

Harrell Stream and Wetland Mitigation Site
As-Built Baseline Monitoring Report

FINAL

Harrell Stream and Wetland Mitigation Site
NCDMS Contract No. 007006
NCDMS Project No. 100005
DWR# 20161077
USACE Action ID: SAW-2016-02202
Jackson County, North Carolina
Data Collected: November 1st, 2019 – January 22nd 2020
Date Submitted: February 7th, 2020



Submitted to:

NCDEQ-Division of Mitigation Services
1652 Mail Service Center Raleigh N C 27699-1652

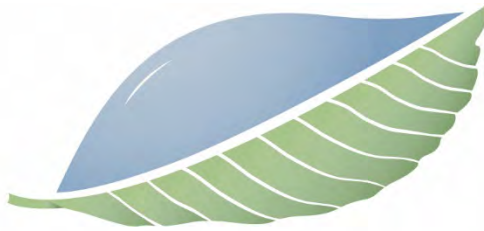
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Prepared for:



37 Haywood Street, Suite 100
Asheville, NC 28801

Prepared by:



EQUINOX

balance through proper planning

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February 5, 2020

Paul Wiesner
Western Regional Supervisor
DENR Division of Mitigation Services
5 Ravenscroft Dr., #102
Asheville, NC 28801

Subject: Draft As-Built Baseline Monitoring Report (Task 6)
Harrell Stream & Wetland Site, Jackson County
Little Tennessee River Basin – CU 06010203 – Jackson County
DMS Project ID No. 100005
DEQ Contract #007006

Dear Mr. Wiesner,

Equinox/EWS has reviewed and addressed the comments for the draft As-Built Baseline Monitoring Report and Record Drawings for the Harrell Stream & Wetland Site. This deliverable documents stream and wetland restoration, enhancement and preservation assets totaling 1,854 Stream Mitigation Units (SMU) and 3,530 riparian Wetland Mitigation Units (WMU). Comments provided by NCDMS on January 30, 2020 are listed below with red text indicating how each was addressed in the final iteration of the report:

General: The NC IRT has indicted that project credits are determined at the IRT mitigation plan approval stage unless major changes or deviations occur. The Harrell Stream and Wetland Site was approved for 1,854 SMUs (cold) and 3,530 WMUs (riparian) in the mitigation plan. Please update the report and report text accordingly. **Report and text updated accordingly.**

Cover Page: The DWR # on the cover is incorrect. The correct DWR # is 20161077. Please correct on the cover and report wide. **Project number corrected on cover page and throughout report.**

Section 1.1 Project Setting and Background: 2nd paragraph typos; “At the downstream end of Harrell Creek, the profile of the channel was raised **and** proper.....” & “**These** measures contribute to reduced....” Please QA/QC and correct text typos report wide. **Typos assessed and corrected throughout report.**

Section 1.3 Monitoring Plan Components: If applicable, please briefly discuss any updated locations of monitoring devices/plot locations from the IRT approved mitigation plan. **Language included in reference to updated monitoring feature locations.**

Section 1.3 Monitoring Plan Components: The section notes; “Changes from the approved Mitigation Plan are denoted with an asterisk (*) and are explained in the next paragraph.” DMS recommends removing this

statement as there are currently no reported deviations from the IRT approved mitigation plan. Please review and update accordingly. **Statement removed from report.**

Section 1.4 Project Performance Standards: The table provided is from the Fletcher Mitigation site and is not applicable to this project. The project performance standards table should be the same as Table 18 from the 2019 IRT approved Harrell Stream and Wetland Mitigation Plan. In addition, the 2019 IRT approved Harrell Stream and Wetland Mitigation plan documents alternative performance standard for vegetation vigor. This information should be included in the revised report and should be synonymous with the approved mitigation plan. Please QA/QC and correct as necessary. **Description in table updated to include specific language on alternative performance standards approved in the Final Mitigation Plan.**

Section 1.6 Restoration Type and Approach (or an additional section): Please describe and explain construction/ as-built changes that deviate from the approved mitigation plan in this section (or add an additional section). Stream changes from 115+00 – 117+00 should be described in detail. **Detailed description of stream changes included.** Please also include information regarding any issues or mitigating factors, which may have arisen during (or the period immediately after) construction (e.g. impoundment changes, extreme precipitation trends or events, beaver activity etc.), which may require consideration or attention during project monitoring. Please update accordingly. **A new subsection 1.6.3 “Additional Site Considerations” was added and includes a paragraph with language in reference to the beaver activity observed at the lower end of Reach 1D and related information.**

Section 1.6 Restoration Type and Approach (or an additional section): Please add text to the report to document that DMS, EW Solutions, and Stantec met a representative of the Eastern Band of Cherokee Indians (EBCI) on January 9, 2020 for an on-site pre-planting meeting to review the planting plan and proposed planting logistics. Please also include text noting that the EBCI were provided project planting dates and observed planting within the documented cultural resource areas as required. Please note that no cultural resources or artifacts were identified by the planting contractor or the EBCI during project planting and the EBCI was complimentary of the project mitigation efforts on the site. **A paragraph was added under Section 1.6.3 “Additional Site Considerations” with according language referring to pre- and post-planting consultations with EBCI.**

Table 1: Please use the Creditable Footage and Creditable Acreages from the approved mitigation plan in the table’s “Mitigation Plan Footage or Acreage” column. **Table updated accordingly.**

Table 1: For Wetland A (Re (Pres)) please replace “NC” with 1.58 in the “As-Built Centerline Footage or Acreage” column. This is not a credit column. Please add a footnote in the Project Credits Section indicating that the wetland will be protected but is not generating wetland credit due to the 100% Restoration (R) credit requirement in RFP 16-008611. **Table updated accordingly and footnote added in reference to wetland credit.**

Table 1: The “*” footnote is not applicable to the first part of the table. It should be combined and included with the “%” footnote in the Project Credits section. Please see the comment below. **Footnote updated accordingly.**

Table 1: The Project Credits portion of the table should be updated to the total project credits established in the IRT approved mitigation plan; 1,854 SMUs (cold) and 3,530 WMUs (riparian). The “%” footnote should be updated to, “Project credits reflect the sum of credits outlined in the IRT approved mitigation plan. Mitigation plan credits account for breaks in conservation easements and are based on centerline design stream stationing and taken from the IRT approved mitigation plan.” **Table and footnote updated accordingly.**

Table 1: In the Project Credits portion of the asset table, stream preservation credits are listed as 640; this is incorrect and should be updated to 64. **Table updated accordingly.**

Table 1: Consider adding comments in the comment column of the table as shown in the DMS May 2019 Asset Map Template (attached). **Comments added where applicable.**

Table 2: The Mitigation Plan - Data Collection Complete should be in Dec. 2018. The MY0 Stream Assessment and Vegetation Assessment rows do not require a Completion or Delivery date as they are data collection entries. Please QA/QC the table and update accordingly. **Table updated accordingly.**

Table 3: Please update the monitoring performers row to include the current point of contact at Equinox. Additionally, the MY0 date should be 2020. Please QA/QC the table and update accordingly. **Table updated accordingly.**

Table 4: In the regulatory considerations section, please include the 404 # SAW-2016-02202 and the 401 # 20161077. These regulatory considerations were resolved with the 404 and 401 permits, not the USACE jurisdiction determination. Please update. **Table updated accordingly.**

Table 4: The Historic Preservation Act is applicable to the project. Both the Endangered Species Act and the Historic Preservation Act were resolved with the FHWA Categorical Exclusion (CE)/ ERTR. Please confirm that the FEMA Floodplain Compliance was a regulatory consideration on the site. If confirmed, please include the FEMA Floodplain Compliance permit # in the table and include a copy of the permit and any supporting documentation in the final electronic submittal (digital support files). **Floodplain compliance permit information is now included in the table as well as final electronic submittal.**

Table 4: The table 4 footnotes submitted with the draft are not applicable to the table. Please QA/QC the table and update accordingly. **Footnotes removed, table updated accordingly.**

Figure 2: Please include reach breaks in the legend for clarity. Recommend bringing the stream layer to the top of the GIS stack for better map clarity. Please include the wetland rehabilitation feature identified in Table 1 on the figure and in the legend. The wetland rehabilitation shape should also be included in the revised digital support files. **Breaks are now included in map legend; map features were layered accordingly for better visual clarity; rehabilitation feature was added to map & legend.**

Figure 3: Please include the wetland rehabilitation feature identified in Table 1 on the figure and in the legend. **Rehabilitation feature was added to map & legend.**

Figure 3: The legend symbol for the continuous stage recorder does not appear to coincide with what is shown on the map. Please QA/QC and update the map as necessary. **Map & legend updated for consistency.**

Table 5: Please round the “Stems per ACRE” row entries to the nearest whole number in the table. Please check the “size (ACRES)” entry for the Annual Means column. Correct as necessary. **Corrections made and table updated accordingly.**

Table 6: This table is not typically included in the MY0 report; however, it notes that 9.5% of the conservation easement has invasive areas of concern. In the report text, please explain why 0.8 acres of invasive areas of concern remain on the site post construction. **Explanation added describing invasives remaining and treatment plans.** If not during construction/ MY0, when will these invasive areas be treated? There are also three (3) footnote callouts shown in the table but no footnotes are included. Please address in the response letter and update as the report as necessary. **Footnotes updated; planned invasives treatment addressed in footnote; table updated accordingly.**

Digital Support File Comments:

- DMS does not have a feature for Reach 1A. Please update the digital support files accordingly. **Reach 1A feature now included in digital support files.**

- The wetland restoration feature provided should be segmented to match the asset table. Also, as provided, the wetland restoration feature has an acreage of 3.39 whereas the reported acreage is 3.53, while the wetland preservation feature is 1.89 acres but the reported acreage is 1.58. Please provide DMS with wetland features that are segmented based on the asset table that are representative of the reported acreages. **Wetland feature acreages have been corrected to reflect reported acreages.**

- DMS needs the excel file(s) used to produce the stream cross section figures, and the pebble count figures. Please include the required files in the revised digital support files. **Required files are now included in the digital support files.**

-Please provide the Kee Mapping as-built .pdf and .dwg files with the final electronic submittal. This as-built survey should bear a Professional Land Surveyor (PLS) seal. **Signed and sealed as-built included in Appendix E.**

-Please provide the final Stantec design plan .pdf and .dwg files with the final electronic submittal. The design plan should bear a Professional Engineer's seal. **Signed and sealed final designs are now included in the final electronic submission.**

-Please include all required project permits and the FEMA Floodplain Compliance permit (if applicable) and any supporting documentation in the final electronic submittal. This should be included in a separate "Project Permits" folder. **Copies of all required permits are now included in the final electronic submittal.**

The Equinox project manager for this project is Mr. Danvey Walsh. His contact is as follows:

Environmental Scientist
Equinox
37 Haywood Street
Asheville, NC 28801
Office: 828-253-6856 ext. 201
Fax: 828-253-8256

Sincerely,



Danvey Walsh

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Table of Contents

1.0	Project Summary.....	1
1.1.	Project Setting and Background.....	1
1.2.	Project Goals and Objectives	1
1.3.	Monitoring Plan Components	3
1.4.	Project Performance Standards	4
1.5.	Mitigation Components.....	5
1.6.	Restoration Type and Approach	5
1.7.	As-Built Record Drawings.....	7
1.8.	Vicinity Map	8
2.0	References.....	9
	Appendix A Background Tables	10
	Appendix B Visual Assessment Data.....	16
	Appendix C Vegetation Plot Data	26
	Appendix D Stream Measurement and Geomorphology Data	32
	Appendix E As-Built Survey and Record Drawings Plan Set.....	58

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1.0 PROJECT SUMMARY

1.1. Project Setting and Background

The Harrell Stream and Wetland Mitigation Site (Harrell Mitigation Site) is located in the Little Tennessee River (CU 06010203). The Harrell Mitigation Site also lies within the lower portion of the Eastern Little Tennessee River Basin (HUC 06010203010060) watershed which is identified as a Targeted Local Watershed (TLW) according to the 2008 Little Tennessee River Basin Restoration Priorities (RBRP) Plan. Project work at the Harrell Site was completed in early September 2019, and included construction, monitoring feature installation, and fence installation; bare root and live stake installation occurred in mid-January 2020. Through the project work, a total of 1,790 linear feet were restored, 640 linear feet were preserved, 0.22 acre of wetland were rehabilitated, and 3.31 acres for wetland were re-established. The Harrell Mitigation Site generated a total of 1,854 SMU's and 3.53 WMU's. Refer to Table 1 for the project components and mitigation credit information and Figure 2 for the Project Asset Map.

Historic land use at the Harrell Mitigation Site consisted of silvicultural logging and agricultural use for at least 40 years, according to historic aerial photos. Historic agricultural practices, relocation of the channel, and berm construction along the right descending bank of Harrell Creek had functionally removed the stream's connectivity with the floodplain and adjacent wetlands, resulting in highly degraded wetland function. Two poorly functioning culverts have also degraded the ecological connectivity of the stream at the headwaters of the Harrell Mitigation Site. The lack of deep-rooted vegetation and unstable vegetation and unstable channel characteristics have contributed to the degradation of the streambanks on both sides of the project. Ecological function has been restored to the existing streams, wetlands and riparian corridor by returning the existing stream and wetlands to a stable condition. The relocation of Harrell Creek to the historic floodplain and removal of the berm has restored proper floodplain connectivity and improved wetland hydrology. The restoration of the upper reach addressed a perched culvert, removed a second pipe crossing, and corrected erosion issues from an existing logging road through the installation of stormwater control devices. At the downstream end of Harrell Creek, the profile of the channel was raised and proper channel dimensions were restored. Additional measures that promoted functional uplift included stabilizing and revegetating stream banks and adjacent disturbed areas, restoring floodplain connectivity and wetland hydrology, reestablishing wooded riparian areas. These measures contribute to reduced downstream sediment and nutrient loads, as well as improving aquatic and terrestrial habitat.

This project is protected by an 8.45 acre conservation easement and is located approximately 2.8 miles southeast of Cullowhee, NC in Jackson County at 35.300553° N, -83.133689° W. The Harrell Mitigation Site is bounded by agricultural land.

1.2. Project Goals and Objectives

The project goals address stressors identified in the TLW and priority subwatershed, as outline in the Final Mitigation Plan, and include:

- Provide a network of streams with natural, stable forms that support proper stream functions;
- Improve groundwater hydrology to support recovery of native riparian vegetation;
- Reduce sediment inputs from eroding stream banks to reduce fine sediment loads and percentage of fines in the bed-material load;

- Restore proper sediment transport to support channel stability and bedform diversity;
- Improve substrate quality to facilitate hyporheic flow and support aquatic communities;
- Improve quantity, quality, and diversity of habitats to support healthy aquatic communities;
- Reduce pollutant inputs to the project streams (fecal coliform, nitrogen, phosphorus) to restore a balance to proper nutrient cycles;
- Improve riparian vegetation community to provide temperature regulation of the stream, provide a future source of organic inputs, and aid in long-term channel bank stability;
- Restore areas of former riparian wetlands so that the hydrology and soils will support wetland vegetative communities and wildlife;
- Improve landscape connectivity that allows space for biotic and abiotic process and provides a source and sink for natural populations; and,
- Prevent the site from future impacts of development and agricultural issues.

The following objectives are proposed for accomplishing the above listed goals as outlined in the Final Mitigation Plan:

- Construct stream channels that will maintain proper dimension, pattern, and profile;
- Construct streams with proper bankfull to floodplain relationship;
- Construct streams that provide naturally stable dimensions and stabilize constructed banks with appropriate bioengineering;
- Construct streams that maintain an appropriate sediment transport balance with the sediment that is supplied by the watershed so that the overall stream profile neither aggrades nor degrades over time;
- Create and improve stream bedform diversity by constructing pools of varied depths and riffles of varied slopes;
- Construct stable riffles that provide an improved diversity of bed material clast and a reduction in fines relative to existing conditions;
- Construct in-stream habitat features from native material to provide diversity of habitat;
- Provide a buffer from agricultural activities and row crops;
- Plant native climax tree species and understory species in the riparian zone;
- Reconstruct stream channels that are properly connected to the riparian wetlands;
- Re-grade topography to eliminate ditches and drainage features;
- Plant native wetland tree and shrub species; and,
- Establish a conservation easement that provides a minimum buffer from future activities in the adjacent watershed and ensure aquatic organism passage by correcting perched culverts or removing other barriers within the easement.

1.3. Monitoring Plan Components

The monitoring plan from the approved Harrell Mitigation Site Mitigation Plan is listed below. Monitoring cross sections 1 and 2 were installed approximately 200 feet downstream of their location on the IRT approved mitigation plan map. The installed locations of cross sections 1 and 2 are still within Wetland B. Vegetation plot 3 was moved approximately 50 feet eastward due to stream channel component constraints associated with the proposed location. Other monitoring feature locations did not deviate significantly from the approved plan.

Harrell Mitigation Site Monitoring Plan Components				
Parameter	Method	Quantity	Frequency	Notes
Dimension	Riffle Cross Sections	3	Years 1, 2, 3, 5, & 7	Measured dimensions will be compared to reference dimensions to calculate bed-width index and max-depth index
	Pool Cross Sections	3	Years 1, 2, 3, 5, & 7	Bank pins will be installed only in areas of concern
Pattern	Visual Inspection	None	Bi-annual	Bank pins will be installed only in areas of concern
Profile	Visual Inspection	None	Bi-annual	Additional profile measurements may be required if problems are identified during the monitoring period
Substrate	Pebble Counts	3	Years 1, 2, 3, 5, & 7	
Surface Water Hydrology	Stream Gauge -Continuous Recorder	1	Semi-annual	The device will be inspected on a semi-annual basis to document the occurrence of bankfull events on the project
Groundwater Hydrology	Groundwater Gauges	9	Annual	Data will be downloaded on a monthly basis during the growing season
Vegetation	Vegetation Plots	5	Annual	Vegetation monitoring will follow CVS protocol
Exotic and Nuisance Vegetation	Visual Inspection	N/A	Semi-annual	Approximate locations of exotic and nuisance vegetation and the occurrence of beaver dams will be mapped
Project Boundary	Visual Inspection	N/A	Semi-annual	Locations of vegetation damage, boundary encroachments, etc. will be mapped

1.4. Project Performance Standards

The stream restoration performance standards for the project will follow accepted and approved criteria based on the Final Mitigation Plan for the Harrell Mitigation Site (2019). Performance standards conform with the performance criteria provided in The Harrell Site Mitigation Plan which references the DMS Stream and Wetland Mitigation Plan Template and Guidance (October 2015), the Annual Monitoring Template (April 2015), and the Closeout Report Template (v2.1 March 2015). Performance criteria will be evaluated throughout the seven-year monitoring period.

Harrell Mitigation Site Performance Standards		
Objective	Performance Standard	Monitoring Approach
Construct stream channels that will maintain proper dimension, pattern and profile	<ul style="list-style-type: none"> · Riffle section W/D ratios should remain within the range of the appropriate stream type. · BHR should not exceed 1.2. BHR should not change more than 10% in any given monitoring interval. Changes that do occur should indicate a trend toward stability. · Entrenchment Ratios should be ≥ 2.2 for C/E channels and ≥ 1.4 for B Channels. · Document continuous surface flow in tributaries for at least 30 consecutive days in each year 	<p>Survey of select cross sections and visual assessment.</p> <p>Continuous stage recorders for base</p>
Construct streams with proper bankfull to floodplain relationship	Four bankfull events or greater, in separate years, will be documented during the monitoring period	Crest gauges, continuous stage recorders, and debris lines.
Construct streams that provide naturally stable dimensions and stabilize constructed banks with appropriate bioengineering	Channel banks should generally remain stable. Where bank migration does occur, it should not exceed 20% of the bankfull width.	Visual assessment and bank pin monitoring as necessary.
Construct streams that maintain an appropriate sediment transport balance with the sediment that is supplied by the watershed so that the overall stream profile neither aggrades nor degrades over time.	Profile adjustments should not indicate significant aggradation or degradation. BHR requirements as stated above.	Resurvey of longitudinal profile if visual assessment indicates potential instability.
Create and improve stream bedform diversity by constructing pools of varied depths and riffles of varied slopes	Profile should maintain a diversity of depths expressed in riffle/pool forms.	Visual assessment

Objective	Performance Standard	Monitoring Approach
Construct stable riffles that provide an improved diversity of bed material clast and a reduction in fines relative to existing conditions	Substrate material should progress towards or maintain coarser material in riffles and runs with finer material present in pools and glides.	Pebble count measurements at surveyed cross sections
Construct in-stream habitat features from native material to provide a diversity of habitats	In-stream habitat structures should remain intact and functional.	Visual assessment
Provide a buffer from agricultural activities and row crops	Record conservation easement prior to implementation.	None
Plant native climax tree species and understory species in the riparian zone	Minimum of 320 stems/ac present at MY-3. Minimum of 260 stems/ac present at MY-5. Minimum of 210 stems/ac present at MY-7.	Vegetation plots
Reconstruct stream channels that are properly connected to the riparian wetlands	Groundwater elevation within 12 inches of the ground surface for 12% of the growing season.	Groundwater monitoring gauges
Re-grade topography to eliminate ditches and drainage features	Groundwater elevation within 12 inches of the ground surface for 12% of the growing season.	Groundwater monitoring gauges
Plant native wetland tree and shrub species	Minimum of 320 stems/ac present at MY-3. Minimum of 260 stems/ac present at MY-5. Minimum of 210 stems/ac present at MY-7. Approved alternative performance standard for height metric: planted stems in the wetlands will meet a minimum of 4 feet in height at MY-5 and six feet in height at MY-7.	Vegetation plots
Establish a conservation easement that provides a minimum buffer from future activities in the adjacent watershed.	Record conservation easement prior to implementation.	None

1.5. Mitigation Components

The Harrell Mitigation Site generated 1,854 SMUs and 3.53 WMUs. Refer to Figure 2 for the project component/ asset map for a visual description of the project assets and Table 1 for project components and mitigation credit information for the Harrell Site. These credits are based on the IRT approved mitigation plan.

1.6. Restoration Type and Approach

Earthwork activities included excavation of the proposed channels, partial or complete backfilling of existing channels, and removal of spoil berms. Grading was designed to restore or mimic natural contours.

1.6.1. Stream Restoration

Harrell Creek Reach 1B

Reach 1B was constructed using a headwater treatment, which is appropriate for small streams and steep slopes. The channel bed and banks were constructed of a harvested cobble/ brush matrix. The harvested cobble is of a sufficient size to resist the elevated shear stress and the brush provides roughness, which encourages stability in the high-performance reach.

Harrell Creek Reach 1C and 1D

Reaches 1C and 1D were constructed to form a low-gradient, meandering, Type-E channel. Channel banks were constructed of harvested sod and willow transplants to provide immediate roughness, bank stability, and shading. The stream bed was constructed using harvested cobble. The riffle slopes in these reaches are lower than the maximum sustainable design riffle slopes allowed by large cobble size, but the utilization of cobble, in conjunction with the willow transplants, discourages the growth of herbaceous vegetation within the channel bed. After completion of grading operations, the remaining topsoil and was redistributed across the floodplain bench to facilitate vegetation success.

Channel construction deviated from the design in one area; from approximate STA 115+75 to approximate STA 117+20. In this location the contractor encountered unstable soil conditions and was unable to restore the channel in its existing location. It was determined that adjusting the channel to its as-built location was the preferable alternative, both in terms of constructability and stability.

1.6.2. Wetland Rehabilitation and Re-establishment

Re-establishment of the wetlands involved removal of any overburden material to expose the underlying buried hydric soils. Wetland hydrology was restored by raising stream bed elevations. Additional grading activities included harvesting usable topsoil material for re-use on portions of the re-graded floodplain, removal of spoil berms, and grading of off-channel depressional features to provide additional retention of surface water and increased habitat diversity. Re-establishment areas were planted with native vegetation. Rehabilitation of the existing wetlands involved stabilizing wetland hydrology and replanting.

1.6.3. Additional Site Considerations

Tribal Consultation

Representatives from DMS, EW Solutions, and Stantec met with Steven Yerka, Tribal Historic Preservation Specialist with the Eastern Band of Cherokee Indians (EBCI) on January 9, 2020 for an on-site meeting to review the planting plan and proposed planting logistics. The EBCI were provided project planting dates and observed planting within the documented cultural resource areas as required. No cultural resources or artifacts were identified by the planting contractor or the EBCI during project planting and EBCI was complimentary of the project mitigation efforts on the site.

Nuisance Wildlife

Beaver activity was noted in reach 1D prior to, during, and after completion of construction. No dams or lodges are present, but beaver have placed vegetative material into the upstream end of the culvert under Caney Fork Road, which caused temporary inundation of the lower half of Reach 1D; the

culvert was cleared in mid-January, allowing for the area to drain. Equinox has initiated discussions with NCDOT Division 14 engineers who have committed to regular monitoring of the culvert to identify and address impoundment, when necessary. Furthermore, NCDOT will employ an on-call nuisance wildlife professional if trapping and removal of beaver becomes necessary.

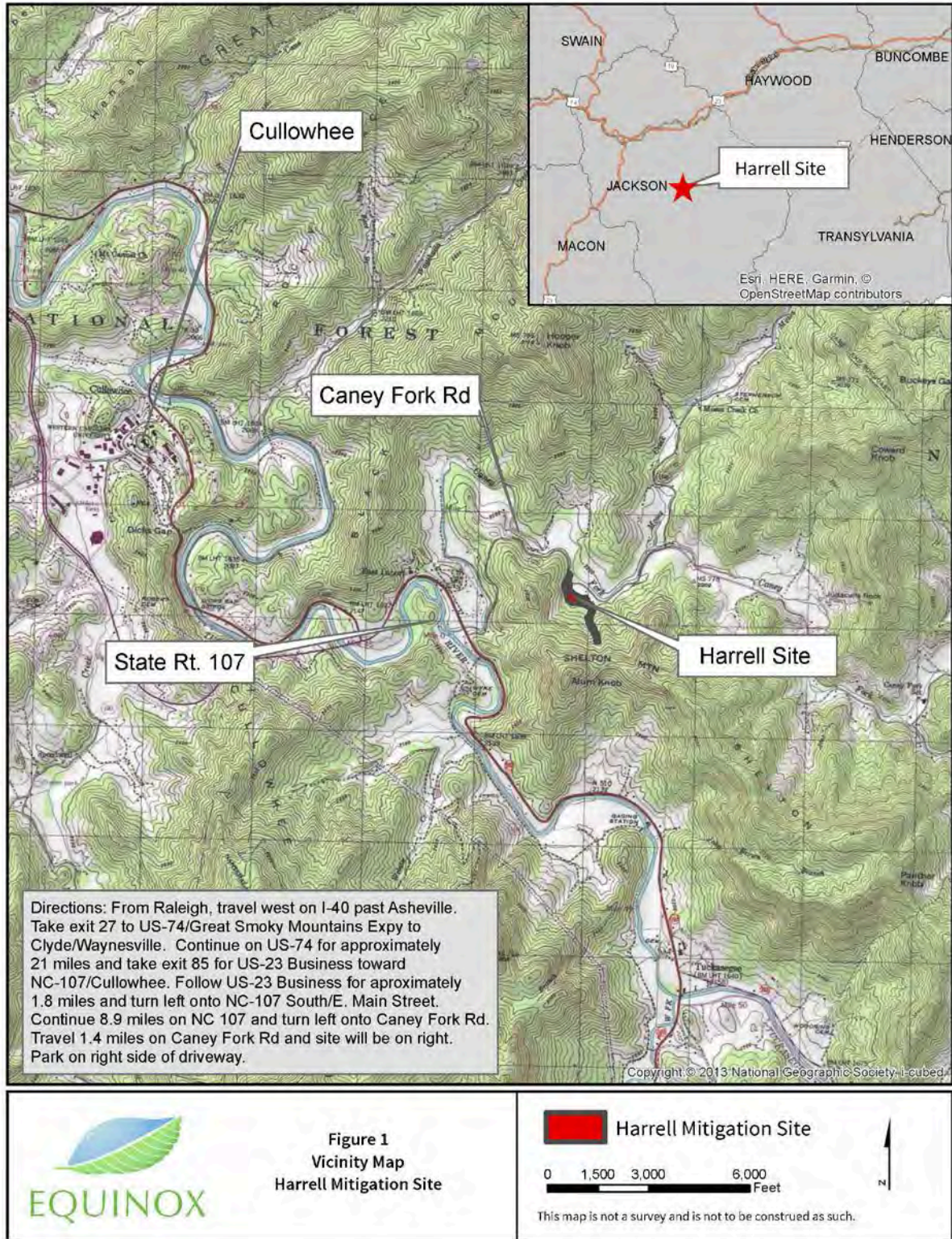
1.7. As-Built Record Drawings

A sealed set of the record drawings are located in Appendix E. Adjustments from the design plans are listed below.

Harrell Creek – Reach 1C

- Sta 115+75 – 117+17 Thalweg & Top of Bank Deviation

1.8. Vicinity Map



2.0 REFERENCES

Kee Mapping and Survey. 2019. As-Built Survey of Harrell Creek Restoration Project. Prepared for EW Solutions.

Stantec Consulting, Inc. 2019. Final Mitigation Plan – Harrell Mitigation Site. . Prepared for North Carolina Department of Environmental Quality, Division of Mitigation Services. DMS Project No. 100005.

Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (<http://cvs.bio.unc.edu/methods.htm>).

DMS Stream and Wetland Mitigation Annual Monitoring Template (June 2017)

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Appendix A

Background Tables

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Table 1. Project Mitigation Assets and Components									
Harrell Mitigation Site									
Project Segment	Existing Footage or Acreage	Mitigation Plan Footage or Acreage	Mitigation Category	Restoration Level	Priority Level	Mitigation Ratio (X:1)		As-Built Centerline Footage or Acreage [^]	Comments
Reach 1A	654	640	Cold	P	NA	10.0		640	
Reach 1B	286	273	Cold	R	PI	1.0		273	Less 38' for crossing and outlet protection. Less than 30' buffer for 41 LF
Reach 1C	1,265	1,268	Cold	R	PI	1.0		1,189	0.026 ac impact to Wetland B
Reach 1D	223	249	Cold	R	P1	1.0		294	Less 13' for ROW Less than 30' buffer for 32 LF 0.008 ac impact to Wetland A
Wetland A	1.59	1.58	RNR	Re (Pres)		0.0		1.58	Existing wetland will be protected 0.008 ac impact to Wetland A for stream construction
Wetland A	1.59	0.26	RNR	R(Re-est)		1.0		0.26	Area of the existing channel within the wetland was filled and replanted
Wetland B	0.24	0.22	RNR	R (Rehab)		1.0		0.22	0.026 ac impact to Wetland B for stream construction
Wetland C	-	3.05	RNR	R (Re-Est)		1.0		3.05	

[^] Based on centerline calculations from the as-built survey, accounts for breaks in conservation easement and utility right-of-ways.

