

FINAL MITIGATION PLAN

**Groundhog Hollow Project
Alexander County, North Carolina**

**Catawba River Basin
HUC 03050101**



**DMS Project #: 100049
Contract #: 7417
USACE Action ID: SAW-2018-00450
RFP: 16-007277**

Prepared for:

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

Prepared by:

Resource Environmental Solutions, LLC
For Environmental Banc & Exchange, LLC
302 Jefferson Street, Suite 110
Raleigh, NC 27605
919-209-1052



September 2019

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

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

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



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

August 15, 2019

Regulatory Division

Re: NCIRT Review and USACE Approval of the NCDMS Groundhog Hollow Site / Alexander County / SAW-2018-00450; NCDMS Project # 100049

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

Dear Mr. Baumgartner:

The purpose of this letter is to provide the North Carolina Division of Mitigation Services (NCDMS) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day comment period for the Groundhog Hollow Mitigation Plan, which closed on August 13, 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,

Kim Browning
Mitigation Project Manager
for Henry Wicker

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List

Paul Wiesner—NCDMS

Bradley Breslow—RES



NORTH CAROLINA
Environmental Quality

ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

TIM BAUMGARTNER
Director

May 20, 2019

Mr. Brad Breslow
Resource Environmental Solutions, LLC
For Environmental Banc & Exchange, LLC
302 Jefferson Street, Suite 110
Raleigh, N.C. 27605

Subject: DRAFT Mitigation Plan for the
Groundhog Hollow Project
Catawba River Basin – CU# 03050101– Alexander County
DMS Project ID No. 100049
Contract # 7417

Dear Mr. Breslow:

On April 22, 2019, the Division of Mitigation Services (DMS) received the DRAFT Mitigation Plan for the Groundhog Hollow project from Resource Environmental Solutions, LLC (RES).

The report establishes the proposed mitigation activities on the project site. Anticipated mitigation on the site includes 2,851 Linear Feet (LF) of Stream Restoration; 306 LF of Stream Enhancement (Level I); 2,627 LF of Stream Enhancement (Level II) at a 2.5:1 mitigation ratio; and 381 LF of Stream Enhancement (Level II) at a 7.5:1 mitigation ratio for a total of 4,165 Stream Mitigation Units (SMUs). The following are our comments on the DRAFT mitigation plan report and preliminary plan set:

General: Several of the NCDWR stream ID scores for the project streams are at the margins for intermittent/ perennial determinations. DMS recommends including stream cameras or stream gauges to the project monitoring plan to confirm that the project streams meet the hydrology performance standard (30 days of continuous flow each year) as specified in the NCIRT's October 2016 Wilmington District Stream and Wetland Compensatory Mitigation Update.

Section 3.4: Regulatory Considerations (Threatened and Endangered Species): Please update "Federal Administration" to "Federal Highway Administration (FHWA)".

Section 6.2 - Design Parameters - Regional Flood Frequency Analysis: The USGS regression equations are generally applicable to larger drainage areas than the project streams. Please verify the range of drainage areas to which the equations apply and update accordingly.



Figure 9: The mitigation ratio for GF1-A is incorrect and should be updated to 2.5:1. Please QA/QC the figure and table and update as necessary.

Appendix B: Please include the technical proposal conceptual map with the Post Contract IRT Site Visit Minutes for comparison purposes (attached).

Preliminary Plan Set – Sheet S13: Will the concrete spring box on reach GF5 be removed from the conservation easement or left in place? The preliminary plan set notes that it will be removed but Mr. Breslow had indicated that it would be left in place in a previous conversation. Please confirm and update as necessary.

Appendix C - Site Protection Instrument – Table C1: The County for each project parcel is “Johnston”. Please QA/QC the table and update as necessary.

Plan Sheets:

- 1) E1 Legend - The Existing Stream is indicated by a TB line with blue fill. Please indicate whether this is Top of Bank or the topographic area inundated during the bankfull discharge. Please add an entry for the proposed livestock fencing.
- 2) Please consider adding details throughout the plan sheets calling out improvements proposed in Section 6.2 such as culverts to be removed, knick-point and headcut stabilization areas, floodplain construction areas, livestock fence, etc.
- 3) Please add lines for the proposed top of bank where grading changes are proposed in enhancement areas. An example of this is in sheet S2 at station 6+00 where a proposed brush toe is shown and a proposed step pool is depicted at station 7+25 but no linework is given for the top of bank.

At your earliest convenience, please provide a written response letter addressing the DMS comments provided and a revised/ updated electronic copy of the draft mitigation plan. The comment response letter should be included with the revised draft mitigation plan after the report cover. If you have any questions, please contact me at any time at (828) 273-1673 or email me at paul.wiesner@ncdenr.gov.

Sincerely,

Paul Wiesner

Paul Wiesner
Western Regional Supervisor
NCDEQ – Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801
(828)273-1673 Mobile

cc: file



M E M O R A N D U M



302 Jefferson Street, Suite 110 Raleigh, North Carolina 27605 919.209.1062 tel.
919.829.9913 fax

TO: North Carolina Division of Mitigation Services

FROM: Brad Breslow - RES

DATE: May 28, 2019

**RE: Response to Groundhog Hollow Draft Mitigation Plan Comments DMS Project ID
No. 100049, Contract #7417**

General

- a) Several of the NCDWR stream ID scores for the project streams are at the margins for intermittent/perennial determinations. DMS recommends including stream cameras or stream gauges to the project monitoring plan to confirm that the project streams meet the hydrology performance standard (30 days of continuous flow each year) as specified in the NCIRT's October 2016 Wilmington District Stream and Wetland Compensatory Mitigation Update.
It has been RES' understanding that enhancement activities that do not affect bed elevation and that have been deemed jurisdictional by the ACOE in the PJD, do not require flow monitoring, which is the case for the pertinent reaches. With that said, RES still proposes three "Stage Recorders" on reaches GF1-B, GF2-B, and GF3-B, which are capable of recording flow as specified in the NCIRT's October 2016 Wilmington District Stream and Wetland Compensatory Mitigation Update.
- b) **Section 3.4: Regulatory Considerations (Threatened and Endangered Species):** Please update "Federal Administration" to "Federal Highway Administration (FHWA)".
The sentence has been updated.
- c) **Section 6.2: Design Parameters - Regional Flood Frequency Analysis:** The USGS regression equations are generally applicable to larger drainage areas than the project streams. Please verify the range of drainage areas to which the equations apply and update accordingly.
RES utilized a Regional Flood Frequency Analysis to prepared localized flood frequency curves. These curves use data from USGS stream gauges with drainage areas less than 10 sq. miles. This analysis was just one of several tools used to help determine an appropriate bankfull discharge. USGS regression equations were not used to determine bankfull discharges.
- d) **Figure 9:** The mitigation ratio for GF1-A is incorrect and should be updated to 2.5:1. Please QA/QC the figure and table and update as necessary.
The Figure has been updated.

- e) **Preliminary Plan Set – Sheet S13:** Will the concrete spring box on reach GF5 be removed from the conservation easement or left in place? The preliminary plan set notes that it will be removed but Mr. Breslow had indicated that it would be left in place in a previous conversation. Please confirm and update as necessary.

The spring house will be retained but the tin roof will be removed and disposed of offsite. The concrete structure directly downstream of the spring house will be removed as part of the project.

Plan Sheets

- 1) E1 Legend - The Existing Stream is indicated by a TB line with blue fill. Please indicate whether this is Top of Bank or the topographic area inundated during the bankfull discharge. Please add an entry for the proposed livestock fencing.

All lines labeled TB indicate existing Top of Bank as shown on the notes sheet. Proposed fenceline has been added to the legend.

- 2) Please consider adding details throughout the plan sheets calling out improvements proposed in Section 6.2 such as culverts to be removed, knick-point and headcut stabilization areas, floodplain construction areas, livestock fence, etc.

Additional callouts have been added to the design plans to reflect enhancement activities proposed in Section 6.2.

- 3) Please add lines for the proposed top of bank where grading changes are proposed in enhancement areas. An example of this is in sheet S2 at station 6+00 where a proposed brush toe is shown and a proposed step pool is depicted at station 7+25 but no linework is given for the top of bank.

Proposed Bankfull is now labeled on sheet E1 in place of Proposed Top of Bank. A proposed bankfull line has been added to enhancement areas where applicable. Please note that proposed brush toe and bankfull overlap.

Appendices

- a) **Appendix B:** Please include the technical proposal conceptual map with the Post Contract IRT Site Visit Minutes for comparison purposes (attached).

The technical proposal conceptual map has been included.

- b) **Appendix C - Site Protection Instrument – Table C1:** The County for each project parcel is “Johnston”. Please QA/QC the table and update as necessary.

All instances of “Johnston” has been changed to “Alexander.”



REPLY TO
ATTENTION OF:

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

CESAW-RG/Browning

July 29, 2019

MEMORANDUM FOR RECORD

SUBJECT: Groundhog Hollow Mitigation Site - NCIRT Comments during 30-day Mitigation Plan Review

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

NCDMS Project Name: Groundhog Hollow Site, Alexander County, NC

USACE AID#: SAW-2018-00450

NCDMS #: 100049

30-Day Comment Deadline: July 13, 2019

DWR Comments, Mac Haupt and Erin Davis:

1. Section 6.2, page 23 – The site meeting notes for GF3 state the “group agreed with Enhancement I and Restoration treatments which would include mostly focus on raising bed elevation, bank stabilization and riparian buffer improvements”. However, the proposed enhancement activities for GF3-A mirror GF1-A and GF2-A, which are both Enhancement II. The GF3-A existing conditions note the “channel has adequate riffle pool sequence and no knick-points or active downcutting” (page 11). Based on the information provided, DWR believes 2.5:1 is a more appropriate ratio for GF3-A.
2. Section 6.2, page 23 – The site meeting notes for GF5 state that the “group agreed to Enhancement II crediting”. However, the proposed Enhancement II activities mirror GF4-B, which has a 7.5:1 ratio. And it appears GF5 has less riparian planting compared to GF4-B, since over half of the GF5 easement area is marked as supplemental planting on Sheet P1. Since there is no bed/bank work and the buffer is partially forested, DWR believes 7.5:1 is a more appropriate ratio for GF5.
3. Section 6.2, page 24 In-Stream Structures – Sod mats are identified as a potential bank stabilization treatment. Please include a detail for this treatment in Appendix A or add treatment information to applicable existing detail(s).
4. Section 6.3, page 27 - Are the locations of the alternative livestock watering facilities known? If not, is there an estimated minimum distance from the facilities to the easement?
5. Section 6.4, page 28 Plant Community Restoration – Completion of construction by the end of May means potentially planting in June, which would put the 180-day vegetative monitoring in December. Planting beyond the IRT 2016 guidance date of March 15th is not recommended, particularly for installation of (dormant) live stakes, and may result in an extended monitoring period being required. DWR would question the validity of MY1 vegetative survey results if performed after leaf drop.
6. Section 6.4, page 29 On-Site Invasive Species Management – Please amend the first sentence to denote that treatment of invasive species will be required within the entire easement.

7. Section 6.4, page 29 Soil Restoration - No field soil data was provided. Was a soil site investigation completed? At minimum please include all wetland determination forms associated with the PJD in the final mitigation plan. Since vegetative cover and vigor can be a challenge on priority II restoration banks/benches, please include details on how the soil restoration will be addressed during construction and reference potential adaptive management. Also, please identify what measures will be taken to reduce the risk of invasive plant re-establishment/spreading from any topsoil stockpiled for reuse onsite.
8. Section 6.5, page 30 – Proposed wetland impacts are noted to be temporary, however, the stream restoration design has the relocated channel(s) going through features WC, WD, WE and Pond. Please describe how the Site’s total wetland area will be maintained and no net loss of will be documented.
9. Section 6.7, page 33 - Section 3.7 notes that all existing utilities will be removed from the easement; however, Sheet E2 shows three (3) locations where overhead utility lines cross the easement (north of GF1A 12+75; west of GF2B 10+00; east of GF4B 7+50). Have these utility crossings been accounted for in the buffer credit calculation and resulting mitigation credits? If so, please update Figure 10 and add corresponding notes to Table 15. Also, there appears to be multiple poles located within the easement, including one within the proposed grading limits near GF2-B 10+75. Are any poles proposed for relocation?
10. Table 16, page 37 – DWR would prefer stage recorders be inspected quarterly to reduce the duration of potential missing data in the event of equipment failure.
11. Figure 11 Monitoring Plan –
 - a. Please add the existing wetlands layer to the monitoring plan figure.
 - b. Please shift GF2-B & GF3-B recorders just upstream of nearby cross sections.
 - c. Regarding the DMS comment about adding stream gauges on intermittent reaches, the IRT 2016 guidance section VI.A.6. (page 9) states that “where restoration *or enhancement* activities are proposed for intermittent streams, monitoring gauges should be installed...”.
12. Sheet E1 – Please include the floodplain sill and culvert icons in the legend.
13. Sheet S4 – Please confirm that a 20LF culvert is a sufficient length for the 100-ft wide crossing near GF1-B 24+00.
14. Sheets S4 & S5 – The proposed design includes relocating areas of the stream channel closer to the toe of slope and situating multiple bends along the floodplain grading limit (GF1-B 20+25, 21+25, 25+50). Please explain why this proposed.
15. Sheet S5 – GF3-B and GF1-B have been relocated to within wetland WD; in this area the new channels are within 25 feet of each other and run parallel for 75-100 feet. This configuration results in more wetland impact compared to GF3-B tying into GF1-B closer to 29+00. Please provide the rational for the current proposed design approach.
16. Sheet S6 – Did you consider installing a constructed riffle at the transition from Restoration to Enhancement II reaches on GF1-B (34+50)?
17. Sheet S6 & S10 – Please explain why proposed grading limits extend outside of the easement.
18. Sheet S7 – Did you consider installing a constructed riffle between the proposed headcut stabilization (2+00) and log structure (4+74) on GF2-A?
19. Sheet S8 – What is the proposed bank stabilization at GF2A 7+75? The callout doesn’t match any of the legend icons.
20. Sheet S9 – Please confirm whether the entire relic earthen dam will be removed.
21. Sheet S12 – In the site meeting notes DWR expressed concern over no bed/bank work being proposed for the GF4-B gully section. The GF4-B existing conditions state that “the buffer within the gully is predominantly composed of privet” (page 13) and the restoration approach includes invasive vegetation treatment (page 23). Please describe how the banks will be stabilized following the removal of privet.
22. Sheet P1 – Live stake species listed in the planting table do not match the species noted in the D3 detail, please update.
23. Sheet D4 - No ford crossings were called out in the design, please update.

Kim Browning, USACE:

1. Even though there are no wetland credits being sought, and existing wetlands are fairly small, the restoration reach is going through features WC, WD, and WE. Please ensure that permanent impacts to these wetlands during construction do not result in loss of function, though it is anticipated that overall wetland function will improve from increased hydrology in this area. It's recommended that a temporary veg plot be placed in this area.
2. It would be helpful to depict photo points/digital image stations on Figure 11.
3. Section 4, Functional Uplift Potential: The functional pyramid is cited to show existing conditions for each category, and was used to describe the functional uplift potential of the project, which is appreciated. Please note that the functional pyramid and SQT tool have not been approved for use by the IRT in determining success for mitigation projects. Several of the sections refer to existing conditions as not-functioning or functioning-at-risk. How did you determine this? The SQT forms are not included. It would be beneficial to include the NCSAM assessment.
4. GF4-B: The IRT field visit indicated that there was a large gully below the culvert and that additional structures and bank work would be beneficial here, and now the proposed approach is cattle exclusion and supplemental planting at 7.5:1. Do you anticipate that this erosion will increase over the monitoring period and contribute sediment downstream, potentially causing aggradation in GF3-A?
5. Was the coordination with USFWS and WRC regarding the NLEB resolved? When you submit the PCN, please include a note with how many acres of trees will be cleared.
6. Please include a performance standard of at least 30-days of consecutive flow on intermittent reaches (GF4A and GF4B). Please include monitoring flow gauges in the upper third of 4A. Does this reach have the potential to become more wetland-like? I was unable to make a site visit and the photo on page 13 looks questionable.
7. Please describe in the text narrative and in the Plan Sheets what will be done with the relic earthen dam and its sediment.

Kim Browning
Mitigation Project Manager
Regulatory Division

MEMORANDUM



302 Jefferson Street, Suite 110

Raleigh, North Carolina 27605

919.209.1052 tel.

