FINAL MITIGATION PLAN
Harrell Mitigation Site

Jackson County, NC
Project Number: 100005
Contract Number: 7006
RFP: 16-006811

Little Tennessee River Basin
Cataloging Unit 06010203010060

Prepared for:
North Carolina Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

January 15, 2019

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January 15, 2019
File: Final Mitigation Project for the
Harrell Mitigation Site
Little Tennessee River Basin – CU# 06010203
Jackson County
DMS Project ID No. 100005 / DEQ Contract #7006
A/E Project ID No. 1726211094

Attention: Paul Wiesner, Western Regional Supervisor
NCDEQ-DMS
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

Dear Mr. Wiesner,

Reference: Harrell Site Draft Mitigation Plan

EW Solutions has addressed the comments provided by the IRT for the review of the Draft Mitigation Plan. The following is a description and explanation of revisions that have been completed to address the comments:

Todd Bowers, USEPA, July 5, 2018:

Section 4.3 Wetland Assessment

Comment: Very pleased to see a wide range of ground water gauge data and the soil evaluation provided to support the analysis of wetland restoration and enhancement approaches. Generally, I agree that the information provided is sufficient and substantiates the provider's plan to preserve, enhance and restore the mosaic of wetlands on-site.

Response: Noted and appreciated.

Section 5.0 Functional Uplift and Potential

Comment: The functional assessment included is presented very well and clearly outlines the current functions, conditions and stressors to those functions for each reach.

Response: Noted and appreciated.

Reference: Harrell Site Draft Mitigation Plan

Comment: Table 10 is a clear and concise summary of the functional uplift potential.

Response: Noted and appreciated.

Section 6.0 Goals and Objectives

Comment: Very well presented preliminary and expanded goals tied to function and the development of objectives!

Response: Noted and appreciated.

Comment: I have only one small comment on Table 12 Goal of "improving landscape connectivity" to include an objective of providing for or ensuring aquatic organism passage by removing perched culverts or other barriers.

Response: Language has been revised within Table 12.

Section 7.1.2 Vegetation Communities

Comment: There seems to be a lack of information pertaining to the Swamp-Forest Bog Complex and the Piedmont/Mountain Semi-Permanent Impoundment plant community types. Specifically, the document should define which subtype of Swamp-Forest Bog and what plant species are being utilized per Schafale 2012.

Response: Language has been added.

Comment: The project planting plans do not address the different community types other than "wetland" and "riparian" planting zones.

Response: Due to the small area of replanting that will occur within the Piedmont/Mountain Semi permanent Impoundment community, the planting plan combines both wetland communities and is labeled as "Wetland Planting Zone." An additional note has been added to the Planting Plan detailing this.

Comment: Recommend adding the percentage of each species included in planting plans to avoid any one species comprising more than 50% of stems planted.

Response: The note within the Planting Plan Details of the design plans has been revised.

Reference: Harrell Site Draft Mitigation Plan

Comment: Lastly, the Asset map (Figure 4) and Proposed Monitoring Map (Figure 5) do not show these community types. Each community type should be represented by at least a single vegetation monitoring plot.

Response: Figures 4 and 5 have been updated to show each community. Only small areas within the Piedmont/Mountain Semi permanent Impoundment community, near the existing channel, will be planted due to construction activities. Vegetation plots that have been selected are representative of the natural communities at the site that will be planted.

Section 7.2.4 Wetland Design Overview

Comment: If supplemental plantings are to occur in preservation areas (Wetland A), especially with a 5:1 ratio, I would recommend that some vegetation monitoring plots are included to monitor survivorship.

Response: Planting and credit seeking for Wetland A has been revised. Supplemental planting will only occur in areas of ground disturbance. Areas of fill within the existing channel and not within the delineated wetland are proposed as Wetland Re-Establishment, with a proposed credit ratio of 1:1.

Comment: Target community of Swamp-Forest Bog is not addressed in this section or in the planting plan of Page 189.

Response: Language has been added and the planting plan has been updated.

Section 7.2.6 Implementation Methods

Comment: Recommend clarity of how re-establishment areas will "be ripped". The soil report recommends shallow ripping only with deep ripping deemed not necessary.

Response: Language has been added.

Comment: The planting plan does not include Swamp-Forest Bog plant community

Response: The planting plan has been updated to include the delineation of the Piedmont/Mountain Semi permanent Impoundment community and the Swamp-Forest Bog community. As stated in a previous comment, the proposed planting does not differentiate between the two communities due to the small area of the Piedmont/ Mountain Semi permanent Impoundment community proposed to be planted.

Comment: Recommend clarifying that the provider is not seeking additional stream credits due to buffer widths exceeding the 30-foot minimum.

Response: Language has been added.

Reference: Harrell Site Draft Mitigation Plan

Section 7.3 Risk Evaluation

Comment: Recommend adding beaver encroachment in the Risk Evaluation and Table 16.

Response: Language has been added.

Section 9.0 Performance Standards

Comment: Recommend reviewing the entire document to consistently use "four bankfull events" for documented occurrences of floodplain connectivity over the 7-year monitoring period.

Response: Discrepancies within the Mitigation Plan have been corrected.

Comment: Include the number of continuous days for groundwater elevation to meet the within 12 inches of the ground surface performance standard as well as the percentage of the growing season.

Response: Groundwater gauge data presented in Appendix C has been updated to show the number of consecutive days the groundwater is within 12 inches of the ground surface, and the resulting percentage of the growing season.

Mac Haupt, NCDWR, July 5, 2018:

Section 8.1 Determination of Credit

Comment: Table 17- Wetland A is listed as preservation at 5:1, the justification for the ratio is planting. Initially, DWR would need to know more about the extent of the plantings before a final ratio can be negotiated. Secondly, does it need to be planted? Recollections from the site visit don't lean towards needing planting. DWR is assuming that the berm removal areas are not within the proposed preservation area? One concern is in the berm removal area there were a number of larger trees, are most of those to be taken down? It appears since the existing stream is within this wetland area, then will be moved to outside of the proposed wetland polygon, including removal of a berm and filling the old channel, it warrants the question, is this wetland area more of an enhancement area than preservation? Or some combination of both?

Response: As stated in a previous comment, the planting and credit seeking for Wetland A has been revised. Replanting will only occur in areas of ground disturbance. Areas of fill within the existing channel and not within the delineated wetland are proposed as Wetland Re-Establishment, with a proposed credit ratio of 1:1. No credits will be pursued for Wetland Preservation. The majority of berms are located outside the existing wetland boundary, and as a part of the proposed grading over half of these will be excavated. Most woody material removed along with these berms,

especially larger trees, will be repurposed into the construction of the proposed channel and structures.

Section 9.1 Proposed Alternative Performance Standards for Vegetation Vigor

Comment: DWR is open to the proposed alternative performance standards for height and vigor, however, DWR will need more representative mountain species included in the planting plan, particularly for the tree species. DWR would like to see a substitute or additions to the proposed tree species, certainly more mountain-like species can be found other than Sycamore and Tulip Poplar. In addition, Stantec/EW should consider mountain laurel and rhododendron for the shrub layer. Some larger container species would likely help survival and growth as well.

Response: EW considered the tree species surrounding the site when selecting trees for the planting list. The trees species surrounding the Harrell Site include tulip poplar, sycamore, and red maple. The Harrell Site also drains directly to the Caney Fork River, a larger stream system with an abundance of canopy species typical of montane alluvial forests, including tulip poplar, sycamore, and red maples. With the exception of sycamore, these species would naturally occur in and around a Swamp-Forest Bog Complex (Typic Subtype). Of note is the naturally-homogeneous canopy that is typical of swamp forest-bog complex –red maple generally dominates and undergoes a successional growth pattern of growing large then uprooting and overturning, creating light gaps which are then invaded by pioneer plants. However, since DMS requirements specifically prohibit the planting of red maple this species is not included in the planting list. With regard to species composition, a multitude of montane species are included in the shrub layer of the SFBC, where an increase in plant diversity can be seen. These species include winterberry, buttonbush, spicebush, elderberry, and possum haw. It is understandable that DWR would like to see mountain laurel or rhododendron in the shrub layer, however the soils at the site do not support these species. The diversity of flora of the Harrell site, both in the bottomlands and the uplands surrounding the easement area, is indicative of generally rich, higher-pH soils which are not supportive of mountain laurel and rhododendron, which typically thrive in soils with moderate to high acidity. The areas where rhododendron and mountain laurel would be planted are also very wet and both of these species root systems, the latter more so than the former, prefer drier conditions.

Section 10.0 Monitoring Plan

Comment: Rather than a crest gauge, as proposed in Table 19, DWR would like to see a stream gauge placed in the stream at station 113+00 (sheet 9, design sheets).

Response: A stream gauge (continuous stage recorder) will be placed in the stream for use as a crest gauge.

Appendix B Plan Sheets

Comment: DWR does like the outlay of the design sheets, with a clear line for existing bed and proposed be with scale that clearly depicts bedform changes.

Response: Noted and appreciated.

Comment: The constructed riffle at station 115+50 appears very steep, DWR wonders whether a constructed riffle versus some sort of step down structure, cascading cross vane (?), would be more appropriate.

Response: Both options have been examined and it was decided that a steeper slope combining woody material is a lower risk option, and is more analogous to a naturally occurring feature, than a set of large step structures.

Andrea Hughes, USACE, August 10, 2018:

General

Comment: Please update the mitigation plan to reflect documentation, design, and monitoring revisions associated with Section 106 concerns. The boundary of the cultural resource site should be protected with temporary fencing to avoid encroachment during construction.

Response: Language has been added to reflect the Section 106 concerns. The installation of a protective fence around the cultural resource area is specified within the Erosion Control plans.

Comment: According to aerials, it appears that a large majority of the existing wetlands and the wetland re-establishment areas are forested yet these areas are proposed for planting on design sheet P-2? What is the acreage of woody vegetation that will be removed during construction?

Response: The proposed design will include the grading and replanting of a wooded area slightly larger than 1 acre. The majority of the woody material removed will be repurposed in the construction of the proposed channel and structures.

Comment: The plan indicates that Wetland A is proposed as preservation at a 5:1 ratio based on supplemental planting. Typically, areas that require supplemental planting are considered

enhancement (EIII). The provider should indicate the percentage of Wetland A that will require planting and propose appropriate monitoring and performance standards for planted areas.

Response: As stated in previous comments, the planting and credit seeking for Wetland A has been revised. Replanting will only occur in areas of ground disturbance. Areas of fill within the existing channel and not within the delineated wetland are proposed as Wetland Re-Establishment, with a proposed credit ratio of 1:1. This results in 0.26 acres seeking credits at 1:1 and no credits being sought for the 1.59 acres of wetland preservation. Effectively, 16% of the total area is proposed to be planted.

Section 4.1 Existing Stream Morphology

Comment: Page 15, Table 7 indicates Reach 1C as stream types E and F and Reach 1D as stream type E. Page 16 indicates Reach 1C and 1D of Harrell Creek as C and E type channels transitioning occasionally into D type braided channels. Please explain the discrepancy.

Response: Language has been corrected to "E and F type channels."

Appendix C Assessment Data

Comment: Please provide a chart depicting the consecutive number of days per year the groundwater levels were within 12 inches of the ground surface for each well.

Response: Groundwater gauge data presented in Appendix C has been updated to show the number of consecutive days the groundwater is within 12 inches of the ground surface and the resulting percentage of the growing season.

Appendix F Site Protection Instrument

Comment: You should provide a draft copy of the site protection document proposed for recording.

Response: The recorded plat containing the conservation easement has been added.

Appendix G Credit Release Schedule

Comment: Under credit release, please revise this section to state the reserve of 10% stream credits shall be released after four bank full events have occurred in separate years. Also, please update the stream credit release chart to show the 10% release beginning in Year 4.

Reference: Harrell Site Draft Mitigation Plan

Response: Language has been revised.

Comment: Please remove all statements related to early termination of monitoring.

Response: Language has been revised.

Appendix K Wetland JD Forms

Comment: Please include updated and signed JD forms.

Response: Updated JD forms have been added.

Respectfully,

Stantec Consulting Services, Inc.

Christopher M. Engle, P.E.
Senior Project Engineer

Attachment: Harrell Site Mitigation Plan

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

December 21, 2018

Regulatory Division

Re: NCIRT Review and USACE Approval of the Harrell Stream and Wetland Mitigation Plan; SAW-2016-02202; NCDMS Project # 100005

Mr. Tim Baumgartner
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Mr. Baumgartner:

The purpose of this letter is to provide the North Carolina Division of Mitigation Services (NCDMS) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day comment period for the Harrell Stream and Wetland Mitigation Plan, which closed on December 21, 2018. These comments are attached for your review.

Based on our review of these comments, we have determined that no major concerns have been identified with the Draft Mitigation Plan, which is considered approved with this correspondence. However, several minor issues were identified, as described in the attached comment memo, which must be addressed in the Final Mitigation Plan, including coordination with the Cherokee Nation's letter dated November 16, 2018.

The Final Mitigation Plan is to be submitted with the Preconstruction Notification (PCN) Application for Nationwide permit approval of the project along with a copy of this letter. Issues identified above must be addressed in the Final Mitigation Plan. All changes made to the Final Mitigation Plan should be summarized in an errata sheet included at the beginning of the document. If it is determined that the project does not require a Department of the Army permit, you must still provide a copy of the Final Mitigation Plan, along with a copy of this letter, to the appropriate USACE field office at least 30 days in advance of beginning construction of the project. Please note that this approval does not preclude the inclusion of permit conditions in the permit authorization for the project, particularly if issues mentioned above are not satisfactorily addressed. Additionally, this letter provides initial approval for the Mitigation Plan, but this does not guarantee that the project will generate the requested amount of mitigation credit. As you are aware, unforeseen issues may arise during construction or monitoring of the project that may require maintenance or reconstruction that may lead to reduced credit.

Thank you for your prompt attention to this matter, and if you have any questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please call me at 919-554-4884, ext 60.

Sincerely,

Kim Browning
Mitigation Specialist
for Henry Wicker

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
Paul Wiesner – NCDMS

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

CESAW-RG/Browning December 6, 2018

MEMORANDUM FOR RECORD

SUBJECT: NCDMS Harrell Mitigation Site - NCIRT Comments During 30-day Mitigation Plan Review

PURPOSE: The comments listed below were posted to the NCDMS SharePoint Site during the 30-day comment period in accordance with Section 332.8(g) of the 2008 Mitigation Rule.

NCDMS Project Name: NCDMS Harrell Mitigation Site, Jackson County, North Carolina

USACE AID#: SAW-2016-02202

NCDMS #: 10005

30-Day Comment Deadline: July 5, 2018 (Section 106 Consultation received 11/01/2018)

Todd Bowers, USEPA, July 5, 2018:

* Section 4.3/Page 17 Wetland Assessment.
    * Very pleased to see a wide range of ground water gauge data and the soil evaluation provided to support the analysis of wetland restoration and enhancement approaches. Generally, I agree that the information provided is sufficient and substantiates the provider's plan to preserve, enhance and restore the mosaic of wetlands on-site.
* Section 5.0 Functional Uplift and Potential:
    * The functional assessment included is presented very well and clearly outlines the current functions, conditions and stressors to those functions for each reach.
    * Table 10 is a clear and concise summary of the functional uplift potential.
* Section 6.0 Goals and Objectives
    * Very well presented preliminary and expanded goals tied to function and the development of objectives!
    * I have only one small comment on Table 12 Goal of "improving landscape connectivity" to include an objective of providing for or ensuring aquatic organism passage by removing perched culverts or other barriers.
* Section 7.1.2/Page 28: Vegetation Communities
    * There seems to be a lack of information pertaining to the Swamp-Forest Bog Complex and the Piedmont/Mountain Semi-Permanent Impoundment plant community types. Specifically, the document should define which subtype of Swamp-Forest Bog and what plant species are being utilized per Schafale 2012.
    * The project planting plans do not address the different community types other than "wetland" and "riparian" planting zones.

* Recommend adding the percentage of each species included in planting plans to avoid any one species comprising more than 50% of stems planted.
    * Lastly, the Asset map (Figure 4) and Proposed Monitoring Map (Figure 5) do not show these community types. Each community type should be represented by at least a single vegetation monitoring plot.
* Section 7.2.4/Page 32: Wetland Design Overview
    * If supplemental plantings are to occur in preservation areas (Wetland A), especially with a 5:1 ratio, I would recommend that some vegetation monitoring plots are included to monitor survivorship.
    * Target community of Swamp-Forest Bog is not addressed in this section or in the planting plan of Page 189.
* Section 7.2.6/Page 34-35: Implementation Methods
    * Recommend clarity of how re-establishment areas will "be ripped". The soil report recommends shallow ripping only with deep ripping deemed not necessary.
    * The planting plan does not include Swamp-Forest Bog plant community
    * Recommend clarifying that the provider is not seeking additional stream credits due to buffer widths exceeding the 30-foot minimum.
* Section 7.3/Page 35: Risk Evaluation
    * Recommend adding beaver encroachment in the Risk Evaluation and Table 16.
* Section 9.0/Page 41: Performance Standards
    * Recommend reviewing the entire document to consistently use "four bankfull events" for documented occurrences of floodplain connectivity over the 7-year monitoring period.
    * Include the number of continuous days for groundwater elevation to meet the within 12 inches of the ground surface performance standard as well as the percentage of the growing season.

Mac Haupt, NCDWR, July 5, 2018:

1. Table 17- Wetland A is listed as preservation at 5:1, the justification for the ratio is planting. Initially, DWR would need to know more about the extent of the plantings before a final ratio can be negotiated. Secondly, does it need to be planted? Recollections from the site visit don't lean towards needing planting. DWR is assuming that the berm removal areas are not within the proposed preservation area? One concern is in the berm removal area there were a number of larger trees, are most of those to be taken down? It appears since the existing stream is within this wetland area, then will be moved to outside of the proposed wetland polygon, including removal of a berm and filling the old channel, it warrants the question, is this wetland area more of an enhancement area than preservation? Or some combination of both?
2. Section 9.1- DWR is open to the proposed alternative performance standards for height and vigor, however, DWR will need more representative mountain species included in the planting plan, particularly for the tree species. DWR would like to see a substitute or additions to the proposed tree species, certainly more mountain-like species can be found other than Sycamore and Tulip Poplar. In addition, Stantec/EW should consider

mountain laurel and rhododendron for the shrub layer. Some larger container species would likely help survival and growth as well.

3. Rather than a crest gauge, as proposed in Table 19, DWR would like to see a stream gauge placed in the stream at station 113+00 (sheet 9, design sheets).
4. DWR does like the outlay of the design sheets, with a clear line for existing bed and proposed be with scale that clearly depicts bedform changes.
5. The constructed riffle at station 115+50 appears very steep, DWR wonders whether a constructed riffle versus some sort of step down structure, cascading cross vane (?), would be more appropriate.

Andrea Hughes, USACE, August 10, 2018:

1. Please update the mitigation plan to reflect documentation, design, and monitoring revisions associated with Section 106 concerns. The boundary of the cultural resource site should be protected with temporary fencing to avoid encroachment during construction.
2. According to aerials, it appears that a large majority of the existing wetlands and the wetland re-establishment areas are forested yet these areas are proposed for planting on design sheet P-2? What is the acreage of woody vegetation that will be removed during construction?
3. The plan indicates that Wetland A is proposed as preservation at a 5:1 ratio based on supplemental planting. Typically, areas that require supplemental planting are considered enhancement (EIII). The provider should indicate the percentage of Wetland A that will require planting and propose appropriate monitoring and performance standards for planted areas.
4. Page 15, Table 7 indicates Reach 1C as stream types E and F and Reach 1D as stream type E. Page 16 indicates Reach 1C and 1D of Harrell Creek as C and E type channels transitioning occasionally into D type braided channels. Please explain the discrepancy.
5. Appendix C: Please provide a chart depicting the consecutive number of days per year the groundwater levels were within 12 inches of the ground surface for each well.
6. Appendix F: You should provide a draft copy of the site protection document proposed for recording.
7. Appendix G: Under credit release, please revise this section to state the reserve of 10% stream credits shall be released after four bank full events have occurred in separate years. Also, please update the stream credit release chart to show the 10% release beginning in Year 4.
8. Appendix G: Please remove all statements related to early termination of monitoring.
9. Please include updated and signed JD forms.

Kim Browning
Mitigation Specialist
Regulatory Division

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5 Dogwood Road
Asheville, NC 28806

828.667.3838 PHONE
828.667.3839 FAX

www.TRCsolutions.com

October 11, 2018

Ms. Linda Hall
Assistant State Archaeologist
State Historic Preservation Office
176 Riceville Road
Asheville, North Carolina 28805

Re: Harrell Stream and Wetland Restoration Project Update (ER 16-2105), Upper Tuckasegee River, Jackson County, North Carolina

TRC Environmental Corporation (TRC) completed an archaeological survey for the proposed ca. 5-acre Harrell Stream Restoration Project in Jackson County, North Carolina on April 20–21, and on May 4 and 19, 2017 and that survey was detailed in a technical report finished shortly thereafter (Nelson 2017). The project area is located within an open field and wooded drainage south and west of a residence at 1414 Caney Fork Road, approximately 75 m southwest of Caney Fork Creek.

This study was conducted on behalf of Equinox Environmental to produce information on the presence and location of significant cultural resources within the project area in order to comply with Section 106 of the National Historic Preservation Act and so that the information could be considered for planning purposes. The survey satisfied the requirements for an intensive archaeological survey as defined by the North Carolina State Historic Preservation Office and Office of State Archaeology (NC HPO/OSA).

The survey resulted in the identification of one archaeological site, 31JK603, which is a Middle to Late Qualla (A.D. 1500–1838) phase (late prehistoric to historic Cherokee) habitation site. Based on the artifact density encountered, it is likely that site 31JK603 contains intact subsurface deposits such as structural patterns, pit features, and/or human graves. This site has the potential to provide substantial information concerning the late prehistory and early history of the region and is considered potentially eligible for the National Register of Historic Places (NRHP) under Criterion D. If 31JK603 could not be avoided by the proposed project, additional testing (e.g., mechanized stripping and/or test unit excavation) was recommended to investigate those parts of the site that might be affected by the project, and to further assess its integrity and NRHP eligibility (Nelson 2017).

The NC HPO concurred with that recommendation (Gledhill-Earley 2017), and Equinox Environmental has subsequently redesigned the new stream alignment in order to avoid the site (Figure 1). No ground disturbing activities will be conducted in the 31JK603 boundary other than tree planting. Tree planting (up to 1428 in number) will be done with bare root trees by a narrow dibble bar that will penetrate no deeper than 25 cm (10 inches), so will be largely confined to the plowzone, which ranges from 17–56 cm in thickness. Trees to be planted will be native to the area and no species that produce a tap root will be planted. Wetland conditions on site will lead to broad and swallow rooting. The Eastern Band of Cherokee Indians Tribal Historic Preservation Office has offered to send one of their staff out to observe the planting activities. Orange sediment fence will be installed just outside the site boundary to keep construction equipment and other activities completely out of the area, and this will be considered a restricted area. No construction activities will occur within 31JK603 boundary, nor will any occur to the north of that boundary

as the site likely continues in that direction. No monitoring features will be installed within the 31JK603 boundary or to the north of that boundary.

The tested portion of site 31JK603 lies largely within the proposed conservation easement. We believe the redesign not only accomplishes the project's goal of stream restoration and wetland reestablishment, but also helps preserve this Cherokee archaeological site. If you have any questions or concerns about this investigation or about the preservation and avoidance plans for 31JK603 please feel free to contact Steve Melton at (828)-253-6856 x 207 or steve@equinoxenvironmental.com or me at (828) 230-4812 or tbenyshek@trcsolutions.com. We look forward to hearing from you.

Sincerely,

Tasha Benyshek, M.A.
Senior Archaeologist, Asheville

References

Glehill-Earley, Renee
2017 Harrell Stream Mitigation, Upper Tuckasegee River, Jackson County, ER 16-2105_7. NC HPO letter to Equinox Environmental, Asheville.

Toombs, Elizabeth
2018 Harrell Stream and Wetland Mitigation Site. Cherokee Tribal Historic Preservation Office letter to United States Army Corps of Engineers, Regulatory Division, Wilmington District.

Nelson, Michael
2017 *Archaeological Survey for the Harrell Stream Restoration Project, Jackson County, North Carolina*. TRC Environmental, Asheville. Report submitted Equinox Environmental, Asheville.

Site Boundary (31JK603)

Shovel Test Negative

Shovel Test Positive

New Stream Alignment

Conservation Easement Boundary

Wetland Re-Establishment

Wetland Preservation

Logging Road

Parcel Data (2018)

Proposed Monitoring Features

Crest Gauge

Groundwater Gauge

Monioring Cross-section

Vegetation Plot

EQUINOX

balance through proper planning

Conceptual Plan
Harrell Stream And Wetland
Restoration Site
Jackson County, NC

N

W E

S

0 125 250

Feet

Note: This map is not a survey and is not to be construed as such

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North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

September 26, 2017

Steve Melton
Equinox Environmental
37 Haywood Street, Suite 100
Asheville, NC 28801

steve@equinoxenvironmental.com

Re: Harrell Stream Mitigation, Upper Tuckasegee River, Jackson County, ER 16-2105

Dear Mr. Melton:

Thank you for your letter of September 20, 2017, providing the redesigned plans for the above project.

The revised map indicates that archaeological site 31JK603 will be avoided by ground disturbing activities. Therefore, no additional archaeological work is recommended in connection with this project. We appreciate your efforts to avoid impact to potentially significant archaeological resources.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Ramona Bartos

GWYᏰ DᏰP
CHEROKEE NATION®
P.O. Box 948 • Tahlequah, OK 74465-0948 • 918-453-5000 • cherokee.org

Office of the Chief

Bill John Baker
Principal Chief
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S. Joe Crittenden
Deputy Principal Chief
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September 28, 2018

Andrea Hughes
United States Army Corps of Engineers
Regulatory Division, Wilmington District
11405 Falls of Neuse Road
Wake Forest, NC 27587

Re: Harrell Stream and Wetland Mitigation Site

Ms. Andrea Hughes:

The Cherokee Nation (Nation) is in receipt of the related cultural resource survey map about and design plans for the **Harrell Stream and Wetland Mitigation Site**, and appreciates the opportunity to provide comment upon this project. Please allow this letter to serve as the Nation's continued interest in acting as a consulting party to this proposed undertaking.

The Nation maintains databases and records of cultural, historic, and pre-historic resources in this area. Our Historic Preservation Office reviewed this project, cross referenced the project's legal description against our information, and found instances where this project occurs within the boundaries of culturally sensitive Site 31JK603, a property eligible for the National Register of Historic Places under Criterion D. Thus, this Office finds that the proposed project will have an **adverse effect** on Site 31JK603.

The Nation requests that the proposed undertaking avoid direct and indirect effects to Site 31JK603. Additionally, the Nation requests that the United States Army Corps of Engineers conduct appropriate inquiries with other pertinent Tribal and Historic Preservation Offices regarding historic and prehistoric resources not included in the Nation's databases or records.

If you require additional information or have any questions, please contact me at your convenience. Thank you for your time and attention to this matter.

Wado,

Elizabeth Toombs, Tribal Historic Preservation Officer
Cherokee Nation Tribal Historic Preservation Office
elizabeth-toombs@cherokee.org
918.453.5389

CC: Ramona Bartos, North Carolina State Historic Preservation Office

GWYᏭ DᏃᏢ
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Office of the Chief

Bill John Baker
Principal Chief
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S. Joe Crittenden
Deputy Principal Chief
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November 16, 2018

Donnie Brew
Federal Highway Administration, North Carolina Division
310 New Bern Avenue, Suite 410
Raleigh, NC 27601

Re: Harrell Stream and Wetland Mitigation Site

Mr. Donnie Brew:

The Cherokee Nation (Nation) is in receipt of your correspondence about **Harrell Stream and Wetland Mitigation Site**, and appreciates the opportunity to provide comment upon this project. Please allow this letter to serve as the Nation's continued interest in acting as a consulting party to this proposed undertaking.

The Nation maintains databases and records of cultural, historic, and pre-historic resources in this area. Our Historic Preservation Office reviewed this project, cross referenced the project's legal description against our information, and found instances where this project intersects or adjoins such resources. However, the Nation notes that the Federal Highway Administration (FHWA) and the United States Corps of Engineers (USACE) will take protective measures to ensure that Site 31JK603 is protected from the proposed project's indirect and direct effects. Thus, this Office does not object to the project proceeding as long as the following recommendations are observed:

- Regarding Site 31JK603, the Nation concurs with the redesigned alignment and provided work plan to limit tree planting to no deeper than 25 cm (10 in) in addition to protecting the site from the project's indirect and direct activities;

- The Nation also concurs that tribal monitor(s) provided by the Eastern Band of Cherokee Indians should be present throughout ground-disturbing activities for this proposed project;

- The Nation requests that Federal Highway Administration (FHWA) re-contact this Office for additional consultation if there are any changes to the scope of or activities within the Area of Potential Effect;

- The Nation requests that FHWA halt all project activities immediately and re-contact our Offices for further consultation if items of cultural significance are discovered during the course of this project; and

- The Nation requests that FHWA conduct appropriate inquiries with other pertinent Tribal and Historic Preservation Offices regarding historic and prehistoric resources not included in the Nation's databases or records.

If you require additional information or have any questions, please contact me at your convenience. Thank you for your time and attention to this matter.

Wado,

Elizabeth Toombs, Tribal Historic Preservation Officer
Cherokee Nation Tribal Historic Preservation Office
elizabeth-toombs@cherokee.org
918.453.5389

Sign-off Sheet

This document entitled FINAL MITIGATION PLAN Harrell Mitigation Site was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of EW Solutions, LLC. Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by 

(signature)

Amber L Coleman, LSS, PWS

Reviewed by 

(signature)

Chris Engle, PE

Approved by 

(signature)

Grant Ginn, PE

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HARRELL MITIGATION SITE
MITIGATION PLAN

Mitigation Plan Preparation

Mitigation Provider:	**EW Solutions, LLC** 37 Haywood Street, Suite 100 Asheville, NC 28778 (828) 253-6956 Project Manager: Steve Melton
Design and Mitigation Plan Preparation Firm:	**Stantec Consulting Services Inc.** 56 College Street, Suite 201 Asheville, NC 28801 (828) 449-1930 Senior Engineer: S. Grant Ginn, PE Senior Scientist: Amber Coleman, PWS, LSS
Environmental Services Firm:	**Equinox Environmental** 37 Haywood Street, Suite 100 Asheville, NC 28778 (828)253-6856 Senior Scientist: Steve Melton

Regulatory Compliance

This mitigation plan has been written in conformance with the requirements of the following:

- Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010.

These documents govern NCDMS operations and procedures for the delivery of compensatory mitigation.

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1.0 INTRODUCTION

EW Solutions (EWS) proposes to restore and protect one stream and associated wetlands in Jackson County as a full-delivery mitigation project for the North Carolina Division of Mitigation Services (DMS). The Harrell Mitigation Site (the Site) is located approximately 2.8 miles southeast of Cullowhee, NC (Figure 1). The Site consists of a small unnamed tributary to Caney Fork and its adjacent wetlands. The unnamed tributary is referred to as Harrell Creek for purposes of this plan. The Harrell Site encompasses approximately 8.4 acres of seep-fed headwater stream continuing to an actively managed floodplain. The stream channel was likely relocated, and a berm was constructed redirecting and creating an unnatural flow of the stream. This mitigation plan describes the details, methods, and protocols to provide restoration and preservation activities of the project stream along with restoration of wetlands through rehabilitation and re-establishment.

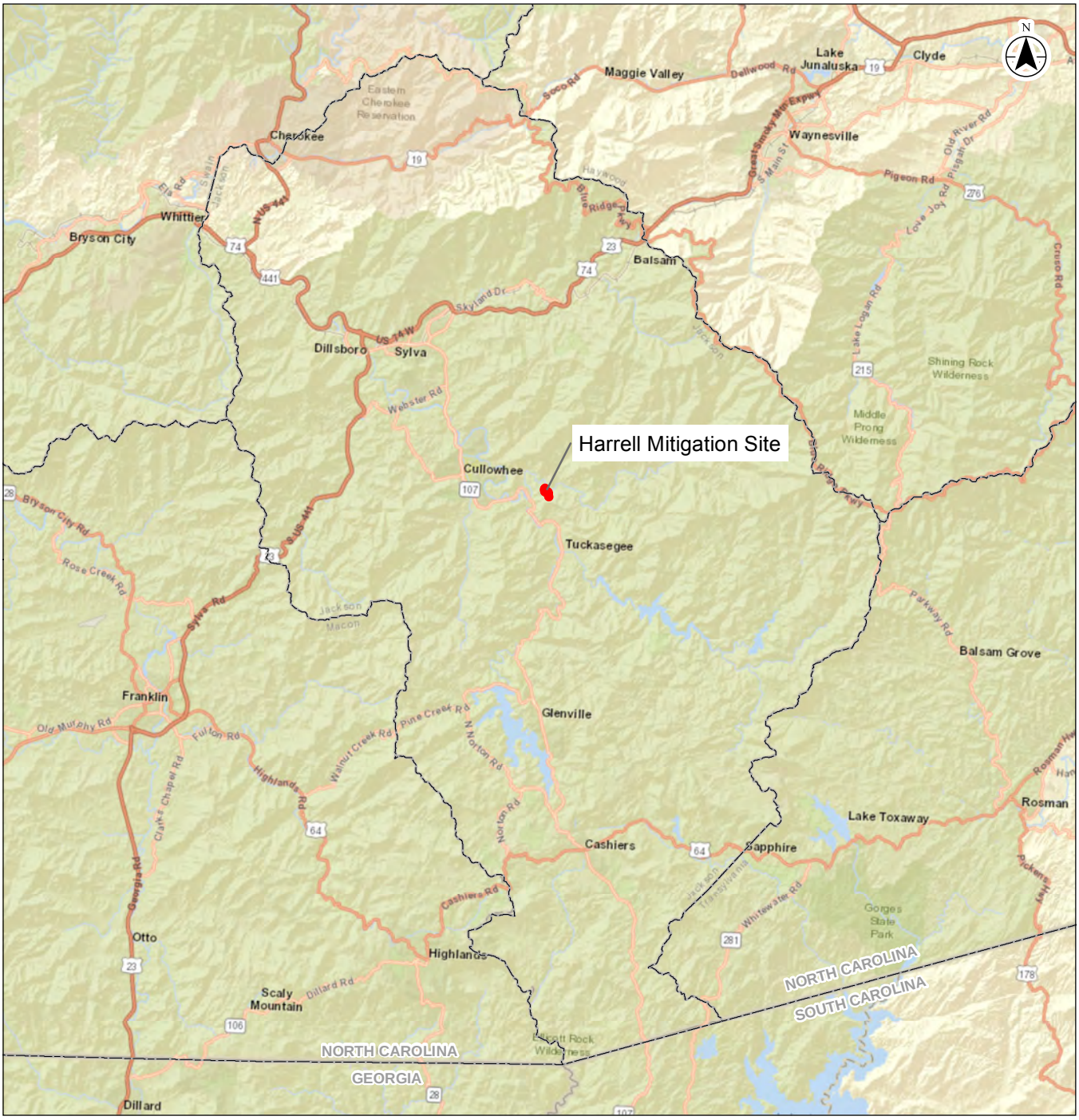
Historic land use at the Site has consisted of silvicultural logging and agricultural use for at least 40 years, according to historical aerial photos. Historic agricultural practices, relocation of the channel, and berm construction along the right descending bank of Harrell Creek has functionally removed 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 Site. The lack of deep-rooted vegetation and unstable channel characteristics appears to have contributed to the degradation of streambanks on both sides of the project.

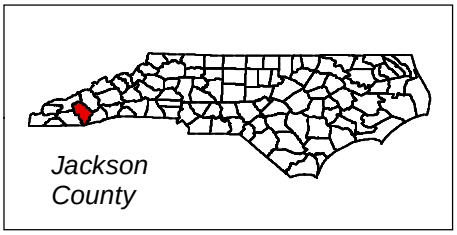
The goal of the project is to restore ecological function to the existing stream, wetlands, and riparian corridor by returning the existing stream and wetlands to a stable condition. The relocation of Harrell Creek to the historic floodplain and removal of the berm will alter the flooding frequency of the channel, restore proper floodplain connectivity, and improve wetland hydrology. The restoration within the upstream reach will consist of addressing a perched culvert, removing a second pipe crossing, and correcting erosion issues from an existing logging road through the installation of storm water control devices. At the downstream end of Harrell Creek, the profile of the channel will be raised and proper channel dimensions will be restored.

Measures to promote functional uplift will include stabilizing and revegetating stream banks and adjacent disturbed areas, restoring floodplain connectivity and wetland hydrology, and reestablishing wooded riparian areas. These measures will likely contribute to reduced downstream sediment and nutrient loads, as well as improving aquatic and terrestrial habitats.

Table 1 Project Descriptors

Project Descriptors	
River Basin	Little Tennessee River
Hydrologic Unit Code (HUC)	06010203
Physiographic Region	Blue Ridge Mountains
EPA Level IV Ecoregion	Southern Crystalline Ridges and Mountains (66d)
Latitude/Longitude	35^0 18' 1.97" N, 83^0 7' 58.28" W
Street Address	1414 Caney Fork Rd., Cullowhee, NC 28723
Existing Stream Length (ft)	2,595 linear feet
Existing Wetland Area (ac)	1.83 acres
Expected Stream Mitigation Units (SMU)	1,854 stream mitigation units
Expected Wetland Mitigation Units (WMU)	3.53 wetland mitigation units





Legend

County Boundaries

Harrell Site Boundary

0 4 8 Miles

1:350,000 (at original document size of 8.5x11)

Stantec

EW SOLUTIONS

Project Location
Jackson Co, NC

Prepared by ALC on 2017-11-20
Reviewed by MMR on 2017-11-21

Client/Project
EW Solutions
Harrell Mitigation Site
Project Number: 100005

Figure No.
1

Title
Vicnity Map

Notes
1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Base features: layer sources.
3. Base Imagery: ESRI Map Services.

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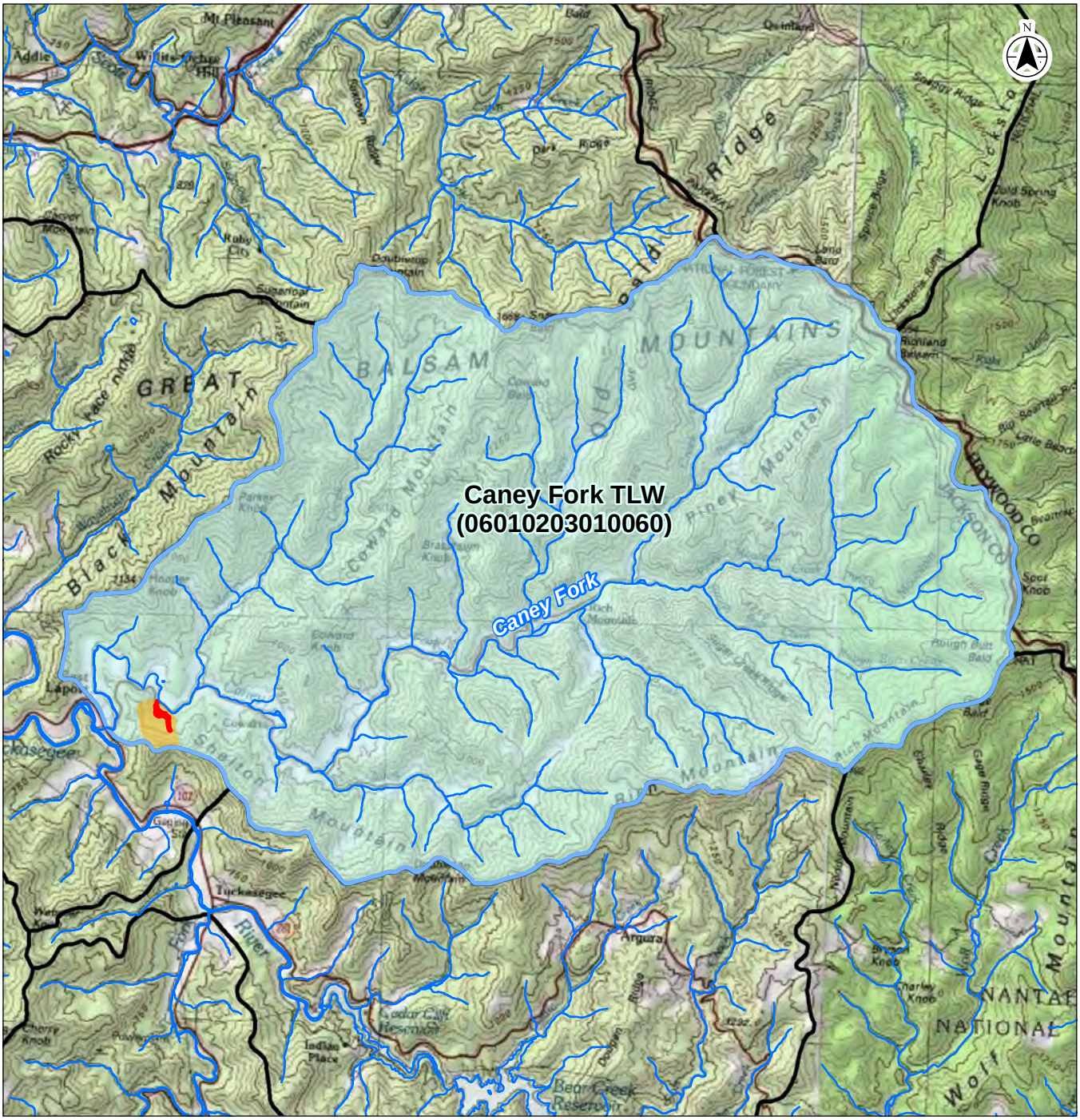
2.0 WATERSHED APPROACH AND SITE SELECTION

The Harrell Stream and Wetland Mitigation Site was selected to support the DMS watershed planning approach to restoration activities. A product of the watershed planning by the DMS was the development of the River Basin Restoration Plans (RBRP) to identify restoration goals and targeted local watersheds (TLW). The Site lies in the Eastern Little Tennessee River Basin, which is identified as a Targeted Local Watershed according to the 2008 Little Tennessee River Basin Restoration Priorities Plan (NCDMS 2008). The Little Tennessee RBRP identifies broad restoration goals for the River Basin, including implementing wetland and stream restoration projects that reduce sources of sediment and nutrients by restoring riparian buffer vegetation, stabilizing banks, and restoring natural geomorphology, especially in headwater streams. A list of preliminary project goals for the Site has been developed to identify how the project will help to meet the overall goals of the RBRP. The table below illustrates the linkage between the on-site watershed stressors and the preliminary goals for the Site. These preliminary goals will be further defined and expanded in Section 6 of this report following the functional assessment of the existing site conditions.

Table 2 Watershed Stressors and Preliminary Project Goals

Stressors	Preliminary Goals
Streambank erosion Floodplain disconnection Wetland Ditching	Reduce sediment inputs from eroding stream banks Restore floodplain connectivity Restore wetland hydrologic function
Nutrient enrichment Decreased Dissolved Oxygen	Reduce nutrient inputs to the project streams (nitrogen, phosphorus) Increase dissolved oxygen levels
Habitat Fragmentation Ecological Function	Reduce maximum water temperatures Restore buffers with native riparian plant community Improve aquatic habitat complexity Improve terrestrial habitat



Legend

- USGS 24K Streams (Little Tennessee Basin)
- Harrell Site Boundary
- Harrell Creek Watershed
- Caney Fork Targeted Local Watershed
- 14-digit Hydrologic Units

0 6,000 12,000 Feet

1:110,000 (at original document size of 8.5x11)

Stantec EW SOLUTIONS

Project Location
Jackson Co, NC

Prepared by ALC on 2017-11-30
Technical Review by CME on 2017-12-21
Independent Review by SGG on 2017-01-04

Client/Project
EW Solutions
Harrell Mitigation Site
Project Number: 100005

Figure No.
2

Title
Watershed Map

Notes
1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Base features: USGS, NCCGIA, Stantec.
3. Base Imagery: ESRI Map Services.

V:\1726\active\172621094\03_data\vis_cad\Figure 2_Watershed.mxd Revised: 2018-01-10 By: acoleman

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3.0 WATERSHED AND RESOURCE CONDITIONS

Investigations into the existing resource conditions were conducted as a part of the Environmental Resource Technical Report (ERTR), dated October 2017, prepared by Equinox Environmental. A summary of the findings from the ERTR are presented in the following sections and include jurisdictional determinations for aquatic resources and effects on threatened and endangered species. Investigations were conducted to evaluate historical land use and future development trends, which included review of available historical aerial and satellite imagery, interviews with local residents and property managers, and interviews with planning authorities. Additionally, investigations were conducted into the geology, physiography, and soil properties which included review of the geologic mapping by the NC Geologic Survey, topographic mapping of the Site, and the Jackson County Soil Survey. The following sections summarize these findings and their potential influence on the characteristics of the Site.

3.1 USGS HYDROLOGIC CODE AND NCDWR RIVER BASIN DESIGNATIONS

Harrell Creek drains to Caney Fork, part of the Tuckasegee River watershed. The following table lists the watershed designations.

Table 3 Watershed Designations

Watershed Designations	
River Basin	Little Tennessee River
DWR Sub-basin	04-04-02
Watershed	Eastern Little Tennessee River (Tuckasegee River) LT03
Hydrologic Unit Code (HUC)	06010203010060
NCDWR Classification (1992)	WS-III; Tr
Thermal Regime	Cold
EPA 303(d) List	Not Listed

3.2 WATERSHED CHARACTERIZATION

A large portion of this watershed is in the Nantahala National Forest and 95% of the watershed's landcover is forested. The remaining land uses are comprised of agriculture and residential use. There are no significant developments within the watershed that are altering the hydrologic regime. Jackson County receives moderate rainfall, having an annual precipitation averaging approximately 52 inches.

Table 4 Watershed Characterization

Watershed Characterization						
Reach	**DA (mi^2)**	**DA (ac)**	**Forest**	**Agriculture**	**Residential**	**Impervious**
Harrell Creek	0.16	102	95%	2.3%	2.4%	0.04

3.3 PHYSIOGRAPHY, GEOLOGY, AND SOILS

The Harrell Site lies in the Southern Crystalline Ridges and Mountains Level IV ecoregion of the Blue Ridge Level III ecoregion (Griffith et al. 2002), which is also located within the Blue Ridge Belt, Ashe Metamorphic Suite and Tallulah Falls, Muscovtie-Biotite Gneiss Formation. The crystalline rock types are mostly gneiss and schist and are generally covered by well-drained, acidic, loamy soil. Bedrock outcrops are present within the existing channel in the preservation reach, but as the stream nears the valley bottom these become less frequent and are only present along the toe of slope. Streams within the ecoregion are generally high gradient, often with boulder and bedrock substrates. The dominant soils found on site include sandy loam and gravelly loam soils. The surrounding geology provides the underlying valley forms, soils and stream substrate but does not represent any unexpected constraints or limitations on the natural stream process.

The valley associated with Reaches 1A and 1B is steep and colluvial. This valley presents structurally influenced morphology which acts to limit channel belt-width development and support low sinuosity plan form. Reaches 1C and 1D are within a broad alluvial valley associated with Caney Fork to which Harrell Creek ultimately discharges. The low gradient of the valley encourages the retention of surface water and groundwater which is necessary for the development and maintenance of hydric soils.

Table 5 Physiographic and Geologic Characterization

Physiography and Geology			
Level IV Ecoregion		Southern Crystalline Ridges and Mountains	
Local Lithology		Blue Ridge Belt - Gneiss and Schist	
Soil Class		Nikwasi, Rosman, Cullasaja-Tuckasegee complex, Trimont and Biltmore	
Elevation Range		2,180-2,460 ft. msl.	
Reach	Valley Form	Cross Slope	Longitudinal Slope
1A	Colluvial	60%	25%
1B	Colluvial	30% - 70%	6% - 20%
1C	Alluvial Floodplain	0.5% - 1.2%	0.7%
1D	Alluvial Floodplain	2% - 4%	0.3%

3.4 JURISDICTIONAL DETERMINATIONS

As documented in the ERTR, Harrell Creek within the project site is considered a perennial stream (see Appendix J for NCDWR Stream Classification Forms). The headwaters also include an additional small perennial tributary (mitigation is not proposed for this tributary). Harrell Creek (S01) had a score of 30.5 using the NCDWR rating methodology. Potential jurisdictional wetlands occur on the east and west sides of the project (see Figure 3). The approximate area of existing wetlands on the project is 2.06 acres, resulting from 1.82 acres for Wetland A and 0.24 acres for Wetland B. Of this total only 1.83 acres lie within the conservation easement and are being accounted for mitigation credit. The preliminary JD (Action ID SAW-2016-02202) for the project site has been completed and can be found in Appendix K.

3.5 THREATENED AND ENDANGERED SPECIES

As documented in the ERTR, the project is expected to have no effect on any threatened and endangered species listed in the USFWS IPaC database with the possible exception of the Northern Long-Eared Bat (NLEB). Follow-up consultation with the USFWS determined that the project could involve incidental take of the NLEB, however this is not prohibited by the final 4(d) rule.

Table 6 Threatened and Endangered Species List for the Harrell Site

Species	Scientific Name	State Status	Federal Status	Biological Conclusion
Swamp Pink	*Helonia bullata*	Threatened	Threatened	No Effect
Small Whorled Pogonia	*Isotria medeoloides*	Threatened	Threatened	No Effect
Northern Long-eared Bat	*Myotis septentrionalis*	N/A	Threatened	May Affect
Indiana Bat	*Myotis sodalis*	Endangered	Endangered	No Effect
Carolina Northern Flying Squirrel	*Glaucomys sabrinus coloratus*	Endangered	Endangered	No Effect
Appalachian Elktoe	*Alasmidonta raveneliana*	Endangered	Endangered	No Effect
Rock Gnome Lichen	*Gymnoderma lineare*	N/A	Endangered	No Effect
Spruce-fir Moss Spider	*Microhexura montivaga*	N/A	Endangered	No Effect

3.6 CULTURAL RESOURCE INVESTIGATION

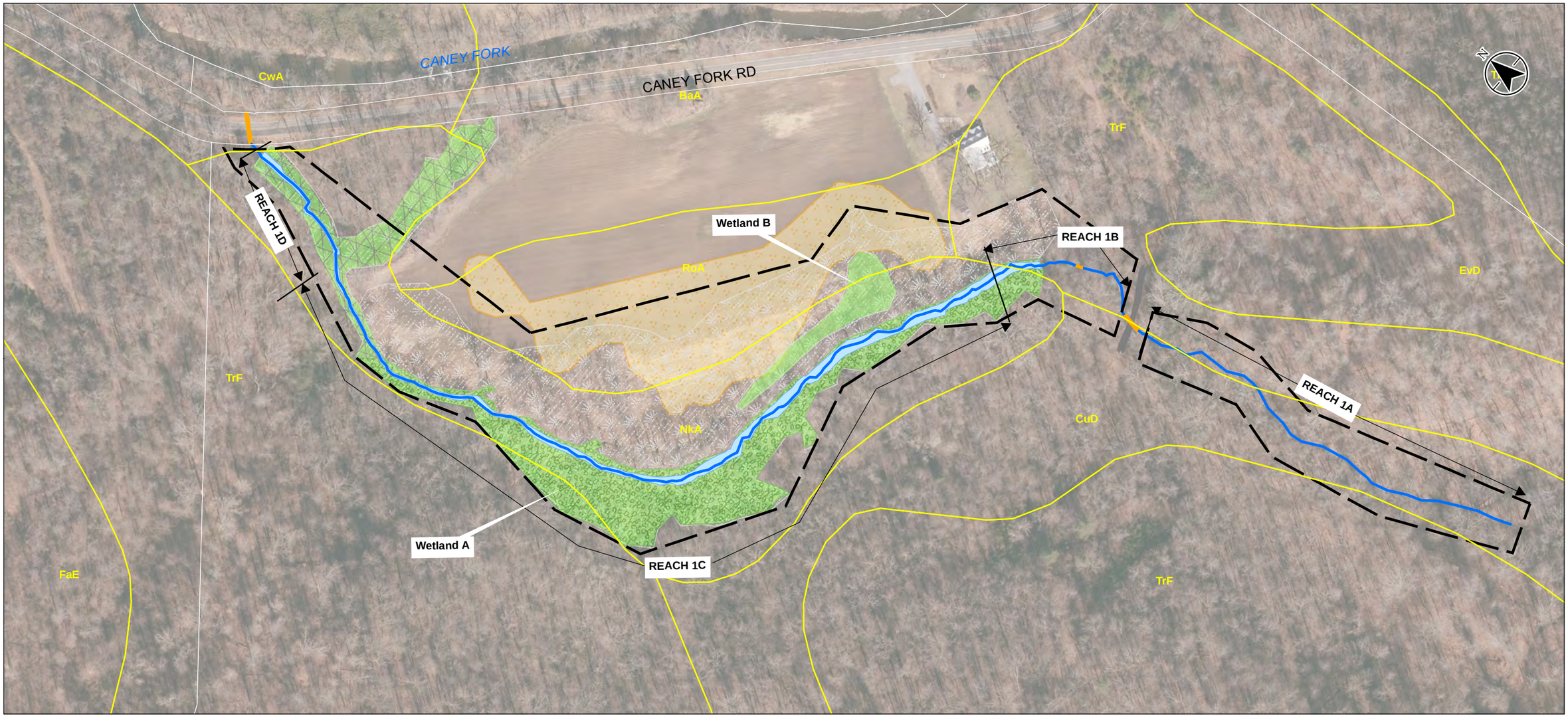
An archaeological survey was completed for the project site on April 20-21, May 4, and May 19, 2017. The study was conducted to evaluate the presence and location of significant cultural resources within the project area in order to comply with Section 106 of the National Historic Preservation Act. Background research revealed no previously recorded archaeological sites within the project study area, but 20 recorded sites located within a mile radius of the site. The area is considered to have a high potential for archaeological resources. A shovel test was completed on the site at 20-m and 10-m intervals with the project area, with an exception of the steep colluvial portion of the site. A total of 81 shovel tests were excavated. Furthermore, a visual inspection of the entire project area was conducted to identify any surface artifacts or above-ground features.

The survey resulted in the identification of one archaeological site, 31JK603, which is a Middle to Late Qualla (A.D. 1500-1838) phase (late prehistoric to historic Cherokee) habitation site. Artifacts were recovered indicating the site likely contains intact subsurface deposits such as structural patterns, pit features, and/or human graves. The site has the potential to provide substantial information concerning the late prehistory and early history of the region and is considered potentially eligible for the National Register of Historic Places (NRHP) under Criterion D. The designated cultural resources area is included on Figure 3. The proposed mitigation construction activities for this mitigation site will avoid the cultural resources area to prevent disruption of potential artifacts. A representative of the Eastern Band of the Cherokee Nation shall be required to be on-site throughout ground disturbance activities. All activities will be halted, and all relevant agencies will be notified if items of cultural significance are discovered or if proposed mitigation construction activities are changed.

3.7 HISTORICAL LAND USE AND DEVELOPMENT TRENDS

Historical land use at the Site has consisted of agriculture and forestry. The upper reaches (1A and 1B) consists of steep, forested headwaters which have been subject to historic logging. The lower portion of the reach was likely moved to the west before transitioning to the broad floodplain of Caney Fork. This area has been highly manipulated historically and portions have been under active agricultural management for at least 40 years as demonstrated in historical aerial photos. Along the lower reaches (1C and 1D) agricultural practices have resulted in dredging and realignment of the channel to the south and west edge of the floodplain in order to increase the arable land. This effort was accompanied by the construction of berms and ditches in a likely attempt to affect groundwater hydrology. The stream bed within the lower reaches (1C) is dominated by sand, gravel, and silt materials eroded from the riparian and upland areas.

Land use changes are not anticipated within the watershed and development pressure is relatively low. There are no projected land use trends that are expected to influence the project.



Notes
1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Base features USDA-NRCS, NCCGIA, Stantec, Equinox, George Lankford.
3. Orthoimagery © NCCGIA 2015

Legend
- Proposed Conservation Easement
- Pipes
- Forestry Road
- Jackson County Parcels
- Jackson County Soil Survey
- Harrell Creek (Perennial)
- Existing Channel Area
- Hydric Soils
- Cultural Resource Boundary

Potential Jurisdictional Wetlands
- Wetland A Piedmont / Mountain Semi-Permanent Impoundment
- Wetland A Swamp Forest Bog
- Wetland B

Jackson County Soil Map Units
BaA - Biltmore sand, 0-3% slopes, frequently flooded
CuD - Cullasaja-Tuckasegee complex, 15-30% slopes, stony
CwA - Cullowhee fine sandy loam, 0-2% slopes, occasionally flooded
EvD - Evard-Cowee complex, 15-30% slopes
FaE - Fannin fine sandy loam, 30-50% slopes
NkA - Nikwasi fine sandy loam, 0-2% slopes, frequently flooded
RoA - Rosman fine sandy loam, 0-2% slopes, occasionally flooded
TrF - Trimont gravelly loam, 50-95% slopes, stony

0 120 240 Feet

1:1,800 (At original document size of 11x17)

Stantec

Project Location
Jackson County, NC

Prepared by ALC on 2018-12-19
Technical Review by CME on 2018-12-20
Independent Review by SGG on 2018-12-20

Client/Project
EW Solutions
Harrell Mitigation Site
Project Number: 100005

Figure No.
3

Title
Existing Features and Soils Map

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4.0 SITE CONDITIONS

The following assessment of existing stream conditions consists of documentation of existing channel morphology and an evaluation of the channel stability. Assessment of existing wetland conditions consisted of performing jurisdictional determinations and USACE verification along with a soils survey of hydric soils.

4.1 EXISTING STREAM MORPHOLOGY

To assess existing geomorphic conditions, cross section measurements were taken at ten (10) locations within the Site. These measurements were used to evaluate existing width-depth ratios, bank-height ratios, entrenchment ratios and stream classification (See Appendix C). Additionally, a bed-width index and a max-depth index were calculated to assess departure from reference conditions. Data collected from naturalized streams in the surrounding watersheds, the reference reach surveys and the regional curve sites were used to develop regional hydraulic geometry relationships for reference channel bed-width and reference maximum bankfull depth.

Table 7 Morphologic Table

Morphological Table				
Description	Reach 1A	Reach 1B	Reach 1C	Reach 1D
Stream Type	A and B	G	E and F	E
Valley Type	II	II	VIII	VIII
W_{BKF} (ft)	3.3 - 5.4	3.6 - 4.2	4.1 - 12.0	4.3
D_{BKF} (ft)	0.3 - 0.5	0.7	0.1 - 0.4	0.6
A_{BKF} (ft^2)	0.9 - 1.8	1.8 - 2.8	1.9 - 3.7	2.4
V_{BKF} (fps)	2.9 - 5.3	2.5 - 3.8	3.5 - 7.0	5.8
Q_{BKF} (cfs)	5	7	13	14
$Slope_{WS}$ (ft/ft)	0.1 - 0.25	0.036 - 0.21	0.002 - 0.018	0.002 - 0.005
Sinuousity	1.02	1.03	1.11	1.04
W/D Ratio	10.1 - 25.4	6.4 - 7.1	7.42 - 77.8	7.7
Ent. Ratio	1.2 - 2.3	1.4	1.3 - 3.4	2.6
D_{50} (mm)	14	20	< 0.1	< 0.1
D_{84} (mm)	63	120	< 0.1	< 0.1

4.2 STREAM CONDITION ASSESSMENT

Vertical and lateral stability were evaluated by a departure analysis for channel bed width and maximum bankfull depth. The bed-width index (BWI) was calculated by dividing the channel bed-width measurements taken from the site by the reference bed-width, and the max-depth index (MDI) was calculated by dividing the measured maximum bankfull depth by the reference

maximum bankfull depth. The reference dimensions are based on the hydraulic geometry relationships developed for the watershed (Appendix E, Section 3.1). BWI values less than 1.0 indicate that the bed is narrower than the natural bed width and there will be a tendency for the channel to widen resulting in scour at the toe of bank. MDI values greater than 1.0 indicate that the channel depth is greater than the natural channel depth and that the resulting increase in shear stress may cause scour in the bed.

Vertical and lateral stability were further evaluated by mapping existing erosional and depositional features throughout the site and calculating bank erosion hazard index (BEHI) and near-bank stress (NBS) rating. Table 8 below provides a summary of assessment findings for each stream reach along with a subjective determination of the general stability status for each reach. The detailed assessment data supporting this summary can be found in Appendix C.

Table 8 Instability Indicators

Instability Indicators						
Reach	BEHI	NBS	BWI	MDI	BHR	Status
Reach 1A	Mod.	V. Low	1.1 - 1.4	0.7 - 0.9	0.9 - 1.1	Stable
Reach 1B	V. High	Low	1.4 - 9.9	1.1 - 1.4	1.4 - 9.9	Severe
Reach 1C	Low	V. Low	1.4 - 9.9	0.7 – 0.9	1.4 - 9.9	Unstable
Reach 1D	Low	V. Low	0.3 - 0.7	1.1 - 1.4	0.9 - 1.1	Unstable

Upstream, the Site consists of steep forested headwaters with a high gradient A-type channel (Reach 1A). The upper portions have been historically logged; however, stream habitat in this reach is high quality with abundant Ephemeroptera, Plecoptera, and Trichoptera populations noted throughout the reach. Near the beginning of Reach 1B, a logging road crosses the channel over a perched culvert. Another smaller poorly functioning culvert is located near the bottom of this reach where it transitions to the floodplain of Caney Fork.

The broad floodplain has been highly manipulated historically and portions of it have been under active agricultural management for at least 40 years. Harrell Creek reaches (Reach 1C and 1D) in this area are E and F-type channels, transitioning occasionally into D-type braided channels. A continuous existing, high-quality wetland is located along the margins of this section of Harrell Creek. The channel has likely been relocated to the toe of slope along the southern boundary of the Site and a berm was constructed along the right-descending bank, functionally removing connectivity with the floodplain as well as degrading hydrologic connection between the stream and the adjacent historical wetlands. Impacts to onsite streams are mainly a result of floodplain alteration and water quality stressors from active agricultural management.

4.3 WETLAND ASSESSMENT

A hydric soils analysis of the project area by a licensed soil scientist as well as a jurisdictional determination and USACE verification were completed for the site.

The mapped soils units in the investigated area are Nikwasi, Rosman, and Biltmore soils. Based upon field observation across the site, the NRCS mapped units have a moderately strong correlation to actual on-site conditions (texture, color range, and general variability trends). Soils across the site are sandy textured throughout with limited silty or clayey horizons. Soils at the site include the NRCS map units Nikwasi (Cumulic Humaquepts) and Rosman (Fluventic Humudepts). The field observations support that most of the area is most similar to Nikwasi and grades to the better drained Rosman. The floodplain was found to exhibit an extensive area of continuous relic hydric soil. These soils exhibit the A12-Thick Dark Surface and F-6 Redox Dark Surface hydric soil indicators.

Flooding is frequent in natural conditions. Landscape position has the largest effect on natural drainage and length of saturation for these soils and often has been modified to increase drainage and reduce saturation length. Existing land use, ditching, and cultivation have altered the current hydrology and surface soil characteristics such that the majority of the agricultural field is no longer classified as a wetland. Removal of the berm and reconnecting Harrell Creek to the remainder of the floodplain have the potential to provide appropriate wetland hydrologic restoration (Lankford, 2017 – Appendix C).

During the delineation, one large existing wetland complex was identified along Harrell Creek within the Caney Fork floodplain area. Much of the existing wetland is under active agricultural management and some forested wetlands are present along the stream. Wetland A includes the continuous wetland along Harrell Creek while Wetland B is a smaller wetland area in the agricultural field separated from Wetland A by a berm parallel to Harrell Creek (See Figure 3).

In order to asses existing groundwater conditions, six monitoring gauges were installed in early April 2017. Gauge 3 is located within the existing wetland B, Gauge 2 is located on the northern edge of Wetland B, and Gauges 1 and 4-6 are located within the proposed wetland restoration area. Data has been collected from the gauges through September of 2017 and is shown in Appendix C along with a map showing existing gauge locations. Confirming wetland hydrology, Gauge 3 has groundwater levels within 12 inches of the surface for the entire range of monitoring data. Gauges 1, 2, 4 and 5 show fluctuations in groundwater levels in the agricultural field within 12 inches of the surface for small periods of time during the growing season but not at the duration needed to meet wetland hydrology. Gauge 6 shows lower groundwater levels, which may indicate a greater effect from historic field manipulation and stream incision. The initial findings suggest that the agricultural ditches may be affecting groundwater levels, but that proximal groundwater is promising for wetland restoration efforts. The groundwater gauges will continue to be monitored until the beginning of construction. Additional groundwater hydrology discussion can be found in section 7.2.5 of this report.

5.0 FUNCTIONAL UPLIFT AND POTENTIAL

5.1 FUNCTIONAL ASSESSMENT

The functional assessment provided in this report is based on the functional objectives identified by Fischenich (2006). Fischenich summaries stream functions into five categories with three key function/processes each for a total of fifteen stream functions. In order to provide a structure that facilitates the association of stream functions to project goals, objectives and outcomes, these fifteen functions have been reorganized into the following five primary functions:

- Provide water transport and storage
- Provide sediment transport and storage
- Provide organic material transport and storage
- Provide natural communities
- Provide landscape connectivity

The five primary functions are further divided into eighteen supported attributes that represent the functions identified by Fischenich and the functions identified by Harmon (2012) in pyramid levels 2 through 5 as follows:

- The function of providing water transport and storage supports proper seasonal flows, channel forming flows, overbank flows, hyporheic flow, and groundwater flow.
- The function of providing sediment transport and storage supports bed-form diversity, energy management, sediment continuity, and substrate quality.
- The function of providing organic material transport and storage supports bed-form diversity, energy management, and aquatic habitat.
- The function of providing natural communities supports temperature and oxygen regulation, processing of organic matter and nutrients, and biodiversity.
- The function of providing landscape diversity supports latitudinal connectivity of biotic and abiotic processes, longitudinal connectivity of biotic and abiotic processes, and sources and sinks for natural populations.