Project Credits

Restoration Level	Stream			Riparian Wetland		Non-Rip	Coastal
	Warm	Cool	Cold	Riverine	Non-Riv	Wetland	Marsh
Restoration	-	-	1790	-	-	-	-
Re-establishment				-	3.31	-	-
Rehabilitation				-	0.22	-	-
Enhancement				-	-	-	-
Enhancement I	-	-	-				
Enhancement II	-	-	-				
Creation				-	-	-	-
Preservation	-	-	64	-	-	-	
Total Credits[%]	-	-	1,854	-	3.53	-	-

[%] Project credits reflect the sum of credits outlined in the IRT approved mitigation plan. Mitigation plan credits account for breaks in conservation easements and are based on centerline design stream stationing and taken from the IRT approved mitigation plan. Mitigation plan credits are the same as the IRT approved mitigation plan.

* Wetland A will be protected but is not generating wetland credit due to the 100% Restoration credit requirement in RFP 16-008611

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Table 2. Project Activity and Reporting History Harrell Mitigation Site		
Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	Dec - 2018	Jan - 2019
Mitigation Plan Addendum	-	-
Final Design - Construction Plans	-	June - 2019
Construction	-	Aug - 2019
Temporary S&E Mix Applied	-	Aug - 2019
Permanent Seed Mix Applied	-	Aug - 2019
Bare Root and Live Stake Plantings	-	Jan - 2020
Baseline Monitoring Document (Year 0 Monitoring - Baseline)	Jan - 2020	Feb - 2020
Stream Assessment	Jan - 2020	-
Vegetation Assessment	Jan - 2020	
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

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Table 3. Project Contacts Harrell Mitigation Site	
Prime Contractor	EW Solutions 37 Haywood Street, Suite 100 Asheville, NC 28801 David Tuch (828) 253-6856
Designer	Stantec Consulting, Inc 56 College Street, Suite 201 Asheville, North Carolina 28801 Grant Ginn (828) 449-1930
Construction Contractor	Penland Contracting, Inc 300 NP&L Loop Franklin, NC 28734 Lewis Penland (828) 421-1753
Seeding Contractor	Penland Contracting, Inc 300 NP&L Loop Franklin, NC 28734 Lewis Penland (828) 421-1753
Planting Contractor	Equinox 37 Haywood St. Asheville, North Carolina 28801 Owen Carson (828) 253-6856
As-built Surveys	Kee Mapping 88 Central Ave. Asheville, NC 28801 Brad Kee (828) 575-9021
Seeding Mix Source	Hancock Farm & Seed 18724 Hancock Farm Rd Dade City, FL 333523 (352) 567-6971
Live Stakes	Mellow Marsh Farms 1312 Woody Store Road Siler City, NC 27344 (919) 742-1200
Monitoring Performers (MY0)- 2020	Equinox 37 Haywood St. Asheville, North Carolina 28801 Owen Carson (828) 253-6856 ext. 204 Danvey Walsh (828) 253-6856 ext.201

Table 4. Project Baseline Information and Attributes				
Project Information				
Project Name	Harrell Stream and Wetland Mitigation Site			
County	Jackson			
Project Area (acres)	8.45			
Project Coordinates (latitude and longitude)	35.300533° N, -83.133689° W			
Project Watershed Summary Information				
Physiographic Province	Blue Ridge Mountains			
River Basin	Little Tennessee			
USGS Hydrologic Unit 8-digit	6010203	USGS Hydrologic Unit 14-digit	06010203010060	
DWR Sub-basin	04-04-02			
Project Drainage Area (acres)	102.0			
Project Drainage Area Percentage of Impervious Area	< 1%			
CGIA Land Use Classification	Agricultural			
Reach Summary Information				
Parameters	Reach 1A	Reach 1B	Reach 1C	Reach 1D
Length of Reach (linear feet)	640	273	1,268	249
Valley Confinement (Rosgen)	II	II	VII	VII
Drainage area (miles ²)	0.05	0.07	0.16	0.17
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	C	C	C	C
Stream Classification (existing)	A & B	G	E & F	E
Stream Classification (proposed)	A	B4	E4	E4
FEMA classification	-	-	-	-
Wetland Summary Information				
Parameters	Wetland A	Wetland B	Wetland C	
Size of Wetland (acres)	1.58	0.22	3.05	
Wetland Type (non-riparian, riparian riverine or riparian non-riparian)	Riparian	Riparian	Riparian	
Mapped Soil Series	NkA	NkA	NkA	
Drainage class	poorly	poorly	poorly	
Soil Hydric Status	Hydric	Hydric	Hydric	
Source of Hydrology	Groundwater	Groundwater	Groundwater	
Hydrologic Impairment	Agriculture/ Ditching	Agriculture/ Ditching	Agriculture/ Ditching	
Native vegetation community	Swamp-Forest Bog	Swamp-Forest Bog	Swamp-Forest Bog	
Percent composition of exotic invasive vegetation	15%	15%	1%	
Regulatory Considerations				
Regulation	Applicable?	Resolved?	Supporting Documentation	
Waters of the United States – Section 404	Yes	Yes	404 Permit #SAW-2016-02202	
Waters of the United States – Section 401	Yes	Yes	401 Permit #20161077	
Endangered Species Act	Yes	Yes	FFHWA Categorical Exclusion (CE)/ERTR	
Historic Preservation Act	Yes	N/A	FFHWA Categorical Exclusion (CE)/ERTR	
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A	
FEMA Floodplain Compliance	Yes	Yes	FEMA Floodplain Requirements Checklist (Jan-2019)	
Essential Fisheries Habitat	No	N/A	Jackson County, NC Floodplain Development Permit #2019-F187	
			N/A	

Appendix B
Visual Assessment Data

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Figure 2
 Assets Map
 Harrell Mitigation Site
 Jackson County, NC
 January 15, 2020



--- Conservation Easement
 - - - Boundary

Streams

- Preservation
- Restoration
- Reach Breaks

Wetlands

- Preservation (No Credit)
- Reestablishment
- Rehabilitation



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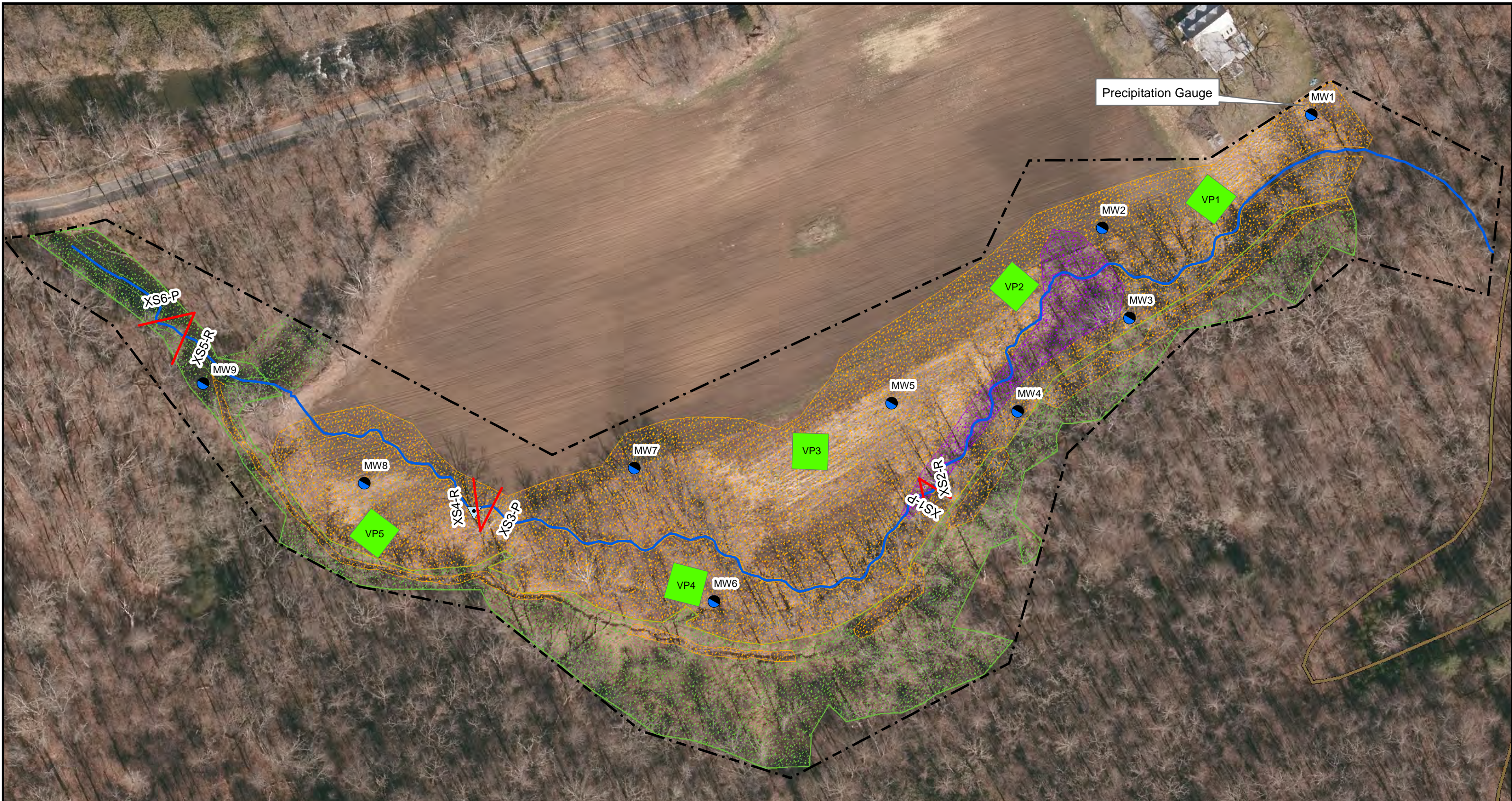






Figure 3
 Monitoring Features Map
 Harrell Mitigation Site
 Jackson County, NC
 January 15, 2020



Monitoring Features

-  Continuous Stage Recorder
-  Groundwater Gauge
-  Monitoring Cross Section
-  Vegetation Plot

-  Stream
-  Wetland Reestablishment
-  Wetland Preservation
-  Wetland Rehabilitation
-  Conservation Easement Boundary

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Vegetation Plot Photos



Vegetation Monitoring Plot 1



Vegetation Monitoring Plot 2



Vegetation Monitoring Plot 3



Vegetation Monitoring Plot 4



Vegetation Monitoring Plot 5

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Appendix C

Vegetation Plot Data

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Table 5: Current Plot Data (MY0) 2020 Harrell Mitigation Site																				
Scientific Name	Common Name	Species Type	Current Plot Data (MY0 2020)															Annual Means		
			100005-01-0001			100005-01-0002			100005-01-0003			100005-01-0004			100005-01-0005			MY0 (2020)		
			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	4	4	4	2	2	2	2	2	2	4	4	4	7	7	7	19	19	19
Asimina triloba	pawpaw	Tree										3	3	3				3	3	3
Betula nigra	river birch	Tree										4	4	4	6	6	6	10	10	10
Cephalanthus occidentalis	common buttonbush	Shrub							2	2	2	5	5	5	1	1	1	8	8	8
Cornus amomum	silky dogwood	Shrub	2	2	2	3	3	3	4	4	4	2	2	2	2	2	2	13	13	13
Fraxinus pennsylvanica	green ash	Tree	2	2	2	3	3	3	3	3	3	1	1	1	1	1	1	10	10	10
Ilex verticillata	common winterberry	Shrub	1	1	1	1	1	1				1	1	1	6	6	6	9	9	9
Lindera benzoin	northern spicebush	Shrub	2	2	2	1	1	1				5	5	5				8	8	8
Salix nigra	black willow	Tree	1	1	1	3	3	3				1	1	1	1	1	1	6	6	6
Stem count			12	12	12	13	13	13	11	11	11	26	26	26	24	24	24	86	86	86
size (ares)			1			1			1			1			1			5		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.12		
Species count			6	6	6	6	6	6	4	4	4	9	9	9	7	7	7	9	9	9
Stems per ACRE			486	486	486	526	526	526	445	445	445	1052	1052	1052	971	971	971	696	696	696

P=Planted, T=Planted & Volunteer

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

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Table 6: Vegetation Condition Assessment						
Planted Acreage	4.46					
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	n/a	0	0	0.00%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	n/a	0	0	0.00%
Total				0	0	0.00%
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	n/a	0	0	0.00%
Cumulative Total				0	0	0.00%
Easement Acreage	8.43					
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern¹	Areas or points (if too small to render as polygons at map scale).	1000 SF	Red 10% crosshatch	7	0.8	9.50%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	n/a	0	0	0.00%
¹ Remaining invasive areas are those that were unable to be treated mechanically during construction and consist of scattered individuals or small clusters of plants; treatment of these remaining populations is to occur in early summer of 2020.						

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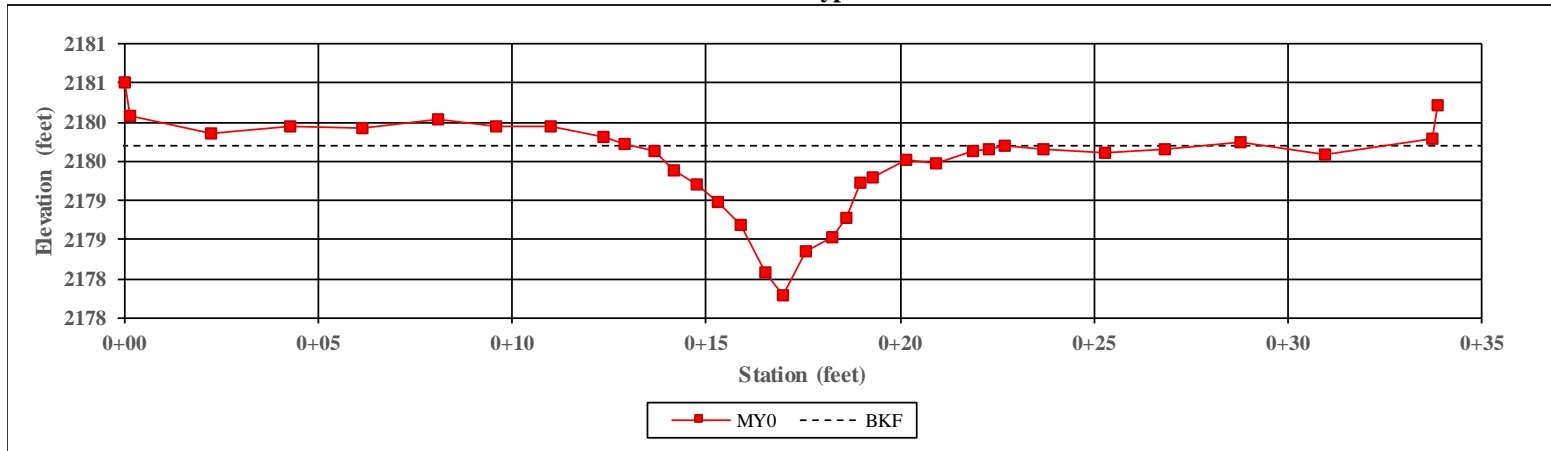
Appendix D
Stream Measurement and Geomorphology Data

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Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1C

XS Number: 1
XS Type: Pool

Station: 107+75



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	9.6	-	-	-	-	-	-	-
Floodprone Width (ft)	50.0	-	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.6	-	-	-	-	-	-	-
Bankfull Max Depth (ft)	1.9	-	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	6.0	-	-	-	-	-	-	-
Width/Depth Ratio	15.2	-	-	-	-	-	-	-
Entrenchment Ratio	5.2	-	-	-	-	-	-	-
Bank Height Ratio	1.0	-	-	-	-	-	-	-



Left Descending Bank

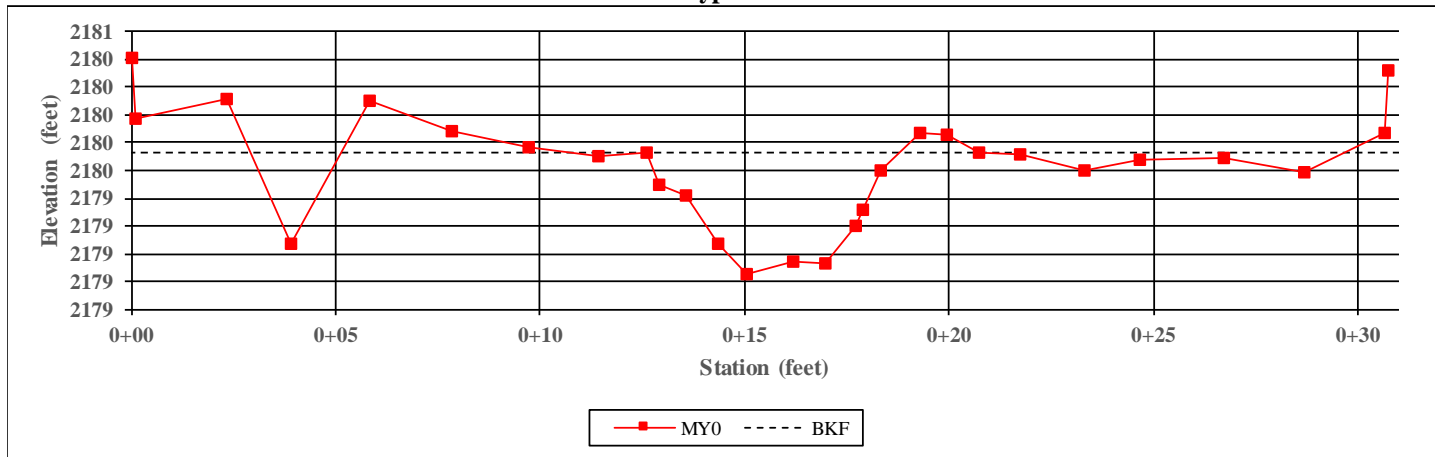


Right Descending Bank

Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1C

XS Number: 2
XS Type: Riffle

Station: 107+88



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	6.2	-	-	-	-	-	-	-
Floodprone Width (ft)	50.0	-	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.6	-	-	-	-	-	-	-
Bankfull Max Depth (ft)	0.9	-	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	3.4	-	-	-	-	-	-	-
Width/Depth Ratio	11.2	-	-	-	-	-	-	-
Entrenchment Ratio	8.1	-	-	-	-	-	-	-
Bank Height Ratio	1.1	-	-	-	-	-	-	-



Left Descending Bank

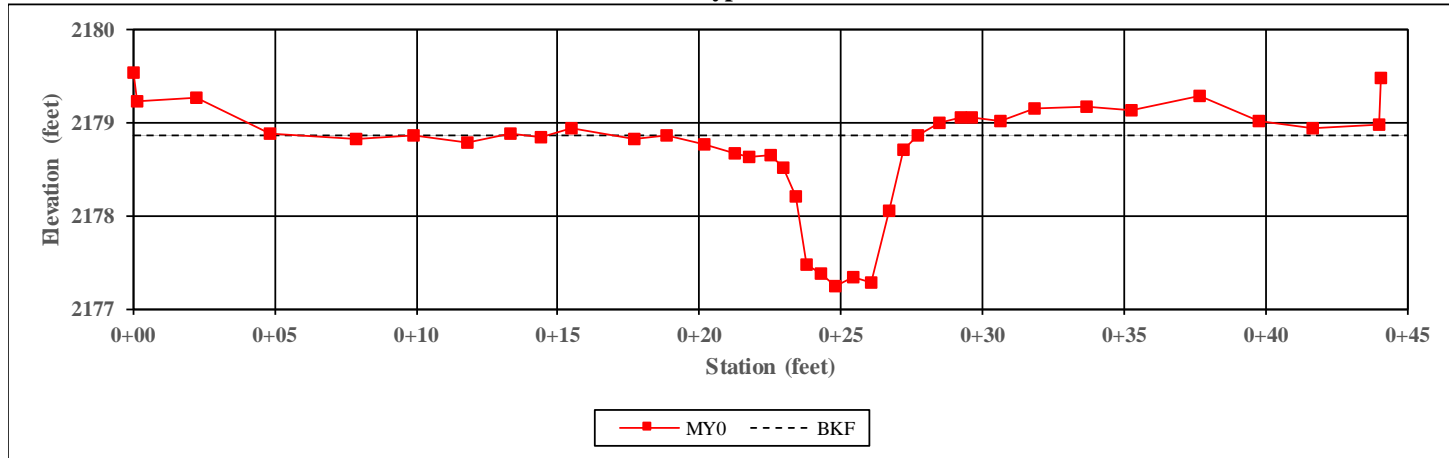


Right Descending Bank

Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1C

XS Number: 3
XS Type: Pool

Station: 112+76



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	5.2	-	-	-	-	-	-	-
Floodprone Width (ft)	50.0	-	-	-	-	-	-	-
Bankfull Mean Depth (ft)	1.0	-	-	-	-	-	-	-
Bankfull Max Depth (ft)	1.6	-	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	5.3	-	-	-	-	-	-	-
Width/Depth Ratio	5.1	-	-	-	-	-	-	-
Entrenchment Ratio	9.6	-	-	-	-	-	-	-
Bank Height Ratio	1.1	-	-	-	-	-	-	-



Left Descending Bank

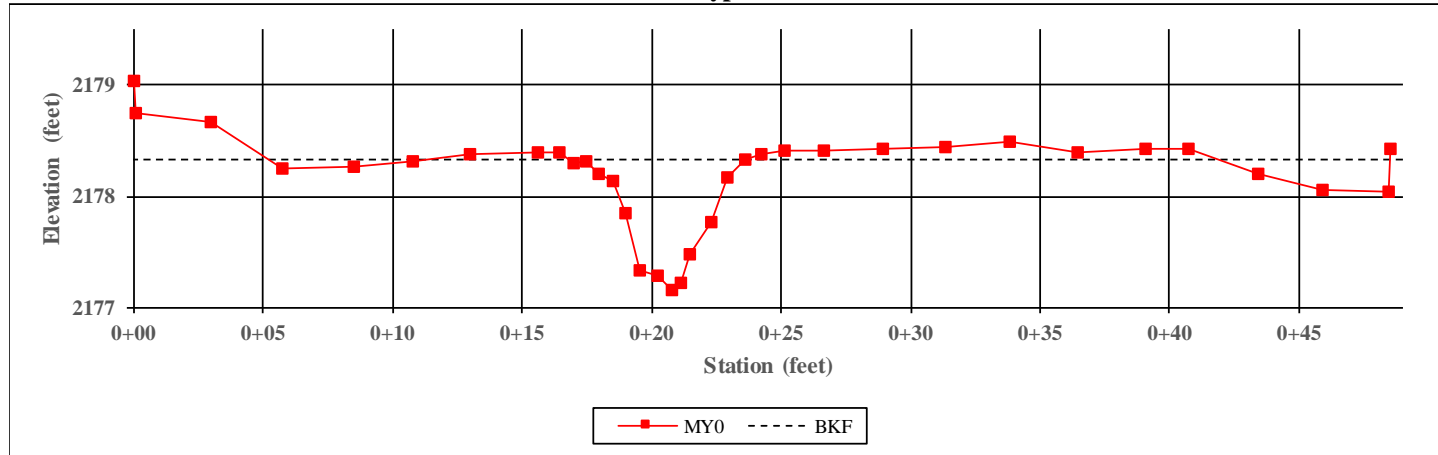


Right Descending Bank

Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1C

XS Number: 4
XS Type: Riffle

Station: 112+90



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	6.8	-	-	-	-	-	-	-
Floodprone Width (ft)	50.0	-	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.5	-	-	-	-	-	-	-
Bankfull Max Depth (ft)	1.2	-	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	3.6	-	-	-	-	-	-	-
Width/Depth Ratio	12.6	-	-	-	-	-	-	-
Entrenchment Ratio	14.8	-	-	-	-	-	-	-
Bank Height Ratio	1.0	-	-	-	-	-	-	-



Upstream Right and Left Bank

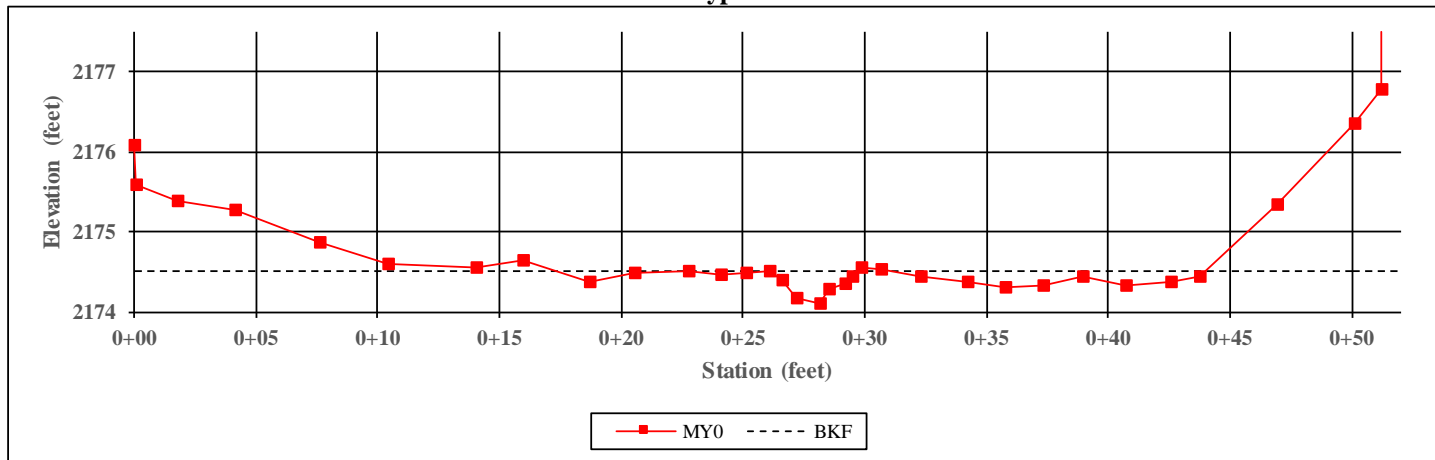


Right Descending Bank

Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1D

XS Number: 5
XS Type: Riffle

Station: 116+36



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	2.5	-	-	-	-	-	-	-
Floodprone Width (ft)	33.4	-	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.3	-	-	-	-	-	-	-
Bankfull Max Depth (ft)	0.4	-	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	0.7	-	-	-	-	-	-	-
Width/Depth Ratio	8.6	-	-	-	-	-	-	-
Entrenchment Ratio	13.2	-	-	-	-	-	-	-
Bank Height Ratio	1.0	-	-	-	-	-	-	-



Left Descending Bank

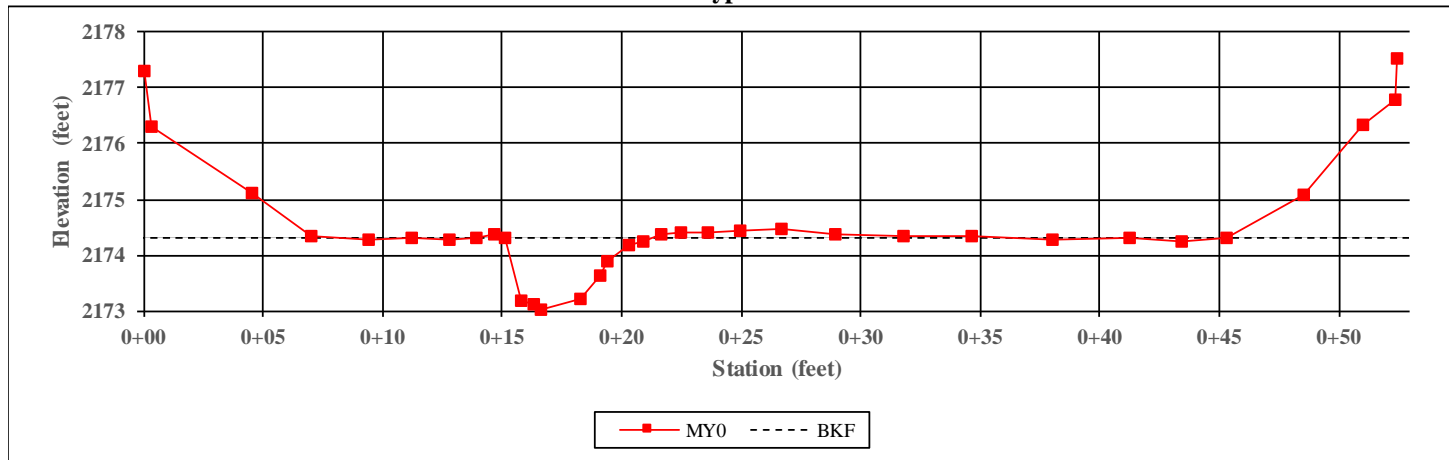


Right Descending Bank

Project Name: Harrell Stream & Wetland
Reach Name: Harrell Creek Reach 1D

XS Number: 6
XS Type: Pool

Station: 116+65



CHANNEL DIMENSIONS SUMMARY	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankful Width (ft)	6.1	-	-	-	-	-	-	-
Floodprone Width (ft)	38.3	-	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.7	-	-	-	-	-	-	-
Bankfull Max Depth (ft)	1.3	-	-	-	-	-	-	-
Bankfull Cross-Sectional Area (ft ²)	4.5	-	-	-	-	-	-	-
Width/Depth Ratio	8.3	-	-	-	-	-	-	-
Entrenchment Ratio	6.3	-	-	-	-	-	-	-
Bank Height Ratio	1.0	-	-	-	-	-	-	-

