FINAL MITIGATION PLAN

Greenbrier Stream Restoration Site

Yadkin County, North Carolina

NC DEQ Contract No. 7616
DMS ID No. 100086
USACE Action ID No. SAW-2018-01755
NCDWR ID: 20181272
RFP No. 16-007406

Yadkin River Basin
HUC 03040101

Prepared for:

Mitigation Services
ENVIRONMENTAL QUALITY

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

December 2019

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

REPLY TO
ATTENTION OF:

December 12, 2019

Regulatory Division

Re: NCIRT Review and USACE Approval of the NCDMS Greenbrier Stream Restoration Site / Yadkin Co./ SAW-2018-01755/ NCDMS Project # 100086

Mr. Tim Baumgartner
North Carolina Division of Mitigation Services
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 Greenbrier Stream Restoration Draft Mitigation Plan, which closed on November 3, 2019. 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.

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,

BROWNING.KIMBERLY.DANIELLE.1527683510

Digitally signed by BROWNING.KIMBERLY.DANIELLE.1527683510
Date: 2019.12.12 11:56:29 -05'00'

Kim Browning
Mitigation Project Manager
for Tyler Crumbley

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
Paul Wiesner– NCDMS
Kevin Tweedy, Jake Byers—EPR

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

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December 16, 2019

Paul Wiesner
North Carolina Department of Environmental Quality
Division of Mitigation Services (NCDMS)
Western DMS Field Office
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

Subject: **Mitigation Plan Report and Construction Plans**
Greenbrier Stream Restoration Project
Yadkin River Basin Cataloging Unit 03040101
DMS Project ID #100086
Contract # 7616

Dear Mr. Wiesner,

Ecosystem Planning and Restoration (EPR) has reviewed the comments of the Draft Mitigation Plan and Preliminary Plans for the Greenbrier Stream Restoration Project provided by the North Carolina Interagency Review Team (NCIRT) on 11/22/2019. The comments have been addressed as described below to create the Final Mitigation Plan for the Greenbrier Stream Restoration Project.

Comments from NCIRT are provided on the following pages in italics with our responses immediately following the comment, according to the following format:

Reviewer

1. *NCIRT Comment*
    - EPR Response

Please contact me at the above phone number or address with any questions.
Sincerely,

Kevin Tweedy, PE

Erin Davis, NCDWR

1. *Page 2, Section 1.1 – DWR appreciates that the proposed farm crossing will be located within the existing utility easement to reduce fragmentation.*
    - Response: N/A

2.
    a. *Page 13, Section 7.0 – Given the small drainage areas, flow is a general concern for this project. In particular, whether flow will be sustained in the upper 100-foot section of UT1B that is proposed to be raised 1-2 feet.*
        - Response: DWR's concerns are noted. Flow gages are being placed within UT1 R1, UT1A-1 and UT1B as shown on Figure 9 to document the flow duration in these reaches.

    b. *Page 13, Section 7.0 – No wood is proposed to be added to the channel or bank along UT1 Reach 1, UT1A or UT1B. DWR would like woody treatments to be considered for these reaches.*
        - Response: A small amount of toe wood is being proposed along UT1 R1 at approximate stations 10+40 and 11+60. Additionally, several log j-hook vanes are being used along this reach adding large woody debris. Due to the design bankfull slope of this reach, it was determined that using rock material for constructed riffles used for grade control was a more conservative and appropriate approach. Woody material (logs and brush) generated on-site is also limited. As such, grade control woody riffles and toe wood have been heavily incorporated into UT1 R3 where the slopes are lower, the bed form morphology is riffle-pool, and the drainage area is larger. The larger drainage area will likely ensure that flow throughout this reach is large enough to keep the woody material used for grade control features saturated, thus preventing decomposition of the woody material. All woody material generated on-site will be incorporated into the project.

3. *Page 13, Section 7.1 – Based on the profile survey of the existing grade provided on Sheet 4, the culvert does not appear to be perched. Please confirm.*
    - Response: The existing profile shown on sheet 4 is the profile of the existing ground along the proposed alignment. As can be seen from the plan view, the design alignment has been straightened so that flow out of the culvert is now directed down valley. The existing profile along the existing alignment can be seen in UT1 profile in Appendix 4. While this culvert isn't cantilevered above the existing stream channel, the elevation difference between the invert of the pipe and the bottom of the existing channel is approximately 8 feet at an 18% slope making any aquatic organism passage unlikely.

4. *Page 14, Section 7.1 – Since establishment of vegetative cover and vigor can be a challenge on Priority II restoration banks/benches, please include a discussion on how the soil restoration will be addressed during construction and reference potential adaptive management.*
    - Response: A statement was added to the third paragraph of section 7.1 stating "Existing topsoil where grading is proposed will be stripped and stockpiled separately from the underlying subsoil. Once the channel, bankfull benches, and terraces have been roughly graded, six to eight inches of the stockpiled topsoil will be applied to bring the features up to the finish grades and to ensure a soil media capable of supporting healthy vegetation. If substantial areas of planted vegetation do not survive or grow with vigor, maintenance will be conducted in accordance with the Maintenance Plan in Appendix 10 of this Mitigation Plan."

5. *Page 16, Sections 7.2 – For Table 10c, should there be a footnote associated with the sinuosity asterisk?*
    - Response: This asterisk has been deleted.

6. *Page 17, Section 7.3 – For Table 10d, are there sinuosity values for UT1B?*
    - Response: Sinuosity values for UT1B have been added to Table 10d.

7. *Page 17, Section 7.4 – This section identifies both chemical and mechanical methods to be used during construction to treat invasives. However, Appendix 9 only notes mechanical methods during construction. Please confirm methodology. Also, DWR echoes DMS' concern regarding fescue within the easement and requests EPR consider treating prior to construction. And as noted in Appendix 9, invasive species should be treated within the entire easement, including the 20-25 percent invasive cover within the wetlands. DWR recommends treating woody invasives at minimum annually during the monitoring/maintenance period.*
    - Response: Invasive woody species not mechanically removed during construction will be chemically treated during the construction period or at a time where the treatment will have the greatest probability of success. Stiltgrass within the wetlands will be treated during construction or at a time where the treatment will have the greatest probability of success. The conservation easement will be assessed annually, and any additional chemical treatments will be conducted on an as-needed basis. It is anticipated that planted herbaceous and woody species will outcompete any remaining fescue within the easement. If fescue begins to outcompete the native vegetation, chemical treatments will be conducted in those areas.

8. *Page 17, Section 7.5 – Were available local government and state transportation planning documents for the project vicinity reviewed and/or agencies consulted regarding any potential future development projects?*
    - Response: No. The project is in a rural area of NC; the closest major city is Winston-Salem, approximately 30 miles to the east. The closest major roadways to the site are I-77 to the east and US 421 to the south. Based on the NC

Department of Transportation State Transportation Improvement Program (STIP), neither roadway is scheduled to have its capacity increased over the most recent planning horizon (2030).

9. *Page 20, Section 8.2 – Please update the following bullet to include the italicized text from the 2016 Mitigation Update Guidance. Planted and volunteer stems are counted, provided they are native to the site and from the approved planting list included in the Mitigation Plan.*
    - Response: The requested update has been made.

10. *Page 21, Section 8.3 – For consistency, please use the same text for project objectives in Table 9 and Table 11. Also, please reference required bankfull events and minimum consecutive flow days in the Table 11 performance criteria column.*
    - Response: The text in Tables 9 and 11 has been revised to be more consistent. The requirements of having four bankfull events in separate years and 30 consecutive days of documented stream flow each year in each reach have been added to Table 11.

11. *Page 23, Section 9.2 – Based on Table 1, a total of 6.3 acres are proposed for planting. Please include an additional fixed veg monitoring plot to meet the 2 percent minimum site coverage referenced in the 2016 Mitigation Update.*
    - Response: An additional fixed vegetation plot has been added to Table 13 bringing the total (random + fixed) number of plots to 6.

12. *Page 24, Section 9.3 – Please include photo locations at the culvert crossing. Also, visual monitoring should include problem areas concerning encroachment/site boundary and beaver (as applicable).*
    - Response: Section 9.3 has been revised to state that photos will be taken at the stream crossings. This section has also been revised to include easement encroachments, and beavers as potential problem areas.

13. *Figures – On Figure 9 please indicate by line color restoration and enhancement reaches and label cross sections.*
    - Response: The stream reaches have been color coded to correspond to the approach (Restoration vs Enhancement II). An additional vegetation monitoring plot has also been added to this figure as described in comment 11 above. The cross sections will be labeled once the monitoring cross sections have been installed post construction. A CCPV map included in the Baseline and subsequent monitoring reports will show these labeled cross sections.

14. *Appendix 4 – a. The cross-section sheets River Name is identified as UT to Meadow Brook. If this is the project site, please rename for clarity to either Greenbrier Stream Restoration Project or UT to South Deep Creek (as noted on page 1); b) Please provide a labelled map correlating to plotted cross sections 1 through 8; and c) For Table 2, please separate out stream and vegetation survey monitoring dates.*
    - Response: The cross-section sheets have been relabeled as Greenbrier Stream Restoration Project. Figure 2 has been revised to show the existing condition cross section locations and has been labeled. Table 2 shows the dates for the

total monitoring period for each year. The dates and frequency of channel and vegetation monitoring are shown in Tables 12 and 13 in Section 9.

15. *Appendix 8 - Please include a plunge pool detail (as previously requested by DMS). Based on the design provided, it appears the Class 1 stone plunge pools will be functioning primarily as armored outlet structures. DWR does not support these riprap areas as stream restoration credit length.*
    - Response: Stabilized plunge pools have been included in the design to ensure that high energy flows exiting the NCDOT culvert and the steep grade transition from UT1 R2 to UT1 R3 will not cause erosion. The bed elevation in the location of the upstream plunge pool will be raised approximately 8' to reconnect the downstream section of this stream to the section above this culvert. The plunge pools will be deep and provide an area for energy dissipation. Lining the pool with stone will prevent degradation. The pools will hold water year-round providing much needed pool habitat in a system that currently lacks pools. It is expected that detritus and fines will deposit in the pools which will make these sections function more naturally over time. Additionally, the downstream plunge pool will have toe wood installed along the banks, which will protect the stream banks and provide large woody debris. The level of required intervention to raise this channel and the functional benefits to habitat, aquatic passage, and stability should warrant restoration credit in these sections regardless of the need to harden the plunge pool with quarried stone. Two details showing both plunge pools have been added to the plans.

16. *Sheet 2C – The proposed channel fill and ditch plug are shown using a single icon on the plan sheets. Please confirm that all indicated channel areas will be filled to existing adjacent grade. If partial ditch filling is proposed, please include a separate detail and indicate the maximum depth from top of bank to be filled. Also, please confirm whether proposed ditch plugs will have a restrictive material core (clay composition).*
    - Response: Any abandoned channel areas will be filled to the adjacent grades. No low areas are currently designed excluding one jurisdictional wetland area (WC) which will not be filled. The contractor will use judgement in selecting and placing soil material where new channel is near the old channel and incorporate higher clay content material wherever possible.

17. *Sheet 3B - DWR appreciates the plant list diversity, including species with varying growth rates such as water oak and understory trees/shrubs. Have you had success with redbud establishment? Based on Schafale (2012), an alternative to redbud to consider could be Carpinus caroliniana.*
    - Response: Redbud has been successfully established on past mitigation projects. Hornbeam is also a good suggestion and will be considered as an alternate if species are unavailable during planting.

18. *Sheet 4 – Please show the existing road right-of-way boundary line. DWR recommends a 50-ft setback of the proposed easement from the existing road edge to avoid potential future transportation easement encroachment requests.*
    - Response: The NCDOT right-of-way boundary has been added to the sheets. Please note that stream crediting along UT1 does not begin until after UT1

leaves the NCDOT right-of-way boundary at station 10+06. Asset tables have been updated to reflect this.

19. *Sheet 6 – Sections of proposed bench width along UT1 Reach 3 appear to be only 5 feet wide. DWR recommends that benches be at least two times bankfull width. Particularly of concern are the bench widths on the outer meander bends where much of the flow energy vectors are directed.*
    - Response: While some individual bench widths are approximately 5' wide, the overall floodplain width through this section is greater than 40' which is over five times the bankfull width. When flows greater than bankfull occur, flows spread out evenly across the floodplain and are directed down valley. Directional vectors are not as much of a concern on the floodplain as they are in the channel where flows are confined. As such, EPR has determined that this floodplain width is adequate along this reach.

20. *Sheet 7 - The proposed bankfull bench extent of the right side of UT1 Reach 3 is not shown. Please include.*
    - Response: The bench on the right side of UT1 Reach 3 ends at approximate station 25+10 where the priority 2 restoration transition to priority 1. The area on the left side of this reach is lower than the field section on the right side. The bench limits shown on the left side of the stream from approximate station 25+10 downward are to show the extents of filling to ensure a floodplain at the bankfull elevation.

21. *Sheet 9 - Please include proposed locations of gates for site access by regulatory and stewardship staff.*
    - Response: Gates have been labeled on sheets 9 and 10.

Kim Browning, USACE

1. *The correct USACE Action ID is SAW-2018-01755. Please correct the cover page.*
    - Response: The USACE Action ID has been corrected.

2. *It would be beneficial to add some coarse woody debris to the depressional areas in the buffers and throughout the adjacent wetlands for habitat, and to help store sediment, increase water storage/infiltration, and absorb water energy during overbank events.*
    - Response: EPR agrees with this statement. Any woody material not needed for in-stream structures or toe wood will be utilized in the suggested manner.

3. *When submitting the PCN, please include an estimate of the number of trees, or acres, to be cleared for the NLEB 4(d) Rule.*
    - Response: There will be approximately 1 acre of sparsely wooded areas cleared as part of the project. This information will be provided on the PCN.

4. *The proposed crossing/utility break was not presented on the original technical proposal map. Please include proposed crossings on future submittals.*
    - Response: Noted. The single pole utility line was not noticed initially.

5. *The figures have conflicting information regarding the inclusion of UT1C. This reach is only depicted on Figures 2 and 6. Please confirm that this reach is not included for credit.*
    - Response: UT1C is **not** included for credit.

6. *Section 7 refers to two vegetated swales. It appears these are planned above UT1a-1 and UT1b. Please confirm that these areas are not within jurisdictional waters. They appear to intersect wetlands.*
    - Response: Existing jurisdictional wetland areas are shown on the design plan sheets (See legend on sheet 1A for symbology). As can be seen from sheets 5 and 7 where these swales are proposed, no wetlands will be impacted.

7. *It would be preferable to move the flow gauge on UT1a-1 to the upper third of the reach.*
    - Response: The flow gauge along this reach will be installed closer to the top of this reach. Figure 9 has been revised to reflect this.

8. *Please show photo points on Fig 9 (Section 9.3).*
    - Response: As stated in Section 9.3, photos will be taken at all vegetation plots, all monitored cross sections, and all monitoring gauges, stream crossings, and at stream stations along the project reaches. The locations of the photo points at stream stations along the reach will be determined during the baseline monitoring setup to ensure the best locations are utilized.

9. *Section 8.1, page 18: The 2018 DMS Technical Workgroup Guidance is not an addendum to the NCIRT 2016 Guidance.*
    - Response: Noted.

10. *Sections 7.4 and 9: Present invasive species listed in section 3.2 also include knotweed. Please add this to those sections.*
    - Response: The 'knotweed' referred to in section 3.2 are species of the genus *Persicaria* (included in the text), which are separate from Japanese knotweed (*Polygonum cuspidatum*). Another term for the *Persicaria* species, smartweed, has been substituted to avoid confusion.

11. *Section 7.5: Project Risks and Uncertainties—I appreciate the thought put into this section. This would be great to see in all mitigation plans. Under encroachments, it may be beneficial to consider the road proximity in regard to future encroachments for road widening/repairs. It may also be beneficial to consider the utility easement maintenance.*
    - Response: Language has been added to this section to address the potential issues noted above.

12. *Section 8.2: Planted and volunteer stems are only counted if they are on the approved planting plan.*

a. It is recommended to add a performance standard addressing the control of invasive species (to less than 5%).

- Response: Section 8.2 states that only volunteers included in the approved planting plan shall be counted. Also, per the October 2016 Wilmington District Stream and Wetland Compensatory Mitigation Update, no specific performance standards have been established for controlling invasive species. However, per the Invasive Species Plan included in Appendix 9, the goal to control invasive species to comprise less than 5% of the total easement area is listed. The easement will be monitored annually, and any invasive species areas will be noted and mapped. Treatment will be conducted as needed throughout the monitoring period.

13. *Table 13: It would be beneficial to see invasives listed.*
    - Response: Invasive species currently found on-site are listed in Section 7.4 and in Appendix 9.

14. *Please depict the location of all gates on design sheets. This is beneficial for monitoring and IRT site visits.*
    - Response: Gates have been added to sheets 9 and 10.

15. *Design Sheet 6: Proposed bench width along UT1 R-3 appears to be very narrow. Benches be at least two times bankfull width.*
    - Response: Please see the response to DWR comment 19 above.

FINAL
MITIGATION PLAN

Greenbrier Stream Restoration Site
Yadkin County, North Carolina
NC DEQ Contract No. 7616
DMS ID No. 100086
USACE Action ID No. SAW-2018-01755
NCDWR ID: 20181272

Yadkin River Basin
HUC 03040101

Prepared for:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

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Contributing Staff:

Kevin Tweedy, PE
Jake Byers, PE
Amy James, PWS
Russell Myers

EXECUTIVE SUMMARY

The Greenbrier Stream Restoration Project (Project; Site) is located in the South Deep Creek watershed of the Yadkin-Pee Dee River Basin, in NCDMS targeted local watershed 03040101130020. The Project is located in Yadkin County off Meadow Brook Drive and Collins Road, approximately 1.5 miles north of US 421 and 1 mile west of I-77 and will involve the restoration of streams heavily impacted by cattle and channelized to promote cattle grazing activities. The restoration of the proposed streams and riparian buffers, as well as their permanent conservation, will ensure their protection from future growth and development in the Yadkin River basin.

The Project is comprised of four unnamed tributaries (UT1, UT1A, UT1A-1, and UT1B) to South Deep Creek, all of which are in degraded condition due to cattle access and/or channelization. Restoration practices will involve partially raising the streambeds of the project streams and reconnecting them with active floodplains along the fall of the valley, thereby restoring flow dynamics and a functioning headwater stream system. Restoration activities proposed as part of the Project will likely improve the water quality of receiving waters and improve habitat for biota.

The proposed mitigation activities on the Site will provide an estimated 2,413.48 stream credits within a 6.7-acre conservation easement. The headwater streams proposed for restoration have been impacted by farming practices, past stream channelization, and direct cattle access.

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 North Carolina Division of Mitigation Services (NCDMS) operations and procedures for the delivery of compensatory mitigation.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 PROJECT INTRODUCTION

Ecosystem Planning and Restoration, PLLC (EPR) is contracted with the NC Division of Mitigation Services (DMS) to provide stream mitigation credits in the Yadkin-Pee Dee River Basin (Hydrologic Cataloging Unit [HUC] 03040101). The project is located in Yadkin County off Meadow Brook Drive and Collins Road, approximately 1.5 miles north of US 421 and 1.0 mile west of I-77 (Figure 1). The project lies within the DMS targeted local watershed 03040101130020 and the Northern Inner Piedmont EPA Level IV ecoregion.

The Greenbrier Stream Restoration Project (Project; Site) involves the restoration and/or enhancement of four unnamed tributaries (UT1, UT1A, UT1A-1 and UT1B) to South Deep Creek. UT1 is the mainstem UT and is a perennial channel throughout its length. UT1 exhibits significant instability due to direct cattle access, trampling, and active bank erosion. UT1A is a small, intermittent tributary that flows into UT1 approximately mid-way along the UT1 reach. Active erosion due to cattle access and trampling is present throughout its length. UT1A-1 is a short intermittent stream that begins at a pronounced headcut and flows into UT1A near its origin. It has also been subject to cattle trampling and appears to have been channelized in the past. UT1B is a small, intermittent tributary that flows into UT1 and begins at a headcut that intercepts groundwater discharge. This reach is actively eroding due to heavy cattle trampling. In addition, the channel has become deeply incised due to the headcut moving upstream. The naming convention for the stream reaches and their locations within the project are illustrated in Figure 2. Restoration practices will involve raising the streambeds of the project streams and reconnecting them with active floodplains along the fall of the valley, thereby restoring flow dynamics and a healthy headwater stream system. Woody buffers at least 50 feet in width will be established along all reaches, and all work will be protected by a perpetual conservation easement.

The Greenbrier Stream Restoration site was instituted via NCDEQ-DMS RFP # 16-007406. As approved by the NCIRT, all projects contracted under the 16-007406 RFP have a cool or warm service type. Penalties will not be assessed for using these project mitigation credits to satisfy cool or warm requirements.

Site activities, which will provide an estimated 2,413.48 stream mitigation credits within a 6.7-acre conservation easement, include the following:

- Restoration of 2,336 linear feet of stream channels that have been straightened and channelized for cattle grazing activities;
- Enhancement of 193.7 linear feet of stream channel that have been degraded by erosion and direct cattle access;
- Restoration of riparian buffers 50 feet in width or wider along all stream reaches; and
- Implementation of BMPs to remove cattle from the easement and improve agricultural runoff into the reaches.

Though the Project will provide significant improvements to existing wetland connectivity and function within the riparian buffer, no credits are sought for the wetlands within the Site.

Table 1. General Project Information

Project Information	
Project Name	Greenbrier Stream Restoration Site
County	Yadkin
Easement Area (acres)	6.7
Project Coordinates (latitude and longitude)	36°8'54"N, 80°49'46"W
Planted Acreage (acres of woody stems planted)	6.3

1.1 Property Ownership and Boundary

The Site will consist of an approximately 6.7-acre easement located inside a 33-acre parcel owned by Donnie R. Ireland. A perpetual conservation easement has been prepared that incorporates the results of this Mitigation Plan (Appendix 1). The conservation easement is depicted on a recordable plat, signed by the owner, that has been recorded in the Yadkin County Register of Deeds. Fencing located slightly outside the easement boundary will prevent encroachment and protect the mitigation area from anticipated future livestock presence on the Site.

One farm crossing is required to allow livestock and farm equipment to access fields and pastures on either side of the Site streams. The culverted crossing will be located within the single-pole powerline easement that crosses the site in the upper half of UT1. Fencing installed around the crossing will ensure permanent exclusion of livestock.

1.2 Utilities

One single-pole powerline easement crosses the site in the upper half of UT1. This easement will be excluded from the conservation easement area and will coincide with the location of a culverted stream crossing that will provide the landowner access to both sides of the project after restoration. No other utility easements are located on the Site.

1.3 Site Access

All portions of the conservation easement are accessible via Meadow Brook Drive, which will provide perpetual access.

2.0 WATERSHED APPROACH AND SITE SELECTION

The South Deep Creek watershed (03040101130020), shown in Figure 3 is a moderately developed water supply watershed (WS-III) and a targeted local watershed (NCEEP, 2009). As such, the Project will provide numerous water quality and ecological benefits within the South Deep Creek and Yadkin River watersheds. Major goals for the Upper Yadkin Pee-Dee River Basin identified in the River Basin Restoration Priorities (RBRP) include:

1) Restoration of water quality and aquatic habitat in impaired stream segments;
2) Protection of high-resource value waters, including waters within water supply watersheds (WSW);
3) Continuation of existing watershed restoration and protection initiatives; and
4) Implementation of agricultural BMPs within high-priority rural sub-watersheds, especially with respect to limiting inputs of sediment, nutrients, and fecal coliform from active farming operations.

In addition to these larger watershed goals, water quality concerns from agricultural lands, animal operations, and disturbed buffers are specific concerns listed for South Deep Creek. The Yadkin Pee-Dee Basinwide Water Quality Plan (NCDWQ, 2008), considers South Deep Creek impaired by turbidity from agricultural practices and impervious surfaces.

The Project will restore a healthy headwater stream system in what is currently an active cattle pasture in a WS-III watershed that is 57% agricultural land use at the 14-digit HUC level. The Project will restore riparian buffers at least 50 feet in width along all stream reaches and will implement agricultural BMP's and exclude cattle from the streams. Implementing BMPs ensures these resources provide long-term stability and water quality improvements. The Project will continue existing water quality initiatives in the watershed and address each of the above-mentioned watershed goals by:

- Restoring aquatic habitats and stabilizing stream banks that are currently degraded by cattle access and bank erosion;
- Improving water quality by excluding cattle, restoring buffers, and stabilizing streams that are part of a WS-III watershed;
- Continuing existing water quality initiatives that are on-going in the watershed; and
- Implementing agricultural BMPs such as fencing and vegetated swales in a rural sub-watershed.

These goals are reflected in the project goals and objectives outlined in Section 6.0 of this report.

3.0 BASELINE AND EXISTING CONDITIONS

The Project is in a rural area of western Yadkin County. Land use within the project's immediate watershed is comprised of approximately 49% agricultural land, 42% forest, and 8% developed land, including open space and low intensity development. The Site is impacted by farming practices, past stream channelization, and direct cattle access. Riparian buffers have been cleared or heavily thinned along all stream reaches, and cattle have access (or have had access in the recent past) to the entire site. Hoof shear and/or shear stresses have severely impacted the stream banks along the Project reaches, causing significant, on-going sedimentation to downstream waters.

While the Site is close to two main thoroughfares (I-77 and US Route 421), there are no foreseeable signs of impending land use changes or development pressure that would impact the Project's watershed. The conservation easement will eliminate potential for future development and/or agricultural use in the floodplain areas of the restored streams.

The existing watersheds were delineated using a variety of information, including USGS 7.5-minute topographic quadrangles, USGS StreamStats, and site-specific topographic survey data. All Project streams are considered cool water channels. Land use and watershed areas for each stream reach are provided in Table 2.

Table 2. Project Land Use and Watershed Characteristics

Land Use and Watershed Characteristics					
Physiographic Province	Piedmont				
Level III, IV Ecoregions	Piedmont, Northern Inner Piedmont				
River Basin	Yadkin				
USGS Hydrologic Units 8-digit, 14-digit	03040101, 03040101130020				
DWR Sub-basin	03-07-02				
Reaches	**UT1**	**UT1A**	**UT1A-1**	**UT1B**	**UT1C+**
Drainage area (acres)*	85	8	8	10	N/A
Drainage area (sq. miles)*	0.13	0.01	0.01	0.02	N/A
Thermal Regime	Cool	Cool	Cool	Cool	N/A

* Represents the most downstream portion of the existing reach.
+ This stream is not proposed for restoration or enhancement work as part of this project.

3.1 Physiography, Topography, and Soils

The Project lies within the Piedmont physiographic province and Level III Piedmont ecoregion. This region is a transitional area between the mountainous Appalachians ecoregions and the flat coastal plain, with irregular plains and some hills. Its geology is generally dominated by a mosaic of metamorphic and igneous rocks, most of which are covered with saprolite; however, exposed rock can be found as streamside bluffs and scattered granitic domes and flatrocks. More specifically, the Site lies within the Inner Piedmont, Chauga Belt, Smith River Allochthon, and Sauratown Mountain geologic belt (NCGICC, 2019). Further, the Project lies within the Northern Inner Piedmont EPA Level IV ecoregion, which is characterized by higher elevations, rougher topography, and steeper stream gradients than other areas of the Piedmont. The area gets 45 inches of annual average precipitation,

which is evenly spread throughout the year. Most of the Project is situated in a moderately wide section of valley with a narrower valley at the upstream end (Figure 5).

The upper section of UT1 contains a bedrock-controlled area that is likely formed from metamorphosed granitic rock, dated to approximately 455-540 my. This type of rock is generally equigranular to megacrystic, foliated to massive and includes Toluca Granite (Fullagar and Odom, 1973).

Soils present on the Site include Clifford, Nathalie, Fairview, and Delila soil series (Figure 6). Clifford sandy clay loam exists along the floodplain as well as on the adjacent terraces and uplands of the Site. Clifford soils are moderately eroded, well-drained soils composed of saprolite residuum weathered from schist and/or gneiss, with slopes ranging from six to ten percent. Delila fine sandy loam can be found along the majority of UT1. Delila is a poorly drained soil composed of alluvium and/or colluvium over saprolite derived from granite and gneiss, with slopes ranging from zero to six percent. Fairview fine sandy loam is a well-drained, moderately eroded soil present on the northern side of UT1 that runs northward well out of the easement. Fairview consists of saprolite derived from granite and gneiss and/or schist, with slopes ranging from six to ten percent. Nathalie fine sandy loam is found in the floodplain at the eastern end of the Project, while Nathalie sandy clay loam is located along UT1 at the western end of the Project. Both soils are well-drained, have slopes ranging from six to ten percent, and consist of saprolite derived from granite and gneiss and/or schist. Nathalie sandy clay loam is a moderately eroded soil. Of all the soil series present on the Site, only Delila fine sandy loam is classified as a hydric soil.

Soil types within the project area mapped by the NRCS Web Soil Survey are further described below in Table 3.

Table 3. Project Soil Types and Descriptions.

Soil Name	Description	Hydric Status
Clifford	Clifford fine sandy loam and sandy clay loam are very deep, well-drained soils located on interfluves, along ridges and hillslopes. Both have a moderately high to high water capacity and are not subject to flooding.	Non-hydric
Delila	Delila fine sandy loam is a very deep, poorly drained soil located along flats and at the heads of small drainageways in uplands. It has a very low to moderately low water capacity and is not subject to flooding.	Hydric
Fairview	Fairview fine sandy loam is a very deep, well-drained soil located on ridges and hillslopes. It has a moderately high to high water capacity and is not subject to flooding.	Non-hydric
Nathalie	Nathalie fine sandy loam and sandy clay loam are very deep, well-drained soils located on ridges and low hills. Both have a moderately high to high water capacity and are not subject to flooding.	Non-hydric

3.2 Existing Vegetation

Vegetation throughout the Site is significantly impacted by cattle grazing, which has resulted in sparse canopy trees along the reaches, which account for the majority of the woody vegetation. Common plant species that are found on the Site are described below. Photographs of the site can be found in Appendix 2.

Canopy species observed at the site include red maple (*Acer rubrum)*, American holly (*Ilex opaca)*, sweet gum *(Liquidambar styraciflua)*, black walnut (*Juglans nigra*) tulip poplar (*Liriodendron tulipifera)*, black locust (*Robina pseudoacacia)*, tree-of-heaven (*Ailanthus altissima)*, hackberry (*Celtis occidentalis)*, black cherry (*Prunus serotina)*, and sycamore (*Platanus occidentalis).* The sparse understory consists of eastern red cedar (*Juniperus virginiana)*, Chinese privet (*Ligustrum sinense)*, crab apple (*Malus spp.)*, and multiflora rose (*Rosa multiflora).* A dense understory is present along UT1 downstream of Collins Road where cattle have been excluded. Species present are the same as those listed above but in a much denser arrangement than the pasture areas. The herb layer is dominated by pasture grasses, as well as Japanese stiltgrass (*Microstegium vimineum*) and various species of smartweed (*Persicaria* spp.) in wetter areas.

3.3 Project Resources

EPR conducted investigations for jurisdictional waters of the U.S. in March and October 2018. Wetlands were assessed using the U.S. Army Corps of Engineers (USACE) Routine On-site Determination Method. This method is defined by the 1987 Corps of Engineers Wetland Delineation Manual and the Eastern Mountains and Piedmont Regional Supplement. Potential jurisdictional wetlands were assessed using the USACE Wetland Determination Data Form and the NC Wetland Assessment Method (NCWAM). Streams were assessed for flow permanence using the NCDWR Stream Identification Form. A copy of these forms can be found in Appendix 3. Five jurisdictional streams (Table 4) and four wetlands (Table 5) were delineated during the on-site investigations.
A Preliminary Jurisdictional Determination (PJD) package was submitted to the USACE on November 26, 2018. A site visit was conducted on May 1, 2019 to review the water resources delineated by EPR. The meeting was attended by William Elliott (USACE) and Amy James (EPR). The notification of preliminary jurisdictional determination (PJD) dated May 7th, 2019 is provided in Appendix 3.

Table 4. Jurisdictional Stream Resources Within the Project Boundary

	Reach Summary				
Reach	**UT1**	**UT1A**	**UT1A-1**	**UT1B**	**UT1C***
Existing Length (LF)	1,958	115	154	195	158
Drainage area (acres)	85	8	8	10	N/A
Drainage area (sq. miles)	0.13	0.01	0.01	0.02	N/A
Existing Valley slope (ft/ft)	0.016-0.0187	0.048	0.038	0.0258	N/A
EPR - NCDWR Stream Score	37	25	24.5	21.5	23.5
Perennial or Intermittent	P	I	I	I	I
EPR - USACE Stream Quality Score	35	43	32	28	N/A
NCDWR Water Quality Classification	WS-III				
Rosgen Classification of Existing Conditions	B4c/B4	F4	B4	G4	N/A
Simon Evolutionary Stage	IV	IV	III	III	N/A
FEMA Zone Classification	X				

* This stream is not proposed for restoration or enhancement work as part of this project.

Table 5. Jurisdictional Wetland Resources Within the Project Boundary.

Wetland Summary				
Wetland	**A**	**B**	**C**	**D**
Size of Wetland (AC)	0.04	0.01	0.02	0.13
Wetland Type (non-riparian, riparian riverine, or riparian non-riverine)	Riparian riverine			
Predominant Mapped Soil Series	Fairview fine sandy loam		Delila fine sandy loam	
Drainage Class	Well-drained		Poorly drained	
Soil Hydric Status	Non-Hydric+		Hydric	
Source of Hydrology	Groundwater, precipitation, runoff, and overbank flooding			
Hydrologic Impairment	Stream channelization and cattle access			
Native Vegetation Community	Headwater Forest*			
% Exotic Invasive Vegetation	25	25	20	20

* Wetlands are categorized as headwater forests by NCWAM but have been altered by grazing activities.

+ Jurisdictional wetlands were identified on soils mapped as non-hydric.

4.0 FUNCTIONAL UPLIFT

This section of the report is provided to document the existing and proposed functional conditions of the Project. While functional parameters are assessed and presented, the functional assessment used is not proposed for mitigation crediting or determining project success. Performance standards are provided in Section 8.

In their current condition, the hydrologic resources on the Site are severely degraded. The most severe impairments present on the Site are largely the result of direct cattle access to streams and wetlands, channelization, and removal of riparian vegetation and include: 1) direct inputs of sediment, nutrients, and coliform into the stream; 2) channel instability and erosion; 3) lack of bedform diversity; and 4) degraded riparian vegetation. Functional uplift will come from restoring project streams and adjacent floodplain wetlands to a stable, functioning condition, which will be accomplished by restoring the channels to their historic valley, raising the beds, and connecting them to the adjacent wetlands at lower flows, restoring natural riparian vegetation, and excluding livestock from all project streams. The exclusion of livestock will remove a direct source of nutrients, coliform, and sediment from the system, as well as a major contributor to channel instability. The addition of in-stream structures will help to ensure channel stability and will provide greater bedform diversity, enhancing aquatic habitat for native species. Restored riparian buffers will provide woody debris and detritus for aquatic organisms, reduced water temperatures and increased dissolved oxygen concentrations, shade, and diverse aquatic and terrestrial habitats that are appropriate for the ecoregion and landscape setting.

Based on field evaluations of the project stream reaches and proposed mitigation practices described in Section 7.0, functional ratings were developed for the existing and proposed conditions of the project reaches (Table 6), following the methodology and definitions described in Harman, et al., 2012.

Table 6. Functional Category Summary for Project Reaches

Functional Category	Existing				Proposed
	UT1	UT1A	UT1B	UT1A-1	All Reaches
Hydrology[1]	FAR	FAR	FAR	FAR	FAR
Hydraulics[2]	NF	NF	NF	NF	F
Geomorphology[3]	NF	NF	NF	NF	F
Physicochemical[4]	Assumed				Modest Lift Assumed
Biology[5]					

Note 1: Hydrology – all reaches are listed as Functioning At-Risk (FAR) in their existing and proposed conditions, due to modifications in the upstream watershed and/or road culverts that are upstream of the project reaches, which are likely affecting the hydrology of the system as a whole.

Note 2: Hydraulics – all existing reaches are incised and floodplain access has been greatly reduced; therefore all are listed as Not Functioning (NF). Restoration practices will restore proper floodplain connection and channel hydraulics. Groundwater and surface water connections will also be restored.

Note 3: Geomorphology – all reaches exhibit significantly larger and deeper channels than would naturally occur. Channel instability is apparent in all reaches to varying degrees, therefore all reaches are listed as Not Functioning (NF). Restoration practices will restore stable stream channels that are self-sustaining over time.

Note 4: Physicochemical – While no water quality sampling data have been collected, water quality is assumed to be impaired and Not Functioning (NF) due to direct livestock access to all project reaches and portions of the upstream watersheds. Restoration practices will restore woody riparian buffers and exclude livestock, thereby providing water quality benefits. The restored condition is listed as Functioning At-Risk (FAR) since there are water quality impacts (primarily pasture land) upstream of the project reaches that will not be addressed.

Note 5: Biology – Preliminary observations indicate the minimal presence of aquatic life (fish, amphibians, macroinvertebrates) in each of the proposed stream reaches; therefore, all are assumed to be Not Functioning (NF). After restoration, Site stressors will be reduced and with improved stream stability, habitat, and shading, it is likely that the reaches will be more fully functioning but will still be considered FAR due to overall watershed stressors.

While no wetland credits are proposed for the Site, NCWAM was used to establish a baseline of wetland function for the four existing wetlands. All wetlands were assessed as Headwater Forest NCWAM wetland types. The functional ratings for each wetland are presented in Table 7. The NCWAM results pages are provided in Appendix 3. The proposed planting plan (provided in section 7.4 and Appendix 8) will establish a wooded riparian buffer with canopy species, enhancing water quality and habitat functions throughout the conservation easement.

Table 7. Summary of NCWAM Wetland Functional Ratings for Existing Conditions

	Wetlands and Functional Ratings		
	WA & WB	**WC**	**WD**
Hydrology	Low	Medium	High
Water Quality	Medium	High	High
Habitat	Low	Low	Low
Overall	Low	Medium	High

5.0 REGULATORY CONSIDERATIONS

Regulatory considerations for the Site are shown in Table 8 and described in the following sections.

Table 8. Summary of Regulatory Considerations

Regulatory Parameter	Applicable?	Resolved?	Supporting Docs.
Waters of the United States - Section 401/404	Yes	No	Appendix 3
Endangered Species Act	Yes	Yes	Appendix 6
National Historic Preservation Act	Yes	Yes	Appendix 6
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

5.1 401/404

There will be minor impacts to the wetlands onsite due to realignment of channel features, but restoration activities are anticipated to result in uplift to overall wetland function. There will be 0.015 acre of permanent impacts to Wetlands A and D due to stream channel realignment, though there will be no net loss of wetland function on the site. A PJD package was submitted to NCDWR and USACE on November 26th, 2018 and notification of PJD was approved on May 7th, 2019. The signed PJD is provided in Appendix 3.

Stream channel impacts will be due to restoration activities and relocation of the restored channels to their historic valleys. Construction activities will be conducted under a Nationwide Permit #27, Aquatic Habitat Restoration, Enhancement, and Establishment Activities with the submittal and approval of a pre-construction notification.

5.2 Categorical Exclusion for Biological and Historical Resources

A Categorical Exclusion (CE) document for the Greenbrier Stream Restoration Project was approved by the Federal Highway Administration (FHWA) on November 9, 2018 and is provided in Appendix 6. The CE document investigates the presence of threatened and endangered species and any historical resources that may occur within the Site.

5.2.1 Biological Resources

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C 1531 et seq.), defines protection for species with the Federal Classification of Threatened (T) or Endangered (E). An "Endangered Species" is defined as "any species which is in danger of extinction throughout all or a significant portion of its range" and a "Threatened Species" is defined as "any species which is likely to become an Endangered Species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C 1532).

EPR requested review and comment from the U.S. Fish and Wildlife Service (USFWS) on September 20, 2018 regarding the project's potential impacts to threatened or endangered species. The USFWS did not provide any comment within the 45-day time frame. Additionally, a Northern Long-Eared

Bat (NLEB) 4(d) Streamlined Consultation Form was sent from the Federal Highway Administration (FHWA) to the USFWS on September 18, 2018. The USFWS letter and NLEB Streamlined Consultation Form are included in the Categorical Exclusion document found in Appendix 6.

5.2.2 Historical Resources

The CE document investigates the occurrence of any historical resources protected under The National Historic Preservation Act (NHPA) of 1966. The NHPA, as amended (16 U.S.C. 470), defines the policy of historic preservation to protect, restore, and reuse districts, sites, structures, and objects significant in American history, architecture, and culture. Section 106 of the NHPA mandates that federal agencies account for the effect of an undertaking on any property that is included in, or is eligible for inclusion in, the National Register of Historic Places.

EPR requested review and comment from the North Carolina State Historic Preservation Office (SHPO) on September 27, 2018 regarding the project's potential impacts to cultural resources. SHPO responded with a letter on October 23, 2018 stating that they were "aware of no historic resources which would be affected by the project". All correspondence with SHPO is included in the CE document found in Appendix 6.

5.3 FEMA Floodplain Compliance

Upon review of the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program's Digital Flood Insurance Rate Mapping (DFIRM) panels 3710484600K and 3710486600J, effective May 18, 2009, Greenbrier is mapped in an area of minimal flood hazard (Zone X; Figure 7). Therefore, under the current regulations, work associated with this project is not regulated and a Letter of Map Revision (LOMR) will not be necessary to revise the floodplain mapping of the Site.

6.0 MITIGATION PROJECT GOALS AND OBJECTIVES

While the ultimate goal of the Project is to restore a self-sustaining headwater stream-wetland complex, more specific project goals and objectives were developed for the South Deep Creek Watershed based on the Upper Yadkin Pee-Dee RBRP (NCEEP, 2009) and Yadkin Pee-Dee River Basinwide Water Quality Plan (NCDWQ, 2008) and are provided in Table 9.

Table 9. Goals and Objectives for the Greenbrier Stream Restoration Project

Goals	Objectives
Reduce Sediment Inputs and Stream Turbidity	▪ Stabilize eroding stream banks. ▪ Install fencing to exclude livestock from project streams. ▪ Reduce the amount of land in active livestock pasture. ▪ Increase distance between active farming operations and receiving waters by re-establishing a riparian buffer permanently protected through a conservation easement. ▪ Restore riparian buffers to filter runoff.
Reduce Nutrient Inputs	▪ Install fencing to exclude livestock from project streams. ▪ Reduce the amount of land in active livestock pasture. ▪ Increase distance between active farming operations and receiving waters by re-establishing a riparian buffer permanently protected through a conservation easement. ▪ Restore riparian buffers to filter runoff.
Reduce Fecal Coliform Inputs	▪ Install fencing to exclude livestock from project streams. ▪ Reduce the amount of land in active livestock pasture. ▪ Increase distance between active farming operations and receiving waters by re-establishing a riparian buffer permanently protected through a conservation easement. ▪ Restore riparian buffers to filter runoff.
Restore / Enhance Degraded Riparian Buffers	▪ Restore riparian buffer vegetation to filter runoff and provide organic matter and shade. ▪ Protect riparian buffers with a permanent conservation easement.
Protect High Resource Value Waters (including HQW, ORW, and WS classifications)	▪ Restore appropriate bed form diversity, headwater stream/wetland form, and in-stream structures to provide appropriate habitat. ▪ Restore minimum 50-foot riparian buffers along all project reaches. ▪ Protect riparian buffers with a permanent conservation easement.
Implement Agricultural BMPs in Agricultural Watersheds	▪ Install fencing to exclude livestock from project streams. ▪ Install alternative watering systems to keep livestock away from streams. ▪ Restore and protect riparian buffers. ▪ Install vegetated swales to slow and filter concentrated runoff before entering the streams.

The performance standards associated with these goals and objectives are covered in Section 8.0 of this report.

7.0 DESIGN APPROACH AND MITIGATION WORK PLAN

The Project involves the restoration of four unnamed tributaries to South Deep Creek. UT1 is the perennial mainstem that the other tributaries ultimately flow into.

The construction drawings provided in Appendix 8 describe the proposed construction methods including locations and elevations of all pertinent features. Data characterizing the existing, proposed, and design morphological characteristics for each reach can be found in Appendix 4. The design approach for each reach is provided in the sections below. The naming convention and locations of the hydrologic assets on the Site are illustrated in Figure 8.

Regional curves including the rural Piedmont regional curve (Harman, 1999), the NC rural Mountain and Piedmont regional curve developed by NRCS (Walker, 2012; unpublished), and the revised rural Piedmont regional curve (Harman, 2012) were used to verify bankfull discharge and area on project streams. The bankfull areas provided by these regional curves all matched well with areas calculated from bankfull indicators on surveyed cross sections with the closest correlation generally being between the field indicators and the Walker curve.

Rather than relying on a single reference reach for design criteria, the design criteria applied to the Project are based on surveys of multiple reference reaches conducted in the past, published reference reach data, and on design criteria and monitoring data from past successful restoration projects performed throughout the Piedmont region of North Carolina. Specifically, reference data compiled and presented by Lowther (2008) for similar stream types, drainage areas, and slopes within the Piedmont of North Carolina were reviewed to evaluate appropriate ranges of sinuosity and pattern data. Lowther evaluated 19 reference reach streams across the Piedmont of North Carolina – our assessment focused on only the streams in the western portion of the presented data set that were closest to the project site. Since the ranges provided by this analysis were quite wide, EPR evaluated this reference information against past completed stream restoration projects that have performed well and have been tested by significant storm events. EPR staff has several successful projects similar to the Greenbrier site that were restored over 15 years ago and have remained stable with incorporated wetland components. These include the Hanging Rock Creek Site in Avery County, the Mitchell River – Darnell Site in Surry County, and the Mitchell River – Kraft Site in Surry County. Each of these past projects have similar slopes and bed conditions as the Greenbrier stream reaches and have been in place for over 15 years. The design criteria used for the Greenbrier site relied heavily on lessons learned from these past projects. Regional curve data and design criteria are provided in the morphological tables provided in Appendix 4.

7.1 Unnamed Tributary 1 (UT1)

UT1 is the perennial mainstem tributary on the Site to which the other reaches flow. It spans the entire length of the Project, beginning at the western end below a perched culvert under Collins Road and leaving the Site at the eastern end of the easement. The entire reach length is approximately 1,958 linear feet. Instability is evident reach-wide, either through direct cattle access and trampling or active bank erosion. Stressors such as agricultural impacts and anthropogenic channel modification have resulted in channel incision, mass wasting of banks due to channel

evolutionary processes, localized channel scour, and degraded riparian habitat on a reach-wide scale.

UT1's condition varies along its length. The upstream section (Reach 1) starts as an incised channel that has likely been relocated to the edge of the existing valley and classifies as a Rosgen Bc. Once the stream approaches its confluence with UT1A and a large bedrock outcrop slide (Reach 2), it becomes less incised but is still degraded due to cattle access. Downstream of the bedrock outcrop (Reach 3) the reach again becomes deeply incised with near vertical stream banks. Further downstream on UT1, towards its confluence with UT1B, the level of incision decreases despite the channel remaining highly unstable as it approaches the conservation easement boundary.

Due to the level of existing incision along UT1, a Priority II approach will be used to excavate a new floodplain and raise the restored channel. The new channel will be moved away from the edge of the valley and re-aligned across the newly constructed floodplain throughout most of its length. UT1 Reach 1 is designed as a B4 stream type. As described above, a bankfull bench will be excavated to provide floodplain access along UT1 Reach 1. In-stream structures will be used to provide grade control, bank protection, and improve habitat along this reach. A culverted crossing is proposed along this reach and will be located to coincide with an existing utility line crossing. Existing topsoil where grading is proposed will be stripped and stockpiled separately from the underlying subsoil. Once the channel, bankfull benches, and terraces have been roughly graded, six to eight inches of the stockpiled topsoil will be applied to bring the features up to the finish grades and to ensure a soil media capable of supporting healthy vegetation. If substantial areas of planted vegetation do not survive or grow with vigor, maintenance will be conducted in accordance with the Maintenance Plan in Appendix 10 of this Mitigation Plan.

UT1 Reach 2 is a short section of Enhancement Level II that is proposed beginning at approximate station 18+79. This section of existing channel is a steep bedrock slide. Planting of the riparian buffer, invasive species treatment, and livestock exclusion is proposed for this section.

UT1 Reach 3 begins below this bedrock slide where a large plunge pool will be constructed to dissipate energy from the steep slide and abrupt slope change. Priority II restoration will continue from the plunge pool down as a meandering C4 stream type for approximately 550 feet where the stream then transitions to a Priority 1 restoration approach for the remainder of the reach. Throughout Reach 3, in-stream structures and bio-engineering will be used to control grade, protect stream banks, and improve habitat.

Tables 10a and 10b provide a summary of existing and proposed stream morphological information and design criteria for UT1 Reach 1 and UT1 Reach 3. Detailed morphological tables are provided for all stream reaches in Appendix 4.

A sediment transport analysis was performed to ensure that the stream restoration design creates a stable channel that does not aggrade or degrade over time. Raising the bed elevation at the upstream extent of UT1 Reach 1 to reconnect the stream with the perched culvert under Collins Road steepened the bankfull slope along this reach, which resulted in an increase in shear stress.

While this increase in shear stress will mobilize particles larger than the existing d100, in-stream structures are included in this reach that are designed to be immobile such as constructed riffles and cross vanes. Therefore, this reach will transport sediment while not degrading. Sediment transport analysis along UT1 Reach 3 predicts a mean depth and slope that match extremely well with the design mean depth and slope, which indicates that this reach will transport the supplied sediment load while remaining stable. However, immobile riffles and grade control structures will also be constructed along this reach to provide an additional level of protection against degradation. The full sediment transport analysis is provided in Appendix 4 along with the sub-pavement and pavement sample results.

Table 10a. Morphology Table for UT1 Reach 1

Parameter	Regional Curve (Walker, 2012)	Existing	Design Criteria (Typical)
Contributing Drainage Area (sq. mi.)	0.062		
Channel/Reach Classification	-	B4c	B4
Bankfull Width (feet)	6.23	4.29-5.32	6.2
Bankfull Mean Depth (feet)	0.5	0.48-0.76	0.5
Bankfull Area (ft^2)	3.1	2.56-3.26	3.0
Bank Height Ratio	-	1.48-2.76	1.0
Entrenchment Ratio	-	1.62-1.87	1.8-4.6
Bankfull Shear Stress (lb/ft^2)	-	0.45	0.82
Average Bankfull Velocity (fps)	2.0	2.15-2.73	2.3
Bankfull Discharge (cfs)	6.2	7.0	7.0
Water Surface Slope (ft/ft)	-	0.0175	.035
Sinuosity	-	1.07	1.03
D16/ 35/ 50 /84/95/ di_pavement/ di_subpavement (mm)	-	6.95/11.85/18.36/36.66/55.17/90 1/8.29/19.02/67.99/72.81/75	

Table 10b. Morphology Table for UT1 Reach 3

Parameter	Regional Curve (Walker, 2012)	Existing	Design Criteria (Typical)
Contributing Drainage Area (sq. mi.)	0.12		
Channel/Reach Classification	-	B4	C4
Bankfull Width (feet)	7.96	7.1-11.5	7.6
Bankfull Mean Depth (feet)	0.6	0.4-0.57	0.6
Bankfull Area (ft^2)	4.78	4.1-4.6	4.5
Bank Height Ratio	-	2.2-3.5	1.0
Entrenchment Ratio	-	1.6-1.7	2.5-10.0
Bankfull Shear Stress (lb/ft^2)	-	0.79	0.54
Average Bankfull Velocity (fps)	2.2	3.1-2.7	2.8
Bankfull Discharge (cfs)	10.4	12.5	12.5
Water Surface Slope (ft/ft)	-	0.015	0.013
Sinuosity	-	1.09	1.22
D16/ 35/ 50 /84/95/ di_pavement/ di_subpavement (mm)	-	0.067/5.6/9.13/28.4/52.82/180 1/8.29/19.02/67.99/72.81/75	

7.2 UT1A-1 and UT1A

Reach UT1A-1 starts at a large headcut that has formed from overland runoff. This headcut will be stabilized using grade control structures and unstable banks will be sloped. Established native vegetation has maintained stability along the left bank of UT1A-1 and will not be disturbed. UT1A begins at the downstream end of UT1A-1 where the channel alignment is being moved to follow the low point in the valley and ensure a stable transition to UT1. UT1A will be a Priority Level II restoration approach with an excavated floodplain. Due to the small drainage area, stream energy along this reach will be minimal. Grade control structures are incorporated to prevent downcutting and to improve bedform diversity. A vegetated swale will be constructed above UT1A-1 to treat and filter runoff coming from adjacent agricultural areas. The swale will be lined with coir fiber matting and planted with native herbaceous vegetation. Table 10c provides a summary of existing and proposed stream morphological information and design criteria for UT1A. Detailed morphological tables are provided for all stream reaches in Appendix 4.

Table 10c. Morphology Table for UT1A

Parameter	Regional Curve (Walker, 2012)	Existing	Design Criteria (Typical)
Contributing Drainage Area (sq. mi.)	.0125		
Channel/Reach Classification	-	F4	B4
Bankfull Width (feet)	3.45	3.75	3.6
Bankfull Mean Depth (feet)	0.31	0.14	0.28
Bankfull Area (ft^2)	1.1	0.52	1.0
Bank Height Ratio	-	14.8	1.0
Entrenchment Ratio	-	1.25	1.4-2.8
Bankfull Shear Stress (lb/ft^2)	-	0.68	0.35
Average Bankfull Velocity (fps)	1.61	3.8	2.0
Bankfull Discharge (cfs)	1.76	2.0	2.0
Water Surface Slope (ft/ft)	-	0.078	0.02
Sinuosity	-	1.01	1.03
D16/ 35/ 50 /84/95/ di_pavement/ di_subpavement (mm)	-	N/A (sandbed stream)	

7.3 UT1B

UT1B is similar to UT1A in that it is a small headwater stream with significant groundwater inputs. UT1B also begins at a large headcut and flows down valley to its confluence with UT1. This reach is severely incised and has stream banks that are near vertical. The headcut will be stabilized with grade control structures and the bed elevation raised. Raising the bed elevation will likely improve the hydrology in the adjacent wetlands. Banks will be sloped in the upper 100 feet of this reach. Below the bank sloping sections, the channel alignment is being shifted slightly away from the adjacent wetlands to avoid and minimize disturbance. This reach is designed as a Priority Level I, B stream type and constructed riffles will be installed along this reach to control the bed grades and to improve bed form diversity. This headwater reach does not have an upstream sediment supply so installing constructed riffles will prevent degradation and ensure long term stability. A vegetated swale will be constructed above UT1B to treat and filter runoff coming from adjacent agricultural

areas. The swale will be lined with coir fiber matting and planted with native herbaceous vegetation. Table 10d provides a summary of existing and proposed stream morphological information and design criteria for UT1B.

Table 10d. Morphology Table for UT1B

Parameter	Regional Curve (Walker, 2012)	Existing	Design Criteria (Typical)
Contributing Drainage Area (sq. mi.)	0.0156		
Channel/Reach Classification	-	G4	B4
Bankfull Width (feet)	3.45	4.73	3.6
Bankfull Mean Depth (feet)	0.31	0.48	0.28
Bankfull Area (ft^2)	1.1	2.3	1.0
Bank Height Ratio	-	7.6	1.0
Entrenchment Ratio	-	1.3	2.0
Bankfull Shear Stress (lb/ft^2)	-	0.75	0.3
Average Bankfull Velocity (fps)	1.61	1.0	2.3
Bankfull Discharge (cfs)	1.76	2.3	2.3
Water Surface Slope (ft/ft)	-	.024	0.017
Sinuosity	-	1.08	1.07
D16/ 35/ 50 /84/95/ di_pavement/ di_subpavement (mm)	-	N/A (sandbed stream)	

7.4 Vegetation and Planting Plan

Species selection for re-vegetation of stream buffer areas will generally follow those suggested by Schafale and Weakley (1990) for Piedmont/Low Mountain Alluvial Forest and Schafale (2012) for Piedmont Alluvial Forest, as well as wetness tolerances cited in *WRP Technical Note VN-RS-4.1* (WRP 1997). The native species selected for establishment at the Site represent a range of growth rates and varying tolerances to shade and moisture. These range of characteristics were selected to ensure that the appropriate vegetation cover develops over the Site.

Species lists, site preparation, planting density, planting methods, and materials are detailed in the construction drawings and specifications included in Appendix 8.

Invasive species identified at the Site include Chinese privet, tree-of-heaven, and multiflora rose in the streamside areas, as well as Japanese stiltgrass along the stream and in wet areas. During construction, the existing invasive vegetation species will be controlled using chemical and mechanical methods. An invasive species plan is included in Appendix 9.

7.5 Project Risks and Uncertainties

Listed below are identified project risks and uncertainties that have been evaluated in the development of design plans for the site, along with methods that have been/will be used to address these concerns.

- Land use development: There is potential for increased land development around the site in the future that could lead to additional runoff and changes to watershed hydrology.

  - Methods to Address: The project area has seen little development in recent years and it is unlikely that development will threaten the site in the foreseeable future. Restoration of the site to reconnect streams to their floodplains will reduce the likelihood of future degradation from watershed changes, as increased flows will spread over a wider floodplain. Grade control (in the form of constructed in-stream structures and natural bedrock outcrops) will decrease the chances of future channel incision.

- Easement Encroachment: There is potential for landowner encroachment into the permanent conservation easement.

  - Methods to Address: EPR has had considerable discussions with the landowner regarding the project requirements and limitations of easement access and is confident that the landowner fully understands and will maintain the easement protections. The easement boundaries will be fenced with barbed wire fencing and clearly marked per NCDMS requirements. Any encroachments that do occur will be remedied by EPR to address any damage and provide any other corrections required by NCDMS and/or the IRT.

- Drought and Floods: There is potential for extreme climatic conditions during the monitoring period of the project.

  - Methods to Address: EPR will apply adaptive management techniques as necessary to meet the site performance criteria. Such adaptive management may include replanting, channel damage repair, irrigation, or other methods. If adaptive management activities are significant, additional monitoring may be required by the IRT.

- Beavers: While there was no evidence of recent beaver activity during recent assessments, there is potential for beavers to colonize the site during the monitoring period of the project.

  - Methods to Address: Due to the watershed size, beaver colonization is unlikely. However, EPR will take steps to trap and remove beaver if they colonize the Site during the monitoring period.

- Hydrologic Trespass: There is potential for the stream restoration to create conditions under which hydrologic trespass on adjoining landowners is more likely.

  - The majority of the project has been designed and will be constructed utilizing a priority 2 restoration approach, which will greatly reduce the potential of hydrologic trespass outside of the conservation easement boundary. Along UT1 Reach 3 where the stream transitions to a priority 1 restoration approach, the conservation easement boundary is located up the adjacent hill slopes. The ground elevations along the

conservation easement boundary in this area are approximately 2 to 3 feet above the bankfull elevation. Based on Manning's equation, the cross section from easement boundary to easement boundary along UT1 Reach 3 will convey approximately 689 cubic feet per second (cfs). Using USGS regression equations, which utilize drainage areas and impervious surface, the estimated discharge from the 500-year recurrence interval is 185 cfs. Based off this information, the possibility of hydrologic trespass is extremely unlikely and is not expected to be an issue.

Additional risk and uncertainties may include future NCDOT road widening along Collins Road and utility line maintenance along the existing overhead utility line. The conservation easement abuts both the NCDOT right-of-way and the utility line right-of-way. The widening of Collins Road is very unlikely due to the area's rural nature and current development trends. The maintenance of the utility right-of-way will be limited to any branches or limbs growing into it from surrounding areas as the stream crossing within the right-of-way will limit vegetation growth and the need for significant maintenance activities. Any limb clearing the utility requires should be conducted within the right-of-way and should not have a detrimental impact on the health of the planted vegetation within the conservation easement boundary.

