



**MONITORING YEAR 0
ANNUAL REPORT
FINAL**

October 2021

BUG HEADWATERS MITIGATION SITE

Wilkes County, NC
Yadkin River Basin
HUC 03040101

DMS Project No. 100084
NCDEQ Contract No. 7617
DMS RFP No. 16-007406
USACE Action ID No. 2018-01788
DWR Project No. 2018-1273
Data Collection Dates: April 2021

PREPARED FOR:



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



October 27, 2021

Mr. Matthew Reid
Western Project Manager
NCDENR- Division of Mitigation Services
5 Ravenscroft Dr, Suite 102
Asheville, NC 28801

Subject: Draft MY0 Report Review
Bug Headwaters Mitigation Site, Wilkes County
Yadkin River Basin: 03040101
DMS Project ID No. 100084
DEQ Contract #. 7617

Dear Mr. Reid:

On September 28, 2021, Wildlands Engineering received comments from the North Carolina Division of Mitigation Services (DMS) regarding the Draft As-Built Baseline Report dated September 17, 2021. The following letter documents DMS feedback and Wildlands' corresponding responses and revisions to the As-Built Report.

There were approximately 19 boulder sills replaced with log sills throughout the project. Since native boulder material was not found on site and logs were abundant, the decision to use logs and reduce offsite material was made. Does WEI have concerns with 9 of the log sill replacements occurring on intermittent channels (UT1) where dry channels are likely to occur for large portions of the year?

Response: Much of the intermittent channel lengths (especially UT1) feature adjacent wetlands and groundwater seeps. On intermittent channels, boulder sills were strategically replaced with log sills in areas with groundwater entry and a high water table to reduce the possibility of log decay. These locations were wet during construction and still wet during an internal as-built site walk on 08/05/21. WEI does not anticipate dry channels for large portions of the year in these areas.

Vegetation Monitoring: The 2016 Wilmington District Stream and Wetland Compensatory Mitigation Update requires a combination of permanent fixed and random plots to demonstrate vegetation coverage. No random plots were included in the MY0 report. Please include random plots with the MY1 submission.

Response: Three permanent fixed plots (VP 3, VP 13 & VP 15) will be converted to random plots during MY1 survey.

Section 2: Consider adding a statement that a minimum 30' buffer was maintained with the approved revisions to the UT3 alignment. A figure was included with the IRT correspondence dated April 22, 2021 and is found in Appendix F.

Response: This has been included in Section 2.

3.1 Vegetative Assessment: Section references MY1. This should be MY0.

Response: This has been updated.

The IRT has requested photos be included of culverts and stream crossing in annual monitoring reports. DMS recommends adding additional photo points at culverts and stream crossings beginning in MY1.

Response: Culvert and stream crossings will now be included in the MY1 report.

XS Plots: Right side of all plots have been cut off accidentally in draft report. Please revise for final

Response: The XS plots were cut off in the reduced version of the draft report. This has been corrected.

CCPV: UT3 alignment should be shown as constructed on the CCPV. It is currently shown in the design location prior to the realignment. This deviation is captured correctly in the asbuilt/redline drawing, but is not necessary for the CCPV.

Response: The UT3 realignment is now shown in the CCPV and in the digital files as "Design_Centerlines_Final".

Sheet 1.12: Revise note #2 for final.

Response: Note #2 has been removed.

Sheet 1.17 and 1.18: Symbol for "asbuilt culvert" is shown on each sheet. Please revise or explain.

Response: The two "as-built culvert" symbols have been removed.

Sheet 1.21: Note indicates riffle at 201+36 is covered in sediment and will be repaired or maintained as needed. Please add call out to CCPV and provide update in MY1 report.

Response: A callout has been added to the CCPV and an update will be provided in MY1.

Sheet 1.27: PP19 is incorrectly labeled. It should be PP27.

Response: PP19 labeling has been updated.

Sheet 1.34: PP27 is incorrectly labeled. It should be PP37.

Response: PP27 labeling has been updated.

2.1.15 UT4 and Sheet 1.45: Note says outlet protection material will be added as needed to maintain stability of the confluence. Does WEI have concerns with the current condition of the outlet and expect to performance maintenance at regular intervals? Outlets should be constructed with long term stability in mind. If adaptive management is needed, please notify DMS and IRT.

Response: WEI does not have concerns with the condition of the outlet nor expect to perform maintenance at regular intervals. The outlet was stable during an internal as-built site walk on 08/05/21. If the need for adaptive management arises, DMS and IRT will be notified.

When WEI notified the IRT of the UT3 realignment (email dated 4/22/21, Appendix F), the IRT requested DMS to indicate the change in linear feet associated with the new alignment when the asbuilt is submitted for IRT review. According to Table 1, the change from Mitigation Plan to Asbuilt in linear feet for UT3 is 28'. Please verify if the change in alignment for UT3 accounts for the reduction in 28'.

Response: The UT3 alignment change does not account for the 28' reduction in stream length. The originally proposed alignment was 810 feet, while the realigned stream submitted to the IRT was 811 feet. The reduction in stream footage is related to the typical difference between overall design alignment length and the surveyed stream lengths.

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,

A handwritten signature in black ink, appearing to read 'J. Lorch', written in a cursive style.

Jason Lorch, *Monitoring Coordinator*

EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a full delivery project at the Bug Headwaters Mitigation Site (Site) for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) to restore a total of 8,700 linear feet of perennial and intermittent streams in Wilkes County, NC. The Site will generate 7,589.533 stream credits. The Site is located approximately 9.5 miles northwest of the Town of Elkin in the Yadkin River Basin 8-Digit Hydrologic Unit Code (HUC) 03040101. The Site is on two adjacent row crop and livestock farms in the foothills of the Blue Ridge Mountains. The Site is technically in the Piedmont but is near the border of the Piedmont and mountain physiographic region. The Site is located within a Targeted Local Watershed (TLW) presented in the 2009 Upper Yadkin-Pee Dee River Basin Restoration Priorities (RBRP) (NC DMS, 2009). The Site is located in the Yadkin River Basin HUC 03040101070010 and NC Division of Water Resources (DWR) Subbasin 03-07-01. The project involves the restoration and enhancement of Big Bugaboo Creek and eight unnamed tributaries to Big Bugaboo Creek. The downstream drainage area of the Site is 322 acres. The 22.50 acre Site is protected with a permanent conservation easement.

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

- Improve the stability of stream channels;
- Improve instream habitat;
- Reconnect channels with floodplains and riparian wetlands;
- Restore and improve riparian buffers; and
- Permanently protect the Site from harmful land uses.

Site construction was completed in April 2021, as-built surveys were completed in May 2021, and planting was completed in April 2021. Monitoring Year 0 (MY0) assessments and site visits were completed in April 2021. Overall, the Site has met the required vegetation and stream success criteria for MY0. All fifteen vegetation monitoring plots met the interim success criteria with an average stem density of 601 planted stems per acre. All restored streams are stable and functioning as designed. Hydrologic data will be collected and reported during MY1.



BUG HEADWATERS MITIGATION SITE
Monitoring Year 0 Annual Report

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Section 1: PROJECT OVERVIEW

The Bug Headwaters Mitigation Site (Site) is located in Wilkes County, approximately 9.5 miles northwest of the Town of Elkin. The Site is on two adjacent row crop and livestock farms in the foothills of the Blue Ridge Mountains. It is near the border of the Piedmont and mountain physiographic region but is technically in the Piedmont. The Site is within Hydrologic Unit Code (HUC) 03040101070010, Subbasin 03-07-01, and is located within a Targeted Local Watershed identified in the 2009 Yadkin-Pee Dee River Basin Restoration Priorities (RBRP) (NC DMS, 2009). The project watershed consists primarily of agricultural and wooded land. The drainage area for the Site is 322 acres (0.50 square miles).

1.1 Project Quantities and Credits

The Site is located on two parcels under 2 different landowners and a conservation easement was recorded on 22.50 acres. Mitigation work within the Site included restoration, enhancement I, and enhancement II of 8,700 linear feet of perennial and intermittent stream channels. The project is expected to provide 7,589.533 cool water stream credits by closeout.

Table 1: Project Quantities and Credits

PROJECT MITIGATION QUANTITIES							
Project Segment	Mitigation Plan Footage	As-Built Footage	Mitigation Category	Restoration Level	Mitigation Ratio (X:1)	Credits	Comments
Stream							
Big Bugaboo Creek R1	868	869	Cool	R	1.0	868.000	Full Channel Restoration, Fencing Out Livestock
Big Bugaboo Creek R2	981	981	Cool	EI	1.5	654.000	Constructed Riffles, Fencing Out Livestock, Internal Crossing
Big Bugaboo Creek R3	1,764	1,756	Cool	R	1.0	1,764.000	Pond Removal, Full Channel Restoration, Fencing Out Livestock, Internal Crossing
Big Bugaboo Creek R4	394	390	Cool	EI	1.5	262.666	Graded Bankfull Bench, Fencing Out Livestock
UT1	389	390	Cool	R	1.0	389.000	Full Channel Restoration, Fencing Out Livestock
UT2 R1	505	505	Cool	EII	2.5	202.000	Fencing Out Livestock, Minor Bank Grading
UT2 R2	80	78	Cool	EI	1.5	53.333	Raised Riffle Bed, Fencing Out Livestock, Utility Crossing
UT2 R3	436	440	Cool	R	1.0	436.000	Full Channel Restoration, Fencing Out Livestock
UT2 R4	314	301	Cool	EI	1.5	209.333	Bank Grading, Fencing Out Livestock
UT2 R5	741	729	Cool	R	1.0	741.000	Full Channel Restoration, Fencing Out Livestock, Internal Crossing
UT2A R1	135	134	Cool	EII	2.5	54.000	Fencing Out Livestock, Utility Crossing

UT2A R2	445	445	Cool	R	1.0	445.000	Full Channel Restoration, Fencing Out Livestock
UT2B	168	167	Cool	EII	2.5	67.200	Bank Stabilization, Fencing Out Livestock
UT3	1,412	1,384	Cool	R	1.0	1,412.000	Pond Removal, Full Channel Restoration, Fencing Out Livestock
UT4	128	131	Cool	EII	4.0	32.000	Fencing Out Livestock
Total:						7,589.533	

Restoration Level	Stream		
	Warm	Cool	Cold
Restoration		6,055.000	
Enhancement I		1,179.333	
Enhancement II		355.200	
Preservation			
Totals		7,589.533	
Total Stream Credit		7,589.533	

1.2 Project Goals and Objectives

The project is intended to provide numerous ecological benefits. Table 2 below describes expected outcomes to water quality and ecological processes and provides project goals and objectives.

Table 2: Goals, Performance Criteria, and Functional Improvements

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Improve the stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Reduce erosion and sediment inputs; maintain appropriate bed forms and sediment size distribution.	ER stays over 2.2 and BHR below 1.2 with visual assessments showing progression towards stability.	Cross-section monitoring and visual inspections.	No deviations from design.
Improve instream habitat.	Install habitat features such as cover logs, log sills, and bush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth. Fence out livestock.	Support biological communities and processes. Provide aquatic habitats for diverse populations of aquatic organisms.	There is no required performance standard for this metric.	N/A	N/A

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Reconnect channels with floodplains and riparian wetlands.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to existing floodplain.	Reduce shear stress on channel; hydrate adjacent wetland areas; 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.	Four bankfull events in separate years within monitoring period. 30 consecutive days of flow for intermittent channel.	Crest gauges and/or pressure transducers recording flow elevations.	Reported in MY1.
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.	There is no required performance standard for this metric.	N/A	N/A
Restore / improve riparian buffers.	Plant native tree species in riparian zones where currently insufficient.	Provide a canopy to shade streams and reduce thermal loadings; stabilize stream banks and floodplain; support water quality and habitat goals.	Survival rate of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7.	One hundred square meter vegetation plots are placed on 2% of the planted area of the Site and monitored annually.	All 15 vegetation plots have a planted stem density greater than 320 stems per acre.
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.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.	No easement encroachments.

1.3 Project Attributes

The Site includes the headwaters of Big Bugaboo Creek. All project reaches and the majority of the watershed areas are contained within two farms, the larger of which is owned by Horace Randle Wood while the smaller is owned by Gaye Swaim. Mr. Wood has owned the property and used it exclusively to graze cattle since 2012. His property was historically used for grazing cattle though tobacco was also cultivated on small sections of the property. Prior to construction, the Wood property remained mostly non-forested cattle pasture with cattle having access to all surface waters on the property other than a pond just below the confluence of Big Bugaboo Creek and UT2 and short reaches of both of these streams just upstream of the pond. Cattle access has severely degraded a majority of the streams. The Swaim property has been in the family for over 60 years and had primarily been used for row crop agriculture. Prior to construction, it was used to cultivate corn and soybeans. There was an in-line pond



on the Swaim property that received heavy sediment loads whenever the fields were tilled due to the absence of a vegetated buffer around the pond. The remaining portions of the watershed outside of the Wood and Swaim properties are mostly cleared and used for pasture and row crops, although there is a pocket of forested area on the southeastern side of the watershed and wooded riparian corridors are present on the far upstream and downstream ends of the Site. Table 3 below and Table 8 in Appendix C present additional information on pre-restoration conditions.

Table 3: Project Attributes

PROJECT INFORMATION						
Project Name	Bug Headwaters Mitigation Site	County	Wilkes County			
Project Area (acres)	22.50	Project Coordinates	36.32139 N, 80.98432 W			
PROJECT WATERSHED SUMMARY INFORMATION						
Physiographic Province	Piedmont	River Basin	Yadkin			
USGS HUC 8-digit	03040101	USGS HUC 14-digit	03040101070010			
DWR Sub-basin	03-07-01	Land Use Classification	86% agriculture, 12% forested, 2% developed			
Project Drainage Area (acres)	322	Percentage of Impervious Area	2%			
RESTORATION TRIBUTARY SUMMARY INFORMATION						
Parameters	Big Bugaboo Creek	UT1	UT2	UT2A	UT3	
Pre-project length (feet)	4,007	389	2,076	580	1,412	
Post-project (feet)	3,996	390	2,053	579	1,384	
Valley confinement	Confined to Unconfined	Confined	Moderately Confined	Confined	Moderately Confined	
Drainage area (acres)	322	7	65	17	96	
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Perennial	Intermittent	Perennial	
DWR Water Quality Classification	C					
Dominant Stream Classification (existing)	F4/B4	B4	F4b	A4	G4	
Dominant Stream Classification (proposed)	B4/C4	B4	C4b	B4A	C4	
Dominant Evolutionary class (Simon) if applicable	Stage III					
REGULATORY CONSIDERATIONS						
Parameters	Applicable?	Resolved?	Supporting Documentation			
Water of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No. 27 and DWQ 401 Water Quality Certification No. 4134.			
Water of the United States - Section 401	Yes	Yes				
Endangered Species Act	Yes	Yes	Categorical Exclusion in Mitigation Plan (Wildlands, 2020)			
Historic Preservation Act	Yes	Yes				
Coastal Zone Management Act (CZMA or CAMA)	N/A	N/A	N/A			
Essential Fisheries Habitat	N/A	N/A	N/A			

Section 2: As-Built Condition (Baseline)

The Site construction and as-built surveys were completed in April and May 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.

Native boulder material was not found on site, so boulders were transported from a quarry. Since logs were abundant on the site, some boulder sills were replaced with log sills to reduce the amount of off-site material needed. The quarry boulders were mainly used in structures at the headwaters of the stream channels that are likely to be intermittently dry during the summer. This was done to help prevent the logs from rotting during the dry times of the year.

Due to severe ground instability in the drained ponds during construction, the upper portion of UT3 was moved up to 18 feet to the left of the design centerline. This allowed for equipment to construct the stream channel from the side of the pond where the ground was drier instead of near the center. A minimum 30-foot buffer was maintained with the approved revisions to the UT3 alignment. A figure was included with the IRT correspondence dated April 22, 2021, and is found in Appendix F.

There was a 60-foot reduction in stream length from Mitigation Plan Footage to As-Built Footage throughout the Site. UT3 has a 28-foot reduction in stream length, however, this is not due to the alignment change. The originally proposed alignment was 810 feet, while the realigned stream submitted to the IRT was 811 feet. The As-Built Plans show that streams were constructed as designed with only minor deviations. The reduction in stream footage is related to the typical difference between overall design alignment length and the surveyed stream lengths.

Unstable ground in both pond bottoms slowed down construction delaying planting until April. Correspondence notifying DMS and the IRT of the delayed planting is documented in Appendix F. Ground instability also prohibited fence to be installed around both ponds. Newly installed fence was tied into existing fence along the edge of the former pond on Big Bugaboo Creek Reach 3 rather than being installed through the pond as designed. Cattle are completely excluded from the Site. If the pond dries sufficiently for cattle to graze the pond bottom outside the easement, the fence will be relocated to just outside the easement as designed. Detailed fencing changes are documented in Appendix E on Plan Sheet 5.03 and 5.07.

2.1 As-Built/Record Drawings

A sealed half-size set of record drawings are in Appendix E which includes the post-construction survey, alignments, structures, and monitoring features. These include redlines for any significant field adjustments made during construction that differ from the design plans. Where needed, adjustments were made during construction based on field evaluations and are listed below.

2.1.1 Big Bugaboo Reach 1

- STA 103+80 & STA 104+15 – boulder sill replaced with log sill due to no native boulders on site;
- STA 105+59 – boulder sill replaced with log sill due to no native boulders on site;
- STA 107+60 – boulder sill replaced with log sill due to no native boulders on site; and
- STA 107+95 - STA 108+12 – no suitable sod on site. Banks quickly stabilized with seeded vegetation and coir fiber matting.

2.1.2 Big Bugaboo Reach 2

- STA 111+24 – log sill was added to increase stream bed stability;
- STA 111+23 – STA 111+61 brush toe was added to increase bank stability;
- STA 112+36 - STA 112+57 – riffle, and boulder sill added for increased stream bed stability;
- STA 113+23 & STA 113+63 – boulder sill replaced with log sill due to no native boulders on site;
- STA 114+24 - STA 114+49 & STA 114+68 - STA 114+84 – riffle added for increased stream bed stability;
- STA 114+49 - STA 114+66 & STA 114+85 - STA 115+05 – brush toe added for increased channel stability;
- STA 115+05 - STA 115+86 riffle extended for increased stream bed stability;
- STA 116+26 – log sill replaced with boulder sill for increased stream bed stability;
- STA 117+27 - STA 118+48 – alignment was relocated due to shallow bedrock in proposed location; and
- STA 119+63 - STA 119+79 – No suitable sod on site. Banks quickly stabilized with seeded vegetation and coir fiber matting.

2.1.3 Big Bugaboo Reach 3

- STA 121+81 – boulder sill replaced with log sill due to no native boulders on site;
- STA 124+60 - STA 124+92 brush toe replaced with cover log with extra boulder toe due to on-site brush material was no longer available;
- STA 125+68 – boulder sill replaced with log sill due to no native boulders on site;
- STA 126+28 – concentrated flow outlet added to stabilize bank;
- STA 126+88 – boulder sill replaced with log sill due to no native boulders on site;
- STA 130+23 – boulder sill replaced with log sill due to no native boulders on site; and
- STA 133+01 - STA 133+31 brush toe was added to increase bank stability.

2.1.4 Big Bugaboo Reach 4

- STA 140+28 – log sill added to increase stream bed stability.

2.1.5 UT1

- STA 201+01, STA 201+37, STA 202+00, & STA 202+33 – boulder sill replaced with log sill due to no native boulders on site;
- STA 201+36 – brush toe not installed. Wetland outlet swale was added;
- STA 202+00 - STA 202+22 – brush toe replaced by juncus mats to reduce equipment impact on wetlands. Juncus was harvested with no storage or transportation needed;
- STA 202+83, STA 203+44, STA 203+50, STA 203+66, & STA 203+88 – boulder sill replaced with log sill due to no native boulders on site; and
- STA 202+33 - STA 202+59, STA 202+60 - STA 202+83, & STA 202+83 - STA 203+24 – brush toe removed. Channel cross-section too small to maintain riffle thalweg without piping through the brush toe structure. Additionally, curve radii are large and brush toe not needed for stability.

2.1.6 UT2 Reach 1

- STA 300+24 - Boulder sill replaced with log sill due to no native boulders on site;
- STA 301+53 - STA 301+61 – no suitable sod on site. Banks quickly stabilized with seeded vegetation and coir fiber matting; and
- STA 304+95 - STA 305+38 – bank grading removed. Bank had stable grade at time of construction.



2.1.7 UT2 Reach 2

- STA 306+18 – STA 306+29 & STA 306+43 - STA 306+50 – no suitable sod on site. Banks quickly stabilized with seeded vegetation and coir fiber matting; and
- STA 306+60 - STA 306+68 & STA 306+68 - STA 306+76 – no suitable sod on site. Banks quickly stabilized with seeded vegetation and coir fiber matting.

2.1.8 UT2 Reach 3

- STA 307+49 - STA 307+59 & STA 308+42 – STA 308+53 – no suitable sod on site. Banks quickly stabilized with seeded vegetation and coir fiber matting; and
- STA 309+47 - STA 309+55 & STA 309+77 - STA 309+92 – no suitable sod on site. Banks quickly stabilized with seeded vegetation and coir fiber matting.

2.1.9 UT2 Reach 4

- STA 312+78 - STA 313+04 & STA 313+29 - STA 313+75 – brush toe added to stabilize streambank; and
- STA 313+99 & STA 314+54 – log sill added for additional stream bed stability.

2.1.10 UT2 Reach 5

- STA 315+04 - STA 315+20, STA 315+37 - STA 315+56, & STA 315+77 - STA 315+92 – no suitable sod on site. Banks quickly stabilized with seeded vegetation and coir fiber matting; and
- STA 321+90 - STA 322+05 – log vane replaced by boulder sill and brush toe to increase bank stability.

2.1.11 UT2A Reach 1

- STA 400+06 - STA 402+08 – banks were graded to stabilize credited and non-credited stream sections.

2.1.12 UT2A Reach 2

- STA 402+59 - STA 402+69 – no suitable sod on site. Banks quickly stabilized with seeded vegetation and coir fiber matting;
- STA 405+04 – boulder sill removed. Step pool sills too close together and boulders too large to construct as designed;
- STA 406+40 - STA 406+49 – brush toe replaced with boulder toe to stabilize stream section; and
- STA 406+49 – Boulder toe added to stabilize stream section.

2.1.13 UT2B

- STA 500+00 - STA 501+18 – due to increased degradation, bank grading and grade control added to stabilize EII Reach.

2.1.14 UT3

- STA 601+13 - STA 601+33 & STA 601+47 - STA 601+91 – vegetative soil lifts replaced by brush toe revetment. Proposed cross-section too shallow for multiple soil lifts;
- STA 600+34 - STA 602+60 & STA 603+56 - STA 606+69 – stream realignment for better constructability through pond area;
- STA 605+61 – cover log added for bank stability and habitat creation;
- STA 607+24 – log vane replaced by brush toe and log sill. Log with acceptable dimensions for vane arm not available on site;
- STA 607+67 – UT6 lined with stone bank fortification;



- STA 607+74 - STA 607+88 – vegetative soil lifts replaced by brush toe revetment. Proposed cross-section too shallow for multiple soil lifts;
- STA 608+09 - STA 608+27 – replaced brush toe with stone for bank fortification to protect against cattle trampling and wallowing;
- STA 609+21 – wetland outlet protection installed but not surveyed due to it being covered in coir and vegetation;
- STA 610+09 – replaced log vane with extended brush toe and log sill for bank stabilization;
- STA 610+71 - STA 610+89 & STA 611+78 - STA 612+03 – brush toe was used instead of soil lifts due to channel dimensions not being deep enough for multiple soil lifts; and
- STA 612+80 - STA 612+98 – brush toe was used instead of soil lifts due to channel dimensions not being deep enough for multiple soil lifts.

2.1.15 UT4

- STA 701+14 - STA 701+30 – slope grading not done due to bank having a stable slope and additional grading was not necessary; and
- STA 701+22 - STA 701+29 – outlet protection installed but not surveyed due to vegetation overgrown at confluence. Outlet protection material will be added as needed to maintain stability of the confluence.



Section 3: Monitoring Year 0 Data Assessment

Annual monitoring and site visits were conducted during MY0 to assess the condition of the project. The vegetation and stream success criteria for the Site follow the approved success criteria presented in the Mitigation Plan (Wildlands, 2020). Performance criteria for vegetation, stream, and hydrologic assessment are located in Section 1.2 Table 3: Goals, Performance Criteria, and Functional Improvements.

3.1 Vegetative Assessment

The MY0 vegetative survey was completed in April 2021. Vegetation monitoring resulted in a stem density range of 526 to 648 planted stems per acre which is well above the interim requirement of 320 stems per acre required at MY3. Average stem density was 601 planted stems per acre. All 15 vegetation plots met the interim success criteria and are on track to meet the final success criteria required for MY7. Refer to Appendix A for Vegetation Plot Photographs and the Vegetation Condition Assessment Table and Appendix B for Vegetation Plot Data.

3.2 Vegetation Areas of Concern

No vegetation areas of concern were identified during MY0.

3.3 Stream Assessment

Morphological surveys for MY0 were conducted in April 2021. All streams within the Site are stable and functioning as designed. All 18 cross-sections at the Site show little to no change in the bankfull area and width-to-depth ratio, and bank height ratios are less than 1.2. Substrate measurements indicate the maintenance of coarser material in the riffle reaches and finer particles in the pools. Refer to Appendix A for the Visual Stream Morphology Stability Assessment Table and Stream Photographs. Refer to Appendix C for Stream Geomorphology Data.

3.4 Stream Areas of Concern

No stream areas of concern were identified during MY0.

3.5 Hydrology Assessment

Hydrologic data will be collected and reported during MY1.

3.6 Wetland Assessment

The extent of wetlands will be reverified during MY5. No performance standard is tied to reverification.

3.7 Adaptive Management Plan

No adaptive management plans are needed at this time.

3.8 Monitoring Year 0 Summary

Overall, the Site looks good, is performing as intended, and is on track to meet success criteria. All vegetation plots are on track to exceed the MY3 interim requirement of 320 planted stems per acre, and all streams within the Site are stable and meeting project goals.

Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. All raw data supporting the tables and figures in the appendices are available from DMS upon request.



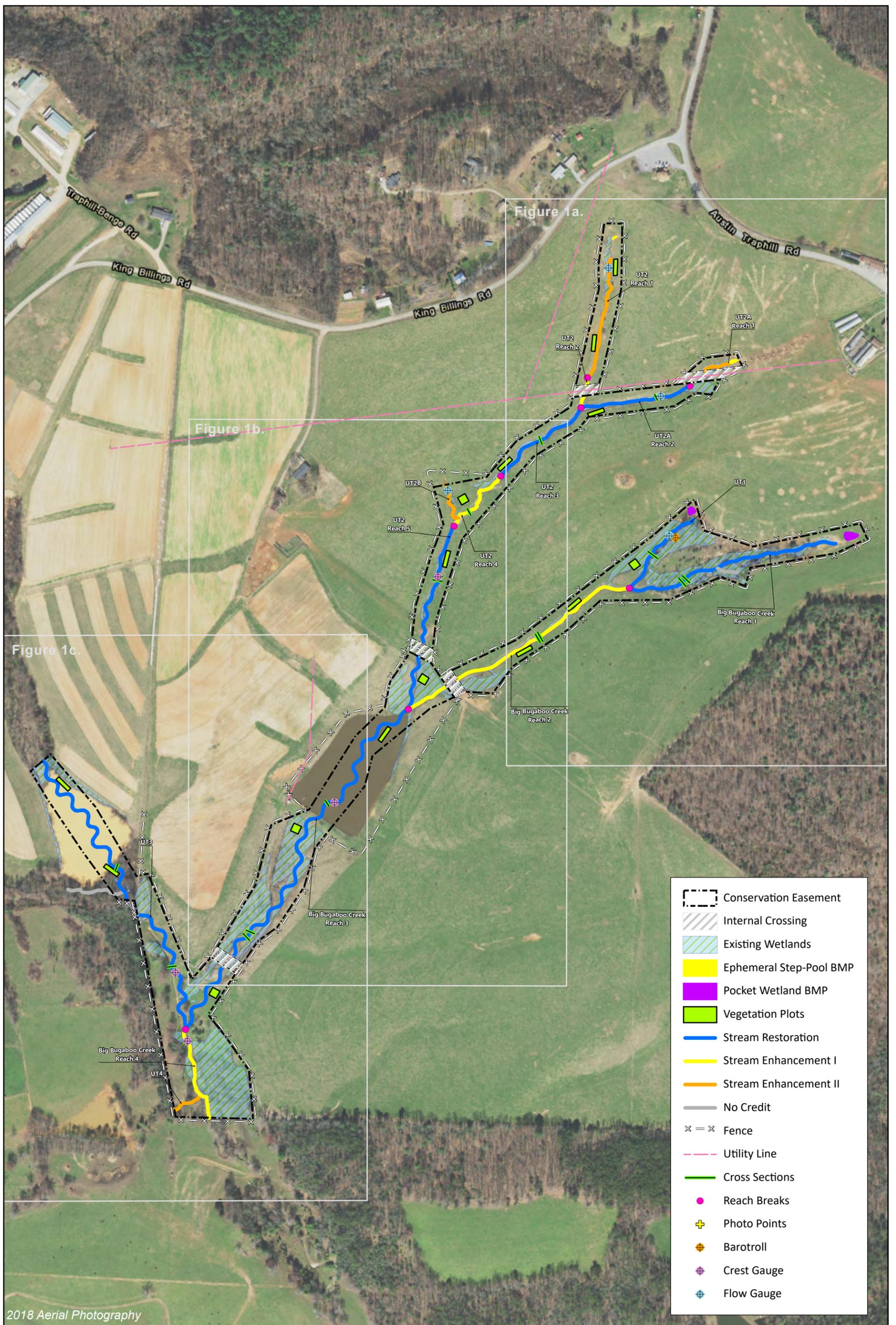
Section 4: METHODOLOGY

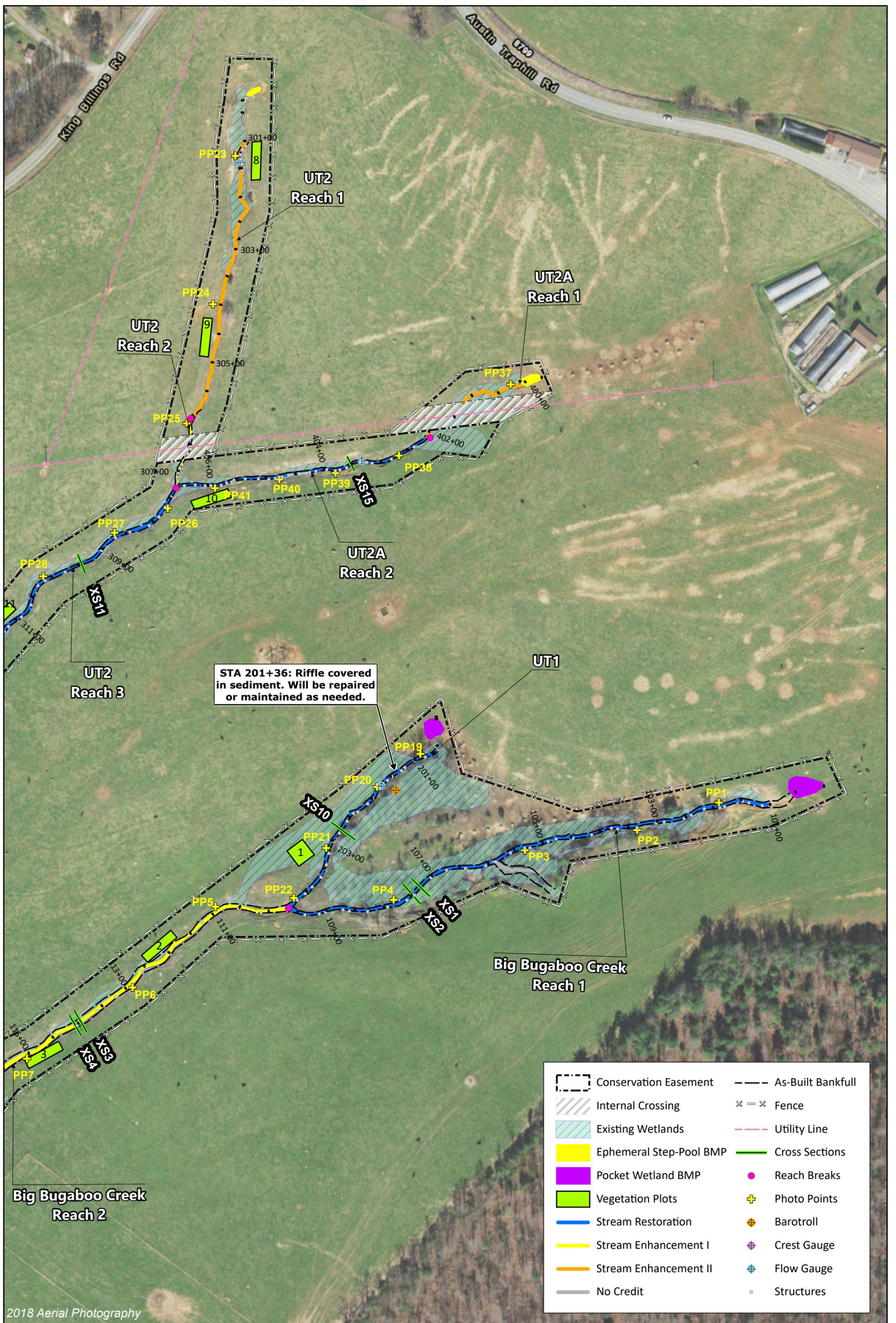
Geomorphic data was collected following the standards outlined in The Stream Channel Reference Site: An Illustrated Guide to Field Techniques (Harrelson et al., 1994) and in Stream Restoration: A Natural Channel Design Handbook (Doll et al., 2003). All Integrated Current Condition Mapping was recorded using a Trimble handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcGIS. Crest gauges and pressure transducers were installed in riffle cross-sections and monitored throughout the year. Hydrologic monitoring instrument installation and monitoring methods are in accordance with the United States Army Corps of Engineers standards (USACE, 2003). Vegetation monitoring protocols followed the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008).

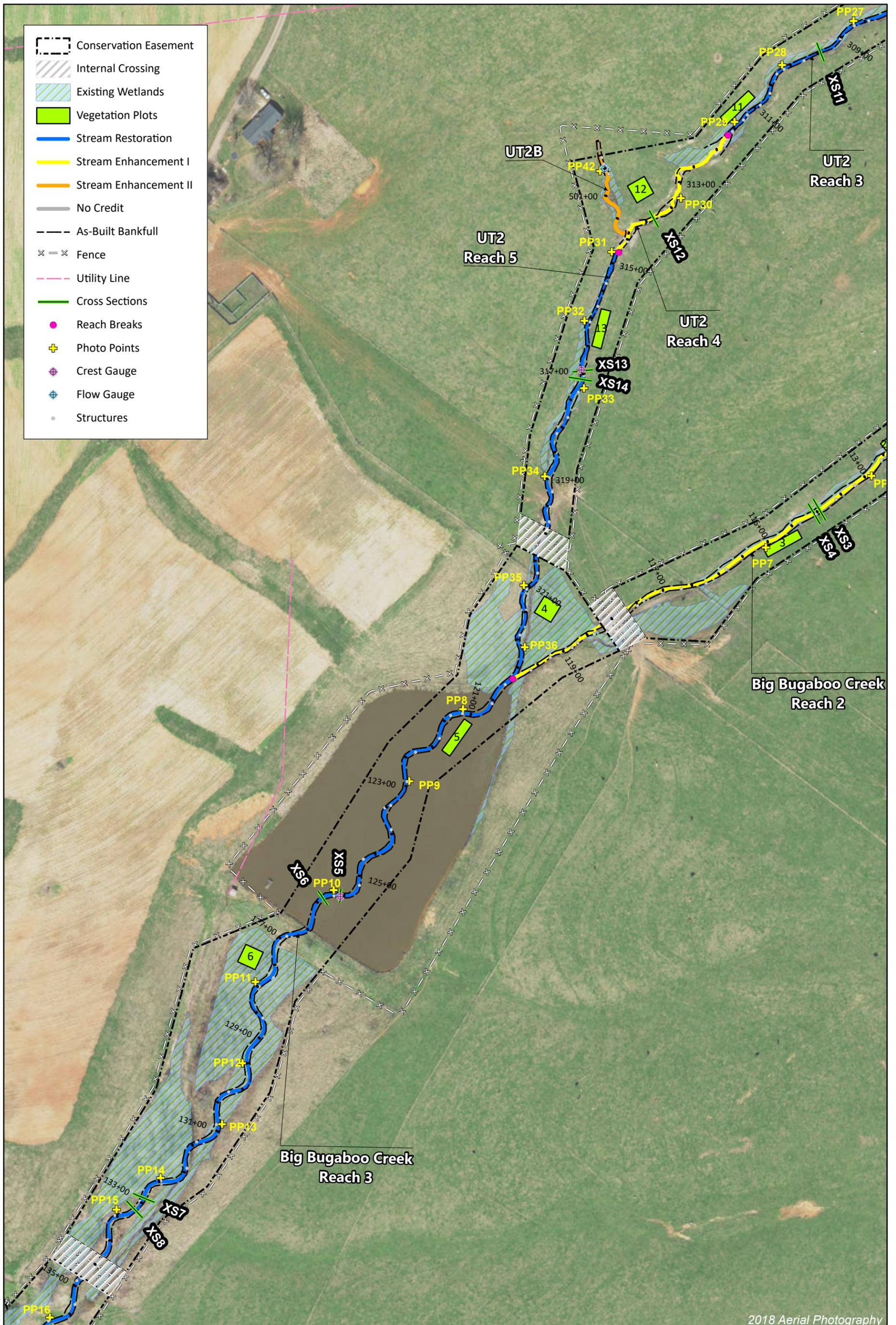


Section 5: REFERENCES

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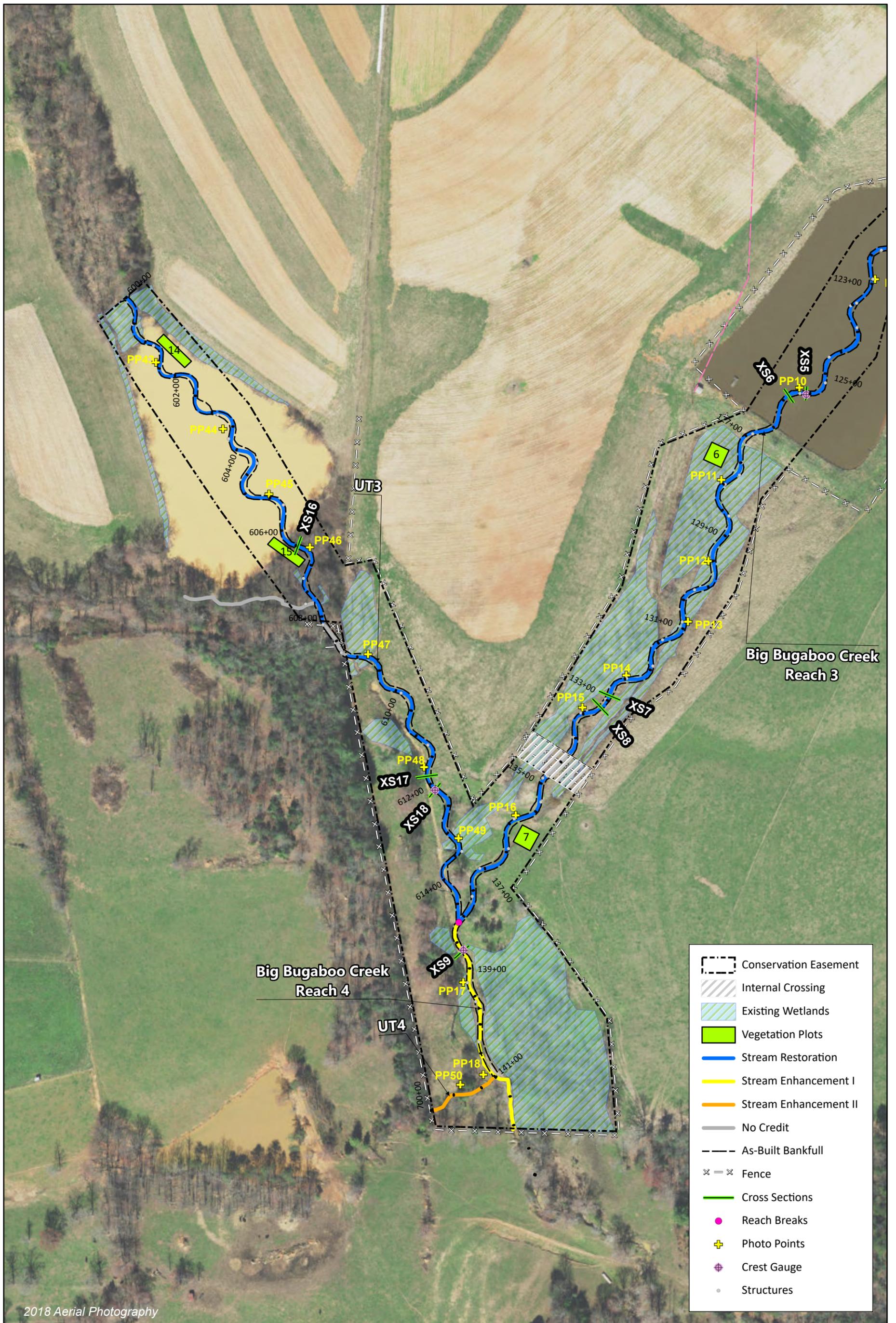


2018 Aerial Photography



Figure 1b. Current Condition Plan View
 Bug Headwaters Mitigation Site
 Yadkin Basin 03040101
 Monitoring Year 0 - 2021

Wilkes County, NC



APPENDIX A. Visual Assessment Data

Table 4. Visual Stream Morphology Stability Assessment Table

Bug Headwaters Mitigation Site
 DMS Project No. 100084
 Monitoring Year 0 - 2021

Big Bugaboo Reach 1 - 4

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	3,996
					Assessed Bank Length	7,992
Bank	Surface Scour/ Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
Totals:					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	25	25		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	58	58		100%

UT1

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	390
					Assessed Bank Length	780
Bank	Surface Scour/ Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
Totals:					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	15	15		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	4	4		100%

Table 4. Visual Stream Morphology Stability Assessment Table

Bug Headwaters Mitigation Site
 DMS Project No. 100084
 Monitoring Year 0 - 2021

UT2 Reach 1 - 5

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	2,053
					Assessed Bank Length	4,106
Bank	Surface Scour/ Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
Totals:					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	22	22		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	30	30		100%

UT2A Reach 1 - 2

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	580
					Assessed Bank Length	1,160
Bank	Surface Scour/ Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
Totals:					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	14	14		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	7	7		100%

Table 4. Visual Stream Morphology Stability Assessment Table

Bug Headwaters Mitigation Site
 DMS Project No. 100084
 Monitoring Year 0 - 2021

UT2B

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	168
					Assessed Bank Length	336
Bank	Surface Scour/ Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
Totals:					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	4	4		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	0	0		N/A

UT3

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	1,384
					Assessed Bank Length	2,768
Bank	Surface Scour/ Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
Totals:					0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0		N/A
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	23	23		100%

Table 4. Visual Stream Morphology Stability Assessment Table

Bug Headwaters Mitigation Site
 DMS Project No. 100084
 Monitoring Year 0 - 2021

UT4

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	128
					Assessed Bank Length	256
Bank	Surface Scour/ Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
					Totals:	0
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0		N/A
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	0	0		N/A

Table 5. Vegetation Condition Assessment Table

Bug Headwaters Mitigation Site

DMS Project No. 100084

Monitoring Year 0 - 2021

Planted Acreage 19.00

Vegetation Category	Definitions	Mapping Threshold (ac)	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10	0	0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10	0	0%
Total			0	0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10	0	0%
Cumulative Total			0.0	0%

Easement Acreage 22.50

Vegetation Category	Definitions	Mapping Threshold (ac)	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Invasive species included in summation above should be identified in report summary.	0.10	0	0%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	none	0 Encroachments Noted / 0 ac	

STREAM PHOTOGRAPHS



PHOTO POINT 1 Big Bugaboo R1 – upstream (03/30/2021)



PHOTO POINT 1 Big Bugaboo R1 – downstream (03/30/2021)



PHOTO POINT 2 Big Bugaboo R1 – upstream (03/30/2021)



PHOTO POINT 2 Big Bugaboo R1 – downstream (03/30/2021)



PHOTO POINT 3 Big Bugaboo R1 – upstream (03/30/2021)



PHOTO POINT 3 Big Bugaboo R1 – downstream (03/30/2021)





PHOTO POINT 4 Big Bugaboo R1 – upstream (03/30/2021)



PHOTO POINT 4 Big Bugaboo R1 – downstream (03/30/2021)



PHOTO POINT 5 Big Bugaboo R2 – upstream (03/30/2021)



PHOTO POINT 5 Big Bugaboo R2 – downstream (03/30/2021)



PHOTO POINT 6 Big Bugaboo R2 – upstream (03/30/2021)



PHOTO POINT 6 Big Bugaboo R2 – downstream (03/30/2021)





PHOTO POINT 7 Big Bugaboo R2 – upstream (03/30/2021)



PHOTO POINT 7 Big Bugaboo R2 – downstream (03/30/2021)



PHOTO POINT 8 Big Bugaboo R3 – upstream (04/29/2021)



PHOTO POINT 8 Big Bugaboo R3 – downstream (04/29/2021)



PHOTO POINT 9 Big Bugaboo R3 – upstream (04/29/2021)



PHOTO POINT 9 Big Bugaboo R3 – downstream (04/29/2021)





PHOTO POINT 10 Big Bugaboo R3 – upstream (04/29/2021)



PHOTO POINT 10 Big Bugaboo R3 – downstream (04/29/2021)



PHOTO POINT 11 Big Bugaboo R3 – upstream (04/29/2021)



PHOTO POINT 11 Big Bugaboo R3 – downstream (04/29/2021)



PHOTO POINT 12 Big Bugaboo R3 – upstream (04/29/2021)



PHOTO POINT 12 Big Bugaboo R3 – downstream (04/29/2021)





PHOTO POINT 13 Big Bugaboo R3 – upstream (04/29/2021)



PHOTO POINT 13 Big Bugaboo R3 – downstream (04/29/2021)



PHOTO POINT 14 Big Bugaboo R3 – upstream (04/29/2021)



PHOTO POINT 14 Big Bugaboo R3 – downstream (04/29/2021)



PHOTO POINT 15 Big Bugaboo R3 – upstream (04/29/2021)

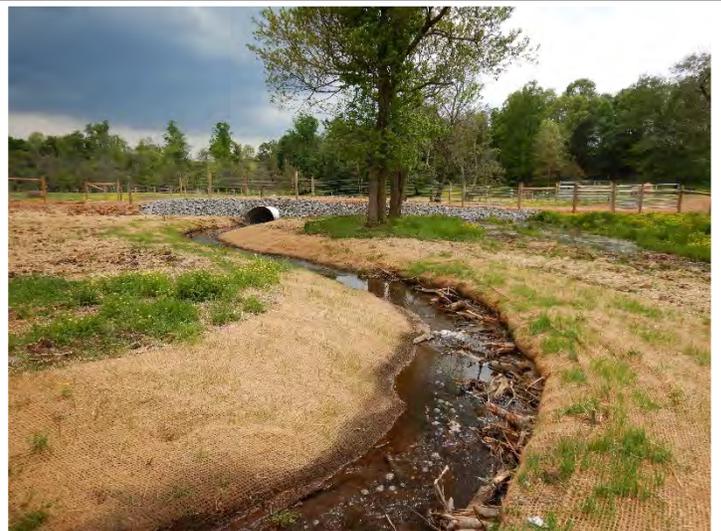


PHOTO POINT 15 Big Bugaboo R3 – downstream (04/29/2021)





PHOTO POINT 16 Big Bugaboo R3 – upstream (04/29/2021)



PHOTO POINT 16 Big Bugaboo R3 – downstream (04/29/2021)



PHOTO POINT 17 Big Bugaboo R4 – upstream (04/21/2021)



PHOTO POINT 17 Big Bugaboo R4 – downstream (04/21/2021)



PHOTO POINT 18 Big Bugaboo R4 – upstream (04/21/2021))



PHOTO POINT 18 Big Bugaboo R4 – downstream (04/21/2021)





PHOTO POINT 19 UT1 – upstream (03/30/2021)



PHOTO POINT 19 UT1 – downstream (03/30/2021)



PHOTO POINT 20 UT1 – upstream (03/30/2021)



PHOTO POINT 20 UT1 – downstream (03/30/2021)



PHOTO POINT 21 UT1 – upstream (03/30/2021)



PHOTO POINT 21 UT1 – downstream (03/30/2021)





PHOTO POINT 22 UT1 – upstream (03/30/2021)



PHOTO POINT 22 UT1 – downstream (03/30/2021)



PHOTO POINT 23 UT2 R1 – upstream (03/30/2021)



PHOTO POINT 23 UT2 R1 – downstream (03/30/2021)



PHOTO POINT 24 UT2 R1 – upstream (03/30/2021)



PHOTO POINT 24 UT2 R1 – downstream (03/30/2021)





PHOTO POINT 25 UT2 R2 – upstream (03/30/2021)



PHOTO POINT 25 UT2 R2 – downstream (03/30/2021)



PHOTO POINT 26 UT2 R3 – upstream (03/30/2021)



PHOTO POINT 26 UT2 R3 – downstream (03/30/2021)



PHOTO POINT 27 UT2 R3 – upstream (03/30/2021)



PHOTO POINT 27 UT2 R3 – downstream (03/30/2021)





PHOTO POINT 28 UT2 R3 – upstream (03/30/2021)



PHOTO POINT 28 UT2 R3 – downstream (03/30/2021)



PHOTO POINT 29 UT2 R3 – upstream (03/30/2021)



PHOTO POINT 29 UT2 R3 – downstream (03/30/2021)



PHOTO POINT 30 UT2 R4 – upstream (03/30/2021)



PHOTO POINT 30 UT2 R4 – downstream (03/30/2021)





PHOTO POINT 31 UT2 R5 – upstream (03/30/2021)



PHOTO POINT 31 UT2 R5 – downstream (03/30/2021)



PHOTO POINT 32 UT2 R5 – upstream (03/30/2021)



PHOTO POINT 32 UT2 R5 – downstream (03/30/2021)



PHOTO POINT 33 UT2 R5 – upstream (03/30/2021)



PHOTO POINT 33 UT2 R5 – downstream (03/30/2021)





PHOTO POINT 34 UT2 R5 – upstream (04/29/2021)



PHOTO POINT 34 UT2 R5 – downstream (04/29/2021)



PHOTO POINT 35 UT2 R5 – upstream (04/29/2021)



PHOTO POINT 35 UT2 R5 – downstream (04/29/2021)



PHOTO POINT 36 UT2 R5 – upstream (05/06/2021)



PHOTO POINT 36 UT2 R5 – downstream (05/06/2021)





PHOTO POINT 37 UT2A R1 – upstream (03/30/2021)



PHOTO POINT 37 UT2A R1 – downstream (03/30/2021)



PHOTO POINT 38 UT2A R2 – upstream (03/30/2021)



PHOTO POINT 38 UT2A R2 – downstream (03/30/2021)



PHOTO POINT 39 UT2A R2 – upstream (03/30/2021)



PHOTO POINT 39 UT2A R2 – downstream (03/30/2021)





PHOTO POINT 40 UT2A R2 – upstream (03/30/2021)



PHOTO POINT 40 UT5A – downstream (03/30/2021)



PHOTO POINT 41 UT2A R2 – upstream (03/30/2021)



PHOTO POINT 41 UT2A R2 – downstream (03/30/2021)



PHOTO POINT 42 UT2B – upstream (05/06/2021)



PHOTO POINT 42 UT2B – downstream (05/06/2021)





PHOTO POINT 43 UT3 – upstream (05/06/2021)



PHOTO POINT 43 UT3 – downstream (05/06/2021)



PHOTO POINT 44 UT3 – upstream (05/06/2021)



PHOTO POINT 44 UT3 – downstream (05/06/2021)



PHOTO POINT 45 UT3 – upstream (05/06/2021)



PHOTO POINT 45 UT3 – downstream (05/06/2021)





PHOTO POINT 46 UT3 – upstream (05/06/2021)



PHOTO POINT 46 UT3 – downstream (05/06/2021)



PHOTO POINT 47 UT3 – upstream (05/06/2021)



PHOTO POINT 47 UT3 – downstream (05/06/2021)



PHOTO POINT 48 UT3 – upstream (04/21/2021)



PHOTO POINT 48 UT3 – downstream (04/21/2021)





PHOTO POINT 49 UT3 – upstream (04/21/2021)



PHOTO POINT 49 UT3 – downstream (04/21/2021)



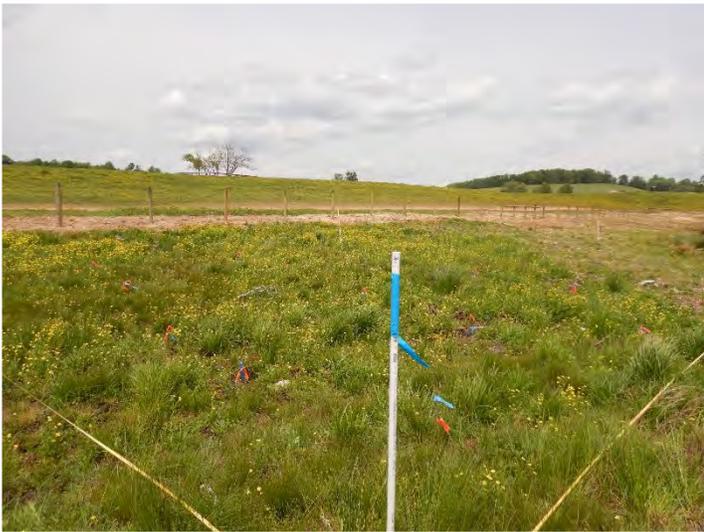
PHOTO POINT 50 UT4 – upstream (04/21/2021)



PHOTO POINT 50 UT4 – downstream (04/21/2021)



VEGETATION PLOT PHOTOGRAPHS



VEG PLOT 1 (4/29/2021)



VEG PLOT 2 (4/29/2021)



VEG PLOT 3 (4/29/2021)



VEG PLOT 4 (4/29/2021)



VEG PLOT 5 (4/29/2021)



VEG PLOT 6 (4/29/2021)





VEG PLOT 7 (4/29/2021)



VEG PLOT 8 (4/29/2021)



VEG PLOT 9 (4/29/2021)



VEG PLOT 10 (4/29/2021)



VEG PLOT 11 (4/29/2021)



VEG PLOT 12 (4/29/2021)





VEG PLOT 13 (4/29/2021)



VEG PLOT 14 (4/29/2021)



VEG PLOT 15 (4/29/2021)



APPENDIX B. Vegetation Plot Data

Table 6. Vegetation Plot Data

Bug Headwaters Mitigation Site

DMS Project No. 100084

Monitoring Year 0 - 2021

Planted Acreage	19.00
Date of Initial Plant	2021-04-29
Date of Current Survey	2021-04-29
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/ Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F	
					Planted	Total								
Species Included in Approved Mitigation Plan	Acer negundo	boxelder	Tree	FAC	1	1	1	1			2	2	3	3
	Betula nigra	river birch	Tree	FACW	3	3	3	3	3	3	3	3		
	Diospyros virginiana	common persimmon	Tree	FAC			1	1	1	1				
	Liriodendron tulipifera	tuliptree	Tree	FACU					1	1				
	Morus rubra	red mulberry	Tree	FACU			1	1					1	1
	Nyssa sylvatica	blackgum	Tree	FAC	3	3	1	1	1	1	2	2		
	Platanus occidentalis	American sycamore	Tree	FACW	3	3	1	1	3	3	1	1	3	3
	Prunus serotina	black cherry	Tree	FACU										
	Quercus phellos	willow oak	Tree	FAC	3	3	2	2	4	4	3	3	3	3
	Quercus rubra	northern red oak	Tree	FACU			1	1	2	2				
Ulmus americana	American elm	Tree	FACW	2	2	5	5			4	4	2	2	
Ulmus rubra	slippery elm	Tree	FAC									3	3	
Sum	Performance Standard				15	15	16	16	15	15	15	15	15	15
Mitigation Plan Performance Standard	Current Year Stem Count					15		16		15		15		15
	Stems/Acre					607		648		607		607		607
	Species Count					6		9		7		6		6
	Dominant Species Composition (%)					20		31		27		27		20
	Average Plot Height					2		2		2		2		2
% Invasives					0		0		0		0		0	
Post Mitigation Plan Performance Standard	Current Year Stem Count					15		16		15		15		15
	Stems/Acre					607		648		607		607		607
	Species Count					6		9		7		6		6
	Dominant Species Composition (%)					20		31		27		27		20
	Average Plot Height					2		2		2		2		2
% Invasives					0		0		0		0		0	

Table 6. Vegetation Plot Data

Bug Headwaters Mitigation Site

DMS Project No. 100084

Monitoring Year 0 - 2021

Planted Acreage	19.00
Date of Initial Plant	2021-04-29
Date of Current Survey	2021-04-29
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/ Shrub	Indicator Status	Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F		Veg Plot 9 F		Veg Plot 10 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Acer negundo	boxelder	Tree	FAC	3	3	1	1	1	1				
	Betula nigra	river birch	Tree	FACW	3	3	2	2			2	2	4	4
	Diospyros virginiana	common persimmon	Tree	FAC			1	1	1	1	2	2		
	Liriodendron tulipifera	tuliptree	Tree	FACU					1	1				
	Morus rubra	red mulberry	Tree	FACU			1	1	2	2				
	Nyssa sylvatica	blackgum	Tree	FAC			2	2	1	1	2	2	2	2
	Platanus occidentalis	American sycamore	Tree	FACW	3	3	2	2	1	1	3	3	3	3
	Prunus serotina	black cherry	Tree	FACU					2	2	1	1		
	Quercus phellos	willow oak	Tree	FAC	3	3	2	2	3	3	2	2	2	2
	Quercus rubra	northern red oak	Tree	FACU			1	1			2	2	2	2
Ulmus americana	American elm	Tree	FACW			1	1	3	3	1	1	2	2	
Ulmus rubra	slippery elm	Tree	FAC			3	3							
Sum	Performance Standard				15	15	13	13	15	15	15	15	15	15
Mitigation Plan Performance Standard	Current Year Stem Count					15		13		15		15		15
	Stems/Acre					607		526		607		607		607
	Species Count					5		9		9		8		6
	Dominant Species Composition (%)					20		15		20		20		27
	Average Plot Height					2		2		2		2		2
% Invasives					0		0		0		0		0	
Post Mitigation Plan Performance Standard	Current Year Stem Count					15		13		15		15		15
	Stems/Acre					607		526		607		607		607
	Species Count					5		9		9		8		6
	Dominant Species Composition (%)					20		15		20		20		27
	Average Plot Height					2		2		2		2		2
% Invasives					0		0		0		0		0	

Table 6. Vegetation Plot Data

Bug Headwaters Mitigation Site

DMS Project No. 100084

Monitoring Year 0 - 2021

Planted Acreage	19.00
Date of Initial Plant	2021-04-29
Date of Current Survey	2021-04-29
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/ Shrub	Indicator Status	Veg Plot 11 F		Veg Plot 12 F		Veg Plot 13 F		Veg Plot 14 F		Veg Plot 15 F	
					Planted	Total								
Species Included in Approved Mitigation Plan	Acer negundo	boxelder	Tree	FAC	1	1	1	1	1	1	1	1	6	6
	Betula nigra	river birch	Tree	FACW	2	2	2	2	3	3	1	1	2	2
	Diospyros virginiana	common persimmon	Tree	FAC										
	Liriodendron tulipifera	tuliptree	Tree	FACU	2	2								
	Morus rubra	red mulberry	Tree	FACU			1	1	1	1				
	Nyssa sylvatica	blackgum	Tree	FAC	2	2	2	2	3	3	2	2	1	1
	Platanus occidentalis	American sycamore	Tree	FACW	1	1	2	2	2	2	3	3	1	1
	Prunus serotina	black cherry	Tree	FACU			1	1						
	Quercus phellos	willow oak	Tree	FAC	2	2	2	2	1	1	4	4	2	2
	Quercus rubra	northern red oak	Tree	FACU	2	2	2	2			1	1		
Ulmus americana	American elm	Tree	FACW	3	3	2	2	3	3	1	1	1	1	
Ulmus rubra	slippery elm	Tree	FAC					1	1	2	2	1	1	
Sum	Performance Standard				15	15	15	15	15	15	15	15	14	14
Mitigation Plan Performance Standard	Current Year Stem Count					15		15		15		15		14
	Stems/Acre					607		607		607		607		567
	Species Count					8		9		8		8		7
	Dominant Species Composition (%)					20		13		20		27		43
	Average Plot Height					2		2		2		2		2
% Invasives					0		0		0		0		0	
Post Mitigation Plan Performance Standard	Current Year Stem Count					15		15		15		15		14
	Stems/Acre					607		607		607		607		567
	Species Count					8		9		8		8		7
	Dominant Species Composition (%)					20		13		20		27		43
	Average Plot Height					2		2		2		2		2
% Invasives					0		0		0		0		0	

Table 7. Vegetation Performance Standards Summary Table

Bug Headwaters Mitigation Site

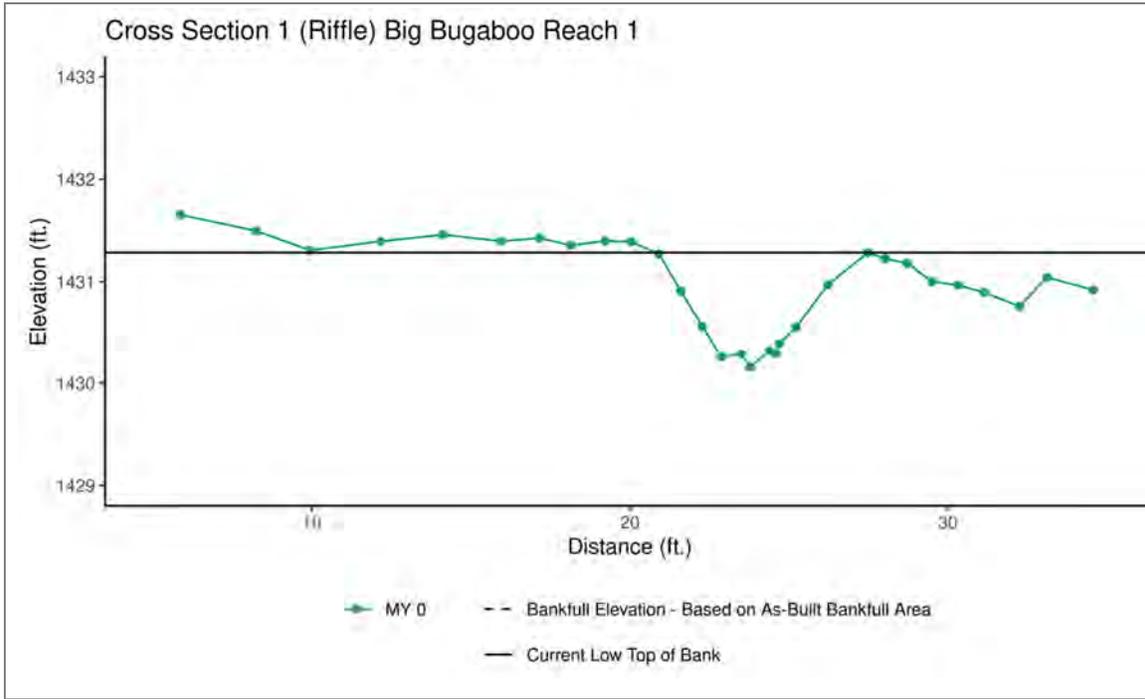
DMS Project No. 100084

Monitoring Year 0 - 2021

	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	607	2	6	0	648	2	9	0	607	2	7	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	607	2	6	0	607	2	6	0	607	2	5	0
	Veg Plot 7 F				Veg Plot 8 F				Veg Plot 9 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	526	2	9	0	607	2	9	0	607	2	8	0
	Veg Plot 10 F				Veg Plot 11 F				Veg Plot 12 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	607	2	6	0	607	2	8	0	607	2	9	0
	Veg Plot 13 F				Veg Plot 14 F				Veg Plot 15 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	607	2	8	0	607	2	8	0	567	2	7	0

APPENDIX C. Stream Geomorphology Data

Cross-Section Plots

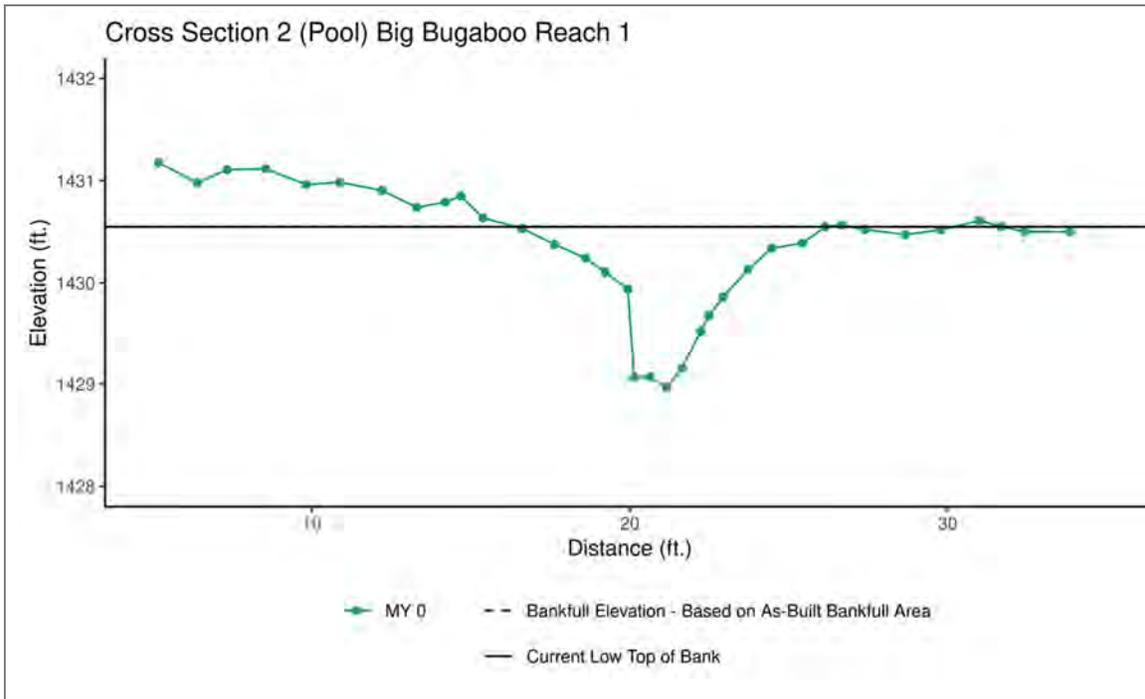


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,431.28					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,430.16					
LTOB Elevation	1,431.28					
LTOB Max Depth	1.127					
LTOB Cross Sectional Area	4.03					



Downstream (03/30/2021)



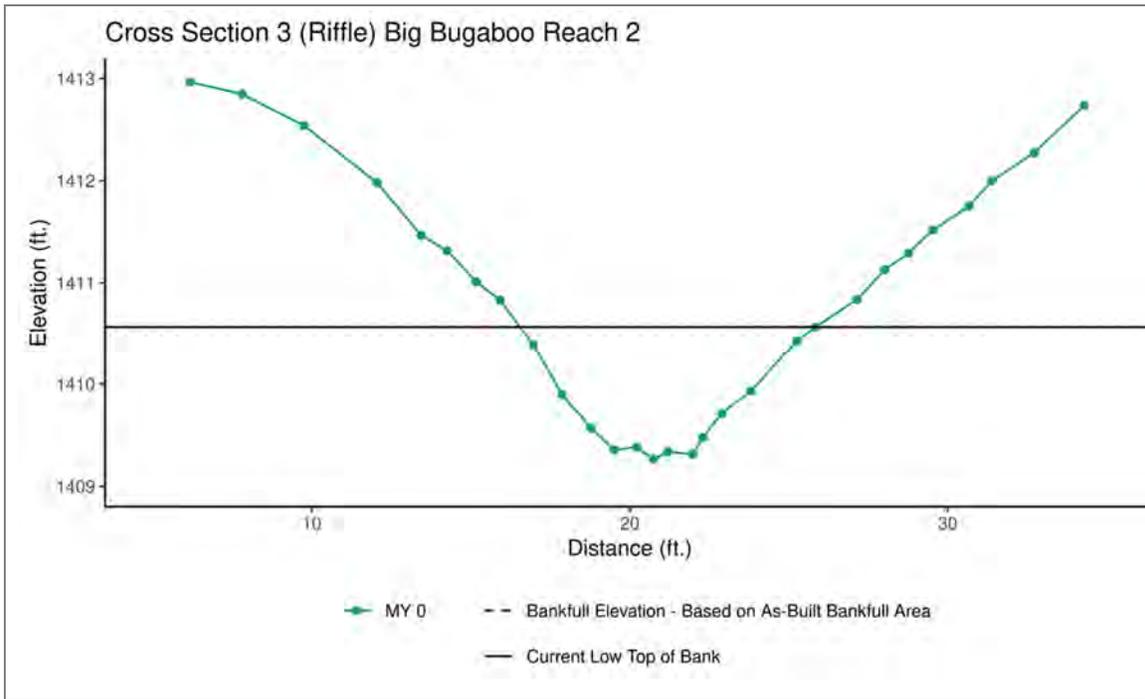


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,430.55					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,428.97					
LTOB Elevation	1,430.55					
LTOB Max Depth	1.582					
LTOB Cross Sectional Area	5.61					



Downstream (03/30/2021)

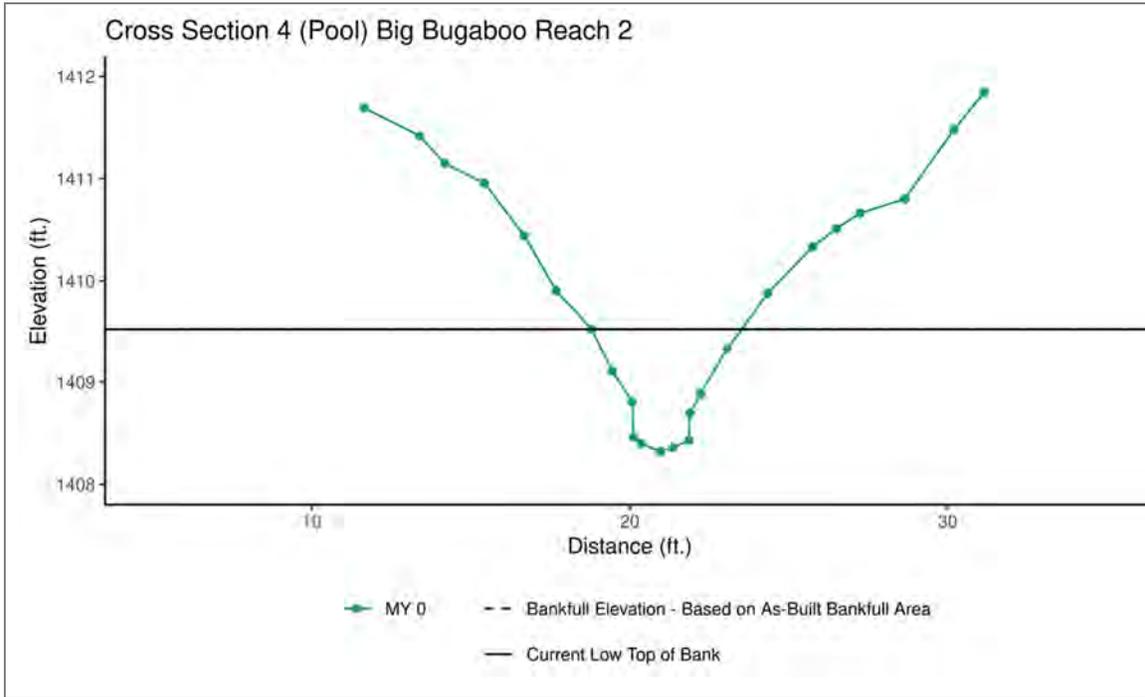




	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,410.57					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,409.27					
LTOB Elevation	1,410.57					
LTOB Max Depth	1.301					
LTOB Cross Sectional Area	7.26					



Downstream (03/30/2021)

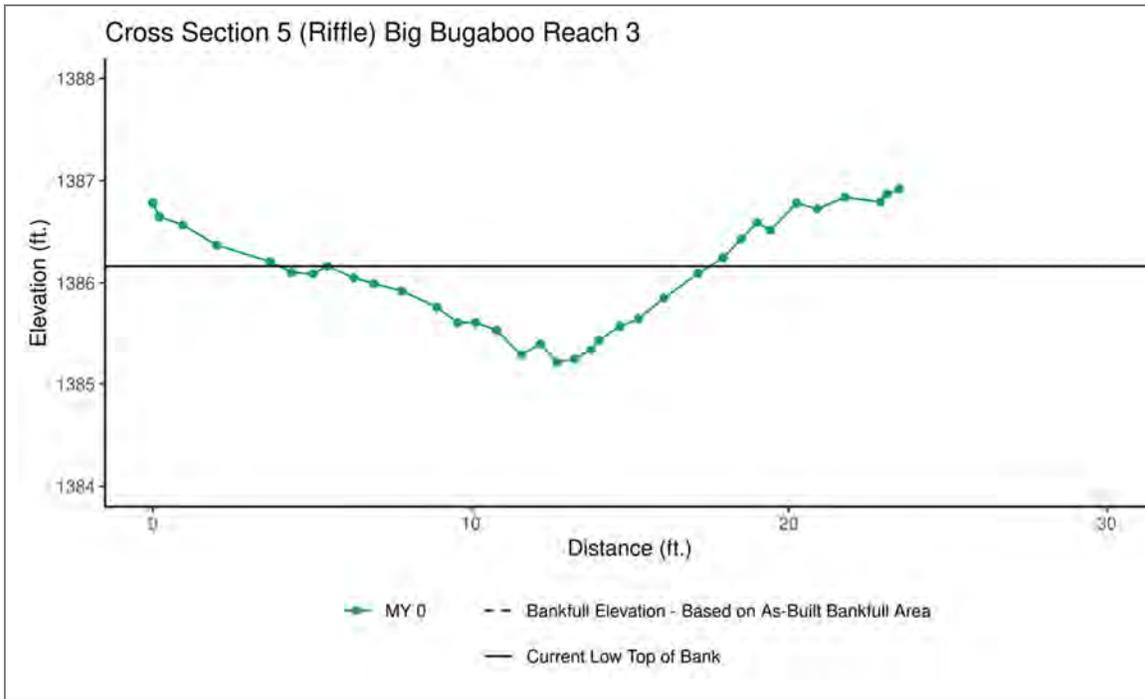


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,409.53					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,408.32					
LTOB Elevation	1,409.53					
LTOB Max Depth	1.205					
LTOB Cross Sectional Area	3.20					



Downstream (03/30/2021)



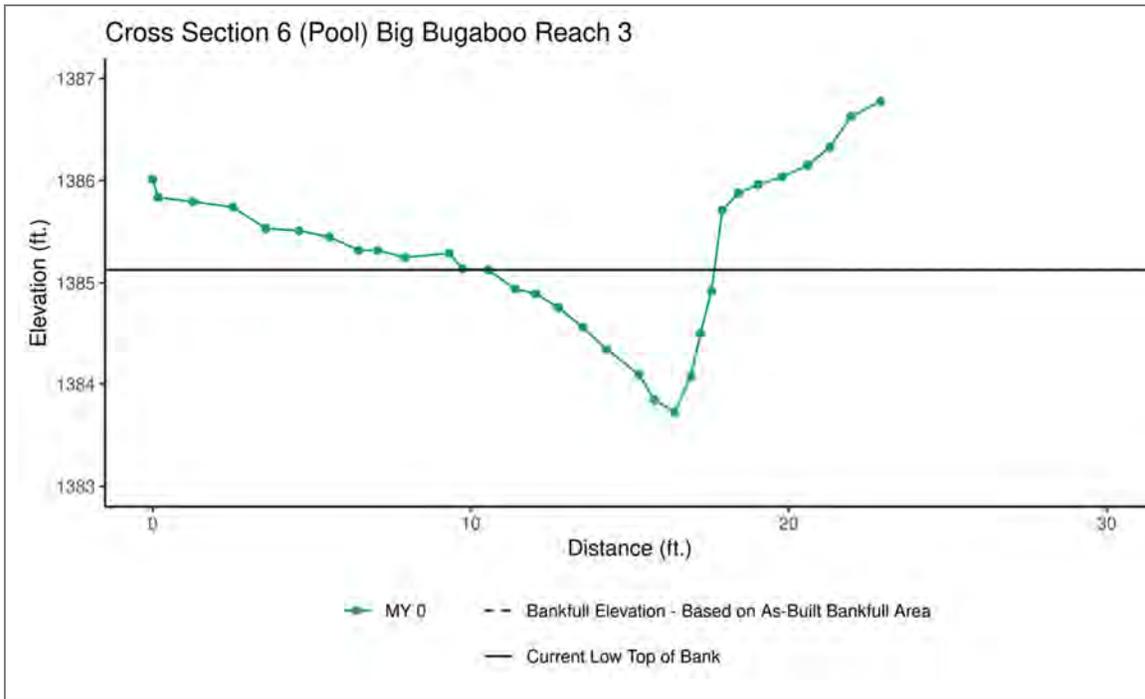


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,386.16					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,385.21					
LTOB Elevation	1,386.16					
LTOB Max Depth	0.949					
LTOB Cross Sectional Area	5.66					



Downstream (04/29/2021)



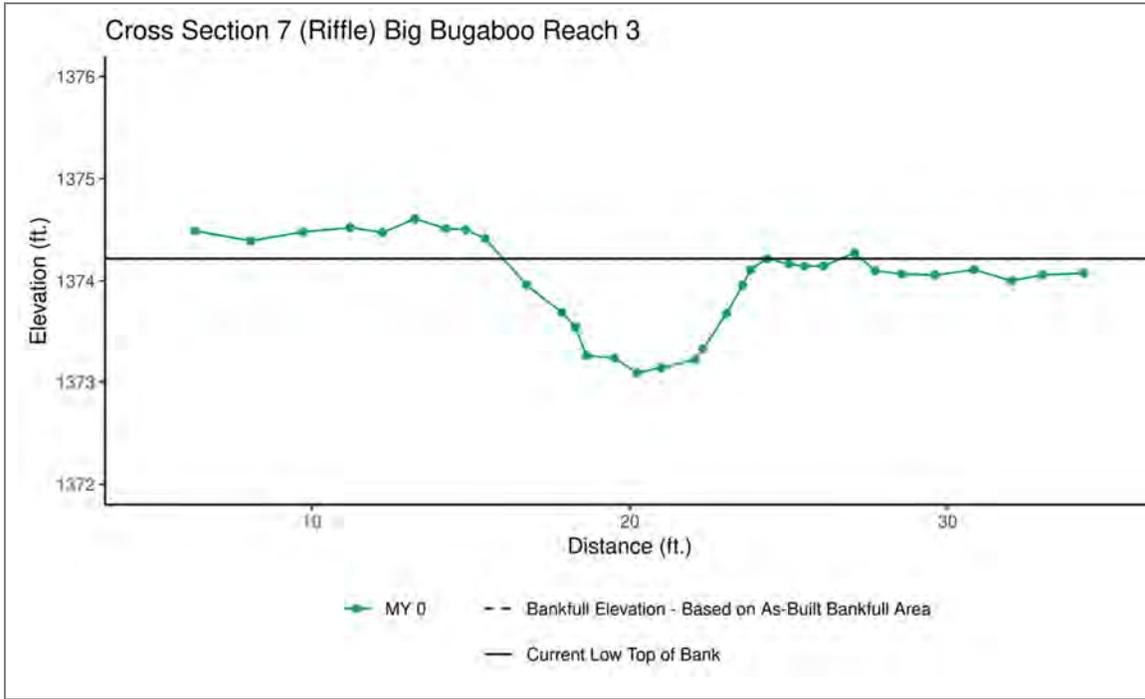


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,385.13					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,383.73					
LTOB Elevation	1,385.13					
LTOB Max Depth	1.4					
LTOB Cross Sectional Area	4.66					



Downstream (04/29/2021)



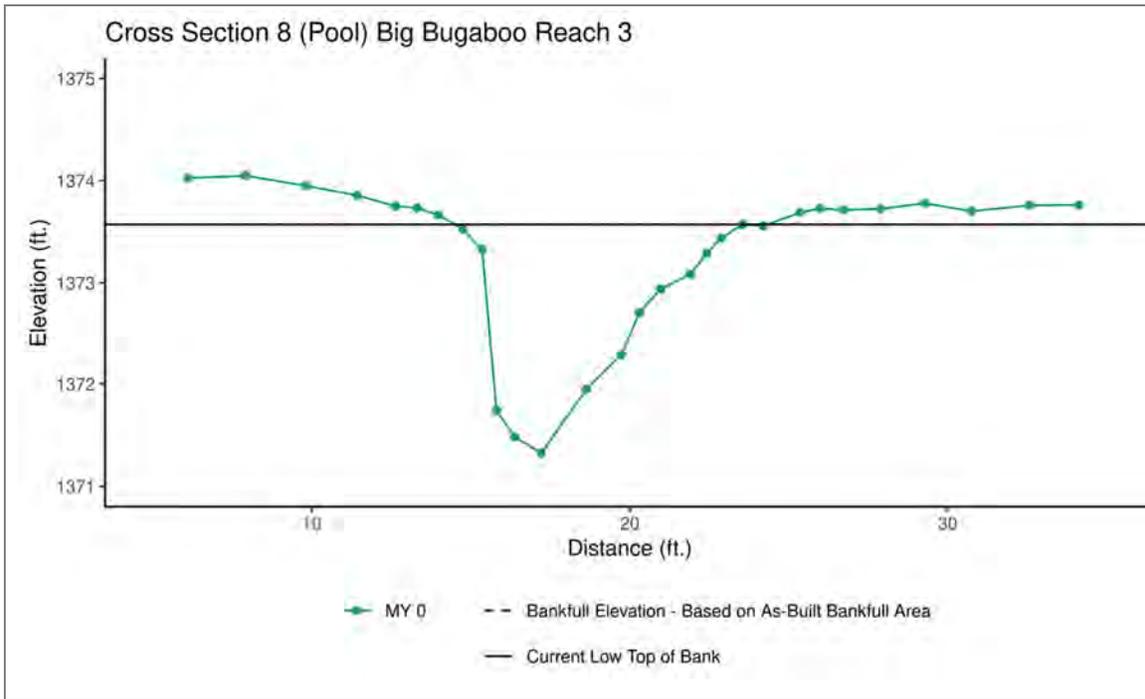


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,374.22					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,373.09					
LTOB Elevation	1,374.22					
LTOB Max Depth	1.126					
LTOB Cross Sectional Area	5.64					



Downstream (04/14/2021)



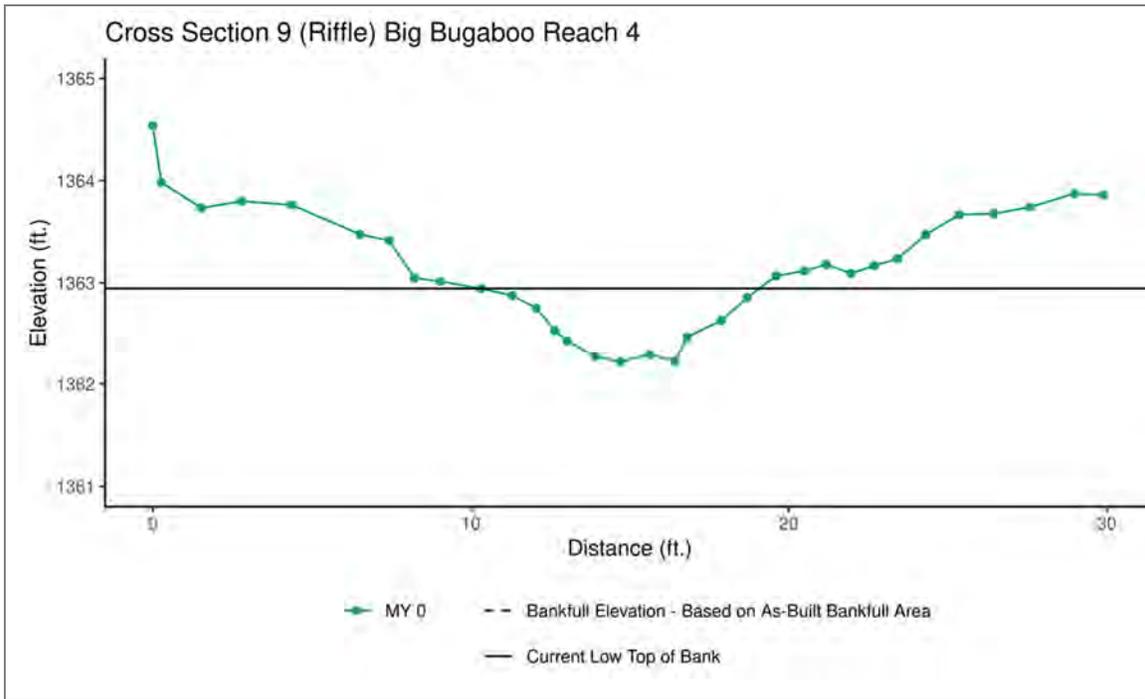


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,373.57					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,371.33					
LTOB Elevation	1,373.57					
LTOB Max Depth	2.246					
LTOB Cross Sectional Area	9.80					



Downstream (04/14/2021)



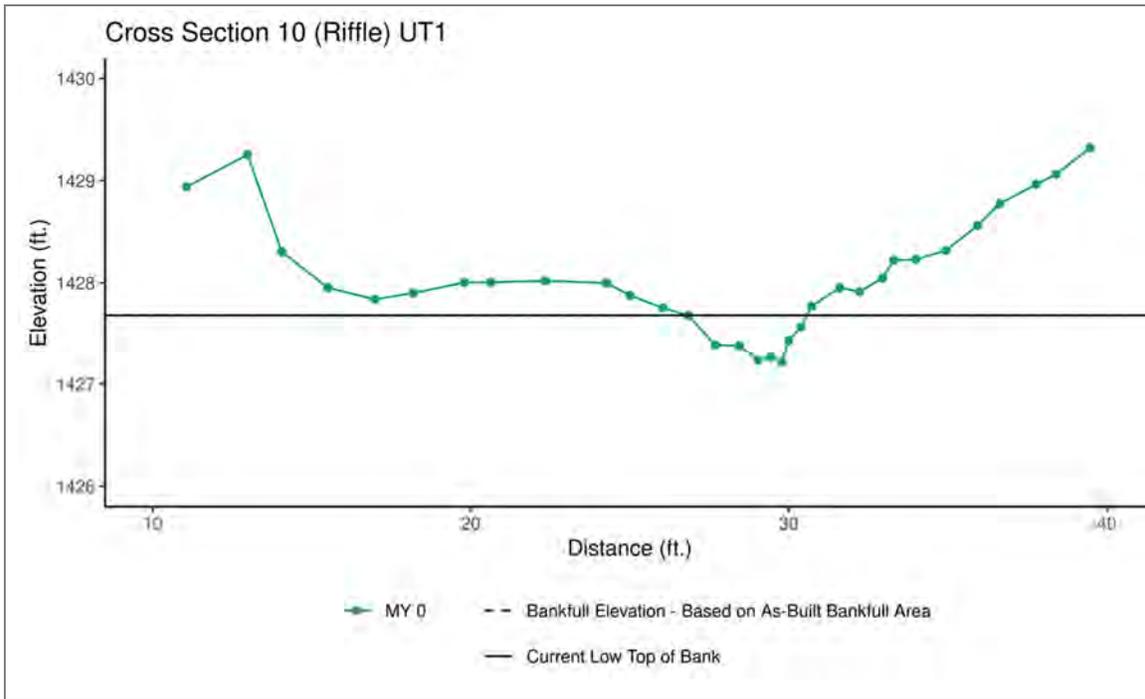


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,362.95					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,362.22					
LTOB Elevation	1,362.95					
LTOB Max Depth	0.726					
LTOB Cross Sectional Area	3.58					