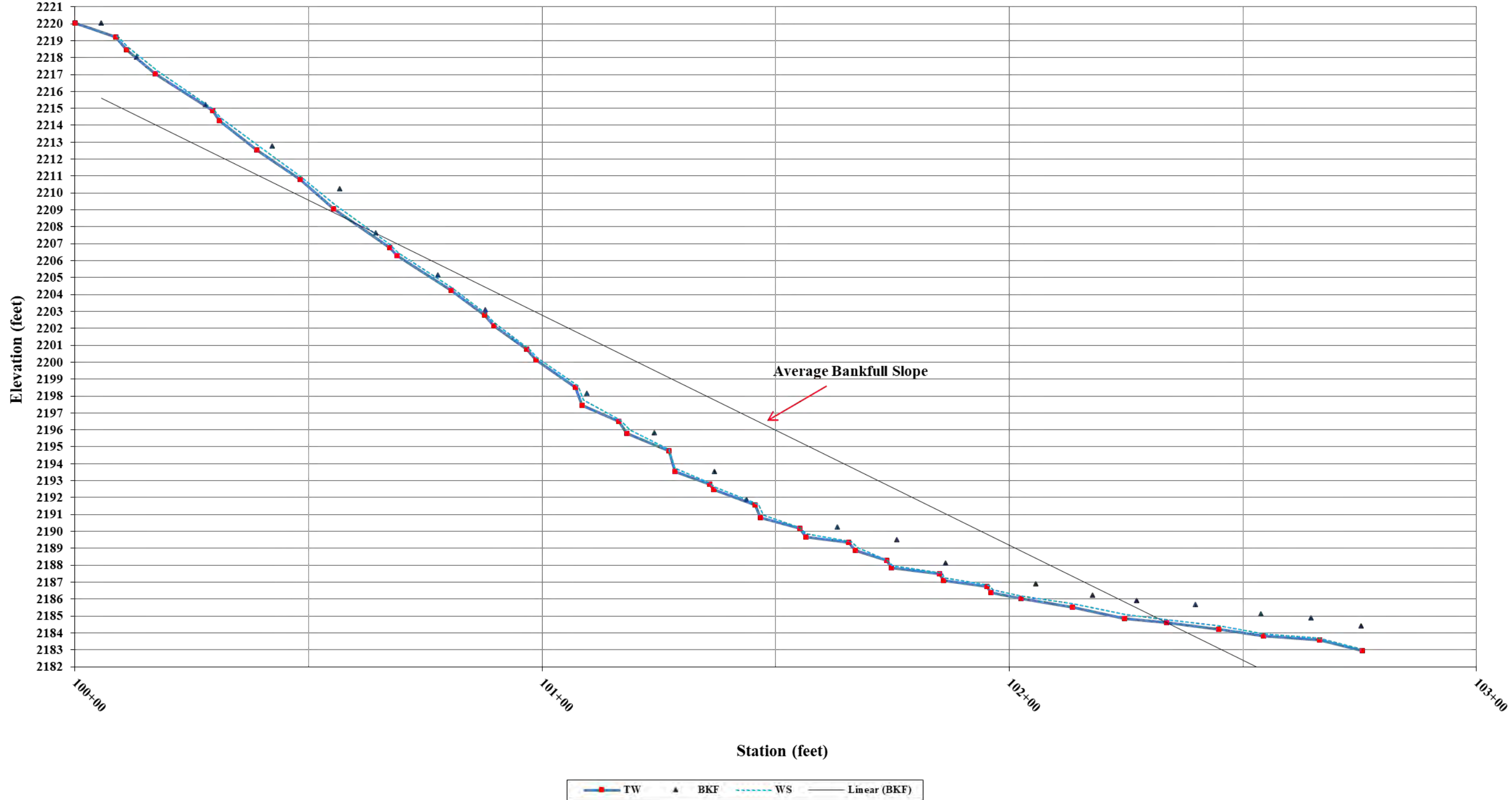


Left Descending Bank

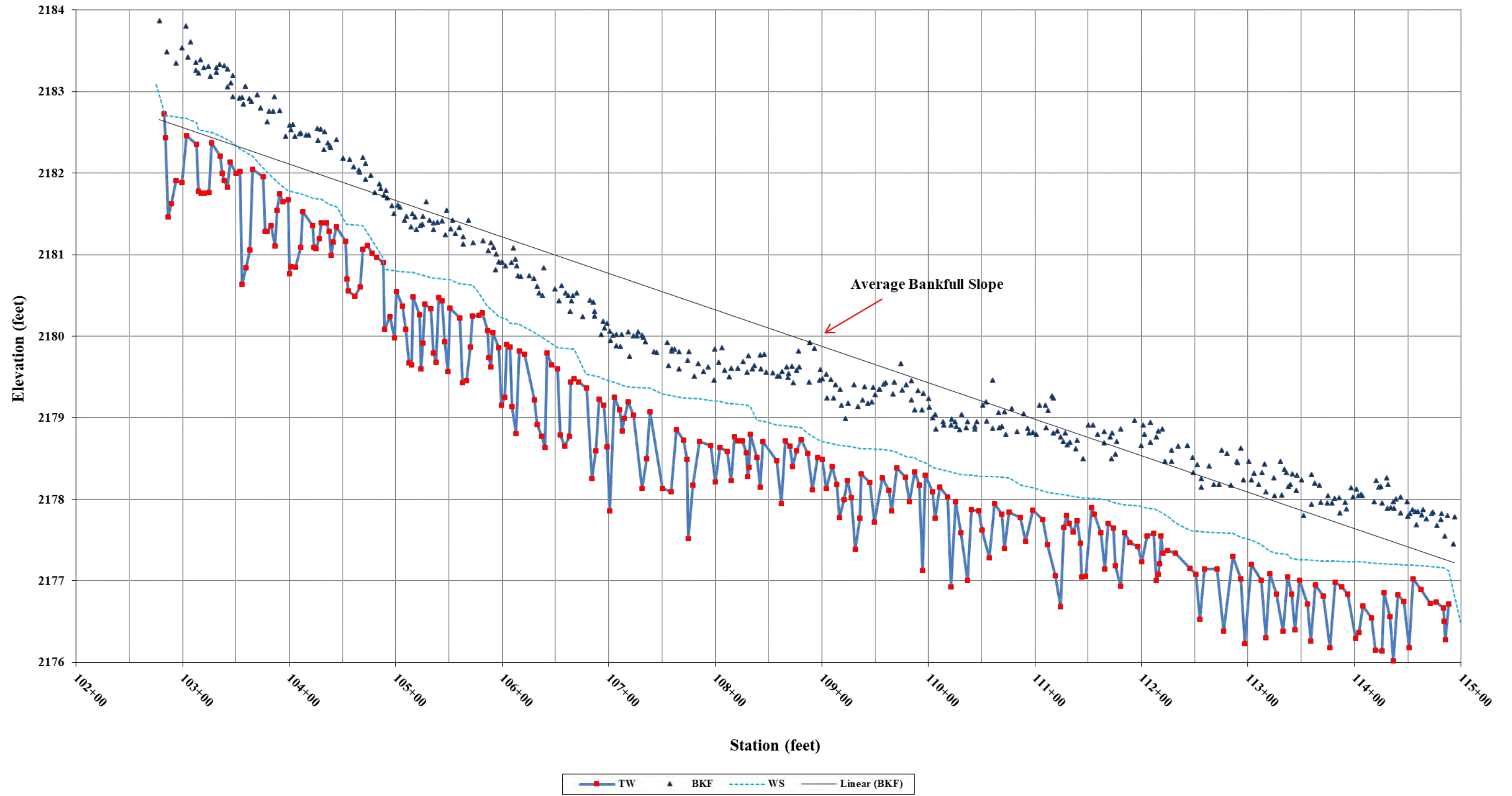


Right Descending Bank

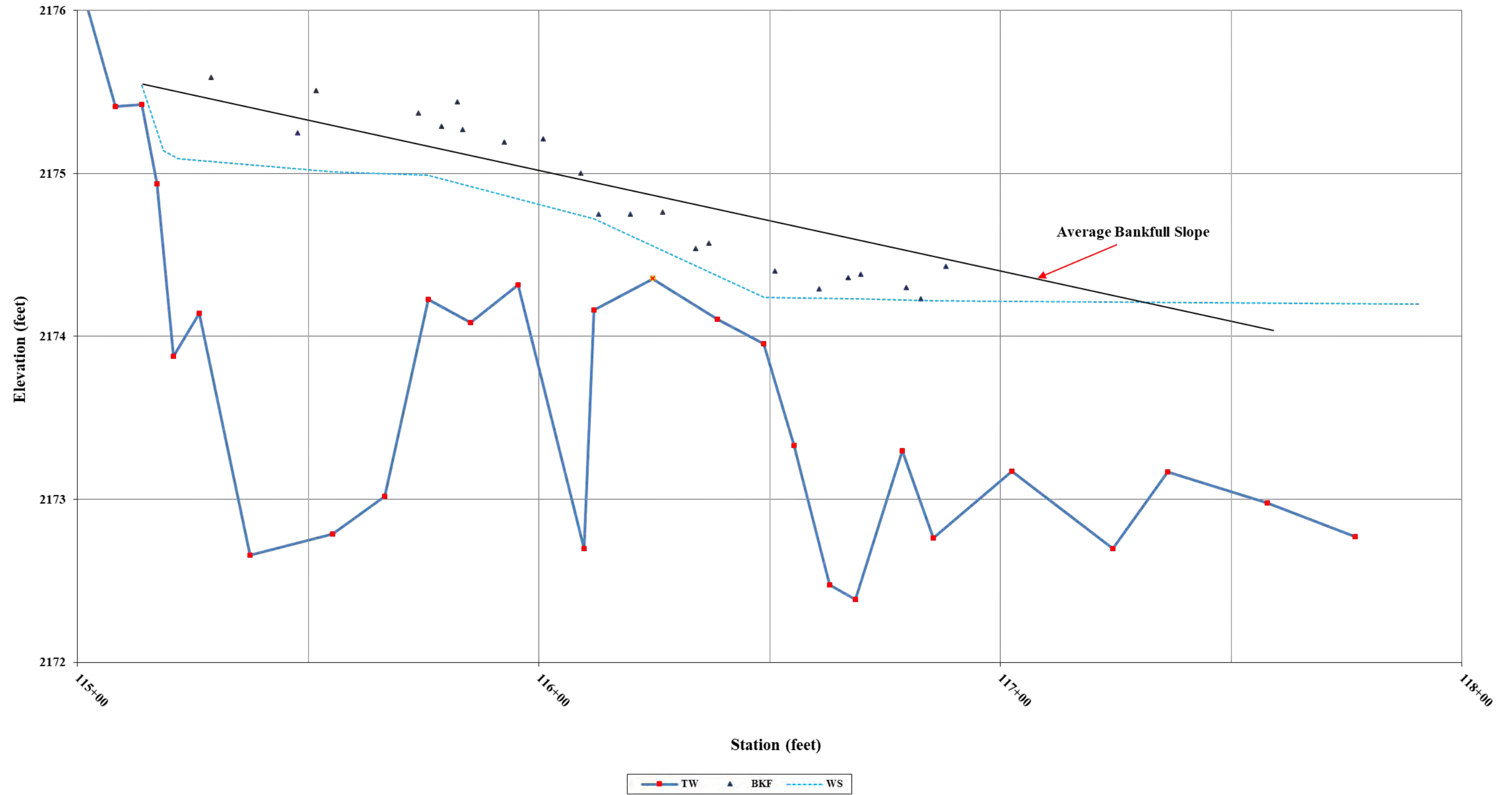
**Harrell Creek Reach 1B - Longitudinal Profile
Stationing 100+00 to 102+80**



Harrell Creek Reach 1C - Longitudinal Profile
Stationing 102+80 to 115+00

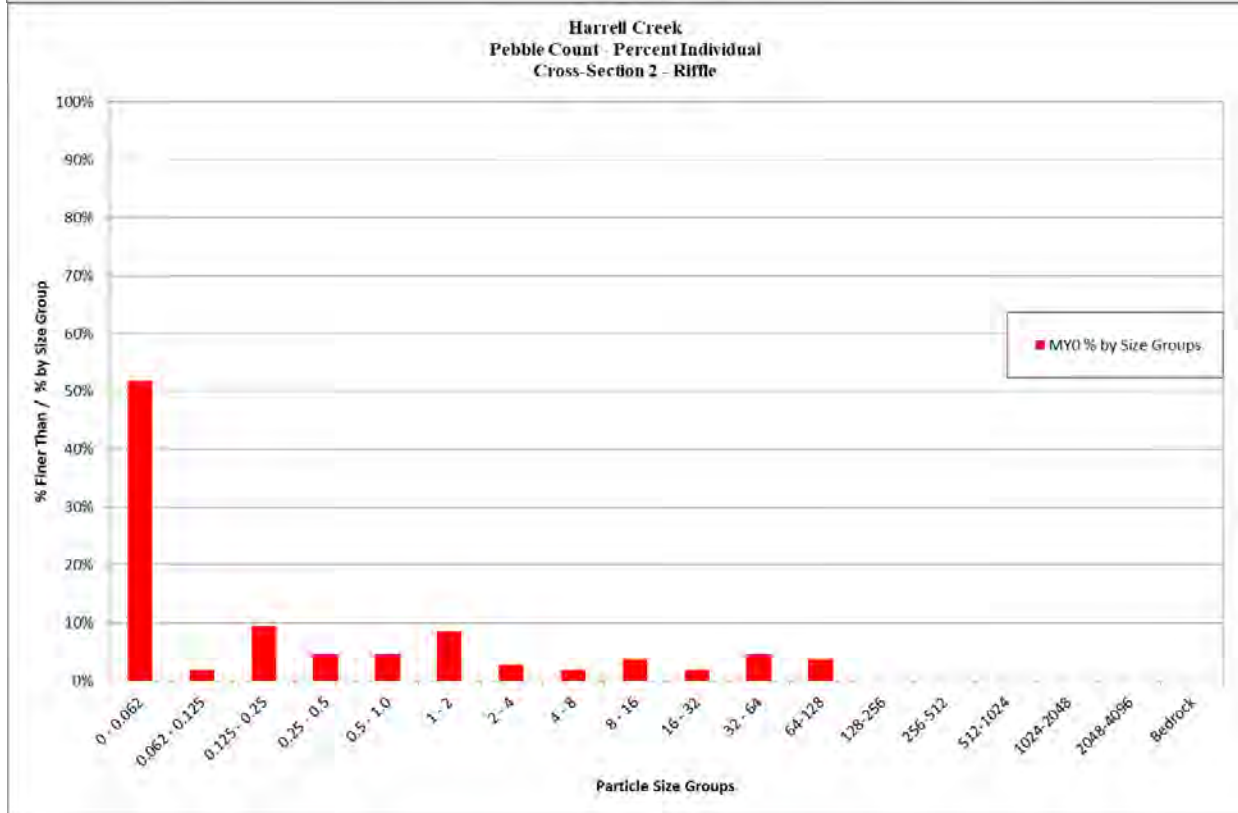
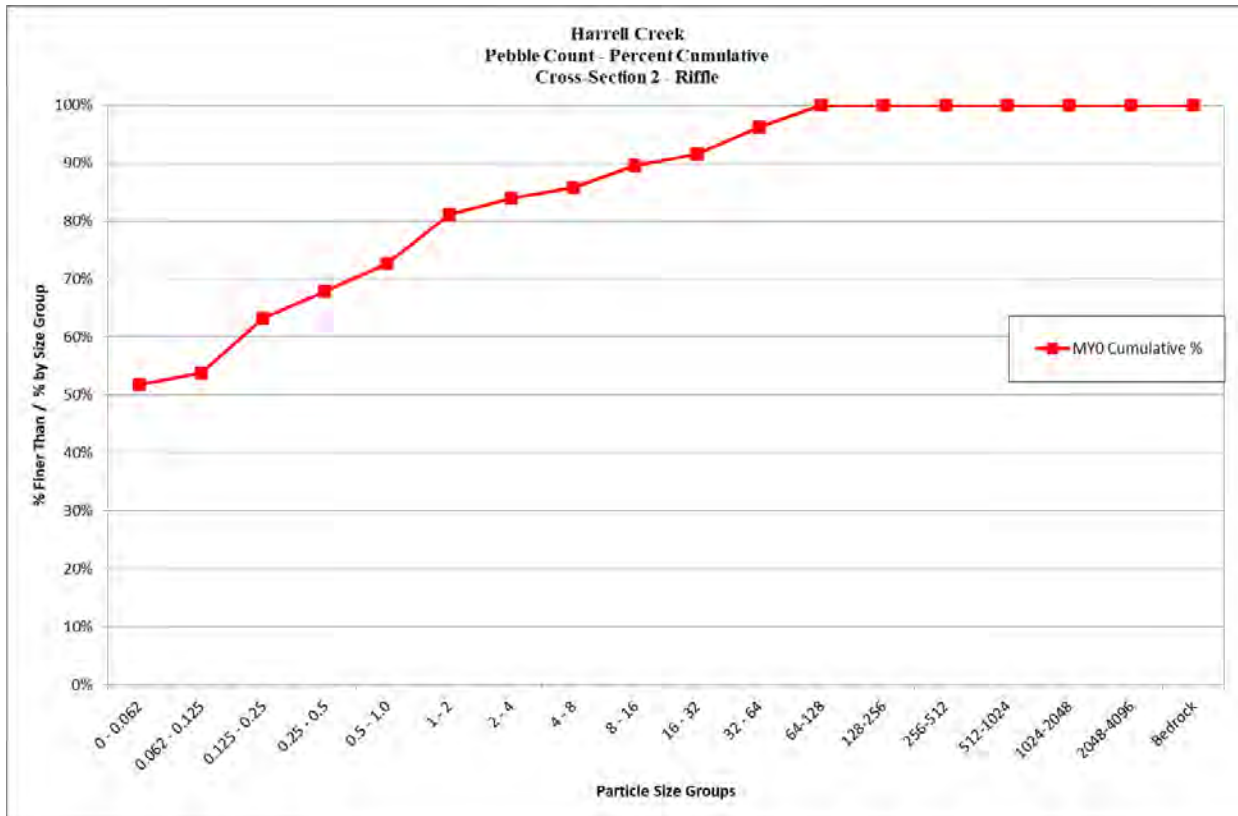


Harrell Creek Reach 1D - Longitudinal Profile
 Stationing 115+00 to 117+80

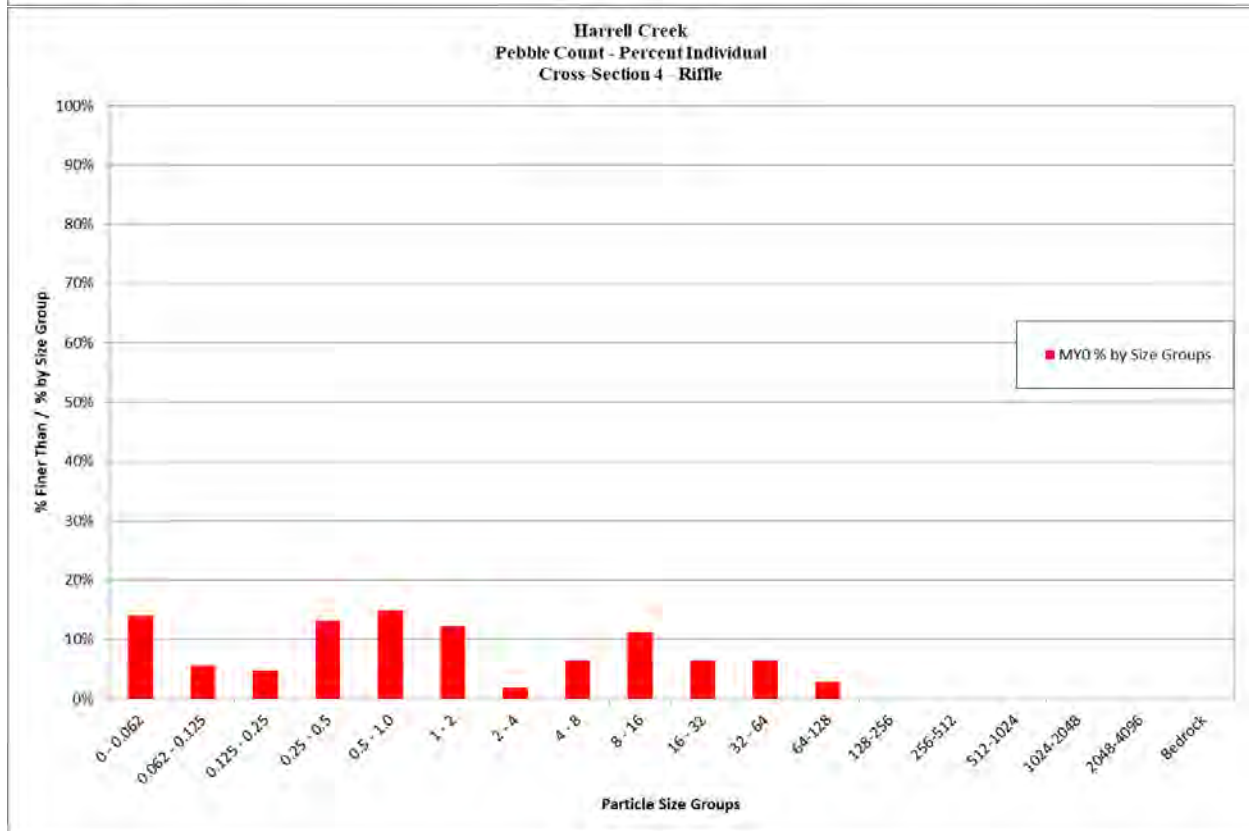
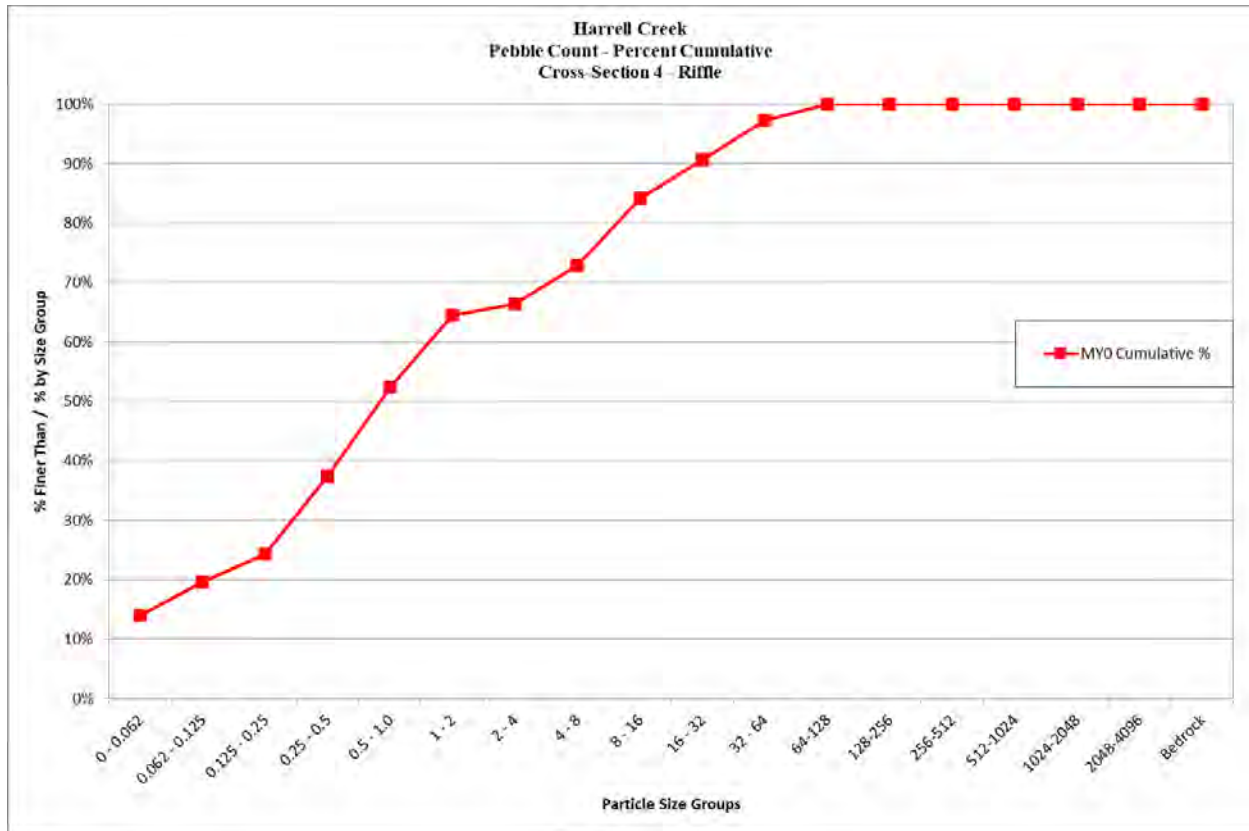


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Harrell Mitigation Site			
Cross Section 2 - Riffle			
Monitoring Year - 2020; MY0			
Bed Surface Material Particle Size Class (mm)	Number	% Individual	% Cumulative
0 - 0.062	55	51.9%	52%
0.062 - 0.125	2	1.9%	54%
0.125 - 0.25	10	9.4%	63%
0.25 - 0.5	5	4.7%	68%
0.5 - 1.0	5	4.7%	73%
1 - 2	9	8.5%	81%
2 - 4	3	2.8%	84%
4 - 8	2	1.9%	86%
8 - 16	4	3.8%	90%
16 - 32	2	1.9%	92%
32 - 64	5	4.7%	96%
64-128	4	3.8%	100%
128-256	0	0.0%	100%
256-512	0	0.0%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	106	100%	100%
Summary Data			
	D50	0.062	
	D84	4	
	D95	55	



Harrell Mitigation Site			
Cross Section 4 - Riffle			
Monitoring Year - 2020; MY0			
Bed Surface Material Particle Size Class (mm)	Number	% Individual	% Cumulative
0 - 0.062	15	14.0%	14%
0.062 - 0.125	6	5.6%	20%
0.125 - 0.25	5	4.7%	24%
0.25 - 0.5	14	13.1%	37%
0.5 - 1.0	16	15.0%	52%
1 - 2	13	12.1%	64%
2 - 4	2	1.9%	66%
4 - 8	7	6.5%	73%
8 - 16	12	11.2%	84%
16 - 32	7	6.5%	91%
32 - 64	7	6.5%	97%
64-128	3	2.8%	100%
128-256	0	0.0%	100%
256-512	0	0.0%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	107	100%	100%
Summary Data			
D50		0.9	
D84		16	
D95		54	



Harrell Mitigation Site			
Cross Section 5 - Riffle			
Monitoring Year - 2020; MY0			
Bed Surface Material Particle Size Class (mm)	Number	% Individual	% Cumulative
0 - 0.062	24	22.6%	23%
0.062 - 0.125	7	6.6%	29%
0.125 - 0.25	2	1.9%	31%
0.25 - 0.5	8	7.5%	39%
0.5 - 1.0	7	6.6%	45%
1 - 2	21	19.8%	65%
2 - 4	4	3.8%	69%
4 - 8	9	8.5%	77%
8 - 16	13	12.3%	90%
16 - 32	4	3.8%	93%
32 - 64	4	3.8%	97%
64-128	2	1.9%	99%
128-256	1	0.9%	100%
256-512	0	0.0%	100%
512-1024	0	0.0%	100%
1024-2048	0	0.0%	100%
2048-4096	0	0.0%	100%
Bedrock	0	0.0%	100%
Total	106	100%	100%
		Summary Data	
		D50	1.2
		D84	11
		D95	49

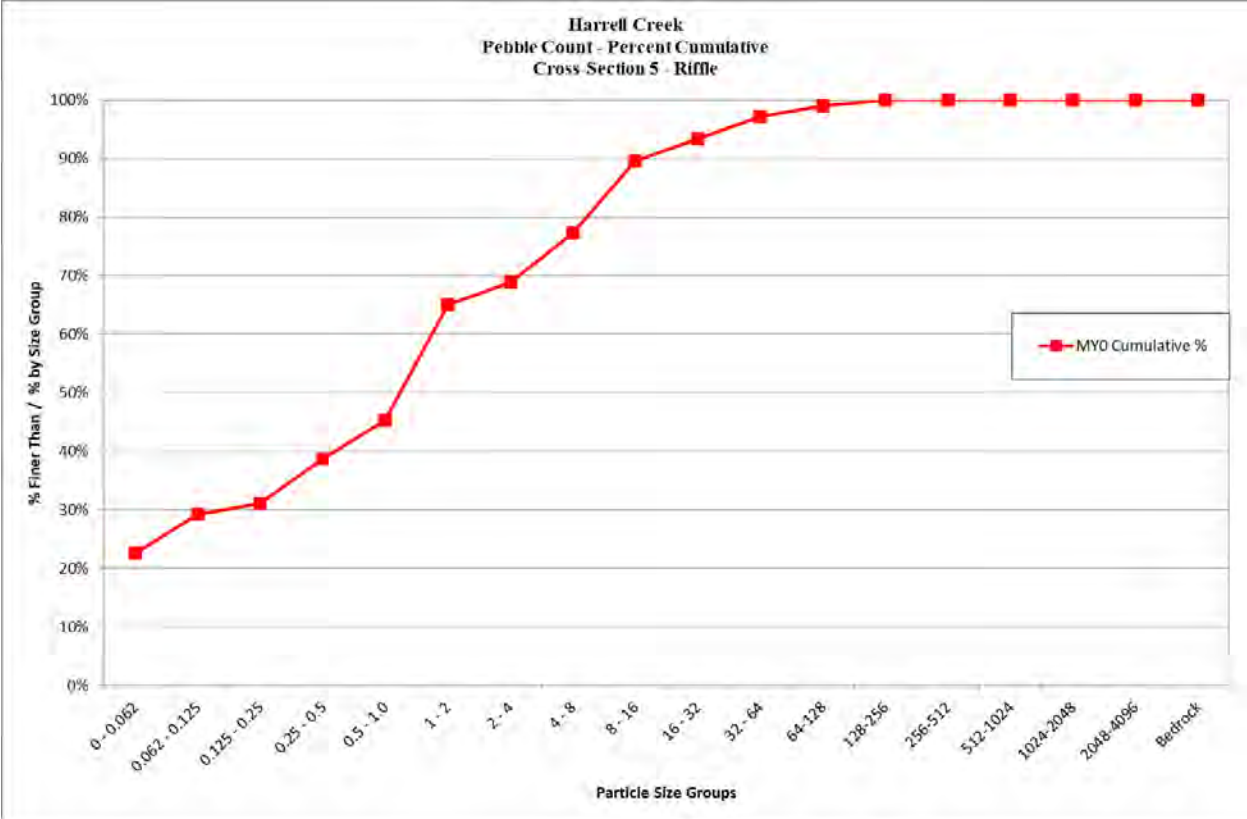
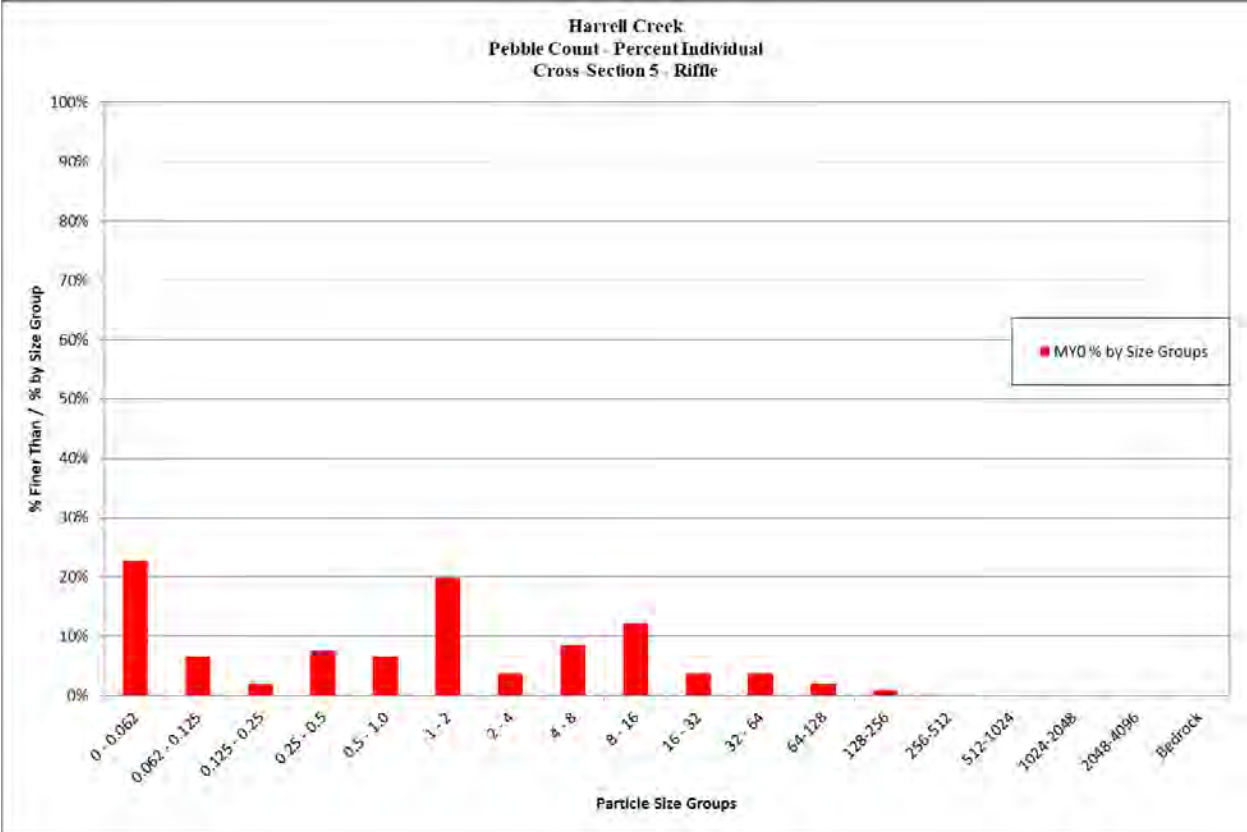


