Year 3 Monitoring Report

FINAL

Greenbrier Stream Mitigation Project

Yadkin County, North Carolina

Monitoring Year 3

Data Collection Period:	**Submission Date:**
August – November 2022	**December 2022**

NCDEQ Contract No. 7616
DMS ID No. 100086
USACE Action ID No. SAW-2018-01755
NCDWR ID: 20181272
Yadkin River Basin
HUC 03040101

Prepared For:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27603

Prepared By:

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Mr. Paul Wiesner
NCDEQ – Division of Mitigation Services
DEQ Asheville Regional Office
2090 U.S. 70 Highway
Swannanoa, N.C. 28778-8211

December 9, 2022

RE: Response to Draft MY3 Monitoring Report Comments dated December 2, 2022
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 MY3 Monitoring Report provided December 2, 2022. The comments have been addressed as described below and the Final Baseline Report and electronic deliverables have been revised in response to this review.

- ***General:*** *The following are DMS notes from the project's 4/20/2022 IRT Credit Release meeting for MY2 (2021): EPR noted that supplemental planting was conducted in MY2(2021) on the site and was successful. No supplemental planting was conducted in MY3(2022). The IRT requested that one of the random plots be captured on the north side of the site near cross-section 6 in MY3(2022).*
    - **VP6-R was located in the requested area of the left bank of UT1 near XS-6 during MY3.**

  The IRT noted species dominance in vegetation plots as a potential concern. The IRT asked that EPR look at vegetation diversity and address it accordingly if a supplemental planting effort is planned for the site in the future.
    - **As of MY3 monitoring, vegetation species diversity is not a concern for the Greenbrier Site.**

  Vegetation Plot VP3F has a reported low height in both MY1(2020) & MY2(2021). EPR will take a look and determine if soil amendments will be required in the area and will continue to monitor vegetation plot height site wide.
    - **Overall, average tree heights across the site increased from 1.7 feet in MY2 to 3.3 feet in MY3. This shows a significant increase toward meeting the Year 5 performance criteria of 7 feet.**

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The IRT noted that cross-section 8 on UT1b appears to be aggrading. The IRT requested that this cross section be discussed, and all cross sections be reviewed and discussed in detail in the MY3(2022) report.

- **Cross section 8 on UT1B has experienced some growth of channel vegetation in past monitoring years that has resulted in a decrease in bankfull area from year to year. In MY3, it was noted that this cross section is now almost entirely shaded and vegetation should not be as much of an issue in future monitoring years. This is addressed in the Final Report.**

All flow gauges met the established success criteria. Invasives were discussed and none were reported in MY2(2021). EPR will continue to treat invasive throughout the monitoring term and plans to be on-site to monitor and treat invasives in May 2022. The IRT requested that culvert inlet and outlet photos be taken at all crossings in the MY3(2022) report (Collins Road & the project mainstem crossing).

- **Photos of the culvert crossings have been added to the photo log and will be replicated in future monitoring years.**

Please review, respond and update the report text as necessary to document and incorporate the discussions and requests from the 4/20/2022 IRT Credit Release meeting.

The following action items were identified during the 11/8/2022 MY3(2022) DMS property boundary assessment:

•Evaluate the extent of permissible mowing areas along platted roads and limit road shoulder mowing to allowable areas. The landowner should be notified of any areas where mowing will be restricted. Supplemental easement boundary marking (additional boundary markers; horse tape; etc.) should be installed to establish a new mow-line in any applicable areas.

- **This mowing and easement encroachment is addressed at the end of Section 2.2.1 in the Final MY3 Monitoring Report. The landowner has been informed of this encroachment and additional signage will be installed along the easement boundary during winter 2022.**

•The Recorded Plat notes a 16' Private R/W along Meadow Brook Road. Please confirm that the recorded conservation easement ties to the noted ROW and the areas do not overlap.

- **EPR has confirmed (12/8/2022) that the recorded conservation easement and the ROW do not overlap.**

•Conduct fence maintenance by removing fallen trees and repairing damaged wire.

- **The fence will be repaired and the trees removed in winter 2022.**

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•The nails used to fasten the conservation easement signs to the posts are coming loose. Re-fasten displaced signs. Recommend replacing the nails with upgraded fasteners.

- **The loose signs will be re-fastened to the posts during winter 2022.**

- ***General_UT1B_Appendix F (IRT Correspondence*)**: *During the 11/8/22 IRT credit release site visit, the IRT noted that they had concerns about the lower extents of UT1B turning into a braided wetland system and noted that the stream credit along this section of the reach should be considered "at risk". In the response letter and revised report, please provide a linear footage and stream mitigation credit estimate of the potential "at risk" stream section of UT1B*
  - **128 feet of lower UT1B is currently considered at risk. This equates to 128 credits. A shapefile of this at-risk area has been included in the digital submittal. This is addressed in the Final Report in Section 2.1.3.**

- ***Section 2.2.1 Vegetation Monitoring Data*** *- This section indicates that the MY2 (2021) supplemental planting area is shown on the CCPV maps. This is incorrect. DMS recommends adding the 2021 supplemental planting map to Appendix B along with the 2021 supplemental planting list. In addition, the report text regarding the 2021 supplemental planting does not appear to be consistent with the Greenbrier 2021 Supplemental Planting Species List provided in Appendix B. The planting list appears to have discrepancies as well. Please QA/QC the report text and planting list in Appendix B to confirm they are correct and consistent*
  - **Appendix B has been updated to include the correct supplemental planting list. Appendix B now includes Greenbrier MY2 CCPV which shows areas that were supplementally planted in 2021.**

- ***CCPV Maps & Table 5. Vegetation Condition Assessment Table*** *- The project encroachment identified on the site on 11/8/22 should be clearly shown on the CCPV maps and reported in the Table 5 vegetation condition assessment table.*
  - **Easement encroachment area has been added to the CCPV and Table 5 has been updated accordingly.**

- ***CCPV Maps*** *– In the map legend, please update Streams – Enhancement to Streams – Enhancement II. Two (2) small, vegetated overbank side channels were noted in the 11/8/2022 IRT credit release site visit meeting notes. Please show these areas on the CCPV map sheets for reference and briefly discuss them in the report text. EPR committed to taking additional photos of these areas in future project monitoring reports.*
  - **The CCPV maps have been updated to show the Enhancement streams as Enhancement II. The two small overbank side channels have also been added to the CCPV as CPA-1 and CPA-3. A discussion of how they will be monitored in future years has been added to the report in Section 2.1.3.**

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- ***Appendix A - Photo Logs:*** *At the 4/20/2022 IRT credit release meeting, the IRT requested supplemental photos of the culvert inlets and outlets to confirm crossing stability and sufficient organism passage. Please provide the additional crossing photos in the revised MY3 report to document the culverts as requested. These additional culvert photos should be labeled accordingly.*
    - **Culvert photos have been provided in the revised MY3 report. New photo points are now associated with these culvert photos (Photo points 17,18,19).**

- ***Appendix D – Stream Flow Data Graphs:*** *On the graphs, please add a call out showing both the start and end of the 307 & 54 consecutive days of stream flow reported. Further comments regarding these graphs are provided in the digital support files comments below.*
    - **Graphs have been updated to call out the consecutive days of flow.**

- ***Appendix E – Table 11:*** *Please remove future dates from the cells where monitoring has not been completed to date (MY4-MY7).*
    - **The future dates have been removed from Table 11.**

<u>Electronic Support File Comments:</u>

- *The identified LTB in a few of the cross sections seems slightly off (ex. cross section 3). Please review the data and confirm its accuracy.*
    - **After reviewing cross sections, XS-5 LTB was changed to a lower elevation on the opposite bank. XS-5 now has a bankfull area that is closer to As-built conditions and the bank height ratio is near 1.0. All other cross sections reviewed had reasonable LTB calls that coincide with previous monitoring years' stationing and elevation.**

- *The number of days of consecutive flow indicated in the tables beneath the graphs for gauges 2 and 3 do not appear to be accurate. Please specify the 307 and 54 days of consecutive flow indicated on the GBSG2 and GBSG3 graphs respectively; the water level presented in the first is not sufficient to sum to 307 and the level appears to fall below the downstream thalweg elevation for many of the 54 days in the latter. Please review and resubmit these electronic gauge files and update the MY3 report as necessary.*
    - **All hydrographs have been updated to show number of consecutive flow days and the specific dates. Consecutive flow days for SG1 and SG2 have been verified and are accurate. Water level readings for SG2 are likely being inflated by fine organic sediments from the upstream riparian wetland, but EPR believes this channel demonstrates near perennial flow due to groundwater interaction. A game camera will be installed on SG2 to provide further evidence of flow during MY4.**

      SG3, which is installed in UT1B, demonstrated 50 consecutive days of flow from 2/22/2022 to 4/12/2022. Within this time period, the flow data, which is collected

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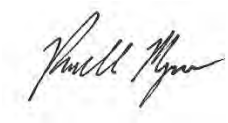
hourly, occasionally drops below the surveyed downstream riffle elevation for a few hours at a time, but only by as much as 0.024'. This amount of fluctuation in the stream flow is well below the survey tolerance of the measurements for the elevations of the downstream riffle, bankfull, and the logger itself. Not counting the days when the data briefly dropped below the downstream elevation line, the gauge still demonstrated 35 consecutive days of flow from 2/22/2022 to 3/28/2022 and met the performance criteria for MY3.

- *In EPR's comment response letter, please also provide the methodology used for installing, assessing, and determining stream flow for the on-site gauges.*
    - **Stream gauges are installed toward the downstream ends of pools where the logger is likely to remain underwater during periods of flow. The logger is mounted inside a PVC casing with well screen at the bottom, and the PVC is secured to a 6' T-post using hose clamps. The elevations of the logger, bankfull, and the downstream grade controlling feature, such as a constructed riffle, are surveyed using a laser level. A nearby surveyed cross section pin is used as a benchmark. The logger takes a water level reading every hour and the pressure readings are calibrated using atmospheric barometric pressure data from a nearby gauge installed on the floodplain. The depth and elevation of water above the logger is compared to the elevations for the downstream grade control feature and the bankfull elevation to determine whether the stream was flowing and whether a bankfull event had been recorded. Multiple bankfull readings during a single 24 hour period are considered a single event. Stream flow data is interpreted by assuming that a day with a majority of readings above the downstream grade control elevation is a successful day. If a day has multiple readings that fall significantly below that elevation, it is considered to be an unsuccessful day. These readings and success/failure are automatically calculated and assessed in the gauge spreadsheet, then manually verified and adjusted for erroneous readings as needed.**

If you have any questions regarding the MY3 Monitoring Report, please contact me at 304-661-9974 or via email at rmyers@eprusa.net.

Sincerely,



Russell Myers

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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 (NCDMS) to provide 2,300 stream mitigation credits (SMCs) in the Yadkin River Basin, Hydrologic Unit Code (HUC) 03040101. The Project was instituted via NCDEQ-DMS RFP # 16-007406. 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.

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 approximately 49% agricultural land, 42% forest, and 8% developed land, including open space and low intensity development. Prior to construction activities, project streams were incised, straightened, and suffered from significant damage from cattle. The adjacent wetlands were small, but similarly trampled, and heavily grazed. Pre-construction, or pre-existing, site conditions are provided in Table 8 of Appendix C. 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). These goals and objectives are presented in Table 2.

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 Appendix E.

1.2 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 follows the guidance *NCDMS Annual Monitoring Report Format, Data, and Content Requirements* (October 2020). Table 2 details the United States Army Corps of Engineers (USACE) success criteria that evaluate whether project goals have been met throughout the monitoring period.

Table 1. Project Mitigation Quantities and Credits

Project Component (reach ID, etc.)	Original Mitigation Plan (ft)	As-built (ft)	Thermal Regime	Original Restoration Level	Original Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
UT1 Reach 1	843.00	852.00	Warm	R	1.00000	843.00	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
UT1 Reach 2	40.00	40.00	Warm	E2	2.50000	16.00	Bank stabilization, Bioengineering, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement
UT1 Reach 3	1097.00	1141.00	Warm	R	1.00000	1097.00	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
UT1A-1	153.70	145.00	Warm	E2	2.50000	61.48	Grade Control Structures, Bank Stabilization, Exclusion of Livestock, and Permanent Conservation Easement.
UT1A	148.50	153.00	Warm	R	1.00000	148.50	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
UT1B	247.50	228.00	Warm	R	1.00000	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. Summary: Goals, Performance and Results

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Reduce sediment inputs and stream turbidity;	▪ Stabilize eroding stream banks. ▪ Install fencing to exclude livestock from project streams. ▪ Increase distance between active farming operations and receiving waters by re-establishing a riparian buffer permanently protected through a conservation easement.	▪ The exclusion of livestock will remove a direct source of nutrients, coliform, and sediment from the system, as well as a major contributor to channel instability. ▪ Restored riparian buffers will provide woody debris and detritus for aquatic organisms, reduced water temperatures, and increased dissolved oxygen concentrations, as well as shade and diverse aquatic and terrestrial habitats that are appropriate for the ecoregion and setting.	▪ Recordation and protection of a conservation easement meeting NCDMS guidelines ▪ Visual inspection of fence installed to exclude cattle from the stream and riparian buffer, demonstrating no encroachment. ▪ Vegetation success criteria of 320 native stems/acre in Year 3, 260 stems/acre in Year 5 and 210 native stems/acre in Year 7. ▪ Trees must average 7 feet in height at year 5, and 10 feet in height at year 7. ▪ Visual inspection of BMP's to ensure proper function during monitoring period. ▪ Geomorphic cross sections indicate stable sections over the monitoring period. ▪ Bank height ratio (BHR) cannot exceed 1.2 for all measured cross sections on a given reach. ▪ Entrenchment ratio (ER) must be 2.2 or above for all measured riffle cross-sections for C/E stream types and 1.4 or above for B stream types.	<u>Permanent Vegetation Plots</u> 4 permanent vegetation plots, 0.02 acre in size, surveyed during As-built, Years 1, 2, 3, 5, and 7 between July 1st and leaf drop. Data collection includes species, height, planted vs. volunteer, and age.	In Monitoring Year 3, all permanent vegetation plots exceeded the performance standard as indicated for stem density in Year 3 with an average of 556 stems/acre.
Reduce nutrient inputs	▪ Install fencing to exclude livestock from project streams. ▪ Reduce the amount of land in active livestock pasture. ▪ Increase distance between active farming operations and receiving waters by re-establishing a riparian buffer permanently protected through a conservation easement. ▪ Restore riparian buffers to filter runoff.			<u>Annual Random Vegetation Plots</u> 2 randomly selected vegetation plots, 0.02 acre in size, surveyed during As-built, Years 1, 2, 3, 5, and 7 between July 1st and leaf drop. Data collection includes species and height.	The 2 randomly selected vegetation plots had an average stem density of 667 stems/acre and have met the interim success criteria of 320 native stems/acre in Year 3.
Reduce Fecal Coliform Inputs	▪ Install fencing to exclude livestock from project streams. ▪ Reduce the amount of land in active livestock pasture. ▪ Increase distance between active farming operations and receiving waters by re-establishing a riparian buffer permanently protected through a conservation easement.			<u>Cross Sections</u> Cross sections are surveyed during Years 1,2,3,5, and 7. 8 total cross sections, 6 on UT1 (3 riffle/3 pool), 1 on UT1A and 1 on UT1B.	The Year 3 monitoring cross-section survey indicates that the project streams are geomorphically stable and restored channel dimensions have not changed significantly during Monitoring Year 3. Some cross sections show some fluctuation in depth but all within an expected range. Overall, the cross sections indicate that all project streams are stable and functioning as intended.
Restore / Enhance Degraded Riparian Buffers	▪ Restore riparian buffer vegetation to filter runoff and provide organic matter and shade. ▪ Protect riparian buffers with a permanent conservation easement.				
Implement Agricultural BMPs in Agricultural Watersheds	▪ Install fencing to exclude livestock from project streams. ▪ Install alternative watering systems to keep livestock away from streams. ▪ Restore and protect riparian buffers. ▪ Install vegetated swales to slow and filter concentrated runoff before entering the streams.				