8.0 PERFORMANCE STANDARDS

Performance criteria outlined in the *NCDMS Mitigation Plan Template* (ver. 06/2017), and *U.S. Army Corps of Engineers – Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District* (October 24, 2016), will be followed and are briefly outlined below. Monitoring information can be found in Section 9.0.

8.1 Restored Stream Channels

The required performance criteria for restored stream channels, per USACE Guidance are summarized briefly below:

- All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05.
- Continuous surface flow must be documented each year for at least 30 consecutive days for intermittent channels.
- Bank height ratio (BHR) cannot exceed 1.2 for all measured cross sections on a given reach.
- Entrenchment ratio (ER) must be above 2.2 for all measured riffle cross-sections for C and E stream types and above 1.4 for B stream types.
- BHR and ER should not change by more than 10% in any given year for all measured cross sections on a given reach.
- Must document occurrence of at least 4 bankfull events in separate years during the monitoring period.

8.2 Riparian Vegetation

The required performance criteria for planted riparian vegetation, per USACE Guidance are summarized below:

- Within planted portions of the site, a minimum of 320 stems per acre must be present at year 3; a minimum of 260 stems per acre must be present at year 5; and a minimum of 210 stems per acre must be present at year 7.
- Trees must average 7 feet in height at year 5, and 10 feet in height at year 7. Certain native species, which are appropriate to plant on-site to provide a diverse vegetation community, do not typically grow to these heights in 7 years and will be excluded from the height performance standard. For this project, the excluded species is *Quercus nigra* (water oak).
- Planted and volunteer stems are counted, provided they are native to the site and from the approved planting list included in the Mitigation Plan.
- Any single species can only account for 50% of the required stems per monitoring plot

8.3 Compatibility with Project Goals

The required performance criteria described above, plus project-specific criteria, allow evaluation of whether the project goals have been met after the site has been completed. In Table 11, the

Project objectives are listed, along with the performance criteria that will allow documentation of whether these objectives have been achieved. Fulfillment of these objectives will allow the Project to achieve the goals outlined in Section 6.0.

Table 11. Project Objectives and Associated Performance Criteria

Objective	Performance Criteria
Reduce the amount of land in active livestock pasture	• Recordation and protection of a conservation easement meeting NCDMS guidelines.
Install fencing to exclude livestock from project streams	• Recordation and protection of a conservation easement meeting NCDMS guidelines. • Visual inspection of fence installed to exclude cattle from the stream and riparian buffer, demonstrating no encroachment.
Increase distance between active farming operations and receiving waters by re-establishing a riparian buffer permanently protected through a conservation easement	• Recordation and protection of a conservation easement meeting NCDMS guidelines.
Restore riparian buffers to filter runoff	• Vegetation success criteria of 260 native stems/acre in Year 5 and 210 native stems/acre in Year 7. • Recordation and protection of a conservation easement meeting NCDMS guidelines.
Stabilize eroding stream banks	• Geomorphic cross sections indicate stable sections over the monitoring period. • Visual inspection of fence installed to exclude cattle from the stream and riparian buffer, demonstrating no encroachment.
Restore bed form diversity, with in-stream structures to provide appropriate habitat	• Geomorphic cross sections that document a variety of channel depths and forms. • Visual documentation of in-stream structure stability during annual monitoring.
Restore appropriate bed form diversity, headwater stream/wetland form, and in-stream structures to provide appropriate habitat	• Geomorphic cross sections indicate stable sections over the monitoring period. • Bank height ratio (BHR) cannot exceed 1.2 for all measured cross sections on a given reach. • Entrenchment ratio (ER) must be 2.2 or above for all measured riffle cross-sections for C/E stream types and 1.4 or above for B stream types. • Documentation of hydrophytic vegetation within vegetation monitoring plots. • Documentation of four bankfull events in different years throughout the monitoring period. • Documentation of 30 days of consecutive stream flow in all reaches each monitoring year.
Protect riparian buffers with a permanent conservation easement	• Recordation of a conservation easement meeting NCDMS guidelines.
Install fencing to exclude livestock from project streams	• Visual inspection of fence installed to exclude cattle from the stream and riparian buffer, demonstrating no encroachment.

Objective	Performance Criteria
Install alternative watering systems to keep livestock away from streams	• Visual documentation of installed watering system and regular checks on its operation during annual monitoring.
Install vegetated swales to slow and filter concentrated runoff before entering the streams.	• Visual inspection of BMP's to ensure proper function during monitoring period.

9.0 MONITORING PLAN

The monitoring plan for the Site will follow the guidance outlined in the *NCDMS Mitigation Plan Template* (ver. 06/2017), and *U.S. Army Corps of Engineers – Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District* (October 24, 2016). Monitoring data collected on the site will include reference photos, plant survival analyses, channel stability analyses, as well as any other data specifically required by permit conditions.

The As-Built Baseline Monitoring Report Template (ver. 06/2017) will be used to document the baseline conditions and to prepare the as-built record drawings for the Site. As-built surveys will be conducted within 60 days after project implementation is completed (following planting and monitoring installations) to document the recently constructed features and conditions of the Site.

Annual monitoring data will be reported using the NCDMS Monitoring Report Template (ver. 06/2017). The monitoring report shall provide a project data chronology that will facilitate an understanding of project status and trends, population of DMS databases for analysis, and assist in decision making regarding project close-out. Monitoring will be conducted for a period of seven years, with annual monitoring reports submitted to NCDMS no later than November 30 of each monitoring year.

While monitoring reports will be completed annually, not all monitoring reports will include the same information. All monitoring reports will include at least a brief narrative of site developments, a representative photo log, and a Current Condition Plan View (CCPV). Further monitoring measurements are detailed in the following sections.

9.1 Stream Monitoring

Stream monitoring will include monitoring of the hydrologic and geomorphic functions of UT1, UT1A, and UT1B. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table 12. Monitoring parameters follow USACE guidance but will also allow monitoring of parameters to document site performance related to the project goals listed in Section 6.0. The proposed approximate locations of monitored cross sections are shown in Figure 9.

Table 12. Stream Monitoring Summary

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

*Parameters for stream dimension to be measured as described in the 2018 Standard Measurement of the BHR monitoring parameter technical workgroup.

9.2 Riparian Vegetation Monitoring

Vegetation monitoring will evaluate the establishment of planted and volunteer vegetation across the site. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table 13. Monitoring parameters follow USACE guidance but will also allow monitoring of parameters to document site performance related to the project goals listed in Section 6.0.

Table 13. Riparian Vegetation Monitoring Summary

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

During quantitative vegetation sampling, sample plots (100 square meters, or 0.02 acre) will be installed within the site as per guidelines established by the Level 1 and 2 protocols in *CVS-DMS Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008). Visual observations of the percent

cover of shrub and herbaceous species will also be documented by photograph. The proposed locations of permanent vegetation plots are shown in Figure 9.

9.3 Visual Assessment Monitoring

A visual assessment of the entire project will be conducted on an annual basis. The culmination of this data will be presented in the Current Condition Plan View (CCPV) with supporting documentation outlined by DMS's guidance titled *Annual Monitoring Report Format, Data Requirements, and Content Guidance* dated June 2017, and associated excel tables dated May 2019. This includes photos of all vegetation plots, all monitored cross sections, and all monitoring gauges, stream crossings, and stream stations. In addition, any problem areas concerning vegetation, in-stream structures, channel migration, easement encroachments, or beavers will be noted and documented with photos. After DMS's review of the documentation, additional monitoring protocols may be required to ensure project success can be achieved.

10.0 ADAPTIVE MANANGEMENT PLAN

In the event the mitigation site or a 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.

A maintenance plan is provided in Appendix 10, summarizing the types of issues that may arise during monitoring and how those issues would be addressed.

11.0 LONG-TERM MANAGEMENT PLAN

The site will be transferred to the NCDEQ Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. Funding will be supplied by the responsible party on a yearly basis until such time an endowment is established.

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 to identify boundary markings, as needed. Any livestock or associated fencing or permanent crossings will be the responsibility of the owner of the underlying fee to maintain.

12.0 DETERMINATION OF CREDITS

Mitigation credits presented in Table 14a are projections based upon site design. Upon completion of site construction, the project components and credit data will be adjusted, if necessary, to be consistent with the as-built condition, and any changes will be described in the As-built Monitoring Report. The project proposes to provide stream credits derived from stream enhancement and stream restoration activities as shown in Figure 8. Any proposed deviation from the project credits established in the IRT approved mitigation plan would require a mitigation plan addendum submitted to the IRT for review and approval.

Descriptions of the stream restoration ratios are presented below in Table 14a. Table 14b presents the length and area summations by mitigation category and Table 14c shows the overall summary of assets. The proposed credit release schedule is provided in Appendix 11.

Where possible, stream riparian buffers in excess of the minimum 50-feet have been restored along both banks for 6.7 protected acres.

Table 14a. Greenbrier Stream Restoration Project Streams Asset Table

Project Component	Existing Footage	Stationing	Mitigation Plan Footage [A]	Restoration Level [B]	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits	Notes/ Comments
UT1 Reach 1	926.4	10+06 [C]-18+79	843	R	PII	1	843	Full channel restoration, planted buffer, exclusion of livestock, and permanent conservation easement.
UT1 Reach 3	991.6	19+19-30+16	1097	R	PI/II	1	1097	
UT1 Reach 2	40.0	18+79-19+19	40	EII	N/A	2.5	16	Planted buffer, invasive species treatment, exclusion of livestock, and permanent conservation easement.
UT1A-1	153.7	10+00-11+53.7	153.7	EII	N/A	2.5	61.48	Stabilize headcut, slope banks, exclusion of livestock, and permanent conservation easement.
UT1A	115	11+53.7-13+02.2	148.5	R	PII	1	148.5	Full channel restoration, planted buffer, exclusion of livestock, and permanent conservation easement.
UT1B	195	10+00-12+47.5	247.5	R	PII	1	247.5	
Totals	**2,421.7**		**2,529.7**				**2,413.48**	
Total Assets Summary: 2,413.48 stream mitigation credits*								

[A] Excludes length of crossing

[B] R = Restoration, E= Enhancement

[C] Crediting begins at station 10+06 outside of the NCDOT R/W

*EPR is under contract with the Division of Mitigation Services to provide 2,300 stream mitigation credits. Any additional stream mitigation credits beyond the contracted amount will not be realized by EPR.

Table 14b. Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)
Restoration	2,336
Enhancement	
Enhancement I	
Enhancement II	193.7
Rehabilitation	
Preservation	
High Quality Pres	

Table 14c. Overall Assets Summary

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

13.0 FINANCIAL ASSURANCES

A statement regarding the financial assurances for the project can be found in Appendix 12.

14.0 IRT ON-SITE MEETING

Representatives of the USACE, US EPA, NC DEQ, NC WRC, NC DMS, and EPR attended an on-site meeting for the Greenbrier Full Delivery Project on September 25, 2018. The meeting minutes were distributed on October 29, 2018 and can be found in Appendix 13.

15.0 REFERENCES

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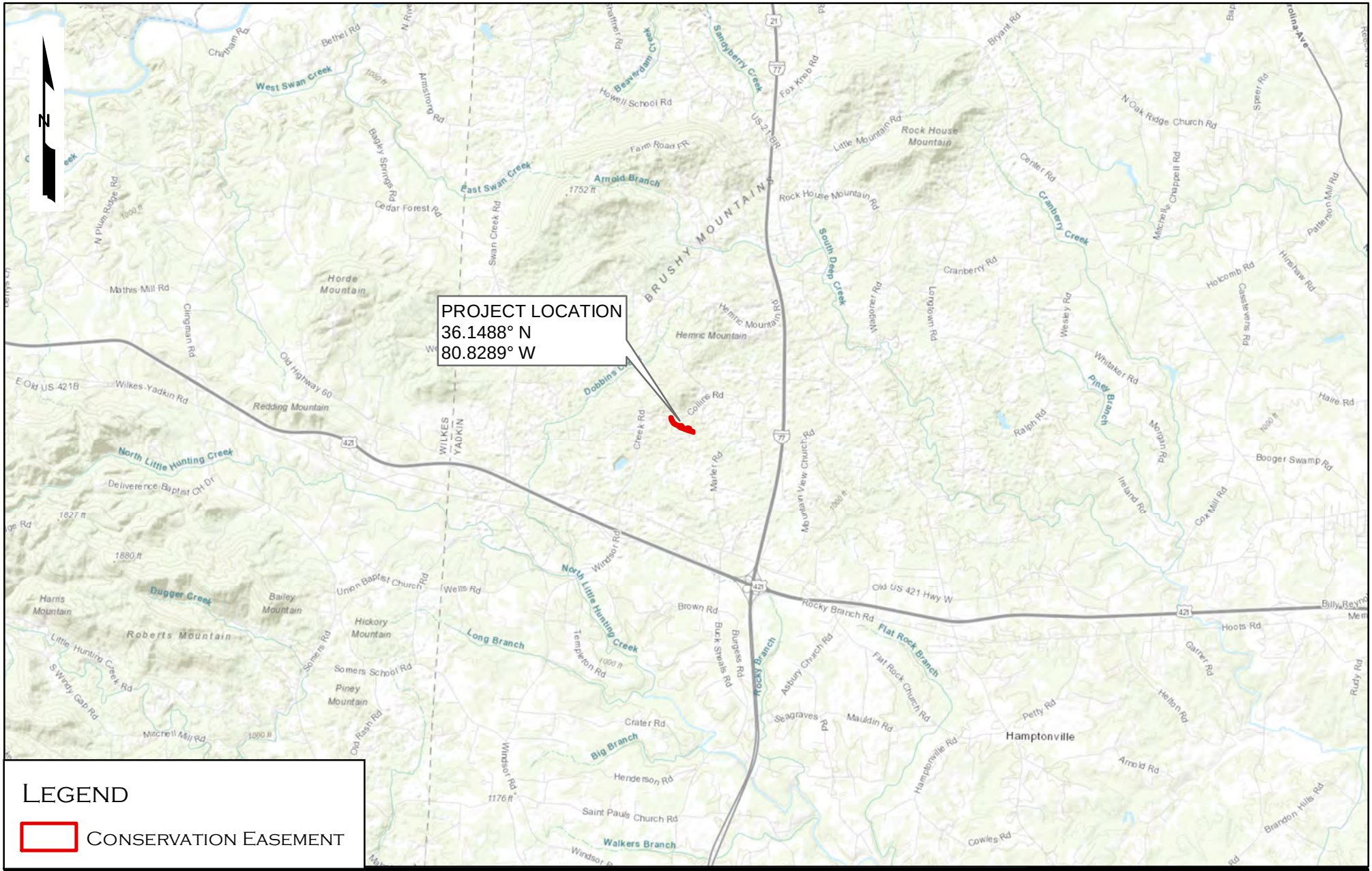


LEGEND

Conservation Easement

0 1 2 Miles

GREENBRIER STREAM RESTORATION

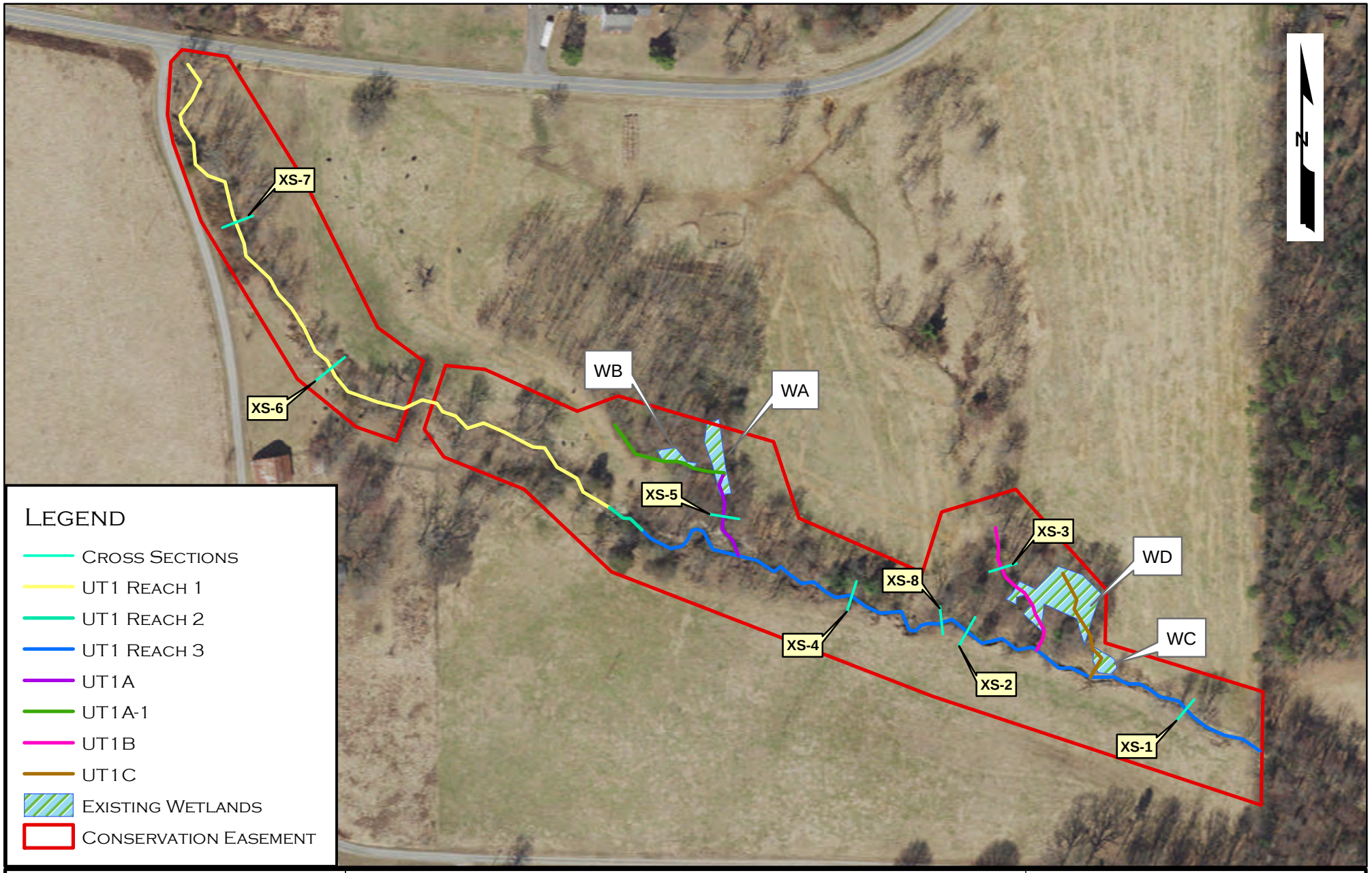
VICINITY MAP

PREPARED FOR:
NCDEQ
DIVISION OF
MITIGATION SERVICES

FIGURE 1

YADKIN COUNTY, NC

PREPARED BY:
ECOSYSTEM
PLANNING &
RESTORATION



0 175 FEET

GREENBRIER STREAM RESTORATION

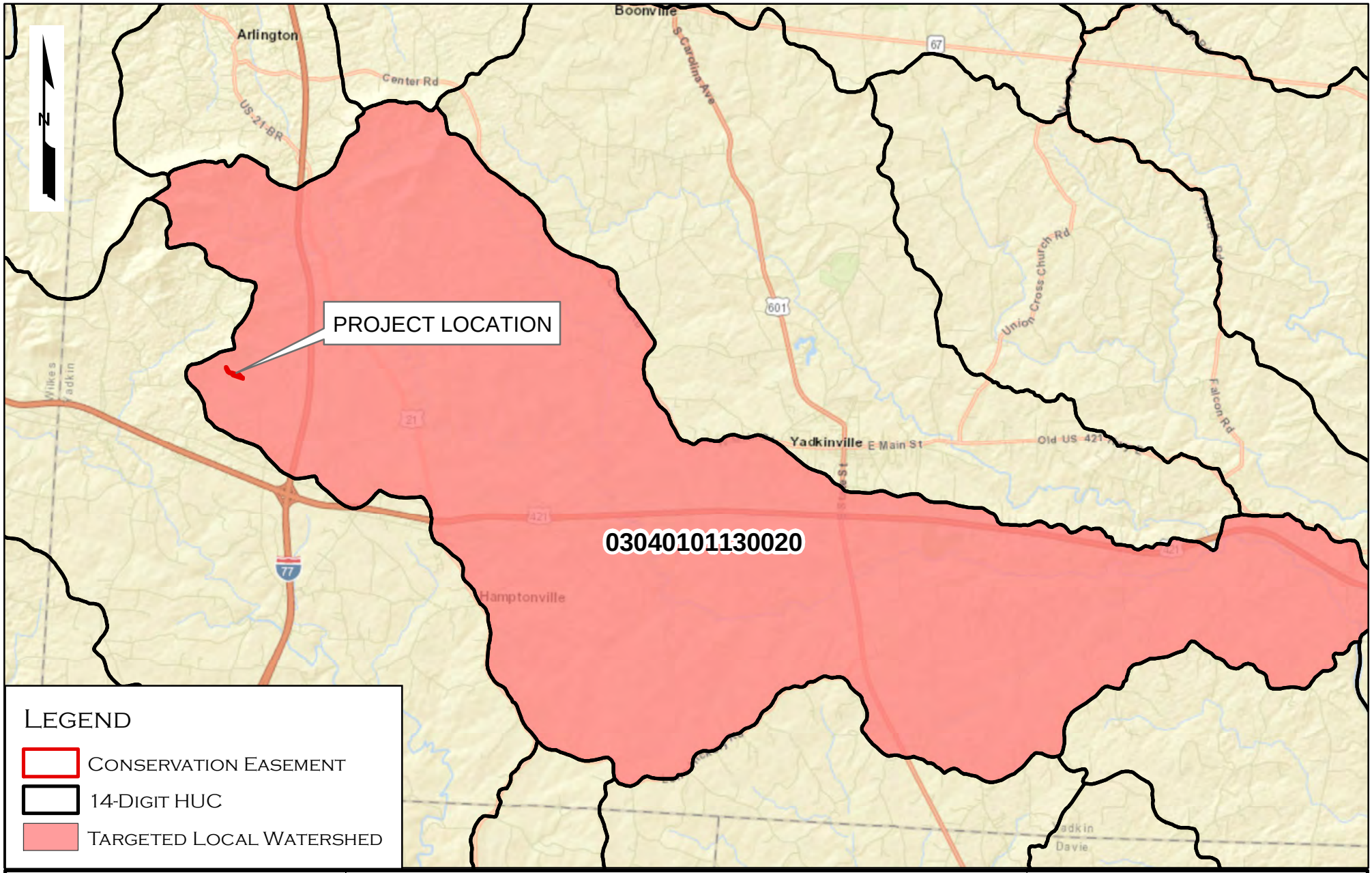
EXISTING CONDITIONS MAP

PREPARED FOR:
NCDEQ
DIVISION OF
MITIGATION SERVICES

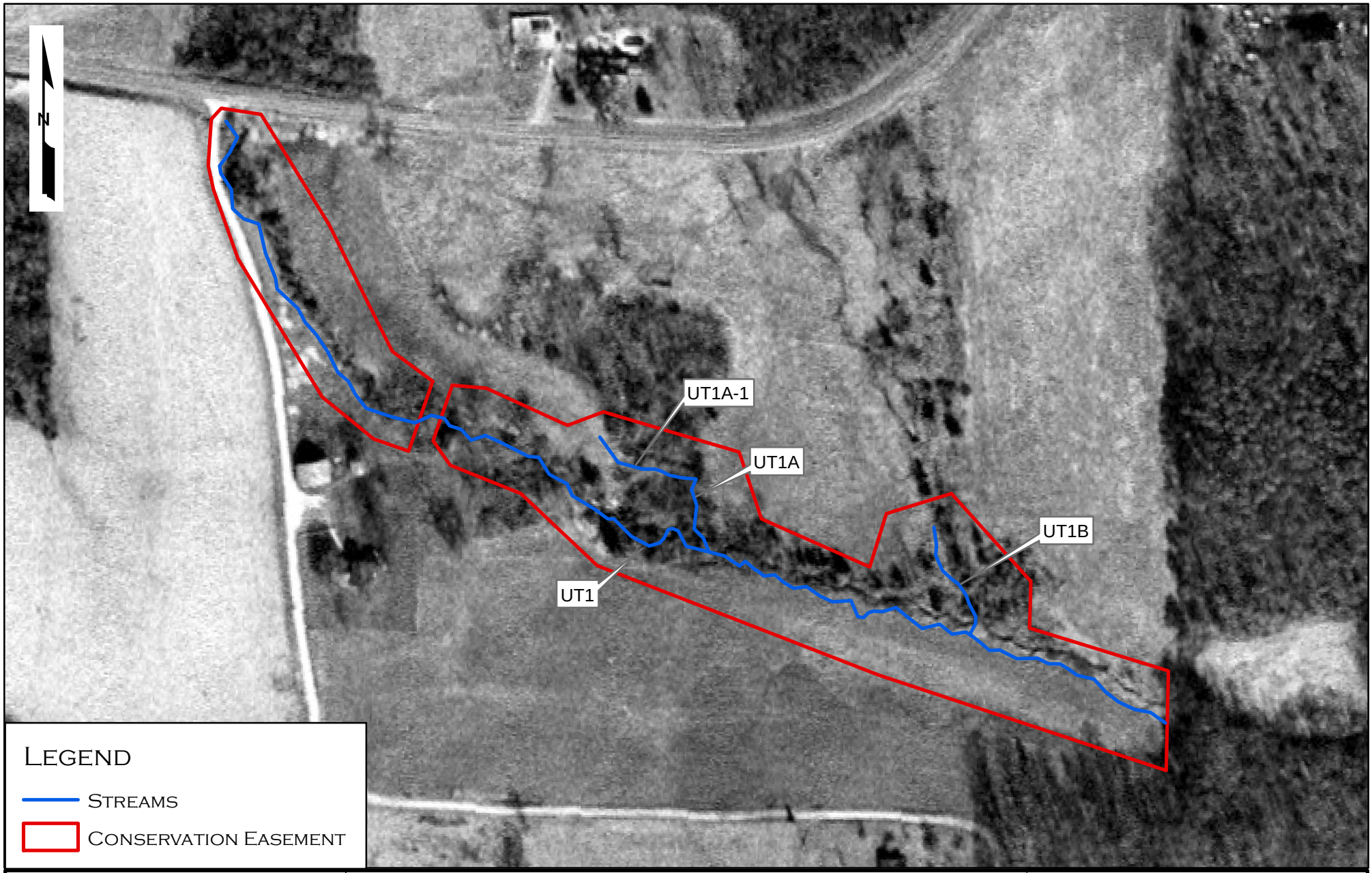
FIGURE 2

YADKIN COUNTY, NC

PREPARED BY:
ECOSYSTEM
PLANNING &
RESTORATION



0 1 2 Miles	GREENBRIER STREAM RESTORATION HYDROLOGIC UNIT MAP	PREPARED FOR: NCDEQ Division of Mitigation Services
FIGURE 3	YADKIN COUNTY, NC	PREPARED BY: Ecosystem Planning & Restoration



0 100 200
Feet

GREENBRIER STREAM RESTORATION

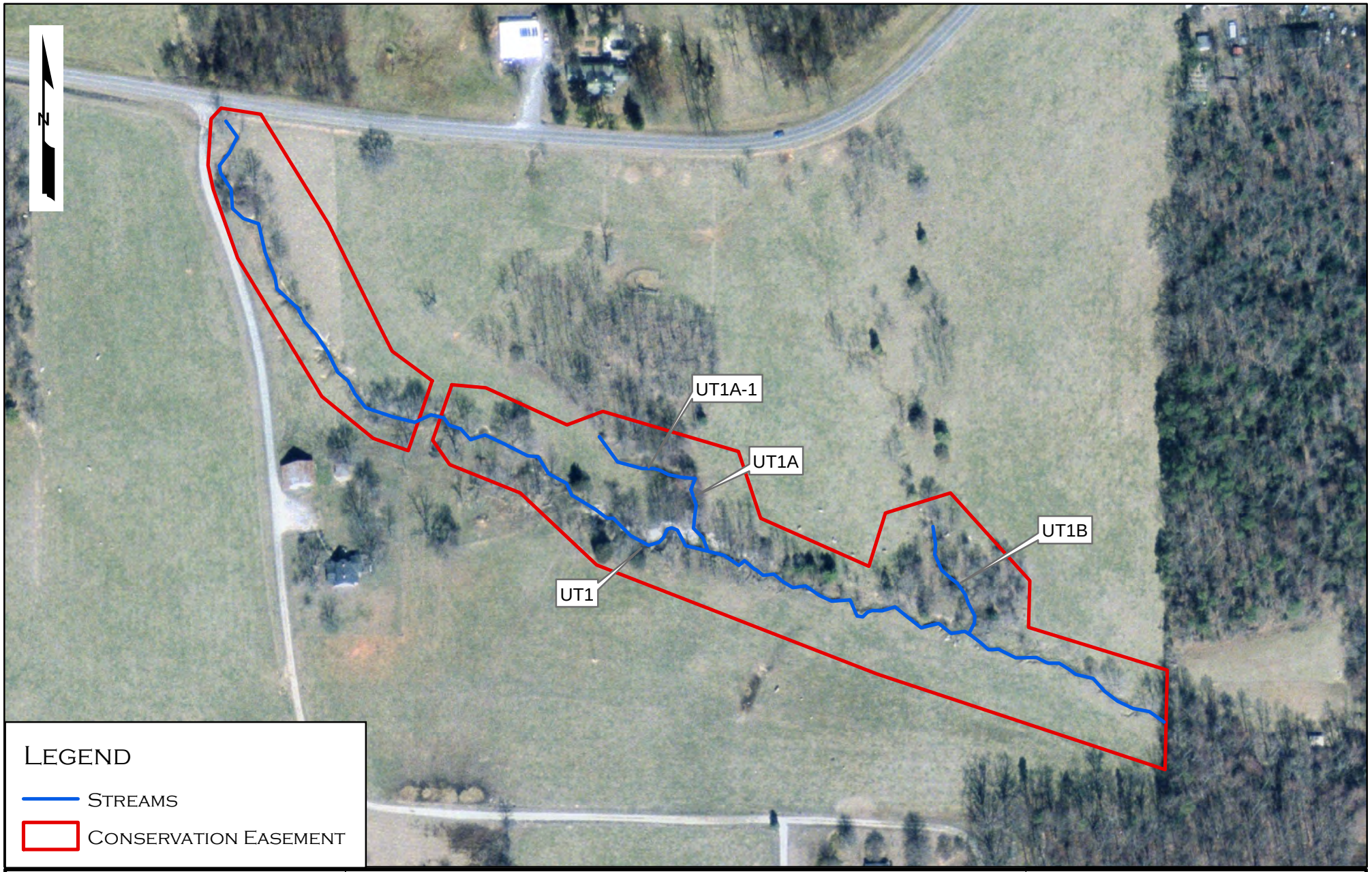
1993 HISTORICAL AERIAL MAP

PREPARED FOR:
NCDEQ
DIVISION OF
MITIGATION SERVICES

FIGURE 4A

YADKIN COUNTY, NC

PREPARED BY:
EPR
ECOSYSTEM
PLANNING &
RESTORATION



0 100 200
Feet

GREENBRIER STREAM RESTORATION

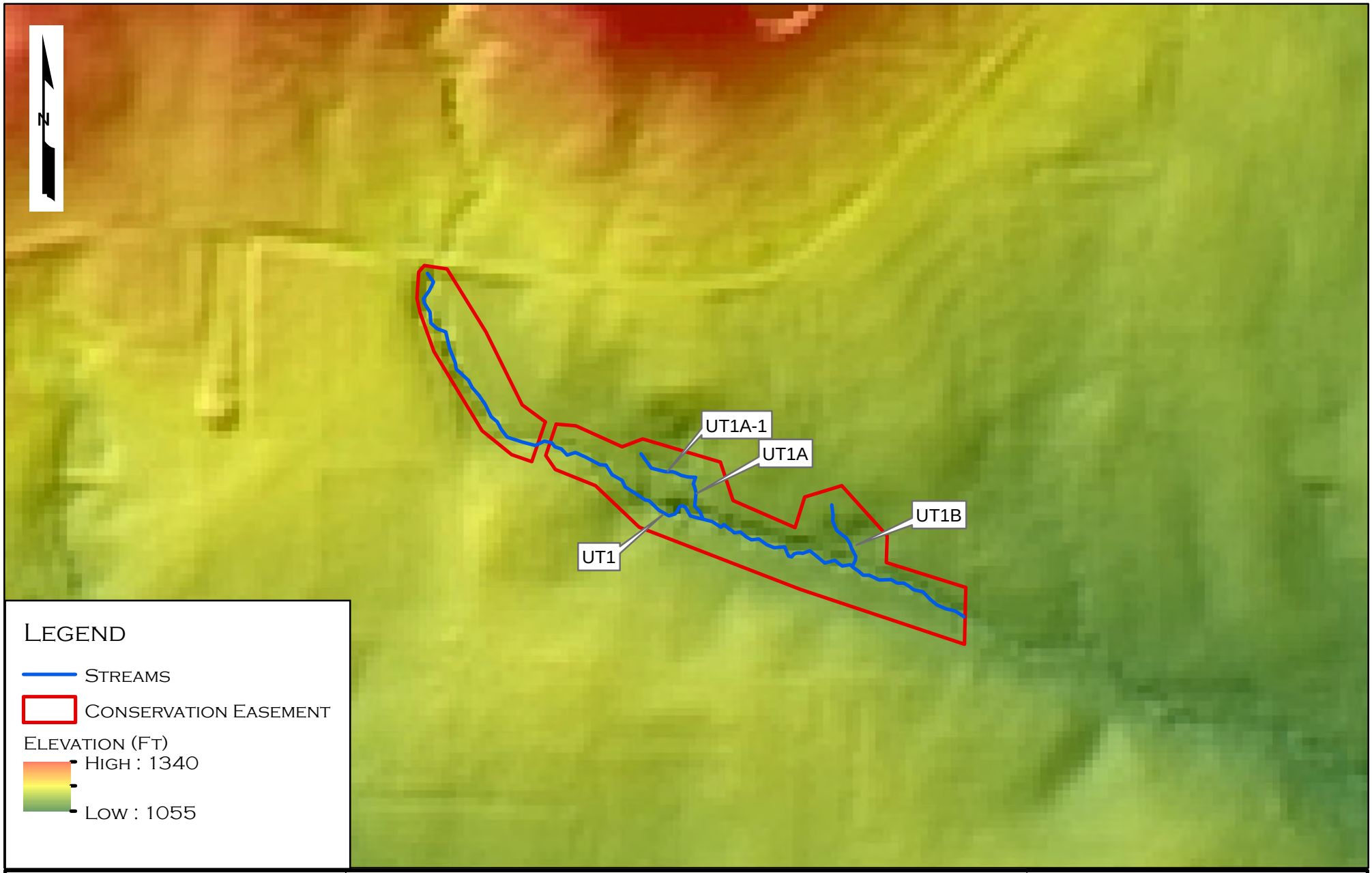
2002 HISTORICAL AERIAL MAP

PREPARED FOR:
NCDEQ
DIVISION OF
MITIGATION SERVICES

FIGURE 4B

YADKIN COUNTY, NC

PREPARED BY:
EPR
ECOSYSTEM
PLANNING &
RESTORATION



0 175 350
Feet

GREENBRIER STREAM RESTORATION

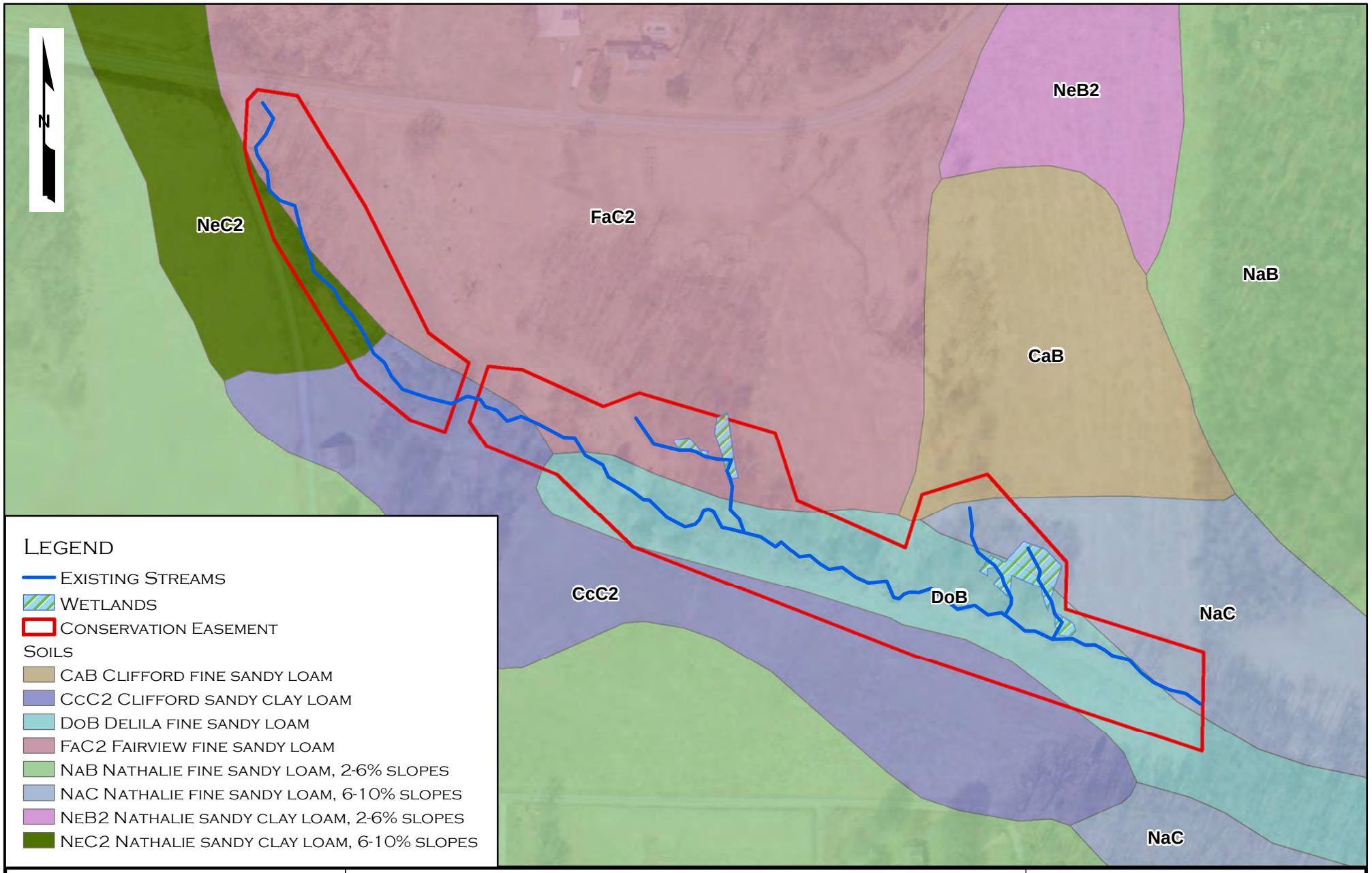
LIDAR MAP

PREPARED FOR:
NCDEQ
Division of
Mitigation Services

FIGURE 5

YADKIN COUNTY, NC

PREPARED BY:
Ecosystem
Planning &
Restoration



0 100 200 Feet

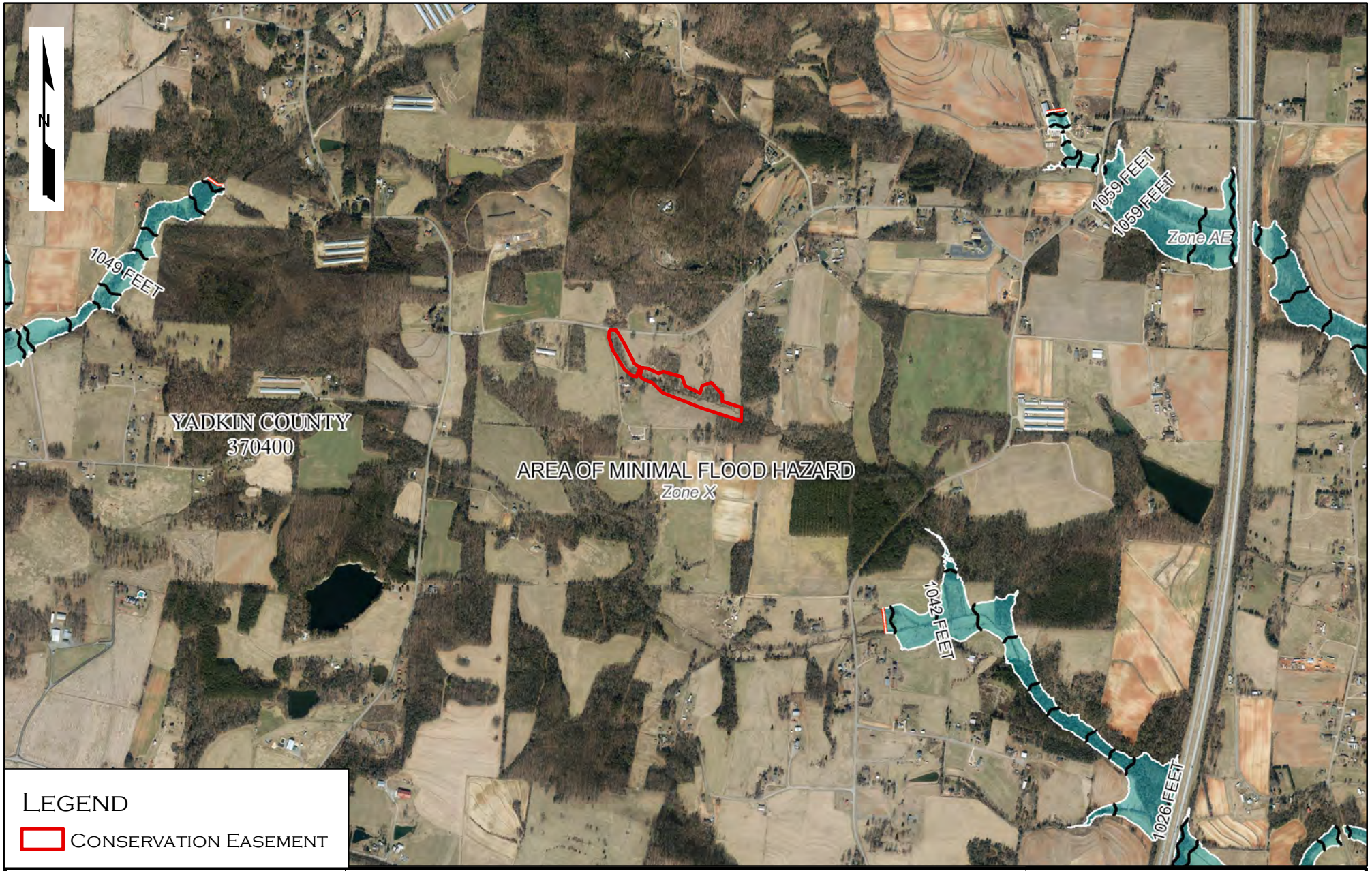
GREENBRIER STREAM RESTORATION
SOILS MAP

PREPARED FOR:
NCDEQ
DIVISION OF
MITIGATION SERVICES

FIGURE 6

YADKIN COUNTY, NC

PREPARED BY:
ECOSYSTEM PLANNING & RESTORATION



Legend

Conservation Easement

0 1,000 2,000 Feet

GREENBRIER STREAM RESTORATION

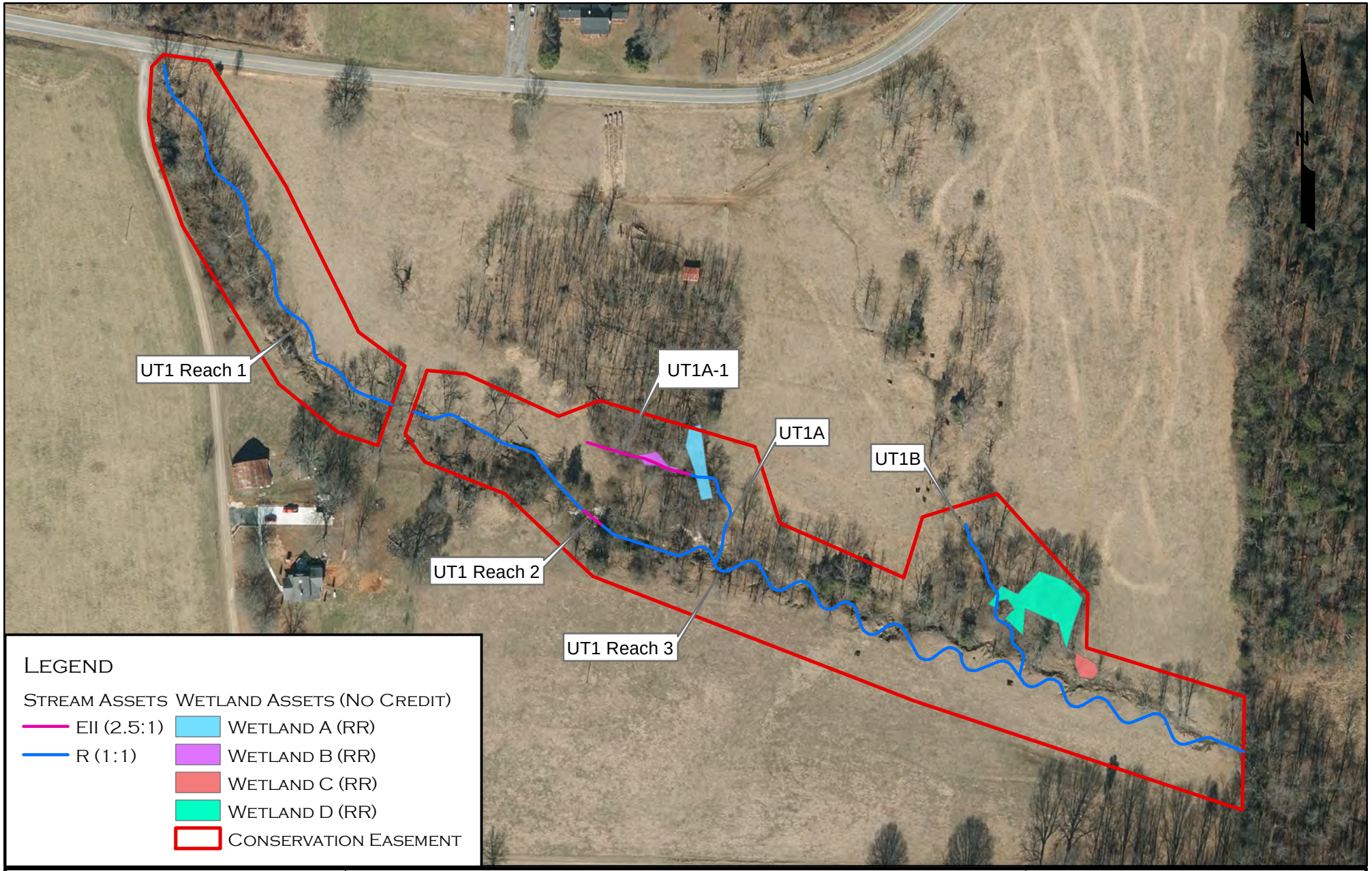
FEMA FLOODPLAIN MAP

Figure 7

YADKIN COUNTY, NC

PREPARED FOR:
NCDEQ
Division of
Mitigation Services

PREPARED BY:
Ecosystem
Planning &
Restoration



0 200 Feet

Greenbrier Stream Restoration

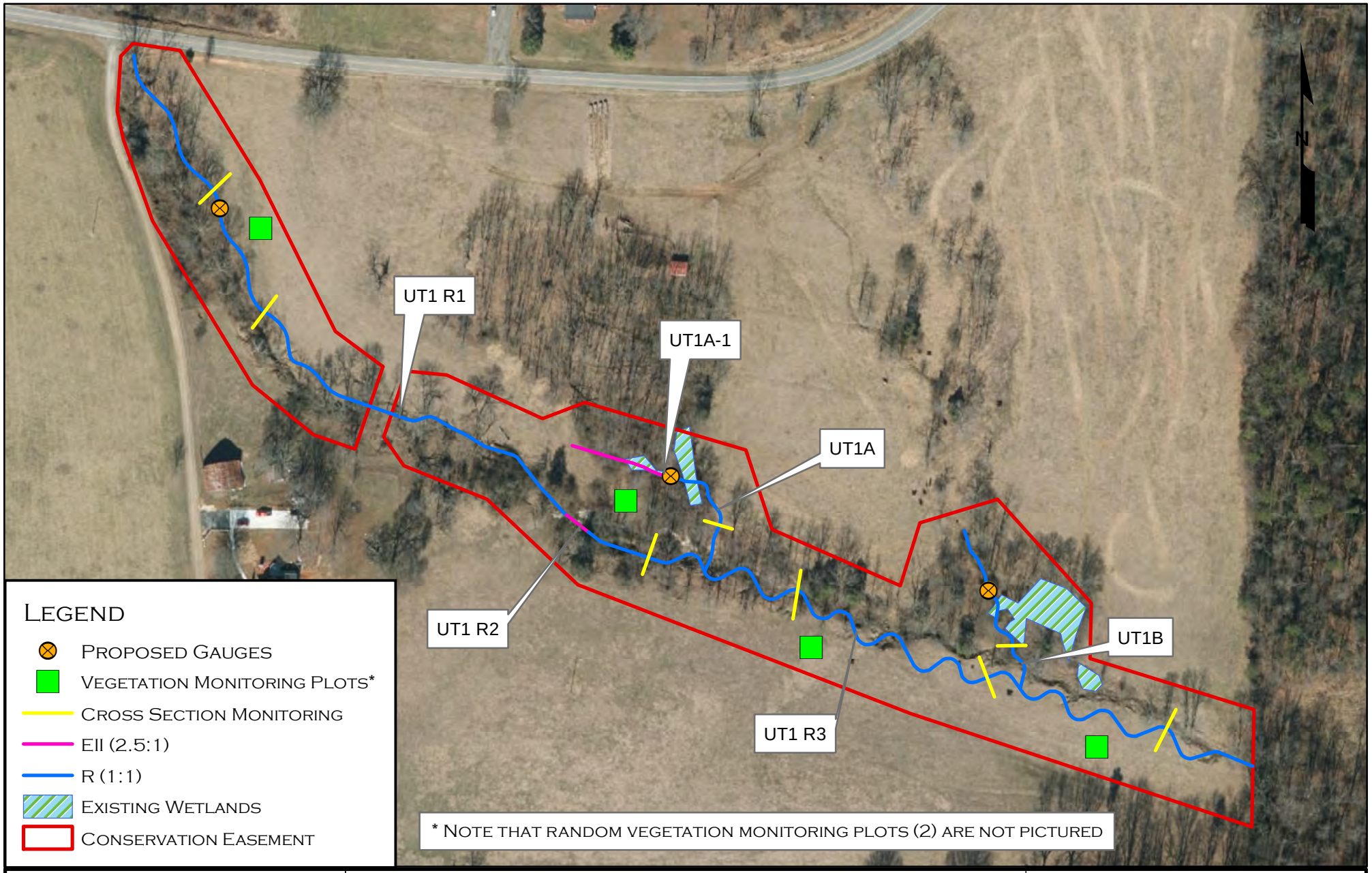
Asset Map

Prepared for:
NCDEQ
Division of
Mitigation Services

Figure 8

Yadkin County, NC

Prepared by:
Ecosystem
Planning &
Restoration



0 150 Feet

Greenbrier Stream Restoration

Proposed Monitoring Features

Yadkin County, NC

Figure 9

Prepared for:
NCDEQ
Division of
Mitigation Services

Prepared by:
Ecosystem Planning & Restoration

Appendix 1

SITE PROTECTION INSTRUMENT

FILED ELECTRONICALLY
YADKIN COUNTY NC
ARIC WILHELM
REGISTER OF DEEDS

FILED	Sep 26, 2019
AT	10:00:16 AM
BOOK	01269
START PAGE	0672
END PAGE	0685
INSTRUMENT #	03537
EXCISE TAX	$140.00

Tax Collector: LP
Land Records: LP
Tax Appraisal: LP

STATE OF NORTH CAROLINA

DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS PROVIDED PURSUANT TO FULL DELIVERY MITIGATION CONTRACT

YADKIN COUNTY

SPO File Number: 99-AB
DMS Project Number: 100086, Contract #7616

Excise Tax: $140.00

Prepared by and return to: Jason A. Brenner, Esq.
310 East Main Street Suite 355
Carrboro, NC 27510

THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS, made this 24th day of September, 2019, by Donnie R. Ireland, a natural unmarried person resident of the State of North Carolina, ("**Grantor**"), whose mailing address is 2433 Hamptonville Road, Hamptonville, NC 27020, to the State of North Carolina, ("**Grantee**"), with a mailing address of State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between ECOSYSTEM PLANNING AND RESTORATION, LLC, a limited liability company with offices at 1150 SE Maynard Rd, Suite 140, Cary, North Carolina 27511, and the North Carolina Department of Environment and Natural Resources, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environment and Natural Resources Purchase and Services Contract Number 7183.

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Department of Environment and Natural Resources and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Understanding, (MOU) duly executed by all parties on November 4, 1998. This MOU recognized that the Wetlands Restoration Program was to provide effective compensatory mitigation for authorized impacts to wetlands, streams and other aquatic resources by restoring, enhancing and preserving the wetland and riparian areas of the State; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003, which recognizes that the Division of Mitigation Services (formerly Ecosystem Enhancement Program) is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the Department of Environment and Natural Resources, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the North Carolina Wildlife Resources Commission, the North Carolina Division of Water Quality, the North Carolina Division of Coastal Management, and the National Marine Fisheries Service entered into an agreement to continue the In-Lieu Fee operations of the North Carolina Department of Natural Resources' Division of Mitigation Services (formerly Ecosystem Enhancement Program) with an effective date of 28 July, 2010, which supersedes and replaces the previously effective MOA and MOU referenced above; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, the Division of Mitigation Services in the Department of Environment and Natural Resources, which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in North Buck Shoals Township, Yadkin County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 32.88 acres and being conveyed to the Grantor by deed as recorded in **Deed Book 689 at Page 76** of the Yadkin County Registry, North Carolina; and

WHEREAS, Grantor is willing to grant a Conservation Easement and Right of Access over the herein described areas of the Property, thereby restricting and limiting the use of the areas of the Property subject to the Conservation Easement to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept said Easement and Access Rights. The Conservation Easement shall be for the protection and benefit of the waters of the unnamed tributaries to South Deep Creek.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement and Right of Access together with an access easement to and from the Conservation Easement Area described below.

The Conservation Easement Area consists of the following:

Easement Areas 1 and 2 containing a total of **6.707 acres** as shown on the plat of survey entitled "Conservation Easement Survey for: The State of North Carolina, Division of Mitigation Services," dated September 13, 2019 by Kinder Land Surveying of Mount Airy, NC, PLS Number L-4462.

See attached "**Exhibit A**", Legal Description of area of the Property hereinafter referred to as the "Conservation Easement Area."

The purposes of this Conservation Easement are to maintain, restore, enhance, construct, create and preserve wetland and/or riparian resources in the Conservation Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Conservation Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

Pursuant to law, including the above referenced statutes, this Conservation Easement and Right of Access shall be perpetual and it shall run with, and be a continuing restriction upon the use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

II. ACCESS EASEMENT

Grantor hereby grants and conveys unto Grantee, its employees, agents, successors and assigns, a perpetual, non-exclusive easement for ingress and egress over and upon the Property at all reasonable times and at the location more particularly described on **Exhibit B** ("Access Easement") attached hereto and incorporated herein by this reference, to access the Conservation Easement Area for the purposes set forth herein. This grant of easement shall not vest any rights in the public and shall not be construed as a public dedication of the Access Easement. Grantor covenants, represents and warrants that it is the sole owner of and is seized of the Property in fee simple and has the right to grant and convey this Access Easement.

III. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Conservation Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Conservation Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. Any rights not expressly reserved hereunder by the Grantor, including the rights to all mitigation credits, including, but not limited to, stream, wetland, and riparian buffer mitigation units, derived from each site within the area of the Conservation Easement, are conveyed to and belong to the Grantee. Without limiting the generality of the foregoing, the following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Conservation Easement Area for the purposes thereof.

B. Motorized Vehicle Use. Motorized vehicle use in the Conservation Easement Area is prohibited except within a Crossing Area(s) or Road or Trail as shown on the recorded survey plat.

C. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Conservation Easement Area not inconsistent with this Conservation Easement, and the right of access to the Conservation Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

D. Damage to Vegetation. Except within Crossing Area(s) as shown on the recorded survey plat and as related to the removal of non-native plants, diseased or damaged trees, or vegetation that destabilizes or renders unsafe the Conservation Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Conservation Easement Area is prohibited.

E. Industrial, Residential and Commercial Uses. All industrial, residential and commercial uses are prohibited in the Conservation Easement Area.

F. Agricultural Use. All agricultural uses are prohibited within the Conservation Easement Area including any use for cropland, waste lagoons, or pastureland.

G. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Conservation Easement Area.

H. Roads and Trails. There shall be no construction or maintenance of new roads, trails, walkways, or paving in the Conservation Easement. All existing roads, trails and crossings within the Conservation Easement Area shall be shown on the recorded survey plat.

I. Signs. No signs shall be permitted in the Conservation Easement Area except interpretive signs describing restoration activities and the conservation values of the Conservation Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Conservation Easement Area.

J. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery, or any other material in the Conservation Easement Area is prohibited.

K. Grading, Mineral Use, Excavation, Dredging. There shall be no grading, filling, excavation, dredging, mining, drilling, hydraulic fracturing; removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

L. Water Quality and Drainage Patterns. There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Conservation Easement Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns is allowed. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides in the Conservation Easement Area is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Conservation Easement Area may temporarily be withdrawn for good cause shown as needed for the survival of livestock on the Property.

M. Subdivision and Conveyance. Grantor voluntarily agrees that no further subdivision, partitioning, or dividing of the Conservation Easement Area portion of the Property owned by the Grantor in fee simple ("fee") that is subject to this Conservation Easement is allowed. Any future transfer of the Property shall be subject to this Conservation Easement and Right of Access and to the Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Conservation Easement Area for the purposes set forth herein.

N. Development Rights. All development rights are permanently removed from the Conservation Easement Area and are non-transferrable.

O. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Conservation Easement Area or any intentional introduction of non- native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is not inconsistent with the purposes of this Conservation Easement, and the Grantor obtains advance written approval from the Division of Mitigation Services, 1652 Mail Services Center, Raleigh, NC 27699-1652.

IV. GRANTEE RESERVED USES

A. Right of Access, Construction, and Inspection. The Grantee, its employees, agents, successors and assigns, shall have a perpetual Right of Access over and upon the Conservation Easement Area to undertake or engage in any activities necessary to construct, maintain, manage, enhance, repair, restore, protect, monitor and inspect the stream, wetland and any other riparian resources in the Conservation Easement Area for the purposes set forth herein or any long-term management plan for the Conservation Easement Area developed pursuant to this Conservation Easement.

B. Restoration Activities. These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterraneous water flow.

C. Signs. The Grantee, its employees and agents, successors or assigns, shall be permitted to place signs and witness posts on the Property to include any or all of the following: describe the project, prohibited activities within the Conservation Easement, or identify the project boundaries and the holder of the Conservation Easement.

D. Fences. Conservation Easements are purchased to protect the investments by the State (Grantee) in natural resources. Livestock within conservations easements damages the investment and can result in reductions in natural resource value and mitigation credits which would cause financial harm to the State. Therefore, Landowners (Grantor) with livestock are required to restrict livestock access to the Conservation Easement area. Repeated failure to do so may result in the State (Grantee) repairing or installing livestock exclusion devices (fences) within the conservation area for the purpose of restricting livestock access. In such cases, the landowner (Grantor) must provide access to the State (Grantee) to make repairs.