Table 7. Baseline Stream Data Summary																										
Harrell Mitigation Site - Harrell Creek Reach 1B (273 feet)																										
Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline							
	LL	UL	Eq.	Min	Mean	Med	Max	SD	N	Min	Mean	Med	Max	SD	N	Min	Mean	Max	Min	Mean	Med	Max	SD	N		
Dimension & Substrate - Riffle																										
Bankfull Width (ft)	-	-	-	3.6	3.9	-	4.2	-	2	3.3	-	-	5.4	-	-	-	6.5	-	-	-	-	-	-	-	-	-
Floodprone Width (ft)	-	-	-	5.0	5.5	-	6.0	-	2	7.0	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	
Bankfull Mean Depth (ft)	-	-	-	0.7	0.7	-	0.7	-	2	0.3	-	-	0.5	-	-	-	0.34	-	-	-	-	-	-	-	-	
Bankfull Max Depth (ft)	-	-	-	0.8	0.8	-	0.8	-	2	0.4	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	
Bankfull Cross Sectional Area (ft ²)	-	-	-	1.8	2.3	-	2.8	-	2	0.9	-	-	1.8	-	-	-	2.2	-	-	-	-	-	-	-	-	
Width/Depth Ratio	-	-	-	6.4	6.8	-	7.1	-	2	10.1	-	-	25.4	-	-	-	18.6	-	-	-	-	-	-	-	-	
Entrenchment Ratio	-	-	-	1.4	1.4	-	1.4	-	2	1.2	-	-	2.3	-	-	-	2.7	-	-	-	-	-	-	-	-	
Bank Height Ratio	-	-	-	2.1	2.4	-	2.7	-	2	1.0	-	-	1.3	-	-	-	1.0	-	-	-	-	-	-	-	-	
d50 (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Profile																										
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Riffle Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pool Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pool Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.7	14.3	17.8	-	-	-	-	-	-	-	
Pattern																										
Channel Belt Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.0	-	11.7	-	-	-	-	-	-	-	
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.0	-	-	-	-	-	-	-	-	-	
Rc: Bankfull Width (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Meander Width Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Substrate, Bed and Transport Parameters																										
Reach Shear Stress (Competency) lb/ft ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Max Part Size (mm) Mobilized at Bankfull	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Stream Power (Transport Capacity) W/m ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Additional Reach Parameters																										
Drainage Area (mi ²)	-	-	-	-	-	-	0.06	-	-	-	-	-	0.05	-	-	0.07	-	-	-	-	-	-	-	0.07	-	
Rosgen Classification	-	-	-	-	-	-	G	-	-	-	-	-	B:A	-	-	B	-	-	-	-	-	-	-	B	-	
Bankfull Velocity (fps)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bankfull Discharge (cfs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Valley Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Channel Thalweg Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sinuosity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Water Surface Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bankfull Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
% of Reach with Eroding Banks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 7. Baseline Stream Data Summary																									
Harrell Mitigation Site - Harrell Creek Reach 1C (1,189 feet)																									
Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline						
Dimension & Substrate - Riffle	LL	UL	Eq.	Min	Mean	Med	Max	SD	N	Min	Mean	Med	Max	SD	N	Min	Mean	Max	Min	Mean	Med	Max	SD	N	
Bankfull Width (ft)	-	-	-	4.1	7.1	5.0	10.0	3.7	5	6.3	8.5	-	10.7	-	-	4.1	-	6.2	6.5	-	6.8	0.4	2		
Floodprone Width (ft)	-	-	-	11.0	13.4	13.0	13.0	1.8	5	25.0	32.2	-	40	-	-	>50	-	50.0	50.0	-	50.0	0.0	2		
Bankfull Mean Depth (ft)	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	0.7	-	0.5	0.6	-	0.6	0.1	2		
Bankfull Max Depth (ft)	-	-	-	0.2	0.6	0.6	0.9	0.3	5	1.2	1.4	-	1.6	-	-	0.9	-	0.9	1.0	-	1.2	0.2	2		
Bankfull Cross Sectional Area (ft ²)	-	-	-	1.9	2.4	2.3	3.7	0.7	5	8.8	8.8	-	10	-	-	2.7	-	3.4	3.5	-	3.6	0.1	2		
Width/Depth Ratio	-	-	-	7.4	26.6	13.4	77.8	29.7	5	5.2	8.4	-	10.5	-	-	6.1	-	11.2	11.9	-	12.6	1.0	2		
Entrenchment Ratio	-	-	-	1.3	2.2	2.5	2.6	0.9	5	2.5	3.5	-	3.8	-	-	8.6	-	8.1	11.4	-	14.8	4.7	2		
Bank Height Ratio	-	-	-	1.0	1.7	2.0	0.4	5	0.8	1.0	-	1.1	-	-	1.0	-	1.0	1.1	-	1.1	0.1	2			
d50 (mm)	-	-	-	-	-	-	-	-	-	13.0	-	-	-	-	-	-	-	0.1	0.5	-	0.9	0.59	2		
Profile																									
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	4.0	6.6	-	10.0	-	-	-	-	4.5	11.6	9.8	34.0	6.2	35		
Riffle Slope (ft/ft)	-	-	-	-	-	-	-	-	-	0.9	2.2	-	4.0	-	0.004	-	0.06	1.156	1.321	0.000	1.725	0.167	35		
Pool Length (ft)	-	-	-	-	-	-	-	-	-	3.0	15.2	-	23.0	-	-	-	-	3.3	10.6	0.0	38.5	6.0	56		
Pool Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	1.8	0.0	2.9	0.4	60		
Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	0.8	1.6	-	2.5	-	8.2	10.9	13.6	1.0	18.7	0.0	41.0	7.8	64		
Pattern																									
Channel Belt Width (ft)	-	-	-	-	-	-	-	-	-	20.0	33.0	-	53.0	-	-	-	-	2.7	8.7	8.0	29.4	4.1	52		
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	7.5	11.2	-	15.0	-	-	18.0	-	16.8	17.8	17.6	19.2	0.9	8		
Rc: Bankfull Width (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.6	2.8	2.7	3.0	0.1	8		
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	25.0	41.0	-	56.0	-	-	-	-	24.6	37.7	38.7	58.3	7.9	30		
Meander Width Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.1	-	0.4	1.3	1.2	4.5	0.6	8			
Substrate, Bed and Transport Parameters																									
Reach Shear Stress (Competency) lb/ft ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Max Part Size (mm) Mobilized at Bankfull	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Stream Power (Transport Capacity) W/m ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Additional Reach Parameters																									
Drainage Area (mi ²)	-	-	-	-	-	0.16	-	-	-	0.25	-	-	-	-	0.16	-	-	0.16	-	-	0.16	-	-		
Rosgen Classification	-	-	-	-	-	E	-	-	-	E,F	-	-	-	-	E4	-	-	E4	-	-	E4	-	-		
Bankfull Velocity (fps)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Bankfull Discharge (cfs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.0	-	-	-	-	-	-	-	-		
Valley Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,000	-	-		
Channel Thalweg Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,189	-	-		
Simuosity	-	-	-	-	-	-	-	-	-	1.63	-	-	-	-	1.25	-	-	1.25	-	-	1.19	-	-		
Water Surface Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.005	-	-	0.005	-	-	0.005	-	-		
Bankfull Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.008	-	-	0.008	-	-	0.005	-	-		
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
% of Reach with Eroding Banks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

Table 7. Baseline Stream Data Summary																								
Harrell Mitigation Site - Harrell Creek Reach 1D (294 feet)																								
Parameter	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			As-Built / Baseline					
Dimension & Substrate - Riffle	LL	UL	Eq.	Min	Mean	Med	Max	SD	N	Min	Mean	Med	Max	SD	N	Min	Mean	Max	Min	Mean	Med	Max	SD	N
Bankfull Width (ft)	-	-	-	2.9	-	-	2.9	-	1	6.3	8.5	-	10.7	-	-	-	4.2	-	2.5	-	-	2.5	0.0	1
Floodprone Width (ft)	-	-	-	35.0	-	-	35.0	-	1	25.0	32.2	-	40	-	-	-	>50	-	33.4	-	-	33.4	0.0	1
Bankfull Mean Depth (ft)	-	-	-	0.7	-	-	0.7	-	1	-	-	-	-	-	-	-	1.6	-	0.3	-	-	0.3	0.0	1
Bankfull Max Depth (ft)	-	-	-	1.0	-	-	1.0	-	1	1.2	1.4	-	1.6	-	-	-	2.3	-	0.4	-	-	0.4	0.0	1
Bankfull Cross Sectional Area (ft ²)	-	-	-	2.4	-	-	2.4	-	1	8.8	8.8	-	10	-	-	-	2.8	-	0.7	-	-	0.7	0.0	1
Width/Depth Ratio	-	-	-	3.5	-	-	3.5	-	1	5.2	8.4	-	10.5	-	-	-	6.1	-	8.6	-	-	8.6	0.0	1
Entrenchment Ratio	-	-	-	12.1	-	-	12.1	-	1	2.5	3.5	-	3.8	-	-	-	8.4	-	13.2	-	-	13.2	0.0	1
Bank Height Ratio	-	-	-	1.0	-	-	1.0	-	1	0.8	1.0	-	1.1	-	-	-	1.0	-	1.0	-	-	1.0	0.0	1
d50 (mm)	-	-	-	-	-	-	-	-	-	-	-	-	13.0	-	-	-	-	-	1.2	-	-	1.2	0	1
Profile																								
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	4.0	6.6	-	10.0	-	-	4.0	6.6	-	10.0	-	-	27.0	7.2	35
Riffle Slope (ft/ft)	-	-	-	-	-	-	-	-	-	0.9	2.2	-	4.0	-	-	0.9	2.2	-	4.0	-	-	0.97	0.03	35
Pool Length (ft)	-	-	-	-	-	-	-	-	-	3.0	15.2	-	23.0	-	-	3.0	15.2	-	23.0	-	-	48.5	23.3	2
Pool Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	0.2	2
Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	0.8	1.6	-	2.5	-	-	0.8	1.6	-	2.5	-	-	72.0	n/a	1
Pattern																								
Channel Belt Width (ft)	-	-	-	-	-	-	-	-	-	20.0	33.0	-	53.0	-	-	-	-	-	53.0	-	-	15.4	1.1	3
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	7.5	11.2	-	15.0	-	-	18.0	-	15.0	-	-	-	22.0	0.2	2
Rc: Bankfull Width (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.8	0.1	2
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	25.0	41.0	-	56.0	-	-	-	-	-	56.0	-	-	102.9	19.7	5
Meander Width Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.1	-	-	-	-	-	6.2	0.4	2
Substrate, Bed and Transport Parameters																								
Reach Shear Stress (Competency) lb/ft ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max Part Size (mm) Mobilized at Bankfull	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (Transport Capacity) W/m ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																								
Drainage Area (mi ²)	-	-	-	-	-	-	0.17	-	-	-	-	-	0.25	-	-	-	0.17	-	-	-	-	-	-	-
Rosgen Classification	-	-	-	-	-	-	E	-	-	-	-	-	E:F	-	-	-	E4	-	-	-	-	-	-	E4
Bankfull Velocity (fps)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bankfull Discharge (cfs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-
Valley Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	275
Channel Thalweg Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	294
Sinuosity	-	-	-	-	-	-	-	-	-	-	-	-	1.63	-	-	-	1.06	-	-	-	-	-	-	1.07
Water Surface Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	-	-	-	-	-	0.005
Bankfull Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	-	-	-	-	-	0.006
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% of Reach with Eroding Banks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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**Table 8. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Harrell Mitigation Site**

Dimension	Cross Section 1 (Pool) Harrell Creek Reach 1C								Cross Section 2 (Riffle) Harrell Creek Reach 1C								Cross Section 3 (Pool) Harrell Creek Reach 1C								Cross Section 4 (Riffle) Harrell Creek Reach 1C								Cross Section 5 (Riffle) Harrell Creek Reach 1D							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Record Elevation (datum) Used	2179.9								2179.6								2178.2								2178.4								2174.5							
Low Bank Height Elevation (datum) Used	2179.9								2179.6								2178.2								2178.4								2174.5							
Bankfull Width (ft)	9.6								6.2								5.2								6.8								2.5							
Floodprone Width (ft)	50+								50+								50+								50+								33.4							
Bankfull Mean Depth (ft)	0.6								0.6								1.0								0.5								0.3							
Bankfull Max Depth (ft)	1.9								0.9								1.6								1.2								0.4							
Bankfull Cross Sectional Area (ft ²)	6.0								3.4								5.3								3.6								0.7							
Bankfull Width/Depth Ratio	15.2								11.2								5.1								12.6								8.6							
Bankfull Entrenchment Ratio	5.2								16.1								9.6								14.8								13.2							
Bankfull Bank Height Ratio	1.0								1.1								1.1								1.0								1.0							
Low Top of Bank Depth (ft)	1.9								1.0								1.8								1.2								0.4							
	Cross Section 6 (Pool) Harrell Creek Reach 1D																																							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7																																
Record Elevation (datum) Used	2174.4																																							
Low Bank Height Elevation (datum) Used	2174.4																																							
Bankfull Width (ft)	6.1																																							
Floodprone Width (ft)	38.3																																							
Bankfull Mean Depth (ft)	0.7																																							
Bankfull Max Depth (ft)	1.3																																							
Bankfull Cross Sectional Area (ft ²)	4.5																																							
Bankfull Width/Depth Ratio	8.3																																							
Bankfull Entrenchment Ratio	6.2																																							
Bankfull Bank Height Ratio	1.0																																							
Low Top of Bank Depth (ft)	1.3																																							

**Table 9. Monitoring Data - Stream Reach Data Summary
Harrell Reach 1B (273 feet)**

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 5						MY - 7					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension & Substrate - Riffle																																				
Bankfull Width (ft)	-	-	-	-	-	-																														
Floodprone Width (ft)	-	-	-	-	-	-																														
Bankfull Mean Depth (ft)	-	-	-	-	-	-																														
Bankfull Max Depth (ft)	-	-	-	-	-	-																														
Bankfull Cross-Sectional Area (ft ²)	-	-	-	-	-	-																														
Width/Depth Ratio	-	-	-	-	-	-																														
Entrenchment Ratio	-	-	-	-	-	-																														
Bank Height Ratio	-	-	-	-	-	-																														
Profile																																				
Riffle Length (ft)	6.6	23.5	9.2	79.2	29.2	10																														
Riffle Slope (ft/ft)	0.039	0.089	0.084	0.199	0.051	10																														
Pool Length (ft)	-	-	-	-	-	-																														
Pool Max Depth (ft)	-	-	-	-	-	-																														
Pool Spacing (ft)	-	-	-	-	-	-																														
Pattern																																				
Channel Belt Width (ft)	-	-	-	-	-	-																														
Radius of Curvature (ft)	-	-	-	-	-	-																														
Rc: Bankfull Width (ft/ft)	-	-	-	-	-	-																														
Meander Wavelength (ft)	-	-	-	-	-	-																														
Meander Width Ratio	-	-	-	-	-	-																														
Additional Reach Parameters																																				
Rosgen Classification	B4																																			
Channel Thalweg Length (ft)	273																																			
Sinuosity (ft)	1.03																																			
Water Surface Slope (Channel) (ft/ft)	0.145																																			
Bankfull Slope (ft/ft)	0.136																																			
Ri% / Ru% / P% / G% / S%	87%	1%	0%	13%	0%																															

- Information Unavailable

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

**Table 9 Cont'd. Monitoring Data - Stream Reach Data Summary
Harrell Reach 1C (1,189 feet)**

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 5						MY - 7					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension & Substrate - Riffle																																				
Bankfull Width (ft)	6.2	6.5	-	6.8	0.4	2																														
Floodprone Width (ft)	50.0	50.0	-	50.0	0.0	2																														
Bankfull Mean Depth (ft)	0.5	0.6	-	0.6	0.1	2																														
Bankfull Max Depth (ft)	0.9	1.0	-	1.2	0.2	2																														
Bankfull Cross-Sectional Area (ft ²)	3.4	3.5	-	3.6	0.1	2																														
Width/Depth Ratio	11.2	11.9	-	12.6	1.0	2																														
Entrenchment Ratio	8.1	11.4	-	14.8	4.7	2																														
Bank Height Ratio	1.0	1.1	-	1.1	0.1	2																														
Profile																																				
Riffle Length (ft)	4.5	11.6	9.8	34.0	6.2	35																														
Riffle Slope (ft/ft)	1.156	1.321	0.000	1.725	0.167	35																														
Pool Length (ft)	3.3	10.6	0.0	38.5	6.0	56																														
Pool Max Depth (ft)	0.9	1.8	0.0	2.9	0.4	60																														
Pool Spacing (ft)	1.0	18.7	0.0	41.0	7.8	64																														
Pattern																																				
Channel Belt Width (ft)	2.7	8.7	8.0	29.4	4.1	52																														
Radius of Curvature (ft)	6.8	7.8	7.6	9.2	0.9	8																														
Rc: Bankfull Width (ft/ft)	1.0	1.2	1.2	1.4	0.1	8																														
Meander Wavelength (ft)	24.6	37.7	38.7	58.3	7.9	30																														
Meander Width Ratio	3.8	5.8	6.0	9.0	1.2	30																														
Additional Reach Parameters																																				
Rosgen Classification	E4																																			
Channel Thalweg Length (ft)	1,189																																			
Sinuosity (ft)	1.19																																			
Water Surface Slope (Channel) (ft/ft)	0.0050																																			
Bankfull Slope (ft/ft)	0.0050																																			
Ri% / Ru% / P% / G% / S%	32%	3%	48%	16%	0%																															

- Information Unavailable

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

**Table 9 Cont'd. Monitoring Data - Stream Reach Data Summary
Harrell Reach 1D (294 feet)**

Parameter	Baseline						MY - 1						MY - 2						MY - 3						MY - 5						MY - 7					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension & Substrate - Riffle																																				
Bankfull Width (ft)	2.5	-	-	2.5	0.0	1																														
Floodprone Width (ft)	33.4	-	-	33.4	0.0	1																														
Bankfull Mean Depth (ft)	0.3	-	-	0.3	0.0	1																														
Bankfull Max Depth (ft)	0.4	-	-	0.4	0.0	1																														
Bankfull Cross-Sectional Area (ft ²)	0.7	-	-	0.7	0.0	1																														
Width/Depth Ratio	8.6	-	-	8.6	0.0	1																														
Entrenchment Ratio	13.2	-	-	13.2	0.0	1																														
Bank Height Ratio	1.0	-	-	1.0	0.0	1																														
Profile																																				
Riffle Length (ft)	12.7	19.6	9.8	27.0	7.2	35																														
Riffle Slope (ft/ft)	0.90	0.94	0.00	0.97	0.03	35																														
Pool Length (ft)	15.5	32.0	0.0	48.5	23.3	2																														
Pool Max Depth (ft)	1.1	1.2	0.0	1.4	0.2	2																														
Pool Spacing (ft)	72.0	72.0	0.0	72.0	n/a	1																														
Pattern																																				
Channel Belt Width (ft)	12.7	19.6	9.8	27.0	7.2	35																														
Radius of Curvature (ft)	0.9	0.9	0.0	1.0	0.0	35																														
Rc: Bankfull Width (ft/ft)	15.5	32.0	0.0	48.5	23.3	2																														
Meander Wavelength (ft)	1.1	1.2	0.0	1.4	0.2	2																														
Meander Width Ratio	72.0	72.0	0.0	72.0	n/a	1																														
Additional Reach Parameters																																				
Rosgen Classification				E4																																
Channel Thalweg Length (ft)				294																																
Sinuosity (ft)				1.07																																
Water Surface Slope (Channel) (ft/ft)				0.005																																
Bankfull Slope (ft/ft)				0.006																																
Ri% / Ru% / P% / G% / S%	19%	41%	21%	8%	11%																															

- Information Unavailable

N/A - Information does not apply.

Ri = Riffle / Ru = Run / P = Pool / G = Glide / S = Step

Appendix E
As-Built Survey and Record Drawings Plan Set

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NC DMS PROJECT No. 100005

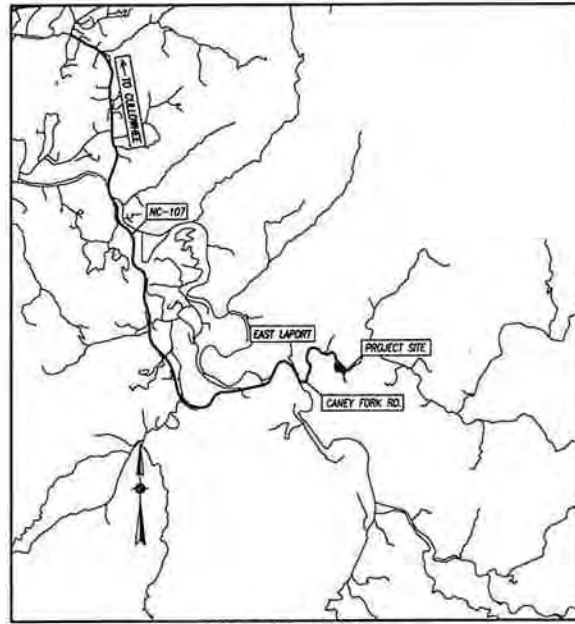
EW SOLUTIONS, LLC

HARRELL MITIGATION PROJECT

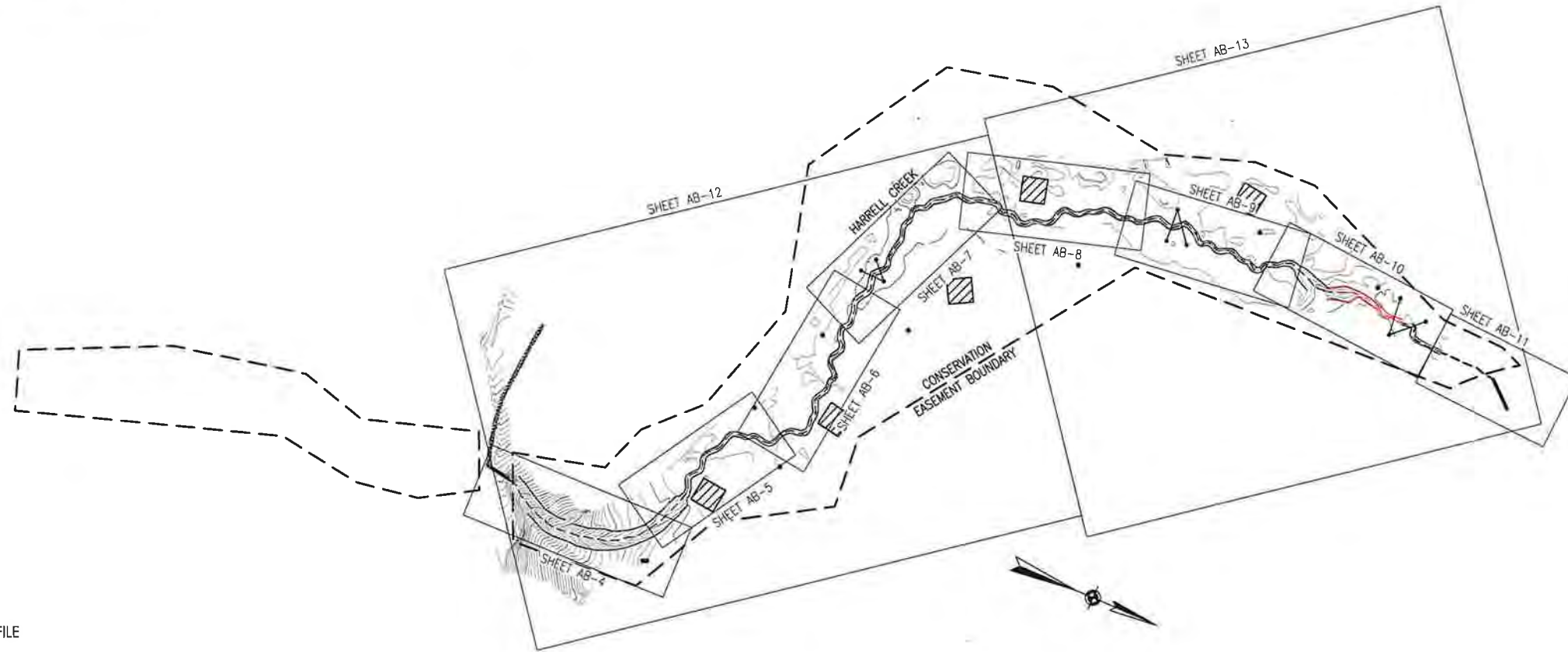
HARRELL CREEK
JACKSON COUNTY, NORTH CAROLINA

STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
NC	172621094	AB-1	12

FINAL PLANS		DATE
1	SHEETS 1, 1A, P-1, EC-1, EC-3, EC-4	1/15/19
2	SHEETS 1, EC-1, EC-3, EC-4	4/5/19
3	SHEETS 1, 12, 13, EC-1, EC-3, EC-3A, EC-4	4/9/19
4	SHEETS 1-3, 10-13, P-1, P-2, EC-1, EC-2, EC-3, EC-4, XS-1, XS-2, XS-3	5/1/19
AS-BUILT PLANS RECORD SET		1/17/20
REVISIONS		



VICINITY MAP
NOT TO SCALE

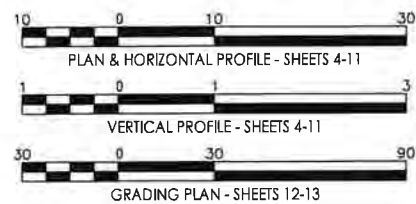


SHEET INDEX

SHEET NO.	DESCRIPTION
AB-1	TITLE SHEET
AB-1A	AS-BUILT SITE PLAN
AB-4 - AB-11	AS-BUILT PLAN AND PROFILE
AB-12 - AB-13	GRADING PLAN

AS-BUILT PLANS

GRAPHIC SCALES (SCALE IN FEET)



PROJECT LENGTHS

PROPOSED RESTORATION:	HARRELL CREEK = 1,791 FT
PROPOSED PRESERVATION:	HARRELL CREEK = 640 FT
	TOTAL = 2,422 FT

PREPARED BY:



Stantec Consulting Services Inc.
License No. F-0672
54 College St., Suite 201
Asheville, North Carolina 28801
Phone: 828-229-8446
www.stantec.com



CHRIS ENGLE
PROJECT ENGINEER

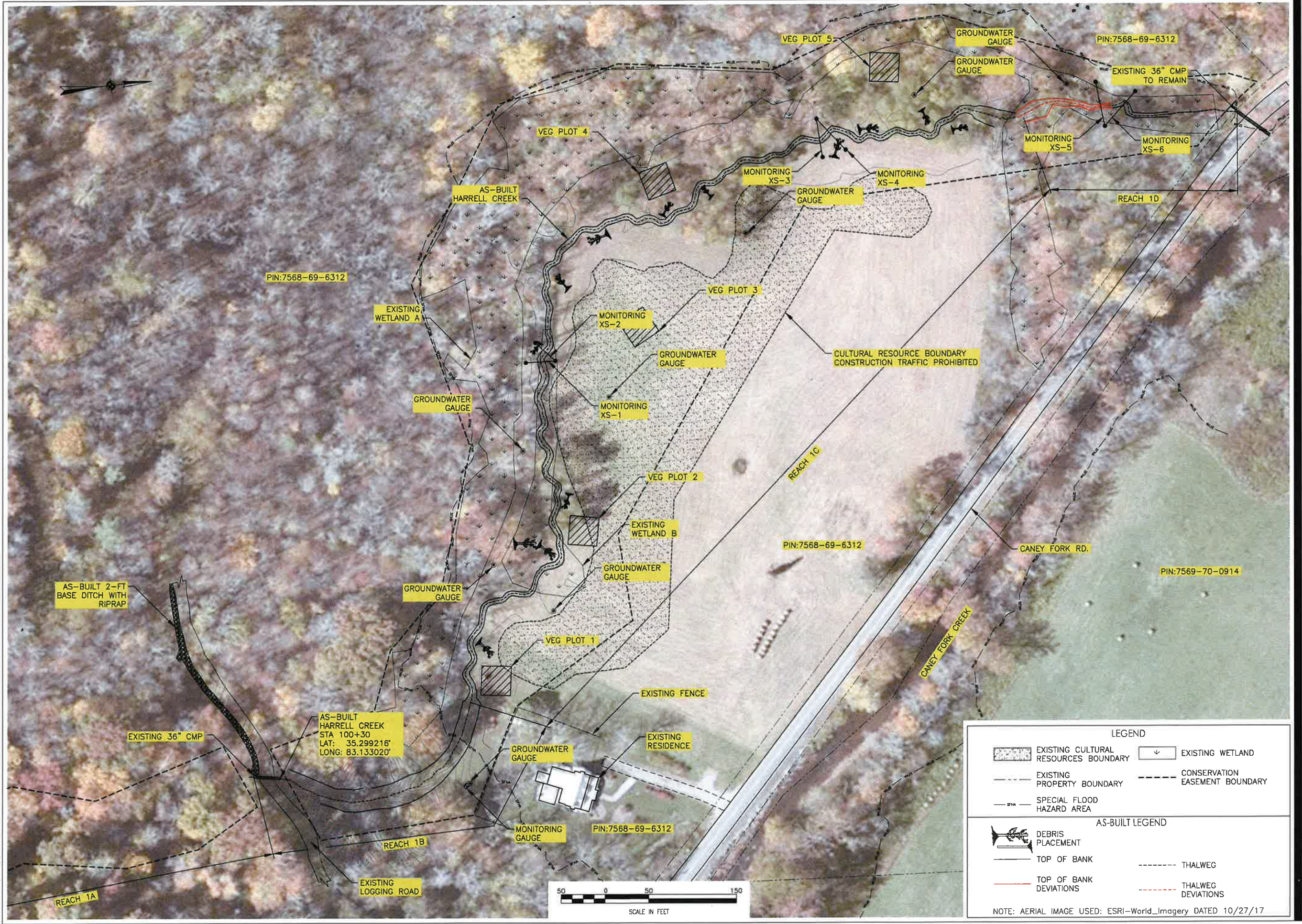
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




