As-built Baseline Monitoring Report

FINAL

Greenbrier Stream Mitigation Project

Yadkin County, North Carolina

Monitoring Year 0

Data Collection Period: April 2020

Submission Date: July 2020

NCDEQ Contract No. 7616
DMS ID No. 100086
USACE Action ID No. SAW-2018-01755
NCDWR ID: 20181272

Prepared For:

NC Department of Environmental Quality
Division of Mitigation Services
217 West Jones Street; 3rd Floor
Raleigh, NC 27603

Prepared By:

Ecosystem Planning and Restoration
1150 SE Maynard Road, Suite 140
Cary, NC 27511

Ecosystem Planning and Restoration, LLC
1150 SE Maynard Road, Suite 140
Raleigh, NC 27511

Phone: (919) 388-0787
www.eprusa.net

Mr. Paul Wiesner
NCDEQ – Division of Mitigation Services
5 Ravencroft Dr., Suite 102
Asheville, NC 28801

July 31, 2020

RE: Response to Draft As-Built Baseline Monitoring Report (MY0) Comments dated July 24, 2020
Greenbrier Stream Mitigation Site
Yadkin River Basin – CU# 03040101 - Yadkin County, North Carolina
NCDMS Project # 100086, Contract # 7616

Dear Mr. Wiesner,

Ecosystem Planning and Restoration (EPR) has reviewed the comments on the Draft As-Built Baseline Monitoring Report provided July 24, 2020. The comments have been addressed as described below and the Final Baseline Report and electronic deliverables have been revised in response to this review.

- *Section 1.0 Project Summary: As noted in the IRT approved mitigation plan, please include the following statement in Section 1.0 Project Summary; "The Greenbrier Stream Restoration site was instituted via NCDEQ-DMS RFP # 16-007406. As approved by the NCIRT, all projects contracted under the 16-007406 RFP have a cool or warm service type. Penalties will not be assessed for using these project mitigation credits to satisfy cool or warm requirements."*
    - **The statement has been added to the first paragraph of Section 1.0 Project Summary.**

- *Table 1: The "Mitigation Plan Footage or Acreage" for UT1 R1 should be updated to 843 linear feet as documented in the IRT approved mitigation plan.*
    - **Mitigation Plan Footage for UT1 R1 has been updated to 843 linear feet in Table 1.**

- *Table 2: The project's Institution Date is 6/27/2018 (contract execution date). The project mitigation plan was finalized (IRT approved) in December 2019. Please include the data collection complete date for the as-built survey (even if it is the same as the completion date). Please include the month/s in the data collection complete date cell for the As-built Baseline Monitoring Report. Please update the As-built Baseline Monitoring Report Completion date. Please QA/QC the table and update accordingly.*
    - **Table 2 has been updated and the dates in the table have been reviewed.**

ECOSYSTEM PLANNING & RESTORATION

Ecosystem Planning and Restoration, LLC
1150 SE Maynard Road, Suite 140
Raleigh, NC 27511

Phone: (919) 388-0787
www.eprusa.net

- *Table 4: Please include the project stream's thermal regime (warm) in the table. DMS understands that this is not in the DMS template/guidance but is an important element of the project information.*
    - **The project thermal regime information has been added to Table 4.**

- *CCPV Maps: Please remove the Pre-Existing Stream layer from the CCPV sheets in the report. Please keep this layer in the electronic support files for reference and documentation. DMS understands that this layer is requested in the MY0 template/ guidance; however, it clutters the map for this project. DMS & EPR can provide the IRT with a comparison map of the existing channel and constructed channel upon request.*
    - **The Pre-Existing stream layer has been removed from the CCPV map but the shapefile is still included in the electronic support files.**

- *Table 7: In the Annual Means column, the "size (ACRES)" cell is currently 0.10. With four permanent plots, shouldn't that be 0.08? Please QA/ QC and update the table as necessary.*
    - **The size in acres of each plot is .024711 acres, which was rounded to .02 in Table 7 of the draft submission. When the area of all 4 plots was combined, it rounded to 0.10 acres. These acreages have been expanded to 6 significant figures to more accurately reflect the size of each plot.**

- *Stream Data & Cross Section Plots: Four (4) of the cross section plots appear to be mislabeled. Based on the record drawings, there are no cross sections located in reach UT1 Reach 2. Further; the cross section features (Riffle/ Pool) in Table 9 (XS 4,5, & 8) do not match what is shown on the cross section plots. As an example, Table 9 notes that Cross Section 8 is a Pool while the Cross Section 8 plot identifies it as a Riffle. Please QA/ QC and correct the cross section plots, labels, and stream data (Tables 8a-Table 10d) and confirm it is correct in the final MY0 report. The electronic support files should also be updated accordingly.*
    - **The cross section plots have been relabeled and Table 9 has been updated to match the cross section plots. The electronic support files have also been updated.**

- *Appendix E: Record Drawings: Please also provide Record Drawing planting sheets noting any planting substitutions/ deviations from the IRT approved mitigation plan's planting plan (Appendix 8 Sheets 3B, 9, and 10 in the IRT approved mitigation plan). Planting deviations and substitutions should be shown in red.*
    - **There were no planting substitutions or deviations from the IRT approved mitigation plan's planting plan. Two plan sheets have been added to the As-Built plans to show the planting plan.**

Electronic Support File Comments:

- *Please merge and attribute segments that were provided for the as-built stream features, and format these features so that each record/feature in the attribute table represents a project*

ECOSYSTEM PLANNING & RESTORATION

Ecosystem Planning and Restoration, LLC
1150 SE Maynard Road, Suite 140
Raleigh, NC 27511

Phone: (919) 388-0787
www.eprusa.net

component within the asset table. Please ensure that the feature lengths match the reported as-built footage.

- **The features in the GB_AsBuilt_Streams shapefile have been merged for each individual reach and attributes for the reach name, mitigation approach, and length in linear feet have been added for each feature. The as-built footage in Appendix A, Table 1 has been updated to match the footage for each feature in the As-Built streams shapefile.**

- *Please include the zero credit stream feature that connects creditable features (i.e. easement break that segments UT1R1). Also, please include the UT1R2 EII segment.*
  - **The zero credit stream feature at the culvert crossing on UT1 Reach 1 has been added, as well as the EII segment of UT1R2. These features can be found in the GB_AsBuilt_Streams shapefile.**

- *Please include the easement polygon feature included in Figs. 2-2B.*
  - **The conservation easement polygon has been included in the electronic submittal. The shapefile is named GB_CE.**

- *Please review and revise labeling in Figs. 2-2B, specifically for UT1R2 and UT1R3, as well as UT1A and UT1A-1.*
  - **Stream name labels in Figures 2-2B have been revised.**

- *Please provide the stand alone as-built .pdf and .dwg files with the final electronic submittal. This as-built survey should bear a Professional Land Surveyor (PLS) seal.*
  - **A .pdf and .dwg version of the as-built survey have been included in the electronic submittal Support Files, 5. As-Built Plans.**

If you have any questions regarding the As-Built Baseline Report, please contact me at 919-388-0787 or via email at ajames@eprusa.net.

Sincerely, Amy James, PWS

TABLE OF CONTENTS

TABLES

APPENDICES

1.0 PROJECT SUMMARY

Ecosystem Planning and Restoration, PLLC (EPR) implemented the Greenbrier Stream Mitigation Project (Project; Site) for the North Carolina Division of Mitigation Services (DMS) to provide 2,300 stream mitigation credits (SMCs) in the Yadkin River Basin, Hydrologic Unit Code (HUC) 03040101. The Greenbrier Stream Mitigation Project was instituted via NCDEQ-DMS RFP # 16-007406. As approved by the NCIRT, all projects contracted under the 16-007406 RFP have a cool or warm service type. Penalties will not be assessed for using these project mitigation credits to satisfy cool or warm requirements. The Project restored and enhanced 2,530 linear feet (LF) of one perennial (UT1) and three intermittent (UT1A, UT1A-1, and UT1B) unnamed tributaries (UT) to South Deep Creek within a 6.7-acre conservation easement. Mitigation assets are listed in Table 1 of Appendix A.

The Site is located in DMS targeted local watershed 03040101130020. The Site was historically utilized for agricultural and cattle practices. As such, streams and existing wetlands in the project area were adversely impacted by direct cattle access, farming activities, and stream channelization. The Site is situated on once active pastureland in a WS-III watershed that is 57% agricultural land, 33% forest, 6% developed open space, and 3% herbaceous land. Prior to construction activities, project streams were incised, straightened, and suffered from significant cattle damage. The adjacent wetlands were small, but similarly trampled, and heavily grazed. Pre-construction, or pre-existing, site conditions are provided in Table 4 of Appendix A and the Baseline Stream Data Summary Tables in Appendix D. Photos and a more detailed description of Site conditions before restoration are available in the Mitigation Plan (Final version submitted December 2019).

1.1 Goals and Objectives

The Project goals were established based on an assessment of site conditions and restoration potential with careful consideration of the stressors identified in the Upper Yadkin Pee-Dee River Basin Restoration Priorities (RBRP) report (NCEEP, 2009) and Yadkin Pee-Dee Basinwide Water Quality Plan (NCDWQ, 2008). As such, the established project goals include:

1) Reduce sediment inputs and stream turbidity;
2) Reduce nutrient inputs;
3) Reduce fecal coliform inputs;
4) Restore/enhance degraded riparian buffers;
5) Protect high resource value waters (including water supply classifications);
6) Implement agricultural best management practices (BMPs) in agricultural watersheds.

Site construction, planting, and baseline vegetation data collection were completed in April 2020 and the as-built survey was completed in May 2020. A detailed timeline of the Project activity and reporting history is provided in Table 2 of Appendix A. During construction, minor adjustments were made to the project design. All changes from the design are detailed below in Section 1.3.1. Baseline (MY0) profiles and cross-section dimensions closely match the design

parameters with little variation. The Site was built as designed and is expected to meet the upcoming monitoring year's success criteria.

The proposed streams were broken into six reaches for design purposes. UT1 consists of three reaches while each of the other three tributaries consist of one reach. The design criteria were based on surveys of multiple reference reaches conducted in the past, published reference reach data, and on design criteria and monitoring data from past successful restoration projects performed throughout the Piedmont region of North Carolina. Restoration practices involved raising the streambeds of the project streams and reconnecting them with active floodplains along the fall of the valley, thereby restoring flow dynamics and a healthy headwater stream system. Buffers in excess of 50 feet were established along most reaches.

Functional uplift will come from restoring natural riparian vegetation, excluding livestock from all project streams, and restoring the project streams to a stable condition, connected to their adjacent floodplains. The Project has restored the plan and bed form diversity to conditions similar to reference channels (Appendix D, Table 8). Functional uplift was achieved by incorporating rock and woody structures throughout the reach and by planting a forested buffer that will serve as a source of large woody debris in the future. Additionally, lateral stability was improved in the short term by removing the cattle and reducing shear stresses in the channel. As the riparian buffer continues to establish, lateral stability should improve further and increase the resiliency of the restored channels.

1.2 Mitigation Components

The current condition plan view (CCPV) in Appendix B (Figure 2) shows the mitigation assets along with the location of monitoring features. Post-construction conditions (Appendix A, Table 1) at the Site generated 2,413.48 SMCs as a result of the following:

- 2,336 linear feet of Priority 2 stream restoration
- 193.7 linear feet of Enhancement II

As illustrated in the As-Built Plan Sheets in Appendix E, the plan form of the proposed streams did not deviate significantly from the proposed design and the stream lengths are unchanged from the approved mitigation plan.

Additional construction activities performed at the Site included the following:

- Installing approximately 900 live stakes along restored and enhanced streambanks,
- Planting approximately 4,450 trees and shrubs within the easement,
- Fencing of the entire conservation easement, and
- Installing a well, multiple cattle waterers, and water lines to support these facilities.

1.3 Construction

Construction began in March 2020 and site earthwork was completed at the end of April 2020. Table 3 in Appendix A outlines the Project contacts. During construction there was at least one

bankfull, or near bankfull, discharge event. Site visits after the event documented wrack lines and recent sediment deposition on the floodplain of the newly built channel.

Deviations from the design are shown in the As-Built Plan Sheets (Appendix E) and are described in detail within this section.

1.3.1 In-Stream Work and Floodplain Grading

The As-Built Plan Sheets (Appendix E) provide a visual markup of the design to show what was installed during construction. The Site was built as designed and is expected to meet the upcoming monitoring year's success criteria. All changes from the design are detailed below.

The alignment of the constructed stream was altered slightly at the downstream end of the culvert under Collins Road to preserve a large sycamore. A small boulder toe was constructed downstream of the pipe to protect the road embankment.

The upstream end (10+00 to 10+50) of UT1A-1 was relocated slightly from the design plans to match the alignment of the existing valley. This did not result in a reduction in enhanced stream length and the step pool sequence was constructed as designed.

All woody riffles were changed to constructed stone riffles throughout the site at the direction of the engineer. Brush material was installed in each constructed riffle to provide woody material in each structure.

UT1 R1 Station 17+25: Rock step was not constructed. Due to bedrock in the channel.

UT1 R3 Station 27+75: Toe wood was added to meander bend to provide additional bank protection and large woody debris.

1.4 Site Planting

Site planting (including live stakes) was completed in April 2020. No significant changes were made to the original planting plan.

2.0 BASELINE DATA ASSESSMENT

This report establishes the baseline data that will be used to determine the success of the Greenbrier Stream Mitigation Project. The performance criteria and as-built site conditions are described in the following sections to evaluate whether the project is meeting the success criteria in subsequent monitoring years.

2.1 Performance Criteria

Project success criteria were established in accordance with the *NCDMS Mitigation Plan Template* (ver. 06/2017), and *U.S. Army Corps of Engineers – Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District* (October 24, 2016). The monitoring plan for the site will follow this guidance. Table A details the USACE success criteria that evaluate whether project goals have been met throughout the monitoring period.

Table A. USACE Mitigation Success Criteria

Restored Stream Channels
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • Continuous surface flow must be documented each year for at least 30 consecutive days, for both perennial and intermittent streams. • Bank height ratio (BHR) cannot exceed 1.2 for all measured cross sections on a given reach. • Entrenchment ratio (ER) must be above 2.2 for all measured riffle cross-sections on a given reach for C and E streams stream types and above 1.4 for B stream types. • BHR and ER should not change by more than 10% in any given year for all measured cross sections on a given reach. • Must document occurrence of at least 4 bankfull events in separate years during the monitoring period.
Riparian Vegetation
• Within planted portions of the site, a minimum of 320 stems per acre must be present at year 3; a minimum of 260 stems per acre must be present at year 4; and a minimum of 210 stems per acre must be present at year 7. • Trees must average 7 feet in height at year 5, and 10 feet in height at year 7. Certain native species, which are appropriate to plant on-site to provide a diverse vegetation community, do not typically grow to these heights in 7 years and will be excluded from the height performance standard. For this project, the excluded species is *Quercus nigra* (water oak). • Planted and volunteer stems are counted, provided they are included in the approved planting list for the site. • Any single species can only account for 50% of the required stems per monitoring plot.

2.2 Stream Monitoring

Stream monitoring will include monitoring of the hydrologic and geomorphic functions of UT1, UT1A, and UT1B. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table B. These monitoring parameters follow USACE guidance but will also allow for monitoring of other parameters to document site performance related to the project goals listed in Section 1.1. The locations of the established monitoring cross sections are shown in Figure 2 (Appendix B).

Table B. Stream Monitoring Summary

Parameter	Method	Schedule/ Frequency	Number/ Extent
Stream Profile	Full longitudinal survey	As-built only (unless otherwise required)	All restored and enhanced stream channels
Stream Dimension	Cross sections	Years 1, 2, 3, 5, and 7	UT1 – 6 (3 riffle/3 pool) UT1A – 1 (riffle) UT1B – 1 (riffle)
Channel Stability	Visual Assessment	Yearly	All restored stream channels
	Additional Cross sections	Yearly	Only if instability is documented during monitoring
Stream Hydrology	Pressure transducers Precipitation recorder Photos of flood indicators	Continuous recording through monitoring period	UT1 – 1 UT1A – 1 UT1B - 1
OHWM	Visual assessment and documentation of indicators outlined in RGL 05-05	Yearly	All restored stream channels

2.2.1 Stream Profile

A full longitudinal profile was surveyed for the entire length of the restored streams in May 2020 to document as-built conditions. This survey is tied to a permanent benchmark and includes thalweg, right bank, and left bank features. Profile measurements were taken at the head of each feature (e.g. riffle, pool) and at the max depth of pools. The locations of in-stream structures and cross-sections are shown on the profile plot as well, which is included in Appendix D.

The surveyed longitudinal profile shows that the constructed bedform features are consistent with the reference and design criteria. Table 8 in Appendix D summarizes the measured profile data. The longitudinal profile will not be surveyed in subsequent years unless vertical channel instability has been observed during monitoring and remedial actions or repairs are needed.

2.2.2 Stream Dimension

Eight (8) permanent cross sections were installed across the site; 6 on UT1 and 1 each on UT1A and UT1B. Five (5) cross sections were installed in riffles and 3 were installed in pools. Each cross-section was marked using a length of rebar and steel t-posts on both streambanks. The location and elevation of each pin was recorded to facilitate data comparison from year to year. Cross-sections will be surveyed in Monitoring Years 1, 2, 3, 5, and 7 and reported data will include measurements of Bank Height Ratio (BHR) and Entrenchment Ratio (ER). Reference

photos will be taken of both streambanks every year to provide a visual assessment of any changes that may occur.

The surveyed cross-sections indicate that the as-built stream dimensions are consistent with the reference and design criteria. The cross-section plots, photos, and data summary (Tables 8, 9, and 10) are included in Appendix D. These tables will be updated in subsequent monitoring years to facilitate comparison between monitoring years. There should be little change in the channel dimension data over the monitoring period, but if changes do take place they will be documented and evaluated to determine if they indicate a shift toward stability (potentially represented by settling, vegetative changes, or deposition on top of stream banks) or instability (represented by erosion and down-cutting). Any unstable areas will be assessed to determine whether they are systemic and whether repairs are needed.

2.2.3 Channel Stability

Channel stability will be assessed on a yearly basis using photographs to visually document the condition of the restored project streams. Photographs will be taken from the same location in the same direction each year. Sixteen (16) photo points were established during baseline monitoring and are shown in the CCPV (Figure 2) and As-Built Plan Sheets (Appendix E).

Visual assessments of channel stability will also be made regularly throughout the monitoring year. Any potential issues with the site will be documented, photographed, and reported in the yearly monitoring report. Additional cross-sections will only be surveyed if instability is documented during monitoring.

2.2.4 Stream Hydrology

Three (3) pressure transducers were installed in UT1, UT1A, and UT1B to document stream flow and the occurrence of bankfull events within the monitoring period. The locations of these gauges are shown in the CCPV (Figure 2 in Appendix B) and As-Built Plan Sheets (Appendix E). All three gauges were installed in the downstream end of pools. The constructed bankfull elevation at each gauge was recorded. This elevation will be compared with the gauge readings to determine whether a bankfull event has occurred. Photos will be taken of flood indicators such as debris lines and sediment deposition on the floodplain whenever it is apparent that a bankfull event has occurred.

This Project will utilize a tipping bucket rain gauge installed at another EPR-completed stream restoration approximately 0.75 miles to the southeast (Meadowbrook, DMS project no. 100024) to accurately document rainfall at the Site. The rainfall data will be compared to the flow gauge data to verify that high flows at the Site are correlated with rainfall events. The monitoring gauges will be downloaded regularly throughout each monitoring year and data will be presented in the annual monitoring reports.

2.3 Riparian Vegetation

Riparian vegetation monitoring will evaluate the establishment of planted and volunteer vegetation across the site. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table C. These monitoring parameters follow USACE guidance but will also allow for monitoring of other parameters to document site performance related to the project goals listed in Section 1.1.

Table C. Riparian Vegetation Monitoring Summary

Parameter	Method	Schedule/ Frequency	Number/ Extent	Data Collected
Vegetation establishment and vigor	Permanent vegetation plots, 0.02 acre in size (minimum)	Between July 1st and leaf drop. As-built, Years 1, 2, 3, 5, and 7	4 plots, spread across site	Species, height, location, planted vs. volunteer, and age.
	Annual random vegetation plots, 0.02 acre in size (minimum)	Between July 1st and leaf drop. Years 1, 2, 3, 5, and 7	2 plots, randomly selected each year	Species, and height.

2.3.1 Baseline Vegetation Monitoring

Baseline vegetation monitoring occurred in April 2020, soon after site planting was completed. Final vegetation plot location did not vary significantly from the locations suggested in the mitigation plan. The corners of the permanent vegetation plots were marked using steel t-posts and the location of each plot was surveyed during the as-built survey. The individual trees within each permanent plot were tagged to facilitate monitoring efforts in future years, though due to the time of year, short time span from planting, and general stem size/characteristics, species identification could not be completed for the Baseline Report. The planted stems were counted and measured during baseline monitoring. Species data will be collected during Monitoring Year 1. In subsequent monitoring years, the location of the temporary random vegetation plots will be recorded using GPS and species and height data will be collected.

Planted stems per plot ranged from 15 to 19, or 607 to 769 stems per acre. The locations of the 4 permanent vegetation plots are shown in the CCPV (Figure 2).

3.0 REFERENCES

North Carolina Ecosystem Enhancement Program. 2009. Upper Yadkin Pee-Dee River Basin Restoration Priorities.

North Carolina Department of Environmental Quality, Division of Mitigation Services. 2017. As-built Baseline Monitoring Report Format, Data, and Content Requirement June 2017.

North Carolina Division of Water Quality. 2008. Yadkin Pee-Dee Basinwide Water Quality Plan.

U.S. Army Corps of Engineers. 2016. Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District.