A detailed functional assessment form has been completed for each stream reach of the project and is included in Appendix D. This functional assessment form describes the condition of each of the eighteen supported attributes. The condition statement is provided in either qualitative or quantitative expressions as appropriate for the specified function. A brief "Cause/Association" statement is also provided to further identify the source of the impaired condition and/or site elements that are associated with the impairment. Each supported attribute is assigned a qualitative status of optimal, suboptimal, marginal, or poor which is intended to provide consistency with the terminology adopted by the EPA for rapid bioassessment protocols. The following tables collapse the detailed assessment form down to the five primary functions and provide a summary of the function condition and associated causes:

Table 9a Functional Assessment Summary Reach 1A

Functional Assessment Summary Reach 1A			
Function	Status	Condition	Cause/Association
Water Transport and Storage		Normal baseflow; no entrenchment	Forested watershed
Sediment Transport and Storage		Uniform sediment distribution; little erosion	Normal shear stress levels; good riffle/pool complex
Organic Material Transport and Storage		Forced pools, wood-complex riffles limited; organic storage available	Rock driven steeper reach; some LWD supply available but not fully productive; past logging activity
Natural Communities		Full shading; high biomass and species diversity	Mature riparian vegetation
Landscape Connectivity		Habitat connectivity and established population equilibrium	Abundant riparian buffer; forested watershed
Optimal Suboptimal Marginal Poor			

Table 9b Functional Assessment Summary Reach 1B

Functional Assessment Summary Reach 1B			
Function	Status	Condition	Cause/Association
Water Transport and Storage		Normal baseflow but incised reach	Entrenchment limiting overbank flooding and affecting adjacent groundwater
Sediment Transport and Storage		Elevated scour downstream / elevated deposition upstream	Pipe influencing sediment transport equilibrium
Organic Material Transport and Storage		Forced pools, wood-complex riffles, organic storage limited	Limited LWD; pipe influencing organic material presence; past logging activity
Natural Communities		Near full shading; high biomass and species diversity	Forested watershed; adequate biomass/diversity; presence of invasive species
Landscape Connectivity		Fragmented connectivity with functioning habitat	Well connected to forested watershed upstream; partially connected downstream
Optimal Suboptimal Marginal Poor			

Table 9c Functional Assessment Summary Reach 1C

Functional Assessment Summary Reach 1C			
Function	Status	Condition	Cause/Association
Water Transport and Storage		Normal baseflow; minor entrenchment	Forested watershed, springfed baseflow; wetlands adjacent to stream
Sediment Transport and Storage		Minimal riffle/pool form; excessive aggradation	Reach is low gradient resulting in siltation and slackwater
Organic Material Transport and Storage		Limited LWD; abundant leaf packs and organic storage potential	Right bank riparian area is in cultivation; stream is too slow for LWD to affect bedform; leaf packs provide all roughness
Natural Communities		Partial shading; high biomass and species diversity in forested areas; limited diversity on right bank	Mature forest on left bank; cultivation on right bank
Landscape Connectivity		Fragmented connectivity with functioning habitat	Well connected to forested watershed upstream; partially connected downstream
Optimal Suboptimal Marginal Poor			

Table 9d Functional Assessment Summary Reach 1D

Functional Assessment Summary Reach 1D			
Function	Status	Condition	Cause/Association
Water Transport and Storage		Normal baseflow; no entrenchment	Forested watershed, springfed baseflow; wetlands adjacent to stream
Sediment Transport and Storage		Minimal riffle/pool form; excessive aggradation	Reach is low gradient resulting in siltation and slackwater
Organic Material Transport and Storage		Limited LWD; some leaf packs; herbaceous vegetation growing within channel	Limited supply of LWD; right bank riparian area is in cultivation
Natural Communities		Partial shading; low biomass and diversity on right bank	Limited riparian buffer on right bank due to cultivation
Landscape Connectivity		Limited connectivity with functioning habitat	Cultivation along right riparian corridor limits seed source and landscape connectivity
Optimal Suboptimal Marginal Poor			

5.2 FUNCTIONAL UPLIFT POTENTIAL

The functional uplift potential for each stream reach is detailed in Table 10 which shows the lift associated with each of the five primary functions and then provides a summary of the overall functional lift in the last column. The functional potential is considered within the context of ultimate maturation of the site attributes and not limited to the potential that may be expected within the monitoring period. For the purposes of this summation the overall functional potential is assigned a description of optimal if four out of five primary functions are ranked as optimal.

Landscape connectivity for Reach 1D is the only factor that won't potentially be uplifted to optimal conditions. Although landscape connectivity functions will improve with the establishment of a riparian buffer, Harrell Creek will be disconnected from the downstream landscape by Caney Fork Road.

Aside from this limiting factor, each of the five primary functions of water transport and storage, sediment transport and storage, organic material transport and storage, natural communities, and landscape connectivity will be addressed.

Table 10 Functional Uplift Potential

Functional Uplift Potential							
Reach	State	Water Transport and Storage	Sediment Transport and Storage	Organic Material Transport and Storage	Natural Communities	Landscape Connectivity	Overall Potential Lift
Reach 1A	Existing	Optimal	Optimal	Suboptimal	Optimal	Optimal	Optimal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Optimal	
Reach 1B	Existing	Marginal	Poor	Marginal	Suboptimal	Suboptimal	Marginal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Optimal	
Reach 1C	Existing	Optimal	Marginal	Suboptimal	Suboptimal	Suboptimal	Suboptimal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Optimal	
Reach 1D	Existing	Optimal	Marginal	Marginal	Marginal	Marginal	Marginal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
Optimal Suboptimal Marginal Poor							

6.0 GOALS AND OBJECTIVES

The preliminary goals identified in Section 2 of this report are rearranged in Table 11 below to illustrate their association to the five primary stream functions. To more fully address the functional performance of the site, these preliminary goals are further expanded and defined into the listed project goals. These expanded project goals are then linked to specific objectives for the project in Table 12.

The assessment of site conditions and existing stream functions identified deficiencies in stream functions that are addressed in the following expansion of the project goals:

- Water Transport and Storage – goals have been expanded to address functional deficiencies associated with lack of natural, stable channel forms and groundwater hydrology.
- Sediment Transport and Storage – two additional goals have been added and expanded to address functional deficiencies associated with substrate quality, channel stability, and bed form diversity.
- Organic Material Transport and Storage – a goal has been added to address functional deficiencies associated with habitat diversity and quality.
- Natural Communities – the goals have been expanded to address functional deficiencies associated with nutrient cycles, temperature regulation, future organic inputs, and wetland communities.
- Landscape Connectivity – the goals have been expanded to address functional deficiencies associated with limited capacity for biotic and abiotic processes and to address future potential impacts on connectivity.

Table 11 Stream Functions and Project Goals

Function	Preliminary Goals	Expanded Project Goals
Water Transport and Storage	Restore floodplain connectivity	Provide a stream with natural, stable forms that supports proper stream functions
	Restore wetland hydrologic capacity	Improve groundwater hydrology to support recovery of native riparian vegetation and wetland function
Sediment Transport and Storage	Reduce sediment inputs from eroding stream banks	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
Organic Material Transport and Storage	None identified in preliminary goals	Improve quantity, quality, and diversity of habitats to support healthy aquatic communities
Natural Communities	Improve aquatic habitat complexity	Improve quantity, quality and diversity of habitats to support healthy aquatic communities
	Improve terrestrial habitat	Restore areas of former riparian wetlands so that the hydrology and soils will support wetland vegetative communities and wildlife
	Reduce nutrient inputs to the project streams (nitrogen, phosphorus)	Reduce pollutant inputs to the project streams (fecal coliform, nitrogen, phosphorus) to restore a balance to proper nutrient cycles
	Reduce maximum water temperatures	Improve riparian vegetation community to provide temperature regulation of the streams, provide a future source of organic inputs, and aid in long-term channel bank stability
	Increase dissolved oxygen levels	
Landscape Connectivity	Restore buffers with native riparian plant community	Improve landscape connectivity that allows space for biotic and abiotic process and provides a source and sink for natural populations
		Prevent the site from future impacts of agricultural uses

Table 12 Goals and Objectives

Goals	Objectives
Provide a stream with natural, stable forms that supports proper stream functions	Construct stream channels that will maintain proper dimension, pattern and profile
Improve groundwater hydrology to support recovery of native riparian vegetation and wetland function	Construct streams with proper bankfull to floodplain relationship
Reduce sediment inputs from eroding stream banks to reduce fine sediment loads and percentage of fines in the bed-material load	Construct streams that provide naturally stable dimensions and stabilize constructed banks with appropriate bioengineering
Restore proper sediment transport to support channel stability and bedform diversity	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
Improve substrate quality to facilitate hyporheic flow and support aquatic communities	Construct stable riffles that provide an improved diversity of bed material clast and a reduction in fines relative to existing conditions
Improve quantity, quality and diversity of habitats to support healthy aquatic communities	Construct in-stream habitat features from native material to provide a diversity of habitats
Reduce pollutant inputs to the project streams (fecal coliform, nitrogen, phosphorus) to restore a balance to proper nutrient cycles	Provide a buffer from agricultural activities and row crops
Improve riparian vegetation community to provide temperature regulation of the streams, provide a future source of organic inputs, and aid in long-term channel bank stability	Plant native climax tree species and understory species in the riparian zone
Restore areas of former riparian wetlands so that the hydrology and soils will support wetland vegetative communities and wildlife	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

Goals	Objectives
Improve landscape connectivity that allows space for biotic and abiotic process and provides a source and sink for natural populations	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
Prevent the site from future impacts of development and agricultural uses	

7.0 DESIGN APPROACH AND MITIGATION WORKPLAN

7.1 DESCRIPTION OF REFERENCE STREAM(S), WETLAND, AND VEGETATION COMMUNITIES

Reference streams and wetlands were investigated to provide guidance for design. Although reference sites do not necessarily provide a direct correlation to potential restoration conditions they can be useful in providing guidance in developing the conceptual framework of the design and in setting targets in certain design elements, habitat components, and community compositions.

7.1.1 Reference Stream Reaches

Searches were conducted first upstream and downstream of the Site and then into surrounding watersheds to find suitable references that contained comparable slope, bed material, and valley type. No reference reaches were identified immediately upstream or downstream of the site or in the surrounding watershed. Two references were eventually identified outside of the watershed but within the Blue Ridge hydrophysiographic region. The reference reaches were selected to represent the probable configurations for the downstream reaches of the proposed stream. Detailed geomorphic survey and Level II Rosgen classifications were conducted on each reach (See Appendix E). Within the upstream preservation reach, reference cross sections were measured at multiple locations where stable and mature conditions were apparent. While the length of the stable reach at these locations was not long enough to be considered of reference quality, the measured sections will be used in the design of the type B stream reach.

Two type E4 stream references were located Transylvania County; one on the South Fork Mills River and the other on Club Gap Branch. The watersheds of both streams are predominantly forested and although they do have many characteristics in common with the project watershed they do reside in the high rainfall region (>90 inches/year) of the mountains. This difference in rainfall produces considerably larger stream channels when compared to lower rainfall regions of the mountains. Both streams are located in the Pink Beds area of the Pisgah National Forest. The type E references will be used for proposed type E stream reaches.

Table 13 Reference Reach Morphologic Data

Reference Reach Morphological Table		
Description	Club Gap Branch	South Fork Mills River
Stream Type	E4	E4
Valley Type	VIII	VIII
D.A. (mi^2)	0.25	0.72
W_{BKF} (ft)	6.3 – 10.7	12.0 – 16.5
D_{BKF} (ft)	1.0 – 1.2	1.4 – 1.8
A_{BKF} (ft^2)	7.7 – 10.0	18.2 – 35.9
$Slope_{WS}$ (%)	0.84	0.54
Sinuosity	1.6	1.2 – 1.5
W/D Ratio	6 – 11	7 – 10
Ent. Ratio	2.3 – 4.8	4.3 – 5.5
D_{50} (mm)	13 – 17	30 – 42
D_{84} (mm)	22 – 33	63 – 68

7.1.2 Reference Wetlands and Vegetative Communities

Reference wetlands are difficult to identify in the mountain region due to the extensive impacts to the relatively scarce resource of bottomland floodplains. Additionally, the climatic and geologic variability in the mountain region can produce seemingly comparable wetland and/or bottomland features with divergent hydro-periods. To address the need to provide reference criteria for the proposed restoration the vegetation will be based on descriptions provided in literature for natural mountain vegetation communities and hydrology will be based primarily on suggested guidance from the soils investigation.

Vegetation Communities

The target vegetation communities for the site will be Headwater Forest according to North Carolina Wetland Assessment Method (NCWAM) and Swamp-Forest Bog Complex and Piedmont/Mountain Semipermanent Impoundment according to NCNHP (Schafale 2012). Dominant canopy species for the Headwater Forest include green ash (*Fraxinus pennsylvanica*), tulip poplar (*Liriodendron tulipifera*), pawpaw (*Asimina triloba*), black willow (*Salix nigra*), ironwood (*Carpinus caroliniana*) and sycamore (*Platanus occidentalis*). The primary understory species associated with the Headwater forest includes winterberry (*Ilex verticillata*), buttonbush (*Cephalanthus occidentalis*), tag alder (*Alnus serrulata*), spicebush (*Lindera benzoin*), witch hazel (*Hamamelis virginiana*), elderberry (*Sambucus canadensis*), and possum haw (*Viburnum nudum*), and silky dogwood (*Cornus amomum*). Dominant canopy species for the Swamp-Forest Bog Complex (Typic Subtype) include Eastern hemlock (Tsuga Canadensis) and Red Maple (Red maple). Other trees include Black Willow (Salix nigra), Sweet Birch (Betula lenta), Yellow birch (B.

alleghaniensis), White oak (Quercus alba), White pine (Pinus strobus), Green ash (Fraxinus pennsylvanica), Sycamore (Plantanus occidentalis), Tulip poplar (Liriodendron tulipiferia), and various other alluvial species. The primary understory species associated with the Swamp-Forest Bog Complex (Typic Subtype) include rhododendron (Rhododendron maximum), mountain laurel (Kalmia latifolia), and mountain doghobble (Leucothoe fontanesiana). Other common shrubs include Silky willow (Salix sericea), Tag alder (Alnus serrulata), Mountain winterberry (Ilex montana), Silky dogwood (Cornus amomum), Possum haw (Viburnum nudum), and Poison sumac (Toxicodendron [Rhus] vernix).

Reference Hydrology

In order to supplement the hydrology guidance developed from the soils investigation, one groundwater monitoring gauge will be installed within the onsite jurisdictional wetlands adjacent to stream Reach 1D to document hydrology in conjunction with post-construction monitoring of the restored wetlands.

7.2 DESIGN APPROACH

7.2.1 Stream Design Overview

The stream design approach is composed of three parts; conceptual design, stream component design, and design validation. The conceptual design consists of developing a conceptual framework for the restoration efforts. The stream component design establishes the channel parameters and channel configuration required to carry out the conceptual design. Finally, the validation phase consists of testing and refining the channel configuration using analytical tools.

Development of the conceptual framework begins with a determination of where restoration or enhancement efforts are warranted. Where restoration activities are proposed, it is then necessary to determine the appropriate stream type given the valley setting. Preferably the stream type can be matched to the natural valley but occasionally site constraints dictate that alterations to the valley form are required to provide an appropriate match with stream and valley. Table 14 provides a listing of the restoration approach for each stream reach and is followed by a narrative of the conceptual framework.

Table 14 Restoration Approach

Restoration Approach				
Reach	Restoration Level	Restoration Approach	Stream Type	Rationale
Reach 1A	Preservation	N/A	A	Stream is naturalized and is stable
Reach 1B	Restoration	Priority I	B4	Reconstruction required to address entrenchment, channel dimensions and pattern
Reach 1C	Restoration	Priority I	E4	Reconstruction required to address channel dimensions and pattern and restore wetland hydrology
Reach 1D	Restoration	Priority I	E4	Reconstruction required to address entrenchment, channel dimensions and restore wetland hydrology

The conceptual approach for Harrell Creek Reach 1B is to reshape the valley and construct a new headwater stream that corrects the split flow of the existing channel and better follows the natural down-valley path. The stream grade will be raised at the upstream end of the reach and lowered toward the downstream end of the reach. This will correct the hanging culvert that acts as the upstream connection point and will allow better control of overbank flows through this steep reach. While adjusting the alignment, consideration was given to the preservation of mature trees of desirable species.

The conceptual approach for Reach 1C and 1D are linked to the restoration approach for the adjacent wetlands. Harrell Creek is proposed to be relocated into the area that has been mapped as hydric soils. This will involve backfilling the abandoned channel, removing the berm between the stream and the field, and regrading portions of the field to provide more suitable wetland topography and grade. The Type-E stream channel is proposed to meander across the regraded field to maximize the hydrologic connection between the stream and the restored wetlands without disturbing the cultural resources area. As the stream approaches the downstream project limits, the existing alignment will be utilized as much as possible, while correcting channel dimensions.

7.2.2 Stream Component Design

The stream component design involves establishing the proposed channel dimensions, laying out the channel alignment, and establishing the channel profile. The proposed channel dimensions are established initially through hydraulic geometry relationships of the stream bed-width and maximum riffle depth. Traditional natural channel design methods place the greatest emphasis on cross sectional area, width-depth ratio and bankfull discharge as the basis for design. Although

these are important in the design process, they represent composite or derived values and are therefore more difficult to determine with necessary precision than the more simple and direct metrics of bed-width and max-depth. Additionally, bed-width and max-depth are more sensitive to the particular attributes of the local watershed and geology.

Four hydraulic geometry relationships have been developed and are included in Section 3 of the design calculations in Appendix E. Four curves are plotted on each of these graphs. The regional curve is plotted as a reference for the slope and position of published data. The dashed local curve is plotted to represent the data collected in the local and surrounding watersheds. The two red design lines are adjusted off the local curve to reflect morphological variations between the target B-type and E-type streams.

Based on the initial selections of the design bed-width and max-depth, the remaining key channel dimensions and dimensionless ratios are calculated in Section 5 of Appendix E. These calculations are performed for specific locations within the project so that direct comparisons can be made to existing channel features that can provide confirmation of the appropriateness of the proposed configuration. Section 6 (Appendix E) then provides the calculations of design dimension for each stream reach based on the section design.

The design alignment is based partly on the results obtained from the section design but primarily on the topography of the site. The valley position, the nature of the cross slope of the valley, existing mature vegetation, and constraints and obstructions all play a determining factor in the plan form configuration. Although stream type, typical belt-width, meander ratios, and pool spacing are all important elements of the design alignment, ultimately it is the landscape form that is the primary influence on how and where the stream should run.

In the final step in the stream component design, the overall profile is established to set the proposed bankfull elevation to match the target elevations identified in the conceptual design. The target elevations may include abandoned floodplains, existing terraces, existing bankfull features, buried 'A' horizons, exposed tree bases, or proposed floodplain surfaces. Refinement of the overall profile to include riffle-pool or step-pool bedform features is accomplished in the design validation phase.

7.2.3 Stream Design Validation

Hydrologic and Hydraulic Analysis

The proposed channel sections were evaluated for their ability to convey the bankfull flows and the flood flows of the watershed by performing a hydraulic analysis. Flood flow hydrology was based on USGS Regional Regression equations for the Blue Ridge-Piedmont hydrologic area. Bankfull discharge was based on the NRCS revised regional curves for the North Carolina Mountain hydrologic area. The hydraulic analysis consisted of modeling the design sections using the Federal Highway Administration's Hydraulic Toolbox software package. Proposed sections were evaluated for their ability to convey bankfull and greater-than-bankfull discharges. (Appendix E, Section 8.0).

The ability to accurately verify bankfull discharge within the site is limited by the degraded channel conditions and the lack of clear bankfull indicators. Additional bankfull verification is provided through the hydraulic geometry curves assembled from locations on site, immediately adjacent to the site, within the watershed and the neighboring watersheds.

Sediment Transport Analysis

Due to the location and nature of this site, originating within a headwater system and transitioning into a low-gradient wetland complex, the stream manages a low sediment load. The sediment observed moving through the system is predominately generated from instabilities within the site, and can be anticipated to further decrease following successful implementation of restoration efforts. Therefore, no sediment transport analysis was conducted.

Reaches 1A & 1B exist within the context of a colluvial debris feature, and a gravel and cobble substrate was observed throughout. Competence calculations were performed using the D_{50} and D_{84} of the observed substrate to determine the maximum allowable riffle slope given the proposed channel configurations.

Design Refinement

The findings of the design validation procedures are used to adjust and refine the design of the various stream components. The sediment competence analysis is used to evaluate existing bed material and establish the maximum sustainable design riffle slopes. These riffle slopes are then applied to the detailed bed form profile. Where incongruences occur, attempts are first made to resolve them with adjustments to the channel profile. Occasionally, some incompatibilities in the profile design must be resolved with the design of a threshold transition reach. Section 10 of Appendix E provides a summary of the transition reach calculations. Finally, the channel bed material is designed to be consistent with results of the above design validation. Where appropriate and sufficient bed material is available on site it will be harvested and used in the reconstruction of stream bed. Where it is deficient in quality or quantity it will supplemented and blended with quarry stone to produce a suitable bed material mix. The proposed bed material mixes are tabulated in Section 11 of Appendix E.

7.2.4 Wetland Design Overview

The wetland design approach is composed of two parts; conceptual design and wetland component design. The conceptual design consists of developing a conceptual framework for the restoration efforts. The wetland component design establishes the topographic alterations and configuration required to carry out the conceptual design.

Development of the conceptual framework begins with a determination of where restoration or enhancement efforts are warranted. Where restoration activities are proposed, it is then necessary to discern between re-establishment and rehabilitation; with re-establishment consisting of areas that contain hydric soils but that are not presently considered jurisdictional wetlands and rehabilitation consisting of areas of degraded jurisdictional wetlands. Table 15 provides a listing of

the restoration approach for each wetland area and is followed by a narrative of the conceptual framework.

Table 15 Wetland Restoration Approach

Wetland Restoration Approach				
Wetland Area ID	Location	Restoration Approach	Restoration Type	Rationale
A	Reach 1C	Preservation	N/A	No improvement needed
A	Reach 1C (Existing Ditches)	Restoration	Re-establishment	Past ditching and grading needs to be corrected to re-establish ground surface
B	Reach 1C	Restoration	Rehabilitation	Past ditching and grading needs to be corrected to re-establish hydrology
C	Reach 1C	Restoration	Re-establishment	Past ditching and grading needs to be corrected to re-establish hydrology

The conceptual approach for Area A is to protect existing wetlands and re-establish functioning wetlands in areas where the existing channel is to be filled. This wetland was deemed jurisdictional by the Army Corps of Engineers and presents functionally optimal and stable characteristics. Portions of the existing channel will be filled to re-establish ground surface elevations that are consistent with adjacent wetland surface. Plantings will be installed in these areas with the target community being Headwater Forest (NCWAM) (NCWFAT 2016).

The conceptual approach for Area B is to return existing wetlands to a highly functioning state through rehabilitation. The conceptual approach for Area C is the re-establishment of wetland conditions throughout the area identified as having hydric soils. This will be accomplished by returning Harrell Creek to a stream course that meanders across these proposed wetland areas and by eliminating topographic features that are detrimental to functioning wetlands. Proposed work includes grading down the existing earthen berm, backfilling the abandoned channel and installing plantings. Additionally, the overall topography will be reshaped to create off-channel depressional areas. The target community for this area is also Headwater Forest (NCWAM) (NCWFAT 2016).

7.2.5 Wetland Component Design

The wetland component design consists of developing an approach to restore wetland hydrology and establishing the proposed wetland design surface. A proposed grading plan has been developed to address the deficiencies in wetland hydrology (Appendix B, Sheets 12 and 13). The

grading plan was developed in conjunction with an analysis of the soils mapping. The main elements of the grading plan provide for realignment of Harrell Creek into the proposed wetland area, removal of the existing earthen berm, backfilling of the abandoned stream, and regrading of topography to provide off-channel depressional areas. The proposed configuration of Harrell Creek will provide a proper bankfull depth which will allow for more frequent overbank flooding, thus establishing a reconnection of hydrology. The proposed grading plan is designed to intersect and expose hydric soils that were identified and mapped in the soils investigation.

Mitigation guidance for common mountain soil series suggests a hydroperiod for the Nikwasi soil (Cumulic Humaquepts) of 12-16 percent and 10-12 percent for the Rosman (Fluventic Humedepts), during which the water table is within 12 inches of the surface (US Army Corps of Engineers 2016). Both soils are characterized as fine sandy loams.

Groundwater gauges were installed at 6 locations throughout the site (see Figure C.1) to generate a baseline for validation of groundwater hydrology improvement. Gauges 1, 2 and 3 were installed in or adjacent to Existing Wetland B, and Gauges 4, 5 and 6 were installed within the existing hydric soils area proposed for wetland restoration. Data collected from gauges 1, 2, 4 and 5 indicates the depth to groundwater from the surface is only slightly outside the maximum of 12" required to meet wetland hydrology. This suggests a high likelihood of meeting wetland success criteria through implementation of restoration activities. Data from Gauge 6 indicates a significantly increased depth to groundwater which implies greater uncertainty of successful restoration in that location. This uncertainty will be mitigated through partial removal of overburden, thus lowering the ground surface, and the realignment of the stream channel to a location that will encourage rehydration of the hydric area.

The proposed removal of overburden and the regrading of the hydric soil area is estimated to result in approximately 900 CY of material. The depth of overburden removal is approximately 2 to 6 inches throughout the majority of the site. Total depth of excavation will not exceed 12 inches except where discrete remnant berms were constructed and are required to be removed.

7.2.6 Implementation Methods

Stream Restoration

An exploratory effort will be completed in proximity to the proposed channel work to access and harvest suitable bed material for installation in the proposed channel bed. Where the quantity of existing bed material is insufficient it will be supplemented with off-site material of appropriate size.

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

Reaches 1C and 1D shall be constructed to form a low-gradient, meandering, Type-E channel. Channel banks shall be constructed of harvested sod and willow transplants to provide immediate

roughness, bank stability and shading. The stream bed shall be constructed using harvested cobble. The riffle slopes in these reaches are lower than the maximum sustainable design riffle slopes allowed by the large cobble size, but the utilization of cobble, in conjunction with the willow transplants, is preferable because it will discourage the growth of herbaceous vegetation within the channel bed. After completion of grading operations, remaining topsoil and sod will be redistributed across the floodplain bench to facilitate vegetation success.

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

Wetland Rehabilitation and Re-establishment

Re-establishment of the wetlands, where proposed, will involve the removal of any overburden material to expose the underlying buried hydric soils. Wetland hydrology will be restored by raising the stream bed elevations. Additional grading activities may include harvesting usable topsoil material for re-use on portions of the re-graded floodplain, removal of spoil berms, and grading off-channel depressional features to provide for additional retention of surface water and increased habitat diversity. Re-establishment areas within existing hydric soils will be ripped using a shallow subsurface plow no more than 10 inches, likely a chisel plow, to remove effects of past compaction and planted with native wetland vegetation. Invasive species will be removed and a riparian wetland vegetation community with be established.

Rehabilitation of existing wetlands, where proposed, will primarily involve stabilizing wetland hydrology and replanting.

Impacts to existing wetlands will be temporary or offset by the expansion of wetlands by the proposed design. For example, wetlands A and B will be impacted by the proposed channel alignment, but these impacts this will be offset by the increase in the wetland boundary area due to proposed grading and increased hydrologic connection.

Planting Plan

The final stage of construction will consist of seeding and planting within the conservation easement to establish native forest and herbaceous communities. The riparian buffer along stream restoration reaches will be planted with native vegetation selected to create a Headwater Forest community throughout the Site and in the wetland areas. The planting plan figures and the species list are shown in the construction plans (Appendix B, sheets P1-P2A). The riparian buffer area (approximately 6.9 acres) will be planted with bare root seedlings at a density of 680 stems per acre on an approximate spacing of 8 feet. Additionally, stream banks will be planted with live stakes according to the details and species list in the construction plan (Appendix B, Sheet P1). The planted buffer will extend a minimum of 30 feet past either side of the stream top of bank, except in locations where existing structures, right-of-way or utilities prevent the full width from being established. While this project is not seeking buffer credits, the proposed design results in less than 2% of the total stream side buffer width being less than 30 feet. Locations where buffer widths

are less than 30 feet are included on Figure 4. No additional credit will be pursued in areas where the planted buffer extends greater than 30 feet.

7.3 RISK EVALUATION

Although a formal risk assessment has not been conducted as a part of this project, the assessment and design process is structured to identify areas of concern and potential risk to the project success or liabilities that may develop in association with the project. These identified concerns are listed in Table 16 below along with a subjective risk assessment (Low, Moderate, High) and potential courses of action that could remedy or mitigate the issue.

Table 16 Risk Evaluation

Risk Evaluation		
Identified Concern	**Risk Level**	**Potential Remedy**
Watershed buildout	Low	None
Groundwater hydrologic trespass	Low	Grading plan designed to minimize occurrence of hydrologic trespass.
Excessive sediment loads to Harrell Creek	Low	If pools fill in, then provide maintenance operations to remove sediment.
Invasive species colonization	Moderate	Treat any emergences of invasive species during the monitoring period.
Beaver encroachment	Low	Remove any structures created by beavers during the monitoring period. Seek other removal options if beavers become established.

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8.0 CREDIT YIELD

8.1 DETERMINATION OF CREDITS

Mitigation credits presented in the following table are projections based upon site design. Upon completion of site construction, the project components and credits data will be revised to be consistent with the as-built condition.

Table 17 Project Assets

Stream Mitigation Components								
Component (Reach ID)	Location (Sta)	Existing (ft)	Rest. (ft)	Creditable (ft)	Rest. Level	Ratio	Credits (SMU)	Comments
Reach 1A	93+46 – 100+00	654	640	640	P	10:1	64.0	
Reach 1B	100+00 – 103+11	286	311	273	R	1:1	273.0	Less 38' for crossing and outlet protection Less than 30' buffer for 41 LF
Reach 1C	103+11 – 115+79	1265	1268	1268	R	1:1	1268.0	0.026 ac impact to Wetland B
Reach 1D	115+79 – 118+41	223	262	249	R	1:1	249.0	Less 13' for ROW Less than 30' buffer for 32 LF 0.008 ac impact to Wetland A
Wetland Mitigation Components								
Component	Position and HydroType	Existing (ac)	Rest. (ac)	Creditable (ac)	Rest. Level	Ratio	Mitigation Credits	Comments
Wetland A	Reach 1C - RNR	1.59	1.58	-	RE (Pres)	-	0.0	Existing wetland will be protected 0.008 ac impact to Wetland A for stream construction
Wetland A	Reach 1C - RNR	1.59	0.26	0.26	R (Re-Est)	1:1	0.26	Area of the existing channel within the wetland will be filled and replanted
Wetland B	Reach 1C - RNR	0.24	0.22	0.22	R (Rehab)	1:1	0.22	0.026 ac impact to Wetland B for stream construction
Wetland C	Reach 1C - RNR	-	3.05	3.05	R (Re-Est)	1:1	3.05	

Mitigation Category Summation					
Restoration Level	Stream (linear feet)	Riparian Wetlands (ac)		Non-Riparian Wetlands (ac)	Credited Buffer (sqft)
		Riverine	Non-Riverine		
Restoration	1790				N/A
Rehabilitation			0.22		N/A
Re-establishment			3.31		N/A
Enhancement I					
Enhancement II					
Creation					
Preservation	640				N/A
High Quality Preservation					

Overall Asset Summary			
Stream (SMUs)	**Riparian Wetland (WMUs)**	**Non-Riparian Wetland (WMUs)**	**Buffer**
1,854	**3.53**	**0.0**	**N/A**

Steam Abbreviations: R – Restoration, EI – Enhancement I, EII – Enhancement II, P – Reservation
Wetland Abbreviations: RR – Riparian Riverine, RNR – Riparian Non-riverine, NR – Non-riverine
RE (Pres) – Restoration Equivalent (Preservation), R (Rehab) – Restoration Rehabilitation,
R(Re-Est) – Restoration (Re-establishment)

CANEY FORK

CANEY FORK RD

Wetland B

REACH 1B

REACH 1D

Wetland C

REACH 1A

Wetland A - to be re-established

REACH 1C

Notes

1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Base features USDA-NRCS, NCCGIA, Stantec, Equinox, George Lankford.
3. Orthoimagery © NCCGIA 2015

Legend

- Wetland Re-establishment
- Wetland Re-establishment - Piedmont / Mountain Semi-Permanent Impoundment
- Wetland Re-establishment - Swamp Forest Bog
- Wetland Rehabilitation
- Wetland Preservation
- Stream Preservation
- Stream Restoration
- Buffer Widths less than 30ft
- Forestry Road
- Jackson County Parcels
- Proposed Conservation Easement

0 150 300 Feet

1:1,800 (At original document size of 11x17)

Stantec

Project Location
Jackson County, NC

Prepared by ALC on 2018-12-19
Technical Review by CME on 2018-12-19
Independent Review by SGG on 2018-12-19

Client/Project
EW Solutions
Harrell Mitigation Site
Project Number: 100005

Figure No.
4

Title
Asset Map

V:\1726\active\172621094103_data\gis_cad\Figure_4_Asset_Map\rev_Jan2019.mxd Revised: 2019-01-09 By: acoleman

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9.0 PERFORMANCE STANDARDS

The stream and wetland performance standards will conform with the performance criteria provided in 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). The restoration and enhancement components are assigned specific performance standards for geomorphology, hydrology, and vegetation. Performance criteria is proposed to be evaluated throughout the seven-year monitoring period. Table 18 provides a list of the performance standards associated with each project objective along with a description of the monitoring approach.

Table 18 Performance Standards

Performance Standards		
Objective	**Performance Standard**	**Monitoring Approach**
Construct stream channels that will maintain proper dimension, pattern and profile	• 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.	Survey of select cross sections and visual assessment. Continuous stage recorders for base Flow.
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.

Performance Standards		
Objective	**Performance Standard**	**Monitoring Approach**
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
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.	Vegetation plots

Performance Standards		
Objective	**Performance Standard**	**Monitoring Approach**
Establish a conservation easement that provides a minimum buffer from future activities in the adjacent watershed.	Record conservation easement prior to implementation.	None

9.1 PROPOSED ALTERNATIVE PERFORMANCE STANDARDS FOR VEGETATION VIGOR

Mitigation credits presented in the following table are projections based upon site design. Upon completion of site construction, the project components and credits data will be revised to be consistent with the as-built condition Section 5.B of the Wilmington District Stream & Wetland Compensatory Mitigation Update, as approved by the NC Interagency Review Team (10.24.2016), details performance standards for planted vegetation on mitigation sites. Subsection 5.B.1 includes minimum stems/acre quotas at years three, five, and seven, whereas subsection 5.B.2 prescribes specific performance metrics for planted stems within vegetation monitoring plots. Specifically, 5.B.2 mandates that planted stems in projects located within mountain counties shall meet height requirements of six feet and eight feet in monitoring years 5 and 7, respectively; the rule also states that:

"Alternative performance standards for vegetation vigor or density may be proposed…for sites…with slow-growing species, woody shrub species, or primarily with understory species (e.g., shrubs in currently forested areas, bogs, pine savannahs, wetland mosaics with open spring ponds, etc.)." (7)

We are proposing alternative performance standards for height/vigor be applied to portions of the Harrell site that occur within similar habitats as described in the above quotation, namely the "currently forested areas, bogs…[and] wetland mosaics". The target natural community types (currently present onsite within preservation areas) consist of Piedmont/Mountain Semipermanent Impoundment and Swamp Forest-Bog Complex, both of which fit the above excerpted description and both of which are described below using excerpts from the Classification of the Natural Communities of North Carolina: Third Approximation (Schafale & Weakley 1990):

Piedmont/Mountain Semipermanent Impoundment – "Beaver ponds and similar small, old, undisturbed, man-made impoundments. Generally occur in floodplains and valleys with low gradient. Palustrine, permanently flooded in the center, grading outward to the prevailing hydrology of the surrounding area….In the absence of…disturbance, the ponds slowly fill with clayey or mucky sediment and are invaded by trees." (173)

Swamp Forest-Bog Complex – "Poorly-drained bottomlands, generally with visible microtopography of ridges and sloughs or depressions. Alluvial soils. Generally mapped as Toxaway or Wehadkee. Palustrine, seasonally to semi-permanently saturated. Flooding frequency is unknown. Seepage is sometimes present. The factors for creating and maintaining these…are not well known…boggy openings are generally associated with small depressions…[and] may be successional remnant s of once more extensive bog areas." (181)

These natural communities remain consistently saturated and at times experience medium- to long-term inundation, limiting the location and composition of their flora and also leading to suppressed vigor of said flora. Because we propose to revegetate the site with plants that are adapted for the above apex communities (see Section 7.1.2 for reference community details) and because we will be held to performance standards, we feel it prudent to propose that height/vigor metrics for planted stems across the project be reduced from "…6 feet in height at year five and 8 feet in height at year seven…" to a minimum of "4 feet in height at year five and 6 feet in height at year seven". We feel that although we will be able to meet minimum stems/acre requirements throughout the life of the project, our experience working in these community types leads us to believe that certain planted tree stems will take the full project life to achieve appropriate apical dominance, and other planted shrub stems, however vigorous, might never meet current performance standards within the regulatory life of the project. Following this logic we have selected species for revegetation that occur naturally within and are therefore well-suited to these natural community types.

10.0 MONITORING PLAN

Monitoring data will be reported using the NCDMS monitoring template. The monitoring report shall provide a project data chronology that will facilitate an understanding of project status and trends, will provide population of NCDMS databases for analysis, research purposes, and will assist in decision making regarding project close-out.

Table 19 Monitoring Plan Components

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

Monitoring Plan Components				
Parameter	**Method**	**Quantity**	**Frequency**	**Notes**
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

CANEY FORK

CANEY FORK RD

REACH 1

Wetland B

Wetland C

Wetland A - to be re-established

Legend

- Stream Preservation
- Stream Restoration
- Wetland Re-establishment
- Wetland Re-establishment - Piedmont / Mountain Semi-Permanent Impoundment
- Wetland Re-establishment - Swamp Forest Bog
- Wetland Rehabilitation
- Wetland Preservation
- Forestry Road
- Jackson County Parcels
- Proposed Conservation Easement
- Continuous Stage Recorder
- Groundwater Gauge
- Monitoring XS
- Veg Plot

0 150 300 Feet

1:1,800 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Base features USDA-NRCS, NCCGIA, Stantec, Equinox, George Lankford.
3. Orthoimagery © NCCGIA 2015

Stantec

Project Location
Jackson County, NC

Prepared by ALC on 2018-12-19
Technical Review by CME on 2018-12-19
Independent Review by SGG on 2018-12-19

Client/Project
EW Solutions
Harrell Mitigation Site
Project Number: 100005

Figure No.
5

Title
Proposed Monitoring Map

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11.0 MANAGEMENT PLAN

11.1 ADAPTIVE MANAGEMENT PLAN

In the event the mitigation site or specific component of the mitigation site fails to achieve the necessary performance standards as specified in the mitigation plan, the sponsor shall notify the members of the IRT and work with the IRT to develop contingency plans and remedial actions.

11.2 LONG-TERM MANAGEMENT PLAN

The site will be transferred to the NCDEQ Stewardship Program (or 3rd party if approved). This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. Funding will be supplied by the responsible party on a yearly basis until such time an endowment is established. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statue GS 113A-232(d)(3). Interest gained by the endowment fund may be used for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable. The Stewardship Program will periodically install signage as needed to identify boundary markings as needed. Any livestock or associated fencing or permanent crossings will be the responsibility the owner of the underlying fee to maintain.

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12.0 REFERENCES

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APPENDICES

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Appendix A PHOTO LOG

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Photo 1. Harrell Creek facing upstream @ Sta 99+77 Reach 1A 10-10-17

Photo 2. Harrell Creek facing downstream @ Sta 100+50 Reach 1B 9-21-17

Photo 3. Harrell Creek facing upstream @ Sta 104+20 Reach 1C 9-21-17

Photo 4. Harrell Creek looking downstream @ Sta 114+00 Reach 1C 10-10-17

Photo 5. Harrell Creek looking downstream @ Sta 116+25 Reach 1D 9-21-17

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Appendix B PLAN SHEETS

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NC DMS PROJECT No. 100005

STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
NC	172621094	1	18

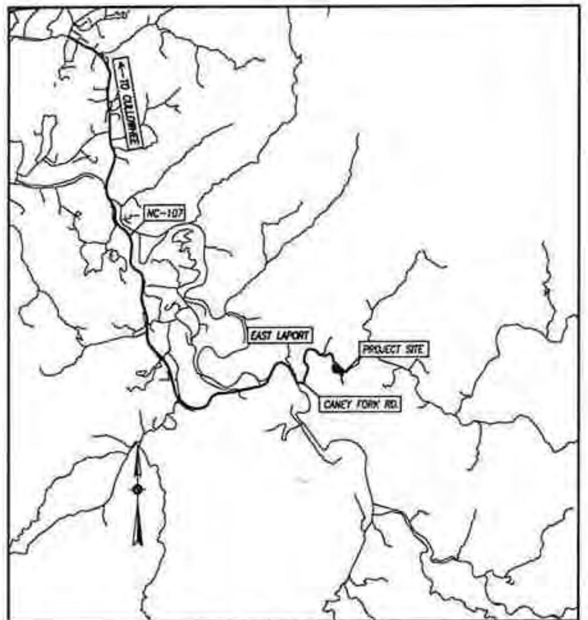
	FINAL PLANS	1/15/19

REVISIONS

EW SOLUTIONS, LLC

HARRELL MITIGATION PROJECT

HARRELL CREEK
JACKSON COUNTY, NORTH CAROLINA



VICINITY MAP
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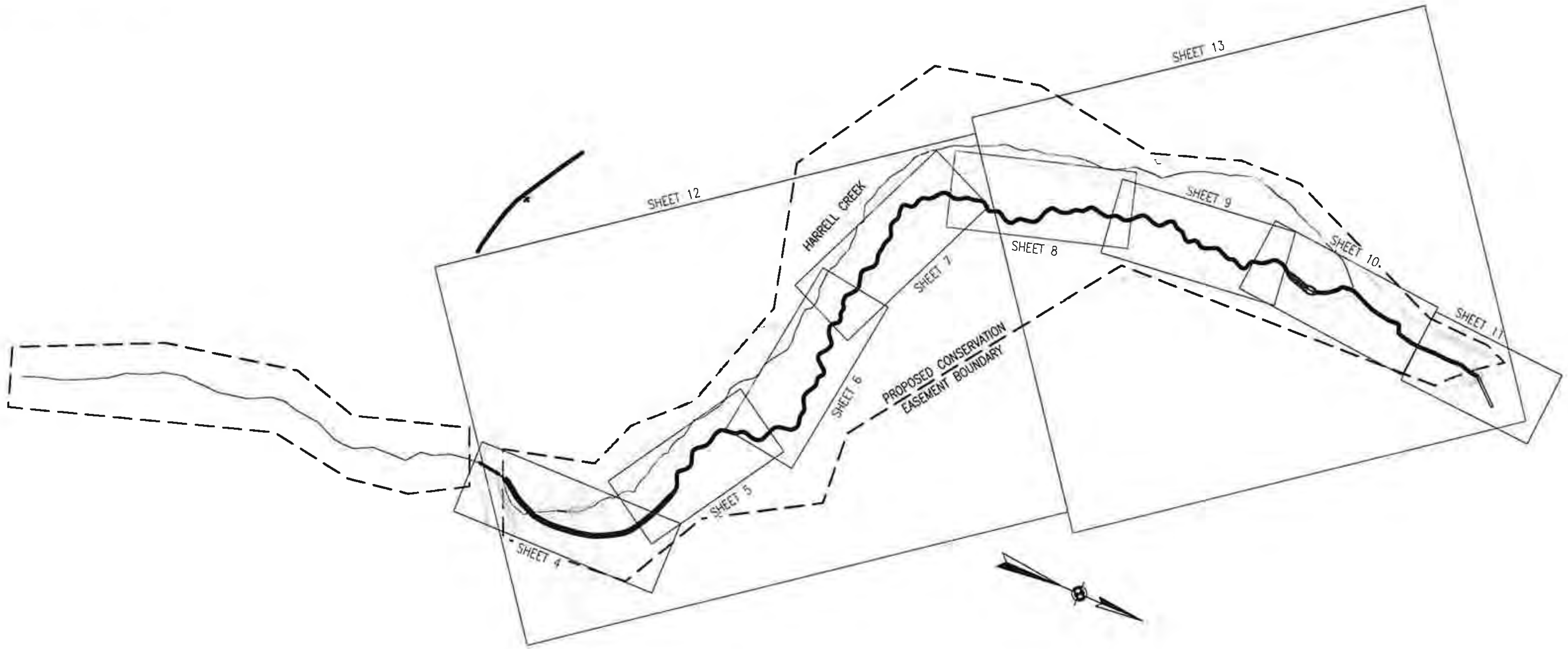


SHEET INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET
1A	SITE PLAN
2	TYPICAL SECTIONS
3 - 3B	DETAILS
4 - 11	PLAN AND PROFILE
12 - 13	GRADING PLAN
P-1	PLANTING DETAILS
P-2	PLANTING PLAN
EC-1 - EC-4	EROSION CONTROL PLAN
~~XS-1 - XS-6~~	~~CROSS SECTIONS~~

CONSTRUCTION PLANS ONLY

FINAL PLANS

GRAPHIC SCALES (SCALE IN FEET)

10 0 10 30
PLAN & HORIZONTAL PROFILE - SHEETS 4-11

1 0 1 3
VERTICAL PROFILE - SHEETS 4-11

PROJECT LENGTHS

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

PREPARED BY:

Stantec

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

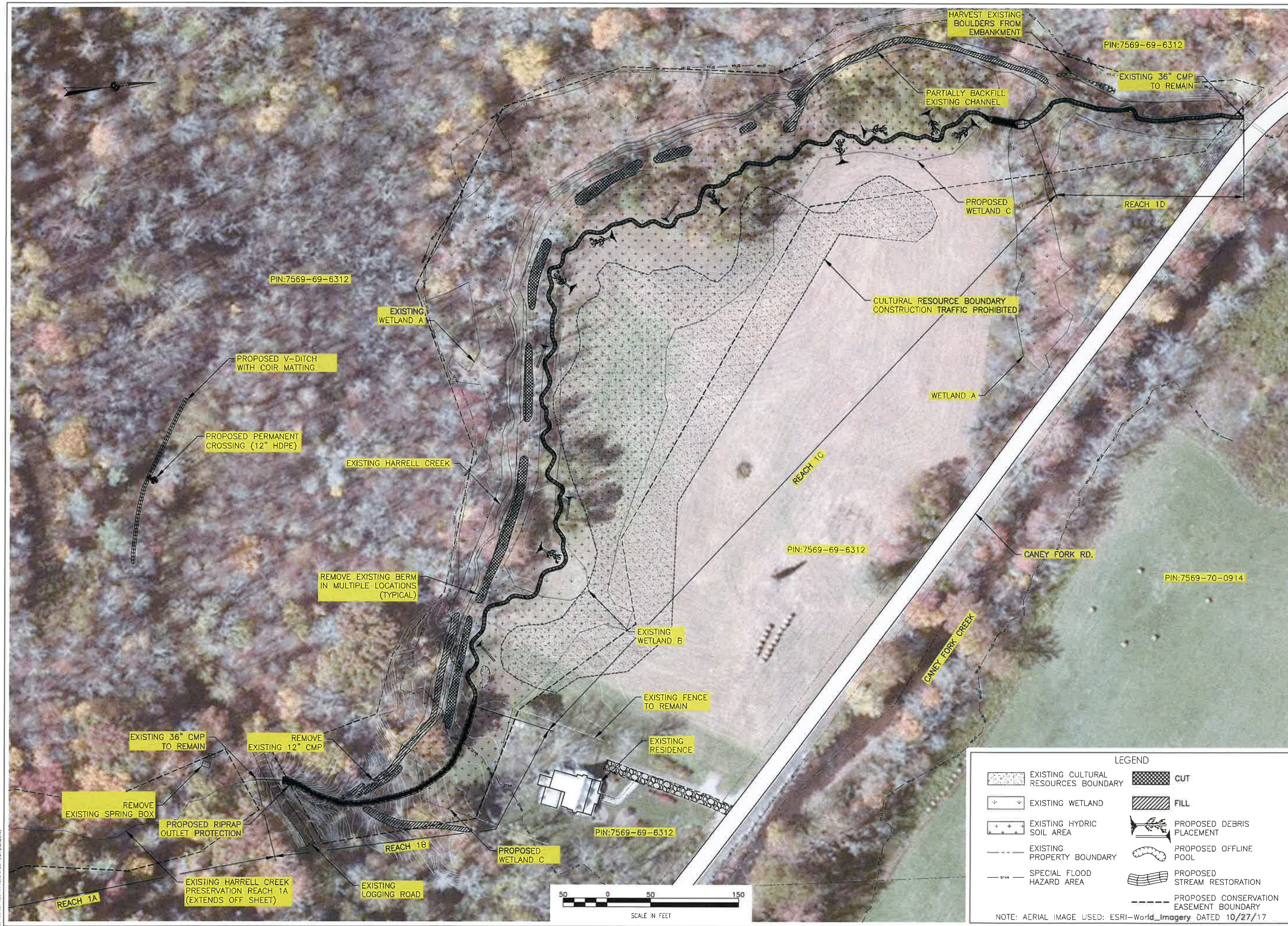
NORTH CAROLINA PROFESSIONAL SEAL 038598 ENGINEER CHRISTOPHER M. ENGLE
1/21/19

CHRIS ENGLE
PROJECT ENGINEER

PREPARED FOR:

NC DMS

PAUL WIESNER
PROJECT MANAGER


HARVEST EXISTING BOULDERS FROM EMBANKMENT
PIN:7569-69-6312
EXISTING 36" CMP TO REMAIN
PARTIALLY BACKFILL EXISTING CHANNEL
PROPOSED WETLAND C
REACH 1D
PIN:7569-69-6312
EXISTING WETLAND A
CULTURAL RESOURCE BOUNDARY CONSTRUCTION TRAFFIC PROHIBITED
PROPOSED V-DITCH WITH COIR MATTING
WETLAND A
PROPOSED PERMANENT CROSSING (12" HDPE)
EXISTING HARRELL CREEK
REACH 1C
PIN:7569-69-6312
CANEY FORK RD.
PIN:7569-70-0914
REMOVE EXISTING BERM IN MULTIPLE LOCATIONS (TYPICAL)
EXISTING WETLAND B
CANEY FORK CREEK
EXISTING FENCE TO REMAIN
EXISTING 36" CMP TO REMAIN
REMOVE EXISTING 12" CMP
EXISTING RESIDENCE
REMOVE EXISTING SPRING BOX
PROPOSED RIPRAP OUTLET PROTECTION
PIN:7569-69-6312
REACH 1B
PROPOSED WETLAND C
EXISTING HARRELL CREEK PRESERVATION REACH 1A (EXTENDS OFF SHEET)
EXISTING LOGGING ROAD
REACH 1A
50 0 50 150
SCALE IN FEET
LEGEND
EXISTING CULTURAL RESOURCES BOUNDARY
CUT
EXISTING WETLAND
FILL
EXISTING HYDRIC SOIL AREA
PROPOSED DEBRIS PLACEMENT
EXISTING PROPERTY BOUNDARY
PROPOSED OFFLINE POOL
SPECIAL FLOOD HAZARD AREA
PROPOSED STREAM RESTORATION
PROPOSED CONSERVATION EASEMENT BOUNDARY
NOTE: AERIAL IMAGE USED: ESRI-World_Imagery DATED 10/27/17

Stantec

56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

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Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

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

Title
SITE PLAN

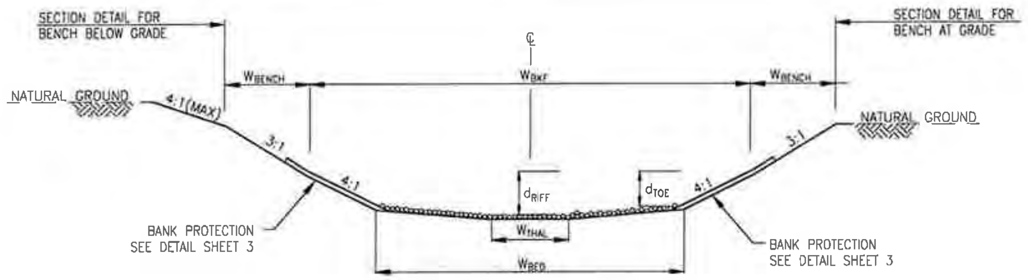
Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 033595 ENGINEER CHRISTOPHER M. ENGLE
1/21/19

Project Number: 172621094

RTS	SGG	CME	18.12.21
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0 Sheet 1A



SECTION 1
TYPICAL RIFFLE
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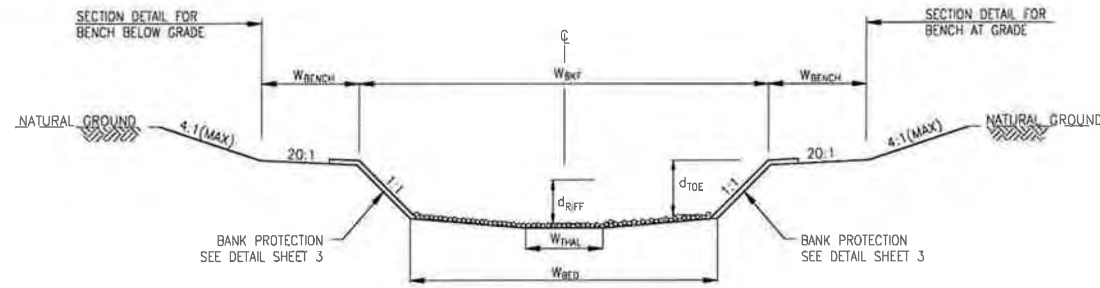

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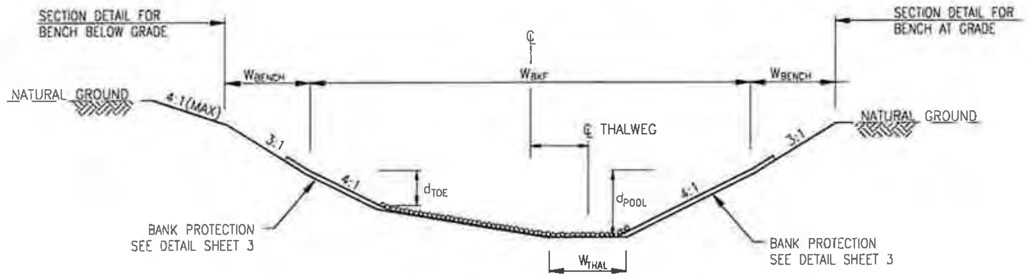
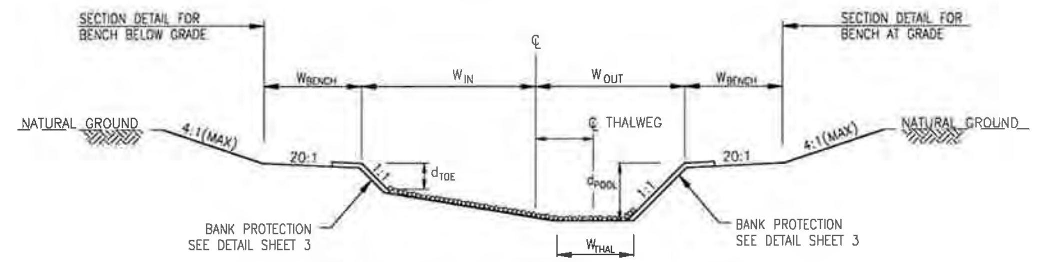
TYPICAL RIFFLE
NOT TO SCALE



SECTION 1
TYPICAL POOL
NOT TO SCALE



SECTION 2
TYPICAL POOL
NOT TO SCALE

TABLE 1: SECTION DIMENSIONS

REACH	TYPICAL SECTION	STATION	RIFFLE DIMENSIONS						POOL DIMENSIONS			
			W_{BKF} (ft)	W_{BED} (ft)	W_{THAL} (ft)	W_{BENCH} (ft)	d_{RIFF} (ft)	d_{TOE} (ft)	W_{IN} (ft)	W_{OUT} (ft)	d_{POOL} (ft)	APPROX. POOL DEPTH (ft)
REACH 1A	-	93+45 TO 100+00	-	-	-	-	-	-	-	-	-	-
REACH 1B	1	100+00 TO 103+11	6.4	3.0	0.9	4	0.53	0.42	3.83	3.19	0.79	0.5
REACH 1C	2	103+11 TO 115+30	4.1	2.6	0.8	2	0.90	0.72	2.43	2.03	1.35	0.5
REACH 1C - TRANSITION	1	115+30 TO 115+96	8.6	4.5	1.3	6	0.64	0.52	5.15	4.29	0.97	0.5
REACH 1D	2	115+96 TO 118+41	4.2	2.7	0.8	2	0.92	0.73	2.49	2.08	1.37	0.5

NOTE: APPROXIMATE POOL DEPTH IS DEPTH OF POOL RELATIVE TO DOWNSTREAM HEAD OF RIFFLE

TABLE 2: SUPPLEMENTAL BED MATERIAL

REACH	PERCENT OF TOTAL MIX							DEPTH OF BED MATERIAL (FT)
	ON-SITE HARVEST BRUSH	ON-SITE HARVEST GRAVEL	1/2" STONE (NO. 57)	3/4" STONE (NO. 5)	2" STONE (SURGE)	6" STONE NCDOT (CLASS A)	12" STONE NCDOT (CLASS B)	
REACH 1A	-	-	-	-	-	-	-	-
REACH 1B	20%	20%	-	-	-	20%	40%	3.0
REACH 1C	-	100%	-	-	-	-	-	0.5
REACH 1C - TRANSITION	20%	20%	-	-	-	20%	40%	3.0
REACH 1D	-	100%	-	-	-	-	-	0.5

NOTE: IT IS ANTICIPATED THAT ADEQUATE BED MATERIAL WILL BE AVAILABLE FOR HARVEST ON SITE, AND THAT NO QUARRY STONE WILL BE REQUIRED FOR USE AS BED MATERIAL FOR HARRELL CREEK. THE D_{50} OF INSTALLED BED MATERIAL SHALL BE APPROXIMATELY 20mm (MIN).

TABLE 3: MORPHOLOGIC TABLE

REACH	REACH 1A	REACH 1B	REACH 1C	REACH 1D
STREAM TYPE	B	B	E	E
DRAINAGE AREA (mi^2)	0.05	0.07	0.16	0.17
W_{BKF} (ft)	5.7	6.4	4.1	4.2
XS_{BKF} (ft)	1.8	2.2	2.7	2.8
d_{MEAN} (ft)	0.3	0.3	0.7	0.7
d_{MAX} (ft)	0.5	0.5	0.9	0.9
S_{AVG} (ft/ft)	0.25	0.13	0.005	0.003
S_{VALLEY} (ft/ft)	0.26	0.20	0.008	0.003
W/D RATIO	18.2	18.6	6.1	6.1
ENTRENCHMENT RATIO	1.2	2.7	8.6	8.4
SINUOSITY	1.03	1.02	1.25	1.06
POOL-POOL RATIO	2.3 - 3.8	2.3 - 3.8	4 - 6	4 - 6
MEANDER WIDTH RATIO	2.1	2.1	4.1	4.3

CONSTRUCTION SEQUENCE

THE CONTRACTOR SHALL FOLLOW THE SEQUENCE OF CONSTRUCTION IN ACCORDANCE WITH THE PLANS AND AS DIRECTED BY THE ENGINEER.

THE CONTRACTOR SHALL CONDUCT STREAM WORK, INCLUDING INSTALLATION OF IN-STREAM STRUCTURES, GRADING, STABILIZATION MEASURES, AND SEEDING AND MULCHING, ON A SECTION OF STREAM THAT CAN BE ENTIRELY COMPLETED IN A SINGLE DAY.

1. THE CONTRACTOR SHALL IDENTIFY THE PROJECT BOUNDARY, LIMITS OF DISTURBANCE, SENSITIVE AREAS, STAGING AREAS, AND CONSTRUCTION ENTRANCES WITH THE ENGINEER.
2. THE CONTRACTOR SHALL PREPARE STABILIZED CONSTRUCTION ENTRANCES.
3. THE CONTRACTOR SHALL MOBILIZE EQUIPMENT, MATERIALS, PREPARE STAGING AREAS, AND STOCKPILE AREAS.
4. CONSTRUCTION TRAFFIC TO BE LIMITED TO "LIMITS OF DISTURBANCE" AS INDICATED ON THE CONSTRUCTION PLANS OR AS DIRECTED BY THE ENGINEER.
5. THE CONTRACTOR SHALL INSTALL ALL TEMPORARY ROCK CHECK DAMS, SILT FENCE, AND MULCHING AROUND ALL CONSTRUCTION AREAS INCLUDING STAGING AND STOCKPILE AREAS AS INDICATED ON THE CONSTRUCTION PLANS OR AS DIRECTED BY THE ENGINEER.
6. THE CONTRACTOR SHALL INSTALL ALL TEMPORARY STREAM CROSSINGS. DITCHES AND STREAM REACHES WILL BE LEFT OPEN DURING INITIAL PHASES OF CONSTRUCTION TO ALLOW FOR DRAINAGE AND TO KEEP SITE ACCESSIBLE.
7. PUMP-AROUND OPERATION SHALL BE USED TO DIVERT FLOW DURING CONSTRUCTION EXCEPT AS ALLOWED BY THE ENGINEER. **ALL EXCAVATION SHALL BE PERFORMED IN THE DRY** OR IN ISOLATED REACHES EXCEPT AS ALLOWED BY THE ENGINEER.
8. THE CONTRACTOR SHALL BEGIN CLEARING, FLOODPLAIN EXCAVATION, AND GRADING WORK TO DESIGN GRADES AT THE UPSTREAM END OF THE CHANNEL AS INDICATED ON THE CONSTRUCTION PLANS. THE CONTRACTOR SHALL NOT DISTURB ANY MORE FLOODPLAIN AREA LARGER AND STREAM REACH LONGER THAN CAN STABILIZED IN ONE DAY.
9. ONCE A SECTION OF STREAM AND FLOODPLAIN HAVE BEEN EXCAVATED TO DESIGN GRADES, IN-STREAM STRUCTURES, MATTING, AND TRANSPLANTS SHALL BE INSTALLED IN THAT SECTION. EXISTING BED MATERIAL SHALL BE HARVESTED AND PLACED IN THE CONSTRUCTED CHANNEL.
10. THE CONTRACTOR SHALL BEGIN INSTALLING IN-STREAM STRUCTURES FROM THE UPSTREAM SECTION WORKING DOWNSTREAM. **ALL CONSTRUCTION WORK IS TO BE PERFORMED IN THE DRY** UNLESS OTHERWISE DIRECTED BY THE ENGINEER OR OTHER REGULATORY AGENCY. IF EXCESSIVE SEDIMENTATION DOWNSTREAM BECOMES A CONCERN, THE ENGINEER OR PROJECT MANAGER IN CHARGE MAY DIRECT THE CONTRACTOR TO INSTALL A TEMPORARY ROCK CHECK DAM AND SETTLING BASIN DOWNSTREAM. THIS AREA IS TO BE MAINTAINED ON A REGULAR BASIS BY THE CONTRACTOR.
11. ONCE A STREAM WORK PHASE IS COMPLETE, THE CONTRACTOR WILL APPLY TEMPORARY SEEDING, PERMANENT SEEDING, AND MULCH TO ALL AREAS DISTURBED DURING CONSTRUCTION. TEMPORARY AND PERMANENT SEEDING MIXTURES WILL BE APPLIED AS SHOWN ON THE PLANTING PLAN. TEMPORARY SEEDING WILL BE APPLIED IN ALL AREAS SUSCEPTIBLE TO EROSION SUCH THAT GROUND COVER IS ESTABLISHED WITHIN 7 WORKING DAYS FOLLOWING COMPLETION OF ANY GRADING PHASE. PERMANENT GROUND COVER WILL BE ESTABLISHED FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS FOLLOWING COMPLETION OF CONSTRUCTION.
12. ALL SEEDING AND MULCHING SHALL BE COMPLETED BEFORE LEAVING THE PROJECT SITE ALONG WITH REMOVAL OF ANY TEMPORARY STREAM CROSSINGS AND TEMPORARY CHECK DAMS.
13. THE CONTRACTOR OR OTHER QUALIFIED PERSONNEL SHALL PLANT ALL WOODY VEGETATION AND INSTALL LIVE STAKING ACCORDING TO THE PLANTING DETAILS AND SPECIFICATIONS. ALL PERMANENT SEEDING AND PLANTINGS SHALL BE PERFORMED DURING THE APPROPRIATE TIME OF YEAR.
14. THE CONTRACTOR SHALL ENSURE THAT THE SITE IS FREE OF TRASH AND LEFTOVER MATERIALS PRIOR TO DEMOBILIZATION OF EQUIPMENT FROM THE SITE.