E. Crossing Area(s). The Grantee is not responsible for maintenance of crossing area(s), however, the Grantee, its employees and agents, successors or assigns, reserve the right to repair crossing area(s), at its sole discretion and to recover the cost of such repairs from the Grantor if such repairs are needed as a result of activities of the Grantor, his successors or assigns.

V. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features in the Conservation Easement Area that may have been damaged by such unauthorized activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, the Grantee shall,

except as provided below, notify the Grantor in writing of such breach and the Grantor shall have ninety (90) days after receipt of such notice to correct the damage caused by such breach. If the breach and damage remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by bringing appropriate legal proceedings including an action to recover damages, as well as injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Conservation Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief, if the breach is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement, and the Grantor and Grantee acknowledge that the damage would be irreparable and remedies at law inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Conservation Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor is complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury or change in the Conservation Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life or damage to the Property resulting from such causes.

D. Costs of Enforcement. Beyond regular and typical monitoring expenses, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

VI. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon

the Property. Grantee shall not be responsible for any costs or liability of any kind related to the ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

C. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown herein or to other addresses as either party establishes in writing upon notification to the other.

D. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees that any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed is subject to the Conservation Easement herein created.

E. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

F. This Conservation Easement and Right of Access may be amended, but only in writing signed by all parties hereto, or their successors or assigns, if such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement. The owner of the Property shall notify the State Property Office and the U.S. Army Corps of Engineers in writing sixty (60) days prior to the initiation of any transfer of all or any part of the Property or of any request to void or modify this Conservation Easement. Such notifications and modification requests shall be addressed to:

Division of Mitigation Services Program Manager
NC State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

and

General Counsel
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403

G. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the

conservation purposes described in this document.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Conservation Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Conservation Easement Area, and the right of quiet enjoyment of the Conservation Easement Area,

TO HAVE AND TO HOLD, the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes,

AND Grantor covenants that Grantor is seized of the Property in fee and has the right to convey the permanent Conservation Easement herein granted; that the same is free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

Donnie R. Ireland (SEAL)
Donnie R. Ireland

NORTH CAROLINA
COUNTY OF Yadkin

I, Ashlee Schaller, a Notary Public in and for ~~the~~ Durham County and State aforesaid, do hereby certify that Donnie R. Ireland, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 24th day of September, 2019.

Ashlee Glynell Schaller
Notary Public

ASHLEE GLYNELL SCHALLER
Notary Public
Durham County
NORTH CAROLINA

My commission expires:

01/17/2022

Exhibit A

CONSERVATION EASEMENT
FOR:
STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
GREENBRIER STREAM RESTORATION SITE
DMS SITE ID NO. 100086
SPO FILE NO. 99-AB
NORTH BUCK SHOALS TOWNSHIP,
YADKIN COUNTY NORTH CAROLINA

BEING all of "Easement Area '1'" and "Easement Area '2'" as shown on that plat entitled "Conservation Easement Prepared for The State of North Carolina, Division of Mitigation Services" and recorded in Plat Book 12, Page 615, Yadkin County Registry.

SUBJECT TO a perpetual easement to the use of the existing roadway being 16 feet wide and extending from S.R. No. 1323 and leading through said property and adjoining and being contiguous to the property owned by other persons and the use of this roadway shall be and is hereby granted perpetually to the general traveling public and any and all land owners, who adjoin said roadway, said roadway having been surveyed by courses and distances by T. Roy Sheek and shown on plat dated June 12, 1985, prepared by said surveyor.

SUBJECT TO the perpetual roadway easement being 20 feet wide and located at the extreme northeastern portion of the property and extending from railroad spike in the center of S.R. 1323 and to the real property currently owned by John H. VanHoy, Jr. These roadway easements herein specified shall be perpetual and run with the land herein described.

Further being described as:

"EASEMENT AREA "1"

BEGINNING POINT DESIGNATED AS "1" ON PLAT AS PREVIOUSLY DESCRIBED, POINT BEING A ⅝" CAPPED REBAR, SAID ⅝" REBAR HAVING THE N.C. GRID COORDINATES:
North: 8788541.76 East : 1459234.96
Thence the following Course:S 81-29-35 E Length: 61.55 to a ⅝"REBAR having N.C. Grid Coordinates: North: 878532.66 East : 1459295.83
Thence the following Course:S 31-35-16 E Length: 196.47 to a ⅝"REBAR having N.C. Grid Coordinates: North: 878365.30 East : 1459398.75

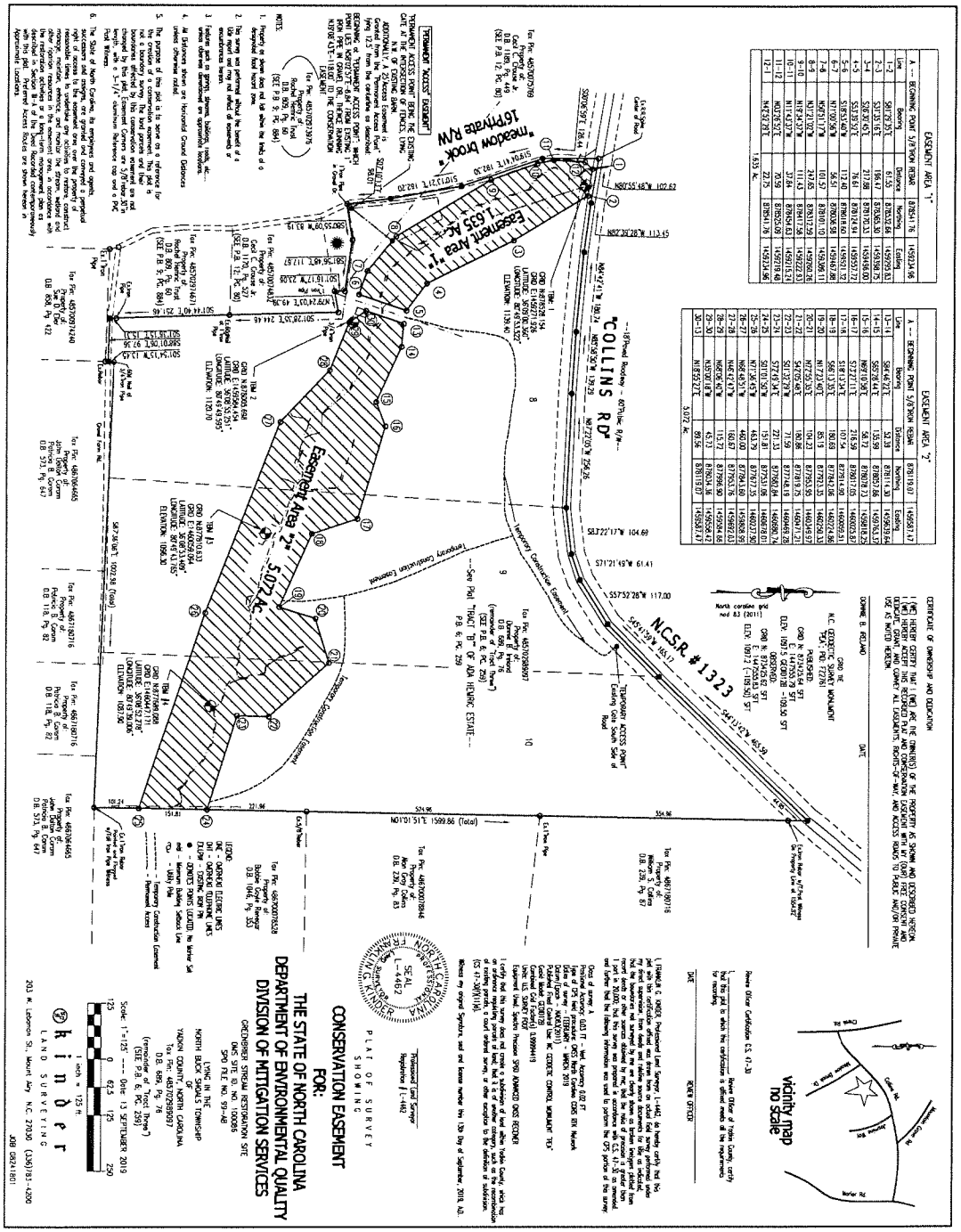
Thence the following Course:S 26-30-45 E Length: 217.88 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878170.33 East : 1459496.00
Thence the following Course: S 53-39-52 E Length: 76.61 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878124.94 East : 1459557.72
Thence the following Course: S 18-53-40 W Length: 112.4 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878018.60 East : 1459521.32
Thence the following Course: N 71-00-56 W Length: 56.51 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878036.98 East : 1459467.88
Thence the following Course: N 50-51-17 W Length: 101.57 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878101.10 East : 1459389.11
Thence the following Course: N 31-21-02 W Length: 247.65 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878312.59 East : 1459260.26
Thence the following Course: N 19-34-37 W Length: 111.43 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878417.58 East : 1459222.93
Thence the following Course: N 11-43-37 W Length: 37.84 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878454.63 East : 1459215.24
Thence the following Course: N 03-26-52 E Length: 70.59 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878525.09 East : 1459219.48
Thence the following Course: N 42-52-29 E Length: 22.75 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878541.76 East : 1459234.96
THIS POINT BEING THE "POINT OF BEGINNING, having a Perimeter: 1313.25
Area of: 71,230 Sq Ft;(or) 1.635 Ac.

"EASEMENT AREA "2"

BEGINNING POINT DESIGNATED AS "13" ON PLAT AS PREVIOUSLY DESCRIBED, POINT BEING A ⅝" CAPPED REBAR, SAID 5⁄8" REBAR HAVING THE N.C. GRID COORDINATES:
Coordinates: North: 878119.07 East : 1459587.47
Thence the following Course: S 84-46-22 E Length: 52.39 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878114.30 East : 1459639.64
Thence the following Course: S 65-28-44 E Length: 135.99 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878057.86 East : 1459763.37
Thence the following Course: N 69-10-58 E Length: 58.72 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878078.73 East : 1459818.25
Thence the following Course: S 73-27-11 E Length: 216.59 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 878017.05 East : 1460025.87
Thence the following Course: S 18-13-34 E Length: 107.54 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 877914.90 East : 1460059.51
Thence the following Course: S 66-13-35 E Length: 180.69 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 877842.06 East : 1460224.86
Thence the following Course: N 17-23-40 E Length: 85.19 to a ⅝"REBAR having N.C.
Grid Coordinates: North: 877923.35 East : 1460250.33

Thence the following Course: N 72-55-35 E Length: 104.23 to a ⅝"REBAR having N.C. Grid Coordinates: North: 877953.95 East : 1460349.97
Thence the following Course: S 42-05-48 E Length: 180.86 to a ⅝"REBAR having N.C. Grid Coordinates: North: 877819.75 East : 1460471.21
Thence the following Course: S 01-32-29 W Length: 71.59 to a ⅝"REBAR having N.C. Grid Coordinates: North: 877748.19 East : 1460469.28
Thence the following Course: S 72-49-34 E Length: 221.33 to a ⅝"REBAR having N.C. Grid Coordinates: North: 877682.84 East : 1460680.74
Thence the following Course: S 01-01-50 W Length: 151.81 to a ⅝"REBAR having N.C.Grid Coordinates: North: 877531.06 East : 1460678.01
Thence the following Course: N 71-36-45 W Length: 463.79 to a ⅝"REBAR having N.C. Grid Coordinates: North: 877677.35 East : 1460237.90
Thence the following Course: N 68-48-51 W Length: 460.00 to a ⅝"REBAR having N.C. Grid Coordinates: North: 877843.60 East : 1459808.99
Thence the following Course: N 46-42-47 W Length: 160.67 to a ⅝"REBAR having N.C. Grid Coordinates: North: 877953.76 East : 1459692.03
Thence the following Course: N 68-06-40 W Length: 115.72 to a ⅝"REBAR having N.C. Grid Coordinates: North: 877996.90 East : 1459584.66
Thence the following Course: N 35-00-18 W Length: 45.73 to a ⅝"REBAR having N.C. Grid Coordinates: North: 878034.36 East : 1459558.42
Thence the following Course: N 18-55-27 E Length: 89.56 to a ⅝"REBAR having N.C. Grid Coordinates: North: 878119.07 East : 1459587.47
THIS POINT BEING THE POINT OF BEGINNING; HAVING A Perimeter: 2902.39;
Area: 220,950 Sq Ft (or) 5.072 Ac.

Exhibit B


CERTIFICATE OF OWNERSHIP AND DEDICATION
"COLLINS RD"
NCSR #1323
Meadow Brook 16'Private R/W
Easement Area "1" - 11.635 Ac.±
Easement Area "2" - 5.072 Ac.±
TEMPORARY ACCESS EASEMENT
TEMPORARY "ACCESS EASEMENT"
Temporary Construction Easement
Temporary Construction Access Easement
Permanent Access
vicinity map
no scale
CONSERVATION EASEMENT
FOR:
THE STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
GREENBRIER STREAM RESTORATION SITE
DMS SITE ID. NO. 100086
SPO FILE NO. 99-48
LYING IN THE
NORTH BUCK SHOALS TOWNSHIP
YADKIN COUNTY, NORTH CAROLINA
PLAT OF SURVEY
SHOWING
rhinoper
LAND SURVEYING
203 W. Lebanon St., Mount Airy, N.C. 27030 (336)786-4200
JOB: SR241801

FILED ELECTRONICALLY
YADKIN COUNTY NC
ARIC WILHELM
REGISTER OF DEEDS

FILED	Sep 26, 2019
AT	10:00:54 AM
BOOK	01269
START PAGE	0686
END PAGE	0690
INSTRUMENT #	03538
EXCISE TAX	$0.00

Prepared by and return to: Jason A. Brenner, Esq.
310 East Main Street Suite 355
Carrboro, NC 27510

NORTH CAROLINA

ACCESS EASEMENT AGREEMENT

YADKIN COUNTY

THIS ACCESS EASEMENT AGREEMENT (the "Agreement") is entered into this 24th day of September, 2019 by and between DONNIE R. IRELAND, whose mailing address is 2433 Hamptonville Rd., Hamptonville, North Carolina 27020, ("Grantor"), in favor of Ecosystem Planning and Restoration, LLC ("Grantee"), with a mailing address of 1150 SE Maynard Rd, Suite 140, Cary, North Carolina 27511.

WITNESSETH

WHEREAS, Grantor owns that certain parcel of land consisting of approximately Thirty-Two Point Eight Eight (32.88) acres located in Yadkin County, North Carolina and having Parcel No. 485702989097 and shown and described more particularly on the recorded plat referenced herein below (the "Property); and

WHEREAS, Grantor desires to grant to Grantee an access easement over the Property in conjunction with Grantor's grant of that certain Deed of Conservation Easement in favor of State of North Carolina, Department of Administration.

AGREEMENT

NOW, THEREFORE, for valuable consideration, the receipt and sufficiency of which is hereby acknowledged by Grantor, and in consideration of the covenants set forth herein, Grantor does hereby give, grant, and convey unto Grantee, its successors and assigns, officers, employees, contractors, subcontractors, and any other authorized representatives of Grantee the following easements:

1. Temporary rights of access, including the associated rights of ingress, egress, and regress, to, on, and over, the portions of the Property depicted as being within the conservation easement areas in that certain plat entitled "Conservation Easement Survey for the State of North Carolina, Division of Mitigation Services" recorded in the Yadkin County Registry in Plat Book 12, Page 015, (the "Plat") to perform construction and restore certain easement areas on the Property to conditions determined by the North Carolina Division of Mitigation Services ("DMS"), including sufficient rights and access to allow movement of vehicles,

pedestrians, and heavy equipment over such access area as necessary. Such access areas shall extend for twenty (20) feet in width over portions of the property shown in the Plat. The rights set forth in this instrument shall terminate eighteen (18) months from this date, or upon the completion of construction activities and project construction phase approval and close-out signified by DMS, whichever is first to occur; and

2. Rights of access, including the associated rights of ingress, egress, and regress, to, on, and over portions of the Property to monitor site conditions as required by the North Carolina Division of Mitigation Services ("DMS"), including sufficient rights and access to allow movement of vehicles and pedestrians as necessary, and, additionally, rights of access, including the associated rights of ingress, egress, and regress sufficient to allow movement of vehicles, pedestrians, and heavy equipment for the purposes of making repairs, alterations, and additions to the construction site work performed by Grantee on the Property. Such access areas shall extend for twenty (20) feet in width over the portions of the property shown in the Plat. The rights set forth in this instrument shall terminate eight (8) years from this date, or upon the completion of monitoring activities and project close-out signified by DMS, whichever is first to occur.

Grantee agrees to indemnify, protect and defend Grantor, and hold Grantor harmless from and against any loss, claim or damage, including reasonable attorney's fees, resulting from Grantee's use of the Property.

TO HAVE AND TO HOLD the rights, privileges, and easement as aforesaid, across, over and through the Property for the benefit of Grantee and its successors and assigns. Grantor warrants that he has good and indefeasible fee simple title to the Property to all encumbrances of record, and that he has the right to grant this Easement, and they will warrant and defend the title to the same against the lawful claims of all persons whomsoever during the term of this Agreement.

[THIS SPACE INTENTIONALLY LEFT BLANK-SIGNATURE PAGES TO FOLLOW]

IN WITNESS WHEREOF, Grantor and Grantee have caused this instrument to be duly executed, all as of the day and year first above written.

GRANTOR:

DONNIE R. IRELAND

STATE OF NORTH CAROLINA §
§
COUNTY OF Yadkin §

I certify that the following person(s) personally appeared before me this day, each acknowledging to me that he or she signed the foregoing document: **Donnie R. Ireland**

Date: 09/24/2019

Official Signature of Notary Public

ASHLEE GLYNELL SCHALLER
Notary Public
Durham
County
NORTH CAROLINA

Commission Expires: 01/17/2022

GRANTEE:

ECOSYSTEM PLANNING AND RESTORATION, PLLC

By: _____

Name: Kevin Tweedy

Title: Vice-President

STATE OF NORTH CAROLINA §
§
COUNTY OF WAKE §

I certify that the following person(s) personally appeared before me this day, each acknowledging to me that he or she signed the foregoing document: **Kevin Tweedy**.

Date: 9/23/19

_____
Official Signature of Notary Public

WARD E. ELIS
NOTARY PUBLIC
WAKE COUNTY, N.C.
My Commission Expires 2-6-2024.

12-615

1269
0690

EASEMENT AREA "1"				
A -- BEGINNING POINT 5/8"IRON REBAR			878541.76	1459234.96
Line	Bearing	Distance	Northing	Easting
1-2	S81°29'35"E	61.55	878532.66	1459295.83
2-3	S31°35'16"E	196.47	878365.30	1459398.75
3-4	S26°30'45"E	217.88	878170.33	1459496.00
4-5	S53°39'52"E	76.61	878124.94	1459557.72
5-6	S18°53'40"W	112.40	878018.60	1459521.32
6-7	N71°00'56"W	56.51	878036.98	1459467.88
7-8	N50°51'17"W	101.57	878101.10	1459389.11
8-9	N31°21'02"W	247.65	878312.59	1459260.26
9-10	N19°34'37"W	111.43	878417.58	1459222.93
10-11	N11°43'37"W	37.84	878454.63	1459215.24
11-12	N03°26'52"E	70.59	878525.09	1459219.48
12-1	N42°52'29"E	22.75	878541.76	1459234.96
1.635 Ac.				

EASEMENT AREA "2"				
A -- BEGINNING POINT 5/8"IRON REBAR			878119.07	1459587.47
Line	Bearing	Distance	Northing	Easting
13-14	S84°46'22"E	52.39	878114.30	1459639.64
14-15	S65°28'44"E	135.99	878057.86	1459763.37
15-16	N69°10'58"E	58.72	878078.73	1459818.25
16-17	S73°27'11"E	216.59	878017.05	1460025.87
17-18	S18°13'34"E	107.54	877914.90	1460059.51
18-19	S66°13'35"E	180.69	877842.06	1460224.86
19-20	N17°23'40"E	85.19	877923.35	1460250.33
20-21	N72°55'35"E	104.23	877953.95	1460349.97
21-22	S42°05'48"E	180.86	877819.75	1460471.21
22-23	S01°32'29"W	71.59	877748.19	1460469.26
23-24	S72°49'34"E	221.33	877682.84	1460680.74
24-25	S01°01'50"W	151.81	877531.06	1460678.01
25-26	N71°36'45"W	463.79	877677.35	1460237.90
26-27	N68°48'51"W	460.00	877843.60	1459808.99
27-28	N46°42'47"W	160.67	877953.76	1459692.03
28-29	N68°06'40"W	115.72	877996.90	1459584.66
29-30	N35°00'18"W	45.73	878034.36	1459558.42
30-13	N18°55'27"E	89.56	878119.07	1459587.47
5.072 Ac.				

FILED Sep 24, 2019 02:02:18 pm
BOOK 00012
PAGE 0615
INSTRUMENT # 03508
FILED FOR RECORD - YADKIN COUNTY NC
ARIC WILHELM, REGISTER OF DEEDS

CERTIFICATE OF OWNERSHIP AND DEDICATION

I (WE) HEREBY CERTIFY THAT I (WE) ARE THE OWNER(S) OF THE PROPERTY AS SHOWN AND DESCRIBED HEREON. I (WE) HEREBY ACCEPT THIS RECORDED PLAT AND CONSERVATION EASEMENT WITH MY (OUR) FREE CONSENT AND DEDICATE, GRANT, AND CONVEY ALL EASEMENTS, RIGHTS-OF-WAY, AND ACCESS ROADS TO PUBLIC AND/OR PRIVATE USE AS NOTED HEREON.

DONNIE B. IRELAND DATE

GRID TIE
N.C. GEODECTIC SURVEY MONUMENT
"PEA"; PID: FZ2761
PUBLISHED:
GRID N: 873425.64 SFT
E: 1447555.79 SFT
ELEV: 1097.5 GEOID12B -109.50 SFT
OBSERVED:
GRID N: 873425.62 SFT
E: 1447555.83 SFT
ELEV: 1097.2 (-109.50) SFT

North Carolina grid nad 83 (2011)

vicinity map
no scale

Review Officer Certification G.S. 47-30

I, Dawn Vallieres, Review Officer of Yadkin County, certify that this plat to which this certification is affixed meets all the requirements for recording.

9/24/2019 Dawn Vallieres
DATE REVIEW OFFICER

I, FRANKLIN G. KINDER, Professional Land Surveyor, L-4462, do hereby certify that this plat with this certification affixed was drawn from an actual field survey performed under my direct supervision; from deeds and relative source documents for title as indicated; that the boundaries not surveyed by me are clearly shown as broken lines/types plotted from record deeds or other sources obtained by me; that the ratio of precision is greater than 1 part in 20,000; that this survey was prepared in accordance with G.S. 47-30 as amended, and further that the following information was used to perform the GPS portion of this survey:

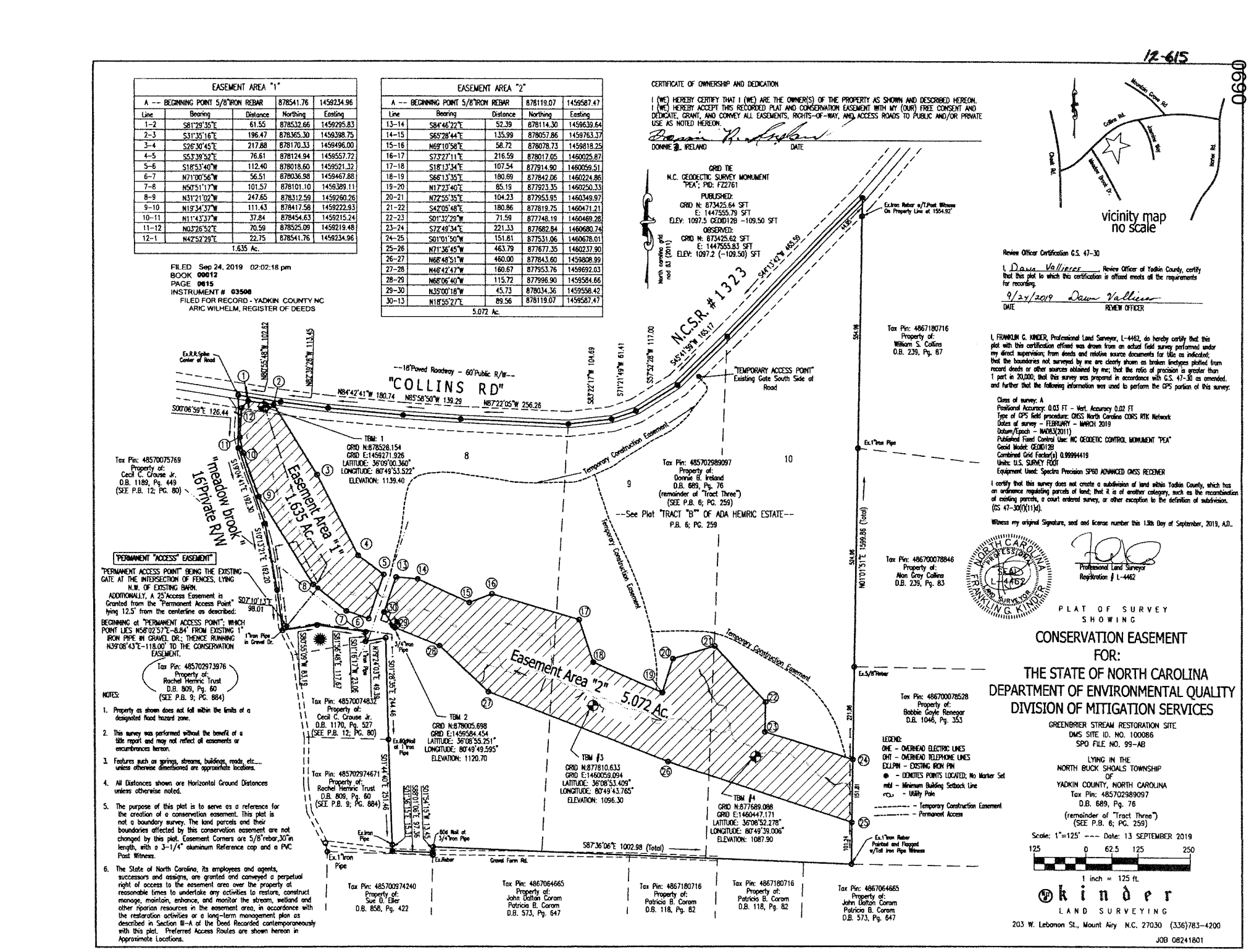
Class of survey: A
Positional Accuracy: 0.03 FT - Vert. Accuracy 0.02 FT
Type of GPS field procedure: GNSS North Carolina CORS RTK Network
Dates of survey - FEBRUARY - MARCH 2019
Datum/Epoch - NAD(X)(2011)
Published Fixed Control Use: NC GEODETIC CONTROL MONUMENT "PEA"
Geoid Model: GEOID12B
Combined Grid Factor(s) 0.999994419
Units: U.S. SURVEY FOOT
Equipment Used: Spectra Precision SP60 ADVANCED GNSS RECEIVER

I certify that this survey does not create a subdivision of land within Yadkin County, which has an ordinance regulating parcels of land; that it is of another category, such as the recombination of existing parcels, a court ordered survey, or other exception to the definition of subdivision. (GS 47-30(f)(11)d).

Witness my original Signature, seal and license number this 13th Day of September, 2019, A.D..

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

Professional Land Surveyor
Registration # L-4462



"PERMANENT ACCESS" EASEMENT

"PERMANENT ACCESS POINT" BEING THE EXISTING GATE AT THE INTERSECTION OF FENCES, LYING N.W. OF EXISTING BARN.
ADDITIONALLY, A 25'Access Easement in Granted from the "Permanent Access Point" lying 12.5' from the centerline as described:
BEGINNING at "PERMANENT ACCESS POINT"; WHICH POINT LIES N58°02'57"E-8.84' FROM EXISTING 1" IRON PIPE IN GRAVEL DR.; THENCE RUNNING N39°08'43"E-118.00' TO THE CONSERVATION EASEMENT.

NOTES:

1. Property as shown does not fall within the limits of a designated flood hazard zone.
2. This survey was performed without the benefit of a title report and may not reflect all easements or encumbrances hereon.
3. Features such as springs, streams, buildings, roads, etc.... unless otherwise dimensioned are approximate locations.
4. All Distances shown are Horizontal Ground Distances unless otherwise noted.
5. The purpose of this plat is to serve as a reference for the creation of a conservation easement. This plat is not a boundary survey. The land parcels and their boundaries affected by this conservation easement are not changed by this plat. Easement Corners are 5/8"rebar,30"in length, with a 3-1/4" aluminum Reference cap and a PVC Post Witness.
6. The State of North Carolina, its employees and agents, successors and assigns, are granted and conveyed 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 other riparian resources in the easement area, in accordance with the restoration activities or a long-term management plan as described in Section III-A of the Deed Recorded contemporaneously with this plat. Preferred Access Routes are shown hereon in Approximate Locations.

LEGEND:
OHE - OVERHEAD ELECTRIC LINES
OHT - OVERHEAD TELEPHONE LINES
EX.I.P.IN - EXISTING IRON PIN
● - DENOTES POINTS LOCATED; No Marker Set
mbl - Minimum Building Setback Line
- Utility Pole
- - - - - - - - - - - Temporary Construction Easement
- - - - - - - - - - - Permanent Access

PLAT OF SURVEY SHOWING

CONSERVATION EASEMENT FOR:

THE STATE OF NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISION OF MITIGATION SERVICES

GREENBRIER STREAM RESTORATION SITE
DMS SITE ID. NO. 100086
SPO FILE NO. 99-AB

LYING IN THE
NORTH BUCK SHOALS TOWNSHIP
OF
YADKIN COUNTY, NORTH CAROLINA
Tax Pin: 485702989097
D.B. 689, Pg. 76
(remainder of "Tract Three")
(SEE P.B. 6; PG. 259)

Scale: 1"=125' --- Date: 13 SEPTEMBER 2019

125 0 62.5 125 250
1 inch = 125 ft.

kinder
LAND SURVEYING
203 W. Lebanon St., Mount Airy N.C. 27030 (336)783-4200

JOB 08241801

12-615

EASEMENT AREA "1"				
A -- BEGINNING POINT 5/8"IRON REBAR			878541.76	1459234.96
Line	Bearing	Distance	Northing	Easting
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1.635 Ac.				

EASEMENT AREA "2"				
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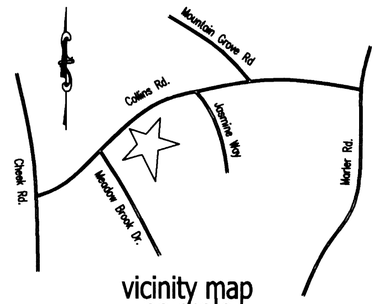
29-30	N35°00'18"W	45.73	878034.36	1459558.42
30-13	N18°55'27"E	89.56	878119.07	1459587.47
5.072 Ac.				

FILED Sep 24, 2019 02:02:18 pm
BOOK **00012**
PAGE **0615**
INSTRUMENT # **03508**
FILED FOR RECORD - YADKIN COUNTY NC
ARIC WILHELM, REGISTER OF DEEDS

CERTIFICATE OF OWNERSHIP AND DEDICATION

I (WE) HEREBY CERTIFY THAT I (WE) ARE THE OWNER(S) OF THE PROPERTY AS SHOWN AND DESCRIBED HEREON. I (WE) HEREBY ACCEPT THIS RECORDED PLAT AND CONSERVATION EASEMENT WITH MY (OUR) FREE CONSENT AND DEDICATE, GRANT, AND CONVEY ALL EASEMENTS, RIGHTS-OF-WAY, AND ACCESS ROADS TO PUBLIC AND/OR PRIVATE USE AS NOTED HEREON.

DONNIE B. IRELAND DATE



vicinity map
no scale

Review Officer Certification G.S. 47-30

I, Dawn Vallieres, Review Officer of Yadkin County, certify that this plat to which this certification is affixed meets all the requirements for recording.

9/24/2019 Dawn Vallieres
DATE REVIEW OFFICER

GRID TIE
N.C. GEODECTIC SURVEY MONUMENT
"PEA"; PID: FZ2761
PUBLISHED:
GRID N: 873425.64 SFT
E: 1447555.79 SFT
ELEV: 1097.5 GEOID12B -109.50 SFT
OBSERVED:
GRID N: 873425.62 SFT
E: 1447555.83 SFT
ELEV: 1097.2 (-109.50) SFT
North carolina grid nad 83 (2011)

N.C.S.R. #1323
S44°13'42"W 465.59
S45°41'59"W 165.17
S57°52'28"W 117.00
S83°22'17"W 104.69
S71°21'49"W 61.41
N84°42'41"W 180.74
N85°58'50"W 139.29
N87°22'05"W 256.26
--18'Paved Roadway - 60'Public R/W--
"COLLINS RD"
Ex.R.R.Spike Center of Road
N80°55'48"W 102.62
N82°39'28"W 113.45
S00°06'59"E 126.44
Ex.Iron Rebar w/T.Post Witness On Property Line at 1554.92'
44.96
554.96
"TEMPORARY ACCESS POINT" Existing Gate South Side of Road
Ex.1"Iron Pipe
524.96
N01°01'51"E 1599.86 (Total)
221.96
151.81
101.24
S87°36'06"E 1002.98 (Total)
Ex.5/8"Rebar
Ex.1"Iron Rebar Painted and Flagged w/Tall Iron Pipe Witness
Ex.Rebar
Gravel Farm Rd.

TBM: 1
GRID N:878528.154
GRID E:1459271.926
LATITUDE: 36°09'00.360"
LONGITUDE: 80°49'53.522"
ELEVATION: 1139.40

TBM 2
GRID N:878005.698
GRID E:1459584.454
LATITUDE: 36°08'55.251"
LONGITUDE: 80°49'49.595"
ELEVATION: 1120.70

TBM #3
GRID N:877810.633
GRID E:1460059.094
LATITUDE: 36°08'53.409"
LONGITUDE: 80°49'43.765"
ELEVATION: 1096.30

TBM #4
GRID N:877689.088
GRID E:1460447.171
LATITUDE: 36°08'52.278"
LONGITUDE: 80°49'39.006"
ELEVATION: 1087.90

Temporary Construction Easement
Temporary Construction Easement
Temporary Construction Easement
Temporary Construction Easement
Easement Area "1" 1.635 Ac.
Easement Area "2" 5.072 Ac.
"meadow brook" 16'Private R/W
S10°13'21"E 162.20
S19°04'41"E 192.30
S07°10'13"E 98.01
S80°55'09"W 83.19
S81°56'48"E 117.67
S01°16'17"W 23.06
N79°24'03"E 49.39
S01°28'35"E 244.46
S01°44'40"E 251.46
S88°01'06"E 97.36
S01°54'15"W 13.45
S07°36'15"E 15.31
Ex.1"Iron Pipe in Gravel Dr.
3/4"Iron Pipe
Ex.60dNail at 1"Iron Pipe
Ex.Iron Pipe
60d Nail at 3/4"Iron Pipe
Ex.1"Iron Pipe

Tax Pin: 48570075769
Property of:
Cecil C. Crouse Jr.
D.B. 1189, Pg. 449
(SEE P.B. 12; PG. 80)

Tax Pin: 485702989097
Property of:
Donnie B. Ireland
D.B. 689, Pg. 76
(remainder of "Tract Three")
(SEE P.B. 6; PG. 259)
--See Plat "TRACT "B"" OF ADA HEMRIC ESTATE--
P.B. 6; PG. 259

Tax Pin: 4867180716
Property of:
William S. Collins
D.B. 239, Pg. 87

Tax Pin: 486700078846
Property of:
Alan Gray Collins
D.B. 239, Pg. 83

Tax Pin: 486700078528
Property of:
Bobbie Gayle Renegar
D.B. 1046, Pg. 353

Tax Pin: 485702973976
Property of:
Rachel Hemric Trust
D.B. 809, Pg. 60
(SEE P.B. 9; PG. 884)

Tax Pin: 485702974671
Property of:
Rachel Hemric Trust
D.B. 809, Pg. 60
(SEE P.B. 9; PG. 884)

Tax Pin: 485700748327
Property of:
Cecil C. Crouse Jr.
D.B. 1170, Pg. 527
(SEE P.B. 12; PG. 80)

Tax Pin: 485700974240
Property of:
Sue D. Eller
D.B. 858, Pg. 422

Tax Pin: 4867064665
Property of:
John Dalton Coram
Patricia B. Coram
D.B. 573, Pg. 647

Tax Pin: 4867180716
Property of:
Patricia B. Coram
D.B. 118, Pg. 82

Tax Pin: 4867180716
Property of:
Patricia B. Coram
D.B. 118, Pg. 82

Tax Pin: 4867064665
Property of:
John Dalton Coram
Patricia B. Coram
D.B. 573, Pg. 647

"PERMANENT "ACCESS" EASEMENT"

"PERMANENT ACCESS POINT" BEING THE EXISTING GATE AT THE INTERSECTION OF FENCES, LYING N.W. OF EXISTING BARN.
ADDITIONALLY, A 25'Access Easement is Granted from the "Permanent Access Point" lying 12.5' from the centerline as described:

BEGINNING at "PERMANENT ACCESS POINT"; WHICH POINT LIES N58°02'57"E-8.84' FROM EXISTING 1" IRON PIPE IN GRAVEL DR.; THENCE RUNNING N39°08'43"E-118.00' TO THE CONSERVATION EASEMENT.

NOTES:

1. Property as shown does not fall within the limits of a designated flood hazard zone.
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I, FRANKLIN G. KINDER, Professional Land Surveyor, L-4462, do hereby certify that this plat with this certification affixed was drawn from an actual field survey performed under my direct supervision; from deeds and relative source documents for title as indicated; that the boundaries not surveyed by me are clearly shown as broken linetypes plotted from record deeds or other sources obtained by me; that the ratio of precision is greater than 1 part in 20,000; that this survey was prepared in accordance with G.S. 47-30 as amended. and further that the following information was used to perform the GPS portion of this survey:

Class of survey: A
Positional Accuracy: 0.03 FT - Vert. Accuracy 0.02 FT
Type of GPS field procedure: GNSS North Carolina CORS RTK Network
Dates of survey - FEBRUARY - MARCH 2019
Datum/Epoch - NAD83(2011)
Published Fixed Control Use: NC GEODETIC CONTROL MONUMENT "PEA"
Geoid Model: GEOID12B
Combined Grid Factor(s) 0.99994419
Units: U.S. SURVEY FOOT
Equipment Used: Spectra Precision SP60 ADVANCED GNSS RECEIVER

I certify that this survey does not create a subdivision of land within Yadkin County, which has an ordinance regulating parcels of land; that it is of another category, such as the recombination of existing parcels, a court ordered survey, or other exception to the definition of subdivision. (GS 47-30(f)(11)d).

Witness my original Signature, seal and license number this 13th Day of September, 2019, A.D..

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

Professional Land Surveyor
Registration # L-4462

PLAT OF SURVEY SHOWING

CONSERVATION EASEMENT FOR: THE STATE OF NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISION OF MITIGATION SERVICES

GREENBRIER STREAM RESTORATION SITE
DMS SITE ID. NO. 100086
SPO FILE NO. 99-AB

LYING IN THE
NORTH BUCK SHOALS TOWNSHIP
OF
YADKIN COUNTY, NORTH CAROLINA
Tax Pin: 485702989097
D.B. 689, Pg. 76
(remainder of "Tract Three")
(SEE P.B. 6; PG. 259)

LEGEND:
OHE - OVERHEAD ELECTRIC LINES
OHT - OVERHEAD TELEPHONE LINES
EX.I.PIN - EXISTING IRON PIN
● - DENOTES POINTS LOCATED; No Marker Set
mbl - Minimum Building Setback Line
- Utility Pole
---------- - Temporary Construction Easement
---------- - Permanent Access

Scale: 1"=125' --- Date: 13 SEPTEMBER 2019

125 0 62.5 125 250
1 inch = 125 ft.

kinder
LAND SURVEYING
203 W. Lebanon St., Mount Airy N.C. 27030 (336)783-4200

JOB 08241801

Appendix 2

SITE PHOTOGRAPHS

View of start of UT1 from Collins Rd.

Pipe conveying flow to UT1 under Collins Rd.

Top of Greenbrier UT1 R1, looking upstream towards Collins Rd.

View of UT1 R1 valley, looking downstream.

View of fenced in area around UT1 R1.

Cattle crossing of UT1, just downstream of end of fenced area (R1).

View of UT1 R1 looking downstream in un-fenced area; note trampling of banks in the foreground.

View of bedrock controlled UT1 R2

View of bedrock controlled UT1 R2

UT1 R3, looking downstream towards confluence with UT1A; note massive bank erosion.

View of UT1A-1 and Wetland B, looking upstream. Note presence of hoof shear and trampling.

View of Wetland A looking upslope.

View of UT1A looking upstream

View of UT1A looking downstream towards confluence with UT1.

UT1 R3, looking upstream. Note heavy sediment load.

Vertical banks along UT1 R3.

Headcut at start of UT1B.

View of UT1B looking upstream.

View of Wetland D, looking upslope.

View of UT1 R3, looking downstream of UT1B confluence; outlet of UT1C and Wetland C noted.

Appendix 3

PRELIMINARY JURISDICTIONAL DETERMINATION &

NCWAM RATING FORMS

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action ID: **SAW-2018-01755** County: **Yadkin** U.S.G.S. Quad: **Elkin South**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: **Donnie Ray Ireland**
Address: **Collins Rd.**
Hamptonville, NC 27020
Telephone Number: **336-244-5002**

Size (acres): **7**
Nearest Waterway: **Dobbins Creek**
River Basin/ HUC: **Upper Yadkin**

Nearest Town: **Hamptonville**
Coordinates: **36.149289, -80.828755**

Location description: **The site is located at the intersection of Meadowbrook Dr and Collins Rd. in Hamptonville, NC**

Indicate Which of the Following Apply:

A. Preliminary Determination

X There are waters, including wetlands, on the above described project area, 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. 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 are wetlands on the above described 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 of the U.S. on your 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 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 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 waters of the U.S. including wetlands on the above described 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 of the U.S. on your 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 of the U.S. including wetlands on your project area have been delineated and the delineation has been verified by the Corps. 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 of the U.S. including wetlands have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on_____. 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 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 to determine their requirements.

Placement of dredged or fill material within waters of the US and/or 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 **William Elliott** at **828-271-7980, ext. 4225** or **amanda.jones@usace.army.mil**.

C. Basis for Determination:

See attached preliminary jurisdictional determination form.

The site contains wetlands as determined by the 1987 Corps of Engineers Wetland Delineation Manual and the Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Eastern Mountain and Piedmont Region (version 2.0). These wetlands are adjacent to stream channels located on the property that exhibit indicators of ordinary high water marks.

D. Remarks:

The potential waters of the U.S., at this site, were verified on-site by the Corps on May 1, 2019 and are as approximately depicted on the attached Potential Wetland/Waters Map

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 **N/A (Preliminary-JD)**.

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: William Elliott

William Elliott

Issue Date of JD: **Apr 7, 2019** Expiration Date: N/A Preliminary JD

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:
Kevin L. Tweedy 559 Jones Franklin Rd. Suite 150, Raleigh, NC 27606

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL		
Applicant: **Donnie Ray Ireland**	File Number: **SAW-SAW-2018-01755**	Date: **Apr 7, 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: **District Engineer, Wilmington Regulatory Division,** **Attn: William Elliott** **151 Patton Avenue, Room 208** **Asheville, North Carolina 28801-5006** **828-271-7980, ext. 4232**	If you only have questions regarding the appeal process you may also contact: 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.: William Elliott, 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

PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: May 7, 2019

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Kevin Tweedy, 559 Jones Franklin Rd., Suite 150 Raleigh, NC 27606 for Donnie Ray Ireland, Collins Rd. Hamptonville, NC

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:CESAW-RG-A, SAW-2018-01755

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION: Greenbrier Stream Restoration Site (NCDMS Full Delivery); restore or enhance 4 tributaries to South Deep Creek in Yadkin County.

(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)

State: NC County/parish/borough: Yadkin City: Hamptonville

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

Lat.: 36.148350 °N Long.: -80.829224 °W

Universal Transverse Mercator: 17S

Name of nearest waterbody: South Deep Creek

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

☐ Office (Desk) Determination. Date:

☒ Field Determination. Date(s): MAY 1-2019

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 resources in review area (acreage and linear feet, if applicable	Type of aquatic resources (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)
UT1	36.148289	-80.828982	1,975 lf	Non-wetland; perennial stream	Section 404
UT1a	36.148457	-80.829175	120 lf	Non-wetland; intermittent stream	Section 404
UT1b	36.148255	-80.827883	187 lf	Non-wetland; intermittent stream	Section 404

UT1c	36.148128	-80.827559	158 lf	Non-wetland; intermittent stream	Section 404
UT1a-1	36.148673	-80.829496	170 lf	Non-wetland; intermittent stream	Section 404
WA	36.148679	-80.829203	0.04 ac	Wetland	Section 404
WB	36.148673	-80.829396	0.01 ac	Wetland	Section 404
WC	36.147946	-80.827435	0.02 ac	Wetland	Section 404
WD	36.14818	-80.827633	0.13 ac	Wetland	Section 404

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:_____

☒ 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: Elkin South

☒ Natural Resources Conservation Service Soil Survey. Citation: Web Soil Survey

☐ 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: ☐ X Aerial (Name & Date):_____
or ☐ Other (Name & Date):_____

☐ Previous determination(s). File no. and date of response letter:_____

☐ Other information (please specify):_____

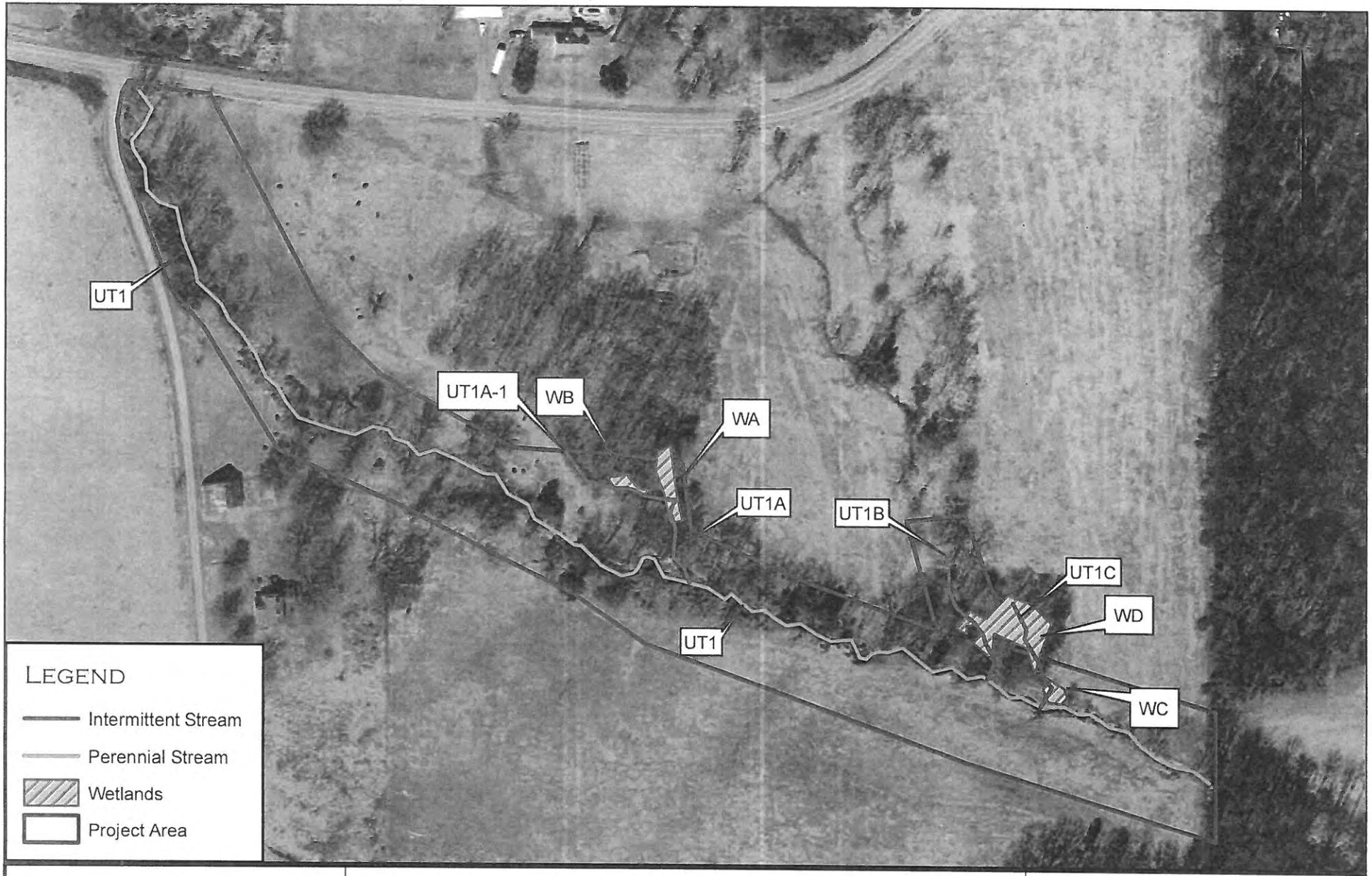
IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

Signature and date of Regulatory staff member completing PJD
MAY 7- 2019

Kevin Tweedy Digitally signed by Kevin Tweedy Date: 2018.11.26 09:32:04 -05'00'

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

[1] Districts may establish timeframes for requester to return signed PJD forms. If the requester 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.



0 150 300 Feet

GREENBRIER STREAM RESTORATION SITE

POTENTIAL JURISDICTIONAL RESOURCES

PREPARED BY:
ECOSYSTEM PLANNING & RESTORATION

FIGURE 3

YADKIN COUNTY, NORTH CAROLINA

NOVEMBER 2018

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	WA and WB	Date of Assessment	10/17/2018
Wetland Type	Headwater Forest	Assessor Name/Organization	A. James

Notes on Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	NO
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-surface Storage and Retention	Condition	**LOW**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence (Y/N)	**YES**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence (Y/N)	**YES**
	Physical Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

Function Rating Summary

Function	Metrics	Rating
Hydrology	Condition	**LOW**
Water Quality	Condition	**MEDIUM**
	Condition/Opportunity	**HIGH**
	Opportunity Presence (Y/N)	**YES**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	WC	Date of Assessment	10/17/2018
Wetland Type	Headwater Forest	Assessor Name/Organization	A. James

Notes on Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	NO
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence (Y/N)	**YES**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence (Y/N)	**YES**
	Physical Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

Function Rating Summary

Function	Metrics	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**HIGH**
	Condition/Opportunity	**HIGH**
	Opportunity Presence (Y/N)	**YES**
Habitat	Condition	**LOW**

Overall Wetland Rating **MEDIUM**

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	WD	Date of Assessment	10/17/2018
Wetland Type	Headwater Forest	Assessor Name/Organization	A. James

Notes on Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	NO
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**MEDIUM**
	Sub-surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence (Y/N)	**YES**
	Particulate Change	Condition	**HIGH**
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence (Y/N)	**YES**
	Physical Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

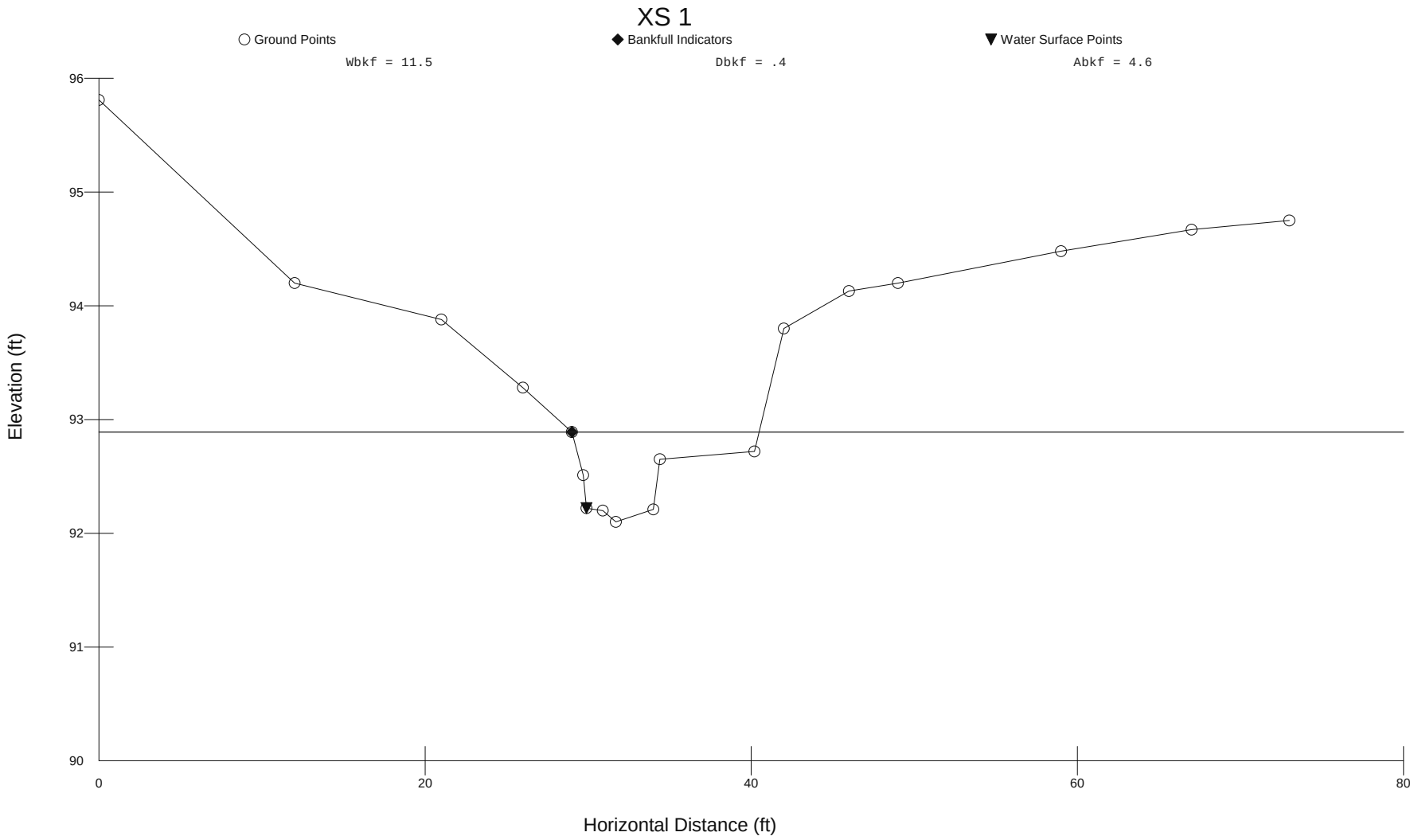
Function Rating Summary

Function	Metrics	Rating
Hydrology	Condition	**HIGH**
Water Quality	Condition	**HIGH**
	Condition/Opportunity	**HIGH**
	Opportunity Presence (Y/N)	**YES**
Habitat	Condition	**LOW**

Overall Wetland Rating **HIGH**

Appendix 4

DATA ANALYSIS & MORPHOLOGICAL TABLES


XS 1
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 11.5
Dbkf = .4
Abkf = 4.6
96
95
94
93
92
91
90
Elevation (ft)
0
20
40
60
80
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1
Cross Section Name: XS 1
Survey Date: 10/19/2018

Cross Section Data Entry

BM Elevation: 99 ft
Backsight Rod Reading: 1 ft

TAPE	FS	ELEV	NOTE
0	4.19	95.81	
12	5.8	94.2	
21	6.12	93.88	
26	6.72	93.28	
29	7.11	92.89	BKF
29.7	7.49	92.51	
29.9	7.78	92.22	LEW
30.9	7.8	92.2	
31.7	7.9	92.1	TW
34	7.79	92.21	
34.4	7.35	92.65	
40.2	7.28	92.72	
42	6.2	93.8	
46	5.87	94.13	
49	5.8	94.2	
59	5.52	94.48	
67	5.33	94.67	
73	5.25	94.75	

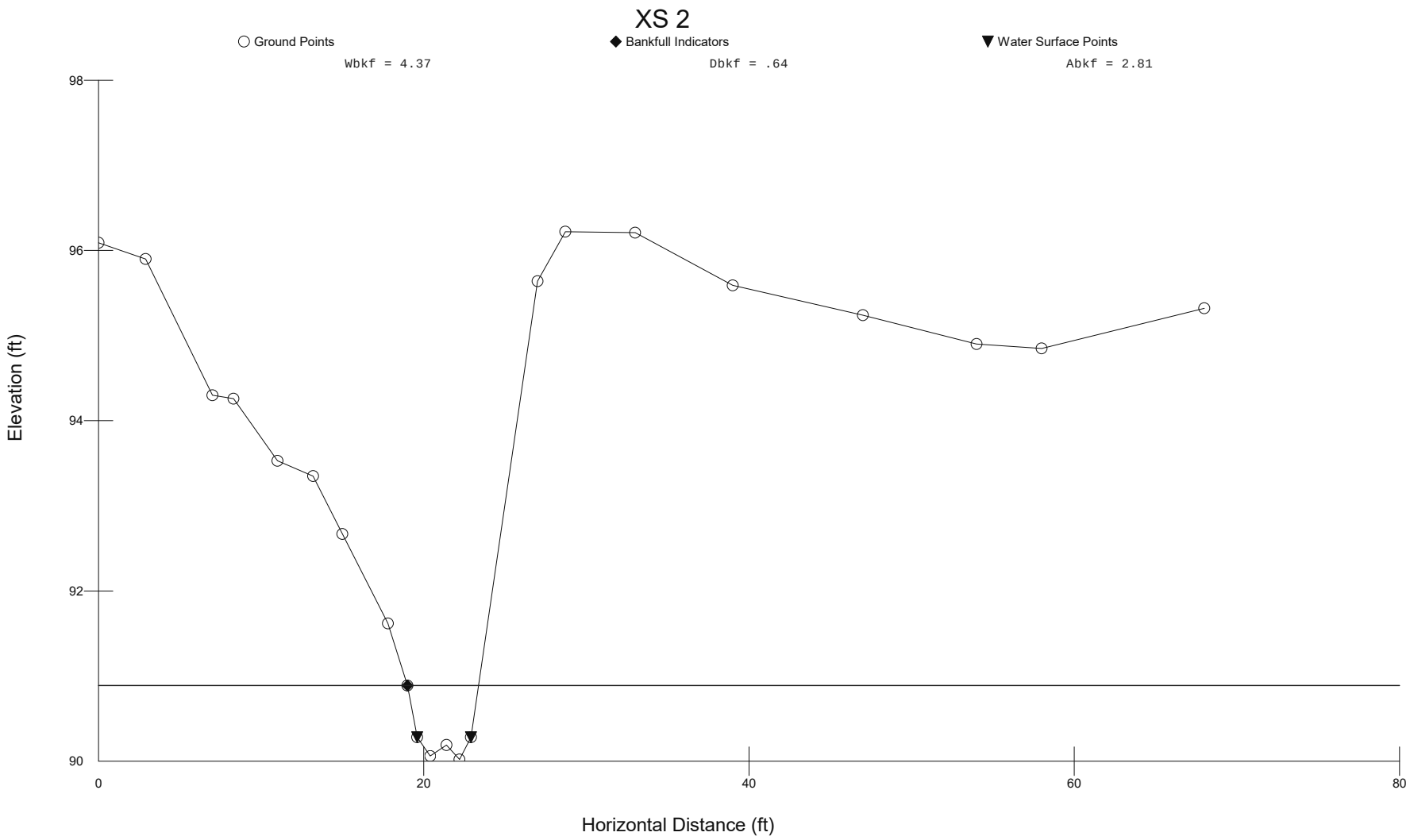
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	93.68	93.68	93.68
Bankfull Elevation (ft)	92.89	92.89	92.89
Floodprone Width (ft)	19.13	-----	-----
Bankfull Width (ft)	11.48	5.74	5.74
Entrenchment Ratio	1.67	-----	-----
Mean Depth (ft)	0.4	0.6	0.2
Maximum Depth (ft)	0.79	0.79	0.24
Width/Depth Ratio	28.7	9.51	28.7
Bankfull Area (sq ft)	4.6	3.47	1.13
Wetted Perimeter (ft)	11.98	6.43	6.02
Hydraulic Radius (ft)	0.38	0.54	0.19
Begin BKF Station	29	29	34.74
End BKF Station	40.48	34.74	40.48