Appendix A

Project Information Tables

Table 1. Project Mitigation Components

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Baseline Information and Attributes

Table 1. Project Mitigation Components
Greenbrier Stream Mitigation Project (NCDMS Project No. 100086)

Project Component (reach ID, etc.)[1]	Wetland Position and HydroType[2]	Existing Footage or Acreage	Stationing	Mitigation Plan Footage or Acreage	As-Built Footage or Acreage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
UT1 Reach 1		926	10+06 - 18+79	843.00	852.00	R	P2	1	843.00	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
UT1 Reach 2		40	18+79 - 19+19	40.00	40.00	E2	E2	2.5	16.00	Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement
UT1 Reach 3		992	19+19 - 30+16	1097.00	1141.00	R	P1, P2	1	1097.00	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
UT1A-1		154	10+00 - 11+54	153.70	145.00	E2	E2	2.5	61.48	Grade Control/Habitat Structures, Benching, Exclusion of Livestock, and Permanent Conservation Easement.
UT1A		115	11+54 - 13+02	148.50	153.00	R	P2	1	148.50	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
UT1B		195	10+00 - 12+48	247.50	228.00	R	P2	1	247.50	
								Total Assets Summary:	**2,413.48**	

Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)
		Riverine	Non-Riverine	
Restoration	2,336			
Enhancement				
Enhancement I				
Enhancement II	193.7			
Rehabilitation				
Preservation				
High Quality Pres				

Overall Assets Summary

Asset Category	Overall Credits
Stream	**2,413.48**

Table 2. Project Activity and Reporting History
Greenbrier Stream Mitigation Project (NCDMS Project No. 100086)

Elapsed Time Since grading complete: **0 yrs 0 months**
Elapsed Time Since planting complete: **0 yrs 0 months**
Number of reporting Years[1]: **0**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Institution Date	--	Jun-18
404 permit date	--	Feb-20
Final Mitigation Plan	2018 - 2019	Dec-19
Final Design – Construction Plans	--	Feb-20
Site Earthwork	March - April 2020	Apr-20
Bare-root plantings	--	Apr-20
As-built Survey	Jun-20	Jun-20
As-built Baseline Monitoring Report	May-20	Jul-20
Year 1 Monitoring	2020	Nov-20
Year 2 Monitoring	2021	Nov-21
Year 3 Monitoring	2022	Nov-22
Year 4 Monitoring	2023	Nov-23
Year 5 Monitoring	2024	Nov-24
Year 6 Monitoring	2025	Nov-25
Year 7 Monitoring	2026	Nov-26

1 = The number of reports or data points produced excluding the baseline

Table 3. Project Contacts Table
Greenbrier Stream Mitigation Project (NCDMS Project No. 100086)

Designer Primary project design POC	Ecosystem Planning and Restoration, PLLC 1150 SE Maynard Road, Suite 140, Cary, NC 27511 Kevin Tweedy, PE (919) 388-0787
Construction Contractor Construction contractor POC	North State Environmental 2889 Lowery St, Winston-Salem, NC 27101 Darrell Westmoreland
Survey Contractor Survey contractor POC	Kinder Land Surveying 203 W. Lebanon St., Mount Airy, NC 27030 Frank Kinder (336) 783-4200
Planting Contractor Planting contractor POC	North State Environmental 2889 Lowery St, Winston-Salem, NC 27101 Darrell Westmoreland
Seeding Contractor Contractor POC	North State Environmental 2889 Lowery St, Winston-Salem, NC 27101 Darrell Westmoreland
Seed Mix Source	Green Resource, Colfax, NC 336-855-6363
Nursery Stock Supplier	Dykes and Son Nursery, McMinnville, TN 931-668-8833
Live Stake Supplier	Foggy Mountain Nursery, Lansing, NC 336-384-5323
Monitoring Performers	Ecosystem Planning and Restoration, PLLC
Stream Monitoring POC	Jake Byers, EPR (828) 348-8580
Vegetation Monitoring POC	Amy James, EPR (919) 388-0787

Table 4. Project Baseline Information and Attributes
Greenbrier Stream Mitigation Project (NCDMS Project No. 100086)

Project Background Information				
Project Name	Greenbrier Stream Restoration Project			
County	Yadkin			
Project Area (acres)	6.7			
Project Coordinates (latitude and longitude)	latitude 36 deg 8' 54" N, longitude 80 deg 49' 46" W			
Planted Acreage (Acres of Woody Stems Planted)	6.3			
Project Watershed Summary Information				
Physiographic Province	Piedmont			
River Basin	Yadkin Pee-Dee			
USGS Hydrologic Unit 8-digit	03040101	USGS Hydrologic Unit 14-digit	3040101130020	
Project Drainage Area (Acres and Square Miles)	85 acres/ 0.13 Sq.Mi. (Total)			
Project Stream Thermal Regime	Warm			
Project Drainage Area Percentage of Impervious Area	<1%			
CGIA Land Use Classification	Agriculture/Pasture 49%, Forest 42%, 8% Residential/Developed			

Reach Summary Information				
Parameters	**UT1**	**UT1A-1**	**UT1A**	**UT1B**
Length of reach (linear feet)	1958	154	115	195
Valley confinement (Confined, moderately confined, unconfined)	Moderately confined	Unconfined	Unconfined	Unconfined
Drainage area (Acres and Square Miles)	0.13 Sq.Mi., 85 Ac	0.01 Sq.Mi., 8 Ac	0.01 Sq.Mi., 8 Ac	0.02 Sq.Mi., 10 Ac
Perennial, Intermittent, Ephemeral	Perennial (37)	Intermittent (24.5)	Intermittent (25)	Intermittent (21.5)
NCDWR Water Quality Classification	WS-III	WS-III	WS-III	WS-III
Stream Classification (existing)	B4c/B4	B4	F4	G4
Stream Classification (proposed)	B4/C4	B4	B4	B4
Evolutionary trend (Simon)	IV	III	IV	III
FEMA classification	X	X	X	X

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	USACE NWP 27 - ID# SAW-2018-01755
Water of the United States - Section 401	Yes	Yes	DWR 401 WQC No. 4134 -- ID # 20181272
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	General Permit NCG010000 - ID # YADKI-2020-010
Endangered Species Act	No	Yes	Categorical Exclusion Document; Appendix 6 in Mitigation Plan
Historic Preservation Act	No	Yes	
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

Appendix B

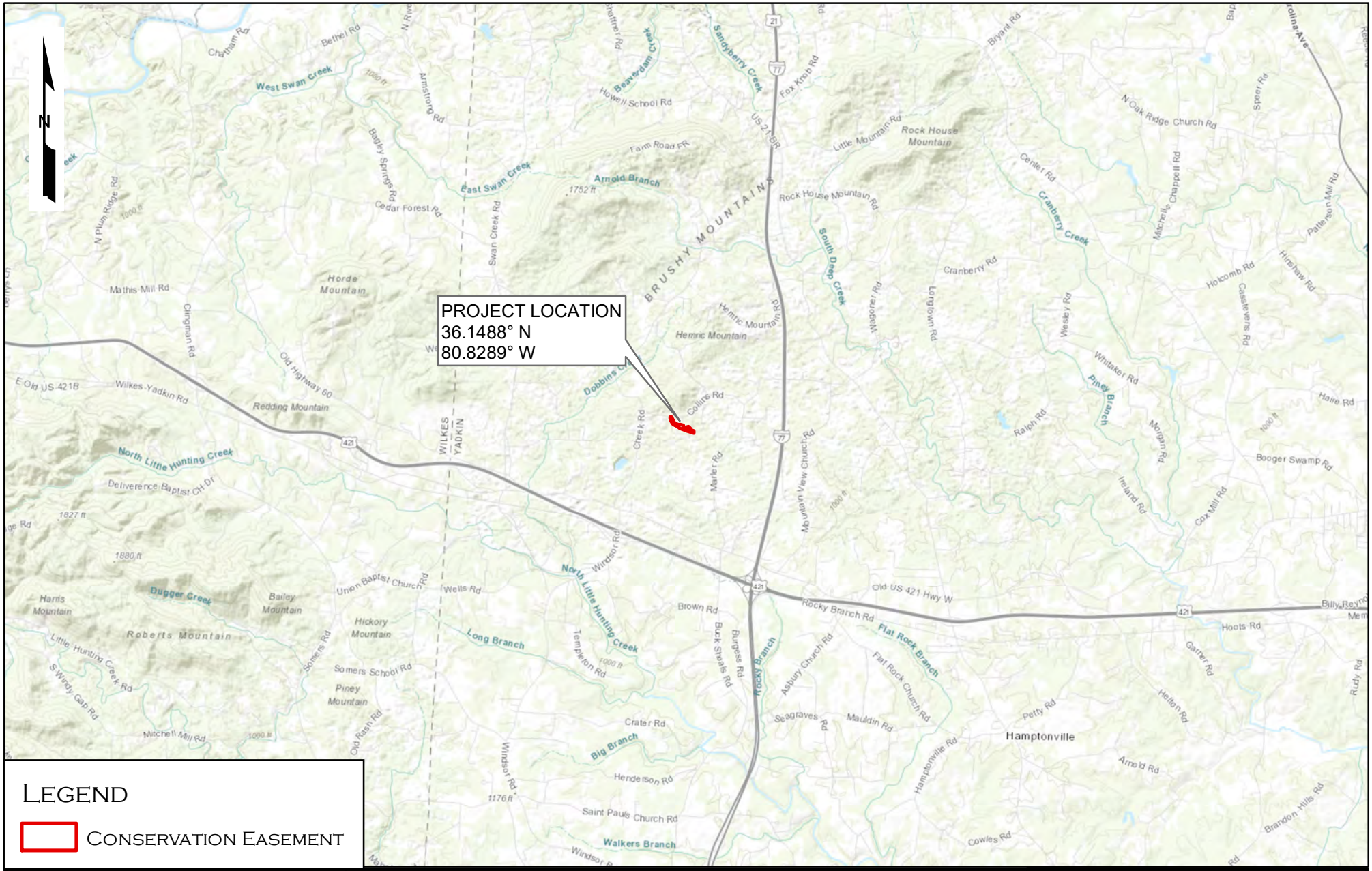
Visual Assessment Exhibits and Guidance

Figure 1. Vicinity Map

Figure 2. Current Condition Plan View

Baseline Photo Log

Vegetation Photo Log



LEGEND

Conservation Easement

0 1 2 Miles

GREENBRIER STREAM RESTORATION

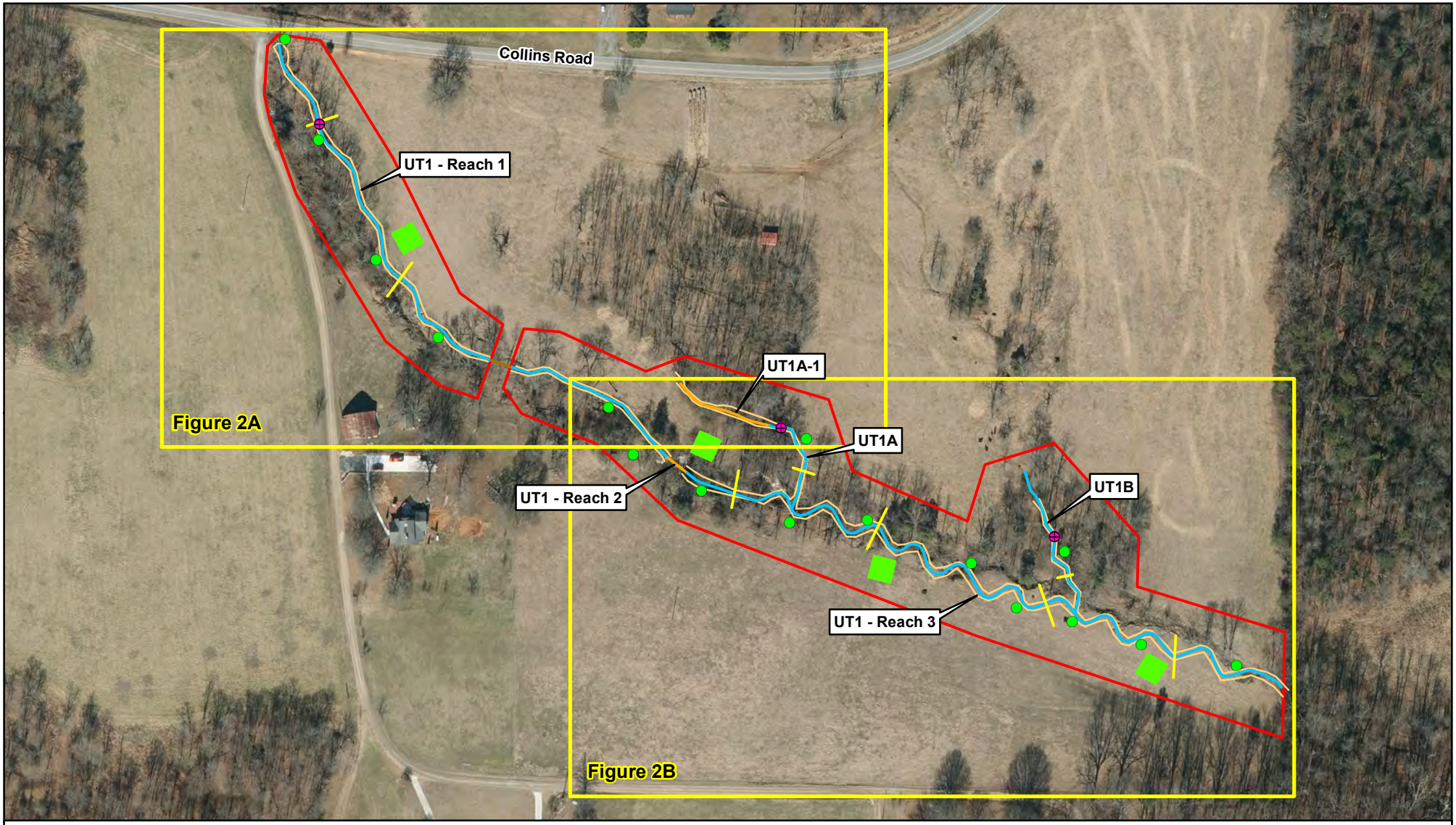
VICINITY MAP

PREPARED FOR:
NCDEQ
DIVISION OF
MITIGATION SERVICES

FIGURE 1

YADKIN COUNTY, NC

PREPARED BY:
ECOSYSTEM
PLANNING &
RESTORATION



Streams - Restoration
Streams - Enhancement
No Credit
Conservation Easement
Top of Bank
Photo Points
Stream Gauges
Cross Sections
Veg Plots

NC OneMap Orthoimagery (2018)

0 100 200 Feet

1 inch = 200 feet

N

GREENBRIER STREAM RESTORATION SITE

CURRENT CONDITION PLAN VIEW: OVERVIEW MAP

MY0: 2020

DMS PROJECT ID# 100086

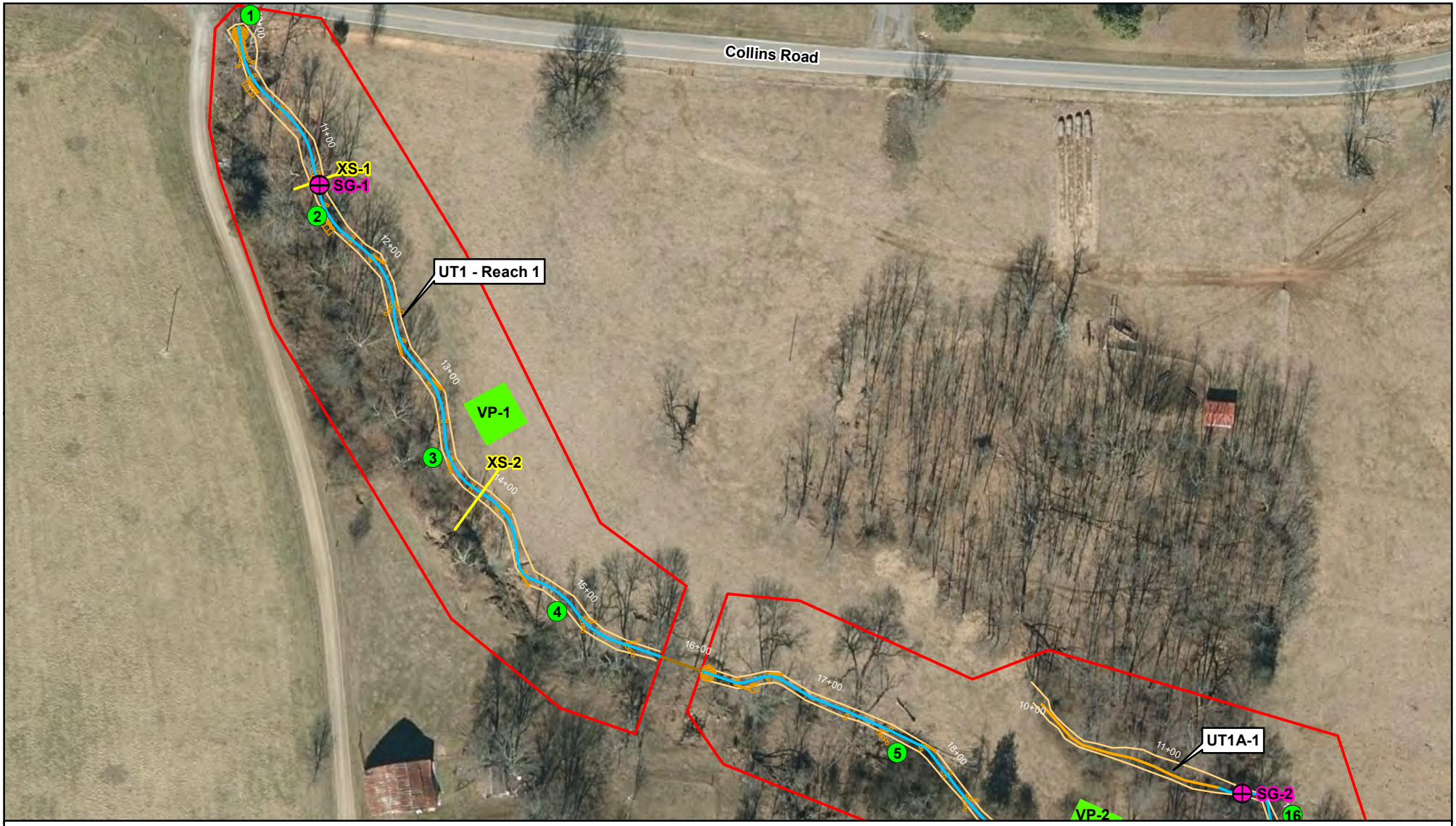
JULY 2020

FIGURE 2

YADKIN COUNTY, NC

NC Mitigation Services

ECOSYSTEM PLANNING & RESTORATION



Streams - Restoration
Streams - Enhancement
No Credit
Conservation Easement
Structures
Top of Bank
Photo Points
Stream Gauges
Cross Sections
Veg Plots

NC OneMap Orthoimagery (2018)

0 100 Feet

1 inch = 100 feet

N

GREENBRIER STREAM RESTORATION SITE

CURRENT CONDITION PLAN VIEW: ASSET MAP

MY0: 2020

DMS PROJECT ID# 100086

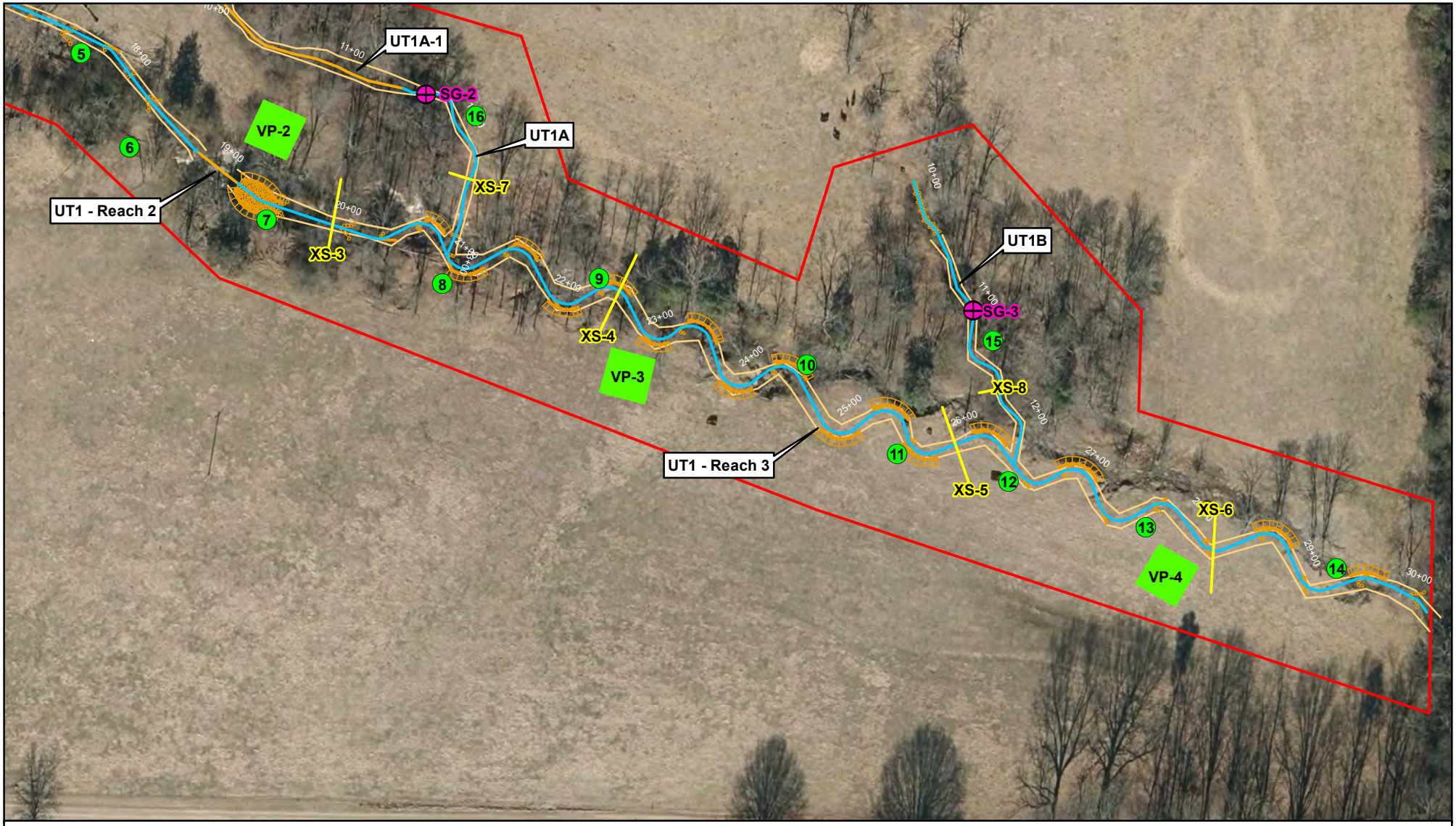
JULY 2020

FIGURE 2A

YADKIN COUNTY, NC

NC Mitigation Services

ECOSYSTEM PLANNING & RESTORATION



Streams - Restoration
Streams - Enhancement
No Credit
Conservation Easement
Structures
Top of Bank
Photo Points
Stream Gauges
Cross Sections
Veg Plots

NC OneMap Orthoimagery (2018)

0 100 Feet
1 inch = 100 feet

N

GREENBRIER STREAM RESTORATION SITE

CURRENT CONDITION PLAN VIEW: ASSET MAP

MY0: 2020

DMS PROJECT ID# 100086

JULY 2020

FIGURE 2B

YADKIN COUNTY, NC

Mitigation Services

Ecosystem Planning & Restoration

Greenbrier Stream Mitigation Project
Baseline (April 2020) - Photo Log

Photo Point 1 – UT1 Reach 1, Sta. 10+00
Facing Downstream (4/29/2020)

Photo Point 2 – UT1 Reach 1, Sta. 11+50
Facing Upstream (4/29/2020)

Photo Point 3 – UT1 Reach 1, Sta. 13+55
Facing Downstream (4/29/2020)

Photo Point 4 – UT1 Reach 1, Sta. 15+00
Facing Downstream (4/29/2020)

Photo Point 5 – UT1 Reach 1, Sta. 17+60
Facing Upstream (4/29/2020)

Photo Point 6 – UT1 Reach 1, Sta. 18+50
Facing Downstream (4/29/2020)

ECOSYSTEM PLANNING & RESTORATION

Greenbrier Stream Mitigation Project
Baseline - Photo Log

Photo Point 7 – UT1 Reach 3, Sta. 19+60
Facing Upstream (4/29/2020)