Table 2. Summary: Goals, Performance and Results

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Protect High Resource Value Waters (including HQW, ORW, and WS classifications)	▪ Restore appropriate bed form diversity, headwater stream/wetland form, and in-stream structures to provide appropriate habitat. ▪ Restore minimum 50-foot riparian buffers along all project reaches. ▪ Protect riparian buffers with a permanent conservation easement.	▪ Functional uplift will occur by restoring project channels to their historic valley, raising the streambeds, and connecting them to adjacent wetlands at lower flows. ▪ The addition of in-stream structures help to ensure channel stability and will provide greater bedform diversity, enhancing aquatic habitat for native species.	▪ Documentation of hydrophytic vegetation within vegetation monitoring plots. ▪ Documentation of four bankfull events in different years throughout the monitoring period. ▪ Documentation of 30 days of consecutive stream flow in all reaches each monitoring year	<u>Stream Profile</u> Full longitudinal survey on all restored and enhanced stream channels. Data was collected during As-built survey only.	A full longitudinal survey of the project streams was conducted during As-built monitoring. No signs of instability or degradation were noted during MY3 monitoring. Additional longitudinal profile surveys will not be conducted unless stability issues are identified in future monitoring years.
				<u>Visual Assessment</u> Conducted yearly on all restored stream channels and in-stream structures.	Stream photo points and visual assessment indicate that all restored channels and in-stream structures are performing as intended. No stream problem areas were observed.
				<u>Additional Cross Sections</u> Only surveyed if instability is documented during monitoring	No channel instability was documented during MY3 monitoring, so no additional cross sections were surveyed.
				<u>Stream Hydrology Monitoring</u> 3 pressure transducers (1 on UT1, UT1A, and UT1B) and a rain gauge will record precipitation and streamflow data continuously through the monitoring period. Photos of high-water indicators will be taken yearly.	Flow gauge data from MY3 indicate that both UT1 and UT1B met the established success criteria of 30 days or more of consecutive flow throughout the year. In addition, SG-1 recorded 3 bankfull events and SG-3 recorded 5 bankfull events during 2022. Due to equipment issues with SG-2, neither consecutive flow days nor bankfull events could be verified on UT1A. However strong stream flow has been observed along UT1A at every site visit.

Table 3. Project Attribute Table

Project Background Information				
Project Name		Greenbrier Stream Restoration Project		
County		Yadkin		
Project Area (acres)		6.7		
Project Coordinates (latitude and longitude)		latitude 36.1488 N, longitude 80.8289 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 Sq. Mi.)		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	Intermittent	Intermittent	Intermittent
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

2.0 MONITORING DATA ASSESSMENT

Monitoring Year 3 (MY3) data was collected in August through November 2022. Current site conditions and monitoring data are described in the following sections to evaluate whether the project is meeting the success criteria established in the mitigation plan.

2.1 Stream Monitoring

Stream monitoring involves field data collection to assess the hydrologic and geomorphic functions of UT1, UT1A, and UT1B. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table 2. 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 Table 2. The locations of the established monitoring cross sections and stream gauges are shown in Figure 2 Current Condition Plan View (CCPV).

2.1.1 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 was tied to a permanent benchmark and includes thalweg, right bank, and left bank features. Profile measurements were taken at the head and tail of each riffle, inverts of in-stream structures, and at the max depth of pools. The longitudinal profile will not be surveyed during annual monitoring unless vertical channel instability has been observed during monitoring and remedial actions or repairs are needed.

2.1.2 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 three (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 were surveyed using a Topcon RL-H5A Self Leveling Laser Level. Reported data includes measurements of bankfull elevation (based on the as-built bankfull area), bank height ratio (based on the as-built bankfull area), thalweg elevation, elevation of the low top of bank, maximum depth from the low top of bank, and low top of bank cross-sectional area (Appendix C). Stream dimension measurements were made using the most recent version of the NCDMS cross section tool. Reference photos were taken of both streambanks to provide a visual assessment of any changes that may have occurred since the previous monitoring year.

The Year 3 monitoring cross-section survey indicates that the project streams are stable and restored channel dimensions have not changed significantly during Monitoring Year 3. Cross sections were surveyed in October 2022 near the end of the growing season. At this time, portions of the stream channels still had vegetation growing in them, which affected the cross-section plots slightly. Every effort was made to survey the existing stream channel bottom and not the vegetation, but some of the cross-sections (XS3, XS6, and XS7) indicate that the channels appear to be temporarily aggraded. EPR does not believe this will be a long-term issue as the planted riparian trees and shrubs will continue to shade out the herbaceous vegetation growing in the channels. A decrease in channel vegetation was noted from previous monitoring years and has a direct correlation with stream shading and woody vegetative growth on streambanks. The riffle cross-sections showed only minor fluctuations compared to the as-built conditions and all restored streams meet the success criteria for restored stream

channels as established in the mitigation plan and shown in Table 2. The cross-section plots, photos, and data summary (Table 9) are included in Appendix C.

2.1.3 Channel Stability

Channel stability is assessed on a yearly basis using photographs to visually document the condition of the restored project streams. Photographs are taken from the same location in the same direction each year. 16 photo points were established during baseline monitoring and are shown in Appendix A. Three 3 more points have been established since baseline monitoring, for a total of 19 photo points. The locations of each permanent photo point are shown in the CCPV (Figure 2). Visual assessments of channel stability and in-stream structure condition were also made regularly throughout Monitoring Year 3.

Stream photo points and visual assessments indicate that all restored channels and in-stream structures are in good condition and performing as intended. No significant stream problem areas were observed. Some sections of the restored channels contain thick herbaceous vegetation; however, it does not appear to be causing any significant problems. EPR believes this is a temporary issue and the vegetation should flush through the stream system during the dormant season and eventually be shaded out by streamside trees and shrubs. To further expedite stream shading, EPR will plant additional live stakes along bare channel areas during the dormant season 2022-2023.

During the IRT Credit Release Site Visit in November 2022, the IRT noted two small, vegetated overbank side channels, one along the left bank of UT1 Reach 1 below the culvert crossing and one along the left bank of UT1B. These two areas have been included in the CCPV as CPA-1 and CPA-3. These side channels will be inspected during future site visits to ensure they continue to remain stable. Additional photos will be taken of these areas during MY4 monitoring. The IRT Site Visit Meeting Minutes are included in Appendix F.

The IRT also expressed concern that the lower extent of UT1B is at risk of turning into a braided stream/wetland system. This section includes 128 linear feet of channel with 128 credits being at risk. EPR will continue to monitor UT1B in MY4. This reach is mostly shaded by willows as of the end of MY3 and will likely remain clear and stable in future monitoring years. This section of UT1B is shown in the CCPV as CPA-2.

2.1.4 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). All three gauges were installed in the downstream end of pools. The constructed bankfull elevation at each gauge was recorded, as well as the elevation of the downstream controlling grade. These elevations are compared with the gauge readings to determine whether the stream is flowing and if a bankfull event has occurred.

This Project utilizes 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 can be compared to the flow gauge data to verify that high flows at the Site are correlated with rainfall events. The monitoring gauges were downloaded regularly throughout Monitoring Year 3. Rainfall data is presented in Figure 3. Monthly Rainfall Summary Data and the precipitation and water level hydrographs are included in Appendix D.

Flow gauge data from MY3 indicate that two out of the three (SG-1, SG-3) project streams met the established success criteria of 30 days or more of consecutive flow throughout the year. According to the gauge for UT1 (SG-1), the stream had 307 days of consecutive flow and 3 bankfull events during Monitoring Year 3. Data from SG-2, located in UT1A, is difficult to accurately assess. The water level shown by SG-2 exceeds the bankfull elevation for the entirety of MY3, which is not accurate. EPR believes that suspended organic materials flowing into the stream via adjacent wetlands could be the cause of this exaggeration in water level. These organics likely accrued around the gauge and may be causing erroneous pressure readings. Based on visual assessments, historical gauging data from UT1a, and similarities in the water level fluctuations of other stream gauges, EPR believes that UT1A demonstrates nearly year-round flow and that the performance standard of 30 consecutive days of flow was met on UT1A. EPR cleaned and resurveyed the elevation of SG-2 at last gauge download. Data from SG-2 will be closely monitored in MY3 to determine if this trend continues, but EPR does not believe that this issue will be resolved as long as the riparian wetland continues to contribute fine organic sediment to the stream. EPR will install a game camera on the reach for MY4 to further demonstrate consecutive days of flow. SG-3, which is installed in UT1B, documented 50 days of consecutive flow and recorded 5 bankfull events.

2.2 Riparian Vegetation Monitoring

Riparian vegetation monitoring evaluates the growth and development of planted and volunteer vegetation across the site. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table 2. 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 Table 2.

2.2.1 Vegetation Monitoring Data

Four (4) permanent vegetation monitoring plots were monitored across the site. 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 flagged and identified to facilitate repeat monitoring each year. In addition to the 4 permanent plots, 2 randomly placed vegetation plots are established each vegetation monitoring year and the location of these plots is recorded using GPS. All vegetation plots for MY3 are shown in the CCPV (Figure 2). Annual vegetation data was compiled and summarized using the most recently updated version of the DMS Vegetation Data Entry Tool.

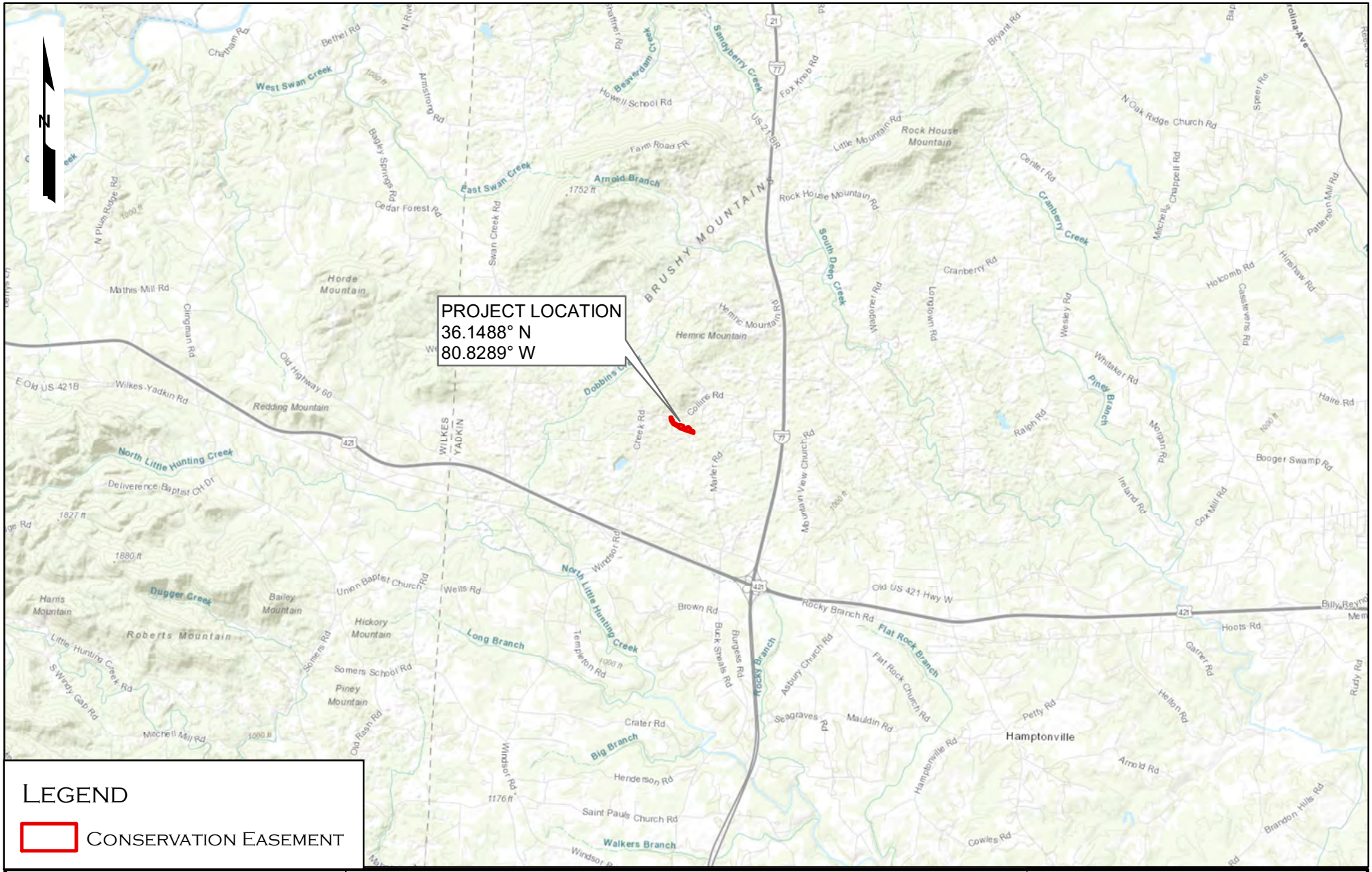
As documented in the Monitoring Year 2 report, the Greenbrier conservation easement area was supplementally planted in March 2021 in response to areas of low growth and stem count in Monitoring Year 1. Vegetation across the majority of the site was performing well in MY1 so these areas were only supplementally planted using a low stem density. Two areas (the left terrace along UT1 Reach 1 and the floodplain along lower UT1 Reach 3) were replanted using a higher number of stems because the trees in these areas had been smothered by dense herbaceous vegetation in MY1. A total of 1.28 acres were replanted (500 stems per acre) and 3.19 acres were supplementally planted (200 stems per acre). A total of 71% of the original planted area was replanted in 2021, but most of this was done using a low stem density. The supplementally planted areas are shown in the CCPV (Figure 2). A planted species list is provided in Appendix B and matches the species in the approved mitigation plan that were originally planted after construction.