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


XS 2
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 4.37
Dbkf = .64
Abkf = 2.81
98
96
94
92
90
Elevation (ft)
0
20
40
60
80
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1
Cross Section Name: XS 2
Survey Date: 10/19/2018

Cross Section Data Entry

BM Elevation: 99 ft
Backsight Rod Reading: 1 ft

TAPE	FS	ELEV	NOTE
0	3.91	96.09	
2.9	4.1	95.9	
7	5.7	94.3	
8.3	5.74	94.26	
11	6.47	93.53	
13.2	6.65	93.35	
15	7.33	92.67	
17.8	8.38	91.62	
19	9.11	90.89	BKF
19.6	9.72	90.28	LEW
20.4	9.94	90.06	TW
21.4	9.81	90.19	
22.2	9.98	90.02	
22.9	9.72	90.28	REW
27	4.36	95.64	TOB
28.7	3.78	96.22	
33	3.79	96.21	
39	4.41	95.59	
47	4.76	95.24	
54	5.1	94.9	
58	5.15	94.85	
68	4.68	95.32	

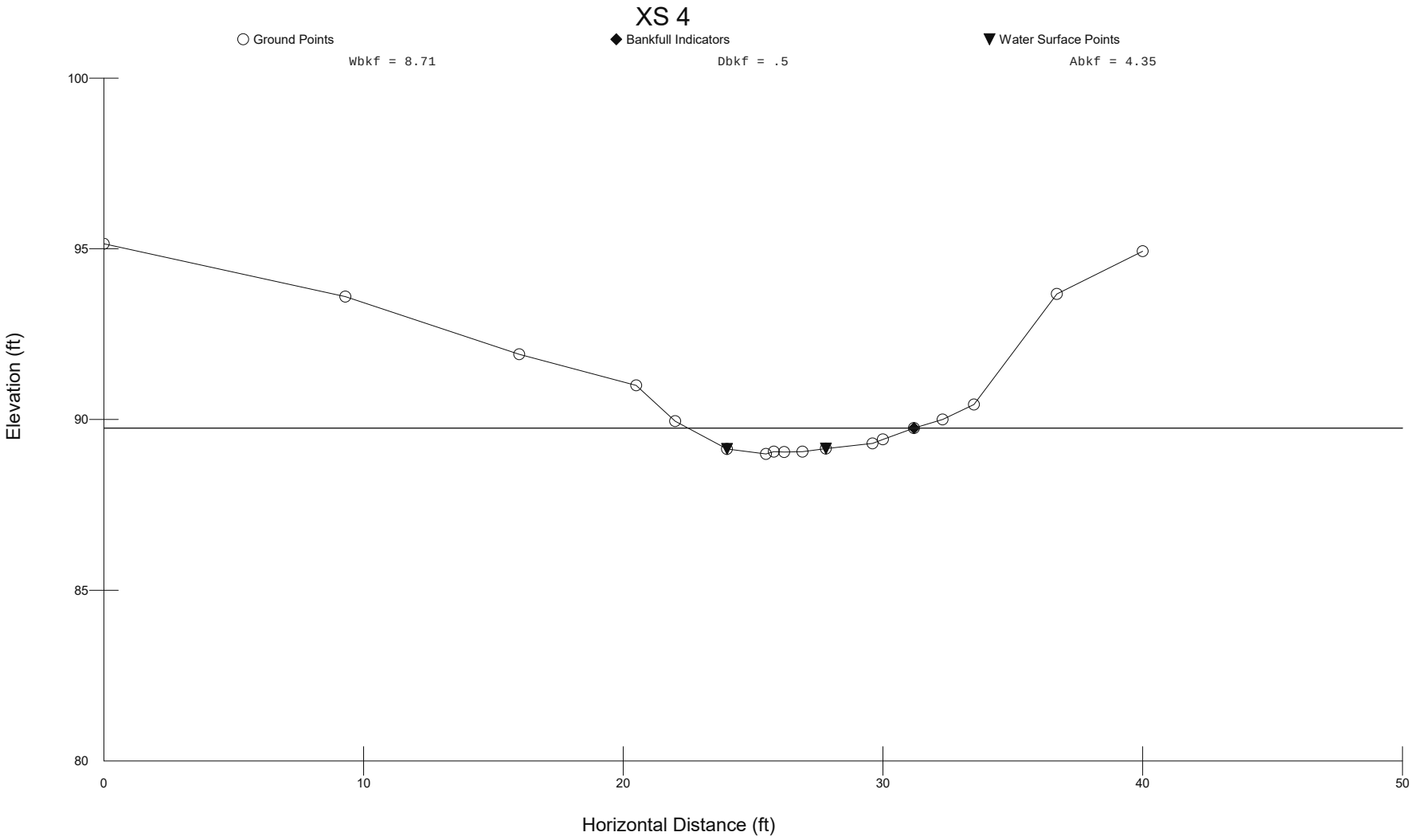
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	91.76	91.76	91.76
Bankfull Elevation (ft)	90.89	90.89	90.89
Floodprone Width (ft)	6.61	-----	-----
Bankfull Width (ft)	4.37	2.18	2.19
Entrenchment Ratio	1.51	-----	-----
Mean Depth (ft)	0.64	0.63	0.66
Maximum Depth (ft)	0.87	0.83	0.87
Width/Depth Ratio	6.83	3.48	3.32
Bankfull Area (sq ft)	2.81	1.37	1.45
Wetted Perimeter (ft)	5.03	3.2	3.28
Hydraulic Radius (ft)	0.56	0.43	0.44
Begin BKF Station	19	19	21.18
End BKF Station	23.37	21.18	23.37

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


XS 4
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 8.71
Dbkf = .5
Abkf = 4.35
100
95
90
85
80
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1
Cross Section Name: XS 4
Survey Date: 10/19/2018

Cross Section Data Entry

BM Elevation: 99 ft
Backsight Rod Reading: 1 ft

TAPE	FS	ELEV	NOTE
0	4.85	95.15	
9.3	6.4	93.6	
16	8.09	91.91	
20.5	9	91	
22	10.05	89.95	
24	10.86	89.14	LEW
25.5	11.01	88.99	
25.8	10.94	89.06	
26.2	10.95	89.05	
26.9	10.94	89.06	
27.8	10.85	89.15	REW
29.6	10.7	89.3	
30	10.58	89.42	
31.2	10.25	89.75	bkf
32.3	10	90	
33.5	9.56	90.44	
36.7	6.32	93.68	
40	5.07	94.93	

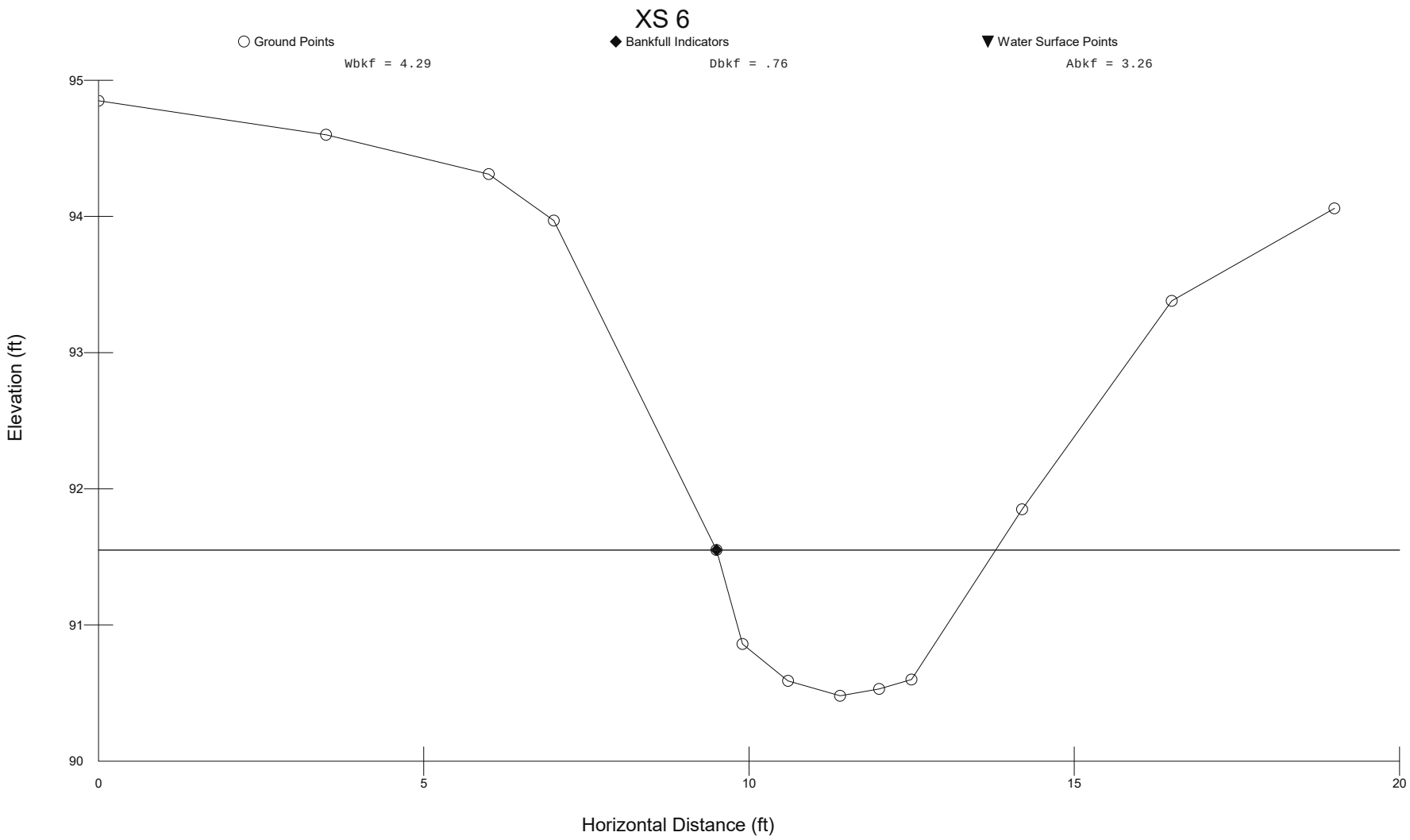
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	90.51	90.51	90.51
Bankfull Elevation (ft)	89.75	89.75	89.75
Floodprone Width (ft)	12.37	-----	-----
Bankfull Width (ft)	8.71	4.14	4.57
Entrenchment Ratio	1.42	-----	-----
Mean Depth (ft)	0.5	0.55	0.45
Maximum Depth (ft)	0.76	0.76	0.69
Width/Depth Ratio	17.42	7.5	10.16
Bankfull Area (sq ft)	4.35	2.28	2.07
Wetted Perimeter (ft)	8.91	4.96	5.34
Hydraulic Radius (ft)	0.49	0.46	0.39
Begin BKF Station	22.49	22.49	26.63
End BKF Station	31.2	26.63	31.2

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


XS 6
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 4.29
Dbkf = .76
Abkf = 3.26
95
94
93
92
91
90
Elevation (ft)
0
5
10
15
20
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1
Cross Section Name: XS 6
Survey Date: 10/19/2018

Cross Section Data Entry

BM Elevation: 99 ft
Backsight Rod Reading: 1 ft

TAPE	FS	ELEV	NOTE
0	5.15	94.85	
3.5	5.4	94.6	
6	5.69	94.31	
7	6.03	93.97	
9.5	8.45	91.55	bkf
9.9	9.14	90.86	
10.6	9.41	90.59	
11.4	9.52	90.48	
12	9.47	90.53	
12.5	9.4	90.6	
14.2	8.15	91.85	
16.5	6.62	93.38	
19	5.94	94.06	

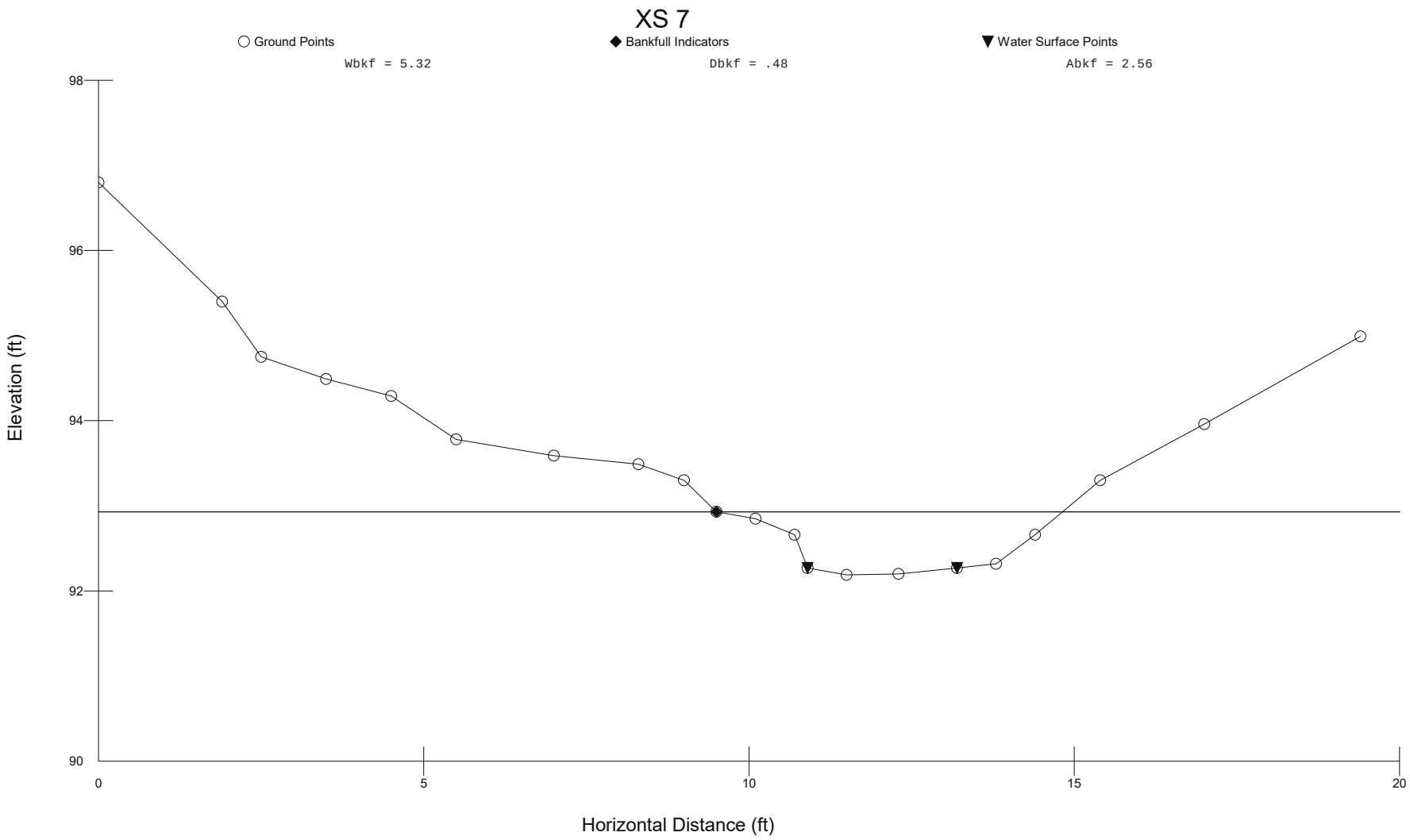
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	92.62	92.62	92.62
Bankfull Elevation (ft)	91.55	91.55	91.55
Floodprone Width (ft)	6.96	-----	-----
Bankfull Width (ft)	4.29	2.15	2.14
Entrenchment Ratio	1.62	-----	-----
Mean Depth (ft)	0.76	0.83	0.69
Maximum Depth (ft)	1.07	1.07	1.05
Width/Depth Ratio	5.64	2.58	3.1
Bankfull Area (sq ft)	3.26	1.79	1.47
Wetted Perimeter (ft)	5.07	3.66	3.51
Hydraulic Radius (ft)	0.64	0.49	0.42
Begin BKF Station	9.5	9.5	11.65
End BKF Station	13.79	11.65	13.79

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


XS 7
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 5.32
Dbkf = .48
Abkf = 2.56
98
96
94
92
90
Elevation (ft)
0
5
10
15
20
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1
Cross Section Name: XS 7
Survey Date: 10/19/2018

Cross Section Data Entry

BM Elevation: 99 ft
Backsight Rod Reading: 1 ft

TAPE	FS	ELEV	NOTE
0	3.2	96.8	
1.9	4.6	95.4	
2.5	5.25	94.75	
3.5	5.51	94.49	
4.5	5.71	94.29	
5.5	6.22	93.78	
7	6.41	93.59	
8.3	6.51	93.49	
9	6.7	93.3	LTOB
9.5	7.07	92.93	bkf
10.1	7.15	92.85	
10.7	7.34	92.66	
10.9	7.73	92.27	LEW
11.5	7.81	92.19	
12.3	7.8	92.2	
13.2	7.73	92.27	REW
13.8	7.68	92.32	Toe
14.4	7.34	92.66	
15.4	6.7	93.3	
17	6.04	93.96	
19.4	5.01	94.99	

Cross Sectional Geometry

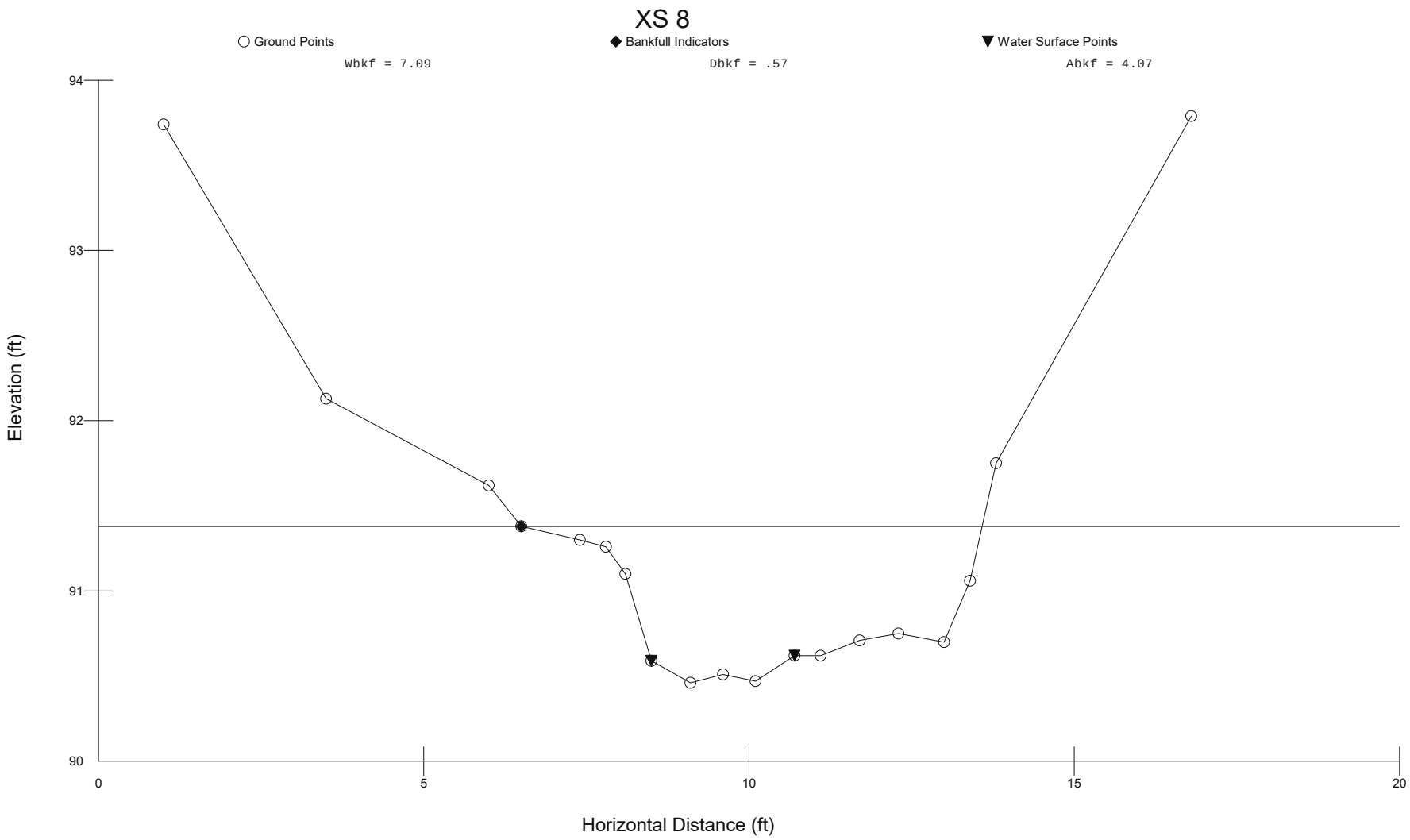
	Channel	Left	Right
Floodprone Elevation (ft)	93.67	93.67	93.67
Bankfull Elevation (ft)	92.93	92.93	92.93
Floodprone Width (ft)	9.93	-----	-----
Bankfull Width (ft)	5.32	2.9	2.42
Entrenchment Ratio	1.87	-----	-----
Mean Depth (ft)	0.48	0.45	0.52
Maximum Depth (ft)	0.74	0.74	0.72
Width/Depth Ratio	11.08	6.46	4.65
Bankfull Area (sq ft)	2.56	1.3	1.25
Wetted Perimeter (ft)	5.77	3.9	3.32
Hydraulic Radius (ft)	0.44	0.33	0.38
Begin BKF Station	9.5	9.5	12.4
End BKF Station	14.82	12.4	14.82

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side

Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


XS 8
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 7.09
Dbkf = .57
Abkf = 4.07
94
93
92
91
90
Elevation (ft)
0
5
10
15
20
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1
Cross Section Name: XS 8
Survey Date: 10/19/2018

Cross Section Data Entry

BM Elevation: 99 ft
Backsight Rod Reading: 1 ft

TAPE	FS	ELEV	NOTE
1	6.26	93.74	
3.5	7.87	92.13	
6	8.38	91.62	
6.5	8.62	91.38	BKF
7.4	8.59	91.3	
7.8	8.74	91.26	
8.1	8.9	91.1	
8.5	9.41	90.59	LEW
9.1	9.54	90.46	
9.6	9.49	90.51	
10.1	9.53	90.47	
10.7	9.38	90.62	REW
11.1	9.38	90.62	
11.7	9.29	90.71	
12.3	9.25	90.75	
13	9.3	90.7	RCH
13.4	8.94	91.06	
13.8	8.25	91.75	
16.8	6.21	93.79	

Cross Sectional Geometry

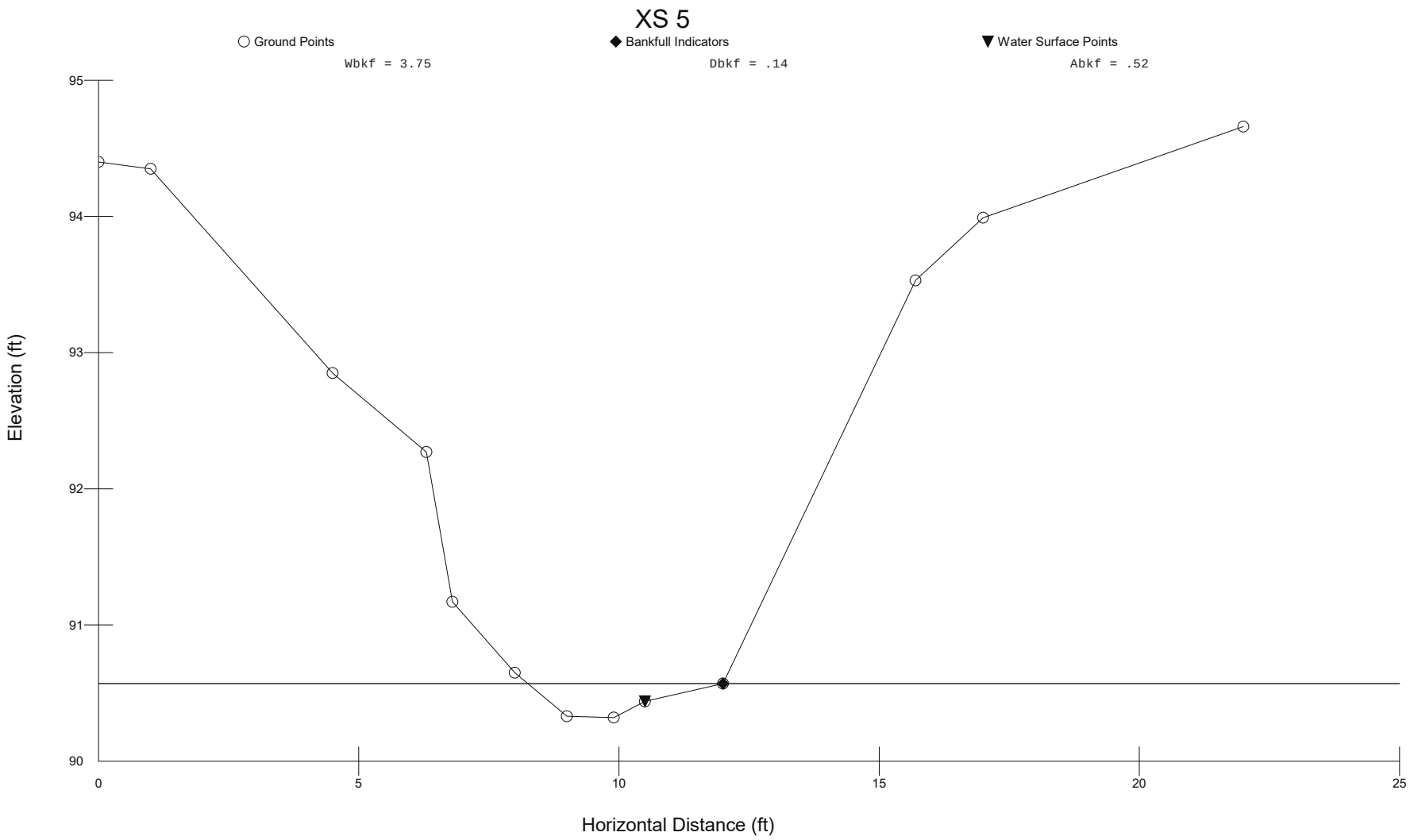
	Channel	Left	Right
Floodprone Elevation (ft)	92.3	92.3	92.3
Bankfull Elevation (ft)	91.38	91.38	91.38
Floodprone Width (ft)	11.37	-----	-----
Bankfull Width (ft)	7.09	4.03	3.06
Entrenchment Ratio	1.61	-----	-----
Mean Depth (ft)	0.57	0.53	0.64
Maximum Depth (ft)	0.92	0.92	0.8
Width/Depth Ratio	12.44	7.65	4.78
Bankfull Area (sq ft)	4.07	2.12	1.94
Wetted Perimeter (ft)	7.75	5.16	4.2
Hydraulic Radius (ft)	0.52	0.41	0.46
Begin BKF Station	6.5	6.5	10.53
End BKF Station	13.59	10.53	13.59

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			

Movable Particle (mm)


XS 5
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 3.75
Dbkf = .14
Abkf = .52
95
94
93
92
91
90
Elevation (ft)
0
5
10
15
20
25
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1A
Cross Section Name: XS 5
Survey Date: 10/19/2018

Cross Section Data Entry

BM Elevation: 99 ft
Backsight Rod Reading: 1 ft

TAPE	FS	ELEV	NOTE
0	5.6	94.4	
1	5.65	94.35	
4.5	7.15	92.85	
6.3	7.73	92.27	
6.8	8.83	91.17	
8	9.35	90.65	
9	9.67	90.33	
9.9	9.68	90.32	TW
10.5	9.56	90.44	REW
12	9.43	90.57	bkf
15.7	6.47	93.53	
17	6.01	93.99	
22	5.34	94.66	

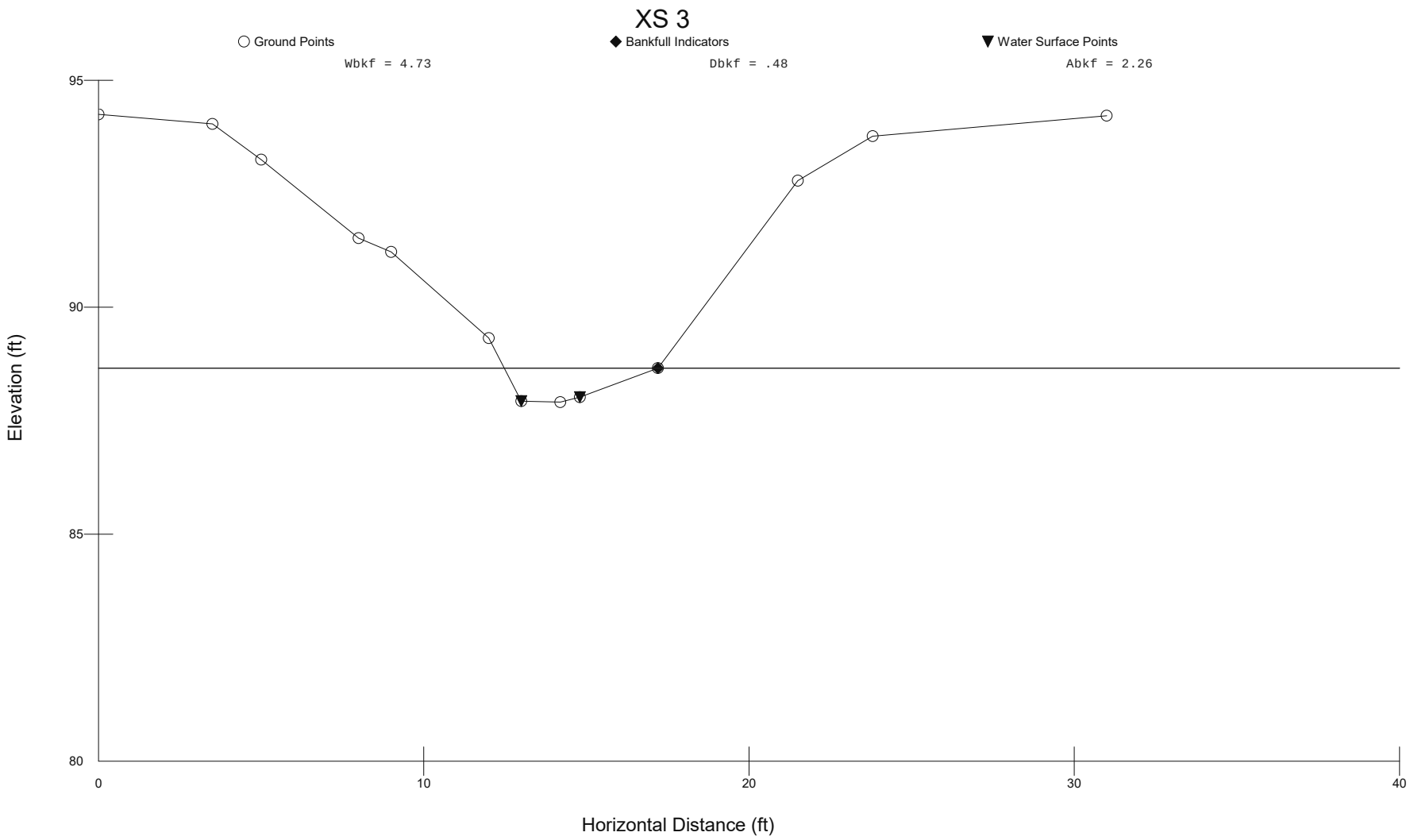
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	90.82	90.82	90.82
Bankfull Elevation (ft)	90.57	90.57	90.57
Floodprone Width (ft)	4.7	-----	-----
Bankfull Width (ft)	3.75	1.88	1.87
Entrenchment Ratio	1.25	-----	-----
Mean Depth (ft)	0.14	0.19	0.09
Maximum Depth (ft)	0.25	0.25	0.2
Width/Depth Ratio	26.79	9.74	20.78
Bankfull Area (sq ft)	0.52	0.36	0.16
Wetted Perimeter (ft)	3.81	2.13	2.09
Hydraulic Radius (ft)	0.14	0.17	0.08
Begin BKF Station	8.25	8.25	10.13
End BKF Station	12	10.13	12

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


XS 3
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 4.73
Dbkf = .48
Abkf = 2.26
95
90
85
80
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1B
Cross Section Name: XS 3
Survey Date: 10/19/2018

Cross Section Data Entry

BM Elevation: 99 ft
Backsight Rod Reading: 1 ft

TAPE	FS	ELEV	NOTE
0	5.75	94.25	
3.5	5.96	94.04	
5	6.75	93.25	
8	8.48	91.52	
9	8.78	91.22	
12	10.68	89.32	
13	12.07	87.93	LEW
14.2	12.09	87.91	TW
14.8	11.98	88.02	REW
17.2	11.34	88.66	bkf
21.5	7.21	92.79	
23.8	6.23	93.77	
31	5.78	94.22	

Cross Sectional Geometry

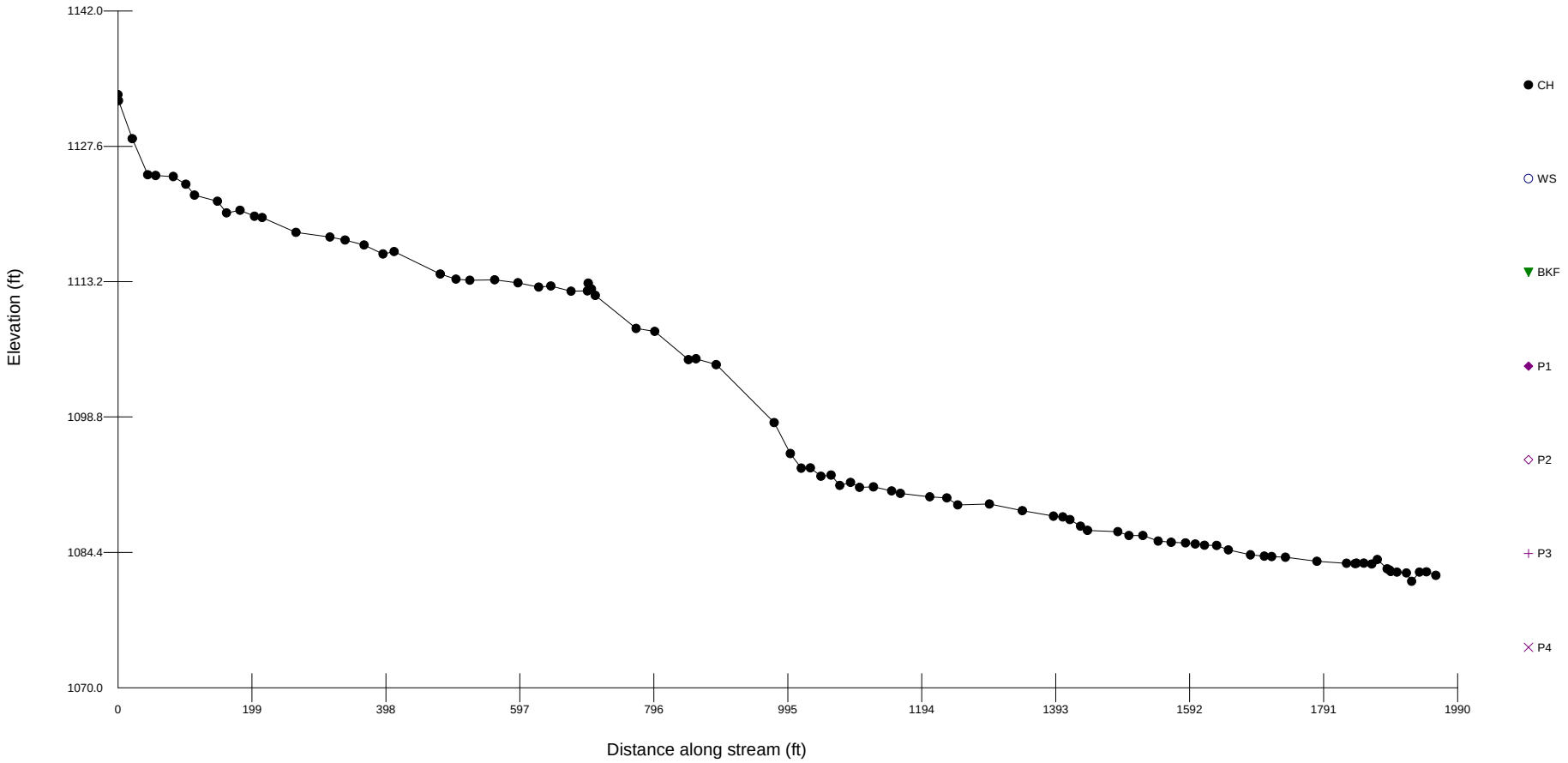
	Channel	Left	Right
Floodprone Elevation (ft)	89.41	89.41	89.41
Bankfull Elevation (ft)	88.66	88.66	88.66
Floodprone Width (ft)	6.12	-----	-----
Bankfull Width (ft)	4.73	2.37	2.36
Entrenchment Ratio	1.3	-----	-----
Mean Depth (ft)	0.48	0.64	0.31
Maximum Depth (ft)	0.75	0.75	0.63
Width/Depth Ratio	9.85	3.68	7.61
Bankfull Area (sq ft)	2.26	1.52	0.74
Wetted Perimeter (ft)	5.19	3.38	3.07
Hydraulic Radius (ft)	0.44	0.45	0.24
Begin BKF Station	12.47	12.47	14.84
End BKF Station	17.2	14.84	17.2

Entrainment Calculations

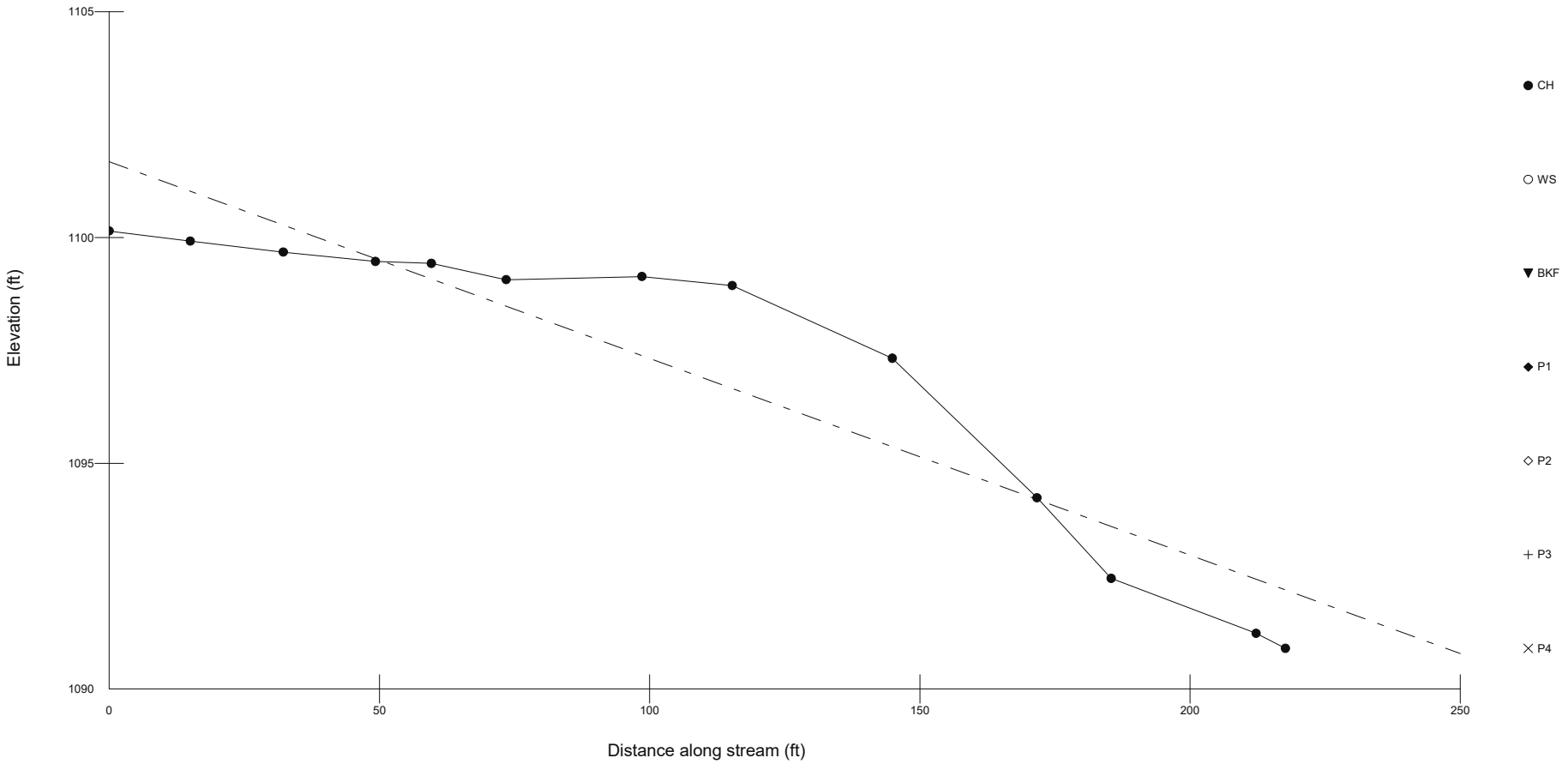
Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

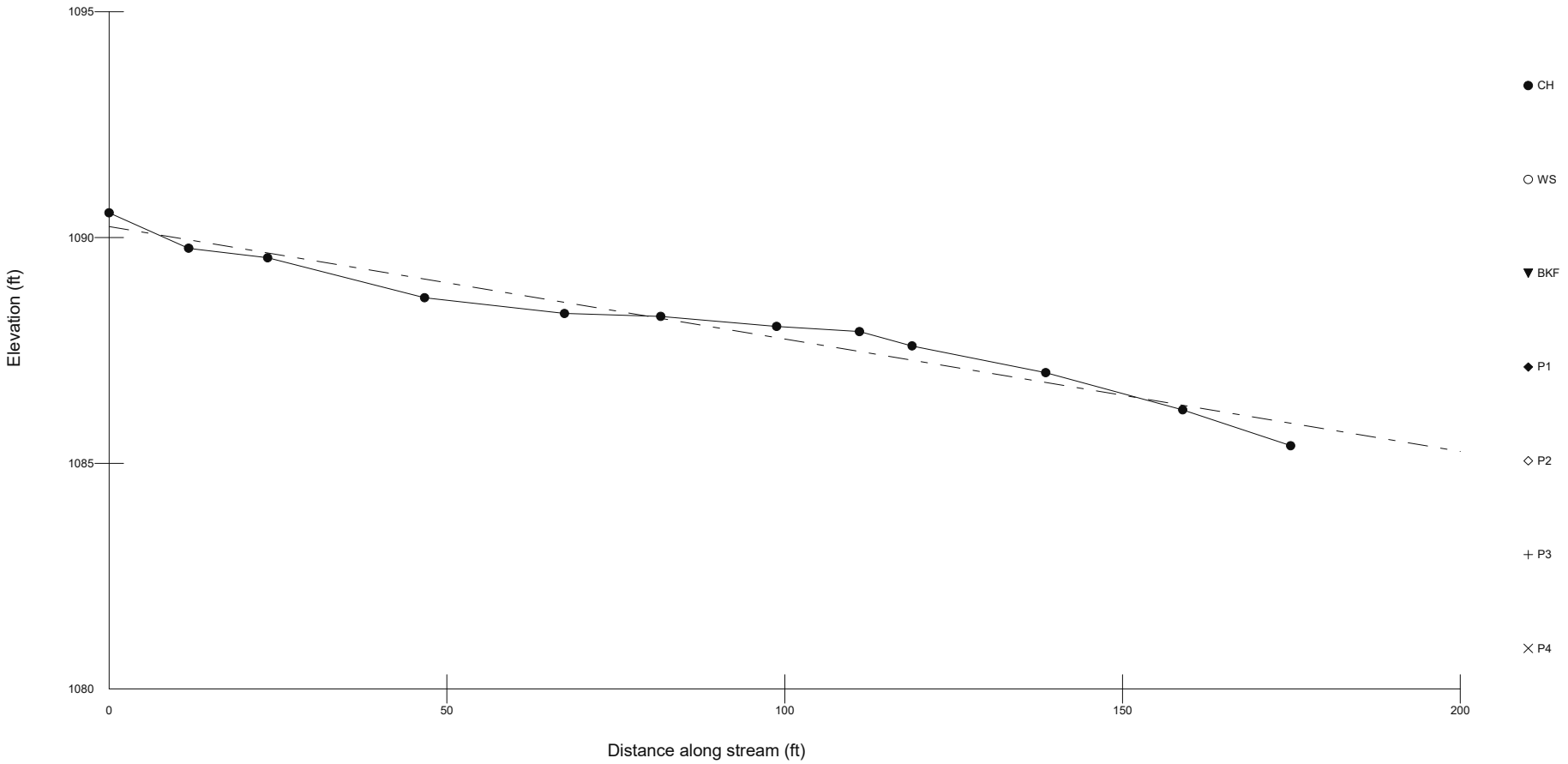
UT1 Profile


1142.0
1127.6
1113.2
1098.8
1084.4
1070.0
Elevation (ft)
0
199
398
597
796
995
1194
1393
1592
1791
1990
Distance along stream (ft)
CH
WS
BKF
P1
P2
P3
P4

UT1A Profile



UT1B Profile



Greenbrier Stream Restoration Project: UT1 Reach 1						
	Existing		Design		Reference Data	
	Stream Values		Stream Values			
Parameter	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
Drainage Area, DA (sq mi)	0.062		0.062			
Stream Type (Rosgen)	B4c		B4		B4	
Bankfull Discharge, Qbkf (cfs)	7		7			
Bankfull Riffle XSEC Area, Abkf (sq ft)	2.56	3.26	3.0			
Bankfull Mean Velocity, Vbkf (ft/s)	2.73	2.15	2.3		4.00	6.00
Bankfull Riffle Width, Wbkf (ft)	4.29	5.32	6.2			
Bankfull Riffle Mean Depth, Dbkf (ft)	0.48	0.76	0.5			
Width to Depth Ratio, W/D (ft/ft)	5.64	11.10	13.0		12	18
Width Floodprone Area, Wfpa (ft)	20.00	33.00	25.0	45.0		
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.62	1.87	4.0	7.3		
Riffle Max Depth @ bkf, Dmax (ft)	0.74	1.05	0.6			
Riffle Max Depth Ratio, Dmax/Dbkf	1.38	1.50	1.2		1.2	1.4
Max Depth @ tob, Dmaxtob (ft)	1.10	2.90	0.6			
Bank Height Ratio, Dtob/Dmax (ft/ft)	1.48	2.76	1.0		1.0	1.1
Meander Length, Lm (ft)	N/A	N/A	N/A	N/A		
Meander Length Ratio, Lm/Wbkf	N/A	N/A	N/A	N/A		
Radius of Curvature, Rc (ft)	N/A	N/A	N/A	N/A		
Rc Ratio, Rc/Wbkf	N/A	N/A	N/A	N/A		
Belt Width, Wblt (ft)	N/A	N/A	N/A	N/A		
Meander Width Ratio, Wblt/Wbkf	N/A	N/A	N/A	N/A		
Sinuosity, K	1.07		1.03		1.10	1.20
Valley Slope, Sval (ft/ft)	0.0187		0.0360		0.005	0.0015
Channel Slope, Schan (ft/ft)	0.0175		0.0350			
Slope Riffle, Srif (ft/ft)	0.0268	0.0380	0.0385	0.0630		
Riffle Slope Ratio, Srif/Schan	1.53	2.17	1.10	1.80	1.1	1.8
Slope Pool, Spool (ft/ft)	0.0000	0.0166	0.0000	0.0125		
Pool Slope Ratio, Spool/Schan	0.00	0.95	0.00	0.36	0	0.4
Pool Max Depth, Dmaxpool (ft)	0.60	1.90	1.4			
Pool Max Depth Ratio, Dmaxpool/Dbkf	0.79	2.50	2.8		2	3.5
Pool Width, Wpool (ft)	N/A	N/a	8.1			
Pool Width Ratio, Wpool/Wbkf			1.3		1.1	1.5
Pool-Pool Spacing, Lps (ft)	40.00	120.00	3.0	31.0		
Pool-Pool Spacing Ratio, Lps/Wbkf	7.52	22.56	0.5	5.0	0.5	5

Greenbrier Stream Restoration Project: UT1 Reach 3						
	Existing		Design		Reference Data	
	Stream Values		Stream Values			
Parameter	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
Drainage Area, DA (sq mi)	0.062		0.062			
Stream Type (Rosgen)	B4		C4		C4	
Bankfull Discharge, Qbkf (cfs)	12.5		12.5			
Bankfull Riffle XSEC Area, Abkf (sq ft)	4.07	4.60	4.5			
Bankfull Mean Velocity, Vbkf (ft/s)	3.07	2.72	2.8		3.50	5.00
Bankfull Riffle Width, Wbkf (ft)	7.09	11.50	7.6			
Bankfull Riffle Mean Depth, Dbkf (ft)	0.40	0.57	0.6			
Width to Depth Ratio, W/D (ft/ft)	12.44	28.70	13.0		12	15
Width Floodprone Area, Wfpa (ft)	11.37	19.13	20.0	88.0		
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.61	1.67	2.6	11.6		
Riffle Max Depth @ bkf, Dmax (ft)	0.79	0.92	0.8			
Riffle Max Depth Ratio, Dmax/Dbkf	1.61	2.30	1.3		1.2	1.5
Max Depth @ tob, Dmaxtob (ft)	3.26	1.70	0.8			
Bank Height Ratio, Dtob/Dmax (ft/ft)	2.15	3.50	1.0		1.0	1.1
Meander Length, Lm (ft)	N/A	N/A	53	107		
Meander Length Ratio, Lm/Wbkf	N/A	N/A	7.0	14.0	7	14
Radius of Curvature, Rc (ft)	N/A	N/A	15	23		
Rc Ratio, Rc/Wbkf	N/A	N/A	2.0	3.0	2	3
Belt Width, Wblt (ft)	N/A	N/A	27	61		
Meander Width Ratio, Wblt/Wbkf	N/A	N/A	3.5	8.0	3.5	8
Sinuosity, K	1.09		1.22		1.20	1.40
Valley Slope, Sval (ft/ft)	0.0160		0.0160		0.005	0.015
Channel Slope, Schan (ft/ft)	0.0150		0.0130			
Slope Riffle, Srif (ft/ft)	0.0160	0.0460	0.0144	0.0234		
Riffle Slope Ratio, Srif/Schan	1.07	3.07	1.11	1.80	1.1	1.8
Slope Pool, Spool (ft/ft)	0.0000	0.0100	0.0000	0.0003		
Pool Slope Ratio, Spool/Schan	0.00	0.67	0.00	0.02	0	0.2
Pool Max Depth, Dmaxpool (ft)			1.5			
Pool Max Depth Ratio, Dmaxpool/Dbkf	0.00	0.00	2.5		2	3.5
Pool Width, Wpool (ft)			9.9			
Pool Width Ratio, Wpool/Wbkf			1.3		1.1	1.5
Pool-Pool Spacing, Lps (ft)			26.5	53.0		
Pool-Pool Spacing Ratio, Lps/Wbkf	0.00	0.00	3.5	7.0	3.5	7

Greenbrier Stream Restoration Project: UT1A						
	Existing		Design		Reference Data	
	Stream Values		Stream Values			
Parameter	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
Drainage Area, DA (sq mi)	0.0125		0.0125			
Stream Type (Rosgen)	F4		B4		B4	
Bankfull Discharge, Qbkf (cfs)	2		2			
Bankfull Riffle XSEC Area, Abkf (sq ft)	0.52		1.0			
Bankfull Mean Velocity, Vbkf (ft/s)	3.8		2.0		4.00	6.00
Bankfull Riffle Width, Wbkf (ft)	3.75		3.6			
Bankfull Riffle Mean Depth, Dbkf (ft)	0.14		0.28			
Width to Depth Ratio, W/D (ft/ft)	26.79		12.9		12	18
Width Floodprone Area, Wfpa (ft)	4.70		5.0	10.0		
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.25		1.4	2.8		
Riffle Max Depth @ bkf, Dmax (ft)	0.25		0.4			
Riffle Max Depth Ratio, Dmax/Dbkf	1.8		1.3		1.2	1.4
Max Depth @ tob, Dmaxtob (ft)	3.70		0.4			
Bank Height Ratio, Dtob/Dmax (ft/ft)	14.8		1.0		1.0	1.1
Meander Length, Lm (ft)	N/A	N/A	N/A	N/A		
Meander Length Ratio, Lm/Wbkf	N/A	N/A	N/A	N/A	N/A	N/A
Radius of Curvature, Rc (ft)	N/A	N/A	N/A	N/A		
Rc Ratio, Rc/Wbkf	N/A	N/A	N/A	N/A	N/A	N/A
Belt Width, Wblt (ft)	N/A	N/A	N/A	N/A		
Meander Width Ratio, Wblt/Wbkf	N/A	N/A	N/A	N/A	N/A	N/A
Sinuosity, K	1.01		1.03		1.10	1.20
Valley Slope, Sval (ft/ft)	0.0480		0.0210		0.02	0.03
Channel Slope, Schan (ft/ft)	0.0780		0.0200			
Slope Riffle, Srif (ft/ft)	0.0290	0.1100	0.0230	0.0360		
Riffle Slope Ratio, Srif/Schan	0.37	1.41	1.15	1.80	1.1	1.8
Slope Pool, Spool (ft/ft)	N/A	N/A	0.0000	0.0080		
Pool Slope Ratio, Spool/Schan	N/A	N/A	0.00	0.40	0	0.4
Pool Max Depth, Dmaxpool (ft)	N/A	N/A	0.7			
Pool Max Depth Ratio, Dmaxpool/Dbkf	N/A	N/A	2.5		2	3.5
Pool Width, Wpool (ft)	N/A	N/A	4.7			
Pool Width Ratio, Wpool/Wbkf	N/A	N/A	1.3		1.1	1.5
Pool-Pool Spacing, Lps (ft)	N/A	N/A	2.0	18.0		
Pool-Pool Spacing Ratio, Lps/Wbkf	N/A	N/A	0.6	5.0	0.5	5

Greenbrier Stream Restoration Project: UT1B						
	Existing		Design		Reference Data	
	Stream Values		Stream Values			
Parameter	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
Drainage Area, DA (sq mi)	0.0156		0.0156			
Stream Type (Rosgen)	G4		B4		B4	
Bankfull Discharge, Qbkf (cfs)	2.3		2.3			
Bankfull Riffle XSEC Area, Abkf (sq ft)	2.26		1.0			
Bankfull Mean Velocity, Vbkf (ft/s)	1.0		2.3		4.00	6.00
Bankfull Riffle Width, Wbkf (ft)	4.73		3.6			
Bankfull Riffle Mean Depth, Dbkf (ft)	0.48		0.28			
Width to Depth Ratio, W/D (ft/ft)	9.85		12.9		12	18
Width Floodprone Area, Wfpa (ft)	4.73		5.0	10.0		
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.30		1.4	2.8		
Riffle Max Depth @ bkf, Dmax (ft)	0.77		0.4			
Riffle Max Depth Ratio, Dmax/Dbkf	1.6		1.3		1.2	1.4
Max Depth @ tob, Dmaxtob (ft)	5.89		0.4			
Bank Height Ratio, Dtob/Dmax (ft/ft)	7.6		1.0		1.0	1.1
Meander Length, Lm (ft)	N/A	N/A	N/A	N/A		
Meander Length Ratio, Lm/Wbkf	N/A	N/A	N/A	N/A	N/A	N/A
Radius of Curvature, Rc (ft)	N/A	N/A	N/A	N/A		
Rc Ratio, Rc/Wbkf	N/A	N/A	N/A	N/A	N/A	N/A
Belt Width, Wblt (ft)	N/A	N/A	N/A	N/A		
Meander Width Ratio, Wblt/Wbkf	N/A	N/A	N/A	N/A	N/A	N/A
Sinuosity, K	1.08		1.15		1.10	1.20
Valley Slope, Sval (ft/ft)	0.0258		0.0200		0.02	0.03
Channel Slope, Schan (ft/ft)	0.0239		0.0170			
Slope Riffle, Srif (ft/ft)	0.0350	0.0420	0.0187	0.0300		
Riffle Slope Ratio, Srif/Schan	1.46	1.76	1.10	1.76	1.1	1.8
Slope Pool, Spool (ft/ft)	N/A	N/A	0.0000	0.0070		
Pool Slope Ratio, Spool/Schan	N/A	N/A	0.00	0.41	0	0.4
Pool Max Depth, Dmaxpool (ft)	N/A	N/A	0.7			
Pool Max Depth Ratio, Dmaxpool/Dbkf	N/A	N/A	2.5		2	3.5
Pool Width, Wpool (ft)	N/A	N/A	4.7			
Pool Width Ratio, Wpool/Wbkf	N/A	N/A	1.3		1.1	1.5
Pool-Pool Spacing, Lps (ft)	N/A	N/A	2.0	18.0		
Pool-Pool Spacing Ratio, Lps/Wbkf	N/A	N/A	0.6	5.0	0.5	5

Table 1. Project: Greenbrier (ID-100086) - Mitigation Assets and Components

Project Component (reach ID, etc.)[1]	Wetland Position and HydroType[2]	Existing Footage or Acreage	Stationing	Mitigation Plan Footage or Acreage	As-Built Footage or Acreage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
UT1 R1		926	10+06 - 18+79	849.00	843.00	R	P2	1	843.00	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
UT1 R2		40	18+79 - 19+19	40.00	40.00	E2	E2	2.5	16.00	Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement
UT1 R3		992	19+19 - 30+16	1097.00	1097.00	R	P1, P2	1	1097.00	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
UT1A-1		154	10+00 - 11+54	153.70	153.70	E2	E2	2.5	61.48	Grade Control/Habitat Structures, Benching, Exclusion of Livestock, and Permanent Conservation Easement.
UT1A		115	11+54 - 13+02	148.50	148.50	R	P2	1	148.50	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
UT1B		195	10+00 - 12+48	247.50	247.50	R	P2	1	247.50	
Total Assets Summary:	**2,413.48**									

Length and Area Summations by Mitigation Category

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

Overall Assets Summary

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

General Note - The above component table is intended to be a close complement to the asset map. Each entry in the above table should have clear distinction and appropriate symbology in the asset map.