NC DMS

PAUL WIESNER
PROJECT MANAGER






VA 1726 (revised) 1/26/20 (P) (DW) CAA / Bulletin 1726 (09/16) IA AS SitePlan.dwg
2020/11/17 1:42 PM B.J. Stokes, Ryan



LEGEND

 EXISTING CULTURAL RESOURCES BOUNDARY	 EXISTING WETLAND
 EXISTING PROPERTY BOUNDARY	 CONSERVATION EASEMENT BOUNDARY
 SPECIAL FLOOD HAZARD AREA	

AS-BUILT LEGEND

 DEBRIS PLACEMENT	 THALWEG
 TOP OF BANK	 THALWEG DEVIATIONS
 TOP OF BANK DEVIATIONS	

NOTE: AERIAL IMAGE USED: ESRI-World_Imagery DATED 10/27/17




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The Contractor shall verify and be responsible for all dimensions. Do NOT scale the drawings. Any errors or omissions shall be reported to Stantec without delay. Stantec is not responsible for any inaccuracies or errors that may occur or be caused by the Contractor. 11/17/20

Revision	Date	By	App'd.	Issued
REV2 - LOGGING ROAD STABILIZATION	19.05.22	CME		
REV1 - PROPERTY PIN NUMBERS	19.04.05	CME		
	19.04.05	CME		
	19.04.05	CME		
	19.04.05	CME		
	19.04.05	CME		

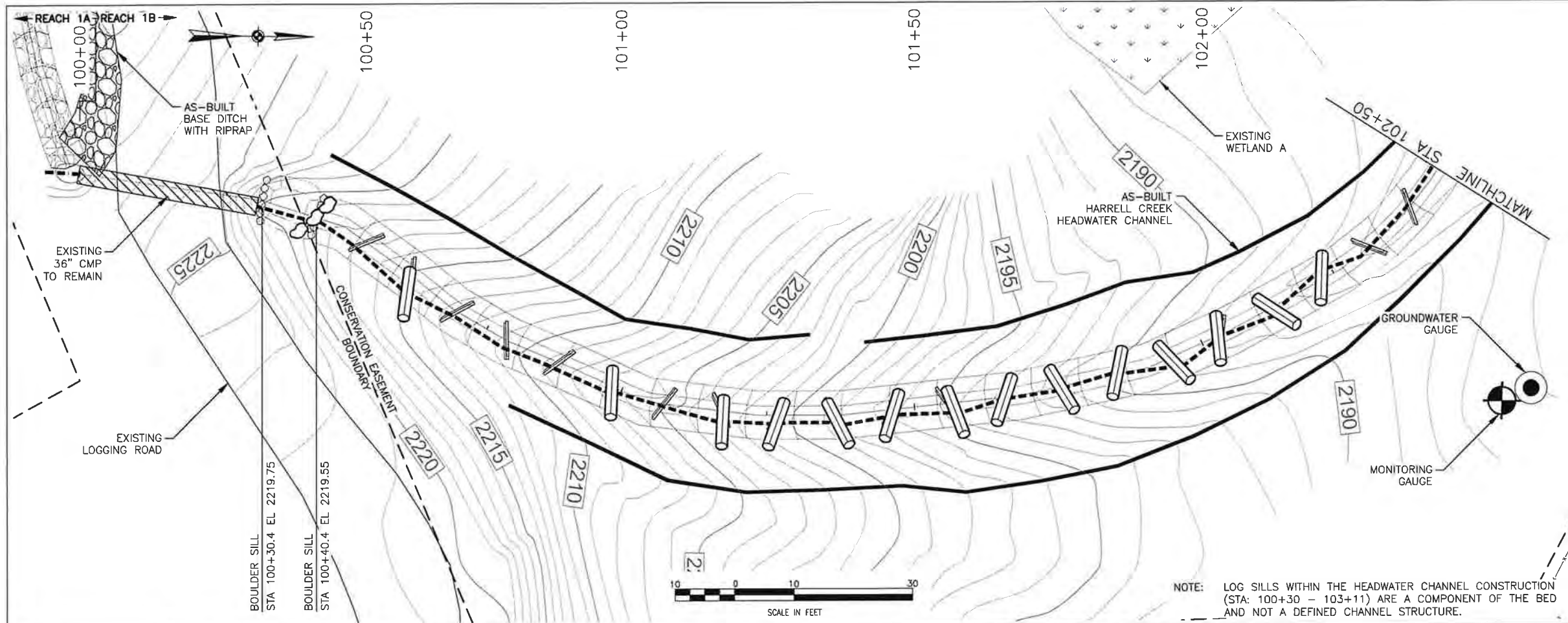
Client/Project: EW SOLUTIONS, LLC
Project Name: HARRELL STREAM AND WETLAND MITIGATION
Location: JACKSON COUNTY, NORTH CAROLINA
Title: SITE PLAN - AS-BUILT

Permit-Seal



Project Number: 172621094

Revision	Sheet	RTS	SGG	CME	00.01.17
4	AB-1A	Dwn.	Chd.	Dgn.	YY.MM.DD



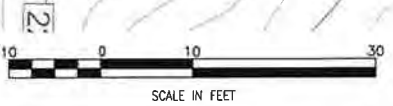
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LEGEND

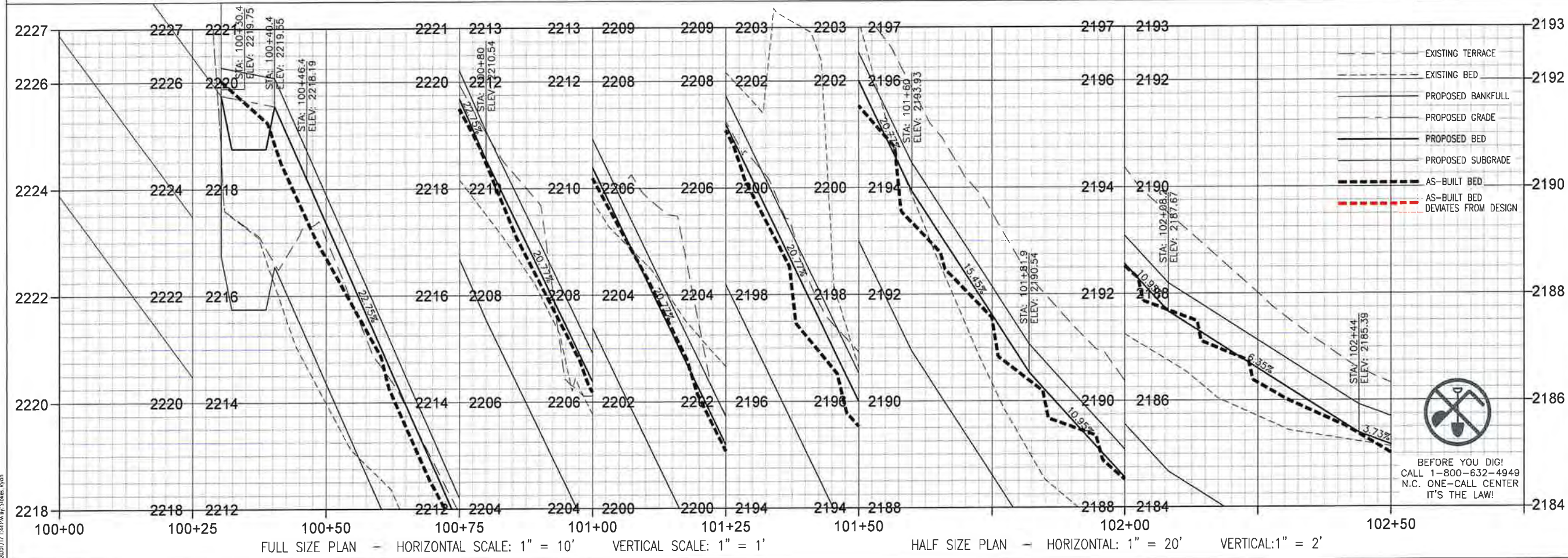
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- EXISTING WETLAND
- EXISTING FENCE
- PROPERTY BOUNDARY
- PROPOSED RIPRAP

AS-BUILT LEGEND

- TOP OF BANK
- TOP OF BANK DEVIATIONS
- THALWEG
- THALWEG DEVIATIONS
- PRESERVED TREE
- LOG SILL
- BOULDER SILL
- DEBRIS PLACEMENT
- BRUSH TOE



NOTE: LOG SILLS WITHIN THE HEADWATER CHANNEL CONSTRUCTION (STA: 100+30 - 103+11) ARE A COMPONENT OF THE BED AND NOT A DEFINED CHANNEL STRUCTURE.

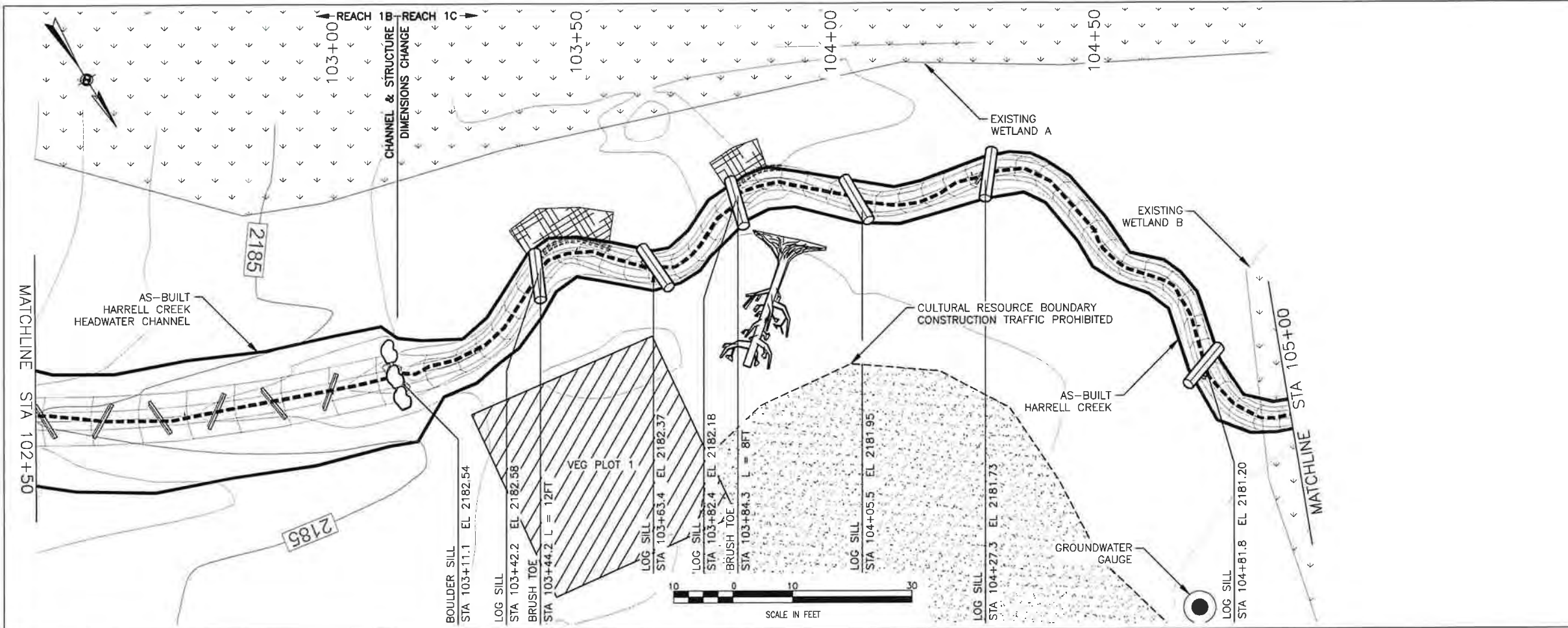


Revision	By	Date
REV-4 - PROPOSED EARTHWORK	CME	19.03.29
	App'd	TY/MM/DD
	CME	
	By	
	App'd	TY/MM/DD

Client/Project: EW SOLUTIONS, LLC
 HARRELL CREEK AND WETLAND MITIGATION
 JACKSON COUNTY, NORTH CAROLINA
 Title: PLAN & PROFILE - AS-BUILT
 STA 100+00 - 102+50



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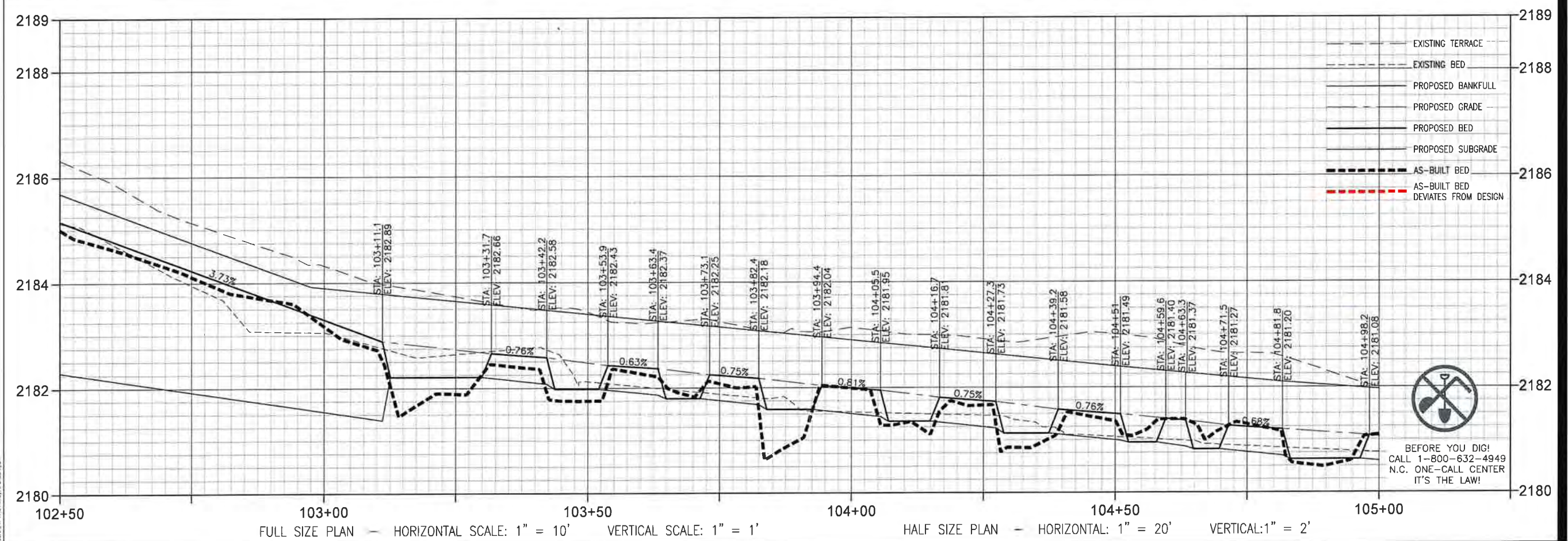
LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- EXISTING WETLAND
- EXISTING FENCE
- PROPERTY BOUNDARY
- PROPOSED RIPRAP

AS-BUILT LEGEND

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REV	DESCRIPTION	DATE	BY	APP'D
REV 4	PROPOSED EARTH BERM	19.05.20	YY.MM.DD	
	Revision			
	Issued			

Client/Project
 EW SOLUTIONS, LLC
 HARRELL STREAM AND WETLAND MITIGATION

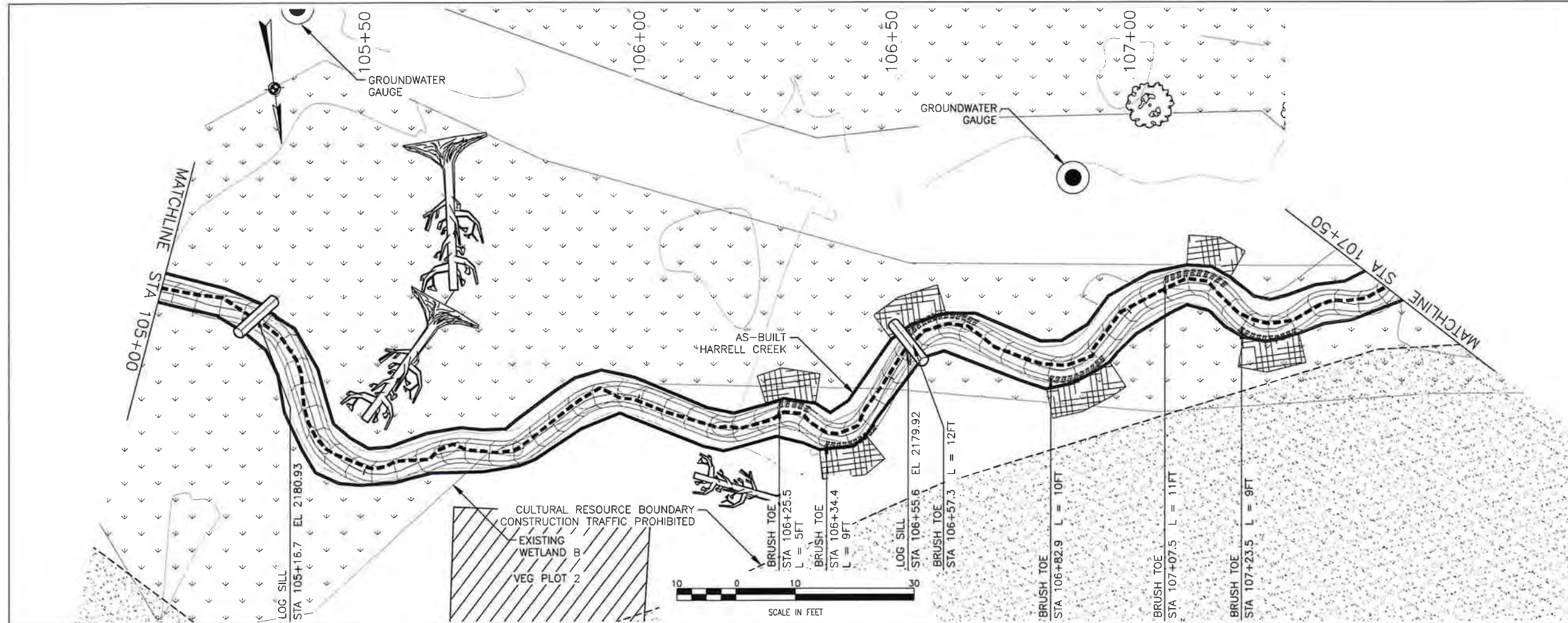
Permit/Scale
 JACKSON COUNTY, NORTH CAROLINA
 Title
 PLAN & PROFILE - AS-BUILT
 STA 102+50 - 103+00

Project Number: 172621094

RIS SGG CME 20.01.17
 Dwn. Chkd. Dsgn. YY.MM.DD

Revision Sheet
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- EXISTING FENCE
- PROPERTY BOUNDARY
- PROPOSED RIPRAP

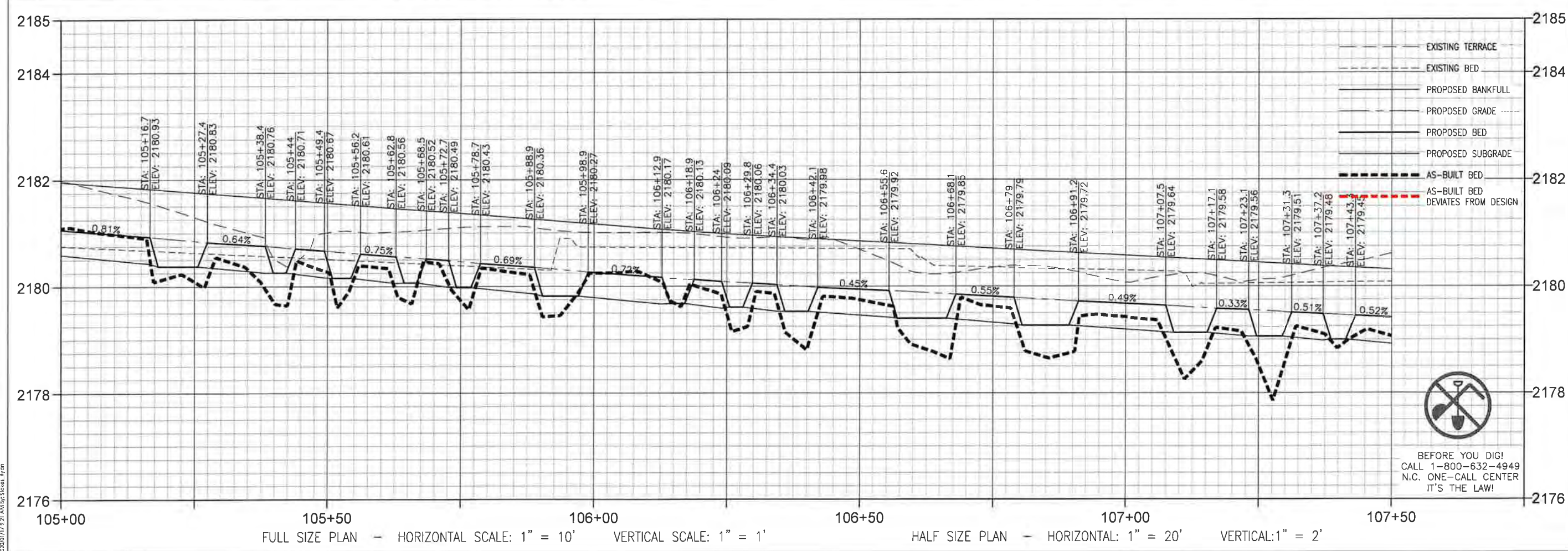
AS-BUILT LEGEND

- TOP OF BANK
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Revised: 11/17/20
By: Y.YAM/DO
Appd: Y.YAM/DO
Issued: Y.YAM/DO



Client/Project: EW SOLUTIONS, LLC
HARRELL STREAM AND WETLAND MITIGATION
JACKSON COUNTY, NORTH CAROLINA

Permit/Seal: [Professional Engineer Seal for Christopher M. Noble, License No. 35458]

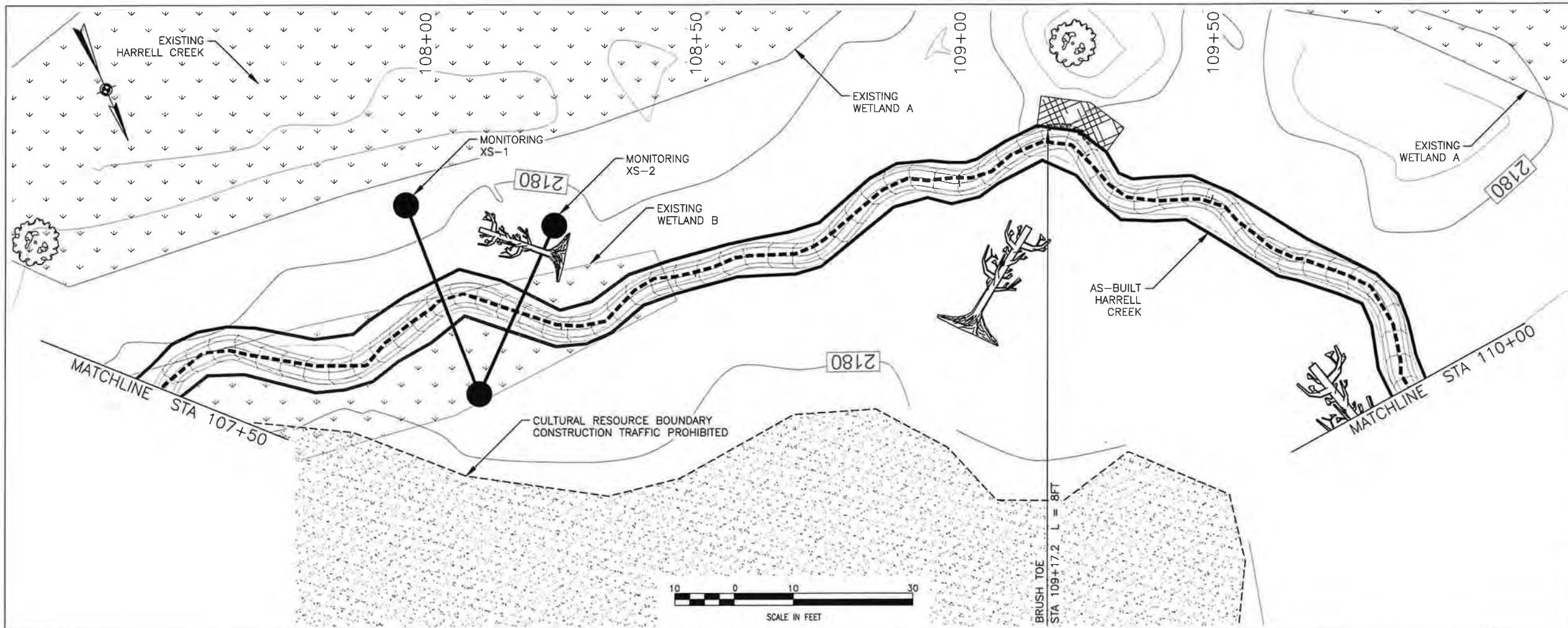
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Revision: 0
Sheet: AB-6

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Dwn: Chkd, Dsgn, YY.MM.DD

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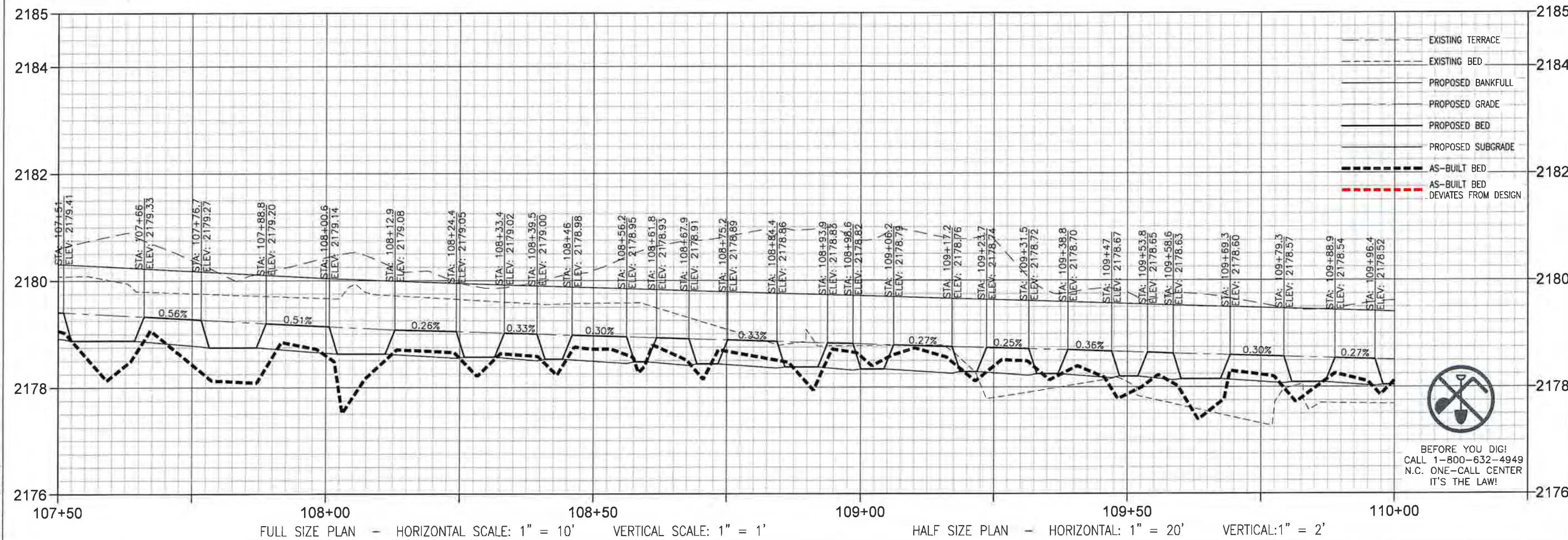
LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- EXISTING WETLAND
- EXISTING FENCE
- PROPERTY BOUNDARY
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AS-BUILT LEGEND

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Harrell Stream and Wetland Mitigation