GENERAL NOTES:

1. CONTRACTOR SHALL PERFORM ALL NECESSARY SUBSURFACE UTILITY INVESTIGATIONS PRIOR TO COMMENCING CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFICATION OF EXISTING CONDITIONS, OBSTRUCTIONS, AND UTILITIES WHICH MAY AFFECT PROPOSED WORK.
2. ALL MECHANIZED EQUIPMENT OPERATED IN OR NEAR THE STREAM, ITS TRIBUTARIES, OR WETLANDS SHALL BE INSPECTED REGULARLY AND MAINTAINED TO PREVENT CONTAMINATION OF STREAM WATERS FROM FUELS, LUBRICANTS, HYDRAULIC FLUIDS, OR OTHER TOXIC MATERIALS. A CONTINGENCY PLAN SHALL BE DEVELOPED FOR THE USE OF THESE MATERIALS, INCLUDING SPILL CONTAINMENT, CLEAN UP, AND NOTIFICATION TO THE APPROPRIATE AGENCIES. SPILL KITS, SORBENTS, AND CONTAINERS FOR DISPOSAL SHALL BE RETAINED ON SITE.
3. ALL EQUIPMENT MAINTENANCE SHALL BE PERFORMED AT LEAST 50 FT FROM THE STREAM AND WETLANDS.
4. CLEARING AND GRUBBING SHALL BE LIMITED TO THAT WHICH IS NECESSARY FOR CONSTRUCTION OF THE PROPOSED CHANNEL AND SHALL BE APPROVED BY THE ENGINEER.
5. CONTRACTOR IS RESPONSIBLE FOR PROVIDING SAFE INGRESS AND EGRESS FROM SITE FOR ALL VEHICLES INCLUDING, BUT NOT LIMITED TO, TRAFFIC ON ADJACENT PUBLIC ROADS AFFECTED BY CONSTRUCTION TRAFFIC.
6. CONTRACTOR SHALL DISPOSE OF ALL WASTE MATERIALS GENERATED BY CONSTRUCTION ACTIVITIES IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRS TO EXISTING FACILITIES FROM DAMAGES OCCURRING AS A RESULT OF CONSTRUCTION ACTIVITIES.
8. THE INSTALLATION OF EROSION CONTROL MEASURES AND PRACTICES SHALL OCCUR PRIOR TO LAND DISTURBING ACTIVITIES.

CHANNEL CONSTRUCTION NOTES:

1. CONSTRUCTION SHALL BEGIN AT THE UPSTREAM END OF EACH CHANNEL REACH AND PROCEED DOWNSTREAM UNLESS APPROVED OTHERWISE BY THE ENGINEER.
2. BED MATERIAL ON RIFFLE SECTIONS SHALL CONSIST OF BED MATERIAL EXCAVATED FROM EXISTING CHANNEL. WHERE INSUFFICIENT BED MATERIAL IS PRESENT IT SHALL BE SUPPLEMENTED WITH MATERIAL ACCORDING TO TABLE 2 AND AS DIRECTED BY THE ENGINEER.
3. THE CHANNEL BANKS SHALL BE STABILIZED ACCORDING TO THE BANK PROTECTION DETAILS ON SHEET 3.
4. DIMENSION TOLERANCES SHALL BE AS FOLLOWS:
   - WIDTH: +/- 0.5 FT
   - DEPTH: +/- 0.1 FT
   - RIFFLE ELEVATIONS: +/- 0.1 FT
   - POOL ELEVATIONS: + 0.1 FT, - 0.5 FT
   - STRUCTURE ELEVATIONS: +/- 0.1 FT
5. EXISTING CHANNEL INDICATED TO BE FILLED ON PLANS SHALL BE BACKFILLED WITH 1-FOOT LIFTS AND COMPACTED TO IN-SITU SOIL DENSITY. CHANNEL SHALL BE FREE FROM BRUSH AND ORGANIC DEBRIS PRIOR TO BACKFILLING.
6. PUMP AROUND OPERATION SHALL BE USED TO DIVERT FLOW DURING CONSTRUCTION WHEN PRACTICAL. WHEN PUMPING AROUND BECOMES IMPRACTICAL, CONTRACTOR SHALL UTILIZE AN APPROPRIATE METHOD TO ISOLATE THE WORK AREA FROM ACTIVE FLOW TO REDUCE DOWNSTREAM SEDIMENTATION.

TREE SURVEY/HARVEST/PROTECTION NOTES:

1. WOODY MATERIAL WILL BE HARVESTED ON-SITE FOR USE AS IN-STREAM STRUCTURES FOR STREAMBANK STABILITY, GRADE CONTROL, AND AQUATIC HABITAT ENHANCEMENT/RESTORATION. WOODY MATERIAL INCLUDES BOTH LARGE AND SMALL SIZE DIAMETER TREES INCLUDING STEM AND ROOT MASS. TREES WILL BE HARVESTED FROM UPLAND AREAS AS WELL AS ALONG RECONSTRUCTED STREAM BANKS DURING THE RESTORATION CONSTRUCTION PROCESS.
2. PREFERRED HARVEST TREES TO BE SELECTED FOR RESTORATION PURPOSES SHALL FIRST INCLUDE ALL DISEASED, DAMAGED, HAZARD, AND UNDESIRABLE TREE SPECIES UNTIL THE QUANTITIES NEEDED FOR STREAM RESTORATION ARE MET. AREAS SELECTED FOR HARVEST SHALL OCCUR WITHIN THE LIMITS OF DISTURBANCE AND DELINEATED BY A CERTIFIED ARBORIST OR OTHER PROFESSIONAL ECOLOGIST/BIOLOGIST.
3. TRANSPLANTS WILL BE SELECTED AND RELOCATED AS DIRECTED BY THE ENGINEER.
4. ALL WOODY MATERIALS WILL BE STOCKPILED IN THE APPROVED STAGING AND STOCKPILE AREAS.
5. IN ALL AREAS WHERE TREES ARE HARVESTED PROPER BMP AND EROSION AND SEDIMENT CONTROL WILL BE IMPLEMENTED AND THE AREA IMMEDIATELY STABILIZED WITH TEMPORARY AND PERMANENT SEEDING/MULCH AS HARVESTING OCCURS.

SURVEY:

THE COORDINATE SYSTEM IS THE NAD83 NORTH CAROLINA STATE PLANE GRID.

THE VERTICAL DATUM IS NAVD88.

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TYPICAL SECTIONS

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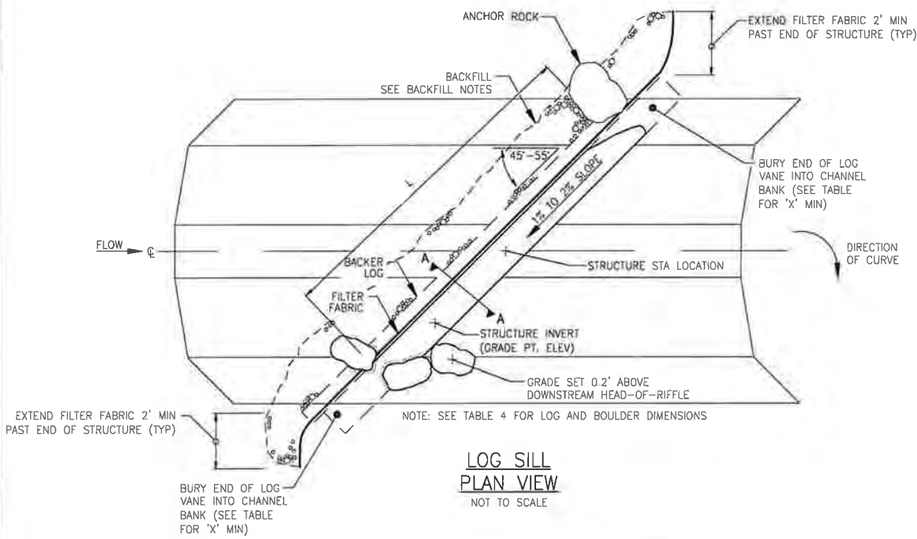
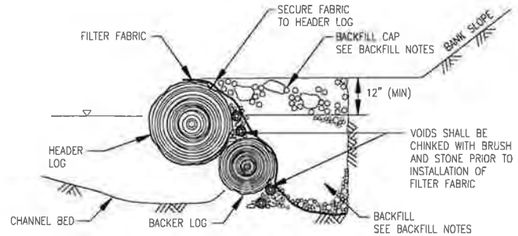
Revision 0 Sheet 2



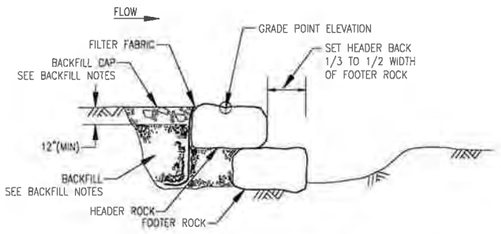
LOG SILL
PLAN VIEW
NOT TO SCALE



SECTION A-A
NOT TO SCALE

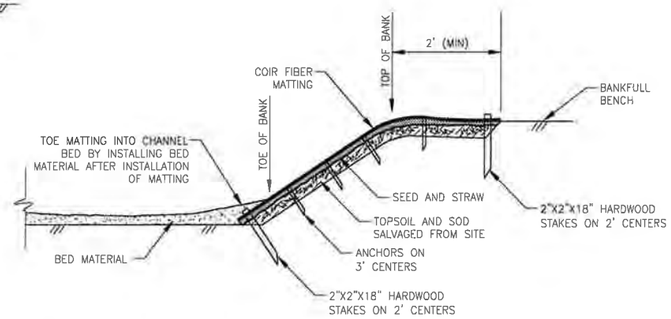
TABLE 4: STRUCTURE DIMENSIONS						
REACH	STRUCTURES		BOULDERS			TOTAL LOG LENGTH (FT)
	L (FT)	X (FT)	LENGTH (FT)	WIDTH (FT)	DEPTH (FT)	
REACH 1B	5	3	2.5-3.5	2.0-2.5	1.5-2.0	11
REACH 1C	4	3	2.5-3.5	2.0-2.5	1.5-2.0	10
REACH 1D	4	3	2.5-3.5	2.0-2.5	1.5-2.0	10

TABLE 5: LOG DIAMETERS		
TOTAL LOG LENGTH (FT)	MIN DIAMETER (IN)	MAX DIAMETER (IN)
< 20	8	12
20-40	12	18
40-60	18	24

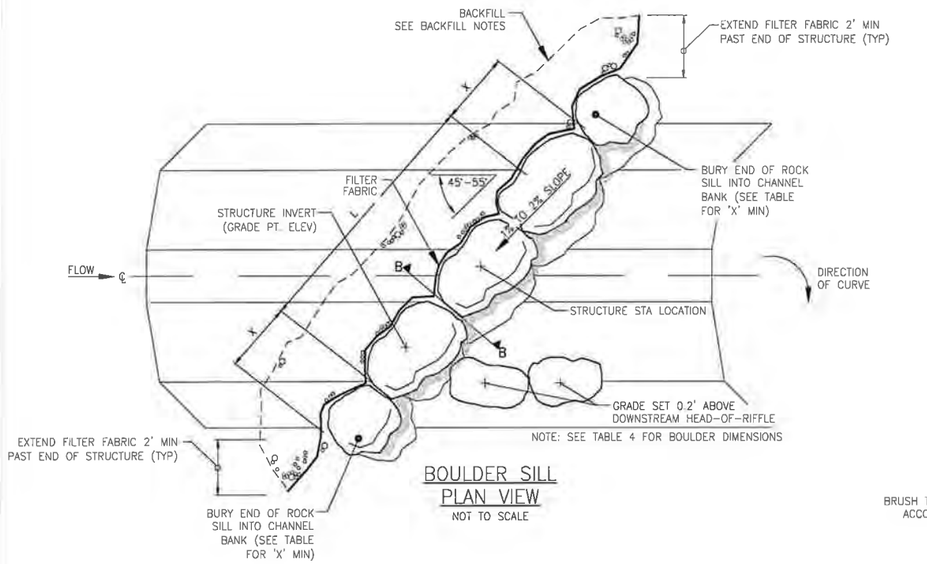


SECTION B-B
NOT TO SCALE

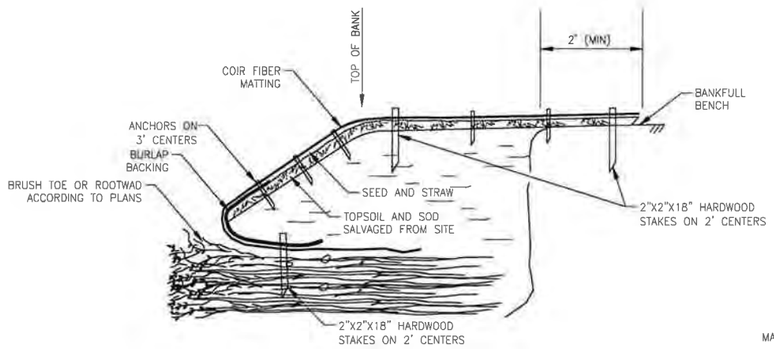
BACKFILL NOTES:
1. STRUCTURE BACKFILL MATERIAL SHALL CONSIST OF ON-SITE SOIL COMPACTED TO IN-SITU DENSITY.
2. STRUCTURE BACKFILL CAP SHALL CONSIST OF 4-6" STONE/GRAVEL HARVESTED ON-SITE.
3. ALL VOIDS AND GAPS BETWEEN BOULDERS AND LOGS SHALL BE CHINKED WITH BRUSH AND STONE PRIOR TO INSTALLATION OF FILTER FABRIC.



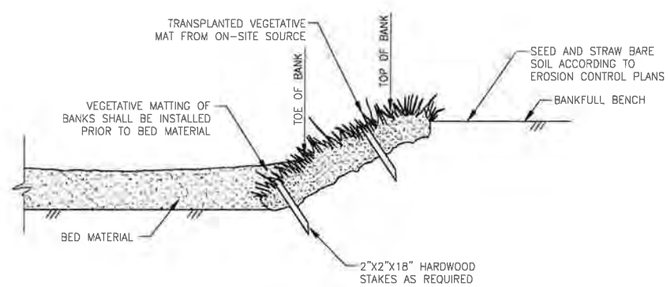
BANK PROTECTION
SOD AND MAT
NOT TO SCALE



BOULDER SILL
PLAN VIEW
NOT TO SCALE



BANK PROTECTION
SOIL LIFT
NOT TO SCALE



BANK PROTECTION
SOD TRANSPLANT
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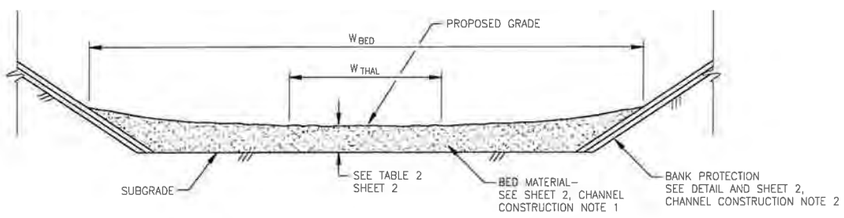

BED MATERIAL DETAIL
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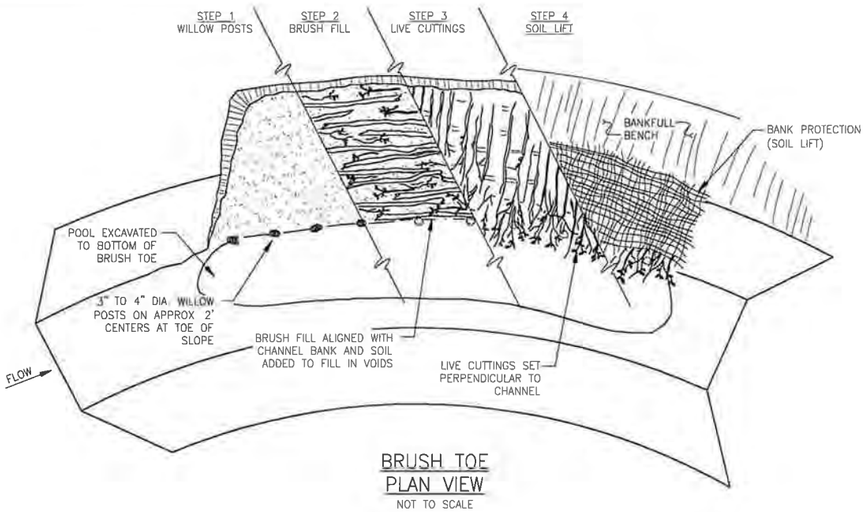

BRUSH TOE
PLAN VIEW
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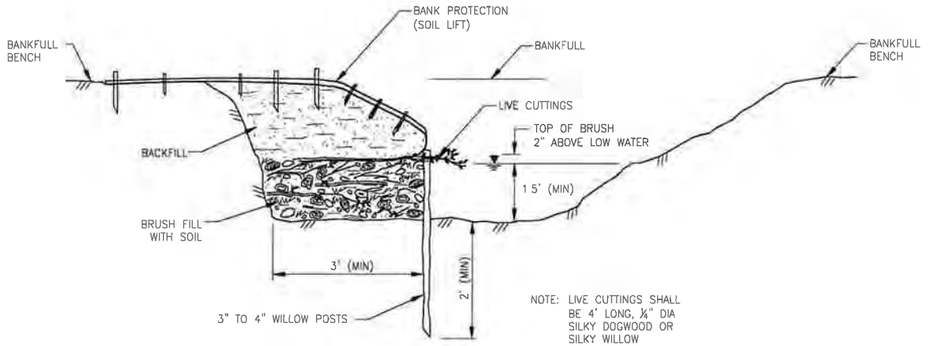

BRUSH TOE
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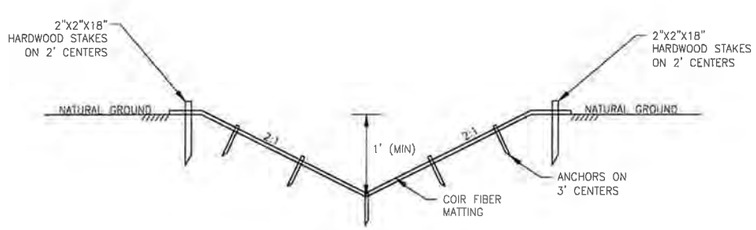
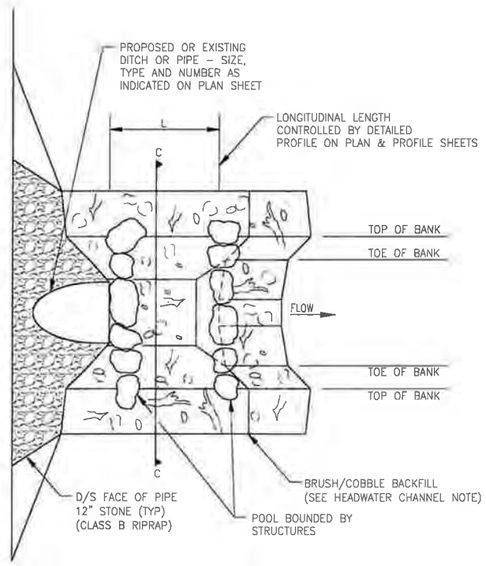


"V" DITCH
WITH COIR
NOT TO SCALE



OUTLET PROTECTION
PLAN VIEW
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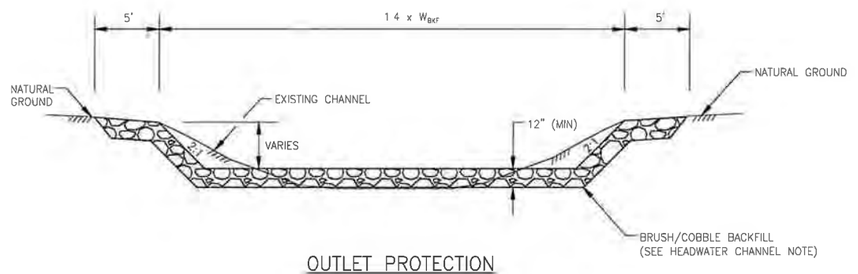

OUTLET PROTECTION
SECTION C–C
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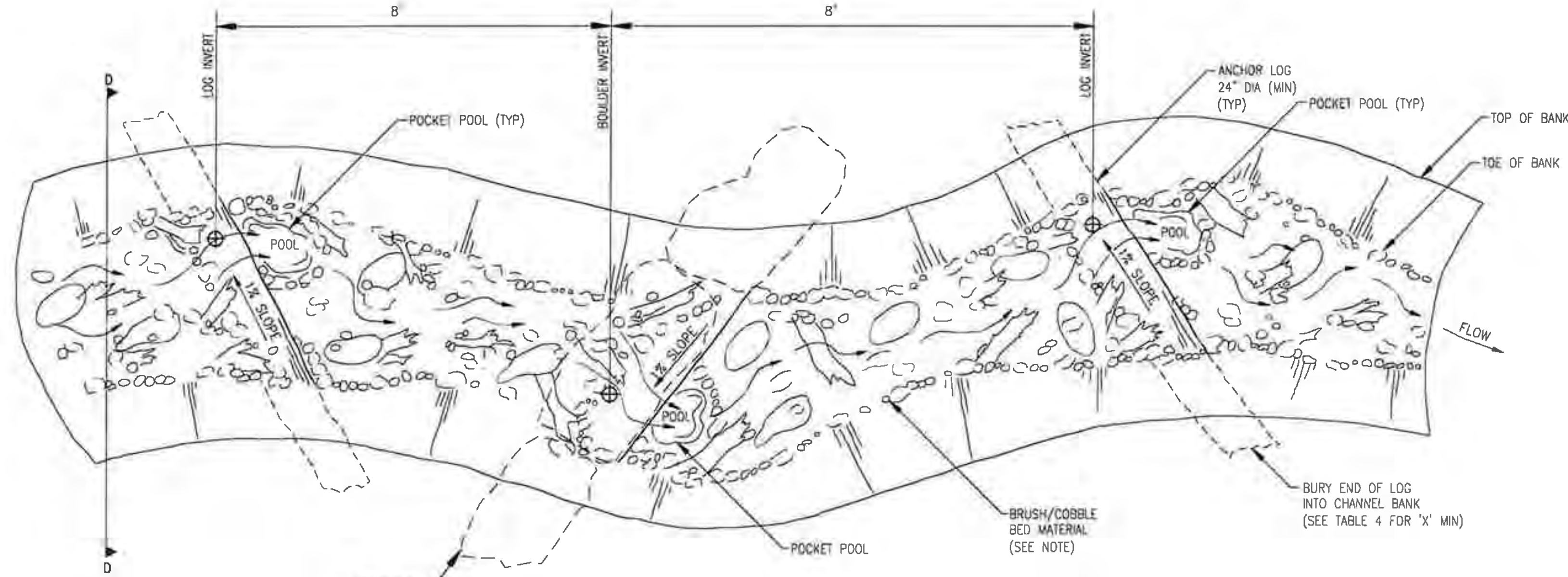
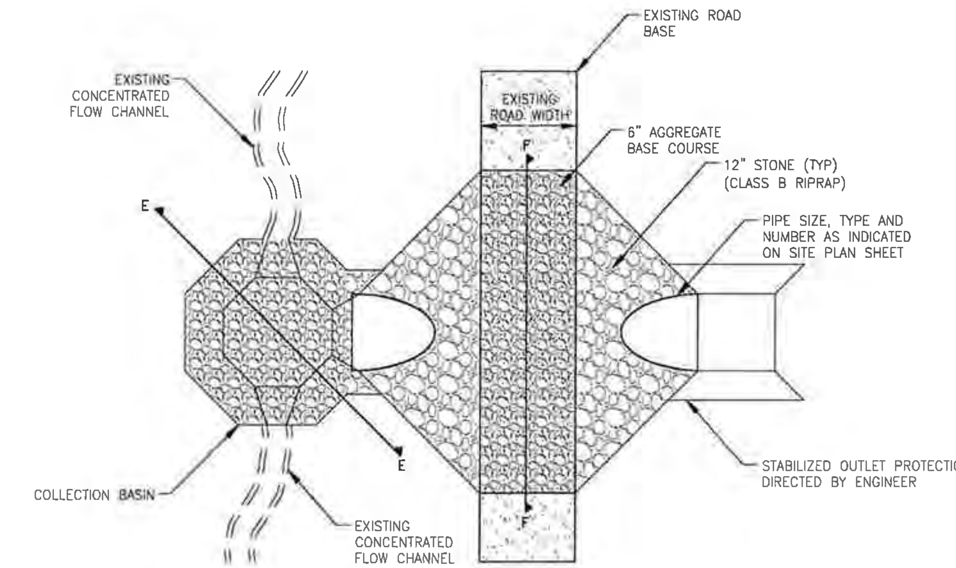
Sheet: 3A

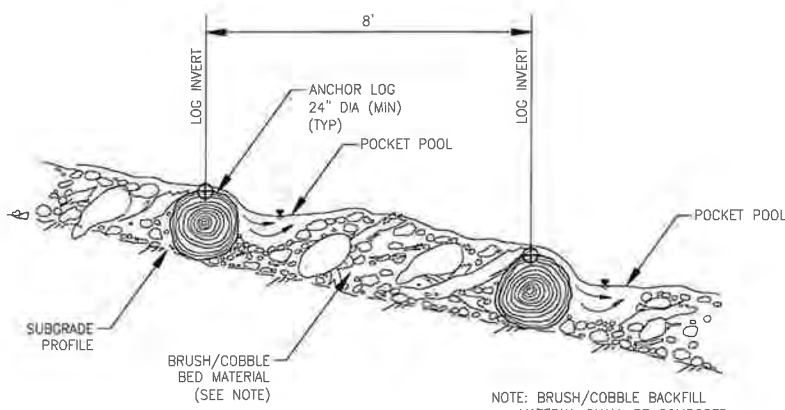


NOTE: 1 SEE TABLE 4 FOR BOULDER DIMENSIONS
2 COMBINATION LOGS AND BOULDERS

HEADWATER CHANNEL
PLAN
NOT TO SCALE

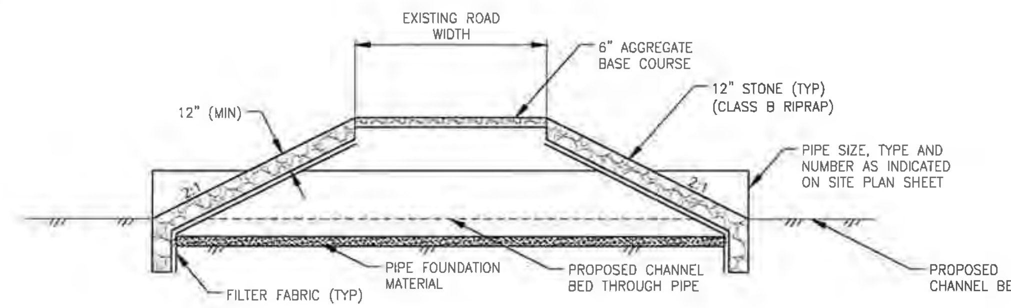


PERMANENT ROAD CROSSING
(PIPE)
PLAN VIEW
NOT TO SCALE



HEADWATER CHANNEL
PROFILE
NOT TO SCALE

NOTE: BRUSH/COBBLE BACKFILL
MATERIAL SHALL BE COMPOSED
OF: 20% LIMBS (4-6 IN DIAMETER)
10% GRAVEL (SURGE OR HARVESTED ON-SITE)
30% 6" STONE (RIPRAP OR HARVESTED ON-SITE)
60% 12" STONE (RIPRAP OR HARVESTED ON-SITE)
10% SOIL (ON-SITE)



PERMANENT ROAD CROSSING
(PIPE)
PROFILE
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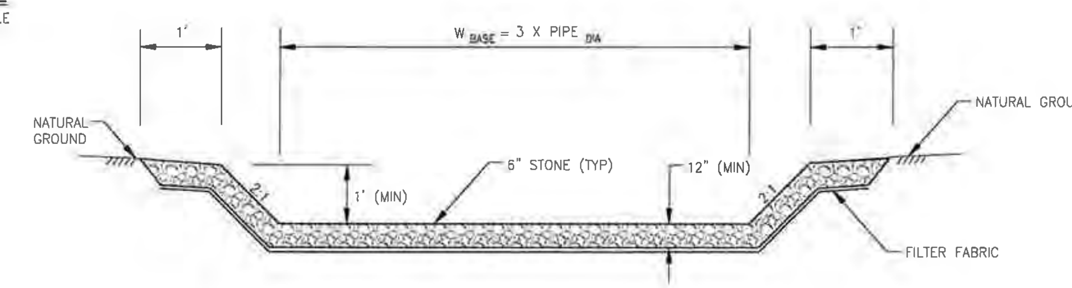
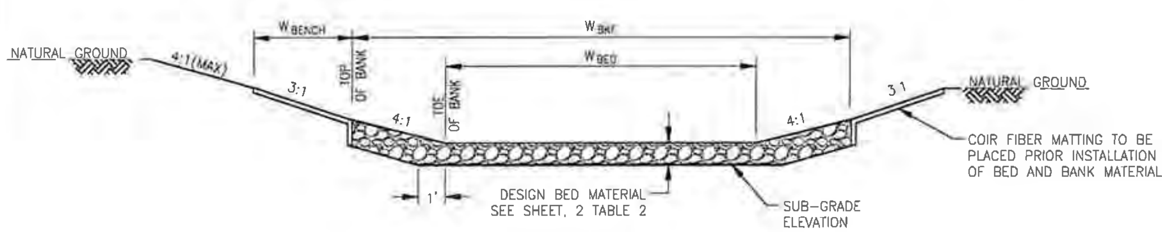


COLLECTION BASIN
SECTION E–F
NOT TO SCALE



HEADWATER CHANNEL
SECTION D–D
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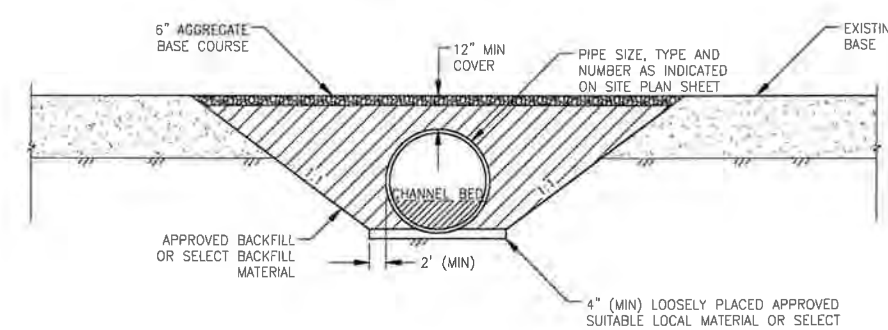

PERMANENT ROAD CROSSING
(PIPE)
SECTION F–F
NOT TO SCALE

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2019/01/16 12:51 PM By: Stokes, Ryan (Asheville)

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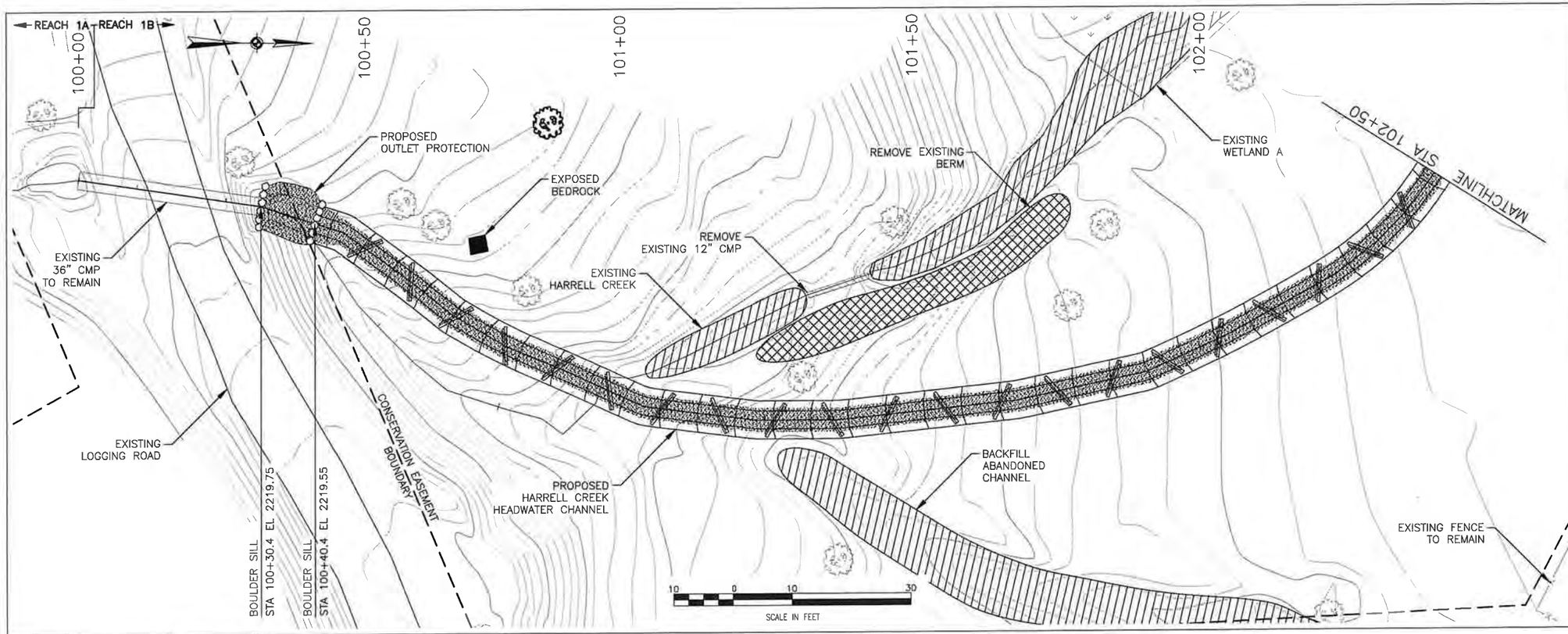

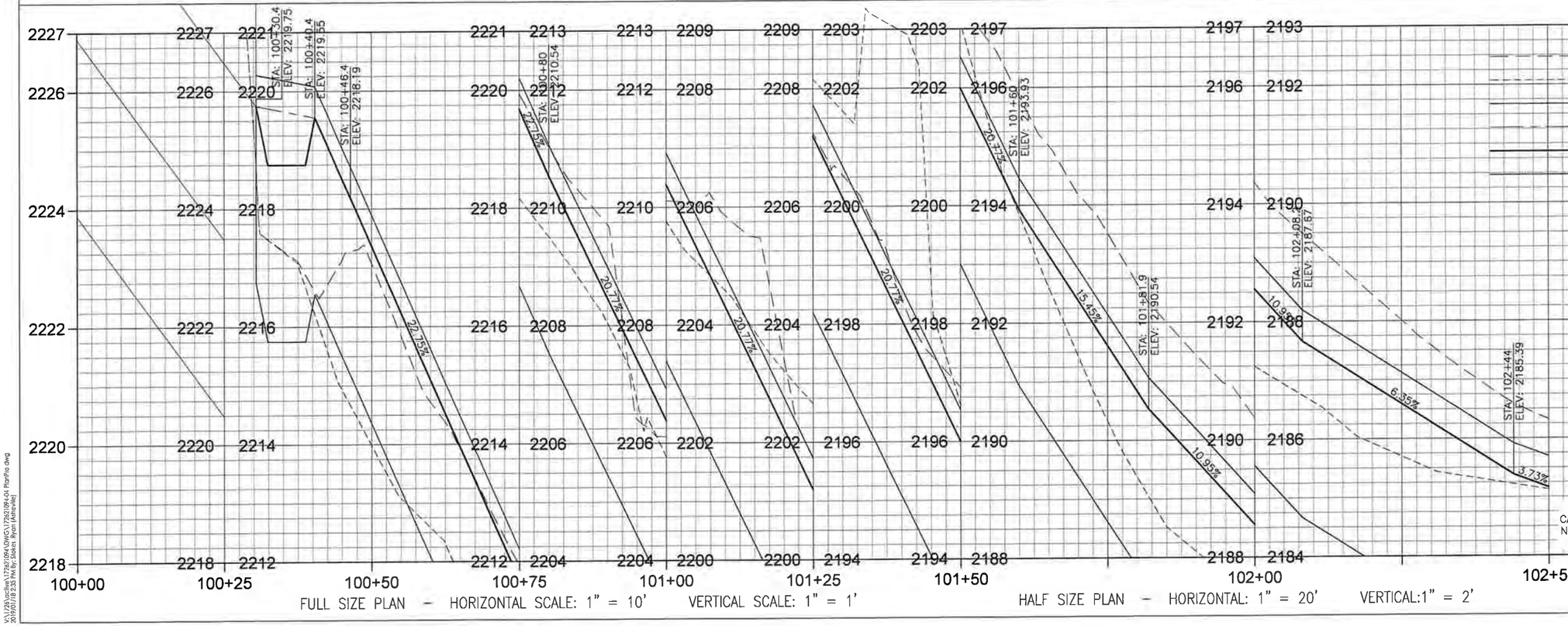

FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 10' VERTICAL SCALE: 1" = 1'

HALF SIZE PLAN – HORIZONTAL: 1" = 20' VERTICAL:1" = 2'

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NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. EAGLE
12/19

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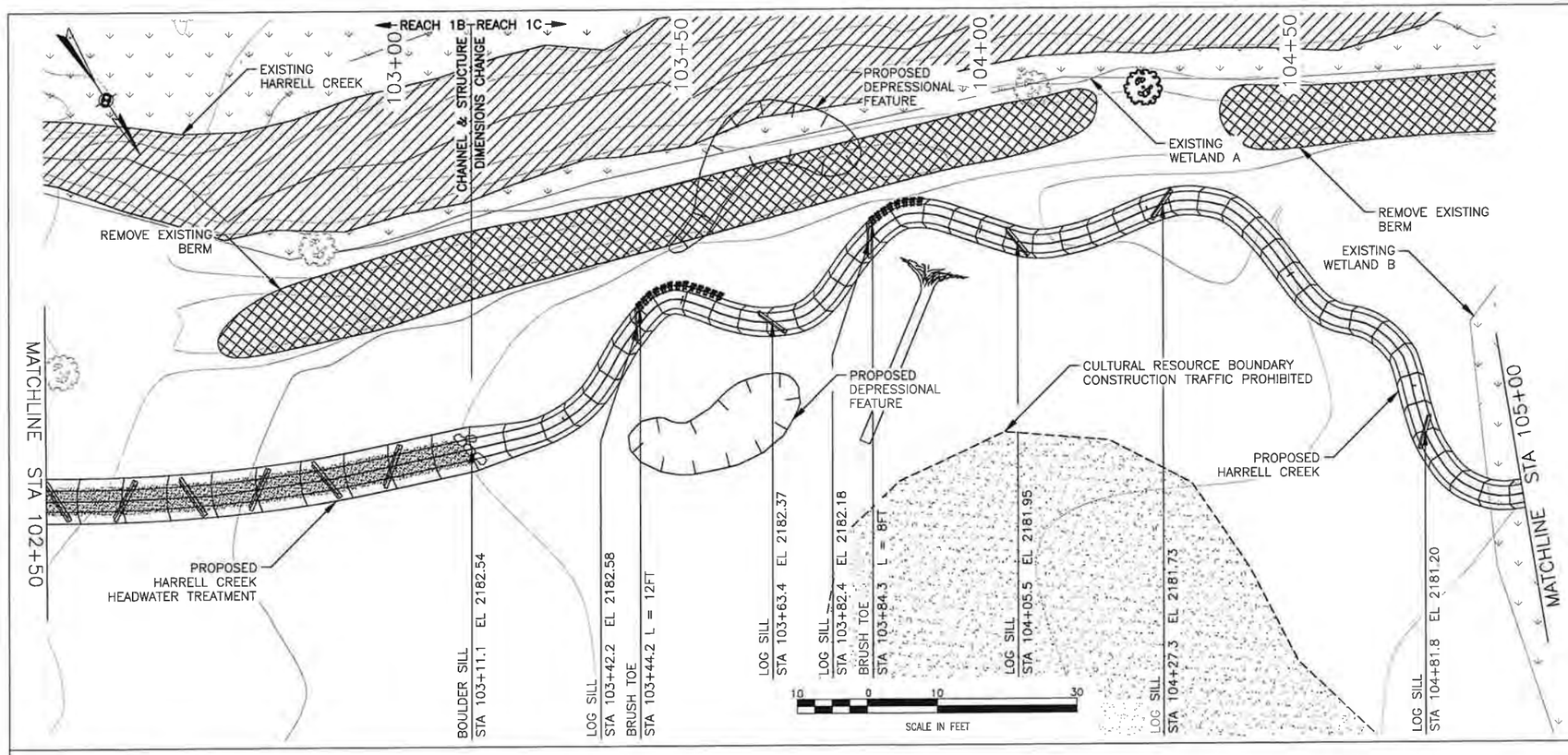
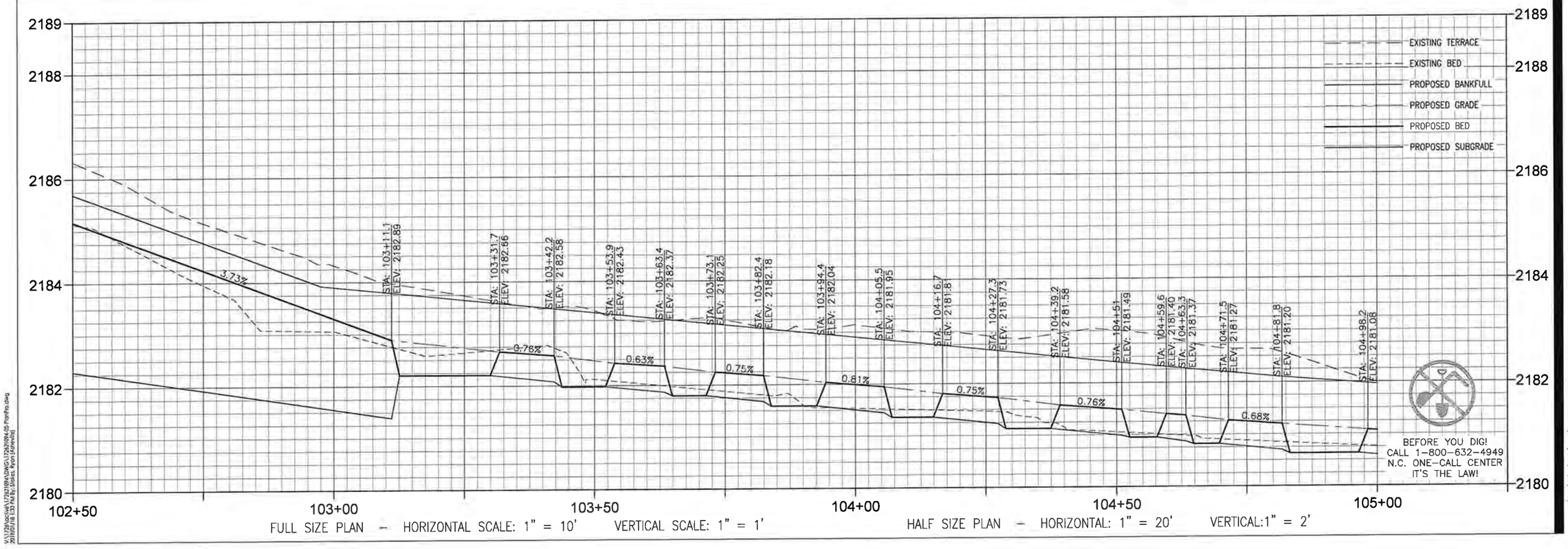
2019/01/18 2:33 PM By: Stokes, Ryan (Asheville)





FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 10' VERTICAL SCALE: 1" = 1'

HALF SIZE PLAN – HORIZONTAL: 1" = 20' VERTICAL:1" = 2'

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2019/01/18 11:33 PM By: Stokes, Kevin (Asheville)

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

Title
PLAN & PROFILE
STA 102+50 - 105+00

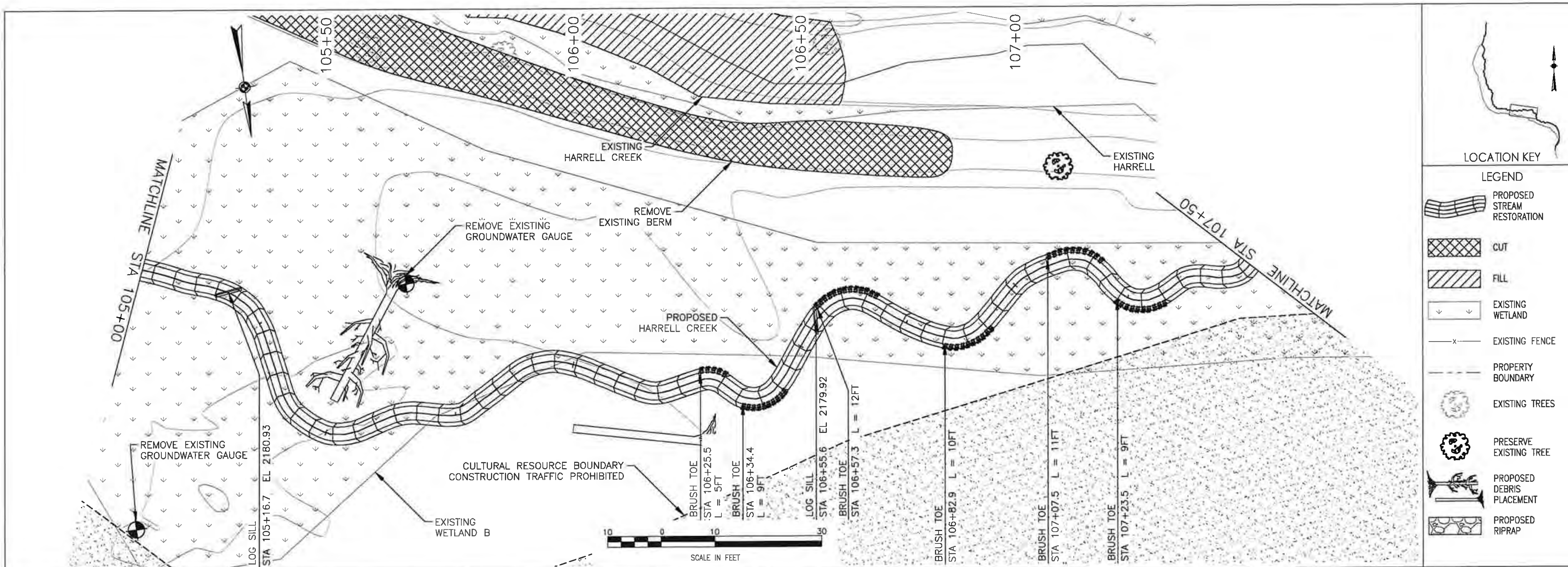
Permit-Seal

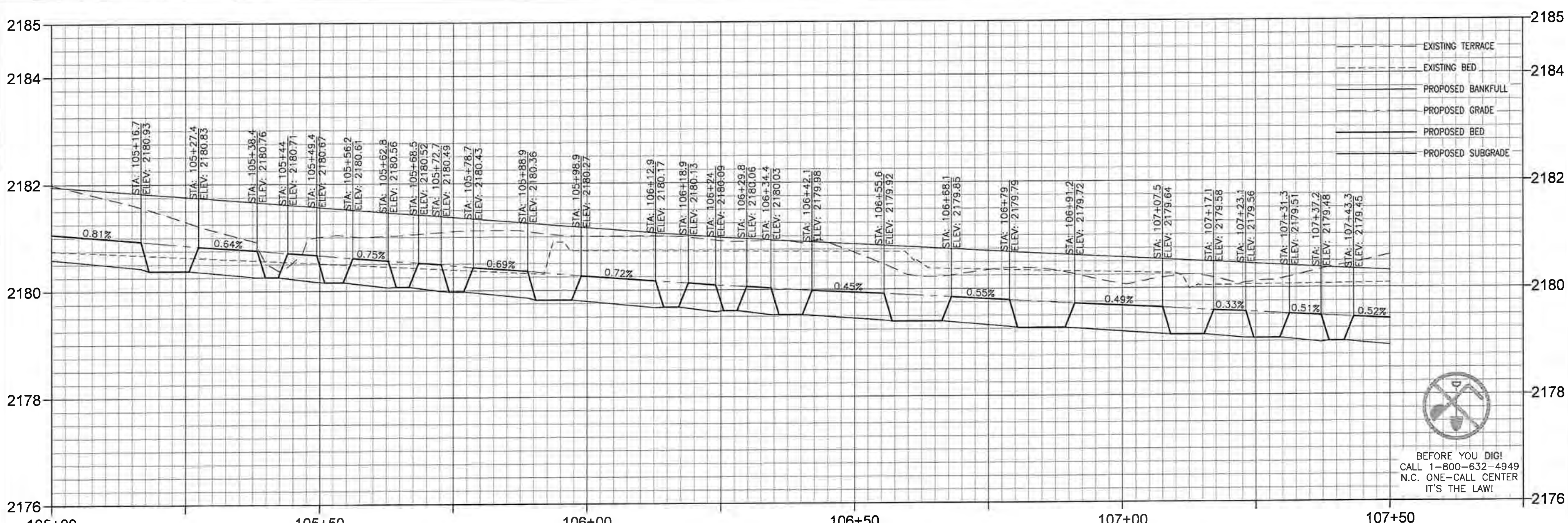
NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGEL
1/21/19

Project Number: 172621094

RTS	SGG	CME	19.01.15
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0 Sheet 5





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JACKSON COUNTY, NORTH CAROLINA

Title
PLAN & PROFILE
STA 105+00 - 107+50

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038695 ENGINEER CHRISTOPHER M. ENGLE
1/21/19

Project Number: 172621094

RTS	SGG	CME	19.01.15
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Revision 0
Sheet 6

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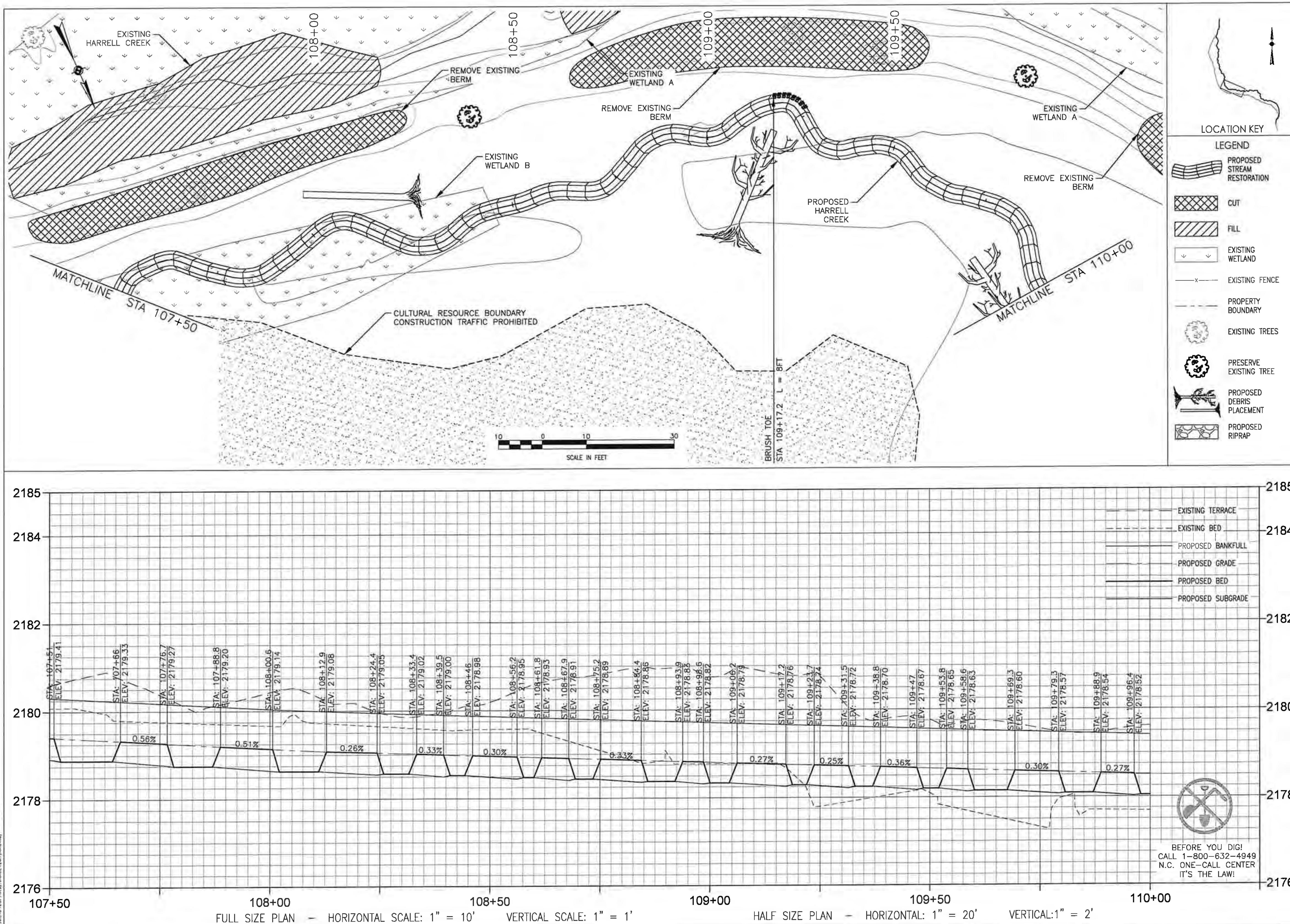

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EW SOLUTIONS, LLC
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JACKSON COUNTY, NORTH CAROLINA

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PLAN & PROFILE
STA 107+50 - 110+00

Permit-Seal

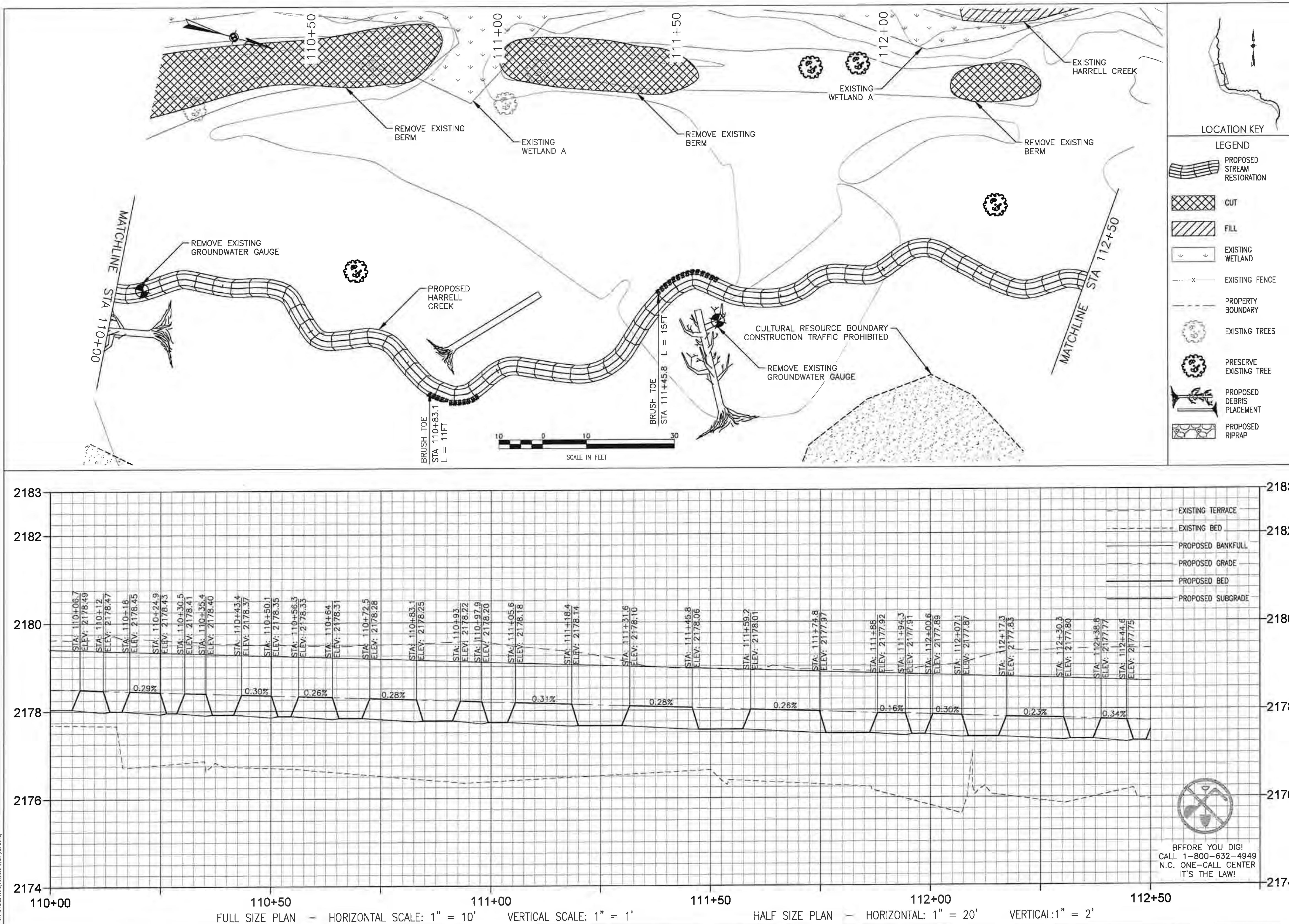
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038595 CHRISTOPHER M. ENGLE

1/21/19

Project Number: 172621094

RTS	SGG	CME	19.01.15
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0 Sheet 7



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EW SOLUTIONS, LLC
HARRELL STREAM AND WETLAND MITIGATION
JACKSON COUNTY, NORTH CAROLINA

Title
PLAN & PROFILE
STA 110+00 - 112+50

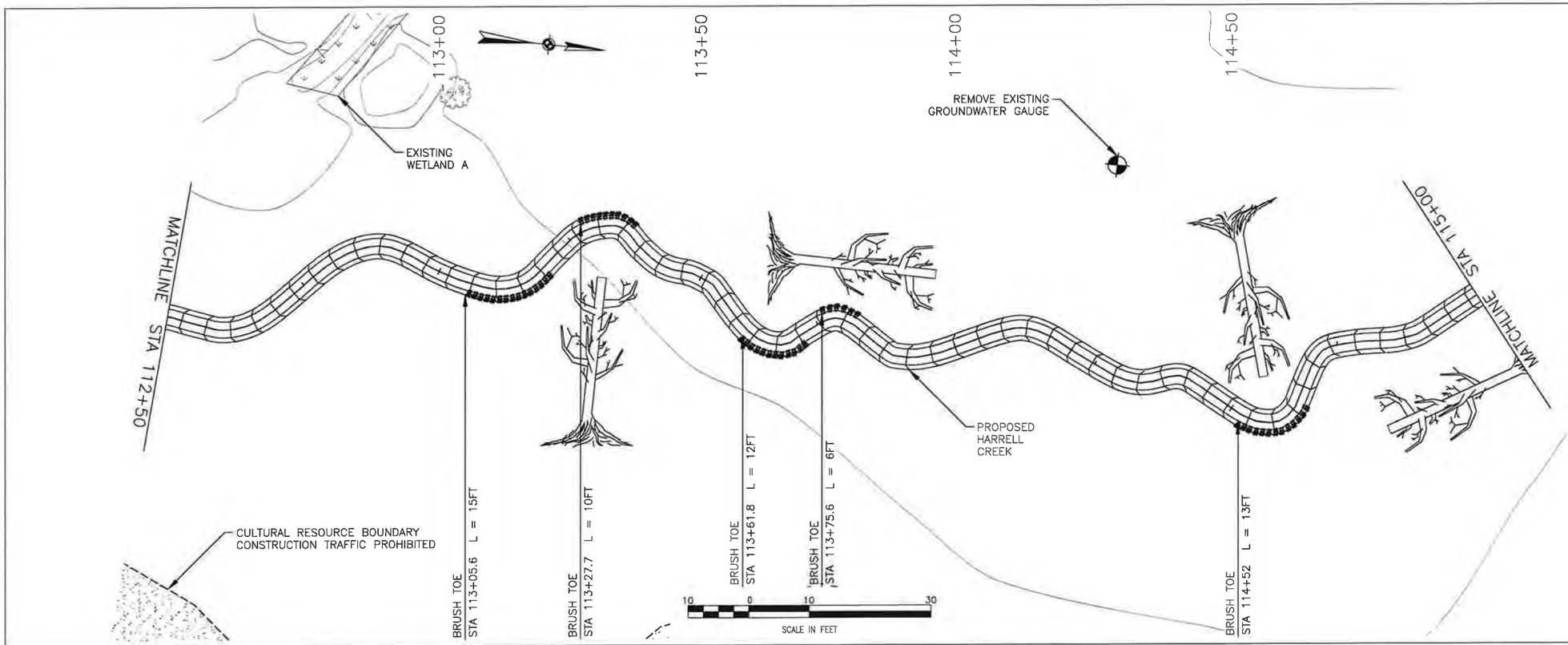
Permit-Seal

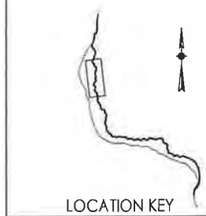
NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE

Project Number: 172621094

RTS	SGG	CME	19.01.15
Dwn.	Chkd.	Dsgn.	YY.MM.DD

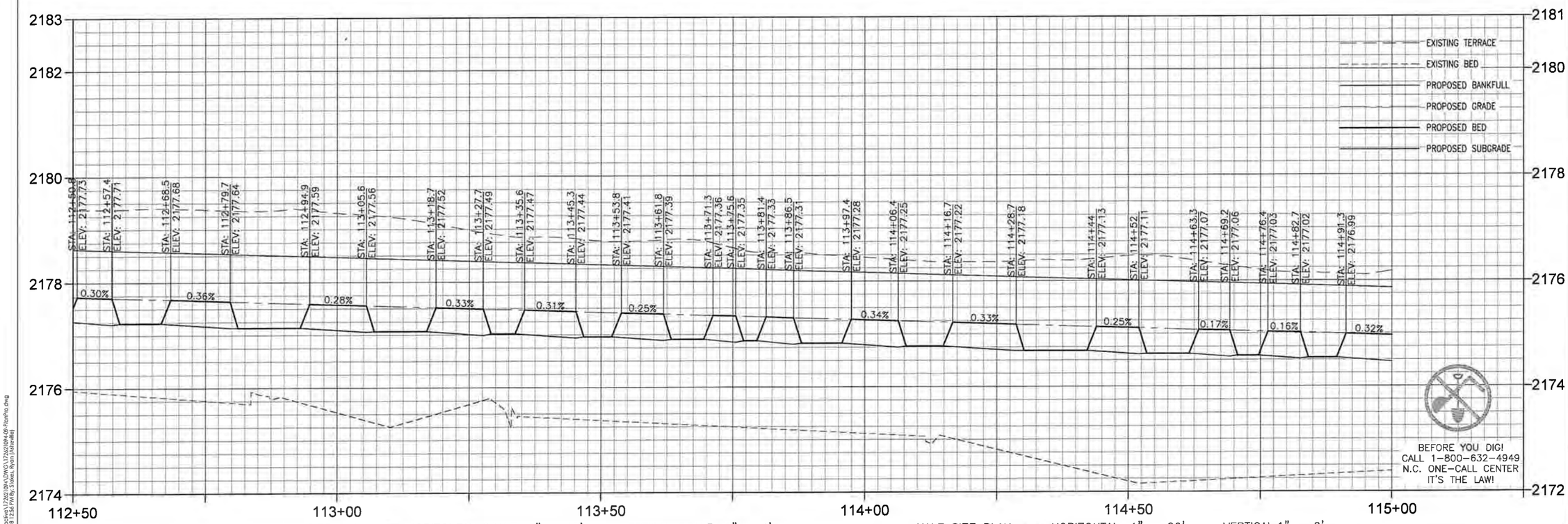
Revision 0 Sheet 8





LEGEND

- PROPOSED STREAM RESTORATION
- CUT
- FILL
- EXISTING WETLAND
- EXISTING FENCE
- PROPERTY BOUNDARY
- EXISTING TREES
- PRESERVE EXISTING TREE
- PROPOSED DEBRIS PLACEMENT
- PROPOSED RIPRAP



FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 10' VERTICAL SCALE: 1" = 1'

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

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038095 ENGINEER CHRISTOPHER M. PAGLIA
1/21/19