1 - **Wetland Groups** represent pooled wetland polygons in the map with the same wetland type and restoration level. If some of the wetland polygons within a group are in meaningfully different landscape positions, soil types or have different community targets (as examples), then further segmentation in the table may be warranted. Wetland features impacted by credit modifiers such as utilities shall be listed as a distinct record with the impacted acreage tallied as discreet records in the table (See Wetland 7 above)

2 - **Wetland Position and Hydro Type** - Indicates Riparian Riverine, (RR) , riparinan non-riverine (RNR) or Non-Riverine (NR)

3- **Buffer Assets - due to the complex nature of buffer and nutrient offset assets they are not included in this example table. Please see the DMS buffer mitigation plan template for the required asset table information.**

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

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

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Institution Date	NA	Sep-18
404 permit date	NA	
Restoration Plan	Mar-19	Nov-19
Final Design – Construction Plans	Jun-19	Dec-19
Construction	NA	Feb-20
Containerized, bare root and B&B plantings for reach/segments 1&2	NA	Mar-20
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	Mar-20	Nov-20
Year 1 Monitoring	Mar-21	Nov-21
Year 2 Monitoring	3/13/20222	Nov-22
Structural maintenance (bench expansion,	NA	
Year 3 Monitoring	Mar-23	Nov-23
Supplemental planting of containerized	NA	
Year 4 Monitoring	Mar-24	Nov-24
Year 5 Monitoring	Mar-25	Nov-25
Year 6 Monitoring	Mar-26	Nov-26
Year 7 Monitoring	Mar-27	Nov-27

Bolded items are examples of those items that are not standard, but may come up and should be included
Non-bolded items represent events that are standard components over the course of a typical project, but the one listed may not be all inclusive.
The above are obviously **not** the extent of potential relevant project activities, but are just provided as example as part of this exhibit.
If planting, morphology, or hydrology monitoring are on split schedules for some reason that should be made clear in this table
1 = The number of reports or data points produced excluding the baseline

Table 3. Project Contacts Table Greenbrier Stream Restoration Project (NCDMS Project No. 100086)	
Designer	Ecosystem Planning and Restoration, PLLC
	1150 SE Maynard Road, Suite 140, Cary, NC 27511
Primary project design POC	Kevin Tweedy, PE (919) 388-0787
Construction Contractor	Firm Information / Address
Construction contractor POC	POC name and phone
Survey Contractor	Kinder Land Surveying
	203 W. Lebanon St., Mount Airy, NC 27030
Survey contractor POC	Frank Kinder (336) 783-4200
Planting Contractor	Firm Information / Address
Planting contractor POC	POC name and phone
Seeding Contractor	Company Information / Address
Contractor point of contact	POC name and phone
Seed Mix Sources	Company and Contact Phone
Nursery Stock Suppliers	Company and Contact Phone
Monitoring Performers	Firm Information / Address
Stream Monitoring POC	Jake Byers, EPR (828) 348-8580
Vegetation Monitoring POC	Amy James, EPR (919) 388-0787

Table 4. Project Background Information			
Project Name	Greenbrier Stream Restoration Project		
County	Yadkin		
Project Area (acres)	6.7		
Project Coordinates (latitude and longitude)	latitude 36 deg 8’ 54” N, longitude 80 deg 49’ 46” W		
Planted Acreage (Acres of Woody Stems Planted)	6.3		
Project Watershed Summary Information			
Physiographic Province	Piedmont		
River Basin	Yadkin Pee-Dee		
USGS Hydrologic Unit 8-digit	03040101	USGS Hydrologic Unit 14-digit	3040101130020
DWR Sub-basin	03-07-02		
Project Drainage Area (Acres and Square Miles)	85 acres/ 0.13 Sq.Mi. (Total)		
Project Drainage Area Percentage of Impervious Area	<1%		
CGIA Land Use Classification	Agriculture/Pasture 49%, Forest 42%, 8% Residential/Developed		

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

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	No	Appendix 3
Water of the United States - Section 401	Yes	No	Appendix 3
Endangered Species Act	Yes	Yes	Categorical Exclusion Packet
Historic Preservation Act	No	Yes	Categorical Exclusion Packet
Coastal Zone Management Act (CZMA or CAMA)	No	NA	NA
FEMA Floodplain Compliance	No	NA	DMS Floodplain Checklist
Essential Fisheries Habitat	No	NA	NA

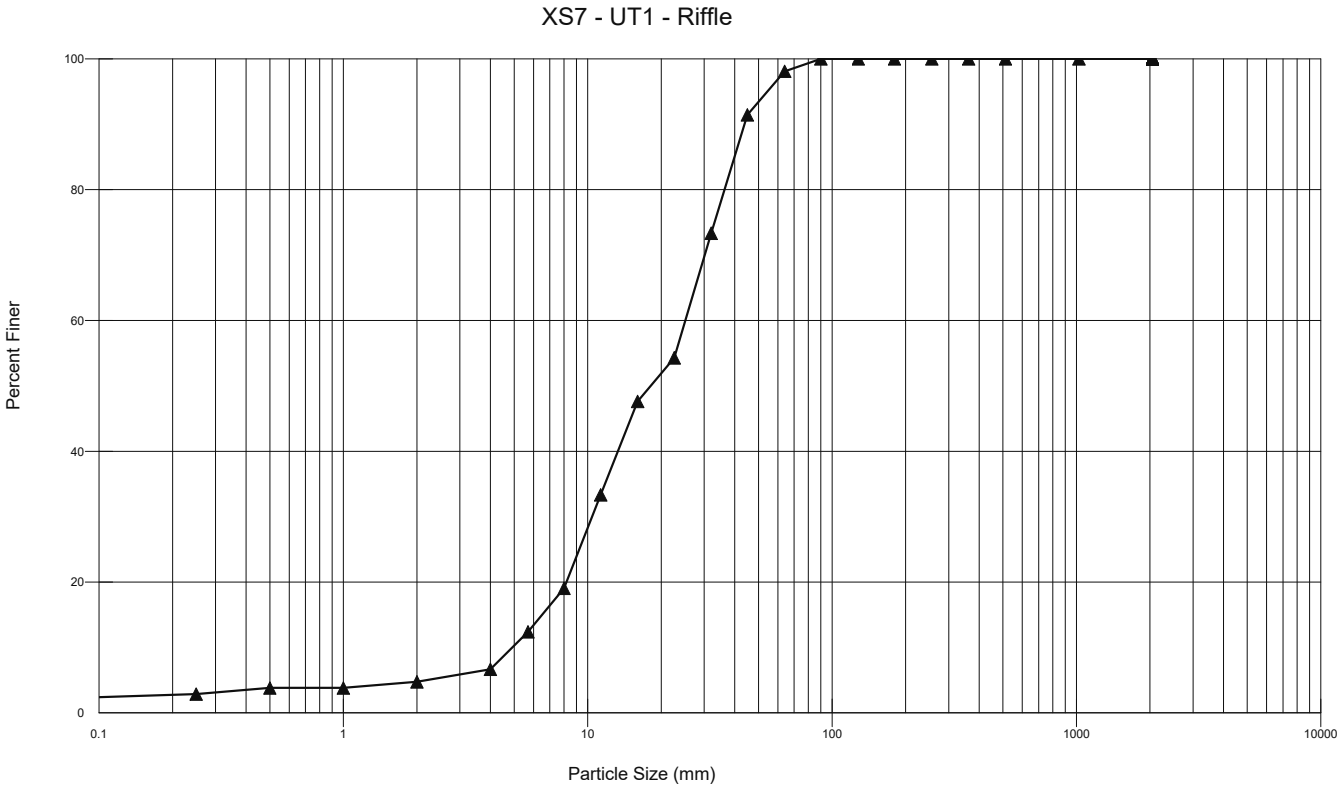
RIVERMORPH PARTICLE SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1
Sample Name: XS7
Survey Date: 10/26/2018

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	0	0.00	0.00
0.062 - 0.125	0	0.00	0.00
0.125 - 0.25	3	2.86	2.86
0.25 - 0.50	1	0.95	3.81
0.50 - 1.0	0	0.00	3.81
1.0 - 2.0	1	0.95	4.76
2.0 - 4.0	2	1.90	6.67
4.0 - 5.7	6	5.71	12.38
5.7 - 8.0	7	6.67	19.05
8.0 - 11.3	15	14.29	33.33
11.3 - 16.0	15	14.29	47.62
16.0 - 22.6	7	6.67	54.29
22.6 - 32.0	20	19.05	73.33
32 - 45	19	18.10	91.43
45 - 64	7	6.67	98.10
64 - 90	2	1.90	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	6.95
D35 (mm)	11.85
D50 (mm)	18.36
D84 (mm)	39.66
D95 (mm)	55.17
D100 (mm)	90
Silt/Clay (%)	0
Sand (%)	4.76
Gravel (%)	93.34
Cobble (%)	1.9
Boulder (%)	0
Bedrock (%)	0

Total Particles = 105.


XS7 - UT1 - Riffle
Percent Finer
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Particle Size (mm)

RIVERMORPH PARTICLE SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1
Sample Name: XS 7 Sub-Pave
Survey Date: 11/06/2018

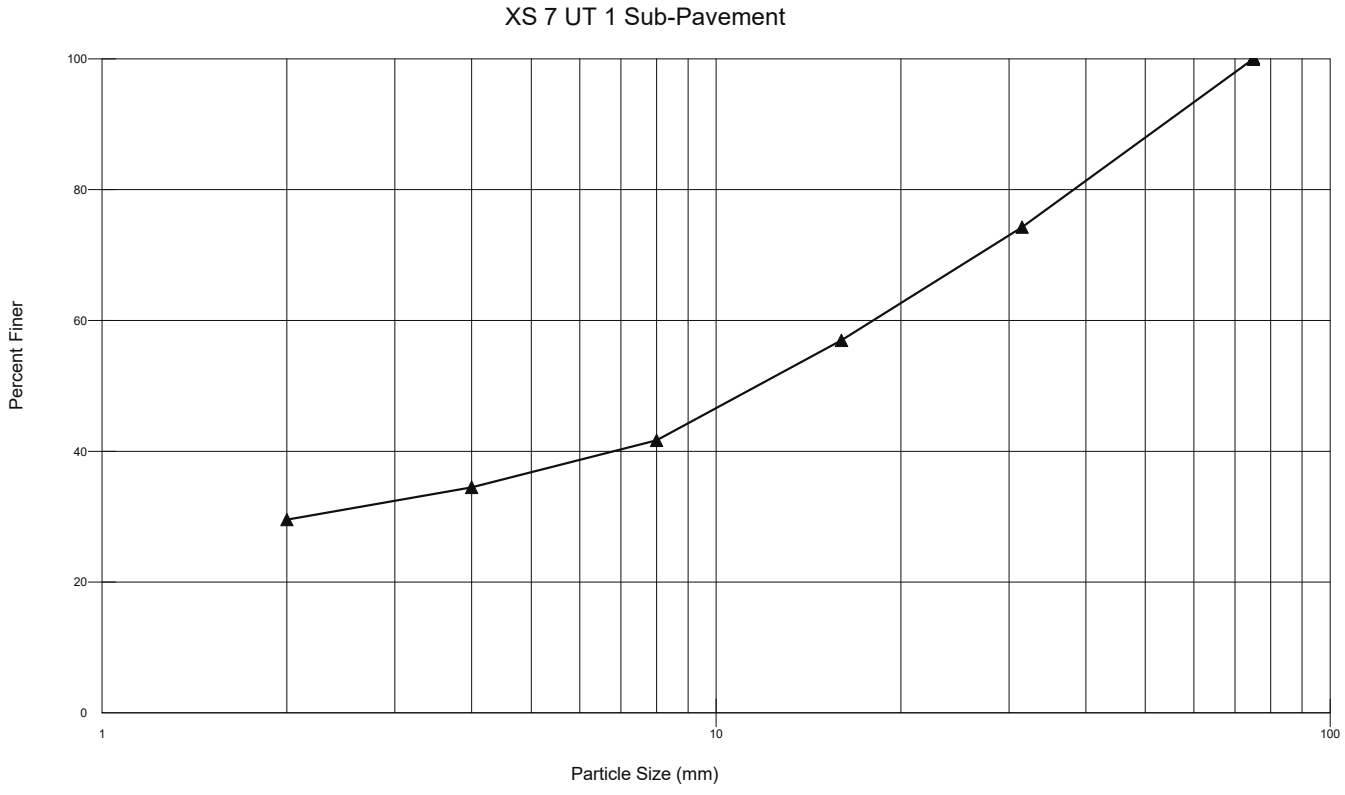
SIEVE (mm)	NET WT
31.5	0.45
16	1.54
8	1.36
4	0.64
2	0.44
PAN	2.63

D16 (mm)	0
D35 (mm)	4.28
D50 (mm)	12.35
D84 (mm)	47.95
D95 (mm)	66.55
D100 (mm)	75
Silt/Clay (%)	0
Sand (%)	29.55
Gravel (%)	65.75
Cobble (%)	4.7
Boulder (%)	0
Bedrock (%)	0

Total Weight = 8.9000.

Largest Surface Particles:

	Size(mm)	Weight
Particle 1:	75	1.1
Particle 2:	60	0.74


XS 7 UT 1 Sub-Pavement
Percent Finer
100
80
60
40
20
0
1
10
100
Particle Size (mm)

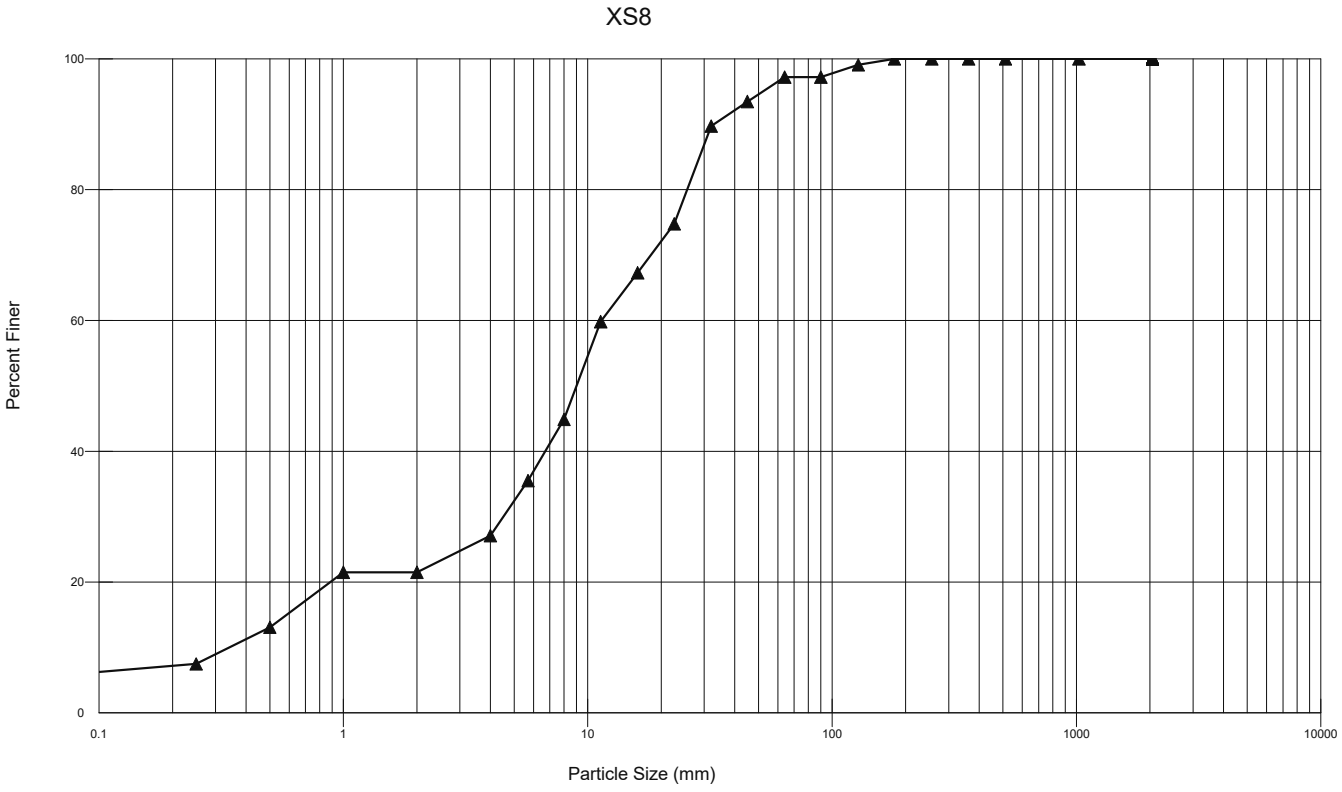
RIVERMORPH PARTICLE SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1
Sample Name: XS8
Survey Date: 10/26/2018

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	0	0.00	0.00
0.062 - 0.125	0	0.00	0.00
0.125 - 0.25	8	7.48	7.48
0.25 - 0.50	6	5.61	13.08
0.50 - 1.0	9	8.41	21.50
1.0 - 2.0	0	0.00	21.50
2.0 - 4.0	6	5.61	27.10
4.0 - 5.7	9	8.41	35.51
5.7 - 8.0	10	9.35	44.86
8.0 - 11.3	16	14.95	59.81
11.3 - 16.0	8	7.48	67.29
16.0 - 22.6	8	7.48	74.77
22.6 - 32.0	16	14.95	89.72
32 - 45	4	3.74	93.46
45 - 64	4	3.74	97.20
64 - 90	0	0.00	97.20
90 - 128	2	1.87	99.07
128 - 180	1	0.93	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	0.67
D35 (mm)	5.6
D50 (mm)	9.13
D84 (mm)	28.4
D95 (mm)	52.82
D100 (mm)	179.99
Silt/Clay (%)	0
Sand (%)	21.5
Gravel (%)	75.7
Cobble (%)	2.8
Boulder (%)	0
Bedrock (%)	0

Total Particles = 107.


XS8
Percent Finer
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Particle Size (mm)

RIVERMORPH PARTICLE SUMMARY

River Name: Greenbrier Stream Restoration Project
Reach Name: UT1
Sample Name: XS 8 Sub-Pave
Survey Date: 11/06/2018

SIEVE (mm)	NET WT
31.5	1.45
16	3.06
8	2.47
4	1.28
2	1
PAN	10.59

D16 (mm)	0
D35 (mm)	0
D50 (mm)	0
D84 (mm)	25.35
D95 (mm)	53.4
D100 (mm)	75
Silt/Clay (%)	0
Sand (%)	51.76
Gravel (%)	46.4
Cobble (%)	1.84
Boulder (%)	0
Bedrock (%)	0

Total Weight = 20.4600.

Largest Surface Particles:

	Size(mm)	Weight
Particle 1:	75	0.4
Particle 2:	40	0.21


XS 8 UT1 Sub-Pavement
Percent Finer
100
80
60
40
20
0
1
10
100
Particle Size (mm)

Greenbrier Stream Restoration
UT1 Sediment Transport Analysis

For this project, a qualitative sediment supply analysis was conducted from visual inspections of the project reaches and from aerial photography. Livestock operations exist within the watershed, likely causing accelerated bank erosion that is transported to the project reaches. The condition of the streams within the agricultural areas within the watershed are similar to the condition of the project streams. Field conditions also show that aggradation is not a significant problem. Once the project is complete, on-site sediment sources from bank erosion will be stabilized. Stream power was calculated but does not provide significant useful information since a sediment rating curve has not been developed for the site. Instead, the focus of this project's sediment transport analysis will focus on competency.

Sediment Competency Analysis

To conduct the sediment competency analyses, pavement (pebble count) and sub-pavement sediment samples were taken on UT1 Reach 1 and UT1 Reach 3 at surveyed riffle cross sections. Small, steep headwater tributaries are considered supply reaches and sediment competency is generally not a concern. Since UT1 Reach 1 is in the uppermost extent of the watershed, this reach is likely a supply reach. The sediment samples were weighed to generate cumulative frequency plots. The sediment competence analysis was conducted using the methodologies presented in WARSSS (2006). Design mean depth and slope were checked against the predicted required depths and slopes to provide confidence that the design streams will be able to transport their sediment supplies. Analysis was conducted using critical dimensionless shear stress and dimensional shear stress methodologies where applicable. Dimensionless shear stress analysis provides a critical depth and slope to entrain the largest particle in the sediment sample while the dimensional analysis uses the Shield's curve to compare the shear stress value to the size particle able to be entrained by that shear stress. The Modified Shield's curve based on Colorado field data (WARSSS, 2006) and the Shield's Curve is based on laboratory and field data compiled from various sources (Leopold et al., 1964). The results from the analysis are presented below in Table 1.

Table 1. Competence Analysis

Parameter	UT1 Reach 1	UT1 Reach 3
Design Bankfull Slope (ft/ft)	0.035	0.013
Design Mean Depth (ft)	0.5	0.6
D50 Pavement (mm)	11.4	9.1
D50 Sub-pavement (mm)	19.0	2.0
D100 Sub-pavement (mm)	75	75.0
Critical Dimensionless Shear[1]	N/A	0.022
Required Mean Depth from Dimensionless Analysis (ft)	N/A	0.69
Required Slope from Dimensionless Analysis (ft/ft)	N/A	0.015
Dimensional Shear (lbs./sq-ft)	0.91	0.41

Table 1. Competence Analysis		
Parameter	**UT1 Reach 1**	**UT1 Reach 3**
Largest Movable Particle (mm) (Mod. Shields Curve)	141.8	79.6
Largest Movable Particle (mm) (Shield's Curve)	70.7	31.2
Predicted Shear Stress to move D100 (lbs./sq-ft) (Mod. Shield's Curve)	0.39	0.39
Predicted Shear Stress to move D100 (lbs./sq-ft) (Shield's Curve)	1.0	1.0
Predicted mean depth to move D100 (ft) (Mod. Shield's Curve)	0.18	0.48
Predicted mean depth to move D100 (ft) (Shield's Curve)	0.46	1.23
Predicted slope to move D100 (ft/ft) (Shield's Curve)	0.0125	0.01
Predicted slope to move D100 (ft/ft) (Mod. Shield's Curve)	0.032	0.027
[1] Listings of N/A mean that the dimensionless shear equations were not valid based on sediment size ratios.		

UT1 Reach 1 is a headwater supply reach and as such does not have a significant upstream sediment supply to transport. Sediment being transported by this reach is mainly coming from localized bank erosion. The analysis shows that this reach will transport a D100 greater than the existing D100. This is due to raising the bed elevation to better connect with the existing culvert at the upstream extent of the project. Raising the bed has steepened the channel slope and increased the shear stress. However, this analysis shows that supplied sediment will be transported through the reach with no concerns of aggradation. In-stream structures designed to be immobile are incorporated throughout this reach to prevent any degradation. The sediment transport analysis for UT1 Reach 3 using the design geometry and profile matches well with the predicted values lending confidence that the stream will move the bed load that is supplied. Excess shear stress from flood flows greater than the bankfull discharge will be lessened by providing floodplain access through restoration activities. Grade control features such as j-hooks, and constructed riffles will prevent channel incision.

References

Leopold, L.B., G.M. Wolman, and J.P. Miller. 1964. Fluvial Processes in Geomorphology. San Francisco, CA: W.H. Freeman.

Rosgen DL. 2006. A watershed assessment for river stability and sediment supply (WARSSS). Fort Collins (CO): Wildland Hydrology Books.

Greenbrier Stream Restoration Project: Bankfull Discharge Analysis Summary		
Estimating Method	**Bankfull Velocity (ft/sec)**	**Bankfull Discharge (cfs)**
	UT1 Reach 1	
NC Rural Piedmont Regional Curve[1]	3.8	12.0
NRCS NC Rural Mountain and Piedmont Regional Curve[2]	2.0	6.2
Friction Factor to Relative Roughness Ratio method[3]	2.8	7.2
Manning's "n" from friction factor and relative roughness[3]	2.7	6.9
Manning's "n" from stream type[3]	2.9	7.3
Design Estimate	2.3	7.0
	UT1 Reach 3	
NC Rural Piedmont Regional Curve[1]	3.8	19.3
NRCS NC Rural Piedmont Regional Curve[2]	2.2	10.4
Friction Factor to Relative Roughness Ratio method[3]	3.2	12.8
Manning's "n" from friction factor and relative roughness[3]	3.0	12.0
Manning's "n" from stream type[3]	2.8	11.4
Design Estimate	2.8	12.5
	UT1A	
NC Rural Piedmont Regional Curve[1]	3.5	3.8
NRCS NC Rural Piedmont Regional Curve[2]	1.6	1.8
Friction Factor to Relative Roughness Ratio method[3]	N/A	N/A
Manning's "n" from friction factor and relative roughness[3]	N/A	N/A
Manning's "n" from stream type[3]	2.1	1.1
Design Estimate	2.0	2.0
	UT1B	
NC Rural Piedmont Regional Curve[1]	3.5	4.5
NRCS NC Rural Piedmont Regional Curve[2]	1.6	2.1
Friction Factor to Relative Roughness Ratio method[3]	N/A	N/A
Manning's "n" from friction factor and relative roughness[3]	N/A	N/A
Manning's "n" from stream type[3]	2.2	4.9
Design Estimate	2.3	2.3

Notes:

[1]NC Piedmont Regional Curve (Harman et al., 1999).

[2] NC Rural Mountain and Piedmont Regional Curve developed by NRCS (Walker, 2012).

[3]WARSSS, 2006 spreadsheet. Bankfull discharge estimates vary based on Manning's Equation for the riffle cross section.

Appendix 5

USACE & NCDWR STREAM ASSESSMENT FORMS

UT1

NC DWQ Stream Identification Form Version 4.11

Date: 3/15/18	**Project/Site:** Groundbrier Stream Mitigation	**Latitude:** 36.1454
Evaluator: R. Lapsia	**County:** Yadkin	**Longitude:** -80.8314
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 31.0	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Elkin South *e.g. Quad Name:*

A. Geomorphology (Subtotal = 22.5)	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 = 6)				
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) Mod. Variable	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: Deeply incised stream through the property. Several bedrock grade control and headcuts through. Very minnows. Several Mayflies & caddis flys.

Sketch:

UT1A

NC DWQ Stream Identification Form Version 4.11

Date: 3/15/18	**Project/Site:** Greenbrier Stream Site	**Latitude:** 36.1486
Evaluator: R. Lapsic	**County:** Yadkin	**Longitude:** -80.8152
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Elkin South *e.g. Quad Name:*

A. Geomorphology (Subtotal = 12.5)	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 = 6)				
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 = 6.5)				
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) Midge	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: Begins at confluence of wetland and ephemeral ditch. Stream incised with significant headcut. Cattle Access has impacted stream banks + bed

Sketch:

UT 1 B

NC DWQ Stream Identification Form Version 4.11

Date: 3/15/18	**Project/Site:** Greenbriar Stream Site	**Latitude:** 36.1484
Evaluator: R. Lepsic	**County:** Yadkin	**Longitude:** -80.8279
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 21.5	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** Elkin South *e.g. Quad Name:*

A. Geomorphology (Subtotal = 12.5)	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 = 3)				
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)				
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: Located in gully downstream of 3' headcut. Banks ~8' tall. Significant sediment and erosion. Becomes perennial where gully ends. Banks become lower and receives additional hydrology from springs entering.

Sketch:

NC DWQ Stream Identification Form Version 4.11

UT22-2

Date: 10/17/18	**Project/Site:** Greenbrier	**Latitude:** 36.1488
Evaluator: A. James	**County:** Yadkin	**Longitude:** 80.8297
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 24.5	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:* Elkin South

A. Geomorphology (Subtotal = 11.5)	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

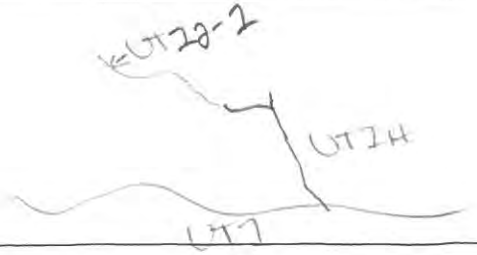
B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 7.5)				
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:

Sketch:



UT1C

NC DWQ Stream Identification Form Version 4.11

Date: 10/17/18	**Project/Site:** Greentree	**Latitude:** 36.1481
Evaluator: AJ JAMES	**County:** YADKIN	**Longitude:** -80.8276
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 23.5	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** S. ELKIN *e.g. Quad Name:*

A. Geomorphology (Subtotal = 12)	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

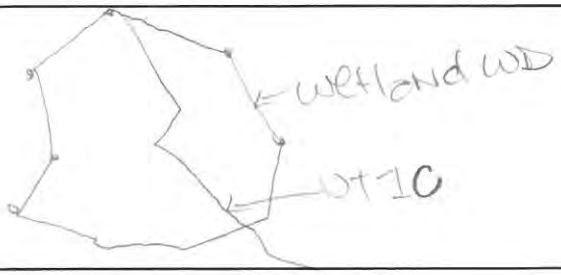
B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	(1)	(2)	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 6)				
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:

Sketch:



USACE AID#_____ DWQ #_____ Site # UT1 (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: EPR
2. Evaluator's name: A. Jones
3. Date of evaluation: 10/17/2018
4. Time of evaluation: 10:30 am
5. Name of stream: UTS. Deep Creek (UT1)
6. River basin: Yadkin
7. Approximate drainage area: 85 acres
8. Stream order: 1st
9. Length of reach evaluated: 1,958
10. County: Yadkin
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any): N/A

Latitude (ex. 34.872312): 36.148289, -80.828982 Longitude (ex. -77.556611):_____

Method location determined (circle): (GPS) Topo Sheet (Ortho (Aerial) Photo/GIS) Other GIS Other_____

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):
S. of Collins Rd.

14. Proposed channel work (if any): Restoration/enhancement

15. Recent weather conditions: Fall-like, wet

16. Site conditions at time of visit: Sunny, clear 70°

17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters ___Nutrient Sensitive Waters ___Water Supply Watershed ✓ (I-IV)

18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:_____

19. Does channel appear on USGS quad map? (YES) NO

20. Does channel appear on USDA Soil Survey? (YES) NO

21. Estimated watershed land use: 8 % Residential ___% Commercial ___% Industrial 49 % Agricultural 42 % Forested ___% Cleared / Logged ___% Other (_____)

22. Bankfull width: 4-11

23. Bank height (from bed to top of bank): 3-10

24. Channel slope down center of stream: ✓ Flat (0 to 2%) ___Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)

25. Channel sinuosity: ___Straight ✓ Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 35 **Comments:**_____

Evaluator's Signature _____ **Date** 10/17/18

This channel evaluation form is intended to be used only as a guide to assist landowners and environmental professionals in gathering the data required by the United States Army Corps of Engineers to make a preliminary assessment of stream quality. The total score resulting from the completion of this form is subject to USACE approval and does not imply a particular mitigation ratio or requirement. Form subject to change – version 06/03. To Comment, please call 919-876-8441 x 26.

STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	4
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	2
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	1
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	2
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	1
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	1
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	2
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	2
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	0
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	2
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	1
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	1
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	0
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	3
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	2
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	2
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	2
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	1
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	1
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						35

* These characteristics are not assessed in coastal streams.

USACE AID#_____ DWQ #_____ Site #UT1A (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: EPR
2. Evaluator's name: A. James
3. Date of evaluation: 10/17/18
4. Time of evaluation: 12pm
5. Name of stream: UT South Deep Creek (UT1A)
6. River basin: Yadkin
7. Approximate drainage area: 8 acres
8. Stream order: zero
9. Length of reach evaluated: 115
10. County: Yadkin
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any):

Latitude (ex. 34.872312): 36.148457 Longitude (ex. -77.556611): -80.829175

Method location determined (circle): (GPS) Topo Sheet (Ortho (Aerial) Photo/GIS) Other GIS Other

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location): South of Collins Rd.
14. Proposed channel work (if any): Restoration
15. Recent weather conditions: Fall-like, wet
16. Site conditions at time of visit: Sunny, clear 70°
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters ___Nutrient Sensitive Waters ___Water Supply Watershed ✓(I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:
19. Does channel appear on USGS quad map? YES (NO)
20. Does channel appear on USDA Soil Survey? YES (NO)
21. Estimated watershed land use: ___% Residential ___% Commercial ___% Industrial 95% Agricultural 5% Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 3-4
23. Bank height (from bed to top of bank): 3-6
24. Channel slope down center of stream: ✓Flat (0 to 2%) ___Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: ___Straight ✓Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 43 **Comments:**

Evaluator's Signature _____ **Date** 10/17/18

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	3
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	4
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	2
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	4
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	1
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	1
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	2
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	2
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	3
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	2
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	1
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	2
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	3
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	0
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	2
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	2
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	3
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	3
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	0
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	0
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						43

* These characteristics are not assessed in coastal streams.

USACE AID#_____ DWQ #_____ Site #UT1B (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: EPR
2. Evaluator's name: A. James
3. Date of evaluation: 10/17/'18
4. Time of evaluation: 2pm
5. Name of stream: UTS. Deep Creek (UT1B)
6. River basin: Yadkin
7. Approximate drainage area: 10 acres
8. Stream order: zero
9. Length of reach evaluated: 195
10. County: Yadkin
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any): _____

Latitude (ex. 34.872312): 36.148255 Longitude (ex. -77.556611): -80.827883

Method location determined (circle): (GPS) Topo Sheet (Ortho (Aerial) Photo/GIS) Other GIS Other _____

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location): S. of Collins Rd.
14. Proposed channel work (if any): Restoration
15. Recent weather conditions: Fall-like, wet
16. Site conditions at time of visit: Sunny, clear 70°
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters ___Nutrient Sensitive Waters ___Water Supply Watershed ✓(I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area: _____
19. Does channel appear on USGS quad map? YES (NO)
20. Does channel appear on USDA Soil Survey? YES (NO)
21. Estimated watershed land use: ___% Residential ___% Commercial ___% Industrial 98% Agricultural 2% Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 4-5
23. Bank height (from bed to top of bank): 4-8
24. Channel slope down center of stream: ✓Flat (0 to 2%) ___Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: ___Straight ✓Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 28 **Comments:** _____

Evaluator's Signature _____ **Date** 10/17/'18

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	2
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	2
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	1
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	3
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	0
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	1
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	2
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	1
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	2
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	1
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	1
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	1
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	0
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	1
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	2
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	1
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	2
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	0
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	0
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						28

* These characteristics are not assessed in coastal streams.

UT2-A1

USACE AID#_____ DWQ #_____ Site #____ (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: EPR
2. Evaluator's name: A. James
3. Date of evaluation: 10/17/'18
4. Time of evaluation: 1:30pm
5. Name of stream: UT to S. Deep Creek (UT2A-2)
6. River basin: Yadkin
7. Approximate drainage area: 8 acres
8. Stream order: Zero
9. Length of reach evaluated: 154
10. County: Yadkin
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any):

Latitude (ex. 34.872312): 36.148673 Longitude (ex. -77.556611): -80.829496

Method location determined (circle): (GPS) Topo Sheet (Ortho (Aerial) Photo/GIS) Other GIS Other

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):
S. of Collins Rd.
14. Proposed channel work (if any): Enhancement II
15. Recent weather conditions: Fall-like, wet
16. Site conditions at time of visit: Sunny, clear 70°
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters ___ Nutrient Sensitive Waters ___Water Supply Watershed ✓(I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:
19. Does channel appear on USGS quad map? YES (NO)
20. Does channel appear on USDA Soil Survey? YES (NO)
21. Estimated watershed land use: ___% Residential ___% Commercial ___% Industrial 98% Agricultural 2% Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 2-3
23. Bank height (from bed to top of bank): 2-5
24. Channel slope down center of stream: ___Flat (0 to 2%) ___Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: ✓Straight ___Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 32 **Comments:**

Evaluator's Signature _____ **Date** 10/17/'18

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	2
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	1
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	2
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	2
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	1
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	1
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	2
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	1
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	3
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	1
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	1
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	2
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	0
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	1
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	2
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	3
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	2
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	0
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	0
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						32

* These characteristics are not assessed in coastal streams.

Appendix 6

APPROVED FHWA CATEGORICAL EXCLUSION CHECKLIST

A copy of the entire Categorical Exclusion with supporting documentation is available by request from NC Division of Mitigation Services

Appendix A

Categorical Exclusion Form for Division of Mitigation Services Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Greenbrier Stream Restoration Site
County Name:	Yadkin County
NCDMS Number:	100086
Project Sponsor:	Ecosystem Planning and Restoration, PLLC
Project Contact Name:	Kevin Tweedy, PE
Project Contact Address:	559 Jones Franklin Road, Suite 150, Raleigh NC 27606
Project Contact E-mail:	ktweedy@eprusa.net
NCDMS Project Manager:	Paul Wiesner

Project Description

The project involves the restoration and enhancement of four unnamed tributaries to South Deep Creek. Restoration practices will involve partially raising the streambeds and reconnecting them with active floodplains along the fall of the valley, thereby restoring flow dynamics and a healthy headwater stream system.

For Official Use Only

Reviewed By:

11-9-2018 — Paul Wiesner

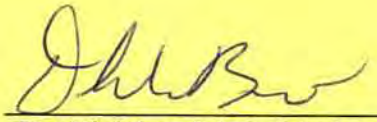
Date — **NCDMS Project Manager**

Conditional Approved By:

Date — **For Division Administrator FHWA**

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

Final Approval By:

11-9-18 — 

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

Appendix 7

DMS FLOODPLAIN REQUIREMENTS CHECKLIST

NCDMS Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program and NC Floodplain Mapping program to be filled out for all NCDMS 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 NCDMS.

Project Location

Name of project:	Greenbrier Stream Restoration Project
Name if stream or feature:	Unnamed tributaries (UT) to South Deep Creek (all unregulated)
County:	Yadkin
Name of river basin:	Yadkin
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Yadkin County (CID 370400)
DFIRM panel number for entire site:	3710486600J Effective 5/18/2009
Consultant name:	Ecosystem Planning and Restoration
Phone number:	919.388.0787
Address:	1150 SE Maynard Rd. Suite 140 Cary, NC 27511

Design Information

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

The Greenbrier Stream Restoration Project consists of instituting stream restoration and enhancement practices following natural channel design techniques along the main stem and three tributaries.

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

Reach	**Length (Mitigation)**	**Priority**
UT1 to South Deep Creek R1	*849*	*Two (Restoration)*
UT1 R2	*40*	*Two (Enhancement)*
UT1 R3	*1097*	*One and Two (Restoration)*
UT1A-1	*154*	*Two (Enhancement)*
UT1A	*149*	*Two (Restoration)*
UT1B	*248*	*Two (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: N/A

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: Dawn Vallieres
Email: dvallieres@yadkincountync.gov
Phone Number: (336) 679 – 4243

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: N/A

Comments: N/A

Name: Jake Byers Signature: [signature]

Title: Water Resources Engineer Date: 7/19/19

Appendix 8

DESIGN PLAN SHEETS

PROJECT: GREENBRIER STREAM RESTORATION

NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES

YADKIN COUNTY

LOCATION: COLLINS RD., YADKIN COUNTY, NC

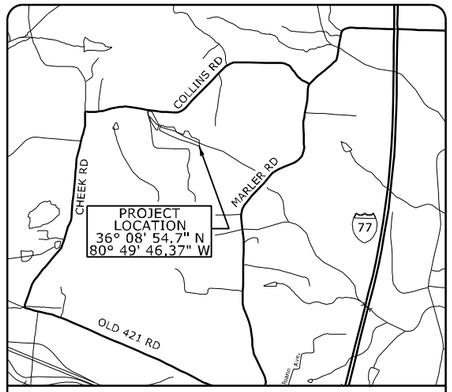
TYPE OF WORK: STREAM RESTORATION

STATE	PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	104	1	30

PROJECT LENGTH

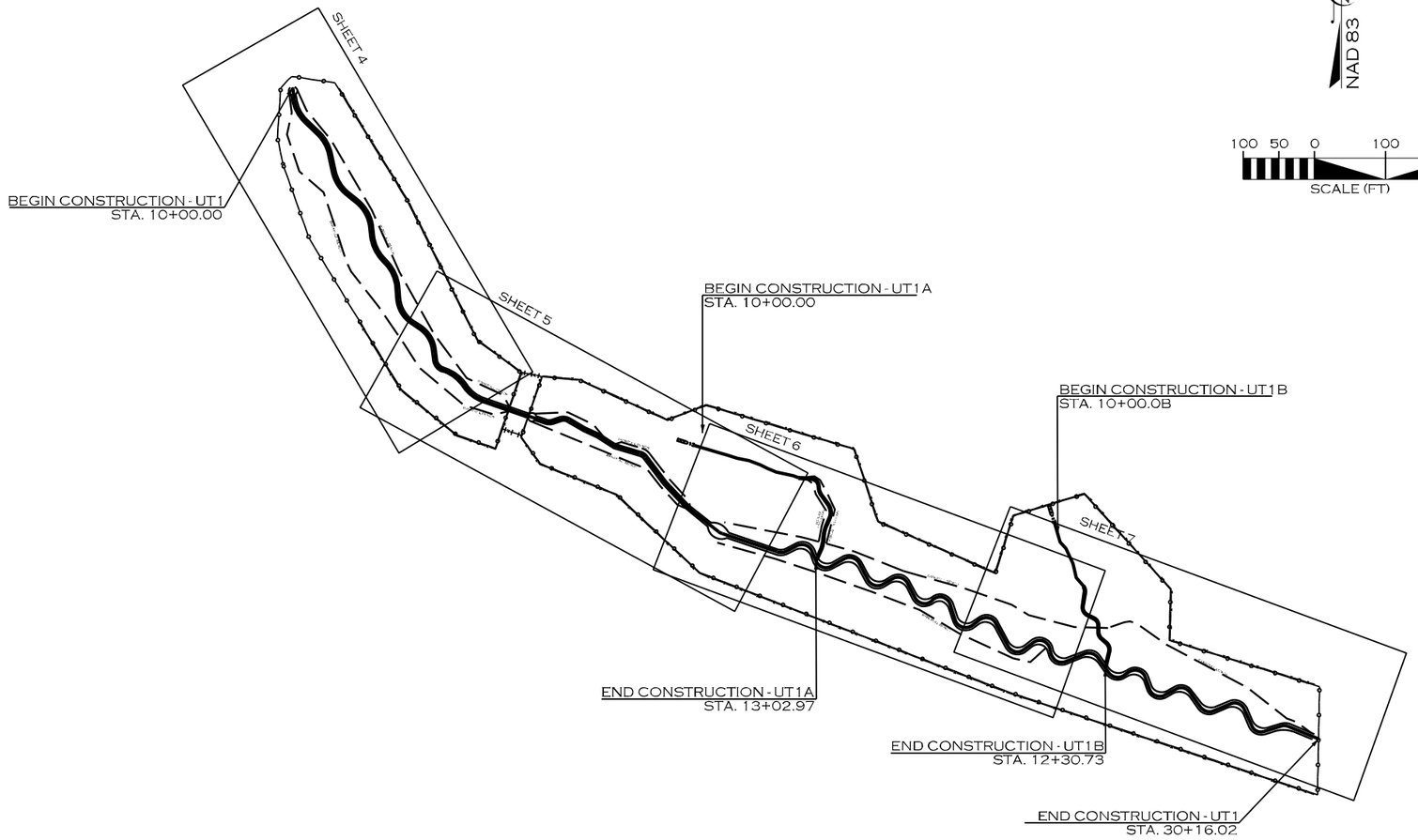
EXISTING STREAM LENGTH = 2,358 FEET

PROPOSED DESIGN STREAM LENGTH = 2,550 FEET



VICINITY MAP

INDEX OF SHEETS



NAD 83

100 50 0 100 200
SCALE (FT)

GRAPHIC SCALES

20 10 0 20 40
PLANS

20 10 0 20 40
PROFILE (HORIZONTAL)

10 2.5 0 5 20
PROFILE (VERTICAL)

REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

PREPARED FOR:

NC Mitigation Services ENVIRONMENTAL QUALITY

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

PAUL WIESNER
PROJECT MANAGER

PREPARED IN THE OFFICE OF:

EPR Ecosystem Planning & Restoration
1150 SE MAYNARD ROAD
SUITE 140
RALEIGH, NC 27511
LICENSE # P-1182

WINTER 2019
LETTING DATE:

JAKE BYERS, PE
PROJECT ENGINEER

PROJECT ENGINEER

PROGRESS DRAWING
FOR REVIEW PURPOSES ONLY
DO NOT USE FOR CONSTRUCTION

SIGNATURE: P.E.

STREAM CONVENTIONAL SYMBOLS

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

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

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

GENERAL NOTES

1. THE CONTRACTOR IS REQUIRED TO INSTALL INSTREAM STRUCTURES USING A TRACK HOE WITH A HYDRAULIC THUMB OF SUFFICIENT SIZE TO PLACE BOULDERS, AND LOGS.
2. WORK IS BEING PERFORMED AS AN ENVIRONMENTAL RESTORATION PLAN. THE CONTRACTOR SHOULD MAKE ALL REASONABLE EFFORTS TO REDUCE SEDIMENT LOSS AND MINIMIZE DISTURBANCE OF THE SITE WHILE PERFORMING THE CONSTRUCTION WORK.
3. CONSTRUCTION IS SCHEDULED TO BEGIN WINTER 2019.
4. ALL EXISTING CHANNELS TO BE FILLED SHALL HAVE ALLUVIUM EXCAVATED AND STOCKPILED FOR THE USE IN IN-STREAM STRUCTURES PRIOR TO FILLING.
5. ALL DISTURBED STREAM BANKS SHALL BE SEEDED, MULCHED, MATTED AND LIVE STAKED UNLESS OTHERWISE NOTED.
6. STONE BACKFILL FOR INSTREAM STRUCTURES SHALL INCLUDE AN EVEN MIX OF CLASS A, CLASS B AND ONSITE ALLUVIUM IF AVAILABLE. IF ONSITE ALLUVIUM IS NOT AVAILABLE CLASS A, CLASS B AND #57 STONE.
7. REMOVE AND DISPOSE OF ALL EXISTING FENCING WITHIN CONSERVATION EASEMENT.
8. PRIOR TO BEGINNING ANY LAND DISTURBING ACTIVITIES, NOTIFICATION AND APPROVAL MUST BE GRANTED FROM THE US ARMY CORP OF ENGINEERS, AND NC DIVISION OF WATER RESOURCES.
9. THE CONTRACTOR SHALL CONTACT NORTH CAROLINA "ONE CALL"CENTER (1.800.632.4949) BEFORE ANY EXCAVATION.
10. THE CONTRACTOR WILL MOBILIZE EQUIPMENT AND MATERIALS TO THE SITE USING THE EXISTING ACCESS ROAD OFF COLLINS ROAD.
11. THE CONTRACTOR WILL UTILIZE EXISTING ENTRANCES, PATHS, AND ROADS TO THE EXTENT POSSIBLE. ANY NECESSARY STREAM CROSSINGS SHALL CONSIST OF TIMBER MAT CROSSINGS AND BE BORDERED BY SILT FENCE.
12. CONTRACTOR WILL STORE ALL EQUIPMENT AND MATERIALS IN STAGING AND STOCKPILE AREAS.
13. ANY STOCKPILED SOIL MATERIAL SHALL BE BOARDERED BY SILT FENCE.
14. A PUMP-AROUND OPERATION SHALL BE UTILIZED FOR ALL IN CHANNEL WORK. WORK SHALL BE CONDUCTED IN THE DRY.
15. IMMEDIATELY UPON COMPLETION OF BANK GRADING, THE SLOPE WILL BE RESEEDED, MULCHED, AND MATTED WITH EROSION CONTROL MATTING UNLESS ANOTHER TREATMENT IS SHOWN IN THE DESIGN PLANS.
16. UPON COMPLETION OF EACH SECTION OF THE CHANNEL CONSTRUCTION, ALL DISTURBED FLOODPLAIN AREAS INCLUDING STAGING AREAS AND HAUL ROADS, SHALL BE SEEDED AND MULCHED. TREES AND SHRUBS SHALL BE PLANTED IN ACCORDANCE WITH THE VEGETATION SELECTION AND THE PLANS. PERMANENT SEEDING MIXTURES SHALL BE APPLIED AS SHOWN ON THE PLANS. SEEDING SHALL BE APPLIED IN ALL DISTURBED AREAS AND AREAS WITHIN THE WORK AREA SUSCEPTIBLE TO EROSION (I.E. DISTURBED DITCH BANKS, STEEP SLOPES, AND SPOIL AREAS).
17. CONTRACTOR SHALL NOT DISTURB STABLE SECTIONS OF THE CHANNEL AS DIRECTED BY THE ENGINEER.
18. ALL AREAS SHOULD BE SEEDED AND MULCHED BEFORE LEAVING THE PROJECT REACH. REMOVE TEMPORARY STREAM CROSSINGS AND ANY IN-STREAM TEMPORARY ROCK DAMS. ALL WASTE MATERIAL MUST BE REMOVED FROM THE PROJECT SITE.
19. THE CONTRACTOR SHALL PLANT WOODY VEGETATION AND LIVE STAKES, ACCORDING TO PLANTING DETAILS AND SPECIFICATIONS. THEY SHOULD COMPLETE THE REFORESTATION (BARE ROOT PLANTING) PHASE OF THE PROJECT AT THE APPROPRIATE TIME OF THE YEAR.
20. THE CONTRACTOR SHALL ENSURE THAT THE SITE IS FREE OF TRASH AND LEFTOVER CONSTRUCTION MATERIALS BEFORE MOVING ON TO A NEW SECTION OF CHANNEL.
21. CONSERVATION EASEMENT BOUNDARY AND FENCING ARE SHOWN ON THE VEGETATION AND FENCING PLAN SHEETS.
22. ANY TREES THAT HAVE BEEN DAMAGED DURING CONSTRUCTION AND ARE NOT LIKELY TO SURVIVE SHALL BE REMOVED
23. EXISTING TOPSOIL SHALL BE CAREFULLY STRIPPED AS TO NOT BECOME INTERMINGLED WITH SUBSOIL AND STOCKPILED SEPARATELY. AFTER STREAMBANKS, BANKFULL BENCHES, FLOODPLAINS, AND TERRACE SLOPES HAVE BEEN ROUGHLY GRADED, THESE AREAS WILL BE BROUGHT UP TO THEIR FINISH GRADES USING 6 TO 8 INCHES OF TOPSOIL

PROJECT # 104 | SHEET NO. 1A

SYMBOLOGY / NOTES

REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

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

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

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

PROJECT ENGINEER

PROGRESS DRAWING
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12/6/2019
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RAMERS

CONSTRUCTION SEQUENCE

PROJECT # 104 | SHEET NO. 1B

CONSTRUCTION SEQUENCE

PHASE 1 – ENTIRE PROJECT
MOBILIZATION AND GENERAL EROSION CONTROL

1. Limits of Disturbance is 9.87 acres.

2. Identify and locate staging areas, stockpile areas, construction entrances, stream crossings required for construction access; limits of silt fencing, and construction access and haul roads as shown on plans.

3. Install construction entrance.

4. Install stream crossings required for construction access.

5. Stockpile materials in designated areas.

6. Install silt fencing to the limits shown on the plans and at any other locations as directed by the Engineer. Silt fencing will be installed along the downslope/stream side limits of all staging and stockpile areas.

7. Upon the completion of phase 1, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

8. Emergency Contact for Erosion and Sedimentation Control is:

Jake Byers
Ecosystem Planning and Restoration
828-348-8580

NOTE: Each phase will be completed prior to beginning work on another phase. Upon the completion of each phase, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

All excavated soil materials not utilized will be stockpiled and maintained according to the project specifications. While onsite, unused material must be located in designated stockpile locations and must be provided temporary or permanent stabilization within 14 days of placement.

After the completion of construction, all unused soil materials shall be spread onsite in designated areas on the properties owned and operated by Donnie Ireland, at the direction of the Engineer and the said property owner. Spread soil must be stabilized using seeding and mulch per the project specifications within 14 days of placement.

If any excavated soil materials need to be, are specified to, and actually are disposed of off-site by the Contractor, the Contractor is responsible for disposal of such soil materials in a permitted area, as well as for providing and implementing an erosion and sedimentation control plan and permit, or any other required permit(s), for the location(s) off site where such materials are disposed.

PHASE 2 – UT1 29+60 to 30+16
CHANNEL RESTORATION IN PLACE

1. Perform construction staking.

2. Begin pump-around operation at upstream end of specified reach. Install an impervious dike at upstream and downstream ends of the proposed limits of the area of active construction in order to isolate all work from stream flow. Pump-around operation should be conducted in accordance with the typical pump-around operation detail as shown on the plans. Turbid water between impervious dikes must be pumped with a separate pump into a special stilling basin to be discharged downstream of the impervious dikes in accordance with the typical pump-around operation detail as shown on the plans.

3. Perform required removal and treatment of any exotic vegetation within and adjacent to the specified reach limits. All required removal and treatment (initial treatment) of exotic vegetation should be completed prior to proceeding with the remaining activities in this phase.

4. Perform required clearing and grubbing. Segregate and stockpile topsoil and other soil material in accordance with the project specifications.

5. Beginning at the downstream end of the area of active construction, proceed in the upstream direction with floodplain, channel and in-stream structure construction as specified on the plans.

6. Perform all topsoil replacement, vegetation transplanting, seeding (temporary and permanent), soil amendment, mulching, and installation of all coir fiber matting as specified on the plans and the project specifications. Associated disturbed stream banks will have temporary and permanent seed, soil amendments, mulch, and coir fiber matting applied to them as work progresses and by the end of each day. Coir fiber matting will be installed on top of the seeded, amended, and mulched stream banks according to the project specifications.

7. Remove and dispose of all unused vegetation and excavated materials.

8. All remaining disturbed areas are to be amended, seeded, mulched and matted according to the project plans and specifications and at a minimum within 14 days of disturbance.

9. Upon the completion of phase 2, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

PHASE 3 – UT1 24+35 to 29+60
OFFLINE CHANNEL RESTORATION

1. Perform construction staking.

2. The existing channel will remain active in order to isolate all work from stream flow. Ensure all work for this phase maintains a 5-foot setback from the existing channel.

3. Perform required removal and treatment of exotic vegetation within and adjacent to the specified reach limits. All required removal and treatment (initial treatment) of exotic vegetation should be completed prior to proceeding with the remaining activities in this phase.

4. Locate and flag any vegetation transplants, including individual specimens and vegetated mats.

5. Perform required clearing and grubbing. Segregate and stockpile topsoil and other soil material in accordance with the project specifications.

6. Beginning at the downstream end of the area of active construction, proceed in the upstream direction with the Floodplain, Channel, and in-stream structure construction as specified on the plans.

7. Perform all topsoil replacement, vegetation transplanting, seeding (temporary and permanent), soil amendment, mulching, and installation of all coir fiber matting as specified on the plans and the project specifications. Associated stream banks will have temporary and permanent seed, soil amendments, mulch, and coir fiber matting applied to them as work progresses and by the end of each day. Coir fiber matting will be installed on top of the seeded, amended, and mulched stream banks according to the project specifications.

8. Remove and dispose of all unused vegetation and excavated materials.

9. All remaining disturbed areas are to be amended, seeded, mulched and matted according to the project plans and specifications and at a minimum within 14 days of disturbance.

10. Upon the completion of phase 3, the existing channel will remain active.

11. Upon the completion of phase 3, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

PREPARED FOR:
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YADKIN COUNTY, NC

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LICENSE # P-1182

PROJECT ENGINEER

PROGRESS DRAWING
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12/5/2019
R:\PROJECTS\RDU\104_NCDEQ_GREENBRIER_FD\CADD\PLANS\GREENBRIER_PSH_1B.DGN
EVERS

CONSTRUCTION SEQUENCE (CONT.)

PROJECT # 104 | SHEET NO. 1C

CONSTRUCTION SEQUENCE

PHASE 4 – UT1B 11+04 TO 11+85
OFFLINE CHANNEL RESTORATION

1. Perform construction staking.

2. The existing channel will remain active in order to isolate all work from stream flow. Ensure all work for this phase maintains a 5-foot setback from the existing channel.

3. Perform required removal and treatment of exotic vegetation within and adjacent to the specified reach limits. All required removal and treatment (initial treatment) of exotic vegetation should be completed prior to proceeding with the remaining activities in this phase.

4. Locate and flag any vegetation transplants, including individual specimens and vegetated mats.

5. Perform required clearing and grubbing. Segregate and stockpile topsoil and other soil material in accordance with the project specifications.

6. Beginning at the downstream end of the area of active construction, proceed in the upstream direction with the floodplain, channel, and in-stream structure construction as specified on the plans.

7. Perform all topsoil replacement, vegetation transplanting, seeding (temporary and permanent), soil amendment, mulching, and installation of all coir fiber matting as specified on the plans and the project specifications. Associated stream banks will have temporary and permanent seed, soil amendments, mulch, and coir fiber matting applied to them as work progresses and by the end of each day. Coir fiber matting will be installed on top of the seeded, amended, and mulched stream banks according to the project specifications.

8. Remove and dispose of all unused vegetation and excavated materials.

9. All remaining disturbed areas are to be amended, seeded, mulched and matted according to the project plans and specifications and at a minimum within 14 days of disturbance.

10. Upon the completion of phase 4, the existing channel will remain active.

11. Upon the completion of phase 4, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

PHASE 5 – UT1B 10+00 TO 11+04
CHANNEL RESTORATION IN PLACE

1. Perform construction staking.

2. Begin pump-around operation at upstream end of specified reach. Install an impervious dike at upstream and downstream ends of the proposed limits of the area of active construction in order to isolate all work from stream flow. Pump-around operation should be conducted in accordance with the typical pump-around operation detail as shown on the plans. Turbid water between impervious dikes must be pumped with a separate pump into a special stilling basin to be discharged downstream of the impervious dikes in accordance with the typical pump-around operation detail as shown on the plans.

3. Perform required removal and treatment of any exotic vegetation within and adjacent to the specified reach limits. All required removal and treatment (initial treatment) of exotic vegetation should be completed prior to proceeding with the remaining activities in this phase.

4. Perform required clearing and grubbing. Segregate and stockpile topsoil and other soil material in accordance with the project specifications.

5. Beginning at the downstream end of the area of active construction, proceed in the upstream direction with floodplain, channel and in-stream structure construction as specified on the plans.

6. Perform all topsoil replacement, vegetation transplanting, seeding (temporary and permanent), soil amendment, mulching, and installation of all coir fiber matting as specified on the plans and the project specifications. Associated disturbed stream banks will have temporary and permanent seed, soil amendments, mulch, and coir fiber matting applied to them as work progresses and by the end of each day. Coir fiber matting will be installed on top of the seeded, amended, and mulched stream banks according to the project specifications.

7. Remove and dispose of all unused vegetation and excavated materials.

8. All remaining disturbed areas are to be amended, seeded, mulched and matted according to the project plans and specifications and at a minimum within 14 days of disturbance.

9. Upon the completion of phase 5, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

PHASE 6 – UT1 24+35; UT1B 11+85
CHANNEL CONNECTIONS

1. Complete connection of proposed UT1 channel at station 24+50 by plugging the existing channel in this location and diverting all flow into new stabilized channel. The existing channel shall remain open to allow for drainage.

2. Complete channel grading, instream structure installation, seeding, mulching and matting along UT1B from 11+90 down to the confluence with UT1.

3. The existing UT1B channel shall be plugged where the proposed channel goes offline near station 11+05 and flow diverted into the new UT1B channel. This existing UT1B channel shall remain open to allow for drainage.

4. Prior to filling existing channel, any usable gravel or cobble bed material shall be excavated and stored in designated stockpile areas.

5. The existing UT1 channel shall be filled and compacted per the plans and specifications from station 24+50 to 29+60.

6. Perform all topsoil replacement, vegetation transplanting, seeding (temporary and permanent), soil amendment, mulching, and installation of all coir fiber matting as specified on the plans and the project specifications. Associated stream banks will have temporary and permanent seed, soil amendments, mulch, and coir fiber matting applied to them as work progresses and by the end of each day. Coir fiber matting will be installed on top of the seeded, amended, and mulched stream banks according to the project specifications.

7. All remaining disturbed areas are to be amended, seeded, mulched and matted according to the project plans and specifications and at a minimum within 14 days of disturbance.