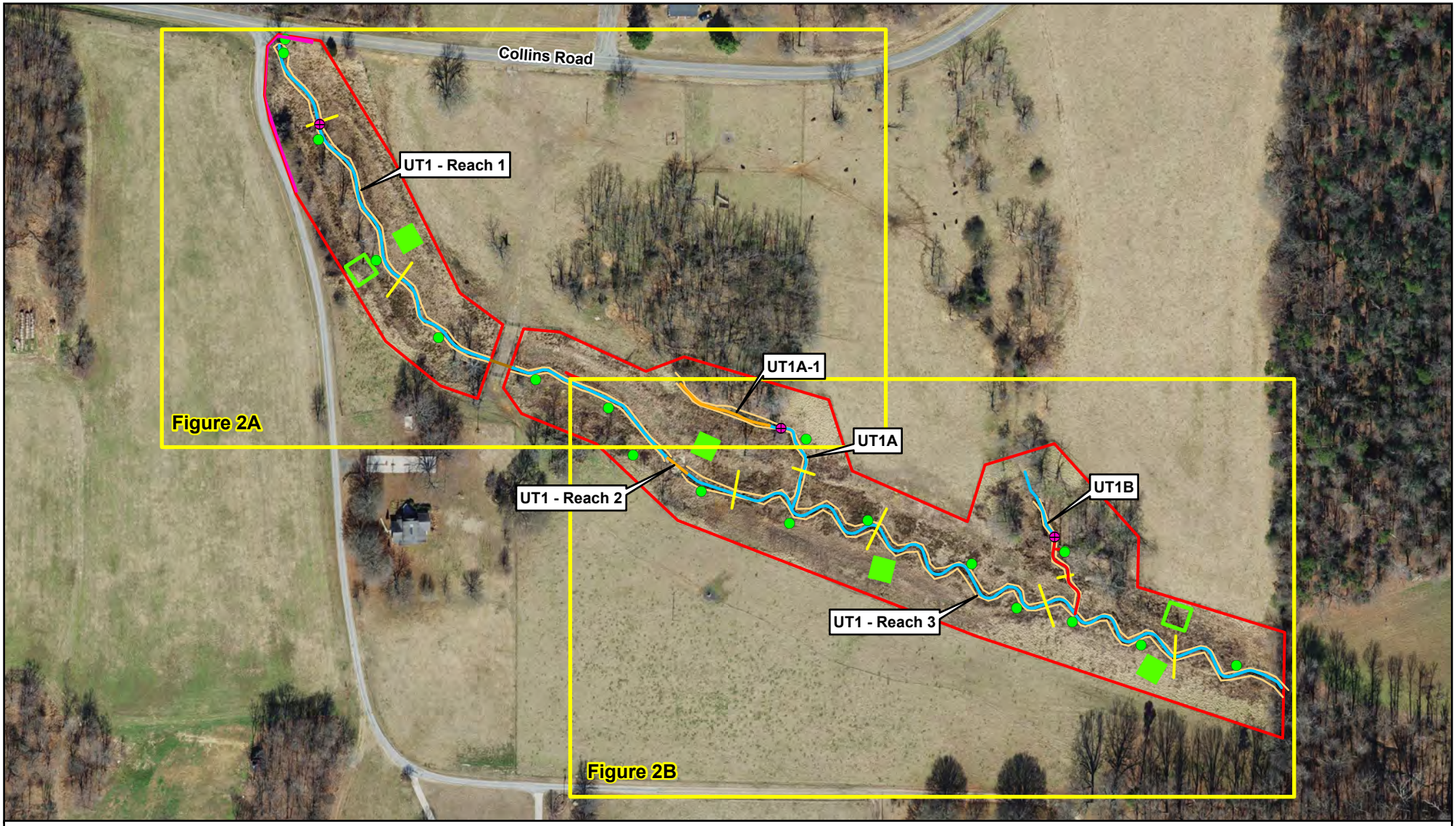
Year 3 vegetation monitoring occurred August 2022 before leaf drop. Stem counts for the vegetation plots (fixed and random) ranged from 10 trees per plot (405 trees per acre) in VP-4 F (Fixed) to 21 trees per plot (850 trees per acre) in VP-1 F (Fixed). The average stem density from all 6 vegetation plots (fixed and random) was 15 trees per plot (566 trees per acre). Therefore, the vegetation plot data indicates that planted trees on the Site are meeting the interim success criteria of 320 stems/acre in Monitoring Year 3. Average planted stem height for Monitoring Year 3 was 3.3 feet, up from the average stem height of 1.7 feet in MY2. This increase in stem height shows consistent growth among planted stems. Success criteria for stem height does not take effect until MY5, but stem height will be continually monitored for MY4 and MY5 to determine whether the site appears to be on track to meet the performance criteria in MY5.

Small amounts of Chinese privet and Bradford pear were spot treated February 2022. No other areas of concern regarding invasive species were noted during subsequent MY3 site visits.

As documented in the IRT Credit Release Site Visit notes in Appendix F, EPR will plant some additional trees in areas of apparent low stem density during the 2022-2023 dormant season. These areas are small (less than 0.1 acre) and the species planted will be from the approved species list in the mitigation plan.

It was noted during a DMS property boundary assessment on 11/8/2022 that mowing had been occurring within the conservation easement along Meadow Brook Road. The landowner has been informed of this encroachment and additional signage will be installed along the easement boundary during winter 2022. Additionally, it was note that the nails used to hang several of the easement signs had become loose. The loose signs will be re-fastened to the posts in during winter 2022 as well.


PROJECT LOCATION
36.1488° N
80.8289° W
N
BRUSHY MOUNTAINS
West Swan Creek
East Swan Creek
Arnold Branch
Rock House Mountain
Hemric Mountain
Horde Mountain
Redding Mountain
Roberts Mountain
Harris Mountain
Bailey Mountain
Hickory Mountain
Piney Mountain
North Little Hunting Creek
Dugger Creek
Long Branch
Big Branch
Rocky Branch
Flat Rock Branch
Cranberry Creek
South Deep Creek
Hamptonville
Old US 421 Hwy W
Rocky Branch Rd
Wilkes Yadkin Rd
Old Highway 60
Collins Rd
Union Baptist Church Rd
Somers School Rd
Crater Rd
Henderson Rd
Saint Pauls Church Rd
Walkers Branch
Deliverence Baptist Ch
Mathis Mill Rd
Cedar Forest Rd
Howell School Rd
Farm Road FR
Little Mountain Rd
Cranberry Rd
Brown Rd
Wells Rd
Windsor Rd
Mauldin Rd
Seagraves Rd
Asbury Church Rd
Fat Rock Church Rd
Hoots Rd
Booger Swamp Rd
Haire Rd
Ireland Rd
Cox Mill Rd
Arnold Rd
Brandon Hills Rd
Petty Rd
Helton Rd
Garner Rd
Rudy Rd
Ralph Rd
Morgan Rd
Piney Branch
Whitaker Rd
Wesley Rd
Holcomb Rd
Hinshaw Rd
Patterson Mill Rd
Center Rd
Mitchells Chapel Rd
N Oak Ridge Church Rd
Bryant Rd
Fox Knob Rd
Sandyberry Creek
Beaverdam Creek
Armstrong Rd
Bagley Springs Rd
Swan Creek Rd
N Plum Ridge Rd
Chatham Rd
Bethel Rd
Clingman Rd
Mahler Rd
Creek Rd
Mountain View Church Rd
Longtown Rd
Wagoner Rd
Hemric Mountain Rd
Buck Shoals Rd
Burgess Rd
Templeton Rd
Somers Rd
Old Rash Rd
Windsor Rd
Hampton Rd
Cowles Rd
S Windy Gap Rd
Little Hunting Creek Rd
Mitchell Mill Rd
1752 ft
1827 ft
1880 ft
1176 ft
1000 ft
421
21
77
LEGEND
Conservation Easement
0 1 2
Miles
GREENBRIER STREAM RESTORATION
VICINITY MAP
PREPARED FOR:
NCDEQ
Division of
Mitigation Services
Figure 1A
YADKIN COUNTY, NC
PREPARED BY:
Ecosystem
Planning &
Restoration
EPR



Streams - Restoration
Streams - Enhancement II
No Credit
Conservation Easement
Top of Bank
Photo Points
Stream Gauges
Cross Sections
Fixed Veg Plot - Successful
Random Veg Plot - Successful
Stream Problem Areas
Easement Encroachment

NC OneMap Orthoimagery (2018)

0 100 200 Feet

1 inch = 200 feet

N

GREENBRIER STREAM RESTORATION SITE

CURRENT CONDITION PLAN VIEW: OVERVIEW MAP

MY3: 2022

DMS PROJECT ID# 100086

DEC 2022

FIGURE 2

YADKIN COUNTY, NC

NC Mitigation Services

EPR Ecosystem Planning & Restoration

Streams - Restoration
Streams - Enhancement II
No Credit
Conservation Easement
Structures
Top of Bank
Photo Points
Stream Gauges
Cross Sections
Fixed Veg Plot - Successful
Random Veg Plot - Successful
Easement Encroachment
Stream Problem Areas

NC OneMap Orthoimagery (2018)

0 100 Feet

1 inch = 100 feet

N

GREENBRIER STREAM RESTORATION SITE

CURRENT CONDITION PLAN VIEW: ASSET MAP

MY3: 2022

DMS PROJECT ID# 100086

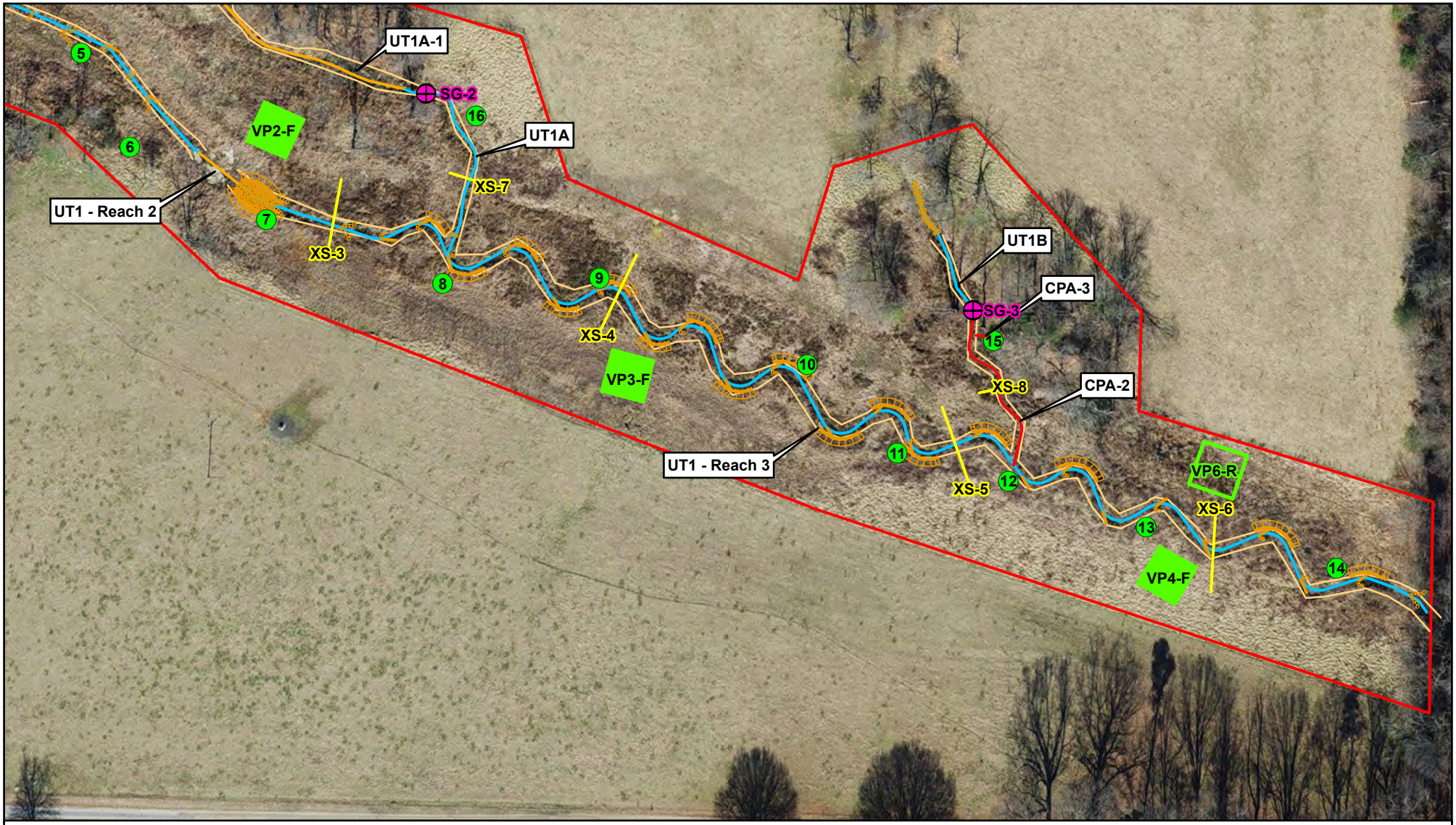
DEC 2022

FIGURE 2A

YADKIN COUNTY, NC

Mitigation Services

ECOSYSTEM PLANNING & RESTORATION



Streams - Restoration
Streams - Enhancement II
No Credit
Conservation Easement
Structures
Top of Bank
Photo Points
Stream Gauges
Cross Sections
Fixed Veg Plot - Successful
Random Veg Plot - Successful
Easement Encroachment
Stream Problem Areas

NC OneMap Orthoimagery (2018)

0 100 Feet

1 inch = 100 feet

N

GREENBRIER STREAM RESTORATION SITE

CURRENT CONDITION PLAN VIEW: ASSET MAP

MY3: 2022

DMS PROJECT ID# 100086

DEC 2022

FIGURE 2B

YADKIN COUNTY, NC

NC Mitigation Services

ECOSYSTEM PLANNING & RESTORATION

3.0 REFERENCES

North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS). DMS Vegetation Data Entry Tool, March 2022. https://ncdms.shinyapps.io/Veg_Table_Tool/

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

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

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

Appendix A

Visual Assessment Data

Table 4. Visual Stream Morphology Stability Assessment Table

Table 5. Vegetation Condition Assessment Table

Vegetation Photo Log

Photo Log

Table 4a. Visual Stream Morphology Stability Assessment Table
Greenbrier Stream Mitigation Project (DMS No.100086)

Reach ID	**UT1 Reach 1**
Assessed Stream Length (ft)	**843**
Assessed Bank Length (ft)	**1686**
Assessment Date	**11/3/2022**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			20	99%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	20	99%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	24	24		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	24	24		100%

Table 4b. Visual Stream Morphology Stability Assessment Table
Greenbrier Stream Mitigation Project (DMS No.100086)

Reach ID	**UT1 Reach 3**
Assessed Stream Length (ft)	**1097**
Assessed Bank Length (ft)	**2194**
Assessment Date	**11/3/2022**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	15	15		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	24	24		100%

Table 4c. Visual Stream Morphology Stability Assessment Table
Greenbrier Stream Mitigation Project (DMS No.100086)

Reach ID	**UT1A**
Assessed Stream Length (ft)	**148.5**
Assessed Bank Length (ft)	**297**
Assessment Date	**11/3/2022**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	6	6		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	6	6		100%

Table 4d. Visual Stream Morphology Stability Assessment Table
Greenbrier Stream Mitigation Project (DMS No.100086)

Reach ID	**UT1B**
Assessed Stream Length (ft)	**247.5**
Assessed Bank Length (ft)	**495**
Assessment Date	**11/3/2022**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			9	98%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	9	98%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	6	6		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	6	6		100%

Table 5. Vegetation Condition Assessment Table
Greenbrier Stream Mitigation Project (DMS No.100086)

Planted Acreage **6.34**
Assessment Date **11/3/2022**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.1 acres	0.00	0.0%
		Total	0.00	0.0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.25 acres	0.00	0.0%
		Cumulative Total	0.00	0.0%

Easement Acreage **6.7**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Species included in summation above should be identified in report summary.	0.1 acres	0.00	0.0%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	None	Mowing from road shoulder into easement along Meadowbrook Dr. Total encroachment area of .02 acres.	