Project Number: 172621094

RTS	SGG	CME	19.01.15
Dwn.	Chkd.	Dsgn.	YY.MM.DD

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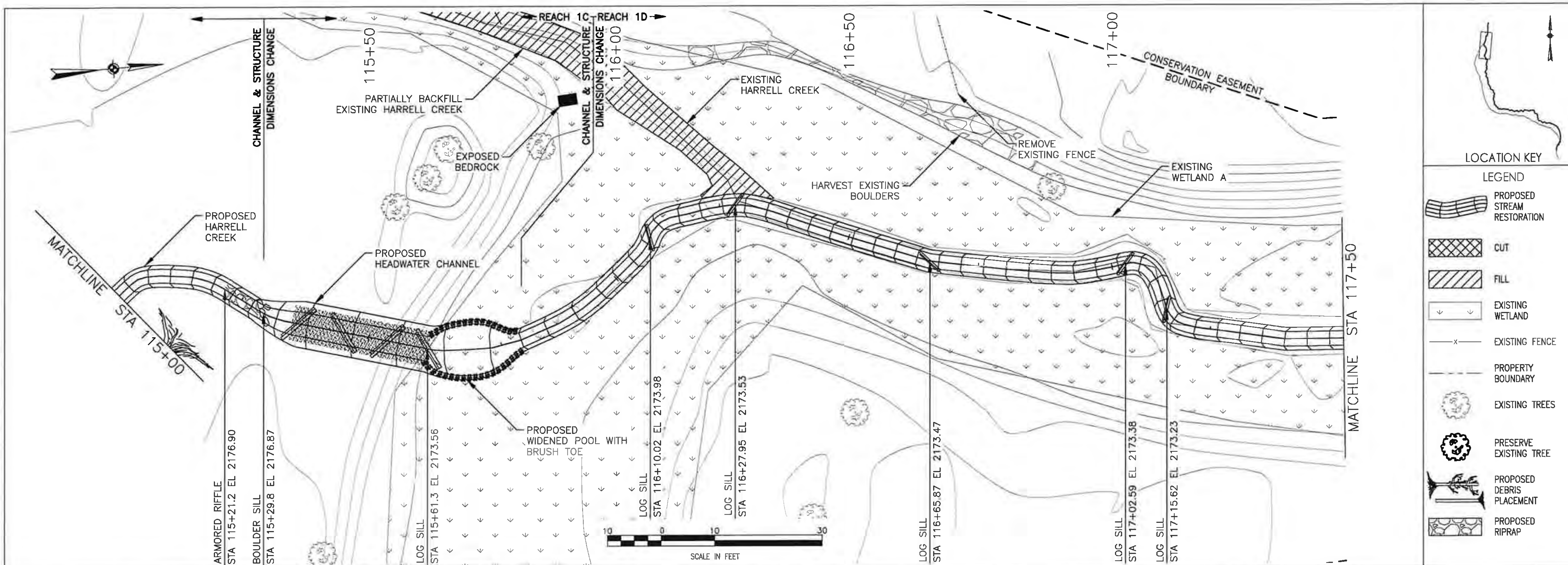
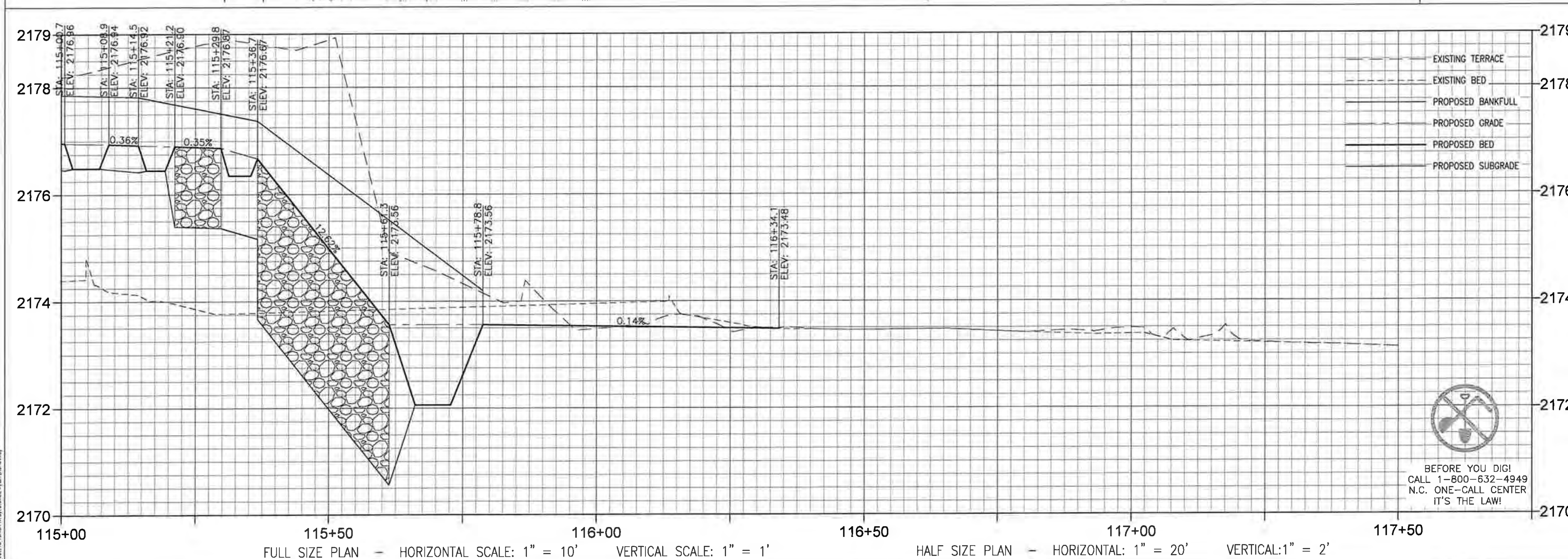
Sheet 9

Title
PLAN & PROFILE
STA 112+50 - 115+00





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JACKSON COUNTY, NORTH CAROLINA

Title
PLAN & PROFILE
STA 115+00 - 117+50

Permit-Seal
NORTH CAROLINA PROFESSIONAL SEAL 039595 ENGINEER CHRISTOPHER M. ENGLE 1/21/19

Project Number: 172621094

RTS	SGG	CME	19.01.15
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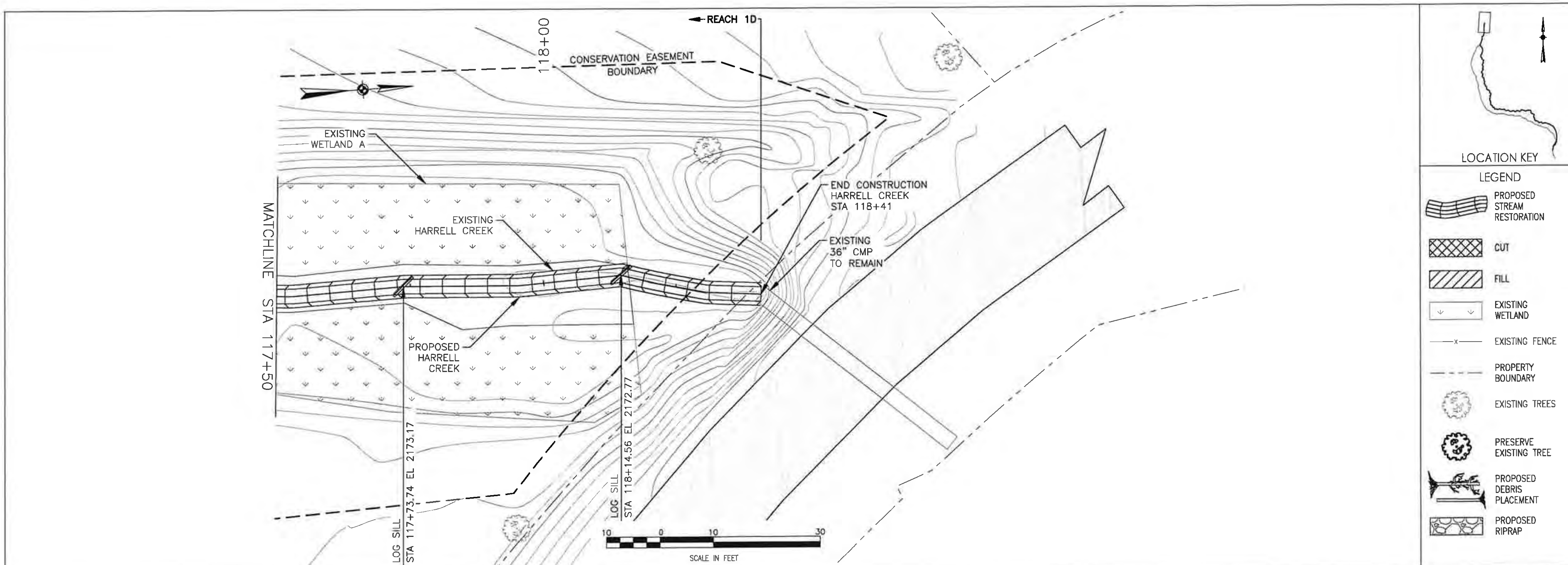
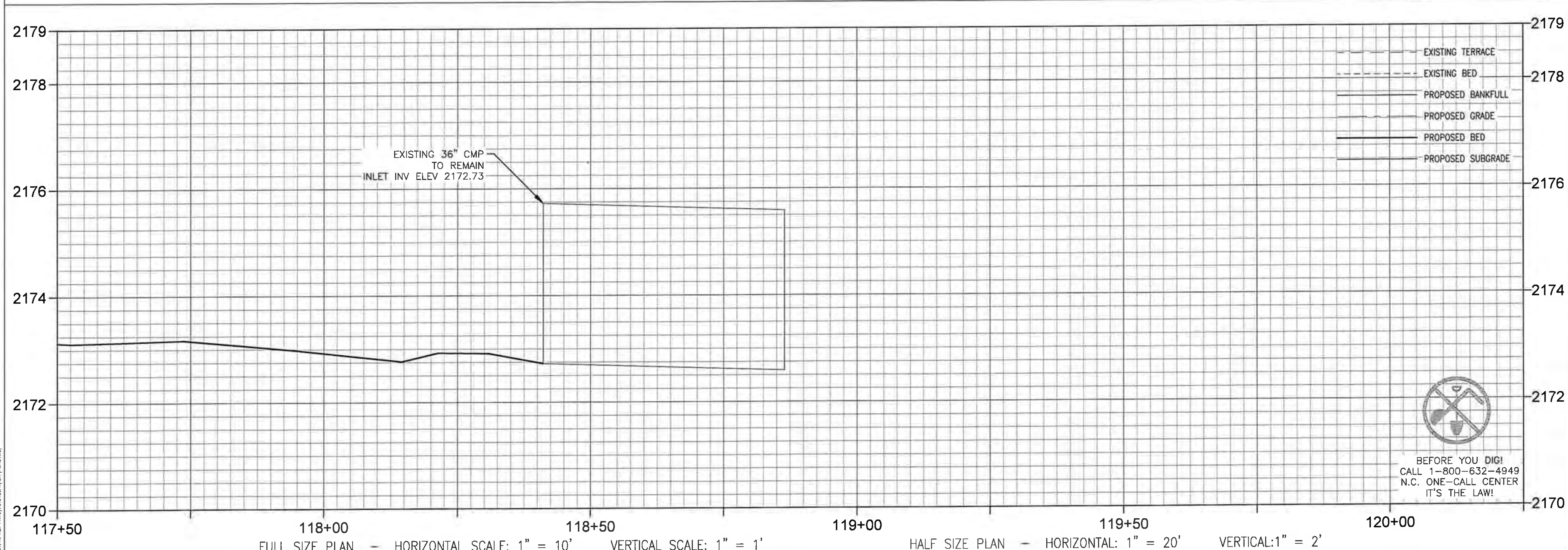
Revision 0 Sheet 10





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HARRELL STREAM AND WETLAND MITIGATION
JACKSON COUNTY, NORTH CAROLINA

Title
PLAN & PROFILE
STA 117+50 - 118+75

Permit-Seal

1/21/19

Project Number: 172621094

RTS	SGG	CME	19.01.15
Dwn.	Chkd.	Dsgn.	YY.MM.DD

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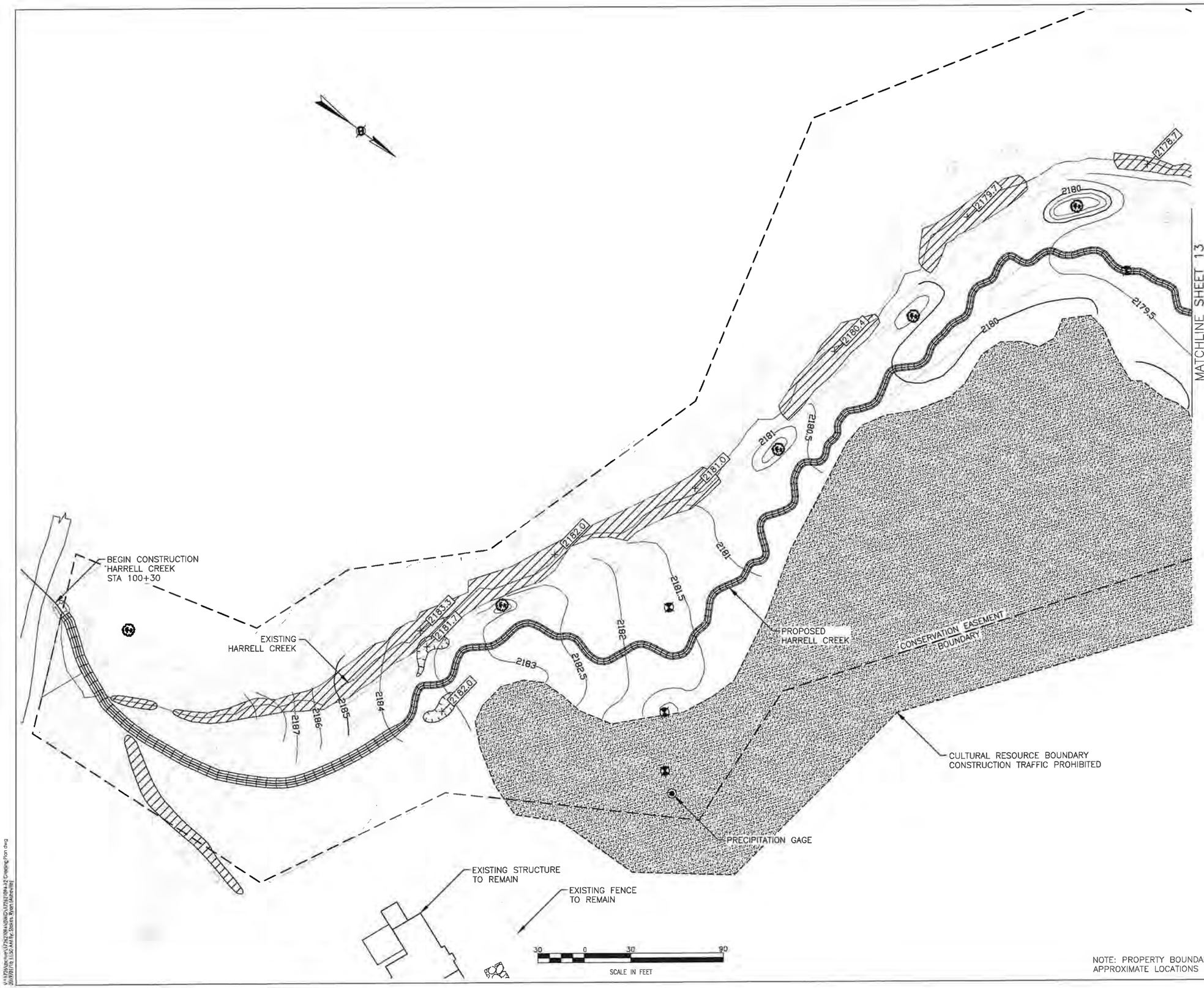

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Client/Project
EW SOLUTIONS, INC

HARRELL STREAM AND WETLAND MITIGATION

JACKSON COUNTY, NORTH CAROLINA

Title
GRADING PLAN

Permit-Seal

Project Number: 172621094

RTS	SGG	CME	19.01.15
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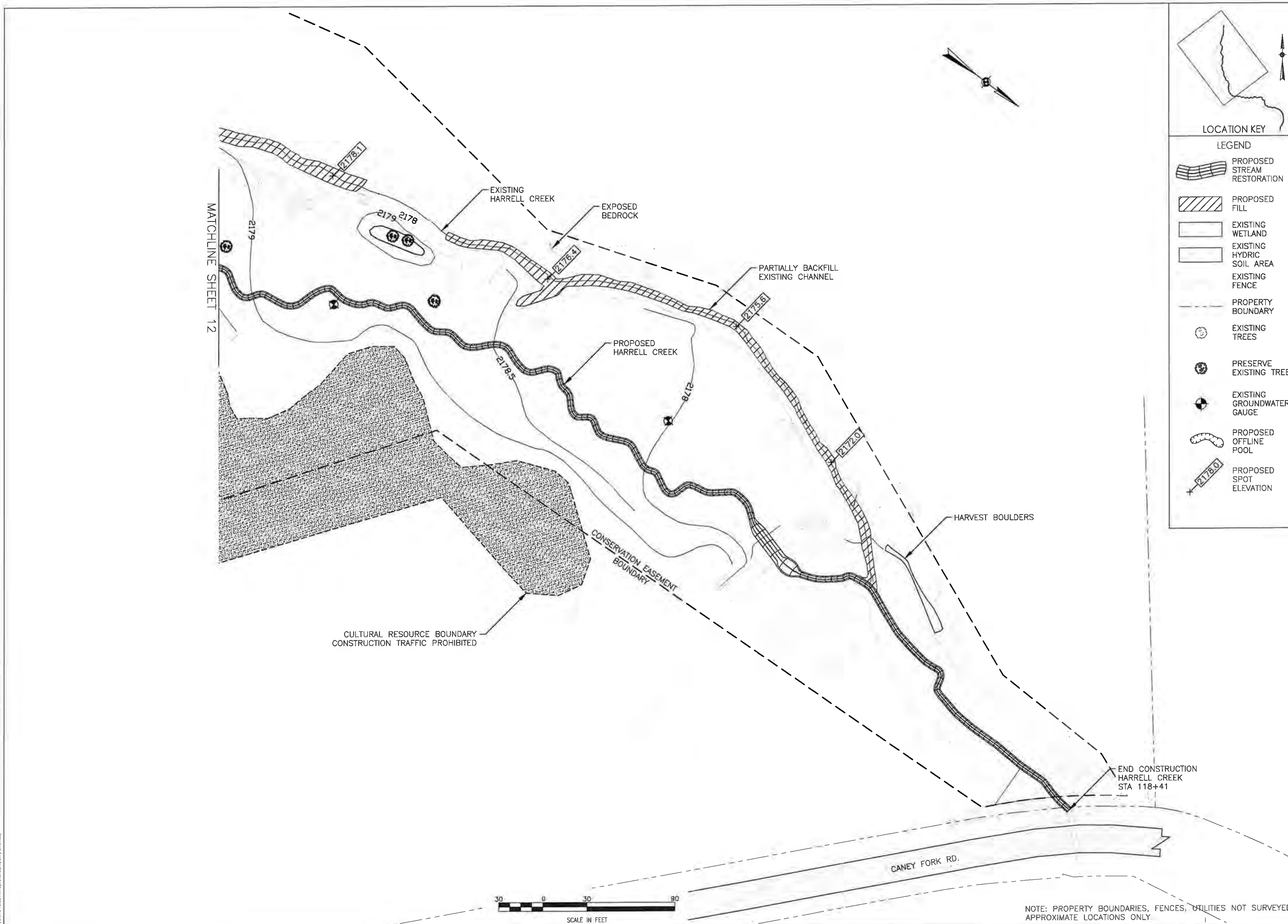
Revision 0

Sheet 12



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

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HARRELL STREAM AND WETLAND MITIGATION
JACKSON COUNTY, NORTH CAROLINA

Title
GRADING PLAN

Permit-Seal

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036585 CHRISTOPHER M. ENGLE 1/21/19

Project Number: 172621094

RTS	SGG	CME	18.12.21
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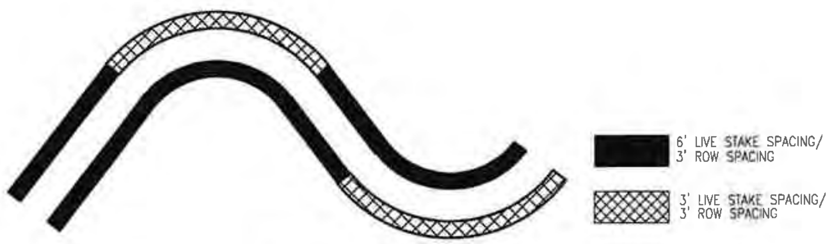
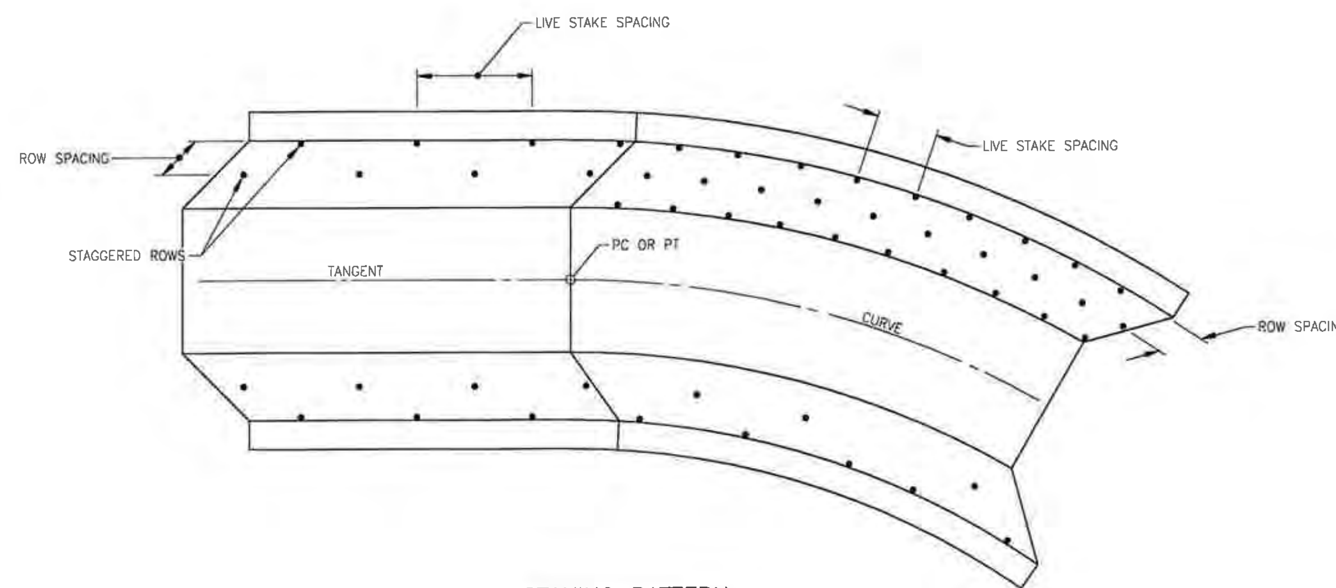
Revision 0
Sheet 13



PLAN VIEW



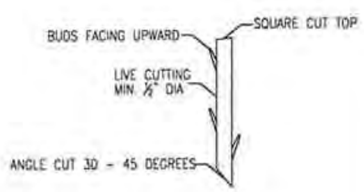
STAKING PATTERN
NOT TO SCALE

PLANTING NOTES:

TEMPORARY AND PERMANENT SEED
1. ALL DISTURBED AREAS WILL BE STABILIZED USING MULCH AND TEMPORARY SEED TO PROVIDE ADEQUATE GROUND COVER AND CONDITION THE SOIL
2. MULCH MUST BE ADDED TO ACHIEVE 80% COVERAGE (ROUGHLY 2 TONS/ACRE FOR WHEAT STRAW)
3. A FERTILITY SOIL TEST SHALL BE USED TO DETERMINE FERTILIZER AMOUNTS OR, IF NO SOIL TEST IS AVAILABLE, A STANDARD MIXTURE SHALL BE APPLIED OF 2 TONS OF LIME PER ACRE AND 700-1000 LBS OF 10-10-10 FERTILIZER PER ACRE

BARE ROOT PLANTINGS
1. PLANT BARE ROOT SHRUBS AND TREES IN AREAS AS INDICATED ON THE PLANS
2. PROVIDE 8 FT OF SPACING BETWEEN INSTALLED PLANTS
3. LOOSEN COMPACTED SOIL AND PLANT IN HOLES FORMED WITH A MATTOCK, DIBBLE BAR OR EQUAL
4. PROVIDE PLANTING HOLE SUFFICIENT IN SIZE AND DEPTH TO PREVENT CROWDING OF ROOTS
5. ROOTS SHALL BE KEPT MOIST DURING TRANSPORTATION, DISTRIBUTION, AND INSTALLATION
6. PLANTS SHALL BE HEELED-IN INTO MOIST SOIL IF NOT PROMPTLY PLANTED AFTER DELIVERY TO THE PROJECT SITE

LIVE STAKES:
1. STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY
2. STAKES THAT ARE SPLIT SHALL NOT BE INSTALLED
3. STAKES SHALL BE INSTALLED ORTHOGONALLY TO THE BANK AND WITH BUDS POINTING UPWARDS.
4. STAKES SHALL BE ½ TO 2 INCHES IN DIAMETER AND 2 TO 3 FEET IN LENGTH
5. AFTER INSTALLATION, THE TOP PORTION OF STAKES SHALL BE PRUNED WITH A SQUARE CUT LEAVING NO LESS THAN 3 INCHES AND NO MORE THAN 6 INCHES ABOVE THE GROUND



LIVE STAKE DETAIL

NUMBER OF LIVE STAKE ROWS

CHANNEL DEPTH (FT)	INSIDE OF BEND	TANGENT	OUTSIDE OF BEND
0 - 1.5	1	1	2
1.5 - 2.5	2	2	3
2.5 - 3.5	3	3	4

	COMMON NAME	SCIENTIFIC NAME
WETLAND PLANTINGS COMBINATION OF PEIDMONT/MOUNTAIN SEMIPERMANENT IMPOUNDMENT AND SWAMP-FOREST BOG COMPLEX		
TREES	Green ash	*Fraxinuspennsylvanica*
	Sycamore	*Platanusoccidentalis*
	Tulip poplar	*Liriodendron tulipifera*
SHRUBS	Winterberry	*Ilex verticillata*
	Tag alder	*Alnusserrulata*
	Buttonbush	*Cephalanthusoccidentalis*
	Spicebush	*Lindera benzoin*
	Elderberry	*Sambucuscanadensis*
	Possum haw	*Viburnum nudum*
	Silky dogwood	*Cornusamomum*
RIPARIAN PLANTINGS		
TREES	Pawpaw	*Asimina triloba*
	Sycamore	*Platanusoccidentalis*
	Black willow	*Salix nigra*
	Tulip poplar	*Liriodendron tulipifera*
	Ironwood	*Carpinuscaroliniana*
	Green ash	*Fraxinuspennsylvanica*
SHRUBS	Spicebush	*Lindera benzoin*
	Buttonbush	*Cephalanthusoccidentalis*
	Witch hazel	*Hamamelisvirginiana*
	Silky dogwood	*Cornusamomum*
	Tag alder	*Alnusserrulata*
LIVE STAKES	Silky dogwood	*Cornusamomum*
	Buttonbush	*Cephalanthusoccidentalis*
	Silky willow	*Salix sericea*
	Elderberry	*Sambucuscanadensis*

NOTES:
1. PLANT SPECIES TO BE INSTALLED SHALL BE DEPENDENT ON SPECIES AVAILABILITY
2. CONTRACTOR MAY MODIFY COMPOSITION AS APPROVED BY ENGINEER
3. COMPOSITION MUST INCLUDE 50% OF THE LISTED SPECIES AND NO ONE SPECIES MAY BE GREATER THE 50% OF THE TOTAL COMPOSITION

COMMON NAME	SCIENTIFIC NAME	SEEDING DENSITY (lbs/acre)	% MIX
PERMANENT MIX			
Switchgrass	*Panicum virgatum*	6	15
Broom Sedge	*Andropogon viginicus*	6	15
Indian Grass	*Sorhgastrum nutans*	8	20
Eastern Gamma Grass	*Tripsacum dactyoides*	10	25
Joe-Pye Weed	*Eupatorium fistulosum*	4	10
Deer tongue	*Panicum clandestinum*	6	15
	Totals	40	100%

PLANTING DATES	SEED TYPE	SEEDING DENSITY lbs/acre
TEMPORARY MIX		
Jan 1 - May1	Wheat or Rye Grain	50
May 1 - August 15	Brown Top Millet	20
Aug 15-Dec 31	Wheat or Rye Grain	50

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

Title
PLANTING PLAN

Permit-Seal

Project Number: 172621094

RTS	SGG	CME	19.01.15
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0 | Sheet P-1

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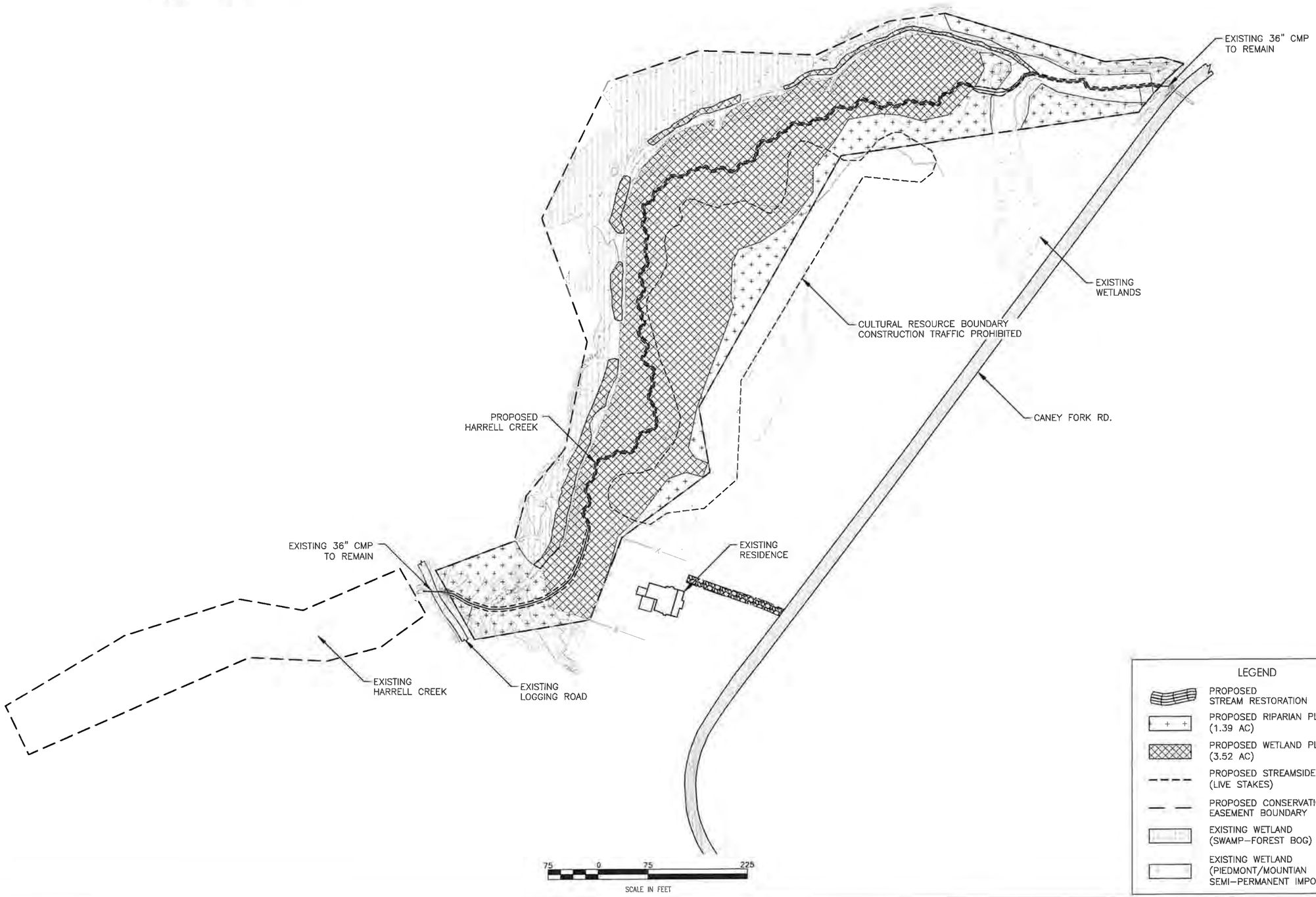
2019/01/18 1:12 PM By: Stokes, Ryan (Asheville)



LEGEND

- PROPOSED STREAM RESTORATION
- PROPOSED RIPARIAN PLANTING (1.39 AC)
- PROPOSED WETLAND PLANTING (3.52 AC)
- PROPOSED STREAMSIDE PLANTING (LIVE STAKES)
- PROPOSED CONSERVATION EASEMENT BOUNDARY
- EXISTING WETLAND (SWAMP–FOREST BOG)
- EXISTING WETLAND (PIEDMONT/MOUNTIAN SEMI–PERMANENT IMPOUNDMENT)

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

Title
PLANTING PLAN
FULL SITE

Permit-Seal

Project Number: 172621094

RTS	SGG	CME	9.01.15
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0
Sheet P-2

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2015/09/18 1:17 PM By: Stacci, Ryan (Asheville)

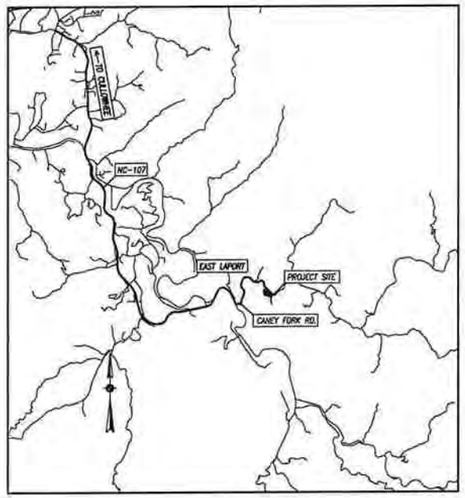
EW SOLUTIONS, LLC

STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
NC	172621094	1	5

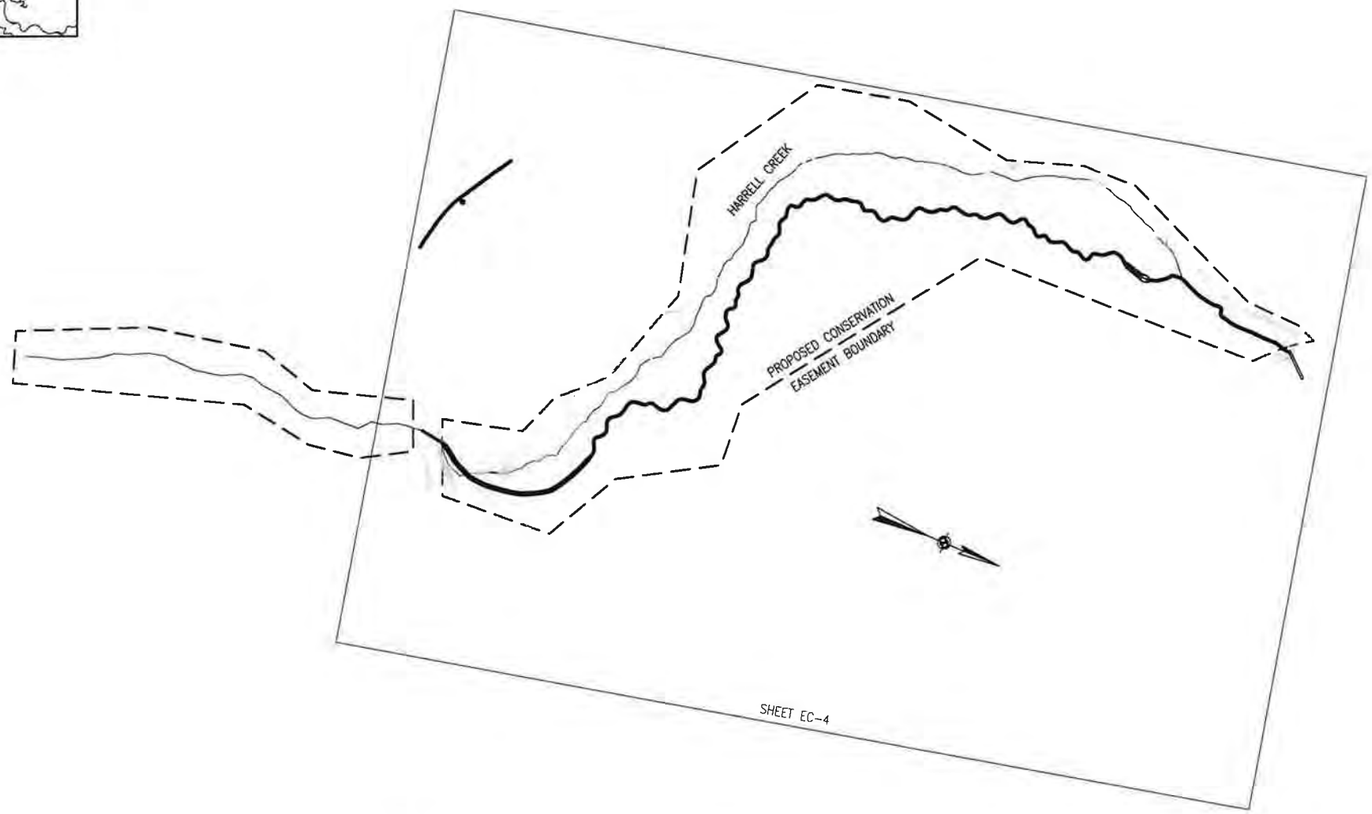
	EROSION CONTROL PLANS	1/15/19
ITEM	DESCRIPTION	DATE
	REVISIONS	

HARRELL MITIGATION PROJECT

HARRELL CREEK
JACKSON COUNTY, NORTH CAROLINA



VICINITY MAP
NOT TO SCALE



SHEET INDEX

SHEET NO.	DESCRIPTION
EC-1	TITLE SHEET
EC-2	SITE PLAN
EC-3 - EC-3A	DETAILS
EC-4	PLAN

EROSION CONTROL PLANS

NC DMS PROJECT No. 100005

GRAPHIC SCALES (SCALE IN FEET)

50 0 50 150

PLAN - SHEETS EC4

PROJECT LENGTHS

PROPOSED RESTORATION:	HARRELL CREEK	= 1,782 FT
PROPOSED PRESERVATION:	HARRELL CREEK	= 640 FT
	TOTAL	= 2,422 FT

PREPARED BY:

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

NORTH CAROLINA PROFESSIONAL SEAL 036596 ENGINEER CHRISTOPHER M. ENGLE
1/21/19

CHRIS ENGLE
PROJECT ENGINEER

PREPARED FOR:

NC DMS

PAUL WIESNER
PROJECT MANAGER

V:\172\active\172621094\DWG\172621094 EC-01-Cover.dwg
2019/01/18 10:03 AM By: Engle, Chris

GENERAL NOTES:

DISTURBED ACREAGE: 10.54 ACRES INCLUDING CONSTRUCTION EASEMENT

1. SITE SOILS: NIKWASI, ROSMAN, CULLASAJA–TUCKASEGEE COMPLEX, TRIMONT, AND BILTMORE.
2. RECEIVING WATERS: CANEY FORK, CLASSIFIED AS A WS–III; Tr STREAM.
3. THE CONTRACTOR SHALL INSTALL AND MAINTAIN THROUGHOUT THE DURATION OF CONSTRUCTION ALL EROSION CONTROL MEASURES IN ACCORDANCE WITH THESE PLANS AND IN ACCORDANCE WITH APPLICABLE EROSION AND SEDIMENT CONTROL REGULATIONS.
4. ALL EROSION CONTROL MEASURES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE NORTH CAROLINA EROSION AND SEDIMENT CONTROL REGULATIONS, U.S. DEPARTMENT OF AGRICULTURE, AND U.S. NATURAL RESOURCES CONSERVATION SERVICE REGULATIONS.
5. THE CONTRACTOR SHALL CONTINUOUSLY MAINTAIN ALL EROSION CONTROL DEVICES AND STRUCTURES TO MINIMIZE EROSION.
6. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED CONTINUOUSLY, RELOCATED WHEN AND AS NECESSARY, AND SHALL BE CHECKED AFTER EVERY RAINFALL. SEEDED AREAS SHALL BE CHECKED REGULARLY AND SHALL BE WATERED, FERTILIZED, RE–SEEDED, AND MULCHED AS NECESSARY TO OBTAIN A DENSE STAND OF GRASS. IF ANY MEASURE IS FOUND TO BE DAMAGED, DEFICIENT, OR UNSTABLE IT SHALL BE REPAIRED IMMEDIATELY.
7. DISTURBED AREAS THAT ARE NOT OTHERWISE STABILIZED SHALL BE AMENDED AND SEEDED, TEMPORARILY OR PERMANENTLY IN ACCORDANCE WITH THE NORTH CAROLINA SEDIMENT CONTROL REGULATIONS. PERMANENT SEEDING AND GRASS ESTABLISHMENT ARE REQUIRED PRIOR TO PROJECT COMPLETION AND ACCEPTANCE.
8. ALL PERIMETER DIKES, SWALES, DITCHES, PERIMETER SLOPES AND ALL SLOPES STEEPER THAN 3:1 SHALL BE PROVIDED TEMPORARY OR PERMANENT STABILIZATION WITH GROUND COVER WITHIN 7 DAYS OF ANY LAND–DISTURBING ACTIVITY.
9. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 14 DAYS AFTER FINAL SITE STABILIZATION OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED. TRAPPED SEDIMENT AND DISTURBED SOIL AREAS RESULTING FROM THE DISPOSITION OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED TO PREVENT FURTHER EROSION AND SEDIMENTATION.
10. WHERE SEDIMENT IS TRANSPORTED ONTO A PAVED OR PUBLIC ROAD SURFACE, THE ROAD SURFACE SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY. SEDIMENT SHALL BE REMOVED FROM THE ROADS BY SHOVELING OR SWEEPING AND TRANSPORTED TO A SEDIMENT CONTROL DISPOSAL AREA. STREET WASHING SHALL BE ALLOWED ONLY AFTER SEDIMENT IS REMOVED IN THIS MANNER.
11. A CONSTRUCTION ENTRANCE SHALL BE INSTALLED AT ALL ACCESS POINTS FROM ANY PUBLIC ROAD. WHEN A CRUSHED STONE CONSTRUCTION ENTRANCE HAS BEEN COVERED WITH SOIL OR HAS BEEN PUSHED INTO THE SOIL BY CONSTRUCTION TRAFFIC, IT SHALL BE REPLACED WITH A DEPTH OF STONE EQUAL TO THAT OF THE ORIGINAL APPLICATION.
12. ALL DRAINAGE INLETS SHALL BE PROTECTED FROM SILTATION. INEFFECTIVE PROTECTION DEVICES SHALL BE IMMEDIATELY REPLACED AND THE INLET CLEANED. FLUSHING IS NOT AN ACCEPTABLE METHOD OF CLEANING.
13. DURING CONSTRUCTION OF THE PROJECT, SOIL STOCKPILES SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE TEMPORARY PROTECTION AND PERMANENT STABILIZATION OF ALL SOIL STOCKPILES ON SITE AS WELL AS SOIL INTENTIONALLY TRANSPORTED FROM THE PROJECT SITE.
14. SEDIMENT BASINS AND TRAPS, PERIMETER DIKES, SEDIMENT BARRIERS, AND OTHER MEASURES INTENDED TO TRAP SEDIMENT SHALL BE CONSTRUCTED AS A FIRST STEP IN ANY LAND DISTURBING ACTIVITY AND SHALL BE MADE FUNCTIONAL BEFORE UPSLOPE LAND DISTURBANCE TAKES PLACE.
15. STABILIZATION MEASURES SHALL BE APPLIED TO STRUCTURES SUCH AS DAMS, DIKES, AND DIVERSIONS, IMMEDIATELY AFTER INSTALLATION.
16. ALL SILT BASINS, SILT TRAPS, AND SEDIMENT BASINS SHALL BE CLEANED OUT WHEN HALF OF THE CAPACITY HAS BEEN REACHED.
17. CONSTRUCTION ACTIVITIES SHALL BE LIMITED TO AREA INSIDE THE CONSERVATION EASEMENT AND THE TEMPORARY CONSTRUCTION EASEMENT.

CONSTRUCTION SEQUENCE

THE CONTRACTOR SHALL FOLLOW THE SEQUENCE OF CONSTRUCTION IN ACCORDANCE WITH THE PLANS AND AS DIRECTED BY THE ENGINEER.

THE CONTRACTOR SHALL CONDUCT STREAM WORK, INCLUDING INSTALLATION OF IN–STREAM STRUCTURES, GRADING, STABILIZATION MEASURES, AND SEEDING AND MULCHING, ON A SECTION OF STREAM THAT CAN BE ENTIRELY COMPLETED IN A SINGLE DAY. THE AFOREMENTIONED CONSTITUTES SAME–DAY–STABILIZATION PROTOCOL.

1. THE CONTRACTOR SHALL IDENTIFY THE PROJECT BOUNDARY, LIMITS OF DISTURBANCE, SENSITIVE AREAS, STAGING AREAS, AND CONSTRUCTION ENTRANCES WITH THE ENGINEER.
2. THE CONTRACTOR SHALL SUBMIT A PRE–DISTURBANCE NOTIFICATION TO THE ASHEVILLE AREA OFFICE INSPECTOR.
3. THE CONTRACTOR SHALL PREPARE STABILIZED CONSTRUCTION ENTRANCES AS INDICATED ON THE PLAN.
4. THE CONTRACTOR SHALL MOBILIZE EQUIPMENT, MATERIALS, PREPARE STAGING AREAS, AND STOCKPILE AREAS AS SHOWN ON THE PLANS.
5. CONSTRUCTION TRAFFIC TO BE LIMITED TO 'LIMITS OF DISTURBANCE' AS INDICATED ON THE CONSTRUCTION PLANS AND AS DIRECTED BY THE ENGINEER.
6. THE CONTRACTOR SHALL INSTALL ALL TEMPORARY ROCK CHECK DAMS, SILT FENCE, TREE PROTECTION FENCE, AND MULCHING AROUND ALL CONSTRUCTION AREAS INCLUDING STAGING AND STOCKPILE AREAS AS INDICATED ON THE CONSTRUCTION PLANS AND AS DIRECTED BY THE ENGINEER.
7. THE CONTRACTOR SHALL INSTALL ALL TEMPORARY STREAM CROSSINGS AS SHOWN ON THE PLANS. DITCHES AND STREAM REACHES WILL BE LEFT OPEN DURING INITIAL PHASES OF CONSTRUCTION TO ALLOW FOR DRAINAGE AND TO KEEP SITE ACCESSIBLE.
8. PUMP–AROUND OPERATION SHALL BE USED TO DIVERT FLOW DURING CONSTRUCTION EXCEPT AS ALLOWED BY THE ENGINEER. **ALL EXCAVATION SHALL BE PERFORMED IN THE DRY** OR IN ISOLATED REACHES EXCEPT AS ALLOWED BY THE ENGINEER.
9. THE CONTRACTOR SHALL BEGIN CLEARING, FLOODPLAIN EXCAVATION, AND GRADING WORK TO DESIGN GRADES AT THE UPSTREAM END OF EACH CHANNEL AS INDICATED ON THE CONSTRUCTION PLANS. THE CONTRACTOR SHALL NOT DISTURB ANY MORE FLOODPLAIN AREA LARGER AND STREAM REACH LONGER THAN CAN STABILIZED IN ONE DAY.
10. ONCE A SECTION OF STREAM AND FLOODPLAIN HAVE BEEN EXCAVATED TO DESIGN GRADES, IN–STREAM STRUCTURES, MATTING, AND TRANSPLANTS SHALL BE INSTALLED IN THAT SECTION. EXISTING BED MATERIAL SHALL BE HARVESTED AND PLACED IN THE CONSTRUCTED CHANNEL DURING PUMP–AROUND OPERATIONS SO THAT BOTH CHANNELS ARE IN THE DRY DURING CONSTRUCTION ACTIVITIES.
11. THE CONTRACTOR SHALL BEGIN INSTALLING IN–STREAM STRUCTURES FROM THE UPSTREAM SECTION WORKING DOWNSTREAM. **ALL CONSTRUCTION WORK IS TO BE PERFORMED IN THE DRY** UNLESS OTHERWISE DIRECTED BY THE ENGINEER OR OTHER REGULATORY AGENCY. IF EXCESSIVE SEDIMENTATION DOWNSTREAM BECOMES A CONCERN, THE ENGINEER OR PROJECT MANAGER IN CHARGE MAY DIRECT THE CONTRACTOR TO INSTALL A TEMPORARY ROCK CHECK DAM AND SETTLING BASIN DOWNSTREAM. THIS AREA IS TO BE MAINTAINED ON A REGULAR BASIS BY THE CONTRACTOR.
12. ONCE A STREAM WORK PHASE IS COMPLETE, THE CONTRACTOR WILL APPLY TEMPORARY SEEDING, PERMANENT SEEDING, AND MULCH TO ALL AREAS DISTURBED DURING CONSTRUCTION. TEMPORARY AND PERMANENT SEEDING MIXTURES WILL BE APPLIED AS SHOWN ON THE PLANTING PLAN. TEMPORARY SEEDING WILL BE APPLIED IN ALL AREAS SUSCEPTIBLE TO EROSION SUCH THAT GROUND COVER IS ESTABLISHED WITHIN 7 WORKING DAYS FOLLOWING COMPLETION OF ANY GRADING PHASE. PERMANENT GROUND COVER WILL BE ESTABLISHED FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS FOLLOWING COMPLETION OF CONSTRUCTION.
13. ALL SEEDING AND MULCHING SHALL BE COMPLETED BEFORE LEAVING THE PROJECT SITE ALONG WITH REMOVAL OF ANY TEMPORARY STREAM CROSSINGS AND TEMPORARY CHECK DAMS.
14. THE CONTRACTOR OR OTHER QUALIFIED PERSONNEL SHALL PLANT ALL WOODY VEGETATION AND INSTALL LIVE STAKING ACCORDING TO THE PLANTING DETAILS AND SPECIFICATIONS. ALL PERMANENT SEEDING AND PLANTINGS SHALL BE PERFORMED DURING THE APPROPRIATE TIME OF YEAR.
15. THE CONTRACTOR SHALL SUBMIT A POST–STABLIZATION NOTIFICATION TO THE ASHEVILLE AREA OFFICE INSPECTOR.
16. THE CONTRACTOR SHALL ENSURE THAT THE SITE IS FREE OF TRASH AND LEFTOVER MATERIALS PRIOR TO DEMOBILIZATION OF EQUIPMENT FROM THE SITE.

PHASING OF WORK:

1. INSTALL PROTECTION FENCE AROUND CULTURAL RESOURCE BOUNDARY.
2. REMOVE BREM/SPOIL PILES AND TREES FROM ALONGSIDE EXISTING CHANNEL ACCORDING TO GRADING PLAN. HARVEST BOULDERS FROM TOE OF SLOPE AT APPROX. STA 116+50. PREP LOGS AND BRUSH, AND STOCKPILE/STAGE MATERIALS FOR USE IN CHANNEL CONSTRUCTION.
3. CONSTRUCT CHANNEL IN–THE–DRY FROM STA 101+00 TO STA 104+00. INSTALL TEMPORARY DIVERSION CHANNEL AT STA 104+00.
4. PUMP AROUND FROM P_1 TO S_1 AND CONSTRUCT FROM STA 100+30 TO STA 101+00. CONNECT AND BACKFILL ABANDONED CHANNEL.
5. CONSTRUCT CHANNEL FROM STA 104+00 TO STA 109+25 IN–THE–DRY AND INSTALL TEMPORARY DIVERSION CHANNEL AT STA 109+25. EXCAVATE FLOODPLAIN TO DESIGN GRADES TO STA 109+25.
6. PUMP AROUND FROM P_2 TO S_2. REMOVE TEMPORARY DIVERSION CHANNEL AT STA 104+00 AND CONNECT.
7. CONSTRUCT CHANNEL FROM STA 109+25 TO STA 112+90 IN–THE–DRY AND INSTALL TEMPORARY DIVERSION CHANNEL AT STA 112+90. EXCAVATE FLOODPLAIN TO DESIGN GRADES TO STA 112+90.
8. PUMP AROUND FROM P_3 TO S_3. REMOVE TEMPORARY DIVERSION CHANNEL AT STA 109+25 AND CONNECT.
9. CONSTRUCT CHANNEL FROM STA 112+90 TO STA 116+00 IN–THE–DRY AND EXCAVATE FLOODPLAIN TO DESIGN GRADES TO STA 115+50.
10. PUMP AROUND FROM P_4 TO S_4. REMOVE TEMPORARY DIVERSION CHANNEL AT STA 112+90 AND CONNECT.
11. PUMP–AROUND P_5 TO S_5 AND CONSTRUCT CHANNEL FROM STA 116+00 TO PROJECT OUTFALL.

SITE PRESERVATION AGREEMENT:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE BY THE CONTRACTOR TO EXISTING FACILITIES INCLUDING BUT NOT LIMITED TO ROADS, GATES, FENCES, CURBS, AND UTILITIES. CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT ALL ACCESS LOCATIONS PER THE PLANS AND SPECIFICATIONS.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY IMPROVEMENT TO THE ROAD CONDITION, GATES, AND FENCES, REQUIRED FOR ACCESS DURING CONSTRUCTION.

EROSION CONTROL MEASURES DURING CONSTRUCTION:
DURING CONSTRUCTION THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ADDITIONAL EROSION CONTROL MEASURES NOT SHOWN ON THE PLANS BUT NECESSARY TO CONTROL EXCESS SEDIMENT, IF DETERMINED BY THE ENGINEER.

STOCKPILE AND STAGING AREAS:
STOCKPILE AREAS FOR STORING MATERIALS WILL BE PRE–APPROVED AND IDENTIFIED PRIOR TO WORK BEGINNING TO ENSURE PROTECTION OF THE SITE STREAMS FROM EXCESSIVE SEDIMENTATION. **ALL STOCKPILE AND STAGING AREAS SHALL BE LOCATED 25 FT (MIN) FROM TOP OF STREAM BANKS.** SPECIFIED AREAS SHOWN ON THE PLANS HAVE BEEN ESTABLISHED AS STAGING AREAS. THE CONTRACTOR MAY ESTABLISH ADDITIONAL STAGING AREAS ALONG THE PROJECT, AS NECESSARY, TO CARRY OUT THE WORK. ALL STAGING AREAS MUST BE INSIDE THE LIMITS OF DISTURBANCE AND APPROVED BY THE ENGINEER. SILT FENCE SHALL BE REQUIRED IN AREAS WHERE LOOSE SOIL HAS BEEN PLACED IN THE STAGING OR STOCKPILE AREAS.

MISCELLANEOUS:
THE CONTRACTOR SHALL BE RESPONSIBLE FOR HAVING A RAIN GAUGE ON THE PROJECT SITE AND FOR RECORDING DAILY RAINFALL AMOUNTS DURING CONSTRUCTION.

MAJOR ELEMENTS OF DWR CONSTRUCTION GENERAL PERMIT

1) GROUND STABILIZATION

SITE AREA DESCRIPTION	STABILIZATION TIME FRAME	STABILIZATION TIME FRAME EXCEPTIONS
PERIMETER DIKES, SWALES, DITCHES AND SLOPES	7 DAYS	NONE
HIGH QUALITY WATER (HQW) ZONES	7 DAYS	NONE
SLOPES STEEPER THAN 3:1	7 DAYS	FOR SLOPES ≤ 10' IN LENGTH AND NOT STEEPER THAN 2:1, 14 DAYS ALLOWED
SLOPES 3:1 OR FLATTER	14 DAYS	7 DAYS FOR SLOPES > 50' IN LENGTH
ALL OTHER AREAS WITH SLOPES FLATTER THAN 4:1	14 DAYS	NONE (EXCEPT FOR PERIMETERS AND HQW ZONES)

2) BUILDING WASTE HANDLING

NO PAINT OR LIQUID WASTES IN STREAM OR STORM DRAINS
DEDICATED AREAS FOR DEMOLITION, CONSTRUCTION AND OTHER WASTES MUST BE LOCATED 50' FROM STORM DRAINS AND STREAMS UNLESS NO REASONABLE ALTERNATIVES AVAILABLE
EARTHEN–MATERIAL STOCKPILES MUST BE LOCATED 50' FROM STORM DRAINS AND STREAMS UNLESS NO REASONABLE ALTERNATIVES AVAILABLE
CONCRETE MATERIALS MUST BE CONTROLLED TO AVOID CONTACT WITH SURFACE WATERS, WETLANDS OR BUFFERS

3) DISCHARGES TO FEDERALLY–LISTED WATERS

REQUIREMENTS ARE THE SAME AS IN PREVIOUS PERMIT.
THE PERMIT ALLOWS REDUCTION FROM THE 20–ACRE MINIMUM IF THE DIRECTOR OF DWQ DETERMINES THAT OTHER BMPs PROVIDE EQUIVALENT PROTECTION.

4) CONDITIONS IN EROSION & SEDIMENTATION CONTROL PLANS

DESIGNATION ON THE PLANS WHERE THE 7– AND 14–DAY GROUND STABILIZATION REQUIREMENTS OF THE NPDES PERMIT APPLY
DESIGNATION ON THE PLANS WHERE BASINS THAT COMPLY WITH THE SURFACE–WITHDRAWAL REQUIREMENTS OF THE NPDES PERMIT ARE LOCATED

5) SEDIMENT BASINS

OUTLET STRUCTURES MUST WITHDRAW FROM BASIN SURFACE UNLESS DRAINAGE AREA IS LESS THAN 1 ACRE.
USE ONLY DWQ–APPROVED FLOCCULANTS.

6) IMPLEMENTATION OF NEW PERMIT CONDITIONS

PROJECTS PERMITTED UNDER THE PREVIOUS PERMIT CAN CONTINUE TO FOLLOW THE PREVIOUSLY–PERMITTED CONDITIONS.
COMPLETE APPLICATIONS RECEIVED PRIOR TO AUGUST 3, 2011 CAN FOLLOW CONDITIONS OF APPROVED APPLICATION.
APPLICATIONS RECEIVED AFTER AUGUST 2, 2011 MUST COMPLY WITH NEW PERMIT CONDITIONS.

7) SELF–INSPECTIONS

RAINFALL DATA
DAILY RAINFALL AMOUNTS SHALL BE RECORDED. RECORD "ZERO" IF NO RAINFALL OCCURRED. IF NO DAILY RAIN GAUGE OBSERVATIONS ARE MADE DURING WEEKEND OR HOLIDAY PERIODS, AND NO INDIVIDUAL–DAY RAINFALL INFORMATION IS AVAILABLE, THE CUMULATIVE RAIN MEASUREMENT FOR THOSE UN–ATTENDED DAYS WILL DETERMINE IF A SITE INSPECTION IS NEEDED.

GROUND STABILIZATION AND GRADING
GROUND STABILIZATION MEASURES SHALL BE RECORDED AFTER EACH PHASE OF GRADING AND INSPECTED TO ENSURE GROUND COVER IS SUFFICIENT TO RESIST EROSION WITHIN THE ALLOTTED TIME FRAME GIVEN THE AREA DESCRIPTION.

EROSION AND SEDIMENTATION CONTROL MEASURES
EROSION CONTROL MEASURES SHALL BE INSPECTED TO ENSURE THAT THEY ARE OPERATING CORRECTLY. INSPECTION RECORDS MUST BE MAINTAINED FOR EACH INSPECTION EVENT AND FOR EACH MEASURE.

STORMWATER DISCHARGE OUTFALLS
STORMWATER RUNOFF DISCHARGE OUTFALLS SHALL BE INSPECTED BY OBSERVATION FOR EROSION, SEDIMENTATION AND OTHER STORMWATER DISCHARGE CHARACTERISTICS SUCH AS CLARITY, FLOATING SOLIDS, AND OIL SHEENS. REPORT ANY VISIBLE SEDIMENT BEING DEPOSITED IN ANY STREAM OR WETLAND OR ANY NONCOMPLIANCE WHICH MAY ENDANGER HEALTH OR THE ENVIRONMENT TO THE DIVISION OF LAND QUALITY OR THE APPROPRIATE REGIONAL OFFICE WITHIN 24 HOURS OF INSPECTION.

INSPECTIONS
INSPECTIONS OF SEDIMENT AND EROSION CONTROL MEASURES AND STORMWATER DISCHARGE OUTFALLS SHALL BE MADE AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN 24 HOURS AFTER ANY STORM EVENT OF GREATER THAN 0.50 INCHES OF RAIN PER 24 HOUR PERIOD. INSPECTIONS ARE ONLY REQUIRED TO BE MADE DURING NORMAL BUSINESS HOURS AND TO BE CERTIFIED BY THE FINANCIAL RESPONSIBLE PARTY / PERMITEE OR AGENT / DESIGNEE.

RECORDS OF INSPECTIONS
RECORDS OF INSPECTIONS MADE DURING THE PREVIOUS 30 DAYS SHALL REMAIN ON THE SITE AND AVAILABLE FOR AGENCY INSPECTORS AT ALL TIMES DURING NORMAL WORKING HOURS. OLDER RECORDS MUST BE MAINTAINED FOR A PERIOD OF THREE YEARS AFTER PROJECT COMPLETION AND MADE AVAILABLE UPON REQUEST. THE RECORDS MUST PROVIDE THE DETAILS OF EACH INSPECTION INCLUDING OBSERVATIONS, AND ACTIONS TAKEN. USE OF ELECTRONICALLY–AVAILABLE RECORDS, IN LIEU OF THE REQUIRED PAPER COPIES FOR INSPECTION WILL BE ALLOWED IF SHOWN TO PROVIDE EQUAL ACCESS AND UTILITY AS THE HARD–COPY RECORDS.

SELF–INSPECTION FORMS CAN FOUND AT
HTTPS://DEQ.NC.GOV/ABOUT/DIVISIONS/ENERGY–MINERAL–LAND–RESOURCES/EROSION–SEDIMENT–CONTROL/FORMS

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Revision	By	Appd.	YY.MM.DD

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

Title
NOTES

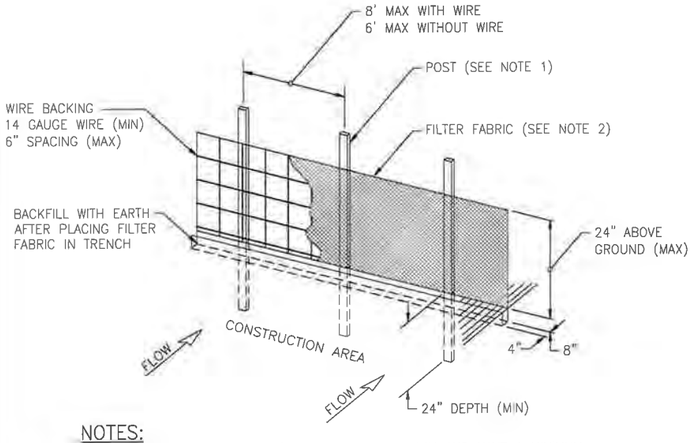
Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038596 ENGINEER CHRISTOPHER M. ENGLE 1/21/19

Project Number: 172621094

RTS	SGG	CME	19.01.15
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0 | Sheet EC-2



NOTES:

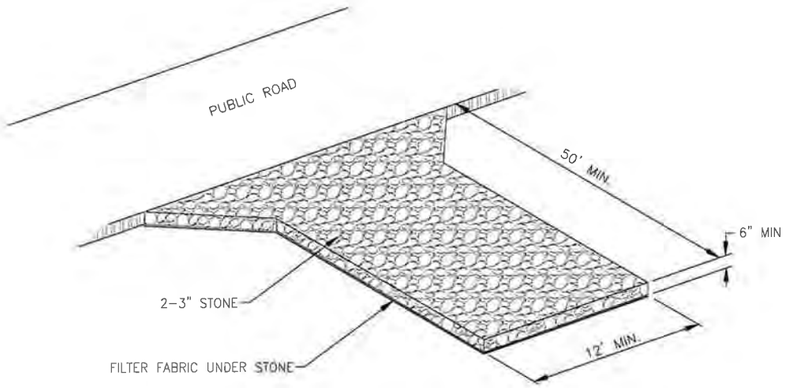
1. POSTS SHALL BE 1.25 LB/LF STEEL AT A MINIMUM AND HAVE A MINIMUM LENGTH OF 5-FT. POSTS SHALL ALSO HAVE PROJECTIONS TO FACILITATE FASTENING FABRIC.
2. FILTER FABRIC SHALL MEET THE FOLLOWING:
   A) MINIMUM WIDTH OF 36 INCHES.
   B) EOS NOT LARGER THAN U.S. STANDARD SIEVE NO. 30
   C) GRAB STRENGTH 90 LB.
   D) CONFORM TO ASTM D-6461
3. WIRE OR PLASTIC ZIP TIES WITH A TENSILE STRENGTH OF 50 LB. SHALL BE USED TO ATTACH FABRIC TO POSTS.
4. SILT FENCE INSTALLATION SHALL CONFORM WITH ASTM D 6462.
5. SILT FENCE TO BE INSTALLED IN LOCATIONS AS SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN AND AS DIRECTED BY THE ENGINEER PRIOR TO BEGINNING OF CONSTRUCTION TO CONTROL SEDIMENT.
6. SILT FENCE TO BE INSTALLED AROUND STOCKPILE LOCATIONS SHALL BE SET A MINIMUM DISTANCE OF 5-FT FROM TOE OF SLOPE.

MAINTENANCE:

1. SILT FENCE SHALL BE INSPECTED AT LEAST ONCE A WEEK AND AFTER EACH RAINFALL EVENT.
2. REPLACE ANY PORTION OF SILT FENCE THAT HAS COLLAPSED, TEARS, OR BECOMES INEFFECTIVE.
3. REMOVE SEDIMENT AS NECESSARY TO PROVIDE ADEQUATE STORAGE VOLUME.
4. SILT FENCE TO BE REMOVED AND THE AREA TO BE RESTORED TO ITS NATURAL CONDITION WHEN PERMANENT EROSION AND SEDIMENT CONTROL PROCEDURES ARE EFFECTIVE.