JACKSON COUNTY, NORTH CAROLINA

Revision: 0 Sheet: AB-7

By: YJMM/DD
Appd: YJMM/DD

Issue Date: 20.01.17

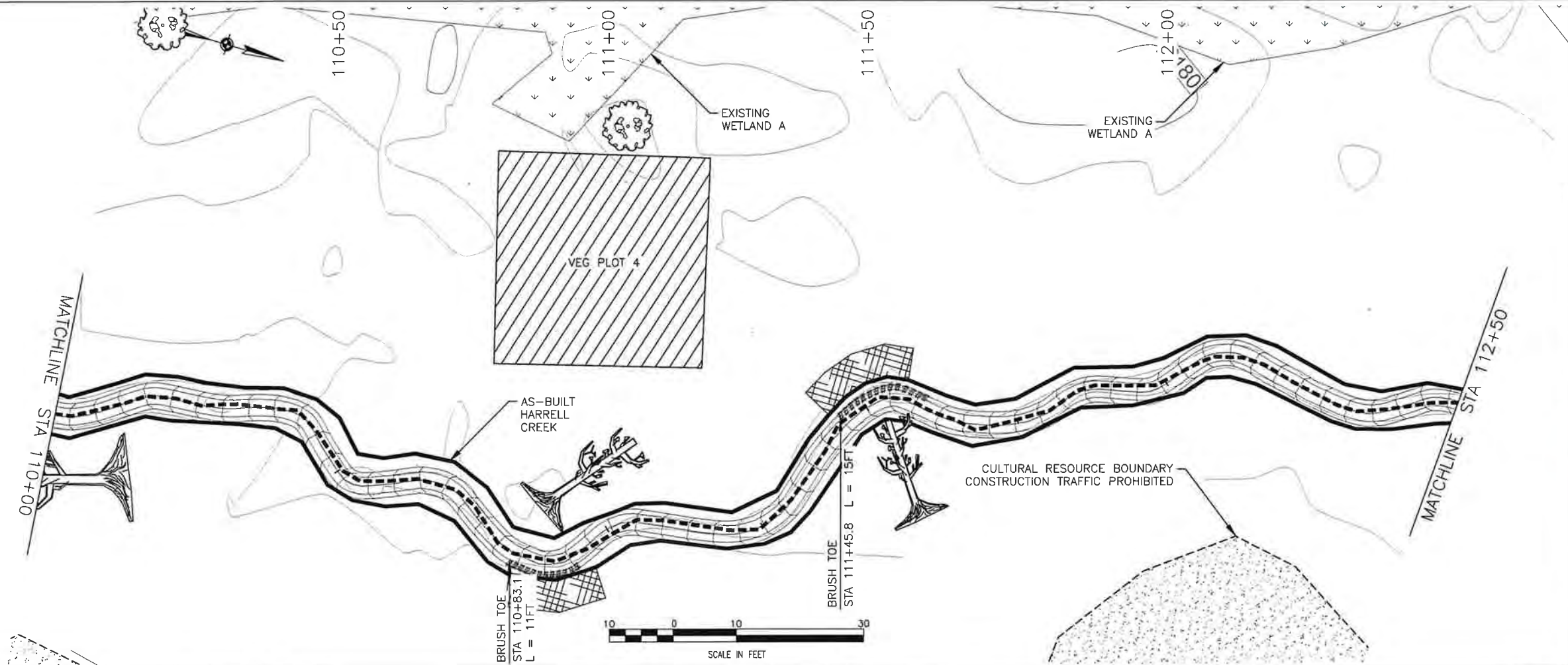
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Dwn: Chkd: Dsgn: YJMM/DD

Professional Engineer Seal: Christopher M. Engle, No. 036695, State of North Carolina, Expires 11/7/20

PLAN & PROFILE - AS-BUILT
STA 107+50 - 110+00

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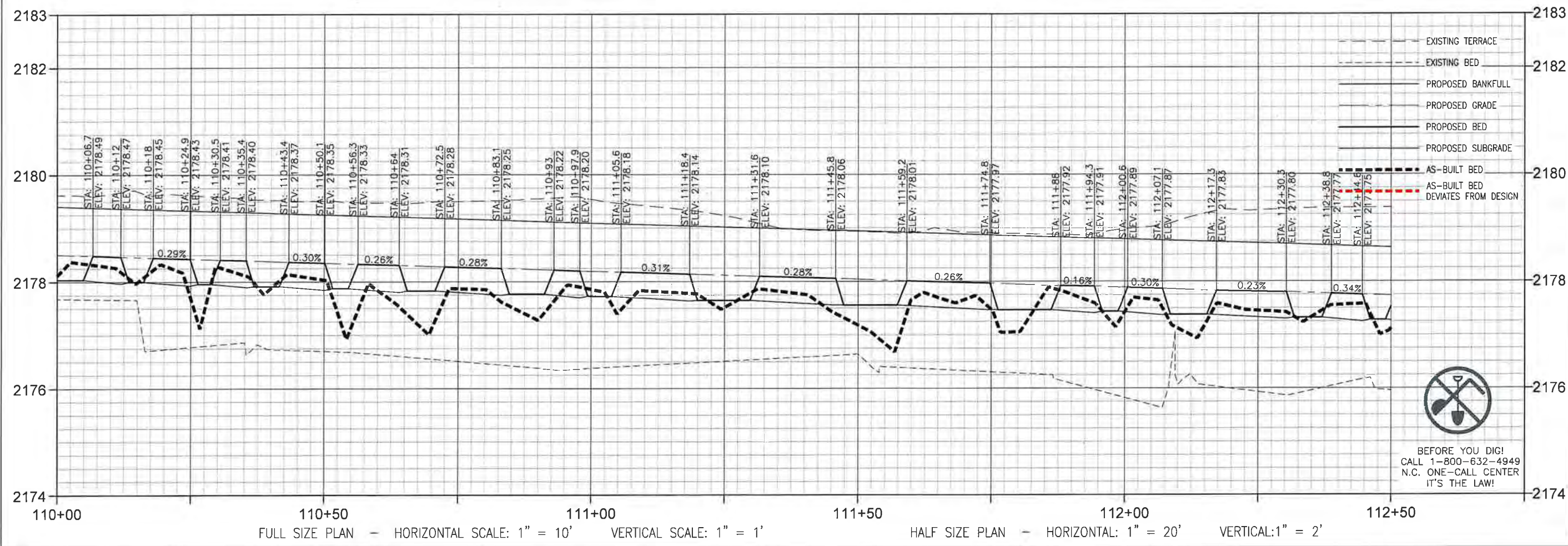
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LEGEND

- PROPOSED STREAM RESTORATION
- EXISTING WETLAND
- EXISTING FENCE
- PROPERTY BOUNDARY
- PROPOSED RIPRAP

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 JACKSON COUNTY, NORTH CAROLINA

Permit-Seal: NORTH CAROLINA PROFESSIONAL SEAL 036598
 ENGINEER CHRISTOPHER M. ENBLE 11/17/20

Project Number: 172621094

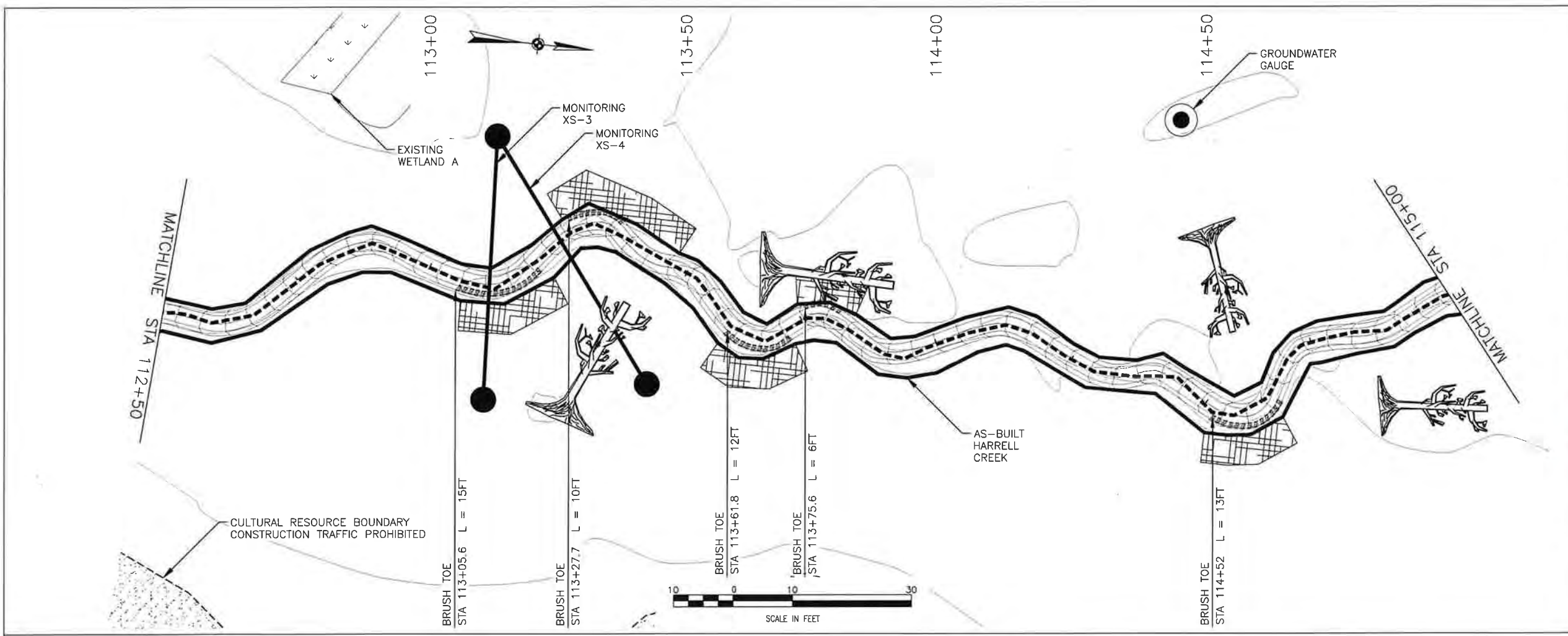
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Issue: Y7.AM.DD

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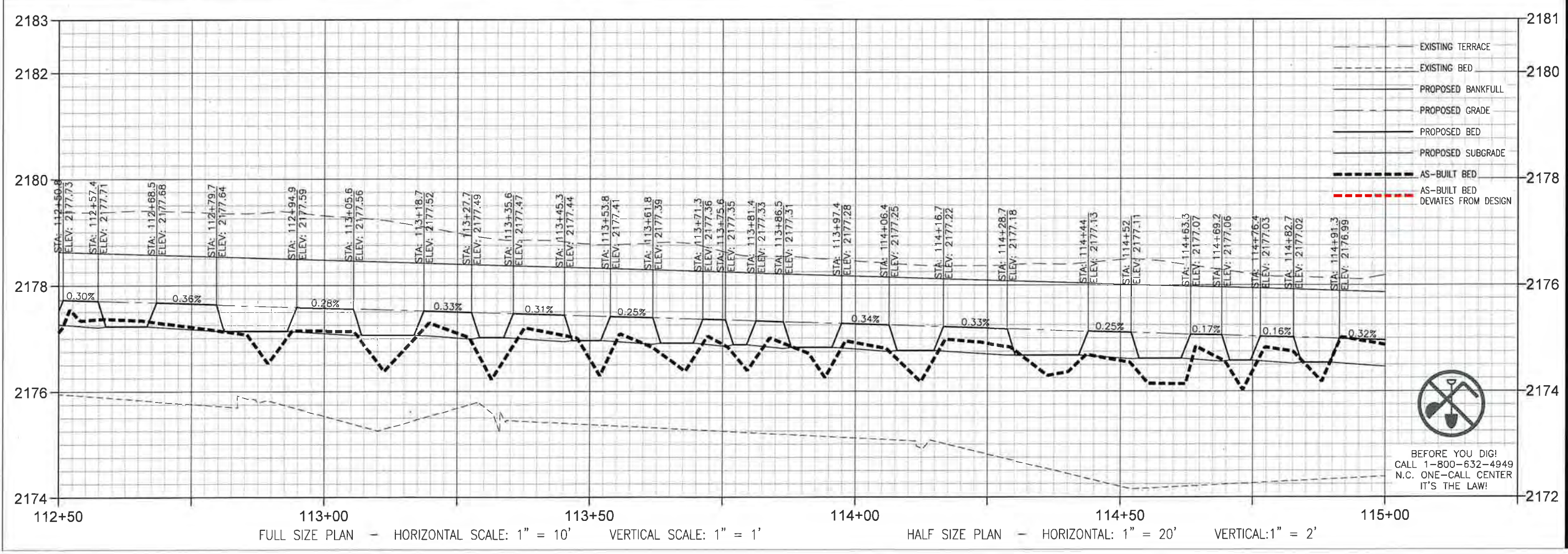
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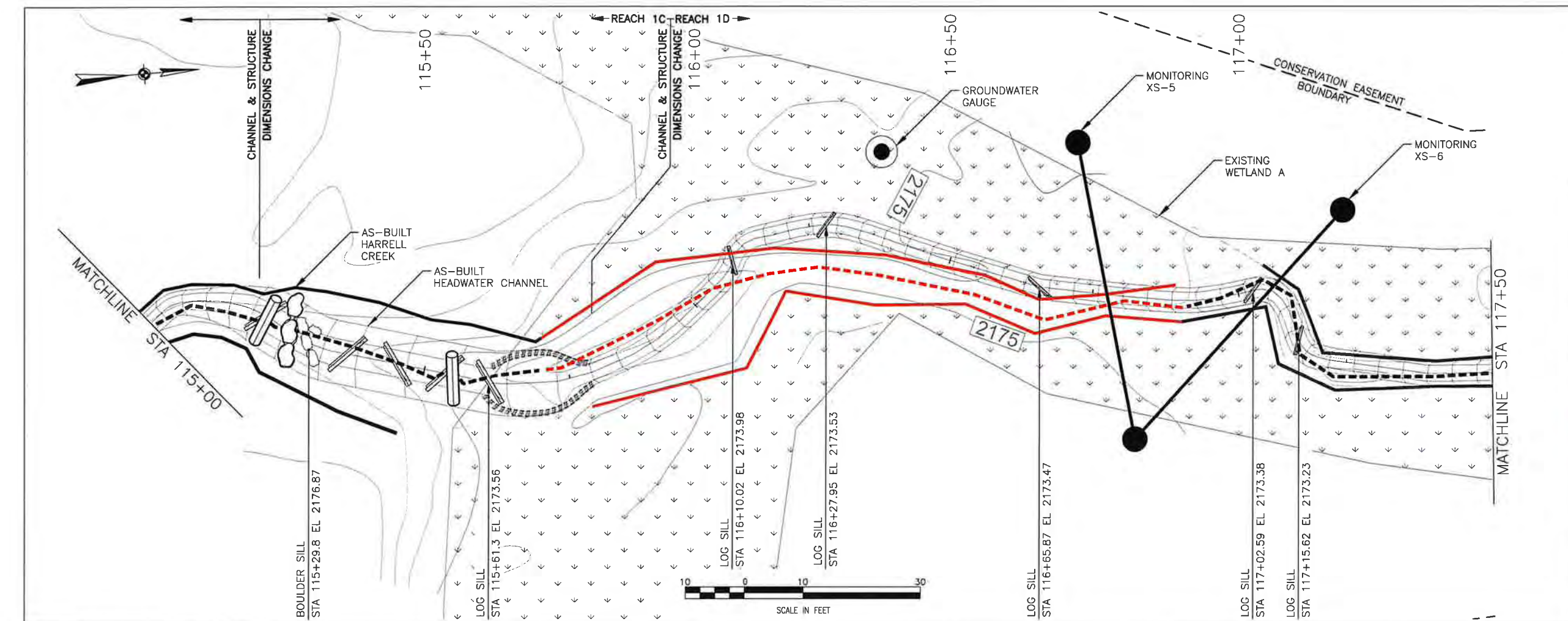
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Permit-Seal: HARRELL STREAM AND WETLAND MITIGATION
JACKSON COUNTY, NORTH CAROLINA
Title: PLAN & PROFILE - AS-BUILT
STA 112+50 - 115+00

Project Number: 172621094

Revision: 0 Sheet: AB-9

RTS: SGG: CME: 20.01.17
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LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- EXISTING WETLAND
- EXISTING FENCE
- PROPERTY BOUNDARY
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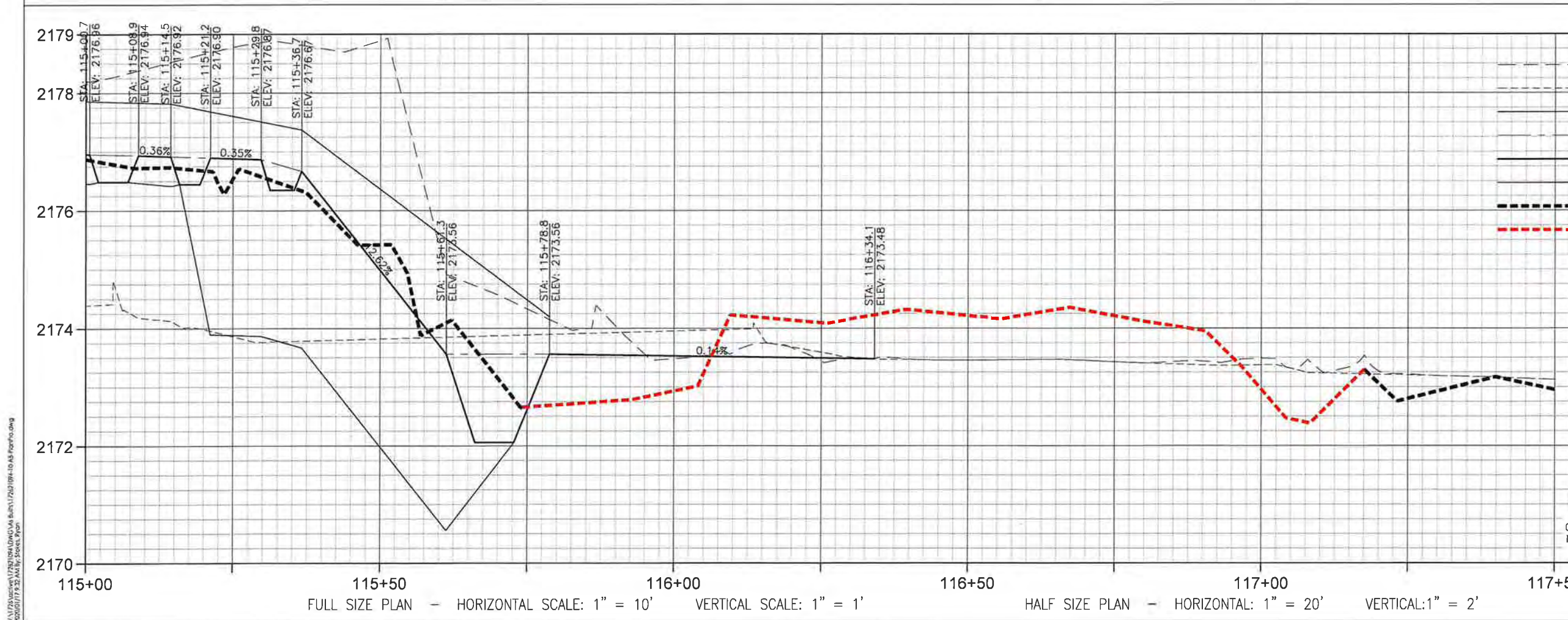
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Client/Project: REV-4 - HEADWATER TRANSITION
Permit/Seal: EW SOLUTIONS, LLC

Revision: CME 19.05.29
By: YRAM/DD

Appd: YRAM/DD

Issued: YRAM/DD



LEGEND

- EXISTING TERRACE
- EXISTING BED
- PROPOSED BANKFULL
- PROPOSED GRADE
- PROPOSED BED
- PROPOSED SUBGRADE
- AS-BUILT BED
- AS-BUILT BED DEVIATES FROM DESIGN

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Client/Project: EW SOLUTIONS, LLC
Permit/Seal: HARRELL STREAM AND WETLAND MITIGATION

JACKSON COUNTY, NORTH CAROLINA

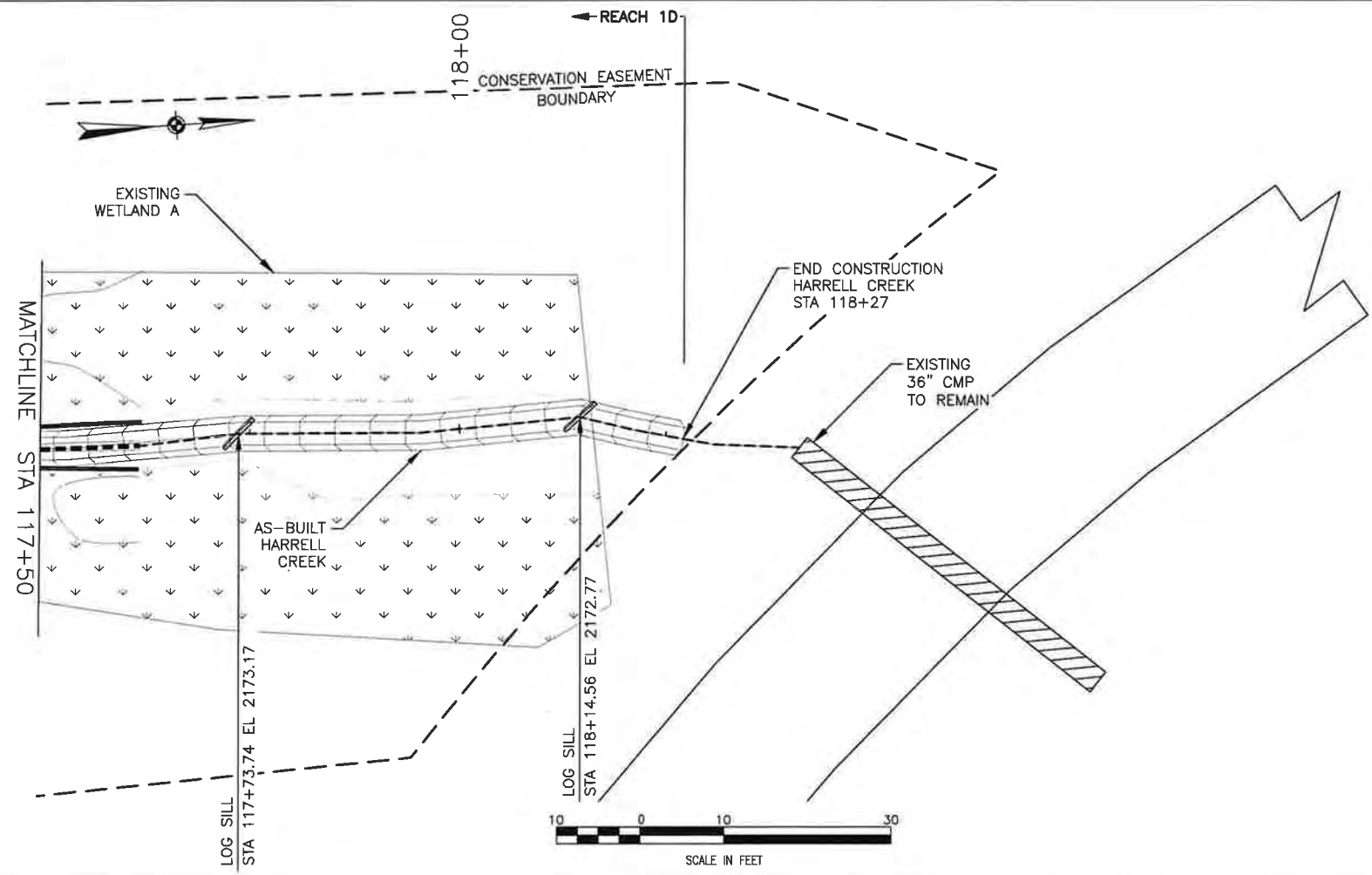
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STA 115+00 - 117+50

Project Number: 172621094

Revision: R1S 20.01.17
Dwn: SGG Chkd: CME Dsgn: YRAM/DD

Revision: 0 Sheet: AB-10

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LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- EXISTING WETLAND
- EXISTING FENCE
- PROPERTY BOUNDARY
- PROPOSED RIPRAP

AS-BUILT LEGEND

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- THALWEG DEVIATIONS
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Client/Project: EW SOLUTIONS, LLC
Title: HARRELL STREAM AND WETLAND MITIGATION
Permit-Seal: JACKSON COUNTY, NORTH CAROLINA

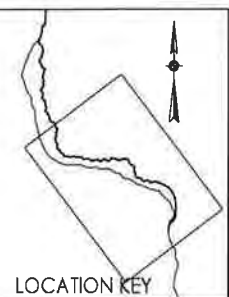
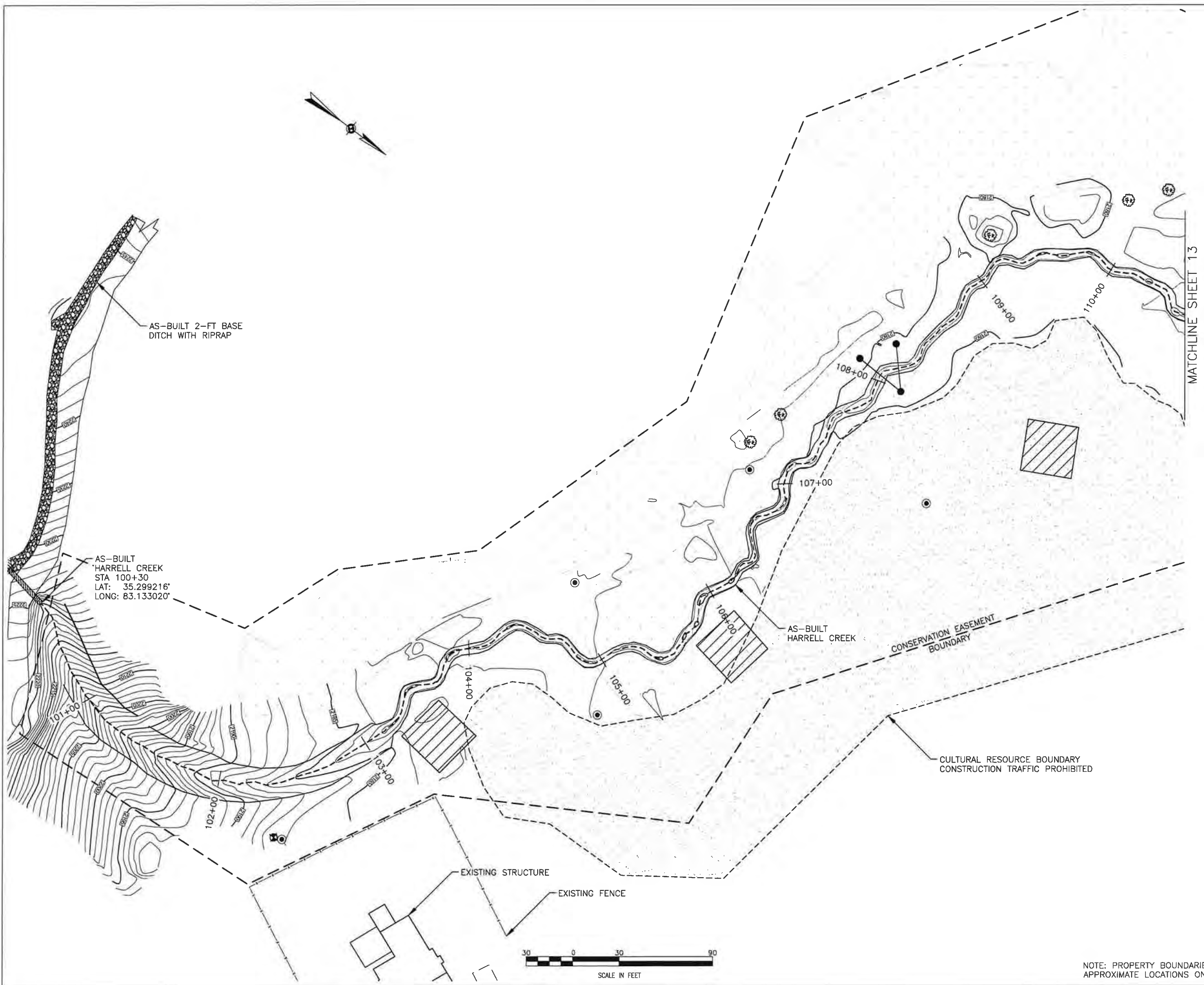
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Project Number: 172621094

Revision: 0
Dwn. Chkd. SGG
CME
Dgn. YY.MM.DD

20.01.17

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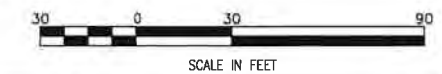


LEGEND

- EXISTING WETLAND
- EXISTING FENCE
- PROPERTY BOUNDARY

AS-BUILT LEGEND

- PRESERVED TREE
- VEG PLOT
- GROUNDWATER GAUGE
- MONITORING GAUGE
- MONITORING CROSS SECTION
- TOP OF BANK
- TOP OF BANK DEVIATION
- THALWEG
- THALWEG DEVIATIONS



NOTE: PROPERTY BOUNDARIES, FENCES, UTILITIES NOT SURVEYED, APPROXIMATE LOCATIONS ONLY.

12 1/2 WALL STREET, SUITE C
 ASHEVILLE, NC 28801
 www.stantec.com

The Client shall verify the accuracy of the information provided. Stantec shall not be responsible for any errors or omissions in this drawing. The Client shall be responsible for obtaining all necessary permits and approvals. The Client shall be responsible for obtaining all necessary permits and approvals. The Client shall be responsible for obtaining all necessary permits and approvals.