Photo Point 8 – UT1 Reach 3, Sta. 21+00
Looking Upstream at UT1A From UT1 (4/29/2020)

Photo Point 9 – UT1 Reach 3, Sta. 22+40
Facing Downstream (4/29/2020)

Photo Point 10 – UT1 Reach 3, Sta. 24+30
Facing Upstream (4/29/2020)

Photo Point 11 – UT1 Reach 3, Sta. 25+55
Facing Downstream (4/29/2020)

Photo Point 12 – UT1 Reach 3, Sta. 26+45
Looking Upstream at UT1B From UT1 (4/29/2020)

Greenbrier Stream Mitigation Project
Baseline - Photo Log

Photo Point 13 – UT1 Reach 3, Sta. 27+55
Facing Upstream (4/29/2020)

Photo Point 14 – UT1 Reach 3, Sta. 29+45
Facing Downstream (4/29/2020)

Photo Point 15A – UT1B, Sta. 11+90
Facing Downstream (4/29/2020)

Photo Point 15B – UT1B, Sta. 11+90
Facing Upstream (4/29/2020)

Photo Point 16 – UT1A, Sta. 12+00
Facing Downstream (4/29/2020)

Photo Point 16B – UT1A, Sta. 12+00
Facing Upstream Towards UT1A-1 (4/29/2020)

Greenbrier Stream Mitigation Project
Vegetation Photo Log

Veg Plot 1 – NE Corner (4/29/2020)

Veg Plot 2 – NW Corner (4/29/2020)

Veg Plot 3 – NW Corner (4/29/2020)

Veg Plot 4 – NW Corner (4/29/2020)

Appendix C

Vegetation Plot Data

Table 5. Vegetation Planting Information

Table 6. Riparian Buffer Vegetation Totals

Table 7. Stem Count By Plot

Table 5. Vegetation Planting Information
Greenbrier Stream Mitigation Project (DMS No.100086)

Livestake Planting (1.5 acres)			
Scientific Name	**Common Name**	**% by Species**	**Approx. Stem Count**
Sambucus canadensis	Elderberry	10%	92
Cornus amonum	Silky Dogwood	40%	367
Salix sericea	Silky Willow	30%	275
Salix nigra	Black Willow	20%	184
	Total	100%	918

Trees (75%) Planted 9' X 9' Spacing – 538 Trees/ Acre				
Scientific Name	**Common Name**	**% by Species**	**Approx. Stem Count**	**Wetland Indicator Status**
Betula nigra	River Birch	20%	682	FACW
Platanus occidentalis	Sycamore	20%	682	FACW
Quercus nigra	Water Oak	10%	341	FAC
Ulmus americana	American Elm	10%	341	FACW
Diospryos virginiana	Persimmon	10%	341	FAC
Quercus phellos	Willow Oak	10%	341	FAC
Liriodendron tulipifera	Tulip Poplar	20%	682	FAC
	Total	100%	3411	

Shrubs (25%) Planted 16' X 16' Spacing - 164 Shrubs/ Acre				
Scientific Name	**Common Name**	**% by Species**	**Approx. Stem Count**	**Wetland Indicator Status**
Alnus serrulata	Tag Alder	20%	208	FACW
Lindera benzoin	Spicebush	25%	260	FACW
Cercis canadensis	Redbud	20%	208	FACU
Sambucus canadensis	Elderberry	15%	156	FAC
Cornus amomum	Silky Dogwood	20%	208	FACW
	Total	100%	1040	

Table 6. Riparian Buffer Vegetation Totals

Plot #	Total Stems per Acre	Success Criteria Met?
1	728	Yes
2	607	Yes
3	769	Yes
4	688	Yes
Project Avg	698	Yes

Table 7. Stem Count By Plot
Greenbrier Stream Mitigation Project (DMS No.100086)

Scientific Name	Common Name	Species Type	Current Plot Data (MY0 2020)												Annual Means		
			VP-1			VP-2			VP-3			VP-4			MY0 (2020)		
			Planted	Vol	Total	Planted	Vol	Total	Planted	Vol	Total	Planted	Vol	Total	Planted	Vol	Total
Betula nigra	River Birch	Tree															
Platanus occidentalis	Sycamore	Tree															
Quercus nigra	Water Oak	Tree															
Ulmus americana	American Elm	Tree															
Diospryos virginiana	Persimmon	Tree															
Quercus phellos	Willow Oak	Tree															
Liriodendron tulipifera	Tulip Poplar	Tree															
Alnus serrulata	Tag Alder	Shrub															
Lindera benzoin	Spicebush	Shrub															
Cercis canadensis	Redbud	Shrub															
Sambucus canadensis	Elderberry	Shrub															
Cornus amomum	Silky Dogwood	Shrub															
Initial count of bare root planted stems, species TBD			18		18	15		15	19		19	17		17	69		69
		Stem count	18	0	18	15	0	15	19	0	19	17	0	17	69	0	69
		size (ares)	1			1			1			1			1		
		size (ACRES)	0.024711			0.024711			0.024711			0.024711			0.098844		
		Species count	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
		Stems per ACRE	728	0	728	607	0	607	769	0	769	688	0	688	698	0	698

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%
- Volunteer Species Included in Total

Appendix D

Stream Geomorphology

Table 8. Baseline Stream Data Summary

Table 9. Monitoring Data – Dimensional Morphology Summary

Table 10. Monitoring Data – Stream Reach Data Summary

Longitudinal Profile Plot

Cross Section Plots

Table 8a. Baseline Stream Data Summary
Greenbrier Stream Mitigation Project (DMS No. 100086) - UT1 Reach 1 (843 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	2.6	12	6.2	4.3	4.8	4.8	5.3	0.7	2	3.26	6.2	-	6.6	-	-	5.7	6.2	6.7	-	5.9	-	-	-	1
Floodprone Width (ft)				20.0	26.5	26.5	33.0	9.2	2	8.7	11.2	-	13.7	-	-	25.0	35.0	45.0	-	>59.7	-	-	-	1
Bankfull Mean Depth (ft)	0.4	1.4	0.5	0.5	0.6	0.6	0.8	0.2	2	0.5	0.6	-	0.6	-	-	0.4	0.5	0.6	-	0.7	-	-	-	1
[1]Bankfull Max Depth (ft)				0.7	0.9	0.9	1.1	0.2	2	0.7	0.7	-	0.8	-	-	0.5	0.6	0.7	-	1.2	-	-	-	1
Bankfull Cross Sectional Area (ft^2)	1.8	8	3.1	2.6	2.9	2.9	3.3	0.5	2	2.3	2.7	-	3.2	-	-	2.7	3.0	3.3	-	4.0	-	-	-	1
Width/Depth Ratio				5.6	8.4	8.4	11.1	3.9	2	12.0	15.0	-	18	-	-	11.0	13.0	15.0	-	8.8	-	-	-	1
Entrenchment Ratio				1.6	1.7	1.7	1.9	0.2	2	1.4	1.8	-	2.2	-	-	4.0	5.7	7.3	-	>10.1	-	-	-	1
[1]Bank Height Ratio				1.5	2.1	2.1	2.8	0.9	2	1.0	1.0	-	1.0	-	-	1.0	1.0	1.0	-	1.0	-	-	-	1
Profile																								
Riffle Length (ft)				N/A	N/A	N/A	N/A	N/A	N/A	Total riffle length 60-70% of reach length						7	17	33	16	26	24	39	8	14
Riffle Slope (ft/ft)				0.027	0.032	0.032	0.038	0.008	2	0.019	0.025	-	0.032	-	-	0.039	0.051	0.063	0.018	0.028	0.028	0.039	0.005	14
Pool Length (ft)				N/A	N/A	N/A	N/A	N/A	N/A	Total pool length 30-40% of reach length						6	11	19	8	14	15	19	3	14
Pool Max depth (ft)				0.6	1.3	1.3	1.9	0.9	2	1.11	1.5	-	1.9	-	-	1.3	1.4	1.5	1.4	2.0	2.0	2.9	0.4	14
Pool Spacing (ft)				40.0	80.0	80.0	120.0	56.6	25	3.1	17.2	-	31.2	-	-	3	17	31	28	42	40	60	11	14
Pattern																								
Channel Beltwidth (ft)				6.0	19.0	20.0	38.0	11.4	8	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	17.2	20.4	20.5	23.8	2.0	8
Radius of Curvature (ft)				37.0	46.8	47.5	55.0	7.9	4	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	21.7	32.0	27.9	51.7	10.7	10
Rc:Bankfull width (ft/ft)				7.7	9.7	9.9	11.4	1.7	4	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	3.7	5.4	4.7	8.8	1.8	10
Meander Wavelength (ft)				66.0	111.7	86.0	224.0	57.8	11	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	50.0	93.1	99.0	113.0	19.1	9
Meander Width Ratio				1.2	4.0	4.2	7.9	2.4	8	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	2.9	3.5	3.5	4.0	0.3	8
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.45												0.82			1.24					
Max part size (mm) mobilized at bankfull				84												142			160					
Stream Power (transport capacity) lb/s				23												36			34					
Additional Reach Parameters																								
Rosgen Classification				B4c						B4						B4			B4					
Bankfull Velocity (fps)	2.8	1.9	2.0	2.79												2.3			1.8					
Bankfull Discharge (cfs)	5	15	6.2	7												7								
Valley length (ft)				865						-						865								
Channel Thalweg length (ft)				926						-						919			852					
Sinuosity (ft)				1.07						1.1-1.2						1.03			1.02					
Water Surface Slope (Channel) (ft/ft)				0.018						-						0.035			0.032					
BF slope (ft/ft)				0.019						-						0.036			0.032					
[3]Bankfull Floodplain Area (acres)				0.5						-						0.7			0.95					
[4]% of Reach with Eroding Banks				-						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8b. Baseline Stream Data Summary
Greenbrier Stream Mitigation Project (DMS No. 100086) - UT1 Reach 3 (1097 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	2.7	12	8.0	7.1	9.3	9.3	11.5	3.1	2	3.3	4.8	-	6.2	-	-	7.1	7.6	8.1	6.6	6.6	6.6	6.7	0.0	2
Floodprone Width (ft)				11.4	15.3	15.3	19.1	5.5	2	7.6	7.8	-	8.1	-	-	20.0	54.0	88.0	42.3	52.3	52.3	>62.4	-	2
Bankfull Mean Depth (ft)	0.4	1.5	0.6	0.4	0.5	0.5	0.6	0.1	2	0.4	0.5	-	0.6	-	-	0.4	0.6	0.8	0.5	0.5	0.5	0.5	0.0	2
[1]Bankfull Max Depth (ft)				0.8	0.9	0.9	0.9	0.1	2	0.6	0.7	-	0.7	-	-	0.7	0.8	0.9	0.6	0.7	0.7	0.7	0.1	2
Bankfull Cross Sectional Area (ft^2)	2	10	4.8	4.1	4.3	4.3	4.6	0.4	2	1.3	2.4	-	3.6	-	-	4.1	4.5	5.0	3.0	3.0	3.0	3.1	0.1	2
Width/Depth Ratio				12.4	20.6	20.6	28.7	11.5	2	12	14	-	15	-	-	12.0	15.0	18.0	14.5	14.6	14.6	14.7	0.2	2
Entrenchment Ratio				1.6	1.7	1.7	1.7	0.1	2	1.6	1.7	-	1.7	-	-	4.0	5.7	7.3	6.4	7.9	7.9	>9.4	-	2
[1]Bank Height Ratio				2.2	2.9	2.9	3.5	0.9	2	1.0	1.0	-	1.0	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	2
Profile																								
Riffle Length (ft)				N/A	N/A	N/A	N/A	N/A	N/A	Total riffle length 60-70% of reach length						13	21	40	12	29	28	49	10	12
Riffle Slope (ft/ft)				0.016	0.031	0.031	0.046	0.021	2	0.018	0.020	-	0.023	-	-	0.014	0.019	0.023	0.010	0.017	0.017	0.025	0.005	12
Pool Length (ft)				N/A	N/A	N/A	N/A	N/A	N/A	Total pool length 30-40% of reach length						9	21	30	23	28	26	42	6	12
Pool Max depth (ft)				0.9	1.0	1.0	1.1	0.1	2	0.7	1.2	-	1.7	-	-	1.4	1.5	1.7	1.8	2.2	2.2	2.9	0.3	12
Pool Spacing (ft)				N/A	N/A	N/A	N/A	N/A	N/A	17	25	-	33	-	-	26	40	53	30	47	47	62	8	12
Pattern																								
Channel Beltwidth (ft)				8.0	13.8	12.0	23.0	5.0	15.0	16.6	27.3	-	38.0	-	-	27.0	44.0	61.0	29.3	33.5	33.6	37.9	2.5	21
Radius of Curvature (ft)				14.0	28.1	26.0	44.0	11.6	7.0	9.5	11.9	-	14.3	-	-	15.0	19.0	23.0	17.5	22.5	22.4	26.2	2.7	20
Rc:Bankfull width (ft/ft)				1.5	3.0	2.8	4.7	1.2	7.0	2.0	2.5	-	3.0	-	-	2.0	2.5	3.0	2.6	3.4	3.4	3.9	0.4	20
Meander Wavelength (ft)				36.0	71.8	61.0	128.0	29.0	15.0	33.3	49.9	-	66.5	-	-	53.0	80.0	107.0	51.0	67.7	64.5	87.0	9.4	20
Meander Width Ratio				3.9	7.7	6.6	13.8	29.0	15.0	3.5	5.8	-	8.0	-	-	3.5	5.8	8.0	4.4	5.0	5.1	5.7	0.4	8
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.79												0.54			0.38					
Max part size (mm) mobilized at bankfull				87.8												79.6			75.0					
Stream Power (transport capacity) lb/s				18												19			24					
Additional Reach Parameters																								
Rosgen Classification				B4						C4						C4			C4					
Bankfull Velocity (fps)	3.0	6.0	2.2	3.1												2.8			4.1					
Bankfull Discharge (cfs)	6	60	10.4	12.5												12.5								
Valley length (ft)				902						-						902								
Channel Thalweg length (ft)				991.6						-						1097			1141					
Sinuosity (ft)				1.09						1.2 to 1.4						1.22			1.26					
Water Surface Slope (Channel) (ft/ft)				0.015						-						0.013			0.014					
BF slope (ft/ft)				0.016						-						0.016			0.014					
[3]Bankfull Floodplain Area (acres)				0.3						-						1.1			1.6					
[4]% of Reach with Eroding Banks				-						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8c. Baseline Stream Data Summary
Greenbrier Stream Mitigation Project (DMS No. 100086) - UT1A (148.5 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	1	8	3.5	3.8	3.8	3.8	3.8	-	1	1.6	2.5	-	3.5	-	-	3.1	3.6	4.1	-	4.5	-	-	-	1
Floodprone Width (ft)				4.7	4.7	4.7	4.7	-	1	3.5	4.5	-	5.5	-	-	5.0	7.5	10.0	-	22.3	-	-	-	1
Bankfull Mean Depth (ft)	0.3	1	0.3	0.1	0.1	0.1	0.1	-	1	0.3	0.3	-	0.4	-	-	0.2	0.3	0.4	-	0.4	-	-	-	1
[1]Bankfull Max Depth (ft)				0.3	0.3	0.3	0.3	-	1	0.4	0.4	-	0.5	-	-	0.3	0.4	0.5	-	0.6	-	-	-	1
Bankfull Cross Sectional Area (ft^2)	1	6	1.1	0.5	0.5	0.5	0.5	-	1	0.7	0.9	-	1.1	-	-	0.9	1.0	1.1	-	1.8	-	-	-	1
Width/Depth Ratio				26.8	26.8	26.8	26.8	-	1	12.0	15.0	-	18	-	-	10.0	12.9	15.0	-	11.6	-	-	-	1
Entrenchment Ratio				1.3	1.3	1.3	1.3	-	1	1.4	1.8	-	2.2	-	-	1.4	2.1	2.8	-	4.9	-	-	-	1
[1]Bank Height Ratio				14.8	14.8	14.8	14.8	-	1	1.0	1.0	-	1.1	-	-	1.0	1.0	1.0	-	1.0	-	-	-	1
Profile																								
Riffle Length (ft)				N/A	N/A	N/A	N/A	N/A	N/A	Total riffle length 60-70% of reach length						4.0	8.0	11.0	9	14	15	19	4	5
Riffle Slope (ft/ft)				0.029	0.070	0.070	0.110	0.057	2	0.086	0.113	-	0.140	-	-	0.023	0.030	0.036	0.012	0.029	0.032	0.047	0.012	5
Pool Length (ft)				N/A	N/A	N/A	N/A	N/A	N/A	Total pool length 30-40% of reach length						3.0	5.0	12.0	5	12	12	20	5	5
Pool Max depth (ft)				N/A	N/A	N/A	N/A	N/A	N/A	0.7	0.9	-	1.2	-	-	0.6	0.7	0.8	0.5	0.8	0.9	0.9	0.2	5
Pool Spacing (ft)				N/A	N/A	N/A	N/A	N/A	N/A	1.3	6.9	-	12.5	-	-	2.0	10.0	18.0	18	23	22	32	5	4
Pattern																								
Channel Beltwidth (ft)				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Radius of Curvature (ft)				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rc:Bankfull width (ft/ft)				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Meander Wavelength (ft)				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Meander Width Ratio				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.68												0.35			0.40					
Max part size (mm) mobilized at bankfull				N/A												N/A			80					
Stream Power (transport capacity) lb/s				38												10			7					
Additional Reach Parameters																								
Rosgen Classification				F4						B4						B4			B4					
Bankfull Velocity (fps)	3.0	2.0	1.6	3.8												2			1.1					
Bankfull Discharge (cfs)	3	12	1.8	2.0												2.0								
Valley length (ft)				114						-						144								
Channel Thalweg length (ft)				115						-						148.5			153					
Sinuosity (ft)				1.01						1.1 to 1.2						1.03			1.06					
Water Surface Slope (Channel) (ft/ft)				0.078						-						0.020			0.018					
BF slope (ft/ft)				0.078						-						0.021			0.018					
[3]Bankfull Floodplain Area (acres)				0.01						-						0.02			0.13					
[4]% of Reach with Eroding Banks				-						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8d. Baseline Stream Data Summary
Greenbrier Stream Mitigation Project (DMS No. 100086) - UT1B (247.50 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	1	8	3.5	4.7	4.7	4.7	4.7	-	1	1.7	2.7	-	3.7	-	-	3.1	3.6	4.1	-	3.7	-	-	-	1
Floodprone Width (ft)				6.1	6.1	6.1	6.1	-	1	3.8	4.9	-	6.0	-	-	5.0	7.5	10.0	-	>19.34	-	-	-	1
Bankfull Mean Depth (ft)	0.3	1	0.3	0.5	0.5	0.5	0.5	-	1	0.3	0.4	-	0.4	-	-	0.2	0.3	0.4	-	0.2	-	-	-	1
[1]Bankfull Max Depth (ft)				0.8	0.8	0.8	0.8	-	1	0.4	0.5	-	0.5	-	-	0.3	0.4	0.5	-	0.4	-	-	-	1
Bankfull Cross Sectional Area (ft^2)	1	6	1.1	2.3	2.3	2.3	2.3	-	1	0.9	1.1	-	1.3	-	-	0.9	1.0	1.1	-	0.9	-	-	-	1
Width/Depth Ratio				9.9	9.9	9.9	9.9	-	1	12.0	15.0	-	18.0	-	-	10.0	12.9	15.0	-	15.3	-	-	-	1
Entrenchment Ratio				1.3	1.3	1.3	1.3	-	1	1.4	1.8	-	2.2	-	-	1.4	2.1	2.8	-	>5.26	-	-	-	1
[1]Bank Height Ratio				7.6	7.6	7.6	7.6	-	1	1.0	1.0	-	1.1	-	-	1.0	1.0	1.0	-	1.0	-	-	-	1
Profile																								
Riffle Length (ft)				N/A	N/A	N/A	N/A	N/A	N/A	Total riffle length 60-70% of reach length						8.0	10.0	15.0	15	18	19	20	2	3
Riffle Slope (ft/ft)				0.035	0.039	0.039	0.042	0.005	2	0.026	0.035	-	0.043	-	-	0.019	0.024	0.030	0.050	0.055	0.055	0.060	0.004	3
Pool Length (ft)				N/A	N/A	N/A	N/A	N/A	N/A	Total pool length 30-40% of reach length						5.0	12.0	15.0	12	15	12	20	4	3
Pool Max depth (ft)				N/A	N/A	N/A	N/A	N/A	N/A	0.7	1.0	-	1.3	-	-	0.6	0.7	0.8	0.6	0.9	1.0	1.1	0.2	3
Pool Spacing (ft)				N/A	N/A	N/A	N/A	N/A	N/A	1.4	7.5	-	13.7	-	-	2.0	10.0	18.0	27	29	27	34	3	3
Pattern																								
Channel Beltwidth (ft)				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Radius of Curvature (ft)				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rc:Bankfull width (ft/ft)				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Meander Wavelength (ft)				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Meander Width Ratio				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	-	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.75												0.3			0.37					
Max part size (mm) mobilized at bankfull				N/A												N/A			75					
Stream Power (transport capacity) lb/s				11												10			15					
Additional Reach Parameters																								
Rosgen Classification				G4						B4						B4			B4					
Bankfull Velocity (fps)	3.0	2.0	1.6	1												2.3			2.6					
Bankfull Discharge (cfs)	3	12	1.8	2.3												2.3								
Valley length (ft)				181						-						215								
Channel Thalweg length (ft)				195						-						248			228					
Sinuosity (ft)				1.08						1.1 to 1.2						1.15			1.06					
Water Surface Slope (Channel) (ft/ft)				0.0239						-						0.017			0.026					
BF slope (ft/ft)				0.0239						-						0.02			0.026					
[3]Bankfull Floodplain Area (acres)				0.03						-						0.04			0.18					
[4]% of Reach with Eroding Banks				-						-														
Channel Stability or Habitat Metric				-						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 9. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Greenbrier Stream Mitigation Project (DMS No. 100086)

	UT1 Reach 1														UT1 Reach 3																		
	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	1127.92							1120.53							1097.81							1094.95							1090.59						
Bankfull Width (ft)	7.46							5.9							6.62							11.86							6.65						
Floodprone Width (ft)	N/A							>59.7							42.29							N/A							>62.4						
Bankfull Mean Depth (ft)	0.9							0.67							0.45							1.38							0.46						
Bankfull Max Depth (ft)	1.45							1.18							0.63							2.61							0.74						
Bankfull Cross Sectional Area (ft^2)	6.7							3.97							2.99							16.41							3.08						
Bankfull Width/Depth Ratio	8.29							8.81							14.71							8.59							14.46						
Bankfull Entrenchment Ratio	N/A							>10.12							6.39							N/A							>9.39						
Bankfull Bank Height Ratio	1.0							1.0							1.0							1.0							1.0						