TEMPORARY SILT FENCE

NOT TO SCALE



NOTES:

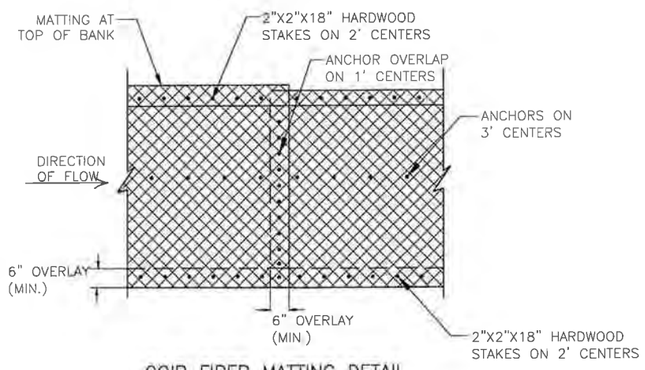
1. GRADE AND REMOVE ALL VEGETATION AND OBJECTIONABLE MATERIAL FROM PROPOSED ENTRANCE AREA.
2. PROVIDE DRAINAGE TO SUITABLE OUTLET.

MAINTENANCE:

1. CONSTRUCTION ENTRANCE SHALL BE INSPECTED AFTER EACH RAINFALL EVENT
2. MAINTAIN CONSTRUCTION ENTRANCE IN CONDITION NECESSARY TO PREVENT MUD OR SEDIMENT FROM LEAVING THE SITE.
3. IMMEDIATELY REMOVE ANY OBJECTIONABLE MATERIAL SPILLED, WASHED, OR TRACKED ONTO PUBLIC ROADWAYS.

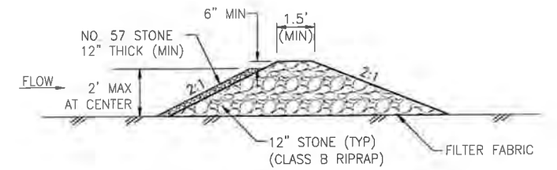
CONSTRUCTION ENTRANCE

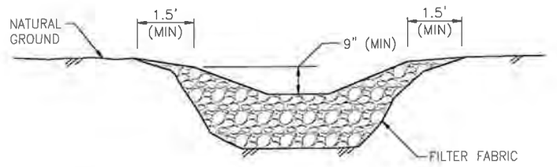
NOT TO SCALE



COIR FIBER MATTING DETAIL
PLAN VIEW

NOT TO SCALE

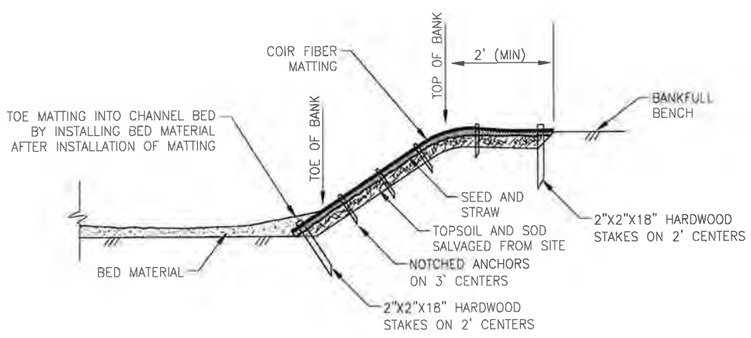




MAINTENANCE:

1. INSPECT ROCK SILT CHECKS AND CHANNELS ONCE A WEEK AND AFTER EVERY SIGNIFICANT RAINFALL EVENT.
2. CLEAN OUT SEDIMENT AND MAKE REPAIRS AS NECESSARY.
3. ROCK SILT CHECKS ARE TO BE REMOVED AND THE AREA TO BE RESTORED TO ITS NATURAL CONDITION WHEN PERMANENT EROSION AND SEDIMENT CONTROL PROCEDURES ARE EFFECTIVE.

ROCK SILT CHECK



BANK PROTECTION
SOD AND MAT

NOT TO SCALE

NOTES:

1. COIR MATTING TO BE UNDERLAIN BY STRAW AND SEED.
2. MATTING SHALL BE INSTALLED PRIOR TO THE INTRODUCTION OF WATER TO A STREAM SECTION.
3. COIR FIBER MATTING REPRESENTS THE MINIMUM LEVEL OF BANK PROTECTION ALLOWABLE. THE PREFERRED METHODS OF BANK PROTECTION ARE PRESENTED WITHIN THE DETAILS OF THE CONSTRUCTION PLANS

MAINTENANCE:

1. BANK PROTECTION SHALL BE INSPECTED AT LEAST ONCE A WEEK AND AFTER EACH SIGNIFICANT RAINFALL EVENT.
2. GOOD CONTACT BETWEEN COIR MATTING AND GROUND MUST BE MAINTAINED. REPAIR IF NECESSARY.
3. MONITOR AND REPAIR AS NECESSARY UNTIL GROUND COVER IS ESTABLISHED

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

Permit-Seal

Project Number: 172621094

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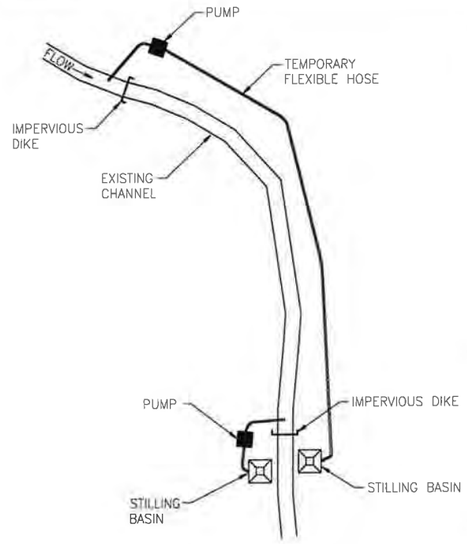
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0

Sheet EC-3



SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP-AROUND

1. INSTALL STILLING BASINS.
2. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
3. PLACE UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. PLACE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS. DEWATER ENTRAPPED AREA.
5. PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLANS.
6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF IMPERIOUS DIKES. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE. (DOWNSTREAM DIKE FIRST).
7. ALL GRADING AND STABILIZATION MUST BE COMPLETED WITHIN THE PUMP-AROUND AREA BETWEEN THE IMPERVIOUS DIKES THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF THE IMPERVIOUS DIKES.
8. REMOVE STILLING BASINS AND BACKFILL. STABILIZED DISTURBED AREA WITH SEED AND MULCH.

NOTES:

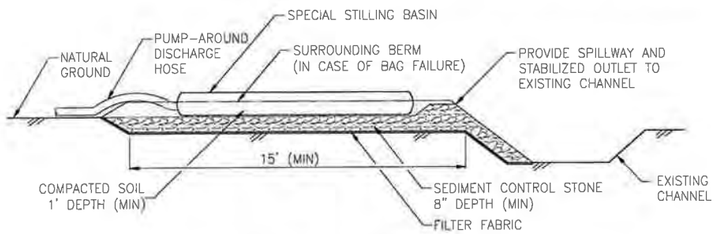
1. ALL EXCAVATION SHALL BE PERFORMED IN ONLY DRY OR ISOLATED SECTIONS OF THE CHANNEL.
2. IMPERVIOUS DIKES ARE TO BE USED TO ISOLATE WORK FROM STREAM FLOW WHEN NECESSARY.
3. ALL GRADED AREAS SHALL BE STABILIZED WITHIN 24 HOURS.
4. MAINTENANCE OF STREAM FLOW OPERATION SHALL BE INCIDENTAL TO THE WORK. THIS INCLUDES SHEETING, DIVERSIONS PIPES, PUMPS AND HOSES.
5. PUMPS AND HOSES SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA.

MAINTENANCE:

1. PUMP AROUND OPERATIONS SHALL BE INSPECTED TWICE DAILY WHEN IN USE, OR AS DIRECTED BY THE ENGINEER.
2. PUMP, SILT BAGS, HOSES, AND STILLING BASIN SHALL BE MAINTAINED IN A CONDITION NECESSARY TO FUNCTION PROPERLY.

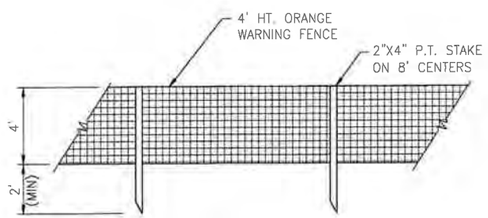
PUMP-AROUND OPERATION (TYP)

NOT TO SCALE



SPECIAL STILLING BASIN WITH ROCK PAD AND BERM

NOT TO SCALE



NOTES:

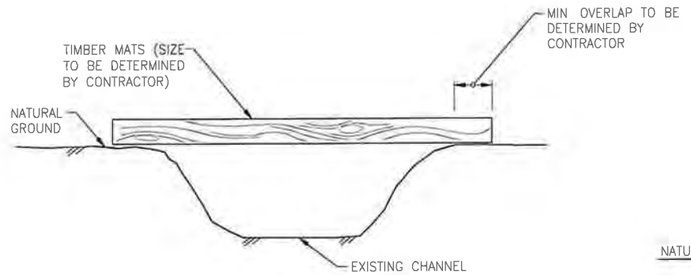
1. PROVIDE FENCE AS SHOWN ON PLAN.
2. PROVIDE AT LEAST ONE FOOT OF DISTANCE FROM TREE TO FENCE FOR EACH INCH OF TREE DBH. LOCATE FENCE OUTSIDE OF CRITICAL ROOT ZONE

MAINTENANCE:

1. REMOVE TREE PROTECTION FENCES WHEN ADJACENT CONSTRUCTION IS COMPLETED.
2. PRUNE ANY DAMAGED LIMBS OR ROOTS. USE TREE PAINT IF NECESSARY.
3. CONTINUE MAINTENANCE CARE IF NECESSARY. THIS MAY INCLUDE WATER, MULCH, AND FERTILIZER.

SENSITIVE AREA PROTECTION FENCE

NOT TO SCALE



NOTES:

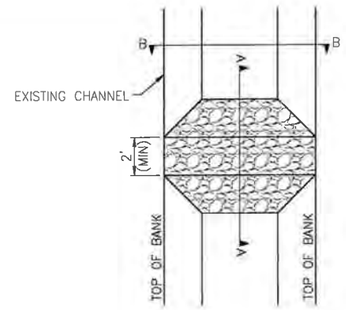
1. CONTRACTOR SHALL USE TIMBER MATS FOR ALL TEMPORARY STREAM CROSSINGS EXCEPT WHERE PERMANENT PIPE OR FORD CROSSINGS ARE USED, OR AS OTHERWISE APPROVED BY THE ENGINEER.
2. TIMBER MATS ARE TO BE SUFFICIENTLY LONG TO EXTEND BEYOND THE BANK SO THAT BANK FAILURE IS PREVENTED.
3. ALL TEMPORARY STREAM CROSSINGS SHALL BE MAINTAINED IN GOOD WORKING CONDITION. REGULAR INSPECTION AND MAINTENANCE OF CROSSINGS IS THE RESPONSIBILITY OF THE CONTRACTOR.

MAINTENANCE:

1. TEMPORARY CROSSINGS SHALL BE INSPECTED ONCE A WEEK AND AFTER EACH RAINFALL EVENT AND REPAIRED OR ADJUSTED TO MAINTAIN PROPER FUNCTION.

TEMPORARY STREAM CROSSING TIMBER MAT

NOT TO SCALE

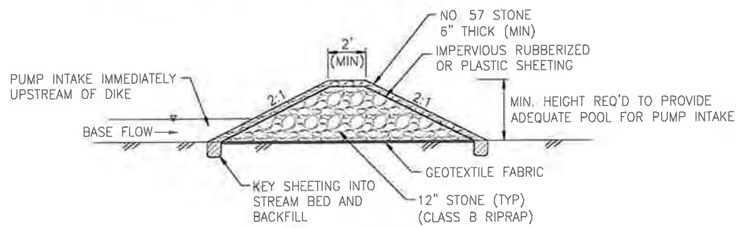


IMPERVIOUS DIKE PLAN VIEW

NOT TO SCALE

MAINTENANCE:

1. INSPECT IMPERVIOUS DIKES AND CHANNELS ONCE A WEEK AND AFTER EVERY SIGNIFICANT RAIN EVENT.
2. CLEAN OUT SEDIMENT AND MAKE REPAIRS WHEN NEEDED.
3. IMPERVIOUS DIKES ARE TO BE REMOVED AND THE AREA TO BE RESTORED TO ITS NATURAL CONDITION WHEN PERMANENT EROSION AND SEDIMENT CONTROL PROCEDURES ARE EFFECTIVE

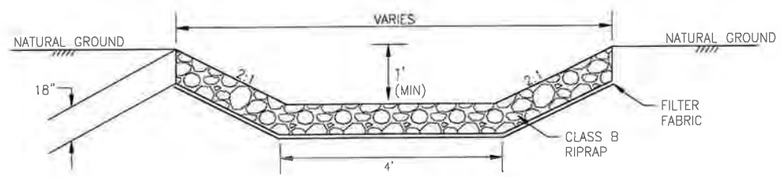


IMPERVIOUS DIKE SECTION A-A

NOT TO SCALE

IMPERVIOUS DIKE SECTION B-B

NOT TO SCALE



MAINTENANCE:

1. INSPECT TEMPORARY DIVERSION CHANNELS ONCE A WEEK AND AFTER EVERY SIGNIFICANT RAINFALL EVENT.
2. MAINTAIN ADJACENT VEGETATION TO PROTECT FROM EROSION.

TEMPORARY DIVERSION CHANNEL

NOT TO SCALE

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

Title
DETAILS

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M PIRKLE

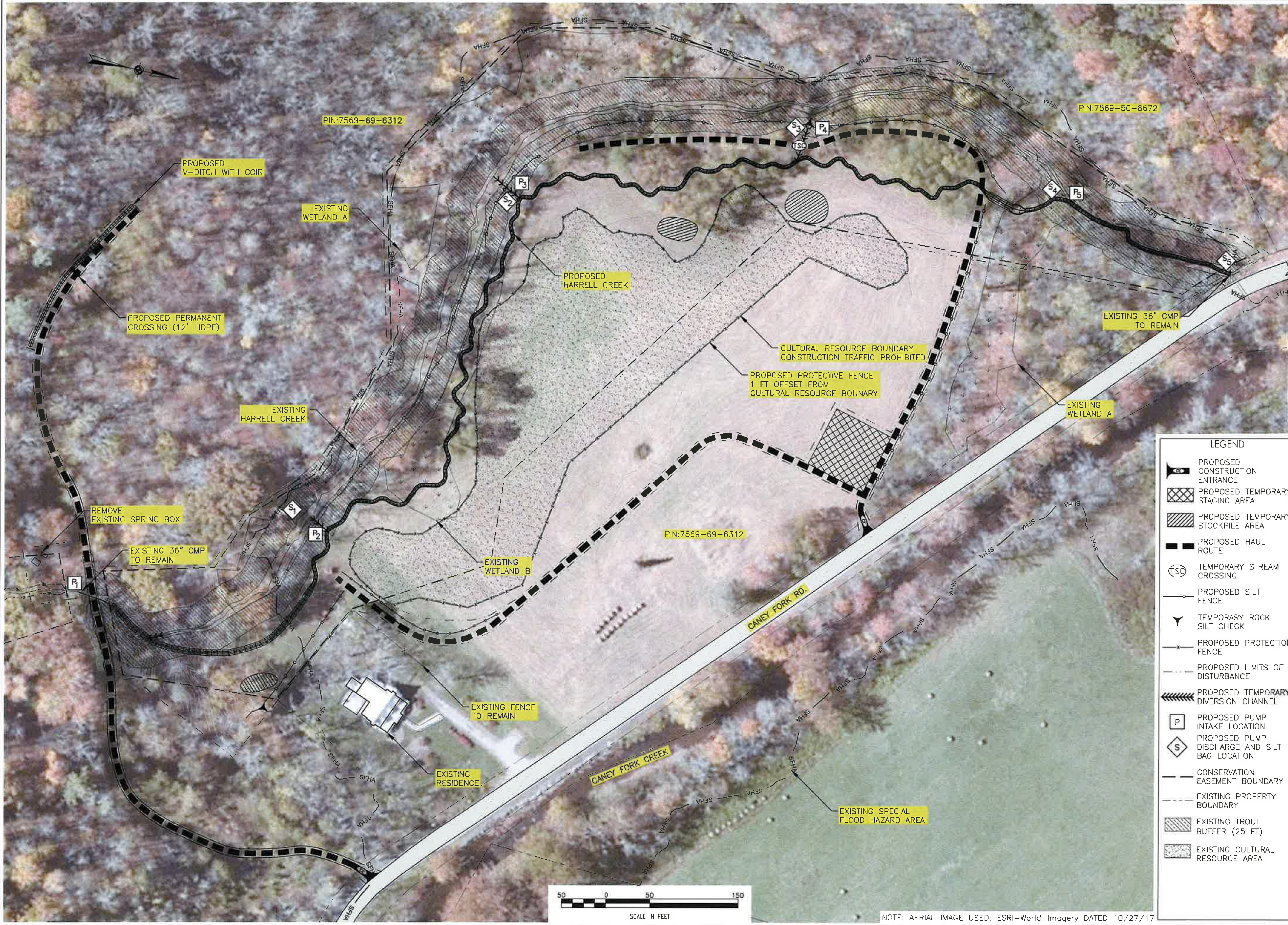
12/1/19

Project Number: 172621094

RTS	SGG	CME	9.01.15
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0

Sheet EC-3A



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

Title
EROSION CONTROL - SITE PLAN

Permit-Seal

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038595 CHRISTOPHER M. ENGLE 1/21/19

Project Number: 172621094

RTS	SGG	CME	19.01.15
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0
Sheet EC-4

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Appendix C ASSESSMENT DATA

Includes:

Erosion rate sheets

Site assessment sheets

Site Hydric Soils Detailed Study

Wetland gauge map and data

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Erosion Rate Calculations

Project: Harrell Creek
Project No.: 172621094-HRLL
Stream: Harrell Creek
Reach: 1A and 1B

Date: 9/21/17
Observer: RTS, CME
Page: 1

Observed Values

Reach Name	1A	1B	1B	1B			
Station/Location	100+40	101+65	101+75	102+25			
Photo No.	R-1	cmp	R-4	R-5			
Reach Length (ft)	115	10	50	50			
Bank	Lt & Rt	Lt & Rt	Lt & Rt	Lt & Rt			
Bank Height (ft)	0.7		1.2	0.8			
Bankfull Height (ft)	0.65		0.65	0.65			
Root Depth (ft)	0.4		0.4	0.4			
Root Density (%)	30%		50%	50%			
Bank Angle (deg)	60		80	45			
Surface Protection (%)	30%		20%	60%			
Bank Material	Gravel	Sand	Sand	Sand			
Stratification	None	None	None	None			
Thalweg Position	Center	Center	Center	Center			
DTOE/DMEAN	< 1	< 1	< 1	< 1			
Local Slope > Avg	No	No	Yes	No			

BEHI Calculation

Bnk Ht / Bkf Ht	1.1		1.8	1.2			
BEHI Score	1.9		7.1	3.8			
Root Depth / Bnk Ht	0.6		0.3	0.5			
BEHI Score	3.6		6.0	4.0			
Weighted Root Density (%)	17%		17%	25%			
BEHI Score	7.7		7.8	6.7			
Bank Angle (deg)	60.0		80.0	45.0			
BEHI Score	4.0		6.0	3.3			
Surface Protection (%)	30%		20%	60%			
BEHI Score	6.0		7.3	3.4			
Bank Material Adjustment	5.0	10.0	10.0	10.0			
Stratification Adjustment	0	0	0	0			
Total BEHI Score	28.3		44.2	31.1			
Rating	Moderate		Very High	High			

NBS Calculation

Thalweg Position Score	1	1	1	1			
Toe Depth Ratio Score	0	0	0	0			
Local Slope Score	0	0	1	0			
Total NBS Rating	1	1	2	1			
WARSS NBS Rating	1	1	3	1			
Rating	Very Low	Very Low	Moderate	Very Low			

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.0		0.7	0.1			
Erosion Total (ft^3/yr)	3		85	8			

Total Erosion (Sheet Total)	96

Erosion Rate Calculations

Project: Harrell Creek
Project No.: 172621094-HRLL
Stream: Harrell Creek
Reach: 1C and1D

Date: 9/21/17
Observer: RTS, CME
Page: 2

Observed Values

Reach Name	1C	1C	1C	1C	1C	1D	
Station/Location	102+75	111+40	112+00	113+80	115+00	115+70	
Photo No.	R-6	R-15	R-16	R-19		R-20	
Reach Length (ft)	915	60	180	120	70	100	
Bank	Lt & Rt	Lt & Rt	Lt & Rt	Lt & Rt	Lt & Rt	Lt & Rt	
Bank Height (ft)	0.3	0.6	0.3	0.6	0.65	0.8	
Bankfull Height (ft)	0.3	0.4	0.3	0.4	0.6	0.6	
Root Depth (ft)	0.301	0.4	0.301	0.4	0.4	0.81	
Root Density (%)	0.8	0.8	0.8	0.8	0.8	0.8	
Bank Angle (deg)	20	45	20	45	45	60	
Surface Protection (%)	1	0.8	1	0.8	0.8	0.8	
Bank Material	Silt/Clay	Sand	Silt/Clay	Sand	Sand	Silt/Clay	
Stratification	None	None	None	None	None	None	
Thalweg Position	Center	Center	Center	Center	Center	Center	
DTOE/DMEAN	< 1	< 1	< 1	< 1	< 1	< 1	
Local Slope > Avg	No	No	Yes	No	No	No	

BEHI Calculation

Bnk Ht / Bkf Ht	1.0	1.5	1.0	1.5	1.1	1.3	
BEHI Score	1.0	5.3	1.0	5.3	2.0	4.4	
Root Depth / Bnk Ht	1.0	0.7	1.0	0.7	0.6	1.0	
BEHI Score	0.0	3.2	0.0	3.2	3.4	0.0	
Weighted Root Density (%)	0.8	0.5	0.8	0.5	0.5	0.8	
BEHI Score	1.7	4.0	1.7	4.0	4.4	1.6	
Bank Angle (deg)	20.0	45.0	20.0	45.0	45.0	60.0	
BEHI Score	2.0	3.3	2.0	3.3	3.3	4.0	
Surface Protection (%)	1.0	0.8	1.0	0.8	0.8	0.8	
BEHI Score	0.0	1.7	0.0	1.7	1.7	1.7	
Bank Material Adjustment	0.0	10.0	0.0	10.0	10.0	0.0	
Stratification Adjustment	0	0	0	0	0	0	
Total BEHI Score	4.7	27.4	4.7	27.4	24.7	11.7	
Rating	Very Low	Moderate	Very Low	Moderate	Moderate	Low	

NBS Calculation

Thalweg Position Score	1	1	1	1	1	1	
Toe Depth Ratio Score	0	0	0	0	0	0	
Local Slope Score	0	0	1	0	0	0	
Total NBS Rating	1	1	2	1	1	1	
WARSS NBS Rating	1	1	3	1	1	1	
Rating	Very Low	Very Low	Moderate	Very Low	Very Low	Very Low	

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.0	0.0	0.0	0.0	0.0	0.0	
Erosion Total (ft^3/yr)	0	1	0	2	2	0	

Total Erosion (Sheet Total)	6

Site Assessment Calculations

Project: Harrell Creek
Project No.: 172621094-HRLL
Stream: Harrell Creek
Reach: 1A and 1B

Date: 9/21/17
Observers: RTS, CME
Page: 3

Observed Values

Section Number	QS-1	QS-2	QS-3	QS-4	QS-5		
Reach Name	1A	1A	1A	1B	1B		
Location	U/S END	U/S END	U/S END	D/S CMP	R-5		
Latitude	35.298716	35.297667	35.298882	35.299275	35.298716		
Longitude	83.132862	83.132862	83.132899	83.132959	83.132862		
D_A (mi^2)	0.05	0.05	0.05	0.05	0.06		
W_{BKF} (ft)	3.3	5.4	4.2	4.2	3.6		
W_{BED} (ft)	2.5	1.9	2.5	3.6	1.7		
D_{BKF} (ft)	0.3	0.3	0.5	0.7	0.7		
$D_{TOE\ LT}$ (ft)	0.0	0.0	0.0	0.0	0.0		
$D_{TOE\ RT}$ (ft)	0.0	0.0	0.0	0.0	0.0		
Field D_{THAL} (ft)	-0.1	-0.1	-0.1	-0.1	-0.1		
W_{THAL} (ft)	0.4	0.3	0.6	0.7	0.5		
Low Bank Heigth (ft)	0.3	0.4	0.6	1.5	1.9		
Bank/Terrace Height (ft)	0.9	1.0	0.8	1.5	2.7		
Flood Prone Width (ft)	8	7	7	6	5		

Section Calculations

D_{MAX} (ft)	0.35	0.35	0.55	0.75	0.75		
Average D_{TOE} (ft)	0.30	0.30	0.50	0.65	0.65		
D_{THAL} (ft)	0.05	0.05	0.05	0.10	0.10		
A_{BKF} (ft)	0.9	1.2	1.8	2.8	1.8		
D_{MEAN} (ft)	0.29	0.21	0.42	0.65	0.51		
W/D ratio	11.6	25.4	10.1	6.4	7.1		
Bank Height Ratio	1.0	1.3	1.1	2.1	2.7		
Entrenchment Ratio	2.3	1.2	1.6	1.4	1.4		

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.0	0.48

Reference Max Depth Equation

Coef	Exp
1.3	0.24

Reference Bed Width (ft)	1.8	1.8	1.9	1.9	2.0		
Bed Width Index (BWI)	1.4	1.0	1.3	1.9	0.8		
Reference D_{MAX} (ft)	0.6	0.6	0.6	0.6	0.7		
Max Depth Index (MDI)	0.6	0.6	0.9	1.2	1.2		

Stream Classification

Stream Type	B	B	A	G	G		

Site Assessment Calculations

Project: Harrell Creek
Project No.: 172621094-HRLL
Stream: Harrell Creek
Reach: 1C and 1D

Date: 9/21/17
Observers: RTS, CME
Page: 4

Observed Values

Section Number	QS-6	QS-7	QS-8	QS-9	QS-10	QS-11	
Reach Name	1C	1C	1C	1C	1C	1D	
Location	R-8	R-10	R-13	R-16	R-19	R-20	
Latitude	35.298716	35.298716	35.300426	35.301000	35.301690	35.301860	
Longitude	83.132862	83.132862	83.135356	83.135562	83.135540	83.135390	
D_A (mi^2)	0.07	0.07	0.15	0.15	0.16	0.17	
W_{BKF} (ft)	10.0	12.0	4.1	5.0	4.3	2.9	
W_{BED} (ft)	7.5	11.0	2.6	2.8	2.4	2.2	
D_{BKF} (ft)	0.3	0.1	0.4	0.3	0.6	0.7	
$D_{TOE\ LT}$ (ft)	-0.1	0.0	0.0	-0.1	0.0	-0.2	
$D_{TOE\ RT}$ (ft)	0.0	0.0	0.0	-0.2	0.0	-0.2	
Field D_{THAL} (ft)	-0.2	-0.1	-0.5	-0.3	-0.3	-0.3	
W_{THAL} (ft)	1.4	3.0	1.1	0.6	0.8	0.6	
Low Bank Height (ft)	0.7	0.3	0.4	0.8	1.2	0.7	
Bank/Terrace Height (ft)	0.7	0.8	1.0	2.5	4.0	0.7	
Flood Prone Width (ft)	13	16	14	13	11	35	

Section Calculations

D_{MAX} (ft)	0.50	0.20	0.90	0.55	0.85	1.00	
Average D_{TOE} (ft)	0.35	0.10	0.40	0.43	0.60	0.90	
D_{THAL} (ft)	0.15	0.10	0.50	0.13	0.25	0.10	
A_{BKF} (ft)	3.7	1.9	2.3	1.9	2.4	2.4	
D_{MEAN} (ft)	0.37	0.15	0.55	0.37	0.56	0.84	
W/D ratio	26.8	77.8	7.4	13.4	7.7	3.5	
Bank Height Ratio	1.7	2.0	1.0	1.9	1.7	1.0	
Entrenchment Ratio	1.3	1.3	3.4	2.5	2.6	12.1	

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.0	0.48

Reference Max Depth Equation

Coef	Exp
1.3	0.24

Reference Bed Width (ft)	2.2	2.2	3.2	3.2	3.3	3.4	
Bed Width Index (BWI)	3.5	5.0	0.8	0.9	0.7	0.6	
Reference D_{MAX} (ft)	0.7	0.7	0.8	0.8	0.8	0.8	
Max Depth Index (MDI)	0.7	0.3	1.1	0.7	1.0	1.2	

Stream Classification

Stream Type	F	F	E	E	E	E	

QS-1

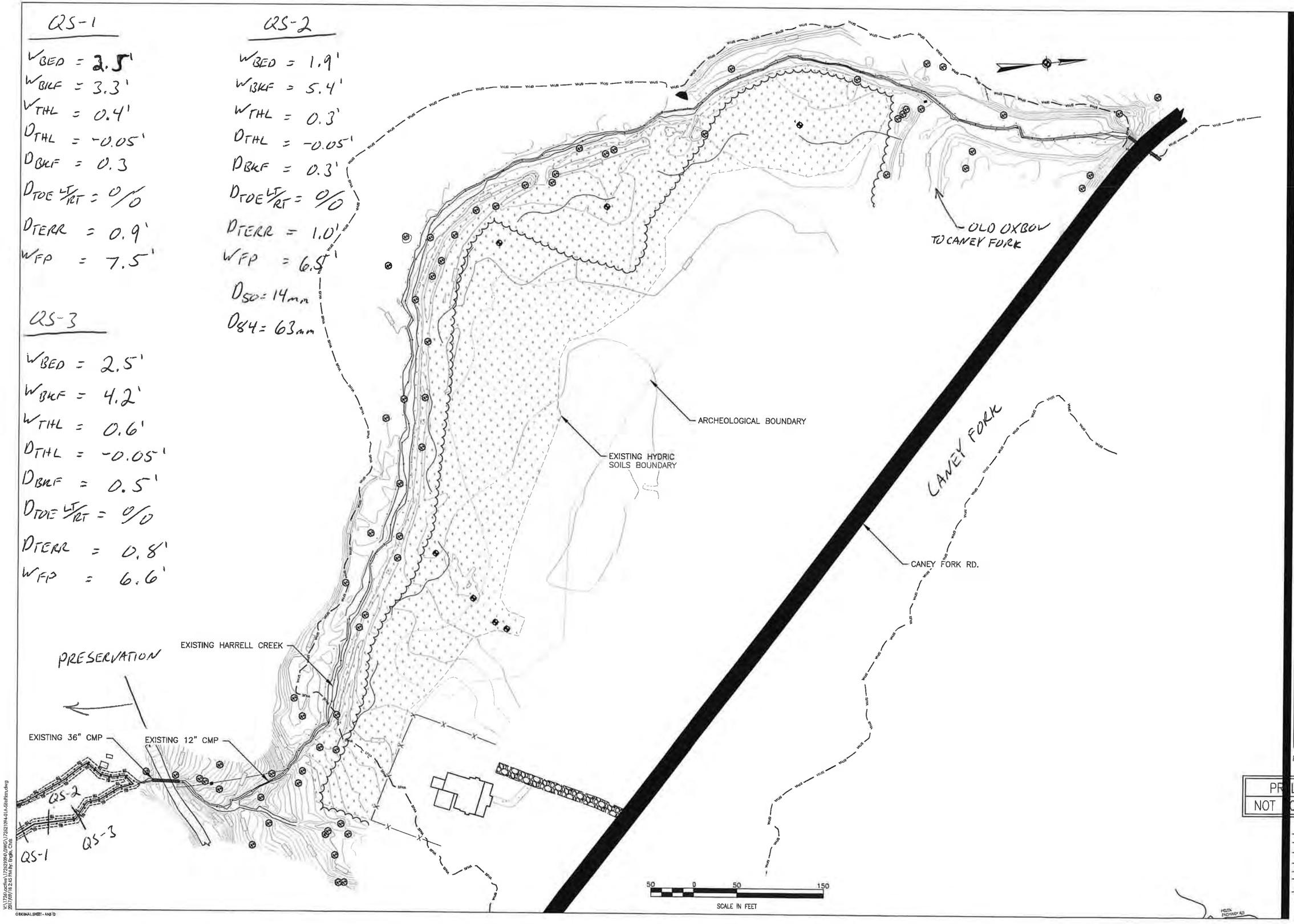
W_{BED} = 2.5'
W_{BKF} = 3.3'
W_{THL} = 0.4'
D_{THL} = -0.05'
D_{BKF} = 0.3
$D_{TOE\ LT/RT}$ = 0/0
D_{TERR} = 0.9'
W_{FP} = 7.5'

QS-2

W_{BED} = 1.9'
W_{BKF} = 5.4'
W_{THL} = 0.3'
D_{THL} = -0.05'
D_{BKF} = 0.3'
$D_{TOE\ LT/RT}$ = 0/0
D_{TERR} = 1.0'
W_{FP} = 6.5'
D_{50} = 14mm
D_{84} = 63mm

QS-3

W_{BED} = 2.5'
W_{BKF} = 4.2'
W_{THL} = 0.6'
D_{THL} = -0.05'
D_{BKF} = 0.5'
$D_{TOE\ LT/RT}$ = 0/0
D_{TERR} = 0.8'
W_{FP} = 6.6'



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EW SOLUTIONS, INC

HARRELL STREAM AND WETLAND MITIGATION

JACKSON COUNTY, NORTH CAROLINA

Title
ASSESSMENT
FULL SITE

Permit-Seal

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

Project Number	172621094		
File Name:	172621094-01A-SITEPLAN.dwg		
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Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. 1A

Revision	Sheet
0	1 of 8

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2017/09/19 2:45 PM By: Engle, Chris

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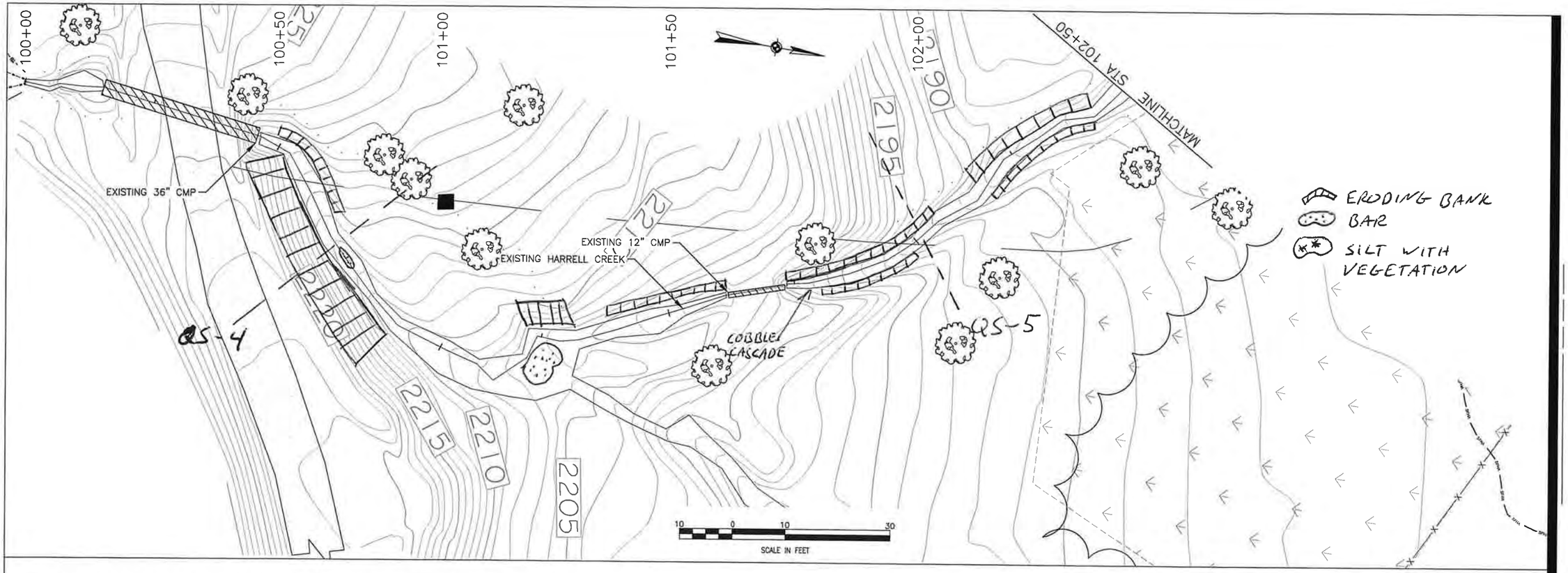

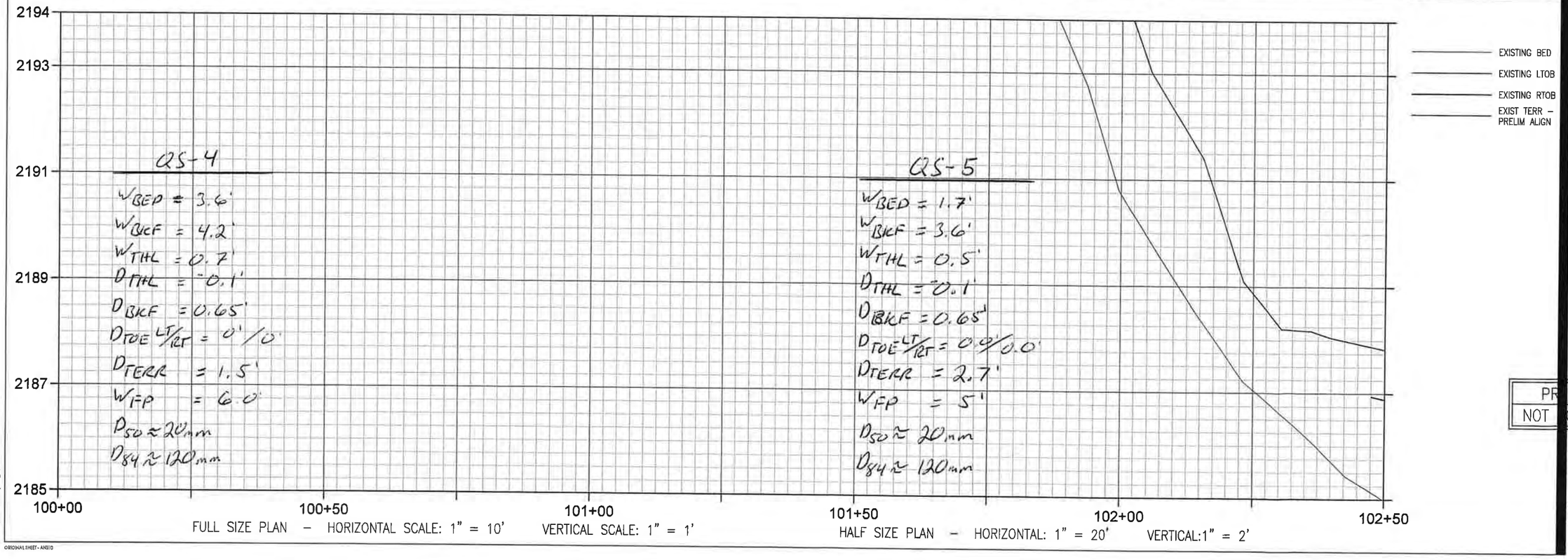

FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 10' VERTICAL SCALE: 1" = 1'

HALF SIZE PLAN – HORIZONTAL: 1" = 20' VERTICAL:1" = 2'

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Client/Project
EW SOLUTIONS, INC

HARRELL STREAM AND WETLAND MITIGATION

JACKSON COUNTY, NORTH CAROLINA

Title
ASSESSMENT
STA 100+00 - 102+50

Permit-Seal

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

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File Name:	172621094-04-PLANPRO.dwg		
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Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. 4
Revision 0
Sheet 2 of 8

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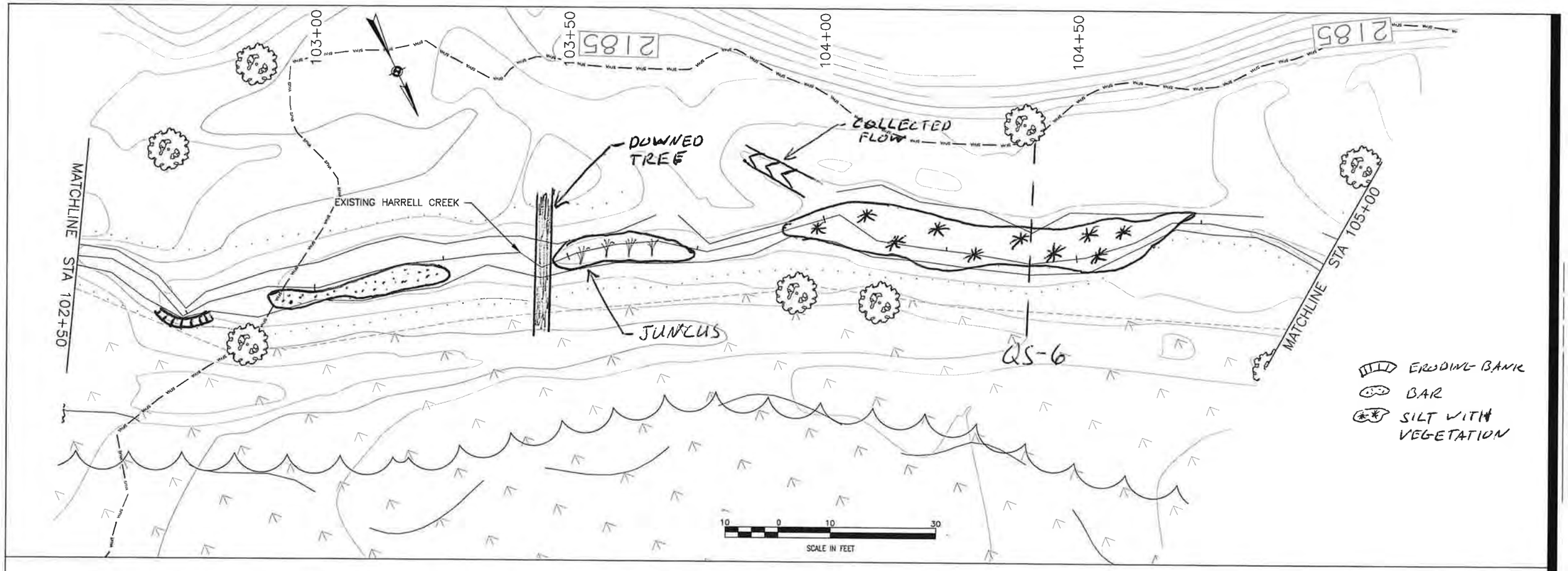

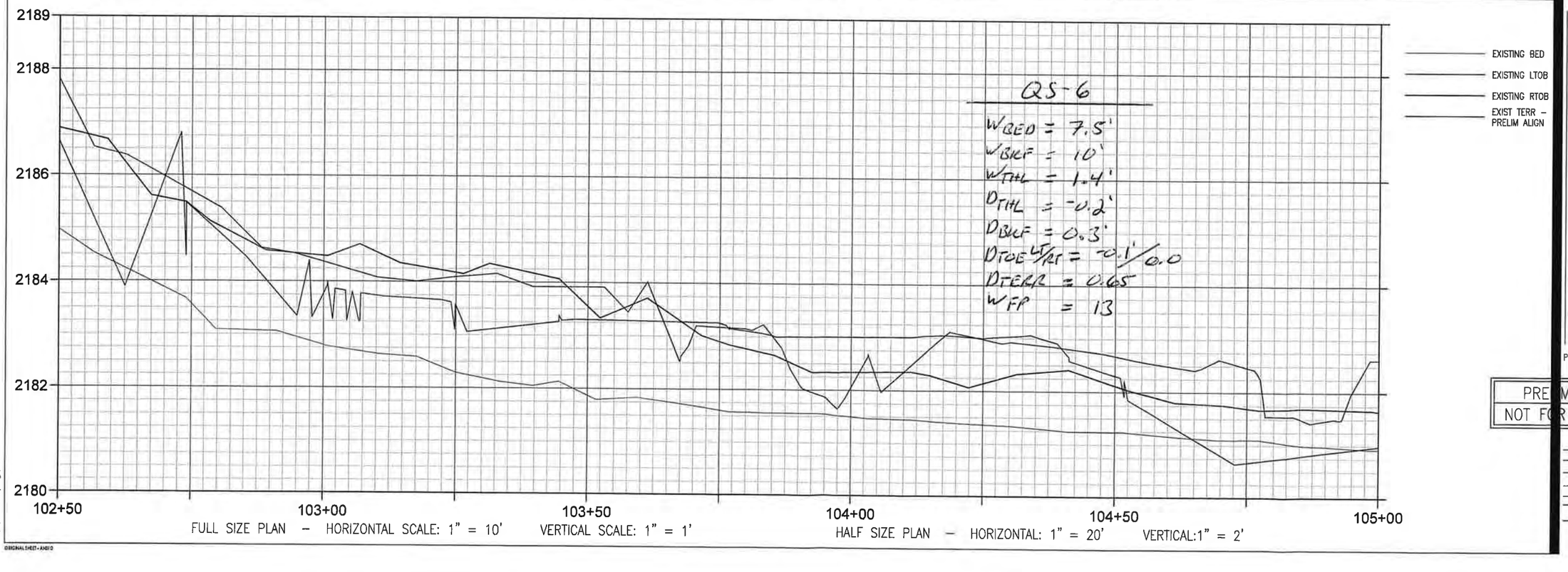

FULL SIZE PLAN – HORIZONTAL SCALE: 1" = 10' VERTICAL SCALE: 1" = 1'

HALF SIZE PLAN – HORIZONTAL: 1" = 20' VERTICAL:1" = 2'

ORIGINAL SHEET - ANSI D

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2017/09/18 8:28 PM By: Engle, Chris

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Client/Project
EW SOLUTIONS, INC

HARRELL STREAM AND WETLAND MITIGATION

JACKSON COUNTY, NORTH CAROLINA

Title
ASSESSMENT
STA 102+50 - 105+00

Permit-Seal

PRELIMINARY PLANS
NOT FOR CONSTRUCTION

Project Number: 172621094
File Name: 172621094-05-PLANPRO.dwg

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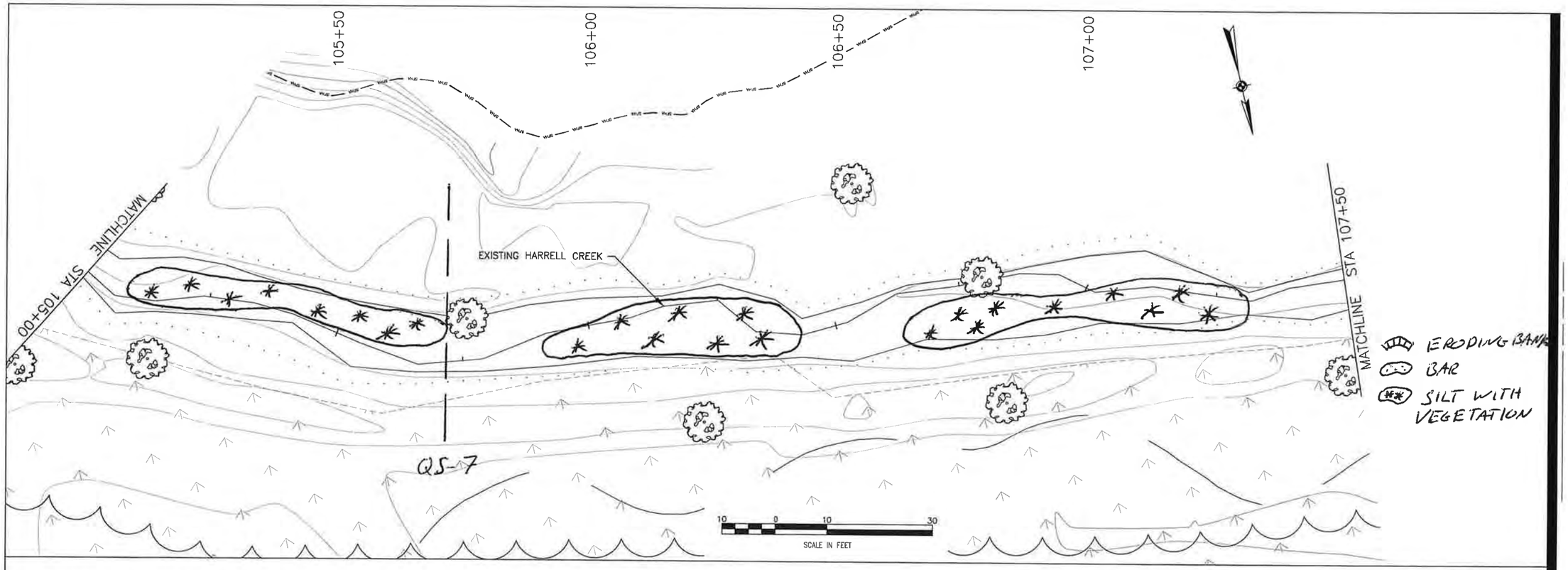
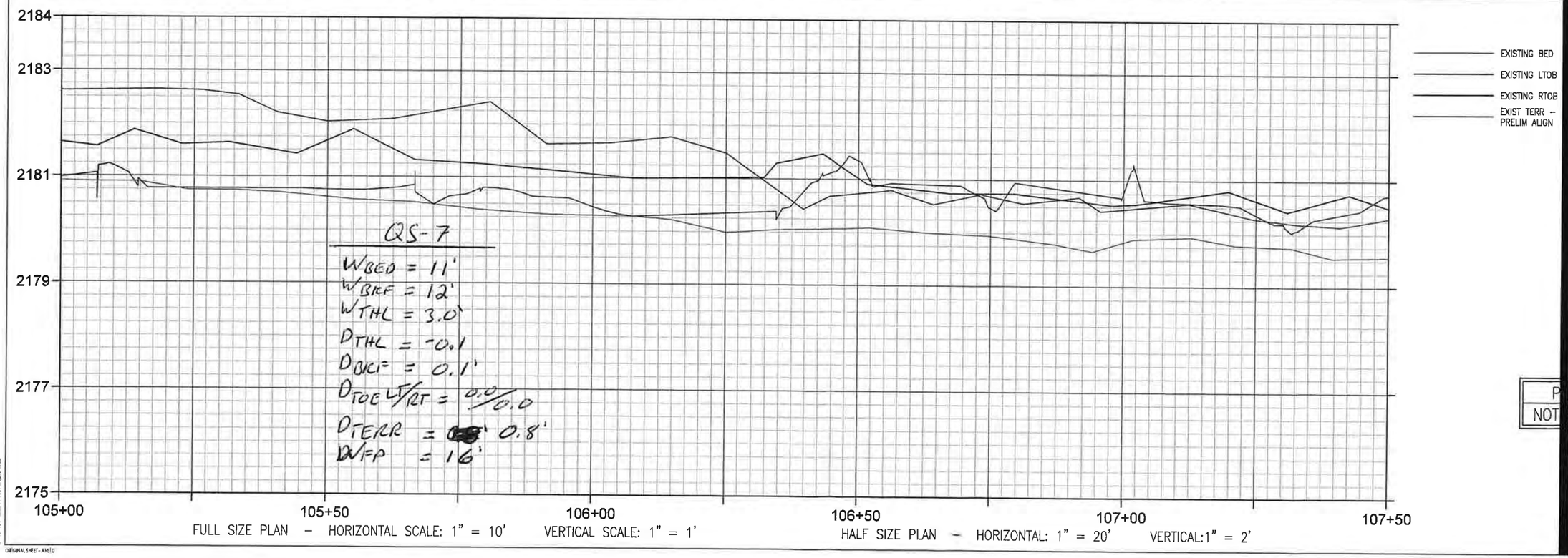
rb	sgg	cme	17.09.15

Drawing No. 5
Revision 0
Sheet 3 of 8





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HARRELL STREAM AND WETLAND MITIGATION

JACKSON COUNTY, NORTH CAROLINA

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Project Number:	172621094
File Name:	172621094-06-PLANPRO.dwg

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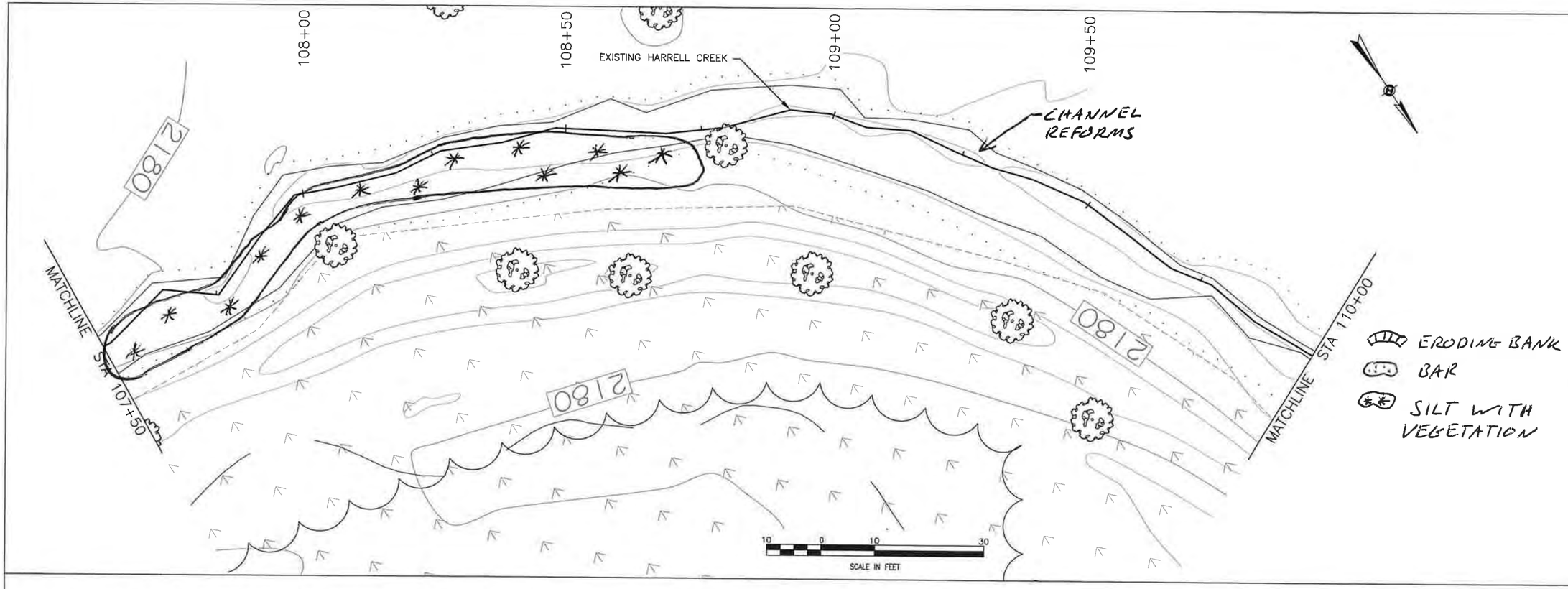
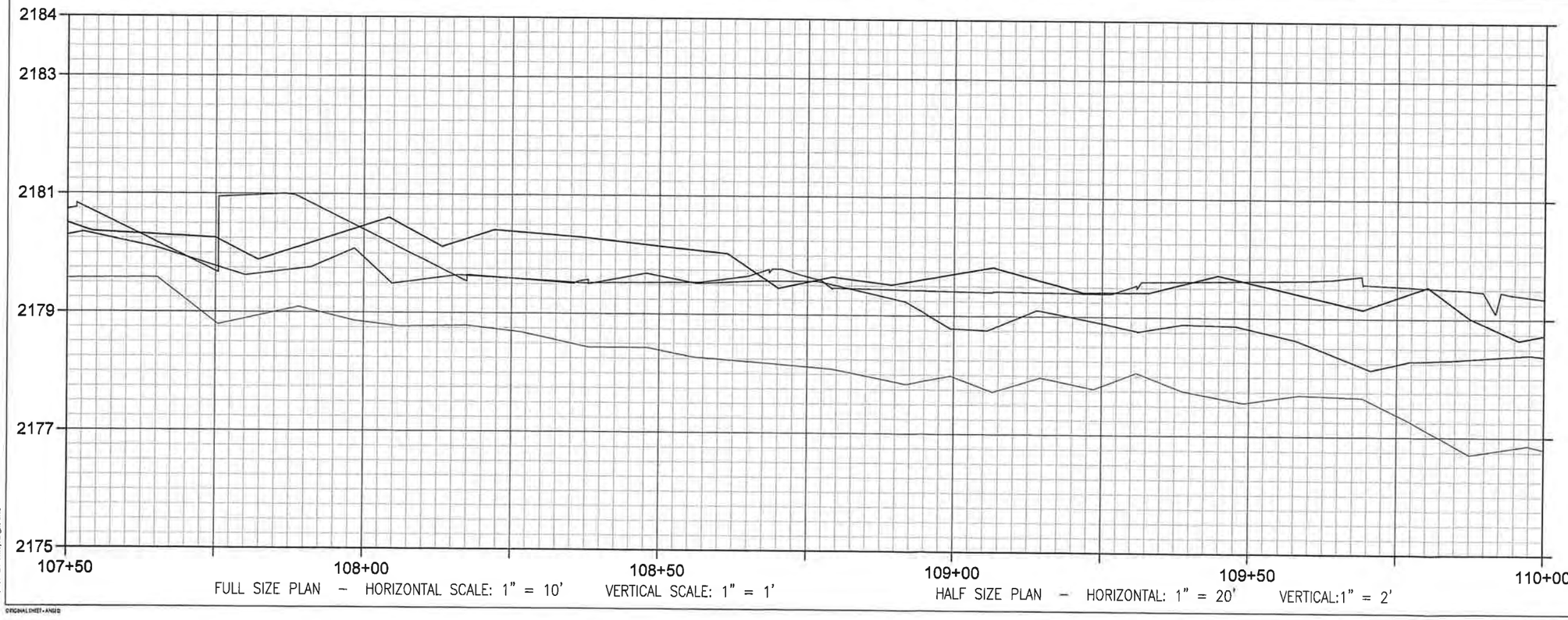
Sheet 4 of 8





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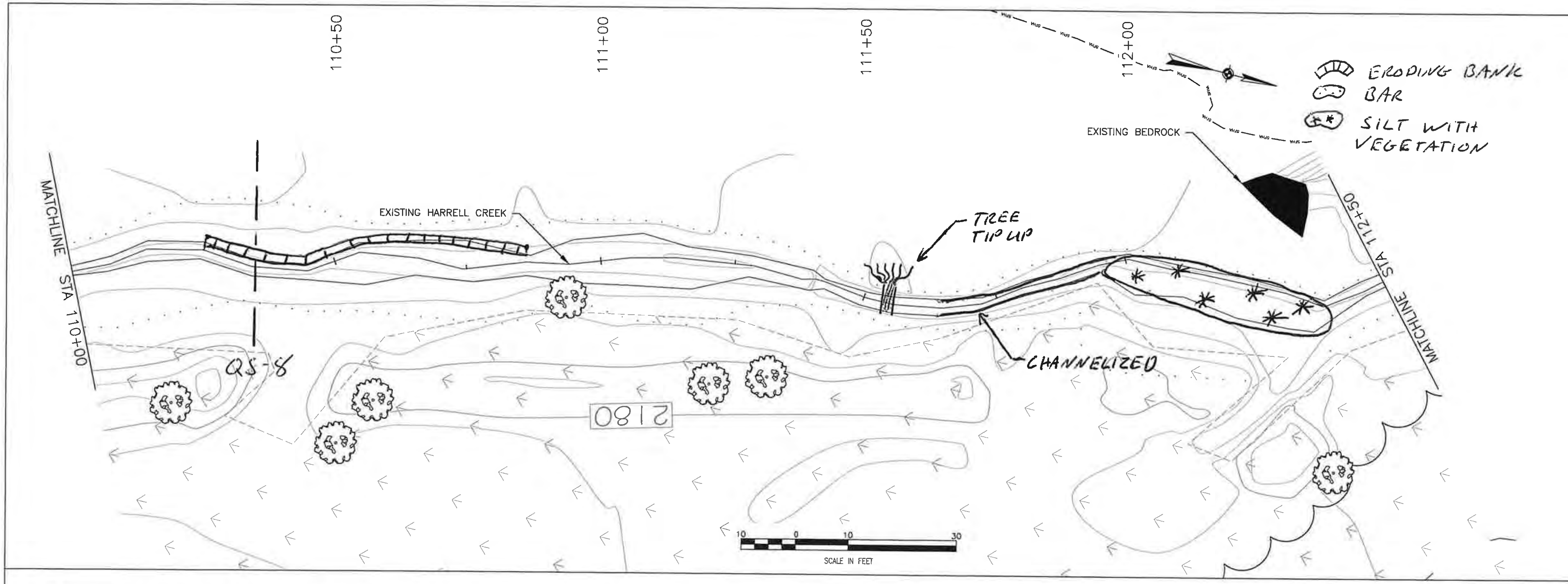

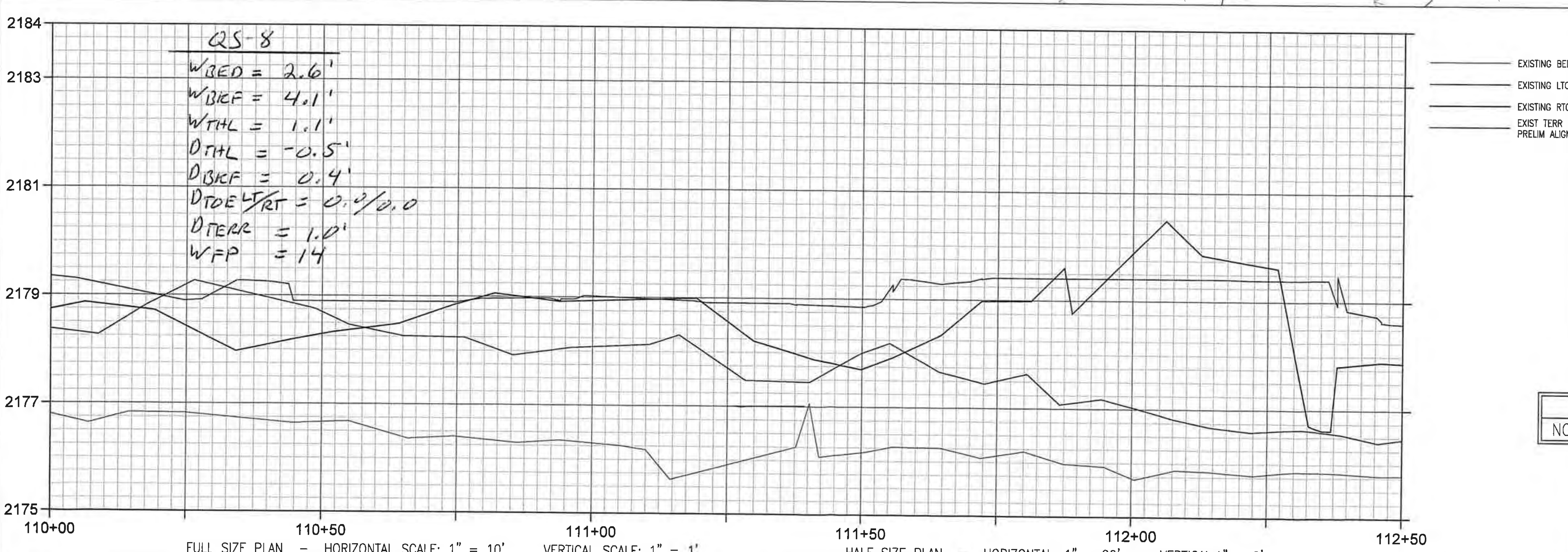

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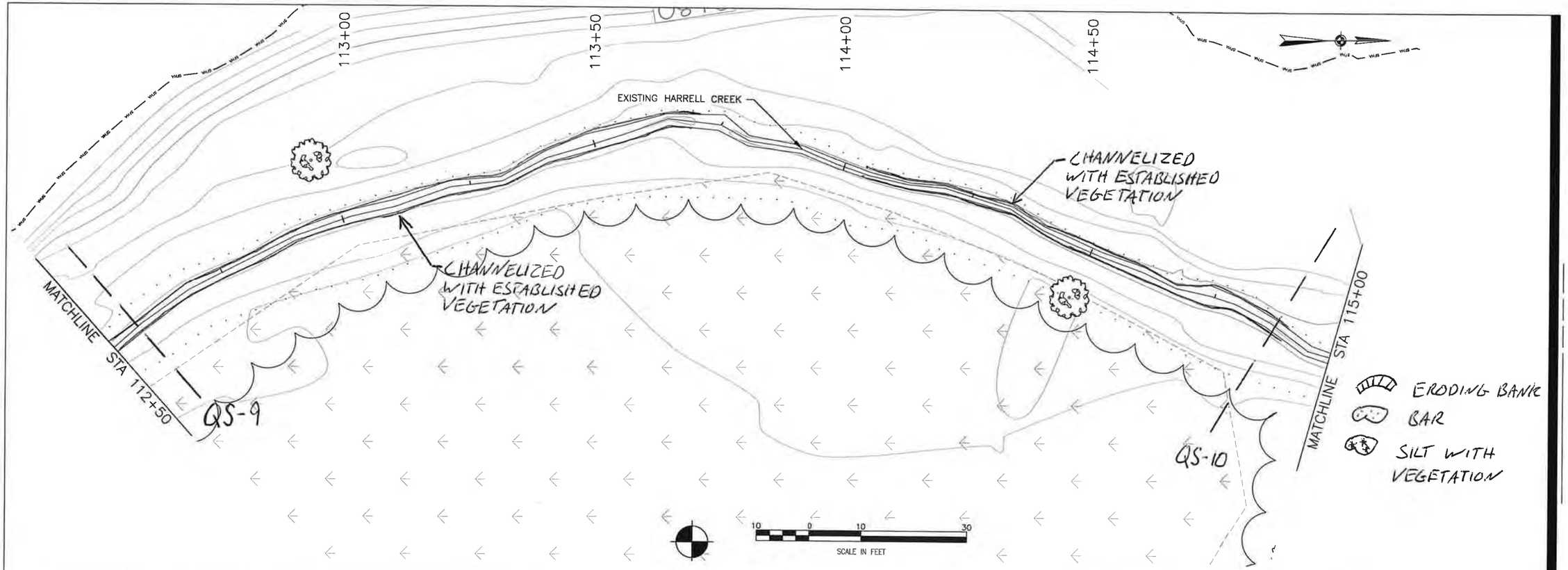

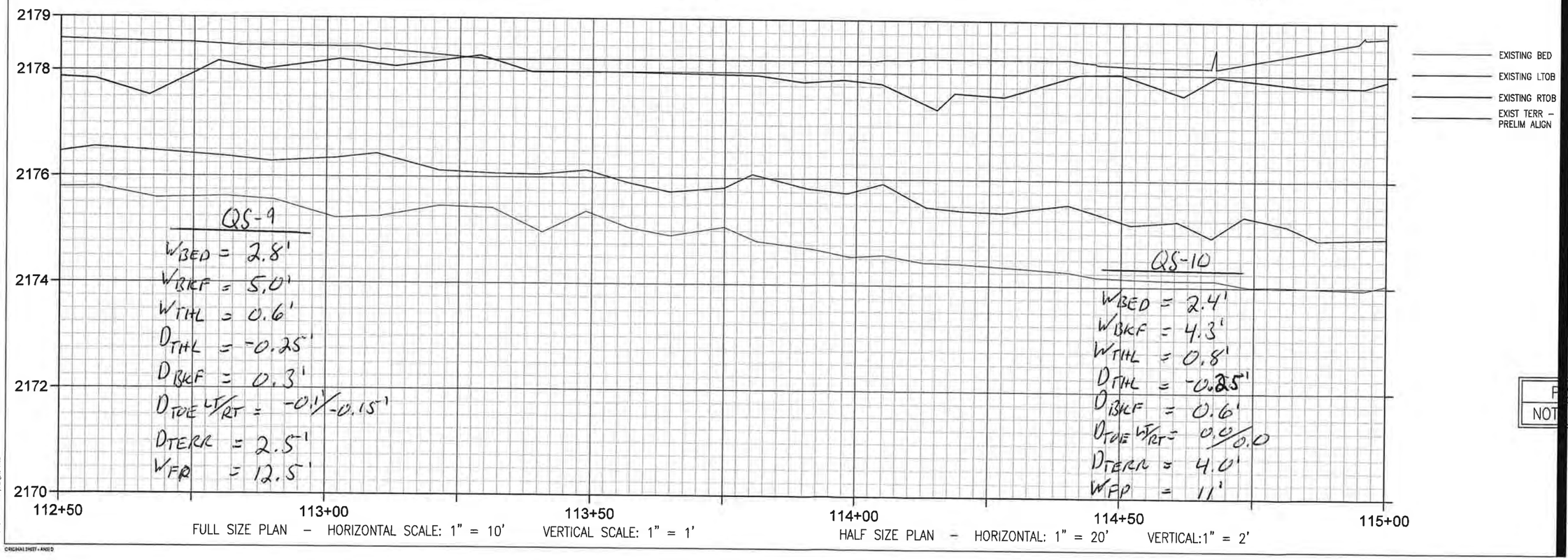

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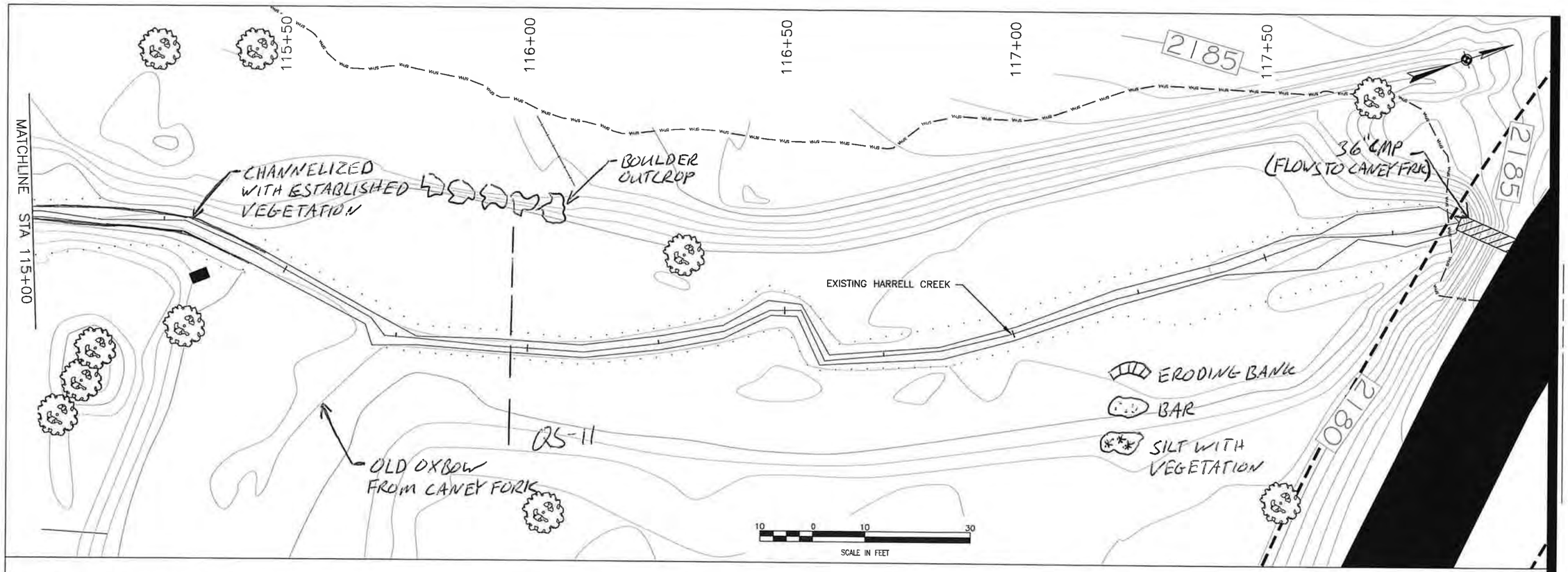
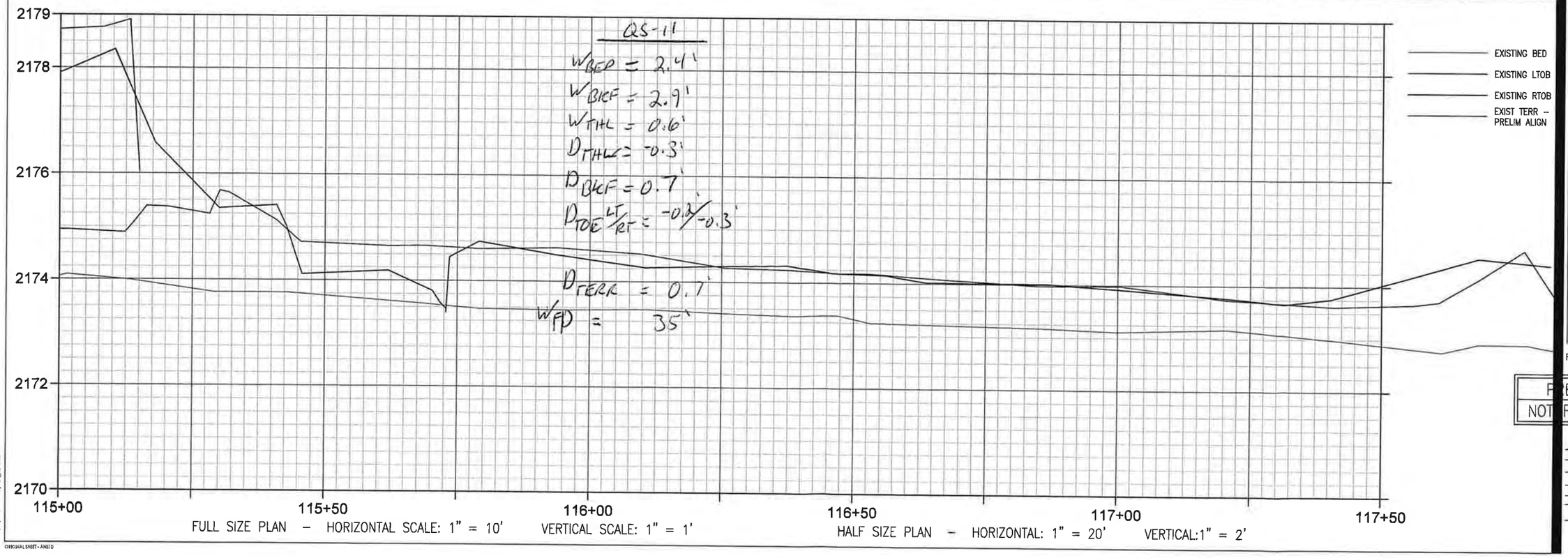
Sheet 7 of 8





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Sheet 8 of 8

Site Hydric Soils Detailed Study
Harrell Mitigation Site
Jackson County NC

Prepared for:

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Equinox Environmental
37 Haywood Street, Suite 100
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Prepared by:

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238 Shady Grove Rd
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July 2017

Soil Scientist Seal

This report describes the results of the soil evaluation performed at the Harrell Mitigation Site in Jackson County, NC. Any subsequent transfer of the report by the user shall be made by transferring the complete report, including figures, maps, appendices, all attachments and disclaimers.

