As-Built Baseline Monitoring Report

FINAL

MONKEY WALL PROJECT

NCDMS Project #100069 (Contract #7536)
USACE Action ID: 2018-01162
DWR Project #20181029

Mitchell County, North Carolina
French Broad River Basin
HUC 06010108

Provided by:

Resource Environmental Solutions, LLC
For Environmental Banc & Exchange, LLC

Provided for:
NC Department of Environmental Quality
Division of Mitigation Services

October 2022

3600 Glenwood Avenue, Suite 100
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October 25, 2022

Mitigation Plan Addendum
Monkey Wall Project
DMS Project ID # 100069
Contract # 7536 **|** RFP 16-007336 (Issued 9/8/2017)
USACE Action ID: SAW-2018-01162 **|** DWR Project # 2018-1029

Dear NC IRT,

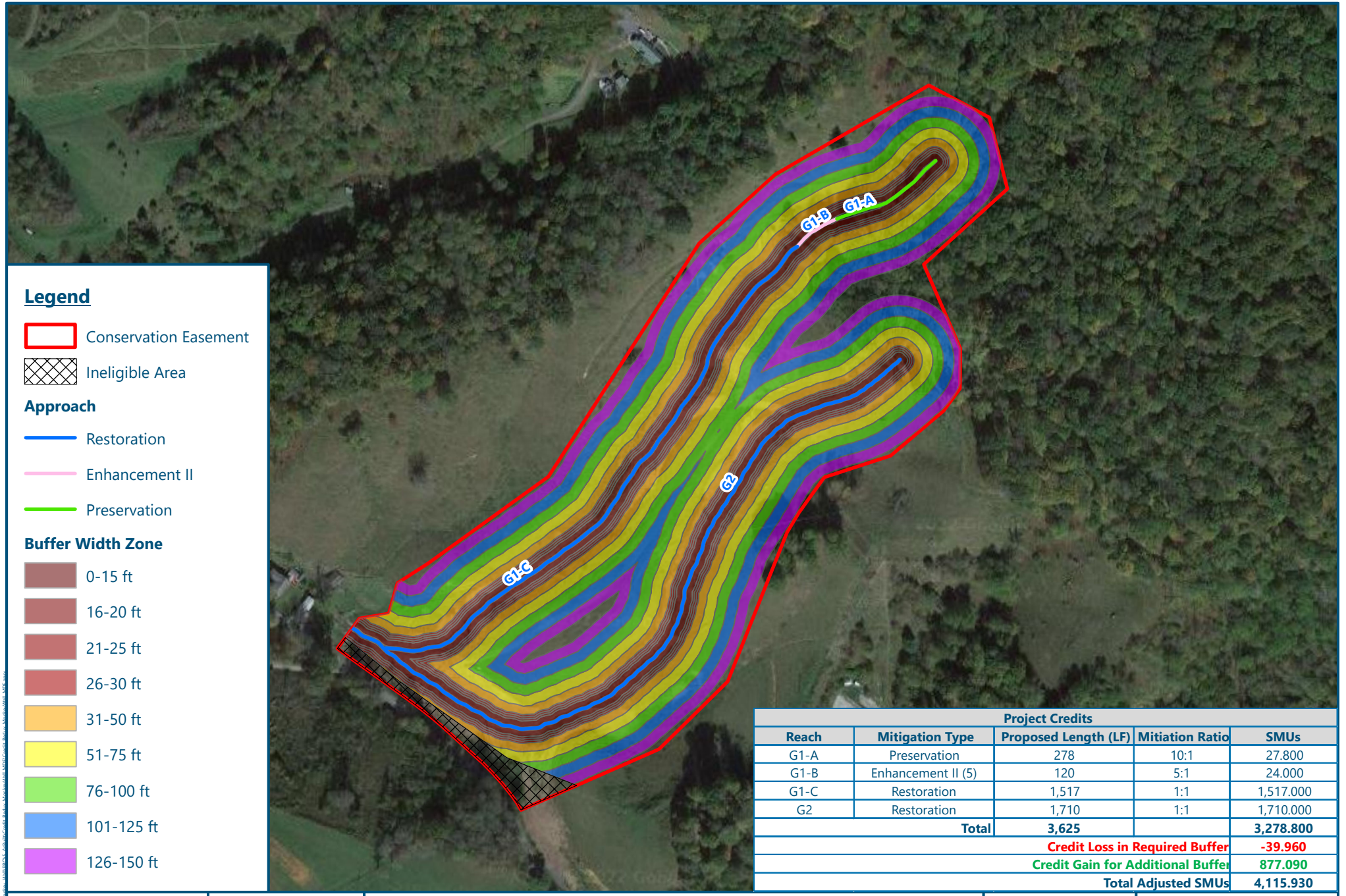
Through stream restoration, enhancement, and preservation, the Monkey Wall Project presents 4,115.930 Cold Stream Mitigation Units (SMU) at As-Built. An additional 241.461 SMU were generated by relocating the utility lines that intersected the project through the center of the conservation easement to the southern boundary of the easement.

Mitigation Plan assets: **3,167.800 Base SMU** and **3,874.469 Total SMU**
As-Built assets: **3,278.800 Base SMU** and **4,115.930 SMU**

The overhead utilities included lines from French Broad Electric and Country Cablevision. French Broad Electric relocated the powerline in April 2022 and Country Cablevision (Zito Media) moved their fiberoptic cable line in October 2022. RES removed the old utility poles in October 2022. RES recalculated the USACE non-standard buffer width using the new utility line location surveyed by Ascension Land Surveying in July 2022 which resulted in a credit loss in required buffer of 39.960 and a credit gain for additional buffer of 877.090. Stewardship has agreed to allow the utility line to remain inside of the conservation easement as a special management area.

Attached is the updated USACE non-standard buffer width calculation spreadsheet and map, and credit table. The abandoned and new utility alignments can be seen on Sheet A1 of the project Record Drawings (Appendix E).

Ryan Medric | Project Manager



Legend

- Conservation Easement
- Ineligible Area

Approach

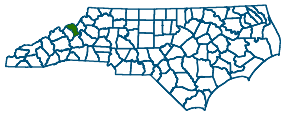
- Restoration
- Enhancement II
- Preservation

Buffer Width Zone

- 0-15 ft
- 16-20 ft
- 21-25 ft
- 26-30 ft
- 31-50 ft
- 51-75 ft
- 76-100 ft
- 101-125 ft
- 126-150 ft

Project Credits

Reach	Mitigation Type	Proposed Length (LF)	Mitiation Ratio	SMUs
G1-A	Preservation	278	10:1	27.800
G1-B	Enhancement II (5)	120	5:1	24.000
G1-C	Restoration	1,517	1:1	1,517.000
G2	Restoration	1,710	1:1	1,710.000
	Total	**3,625**		**3,278.800**
			Credit Loss in Required Buffer	**-39.960**
			Credit Gain for Additional Buffer	**877.090**
			Total Adjusted SMUs	**4,115.930**



N W E S

0 150 300

Feet

As-built Credit Adjustment

Monkey Wall

Mitchell County, North Carolina

Date: 7/8/2022

Drawn by: MDE

Checked by: RTM

1:3,600

res

Restoring a Resilient Earth for a Modern World

Wilmington District Stream Buffer Credit Calculator

Site Name:	Monkey Wall
USACE Action ID:	
NCDWR Project Number:	
Sponsor:	
Number of Exempt Terminal Stream Ends[1]:	0
County:	Mitchell
Minimum Required Buffer Width[2]:	30

Mitigation Type	Mitigation Ratio Multiplier[3]	Creditable Stream Length[4]	Include in Buffer Calculations	Baseline Stream Credit	Buffered Stream Length	Credit From Buffered Streams
Restoration (1:1)	1	3,227	Yes	3227.00	3227.00	3227.00
Enhancement I (1.5:1)	1.5					
Enhancement II (2.5:1)	2.5					
Preservation (5:1)	5					
Other (7.5:1)	7.5					
Other (10:1)	10	278	yes	27.80	278.00	27.80
Custom Ratio 1	5	120	Yes	24.00	120.00	24.00
Custom Ratio 2						
Custom Ratio 3						
Custom Ratio 4						
Custom Ratio 5						
Totals		**3625.00**		3278.80	3625.00	3278.80

	Buffer Width Zone (feet from Ordinary High Water Mark)								
Buffer Zones	**less than 15 feet**	**>15 to 20 feet**	**>20 to 25 feet**	**>25 to 30 feet**	**>30 to 50 feet**	**>50 to 75 feet**	**>75 to 100 feet**	**>100 to 125 feet**	**>125 to 150 feet**
Max Possible Buffer (square feet)[5]	108750	36250	36250	36250	145000	181250	181250	181250	181250
Ideal Buffer (square feet)[6]	109748.61	36662.29	36759.16	36829.98	148186.85	187577.36	190562.38	175001.78	165386.23
Actual Buffer (square feet)[7]	108889.0886	36219.58681	36183.15298	35969.1451	139028.5978	169143.9528	167980.1177	149068.7847	134859.175
Zone Multiplier	50%	20%	15%	15%	9%	7%	6%	5%	3%
Buffer Credit Equivalent	1639.40	655.76	491.82	491.82	295.09	229.52	196.73	163.94	98.36
Percent of Ideal Buffer	99%	99%	98%	98%	94%	90%	88%	85%	82%
Credit Adjustment	-12.84	-7.92	-7.71	-11.50	276.85	206.96	173.42	139.65	80.21

Total Baseline Credit	**Credit Loss in Required Buffer**	**Credit Gain for Additional Buffer**	**Net Change in Credit from Buffers**	**Total Credit**
3278.80	**-39.96**	**877.09**	**837.13**	**4115.93**

[1]Number of terminal stream ends, including all points where streams enter or exit the project boundaries, but not including internal crossings even if they are not protected by the easement.

[2]Minimum standard buffer width measured from the top of bank (50 feet in piedmont and coastal plain counties or 30 feet in mountain counties)

[3]Use the Custom Ratio fields to enter non-standard ratios, which are equal to the number of feet in the feet-to-credit mitigation ratio (e.g., for a perservation ratio of 8 feet to 1 credit, the multiplier would be 8).

[4]Equal to the number of feet of stream in each Mitigation Type. If stream reaches are not creditable, they should be excluded from this measurement, even if they fall within the easement.

[5]This amount is the maximum buffer area possible based on the linear footage of stream length if channel were perfectly straight with full buffer width and no internal crossings. This number is not used in calculations, but is provided as a reference.

[6]Maximum potential size (in square feet) of each buffer zone measured around all creditable stream reaches, calculated using GIS, including areas outside of the easement. The inner zone (0-15') should be measured from the top of the OHWM or the edge of the average stream width if OHWM is not known. Non-creditable stream reaches within the easement should be removed prior to calculating this area wtih GIS.

[7]Square feet in each buffer zone, as measured by GIS, excluding non-forested areas, all other credit type (e.g., wetland, nutrient offset, buffer), easement exceptions, open water, areas failing to meet the vegetation performance standard, etc. Additional credit is given to 150 feet in buffer width, so areas within the easement that are more than 150 feet from creditable streams should not be included in this measurement. Non-creditable stream reaches within the easement should be removed prior to calculating this area wtih GIS.

Table 1. Monkey Wall Project (ID-100069) - Mitigation Assets and Components

Project Segment	Existing Footage or Acreage	Mitigation Plan Footage or Acreage	Mitigation Plan Addendum Footage or Acreage	Migitation Category	Restoration Level	Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits	Mitigation Plan Addendum Credits		As-Built Footage or Acreage	Comments
G1-A	278	278	278	Cold	P	-	10.00000	27.800	27.800		278	Extend riparian buffer to at least 30-feet, livestock exclusion, and conservation easement establishment
G1-B	120	120	120	Cold	EII	-	5.00000	24.000	24.000		120	Extend riparian buffer to at least 30-feet, minor bank stability work, livestock exclusion, and conservation easement establishment
G1-C	1,521	1,453	1,517	Cold	R	1	1.00000	1,453.000	1,517.000		1,517	Full channel restoration, establish a riparian buffer to at least 30-feet, livestock exclusion, and conservation easement establishment
G2	1,595	1,663	1,710	Cold	R	1	1.00000	1,663.000	1,710.000		1,710	Full channel restoration, establish a riparian buffer to at least 30-feet, livestock exclusion, and conservation easement establishment

Note: Project credits were recalculated in a Mitigation Plan Addendum submitted with the As-Built Report; stream length differences are due to the relocation of the utility line that intersected the easement

Project Credits

Restoration Level	Stream				Riparian Wetland	Non-rip Wetland	Coastal Marsh
	Warm	Cool		Cold			
Restoration				3,227.000			
Re-establishment							
Rehabilitation							
Enhancement							
Enhancement I							
Enhancement II				24.000			
Creation							
Preservation				27.800			
Base Credits				3278.800			
NSBW				837.130			
TOTALS				**4,115.930**			

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October 4, 2022

Harry Tsomides
NC DEQ Division of Mitigation Services
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

RE: Monkey Wall Site: Baseline Report and As-Built Drawings (NCDMS ID 100069)

Listed below are comments provided by DMS on June 24, 2022 and July 19, 2022 regarding the Monkey Wall Site: Baseline Report and As-Built Drawings and RES' responses.

1. Table 4—Please provide planting installation date, and stream earthwork completion date.
   The month and year of each completed task are included in Table 4.
2. Fencing—has all the pre-existing fencing and posts been removed from the easement area? If so, please state; if not, please map on as-builts, maps, etc. and provide digital layer and indicate what the plan for removal is.
   The pre-existing fencing has been removed from the project.
3. Photo points—your answer to the digitals question indicates no photo points, but the mitigation plan visual assessment indicates photos as part of visual monitoring.
   The mitigation plan states, "Digital images will be taken at fixed representative locations to record each monitoring event…" Photos are taken at all monitoring stations, including fixed vegetation plots, random vegetation plots, upstream and downstream photos at all cross sections, and photos of all stream and wetland gauge(s). These are the "photo points" that will be collected each monitoring year and are located in Appendix B of the yearly monitoring reports. Any additional problem areas throughout the site, noted in future monitoring years, will also include "photo points" as needed, and will be included within the monitoring reports and associated appendices.
4. Please consider using current templates for future submissions.
   RES will take this into consideration going forward.

Digital Deliverables

Attribute the stream structures and gauge feature classes with structure type and gauge number.
Due to the way that the structures were exported from AutoCAD, each individual point is being represented instead of merged, labeled, structures; therefore, there are over 21,000 unlabeled points in the file. There is not an efficient way to merge these points together without labeled features; however, these structures are individually attributed and displayed in the as-built record

drawings. The attributes for the gauges have been labeled with the types of gauges, as well as the individual gauge IDs.

The following required spatial data is missing from the submission, please submit:

a. Photo point file with station point labels included
   There are no fixed photo points on this project except at each monitoring device, which are labeled.
b. Longitudinal Profile data
   Profile data is in the as-built AutoCAD file.
c. Planted area
   The planted area has been added to the visual assessment data file.
d. Fencing, existing and installed if applicable
   No new fencing was installed during construction. The pre-construction existing fencing file has been included in the visual assessment data file.
e. As-Built AutoCAD file
   This has been added to the Support Files.

Please submit Table 2. Goals, Performance, Results.
This table has been included in the Background Tables file as Table 2.

The asset table and spatial data vary by greater than 5 l.f. on reach G1-C; the asset table indicates 1,529 l.f. while the spatial data attribute table indicates 1,517 l.f.; resolve this conflict.
This conflict has been resolved.

Table of Contents

1.0 Project Summary

1.1 Project Location and Description

The Monkey Wall Project ("Project") is located within a rural watershed in Mitchell County, North Carolina approximately two miles northwest of Bakersville, NC. Water quality stressors affecting the Project included livestock production, agricultural practices, and lack of riparian buffer. The Project presents stream restoration, enhancement, and preservation generating 4,115.930 Cold Stream Mitigation Units (SMU).

The Project's total easement area is 25.28 acres within the overall drainage area of 87 acres. Grazing livestock historically had complete access to both the stream reaches, resulting in bank erosion, sediment deposition, and channel incision. The lack of riparian buffer vegetation, deep-rooted vegetation, and unstable channel characteristics contributed to the degradation of stream banks and surrounding floodplain area.

The stream design approach for the Project was to combine the analog method of natural channel design with analytical methods to evaluate stream flows and hydraulic performance of the channel and floodplain. The analog method involved the use of a reference reach, or "template" stream, adjacent to, nearby, or previously in the same location as the design reach. The template parameters of the analog reach were replicated to create the features of the design reach. The analog approach is useful when watershed and boundary conditions are similar between the design and analog reaches. Hydraulic geometry was developed using analytical methods to identify the design discharge. The wetland approach was closely tied to the stream restoration in that wetland hydrology and vegetation have been re-established as a product of restoring the natural stream system and riparian area along with other hydrologic improvement activities.

The Project has been constructed and planted and will be monitored on a regular basis throughout the seven-year post-construction monitoring period, or until performance standards are met. The Project will be transferred to the NCDEQ Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. Funding will be supplied by the responsible party on a yearly basis until such time an endowment is established.

1.2 Project Goals and Objectives

Through the comprehensive analysis of the Project's maximum functional uplift using the Stream Functions Pyramid Framework, specific, attainable goals and objectives will be realized by the Project. These goals clearly address the degraded water quality and nutrient input from farming that were identified as major watershed stressors in the 2009 French Broad River RBRP. These goals and objectives reflect those stated in the Monkey Wall Project Final Mitigation Plan.

The Project goals are:

- Improve water transport from watershed to the channel in a non-erosive manner in a stable channel;
- Improve flood flow attenuation on-site and downstream by allowing for overbank flows and connection to the floodplain;
- Restore native floodplain and riparian vegetation; and
- Improve instream habitat;
- Reduce sediment, nutrient, and fecal coliform inputs into stream system;
- Indirectly support the goals of the 2009 French Broad RBRP to improve water quality and to reduce sediment and nutrient loads, especially in the Big Rock Creek watershed.

The Project goals were addressed through the following project objectives:

- Designed and reconstructed the stream channel to convey bankfull flows while maintaining stable dimension, profile, and planform;
- Added in-stream structures and bank stabilization measures to protect the restored stream;
- Installed habitat features such as brush toes, woody materials, and pools of varying depths to the restored stream;
- Removed the 268-linear foot rock wall located on the most upstream portion of G2 which daylighted the existing stream and restored the natural profile of the channel;
- Increased forested riparian buffers to at least 30 feet on both sides of the channel along the Project reach with a hardwood riparian plant community;
- Treated exotic invasive species; and
- Established a permanent conservation easement on the Project that excludes future livestock from the stream channel and its associated buffers and prevent future land-use changes.

Functional uplift, benefits, and improvements within the Project area, as based on the Function Based Framework, are outlined in the Final Mitigation Plan**.**

1.3 Project Success Criteria

The success criteria for the Project follows the 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation Update, the Monkey Wall Project Final Mitigation Plan, and subsequent agency guidance. Cross section and vegetation plot monitoring takes place in Years 0, 1, 2, 3, 5, and 7. Stream hydrology and visual monitoring takes place annually. Specific success criteria components are presented below.

Stream Restoration Success Criteria

Four bankfull flow events must be documented within the seven-year monitoring period. The bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until four bankfull events have been documented in separate years.

There should be little change in as-built cross sections. If changes do take place, they should be evaluated to determine if they represent a movement toward a less stable condition (for example down-cutting or erosion) or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross sections shall be classified using the Rosgen stream classification method, and all monitored cross sections should fall within the quantitative parameters defined for channels of the design stream type. Bank height ratio shall not exceed 1.2, and the entrenchment ratio shall be above 2.2 within restored riffle cross sections. Channel stability should be demonstrated through a minimum of four bankfull events documented in the seven-year monitoring period.

Digital images are used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures. Longitudinal images should not indicate the absence of developing bars within the channel or an excessive increase in channel depth. Lateral images should not indicate excessive erosion or continuing degradation of the banks over time. A series of images over time should indicate successional maturation of riparian vegetation.

Vegetation Success Criteria

Specific and measurable success criteria for plant density within the riparian buffers on the Project follow IRT Guidance. The interim measures of vegetative success for the Project is the survival of at least 320 planted three-year old trees per acre at the end of Year 3, 260 trees per acre with an average height of six feet at the end of Year 5, and the final vegetative success criteria is 210 trees per acre with an average height of eight feet at the end of Year 7. Volunteer trees are counted, identified to species, and included in the yearly monitoring reports, but are not included in the success criteria of total planted stems until they are present in the plot for greater than two seasons. Moreover, any single species can only account for up to 50 percent of the required number of stems within any vegetation plot. Any stems in excess of 50 percent will be shown in the monitoring table but will not be used to demonstrate success.

Level	Treatment	Objective	Monitoring Metric	Performance Standard
1 *Hydrology*	Convert the land-use of streams and their watersheds from pasture to riparian forest	To transport water from the watershed to the channel in a non-erosive manner	Percent Project drainage area converted to riparian forest (indirect measurement)	NA
2 *Hydraulic*	Reduce bank height ratios and increase entrenchment ratios by reconstructing the channel to mimic reference reach conditions	Improve flood bank connectivity by reducing bank height ratios and increasing entrenchment ratios	Pressure transducer flow and bankfull monitoring gauge: Inspected quarterly	Four bankfull events occurring in separate years
			Cross sections: Surveyed in Years 1, 2, 3, 5 and 7	Entrenchment ratio shall be above 2.2 within the restored reach
				Bank height ratio shall not exceed 1.2
3 *Geomorphology*	Establish a riparian buffer to reduce erosion and sediment transport into the project stream. Establish stable banks with livestakes, erosion control matting, and other in stream structures.	Reduce erosion rates and channel stability to reference reach conditions Improve bedform diversity (pool spacing, percent riffles, etc.) Increase buffer width to a minimum 30 feet	As-built stream profile	NA
			Cross sections: Surveyed in Years 1, 2, 3, 5 and 7	Entrenchment ratio shall be no less than 2.2 within restored the reach
				Bank height ratio shall not exceed 1.2
			Visual monitoring: Performed at least semiannually	Identify and document significant stream problem areas; i.e. erosion, degradation, aggradation, etc.
			Vegetation plots: Surveyed in Years 1, 2, 3, 5 and 7	MY 1-3: 320 trees/acre MY 5: 260 trees/acre (6 ft tall) MY 7: 210 trees/acre (8 ft tall)
4 *Physicochemical*	Exclude livestock from riparian areas with exclusion fence or conservation easement, and plant a riparian buffer	*Unmeasurable Objective/Expected Benefit* Establish native hardwood riparian buffer and exclude livestock. To achieve appropriate levels for water temperature, dissolved oxygen concentration, and other important nutrients including but not limited to nitrogen and Phosphorus through buffer planting	Vegetation plots: Surveyed in Years 1, 2, 3, 5 and 7 (*indirect measurement*)	MY 1-3: 320 trees/acre MY 5: 260 trees/acre (6 ft tall) MY 7: 210 trees/acre (8 ft tall)
			Visual assessment of established fencing and conservation signage: Performed at least semiannually (*indirect measurement*)	Inspect fencing and signage. Identify and document any damaged or missing fencing and/or signs

1.4 Project Components

The Project area is comprised of a contiguous 25.28-acre easement involving two unnamed tributaries (G1 and G2) totaling 3,384 existing linear feet (LF), which drain into Big Rock Creek, a tributary of the French Broad River. There are also three existing wetlands within the easement area: Wetland A, Wetland B, and Wetland C (WA, WB, and WC, respectively); no wetland mitigation work was completed at the Monkey Wall site.