919.829.9913 fax

TO: NCIRT and NCDMS

FROM: Brad Breslow - RES

DATE: September 26, 2019

RE: Response to Groundhog Hollow Site NCIRT Comments during 30-day Mitigation Plan Review

DMS Project ID No. 100049, Contract #7417, USACE Action ID #SAW-2018-00450

NCDWR Comments, Mac Haupt and Erin Davis:

Section 6

- Section 6.2, page 23** – The site meeting notes for GF3 state the “group agreed with Enhancement I and Restoration treatments which would include mostly focus on raising bed elevation, bank stabilization and riparian buffer improvements”. However, the proposed enhancement activities for GF3-A mirror GF1-A and GF2-A, which are both Enhancement II. The GF3-A existing conditions note the “channel has adequate riffle pool sequence and no knick-points or active downcutting” (page 11). Based on the information provided, DWR believes 2.5:1 is a more appropriate ratio for GF3-A.
RES understands DWR’s concern and has revisited the design approach for this reach. Although the channel exhibits “adequate riffle pool sequence and no knick-points or active downcutting” its entrenchment ratio is 1.6 making it moderately entrenched. To address this entrenchment and promote future stability RES has added floodplain grading to the design approach. This grading can be seen in the design plans on sheet S10. RES believes this additional enhancement of the reach justifies an Enhancement I treatment.
 - Section 6.2, page 23** – The site meeting notes for GF5 state that the “group agreed to Enhancement II crediting”. However, the proposed Enhancement II activities mirror GF4-B, which has a 7.5:1 ratio. And it appears GF5 has less riparian planting compared to GF4-B, since over half of the GF5 easement area is marked as supplemental planting on Sheet P1. Since there is no bed/bank work and the buffer is partially forested, DWR believes 7.5:1 is a more appropriate ratio for GF5.
RES appreciates DWR’s position that the enhancement activities proposed on reach GF5 mirror those proposed on reach GF4-B. While RES agrees that some of the treatments are consistent between reaches the GF5 easement was extended to capture two springs that feed directly to this reach. Additionally, a concrete tank currently buried at the origin of one spring will be removed as part of this reach treatment. Based on these differences RES proposes a revised ratio of 5:1 for this reach.
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3. **Section 6.2, page 24 In-Stream Structures** – Sod mats are identified as a potential bank stabilization treatment. Please include a detail for this treatment in Appendix A or add treatment information to applicable existing detail(s).
A detail has been added to sheet D4.
 4. **Section 6.3, page 27** - Are the locations of the alternative livestock watering facilities known? If not, is there an estimated minimum distance from the facilities to the easement?
The locations of watering facilities have not yet been decided. Typically, RES prefers not to place watering facilities within 50 feet of a conservation easement boundary; however, in the event that topographic and/or landowner demands require deviations from the standard, RES may need to make exceptions.
 5. **Section 6.4, page 28 Plant Community Restoration** – Completion of construction by the end of May means potentially planting in June, which would put the 180-day vegetative monitoring in December. Planting beyond the IRT 2016 guidance date of March 15th is not recommended, particularly for installation of (dormant) live stakes, and may result in an extended monitoring period being required. DWR would question the validity of MY1 vegetative survey results if performed after leaf drop.
Per recent IRT discussions, RES will target that planting will be conducted no later than April 30th. Therefore, **Section 6.4** has been revised accordingly.
 6. **Section 6.4, page 29 On-Site Invasive Species Management** – Please amend the first sentence to denote that treatment of invasive species will be required within the entire easement.
The first sentence has been revised per the comment.
 7. **Section 6.4, page 29 Soil Restoration** - No field soil data was provided. Was a soil site investigation completed? At minimum please include all wetland determination forms associated with the PJD in the final mitigation plan. Since vegetative cover and vigor can be a challenge on priority II restoration banks/benches, please include details on how the soil restoration will be addressed during construction and reference potential adaptive management. Also, please identify what measures will be taken to reduce the risk of invasive plant re-establishment/spreading from any topsoil stockpiled for reuse onsite.
Wetland delineation forms have been included in Appendix I with the PJD.
Erosion Control Notes (Sheet EC1) have been included to outline soil testing and stockpiling.
Also, regarding invasive re-establishment from stockpiled soil, RES has considered thermal killing via “tarping” of stockpiled soil; however, we have concluded that it is not practicable to spread stockpiled soil to an effective (shallow) depth within the confined staging areas within the easement area. Therefore, as is standard for our projects, we will monitor and treat invasives as necessary throughout the monitoring period to ensure the survival of planted trees and establishment of native natural communities.
 8. **Section 6.5, page 30** – Proposed wetland impacts are noted to be temporary, however, the stream restoration design has the relocated channel(s) going through features WC, WD, WE and Pond. Please describe how the Site’s total wetland area will be maintained and no net loss of will be documented.
Although there will be small permanent and temporary impacts to wetlands due to stream relocation, RES is confident that stream restoration practices will improve hydrology and raise the water table, resulting in a net positive gain in wetland area and function. A related discussion has been included in the narrative in **Section 6.5** of the Final Mitigation Plan.
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9. **Section 6.7, page 33** - Section 3.7 notes that all existing utilities will be removed from the easement; however, Sheet E2 shows three (3) locations where overhead utility lines cross the easement (north of GF1A 12+75; west of GF2B 10+00; east of GF4B 7+50). Have these utility crossings been accounted for in the buffer credit calculation and resulting mitigation credits? If so, please update Figure 10 and add corresponding notes to Table 15. Also, there appears to be multiple poles located within the easement, including one within the proposed grading limits near GF2-B 10+75. Are any poles proposed for relocation?

The overhead powerline that intersects GF1-A will remain, and an easement break has been incorporated into the Final Mitigation Plan. Additionally, one existing pole off the right bank of the uppermost section of reach GF1-A is located inside the proposed easement from the Draft Mitigation Plan; therefore, the easement was adjusted several feet to avoid including the pole. The remaining existing powerlines will be decommissioned, removed, and easements abandoned eliminating any further conflicts with the conservation easement. All applicable sections, figures, and design sheets have been updated accordingly to reflect these changes. Also, the buffer credit calculation has been re-applied and reflects the easement changes. As for **Table 15**, GF1-A has been broken into two design segments, (above and below the powerline easement break).

Tables and Figures

10. **Table 16, page 37** – DWR would prefer stage recorders be inspected quarterly to reduce the duration of potential missing data in the event of equipment failure.
Statement has been changed from semiannually to quarterly.
11. **Figure 11 Monitoring Plan** –
- Please add the existing wetlands layer to the monitoring plan figure.
Existing wetland layer has been added to **Figure 11**.
 - Please shift GF2-B & GF3-B recorders just upstream of nearby cross sections.
Stage recorder locations have been moved to the preferred locations.
 - Regarding the DMS comment about adding stream gauges on intermittent reaches, the IRT 2016 guidance section VI.A.6. (page 9) states that “where restoration *or enhancement* activities are proposed for intermittent streams, monitoring gauges should be installed...”.
A flow gauge has been added to reach GF4-A in **Figure 11** and success criteria has been added to **Section 7.1**, further discussed in **Section 8.3**, and included in **Table 16**.

Sheets

12. **Sheet E1** – Please include the floodplain sill and culvert icons in the legend.
Sheet E1 has been updated to include the floodplain sill and the culvert icons.
13. **Sheet S4** – Please confirm that a 20LF culvert is a sufficient length for the 100-ft wide crossing near GF1-B 24+00.
The culvert length is sufficient for current land use. The wider crossing was requested by the land owner to prevent any impact to future land use options.
14. **Sheets S4 & S5** – The proposed design includes relocating areas of the stream channel closer to the toe of slope and situating multiple bends along the floodplain grading limit (GF1-B 20+25, 21+25, 25+50). Please explain why this proposed.
Much of the proposed GF1-B profile is near the existing floodplain elevation and therefore the stream can be positioned near the grading limits but still have adequate floodplain on both sides. The proposed channels do approach the floodplain limits in several areas to promote project success by maintaining a significant offset from the existing channel. Proposed contours have been added

to the plans for additional clarity. Please note that fill for the existing channel is not included in these contours and will be completed per the detail.

15. **Sheet S5** – GF3-B and GF1-B have been relocated to within wetland WD; in this area the new channels are within 25 feet of each other and run parallel for 75-100 feet. This configuration results in more wetland impact compared to GF3-B tying into GF1-B closer to 29+00. Please provide the rationale for the current proposed design approach.
This alignment was chosen to promote future stability by moving the proposed confluence away from existing channels. This alignment also minimizes the project impact to the mature trees in this area.
 16. **Sheet S6** – Did you consider installing a constructed riffle at the transition from Restoration to Enhancement II reaches on GF1-B (34+50)?
Several grade control options were considered at this transition and a step pool structure was determined to be the most conservative at this sensitive area. Please note that a typical riffle detail has been added to sheet D7 and will be used on all riffles not proposed as a riffle grade control.
 17. **Sheet S6 & S10** – Please explain why proposed grading limits extend outside of the easement.
Grading limits extend outside the easement because RES will be filling the existing channel located outside of the easement.
 18. **Sheet S7** – Did you consider installing a constructed riffle between the proposed headcut stabilization (2+00) and log structure (4+74) on GF2-A?
A riffle grade control has been proposed in this area.
 19. **Sheet S8** – What is the proposed bank stabilization at GF2A 7+75? The callout doesn't match any of the legend icons.
The linestyle has been updated to show brush toe.
 20. **Sheet S9** – Please confirm whether the entire relic earthen dam will be removed.
The relic dam will be partially removed and graded such that it is consistent with the proposed floodplain up and downstream. Any unsuitable material or trash found during grading will be disposed of offsite. The design plans have been revised to show proposed grading.
 21. **Sheet S12** – In the site meeting notes DWR expressed concern over no bed/bank work being proposed for the GF4-B gully section. The GF4-B existing conditions state that “the buffer within the gully is predominantly composed of privet” (page 13) and the restoration approach includes invasive vegetation treatment (page 23). Please describe how the banks will be stabilized following the removal of privet.
To ensure bank stability, Chinese privet will be flush cut and sprayed; therefore, subsoil will not be disturbed. Roots will remain intact while plantings establish roots. Additionally, matting may be installed on potentially susceptible banks. **Section 6.2 – Reach GF4-B** has been updated accordingly.
 22. **Sheet P1** – Live stake species listed in the planting table do not match the species noted in the D3 detail, please update.
D3 has been updated to match the planting plan.
 23. **Sheet D4** - No ford crossings were called out in the design, please update.
The ford detail has been removed from the plans.
-

1. Even though there are no wetland credits being sought, and existing wetlands are fairly small, the restoration reach is going through features WC, WD, and WE. Please ensure that permanent impacts to these wetlands during construction do not result in loss of function, though it is anticipated that overall wetland function will improve from increased hydrology in this area. It's recommended that a temporary veg plot be placed in this area.
Although there will be small permanent and temporary impacts to wetlands due to stream relocation, RES is confident that stream restoration practices will improve hydrology and raise the water table, resulting in a net positive gain in wetland area and function. A related discussion has been included in the narrative in **Section 6.5** of the Final Mitigation Plan. There are three random plots that will be monitored each year, during this time RES will make sure at least one plot is in randomly placed within one of the three wetlands each year.
 2. It would be helpful to depict photo points/digital image stations on **Figure 11**. **Section 8.2** has been revised to clarify the locations of digital image stations. Specifically, the revised statement reads, "Digital images will be taken at fixed representative locations to record each monitoring event, as well as any noted problem areas or areas of concern. Fixed image locations will exist at each cross section, each vegetation plot, each stage recorder, and each flow gauge." RES believes that these images, along with images of any problem areas, will provide sufficient visual evidence of the Project's progression. Additionally, **Figure 11** has been revised to include a note stating the locations of fixed image locations.
 3. **Section 4, Functional Uplift Potential** - The functional pyramid is cited to show existing conditions for each category and was used to describe the functional uplift potential of the project, which is appreciated. Please note that the functional pyramid and SQT tool have not been approved for use by the IRT in determining success for mitigation projects. Several of the sections refer to existing conditions as not-functioning or functioning-at-risk. How did you determine this? The SQT forms are not included. It would be beneficial to include the NCSAM assessment.
The SQT tool was not utilized for this Project; therefore, the terms "not-functioning" and "functioning-at-risk" have been removed from the functional uplift narrative.
 4. **GF4-B** - The IRT field visit indicated that there was a large gully below the culvert and that additional structures and bank work would be beneficial here, and now the proposed approach is cattle exclusion and supplemental planting at 7.5:1. Do you anticipate that this erosion will increase over the monitoring period and contribute sediment downstream, potentially causing aggradation in GF3-A?
RES observed significant grade control directly downstream of the subject culvert and determined that any additional work to this area would carry an inordinate risk of failure. Erosion is expected to decrease in this area due to planting and trash removal.
 5. Was the coordination with USFWS and WRC regarding the NLEB resolved? When you submit the PCN, please include a note with how many acres of trees will be cleared.
-

Yes, please see the *Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form*, signed by Donnie Brew of FHWA, in **Appendix K**. As it notes, up to 3 acres of trees may be cleared. In addition, WRC conducted another bat hibernacula survey in January 2019 and did not observe any evidence of bats. **Section 3.4** has been updated to include this information.

6. Please include a performance standard of at least 30-days of consecutive flow on intermittent reaches (GF4A and GF4B). Please include monitoring flow gauges in the upper third of 4A. Does this reach have the potential to become more wetland-like? I was unable to make a site visit and the photo on **page 13** looks questionable.

A flow gauge has been added to reach GF4-A and success criteria has been added to **Section 7.1**, further discussed in **Section 8.3**, and included in **Table 16**. As for reach GF4-A, it is a jurisdictional stream as confirmed in the issued PJD. Considering that we are only proposing enhancement II activities on this reach and not changing bed elevation, it is anticipated that the jurisdictional status of the stream will be unaffected.

7. Please describe in the text narrative and in the Plan Sheets what will be done with the relic earthen dam and its sediment.

The relic dam will be partially removed and graded such that it is consistent with the proposed floodplain up and downstream. Any unsuitable material or trash found during grading will be disposed of offsite. The design plans have been revised to show proposed grading.

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1 PROJECT INTRODUCTION

1.1 Project Components

The Groundhog Hollow Project (“Project”) is located within a rural watershed in Alexander County, North Carolina approximately three and a half miles northwest of Taylorsville. The Project lies within the Catawba River Basin, North Carolina Division of Water Resources (NCDWR) sub-basin 03-08-32, and United States Geological Survey (USGS) 14-digit hydrologic unit code (HUC) 03050101120030 (**Figure 1**). The Project proposes to restore 2,851 linear feet (LF) and enhance 3,278 LF of stream within the Northern Inner Piedmont Level IV ecoregion.

The Project area is comprised of a 20.58-acre easement involving four unnamed tributaries, totaling 6,103 existing LF, which drain directly into the Lower Little River which eventually drains into the Catawba River. The stream mitigation components are summarized in **Table 1**. The Project is accessible from Groundhog Hollow Drive off of Zeb Watts Road. Coordinates for the Project areas are as follows: 35.937201° N, -81.237783° W.

1.2 Project Outcomes

The streams proposed for restoration and enhancement have been significantly impacted by long-term agricultural practices, specifically livestock husbandry, which has contributed to the lack of riparian buffer and degraded channels throughout the Project. Proposed improvements to the Project will help meet the river basin needs expressed in the 2009 (amended, 2018) Upper Catawba River Basin Restoration Priorities (RBRP) as well as ecological improvements to riparian corridor within the easement.

Through stream restoration and enhancement, the Project presents 6,129 LF of proposed stream, generating 4,093.95 Warm Stream Mitigation Units (SMU) (**Table 1**). This mitigation plan is consistent with the May 8, 2018 Post Contract IRT Meeting Minutes and IRT response emails (**Appendix B**).

Table 1. Groundhog Hollow Project Components Summary

Mitigation Approach	Linear Feet	Ratio	Warm SMU
Restoration	2,851	1	2,851.00
Enhancement I	306	1.5	204.00
Enhancement II	2,338	2.5	935.20
Enhancement II	253	5	506.00
Enhancement II	381	7.5	50.80
Total	6,129		4,091.60
Non-standard Buffer Width Adjustment			+2.35*
Total Adjusted SMUs			4,093.95

* Credit adjustment for Non-standard Buffer Width calculation using the Wilmington District Stream Buffer Credit Calculator issued by the USACE in January 2018. See Section 6.6 for further information

2 WATERSHED APPROACH

The Project was selected based on its potential to support the objectives and goals of the North Carolina Division of Mitigation Services (DMS) 2009 (amended, 2018) Upper Catawba RBRP. The Upper Catawba RBRP identified several restoration needs for the entire Catawba River Basin, as well as for HUC 03050101. Five counties are included in the Upper Catawba River Basin, including the towns of Marion, Morganton, Lenoir, and Hickory. The Project watershed was identified as a Target Local Watershed (TLW) (HUC 03050101120030, Lower Little River, Muddy Fork TLW), a watershed that exhibits both the need and opportunity for stream and riparian buffer restoration. Approximately 41% of this TLW is agricultural lands, 47% forest, and contains 50 permitted animal operations, which is the most of any TLW in the Upper Catawba. In addition, the Lower Little River is a 303(d) listed waterbody due to a fair fish bioclassification score (NCDWR, 2016). More specifically, goals outlined in the RBRP for the watershed include:

1. *Restoration of nutrient and sediment-impaired waters (including tributary streams) of the Catawba River mainstem lakes (water supply reservoirs), including Lake James, Lake Rodhiss, Lake Hickory and Lookout Shoals Lake;*
2. *Protection of riparian buffers and aquatic habitat within the headwater reaches of asset-rich watersheds of the upper Catawba River basin, including the upper Linville River, North Fork Catawba River, Wilson Creek, Mulberry Creek, Johns River and Lower Little River;*
3. *Implementation of stormwater assessment and management efforts, including stormwater BMP projects, within urban and suburban subwatersheds in the Linville, Marion, Lenoir, Morganton, Hickory and Taylorsville areas;*
4. *Increased implementation of agricultural BMPs within heavily agricultural sub-watersheds of TLWs, including North and South Muddy Creeks, Silver Creek, lower Lower Creek, Lower Little River, Jumping Run Creek and Elk Shoal Creek; and*
5. *Continuation of the collaborative watershed assessment, planning and restoration efforts that are integral to three existing LWP initiatives in the upper Catawba River basin: Lower Creek (EEP DMS and LCAT), Muddy Creek (Muddy Creek Restoration Partnership) and Lake Rodhiss (WPCOG).*

Current and future population growth leading to habitat conversion is the primary stressor in this watershed leading to water quality impairment and habitat degradation, and the Project will help address the identified stressor as described in **Section 2.1**.

2.1 Site Selection

The Project will directly and indirectly address stressors identified in the RBRP by stabilizing eroding stream banks, reconnecting incised streams to their floodplains, reducing sediment and nutrient loads, and restoring forested buffers along the stream channels. Project-specific goals and objectives will be addressed further in **Section 5**. A project watershed map with the Project's drainage areas is shown on **Figure 2** and watershed planning priority boundaries are shown on **Figure 1**.

The Project will address two of the goals outlined in the 2009 Upper Catawba RBRP. By establishing a permanent conservation easement at the Project, aquatic habitat and riparian buffers within asset rich headwaters of the Lower Little River will be protected in perpetuity (RBRP Goal 2). Additionally, the

Project will implement agricultural BMPs, specifically restorative planting of riparian buffers and installation of cattle exclusion fencing, within the heavily farmed Lower Little River TLW (RBRP Goal 4).