Greenbrier Stream Mitigation Project
Monitoring Year 3 (7/26/2022) - Vegetation Photo Log

Veg Plot 1 – NE Corner (07/26/2022)

Veg Plot 2 – NW Corner (07/26/2022)

Veg Plot 3 – NW Corner (07/26/2022)

Veg Plot 4 – NW Corner (07/26/2022)

Veg Plot 5 R – S Corner (07/26/2022)

Veg Plot 6 R – S Corner (07/26/2022)

Greenbrier Stream Mitigation Project
Monitoring Year 3 (11/03/2022) - Photo Log

Photo Point 1 – UT1 Reach 1, Sta. 10+00
Facing Downstream (11/3/2022)

Photo Point 2 – UT1 Reach 1, Sta. 11+50
Facing Upstream (11/3/2022)

Photo Point 3 – UT1 Reach 1, Sta. 13+55
Facing Downstream (11/3/2022)

Photo Point 4 – UT1 Reach 1, Sta. 15+00
Facing Downstream (11/3/2022)

Photo Point 5 – UT1 Reach 1, Sta. 17+60
Facing Upstream (11/3/2022)

Photo Point 6 – UT1 Reach 1, Sta. 18+50
Facing Downstream (11/3/2022)

Greenbrier Stream Mitigation Project
Monitoring Year 3 (11/03/2022) - Photo Log

Photo Point 7 – UT1 Reach 3, Sta. 19+60
Facing Upstream (11/3/2022)

Photo Point 8 – UT1 Reach 3, Sta. 21+00
Looking Upstream at UT1A From UT1 (11/3/2022)

Photo Point 9 – UT1 Reach 3, Sta. 22+40
Facing Downstream (11/3/2022)

Photo Point 10 – UT1 Reach 3, Sta. 24+30
Facing Upstream (11/3/2022)

Photo Point 11 – UT1 Reach 3, Sta. 25+55
Facing Downstream (11/3/2022)

Photo Point 12 – UT1 Reach 3, Sta. 26+45
Looking Upstream at UT1B From UT1 (11/3/2022)

Greenbrier Stream Mitigation Project
Monitoring Year 3 (11/03/2022) - Photo Log

Photo Point 13 – UT1 Reach 3, Sta. 27+55
Facing Upstream (11/3/2022)

Photo Point 14 – UT1 Reach 3, Sta. 29+45
Facing Downstream (11/3/2022)

Photo Point 15A – UT1B, Sta. 11+90
Facing Downstream (11/3/2022)

Photo Point 15B – UT1B, Sta. 11+90
Facing Upstream (11/3/2022)

Photo Point 16A – UT1A, Sta. 12+00
Facing Downstream (11/3/2022)

Photo Point 16B – UT1A, Sta. 12+00
Facing Upstream Towards UT1A-1 (11/3/2022)

Greenbrier Stream Mitigation Project
Monitoring Year 3 (11/03/2022) - Photo Log

Photo Point 17 – UT1 Reach 1, Sta. 16+50
Facing Upstream (11/3/2022)

Photo Point 18 – UT1 Reach 1, Sta. 10+30
Facing Upstream (11/3/2022)

Photo Point 19 – UT1 Reach 1, Sta. 15+50
Facing Downstream (11/10/2022)

Site Overview
Facing Northeast (11/3/2022)

Site Overview
Facing Southwest (11/3/2022)

Appendix B

Vegetation Plot Data

Table 6. Vegetation Plot Data

Table 7. Vegetation Performance Standards Summary Table

2021 Supplemental Planting Species List

Greenbrier MY2 CCPV Overview Map

Table 6. Vegetation Plot Data
Greenbrier Stream Mitigation Project (NCDMS Project No. 100086)

Planted Acreage	6.34
Date of Initial Plant	2020-04-01
Date(s) of Supplemental Plant(s)	2021-03-03
Date(s) Mowing	N/A
Date of Current Survey	2022-10-08
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 R	Veg Plot 6 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total
Species Included in Approved Mitigation Plan	Alnus serrulata	hazel alder	Tree	FACW							1	1		
	Betula nigra	river birch	Tree	FACW	5	5			4	4	1	1	1	2
	Cercis canadensis	eastern redbud	Tree	UPL			1	1			1	1		
	Cornus amomum	silky dogwood	Shrub	FACW	1	1								1
	Diospyros virginiana	common persimmon	Tree	FAC	2	2	7	7	1	1	1	1		1
	Liriodendron tulipifera	tuliptree	Tree	FACU					2	2	1	1		
	other										1	1		
	Platanus occidentalis	American sycamore	Tree	FACW	6	6	3	3	1	1	2	2	5	8
	Quercus nigra	water oak	Tree	FAC					1	1	1	1		
	Quercus phellos	willow oak	Tree	FACW	1	1			1	1	1	1		
	Salix nigra	black willow	Tree	OBL	1	1							12	
	Sambucus canadensis	American black elderberry	Tree											2
	Ulmus americana	American elm	Tree	FAC	5	5			3	3				1
Sum	Performance Standard				21	21	11	11	13	13	10	10	18	15
Post Mitigation Plan Species	*Acer rubrum*	*red maple*	*Tree*	*FAC*										*1*
	Hamamelis virginiana	*American witchhazel*	*Tree*	*FACU*								*1*		
Sum	Proposed Standard				21	21	11	11	13	13	10	10	18	15
Mitigation Plan Performance Standard	Current Year Stem Count					21		11		13		10	18	15
	Stems/Acre					850		445		526		405	728	607
	Species Count					7		3		7		9	3	6
	Dominant Species Composition (%)					29		64		31		18	67	50
	Average Plot Height (ft.)					2		5		1		2	7	3
	% Invasives					0		0		0		0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					21		11		13		10	18	15
	Stems/Acre					850		445		526		405	728	607
	Species Count					7		3		7		9	3	6
	Dominant Species Composition (%)					29		64		31		18	67	50
	Average Plot Height (ft.)					2		5		1		2	7	3
	% Invasives					0		0		0		0	0	0

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Meets Interim Success Criteria | **Does Not Meet Interim Success Criteria**

Table 7. Vegetation Performance Standards Summary Table
Greenbrier Stream Mitigation Project (NCDMS Project No. 100086)

Vegetation Performance Standards Summary Table												
	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	850	2	7	0	445	5	3	0	526	1	7	0
Monitoring Year 2	769	2	7	0	486	3	5	0	769	1	7	0
Monitoring Year 1	445	2	8	0	364	2	4	0	688	1	7	0
Monitoring Year 0	729	2	9	0	607	1	5	0	769	1	7	0
	Veg Plot 4 F				Veg Plot 5 R				Veg Plot 6 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	405	2	9	0	728	7	3	0	607	3	6	0
Monitoring Year 2	405	2	7	0	526	2	6	0	810	2	7	0
Monitoring Year 1	162	2	3	0	283	2	5	0	972	3	2	0
Monitoring Year 0	486	1	4	0								

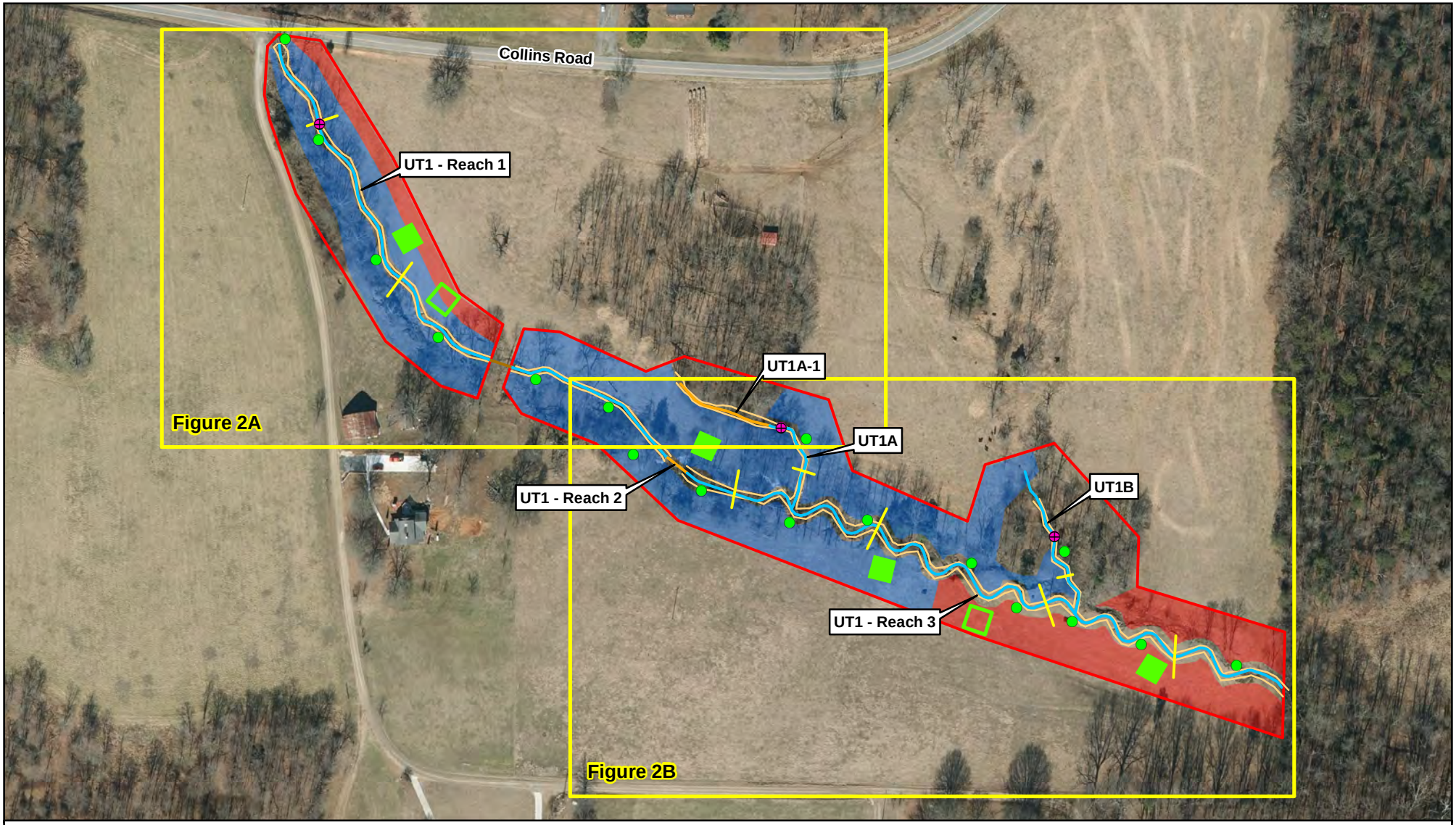
*Each monitoring year represents a different plot for the random vegetation plot "groups". Random plots are denoted with an R, and fixed plots with an F.

Note: DMS Vegetation Tool is not correctly calculating previous monitoring years stem counts due to an error in program. MY3 stem counts are accurate.

Meets Interim Success Criteria	Does Not Meet Interim Success Criteria

Greenbrier 2021 Supplemental Planting Species List

Trees and Shrubs			
The following table lists bare-root vegetation selection for the 2021 replanting effort. -Trees were planted in replanting areas at a total density of 500 stems per acre. Total replanting area was approximately 1.28 acres. -Trees were planted in supplemental planting areas at a total density of 200 stems per acre. Total replanting area was approximately 3.19 acres.			
Common Name	**Scientific Name**	**Percent Planted by Species**	**Wetness Tolerance**
Trees (75%) Planted 9' X 9' Spacing – 538 Trees/ Acre			
River Birch	*Betula nigra*	20%	FACW
Sycamore	*Platanus occidentalis*	20%	FACW
Water Oak	*Quercus nigra*	10%	FAC
American Elm	*Ulmus americana*	10%	FACW
Persimmon	*Diospryos virginiana*	10%	FAC
Willow Oak	*Quercus phellos*	10%	FAC
Tulip Poplar	*Liriodendron tulipifera*	20%	FAC
	Tree Total	100%	
Shrubs (25%) Planted 16' X 16' Spacing - 164 Shrubs/ Acre			
Tag Alder	*Alnus serrulata*	20%	FACW
Spicebush	*Lindera benzoin*	25%	FACW
Redbud	*Cercis canadensis*	20%	FACU
Elderberry	*Sambucus canadensis*	15%	FAC
Silky Dogwood	*Cornus amomum*	20%	FACW
	Shrub Total	100%	



Streams - Restoration
Streams - Enhancement
No Credit
Conservation Easement
Top of Bank
Photo Points
Stream Gauges
Cross Sections
Fixed Veg Plot - Successful
Random Veg Plot - Successful
2021 Replanting
2021 Supplemental Planting

NC OneMap Orthoimagery (2018)

