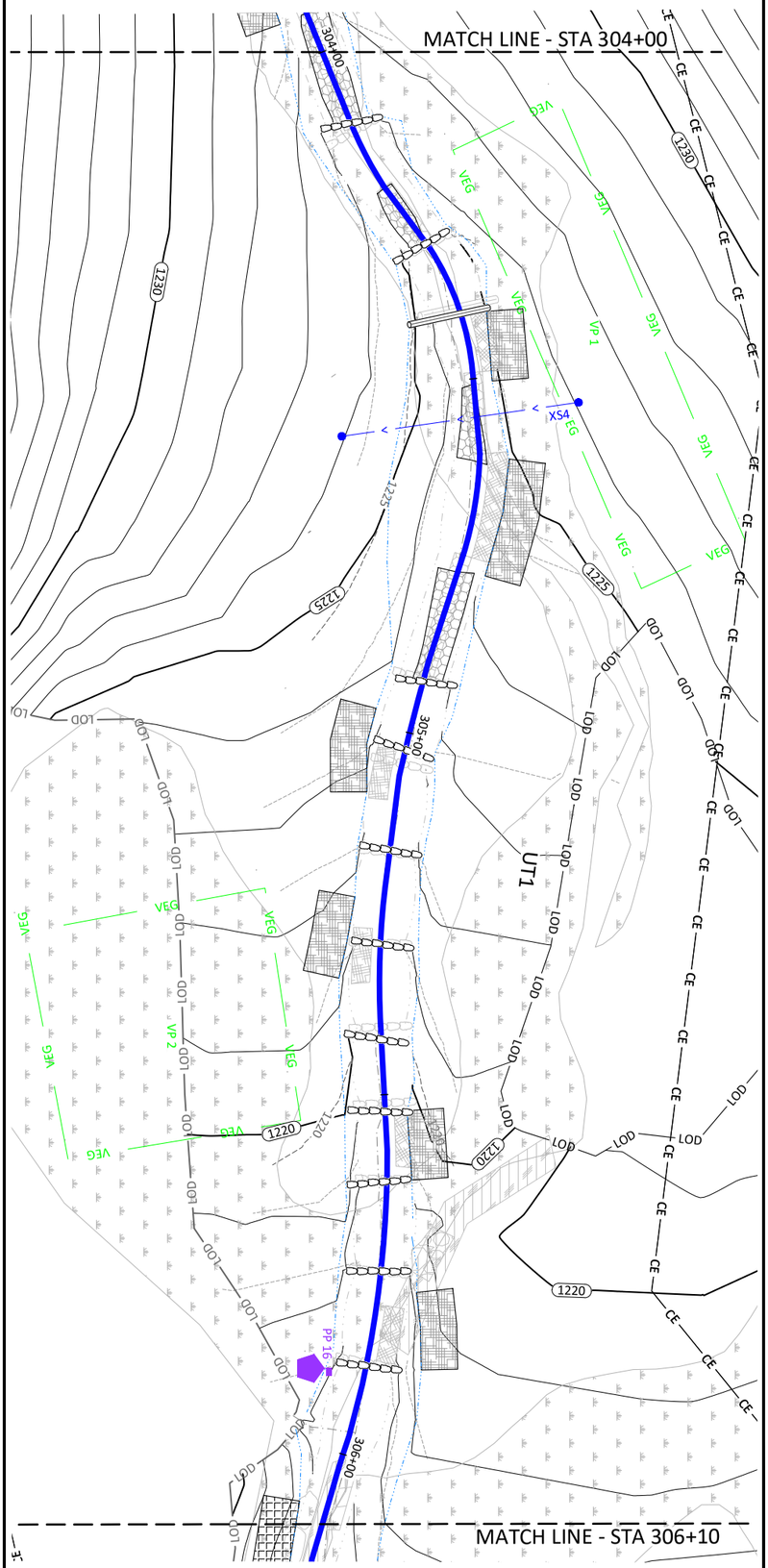
Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

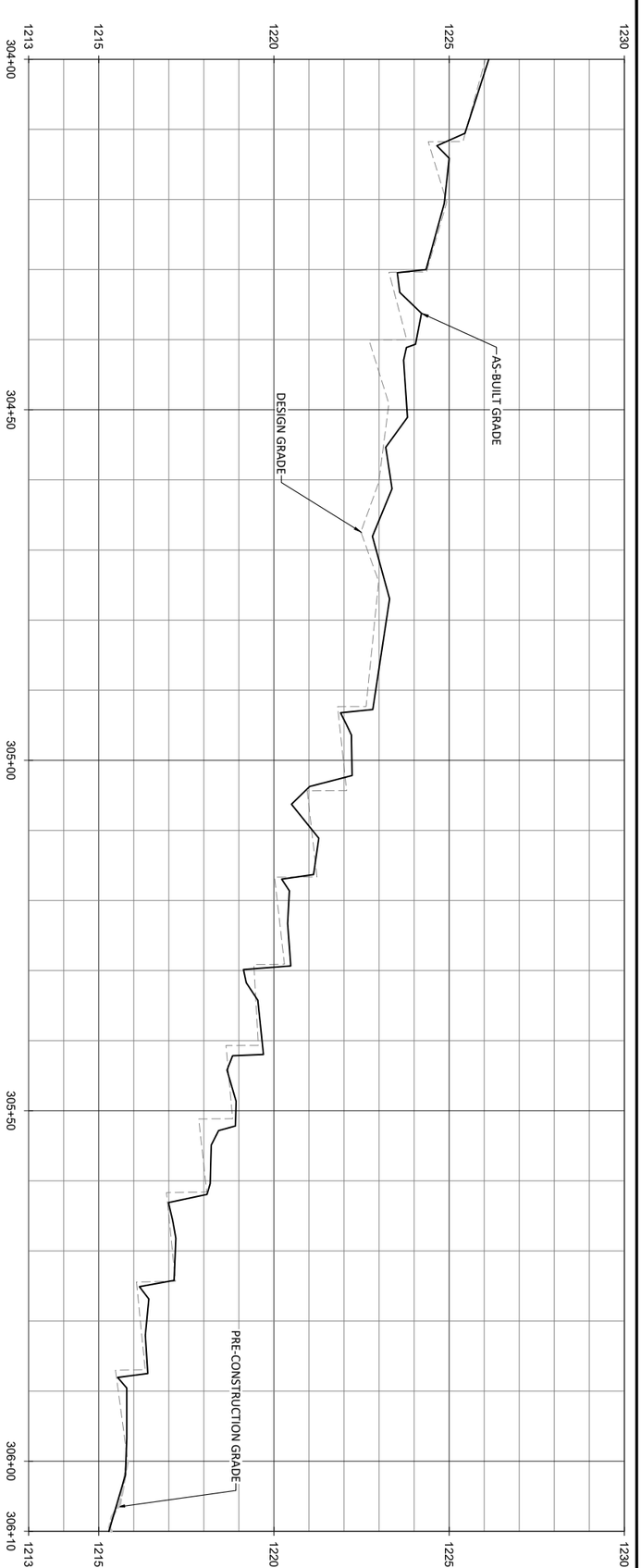
UT1
Stream Plan and Profile

Revisions:

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.13





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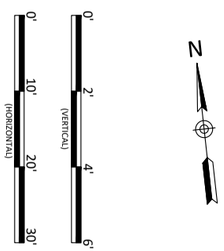
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.



Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Revisions:

1.14
Sheet

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT1
Stream Plan and Profile

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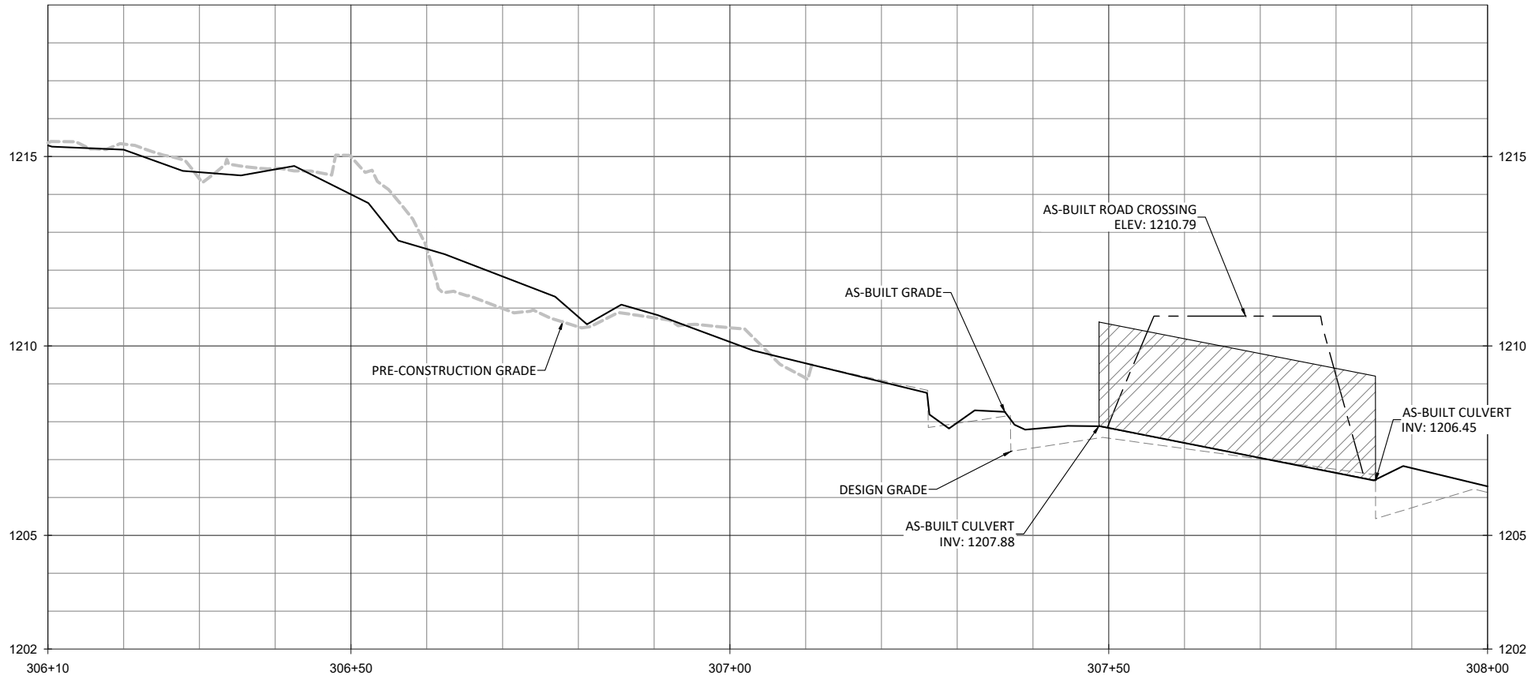
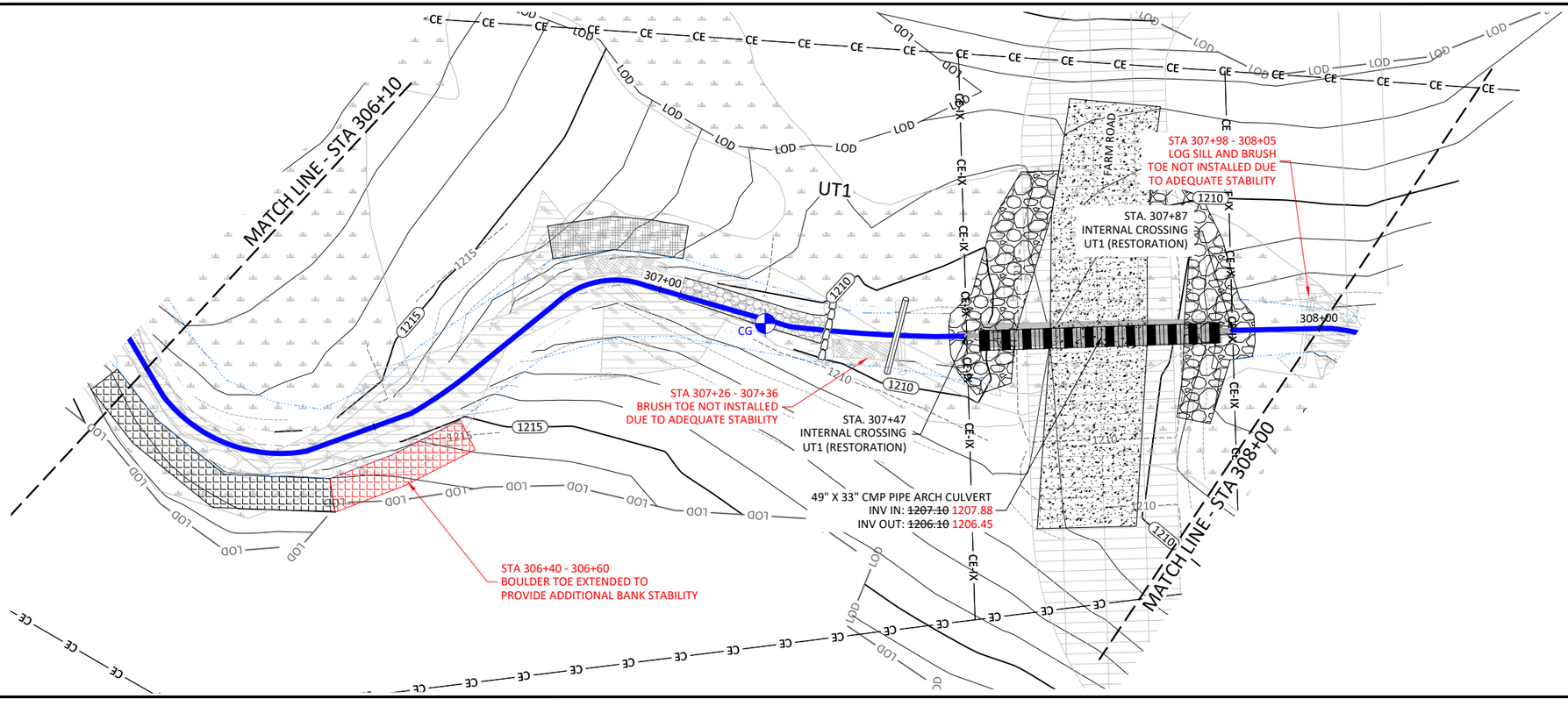
June 10, 2021





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

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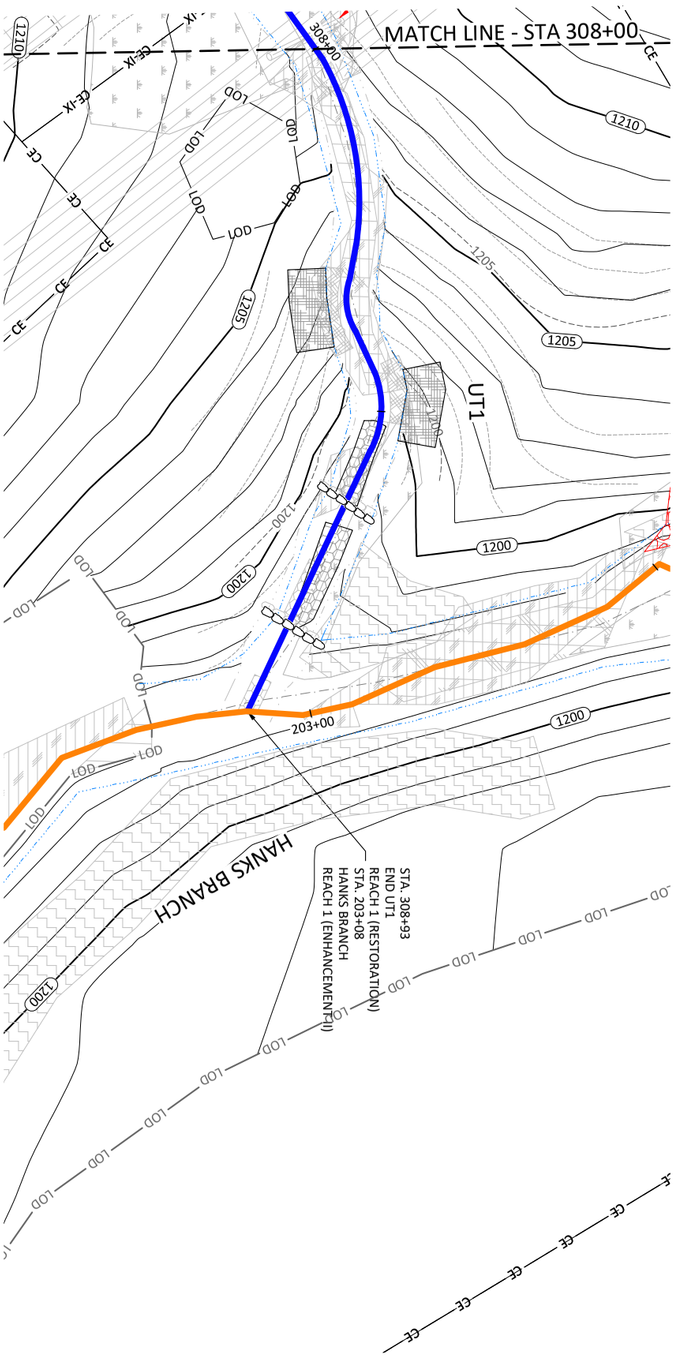
Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

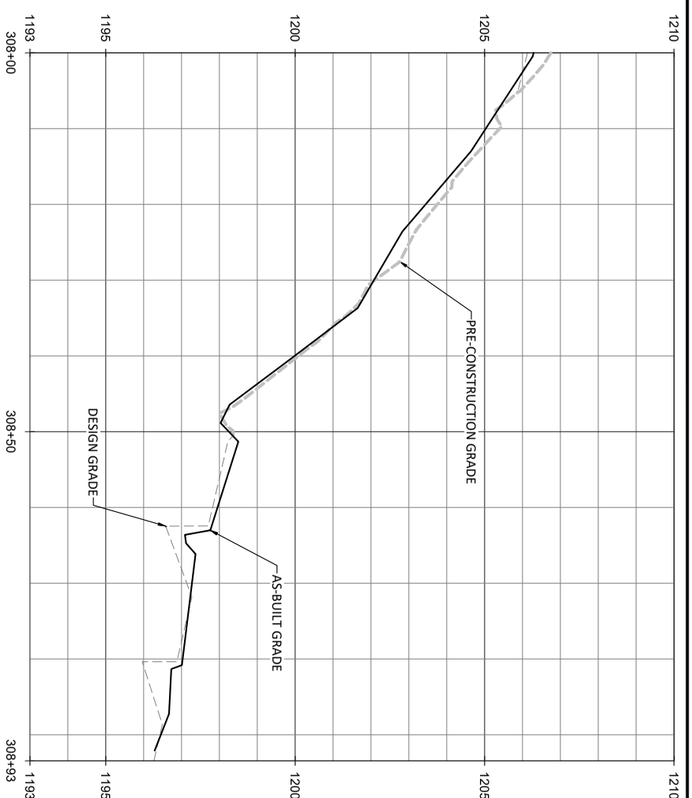
UT1
Stream Plan and Profile

Revisions:

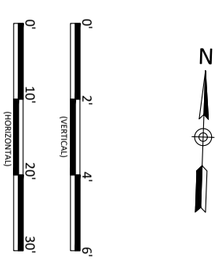
Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.15





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR HANKS BRANCH IS ADDRESSED ON SHEETS 1.04 THROUGH 1.11.



Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Revisions:

1.16
Sheet

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT1
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE MACALUSO 5/25/21

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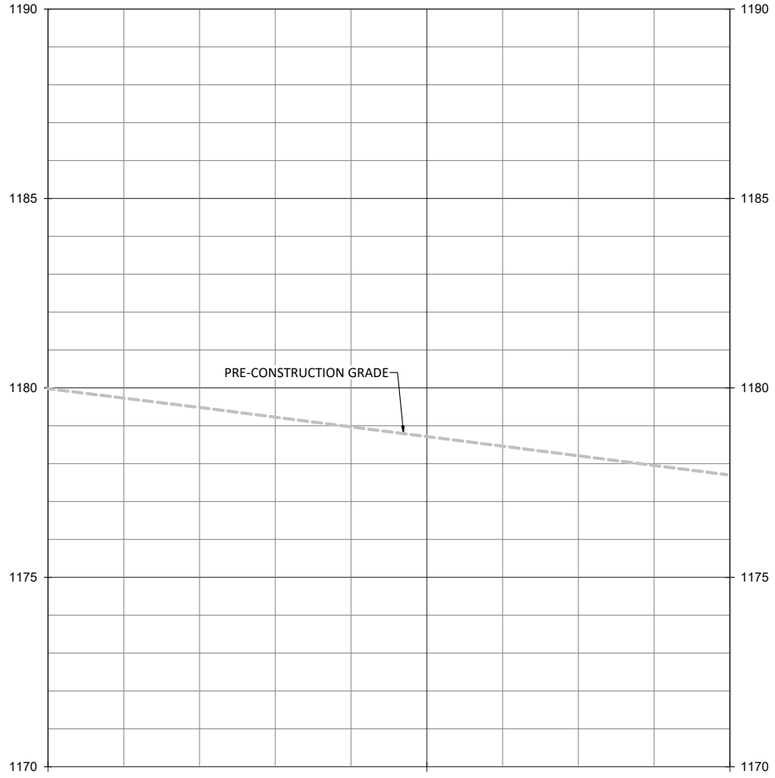
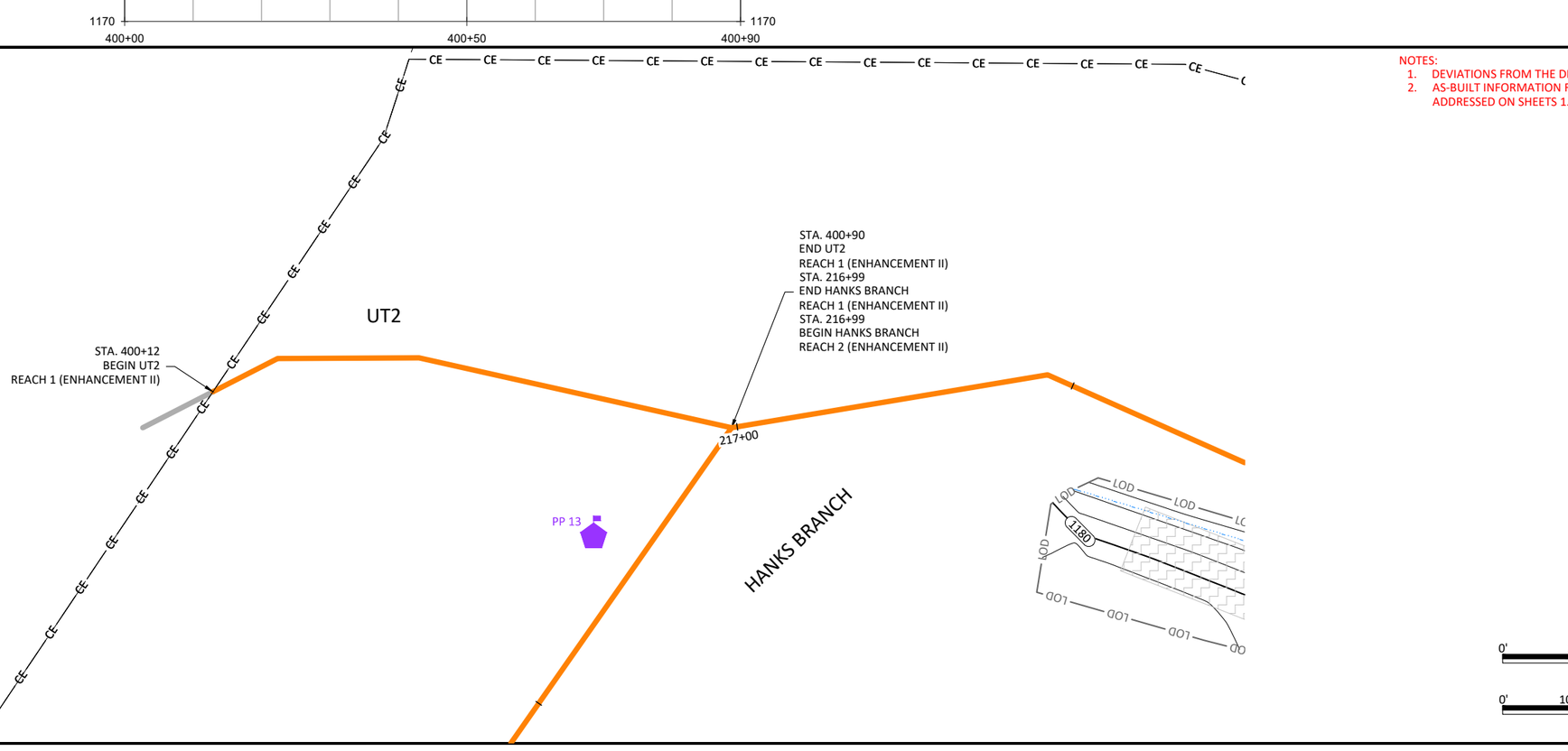
June 10, 2021





NOTES:
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT2
Stream Plan and Profile

Revisions:

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.17

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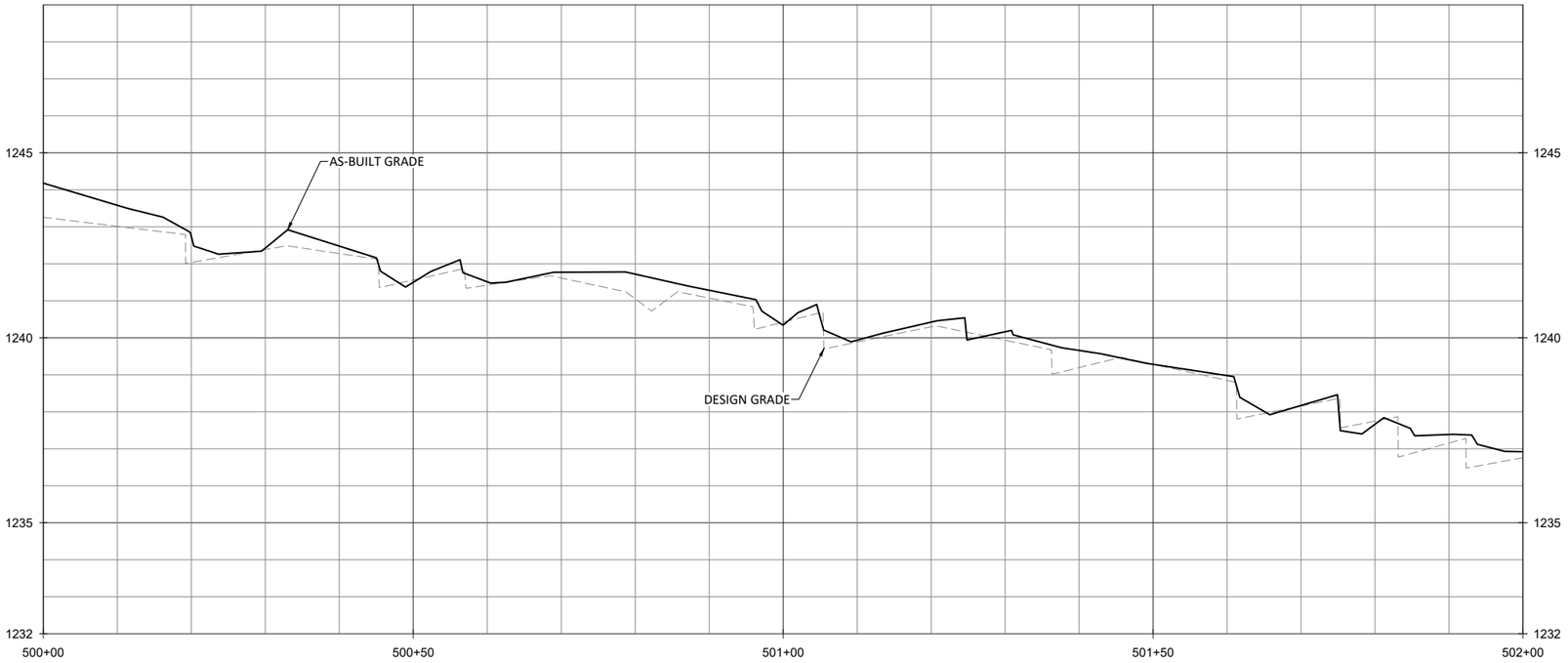

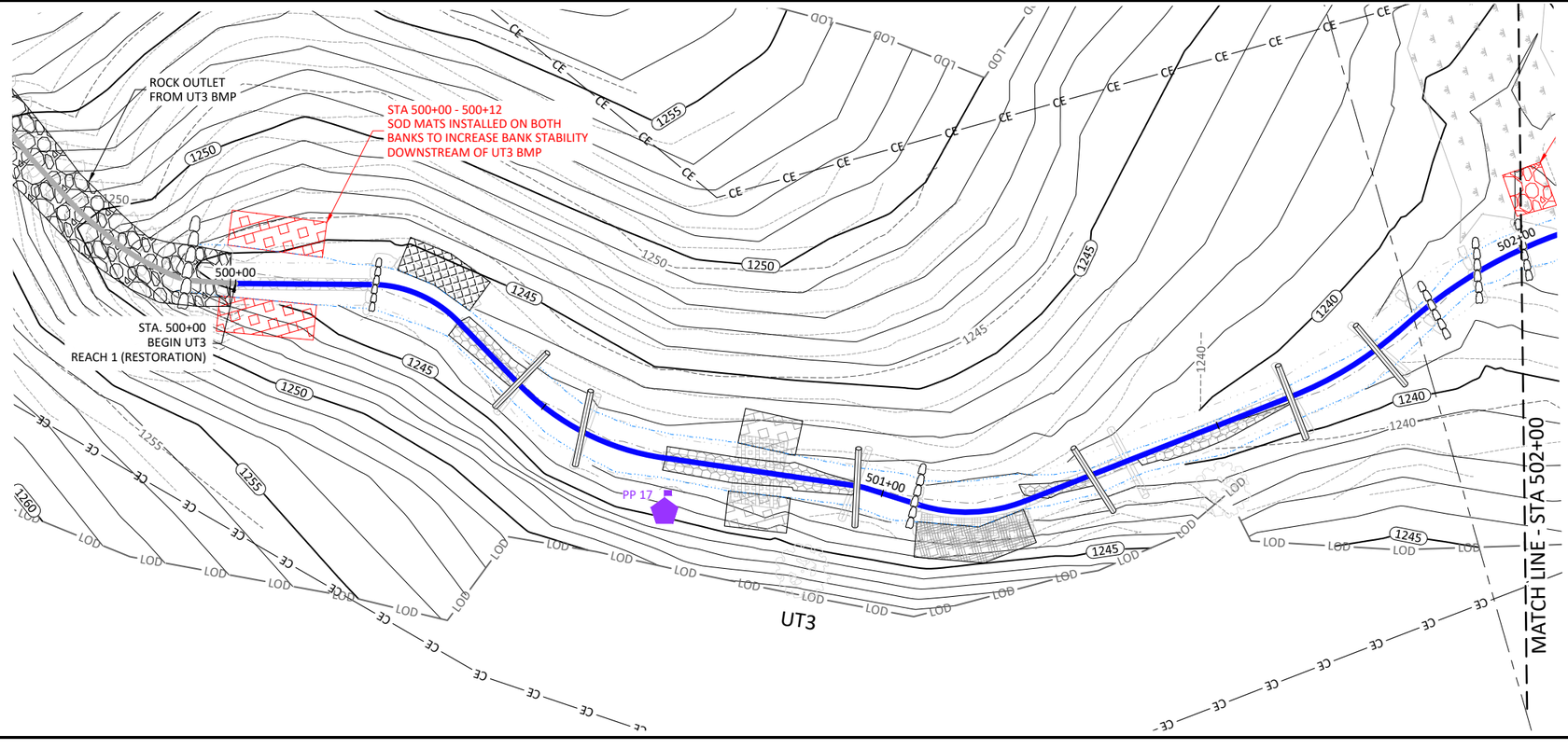

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT3 BMP IS ADDRESSED ON SHEET 2.02.

0' 2' 4' 6' (VERTICAL)

0' 10' 20' 30' (HORIZONTAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

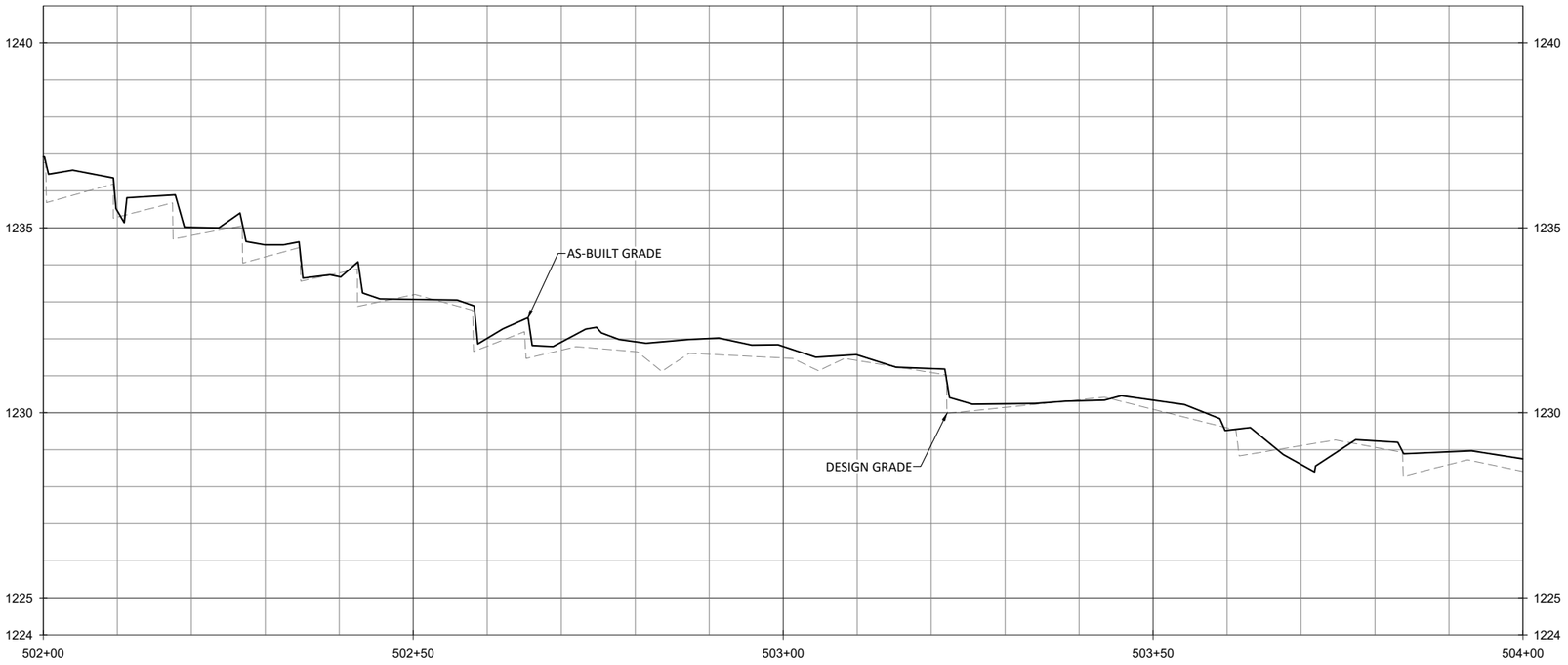
UT3
Stream Plan and Profile

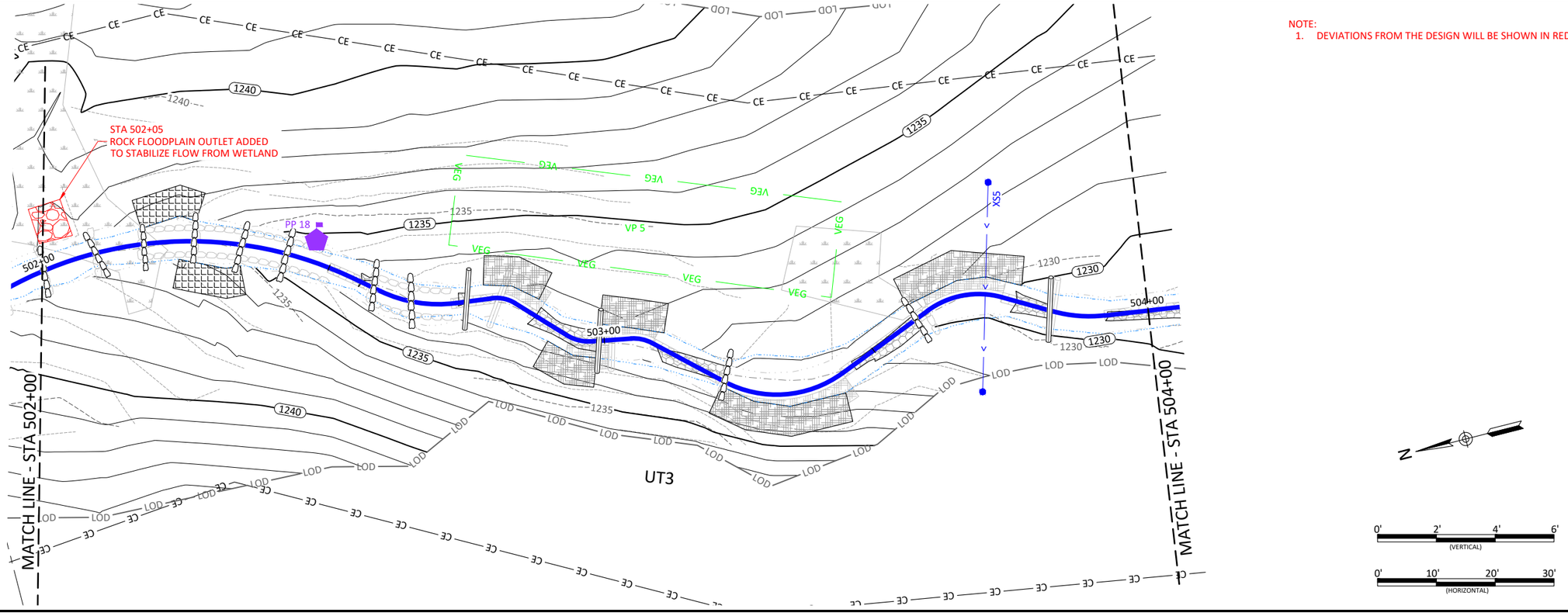
Revisions:

Date: May 26, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.18

June 10, 2021





NOTE:
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0' 2' 4' 6' (VERTICAL)

0' 10' 20' 30' (HORIZONTAL)

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037445 NICOLE MACALUSO

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

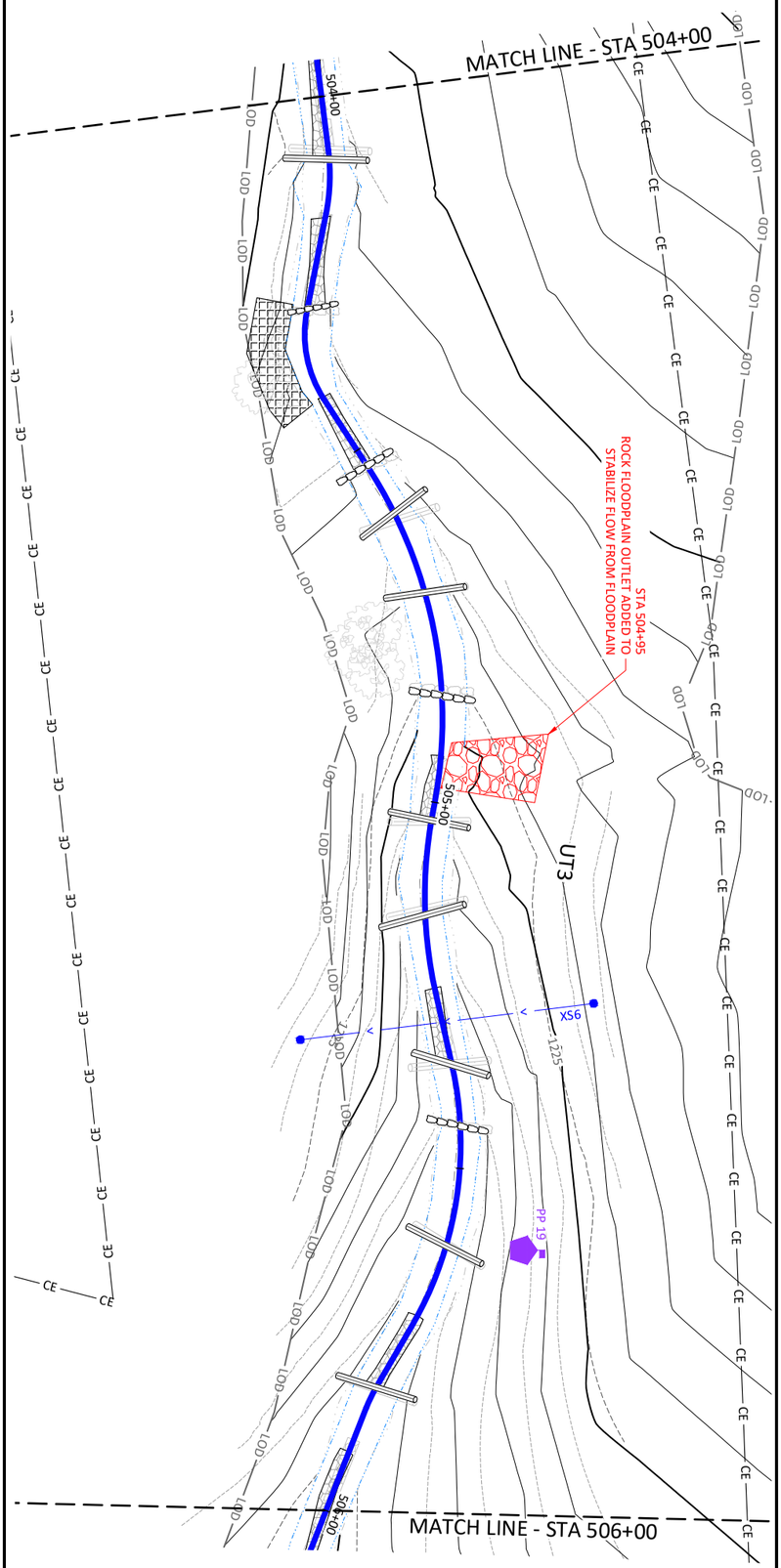
UT3
Stream Plan and Profile

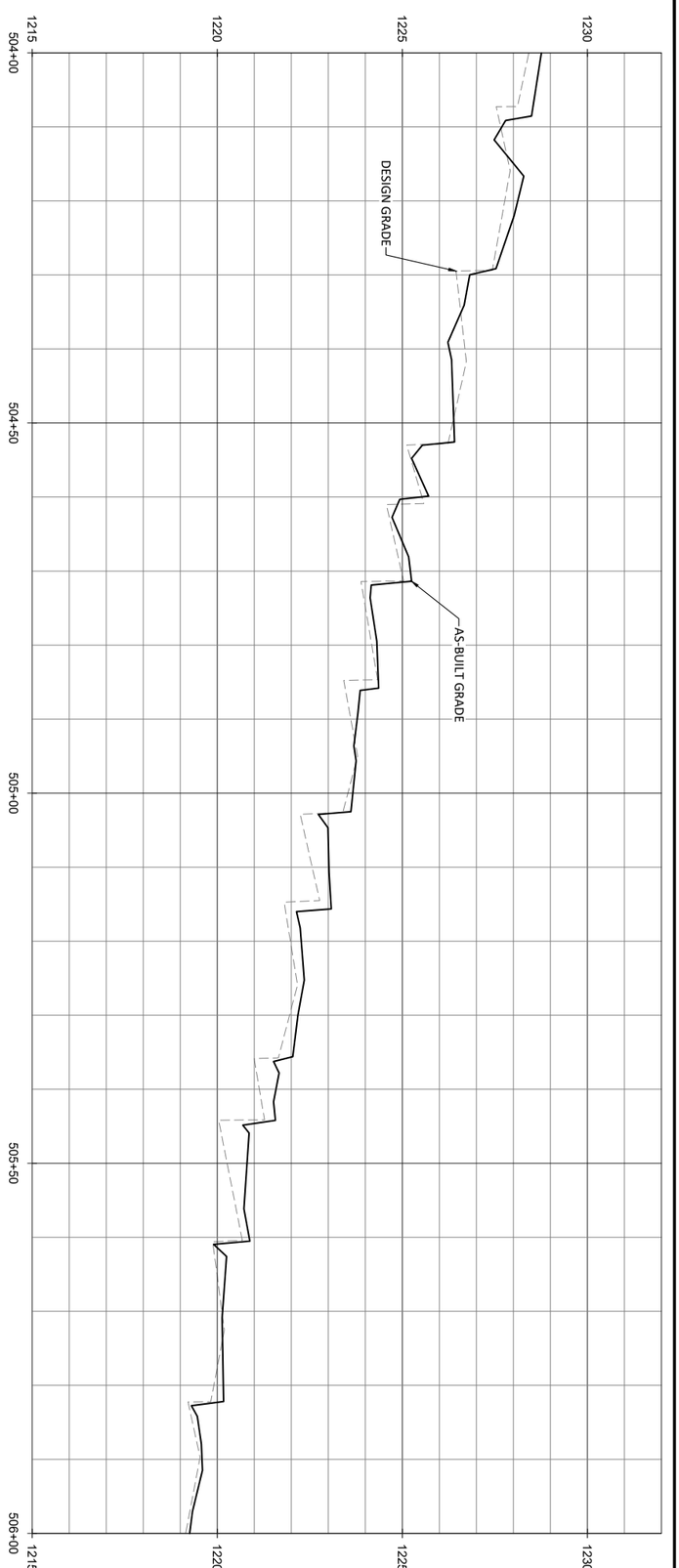
Revisions:

Date: May 26, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

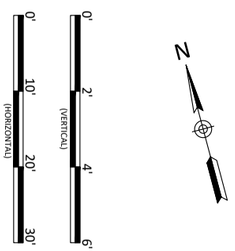
Sheet 1.19

X:\Shared\Projects\005-02177 Lyon Hills Monitoring (Baseline Monitoring, 2021)\Plans\02177-AB UT3 UT5A.dwg





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.



Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Revisions:

1.20
Sheet

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE MACALUSO MILLS 6/25/21

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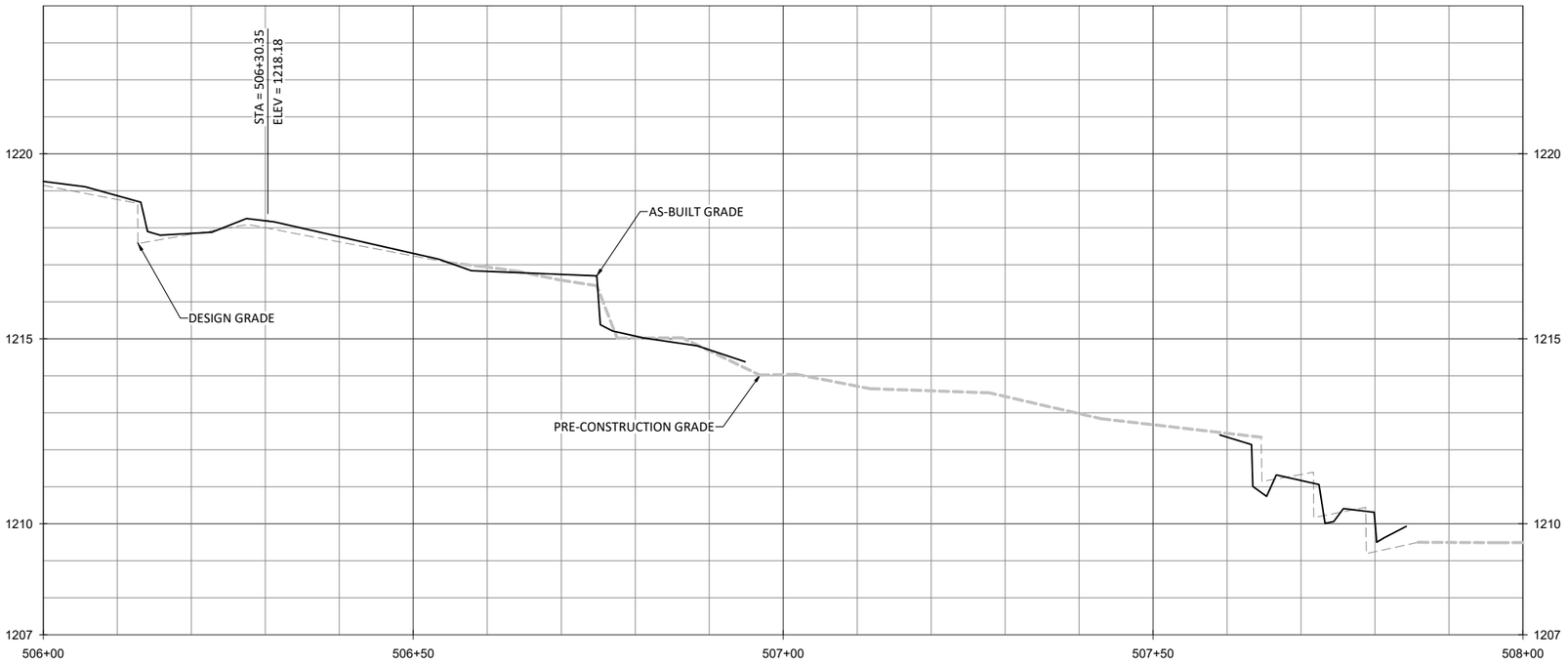

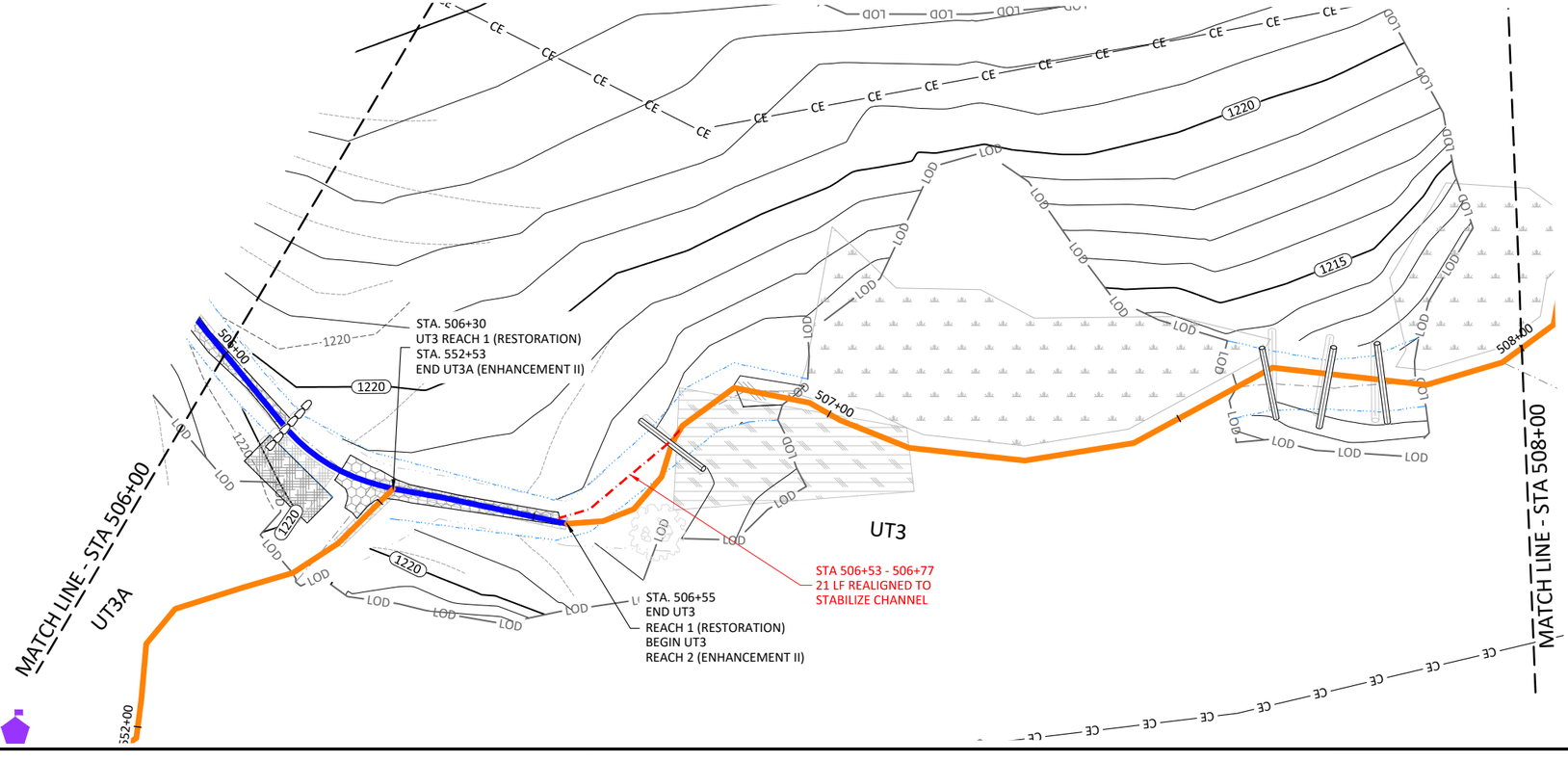

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT3A IS ADDRESSED ON SHEETS 1.28 AND 1.29.

N

0' 2' 4' 6' (VERTICAL)

0' 10' 20' 30' (HORIZONTAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Stream Plan and Profile

Revisions:

Date: May 26, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.21

June 10, 2021

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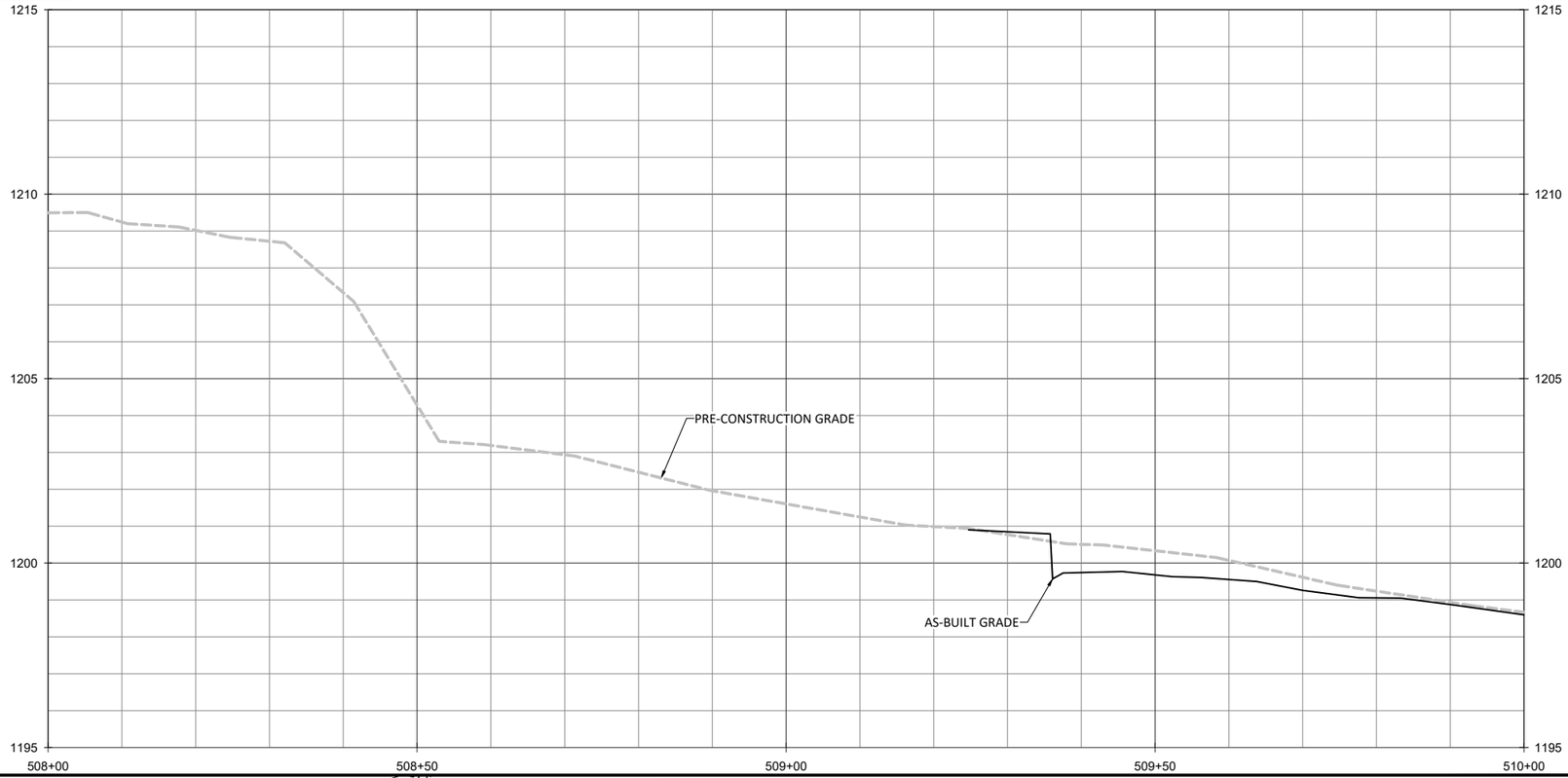
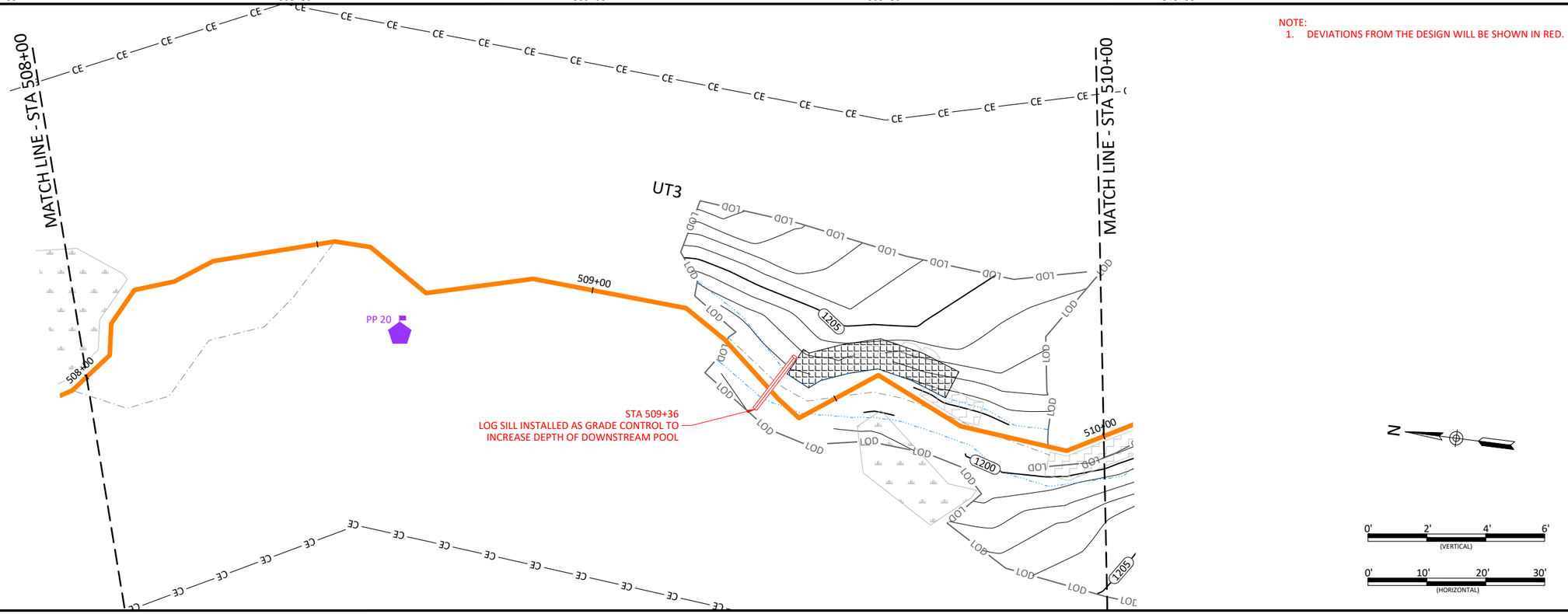
June 10, 2021





NOTE:
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N

0' 2' 4' 6'
(VERTICAL)

0' 10' 20' 30'
(HORIZONTAL)

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037445 NICOLE MACALUSO

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Stream Plan and Profile

Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.22

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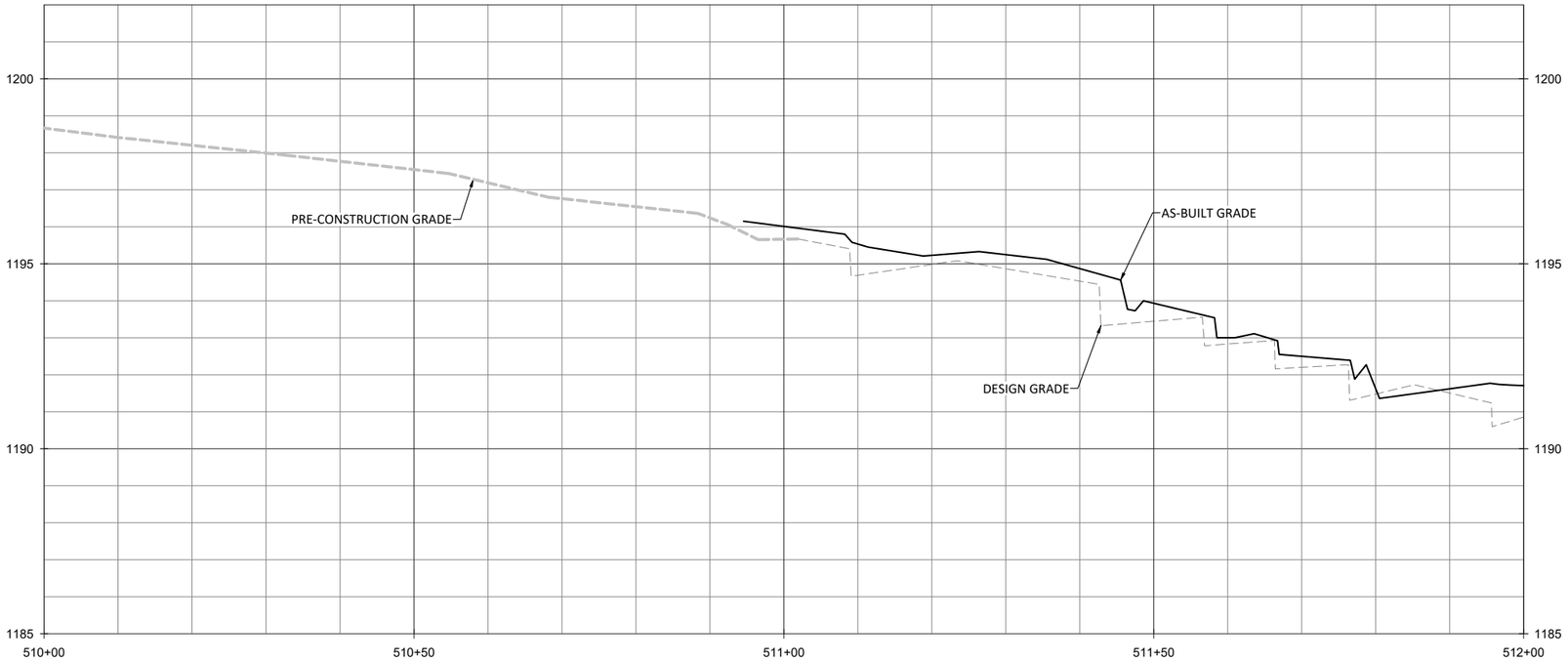

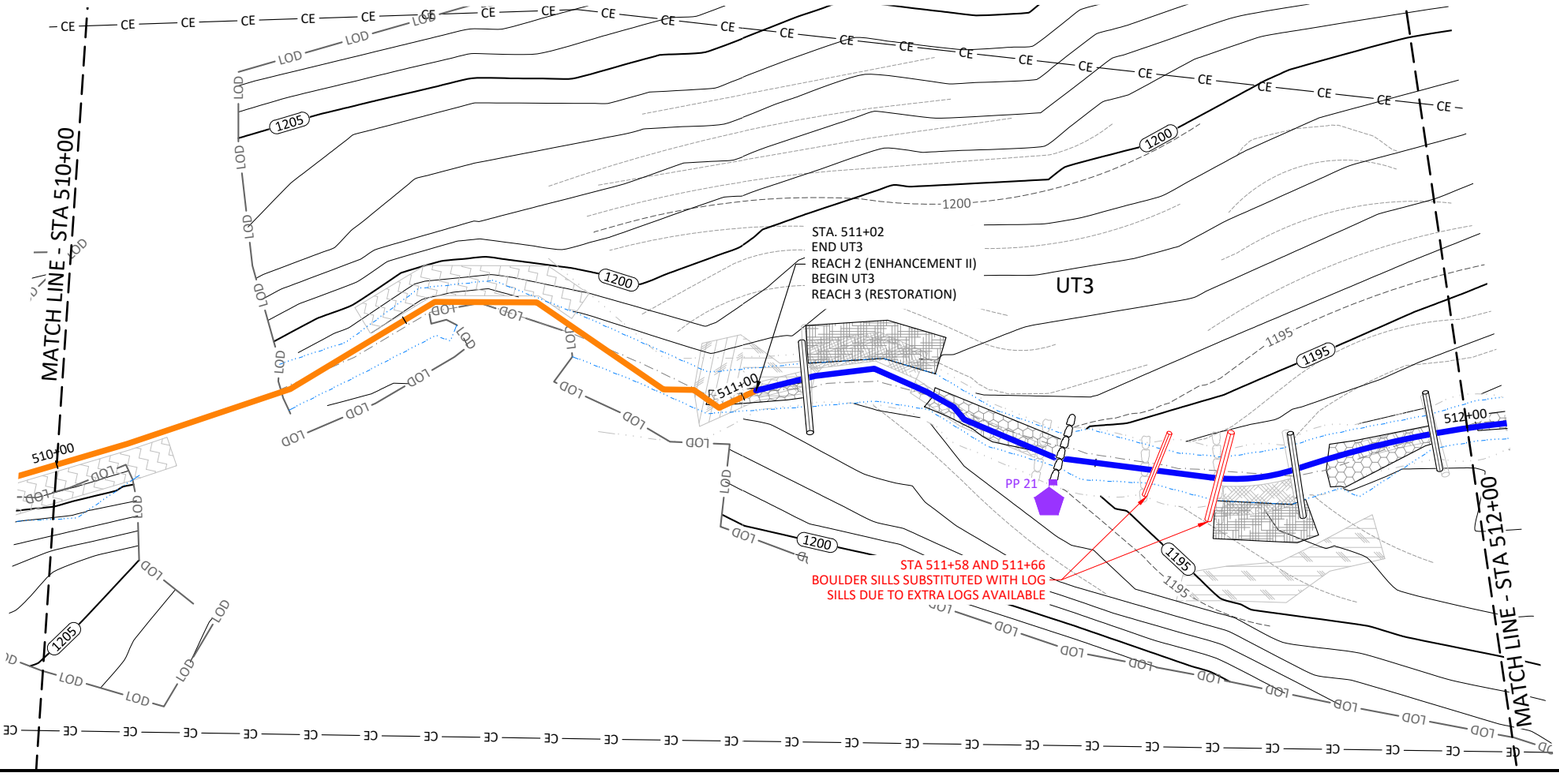

NOTE:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

N

0' 2' 4' 6'
(VERTICAL)

0' 10' 20' 30'
(HORIZONTAL)

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037445 NICOLE MACALUSO 6/25/21

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Stream Plan and Profile

Revisions:

Date: May 26, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.23

June 10, 2021

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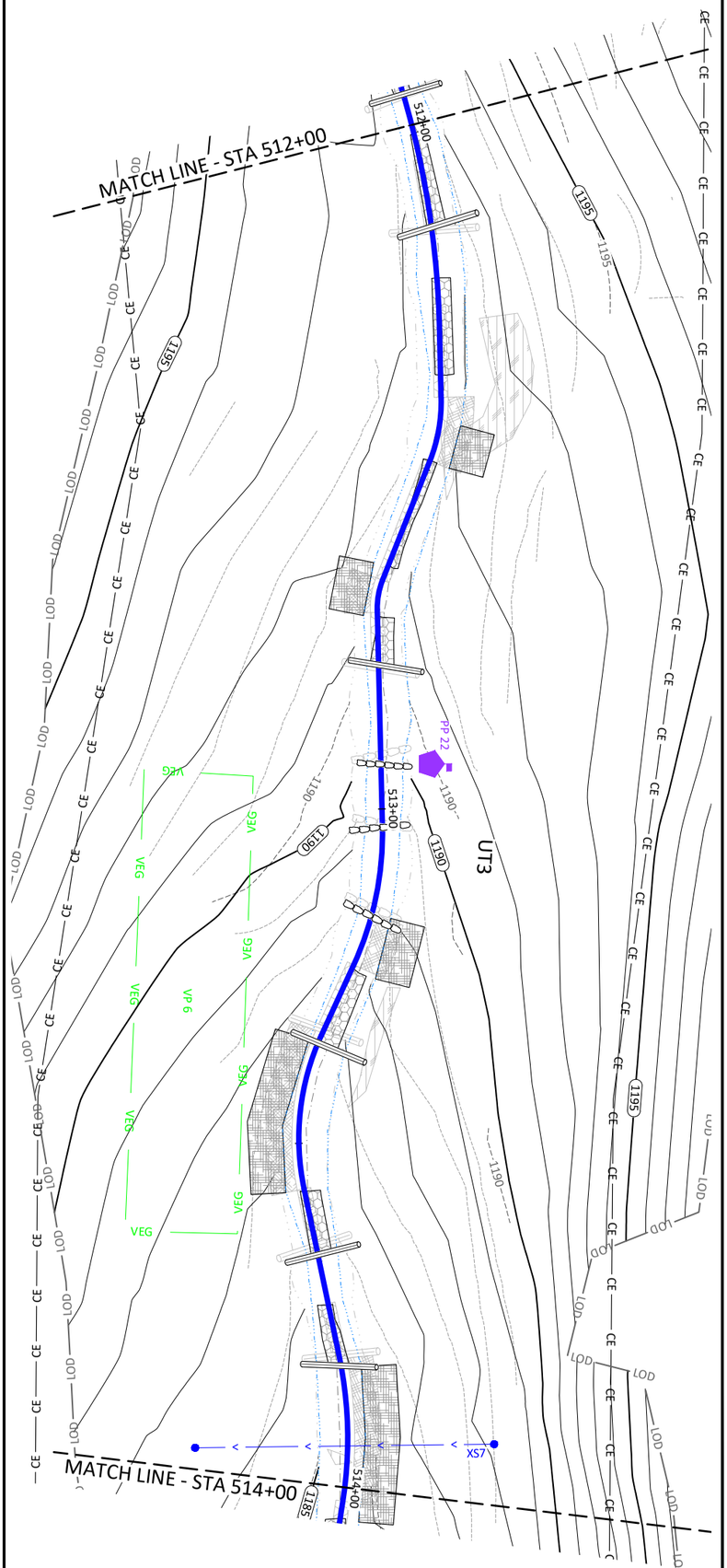

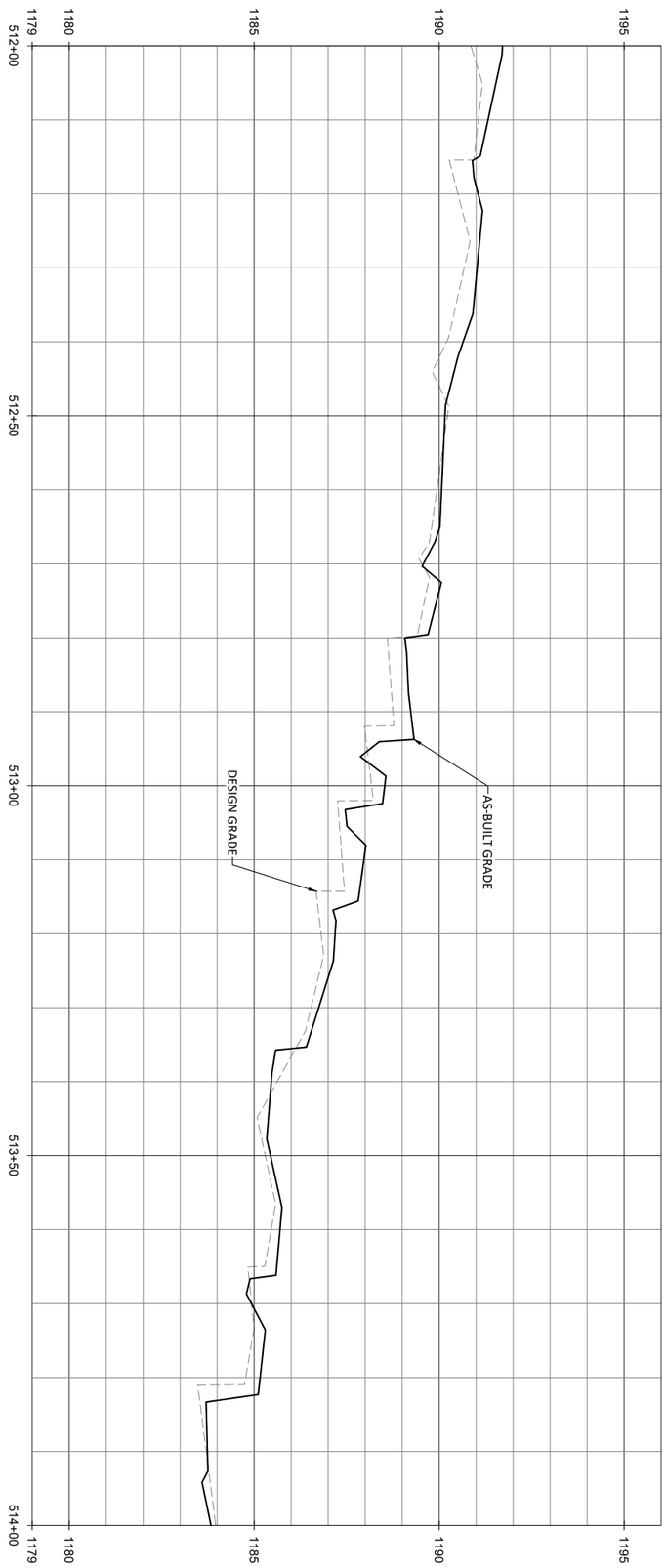

NOTE:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

0' 10' 20' 30' (HORIZONTAL)
0' 2' 4' 6' (VERTICAL)
N

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Revisions:

1.24
Sheet

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER 8/25/21 NICOLE MACALUSO MILLS

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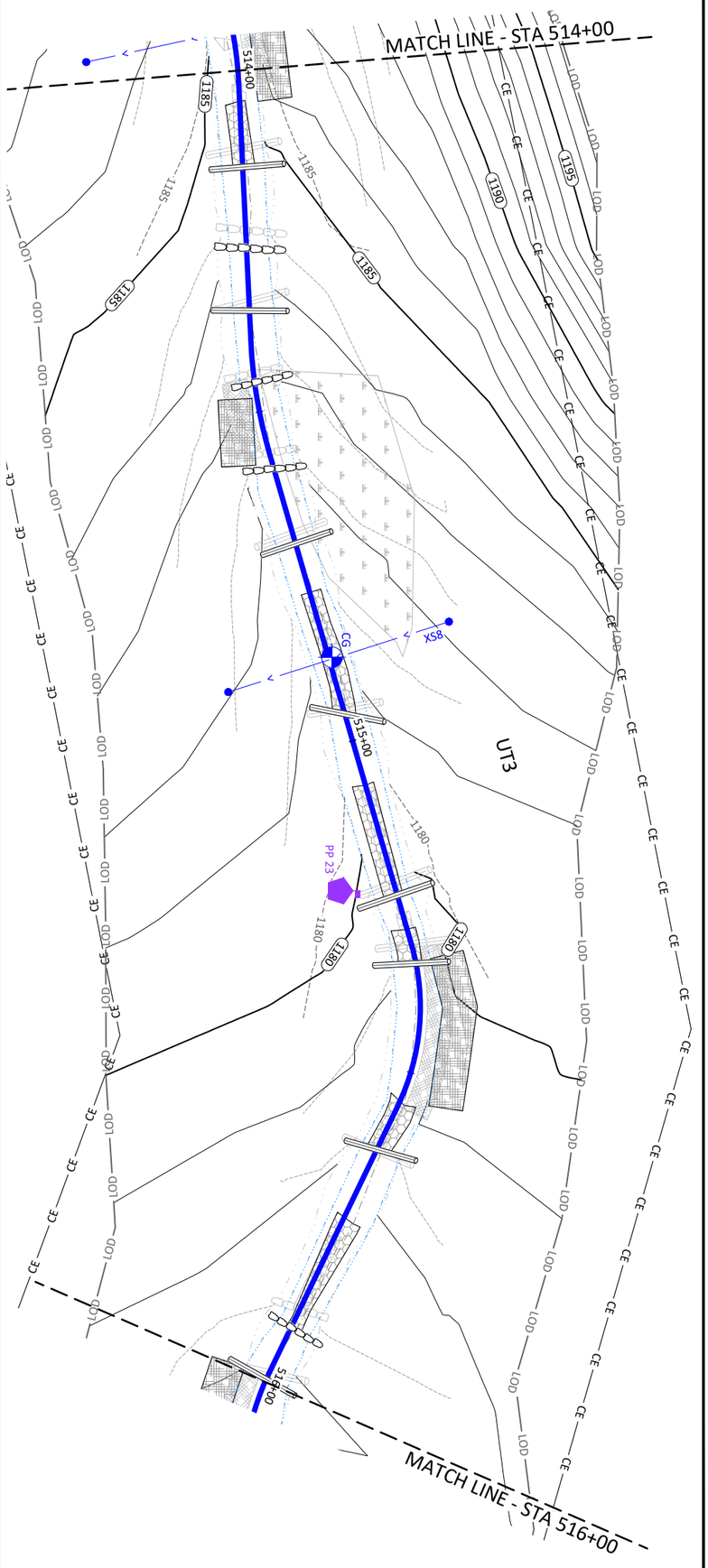

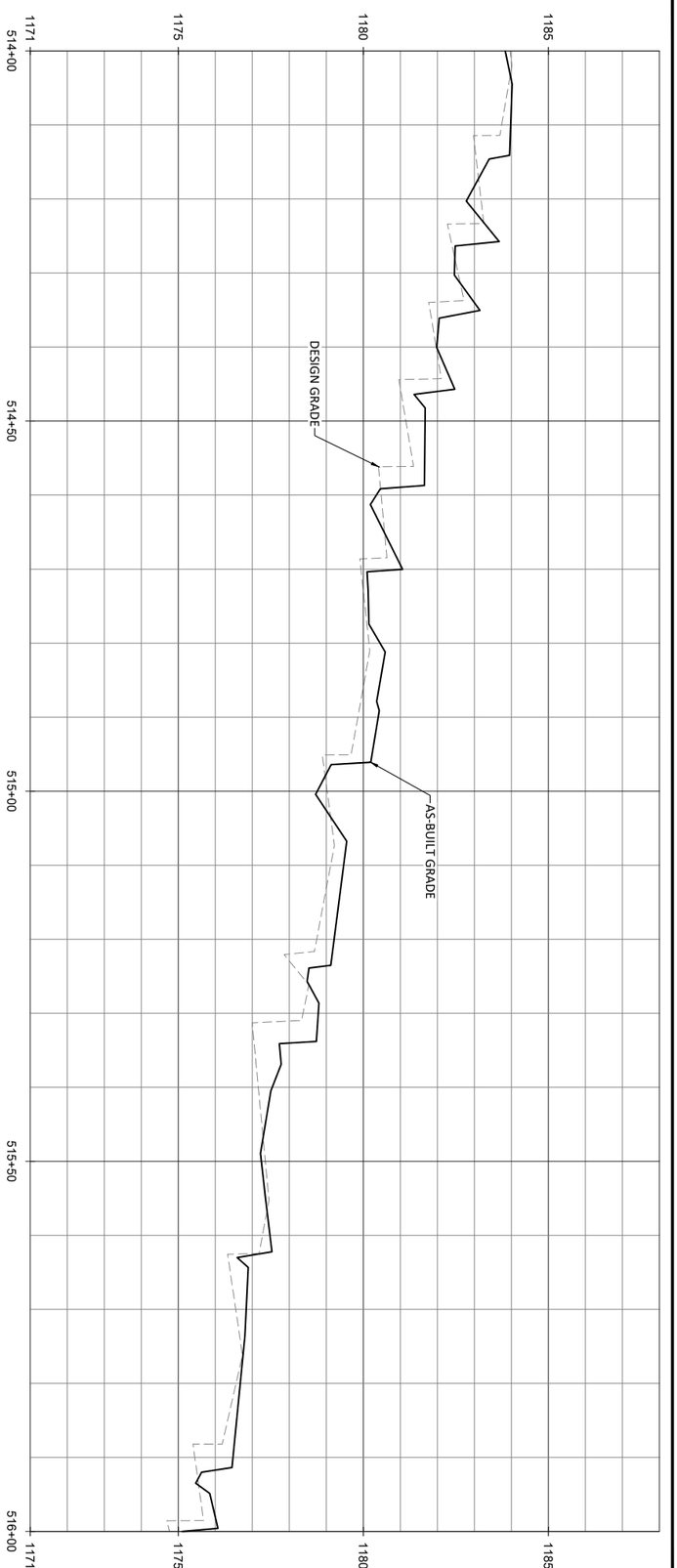

NOTE:
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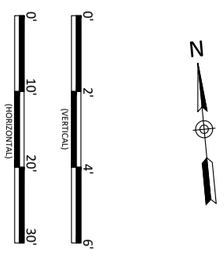

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Revisions:

1.25
Sheet

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER 8/25/21 NICOLE MACALUSO MILLS