REV.	DESCRIPTION	DATE	BY	APP'D.
REV-3	ALIGNMENT STATIONS	19.05.01		
REV-4	PROPOSED GRADING AND BERM	19.05.29		

Revision	By	App'd.	DATE	Issued

Client/Project
 EW SOLUTIONS, INC
 HARRELL CREEK AND WETLAND MITIGATION
 JACKSON COUNTY, NORTH CAROLINA
 Title
 GRADING PLAN - AS-BUILT

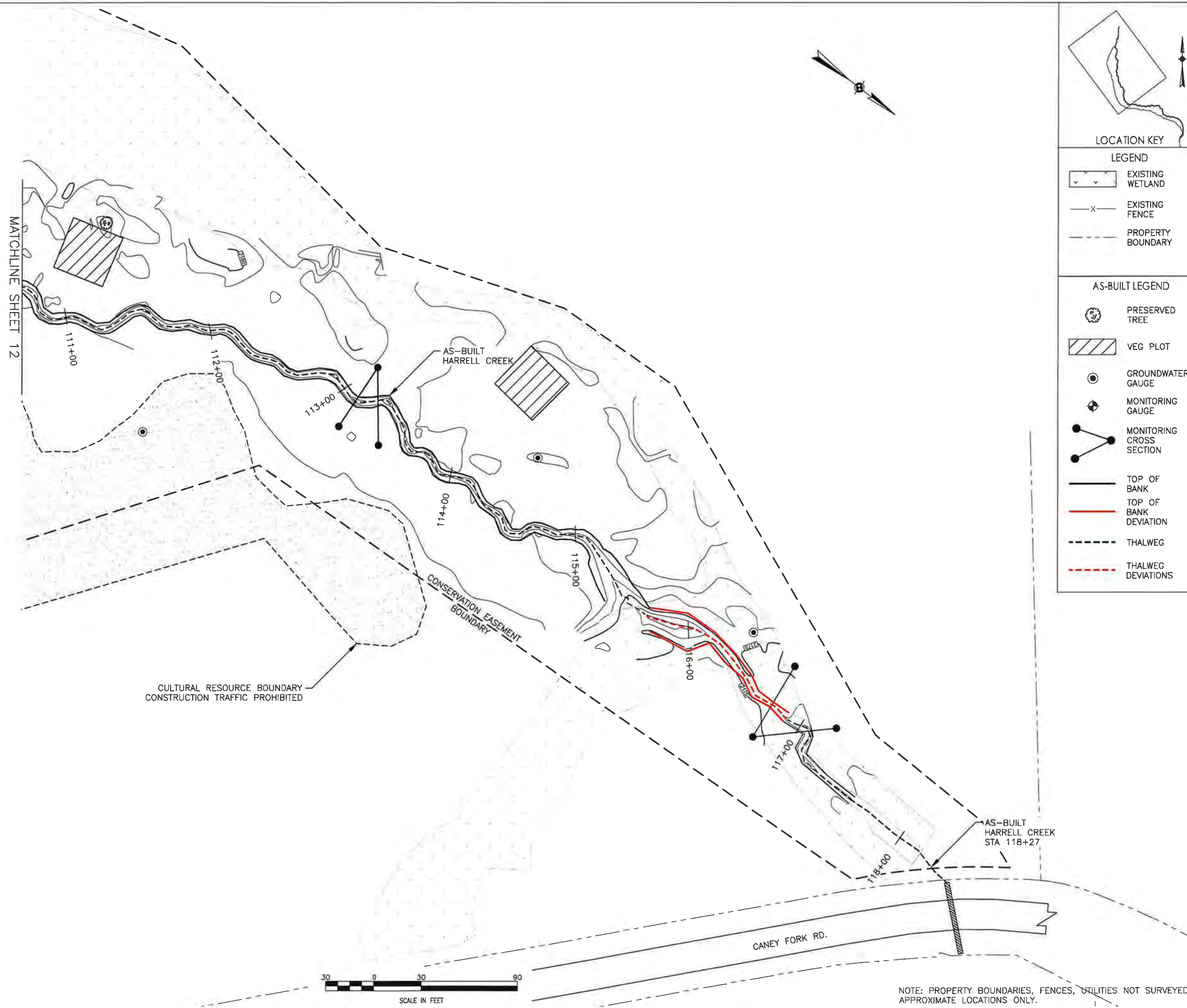
Permit-Seal

Project Number: 172621094

RTS	SGG	CME	20.01.17
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision Sheet
 3 AB-12

V:\172621094\172621094\DWG\A-B\172621094-12-13-AB Grading Plan.dwg
2020/01/17 9:56 AM Mr. Steven Wilson



LEGEND

	EXISTING WETLAND
	EXISTING FENCE
	PROPERTY BOUNDARY

AS-BUILT LEGEND

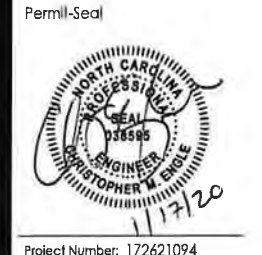
	PRESERVED TREE
	VEG PLOT
	GROUNDWATER GAUGE
	MONITORING GAUGE
	MONITORING CROSS SECTION
	TOP OF BANK
	TOP OF BANK DEVIATION
	THALWEG
	THALWEG DEVIATIONS

REV	DESCRIPTION	CME	CME	DATE
REV-3	ALIGNMENT STATIONS	CME	CME	19.05.01
REV-4	PROPOSED GRADING	CME	CME	19.05.29

Revision	By	Appr	YY.MM.DD

Issue	By	Appr	YY.MM.DD

Client/Project
EW SOLUTIONS, INC
HARRELL STREAM AND WETLAND MITIGATION
JACKSON COUNTY, NORTH CAROLINA
Title
GRADING PLAN - AS-BUILT



Permit-Seal
Project Number: 172621094

RIS	SGG	CME	20.01.17
Dwn.	Chkd.	Dsgn.	YY.MM.DD

NOTE: PROPERTY BOUNDARIES, FENCES, UTILITIES NOT SURVEYED. APPROXIMATE LOCATIONS ONLY.

CERTIFICATE OF SURVEY AND ACCURACY

I, PHILLIP B. KEE, CERTIFY THAT THE GROUND TOPOGRAPHIC SURVEY PORTION OF THIS PROJECT WAS COMPLETED UNDER MY DIRECT SUPERVISION; THAT THIS SURVEY WAS PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET THE FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS; THAT THIS SURVEY WAS PERFORMED TO THE CLASS A HORIZONTAL AND CLASS C VERTICAL WHERE APPLICABLE; THAT THE ORIGINAL DATA WAS OBTAINED BETWEEN THE DATES OF 11/18/19 & 12/02/19; THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD AND ALL COORDINATES ARE BASED ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASED ON NAVD 88; THAT THE GPS PORTION OF THIS PROJECT WAS TO PERFORM A GRID TIE TO THE NC STATE PLANE COORDINATE SYSTEM AND INFORMATION USED IS SHOWN & NOTED HEREON; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION .1606; THAT THIS MAP WAS NOT PREPARED IN ACCORDANCE WITH G.S. 47-30, AS AMENDED AND DOES NOT REPRESENT AN OFFICIAL BOUNDARY SURVEY.

GPS METADATA
SEE SURVEY CONTROL MAP FOR EW SOLUTIONS, LLC BY KEE MAPPING & SURVEYING, PA (LICENSE # C-3039); SIGNED, SEALED AND DATED ON AUGUST 4TH, 2017 BY NOLAN R. CARMACK, NC PLS (LICENSE #5076).

WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 6th DAY OF FEBRUARY, 2020, A.D.

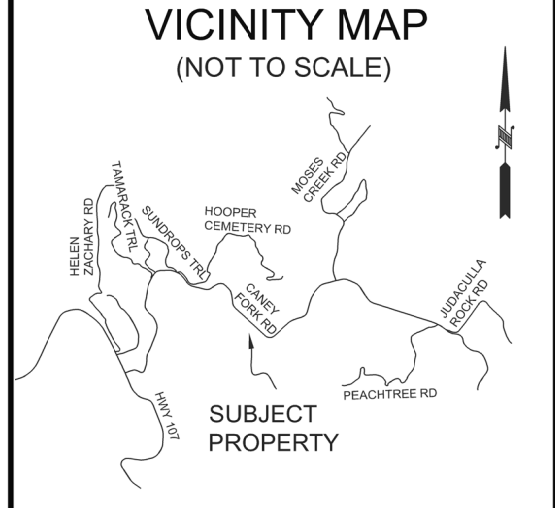
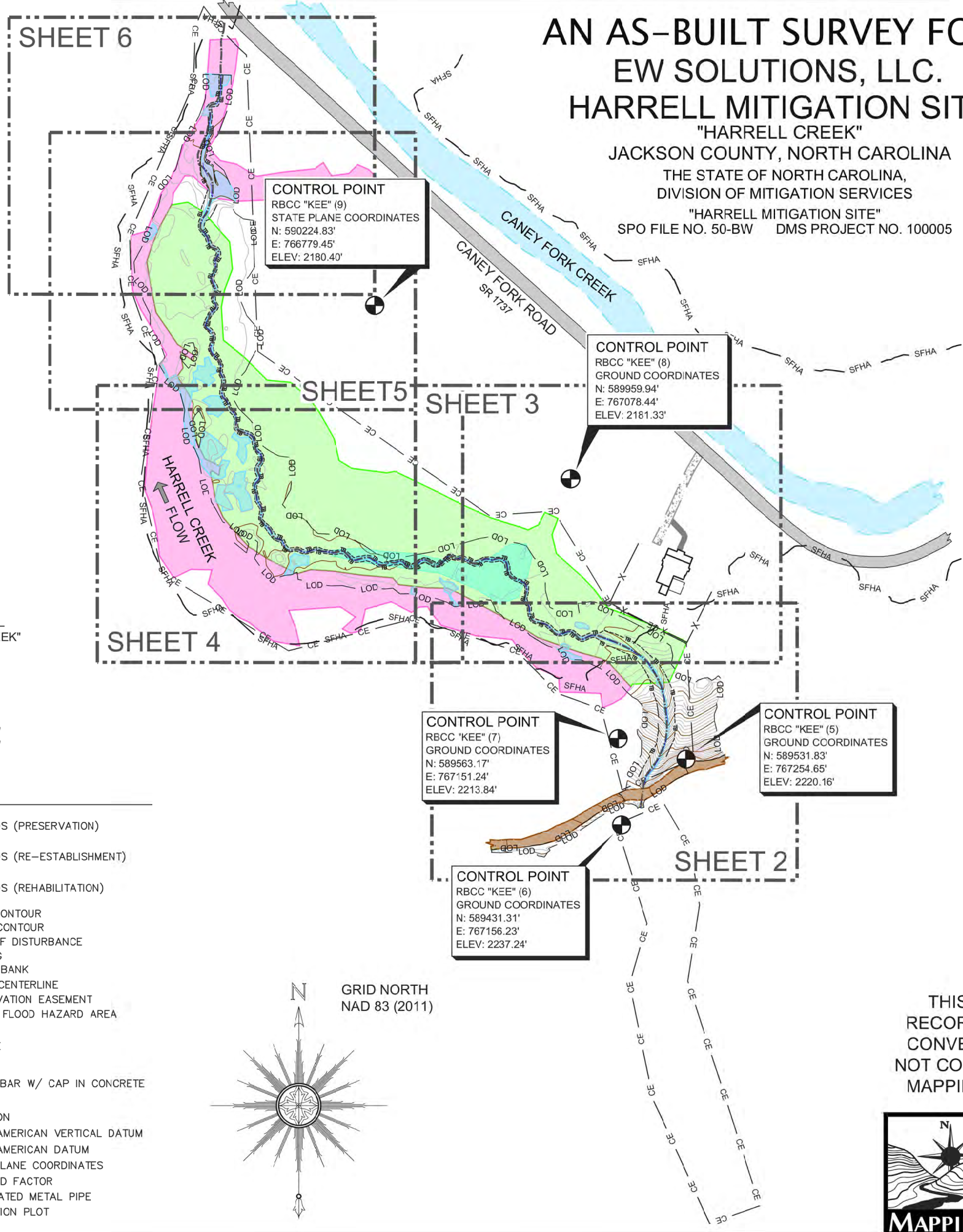


DocuSigned by:
Phillip B. Kee
D965004A7692407...

PHILLIP B. KEE, PLS L-4647

AN AS-BUILT SURVEY FOR: EW SOLUTIONS, LLC. HARRELL MITIGATION SITE

"HARRELL CREEK"
JACKSON COUNTY, NORTH CAROLINA
THE STATE OF NORTH CAROLINA,
DIVISION OF MITIGATION SERVICES
"HARRELL MITIGATION SITE"
SPO FILE NO. 50-BW DMS PROJECT NO. 100005



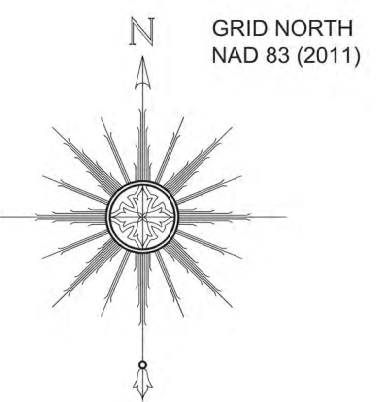
SURVEYOR'S NOTES

- ALL DISTANCES AND COORDINATES ARE GROUND MEASUREMENTS IN US SURVEY FEET UNLESS OTHERWISE NOTED.
- PROPERTY SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS AND RESTRICTIONS THAT ARE RECORDED, UNRECORDED, WRITTEN AND UNWRITTEN.
- CONSERVATION EASEMENT BOUNDARIES SHOWN HEREON WERE TAKEN FROM A PLAT OF SURVEY ENTITLED: "CONSERVATION EASEMENT FOR THE STATE OF NORTH CAROLINA, DIVISION OF MITIGATION SERVICES, HARRELL MITIGATION SITE", PREPARED BY KEE MAPPING & SURVEYING, DATED APRIL 10, 2018 AND RECORDED IN PLAT CABINET 22, SLIDE 606 OF THE JACKSON COUNTY REGISTRY.
- JACKSON COUNTY GIS WEBSITE USED TO IDENTIFY ADJOINING PROPERTY OWNERS.
- BY GRAPHIC DETERMINATION, A PORTION OF THE SUBJECT PROPERTY APPEARS TO LIE WITHIN A SPECIAL FLOOD HAZARD AREA (SFHA) AS DETERMINED BY THE F.E.M.A. MAP#s 3700756900J DATED 04/19/2010.
- STATE PLANE COORDINATES AND ELEVATIONS WERE DERIVED FROM THE CONTROL & EXISTING CONDITIONS TOPOGRAPHIC SURVEY PREPARED BY KEE MAPPING & SURVEYING. THE HORIZONTAL DATUM IS NAD 83 (2011) AND THE VERTICAL DATUM IS NAVD(88). ALL COORDINATES SHOWN HEREON ARE GROUND MEASUREMENTS IN US SURVEY FEET.
- UTILITIES WERE LOCATED BASED ON VISIBLE ABOVE GROUND STRUCTURES, THEREFORE THE LOCATION OF UNDERGROUND UTILITIES ARE APPROXIMATE OR MAY BE PRESENT AND NOT SHOWN HEREON. CALL 1-800-632-4949 BEFORE DIGGING.
- STATIONING FOR PLAN AND PROFILES ARE BASED OFF OF DESIGN CENTERLINES PROVIDED BY EW SOLUTIONS, LLC.
- CONTOUR INTERVAL: 1 FOOT
VERTICAL DATUM: NAVD 88
- AREA OF LIMITS OF DISTURBANCE: 3.46 ACRES
- WETLANDS SHOWN HEREON WERE DELINEATED AND PROVIDED BY EW SOLUTIONS, LLC.

SHEET #	SHEET TITLE
1	COVER SHEET: "HARRELL MITIGATION SITE - HARRELL CREEK"
2	STREAM DATA: "BEGIN HARRELL CREEK"
3	STREAM DATA: "HARRELL CREEK"
4	STREAM DATA: "HARRELL CREEK"
5	STREAM DATA: "HARRELL CREEK"
6	STREAM DATA: "HARRELL CREEK END"
7	STREAM DATA: "CROSS-SECTIONS 1-6"
8	STREAM DATA: "LONGITUDINAL PROFILE: HARRELL CREEK"
9	STREAM DATA: "LONGITUDINAL PROFILE: HARRELL CREEK"

LEGEND

#	STRUCTURE NUMBER	[Pink Box]	WETLANDS (PRESERVATION)
●	1/2" RBR (CROSS-SECTION REBAR)	[Green Box]	WETLANDS (RE-ESTABLISHMENT)
⊙	5/8" RBR W/ "KEE" CAP SET IN CONCRETE	[Light Blue Box]	WETLANDS (REHABILITATION)
—	LOG SILL	—	MINOR CONTOUR
—	BOULDER SILL	—	MAJOR CONTOUR
—	FLOODPLAIN DEBRIS	—	LOD
—	DECIDUOUS TREE (AS NOTED)	—	THALWEG
—	GROUNDWATER GAUGE	—	TOP OF BANK
—	BAROTROLL GAUGE	—	DESIGN CENTERLINE
—	BRUSH TOE	—	CE
—	RIFFLE	—	SFHA
—	POOL/WATER	—	X
—	GRAVEL	—	TREELINE
—	ASPHALT	—	RBR
—	SOIL ROAD	—	RBCC
—	RIP RAP	—	INV
		—	ELEV
		—	NAVD
		—	NAD
		—	SPC
		—	CF
		—	CMP
		—	VP

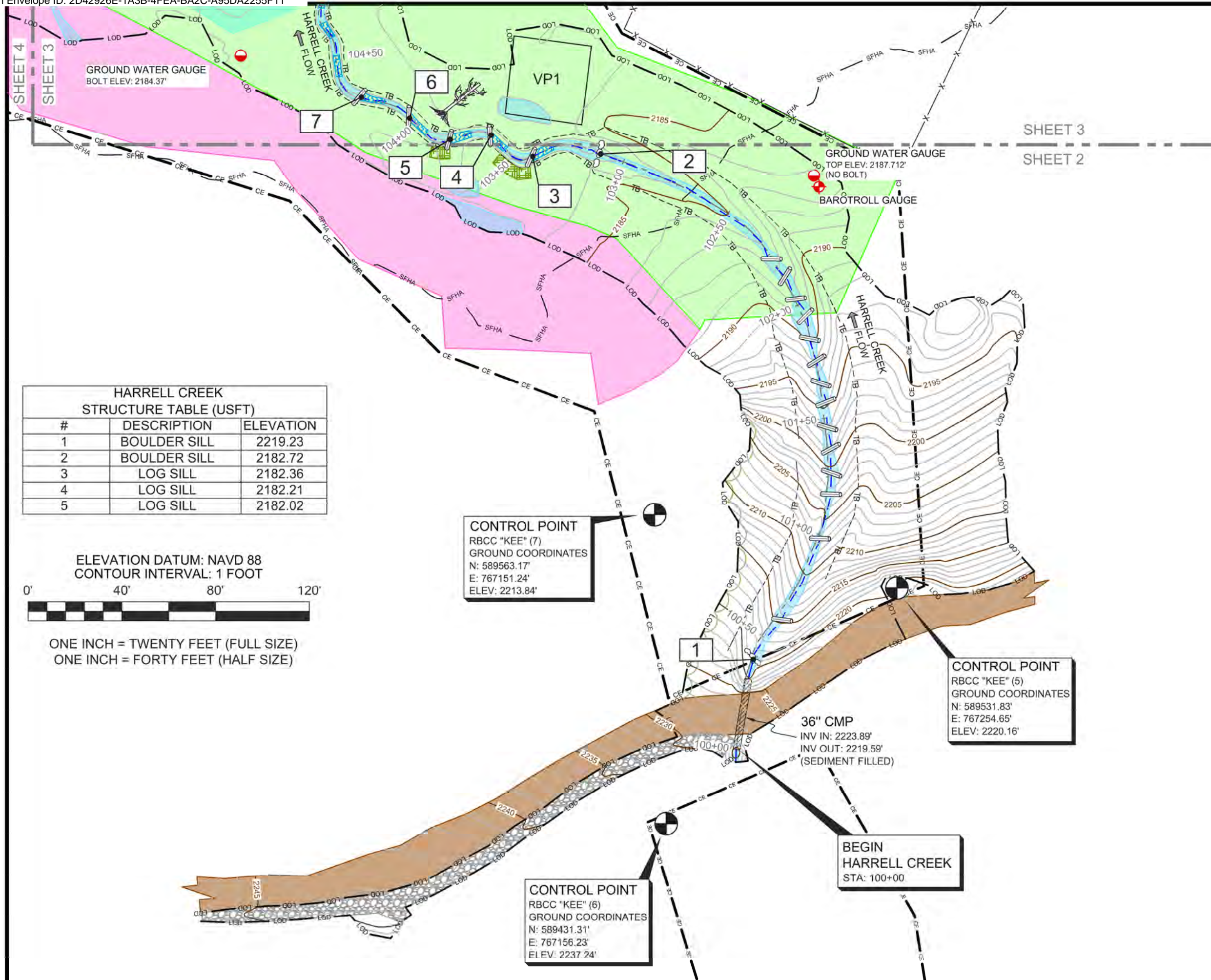


THIS MAP IS NOT FOR RECORDATION, SALES, OR CONVEYANCES AND DOES NOT COMPLY WITH G.S. 47-30 MAPPING REQUIREMENTS.



SHEET SIZE: 11"X 17"
(HALF SIZE)
SHEET:
1 OF 9

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**HARRELL CREEK
STRUCTURE TABLE (USFT)**

#	DESCRIPTION	ELEVATION
1	BOULDER SILL	2219.23
2	BOULDER SILL	2182.72
3	LOG SILL	2182.36
4	LOG SILL	2182.21
5	LOG SILL	2182.02

ELEVATION DATUM: NAVD 88
CONTOUR INTERVAL: 1 FOOT

ONE INCH = TWENTY FEET (FULL SIZE)
ONE INCH = FORTY FEET (HALF SIZE)

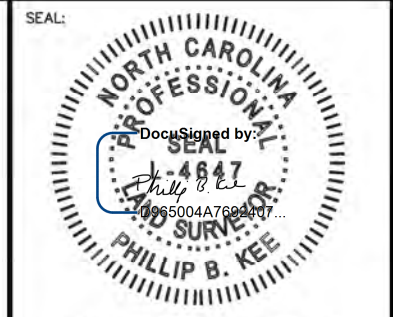
CONTROL POINT
RBCC "KEE" (7)
GROUND COORDINATES
N: 589563.17'
E: 767151.24'
ELEV: 2213.84'

CONTROL POINT
RBCC "KEE" (5)
GROUND COORDINATES
N: 589531.83'
E: 767254.65'
ELEV: 2220.16'

CONTROL POINT
RBCC "KEE" (6)
GROUND COORDINATES
N: 589431.31'
E: 767156.23'
ELEV: 2237.24'

36" CMP
INV IN: 2223.89'
INV OUT: 2219.59'
(SEDIMENT FILLED)

**BEGIN
HARRELL CREEK**
STA: 100+00



PLEASE REFER TO THE COVERSHEET FOR THE STATEMENT OF CERTIFICATION
NOTE: SEE SHEET 1 FOR SURVEYOR'S NOTES & LEGEND

ELEVATION DATUM: NAVD 88
CONTOUR INTERVAL: 1 FOOT

AN AS-BUILT SURVEY FOR:
EW SOLUTIONS, LLC

SPO FILE NO. 50-BW
DMS PROJECT NO. 100005

PROJECT:
HARRELL
MITIGATION SITE

SHEET TITLE:
BEGIN
HARRELL CREEK

TOWNSHIP: CANEY FORK	COUNTY: JACKSON	STATE: NORTH CAROLINA
DRAWN BY: NH,AB	CHECKED BY: PBK	SURVEY BY: LDP,DP,KP,CG
SCALE: AS SHOWN	SURVEY DATES: 11/18/19 - 12/02/19	
JOB: #1910123-AB	SHEET SIZE: 11" X 17"	
#	DATE	REVISIONS

SHEET:
2 OF 9



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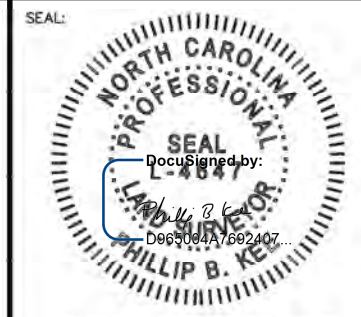
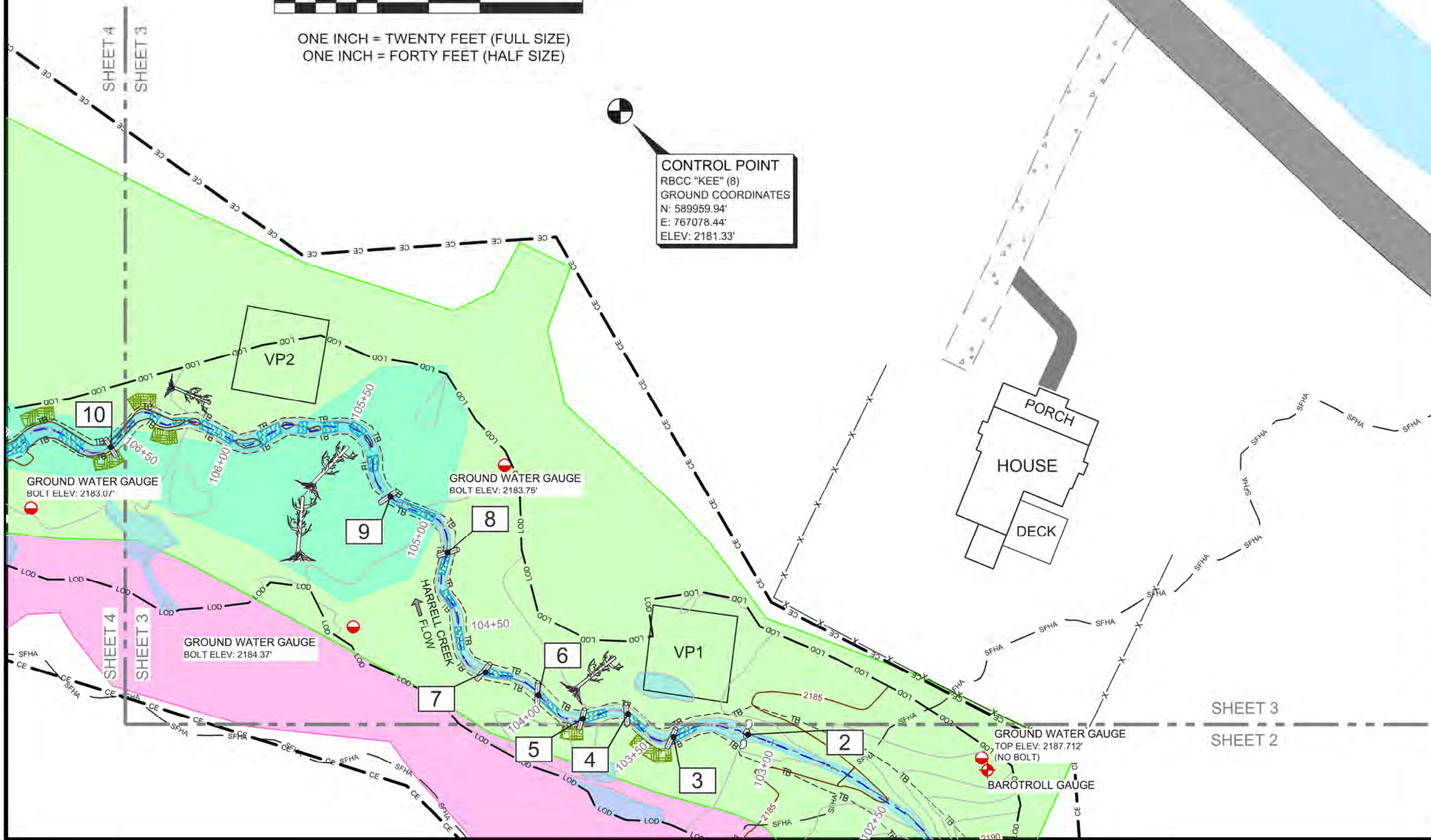
HARRELL CREEK STRUCTURE TABLE (USFT)		
#	DESCRIPTION	ELEVATION
6	LOG SILL	2181.96
7	LOG SILL	2181.67
8	LOG SILL	2181.16
9	LOG SILL	2180.90

ELEVATION DATUM: NAVD 88
CONTOUR INTERVAL: 1 FOOT



ONE INCH = TWENTY FEET (FULL SIZE)
ONE INCH = FORTY FEET (HALF SIZE)

CONTROL POINT
RBCC "KEE" (8)
GROUND COORDINATES
N: 589959.94'
E: 767078.44'
ELEV: 2181.33'



PLEASE REFER TO THE COVERSHEET FOR THE STATEMENT OF CERTIFICATION
NOTE: SEE SHEET 1 FOR SURVEYOR'S NOTES & LEGEND

ELEVATION DATUM: NAVD 88
CONTOUR INTERVAL: 1 FOOT

AN AS-BUILT SURVEY FOR:
EW SOLUTIONS, LLC

SPO FILE NO. 50-BW
DMS PROJECT NO. 100005

PROJECT:
HARRELL
MITIGATION SITE

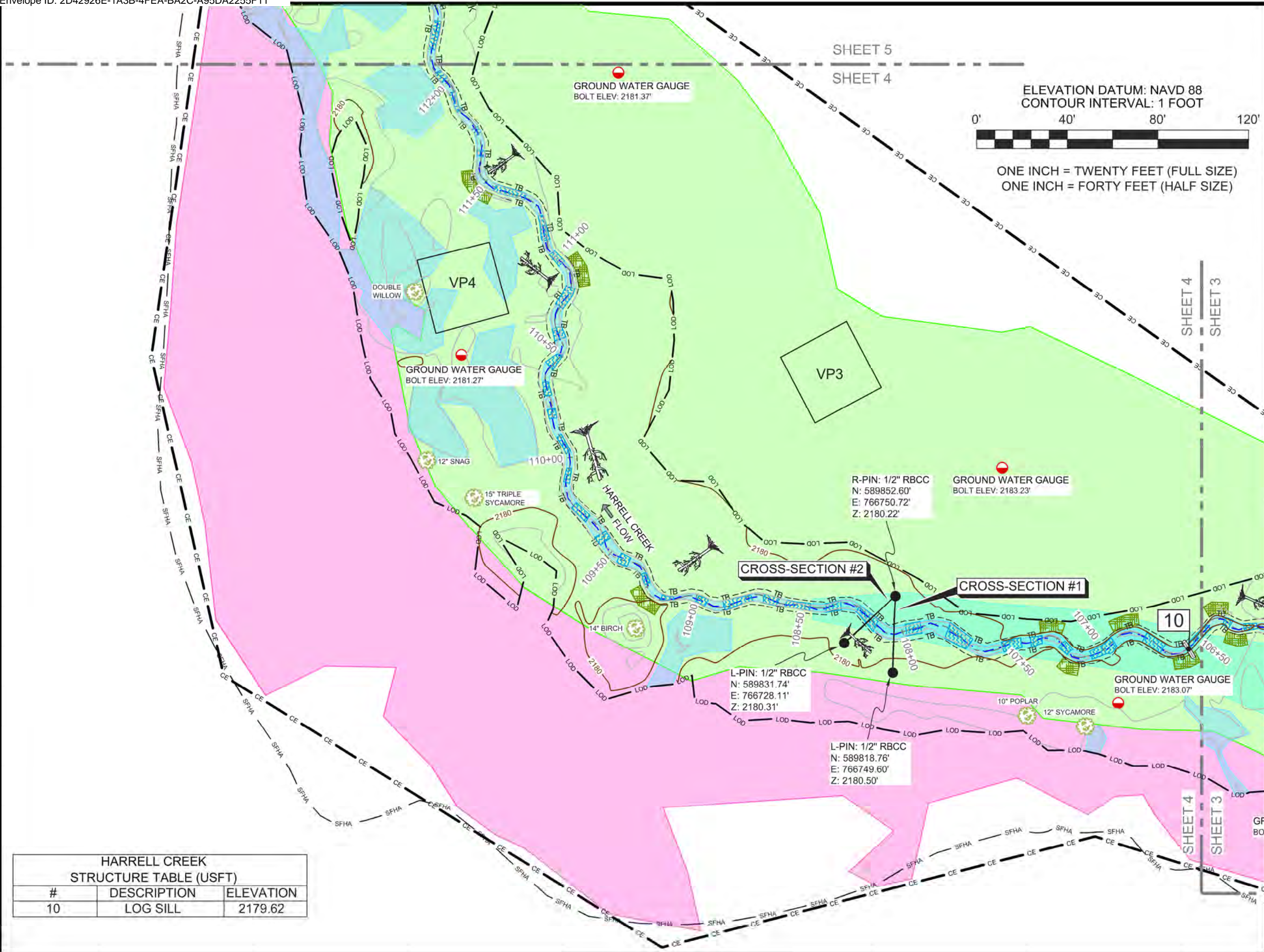
SHEET TITLE:
HARRELL CREEK

TOWNSHIP: CANEY FORK	COUNTY: JACKSON	STATE: NORTH CAROLINA
DRAWN BY: NH, AB	CHECKED BY: PBK	SURVEY BY: LDP, DP, KP, CG
SCALE: AS SHOWN	SURVEY DATES: 11/18/19 - 12/02/19	
JOB: #1910123-AB	SHEET SIZE: (HALF SIZE) 11" X 17"	
#	DATE	REVISIONS