8. Upon the completion of phase 6, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

PHASE 7 – UT1 20+93 TO 24+35
CHANNEL RESTORATION IN PLACE

1. Perform construction staking.

2. The proposed channel meanders in and out of the existing channel throughout this work area. All work shall be conducted in the dry. No more channel can be opened or disturbed then can be completed and stabilized that same day. Multiple pump-around operation setups will be required along this work area. Begin pump-around operation at upstream end of each section that can be completed in the same work day. Install an impervious dike at upstream and downstream ends of the proposed sections in order to isolate all work from stream flow. Pump-around operation should be conducted in accordance with the typical pump-around operation detail as shown on the plans. Turbid water between impervious dikes must be pumped with a separate pump into a special stilling basin to be discharged downstream of the impervious dikes in accordance with the typical pump-around operation detail as shown on the plans.

3. Perform required removal and treatment of any exotic vegetation within and adjacent to the specified reach limits. All required removal and treatment (initial treatment) of exotic vegetation should be completed prior to proceeding with the remaining activities in this phase.

4. Perform required clearing and grubbing. Segregate and stockpile topsoil and other soil material in accordance with the project specifications.

5. Beginning at the downstream end of the area of active construction, proceed in the upstream direction with floodplain, channel and in-stream structure construction as specified on the plans. All usable existing gravel and cobble in the existing channel shall be excavated and utilized in the proposed channel prior to filling. Existing channel sections between the pump around operation setups shall filled concurrently with the proposed

REVISIONS				
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CONSTRUCTION SEQUENCE (CONT.)

channel excavation and instream structure installation per the plans and specifications.

6. Perform all topsoil replacement, vegetation transplanting, seeding (temporary and permanent), soil amendment, mulching, and installation of all coir fiber matting as specified on the plans and the project specifications. Associated disturbed stream banks will have temporary and permanent seed, soil amendments, mulch, and coir fiber matting applied to them as work progresses and by the end of each day. Coir fiber matting will be installed on top of the seeded, amended, and mulched stream banks according to the project specifications.

7. Remove and dispose of all unused vegetation and excavated materials.

8. All remaining disturbed areas are to be amended, seeded, mulched and matted according to the project plans and specifications and at a minimum within 14 days of disturbance.

9. Upon the completion of phase 7, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

PHASE 8 – UT1A 11+50 to 13+02
OFFLINE CHANNEL RESTORATION

1. Perform construction staking.

2. The existing channel will remain active in order to isolate all work from stream flow. Ensure all work for this phase maintains a 5-foot setback from the existing channel.

3. Perform required removal and treatment of exotic vegetation within and adjacent to the specified reach limits. All required removal and treatment (initial treatment) of exotic vegetation should be completed prior to proceeding with the remaining activities in this phase.

4. Locate and flag any vegetation transplants, including individual specimens and vegetated mats.

5. Perform required clearing and grubbing. Segregate and stockpile topsoil and other soil material in accordance with the project specifications.

6. Beginning at the downstream end of the area of active construction, proceed in the upstream direction with the Floodplain, Channel, and in-stream structure construction as specified on the plans.

7. Perform all topsoil replacement, vegetation transplanting, seeding (temporary and permanent), soil amendment, mulching, and installation of all coir fiber matting as specified on the plans and the project specifications. Associated stream banks will have temporary and permanent seed, soil amendments, mulch, and coir fiber matting applied to them as work progresses and by the end of each day. Coir fiber matting will be installed on top of the seeded, amended, and mulched stream banks according to the project specifications.

8. The existing UT1A channel shall then be filled such that all flow is diverted into the newly constructed UT1A channel.

9. Remove and dispose of all unused vegetation and excavated materials.

10. All remaining disturbed areas are to be amended, seeded, mulched and matted according to the project plans and specifications and at a minimum within 14 days of disturbance.

11. Upon the completion of phase 8, the existing channel will remain active.

12. Upon the completion of phase 8, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

PHASE 9 – UT1A/UT1A-1 10+00 to 11+50
CHANNEL RESTORATION IN PLACE

1. Perform construction staking.

2. Begin pump-around operation at upstream end of specified reach. Install an impervious dike at upstream and downstream ends of the proposed limits of the area of active construction in order to isolate all work from stream flow. Pump-around operation should be conducted in accordance with the typical pump-around operation detail as shown on the plans. Turbid water between impervious dikes must be pumped with a separate pump into a special stilling basin to be discharged downstream of the impervious dikes in accordance with the typical pump-around operation detail as shown on the plans.

3. Perform required removal and treatment of any exotic vegetation within and adjacent to the specified reach limits. All required removal and treatment (initial treatment) of exotic vegetation should be completed prior to proceeding with the remaining activities in this phase.

4. Perform required clearing and grubbing. Segregate and stockpile topsoil and other soil material in accordance with the project specifications.

5. Beginning at the downstream end of the area of active construction, proceed in the upstream direction with floodplain, channel and in-stream structure construction as specified on the plans.

6. Perform all topsoil replacement, vegetation transplanting, seeding (temporary and permanent), soil amendment, mulching, and installation of all coir fiber matting as specified on the plans and the project specifications. Associated disturbed stream banks will have temporary and permanent seed, soil amendments, mulch, and coir fiber matting applied to them as work progresses and by the end of each day. Coir fiber matting will be installed on top of the seeded, amended, and mulched stream banks according to the project specifications.

7. Remove and dispose of all unused vegetation and excavated materials.

8. All remaining disturbed areas are to be amended, seeded, mulched and matted according to the project plans and specifications and at a minimum within 14 days of disturbance.

9. Upon the completion of phase 9, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

PHASE 10 – UT1 15+86 20+93
CHANNEL RESTORATION IN PLACE

1. Perform construction staking.

2. The proposed channel meanders in and out of the existing channel throughout this work area. All work shall be conducted in the dry. No more channel can be opened or disturbed then can be completed and stabilized that same day. Multiple pump-around operation setups will be required along this work area. Begin pump-around operation at upstream end of each section that can be completed in the same work day. Install an impervious dike at upstream and downstream ends of the proposed sections in order to isolate all work from stream flow. Pump-around operation should be conducted in accordance with the typical pump-around operation detail as shown on the plans. Turbid water between impervious dikes must be pumped with a separate pump into a special stilling basin to be discharged downstream of the impervious dikes in accordance with the typical pump-around operation detail as shown on the plans.

3. Perform required removal and treatment of any exotic vegetation within and adjacent to the specified reach limits. All required removal and treatment (initial treatment) of exotic vegetation should be completed prior to proceeding with the remaining activities in this phase.

4. Perform required clearing and grubbing. Segregate and stockpile topsoil and other soil material in accordance with the project specifications.

5. Beginning at the downstream end of the area of active construction, proceed in the upstream direction with floodplain, channel and in-stream structure construction as specified on the plans. All usable existing gravel and cobble in the existing channel shall be excavated and utilized in the proposed channel prior to filling. Existing channel sections between the pump around operation setups shall filled concurrently with the proposed channel excavation and instream structure installation per the plans and specifications.

6. Perform all topsoil replacement, vegetation transplanting, seeding (temporary and permanent), soil amendment, mulching, and installation of all coir fiber matting as specified on the plans and the project specifications. Associated disturbed stream banks will have temporary and permanent seed, soil amendments, mulch, and coir fiber matting applied to them as work progresses and by the end of each day. Coir fiber matting will be installed on top of the seeded, amended, and mulched stream banks according to the project specifications.

7. Remove and dispose of all unused vegetation and excavated materials.

8. All remaining disturbed areas are to be amended, seeded, mulched and matted according to the project plans and specifications and at a minimum within 14 days of disturbance.

9. Upon the completion of phase 10, the Contractor shall schedule an inspection of the phase by the Engineer. The Contractor must have written approval from the Engineer that the phase has been completed to satisfactory standards before beginning another phase.

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

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:
EPR ECOSYSTEM PLANNING & RESTORATION
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RALEIGH, NC 27511
LICENSE # P-1182

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CONSTRUCTION SEQUENCE (CONT.)

PROJECT # 104 | SHEET NO. 1E

CONSTRUCTION SEQUENCE

PHASE 11 – UT1 10+50 TO 15+86 OFFLINE CHANNEL RESTORATION

1. PERFORM CONSTRUCTION STAKING.

2. THE EXISTING CHANNEL WILL REMAIN ACTIVE IN ORDER TO ISOLATE ALL WORK FROM STREAM FLOW. ENSURE ALL WORK FOR THIS PHASE MAINTAINS A 5-FOOT SETBACK FROM THE EXISTING CHANNEL.

3. PERFORM REQUIRED REMOVAL AND TREATMENT OF EXOTIC VEGETATION WITHIN AND ADJACENT TO THE SPECIFIED REACH LIMITS. ALL REQUIRED REMOVAL AND TREATMENT (INITIAL TREATMENT) OF EXOTIC VEGETATION SHOULD BE COMPLETED PRIOR TO PROCEEDING WITH THE REMAINING ACTIVITIES IN THIS PHASE.

4. PERFORM REQUIRED CLEARING AND GRUBBING, INCLUDING SPECIFIED REMOVAL OF DEAD MATURE TREES AND/OR DEAD SPECIMEN TREES. SEGREGATE AND STOCKPILE TOPSOIL AND OTHER SOIL MATERIAL IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

5. BEGINNING AT THE DOWNSTREAM END OF THE AREA OF ACTIVE CONSTRUCTION, PROCEED IN THE UPSTREAM DIRECTION WITH THE FLOODPLAIN, CHANNEL, AND IN-STREAM STRUCTURE CONSTRUCTION AS SPECIFIED ON THE PLANS.

6. PERFORM ALL TOPSOIL REPLACEMENT, VEGETATION TRANSPLANTING, SEEDING (TEMPORARY AND PERMANENT), SOIL AMENDMENT, MULCHING, AND INSTALLATION OF ALL COIR FIBER MATTING AS SPECIFIED ON THE PLANS AND THE PROJECT SPECIFICATIONS. ASSOCIATED DISTURBED STREAM BANKS WILL HAVE TEMPORARY AND PERMANENT SEED, SOIL AMENDMENTS, MULCH, AND COIR FIBER MATTING APPLIED TO THEM AS WORK PROGRESSES AND BY THE END OF EACH DAY. COIR FIBER MATTING WILL BE INSTALLED ON TOP OF THE SEEDED, AMENDED, AND MULCHED STREAM BANKS ACCORDING TO THE PROJECT SPECIFICATIONS.

7. REMOVE AND DISPOSE OF ALL UNUSED VEGETATION AND EXCAVATED MATERIALS.

8. UPON THE COMPLETION OF PHASE 11, THE EXISTING CHANNEL WILL REMAIN ACTIVE, CONVEYING FLOW FROM COLLINS ROAD TO THE RESTORED CHANNEL AT STATION 15+86.

9. UPON THE COMPLETION OF PHASE 11, THE CONTRACTOR SHALL SCHEDULE AN INSPECTION OF THE PHASE BY THE ENGINEER. THE CONTRACTOR MUST HAVE WRITTEN APPROVAL FROM THE ENGINEER THAT THE PHASE HAS BEEN COMPLETED TO SATISFACTORY STANDARDS BEFORE BEGINNING ANOTHER PHASE.

PHASE 12 – UT1 10+00 TO 10+50 CHANNEL RESTORATION IN PLACE

1. PERFORM CONSTRUCTION STAKING.

2. BEGIN PUMP-AROUND OPERATION AT UPSTREAM END OF SPECIFIED REACH. INSTALL AN IMPERVIOUS DIKE AT UPSTREAM AND DOWNSTREAM ENDS OF THE PROPOSED LIMITS OF THE AREA OF ACTIVE CONSTRUCTION IN ORDER TO ISOLATE ALL WORK FROM STREAM FLOW. PUMP-AROUND OPERATION SHOULD BE CONDUCTED IN ACCORDANCE WITH THE TYPICAL PUMP-AROUND OPERATION DETAIL AS SHOWN ON THE PLANS. TURBID WATER BETWEEN IMPERVIOUS DIKES MUST BE PUMPED WITH A SEPARATE PUMP INTO A SPECIAL STILLING BASIN TO BE DISCHARGED DOWNSTREAM OF THE IMPERVIOUS DIKES IN ACCORDANCE WITH THE TYPICAL PUMP-AROUND OPERATION DETAIL AS SHOWN ON THE PLANS.

3. PERFORM REQUIRED REMOVAL AND TREATMENT OF ANY EXOTIC VEGETATION WITHIN AND ADJACENT TO THE SPECIFIED REACH LIMITS. ALL REQUIRED REMOVAL AND TREATMENT (INITIAL TREATMENT) OF EXOTIC VEGETATION SHOULD BE COMPLETED PRIOR TO PROCEEDING WITH THE REMAINING ACTIVITIES IN THIS PHASE.

4. PERFORM REQUIRED CLEARING AND GRUBBING. SEGREGATE AND STOCKPILE TOPSOIL AND OTHER SOIL MATERIAL IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

5. BEGINNING AT THE DOWNSTREAM END OF THE AREA OF ACTIVE CONSTRUCTION, PROCEED IN THE UPSTREAM DIRECTION WITH FLOODPLAIN, CHANNEL AND IN-STREAM STRUCTURE CONSTRUCTION AS SPECIFIED ON THE PLANS.

6. PERFORM ALL TOPSOIL REPLACEMENT, VEGETATION TRANSPLANTING, SEEDING (TEMPORARY AND PERMANENT), SOIL AMENDMENT, MULCHING, AND INSTALLATION OF ALL COIR FIBER MATTING AS SPECIFIED ON THE PLANS AND THE PROJECT SPECIFICATIONS. ASSOCIATED DISTURBED STREAM BANKS WILL HAVE TEMPORARY AND PERMANENT SEED, SOIL AMENDMENTS, MULCH, AND COIR FIBER MATTING APPLIED TO THEM AS WORK PROGRESSES AND BY THE END OF EACH DAY. COIR FIBER MATTING WILL BE INSTALLED ON TOP OF THE SEEDED, AMENDED, AND MULCHED STREAM BANKS ACCORDING TO THE PROJECT SPECIFICATIONS.

7. REMOVE AND DISPOSE OF ALL UNUSED VEGETATION AND EXCAVATED MATERIALS.

8. FLOW CAN THEN BE TURNED INTO THE NEW UT1 STREAM CHANNEL. THE EXISTING UT1 CHANNEL SHALL THEN BE FILLED PER THE PLANS AND SPECIFICATIONS. ALL REMAINING DISTURBED AREAS ARE TO BE AMENDED, SEEDED, MULCHED AND MATTED ACCORDING TO THE PROJECT PLANS AND SPECIFICATIONS AND AT A MINIMUM WITHIN 14 DAYS OF DISTURBANCE.

9. UPON THE COMPLETION OF PHASE 12, THE CONTRACTOR SHALL SCHEDULE AN INSPECTION OF THE PHASE BY THE ENGINEER. THE CONTRACTOR MUST HAVE WRITTEN APPROVAL FROM THE ENGINEER THAT THE PHASE HAS BEEN COMPLETED TO SATISFACTORY STANDARDS BEFORE BEGINNING ANOTHER PHASE.

PHASE 13 – ENTIRE PROJECT DEMOBILIZATION AND PLANTING

1. COMPLETE REMAINING MINOR GRADING AND SITE PLANTING PREPARATION WORK, INCLUDING RIPPING AND/OR DISKING, AS SPECIFIED IN THE PROJECT SPECIFICATIONS.

2. ALL REMAINING DISTURBED AREAS, INCLUDING AREAS THAT HAVE BEEN RIPPED AND/OR DISKED ARE TO BE AMENDED, SEEDED, MATTED AND/OR MULCHED ACCORDING TO THE PROJECT SPECIFICATIONS AND AT A MINIMUM WITHIN 14 DAYS OF DISTURBANCE.

3. COMPLETE ALL REMAINING PROPOSED PERMANENT VEGETATION PLANTING PER THE PLANS AND PROJECT SPECIFICATIONS.

4. REMOVE AND DISPOSE OF ALL TRASH, METAL, AND DEBRIS FROM THE SITE ACCORDING TO LOCAL, STATE AND FEDERAL REGULATIONS.

5. RESTORE CONSTRUCTION ACCESS ROADS, STAGING AREAS, AND STOCKPILE AREAS. IMMEDIATELY REGRADE, REPLACE TOPSOIL, AND SEED, AMEND, AND MULCH AS SPECIFIED IN THE PROJECT SPECIFICATIONS. REMOVE ALL TREE PROTECTION FENCING. SILT FENCE SHALL BE REMOVED ONCE THE SITE HAS BEEN STABILIZED WITH VEGETATION.

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PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION A: SELF-INSPECTION

Self-inspections are required during normal business hours in accordance with the table below. When adverse weather or site conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. In addition, when a storm event of equal to or greater than 1.0 inch occurs outside of normal business hours, the self-inspection shall be performed upon the commencement of the next business day. Any time when inspections were delayed shall be noted in the Inspection Record.

Inspect	Frequency (during normal business hours)	Inspection records must include:
(1) Rain gauge maintained in good working order	Daily	Daily rainfall amounts. If no daily rain gauge observations are made during weekend or holiday periods, and no individual-day rainfall information is available, record the cumulative rain measurement for those un-attended days (and this will determine if a site inspection is needed). Days on which no rainfall occurred shall be recorded as "zero." The permittee may use another rain-monitoring device approved by the Division.
(2) E&SC Measures	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the measures inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Indication of whether the measures were operating properly, 5. Description of maintenance needs for the measure, 6. Description, evidence, and date of corrective actions taken.
(3) Stormwater discharge outfalls (SDOs)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the discharge outfalls inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Evidence of indicators of stormwater pollution such as oil sheen, floating or suspended solids or discoloration, 5. Indication of visible sediment leaving the site, 6. Description, evidence, and date of corrective actions taken.
(4) Perimeter of site	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If visible sedimentation is found outside site limits, then a record of the following shall be made: 1. Actions taken to clean up or stabilize the sediment that has left the site limits, 2. Description, evidence, and date of corrective actions taken, and 3. An explanation as to the actions taken to control future releases.
(5) Streams or wetlands onsite or offsite (where accessible)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If the stream or wetland has increased visible sedimentation or a stream has visible increased turbidity from the construction activity, then a record of the following shall be made: 1. Description, evidence and date of corrective actions taken, and 2. Records of the required reports to the appropriate Division Regional Office per Part III, Section C, Item (2)(a) of this permit.
(6) Ground stabilization measures	After each phase of grading	1. The phase of grading (installation of perimeter E&SC measures, clearing and grubbing, installation of storm drainage facilities, completion of all land-disturbing activity, construction or redevelopment, permanent ground cover). 2. Documentation that the required ground stabilization measures have been provided within the required timeframe or an assurance that they will be provided as soon as possible.

NOTE: The rain inspection resets the required 7 calendar day inspection requirement.

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION B: RECORDKEEPING

1. E&SC Plan Documentation

The approved E&SC plan as well as any approved deviation shall be kept on the site. The approved E&SC plan must be kept up-to-date throughout the coverage under this permit. The following items pertaining to the E&SC plan shall be kept on site and available for inspection at all times during normal business hours.

Item to Document	Documentation Requirements
(a) Each E&SC measure has been installed and does not significantly deviate from the locations, dimensions and relative elevations shown on the approved E&SC plan.	Initial and date each E&SC measure on a copy of the approved E&SC plan or complete, date and sign an inspection report that lists each E&SC measure shown on the approved E&SC plan. This documentation is required upon the initial installation of the E&SC measures or if the E&SC measures are modified after initial installation.
(b) A phase of grading has been completed.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate completion of the construction phase.
(c) Ground cover is located and installed in accordance with the approved E&SC plan.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate compliance with approved ground cover specifications.
(d) The maintenance and repair requirements for all E&SC measures have been performed.	Complete, date and sign an inspection report.
(e) Corrective actions have been taken to E&SC measures.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate the completion of the corrective action.

2. Additional Documentation to be Kept on Site

In addition to the E&SC plan documents above, the following items shall be kept on the site and available for inspectors at all times during normal business hours, unless the Division provides a site-specific exemption based on unique site conditions that make this requirement not practical:

(a) This General Permit as well as the Certificate of Coverage, after it is received.

(b) Records of inspections made during the previous twelve months. The permittee shall record the required observations on the Inspection Record Form provided by the Division or a similar inspection form that includes all the required elements. Use of electronically-available records in lieu of the required paper copies will be allowed if shown to provide equal access and utility as the hard-copy records.

3. Documentation to be Retained for Three Years

All data used to complete the e-NOI and all inspection records shall be maintained for a period of three years after project completion and made available upon request. [40 CFR 122.41]

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION C: REPORTING

1. Occurrences that Must be Reported

Permittees shall report the following occurrences:

(a) Visible sediment deposition in a stream or wetland.

(b) Oil spills if:
- They are 25 gallons or more,
- They are less than 25 gallons but cannot be cleaned up within 24 hours,
- They cause sheen on surface waters (regardless of volume), or
- They are within 100 feet of surface waters (regardless of volume).

(c) Releases of hazardous substances in excess of reportable quantities under Section 311 of the Clean Water Act (Ref: 40 CFR 110.3 and 40 CFR 117.3) or Section 102 of CERCLA (Ref: 40 CFR 302.4) or G.S. 143-215.85.

(d) Anticipated bypasses and unanticipated bypasses.

(e) Noncompliance with the conditions of this permit that may endanger health or the environment.

2. Reporting Timeframes and Other Requirements

After a permittee becomes aware of an occurrence that must be reported, he shall contact the appropriate Division regional office within the timeframes and in accordance with the other requirements listed below. Occurrences outside normal business hours may also be reported to the Department's Environmental Emergency Center personnel at (800) 858-0368.

Occurrence	Reporting Timeframes (After Discovery) and Other Requirements
(a) Visible sediment deposition in a stream or wetland	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the sediment and actions taken to address the cause of the deposition. Division staff may waive the requirement for a written report on a case-by-case basis. • If the stream is named on the NC 303(d) list as impaired for sediment-related causes, the permittee may be required to perform additional monitoring, inspections or apply more stringent practices if staff determine that additional requirements are needed to assure compliance with the federal or state impaired-waters conditions.
(b) Oil spills and release of hazardous substances per Item 1(b)-(c) above	• ***Within 24 hours***, an oral or electronic notification. The notification shall include information about the date, time, nature, volume and location of the spill or release.
(c) Anticipated bypasses [40 CFR 122.41(m)(3)]	• ***A report at least ten days before the date of the bypass, if possible***. The report shall include an evaluation of the anticipated quality and effect of the bypass.
(d) Unanticipated bypasses [40 CFR 122.41(m)(3)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days,*** a report that includes an evaluation of the quality and effect of the bypass.
(e) Noncompliance with the conditions of this permit that may endanger health or the environment[40 CFR 122.41(l)(7)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the noncompliance, and its causes; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time noncompliance is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. [40 CFR 122.41(l)(6). • Division staff may waive the requirement for a written report on a case-by-case basis.

PART II, SECTION G, ITEM (4)
DRAW DOWN OF SEDIMENT BASINS FOR MAINTENANCE OR CLOSE OUT

Sediment basins and traps that receive runoff from drainage areas of one acre or more shall use outlet structures that withdraw water from the surface when these devices need to be drawn down for maintenance or close out unless this is infeasible. The circumstances in which it is not feasible to withdraw water from the surface shall be rare (for example, times with extended cold weather). Non-surface withdrawals from sediment basins shall be allowed only when all of the following criteria have been met:

(a) The E&SC plan authority has been provided with documentation of the non-surface withdrawal and the specific time periods or conditions in which it will occur. The non-surface withdrawal shall not commence until the E&SC plan authority has approved these items,

(b) The non-surface withdrawal has been reported as an anticipated bypass in accordance with Part III, Section C, Item (2)(c) and (d) of this permit,

(c) Dewatering discharges are treated with controls to minimize discharges of pollutants from stormwater that is removed from the sediment basin. Examples of appropriate controls include properly sited, designed and maintained dewatering tanks, weir tanks, and filtration systems,

(d) Vegetated, upland areas of the sites or a properly designed stone pad is used to the extent feasible at the outlet of the dewatering treatment devices described in Item (c) above,

(e) Velocity dissipation devices such as check dams, sediment traps, and riprap are provided at the discharge points of all dewatering devices, and

(f) Sediment removed from the dewatering treatment devices described in Item (c) above is disposed of in a manner that does not cause deposition of sediment into waters of the United States.

NORTH CAROLINA Environmental Quality

NCG01 SELF-INSPECTION, RECORDKEEPING AND REPORTING

EFFECTIVE: 04/01/19

12/5/2019
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GROUND STABILIZATION AND MATERIALS HANDLING PRACTICES FOR COMPLIANCE WITH THE NCG01 CONSTRUCTION GENERAL PERMIT

Implementing the details and specifications on this plan sheet will result in the construction activity being considered compliant with the Ground Stabilization and Materials Handling sections of the NCG01 Construction General Permit (Sections E and F, respectively). The permittee shall comply with the Erosion and Sediment Control plan approved by the delegated authority having jurisdiction. All details and specifications shown on this sheet may not apply depending on site conditions and the delegated authority having jurisdiction.

SECTION E: GROUND STABILIZATION

Required Ground Stabilization Timeframes		
Site Area Description	**Stabilize within this many calendar days after ceasing land disturbance**	**Timeframe variations**
(a) Perimeter dikes, swales, ditches, and perimeter slopes	7	None
(b) High Quality Water (HQW) Zones	7	None
(c) Slopes steeper than 3:1	7	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed
(d) Slopes 3:1 to 4:1	14	-7 days for slopes greater than 50' in length and with slopes steeper than 4:1 -7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed
(e) Areas with slopes flatter than 4:1	14	-7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed unless there is zero slope

Note: After the permanent cessation of construction activities, any areas with temporary ground stabilization shall be converted to permanent ground stabilization as soon as practicable but in no case longer than 90 calendar days after the last land disturbing activity. Temporary ground stabilization shall be maintained in a manner to render the surface stable against accelerated erosion until permanent ground stabilization is achieved.

GROUND STABILIZATION SPECIFICATION

Stabilize the ground sufficiently so that rain will not dislodge the soil. Use one of the techniques in the table below:

Temporary Stabilization	Permanent Stabilization
• Temporary grass seed covered with straw or other mulches and tackifiers • Hydroseeding • Rolled erosion control products with or without temporary grass seed • Appropriately applied straw or other mulch • Plastic sheeting	• Permanent grass seed covered with straw or other mulches and tackifiers • Geotextile fabrics such as permanent soil reinforcement matting • Hydroseeding • Shrubs or other permanent plantings covered with mulch • Uniform and evenly distributed ground cover sufficient to restrain erosion • Structural methods such as concrete, asphalt or retaining walls • Rolled erosion control products with grass seed

POLYACRYLAMIDES (PAMS) AND FLOCCULANTS

1. Select flocculants that are appropriate for the soils being exposed during construction, selecting from the *NC DWR List of Approved PAMS/Flocculants*.
2. Apply flocculants at or before the inlets to Erosion and Sediment Control Measures.
3. Apply flocculants at the concentrations specified in the *NC DWR List of Approved PAMS/Flocculants* and in accordance with the manufacturer's instructions.
4. Provide ponding area for containment of treated Stormwater before discharging offsite.
5. Store flocculants in leak-proof containers that are kept under storm-resistant cover or surrounded by secondary containment structures.

EQUIPMENT AND VEHICLE MAINTENANCE

1. Maintain vehicles and equipment to prevent discharge of fluids.
2. Provide drip pans under any stored equipment.
3. Identify leaks and repair as soon as feasible, or remove leaking equipment from the project.
4. Collect all spent fluids, store in separate containers and properly dispose as hazardous waste (recycle when possible).
5. Remove leaking vehicles and construction equipment from service until the problem has been corrected.
6. Bring used fuels, lubricants, coolants, hydraulic fluids and other petroleum products to a recycling or disposal center that handles these materials.

LITTER, BUILDING MATERIAL AND LAND CLEARING WASTE

1. Never bury or burn waste. Place litter and debris in approved waste containers.
2. Provide a sufficient number and size of waste containers (e.g dumpster, trash receptacle) on site to contain construction and domestic wastes.
3. Locate waste containers at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
4. Locate waste containers on areas that do not receive substantial amounts of runoff from upland areas and does not drain directly to a storm drain, stream or wetland.
5. Cover waste containers at the end of each workday and before storm events or provide secondary containment. Repair or replace damaged waste containers.
6. Anchor all lightweight items in waste containers during times of high winds.
7. Empty waste containers as needed to prevent overflow. Clean up immediately if containers overflow.
8. Dispose waste off-site at an approved disposal facility.
9. On business days, clean up and dispose of waste in designated waste containers.

PAINT AND OTHER LIQUID WASTE

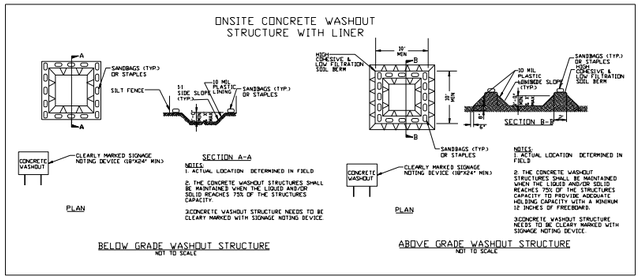
1. Do not dump paint and other liquid waste into storm drains, streams or wetlands.
2. Locate paint washouts at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
3. Contain liquid wastes in a controlled area.
4. Containment must be labeled, sized and placed appropriately for the needs of site.
5. Prevent the discharge of soaps, solvents, detergents and other liquid wastes from construction sites.

PORTABLE TOILETS

1. Install portable toilets on level ground, at least 50 feet away from storm drains, streams or wetlands unless there is no alternative reasonably available. If 50 foot offset is not attainable, provide relocation of portable toilet behind silt fence or place on a gravel pad and surround with sand bags.
2. Provide staking or anchoring of portable toilets during periods of high winds or in high foot traffic areas.
3. Monitor portable toilets for leaking and properly dispose of any leaked material. Utilize a licensed sanitary waste hauler to remove leaking portable toilets and replace with properly operating unit.

EARTHEN STOCKPILE MANAGEMENT

1. Show stockpile locations on plans. Locate earthen-material stockpile areas at least 50 feet away from storm drain inlets, sediment basins, perimeter sediment controls and surface waters unless it can be shown no other alternatives are reasonably available.
2. Protect stockpile with silt fence installed along toe of slope with a minimum offset of five feet from the toe of stockpile.
3. Provide stable stone access point when feasible.
4. Stabilize stockpile within the timeframes provided on this sheet and in accordance with the approved plan and any additional requirements. Soil stabilization is defined as vegetative, physical or chemical coverage techniques that will restrain accelerated erosion on disturbed soils for temporary or permanent control needs.



CONCRETE WASHOUTS

1. Do not discharge concrete or cement slurry from the site.
2. Dispose of, or recycle settled, hardened concrete residue in accordance with local and state solid waste regulations and at an approved facility.
3. Manage washout from mortar mixers in accordance with the above item and in addition place the mixer and associated materials on impervious barrier and within lot perimeter silt fence.
4. Install temporary concrete washouts per local requirements, where applicable. If an alternate method or product is to be used, contact your approval authority for review and approval. If local standard details are not available, use one of the two types of temporary concrete washouts provided on this detail.
5. Do not use concrete washouts for dewatering or storing defective curb or sidewalk sections. Stormwater accumulated within the washout may not be pumped into or discharged to the storm drain system or receiving surface waters. Liquid waste must be pumped out and removed from project.
6. Locate washouts at least 50 feet from storm drain inlets and surface waters unless it can be shown that no other alternatives are reasonably available. At a minimum, install protection of storm drain inlet(s) closest to the washout which could receive spills or overflow.
7. Locate washouts in an easily accessible area, on level ground and install a stone entrance pad in front of the washout. Additional controls may be required by the approving authority.
8. Install at least one sign directing concrete trucks to the washout within the project limits. Post signage on the washout itself to identify this location.
9. Remove leavings from the washout when at approximately 75% capacity to limit overflow events. Replace the tarp, sand bags or other temporary structural components when no longer functional. When utilizing alternative or proprietary products, follow manufacturer's instructions.
10. At the completion of the concrete work, remove remaining leavings and dispose of in an approved disposal facility. Fill pit, if applicable, and stabilize any disturbance caused by removal of washout.

HERBICIDES, PESTICIDES AND RODENTICIDES

1. Store and apply herbicides, pesticides and rodenticides in accordance with label restrictions.
2. Store herbicides, pesticides and rodenticides in their original containers with the label, which lists directions for use, ingredients and first aid steps in case of accidental poisoning.
3. Do not store herbicides, pesticides and rodenticides in areas where flooding is possible or where they may spill or leak into wells, stormwater drains, ground water or surface water. If a spill occurs, clean area immediately.
4. Do not stockpile these materials onsite.

HAZARDOUS AND TOXIC WASTE

1. Create designated hazardous waste collection areas on-site.
2. Place hazardous waste containers under cover or in secondary containment.
3. Do not store hazardous chemicals, drums or bagged materials directly on the ground.

NORTH CAROLINA *Environmental Quality*

NCG01 GROUND STABILIZATION AND MATERIALS HANDLING

EFFECTIVE: 04/01/19

REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

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

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

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

PROJECT ENGINEER

PROGRESS DRAWING
FOR REVIEW PURPOSES ONLY
DO NOT USE FOR CONSTRUCTION

12/5/2019
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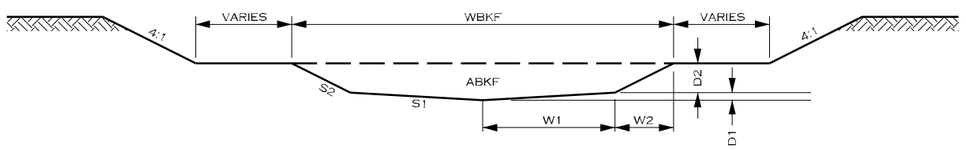
RYAN PETERS

TYPICAL SECTIONS

PROJECT # 104 | SHEET NO. 2

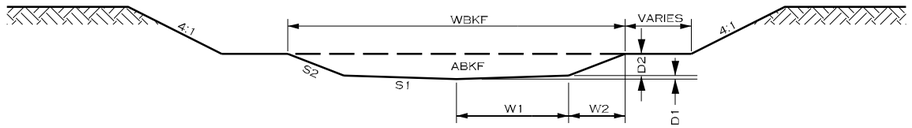
TYPICAL SECTIONS

"Bc" AND "B" TYPE CHANNELS

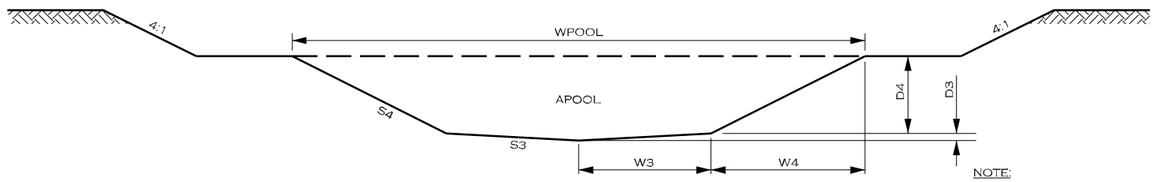


TYPICAL RIFFLE CROSS SECTION

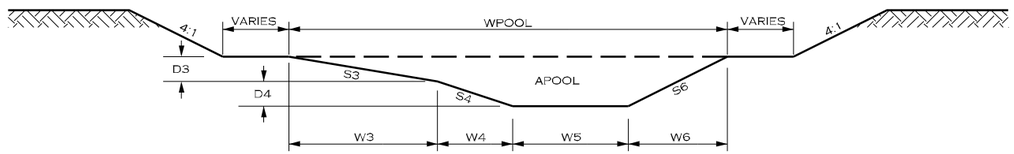
"C" TYPE CHANNELS



TYPICAL RIFFLE CROSS SECTION



TYPICAL POOL CROSS SECTION



TYPICAL POOL RIGHT CROSS SECTION

NOTE:
1. CROSS SECTIONS SHOWN ABOVE ARE FOR PRIORITY 2 RESTORATION. NOT ALL REACHES WILL INCLUDE EXCAVATED BANKFULL BENCHES.
2. LINES SHOWN AS THE BANKFULL BENCH ON THE PLAN SHEETS CORRESPOND TO THE BACK OF THE BENCH SHOWN ON THE TYPICAL SECTIONS.
3. STREAMS SHALL HAVE POSITIVE DRAINAGE FROM THE FLOODPLAIN TO THE STREAM.

B STREAM TYPE TYPICAL CROSS SECTION DIMENSIONS

		RIFFLES								POOLS							
Stream	Station	ABKF	WBKF	W1	W2	D1	D2	S1	S2	APool	WPool	W3	W4	D3	D4	S3	S4
UT1 - Reach 1	10+00 to 19+19	3.0	6.2	2.0	1.1	0.1	0.6	33:1	2:1	6.5	8.1	0.5	3.6	0.0	1.4	N/A	2.5:1
UT1A	10+00 to 13+03	1.0	3.6	1.2	0.7	0.0	0.3	29:1	2:1	2.3	4.7	1.0	1.4	0.0	0.7	N/A	2:1
UT1B	10+00 to 12+30	1.0	3.6	1.2	0.7	0.0	0.3	29:1	2:1	2.3	4.7	1.0	1.4	0.0	0.7	N/A	2:1

C STREAM TYPE TYPICAL CROSS SECTION DIMENSIONS

		RIFFLES								POOLS										
Stream	Station	ABKF	WBKF	W1	W2	D1	D2	S1	S2	APool	WPool	W3	W4	W5	W6	D3	D4	S3	S4	S6
UT1 - Reach 3	19+19 to 30+16	4.5	7.6	2.5	1.4	0.1	0.7	35:1	2:1	8.1	9.9	2.9	2.9	1.1	2.9	0.7	0.7	4:1	4:1	2:1

NOTE:
UT1 - REACH 2 IS AN ENHANCEMENT LEVEL II REACH THAT WILL BE PLANTED AND FENCED ONLY.

12/5/2019
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RMYERS

REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

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

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:

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

PROJECT ENGINEER

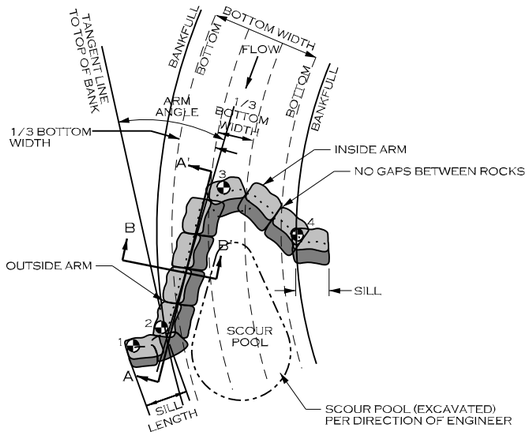
PROGRESS DRAWING
FOR REVIEW PURPOSES ONLY
DO NOT USE FOR CONSTRUCTION

OFFSET ROCK CROSS VANE (OV)

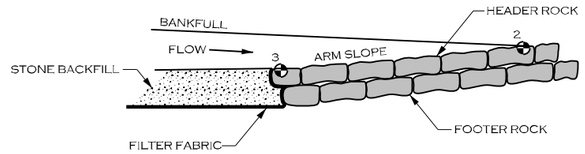
OFFSET ROCK CROSS VANE SPECIFICATIONS		
MATERIALS:	SPECIFICATIONS:	
BOULDER	TYPE: SIZE: NUMBER OF HEADER ROWS: NUMBER OF FOOTER ROWS:	GRANITE OR COMPARABLE 3 FT X 2 FT X 1 FT 1 1
FILTER FABRIC	TYPE: WIDTH UPSTREAM:	TYPE 2 NON-WOVEN 6 FT MINIMUM
STONE BACKFILL	CLASS A, CLASS B AND ON-SITE ALLUVIUM (EVEN MIX)	

NOTES FOR OFFSET ROCK CROSS VANE:

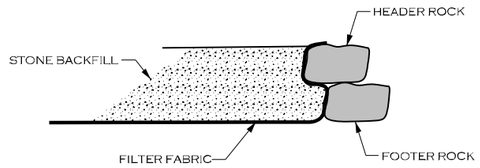
1. STRUCTURE DIMENSIONS AND MEASUREMENTS ARE SHOWN ON THE STRUCTURES TABLE SHEET.
2. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
3. PLACE FOOTER ROCKS AND THEN HEADER ROCKS TO ACHIEVE DESIGN DIMENSIONS AND ELEVATIONS.
4. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER ROCKS.
5. PLACE FILTER FABRIC BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTENDING DOWN TO THE DEPTH OF THE FOOTER ROCKS, THEN OUTWARD THE DISTANCE SPECIFIED IN THE STRUCTURES TABLE SHEET.
6. INSTALL STONE BACKFILL AS SHOWN, TO THE ELEVATION OF THE TOP HEADER ROCK.



⊕ - ELEVATION POINT (SEE STRUCTURE TABLES)



PROFILE VIEW A - A'
VANE OUTSIDE ARM



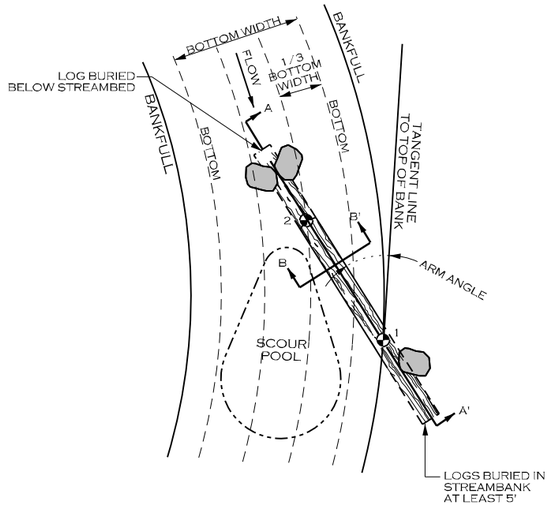
SECTION B - B'
VANE ARM CROSS SECTION

LOG VANE (LV)

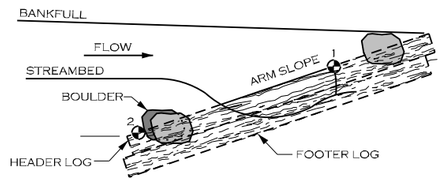
LOG VANE SPECIFICATIONS		
MATERIALS:	SPECIFICATIONS:	
BOULDER	TYPE: SIZE:	GRANITE OR COMPARABLE 3 FT X 2 FT X 1 FT
LOGS	TYPE: SIZE: NUMBER OF HEADER LOGS: NUMBER OF FOOTER LOGS:	HARDWOOD 12 INCH Ø MIN. 1 1
FILTER FABRIC	TYPE: WIDTH UPSTREAM:	TYPE 2 NON-WOVEN 6 FT MINIMUM
STONE BACKFILL	CLASS A, CLASS B AND ON-SITE ALLUVIUM (EVEN MIX)	

NOTES FOR LOG VANE STRUCTURES:

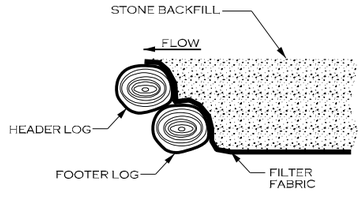
1. STRUCTURE DIMENSIONS AND MEASUREMENTS ARE SHOWN ON THE STRUCTURE TABLES SHEET.
2. LOGS SHOULD BE STRAIGHT, HARDWOOD, AND NOT ROTTEN.
3. BOULDERS MUST BE OF SUFFICIENT SIZE TO ANCHOR LOGS.
4. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOGS.
5. BOULDER SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING.
6. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
7. INSTALL STONE BACKFILL BEHIND THE LOGS.
8. BOLDERS SHALL NOT BE USED WHERE BOTTOM WIDTH IS LESS THAN 6.0'



PLAN VIEW



PROFILE VIEW A - A'



SECTION B - B'

⊕ - ELEVATION POINT (SEE STRUCTURE TABLES)

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

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

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

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

PROJECT ENGINEER

PROGRESS DRAWING
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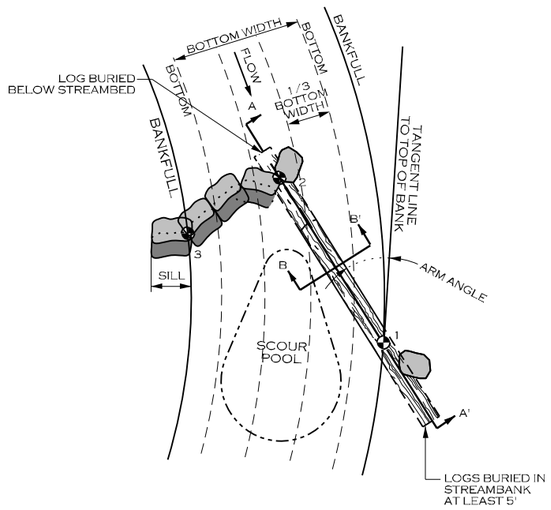
BWERS

PROJECT # 104 | SHEET NO. 2B

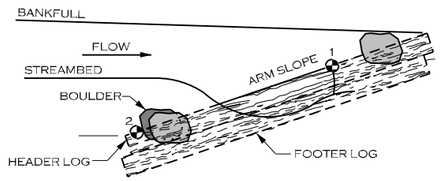
DETAILS

GRADE CONTROL LOG J-HOOK VANE (LJH)

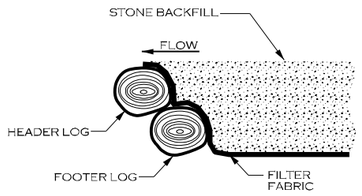


PLAN VIEW

- ELEVATION POINT (SEE STRUCTURE TABLES)



PROFILE VIEW A - A'



SECTION B - B'

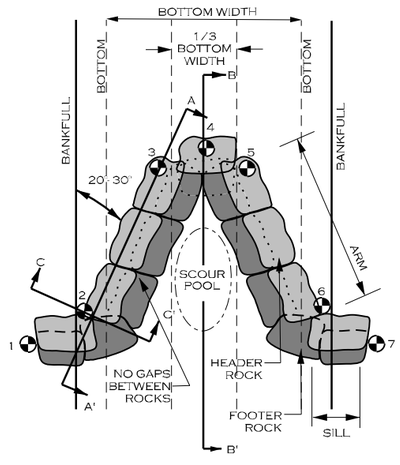
LOG J-HOOK VANE SPECIFICATIONS

MATERIALS:	SPECIFICATIONS:	
BOULDER	TYPE: SIZE:	GRANITE OR COMPARABLE 3 FT X 2 FT X 1 FT
LOGS	TYPE: SIZE: NUMBER OF HEADER LOGS: NUMBER OF FOOTER LOGS:	HARDWOOD 12 INCH Ø MIN. 1 1
FILTER FABRIC	TYPE: WIDTH UPSTREAM:	TYPE 2 NON-WOVEN 6 FT MINIMUM
STONE BACKFILL	CLASS A, CLASS B AND ON-SITE ALLUVIUM (EVEN MIX)	

NOTES FOR LOG J-HOOK VANE STRUCTURES:

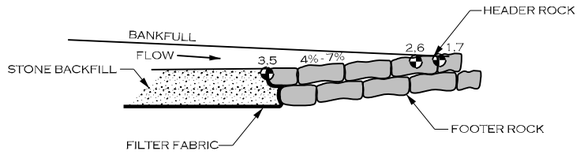
1. STRUCTURE DIMENSIONS AND MEASUREMENTS ARE SHOWN ON THE STRUCTURE TABLES SHEET.
2. LOGS SHOULD BE STRAIGHT, HARDWOOD, AND NOT ROTTEN.
3. BOULDERS MUST BE OF SUFFICIENT SIZE TO ANCHOR LOGS.
4. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOGS.
5. BOULDER SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING.
6. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
7. INSTALL STONE BACKFILL AS SHOWN, TO THE ELEVATION OF THE TOP HEADER ROCK. INSTALL STONE BACKFILL BEHIND LOG.

ROCK CROSS VANE (XV)

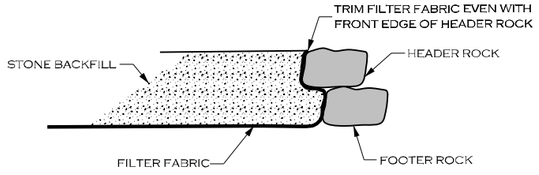


PLAN VIEW

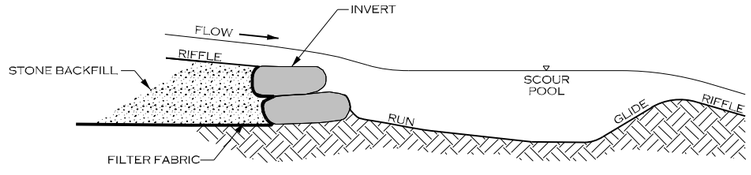
- ELEVATION POINT (SEE STRUCTURES TABLE)



PROFILE VIEW A - A'
VANE ARM



SECTION C - C'
INVERT AND POOL



PROFILE VIEW B - B'
INVERT

ROCK CROSS VANE SPECIFICATIONS

MATERIALS:	SPECIFICATIONS:	
BOULDER	TYPE: SIZE: NUMBER OF HEADER ROWS: NUMBER OF FOOTER ROWS:	GRANITE OR COMPARABLE 3 FT X 2 FT X 1 FT 1 1
FILTER FABRIC	TYPE: WIDTH UPSTREAM:	TYPE 2 NON-WOVEN 6 FT MINIMUM
STONE BACKFILL	CLASS A, CLASS B AND ON-SITE ALLUVIUM (EVEN MIX)	

NOTES FOR CROSS VANE STRUCTURES:

1. DIG A TRENCH BELOW THE STREAM BED FOR FOOTER AND HEADER ROCKS. FILTER FABRIC AND STONE BACKFILL.
2. PLACE FOOTER ROCKS AND THEN HEADER ROCKS TO ACHIEVE DESIGN DIMENSIONS AND ELEVATIONS.
3. USE HAND PLACED STONE TO FILL GAPS AND VOIDS ON UPSTREAM SIDE OF THE HEADER AND FOOTER ROCKS.
4. PLACE FILTER FABRIC BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTENDING DOWN TO THE DEPTH OF THE FOOTER ROCKS, THEN OUTWARD THE DISTANCE SPECIFIED IN THE STRUCTURES TABLE SHEET.
5. INSTALL STONE BACKFILL AS SHOWN, TO THE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.

REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

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

GREENBRIER STREAM RESTORATION SITE
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EPR Ecosystem Planning & Restoration
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RALEIGH, NC 27511
LICENSE # P-1182

PROJECT ENGINEER

PROGRESS DRAWING
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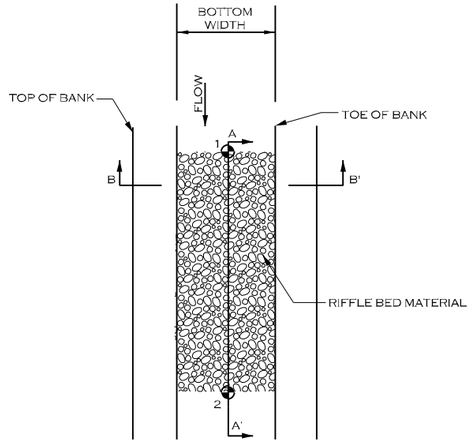
BWERS

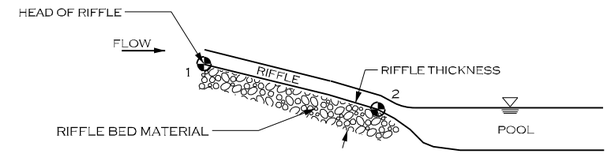
PROJECT # 104 | SHEET NO. 2C

DETAILS

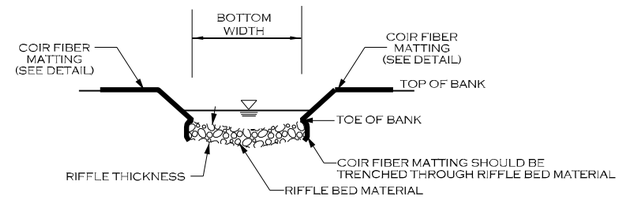
CONSTRUCTED RIFFLE (CR)



PLAN VIEW



PROFILE A - A'



SECTION B - B'

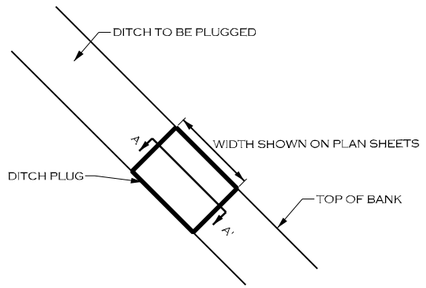
CONSTRUCTED RIFFLE SPECIFICATIONS	
MATERIALS:	SPECIFICATIONS:
RIFFLE BED MATERIAL	TYPE: HARVESTED ON-SITE OR COMPARABLE SIZE: CLASS A, CLASS B AND ON-SITE ALLUVIUM (EVEN MIX) THICKNESS: 16 INCHES MIN.
COIR FIBER MATTING	SEE DETAIL

NOTES FOR CONSTRUCTED RIFFLE STRUCTURES:

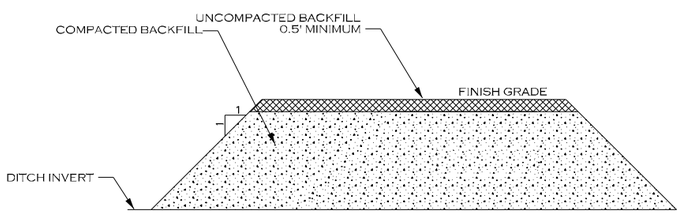
1. GRADE STREAMBED AND BANKS TO PROPOSED DIMENSIONS PER TYPICAL CROSS-SECTION AND PROFILE.
2. EXCAVATE TRENCH BELOW PROPOSED STREAMBED ELEVATION EQUAL TO OR GREATER THAN RIFFLE THICKNESS.
3. INSTALL COIR FIBER MATTING ALONG STREAMBANKS ENSURING MATTING IS SUFFICIENTLY TRENCHED ALONG TOE OF BANK.
4. FILL TRENCH WITH RIFFLE BED MATERIAL TO FINAL DESIGN STREAM GRADE.

- ELEVATION POINT (SEE STRUCTURE TABLES)

DITCH PLUG



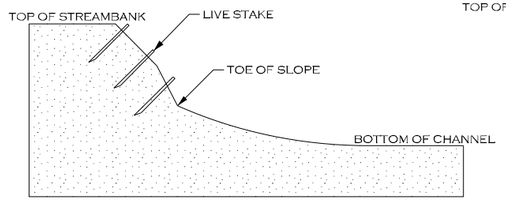
PLAN VIEW



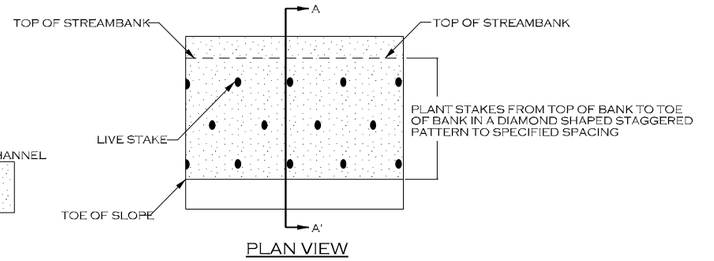
SECTION A - A'

NOTE:
COMPACT BACKFILL USING ON-SITE HEAVY EQUIPMENT IN 10 INCH LIFTS.

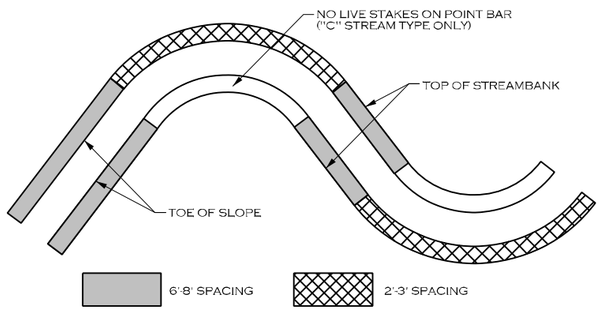
LIVE STAKING



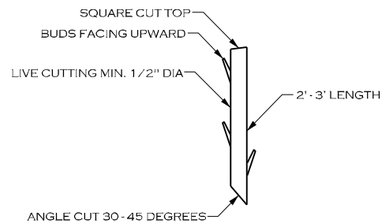
SECTION A - A'



PLAN VIEW



LIVE STAKE SPACING PLAN VIEW



LIVE STAKE DETAIL

NOTES:

1. STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY.
2. DO NOT INSTALL STAKES THAT HAVE BEEN SPLIT.
3. STAKES MUST BE INSTALLED WITH BUDS POINTING UPWARDS.
4. STAKES SHOULD BE INSTALLED PERPENDICULAR TO BANK.
5. STAKES SHOULD BE 1/2 TO 2 INCHES IN DIAMETER AND 2 TO 3 FT LONG.
6. STAKES SHOULD BE INSTALLED LEAVING 1/5 OF STAKE ABOVE GROUND.
7. INSTALL LIVE STAKES ALONG THE "B" STREAM TYPE CHANNELS USING A 4-5 FT. SPACING

REVISIONS				
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1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

PREPARED FOR:
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NC DEPARTMENT OF ENVIRONMENTAL QUALITY
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YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:
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1150 SE MAYNARD ROAD, SUITE 140
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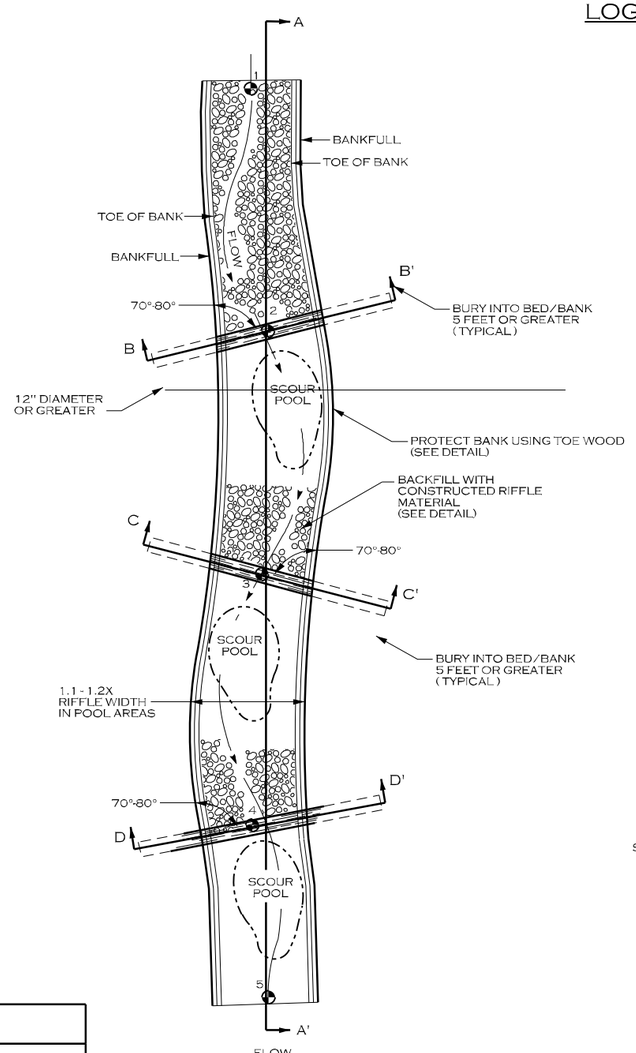
LOG ROLLER (LR)

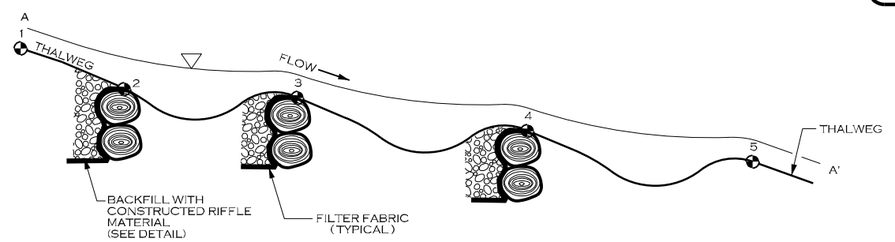
PROJECT # 104 | SHEET NO. 2D

DETAILS

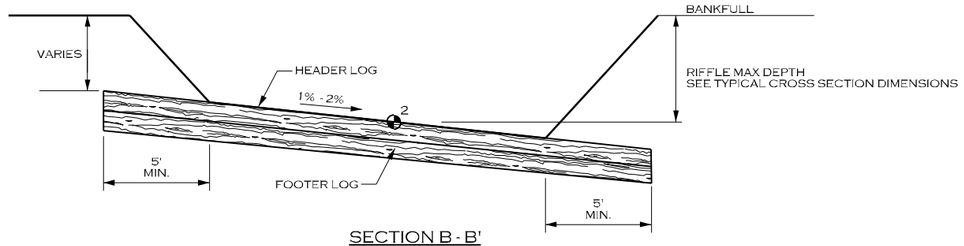


PLAN VIEW

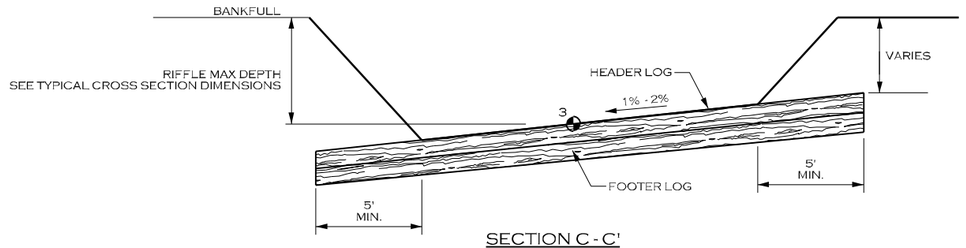
· ELEVATION POINT (SEE STRUCTURE TABLES)



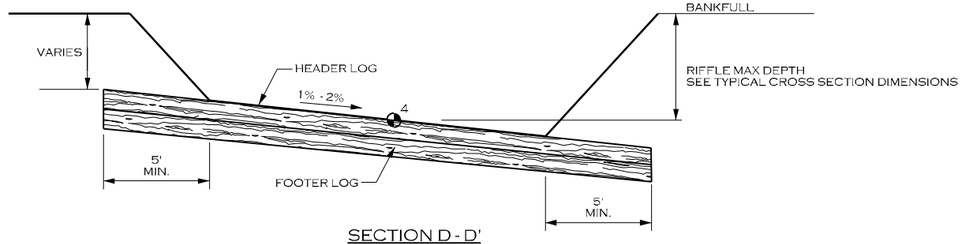
SECTION A - A'



SECTION B - B'



SECTION C - C'



SECTION D - D'

LOG ROLLER SPECIFICATIONS

MATERIALS:	SPECIFICATIONS:
RIFFLE BED MATERIAL	SEE CONSTRUCTED RIFFLE DETAIL
LOGS	TYPE: HARDWOOD SIZE: LENGTH = 2 X WBKF, 12" DIA. NUMBER OF HEADER LOGS: 1 NUMBER OF FOOTER LOGS: 1
FILTER FABRIC	TYPE: TYPE 2 NON-WOVEN WIDTH UPSTREAM: 6 FT MINIMUM

NOTES FOR LOG ROLLER STRUCTURES:

1. STRUCTURE DIMENSIONS AND MEASUREMENTS ARE SHOWN ON THE STRUCTURE TABLES SHEET. NUMBER OF LOGS MAY VARY.
2. LOGS SHOULD BE STRAIGHT, HARDWOOD, AND NOT ROTTEN.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOGS.
4. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
5. RIFFLE STATIONS AND ELEVATIONS (1 & 5) ARE SHOWN ON BOTH THE STRUCTURE TABLES FOR LOG ROLLERS AND CONSTRUCTED RIFFLES IF APPLICABLE.
6. NUMBER OF LOGS MAY VARY.