Study Objectives and Scope

The purpose of the study was to determine the existence and delineate the extent of hydric soils that are potentially suitable for hydrologic restoration and mitigation. This evaluation is a soil delineation and all boundaries shown are based on the detailed field evaluation. Potential of soils for hydrologic restoration in this study is evaluated considering the existing land use and conditions with the sites potential for creating a hydroperiod suitable for the landscape and soils. Restoration potential assumes the successful restoration of the stream to access the floodplain. Practical modifications that utilize the site's natural hydrology may include, but are not limited to surface drainage modifications, plugging drainage ditches, removal of fill materials, and microtopographic alteration such as surface roughening or enhancing existing depressions. Removal of fill material is typically limited due to cost and environmental impacts if an extensive area is involved. Earthwork should be limited to removal of past agricultural modifications necessary to restore surface elevations, site water storage, and increase soil infiltration.

A detailed hydric soil delineation was completed in December, 2016 for areas along the floodplain of a small unnamed tributary to Cane Creek located in Jackson County, North Carolina. This report presents an evaluation of the subject property based upon a field evaluation the purpose of which is to delineate the extent of hydric soil and assess the suitability for wetland restoration/mitigation at the site. This evaluation is a soil delineation and wetland delineation of resources located on the project site. All boundaries shown are based on the detailed field evaluation.

The observations and opinions stated in this report reflect conditions apparent on the subject property at the time of the site evaluation. My findings, opinions, conclusions, and recommendations are based on the locations and boundaries of the property as evident in the field and professional experience.

Project Information and Background

The property is located south of Caney Fork Road (SR 1737) east of Cullowhee, North Carolina (Figure 1). The project site is approximately 10 acres located on a nearly level to slightly sloping floodplain of Caney Fork Creek. Caney fork is a major tributary to the Tuckasegee River, less than 1.5 miles downstream of the project site. Drained and degraded hydric soil is located within an existing agricultural field. A berm west of the field separates it from a small unnamed tributary to Caney Fork and a jurisdictional wetland that extends to the toe of slope. This tributary and wetland drain into what appears to be an old ox-bow of Caney Fork cut off by the paved Caney Fork Road. The ox-bow is also jurisdictional. The unnamed tributary is a zero-order stream that flows northerly within the project site before flowing beneath Caney Fork Road and into Caney Fork Creek.

The surrounding land use is undeveloped forest land, small farms, and single-family homes. Topography to the west is very steep. The site is currently a maintained field that was in bedded strawberry production last season but was recently mowed wheat. The project area exhibits evidence of soil disturbance consistent with long-term cultivation that may include crowning, ditching, and dredging of the channel to aid surface runoff and ease mechanized farming. Evidence of an old silo foundation is within the field and aerial photography from 1993 to 2005 show the presence of a barn near Caney Fork Road. Discussions with the landowner indicate farming at the site since the 1850s. The tributary has been dredged and a berm separates the channel from the field. It is probable that some contouring was performed to facilitate surface runoff in addition to the construction of the berm. The watershed is currently undeveloped forest land with a steep mountainous topography with boulders and exposed rock faces intermittently observed.

Methodology

The area evaluated has high potential for containing hydric soil due to a suitable landscape position and NRCS county soil mapping indicating the presence of hydric soil. A series of soil borings were performed across the site to delineate the boundary between hydric soil and upland soil, to document current soil characteristics, and evaluate the extent of hydric soil suitable for restoration. Soils were evaluated using

morphologic characteristics to determine hydric indicators and evaluate current hydrology using criteria based on "Field Indicators of Hydric Soils in the United States" (USDA, NRCS, 2017, Version 8.1). The boring observations do not contain adequate detail to classify these soils to a series. Indicators used are valid for the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0), (U.S. Army Corps of Engineers. 2012) in Land Resource Region N and MLRA 130B Southern Blue Ridge (USDA, NRCS 2006).

The boundaries were delineated based on evaluation of multiple soil borings, landscape position, and topographic relief. Soil boring locations were approximately located using the Trimble Outdoor Navigator smart phone application and exported to Google Earth. The hydric soil boundary points from field observations were collected with a GPS system by Equinox staff and used to draw the soil boundaries on the figures. A licensed surveyor located all boundary points to create the final boundary.

NRCS Soil Mapping

The project is in the Blue Ridge physiographic region and the landscape varies from relatively broad floodplains to narrow valleys and from rolling hills to very steep mountains USDA (1997). Located in Jackson County, the area is essentially rural and forested.

The soils mapped by the Natural Resource Conservation Service (NRCS 1997) Jackson County soil survey indicate three units mapped at the site; Nikwasi fine sandy loam, Rosman fine sandy loam, and Biltmore sand. The Nikwasi soil unit is mapped linearly along the toe of slope and in the field, the Biltmore sand is mapped linearly along the left bank of Caney Fork with the Rosman soil between these two map units. Each map unit represents an area dominated by one or more major kinds of soil or miscellaneous areas and is identified by the taxonomic classification of the dominant soils. The floodplain soils mapped at the project site are a very poorly drained Nikwasi fine sandy loam, well drained Rosman fine sandy loam, and well drained Biltmore sand. The Nikwasi is farthest from Caney Fork against the steep slope of the surrounding mountains. Adjacent to Caney Fork is the sandy levee Biltmore soil with the Rosman soil located between these mapped units.

The Nikwasi is classified as hydric by the NRCS and the Rosman and Biltmore each are estimated to have five percent hydric inclusions. The Nikwasi soil series has a taxonomic classification of *Cumulic Humaquepts* providing an Aquic suborder and thus meeting a NRCS criteria for hydric soil. The typical Nikwasi soil is used as pasture but is not considered prime farmland. Rosman fine sandy loam is classified as prime farmland with a hydrologic soil group of A. Biltmore sand is classified as prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season with a hydrologic soil group of A. Neither Rosman or Biltmore are hydric, but may contain inclusions of hydric soil. A comparison of characteristics for the soil series found in the floodplain are show in Table 1. The adjacent upland slopes are mapped as Trimont gravelly loam and Cullasaja-Tuckasegee complex.

Expected soil textures in this floodplain are a sandy or loamy surface with a subsoil that is predominantly sandy. Flooding is frequent in natural conditions. Landscape position has the largest effect on natural drainage and length of saturation for these soils and often has been modified to increase drainage and reduce saturation length.

A Nikwasi soil typically has a very dark grayish brown and very dark gray fine sandy loam surface underlain by a dark grayish brown and multicolored extremely gravelly coarse sand to a depth of 60 inches. This soil is susceptible to soil compaction by heavy equipment during site preparation, management and harvesting. This soil is naturally poorly drained, is frequently flooded, has a high water table, and has slow runoff.

Table 1. NRCS Soil Mapping Units at the Harrell Site

Mapping Unit/Series	Drainage Class	Hydric (NRCS)	Seasonal High Water Table (in)	Farmland classification	Taxonomic Class
Nikwasi fine sandy loam frequently flooded or undrained	very poorly	Yes	Very slow to ponded runoff	Not prime farmland	Cumulic Humaquepts
Rosman fine sandy loam occasionally flooded	well	Yes 5% hydric inclusions	Moderately well drained; slow runoff	All areas are prime farmland	Fluventic Humudepts
Biltmore sand frequently flooded	well	Yes 5% hydric inclusions	Slow surface runoff and rapid permeability. Flooding is common.	Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season	Typic Udipsamments

Results and Discussion

The project is located on a gently sloping floodplain of Caney Fork Creek, a higher order channel. A convex levee gently slopes away west from Caney Fork Creek to a concave-linear landform that parallels the base of the adjacent mountain. A small unnamed tributary enters the floodplain at its southern end and flows northeast along the toe of slope and beneath Caney Fork Road before entering Caney Fork Creek. The tributary has a low berm constructed between the channel and an agricultural field.

The concave nature of the wetland and field were enhanced during farming activities to increase surface drainage and prevent flooding from the tributary. The field exhibits evidence of soil disturbance consistent with long-term cultivation that may include crowning to increase the rate of surface runoff and ease mechanized farming. Based upon landowner discussion the site has been in agricultural use since the 1850s including livestock and more recently cultivated crops. A barn visible on earlier aerial photography was located on the higher landscape close to Caney Fork Creek. The barn and silo have been removed. The site was mowed wheat at the time of the site visit. From the observed disturbance in the soil profiles, a plow layer was estimated to be 6 to 10 inches deep.

At the Harrell site, more than 50 shallow borings from 12 to 24 inches were evaluated to delineate the hydric soil boundary (Figure 3). An additional eight were described in detail to document a representative range of soil characteristics at this site (Figure 2 and Appendix A). Characteristics evaluated include texture, color, mottling, and saturation or water table where present. Other important observations were noted as observed.

Jurisdictional Wetlands

On March 21, 2017, the jurisdictional wetlands were verified by Steve Kichefski from the Corps of Engineers. A jurisdictional wetland is present between the channel and mountain slope. Current wetland hydrology was observed to be absent or below 12 inches across most of the field and is likely due to restricted inputs from the stream from the berm between the stream and the field. Within the field a

narrow low depressional area was also delineated that appears to retain wetland hydrology where the elevation is equal to the stream channel across the berm. The groundwater is present at -4 to -10 inches in this area during the dormant season with hydrology extending into the early part of the growing season. Surface water in the field drains along the low concave swale outside of the berm, extending linearly along the berm through a swale that eventually becomes a ditch like feature. Two shallow breaks in the berm allow surface flows to enter the channel through the berm that drops down from the field into the channel.

During the site meeting with the Corps, discussion of current conditions focused on whether visible hydrology has been significantly influence by weather. Recent large rains may have elevated the water table. Conversely this part of the state has been experiencing a drought for the last two to four years. Groundwater gauges prior to construction of the site were recommended to provide information on current day to day levels and response to rainfall and potential draw down to events.

Existing information prior to gauge installation in six open borings from the December soil evaluation were compared to observations from three months prior (Table xx).

Table X. Observed Groundwater Elevation from Open Borings

Boring #	Date	WT Elevation	Date	WT Elevation	WT Change
101	12/21/2016	>-34	3/21/2017	-25	~+9
102	12/21/2016	-12	3/21/2017	**-12**	0
103	12/21/2016	-15	3/21/2017	-15	0
104	12/21/2016	-30	3/21/2017	**-10**	+20
105	12/21/2016	-29	3/21/2017	>-25	NA
106	12/21/2016	**-10**	3/21/2017	**-7.5**	+2.5

There was no significant difference in the observed water table in the four borings located within the field depression and shown in yellow as Jurisdictional Wetlands (Figure 2). Precipitation events occurred immediately prior to both field visits. No information on water table changes, drawdown times, or potential static levels was available. The observations suggest wetland hydrology exists in the area delineated.

Outside of this linear depression the water table was observed to be deeper, from -15 inches to greater than 24 inches. The water table appears to be from groundwater replenished by the perennial mountain stream. Due to the drainage modifications increasing runoff and preventing the stream flow from readily accessing the field, the water table in the field is below the historic normal. Surface soil texture is predominately sandy loam underlain by a sandy loam or silt loam. Because of the sandy nature, soil across the site appears to have moderate to high saturated conductivity. The lack of a restrictive horizon suggests that hydrology in these sandy soils is driven primarily by the water table elevation and is sensitive to drainage modification.

Soils at the site were observed that have a range of characteristics comparable to NRCS mapped Nikwasi and Rosman series. The textural ranges are similar and predominantly sandy but slightly redder hues were observed in profiles. An underlying gravelly layer was not observed to be present within the study depth, but may be present at greater depth. Cobbles at a shallower depth are present closer to Caney Fork. The soils within the field are mostly uniform and variability observed is typical of alluvial systems. The typical soil at the Harrell site exhibits the diagnostic thick surface required by the series. The boring

observations do not contain adequate detail to classify these soils to a series. Representative profiles are provided in Appendix A.

Hydric soil at the Harrell Site is restricted to the concave-concave to concave linear landscape along the toe-of-slope and extend to the edge of the sand levee where the landscape becomes convex. Jurisdictional wetlands occur between the berm and mountain slope, within a narrow linear depression along the berm and in an oxbow at the northeastern end of the project at Caney Fork Road

Soil borings within the field exhibited numerous hydric soil indicators despite the long term agricultural uses. The hydric soil indicators observed were the A12-Thick Dark Surface and F6-Redox Dark Surface. The Thick Dark Surface indicator has black soil greater than 12 inches underlain from over thickened soil in the concave landform. At the Harrell site areas meeting the A12 indicator are greater than 30 inches with a high organic matter content. The F6 indicator has dark surface soil high in organic matter with redox concentrations and does not depend upon the over thickened dark surface. Cultivation mixes the surface layer, destroying these concentrations and drainage usually don't allow them to re-form. The soil within the field at this site exhibited a disturbed plow layer underlain with typical Redox Dark Surface indicators, with some boring retaining relict concentrations. Although variation typical of alluvial soil was observed much of the site would likely have met an F6 indicator prior to disturbance.

Hydric soil indicators can remain present after the saturated conditions they formed under have been removed and are considered relict. The relict features are difficult to identify, especially within these dark sandy and loamy soils. The processes that form hydric features the can be restored if a saturated hydrology is reestablished. Farming and agricultural activities at the site have improved surface drainage, reduced flooding events, and destroyed many of the natural surface features, including some hydric soil indicators. The sandy textures soil at the site indicate a higher lateral conductivity and combined with the increased surface drainage, the field currently has a reduced hydroperiod. A reduced hydroperiod allows increased oxidation of mineral and organic matter to occur within the matric that may blur typical indicators expected. The improved drainage limits reformation of some indicators, especially for the F6-Redox Dark Surface. The presence of redoximorphic concentrations in the upper horizon in some borings suggest this indicator was more wide spread historically.

Typically, under drier conditions, dark or black soil becomes lighter or brown as organic matter is decreased in the presence of oxygen, changing colors throughout the profile. The accumulation of organic matter and mottles destroyed by cultivation are not likely to re-form until a longer, natural saturation period is restored. Where the oxidation-reduction process is not balanced in a normal reduction cycle of repeated saturation and drainage, increases of red and yellow color saturation of the are observed within the soil material. Within the appropriate landscape, these colors may be interpreted as a relict characteristic of hydric conditions (Vepraskas 2015). The observed redder than expected matrix color (in a typical Nikwasi series) and brown surface horizons may reflect a historic saturation and not reflect the current conditions.

Potential Hydroperiod of Restored Soils

Based upon field observation across the site, the NRCS mapped units have a moderately strong correlation to actual on-site conditions, (texture, color range, and general variability trends). Soils across the site are sandy textured throughout with limited silty or clayey horizons. Soils at the site have the NRCS map units Nikwasi (*Cumulic Humaquepts*) and Rosman (*Fluventic Humudepts*). The field observations support that most of the area is most similar to Nikwasi and grades to the better drained Rosman. Mitigation guidance for common mountain soil series by the US Army Corps of Engineers (2016) suggests a hydroperiod range, where the water table is within 12 inches of the surface during the growing season, of 12 to 16 percent for the Nikwasi and 10-12 percent for the Rosman (Table 2).

Hydrologic success for soils at this site should be expected to range from 9 to 16 percent saturation during the growing season. Natural variability expected with wetter areas ranging to 16 percent in the lower elevations and depressions and 9 percent near the upland boundary. The Harrell project is located within a landscape suitable for wetland restoration, appears to have been historically a wetland, and has soil exhibiting hydric indicators. An available water source for hydrology will be available when the tributary is reconnected to the floodplain. Retention and storage within the floodplain will be returned to a natural state with an increased hydroperiod. Given the observed soil characteristics indicating past wetland hydrology, and because of favorable landscape positon, and the potential source for restoring hydrologic inputs, this site appears suitable for successful hydrologic wetland restoration.

Table 2. Wetland Hydroperiod Table for Soil at the Harrell Site

Mapping Unit/Series	Taxonomic Classification	Hydroperiod Range*
Nikwasi fine sandy loam frequently flooded or undrained	Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, nonacid, mesic Cumulic Humaquepts	12-16 %
Rosman fine sandy loam occasionally flooded	Coarse-loamy, mixed, superactive, mesic Fluventic Humudepts	10-12%
Biltmore sand frequently flooded	Typic Mixed, mesic Typic Udipsamments	07-09%
Hemphill clay loam, Rarely flooded	Fine, mixed, active, mesic Umbric Endoaqualfs	(10-12% suggested)

*Source: US Army Corps of Engineers. 2016

Summary Conclusions and Recommendations

The site is currently in agricultural use that has altered the historic landscape, soil morphology, and hydrologic regime. Past landscape and land use changes observed at this site include enhanced drainage, a berm separating the small tributary from a portion of its, past cultivation resulting in soil compaction and surface tillage. These changes have resulted in a loss of surface organic matter and the absence of a normal oxidation cycle reduction cycle characteristic of wetlands. The project is within a concave landscape sloping toward the tributary and berm paralleling the mountain slope. Surface water in the field drains toward the berm and along the concave area into a shallow swale/ditch connected to the tributary.

The floodplain has an extensive area of continuous hydric soil currently in pasture/field with soils exhibiting the A12-Thick Dark Surface and F6-Redox Dark Surface indicators. Existing land use, ditching, and cultivation have altered the current hydrology and surface soil characteristics. The landscape indicates the historic hydrologic input was originally from the tributary and numerous seepage areas along the mountain toe-of-slope. Removal of the berm and reconnecting the tributary to this floodplain has the potential to provide a consistent source of hydrology to existing hydric soil. Topography, soil characteristics, landscape position, and the source for potential hydrology are appropriate for a successful hydrologic restoration at the Harrell site.

Hydrologic restoration may be accomplished by removing the berm and plugging the existing channel to slow and redirect drainage across the floodplain, allowing a natural hydroperiod to return. Surface roughening and enhancing or creating shallow depressions across the restoration area will provide an appropriate landscape for diverse microhabitats. Due to long-term agricultural practices that enhance surface drainage, some areas appear to have excess surface material. Limited removal of this surface

material is recommended where practicable. After the initial construction, effects of compaction and long term agricultural use should be ameliorated by a shallow ripping of the plow layer along the contour to a depth of 8 to 10 inches to insure adequate porosity for infiltration and storage, provide microtopographic relief, and improve vegetative survival and growth. Deep ripping is not necessary.

Generally, the Harrell site appears to have all the conditions for successful wetland restoration. Restoration of this site will reestablish the natural function to these degraded aquatic resources by providing a stable and unique riparian wetland habitat contiguous with the stream. Because of the continuity and inclusion of resource inputs, the limitations at this site are minor.

This report describes the results of the soil evaluation performed at the Harrell Mitigation Site in Jackson County, NC. Any subsequent transfer of the report by the user shall be made by transferring the complete report, including figures, maps, appendices, all attachments and disclaimers.

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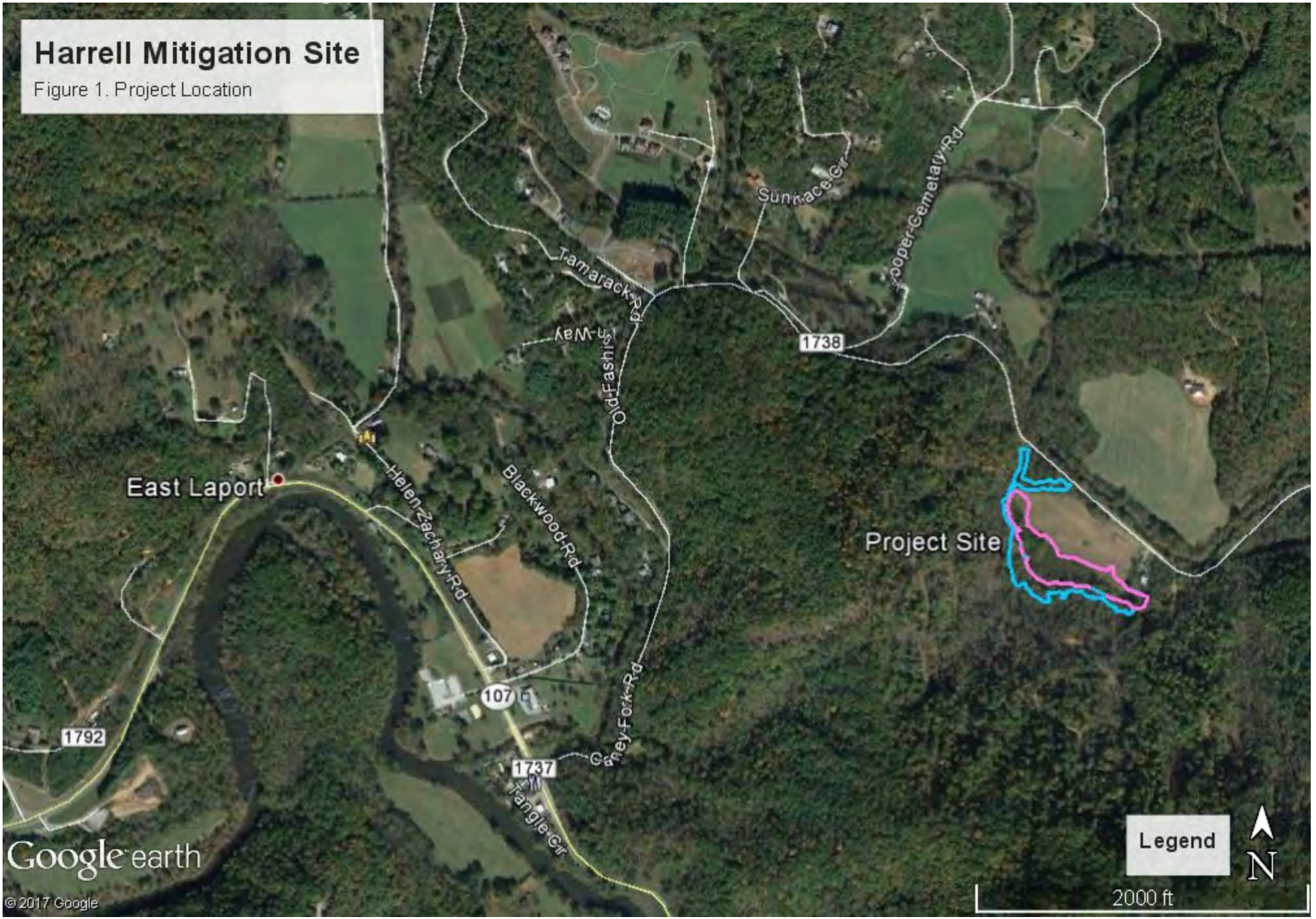
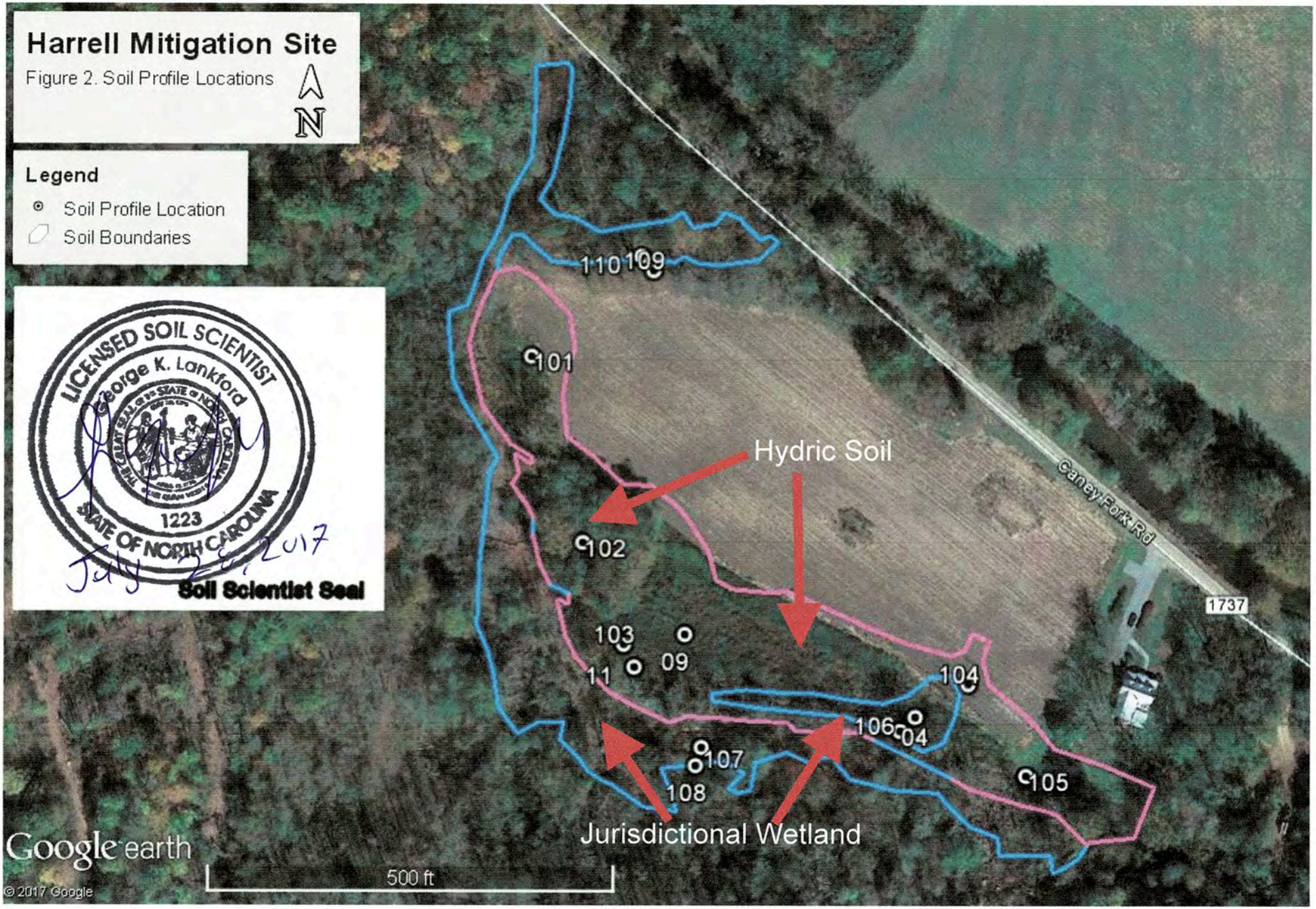
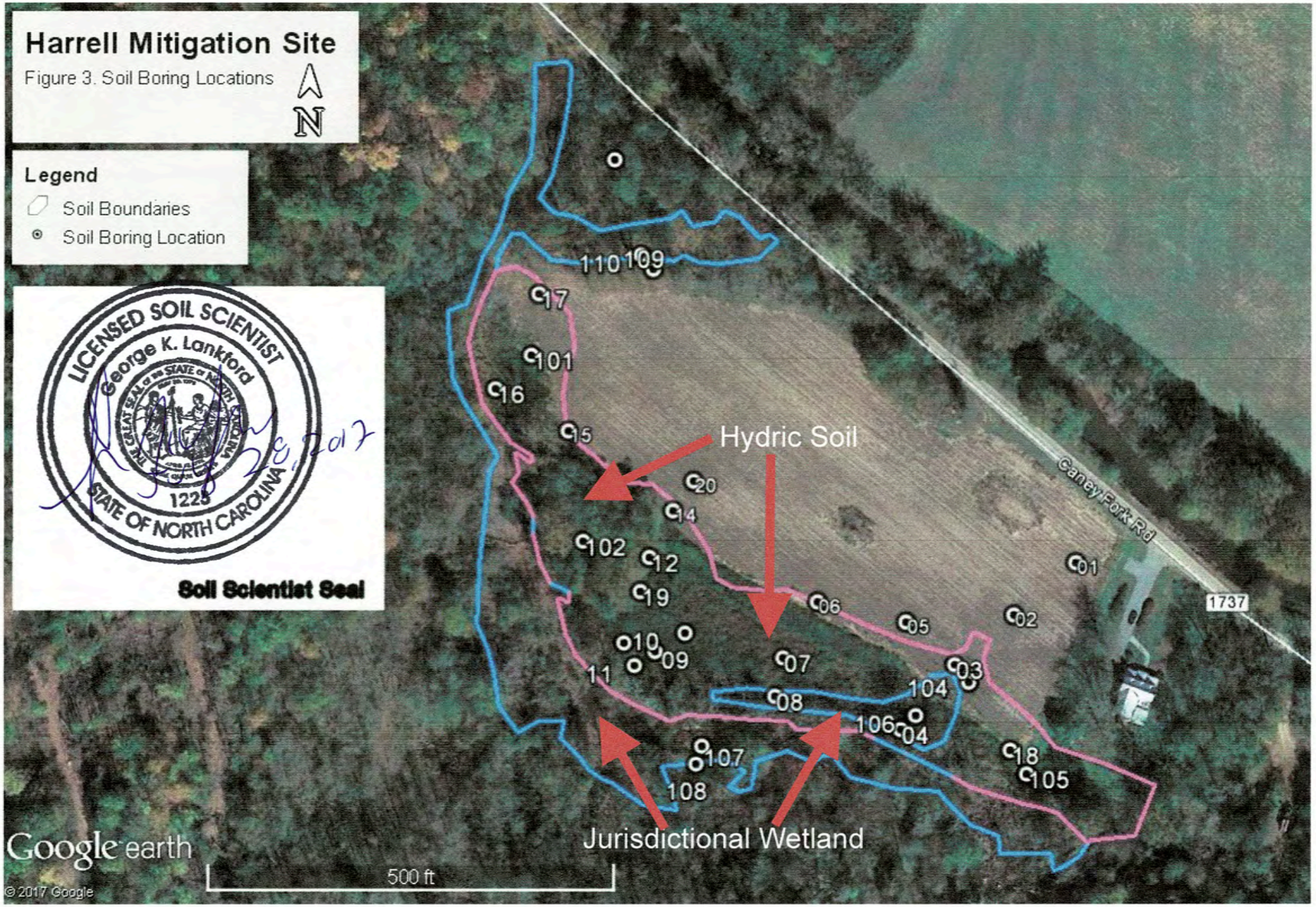
FIGURES

APPENDICE


Harrell Mitigation Site
Figure 1. Project Location
East Laport
Helen Zachary Rd
Blackwood Rd
Old Fashion Way
Tamarack Rd
Sunrace Cir
Cooper Cemetary Rd
1738
Project Site
Caney Fork Rd
107
1737
Tangle Cir
1792
Legend
N
2000 ft
Google earth
© 2017 Google


Harrell Mitigation Site
Figure 2. Soil Profile Locations
N
Legend
Soil Profile Location
Soil Boundaries
LICENSED SOIL SCIENTIST
George K. Lankford
1223
STATE OF NORTH CAROLINA
Soil Scientist Seal
July 27, 2017
110
109
101
Hydric Soil
102
Caney Fork Rd
1737
103
09
11
104
106
04
107
108
105
Jurisdictional Wetland
Google earth
© 2017 Google
500 ft


Harrell Mitigation Site
Figure 3. Soil Boring Locations
N
Legend
Soil Boundaries
Soil Boring Location
LICENSED SOIL SCIENTIST
George K. Lankford
1225
STATE OF NORTH CAROLINA
Soil Scientist Seal
Hydric Soil
Jurisdictional Wetland
Caney Fork Rd
1737
500 ft
Google earth
© 2017 Google

Appendix
Harrell Site -
Soil Boring Descriptions

March 2017

Table. Representative Soil Profiles in Harrell Proposed Wetland Restoration Area

Depth (inches)	Color		Mottle Percentage	Texture	Notes
	Matrix	Mottle			
SB 4 (5-26-16)			Hydric Indicator A12-Thick Dark Surface F6-Redox Dark Surface		
0-10	7.5YR 2.5/1			SiL	Disturbed A_p horizon
10-18	7.5YR 2.5/1	7.5YR 3/4	10%	SiL	Meets F6-Redox Dark Surface
18-36	7.5YR 2.5/1			SiL	
SB 9 (5-26-16)			Hydric Indicator A12-Thick Dark Surface F6-Redox Dark Surface		
0-7	7.5YR 2.5/3			SL	
7-13	7.5YR 2.5/1	7.5YR 3/4	30%	SL	
13-22	7.5YR 4/4	7.5YR 2.5/1	20%	cS	gravel and cobbles
22-26	7.5YR 4/4			cSL	small and medium gravel 10% WT-25 inches
SB 11 (5-26-16)			Hydric Indicator A12-Thick Dark Surface F6-Redox Dark Surface		
0-8	7.5YR 2.5/3			SiL	
8-23	7.5YR 2.5/1	7.5YR 4/4	5%	SiL	
23-28	7.5YR 2.5/3			SL	WT-24 inches
SB 101 (12-21-16)			Hydric Indicator A5-Stratified Layers A12-Thick Dark Surface		
0-5	7.5YR 2.5/2	7.5YR 3/4	8%	SL	micaceous
5-13	7.5YR 2.5/1	7.5YR 3/4	5%	SL	micaceous
13-28	7.5YR 2.5/1	7.5YR 3/4	20%	SiL	
28-34	10 YR 2/1	7.5YR 3/4	3%	SCL	
SB 102 (12-21-16)			Hydric Indicator A5-Stratified Layers A12-Thick Dark Surface F6-Redox Dark Surface		
0-9	7.5YR 2.5/3	7.5YR 3/4	5%	SL	micaceous
9-15	10 YR 2/1	5YR 3/4	10%	SL	micaceous WT-12 inches
15-22	10 YR 2/1	5YR 3/4	5%	SL	micaceous
22-29	10 YR 2/1			SiL	

Appendix
Harrell Site -
Soil Boring Descriptions

March 2017

Table. Representative Soil Profiles in Harrell Proposed Wetland Restoration Area

Depth (inches)	Color		Mottle Percentage	Texture	Notes
	Matrix	Mottle			
SB 103 (12-21-16)			Hydric Indicator F6-Redox Dark Surface		
0-7	7.5YR 2.5/2	7.5YR 3/3	2%	SL	
7-20	7.5YR 2.5/1	7.5YR 2.5/3	2%	SL	micaceous WT-15 inches
20-25	10YR 3/2			SL	
SB 104 (12-21-16)			Hydric Indicator A5-Stratified Layers A12-Thick Dark Surface F6-Redox Dark Surface		
0-10	7.5YR 2.5/2	7.5YR 3/4	2%	SL	
10-21	7.5YR 2.5/1	5YR 3/4	8%	SL	
21-27	10YR 2/1	5YR 3/4	2%	SCL	micaceous
27-35	7.5YR 2.5/2			Si	high in OM WT-30 inches
SB 105 (12-21-16)			Hydric Indicator A12-Thick Dark Surface F3-Depleted Matrix		
0-9	7.5YR 2.5/3			SL	
9-16	7.5YR 4/1	10YR 4/6	10%	SC	micaceous restrictive horizon
16-31	N 2.5/-			SL	WT-29 inches
SB 106 (12-21-16) (lowest elevation relative to tributary)			Hydric Indicator A12-Thick Dark Surface F6-Redox Dark Surface		
0-4	10YR 2/2			SL	
4-10	10YR 2/1	5YR 3/4	5%	SL	micaceous
10-31	7.5YR 2.5/1			SiL	micaceous - high in OM WT-10 inches

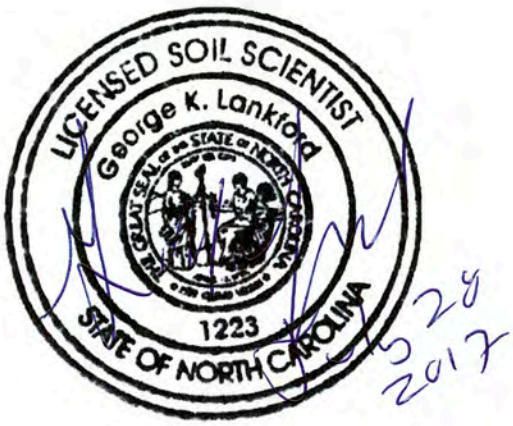
Appendix
Harrell Site -
Soil Boring Descriptions

March 2017

Table. Representative Soil Profiles in Harrell Proposed Wetland Restoration Area

Depth (inches)	Color		Mottle Percentage	Texture	Notes
	Matrix	Mottle			
SB 107 (12-21-16) jurisdictional wetland data point			Hydric Indicator A12- Thick Dark Surface		
0-26	7.5YR 2.5/1			SiL	water table at -3 inches
SB 108 (12-21-16) upland data point			Hydric Indicator None		
0-5	7.5YR 3/3			SL	
5-33	7.5YR 4/4			SCL	
33-38	7.5YR 4/3	7.5YR 5/8	7%	SL	
SB 109 (12-21-16) upland data point			Hydric Indicator None		
0-13	7.5YR 3/3			SL	
13-18	7.5YR 4/4			SL/LS	auger refusal – rocks/cobbles
SB 110 (12-21-16) jurisdictional wetland data point			Hydric Indicator A12- Thick Dark Surface		
0-20	7.5YR 2.5/2			mucky L	auger refusal – rocks/cobbles WT at surface

Texture (follows USDA textural classification)
S = sand, L = loam, Si = silt, C = clay, mucky is a textural modifier
WT = water table elevation relative to surface



Appendix B
Harrell Mitigation Site
Photo Log

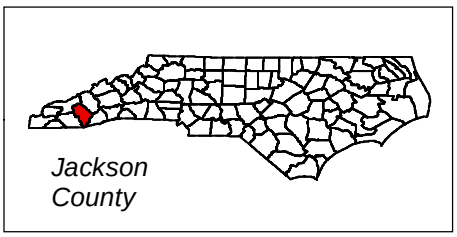
1. Soil Meets A5- Stratified Layers, A12-Thick Dark Surface, and F6-Redox Dark Surface (Profile # 102).

2. Soil Meets A5- Stratified Layers, A12-Thick Dark Surface, and F6-Redox Dark Surface (Profile # 104).

Appendix B
Harrell Mitigation Site
Photo Log

3. Hydric soil area in field with tributary to left.

4. Jurisdictional wetland between berm/tributary and upland slope.



Legend

- Proposed Conservation Easement
- Precipitation Gauge
- Wetland Gauges
- Harrell Creek
- Existing Wetlands
- Hydric Soils

0 200 400 Feet

1:2,400 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Base features: Stantec, Equinox
3. Base Imagery: NCCGIA 2015.

Project Location
Jackson Co, NC

Prepared by ALC on 2017-12-19
Reviewed by RS on 2017-12-20

Client/Project
EW Solutions
Harrell Mitigation Site
Project Number: 100005

Figure No.
C.1

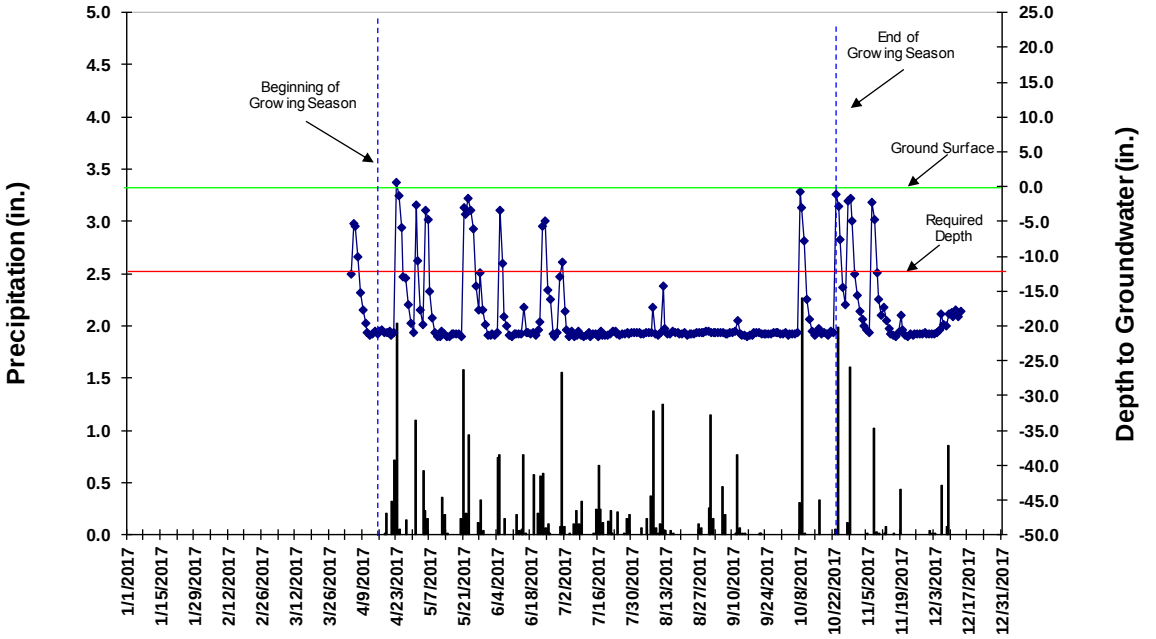
Title
Wetland Gauge Map

V:\11726\active\172621094\03_data\gis_cad\Appendix existing gauges.mxd Revised: 2017-12-21 By: acoleman

Gauge ID: **H1**

Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **5**

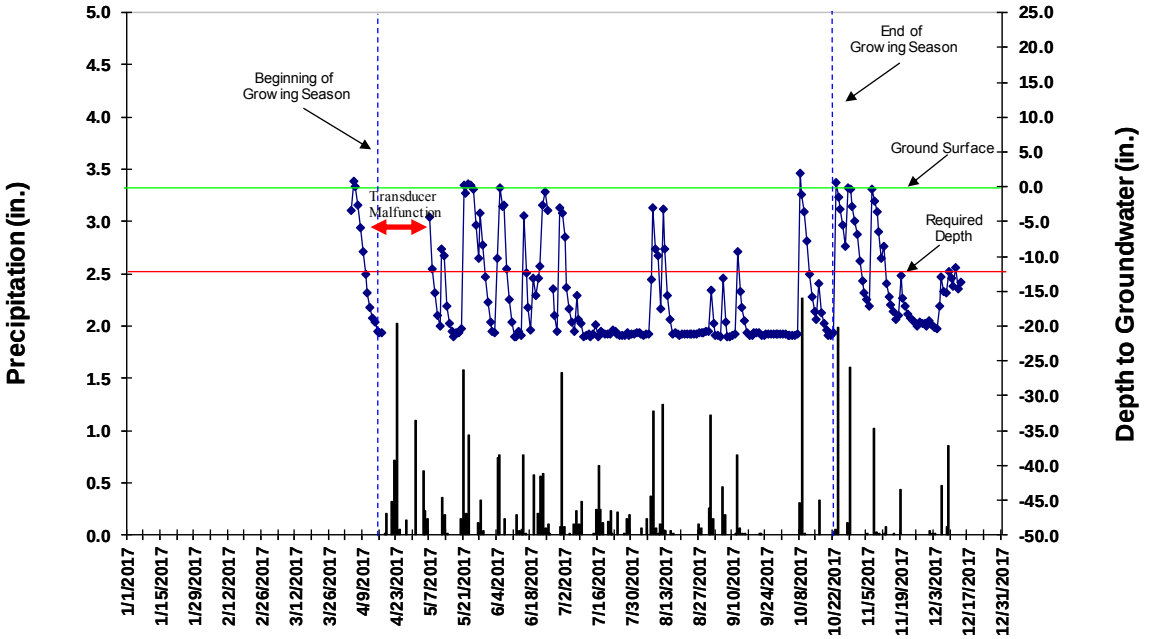
Percentage of Growing Season Water Table within 12 inches of Soil Surface: **2.6%**



Gauge ID: **H2**

Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **21**

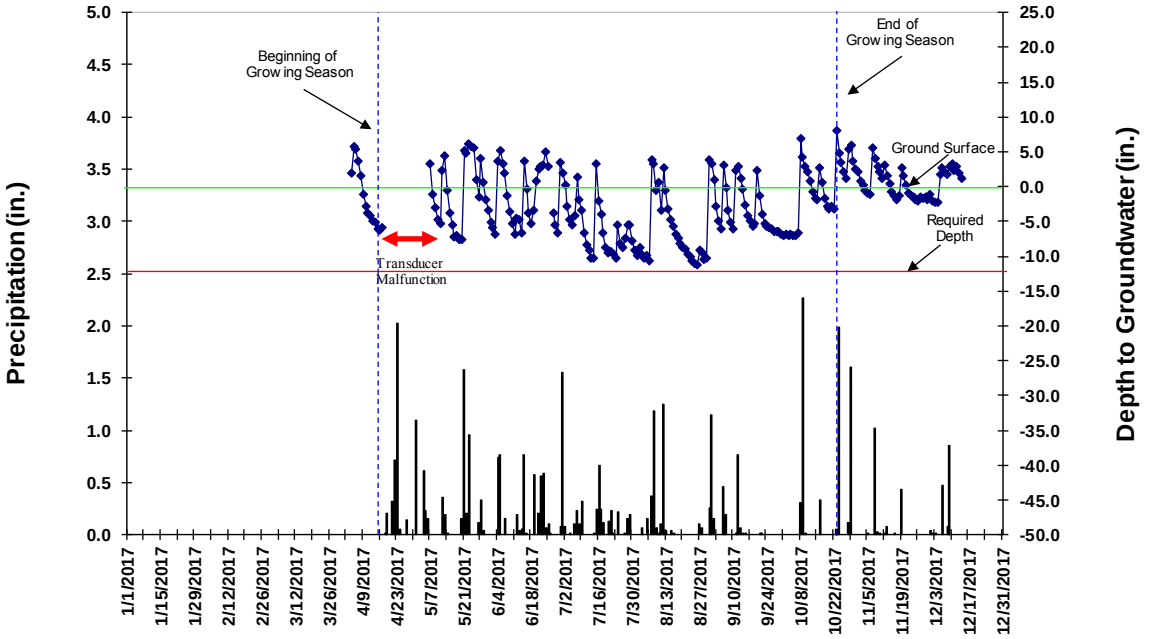
Percentage of Growing Season Water Table within 12 inches of Soil Surface: **11%**



Gauge ID: **H3**

Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **122**

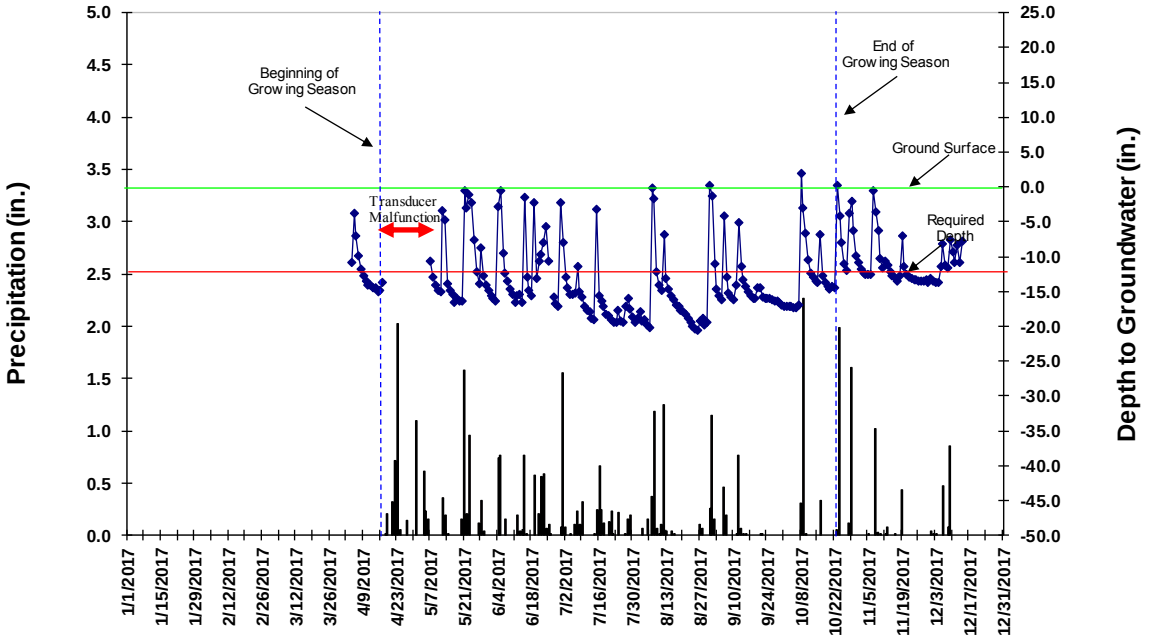
Percentage of Growing Season Water Table within 12 inches of Soil Surface: **63%**



Gauge ID: **H4**

Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **20**

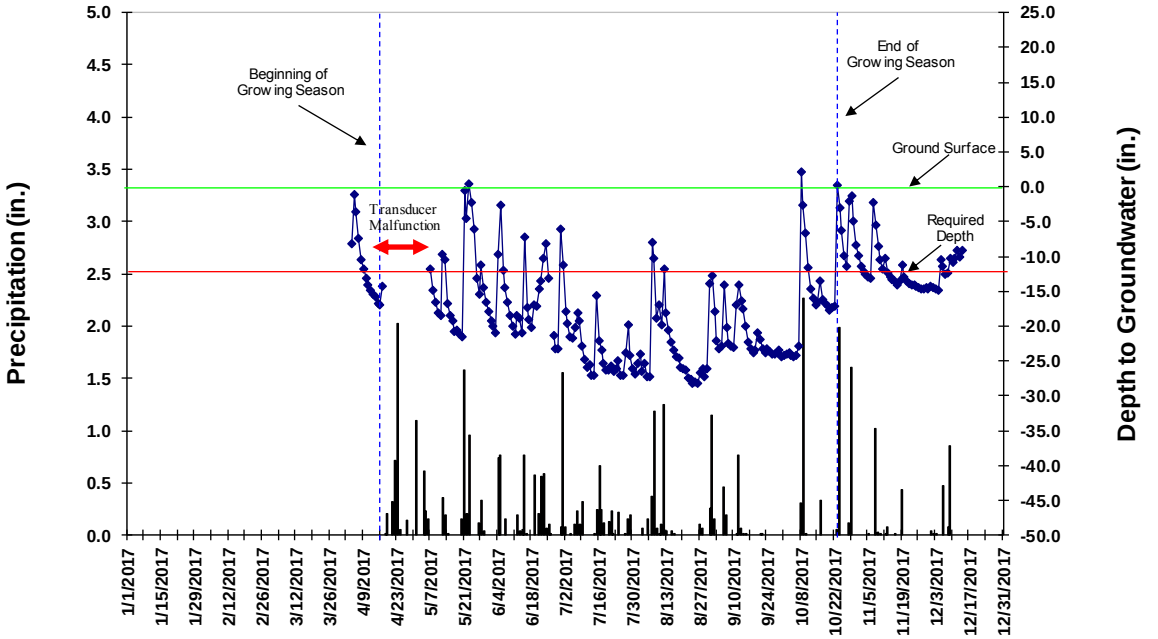
Percentage of Growing Season Water Table within 12 inches of Soil Surface: **10%**



Gauge ID: **H5**

Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **20**

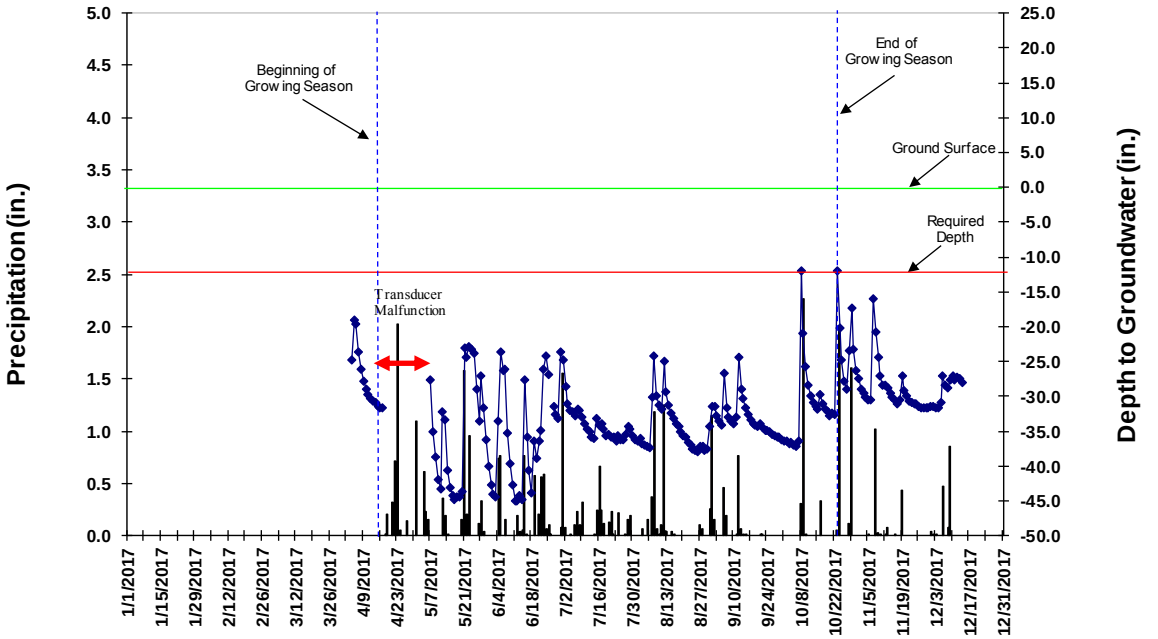
Percentage of Growing Season Water Table within 12 inches of Soil Surface: **10%**



Gauge ID: **H6**

Total Number of Consecutive Days Water Table within 12 inches of Soil Surface: **19**

Percentage of Growing Season Water Table within 12 inches of Soil Surface: **10%**



Appendix D FUNCTIONAL ASSESSMENT

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Harrell Creek Reach 1 (A)				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows		Normal baseflow	Springfed baseflow, forested watershed
	• Channel Forming Flows		$Q_{CHANNEL} = Q_{BANKFULL}$	Not entrenched.
	• Overbank Flooding		$Q_{OVERANK} = Q_{2\ YEAR}$	Not entrenched.
	• Hyporheic Flow		$DEPTH_{SUBSTRATE} < 0.4$ ft Head potentials exist	Appropriate voids within bed material; stream fed by seeps.
	• Groundwater		Stream surface water < 1 ft below terrace	Not entrenchment therefore no drawdown of adjacent groundwater.
Sediment Transport and Storage	• Bed Form Diversity		Riffle/pool form present; Pool spacing < 7•BKF	Riffle/pool steps evident along reach
	• Energy Management		$\tau_{BKF} > 0.5$ $\tau_{10\ YEAR} > 1.0$	Sediment moves through system appropriately; Normal shear stress levels
	• Sediment Continuity		BEHI = Moderate NBS = Very Low Low sediment load	Uniform sediment distribution throughout reach; no indications of excess scour/aggradation
	• Substrate Quality		D_{50} = 14 mm, D_{84} = 63 mm Elevated percentage of small gravel and fines	Past logging activies led to some excess fines in reach
Organic Material Transport and Storage	• Bed Form Diversity		Few LWD forced pools; Few wood complex riffles	Rock driven steeper reach; some organic material present
	• Energy Management		Few LWD Structures	Rock driven steeper reach; some organic material present but not contributing to energy management
	• Aquatic Habitat		Occasional Leaf packs; has organic storage potential but is not fully functioning	Few LWD or snags to trap organic material; past logging within the watershed
Natural Communities	• Temperature and Oxygen Regulation		Adequate shading; Adequate temperature	Canopy present; steeper reach with ample opportunity for oxygenation
	• Process Organic Matter and Nutrients		High Biomass	Forested watershed; adequate biomass input into food chain
	• Biodiversity		Native community	Appropriate native vegetation species present in both abundance and richness; minimal invasives
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width both banks > 200 ft;	Abundant riparian buffer on both banks; extends to edge of drainage area
	• Longitudinal Connectivity of biotic and abiotic process		U/s forest > 500 ft; D/s forest > 500 ft	Connected to Natahala NF u/s forested land-use; d/s connected to wetlands and forested left bank riparian corridor
	• Source and Sink for natural populations		Ample opportunity for population equilibrium	Existing native forest provides excellent seed source; optimum conditions for flora and fauna