Downstream (04/21/2021)



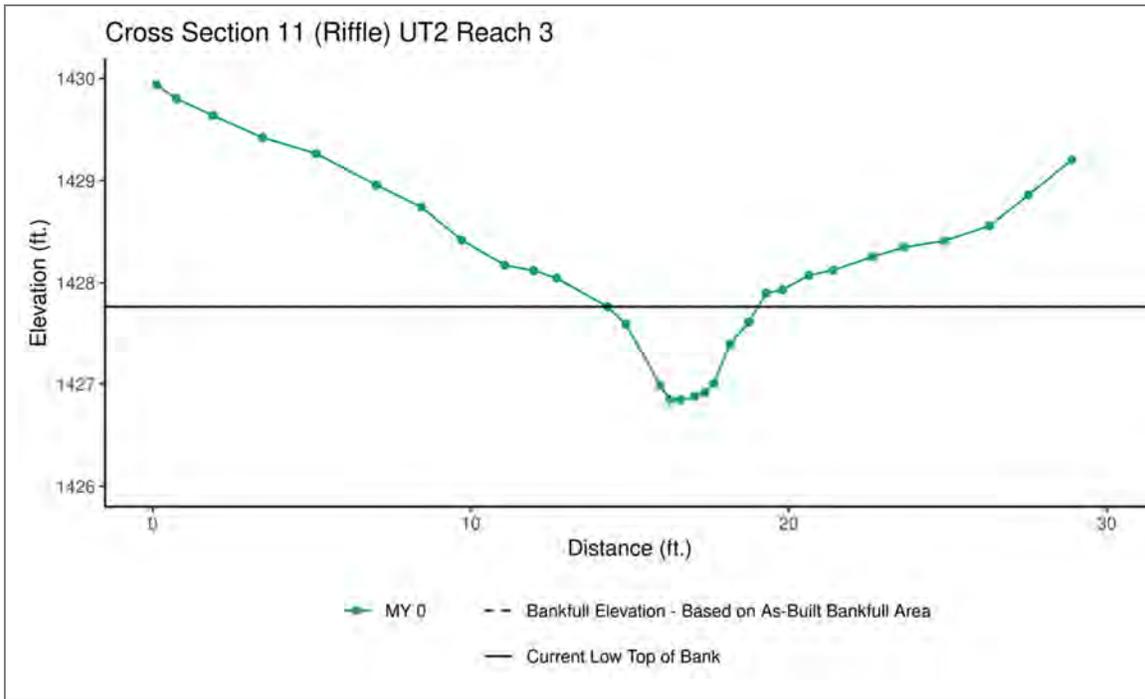


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,427.68					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,427.22					
LTOB Elevation	1,427.68					
LTOB Max Depth	0.46					
LTOB Cross Sectional Area	1.05					



Downstream (03/30/2021)



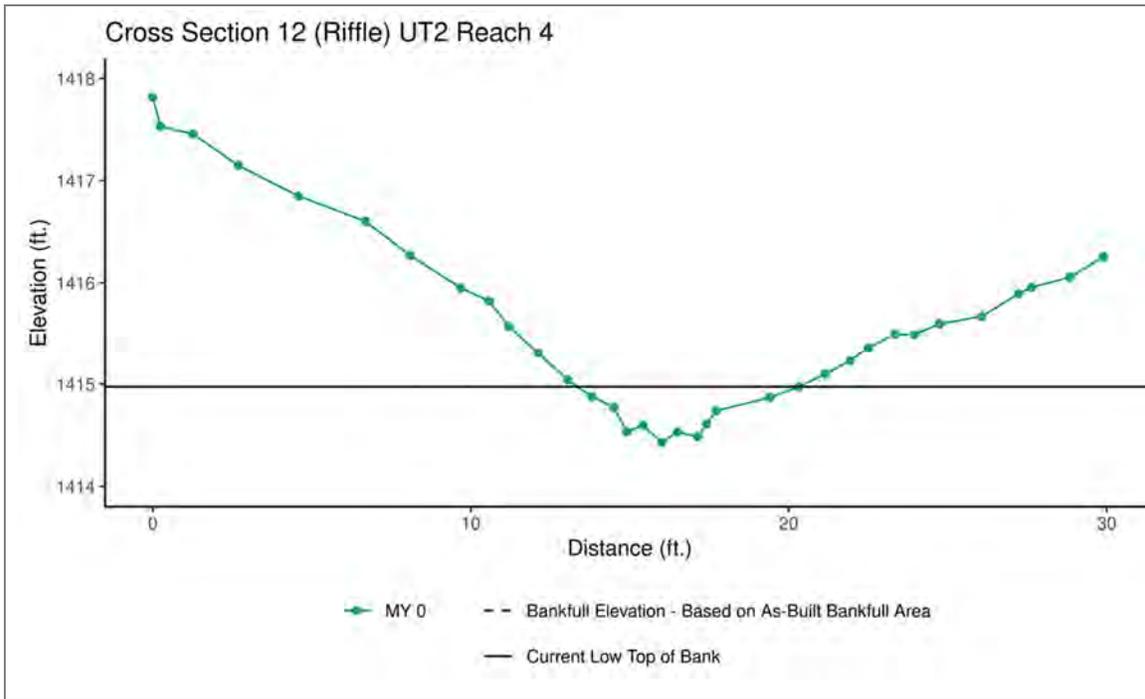


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,427.77					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,426.85					
LTOB Elevation	1,427.77					
LTOB Max Depth	0.922					
LTOB Cross Sectional Area	2.50					



Downstream (03/30/2021)

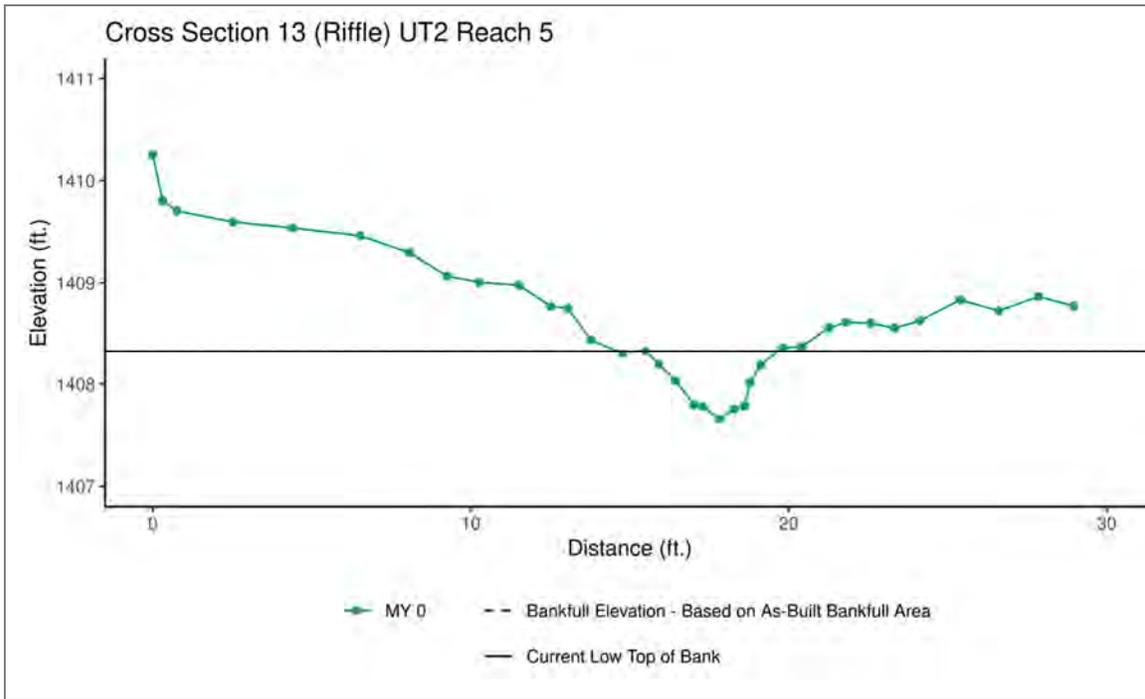




	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,414.97					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,414.43					
LTOB Elevation	1,414.97					
LTOB Max Depth	0.545					
LTOB Cross Sectional Area	1.82					



Downstream (03/30/2021)

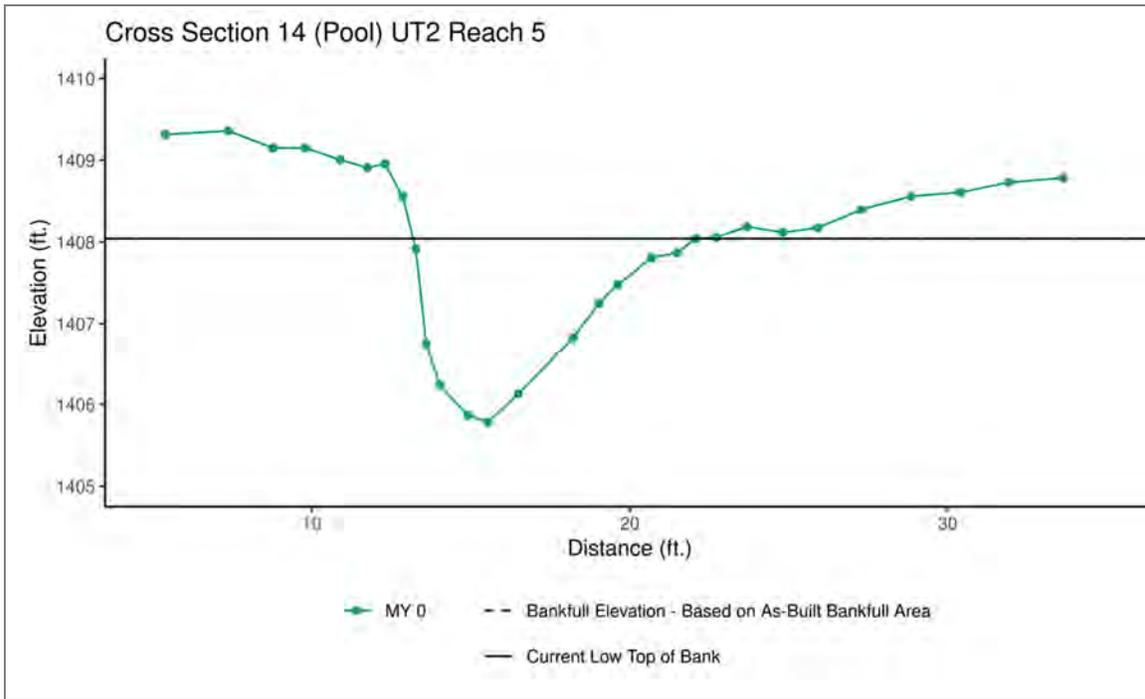


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,408.33					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,407.66					
LTOB Elevation	1,408.33					
LTOB Max Depth	0.668					
LTOB Cross Sectional Area	1.50					



Downstream (03/30/2021)



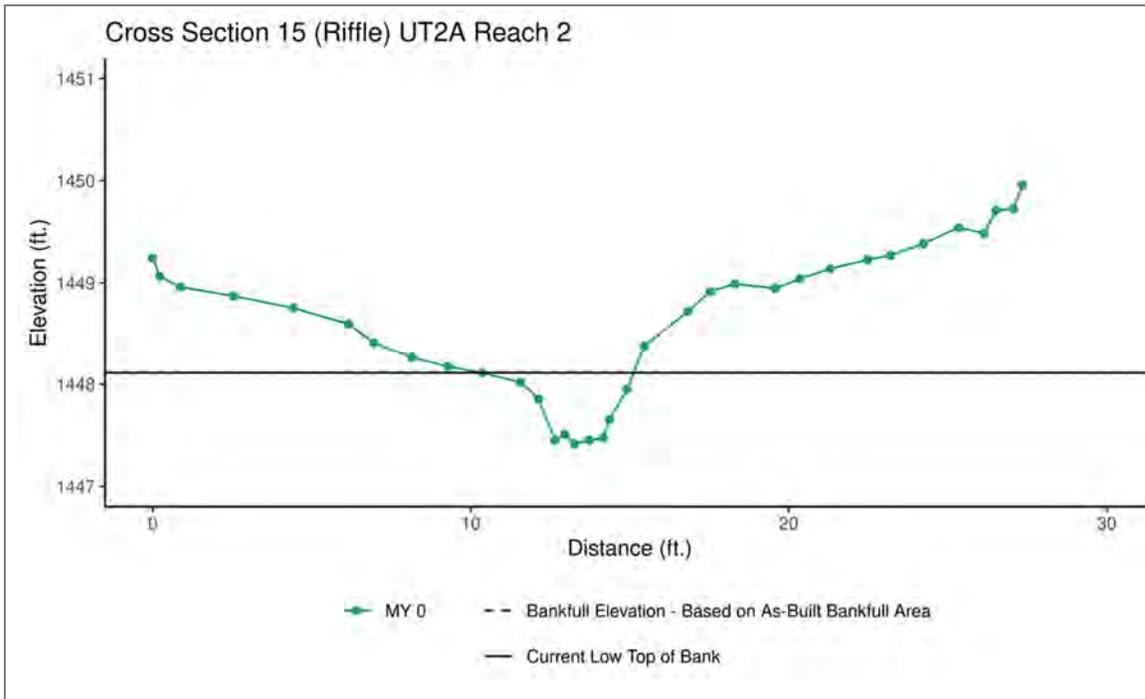


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,408.04					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,405.79					
LTOB Elevation	1,408.04					
LTOB Max Depth	2.255					
LTOB Cross Sectional Area	10.58					



Downstream (03/30/2021)



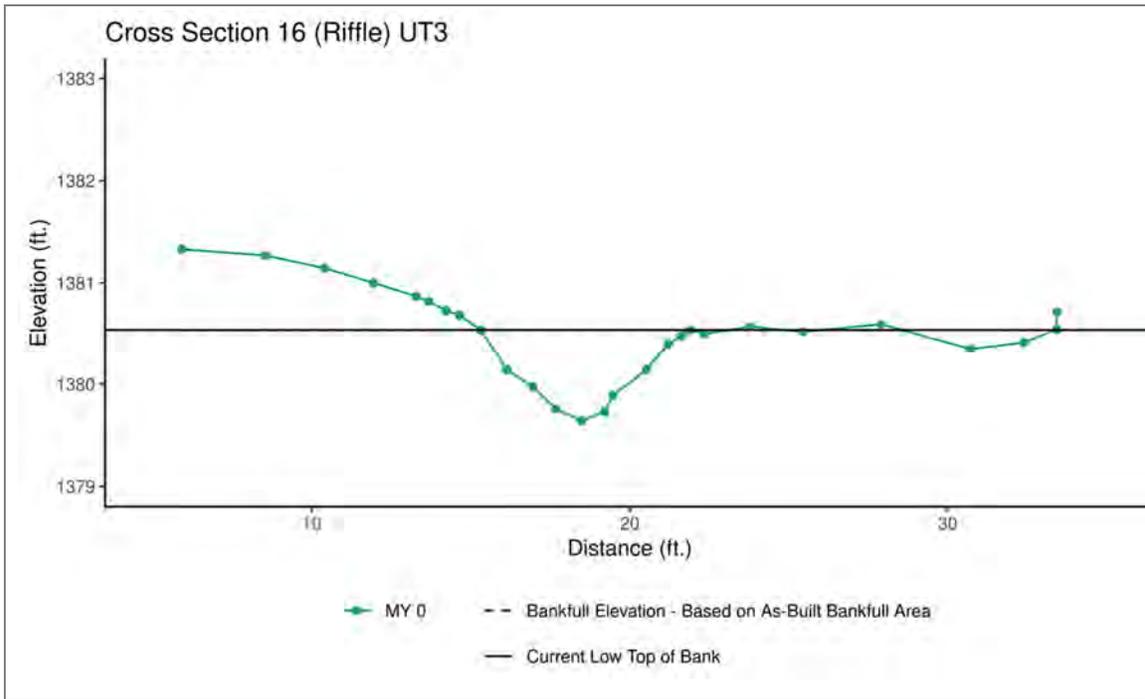


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,448.11					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,447.42					
LTOB Elevation	1,448.11					
LTOB Max Depth	0.694					
LTOB Cross Sectional Area	1.68					



Downstream (03/30/2021)



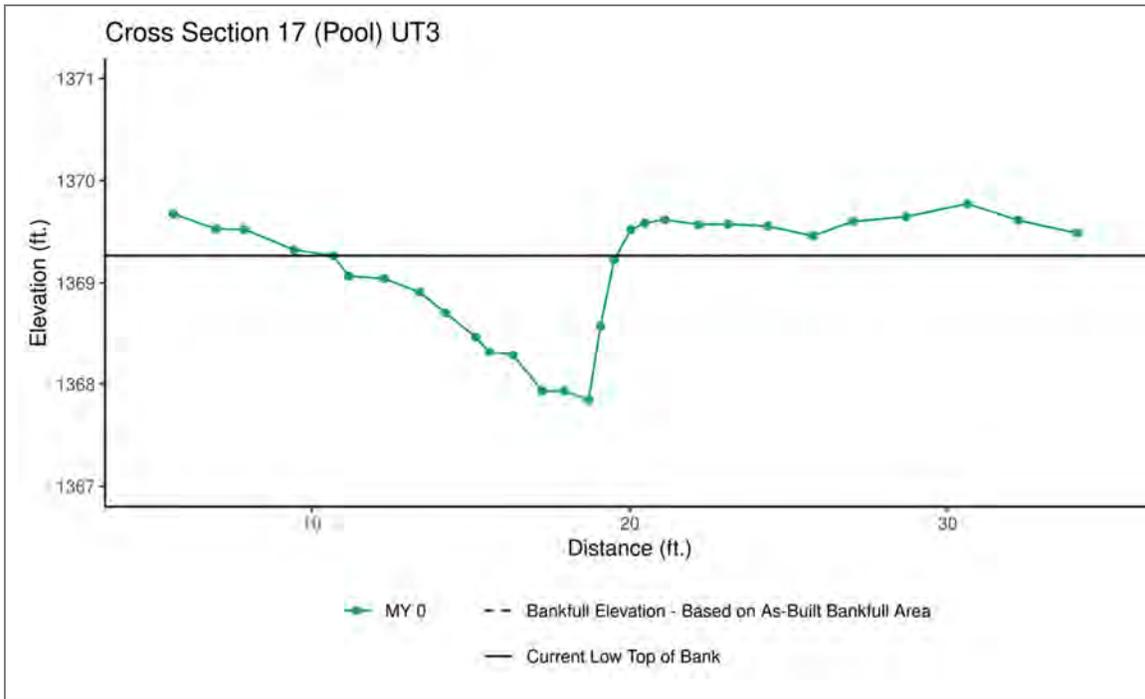


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,380.54					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,379.64					
LTOB Elevation	1,380.54					
LTOB Max Depth	0.896					
LTOB Cross Sectional Area	3.31					



Downstream (05/06/2021)



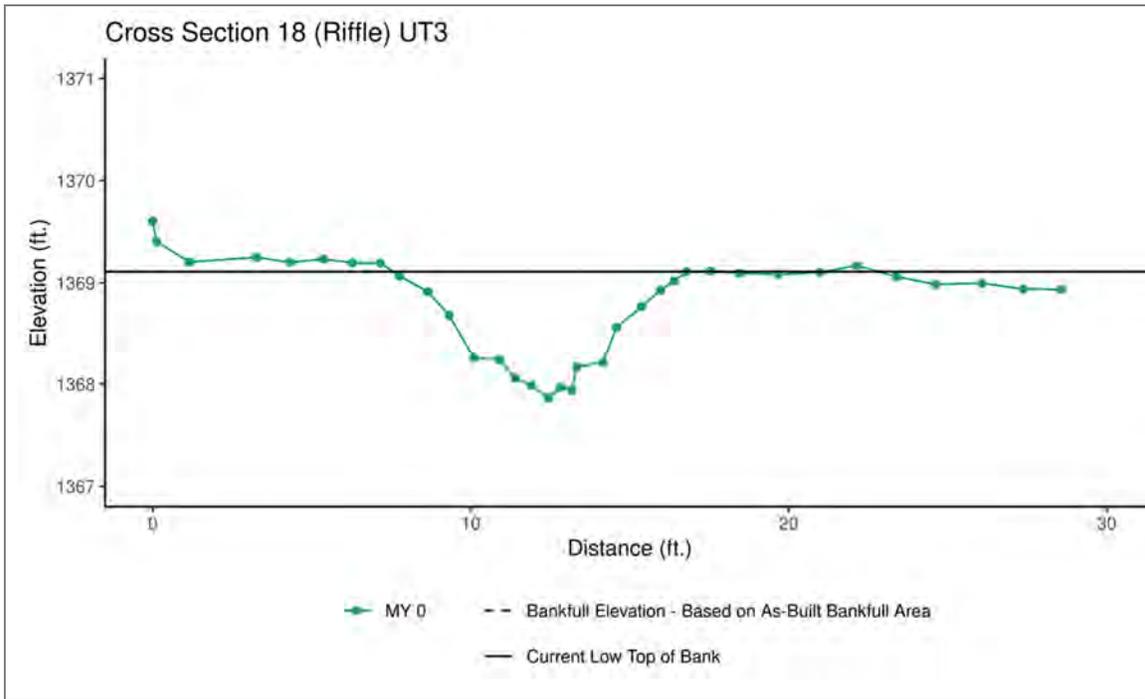


	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,369.27					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,367.93					
LTOB Elevation	1,369.27					
LTOB Max Depth	1.333					
LTOB Cross Sectional Area	6.00					



Downstream (04/21/2021)





	MY0	MY1	MY2	MY3	MY6	MY7
Bankfull Elevation - Based on AB-Bankfull Area	1,369.11					
Bank Height Ratio - Based on AB-Bankfull Area	1.00					
Thalweg Elevation	1,367.87					
LTOB Elevation	1,369.11					
LTOB Max Depth	1.245					
LTOB Cross Sectional Area	5.85					



Downstream (04/21/2021)



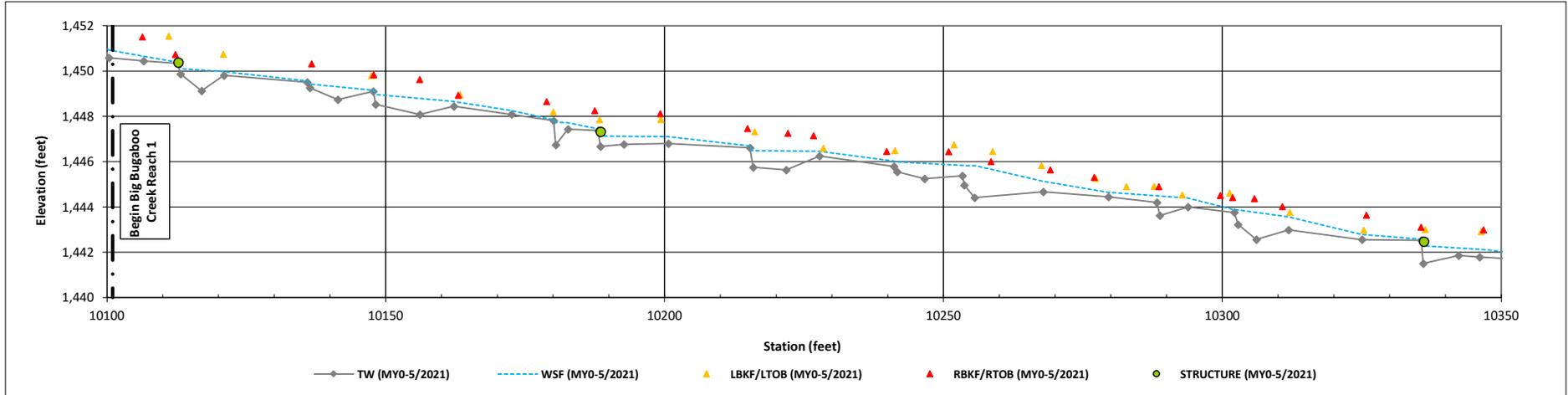
Longitudinal Profile Plots

Bug Headwaters Mitigation Site

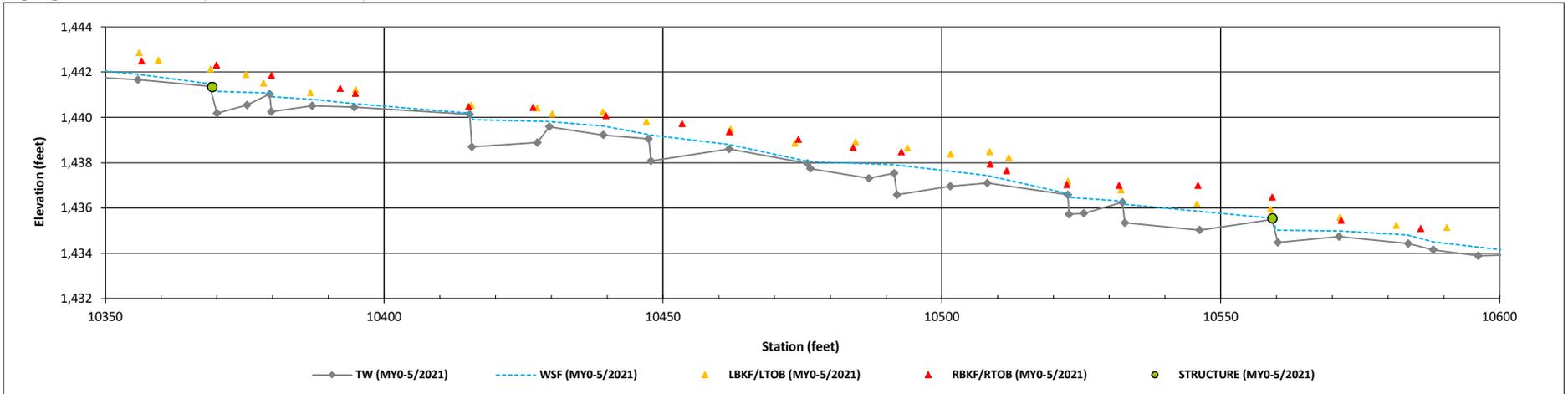
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Creek Reach 1 (STA 101+01 to 103+50)



Big Bugaboo Creek Reach 1 (STA 103+50 to 106+00)



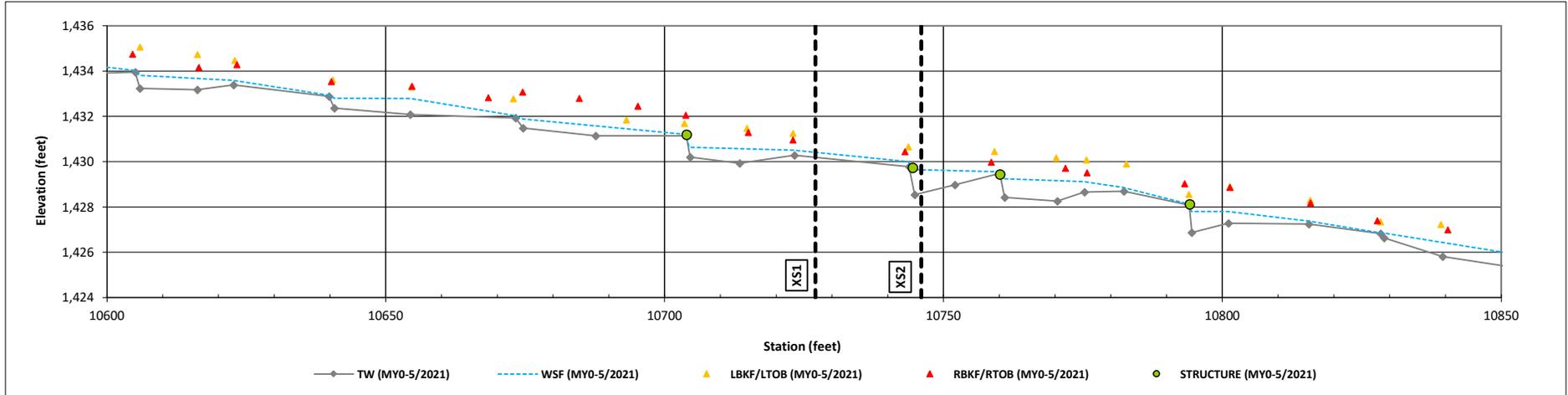
Longitudinal Profile Plots

Bug Headwaters Mitigation Site

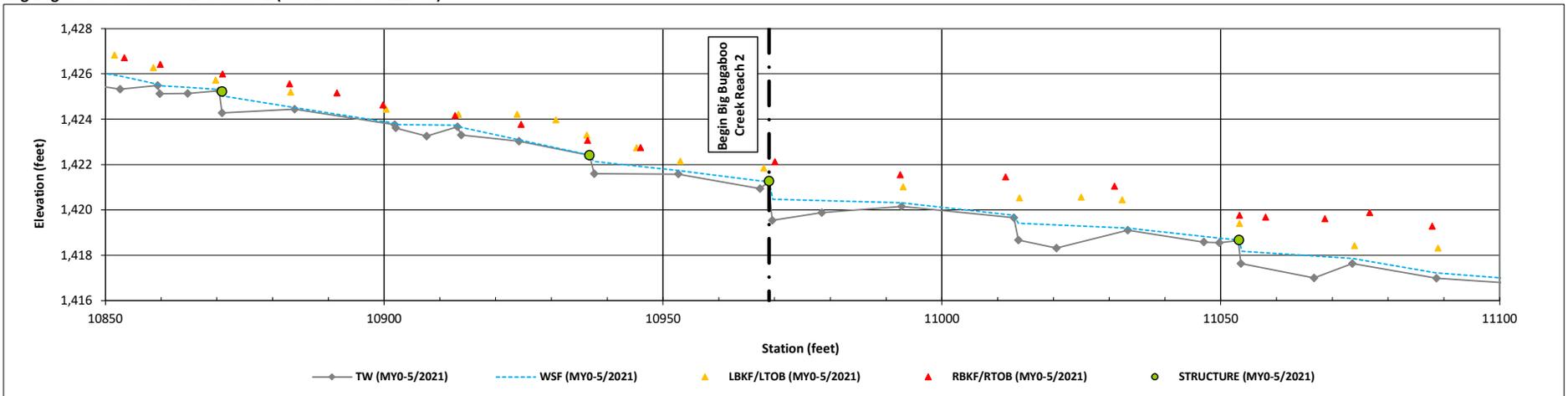
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Creek Reach 1 (STA 106+00 to 108+50)



Big Bugaboo Creek Reach 1 & Reach 2 (STA 108+50 to 111+00)



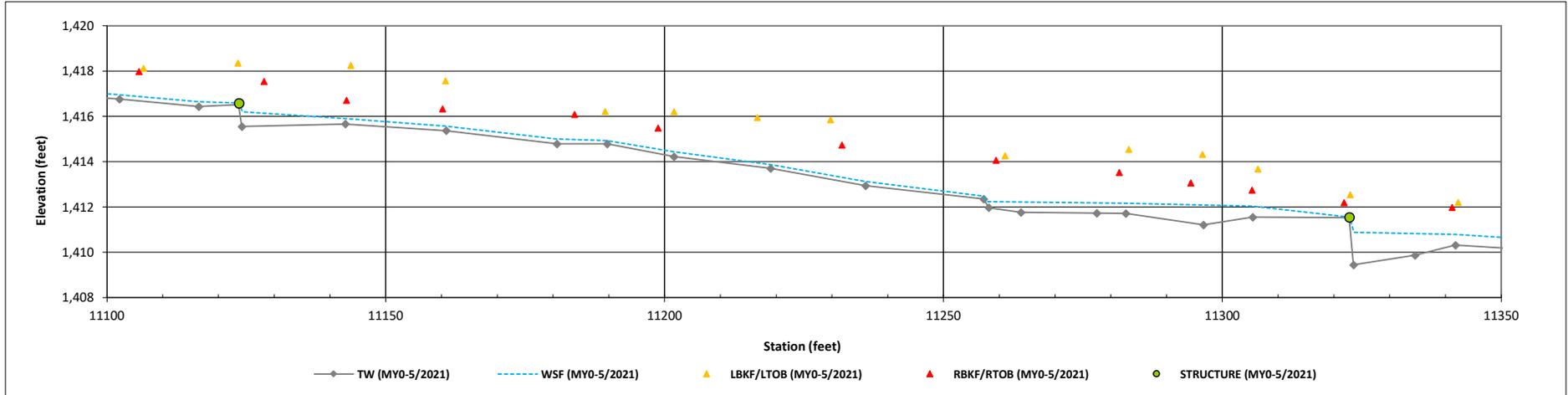
Longitudinal Profile Plots

Bug Headwaters Mitigation Site

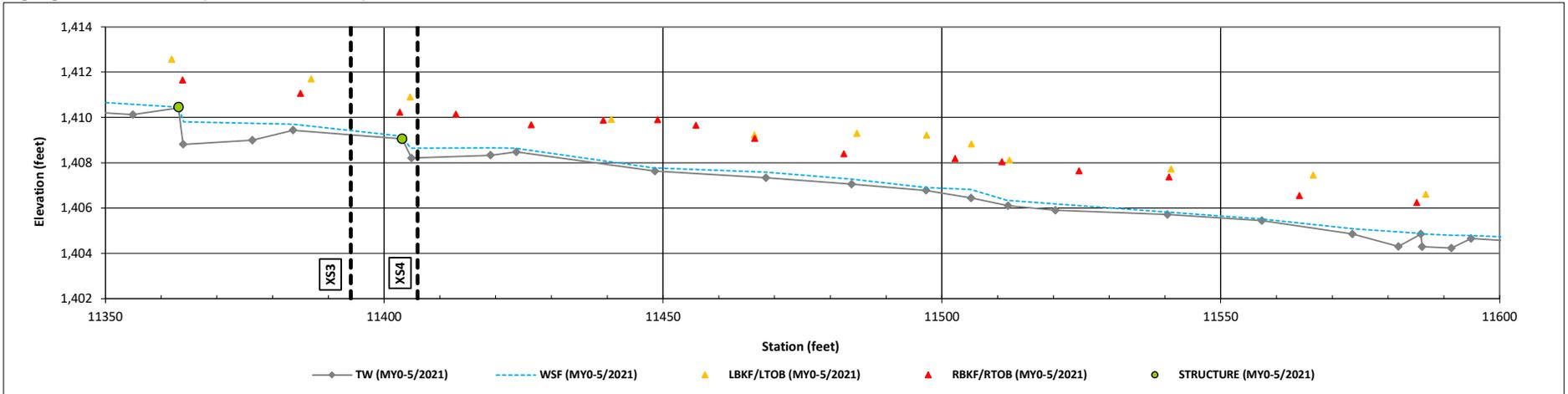
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Creek Reach 2 (STA 111+00 to 113+50)

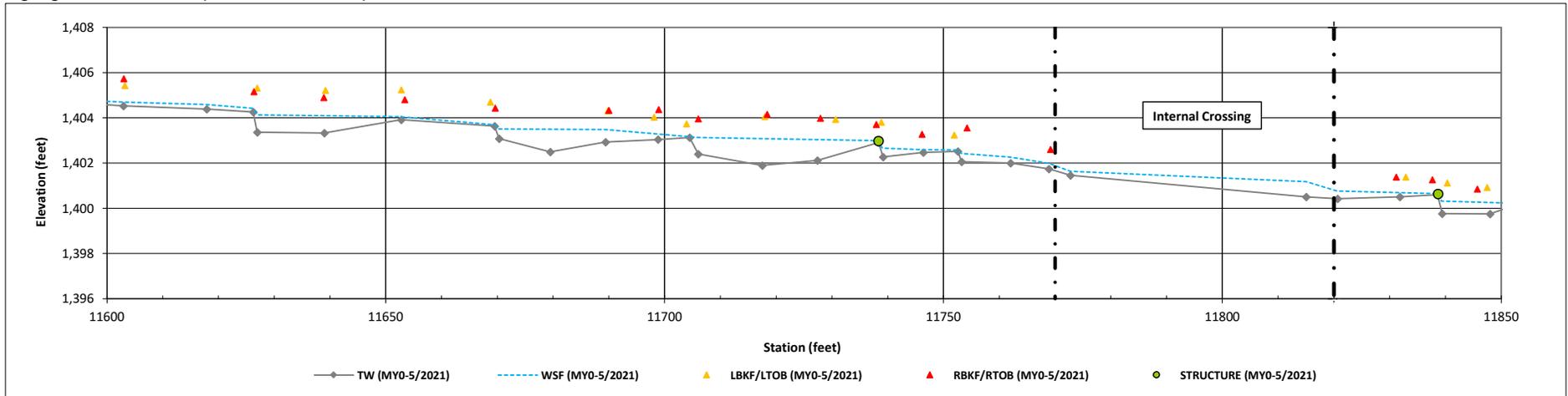


Big Bugaboo Creek Reach 2 (STA 113+50 to 116+00)

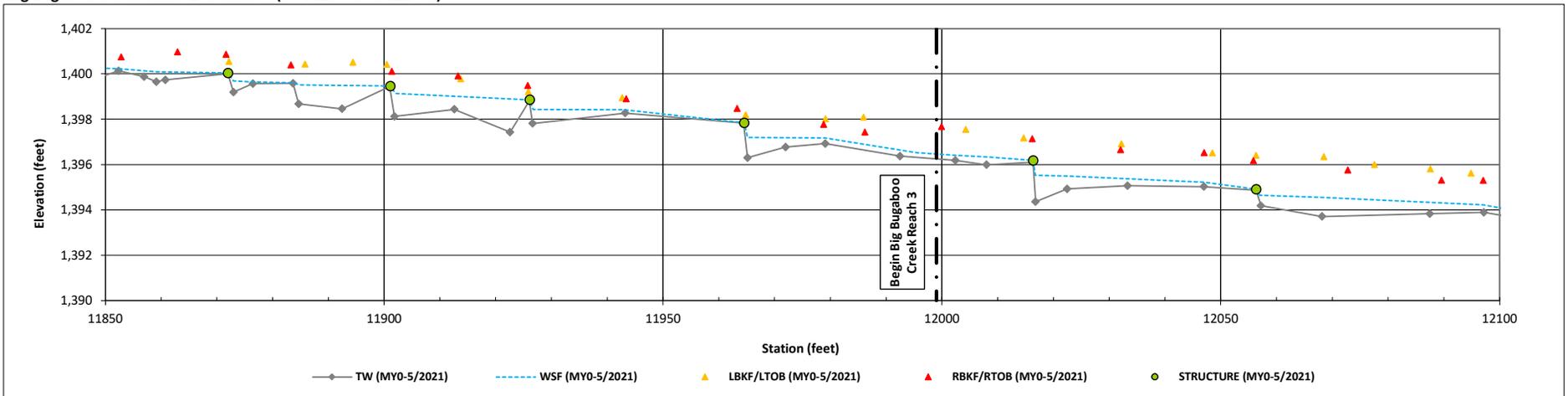


Longitudinal Profile Plots
 Bug Headwaters Mitigation Site
 DMS Project No. 100084
 Monitoring Year 0 - 2021

Big Bugaboo Creek Reach 2 (STA 116+00 to 118+50)

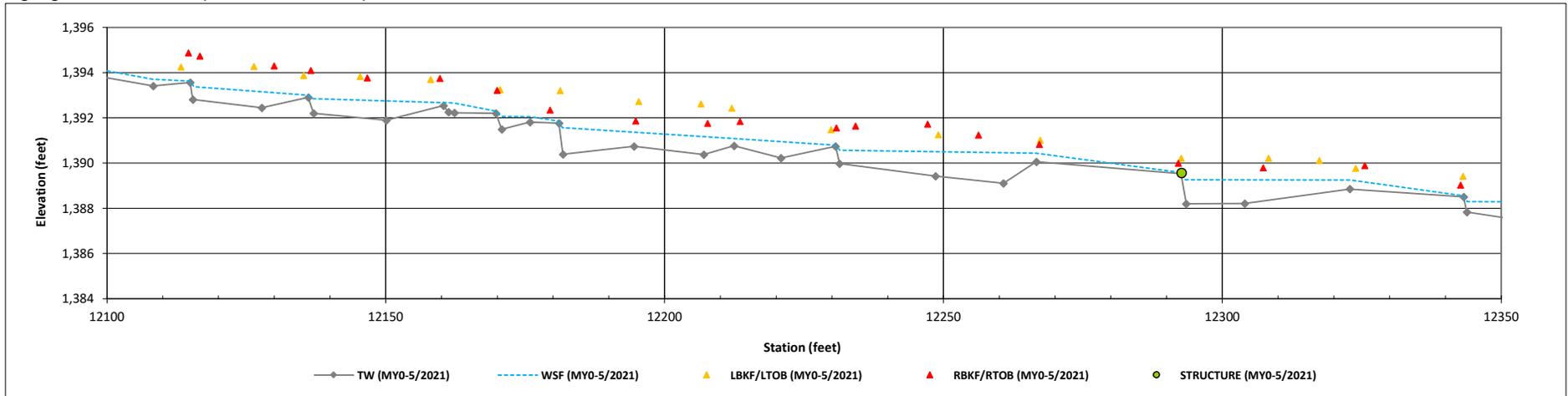


Big Bugaboo Creek Reach 2 & Reach 3 (STA 118+50 to 121+00)

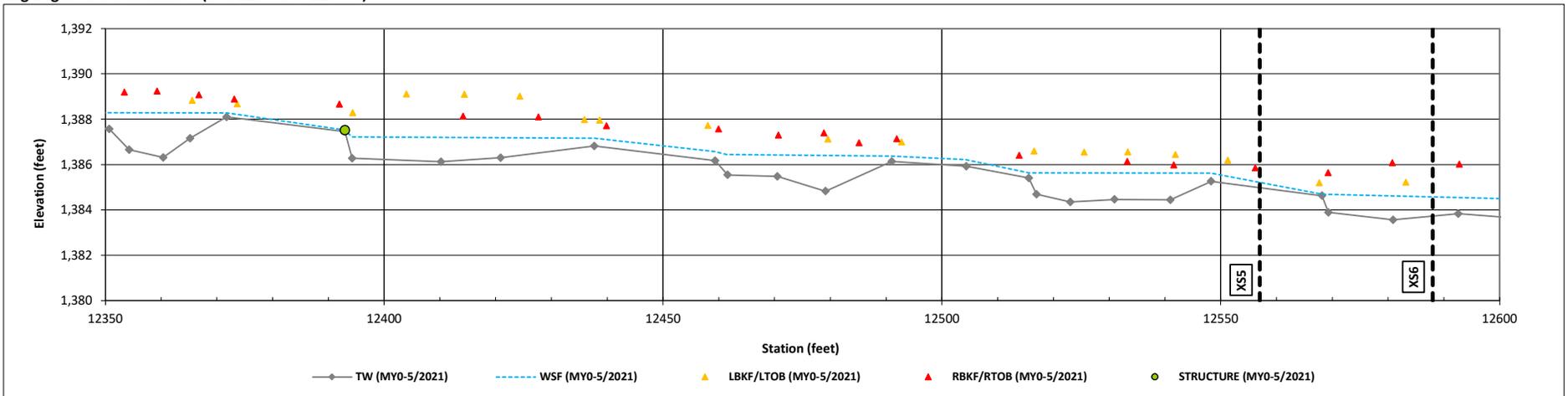


Longitudinal Profile Plots
 Bug Headwaters Mitigation Site
 DMS Project No. 100084
 Monitoring Year 0 - 2021

Big Bugaboo Creek Reach 3 (STA 121+00 to 123+50)

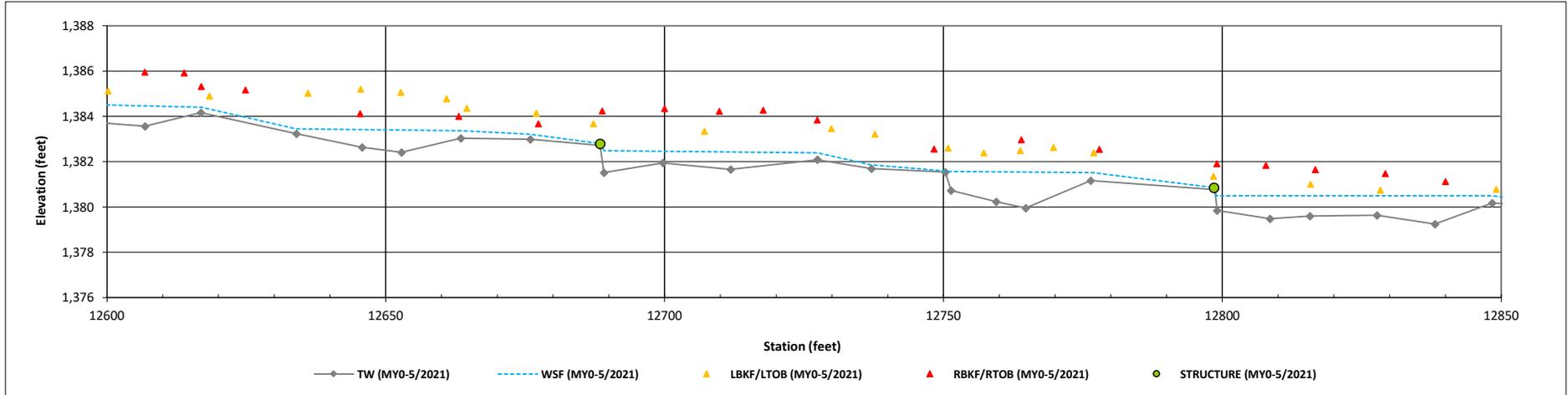


Big Bugaboo Creek Reach 3 (STA 123+50 to 126+00)

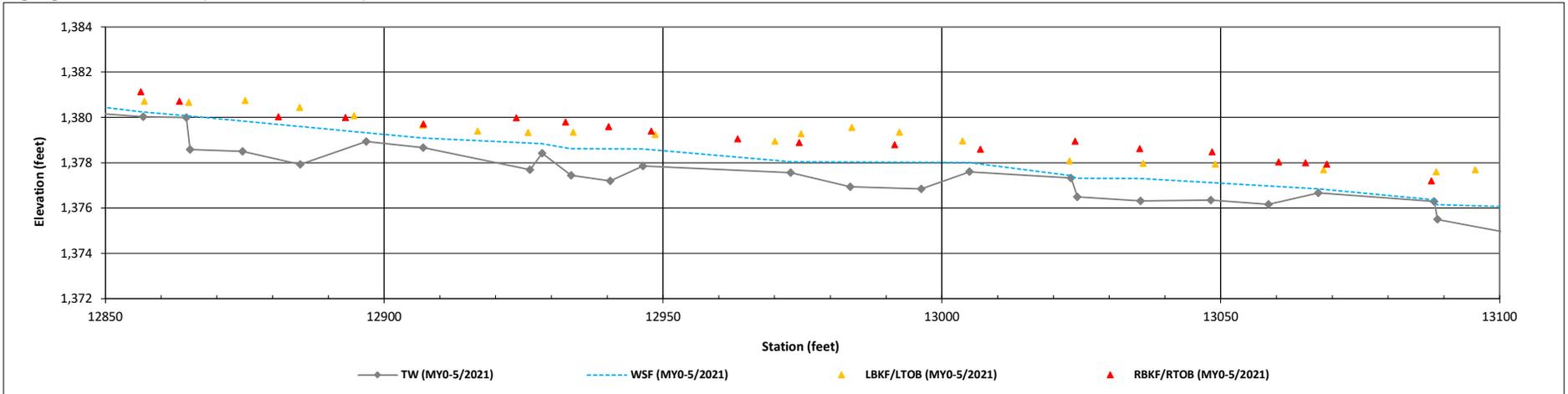


Longitudinal Profile Plots
 Bug Headwaters Mitigation Site
 DMS Project No. 100084
 Monitoring Year 0 - 2021

Big Bugaboo Creek Reach 3 (STA 126+00 to 128+50)

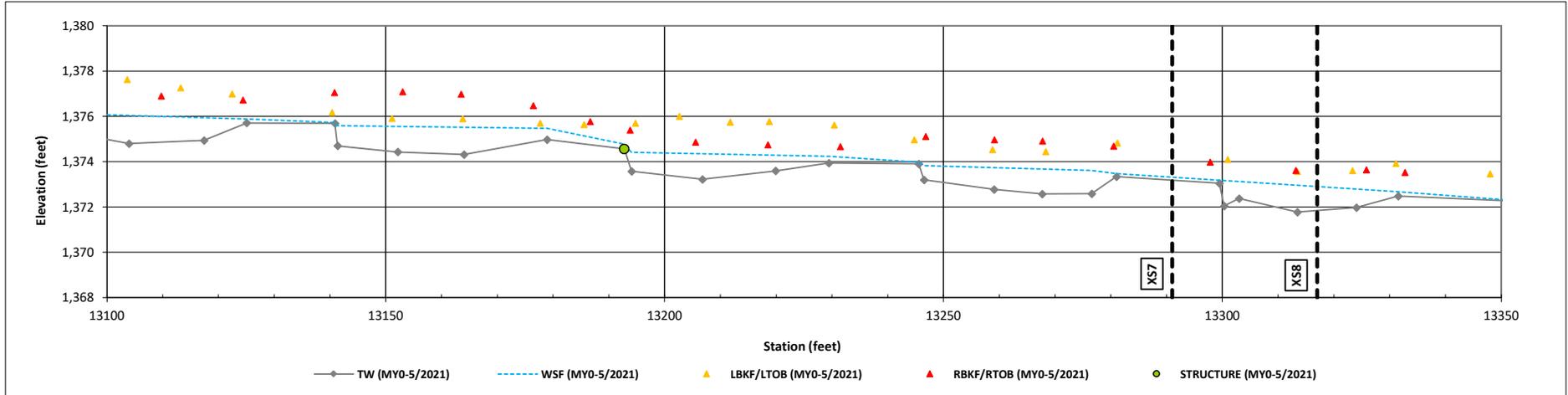


Big Bugaboo Creek Reach 3 (STA 128+50 to 131+00)

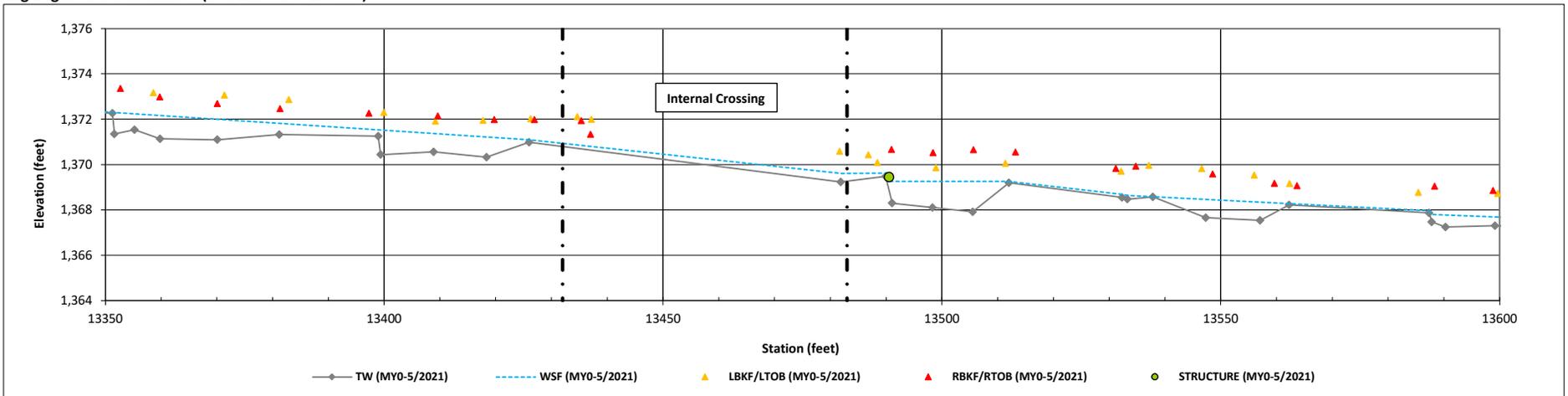


Longitudinal Profile Plots
 Bug Headwaters Mitigation Site
 DMS Project No. 100084
 Monitoring Year 0 - 2021

Big Bugaboo Creek Reach 3 (STA 131+00 to 133+50)



Big Bugaboo Creek Reach 3 (STA 133+50 to 136+00)



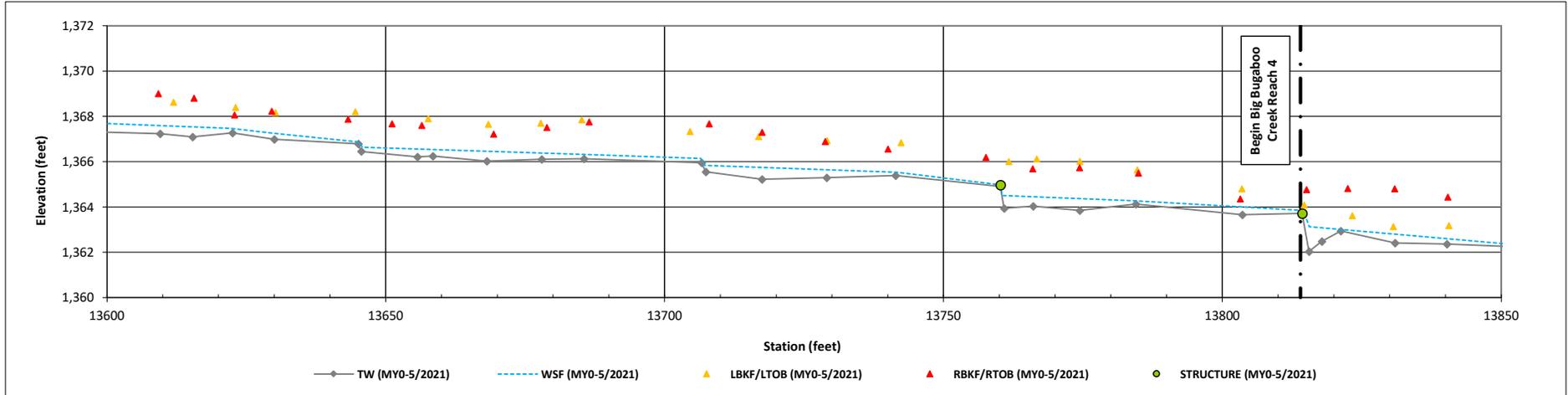
Longitudinal Profile Plots

Bug Headwaters Mitigation Site

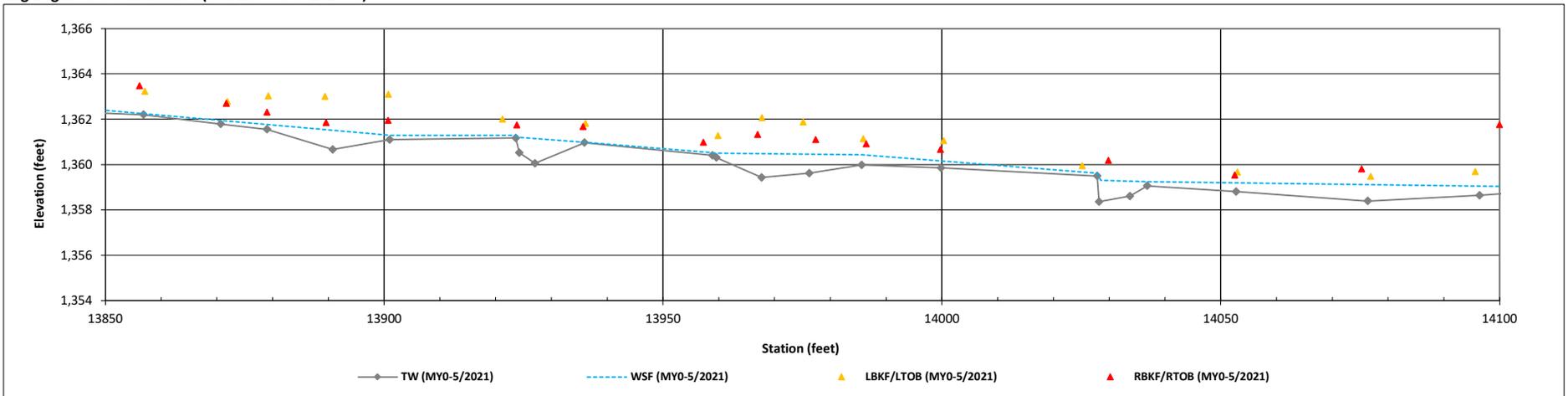
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Creek Reach 3 & Reach 4 (STA 136+00 to 138+50)



Big Bugaboo Creek Reach 4 (STA 138+50 to 141+00)



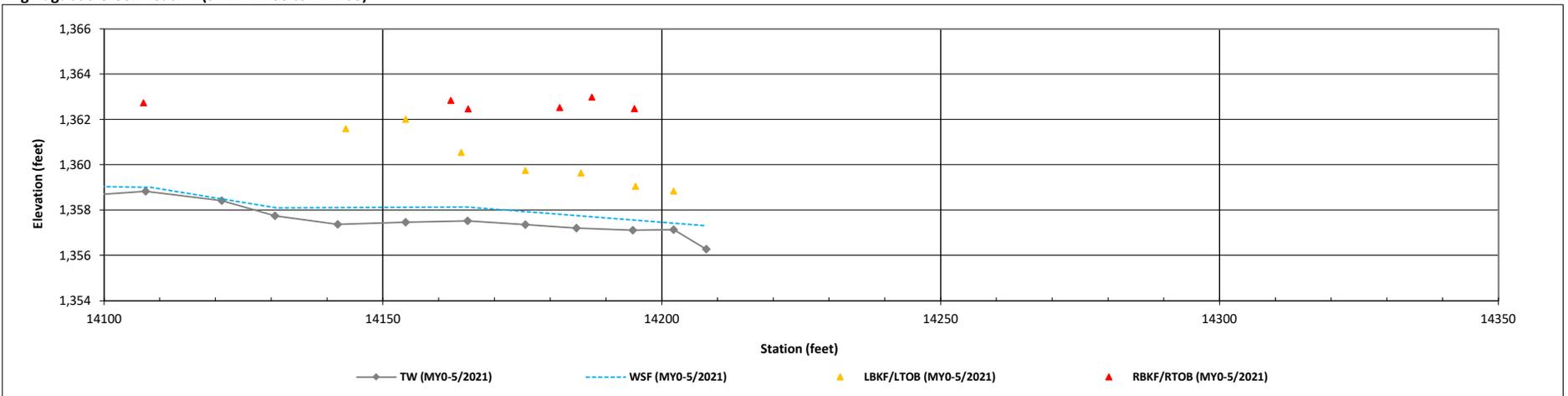
Longitudinal Profile Plots

Bug Headwaters Mitigation Site

DMS Project No. 100084

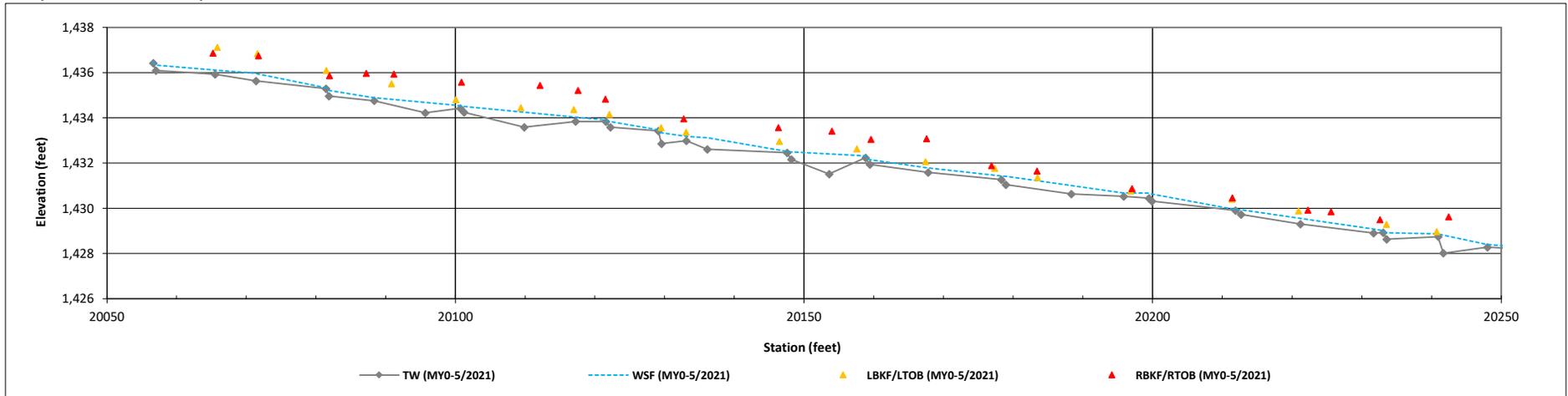
Monitoring Year 0 - 2021

Big Bugaboo Creek Reach 4 (STA 141+00 to 142+08)

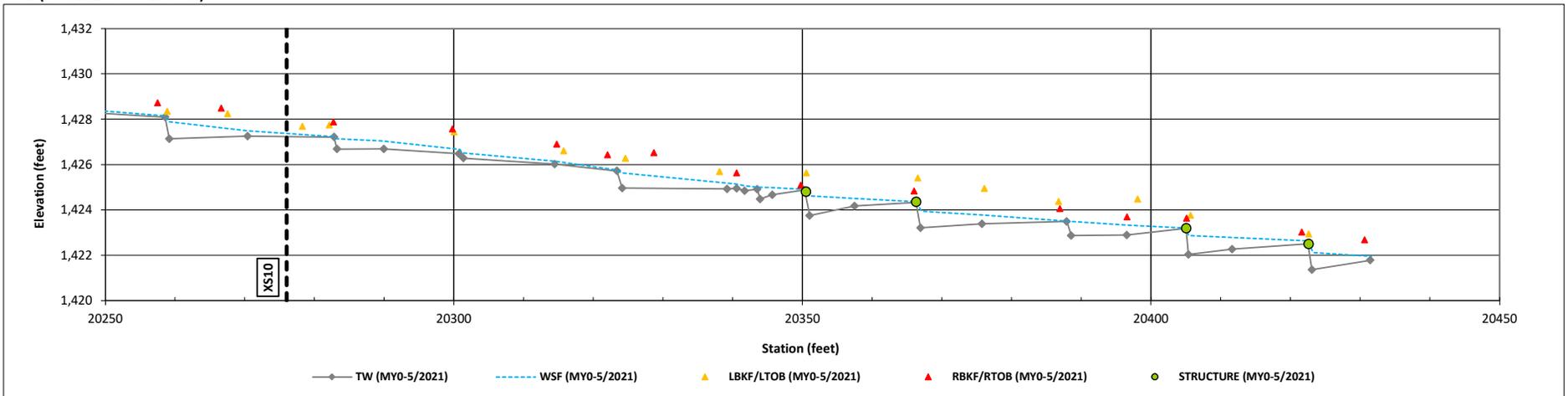


Longitudinal Profile Plots
 Bug Headwaters Mitigation Site
 DMS Project No. 100084
 Monitoring Year 0 - 2021

UT1 (STA 202+56 to 202+50)



UT1 (STA 202+50 to 204+45)



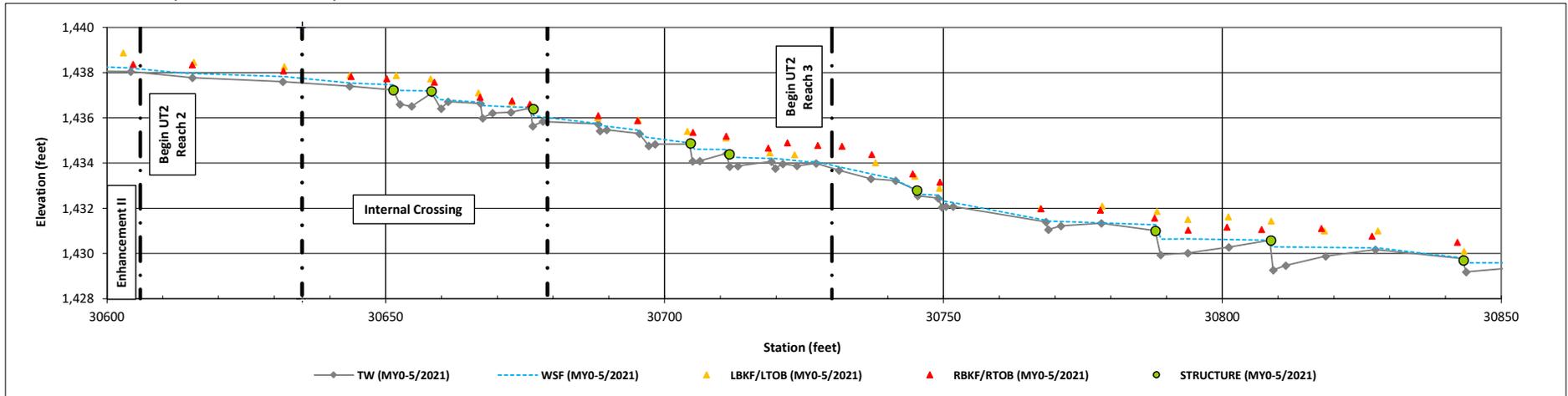
Longitudinal Profile Plots

Bug Headwaters Mitigation Site

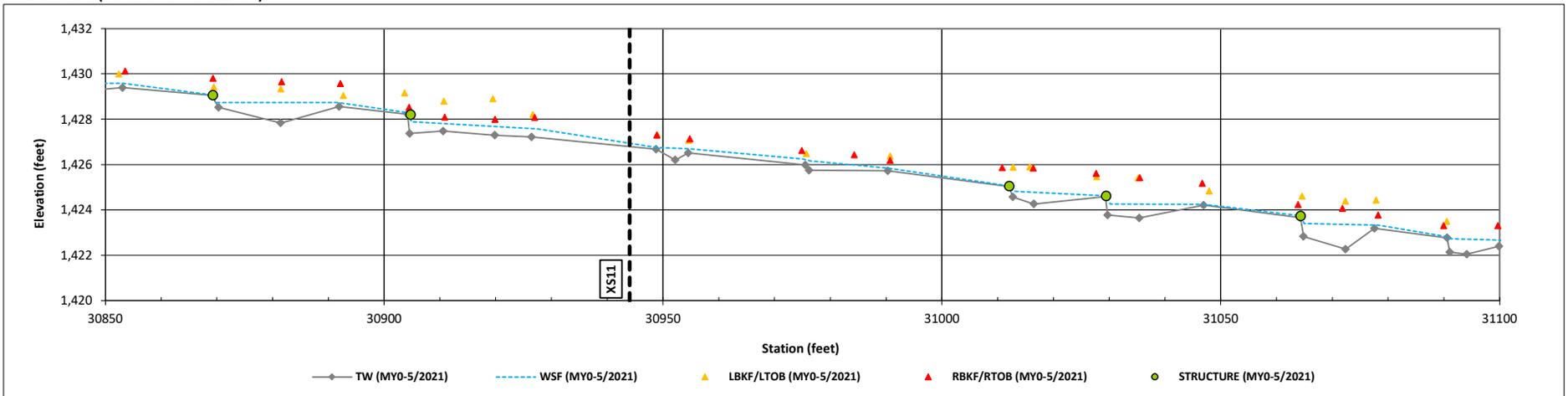
DMS Project No. 100084

Monitoring Year 0 - 2021

UT2 Reach 2 & Reach 3 (STA 306+06 to 308+50)

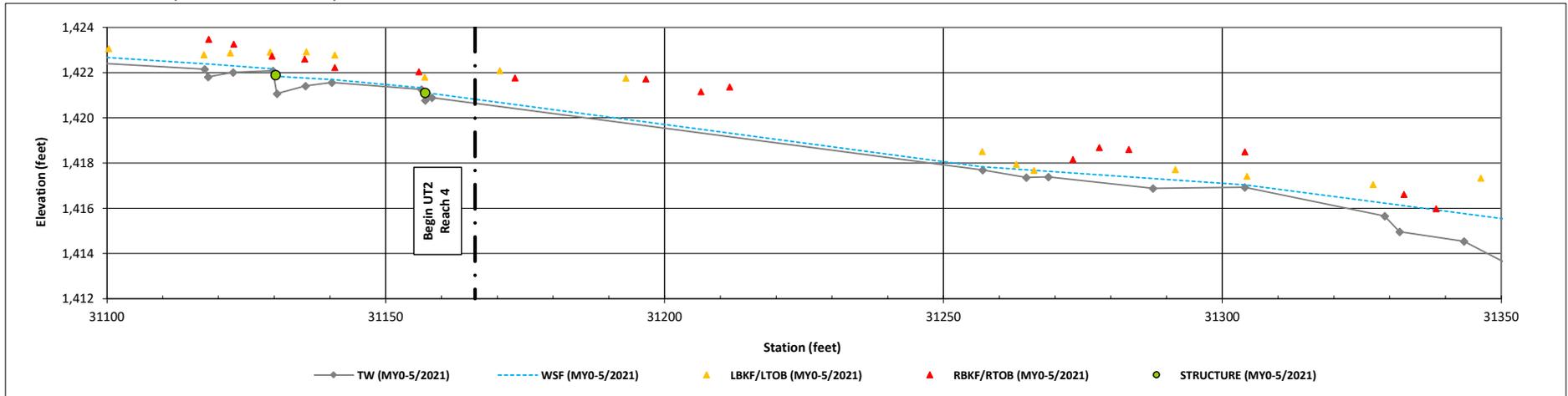


UT2 Reach 3 (STA 308+50 to 311+00)

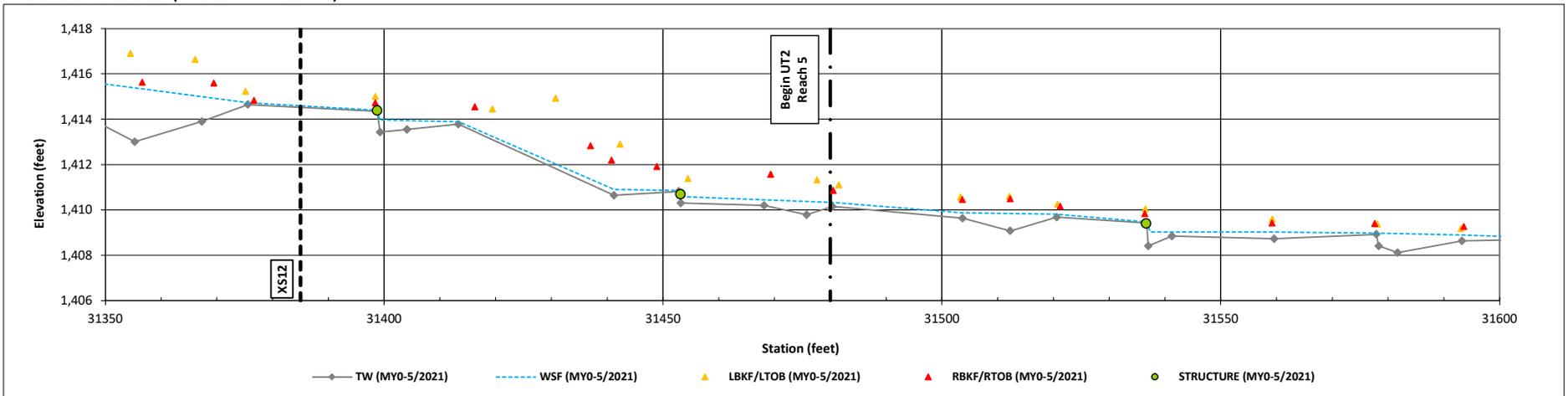


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UT2 Reach 3 & Reach 4 (STA 311+00 to 313+50)

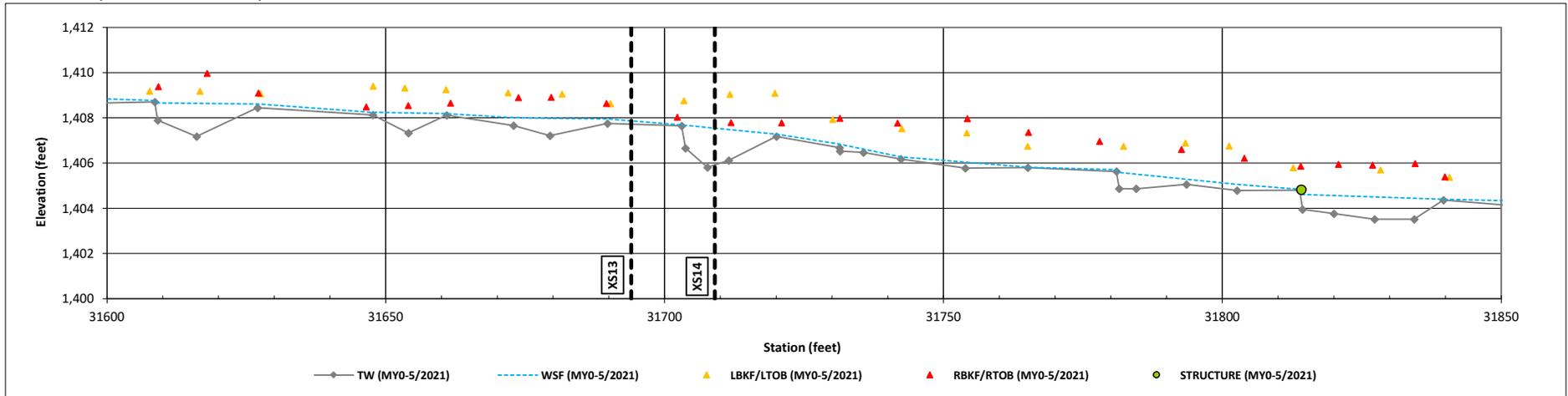


UT2 Reach 4 & Reach 5 (STA 313+50 to 316+00)

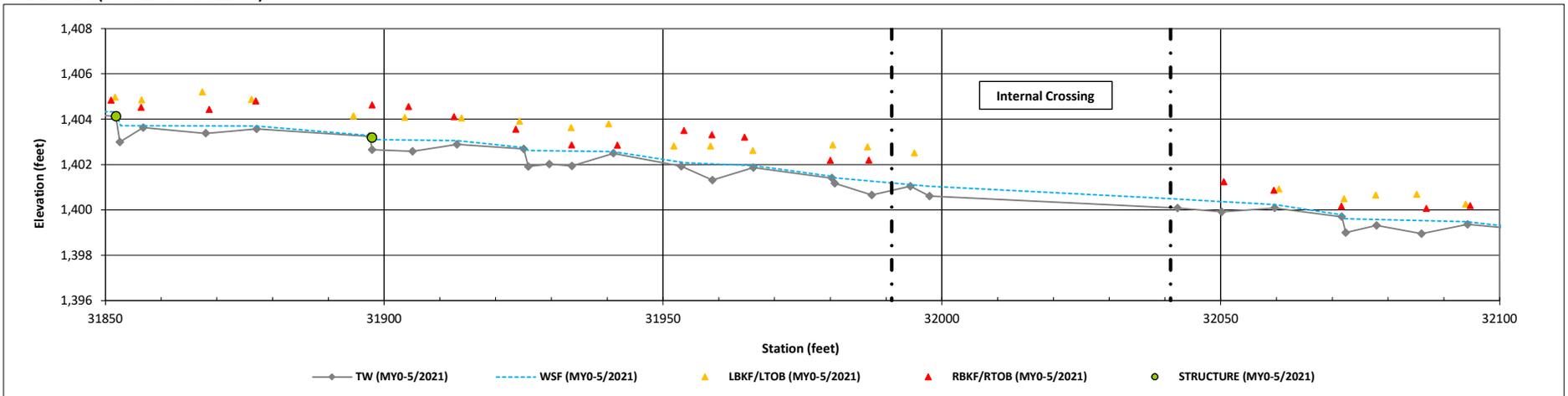


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UT2 Reach 5 (STA 316+00 to 318+50)



UT2 Reach 5 (STA 318+50 to 321+00)



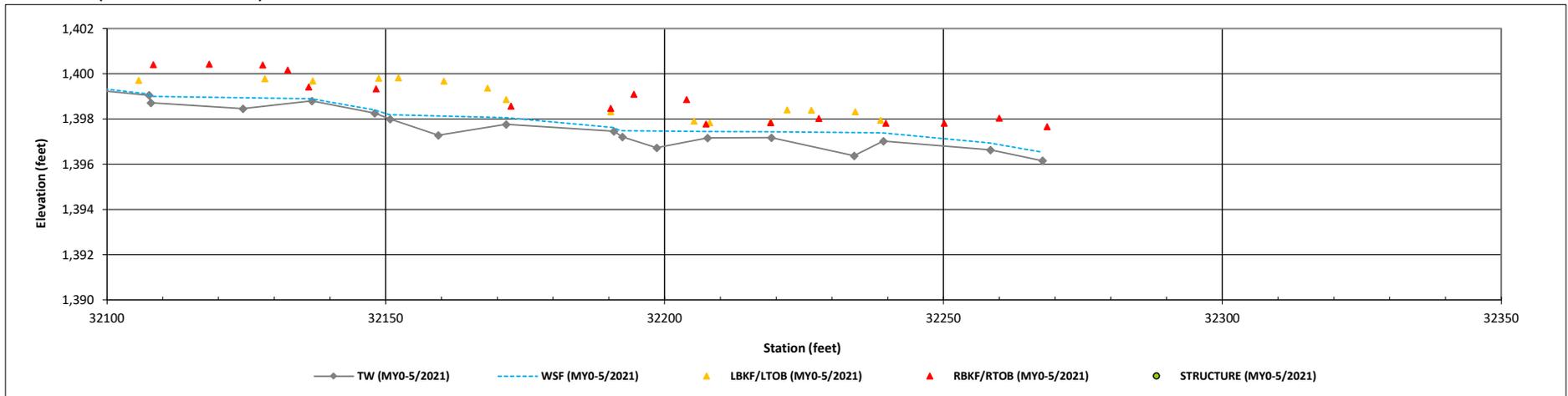
Longitudinal Profile Plots

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UT2 Reach 5 (STA 321+00 to 322+71)



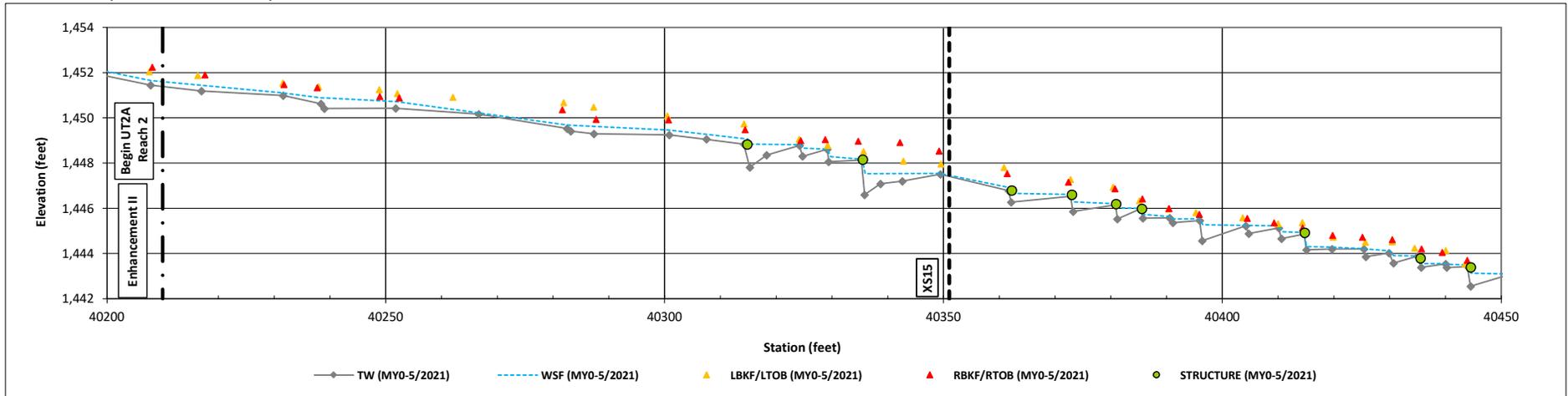
Longitudinal Profile Plots

Bug Headwaters Mitigation Site

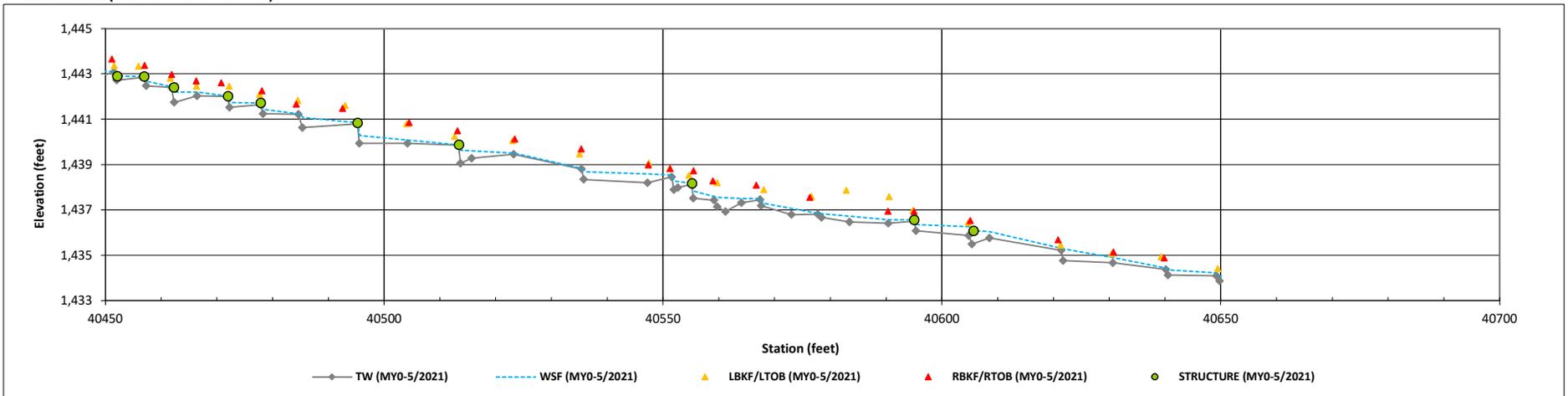
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UT2A Reach 2 (STA 402+10 to 404+50)

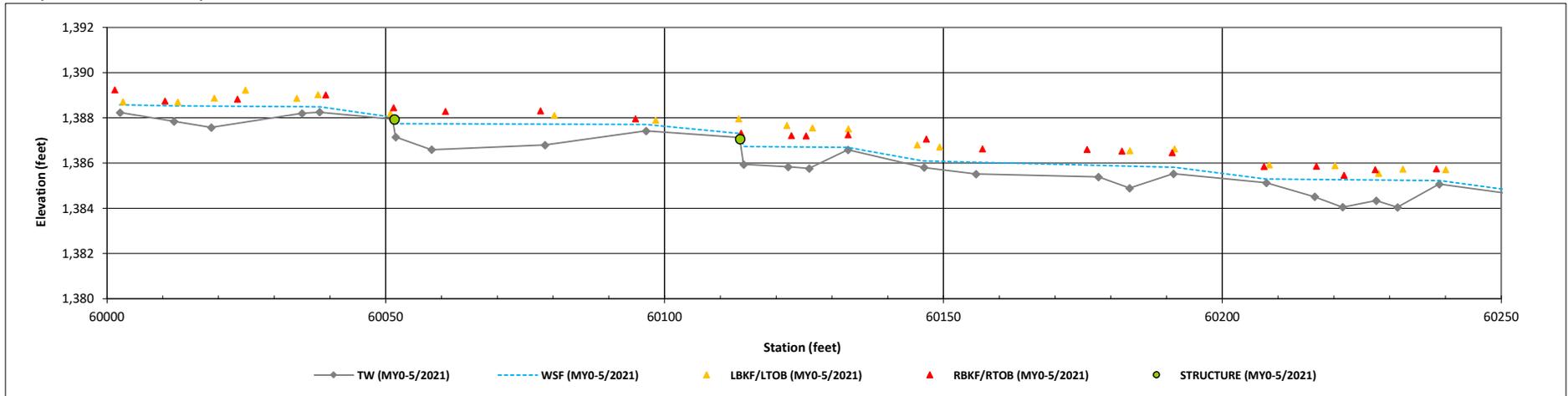


UT2A Reach 2 (STA 404+50 to 406+55)

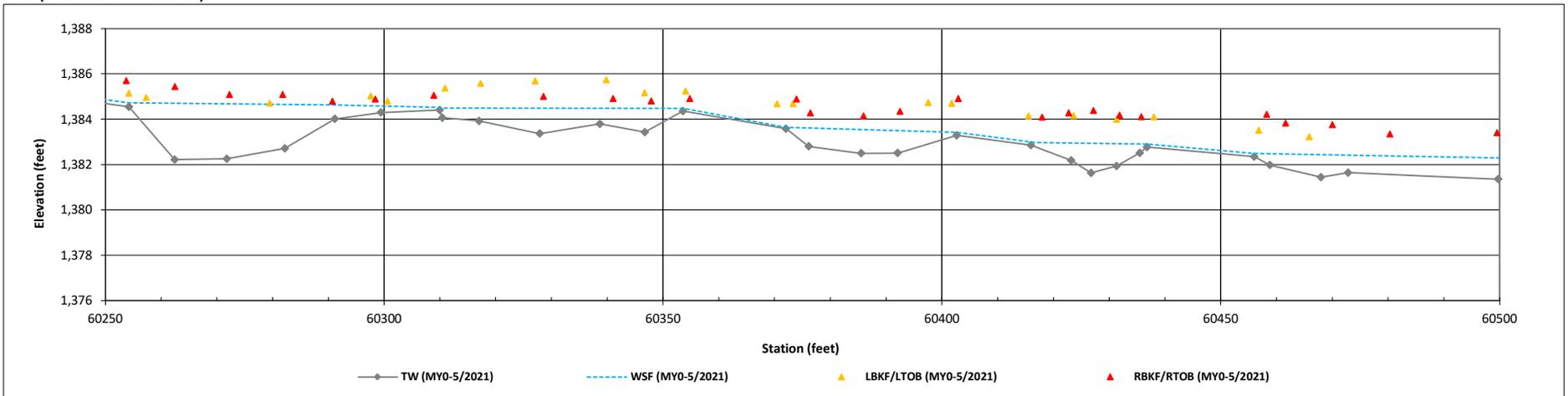


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UT3 (STA 600+00 to 602+50)

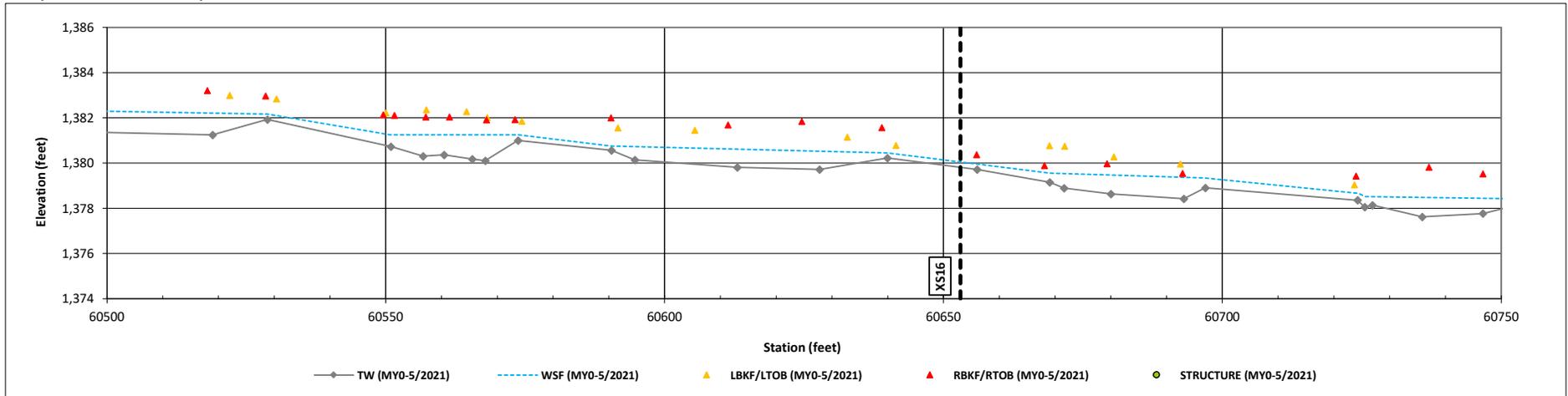


UT3 (STA 602+50 to 605+00)