The Project presents 3,227 LF of stream restoration, 120 LF of stream enhancement, and 278 LF of stream preservation, generating 4,115.930 Cold SMUs. To account for areas of more or less than minimum 30-foot buffer widths, credits were adjusted using the USACE Wilmington District Stream Buffer Credit Calculator. The stream mitigation components are summarized below. Mitigation credits are based on the Mitigation Plan Addendum.

Stream Mitigation				
Reach	**Treatment**	**Linear Feet**	**Ratio**	**Cold SMU**
G1-A	Preservation	278	10	27.800
G1-B	Enhancement II	120	5	24.000
G1-C	Restoration	1,517	1	1,517.000
G2	Restoration	1,710	1	1,710.000
Total	**-**	**3,625**	**-**	**3,278.800**
	Non-standard Buffer Width Adjustment			**837.130***
	Total Adjusted SMUs			**4,115.930**

* Credit adjustment for Non-standard Buffer Width calculation using the Wilmington District Stream Buffer Credit Calculator issued by the USACE in January 2018.

1.5 Stream Design/Approach

The stream component of the Project included a combination of priority I and priority II restoration, enhancement II, and preservation. Stream restoration incorporated the design of a single-thread, high gradient, cascade and step-pool channel system, with parameters based on cascade and step-pool morphology and reference conditions along the representative reaches within the Monkey Wall site. A combination of analog, empirical, and analytical design techniques were used to determine the design discharge and to verify design stability.

Reaches G1 and G2 were designed specific to cascade and step-pool systems for treatment mitigation goals for the site and include a series of cascades and pools connected by riffles and/or boulder and log steps that restore floodplain connectivity to the site. The riffles, steps, and pools provide grade control, energy dissipation and bedform diversity to restore high gradient systems.

The following stream treatment was performed on the Project reaches:

Reach G1-A

A Preservation approach was used for this reach, due to its high quality, wide riparian buffers, and terrain. Preservation activities included:

- Minimal buffer planting on the right bank, to increase riparian buffer beyond 75 feet;
- Livestock exclusion; and
- Establishing a conservation easement to be protected in perpetuity.

Reach G1-B

An Enhancement II approach was used for the reach to address eroding banks and channel entrenchment. Enhancement activities included:

- Livestock exclusion; and
- Riparian buffer planting to 150-feet.

Reach G1-C

A combination of Priority I and Priority II restoration was used for this reach to address eroding banks, channel incision, bed degradation and floodplain connectivity.
Restoration activities included:

- Constructing a new single thread channel and floodplain benches in the existing floodplain;
- Installing log and rock structures to provide grade control with drops no greater than 1.25 feet;
- Establishing a cascade, step-pool or riffle-pool sequence throughout the reach;
- Filling the existing channel;
- Creating floodplain to reduce shear stresses at higher flows;
- Livestock exclusion; and
- Riparian buffer planting to a minimum of 30-feet at the downstream end and out to 150-feet everywhere else

Reach G2

A combination of Priority I and Priority II restoration was used for this reach to address eroding banks, channel incision, bed degradation, and floodplain connectivity.
Restoration activities included:

- Removing the culvert and associated road at the upstream portion of the reach and tying the channel into a seep located above the culvert;
- Removing the rock wall, and daylighting the channel, present on the upper portion of the reach;
- Constructing a new single thread channel and floodplain benches in the existing floodplain;
- Installing log and rock structures to provide grade control with drops no greater than 1.25 feet;
- Establishing a cascade, step-pool or riffle-pool sequence throughout the reach;
- Filling the existing channel;
- Creating floodplain to reduce shear stresses at higher flows;
- Livestock exclusion; and

- Riparian buffer planting to 150-feet on both sides of the stream.

One wetland gauge was installed on the right floodplain of G1-C in WA to monitor wetland hydrology. This data will be reported in yearly monitoring reports. No wetland credits are to be generated on WA; thus, wetland success criteria will not need to be met during the monitoring period.

1.6 Construction and As-Built Conditions

Stream construction was completed in October 2021 and planting was completed on March 10, 2022. The Monkey Wall Project was built to design plans and guidelines. The as-built stream length was exactly the same as proposed in the mitigation plan plus the stream length that was originally removed under the utility lines; however, the total SMUs for the project increased from 3,874.469 SMUs to 4,115.930 SMUs. This change was due to the relocation of utility lines that were previously within the conservation easement. French Broad Electric relocated the powerline in April 2022 and Country Cable (Zito Media) moved the fiberoptic cable line in October 2022. RES also removed the old utility poles in October 2022. More information regarding this is included in the attached Mitigation Plan Addendum. Swales were added to address small erosional areas that formed as a result of stormwater runoff and seeps encountered during construction. Swale locations are shown on the record drawings included in **Appendix E**.

Minor monitoring device location changes were made during as-built installation; however, the quantities remained as proposed in the Final Mitigation Plan. The original installation of two fixed vegetation plots, 6 and 7, interfered with the relocated powerline easement and were therefore shifted outside of the right-of-way on May 3, 2022. There were no changes made to the planting plan.

1.7 Baseline Monitoring Performance (MY0)

The Monkey Wall baseline monitoring activities were performed in March and May 2022. All baseline monitoring data is present below and in the appendices. The Project is on track to meet interim success criteria.

Vegetation

Setup and monitoring of 13 fixed vegetation plots and three random vegetation plots was completed after planting and stream construction on March 24, 2022. The original installation of two plots, 6 and 7, interfered with the relocated powerline easement and were therefore shifted outside of the right-of-way on May 3, 2022. Vegetation data are in **Appendix C**, associated photos are in **Appendix B,** and plot locations are in **Appendix B**. MY0 monitoring data indicates that all plots are exceeding the interim success criteria of 320 planted stems per acre. Planted stem densities ranged from 405 to 809 planted stems per acre with an average of 599 planted stems per acre across all plots. A total of 11 species were documented within the plots. Volunteer species were not noted at baseline monitoring but are expected to establish in upcoming years. The average stem height in the plots was 1.5 feet.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project.

Stream Geomorphology

A total of 12 cross sections were installed and geomorphology data collection for MY0 was conducted on March 24, 2022. Summary tables and cross section plots are in **Appendix D**. Overall the baseline cross sections and profile relatively match the proposed design. The as-built conditions show that shear stress and velocities have been reduced for the restoration reaches. The reaches were designed as a natural mountain cobble-bed channel and remain classified as a mountain cobble-bed channel post-construction.

Visual assessment of the stream channel was performed to document signs of instability, such as eroding banks, structural instability, or excessive sedimentation. The channel is transporting sediment as designed and will continue to be monitored for aggradation and degradation.

Stream Hydrology

Two stage recorders and two flow gauges were installed on March 24, 2022 and will document bankfull events and flow days, respectively. Stream hydrology will be recorded at a frequency of once per hour and data will be included in the Monitoring Year 1 Report in this section and in the appendices. The gauge locations can be found on **Figure 2** and photos are in **Appendix B**.

Wetland Hydrology

One groundwater well was installed on the right floodplain of G1-C in WA to monitor wetland hydrology and will record water table depths at a frequency of twice per day. This data will be reported in yearly monitoring reports in this section and in the appendices. No wetland credits are to be generated on WA; thus, there is no hydroperiod success criteria for this groundwater well.

2.0 Methods

Stream cross section monitoring was conducted using a Topcon GTS-312 Total Station. Three-dimensional coordinates associated with cross-section data were collected in the field (NAD83 State Plane feet FIPS 3200). Morphological data were collected at eight cross-sections. Survey data were imported into CAD, ArcGIS®, and Microsoft Excel® for data processing and analysis. The stage recorders include an automatic pressure transducer placed in PVC casing in a pool at the downstream end of each reach. The elevation of the bed and top of bank at each stage recorder are used to detect bankfull events. The flow gauges also include an automatic pressure transducer placed in a PVC casing in a pool, at the upstream end of each reach. The elevations of the bed, water surface, and immediate downstream riffle are used to determine stream flow.

Vegetation success is being monitored at 13 fixed monitoring plots and three random monitoring plots. Vegetation plot monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008) and includes analysis of species composition and density of planted species. Data are processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with PVC at the origin and metal conduit at the other corners. Photos of each plot are to be taken from the origin each monitoring year. The random plots are to be collected in locations where there are no permanent vegetation plots. Random plots will most likely be collected in the form of 100 square meter belt transects with variable dimensions. Tree species and height will be recorded for each planted stem and the transects will be mapped and new locations will be monitored in subsequent years.

Wetland hydrology is monitored to track the hydrology of the jurisdictional wetland (WA) on site post-stream construction. This is accomplished with one automatic pressure transducer gauge (located in the groundwater well) that will record daily groundwater levels. One automatic pressure transducer is installed above ground for use as a barometric reference. The gauge is downloaded quarterly and wetland hydroperiod is calculated during the growing season. Gauge installation followed current regulatory guidance. Visual observations of primary and secondary wetland hydrology indicators are also recorded during quarterly site visits.

3.0 References

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Resource Environmental Solutions (2020). Monkey Wall Project Final Mitigation Plan.

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Appendix A

Background Tables

Table 1. Monkey Wall Project (ID-100069) - Mitigation Assets and Components

Project Segment	Existing Footage or Acreage	Mitigation Plan Footage or Acreage	Mitigation Plan Addendum Footage or Acreage	Migitation Category	Restoration Level	Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits	Mitigation Plan Addendum Credits		As-Built Footage or Acreage	Comments
G1-A	278	278	278	Cold	P	-	10.00000	27.800	27.800		278	Extend riparian buffer to at least 30-feet, livestock exclusion, and conservation easement establishment
G1-B	120	120	120	Cold	EII	-	5.00000	24.000	24.000		120	Extend riparian buffer to at least 30-feet, minor bank stability work, livestock exclusion, and conservation easement establishment
G1-C	1,521	1,453	1,517	Cold	R	1	1.00000	1,453.000	1,517.000		1,517	Full channel restoration, establish a riparian buffer to at least 30-feet, livestock exclusion, and conservation easement establishment
G2	1,595	1,663	1,710	Cold	R	1	1.00000	1,663.000	1,710.000		1,710	Full channel restoration, establish a riparian buffer to at least 30-feet, livestock exclusion, and conservation easement establishment

Note: Project credits were recalculated in a Mitigation Plan Addendum submitted with the As-Built Report; stream length differences are due to the relocation of the utility line that intersected the easement

Project Credits

Restoration Level	Stream				Riparian Wetland	Non-rip Wetland	Coastal Marsh
	Warm	Cool		Cold			
Restoration				3,227.000			
Re-establishment							
Rehabilitation							
Enhancement							
Enhancement I							
Enhancement II				24.000			
Creation							
Preservation				27.800			
Base Credits				3278.800			
NSBW				837.130			
TOTALS				**4,115.930**			

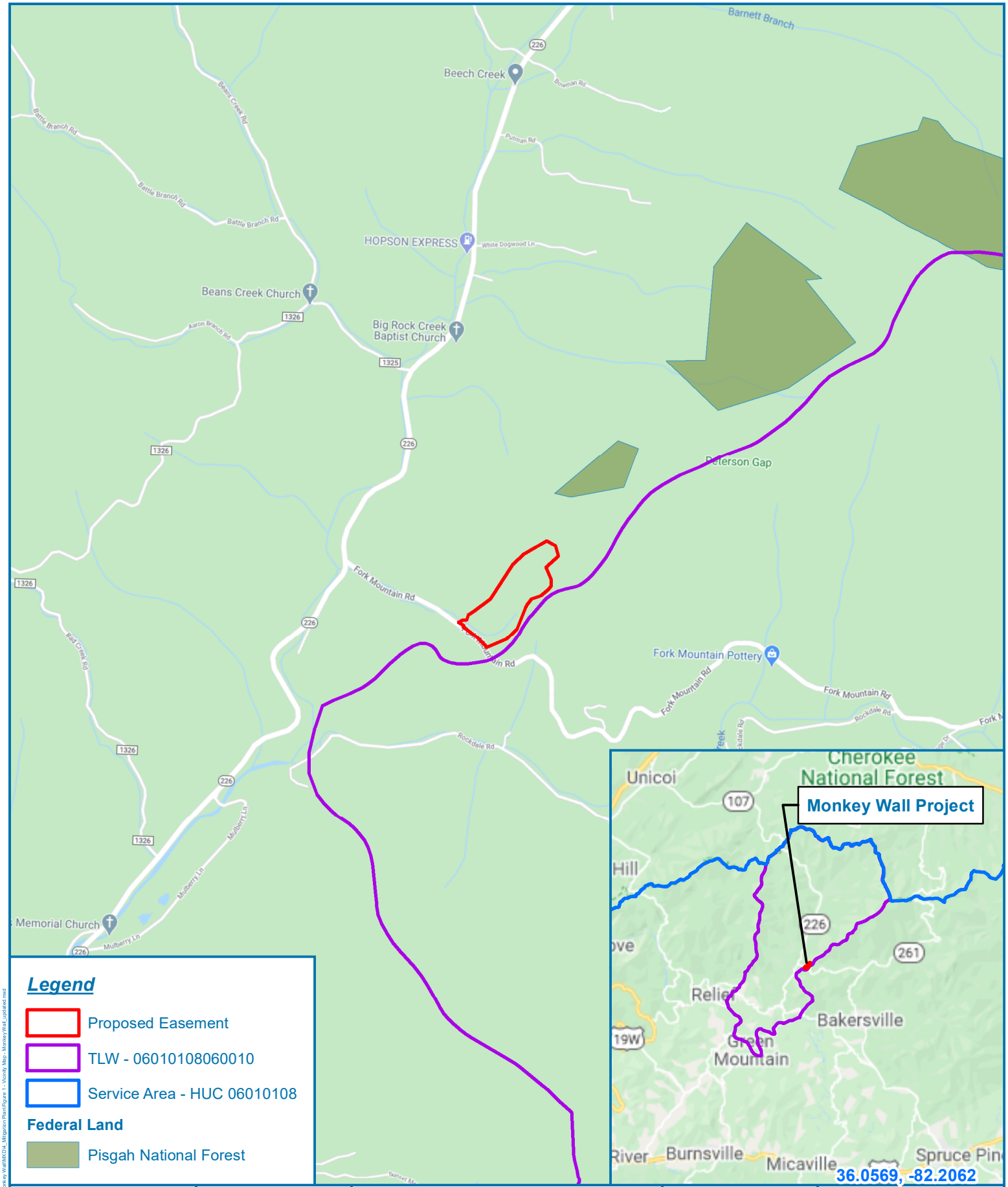
Table 2: Summary: Goals, Performance, and Results					
Goal	**Objective/Treatment**	**Likely Functional Uplift**	**Performance Criteria**	**Measurement**	**Cumulative Monitoring Results**
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime and mimic reference reach conditions.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain. Remove overburden to reconnect with adjacent wetlands.	Dispersion of high flows on the floodplain, increase in biogeochemical cycling within the system, and recharging of riparian wetlands.	Four bankfull events and within monitoring period. At least 30 days of continuous flow each year	Two Flow Gauges at upstream ends of G1-C and G2. Two Stage Recorders at downstream ends of G1-C and G2.	-
Improve water transport from watershed to the channel in a non-erosive manner in a stable channel	Construct stream channels that will maintain stable cross- sections, patterns, and profiles over time.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.	Bank height ratios remain below 1.2 over the monitoring period. Entrenchment ratio shall be no less than 1.4 within restored B channels, and 2.2 for C/E channels. Visual assessments showing progression towards stability.	Cross Sections surveyed in years 1, 2, 3, 5 and 7	-
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zones and plant appropriate species on streambanks.	Reduction in floodplain sediment inputs from runoff, increased bank stability, increased LWD and organic material in streams, increased	Survival rate of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7.	13 Fixed Vegetation Plots and three random Vegetation Plots.	-

Table 3. Project Background Information					
Project Name	Monkey Wall Project				
County	Mitchell				
Project Area (acres)	24.42				
Project Coordinates (latitude and longitude)	36.0559, -82.2067				
Planted Acreage (Acres of Woody Stems Planted)	19.05				
Project Watershed Summary Information					
Physiographic Province	66d - Southern Crystalline Ridges and Mountains				
River Basin	French Broad				
USGS Hydrologic Unit 8-digit	06010108	USGS Hydrologic Unit 14-digit	06010108060010		
DWR Sub-basin	04-03-06				
Project Drainage Area (Acres)	86.6				
Project Drainage Area Percentage of Impervious Area	<1%				
CGIA Land Use Classification	Mixed hardwoods/Conifers, Managed Herbaceous Cover, Unmanaged Herbaceous Cover-Upland, & Mixed Upland Hardwoods				
Reach Summary Information					
Parameters	**G1-A**	**G1-B**	**G1-C**	**G2**	
Length of reach (linear feet)	278	120	1517	1710	
Valley confinement (Confined, moderately confined, unconfined)	Confined	Confined	Confined	Confined	
Drainage area (Acres)	11.83	14.23	86.60	55.09	
Perennial, Intermittent, Ephemeral	Intermittent	Intermittent	Intermittent	Intermittent	
NCDWR Water Quality Classification	C, Tr	C, Tr	C, Tr	C, Tr	
Stream Classification (existing)	A	A	A	A	
Stream Classification (proposed)	B	B	B	B	
Evolutionary trend (Simon)	II	II	II	II	
FEMA classification	Zone X	Zone X	Zone X	Zone X	
Wetland Summary Information					
Parameters	**Wetland A**	**Wetland B**	**Wetland C**		
Size of Wetland (acres)	0.24	0.02	0.01		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian riverine	Riparian riverine	Riparian riverine		
Mapped Soil Series	TsC	BtF	TsD		
Drainage class	Well Drained	Well Drained	Well Drained		
Soil Hydric Status	Non-hydric	Non-hydric	Non-hydric		
Source of Hydrology	Groundwater, surface hydrology	Groundwater	Groundwater		
Restoration or enhancement method (hydrologic, vegetative etc.)	NA	NA	NA		

Table 4. Project Timeline and Contacts Table
Monkey Wall Project

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Mitigation Plan	NA	Jun-20
Final Design – Construction Plans	NA	Jun-21
Stream Construction	NA	Oct-21
Site Planting	NA	Mar-22
As-built (Year 0 Monitoring – baseline)	Apr-22	Oct-22
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

Designer Primary project design POC	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612 Frasier Mullen, PE
Construction Contractor Construction contractor POC	Baker Grading & Landscaping, Inc. / 1000 Bat Cave Road, Old Fort, NC 28762 Charles Baker
Survey Contractor Survey contractor POC	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612 Brian Hockett, PLS
Planting Contractor Planting contractor POC	Shenandoah Habitats David Coleman
Monitoring Performers Project Manager POC Monitoring POC	RES / 3600 Glenwood Ave, Suite 100, Raleigh, NC 27612 Ryan Medric (703) 424-6313 Emily Ulman (910) 274-8231



Legend

- Proposed Easement
- TLW - 06010108060010
- Service Area - HUC 06010108

Federal Land

- Pisgah National Forest

N
W
E
S

0 1,000 2,000

Feet

Figure 1 - Site Location Map

Monkey Wall Mitigation Project

Mitchell County, North Carolina

Date:	2/27/2020
Drawn by:	EJU
Checked by:	MDE
	1 inch = 2,000 feet

res

Document Path: R:\Regional\projects\NC\Monkey Wall\MX014_Mitigation Plan\Figure 1 - Vicinity Map - MonkeyWall_updated.mxd

Appendix B

Visual Assessment Data

res

N

W

E

S

0 75 150

Feet

Figure 2 - Current Conditions Plan View

MY0 2022

Monkey Wall Project

Mitchell County, North Carolina

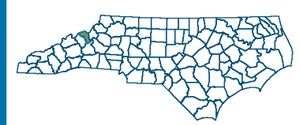
Date: 7/18/2022	Drawn by: EJU
Checked by: RTM	1 in = 150 feet

Legend

- Conservation Easement
- Existing Wetland
- Pre-construction Top of Bank
- Fixed Vegetation Plot
- Random Vegetation Plot
- Relocated Utility Line
- Surveyed Top of Bank

Stream Approach

- Restoration (1:1)
- Enhancement II (5:1)
- Preservation (10:1)
- Cross Section
- Ambient
- Stage Recorder
- Flow Gauge
- Groundwater Well



Document Path: R:\Raleigh\Active\Projects\100518_Monkey_Wall\MY0\07_Monitoring\MY0\Figure 2 - CCPV - Monkey Wall - MY0.mxd

Visual Stream Stability Assessment

Reach	G1-C
Assessed Stream Length	1517
Assessed Bank Length	3034

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.	95	95		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)	NA	NA		NA

Visual Stream Stability Assessment

Reach	G2
Assessed Stream Length	1710
Assessed Bank Length	3420

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.	106	106		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)	NA	NA		NA

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **19.85**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Red Simple Hatch	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Orange Simple Hatch	0	0.00	0.0%
			Total			0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Orange Simple Hatch	0	0.00	0.0%
			Cumulative Total			0.0%

Easement Acreage[2] **24.28**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Yellow Crosshatch	0	0.00	0.0%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Red Simple Hatch	0	0.00	0.0%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Monkey Wall MY0 Vegetation Monitoring Plot Photos – March 2022

Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Vegetation Plot 6 (5/3/2022)

Vegetation Plot 7 (5/3/2022)

Vegetation Plot 8

Vegetation Plot 9

Vegetation Plot 10

Vegetation Plot 11

Vegetation Plot 12

Vegetation Plot 13


Random Vegetation Plot 1


Random Vegetation Plot 2


Random Vegetation Plot 3

Monkey Wall Monitoring Device Photos – March 2022

Flow Gauge G1-C

Flow Gauge G2

Stage Recorder G1-C

Stage Recorder G2

Groundwater Well 1

Appendix C

Vegetation Plot Data

Table 7. Planted Species Summary

Common Name	Scientific Name	Mitigation Plan %	As-Built %	Total Stems Planted
River Birch	*Betula nigra*	15	15	2,300
Tulip Poplar	*Liriodendron tulipifera*	15	15	2,300
Sycamore	*Platanus occidentalis*	15	15	2,300
Shagbark Hickory	*Carya ovata*	10	10	1,500
White Oak	*Quercus alba*	10	10	1,500
Chestnut Oak	*Quercus montana*	10	10	1,500
Northern Red Oak	*Quercus rubra*	5	5	800
Red Mulberry	*Morus rubra*	5	5	800
Eastern Redbud	*Cercis canadensis*	5	5	800
Flowering Dogwood	*Cornus florida*	5	5	800
Tag Alder	*Alnus serrulata*	5	5	800
			Total	15,400
			Planted Area	19.85
			As-built Planted Stems/Acre	776