Status Key: Optimal Suboptimal Marginal Poor

Harrell Creek Reach 1 (B)				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows		Normal baseflow	Springfed baseflow, forested watershed
	• Channel Forming Flows		$Q_{CHANNEL} >> Q_{BANKFULL}$	Entrenchment resulting in excessive storm flow disturbances
	• Overbank Flooding		$Q_{OVERANK} > Q_{5\ YEAR}$	Entrenchment severely limiting frequency of overbank flooding
	• Hyporheic Flow		$DEPTH_{SUBSTRATE} < 0.4$ ft Head potentials exist	Appropriate voids within stream bed.
	• Groundwater		Stream offset from valley; stream surface water 5 ft below terrace	Stream relocated out of valley; Entrenchment resulting in drawdown of adjacent groundwater.
Sediment Transport and Storage	• Bed Form Diversity		Riffle/pool form present; Pool spacing > 7•BKF	Oversteepened reach; elevated shear stress
	• Energy Management		$\tau_{BKF} > 0.6$ $\tau_{10\ YEAR} > 1.5$	Pipe within reach creates discontinuity; Entrenchment resulting in elevated shear stress
	• Sediment Continuity		Pipe present within reach	Pipe influencing sediment transport equilibriums
	• Substrate Quality		U/s of pipe: D_{50} = 3 mm, D_{84} = 9 mm; D/s of pipe: D50 = 15 mm, D84 = 45 mm; Deposition u/s, elevated scour d/s.	Pipe obstruction influencing substrate caliber
Organic Material Transport and Storage	• Bed Form Diversity		No LWD forced pools (1 LWD > 20 BKFs)	Limited opportunity for LWD contact
	• Energy Management		LWD Struct: 1 per >20 Bkf	Limited LWD supply from riparian area; some woody debris input from u/s
	• Aquatic Habitat		u/s of pipe: leaf packs present; d/s of pipe: organic material is scoured away	Limited LWD or snags to trap organic material; pipe influencing organic material presence
Natural Communities	• Temperature and Oxygen Regulation		Suboptimal shading; Adequate temperature	Canopy in reach is not as closed upstream; watershed is adequately shaded; steep reach with ample opportunity for oxygenation;
	• Process Organic Matter and Nutrients		High Biomass	Forested watershed; adequate biomass input into food chain
	• Biodiversity		Native community; some invasive vegetation	Appropriate native vegetation species present in both abundance and richness; presence of multiflora rose
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width Left > 200 ft; Buffer width Right ≈ 100 ft	LB buffer extends to edge of drainage area; RB suboptimal with logging road and residential disturbance within buffer
	• Longitudinal Connectivity of biotic and abiotic process		U/s forest > 500 ft; D/s forest > 500 ft	Connected to Natahala NF u/s forested land-use; d/s connected to wetlands and forested left bank riparian corridor
	• Source and Sink for natural populations		Ample opportunity for population equilibrium	Existing native forest provides excellent seed source; riparian zone includes some invasives; aquatic habitat is slightly degraded

Status Key: Optimal Suboptimal Marginal Poor

Harrell Creek Reach 1 (C)				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows		Normal baseflow	Springfed baseflow, forested watershed
	• Channel Forming Flows		$Q_{CHANNEL} = Q_{BANKFULL}$	Somewhat entrenched in locations
	• Overbank Flooding		$Q_{OVERANK} > Q_{2\ YEAR}$	Somewhat entrenched in locations
	• Hyporheic Flow		$DEPTH_{SUBSTRATE} > 0.5$ ft	Wetland is present adjacent to stream; hyporheic zone is continually saturated
	• Groundwater		Wetlands present	Wetland is present adjacent to stream; groundwater interaction is visible
Sediment Transport and Storage	• Bed Form Diversity		Limited Riffle/pool form	Reach is low gradient resulting in siltation and slackwater
	• Energy Management		Very low shear stress; aggradation	Energy is not being managed by sediment
	• Sediment Continuity		BEHI = Very Low NBS = Very Low Excess fines	Obstructions created by beavers limit continuity
	• Substrate Quality		$D_{50} < 0.05$mm, $D_{84} < 0.05$mm Elevated percentage of silt	Low gradient resulting in high percentages of fine sediments
Organic Material Transport and Storage	• Bed Form Diversity		No LWD forced pools; some LWD present	Stream flow is too slow for LWD to effect bedform
	• Energy Management		Abundant leaf packs; limited LWD	All roughness within channel comes from leaf packs
	• Aquatic Habitat		Abundant leaf packs and organic storage potential; limited LWD	Right bank riparian area has little forested area; limited LWD; other OM inputs present
Natural Communities	• Temperature and Oxygen Regulation		Partial shading; temperature regulated in upstream watershed	Overwidened channel with slow flow; little opportunity for oxygen incorporation within the reach; moderately open canopy
	• Process Organic Matter and Nutrients		Abundant leaf packs and adjacent wetlands present	Good source of OM; wetlands provide excellent nutrient processing
	• Biodiversity		Native community; some invasive vegetation; RB agriculture	LB is appropriate native community; presence of multiflora rose and microstegium; agriculture on RB
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width Left > 200 ft; Buffer width Right ≈ 20 ft	Connected to forested landuse on left bank; active agricultural land use on right bank
	• Longitudinal Connectivity of biotic and abiotic process		U/s forest > 500 ft; D/s forest > 500 ft (LB only)	Connected to Natahala NF u/s forested land-use; d/s connected to forested left bank riparian corridor; RB is agricultural
	• Source and Sink for natural populations		Ample opportunity for population equilibrium	Existing LB native forest provides excellent seed source; right bank is actively managed agricutural land
Status Key: Optimal Suboptimal Marginal Poor				

Harrell Creek Reach 1 (D)				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows		Normal baseflow	Forested watershed, springfed baseflow; wetlands adjacent to stream
	• Channel Forming Flows		$Q_{CHANNEL} = Q_{BANKFULL}$	Not entrenched
	• Overbank Flooding		$Q_{OVERANK} > Q_{2\ YEAR}$	Not entrenched
	• Hyporheic Flow		$DEPTH_{SUBSTRATE} > 0.5$ ft	Wetland is present adjacent to stream; hyporheic zone is continually saturated
	• Groundwater		Wetlands present	Wetland is present adjacent to stream; groundwater interaction is visible
Sediment Transport and Storage	• Bed Form Diversity		Limited Riffle/pool form	Reach is low gradient
	• Energy Management		$\tau_{BKF} > 0.6$ $\tau_{10\ YEAR} > 1.0$	Limited flood relieve resulting in elevated shear stress
	• Sediment Continuity		BEHI = Moderate NBS = Very Low Excess fines	Silty unconsolidated sediment present throughout reach
	• Substrate Quality		$D_{50} < 0.05$mm, $D_{84} < 0.05$mm Elevated percentage of silt	Low gradient resulting in high percentages of fine sediments
Organic Material Transport and Storage	• Bed Form Diversity		No LWD	Limited supply of LWD; active agriculture on RB
	• Energy Management		No LWD; vegetation growing in channel	Limited LWD supply from riparian area; some leaf packs
	• Aquatic Habitat		No LWD; vegetation growing in channel	Limited LWD supply from riparian area; some leaf packs
Natural Communities	• Temperature and Oxygen Regulation		Partial shading; temperature regulated in upstream watershed	Overwidened channel with slow flow; little opportunity for oxygen incorporation within the reach; moderately open canopy
	• Process Organic Matter and Nutrients		Adequate leaf packs and adjacent wetlands	Wetlands provide nutrient processing
	• Biodiversity		Early successional vegetation; some invasive vegetation; RB agriculture	LB is appropriate native community; presence of multiflora rose and microstegium; agriculture on RB
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width Left > 200 ft; Buffer width Right < 20 ft	Connected to forested landuse on left bank; active agricultural land use on right bank
	• Longitudinal Connectivity of biotic and abiotic process		U/s forest > 500 ft(LB only; D/s forest > 500 ft (LB only)	Connected to forested land u/s and d/s left bank riparian corridor; RB is agricultural
	• Source and Sink for natural populations		Ample opportunity for population equilibrium	Existing LB native forest provides excellent seed source; right bank is actively managed agricutural land

Status Key: Optimal Suboptimal Marginal Poor

Appendix E DESIGN CALCULATIONS

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1.0 Conceptual Design

Estimated Channel Values from Regional Curves

Design Status

Complete
1/18/19
RTS

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Hydro-Physio Province: NC Mountains

Regional Curve Equations

	Coefficient	Exponent
W_{BKF}:	17.36	0.3693
A_{BKF}:	18.559	0.6616
d_{MEAN}:	1.1771	0.2697
Q_{BKF}:	55.425	0.7874
W_{BED}:	12	0.45
d_{MAX}:	1.5	0.27

Approximate Equations

	Coefficient	Exponent	
W_{BKF}:	14.53496	0.39	(Not Used in Calculations)
d_{MAX}:	1.64794	0.27	(Not Used in Calculations)

Reach	Estimated Dimensions from Regional Curves								
	Drain. Area (mi^2)	W_{BKF} (ft)	A_{BKF} (ft^2)	d_{MEAN} (ft)	W_{BED} (ft)	d_{MAX} (ft)	Pool Spacing (ft)	Rc (ft)	Tangent Length (ft)
REACH 1A	0.05	5.7	2.6	0.5	3.1	0.7	29	11	11
REACH 1B	0.07	6.5	3.2	0.6	3.6	0.7	33	13	13
REACH 1C	0.16	8.8	5.5	0.7	5.3	0.9	44	18	18
REACH 1C - TRANSITION	0.16	8.8	5.5	0.7	5.3	0.9	44	18	18
REACH 1D	0.17	9.0	5.7	0.7	5.4	0.9	45	18	18

1.1 Reach Locations

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Reach	Existing Thalweg Stationing		Proposed Design Stationing		Description
	Begin	End	Begin	End	
REACH 1A	93+45	100+40	93+45	100+00	Preseravation u/s of CMP
REACH 1B	100+40	102+00	100+00	103+11	CMP to valley bottom
REACH 1C	102+00	115+00	103+11	115+30	Valley bottom to transition
REACH 1C - TRANSITION	115+00	115+72	115+30	115+78	Transition to end of restoration
REACH 1D	115+72	124+27	115+78	118+41	End of restoration to lower CMP

2.0 Discharge Calculations

Design Status
Complete
12/6/17
CME

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Estimated Discharges

Reach	Drainage Area (mi^2)	Bankfull (cfs)	2-yr (cfs)	5-yr (cfs)	10-yr (cfs)	50-yr (cfs)	100-yr (cfs)			
REACH 1A	0.05	5	N/A	22	29	55	67			
REACH 1B	0.07	7	N/A	28	38	73	88			
REACH 1C	0.16	13	N/A	56	75	142	172			
REACH 1C - TRANSITION	0.16	13	N/A	56	75	142	172			
REACH 1D	0.17	14	N/A	58	79	150	181			

2.1 Discharge Calculation Input

Discharge Method Used: NCDOT Rural Equations

Hydro-Physio Province: NC Mountains

NCDOT Rural Equations

Hydrologic Contour:	8.00
Watershed Length:	N/A
Watershed Width:	N/A
Percent Forest:	95

Regional Regression Equations

Event	Coef	Exp
2-yr	135	0.702
5-yr	242	0.677
10-yr	334	0.662
25-yr	476	0.645
50-yr	602	0.635
100-yr	745	0.625
200-yr	908	0.616
500-yr	1160	0.605

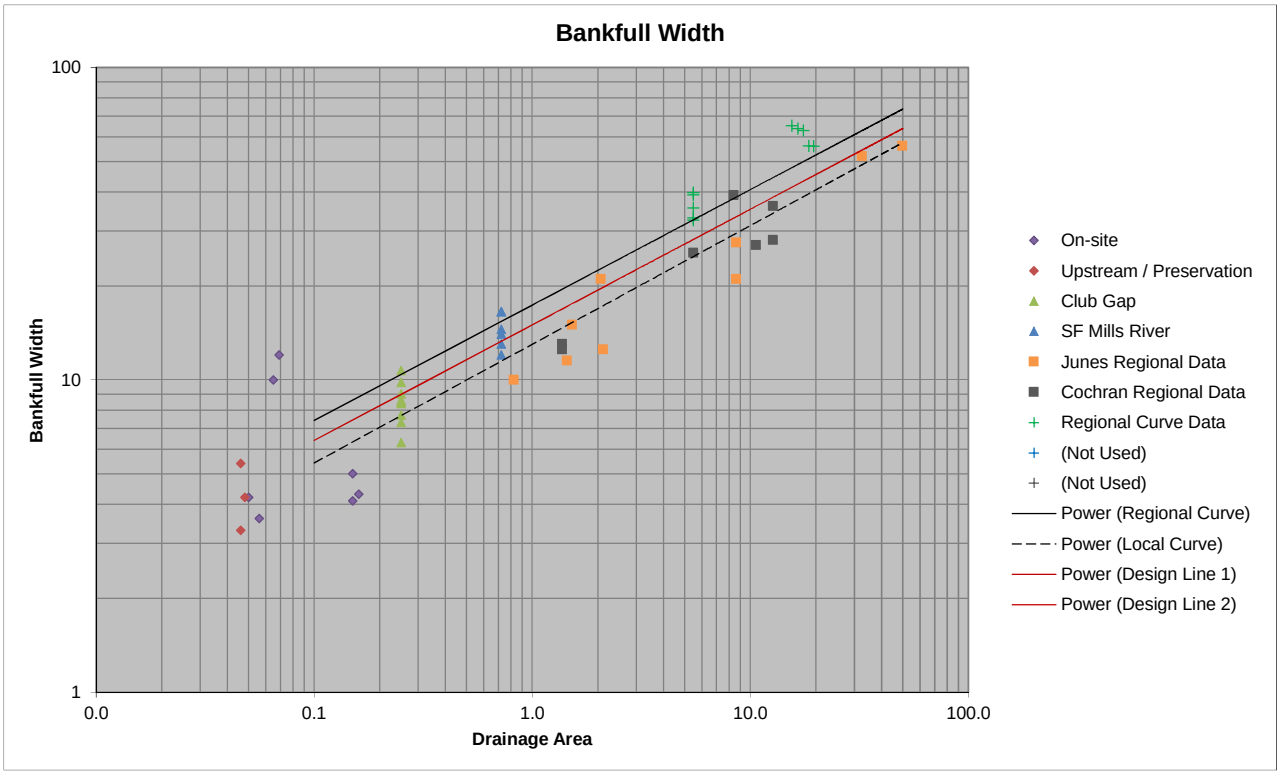
Bankfull Regional Equation

Event	Coef	Exp
Bankfull	55.425	0.7874

3.0 Hydraulic Geometry

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Design Status
Complete
1/18/19
RTS

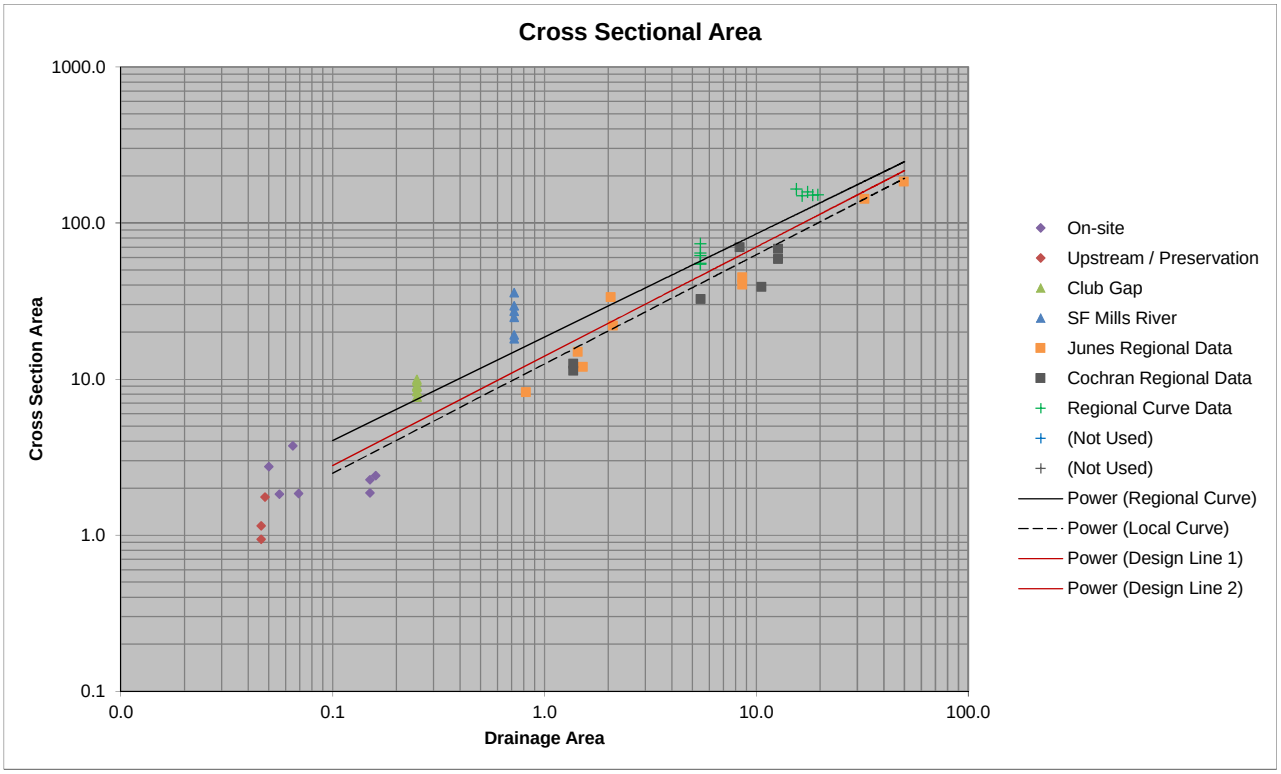


Design Equations

	Coef	Exp
Design Line 1 :	15.0	0.37
Design Line 2 :		

Regional Regression Equations

	Coef	Exp	
Regional Curve :	17.4	0.37	(NC Mountains)
Watershed Curve :	13.0	0.38	



Design Equations

	Coef	Exp
Design Line 1 :	14.0	0.70
Design Line 2 :		

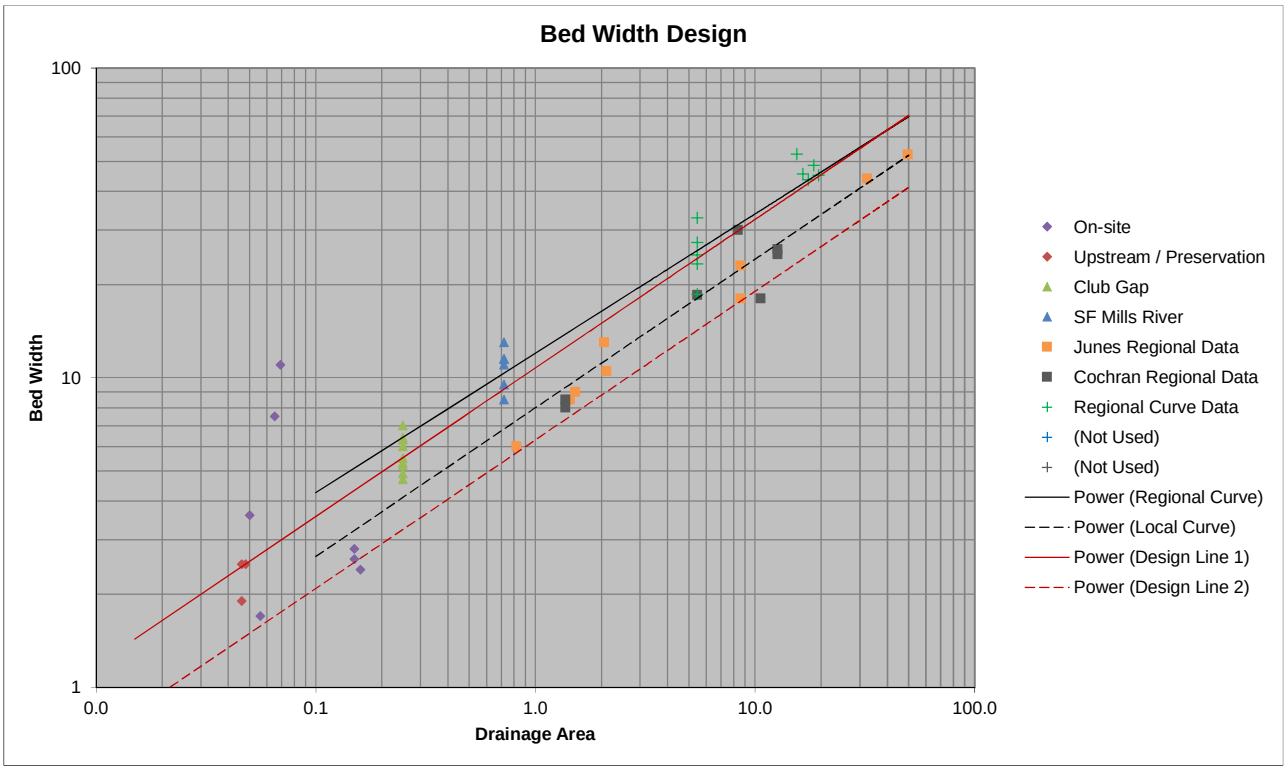
Regional Regression Equations

	Coef	Exp	
Regional Curve :	18.6	0.66	(NC Mountains)
Watershed Curve :	12.5	0.70	

3.1 Hydraulic Geometry

Design Status
Complete
1/18/19
RTS

Project: Harrell Mitigation Project
Project No.: 1.73E+08
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

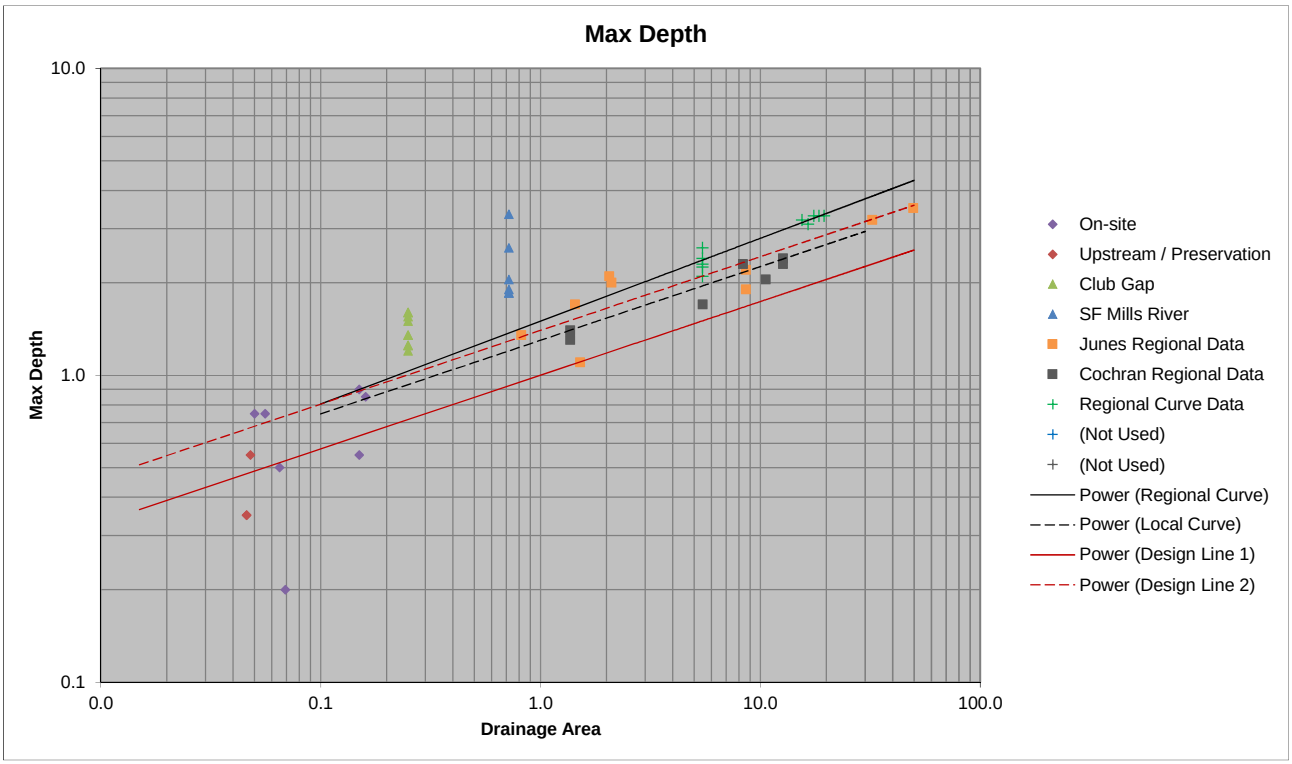


Design Equations

	Coef	Exp
Design Line 1 :	10.8	0.48
Design Line 2 :	6.3	0.48

Regional Regression Equations

	Coef	Exp	
Regional Curve :	12.0	0.45	(NC Mountains)
Watershed Curve :	8.0	0.48	



Design Equations

	Coef	Exp
Design Line :	1.0	0.24

Regional Regression Equations

	Coef	Exp	
Regional Curve :	1.5	0.27	(NC Mountains)
Watershed Curve :	1.3	0.24	

4.0 Sediment Regime

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Design Status
Complete
12/6/17
RTS

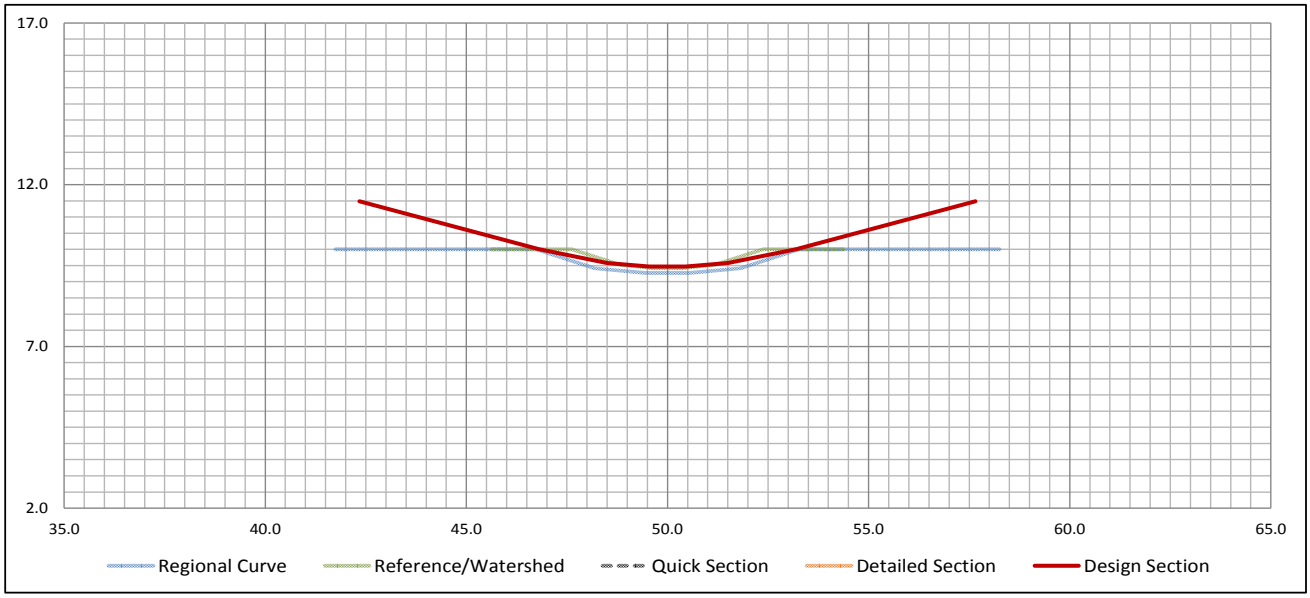
Reach	QS-2	QS-4	QS-5				
Bed Material Nature							
Depth of Bed Probe (ft)	0.3	0.3	0.3				
Matrix Bonding	Moderate	Moderate	Moderate				
Parent Material Exposure	Yes	Yes	Yes				
Well Graded	No	No	No				
Depositional Patterns							
Point Bars	None	Minimal	Minimal				
Mid-channel Bars	None	None	None				
Side-channel Bars	None	Minimal	Minimal				
Diagonal Bars	None	None	None				
Bar Length/W_{BED}	N/A	1 - 1.5	1 - 1.5				
Dune Presentation of Bars	None	None	None				
Channel Branching	None	None	None				
Tributary Deltas	None	None	None				
Dune Length/Height (ft)	N/A	N/A	N/A				
Ripple Length/Height (ft)	N/A	N/A	N/A				
Sediment Measurements							
Pebble Count (Riffle) % Sand							
D_{50}	14	20	20				
D_{84}	63	120	120				
D_{95}							
Pebble Count (Reach) % Sand							
D_{50}							
D_{84}							
D_{95}							
Bar Sample % Sand							
D_{50}							
D_{84}							
D_{95}							
D_{MAX}							
Bed Sample % Sand							
D_{50}		20	20				
D_{84}		120	120				
D_{95}							
Sediment Regime							
Sediment Load	Low	Low	Low				
Sediment Mobility	Mod.Low	Mod.Low	Mod.Low				

5.0 Design Section 1

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Design Status

Complete
1/18/19
CME



Design Section

	Coef	Exp	
W_{BED}	10.75	0.48	
d_{MAX}	1.00	0.24	
Bank Slope	4.0	(H:1)	
Thalweg Ratio	0.3		
Toe Depth Ratio	0.8		
Bench Width Ratio	0.7		
Bench Slope	3	(H:1)	
Drainage Area	0.07	(sq. mi.)	

Point of Comparison
0%

Section Comparisons

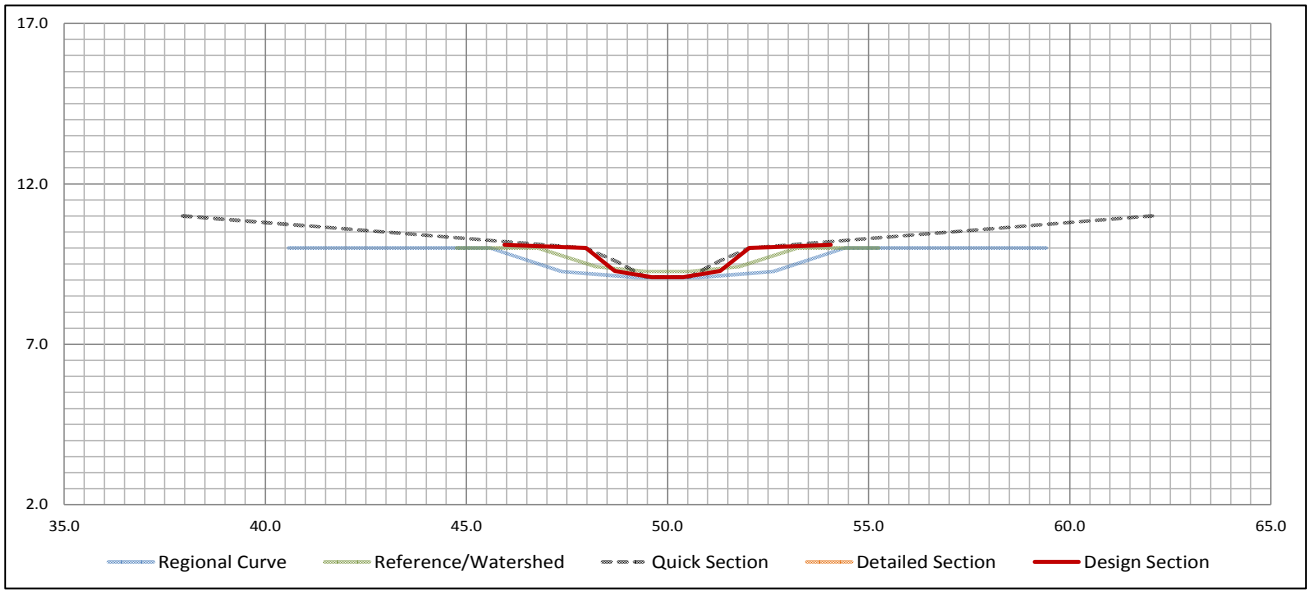
	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
W_{BKF}	6.5	4.7	0.0	0.0	6.4
	98%	135%	#DIV/0!	#DIV/0!	
W_{BED}	3.6	2.4	0.0		3.0
	83%	125%	#DIV/0!		
W_{THL}	1.1	0.7	0.0		0.9
	83%	125%	#DIV/0!		
d_{MAX}	0.7	0.6	0.0	0.0	0.5
	72%	90%	#DIV/0!	#DIV/0!	
d_{TOE}	0.6	0.5	0.0		0.4
	72%	90%	#DIV/0!		
A_{BKF}	3.2	1.9	0.0		2.2
	68%	116%	#DIV/0!	#VALUE!	
d_{MEAN}	0.49	0.40	#DIV/0!		0.34
	70%	86%	#DIV/0!	#VALUE!	
P	6.7	4.9	0.0		6.5
	96%	132%	#DIV/0!	#VALUE!	
Hydr. R	0.47	0.38	#DIV/0!		0.34
	71%	88%	#DIV/0!	#VALUE!	
W/d Ratio	13.2	11.9	#DIV/0!		18.6
	141%	157%	#DIV/0!	#VALUE!	

5.1 Design Section 2

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Design Status

Complete
1/18/2019
CME



Design Section

	Coef	Exp	
W_{BED}	6.30	0.48	
d_{MAX}	1.40	0.24	
Bank Slope	1.0	(H:1)	
Thalweg Ratio	0.3		
Toe Depth Ratio	0.8		
Bench Width Ratio	0.5		
Bench Slope	20	(H:1)	
Drainage Area	0.16	(sq. mi.)	

Point of Comparison
0%

Section Comparisons

	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
W_{BKF}	8.8	6.5	4.1	0.0	4.1
	46%	63%	99%	#DIV/0!	
W_{BED}	5.3	3.5	2.6		2.6
	50%	74%	101%		
W_{THL}	1.6	1.1	1.1		0.8
	50%	74%	71%		
d_{MAX}	0.9	0.7	0.9	0.0	0.9
	99%	123%	100%	#DIV/0!	
d_{TOE}	0.7	0.6	0.4		0.7
	99%	123%	180%		
A_{BKF}	5.5	3.3	2.3		2.7
	49%	82%	120%	#VALUE!	
d_{MEAN}	0.63	0.51	0.55		0.67
	107%	131%	121%	#VALUE!	
P	9.1	6.7	4.6		4.7
	51%	70%	102%	#VALUE!	
Hydr. R	0.60	0.49	0.49		0.58
	96%	118%	118%	#VALUE!	
W/d Ratio	14.1	12.7	7.4		6.1
	43%	48%	82%	#VALUE!	

6.0 Typical Section Dimensions

Design Status

Complete
1/18/19
CME

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Reach	Drainage Area (mi^2)	Design Section	W_{BKF}	W_{BED}	W_{THAL}	W_{BENCH}	d_{MAX}	d_{TOE}	Bank Slope (H:1)
REACH 1A	0.05	1	5.7	2.6	0.8	4	0.49	0.39	4
REACH 1B	0.07	1	6.4	3.0	0.9	4	0.53	0.42	4
REACH 1C	0.16	2	4.1	2.6	0.8	2	0.90	0.72	1
REACH 1C - TRANSITION	0.16	1	8.6	4.5	1.3	6	0.64	0.52	4
REACH 1D	0.17	2	4.2	2.7	0.8	2	0.92	0.73	1

Reach	Pool Dimensions				
	Width Ratio	W_{IN}	W_{OUT}	d_{POOL}/d_{MAX} Ratio	d_{POOL}
REACH 1A	1.1	3.4	2.8	1.5	0.73
REACH 1B	1.1	3.8	3.2	1.5	0.79
REACH 1C	1.1	2.4	2.0	1.5	1.35
REACH 1C - TRANSITION	1.1	5.1	4.3	1.5	0.97
REACH 1D	1.1	2.5	2.1	1.5	1.37

6.1 Hydraulic Dimensions

Design Status

Complete
1/18/19
CME

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Reach	Stream Type	A_{BKF}	P_{WET}	R_{HYD}	d_{MEAN}	W/D Ratio	Entrench Ratio
REACH 1A	B	1.8	5.8	0.31	0.31	18.2	1.2
REACH 1B	B	2.2	6.5	0.34	0.34	18.6	2.7
REACH 1C	E	2.7	4.7	0.58	0.67	6.1	8.6
REACH 1C - TRANSITION	B	3.7	8.7	0.43	0.44	19.7	4.1
REACH 1D	E	2.8	4.8	0.59	0.68	6.1	8.4

6.2 Morphologic Dimensions

Reach	Pool Spacing/W_{AVG}			Pool Spacing				Belt Width	
	min	target	max	min	target	max	min	target	max
REACH 1A	2.3	3.0	3.8	9.4	**12.5**	15.6	6.2	**8.2**	10.3
REACH 1B	2.3	3.0	3.8	10.7	**14.3**	17.8	7.0	**9.4**	11.7
REACH 1C	4.0	5.0	6.0	13.3	**16.7**	20.0	6.7	**13.3**	16.7
REACH 1C - TRANSITION	1.3	1.7	2.1	8.2	**10.9**	13.6	9.8	**13.0**	16.3
REACH 1D	4.0	5.0	6.0	13.7	**17.1**	20.5	6.8	**13.7**	17.1

7.0 Competence Calculations

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Design Status
Complete
1/18/19
RTS

Reach	Hydraulic Radius (ft)	Largest Particle Calculations				Representative Particle Calculations			
		τ*	γ_s	D_{MAX} (mm)	S (ft/ft)	τ*	γ_s	D_{50} (mm)	S (ft/ft)
REACH 1A	0.31	0.040	1.65	120	0.0851	0.100	1.65	20	0.0355
REACH 1B	0.34	0.040	1.65	0	0.0000	0.045	1.65	20	0.0145
REACH 1C	0.58	0.040	1.65	0	0.0000	0.045	1.65	20	0.0084
REACH 1C - TRANSITION	0.43	0.040	1.65	0	0.0000	0.045	1.65	20	0.0114
REACH 1D	0.59	0.040	1.65	0	0.0000	0.045	1.65	20	0.0083

Reach	Calculation Method	Sediment Load	Percent Calculated Slope		Design Slope Range (ft/ft)		
			Min	Max			
REACH 1A	Representative Particle	Low	80%	100%	0.0284	to	0.0355
REACH 1B	Representative Particle	Low	80%	100%	0.0116	to	0.0145
REACH 1C	Representative Particle	Low	80%	100%	0.0067	to	0.0084
REACH 1C - TRANSITION	Representative Particle	Low	80%	100%	0.0091	to	0.0114
REACH 1D	Representative Particle	Low	80%	100%	0.0066	to	0.0083

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Hydraulic Analysis Report

Project Data

Project Title:

Designer:

Project Date: Monday, August 13, 2018

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Reach 1B-HW TRT(NCDOT RUAL)5yr s0.23

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
-11.20	2.86	0.0497
-7.20	1.86	0.0497
-3.20	0.42	0.0497
-1.50	0.11	0.0497
-0.45	0.00	0.0497
0.45	0.00	0.0497
1.50	0.11	0.0497
3.20	0.42	0.0497
7.20	1.86	0.0497
11.20	2.86	-----

Longitudinal Slope: 0.2300 ft/ft

Lining Type: Rock Riprap - 300 mm (12-inch)

Flow: 28.0000 cfs

Result Parameters

Depth: 0.6664 ft

Area of Flow: 3.4174 ft^2

Wetted Perimeter: 7.9226 ft

Hydraulic Radius: 0.4313 ft

Average Velocity: 8.1935 ft/s

Top Width: 7.7691 ft

Froude Number: 2.1771

Critical Depth: 0.9817 ft

Critical Velocity: 4.5581 ft/s

Critical Slope: 0.0432 ft/ft

Critical Top Width: 9.52 ft

Calculated Max Shear Stress: 9.5646 lb/ft^2

Calculated Avg Shear Stress: 6.1906 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0497

Hydraulic Analysis Report

Project Data

Project Title:

Designer:

Project Date: Monday, August 13, 2018

Project Units: U.S. Customary Units

Notes:

Channel Lining Analysis: Channel Lining Design Analysis

Notes:

Lining Input Parameters

Channel Lining Type: Riprap, Cobble, or Gravel

D50: 1 ft

Riprap Specific Weight: 165 lb/ft^3

Water Specific Weight: 62.4 lb/ft^3

Riprap Shape is Angular

Safety Factor: 1

Calculated Safety Factor: 1.44562

Lining Results

Angle of Repose: 41.7 degrees

Relative Flow Depth: 0.439868

Manning's n method: Bathurst

Manning's n: 0.0496104

Channel Bottom Shear Results

V*: 2.22162

Reynold's Number: 182549

Shield's Parameter: 0.138766

shear stress on channel bottom: 9.56465 lb/ft^2

Permissible shear stress for channel bottom: 14.2374 lb/ft^2

channel bottom is stable

Stable D50: 0.971166 ft

Channel Lining Stability Results

the channel is stable

Channel Summary

Name of Selected Channel: Reach 1B-HW TRT(NCDOT RUAL)5yr s0.23

Hydraulic Analysis Report

Project Data

Project Title:

Designer:

Project Date: Monday, August 13, 2018

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Reach 1C HW TRT-5yrs0.146

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
-14.20	2.50	0.0479
-10.20	1.50	0.0479
-4.30	0.64	0.0479
-2.25	0.12	0.0479
-0.65	0.00	0.0479
0.65	0.00	0.0479
2.25	0.12	0.0479
4.30	0.64	0.0479
10.20	1.50	0.0479
14.20	2.50	-----

Longitudinal Slope: 0.1460 ft/ft

Lining Type: Rock Riprap - 300 mm (12-inch)

Flow: 70.0000 cfs

Result Parameters

Depth: 1.0706 ft

Area of Flow: 8.7289 ft^2

Wetted Perimeter: 14.7092 ft

Hydraulic Radius: 0.5934 ft

Average Velocity: 8.0193 ft/s

Top Width: 14.5079 ft

Froude Number: 1.8219

Critical Depth: 1.4000 ft

Critical Velocity: 4.9112 ft/s

Critical Slope: 0.0408 ft/ft

Critical Top Width: 19.03 ft

Calculated Max Shear Stress: 9.7534 lb/ft^2

Calculated Avg Shear Stress: 5.4064 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0500

Hydraulic Analysis Report

Project Data

Project Title:

Designer:

Project Date: Monday, August 13, 2018

Project Units: U.S. Customary Units

Notes:

Channel Lining Analysis: Channel Lining Design Analysis

Notes:

Lining Input Parameters

Channel Lining Type: Riprap, Cobble, or Gravel

D50: 1.1 ft

Riprap Specific Weight: 165 lb/ft^3

Water Specific Weight: 62.4 lb/ft^3

Riprap Shape is Angular

Safety Factor: 1

Calculated Safety Factor: 1.50016

Lining Results

Angle of Repose: 41.9 degrees

Relative Flow Depth: 0.569019

Manning's n method: Bathurst

Manning's n: 0.0561532

Channel Bottom Shear Results

V*: 2.3012

Reynold's Number: 207996

Shield's Parameter: 0.15

shear stress on channel bottom: 10.2621 lb/ft^2

Permissible shear stress for channel bottom: 16.929 lb/ft^2

channel bottom is stable

Stable D50: 1.00031 ft

Channel Lining Stability Results

the channel is stable

Channel Summary

Name of Selected Channel: Reach 1C HW TRT-5yrs0.146

10.0 Transition Reach Design

Project: Harrell Mitigation Project
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Design Status
Complete
1/18/19
RTS

Stone Specification:	NCDOT

Stone Class	Nominal Size (in)	D50 (mm)
Class A	6	118
Class B	12	219
Class I	18	247
Class II	24	350

Reach	Location	Design Discharge (cfs)	Transition Slope (ft/ft)	Design Size (mm)	Selected Stone D_{50} (mm)	Shear Factor of Safety	Nominal Stone Size (in)	Armor Stone Class
REACH 1B	100+40.4	73	0.22	475	350	0.0	24	N/A
REACH 1C - TRANSITION	115+30	142	0.15	488	350	0.0	24	N/A

11.3 Supplemental Bed Material Design

Project: Harrell Mitigation Project **(With Harvested Bed Material)**
Project No.: 172621094
Client: EW Solutions, Inc.
Contract No.: 100005
County/State: Jackson Co, NC

Design Status
Not Required

Material Composition							
Reach	ON-SITE HARVEST MATERIAL	1/2" STONE (NO. 57)	3/4" STONE (NO. 5)	2" STONE (SURGE)	6" STONE NCDOT (CLASS A)	12" STONE NCDOT (CLASS B)	Depth of Material (ft)
REACH 1A	-						
REACH 1B	100%						1
REACH 1C	100%						0.5
REACH 1D	100%						0.5

Design Size Distribution (mm)						
Reach	D_{16}	D_{35}	D_{50}	D_{65}	D_{84}	D_{95}
REACH 1A	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
REACH 1B	5	13	19	24	34	45
REACH 1C	5	13	19	24	34	45
REACH 1D	5	13	19	24	34	45

Summary

Stream:	Club Gap
Watershed:	Forested
Location:	Pink Beds
Latitude:	35.35151
Longitude:	82.77590
State:	North Carolina
County:	Transylvania
Date:	April 1, 2014
Observers:	Grant Ginn, Chris Engle, Ryan Stokes
Channel type:	E4
Drainage area (sq.mi.):	0.25
notes:	---

Dimension		bankfull channel typical	min	max
floodplain:	width flood prone area (ft)	32.2	25.0	40.0
	low bank height (ft)	1.4	1.1	1.8
riffle-run:	x-area bankfull (sq.ft.)	8.8	7.7	10.0
	width bankfull (ft)	8.5	6.3	10.7
	width bed (ft)	5.70	4.7	7.0
	width thalweg (ft)	1.4	1.1	1.7
	depth bankfull (ft)	1.1	1.0	1.2
	depth thalweg (ft)	0.3	0.2	0.5
	max depth (ft)	1.4	1.2	1.6
pool:	x-area pool (sq.ft.)	9.7	8.3	11.8
	width bankfull (ft)	8.3	6.4	9.3
	width bed (ft)	5.0	2.5	6.5
	width thalweg (ft)	1.5	1.0	2.0
	depth bankfull (ft)	1.0	1.0	1.2
	depth thalweg (ft)	0.6	0.6	0.8
	max depth pool (ft)	1.6	1.5	1.8
dimensionless ratios:		typical	min	max
riffle-run:	width depth ratio	8.4	5.2	10.5
	bank height ratio	1.0	0.8	1.1
	entrenchment ratio	3.5	2.3	4.8
	riffle max depth ratio	1.3	1.3	1.5
pool:	width depth ratio	7.3	4.4	9.7
	bank height ratio	0.9	0.7	0.9
	entrenchment ratio	4.4	3.8	4.8
	pool max depth ratio	1.7	1.3	2.1

Pattern	typical	min	max
meander length (ft)	41.0	25.0	56.0
belt width (ft)	33.0	20.0	53.0
amplitude (ft)			
radius (ft)	11.2	7.5	15.0
arc angle (degrees)			
stream length (ft)	200.0		
valley length (ft)	123.0		
Sinuosity	1.63		
Meander Length Ratio	2.0	1.2	2.7
Meander Width Ratio	1.6	1.0	2.6
Radius Ratio	0.5	0.4	0.7

Summary

Stream:	Club Gap
Watershed:	Forested
Location:	Pink Beds
Latitude:	35.35151
Longitude:	82.77590
State:	North Carolina
County:	Transylvania
Date:	April 1, 2014
Observers:	Grant Ginn, Chris Engle, Ryan Stokes
Channel type:	E4
Drainage area (sq.mi.):	0.25
notes:	---

Profile

	typical	min	max
pool-pool spacing (ft)	32.4	17.0	51.0
riffle length (ft)	6.6	10.0	4.0
pool length (ft)	15.2	3.0	23.0
run length (ft)	5.8	4.0	11.0
glide length (ft)	6.4	3.0	10.0
channel slope (%)	0.84		
riffle slope (%)	2.2	0.9	4.0
pool slope (%)	2.0	0.3	3.2
run slope (%)	0.7	0.1	1.6
glide slope (%)	0.9	0.4	2.0
measured valley slope (%)	3		
valley slope from sinuosity (%)	1.4		
Riffle Length Ratio	0.3	0.5	0.2
Pool Length Ratio	0.7	0.1	1.1
Run Length Ratio	0.3	0.2	0.5
Glide Length Ratio	0.3	0.1	0.5
Riffle Slope Ratio	1.9	1.5	4.6
Pool Slope Ratio	0.5	0	0.6
Run Slope Ratio	1.2	5.3	7.5
Glide Slope Ratio	1.2	0.3	0.4
Pool Spacing Ratio	1.6	0.8	2.5

Channel Materials	Riffle Surface	Sub Pavement	BkF Channel
D16 (mm)	0.25	7.2	0.92
D35 (mm)	8	32	13
D50 (mm)	13	50	17
D65 (mm)	17	70	20
D84 (mm)	22	92	33
D95 (mm)	37	110	58
mean (mm)	2.3		5.5
dispersion	26.8		10.2
skewness	-0.5		-0.4
Shape Factor			
% Silt/Clay	1%	0%	0%
% Sand	29%	100%	17%
% Gravel	69%	0%	79%
% Cobble	0%	0%	3%
% Boulder	0%	0%	0%
% Bedrock	1%		
% Clay Hardpan			
% Detritus/Wood			
% Artificial			
Largest Mobile (mm)			

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Club Gap
Reach: Pink Beds

Date: 4/8/14
Observers: gg ,ce, rs
Page: 1

Observed Values

Section Number	1	2	3	4	5	6	7
Reach Name	Trib	Trib	Trib	Trib	Trib	Trib	Trib
Location	Riff 1	Pool 1	Riff 2	Pool 2	Pool 2.1	Riff 3	Pool 3
D_A (mi^2)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
W_{BKF} (ft)	9.8	8.7	10.7	6.4	8.4	9.0	9.0
W_{BED} (ft)	7.0	5.7	5.3	4.4	5.5	4.7	2.5
D_{BKF} (ft)	1.0	1.0	1.1	1.2	1.0	1.0	1.0
$D_{TOE\ LT}$ (ft)	-0.1	0.5	0.1	0.5	0.0	0.0	0.5
$D_{TOE\ RT}$ (ft)	-0.2	0.1	0.0	0.4	0.3	0.1	0.5
Field D_{THAL} (ft)	0.3	0.6	0.2	0.6	0.6	0.3	0.6
W_{THAL} (ft)	1.2	1.5	1.3	1.5	1.6	1.2	1.0
Bank/Terrace Height (ft)	1.1	1.4	1.8	1.5	1.1	1.4	1.3
Flood Prone Width (ft)	30	30	25	40	40	30	40

Section Calculations

D_{MAX}	1.25	1.53	1.20	1.82	1.56	1.25	1.55
Average D_{TOE}	0.88	1.23	1.09	1.65	1.13	1.03	1.40
D_{THAL}	0.38	0.30	0.11	0.17	0.43	0.23	0.15
A_{BKF}	8.9	9.9	9.1	9.4	9.4	7.7	8.3
D_{MEAN}	0.91	1.14	0.85	1.47	1.12	0.85	0.92
W/D ratio	10.8	7.6	12.6	4.4	7.5	10.5	9.7
Bank Height Ratio	0.9	0.9	1.5	0.8	0.7	1.1	0.8
Entrenchment Ratio	3.1	3.4	2.3	6.3	4.8	3.3	4.4

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

Coef	Exp
1.5	0.27

Reference Bed Width	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Bed Width Index (BWI)	1.1	0.9	0.8	0.7	0.9	0.7	0.4
Reference D_{MAX}	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Max Depth Index (MDI)	1.2	1.5	1.2	1.8	1.5	1.2	1.5

Stream Classification

Stream Type	E	E	E	E	E	E	E

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Club Gap
Reach: Pink Beds

Date: 4/8/14
Observers: gg ,ce, rs
Page: 1

Observed Values

Section Number	8	9	10	11	12	13	14
Reach Name	Trib	Trib	Trib	Trib	Trib	Trib	Trib
Location	Riff 4	Riff 4	Riff 4	Pool 4	Riff 5	Riff 5	Pool 5
D_A (mi^2)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
W_{BKF} (ft)	7.3	6.3	7.7	9.1	8.6	8.5	7.5
W_{BED} (ft)	5.5	4.9	5.2	5.0	6.3	6.4	5.5
D_{BKF} (ft)	1.1	1.1	1.2	1.0	1.0	1.0	1.1
$D_{TOE\ LT}$ (ft)	0.5	0.3	0.4	0.0	0.1	0.0	-0.1
$D_{TOE\ RT}$ (ft)	-0.4	-0.2	0.0	0.5	-0.3	-0.2	0.0
Field D_{THAL} (ft)	0.5	0.5	0.4	0.7	0.4	0.4	0.6
W_{THAL} (ft)	1.5	1.7	1.5	1.0	1.2	1.1	1.6
Bank/Terrace Height (ft)	1.6	1.3	1.6	1.5	1.4	1.5	1.5
Flood Prone Width (ft)	25	25	25	35	30	30	30

Section Calculations

D_{MAX}	1.60	1.55	1.60	1.70	1.35	1.35	1.65
Average D_{TOE}	1.18	1.13	1.40	1.23	0.89	0.90	1.08
D_{THAL}	0.43	0.43	0.20	0.48	0.47	0.45	0.58
A_{BKF}	9.0	7.7	9.7	10.1	8.3	8.4	9.0
D_{MEAN}	1.23	1.22	1.26	1.11	0.97	0.99	1.20
W/D ratio	5.9	5.2	6.1	8.2	8.9	8.6	6.2
Bank Height Ratio	1.0	0.8	1.0	0.9	1.0	1.1	0.9
Entrenchment Ratio	3.4	4.0	3.2	3.8	3.5	3.5	4.0

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

Coef	Exp
1.5	0.27

Reference Bed Width	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Bed Width Index (BWI)	0.9	0.8	0.8	0.8	1.0	1.0	0.9
Reference D_{MAX}	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Max Depth Index (MDI)	1.6	1.5	1.6	1.6	1.3	1.3	1.6

Stream Classification

Stream Type	E	E	E	E	E	E	E

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: Club Gap
Reach: Pink Beds

Date: 4/8/14
Observers: gg ,ce, rs
Page: 1

Observed Values

Section Number	15	16					
Reach Name	Trib	Trib					
Location	Riff 6	Pool 6					
D_A (mi^2)	0.25	0.25					
W_{BKF} (ft)	8.4	9.3					
W_{BED} (ft)	6.0	6.5					
D_{BKF} (ft)	1.1	1.0					
$D_{TOE\ LT}$ (ft)	0.0	0.4					
$D_{TOE\ RT}$ (ft)	0.4	0.3					
Field D_{THAL} (ft)	0.4	0.8					
W_{THAL} (ft)	1.5	2.0					
Bank/Terrace Height (ft)	1.3	1.6					
Flood Prone Width (ft)	40	40					

Section Calculations

D_{MAX}	1.50	1.70					
Average D_{TOE}	1.27	1.25					
D_{THAL}	0.24	0.45					
A_{BKF}	10.0	11.8					
D_{MEAN}	1.19	1.27					
W/D ratio	7.1	7.3					
Bank Height Ratio	0.9	0.9					
Entrenchment Ratio	4.8	4.3					

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

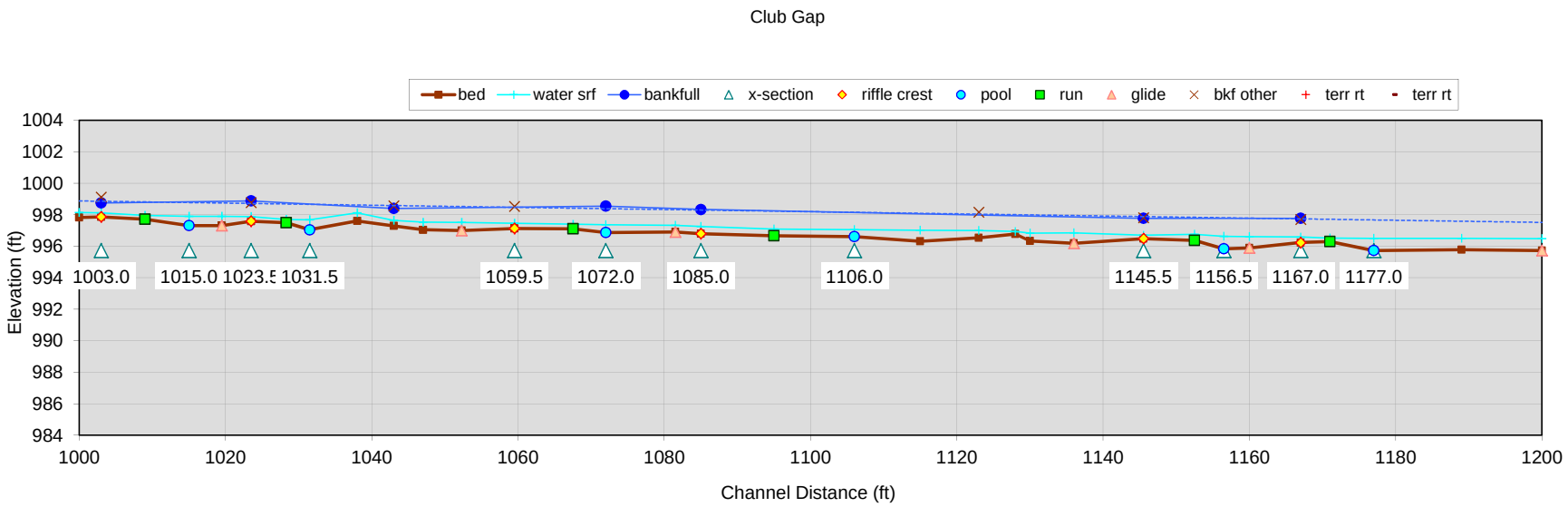
Coef	Exp
1.5	0.27

Reference Bed Width	6.4	6.4					
Bed Width Index (BWI)	0.9	1.0					
Reference D_{MAX}	1.0	1.0					
Max Depth Index (MDI)	1.5	1.6					

Stream Classification

Stream Type	E	E					

Longitudinal Slope Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	0.84	---	1200.0 (58.8 channel widths)	---	---	---
riffle	2.2 (0.9 - 4)	2.6 (1.1 - 4.8)	6.6 (4 - 10)	0.3 (0.2 - 0.5)	---	---
pool	2 (0.3 - 3.2)	2.4 (0.4 - 3.8)	15.2 (3 - 23)	0.7 (0.1 - 1.1)	32.4 (17 - 51)	1.6 (0.8 - 2.5)
run	0.7 (0.1 - 1.6)	0.8 (0.1 - 1.9)	5.8 (4 - 11)	0.3 (0.2 - 0.5)	---	---
glide	0.9 (0.4 - 2)	1.1 (0.5 - 2.4)	6.4 (3 - 10)	0.3 (0.1 - 0.5)	---	---

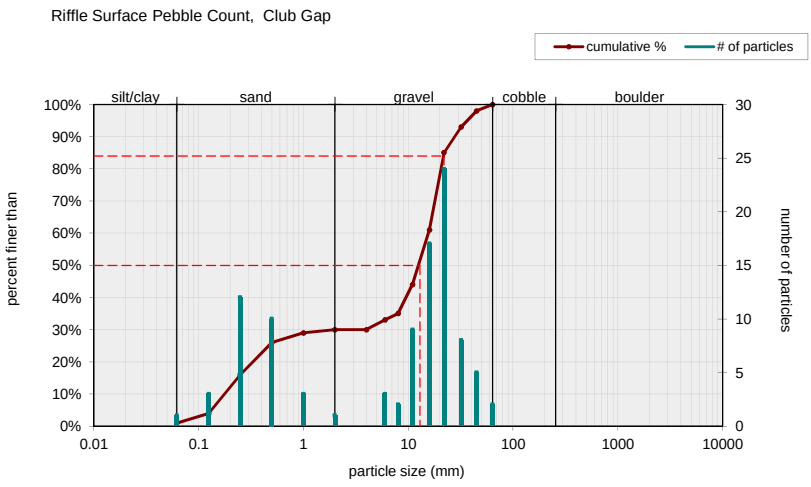
1) Individual Pebble Count

Two individual samples may be entered below. Select sample type for each.