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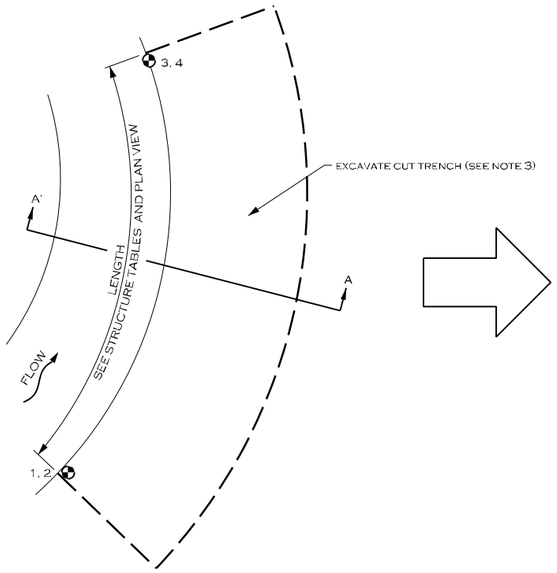
DWERS

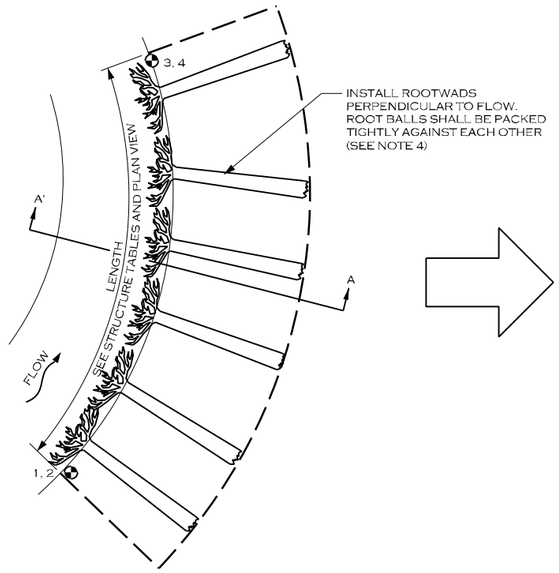
TOEWOOD WITH GEOLIFT (TW)

PROJECT # 104 | SHEET NO. 2E

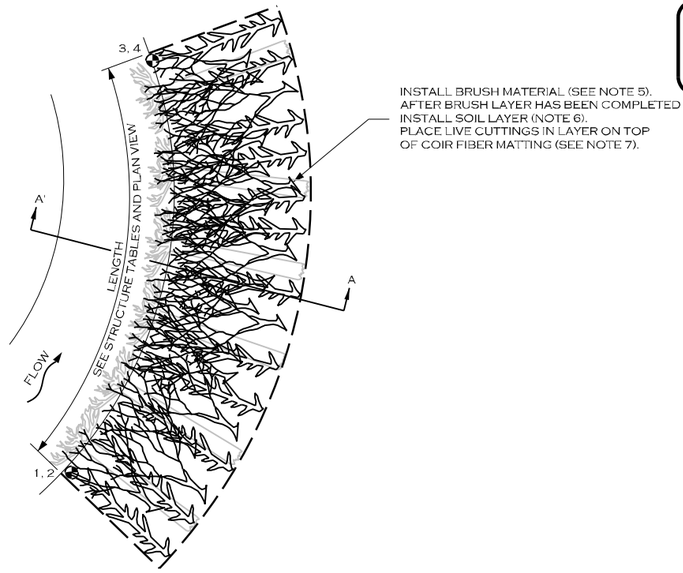
DETAILS



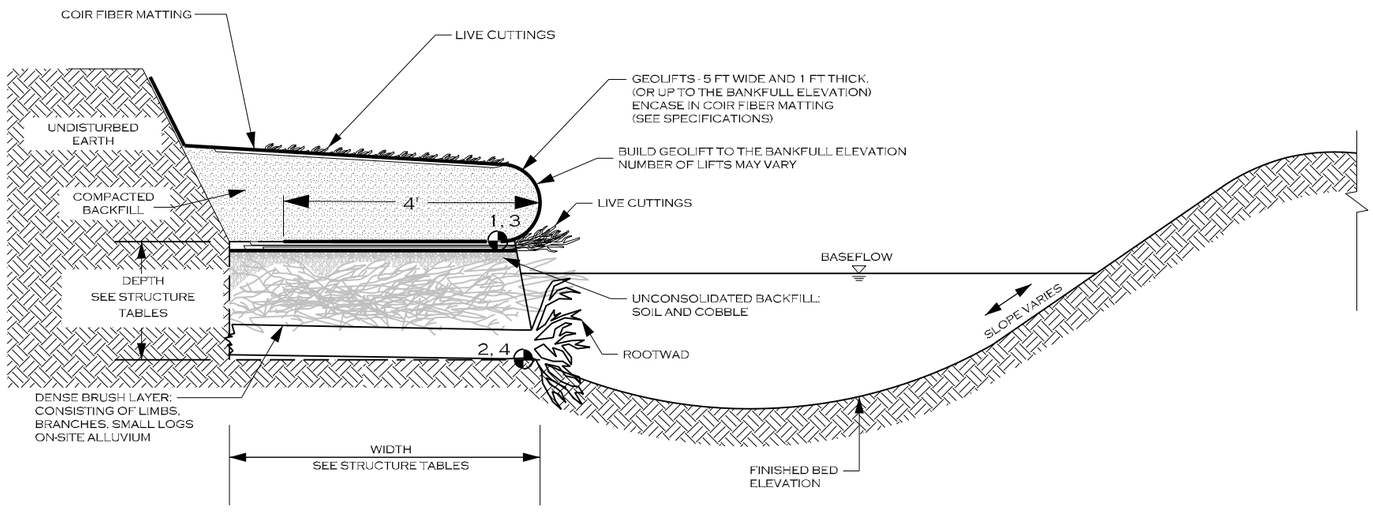
PLAN VIEW - 1
TRENCH EXCAVATION



PLAN VIEW - 2
ROOTWAD INSTALLATION



PLAN VIEW - 3
BRUSH LAYER INSTALLATION



SECTION VIEW

(#) - ELEVATION POINT (SEE STRUCTURE TABLES)

TOEWOOD SPECIFICATIONS

MATERIALS:	SPECIFICATIONS:
BRUSH MATERIAL	TYPE: BRUSH MATERIAL SIZE: MIN. 5 FT LONG, 1 INCH DIAMETER
ROOTWAD MATERIAL	TYPE: HARDWOOD SIZE: MIN. 6 FT LONG MIN. 12 INCH DIAMETER
COIR FIBER MATTING	SEE DETAIL

NOTES FOR TOEWOOD STRUCTURES:

1. STRUCTURE DIMENSIONS AND MEASUREMENTS ARE SHOWN ON THE STRUCTURE TABLES SHEET.
2. DIG A TRENCH ALONG BANK WHERE TOEWOOD IS TO BE INSTALLED TO THE DEPTH AND WIDTH SPECIFIED IN THE DETAILS AND STRUCTURE TABLES. IF TOEWOOD IS BEING PLACED IN A LOCATION WHERE THERE IS NOT EXISTING GROUND, PLACE FILL MATERIAL AND COMPACT TO FORM THE TRENCH FOR THE TOEWOOD MATERIALS.
3. EXCAVATE TRENCH BELOW TOEWOOD GRADE (PLAN VIEW 1). TO ELEVATION POINTS 2 AND 4.
4. INSTALL ROOTWADS PERPENDICULAR TO THE FLOW AS SHOWN IN PLAN VIEW 2.
5. INSTALL BRUSH MATERIAL INCLUDING BRANCHES, LOGS, AND BRUSH, OF AT LEAST 1"IN DIAMETER. LARGE AND SMALL MATERIALS SHALL BE MIXED, PLACED IN LAYERS NO MORE THAN 1 FOOT DEEP, COVERED IN A THIN LAYER OF ONSITE ALLUVIUM, AND COMPACTED BEFORE PLACING THE NEXT LAYER OF TOEWOOD MATERIAL. CONTINUE PLACING MATERIALS TO FORM A DENSE LAYER OF WOODY MATERIALS AND ONSITE ALLUVIUM TO THE DEPTH AND ELEVATIONS SPECIFIED (PLAN VIEW 3).
6. PLACE AN UNCONSOLIDATED LAYER OF SOIL AND COBBLE ON TOP OF BRUSH LAYER.
7. INSTALL LIVE CUTTINGS AT LEAST 5 FEET IN LENGTH.
8. CONSTRUCT GEOLIFTS OR PLACE TRANSPLANTS AS SPECIFIED OR DIRECTED BY THE ENGINEER TO REBUILD THE STREAMBANK ABOVE THE TOEWOOD LAYER.
9. ROOTWADS CAN BE REPLACED WITH LARGER LOGS TO FORM THE BRUSH FOUNDATION PER THE DIRECTION OF THE ENGINEER.
10. FOUNDATION CAN BE BUILT OUT OF CLASS B STONE IN LIEU OF BRUSH OR LOG MATERIAL, PER THE DIRECTION OF THE ENGINEER.

REVISIONS

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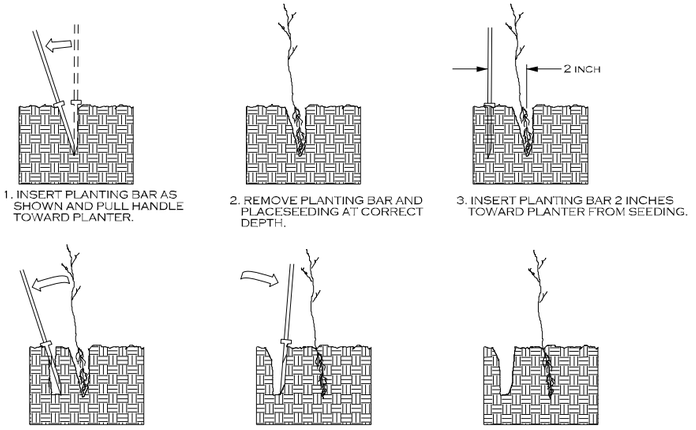
PROJECT # 104 | SHEET NO. 2F

DETAILS

DIBBLE PLANTING METHOD USING THE KBC PLANTING BAR



1. INSERT PLANTING BAR AS SHOWN AND PULL HANDLE TOWARD PLANTER.
2. REMOVE PLANTING BAR AND PLACESEEDING AT CORRECT DEPTH.
3. INSERT PLANTING BAR 2 INCHES TOWARD PLANTER FROM SEEDING.
4. PULL HANDLE OF BAR TOWARD PLANTER, FIRMING SOIL AT BOTTOM.
5. PUSH HANDLE FORWARD FIRMING SOIL AT TOP.
6. LEAVE COMPATION HOLE OPEN. WATER THOROUGHLY.

PLANTING NOTES:

PLANTING BAG

DURING PLANTING, SEEDLINGS SHALL BE KEPT IN A MOIST CANVAS BAG OR SIMILAR CONTAINER TO PREVENT THE ROOT SYSTEMS FROM DRYING.

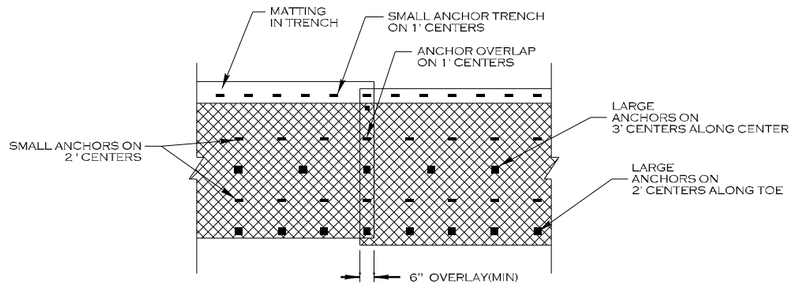
KBC PLANTING BAR

PLANTING BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS SECTION, AND SHALL BE 12 INCHES LONG, 4 INCHES WIDE AND 1 INCH THICK AT CENTER.

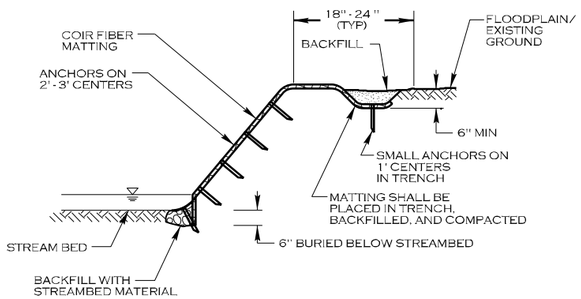
ROOT PRUNING

ALL SEEDLINGS SHALL BE ROOT PRUNED, IF NECESSARY, SO THAT NO ROOTS EXTEND MORE THAN 10 INCHES BELOW THE ROOT COLLAR.

COIR FIBER MATTING



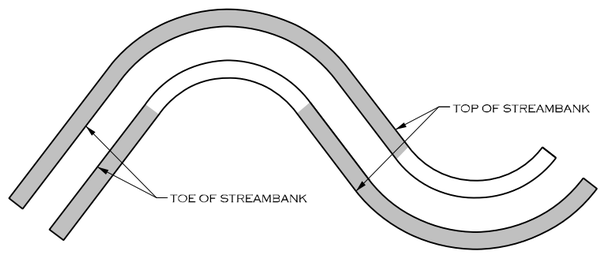
PLAN VIEW



TYPICAL CROSS SECTION

NOTES:

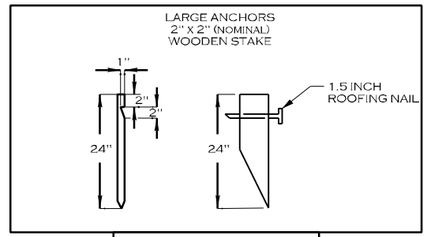
1. IN AREAS TO BE MATTED, ALL SEEDING, SOIL AMENDMENTS, AND SOIL PREPARATION MUST BE COMPLETED PRIOR TO PLACEMENT OF COIR FIBER MATTING.
2. ONLY POINT BARS ON THE "C" TYPE STREAMS WILL NOT BE MATTED AS SHOWN IN THE TYPICAL MATTING PLAN VIEW.



SEE PLAN VIEW SHEET FOR MATTING LOCATIONS

TYPICAL MATTING PLAN VIEW

ANCHOR OPTIONS



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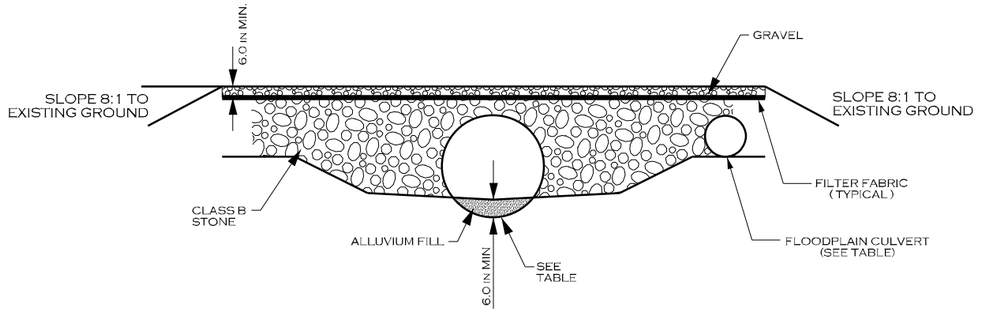
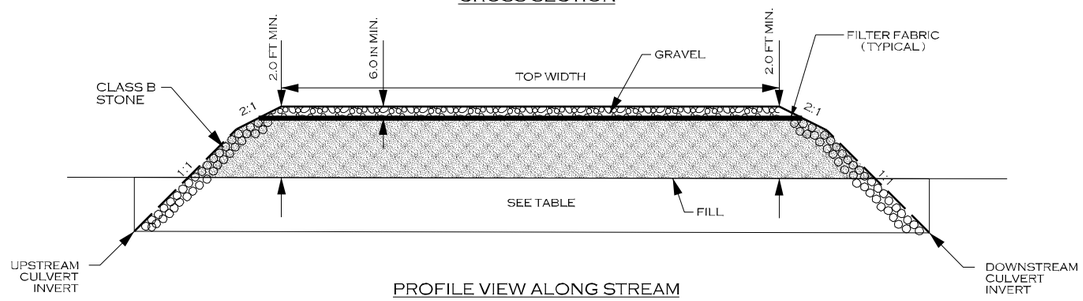
PROJECT # 104 | SHEET NO. 2G

DETAILS

CULVERT DETAIL



CROSS SECTION



PROFILE VIEW ALONG STREAM

VARIABLE	CULVERT UT1	CULVERT FLOODPLAIN
REQUIRED COVER DEPTH	2.0'	2.0'
UPSTREAM INVERT ELEV.	1112.9	1114.1
DOWNSTREAM INVERT ELEV.	1111.7	1112.9
UPSTREAM INVERT STA.	15+78	15+78
DOWNSTREAM INVERT STA.	16+08	16+08
FARM PATH ELEV.	1118.9	1118.9
PIPE SIZE	48''	18''
PIPE LENGTH	30'	30'
TOP WIDTH (FT)	16	16

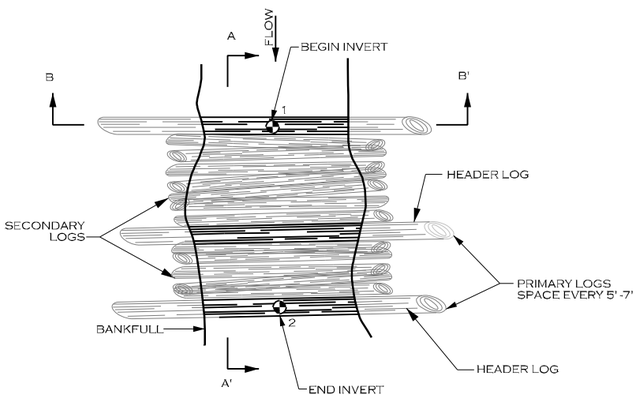
CULVERT SPECIFICATIONS

MATERIALS:	SPECIFICATIONS:
PIPE	TYPE: UT1 : REINFORCED CONCRETE PIPE TYPE: FLOODPLAIN: HDPE
GRAVEL	TYPE: CRUSHER RUN
FILL	TYPE: ON-SITE SOIL
FILTER FABRIC	TYPE: TYPE 2 NON-WOVEN

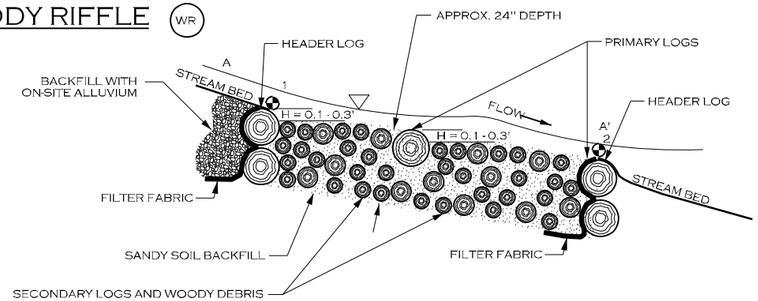
NOTES FOR CULVERT STRUCTURES:

1. STABILIZE FILL AROUND CULVERTS WITH CLASS B STONE. STABILIZE REMAINING ROAD SIDE SLOPES WITH EROSION MATTING ACCORDING TO SPECIFICATIONS.
2. ROADWAY TIE IN SLOPES 8:1 OR FLATTER. AS DIRECTED PER ENGINEER.
3. FILTER FABRIC AND GRAVEL SHALL BE INSTALLED ALONG THE FARM PATH FOR A MINIMUM DISTANCE OF 50 FEET.

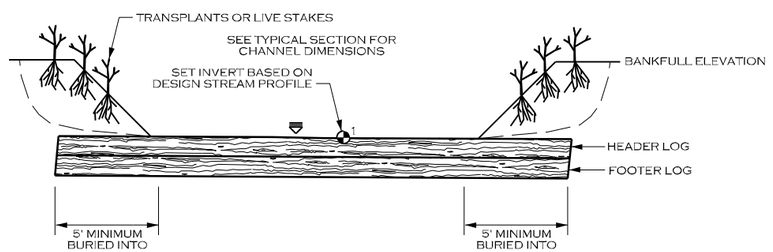
GRADE CONTROL WOODY RIFFLE (WR)



PLAN VIEW



SECTION A - A'



SECTION B - B'

NOTES:

1. PRIMARY LOGS SHOULD BE AT LEAST 10'' OR MORE IN DIAMETER, RELATIVELY STRAIGHT, AND RECENTLY HARVESTED AND EXTENDING INTO THE BANK 5' ON EACH SIDE.
2. SECONDARY LOGS SHOULD BE AT LEAST 1'' IN DIAMETER AND NO LARGER THAN 6'', AND EXTEND INTO THE BANK 2 FEET ON EACH SIDE. WOOD MATERIAL SHALL BE VARYING DIAMETER TO ALLOW MATERIAL TO BE COMPACTED.
3. COIR FIBER MATTING CAN BE USED INSTEAD OF TRANSPLANTS, PER DIRECTION OF ENGINEER.
4. AFTER TRENCH HAS BEEN EXCAVATED A LAYER OF SECONDARY LOGS AND WOODY DEBRIS SHOULD BE PLACED WITH MINIMAL GAPS. A LAYER OF ON-SITE ALLUVIUM SHOULD BE APPLIED TO FILL VOIDS BETWEEN SECONDARY LOGS BEFORE ADDITIONAL LAYERS ARE PLACED.
5. TYPE 2 NON-WOVEN FILTER FABRIC SHALL BE INSTALLED ON THE UPSTREAM AND DOWNSTREAM MOST PRIMARY LOGS AND EXTEND DOWN BELOW THE FOOTER LOGS AND UPSTREAM A MINIMUM OF 6 FEET.

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PROJECT # 104 | SHEET NO. 2H

DETAILS

LOG STEP (LS)

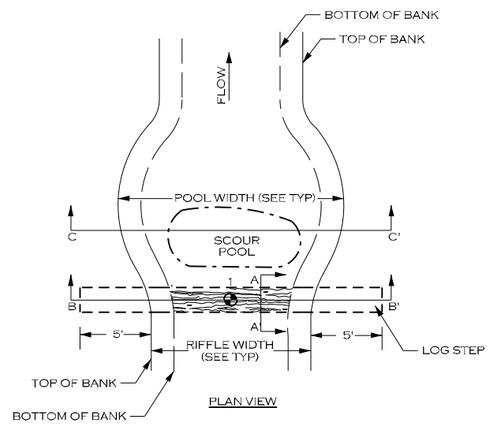
⊕ - ELEVATION POINT (SEE STRUCTURES TABLE)

LOG STEP SPECIFICATIONS

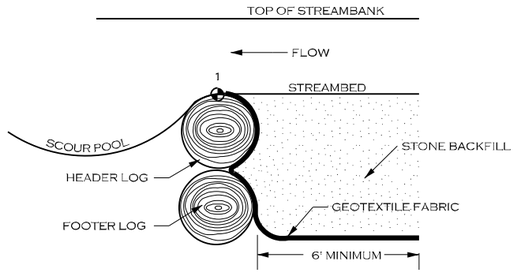
MATERIALS:	SPECIFICATIONS:	
LOGS	TYPE: SIZE: NUMBER OF HEADER LOGS: NUMBER OF FOOTER LOGS:	HARDWOOD 12 INCH Ø MIN. 1 1
FILTER FABRIC	TYPE: WIDTH UPSTREAM:	TYPE 2 NON-WOVEN 6 FT MINIMUM

NOTES FOR LOG STEP STRUCTURES:

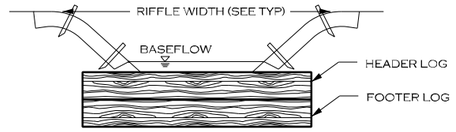
1. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. LOGS >24 INCHES IN DIAMETER MAY BE USED ALONE WITHOUT AN ADDITIONAL LOG.
3. USE GEOTEXTILE FABRIC TO SEAL GAPS BETWEEN LOGS.
4. INSTALL STONE BACKFILL AS SHOWN, TO THE DIMENSIONS INDICATED IN THE STRUCTURES TABLE SHEET.
5. PLACE TRANSPLANTS FROM TOE OF STREAMBANK TO TOP OF STREAMBANK, (IF AVAILABLE)
6. TRANSPLANTS CAN BE SUBSTITUTED WITH COIR FIBER MATTING AT THE DIRECTION OF THE ENGINEER.



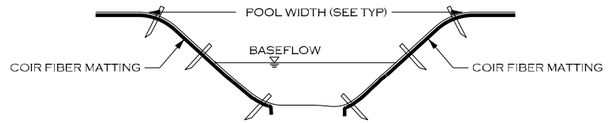
PLAN VIEW



SECTION A-A'



SECTION B-B'



SECTION C-C'

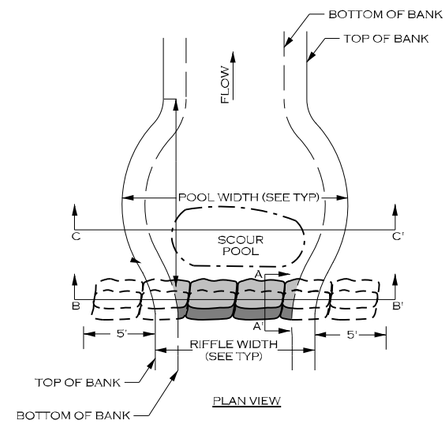
ROCK STEP (RS)

ROCK STEP SPECIFICATIONS

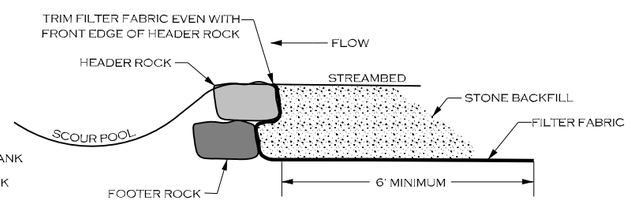
MATERIALS:	SPECIFICATIONS:	
BOULDER	TYPE: SIZE:	GRANITE OR COMPARABLE 3 FT X 2 FT X 1 FT
FILTER FABRIC	TYPE: WIDTH UPSTREAM:	TYPE 2 NON-WOVEN 6 FT MINIMUM

NOTES FOR ROCK STEP STRUCTURES:

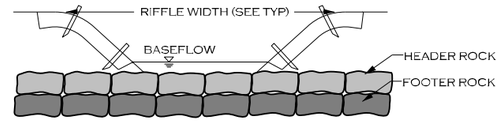
1. DIG A TRENCH BELOW THE STREAM BED FOR FOOTER AND HEADER ROCKS, FILTER FABRIC AND STONE BACKFILL.
2. PLACE FOOTER ROCKS AND THEN HEADER ROCKS TO ACHIEVE DESIGN DIMENSIONS AND ELEVATIONS.
3. USE HAND PLACED STONE TO FILL GAPS AND VOIDS ON UPSTREAM SIDE OF THE HEADER AND FOOTER ROCKS.
4. PLACE FILTER FABRIC BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTENDING DOWN TO THE DEPTH OF THE FOOTER ROCKS, THEN OUTWARD 6 FEET.
5. INSTALL STONE BACKFILL AS SHOWN, TO THE DIMENSIONS INDICATED IN THE STRUCTURES TABLE SHEET.
6. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ONSITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.
7. PLACE TRANSPLANTS FROM TOE OF STREAMBANK TO TOP OF STREAMBANK, IF AVAILABLE.
8. TRANSPLANTS CAN BE SUBSTITUTED WITH COIR FIBER MATTING AT THE DIRECTION OF THE ENGINEER.



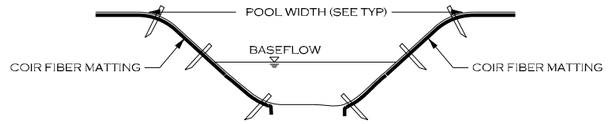
PLAN VIEW



SECTION A-A'



SECTION B-B'



SECTION C-C'

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

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

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

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

PROJECT ENGINEER

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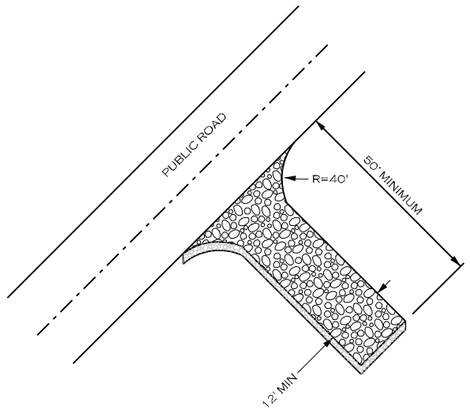
BWERS

PROJECT # 104 | SHEET NO. 21

DETAILS

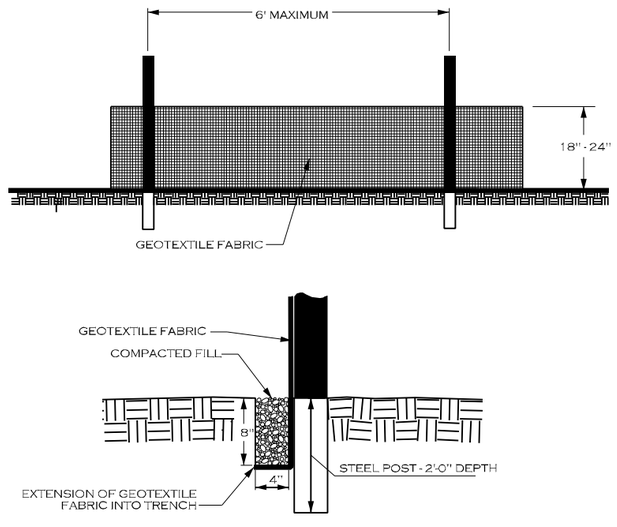
GRAVEL CONSTRUCTION ENTRANCE



NOTES:

1. PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE EXPECTED EQUIPMENT.
2. LOCAL ENTRANCES TO PROVIDE FOR UTILIZATION BY ALL CONSTRUCTION VEHICLES.
3. PLACE GEOTEXTILE FABRIC FOR DRAINAGE BENEATH STONE.
4. MUST BE MAINTAINED IN THE CONDITION WHICH WILL PREVENT TRACKING OR DIRECT MUD INTO STREETS.
5. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED UP IMMEDIATELY.
6. LOCAL GRAVEL CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS TO THE ENTRANCE AND TIMELY MAINTENANCE.
7. NUMBER AND LOCATION OF CONSTRUCTION ENTRANCES AS SHOWN ON PLANS, OR AS DIRECTED BY THE ENGINEER.
8. USE CLASS "A" STONE OR OTHER COURSE AGGREGATE APPROVED BY THE ENGINEER.
9. INSTALL CONSTRUCTION ENTRANCES IN A WAY TO PREVENT VEHICLES LEAVING THE PROJECT SITE FROM BYPASSING CONSTRUCTION ENTRANCES.

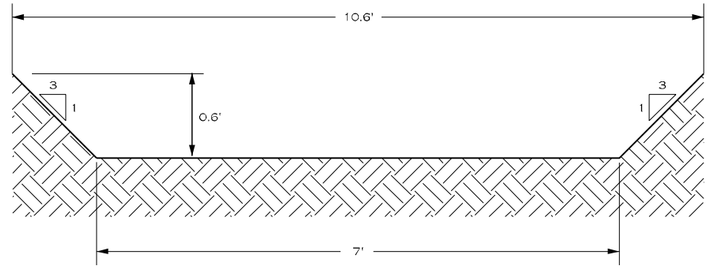
TEMPORARY SILT FENCE



NOTES:

1. USE GEOTEXTILE FABRIC A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE STEEL POSTS.
2. PROVIDE 5' STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE.
3. REMOVE ONCE AREA IS STABLE.

VEGETATED SWALE



NOTES:

1. LINE SIDE SLOPES AND BOTTOM WITH COIR FIBER MATTING.
2. SWALE SHALL BE PLANTED WITH TEMPORARY AND PERMANENT SEEDING.
3. TRANSITIONS TO NATURAL GROUND FROM THE STREAM CHANNELS SHALL BE GRADUAL AND AT THE DIRECTION OF THE ENGINEER.

REVISIONS

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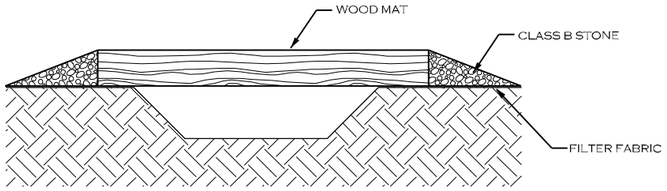
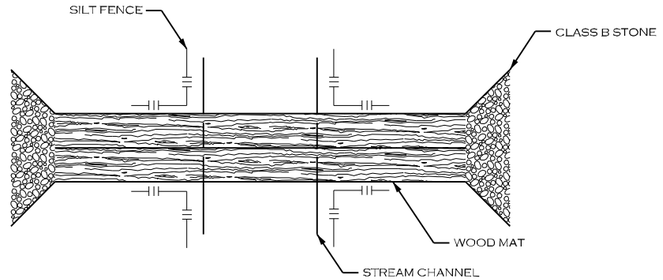
PROJECT # 104 | SHEET NO. 2J

DETAILS

TEMPORARY STREAM CROSSING - WOOD MAT



CROSS SECTION

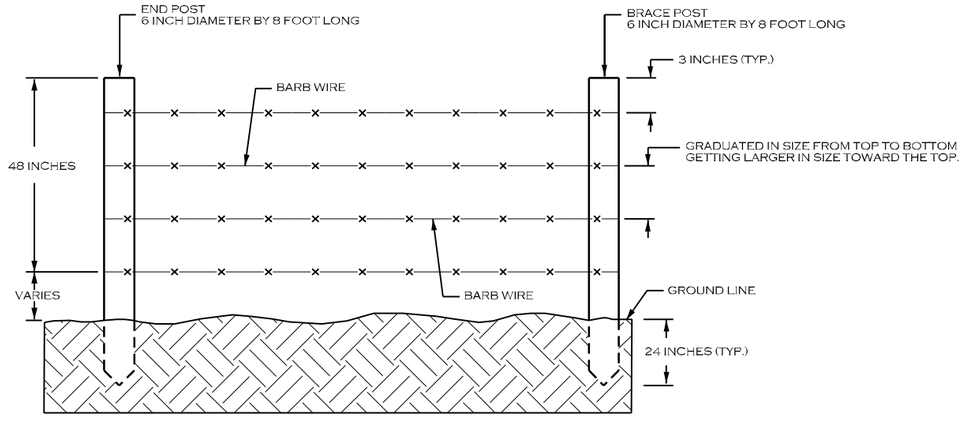


PLAN VIEW

NOTES:

1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
2. HAVE ALL NECESSARY MATERIALS AND EQUIPMENT ON-SITE BEFORE WORK BEGINS.
3. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM.
4. LINE STREAMBANK AND ACCESS RAMP AREA WITH FILTER FABRIC.
5. INSTALL STREAM CROSSING AT RIGHT ANGLE TO THE FLOW.
6. TRANSPLANT SOD FROM ORIGINAL STREAMBANK ONTO SIDE SLOPES FOR LATER USE.
7. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL. BY INSTALLING SILT FENCE ON ALL FOUR CORNERS ADJACENT TO THE STREAM. SEE SILT FENCE DETAIL.
8. STABILIZE AN ACCESS RAMP OF CLASS B STONE TO THE EDGE OF THE WOOD MAT.
9. THE WOOD MAT SHALL BE OF SUFFICIENT SIZE AND WIDTH TO SUPPORT THE LARGEST VEHICLE CROSSING THE CHANNEL.
10. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED. RECOMMENDED AT A 5:1 SLOPE.

BARB WIRE FIELD FENCE



NOTES:

1. END POSTS SHALL BE INSTALLED AT A SPACING OF 10-15 FEET.

REVISIONS

NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

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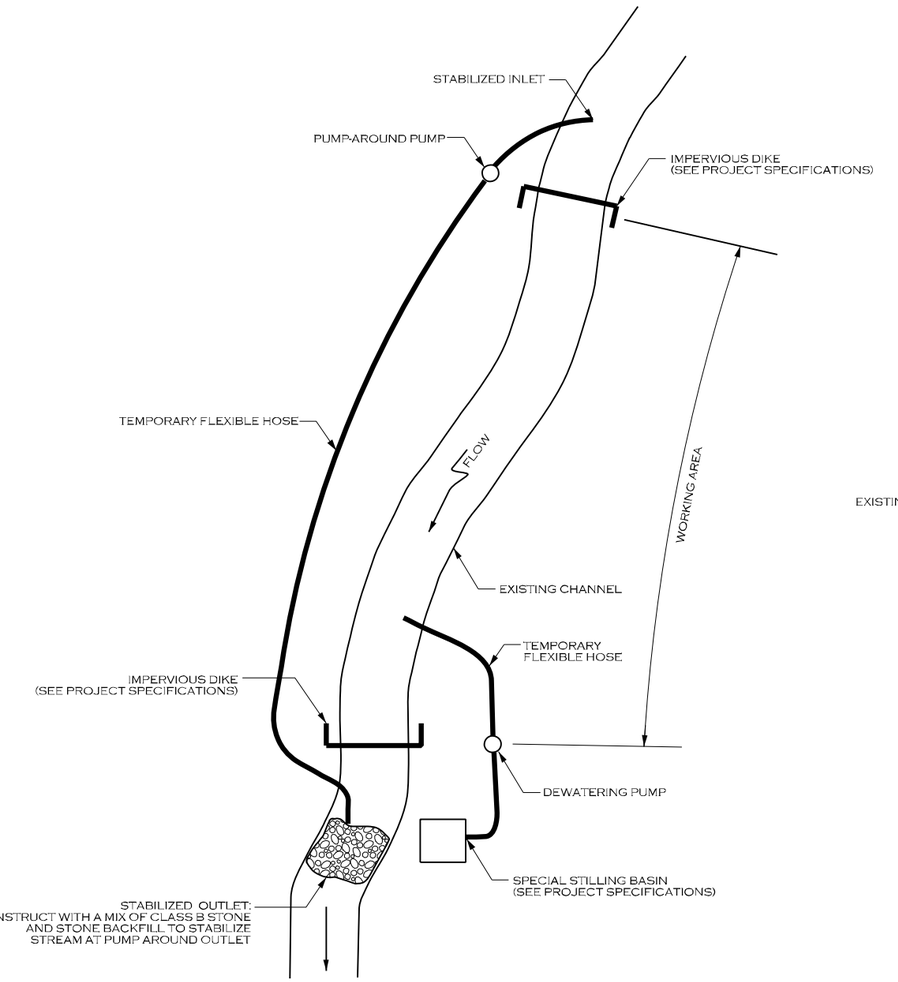
PROJECT # 104 | SHEET NO. 2K

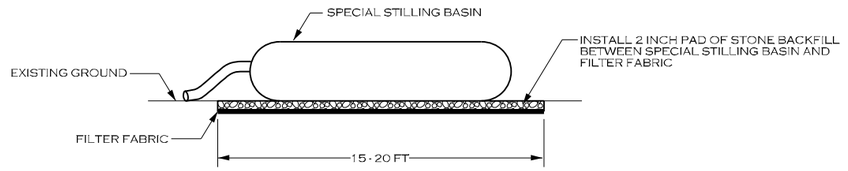
DETAILS

TEMPORARY PUMP - AROUND OPERATION



NOTES:

1. EXCAVATION SHALL BE PERFORMED IN ONLY DRY SECTIONS OF CHANNEL.
2. IMPERVIOUS DIKES SHOULD BE USED TO ISOLATE WORK AREAS FROM STREAM FLOW.
3. THE CONTRACTOR SHALL NOT DISTURB MORE AREA THAN CAN BE STABILIZED IN ONE WORKING DAY.
4. THE PUMP-AROUND PUMP SHOULD ADEQUATELY CONVEY BASEFLOW.



SEQUENCE OF CONSTRUCTION FOR TEMPORARY PUMP - AROUND OPERATION

1. INSTALL STABILIZED OUTLET AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR WILL INSTALL THE PUMP AROUND PUMP AND THE TEMPORARY FLEXIBLE HOSE THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK SITE TO THE SPECIAL STILLING BASIN OR STABILIZED OUTLET.
3. INSTALL UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. INSTALL THE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS IF NEEDED TO DEWATER THE ENTRAPPED AREA. THE PUMP AND HOSE FOR THIS PURPOSE SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. THIS WATER WILL FLOW INTO A SPECIAL STILLING BASIN.
5. THE CONTRACTOR WILL PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLAN AND FOLLOWING THE GENERAL CONSTRUCTION SEQUENCE.
6. THE CONTRACTOR WILL EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF THE IMPERVIOUS DIKE. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE STARTING WITH THE DOWNSTREAM DIKE FIRST.
7. THE CONTRACTOR WILL COMPLETE ALL GRADING AND STABILIZATION IN ONE DAY WITHIN THE PUMP AROUND AREA BETWEEN THE IMPERVIOUS DIKES.
8. ONCE THE WORKING AREA IS COMPLETED, REMOVE THE SPECIAL STILLING BASIN AND STABILIZED OUTLET AND STABILIZE DISTURBED AREAS WITH SEED AND MULCH.

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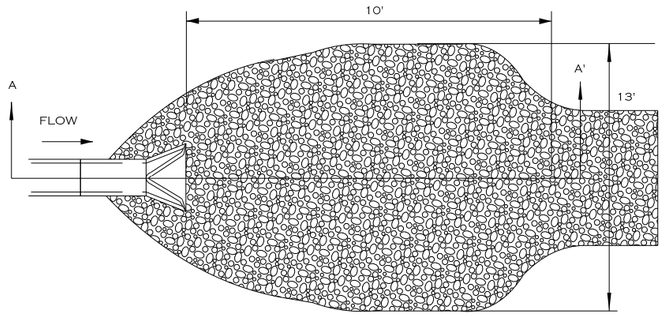
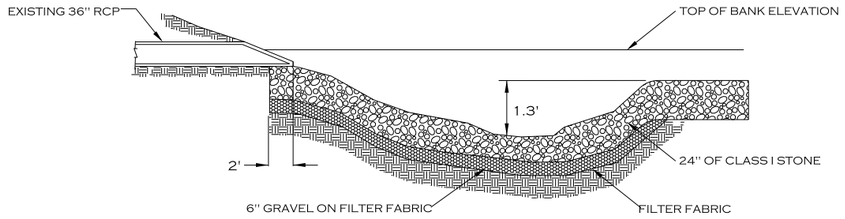
PROJECT # 104 | SHEET NO. 2L

DETAILS

RIP RAP PLUNGE POOL #1
N.T.S.



PLAN

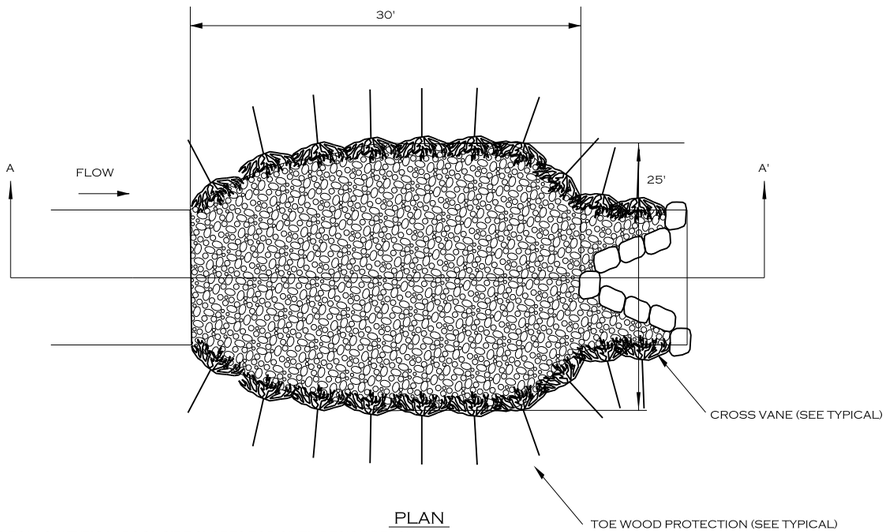


SECTION A-A'

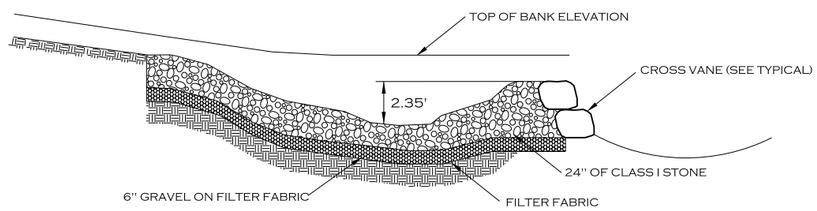
NOTE:

1. FOR POOL CROSS SECTION SHAPE, FOLLOW TYPICAL POOL SIDE SLOPES FOR GIVEN DESIGN REACH.

RIP RAP PLUNGE POOL #2
N.T.S.



PLAN



SECTION A-A'

NOTE:

1. FOR POOL CROSS SECTION SHAPE, FOLLOW TYPICAL POOL SIDE SLOPES FOR GIVEN DESIGN REACH. SEE PLUNGE POOL TYPICAL DETAIL #2

REVISIONS

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STRUCTURE TABLES - UT1, UT1A, AND UT1B

TABLES

Rock Step Structures - UT1 Reach 1

Structure #	Station (ft) at Invert	Elevation (ft) at Invert
RS-1	10+38.10	1130.35
RS-2	10+69.80	1129.30
RS-3	11+79.20	1126.20
RS-4	13+30.40	1121.70
RS-5	13+84.00	1120.10
RS-6	17+22.80	1107.80
RS-7	18+09.50	1105.50

Rock Step Structures - UT1A

Structure #	Station (ft) at Invert	Elevation (ft) at Invert
RS-8	10+02.00	1106.39
RS-9	10+09.00	1105.27
RS-10	10+16.00	1104.19
RS-11	10+25.00	1102.77
RS-12	10+34.00	1101.37
RS-13	12+87.00	1096.38

Rock Step Structures - UT1B

Structure #	Station (ft) at Invert	Elevation (ft) at Invert
RS-14	10+10.00	1097.44
RS-15	10+16.50	1096.68
RS-16	10+23.00	1095.92
RS-17	10+29.50	1095.15
RS-18	10+36.00	1094.39
RS-19	10+42.50	1093.63

Rock Cross Vane Structures - UT1 Reach 1

Structure #	Arm			Sill	Invert	Station (ft)	Elevation (ft)						
	Length (ft)	Angle (deg)	Slope (%)	Length (ft)	Length (ft)	At Pt 4	Pt 1	Pt 2	Pt 3	Pt 4	Pt 5	Pt 6	Pt 7
CV-1	6.5	22	5.4%	4.0	1.3	10+20.20	1131.25	1131.25	1130.90	1130.90	1130.90	1131.25	1131.25
CV-2	6.5	22	5.4%	4.0	1.3	11+21.50	1128.10	1128.10	1127.75	1127.75	1127.75	1128.10	1128.10
CV-3	6.5	22	5.4%	4.0	1.3	12+34.60	1124.80	1124.80	1124.45	1124.45	1124.45	1124.80	1124.80
CV-4	6.5	22	5.4%	4.0	1.3	15+14.30	1116.05	1116.05	1115.70	1115.70	1115.70	1116.05	1116.05
CV-5	6.5	22	5.4%	4.0	1.3	15+51.50	1114.70	1114.70	1114.35	1114.35	1114.35	1114.70	1114.70
CV-6	6.5	22	5.4%	4.0	1.3	17+49.10	1107.45	1107.45	1107.10	1107.10	1107.10	1107.45	1107.45
CV-7	6.5	22	5.4%	4.0	1.3	18+29.30	1105.25	1105.25	1104.90	1104.90	1104.90	1105.25	1105.25

Rock Cross Vane Structures - UT1 Reach 3

Structure #	Arm			Sill	Invert	Station (ft)	Elevation (ft)						
	Length (ft)	Angle (deg)	Slope (%)	Length (ft)	Length (ft)	At Pt 4	Pt 1	Pt 2	Pt 3	Pt 4	Pt 5	Pt 6	Pt 7
CV-8	7.9	22	5.1%	4.0	1.7	19+50.40	1098.40	1098.40	1098.00	1098.00	1098.00	1098.40	1098.40
CV-9	7.9	22	5.1%	4.0	1.7	20+01.10	1097.70	1097.70	1097.30	1097.30	1097.30	1097.70	1097.70
CV-10	7.9	22	5.1%	4.0	1.7	30+01.70	1082.50	1082.50	1082.10	1082.10	1082.10	1082.50	1082.50

Log Vane Structures - UT1 Reach 3

Structure #	Arm			Station (ft) at Pt 2	Elevation (ft)	
	Length (ft)	Angle (deg)	Slope (%)		Pt 2	Pt 1
LV-1	7.9	22°	5.1%	21+97.60	1094.75	1095.15
LV-2	7.9	22°	5.1%	22+84.40	1093.68	1094.08
LV-3	7.9	22°	5.1%	23+70.20	1092.60	1093.00
LV-4	7.9	22°	5.1%	24+72.80	1091.35	1091.75
LV-5	7.9	22°	5.1%	25+13.40	1090.85	1091.25
LV-6	7.9	22°	5.1%	26+04.30	1089.50	1089.90
LV-7	7.9	22°	5.1%	26+52.30	1088.70	1089.10
LV-8	7.9	22°	5.1%	27+32.30	1087.45	1087.85

Log J-Hook Vane Structures - UT1 Reach 1

Structure #	Sill Length (ft)	Outside Arm			Invert Length (ft)	Inside Arm			Station (ft)	Elevation (ft)		
		Length (ft)	Angle (deg)	Slope (%)		Length (ft)	Angle (deg)	Slope (%)	At Pt 2	Pt 1	Pt 2	Pt 3
JV-1	4.0	6.5	22.0	5.4%	1.3	3.0	22.0	2.0%	11+46.40	1127.45	1127.10	1127.16
JV-2	4.0	6.5	22.0	5.4%	1.3	3.0	22.0	2.0%	11+97.50	1125.95	1125.60	1125.66
JV-3	4.0	6.5	22.0	5.4%	1.3	3.0	22.0	2.0%	12+62.60	1123.95	1123.60	1123.66
JV-4	4.0	6.5	22.0	5.4%	1.3	3.0	22.0	2.0%	12+99.10	1122.90	1122.55	1122.61
JV-5	4.0	6.5	22.0	5.4%	1.3	3.0	22.0	2.0%	13+57.00	1121.20	1120.85	1120.91
JV-6	4.0	6.5	22.0	5.4%	1.3	3.0	22.0	2.0%	14+07.10	1119.75	1119.40	1119.46
JV-7	4.0	6.5	22.0	5.4%	1.3	3.0	22.0	2.0%	14+58.50	1118.15	1117.80	1117.86
JV-8	4.0	6.5	22.0	5.4%	1.3	3.0	22.0	2.0%	16+34.90	1111.65	1111.30	1111.36
JV-9	4.0	6.5	22.0	5.4%	1.3	3.0	22.0	2.0%	16+59.10	1110.70	1110.35	1110.41
JV-10	4.0	6.5	22.0	5.4%	1.3	3.0	22.0	2.0%	17+81.30	1106.55	1106.20	1106.26

Log J-Hook Vane Structures - UT1 Reach 3

Structure #	Sill Length (ft)	Outside Arm			Invert Length (ft)	Inside Arm			Station (ft)	Elevation (ft)		
		Length (ft)	Angle (deg)	Slope (%)		Length (ft)	Angle (deg)	Slope (%)	At Pt 2	Pt 1	Pt 2	Pt 3
JV-11	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	20+31.50	1097.25	1096.85	1096.92
JV-12	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	20+59.70	1096.85	1096.45	1096.52
JV-13	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	20+95.00	1096.45	1096.05	1096.12
JV-14	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	21+42.20	1095.85	1095.45	1095.52
JV-15	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	22+33.20	1094.68	1094.28	1094.35
JV-16	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	23+12.50	1093.75	1093.35	1093.42
JV-17	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	24+08.10	1092.58	1092.18	1092.25
JV-18	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	25+51.90	1090.75	1090.35	1090.42
JV-19	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	26+85.20	1088.60	1088.20	1088.27
JV-20	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	27+74.60	1087.20	1086.80	1086.87
JV-21	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	28+23.30	1086.40	1086.00	1086.07
JV-22	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	28+67.50	1085.50	1085.10	1085.17
JV-23	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	29+16.80	1084.45	1084.05	1084.12
JV-24	4.0	7.9	22.0	5.1%	1.7	3.7	22.0	2.0%	29+61.90	1083.45	1083.05	1083.12

Toe-Wood Protection Structures - UT1 Reach 1

Structure #	Toe Wood Dimensions					
	Begin Station (ft)	End Station (ft)	STA Length (ft)	Bank Length (ft)	Width (ft)	Depth (ft)
TW-1	10+38.19	10+48.87	10.7	11.3	4.0	1.5
TW-2	11+56.48	11+64.96	8.5	8.9	4.0	1.5
TW-3	16+42.98	16+49.15	6.2	6.2	4.0	1.5

Toe-Wood Protection Structures - UT1 Reach 3

Structure #	Toe Wood Dimensions					
	Begin Station (ft)	End Station (ft)	STA Length (ft)	Bank Length (ft)	Width (ft)	Depth (ft)
TW-4 (RB)	19+19.00	19+54.36	35.4	41.7	4.0	1.5
TW-5 (LB)	19+19.00	19+54.36	35.4	35.6	4.0	1.5
TW-6	20+63.26	20+78.51	15.3	19.1	4.0	1.5
TW-7	21+00.83	21+22.63	21.8	26.2	4.0	1.5
TW-8	21+48.64	21+66.43	17.8	21.5	4.0	1.5
TW-9	21+94.29	22+13.46	19.2	24.0	4.0	1.5
TW-10	22+39.41	22+54.99	15.6	19.6	4.0	1.5
TW-11	22+82.81	23+00.39	17.6	22.0	4.0	1.5
TW-12	23+18.15	23+41.60	23.4	28.6	4.0	1.5
TW-13	23+66.49	23+87.92	21.4	26.8	4.0	1.5
TW-14	24+09.52	24+34.03	24.5	29.7	4.0	1.5
TW-15	24+69.12	24+94.56	25.4	31.4	4.0	1.5
TW-16	25+11.13	25+35.55	24.4	30.6	4.0	1.5
TW-17	25+49.28	25+72.31	23.0	28.9	4.0	1.5
TW-18	26+02.29	26+26.49	24.2	29.2	4.0	1.5
TW-19	26+81.73	27+09.36	27.6	34.4	4.0	1.5
TW-20	28+63.07	28+91.24	28.2	34.1	4.0	1.5
TW-21	29+54.81	29+79.99	25.2	27.9	4.0	1.5