Table 8. Vegetation Plot Mitigation Success Summary

Plot #	Planted Stems/Acre	Volunteer Stems/Acre	Total Stems/Acre	Success Criteria Met?	Average Planted Stem Height (ft)
1	647	0	647	Yes	1.6
2	567	0	567	Yes	1.4
3	486	0	486	Yes	1.1
4	607	0	607	Yes	1.5
5	647	0	647	Yes	1.3
6	486	0	486	Yes	1.2
7	405	0	405	Yes	1.2
8	526	0	526	Yes	1.6
9	688	0	688	Yes	1.6
10	769	0	769	Yes	1.7
11	607	0	607	Yes	1.4
12	647	0	647	Yes	1.6
13	607	0	607	Yes	1.4
R1	607	0	607	Yes	1.8
R2	486	0	486	Yes	1.6
R3	809	0	809	Yes	1.6
Project Avg	**599**	**0**	**599**	**Yes**	**1.5**

Table 9. Stem Count Total and Planted by Plot Species

Monkey Wall			Current Plot Data (MY0 2022)																														
			100918-01-0001			100918-01-0002			100918-01-0003			100918-01-0004			100918-01-0005			100918-01-0006			100918-01-0007			100918-01-0008			100918-01-0009			100918-01-0010			100918-01-0011		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Alnus serrulata	hazel alder	Shrub	1	1	1							1	1	1				3	3	3												2	2	2
Betula nigra	river birch	Tree				3	3	3										6	6	6	1	1	1	6	6	6				7	7	7	1	1	1
Carya ovata	shagbark hickory	Tree				1	1	1																			1	1	1						
Cercis canadensis	eastern redbud	Tree							1	1	1																3	3	3						
Cornus florida	flowering dogwood	Tree							1	1	1	3	3	3													2	2	2	1	1	1			
Liriodendron tulipifera	tuliptree	Tree	4	4	4	3	3	3	1	1	1	2	2	2	5	5	5							3	3	3	7	7	7						
Morus rubra	red mulberry	Tree				1	1	1							1	1	1													2	2	2			
Platanus occidentalis	American sycamore	Tree										3	3	3				3	3	3	2	2	2	2	2	2	1	1	1	9	9	9	3	3	3
Quercus alba	white oak	Tree	3	3	3				2	2	2	4	4	4	4	4	4				4	4	4	1	1	1	1	1	1				3	3	3
Quercus montana	chestnut oak	Tree	2	2	2				3	3	3				4	4	4				2	2	2										1	1	1
Quercus rubra	northern red oak	Tree	6	6	6	6	6	6	4	4	4	2	2	2	2	2	2				1	1	1	1	1	1	2	2	2				5	5	5
		Stem count	16	16	16	14	14	14	12	12	12	15	15	15	16	16	16	12	12	12	10	10	10	13	13	13	17	17	17	19	19	19	15	15	15
		size (ares)	1			1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	5	5	5	5	6	6	6	6	6	6	5	5	5	3	3	3	5	5	5	5	5	5	7	7	7	4	4	4	6	6	6
		Stems per ACRE	647	647	647	567	567	567	486	486	486	607	607	607	647	647	647	486	486	486	405	405	405	526	526	526	688	688	688	769	769	769	607	607	607

Monkey Wall			Current Plot Data (MY0 2022)															Annual Means		
			100918-01-0012			100918-01-0013			100918-01-R1			100918-01-R2			100918-01-R3			MY0 (2022)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Alnus serrulata	hazel alder	Shrub	2	2	2	2	2	2										11	11	11
Betula nigra	river birch	Tree				4	4	4							10	10	10	38	38	38
Carya ovata	shagbark hickory	Tree																2	2	2
Cercis canadensis	eastern redbud	Tree										1	1	1				5	5	5
Cornus florida	flowering dogwood	Tree													2	2	2	9	9	9
Liriodendron tulipifera	tuliptree	Tree	3	3	3				3	3	3	3	3	3				34	34	34
Morus rubra	red mulberry	Tree				7	7	7							1	1	1	12	12	12
Platanus occidentalis	American sycamore	Tree	2	2	2	2	2	2	3	3	3				7	7	7	37	37	37
Quercus alba	white oak	Tree	4	4	4							1	1	1				27	27	27
Quercus montana	chestnut oak	Tree	1	1	1				1	1	1	1	1	1				15	15	15
Quercus rubra	northern red oak	Tree	4	4	4				8	8	8	6	6	6				47	47	47
		Stem count	16	16	16	15	15	15	15	15	15	12	12	12	20	20	20	237	237	237
		size (ares)	1			1			1			1			1			16		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.40		
		Species count	6	6	6	4	4	4	4	4	4	5	5	5	4	4	4	11	11	11
		Stems per ACRE	647	647	647	607	607	607	607	607	607	486	486	486	809	809	809	599	599	599

Appendix D

Stream Measurement and

Geomorphology Data

Table 10. Baseline Stream Data Summary
Monkey Wall Mitigation Site - Reach G1-C

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
		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
Dimension and Substrate - Riffle Only																									
Bankfull Width (ft)		---	---	---	6.0	6.9	6.9	7.8	1.3	2	---	---	---	---	---	---	---	9.9	---	8.4	8.8	8.8	9.3	0.5	3
Floodprone Width (ft)					12.0	13.6	13.6	15.2	2.3	2	---	---	---	---	---	---	---	35.0	---	43.2	46.1	44.8	50.4	3.8	3
Bankfull Mean Depth (ft)		---	---	---	1.3	1.5	1.5	1.7	0.3	2	---	---	---	---	---	---	---	0.7	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					1.3	1.5	1.5	1.7	0.3	2	---	---	---	---	---	---	---	1.1	---	1.0	1.1	1.2	1.2	0.1	3
Bankfull Cross Sectional Area (ft^2)		---	---	---	4.0	6.1	6.1	8.1	2.9	2	---	---	---	---	---	---	---	6.5	---	5.1	6.0	6.3	6.5	0.8	3
Width/Depth Ratio					7.6	8.2	8.2	8.7	0.8	2	---	---	---	---	---	---	---	15.0	---	---	---	---	---	---	---
Entrenchment Ratio					1.5	1.9	1.9	2.3	0.6	2	---	---	---	---	---	---	---	3.5	---	5.3	5.7	5.8	5.9	0.3	3
[1]Bank Height Ratio					1.1	1.4	1.4	1.6	0.4	2	---	---	---	---	---	---	---	1.0	---	1.0	1.0	1.0	1.0	0.0	3
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	---	---	---	---	---	---	5	---	12	5	---	---	12	---	---
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Length (ft)					---	---	---	---	---	---	---	---	---	---	---	---	8	---	16	8	---	---	16	---	---
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	---	---	---	---	---	---	10	---	21	10	---	---	21	---	---
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Meander Width Ratio					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					---												---			---					
Max part size (mm) mobilized at bankfull					---												---			---					
Stream Power (transport capacity) W/m^2					---												---			---					
Additional Reach Parameters																									
Rosgen Classification					A/B3 moving to G4						---						E4a, C4b			E4a, C4b					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---						---						---			---					
Valley length (ft)					1908						---						1525			1525					
Channel Thalweg length (ft)					1996						---						1529			1529					
Sinuosity (ft)					---						---						---			---					
Water Surface Slope (Channel) (ft/ft)					---						---						---			---					
Channel slope (ft/ft)					0.14						---						0.12			0.12					
[3]Bankfull Floodplain Area (acres)					---						---						---			---					
[4]% of Reach with Eroding Banks					---						---														
Channel Stability or Habitat Metric					---						---														
Biological or Other					---						---														

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

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

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

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

Table 10. Baseline Stream Data Summary
Monkey Wall Mitigation Site - Reach G2

Parameter	Gauge[2]	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)		---	---	---	5.4	6.6	6.6	7.8	---	2	---	---	---	---	---	---	---	9.4	---	8.3	8.8	9.0	9.1	0.4	3
Floodprone Width (ft)					9.9	11.0	11.0	12.0	---	2	---	---	---	---	---	---	---	45.0	---	40.9	44.4	43.2	49.1	4.2	3
Bankfull Mean Depth (ft)		---	---	---	0.7	0.9	0.9	1.0	---	2	---	---	---	---	---	---	---	0.7	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					1.4	1.6	1.6	1.7	---	2	---	---	---	---	---	---	---	1.1	---	1.1	1.2	1.2	1.3	0.1	3
Bankfull Cross Sectional Area (ft^2)		---	---	---	3.7	5.9	5.9	8.1	---	2	---	---	---	---	---	---	---	6.5	---	5.6	6.2	5.8	7.1	0.8	3
Width/Depth Ratio					7.7	7.7	7.7	0.1	---	2	---	---	---	---	---	---	---	13.5	---	---	---	---	---	---	---
Entrenchment Ratio					1.5	1.9	1.9	2.3	---	2	---	---	---	---	---	---	---	5.1	---	5.6	5.8	5.6	6.1	0.3	3
[1]Bank Height Ratio					1.1	1.4	1.4	1.7	---	2	---	---	---	---	---	---	---	1.0	---	1.0	1.0	1.0	1.0	0.0	3
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	---	---	---	---	---	---	5	---	14	5	---	---	14	---	---
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Length (ft)					---	---	---	---	---	---	---	---	---	---	---	---	8	---	14	8	---	---	14	---	---
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	---	---	---	---	---	---	9	---	21	9	---	---	21	---	---
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Meander Width Ratio					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					---												---			---					
Max part size (mm) mobilized at bankfull					---												---			---					
Stream Power (transport capacity) W/m^2					---												---			---					
Additional Reach Parameters																									
Rosgen Classification					G4						---						E4a			E4a					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---												---			---					
Valley length (ft)					1800						---						1702			1702					
Channel Thalweg length (ft)					1890						---						1710			1710					
Sinuosity (ft)					---						---						---			---					
Water Surface Slope (Channel) (ft/ft)					---						---						---			---					
Channel slope (ft/ft)					0.14						---						0.14			0.14					
[3]Bankfull Floodplain Area (acres)					---						---						---			---					
[4]% of Reach with Eroding Banks					---						---														
Channel Stability or Habitat Metric					---						---														
Biological or Other					---						---														

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

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

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

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

Appendix D. Table 11 - Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Project Name/Number: Monkey Wall #100069

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Pool)							Cross Section 4 (Riffle)							Cross Section 5 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2635.1							2634.0							2548.3							2547.7							2519.0						
Bankfull Width (ft)[1]	9.1							-							-							8.3							-						
Floodprone Width (ft)[1]	49.1							-							-							40.9							-						
Bankfull Max Depth (ft)[2]	1.3							1.4							1.6							1.1							1.7						
Low Bank Elevation (ft)	2635.1							2634.0							2548.3							2547.7							2519.0						
Bankfull Cross Sectional Area (ft^2)[2]	7.1							5.6							8.6							5.6							6.7						
Bankfull Entrenchment Ratio[1]	5.6							-							-							6.1							-						
Bankfull Bank Height Ratio[1]	1.0							-							-							1.0							-						

	Cross Section 6 (Riffle)							Cross Section 7 (Pool)							Cross Section 8 (Riffle)							Cross Section 9 (Riffle)							Cross Section 10 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2518.5							2694.3							2691.0							2614.6							2612.4						
Bankfull Width (ft)[1]	9.0							-							8.4							8.8							-						
Floodprone Width (ft)[1]	>43.2							-							>44.8							>50.4							-						
Bankfull Max Depth (ft)[2]	1.2							1.9							1.0							1.2							1.7						
Low Bank Elevation (ft)	2518.5							2694.3							2691.0							2614.6							2612.4						
Bankfull Cross Sectional Area (ft^2)[2]	5.8							9.1							5.1							6.5							7.9						
Bankfull Entrenchment Ratio[1]	>5.6							-							>5.9							>5.8							-						
Bankfull Bank Height Ratio[1]	1.0							-							1.0							1.0							-						

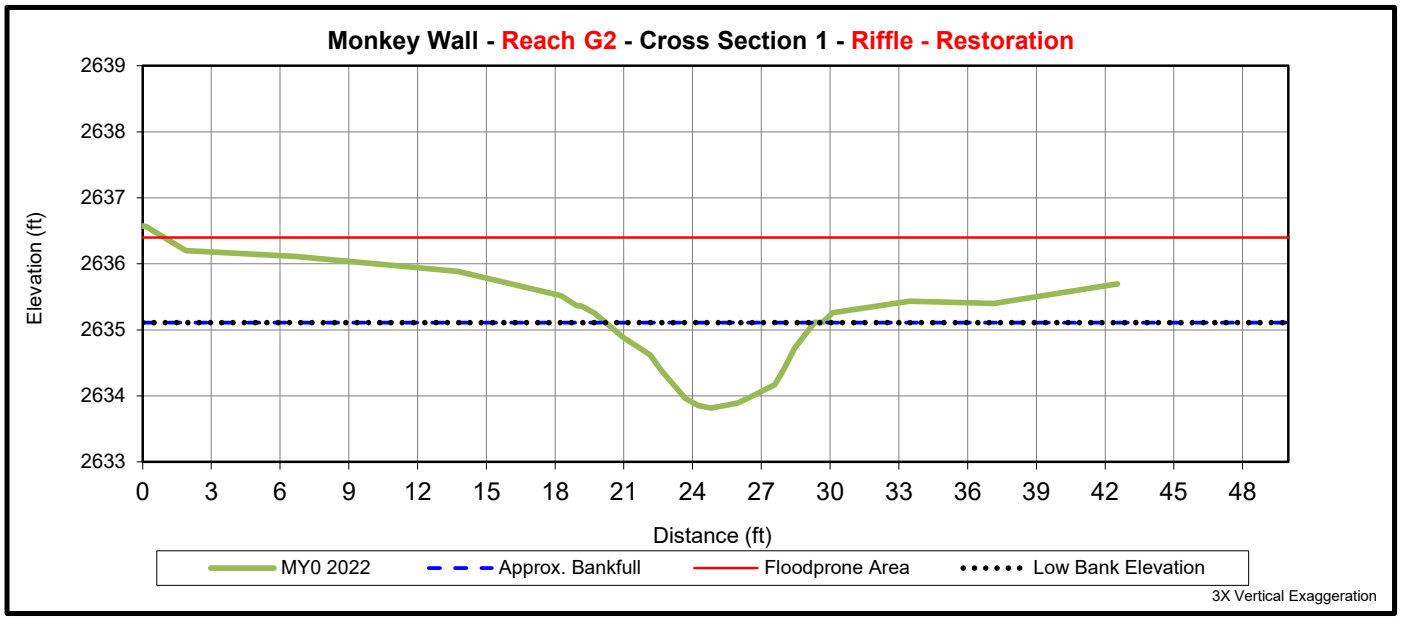
	Cross Section 11 (Riffle)							Cross Section 12 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2539.2							2537.7						
Bankfull Width (ft)[1]	9.3							NA						
Floodprone Width (ft)[1]	43.2							NA						
Bankfull Max Depth (ft)[2]	1.2							1.5						
Low Bank Elevation (ft)	2539.2							2537.7						
Bankfull Cross Sectional Area (ft^2)[2]	6.3							7.3						
Bankfull Entrenchment Ratio[1]	5.3							NA						
Bankfull Bank Height Ratio[1]	1.0							NA						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation

2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

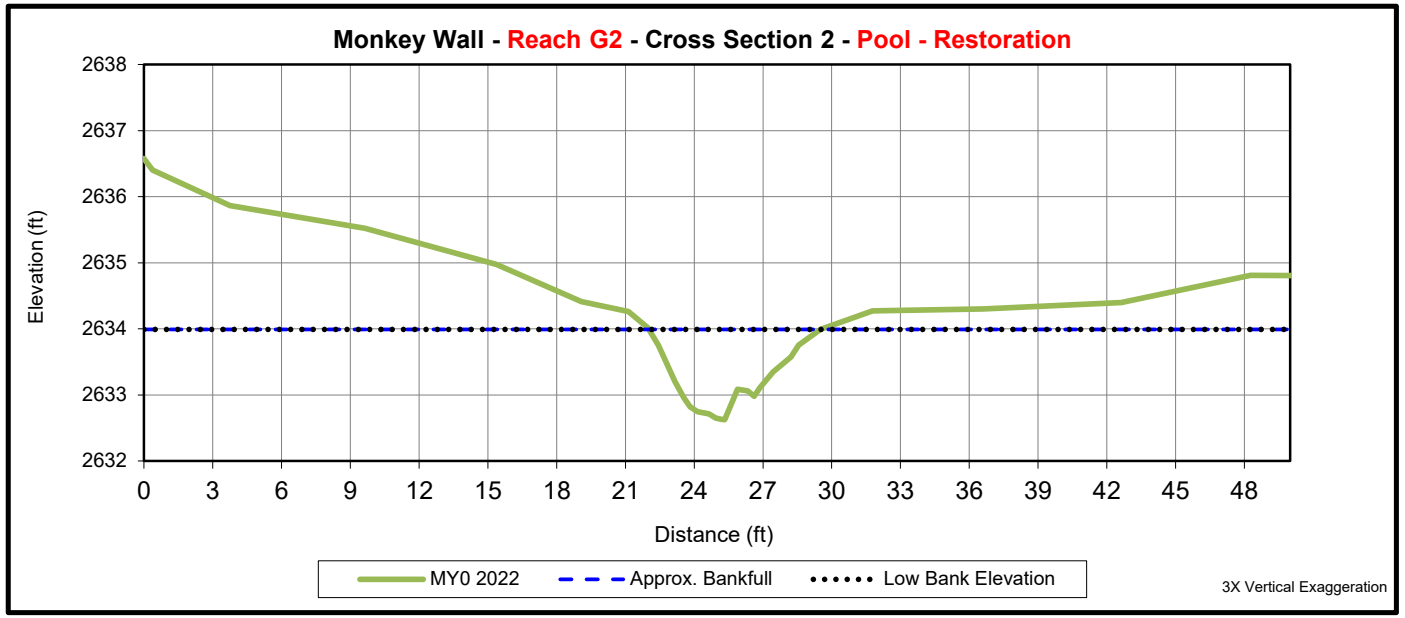


	Cross Section 1 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2635.1						
Bankfull Width (ft)[1]	9.1						
Floodprone Width (ft)[1]	49.1						
Bankfull Max Depth (ft)[2]	1.3						
Low Bank Elevation (ft)	2635.1						
Bankfull Cross Sectional Area (ft^2)[2]	7.1						
Bankfull Entrenchment Ratio[1]	5.6						
Bankfull Bank Height Ratio[1]	1.0						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

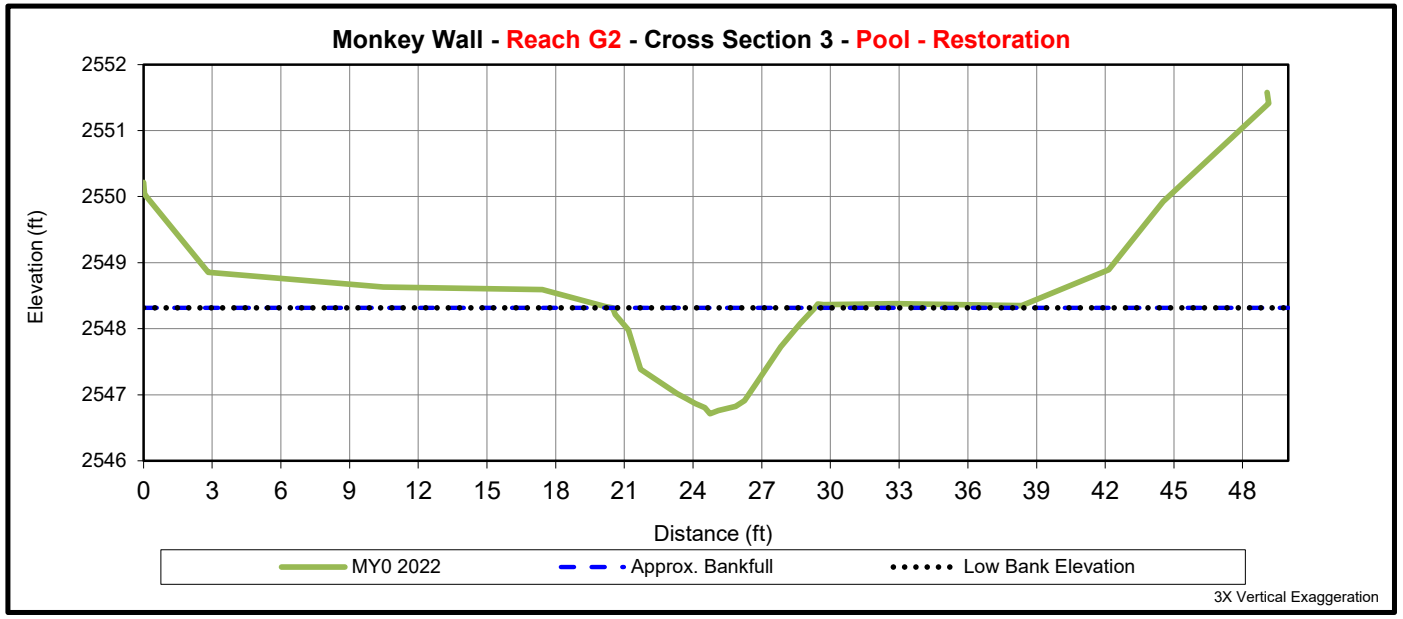


	Cross Section 2 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2634.0						
Bankfull Width (ft)[1]	-						
Floodprone Width (ft)[1]	-						
Bankfull Max Depth (ft)[2]	1.4						
Low Bank Elevation (ft)	2634.0						
Bankfull Cross Sectional Area (ft^2)[2]	5.6						
Bankfull Entrenchment Ratio[1]	-						
Bankfull Bank Height Ratio[1]	-						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