The land required for the construction, management, and stewardship of this Project includes portions of seven parcels in Alexander County with the following ownership in **Table 2 & Figure 3**. Once finalized, a copy of the land protection instrument will be included in **Appendix C**. The DMS Conservation Easement model template will be utilized to draft the site protection instruments. The landowner will be responsible for fence maintenance and repairs to exclude livestock from the conservation easement after the monitoring period has concluded, and the conservation easement document will include the applicable language.

Table 2. Project Parcel and Landowner Information

Owner of Record	PIN Or Tax Parcel ID#	Stream Reach
Gene Lynn & Donna S Fox	3830-84-9704 3830-84-1058 3830-73-5760 3830-82-0800 (Alexander County)	All, including portion of GF1-A
Herman Farms	3830-64-8068 3830-75-5090 (Alexander County)	Portion of GF1-A
Jeffrey Walker	3830-82-9684 (Alexander County)	Portion of GF4-A

3 BASELINE AND EXISTING CONDITIONS

3.1 Watershed Summary Information

Drainage Area and Land Cover

The Project area is comprised of four unnamed tributaries that flow generally west to east and drain directly into the Lower Little River along the eastern limits of the Project. The total drainage area for the Project is 156 acres (0.24 mi²) (**Table 3**); the drainage area of Reach GF1 is 156 acres (0.24 mi²); Reach GF2 is 45 acres (0.07 mi²); Reach GF3 is 39 acres (0.06 mi²); Reach GF4 is 23 acres (0.04 mi²); and Reach GF5 is 9 acres (0.01 mi²). Primary land use within the drainage area consists of approximately 73% pasture, 16% forest, 8% residential, and 3% Confined Animal Feeding Operations (CAFO). (**Figure 4**). Historic and current land-use within the immediate Project area have allowed cattle direct access to the streams. These activities have negatively impacted both water quality and streambank stability in Project streams.

Table 3. Project Watershed Summary Information

Level IV Ecoregion	45e - Northern Inner Piedmont
River Basin	Catawba
USGS Hydrologic Unit 8-digit	03050101
USGS Hydrologic Unit 14-digit	03050101120030
DWR Sub-basin	03-08-32
Surface Water Classification	C
Project Drainage Area (acres)	156
Percent Impervious Area	<1%

3.2 Landscape Characteristics

Physiography and Topography

The Project is located in the Northern Inner Piedmont level IV ecoregion within the Piedmont level III ecoregion. It is a transitional region from the Blue Ridge Mountains to the Piedmont and therefore has higher elevations with more rugged, mountainous terrain compared to most of the Piedmont. With colder temperatures and more snowfall, soils are mostly mesic and the growing season is shorter in the Northern Inner Piedmont compared to the thermic soil and longer growing season in the rest of the Piedmont. Vegetation in the region incorporates mountain plant species and includes more Virginia pine and chestnut oak than the rest of the Piedmont. Streams in the region are usually of higher gradients and include mountain species of macroinvertebrates (Griffith et al. 2002). The topography of the project area is generally rolling with elevations ranging from 1,070 feet to 1,154 feet.

Geology and Soils

According to geology data from the North Carolina Geologic Survey, published in 1985, the Project is dissected by two geologic map units:

The western segment of the Project is within map unit CZbg, occurring in the Inner Piedmont Belt. This map unit is associated with metamorphic type rocks of the biotite gneiss and schist formation that formed during the Cenozoic Era within 63 million years ago. The formation is inequigranular and contains locally abundant potassic feldspar and garnet; interlayered and gradational with calc-silicate rock, sillimanite-mica schist, mica schist, and amphibolite; and includes small masses of granite.

The eastern segment of the Project is within map unit CZms, also occurring in the Inner Piedmont Belt. This map unit is associated with metamorphic type rocks of the mica schist formation that formed during

the Cenozoic Era within 63 million years ago. The formation consists of local compositions of garnet, staurolite, kyanite, or sillimanite along with lenses and layers of quartz schist, micaceous quartzite, calc-silicate rock, biotite gneiss, amphibolite, and phyllite.

The NRCS Web Soil Survey shows several mapping units across the Project. Map units include three soil series. The soil series found on the Project are described below and summarized in **Table 4**.

Project soils are mapped by the NRCS within the easement as Codorus loam, Fairview sandy clay loam, Fairview sandy loam, and Ronda loamy sand (**Figure 5**). Codorus loam makes up approximately 15 percent of the easement and is somewhat poorly drained and found on nearly level floodplains at zero to two percent slopes. Fairview sandy clay loam makes up only three percent of the easement area and is well drained and found on ridges and interfluves at eight to 15 percent slopes. Fairview sandy loam makes up 78 percent of the easement area and is well drained and found on ridges and interfluves at 15 to 25 percent slopes. Ronda loamy sand makes up four percent of the easement area and is excessively drained and found on natural levees on floodplains at zero to five percent slopes.

Table 4. Mapped Soil Series

Map Unit Symbol	Map Unit Name	Percent Hydric	Drainage Class	Hydrologic Soil Group	Landscape Setting
CoA	Codorus loam, 0 to 2 percent slopes, frequently flooded	5%	Somewhat Poorly	B/D	Nearly level floodplains
FcC2	Fairview sandy clay loam, 8 to 15 percent slopes, moderately eroded	0%	Well	C	Ridges and interfluves
FcD2	Fairview sandy loam, 15 to 25 percent slopes	0%	Well	B	Ridges and Interfluves
RnA	Ronda loamy sand, 0 to 5 percent slopes, occasionally flooded	1%	Excessively	A	Natural levees on floodplains

Existing Vegetation

Vegetation around the unbuffered reaches of the Project tributaries are primarily composed of herbaceous vegetation and scattered trees. All reaches have been grazed by livestock, including the narrow, forested riparian areas, and thus lack a well-developed understory and shrub strata. Dominant canopy species within the forested riparian areas across the site include red maple (*Acer rubrum*), American sycamore (*Platanus occidentalis*), American persimmon (*Diospyros virginiana*), eastern red-cedar (*Juniperus virginiana*), yellow poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*), and river birch (*Betula nigra*). Understory species include American holly (*Ilex opaca*) and sawtooth blackberry (*Rubus argutus*). Though highly disturbed, herbaceous species include fescue grass (*Festuca* sp.), dogfennel (*Eupatorium capifolium*), goldenrod (*Solidago* sp.), asters (*Symphotrichum* sp.), and American pokeweed (*Phytolacca Americana*). Invasive species are also present throughout, including multiflora rose (*Rosa multiflora*) and Chinese privet (*Ligustrum sinense*).

3.3 Land Use – Historic, Current, and Future

Historic aerial imagery and landowner interviews indicate that the Project has been used extensively for agricultural purposes, and that the location of the streams have not changed in over 72 years (**Figure 6**).

Currently the area remains in an agricultural community with some neighboring forested property. Several watershed characteristics, such as groundwater, vegetation, surface drainage, and soil parameters have been modified. Livestock currently have access to all stream reaches and are actively degrading the channels. Riparian buffers are either very sparse, narrow or non-existent. Soil structure and surface texture have been altered from long-term active grazing.

The future land use for the Project area will include 20.58 acres of conservation easement that will be protected in perpetuity. The Project easement will have 6,129 linear feet of functioning streams, a minimum 50-foot riparian buffer, and will exclude livestock with fencing. Outside the Project, the area will likely remain in agricultural use.

3.4 Regulatory Considerations

Federal Emergency Management Agency (FEMA)/ Hydrologic Trespass

According to the North Carolina Floodplain Mapping Information System, the downstream segments of reaches GF1 and GF3 are located within the mapped FEMA 100-year floodplain of the Lower Little River; however, no regulated floodway is mapped (FEMA 2018) (**Figure 7**). The design and permitting of the mitigation work will include coordination with the Alexander County Floodplain Administrator. No FEMA permitting will be required for this project as currently designed. No hydrologic trespass will be permitted to adjacent properties upstream or downstream of the Project.

Environmental Screening and Documentation

To ensure that a project meets the “Categorical Exclusion” criteria, the Federal Highways Administration (FHWA) and NCDMS have developed a categorical exclusion (CE) checklist that is included as part of each mitigation project’s Environmental Screening process. The CE Approval Form for the Groundhog Hollow Project is included in **Appendix K** and was approved by DMS and FHWA in June 2018.

Threatened and Endangered Species

Plants and animals with a federal classification of endangered or threatened are protected under provisions of Sections 7 and 9 of the Endangered Species Act of 1973, as amended. The USFWS database (2017) lists two endangered species that may occur in proximity to the Project: Dwarf-flowered heartleaf (*Haxastylis naniflora*) and Northern long-eared bat (*Myotis septentrionalis*). Species and species habitat listed in the USFWS database were inspected during the field investigation to determine whether they occur at the Project. No individual species or habitats were identified on site. Potential impacts to species and species habitat off site, downstream, and within the vicinity of the project were also considered. A letter was sent to the USFWS on March 28, 2018 requesting review and comment of possible issues with respect to threatened and endangered species on the Project. USFWS responded on April 27, 2018 and requested a species survey be conducted for dwarf-flowered heartleaf. RES performed a survey on May 16, 2018 and no suitable habitat for dwarf-flowered heartleaf was found on-site. USFWS correspondence is included in **Appendix K**.

As for NLEB, to comply with the NLEB 4(d) streamlined rule for federal agencies, the required consultation form was submitted by the Federal Highway Administration (FHWA) to the USFWS as part of the Categorical Exclusion. It was determined that the project “may affect the NLEB, but any incidental take of the NLEB is not prohibited by the final 4(d) rule.” However, RES will avoid tree cutting from May 15 – August 15, if possible, in order to protect sensitive summer roosting habitat. Documentation of this

correspondence is included in **Appendix K**. Additionally, during an IRT site visit on March 29, 2018 the North Carolina Wildlife Resources Commission (NCWRC) noted a root cellar in the hillside as potential for bat habitat. NCWRC and RES staff surveyed cellar on April 20, 2018 and did not find any evidence of bats. NCWRC conducted another hibernacula survey in the winter, January 2019, to make sure it was not being used, and, again, no bat evidence was observed.

The Fish and Wildlife Coordination Act requires consultation with state fish and wildlife agencies when “waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted...or otherwise controlled or modified.” A letter was sent to the NCWRC on March 28, 2018 requesting review and comment of possible issues with respect to fish and wildlife resources on the Project. NCWRC responded on April 20, 2018 and recommended that RES correspond with USFWS regarding NLEB, but otherwise had no comment for any other species. Documentation is included in **Appendix K**.

Cultural Resources

A review of the North Carolina State Historic Preservation Office GIS Web Service database revealed that there are no National Registered listings within a one-mile radius of the proposed Project area. No architectural structures or archeological artifacts have been observed or noted during preliminary surveys of the site for restoration purposes. A letter was sent to the North Carolina Department of Cultural Resources, State Historic Preservation Office (SHPO), on March 28, 2018. The letter described the Project and requested a review and comment of potential cultural resources occurring within the vicinity of the Site. RES received a response letter from SHPO on May 1, 2018 which confirmed that no known historic resources would be affected by the project. Therefore, Cultural Resources investigation met the Categorical Exclusion Criteria for FHWA and DMS projects and documentation is included in **Appendix K**.

Table 5. Regulatory Considerations

Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	No	Appendix K
Waters of the United States - Section 401	Yes	No	Appendix K
Endangered Species Act	Yes	Yes	Appendix K
National Historic Preservation Act	Yes	Yes	Appendix K
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	No	Appendix L
Magnuson Stevens Act - Essential Fisheries Habitat	No	N/A	N/A

3.5 Reach Summary Information

The Project area is comprised of a single easement area along four unnamed tributaries that drain directly into the Lower Little River. The Project is split into nine reaches (GF1-A, GF1-B, GF2-A, GF2-B, GF3-A, GF3-B, GF4-A, GF4-B, and GF5) (**Figures 8,9**). Results of the preliminary data collections are presented in **Table 6**. Morphological parameters are located in **Appendix B**.

Table 6. Summary of Existing Channel Characteristics

Reach	Drainage Area (ac)	A _{BKF} ¹ (ft ²)	BKF Width (ft)	BKF Mean Depth (ft)	Low Bank Height (ft)	Width:Depth Ratio	Bank Height Ratio	Entrenchment Ratio	Sinuosity	Slope (ft/ft)
GF1-A	42	1.8	5.3	0.3	2.8	15.9	4.5	1.4	1.16	0.024
GF1-B (US)	46	2.6	4.4	0.6	2.0	7.6	2.3	1.5	1.21	0.019
GF1-B (MS)	111	4.5	8.3	0.5	1.1	15.2	1.3	2.9	1.15	0.017
GF1-B (DS)	156	6.8	6.3	1.1	3.7	5.9	2.8	1.3	1.08	0.016
GF2-A	35	1.6	5.4	0.3	0.8	18.2	1.6	1.6	1.09	0.031
GF2-B	45	4.0	7.7	0.5	1.7	14.8	2.1	1.1	1.19	0.031
GF3-A	36	3.0	5.0	0.6	1.6	8.3	1.9	1.6	1.13	0.022
GF3-B	39	2.9	4.1	0.7	1.5	5.8	1.6	1.5	1.08	0.021
GF4-A	16	1.3	4.2	0.3	2.6	13.8	5.7	1.6	1.10	0.016
GF4-B	23	1.7	5.9	0.3	1.0	19.8	2.0	1.4	1.13	0.027
GF5	9	0.6	4.5	0.1	0.5	32.2	1.0	>2.2	1.23	0.102

¹A_{BKF}= cross-sectional area (measured at approximate bankfull stage as estimated using existing conditions data and NC Regional Curve equations where field indicators were not present)

Note: These calculations are based on measured riffle cross sections

Existing Channel Morphology

GF1

GF1-A

Reach GF1-A begins at the south west limits of the project and flows northeast to GF1-B. The reach has degraded and widened into an F-type channel. The channel valley is moderately confined with a floodplain terrace found along the upper portion of the reach. The channel is subjected to continuous stress from livestock access and while much of the bed has reached quasi-equilibrium the channel banks exhibit moderate erosion from hoof shear. Also, there is an overhead powerline intersecting this reach



Reach GF1-A
Looking upstream



Reach GF1-A
Looking downstream

GF1-B

Reach GF1-B begins downstream of GF1-A and flows northeast past GF2 and GF3 to its confluence with the Lower Little River. The design of this reach was divided into three sections: the upstream section between Reaches GF1-A and the confluence with GF2, the middle section between the confluence with Reaches GF2 and GF3, and the downstream section between the confluence with Reach GF3 and the end of the project. Channel buffers are limited to non-existent along all three sections of the reach.

The upstream portion of Reach GF1-B is a degraded G-type channel that is currently widening toward an F-type morphology. The valley is moderately confined with little to no floodplain terrace observed. The channel is subjected to continuous stress from livestock access and the banks are slumping throughout the reach.

The middle portion of Reach GF1-B is a C-type channel that has been heavily modified by livestock practices. The valley is unconfined relative to the rest of the site with an adequate floodplain present on at least one bank for the entire reach. The channel banks are irregular and slumping due to livestock access, the channel is degrading in the upstream portion of the reach and several large sediment deposits in the downstream portion of the reach have caused the channel to braid and cut a new channel in the left overbank area. This new channel is appropriately sized but lacks the appropriate substrate and slope. Consequently, several headcuts are currently migrating upstream through this channel.

The downstream portion of Reach GF1-B is a G-type channel located in the floodplain of the Lower Little River. The reach is heavily incised due to historic downcutting to tie into the Lower Little River and straightening to promote livestock practices. The banks are steep but stabilized by a mix of native and invasive vegetation. Grade control was observed along this reach where the channel has cut down to bedrock. A relic channel is present in the left overbank, but it no longer conveys a significant watershed. This channel does have a baseflow, which is supplied by groundwater. This channel lacks vegetation and is actively eroding during backwater events from the Lower Little River.



Reach GF1-B – Upper
Looking upstream



Reach GF1-B – Middle
Looking at left bank



Reach GF1-B – Middle
Looking upstream



Reach GF1-B - Lower
Looking downstream

GF2

GF2-A

Reach GF2-A begins at the southern limits of the project and flows north to GF2-B. The reach has previously degraded and widened into an F-type channel. The channel valley is confined with little to no current or historic floodplain present. The channel is subjected to continuous stress from livestock access, subsequently the channel banks exhibit moderate erosion from hoof shear. A 10-foot active headcut is present at the upstream end of the reach. This headcut is acting as a significant sediment source to the downstream channel. The buffer along this reach ranges from absent to somewhat intact.



Reach GF2-A – Looking upstream



Reach GF2-A – Looking downstream

GF2-B

Reach GF2-B begins downstream of Reach GF2-A and flows south to its confluence with Reach GF1-A and B. The reach has previously degraded and widened into an F-type channel. The valley is confined until it meets the floodplain of Reach GF1. The channel is subjected to continuous stress from livestock access and exhibits moderate erosion from hoof shear. There is a small breached impoundment in the right overbank of the existing reach. Limited buffer is present along this reach.



Reach GF2-B – Looking downstream



Reach GF2-B – Looking at left bank

GF3

GF3-A

Reach GF3-A is located along the eastern limits of the project and flows north to an existing ford crossing. The reach has previously degraded into a G-type channel. The channel valley is confined with little to no current or historic floodplain present. The channel is subjected to continuous stress from livestock access, subsequently the channel banks exhibit moderate erosion from hoof shear. The channel bed has adequate riffle pool sequence and no knick-points or active downcutting was observed. No buffer is present along the right bank of this reach and a limited buffer with heavy invasives is present along the left bank.



Reach GF3-A – Looking upstream



Reach GF3-A – Looking downstream

GF3-B

Reach GF3-B begins downstream of Reach GF3-A at an existing ford and flows north to its confluence with Reach GF1-B. The reach has previously degraded into a G-type channel. The channel valley is unconfined; however, downcutting has dislocated the reach from the existing floodplain. The channel is subjected to continuous stress from livestock access, subsequently the channel banks exhibit moderate erosion from hoof shear. A minimal, single row of trees comprises the buffer along this reach.