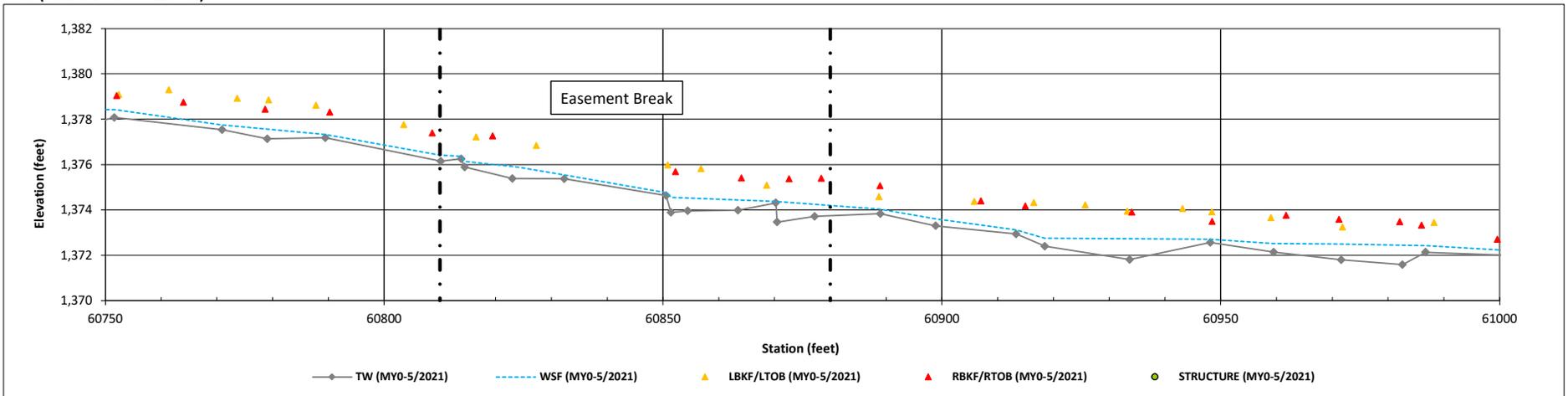


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UT3 (STA 605+00 to 607+50)

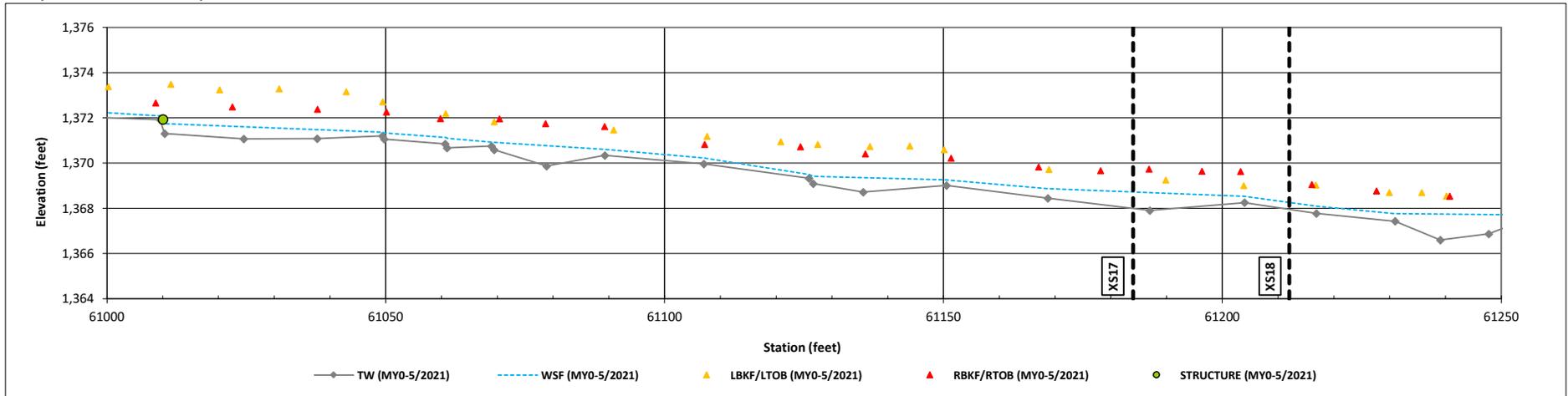


UT3 (STA 607+50 to 610+00)



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UT3 (STA 610+00 to 612+50)



UT3 (STA 612+50 to 614+82)

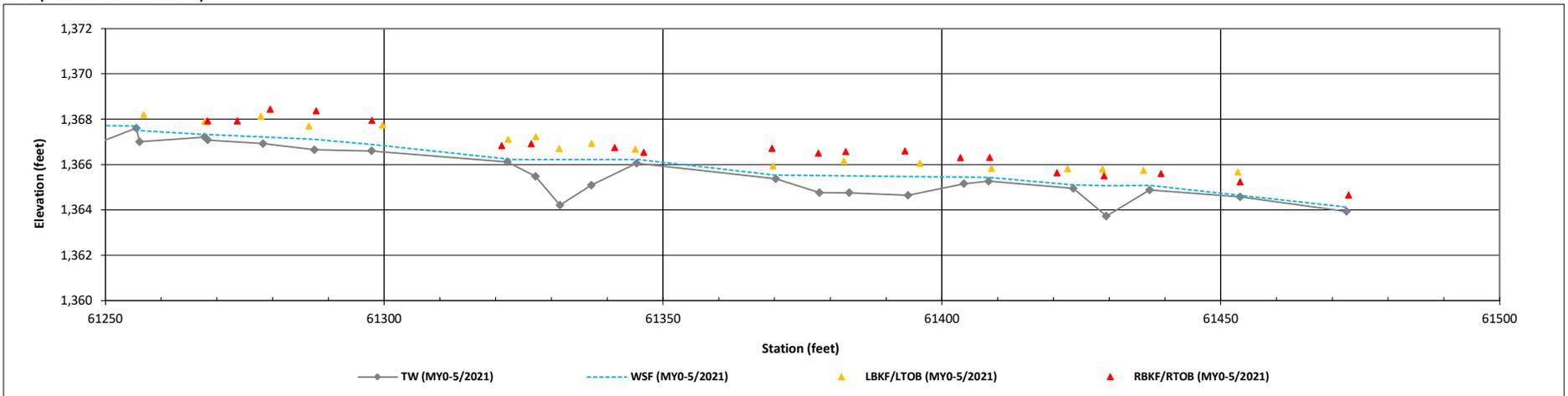


Table 8. Baseline Stream Data Summary

Bug Headwaters Mitigation Site

DMS Project No. 100084

Monitoring Year 0 - 2021

Parameter	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
	Min	Max	n	Min	Max	Min	Max	n
Big Bugaboo Reach 1								
Riffle Only								
Bankfull Width (ft)	11.3		1	6.5		6.7		1
Floodprone Width (ft)	14		1	8	14	80		1
Bankfull Mean Depth	0.3		1	0.5		0.6		1
Bankfull Max Depth	0.6		1	0.8		1.1		1
Bankfull Cross Sectional Area (ft ²)	3.5		1	3.3		4.0		1
Width/Depth Ratio	36.3		1	13.0		11.0		1
Entrenchment Ratio	1.2		1	>1.4		12.0		1
Bank Height Ratio	3.3		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	31			80		61		
Rosgen Classification	F4b			B4		B4		
Bankfull Discharge (cfs)	10.9		1	12.4		19.3		
Sinuosity	1.04			1.02		1.02		
Water Surface Slope (ft/ft) ²	0.0330		1	0.0315	0.0346	0.0350		
Other	---			---		---		
Big Bugaboo Reach 2								
Riffle Only								
Bankfull Width (ft)	4.2		1	9.0		9.3		1
Floodprone Width (ft)	16		1	11	20	19		1
Bankfull Mean Depth	0.8		1	0.7		0.8		1
Bankfull Max Depth	1.1		1	1.0		1.3		1
Bankfull Cross Sectional Area (ft ²)	3.4		1	6.0		7.3		1
Width/Depth Ratio	5.3		1	13.5		11.9		1
Entrenchment Ratio	3.9		1	>1.4		2.0		1
Bank Height Ratio	1.6		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	50			66		49		
Rosgen Classification	B4			B4		B4		
Bankfull Discharge (cfs)	14.1		1	20.4		32.7		
Sinuosity	1.07			1.02		1.02		
Water Surface Slope (ft/ft) ²	0.0228		1	0.0196	0.0216	0.0217		
Other	---			---		---		
Big Bugaboo Reach 3								
Riffle Only								
Bankfull Width (ft)	6.0		1	10.4		8.3	12.5	2
Floodprone Width (ft)	9		1	23	52	48	80	2
Bankfull Mean Depth	1.1		1	0.8		0.5	0.7	2
Bankfull Max Depth	1.4		1	1.2		0.9	1.1	2
Bankfull Cross Sectional Area (ft ²)	6.6		1	8.2		5.6	5.7	2
Width/Depth Ratio	5.4		1	13.0		12.2	27.4	2
Entrenchment Ratio	1.5		1	>2.2		3.8	9.6	2
Bank Height Ratio	2.6		1	1.0		1.0		2
Max part size (mm) mobilized at bankfull	65			66		23	34	2
Rosgen Classification	B4			C4		C4		
Bankfull Discharge (cfs)	34.9		1	34.0		16.2	20.5	2
Sinuosity	1.01			1.16		1.16		
Water Surface Slope (ft/ft) ²	0.0230		1	0.0173	0.0189	0.0171		
Other	---			---		---		

Table 8. Baseline Stream Data Summary

Bug Headwaters Mitigation Site

DMS Project No. 100084

Monitoring Year 0 - 2021

Parameter	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
	Min	Max	n	Min	Max	Min	Max	n
Big Bugaboo Reach 4								
Riffle Only								
Bankfull Width (ft)	18.6		1	11.8		8.7		1
Floodprone Width (ft)	23		1	26	59	20		1
Bankfull Mean Depth	0.8		1	0.1		0.4		1
Bankfull Max Depth	1.2		1	1.3		0.7		1
Bankfull Cross Sectional Area (ft ²)	14.1		1	10.3		3.5		1
Width/Depth Ratio	24.6		1	14.0		21.2		1
Entrenchment Ratio	1.2		1	>2.2		2.3		1
Bank Height Ratio	2.7		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	37			84		20		
Rosgen Classification	F4			C4		C4		
Bankfull Discharge (cfs)	54.5		1	48.3		9.2		
Sinuosity	1.03		1	1.02		1.02		
Water Surface Slope (ft/ft) ²	0.0160		1	0.0127	0.0138	0.0166		
Other	---			---		---		
UT1								
Riffle Only								
Bankfull Width (ft)	11.6		1	4.2		3.7		1
Floodprone Width (ft)	20		1	5	9	19		1
Bankfull Mean Depth	0.2		1	0.3		0.3		1
Bankfull Max Depth	0.4		1	0.5		0.5		1
Bankfull Cross Sectional Area (ft ²)	2.7		1	1.4		1.0		1
Width/Depth Ratio	50.7		1	13.0		13.3		1
Entrenchment Ratio	1.7		1	>1.4		5.1		1
Bank Height Ratio	5.0		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	24			53		32		
Rosgen Classification	B4			B4		B4		
Bankfull Discharge (cfs)	6.9		1	3.9		3.2		
Sinuosity	1.01		1	1.00		1.00		
Water Surface Slope (ft/ft) ²	0.0350		1	0.0329	0.0362	0.0387		
Other	---			---		---		
UT2 Reach 3								
Riffle Only								
Bankfull Width (ft)	9.0		1	7.1		4.7		1
Floodprone Width (ft)	12		1	16	36	19		1
Bankfull Mean Depth	0.4		1	0.5		0.5		1
Bankfull Max Depth	0.9		1	0.8		0.9		1
Bankfull Cross Sectional Area (ft ²)	4.0		1	3.8		2.5		1
Width/Depth Ratio	23.0		1	13.0		9.0		1
Entrenchment Ratio	1.3		1	67.0		4.0		1
Bank Height Ratio	3.4		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	34			>1.4		45		
Rosgen Classification	B4			B4		B4		
Bankfull Discharge (cfs)	13.8		1	14.6		10.0		
Sinuosity	1.10			1.04		1.04		
Water Surface Slope (ft/ft) ²	0.0520		1	0.0244	0.0266	0.0301		
Other	---			---		---		

Table 8. Baseline Stream Data Summary

Bug Headwaters Mitigation Site

DMS Project No. 100084

Monitoring Year 0 - 2021

Parameter	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
	Min	Max	n	Min	Max	Min	Max	n
UT2 Reach 4								
Riffle Only	Min	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	9.0		1	7.1		6.9		1
Floodprone Width (ft)	12		1	16	36	13		1
Bankfull Mean Depth	0.4		1	0.5		0.3		1
Bankfull Max Depth	0.9		1	0.8		0.5		1
Bankfull Cross Sectional Area (ft ²)	4.0		1	3.8		1.8		1
Width/Depth Ratio	23.0		1	13.0		26.5		1
Entrenchment Ratio	1.3		1	>1.4		1.9		1
Bank Height Ratio	3.4		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	34			---		26		
Rosgen Classification	B4			B4		B4		
Bankfull Discharge (cfs)	13.8		1	14.6		5.0		
Sinuosity	1.07			1.07		1.07		
Water Surface Slope (ft/ft) ²	0.0369		1	0.0282	0.0307	0.0334		
Other	---			---		---		
UT2 Reach 5								
Riffle Only	Min	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	9.0		1	8.4		4.2		1
Floodprone Width (ft)	12		1	19	24	25		1
Bankfull Mean Depth	0.4		1	0.6		0.4		1
Bankfull Max Depth	0.9		1	1.5		0.7		1
Bankfull Cross Sectional Area (ft ²)	4.0		1	5.4		1.5		1
Width/Depth Ratio	23.0		1	13.0		11.6		1
Entrenchment Ratio	1.3		1	>2.2		6.0		1
Bank Height Ratio	3.4		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	34			48		18		
Rosgen Classification	F4b			C4b		C4b		
Bankfull Discharge (cfs)	13.8		1	18.8		3.6		
Sinuosity	1.01			1.06		1.06		
Water Surface Slope (ft/ft) ²	0.0200		1	0.0183	0.0200	0.0175		
Other	---			---		---		
UT2A Reach 2								
Riffle Only	Min	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	5.0		1	5.1		4.8		1
Floodprone Width (ft)	12		1	6	11	14		1
Bankfull Mean Depth	0.4		1	0.4		0.4		1
Bankfull Max Depth	0.6		1	0.6		0.7		1
Bankfull Cross Sectional Area (ft ²)	2.0		1	2.0		1.7		1
Width/Depth Ratio	11.0		1	13.0		13.5		1
Entrenchment Ratio	2.4		1	>1.4		2.9		1
Bank Height Ratio	4.8		1	1.0		1.0		1
Max part size (mm) mobilized at bankfull	58			84		40		
Rosgen Classification	A4			B4a		B4a		
Bankfull Discharge (cfs)	8.3		1	7.3		5.9		
Sinuosity	1.04			1.03		1.03		
Water Surface Slope (ft/ft) ²	0.0490		1	0.0454	0.0514	0.0398		
Other	---			---		---		

Table 8. Baseline Stream Data Summary

Bug Headwaters Mitigation Site

DMS Project No. 100084

Monitoring Year 0 - 2021

	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
Parameter	UT3							
Riffle Only	Min	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	7		1	9.5		6.6	9.2	2
Floodprone Width (ft)	9		1	21	48	90		2
Bankfull Mean Depth	0.8		1	0.7		0.5	0.6	2
Bankfull Max Depth	1.1		1	1.1		0.9	1.2	2
Bankfull Cross Sectional Area (ft ²)	5		1	6.8		3.3	5.8	2
Width/Depth Ratio	8		1	13.0		13.1	14.6	2
Entrenchment Ratio	1.4		1	>2.2		9.8	13.7	2
Bank Height Ratio	2.1		1	1.0		1.0		2
Max part size (mm) mobilized at bankfull	43			54		24	30	2
Rosgen Classification	G4			C4b		C4b		
Bankfull Discharge (cfs)	21.7		1	24.6		9.7	19.8	2.0
Sinuosity	1.04			1.21		1.21		
Water Surface Slope (ft/ft) ²	0.0199		1	0.0142	0.0154	0.0164		
Other	---			---		---		

Table 9. Cross-Section Morphology Monitoring Summary

Bug Headwaters Mitigation Site

DMS Project No. 100084

Monitoring Year 0 - 2021

	Big Bugaboo Reach 1												Big Bugaboo Reach 2						
	Cross-Section 1 (Riffle)						Cross-Section 2 (Pool)						Cross-Section 3 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	1,431.28						1,430.55						1,410.57						
Bank Height Ratio - Based on AB Bankfull ¹ Area	1.00						1.00						1.00						
Thalweg Elevation	1,430.16						1,428.97						1,409.27						
LTOB ² Elevation	1,431.28						1,430.55						1,410.57						
LTOB ² Max Depth (ft)	1.127						1.582						1.301						
LTOB ² Cross Sectional Area (ft ²)	4.03						5.61						7.26						
	Big Bugaboo Reach 2						Big Bugaboo Reach 3												
	Cross-Section 4 (Pool)						Cross-Section 5 (Riffle)						Cross-Section 6 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	1,409.53						1,386.16						1,385.13						
Bank Height Ratio - Based on AB Bankfull ¹ Area	1.00						1.00						1.00						
Thalweg Elevation	1,408.32						1,385.21						1,383.73						
LTOB ² Elevation	1,409.53						1,386.16						1,385.13						
LTOB ² Max Depth (ft)	1.205						0.949						1.4						
LTOB ² Cross Sectional Area (ft ²)	3.20						5.66						4.66						
	Big Bugaboo Reach 3						Big Bugaboo Reach 4												
	Cross-Section 7 (Riffle)						Cross-Section 8 (Pool)						Cross-Section 9 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	1,374.22						1,373.57						1,362.95						
Bank Height Ratio - Based on AB Bankfull ¹ Area	1.00						1.00						1.00						
Thalweg Elevation	1,373.09						1,371.33						1,362.22						
LTOB ² Elevation	1,374.22						1,373.57						1,362.95						
LTOB ² Max Depth (ft)	1.126						2.246						0.726						
LTOB ² Cross Sectional Area (ft ²)	5.64						9.80						3.58						

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

²LTOB 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 recorded and tracked above as LTOB max depth.

Table 9. Cross-Section Morphology Monitoring Summary

Bug Headwaters Mitigation Site

DMS Project No. 100084

Monitoring Year 0 - 2021

	UT1						UT2 Reach 3						UT2 Reach 4					
	Cross-Section 10 (Riffle)						Cross-Section 11 (Riffle)						Cross-Section 12 (Riffle)					
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	1,427.68						1,427.77						1,414.97					
Bank Height Ratio - Based on AB Bankfull ¹ Area	1.00						1.00						1.00					
Thalweg Elevation	1,427.22						1,426.85						1,414.43					
LTOB ² Elevation	1,427.68						1,427.77						1,414.97					
LTOB ² Max Depth (ft)	0.46						0.922						0.545					
LTOB ² Cross Sectional Area (ft ²)	1.05						2.50						1.82					
	UT2 Reach 5						UT2A											
	Cross-Section 13 (Riffle)						Cross-Section 14 (Pool)						Cross-Section 15 (Riffle)					
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	1,408.33						1,408.04						1,448.11					
Bank Height Ratio - Based on AB Bankfull ¹ Area	1.00						1.00						1.00					
Thalweg Elevation	1,407.66						1,405.79						1,447.42					
LTOB ² Elevation	1,408.33						1,408.04						1,448.11					
LTOB ² Max Depth (ft)	0.668						2.255						0.694					
LTOB ² Cross Sectional Area (ft ²)	1.50						10.58						1.68					
	UT3																	
	Cross-Section 16 (Riffle)						Cross-Section 17 (Pool)						Cross-Section 18 (Riffle)					
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	1,380.54						1,369.27						1,369.11					
Bank Height Ratio - Based on AB Bankfull ¹ Area	1.00						1.00						1.00					
Thalweg Elevation	1,379.64						1,367.93						1,367.87					
LTOB ² Elevation	1,380.54						1,369.27						1,369.11					
LTOB ² Max Depth (ft)	0.896						1.333						1.245					
LTOB ² Cross Sectional Area (ft ²)	3.31						6.00						5.85					

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

²LTOB 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 recorded and tracked above as LTOB max depth.

Reachwide Pebble Count Plots

Bug Headwaters Mitigation Site

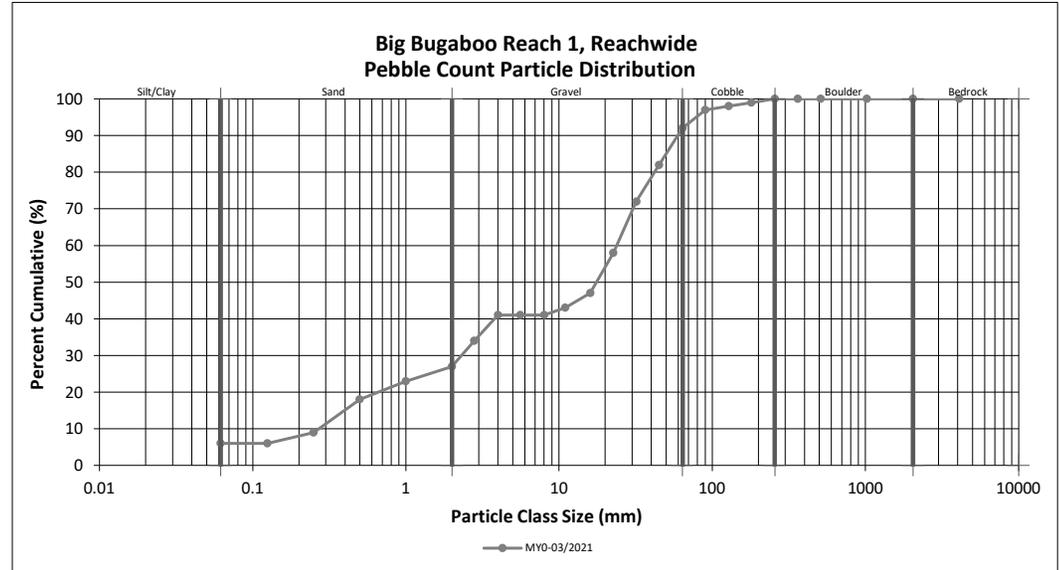
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		6	6	6	6
SAND	Very fine	0.062	0.125					6
	Fine	0.125	0.250		3	3	3	9
	Medium	0.25	0.50	1	8	9	9	18
	Coarse	0.5	1.0		5	5	5	23
	Very Coarse	1.0	2.0		4	4	4	27
GRAVEL	Very Fine	2.0	2.8	1	6	7	7	34
	Very Fine	2.8	4.0	2	5	7	7	41
	Fine	4.0	5.6					41
	Fine	5.6	8.0					41
	Medium	8.0	11.0	1	1	2	2	43
	Medium	11.0	16.0	4		4	4	47
	Coarse	16.0	22.6	10	1	11	11	58
	Coarse	22.6	32	14		14	14	72
	Very Coarse	32	45	10		10	10	82
	Very Coarse	45	64	10		10	10	92
COBBLE	Small	64	90	5		5	5	97
	Small	90	128	1		1	1	98
	Large	128	180	1		1	1	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				60	40	100	100	100

Reachwide Channel materials (mm)	
D ₁₆ =	0.43
D ₃₅ =	2.95
D ₅₀ =	17.6
D ₈₄ =	48.3
D ₉₅ =	78.5
D ₁₀₀ =	256.0



Reachwide Pebble Count Plots

Bug Headwaters Mitigation Site

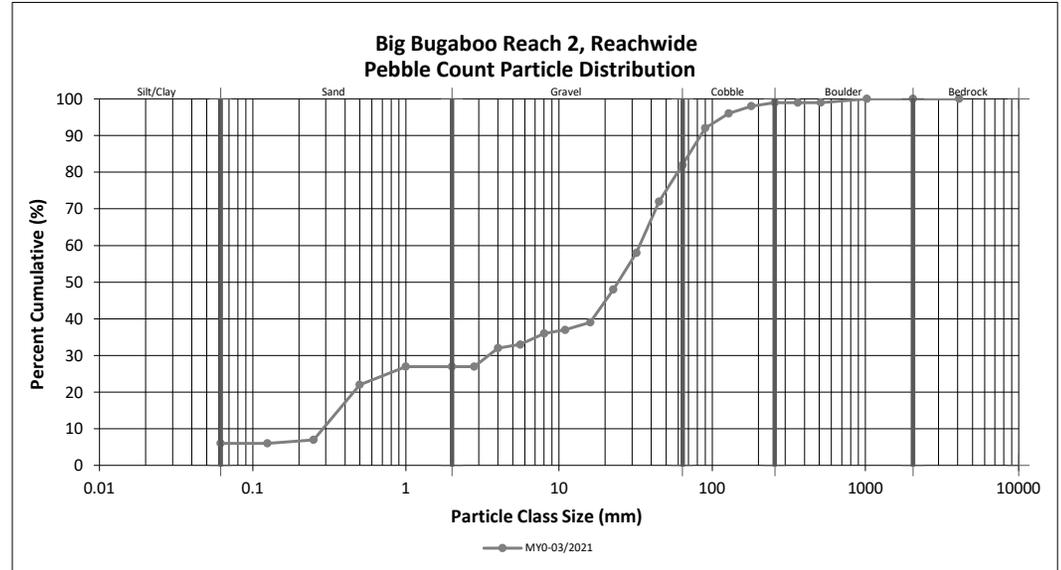
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062		6	6	6	6
<i>SAND</i>	Very fine	0.062	0.125					6
	Fine	0.125	0.250	1		1	1	7
	Medium	0.25	0.50		15	15	15	22
	Coarse	0.5	1.0		5	5	5	27
	Very Coarse	1.0	2.0					27
<i>GRAVEL</i>	Very Fine	2.0	2.8					27
	Very Fine	2.8	4.0		5	5	5	32
	Fine	4.0	5.6		1	1	1	33
	Fine	5.6	8.0		3	3	3	36
	Medium	8.0	11.0		1	1	1	37
	Medium	11.0	16.0		2	2	2	39
	Coarse	16.0	22.6	7	2	9	9	48
	Coarse	22.6	32	10		10	10	58
	Very Coarse	32	45	14		14	14	72
	Very Coarse	45	64	10		10	10	82
<i>COBBLE</i>	Small	64	90	10		10	10	92
	Small	90	128	4		4	4	96
	Large	128	180	2		2	2	98
	Large	180	256	1		1	1	99
<i>BOULDER</i>	Small	256	362					99
	Small	362	512					99
	Medium	512	1024	1		1	1	100
	Large/Very Large	1024	2048					100
<i>BEDROCK</i>	Bedrock	2048	>2048					100
Total				60	40	100	100	100

Reachwide Channel materials (mm)	
D ₁₆ =	0.38
D ₃₅ =	7.10
D ₅₀ =	24.2
D ₈₄ =	68.5
D ₉₅ =	117.2
D ₁₀₀ =	1024.0



Reachwide Pebble Count Plots

Bug Headwaters Mitigation Site

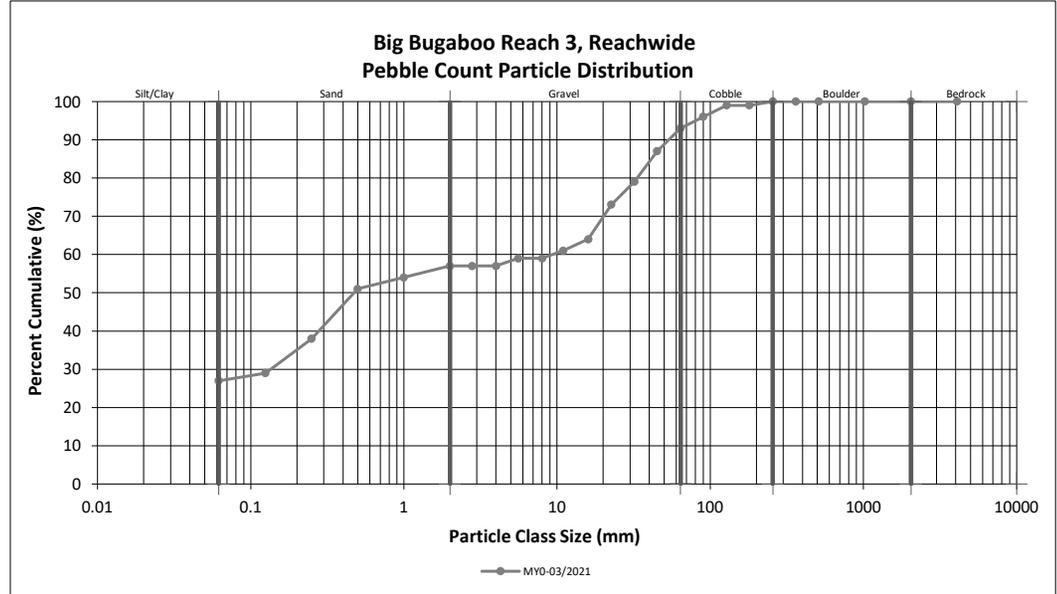
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Reach 3, 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	26	27	27	27
SAND	Very fine	0.062	0.125	2		2	2	29
	Fine	0.125	0.250	2	7	9	9	38
	Medium	0.25	0.50		13	13	13	51
	Coarse	0.5	1.0		3	3	3	54
	Very Coarse	1.0	2.0	2	1	3	3	57
GRAVEL	Very Fine	2.0	2.8					57
	Very Fine	2.8	4.0					57
	Fine	4.0	5.6	1	1	2	2	59
	Fine	5.6	8.0					59
	Medium	8.0	11.0	2		2	2	61
	Medium	11.0	16.0	3		3	3	64
	Coarse	16.0	22.6	5	4	9	9	73
	Coarse	22.6	32	4	2	6	6	79
	Very Coarse	32	45	5	3	8	8	87
Very Coarse	45	64	6		6	6	93	
COBBLE	Small	64	90	3		3	3	96
	Small	90	128	3		3	3	99
	Large	128	180					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				40	60	100	100	100

Reachwide Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	0.20
D ₅₀ =	0.5
D ₈₄ =	39.6
D ₉₅ =	80.3
D ₁₀₀ =	256.0



Reachwide Pebble Count Plots

Bug Headwaters Mitigation Site

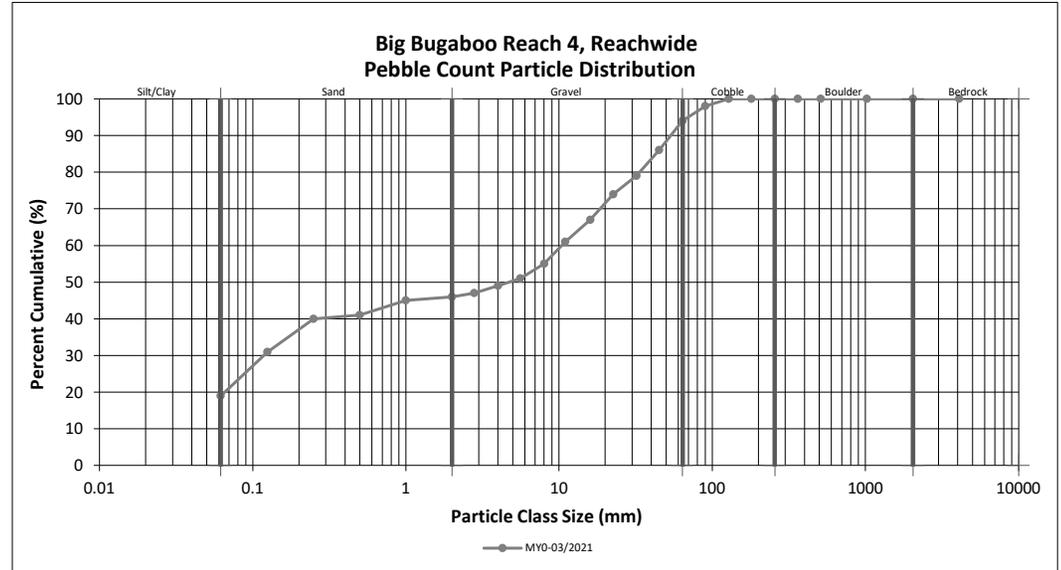
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Reach 4, 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		19	19	19	19
SAND	Very fine	0.062	0.125		12	12	12	31
	Fine	0.125	0.250	2	7	9	9	40
	Medium	0.25	0.50		1	1	1	41
	Coarse	0.5	1.0		4	4	4	45
	Very Coarse	1.0	2.0		1	1	1	46
GRAVEL	Very Fine	2.0	2.8		1	1	1	47
	Very Fine	2.8	4.0		2	2	2	49
	Fine	4.0	5.6	1	1	2	2	51
	Fine	5.6	8.0	3	1	4	4	55
	Medium	8.0	11.0	5	1	6	6	61
	Medium	11.0	16.0	6		6	6	67
	Coarse	16.0	22.6	7		7	7	74
	Coarse	22.6	32	5		5	5	79
	Very Coarse	32	45	7		7	7	86
	Very Coarse	45	64	8		8	8	94
COBBLE	Small	64	90	4		4	4	98
	Small	90	128	2		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				50	50	100	100	100

Reachwide Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	0.17
D ₅₀ =	4.7
D ₈₄ =	40.8
D ₉₅ =	69.7
D ₁₀₀ =	128.0



Reachwide Pebble Count Plots

Bug Headwaters Mitigation Site

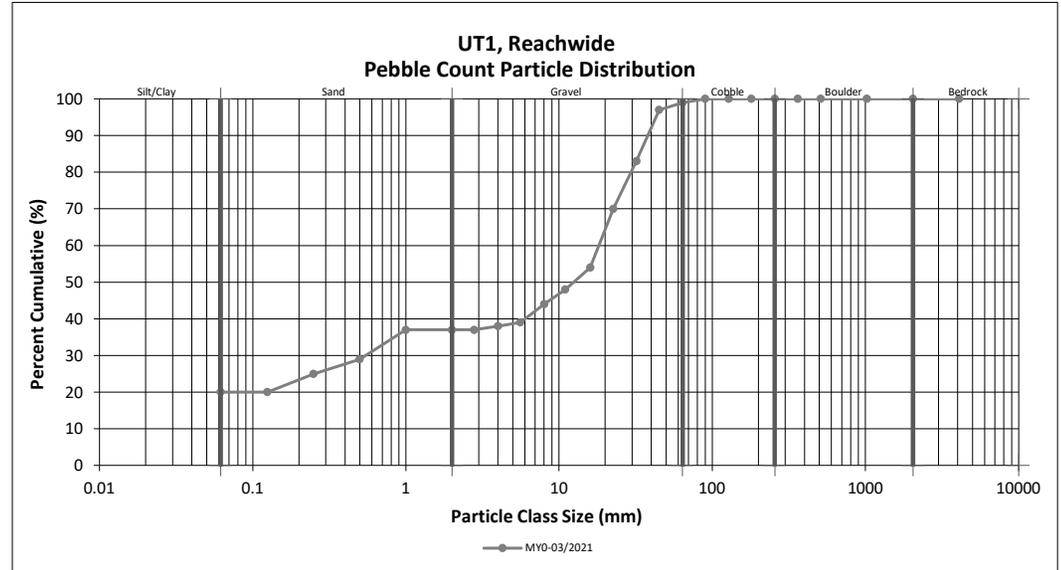
DMS Project No. 100084

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	5	15	20	20	20
SAND	Very fine	0.062	0.125					20
	Fine	0.125	0.250		5	5	5	25
	Medium	0.25	0.50	4		4	4	29
	Coarse	0.5	1.0	5	3	8	8	37
	Very Coarse	1.0	2.0					37
GRAVEL	Very Fine	2.0	2.8					37
	Very Fine	2.8	4.0	1		1	1	38
	Fine	4.0	5.6	1		1	1	39
	Fine	5.6	8.0	3	2	5	5	44
	Medium	8.0	11.0	4		4	4	48
	Medium	11.0	16.0	6		6	6	54
	Coarse	16.0	22.6	15	1	16	16	70
	Coarse	22.6	32	12	1	13	13	83
	Very Coarse	32	45	11	3	14	14	97
	Very Coarse	45	64	2		2	2	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				70	30	100	100	100

Reachwide	
Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	0.84
D ₅₀ =	12.5
D ₈₄ =	32.8
D ₉₅ =	42.9
D ₁₀₀ =	90.0



Reachwide Pebble Count Plots

Bug Headwaters Mitigation Site

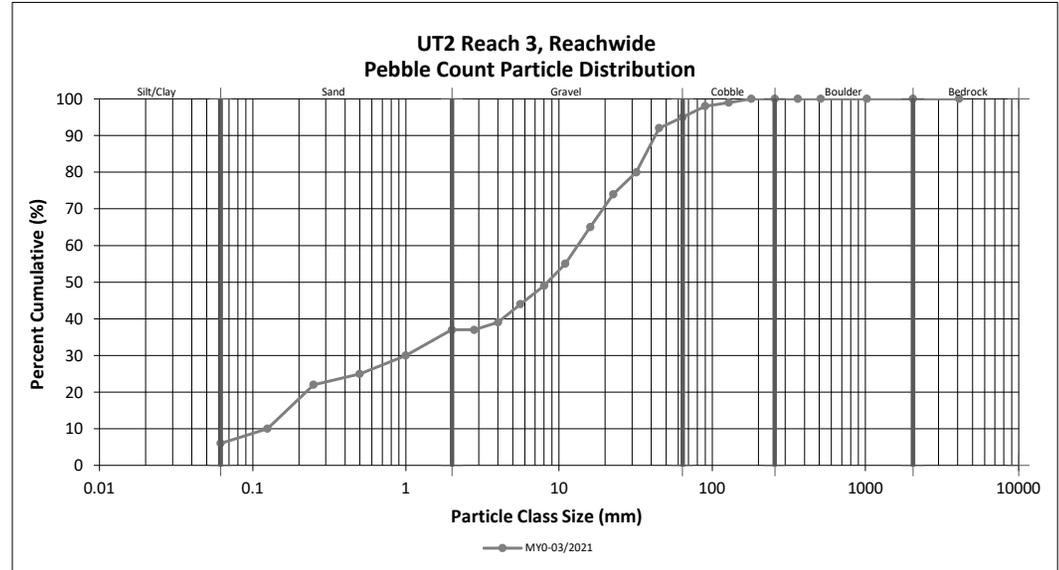
DMS Project No. 100084

Monitoring Year 0 - 2021

UT2 Reach 3, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062		6	6	6	6
<i>SAND</i>	Very fine	0.062	0.125		4	4	4	10
		0.125	0.250		12	12	12	22
	Medium	0.25	0.50		3	3	3	25
	Coarse	0.5	1.0	1	4	5	5	30
	Very Coarse	1.0	2.0		7	7	7	37
<i>GRAVEL</i>	Very Fine	2.0	2.8					37
	Very Fine	2.8	4.0	2		2	2	39
	Fine	4.0	5.6	4	1	5	5	44
	Fine	5.6	8.0	4	1	5	5	49
	Medium	8.0	11.0	5	1	6	6	55
	Medium	11.0	16.0	9	1	10	10	65
	Coarse	16.0	22.6	9		9	9	74
	Coarse	22.6	32	6		6	6	80
	Very Coarse	32	45	12		12	12	92
	Very Coarse	45	64	3		3	3	95
<i>COBBLE</i>	Small	64	90	3		3	3	98
	Small	90	128	1		1	1	99
	Large	128	180	1		1	1	100
	Large	180	256					100
<i>BOULDER</i>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<i>BEDROCK</i>	Bedrock	2048	>2048					100
Total				60	40	100	100	100

Reachwide Channel materials (mm)	
D ₁₆ =	0.18
D ₃₅ =	1.64
D ₅₀ =	8.4
D ₈₄ =	35.9
D ₉₅ =	64.0
D ₁₀₀ =	180.0



Reachwide Pebble Count Plots

Bug Headwaters Mitigation Site

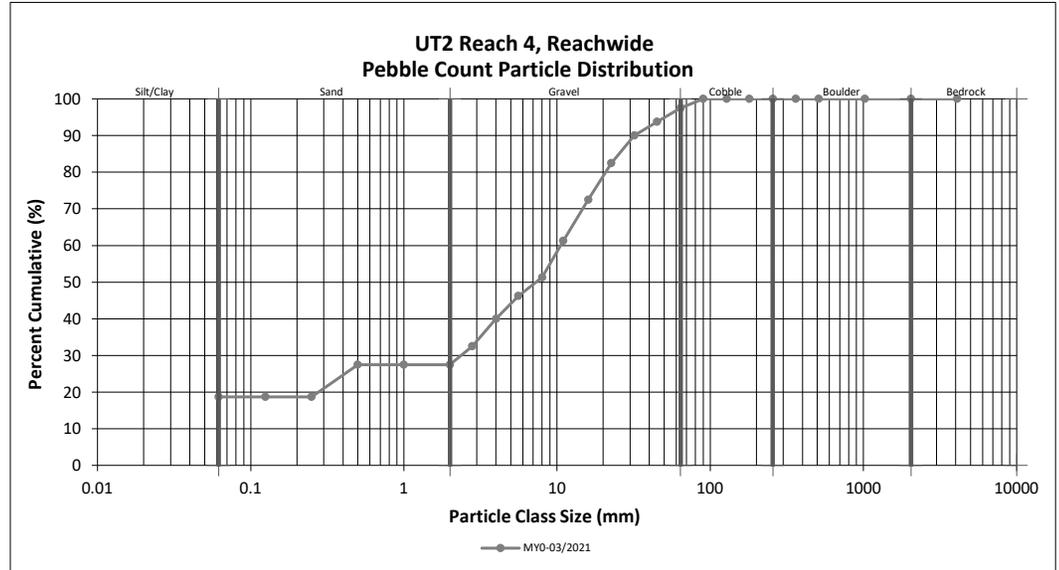
DMS Project No. 100084

Monitoring Year 0 - 2021

UT2 Reach 4, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	1	14	15	19	19
<i>SAND</i>	Very fine	0.062	0.125					19
	Fine	0.125	0.250					19
	Medium	0.25	0.50		7	7	9	28
	Coarse	0.5	1.0					28
	Very Coarse	1.0	2.0					28
<i>GRAVEL</i>	Very Fine	2.0	2.8		4	4	5	33
	Very Fine	2.8	4.0	1	5	6	8	40
	Fine	4.0	5.6	1	4	5	6	46
	Fine	5.6	8.0	3	1	4	5	51
	Medium	8.0	11.0	6	2	8	10	61
	Medium	11.0	16.0	8	1	9	11	73
	Coarse	16.0	22.6	7	1	8	10	83
	Coarse	22.6	32	6		6	8	90
	Very Coarse	32	45	3		3	4	94
	Very Coarse	45	64	2	1	3	4	98
<i>COBBLE</i>	Small	64	90	2		2	3	100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
<i>BOULDER</i>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<i>BEDROCK</i>	Bedrock	2048	>2048					100
Total				40	40	80	100	100

Reachwide	
Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	3.15
D ₅₀ =	7.3
D ₈₄ =	24.2
D ₉₅ =	50.6
D ₁₀₀ =	90.0



Reachwide Pebble Count Plots

Bug Headwaters Mitigation Site

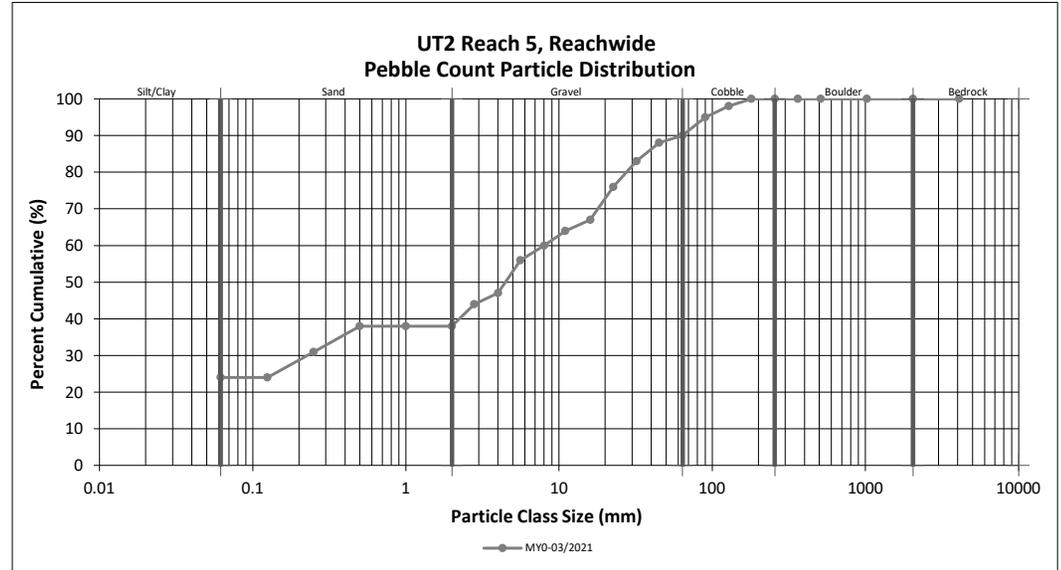
DMS Project No. 100084

Monitoring Year 0 - 2021

UT2 Reach 5, 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	23	24	24	24
SAND	Very fine	0.062	0.125					24
	Fine	0.125	0.250		7	7	7	31
	Medium	0.25	0.50		7	7	7	38
	Coarse	0.5	1.0					38
GRAVEL	Very Fine	2.0	2.8	2	4	6	6	44
	Very Fine	2.8	4.0	3		3	3	47
	Fine	4.0	5.6	4	5	9	9	56
	Fine	5.6	8.0	3	1	4	4	60
	Medium	8.0	11.0	3	1	4	4	64
	Medium	11.0	16.0	2	1	3	3	67
	Coarse	16.0	22.6	8	1	9	9	76
	Coarse	22.6	32	7		7	7	83
	Very Coarse	32	45	5		5	5	88
	Very Coarse	45	64	2		2	2	90
COBBLE	Small	64	90	5		5	5	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 =	0.37
D ₅₀ =	4.5
D ₈₄ =	34.3
D ₉₅ =	90.0
D ₁₀₀ =	180.0



Reachwide Pebble Count Plots

Bug Headwaters Mitigation Site

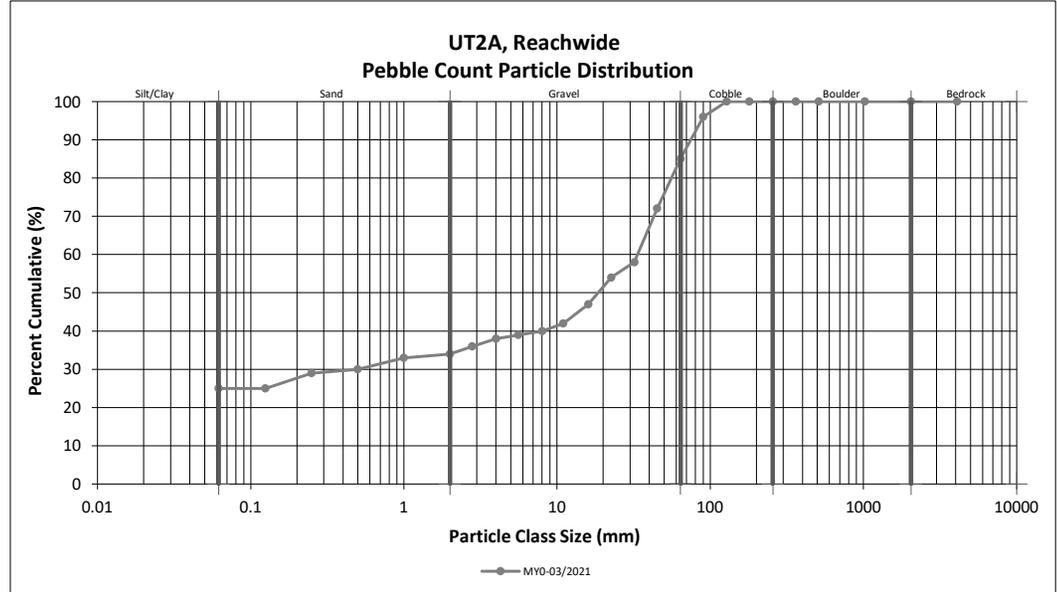
DMS Project No. 100084

Monitoring Year 0 - 2021

UT2A, 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	24	25	25	25
SAND	Very fine	0.062	0.125					25
	Fine	0.125	0.250		4	4	4	29
	Medium	0.25	0.50		1	1	1	30
	Coarse	0.5	1.0		3	3	3	33
	Very Coarse	1.0	2.0		1	1	1	34
GRAVEL	Very Fine	2.0	2.8		2	2	2	36
	Very Fine	2.8	4.0		2	2	2	38
	Fine	4.0	5.6		1	1	1	39
	Fine	5.6	8.0	1		1	1	40
	Medium	8.0	11.0	2		2	2	42
	Medium	11.0	16.0	4	1	5	5	47
	Coarse	16.0	22.6	4	3	7	7	54
	Coarse	22.6	32	2	2	4	4	58
	Very Coarse	32	45	9	5	14	14	72
Very Coarse	45	64	12	1	13	13	85	
COBBLE	Small	64	90	11		11	11	96
	Small	90	128	4		4	4	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				50	50	100	100	100

Reachwide	
Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	2.37
D ₅₀ =	18.6
D ₈₄ =	62.3
D ₉₅ =	87.3
D ₁₀₀ =	128.0



Reachwide Pebble Count Plots

Bug Headwaters Mitigation Site

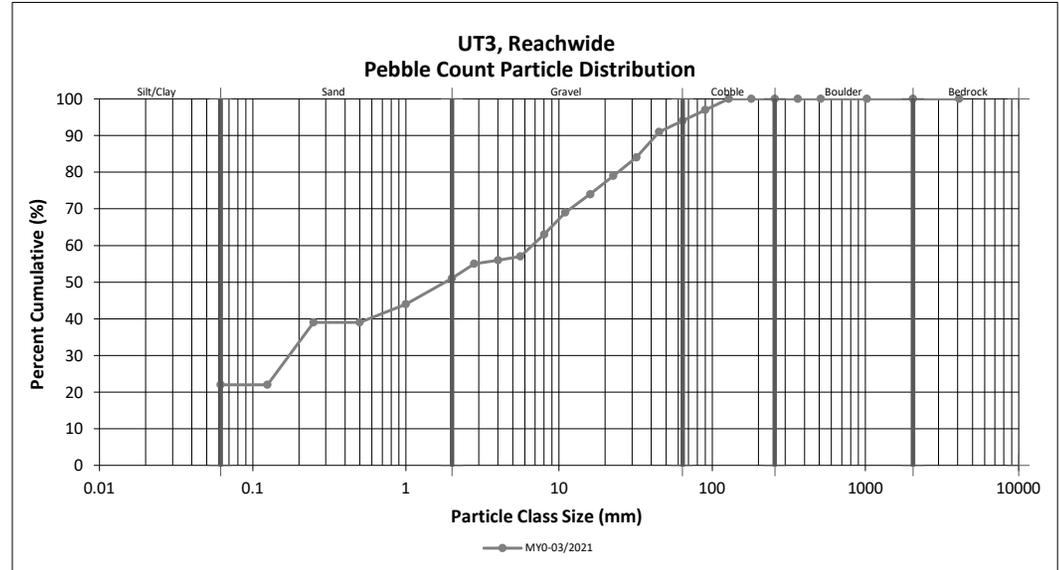
DMS Project No. 100084

Monitoring Year 0 - 2021

UT3, 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	18	22	22	22
SAND	Very fine	0.062	0.125					22
	Fine	0.125	0.250	3	14	17	17	39
	Medium	0.25	0.50					39
	Coarse	0.5	1.0	2	3	5	5	44
	Very Coarse	1.0	2.0		7	7	7	51
GRAVEL	Very Fine	2.0	2.8		4	4	4	55
	Very Fine	2.8	4.0		1	1	1	56
	Fine	4.0	5.6	1		1	1	57
	Fine	5.6	8.0	6		6	6	63
	Medium	8.0	11.0	6		6	6	69
	Medium	11.0	16.0	4	1	5	5	74
	Coarse	16.0	22.6	3	2	5	5	79
	Coarse	22.6	32	5		5	5	84
	Very Coarse	32	45	7		7	7	91
	Very Coarse	45	64	3		3	3	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				50	50	100	100	100

Reachwide	
Channel materials (mm)	
D ₁₆ =	Silt/Clay
D ₃₅ =	0.21
D ₅₀ =	1.8
D ₈₄ =	32.0
D ₉₅ =	71.7
D ₁₀₀ =	128.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

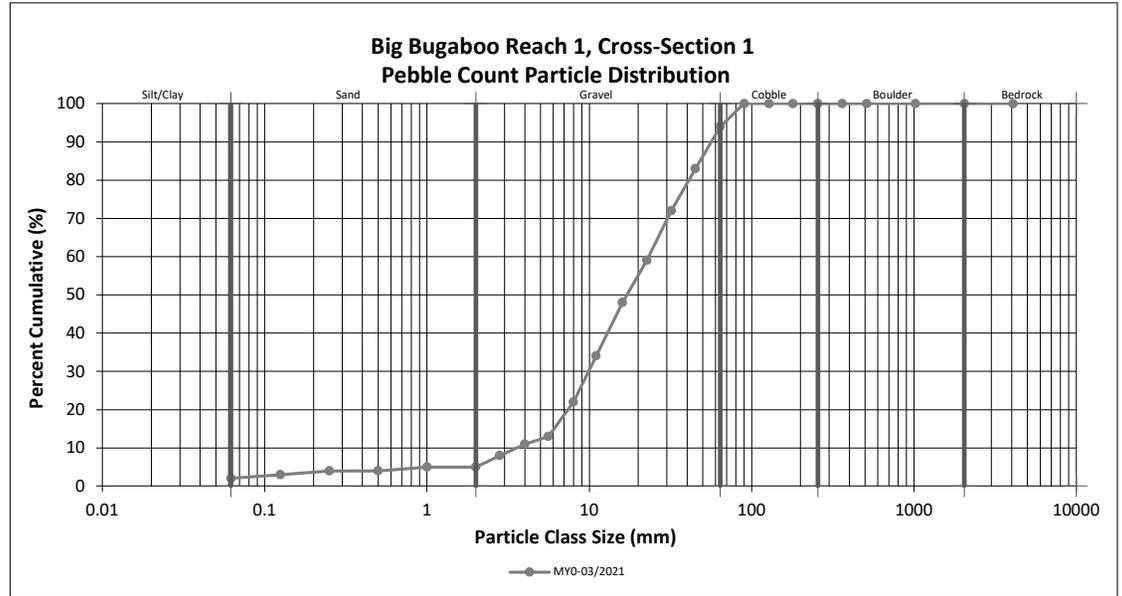
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Reach 1, Cross-Section 1

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	2	2	2
<i>SAND</i>	Very fine	0.062	0.125	1	1	3
	Fine	0.125	0.250	1	1	4
	Medium	0.25	0.50			4
	Coarse	0.5	1.0	1	1	5
	Very Coarse	1.0	2.0			5
<i>GRAVEL</i>	Very Fine	2.0	2.8	3	3	8
	Very Fine	2.8	4.0	3	3	11
	Fine	4.0	5.6	2	2	13
	Fine	5.6	8.0	9	9	22
	Medium	8.0	11.0	12	12	34
	Medium	11.0	16.0	14	14	48
	Coarse	16.0	22.6	11	11	59
	Coarse	22.6	32	13	13	72
	Very Coarse	32	45	11	11	83
	Very Coarse	45	64	11	11	94
<i>COBBLE</i>	Small	64	90	6	6	100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 1	
Channel materials (mm)	
D ₁₆ =	6.31
D ₃₅ =	11.30
D ₅₀ =	17.0
D ₈₄ =	46.5
D ₉₅ =	67.7
D ₁₀₀ =	90.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

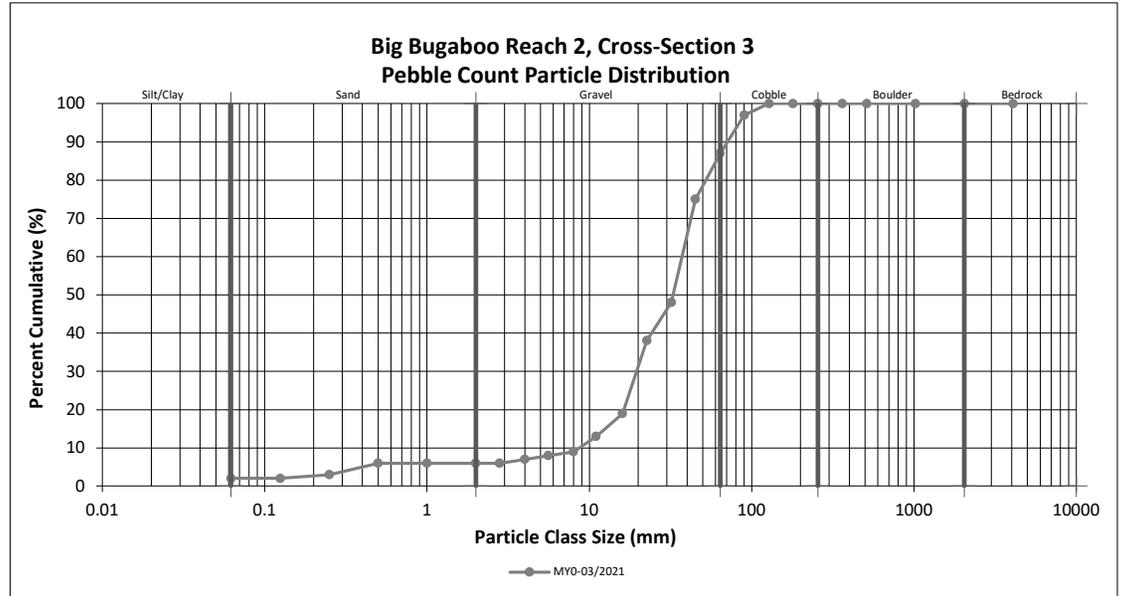
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Reach 2, Cross-Section 3

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	2	2	2
<i>SAND</i>	Very fine	0.062	0.125			2
	Fine	0.125	0.250	1	1	3
	Medium	0.25	0.50	3	3	6
	Coarse	0.5	1.0			6
<i>GRAVEL</i>	Very Coarse	1.0	2.0			6
	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0	1	1	7
	Fine	4.0	5.6	1	1	8
	Fine	5.6	8.0	1	1	9
	Medium	8.0	11.0	4	4	13
	Medium	11.0	16.0	6	6	19
	Coarse	16.0	22.6	19	19	38
	Coarse	22.6	32	10	10	48
	Very Coarse	32	45	27	27	75
<i>COBBLE</i>	Very Coarse	45	64	12	12	87
	Small	64	90	10	10	97
	Small	90	128	3	3	100
	Large	128	180			100
<i>BOULDER</i>	Large	180	256			100
	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<i>BEDROCK</i>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 4	
Channel materials (mm)	
D ₁₆ =	13.27
D ₃₅ =	21.40
D ₅₀ =	32.8
D ₈₄ =	58.6
D ₉₅ =	84.1
D ₁₀₀ =	128.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

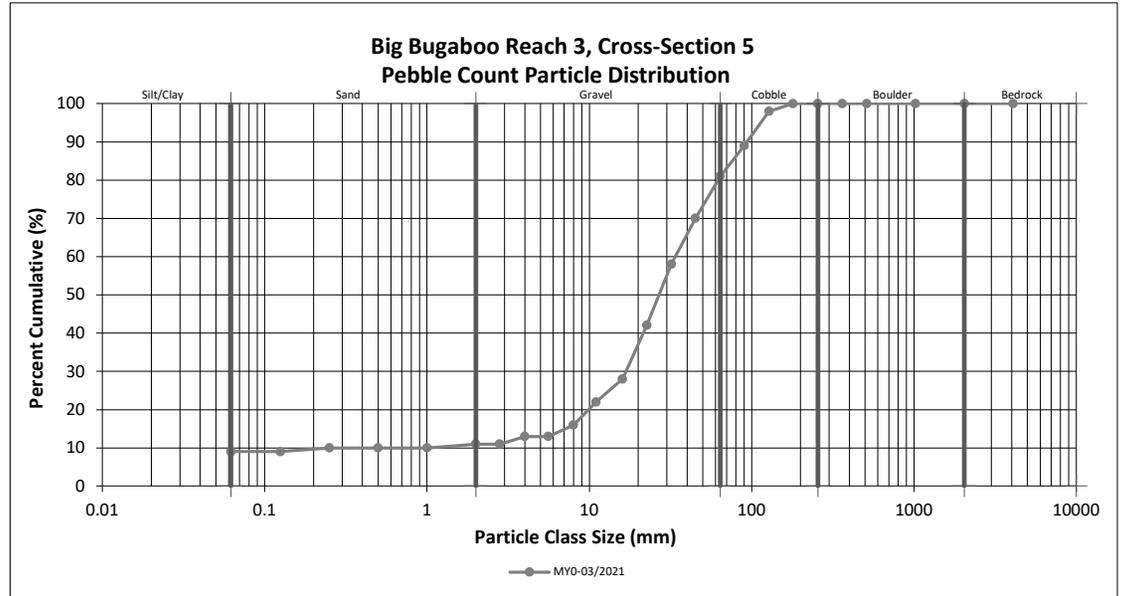
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Reach 3, Cross-Section 5

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	9	9	9
<i>SAND</i>	Very fine	0.062	0.125			9
	Fine	0.125	0.250	1	1	10
	Medium	0.25	0.50			10
	Coarse	0.5	1.0			10
<i>GRAVEL</i>	Very Coarse	1.0	2.0	1	1	11
	Very Fine	2.0	2.8			11
	Very Fine	2.8	4.0	2	2	13
	Fine	4.0	5.6			13
	Fine	5.6	8.0	3	3	16
	Medium	8.0	11.0	6	6	22
	Medium	11.0	16.0	6	6	28
	Coarse	16.0	22.6	14	14	42
	Coarse	22.6	32	16	16	58
	Very Coarse	32	45	12	12	70
<i>COBBLE</i>	Very Coarse	45	64	11	11	81
	Small	64	90	8	8	89
	Small	90	128	9	9	98
	Large	128	180	2	2	100
<i>BOULDER</i>	Large	180	256			100
	Small	256	362			100
<i>BOULDER</i>	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 5	
Channel materials (mm)	
D ₁₆ =	8.00
D ₃₅ =	19.02
D ₅₀ =	26.9
D ₈₄ =	72.7
D ₉₅ =	113.8
D ₁₀₀ =	180.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

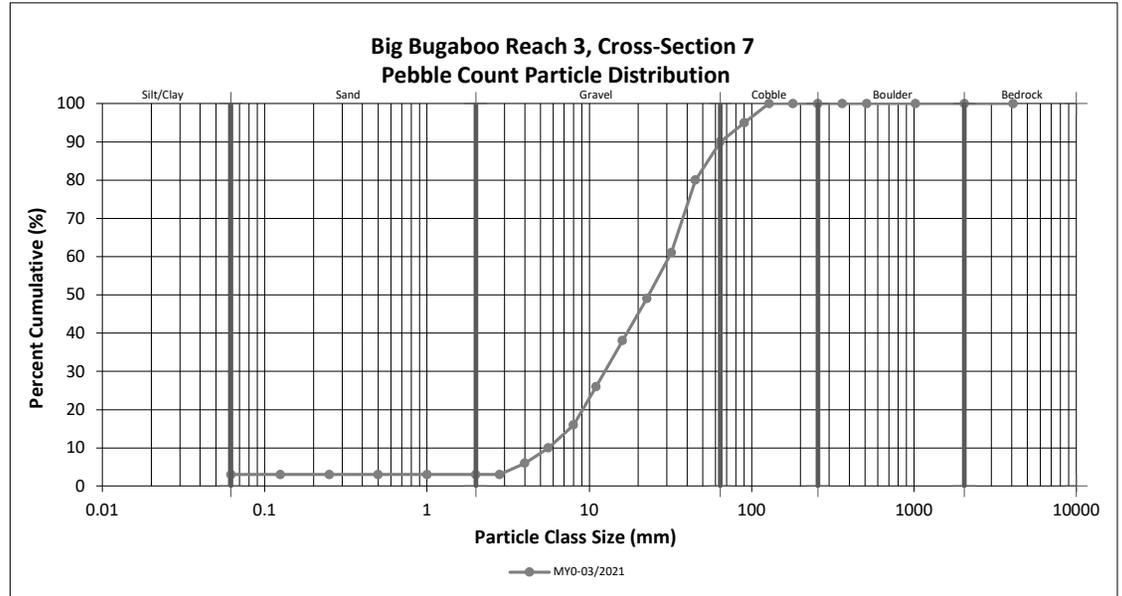
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Reach 3, Cross-Section 7

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	3	3	3
<i>SAND</i>	Very fine	0.062	0.125			3
	Fine	0.125	0.250			3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0			3
<i>GRAVEL</i>	Very Fine	2.0	2.8			3
	Very Fine	2.8	4.0	3	3	6
	Fine	4.0	5.6	4	4	10
	Fine	5.6	8.0	6	6	16
	Medium	8.0	11.0	10	10	26
	Medium	11.0	16.0	12	12	38
	Coarse	16.0	22.6	11	11	49
	Coarse	22.6	32	12	12	61
	Very Coarse	32	45	19	19	80
Very Coarse	45	64	10	10	90	
<i>COBBLE</i>	Small	64	90	5	5	95
	Small	90	128	5	5	100
	Large	128	180			100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 7	
Channel materials (mm)	
D ₁₆ =	8.00
D ₃₅ =	14.57
D ₅₀ =	23.3
D ₈₄ =	51.8
D ₉₅ =	90.0
D ₁₀₀ =	128.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

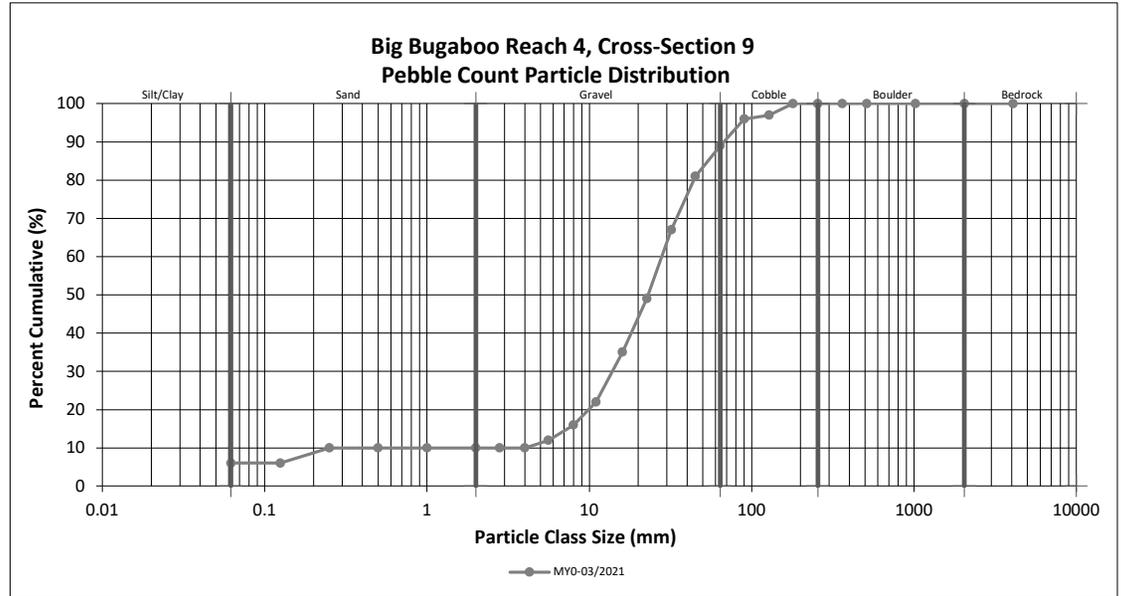
DMS Project No. 100084

Monitoring Year 0 - 2021

Big Bugaboo Reach 4, Cross-Section 9

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	6	6	6
<i>SAND</i>	Very fine	0.062	0.125			6
	Fine	0.125	0.250	4	4	10
	Medium	0.25	0.50			10
	Coarse	0.5	1.0			10
<i>GRAVEL</i>	Very Coarse	1.0	2.0			10
	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0			10
	Fine	4.0	5.6	2	2	12
	Fine	5.6	8.0	4	4	16
	Medium	8.0	11.0	6	6	22
	Medium	11.0	16.0	13	13	35
	Coarse	16.0	22.6	14	14	49
	Coarse	22.6	32	18	18	67
	Very Coarse	32	45	14	14	81
<i>COBBLE</i>	Very Coarse	45	64	8	8	89
	Small	64	90	7	7	96
	Small	90	128	1	1	97
	Large	128	180	3	3	100
<i>BOULDER</i>	Large	180	256			100
	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<i>BEDROCK</i>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 9	
Channel materials (mm)	
D ₁₆ =	8.00
D ₃₅ =	16.00
D ₅₀ =	23.0
D ₈₄ =	51.4
D ₉₅ =	85.7
D ₁₀₀ =	180.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

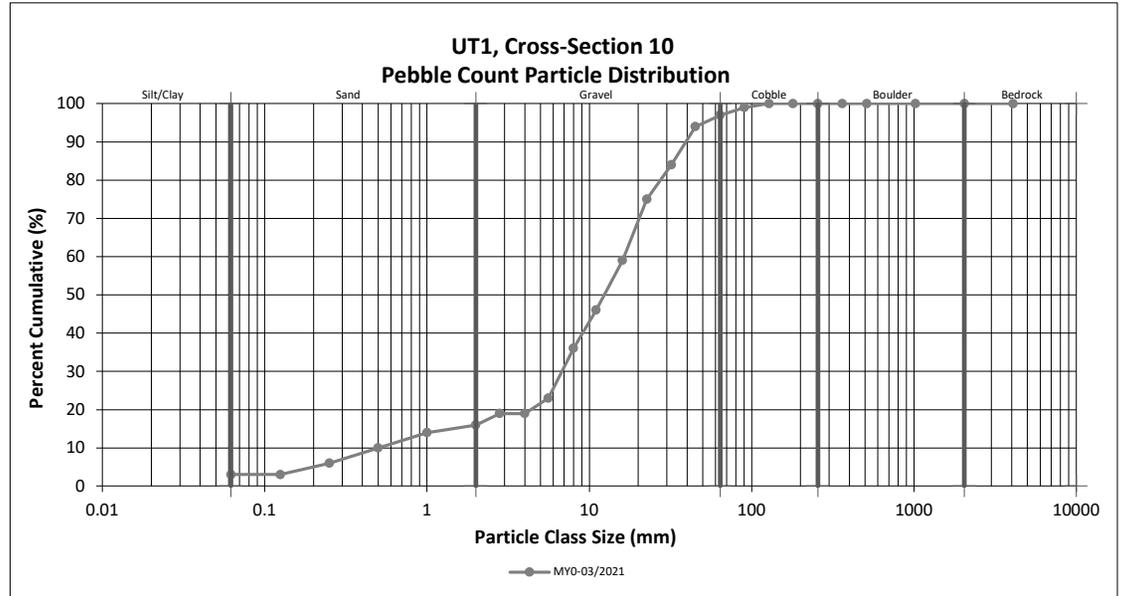
DMS Project No. 100084

Monitoring Year 0 - 2021

UT1, Cross-Section 10

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	3	3	3
<i>SAND</i>	Very fine	0.062	0.125			3
	Fine	0.125	0.250	3	3	6
	Medium	0.25	0.50	4	4	10
	Coarse	0.5	1.0	4	4	14
	Very Coarse	1.0	2.0	2	2	16
<i>GRAVEL</i>	Very Fine	2.0	2.8	3	3	19
	Very Fine	2.8	4.0			19
	Fine	4.0	5.6	4	4	23
	Fine	5.6	8.0	13	13	36
	Medium	8.0	11.0	10	10	46
	Medium	11.0	16.0	13	13	59
	Coarse	16.0	22.6	16	16	75
	Coarse	22.6	32	9	9	84
	Very Coarse	32	45	10	10	94
	Very Coarse	45	64	3	3	97
<i>COBBLE</i>	Small	64	90	2	2	99
	Small	90	128	1	1	100
	Large	128	180			100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 10	
Channel materials (mm)	
D ₁₆ =	2.00
D ₃₅ =	7.78
D ₅₀ =	12.3
D ₈₄ =	32.0
D ₉₅ =	50.6
D ₁₀₀ =	128.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

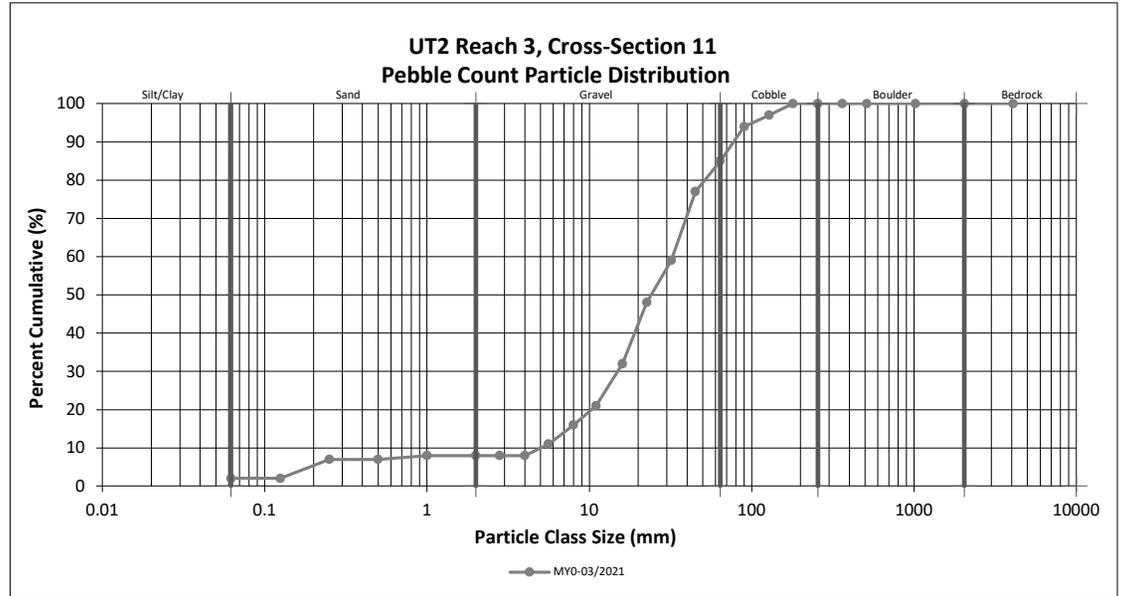
DMS Project No. 100084

Monitoring Year 0 - 2021

UT2 Reach 3, Cross-Section 11

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	2	2	2
<i>SAND</i>	Very fine	0.062	0.125			2
	Fine	0.125	0.250	5	5	7
	Medium	0.25	0.50			7
	Coarse	0.5	1.0	1	1	8
	Very Coarse	1.0	2.0			8
<i>GRAVEL</i>	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0			8
	Fine	4.0	5.6	3	3	11
	Fine	5.6	8.0	5	5	16
	Medium	8.0	11.0	5	5	21
	Medium	11.0	16.0	11	11	32
	Coarse	16.0	22.6	16	16	48
	Coarse	22.6	32	11	11	59
	Very Coarse	32	45	18	18	77
	Very Coarse	45	64	8	8	85
<i>COBBLE</i>	Small	64	90	9	9	94
	Small	90	128	3	3	97
	Large	128	180	3	3	100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 11	
Channel materials (mm)	
D ₁₆ =	8.00
D ₃₅ =	17.07
D ₅₀ =	24.1
D ₈₄ =	61.2
D ₉₅ =	101.2
D ₁₀₀ =	180.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

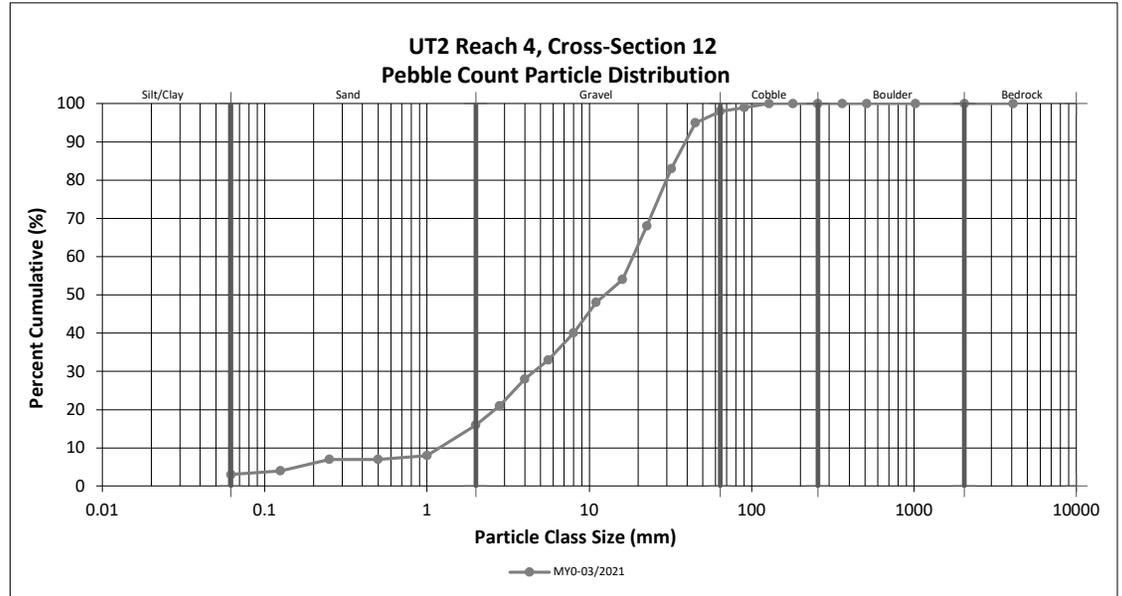
DMS Project No. 100084

Monitoring Year 0 - 2021

UT2 Reach 4, Cross-Section 12

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	3	3	3
<i>SAND</i>	Very fine	0.062	0.125	1	1	4
	Fine	0.125	0.250	3	3	7
	Medium	0.25	0.50			7
	Coarse	0.5	1.0	1	1	8
	Very Coarse	1.0	2.0	8	8	16
<i>GRAVEL</i>	Very Fine	2.0	2.8	5	5	21
	Very Fine	2.8	4.0	7	7	28
	Fine	4.0	5.6	5	5	33
	Fine	5.6	8.0	7	7	40
	Medium	8.0	11.0	8	8	48
	Medium	11.0	16.0	6	6	54
	Coarse	16.0	22.6	14	14	68
	Coarse	22.6	32	15	15	83
	Very Coarse	32	45	12	12	95
	Very Coarse	45	64	3	3	98
<i>COBBLE</i>	Small	64	90	1	1	99
	Small	90	128	1	1	100
	Large	128	180			100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 12	
Channel materials (mm)	
D ₁₆ =	2.00
D ₃₅ =	6.20
D ₅₀ =	12.5
D ₈₄ =	32.9
D ₉₅ =	45.0
D ₁₀₀ =	128.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

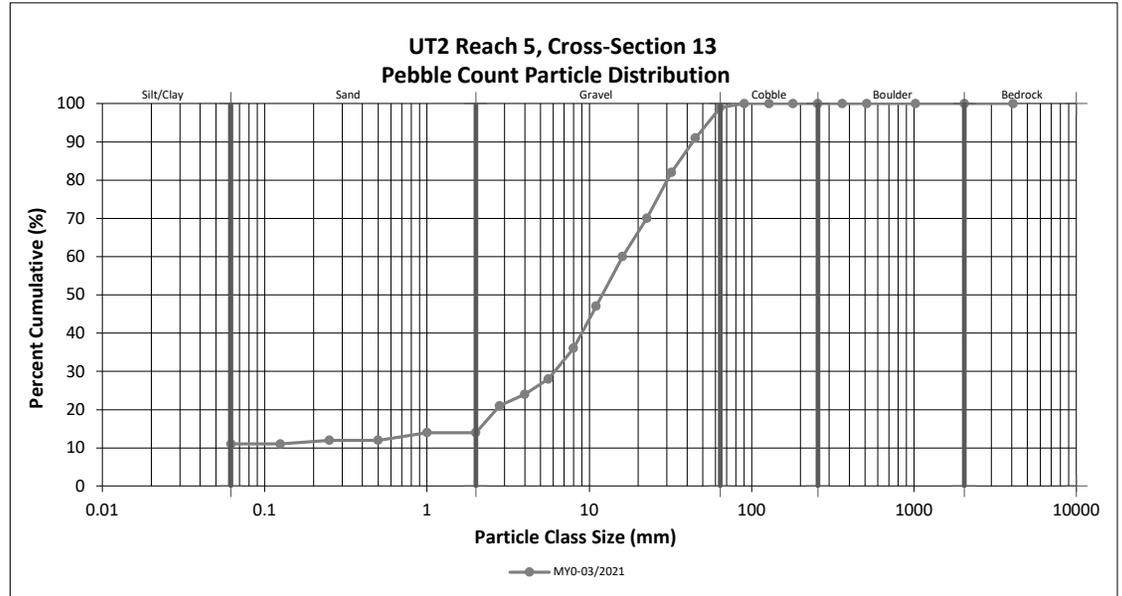
DMS Project No. 100084

Monitoring Year 0 - 2021

UT2 Reach 5, Cross-Section 13

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	11	11	11
<i>SAND</i>	Very fine	0.062	0.125			11
	Fine	0.125	0.250	1	1	12
	Medium	0.25	0.50			12
	Coarse	0.5	1.0	2	2	14
<i>GRAVEL</i>	Very Coarse	1.0	2.0			14
	Very Fine	2.0	2.8	7	7	21
	Very Fine	2.8	4.0	3	3	24
	Fine	4.0	5.6	4	4	28
	Fine	5.6	8.0	8	8	36
	Medium	8.0	11.0	11	11	47
	Medium	11.0	16.0	13	13	60
	Coarse	16.0	22.6	10	10	70
	Coarse	22.6	32	12	12	82
	Very Coarse	32	45	9	9	91
<i>COBBLE</i>	Very Coarse	45	64	8	8	99
	Small	64	90	1	1	100
	Small	90	128			100
	Large	128	180			100
<i>BOULDER</i>	Large	180	256			100
	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<i>BEDROCK</i>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 13	
Channel materials (mm)	
D ₁₆ =	2.20
D ₃₅ =	7.65
D ₅₀ =	12.0
D ₈₄ =	34.5
D ₉₅ =	53.7
D ₁₀₀ =	90.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

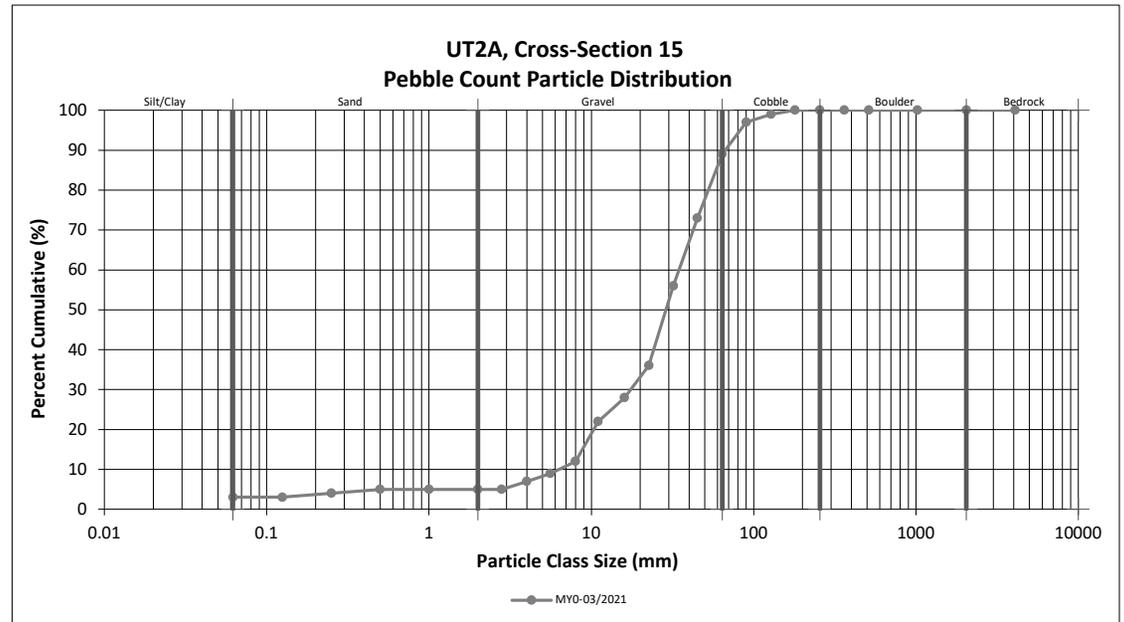
DMS Project No. 100084

Monitoring Year 0 - 2021

UT2A, Cross-Section 15

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	1	1	4
	Medium	0.25	0.50	1	1	5
	Coarse	0.5	1.0			5
GRAVEL	Very Coarse	1.0	2.0			5
	Very Fine	2.0	2.8			5
	Very Fine	2.8	4.0	2	2	7
	Fine	4.0	5.6	2	2	9
	Fine	5.6	8.0	3	3	12
	Medium	8.0	11.0	10	10	22
	Medium	11.0	16.0	6	6	28
	Coarse	16.0	22.6	8	8	36
	Coarse	22.6	32	20	20	56
	Very Coarse	32	45	17	17	73
COBBLE	Very Coarse	45	64	16	16	89
	Small	64	90	8	8	97
	Small	90	128	2	2	99
	Large	128	180	1	1	100
BOULDER	Large	180	256			100
	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
BEDROCK	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 15	
Channel materials (mm)	
D ₁₆ =	9.09
D ₃₅ =	21.65
D ₅₀ =	28.8
D ₈₄ =	57.3
D ₉₅ =	82.6
D ₁₀₀ =	180.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

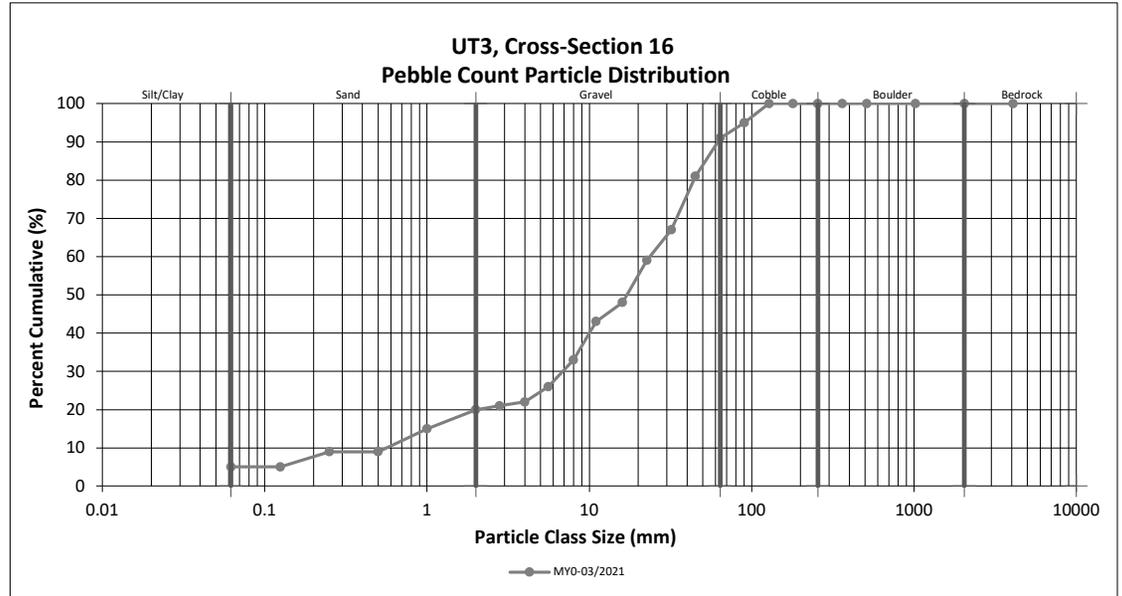
DMS Project No. 100084

Monitoring Year 0 - 2021

UT3, Cross-Section 16

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	5	5	5
<i>SAND</i>	Very fine	0.062	0.125			5
	Fine	0.125	0.250	4	4	9
	Medium	0.25	0.50			9
	Coarse	0.5	1.0	6	6	15
<i>GRAVEL</i>	Very Coarse	1.0	2.0	5	5	20
	Very Fine	2.0	2.8	1	1	21
	Very Fine	2.8	4.0	1	1	22
	Fine	4.0	5.6	4	4	26
	Fine	5.6	8.0	7	7	33
	Medium	8.0	11.0	10	10	43
	Medium	11.0	16.0	5	5	48
	Coarse	16.0	22.6	11	11	59
	Coarse	22.6	32	8	8	67
	Very Coarse	32	45	14	14	81
<i>COBBLE</i>	Very Coarse	45	64	10	10	91
	Small	64	90	4	4	95
	Small	90	128	5	5	100
	Large	128	180			100
<i>BOULDER</i>	Large	180	256			100
	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<i>BEDROCK</i>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 16	
Channel materials (mm)	
D ₁₆ =	1.15
D ₃₅ =	8.53
D ₅₀ =	17.0
D ₈₄ =	50.0
D ₉₅ =	90.0
D ₁₀₀ =	128.0



Cross-Section Pebble Count Plots

Bug Headwaters Mitigation Site

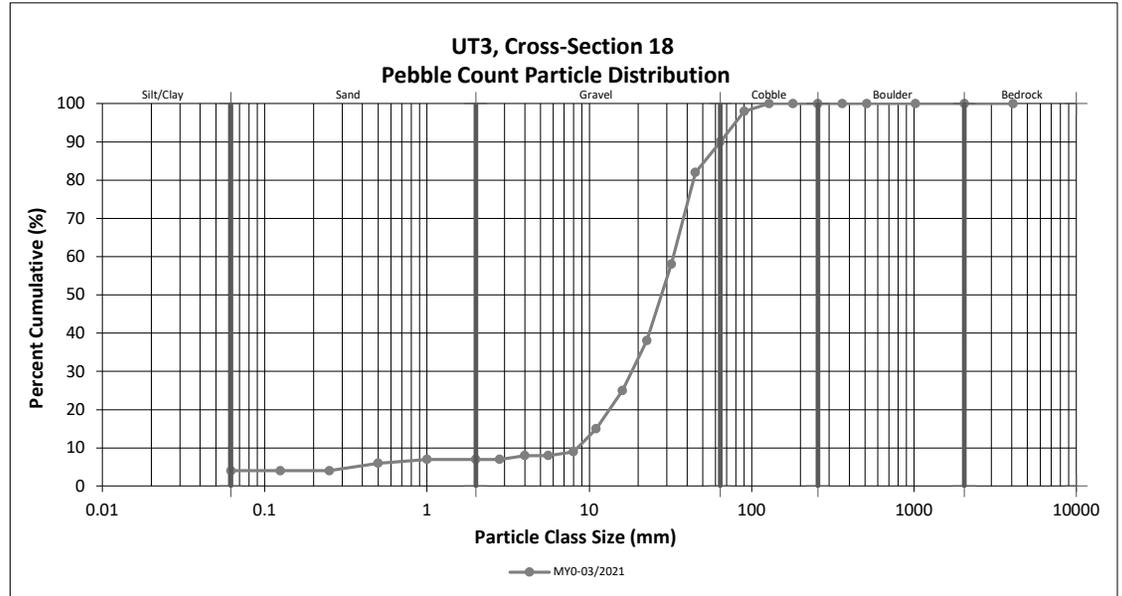
DMS Project No. 100084

Monitoring Year 0 - 2021

UT3, Cross-Section 18

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	4	4	4
<i>SAND</i>	Very fine	0.062	0.125			4
	Fine	0.125	0.250			4
	Medium	0.25	0.50	2	2	6
	Coarse	0.5	1.0	1	1	7
	Very Coarse	1.0	2.0			7
<i>GRAVEL</i>	Very Fine	2.0	2.8			7
	Very Fine	2.8	4.0	1	1	8
	Fine	4.0	5.6			8
	Fine	5.6	8.0	1	1	9
	Medium	8.0	11.0	6	6	15
	Medium	11.0	16.0	10	10	25
	Coarse	16.0	22.6	13	13	38
	Coarse	22.6	32	20	20	58
	Very Coarse	32	45	24	24	82
	Very Coarse	45	64	8	8	90
<i>COBBLE</i>	Small	64	90	8	8	98
	Small	90	128	2	2	100
	Large	128	180			100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
Total				100	100	100

Cross-Section 18	
Channel materials (mm)	
D ₁₆ =	11.42
D ₃₅ =	20.87
D ₅₀ =	27.8
D ₈₄ =	49.1
D ₉₅ =	79.2
D ₁₀₀ =	128.0



APPENDIX D. Project Timeline and Contact Info

Table 10. Project Activity and Reporting History

Bug Headwaters Mitigation Site
 DMS Project No. 100084
Monitoring Year 0 - 2021

Activity or Deliverable		Data Collection Complete	Task Completion or Deliverable Submission
Project Instituted		NA	June 2018
Mitigation Plan Approved		September 2020	September 2020
Construction (Grading) Completed		NA	April 2021
Planting Completed		NA	April 2021
As-Built Survey Completed		May 2021	May 2021
Baseline Monitoring Document (Year 0)	Stream Survey	April 2021	October 2021
	Vegetation Survey	April 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	

Table 11. Project Contact Table

Bug Headwaters Mitigation Site
 DMS Project No. 100084
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
Monitoring Performers Monitoring, POC	Wildlands Engineering, Inc. Jason Lorch 919.851.9986

APPENDIX E. Record Drawings

APPENDIX F. Additional Documentation

Carolyn Lanza

From: Jeff Keaton
Sent: Tuesday, August 10, 2021 8:54 AM
To: Carolyn Lanza
Subject: FW: [External] Bug Headwaters UT3 Revisions

From: Reid, Matthew <matthew.reid@ncdenr.gov>
Sent: Wednesday, April 21, 2021 4:55 PM
To: Jeff Keaton <jkeaton@wildlandseng.com>
Subject: RE: [External] Bug Headwaters UT3 Revisions

Jeff,

Thanks for putting this together so quickly. That's not much of a change. The IRT should not have any issues. Please feel free to notify Kim and share the figure. I do not think they will hold you up on the construction.