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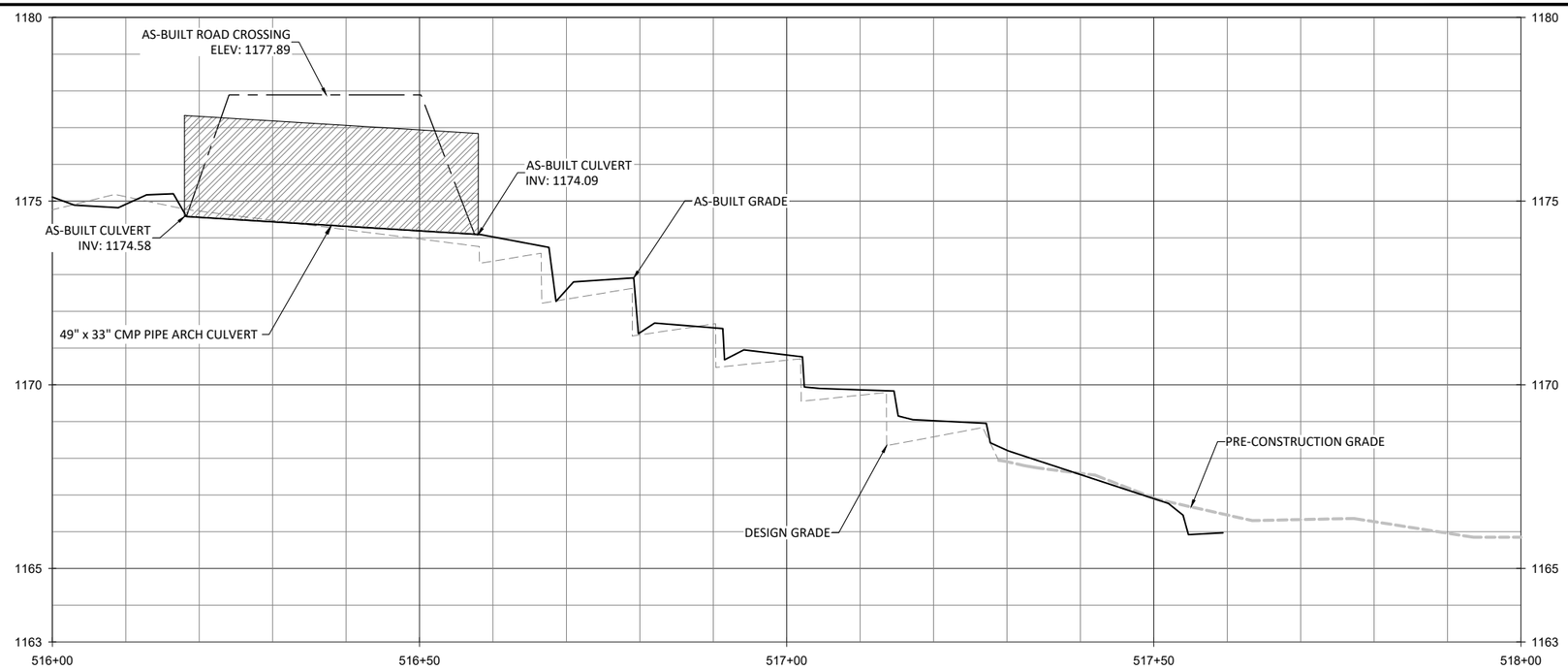

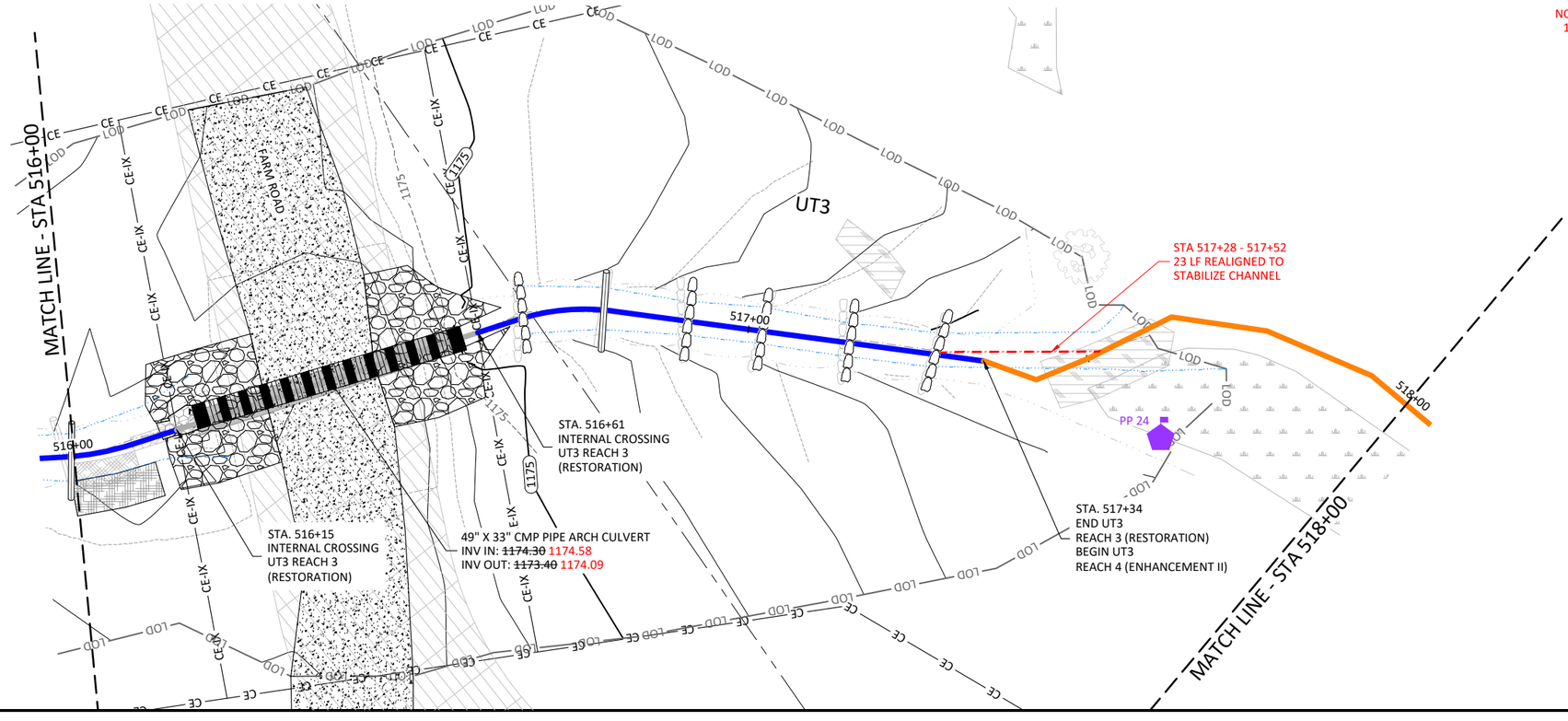

NOTE:
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NICOLE MACALUSO — NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037445 — 8/25/21

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Stream Plan and Profile

Revisions:

Date:	May 26, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.26

June 10, 2021

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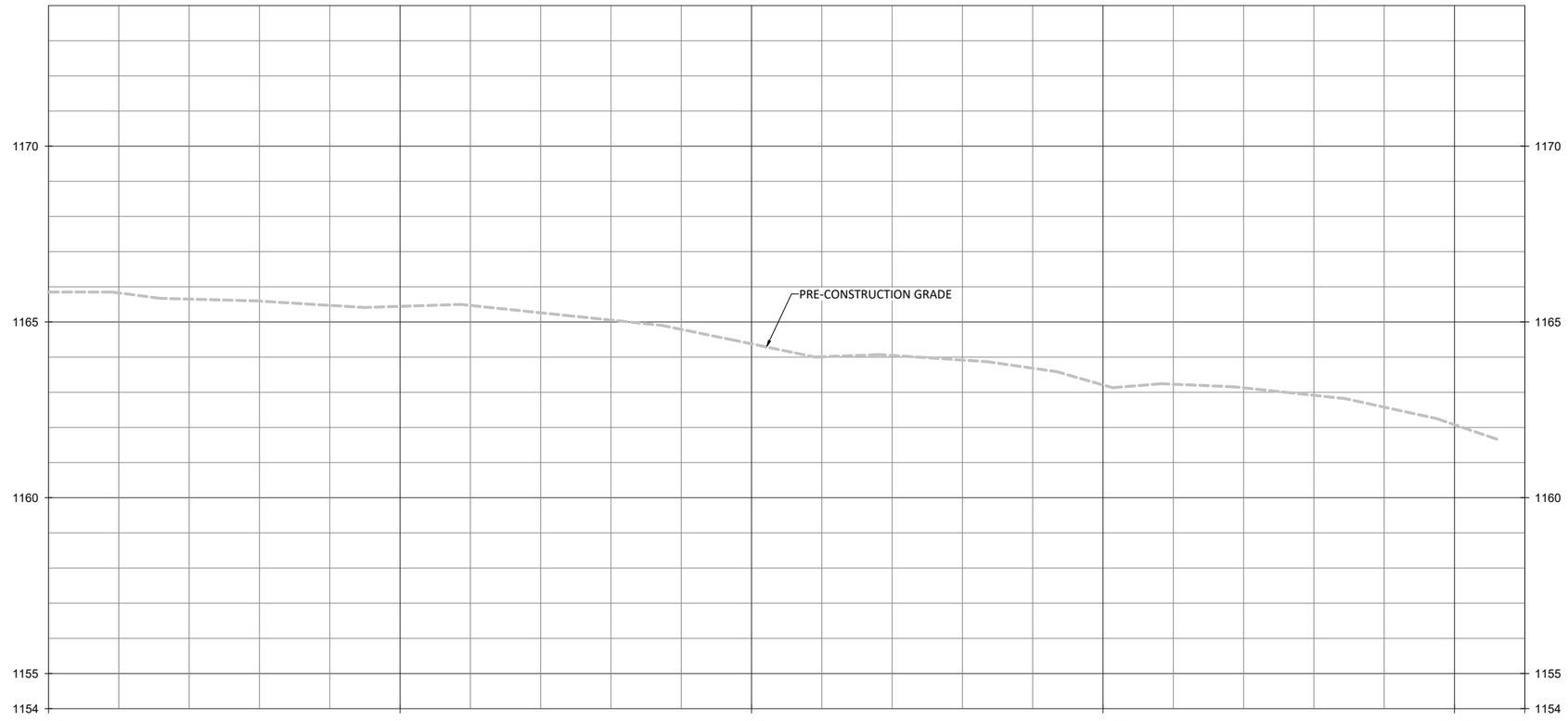
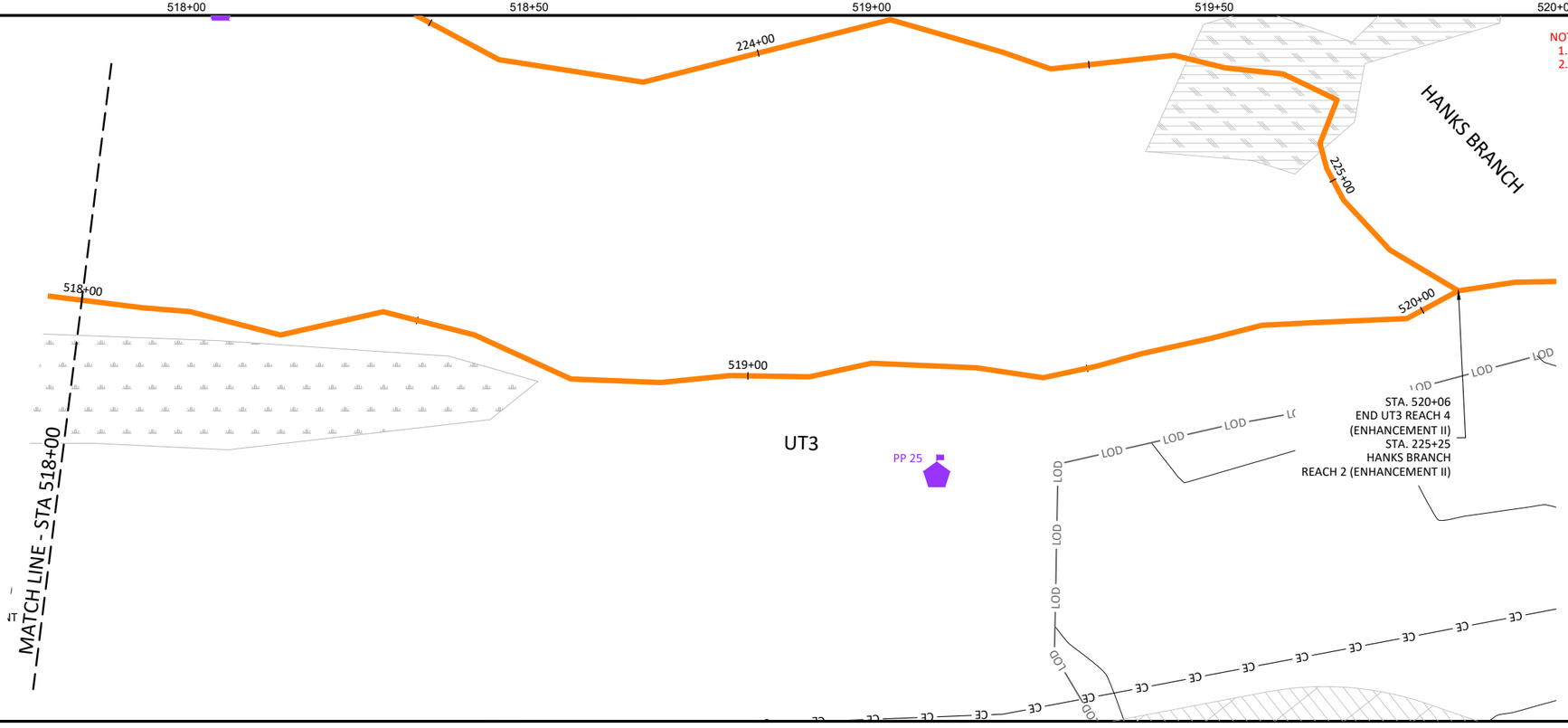
June 10, 2021





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR HANKS BRANCH IS ADDRESSED ON SHEETS 1.04 THROUGH 1.11.

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Stream Plan and Profile

Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.27

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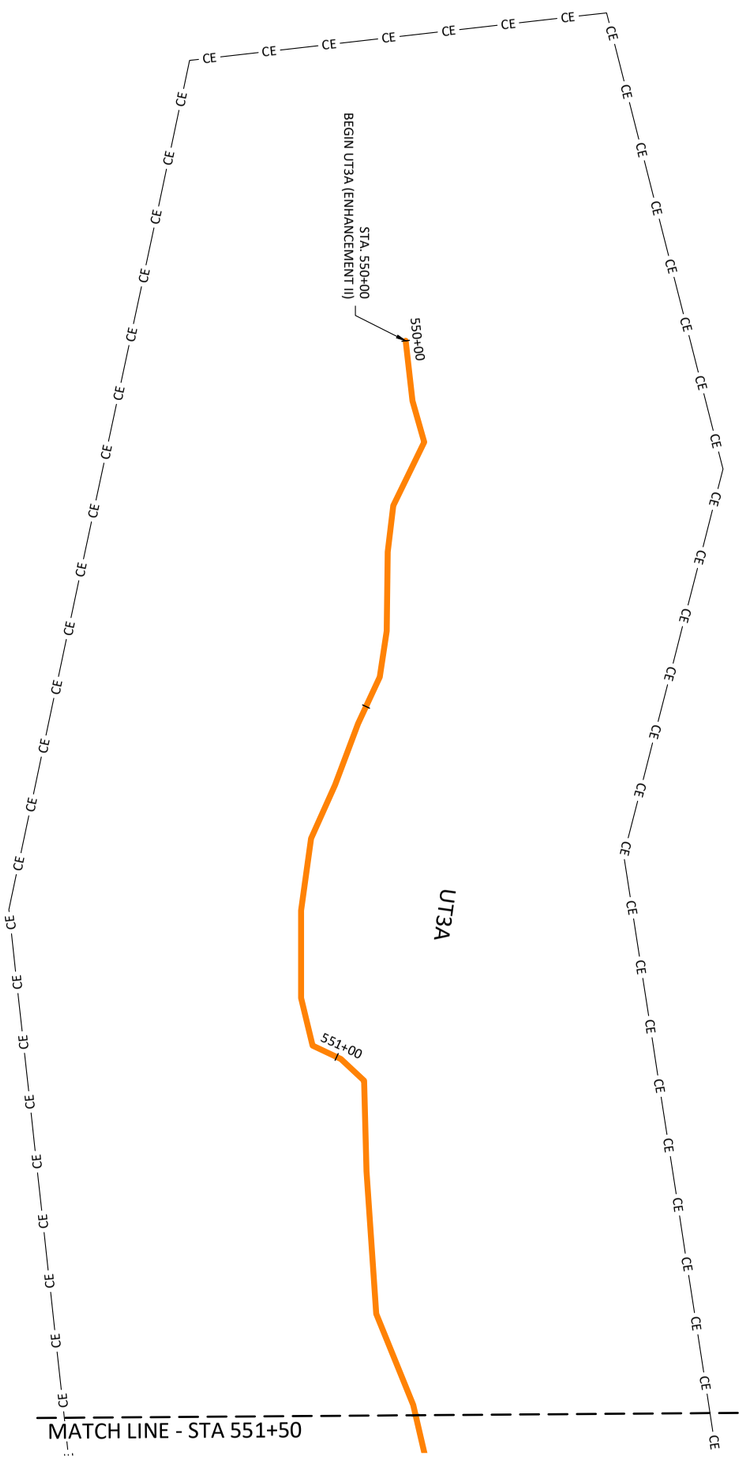

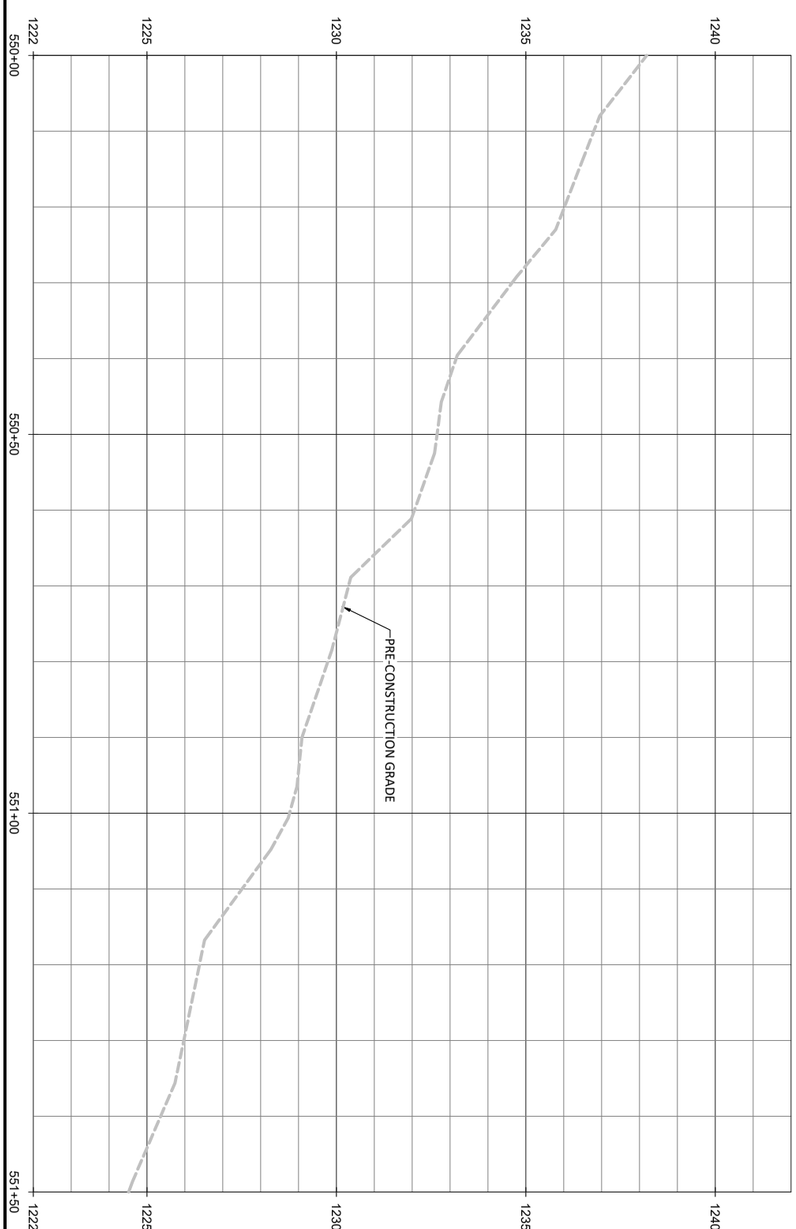

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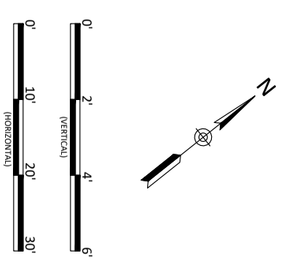

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Revisions:

1.28
Sheet

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3A
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037445 9/25/21 NICOLE MACALUSO MILLER

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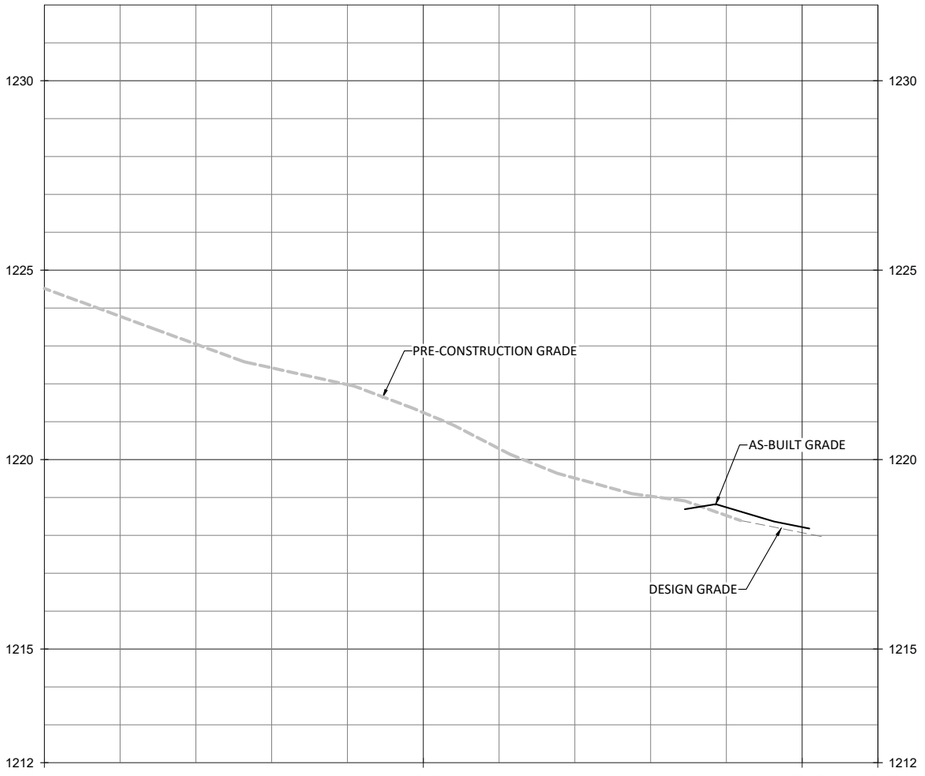

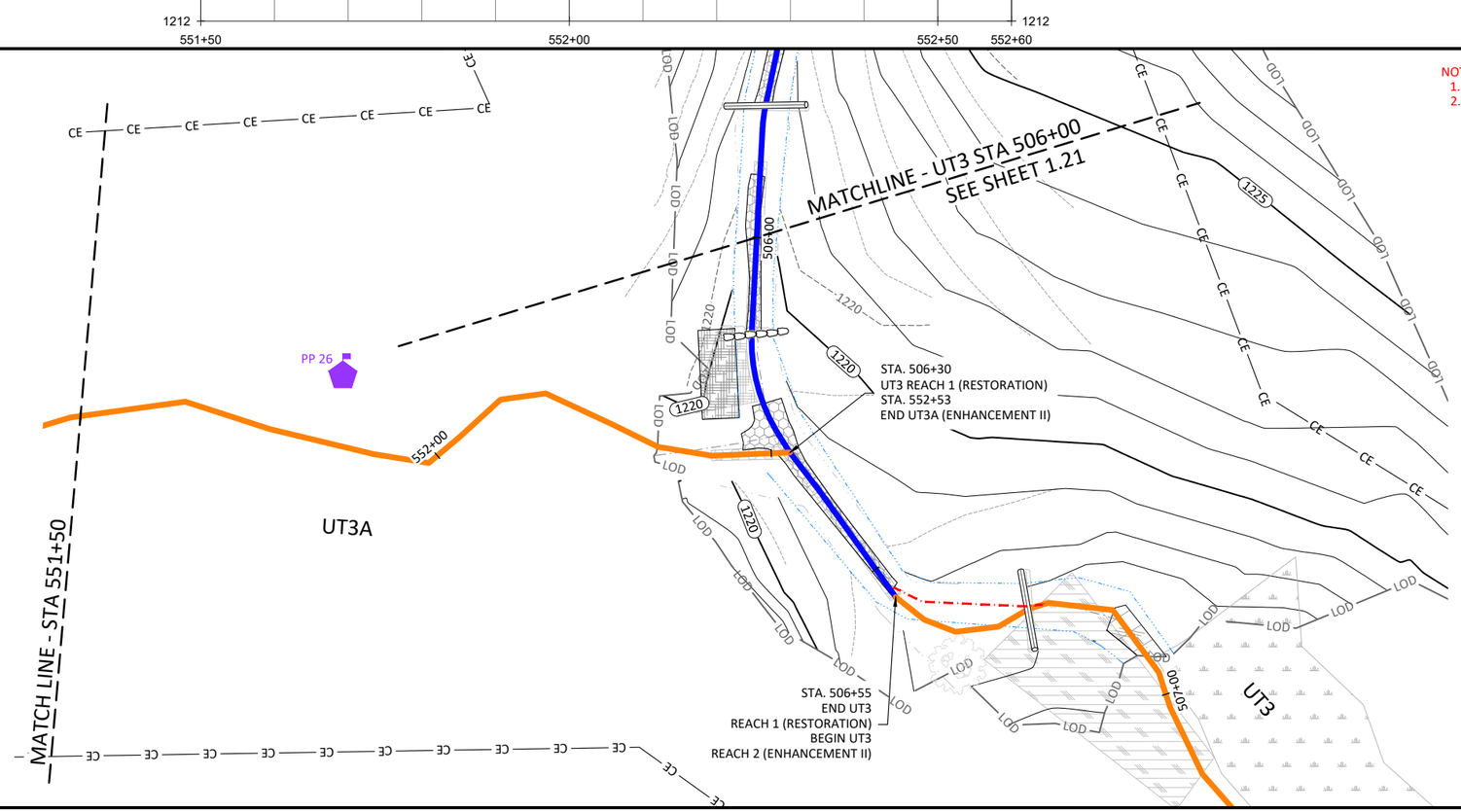

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT3 IS ADDRESSED ON SHEETS 1.18 THROUGH 1.27.

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

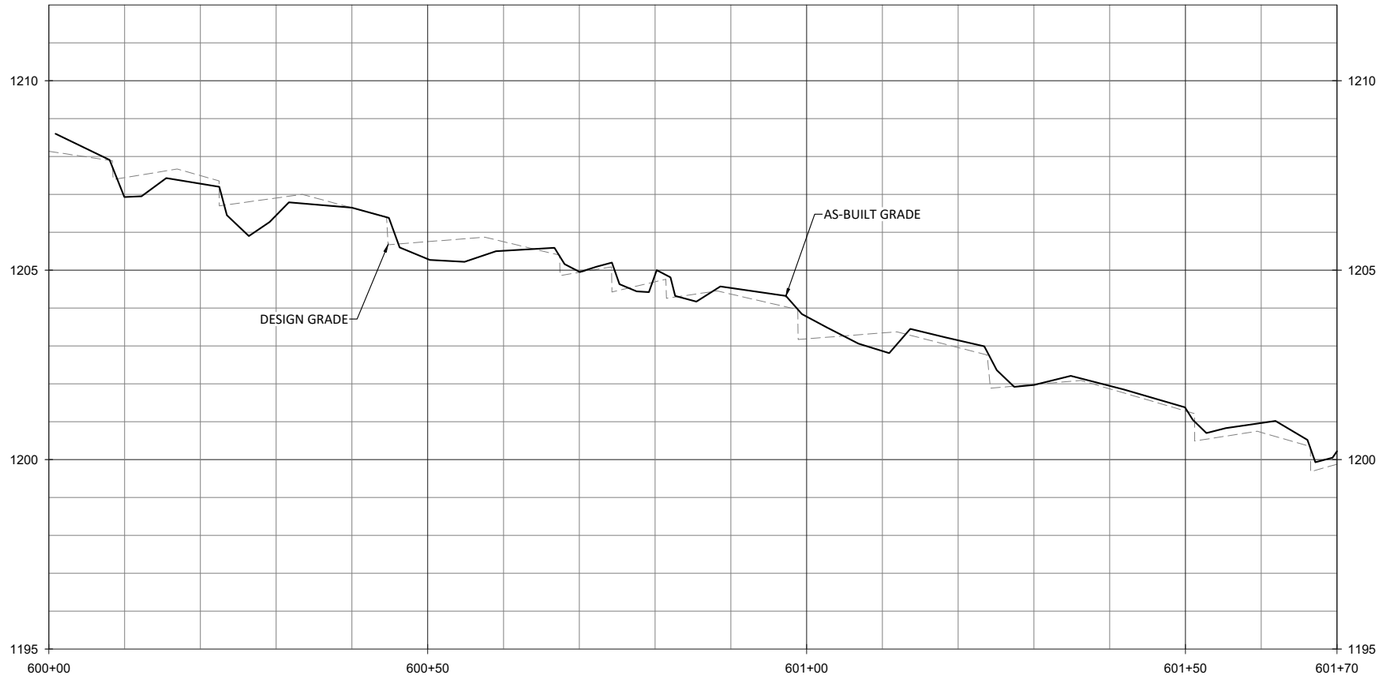
UT3A
Stream Plan and Profile

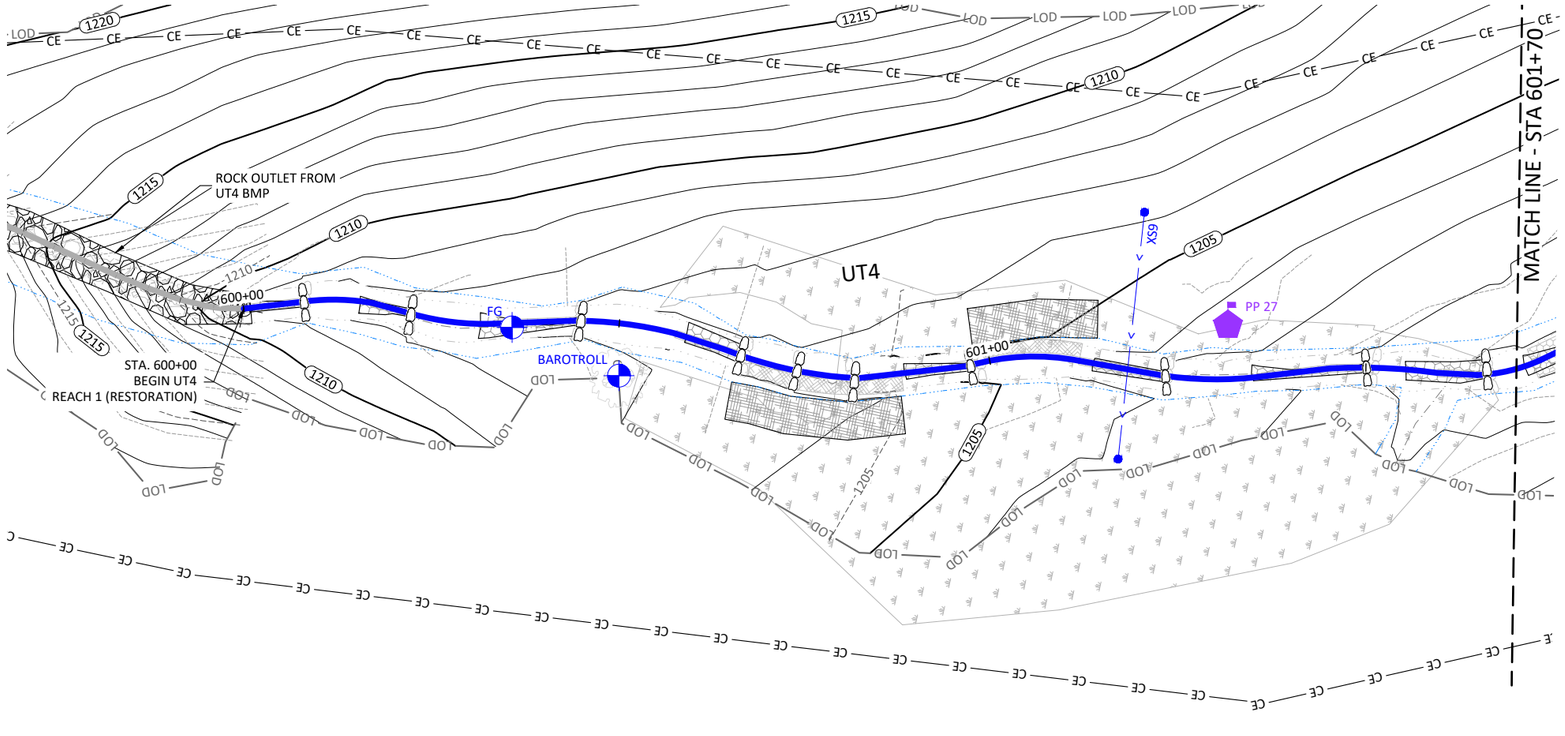
Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.29

June 10, 2021





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT4 BMP IS ADDRESSED ON SHEET 2.03.

N

0' 2' 4' 6'
(VERTICAL)

0' 10' 20' 30'
(HORIZONTAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT4
Stream Plan and Profile

Revisions:

Date: May 26, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.30

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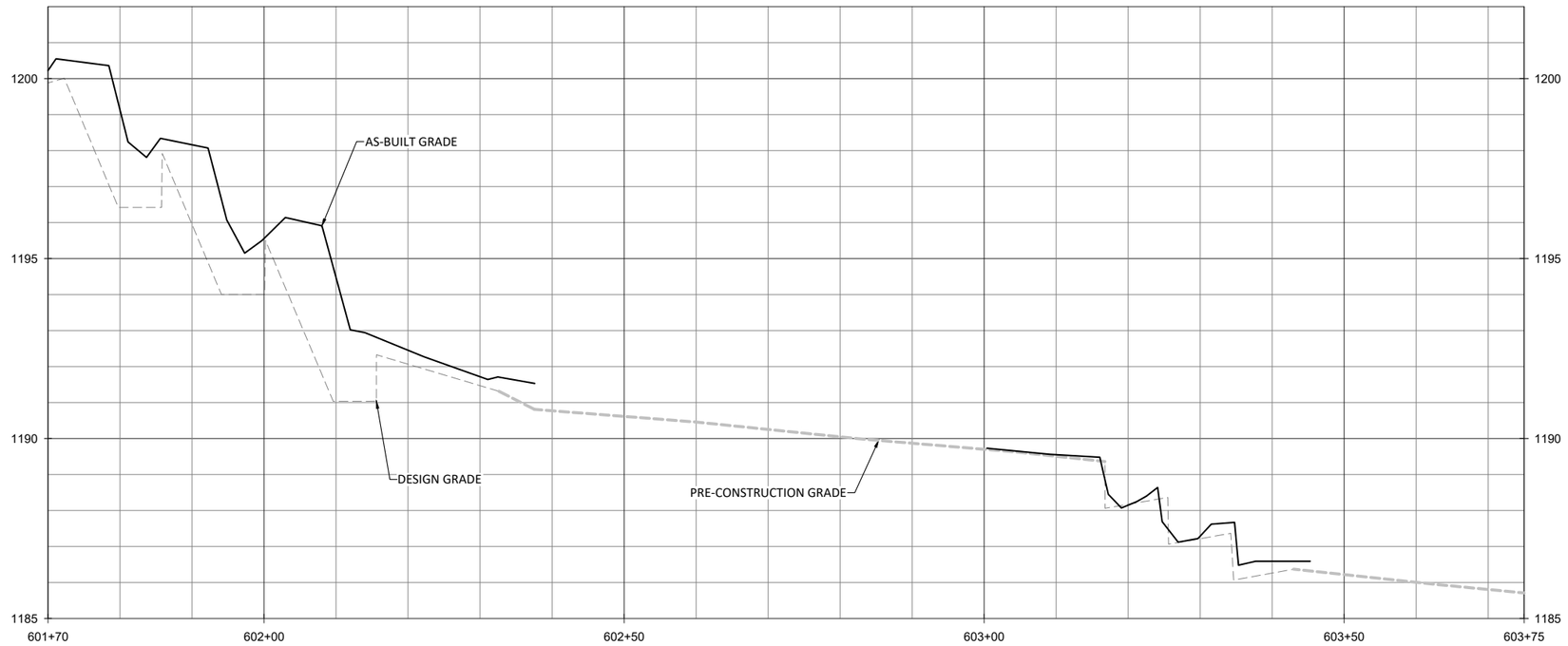

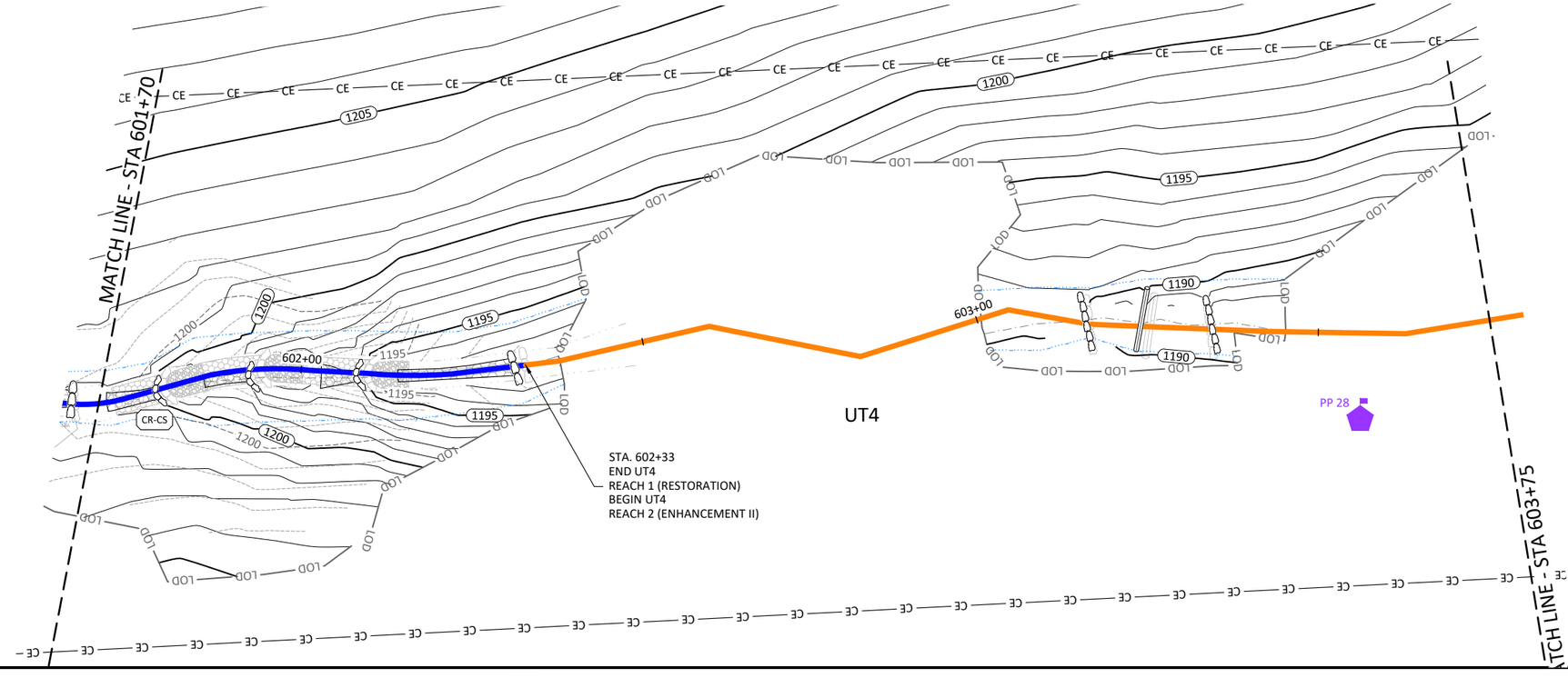

NOTE:
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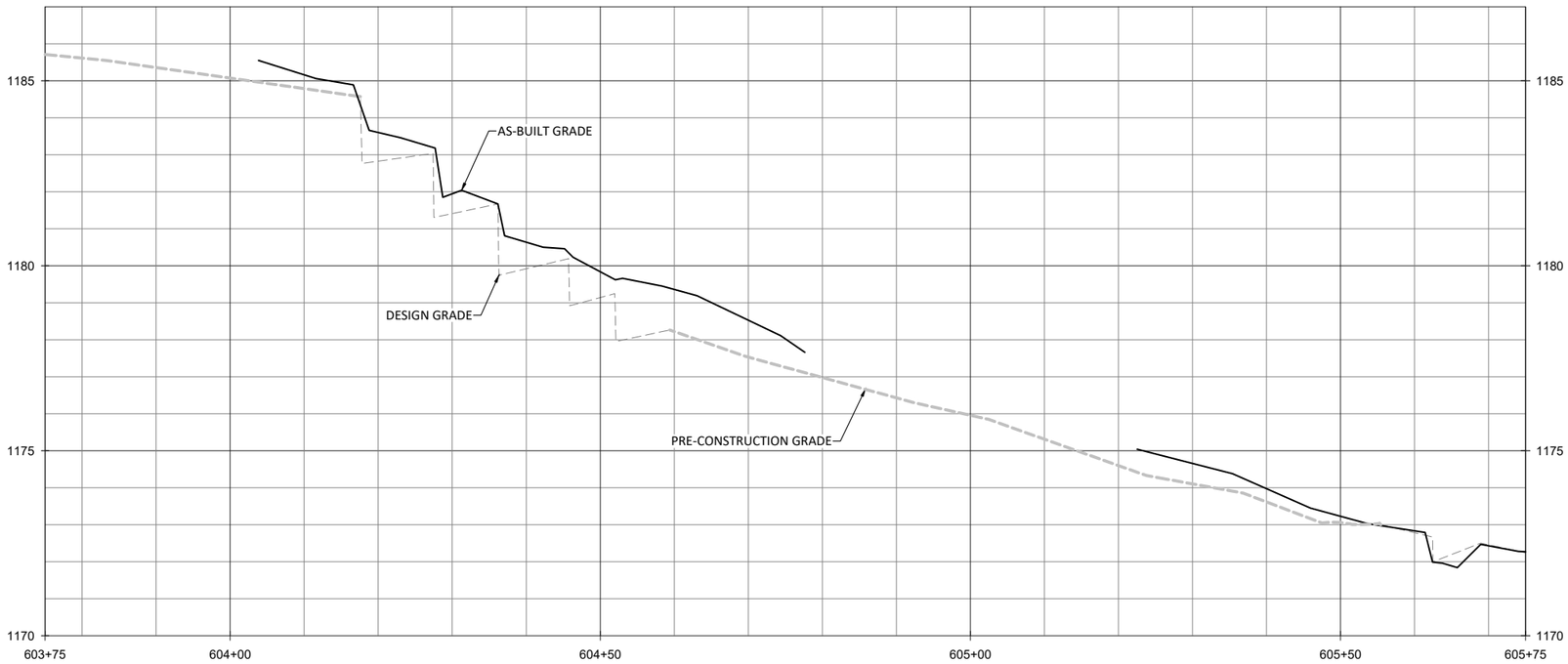
Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