Reach GF3-B – Looking upstream



Reach GF3-B – Looking downstream

GF4

GF4-A

Reach GF4-A is located in the southeastern limits of the project and flows north to an existing culvert crossing. The reach has previously degraded into an F-type channel. The channel valley is unconfined; however, downcutting dislocated the channel from the original floodplain. The channel has since widened and is beginning to form a new floodplain. There is a seven foot actively eroding headcut at the top of the reach. Subjected to continuous stress from livestock access, the channel banks exhibit moderate erosion from hoof shear. No buffer is present along this reach.



Reach GF4-A – Looking upstream



Reach GF4-A – Looking downstream

GF4-B

Reach GF4-B begins downstream of Reach GF4-A at an existing culvert crossing. The reach has previously degraded and widened into an F-type channel. The channel valley is confined with little to no current or historic floodplain present. The channel is subjected to continuous stress from livestock access, however, the channel banks exhibit limited erosion from hoof shear. The upper portion of this reach drops 16 feet from the outlet of the upstream crossing over a 150-foot length of channel. This drop is stabilized by exposed bedrock, large tree roots, and boulders. No buffer is present along this reach outside of the existing gully. The buffer within the gully is predominantly composed of privet.



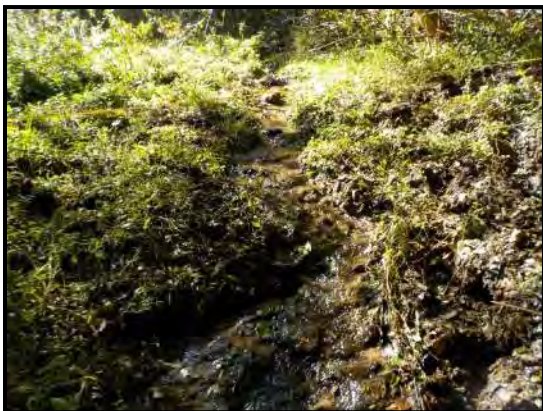
Reach GF4-B – Looking upstream



Reach GF4-B – Looking downstream

GF5

Reach GF5 is in the southern limits of the project and flows east to its confluence with GF3-A. The reach originates in an abandoned stone masonry spring house. Subjected to continuous stress from livestock access, the channel banks are irregular but do not show signs of mass wasting. Limited buffer is present along the upper portion of the reach.



Reach GF5 – Looking upstream



Reach GF5 – Looking downstream

Channel Classification

The streams have been classified as intermittent (GF4) and perennial (GF1, GF2, GF3, and GF5) streams using the NCDWR Stream Identification Form version 4.11 and are G-, F-, and C-stream types as classified using the Rosgen stream classification system (Rosgen, 1996). **Table 7** summarizes these stream parameters and the stream determination scores can be found in **Appendix G**. Stream determinations have been verified by the USACE. In addition, USACE Stream Quality Assessment Worksheets were completed for each reach of the Project and can be found in **Appendix H**.

Table 7. Summary of Stream Parameters

Reach	Hydrology Status	Stream Determination Score	Reach Length (LF)	Rosgen Stream Classification
GF1-A	Perennial	39	1,254	F4b
GF1-B	Perennial	40.5	2,100	G4c/C4
GF2-A	Perennial	31	642	F4b
GF2-B			609	F4b
GF3-A	Perennial	34.5	311	G4
GF3-B			270	G5/6
GF4-A	Intermittent	25.75	283	G4
GF4-B			381	F4b
GF5	Perennial	31.5	253	C4/5

3.6 Existing Wetlands

A survey of existing wetlands was performed on March 7, 2018. Wetland boundaries were delineated using current methodology outlined in the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987). Soils were characterized and classified using the Field Indicators of Hydric Soils in the United States, Version 7.0 (USDA-NRCS 2010). Within the boundaries of the Project, six small jurisdictional wetlands are present (**Figure 8**). Wetlands are labeled as WA (Wetland A) through WF (Wetland F) and are described in **Table 8**. A preliminary jurisdictional determination (PJD) request was sent to the USACE on April 3, 2018 and a confirmed PJD was received on January 31, 2019 (**Appendix D**).

Table 8. Jurisdictional Wetland Summary

Wetland ID	Area (acres)	Cowardin Type	Hydrology Source	Soil Series	Dominant Vegetation
WA	0.06	PEM1	Groundwater seepage	Fairview sandy loam	Soft rush (<i>Juncus effuses</i>), fescue
WB	0.09	PEM1	Groundwater, overland	Fairview sandy loam	Red maple (<i>Acer rubrum</i>), soft rush, shallow sedge (<i>Carex lurida</i>), fescue
WC	0.05	PFO1	Groundwater, flooding	Codorus loam	Red maple, American sycamore, river birch, soft rush
WD	0.15	PFO1	Groundwater, flooding	Codorus loam	Red maple, American sycamore, river birch, soft rush, purplestem aster (<i>Symphotrichum puniceum</i>)
WE	0.04	PEM1	Groundwater seepage	Fairview sandy loam	Chinese privet, shallow sedge
WF	0.01	PEM1	Groundwater seepage	Fairview sandy loam	Chinese privet, shallow sedge

The US Fish and Wildlife Service (USFWS) National Wetland Inventory Map (NWI) does not depict any additional wetland areas within the Project (**Figure 8**).

3.7 Potential Constraints

There are no significant hydrologic or infrastructure constraints to the Project. All existing utilities will be removed from the easement except for one overhead power line intersecting reach GF1-A, which will be included in an easement break. Four easement breaks for culverts are proposed to facilitate landowner access to surrounding parcels. Any culvert maintenance will be the responsibility of RES through completion of monitoring. Once the Project has completed monitoring and the Project is closed out, the culvert will be the responsibility of the landowner(s). Lastly, the Taylorsville Airport, which is privately owned and operated, is located approximately two miles east of the Project.

4 FUNCTIONAL UPLIFT POTENTIAL

The Stream Functions Pyramid Framework (Harman et. al. 2012) uses stream functions to describe project objectives, existing condition assessments and monitoring, performance metrics, and design criteria. The Framework separates stream functions into five categories, ordered into a hierarchy, which communicate the interrelations among functions and illustrate the dependence of higher level functions (biology, physicochemical and geomorphology) on lower level functions (hydrology and hydraulics). Functions that affect the greatest number of other functions are illustrated at the base of the Pyramid, while functions that have the least effect on other functions are illustrated at the top.

Fischenich (2006) found that the most critical functions include those that address hydrodynamic processes, sediment transport processes, stream stability and riparian buffer restoration. By addressing these fundamental functions and processes, a restored stream and riparian system are capable of supporting more dependent functions that typically require time to establish, such as diverse biological communities, chemical and nutrient processes, diverse habitats and improved water and soil quality. The objectives of this Project will address the most critical functional objectives that will allow for a more restored stream and riparian area over time.

A functional based approach broadens the reach-scale goals of a restoration project by contextualizing the functional uplift to the watershed scale. By applying an ecosystem restoration approach, the proposed Project will provide localized ecological and water quality benefits that could in combination with other restoration projects within the watershed have beneficial impacts on the Catawba River Basin. The restoration approach at the reach scale of this Project will benefit the hydraulic and geomorphology functions of the system but could also benefit the upper-level functions (physicochemical and biology) over time and in combination with other restoration projects within the watershed. Anticipated functional benefits and improvements within the Project area, as based on the Function-Based Framework, are outlined in **Table 10**.

4.1 Anticipated Functional Benefits and Improvements

Hydrology

According to the Stream Functions Pyramid Framework, hydrology is defined as the transport of water from the watershed to the channel. The Project will locally address several historic hydrologic disturbances including deforestation and channelization; however, it is not anticipated that the Project will have a significant effect on hydrology at the watershed scale.

Hydraulic

The hydraulic function of the Pyramid is defined as transport of water in the channel, on the floodplain, and through sediments. The greatest potential uplift at the Project will be achieved through increasing floodplain connectivity throughout the Project. Reaches in the Project do not have functioning floodplain connectivity or stable flow dynamics. Reaches where floodplain connectivity is not fully functional will be improved by reducing bank height ratios and increasing entrenchment ratios. Reaches in which stable flow dynamics are not fully functional will be improved by constructing a new stable channel with adequate energy dissipation and grade control.

Geomorphology

Geomorphology, as defined within the Pyramid Framework, is the transport of wood and sediment to create bed forms and dynamic equilibrium. Sediment transport will be improved in reaches that are currently not functioning properly by reducing the excess sediment load entering the stream. This reduction will be achieved by establishing a functional buffer and constructing channels that maintain stable dimension, plan,

and profile. Channel stability and bedform diversity will be improved in restoration reaches by installing a mix of rock and log structures to promote a natural combination of riffle-pool and step-pool sequences. Channel substrate will be supplemented by off-site material to ensure bed stability and habitat creation. Transport and storage of woody debris will be improved through increases in channel roughness from plantings and structures installation. Existing riparian vegetation is not sufficient along Project reaches. Therefore, riparian buffers will be planted out to a minimum of 50 feet to improve the riparian vegetation to improve function, while also providing terrestrial habitat. All of these functional parameters are interconnected and depend on each other, improving this wide range of parameters will result in long-term functional geomorphic uplift.

Physicochemical

The Pyramid Framework defines the physicochemical category as temperature and oxygen regulation and the processing of organic matter and nutrients. Although this Project would support the overarching goal in the Upper Catawba River Basin Priorities to promote nutrient and sediment reduction in impaired waters, it is difficult to measure nutrient and sediment reduction at this project level because they can be affected by so many variables. However, several restoration actions are known to help reduce nutrients and sediment even though they may not be measurable at the project level. These activities include filtering of runoff through buffer areas, the conversion of active farm fields to forested buffers, and improved denitrification and nutrient uptake through buffer zones. Additional benefits may also come from functional uplift of the lower-level stream functions (hydraulics and geomorphology), which will reduce sediment and nutrients in the system through bank stabilization and reforestation. Temperature regulation will also be improved through the restoration of canopy tree species to the stream buffer areas. Oxygen regulation will occur through two actions: first, the temperature of the water directly impacts the amount of gas held by the water. Therefore, by planting the buffer to shade the channel, water temperature is decreased and dissolved oxygen is increased. Second, the drop structures placed in the stream create mixing zones where oxygen dissolves much faster than the standard exchange rate of oxygen to dissolved oxygen. The processing of organic matter will be improved once healthy riffles are shallow enough to catch twigs and branches that then retain leaves. Many of these physicochemical benefits occur slowly over time and are dependent on multiple variables within the stream ecosystem. Therefore, it is not practical or feasible to directly measure these parameters within the monitoring time frame of this project. With that said, it is logical to use existing riparian buffer and visual performance standards to demonstrate the positive correlation between geomorphic parameters and physicochemical parameters. For example, as riparian buffer trees grow, as represented in annual monitoring reports, it is anticipated that canopy cover is actively shading the stream channel and reducing water temperature. This is not a substitute for direct physicochemical monitoring, but it is a useful tool to help project the long-term benefits of the Project in terms of its functional uplift.

Biology

The highest category of the Pyramid is biology and is defined as the biodiversity and life histories of aquatic and terrestrial life, specifically referring to animals. As mentioned for the physicochemical stream function, it will be difficult to see measurable results of the functional uplift of the biological functions at a project scale during the monitoring time frame of the project. However, since the life histories of many species likely to benefit from stream restoration are depending on all the lower-level functions, the functional uplift from the hydraulic and geomorphic levels would likely have a positive effect on the biology over time and in combination with other projects within the watershed is anticipated. Again, there is no substitute for direct biological monitoring, but it is important to understand the hierarchy of the Stream Functions Pyramid Framework in order to help project long-term benefits of the Project, though only categories two and three (hydraulics and geomorphology) will be directly measured during the seven-year monitoring period.

5 MITIGATION PROJECT GOALS AND OBJECTIVES

Through the comprehensive analysis of the Project's maximum functional uplift using the Stream Functions Pyramid Framework, specific, attainable goals and objectives will be realized by the Project. These goals clearly address the degraded water quality and nutrient input from farming that were identified as major watershed stressors in the 2009 (amended 2018) Upper Catawba River RBRP. The Project will address outlined RBRP Goals 1 and 4 (listed in **Section 2**).

The Project goals are:

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

The Project objectives to address the goals are:

- Design and reconstruct stream channels sized to convey bankfull flows that will maintain a stable dimension, profile, and planform;
- Add in-stream structures and bank stabilization measures to protect restored streams;
- Install habitat features such as brush toes, constructed riffles, woody materials, and pools of varying depths to restored streams;
- Increase forested riparian buffers to at least 50 feet on both sides of the channel along the Project reaches with a hardwood riparian plant community;
- Install approximately 12,000 linear feet of livestock exclusion fencing along the easement boundary to ensure livestock will no longer have stream access;
- Treat exotic invasive species; and
- Establish a permanent conservation easement on the Project that will exclude future livestock from stream channels and their associated buffers and prevent future landuse changes.

Anticipated functional uplift, benefits, and improvements within the Project area, as based on the Function Based Framework are outlined in **Table 9**.

Table 9. Functional Benefits and Improvements

Level	Function	Goal	Objective	Measurement Method
1	<u>Hydrology</u> <i>Transport of water from the watershed to the channel</i>	to transport water from the watershed to the channel in a non-erosive manner and maintain a stable water table in riparian wetlands	Convert land-use of streams and their headwaters from pasture to riparian forest	Percent Project drainage area converted to riparian forest (indirect measurement)
2	<u>Hydraulic</u> <i>Transport of water in the channel, on the floodplain, and through the sediments</i>	to transport water in a stable non-erosive manner	Improve flood bank connectivity by reducing bank height ratios and increasing entrenchment ratios	Cross sections Stage recorders Bank Height Ratio Entrenchment Ratio
3	<u>Geomorphology</u> <i>Transport of wood and sediment to create diverse bedforms and dynamic equilibrium</i>	to create a diverse bedform and stable channels that achieve healthy dynamic equilibrium and provide suitable habitat for life	Reduce erosion rates and channel stability to reference reach conditions Improve bedform diversity (pool spacing, percent riffles, etc.) Increase buffer width to 50 feet	As-built stream profile Cross sections Visual monitoring Vegetation plots
4	<u>Physicochemical</u> ^o <i>Temperature and oxygen regulation; processing of organic matter and nutrients</i>	to achieve appropriate levels for water temperature, dissolved oxygen concentration, and other important nutrients including but not limited to Nitrogen and Phosphorus through buffer planting and fencing	<u>Unmeasurable Objective/Expected Benefit</u> Establish native hardwood riparian buffer and exclude livestock.	Vegetation plots (indirect measurement) Established fencing and perpetual conservation easement (indirect measurement)
5	<u>Biology</u> * <i>Biodiversity and life histories of aquatic life histories and riparian life</i>	to achieve functionality in levels 1-4 to support the life histories of aquatic and riparian plants and animals through instream	<u>Unmeasurable Objective/Expected Benefit</u> Improve aquatic habitat through the installation of habitat features, construction of habitat pools at varying depths, and planting the riparian buffer	As-Built Survey (indirect measurement)

^o These categories are measured indirectly; *These categories are not quantifiably measured

6 MITIGATION WORK PLAN

6.1 Reference Stream

The restoration portions of the Project are currently characterized by agricultural and livestock practices. Physical parameters of the Project were used, as well as other reference materials, to determine the target stream type. The “Classification of the Natural Communities of North Carolina” was also used to narrow the potential community types that would have existed at the Project (Schafale, 2012). From that point, an iterative process was used to finalize the details of the Project design.

Targeted reference conditions included the following:

- Located within the physiographic region and ecoregion,
- Similar land use on site and in the watershed,
- Similar soil types on site and in the watershed,
- Ideal, undisturbed habitat – several types of woody debris present,
- Similar topography,
- Similar slope,
- Pattern common among Piedmont streams, and
- Minimal presence of invasive species.

Reference Watershed Characterization

The selected reference stream is an Unnamed Tributary (UT) to Hauser Creek on a closed out DMS mitigation site, located east of Farmington Road in Yadkin County, NC. The reach that was surveyed and analyzed is approximately 200 feet long. The drainage area for this segment of UT to Hauser Creek is 0.05 square miles (29 acres). The land use in the watershed is characterized as mostly forested (80 percent) and cultivated row crops (19 percent). Site photographs of the reference stream are located in **Appendix B**.

The current State classification for this reference reach is WS-IV (NCDWQ 2012a). WS-IV waters are used as sources of water supply for drinking, culinary, or food processing purposes where a WS-I, II or III classification is not feasible.

Reference Discharge

Several hydrologic models/methods were used to develop a bankfull discharge along with indicators of bankfull stage for the reference site. Existing drainage area, land use, slope, roughness, and cross-sectional area were all factors considered when performing the calculations. Using a combination of Piedmont Regional Curves, in-house spreadsheet tools, and a project specific regional flood frequency analysis, the existing discharge for UT to Hauser Creek was calculated to be approximately 7 to 8 cubic feet per second (ft³/s). See **Section 6.2** for a more detailed description of the hydrologic analyses performed for this project.

Reference Channel Morphology

In comparison to the restoration reaches, reference reach UT to Hauser Creek is slightly smaller than the designed restoration reaches when comparing pattern, dimension and profile, which is the reason for using a scaling factor for the design. The scaling factor is based on the difference in bankfull width of the reference channel. The designed reach would then have the necessary dimensions of either a smaller or larger stream corresponding to differences in drainage area. Reach UT to Hauser Creek, the reach was typically 5.2 feet wide and 0.6 feet deep. The cross-sectional area was typically around 3.0 square feet with a width to depth ratio around 8.9. Morphological parameters and cross section plots are included in **Appendix B**.

Reference Channel Stability Assessment

The UT to Hauser Creek reference reach is stable and shows no evidence of incision or erosion in the portion that was surveyed and analyzed. The stream appears to maintain its slope and has sufficient amounts of vegetation to secure its banks. Riparian buffer widths exceed fifty feet on each side. The reference reach received a “Good” rating as the channel demonstrates a stable meandering pattern and a well-vegetated riparian buffer.