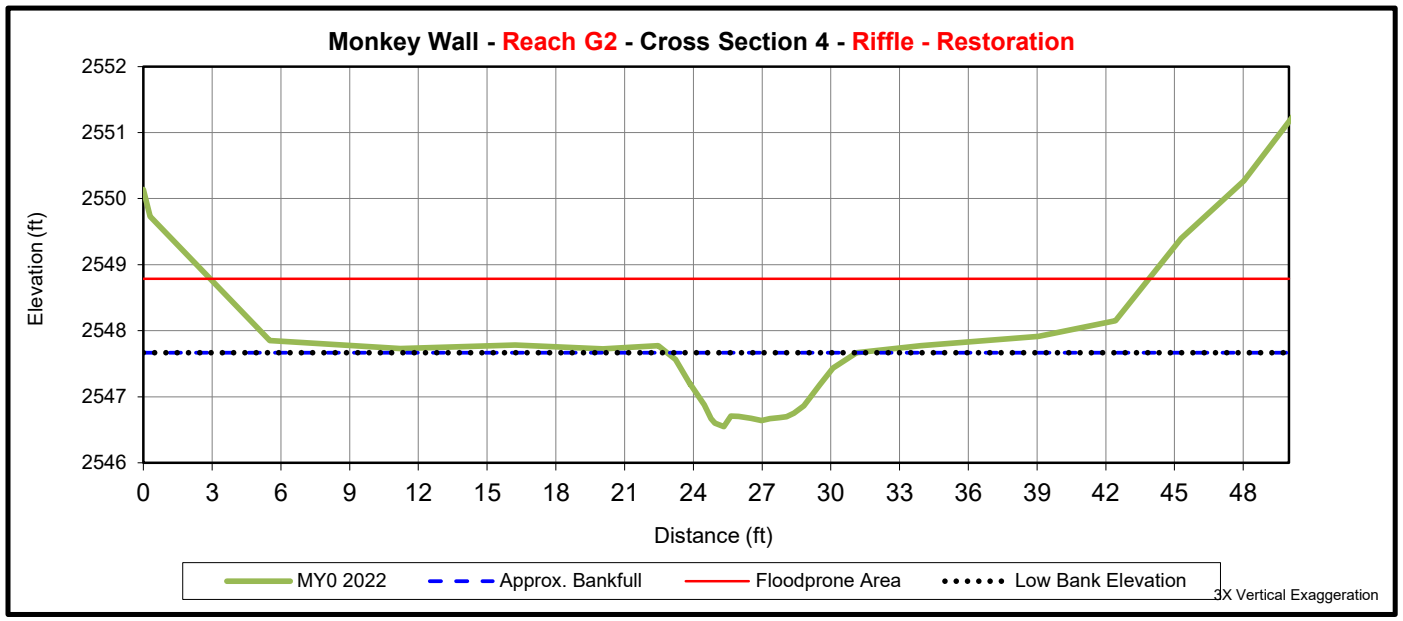


	Cross Section 3 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2548.3						
Bankfull Width (ft)[1]	-						
Floodprone Width (ft)[1]	-						
Bankfull Max Depth (ft)[2]	1.6						
Low Bank Elevation (ft)	2548.3						
Bankfull Cross Sectional Area (ft^2)[2]	8.6						
Bankfull Entrenchment Ratio[1]	-						
Bankfull Bank Height Ratio[1]	-						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

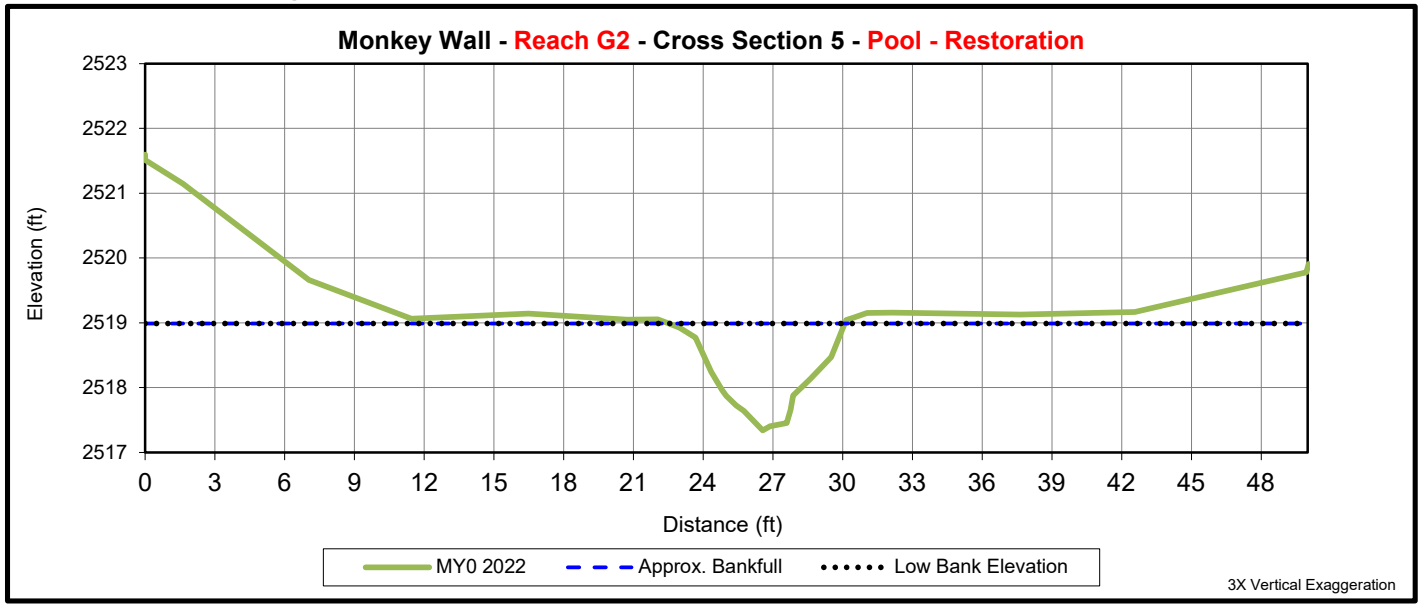


	Cross Section 4 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2547.7						
Bankfull Width (ft)[1]	8.3						
Floodprone Width (ft)[1]	40.9						
Bankfull Max Depth (ft)[2]	1.1						
Low Bank Elevation (ft)	2547.7						
Bankfull Cross Sectional Area (ft^2)[2]	5.6						
Bankfull Entrenchment Ratio[1]	6.1						
Bankfull Bank Height Ratio[1]	1.0						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

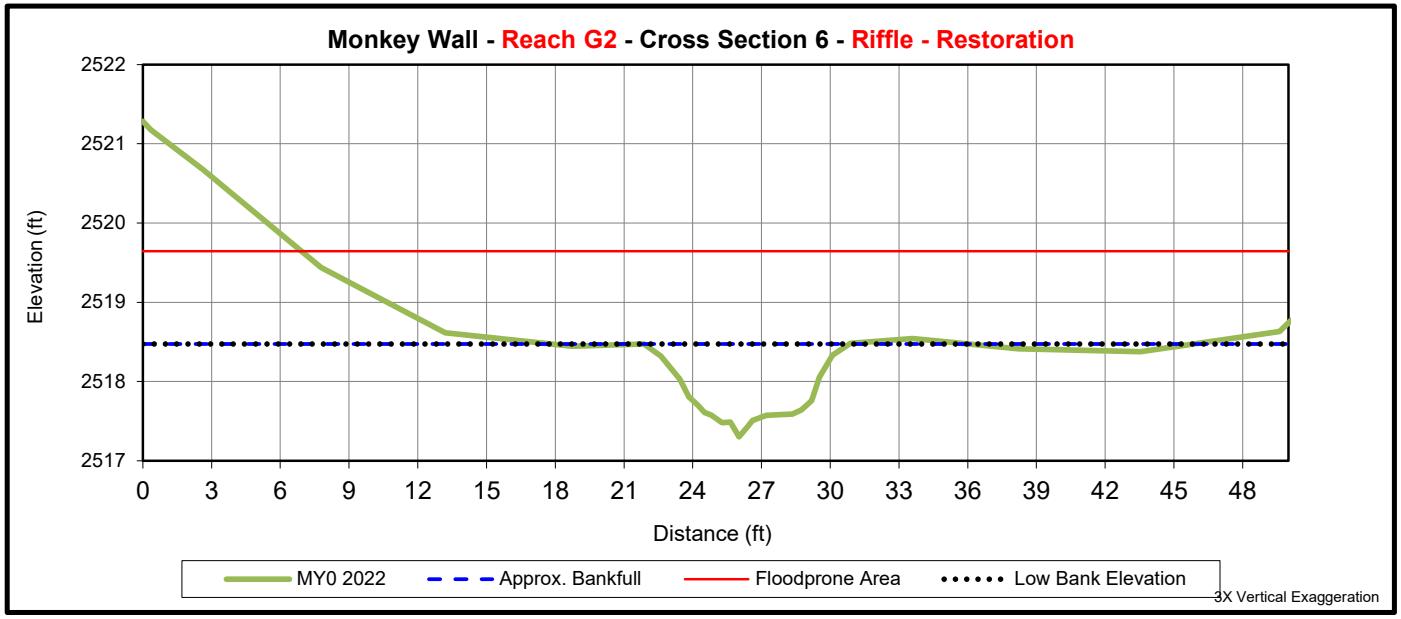


	Cross Section 5 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2519.0						
Bankfull Width (ft)[1]	-						
Floodprone Width (ft)[1]	-						
Bankfull Max Depth (ft)[2]	1.7						
Low Bank Elevation (ft)	2519.0						
Bankfull Cross Sectional Area (ft^2)[2]	6.7						
Bankfull Entrenchment Ratio[1]	-						
Bankfull Bank Height Ratio[1]	-						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

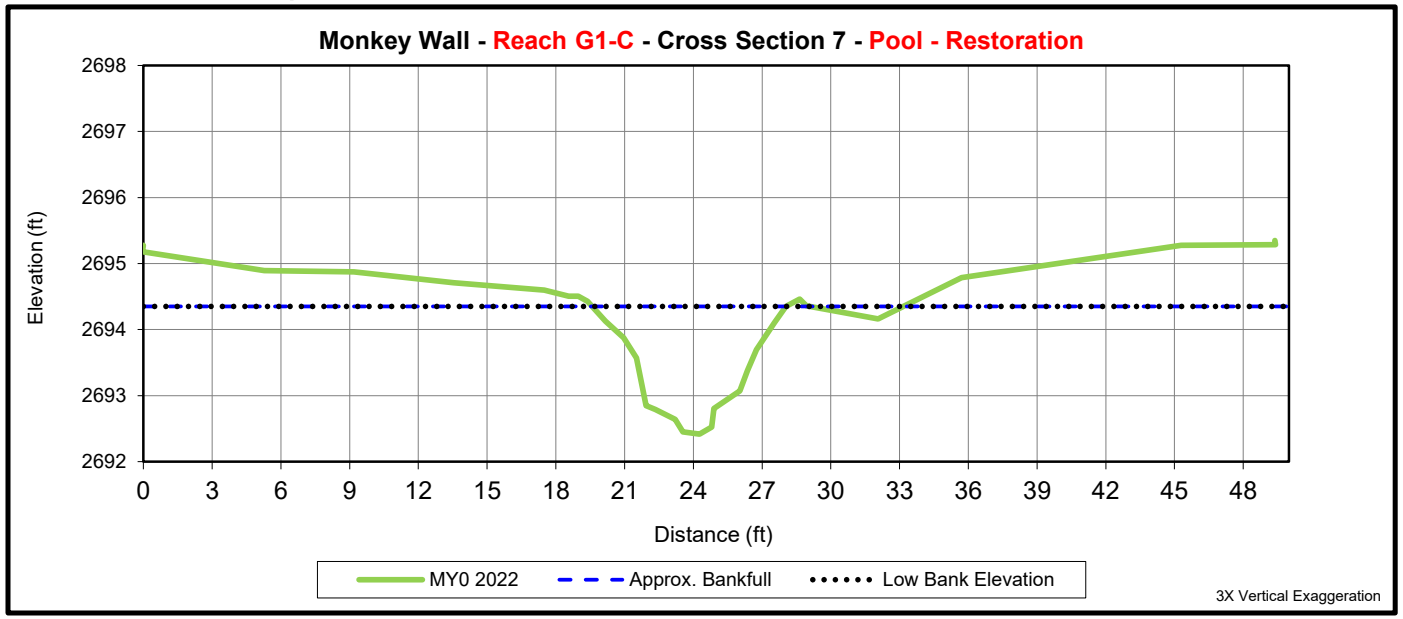


	Cross Section 6 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2518.5						
Bankfull Width (ft)[1]	9.0						
Floodprone Width (ft)[1]	>43.2						
Bankfull Max Depth (ft)[2]	1.2						
Low Bank Elevation (ft)	2518.5						
Bankfull Cross Sectional Area (ft^2)[2]	5.8						
Bankfull Entrenchment Ratio[1]	>5.6						
Bankfull Bank Height Ratio[1]	1.0						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

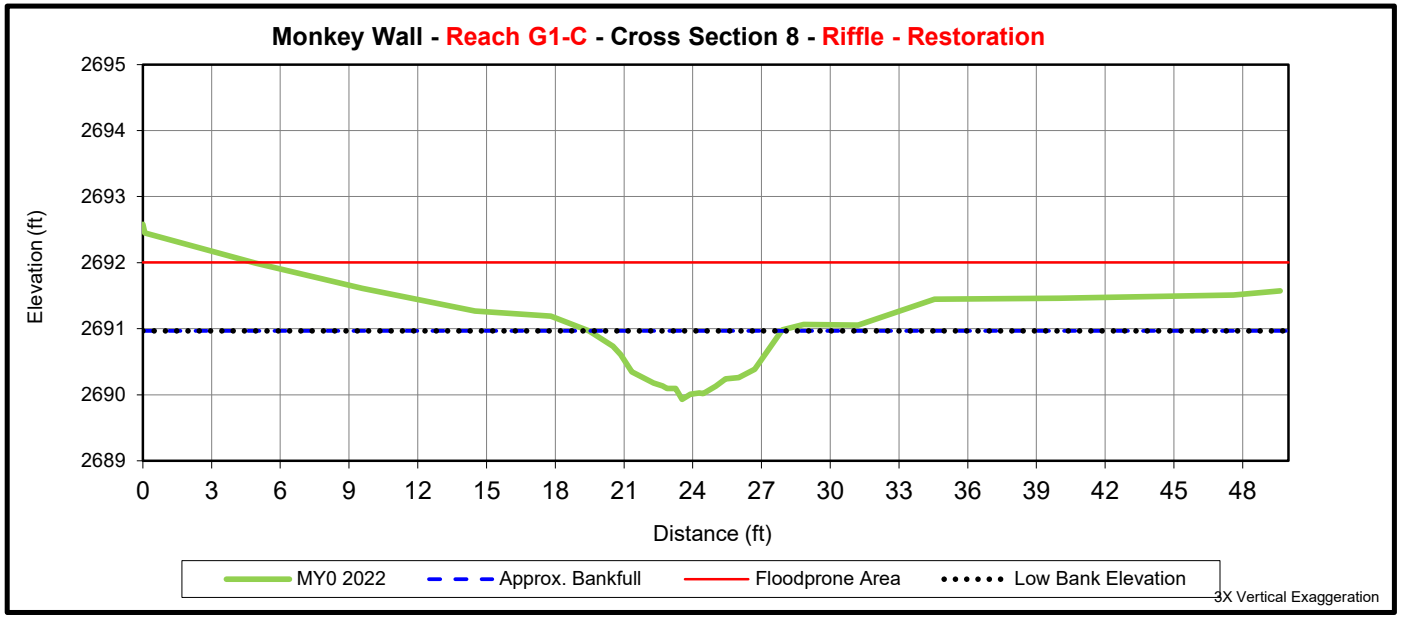


	Cross Section 7 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2694.3						
Bankfull Width (ft)[1]	-						
Floodprone Width (ft)[1]	-						
Bankfull Max Depth (ft)[2]	1.9						
Low Bank Elevation (ft)	2694.3						
Bankfull Cross Sectional Area (ft^2)[2]	9.1						
Bankfull Entrenchment Ratio[1]	-						
Bankfull Bank Height Ratio[1]	-						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

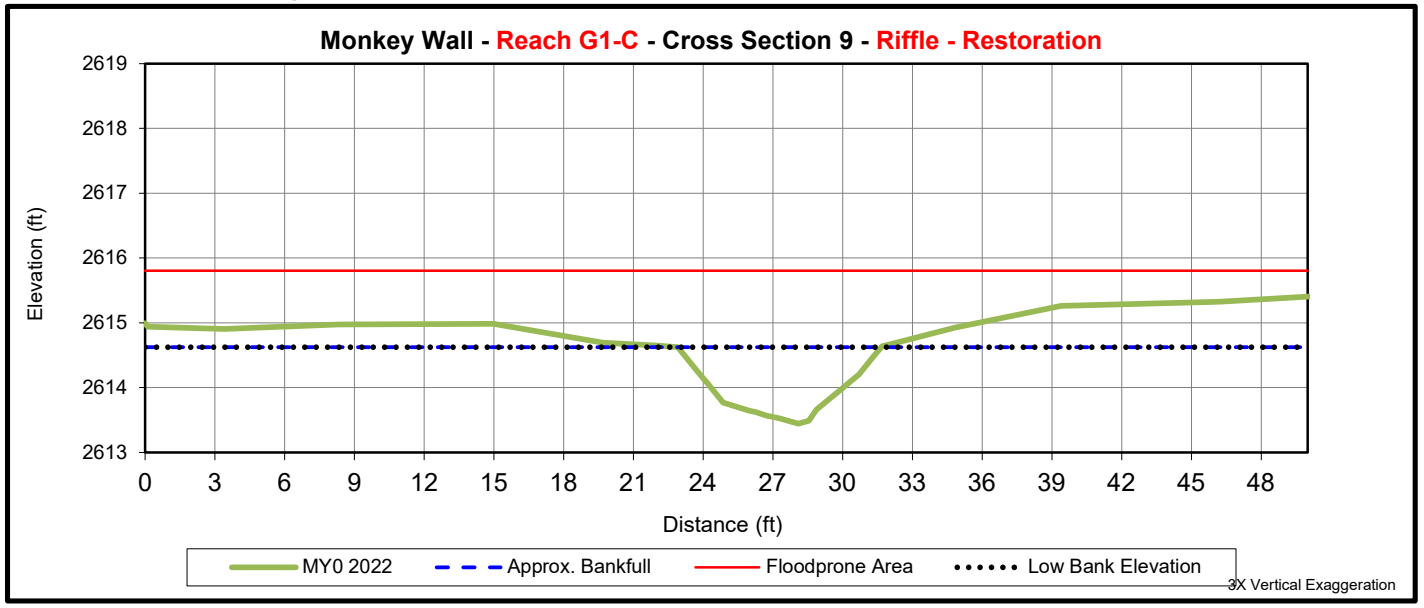


	Cross Section 8 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2691.0						
Bankfull Width (ft)[1]	8.4						
Floodprone Width (ft)[1]	>44.8						
Bankfull Max Depth (ft)[2]	1.0						
Low Bank Elevation (ft)	2691.0						
Bankfull Cross Sectional Area (ft^2)[2]	5.1						
Bankfull Entrenchment Ratio[1]	>5.9						
Bankfull Bank Height Ratio[1]	1.0						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

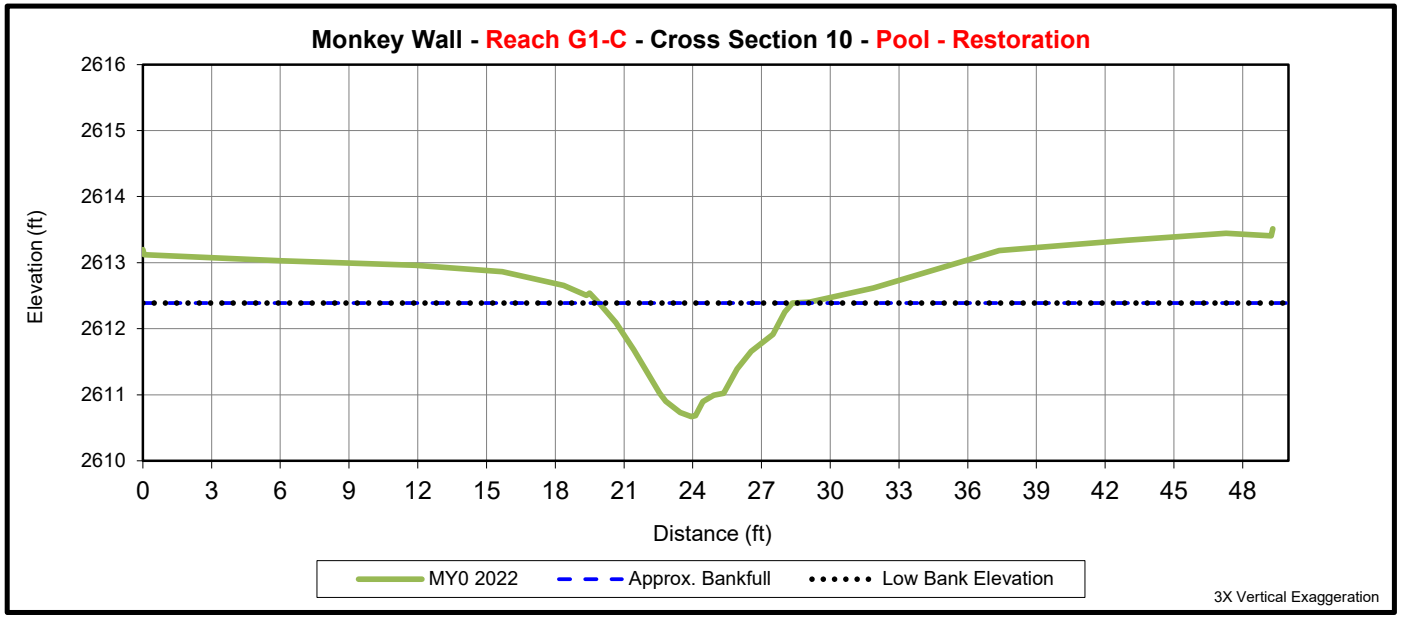


	Cross Section 5 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2519.0						
Bankfull Width (ft)[1]	-						
Floodprone Width (ft)[1]	-						
Bankfull Max Depth (ft)[2]	1.7						
Low Bank Elevation (ft)	2519.0						
Bankfull Cross Sectional Area (ft^2)[2]	6.7						
Bankfull Entrenchment Ratio[1]	-						
Bankfull Bank Height Ratio[1]	-						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