Thanks again,

Matthew Reid
Project Manager - Western Region
NCDEQ-DMS
828-231-7912

Sent from my Verizon, Samsung Galaxy smartphone

----- Original message -----

From: Jeff Keaton <jkeaton@wildlandseng.com>
Date: 4/21/21 4:30 PM (GMT-05:00)
To: "Reid, Matthew" <matthew.reid@ncdenr.gov>
Subject: [External] Bug Headwaters UT3 Revisions

CAUTION: External email. Do not click links or open attachments unless you verify. Send all suspicious email as an attachment to [Report Spam](#).

Matthew – Here is the revision to the alignment of UT3 we are proposing. It doesn't look like much of a change but the meanders will be shifted as much as 18 feet. The length of UT3 with this revision will end up being about 1 foot longer than the original. Let me know if this looks OK and I will forward onto Kim. Thanks.

Jeff Keaton, PE | *Senior Water Resources Engineer*
O: 919.851.9986 x103 **M:** 919.302.6919

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

Carolyn Lanza

From: Jeff Keaton
Sent: Tuesday, September 7, 2021 11:22 AM
To: Carolyn Lanza
Subject: FW: Minor alignment change at Bug Headwaters
Attachments: Bug Headwaters UT3 Proposed Revision.pdf

-----Original Message-----

From: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Thursday, April 22, 2021 1:06 PM
To: Jeff Keaton <jkeaton@wildlandseng.com>
Cc: Reid, Matthew <matthew.reid@ncdenr.gov>; Tugwell, Todd J CIV USARMY CESAW (USA) <Todd.J.Tugwell@usace.army.mil>; Davis, Erin B <erin.davis@ncdenr.gov>
Subject: FW: Minor alignment change at Bug Headwaters

Hi Jeff

Thanks for the notice. That will be fine. When you submit the as-built, please have Paul or Matthew indicate the change in linear feet and that the credits will not be adjusted, and a brief explanation, like below, for the change. Will the planting be completed by April 30?

Thanks

Kim

Kim Browning

Mitigation Project Manager, Regulatory Division | U.S. Army Corps of Engineers

-----Original Message-----

From: Jeff Keaton <jkeaton@wildlandseng.com>
Sent: Thursday, April 22, 2021 9:55 AM
To: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Cc: Reid, Matthew <matthew.reid@ncdenr.gov>
Subject: [Non-DoD Source] Minor alignment change at Bug Headwaters

Hi Kim - Hope you are doing well. The construction on the Bug Headwaters site in Wilkes County is almost complete. We are working on the final few hundred feet of channel. We've encountered some bad soil in a pond bed. Because of this, we need to shift the alignment to the left ranging from 5 to 15 feet. This shift will allow us to expedite completion of the project. The shift will not create a narrow easement on the left side and the overall length of the stream through the pond will be 1 foot longer than the original design. DMS asked me to notify you of this planned alignment change. The attached map shows the original alignment in red and the revised alignment in blue. Of course the as-built report will show this change. Let me know if you have any questions or concerns about this change or if you are OK with us proceeding with the revised alignment. Since this is the last step, we expect major construction to be complete in the next week or so. Thanks.

Jeff Keaton, PE | Senior Water Resources Engineer

O: 919.851.9986 x103 M: 919.302.6919

Wildlands Engineering, Inc. <Blocked<http://www.wildlandseng.com/>>

312 West Millbrook Road, Suite 225

Raleigh, NC 27609

HILDA GAYE SWAIM
D.B. 688, PG. 637
PIN: 4914-31-4177

30' CE Offset

End of Revisions

- Conservation Easement
- 30ft CE Buffer
- Original Alignment
- Original Bankfull
- Revised Alignment
- Revised Bankfull



UT3 Proposed Revisions
Bug Headwaters Mitigation Site
Yadkin River Basin (03040101)

Wilkes County, NC

Carolyn Lanza

From: Carolyn Lanza
Sent: Tuesday, September 7, 2021 4:31 PM
To: Carolyn Lanza
Subject: FW: Planting Season

From: Shawn Wilkerson
Sent: Friday, March 12, 2021 10:03 AM
To: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Subject: RE: Planting Season

Thanks,

-----Original Message-----

From: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Friday, March 12, 2021 10:01 AM
To: Shawn Wilkerson <swilkerson@wildlandseng.com>
Subject: RE: Planting Season

Thanks, I forwarded to Sam and Jordan since their banks are listed. I also forwarded to Bowers to prevent confusion when reviewing the As-Built.

Kim Browning
Mitigation Project Manager, Regulatory Division | U.S. Army Corps of Engineers

-----Original Message-----

From: Shawn Wilkerson <swilkerson@wildlandseng.com>
Sent: Friday, March 12, 2021 9:09 AM
To: Davis, Erin B <erin.davis@ncdenr.gov>; Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>; Tugwell, Todd J CIV USARMY CESAW (USA) <Todd.J.Tugwell@usace.army.mil>; Merritt, Katie <katie.merritt@ncdenr.gov>
Cc: Wiesner, Paul <paul.wiesner@ncdenr.gov>; Crocker, Lindsay <Lindsay.Crocker@ncdenr.gov>; Daniel Taylor <dtaylor@wildlandseng.com>
Subject: [Non-DoD Source] Planting Season

All:

I wanted to update you where our mitigation project planting schedules stand. Once again, a very wet construction season, along with Covid Issues has really challenged our construction schedules but this burst of great weather gives us optimism that all these schedules will be met. I know this is not ideal, and we will not have this issue next year. Please see below and forward to anyone else that you feel needs to be on this email:

Sites 100% planted by 3/15/21.

Sandy Branch - DMS

Critcher - Bank

Honey Mill - DMS

McClenny - DMS/Bank

Moccasin Creek - Bank

Sassarixa - DMS/Bank

Catfish II - Bank

Sites planted by 3/20/21.

White Buffalo- auxiliary planting

Key Mill- auxiliary planting

Vile Creek- auxiliary planting

Alexander- auxiliary planting

Sites planted by 3/31/21.

Perry Hill - DMS/Bank

Lyon Hills - DMS

Sites planted by 4/15/21.

Wyant Farm- DMS

Bug Headwaters - DMS (at least 50-70% of the site, remainder by month end)

Daniels Creek - Bank

Obviously, we will ensure that there is 6 months of growing season before performing year 1 monitoring. Please let me know if you have questions or comments, and if you are ok with this extended planting schedule.

Sincerely,

.....

Shawn D. Wilkerson | President

O: 704.332.7754 x100 M: 704.458.1836

Wildlands Engineering, Inc. <Blocked<http://www.wildlandseng.com/>>

1430 S. Mint St, Suite 104

Charlotte, NC 28203

Bug Headwaters Mitigation Site

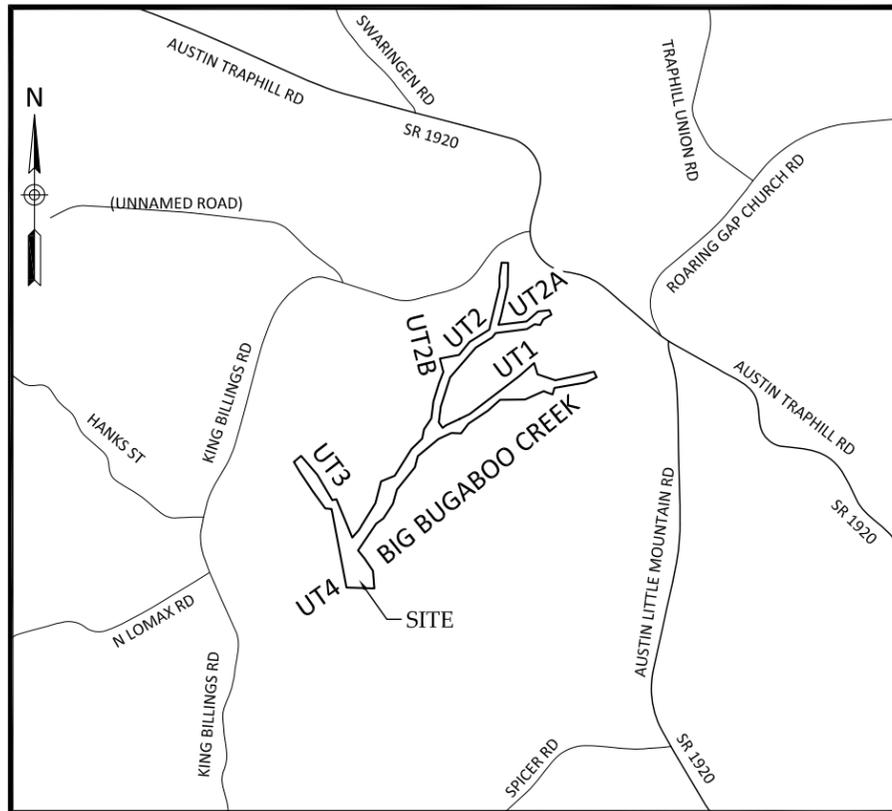
Record Drawings

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 "BUG HEADWATERS MITIGATION SITE", JOB # 2104041-AB, DATED 08/25/21; 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 04/29/21 - 07/06/21; 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 15TH DAY OF SEPTEMBER, 2021, A.D.

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



**AS-BUILT &
RECORD DRAWINGS
SEPTEMBER 15, 2021**

Sheet Index

Title Sheet	0.1
General Overview	0.2
General Notes and Symbols	0.3
Stream Plan and Profile	1.01-1.45
BMP Overview	2.00
BMP Plans	2.01-2.04
Planting Tables	3.00
Planting Overview	3.01
Planting Plan	3.02-3.05
Fencing Plan Overview	5.00
Fencing Plan	5.01-5.07

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

Owner:
DEQ NCDMS
1652 Mail Service Center
Raleigh, NC 27699-1652
Attention: Matthew Reid
919-707-8976

Surveying:
Kee Mapping and Surveying, PA
88 Central Avenue
Asheville, NC 28801
Phillip B. Kee, PLS
828-575-9021

NCDEQ Contract No. 7617
DMS ID No. 100084
Yadkin River Basin
HUC 03040101
USACE Action ID No.
SAW-2018-01788
NCDWR No. 18-1273

Bug Headwaters Record Drawings
Wilkes County, North Carolina

Title Sheet

Revisions:
10/2021 - Revised Sheets 1.12,
1.17, 1.18, 1.27 & 1.34

Date: 09.15.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

0.1

Sheet

Preconstruction Features

	EXISTING SPRING
	UTILITY POLE
	EXISTING GUY WIRE
	EXISTING WELL
	EXISTING TOP OF BANK
	EXISTING FENCE
	EXISTING STORM PIPE
	EXISTING PROPERTY LINE
	OVERHEAD ELECTRIC
	OVERHEAD UTILITY EASEMENT
	CONSERVATION EASEMENT
	CONSERVATION EASEMENT INTERNAL CROSSING
	EXISTING BEDROCK
	EXISTING FARM PATH
	EXISTING WETLAND

As-Designed Features

	NOT FOR CREDIT
	DESIGN PRESERVATION REACH
	DESIGN ENHANCEMENT I REACH
	DESIGN ENHANCEMENT II REACH
	DESIGN RESTORATION REACH
	DESIGNED BANKFULL
	DESIGNED LOG VANE
	DESIGNED LOG SILL
	DESIGNED ROCK SILL
	DESIGNED COVER LOG
	DESIGNED ROCK STEP POOLS
	DESIGNED CULVERT
	DESIGNED CASCADE
	DESIGNED FARM PATH
	DESIGNED RIFFLE
	DESIGNED STREAM BANK GRADING AREA
	DESIGNED ROCK OUTLET
	DESIGNED BRUSH TOE
	DESIGNED TRANSPLANTED SOD MAT
	DESIGNED VEGETATED SOIL LIFT
	DESIGNED BOULDER TOE
	DESIGNED WOVEN WIRE FENCE
	DESIGNED 5 WIRE FENCE
	DESIGNED DOUBLE 2" TUBE STEEL GATE
	DESIGNED SINGLE 2" TUBE STEEL GATE

As-Built Features

	AS-BUILT THALWEG
	AS-BUILT BANKFULL
	LIMITS OF DISTURBANCE
	AS-BUILT 5' MAJOR CONTOUR
	AS-BUILT 1' MINOR CONTOUR
	CROSS SECTION
	PP ## PHOTO POINT
	CG FG BAROTROLL GAUGES
	VEG VP ## VEGETATION PLOT
	AS-BUILT LOG SILL
	AS-BUILT BOULDER SILL
	AS-BUILT COVER LOG
	AS-BUILT CULVERT
	AS-BUILT RIFFLE
	AS-BUILT ROCK OUTLET
	AS-BUILT BRUSH TOE
	AS-BUILT BOULDER TOE
	AS-BUILT FENCE
	AS-BUILT DOUBLE 2" TUBE STEEL GATE
	AS-BUILT SINGLE 2" TUBE STEEL GATE

- NOTES:**
- DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 - NATIVE BOULDER MATERIAL WAS NOT FOUND ON SITE, SO BOULDERS WERE TRANSPORTED FROM A QUARRY. SINCE LOGS WERE ABUNDANT ON THE SITE, SOME BOULDER SILLS WERE REPLACED WITH LOG SILLS TO REDUCE THE AMOUNT OF OFF-SITE MATERIAL NEEDED. THE QUARRY BOULDERS WERE MAINLY USED IN STRUCTURES AT THE HEADWATERS OF THE STREAM CHANNELS THAT ARE LIKELY TO BE INTERMITTENTLY DRY DURING THE SUMMER. THIS WAS DONE TO HELP PREVENT THE LOGS FROM ROTTING DURING THE DRY TIMES OF THE YEAR.



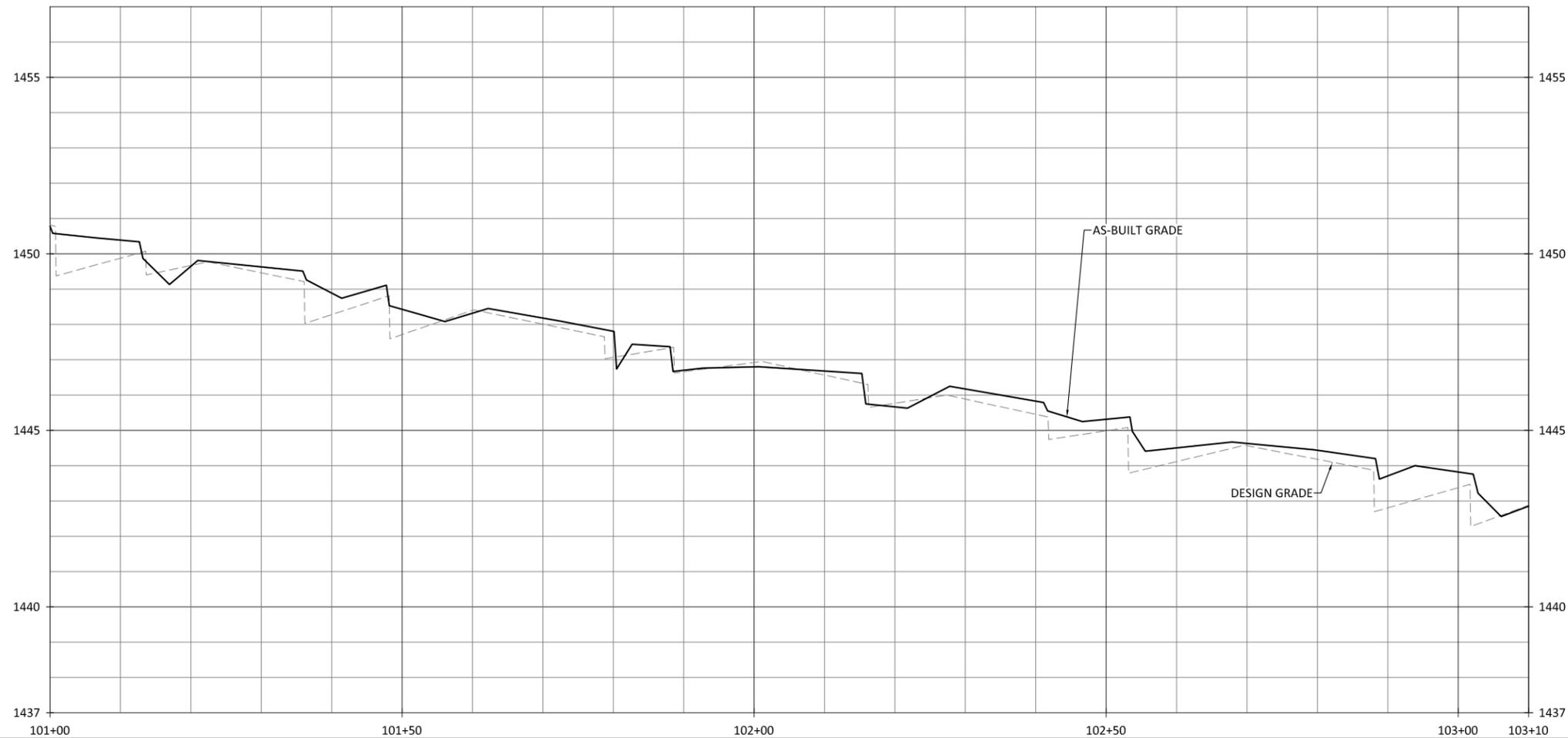
Bug Headwaters Record Drawings Wilkes County, North Carolina

General Notes and Symbols

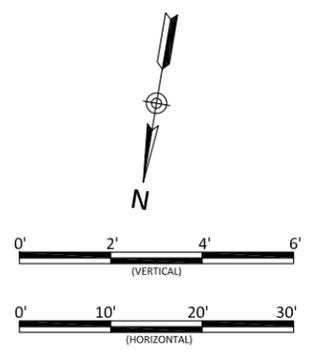
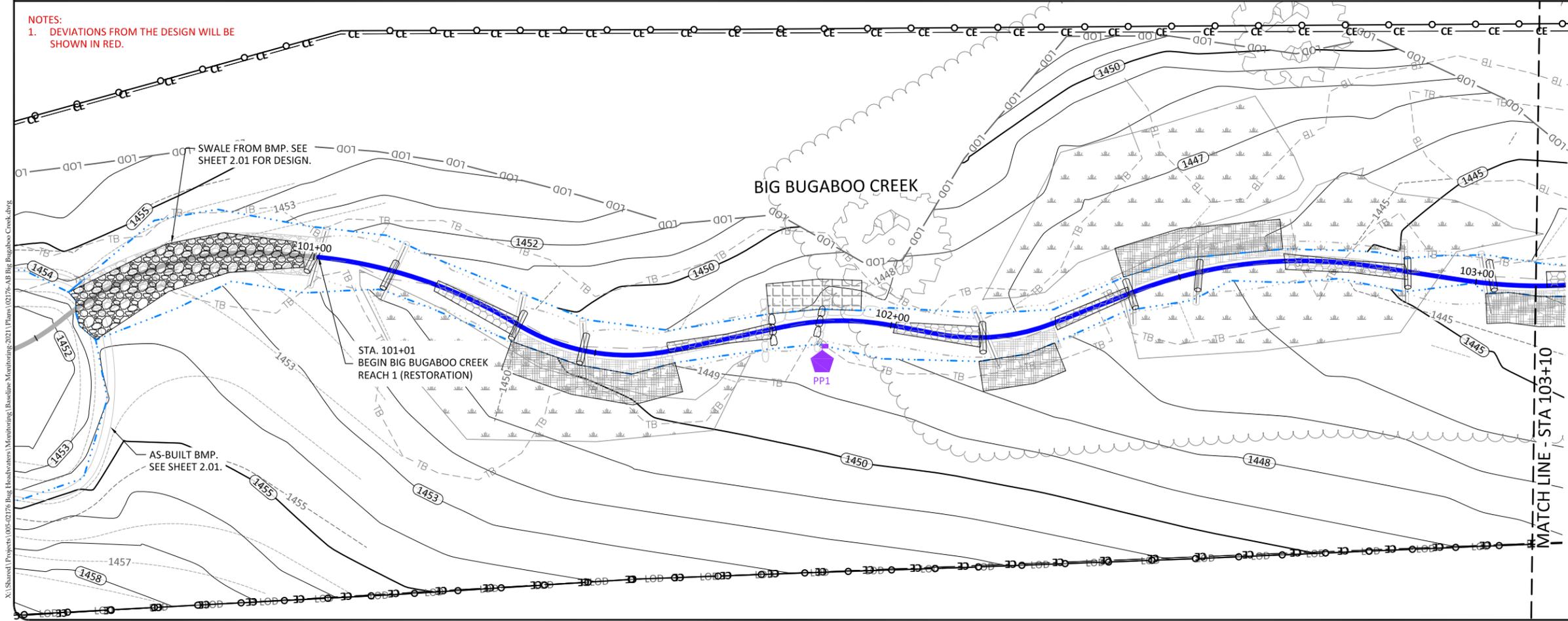
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Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

September 14, 2021



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



Bug Headwaters Record Drawings
 Wilkes County, North Carolina
 Big Bugaboo Creek
 Stream Plan and Profile

WILDLANDS
 ENGINEERING
 312 W. Millbrook Rd. Suite 225
 Raleigh, NC 27609
 Tel: 919.851.9886
 License No. F-0831

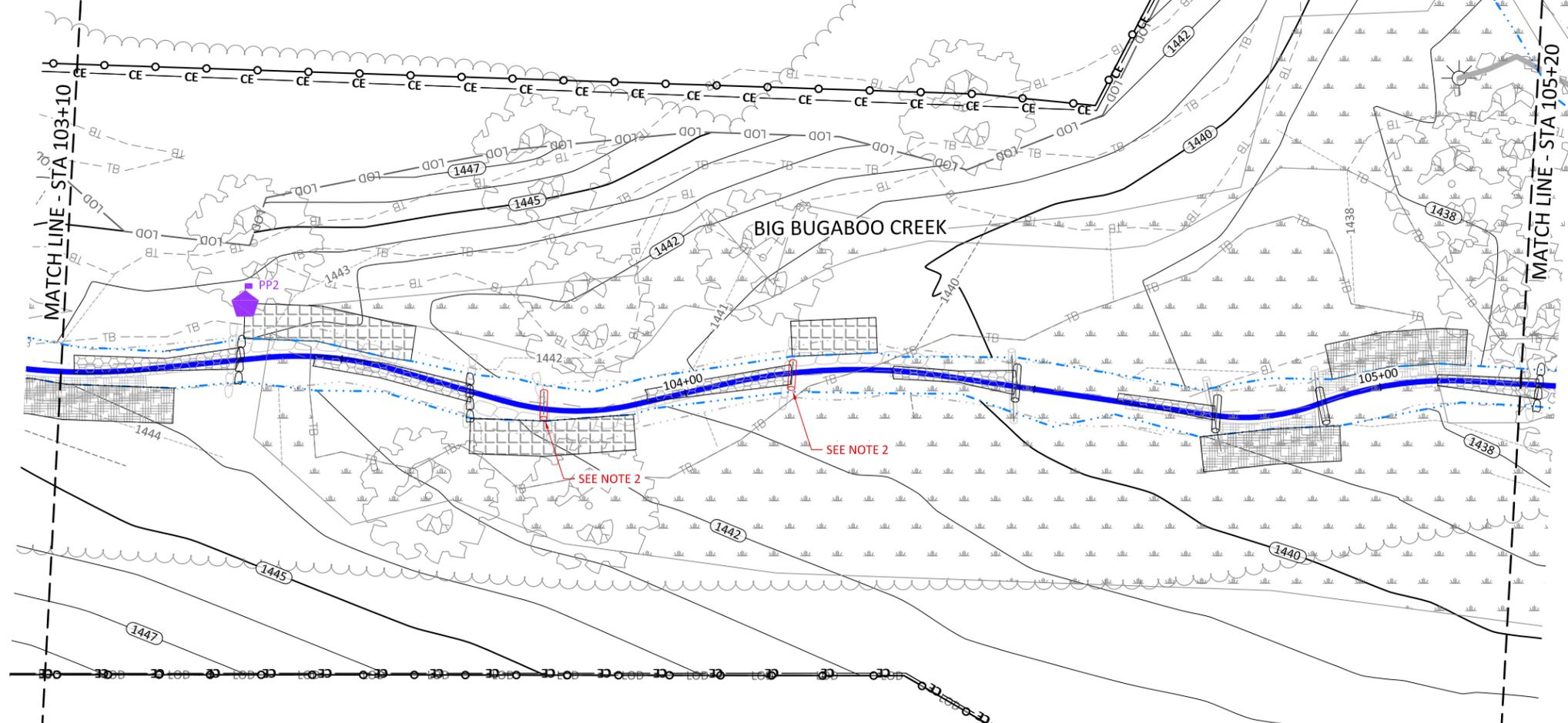
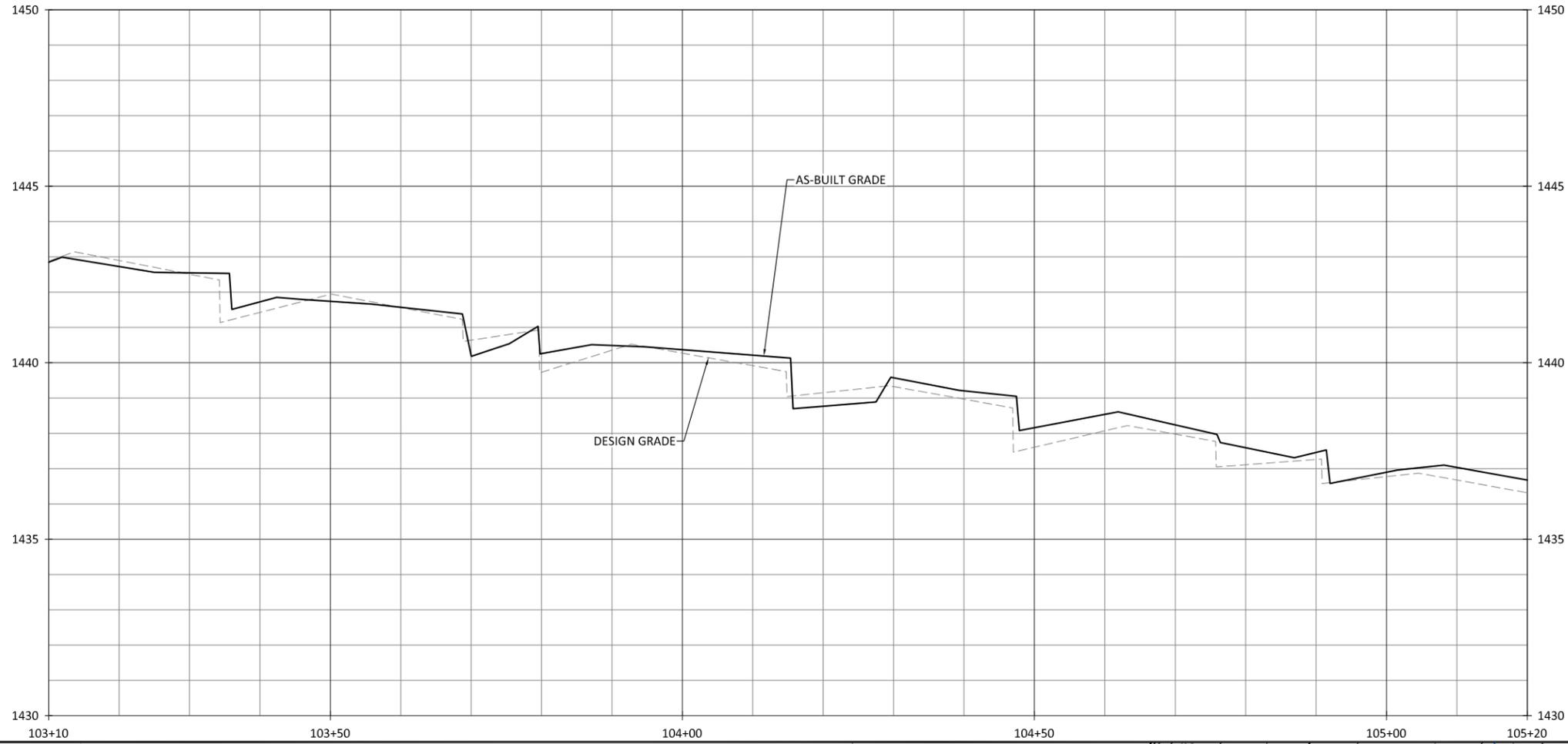


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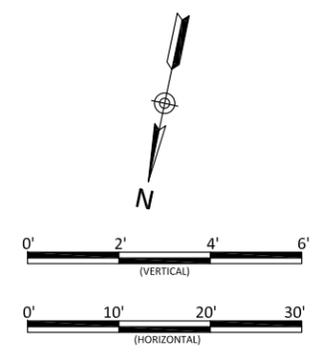
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 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAV
 Checked By: ANA

1.01

Sheet



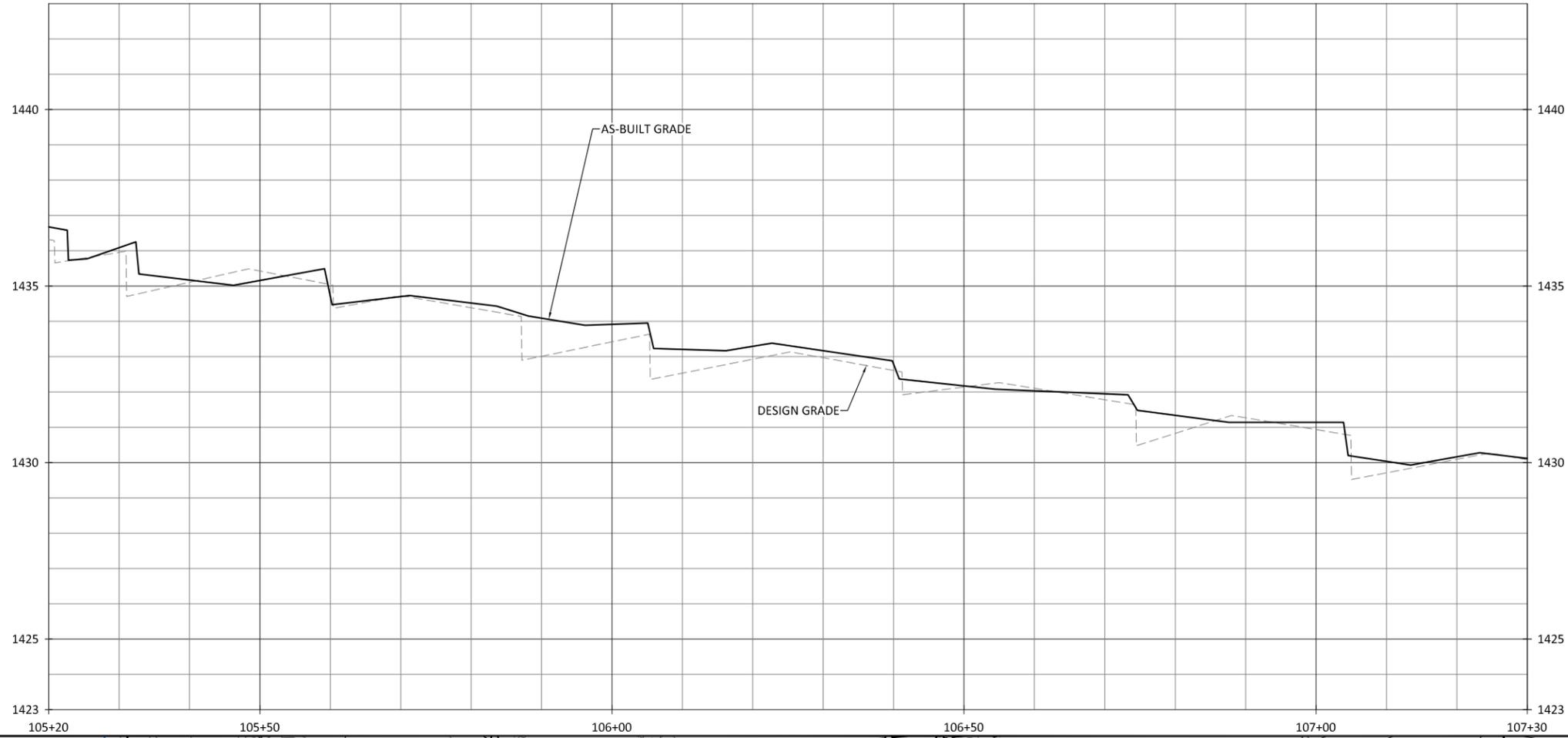
- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 103+80 & STA 104+15 BOULDER SILL REPLACED WITH LOG SILL DUE TO NO NATIVE BOULDERS ON SITE



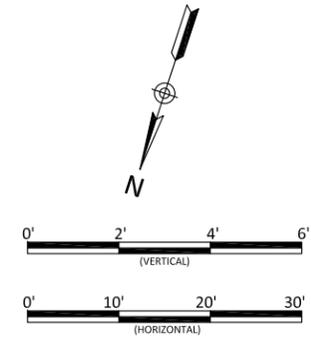
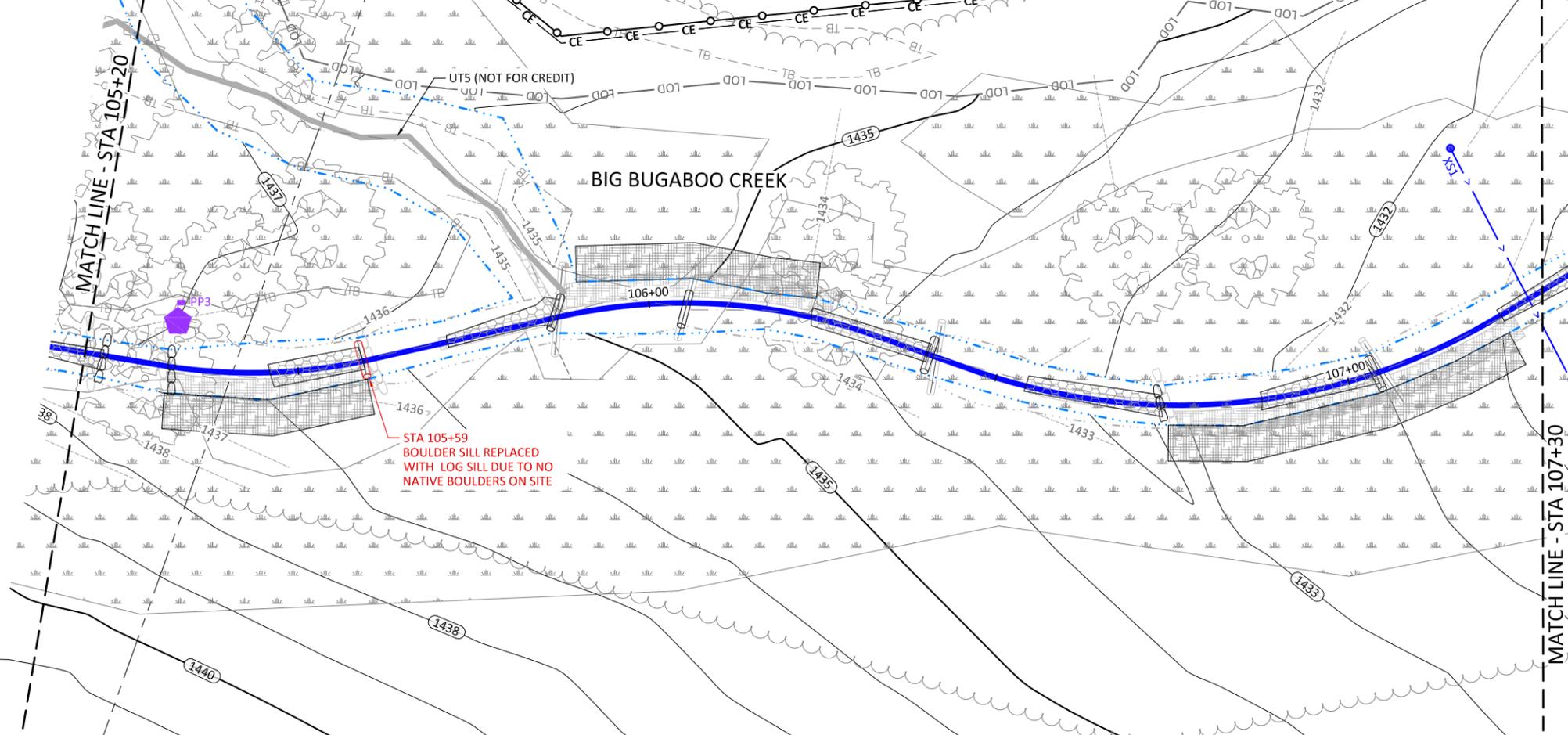
Bug Headwaters Record Drawings
Wilkes County, North Carolina
Big Bugaboo Creek
Stream Plan and Profile

Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA



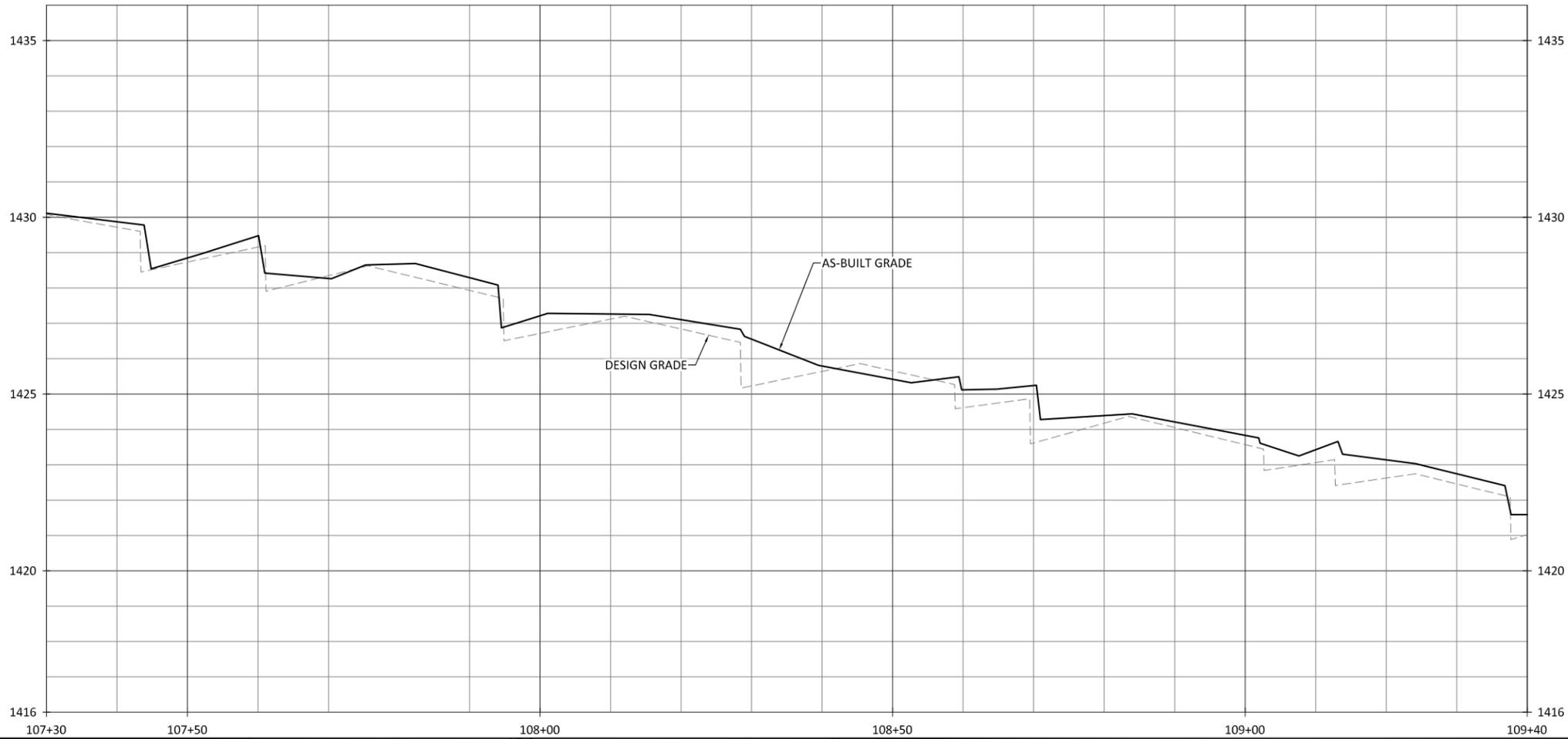
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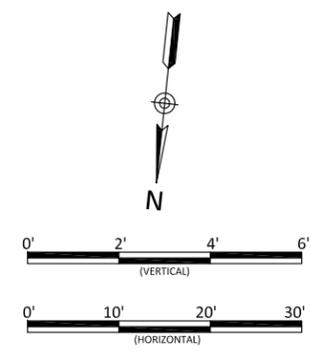
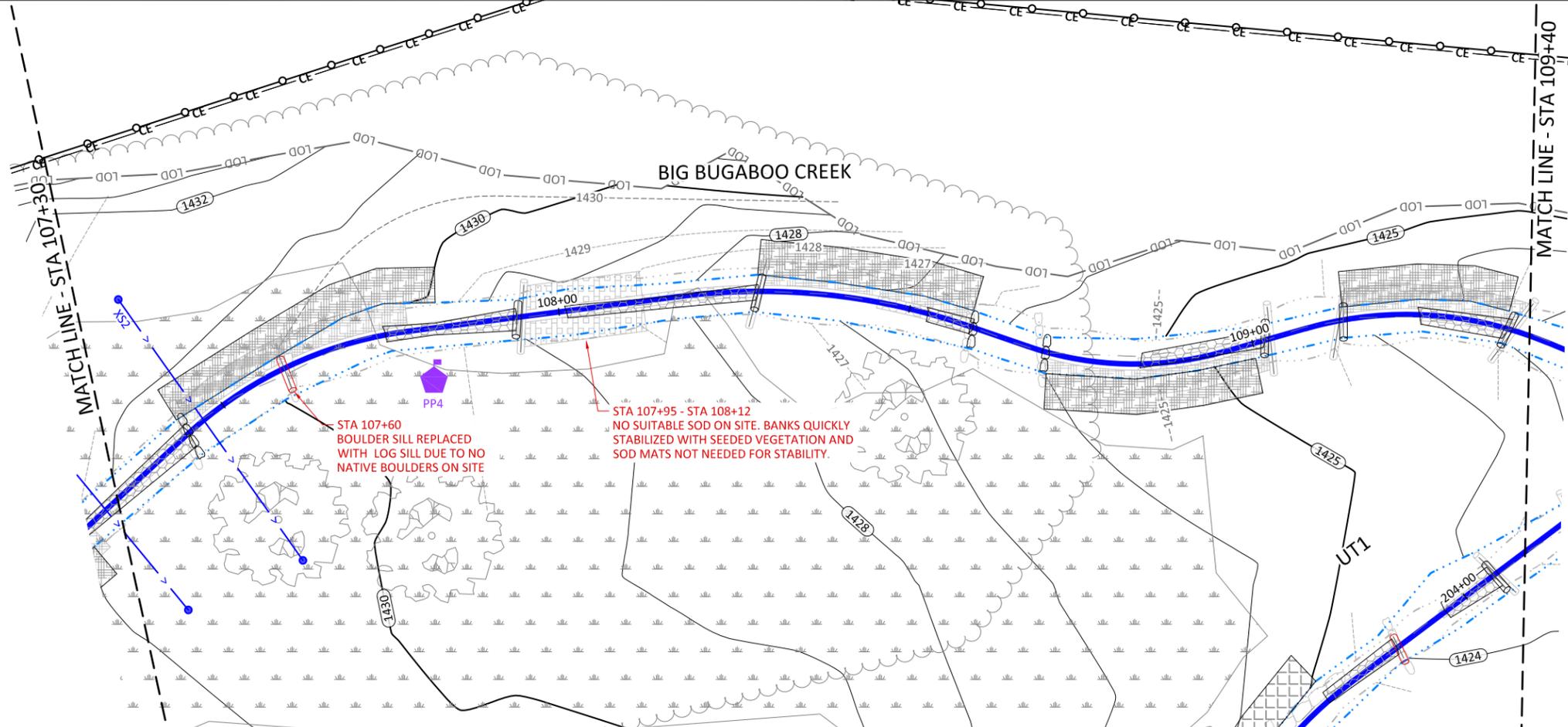
Bug Headwaters Record Drawings
 Wilkes County, North Carolina
 Big Bugaboo Creek
 Stream Plan and Profile

Revisions:

Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT1 IS ADDRESSED ON SHEET 1.21 AND 1.22.



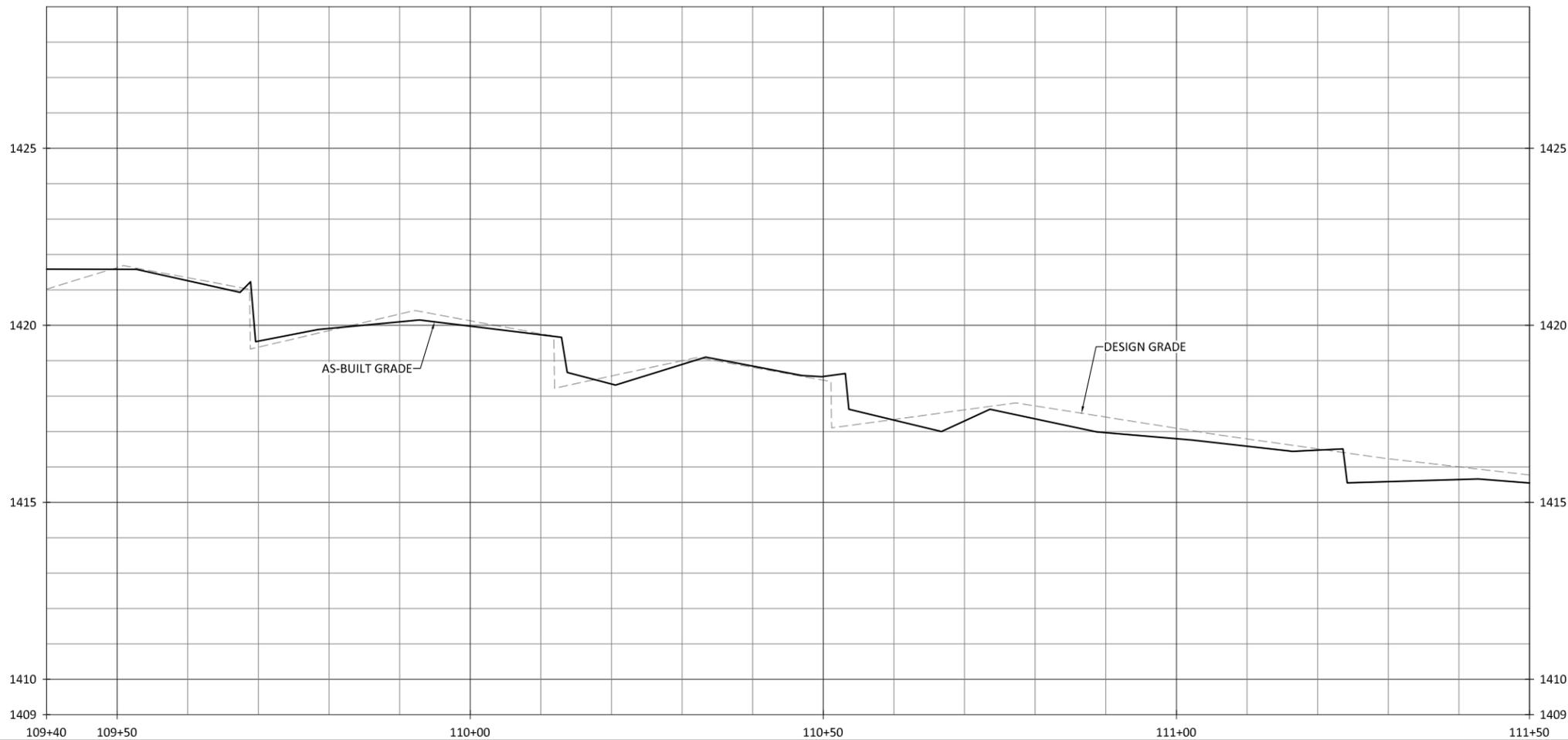
Bug Headwaters Record Drawings
Wilkes County, North Carolina

Big Bugaboo Creek
Stream Plan and Profile

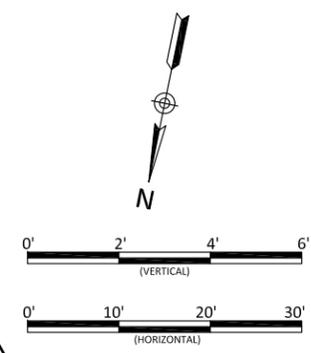
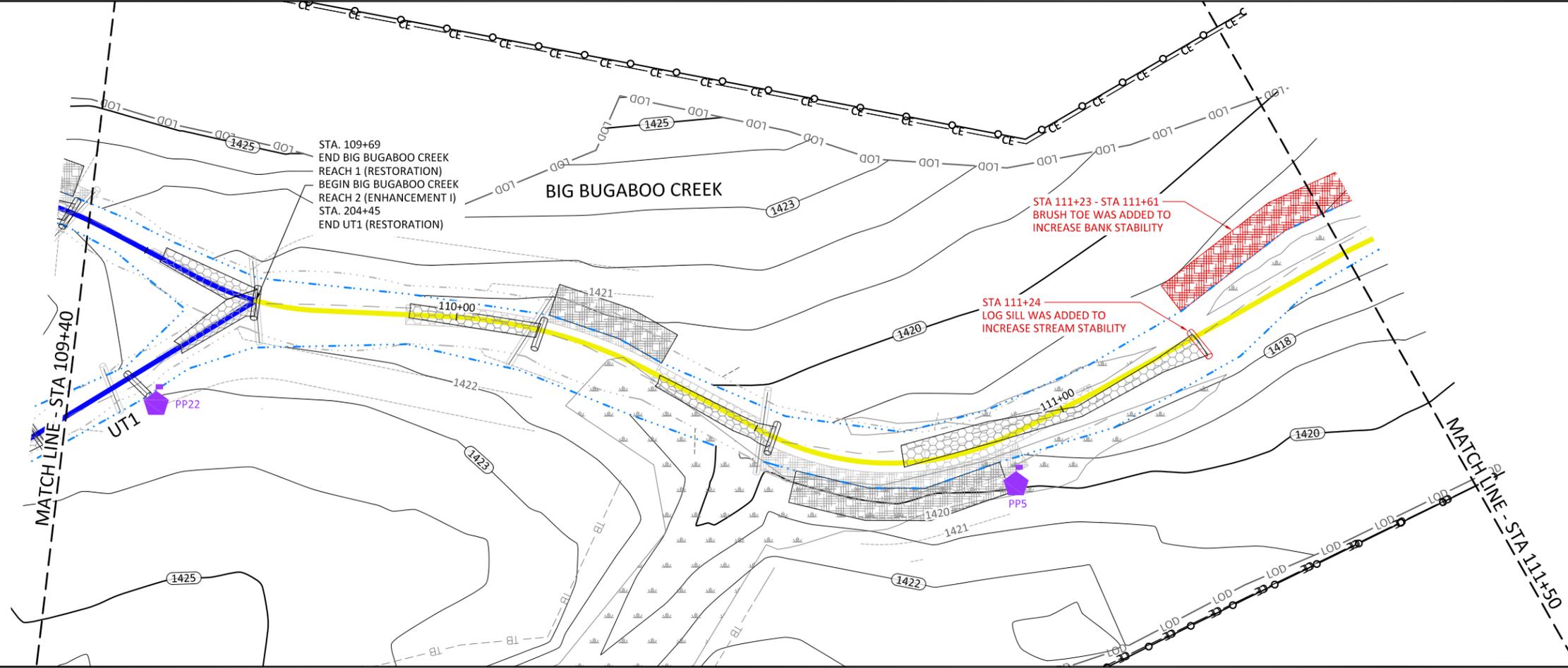
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Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

1.04



- NOTES:
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 2. AS-BUILT INFORMATION FOR UT1 IS ADDRESSED ON SHEET 1.21 AND 1.22.



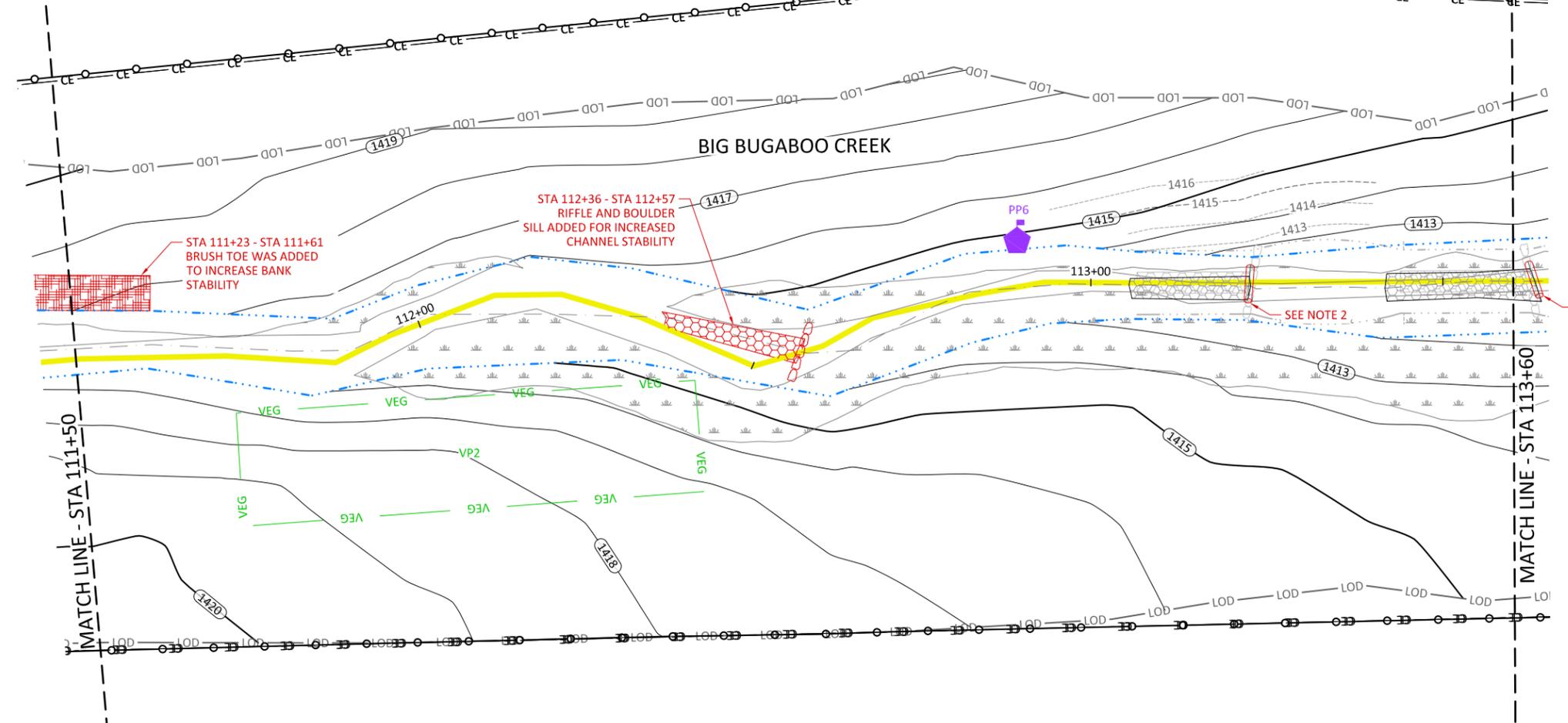
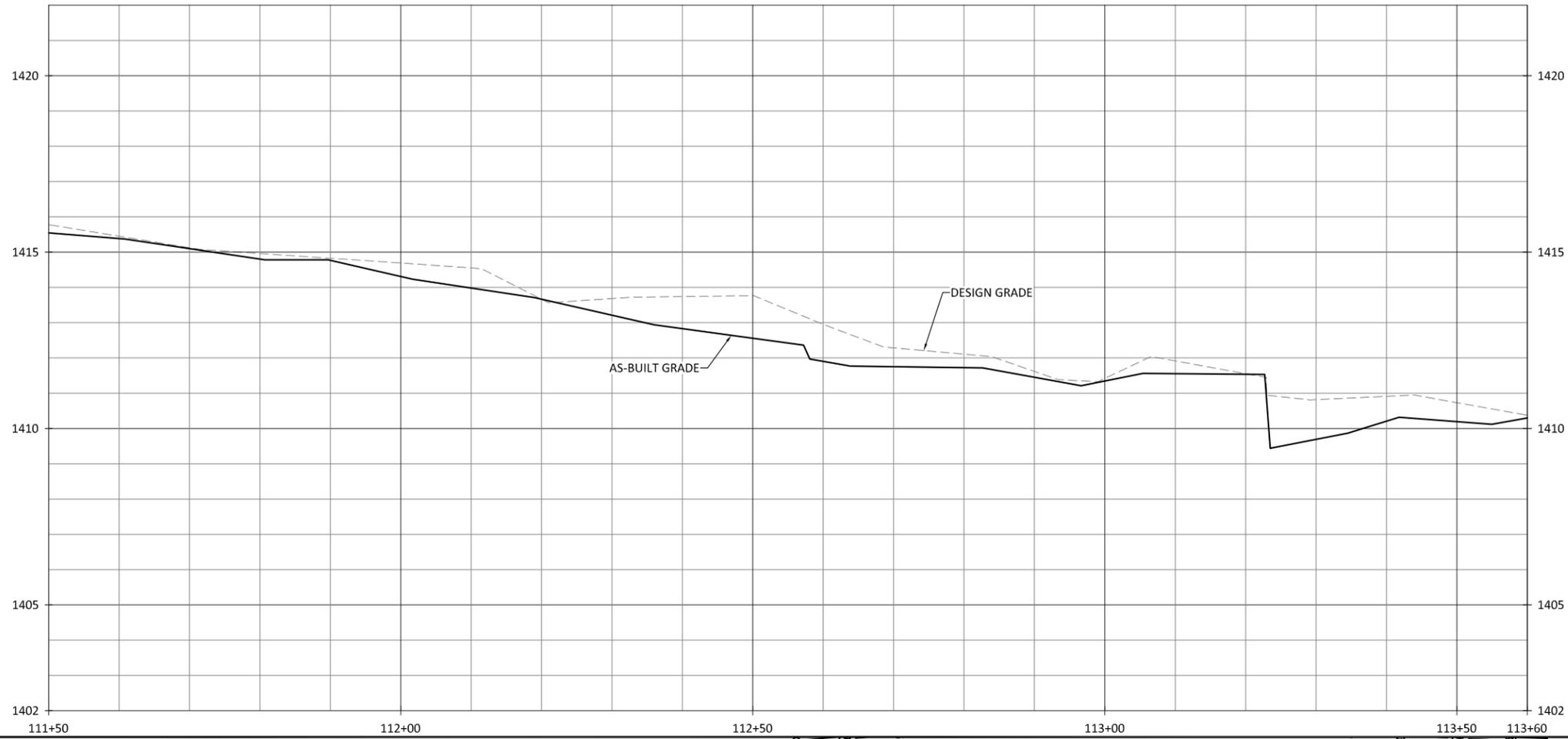
Bug Headwaters Record Drawings
Wilkes County, North Carolina
Big Bugaboo Creek
Stream Plan and Profile

Revisions:

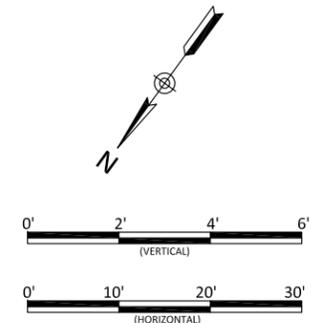
Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

1.05

Sheet



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED
 2. 113+23 & STA 113+63 BOULDER SILL REPLACED WITH LOG SILL DUE TO NO NATIVE BOULDERS ON SITE



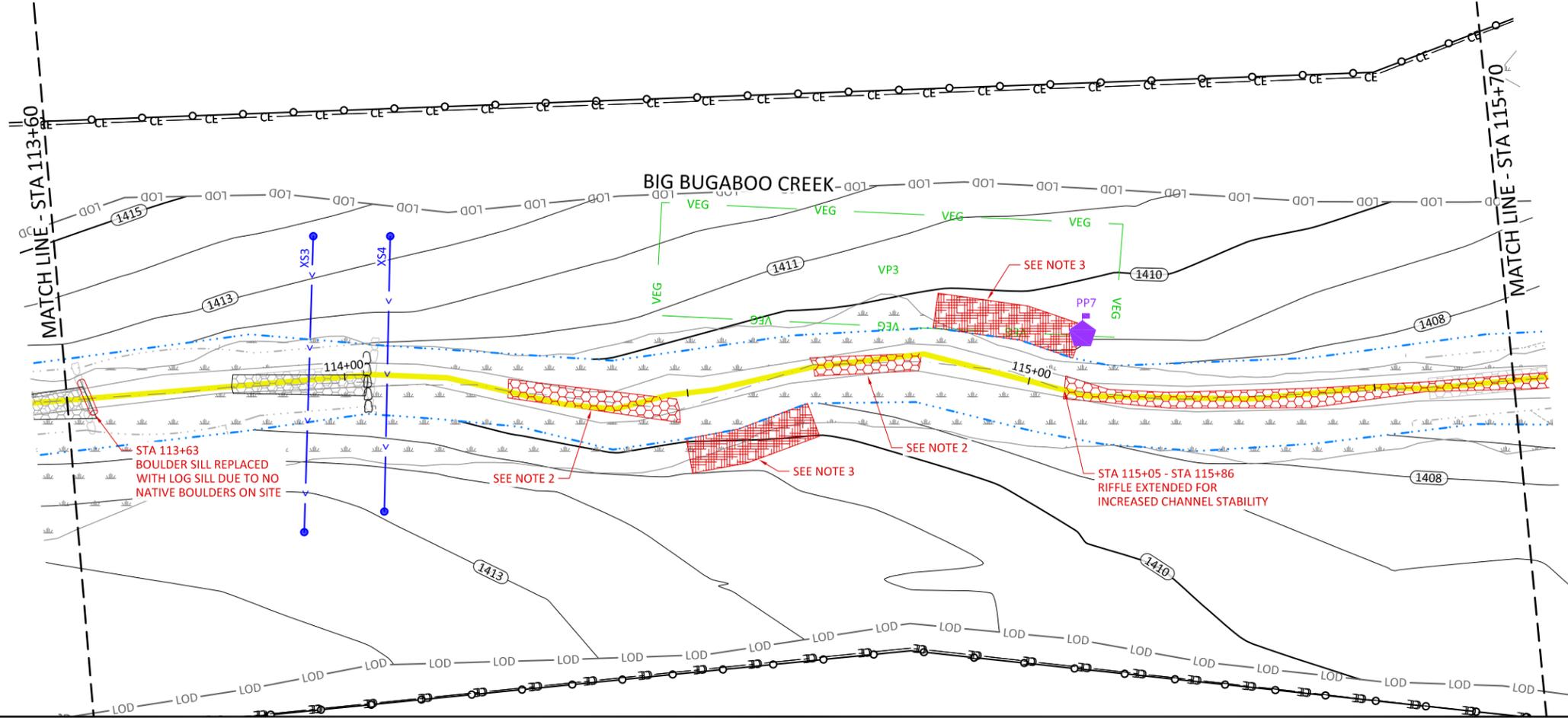
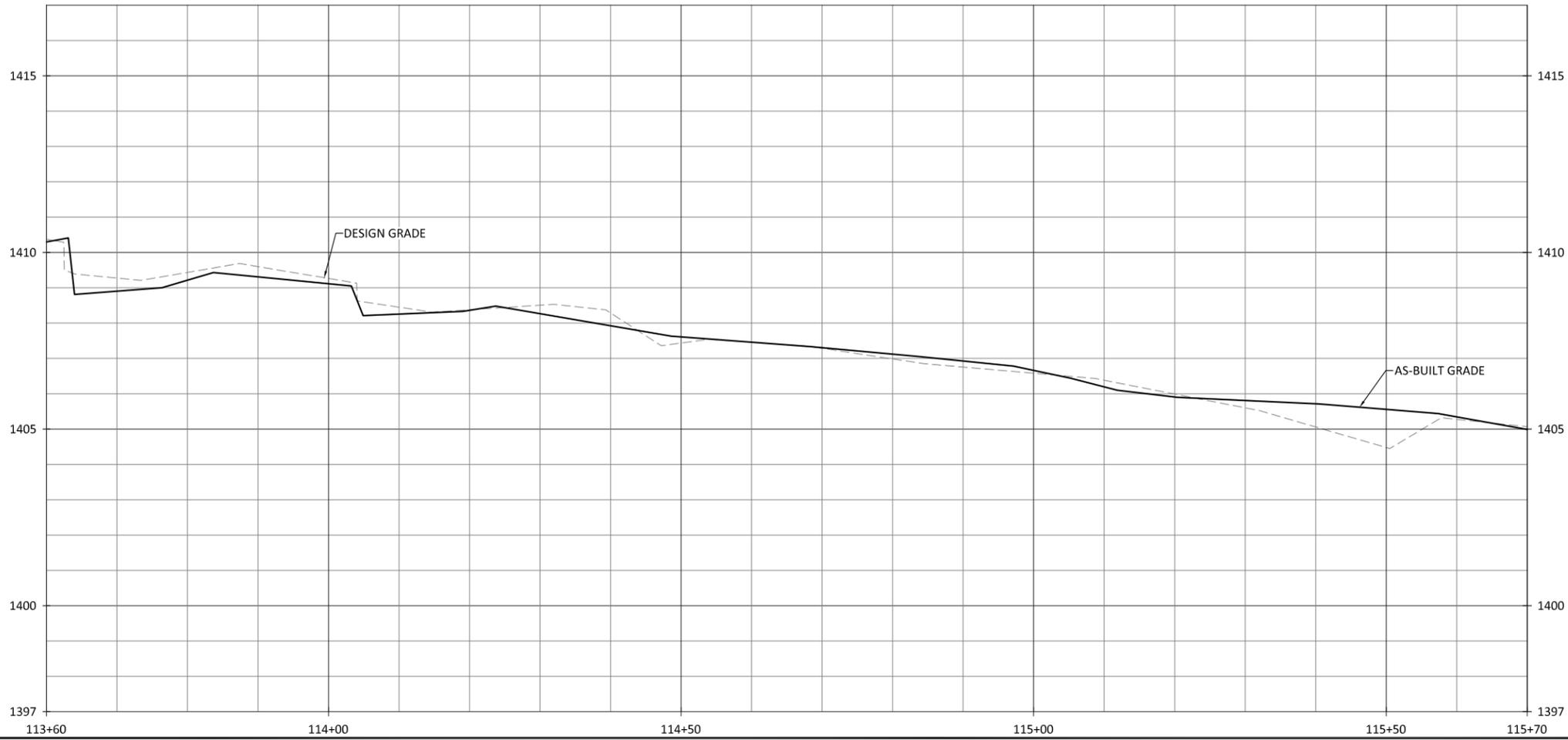
Bug Headwaters Record Drawings
Wilkes County, North Carolina

Big Bugaboo Creek
Stream Plan and Profile

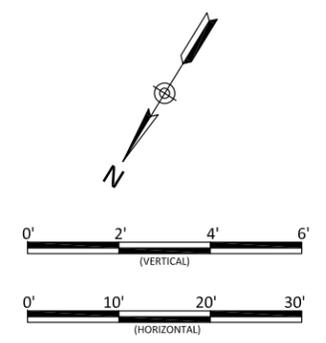
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Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

1.06



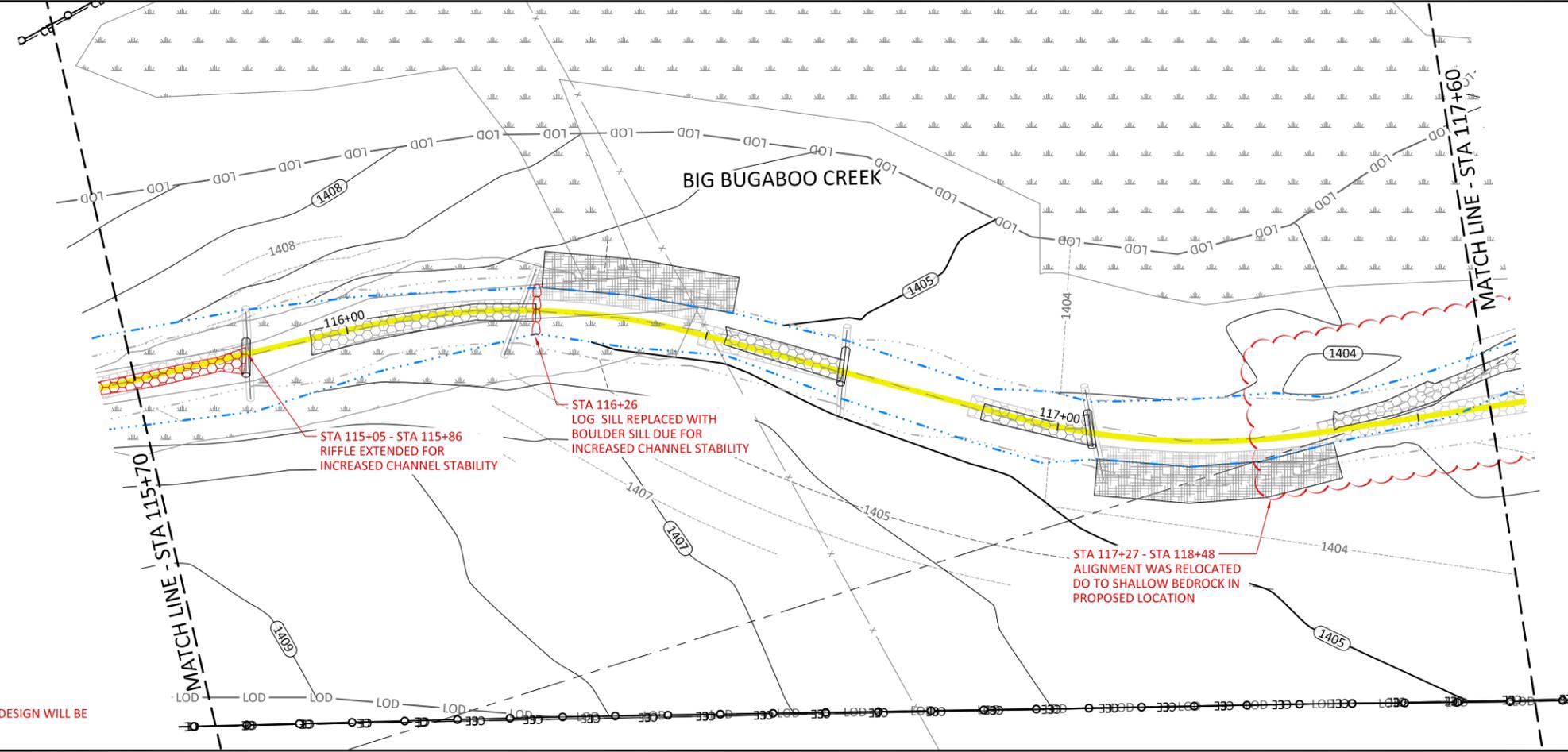
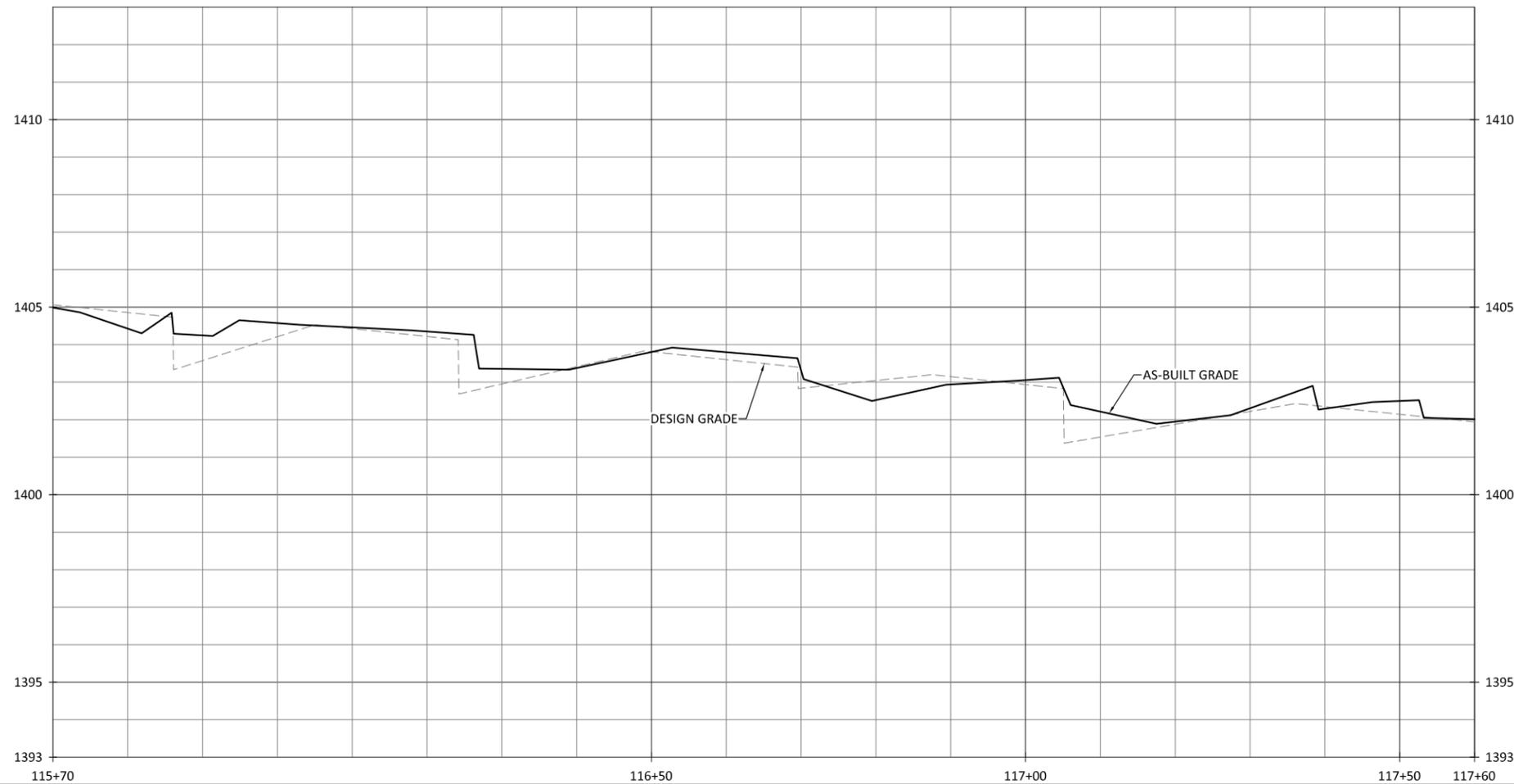
- NOTES:**
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 114+24 - STA 114+49 & STA 114+68 - STA 114+84 RIFFLE ADDED FOR INCREASED CHANNEL STABILITY
 3. STA 114+49 - STA 114+66 & STA 114+85 - STA 115+05 BRUSH TOE ADDED FOR INCREASED CHANNEL STABILITY



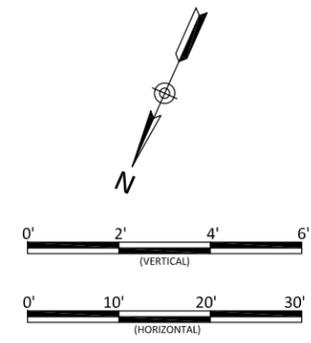
Bug Headwaters Record Drawings
Wilkes County, North Carolina
Big Bugaboo Creek
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Revisions:

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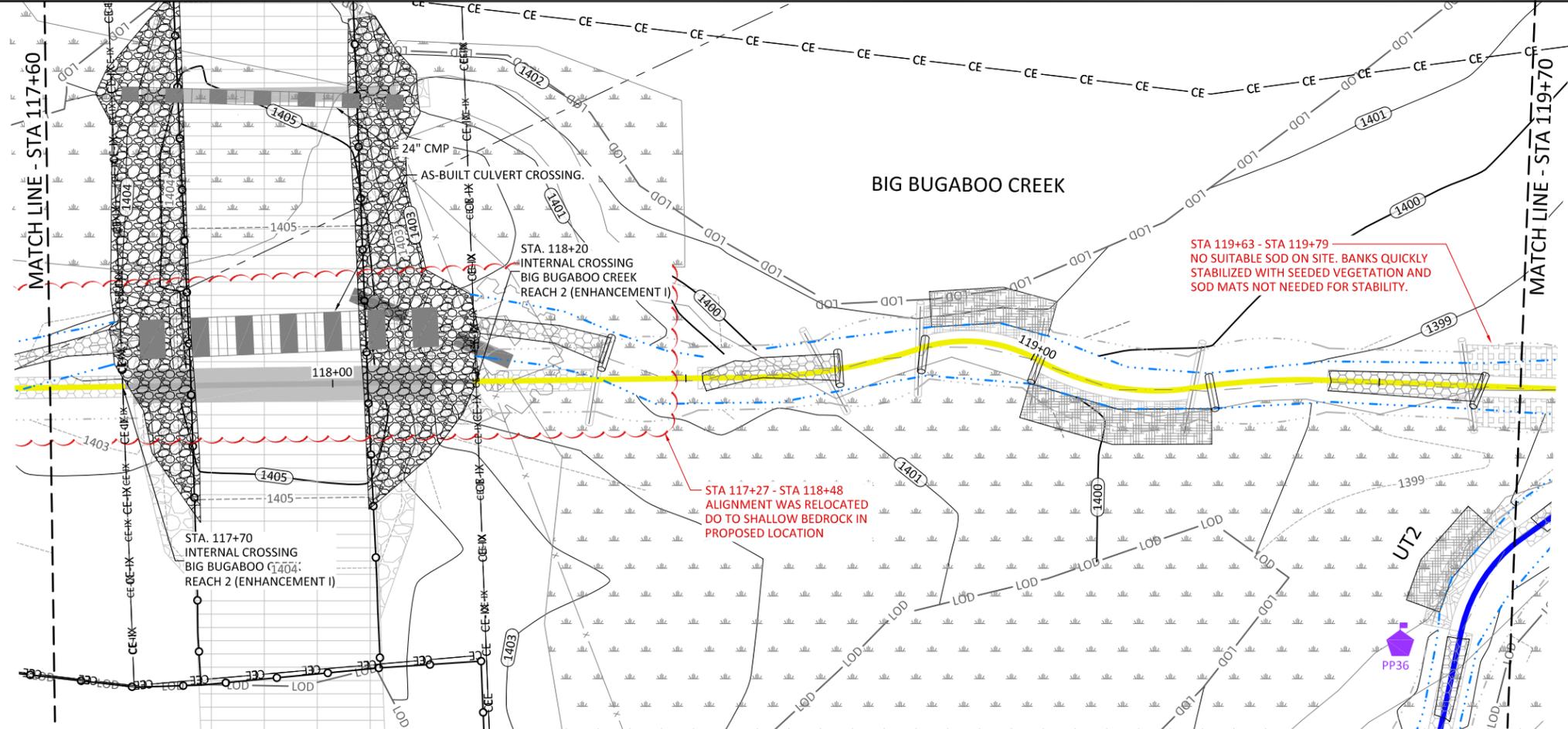
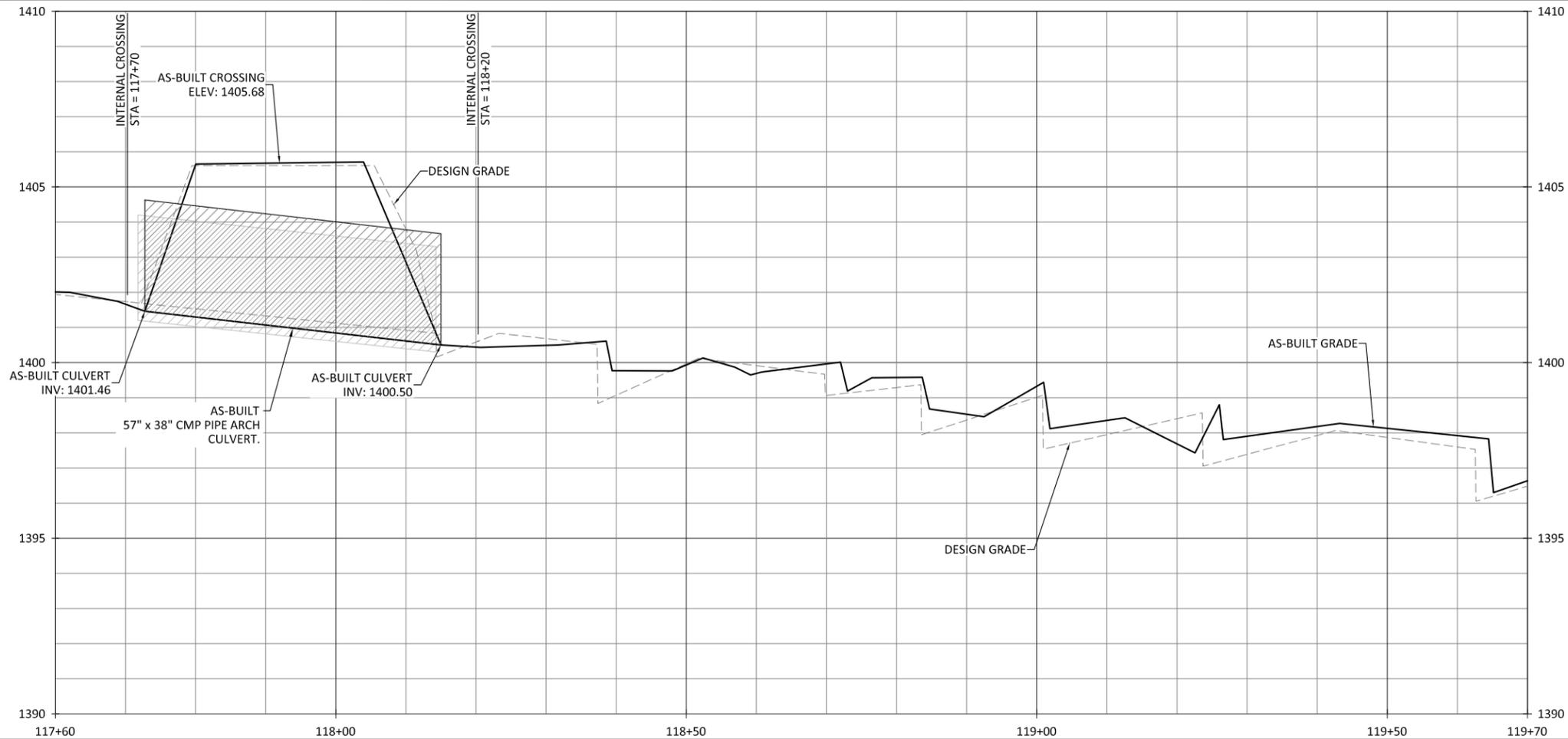


Bug Headwaters Record Drawings
 Wilkes County, North Carolina
 Big Bugaboo Creek
 Stream Plan and Profile

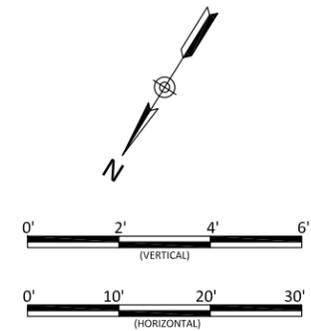
Revisions:

Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAV
 Checked By: ANA

1.08



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT2 IS ADDRESSED ON SHEETS 1.23 THROUGH 1.33.