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	3
fine sand	0.125 - 0.25	12
medium sand	0.25 - 0.5	10
coarse sand	0.5 - 1	3
very coarse sand	1 - 2	1
very fine gravel	2 - 4	
fine gravel	4 - 6	3
fine gravel	6 - 8	2
medium gravel	8 - 11	9
medium gravel	11 - 16	17
coarse gravel	16 - 22	24
coarse gravel	22 - 32	8
very coarse gravel	32 - 45	5
very coarse gravel	45 - 64	2
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		100
bedrock	----------	1
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		101

Note:



Size (mm)	
D16	0.25
D35	8
D50	13
D65	17
D84	22
D95	37

Size Distribution	
mean	2.3
dispersion	26.8
skewness	-0.53

Type			
silt/clay	1%	bedrock	1%
sand	29%		
gravel	69%		
cobble	0%		
boulder	0%		

2) Weighted Pebble Count

Feature Percent of Reach

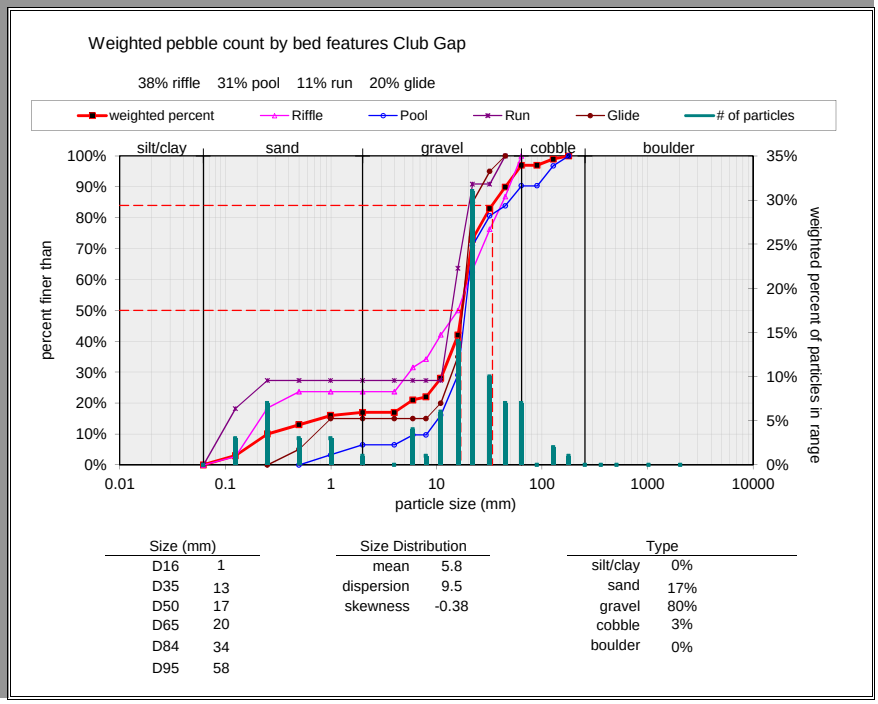
Riffle, Pool, Run, Glide

Riffle	38	%	Run	11 %
Pool	31	%	Glide	20 %

Weighted pebble count by bed features

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	0.0
very fine sand	0.062 - 0.125	3.0
fine sand	0.125 - 0.25	7.0
medium sand	0.25 - 0.5	3.0
coarse sand	0.5 - 1	3.0
very coarse sand	1 - 2	1.0
very fine gravel	2 - 4	0.0
fine gravel	4 - 6	4.0
fine gravel	6 - 8	1.0
medium gravel	8 - 11	6.0
medium gravel	11 - 16	14.0
coarse gravel	16 - 22	31.0
coarse gravel	22 - 32	10.0
very coarse gravel	32 - 45	7.0
very coarse gravel	45 - 64	7.0
small cobble	64 - 90	0.0
medium cobble	90 - 128	2.0
large cobble	128 - 180	1.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock	----------	0.0
clay hardpan	----------	0.0
detritus/wood	----------	0.0
artificial	----------	0.0
total weighted count:		100.0

Note:



Size (mm)	
D16	1
D35	13
D50	17
D65	20
D84	34
D95	58

Size Distribution	
mean	5.8
dispersion	9.5
skewness	-0.38

Type	
silt/clay	0%
sand	17%
gravel	80%
cobble	3%
boulder	0%

Bulk Material Samples

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Bervard, NC

Reach: Club Gap
Location: Sample 1
Sample Type: Bar

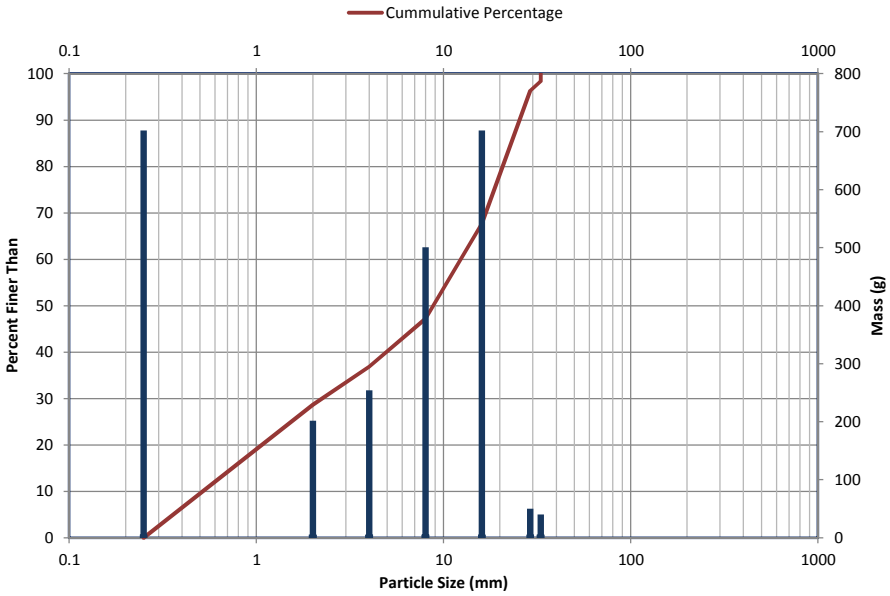
Largest Particle

Dim:	36 X 33 X 15 mm
Mass:	40 g

Second Largest Particle

Dim:	38 X 29 X 21 mm
Mass:	50 g

Size (mm)	Mass (g)
0.25	702
2	202
4	254
8	501
16	702
29	50
33	40
33	
33	
33	
33	
33	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	4	**9**	15	23	28	29%
All Material	1	4	9	15	23	28	29%

Reach: Club Gap
Location: Sample 2 Riff
Sample Type: Pavement

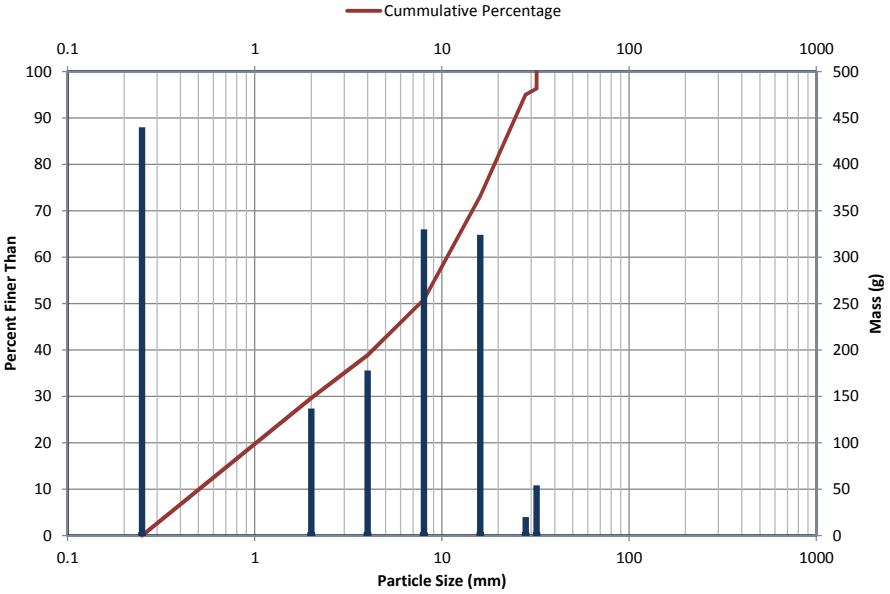
Largest Particle

Dim:	41 X 32 X 22 mm
Mass:	54 g

Second Largest Particle

Dim:	32 X 28 X 12 mm
Mass:	20 g

Size (mm)	Mass (g)
0.25	440
2	137
4	178
8	330
16	324
28	20
32	54
32	
32	
32	
32	
32	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	3	**8**	13	22	28	30%
All Material	1	3	8	13	22	28	30%

Bulk Material Samples

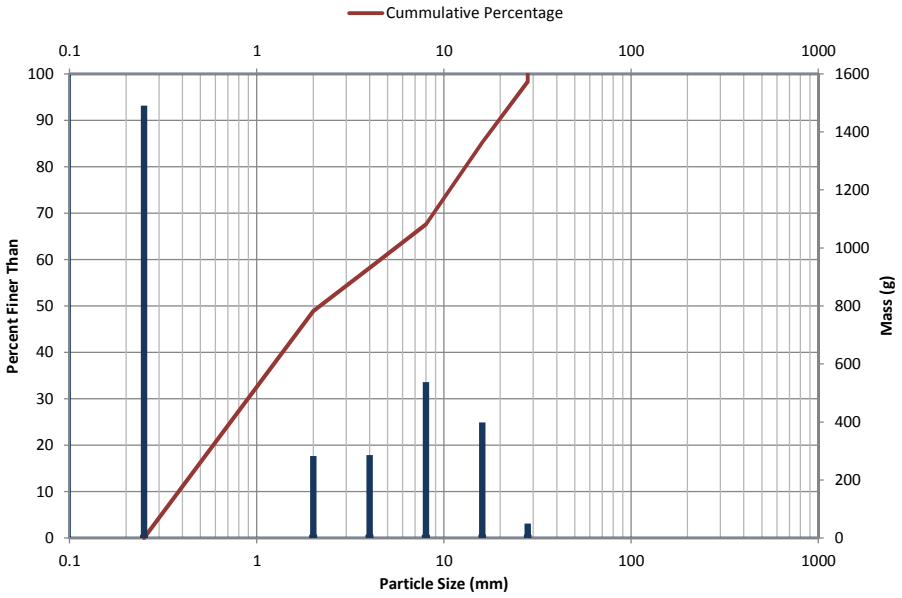
Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Bervard, NC

Reach: Club Gap
Location: Sample 2 Riff
Sample Type: Sediment Trap

Largest Particle
Dim: 42 X 25 X 18 mm
Mass: 50 g

Second Largest Particle
Dim: 40 X 28 X 16 mm
Mass: 39 g

Size (mm)	Mass (g)
0.25	1491
2	283
4	286
8	538
16	399
28	50
28	
28	
28	
28	
28	
28	



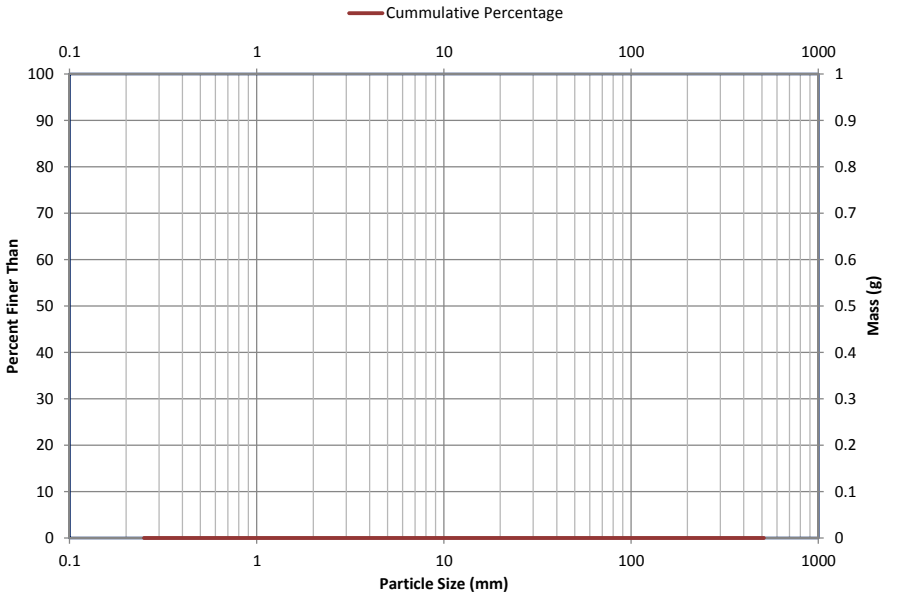
Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	1	2	**2**	7	15	25	49%
All Material	1	2	2	7	15	25	49%

Reach: 0
Location:
Sample Type: Sediment Trap

Largest Particle
Dim: N/A
Mass: N/A

Second Largest Particle
Dim: 0 X 0 X 0 mm
Mass: N/A

Size (mm)	Mass (g)
0.25	
2	
4	
8	
16	
31.5	
63	
90	
128	
180	
255	
512	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample							
All Material							

Club Gap Branch Riffle

Club Gap Branch Pool

Club Gap Branch Pool

Club Gap Branch Bed Material

Summary

Stream:	South Fork Mills River
Watershed:	Forested
Location:	Pink Beds
Latitude:	35.35161
Longitude:	82.77448
State:	North Carolina
County:	Transylvania
Date:	April 1, 2014
Observers:	Grant Ginn, Chris Engle, Ryan Stokes
Channel type:	E4
Drainage area (sq.mi.):	0.72
notes:	---

Dimension		bankfull channel typical	min	max
floodplain:	width flood prone area (ft)	72.5	60.0	72.5
	low bank height (ft)	2.6	2.0	2.6
riffle-run:	x-area bankfull (sq.ft.)	25.9	18.2	35.9
	width bankfull (ft)	14.4	12.0	16.5
	width bed (ft)	10.8	8.5	13.0
	width thalweg (ft)	2.5	2.0	3.5
	depth bankfull (ft)	1.5	1.4	1.8
	depth thalweg (ft)	0.7	0.4	1.7
	max depth (ft)	2.3	1.9	3.3
pool:	x-area pool (sq.ft.)	39.2	32.4	45.9
	width bankfull (ft)	16.0	14.5	17.5
	width bed (ft)	12.8	11.0	14.5
	width thalweg (ft)	3.5	3.0	4.0
	depth bankfull (ft)	1.6	1.6	1.6
	depth thalweg (ft)	1.6	1.5	1.6
	max depth pool (ft)	0.5	0.4	0.6
dimensionless ratios:		typical	min	max
riffle-run:	width depth ratio	8.2	7.1	10.0
	bank height ratio	1.1	0.7	1.6
	entrenchment ratio	4.9	4.3	5.5
	riffle max depth ratio	1.3	1.1	1.5
pool:	width depth ratio	6.6	6.5	6.7
	bank height ratio	0.9	0.8	1.1
	entrenchment ratio	5.0	4.6	5.5
	pool max depth ratio	1.7	1.4	1.9

Pattern	typical	min	max
meander length (ft)			
belt width (ft)			
amplitude (ft)			
radius (ft)			
arc angle (degrees)			
stream length (ft)	416.7		
valley length (ft)			
Sinuosity			
Meander Length Ratio			
Meander Width Ratio			
Radius Ratio			

Summary

Stream:	South Fork Mills River
Watershed:	Forested
Location:	Pink Beds
Latitude:	35.35161
Longitude:	82.77448
State:	North Carolina
County:	Transylvania
Date:	April 1, 2014
Observers:	Grant Ginn, Chris Engle, Ryan Stokes
Channel type:	E4
Drainage area (sq.mi.):	0.72
notes:	---

Profile

	typical	min	max
pool-pool spacing (ft)	84.9	67.9	101.9
riffle length (ft)	82.0	62.6	101.4
pool length (ft)	45.1	13.4	80.3
run length (ft)	20.4	14.3	26.4
glide length (ft)	23.5	12.8	35.5
channel slope (%)	0.5		
riffle slope (%)	0.6	0.6	0.7
pool slope (%)	0.3	0.1	0.6
run slope (%)	0.9		
glide slope (%)	0.4	0.1	1.0
measured valley slope (%)			
valley slope from sinuosity (%)			
Riffle Length Ratio	5.5	4.2	6.8
Pool Length Ratio	3.0	0.9	5.4
Run Length Ratio	1.4	1.0	1.8
Glide Length Ratio	1.6	0.9	2.4
Riffle Slope Ratio	1.2	1.1	1.3
Pool Slope Ratio	0.6	0.1	1.1
Run Slope Ratio	1.7		
Glide Slope Ratio	0.8	0.2	1.8
Pool Spacing Ratio	5.7	4.6	6.9

Channel Materials	Riffle Surface	Sub Pavement	Bar
D16 (mm)	7	2	2
D35 (mm)	26	10	9
D50 (mm)	42	22	20
D65 (mm)	54	36	30
D84 (mm)	68	63	47
D95 (mm)	70	76	56
mean (mm)			
dispersion			
skewness			
Shape Factor			
% Silt/Clay			
% Sand	9%	19%	20%
% Gravel			
% Cobble			
% Boulder			
% Bedrock			
% Clay Hardpan			
% Detritus/Wood			
% Artificial			
Largest Mobile (mm)			

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: South Fork Mills
Reach: Pink Beds

Date: 4/8/14
Observers: gg ,ce, rs
Page: 1

Observed Values

Section Number	1	2	3	4	5	6	7
Reach Name	SF	SF	SF	SF	SF	SF	SF
Location	Riff	Riff	H Riff	Pool	Pool	Riff (U/S Tirb)	Riff (U/S Tirb)
D_A (mi^2)	0.72	0.72	0.72	0.72	0.72	0.72	0.72
W_{BKF} (ft)	16.5	14.5	16.5	14.5	17.5	12.0	13.0
W_{BED} (ft)	11.5	11.0	13.0	11.0	14.5	8.5	9.5
D_{BKF} (ft)	1.6	1.8	1.5	1.6	1.6	1.5	1.4
$D_{TOE\ LT}$ (ft)	0.3	0.7	0.3	0.6	0.4	0.0	0.3
$D_{TOE\ RT}$ (ft)	0.0	-0.4	0.5	-0.3	1.4	0.4	0.0
Field D_{THAL} (ft)	1.7	0.8	0.5	1.5	1.6	0.4	0.5
W_{THAL} (ft)	3.0	3.5	2.0	4.0	3.0	2.0	2.5
Bank/Terrace Height (ft)	2.5	2.7	2.6	3.3	2.5	3.0	2.0
Flood Prone Width (ft)	80	80	80	80	80	60	60

Section Calculations

D_{MAX}	3.34	2.60	1.90	3.10	3.20	1.85	1.85
Average D_{TOE}	1.73	1.95	1.80	1.75	2.48	1.70	1.55
D_{THAL}	1.62	0.65	0.10	1.35	0.73	0.15	0.30
A_{BKF}	35.9	29.6	27.3	32.4	45.9	18.2	19.2
D_{MEAN}	2.17	2.04	1.65	2.24	2.63	1.52	1.48
W/D ratio	7.6	7.1	10.0	6.5	6.7	7.9	8.8
Bank Height Ratio	0.7	1.0	1.4	1.1	0.8	1.6	1.1
Entrenchment Ratio	4.8	5.5	4.8	5.5	4.6	5.0	4.6

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

Coef	Exp
1.5	0.27

Reference Bed Width	10.4	10.4	10.4	10.4	10.4	10.4	10.4
Bed Width Index (BWI)	1.1	1.1	1.3	1.1	1.4	0.8	0.9
Reference D_{MAX}	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Max Depth Index (MDI)	2.4	1.9	1.4	2.3	2.3	1.3	1.3

Stream Classification

Stream Type	E	E	E	E	E	E	E

Site Assessment Calculations

Project: Cochran
Project No.: 1059-CCRN
Stream: South Fork Mills
Reach: Pink Beds

Date: 4/8/14
Observers: gg ,ce, rs
Page: 1

Observed Values

Section Number	8						
Reach Name	S						
Location	Riff (U/S Tirb)						
D_A (mi^2)	0.72						
W_{BKF} (ft)	14.0						
W_{BED} (ft)	11.5						
D_{BKF} (ft)	1.4						
$D_{TOE\ LT}$ (ft)	0.6						
$D_{TOE\ RT}$ (ft)	0.3						
Field D_{THAL} (ft)	0.7						
W_{THAL} (ft)	2.0						
Bank/Terrace Height (ft)	2.0						
Flood Prone Width (ft)	60						

Section Calculations

D_{MAX}	2.05						
Average D_{TOE}	1.85						
D_{THAL}	0.20						
A_{BKF}	24.9						
D_{MEAN}	1.78						
W/D ratio	7.9						
Bank Height Ratio	1.0						
Entrenchment Ratio	4.3						

Index Calculations

Reference Bed Width Equation

Coef	Exp
12.0	0.45

Reference Max Depth Equation

Coef	Exp
1.5	0.27

Reference Bed Width	10.4						
Bed Width Index (BWI)	1.1						
Reference D_{MAX}	1.4						
Max Depth Index (MDI)	1.5						

Stream Classification

Stream Type	E						

Bulk Material Samples

Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Bervard, NC

Reach: South Fork Mills River
Location: Side Bar
Sample Type: Bar

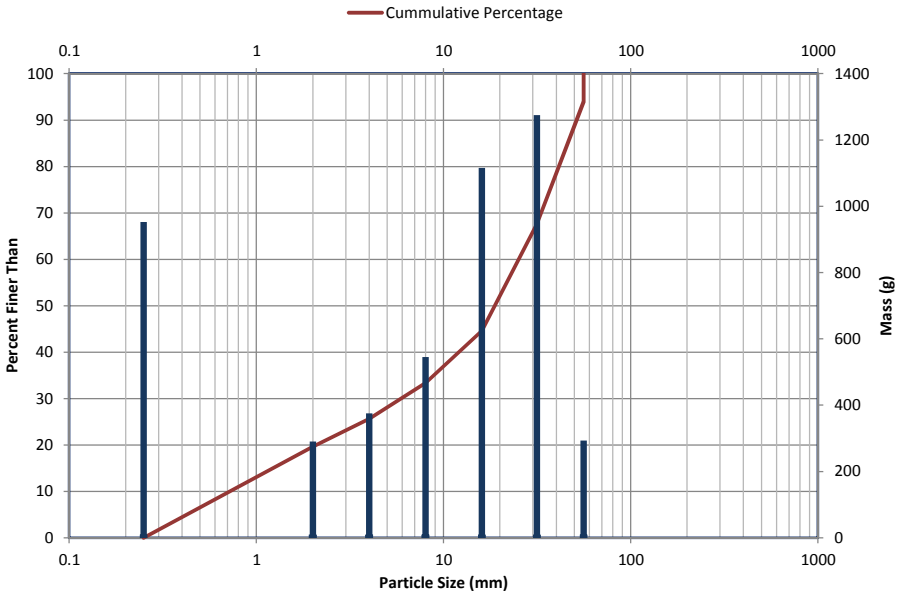
Largest Particle

Dim: 95 X 52 X 30 mm
Mass: 293 g

Second Largest Particle

Dim: 75 X 56 X 21 mm
Mass: 21 g

Size (mm)	Mass (g)
0.25	953
2	290
4	375
8	545
16	1116
31.5	1275
56	293
56	
56	
56	
56	
56	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	2	9	**20**	30	47	56	20%
All Material	2	9	20	30	47	56	20%

Reach: South Fork Mills River
Location: Riffle
Sample Type: Pavement

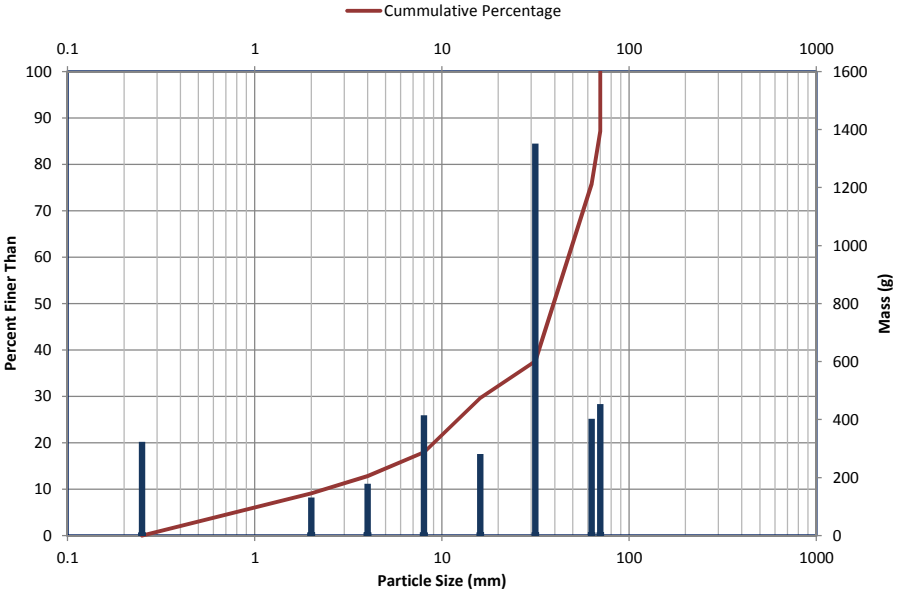
Largest Particle

Dim: 99 X 70 X 32 mm
Mass: 454 g

Second Largest Particle

Dim: 80 X 65 X 50 mm
Mass: 403 g

Size (mm)	Mass (g)
0.25	323
2	131
4	179
8	415
16	281
31.5	1351
63	403
70	454
70	
70	
70	
70	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	7	26	**42**	54	68	70	9%
All Material	7	26	42	54	68	70	9%

Bulk Material Samples

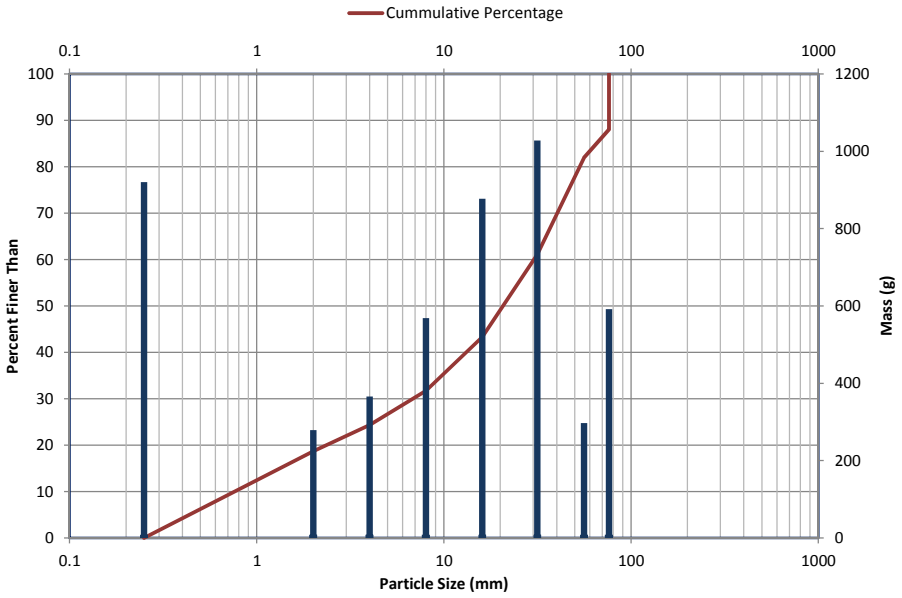
Project: Cochran
Project No.: 1059-CCRN
Client: EBX
Contract No.: NC-01-2013
County/State: Bervard, NC

Reach: South Fork Mills River
Location: Riffle
Sample Type: Sub-pavement

Largest Particle
Dim: 100 X 76 X 45 mm
Mass: 592 g

Second Largest Particle
Dim: 72 X 56 X 54 mm
Mass: 297 g

Size (mm)	Mass (g)
0.25	920
2	279
4	366
8	569
16	877
31.5	1028
56	297
76	592
76	
76	
76	
76	



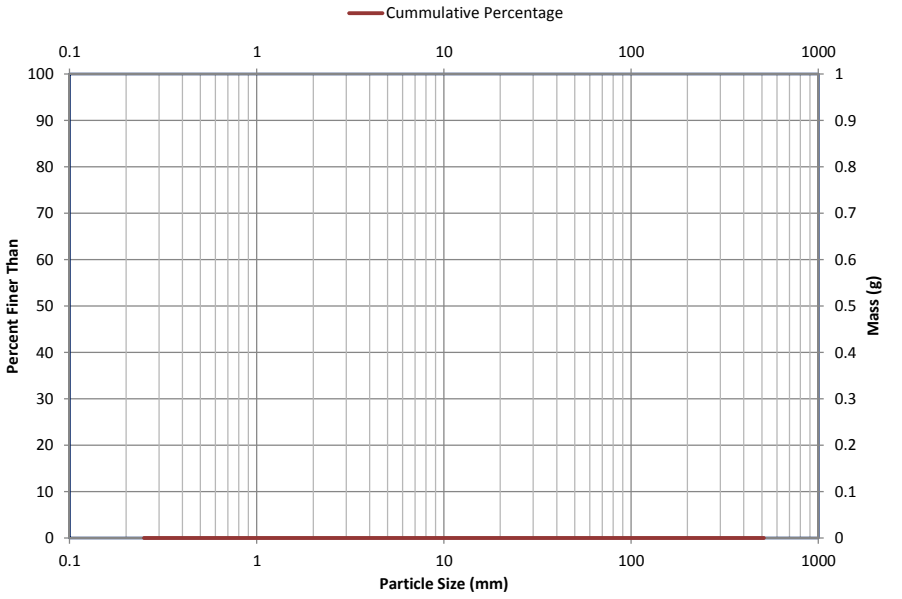
Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample	2	10	**22**	36	63	76	19%
All Material	2	10	22	36	63	76	19%

Reach: 0
Location:
Sample Type: Other

Largest Particle
Dim: N/A
Mass: N/A

Second Largest Particle
Dim: 0 X 0 X 0 mm
Mass: N/A

Size (mm)	Mass (g)
0.25	
2	
4	
8	
16	
31.5	
63	
90	
128	
180	
255	
512	



Sample Statistics							
Material Included	D_{16}	D_{35}	**D_{50}**	D_{65}	D_{84}	D_{95}	% Sand
Entire Sample							
All Material							

South Fork Mills River Riffle

South Fork Mills River Pool

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Appendix F SITE PROTECTION INSTRUMENT

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PC 22 SL 606

CERTIFICATE OF SURVEY AND ACCURACY:

I, PHILLIP B. KEE, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION FROM DEED DESCRIPTION(S) RECORDED IN DB: 1108, PG: 301, AND PB: 10, PG: 673; THAT THE BOUNDARIES NOT SURVEYED ARE INDICATED AS DRAWN FROM INFORMATION AS REFERENCED; THAT THE RATIO OF PRECISION AS CALCULATED DOES NOT EXCEED 1:10,000; 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 PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED.

I ALSO HEREBY CERTIFY THAT THIS PLAT IS OF ONE OF THE FOLLOWING: GS 47-30 F(11) D; THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXCEPTION TO THE DEFINITION OF SUBDIVISION.

GPS METADATA
CLASS OF SURVEY: HORIZONTAL: A
FIELD PROCEDURE: STATIC NETWORK
DATES: 08/24/17
DATUM: NAD83(2011) NAVD 88
EPOCH: 2010
GEOID: 12B
AVERAGE COMBINED FACTOR: 0.99977313
POSITIONAL ACCURACY: HORIZONTAL: 0.08
UNITS: USFT
CORS USED: HAYW, NCSY, FRKN, NCBC

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 10TH DAY OF APRIL, 2018, A.D.

NORTH CAROLINA PROFESSIONAL SEAL L-4647 LAND SURVEYOR PHILLIP B. KEE

THIS DOCUMENT IS NOT VALID UNLESS SIGNED AND SEALED.

Phillip B. Kee
PHILLIP B. KEE, PLS L-4647

JACKSON COUNTY, NORTH CAROLINA

THIS PLAT DOES NOT CREATE A SUBDIVISION OF PROPERTY IN JACKSON COUNTY. THE PURPOSE OF THIS SURVEY IS TO IDENTIFY THE CONSERVATION EASEMENT AREAS ONLY. NO TRANSFER OF PROPERTY IS TAKING PLACE.

I, KMC, REVIEW OFFICER FOR JACKSON COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

KMC 4/27/18
REVIEW OFFICER DATE

CERTIFICATE OF APPROVAL FOR RECORDING:

I CERTIFY THAT THE PLAT SHOWN HEREON COMPLIES WITH THE WATERSHED PROTECTION ORDINANCE AND IS APPROVED FOR RECORDING IN THE REGISTER OF DEEDS OFFICE.

4-27-18
WATERSHED ADMINISTRATOR DATE

NOTICE: THIS PROPERTY IS LOCATED WITHIN A PUBLIC WATER SUPPLY WATERSHED- DEVELOPMENT RESTRICTIONS MAY APPLY.

CERTIFICATE OF OWNERSHIP AND DEDICATION:

I/WE, THE UNDERSIGNED, CERTIFY THAT WE ARE THE OWNER OF THE PROPERTY SHOWN AND DESCRIBED HEREON AND ACCEPT AND ADOPT THIS PLAT AND THE CONSERVATION EASEMENTS WITH OUR/MY FREE CONSENT AND DEDICATE, GRANT AND CONVEY AN EASEMENT OVER OUR ADJACENT PROPERTY FOR ACCESS TO AND FROM THE CONSERVATION EASEMENTS SET FORTH HEREIN.

JUDITH HARRELL DATE

OFFICE OF REGISTER OF DEEDS JOE HAMILTON JACKSON COUNTY, N.C.

SURVEYOR'S NOTES:

1. ALL DISTANCES AND COORDINATES ARE GROUND MEASUREMENTS IN US SURVEY FEET UNLESS OTHERWISE NOTED.
2. AREAS CALCULATED BY THE COORDINATE METHOD.
3. PROPERTY SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS AND RESTRICTIONS THAT ARE RECORDED, UNRECORDED, WRITTEN AND UNWRITTEN.
4. JACKSON COUNTY GIS WEBSITE USED TO IDENTIFY ADJOINING PROPERTY OWNERS.
5. THE PROFESSIONAL SURVEYOR HAS MADE NO INVESTIGATION OR INDEPENDENT SEARCH FOR EASEMENTS, RIGHT OF WAYS, ENCUMBRANCES, RESTRICTIVE COVENANTS, CORRECT OWNERSHIP OR ANY OTHER FACTS THAT AN ACCURATE AND CURRENT TITLE SEARCH MAY DISCLOSE. A NC LICENSED ATTORNEY SHOULD BE CONSULTED.
6. THE STATE OF NORTH CAROLINA, ITS EMPLOYEES AND AGENTS, SUCCESSORS AND ASSIGNS, RECEIVE A PERPETUAL RIGHT OF ACCESS TO THE EASEMENT AREA OVER THE PROPERTY AT REASONABLE TIMES TO UNDERTAKE ANY ACTIVITIES TO RESTORE, CONSTRUCT, MANAGE, MAINTAIN, ENHANCE, AND MONITOR THE STREAM, WETLAND AND ANY OTHER RIPARIAN RESOURCES IN THE EASEMENT AREA, IN ACCORDANCE WITH RESTORATION ACTIVITIES OR A LONG-TERM MANAGEMENT PLAN AS DESCRIBED IN SECTION III-A OF THE CONSERVATION EASEMENT AGREEMENT.
7. THE SURVEYOR HAS MADE NO DETERMINATION TO THE RIGHTS OR INTEREST OTHERS MAY HAVE IN THE ACCESS ROADS SHOWN HEREON AND WAS UNABLE TO FIND ANY EASEMENTS OR RIGHT OF WAYS, UNLESS OTHERWISE NOTED. A NC LICENSED ATTORNEY SHOULD BE CONSULTED.
8. UTILITIES WERE LOCATED BASED ON VISIBLE ABOVE GROUND STRUCTURES AND MARKINGS PROVIDED BY NC 811. THEREFORE, THE LOCATION OF UNDERGROUND UTILITIES ARE APPROXIMATE OR MAY BE PRESENT AND NOT SHOWN HEREON. CALL 1-800-632-4949 BEFORE DIGGING.
9. ALL EXISTING FENCES WITHIN THE CONSERVATION EASEMENT AREAS ARE TO BE REMOVED.
10. 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 AND 3700756800J DATED 4/19/2010.

CURVE	RADIUS	ARC LENGTH	CHORD BEARING	CHORD LENGTH
C1	384.87'	99.27'	S 41°13'55" E	99.00'

LINE	BEARING	DISTANCE
L1	S 66°22'03" W	119.03'
L2	N 01°49'38" E	86.25'
L3	N 21°54'44" E	33.61'
L4	N 66°22'03" E	78.96'
L5	S 33°19'53" W	82.54'
L6	N 09°16'35" E	53.60'

CONSERVATION EASEMENT CORNER-NC DMS CAP (TYPICAL)

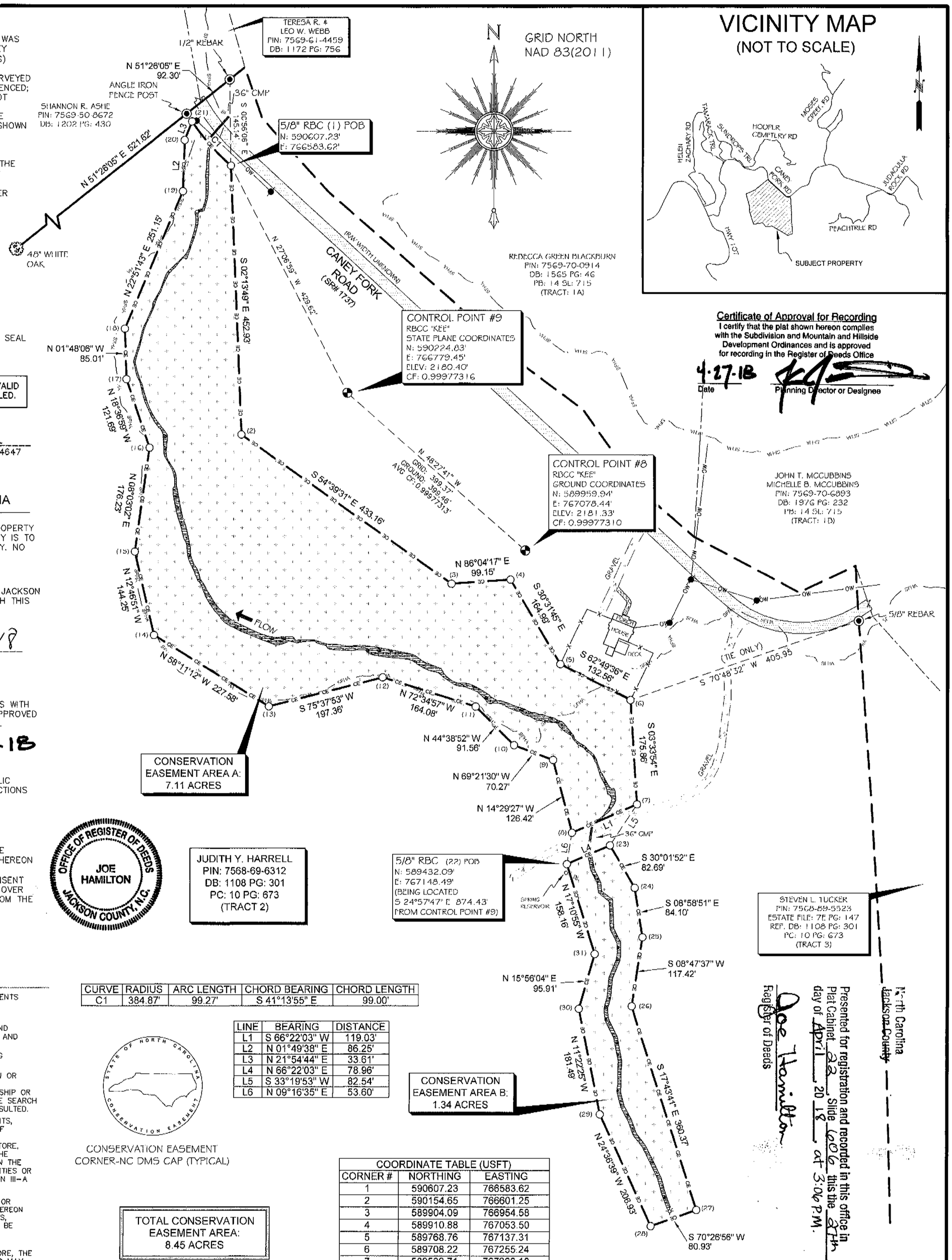
TOTAL CONSERVATION EASEMENT AREA: 8.45 ACRES

0' 120' 240' 360'
ONE INCH = ONE HUNDRED & TWENTY FEET

COORDINATE TABLE (USFT)		
CORNER #	NORTHING	EASTING
1	590607.23	766583.62
2	590154.65	766601.25
3	589904.09	766954.58
4	589910.88	767053.50
5	589768.76	767137.31
6	589708.22	767255.24
7	589532.71	767266.18
8	589484.99	767157.13
9	589607.39	767125.50
10	589632.16	767059.73
11	589697.30	766995.39
12	589746.42	766838.83
13	589697.44	766647.64
14	589817.41	766454.25
15	589958.08	766422.34
16	590132.58	766447.02
17	590247.91	766408.18
18	590332.87	766405.50
19	590564.30	766503.08
20	590650.50	766505.83
21	590681.68	766518.37
22	589432.09	767148.49
23	589463.74	767220.82
24	589392.15	767262.21
25	589309.08	767275.34
26	589193.04	767257.39
27	588849.79	767367.12
28	588822.70	767290.85
29	589010.84	767204.67
30	589188.77	767168.88
31	589280.99	767195.21

LEGEND:

- SET 5/8" RBR W/ "CE" CAP
- CONTROL POINT (5/8" RBC W/ "KEE" CONTROL CAP SET IN CONCRETE)
- EXISTING IRON PIN (AS NOTED)
- SPRING HEAD
- NOT TO SCALE (NTS)
- UTILITY POLE
- ASPHALT
- GRAVEL
- STREAM
- BOUNDARY LINE
- BOUNDARY LINE (NOT SURVEYED)
- OW — OVERHEAD WIRE
- CE — CONSERVATION EASEMENT LINE
- ADJOINER LINES (NOT SURVEYED)
- X — FENCE LINE
- SFHA — SPECIAL FLOOD HAZARD AREA (SFHA)
- CE — CONSERVATION EASEMENT
- PC: — PLAT CABINET
- SL: — SLIDE
- DB: — DEED BOOK
- PG: — PAGE
- RBCC — REBAR WITH ID CAP IN CONCRETE
- POB — POINT OF BEGINNING
- N.A.D. — NORTH AMERICAN DATUM 1983
- SPC — STATE PLANE COORDINATES
- CMP — CORRUGATED METAL PIPE
- CF — COMBINED FACTOR



VICINITY MAP
(NOT TO SCALE)

Certificate of Approval for Recording
I certify that the plat shown hereon complies with the Subdivision and Mountain and Hillside Development Ordinances and is approved for recording in the Register of Deeds Office

4-27-18 Date
Planning Director or Designee

Presented for registration and recorded in this office in Plat Cabinet 22, Slide 606 this the 27th day of April, 20 18 at 3:06 P.M.
Joe Hamilton
Register of Deeds

North Carolina
Jackson County

Cab. 22 Slide 606

A CONSERVATION EASEMENT SURVEY FOR:

THE STATE OF NORTH CAROLINA,
NCDEQ: DIVISION OF MITIGATION SERVICES
"HARRELL MITIGATION SITE"
SPO FILE NO. 50-BW DMS SITE ID NO. 100005

PARCEL IDENTIFICATION #: 7568-69-6312

CURRENT OWNER LISTED AS:
JUDITH Y. HARRELL
SITE ADDRESS: CANEY FORK ROAD, CULLOWHEE, NC 28723

DEED REFERENCE: BOOK: 1108 PAGE: 301 (TRACT 2)
CANEY FORK TOWNSHIP, JACKSON COUNTY, NORTH CAROLINA

SURVEY BY: DD,MB,JM DRAWN BY: DD/NH CHECKED BY: PBK
SURVEY DATE: 08/24/17-01/16/18 JOB #170476-CE

REVISION: DATE REVISED:

SHEET SIZE: 18"X24" | SHEET #: 1 OF 1 | SCALE: 1"=120'

Kee MAPPING & SURVEYING
P.O. Box 2566
Asheville, NC 28802
(828) 575-9021
www.keemap.com
License # C-3039

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Appendix G CREDIT RELEASE SCHEDULE

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CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary Department of the Army (DA) authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Forested Wetlands Credits			
Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70%
5	Fifth year monitoring report demonstrates performance standards are being met	10%	80%
6	Sixth year monitoring report demonstrates performance standards are being met	10%	90%
7	Seventh year monitoring report demonstrates performance standards are being met, and project has received close-out approval	10%	100%

Stream Credits			
Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met (additional 10% released at fourth bankfull event in separate years)	5%	65% (75%)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%)
6	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%)
7	Seventh year monitoring report demonstrates performance standards are being met, and project has received close-out approval	10%	90% (100%)

Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by the NC DMS without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the final Mitigation Plan

b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property

c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; Per the NC DMS Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.

d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 10% of a site's total stream credits shall be released after four bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than four bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the DMS will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

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Appendix H FINANCIAL ASSURANCE

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FINANCIAL ASSURANCE

Pursuant to Section IV H and Appendix III of the Division of Mitigation Service's (formally Ecosystem Enhancement Program) In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the U.S. Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

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Appendix I MAINTENANCE PLAN

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MAINTENANCE PLAN

EW Solutions will monitor the site on a regular basis and shall conduct a physical inspection of the site a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

Component/Feature	Maintenance through project closeout
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Wetland	Routine wetland maintenance and repair activities may include securing of loose coir matting and supplemental installations of live stakes and other target vegetation within the wetland. Areas where storm water and floodplain flows intercept the wetland may also require maintenance to prevent scour.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.

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Appendix J DWR STREAM IDENTIFICATION FORMS

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NCDWR Stream Identification Form Summary

Site Number	Geomorphology Score	Hydrology Score	Biology Score	Total Score	Comments
N/A	23	7.5	6.25	36.75	Perennial tributary to Reach 1A
S01	13	9	8.5	30.5	Reach 1A

Appendix J - NCDWR Stream Classification Forms

REMOVED FROM PROJECT CONSIDERATION

S01 Tributary to Harrell Creek

NC DWQ Stream Identification Form Version 4.11

Date: 1/13/17	**Project/Site:** Harrell	**Latitude:** 35.2991
Evaluator: Owen Carson	**County:** Jackson	**Longitude:** -83.1333
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 36.75	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 23)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	0	1	(2)	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

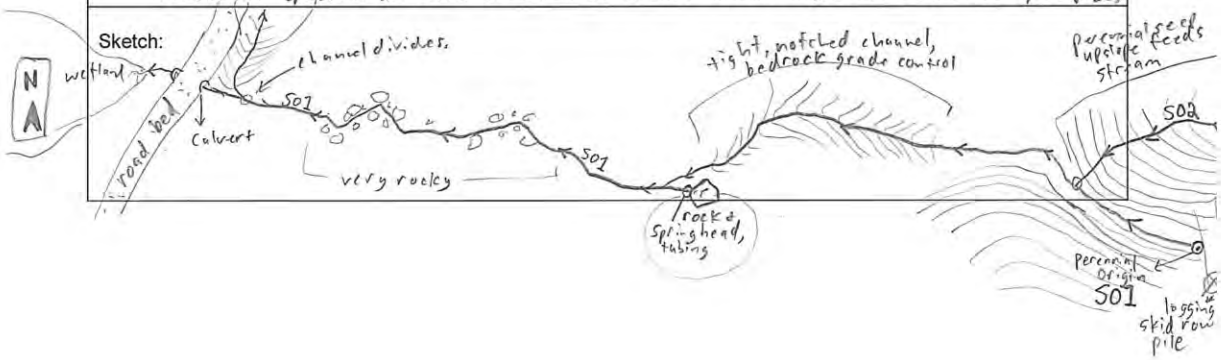
B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.25)				
18. Fibrous roots in streambed	3	2	(1)	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	0	0.5	(1)	1.5
24. Amphibians *	0	(0.5)	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed *	FACW = (0.75) OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: * One Desmognathus salamander observed under rock in channel;
* areas of Spicebush dominance where channel becomes diffuse & ground is saturated by seepage;

Sketch:



NAME CHANGED TO S01 ~~S02~~ Harrell Creek

NC DWQ Stream Identification Form Version 4.11

Date: 1/13/17	**Project/Site:** Harrell	**Latitude:** 35.2986
Evaluator: Owen Carson	**County:** Jackson	**Longitude:** -83.1321
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30.5	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 13)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	(1)	2	3
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	1	(2)	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	(No = 0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

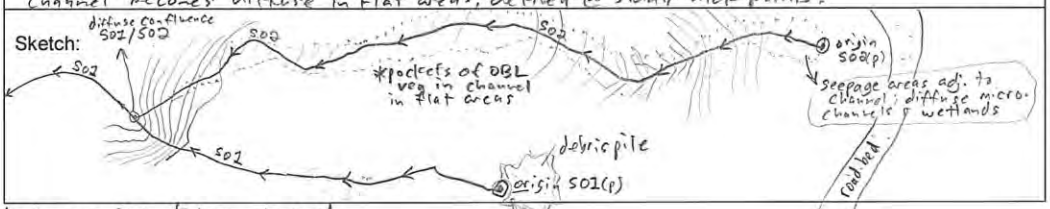
B. Hydrology (Subtotal = 9)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 8.5)				
18. Fibrous roots in streambed	3	2	(1)	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish *	0	0.5	1	(1.5)
24. Amphibians *	0	0.5	1	(1.5)
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; (OBL = 1.5) Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Origin a perennial seep; multiple side seeps create a seep complex @ HW S02, channel becomes diffuse in flat areas, defined @ small nick points.

Sketch:



* abundant crayfish tubes observed
* multiple specimens of Desmognathus salamanders were observed under rocks, leaf litter, & woody debris in & around the channel;

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Appendix K WETLAND JD FORMS

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2016-02202** County: **Jackson** U.S.G.S. Quad: **NC-Sylva South**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: **Ms. Judith Harrell**
Address: **1414 Caney Fork Road**
Cullowhee, NC 28723
Telephone Number: **828-293-3224**
E-mail: **judyonthefork@frontier.com**

Size (acres) **~3**
Nearest Waterway **Caney Fork**
USGS HUC **06010203**
Nearest Town **Cullowhee**
River Basin **Tuckasegee**
Coordinates Latitude: **35.300373**
Longitude: **-83.134084**

Location description: **The Harrell Stream and Wetland Mitigation Project area is located at 1414 Caney Fork Road, Cullowhee, North Carolina 28723.**

Indicate Which of the Following Apply:

A. Preliminary Determination

☒ There appear to be **waters, including wetlands** on the above described project area/property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). The **waters, including wetlands** have been delineated, and the delineation has been verified by the Corps to be sufficiently accurate and reliable. The approximate boundaries of these waters are shown on the enclosed delineation map received via email on **1/9/2019**. Therefore this preliminary jurisdiction determination may be used in the permit evaluation process, including determining compensatory mitigation. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.

☐ There appear to be **waters, including wetlands** on the above described project area/property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). However, since the **waters, including wetlands** have not been properly delineated, this preliminary jurisdiction determination may not be used in the permit evaluation process. Without a verified wetland delineation, this preliminary determination is merely an effective presumption of CWA/RHA jurisdiction over all of the **waters, including wetlands** at the project area, which is not sufficiently accurate and reliable to support an enforceable permit decision. We recommend that you have the **waters, including wetlands** on your project area/property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

B. Approved Determination

☐ There are Navigable Waters of the United States within the above described project area/property subject to the permit requirements of Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403) and Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

☐ There are **waters, including wetlands** on the above described project area/property subject to the permit requirements of Section 404 of the Clean Water Act (CWA) (33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

☐ We recommend you have the **waters, including wetlands** on your project area/property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

☐ The **waters, including wetlands** on your project area/property have been delineated and the delineation has been verified by the Corps. The approximate boundaries of these waters are shown on the enclosed delineation map dated **MAP DATE**. If you wish to have the delineation surveyed, the Corps can review and verify the survey upon completion. Once verified, this survey will provide an accurate depiction of all areas subject to CWA and/or RHA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

☐ The **waters, including wetlands** have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on **SURVEY SIGNED DATE**. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

☐ There are no waters of the U.S., to include wetlands, present on the above described project area/property which are subject to the permit requirements of Section 404 of the Clean Water Act (33 USC 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

☐ The property is located in one of the 20 Coastal Counties subject to regulation under the Coastal Area Management Act (CAMA). You should contact the Division of Coastal Management in **Morehead City, NC, at (252) 808-2808** to determine their requirements.

Placement of dredged or fill material within waters of the US, including wetlands, without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). Placement of dredged or fill material, construction or placement of structures, or work within navigable waters of the United States without a Department of the Army permit may constitute a violation of Sections 9 and/or 10 of the Rivers and Harbors Act (33 USC § 401 and/or 403). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **Steve Kichefski at PM PHONE or PM E-MAIL**.

C. Basis For Determination: See the preliminary jurisdictional determination form dated 1/9/2019.

D. Remarks: This PJD replaces the one issued 30 Nov 2017 to correct pjd map and acreage tables. Previous PJD did not correctly depict Stream 1 throughout Wetland 1 or WoUS acreages correctly.

E. Attention USDA Program Participants

This delineation/determination has been conducted to identify the limits of Corps' Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

F. Appeals Information **(This information applies only to approved jurisdictional determinations as indicated in B. above)**

This correspondence constitutes an approved jurisdictional determination for the above described site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

US Army Corps of Engineers
South Atlantic Division
Attn: Jason Steele, Review Officer
60 Forsyth Street SW, Room 10M15
Atlanta, Georgia 30303-8801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **Not applicable**.
It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.

Corps Regulatory Official: KICHEFSKI.STEVEN.L.1386908539 Digitally signed by KICHEFSKI.STEVEN.L.1386908539 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=KICHEFSKI.STEVEN.L.1386908539 Date: 2019.01.11 11:39:03 -05'00'

Date of JD: **1/9/2019** Expiration Date of JD: **Not applicable**

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete our Customer Satisfaction Survey, located online at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

Copy furnished via email:

Agent: Mr. Owen Carson, Equinox Environmental Consultation & Design, Inc.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **Ms. Judith Harrell**	File Number: **SAW-2016-02202**	Date: **January 11, 2019**

Attached is:	See Section below
☐ INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
☐ PROFFERED PERMIT (Standard Permit or Letter of permission)	B
☐ PERMIT DENIAL	C
☐ APPROVED JURISDICTIONAL DETERMINATION	D
☒ PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the district engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:	If you only have questions regarding the appeal process you may also contact:
District Engineer, Wilmington Regulatory Division, **Attn: Mr. Steve Kichefski** **Asheville Regulatory Office** **U.S Army Corps of Engineers** **151 Patton Avenue, Room 208** **Asheville, North Carolina 28801** **Steven.l.kichefski@usace.army.mil** **828-271-7980**	Mr. Jason Steele, Administrative Appeal Review Officer CESAD-PDO U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 10M15 Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

_____ Signature of appellant or agent.	Date:	Telephone number:

For appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, Attn.: Mr. Steve Kichefski, 69 Darlington Avenue, Wilmington, North Carolina 28403

For Permit denials, Proffered Permits and approved Jurisdictional Determinations send this form to:

Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Jason Steele, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801
Phone: (404) 562-5137

Appendix 1 - REQUEST FOR CORPS JURISDICTIONAL DETERMINATION (JD)

To: District Name Here

CESAW-RG-A

- I am requesting a JD on property located at: 1414 Caney Fork Road Cullowhee, NC 28723 (Street Address)
  City/Township/Parish: Caney Fork County: Jackson State: NC
  Acreage of Parcel/Review Area for JD: +/-3
  Section: _____ Township: _____ Range: _____
  Latitude (decimal degrees): 35.300696 Longitude (decimal degrees): -83.134106
  (For linear projects, please include the center point of the proposed alignment.)
- Please attach a survey/plat map and vicinity map identifying location and review area for the JD.
- ☐ I currently own this property. ___ I plan to purchase this property.
  ☑ I am an agent/consultant acting on behalf of the requestor.
  ☐ Other (please explain): _____.
- Reason for request: (check as many as applicable)
  ☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all aquatic resources.
  ☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all jurisdictional aquatic resources under Corps authority.
  ☑ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps, and the JD would be used to avoid and minimize impacts to jurisdictional aquatic resources and as an initial step in a future permitting process.
  ☐ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps; this request is accompanied by my permit application and the JD is to be used in the permitting process.
  ☐ I intend to construct/develop a project or perform activities in a navigable water of the U.S. which is included on the district Section 10 list and/or is subject to the ebb and flow of the tide.
  ☐ A Corps JD is required in order to obtain my local/state authorization.
  ☐ I intend to contest jurisdiction over a particular aquatic resource and request the Corps confirm that jurisdiction does/does not exist over the aquatic resource on the parcel.
  ☐ I believe that the site may be comprised entirely of dry land.
  ☐ Other: _____
- Type of determination being requested:
  ☐ I am requesting an approved JD.
  ☑ I am requesting a preliminary JD.
  ☐ I am requesting a "no permit required" letter as I believe my proposed activity is not regulated.
  ☐ I am unclear as to which JD I would like to request and require additional information to inform my decision.

By signing below, you are indicating that you have the authority, or are acting as the duly authorized agent of a person or entity with such authority, to and do hereby grant Corps personnel right of entry to legally access the site if needed to perform the JD. Your signature shall be an affirmation that you possess the requisite property rights to request a JD on the subject property.

*Signature: W. Owen Carson Date: January 9, 2019

- Typed or printed name: William "Owen" Carson

Company name: Equinox Environmental Consultation & Design, Inc.

Address: 37 Haywood Street, Ste. 100
Asheville, NC 28801

Daytime phone no.: Office: (828) 253-6856 ext. 204; Cell: (828) 553-9091

Email address: owen@equinoxenvironmental.com

***Authorities:** Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Program of the U.S. Army Corps of Engineers; Final Rule for 33 CFR Parts 320-332.
Principal Purpose: The information that you provide will be used in evaluating your request to determine whether there are any aquatic resources within the project area subject to federal jurisdiction under the regulatory authorities referenced above.
Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public, and may be made available as part of a public notice as required by federal law. Your name and property location where federal jurisdiction is to be determined will be included in the approved jurisdictional determination (AJD), which will be made available to the public on the District's website and on the Headquarters USACE website.
Disclosure: Submission of requested information is voluntary; however, if information is not provided, the request for an AJD cannot be evaluated nor can an AJD be issued.

Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: 1/9/2019

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Owen Carson (Equinox Environmental); 37 Haywood St., Ste. 100 Asheville, NC 28801

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:
CESAW-RG-A, NCDMS Harrell Stream and Wetland Mitigation Site, SAW-2016-02202

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)

State: North Carolina County/parish/borough: Jackson City: Cullowhee

Center coordinates of site (lat/long in degree decimal format):

Lat.: 35.300733 Long.: -83.134106

Universal Transverse Mercator:

Name of nearest waterbody: Caney Fork

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:

☒ Field Determination. Date(s): 12.21.2016; 1.13.2017

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

Site number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
S01	35.298315	-83.132937	2595lf.	perennial stream	USACE/DWQ
W01	35.300582	-83.134933	1.82	wetland	USACE
W02	35.300083	-83.13408	0.24	wetland	USACE

1) The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.
2) In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there *"may be"* waters of the U.S. and/or that there *"may be"* navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for PJD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

- ☒ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
  Map: Orthoimagery, USGS Topographic, Potential Jurisdictional Resources.
- ☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report. Rationale: _____.
- ☐ Data sheets prepared by the Corps: _____.
- ☐ Corps navigable waters' study: _____.
- ☐ U.S. Geological Survey Hydrologic Atlas: _____.
  - ☐ USGS NHD data.
  - ☐ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 7.5-Minute Sylva Quad.
- ☐ Natural Resources Conservation Service Soil Survey. Citation: _____.
- ☐ National wetlands inventory map(s). Cite name: _____.
- ☐ State/local wetland inventory map(s): _____.
- ☐ FEMA/FIRM maps: _____.
- ☐ 100-year Floodplain Elevation is: _____.(National Geodetic Vertical Datum of 1929)
- ☒ Photographs: ☒ Aerial (Name & Date): NCOneMap 2016 Aerial Orthoimagery.
  or ☐ Other (Name & Date): _____.
- ☐ Previous determination(s). File no. and date of response letter: _____.
- ☐ Other information (please specify): _____.

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

KICHEFSKI.STEVEN.L.1386908539

Digitally signed by KICHEFSKI.STEVEN.L.1386908539
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=KICHEFSKI.STEVEN.L.1386908539
Date: 2019.01.11 11:28:11 -05'00'

Signature and date of Regulatory staff member completing PJD

Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)[1]

[1] Districts may establish timeframes for requestor to return signed PJD forms. If the requestor does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

Harrell Site - Potential Jurisdictional Resources Map

Caney Fork

Caney Fork Road

SB 110

SB 109

S01

SB101

SB102

SB103

SB104

SB105

W02

SB106

SB 107

SB 108

W01

S01

S01

WP03

W03

S01

Stream/wetland features are listed as "Potential" as part of the Preliminary Jurisdictional Determination process. An on-site JD field verification occurred on March 21, 2017, which confirmed the location of resources depicted in this map.

- Project Area
- Jackson County Parcel Data (2016)
- Potential Wetlands
- Headwater Seepage Wetland (W03)*
- Existing Hydric Soils
- Potential Stream Footprint Area
- DWQ Streamlines
- Potential Stream Centerlines
- Logging Road
- Roads
- Current Springhead
- Data Points

*Stream centerlines/water surface area extracted from survey;
*W03 boundaries determined via Trimble submeter-accurate GPS w/differential correction.

0 100 200 400 600 Feet

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Appendix L INVASIVE SPECIES

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INVASIVE SPECIES

Invasive species within the riparian buffers and conservation easement will be treated as necessary at the time of construction. The extent of invasive species coverage will be monitored on a semi-annual basis, mapped and controlled as necessary throughout the required monitoring period. Invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.

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Appendix M CATEGORICAL EXCLUSION

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Appendix M

Categorical Exclusion Form for Division of Mitigation Services

Part 1: General Project Information	
Project Name:	Harrell
County Name:	Jackson
EEP Number:	100005
Project Sponsor:	EW Solutions, LLC
Project Contact Name:	Steve Melton
Project Contact Address:	37 Haywood Stree, Suite 100, Asheville, NC 28801
Project Contact E-mail:	Steve@equinoxenvironmental.com
EEP Project Manager:	Paul Wiesner

Project Description

A stream and wetland restoration site in the Caney Fork watershed whose objectives are to restore or preserve 2,850 linear feet of existing stream and reestablishment of 3.2 acres of wetlands. Stream reaches have been previously relocated or ditched resulting in degraded channels; riparian areas have been cleared and regraded resulting in loss of wetlands. Approximately 9.9 acres of riparian buffer will be revegetated and placed in a permanent conservation easement to protect the restored stream channels and riparian wetlands.

For Official Use Only

Reviewed By:

10-12-17
Date


EEP Project Manager

Conditional Approved By:

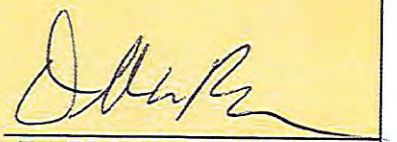
Date

For Division Administrator
FHWA

☐ **Check this box if there are outstanding issues**

Final Approval By:

10-10-17
Date


For Division Administrator
FHWA

Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☐ Yes ☒ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☒ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☒ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☐ No ☒ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☒ Yes ☐ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☒ No ☐ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☒ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☒ No ☐ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☐ Yes ☐ No ☒ N/A
6. Is there an approved hazardous mitigation plan?	☐ Yes ☐ No ☒ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☐ Yes ☒ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☒ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☒ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☒ Yes ☐ No
2. Does the project require the acquisition of real estate?	☒ Yes ☐ No ☐ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☒ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☒ Yes ☐ No ☐ N/A

Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☒ Yes ☐ No
2. Is the site of religious importance to American Indians?	☐ Yes ☒ No ☐ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☒ No ☐ N/A
4. Have the effects of the project on this site been considered?	☐ Yes ☐ No ☒ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☒ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☐ No ☒ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☒ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☒ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☒ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☐ No ☒ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☒ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☒ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☒ Yes ☐ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☐ Yes ☒ No ☐ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☒ No ☐ N/A
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☐ No ☒ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	☐ Yes ☐ No ☒ N/A

6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☐ No ☒ N/A
Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☐ Yes ☒ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	☐ Yes ☐ No ☒ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☒ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☒ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☒ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☒ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☒ Yes ☐ No
2. Have the USFWS and the NCWRC been consulted?	☒ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☒ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☒ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☒ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☒ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☒ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☒ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☒ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☒ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☒ N/A

Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☒ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☒ N/A

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Appendix N FLOODPLAIN CHECKLIST

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EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all EEP projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. State NFIP Engineer), NC Floodplain Mapping Unit (attn. State NFIP Coordinator) and NC Ecosystem Enhancement Program.

Project Location

Name of project:	Harrell Mitigation Site
Name of stream or feature:	Unnamed Tributary to Caney Fork (Harrell Creek)
County:	Jackson County
Name of river basin:	Little Tennessee River
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Jackson County
DFIRM panel number for entire site:	7568 and 7569
Consultant name:	Stantec Consulting Services Inc.
Phone number:	(828) 229-8446
Address:	56 College Street, Suite 201 Asheville, NC 28801

Design Information

Provide a general description of project (one paragraph). Include project limits on a reference orthophotograph at a scale of 1" = 500". See attached plans for project limits.

The Harrell Mitigation Site (the Site) is located approximately 2.8 miles southeast of Cullowhee, NC (Figure 1). The Site consists of a small unnamed tributary to Caney Fork and its adjacent wetlands. The unnamed tributary is referred to as Harrell Creek for purposes of this plan. The Harrell Site encompasses approximately 8.4 acres of seep-fed headwater stream continuing to an actively managed floodplain. The stream channel was likely relocated and a berm was constructed, redirecting and creating an unnatural flow of the stream. The goal of the project is to restore ecological function to the existing stream, 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 will alter the flooding frequency of the channel, restore proper floodplain connectivity, and improve wetland hydrology. The restoration efforts will also include addressing a perched culvert, removing a second pipe crossing, and addressing erosion issues.

Summarize stream reaches or wetland areas according to their restoration priority.

Example

Reach	Length	Priority
Reach 1(A)	640	*Preservation*
Reach 1(B)	273	*One (Restoration)*
Reach 1(C)	1268	*One (Restoration)*
Reach 1(D)	249	*One (Restoration)*

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?

☉ Yes ○ No

If project is located in a SFHA, check how it was determined:

☐ Redelineation

☐ Detailed Study

☑ Limited Detail Study

☐ Approximate Study

☐ Don't know

List flood zone designation:

Check if applies:

☑ AE Zone

- ○ Floodway
- ☉ Non-Encroachment
- ○ None

☐ A Zone

- ○ Local Setbacks Required
- ○ No Local Setbacks Required

If local setbacks are required, list how many feet:

Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?

○ Yes ☉ No

Land Acquisition (Check)

☐ State owned (fee simple)

☐ Conservation easment (Design Bid Build)

☑ Conservation Easement (Full Delivery Project)

Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)

Is community/county participating in the NFIP program?

☒ Yes ☐ No

Note: if community is not participating, then all requirements should be addressed to NFIP (attn: State NFIP Engineer, (919) 715-8000)

Name of Local Floodplain Administrator: Tony Elders
Phone Number: (828) 631-2284

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

☐ No Action

☐ No Rise

☐ Letter of Map Revision

☐ Conditional Letter of Map Revision

☑ Other Requirements

List other requirements:

Jackson County Floodplain Development Permit

Comments: Discussion with Tony Elders, Jackson County Floodplain Administrator (9/4/18). Because no grading occurs within the published XS's FW widths (non-encroachment areas) a No-Rise is not necessary. Only the County Floodplain Development permit is required.

Name: Chris Engle Signature: CMEngle

Title: Project Engineer Date: 1/21/19

JACKSON COUNTY
FLOODPLAIN DEVELOPMENT PERMIT

Permit Number _____ Issuance Date _____ PIN _____
Or Deed Book/Page_____

In accordance with the Jackson County Flood Damage Prevention Ordinance, a Floodplain Development Permit is hereby granted to:

_____

To conduct development activities within the area of special flood hazard on property located at:

_____

This Permit is issued to the aforementioned individual, firm, partnership, etc. for the purpose noted above and in accordance with the Jackson County Flood Damage Prevention Ordinance, Floodplain Development Permit No. _____ and attachments thereto; and is subject to the following modifications and/or performance reservations:

1. Permit issued for the following development only.

Excavation: _____	Fill: _____	Grading: _____
Mining:_____	Dredging:_____	Storage of Equip./Materials_____
Utility Construction: _____	Road Construction: ____	Residential Construction: _____
Nonresidential Construction: _____	Addition: _____	Renovation: _____

Other (specify): _____

Specify the limitations of this permit so there will be no doubt of coverage under its issuance.

2. The lowest floor and all attendant utilities shall be at least 2 feet above the base flood elevation [NGVD 1929_____ or NAVD 1988_____]. ***Check correct datum*** ***Approximate Base Flood Elevation_____***

3. Pursuant to Article 4, Section B (5) of the Jackson County Flood Damage Prevention Ordinance, it shall be the duty of the permit holder to submit to the Floodplain Administrator the Elevation/Floodproofing Certification within 21 calendar days of the floodproofing being completed.

4. Lowest floor be at least two feet above the BFE as determined by a registered land surveyor or provide floodproofing to that same level and have it certified by a registered design professional licensed in the state of NC.

5. Proper Erosion and Sediment control measures shall be installed and maintained in accordance with Jackson County Sediment Control Ordinance and the North Carolina State Standards during fill operations.

6. Provide a minimum of two (2) openings in the foundation wall, having a total area of not less than one square inch for every square foot of enclosed area subject to flooding. The bottom of the openings shall not be greater than one (1) foot above the ground elevation at the perimeter of the foundation wall. The access area to the crawl space may be utilized to meet these criteria provided a mesh or screen door is used.

7. Mobile/Manufactured home shall be installed in accordance with the Jackson County Flood Damage Prevention Ordinance, Article 5, Section B,(2)(b).

8. Upon completion of foundation construction, contact the Permitting & Code Enforcement Office for foundation inspection.

9. This project will not have any impact that will create change to the flood elevations as noted on the Jackson County flood maps.

Failure to comply with the Jackson County Flood Damage Prevention Ordinance, including any modifications and/or performance reservations, could result in assessment of civil penalties or initiation of civil or criminal court actions as defined in Section H of the Jackson County Flood Damage Prevention Ordinance..

Issued this _____ day of _____, 20___.

_____
Jackson County Permitting & Code Enforcement Office
CFM