Reference Riparian Vegetation

The UT to Hauser Creek reference reach riparian community is characteristic of a Piedmont Alluvial Forest. Basal areas for the plots were 12.5 m²/hectare (ha) and 49.6m²/ha and stems per acre was 81 for both plots. Dominant canopy species across the reference reach included sweetgum (*Liquidambar styraciflua*), yellow poplar, American beech (*Fagus grandifolia*), pignut hickory (*Carya glabra*), eastern redcedar, green ash (*Fraxinus pennsylvanica*), red maple, and boxelder (*Acer negundo*). Sub-canopy species included musclewood (*Carpinus caroliniana*), sourwood (*Oxydendron arboreum*), and sawtooth blackberry (*Rubus argutus*). Invasive species were also found within the vegetation survey plots and in the vicinity of the reach, including: multiflora rose and Japanese honeysuckle.

6.2 Design Parameters

Stream Restoration Approach

The treatment plan and design approach were developed based on the existing conditions, project goals, and objectives outlined in sections 3 and 5. The Project will include Priority I and II Restoration and Enhancement Levels I and II. Stream restoration will incorporate the design of a single-thread meandering channel, with parameters based on data taken from reference sites, published empirical relationships, regional curves developed from existing project streams, and NC Regional Curves. Analytical design techniques will also be a crucial element of the project and will be used to determine the design discharge and to verify the overall design. The Conceptual plan is provided in **Figure 9**.

The detailed treatment plan and design approach is as follows:

Reach GF1-A

An Enhancement Level II approach is proposed for this reach to address areas of bed instability, bank erosion, and buffer impacts. Enhancement activities will include:

- Stabilizing a 2-foot knick-point located near station 00+70 by installing two rock sills,
- Removal and regrading of an existing culvert crossing near station 03+50,
- Bank stabilization beginning near station 05+75 by installing a log vane and brush toe,
- Stabilizing a 5-foot headcut located near station 07+10 by installing a rock step-pool,
- Livestock exclusion,
- Riparian planting,
- Invasive vegetation treatment.

Reach GF1-B

An inline restoration approach was used for the upstream portion of the reach to address eroding banks, channel entrenchment, and buffer impacts. Restoration activities will include:

- Raising the channel bed with a mix of log sill, log vanes, riffle grade controls, and clay plugs,
- Normalizing the existing channel alignment to reduce channel stress,
- Establishing a riffle pool sequence throughout the reach,
- Installing brush toe protection on meander bends,
- Transitioning existing vertical channel banks to a minimum 5:1 floodplain slope,
- Livestock exclusion,
- Riparian planting,

- Invasive vegetation treatment.

An offline priority I restoration approach is proposed for the middle portion of the reach to address, eroding banks, channel entrenchment, and channel braiding. Restoration activities include:

- Regrading a new single thread channel in the existing floodplain,
- Installing log and rock structures to provide grade control and habitat,
- Establishing a riffle pool sequence throughout the reach,
- Installing brush toe protection on meander bends,
- Filling the existing channel,
- Replacing an existing ford crossing with a culvert crossing,
- Livestock exclusion,
- Riparian planting.

An offline priority II restoration approach is proposed for the downstream portion of the reach to address, eroding banks, channel entrenchment, and channel braiding. Restoration activities include:

- Regrading a new single thread channel and floodplain,
- Installing log and rock structures to provide grade control and habitat,
- Establishing a riffle pool sequence throughout the reach,
- Installing brush toe protection on meander bends,
- Filling the existing channel,
- Livestock exclusion,
- Riparian planting.

Enhancement Level II is proposed along the portion of the reach that ties into the Lower Little River and is within its non-encroachment area. Enhancement activities include:

- Livestock exclusion,
- Riparian planting,
- Invasive vegetation treatment.

Reach GF2-A

An Enhancement Level II approach is proposed for this reach to address areas of bed instability, bank erosion, and buffer impacts. Enhancement activities will include:

- Stabilizing a 9-foot headcut located near station 01+30 by installing log sills and a log step pool,
- Bed stabilization beginning near station 05+00 by installing a double log drop,
- Bank stabilization beginning near station 07+50 by installing a log vane and brush toe,
- Livestock exclusion,
- Riparian planting,
- Invasive vegetation treatment.

Reach GF2-B

A mix of offline and inline restoration is proposed for this portion of the reach to address eroding banks, channel entrenchment, historic impoundment, and buffer impacts. Restoration activities will include:

- Regrading a new single thread channel in the existing floodplain,
- Installing log and rock structures to provide grade control and habitat,
- Establishing a riffle pool sequence throughout the reach,
- Installing brush toe protection on meander bends,
- Removing the relic earthen dam and relic pond,
- Filling the existing channel,
- Replacing an existing ford crossing with a culvert crossing,
- Livestock exclusion,
- Riparian planting.

Reach GF3-A

An Enhancement Level I approach is proposed for this reach to address areas of bank erosion, and buffer impacts. Enhancement activities will include:

- Stabilizing the left bank near station 08+75 by installing a brush toe,
- Stabilizing the left bank near station 10+25 by installing a brush toe,
- Bank stabilization beginning near station 09+40 and 09+80 by installing a log vane,
- Floodplain grading,
- Livestock exclusion,
- Riparian planting,
- Invasive vegetation treatment.

Reach GF3-B

An offline restoration approach is proposed for this portion of the reach to address eroding banks, channel entrenchment, and buffer impacts. Restoration activities will include:

- Regrading a new single thread channel in the existing floodplain,
- Installing log and rock structures to provide grade control and habitat,
- Establishing a riffle pool sequence throughout the reach,
- Installing brush toe protection on meander bends,
- Filling the existing channel,
- Replacing an existing ford crossing with a culvert crossing,
- Livestock exclusion,
- Riparian planting.

Reach GF4-A

An Enhancement Level II approach is proposed for this reach to address areas of bed instability, bank erosion, and buffer impacts. Enhancement activities will include:

- Stabilizing head cut near station 00+50 by grading a vegetated swale,
- Stabilizing banks near station 01+50 by grading back channel banks,
- Bed stabilization beginning near station 03+30 by installing a rock step-pool,
- Removing and replacing the two existing 24" Corrugated Metal Pipes,
- Livestock exclusion,
- Riparian planting,
- Invasive vegetation treatment.

Reach GF4-B

A limited Enhancement Level II approach is proposed for this reach at a reduced credit ratio. Enhancement activities will include:

- Livestock exclusion,
- Riparian planting,
- Trash removal,
- Invasive vegetation treatment.
 - o To ensure bank stability, Chinese privet will be flush cut and sprayed; therefore, subsoil will not be disturbed. Roots will remain intact while plantings establish roots.

Reach GF5

An Enhancement Level II approach is proposed for this reach to address buffer impacts and protect multiple spring heads. Enhancement activities will include:

- Livestock exclusion,
- Riparian planting,
- Removal of existing concrete tank,
- Invasive vegetation treatment.

Typical Design Sections

Typical cross sections for riffles and pools are shown on the design plan sheets in **Appendix A**. The cross-section dimensions were developed for the two design reaches by using an in-house spreadsheet. The cross sections were altered slightly to facilitate constructability; however, the cross-sectional area, width to depth ratio, and side slopes were preserved. Typical pool sections include pools located on straight reaches and pools on meander bends.

Meander Pattern

The design plans showing the proposed channel alignment are provided in **Appendix A**. The meander pattern was derived directly from the analog reach and was altered in some locations to provide variability in pattern, to avoid on site constraints, to follow the valley pattern, and to make the channel more constructible. The morphologic parameters summarized in the **Appendix B** were applied wherever these deviations occurred.

Longitudinal Profiles

The design profiles are presented in **Appendix A**. These profiles extend throughout the entire project for the proposed channel alignment. The profiles were designed using the analog reach bed features that were sized with the scaling factors. The bed slopes and bankfull energy gradients were determined for each design reach based on the existing valley slope and the sinuosity of the design reach. Log and rock structures will be utilized in the design to control grade, divert flows, and provide additional habitat diversity and stability.

In-Stream Structures

Structures will be incorporated into the channel design to provide additional stability and improve aquatic habitat. Native materials and vegetation will be used for revetments and grade control structures where applicable. Typical structures that will protect the channel bed will include riffle grade controls, sills, vanes, and step-pools.

Woody debris will be placed throughout the channel at locations and at a frequency that is similar to those observed in the analog reaches. Woody habitat features installed will include log toes, brush toes, and log vanes. To provide additional bank stability, sod mats harvested on site will be installed along stream banks during construction if and when feasible. Sod mats will only be harvested and used if comprised of appropriate vegetation. The use of sod mats that include aggressive turf grasses will be avoided. Sod mats are natural sections of vegetation taken from the banks when they were cut during construction and are about nine inches thick. Before installation, proposed banks are graded lower than specified to accommodate the thickness of the mat. The mats are placed on top of the bank to act as a natural stabilizer of native species, and they grow much faster than the combination of coir fiber matting and seeding. Other bank stability measures include the installation of live stakes, brush toes, log vanes, and log toes. Typical details for proposed in-stream structures and revetments are in **Appendix A**.

Data Analysis

Stream Hydrologic Analysis

Hydrologic evaluations were performed for the design reaches using multiple methods to determine and validate the design bankfull discharge and channel geometry required to provide regular floodplain inundation. The use of various methods allows for comparison of results and eliminates reliance on a single model. Peak flows (**Table 10**) and corresponding channel cross sectional areas were determined for comparison to design parameters using the following methods:

- Regional Flood Frequency Analysis,
- AutoCAD’s Hydraflow Hydrographs, and
- NC and VA Regional Curves for the Rural Piedmont.

Regional Flood Frequency Analysis

A flood frequency analysis was completed for the study region using historic gauge data on all nearby USGS gauges with drainage areas less than 6,400 acres (10 mi²) which passed the Dalrymple homogeneity test (Dalrymple, 1960). This is a subset of gauges used for USGS regression equations. Regional flood frequency equations were developed for the 1.1-, 1.5-, and 2-year peak discharges based on the gauge data. Discharges were then computed for the design reach. These discharges were compared to those predicted by the discharge regional curve and USGS regional regression 2-year discharge equations.

AutoCAD’s Hydraflow Express

Hydraflow Express was used to simulate the rainfall-runoff process and establish peak flows for the watersheds. This model was chosen over the U.S. Army Corps of Engineers model HEC-HMS because it allows the user to adjust the peak shape factor. Rainfall data reflecting both a 384 and 484 peak shape factor were used along with a standard Type II distribution, and NRCS hydrology (time of concentrations and runoff curve numbers) (USDA NRCS, 1986), to simulate the rainfall-runoff process.

Regional Curve Regression Equations

The North Carolina Piedmont regional curves by Harman et al. (1999) and Doll et al. (2002) and the Virginia Rural Piedmont regional curves by Lotspeich (2009) for discharge were used to predict the bankfull discharge for the Project. The NC regional curves predicted flows that are similar to those predicted by the 1.1-year flood frequency, while the VA curves are much lower, closer to the flows predicted by the Hydraflow Hydrographs. The regional curve equations for NC discharges by Doll et al. (2002):

- (1) $Q_{bkf}=89.04*(DA)^{0.73}$ (Harman et al., 1999)
- (2) $Q_{bkf}=91.62*(DA)^{0.71}$ (Doll et al., 2002)
- (3) $Q_{bkf}= 43.895*(DA)^{0.9472}$ (Lotspeich, 2009)

Where Q_{bkf} =bankfull discharge (ft³/s) and DA=drainage area (mi²).

Table 10. Peak Flow Comparison

Reach	Drainage Area (Ac)	FFQ Q _{1.1}	FFQ Q _{1.5}	NC Regional Curve Q (1)	NC Regional Curve Q (2)	VA Regional Curve Q (3)	Hydraflow Q ₁	Hydraflow Q ₂	Design Q
GF1-B (Upstream)	46	9	15	13	14	4	3	8	4
GF1-B (Middle)	111	16	28	25	26	8	12	26	8
GF1-B (Downstream)	156	21	35	32	34	12	19	40	12
GF2-B	45	9	15	13	14	4	5	11	6
GF3-B	39	8	14	12	13	3	7	12	7

Sediment Transport Analysis

An erosion and sedimentation analysis was performed to confirm that the restoration design creates a stable gravel bed channel that neither aggrades nor degrades over time. Typically, sediment transport is assessed to determine a stream’s ability to move a specific grain size at specified flows. Various sediment transport

equations are applied when estimating entrainment for sand and gravel bed streams found in the Piedmont. The US Army Corps of Engineers (USACE) report, *Stability Thresholds for Stream Restoration Materials* (Fischenich, 2001), was used to obtain permissible shear stresses and velocities. Data found in this document was obtained from multiple sources using different testing conditions. The following methods and published documents were utilized during the sediment transport analysis:

- Permissible Shear Stress Approach, and
- Permissible Velocity Approach.

Shear Stress Approach

Shear stress is a commonly used tool for assessing channel stability. Allowable channel shear stresses are a function of bed slope, channel shape, flows, bed material (shape, size, and gradation), cohesiveness of bank materials, vegetative cover, and incoming sediment load. The shear stress approach compares calculated shear stresses to those found in the literature.

Critical shear stress is the shear stress required to initiate motion of the channels median particle size (D_{50}).

Table 11. Comparison of Allowable and Proposed Shear Stresses

Reach	Proposed Bed Shear Stress at Bankfull Stage (lbs/ft ²)	Existing Critical Shear Stress (lbs/ft ²)	Allowable Shear Stress ¹		
			Coarse Gravel (lbs/ft ²)	Cobble (lbs/ft ²)	Vegetation (lbs/ft ²)
GF1-B (US)	0.35	0.22	0.33 to 0.67	0.67 to 2.0	0.7 to 1.7
GF1-B (MID)	0.66	0.22	0.33 to 0.67	0.67 to 2.0	0.7 to 1.7
GF1-B (DS)	0.62	0.22	0.33 to 0.67	0.67 to 2.0	0.7 to 1.7
GF2-B	0.75	0.41	0.33 to 0.67	0.67 to 2.0	0.7 to 1.7
GF3-B	0.57	0.001	0.33 to 0.67	0.67 to 2.0	0.7 to 1.7

¹(Fischenich, 2001)

Review of the above table shows that the proposed bed shear stresses for the Project design reaches are above the critical shear stress of the existing channel material. Therefore, all proposed riffles will be supplemented with a substrate mix that has a critical shear stress greater than the proposed bed shear stress at bankfull.

Velocity Approach

Published data are readily available that provide entrainment velocities for different bed and bank materials. A comparison of calculated velocities to these permissible velocities is a simple method to aid in the verification of channel stability. **Table 12** compares the proposed velocities calculated using Manning’s equation with the permissible velocities.

Table 12. Comparison of Permissible and Proposed Velocities

Reach	Manning's "n" Value ¹	Design Velocity (ft/s)	Proposed Bed Material	Permissible Velocity ² (ft/sec)
GF1-B (US)	0.05	1.8	Coarse gravel	2.5 - 6
GF1-B (MID)	0.05	2.5	Coarse gravel	2.5 - 6
GF1-B (DS)	0.05	2.6	Coarse gravel	2.5 - 6
GF2-B	0.05	2.6	Coarse gravel	2.5 - 6
GF3-B	0.05	2.3	Coarse gravel	2.5 - 6

¹(Chow, 1959)

²(Fischenich, 2001)

Sediment Supply

In addition to the stability assessment, a qualitative analysis of sediment supply was performed by characterizing watershed conditions. A combination of field reconnaissance and windshield surveys, existing land use data, and historical aerial photography were analyzed to assess existing and past watershed conditions to determine if any changes occurred that would significantly impact sediment supply.

There is significant instability and erosion along the channels, which appear to be a result of historic cattle activity and agricultural activities occurring up to and along channel banks and not from watershed activities. It is anticipated that sediment supply from agricultural land adjacent to the project will decrease as buffers are enhanced and widened and channels are stabilized and realigned.

6.3 Sediment Control Measures

A suite of sediment control measures will be utilized for the Project to reduce direct effluent inputs, pollutant contamination, and sediment loading. The combination of the following sediment control measures: riparian buffer planting, bank stabilization, stream restoration, livestock exclusion, and livestock watering facilities, will ultimately lead to the functional uplift of the site, while still allowing livestock production to persist through the installation of alternative water sources.

The riparian buffer will be restored along all project reaches. Restored riparian buffers are established adjacent to and up-gradient from watercourses of water bodies to improve water quality. The main advantages of the restored riparian buffer will be to provide water quality treatment, erosion control, and water temperature benefits. Moreover, there will be significant reductions in sedimentation, nutrient input, and fecal coliform input.

To account for eliminating livestock water access, landowners will be provided an alternate water source. A total of four watering facilities will be installed to provide high quality drinking water to livestock.

6.4 Vegetation and Planting Plan

Plant Community Restoration

The restoration of the plant communities is an important aspect of the restoration Project. The selection of plant species is based on what was observed at the reference reach, species present in the forest surrounding the restoration Project, and what is typically native to the area. Several sources of information were used to determine the most appropriate species for the restoration project. The reference stream is located within a disturbed Piedmont Alluvial Forest. Dominant species included sweetgum, red maple, tulip poplar, American beech, pignut hickory, eastern red cedar, green ash, and boxelder. The reference site was chosen

due to the stability of the channel, the physical structure of the forest community, and to evaluate stream habitat.

A Piedmont Alluvial Forest will be the target community along the Project reaches. The target community will be used for the planting areas within the Project, shown in **Appendix A**. The plant species list has been developed and can be found in **Table 13**. Species with high dispersal rates are not included because of locally occurring, adjacent seed sources and the high potential for natural regeneration. The high dispersal species include red maple and sweetgum. In disturbed settings, these species tend to dominate, so while these species could be counted towards success, they should be monitored to ensure they do not outcompete the other proposed species.

The restoration of plant communities along the Project will provide stabilization and diversity. For rapid stabilization of the stream banks (primarily outside meanders), silky dogwood (*Cornus amomum*), eastern cottonwood (*Populus deltoides*) and black willow (*Salix nigra*) were chosen for live stakes along the restored channel because of their rapid growth patterns and high success rates. Willows grow at a faster rate than the species planted around them, and they stabilize the stream banks. Willows will also be quicker to contribute organic matter to the channel. When the other species are bigger, the black willows will slowly stop growing or die out because the other species would outgrow them and create shade that the willows do not tolerate. The live stake species will be planted along the outside of the meander bends three feet from the top of bank, creating a three-foot section along the top of bank. The live stakes will be spaced at least one per three linear feet with alternate spacing vertically.