	UT1 Reach 3							UT1A							UT1B																		
	Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section 8 (Riffle)																		
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+													
Record elevation (datum) used	1086.63							1097.98							1089.94																		
Bankfull Width (ft)	9.95							4.54							3.68																		
Floodprone Width (ft)	N/A							22.27							>19.34																		
Bankfull Mean Depth (ft)	1.27							0.39							0.24																		
Bankfull Max Depth (ft)	2.74							0.63							0.35																		
Bankfull Cross Sectional Area (ft^2)	12.61							1.76							0.87																		
Bankfull Width/Depth Ratio	7.83							11.64							15.33																		
Bankfull Entrenchment Ratio	N/A							4.90							>5.26																		
Bankfull Bank Height Ratio	1.0							1.0							1.0																		

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with DMS. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 10a. Monitoring Data - Stream Reach Data Summary
Greenbrier Stream Mitigation Project (DMS No. 100086) - UT1 Reach 1 (843 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	-	5.9	-	-	-	1																														
Floodprone Width (ft)	-	>59.7	-	-	-	1																														
Bankfull Mean Depth (ft)	-	0.7	-	-	-	1																														
[1]Bankfull Max Depth (ft)	-	1.2	-	-	-	1																														
Bankfull Cross Sectional Area (ft^2)	-	4.0	-	-	-	1																														
Width/Depth Ratio	-	8.8	-	-	-	1																														
Entrenchment Ratio	-	>10.1	-	-	-	1																														
[1]Bank Height Ratio	-	1.0	-	-	-	1																														
Profile																																				
Riffle Length (ft)	16	26	24	39	8	14																														
Riffle Slope (ft/ft)	0.018	0.0279	0.028	0.039	0.0049	14																														
Pool Length (ft)	8	14	15	19	3	14																														
Pool Max depth (ft)	1.4	2.0	2.0	2.9	0.4	14																														
Pool Spacing (ft)	28	42	40	60	11	14																														
Pattern																																				
Channel Beltwidth (ft)	17.2	20.4	20.5	23.8	2.0	8																														
Radius of Curvature (ft)	21.7	32.0	27.9	51.7	10.7	10																														
Rc:Bankfull width (ft/ft)	3.7	5.4	4.7	8.8	1.8	10																														
Meander Wavelength (ft)	50.0	93.1	99.0	113.0	19.1	9																														
Meander Width Ratio	2.9	3.5	3.5	4.0	0.3	8																														

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	B4																																			
Channel Thalweg length (ft)	852																																			
Sinuosity (ft)	1.02																																			
Water Surface Slope (Channel) (ft/ft)	0.032																																			
BF slope (ft/ft)	0.032																																			
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Table 10b. Monitoring Data - Stream Reach Data Summary
Greenbrier Stream Mitigation Project (DMS No. 100086) - UT1 Reach 3 (1097 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	6.6	6.6	6.6	6.7	0.0212	2																														
Floodprone Width (ft)	42.29	52.345	52.345	>62.4	-	2																														
Bankfull Mean Depth (ft)	0.45	0.46	0.46	0.46	0.0071	2																														
[1]Bankfull Max Depth (ft)	0.63	0.69	0.69	0.74	0.0778	2																														
Bankfull Cross Sectional Area (ft^2)	2.99	3.04	3.04	3.08	0.0636	2																														
Width/Depth Ratio	14.46	14.59	14.59	14.71	0.1768	2																														
Entrenchment Ratio	6.39	7.89	7.89	>9.4	-	2																														
[1]Bank Height Ratio	1.0	1.0	1.0	1.0	0	2																														
Profile																																				
Riffle Length (ft)	12	29	28	49	10	12																														
Riffle Slope (ft/ft)	0.010	0.0168	0.0165	0.025	0.0052	12																														
Pool Length (ft)	23	28	26	42	6	12																														
Pool Max depth (ft)	1.8	2.2	2.2	2.9	0.3	12																														
Pool Spacing (ft)	30	47	47	62	8	12																														
Pattern																																				
Channel Beltwidth (ft)	29.3	33.5	33.6	37.9	2.5	21																														
Radius of Curvature (ft)	17.5	22.5	22.4	26.2	2.7	20																														
Rc:Bankfull width (ft/ft)	2.6	3.4	3.4	3.9	0.4	20																														
Meander Wavelength (ft)	51.0	67.7	64.5	87.0	9.4	20																														
Meander Width Ratio	4.4	5.0	5.1	5.7	0.4	8																														

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	C4																																			
Channel Thalweg length (ft)	1141																																			
Sinuosity (ft)	1.26																																			
Water Surface Slope (Channel) (ft/ft)	0.014																																			
BF slope (ft/ft)	0.014																																			
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Table 10c. Monitoring Data - Stream Reach Data Summary
Greenbrier Stream Mitigation Project (DMS No. 100086) - UT1A (148.5 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	-	4.5	-	-	-	1																														
Floodprone Width (ft)	-	22.27	-	-	-	1																														
Bankfull Mean Depth (ft)	-	0.39	-	-	-	1																														
[1]Bankfull Max Depth (ft)	-	0.63	-	-	-	1																														
Bankfull Cross Sectional Area (ft^2)	-	1.76	-	-	-	1																														
Width/Depth Ratio	-	11.64	-	-	-	1																														
Entrenchment Ratio	-	4.9	-	-	-	1																														
[1]Bank Height Ratio	-	1.0	-	-	-	1																														
Profile																																				
Riffle Length (ft)	9	14	15	19	4	5																														
Riffle Slope (ft/ft)	0.012	0.0292	0.032	0.047	0.0122	5																														
Pool Length (ft)	5	12	12	20	5	5																														
Pool Max depth (ft)	0.5	0.8	0.9	0.9	0.2	5																														
Pool Spacing (ft)	18	23	22	32	5	4																														
Pattern																																				
Channel Beltwidth (ft)	N/A	N/A	N/A	N/A	N/A	N/A																														
Radius of Curvature (ft)	N/A	N/A	N/A	N/A	N/A	N/A																														
Rc:Bankfull width (ft/ft)	N/A	N/A	N/A	N/A	N/A	N/A																														
Meander Wavelength (ft)	N/A	N/A	N/A	N/A	N/A	N/A																														
Meander Width Ratio	N/A	N/A	N/A	N/A	N/A	N/A																														

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	B4																																			
Channel Thalweg length (ft)	153																																			
Sinuosity (ft)	1.06																																			
Water Surface Slope (Channel) (ft/ft)	0.018																																			
BF slope (ft/ft)	0.018																																			
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

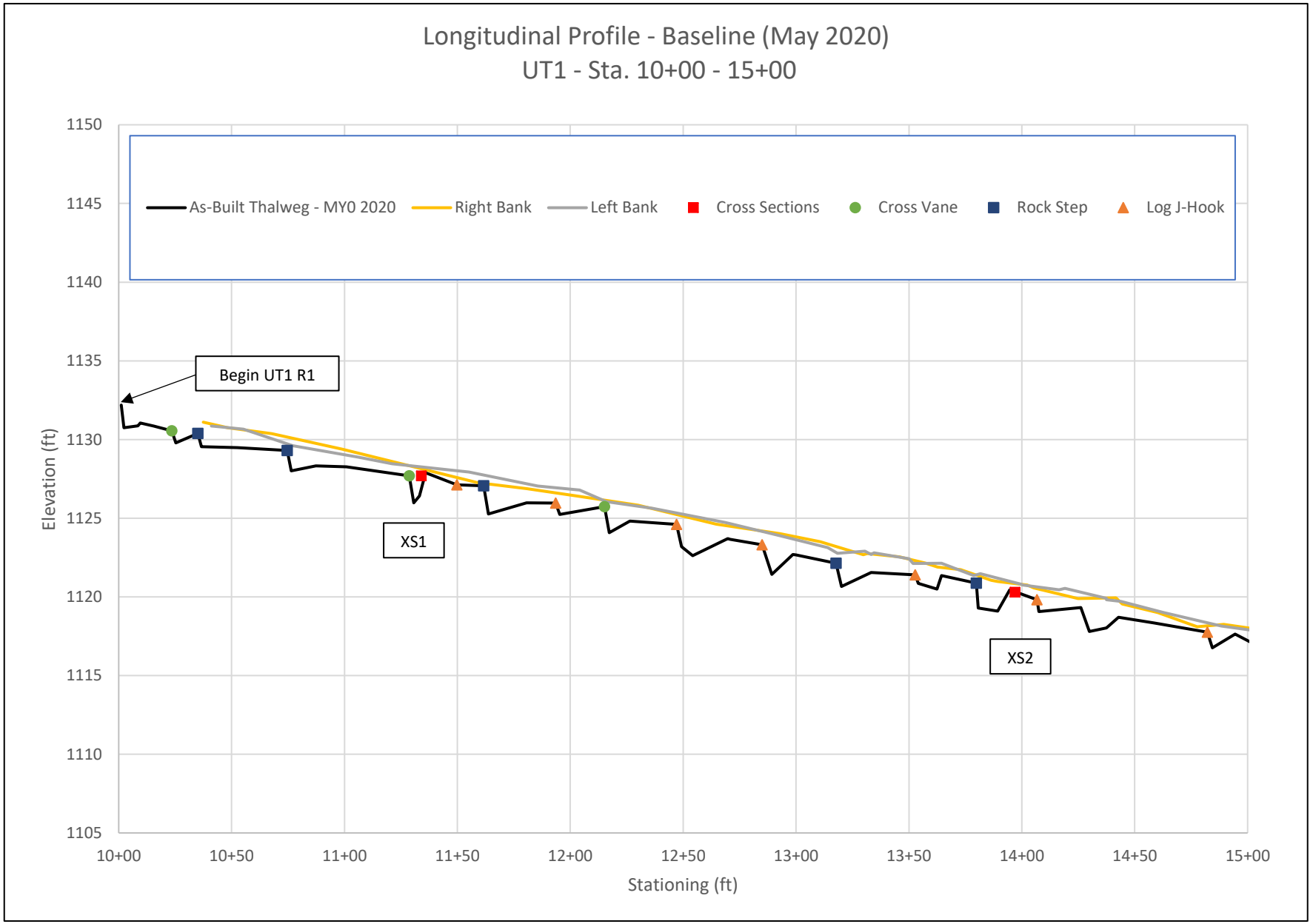
Table 10d. Monitoring Data - Stream Reach Data Summary
Greenbrier Stream Mitigation Project (DMS No. 100086) - UT1B (247.5 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	-	3.7	-	-	-	1																														
Floodprone Width (ft)	-	>19.3	-	-	-	1																														
Bankfull Mean Depth (ft)	-	0.2	-	-	-	1																														
[1]Bankfull Max Depth (ft)	-	0.4	-	-	-	1																														
Bankfull Cross Sectional Area (ft^2)	-	0.9	-	-	-	1																														
Width/Depth Ratio	-	15.3	-	-	-	1																														
Entrenchment Ratio	-	>5.3	-	-	-	1																														
[1]Bank Height Ratio	-	1.0	-	-	-	1																														
Profile																																				
Riffle Length (ft)	15	18	19	20	2	3																														
Riffle Slope (ft/ft)	0.050	0.055	0.055	0.060	0.0041	3																														
Pool Length (ft)	12	15	12	20	4	3																														
Pool Max depth (ft)	0.6	0.9	1.0	1.1	0.2	3																														
Pool Spacing (ft)	27	29	27	34	3	3																														
Pattern																																				
Channel Beltwidth (ft)	N/A	N/A	N/A	N/A	N/A	N/A																														
Radius of Curvature (ft)	N/A	N/A	N/A	N/A	N/A	N/A																														
Rc:Bankfull width (ft/ft)	N/A	N/A	N/A	N/A	N/A	N/A																														
Meander Wavelength (ft)	N/A	N/A	N/A	N/A	N/A	N/A																														
Meander Width Ratio	N/A	N/A	N/A	N/A	N/A	N/A																														

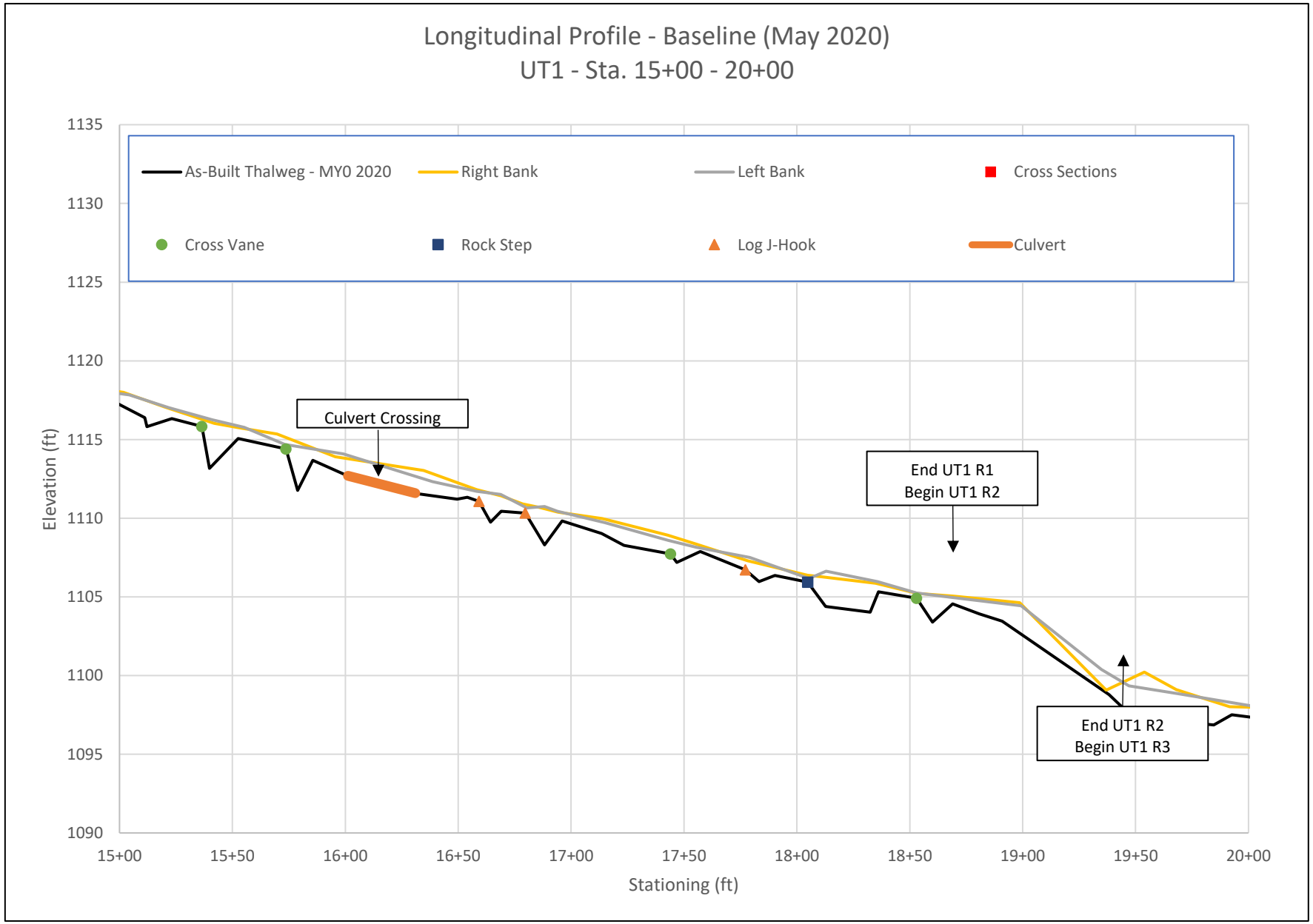
Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

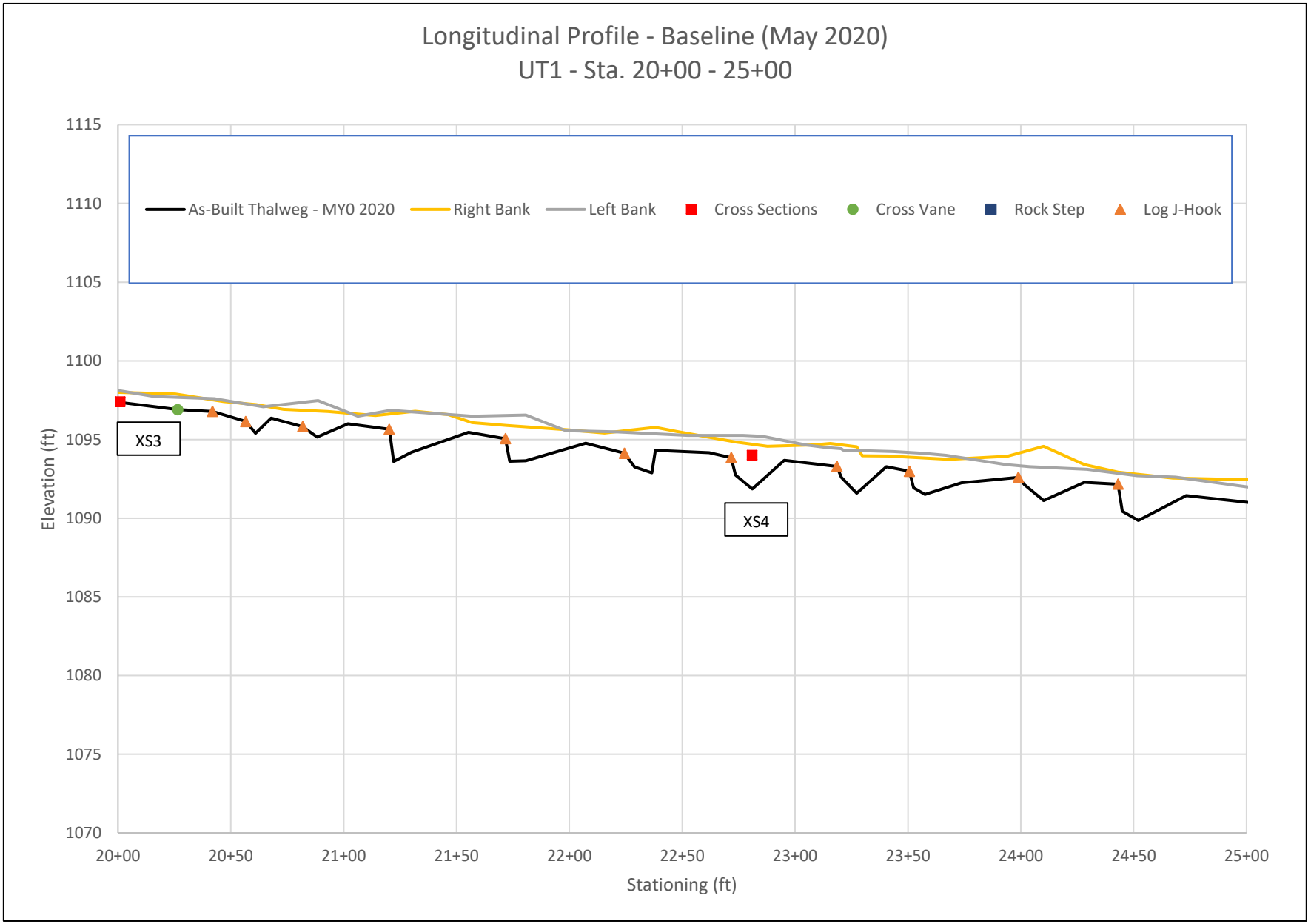
Additional Reach Parameters																																				
Rosgen Classification	B4																																			
Channel Thalweg length (ft)	228																																			
Sinuosity (ft)	1.06																																			
Water Surface Slope (Channel) (ft/ft)	0.026																																			
BF slope (ft/ft)	0.026																																			
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