0 100 200 Feet

1 inch = 200 feet

N

GREENBRIER STREAM RESTORATION SITE

CURRENT CONDITION PLAN VIEW: OVERVIEW MAP

MY2: 2021

DMS PROJECT ID# 100086

DEC 2021

FIGURE 2

YADKIN COUNTY, NC

NC Mitigation Services

ECOSYSTEM PLANNING & RESTORATION

Appendix C

Stream Geomorphology Data

Cross-Sections With Annual Overlays

Table 8. Baseline Stream Data Summary

Table 9. Cross-Section Morphology Data Table

Cross Section Plot - MY3 - October 2022

XS1 - UT1 Reach 1

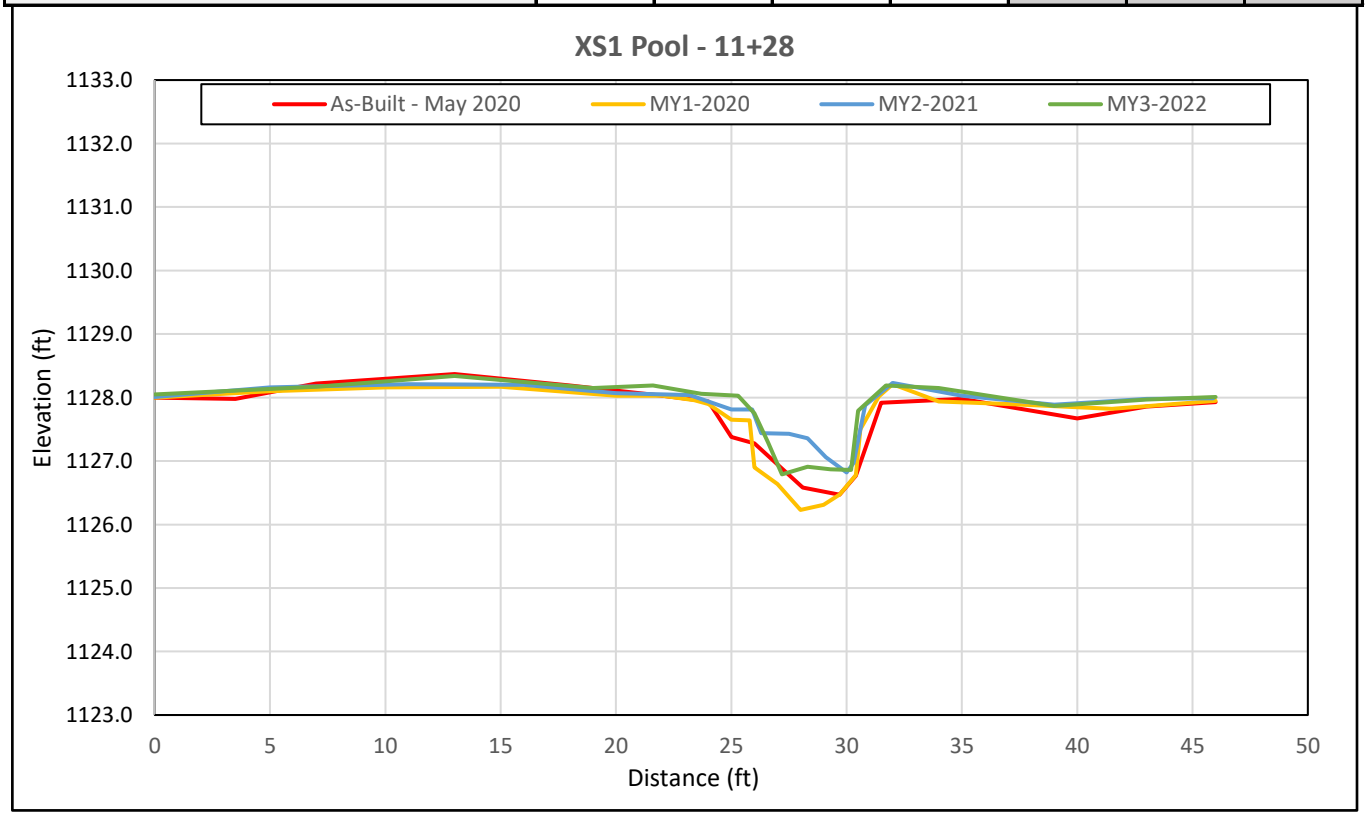
Rosgen Stream Type - B4

Station 11+28 - Pool

XS1 looking upstream

XS1 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1127.92	1127.87	1128.35	1128.35			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.09	0.8	0.79			
Thalweg Elevation	1126.47	1126.23	1126.82	1126.79			
LTOB Elevation	1127.92	1128.02	1128.04	1128.03			
LTOB Max Depth	1.45	1.79	1.22	1.24			
LTOB Cross Sectional Area	6.70	7.87	4.17	4.78			
Entrenchment Ratio	-	-	-	-			



Cross Section Plot - MY3 - October 2022

XS2 - UT1 Reach 1

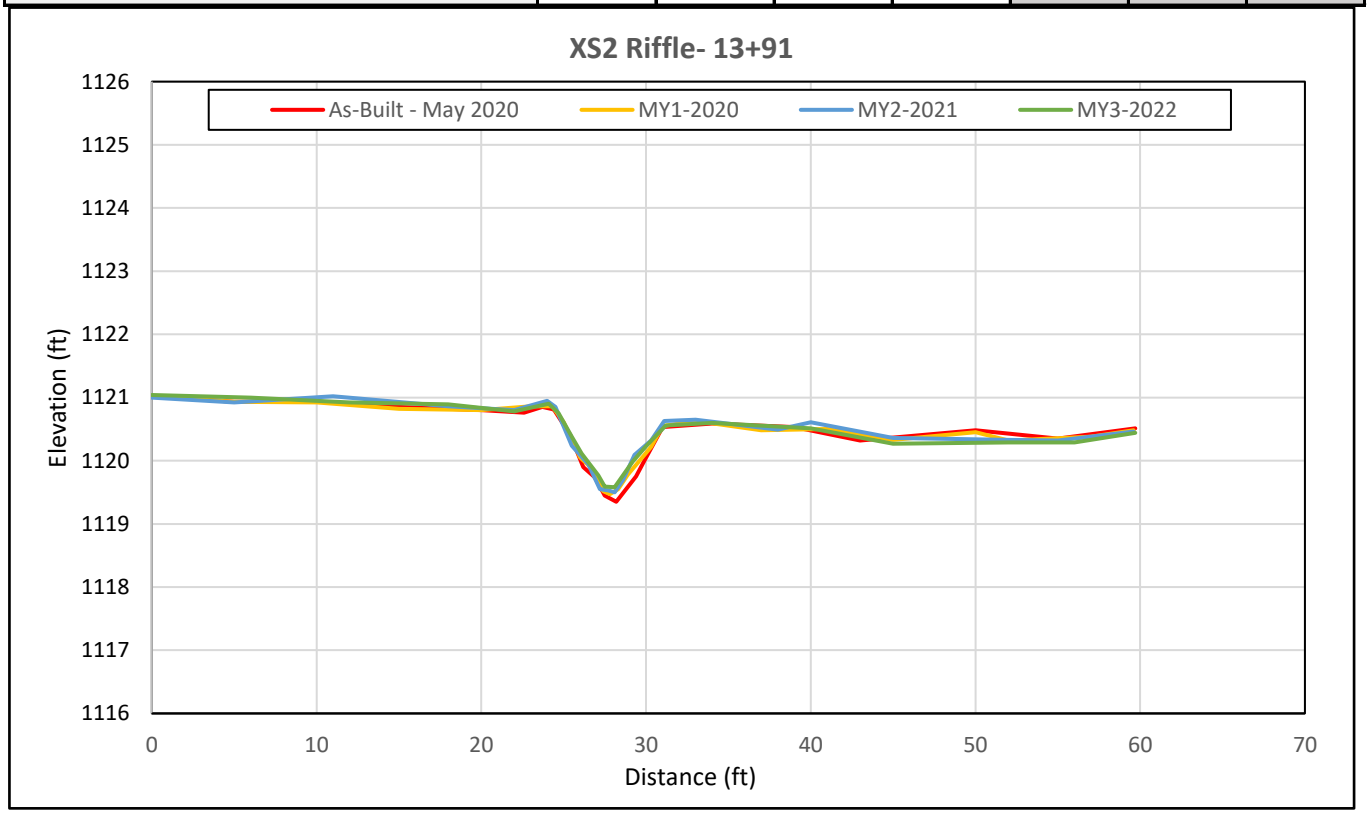
Rosgen Stream Type - B4

Station 13+91 - Riffle

XS2 looking upstream

XS2 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1120.53	1120.61	1120.65	1120.69			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.94	0.98	0.88			
Thalweg Elevation	1119.35	1119.47	1119.50	1119.58			
LTOB Elevation	1120.53	1120.55	1120.63	1120.56			
LTOB Max Depth	1.18	1.08	1.13	0.98			
LTOB Cross Sectional Area	3.97	3.59	3.86	3.19			
Entrenchment Ratio	>10.12	>10.11	>10.17	>10.09			



Cross Section Plot - MY3 - October 2022

XS3 - UT1 Reach 3

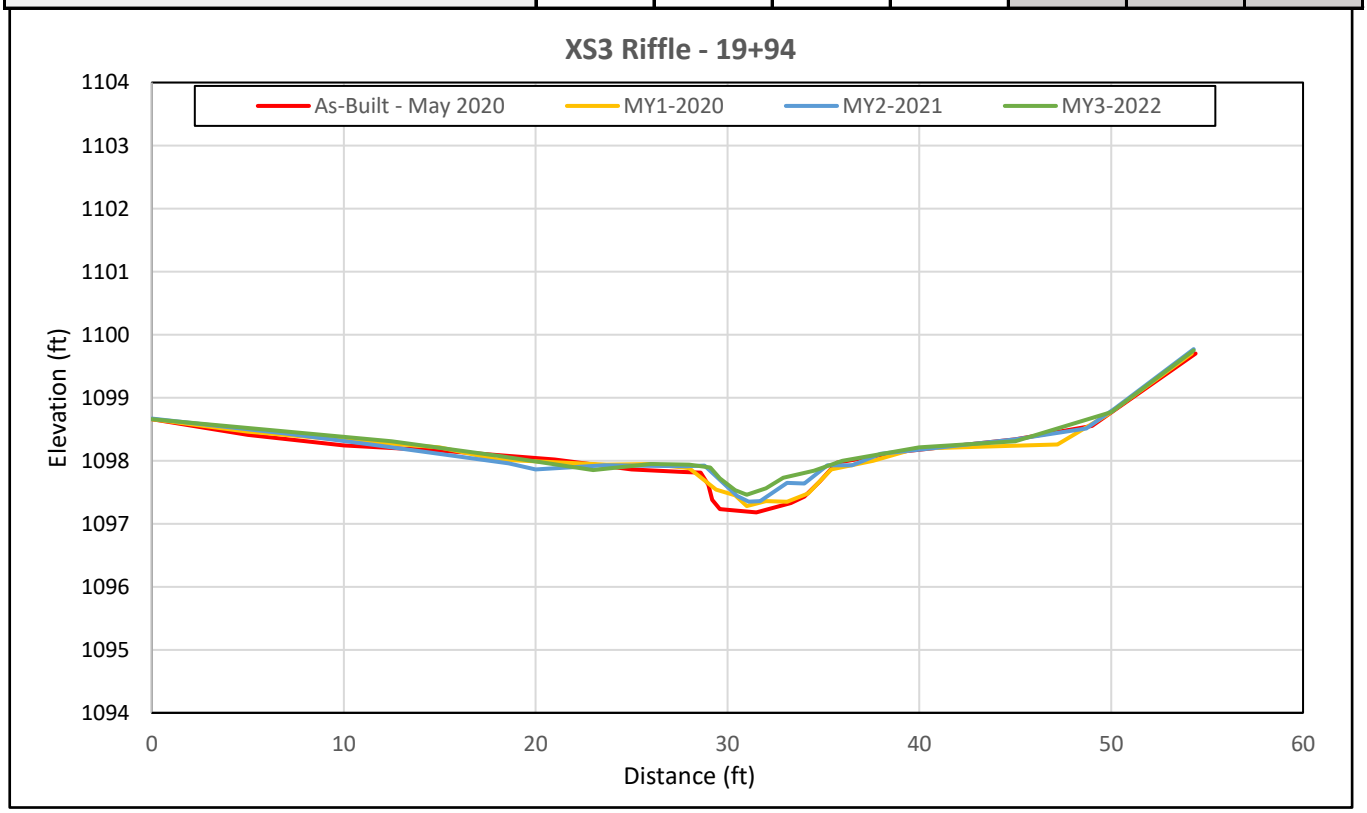
Rosgen Stream Type - C4

Station 19+94 - Riffle

XS3 looking upstream

XS3 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1097.81	1097.90	1098.07	1098.13			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.97	0.79	0.72			
Thalweg Elevation	1097.18	1097.28	1097.35	1097.46			
LTOB Elevation	1097.81	1097.88	1097.92	1097.94			
LTOB Max Depth	0.63	0.60	0.57	0.48			
LTOB Cross Sectional Area	2.99	2.84	2.05	1.60			
Entrenchment Ratio	6.39	5.80	5.75	4.86			



Cross Section Plot - MY3 - October 2022

XS4 - UT1 Reach 3

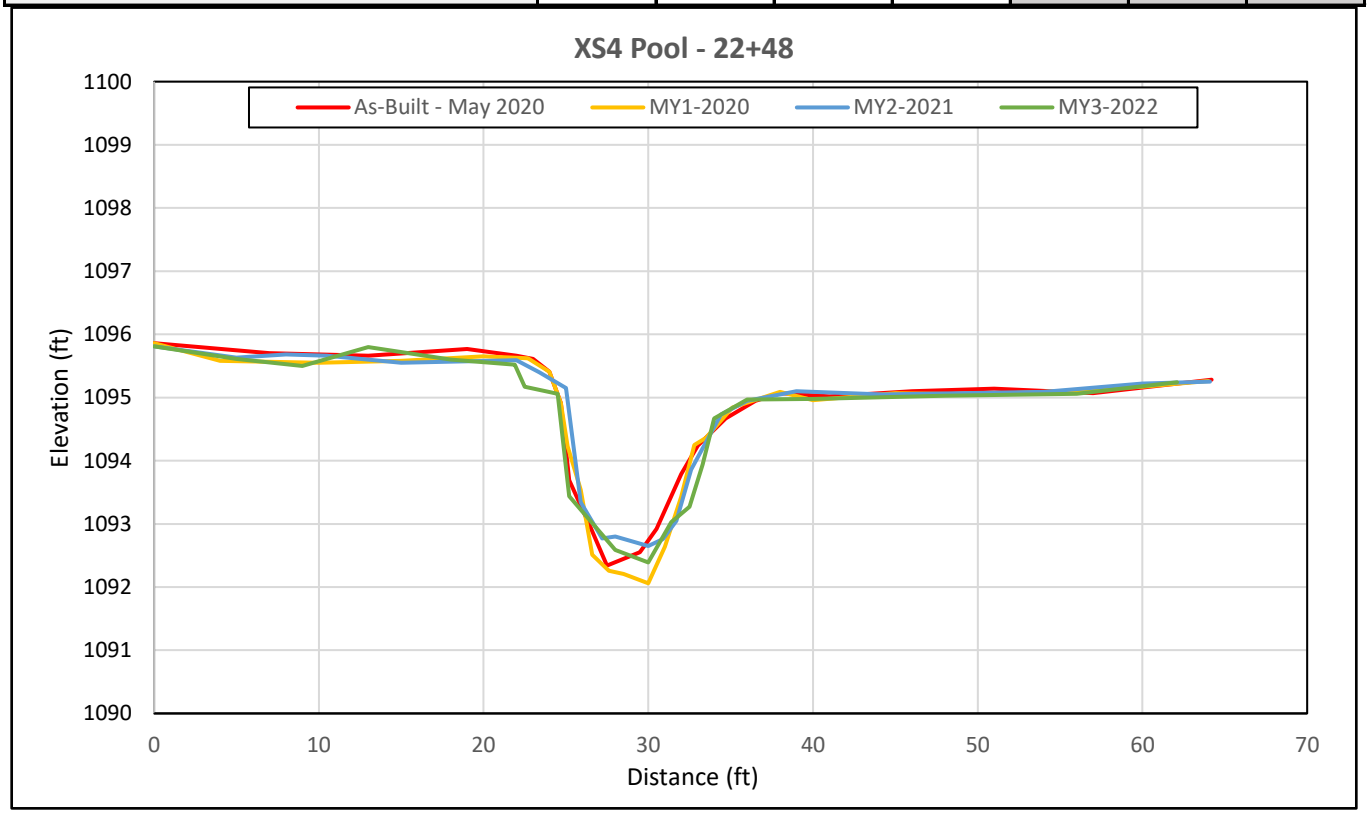
Rosgen Stream Type - C4

Station 22+48 - Pool

XS4 looking upstream

XS4 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1094.95	1094.80	1095.02	1094.83			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.01	1.04	1.06			
Thalweg Elevation	1092.34	1092.06	1092.65	1092.39			
LTOB Elevation	1094.95	1094.84	1095.10	1094.97			
LTOB Max Depth	2.61	2.78	2.45	2.58			
LTOB Cross Sectional Area	16.41	16.85	17.51	17.96			
Entrenchment Ratio	-	-	-	-			