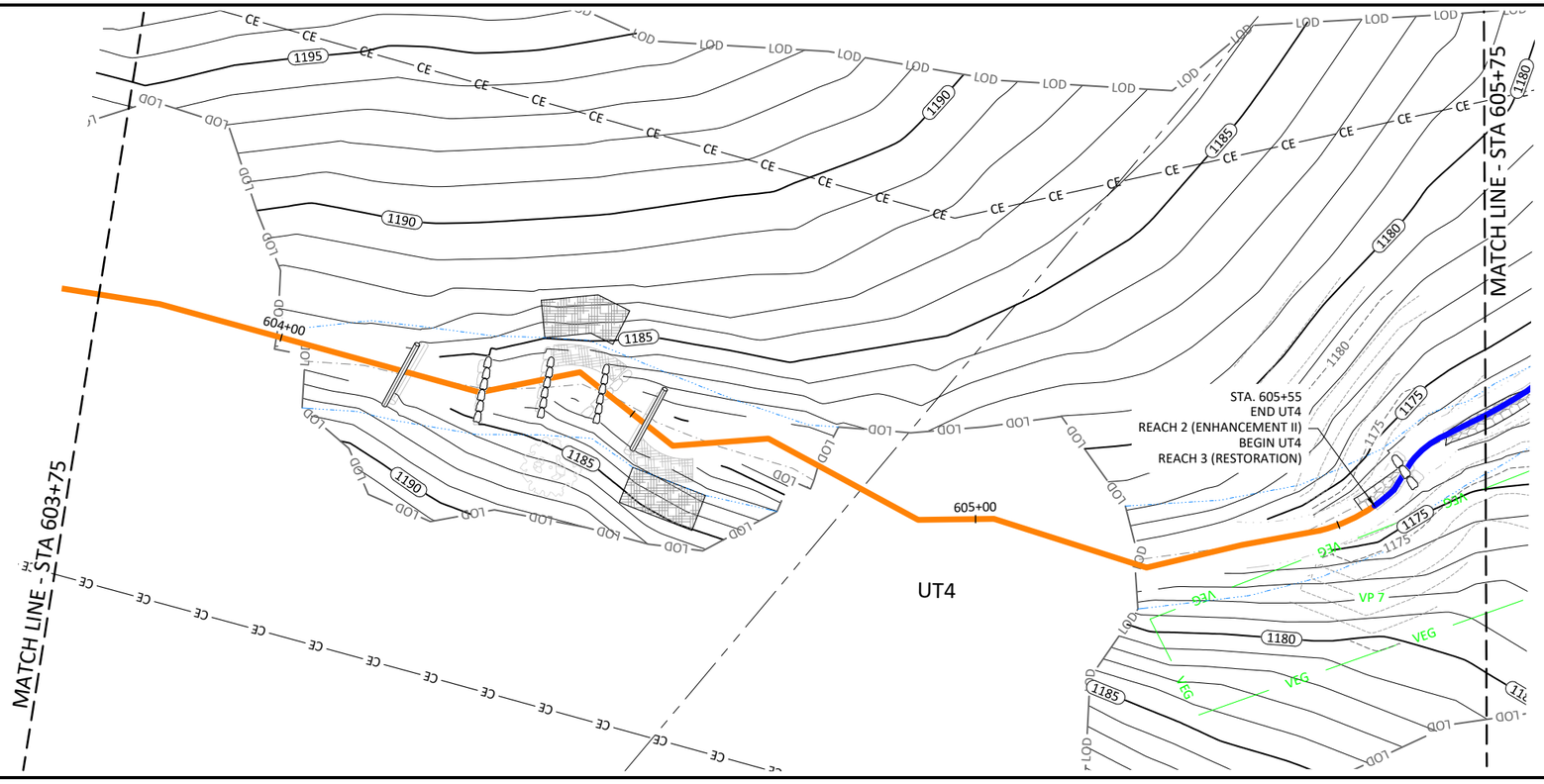
UT4
Stream Plan and Profile

Revisions:

Date:	May 26, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.31





NOTE:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

0' 2' 4' 6' (VERTICAL)

0' 10' 20' 30' (HORIZONTAL)

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NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE MACALUSO

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT4
Stream Plan and Profile

Revisions:

Date: May 29, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.32

June 10, 2021

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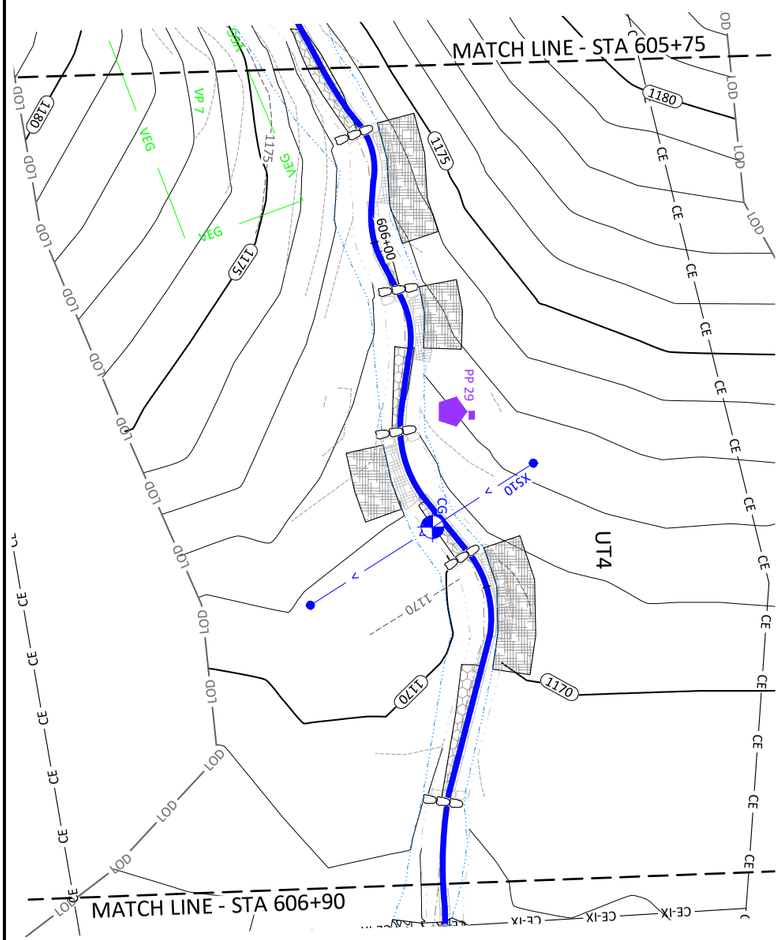

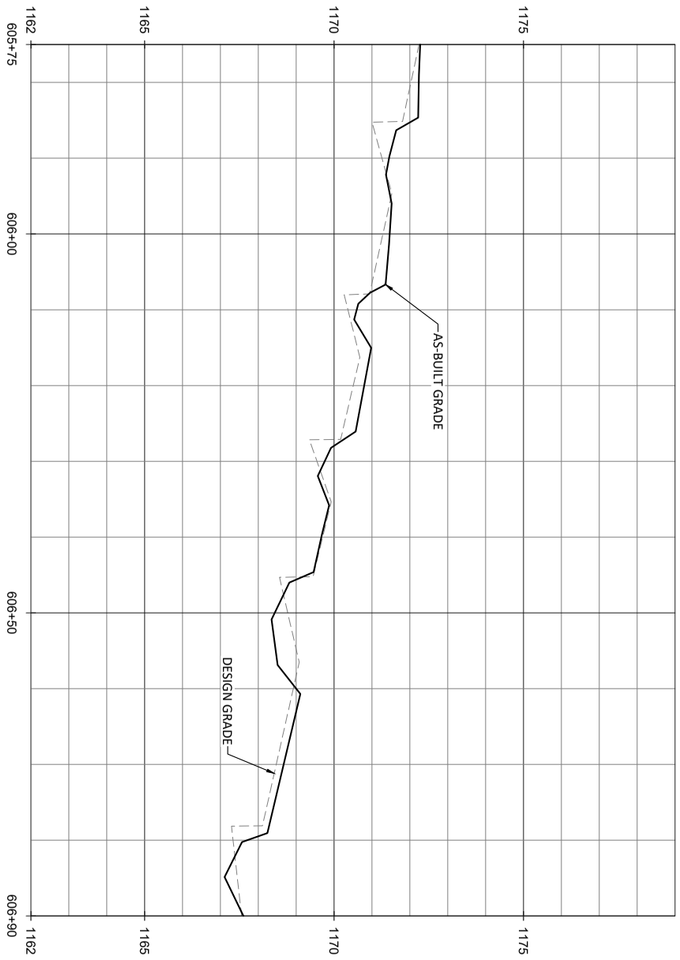

NOTE:
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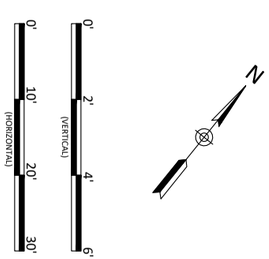

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Revisions:

1.33
Sheet

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT4
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037445 9/25/21 NICOLE MACALUSO MILLER

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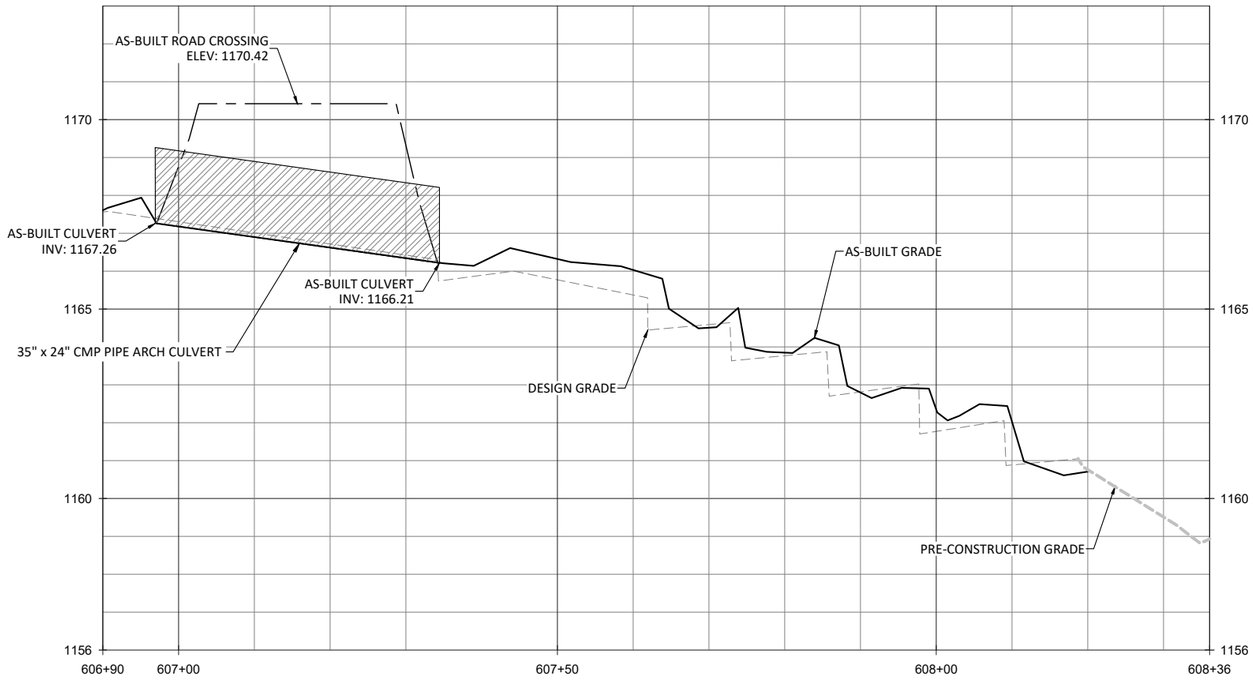

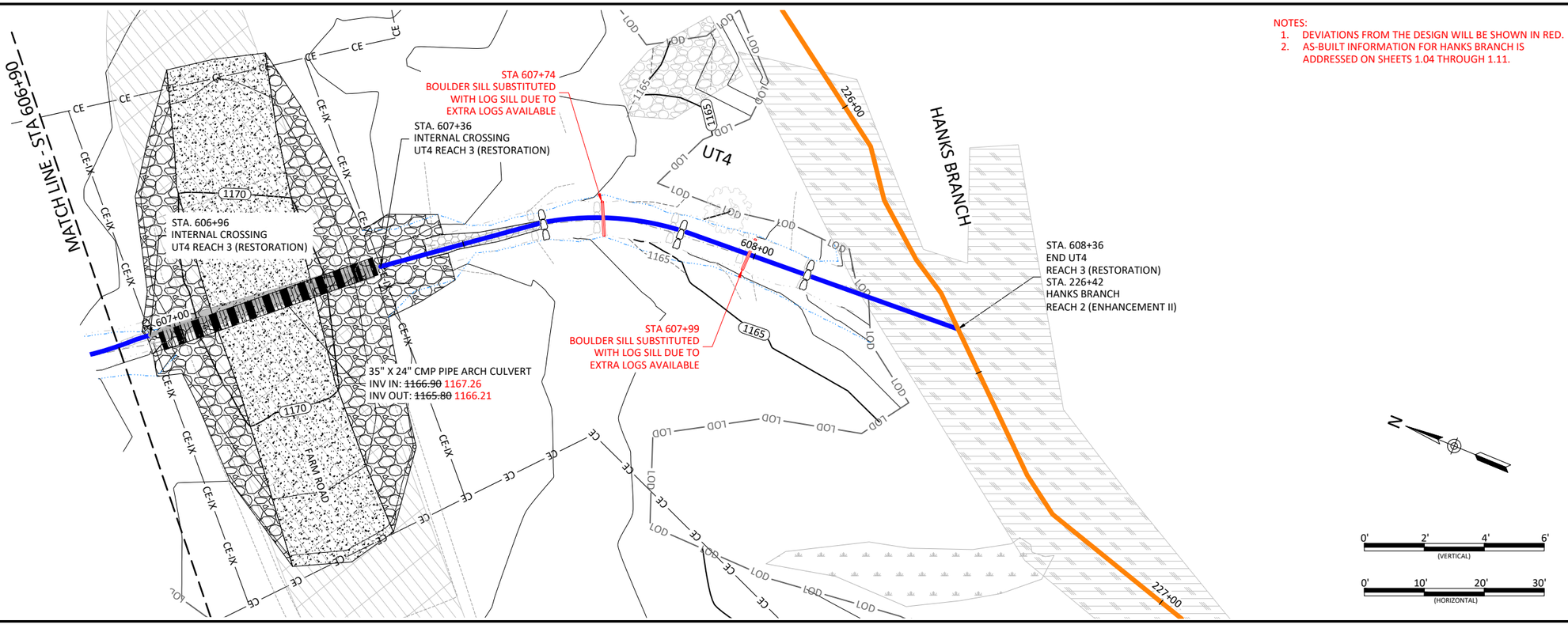

NOTES:
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT4
Stream Plan and Profile

Revisions:

Date:	May 26, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.34

June 10, 2021

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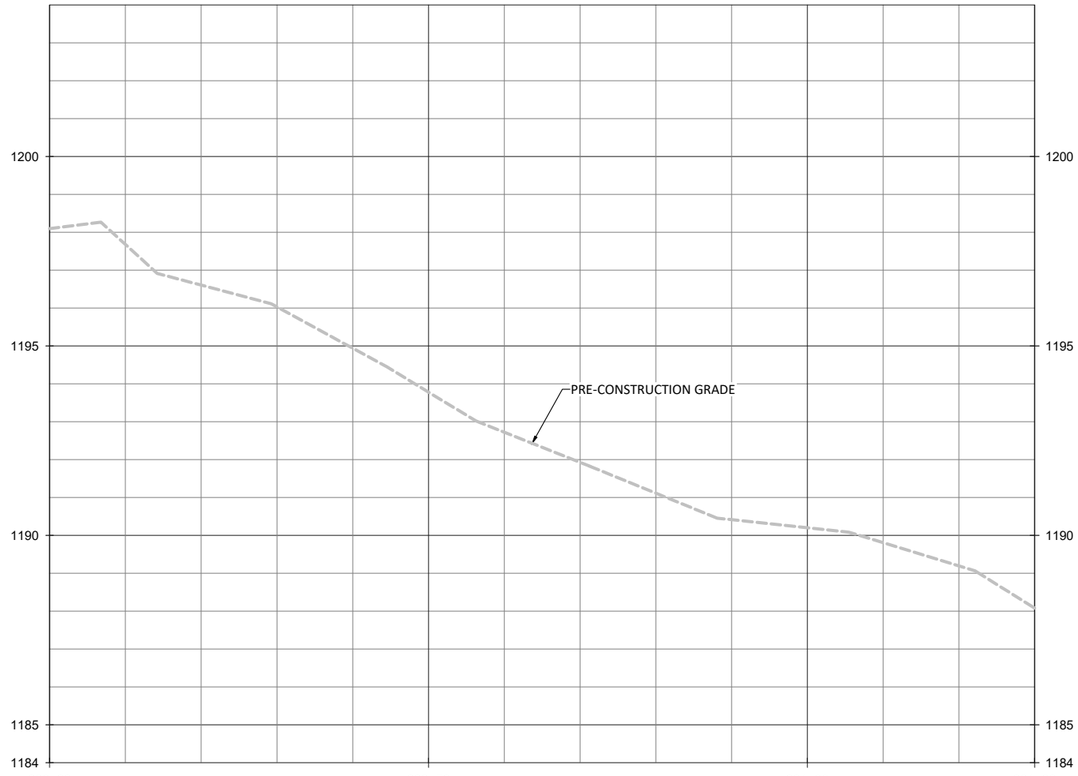

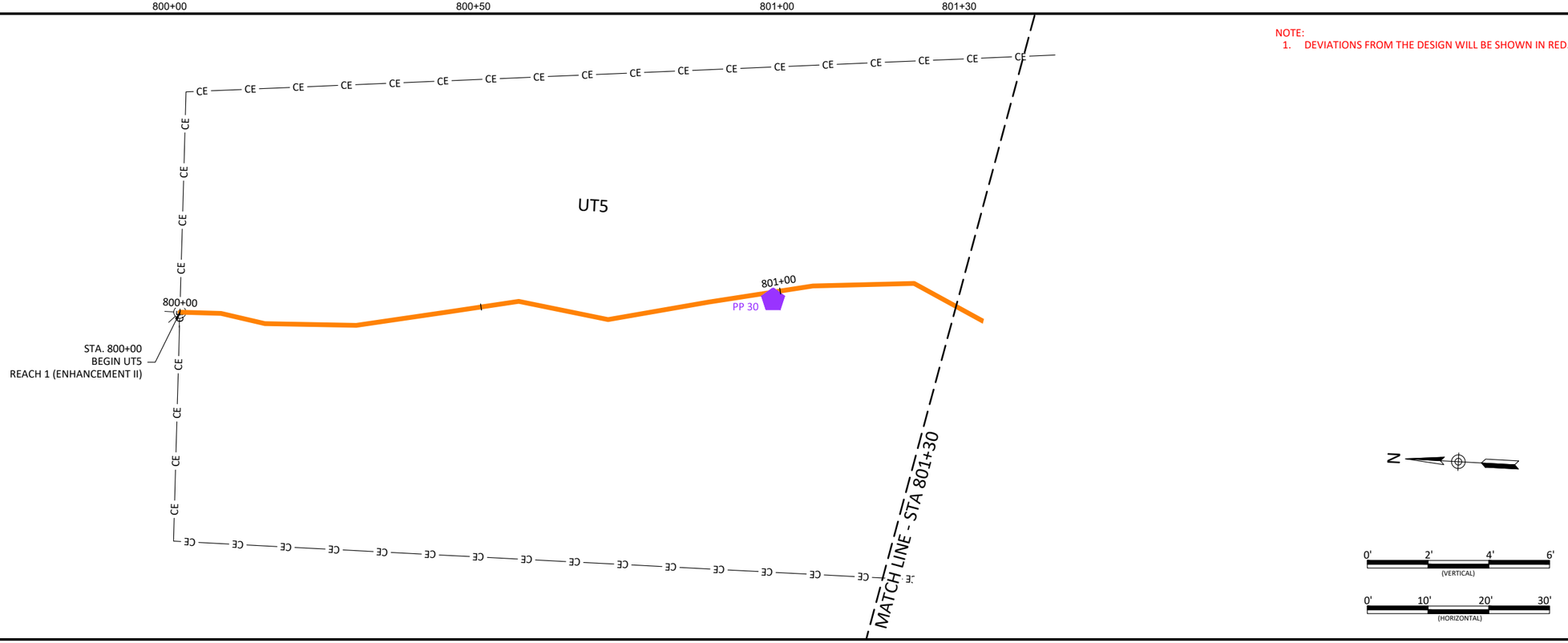

NOTE:
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT5
Stream Plan and Profile

Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.35

June 10, 2021

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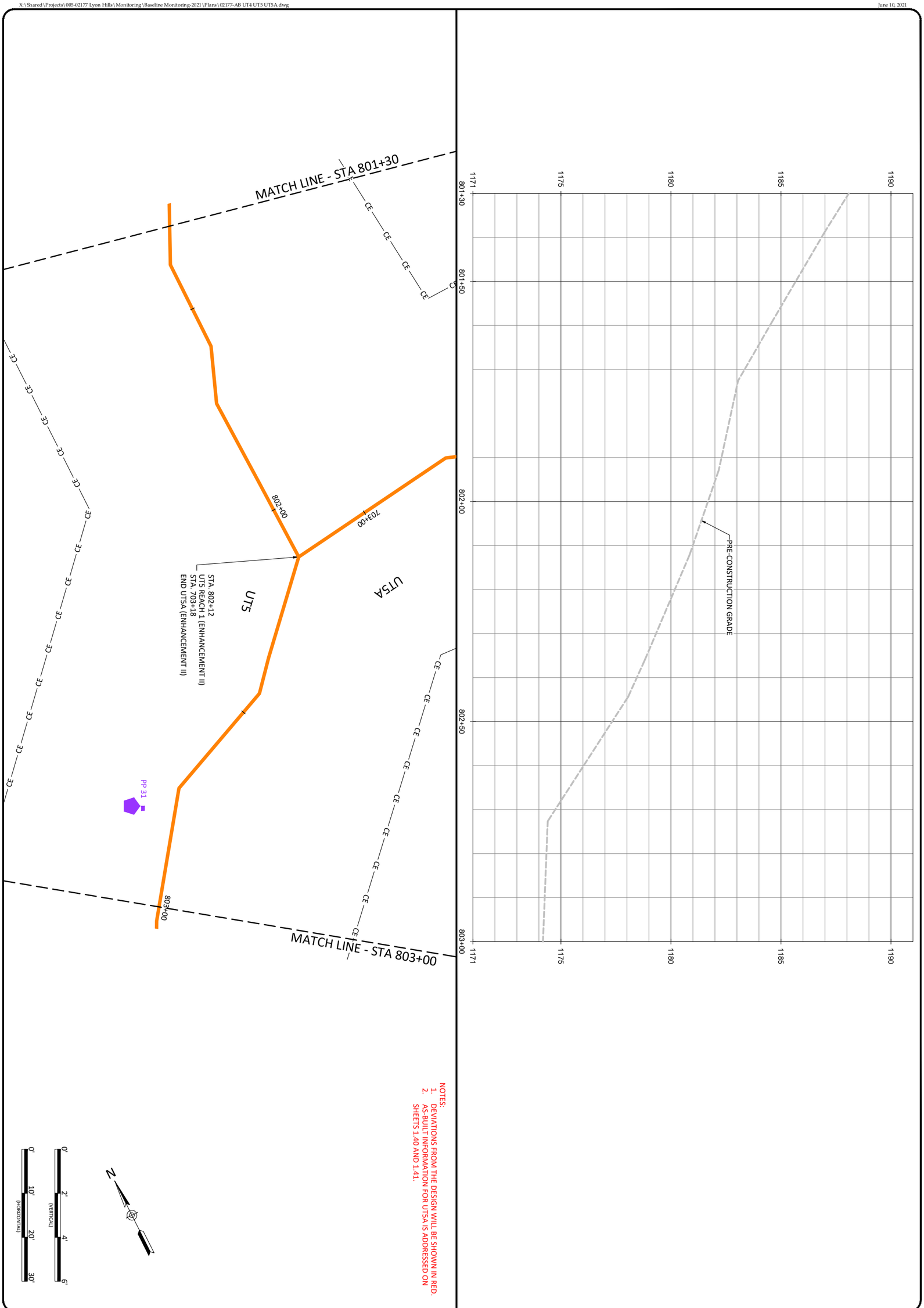

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT5A IS ADDRESSED ON SHEETS 1.40 AND 1.41.

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
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Revisions:

1.36
Sheet

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT5
Stream Plan and Profile

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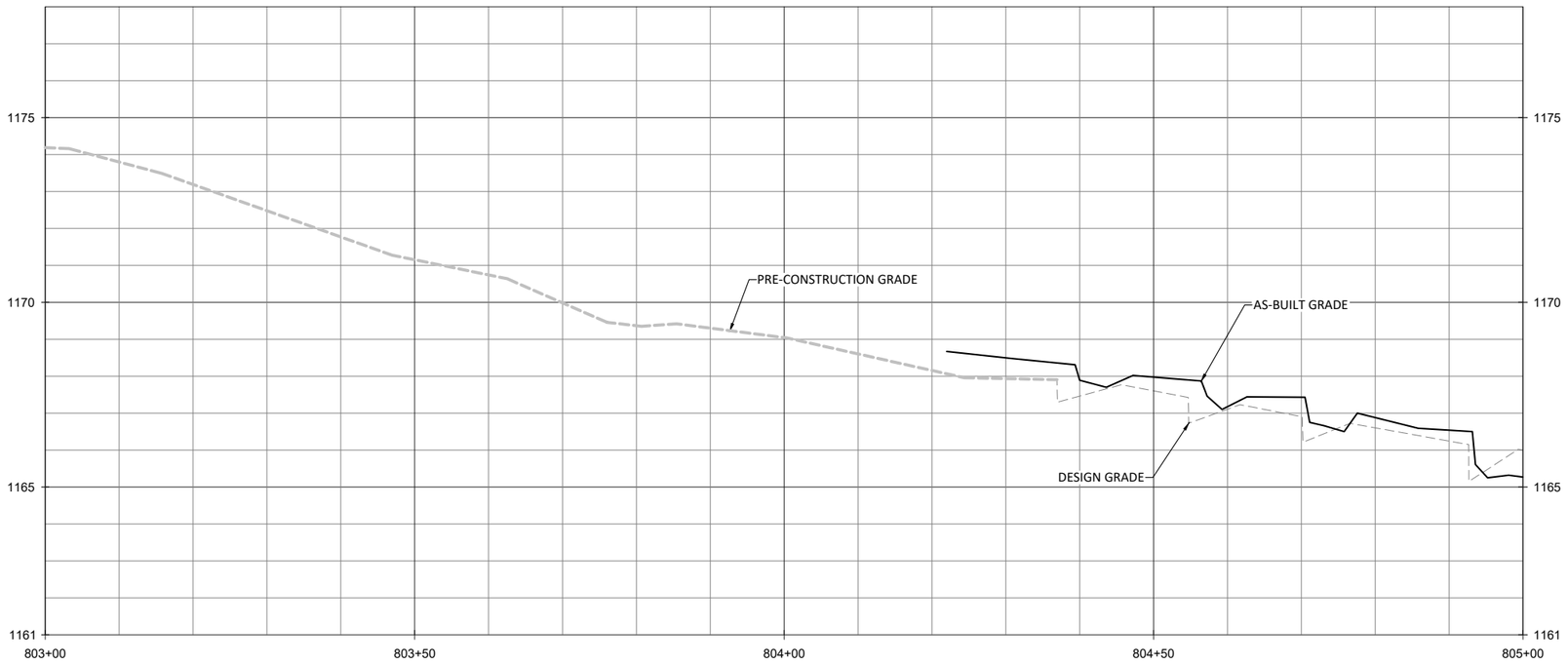

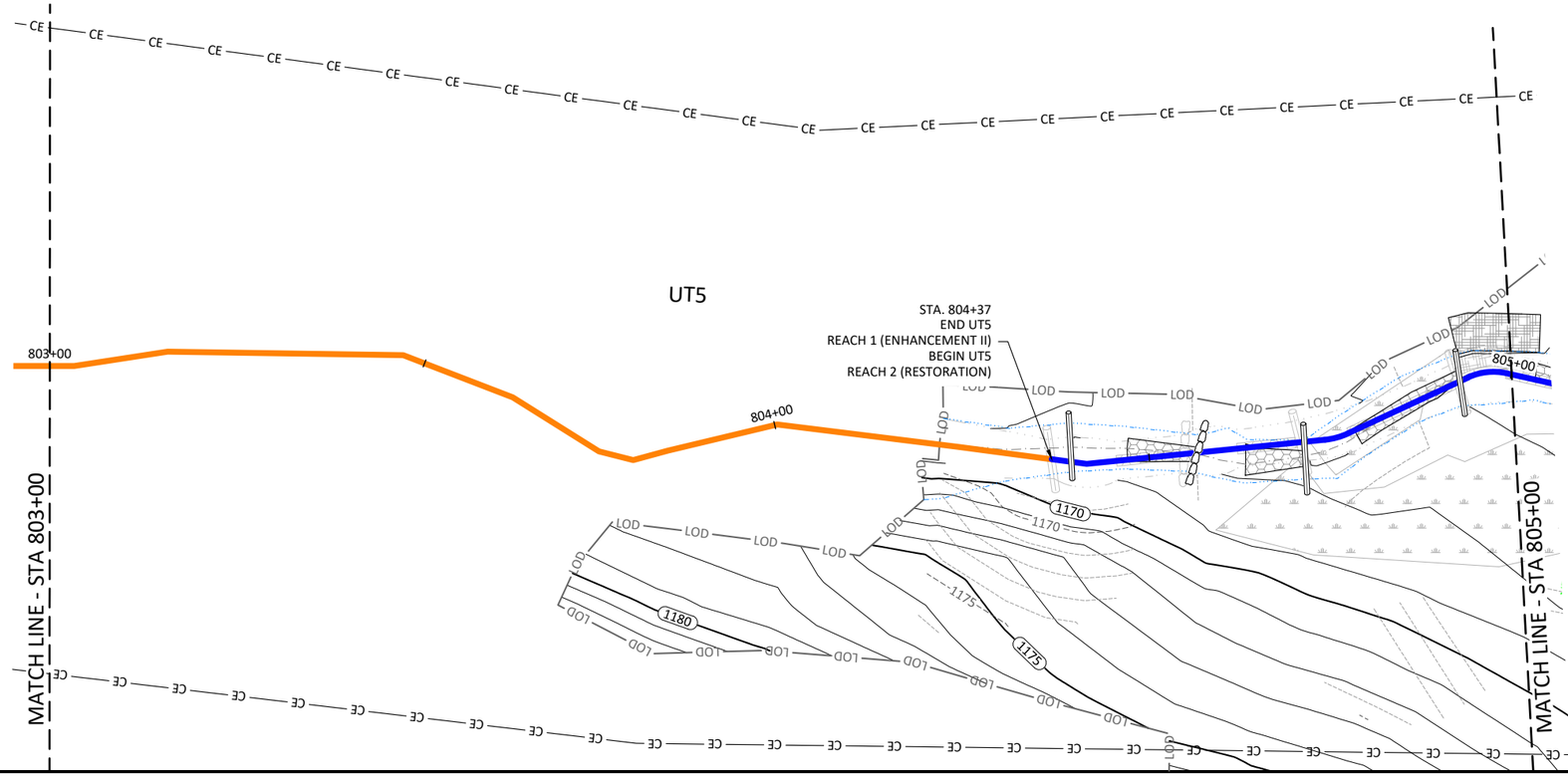

NOTE:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED..

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0' 10' 20' 30' (HORIZONTAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT5
Stream Plan and Profile

Revisions:

Date: May 26, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.37

June 10, 2021

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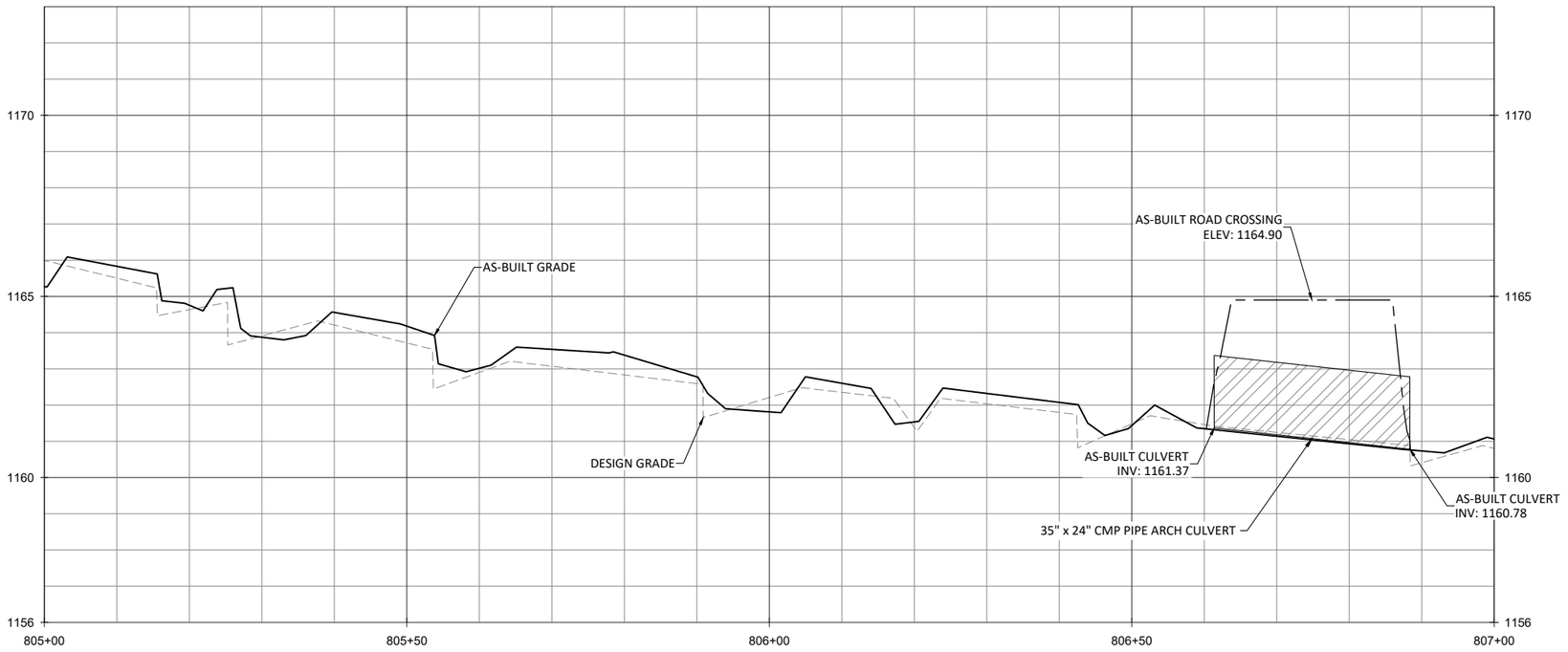
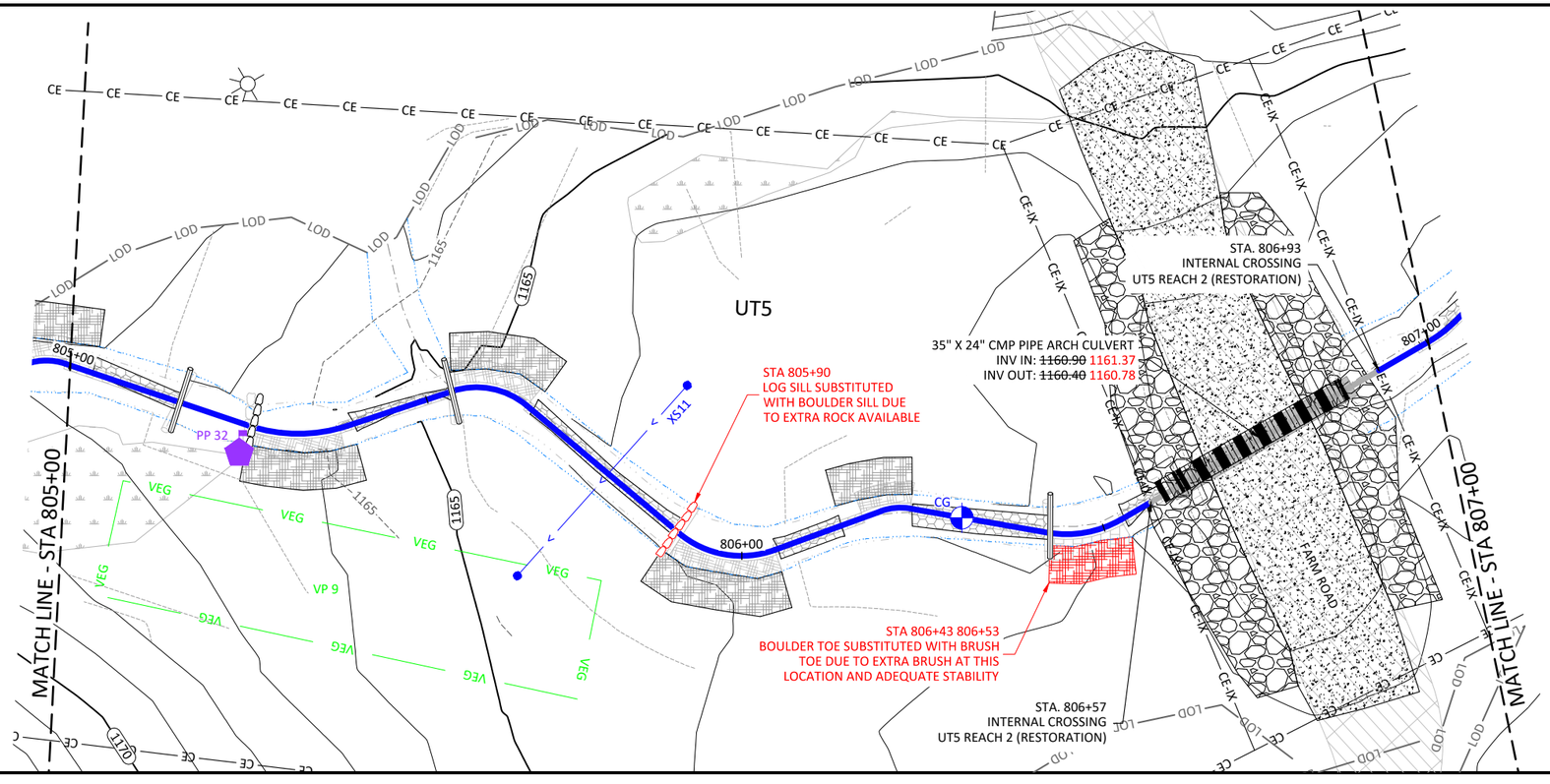
June 10, 2021





NOTE:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

0' 2' 4' 6' (VERTICAL)

0' 10' 20' 30' (HORIZONTAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT5
Stream Plan and Profile

Revisions:

Date:	May 26, 2021
Job Number:	005-02177
Project Engineer:	NMM
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Sheet 1.38

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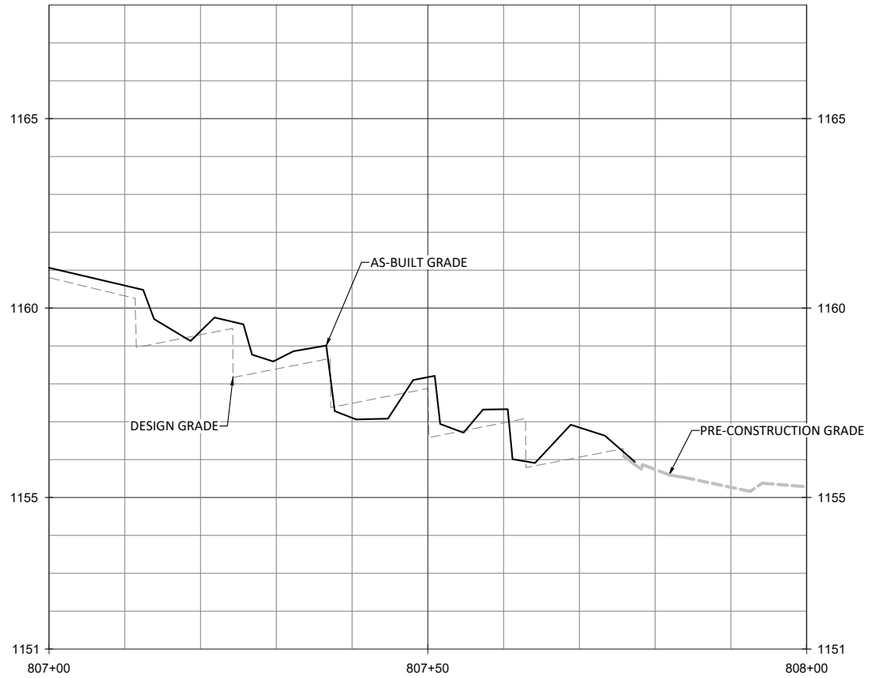

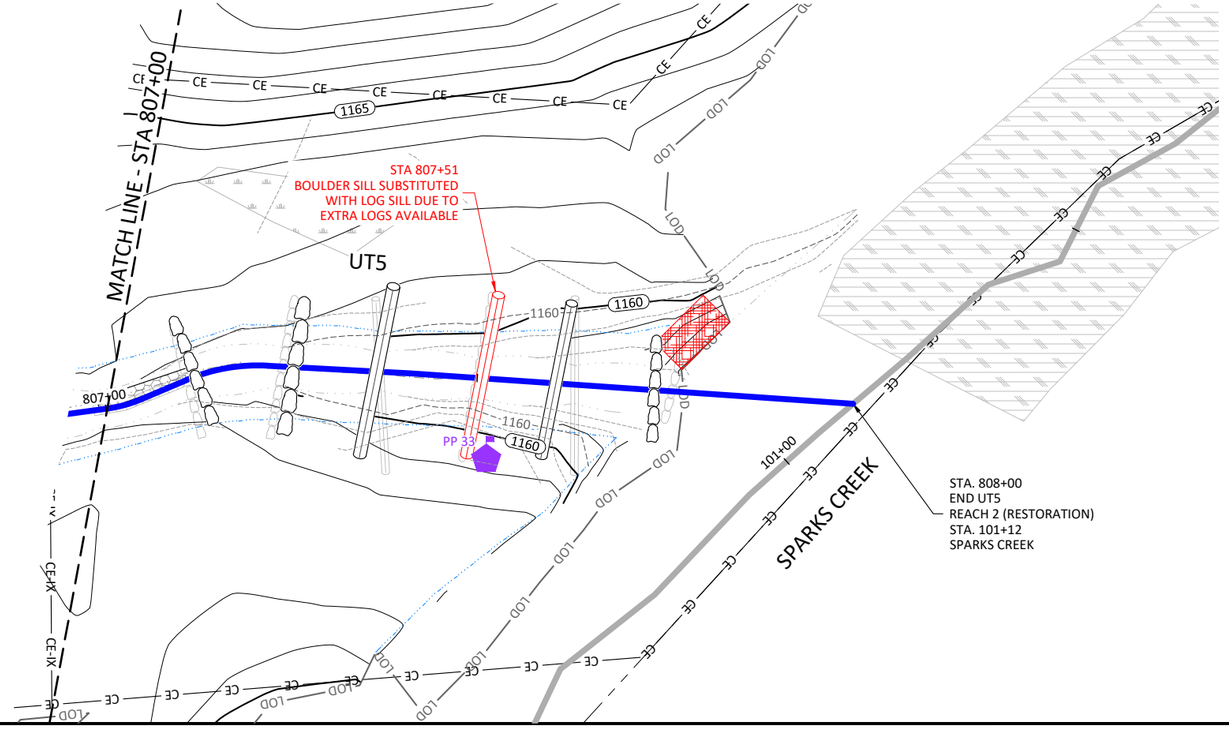

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR SPARKS CREEK IS ADDRESSED ON SHEETS 1.01 THROUGH 1.03.