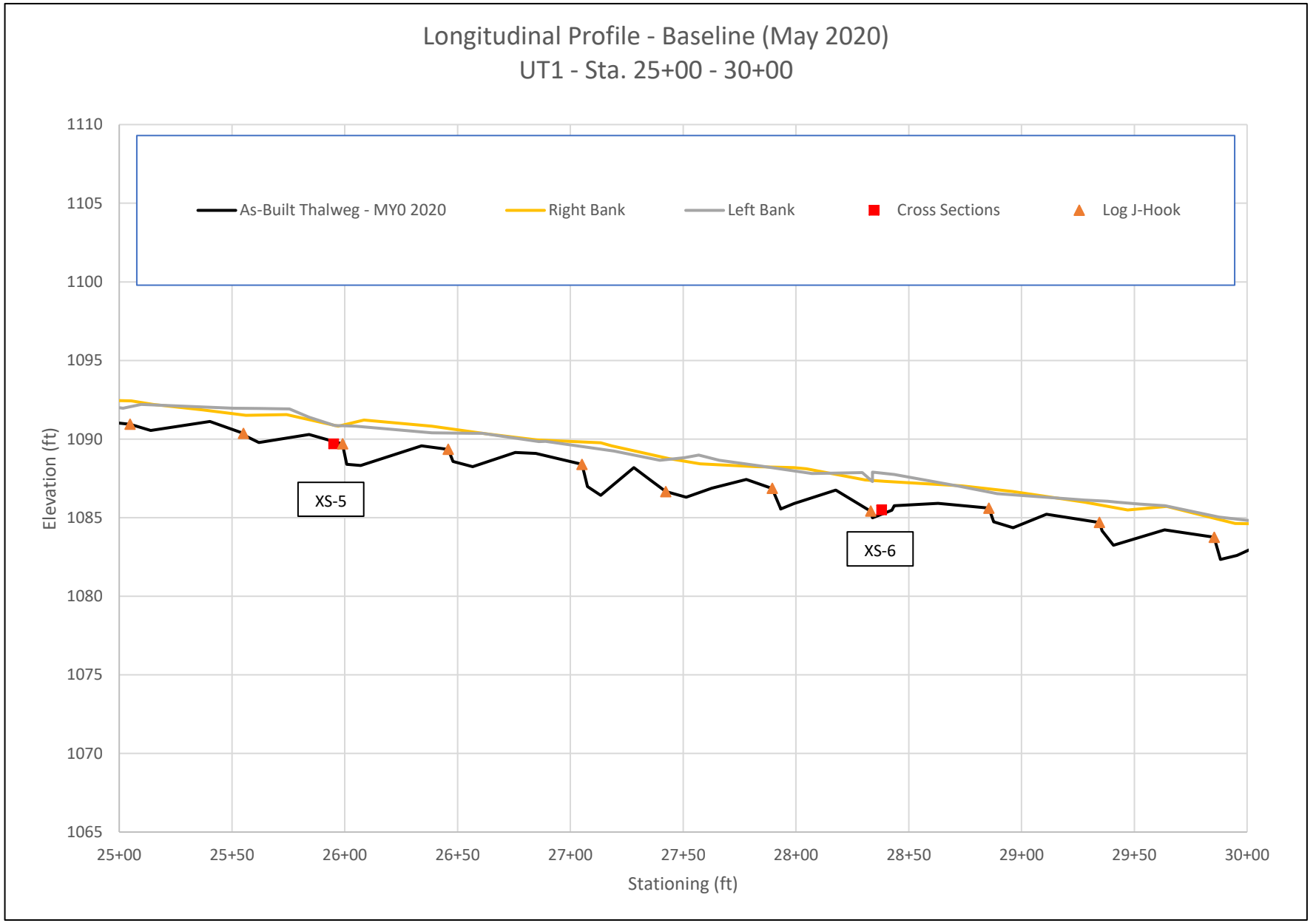


ECOSYSTEM PLANNING & RESTORATION

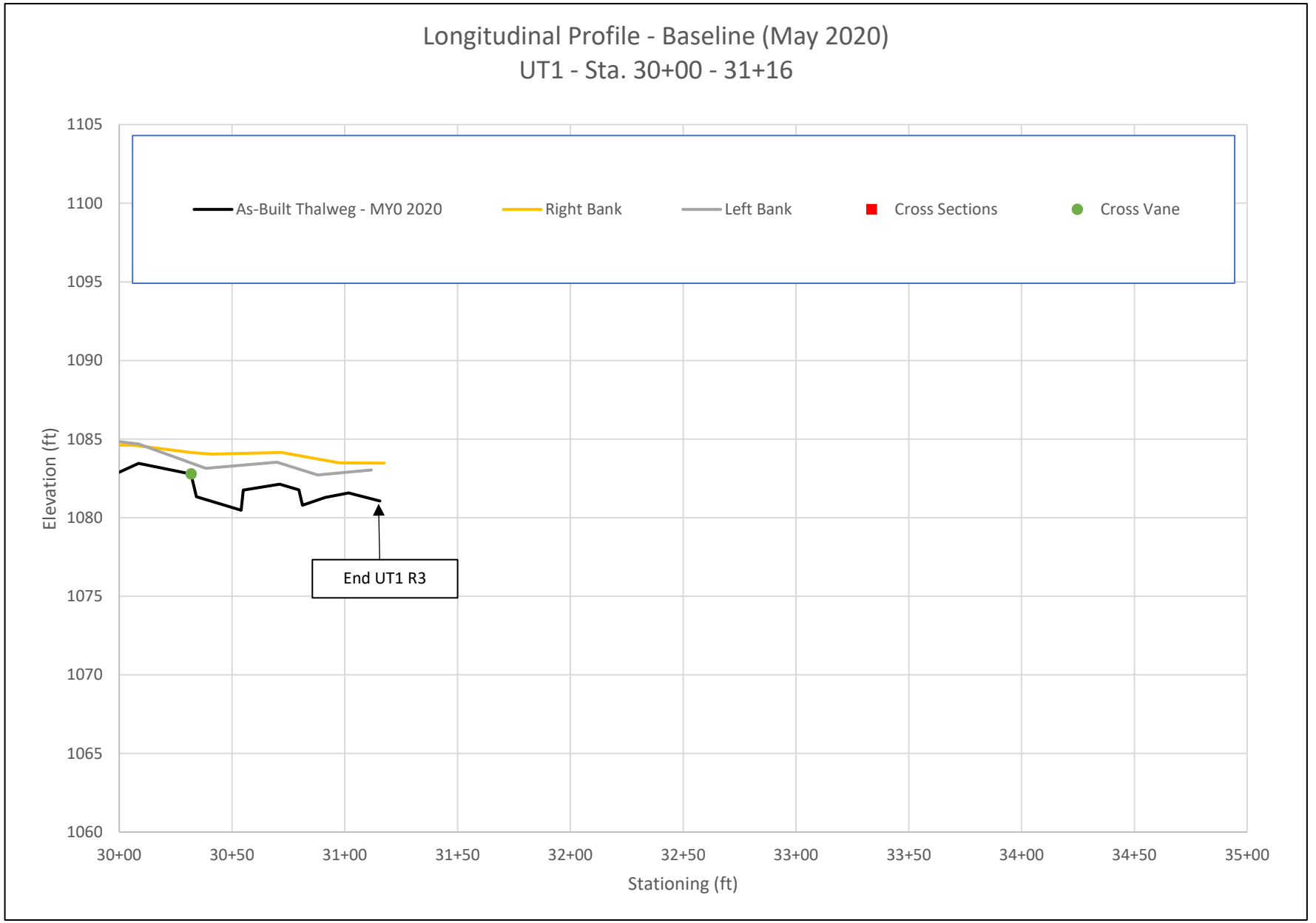

Longitudinal Profile - Baseline (May 2020)
UT1 - Sta. 15+00 - 20+00
As-Built Thalweg - MY0 2020
Right Bank
Left Bank
Cross Sections
Cross Vane
Rock Step
Log J-Hook
Culvert
Culvert Crossing
End UT1 R1
Begin UT1 R2
End UT1 R2
Begin UT1 R3
Elevation (ft)
Stationing (ft)
1135
1130
1125
1120
1115
1110
1105
1100
1095
1090
15+00
15+50
16+00
16+50
17+00
17+50
18+00
18+50
19+00
19+50
20+00



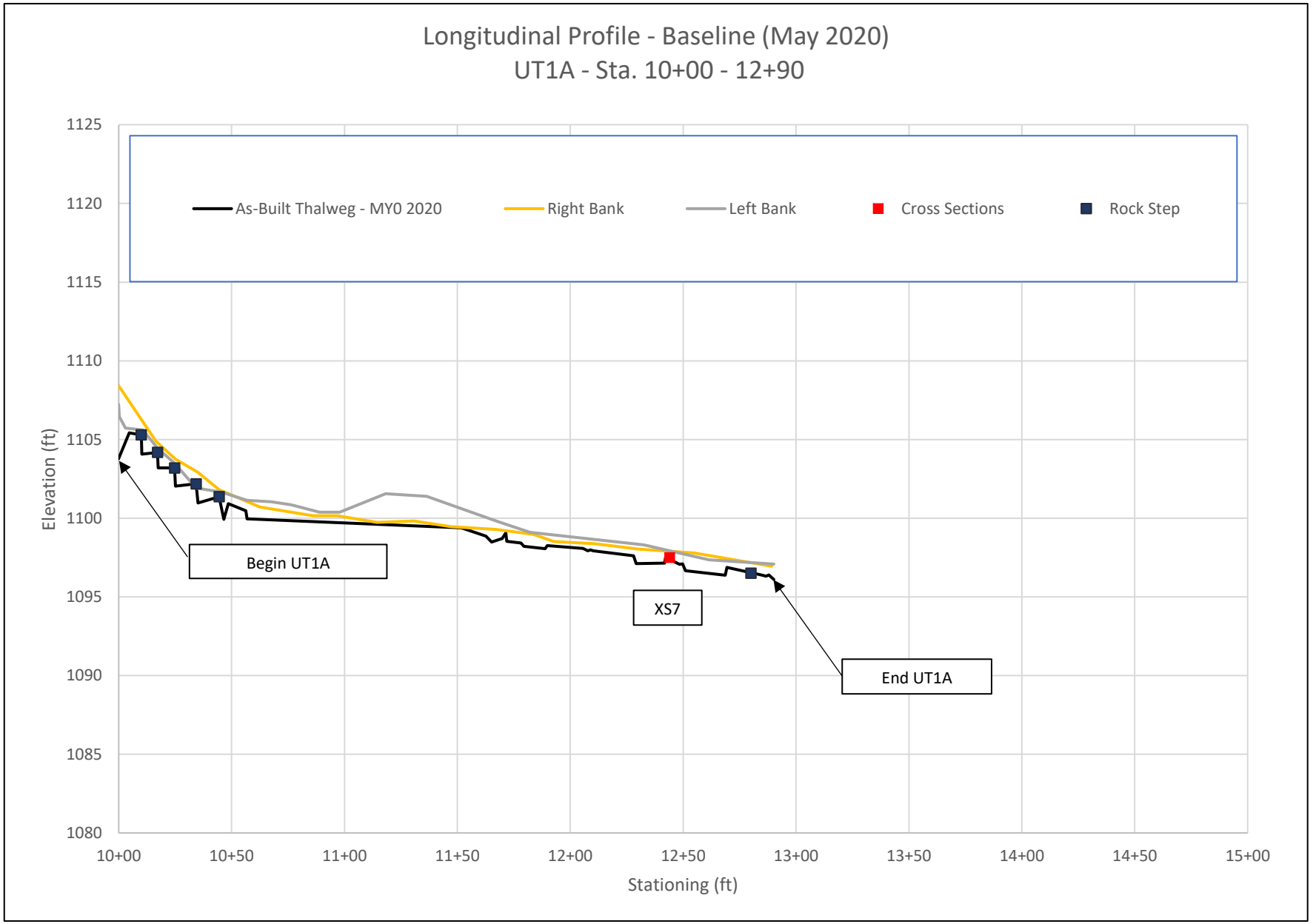
ECOSYSTEM PLANNING & RESTORATION



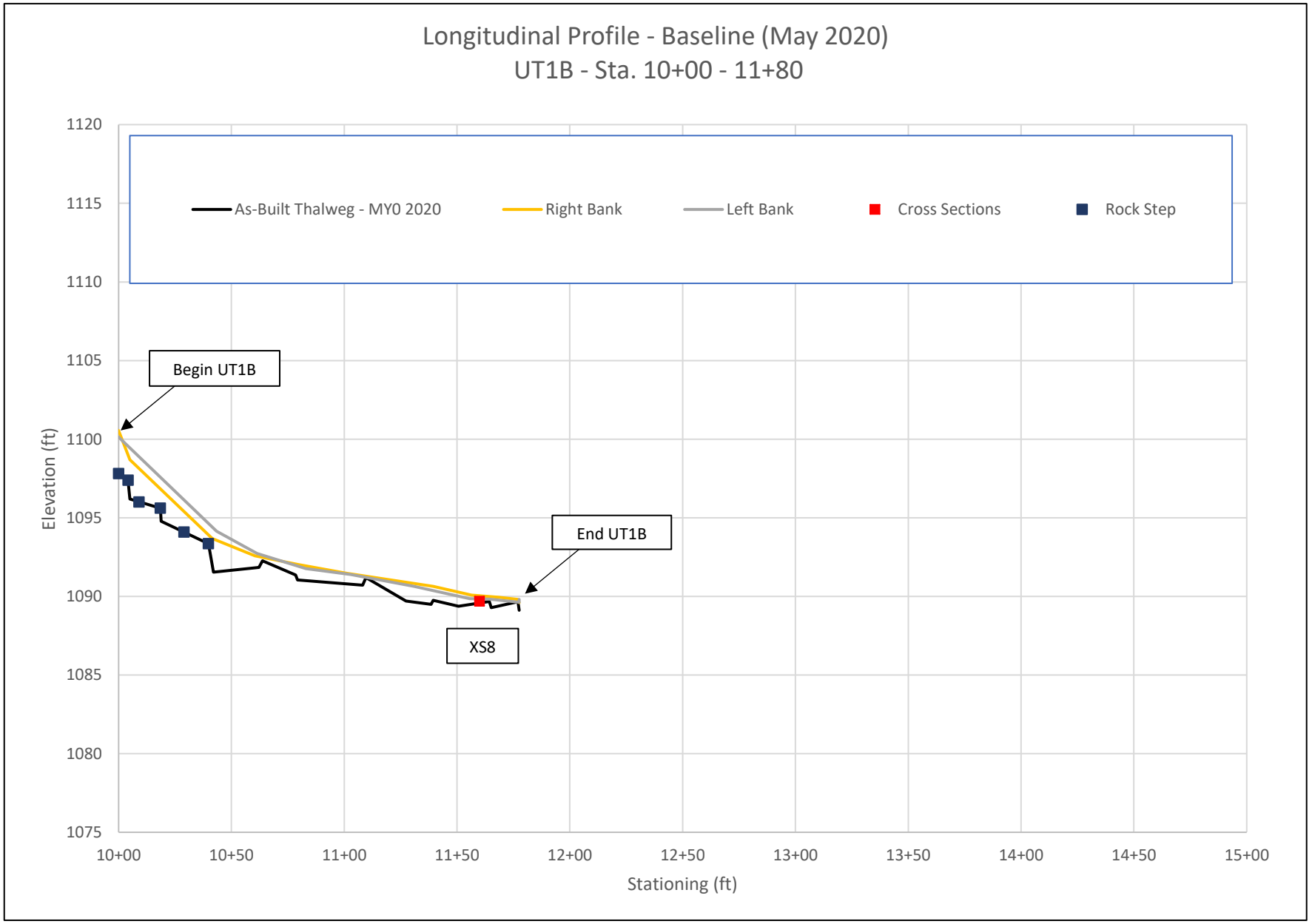
ECOSYSTEM PLANNING & RESTORATION



ECOSYSTEM PLANNING & RESTORATION



ECOSYSTEM PLANNING & RESTORATION



ECOSYSTEM PLANNING & RESTORATION

Cross Section Plot - Baseline - May 2020

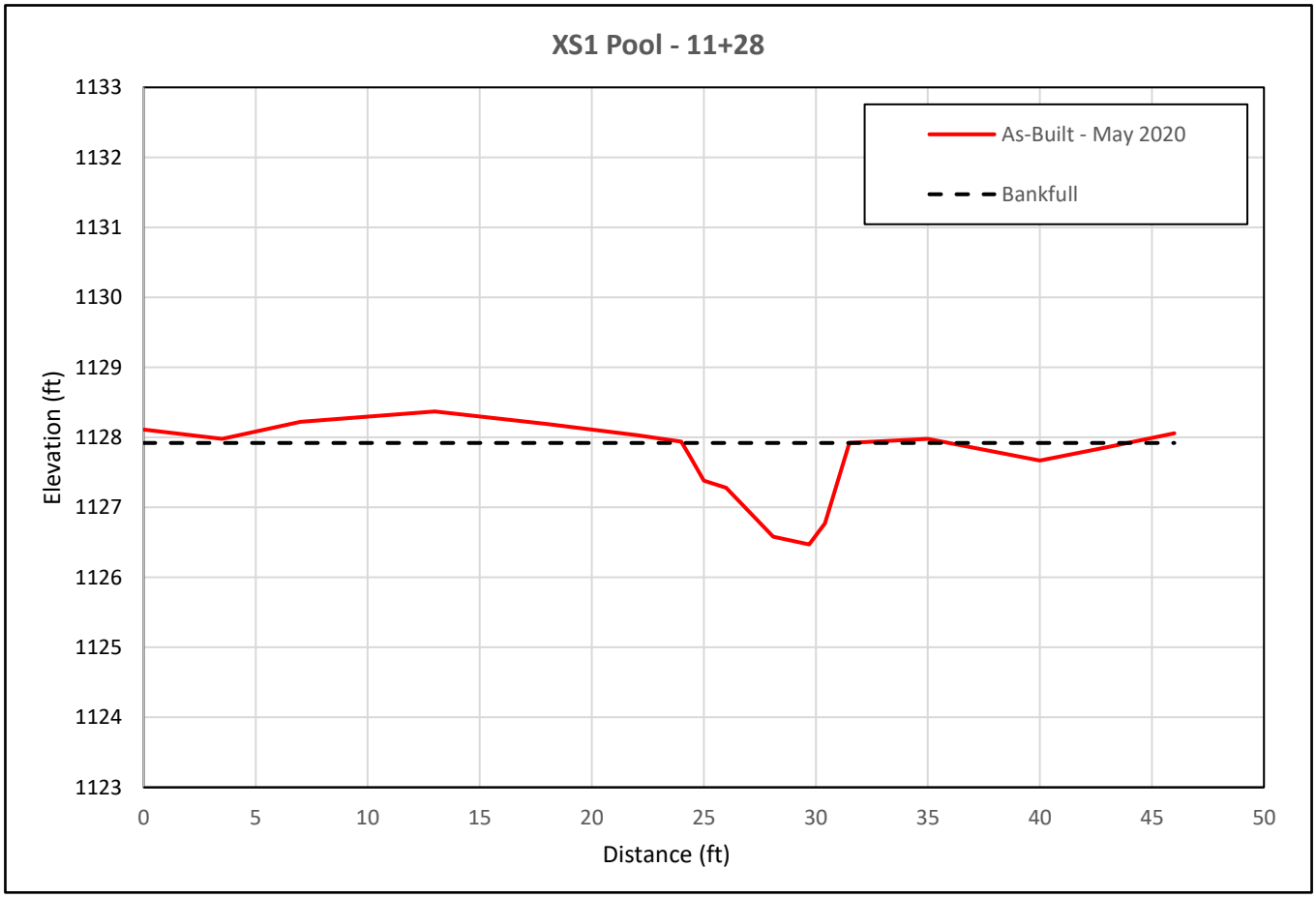
XS1 - UT1 Reach 1

Station 11+28 - Pool

XS1 looking upstream

XS1 facing right bank

Bankfull Elevation (ft)	Bankfull Area (ft^2)	Bankfull Width (ft)	Floodprone Elevation (ft)	Floodprone Width (ft)	Max Depth (ft)	Mean Depth (ft)	W/D Ratio	ER	Bank Height Ratio
1127.92	6.7	7.46	N/A	N/A	1.45	0.9	8.29	N/A	1.0



Cross Section Plot - Baseline - May 2020

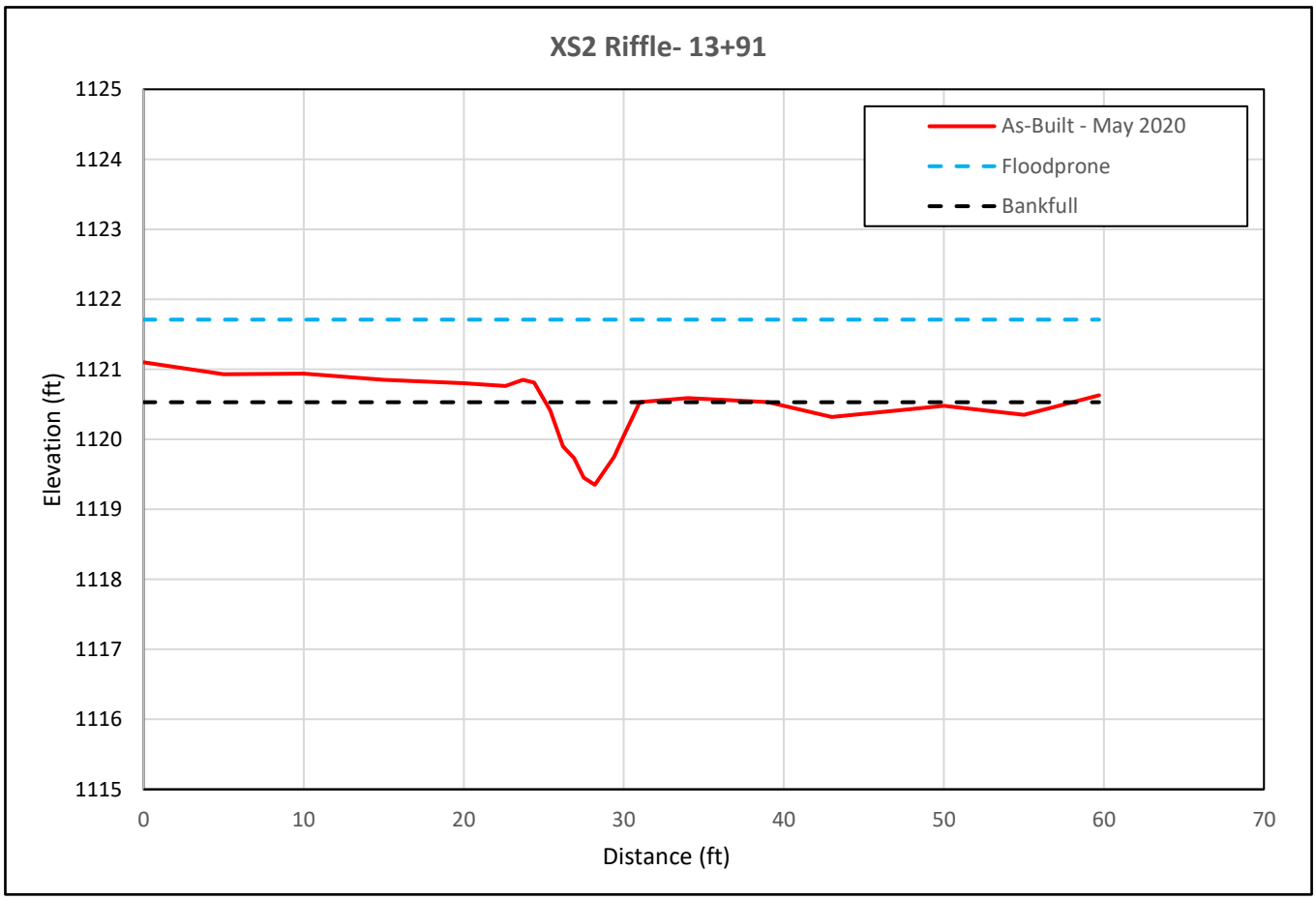
XS2 - UT1 Reach 1

Station 13+91 - Riffle

XS2 looking upstream

XS2 looking downstream

Bankfull Elevation (ft)	Bankfull Area (ft^2)	Bankfull Width (ft)	Floodprone Elevation (ft)	Floodprone Width (ft)	Max Depth (ft)	Mean Depth (ft)	W/D Ratio	ER	Bank Height Ratio
1120.53	3.97	5.9	1121.71	>59.7	1.18	0.67	8.81	>10.12	1.0



Cross Section Plot - Baseline - May 2020

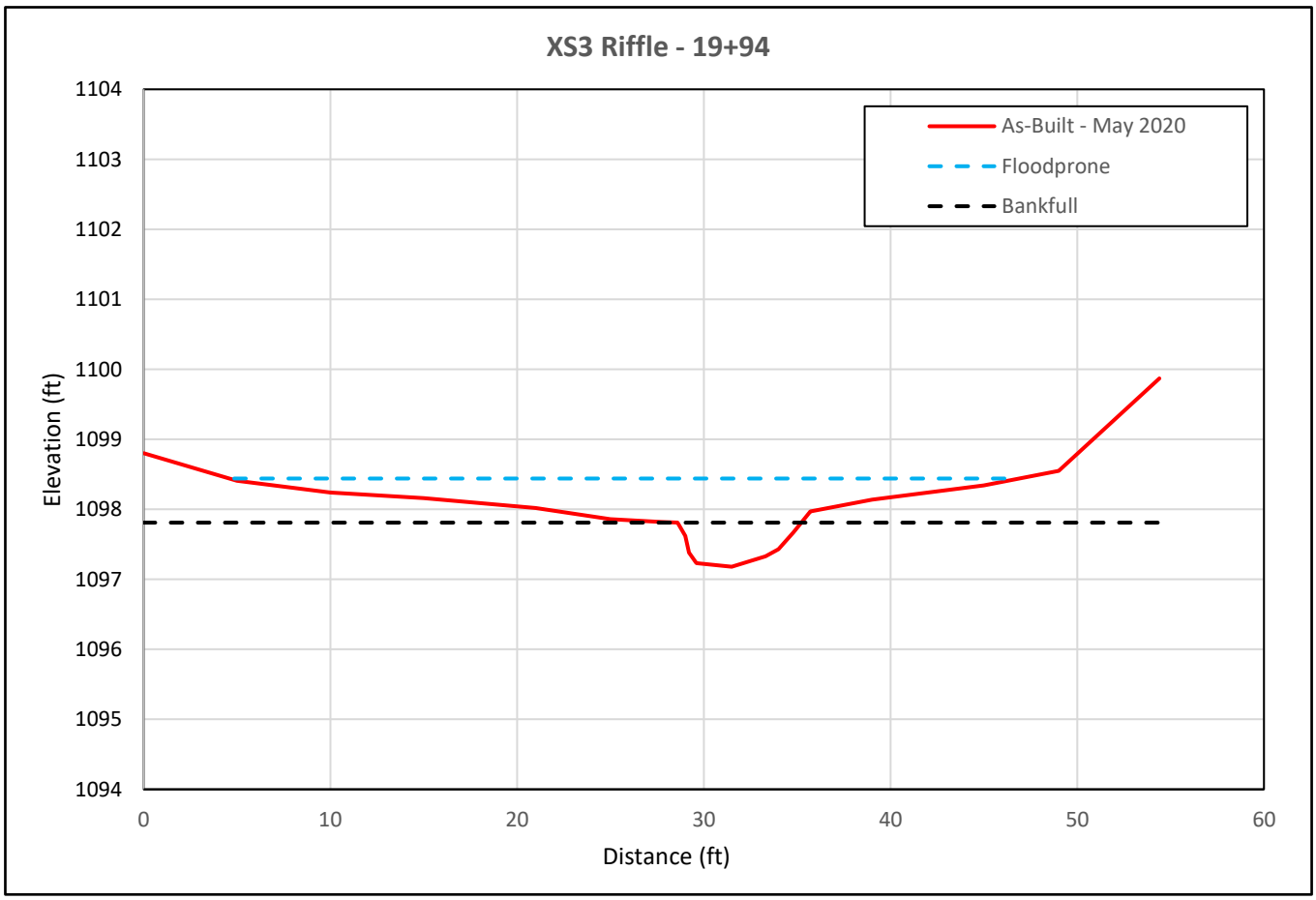
XS3 - UT1 Reach 3

Station 19+94 - Riffle

XS3 looking upstream

XS3 looking downstream

Bankfull Elevation (ft)	Bankfull Area (ft^2)	Bankfull Width (ft)	Floodprone Elevation (ft)	Floodprone Width (ft)	Max Depth (ft)	Mean Depth (ft)	W/D Ratio	ER	Bank Height Ratio
1097.81	2.99	6.62	1098.44	42.29	0.63	0.45	14.71	6.39	1.0