Cross Section Plot - MY3 - October 2022

XS5 - UT1 Reach 3

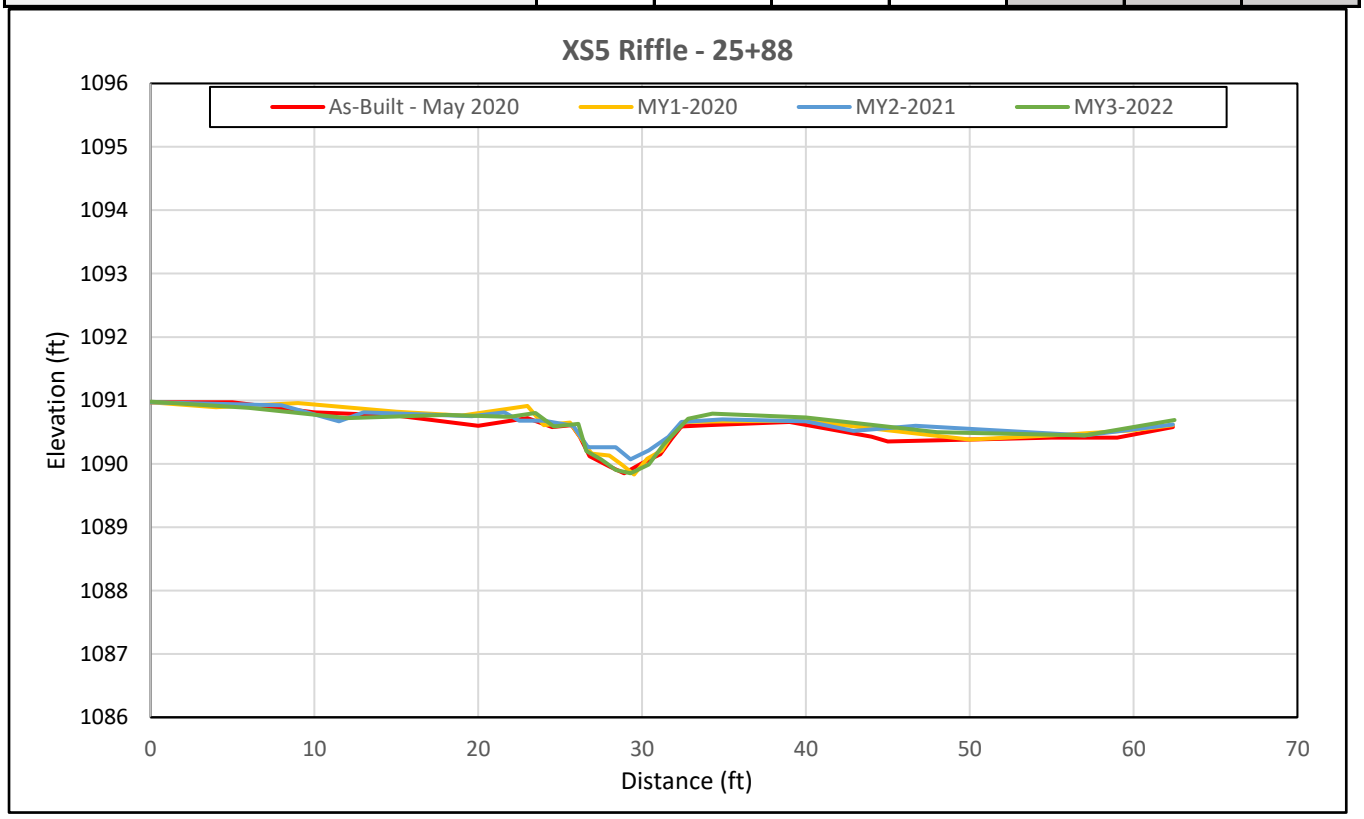
Rosgen Stream Type - C4

Station 25+88 - Riffle

XS5 looking upstream

XS5 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1090.59	1090.64	1090.74	1090.61			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.02	0.88	1.03			
Thalweg Elevation	1089.85	1089.83	1090.07	1089.85			
LTOB Elevation	1090.59	1090.66	1090.66	1090.63			
LTOB Max Depth	0.74	0.83	0.59	0.78			
LTOB Cross Sectional Area	3.08	3.26	2.46	3.23			
Entrenchment Ratio	>9.39	>9.1	>9.84	>10.06			



Cross Section Plot - MY3 - October 2022

XS6 - UT1 Reach 3

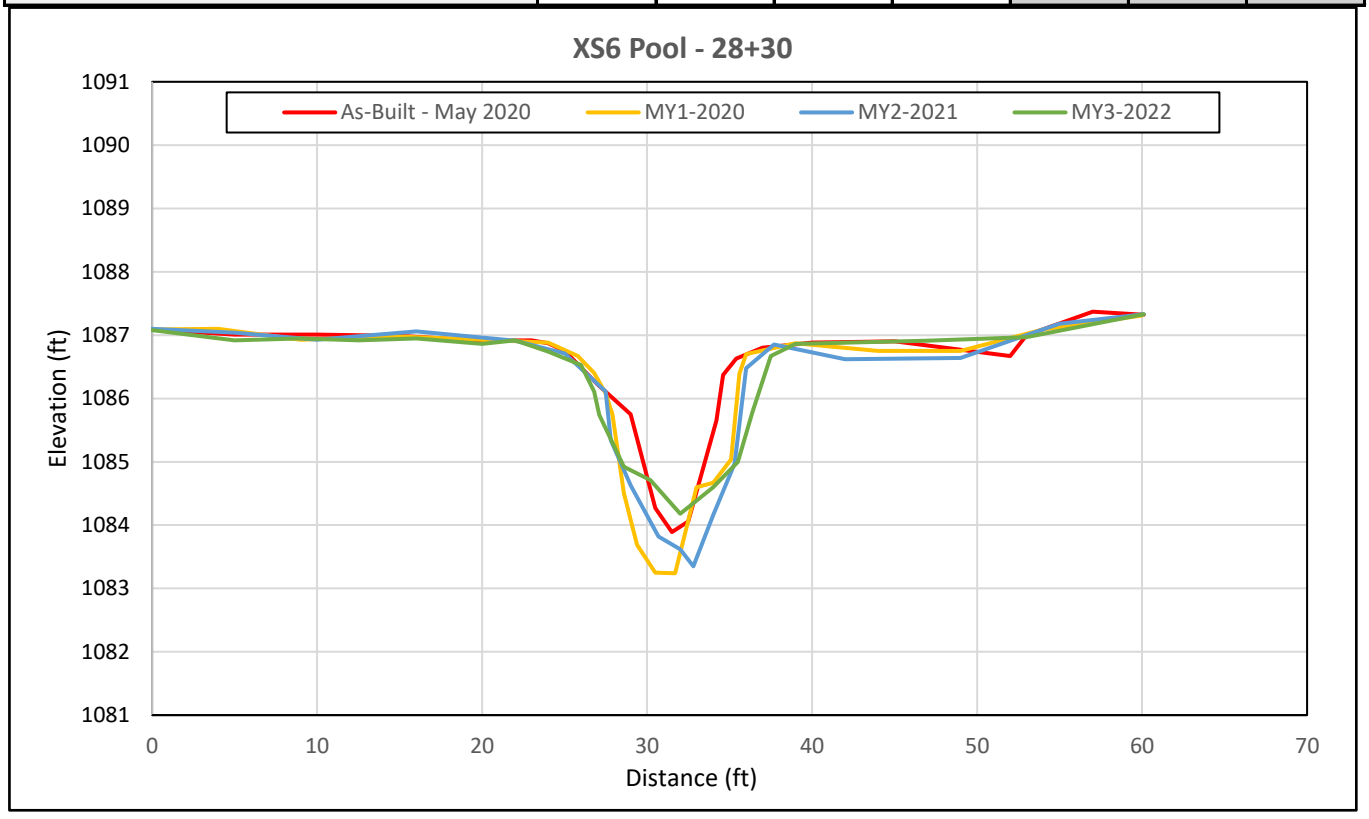
Rosgen Stream Type - C4

Station 28+30 - Pool

XS6 looking upstream

XS6 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1086.63	1085.85	1085.82	1086.13			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.32	1.42	1.37			
Thalweg Elevation	1083.89	1083.24	1083.35	1084.18			
LTOB Elevation	1086.63	1086.70	1086.85	1086.86			
LTOB Max Depth	2.74	3.46	3.50	2.68			
LTOB Cross Sectional Area	12.61	19.95	22.83	21.36			
Entrenchment Ratio	-	-	-	-			



Cross Section Plot - MY3 - October 2022

XS7 - UT1A

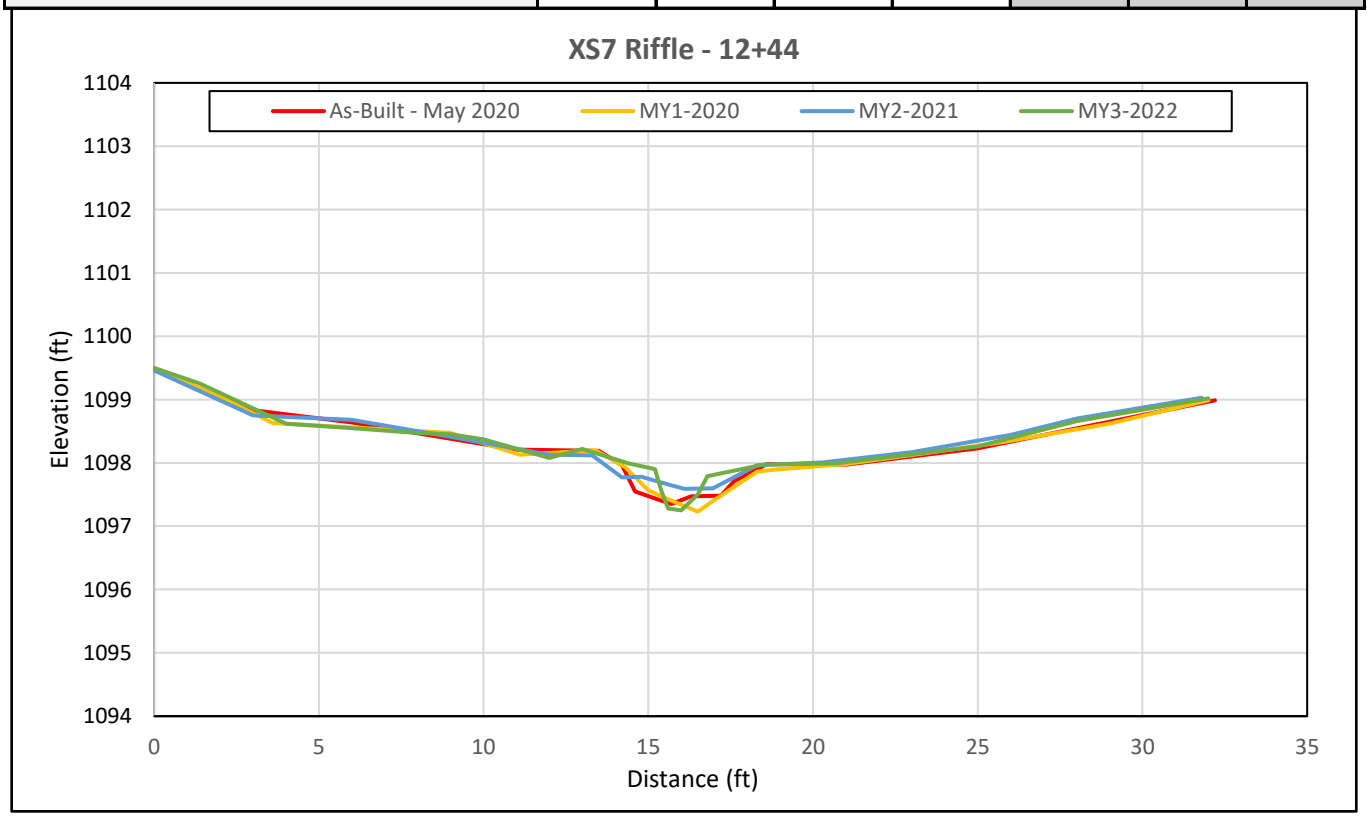
Rosgen Stream Type - B4

Station 12+44 - Riffle

XS7 looking upstream

XS7 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1097.98	1097.96	1098.11	1098.16			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.91	0.71	0.79			
Thalweg Elevation	1097.35	1097.23	1097.59	1097.25			
LTOB Elevation	1097.98	1097.89	1097.96	1097.97			
LTOB Max Depth	0.63	0.66	0.37	0.72			
LTOB Cross Sectional Area	1.76	1.47	1.07	1.01			
Entrenchment Ratio	4.90	4.98	3.25	4.88			



Cross Section Plot - MY3 - October 2022

XS8 - UT1B

Rosgen Stream Type - B4

Station 11+71 - Riffle

XS8 looking upstream

XS8 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1089.94	1090.00	1090.17	1090.07			
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.76	0.47	0.95			
Thalweg Elevation	1089.59	1089.66	1089.72	1089.60			
LTOB Elevation	1089.94	1089.92	1089.93	1090.05			
LTOB Max Depth	0.35	0.26	0.21	0.45			
LTOB Cross Sectional Area	0.87	0.59	0.19	0.79			
Entrenchment Ratio	>5.26	>5.39	>5.69	>7.26			