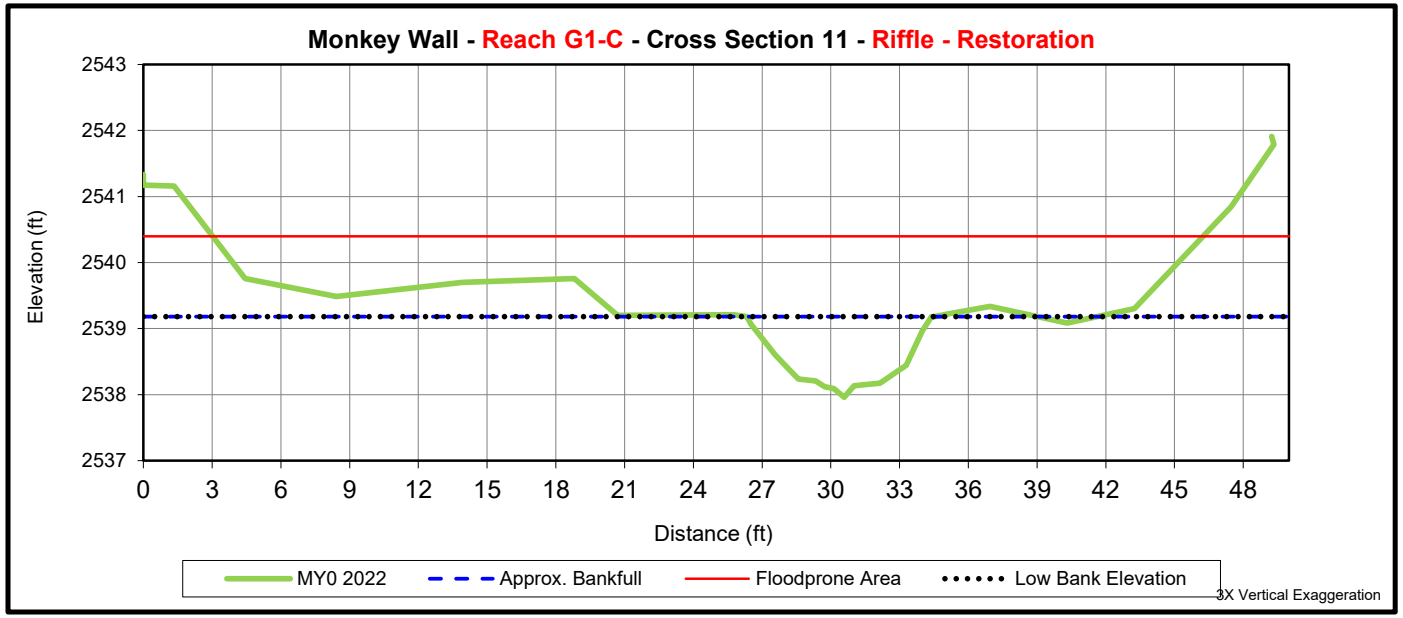


	Cross Section 6 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2518.5						
Bankfull Width (ft)[1]	9.0						
Floodprone Width (ft)[1]	>43.2						
Bankfull Max Depth (ft)[2]	1.2						
Low Bank Elevation (ft)	2518.5						
Bankfull Cross Sectional Area (ft^2)[2]	5.8						
Bankfull Entrenchment Ratio[1]	>5.6						
Bankfull Bank Height Ratio[1]	1.0						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

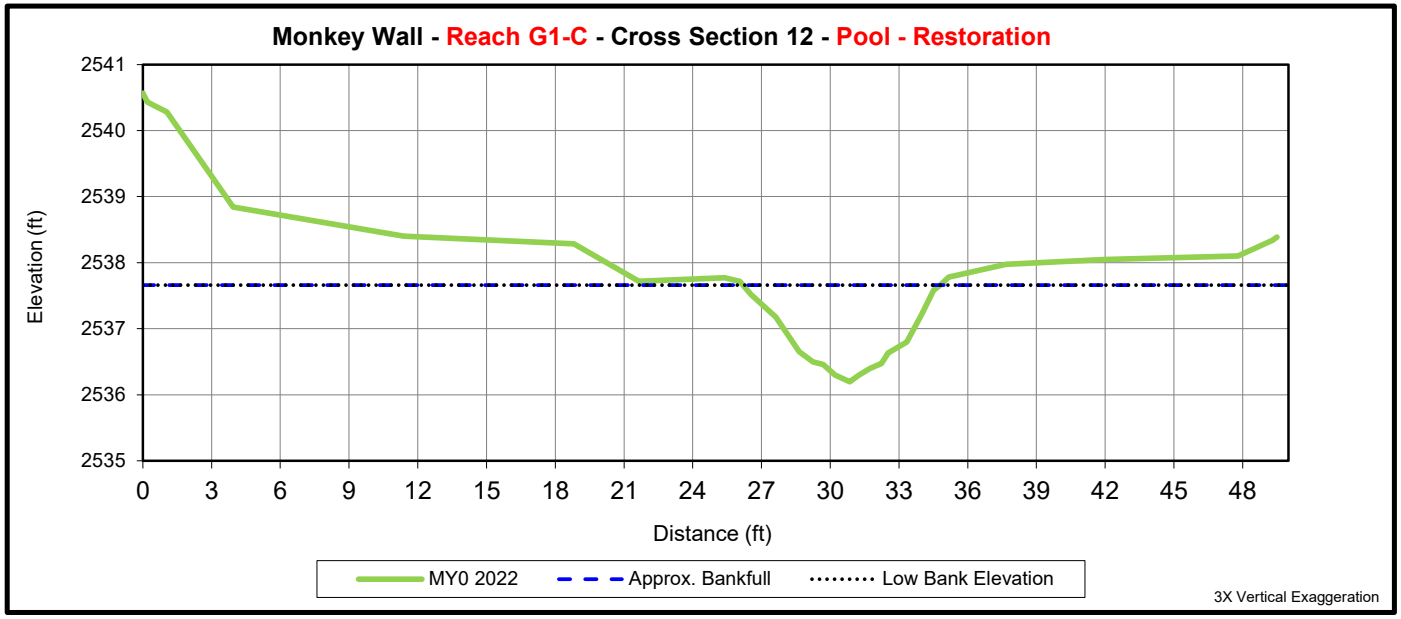


	Cross Section 7 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2694.3						
Bankfull Width (ft)[1]	-						
Floodprone Width (ft)[1]	-						
Bankfull Max Depth (ft)[2]	1.9						
Low Bank Elevation (ft)	2694.3						
Bankfull Cross Sectional Area (ft^2)[2]	9.1						
Bankfull Entrenchment Ratio[1]	-						
Bankfull Bank Height Ratio[1]	-						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream



	Cross Section 8 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	2691.0						
Bankfull Width (ft)[1]	8.4						
Floodprone Width (ft)[1]	>44.8						
Bankfull Max Depth (ft)[2]	1.0						
Low Bank Elevation (ft)	2691.0						
Bankfull Cross Sectional Area (ft^2)[2]	5.1						
Bankfull Entrenchment Ratio[1]	>5.9						
Bankfull Bank Height Ratio[1]	1.0						

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Appendix E

Record Drawings

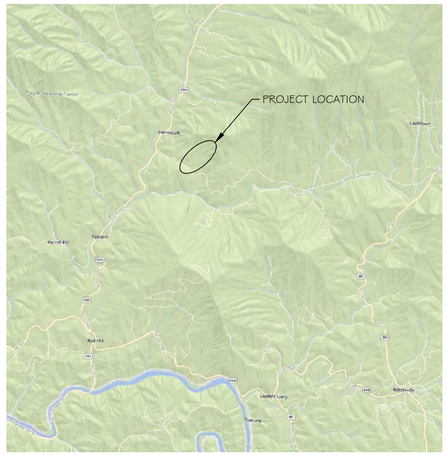
MONKEY WALL SITE RECORD DRAWINGS

PROJECT LOCATION: (36.058169, -82.204638)
MITCHELL COUNTY, NORTH CAROLINA

FRENCH BROAD RIVER BASIN: HUC 06010108
JUNE 2022

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

3600 GLENWOOD AVE, SUITE 100
RALEIGH, NC 27612



VICINITY MAP
NTS

PROJECT DIRECTORY

DESIGNED BY:
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
3600 GLENWOOD AVE., SUITE 100
RALEIGH, NC 27612

DESIGNED FOR:
HARRY TSOMIDES
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
217 WEST JONES ST., SUITE 3000A
RALEIGH, NC 27603

AS-BUILT SURVEY BY:
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
3600 GLENWOOD AVE., SUITE 100
RALEIGH, NC 27612

DMS PROJECT #: 100069
CONTRACT #: 7536
USACE ACTION ID #: SAW-2018-01162
RFP #: 16-007336

MONKEY WALL MITIGATION SITE AS-BUILT SURVEY SEALED BY BRIAN S. HOCKETT, PLS (L-5165) ON MAY 18, 2022.

SITE MAP
NTS

Sheet List Table	
Sheet Number	Sheet Title
-	COVER
A1	OVERVIEW
S1	REACH G1-A
S2	REACH G1-B
S3	REACH G1-C
S4	REACH G1-C
S5	REACH G1-C
S6	REACH G1-C
S7	REACH G2
S8	REACH G2
S9	REACH G2
S10	REACH G2
S11	REACH G2

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Engineering Services Provided By:
RES Environmental Operating Company, LLC
License: F-1428

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN 6/7/22

PLOT DATE: 6/6/2022

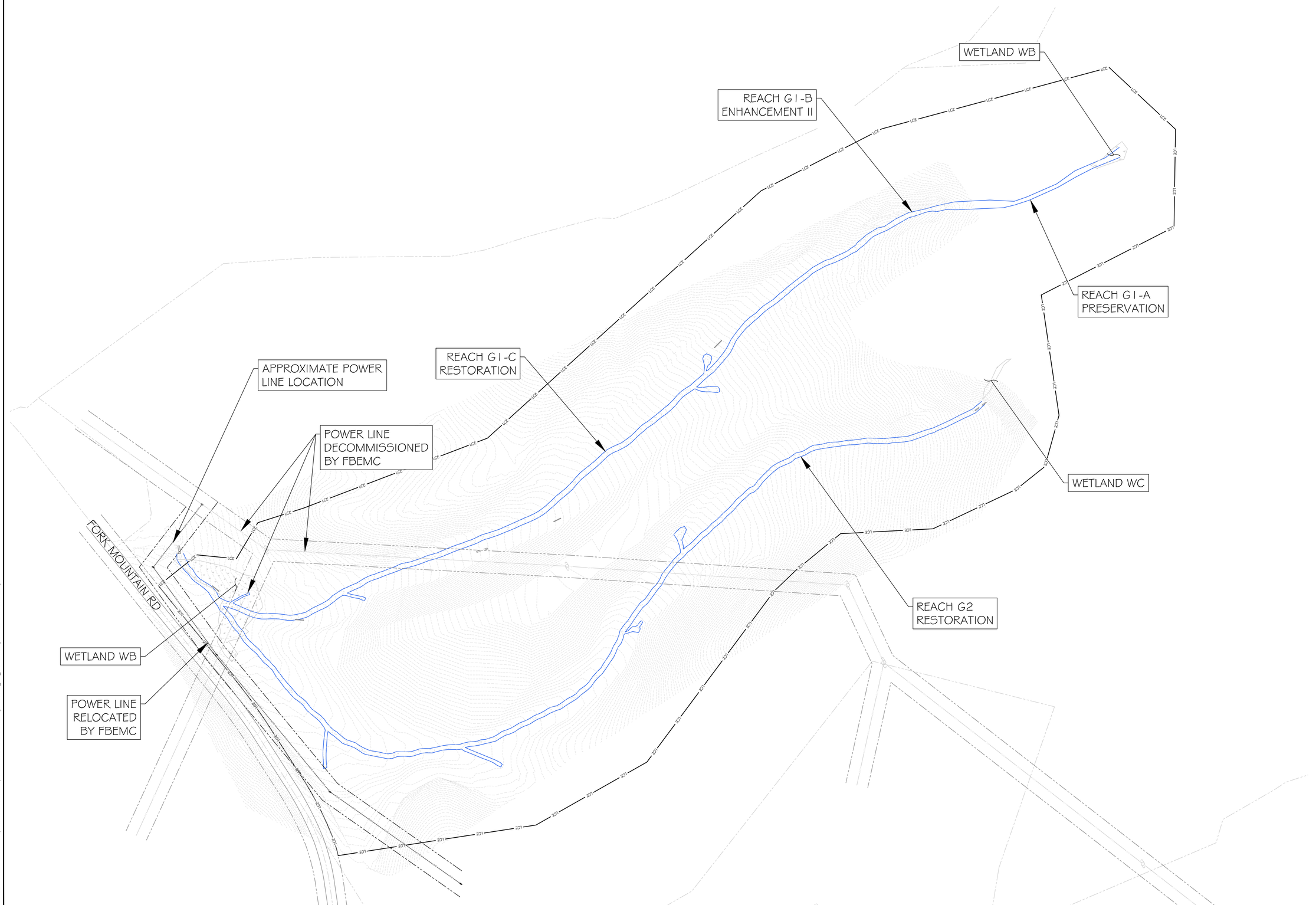
REVISIONS:

RELEASED FOR: AS-BUILT DRAWINGS

PROJECT NUMBER:	100918
PROJECT MANAGER:	BPB
DESIGNED:	AFM
DRAWN:	BSH
CHECKED:	BRC

SHEET NUMBER:

-



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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN
6/7/22

FULL SCALE: 1"=80

0 80 160

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE:
6/7/2022

REVISIONS:

RELEASED FOR:
RECORD DRAWINGS

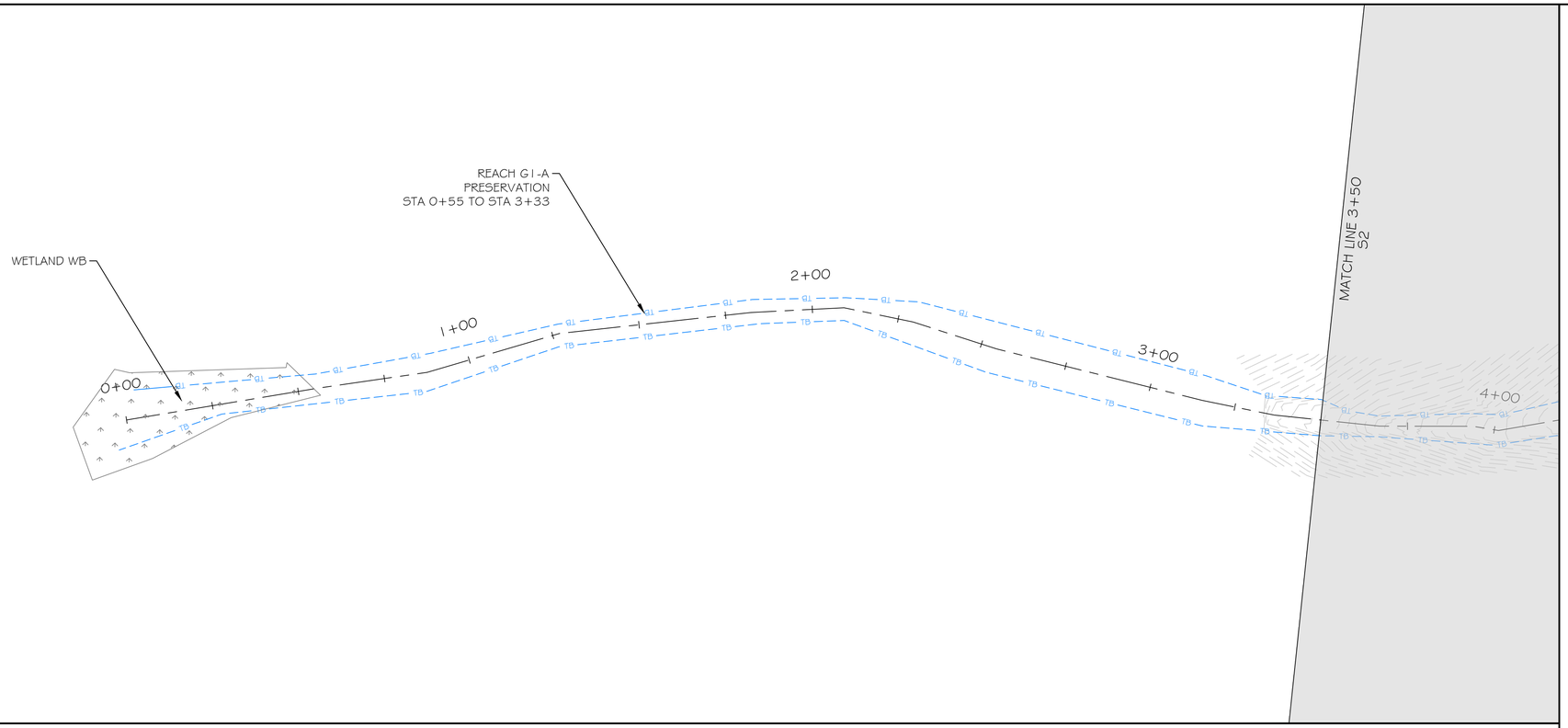
PROJECT NAME:
MONKEY WALL SITE RECORD DRAWINGS
MITCHELL COUNTY, NORTH CAROLINA

DRAWING TITLE:
OVERVIEW

PROJECT NUMBER:	100918
PROJECT MANAGER:	BPB
DESIGNED:	AFM
DRAWN:	TRS
CHECKED:	BRC

SHEET NUMBER:

A1



LEGEND

- AS-BUILT CONTOUR, MAJOR — 50
- AS-BUILT CONTOUR, MINOR — 46
- PROPOSED CONTOUR, MAJOR — 50
- PROPOSED CONTOUR, MINOR — 46
- WETLAND
- AS-BUILT TOP OF BANK — TB
- AS-BUILT BOTTOM OF BANK — BB
- PROPOSED TOP OF BANK
- OVERHEAD ELECTRIC UTILITY LINE
- PROPERTY LINE
- AS-BUILT STONE TOE PROTECTION
- LIMITS OF CONSERVATION EASEMENT — LCE
- AS-BUILT LOG CASCADE STRUCTURE
- AS-BUILT RIFFLE GRADE CONTROL WITH ROCK SILL
- PROPOSED LOG CASCADE STRUCTURE
- PROPOSED RIFFLE GRADE CONTROL WITH ROCK SILL
- GROUNDWATER MONITORING WELL — W
- STAGE RECORDER
- FLOW GAUGE
- MONITORING CROSS SECTION
- VEGETATION MONITORING PLOT — VP#

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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN 6/7/22

FULL SCALE: 1"=20

0 20 40

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 6/7/2022

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME:
MONKEY WALL SITE RECORD DRAWINGS
MITCHELL COUNTY, NORTH CAROLINA

DRAWING TITLE:
REACH G1-A

PROJECT NUMBER:	100918
PROJECT MANAGER:	BPB
DESIGNED:	AFM
DRAWN:	TRS
CHECKED:	BRC

SHEET NUMBER:

S1

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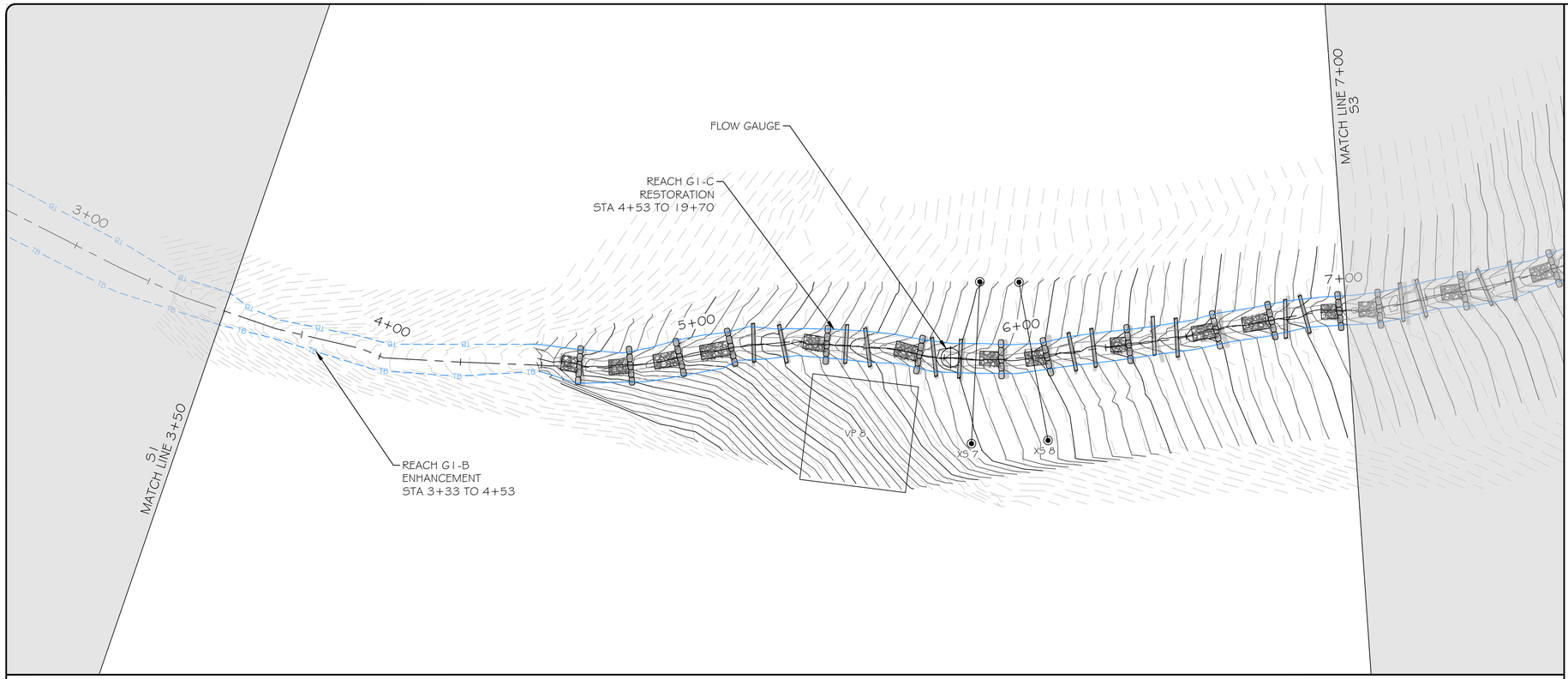

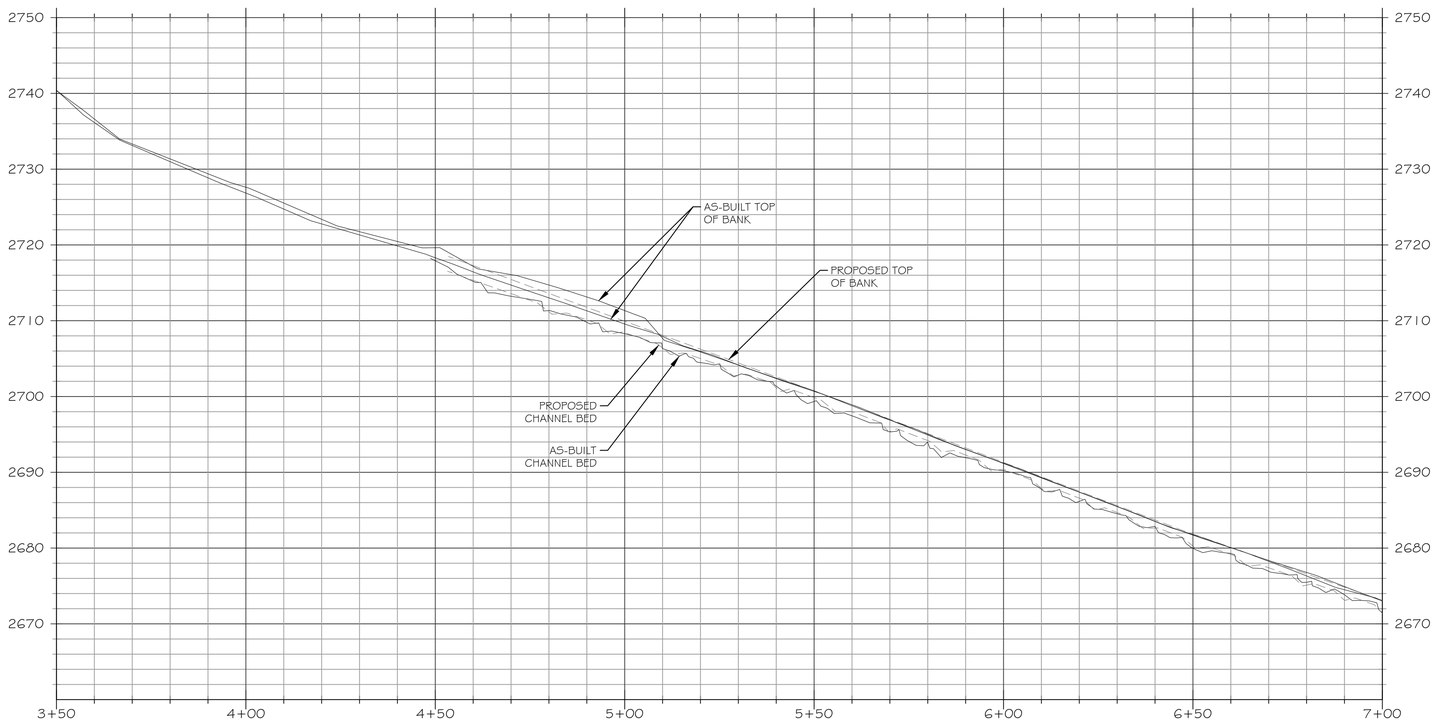

SCALE: HOR 1"=20'; VERT 1"=10'