It is anticipated that the construction will be completed in the spring; therefore, vegetation planting will be conducted no later than April 30, and there will be at least 180 days until the initiation of the first year of monitoring. Furthermore, any replanting that may occur throughout the monitoring phase of the Project will occur between November 15 and March 15, per the October 2016 USACE/NCIRT monitoring guidance.

Table 13. Proposed Plant List

Bare Root Planting Tree Species				
Species	Common Name	Spacing (ft)	Unit Type	% of Total Species Composition
<i>Quercus alba</i>	White Oak	9X6	Bare Root	15
<i>Quercus phellos</i>	Willow Oak	9X6	Bare Root	15
<i>Betula nigra</i>	River Birch	9X6	Bare Root	15
<i>Platanus occidentalis</i>	American Sycamore	9X6	Bare Root	15
<i>Quercus rubra</i>	Northern Red Oak	9X6	Bare Root	10
<i>Celtis occidentalis</i>	Common Hackberry	9X6	Bare Root	10
<i>Liriodendron tulipifera</i>	Yellow Poplar	9X6	Bare Root	10
<i>Diospyros virginiana</i>	Persimmon	9X6	Bare Root	5
<i>Nyssa sylvatica</i>	Black Gum	9X6	Bare Root	5

Live Staking and Live Cuttings Bundle Tree Species		
Species	Common Name	% of Total Species Composition
<i>Salix nigra</i>	Black Willow	40
<i>Populus deltoides</i>	Eastern Cottonwood	30
<i>Cornus ammomum</i>	Silky Dogwood	30

On-Site Invasive Species Management

Treatment for invasive species will be required within the entire easement area. Invasive species will require different and multiple treatment methods, depending on plant phenology and the location of the species being treated (**Appendix J**). All treatment will be conducted as to maximize its effectiveness and reduce chances of detriment to surrounding native vegetation. Treatment methods will include mechanical (cutting with loppers, clippers, or chain saw) and chemical (foliar spray, cut stump, and hack and squirt techniques). Plants containing mature, viable seeds will be removed from the Project and properly disposed. All herbicide applicators will be supervised by a certified ground pesticide applicator with a North Carolina Department of Agriculture and Consumer Services (NCDA&CS) license and adhere to all legal and safety requirements according to herbicide labels, and NC and Federal laws. Management records will be kept on the plant species treated, type of treatment employed, type of herbicide used, application technique, and herbicide concentration and quantities used. These records will be included in all reporting documents.

Soil Restoration

After construction activities, the subsoil will be scarified and any compaction will be deep tilled before the topsoil is placed back over the Project. Any topsoil that is removed during construction will be stockpiled and placed over the Project during final soil preparation. This process should provide favorable soil conditions for plant growth. Rapid establishment of vegetation will provide natural stabilization for the Project.

6.5 Mitigation Summary

Natural channel design techniques have been used to develop the restoration designs described in this document. The combination of the analog and analytical design methods was determined to be appropriate for this Project because the watershed is rural, the causes of disturbance are known and have been abated, and there are minimal infrastructure constraints. The original design parameters were developed from the measured analog/reference reach data and applied to the subject stream. The parameters were then analyzed and adjusted through an iterative process using analytical tools and numerical simulations of fluvial processes. The designs presented in this report provide for the restoration of natural Piedmont gravel-bed channel features and stream bed diversity to improve benthic habitat. The proposed design will allow flows that exceed the design bankfull stage to spread out over the floodplain.

A large portion of the existing stream will be filled using material excavated from the restoration channel. However, multiple segments will be left partially filled to provide habitat diversity and flood storage. Native woody material will be installed throughout the restored reach to reduce bank stress, provide grade control, and increase habitat diversity.

Forested riparian buffers will be established along the Project reaches. An appropriate riparian plant community (Piedmont Alluvial Forest) will be established to include a diverse mix of species. The plant species list has been developed and can be found in **Table 13**. Although there is one planting zone, certain targeted species will be planted in the appropriate target community location. Replanting of native species will occur where the existing buffer is impacted during construction. Replanting of native species will occur where the existing buffer is impacted during construction.

A combination of sediment control measures will be used on site; riparian buffer planting, bank stabilization, stream restoration, livestock exclusions, and livestock watering facilities. This combination of sediment control measures will ultimately lead to the functional uplift of the site by minimizing sedimentation, nutrient input, and fecal coliform input from ongoing livestock and agricultural production outside of the conservation easement.

Due to the nature of the project, complete avoidance of stream and wetland impacts is not possible. Proposed stream impacts, including stream relocation and culverts installation, will be replaced on site. Wetland impacts associated with restoration and enhancement efforts will be both permanent and temporary, though small. However, it is anticipated that the Project will result in net positive wetland area and overall function due to increased hydrology from raising bed elevations and relocating channels within natural valleys. Specifically, the floodplain area around the lower portion of reaches GF1-B and GF3-B, including their confluence, will likely expand the wetland area of WD. In addition, the Project will increase wetland function throughout with the addition of native trees and shrubs along the stream banks and riparian areas. All stream and wetland impacts will be accounted for in the Pre-Construction Notification (PCN) form.

6.6 Determination of Credits

Mitigation credits presented in **Table 14** are projections based upon site design (**Figure 9**). Upon completion of site construction, the project components and credits data will only be revised to be consistent with the as-built condition if there is a large discrepancy. Any deviation from the mitigation plan post approval, including adjustments to credits, will require a request for modification. This will be approved by the USACE.

Table 14. Groundhog Hollow Project (ID-100049) - Mitigation Components

Project Component (reach ID)	Wetland Position and Hydro Type	Existing Footage	Proposed Stationing	Mitigation Plan Footage	As-Built Footage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
GF1-A		1,192*	0+28 to 12+34	1,206	TBD	EII	-	2.5:1	482.40	Bed and bank stabilization, riparian planting, livestock exclusion (Powerline easement: STA 12+34 to 12+70)
GF1-A		62	12+70 to 13+32	62	TBD	EII	-	2.5:1	24.80	Bed and bank stabilization, riparian planting, livestock exclusion
GF1-B		1034	13+32 to 23+52	1,020	TBD	R	P1/P2	1:1	1,020.00	Channel restoration, riparian planting, livestock exclusion (Stream crossing: STA 23+52 to STA 24+12)
GF1-B		936	24+12 to 33+98	986	TBD	R	P1/P2	1:1	986.00	Channel restoration, riparian planting, livestock exclusion
GF1-B		130	33+98 to 35+28	130	TBD	EII	-	2.5:1	52.00	Riparian planting, livestock exclusion
GF2-A		642	1+87 to 8+29	642	TBD	EII	-	2.5:1	256.8	Bed and bank stabilization, riparian planting, livestock exclusion
GF2-B		442	8+29 to 12+80	451	TBD	R	P1/P2	1:1	451.00	Channel restoration, riparian planting, livestock exclusion (Stream crossing: STA 12+80 to STA 13+10)
GF2-B		167	13+10 to 13+93	83	TBD	R	P1/P2	1:1	83.00	Channel restoration, riparian planting, livestock exclusion
GF3-A		311	7+69 to 10+75	306	TBD	EI	-	1.5:1	204.00	Bed and bank stabilization, riparian planting, livestock exclusion (Stream crossing: STA 10+75 to STA 11+07)
GF3-B		270	11+07 to 14+18	311	TBD	R	P1	1:1	311.00	Channel restoration, riparian planting, livestock exclusion
GF4-A		283*	0+56 to 3+54	298	TBD	EII	-	2.5:1	119.20	Bed and bank stabilization, riparian planting, livestock exclusion (Stream crossing: STA 3+54 to STA 3+88)
GF4-B		381	3+88 to 7+69	381	TBD	EII	-	7.5:1	50.80	Riparian planting, livestock exclusion
GF5		253	0+0 to 2+53	253	TBD	EII	-	5:1	50.60	Riparian planting, livestock exclusion
No Wetland Mitigation										

*Existing 14 ft. culverts excluded from footage, but retained in stationing for design purposes

Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)
		Riverine	Non-Riverine	
Restoration	2,851			
Enhancement				
Enhancement I	306			
Enhancement II	2,338			
Enhancement II (5:1)	253			
Enhancement II (7.5:1)	381			
Creation				
Preservation				
High Quality Pres				

Overall Assets Summary

Asset Category	Overall Credits
Stream	4,093.95*
RP Wetland	NA
NR Wetland	NA

* This is the total adjusted SMUs (4,091.60 + 2.35 = 4,093.95)

6.7 Credit Calculations for Non-Standard Buffer Widths

To calculate functional uplift credit adjustments, the Wilmington District Stream Buffer Credit Calculator from the USACE in January 2018 was utilized. To perform this calculation, GIS analysis was performed to determine the area (in square feet) of ideal buffer zones and actual buffer zones around all streams within the project. Minimum standard buffer widths are measured from the top of bank (50 feet in Piedmont and Coastal Plain counties or 30 feet in mountain counties). The ideal buffers are the maximum potential size (in square feet) of each buffer zone measured around all creditable stream reaches, calculated using GIS, including areas outside of the easement. The actual buffer is the square feet in each buffer zone, as measured by GIS, excluding non-forested areas, all other credit type (e.g., wetland, nutrient offset, buffer), easement exceptions, open water, areas failing to meet the vegetation performance standard, etc. The stream lengths, mitigation type, ideal buffer, and actual buffer are all entered into the calculator. This data is processed, and the resulting credit amounts are totaled for the whole project. In conclusion, the Buffer Credit Calculator calculated a net gain of 2.35 credits; therefore, the total adjusted SMUs for the Project is 4,093.95 (**Table 1, Figure 10**).

7 PERFORMANCE STANDARDS

The success criteria for the Project will follow the 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation Update and subsequent agency guidance. Specific success criteria components are presented below.

7.1 Stream Restoration Success Criteria

Bankfull Events

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

Cross Sections

There should be little change in as-built cross sections. If changes do take place, they should be evaluated to determine if they represent a movement toward a less stable condition (for example down-cutting or erosion) or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross sections shall be classified using the Rosgen stream classification method, and all monitored cross sections should fall within the quantitative parameters defined for channels of the design stream type. Bank height ratio shall not exceed 1.2, and the entrenchment ratio shall be above 1.4 within restored riffle cross sections. Channel stability should be demonstrated through a minimum of four bankfull events documented in the seven-year monitoring period.

Digital Image Stations

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

Surface Flow

Intermittent stream reaches will be monitored to document intermittent or seasonal surface flow. This will be accomplished through direct observation and the use of automatic-logging pressure transducers. Intermittent reaches must demonstrate a minimum of 30 consecutive days of flow.

7.2 Vegetation Success Criteria

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

8 MONITORING PLAN

Annual monitoring data will be reported using the DMS Monitoring Report Template dated June 2017 and NC IRT monitoring template. The monitoring report shall provide a project data chronology that will facilitate an understanding of project status and trends, research purposes, and assist in decision making regarding project close-out. Monitoring reports will be prepared annually and submitted to DMS. Monitoring of the Project will adhere to metrics and performance standards established by the USACE's April 2003 Wilmington District Stream Mitigation Guidelines and the NC IRT's October 2016 Wilmington District Stream and Wetland Compensatory Mitigation Update. **Table 15** outlines the links between project objectives and treatments and their associated monitoring metrics and performance standards within the context of functional uplift based on the Stream Functions Pyramid Framework. **Figure 11** depicts the proposed monitoring plan, including approximate numbers and locations of monitoring devices for the Project.

8.1 As-Built Survey

An as-built survey will be conducted following construction to document channel size, condition, and location. The survey will include a complete profile of thalweg, water surface, bankfull, and top of bank to compare with future geomorphic data. Longitudinal profiles will not be required in annual monitoring reports unless requested by USACE. Stream channel stationing will be marked with stakes placed near the top of bank every 200 feet.

8.2 Visual Monitoring

Visual monitoring of all mitigation areas will be conducted a minimum of twice per monitoring year by qualified individuals. The visual assessments will include vegetation density, vigor, invasive species, and easement encroachments. Visual assessments of stream stability will include a complete streamwalk and structure inspection. Digital images will be taken at fixed representative locations to record each monitoring event, as well as any noted problem areas or areas of concern. Fixed image locations will exist at each cross section, each vegetation plot, each stage recorder, and each flow gauge. Results of visual monitoring will be presented in a plan view exhibit with a brief description of problem areas and digital images. Photographs will be used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures. Longitudinal photos should indicate the absence of developing bars within the channel or an excessive increase in channel depth. Lateral photos should not indicate excessive erosion or continuing degradation of the banks over time. A series of photos over time should indicate successional maturation of riparian vegetation.

8.3 Hydrology Events

Continuous stage recorders, a combination of manual crest gauges and automatic-logging pressure transducers, will be installed to document the height and frequency of bankfull events on Priority 1 Restoration reaches. A minimum of one stage recorder will be installed on each tributary that is greater than 1,000 feet in length, with one gauge required for every 5,000 feet of length on each tributary and a maximum of five gauges per tributary. Specifically, stage recorders will be installed on reaches GF1-B, GF2-B, and GF3-B. Additionally, one flow gauge, an automatic-logging pressure transducer, will be installed on the upper third of reach GF4-A to document flow conditions.

8.4 Cross Sections

Permanent cross sections will be installed at a minimum of one per 20 bankfull widths with half in pools and half in riffles on all Restoration and Enhancement I reaches. Morphological data will be measured and recorded for all cross-sections; however, only riffle cross sections will include bank height ratio and

entrenchment ratio measurements. A total of 22 cross sections are proposed across the Project. These cross sections will be monitored in Years 1, 2, 3, 5, and 7.

8.5 Vegetation Monitoring

Vegetation monitoring plots will be 100 square meters, or 0.025 acres, in size and cover a minimum of two percent of the planted area. There will be 12 plots within the planted area (14.42 acres). Plots will be a mixture of fixed and random plots, with nine fixed plots and three random plots. Planted area indicates all area in the easement that will be planted with trees. Existing wooded areas are not included in the planted area; however, these areas will be planted with supplemental trees in disturbed areas where existing tree density is insufficient. The following data will be recorded for all trees in the fixed plots: species, height, planting date (or volunteer), and grid location. For random plots, species and height will be recorded for all woody stems. The location (GPS coordinates and orientation) of the random plots will be identified in the annual monitoring reports. Vegetation will be planted and plots established at least 180 days prior to the initiation of the first year of monitoring. Monitoring will occur in Years 1, 2, 3, 5, and 7 between July 1st and leaf drop. Invasive and noxious species will be monitored so that none become dominant or alter the desired community structure of the Project. If necessary, RES will develop a species-specific treatment plan.

8.6 Scheduling/Reporting

A baseline monitoring report and as-built drawings documenting stream restoration activities will be developed within 60 days of the planting completion on the Project. The report will include all information required by DMS mitigation plan guidelines, including elevations, photographs and sampling plot locations, gauge locations, and a description of initial species composition by community type. The report will also include a list of the species planted and the associated densities. Baseline vegetation monitoring will include species, height, date of planting, and grid location of each stem. The baseline report will follow DMS As-Built Baseline Monitoring Report Template June 2017, USACE guidelines, and the October 2017 Mitigation Credit Calculation Memo.

The monitoring program will be implemented to document system development and progress toward achieving the success criteria. The restored stream morphology will be assessed to determine the success of the mitigation. The monitoring program will be undertaken for seven years or until the final success criteria are achieved, whichever is longer.

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to DMS. The monitoring reports will include all information and be in the format required by USACE.

Table 15. Monitoring Requirements

Level	Treatment	Objective	Monitoring Metric	Performance Standard
1 <i>Hydrology</i>	Convert land-use of Project reaches from pasture to riparian forest	Improve the transport of water from the watershed to the Project reaches in a non-erosive way	NA	NA
2 <i>Hydraulic</i>	Reduce bank height ratios and increase entrenchment ratios by reconstructing channels to mimic reference reach conditions	Improve flood bank connectivity by reducing bank height ratios and increase entrenchment ratios	Stage recorders: Inspected quarterly	Four bankfull events occurring in separate years
			Flow gauge: Inspected quarterly	At least 30 days of continuous flow each year
			Cross sections: Surveyed in Years 1, 2, 3, 5 and 7	Entrenchment ratio shall be no less than 1.4 within restored reaches
				Bank height ratio shall not exceed 1.2
3 <i>Geomorphology</i>	Establish a riparian buffer to reduce erosion and sediment transport into project streams. Establish stable banks with livestakes, erosion control matting, and other in stream structures.	Limit erosion rates and maintain channel stability Improve bedform diversity (pool spacing, percent riffles, etc.) Increase buffer width to 50 feet	As-built stream profile	NA
			Cross sections: Surveyed in Years 1, 2, 3, 5 and 7	Entrenchment ratio shall be no less than 1.4 within restored reaches
			Visual monitoring	Bank height ratio shall not exceed 1.2
			Visual monitoring: Performed at least semiannually	Identify and document significant stream problem areas; i.e. erosion, degradation, aggradation, etc.
			Vegetation plots: Surveyed in Years 1, 2, 3, 5 and 7	MY 1-3: 320 trees/acre MY 5: 260 trees/acre (7 ft. tall) MY 7: 210 trees/acre (10 ft. tall)
			4 <i>Physicochemical</i>	Exclude livestock from riparian areas with exclusion fence, conservation easement, and plant a riparian buffer
Visual assessment of established fencing and conservation signage: Performed at least semiannually <i>(indirect measurement)</i>	Inspect fencing and signage. Identify and document any damaged or missing fencing and/or signs			

9 ADAPTIVE MANAGEMENT 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. Additionally, routine maintenance activities for the Project are outlined in **Appendix F**.