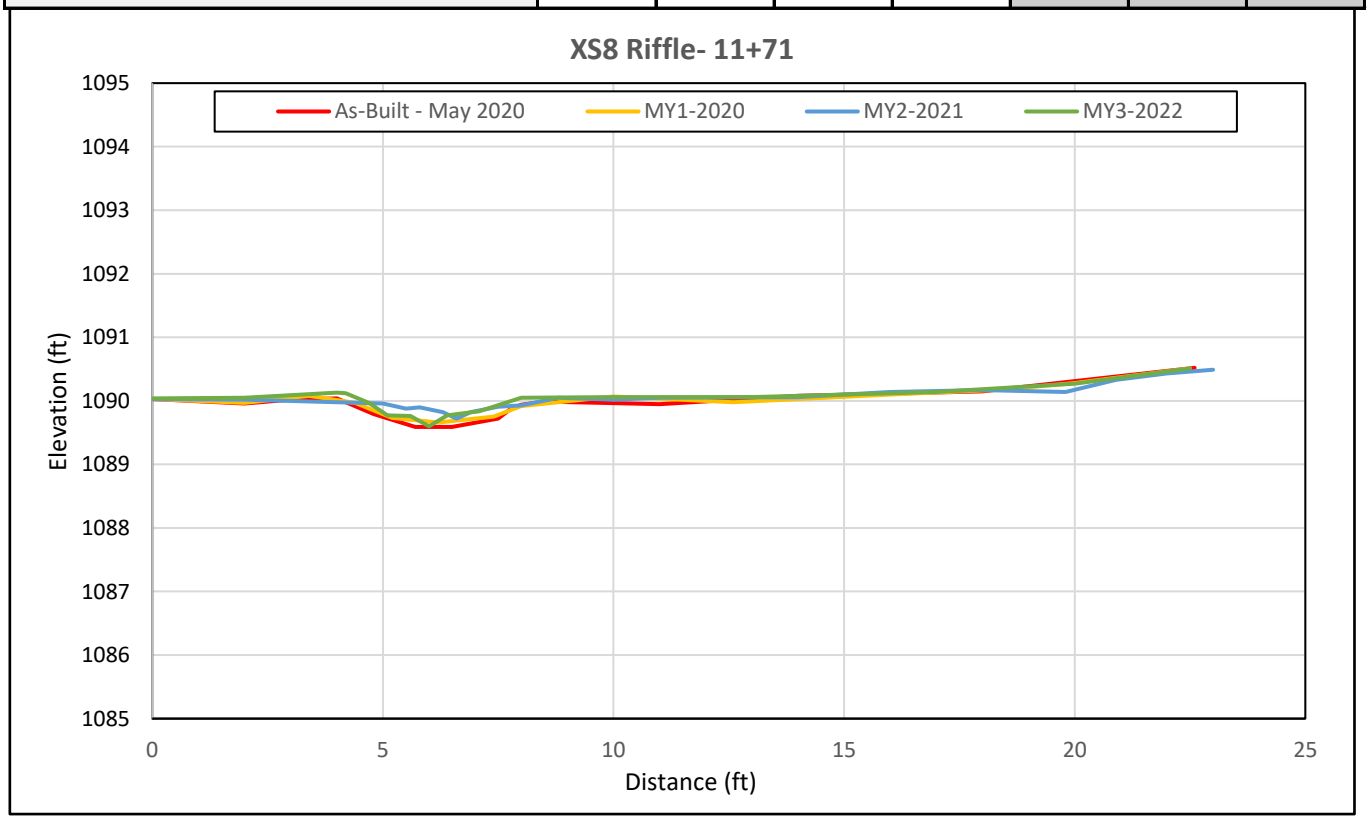


Table 8a. Baseline Stream Data Summary
Greenbrier Stream Mitigation Project (DMS No. 100086) - UT1 Reach 1 (843 feet)

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	-	-	0.0385	0.051	0.063	0.018	0.0279	0.028	0.039	0.0049	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				-						-														

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	0.0168	0.0165	0.025	0.0052	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				-						-														

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	0.0292	0.032	0.047	0.0122	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				-						-														

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	0.0041	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				-						-														

Table 9. Monitoring Data - Cross-Section Morphology Data Table
Greenbrier Stream Mitigation Project (DMS No. 100086)

	UT1 Reach 1 (Rosgen Stream Type - B4)														UT1 Reach 3 (Rosgen Stream Type - C4)													
	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1127.92	1127.87	1128.35	1128.35				1120.53	1120.61	1120.65	1120.69				1097.81	1097.90	1098.07	1098.13				1094.95	1094.80	1095.02	1094.83			
Bank Height Ratio - Based on AB Bankfull[1] Area	1.00	1.09	0.80	0.79				1.00	0.94	0.98	0.88				1.00	0.97	0.79	0.72				1.00	1.01	1.04	1.06			
Thalweg Elevation	1126.47	1126.23	1126.82	1126.79				1119.35	1119.47	1119.50	1119.58				1097.18	1097.28	1097.35	1097.46				1092.34	1092.06	1092.65	1092.39			
LTOB[2] Elevation	1127.92	1128.02	1128.04	1128.03				1120.53	1120.55	1120.63	1120.56				1097.81	1097.88	1097.92	1097.94				1094.95	1094.84	1095.10	1094.97			
LTOB[2] Max Depth (ft)	1.45	1.79	1.22	1.24				1.18	1.08	1.13	0.98				0.63	0.60	0.57	0.48				2.61	2.78	2.45	2.58			
LTOB[2] Cross Sectional Area (ft^2)	6.70	7.87	4.17	4.78				3.97	3.59	3.86	3.19				2.99	2.84	2.05	1.60				16.41	16.85	17.51	17.96			
Entrenchment Ratio	-	-	-	-				>10.12	>10.11	>10.17	>10.09				6.39	5.80	5.75	4.86				-	-	-	-			

	UT1 Reach 3 (Rosgen Stream Type - C4)														UT1A (Rosgen Stream Type - B4)							UT1B (Rosgen Stream Type - B4)						
	Cross Section 5 (Riffle)							Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section 8 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1090.59	1090.64	1090.74	1090.61				1086.63	1085.85	1085.82	1086.13				1097.98	1097.96	1098.11	1098.16				1089.94	1090.00	1090.17	1090.07			
Bank Height Ratio - Based on AB Bankfull[1] Area	1.00	1.02	0.88	1.03				1.00	1.32	1.42	1.37				1.00	0.91	0.71	0.79				1.00	0.76	0.47	0.95			
Thalweg Elevation	1089.85	1089.83	1090.07	1089.85				1083.89	1083.24	1083.35	1084.18				1097.35	1097.23	1097.59	1097.25				1089.59	1089.66	1089.72	1089.60			
LTOB[2] Elevation	1090.59	1090.66	1090.06	1090.63				1086.63	1086.70	1086.85	1086.86				1097.98	1097.89	1097.96	1097.97				1089.94	1089.92	1089.93	1090.05			
LTOB[2] Max Depth (ft)	0.74	0.83	0.59	0.78				2.74	3.46	3.50	2.68				0.63	0.66	0.37	0.72				0.35	0.26	0.21	0.45			
LTOB[2] Cross Sectional Area (ft^2)	3.08	3.26	2.46	3.23				12.61	19.95	22.83	21.36				1.76	1.47	1.07	1.01				0.87	0.59	0.19	0.79			
Entrenchment Ratio	>9.39	>9.1	>9.84	>10.06				-	-	-	-				4.90	4.98	3.25	4.88				>5.26	>5.39	>5.69	>7.26			

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

1 - Bank Height Ratio (BHR) takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.
2 - LTOB Area and Max depth - These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decereases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

Appendix D

Hydrologic Data

Table 10. Bankfull Event Verification

Figure 3. Monthly Rainfall Data

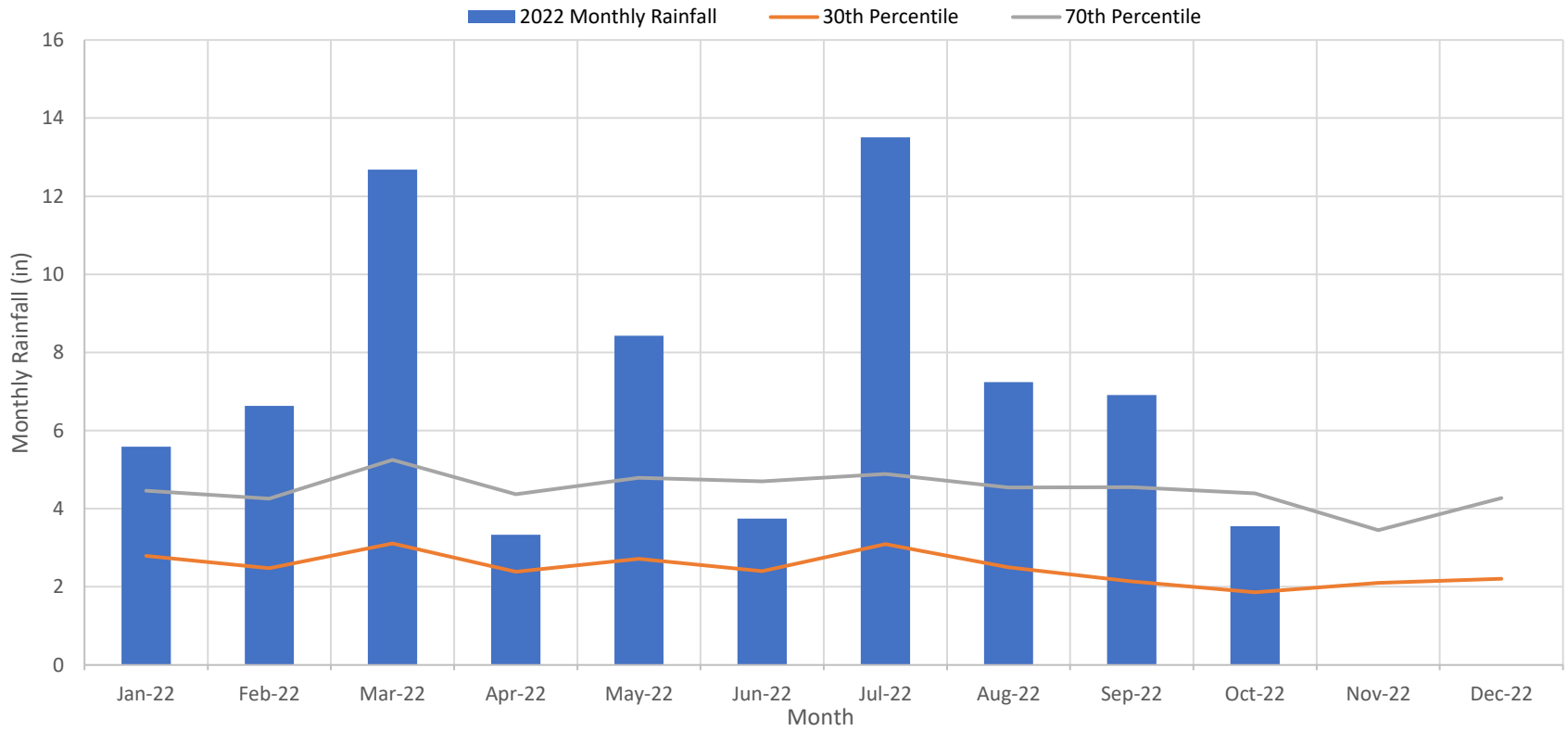
Precipitation and Water Level Hydrographs

Table 10. Bankfull Event Verification
Greenbrier Stream Mitigation Project (DMS No. 100086)

Overbank Events							
Gage ID	**MY1 (2020)**	**MY2 (2021)**	**MY3 (2022)**	**MY4 (2023)**	**MY5 (2025)**	**MY6 (2026)**	**MY7 (2027)**
UT1 Reach 1 - GBSG1	6 separate events: 5/27/2020 5/29/2020 8/9/2020-8/11/2020 8/21/2020 9/29/2020 10/11/2020	1 event: 9/22/2021	3 events: 7/6/2022 7/23/2022 8/6/2022	-	-	-	-
UT1A - GBSG2*	4 separate events: 8/21/2020 9/29/2020 10/11/2020 10/25/2020	0 events	0 events	-	-	-	-
UT1B - GBSG3	10 separate events: 5/21/2020 5/24/2020 5/27/2020 5/29/2020 8/15/2020 8/17/2020 8/21/2020 9/29/2020 10/11/2020 10/25/2020	0 events	5 events: 5/26/2022 7/6/2022 7/23/2022 7/31/2022 8/6/2022	-	-	-	-

* GBSG2 is malfunctioning as of 11/7/22

Greenbrier Stream Restoration Project
Figure 3. Monthly Rainfall Data
Monitoring Year 3 - 2022

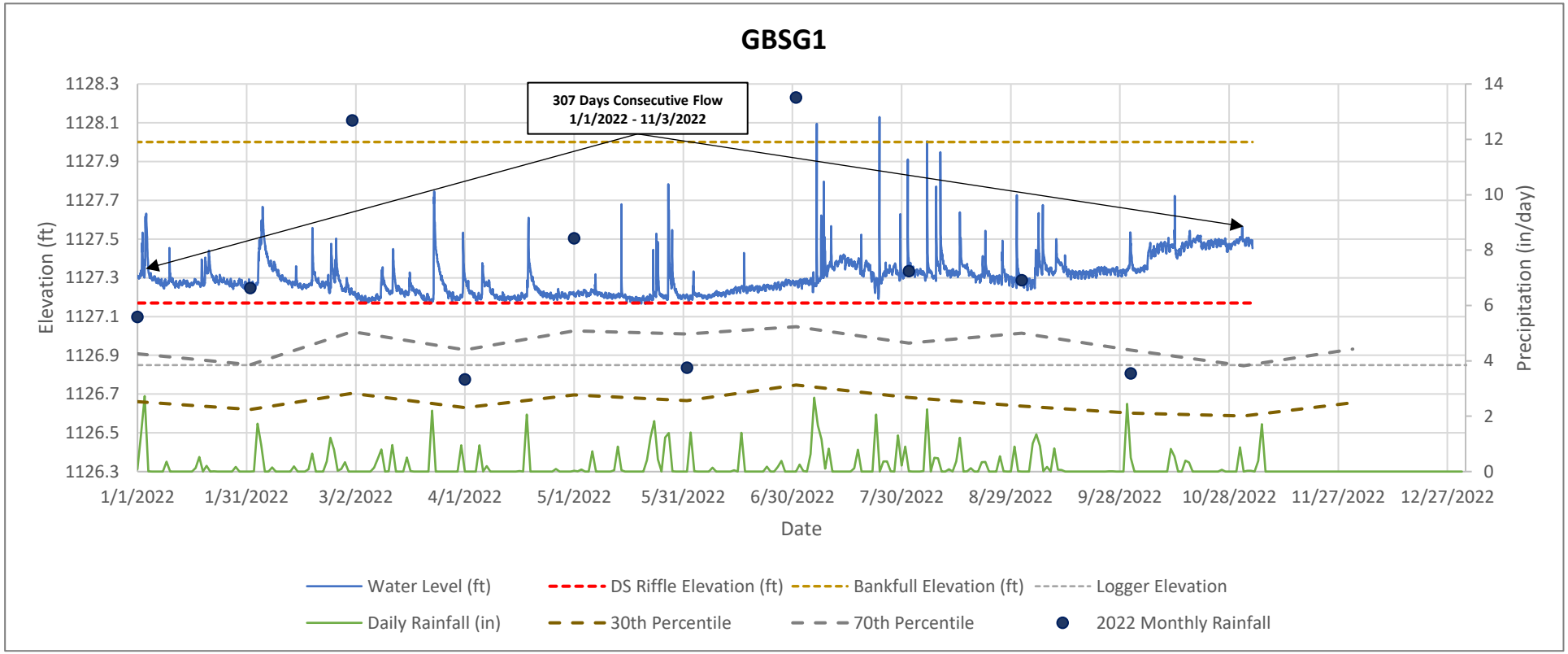


Note: Historic rainfall data from WETS Station: Yadkinville 6 E, NC, 1971-2019. Project rainfall data from HOBO Tipping Bucket Rain Gauge located at the