Cross Section Plot - Baseline - June 2020

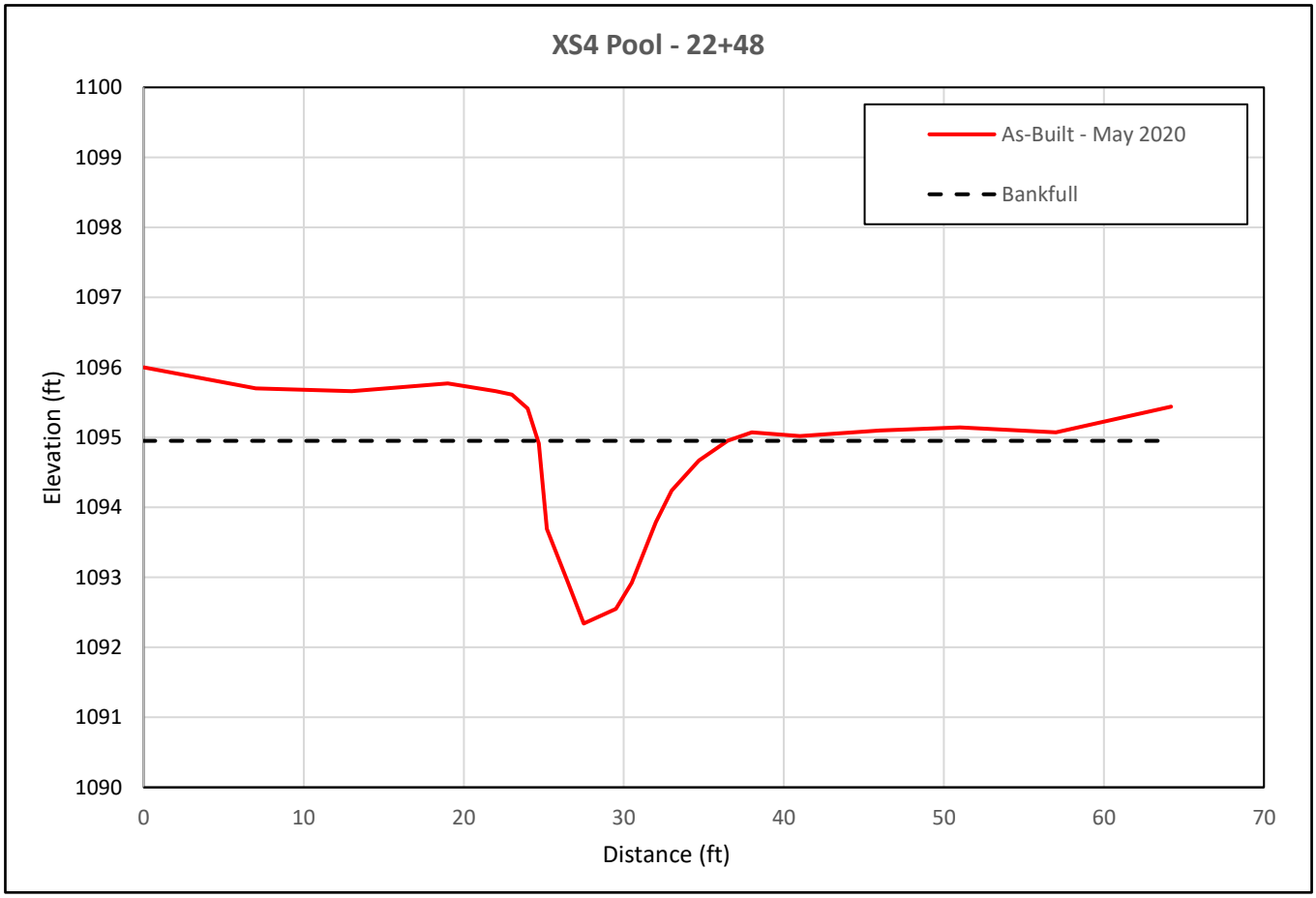
XS4 - UT1 Reach 3

Station 22+48 - Pool

XS4 looking upstream

XS4 looking downstream

Bankfull Elevation (ft)	Bankfull Area (ft^2)	Bankfull Width (ft)	Floodprone Elevation (ft)	Floodprone Width (ft)	Max Depth (ft)	Mean Depth (ft)	W/D Ratio	ER	Bank Height Ratio
1094.95	16.41	11.86	N/A	N/A	2.61	1.38	8.59	N/A	1.0



Cross Section Plot - Baseline - May 2020

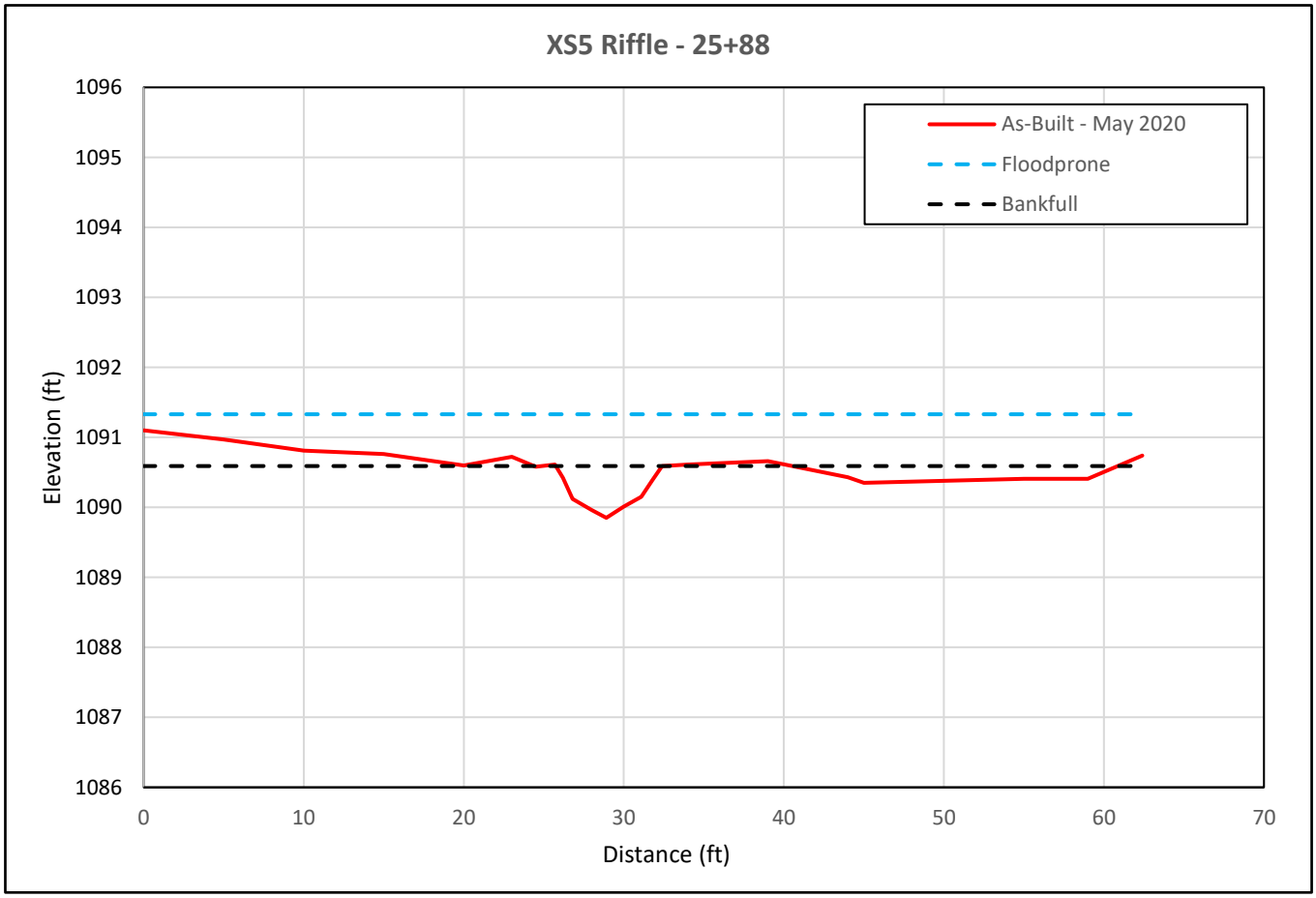
XS5 - UT1 Reach 3

Station 25+88 - Riffle

XS5 looking upstream

XS5 looking downstream

Bankfull Elevation (ft)	Bankfull Area (ft^2)	Bankfull Width (ft)	Floodprone Elevation (ft)	Floodprone Width (ft)	Max Depth (ft)	Mean Depth (ft)	W/D Ratio	ER	Bank Height Ratio
1090.59	3.08	6.65	1091.33	>62.4	0.74	0.46	14.46	>9.39	1.0



Cross Section Plot - Baseline - May 2020

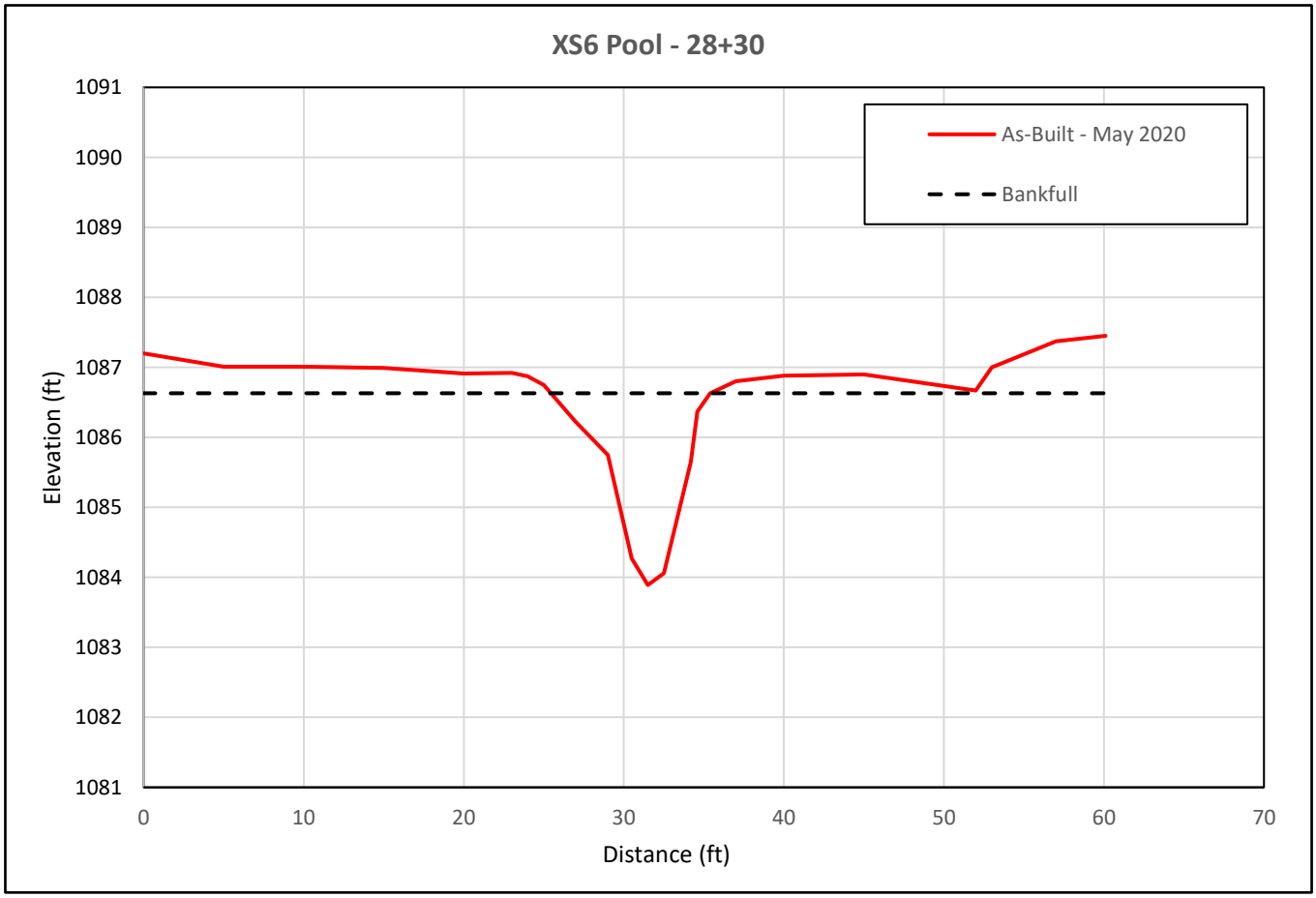
XS6 - UT1 Reach 3

Station 28+30 - Pool

XS6 looking upstream

XS6 looking downstream

Bankfull Elevation (ft)	Bankfull Area (ft^2)	Bankfull Width (ft)	Floodprone Elevation (ft)	Floodprone Width (ft)	Max Depth (ft)	Mean Depth (ft)	W/D Ratio	ER	Bank Height Ratio
1086.63	12.61	9.95	N/A	N/A	2.74	1.27	7.83	N/A	1.0



Cross Section Plot - Baseline - May 2020

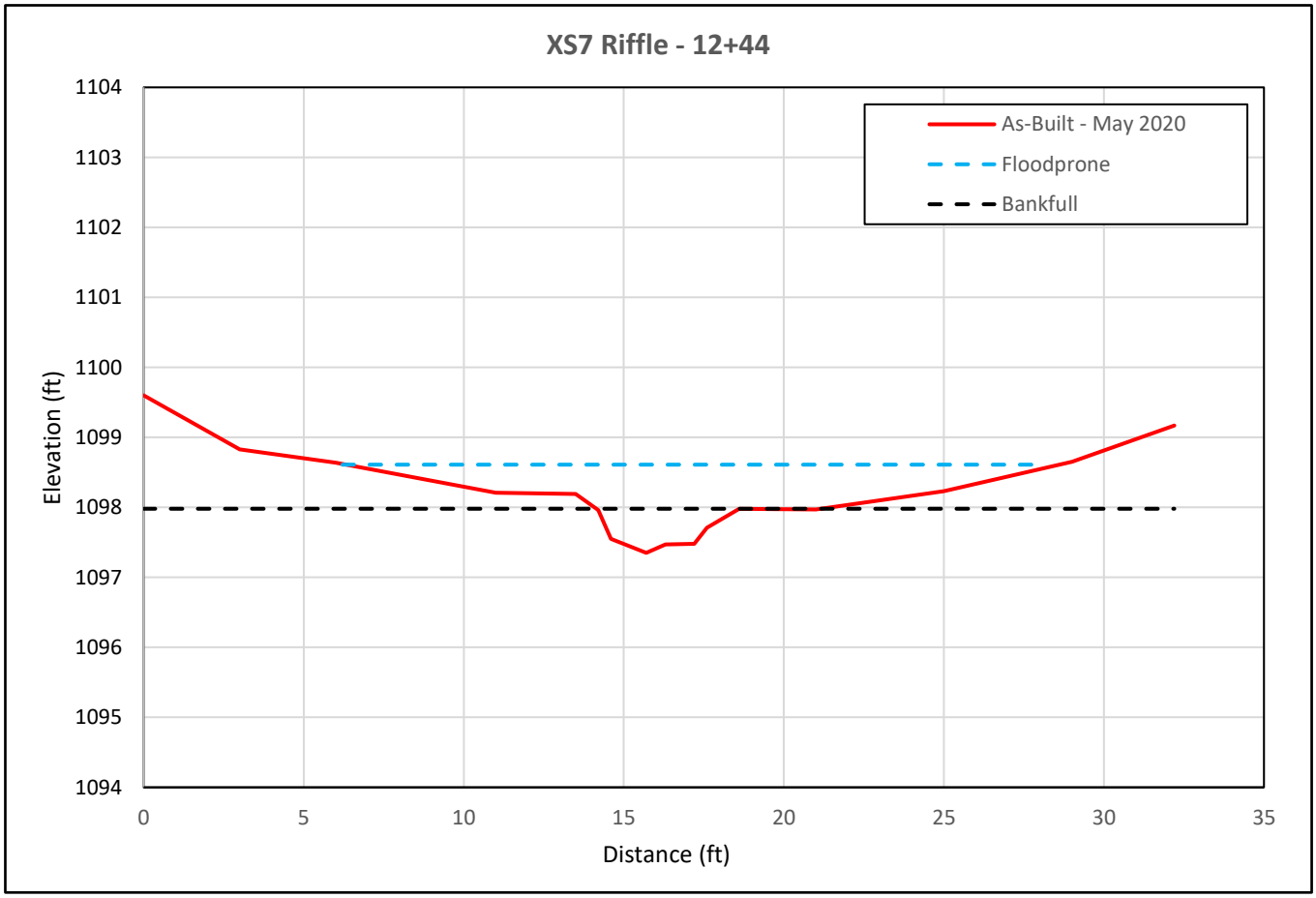
XS7 - UT1A

Station 12+44 - Riffle

XS7 looking upstream

XS7 looking downstream

Bankfull Elevation (ft)	Bankfull Area (ft^2)	Bankfull Width (ft)	Floodprone Elevation (ft)	Floodprone Width (ft)	Max Depth (ft)	Mean Depth (ft)	W/D Ratio	ER	Bank Height Ratio
1097.98	1.76	4.54	1098.61	22.27	0.63	0.39	11.64	4.9	1.0



Cross Section Plot - Baseline - May 2020

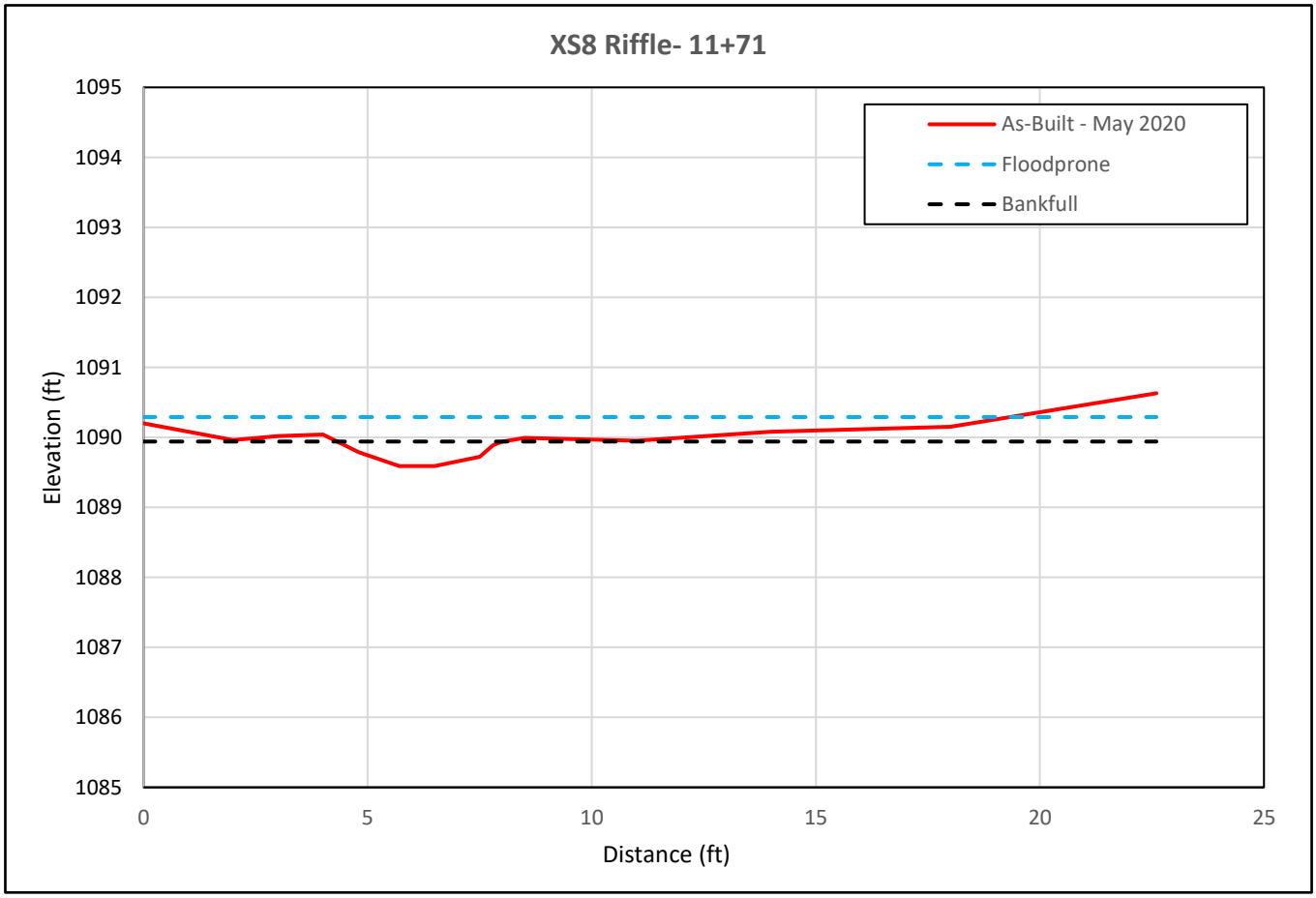
XS8 - UT1B

Station 11+71 - Riffle

XS8 looking upstream

XS8 looking downstream

Bankfull Elevation (ft)	Bankfull Area (ft^2)	Bankfull Width (ft)	Floodprone Elevation (ft)	Floodprone Width (ft)	Max Depth (ft)	Mean Depth (ft)	W/D Ratio	ER	Bank Height Ratio
1089.94	0.87	3.68	1090.29	>19.34	0.35	0.24	15.33	>5.26	1.0