LEGEND

- AS-BUILT CONTOUR, MAJOR — 50
- AS-BUILT CONTOUR, MINOR — 46
- PROPOSED CONTOUR, MAJOR — 50
- PROPOSED CONTOUR, MINOR — 46
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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN 6/7/22

FULL SCALE: 1"=20

0 20 40

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 6/7/2022

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: MONKEY WALL SITE RECORD DRAWINGS
MITCHELL COUNTY, NORTH CAROLINA

DRAWING TITLE: REACH G1-B

PROJECT NUMBER:	100918
PROJECT MANAGER:	BPB
DESIGNED:	AFM
DRAWN:	TRS
CHECKED:	BRC

SHEET NUMBER:

S2

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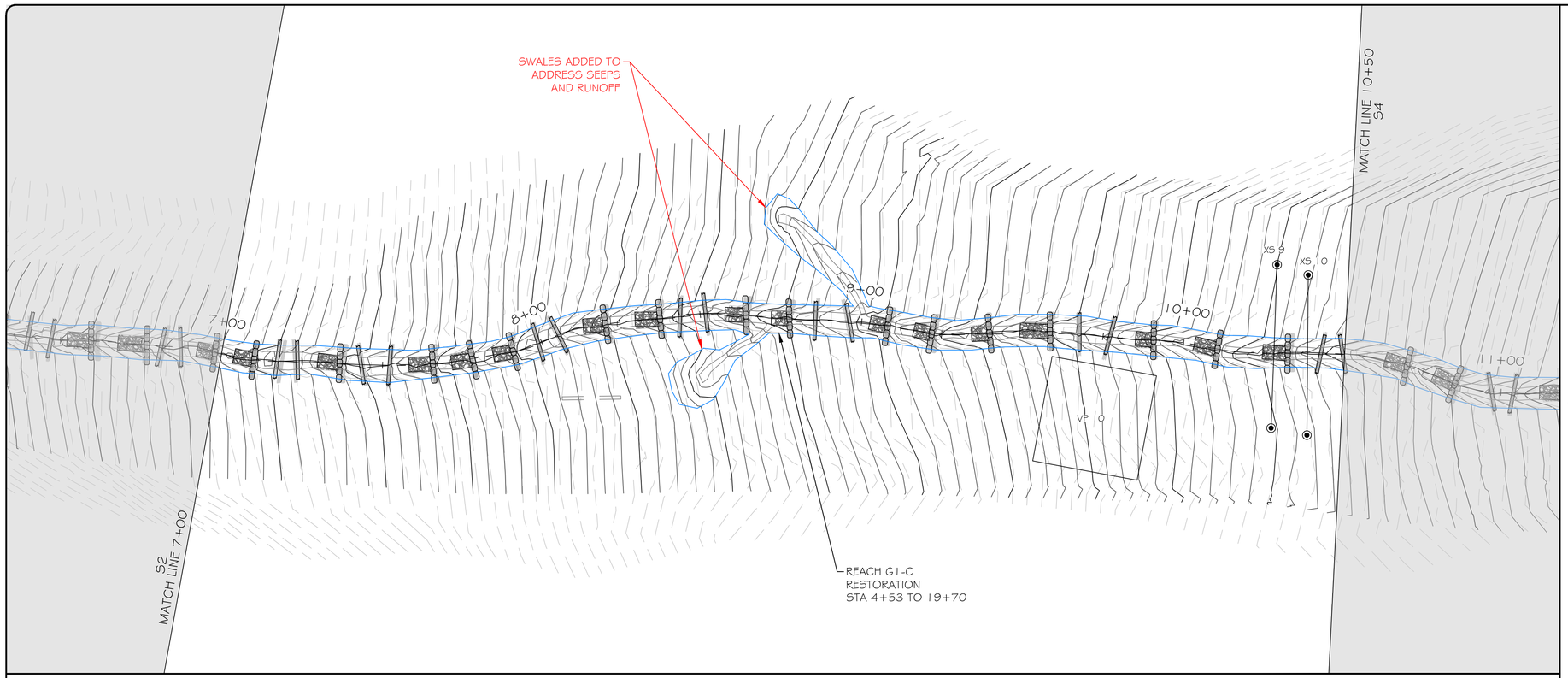

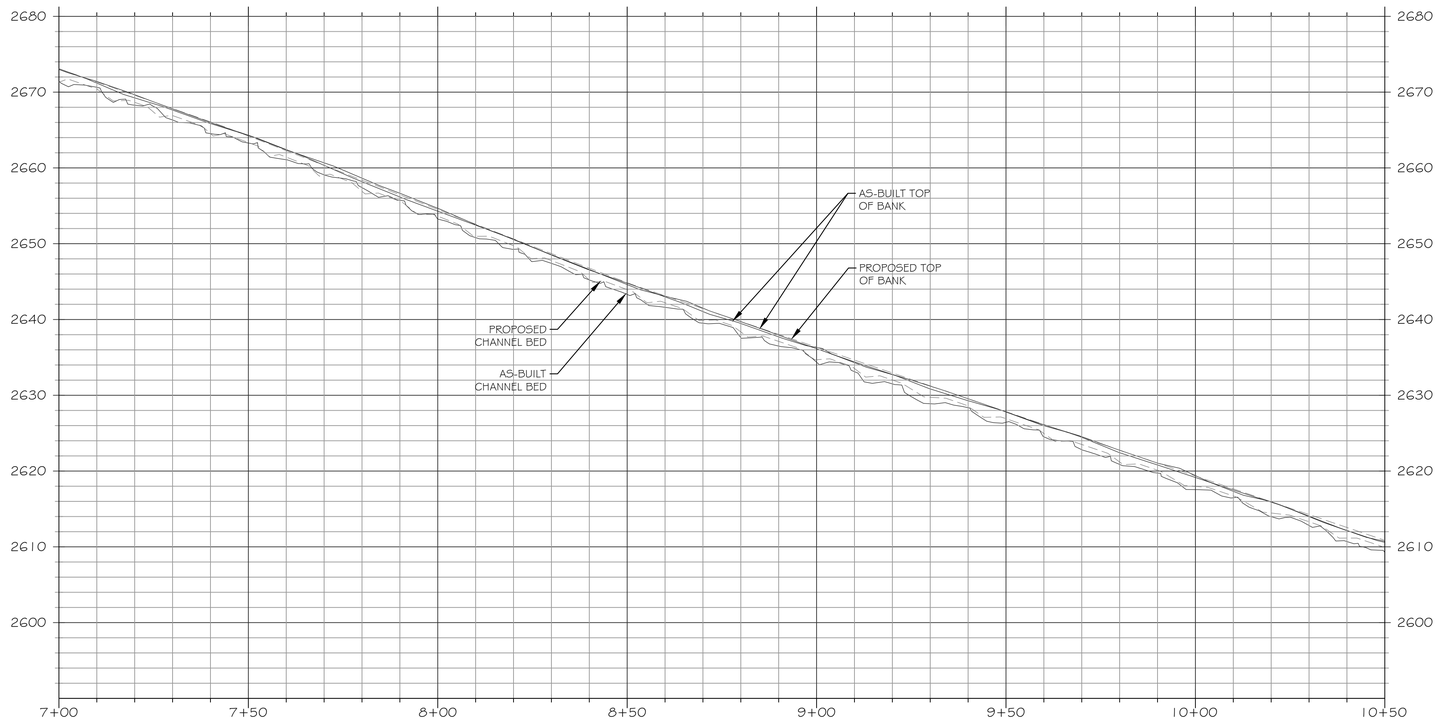

SCALE: HOR 1"=20'; VERT 1"=10'

LEGEND

- AS-BUILT CONTOUR MAJOR — 50
- AS-BUILT CONTOUR MINOR — 46
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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN
6/7/22

FULL SCALE: 1"=20
0 20 40
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 6/7/2022

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: MONKEY WALL SITE RECORD DRAWINGS
MITCHELL COUNTY, NORTH CAROLINA

DRAWING TITLE: REACH G1-C

PROJECT NUMBER:	100918
PROJECT MANAGER:	BPB
DESIGNED:	AFM
DRAWN:	TRS
CHECKED:	BRC

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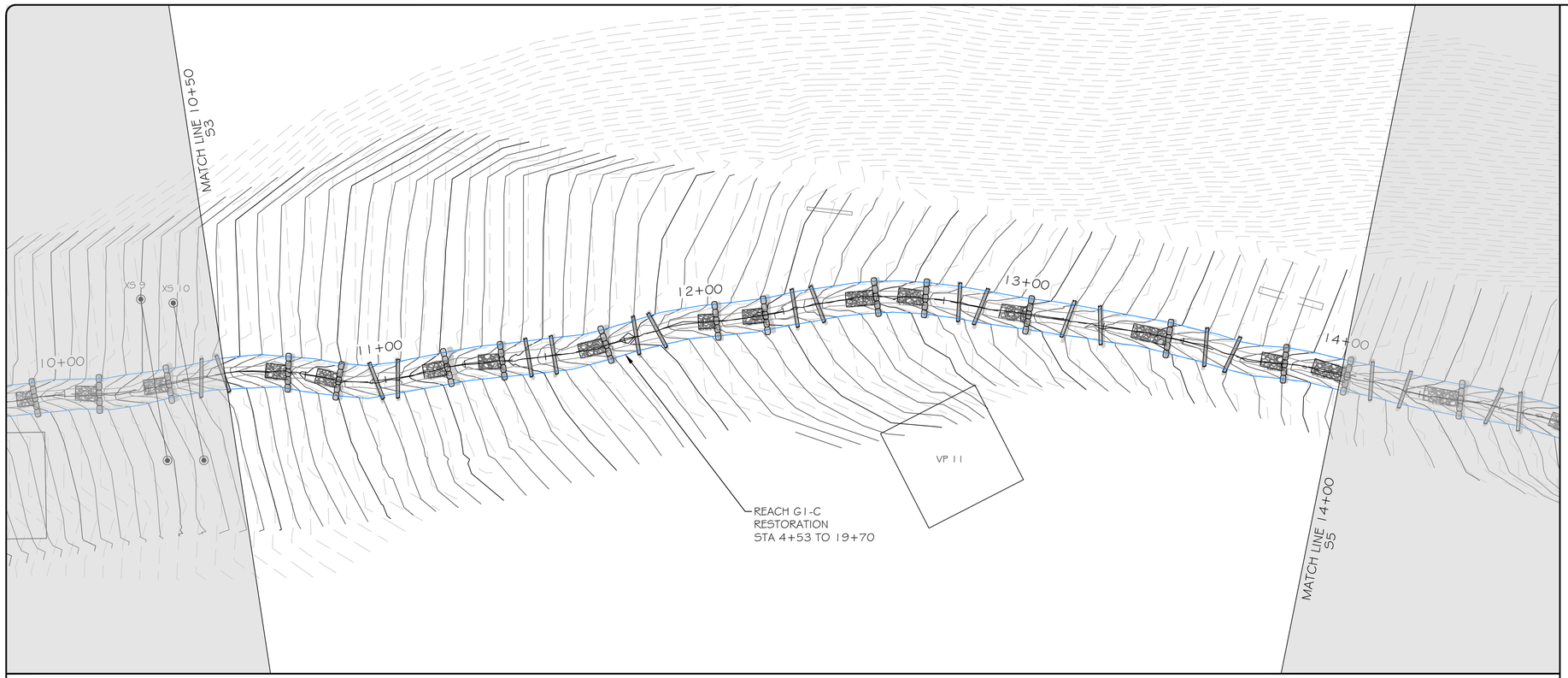

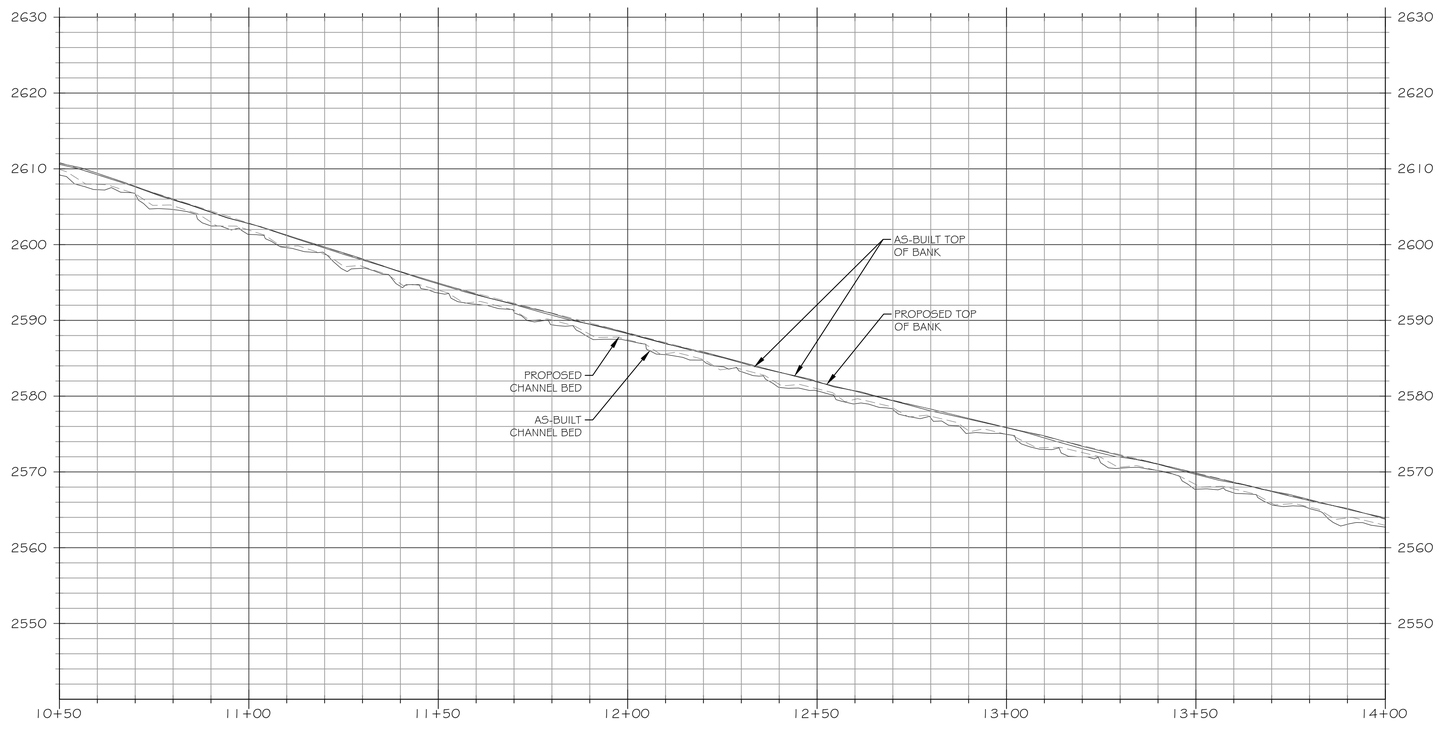

SCALE: HOR 1"=20'; VERT 1"=10'

LEGEND

- AS-BUILT CONTOUR, MAJOR — 50
- AS-BUILT CONTOUR, MINOR — 46
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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN
6/7/22

FULL SCALE: 1"=20

0 20 40

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 6/7/2022

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: MONKEY WALL SITE RECORD DRAWINGS
MITCHELL COUNTY, NORTH CAROLINA

DRAWING TITLE: REACH G1-C

PROJECT NUMBER:	100918
PROJECT MANAGER:	BPB
DESIGNED:	AFM
DRAWN:	TRS
CHECKED:	BRC

SHEET NUMBER:

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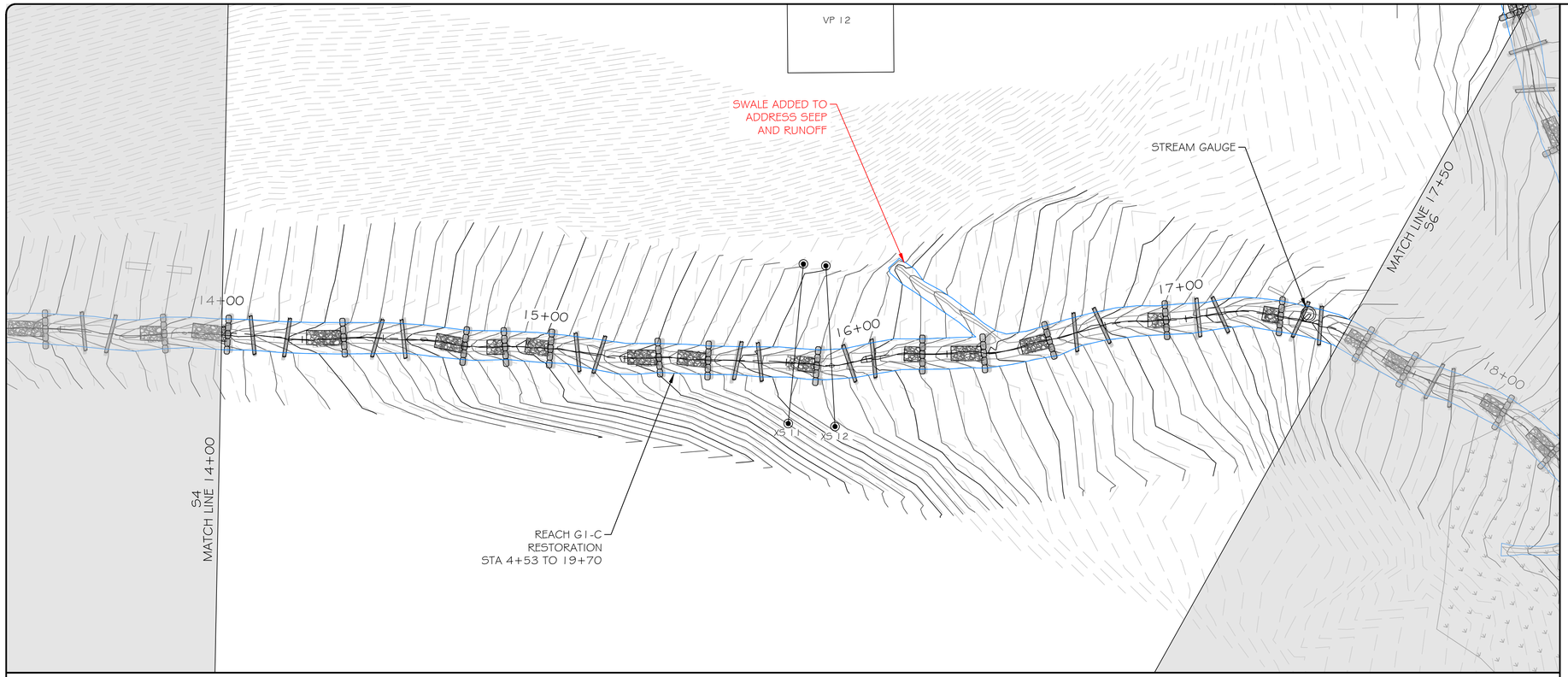

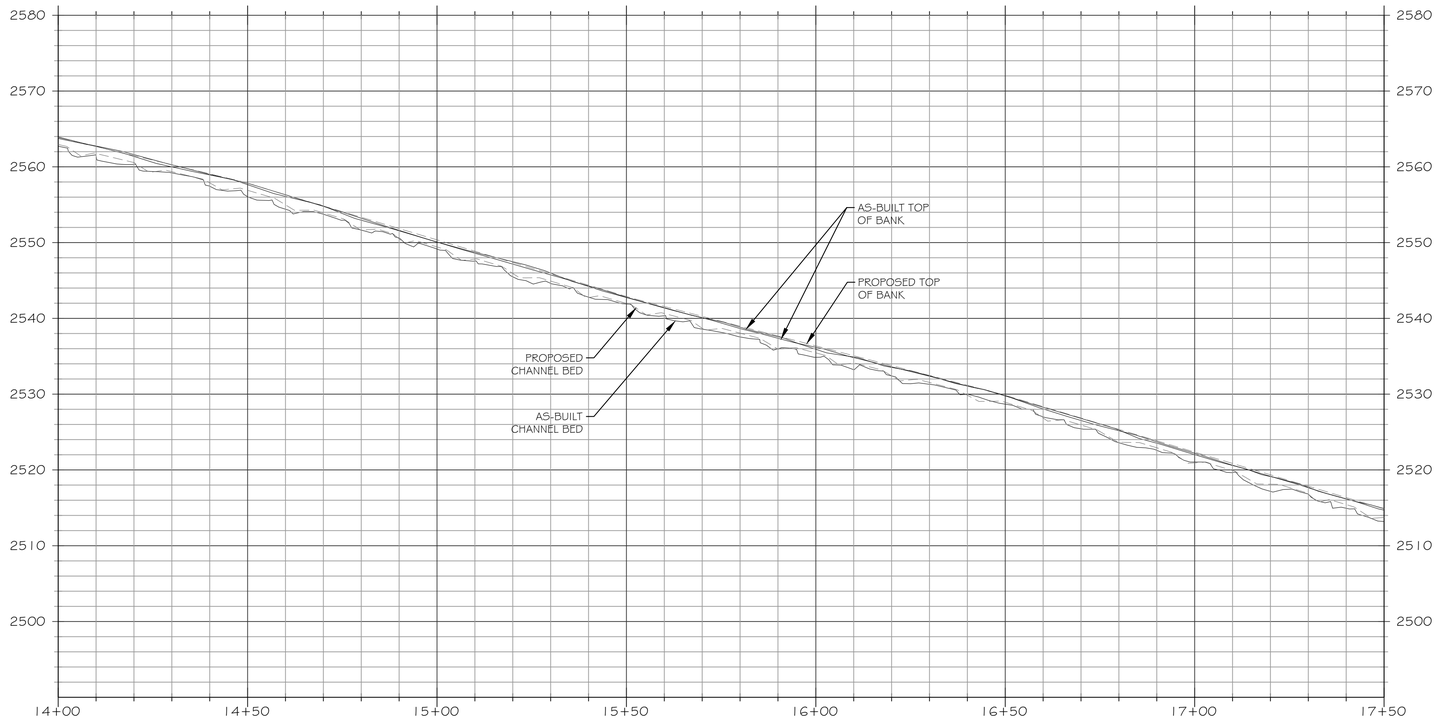

SCALE: HOR 1"=20'; VERT 1"=10'