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0' 2' 4' 6' (VERTICAL)

0' 10' 20' 30' (HORIZONTAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT5
Stream Plan and Profile

Revisions:

Date:	May 26, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
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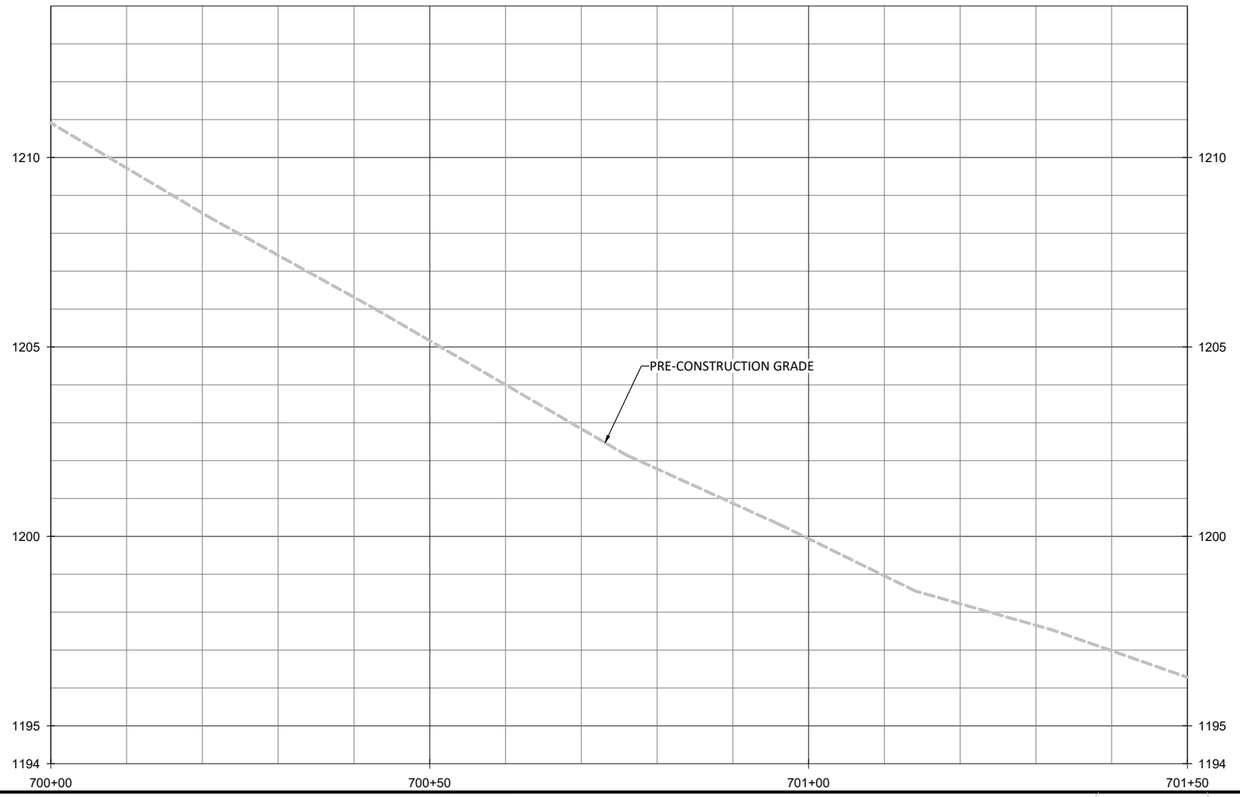
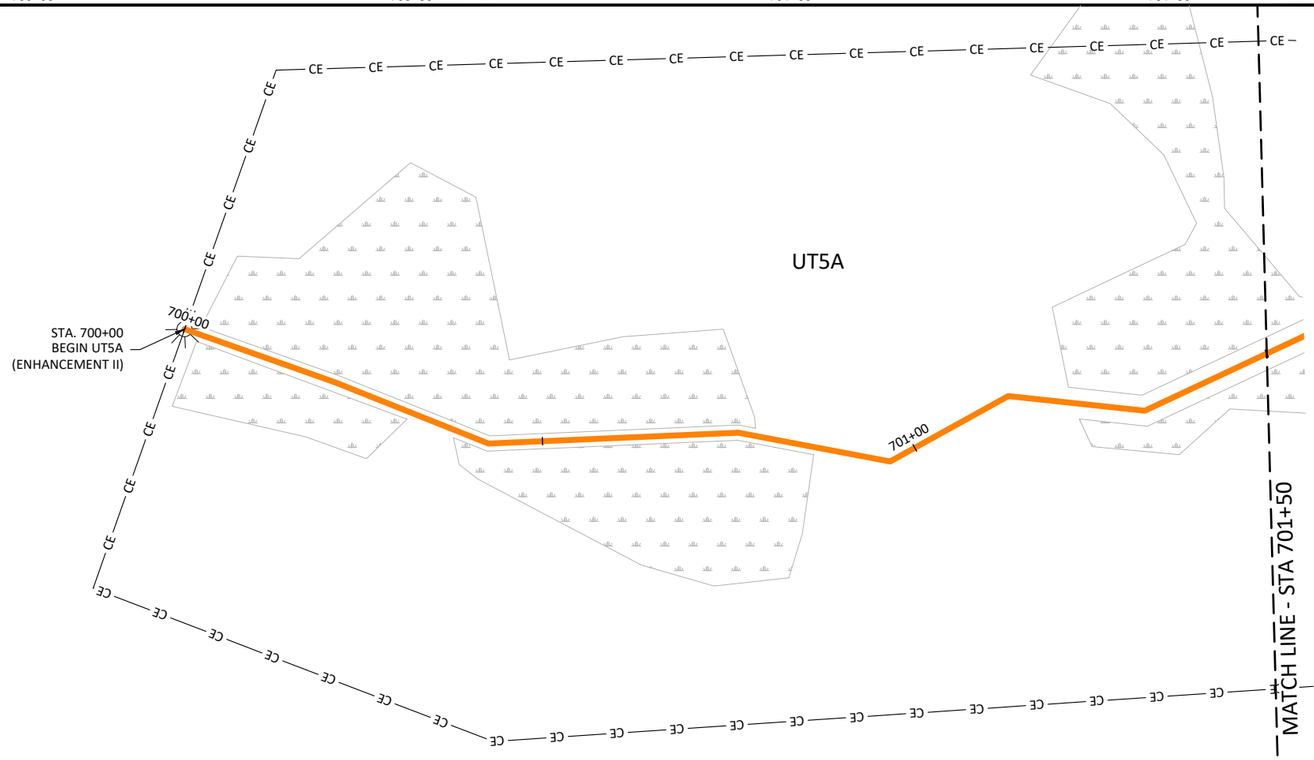
Sheet 1.39





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

N

0' 2' 4' 6'
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0' 10' 20' 30'
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

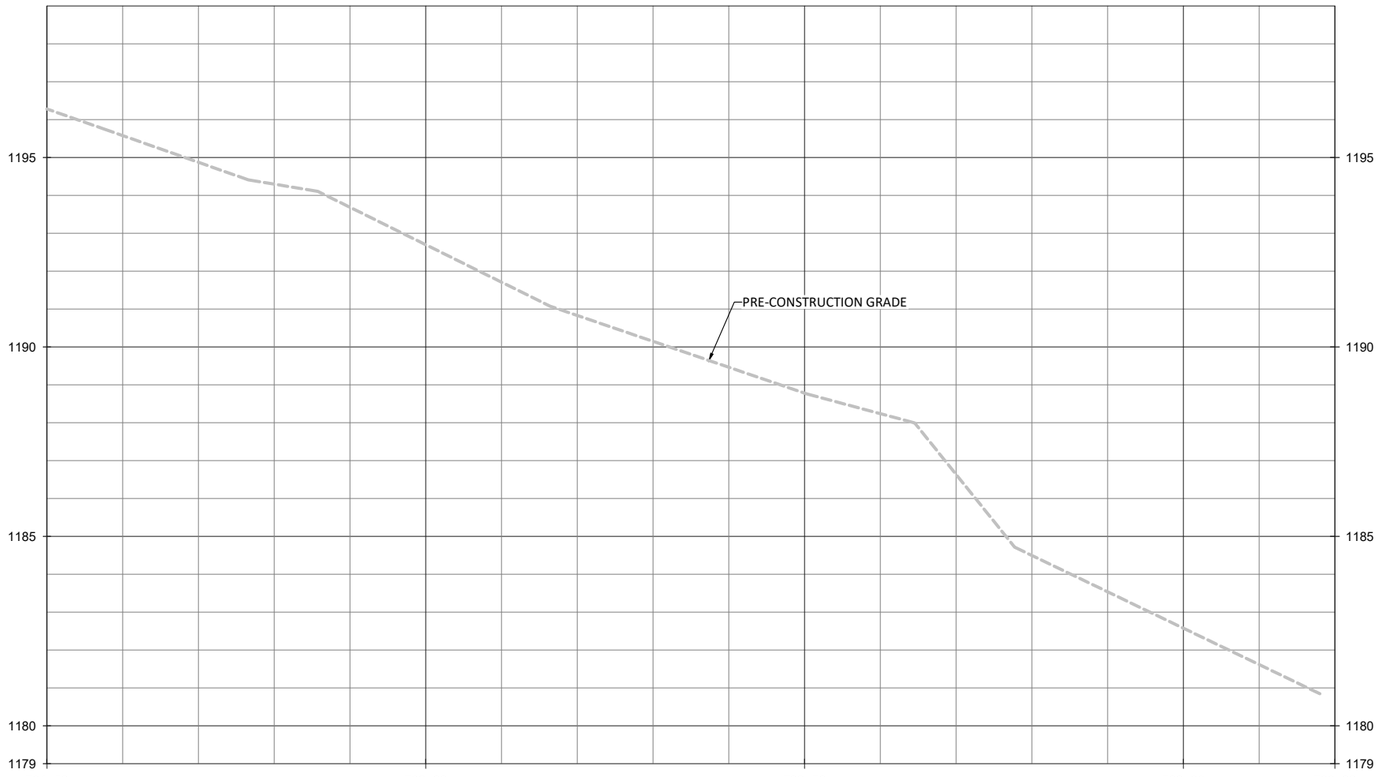
UT5A
Stream Plan and Profile

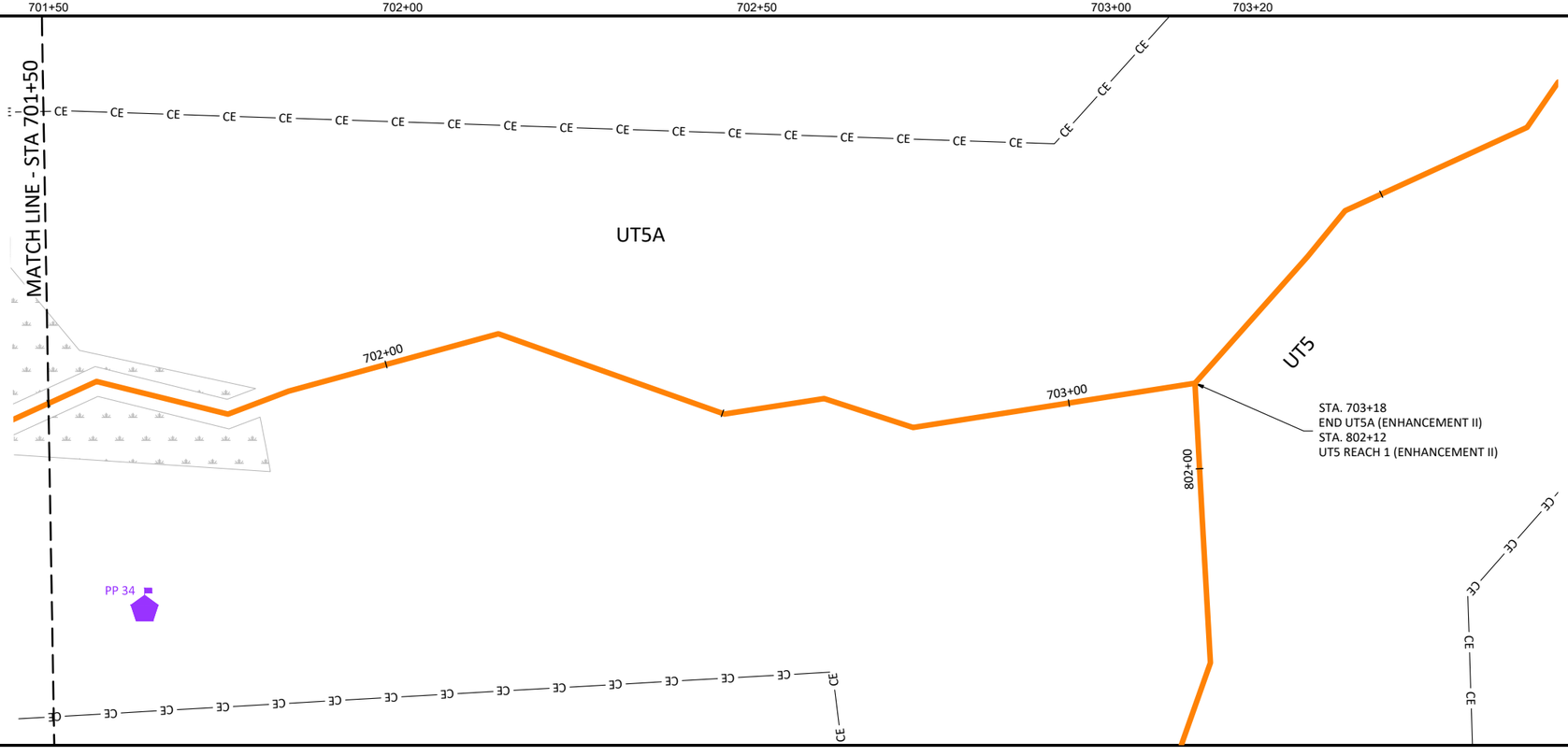
Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 1.40

June 10, 2021





NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT5 IS ADDRESSED ON SHEETS 1.35 THROUGH 1.39.

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT5A
Stream Plan and Profile

Revisions:

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 1.41

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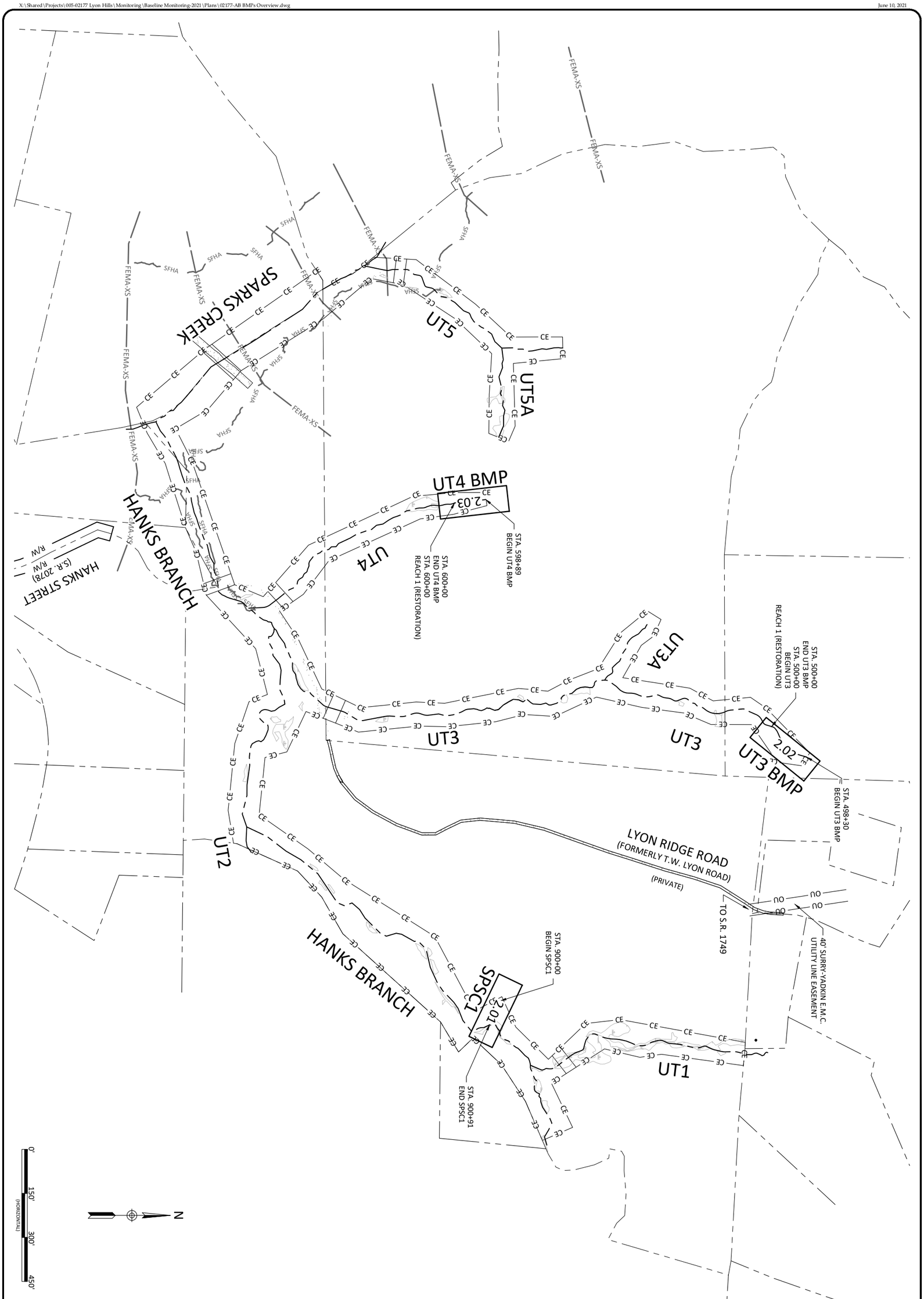

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

2.00
Sheet

Revisions:

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

BMP Overview

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE MACALUSO 6/25/21

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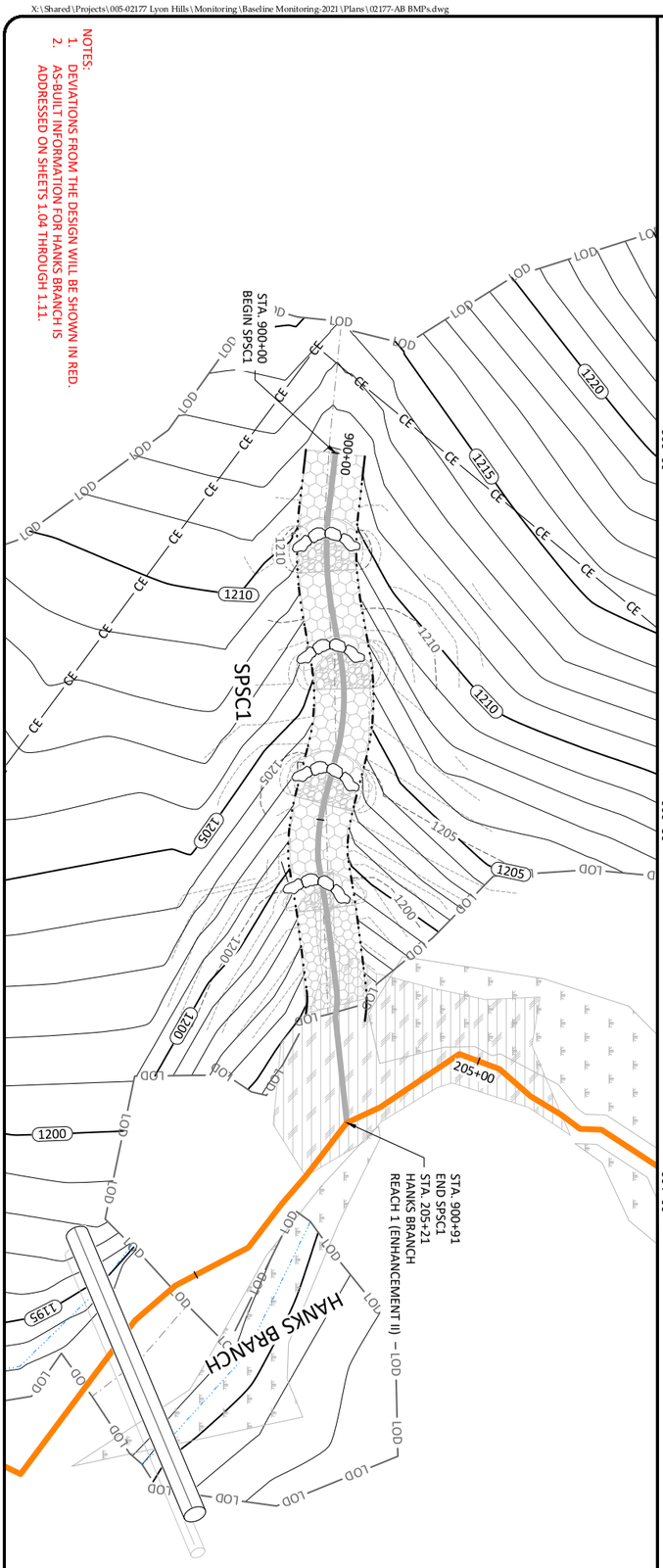
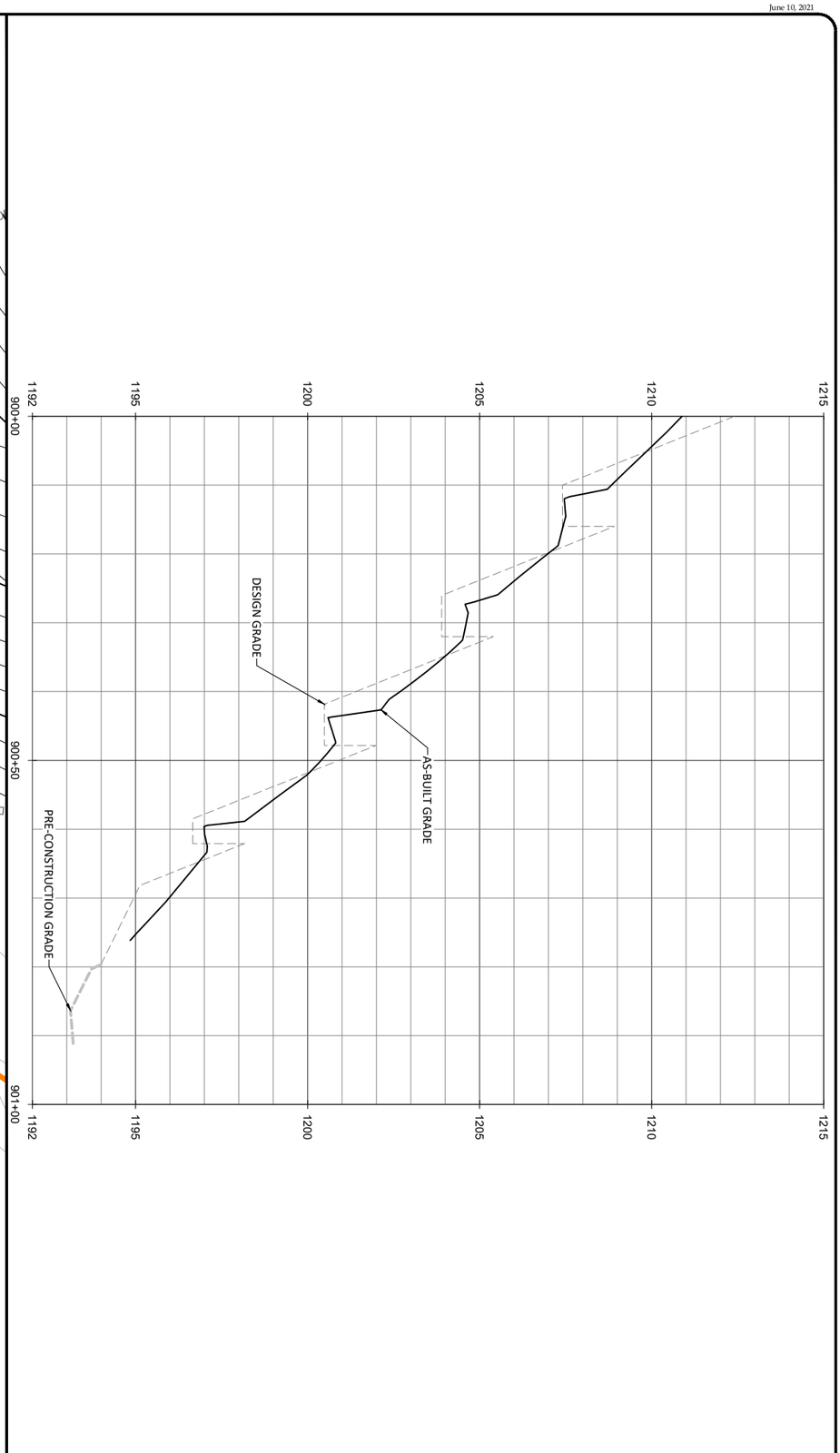
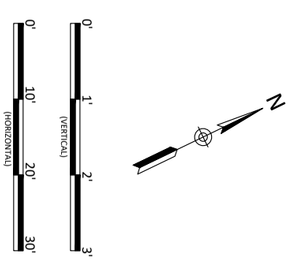
NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR HANKS BRANCH IS ADDRESSED ON SHEETS 1.04 THROUGH 1.11.







Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Revisions:

2.01
Sheet

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

SPSC1
BMP Plans

NORTH CAROLINA PROFESSIONAL SEAL 037445 ENGINEER NICOLE MACALUSO MILLER 5/25/21

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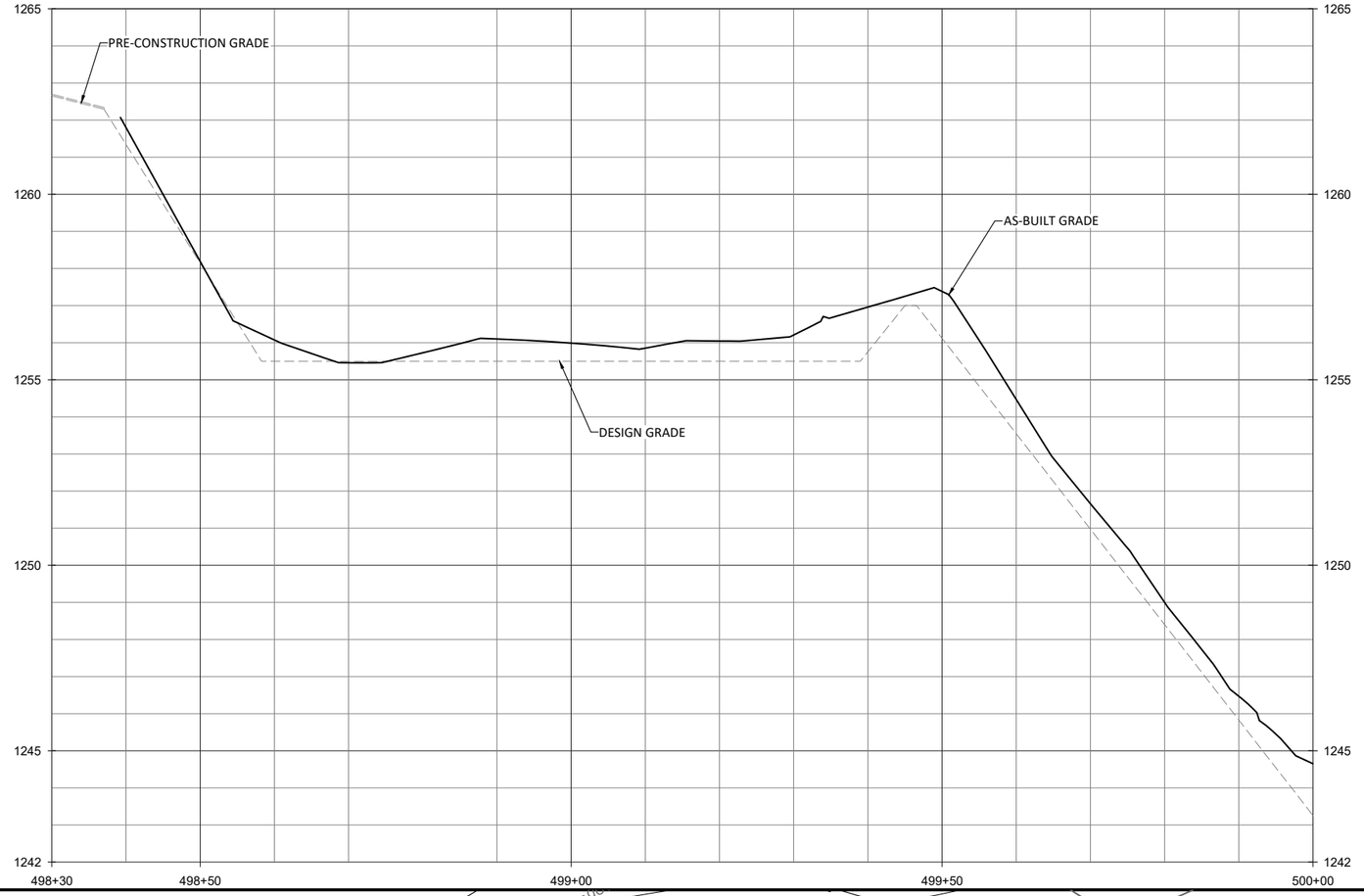

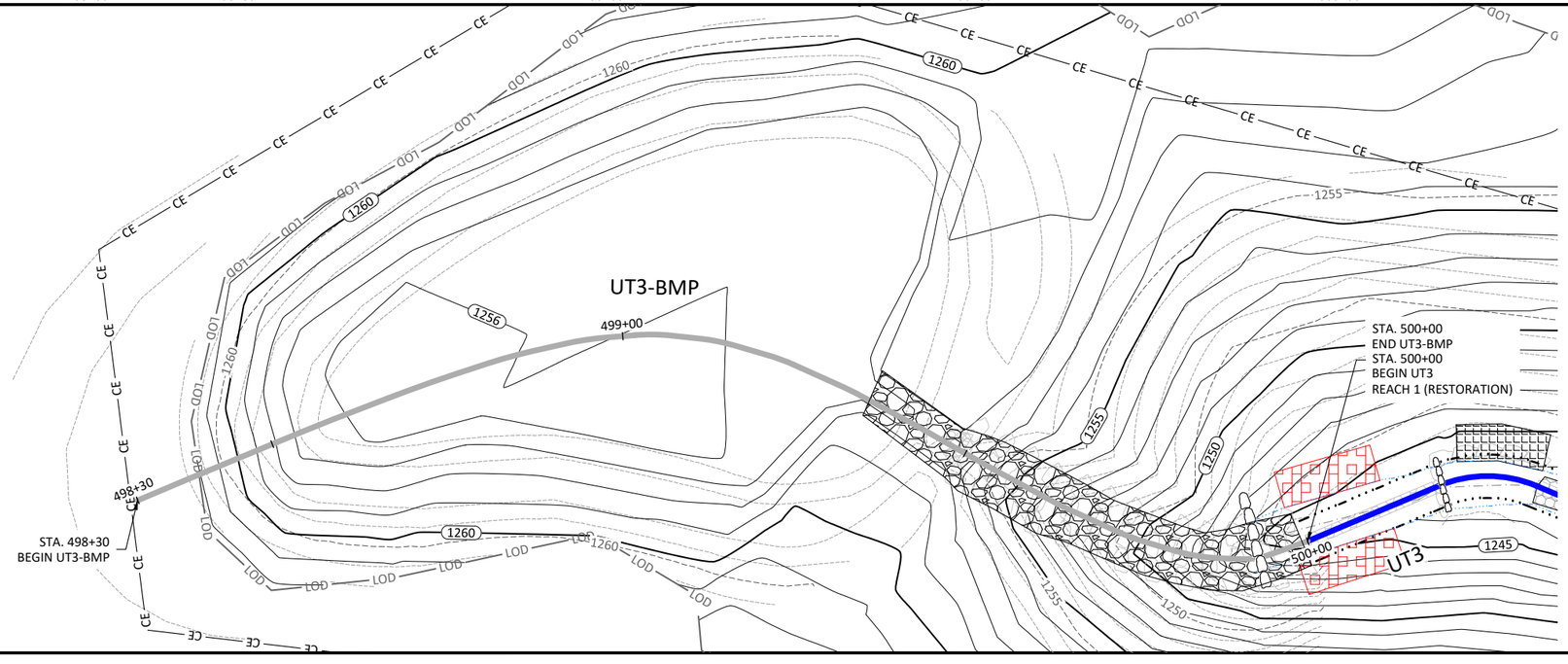

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT3 IS ADDRESSED ON SHEETS 1.18 THROUGH 1.27.

0' 1' 2' 3' (VERTICAL)

0' 10' 20' 30' (HORIZONTAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3 BMP
BMP Plans

Revisions:

Date: May 28, 2021
Job Number: 065-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 2.02

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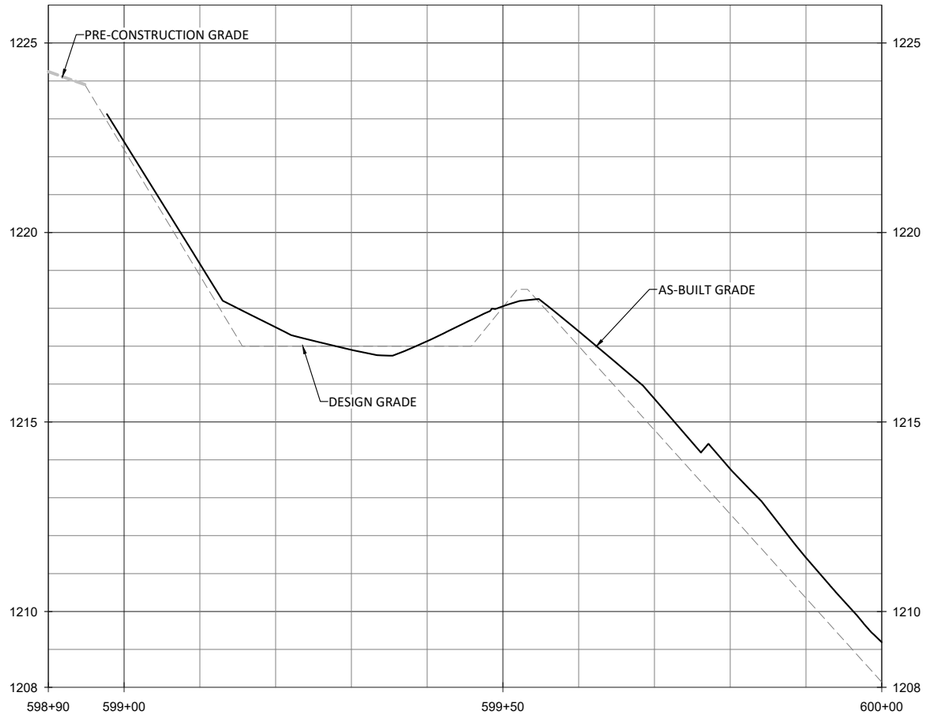

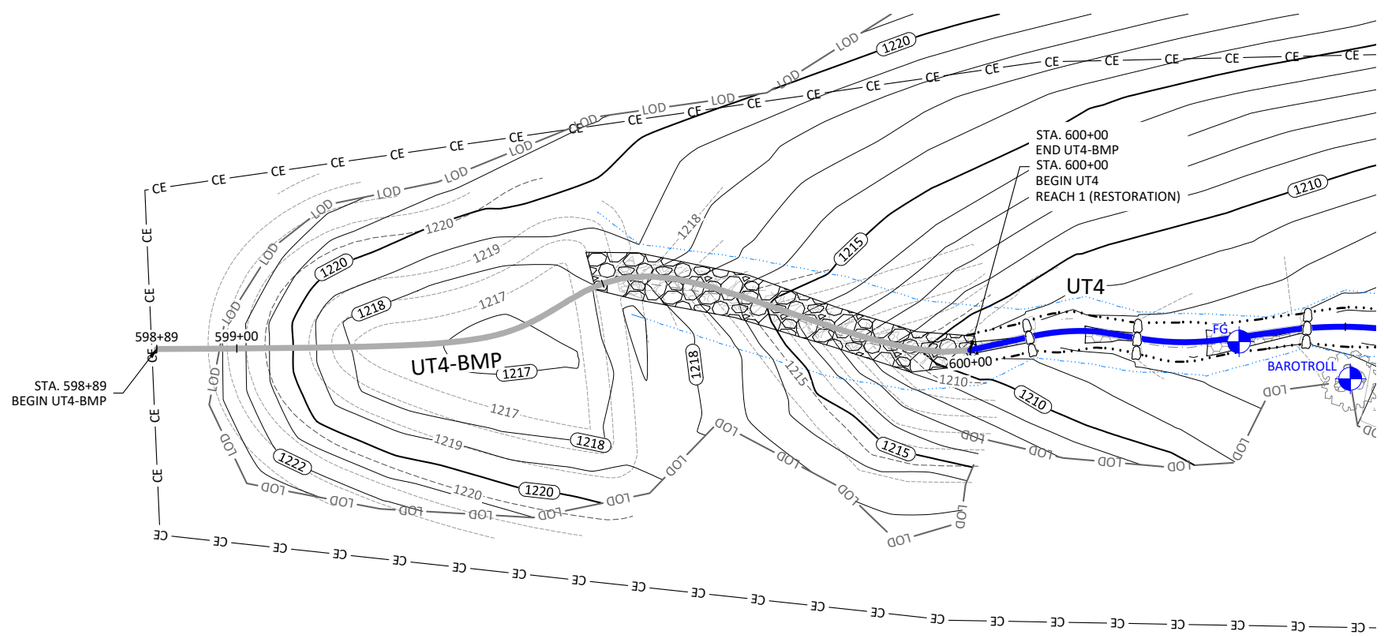

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT4 IS ADDRESSED ON SHEETS 1.30 THROUGH 1.34.