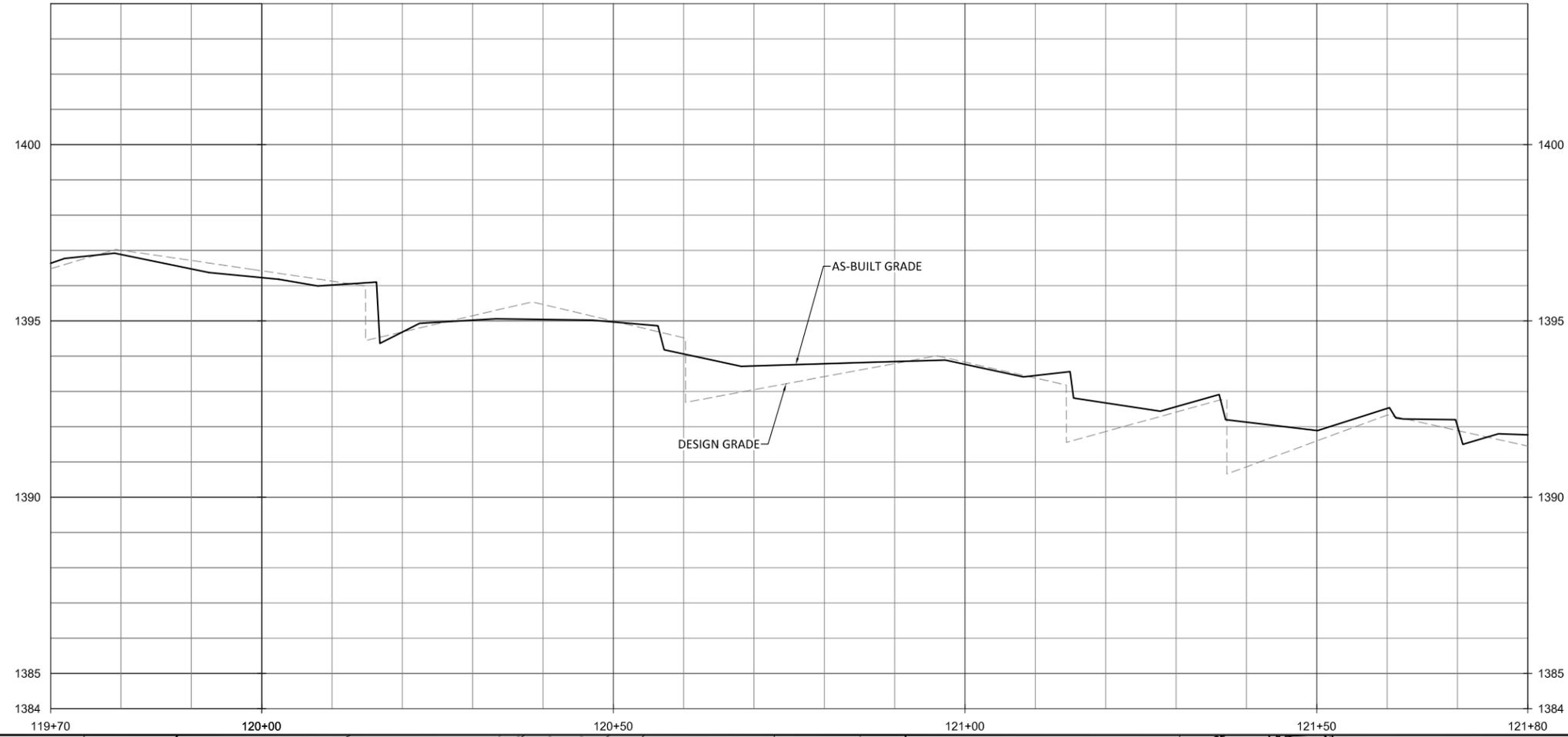


Bug Headwaters Record Drawings
Wilkes County, North Carolina
Big Bugaboo Creek
Stream Plan and Profile

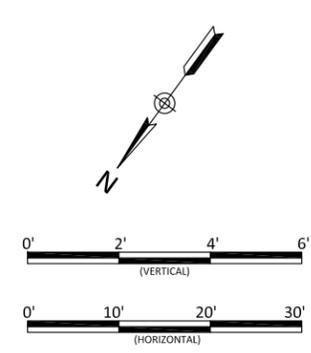
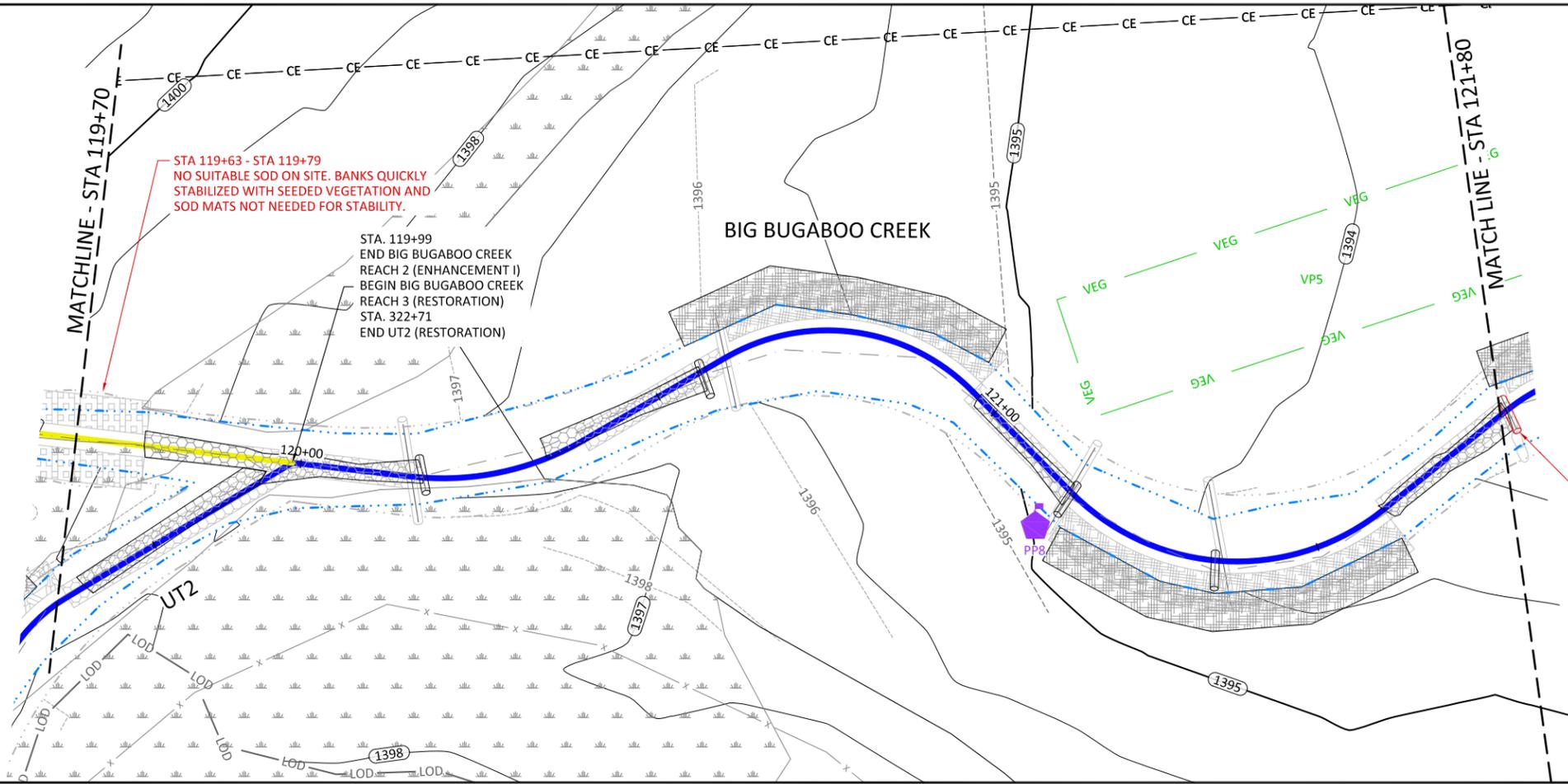
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAV
Checked By: ANA

1.09

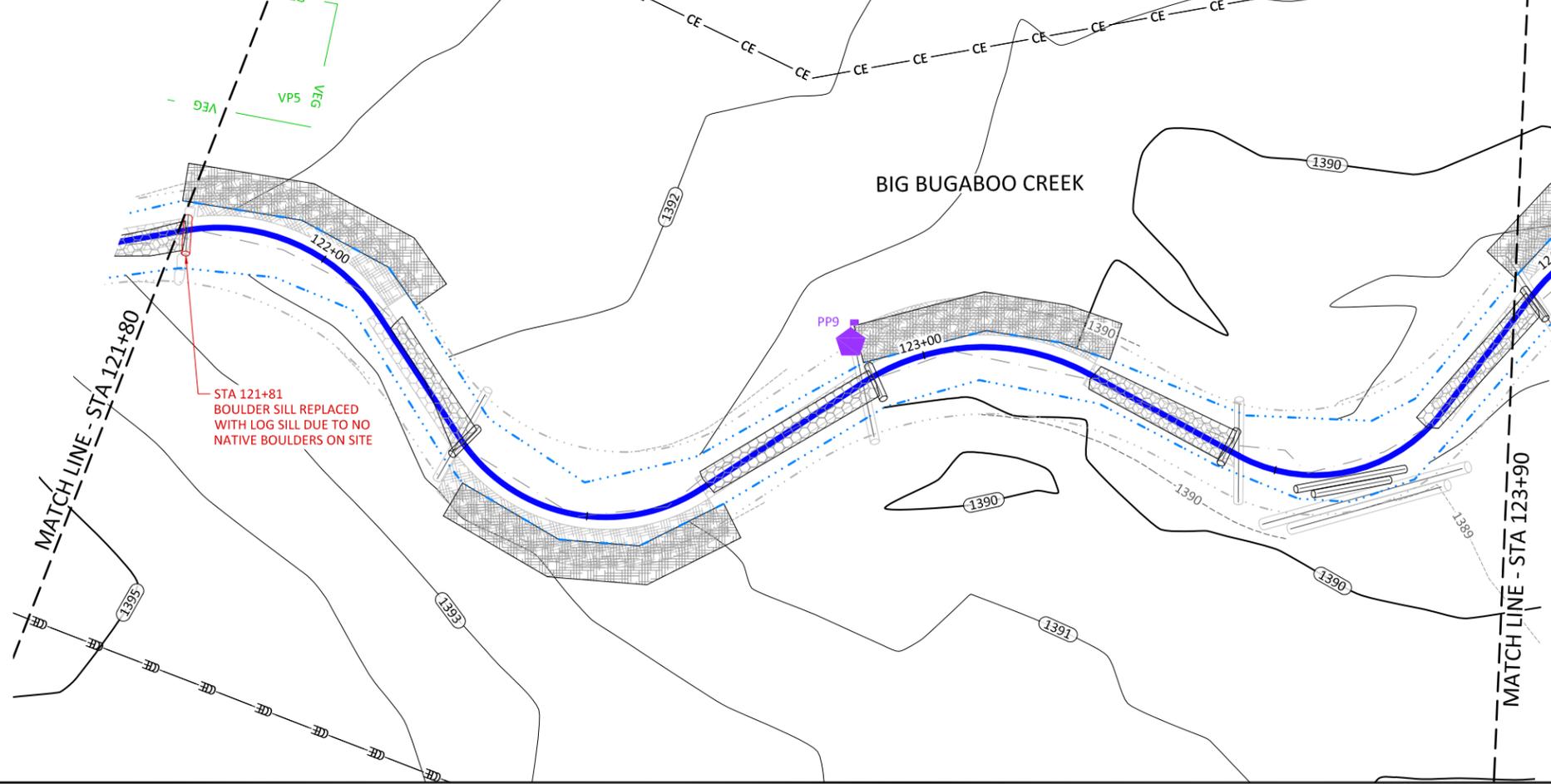
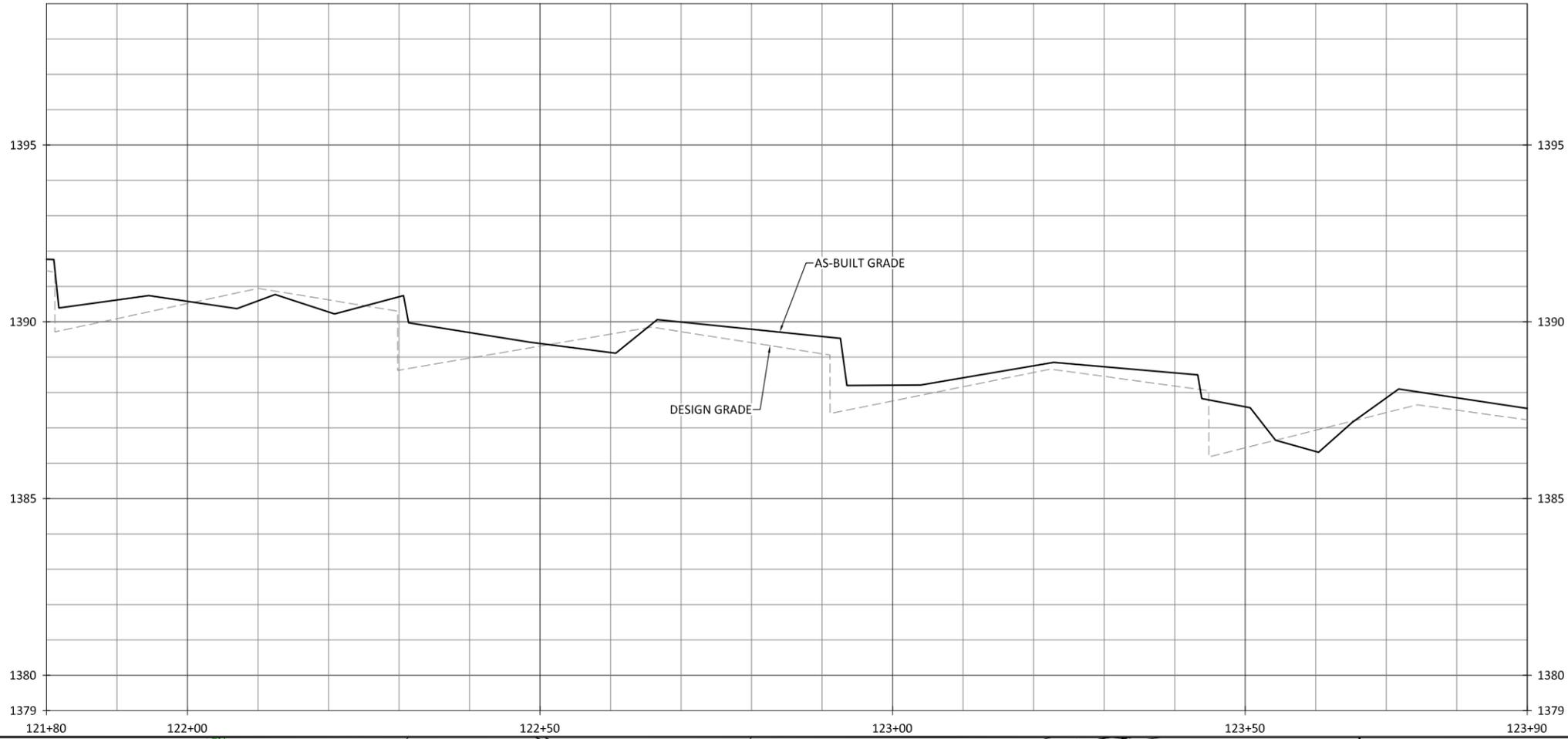


- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT2 IS ADDRESSED ON SHEETS 1.23 THROUGH 1.33.

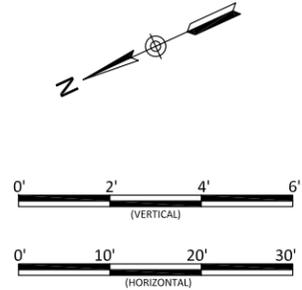


Bug Headwaters Record Drawings
Wilkes County, North Carolina
Big Bugaboo Creek
Stream Plan and Profile

Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA
Revisions:	



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



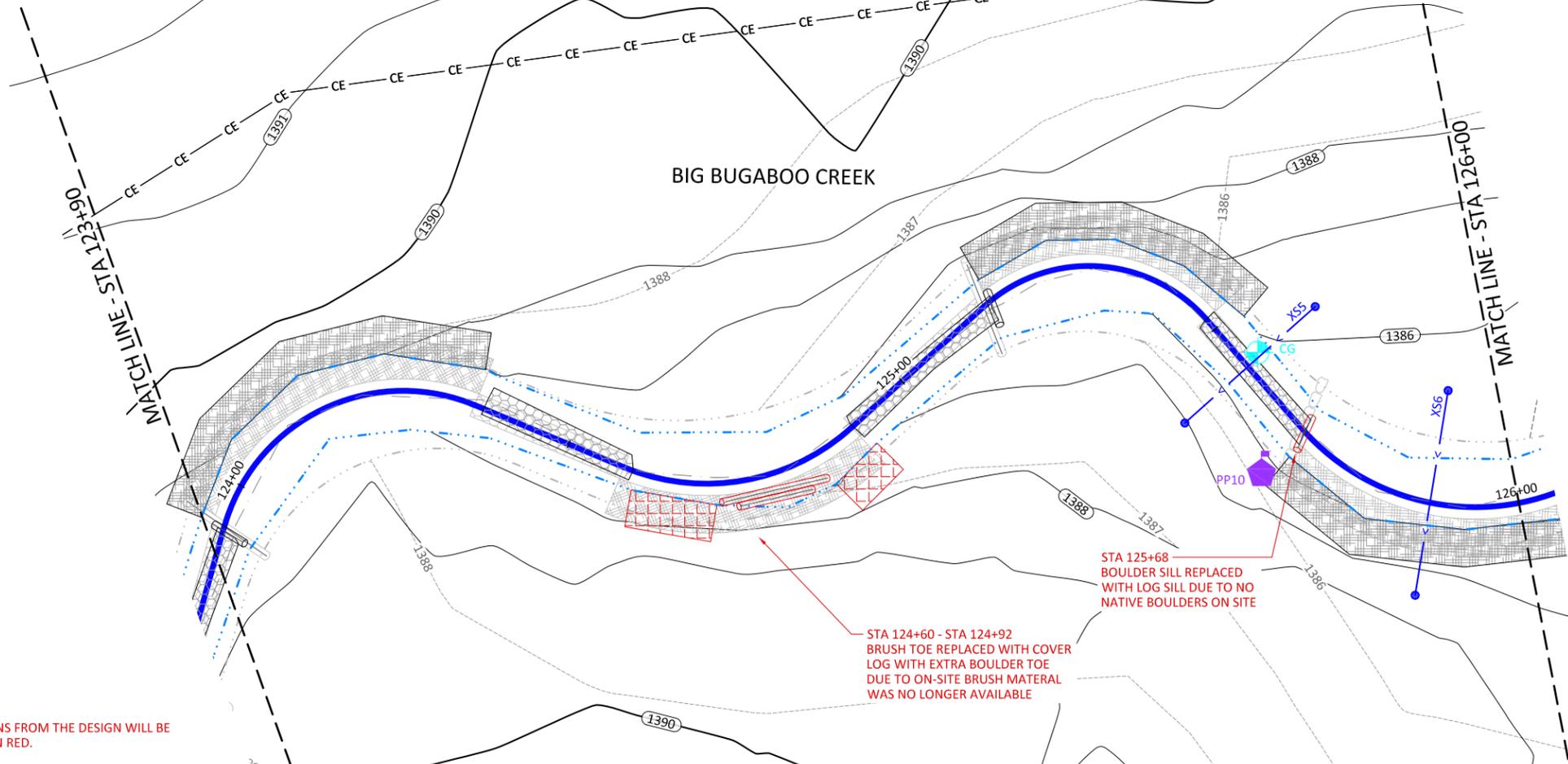
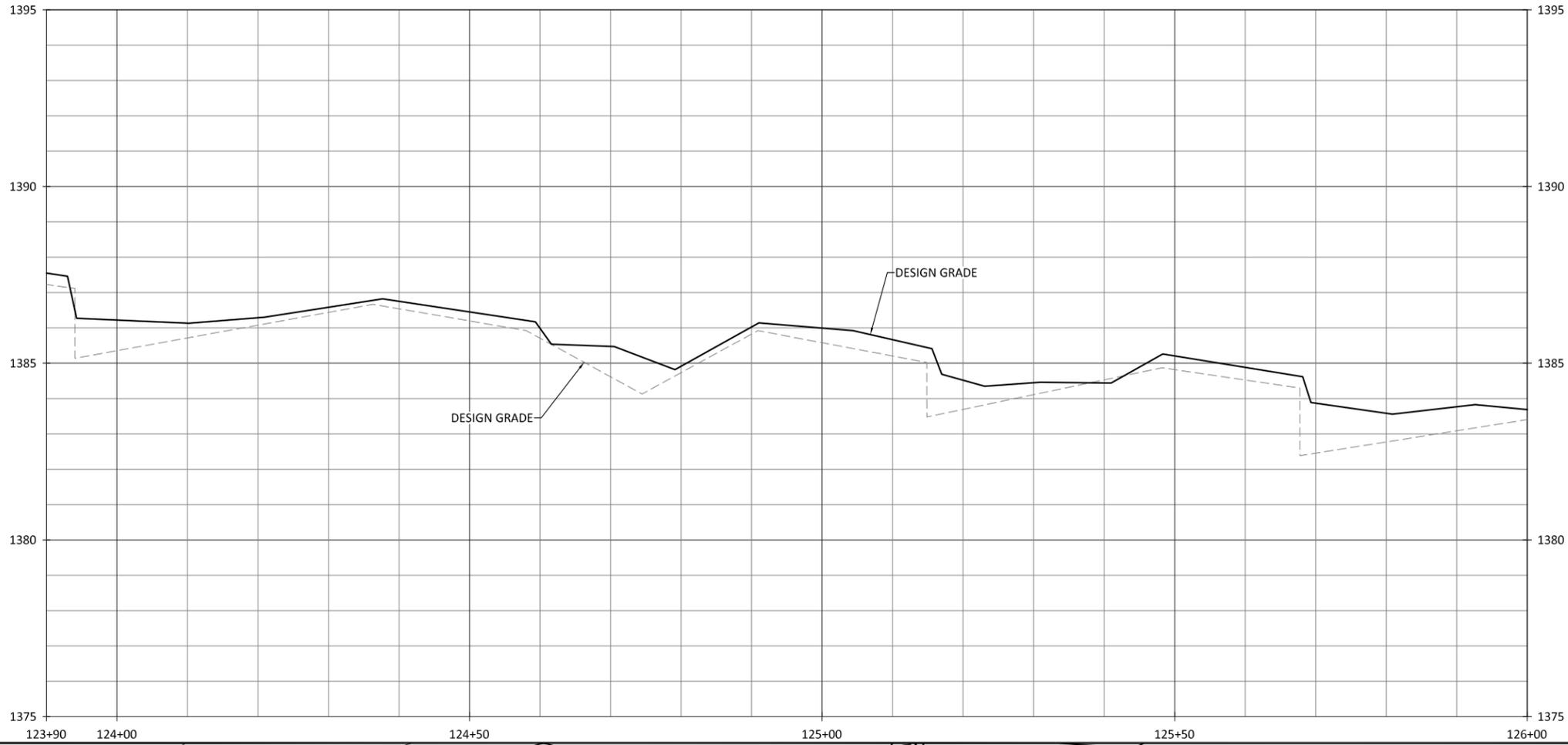
Bug Headwaters Record Drawings
 Wilkes County, North Carolina

Big Bugaboo Creek
 Stream Plan and Profile

Revisions:

Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

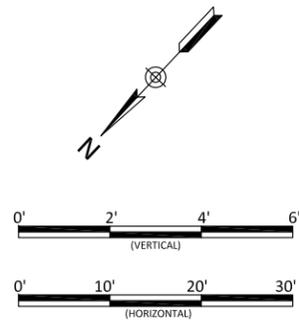
1.11



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

STA 124+60 - STA 124+92
 BRUSH TOE REPLACED WITH COVER LOG WITH EXTRA BOULDER TOE DUE TO ON-SITE BRUSH MATERIAL WAS NO LONGER AVAILABLE

STA 125+68
 BOULDER SILL REPLACED WITH LOG SILL DUE TO NO NATIVE BOULDERS ON SITE



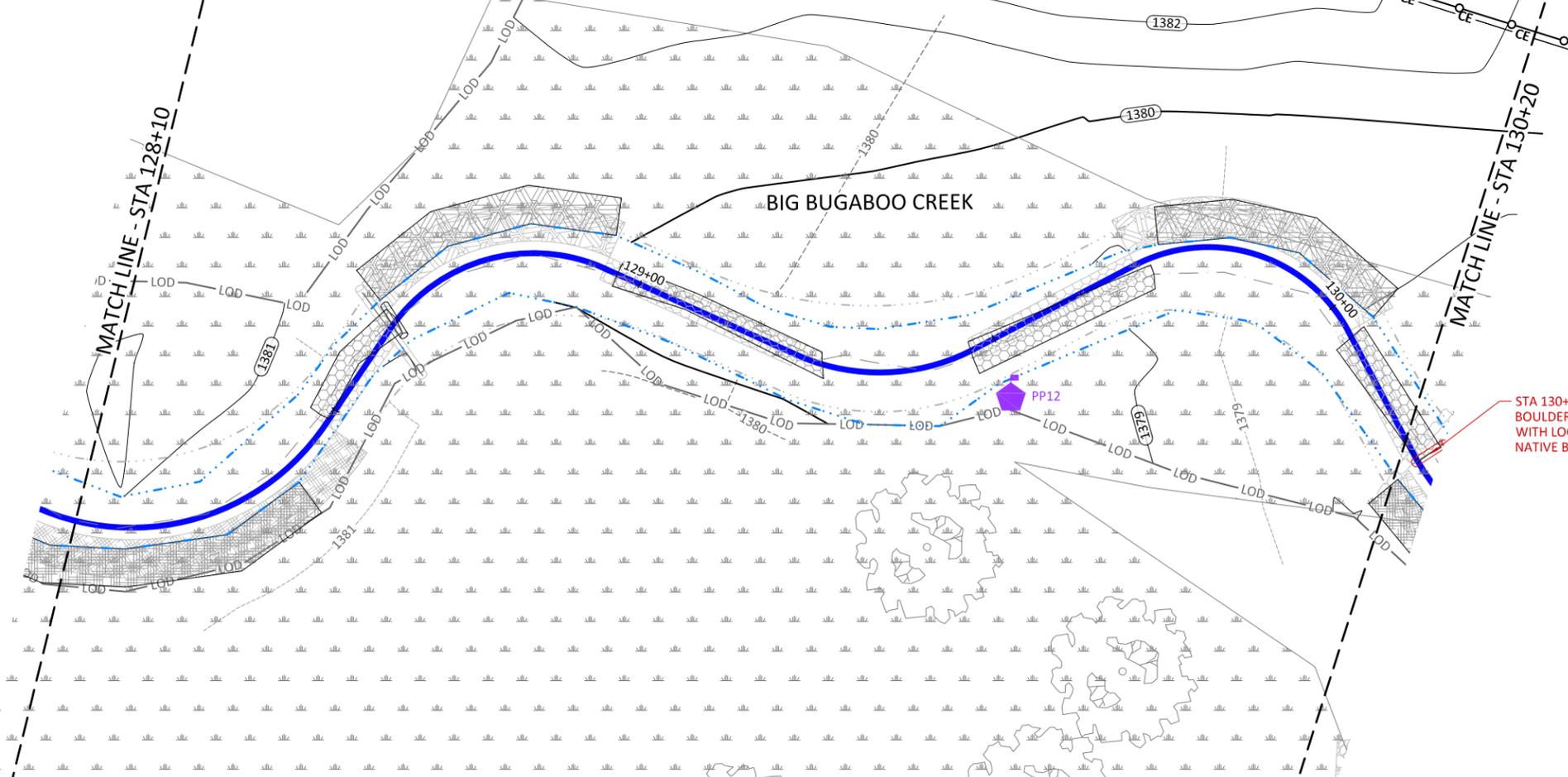
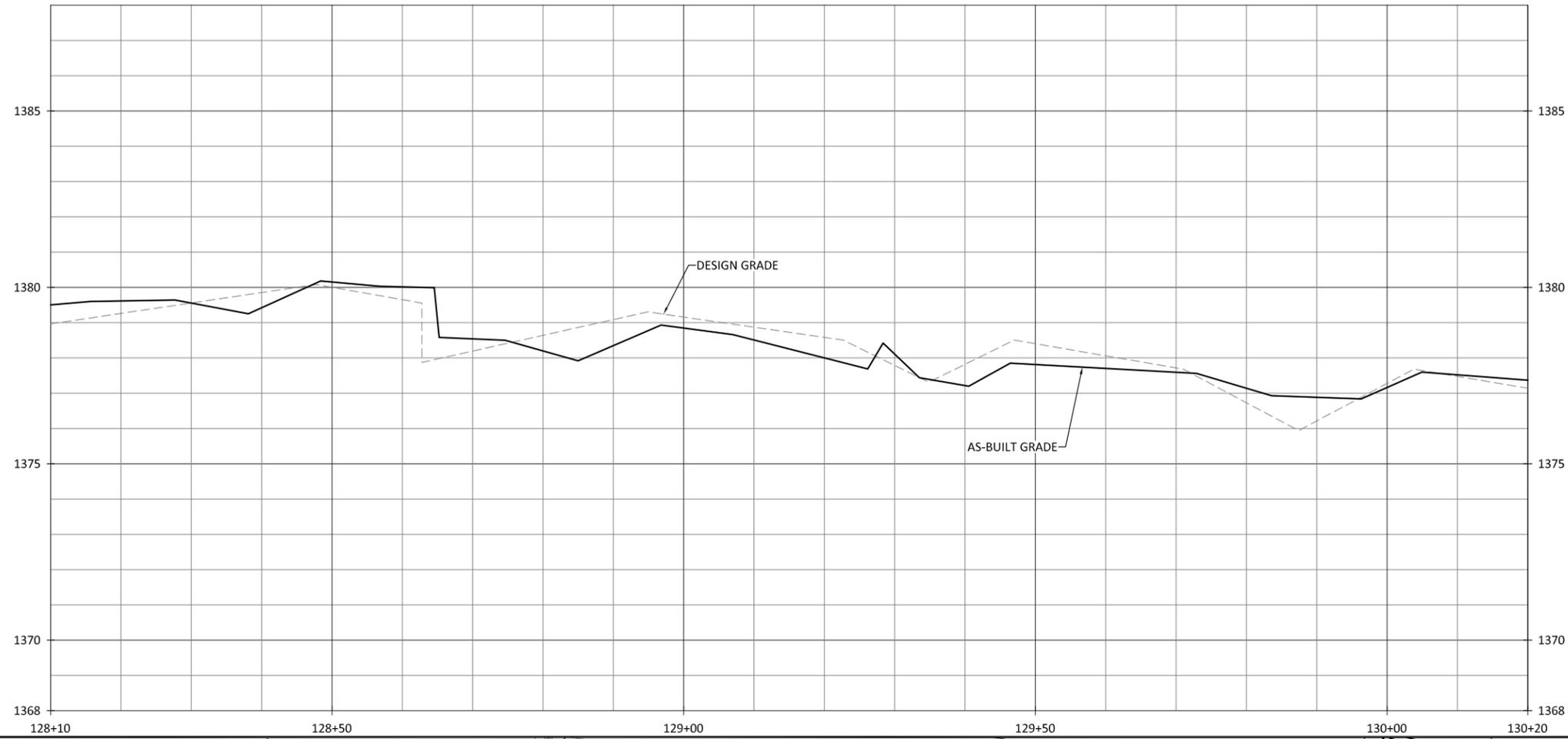
Bug Headwaters Record Drawings
 Wilkes County, North Carolina

Big Bugaboo Creek
 Stream Plan and Profile

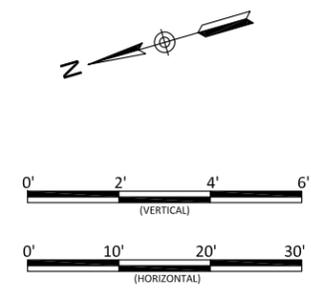
Revisions:
 10,2021 - Updated Notes

Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAV
 Checked By: ANA

1.12



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

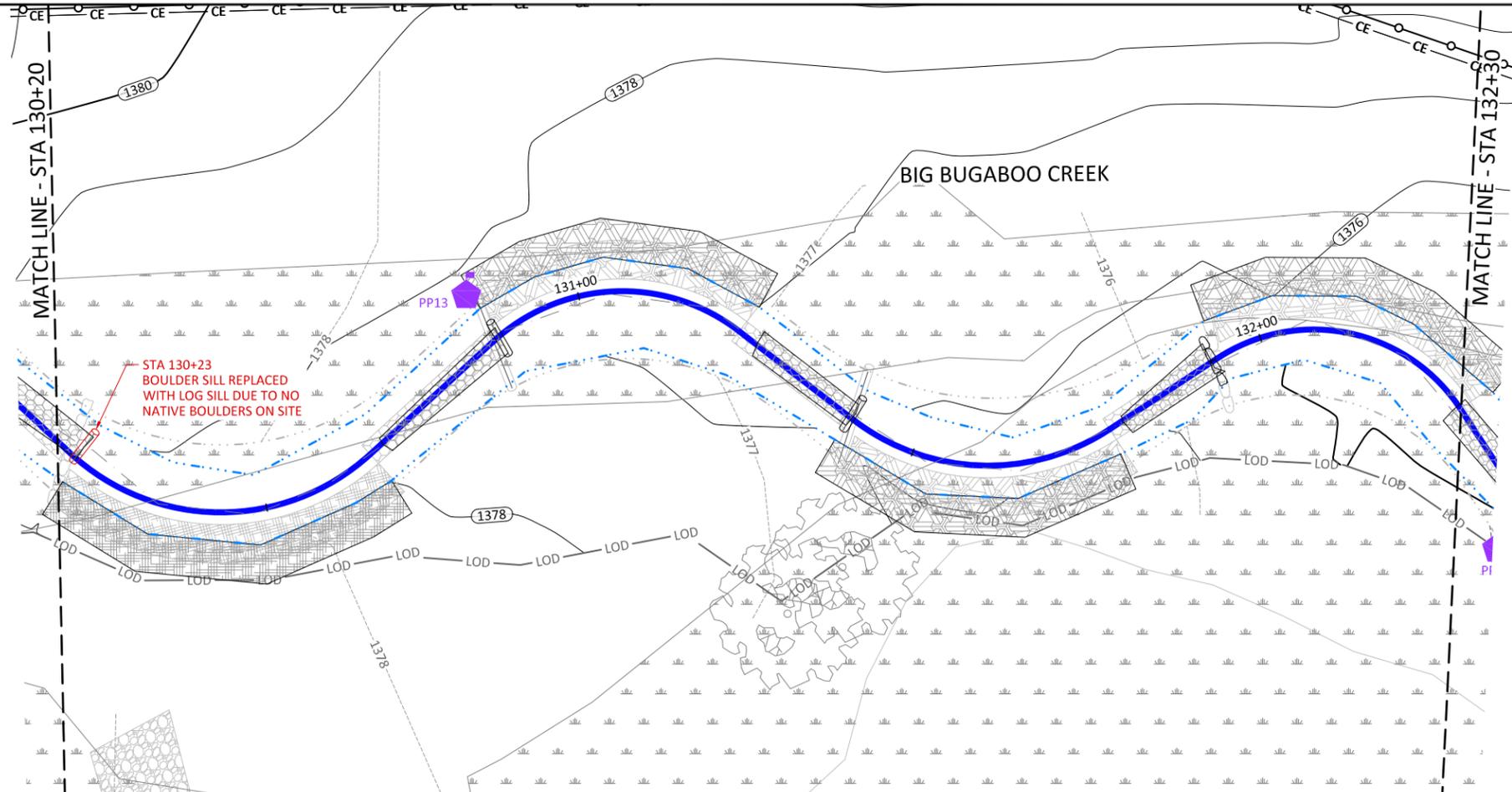
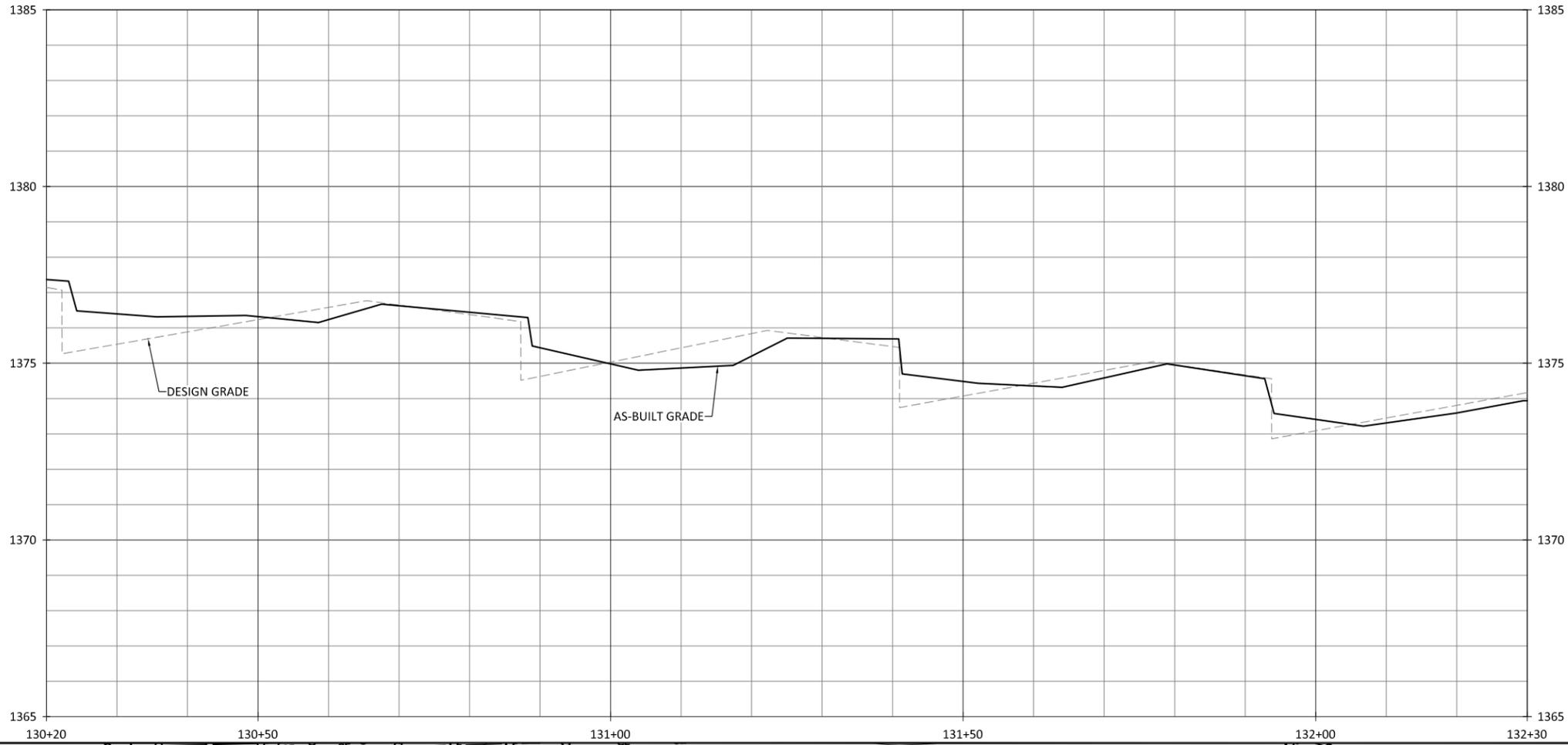


Bug Headwaters Record Drawings
 Wilkes County, North Carolina
 Big Bugaboo Creek
 Stream Plan and Profile

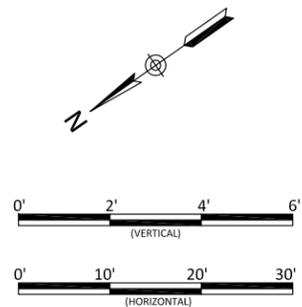
Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

Revisions:

1.14
 Sheet



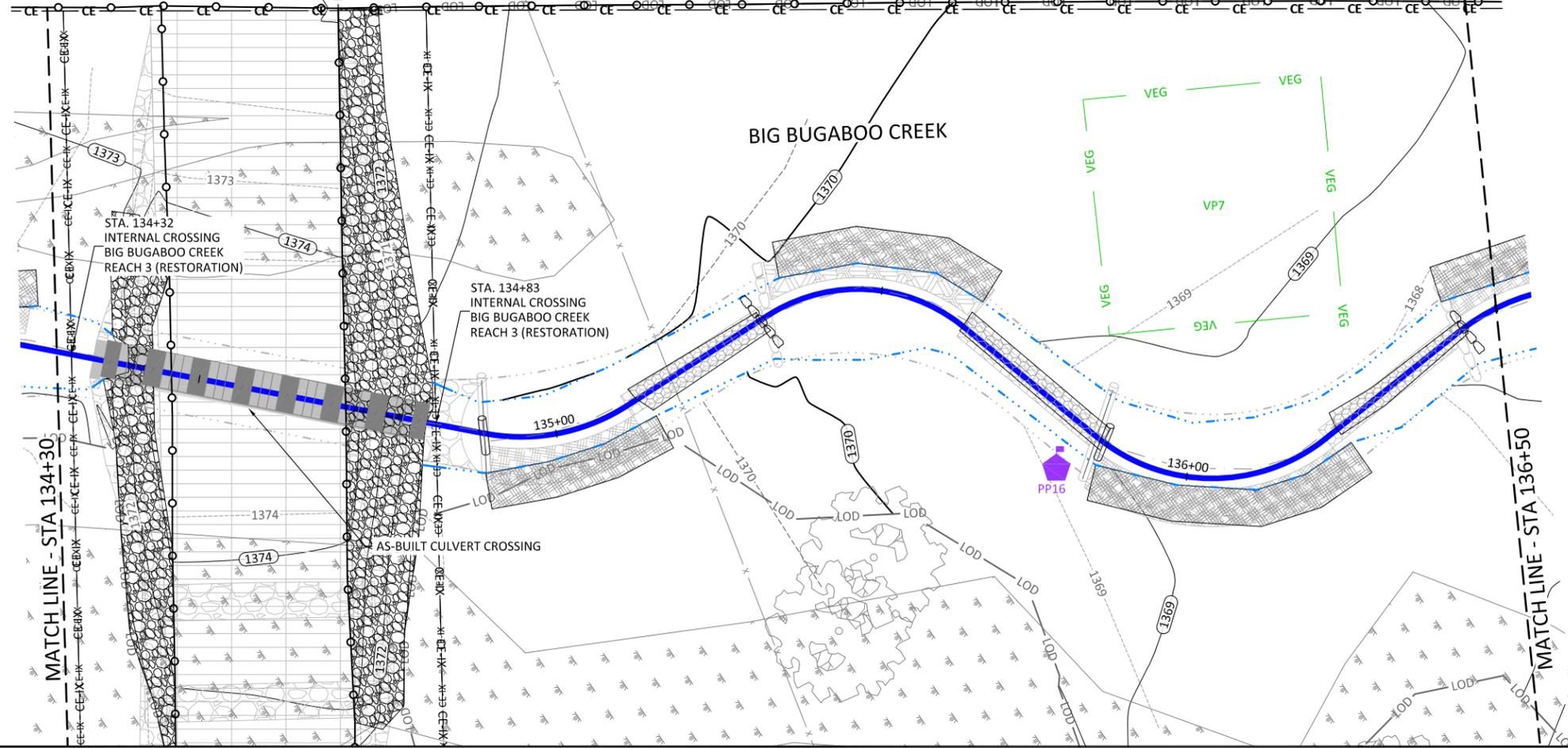
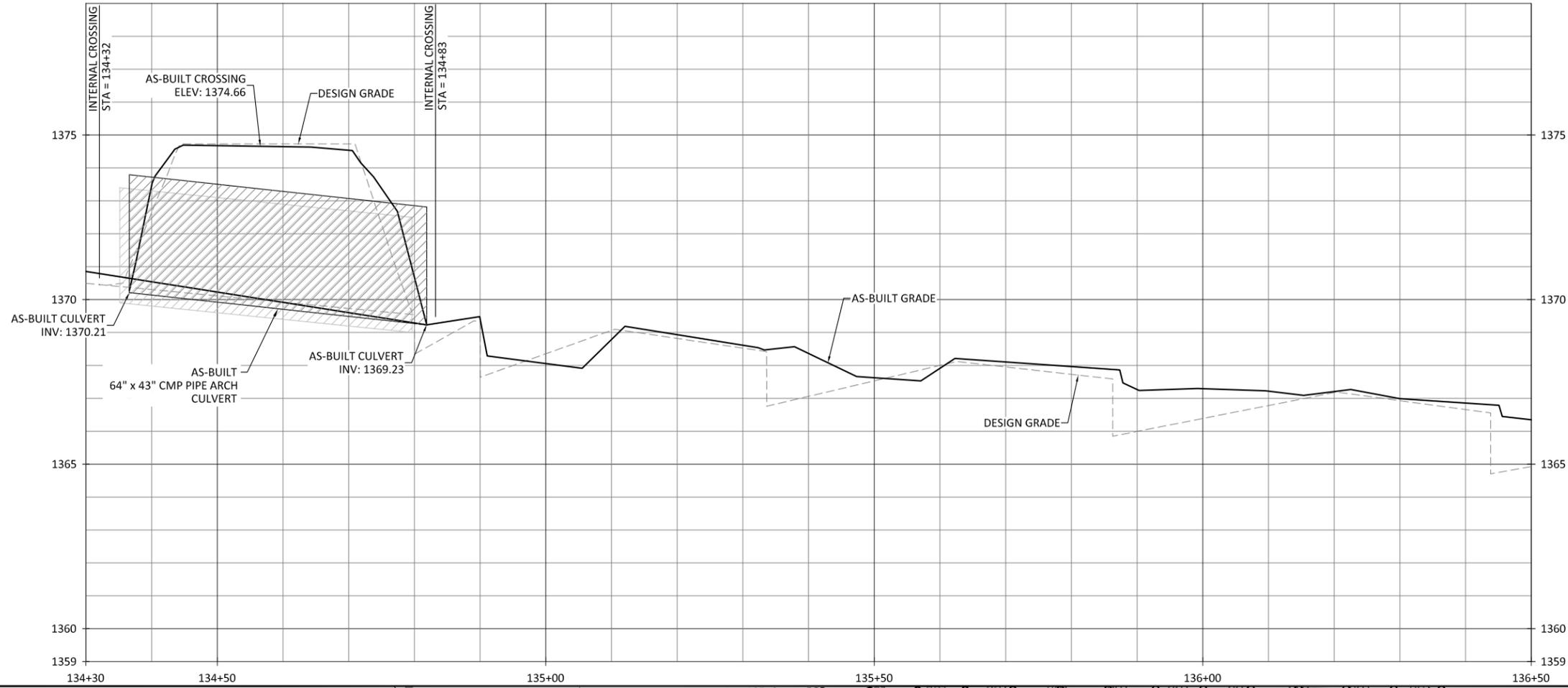
NOTES:
 1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.



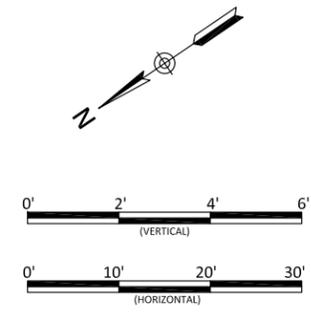
Bug Headwaters Record Drawings
 Wilkes County, North Carolina
 Big Bugaboo Creek
 Stream Plan and Profile

Revisions:

Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA



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

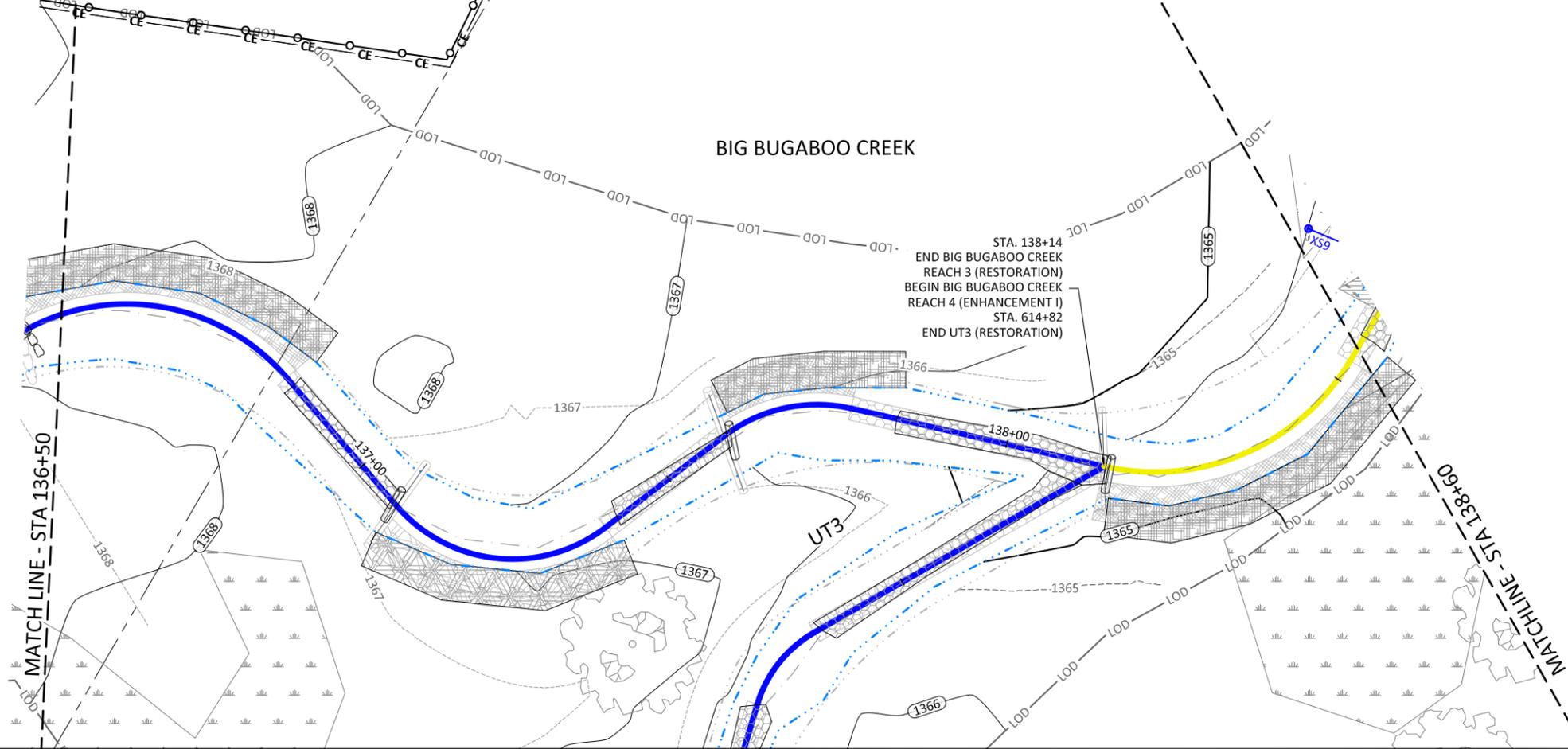
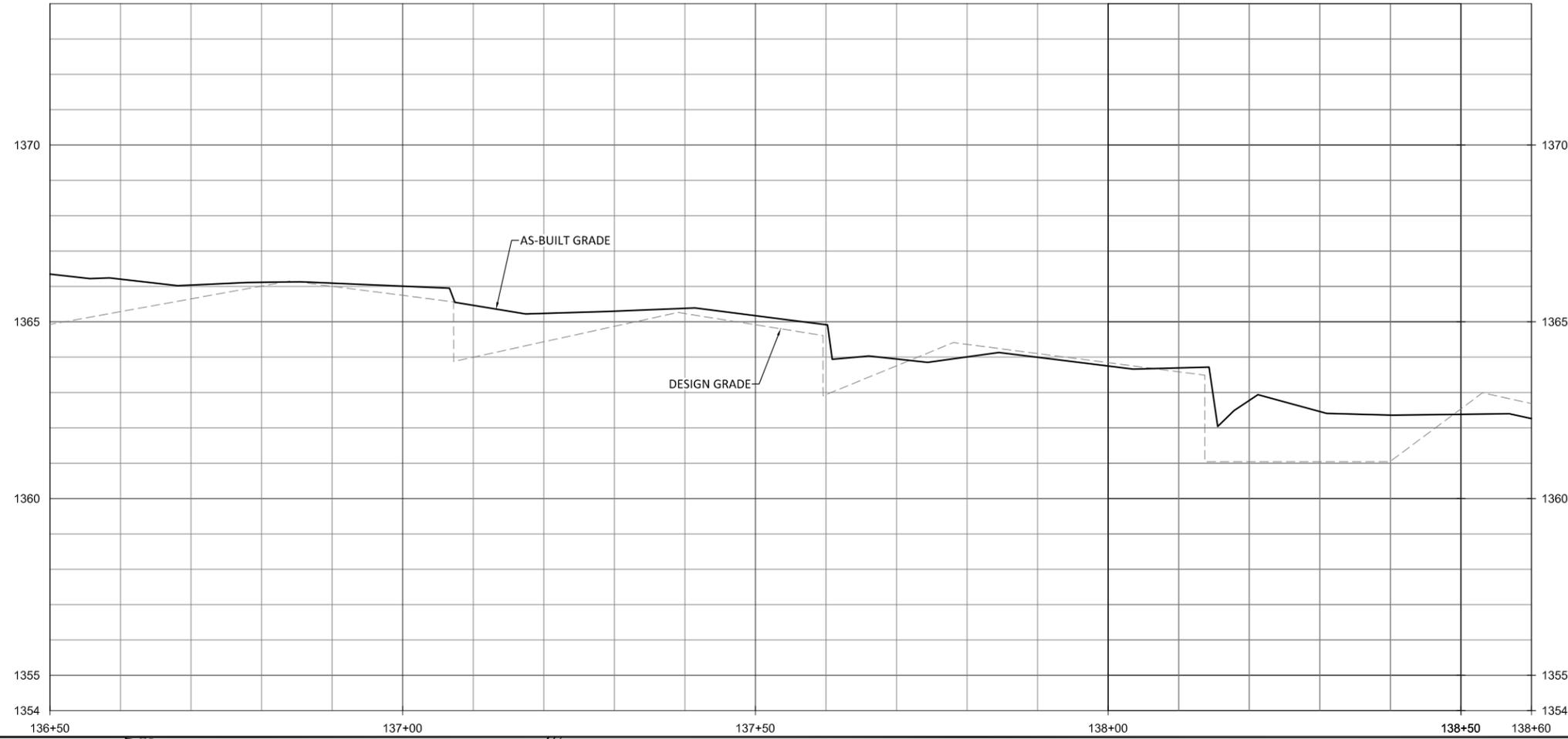


Bug Headwaters Record Drawings
 Wilkes County, North Carolina
 Big Bugaboo Creek
 Stream Plan and Profile

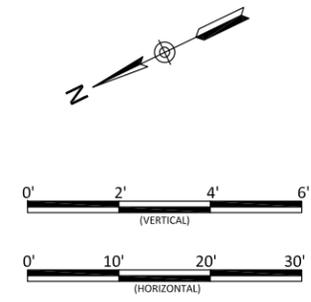
Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

Revisions:
 10.2021 - Removed Demo Items

1.17



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT3 IS ADDRESSED ON SHEETS 1.38 THROUGH 1.44.



Bug Headwaters Record Drawings
Wilkes County, North Carolina

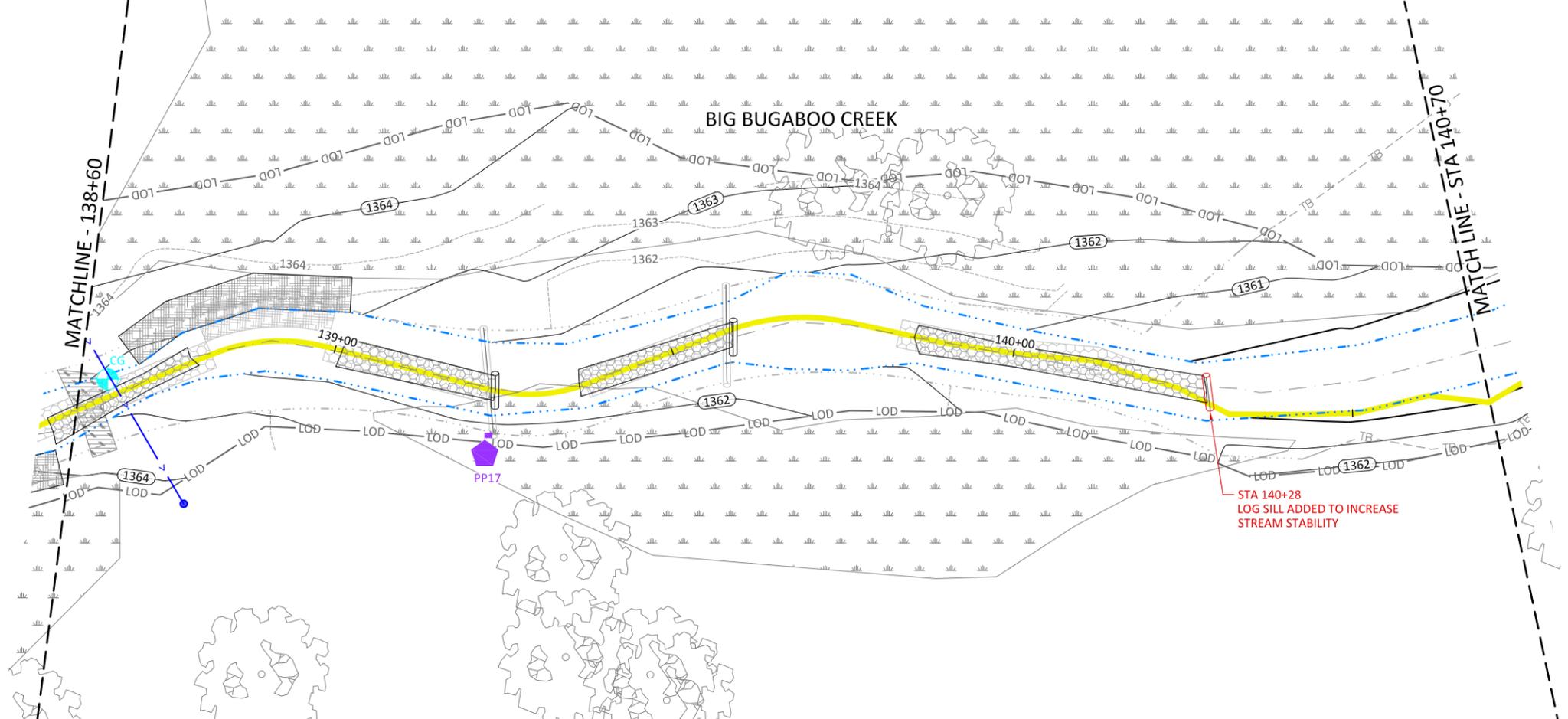
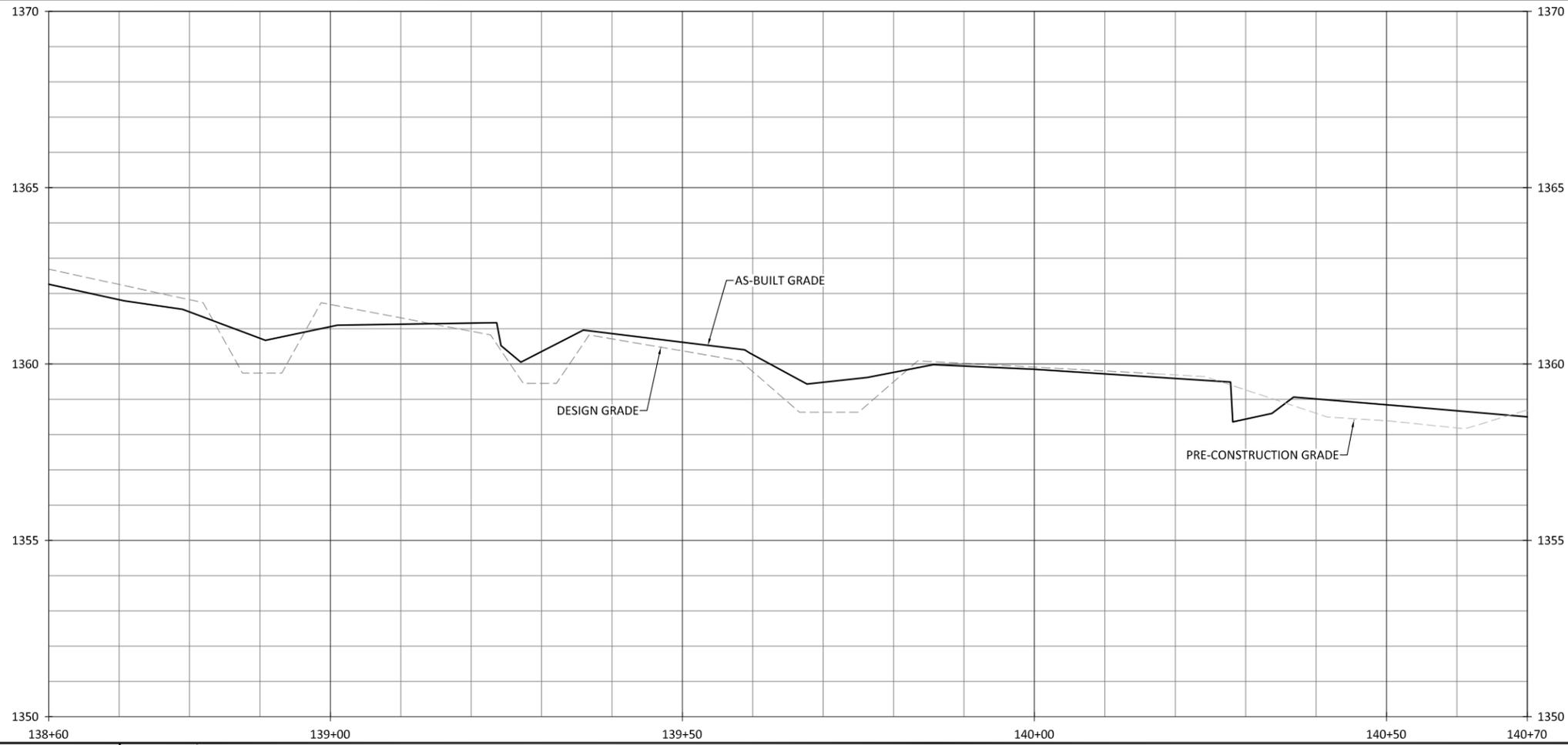
Big Bugaboo Creek
Stream Plan and Profile

Revisions:

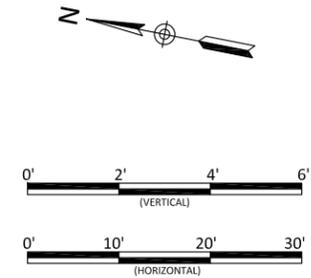
10/2021 - Removed Demo Items

Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

1.18



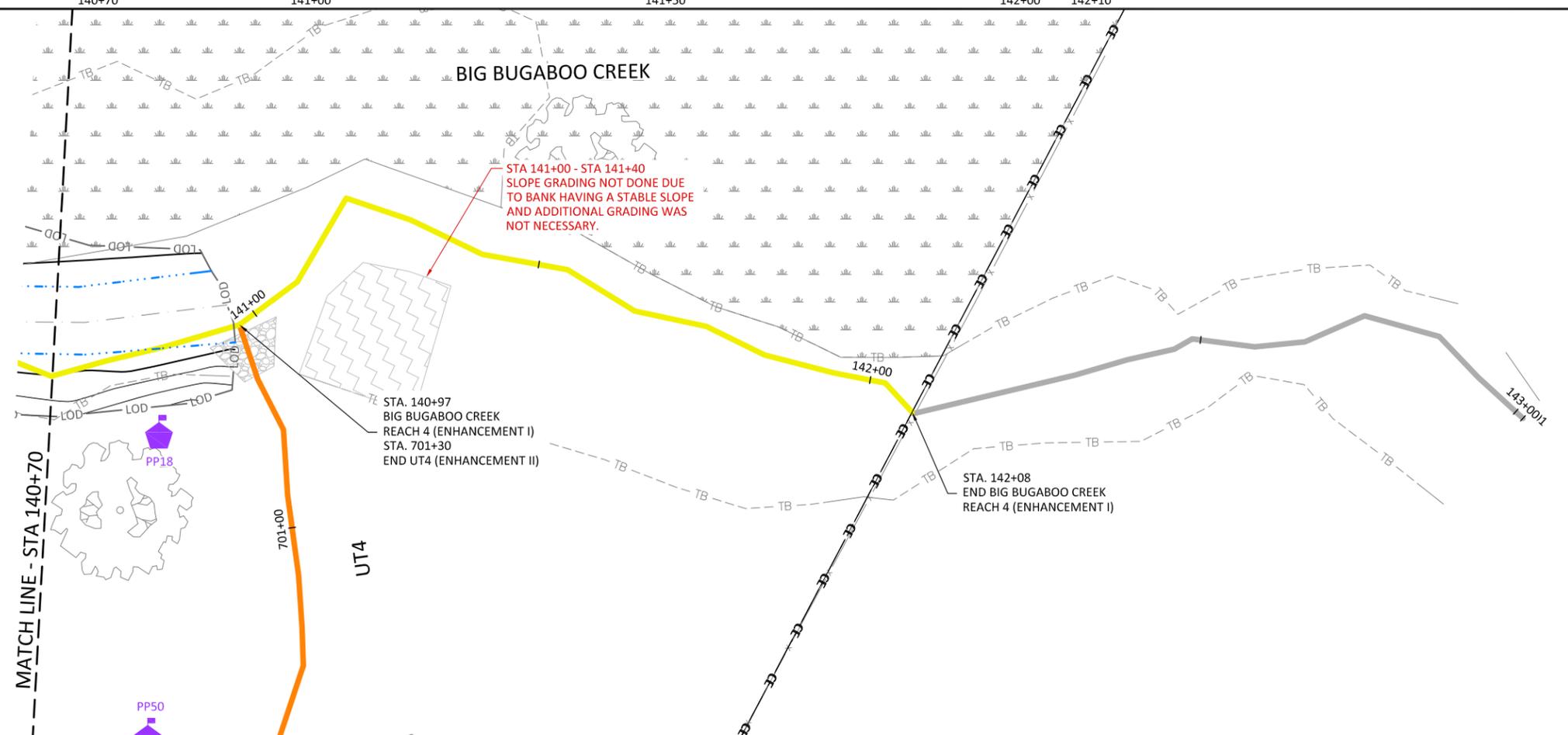
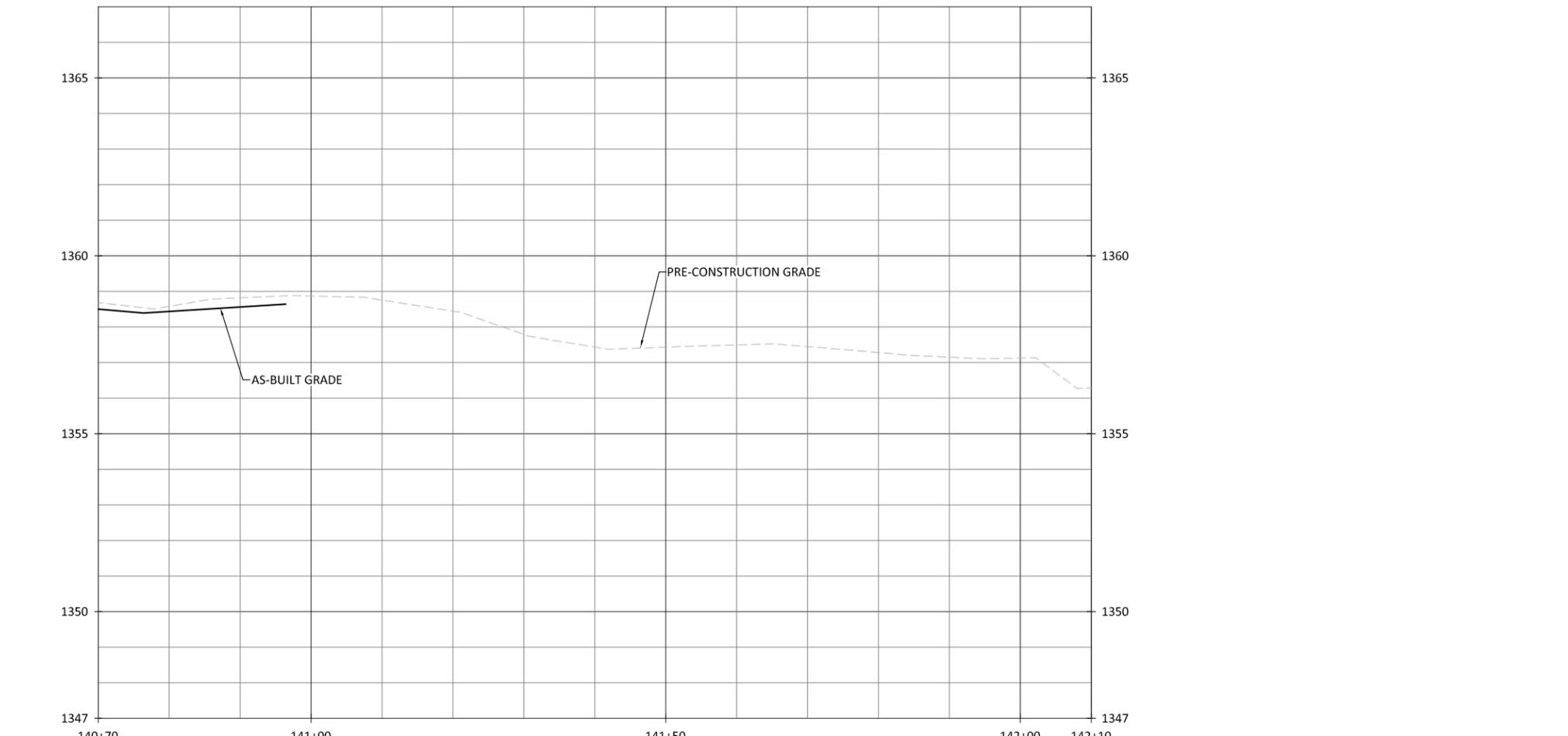
NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.



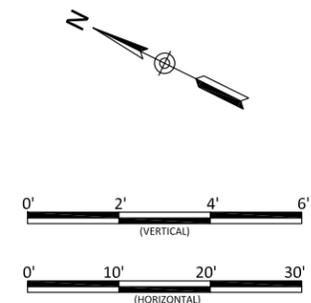
Big Bugaboo Creek
Stream Plan and Profile

Revisions:

Date: 09.15.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA



- NOTES:**
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT4 IS ADDRESSED ON SHEET 1.45.



Bug Headwaters Record Drawings
 Wilkes County, North Carolina
 Big Bugaboo Creek
 Stream Plan and Profile

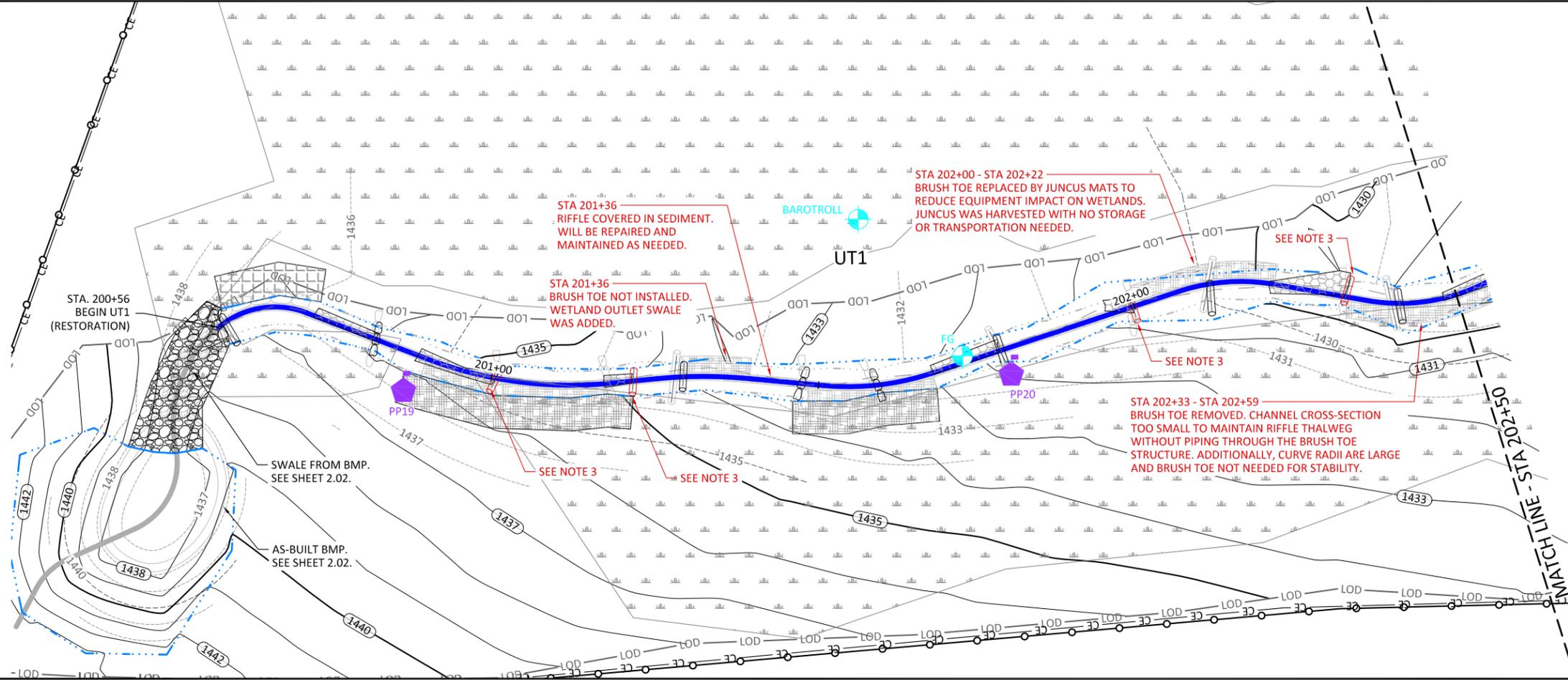
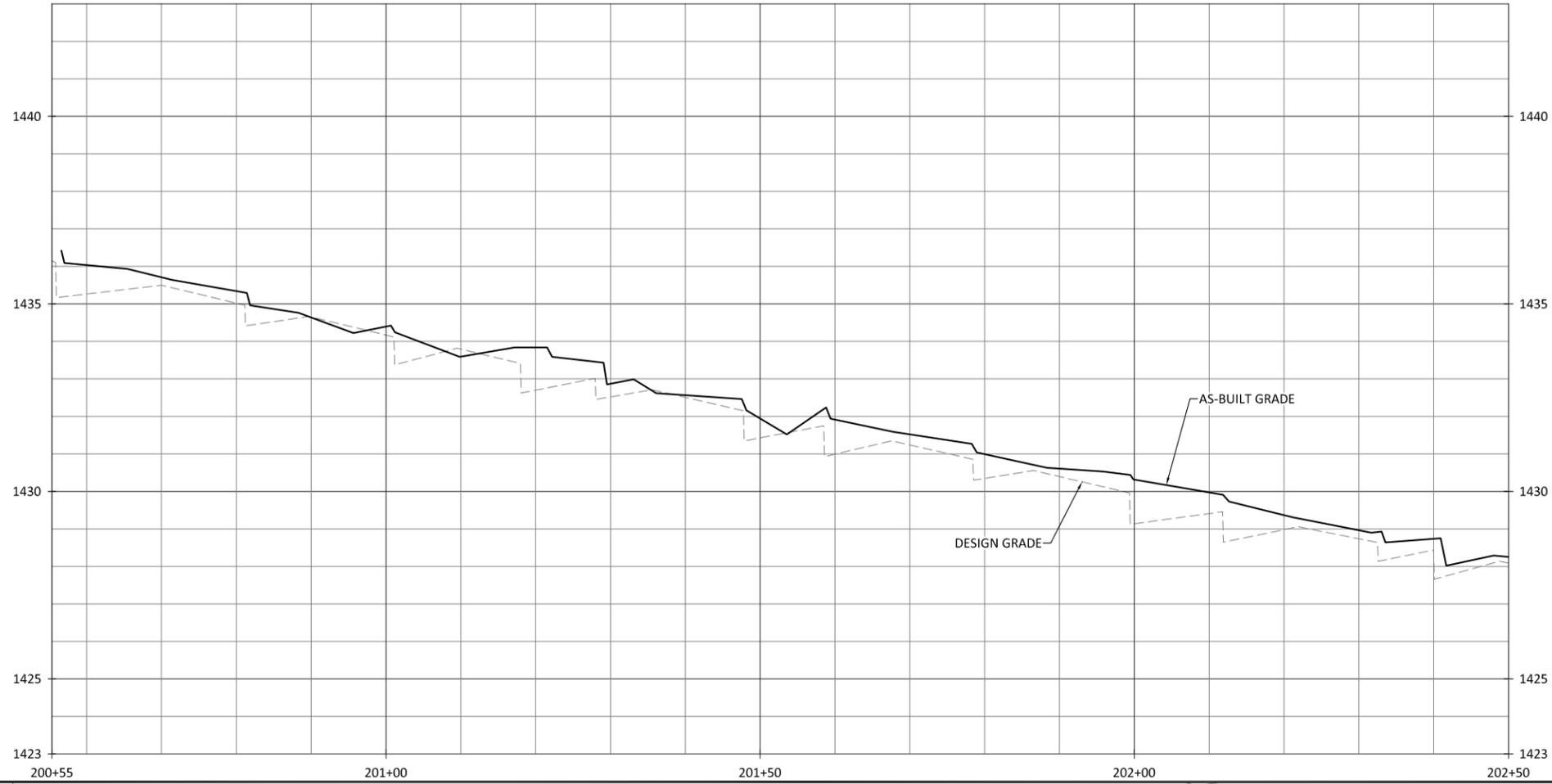


Revisions:	

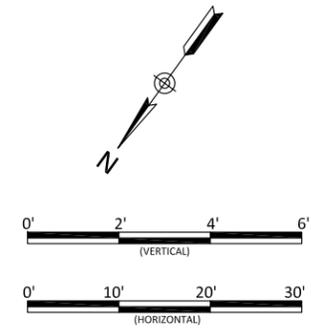
Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

1.20

Sheet



- NOTES:**
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR BMP IS ADDRESSED ON SHEET 2.02.
 3. STA 201+01, 201+37, STA 202+00 & STA 202+33: BOULDER SILL REPLACED WITH LOG SILL DUE TO NO NATIVE BOULDERS ON SITE.



Bug Headwaters Record Drawings
 Wilkes County, North Carolina

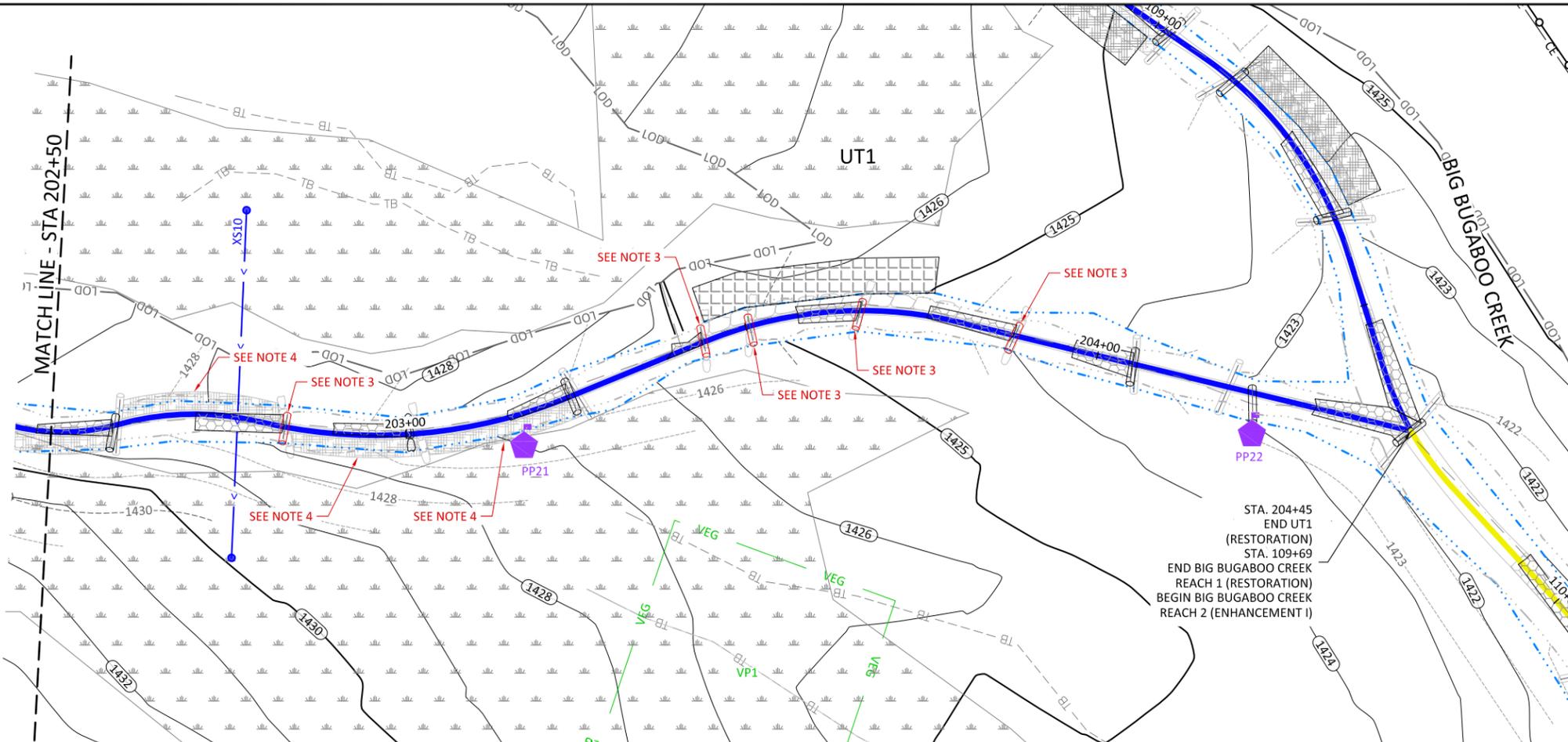
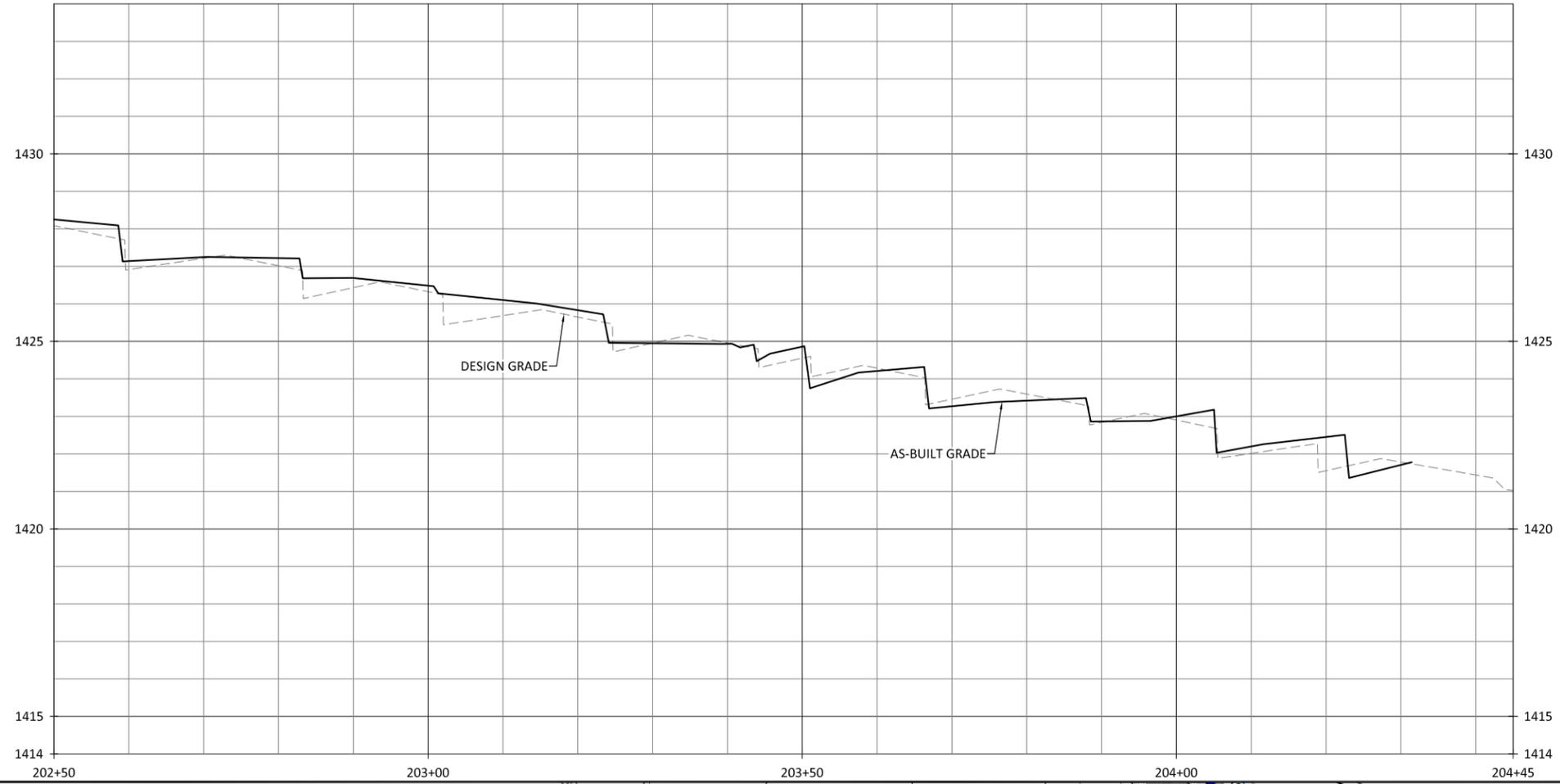


UT1
 Stream Plan and Profile

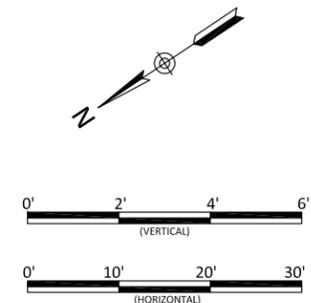
Revisions:

Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA

1.21
 Sheet



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR BIG BUGABOO CREEK IS ADDRESSED ON SHEETS 1.01 THROUGH 1.20.
 3. STA 202+83, STA 203+44, STA 203+50, STA 203+66 & STA 203+88 BOULDER SILL REPLACED WITH LOG SILL DUE TO NO NATIVE BOULDERS ON SITE.
 4. STA 202+33 - STA 202+59, STA 202+60 - STA 202+83 & STA 202+83 - STA 203+24 BRUSH TOE REMOVED. CHANNEL CROSS-SECTION TOO SMALL TO MAINTAIN RIFFLE THALWEG WITHOUT PIPING THROUGH THE BRUSH TOE STRUCTURE. ADDITIONALLY, CURVE RADII ARE LARGE AND BRUSH TOE NOT NEEDED FOR STABILITY.



Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT1
Stream Plan and Profile

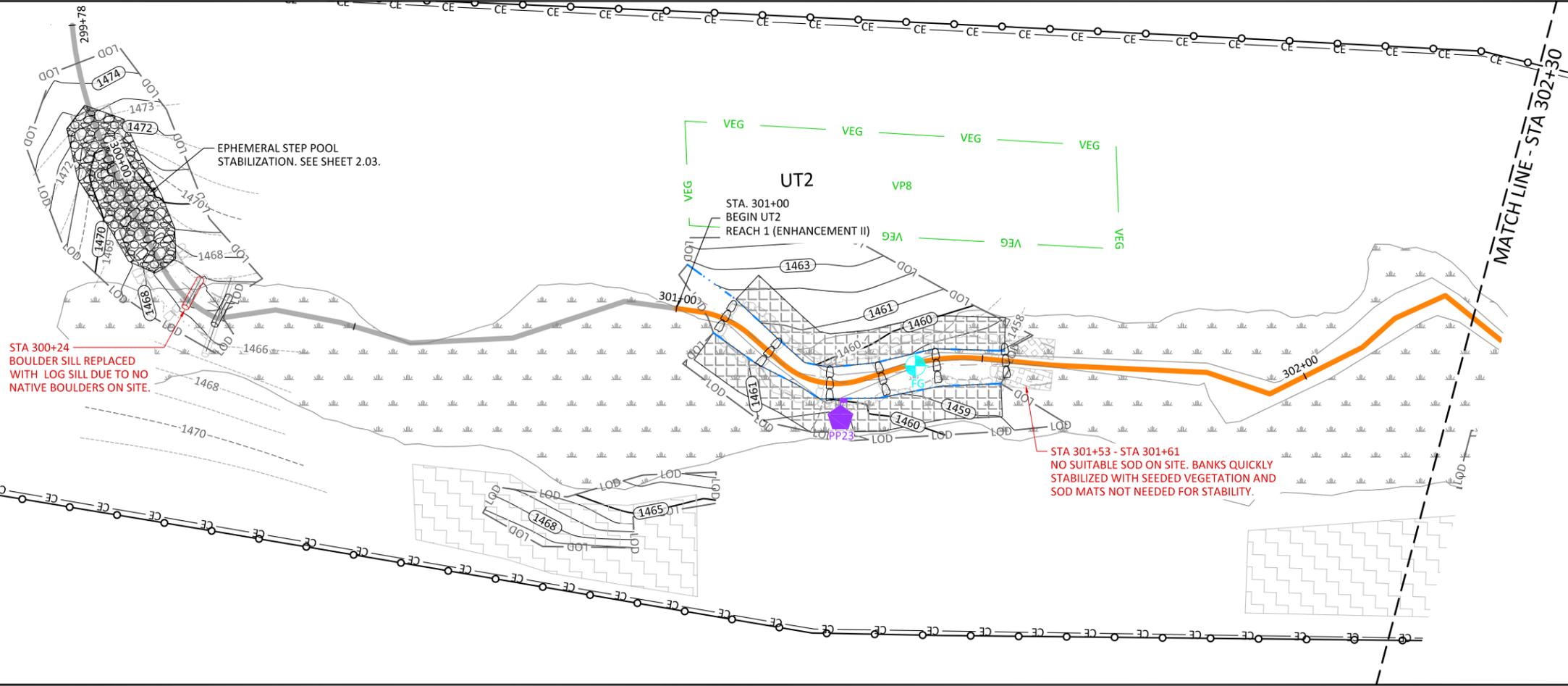
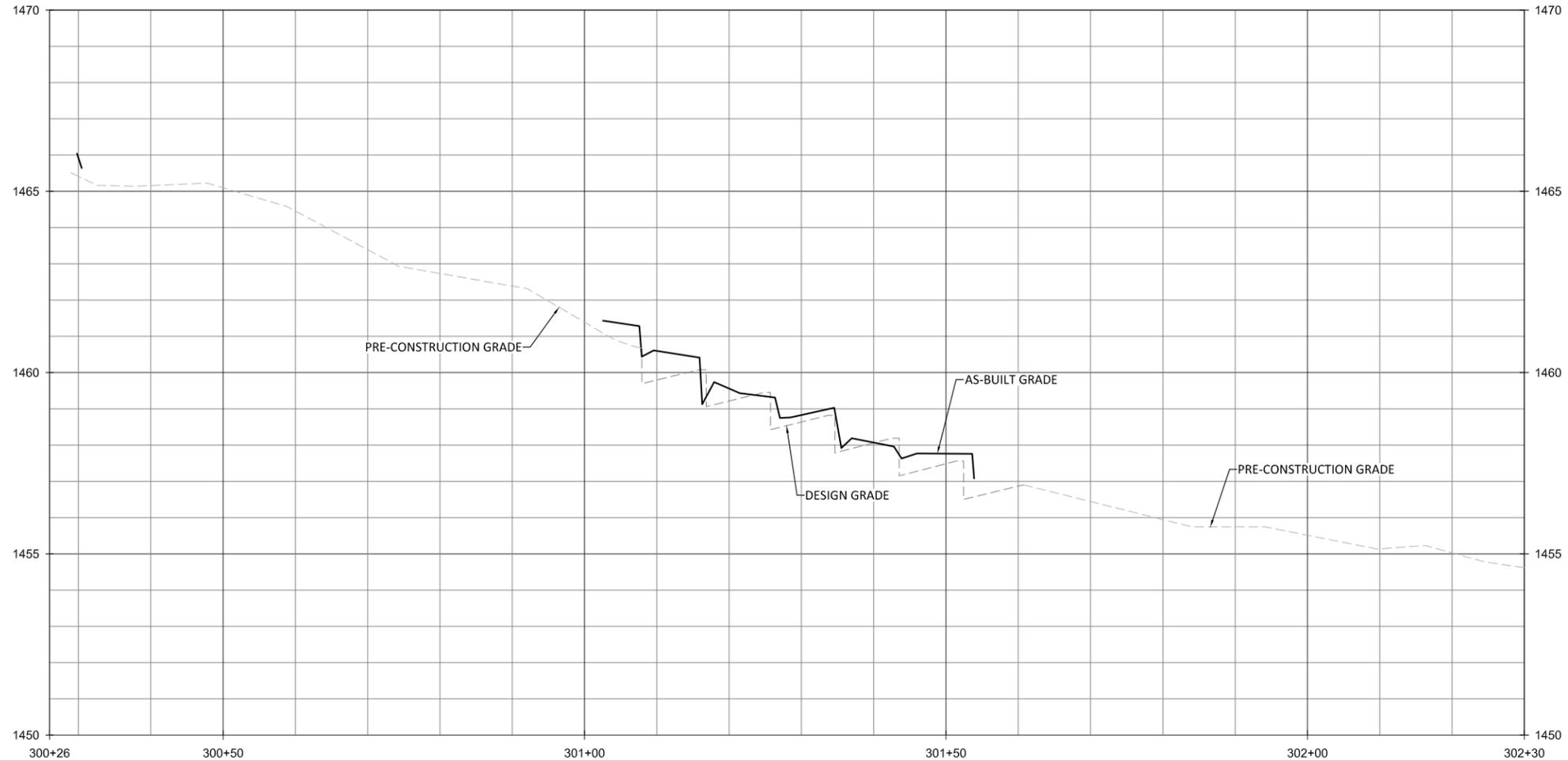
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAV
Checked By: ANA

1.22

Sheet

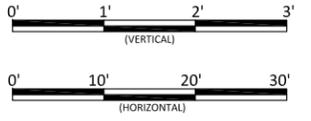




NOTES:
 1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

STA 300+24
 BOULDER SILL REPLACED
 WITH LOG SILL DUE TO NO
 NATIVE BOULDERS ON SITE.

STA 301+53 - STA 301+61
 NO SUITABLE SOD ON SITE. BANKS QUICKLY
 STABILIZED WITH SEEDED VEGETATION AND
 SOD MATS NOT NEEDED FOR STABILITY.



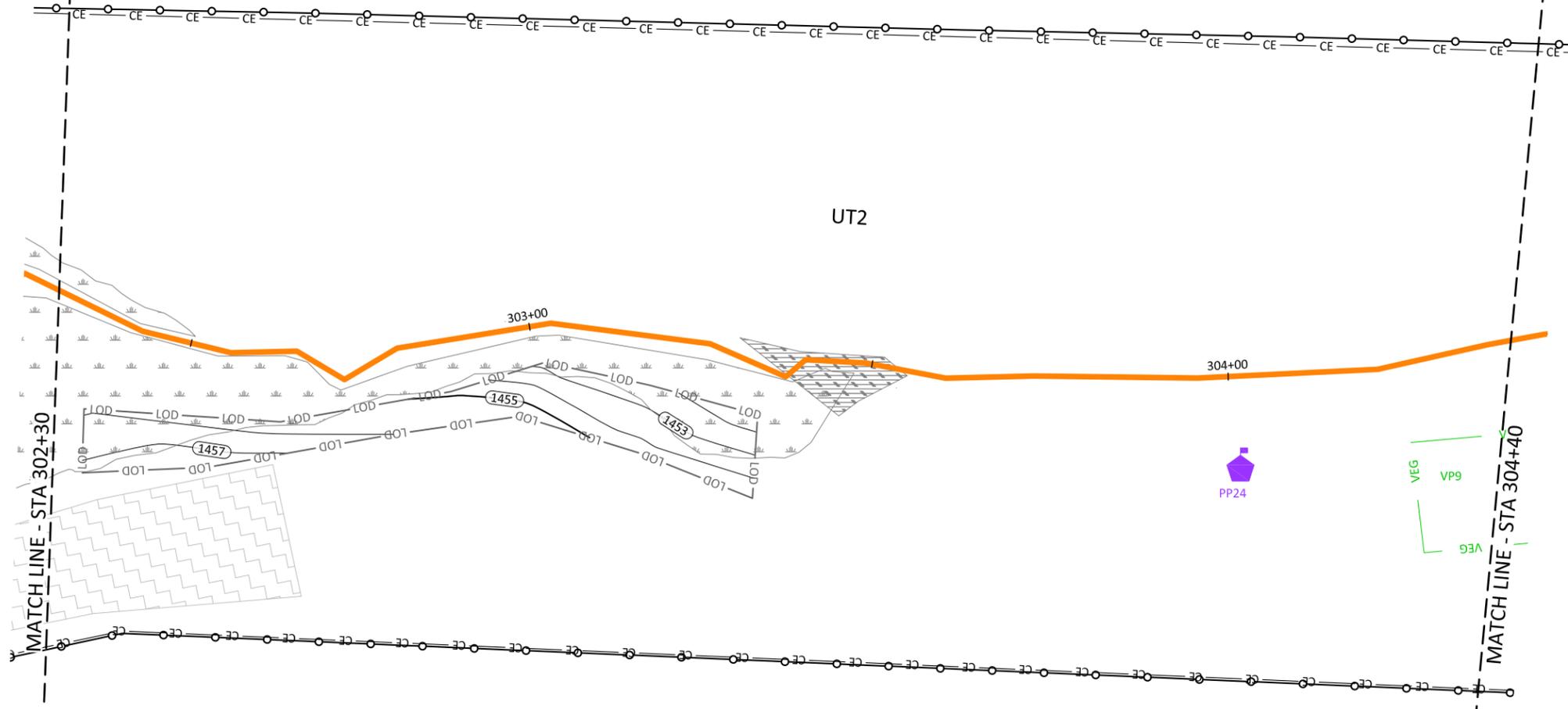
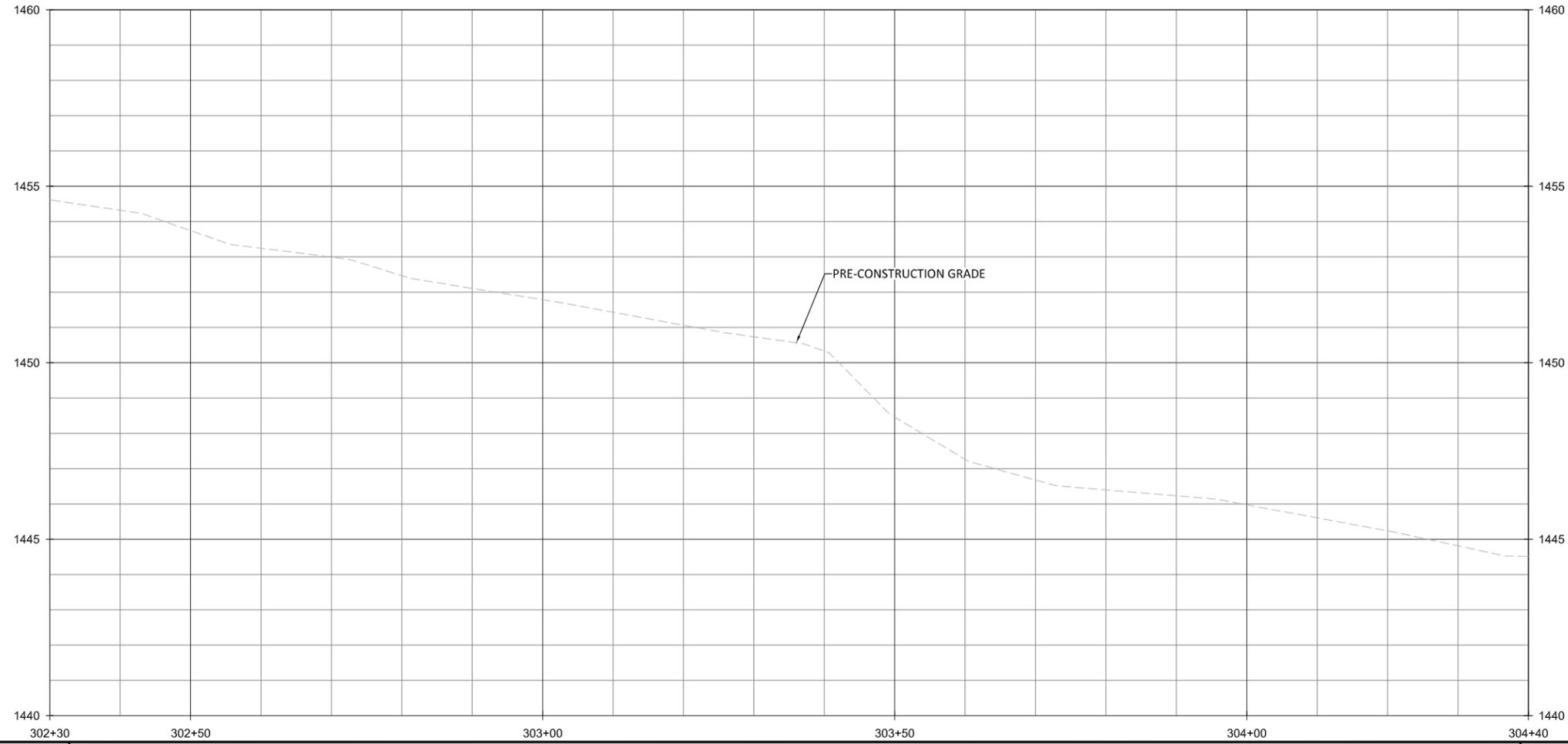
Bug Headwaters Record Drawings
 Wilkes County, North Carolina

UT2
 Stream Plan and Profile

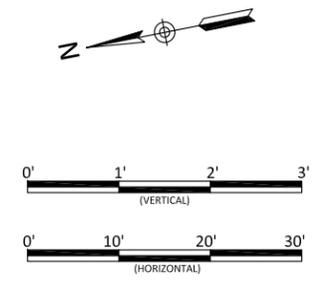
Revisions:

Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA

1.23



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



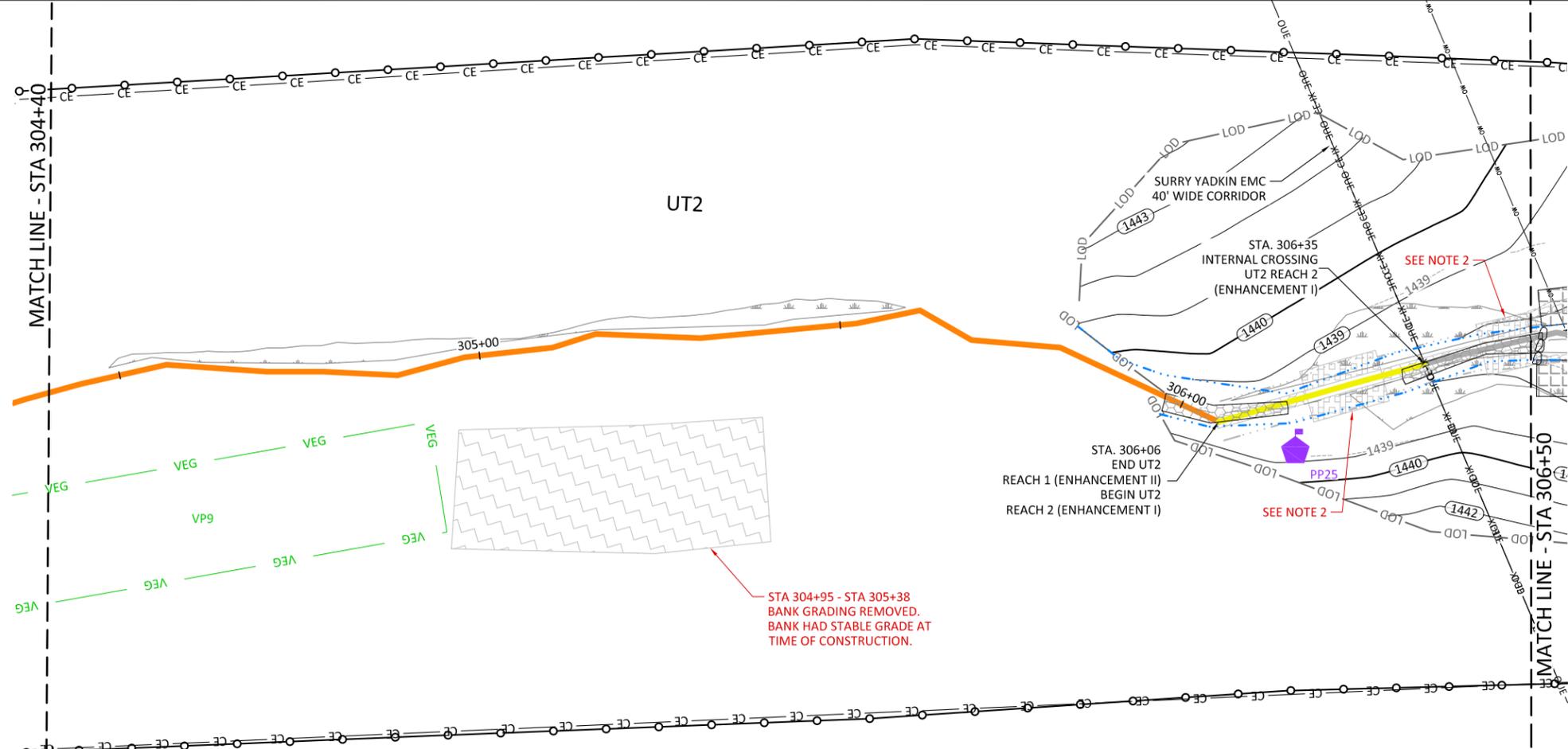
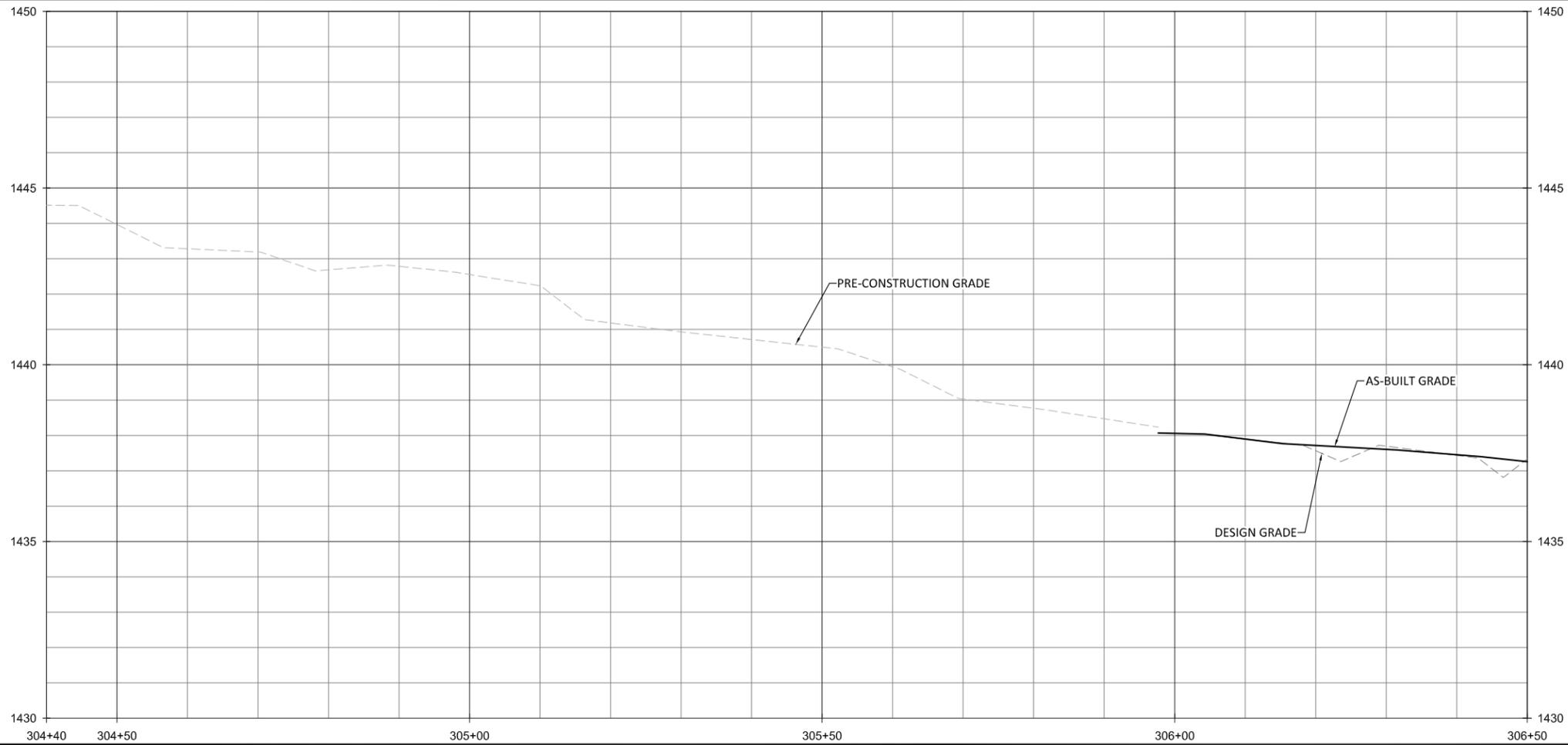
Bug Headwaters Record Drawings
 Wilkes County, North Carolina

UT2
 Stream Plan and Profile

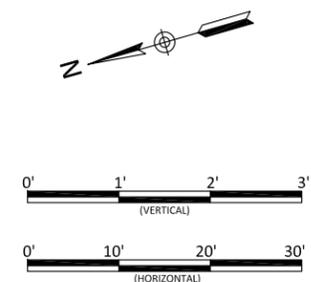
Revisions:

Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA

1.24



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 306+18 - STA 306+29 & STA 306+43 - STA 306+50 NO SUITABLE SOD ON SITE. BANKS QUICKLY STABILIZED WITH SEEDING VEGETATION AND SOD MATS NOT NEEDED FOR STABILITY.



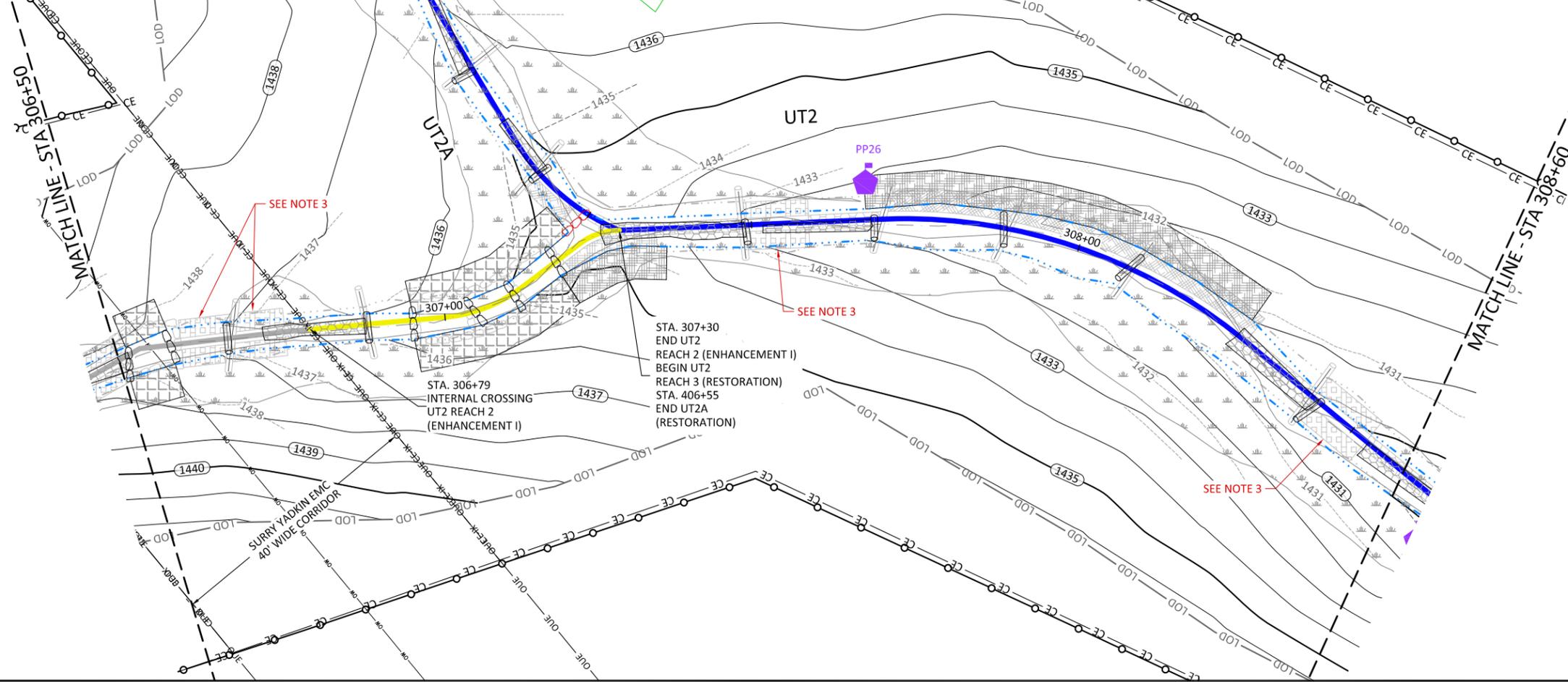
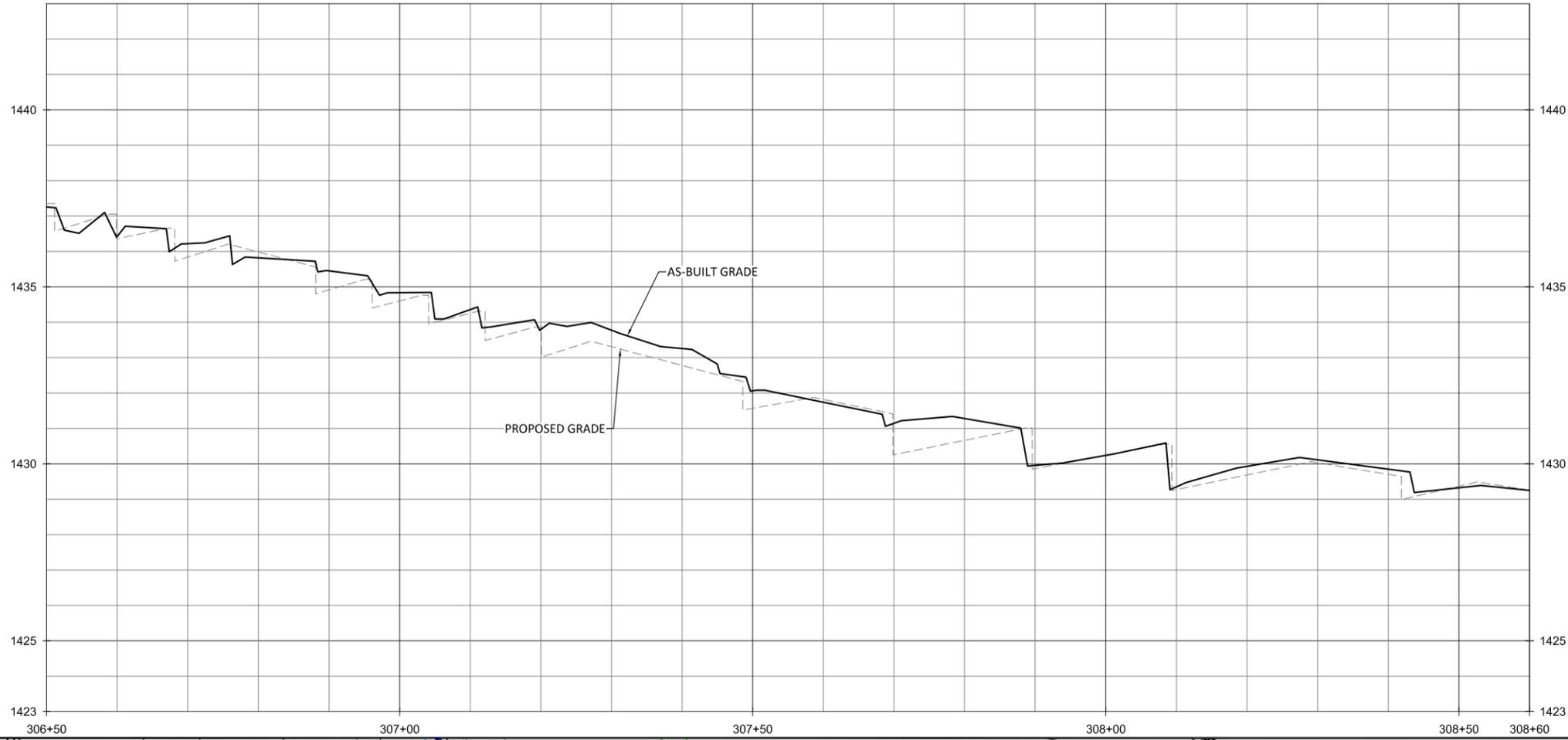
Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT2
Stream Plan and Profile

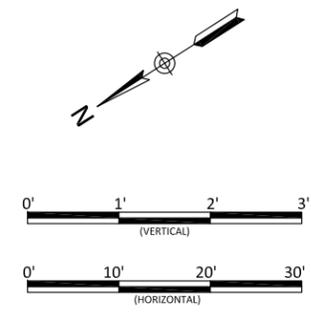
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

1.25
Sheet



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT2A IS ADDRESSED ON SHEETS 1.34 THROUGH 1.36.
 3. STA 306+60 - STA 306+68, STA 306+68 - STA 306+76, STA 307+49 - STA 307+59 & STA 308+42 - STA 308+53 NO SUITABLE SOD ON SITE. BANKS QUICKLY STABILIZED WITH SEEDING VEGETATION AND SOD MATS NOT NEEDED FOR STABILITY.



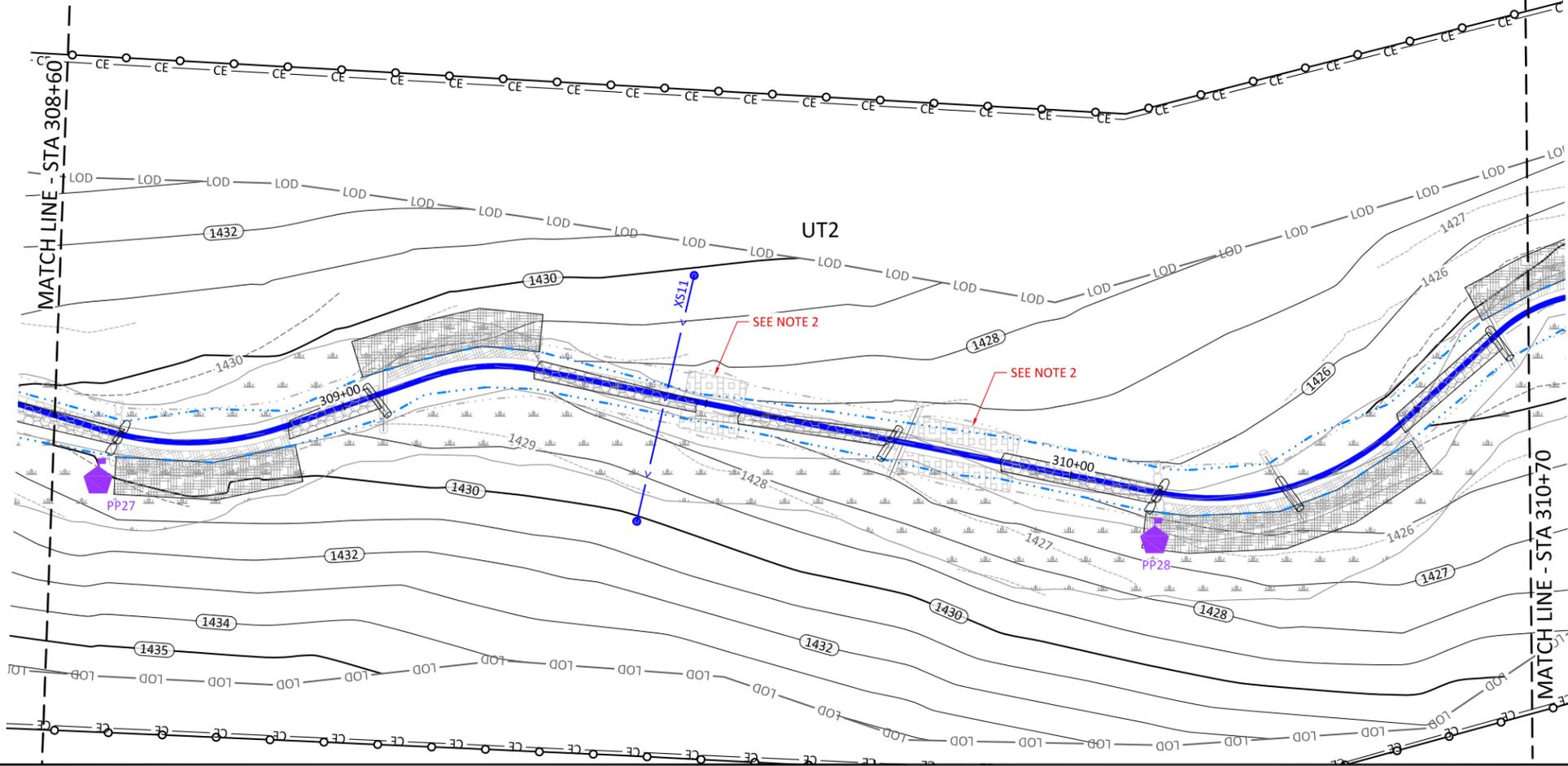
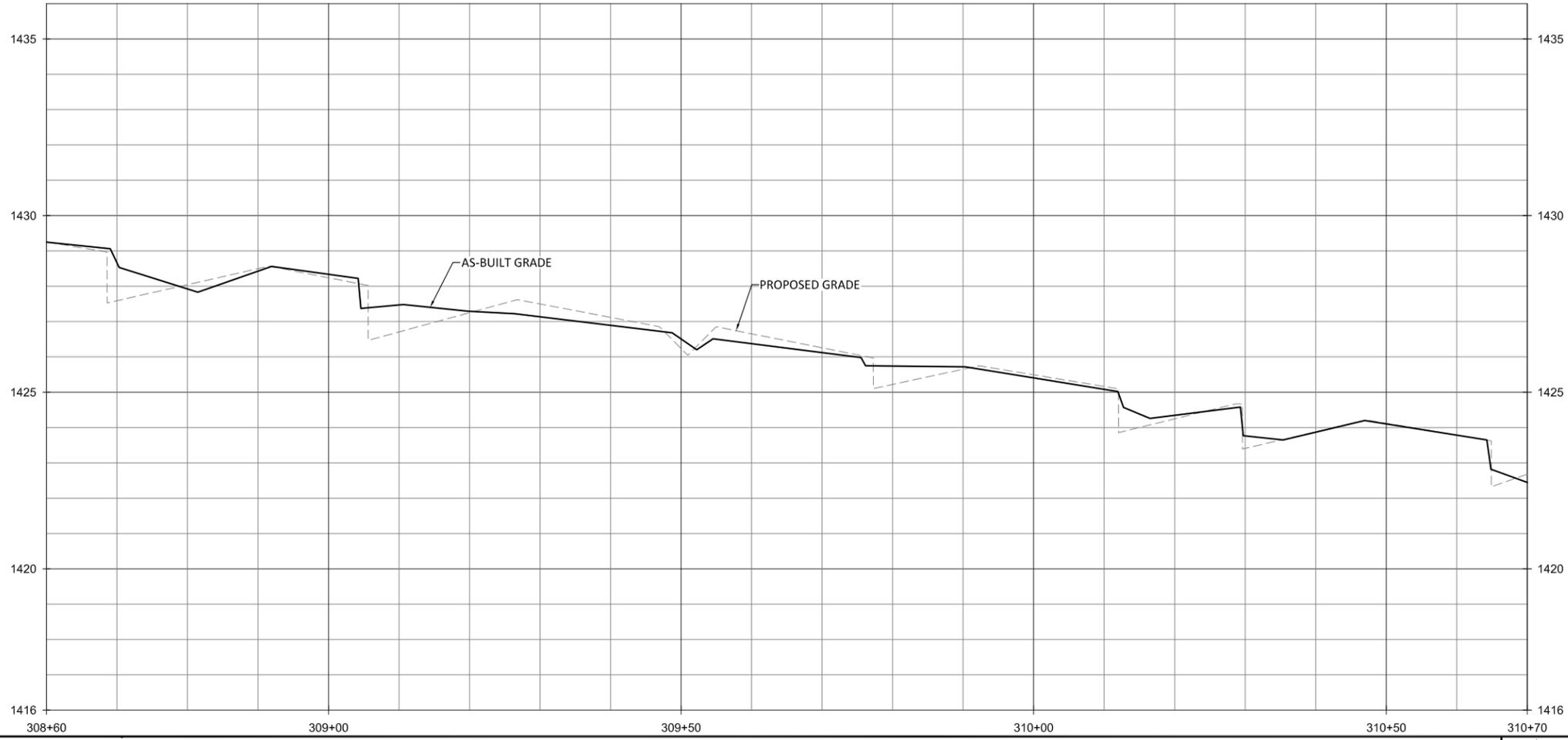
Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT2
Stream Plan and Profile

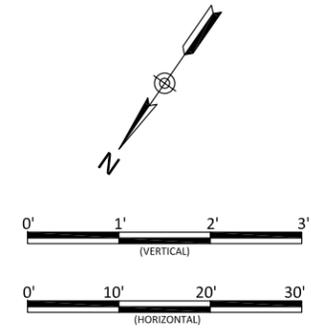
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

1.26



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 309+47 - STA 309+55 & STA 309+77 - STA 309+92
NO SUITABLE SOD ON SITE. BANKS QUICKLY STABILIZED WITH SEEDED VEGETATION AND SOD MATS NOT NEEDED FOR STABILITY.



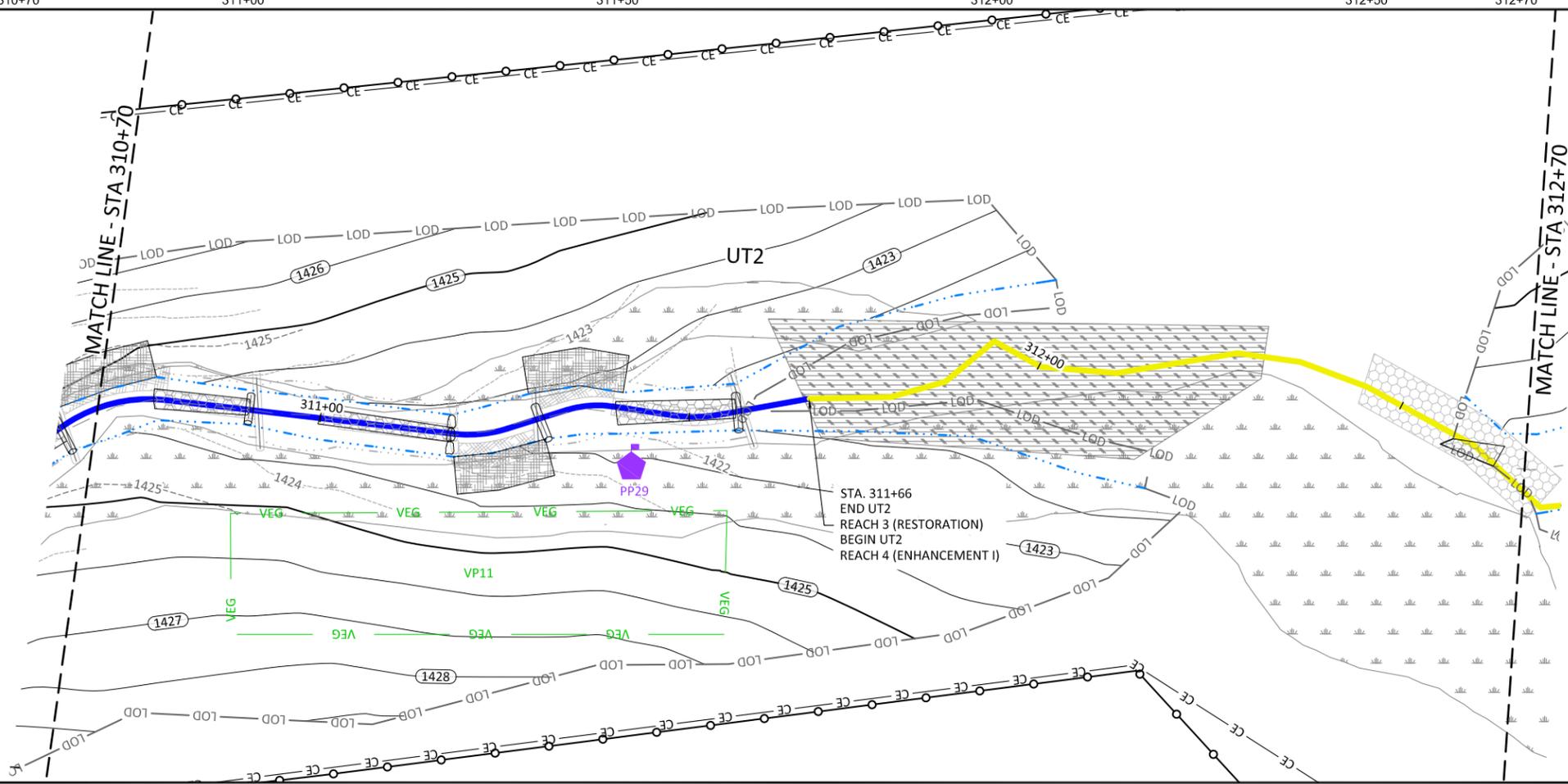
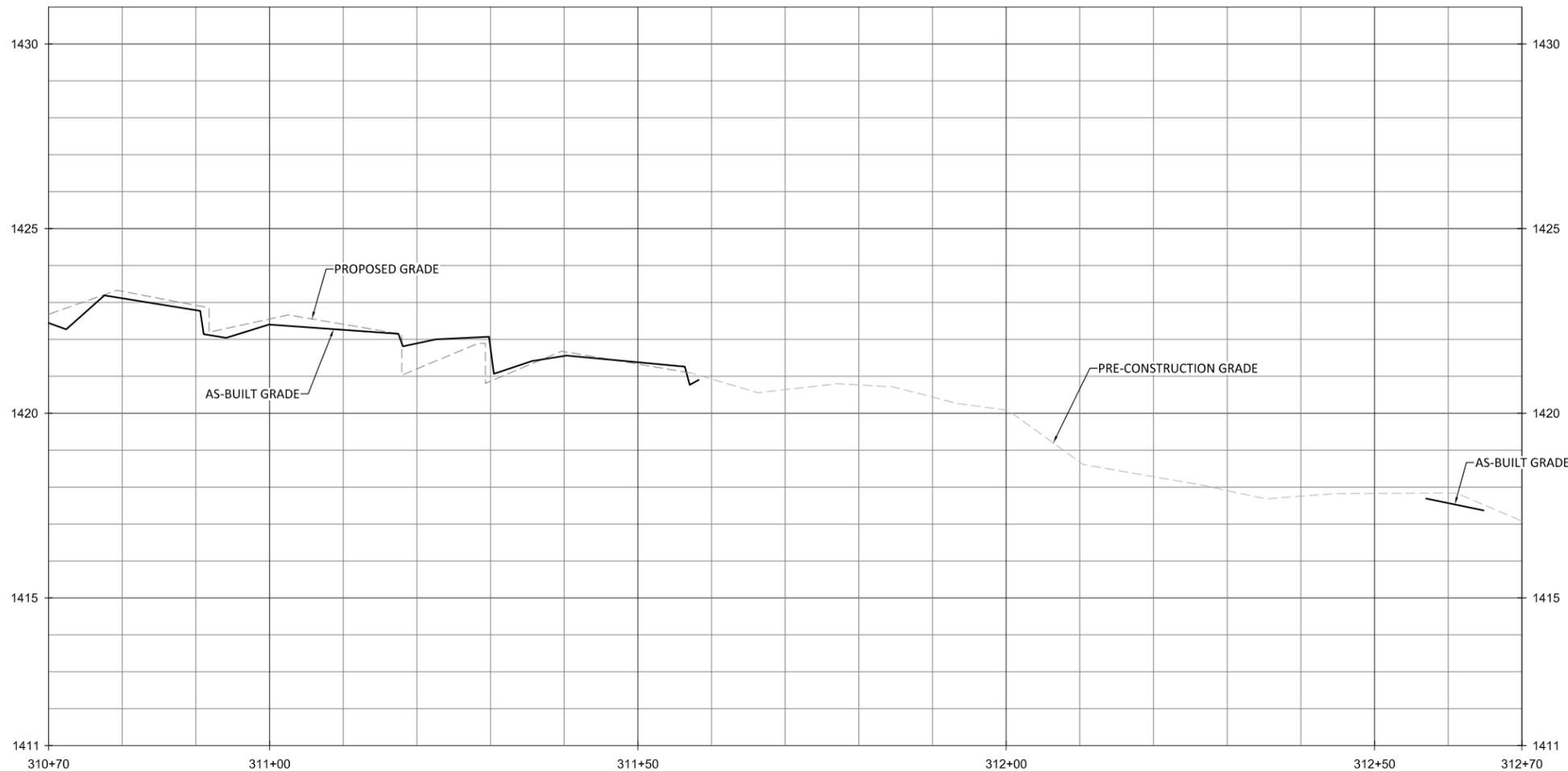
Bug Headwaters Record Drawings
 Wilkes County, North Carolina

UT2
 Stream Plan and Profile

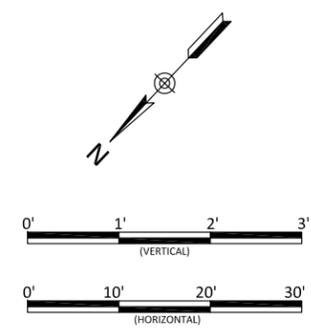
Revisions:
 10.2021 - Corrected a Label

Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA

1.27



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



Bug Headwaters Record Drawings
 Wilkes County, North Carolina

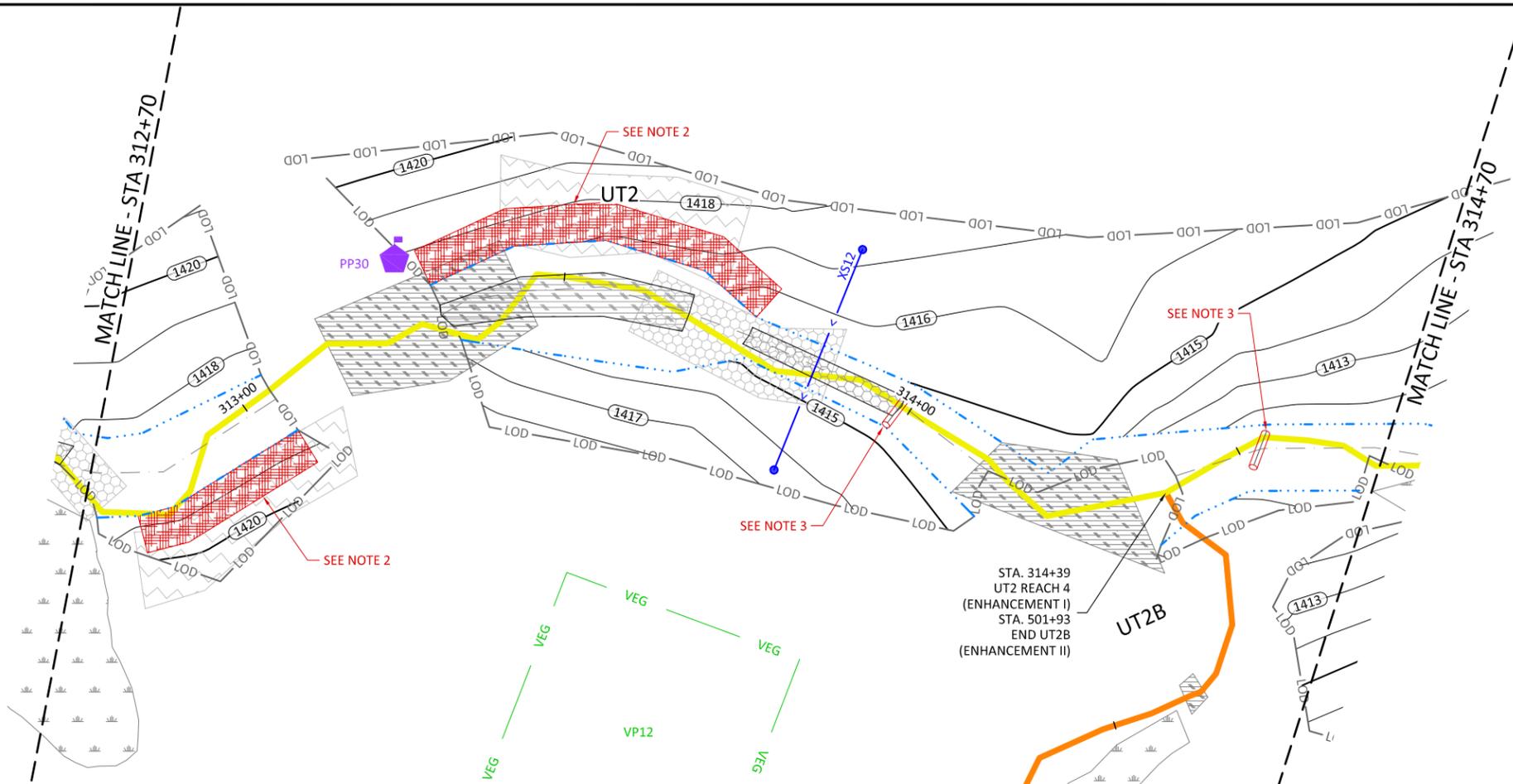
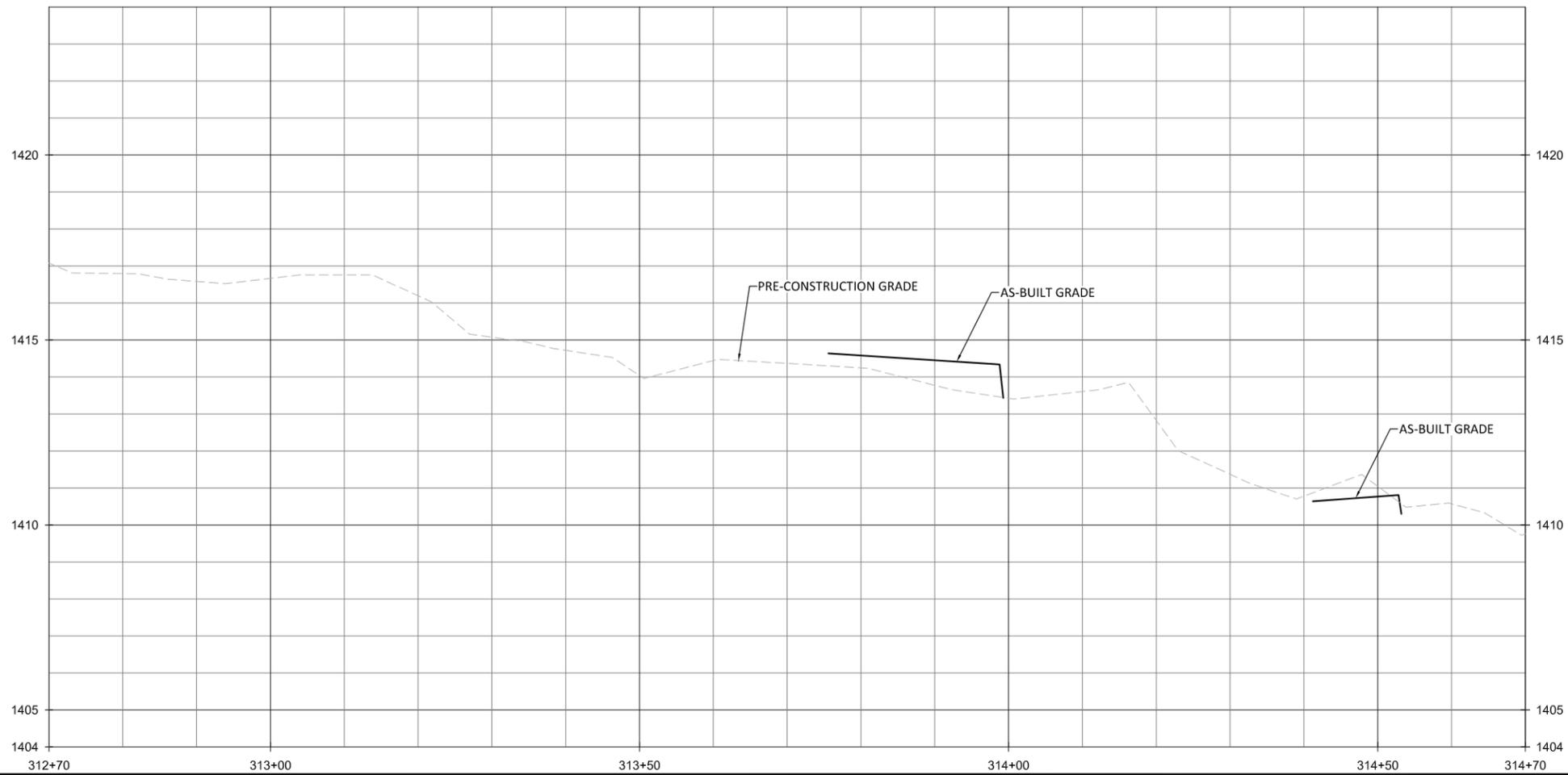
UT2
 Stream Plan and Profile

Revisions:

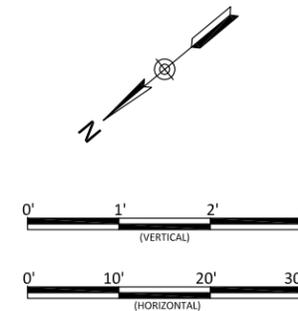
Date: 09/18/2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAV
 Checked By: ANA

1.28





- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 312+78 - STA 313+04 & STA 313+29 - STA 313+75 BRUSH TOE ADDED TO STABILIZE STREAMBANK.
 3. STA 313+99 & STA 314+54 LOG SILL ADDED FOR ADDITIONAL GRADE STABILITY.



Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT2
Stream Plan and Profile

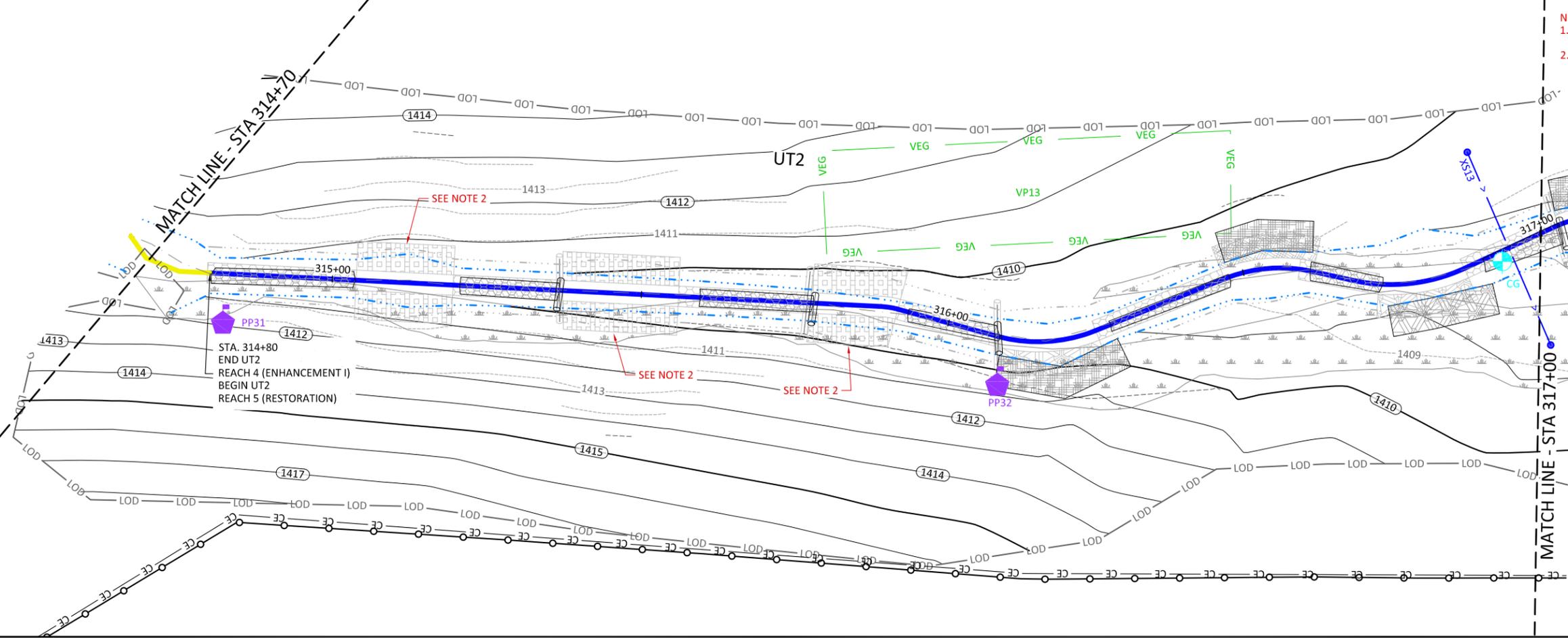
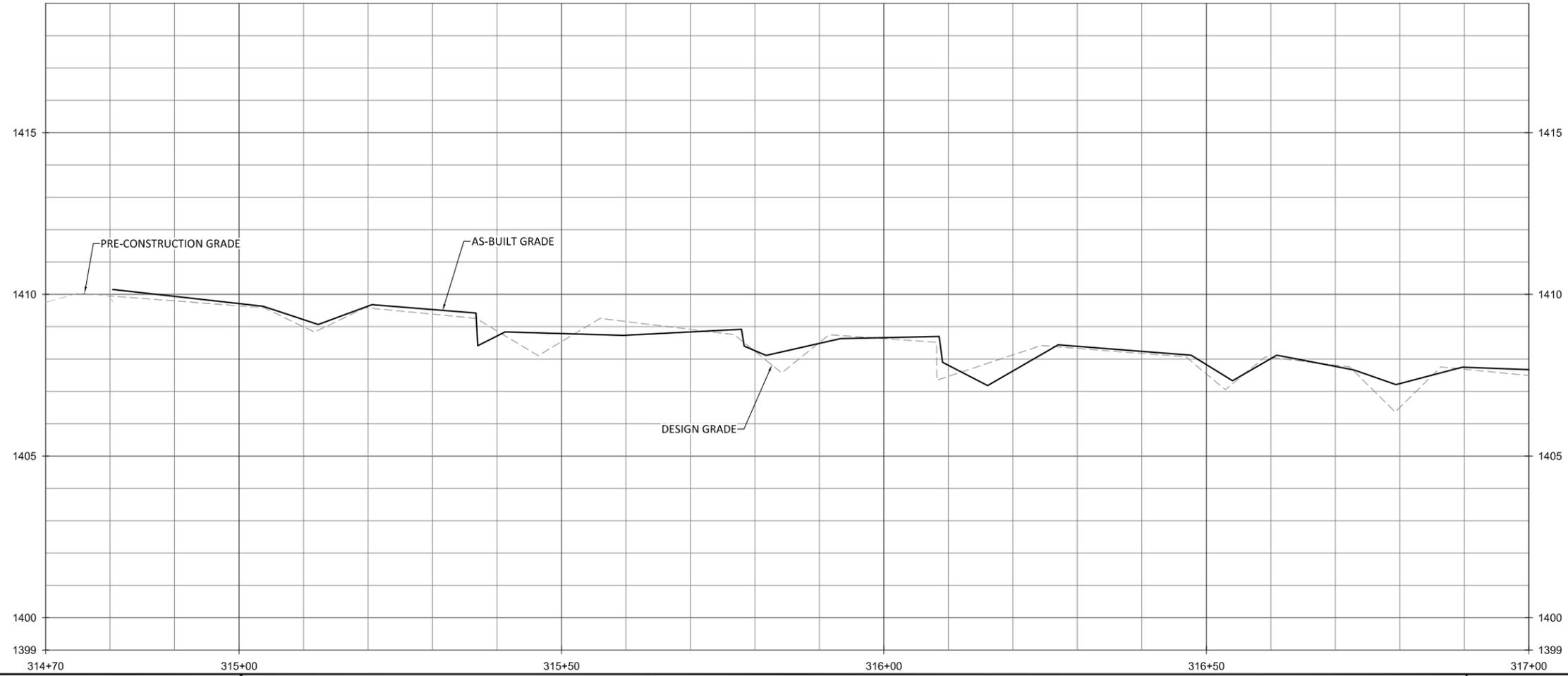
Revisions:

Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

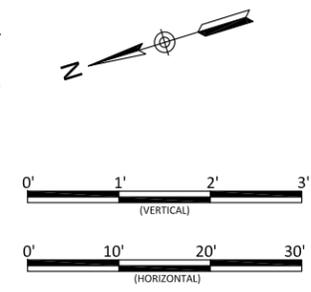
1.29

Sheet





- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 315+04 - STA 315+20, STA 315+37 - STA 315+56 & STA 315+77 - STA 315+92
NO SUITABLE SOD ON SITE. BANKS QUICKLY STABILIZED WITH SEEDING VEGETATION AND SOD MATS NOT NEEDED FOR STABILITY.



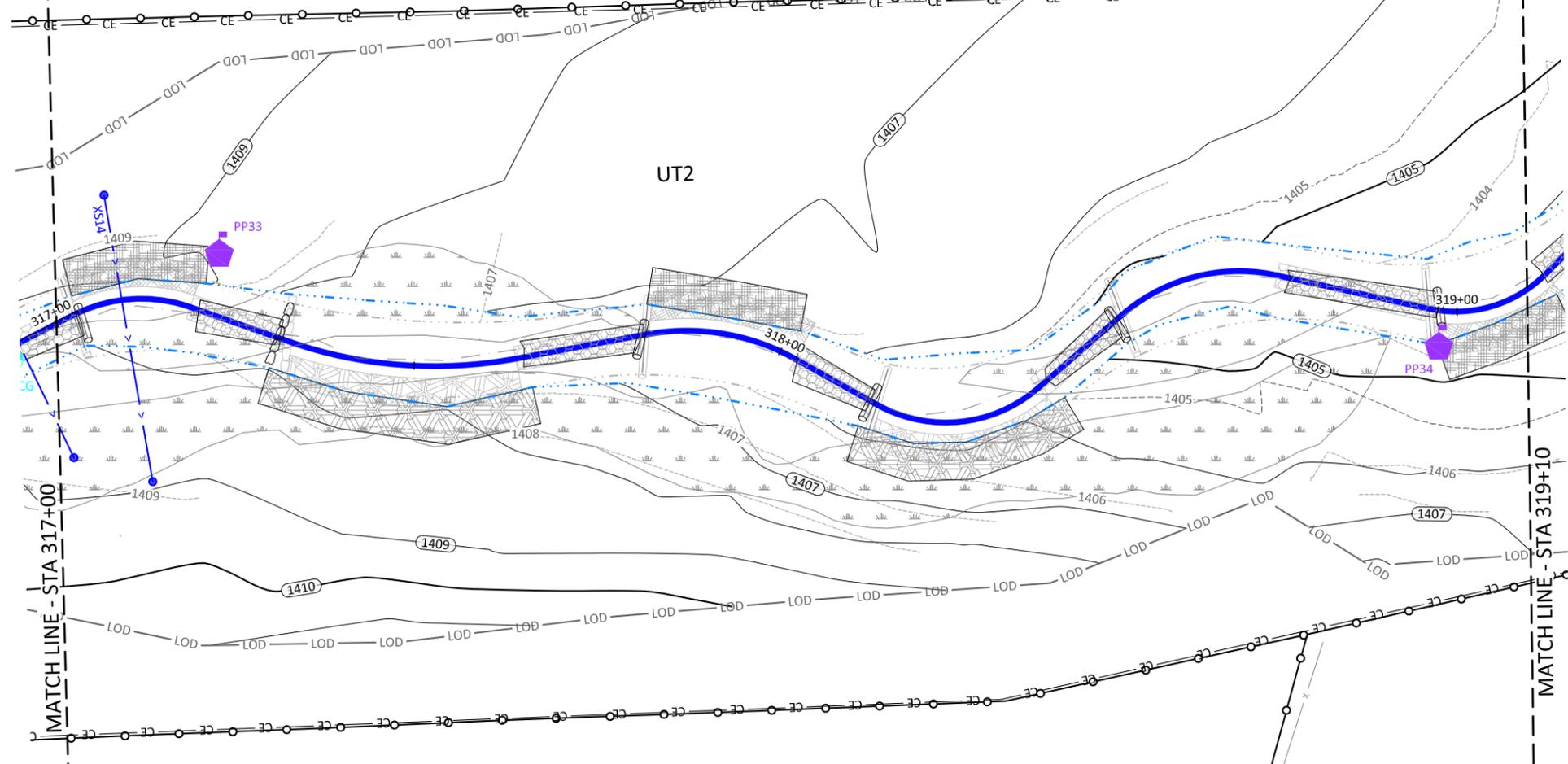
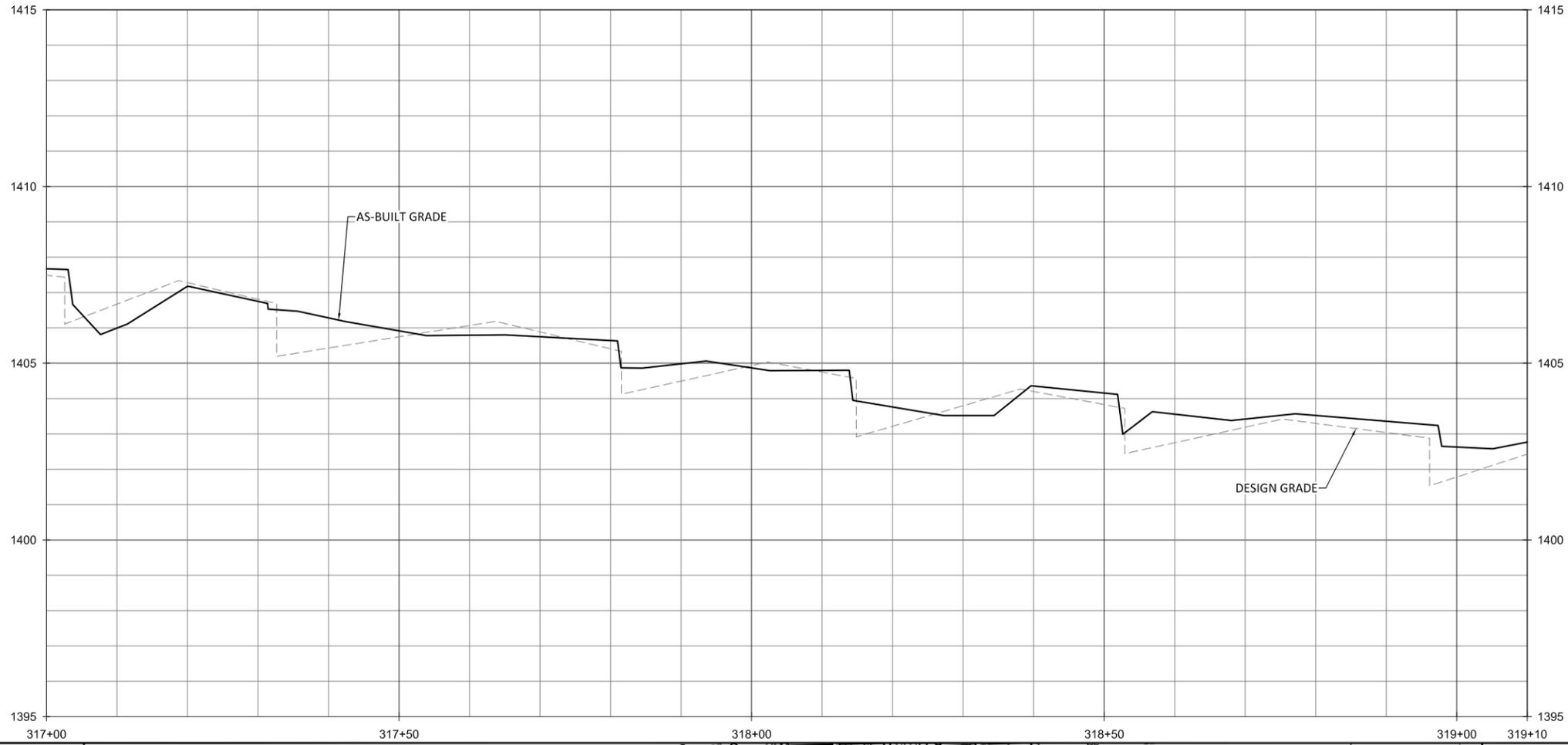
Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT2
Stream Plan and Profile

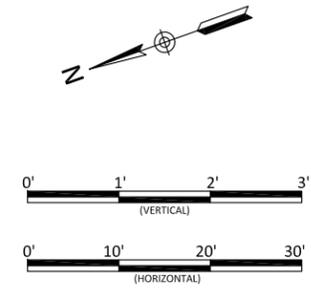
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

1.30



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



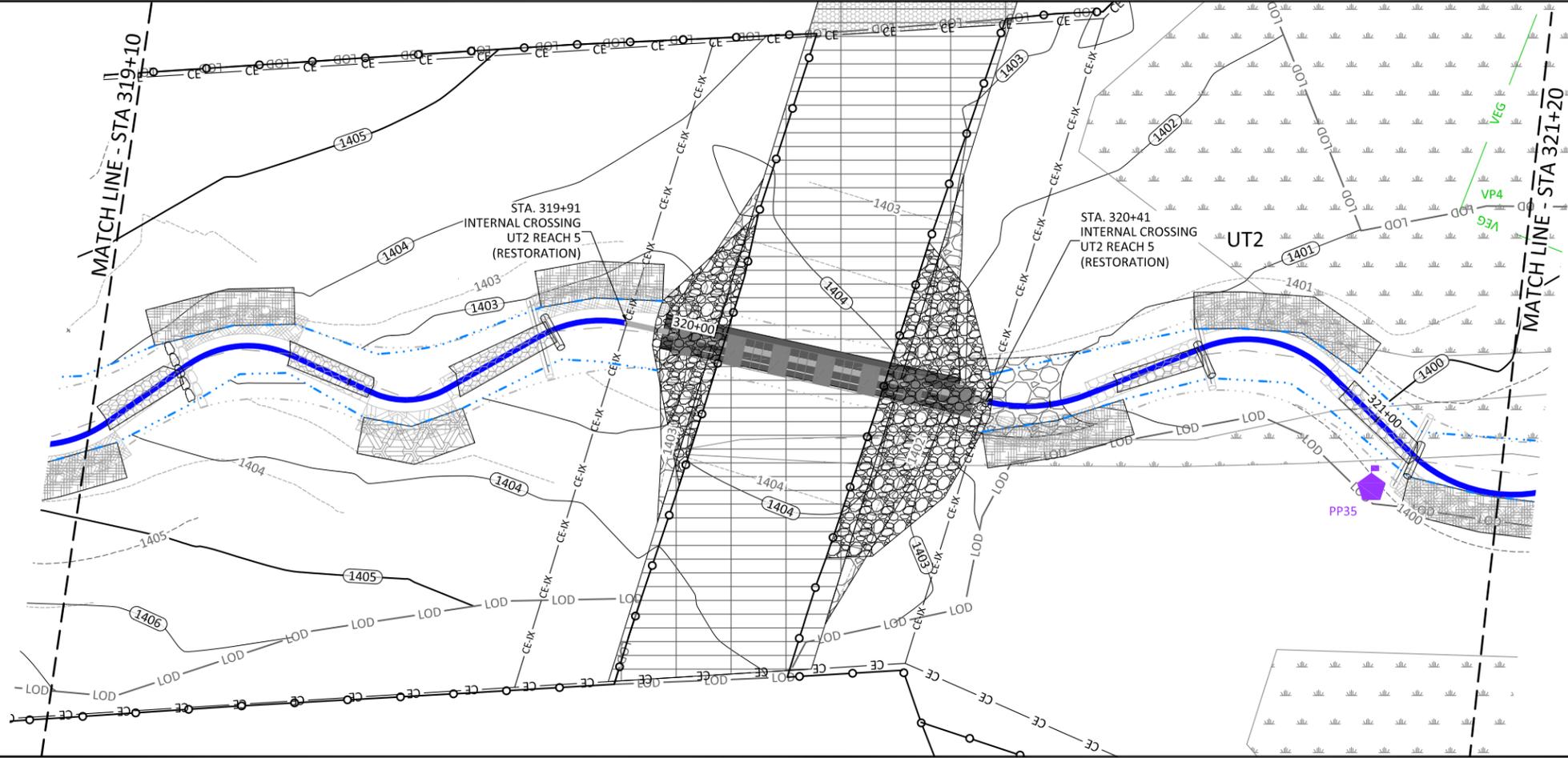
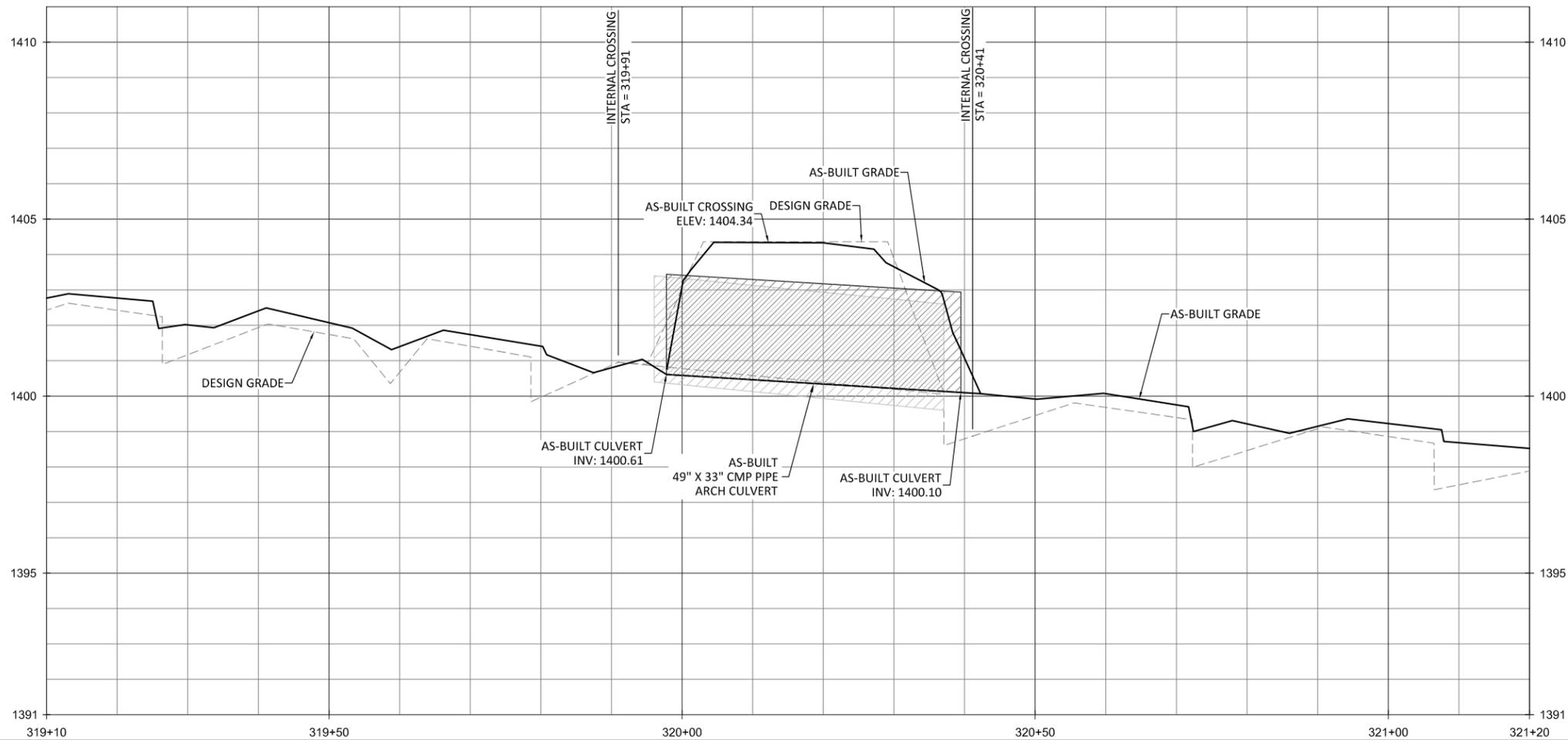
Bug Headwaters Record Drawings
 Wilkes County, North Carolina

UT2
 Stream Plan and Profile

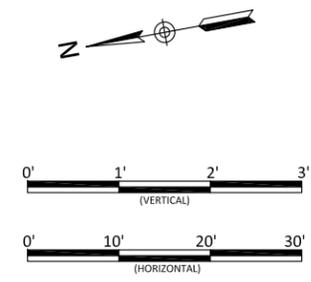
Revisions:

Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

1.31



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



Bug Headwaters Record Drawings
 Wilkes County, North Carolina

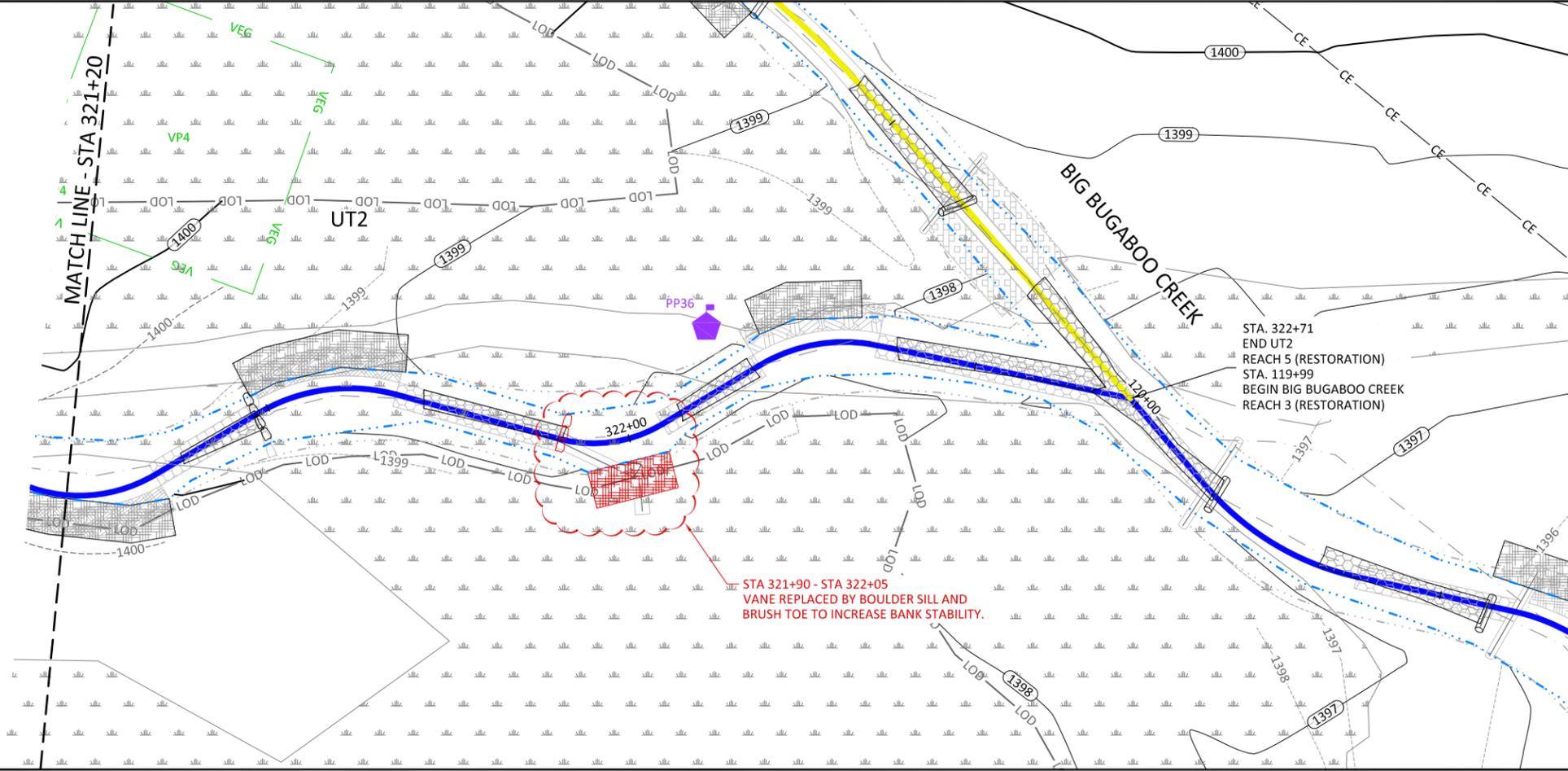
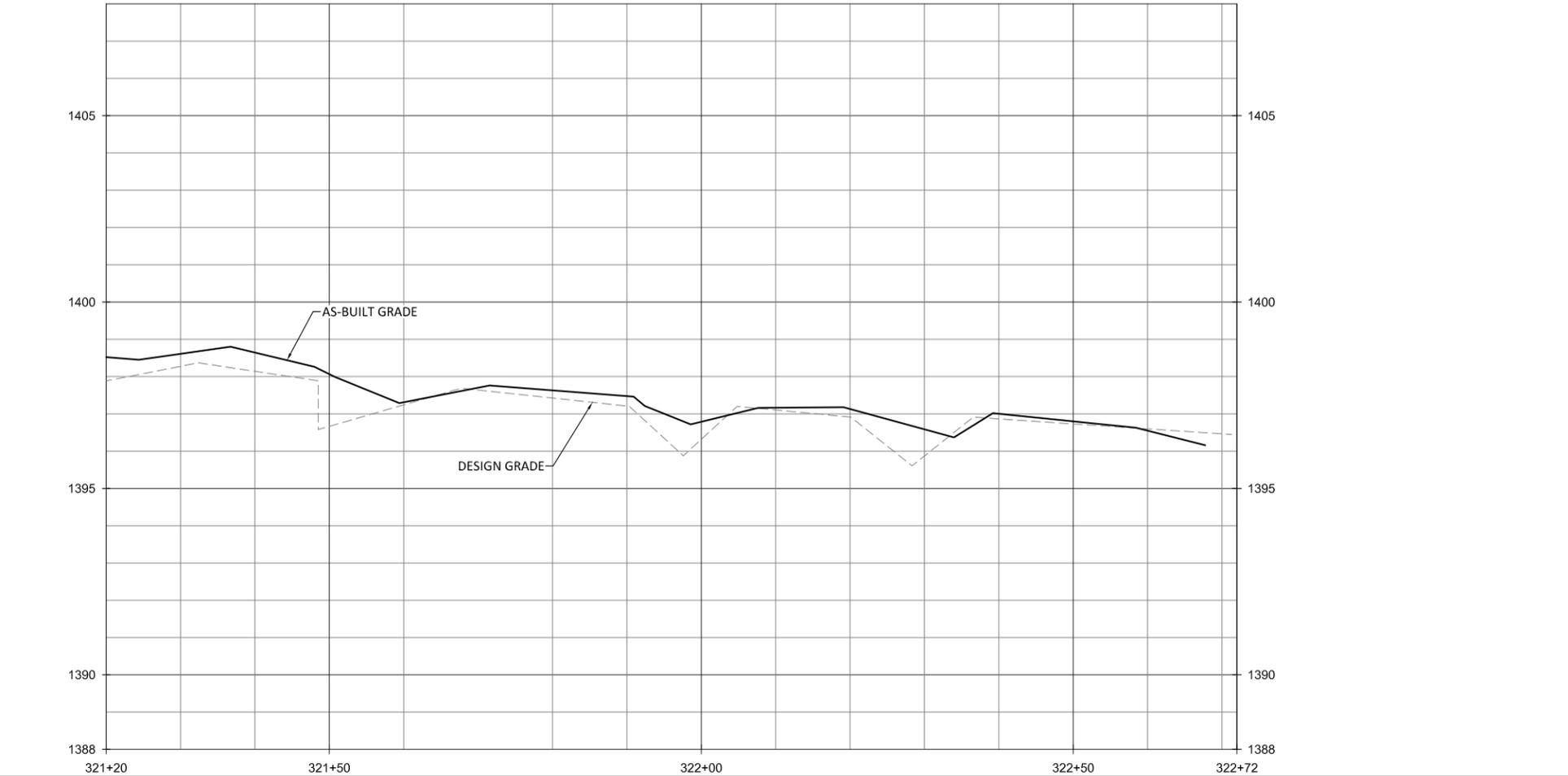
UT2
 Stream Plan and Profile

Revisions:

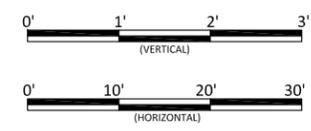
Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAV
 Checked By: ANA

1.32





- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR BIG BUGABOO CREEK IS ADDRESSED ON SHEETS 1.01 THROUGH 1.20.



Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT2
Stream Plan and Profile

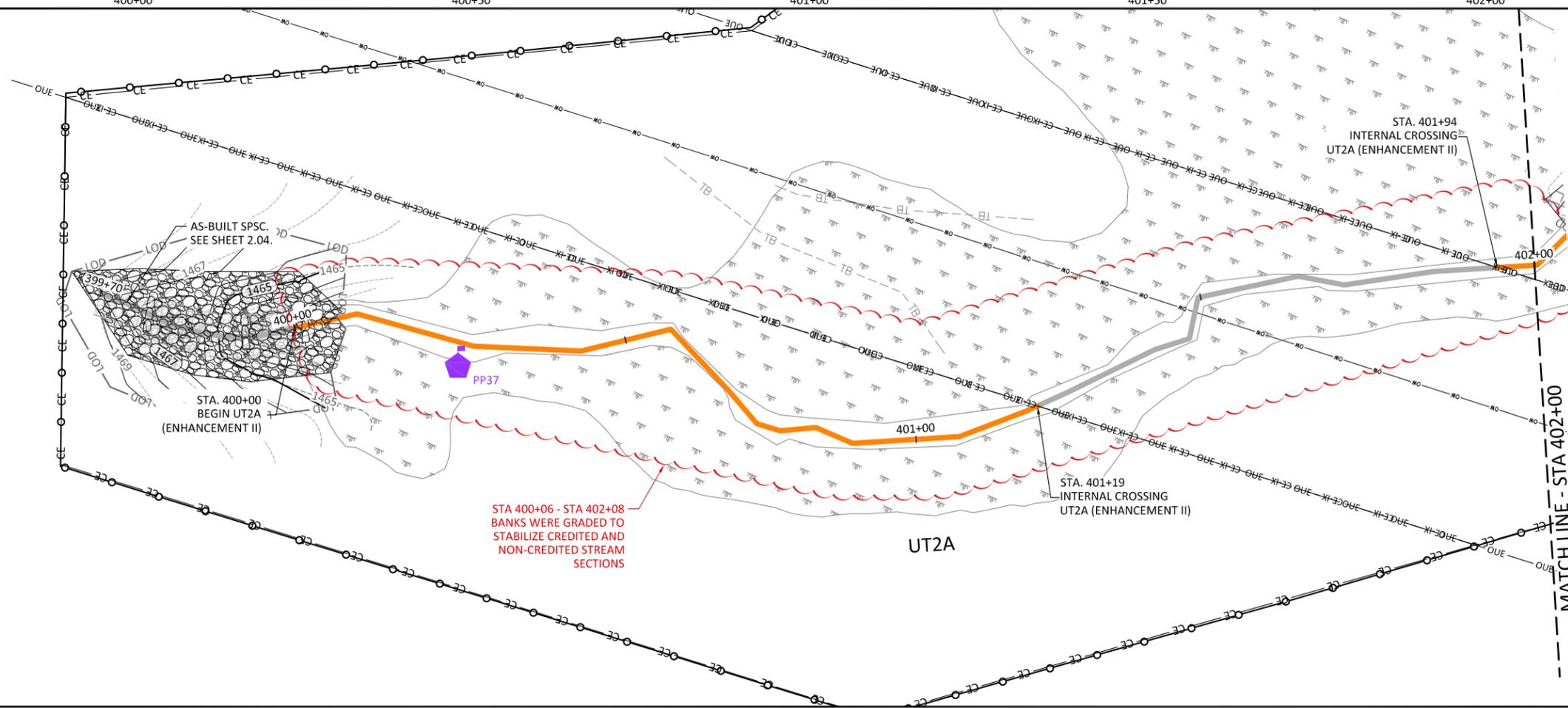
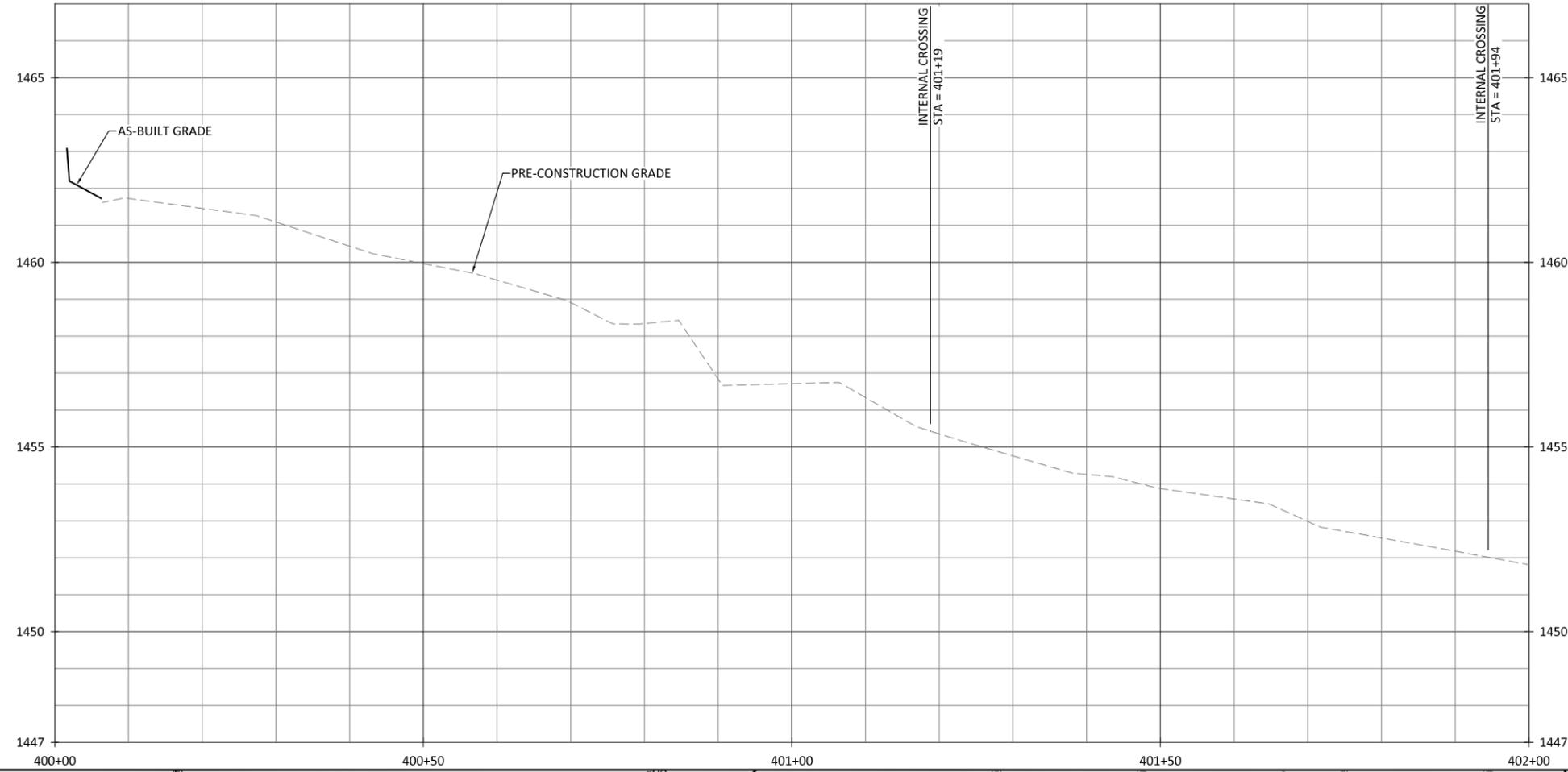
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAV
Checked By: ANA

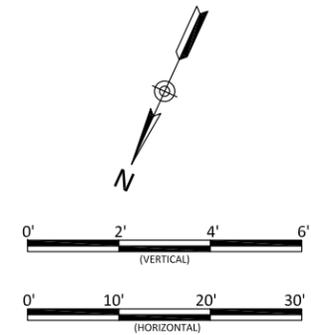
1.33

Sheet





- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR SPSC IS ADDRESSED ON SHEET 2.04.



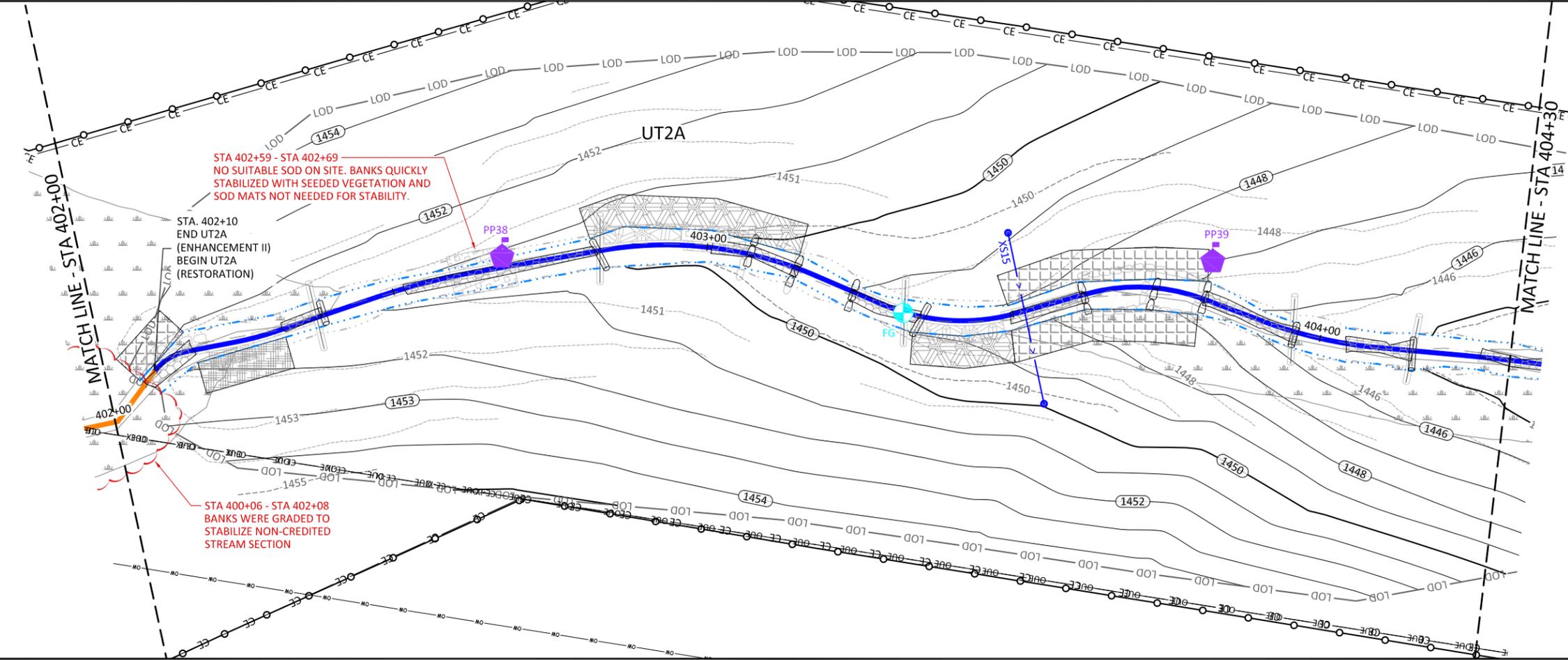
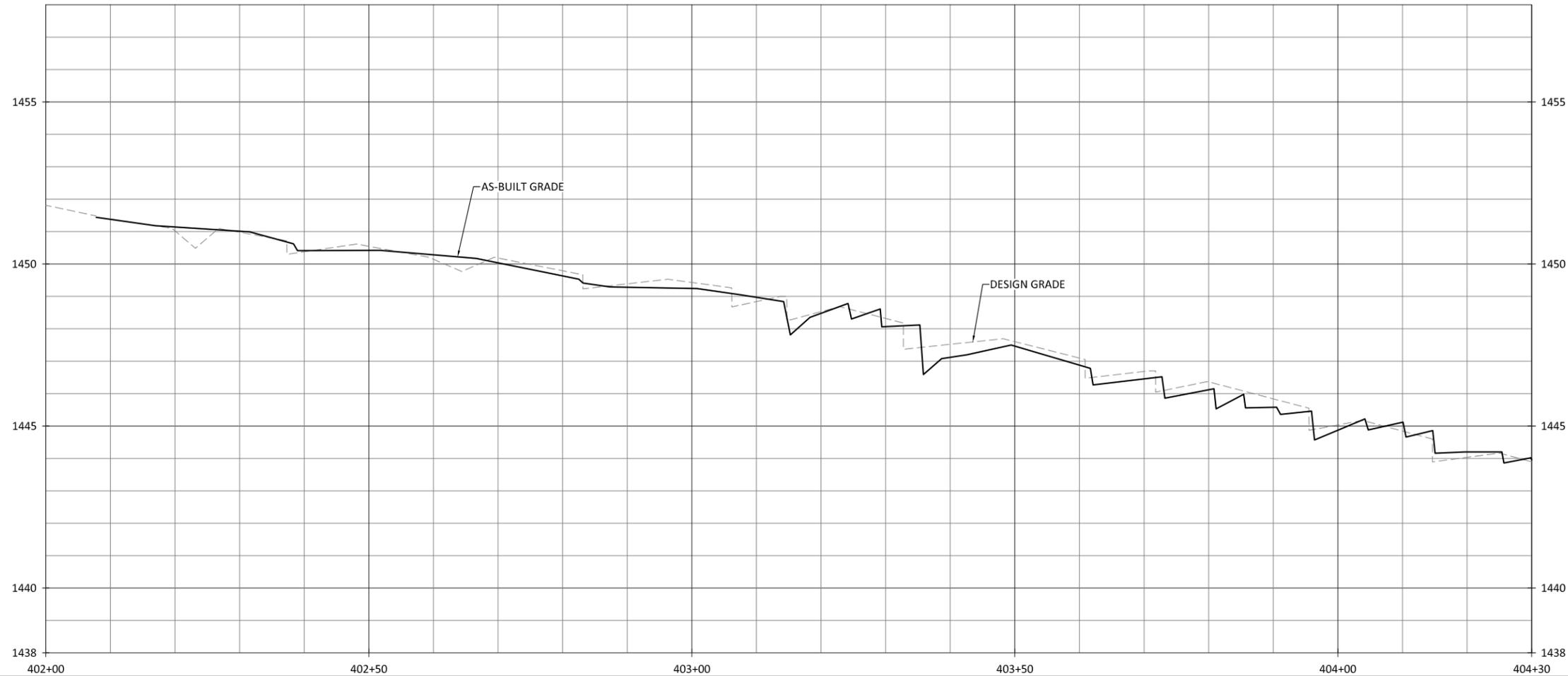
Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT2A
 Stream Plan and Profile

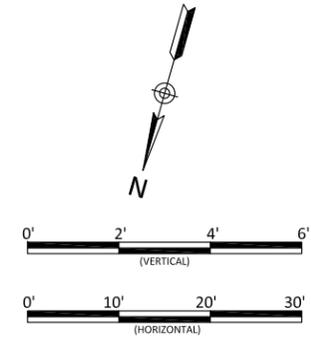
Revisions:
 10/2021 - Corrected a Label

Date: 09/18/2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA

1.34



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



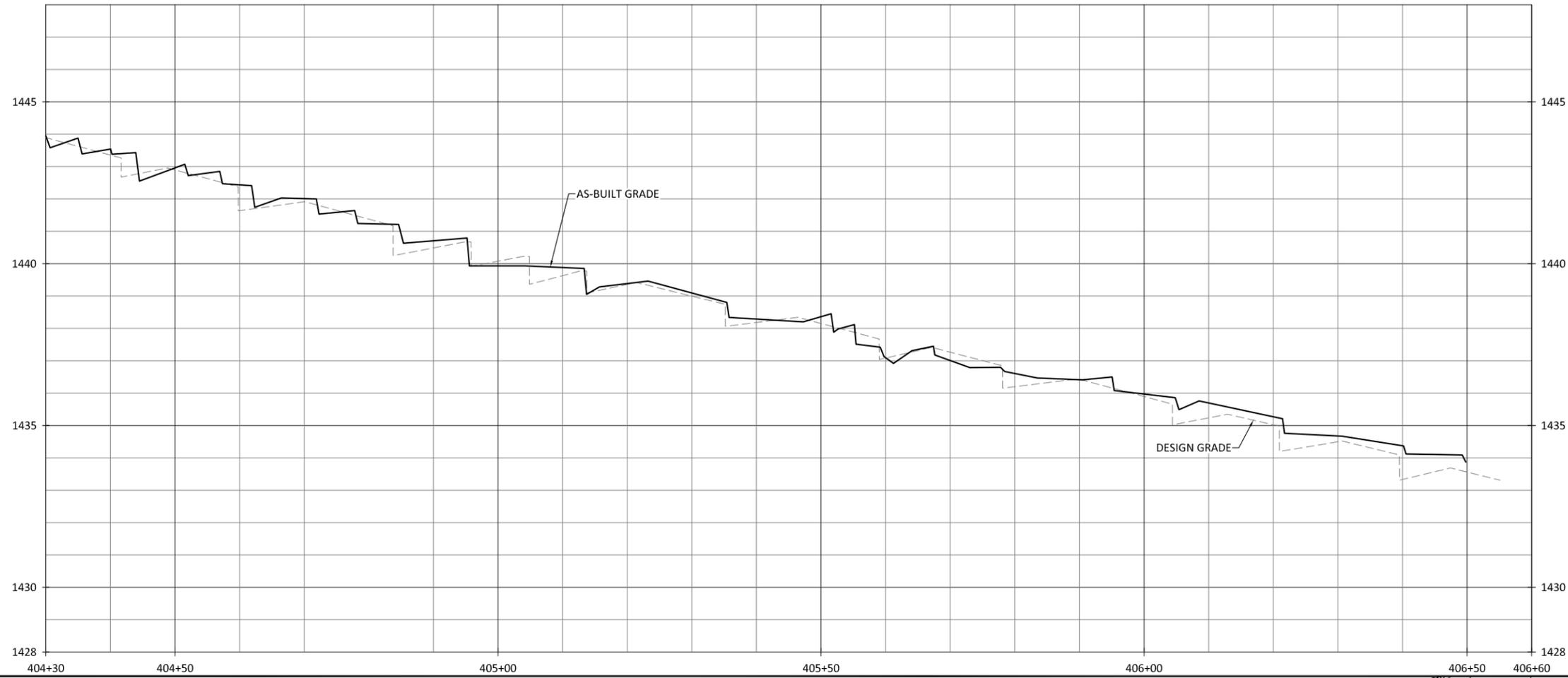
Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT2A
Stream Plan and Profile

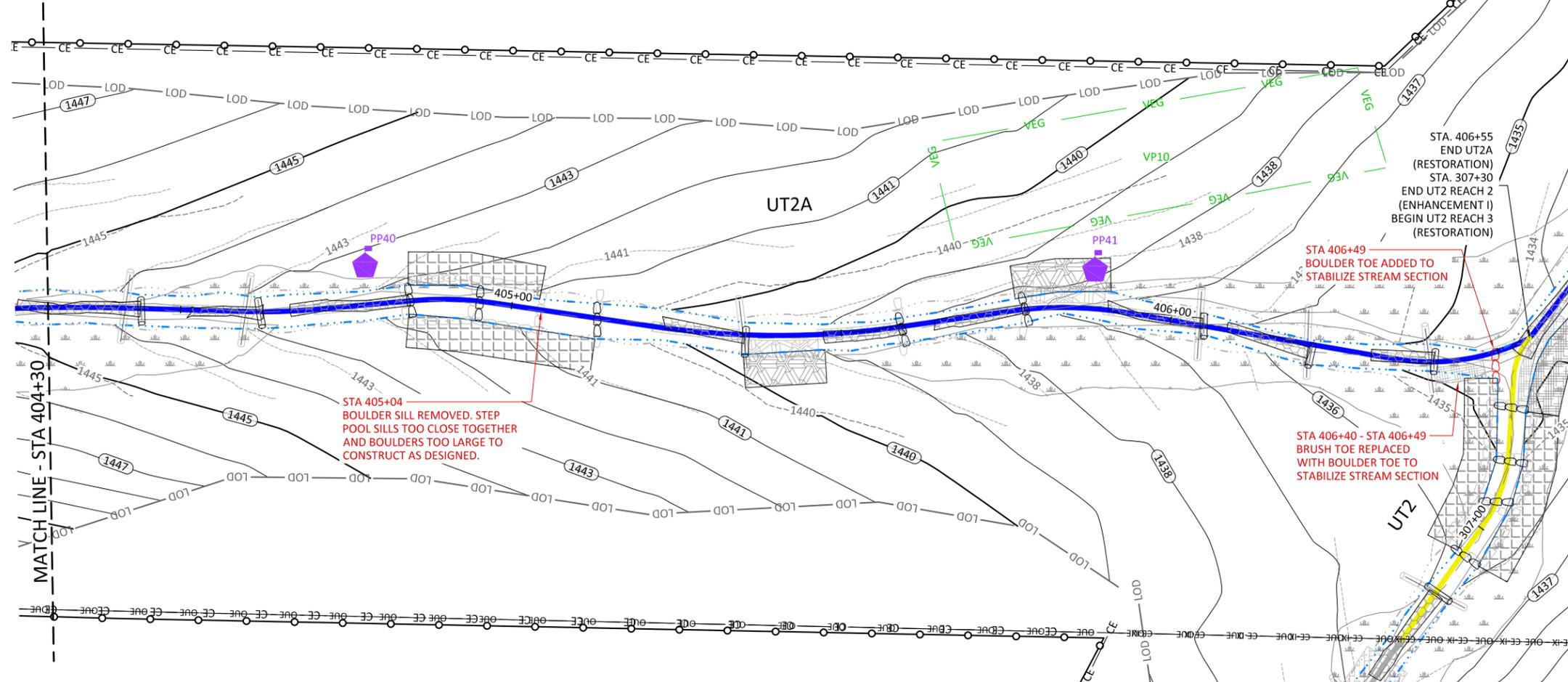
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

1.35



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT2 IS ADDRESSED ON SHEETS 1.23 THROUGH 1.33.



Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT2A
Stream Plan and Profile

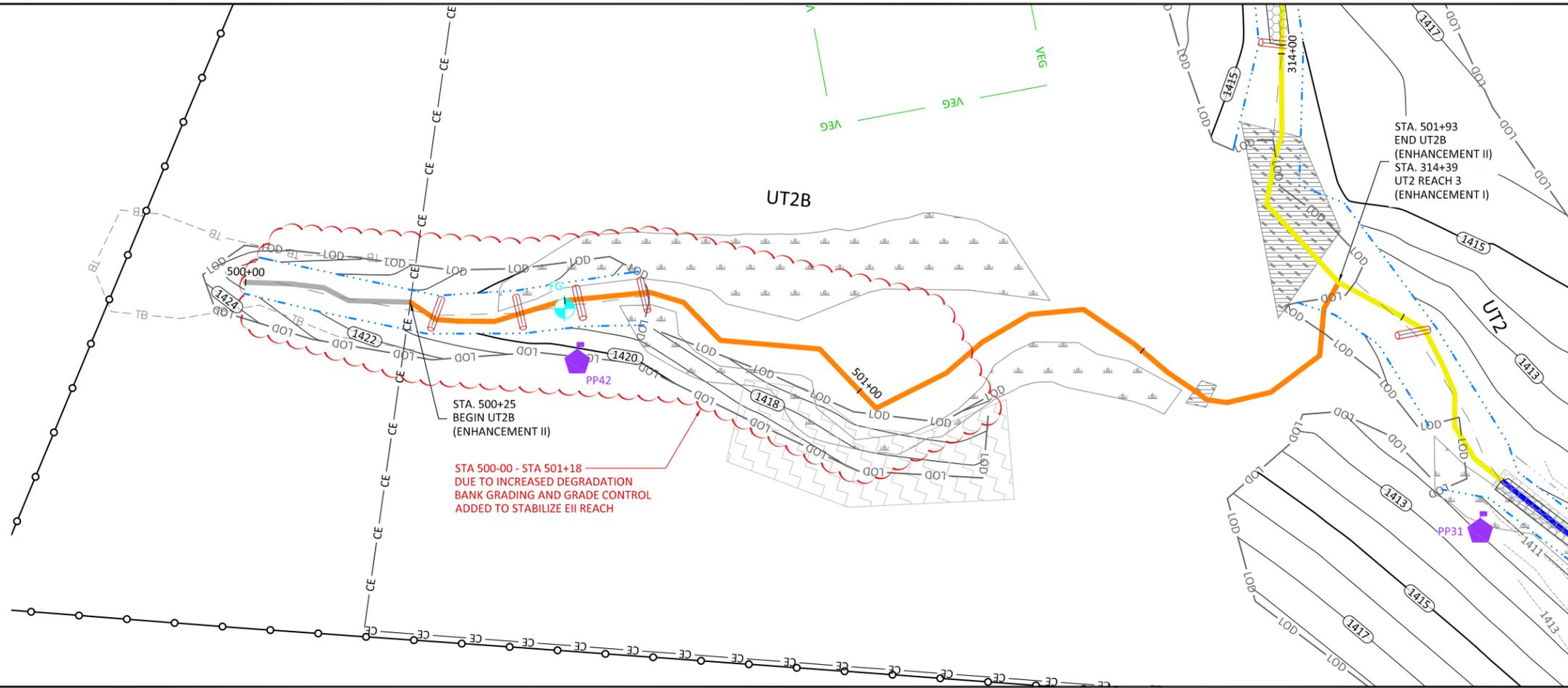
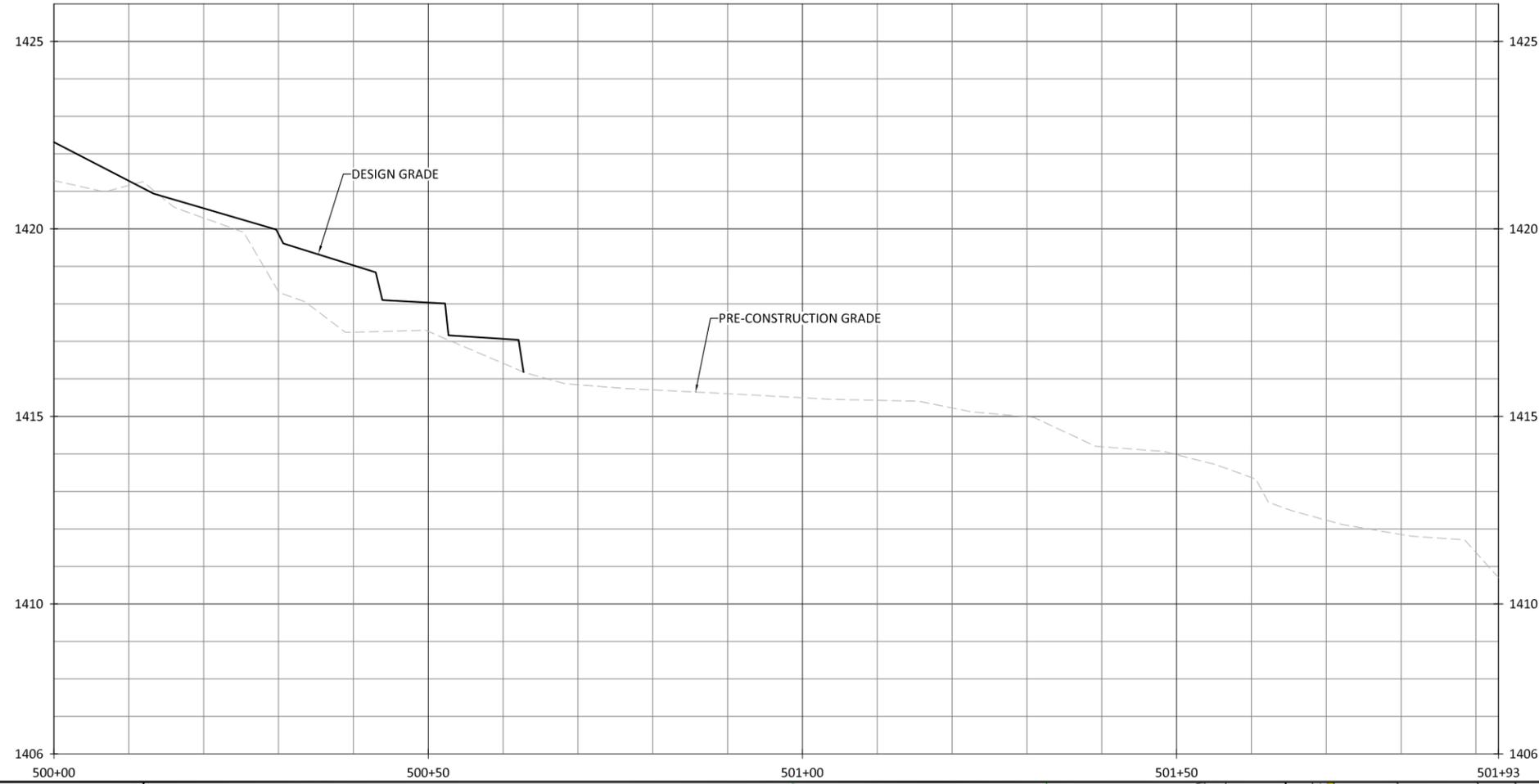
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAV
Checked By: ANA

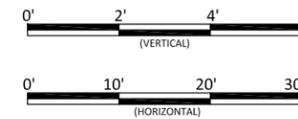
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- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT2 IS ADDRESSED ON SHEETS 1.23 THROUGH 1.33.



Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT2B
Stream Plan and Profile

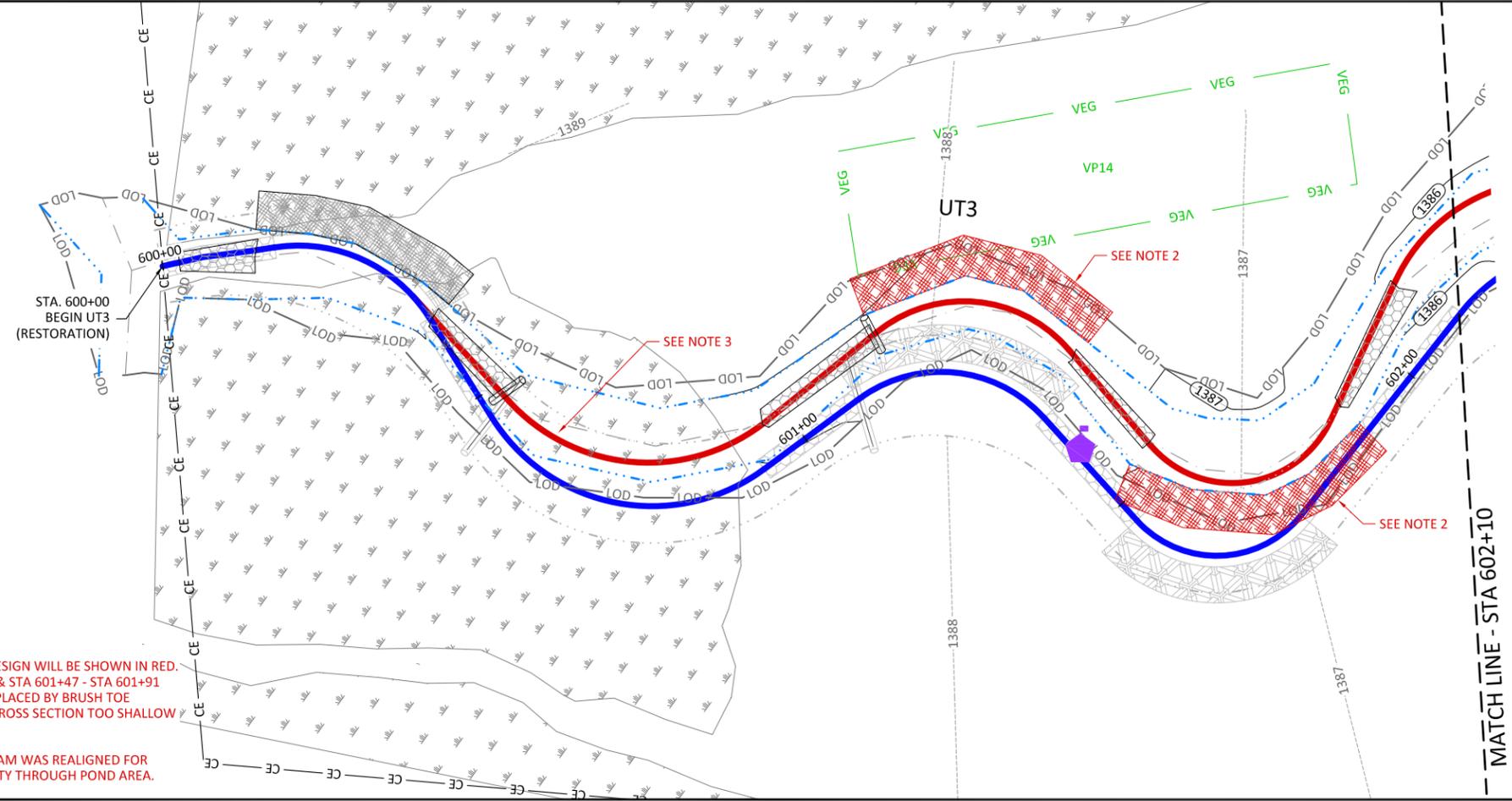
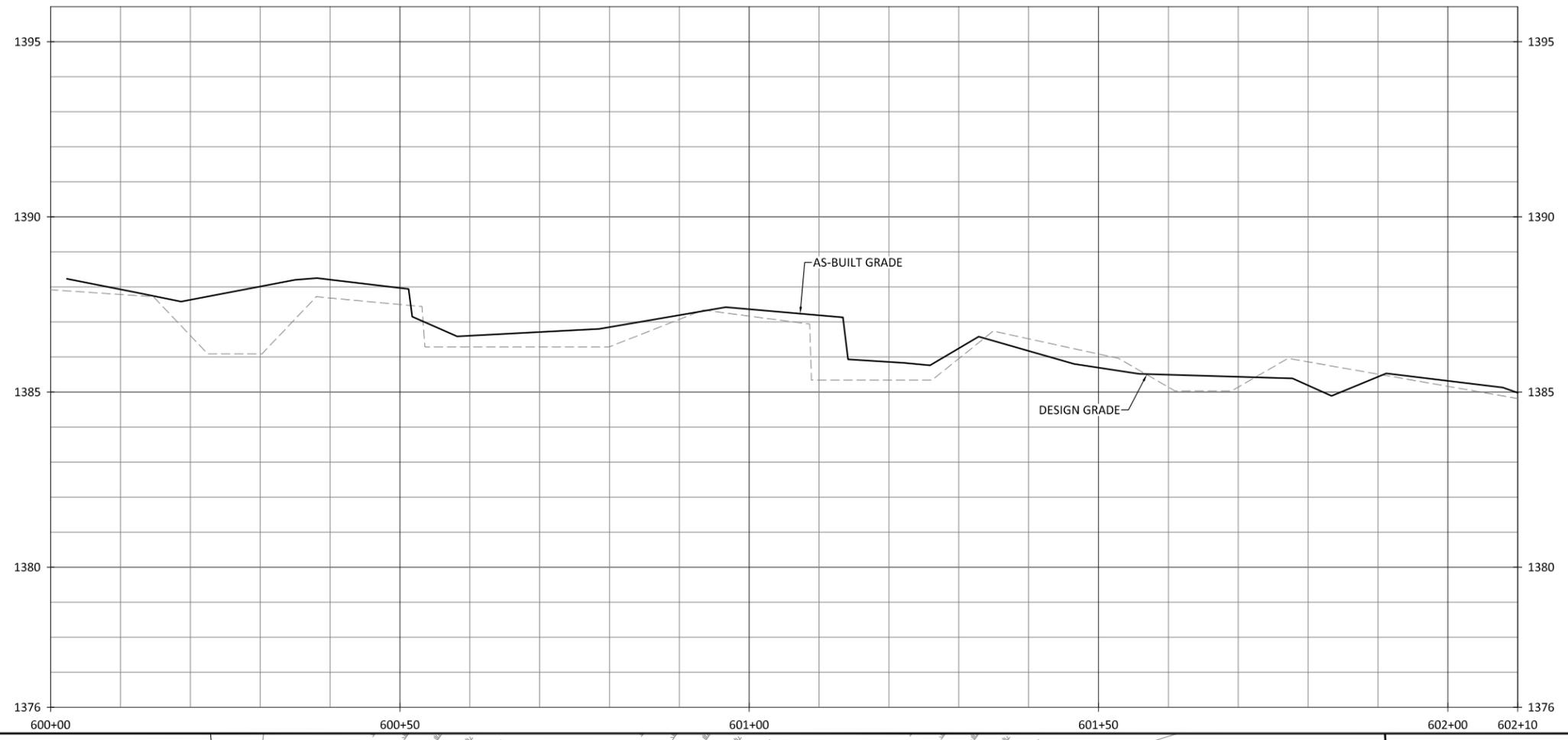
Revisions:

Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

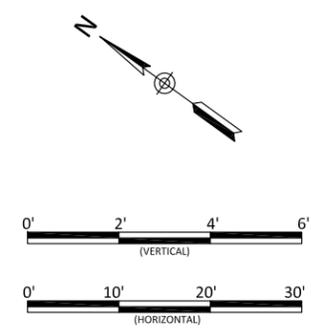
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September 14, 2021
X:\Shared\Projects\005-02176 Bug Headwaters\Monitoring\Baseline-Monitoring-2021\Plans\02176-AB UT1 UT2A UT2B UT3 UT4.dwg



- NOTES:**
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 601+13 - STA 601+33 & STA 601+47 - STA 601+91 VEGETATED SOIL LIFTS REPLACED BY BRUSH TOE REVETMENT. PROPOSED CROSS SECTION TOO SHALLOW FOR MULTIPLE SOIL LIFTS.
 3. STA 600+34 - STA 602+60
231 LINEAR FEET OF STREAM WAS REALIGNED FOR BETTER CONSTRUCTABILITY THROUGH POND AREA.



Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT3
Stream Plan and Profile

Revisions:

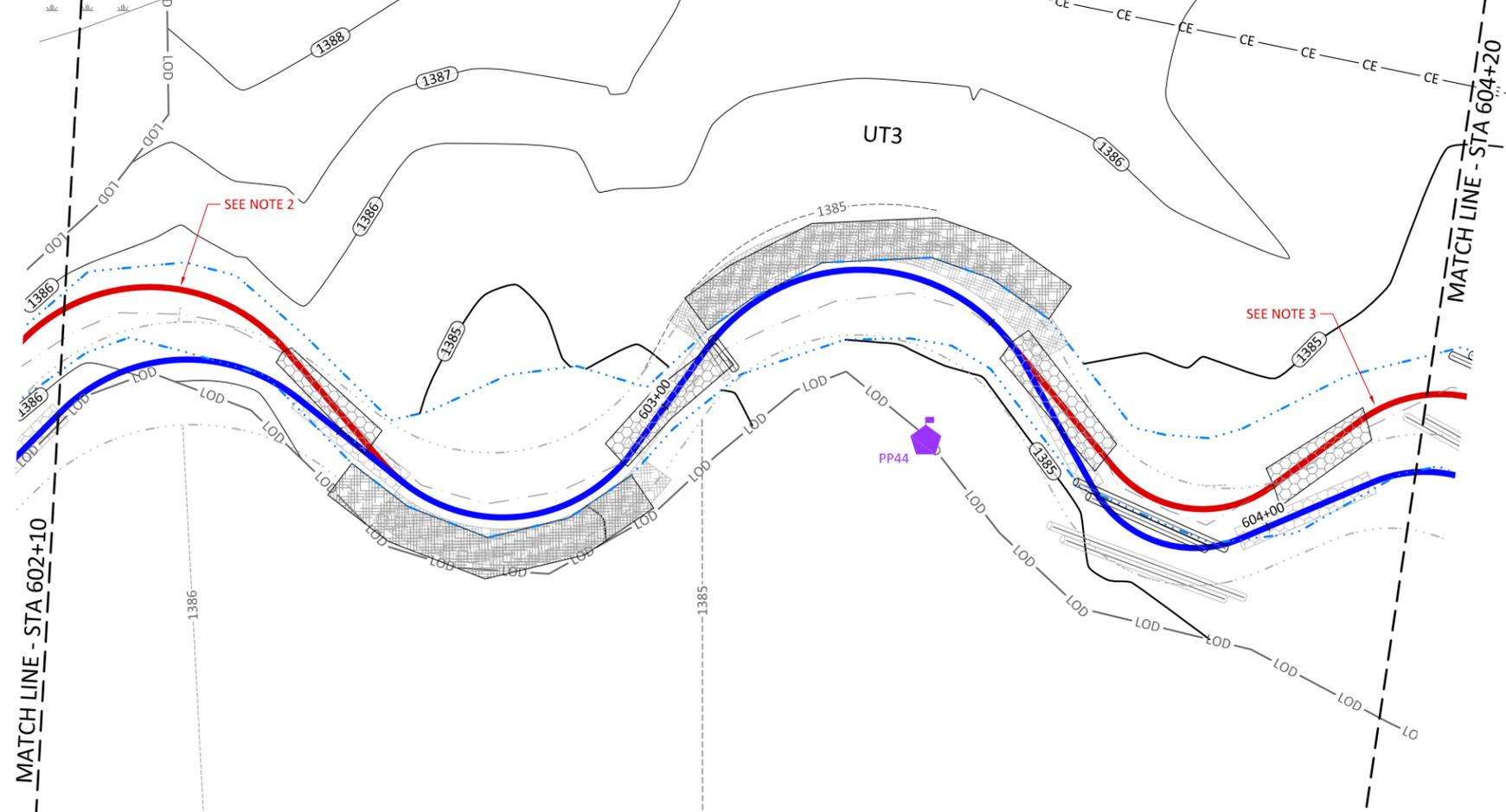
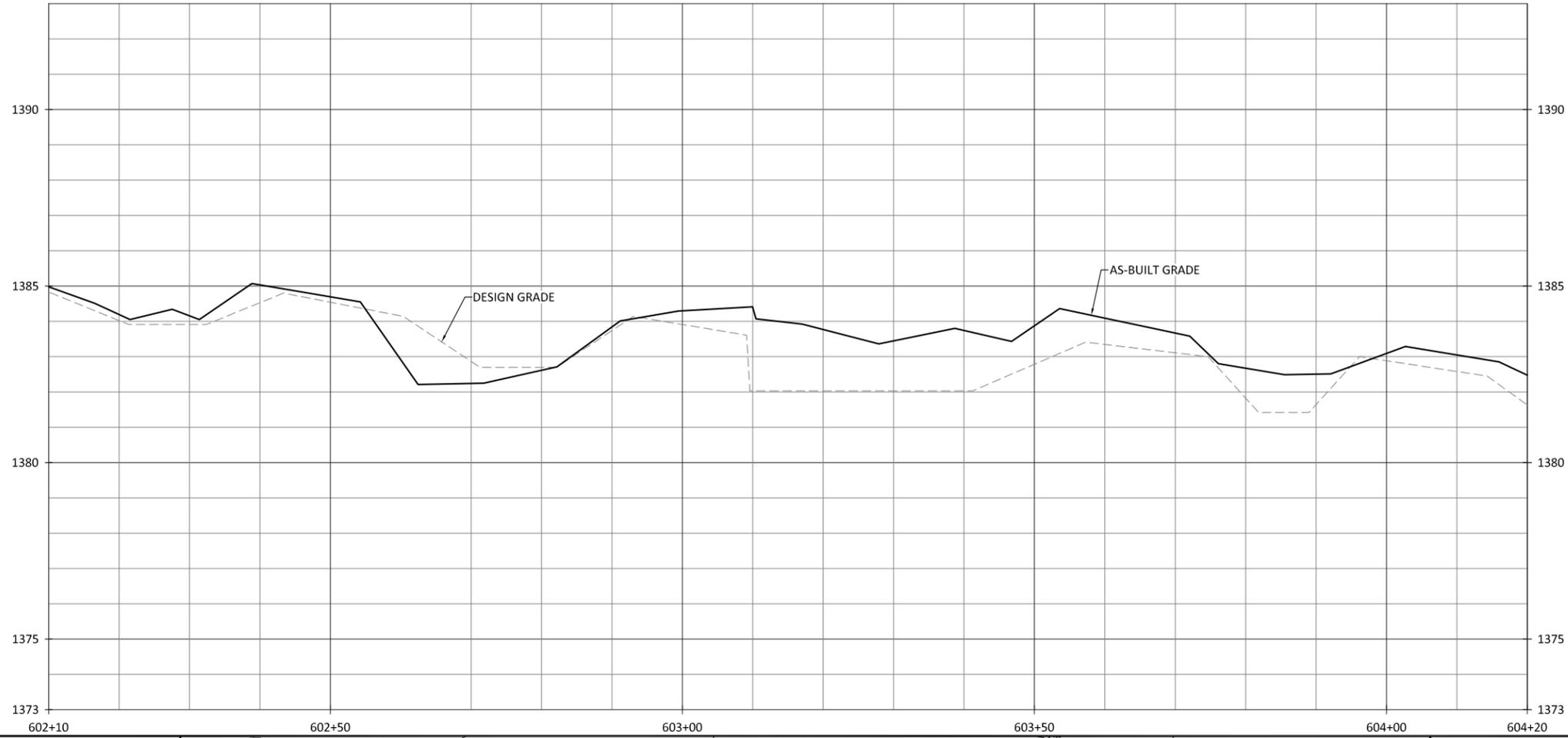
Date:	09/18/2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

1.38

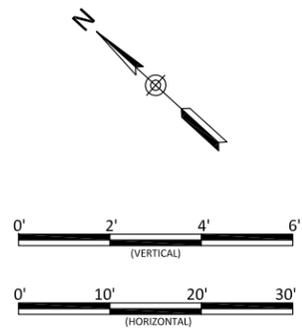
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Raleigh, NC 27609
Tel: 919.851.9886
License No. F-0831





- NOTES:**
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 600+34 - STA 602+60
231 LINEAR FEET OF STREAM WAS REALIGNED FOR BETTER CONSTRUCTABILITY THROUGH POND AREA.
 3. STA 603+56 - STA 606+69
313 LINEAR FEET OF STREAM WAS REALIGNED FOR BETTER CONSTRUCTABILITY THROUGH POND AREA.



Bug Headwaters Record Drawings
Wilkes County, North Carolina

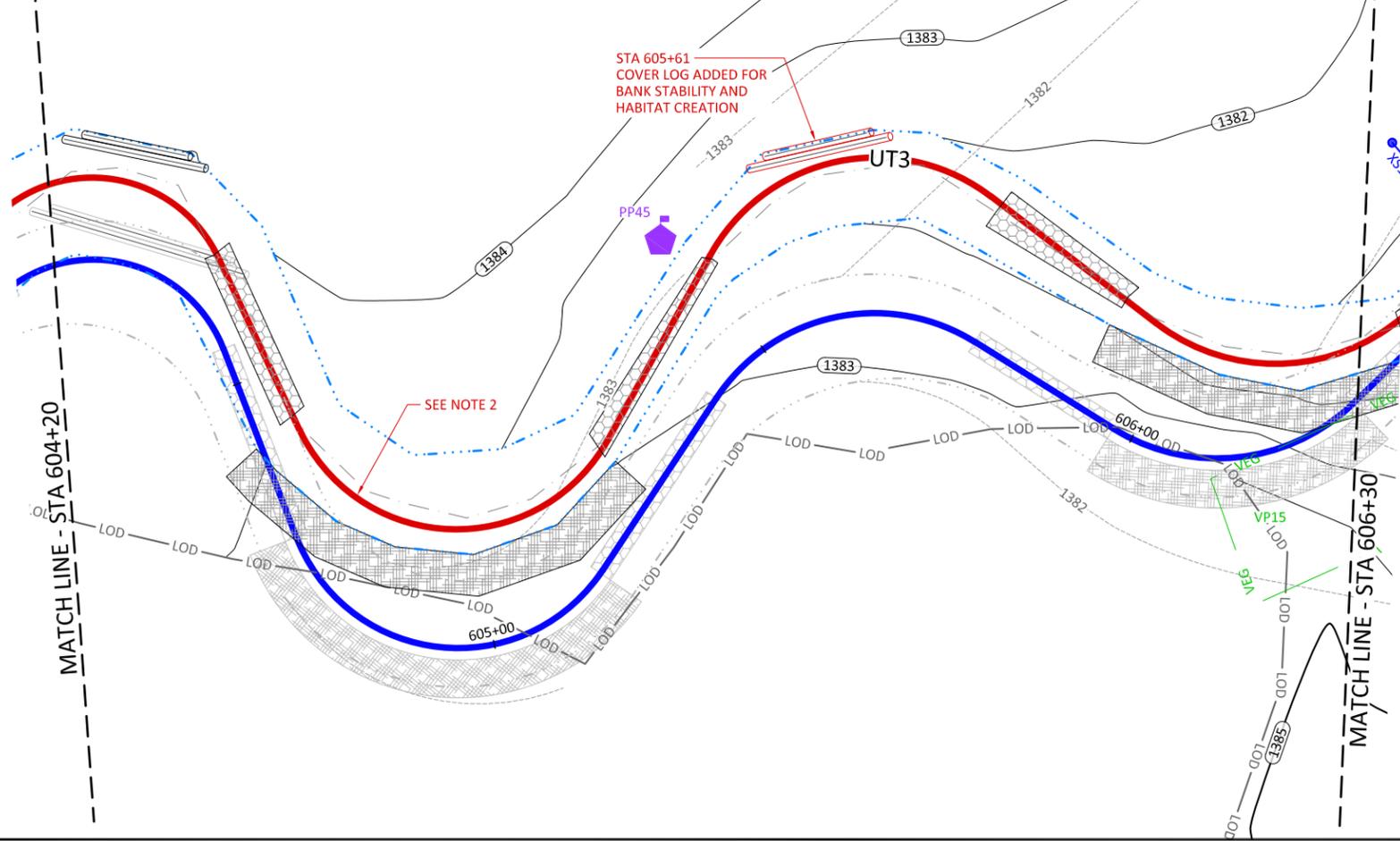
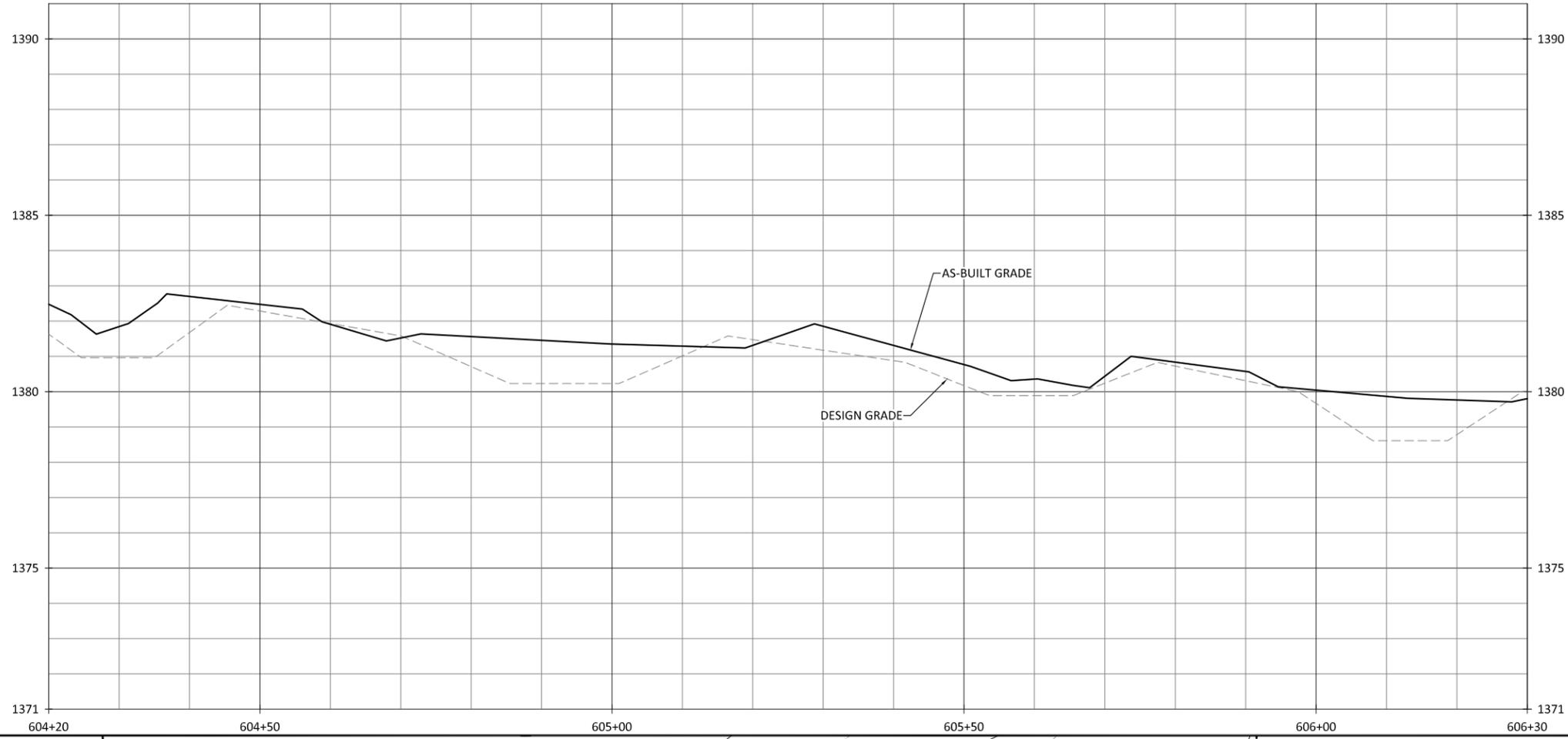
UT3
Stream Plan and Profile

Revisions:

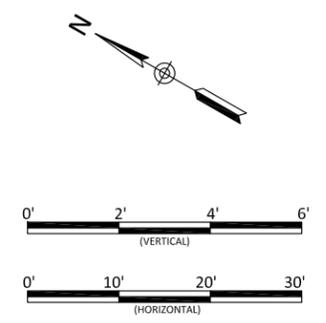
Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

1.39

Sheet



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 603+56 - STA 606+69
313 LINEAR FEET OF STREAM WAS REALIGNED FOR BETTER CONSTRUCTABILITY THROUGH POND AREA.



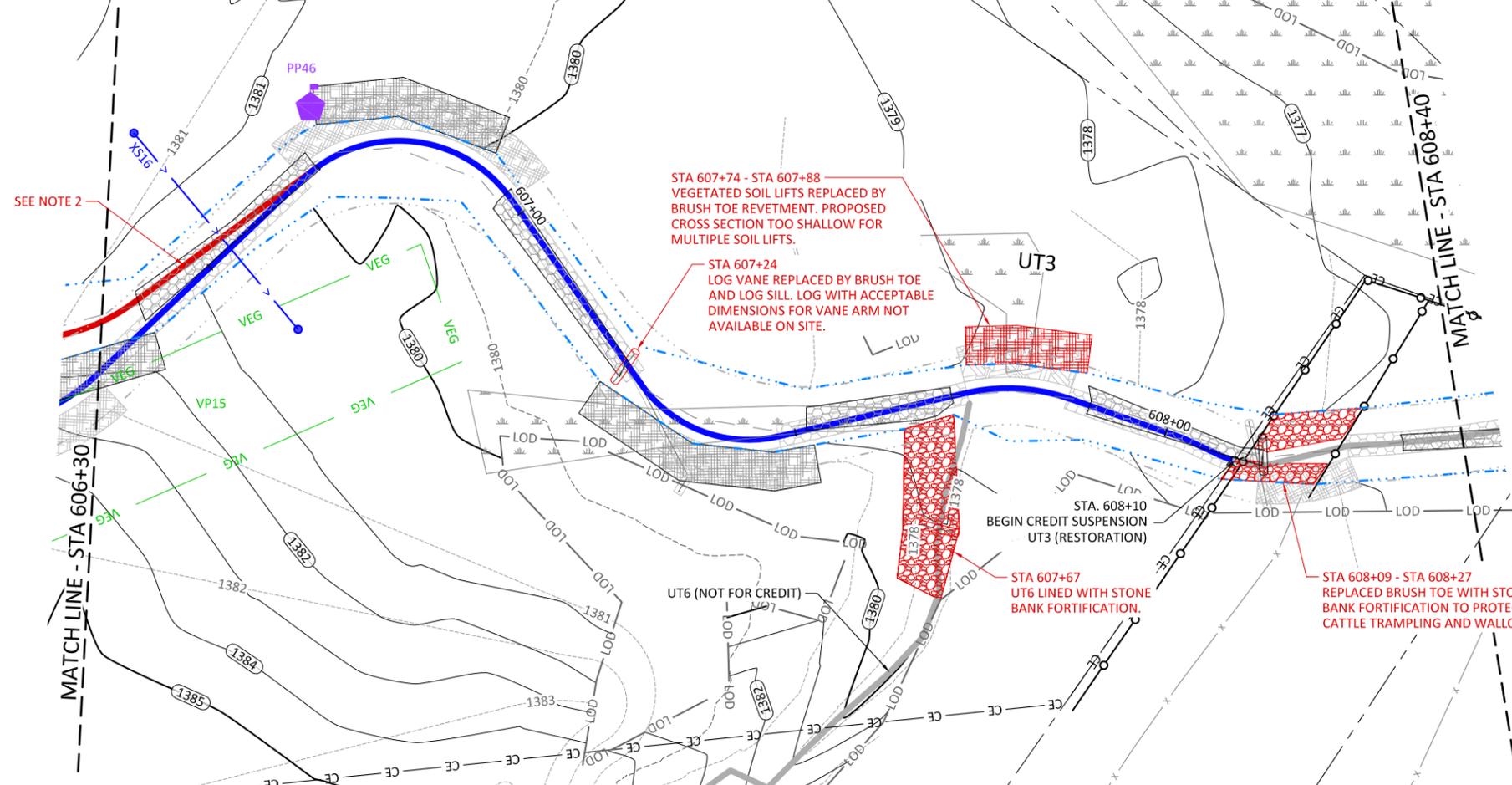
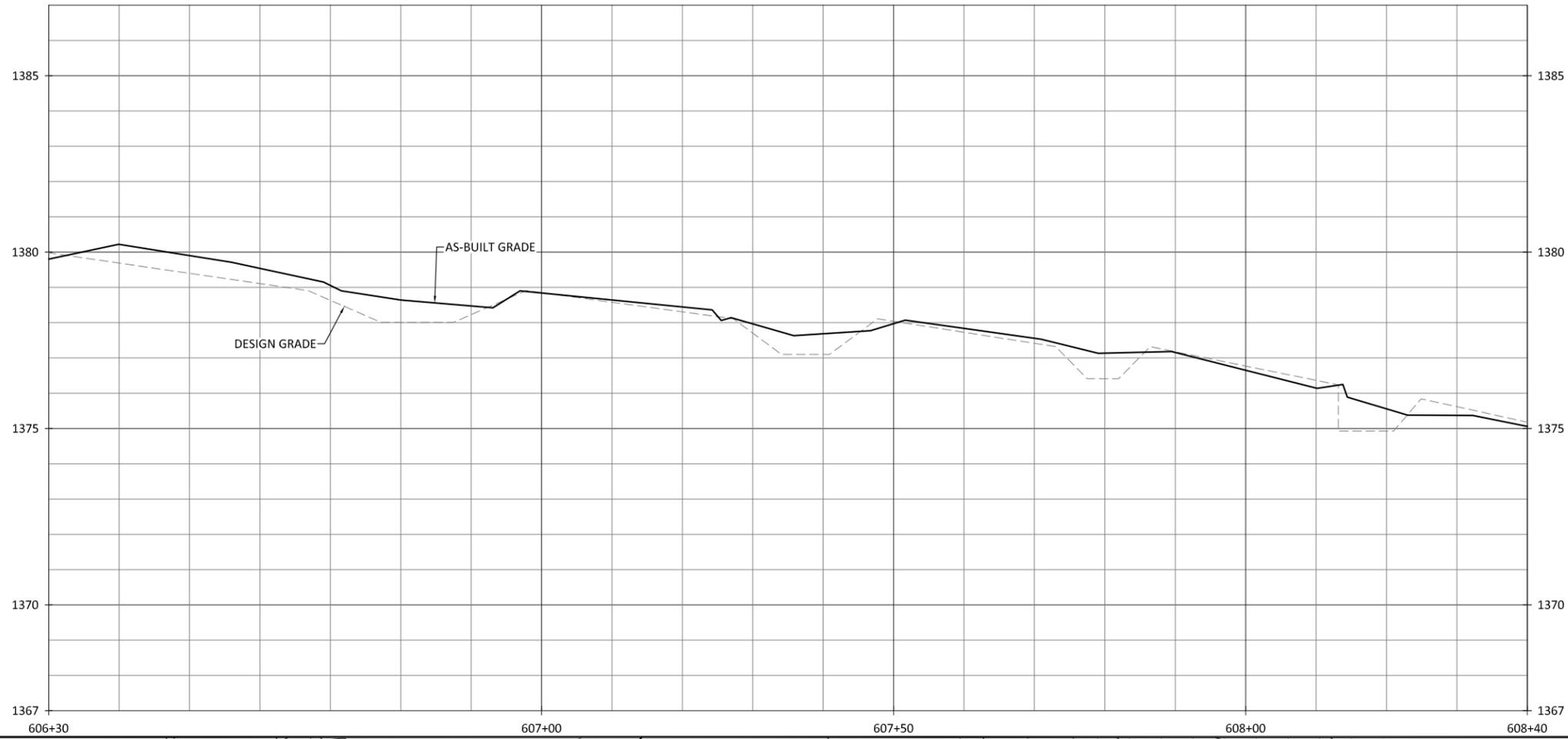
Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT3
Stream Plan and Profile

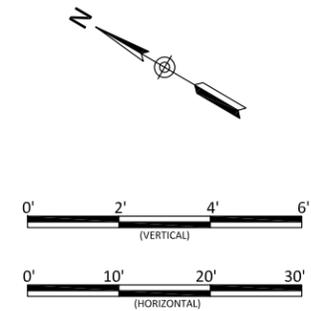
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

1.40
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- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 603+56 - STA 606+69
313 LINEAR FEET OF STREAM WAS REALIGNED FOR BETTER CONSTRUCTABILITY THROUGH POND AREA.



Bug Headwaters Record Drawings
Wilkes County, North Carolina

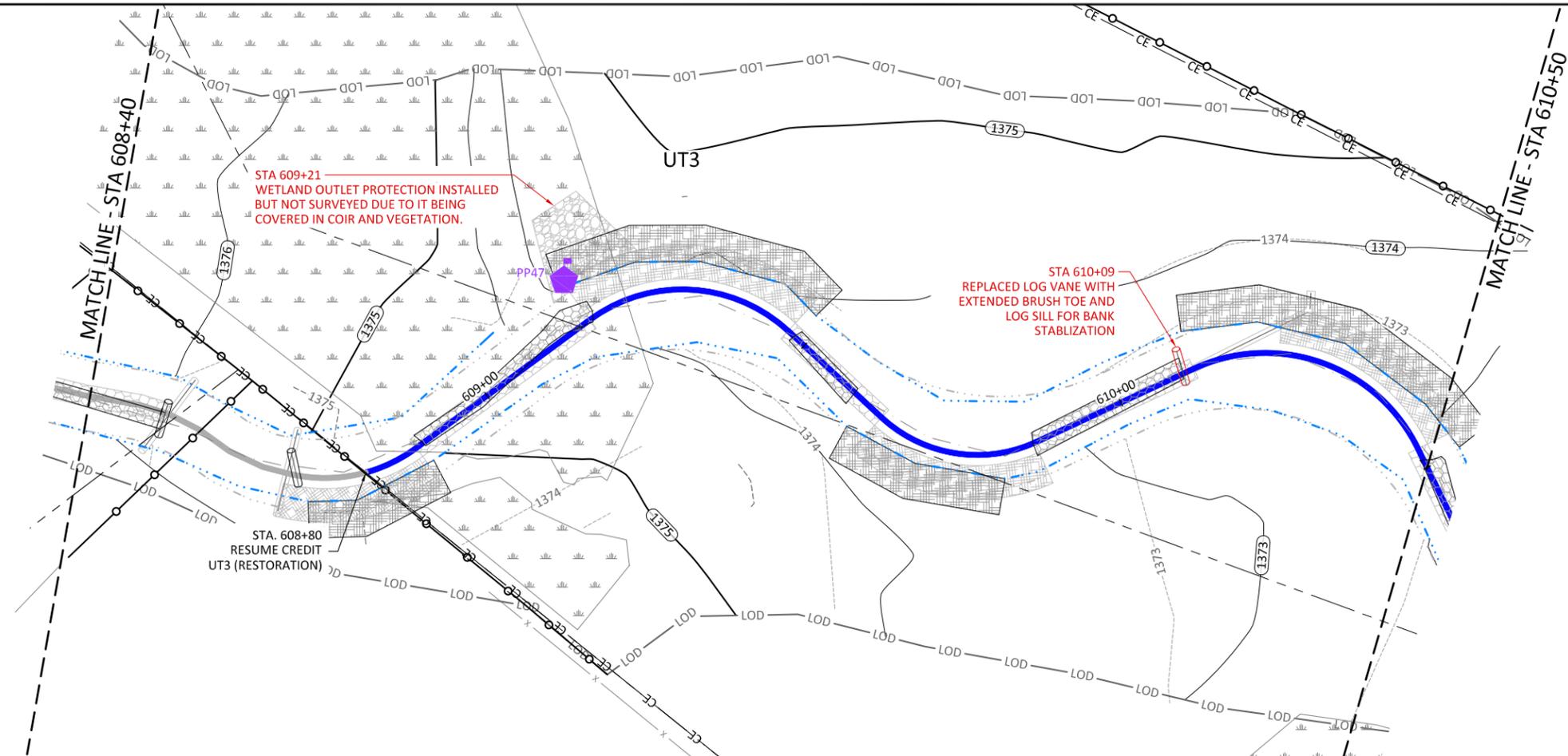
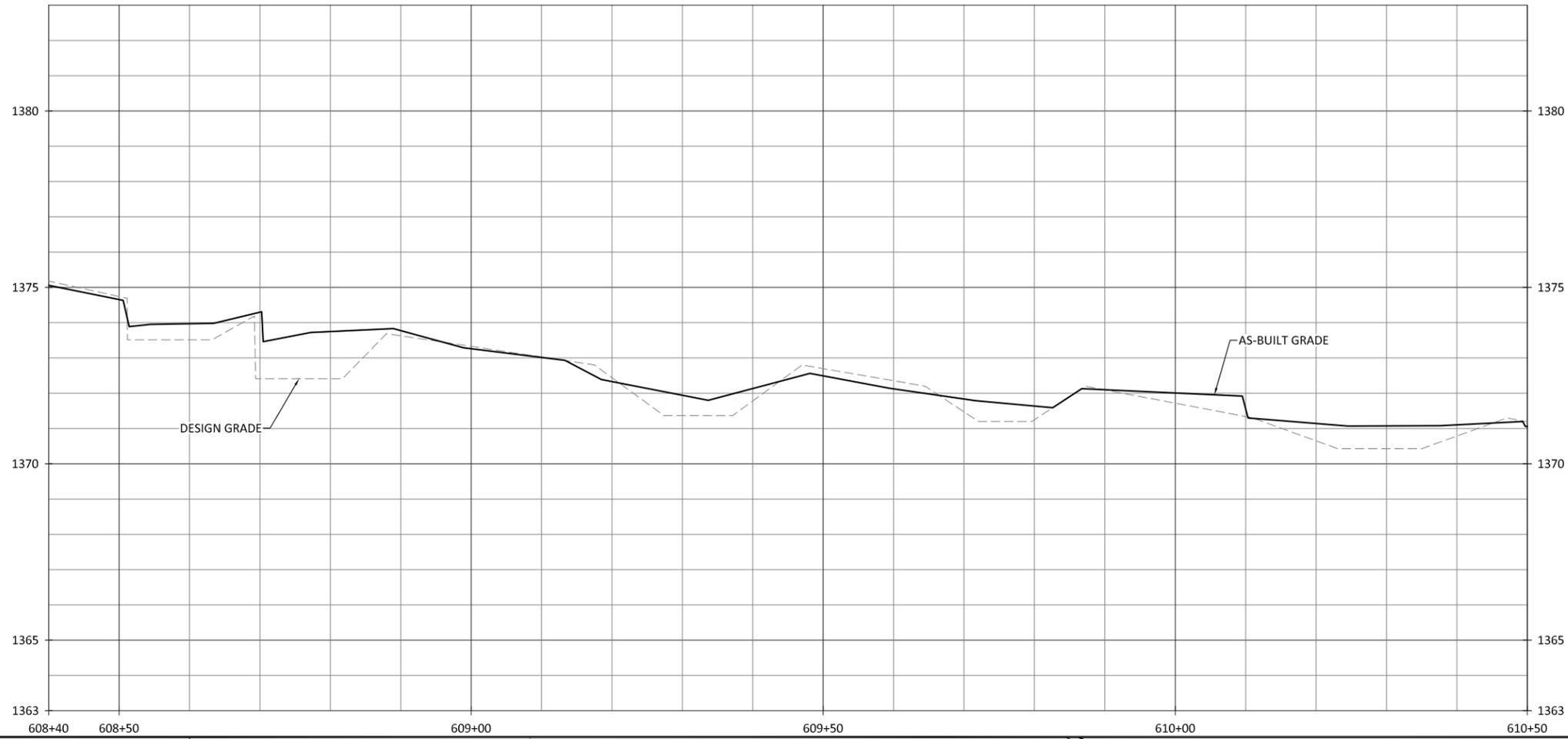
UT3
 Stream Plan and Profile

Revisions:

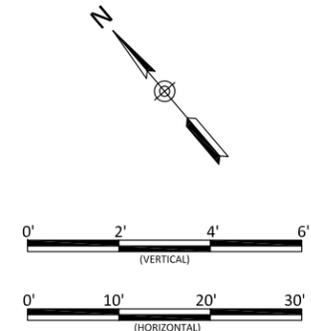
Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

1.41

Sheet



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



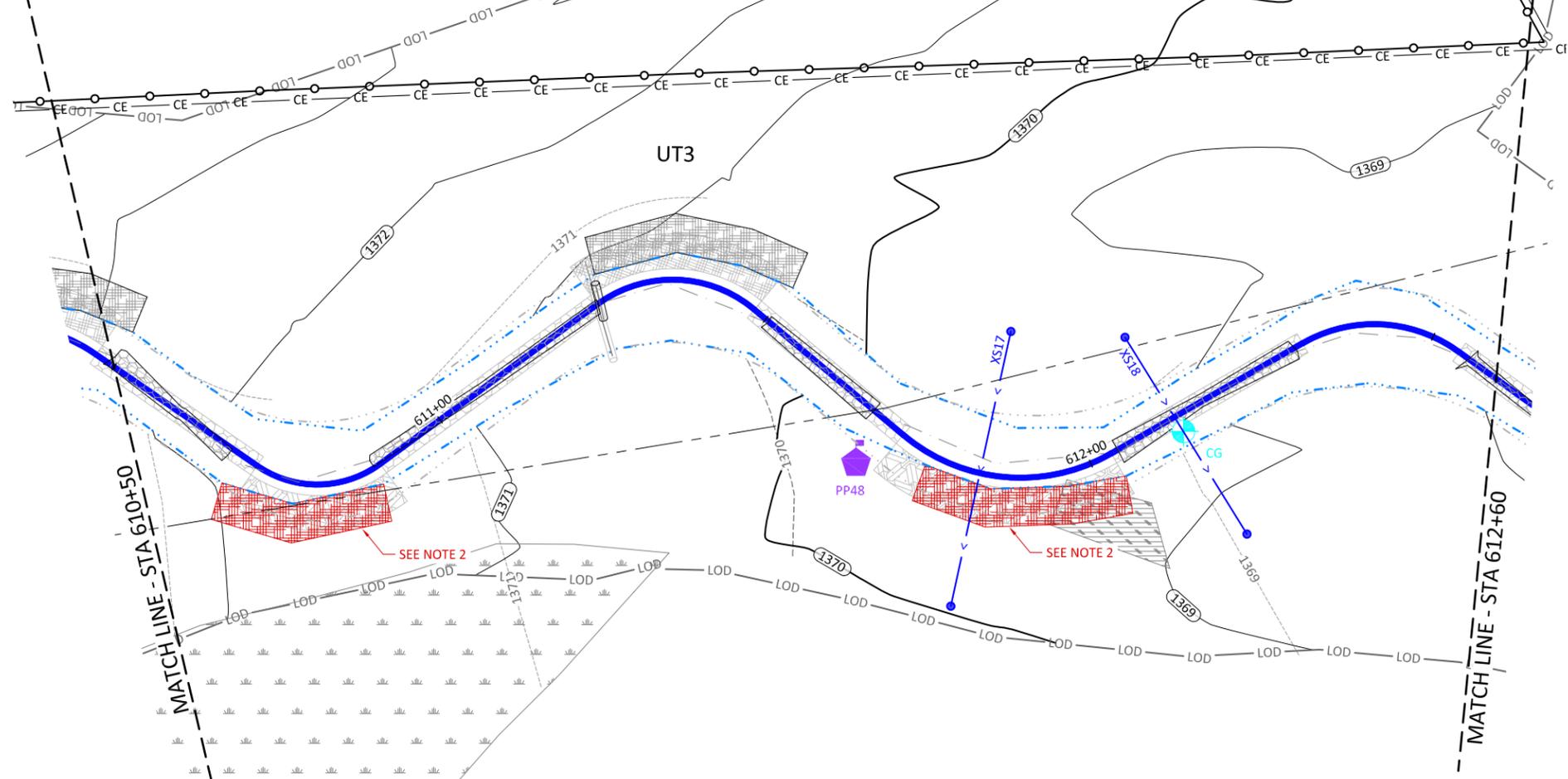
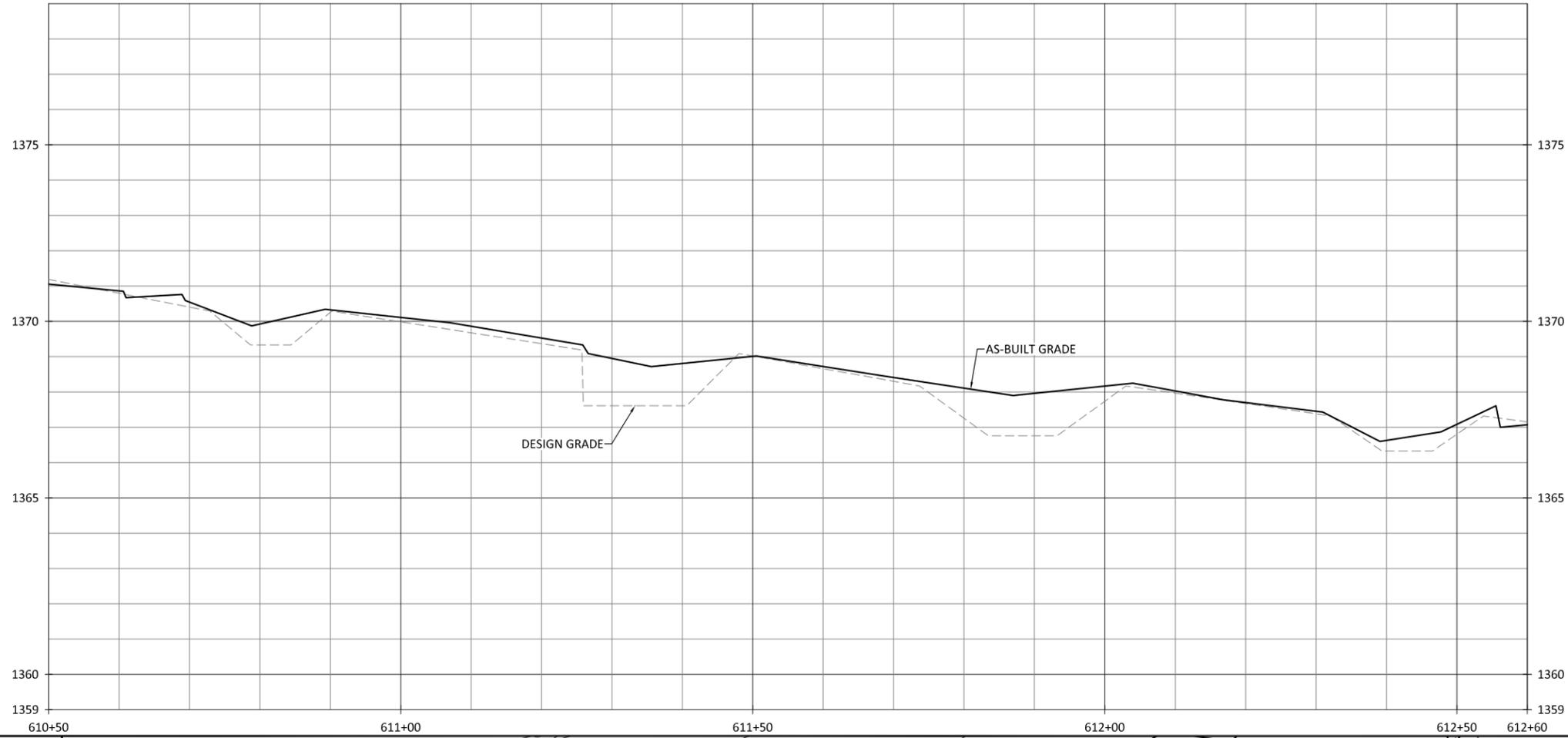
Bug Headwaters Record Drawings
 Wilkes County, North Carolina

UT3
 Stream Plan and Profile

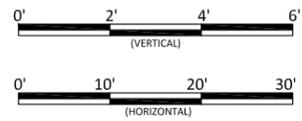
Revisions:

Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

1.42



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. STA 610+71 - STA 610+89 & STA 611+78 - STA 612+03 BRUSH TOE WAS USED INSTEAD OF SOIL LIFTS DUE TO CHANNEL DIMENSIONS NOT DEEP ENOUGH FOR MULTIPLE SOIL LIFTS.



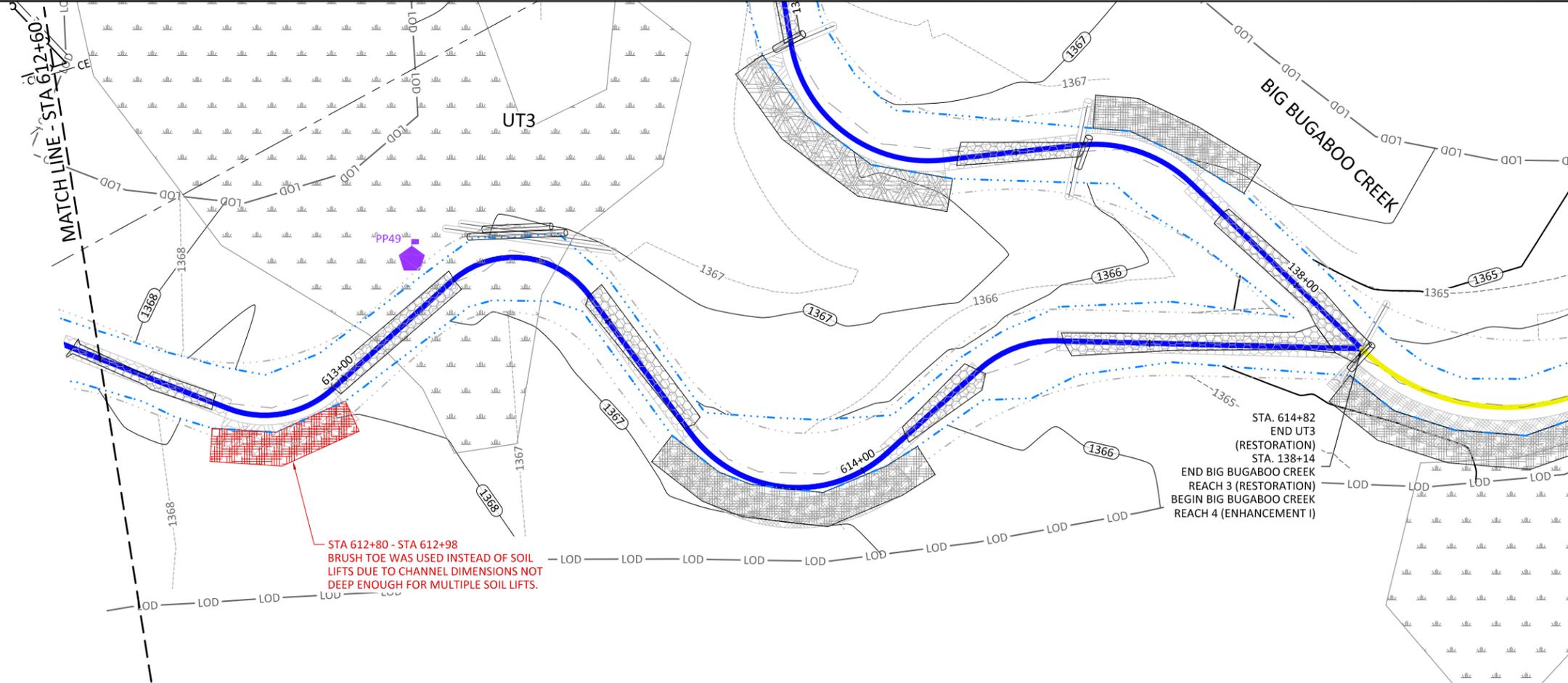
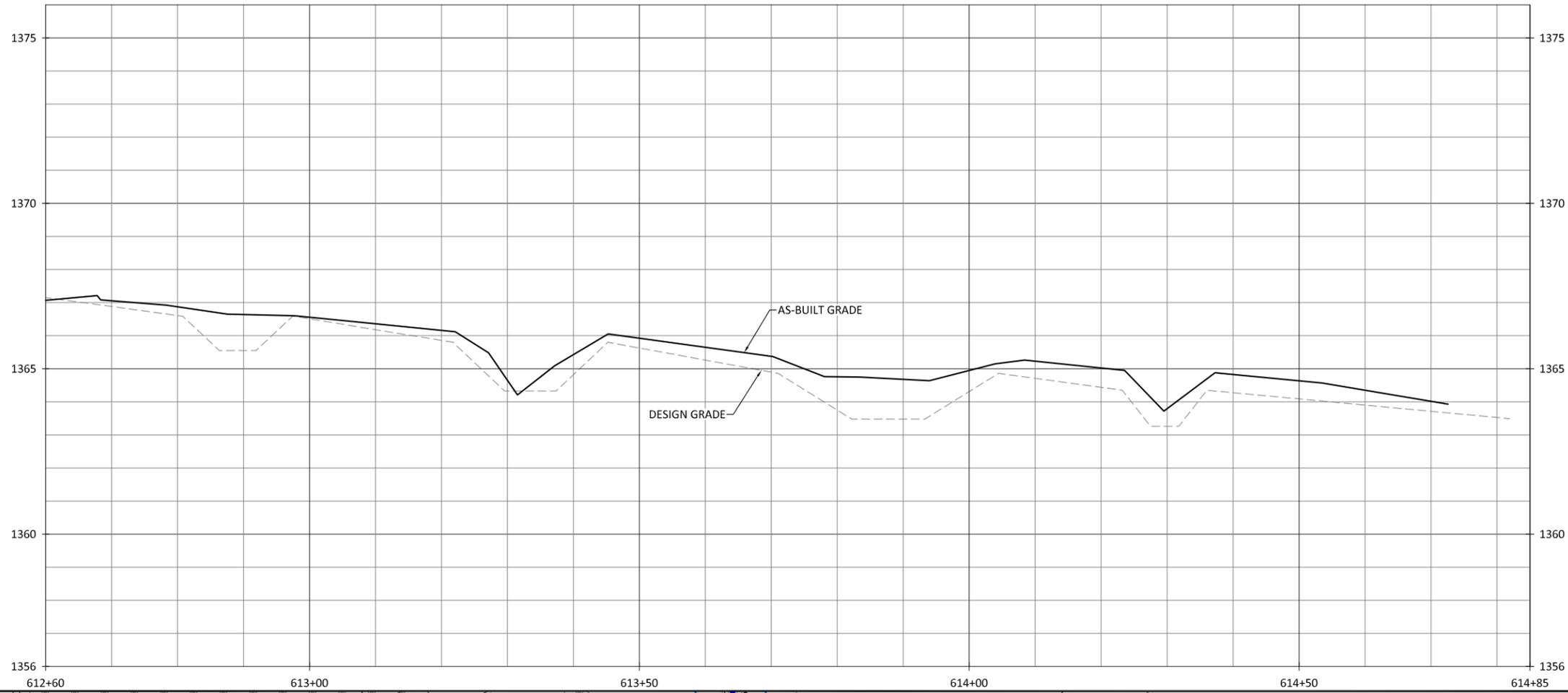
Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT3
Stream Plan and Profile

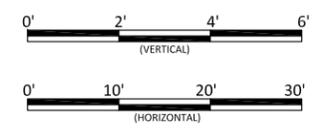
Revisions:

Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

1.43



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR BIG BUGABOO CREEK IS ADDRESSED ON SHEETS 1.01 THROUGH 1.20.



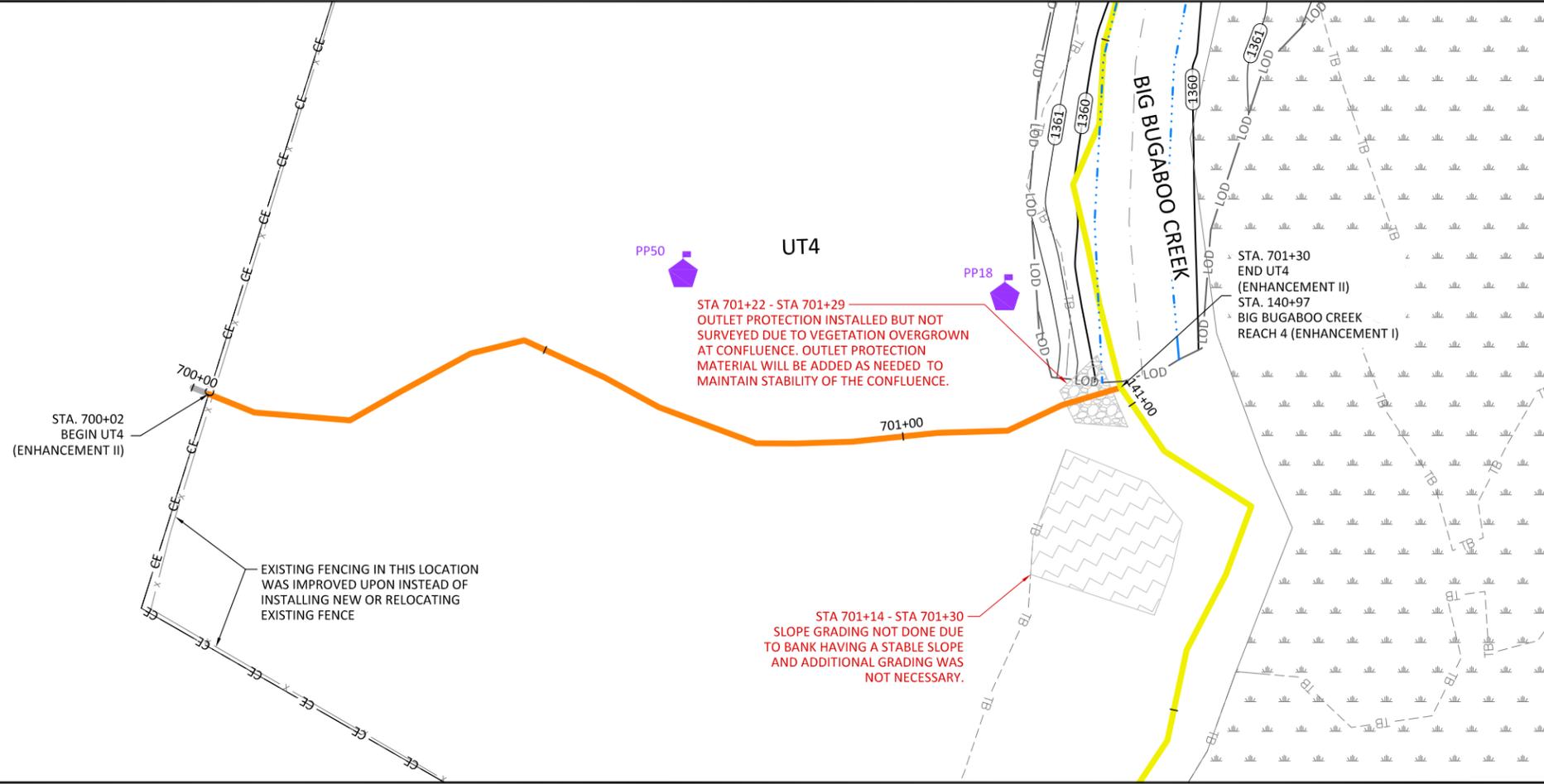
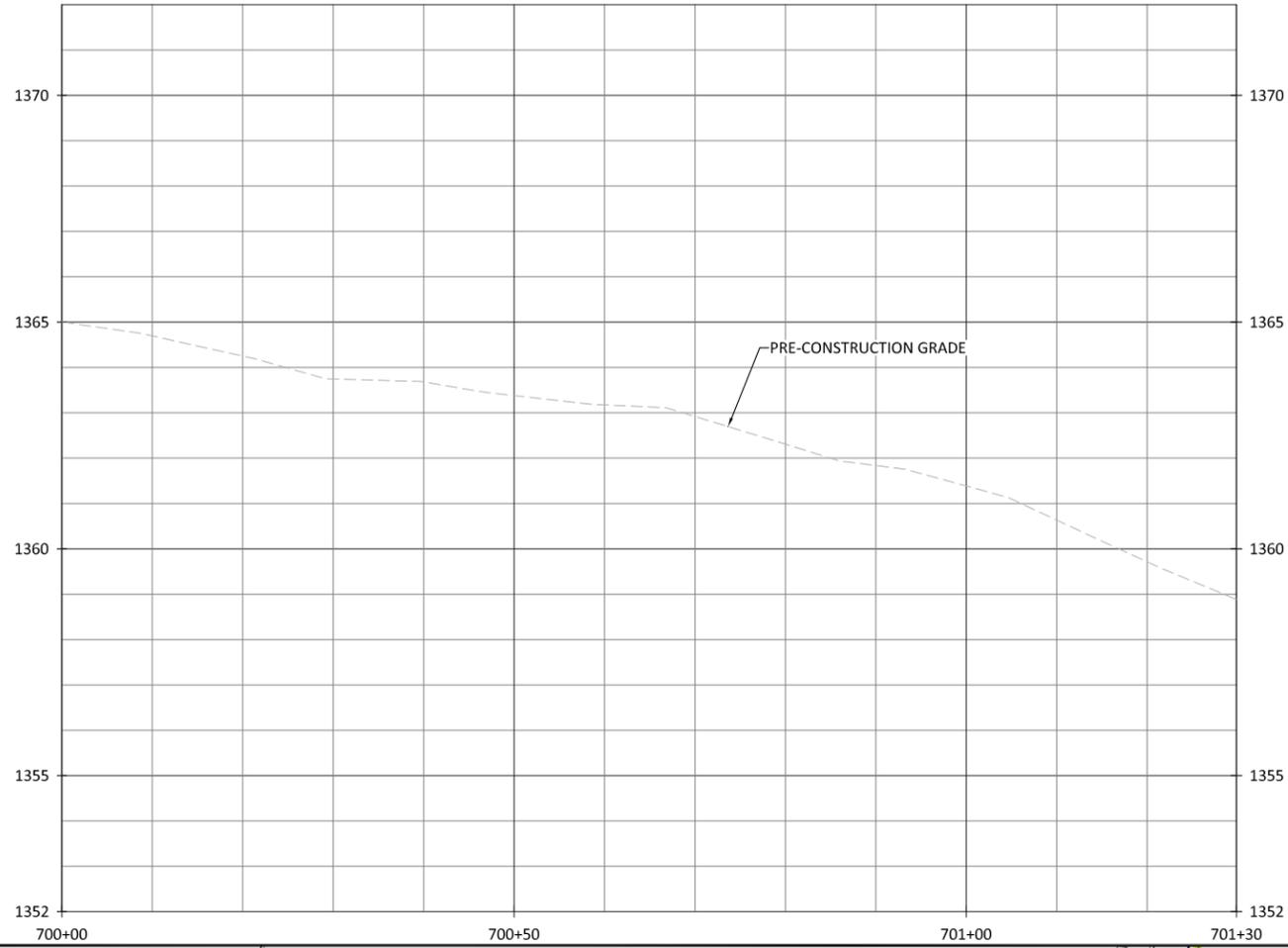
Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT3
Stream Plan and Profile

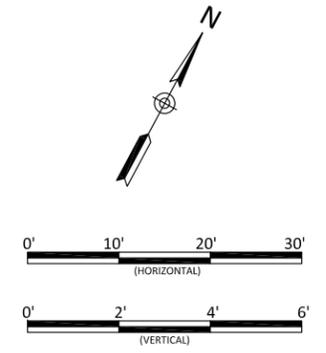
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

1.44



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR BIG BUGABOO CREEK IS ADDRESSED ON SHEETS 1.01 THROUGH 1.20.