LEGEND

- AS-BUILT CONTOUR, MAJOR — 50
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License: F-1428

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN 6/7/22

FULL SCALE: 1"=20

0 20 40

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 6/7/2022

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: MONKEY WALL SITE RECORD DRAWINGS
MITCHELL COUNTY, NORTH CAROLINA

DRAWING TITLE: REACH G1-C

PROJECT NUMBER:	100918
PROJECT MANAGER:	BPB
DESIGNED:	AFM
DRAWN:	TRS
CHECKED:	BRC

SHEET NUMBER:

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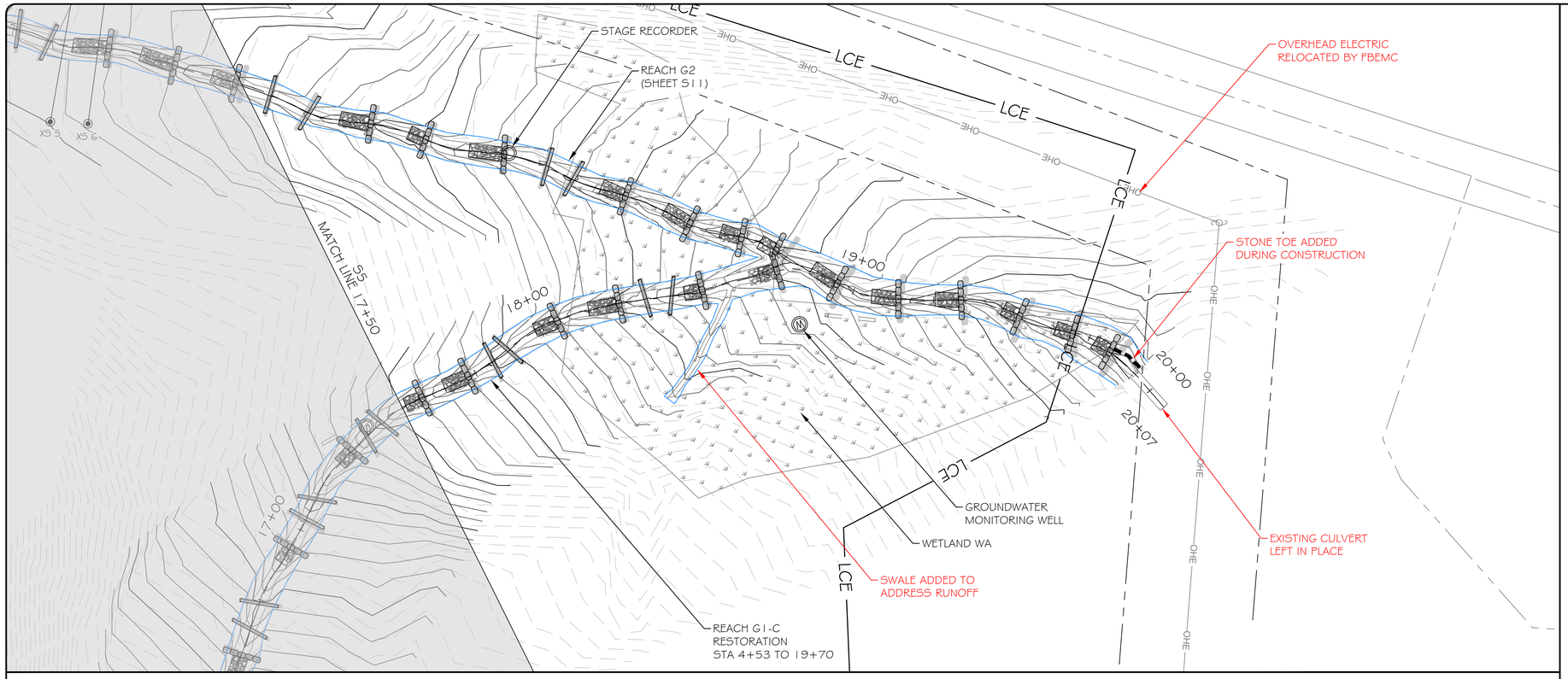

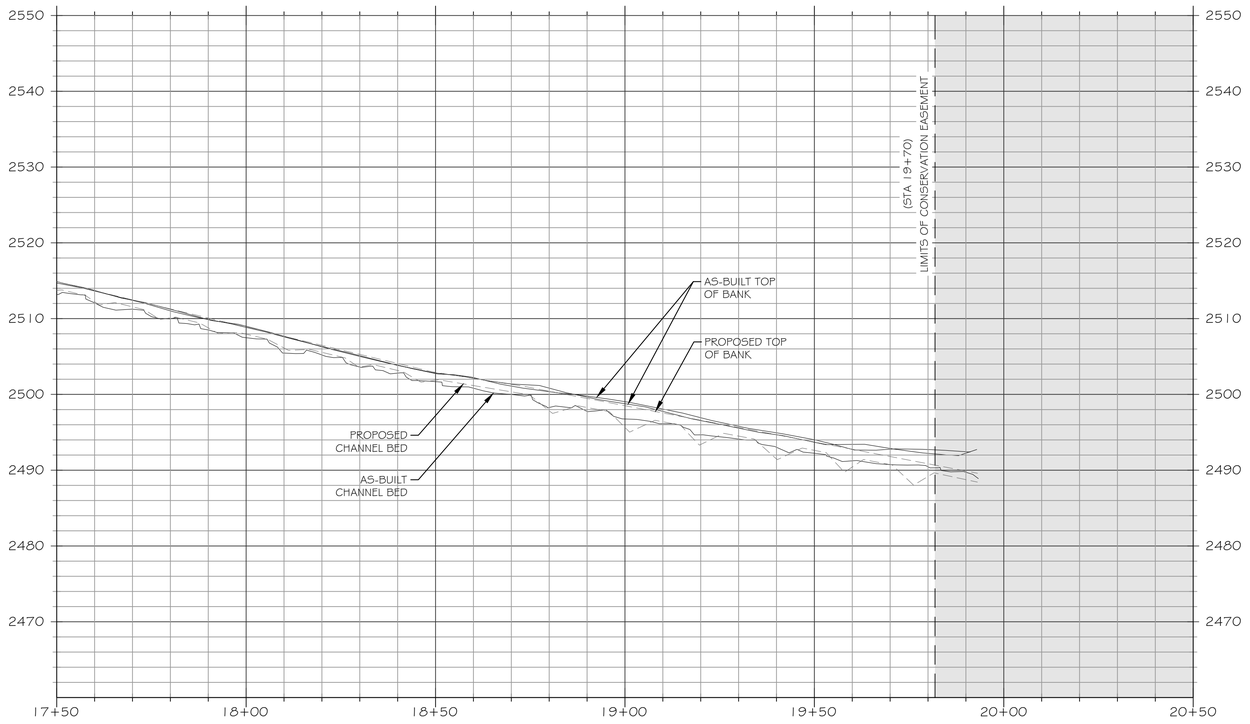

SCALE: HOR 1"=20'; VERT 1"=10'

LEGEND

- AS-BUILT CONTOUR MAJOR — 50
- AS-BUILT CONTOUR MINOR — 46
- PROPOSED CONTOUR MAJOR — 50
- PROPOSED CONTOUR MINOR — 46
- WETLAND
- AS-BUILT TOP OF BANK — TB
- AS-BUILT BOTTOM OF BANK — BB
- PROPOSED TOP OF BANK
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- PROPERTY LINE
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- GROUNDWATER MONITORING WELL — W
- STAGE RECORDER
- FLOW GAUGE
- MONITORING CROSS SECTION
- VEGETATION MONITORING PLOT — VP#

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Engineering Services Provided By:
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License: F-1428

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLAN 6/7/22

FULL SCALE: 1"=20

0 20 40

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 6/7/2022

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: MONKEY WALL SITE RECORD DRAWINGS
MITCHELL COUNTY, NORTH CAROLINA

DRAWING TITLE: REACH G1-C

PROJECT NUMBER:	100918
PROJECT MANAGER:	BPB
DESIGNED:	AFM
DRAWN:	TRS
CHECKED:	BRC

SHEET NUMBER:

S6

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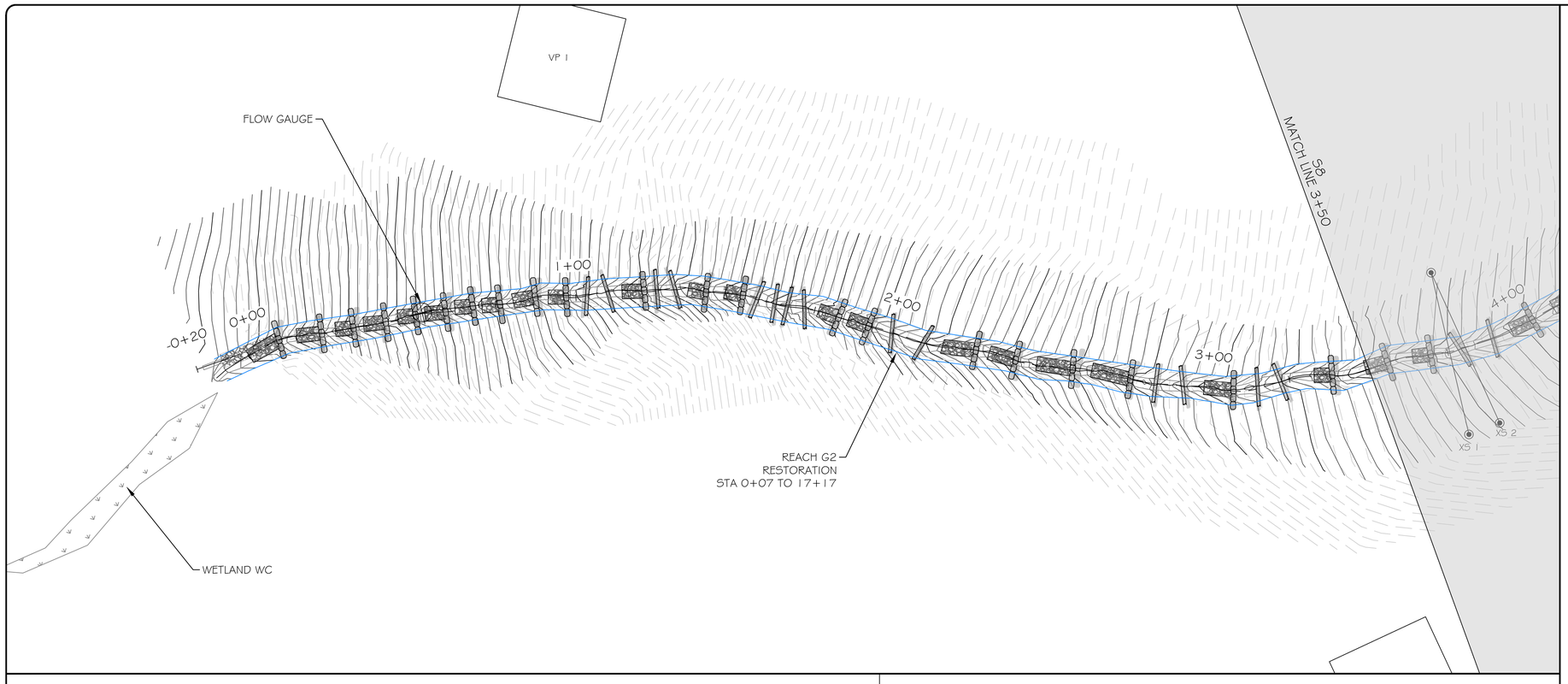

LEGEND

- AS-BUILT CONTOUR, MAJOR — 50
- AS-BUILT CONTOUR, MINOR — 46
- PROPOSED CONTOUR, MAJOR — 50
- PROPOSED CONTOUR, MINOR — 46
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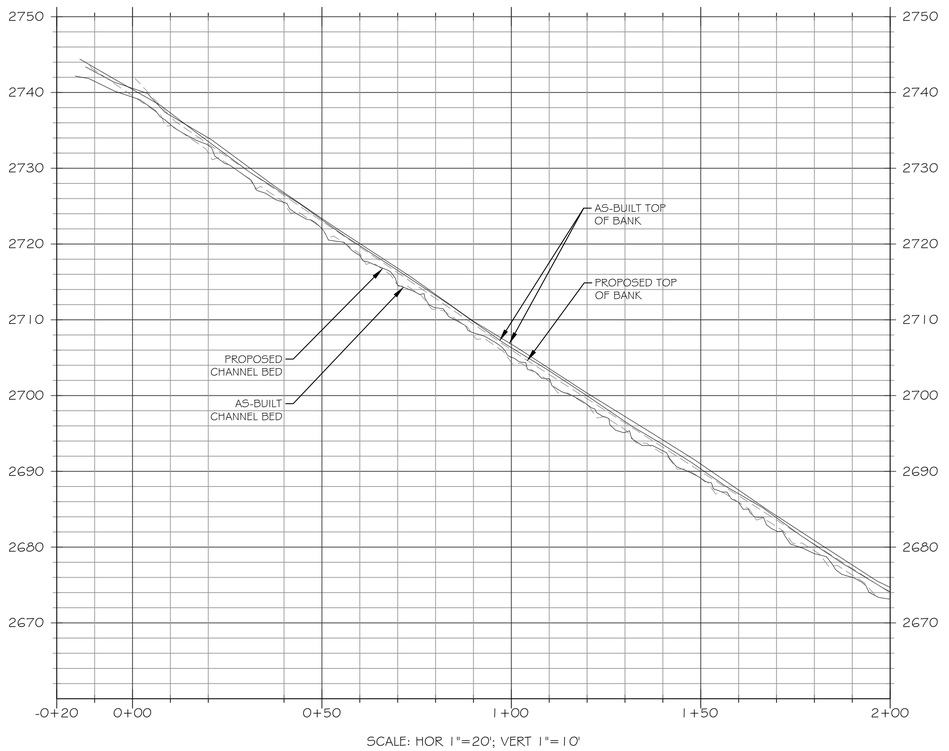
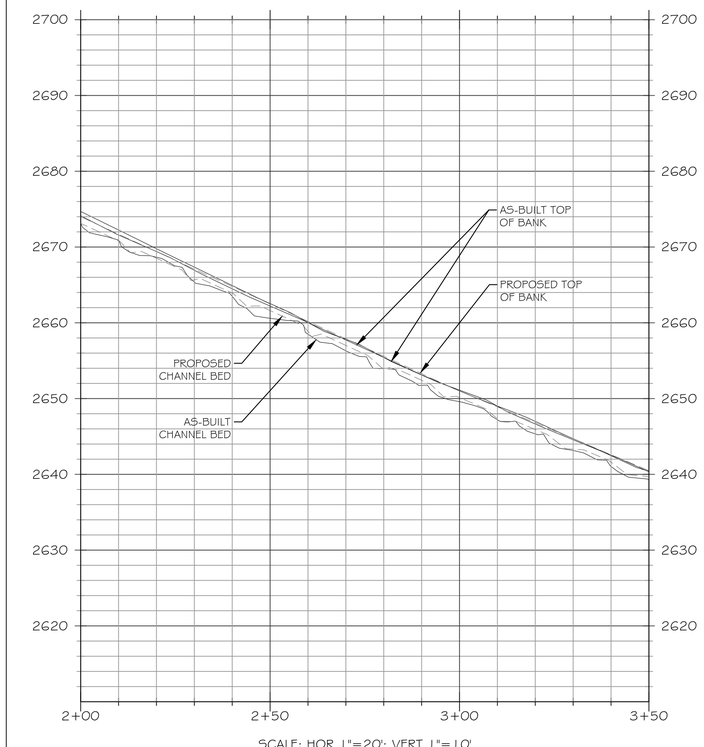
- GROUNDWATER MONITORING WELL — W
- STAGE RECORDER
- FLOW GAUGE
- MONITORING CROSS SECTION
- VEGETATION MONITORING PLOT — VP#



SCALE: HOR 1"=20'; VERT 1"=10'



SCALE: HOR 1"=20'; VERT 1"=10'

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Main: 919.829.9909
www.res.us

Engineering Services Provided By:
RES Environmental Operating Company, LLC
License: F-1428

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN 6/7/22

FULL SCALE: 1"=20

0 20 40

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 6/7/2022

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME:
MONKEY WALL SITE RECORD DRAWINGS
MITCHELL COUNTY, NORTH CAROLINA

DRAWING TITLE:
REACH G2

PROJECT NUMBER:	100918
PROJECT MANAGER:	BPB
DESIGNED:	AFM
DRAWN:	TRS
CHECKED:	BRC

SHEET NUMBER:

S7

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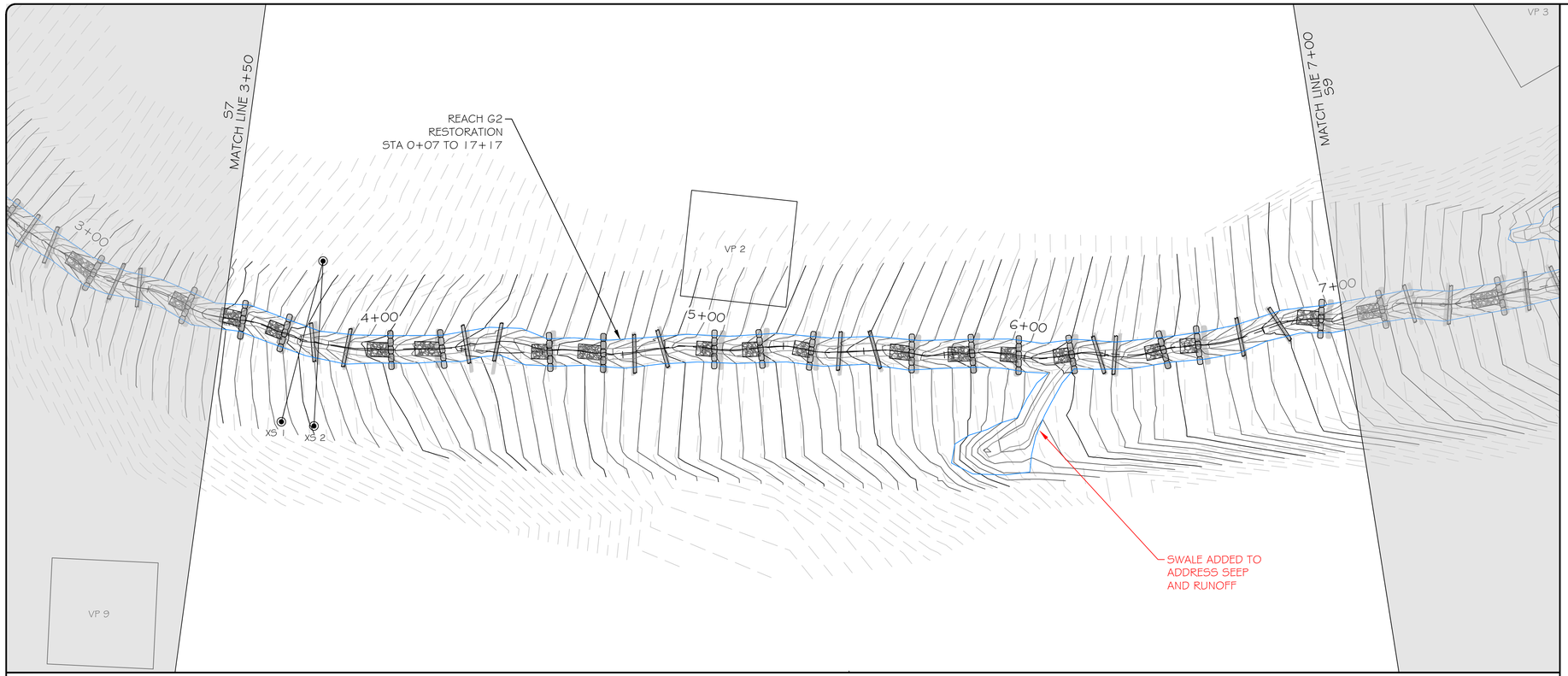

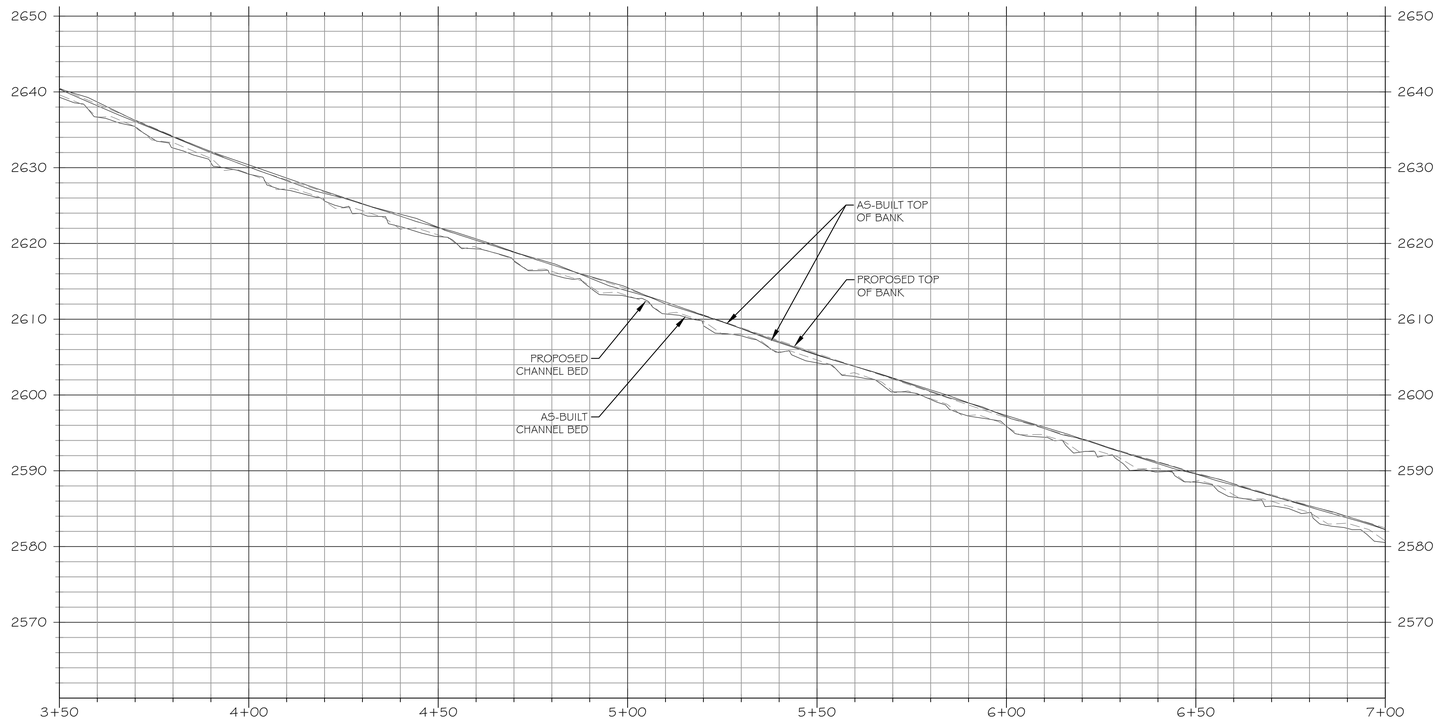

SCALE: HOR 1"=20'; VERT 1"=10'