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0' 1' 2' 3' (VERTICAL)

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT4 BMP
BMP Plans

Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
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Sheet 2.03

June 10, 2021
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June 10, 2021

Streambank Planting Zone 1 - Hanks Branch (0.4 acres)

Live Stakes						
Species	**Common Name**	**Indiv. Spacing**	**Size**	**Stratum**	**Wetland Indicator Status**	**% of Stems**
Salix nigra	Black Willow	3-6 ft.	0.5"-1.5" cal.	Shrub	OBL	35%
Cornus ammomum	Silky Dogwood	3-6 ft.	0.5"-1.5" cal.	Shrub	FACW	20%
Salix sericea	Silky Willow	3-6 ft.	0.5"-1.5" cal.	Shrub	OBL	25%
Sambucus canadensis	Elderberry	3-6 ft.	0.5"-1.5" cal.	Shrub	FACW	10%
Cephalanthus occidentalis	Buttonbush	3-6 ft.	0.5"-1.5" cal.	Shrub	OBL	10%
						100%
Herbaceous Plugs						
Juncus effusus	Common Rush	4 ft.	1.0"- 2.0" plug	Herb	FACW	40%
Cyperus strigosus	False Nutsedge	4 ft.	1.0"- 2.0" plug	Herb	FACW	15%
Carex lurida	Lurid Sedge	4 ft.	1.0"- 2.0" plug	Herb	OBL	15%
Carex crinita	Fringed Sedge	4 ft.	1.0"- 2.0" plug	Herb	OBL	15%
Scirpus cyperinus	Woolgrass	4 ft.	1.0"- 2.0" plug	Herb	OBL	15%
						100%

Streambank Planting Zone 2 - UT1-UT5 (0.5 acres)

Live Stakes						
Species	**Common Name**	**Indiv. Spacing**	**Min. Size**	**Stratum**	**Wetland Indicator Status**	**% of Stems**
Cornus ammomum	Silky Dogwood	3-6 ft.	0.5"-1.5" cal.	Shrub	FACW	30%
Salix sericea	Silky Willow	3-6 ft.	0.5"-1.5" cal.	Shrub	OBL	30%
Sambucus canadensis	Elderberry	3-6 ft.	0.5"-1.5" cal.	Shrub	FACW	15%
Cephalanthus occidentalis	Buttonbush	3-6 ft.	0.5"-1.5" cal.	Shrub	OBL	15%
Physocarpus opulifloium	Ninebark	3-6 ft.	0.5"-1.5" cal.	Shrub	FACW	10%
						100%
Herbaceous Plugs						
Juncus effusus	Common Rush	4 ft.	1.0"- 2.0" plug	Herb	FACW	40%
Cyperus strigosus	False Nutsedge	4 ft.	1.0"- 2.0" plug	Herb	FACW	15%
Carex lurida	Lurid Sedge	4 ft.	1.0"- 2.0" plug	Herb	OBL	15%
Carex crinita	Fringed Sedge	4 ft.	1.0"- 2.0" plug	Herb	OBL	15%
Scirpus cyperinus	Woolgrass	4 ft.	1.0"- 2.0" plug	Herb	OBL	15%
						100%

Riparian Buffer Planting Zone 3 (10.3 acres)

Bare Root						
Species	**Common Name**	**Indiv. Spacing**	**Caliper Size**	**Stratum**	**Wetland Indicator Status**	**% of Stems**
Platanus occidentalis	Sycamore	6-12 ft.	0.25"-1.0"	Canopy	FACW	15%
Quercus rubra	Northern Red Oak	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
Betula nigra	River Birch	6-12 ft.	0.25"-1.0"	Canopy	FACW	15%
Morus rubra	Red Mullberry	6-12 ft.	0.25"-1.0"	Canopy	FACU	5%
Nyssa sylvatica	Blackgum	6-12 ft.	0.25"-1.0"	Canopy	FAC	10%
Ulmus americana	American Elm	6-12 ft.	0.25"-1.0"	Canopy	FACW	10%
Liriodendron tulipifera	Tulip Poplar	6-12 ft.	0.25"-1.0"	Canopy	FACU	3%
Quercus phellos	Willow Oak	6-12 ft.	0.25"-1.0"	Canopy	FAC	15%
Diospyros virginiana	Common Persimmon	6-12 ft.	0.25"-1.0"	Canopy	FAC	7%
Acer negundo	Boxelder	6-12 ft.	0.25"-1.0"	Canopy	FAC	5%
Prunus serotina	Black Cherry	6-12 ft.	0.25"-1.0"	Canopy	FACU	5%
						100%

BMP Obligate Species Planting Zone (0.01 acres)

Herbaceous Plugs						
Species	**Common Name**	**Indiv. Spacing**	**Size**	**Stratum**	**Wetland Indicator Status**	**% of Stems**
Juncus effusus	Common Rush	4 ft.	1.0"- 2.0" plug	Herb	FACW	30%
Sparganium americanum	Eastern Bur Reed	4 ft.	1.0"- 2.0" plug	Herb	OBL	10%
Sagittaria latifolia	Duck Potato	4 ft.	1.0"- 2.0" plug	Herb	OBL	30%
Scirpus cyperinus	Woolgrass	4 ft.	1.0"- 2.0" plug	Herb	OBL	10%
Carex lurida	Lurid Sedge	4 ft.	1.0"- 2.0" plug	Herb	OBL	20%
						100%

Wetland Planting Zone 4 (0.5 acres)

Bare Root						
Species	**Common Name**	**Indiv. Spacing**	**Caliper Size**	**Stratum**	**Wetland Indicator Status**	**% of Stems**
Platanus occidentalis	Sycamore	6-12 ft.	0.25"-1.0"	Canopy	FACW	18%
Ulmus americana	American Elm	6-12 ft.	0.25"-1.0"	Canopy	FACW	10%
Betula nigra	River Birch	6-12 ft.	0.25"-1.0"	Canopy	FACW	18%
Acer negundo	Boxelder	6-12 ft.	0.25"-1.0"	Canopy	FAC	15%
Ulmus rubra	Slippery Elm	6-12 ft.	0.25"-1.0"	Canopy	FAC	6%
Alnus serrulata	Tag Alder	6-12 ft.	0.25"-1.0"	Shrub	OBL	3%
Nyssa sylvatica	Black gum	6-12 ft.	0.25"-1.0"	Canopy	FAC	15%
Quercus phellos	Willow Oak	6-12 ft.	0.25"-1.0"	Canopy	FAC	15%
						100%

Note: Wetland zone species to be planted on 6' spacing in rows spaced 12' apart.

Temporary Seeding (12.3 acres)

Pure Live Seed				
Approved Dates	**Species Name**	**Common Name**	**Stratum**	**Density (lbs/acre)**
Aug 15 - May 1	*Secale cereale*	Rye Grain	Herb	80
May 1 - Aug 15	*Setaria italica*	German Millet	Herb	50

Planting Notes:
1. Non-hatched areas within easement are currently vegetated and will be planted as needed to achieve target density. Buffer planting will occur within the Limits of Disturbance.
2. Buffer zone species to be planted on 6' spacing in rows spaced 12' apart.
3. Wetland Indicator Status data sourced from USDA Plant Database.
4. Permanent riparian seed to be used for seeding Zone 3.
5. Permanent wetland seeding to be used for Zone 4 and UT3 and UT4 BMPs.
6. BMP obligate species herbaceous plugs were installed around perimeter of UT3 and UT4 BMPs at elevations specified on Sheets 3.07 and 3.09.
7. No substitutions or changes were made to the planting plan.

Zone 1 - Streambank Planting - Hanks Branch

Zone 2 - Streambank Planting - UT1-UT5

Zone 3 - Buffer Planting Zone

Zone 4 - Wetland Planting Zone

Zone 5 - Permanent Seeding Outside Easement

Note: Non-hatched areas within easement are currently vegetated and will be planted as needed to achieve target density. Buffer planting will occur within the Limits of Disturbance.

Permanent Seeding Outside Easement Zone 5 (1.5 acres)

Approved Dates					
All Year	*Festuca arundinacea*	Tall Fescue	Herb	40	70%
All Year	*Festuca rubra*	Creeping Red Fescue	Herb	40	10%
All Year	*Dactylis glomerata*	Orchardgrass	Herb	40	20%
					100%

Permanent Wetland Seeding Zone 4 (0.5 acres)

Pure Live Seed (20 lbs/acre)					
Approved Dates	**Species Name**	**Common Name**	**Stratum**	**Wetland Indicator Status**	**Density (lbs/acre)**
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	FACW	1.2
All Year	*Agrostis hyemalis*	Winter Bentgrass	Herb	FAC	1.0
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	FACW	2.0
All Year	*Sparganium americanum*	Eastern Bur Reed	Herb	OBL	0.1
All Year	*Panicum virgatum*	Switchgrass	Herb	FAC	2.0
All Year	*Tripsacum dactyloides*	Eastern Gamagrass	Herb	FACW	2.5
All Year	*Panicum clandestinum*	Deertongue	Herb	FAC	3.0
All Year	*Caex lurida*	Lurid Sedge	Herb	OBL	0.5
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	OBL	2.0
All Year	*Carex lupulina*	Hop Sedge	Herb	OBL	0.5
All Year	*Juncus effusus*	Common Rush	Herb	FACW	2.0
All Year	*Carex frankii*	Frank's Sedge	Herb	OBL	1.0
All Year	*Scirpus cyperinus*	Woolgrass	Herb	OBL	0.2
All Year	*Peltandra virginica*	Arrow Arum	Herb	OBL	0.4
All Year	*Bidens aristosa*	Bur-Marigold	Herb	FACW	1.6
					20.0

Permanent Riparian Seeding Zone 3 (10.3 acres)

Pure Live Seed (20 lbs/acre)					
Approved Dates	**Species Name**	**Common Name**	**Stratum**	**Wetland Indicator Status**	**lbs/acre**
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	FACW	2.0
All Year	*Schizachyrium scoparium*	Little Bluestem	Herb	FACU	1.8
All Year	*Sorghastrum nutans*	Indian Grass	Herb	FACU	2.0
All Year	*Chasmanthium latifolium*	River Oats	Herb	FACU	1.0
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	FACW	3.0
All Year	*Panicum clandestinum*	Deertongue	Herb	FAC	2.5
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	OBL	2.0
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	FACU	1.0
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	FACU	1.0
All Year	*Bidens aristosa*	Bur-marigold	Herb	FACW	1.0
All Year	*Chamaecrista fasciculata var. fasciculata*	Partridge Pea	Herb	FACU	1.0
All Year	*Achillea millefolium*	Yarrow	Herb	FACU	0.5
All Year	*Juncus coriaceous*	Leathery Rush	Herb	FACW	0.5
All Year	*Juncus tenuis*	Path Rush	Herb	FAC	0.5
All Year	*Pycnanthemum tenuifolium*	Slender Mountain Mint	Herb	FACW	0.2
					20.0

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Planting Tables

Revisions:
9-21-2020 Construction
Entrance Location Change

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 3.00

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June 10, 2021

Zone 1 - Streambank Planting - Hanks Branch

Zone 2 - Streambank Planting - UT1-UT5

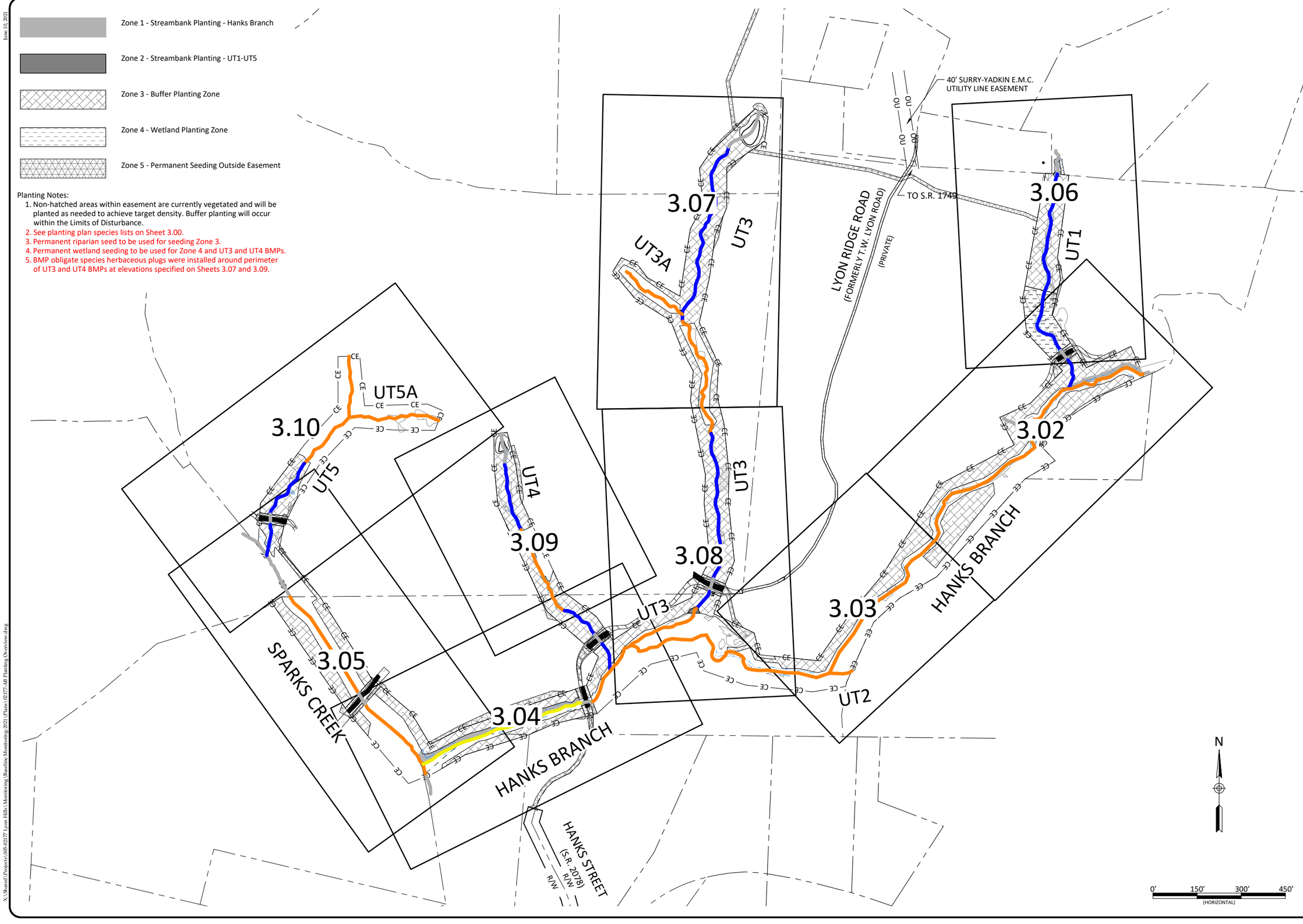
Zone 3 - Buffer Planting Zone

Zone 4 - Wetland Planting Zone

Zone 5 - Permanent Seeding Outside Easement

Planting Notes:

1. Non-hatched areas within easement are currently vegetated and will be planted as needed to achieve target density. Buffer planting will occur within the Limits of Disturbance.
2. See planting plan species lists on Sheet 3.00.
3. Permanent riparian seed to be used for seeding Zone 3.
4. Permanent wetland seeding to be used for Zone 4 and UT3 and UT4 BMPs.
5. BMP obligate species herbaceous plugs were installed around perimeter of UT3 and UT4 BMPs at elevations specified on Sheets 3.07 and 3.09.



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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

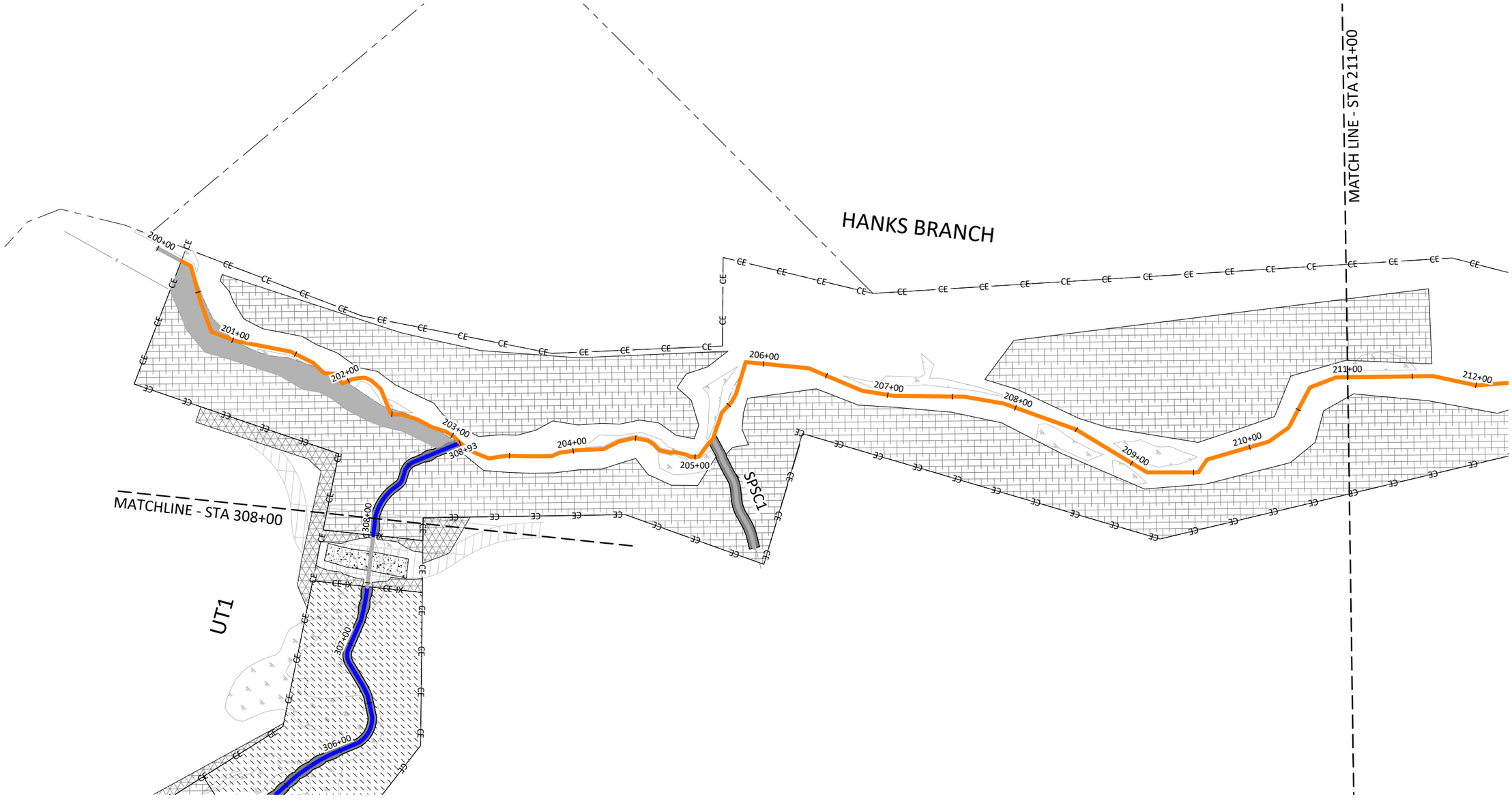
Planting Overview

Revisions:
9-21-2021 Construction
Entrance Location Change

Date:	May 26, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

Sheet 3.01

June 10, 2021



Zone 1 - Streambank Planting - Hanks Branch

Zone 2 - Streambank Planting - UT1-UT5

Zone 3 - Buffer Planting Zone

Zone 4 - Wetland Planting Zone

Zone 5 - Permanent Seeding Outside Easement

Note: Non-hatched areas within easement are currently vegetated and will be planted as needed to achieve target density. Buffer planting occurred within the Limits of Disturbance.

N

0' 40' 80' 120'
(HORIZONTAL)

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Wilkes County, North Carolina

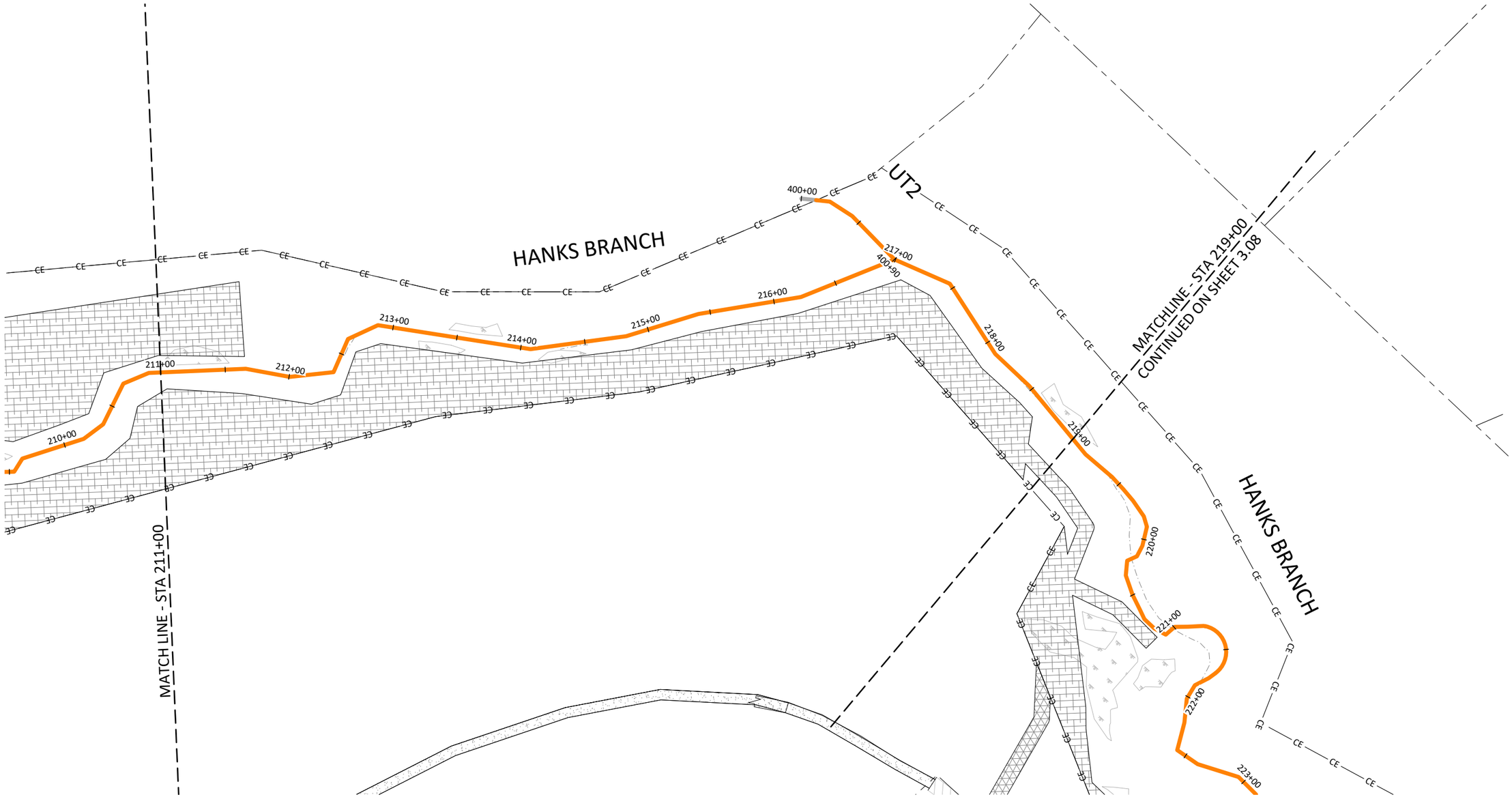
Hanks Branch
Planting Plans

Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 3.02

June 10, 2021



Zone 1 - Streambank Planting - Hanks Branch

Zone 2 - Streambank Planting - UT1-UT5

Zone 3 - Buffer Planting Zone

Zone 4 - Wetland Planting Zone

Zone 5 - Permanent Seeding Outside Easement

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N

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(HORIZONTAL)

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Wilkes County, North Carolina

Hanks Branch
Planting Plans

Revisions:

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
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Sheet 3.03

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June 10, 2021

MATCHLINE - STA 224+00
CONTINUED ON SHEET 3.08

HANKS BRANCH

SPARKS CREEK

UT3

UT4

MATCHLINE - STA 606+00
CONTINUED ON SHEET 3.09

Zone 1 - Streambank Planting - Hanks Branch

Zone 2 - Streambank Planting - UT1-UT5

Zone 3 - Buffer Planting Zone

Zone 4 - Wetland Planting Zone

Zone 5 - Permanent Seeding Outside Easement

Note: Non-hatched areas within easement are currently vegetated and will be planted as needed to achieve target density. Buffer planting occurred within the Limits of Disturbance.

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(HORIZONTAL)

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SEAL 037445
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NORTH CAROLINA

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch
Planting Plans

Revisions:

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 3.04

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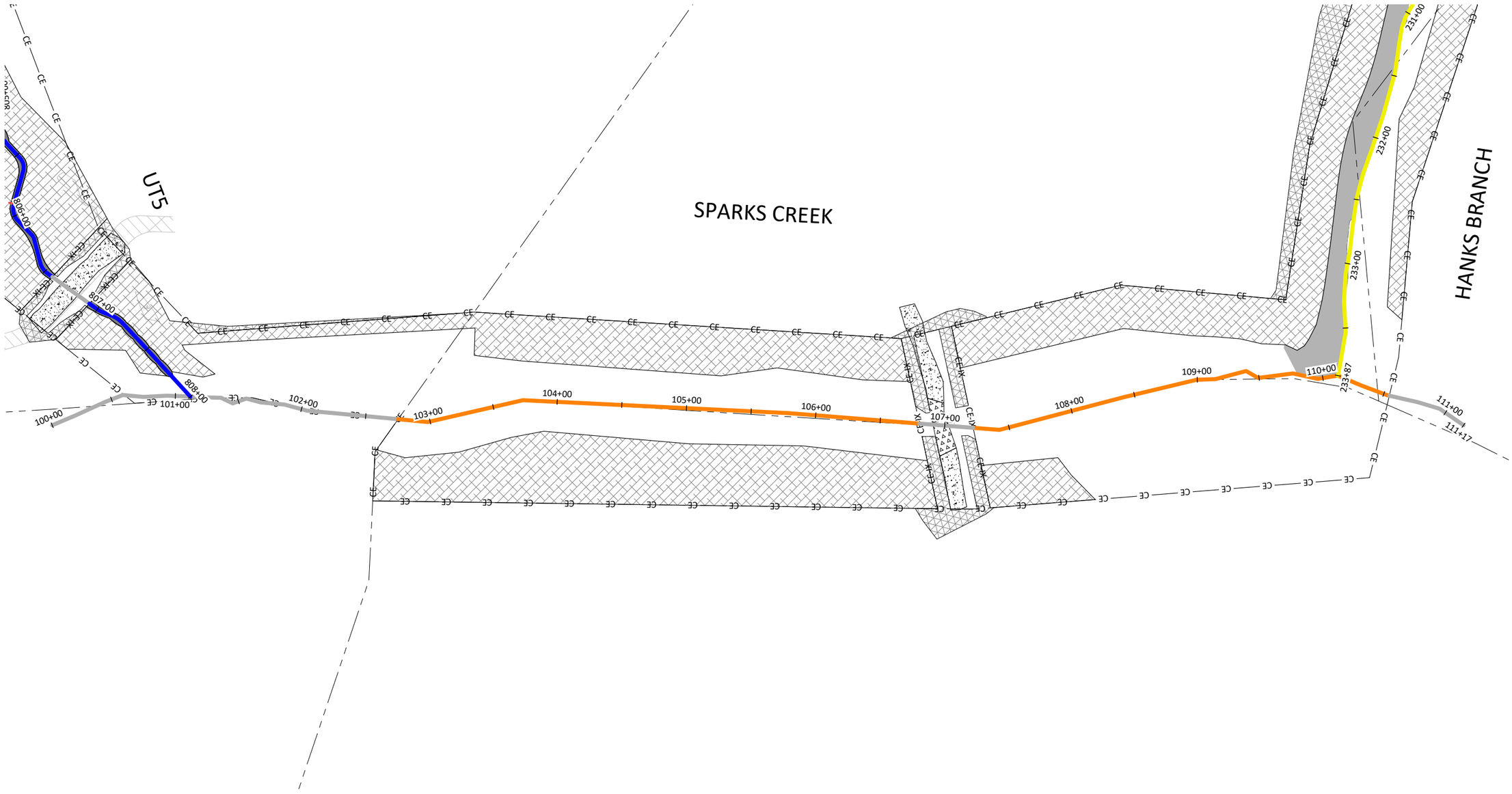

Zone 1 - Streambank Planting - Hanks Branch

Zone 2 - Streambank Planting - UT1-UT5

Zone 3 - Buffer Planting Zone

Zone 4 - Wetland Planting Zone

Zone 5 - Permanent Seeding Outside Easement

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N

0' 40' 80' 120'
(HORIZONTAL)

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Wilkes County, North Carolina

Sparks Creek
Planting Plans

Revisions:

Date: May 28, 2021
Job Number: 05-02177
Project Engineer: NMM
Drawn By: ABP
Checked By: JNK

Sheet 3.05

June 10, 2021

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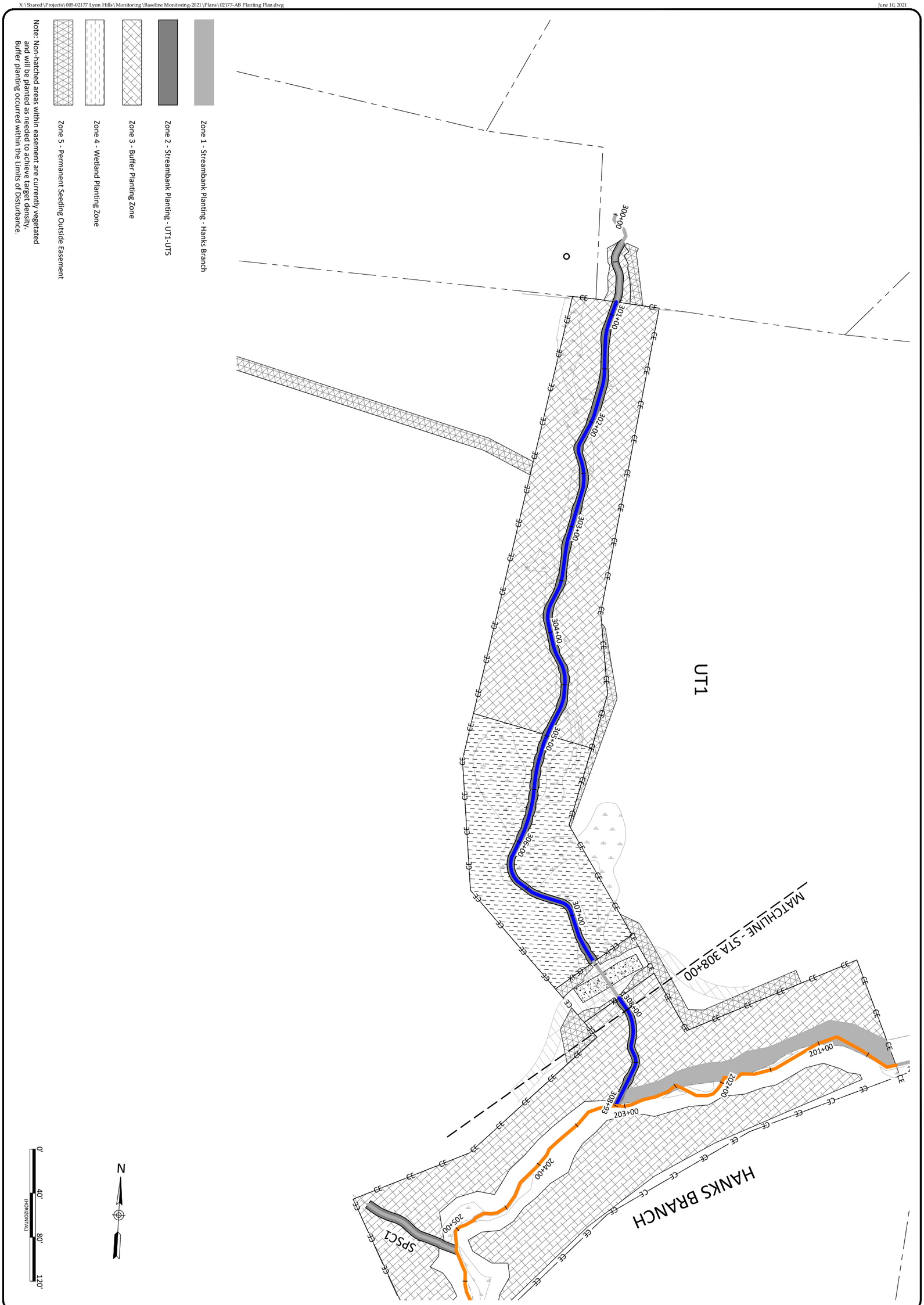

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
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3.06
Sheet

Revisions:

Lyon Hills Mitigation Site As-Built
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UT1
Planting Plans

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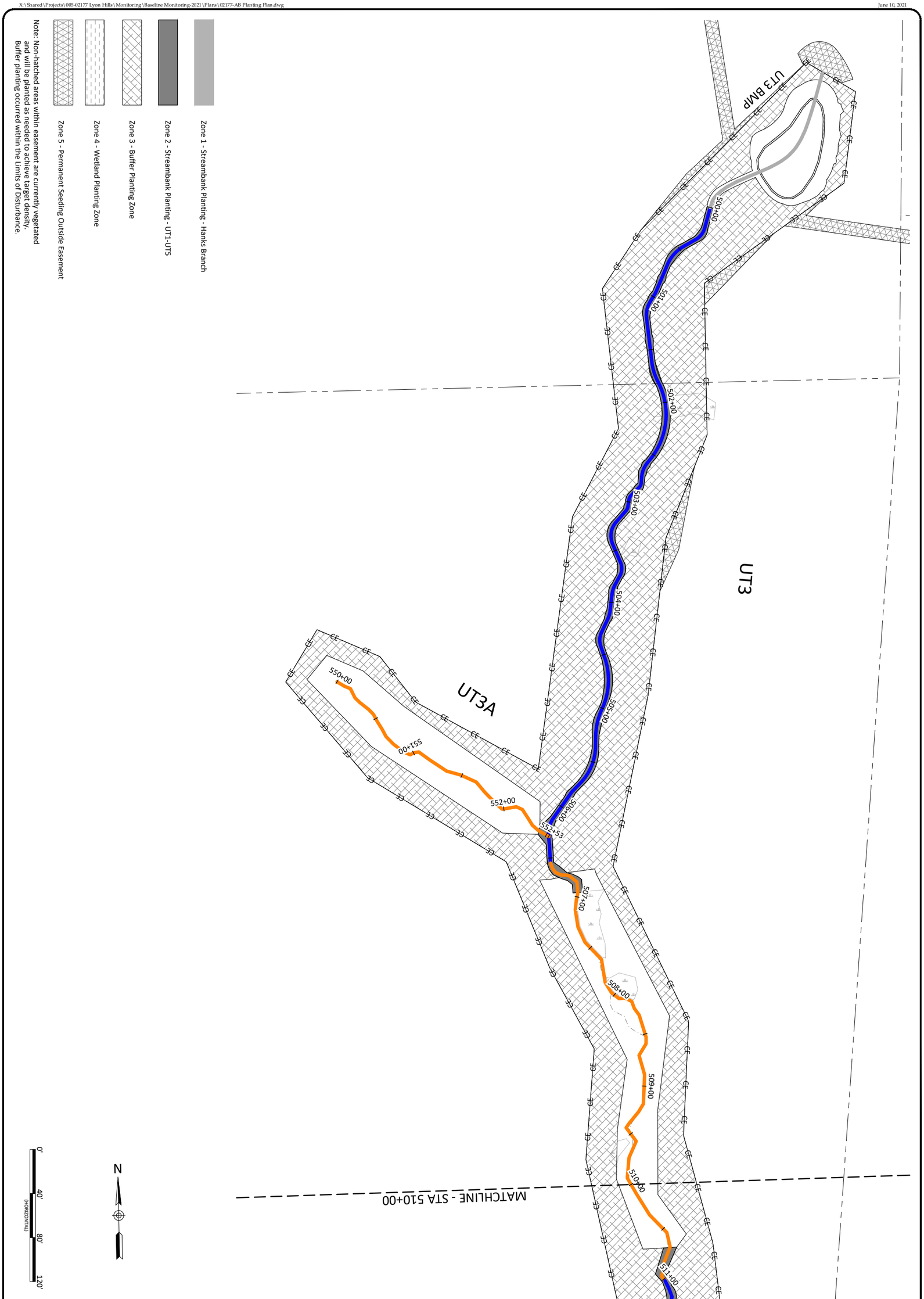

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
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3.07
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Revisions:

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3 & UT3A
Planting Plans

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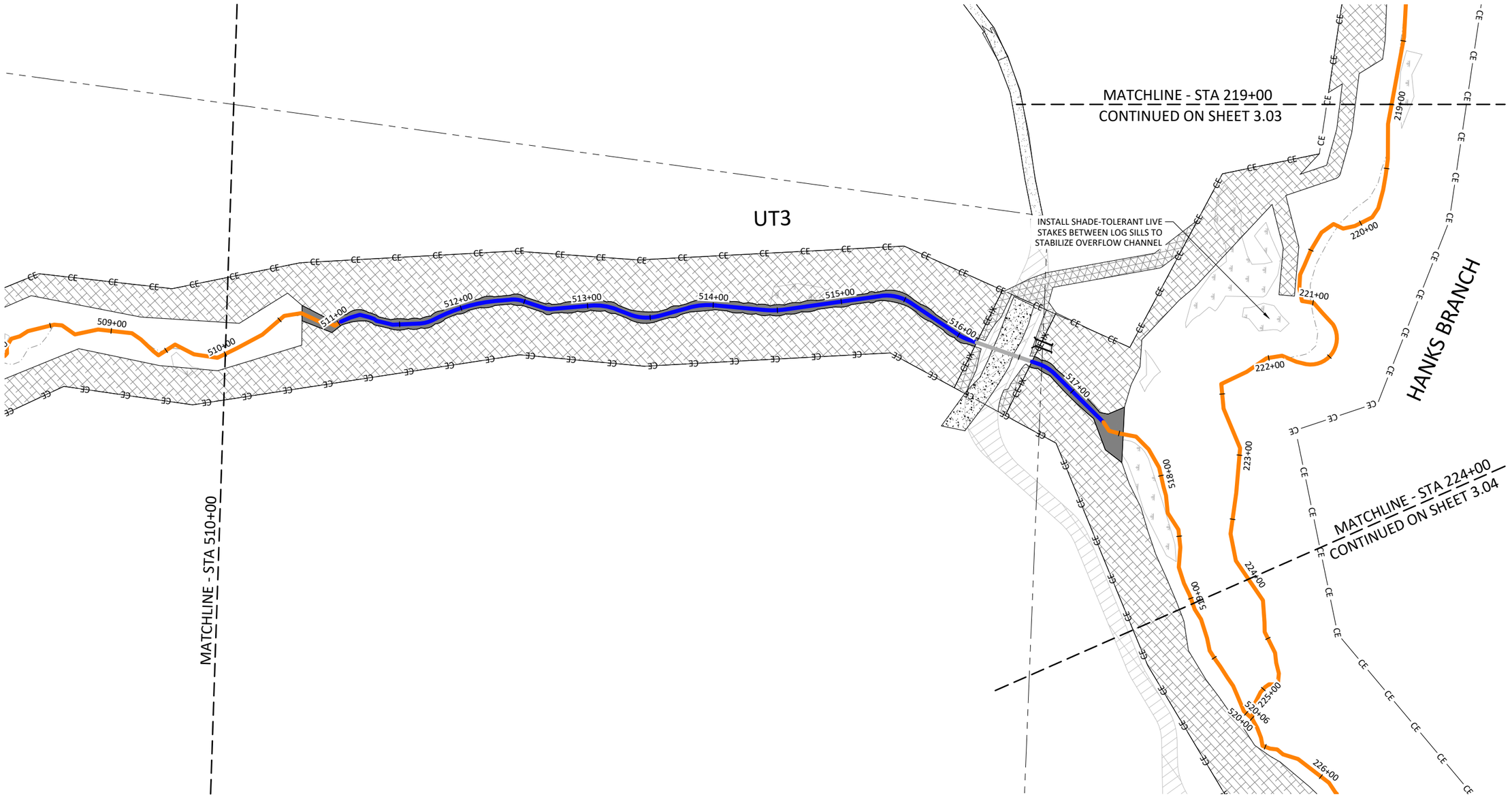
June 10, 2021



Zone 1 - Streambank Planting - Hanks Branch

Zone 2 - Streambank Planting - UT1-UT5

Zone 3 - Buffer Planting Zone

Zone 4 - Wetland Planting Zone

Zone 5 - Permanent Seeding Outside Easement

Note: Non-hatched areas within easement are currently vegetated and will be planted as needed to achieve target density. Buffer planting occurred within the Limits of Disturbance.