Rainfall Summary							
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Annual Precip Total	87.91	37.03	*71.62	-	-	-	-
WETS 30th Percentile	29.79	29.79	29.79	-	-	-	-
WETS 70th Percentile	53.92	53.92	53.92	-	-	-	-
Normal	Y	Y	Y	-	-	-	-

*Note: Precipitation data only collected through 11/9/2022

Greenbrier Stream Mitigation Project
Year 3 (2022) Streamflow Data

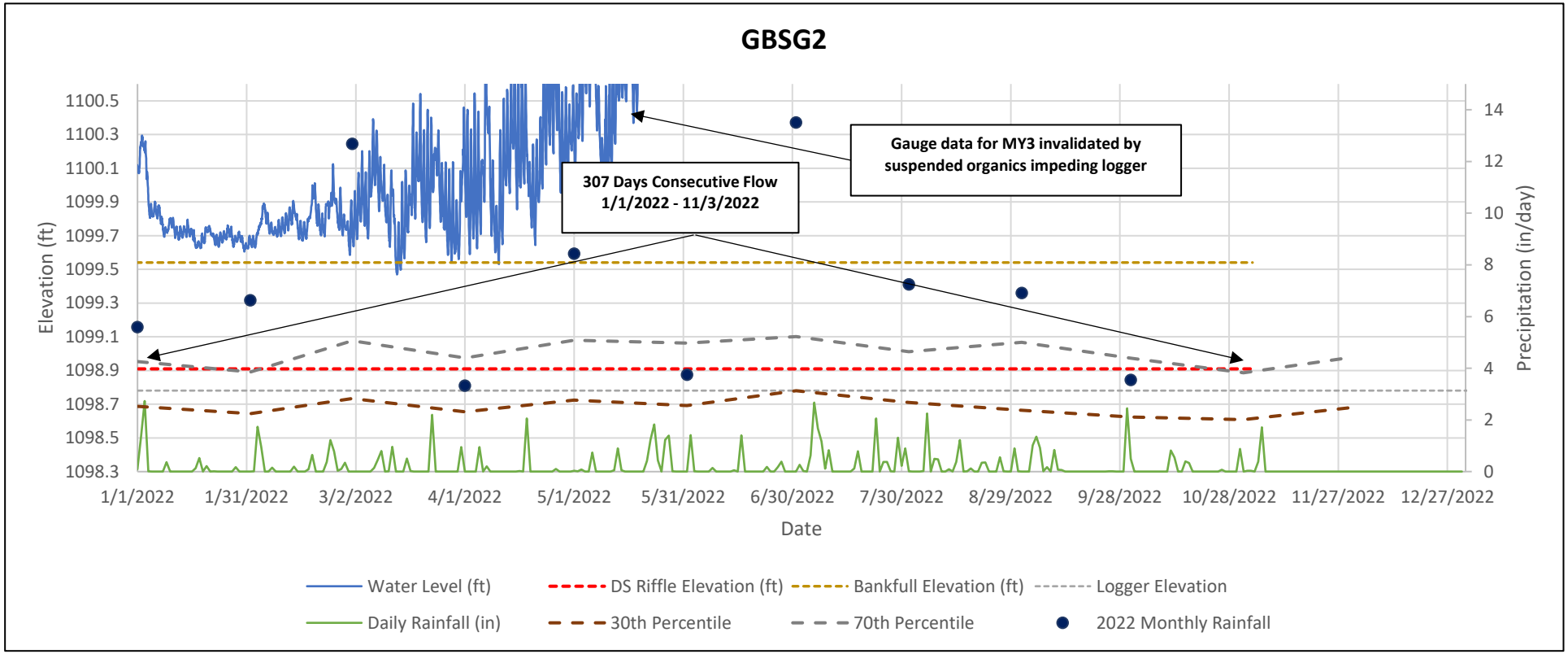


Site Info	
Stream	Greenbrier Stream Mitigation Project
Reach	UT1 Reach 1
Date Installed	4/29/2020
Serial Number	20727108
Reach Type	Perennial

*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Meadow Brook Stream Restoration Site, 0.75 miles SE.

Year 3 (2022) Streamflow Data	
Gauge ID	GBSG1
Start Date	1/1/2022
End Date	11/3/2022
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1126.91
Controlling Grade Elevation (ft)	1127.17
Bankfull Elevation (ft)	1128
Most Consecutive Days of Flow	307
Total Days of Flow	307
Max High Water Level Above Bankfull (ft)	0.13
Bankfull Events	3
Meets Success Criteria	Yes

Greenbrier Stream Mitigation Project
Year 3 (2022) Streamflow Data

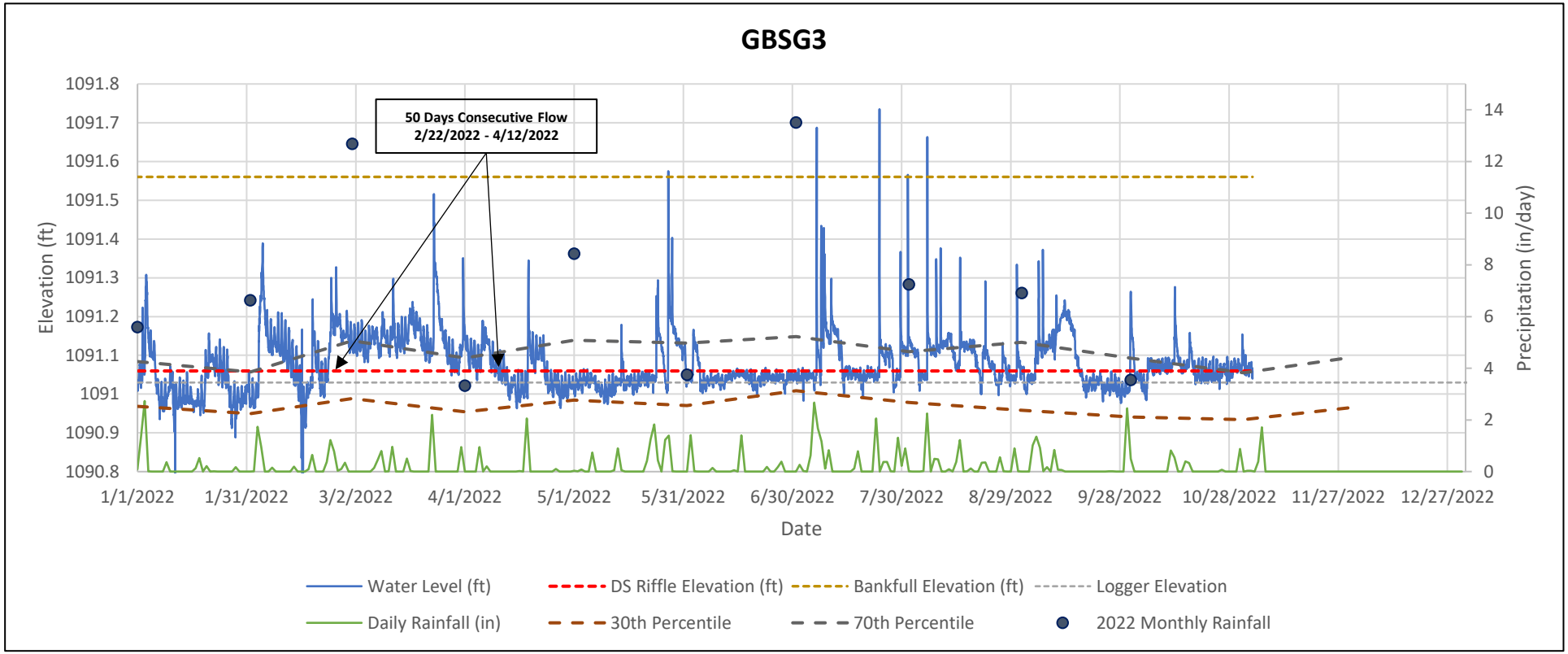


Site Info	
Stream	Greenbrier Stream Mitigation Project
Reach	UT1A
Date Installed	4/29/2020
Serial Number	20727105
Reach Type	Intermittent

*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Meadow Brook Stream Restoration Site, 0.75 miles SE.

Year 3 (2022) Streamflow Data	
Gauge ID	GBSG2
Start Date	1/1/2022
End Date	11/3/2022
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1098.83
Controlling Grade Elevation (ft)	1098.91
Bankfull Elevation (ft)	1099.54
Most Consecutive Days of Flow	307
Total Days of Flow	307
Max High Water Level Above Bankfull (ft)	6.27
Bankfull Events	-
Meets Success Criteria	Yes

Greenbrier Stream Mitigation Project
Year 3 (2022) Streamflow Data



Site Info	
Stream	Greenbrier Stream Mitigation Project
Reach	UT1B
Date Installed	4/29/2020
Serial Number	20758210
Reach Type	Intermittent

*Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Meadow Brook Stream Restoration Site, 0.75 miles SE.

Year 3 (2022) Streamflow Data	
Gauge ID	GBSG3
Start Date	1/1/2022
End Date	11/3/2022
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1091.03
Controlling Grade Elevation (ft)	1091.06
Bankfull Elevation (ft)	1091.56
Most Consecutive Days of Flow	50
Total Days of Flow	226
Max High Water Level Above Bankfull (ft)	0.17
Bankfull Events	5
Meets Success Criteria	Yes

Appendix E

Project Timeline and Contact Info

Table 11. Project Activity and Reporting History

Table 12. Project Contacts Table

Table 11. Project Activity and Reporting History
Greenbrier Stream Mitigation Project (NCDMS Project No. 100086)

Elapsed Time Since grading complete: **2 yrs 7 months**
Elapsed Time Since planting complete: **2 yrs 7 months**
Number of reporting Years[1]: **3**

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	May-20	May-20
As-built Baseline Monitoring Report	May-20	Jul-20
Year 1 Monitoring	Nov-20	Nov-20
Supplemental Bare-root plantings	--	Mar-21
Year 2 Monitoring	Oct-21	Nov-21
Year 3 Monitoring	Oct-22	Nov-22
Year 4 Monitoring	-	-
Year 5 Monitoring	-	-
Year 6 Monitoring	-	-
Year 7 Monitoring	-	-

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

Table 12. 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

Appendix F

IRT Correspondence

Field Meeting Notes - IRT Credit Release Site Visit on 11/8/2022

ECOSYSTEM PLANNING & RESTORATION

November 10, 2022

Mr. Paul Wiesner
Asheville Regional Office
2090 U.S. 70 Highway
Swannanoa, NC 28778-8211

RE: Field Meeting Notes - IRT Credit Release Site Visit on 11/8/2022
Greenbrier Full Delivery Site
DMS Project # 100086
USACE Action ID#: SAW-2018-01755
NC DWR #: 2018-1272 v1
DEQ Contract # 7616

Dear Mr. Wiesner,

This letter is being provided as meeting minutes to a field meeting that occurred at the Greenbrier Full Delivery Site (Site) on November 8, 2022. The site is currently in MY3 (2022). The meeting was conducted to review the current Site conditions and compliance with approved performance standards with IRT members and to receive approval for the project's MY2 (2021) DMS credit release. The Site is located off Meadow Brook Drive and Collins Road in Yadkin County and is proposed to provide 2,413.480 stream mitigation credits within the Yadkin River Basin 03040101.

Attendees:

Paul Wiesner – NCDMS
Kelly Phillips - NCDMS
Todd Tugwell – USACE
Erin Davis – NCDWR
Jake Byers – EPR

The meeting began at approximately 10:30 AM. There was a brief overview of the site history and the remedial actions that have been performed to date. Supplemental site planting had been conducted in 2021. The group walked to the culvert crossing and then into the upstream conservation easement. IRT members requested that a random vegetation monitoring plot be placed in the replanted area along the top of left terrace on upper UT1 Reach 1 in MY5 (no vegetation monitoring in MY4). Jake stated that EPR would put a random plot in this area as requested. No additional project issues were noted on this reach. The IRT and DMS requested upstream and downstream photos of the project crossing and a photo of the Collins Road culvert outlet in MY3 (2022) and future project monitoring reports.

The group then walked down to the area below the crossing. A small, vegetated overbank side channel was noted along the left bank of UT1 Reach 1 below the culvert crossing. While stable, the IRT did request that this area be inspected at subsequent site visits in order to make sure that it remains stable. Photos will be taken at this location and included in future monitoring reports. The group then walked further

downstream and inspected UT1 Reach 2 and upstream Reach 3. No issues were noted here. The group then inspected UT1A. Jake noted that channel maintenance had recently been conducted along this reach to remove existing channel vegetation to allow the stream to flow more freely. Jake noted that in the areas where woody vegetation was well established and was providing significant stream shading, the in-channel vegetation was much less and channel definition was more defined. IRT members requested that no additional channel maintenance be performed along the project reaches after MY3 (2022). Jake stated that EPR would plant additional livestakes and/or trees along the stream banks in thinner areas to help increase channel shading over the dormant season in 2022/2023.

The group then walked further down the valley. IRT members noted a small area of low stem density on the top of the left terrace downstream of UT1A. Jake stated that EPR would plant some additional trees in this area as well. The IRT recommended ring sprays around the planted stems and any supplementally planted trees in the fescue area to help with the success of the planted and supplementally planted trees. The group then walked down to UT1B. The group noted that significant flow was present in this reach. One small area of overbank flow was noted with a small secondary side channel. Jake stated that some additional livestakes and/or trees would be planted in this area to provide additional stabilization. Jake also stated that EPR would place some straw bales in this area to prevent the stream from overflowing into this side channel area in the near term until more vegetation was established. The IRT noted that they had some concern along the lower extents of this reach turning into a braided wetland system and noted that the credit along this section of stream should be considered “at risk”. Paul noted that the credits associated with this reach were well below the final 10% project credit release. The IRT requested some additional photos and visual monitoring of this area during the winter months of MY4. Additional live stakes will also be installed along this reach during the upcoming dormant season.

The group walked along the right bank of UT1- Reach 3 and did not have any concerns other than fescue within the conservation easement. The IRT recommended ring sprays as necessary in the fescue areas to help with the success of the planted and supplementally planted trees.

The group walked back to the initial meeting location. The IRT agreed that MY2 (2021) credits could be release as proposed.

The meeting concluded at approximately 12:00 PM.