10 LONG-TERM MANAGEMENT PLAN

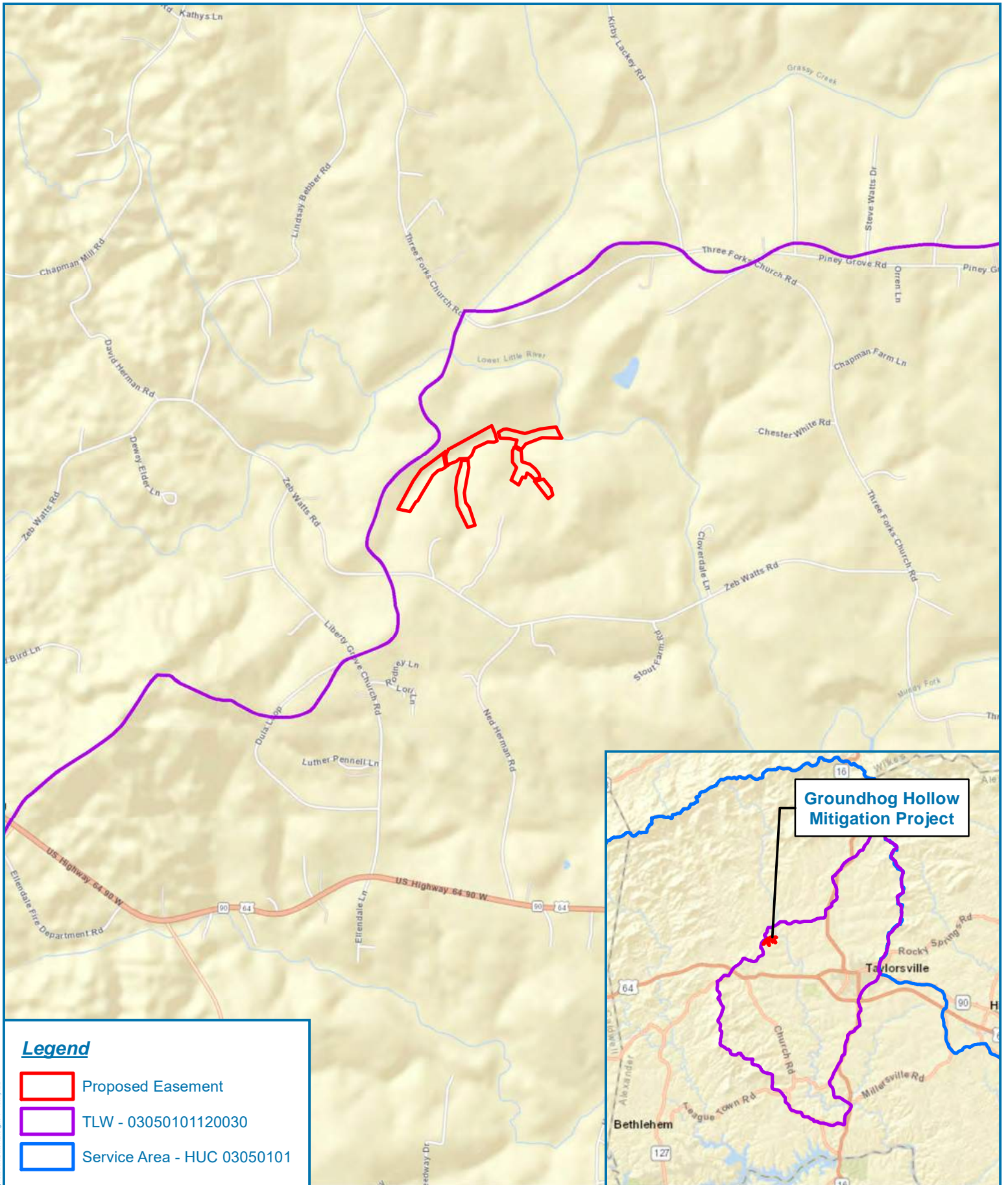
The site will be transferred to the NCDEQ Stewardship Program (or 3rd party if approved). This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are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

The Stewardship Program will periodically install signage as needed to identify boundary markings as needed. Any livestock or associated fencing or permanent crossings will be the responsibility the owner of the underlying fee to maintain.

11 REFERENCES

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Legend

- Proposed Easement
- TLW - 03050101120030
- Service Area - HUC 03050101

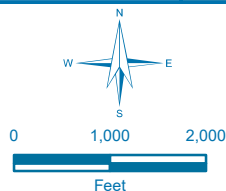


Figure 1 - Vicinity

Groundhog Hollow Mitigation Project

Alexander County, North Carolina

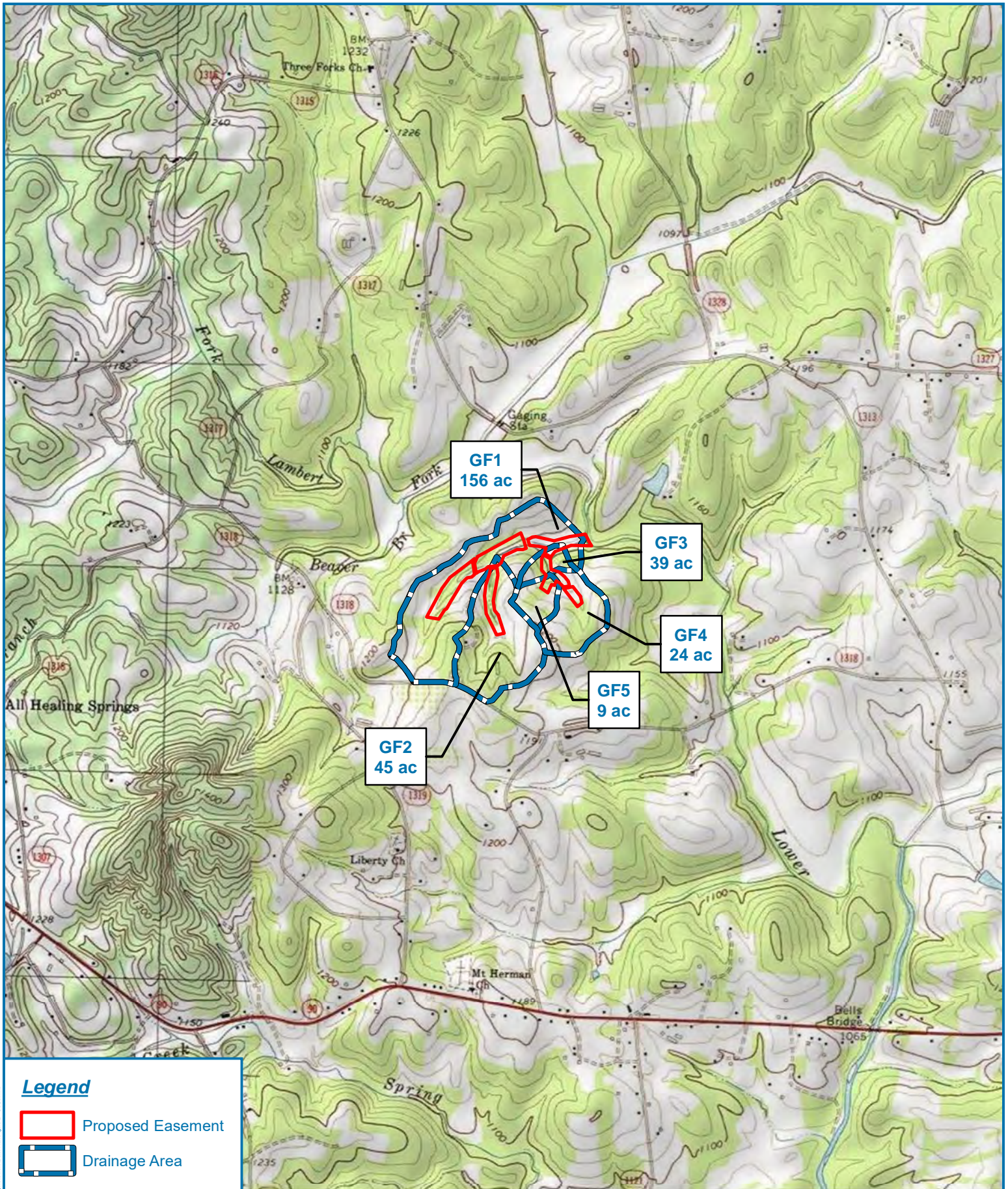
Date: 8/30/2019

Drawn by: MDD



Checked by: BPB

1 inch = 2,000 feet





Legend

-  Proposed Easement
-  Drainage Area

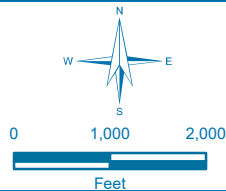


Figure 2 - USGS
 Taylorsville and Ellendale (1973)
Groundhog Hollow
Mitigation Project
 Alexander County, North Carolina

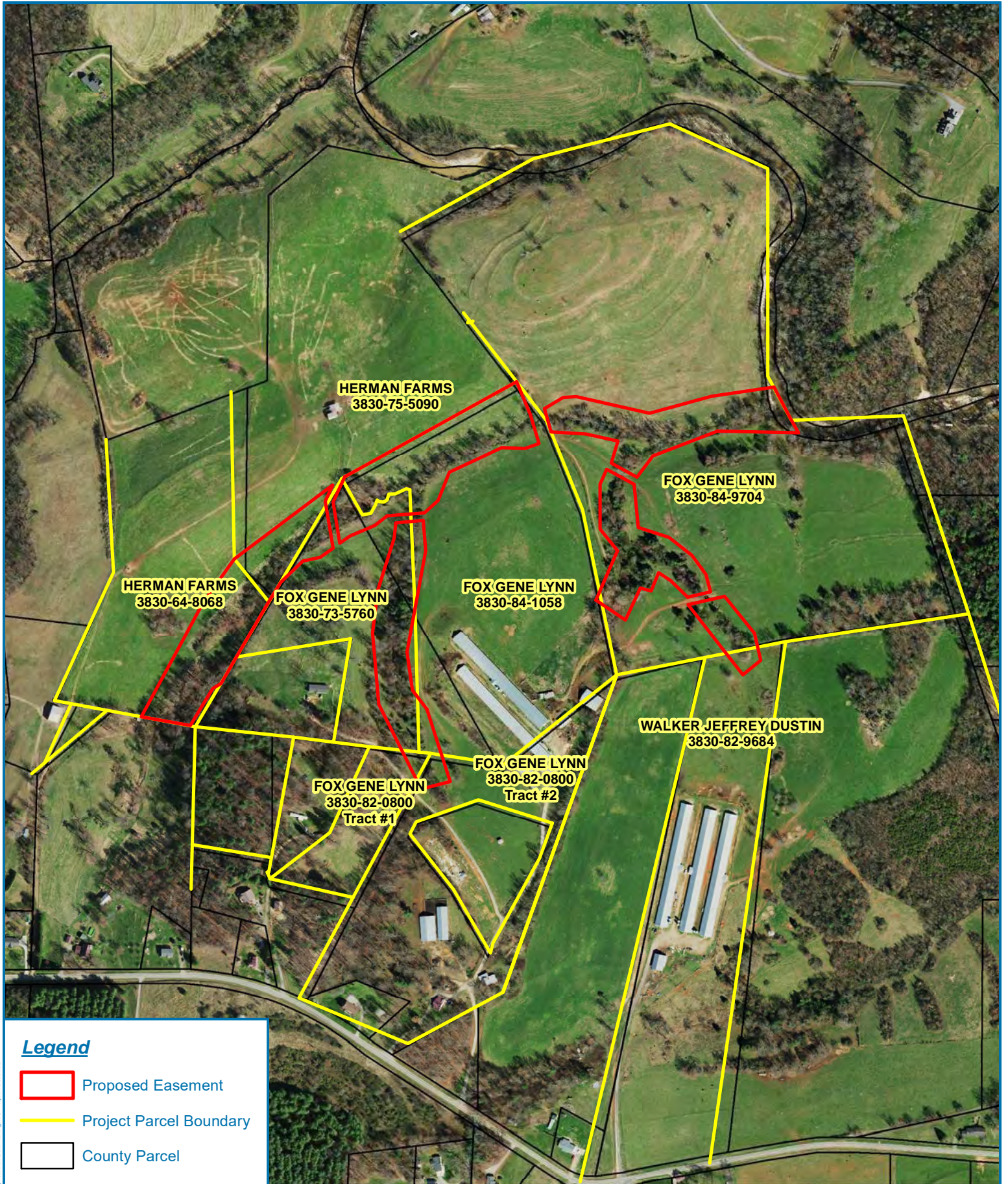
Date: 8/30/2019

Drawn by: MDD


Checked by: BPB

1 inch = 2,000 feet





Legend

-  Proposed Easement
-  Project Parcel Boundary
-  County Parcel

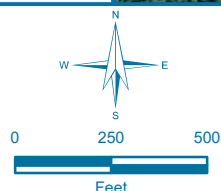


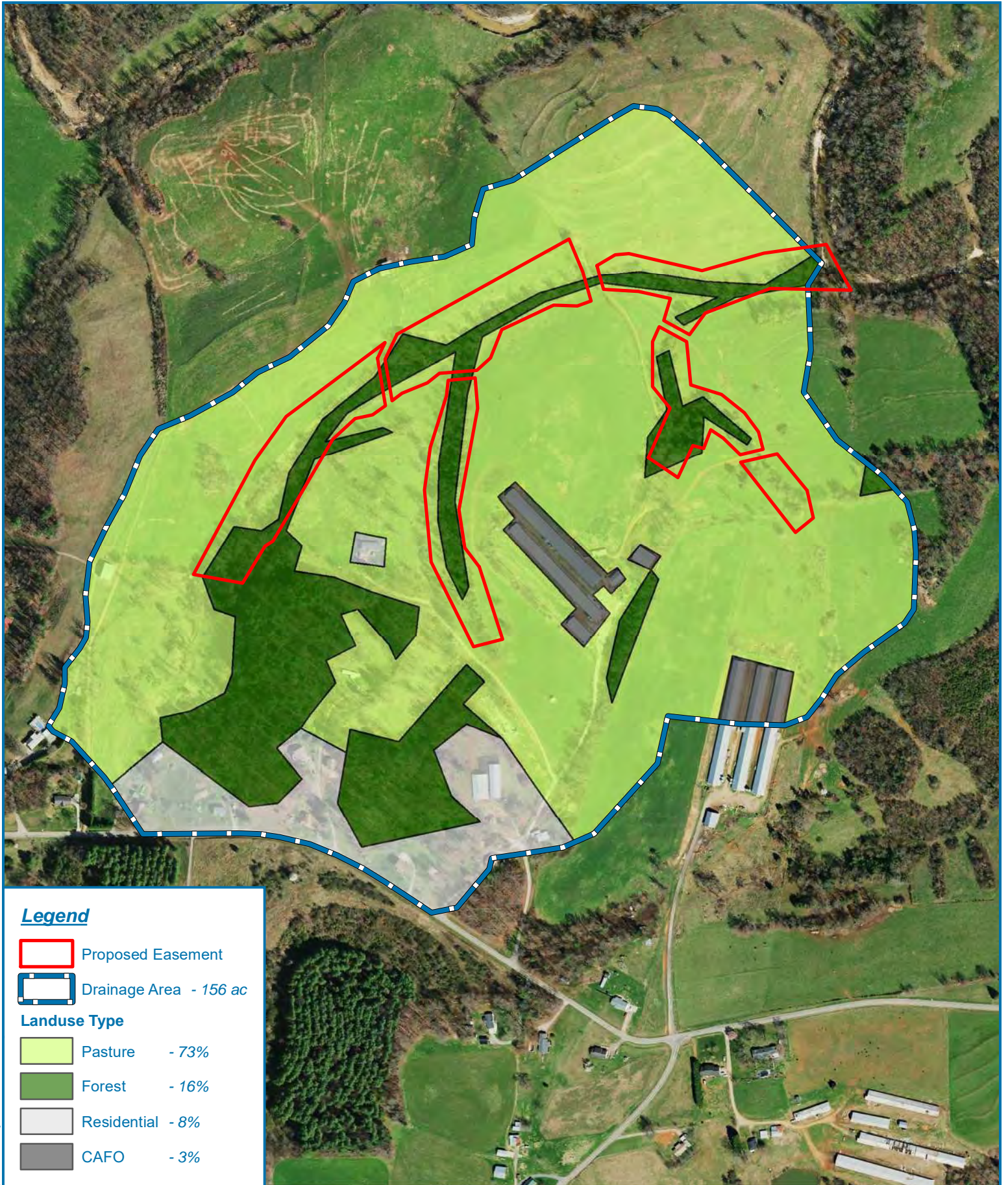
Figure 3 - Project Parcels

Groundhog Hollow Mitigation Project







Alexander County, North Carolina

Date: 8/30/2019
Drawn by: MDD
Checked by: BPB
1 inch = 500 feet





Legend

-  Proposed Easement
-  Drainage Area - 156 ac
- Landuse Type**
-  Pasture - 73%
-  Forest - 16%
-  Residential - 8%
-  CAFO - 3%

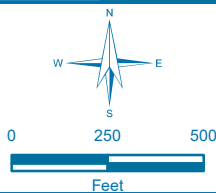
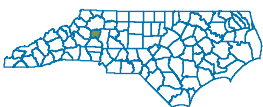


Figure 4 - Landuse
Groundhog Hollow
Mitigation Project

Alexander County, North Carolina

Date: 8/30/2019

Drawn by: MDD

Checked by: BPB

1 inch = 500 feet





Legend

- Proposed Easement
- Hydric (100%)
- Predominantly Hydric (66-99%)
- Partially Hydric (33-65%)
- Predominantly Nonhydric (1-32%)
- Nonhydric (0%)

NRCS - Web Soil Survey 2019

Map Unit Symbol	Map Unit Name	Percent Hydric	Drainage Class	Hydrologic Soil Group	Landscape Setting
CoA	Codorus loam, 0 to 2 percent slopes, frequently flooded	5%	Somewhat Poorly	B/D	Nearly level floodplains
FcC2	Fairview sandy clay loam, 8 to 15 percent slopes, moderately eroded	0%	Well	C	Ridges and interfluves
FcD2	Fairview sandy loam, 15 to 25 percent slopes	0%	Well	B	Ridges and Interfluves
RnA	Ronda loamy sand, 0 to 5 percent slopes, occasionally flooded	1%	Excessively	A	Natural levees on floodplains