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Planting Plans

Revisions:

Date:	May 26, 2021
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Project Engineer:	NMM
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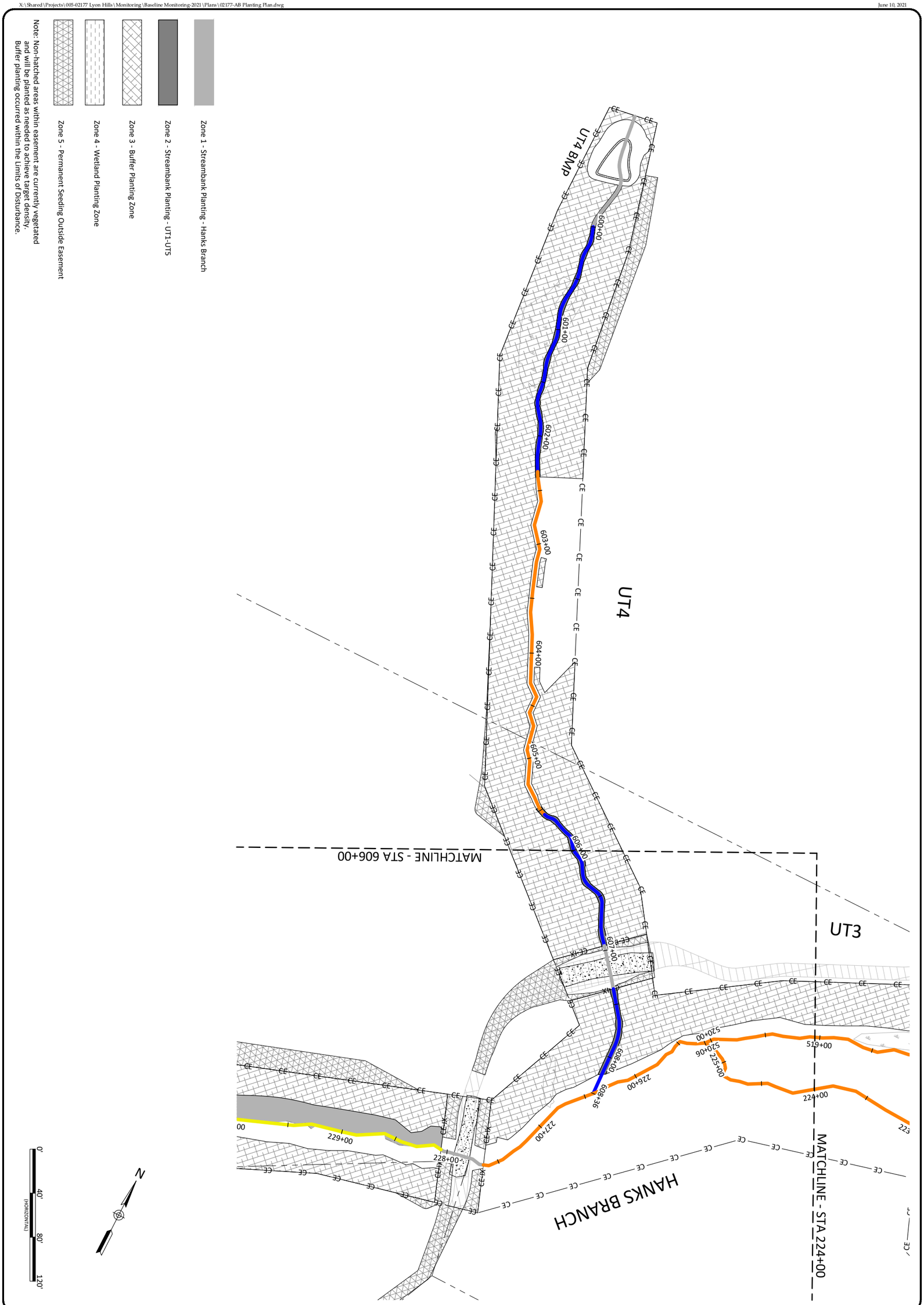
Sheet 3.08



Date:	May 28, 2021
Job Number:	005-02177
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3.09
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Revisions:

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT4
Planting Plans

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Note: Non-hatched areas within easement are currently vegetated and will be planted as needed to achieve target density. Buffer planting occurred within the Limits of Disturbance.

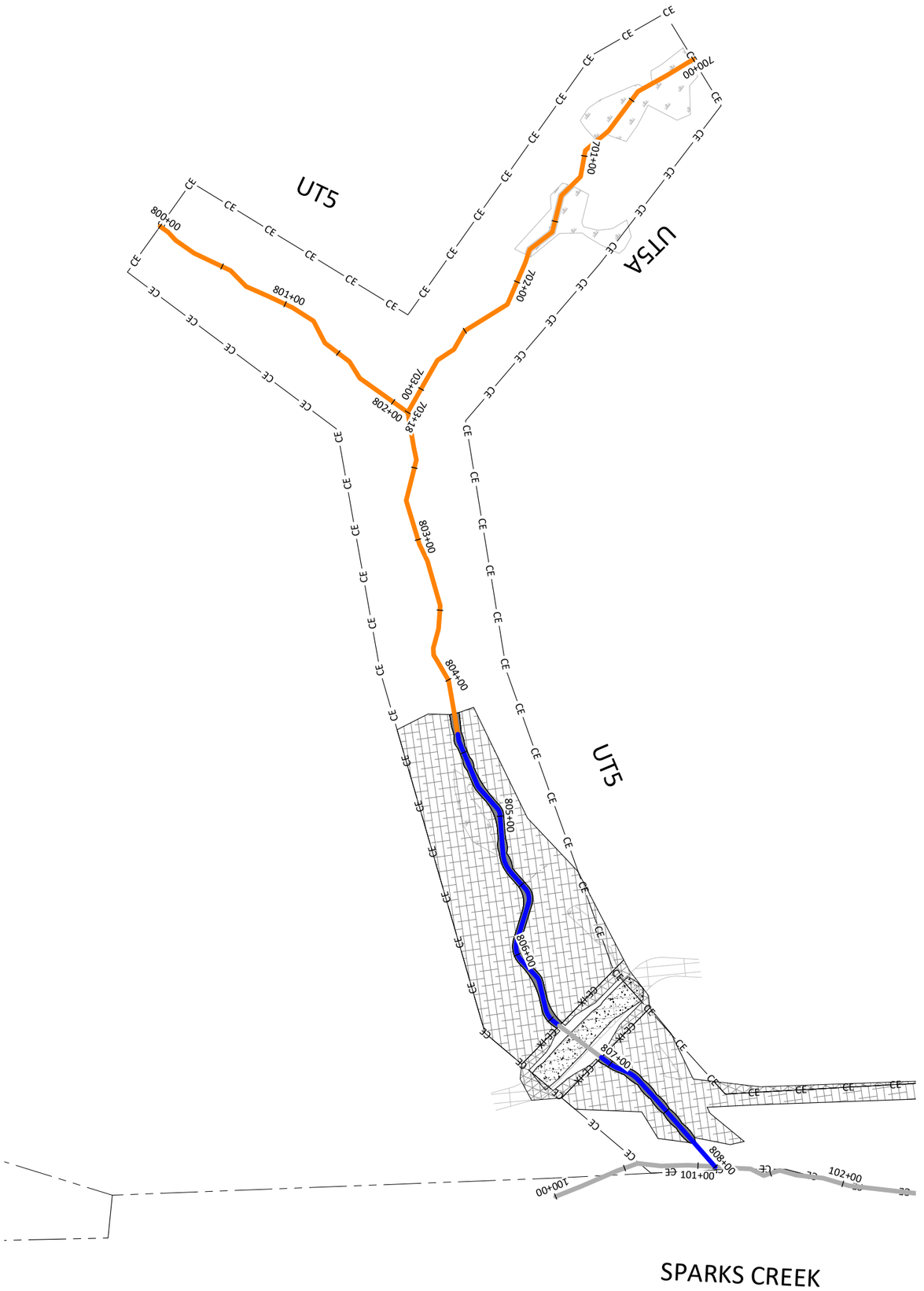
Zone 5 - Permanent Seeding Outside Easement

Zone 4 - Wetland Planting Zone

Zone 3 - Buffer Planting Zone

Zone 2 - Streambank Planting - UT1-UT5

Zone 1 - Streambank Planting - Hanks Branch



0' 40' 80' 120' (HORIZONTAL)

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Date:	May 28, 2021
Job Number:	005-02177
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3.10
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT5 & UT5A
Planting Plans

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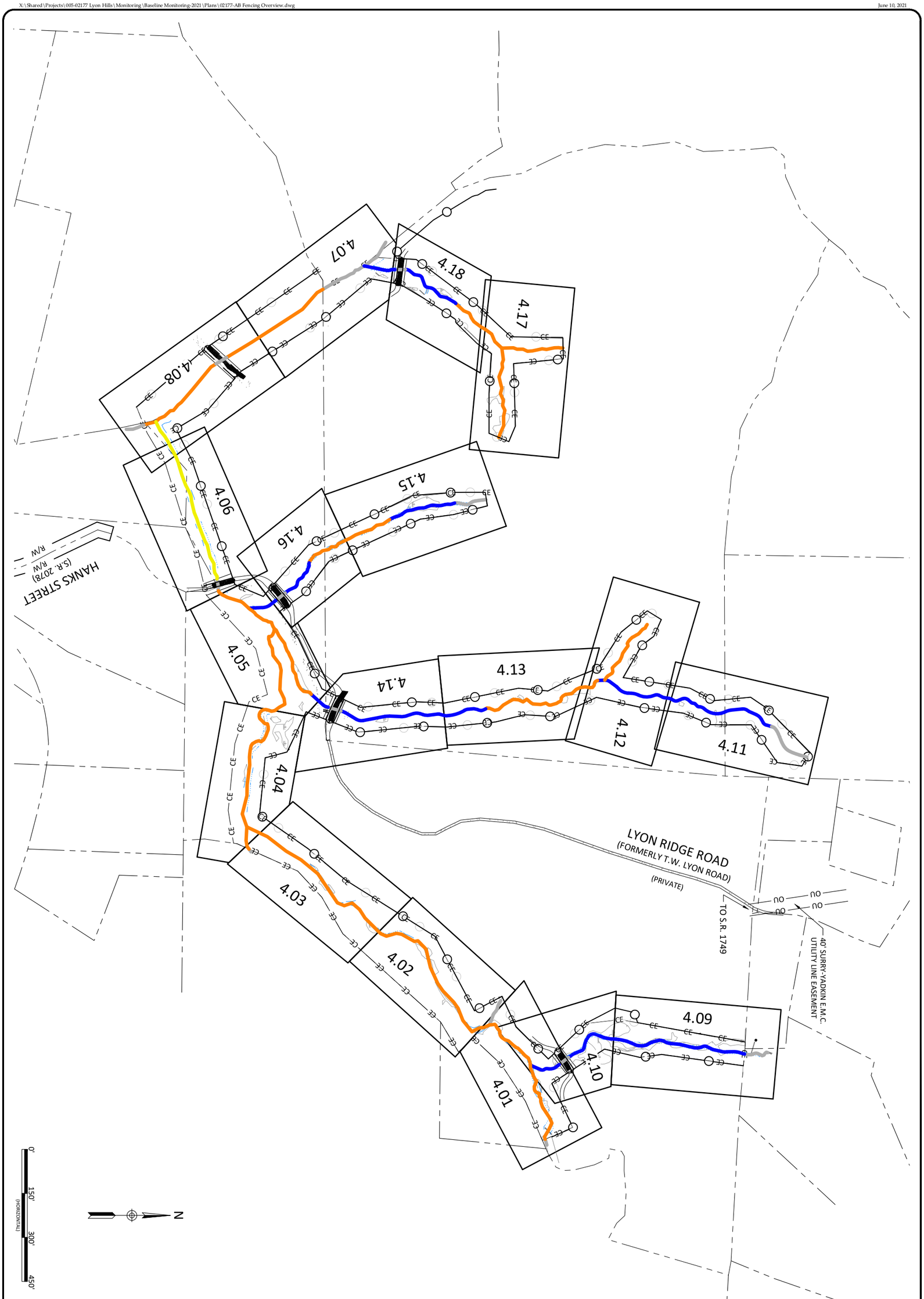

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Drawn By:	ABP
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Revisions:

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Fencing Overview

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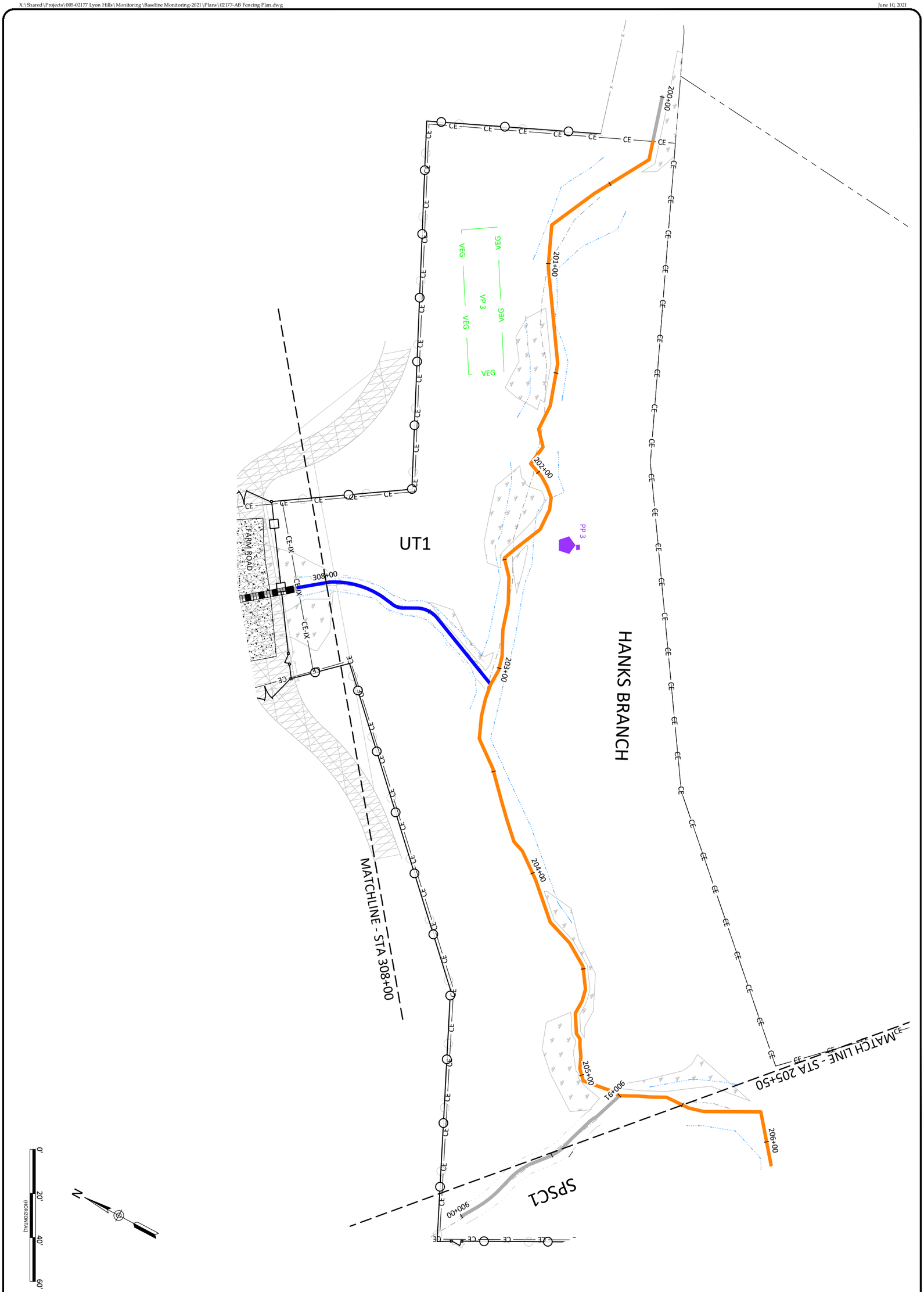

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4.01
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch
Fencing Plan

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037445 8/25/21 NICOLE MACALUSO MILLS

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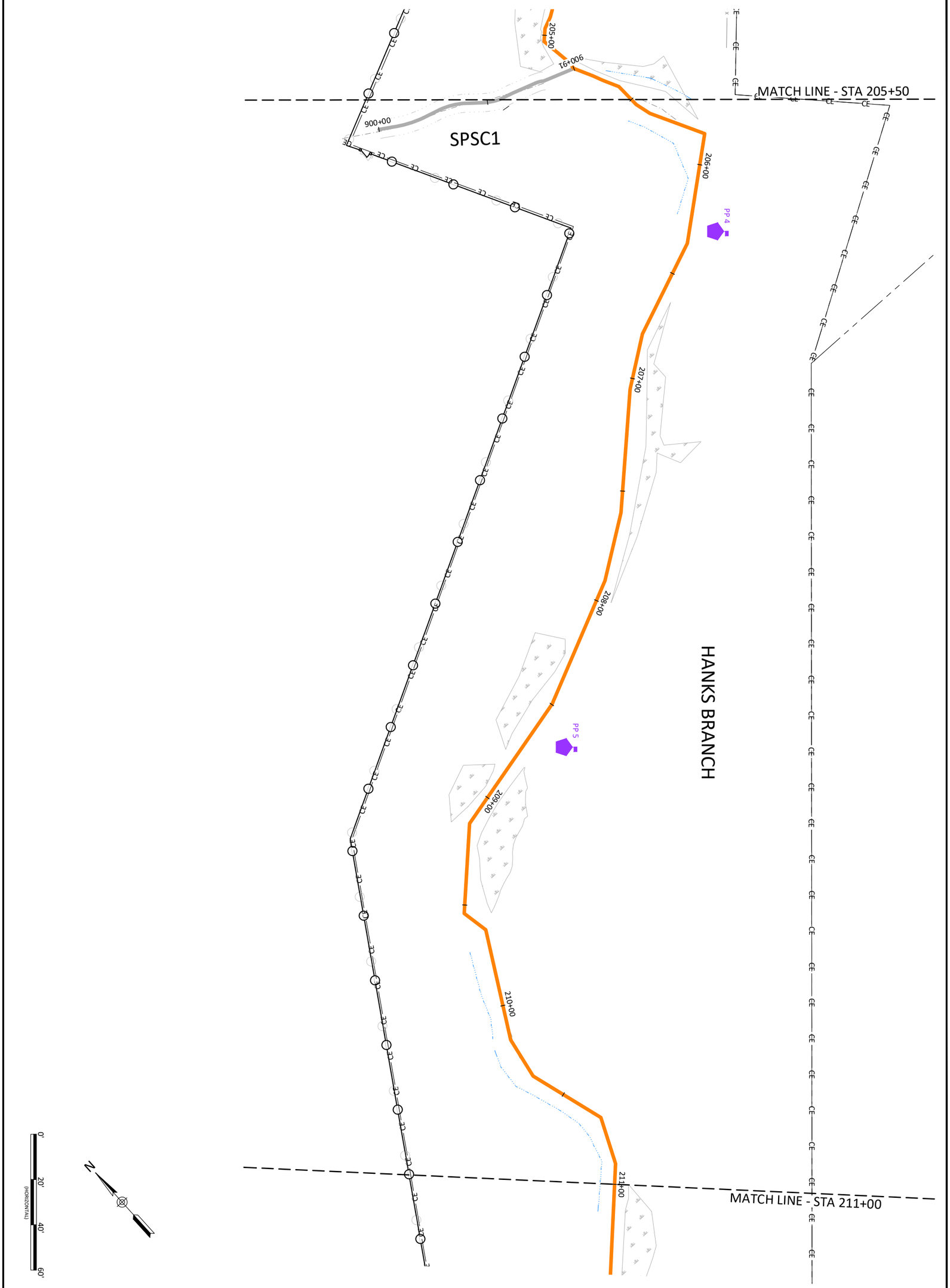

Date:	May 28, 2021
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Wilkes County, North Carolina

Hanks Branch
Fencing Plan

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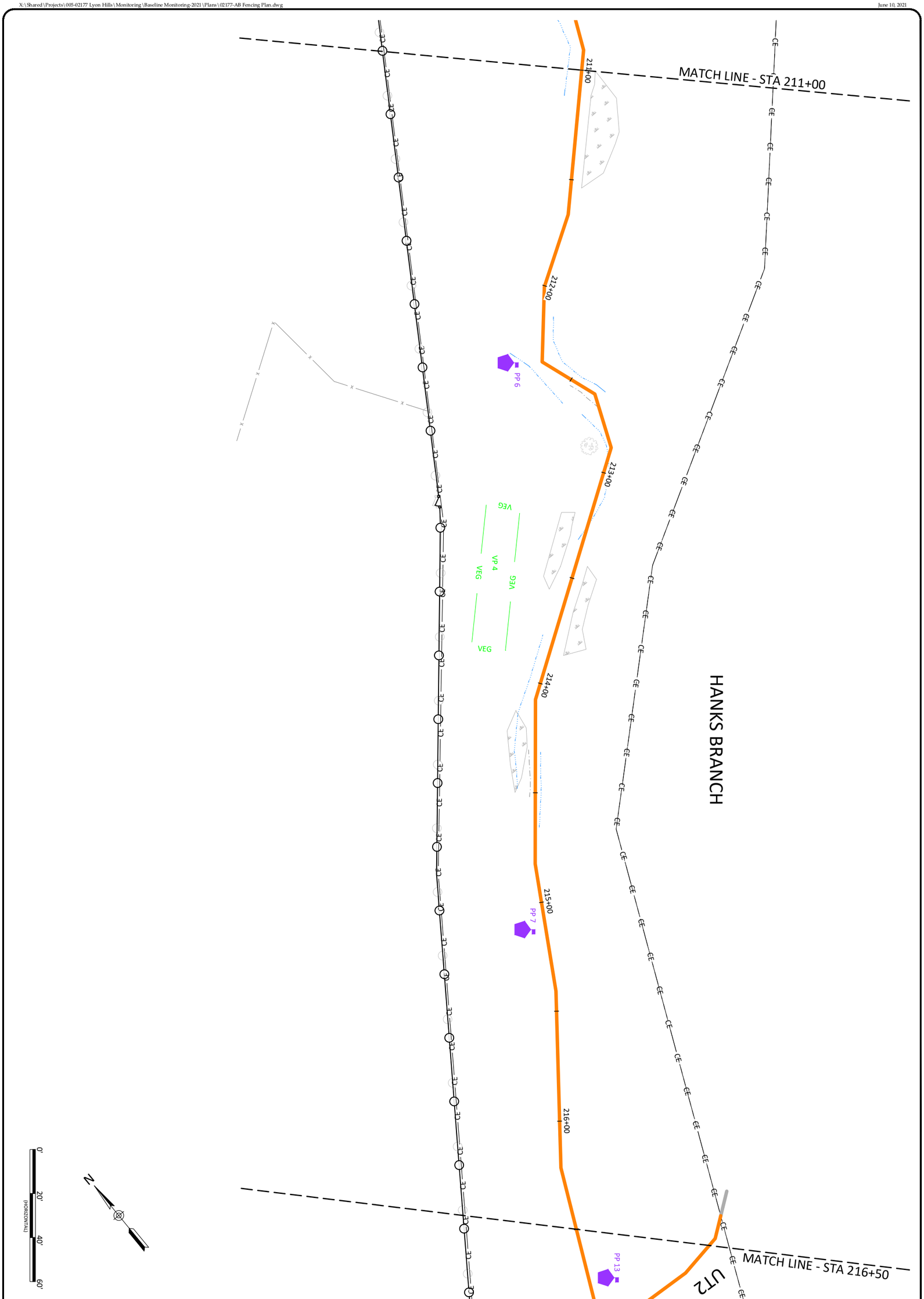

Date:	May 28, 2021
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4.03
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Revisions:

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Hanks Branch
Fencing Plan

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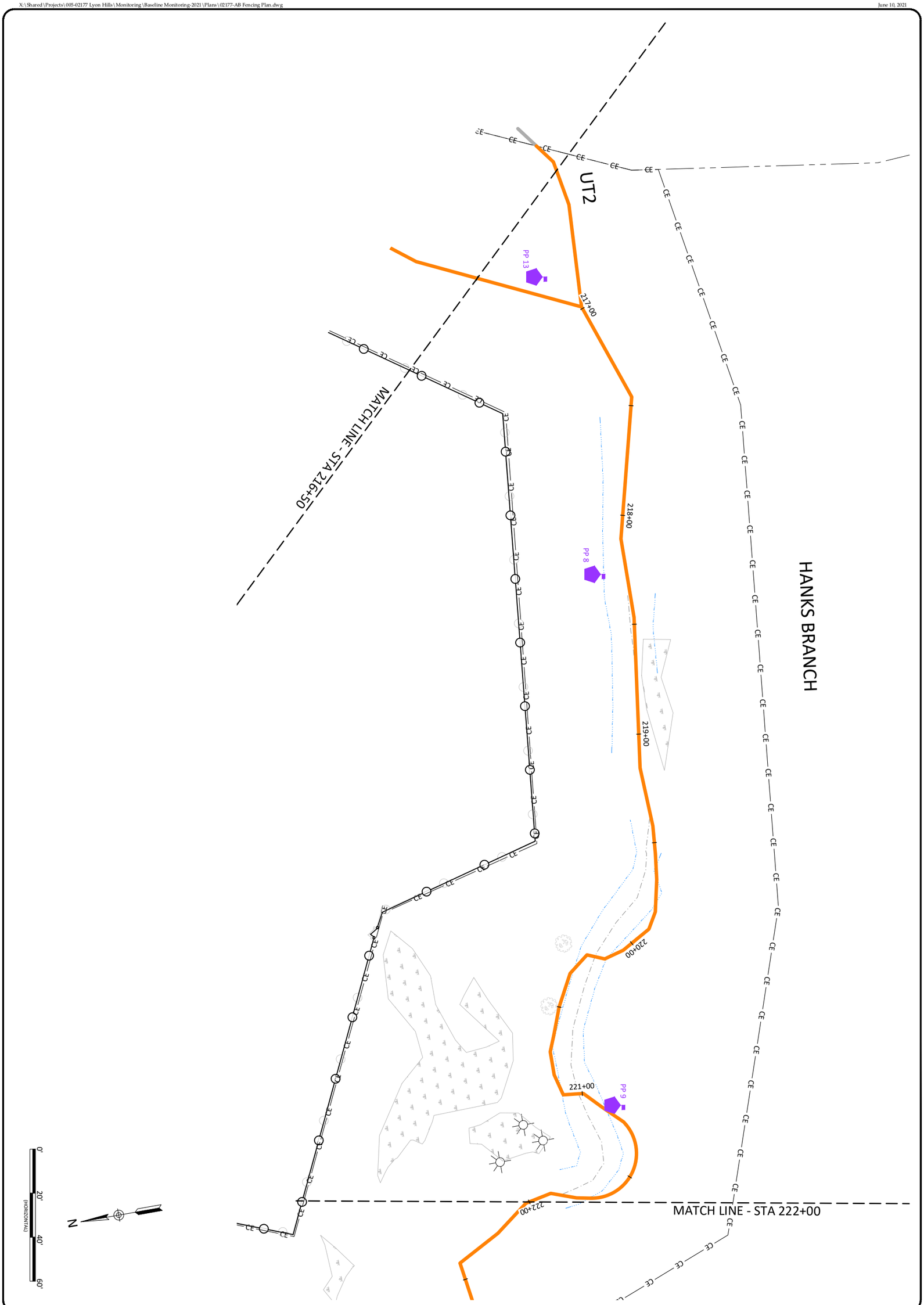

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
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4.04
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Revisions:

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch & UT2
Fencing Plan

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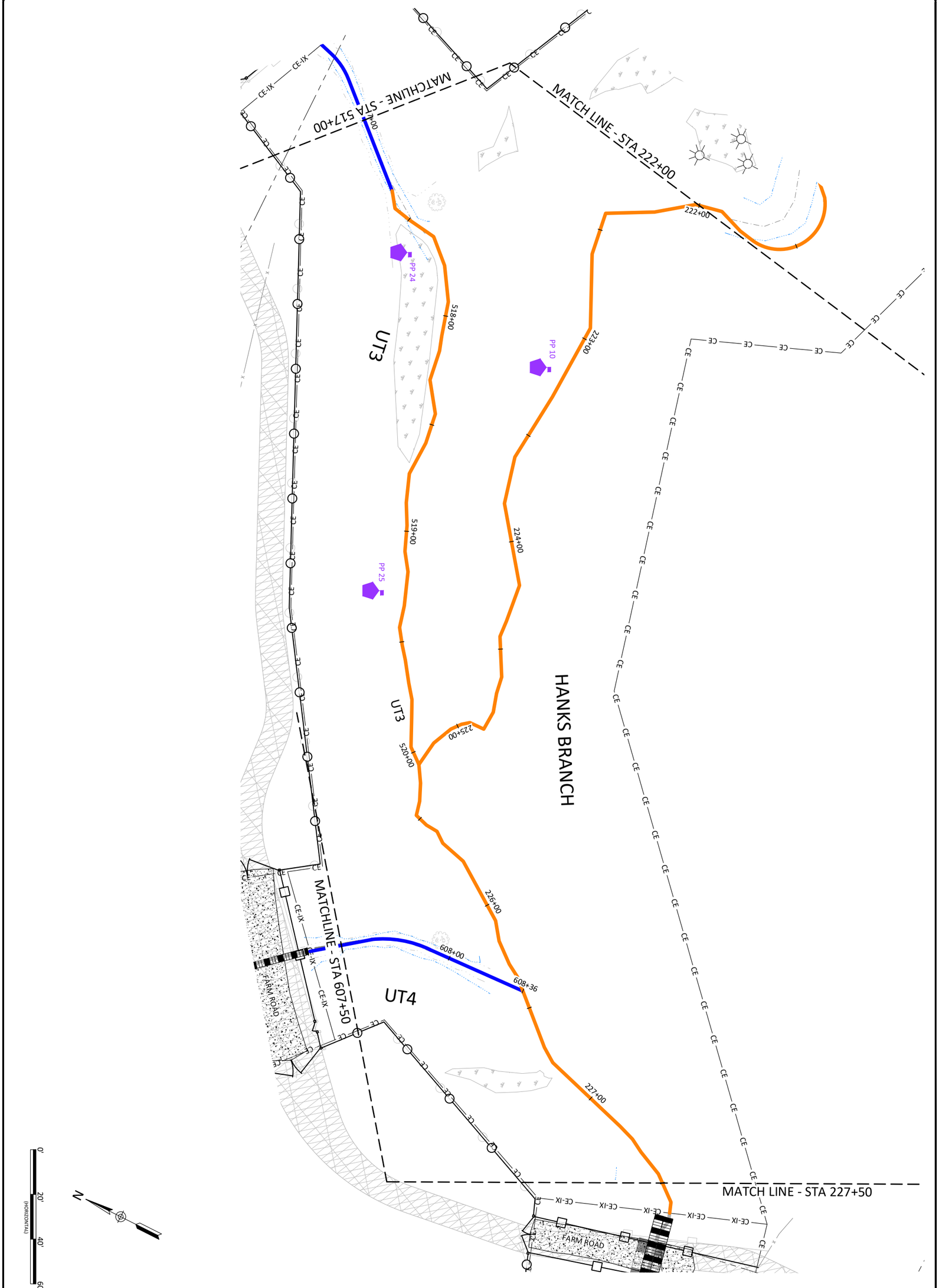

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
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Revisions:

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch
Fencing Plan

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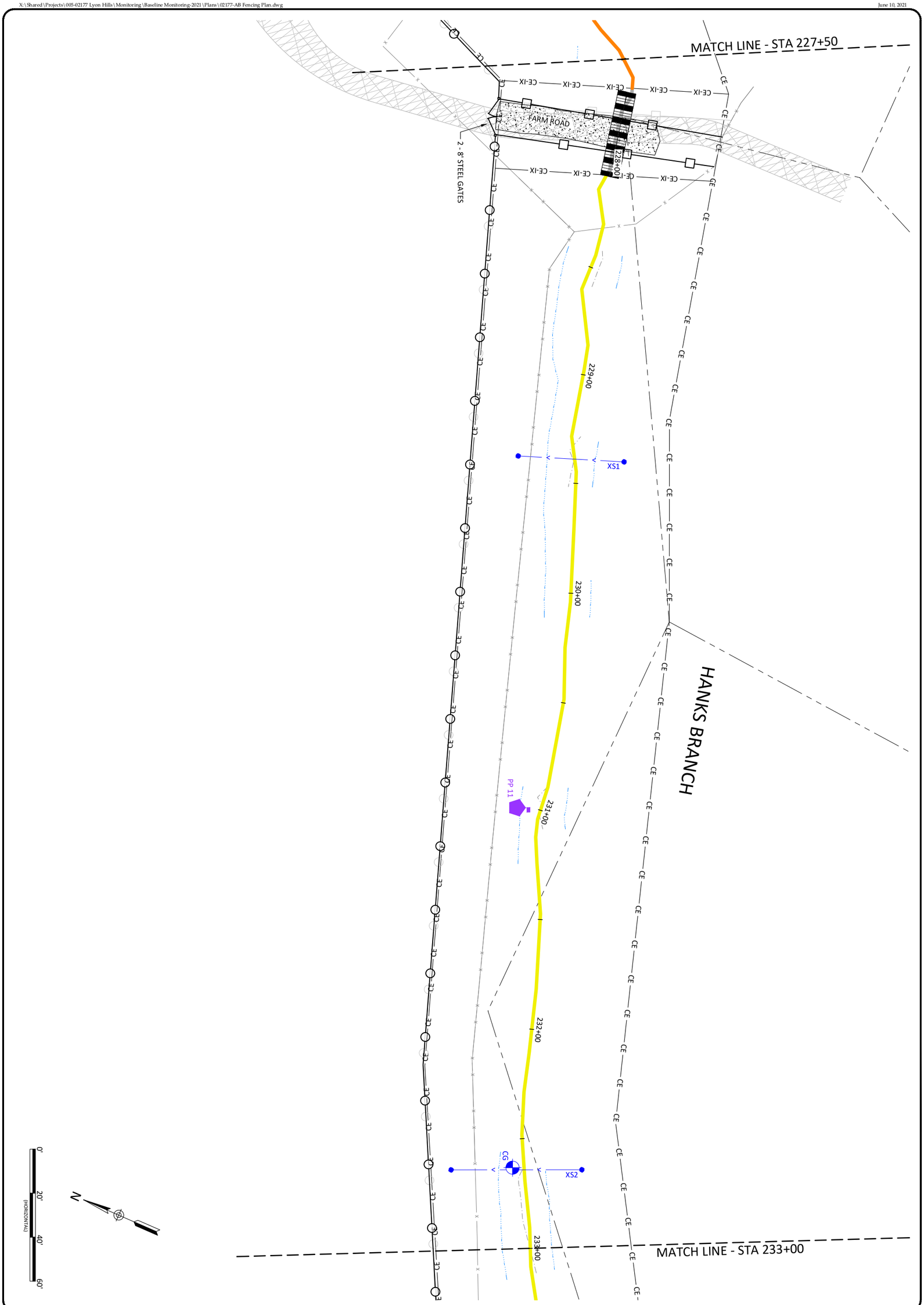

Date: May 28, 2021
Job Number: 005-02177
Project Engineer: NMM
Drawn By: ABP
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4.06
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Hanks Branch
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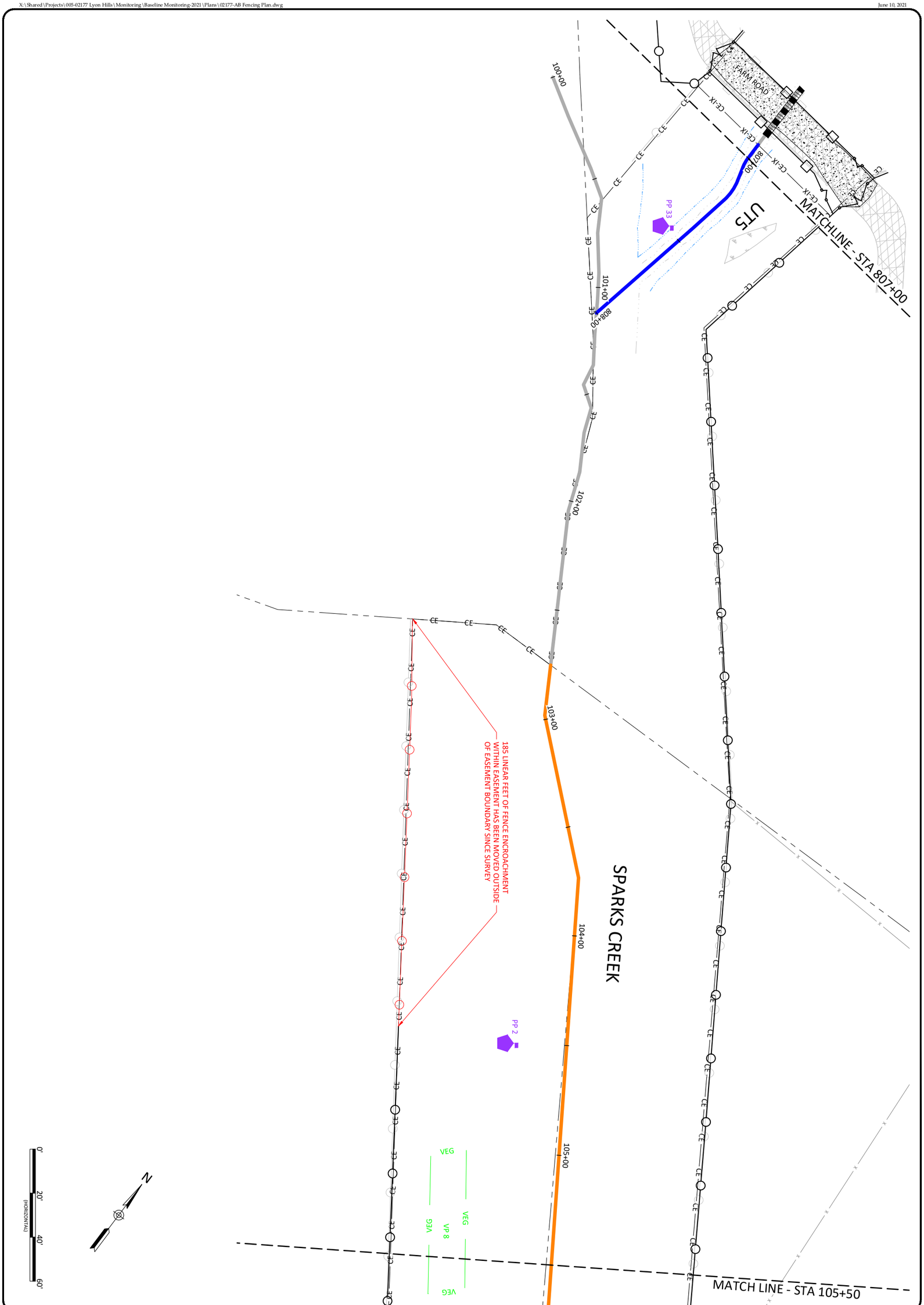

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
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Revisions:

4.07
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Sparks Creek
Fencing Plan