Appendix E

As-Built Plan Drawings

PROJECT: GREENBRIER STREAM RESTORATION

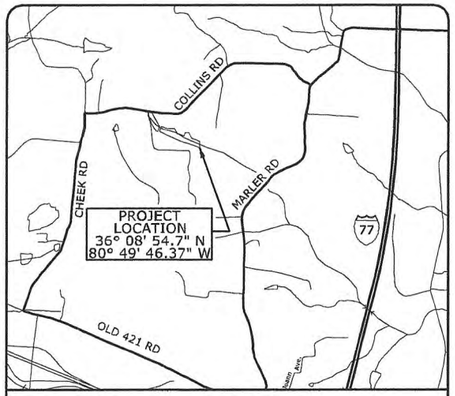
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES

STATE	PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	104	1	7

YADKIN COUNTY

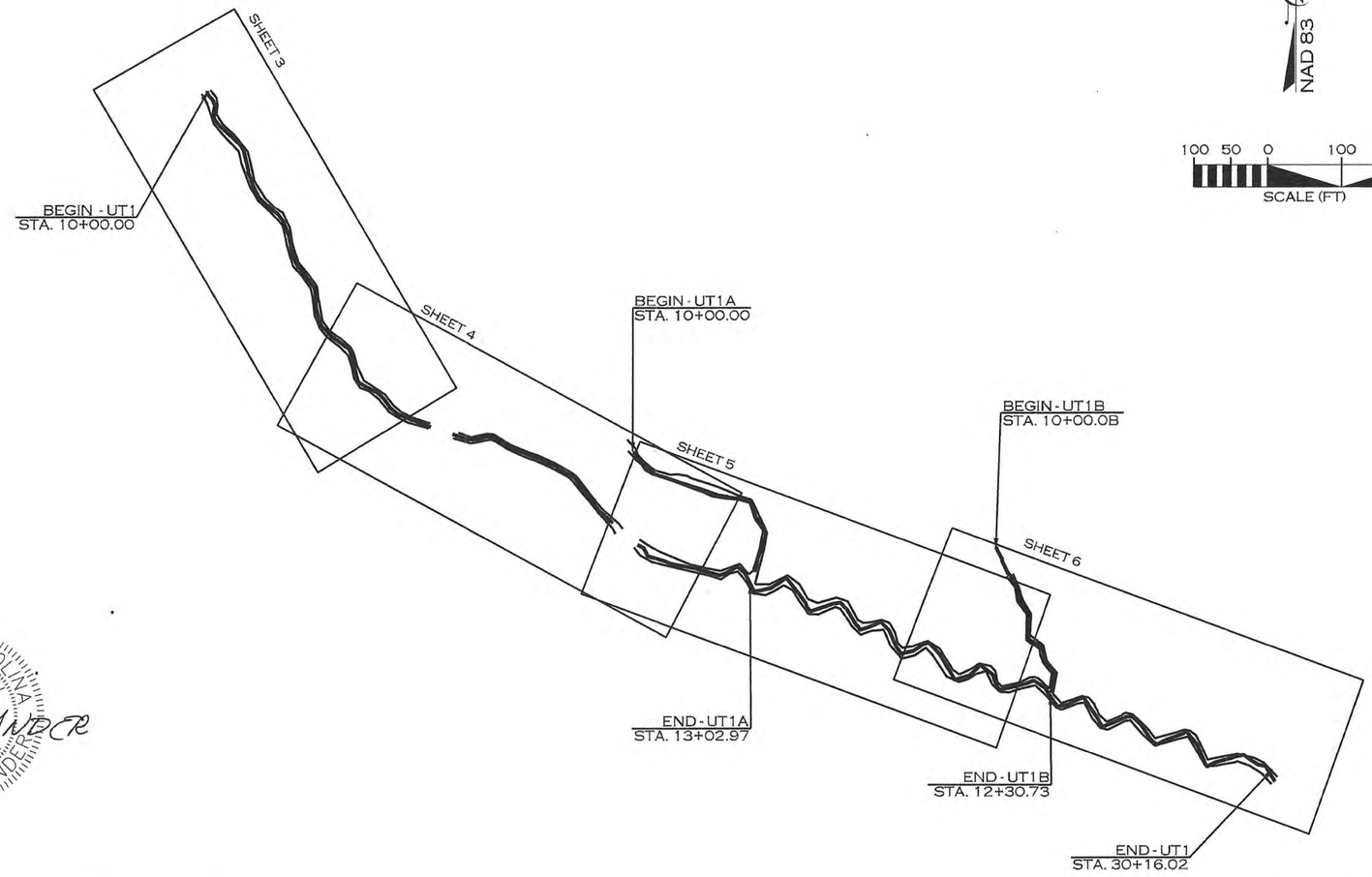
LOCATION: COLLINS RD, YADKIN COUNTY, NC

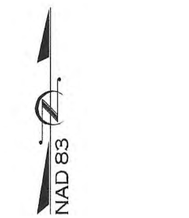
TYPE OF WORK: RECORD DRAWINGS

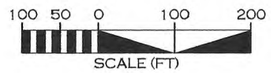


VICINITY MAP

INDEX OF SHEETS





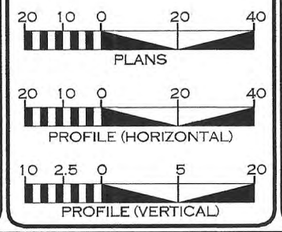


I, Franklin G. Kinder, certify that this map was drawn under my supervision from an actual GPS survey made under my supervision and the following information was used to perform the survey.
Class of survey: A
Positional Accuracy: 0.03 FT – Vert. Accuracy 0.02 FT
Type of GPS field procedure: GNSS North Carolina CORS RTK Network
Dates of survey -May – June 2020
Datum/Epoch – NAD83(2011)
Published Fixed Control Use: N/A
Geoid Model: GEOID12B
Combined Grid Factor(s) 1.00005478
Units: U.S. SURVEY FOOT
Equipment Used: Spectra Precision SP60 ADVANCED GNSS RECEIVER

NORTH CAROLINA PROFESSIONAL SEAL L-4462 LAND SURVEYOR FRANKLIN G. KINDER

07/14/20 FRANK KINDER
DATE FRANKLIN G. KINDER, PLS L-4462

GRAPHIC SCALES



REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	RECORD DRAWINGS	JB	KLT	7/13/20

PREPARED FOR:

NC Mitigation Services ENVIRONMENTAL QUALITY

NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

PAUL WIESNER
PROJECT MANAGER

PREPARED IN THE OFFICE OF:

EPR ECOSYSTEM PLANNING & RESTORATION
1150 SE MAYNARD ROAD
SUITE 140
RALEIGH, NC 27511
LICENSE # P-1182

SPRING 2020
COMPLETION DATE:

JAKE BYERS, PE
PROJECT ENGINEER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS 7/11/20

SIGNATURE: P.E.

PROJECT # 104 | SHEET NO. 2

SYMBOLOGY / NOTES

STREAM CONVENTIONAL SYMBOLS

- ROCK J-HOOK (JH)
- ROCK VANE (RV)
- OFFSET ROCK CROSS VANE (OV)
- ROCK CROSS VANE (XV)
- TEMPORARY SILT CHECK
- ROOT WAD (RW)
- GRADE CONTROL LOG J-HOOK VANE (LJH)
- LOG VANE (LV)
- LOG STEP (LS)
- ROCK STEP (RS)
- LOG CROSS VANE (XV)
- CONSTRUCTED CASCADE (CC)
- CONSTRUCTED RIFFLE (CR)
- BOULDER CLUSTER
- LOG ROLLER (LR)
- GRADE CONTROL WOODY RIFFLE (WR)
- TOEWOOD WITH GEOLIFT (TW)
- SOD MATS (SM)
- DEBRIS JAM (DJ-T#)
- SINGLE WING DEFLECTOR (SW) (SW)
- DOUBLE WING DEFLECTOR (DW)

- — SF — SAFETY FENCE
- — TP — TAPE FENCE
- — ||| — SILT FENCE
- —x— FENCE
- —(CE)— CONSERVATION EASEMENT
- - 20 - - EXISTING MAJOR CONTOUR
- - - - - - EXISTING MINOR CONTOUR
- ---------- LIMITS OF DISTURBANCE
- — — - BANKFULL BENCH (GRADE)
- — · — · · PROPERTY LINE
- — — - DOT RIGHT OF WAY
- ACCESS ROAD
- 10+00 STREAM THALWEG
- STREAM TOP OF BANKS
- FOOT BRIDGE
- TEMPORARY STREAM CROSSING
- PERMANENT FORD STREAM CROSSING (PFC)
- TRANSPLANTED VEGETATION
- TREE REMOVAL
- TREE PROTECTION
- GEOLIFT
- CHANNEL FILL / DITCH PLUG
- GRADE BANK 2:1 OR FLATTER
- EXISTING WETLANDS
- VEGETATED SWALE (VS)
- IMPERVIOUS DIKE

MONITORING FEATURES

- VP VEGETATION MONITORING PLOT
- MONITORING GAUGE
- PHOTO POINT
- XS MONITORING CROSS SECTION

ASBUILT FEATURES

- ASBUILT CONSTRUCTED RIFFLE
- ASBUILT TOE WOOD

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

GENERAL NOTES

1. CONSTRUCTION WAS COMPLETED IN APRIL 2020.
2. TOPOGRAPHIC SURVEY WAS COMPLETED BY KINDER LAND SURVEYING IN OCTOBER 2018.
3. ASBUILT SURVEY WAS COMPLETED BY KINDER LAND SURVEYING IN MAY 2020.
4. ALL WOODY RIFFLES WERE REPLACED WITH CONSTRUCTED RIFFLES PER DIRECTION OF THE ENGINEER.
5. SURVEYED ASBUILT FEATURES ARE SHOWN IN DARK BLACK, DESIGN FEATURES ARE SHOWN IN GREY, AND ANY FIELD CHANGES THAT WERE MADE DURING CONSTRUCTION ARE SHOWN IN RED. THE CONTOURS SHOWN ARE ASBUILT CONTOURS.

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS 7/17/20

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	RECORD DRAWINGS	JB	KLT	7/13/20

PREPARED FOR:
NC Mitigation Services ENVIRONMENTAL QUALITY
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

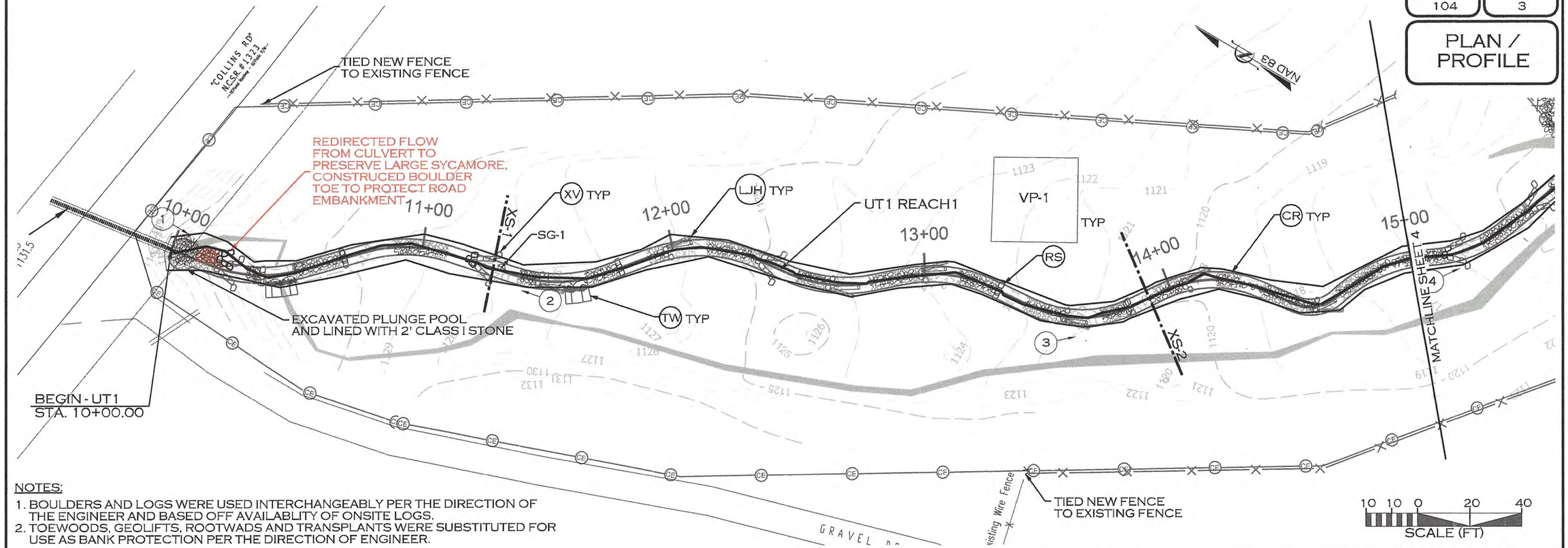
PREPARED IN THE OFFICE OF:
EPR ECOSYSTEM PLANNING & RESTORATION
1150 SE MAYNARD ROAD, SUITE 140
RALEIGH, NC 27511
LICENSE # P-1182

PROJECT ENGINEER

7/17/2020
R:\PROJECTS\RDU\0104_NCDEQ_GREENBRIER_FD\CADD\PLANS\ASBUILT\GREENBRIER_PSH_02.DGN
BYERS

PROJECT # 104 | SHEET NO. 3

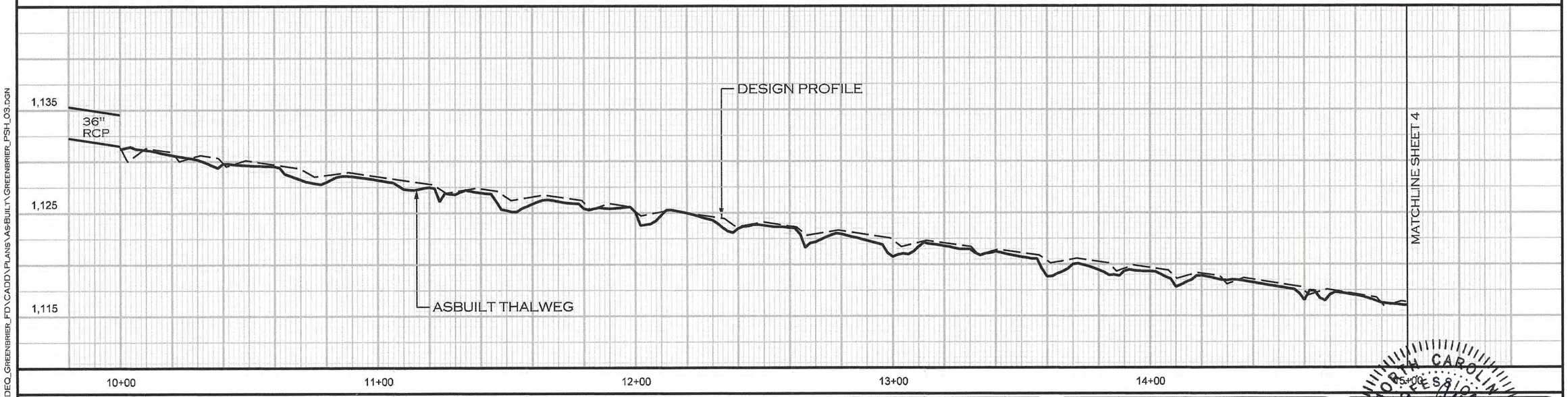
PLAN / PROFILE



NOTES:

1. BOULDERS AND LOGS WERE USED INTERCHANGEABLY PER THE DIRECTION OF THE ENGINEER AND BASED OFF AVAILABLITY OF ONSITE LOGS.
2. TOEWOODS, GEOLIFTS, ROOTWADS AND TRANSPLANTS WERE SUBSTITUTED FOR USE AS BANK PROTECTION PER THE DIRECTION OF ENGINEER.

SCALE (FT): 10 10 0 20 40



REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	RECORD DRAWINGS	JB	KLT	7/13/20

PREPARED FOR:
NC Mitigation Services
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
1150 SE MAYNARD ROAD, SUITE 140
RALEIGH, NC 27511
LICENSE # P-1182

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS
PROJECT ENGINEER
7/17/20

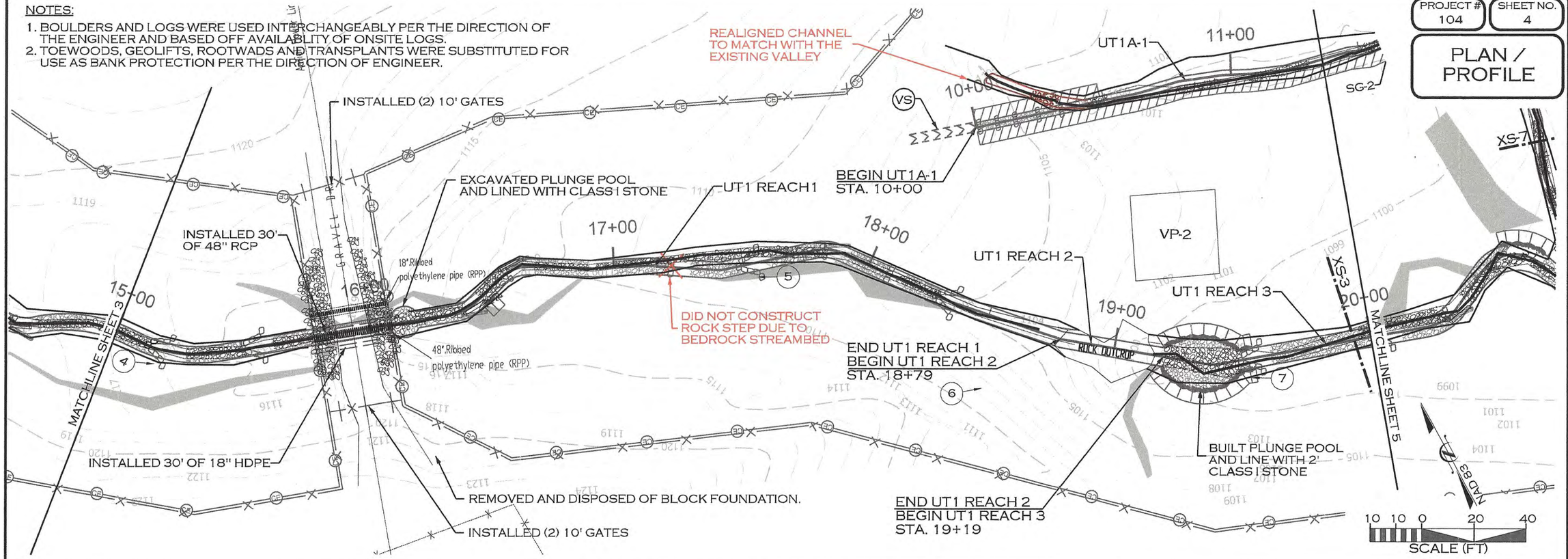
7/17/2020
P:\PROJECTS\RDU\0104_NCDEQ_GREENBRIER_FD\CADD\PLANS\AS-BUILT\GREENBRIER_PSH_03.DGN
RMYERS

NOTES:

1. BOULDERS AND LOGS WERE USED INTERCHANGEABLY PER THE DIRECTION OF THE ENGINEER AND BASED OFF AVAILABILITY OF ONSITE LOGS.
2. TOEWOODS, GEOLIFTS, ROOTWADS AND TRANSPLANTS WERE SUBSTITUTED FOR USE AS BANK PROTECTION PER THE DIRECTION OF ENGINEER.

PROJECT #	SHEET NO.
104	4

PLAN / PROFILE



REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	RECORD DRAWINGS	JB	KLT	7/13/20

PREPARED FOR:

NC Mitigation Services
ENVIRONMENTAL QUALITY

NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:

ECOSYSTEM PLANNING & RESTORATION
1150 SE MAYNARD ROAD, SUITE 140
RALEIGH, NC 27511
LICENSE # P-1182

PROJECT ENGINEER

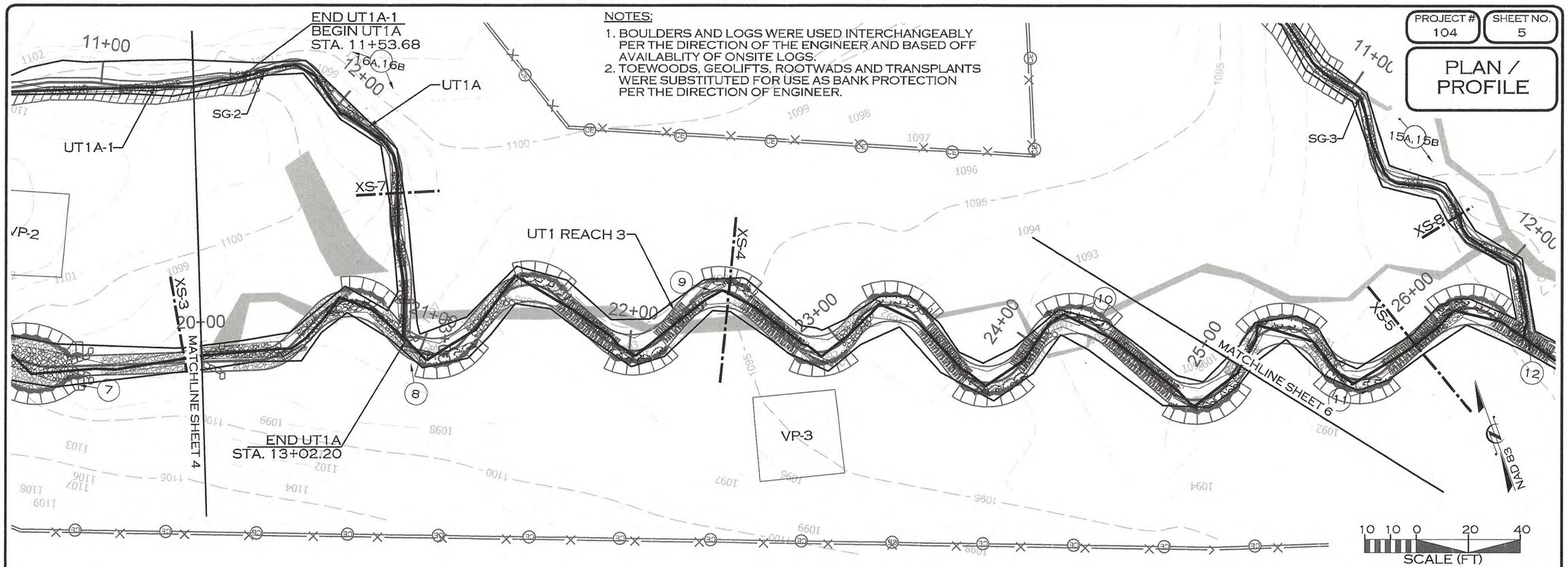
NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS 7/17/20

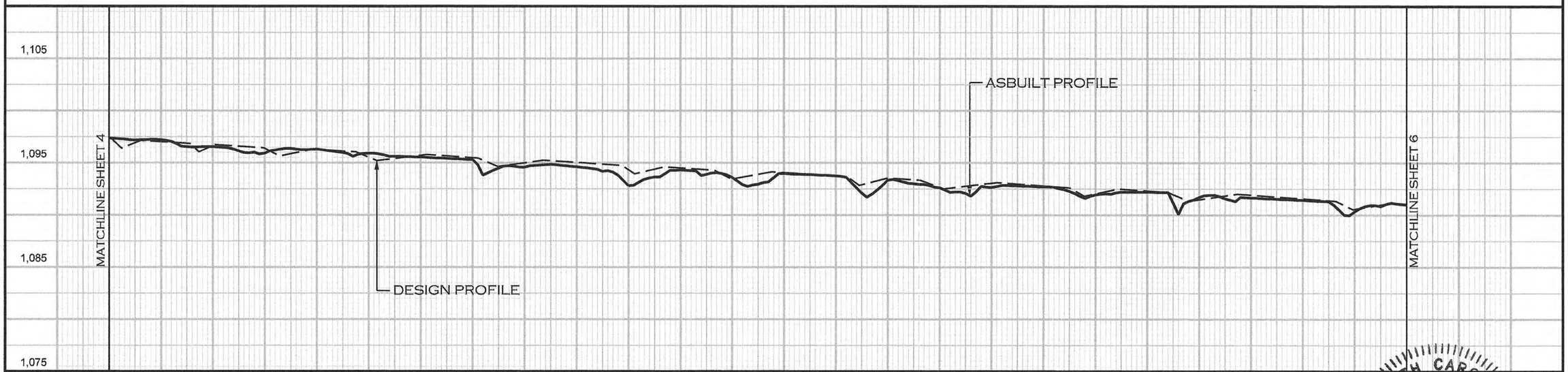
7/17/2020
R:\PROJECTS\RDU\0104_NCDEQ_GREENBRIER_FD\CADD\PLANS\AS-BUILT\GREENBRIER_PSH_04.DGN
RMYERS

PROJECT # 104 | SHEET NO. 5

PLAN / PROFILE

NOTES:
1. BOULDERS AND LOGS WERE USED INTERCHANGEABLY PER THE DIRECTION OF THE ENGINEER AND BASED OFF AVAILABLITY OF ONSITE LOGS.
2. TOEWOODS, GEOLIFTS, ROOTWADS AND TRANSPLANTS WERE SUBSTITUTED FOR USE AS BANK PROTECTION PER THE DIRECTION OF ENGINEER.





REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	RECORD DRAWINGS	JB	KLT	7/13/20

PREPARED FOR:
NC Mitigation Services
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:
EPR ECOSYSTEM PLANNING & RESTORATION
1150 SE MAYNARD ROAD, SUITE 140
RALEIGH, NC 27511
LICENSE # P-1182

PROJECT ENGINEER SEAL
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 039201 JACOB M. BYERS
7/17/2020

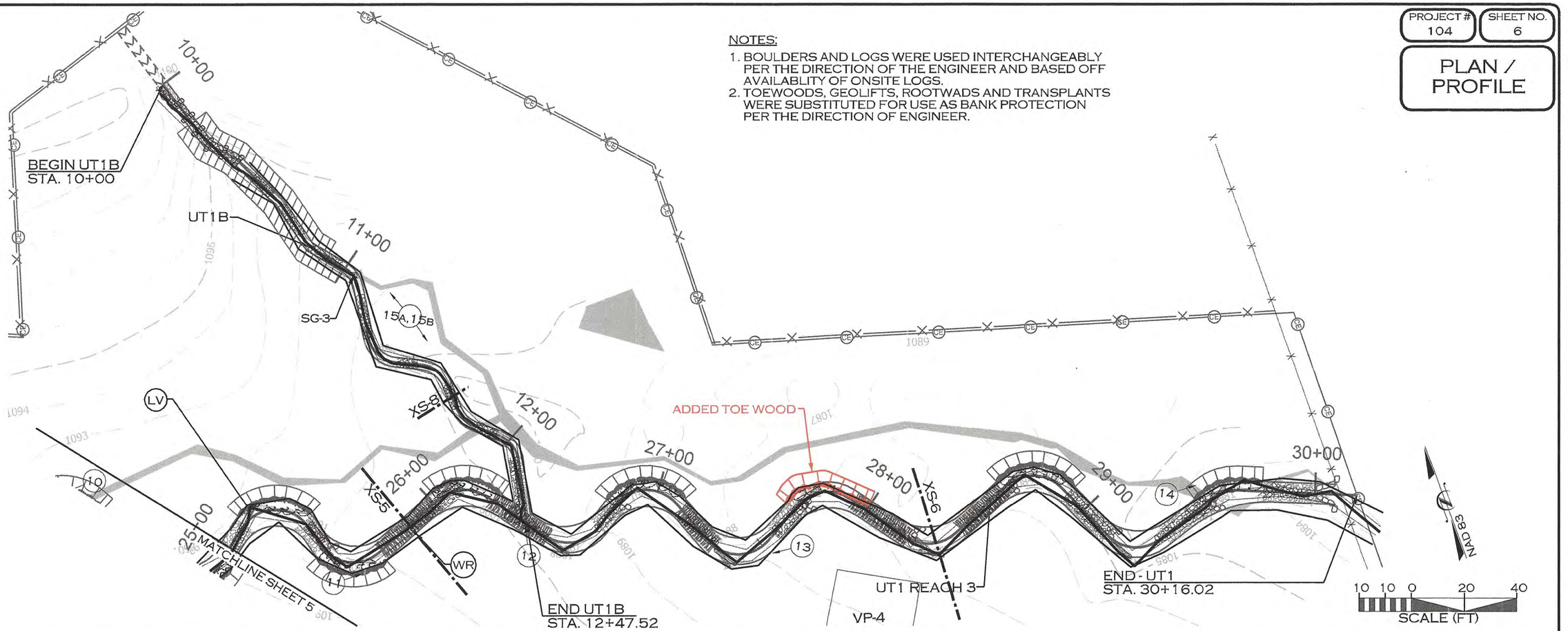
7/17/2020
R:\PROJECTS\RDU0104_NCDEQ_GREENBRIER_FD\CADD\PLANS\AS-BUILT\GREENBRIER_PSH_05.DGN
RMYERS

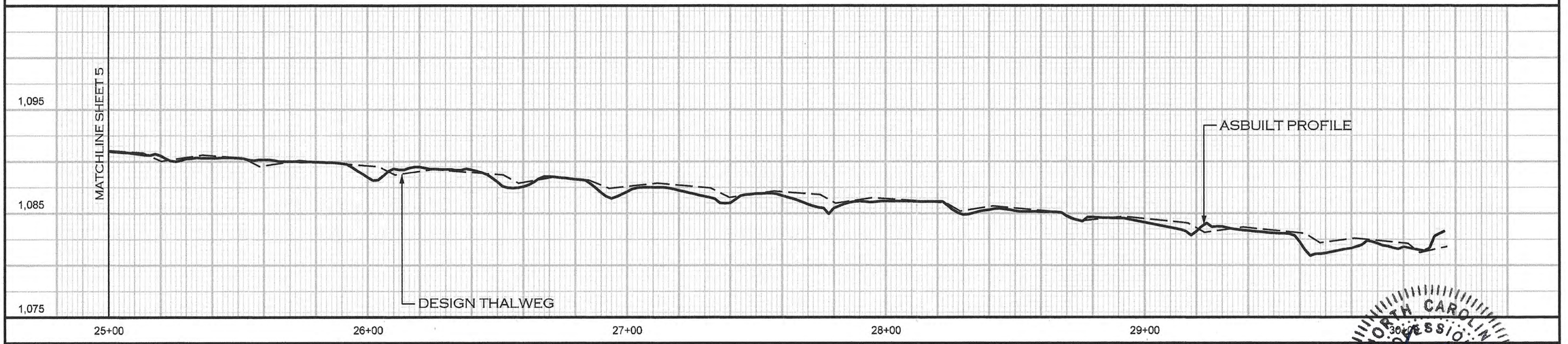
PROJECT # 104 | SHEET NO. 6

PLAN / PROFILE

NOTES:

1. BOULDERS AND LOGS WERE USED INTERCHANGEABLY PER THE DIRECTION OF THE ENGINEER AND BASED OFF AVAILABLITY OF ONSITE LOGS.
2. TOEWOODS, GEOLIFTS, ROOTWADS AND TRANSPLANTS WERE SUBSTITUTED FOR USE AS BANK PROTECTION PER THE DIRECTION OF ENGINEER.





REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	RECORD DRAWINGS	JB	KLT	7/13/20

PREPARED FOR:
NC Mitigation Services
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:
EPR ECOSYSTEM PLANNING & RESTORATION
1150 SE MAYNARD ROAD, SUITE 140
RALEIGH, NC 27511
LICENSE # P-1182

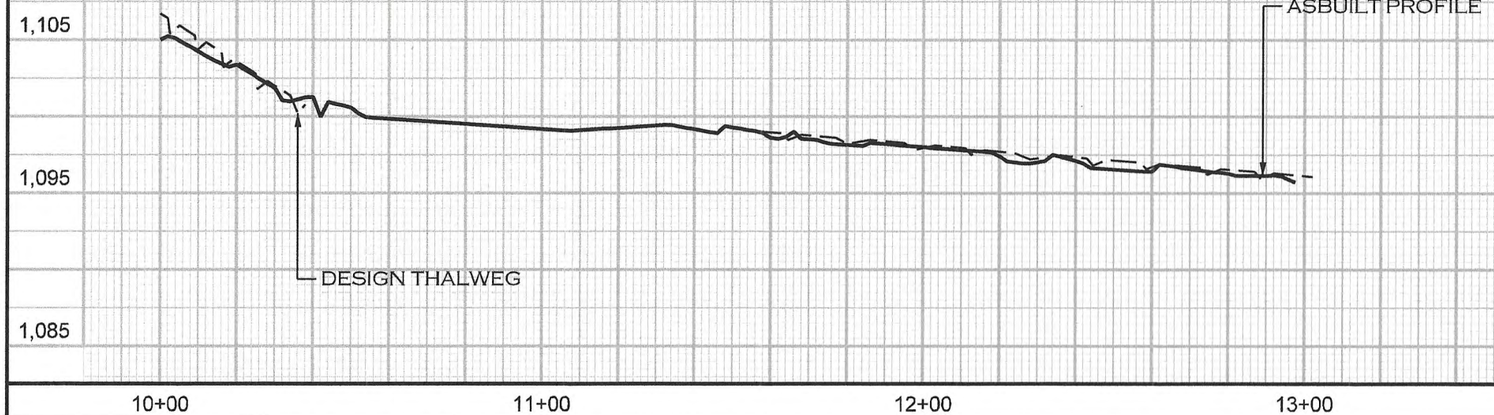
NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS 7/17/20
PROJECT ENGINEER

7/17/2020
R:\PROJECTS\RDU\0104_NCDEQ_GREENBRIER_FD\CADD\PLANS\AS-BUILT\GREENBRIER_PSH_06.DGN
RMYERS

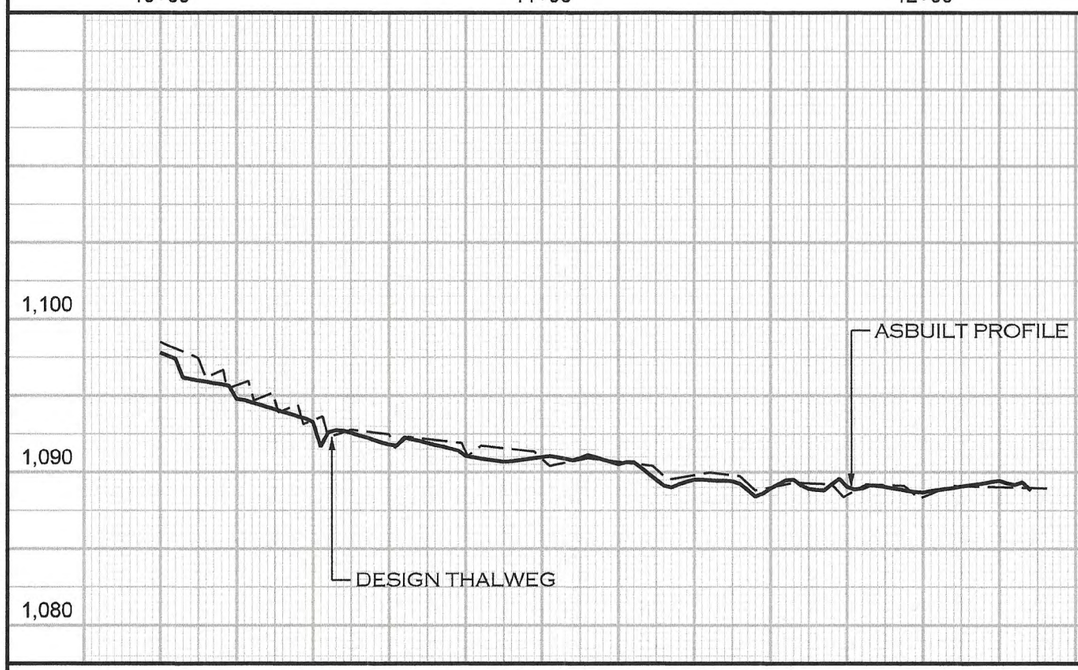
PROJECT # 104 | SHEET NO. 7

PROFILE

UT1A-1 AND UT1A



UT1B



REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	RECORD DRAWINGS	JB	KLT	7/13/20

PREPARED FOR:
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
1150 SE MAYNARD ROAD, SUITE 140
RALEIGH, NC 27511
LICENSE # P-1182

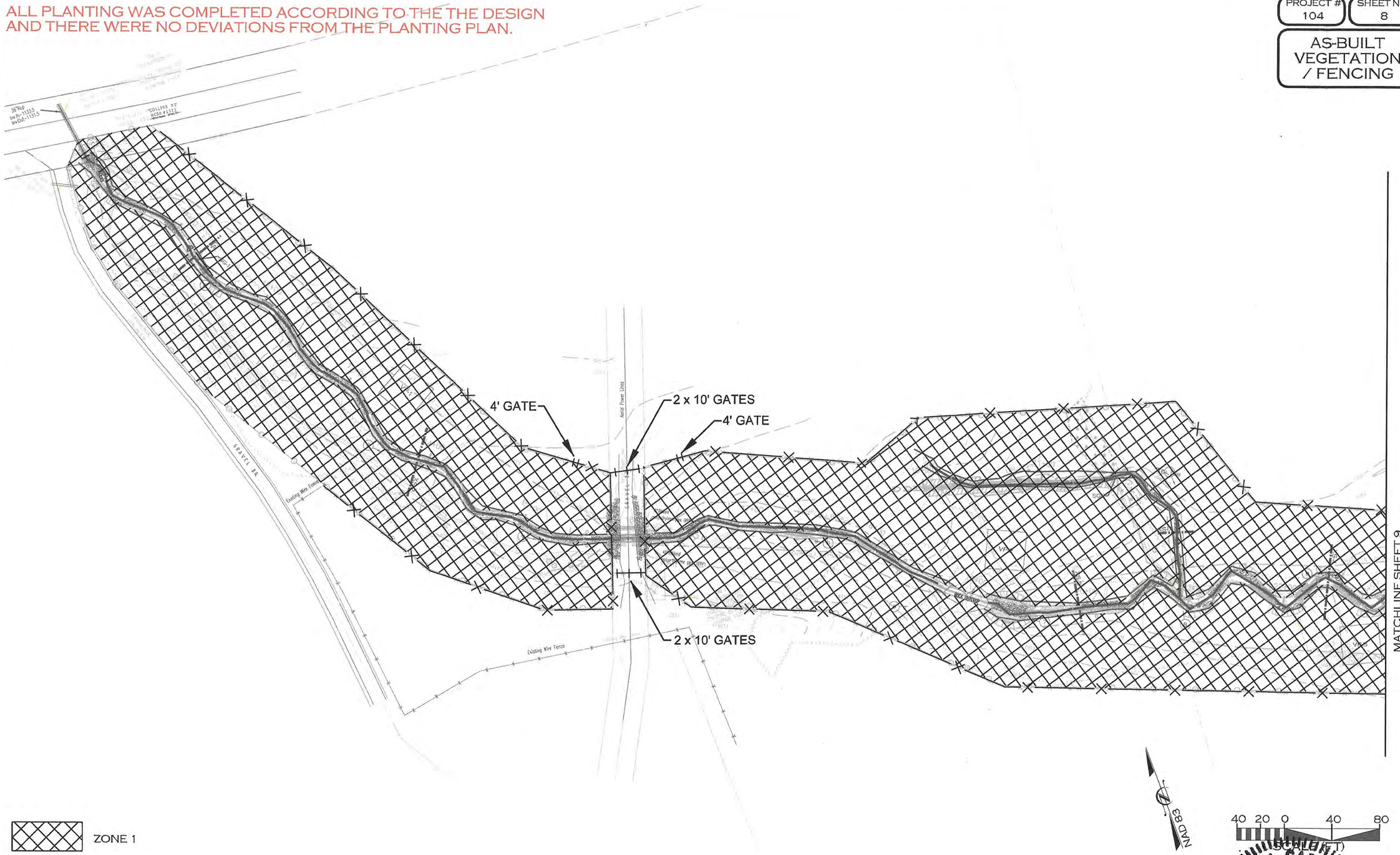
PROJECT ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS
7/17/2020

7/17/2020
R:\PROJECTS\RDU0104_NCDEQ_GREENBRIER_FD\CADD\PLANS\AS-BUILT\GREENBRIER_PSH_07.DGN
RMYERS

ALL PLANTING WAS COMPLETED ACCORDING TO THE THE DESIGN AND THERE WERE NO DEVIATIONS FROM THE PLANTING PLAN.

PROJECT # 104 | SHEET NO. 8

AS-BUILT VEGETATION / FENCING



ZONE 1

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	RECORD DRAWINGS	JB	KLT	7/13/20

PREPARED FOR:
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
1150 SE MAYNARD ROAD, SUITE 140
RALEIGH, NC 27511
LICENSE # P-1182

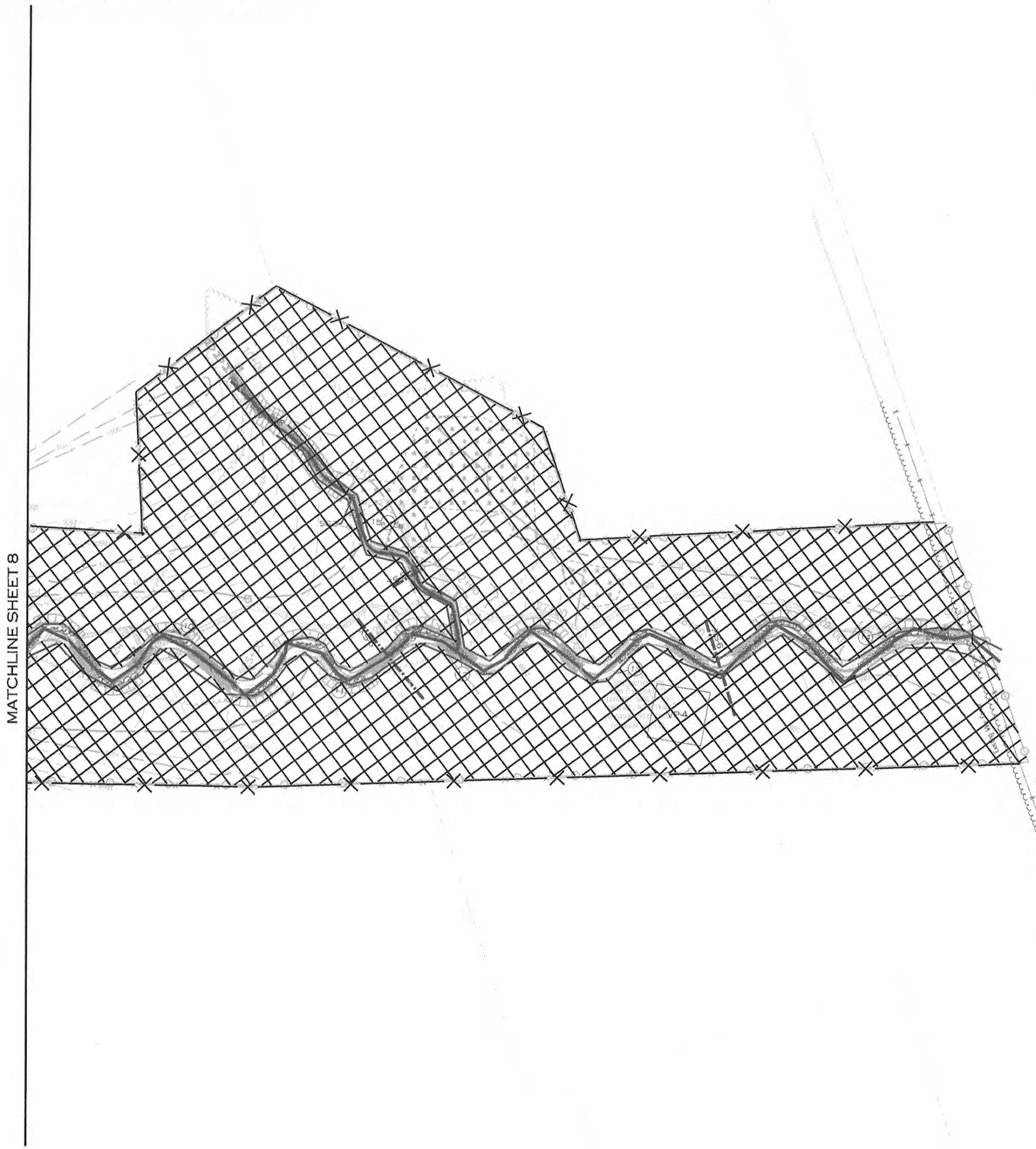
PROJECT ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 038201 ENGINEER JACOB M. BYERS 7/13/20

7/27/2020
R:\PROJECTS\RDU0104_NCDEQ_GREENBRIER_FD\CADD\PLANS\AS-BUILT\GREENBRIER_PSH_08.DGN
RAWERS

ALL PLANTING WAS COMPLETED ACCORDING TO THE THE DESIGN AND THERE WERE NO DEVIATIONS FROM THE PLANTING PLAN.

PROJECT # 104 | SHEET NO. 9

AS-BUILT VEGETATION / FENCING



ZONE 1

NAD 83

40 20 0 40 80
SCALE IN FEET

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	RECORD DRAWINGS	JB	KLT	7/13/20

PREPARED FOR:
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:
ECOSYSTEM PLANNING & RESTORATION
1150 SE MAYNARD ROAD, SUITE 140
RALEIGH, NC 27511
LICENSE # P-1182

PROJECT ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS
7/27/20

7/27/2020
R:\PROJECTS\RDU0104_NCDEQ_GREENBRIER_FD\CADD\PLANS\AS-BUILT\GREENBRIER_PSH_09.DGN
BYERS