SHEET:
3 OF 9



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SHEET 5
SHEET 4

ELEVATION DATUM: NAVD 88
CONTOUR INTERVAL: 1 FOOT



ONE INCH = TWENTY FEET (FULL SIZE)
ONE INCH = FORTY FEET (HALF SIZE)



PLEASE REFER TO THE COVERSHEET FOR THE STATEMENT OF CERTIFICATION
NOTE: SEE SHEET 1 FOR SURVEYOR'S NOTES & LEGEND

ELEVATION DATUM: NAVD 88
CONTOUR INTERVAL: 1 FOOT

AN AS-BUILT SURVEY FOR:
EW SOLUTIONS, LLC

SPO FILE NO. 50-BW
DMS PROJECT NO. 100005

PROJECT:
HARRELL
MITIGATION SITE

SHEET TITLE:
HARRELL CREEK

TOWNSHIP: CANEY FORK COUNTY: JACKSON STATE: NORTH CAROLINA

DRAWN BY: NH,AB CHECKED BY: PBK SURVEY BY: LDP,DP,KP,CG

SCALE: AS SHOWN SURVEY DATES: 11/18/19 - 12/02/19
JOB: #1910123-AB SHEET SIZE: 11" X 17"

#	DATE	REVISIONS

SHEET: 4 OF 9



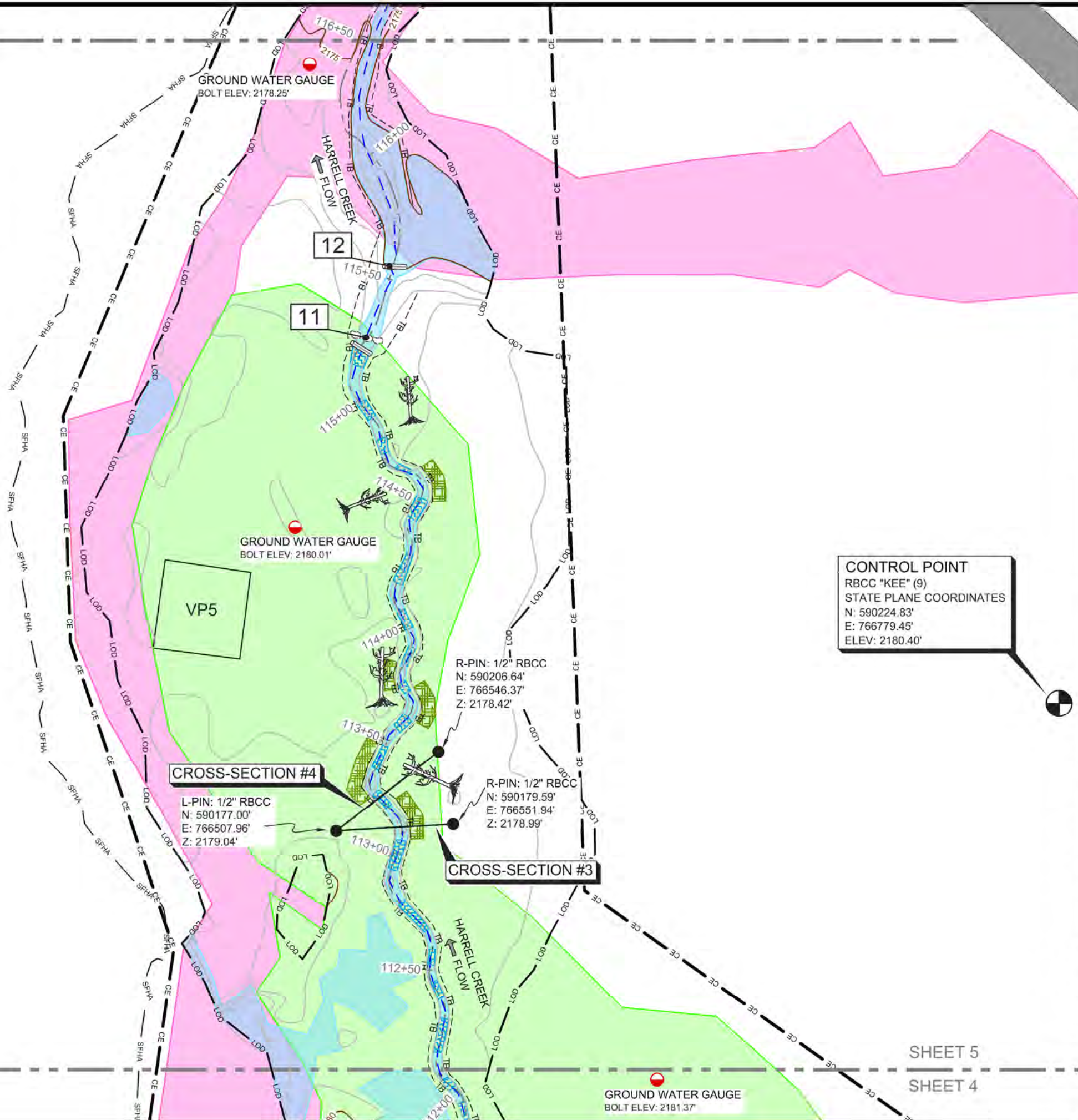
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#	DESCRIPTION	ELEVATION
10	LOG SILL	2179.62

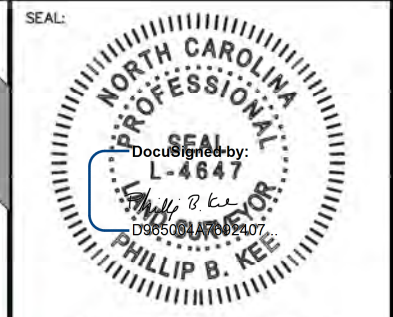
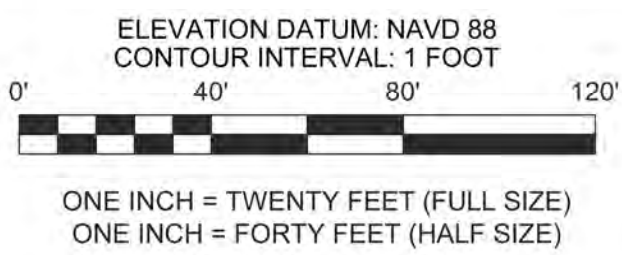
SHEET 6

SHEET 5

HARRELL CREEK STRUCTURE TABLE (USFT)		
#	DESCRIPTION	ELEVATION
11	BOULDER SILL	2176.71
12	LOG SILL	2174.94



CONTROL POINT
 RBCC "KEE" (9)
 STATE PLANE COORDINATES
 N: 590224.83'
 E: 766779.45'
 ELEV: 2180.40'



PLEASE REFER TO THE COVERSHEET FOR THE STATEMENT OF CERTIFICATION
 NOTE: SEE SHEET 1 FOR SURVEYOR'S NOTES & LEGEND

ELEVATION DATUM: NAVD 88
 CONTOUR INTERVAL: 1 FOOT

AN AS-BUILT SURVEY FOR:
 EW SOLUTIONS, LLC

SPO FILE NO. 50-BW
 DMS PROJECT NO. 100005

PROJECT:
 HARRELL
 MITIGATION SITE

SHEET TITLE:
 HARRELL CREEK

TOWNSHIP: CANEY FORK COUNTY: JACKSON STATE: NORTH CAROLINA

DRAWN BY: NH,AB CHECKED BY: PBK SURVEY BY: LDP,DP,KP,CG
 SCALE: AS SHOWN SURVEY DATES: 11/18/19 - 12/02/19
 JOB: #1910123-AB SHEET SIZE: (HALF SIZE) 11" X 17"

#	DATE	REVISIONS

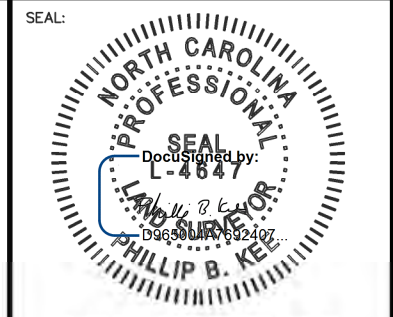
SHEET:
5 OF 9



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SHEET 5

SHEET 4



PLEASE REFER TO THE COVERSHEET FOR THE STATEMENT OF CERTIFICATION
 NOTE: SEE SHEET 1 FOR SURVEYOR'S NOTES & LEGEND

ELEVATION DATUM: NAVD 88
 CONTOUR INTERVAL: 1 FOOT

AN AS-BUILT SURVEY FOR:
 EW SOLUTIONS, LLC

SPO FILE NO. 50-BW
 DMS PROJECT NO. 100005

PROJECT:
 HARRELL MITIGATION SITE

SHEET TITLE:
 HARRELL CREEK END

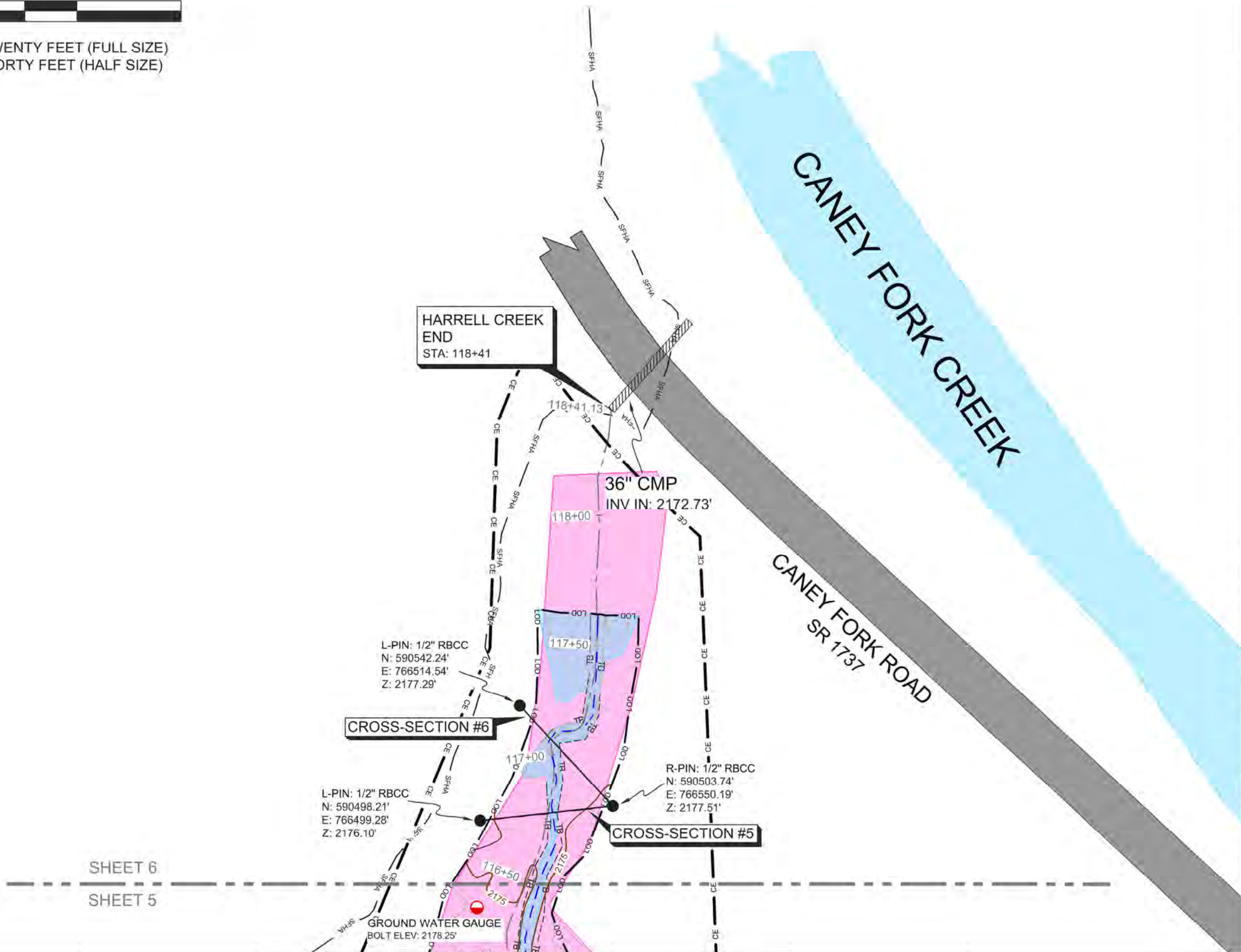
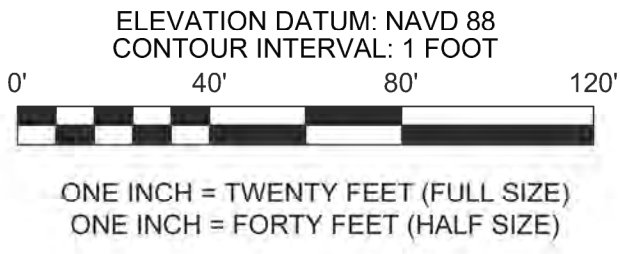
TOWNSHIP: CANEY FORK	COUNTY: JACKSON	STATE: NORTH CAROLINA
DRAWN BY: NH,AB	CHECKED BY: PBK	SURVEY BY: LDP,DP,KP,CG
SCALE: AS SHOWN	SURVEY DATES: 11/18/19 - 12/02/19	
JOB: #1910123-AB	SHEET SIZE: 11" X 17"	

#	DATE	REVISIONS

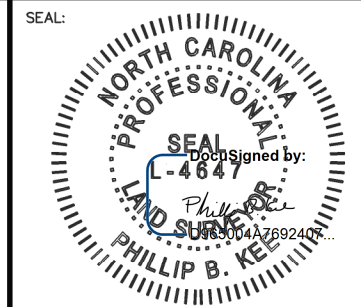
SHEET:
 6 OF 9



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SHEET 6
 SHEET 5



PLEASE REFER TO THE COVERSHEET FOR THE STATEMENT OF CERTIFICATION

NOTE: SEE SHEET 1 FOR SURVEYOR'S NOTES & LEGEND

ELEVATION DATUM: NAVD 88
CONTOUR INTERVAL: 1 FOOT

AN AS-BUILT SURVEY FOR:
EW SOLUTIONS, LLC

SPO FILE NO. 50-BW
DMS PROJECT NO. 100005

PROJECT:
HARRELL
MITIGATION SITE

SHEET TITLE:
CROSS-SECTIONS
1-6

TOWNSHIP: CANEY FORK	COUNTY: JACKSON	STATE: NORTH CAROLINA
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DRAWN BY: NH, AB	CHECKED BY: PBK	SURVEY BY: LDP, DP, KP, CG
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SCALE: AS SHOWN	SURVEY DATES: 11/18/19 - 12/02/19
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JOB: #1910123-AB	SHEET SIZE: 11" X 17"
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#	DATE	REVISIONS

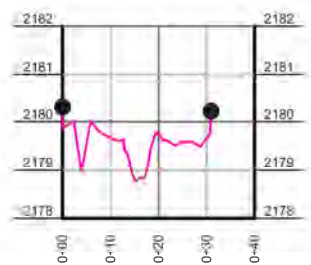
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7 OF **9**



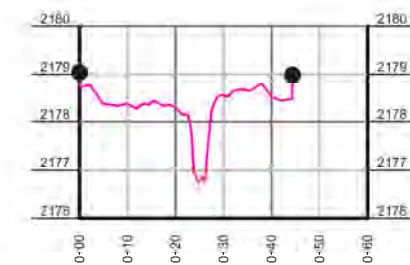
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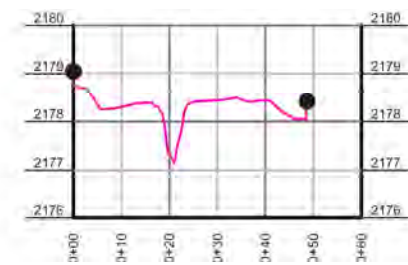
CROSS-SECTION #1-HARRELL CREEK
HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'



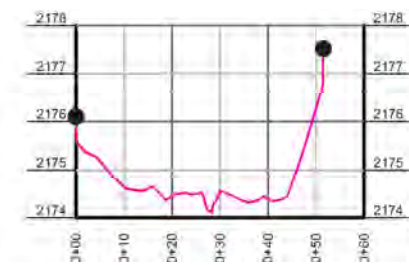
CROSS-SECTION #2-HARRELL CREEK
HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'



CROSS-SECTION #3- HARRELL CREEK
HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'



CROSS-SECTION #4-HARRELL CREEK
HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'



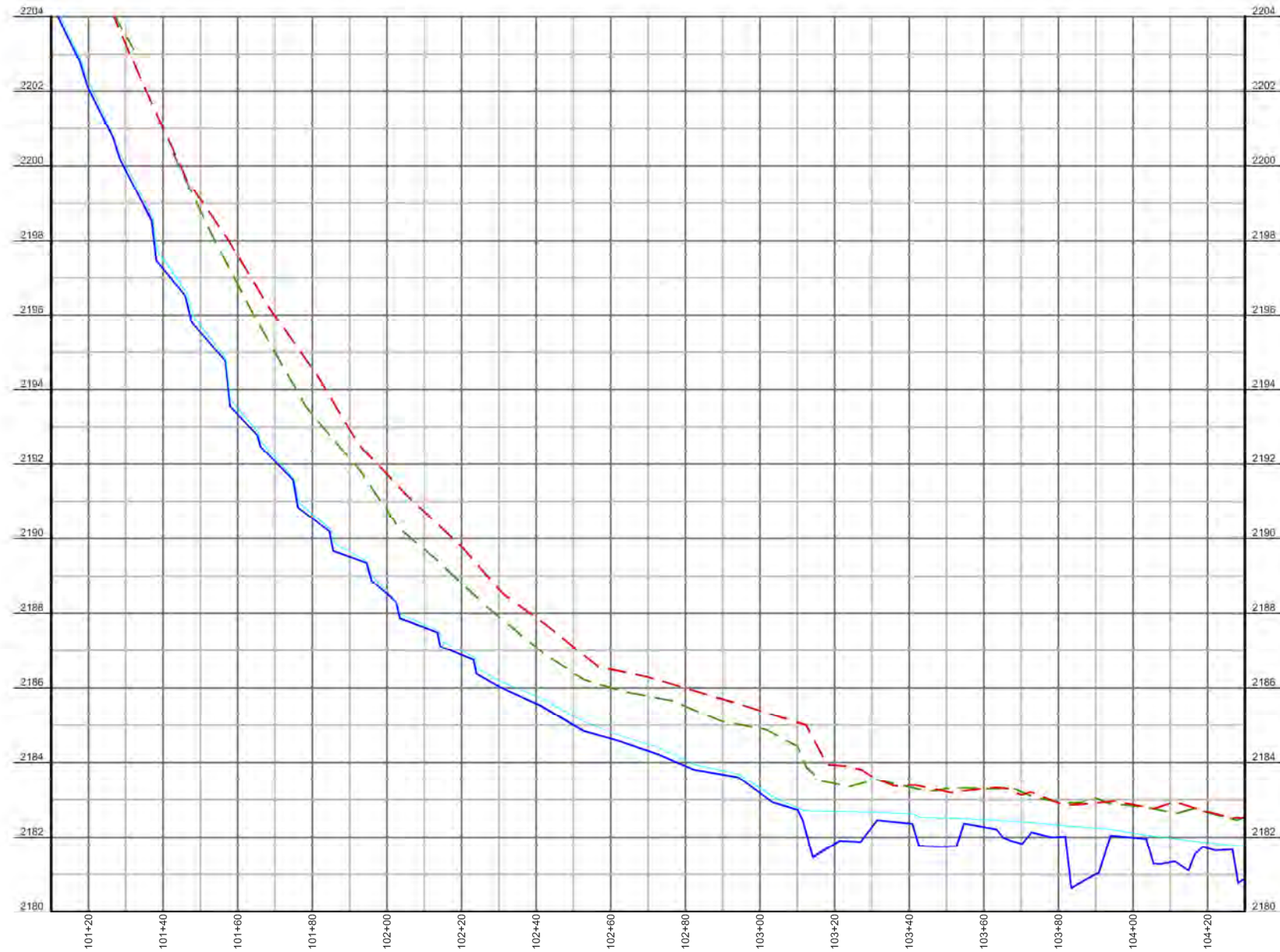
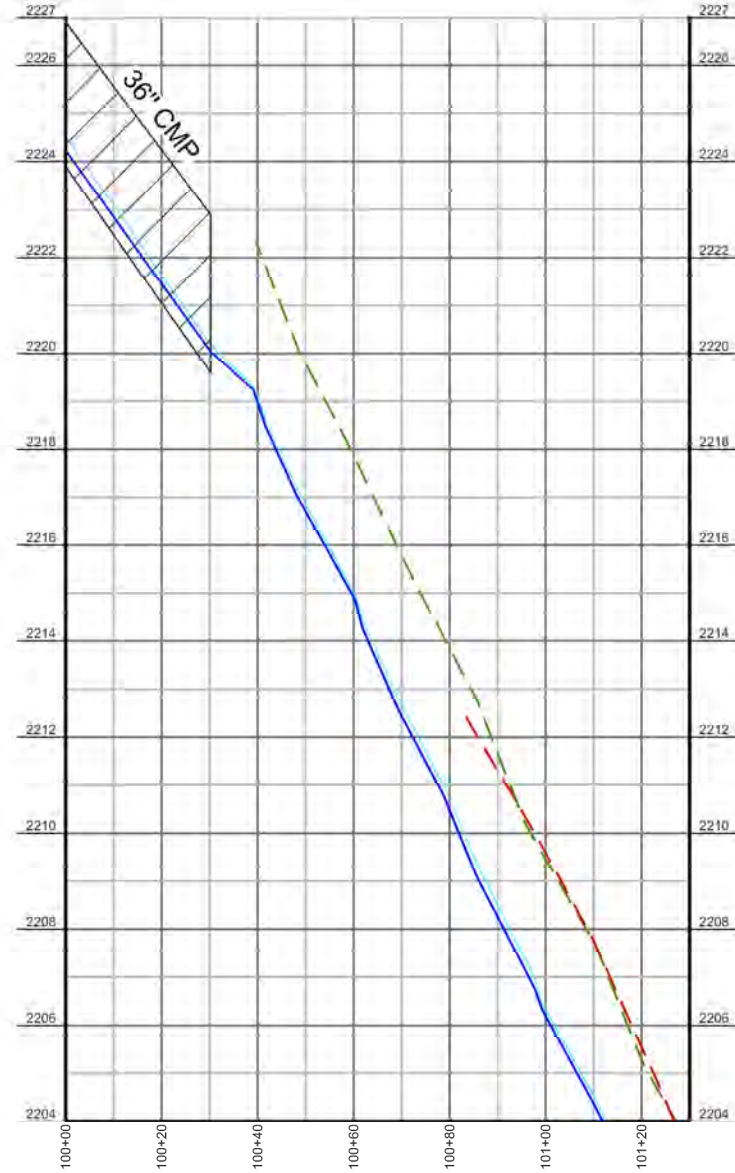
CROSS-SECTION #5-HARRELL CREEK
HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'



CROSS-SECTION #6-HARRELL CREEK
HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'

LEGEND

- CROSS-SECTION REBAR



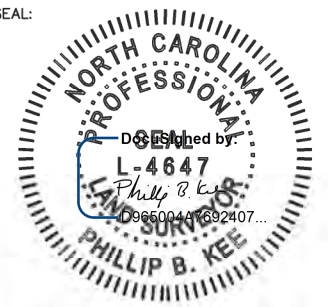
LONGITUDINAL PROFILE-HARRELL CREEK

HORIZONTAL: 1" = 40'
 VERTICAL: 1" = 4'

LEGEND

- THALWEG
- - - WATER SURFACE
- - - RIGHT TOP OF BANK
- - - LEFT TOP OF BANK

SEAL:



PLEASE REFER TO THE COVERSHEET FOR THE STATEMENT OF CERTIFICATION

NOTE: SEE SHEET 1 FOR SURVEYOR'S NOTES & LEGEND

ELEVATION DATUM: NAVD 88
 CONTOUR INTERVAL: 1 FOOT

AN AS-BUILT SURVEY FOR:
 EW SOLUTIONS, LLC

SPO FILE NO. 50-BW
 DMS PROJECT NO. 100005

PROJECT:
 HARRELL
 MITIGATION SITE

SHEET TITLE:
 LONGITUDINAL
 PROFILE

TOWNSHIP: CANEY FORK	COUNTY: JACKSON	STATE: NORTH CAROLINA
-------------------------	--------------------	--------------------------

DRAWN BY: NH,AB	CHECKED BY: PBK	SURVEY BY: LDP,DP,KP,CG
--------------------	--------------------	----------------------------

SCALE: AS SHOWN	SURVEY DATES: 11/18/19 - 12/02/19
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JOB: #1910123-AB	SHEET SIZE: (HALF SIZE) 11" X 17"
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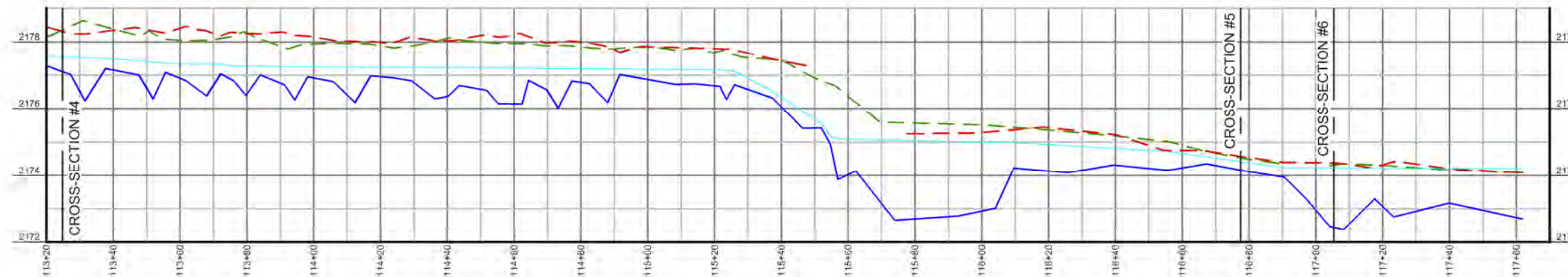
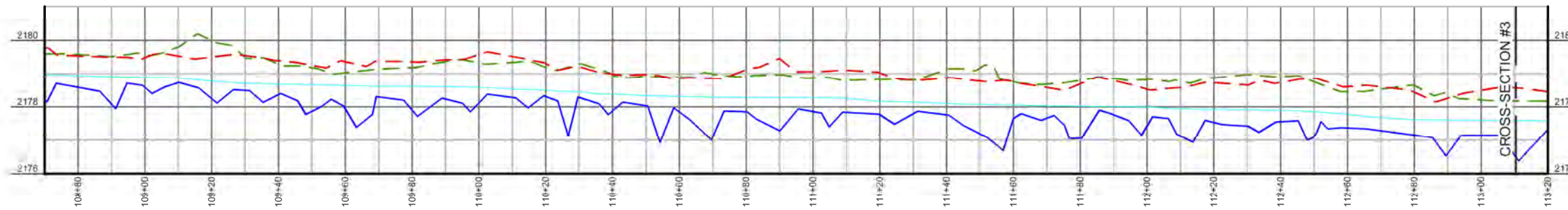
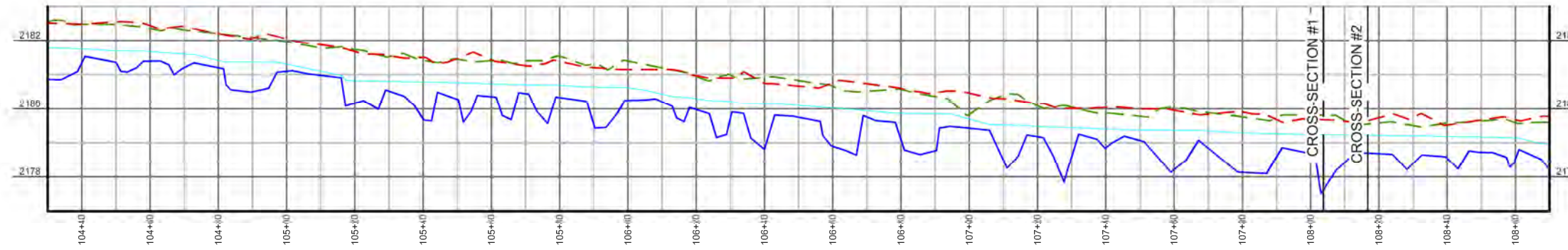
#	DATE	REVISIONS

SHEET:

8 OF 9



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LONGITUDINAL PROFILE-HARRELL CREEK

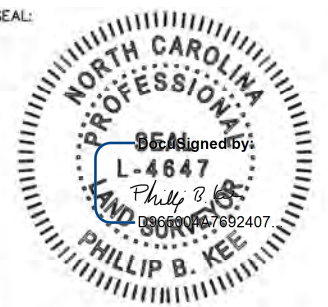
HORIZONTAL: 1" = 40'

VERTICAL: 1" = 4'

LEGEND

- THALWEG
- WATER SURFACE
- RIGHT TOP OF BANK
- LEFT TOP OF BANK

SEAL:



PLEASE REFER TO THE COVERSHEET FOR THE STATEMENT OF CERTIFICATION

NOTE: SEE SHEET 1 FOR SURVEYOR'S NOTES & LEGEND

ELEVATION DATUM: NAVD 88
CONTOUR INTERVAL: 1 FOOT

AN AS-BUILT SURVEY FOR:
EW SOLUTIONS, LLC

SPO FILE NO. 50-BW
DMS PROJECT NO. 100005

PROJECT:
HARRELL
MITIGATION SITE

SHEET TITLE:
LONGITUDINAL
PROFILE

TOWNSHIP: CANEY FORK	COUNTY: JACKSON	STATE: NORTH CAROLINA
DRAWN BY: NH,AB	CHECKED BY: PBK	SURVEY BY: LDP,DP,KP,CG
SCALE: AS SHOWN	SURVEY DATES: 11/18/19 - 12/02/19	
JOB: #1910123-AB	SHEET SIZE: (HALF SIZE) 11" X 17"	

#	DATE	REVISIONS

SHEET:
9 OF **9**



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