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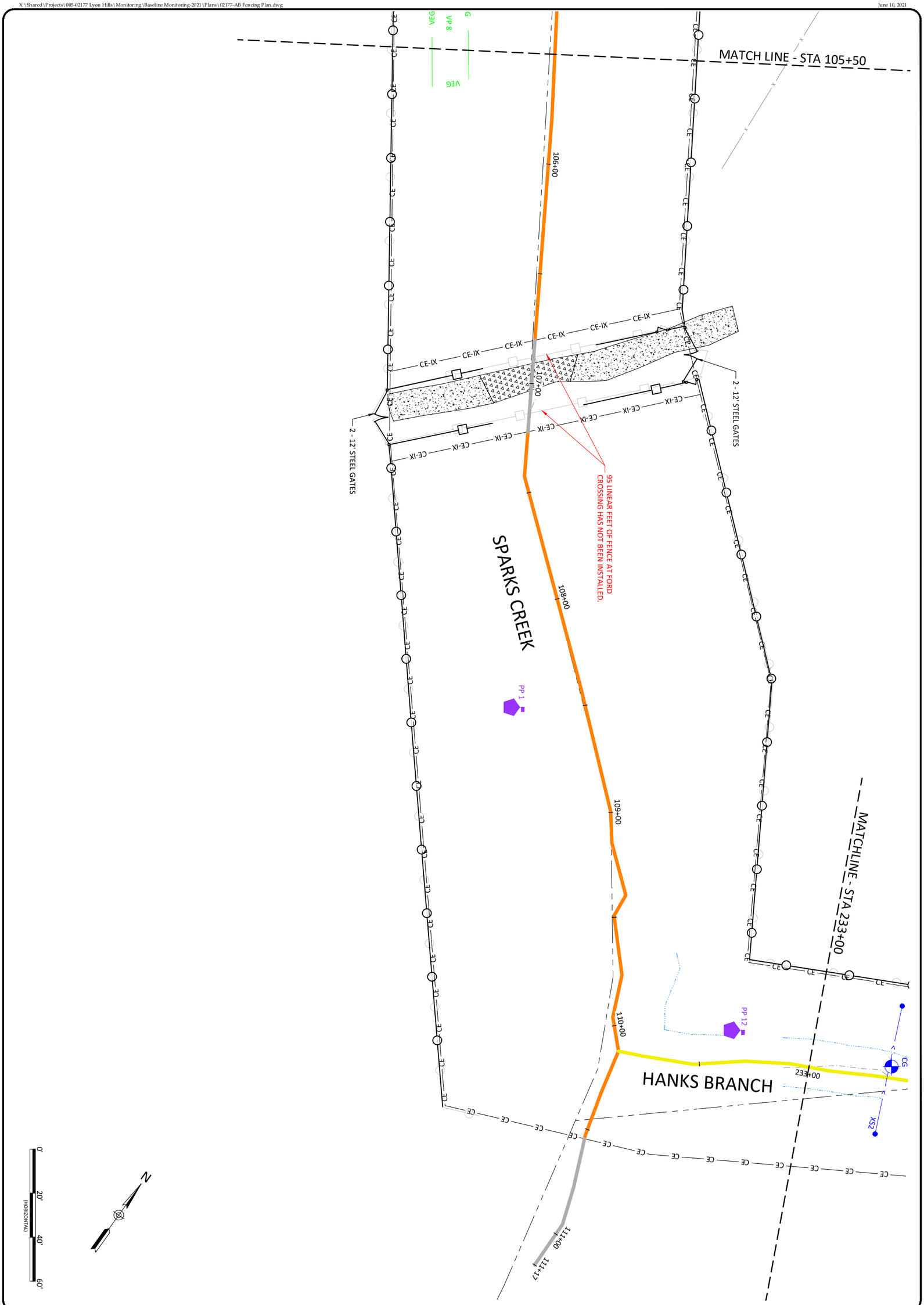

Date:	May 28, 2021
Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
Checked By:	JNK

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Revisions:

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

Sparks Creek
Fencing Plan

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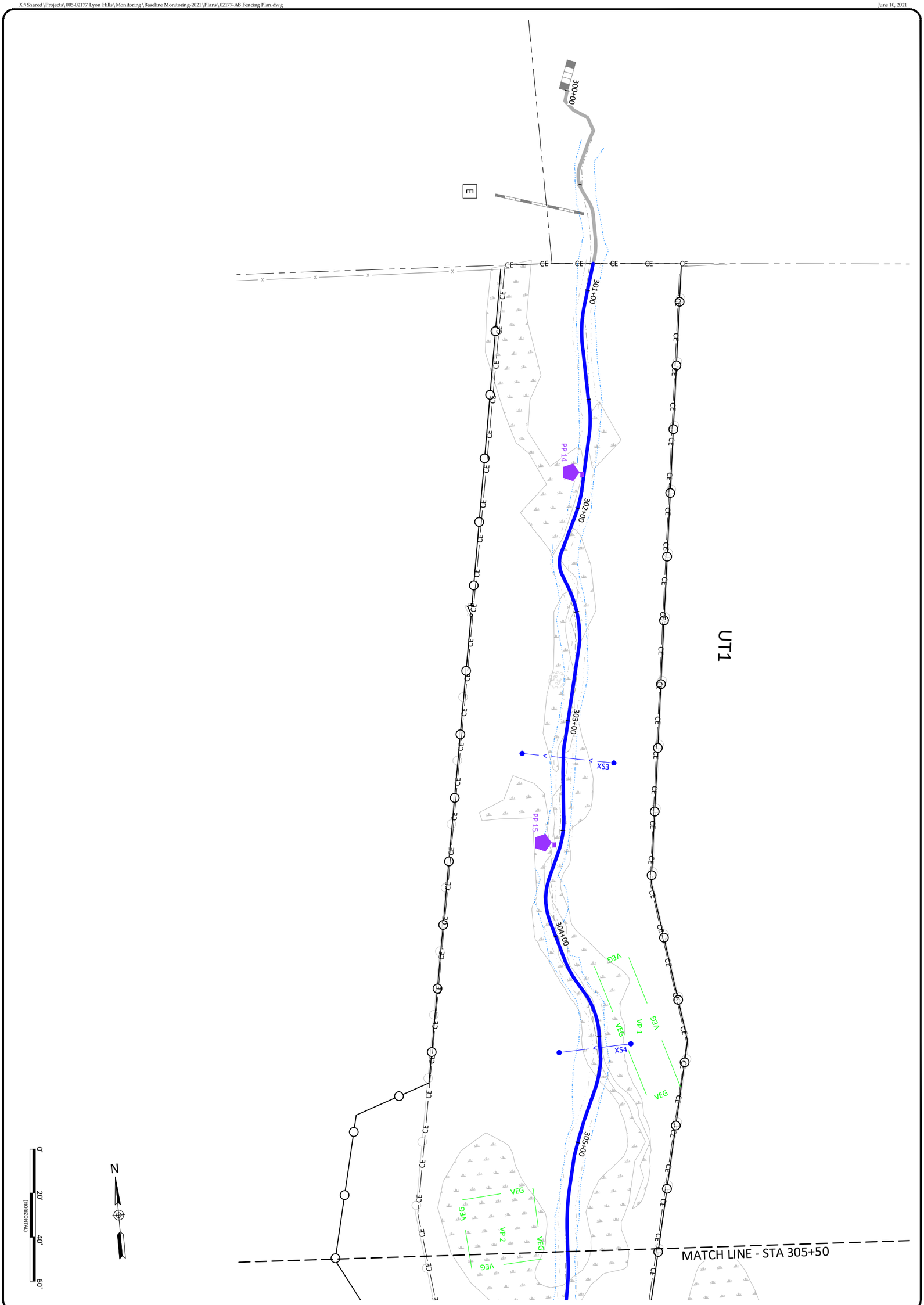

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Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
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4.09
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Revisions:

Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT1
Fencing Plan

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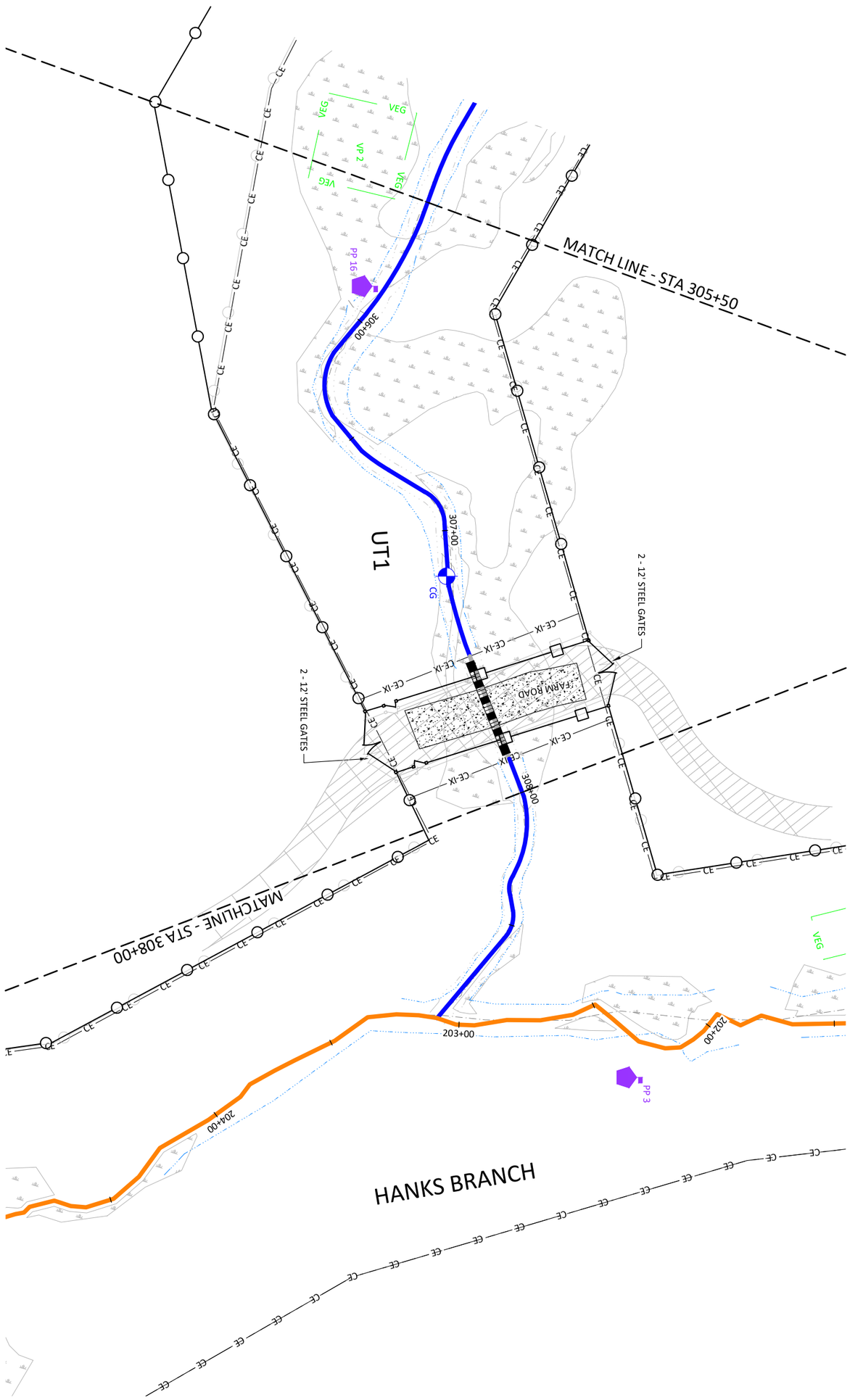

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Job Number:	005-02177
Project Engineer:	NMM
Drawn By:	ABP
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT1
Fencing Plan

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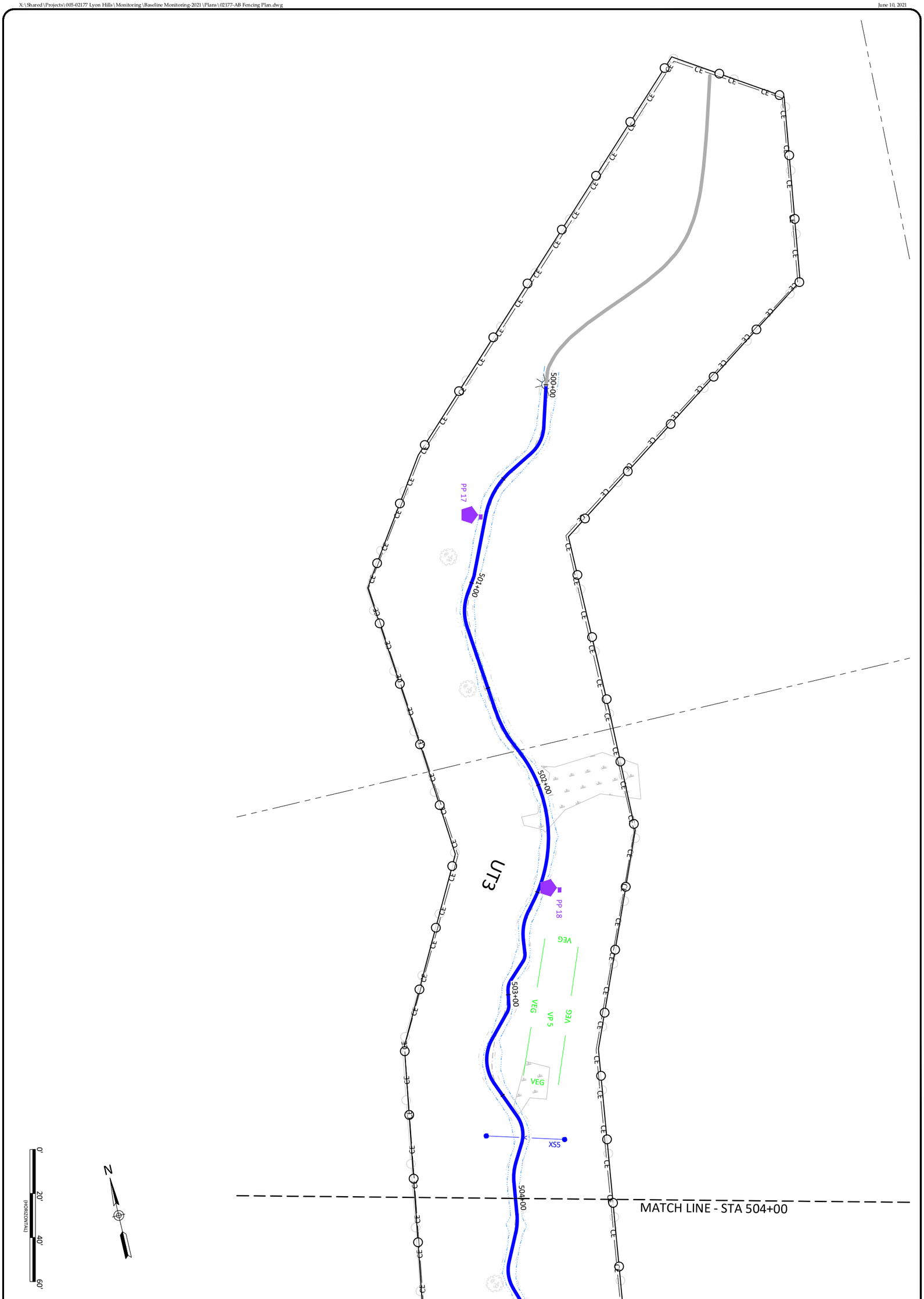

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Job Number:	005-02177
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Fencing Plan

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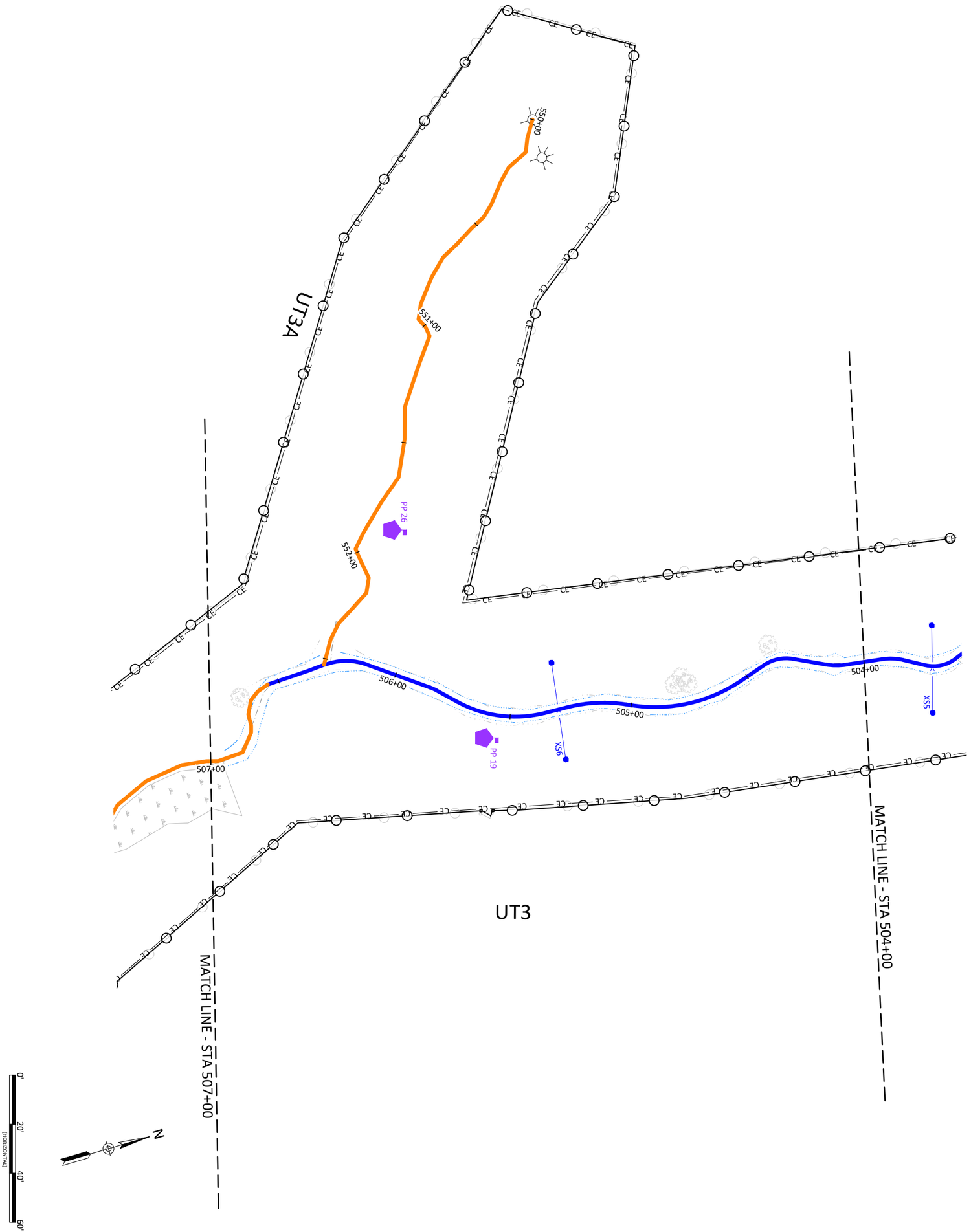

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3 & UT3A
Fencing Plan

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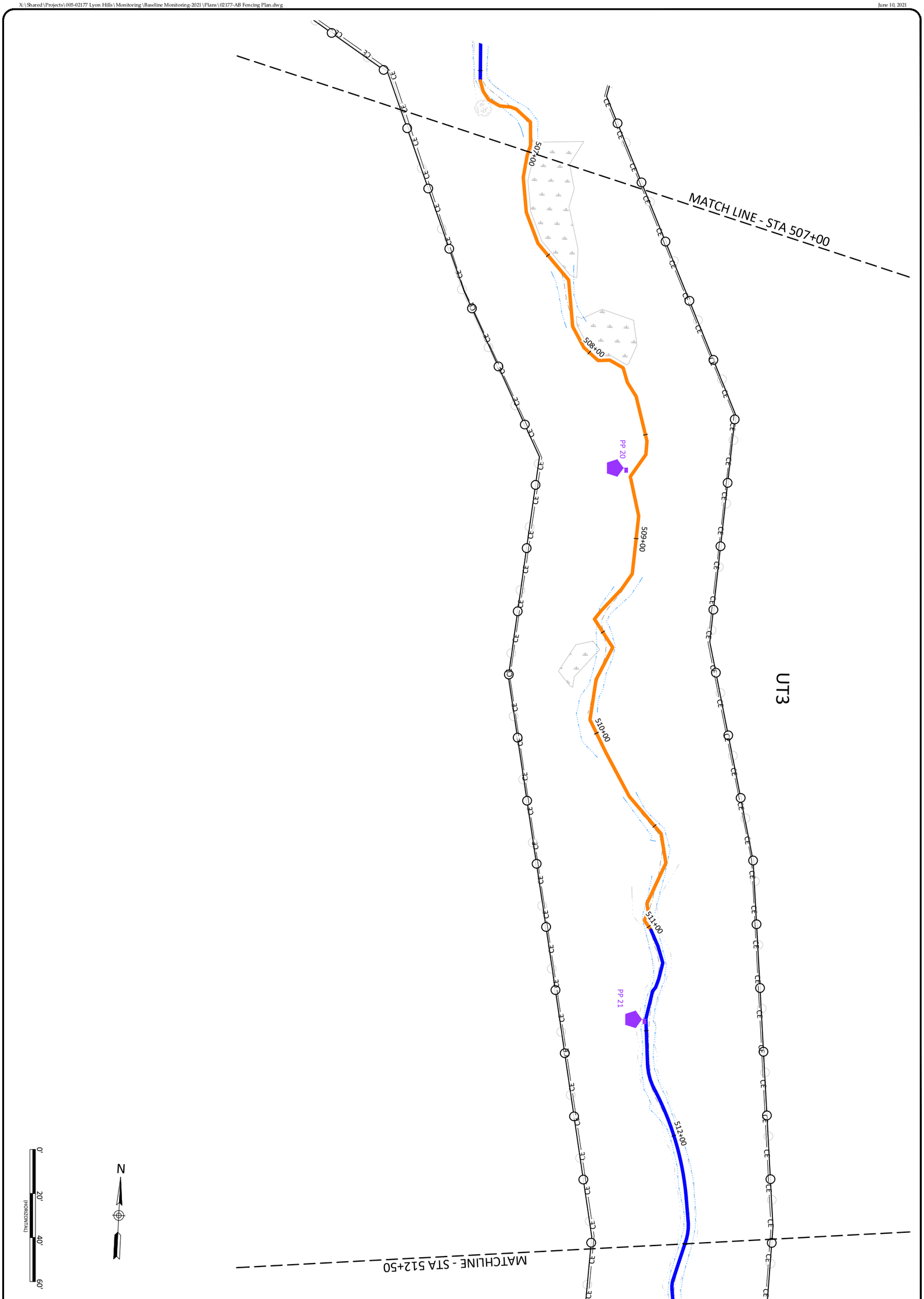

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Job Number:	005-02177
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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT3
Fencing Plan

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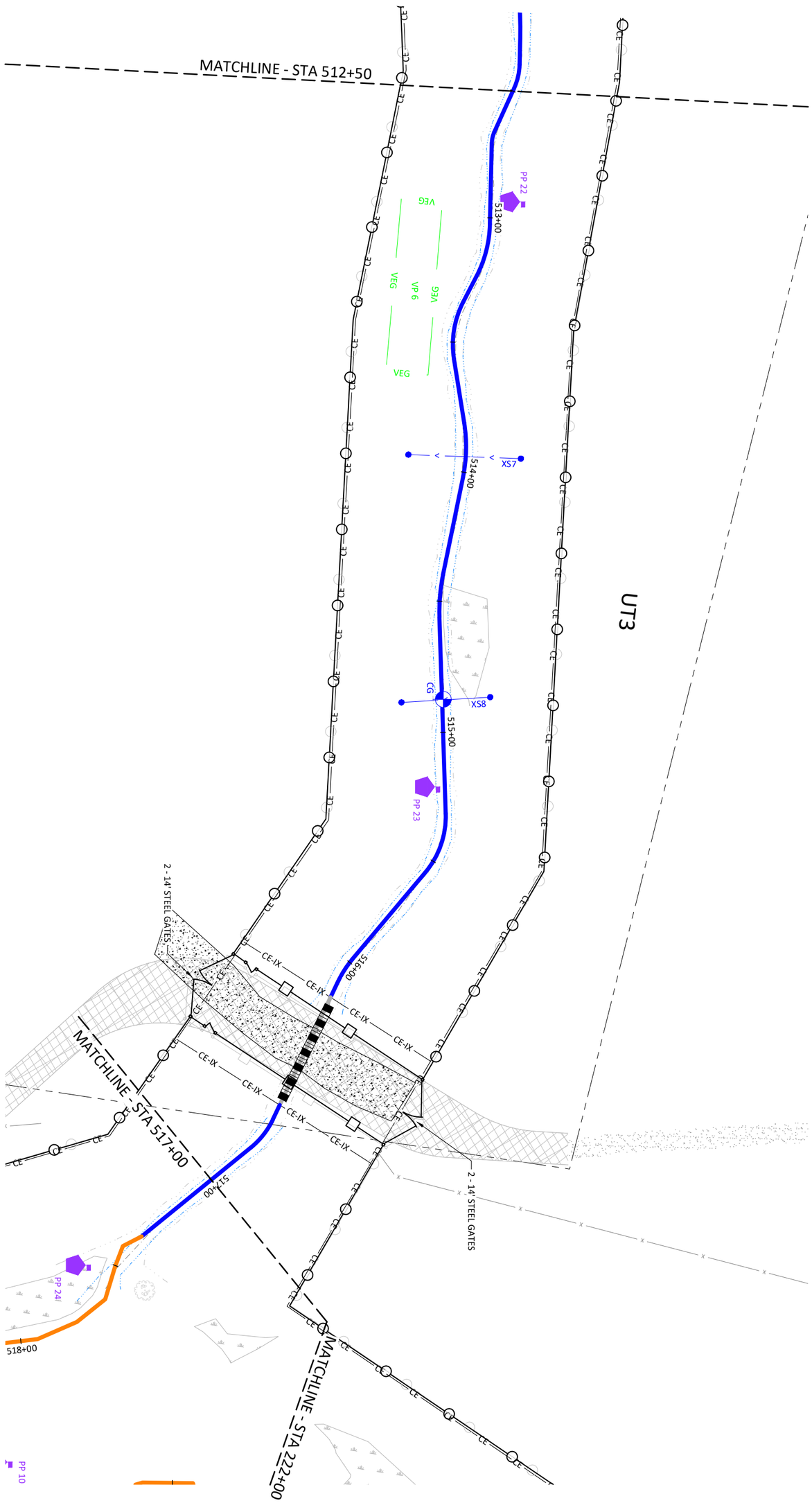

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Wilkes County, North Carolina

UT3
Fencing Plan

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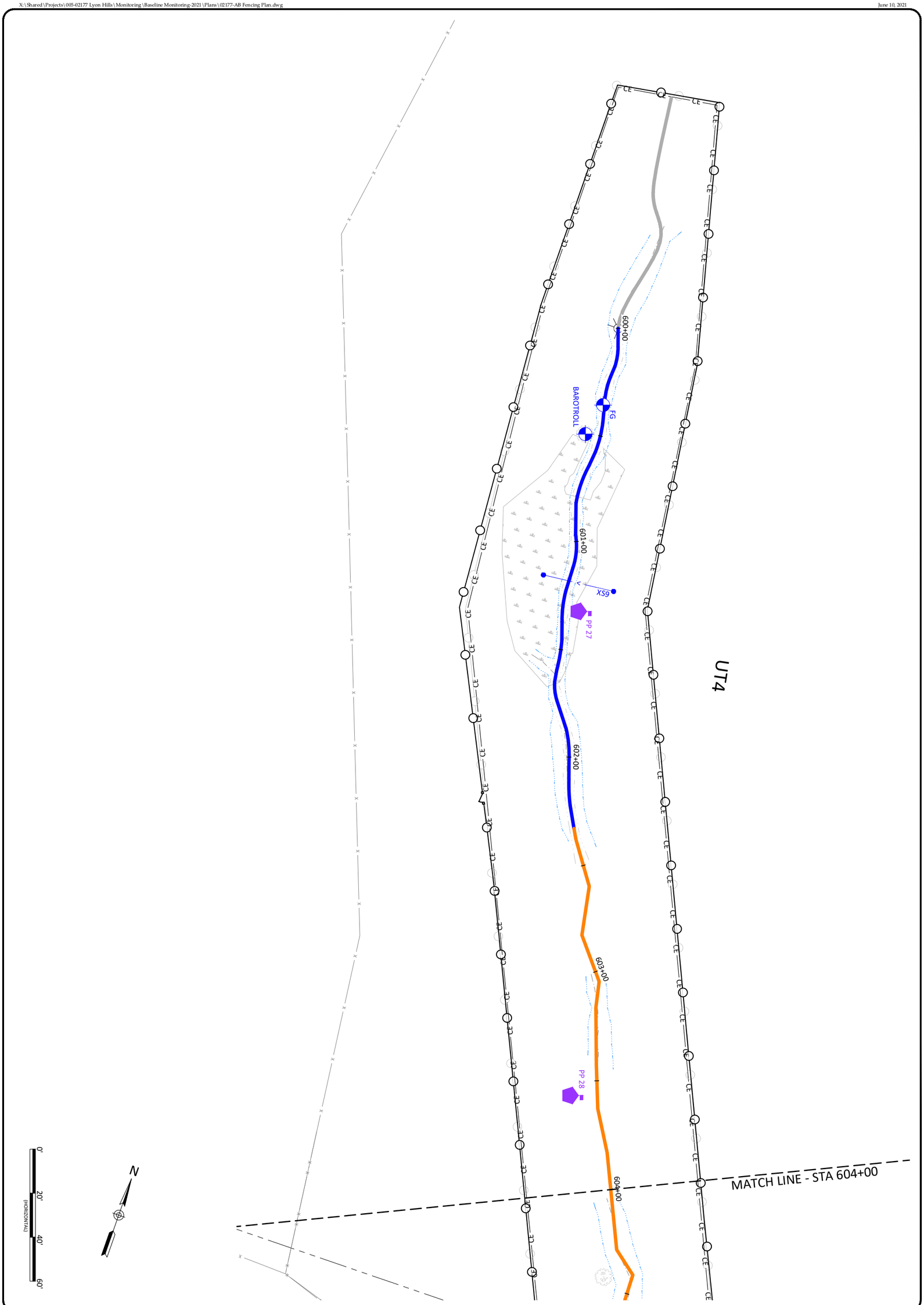

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Lyon Hills Mitigation Site As-Built
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UT4
Fencing Plan

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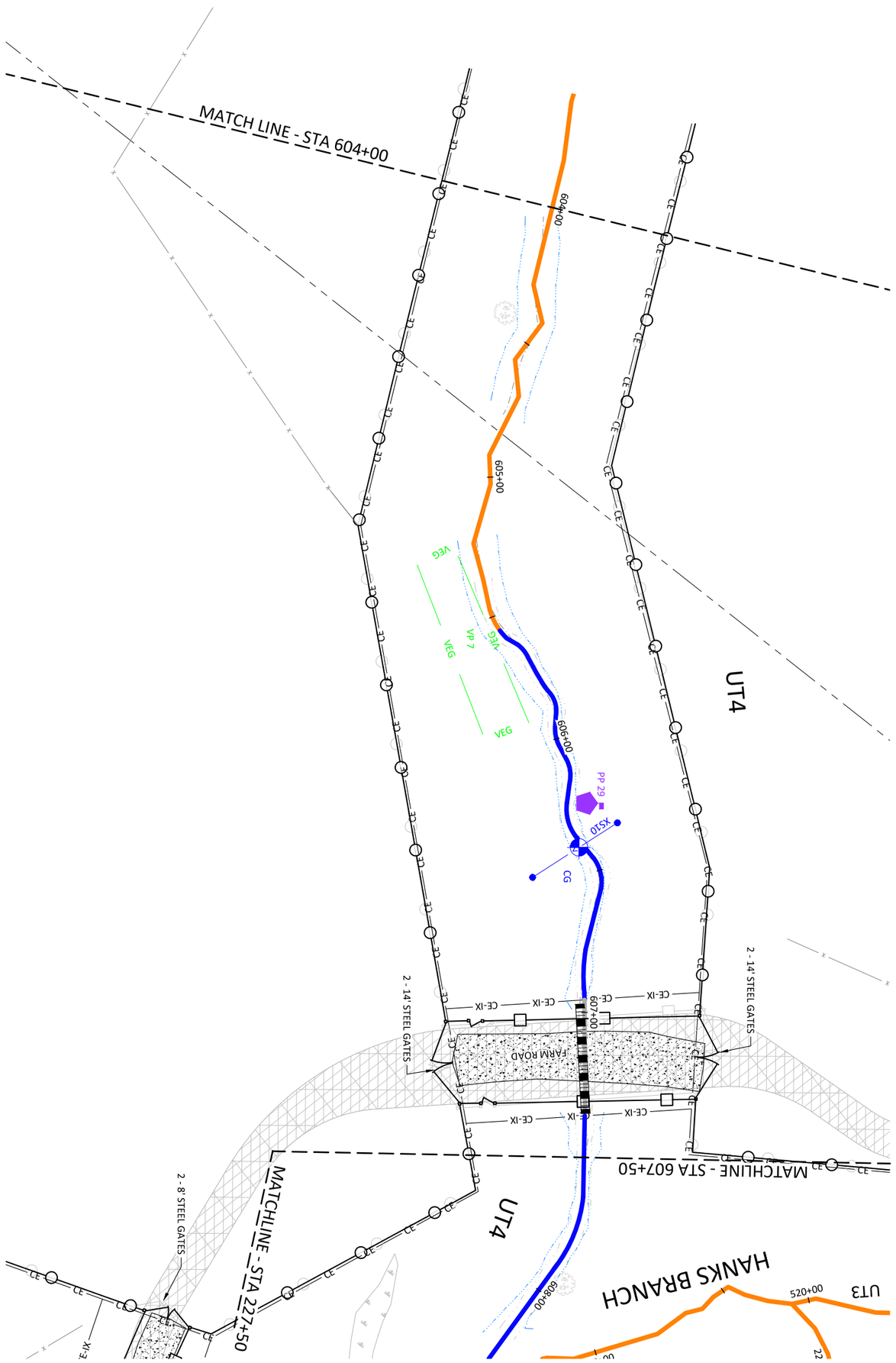

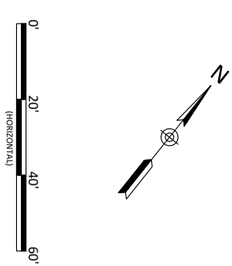

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT4
Fencing Plan

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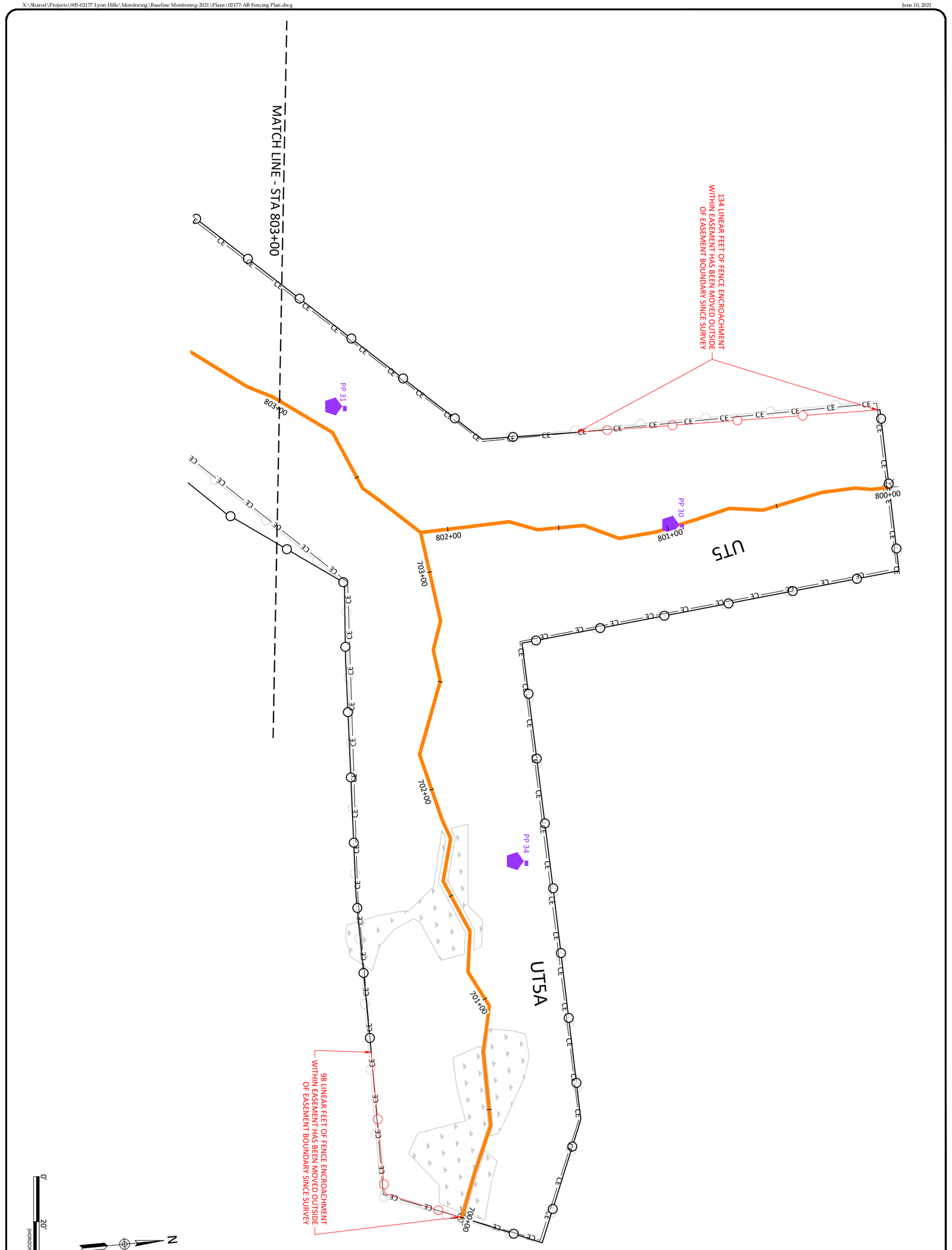

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Lyon Hills Mitigation Site As-Built
Wilkes County, North Carolina

UT5 & UT5A
Fencing Plan

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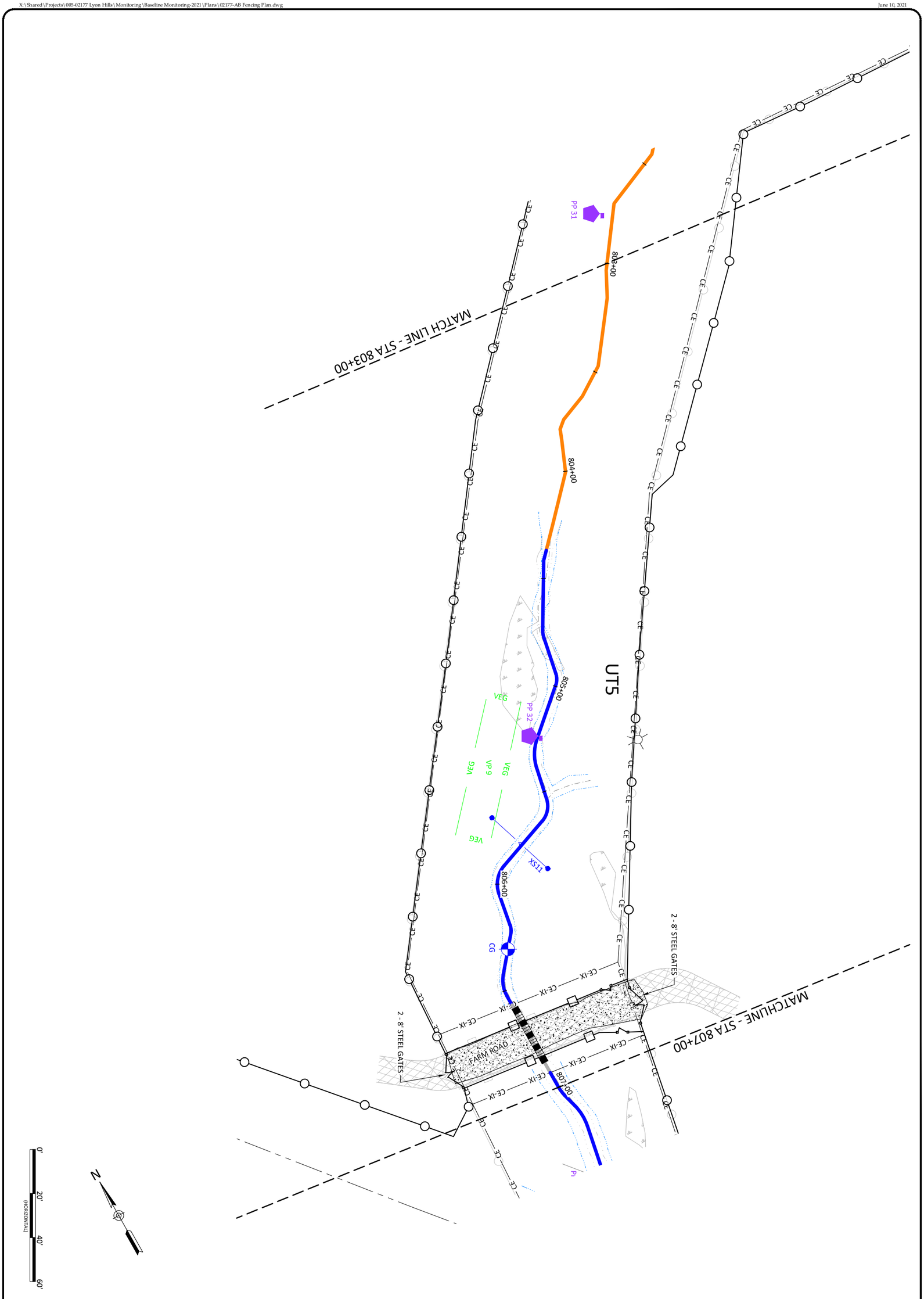

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Lyon Hills Mitigation Site As-Built
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UT5
Fencing Plan

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