Constructed Riffle Structures - UT1 Reach 1

Structure #	Point 1		Point 2		Bottom Width	Length	Slope
	Station	Elevation	Station	Elevation			
CR-1	10+10.00	1131.30	10+18.38	1130.97	4.6	8.4	3.92%
CR-2	10+31.10	1130.60	10+36.19	1130.42	4.6	5.1	3.57%
CR-3	10+48.80	1130.10	10+68.03	1129.37	4.6	19.2	3.81%
CR-4	10+88.60	1128.95	11+09.80	1128.18	4.6	21.2	3.65%
CR-5	11+38.30	1127.40	11+45.23	1127.14	4.6	6.9	3.70%
CR-6	11+64.40	1126.75	11+77.47	1126.26	4.6	13.1	3.72%
CR-7	11+89.90	1125.90	11+96.18	1125.65	4.6	6.3	3.95%
CR-8	12+13.00	1125.25	12+32.95	1124.51	4.6	20.0	3.70%
CR-9	12+50.00	1124.10	12+61.37	1123.65	4.6	11.4	3.97%
CR-10	12+78.70	1123.30	12+97.53	1122.61	4.6	18.8	3.68%
CR-11	13+13.10	1122.30	13+28.41	1121.77	4.6	15.3	3.47%
CR-12	13+40.80	1121.45	13+55.36	1120.91	4.6	14.6	3.70%
CR-13	13+71.50	1120.55	13+81.87	1120.18	4.6	10.4	3.60%
CR-14	13+93.70	1119.90	14+05.10	1119.47	4.6	11.4	3.73%
CR-15	14+18.40	1119.15	14+27.10	1118.85	4.6	8.7	3.45%
CR-16	14+36.40	1118.65	14+56.70	1117.87	4.6	20.3	3.85%
CR-17	14+68.80	1117.55	14+87.90	1116.75	4.6	19.1	4.19%
CR-18	14+97.70	1116.40	15+12.12	1115.79	4.6	14.4	4.22%
CR-19	15+28.50	1115.35	15+49.31	1114.45	4.6	20.8	4.35%
CR-20	15+62.50	1114.00	15+78.40	1113.40	4.6	15.9	3.77%
CR-21	16+18.60	1111.90	16+32.95	1111.37	4.6	14.4	3.68%
CR-22	16+44.70	1110.95	16+56.42	1110.46	4.6	11.7	4.17%
CR-23	16+69.90	1110.00	16+90.90	1109.10	4.6	21.0	4.29%
CR-24	17+00.00	1108.70	17+20.90	1107.88	4.6	20.9	3.95%
CR-25	17+29.40	1107.65	17+47.18	1107.15	4.6	17.8	2.79%
CR-26	17+60.60	1106.80	17+79.37	1106.26	4.6	18.8	2.90%
CR-27	17+91.90	1106.00	18+07.49	1105.56	4.6	15.6	2.84%
CR-28	18+15.00	1105.30	18+27.27	1104.96	4.6	12.3	2.80%

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PROJECT # 104 | SHEET NO. 3A

TABLES

STRUCTURE TABLES - UT1, UT1A, AND UT1B

Constructed Riffle Structures - UT1 Reach 3

Structure #	Point 1		Point 2		Bottom Width	Length	Slope
	Station	Elevation	Station	Elevation			
CR-29	19+61.10	1097.90	19+99.03	1097.33	5.0	37.9	1.50%
CR-30	20+12.30	1097.15	20+29.34	1096.88	5.0	17.0	1.56%
CR-31	20+40.80	1096.75	20+57.67	1096.48	5.0	16.9	1.59%
CR-32	20+78.90	1096.30	20+93.11	1096.08	5.0	14.2	1.55%
CR-33	21+22.40	1095.78	21+40.13	1095.48	5.0	17.7	1.64%
CR-34	23+00.00	1093.55	23+10.42	1093.38	5.0	10.4	1.60%
CR-35	24+94.60	1091.18	25+11.38	1090.89	5.0	16.8	1.73%
CR-36	25+36.30	1090.65	25+50.00	1090.39	5.0	13.7	1.92%
CR-37	26+72.10	1088.50	26+82.73	1088.26	5.0	10.6	2.29%
CR-38	27+56.90	1087.15	27+72.65	1086.84	5.0	15.8	1.98%
CR-39	28+91.90	1084.70	29+14.03	1084.12	5.0	22.1	2.61%
CR-40	29+38.10	1083.65	29+59.61	1083.11	5.0	21.5	2.52%
CR-41	29+81.20	1082.60	29+98.98	1082.17	5.0	17.8	2.44%

Constructed Riffle Structures - UT1A

Structure #	Point 1		Point 2		Bottom Width	Length	Slope
	Station	Elevation	Station	Elevation			
CR-42	10+38.00	1100.78	10+48.00	1100.14	2.4	10.0	6.40%
CR-43	11+50.00	1099.09	11+63.00	1098.89	2.4	13.0	1.54%
CR-44	11+68.00	1098.80	11+77.00	1098.60	2.4	9.0	2.22%
CR-45	11+86.00	1098.45	11+95.00	1098.25	2.4	9.0	2.22%
CR-46	12+03.00	1098.10	12+11.00	1097.93	2.4	8.0	2.12%
CR-47	12+16.00	1097.80	12+24.00	1097.60	2.4	8.0	2.50%
CR-48	12+36.00	1097.45	12+43.00	1097.25	2.4	7.0	2.86%
CR-49	12+48.00	1097.15	12+57.00	1097.00	2.4	9.0	1.67%
CR-50	12+62.00	1096.90	12+73.00	1096.65	2.4	11.0	2.27%
CR-51	12+78.00	1096.55	12+86.00	1096.40	2.4	8.0	1.89%

Constructed Riffle Structures - UT1B

Structure #	Point 1		Point 2		Bottom Width	Length	Slope
	Station	Elevation	Station	Elevation			
CR-52	10+50.00	1092.75	10+60.00	1092.45	2.4	10.0	3.00%
CR-53	10+65.00	1092.30	10+79.00	1091.89	2.4	14.0	2.93%
CR-54	10+84.00	1091.74	10+98.00	1091.32	2.4	14.0	3.00%
CR-55	11+12.00	1090.91	11+29.00	1090.40	2.4	17.0	3.00%
CR-56	11+44.00	1089.96	11+52.00	1089.72	2.4	8.0	3.00%
CR-57	11+66.00	1089.30	11+76.00	1089.20	2.4	10.0	1.00%
CR-58	11+85.00	1089.20	11+95.00	1089.10	2.4	10.0	1.00%
CR-59	12+07.00	1089.10	12+32.47	1088.94	2.4	25.5	0.63%

Woody Riffle Structures - UT1 Reach 3

Structure #	Point 1		Point 2		Bottom Width	Length	Slope
	Station	Elevation	Station	Elevation			
WR-1	21+67.20	1095.25	21+95.59	1094.78	5.0	28.4	1.64%
WR-2	22+13.80	1094.60	22+31.11	1094.31	5.0	17.3	1.68%
WR-3	22+55.30	1094.15	22+83.01	1093.70	5.0	27.7	1.63%
WR-4	23+42.20	1093.10	23+68.72	1092.63	5.0	26.5	1.79%
WR-5	23+88.90	1092.50	24+06.31	1092.21	5.0	17.4	1.69%
WR-6	24+34.80	1092.00	24+71.07	1091.38	5.0	36.3	1.71%
WR-7	25+73.60	1090.10	26+02.27	1089.54	5.0	28.7	1.95%
WR-8	26+25.10	1089.25	26+50.46	1088.74	5.0	25.4	2.02%
WR-9	27+11.80	1087.90	27+30.23	1087.50	5.0	18.4	2.20%
WR-10	27+94.90	1086.50	28+20.61	1086.05	5.0	25.7	1.76%
WR-11	28+41.50	1085.70	28+64.65	1085.17	5.0	23.2	2.31%

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GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

PREPARED IN THE OFFICE OF:

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VEGETATION SELECTION

PROJECT # 104 | SHEET NO. 3B

TABLES

Trees and Shrubs			
The following table lists bare-root vegetation selection for the project site. Species shall be planted at a total density of 702 stems per acre. Total planting area is approximately 6.34 acres. Exact placement of species will be determined prior to site planting.			
Common Name	**Scientific Name**	**Percent Planted by Species**	**Wetness Tolerance**
Trees (75%) Planted 9' X 9' Spacing – 538 Trees/ Acre			
River Birch	*Betula nigra*	20%	FACW
Sycamore	*Platanus occidentalis*	20%	FACW
Water Oak	*Quercus nigra*	10%	FAC
American Elm	*Ulmus americana*	10%	FACW
Persimmon	*Diospryos virginiana*	10%	FAC
Willow Oak	*Quercus phellos*	10%	FAC
Tulip Poplar	*Liriodendron tulipifera*	20%	FAC
	Tree Total	100%	
Shrubs (25%) Planted 16' X 16' Spacing - 164 Shrubs/ Acre			
Tag Alder	*Alnus serrulata*	20%	FACW
Spicebush	*Lindera benzoin*	25%	FACW
Redbud	*Cercis canadensis*	20%	FACU
Elderberry	*Sambucus canadensis*	15%	FAC
Silky Dogwood	*Cornus amomum*	20%	FACW
	Shrub Total	100%	

Live Stakes			
Live staking will be applied to all restored streambanks following the details in the plan set and according to the construction specifications.			
Common Name	**Scientific Name**	**Percentage of Total**	**Wetness Tolerance**
Elderberry	*Sambucus canadensis*	10%	FACW
Silky Dogwood	*Cornus amonum*	40%	FACW
Silky Willow	*Salix sericea*	30%	OBL
Black Willow	*Salix nigra*	20%	OBL
Total		100%	

Temporary Seed			
The following table lists temporary seed mix for the project site. All disturbed areas will be stabilized using mulch and temporary seed.			
Common Name	**Scientific Name**	**Rate**	**Dates**
Cereal Rye Grain	*Secale cereale*	130 LBS/ACRE	September to March
Browntop Millet	*Urochloa ramosa*	40 LBS/ACRE	April to August

Temporary Seed (Pasture)			
The following table lists permanent seed mix for disturbed pasture areas outside of the riparain zone.			
Common Name	**Scientific Name**	**Rate**	**Dates**
Kentucky Bluegrass	*Poa pratensis*	44 LBS/ACRE	September to March
Tall Fescue	*Schedonorus arundinaceus*	218 LBS/ACRE	September to March

Permanent Riparian Seed				
Permanent seed mixtures for the project site shall be planted throughout the floodplain and riparian buffer areas. Permanent seed mixtures shall be applied with temporary seed, as defined in the construction specifications.				
Common Name	**Scientific Name**	**Percent of Mixture**	**Seeding Density (lbs/acre)**	**Wetness Tolerance**
Floodplain Buffer Areas				
Virginia Wildrye	*Elymus virginicus*	20%	3.00	FACW
Autumn bentgrass	*Agrostis perennans*	15%	2.25	FACW
Switchgrass	*Panicum virgatum*	15%	2.25	FAC
Black-Eyed Susan	*Rdubeckia hirta*	10%	1.50	FACU
Lance-Leaved Tick Seed	*Coreopsis lanceolata*	10%	1.50	FACU
Big Blue Stem	*Andropogon gerardii*	10%	1.50	FAC
Eastern Gamma Grass	*Tripsacum dactyloides*	5%	0.75	FACW
Little Blue Stem	*Schizachyrium scoparium*	5%	0.75	FACU
Soft Rush	*Juncus effusus*	5%	0.75	FACW
Yellow Indian Grass	*Sorghastrum nutans*	5%	0.75	FACU

NOTE:

1. ALL AREAS WITHIN ZONE 1 AS SHOWN ON THE VEGETATION PLAN SHALL BE PLANTED WITH THE SPECIES AND AT THE DENSITIES AS DESCRIBED IN THE ABOVE TABLES.
2. LIVE CUTTINGS WILL CONSIST OF THE SAME SPECIES AS THE LIVE STAKES SHOWN ABOVE

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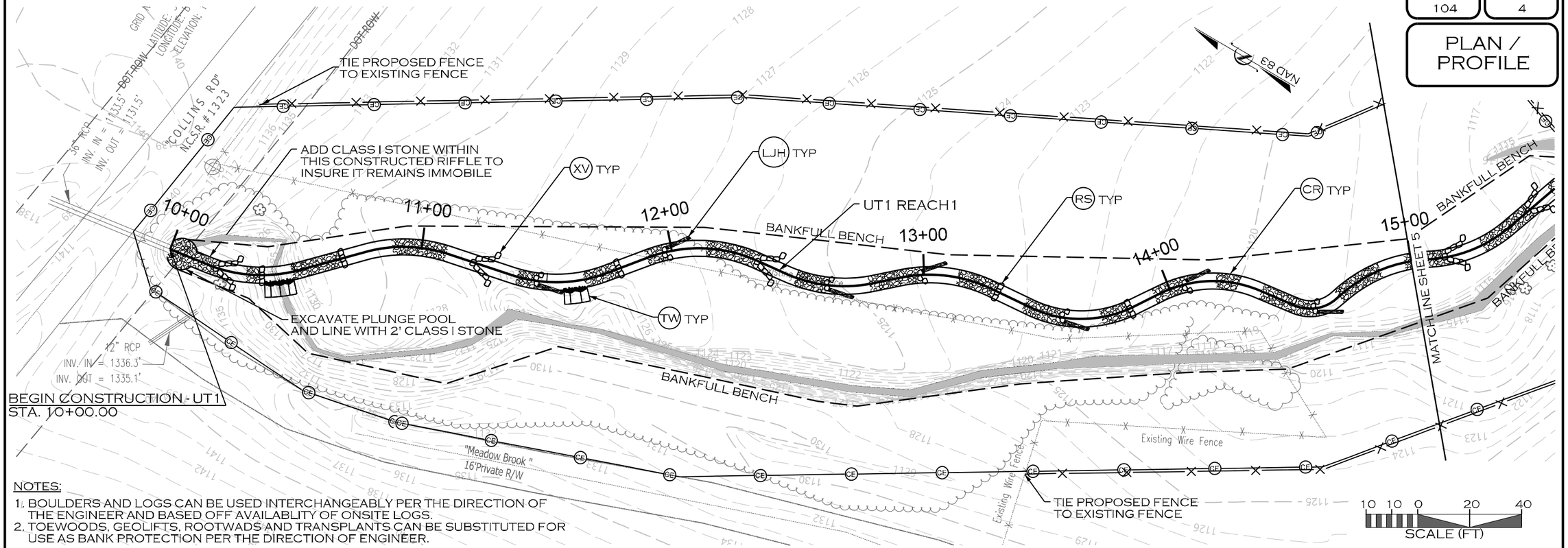
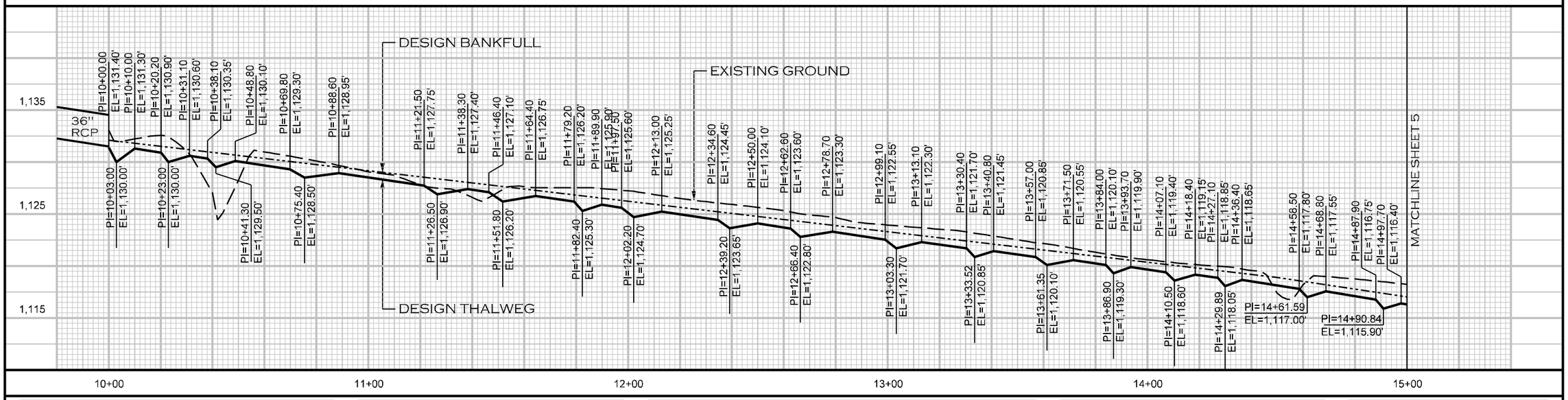
PROJECT #	SHEET NO.
104	4

PLAN / PROFILE



NOTES:

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



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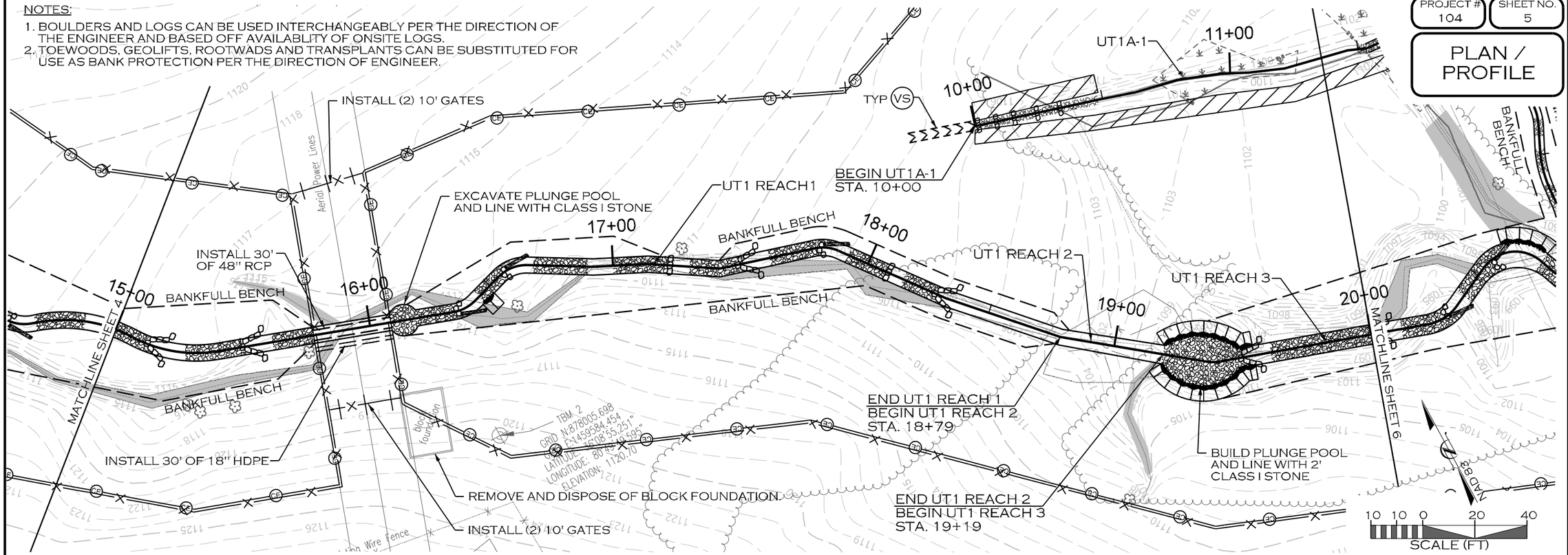
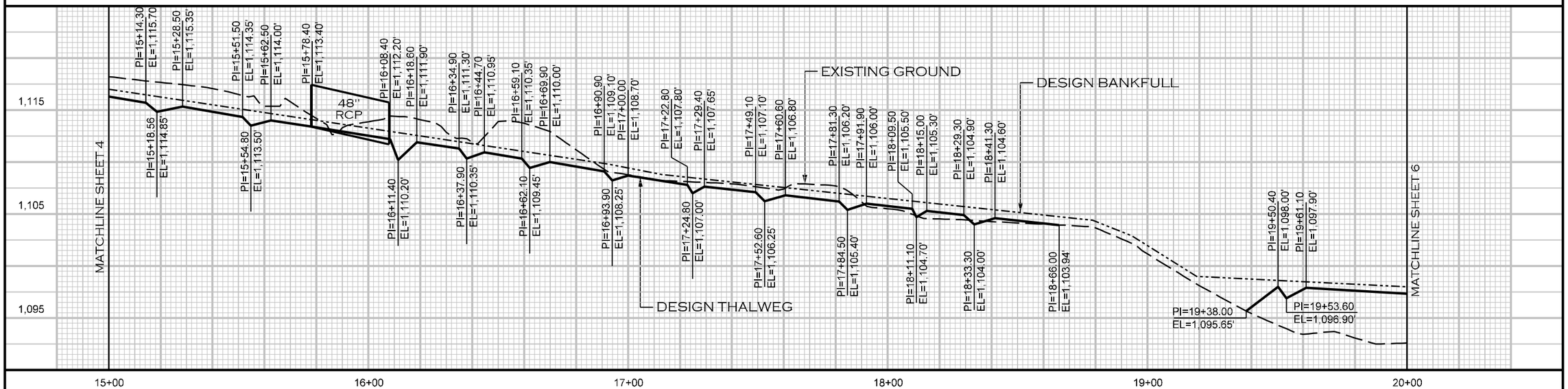
PROJECT #	SHEET NO.
104	5

PLAN / PROFILE





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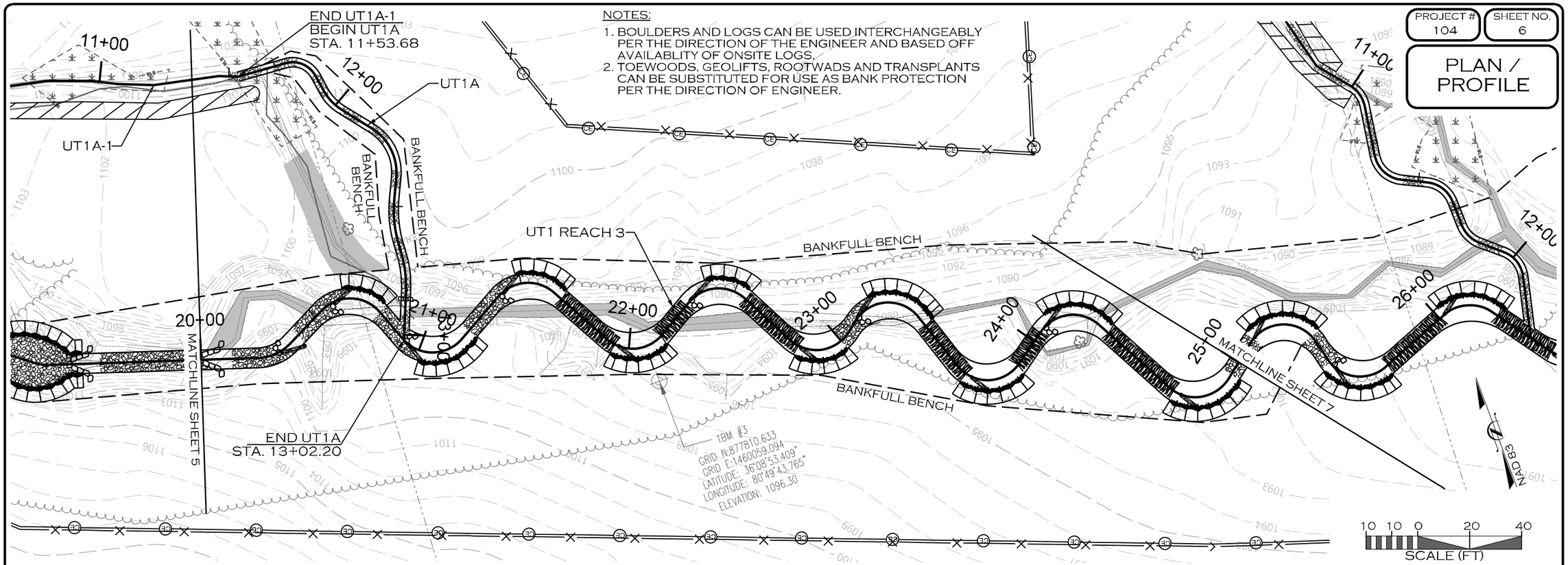
RAVERS

NOTES:

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

PROJECT # 104 | SHEET NO. 6

PLAN / PROFILE



REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

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

GREENBRIER STREAM RESTORATION SITE
YADKIN COUNTY, NC

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

PROJECT ENGINEER

PROGRESS DRAWING
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PLAN / PROFILE

NOTES:

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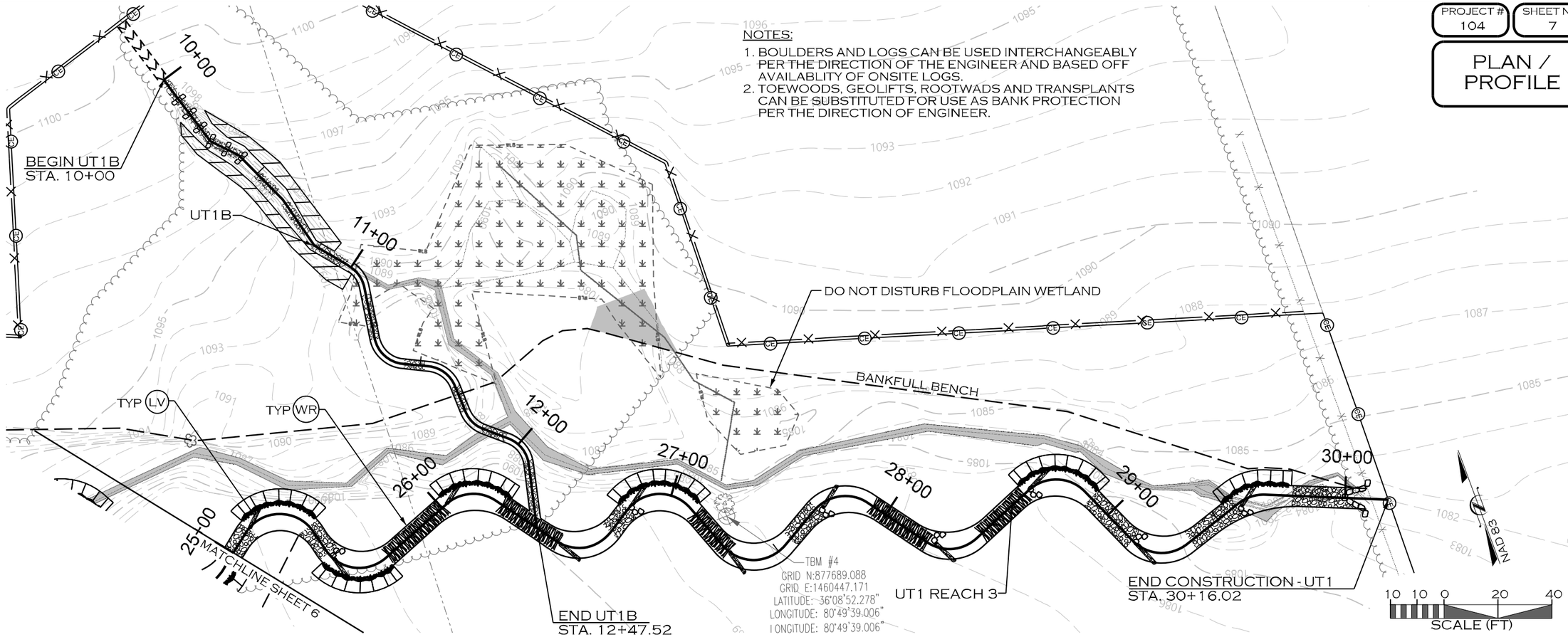

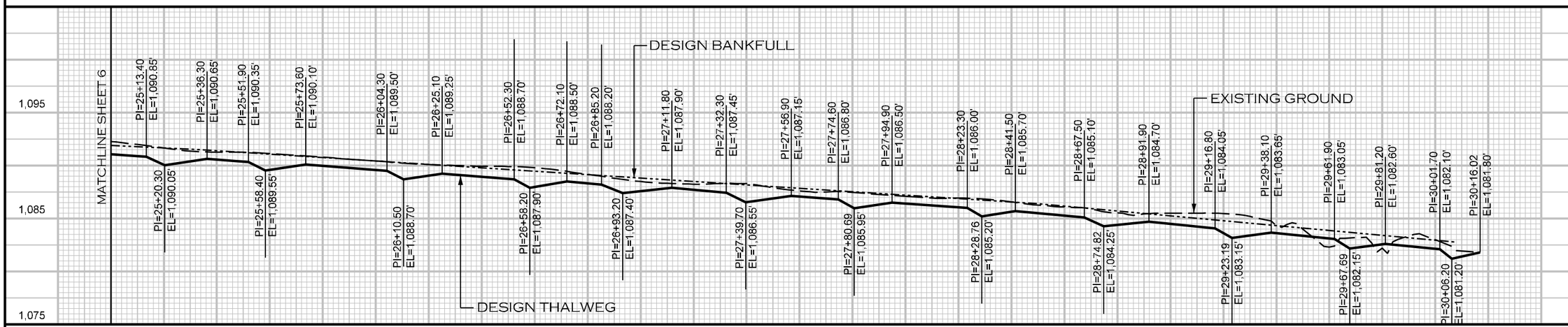

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NO.	DESCRIPTION	ENGR.	APPROV	DATE
1	DRAFT MITIGATION PLAN	JB	KLT	5/20/19

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NC Mitigation Services ENVIRONMENTAL QUALITY

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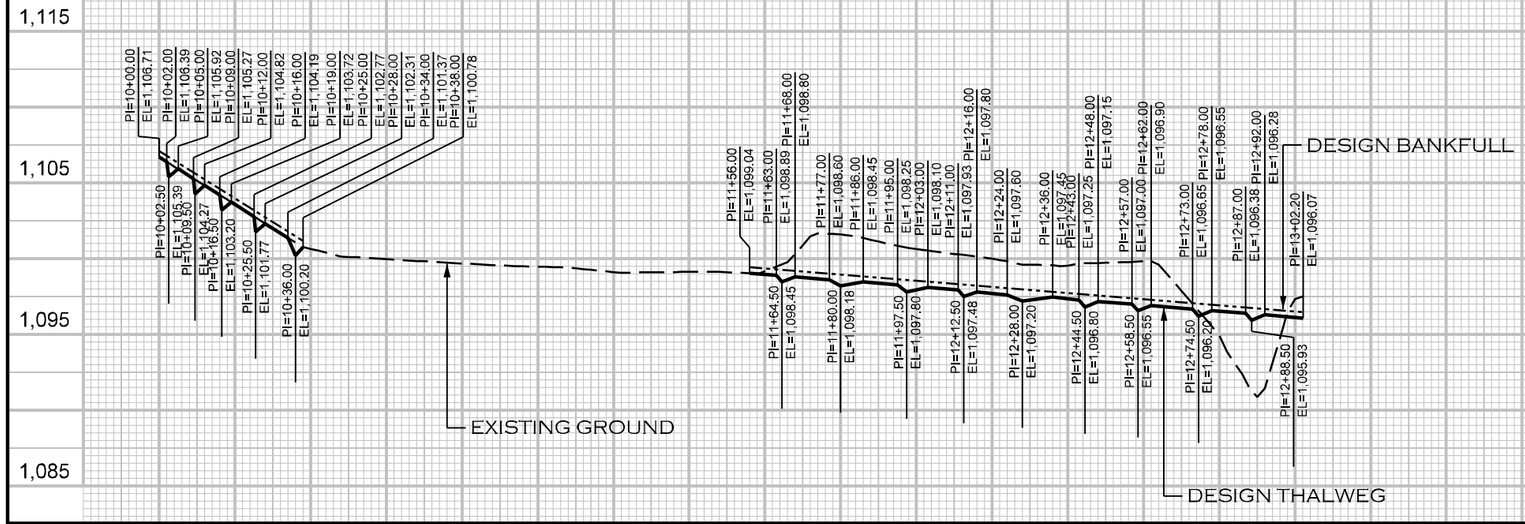
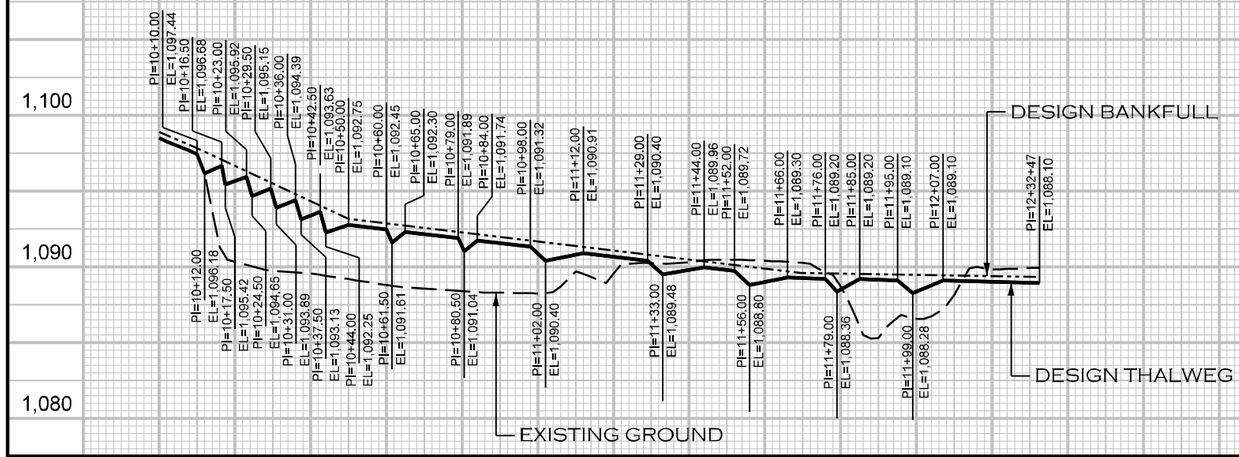
PROJECT #	SHEET NO.
104	8

PROFILE

UT1A-1 AND UT1A



UT1B



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PROJECT # 104 | SHEET NO. 9

VEGETATION / FENCING PLAN

4' GATE

2 x 10' GATES

4' GATE

2 x 10' GATES

MATCHLINE SHEET 10

ZONE 1

NAD 83

40 20 0 40 80
SCALE (FT)

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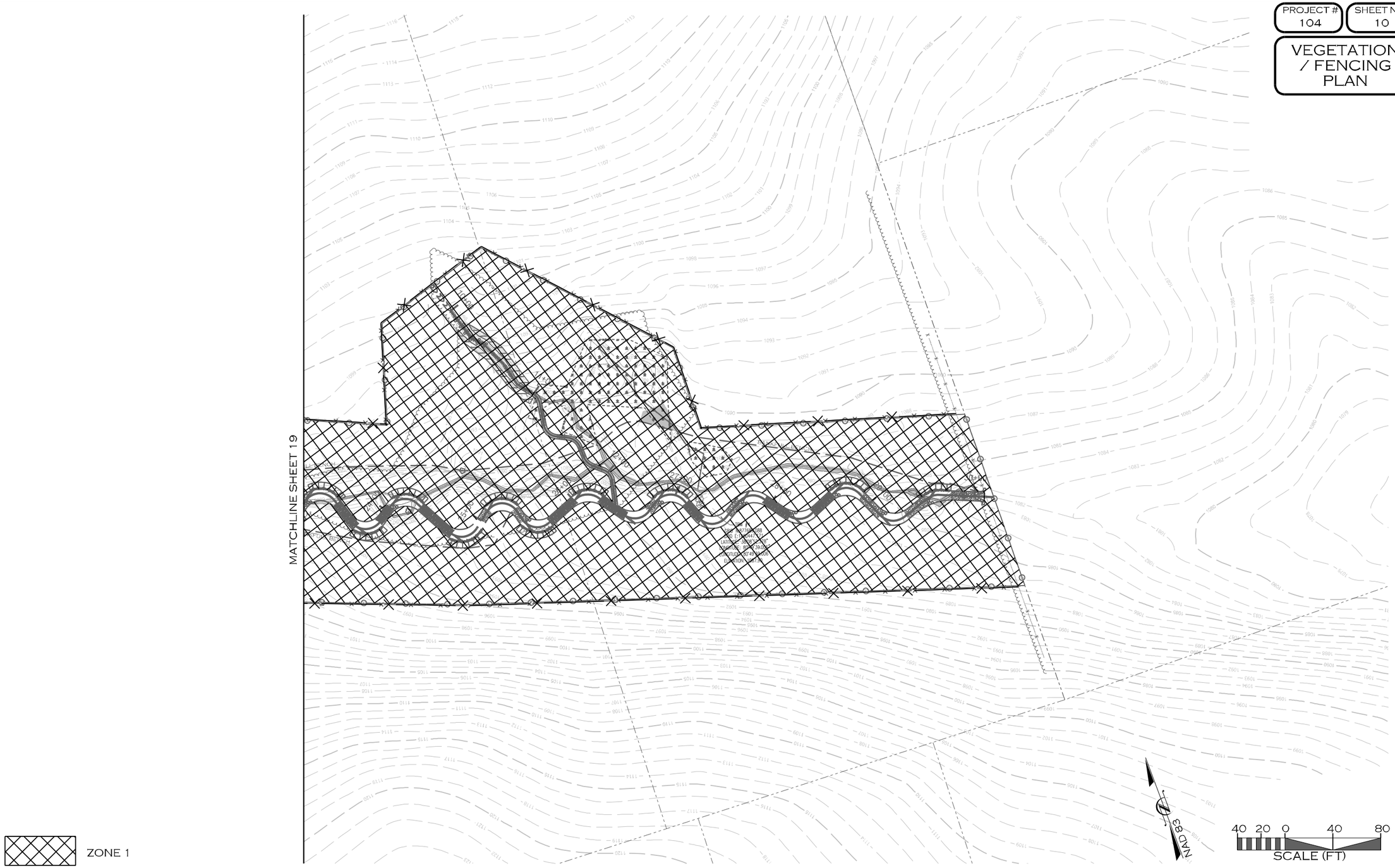
PROJECT # 104 | SHEET NO. 10

VEGETATION / FENCING PLAN



ZONE 1

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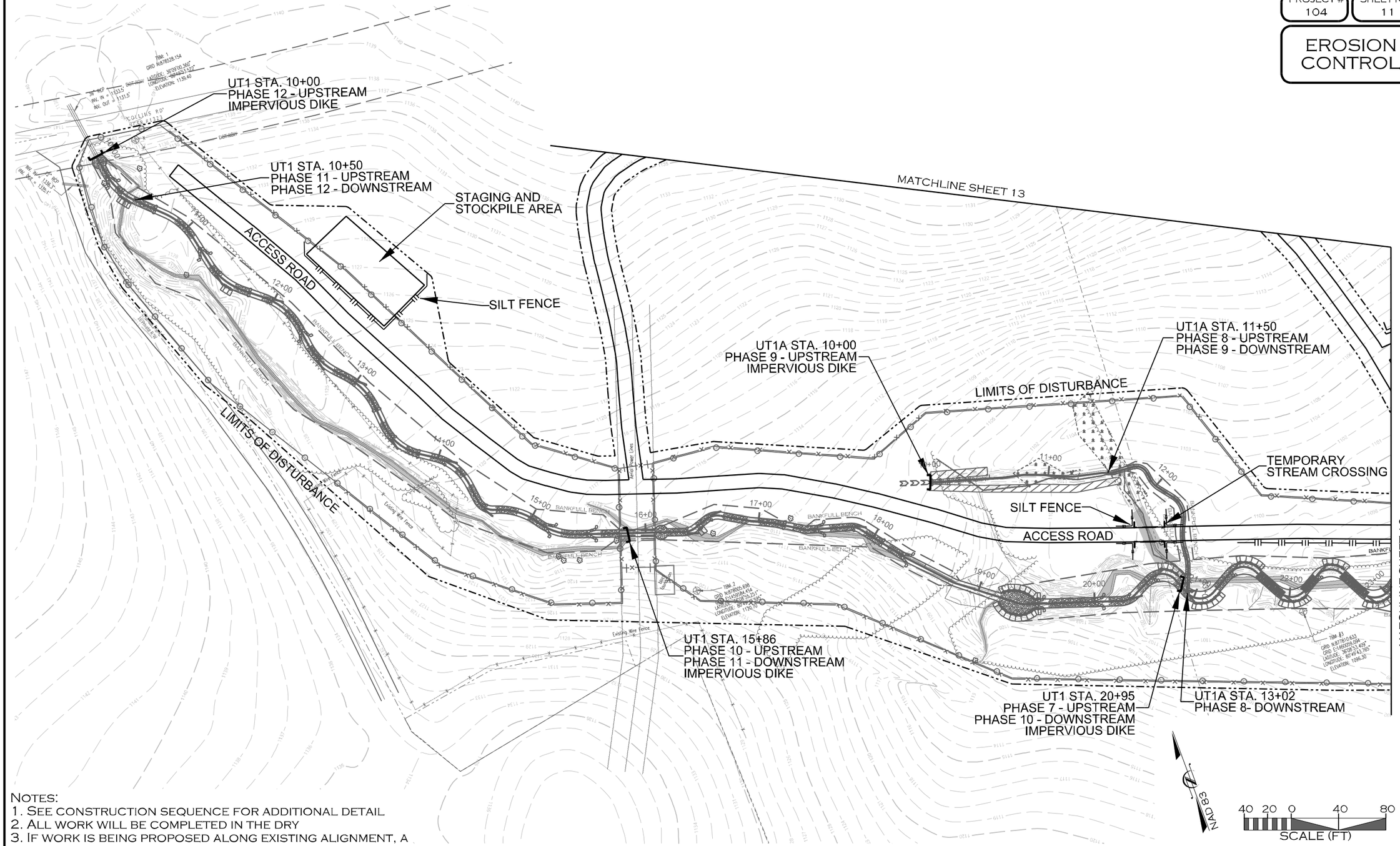
PROJECT # 104 | SHEET NO. 11

EROSION CONTROL



NOTES:
1. SEE CONSTRUCTION SEQUENCE FOR ADDITIONAL DETAIL
2. ALL WORK WILL BE COMPLETED IN THE DRY
3. IF WORK IS BEING PROPOSED ALONG EXISTING ALIGNMENT, A PUMP AROUND OPERATION IS REQUIRED

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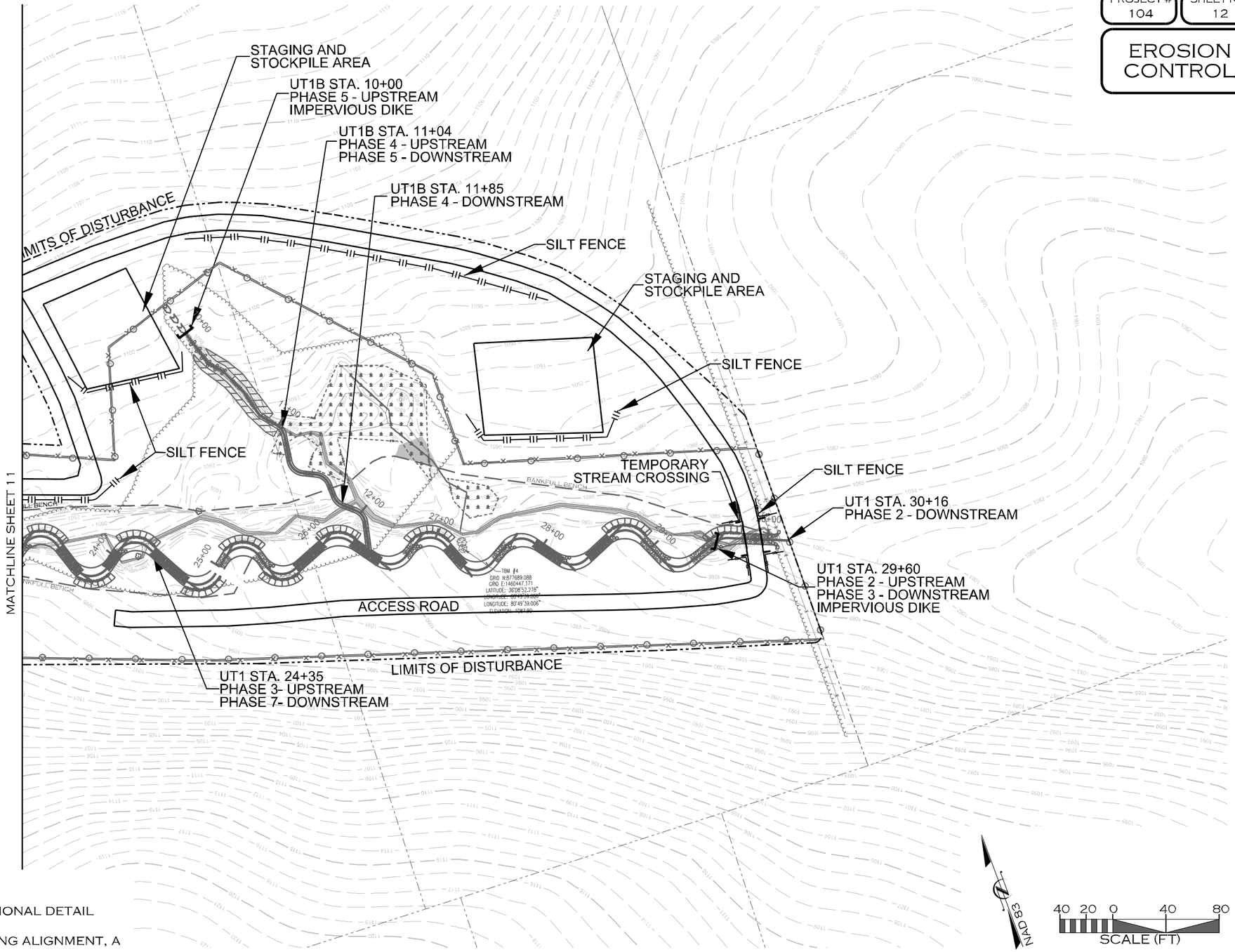
PROJECT # 104 | SHEET NO. 12

EROSION CONTROL



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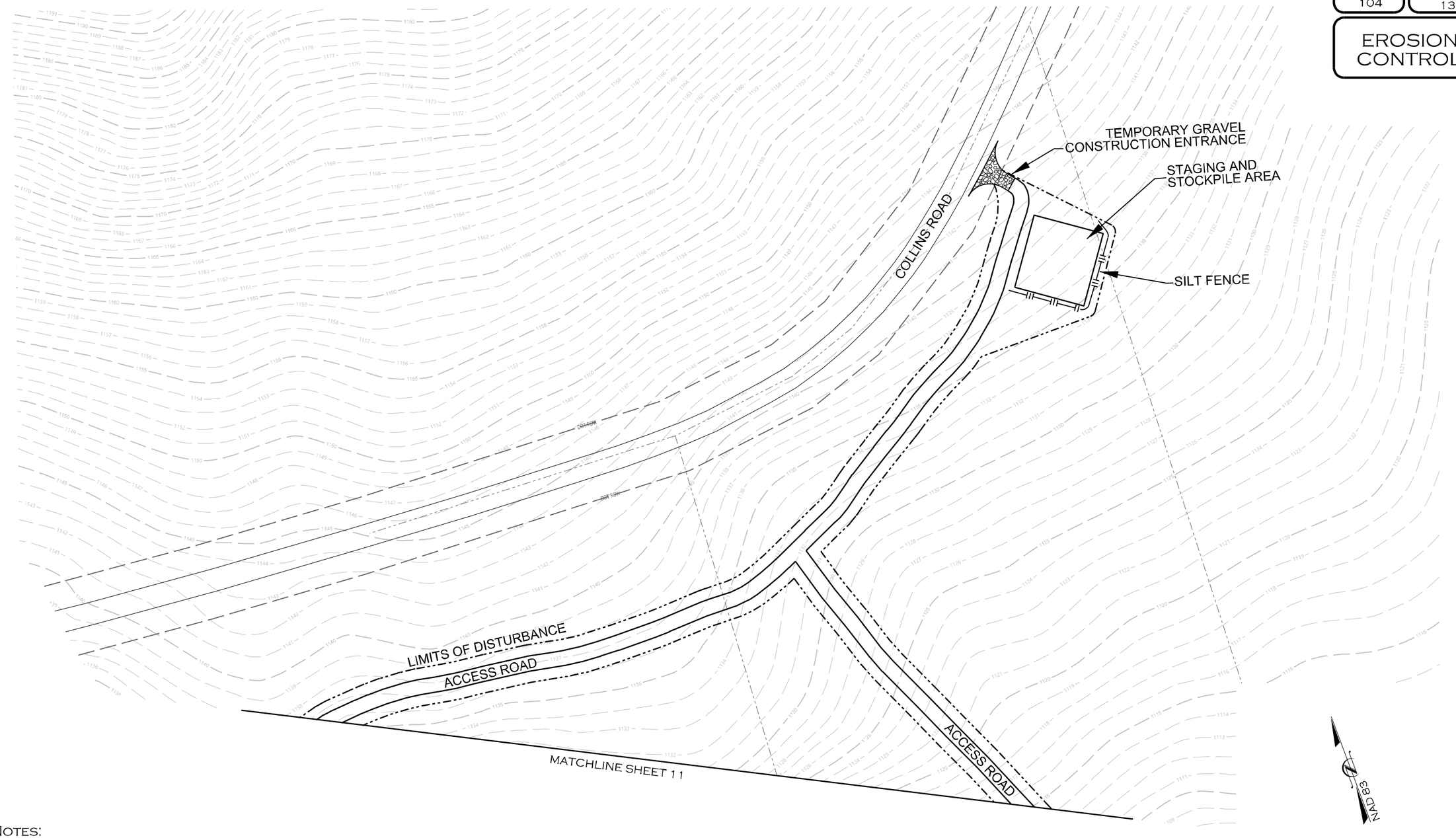
PROJECT # 104 | SHEET NO. 13

EROSION CONTROL



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Appendix 9

INVASIVE SPECIES

Invasive Species Plan

Invasive species vegetation identified at the Site prior to construction included fescue (*Schedonorus* spp.) in the pasture area, Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*), and tree-of-heaven (*Ailanthus altissima*) along the stream corridors and in forested areas, and Japanese stiltgrass (*Microstegium vimineum*) in wetland areas. During construction, the existing invasive vegetation species will be controlled using mechanical methods.

During the monitoring period, the Site will be reviewed annually to locate and to quantify any residual invasive species vegetation. If invasive species are identified at the Site during the monitoring period, their location and extent will be shown on the current condition plan view (CCPV). A corresponding discussion will be included in the annual monitoring report outlining the proposed management plan. Invasive species vegetation will be managed and reviewed on all annual basis to minimize its long-term impact to planted native species. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.

Invasive species will be managed and controlled using a combination of chemical and/or mechanical methods to ensure that these species comprise less than 5% of the total easement acreage. Management and control will continue throughout the project until this percentage is achieved.

Appendix 10

MAINTENANCE PLAN

Maintenance Plan

The Site shall be monitored on a regular basis and a physical inspection of the site shall be conducted 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 close-out
Stream	Routine channel maintenance and repair activities may include securing of loose coir matting and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
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. Exotic 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.
Beaver	Beaver and associated dams are to be removed as they colonize until the project is closed.
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.
Farm Road Crossing	Farm road crossings are located outside the conservation easement. These crossings may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.

Appendix 11

CREDIT RELEASE SCHEDULE

Credit Release Schedule

All credit releases will be based on the total credits 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 NCIRT, 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 in the table below as follows:

Stream Credit Release Schedule
Greenbrier Stream Restoration Site – NCDMS Project No. 100086

Credit Release Milestone	Release Activity	ILF/NCDMS	
		Interim Release	Total Released
1	Site Establishment	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	30%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%
6*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)
7	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)
8*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)
9	Year 7 monitoring report demonstrates that channels are stable, and performance standards have been met and project has been approved for closeout	10%	90% (100%**)

* Please note that vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.
**10% reserve of credits to be held back until the bankfull event performance standard has been met.

The following conditions apply to the credit release schedule:

a. A reserve of 10% of a site's total stream credits will 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 is at the discretion of the NCIRT.

b. After the second milestone, the credit releases are scheduled to occur on an annual basis, assuming that the annual monitoring report has been provided to the USACE and that the monitoring report demonstrates that interim performance standards are being met and that no other concerns have been identified on-site during the visual monitoring. All credit releases require written approval from the USACE.

c. The credits associated with the final credit release milestone will be released only upon a determination by the USACE, in consultation with the NCIRT, of functional success as defined in the Mitigation Plan.

Appendix 12

FINANCIAL ASSURANCES

FINANCIAL ASSURANCES

Pursuant to Section IV H and Appendix III of the Division of Mitigation Services' In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environmental Quality 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.

Appendix 13

MEETING MINUTES FROM IRT ON-SITE MEETING

Ecosystem Planning and Restoration, LLC
559 Jones Franklin Road, Suite 150
Raleigh, NC 27606

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

October 29, 2018

Mr. Paul Wiesner
Western DMS Field Office
5 Ravenscroft Drive
Suite 102
Asheville, N.C. 28801

RE: Field Meeting Notes - Post-Contract IRT Visit to Greenbrier Full Delivery Site
DMS Project # 100086; DEQ Contract # 7616

Dear Mr. Wiesner,

This letter is being provided as meeting minutes to a field meeting that occurred at the Greenbrier Full Delivery Site (Site) on September 25, 2018. The meeting was conducted to review the Site with IRT members after award of the full delivery contract, to determine if the IRT had any concerns related to the Site being proposed for mitigation credit. The Site is located off Meadow Brook Drive and Collins Road in Yadkin County, and is proposed to provide up to 2,300 stream mitigation units (SMUs) within the Yadkin River Basin 03040101.

Attendees:

Paul Wiesner – NCDMS
Periann Russell – NCDMS
Kirsten Ullman – NCDMS
Kelly Phillips - NCDMS
Todd Tugwell – USACE
Mac Haupt – NCDWR
Todd Bowers – USEPA
Andrea Leslie – NCWRC
Amy James – EPR
Kevin Tweedy – EPR

The meeting began at approximately 1:30PM. There was a brief overview of the project by Kevin and then the group walked to the upstream start of the project at Collins Road. As an overall comment, Kevin indicated that beneficial trees that did not interfere with site design would be preserved during construction to the extent possible. The group discussed that the drainage area for UT1 is small and that monitoring of stream flow conditions would likely be required as part of the post-restoration monitoring plan. The group then walked downstream and discussed the proposed restoration/mitigation as they walked. Kevin described that the work would include a Priority Level 2 restoration at the start of UT1 at Collins Rd. that would transition into a Priority 1 farther from the road and continue to the large bedrock outcrop. At the bedrock outcrop, Enhancement II approaches are proposed at a 2.5:1 ratio for a short length.

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559 Jones Franklin Road, Suite 150
Raleigh, NC 27606

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The group then reviewed UT1A. Todd and others expressed concern that the ditch feature that drains into UT1A near the top of the reach may also be jurisdictional (UT1A-1). Kevin said that if the channel is jurisdictional, then it would be added to the project and proposed for enhancement credit at a 2:5:1 ratio, since it is in the proposed easement and is relatively stable. The group had no comment on the proposed design for UT1A itself or the use of a stormwater BMP to slow overland flow upslope before it reaches the channel.

The group discussed the restoration approach below the bedrock enhancement area on UT1, which is proposed as a Priority 2 due to combination of bench cutting and raising the stream bed to provide an active floodplain. There was concern about how the area would be stabilized and worked into the current landscape and channel condition. Kevin described that the restoration would include a combination of benching, bank grading, raising the channel bed, and reconnection further down with historic floodplain features. Detailed topographic data would be needed for the Site to determine the exact degree of benching and profile adjustment, but Kevin proposed to provide detailed justification in the mitigation plan document. Todd Tugwell indicated that if proposed for restoration credit, it should not look the same after restoration as what it looks like in its current condition – the restoration crediting would need to be justified.

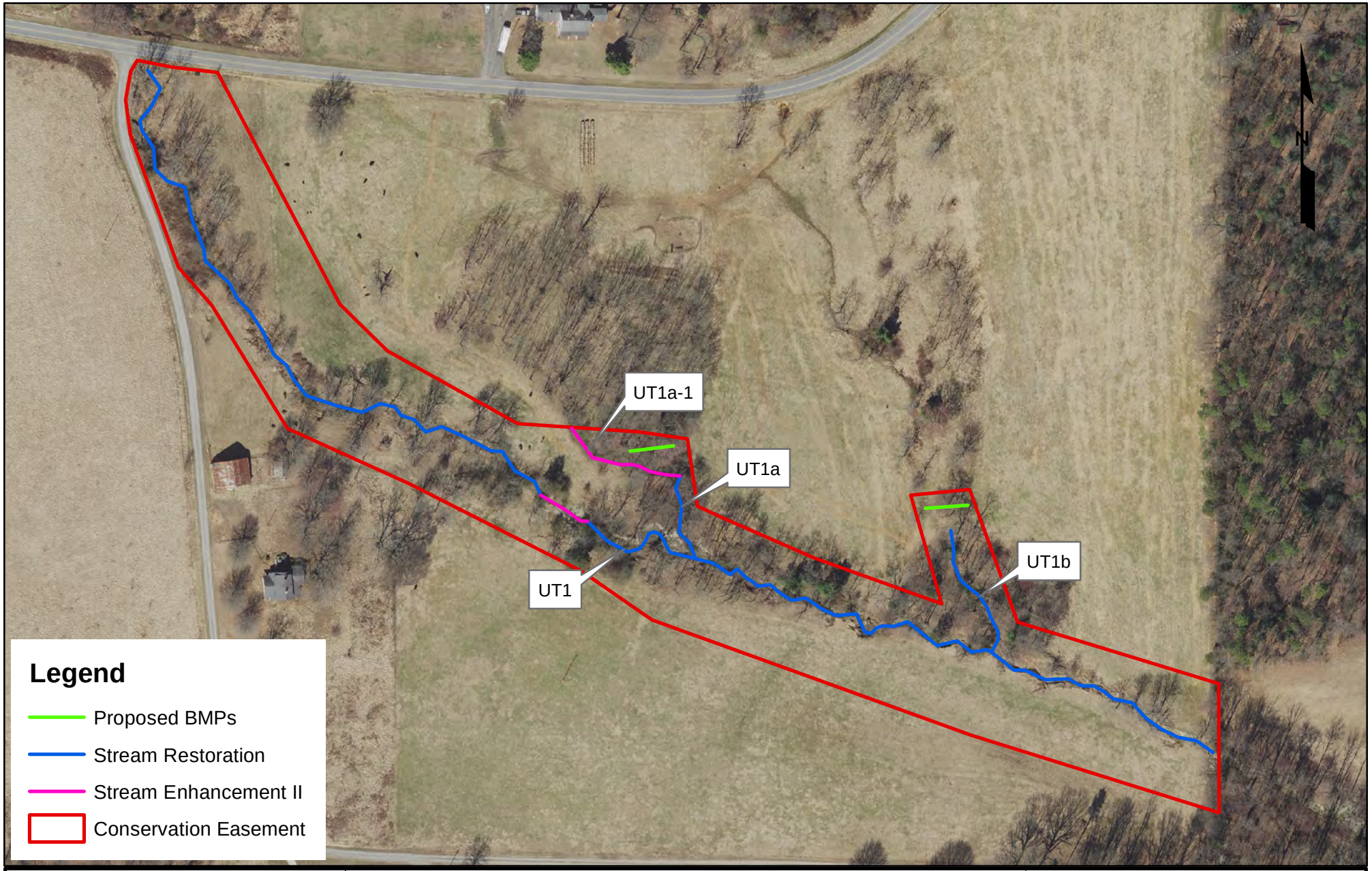
The group also walked the length of UT1b, to its start at a large headcut. The group had no comment on the proposed design for UT1b or the use of a stormwater BMP to slow overland flow upslope before it reaches the channel.

Table 1 and Figure 1 show proposed assets after the site visit.

Table 1. Greenbrier Full Delivery Site Proposed Assets

PROJECT REACH	*TYPE OF MITIGATION*	*LENGTH (FT)*	*RATIO*	*SMU'S*
UT1	Stream Restoration	1,934	1:1	1,934
UT1	Stream Enhancement II	73	2.5:1	29
UT1A	Stream Restoration	155	1:1	155
UT1B	Stream Restoration	184	1:1	184
UT1A-1	Stream Enhancement II	170	2.5:1	68
Totals		**2,516**		**2,370**

The meeting concluded at approximately 2:45PM.



0 100 200 Feet	GREENBRIER STREAM MITIGATION SITE PROPOSED ASSET MAP	PREPARED BY: ECOSYSTEM PLANNING & RESTORATION
FIGURE 1	YADKIN COUNTY, NC	DATE: OCTOBER 2018