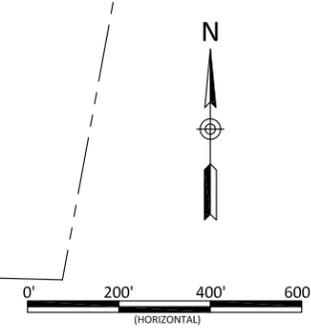
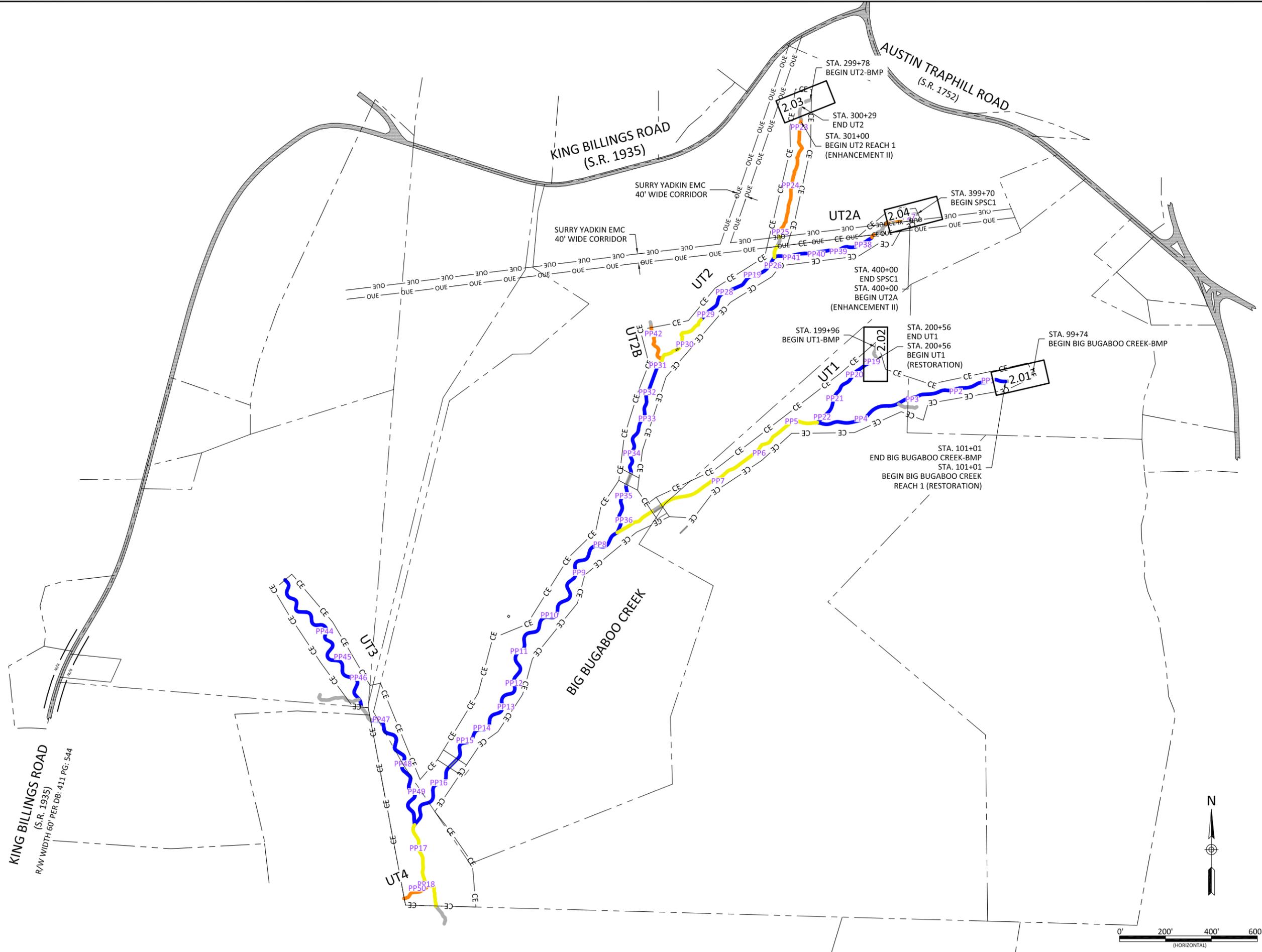


Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT4
Stream Plan and Profile

Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA



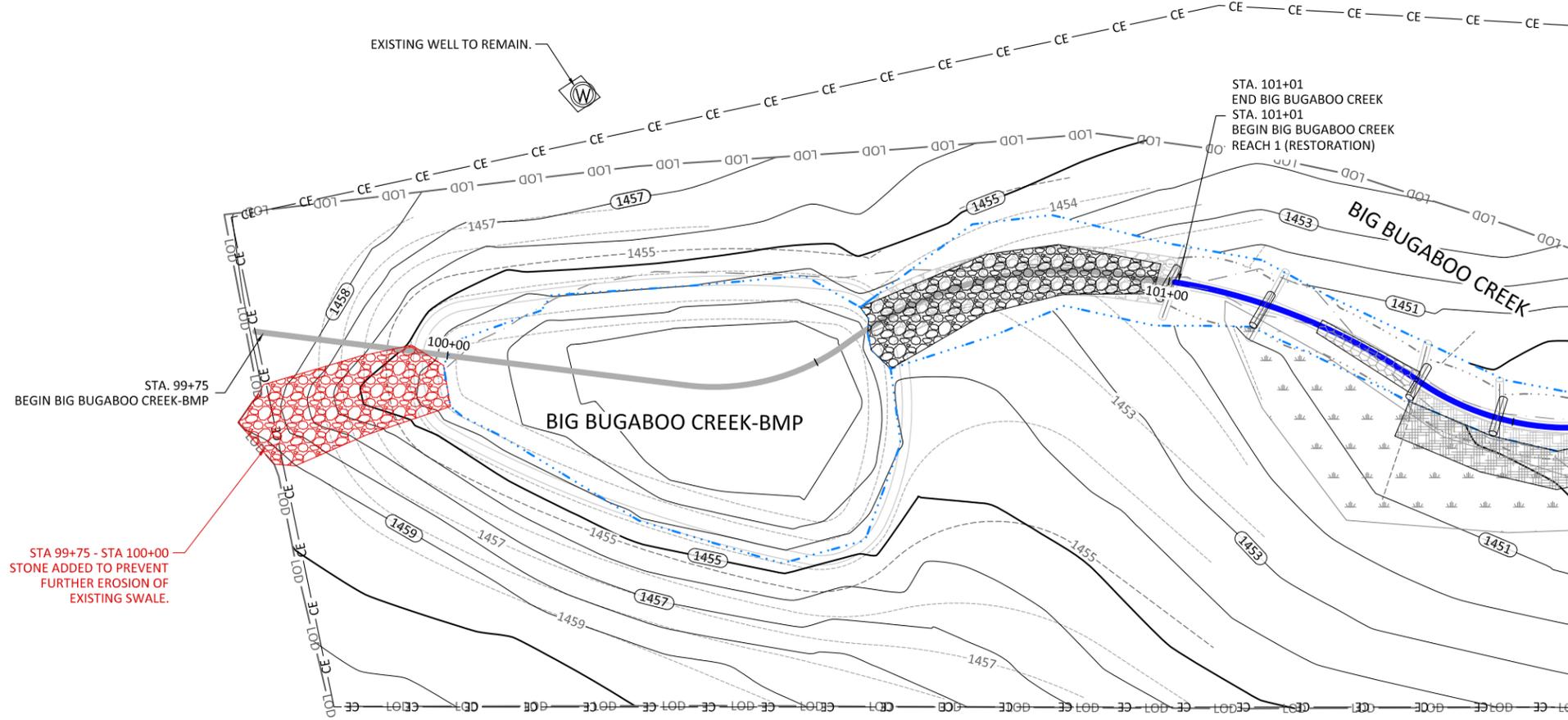
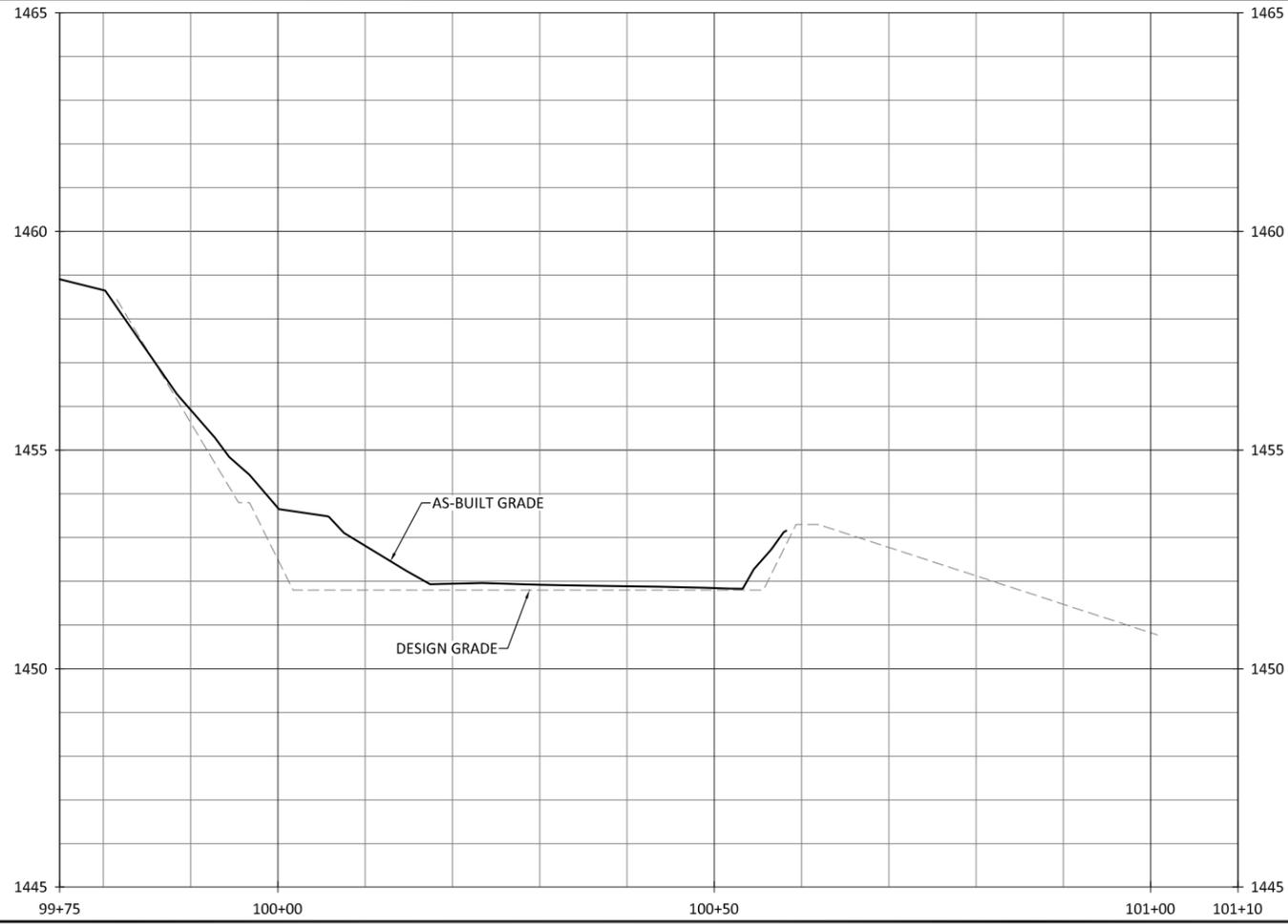
Bug Headwaters Record Drawings
Wilkes County, North Carolina
BMP Overview
BMP Design

Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

Revisions:

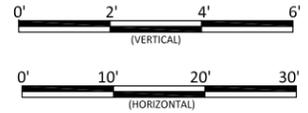
2.00

Sheet



STA 99+75 - STA 100+00
STONE ADDED TO PREVENT
FURTHER EROSION OF
EXISTING SWALE.

- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR BIG BUGABOO CREEK IS ADDRESSED ON SHEETS 1.01 THROUGH 1.20.



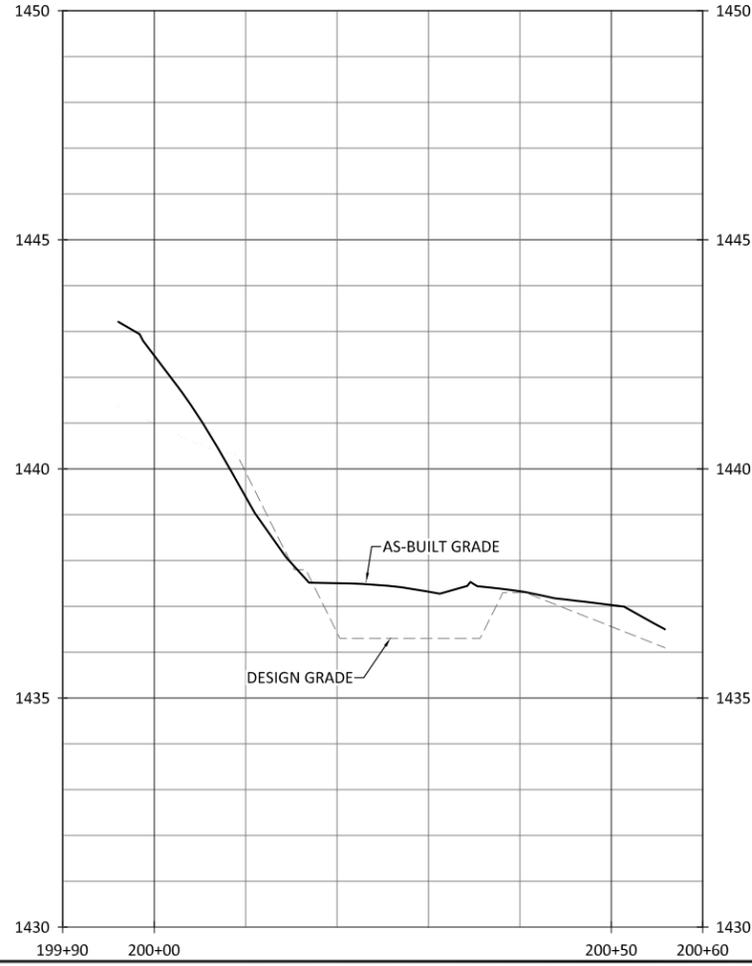
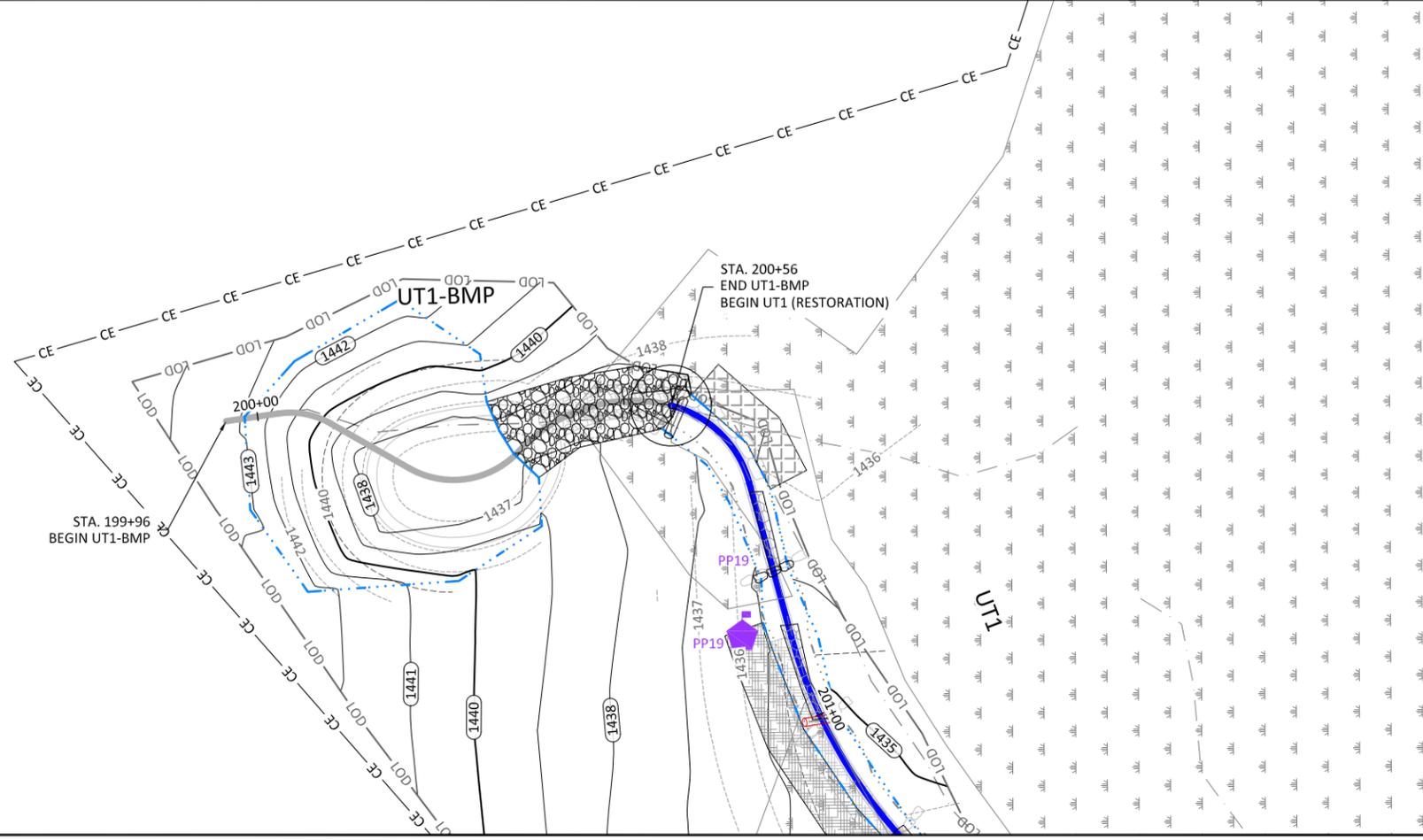
Bug Headwaters Record Drawings
Wilkes County, North Carolina
Big Bugaboo Creek-BMP
BMP Design

Revisions:

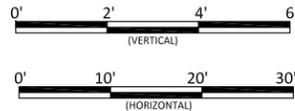
Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

2.01

Sheet



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT1 IS ADDRESSED ON SHEETS 1.21 THROUGH 1.22.



Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

2.02

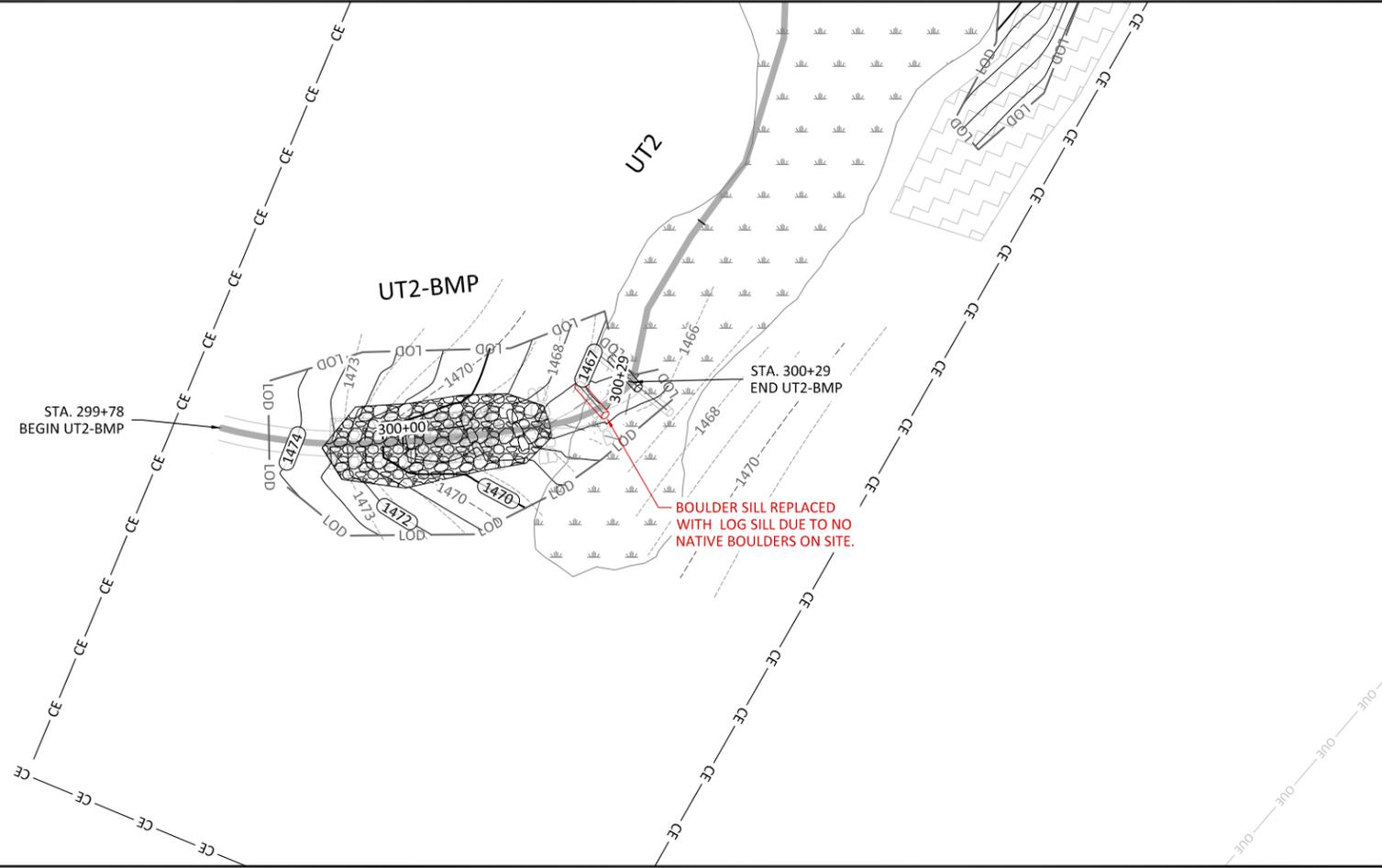
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Revisions:	

Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT1-BMP
BMP Design





- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT2 IS ADDRESSED ON SHEETS 1.23 THROUGH 1.33.



Bug Headwaters Record Drawings
 Wilkes County, North Carolina
 UT2-BMP
 Ephemeral Step Pool Stabilization

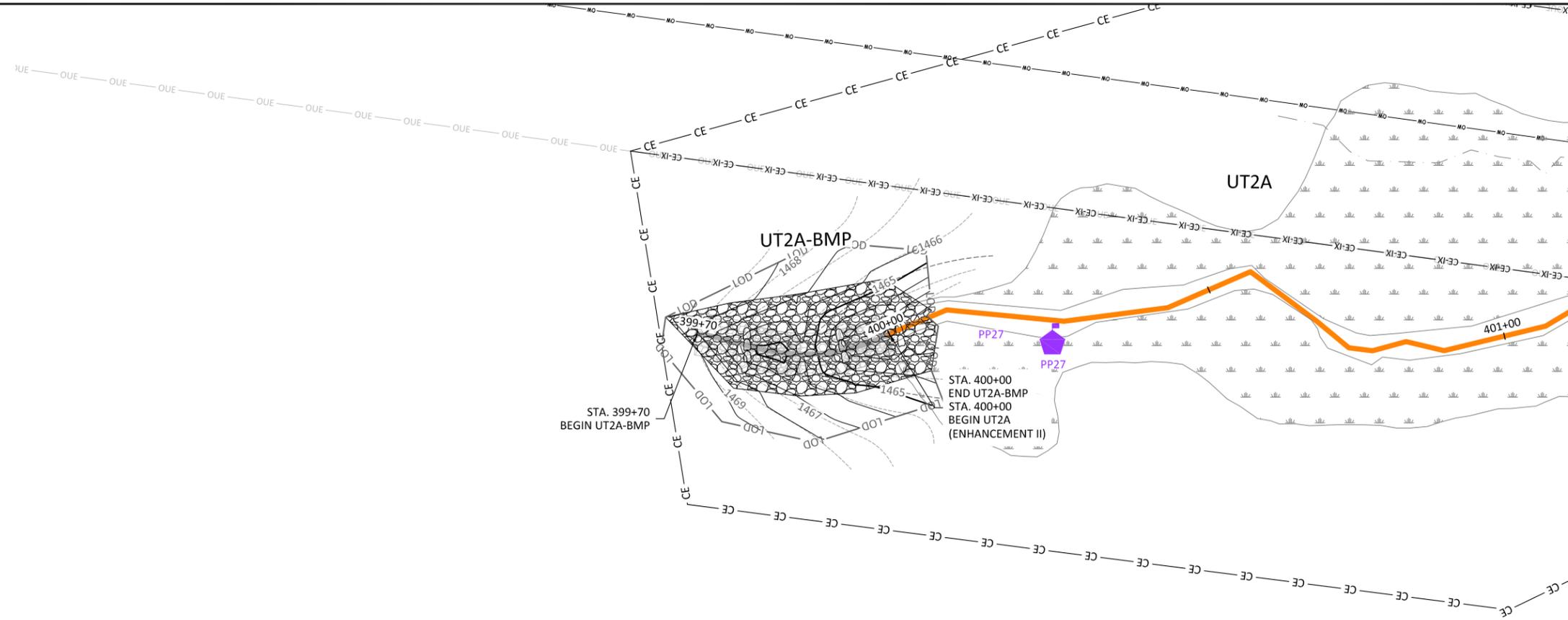
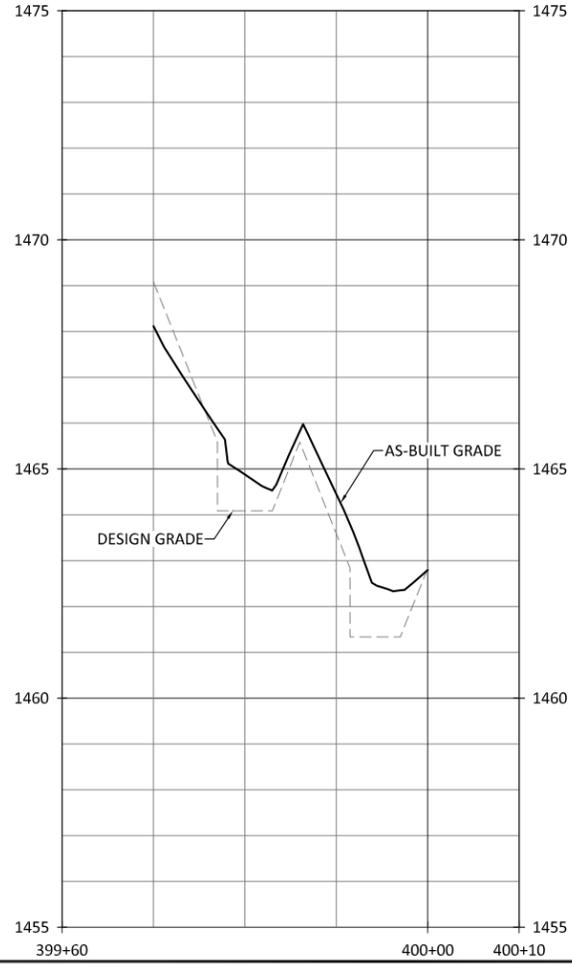
WILDLANDS
 ENGINEERING
 312 W. Millbrook Rd. Suite 225
 Raleigh, NC 27609
 Tel: 919.851.9886
 License No. F-0831



Revisions:

Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA

2.03



- NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
 2. AS-BUILT INFORMATION FOR UT2A IS ADDRESSED ON SHEETS 1.34 THROUGH 1.36.



Bug Headwaters Record Drawings
Wilkes County, North Carolina

UT2A-SPSC
BMP Design

Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

2.04

Streambank Planting Zone 1 (1.1 acres)

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

Streambank Planting Zone 2 (0.58 acres)

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

NOTES:

- DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.

 Zone 1 - Streambank Planting - Big Bugaboo Creek Reach 3 and Reach 4, UT2 Reach 4, UT3

 Zone 2 - Streambank Planting - Big Bugaboo Creek Reach 1 and Reach 2, UT1, UT2 Reach 1 and Reach 24, UT2B

 Zone 3 - Buffer Planting Zone

 Zone 4 - Wetland Planting Zone

 Zone 5 - Permanent Seeding Outside Easement

BMP Obligate Species Planting Zone (0.01 acres)

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

Wetland Planting Zone (9.4 acres)

Bare Root						
Species	Common Name	Indiv. Spacing	Callper Size	Stratum	Wetland Indicator Status	% of Stems
<i>Platanus occidentalis</i>	Sycamore	6-12 ft.	0.25"-1.0"	Canopy	FACW	18%
<i>Ulmus americana</i>	American Elm	6-12 ft.	0.25"-1.0"	Canopy	FACW	10%
<i>Betula nigra</i>	River Birch	6-12 ft.	0.25"-1.0"	Canopy	FACW	48% 19%
<i>Acer negundo</i>	Boxelder	6-12 ft.	0.25"-1.0"	Canopy	FAC	45% 16%
<i>Ulmus rubra</i>	Slippery Elm	6-12 ft.	0.25"-1.0"	Canopy	FAC	6%
<i>Ainus serrulata</i>	Tag Alder	6-12 ft.	0.25"-1.0"	Shrub	OBL	3%
<i>Nyssa sylvatica</i>	Black Gum	6-12 ft.	0.25"-1.0"	Canopy	FAC	15%
<i>Quercus phellos</i>	Willow Oak	6-12 ft.	0.25"-1.0"	Canopy	FAC	45% 16%
						100%

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

NOTE:

- TAG ELDER WAS NOT AVAILABLE. SPECIES COPPOSITION AND PLANTING PERCENTAGES WERE REVISED ACCORDINGLY.

Buffer Planting Zone (9.6 acres)

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

Permanent Seeding Outside Easement (7.8 acres)

Approved Dates	Species Name	Common Name	Stratum	Density (lbs/acre)	Percentage
All Year	<i>Festuca arundinacea</i>	Tall Fescue	Herb	40	70%
All Year	<i>Festuca rubra</i>	Creeping Red Fescue	Herb	40	10%
All Year	<i>Dactylis glomerata</i>	Orchardgrass	Herb	40	20%
					100%

Permanent Riparian Seeding (9.6 acres)

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

Permanent Wetland Seeding (7.1 acres)

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

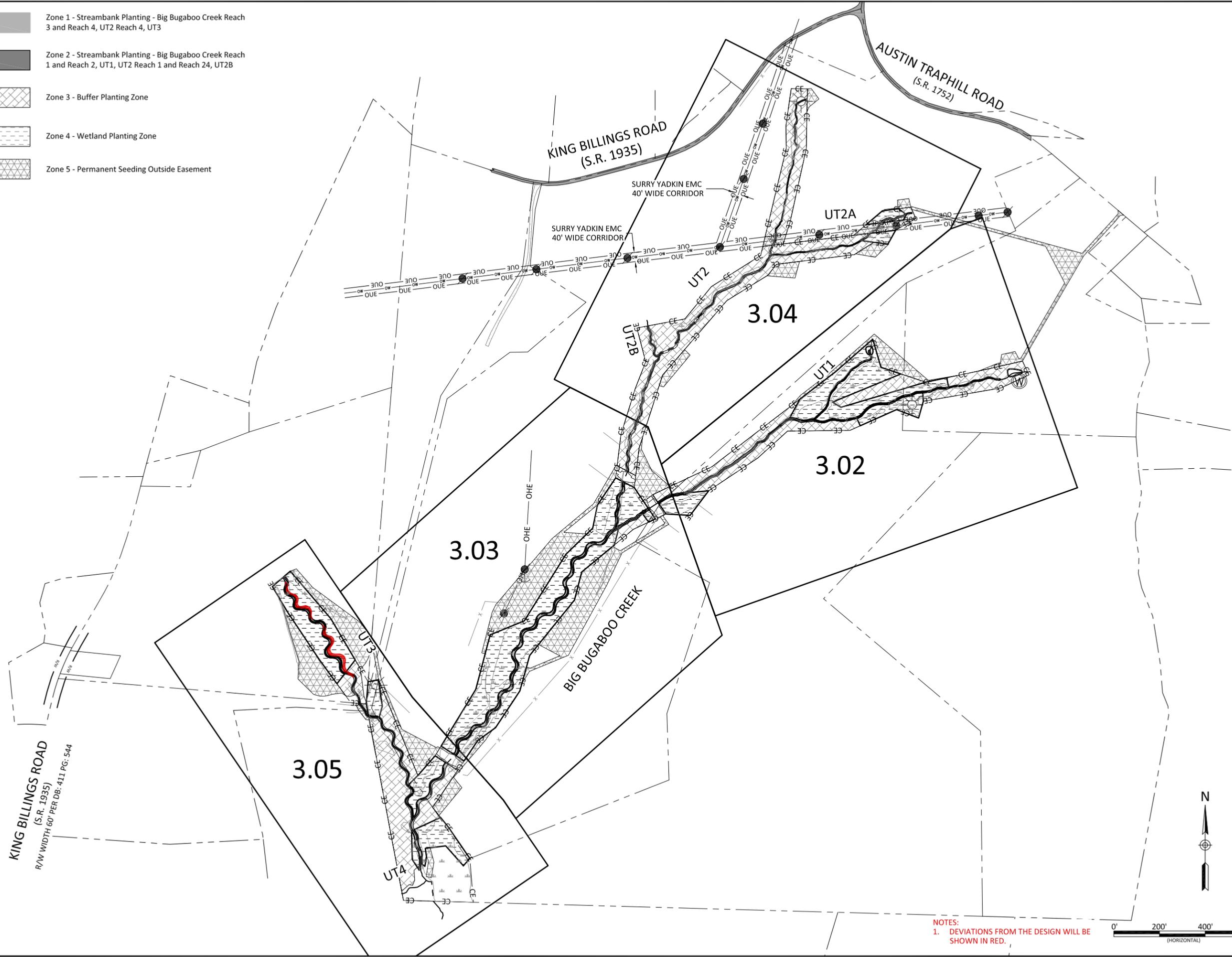
Temporary Seeding (24.6 acres)

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

Planting Notes:

- Non-hatched areas within easement are currently vegetated and were planted as needed to achieve target density. Buffer planting occurred within the Limits of Disturbance.
- Buffer zone species were planted on 6' spacing in rows spaced 12' apart.
- Wetland Indicator Status data sourced from USDA Plant Database.
- Permanent riparian seed was used for seeding Zone 3.
- Permanent wetland seeding was used for Zone 4 and UT3 and UT4 BMPs.
- BMP obligate species herbaceous plugs were installed around perimeter of UT3 and UT4 BMPs at elevations specified on Sheets 3.07 and 3.09.

-  Zone 1 - Streambank Planting - Big Bugaboo Creek Reach 3 and Reach 4, UT2 Reach 4, UT3
-  Zone 2 - Streambank Planting - Big Bugaboo Creek Reach 1 and Reach 2, UT1, UT2 Reach 1 and Reach 24, UT2B
-  Zone 3 - Buffer Planting Zone
-  Zone 4 - Wetland Planting Zone
-  Zone 5 - Permanent Seeding Outside Easement



KING BILLINGS ROAD
(S.R. 1935)
R/W WIDTH 60' PER DB: 411 PG: 544

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



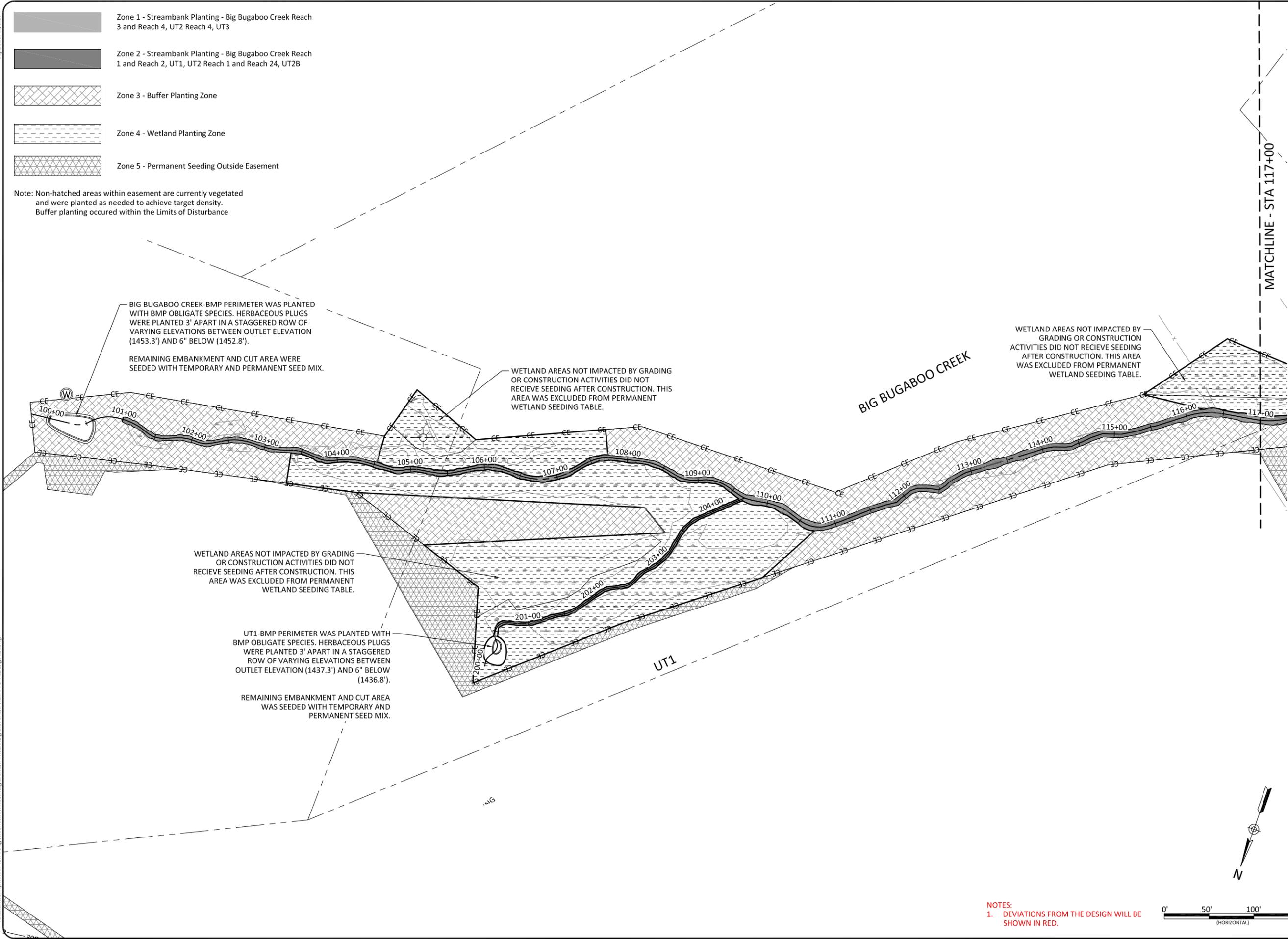
Bug Headwaters Record Drawings
Wilkes County, North Carolina
Planting Overview
Planting Plan

Revisions:	
Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

3.01

-  Zone 1 - Streambank Planting - Big Bugaboo Creek Reach 3 and Reach 4, UT2 Reach 4, UT3
-  Zone 2 - Streambank Planting - Big Bugaboo Creek Reach 1 and Reach 2, UT1, UT2 Reach 1 and Reach 24, UT2B
-  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 were planted as needed to achieve target density. Buffer planting occurred within the Limits of Disturbance



BIG BUGABOO CREEK-BMP PERIMETER WAS PLANTED WITH BMP OBLIGATE SPECIES. HERBACEOUS PLUGS WERE PLANTED 3' APART IN A STAGGERED ROW OF VARYING ELEVATIONS BETWEEN OUTLET ELEVATION (1453.3') AND 6" BELOW (1452.8').

REMAINING EMBANKMENT AND CUT AREA WERE SEEDED WITH TEMPORARY AND PERMANENT SEED MIX.

WETLAND AREAS NOT IMPACTED BY GRADING OR CONSTRUCTION ACTIVITIES DID NOT RECEIVE SEEDING AFTER CONSTRUCTION. THIS AREA WAS EXCLUDED FROM PERMANENT WETLAND SEEDING TABLE.

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UT1-BMP PERIMETER WAS PLANTED WITH BMP OBLIGATE SPECIES. HERBACEOUS PLUGS WERE PLANTED 3' APART IN A STAGGERED ROW OF VARYING ELEVATIONS BETWEEN OUTLET ELEVATION (1437.3') AND 6" BELOW (1436.8').

REMAINING EMBANKMENT AND CUT AREA WAS SEEDED WITH TEMPORARY AND PERMANENT SEED MIX.

MATCHLINE - STA 117+00

BIG BUGABOO CREEK

UT1



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



Bug Headwaters Record Drawings
Wilkes County, North Carolina

Planting Plan

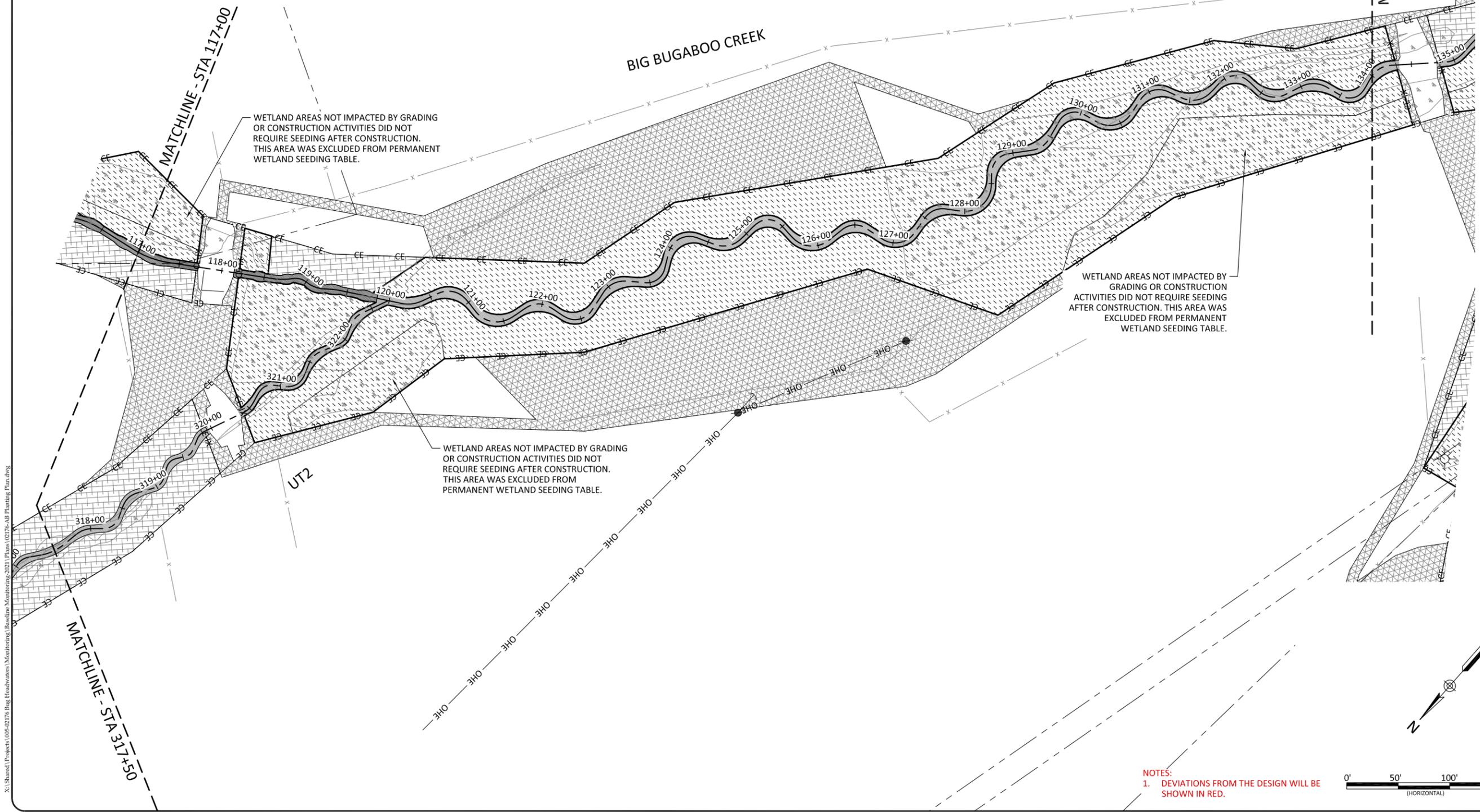
Revisions:

Date: 09.18.2020
Job Number: 005-02176
Project Engineer: NMM
Drawn By: CAW
Checked By: ANA

3.02

-  Zone 1 - Streambank Planting - Big Bugaboo Creek Reach 3 and Reach 4, UT2 Reach 4, UT3
-  Zone 2 - Streambank Planting - Big Bugaboo Creek Reach 1 and Reach 2, UT1, UT2 Reach 1 and Reach 24, UT2B
-  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 were planted as needed to achieve target density. Buffer planting occurred within the Limits of Disturbance



WETLAND AREAS NOT IMPACTED BY GRADING OR CONSTRUCTION ACTIVITIES DID NOT REQUIRE SEEDING AFTER CONSTRUCTION. THIS AREA WAS EXCLUDED FROM PERMANENT WETLAND SEEDING TABLE.

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Bug Headwaters Record Drawings
Wilkes County, North Carolina

Planting Plan

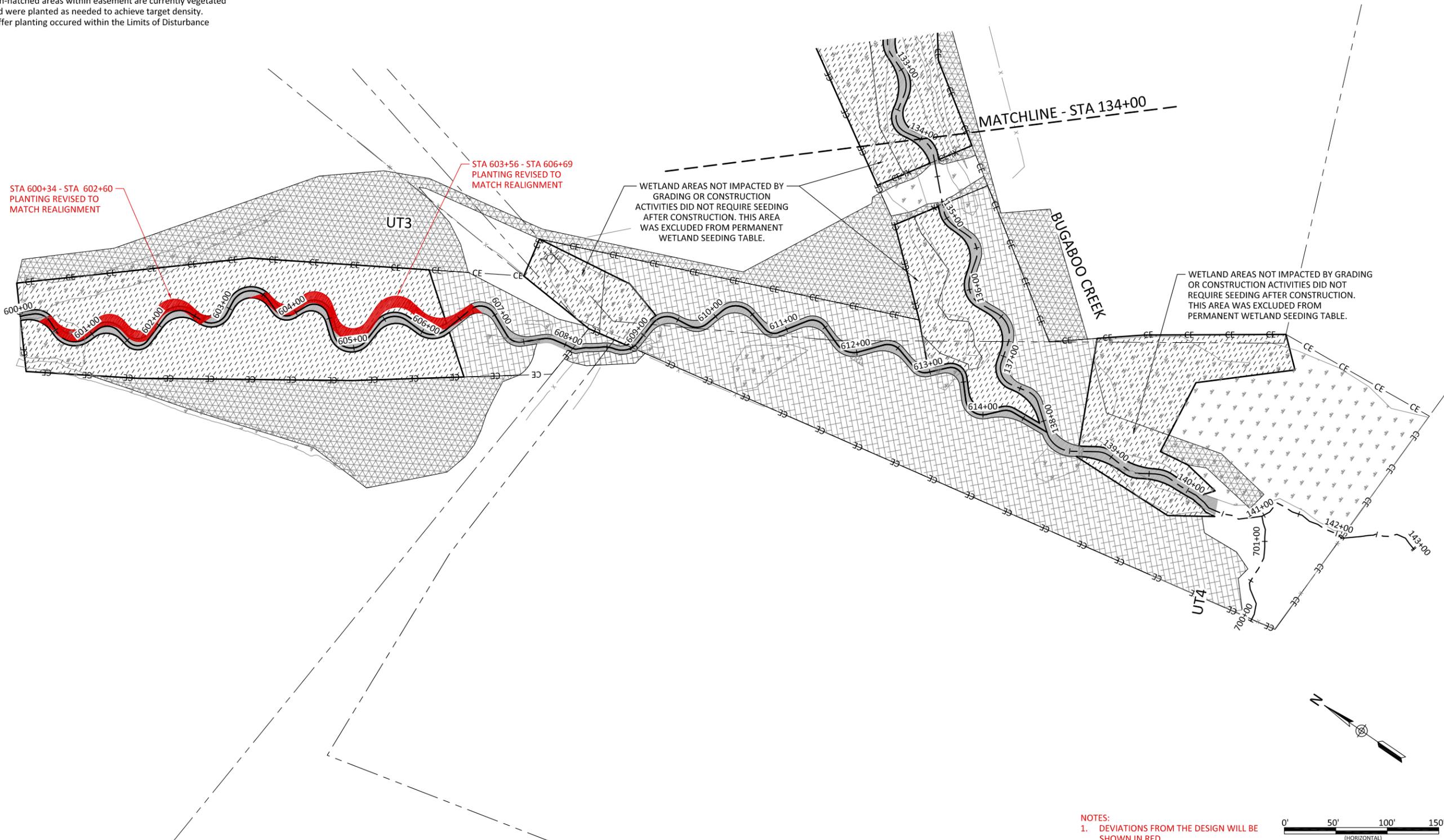
Revisions:

Date:	09.18.2020
Job Number:	005-02176
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	ANA

3.03

-  Zone 1 - Streambank Planting - Big Bugaboo Creek Reach 3 and Reach 4, UT2 Reach 4, UT3
-  Zone 2 - Streambank Planting - Big Bugaboo Creek Reach 1 and Reach 2, UT1, UT2 Reach 1 and Reach 24, UT2B
-  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 were planted as needed to achieve target density. Buffer planting occurred within the Limits of Disturbance



STA 600+34 - STA 602+60
PLANTING REVISED TO
MATCH REALIGNMENT

STA 603+56 - STA 606+69
PLANTING REVISED TO
MATCH REALIGNMENT

WETLAND AREAS NOT IMPACTED BY
GRADING OR CONSTRUCTION
ACTIVITIES DID NOT REQUIRE SEEDING
AFTER CONSTRUCTION. THIS AREA
WAS EXCLUDED FROM PERMANENT
WETLAND SEEDING TABLE.

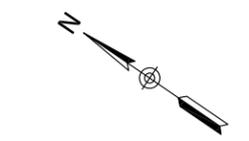
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OR CONSTRUCTION ACTIVITIES DID NOT
REQUIRE SEEDING AFTER CONSTRUCTION.
THIS AREA WAS EXCLUDED FROM
PERMANENT WETLAND SEEDING TABLE.

MATCHLINE - STA 134+00

BUGABOO CREEK

UT3

UT4



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



Bug Headwaters Record Drawings
Wilkes County, North Carolina

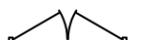
Planting Plan

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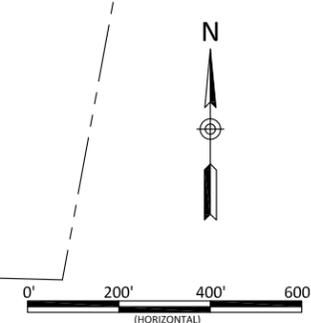
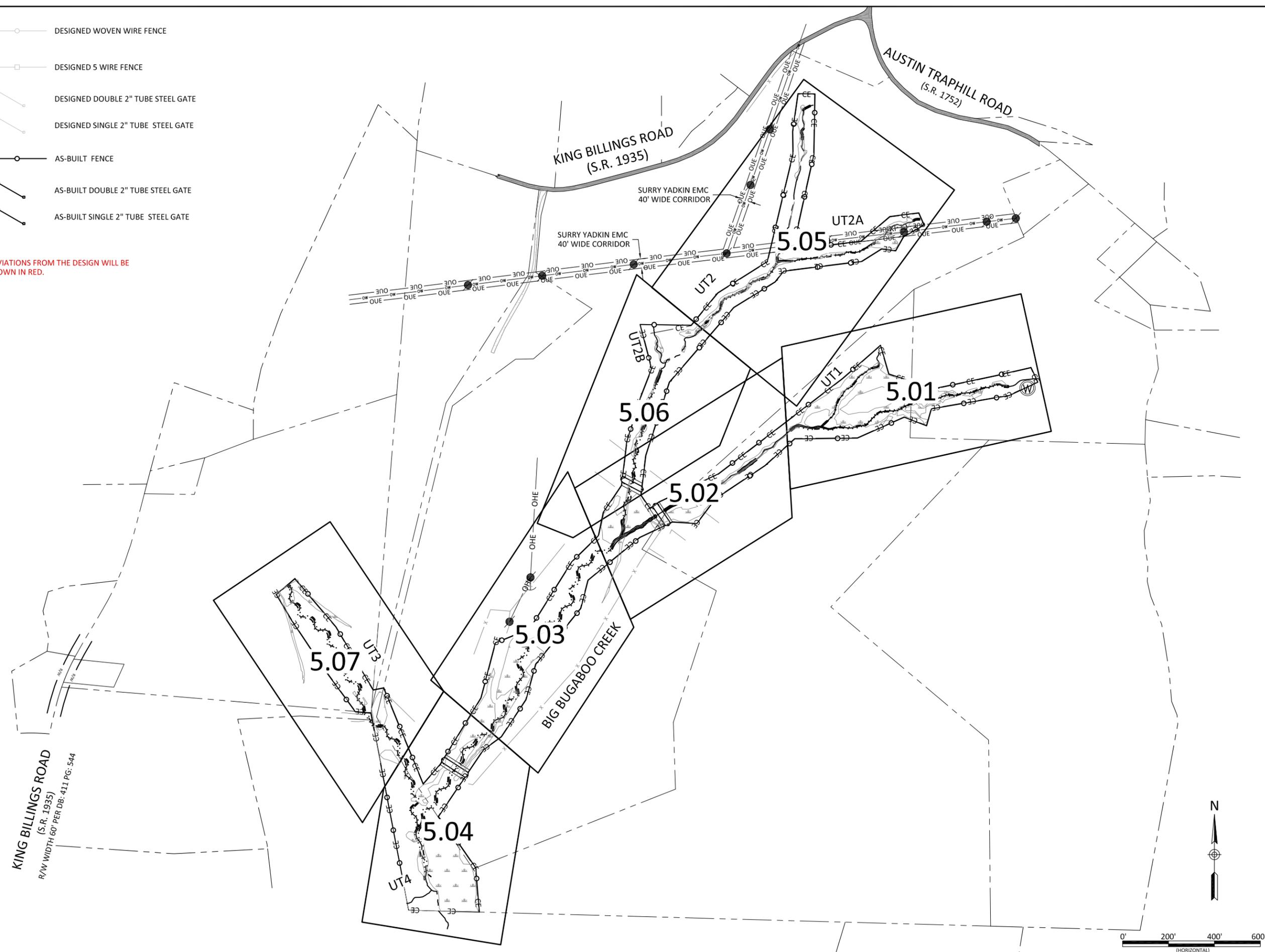
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Drawn By:	CAW
Checked By:	ANA

3.05

September 14, 2021
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-  DESIGNED WOVEN WIRE FENCE
-  DESIGNED 5 WIRE FENCE
-  DESIGNED DOUBLE 2" TUBE STEEL GATE
-  DESIGNED SINGLE 2" TUBE STEEL GATE
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-  AS-BUILT DOUBLE 2" TUBE STEEL GATE
-  AS-BUILT SINGLE 2" TUBE STEEL GATE

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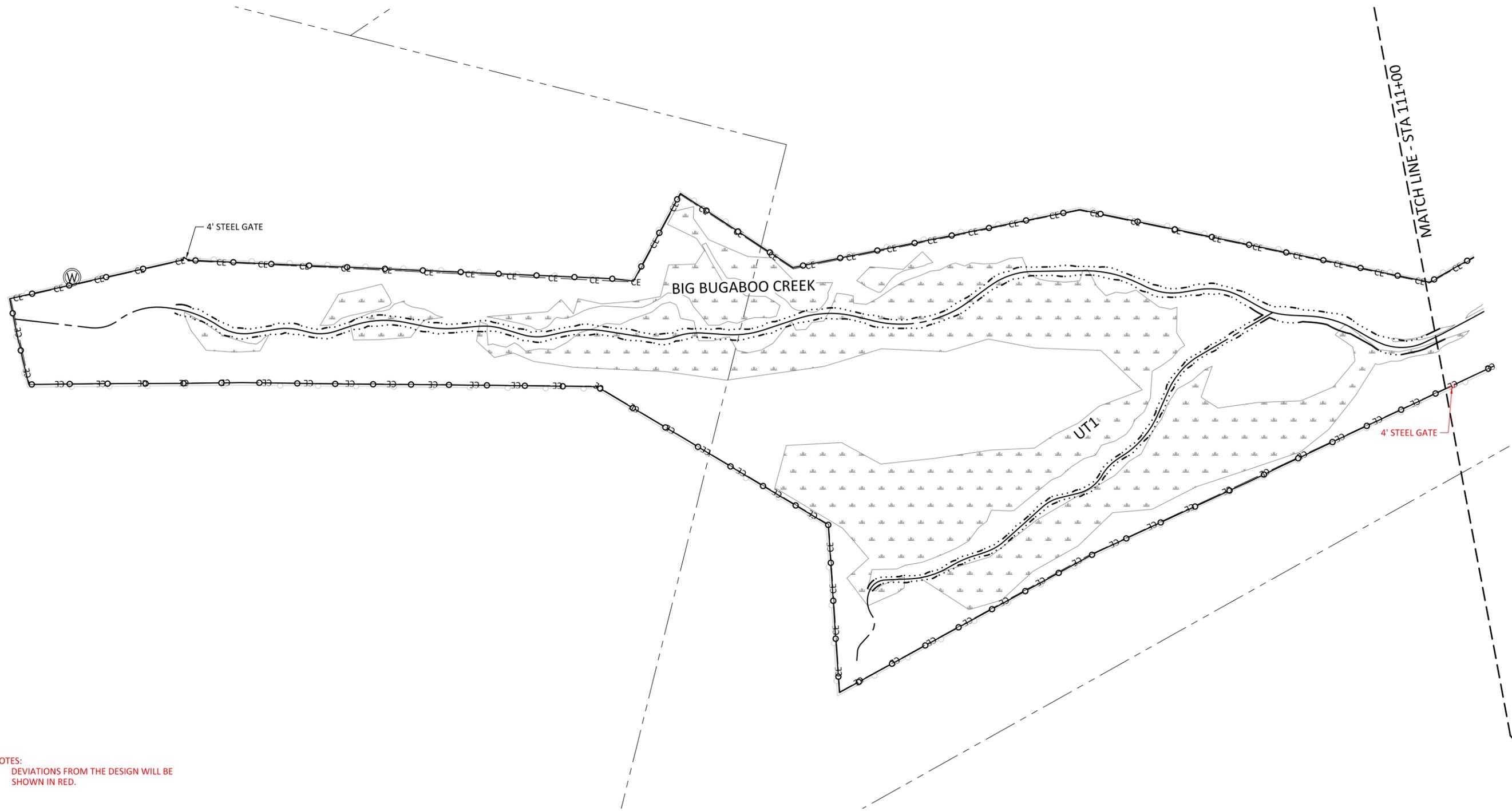


Bug Headwaters Record Drawings
Wilkes County, North Carolina
Fencing Overview
Fencing Plan

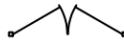
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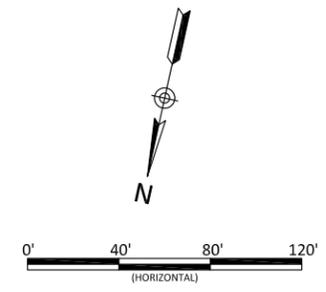
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Sheet



NOTES:
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Bug Headwaters Record Drawings
 Wilkes County, North Carolina

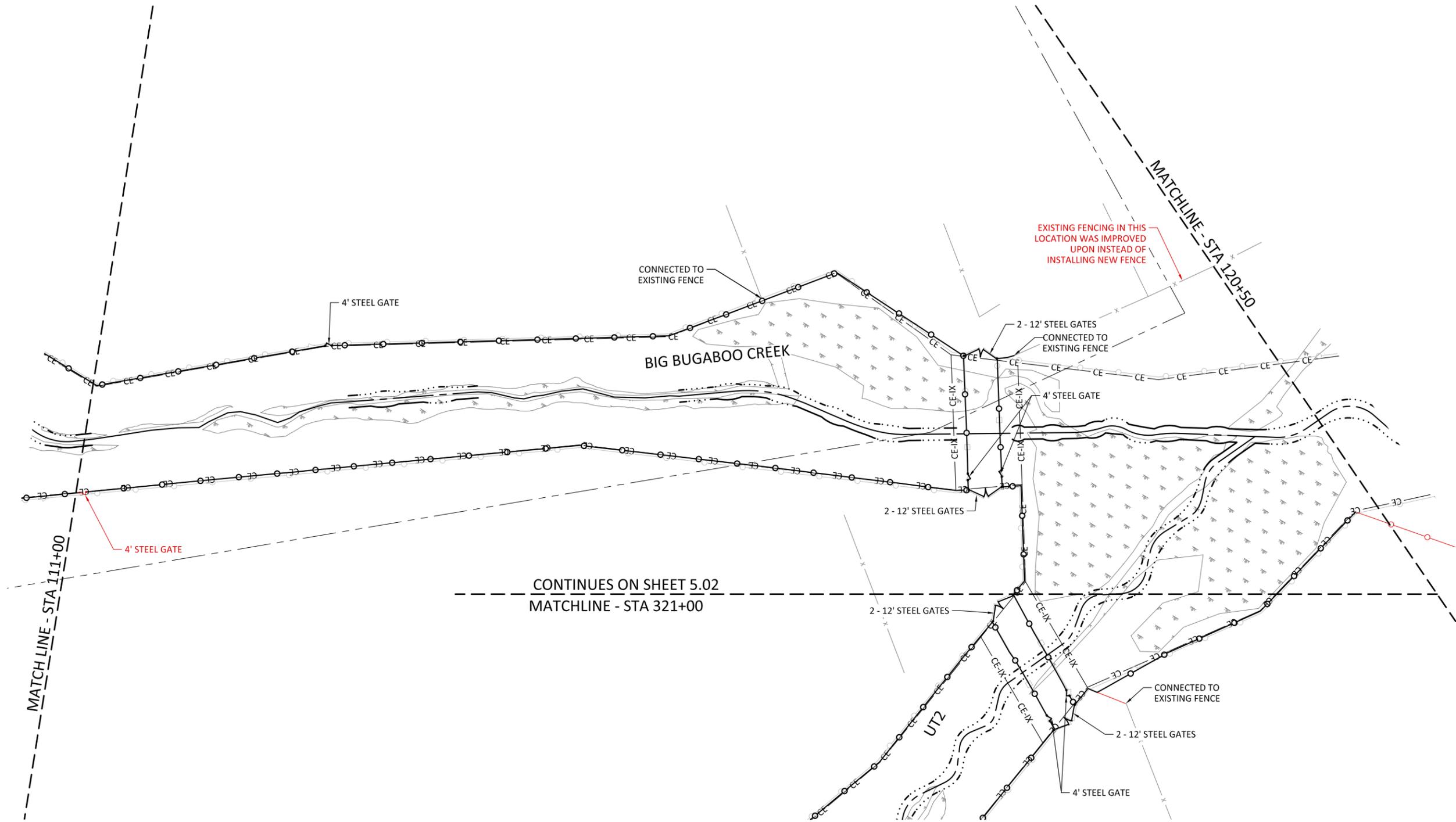
Fencing Plan

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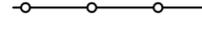
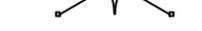
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Project Engineer:	NMM
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5.01

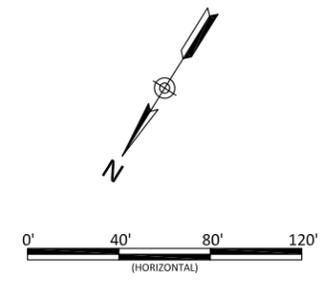




CONTINUES ON SHEET 5.02
MATCHLINE - STA 321+00

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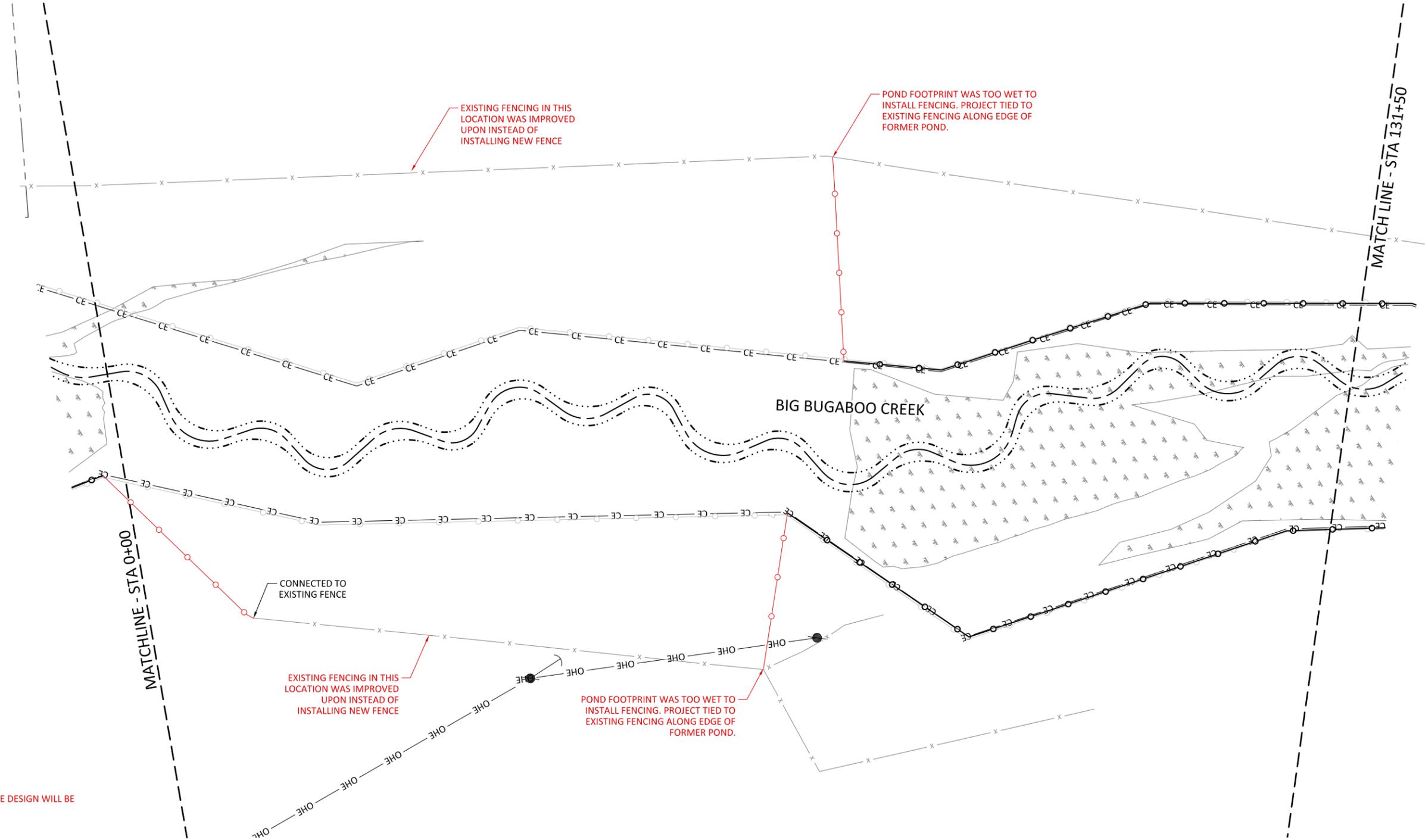
Bug Headwaters Record Drawings
Wilkes County, North Carolina

Fencing Plan

Revisions:

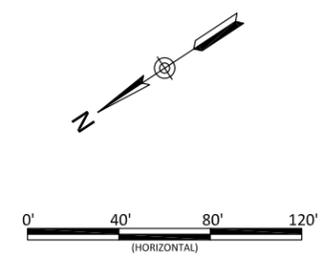
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5.02



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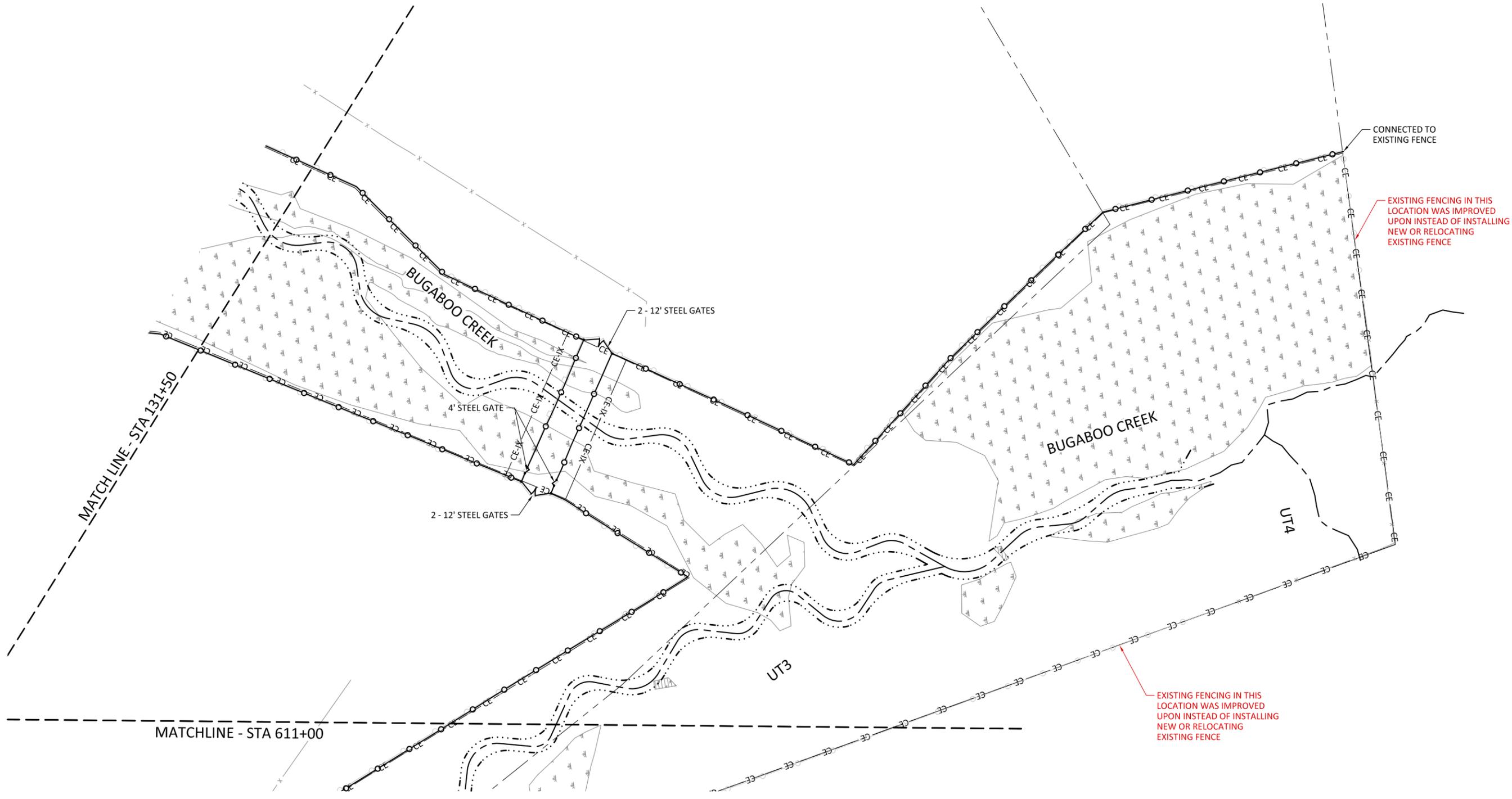
Bug Headwaters Record Drawings
 Wilkes County, North Carolina

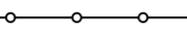
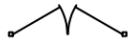
Fencing Plan

Revisions:

Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA

5.03



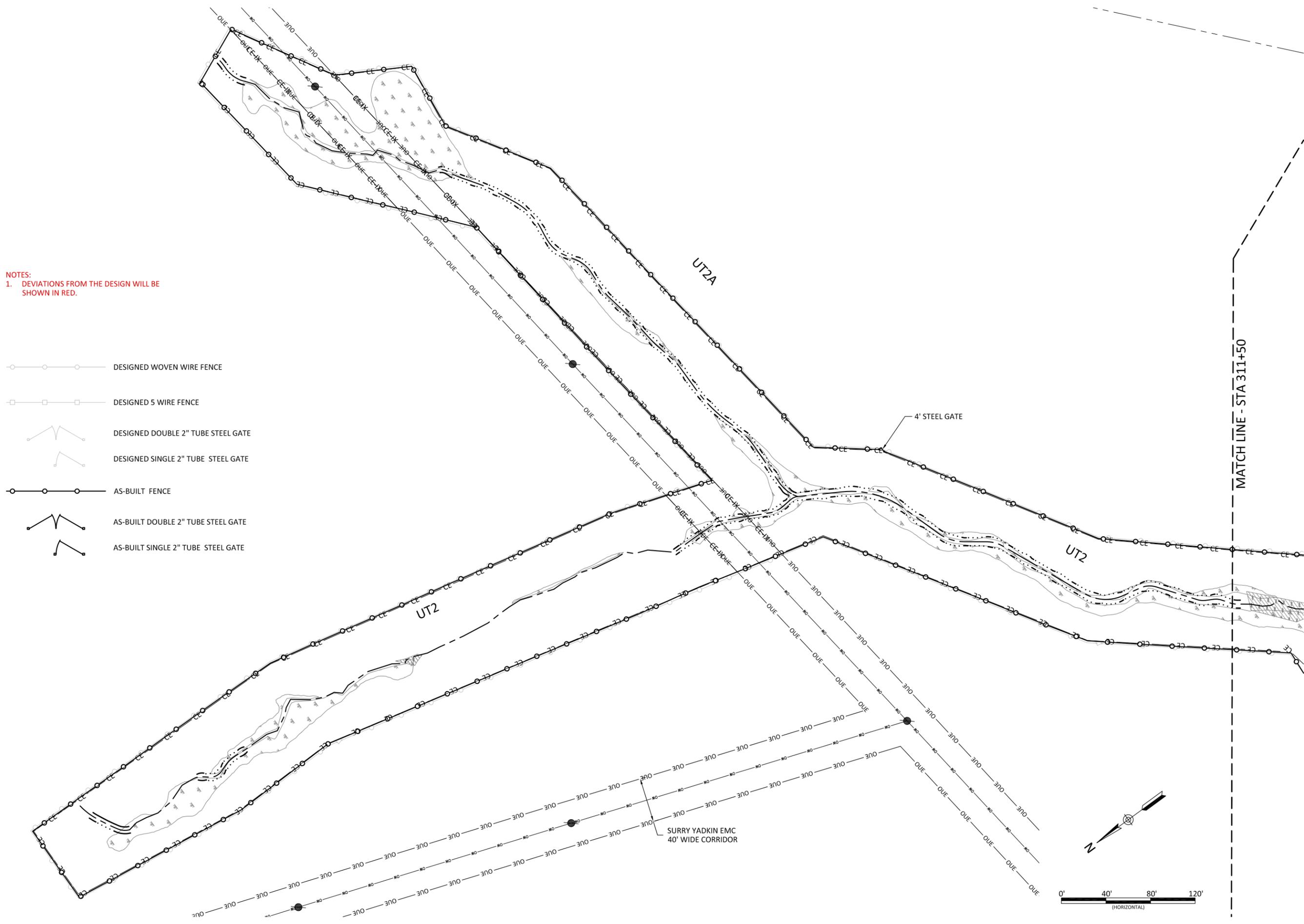
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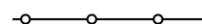
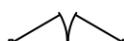


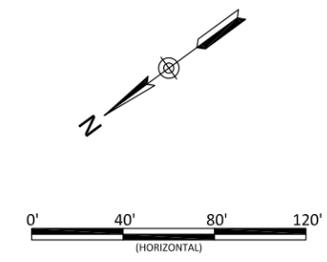
Bug Headwaters Record Drawings
 Wilkes County, North Carolina
 Fencing Plan

Revisions:



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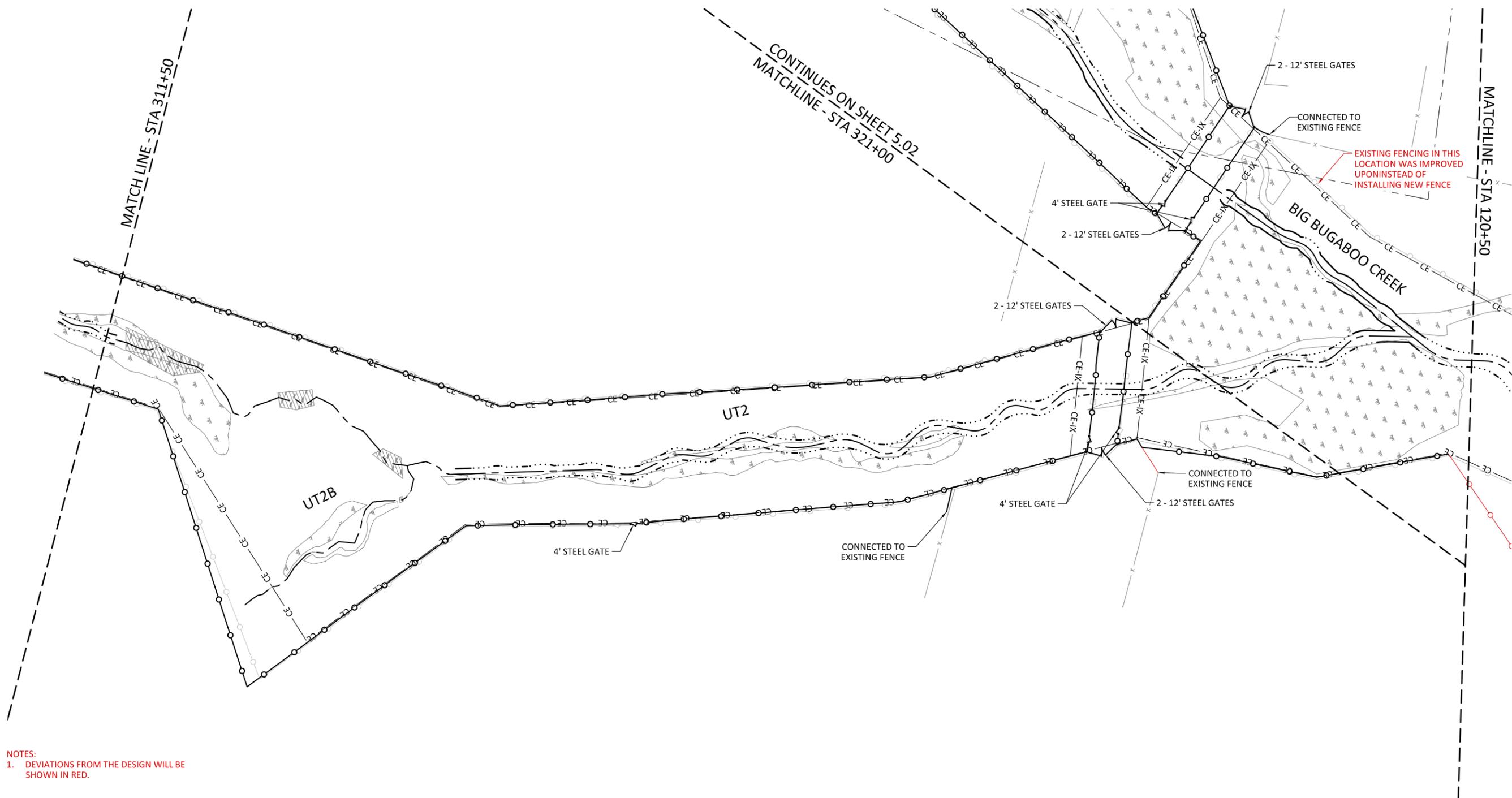
Bug Headwaters Record Drawings
 Wilkes County, North Carolina

Fencing Plan

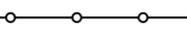
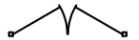
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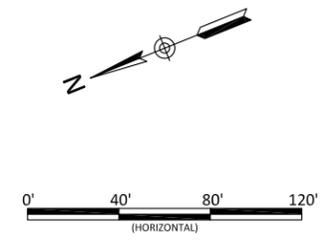
Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA

5.05



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

-  DESIGNED WOVEN WIRE FENCE
-  DESIGNED 5 WIRE FENCE
-  DESIGNED DOUBLE 2" TUBE STEEL GATE
-  DESIGNED SINGLE 2" TUBE STEEL GATE
-  AS-BUILT FENCE
-  AS-BUILT DOUBLE 2" TUBE STEEL GATE
-  AS-BUILT SINGLE 2" TUBE STEEL GATE



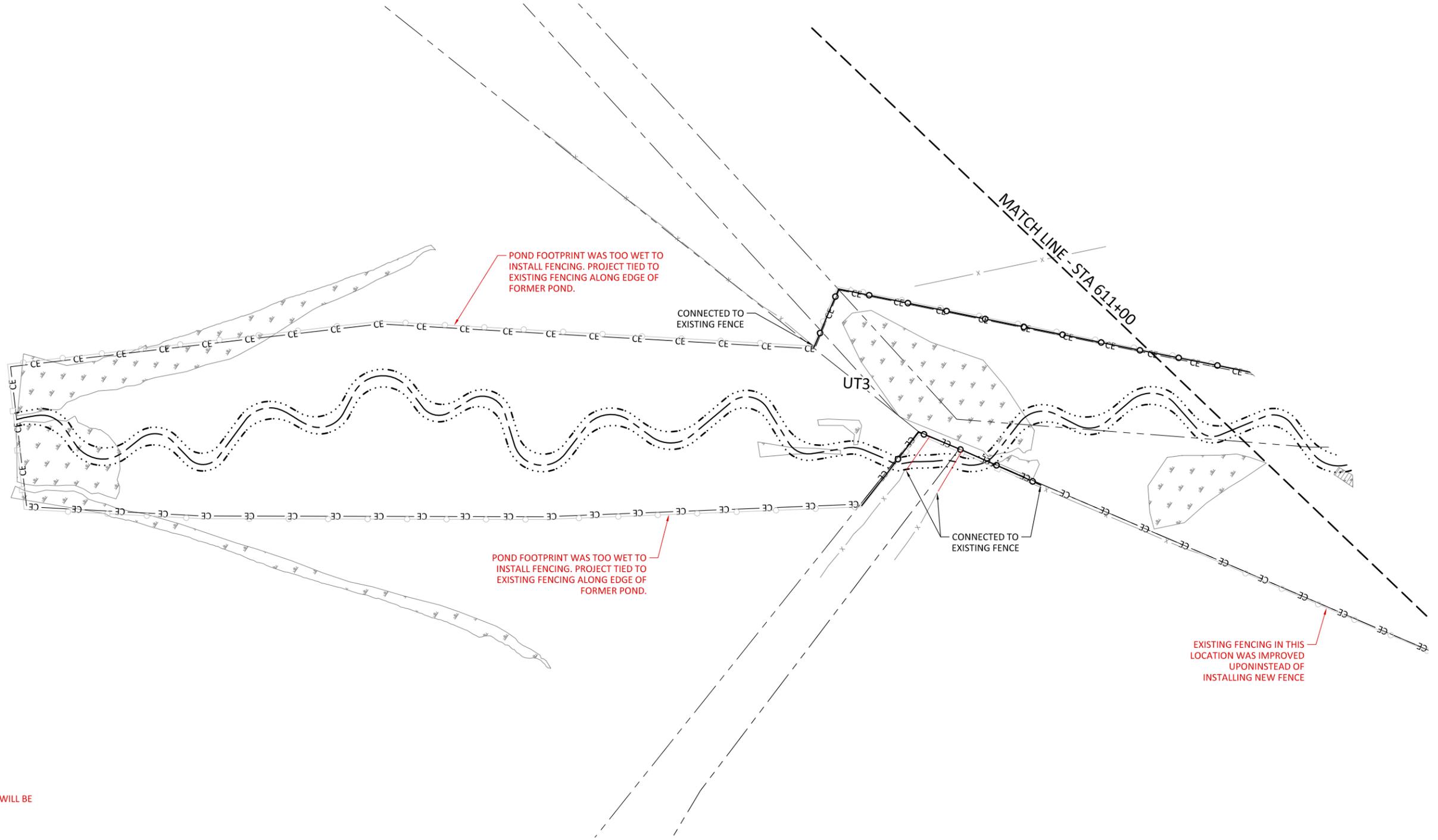
Bug Headwaters Record Drawings
 Wilkes County, North Carolina

Fencing Plan

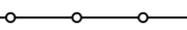
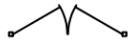
Revisions:

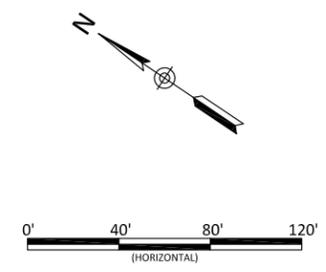
Date: 09.18.2020
 Job Number: 005-02176
 Project Engineer: NMM
 Drawn By: CAW
 Checked By: ANA

5.06



NOTES:
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