LEGEND

- AS-BUILT CONTOUR, MAJOR — 50
- AS-BUILT CONTOUR, MINOR — 46
- PROPOSED CONTOUR, MAJOR — 50
- PROPOSED CONTOUR, MINOR — 46
- WETLAND
- AS-BUILT TOP OF BANK — TB
- AS-BUILT BOTTOM OF BANK — BB
- PROPOSED TOP OF BANK
- OVERHEAD ELECTRIC UTILITY LINE
- PROPERTY LINE
- AS-BUILT STONE TOE PROTECTION
- LIMITS OF CONSERVATION EASEMENT — LCE
- AS-BUILT LOG CASCADE STRUCTURE
- AS-BUILT RIFFLE GRADE CONTROL WITH ROCK SILL
- PROPOSED LOG CASCADE STRUCTURE
- PROPOSED RIFFLE GRADE CONTROL WITH ROCK SILL
- GROUNDWATER MONITORING WELL — W
- STAGE RECORDER
- FLOW GAUGE
- MONITORING CROSS SECTION
- VEGETATION MONITORING PLOT — VP#

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License: F-1428

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN

FULL SCALE: 1"=20

0 20 40

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 6/7/2022

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: MONKEY WALL SITE RECORD DRAWINGS
MITCHELL COUNTY, NORTH CAROLINA

DRAWING TITLE: REACH G2

PROJECT NUMBER:	100918
PROJECT MANAGER:	BPB
DESIGNED:	AFM
DRAWN:	TRS
CHECKED:	BRC

SHEET NUMBER:

S8

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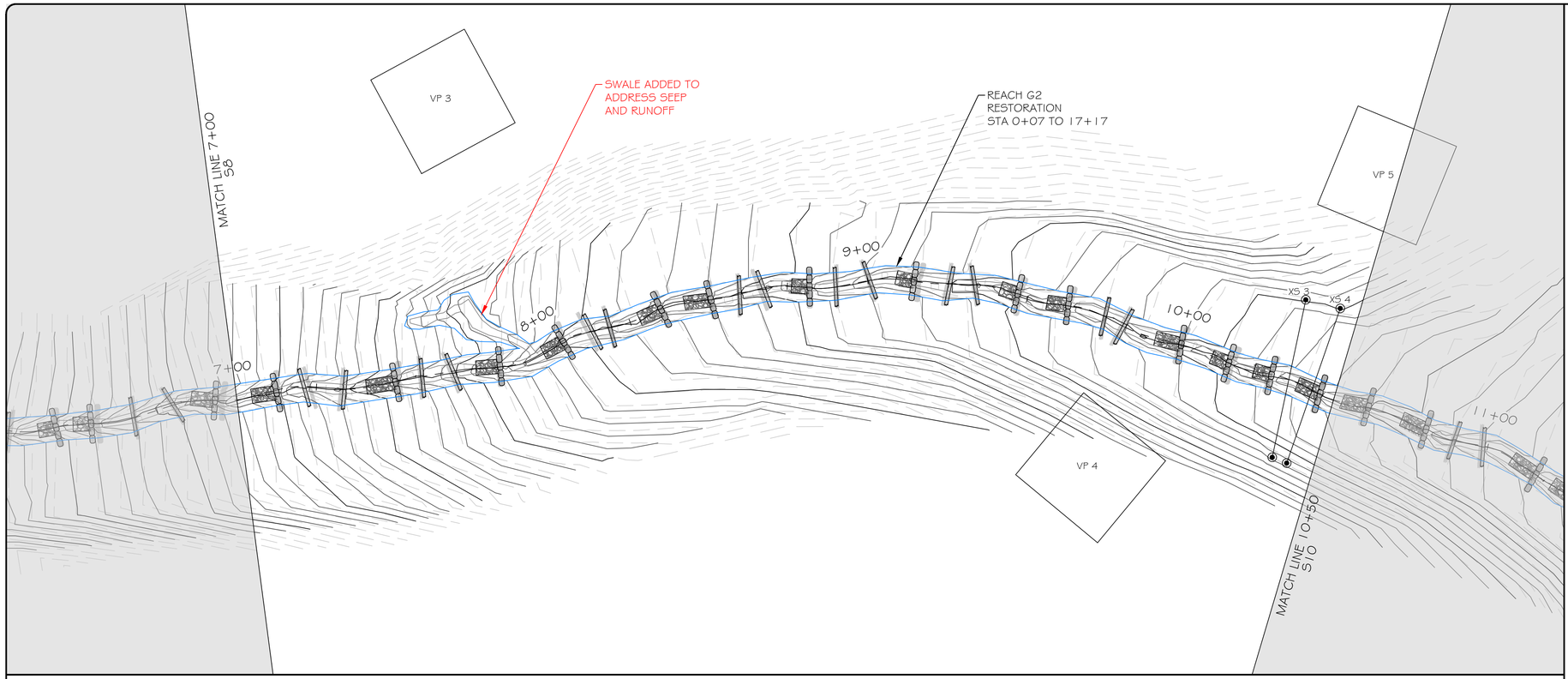

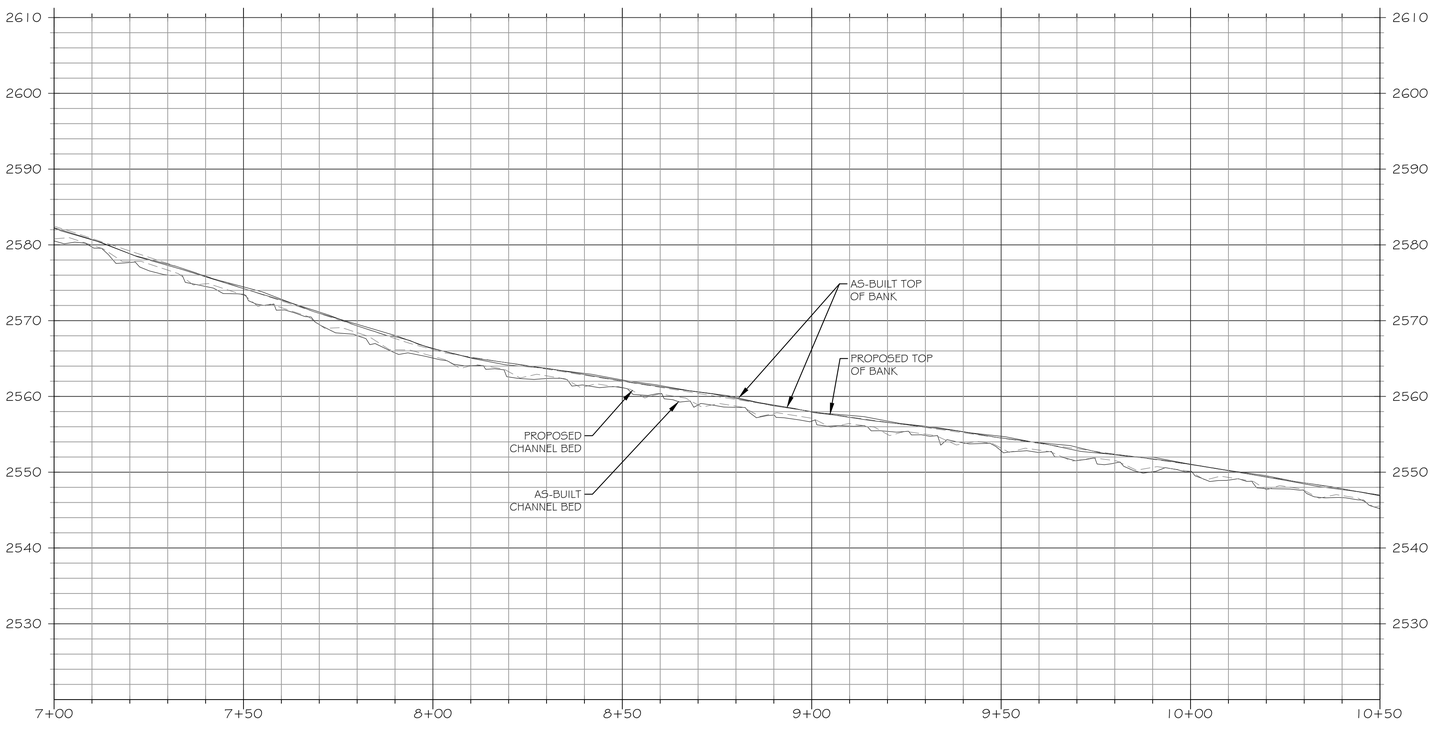

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NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLER 6/7/22

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0 20 40

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PLOT DATE: 6/7/2022

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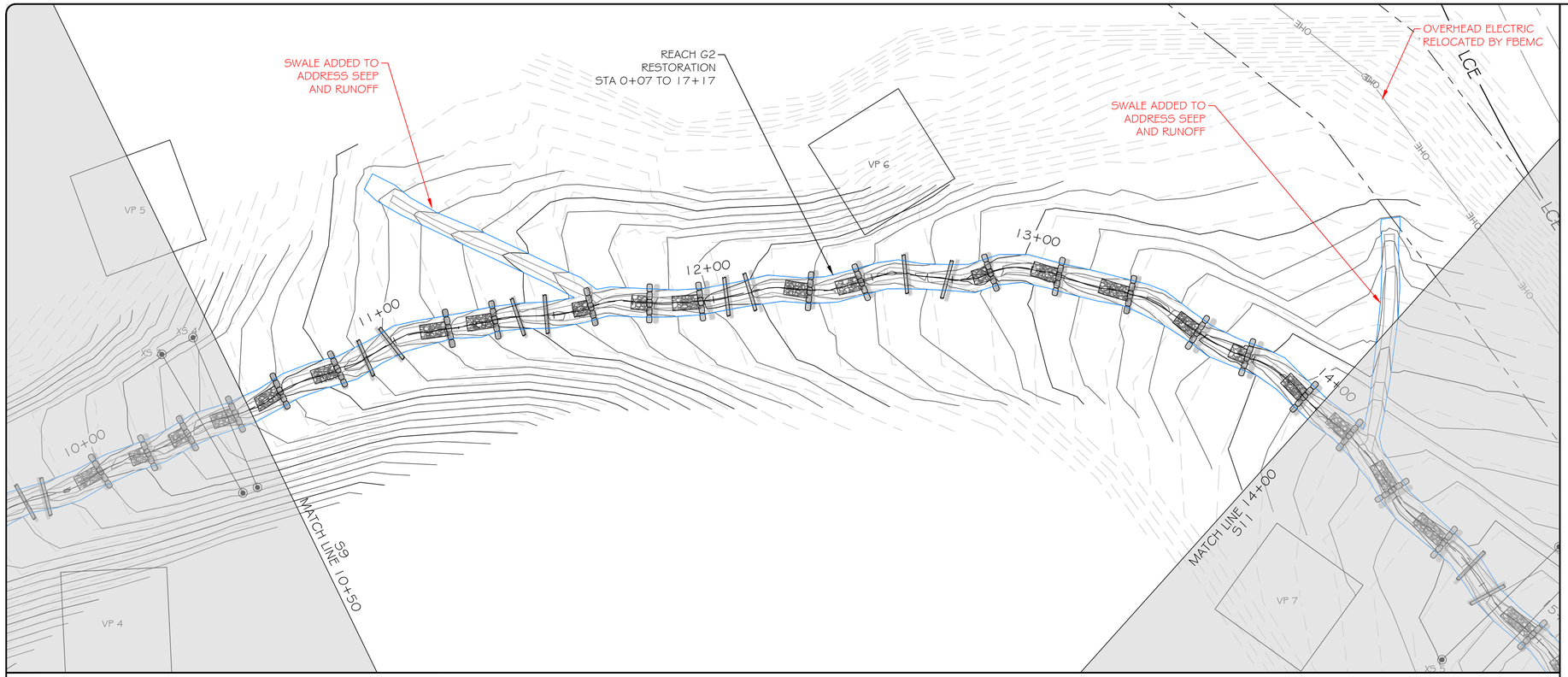

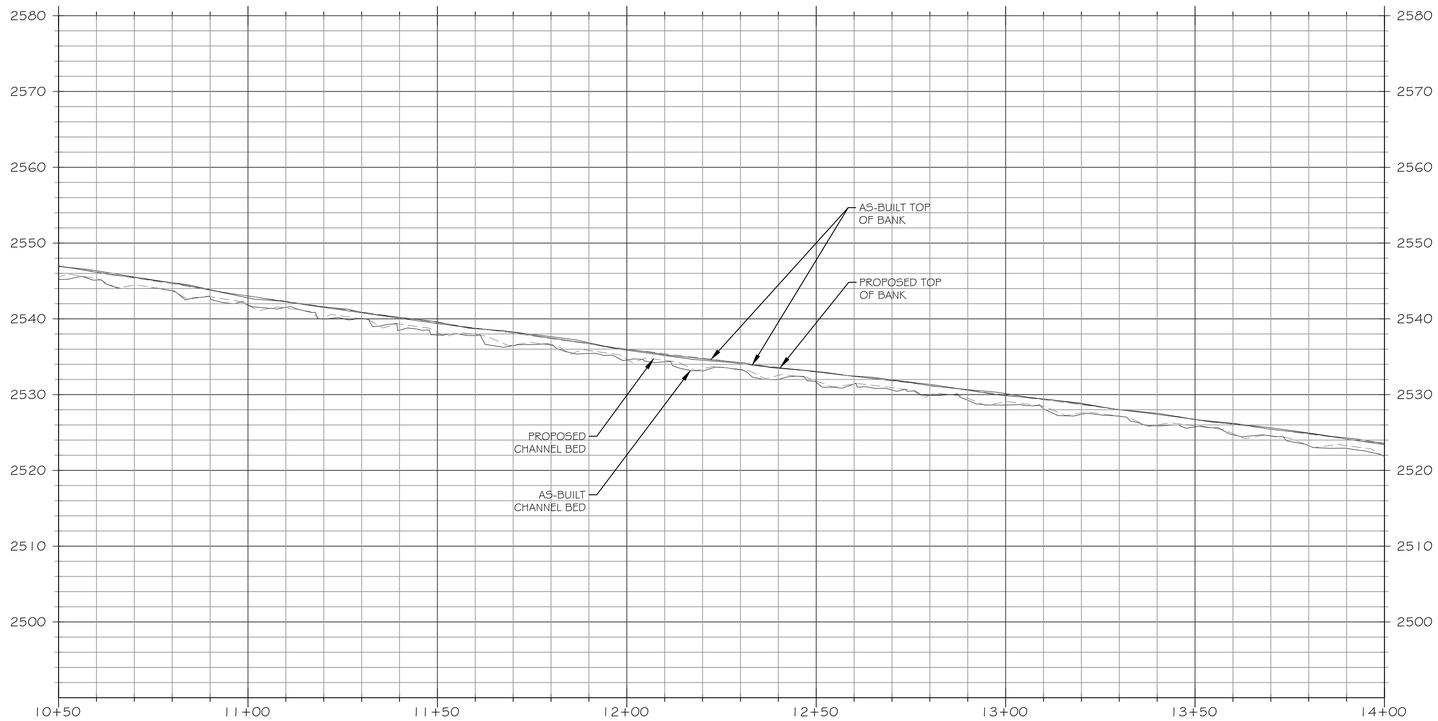

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LEGEND

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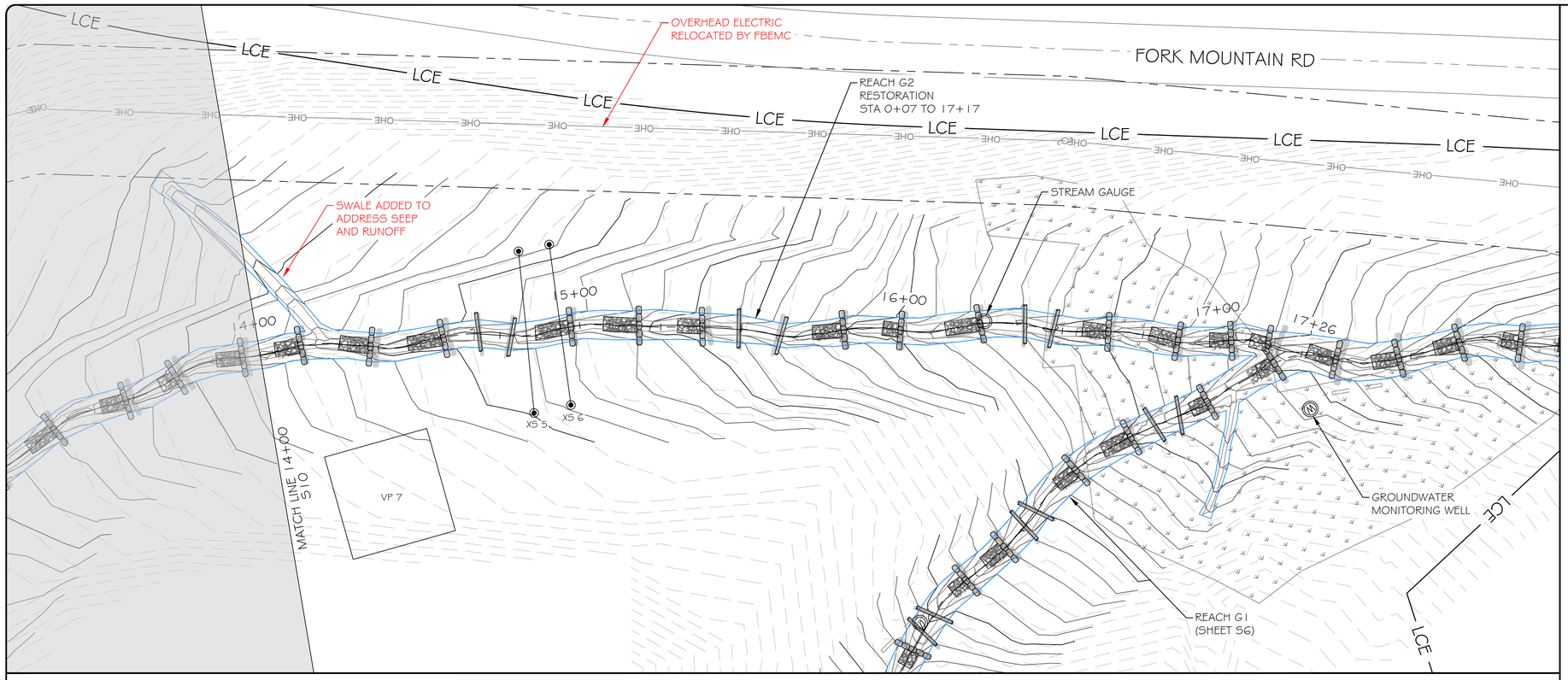

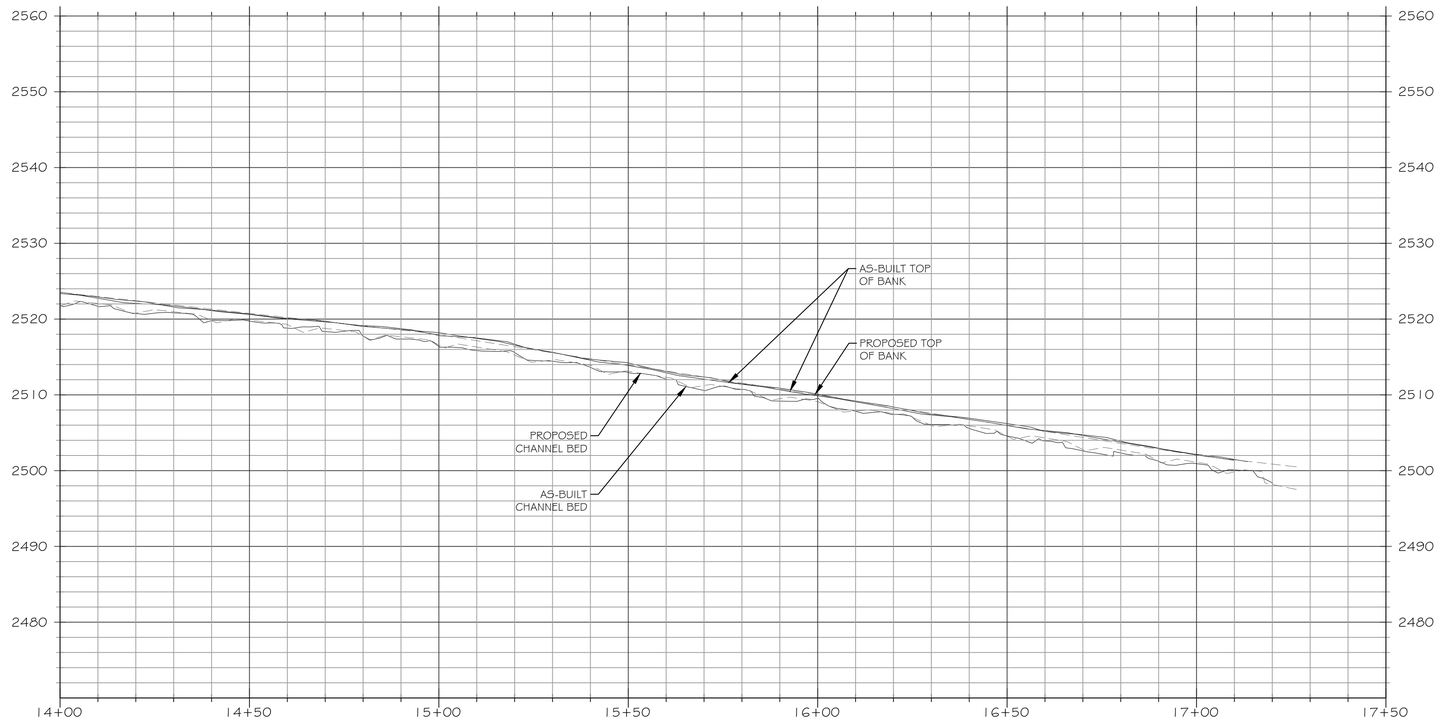

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