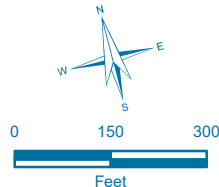
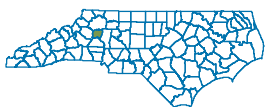


Figure 5 - Soils

Groundhog Hollow Mitigation Project

Alexander County, North Carolina

Date: 8/30/2019

Drawn by: MDD

Checked by: BPB

1 inch = 300 feet



1947



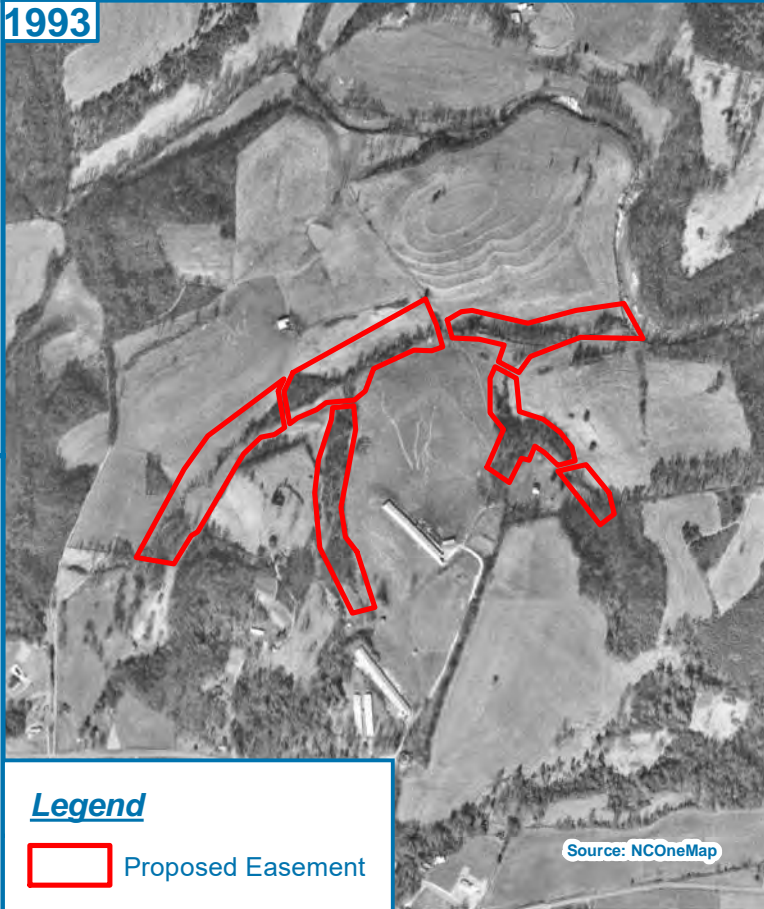
Source: USGS Earth Explorer

1966



Source: USGS Earth Explorer

1993



Source: NCOneMap

2010



Source: NCOneMap

Legend

 Proposed Easement

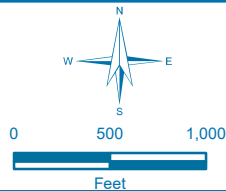


Figure 6 - Historical Imagery

Groundhog Hollow Mitigation Project

Alexander County, North Carolina

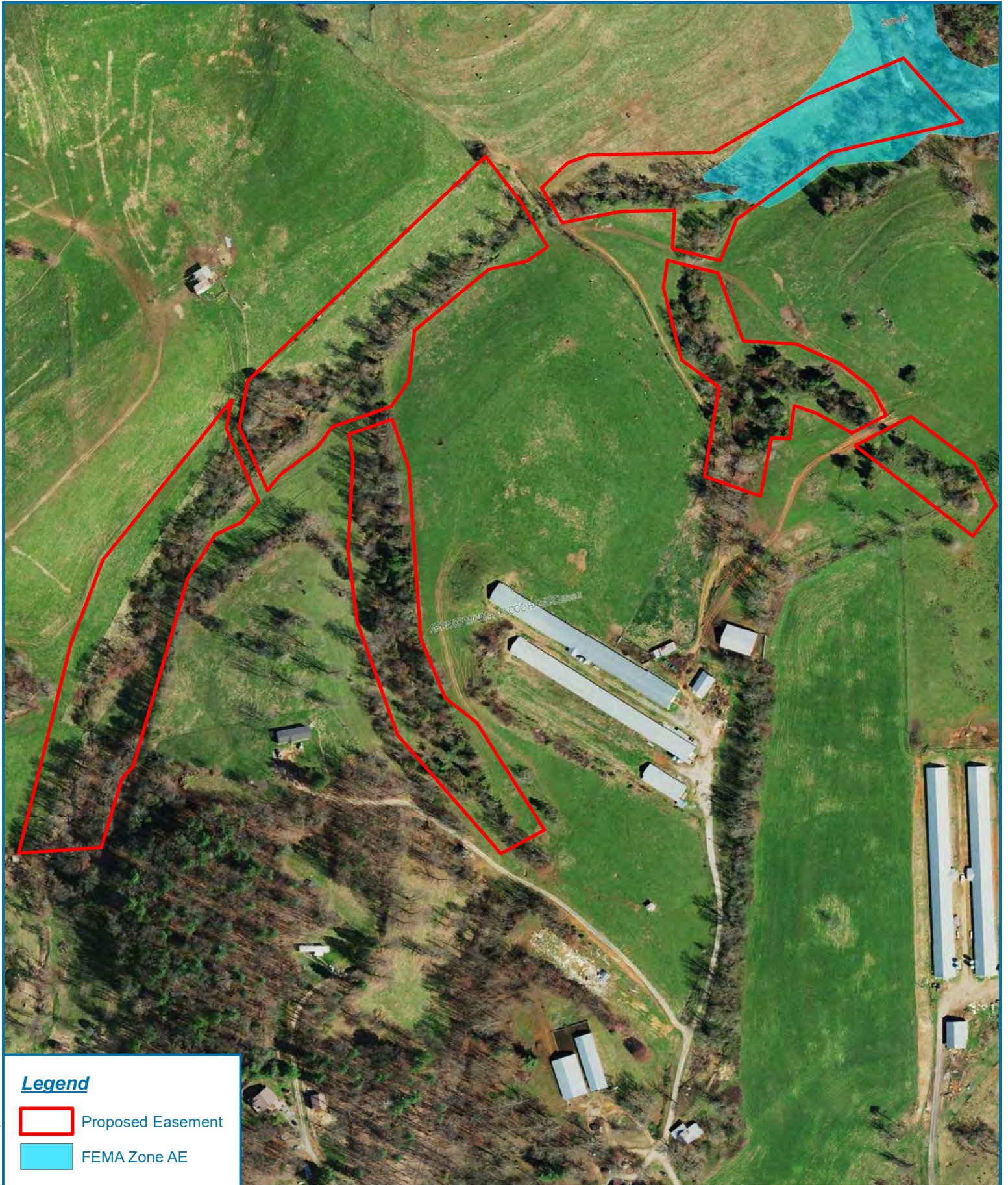
Date: 8/30/2019

Drawn by: MDD



Checked by: BPB

1 inch = 1,000 feet





Legend

-  Proposed Easement
-  FEMA Zone AE

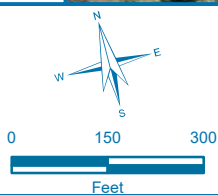


Figure 7 - FEMA
 Panel: 3710382000J eff: 12/18/2007
Groundhog Hollow
Mitigation Project
 Alexander County, North Carolina

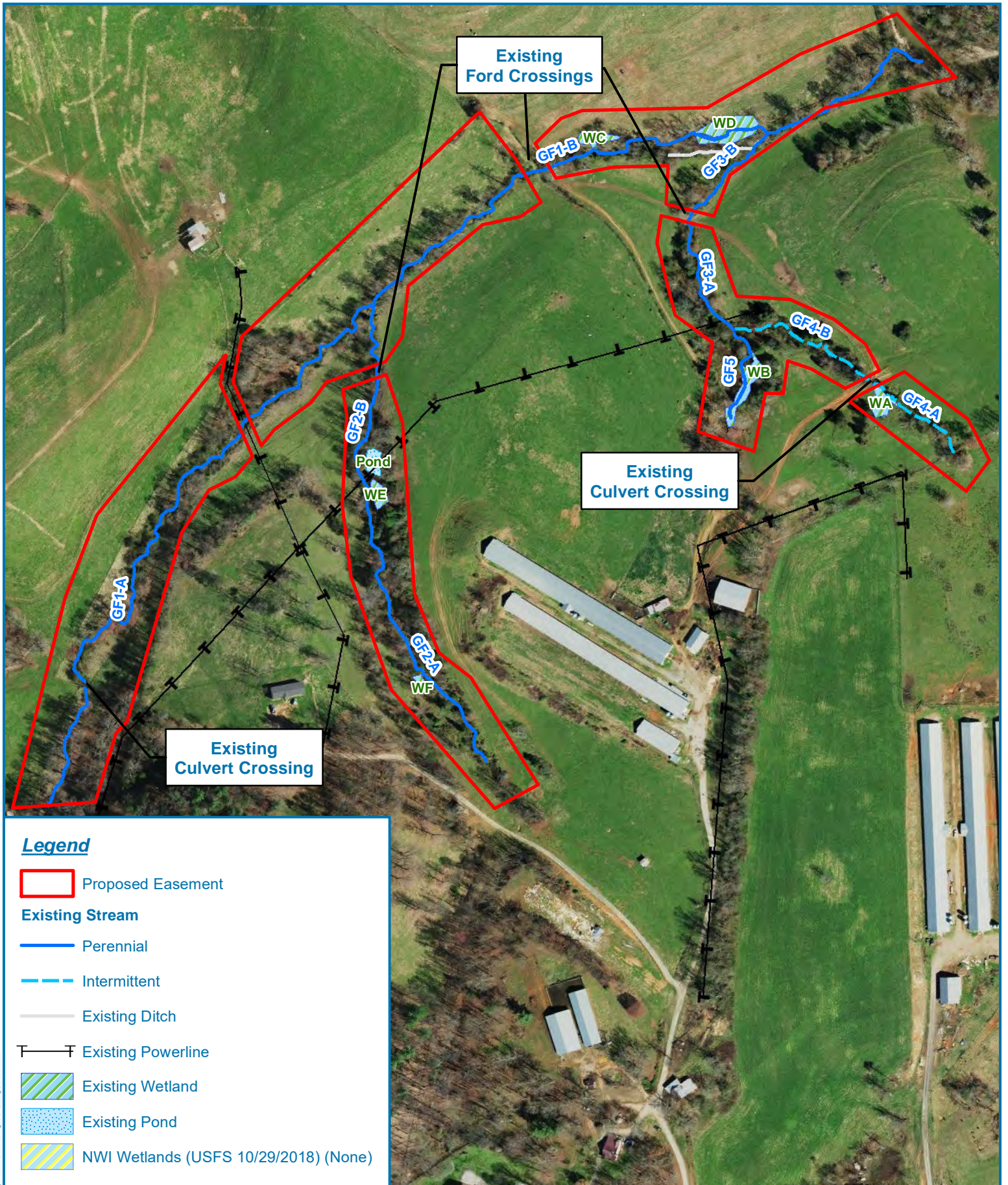
Date: 8/30/2019

Drawn by: MDD

Checked by: BPB

1 inch = 300 feet





Legend

- Proposed Easement
- Existing Stream**
- Perennial
- Intermittent
- Existing Ditch
- Existing Powerline
- Existing Wetland
- Existing Pond
- NWI Wetlands (USFS 10/29/2018) (None)

Figure 8 - Existing Conditions

Groundhog Hollow Mitigation Project

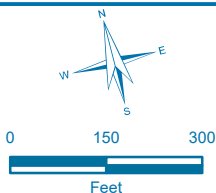
Alexander County, North Carolina

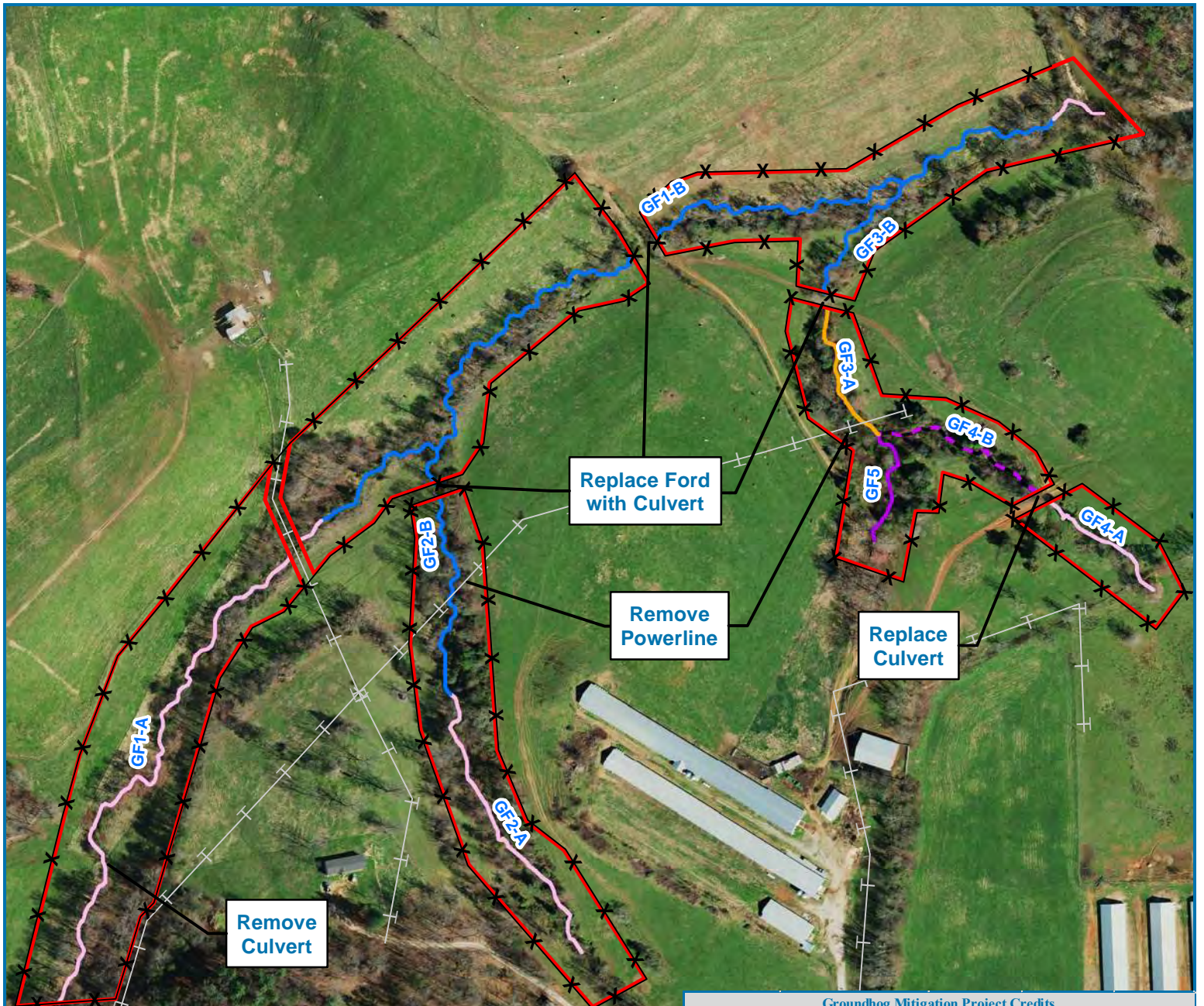
Date: 9/24/2019

Drawn by: MDD

Checked by: BPB

1 inch = 300 feet





Legend

Proposed Easement - (20.58 ac)

X Proposed Fencing

Existing Powerline

Mitigation Approach

Restoration

Enhancement I

Enhancement II

Enhancement II (5:1)

Enhancement II (7.5:1)

Groundhog Mitigation Project Credits				
Reach	Mitigation Type	Proposed Length (LF)	Mitigation Ratio	SMUs
GF1-A	Enhancement II	1,206	1 : 2.5	482.40
	Enhancement II	62	1 : 2.5	24.80
GF1-B	Restoration	1,020	1 : 1.0	1,020.00
	Restoration	986	1 : 1.0	986.00
	Enhancement II	130	1 : 2.5	52.00
GF2-A	Enhancement II	642	1 : 2.5	256.80
GF2-B	Restoration	451	1 : 1.0	451.00
	Restoration	83	1 : 1.0	83.00
GF3-A	Enhancement I	306	1 : 1.5	204.00
GF3-B	Restoration	311	1 : 1.0	311.00
GF4-A	Enhancement II	298	1 : 2.5	119.20
GF4-B	Enhancement II (7.5:1)	381	1 : 7.5	50.80
GF5	Enhancement II (5:1)	253	1 : 5.0	50.60
Total		6,129		4,091.60
Non-Standard Buffer Width Adjustment				2.35
Total Adjusted SMUs				4,093.95

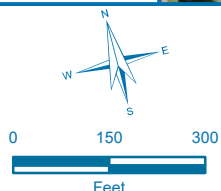


Figure 9 - Conceptual Plan

Groundhog Hollow Mitigation Project

Alexander County, North Carolina

Date: 8/30/2019

Drawn by: MDD

Checked by: BPB

1 inch = 300 feet



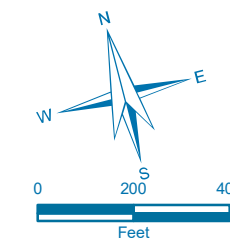


Figure 10 - Buffer Width Zones
Groundhog Hollow Mitigation Project
 Alexander County, North Carolina

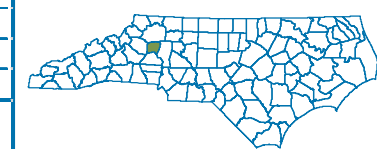
Date: 8/30/2019 Drawn by: MDD
 Checked by: BPB 1 in = 400 feet

Legend

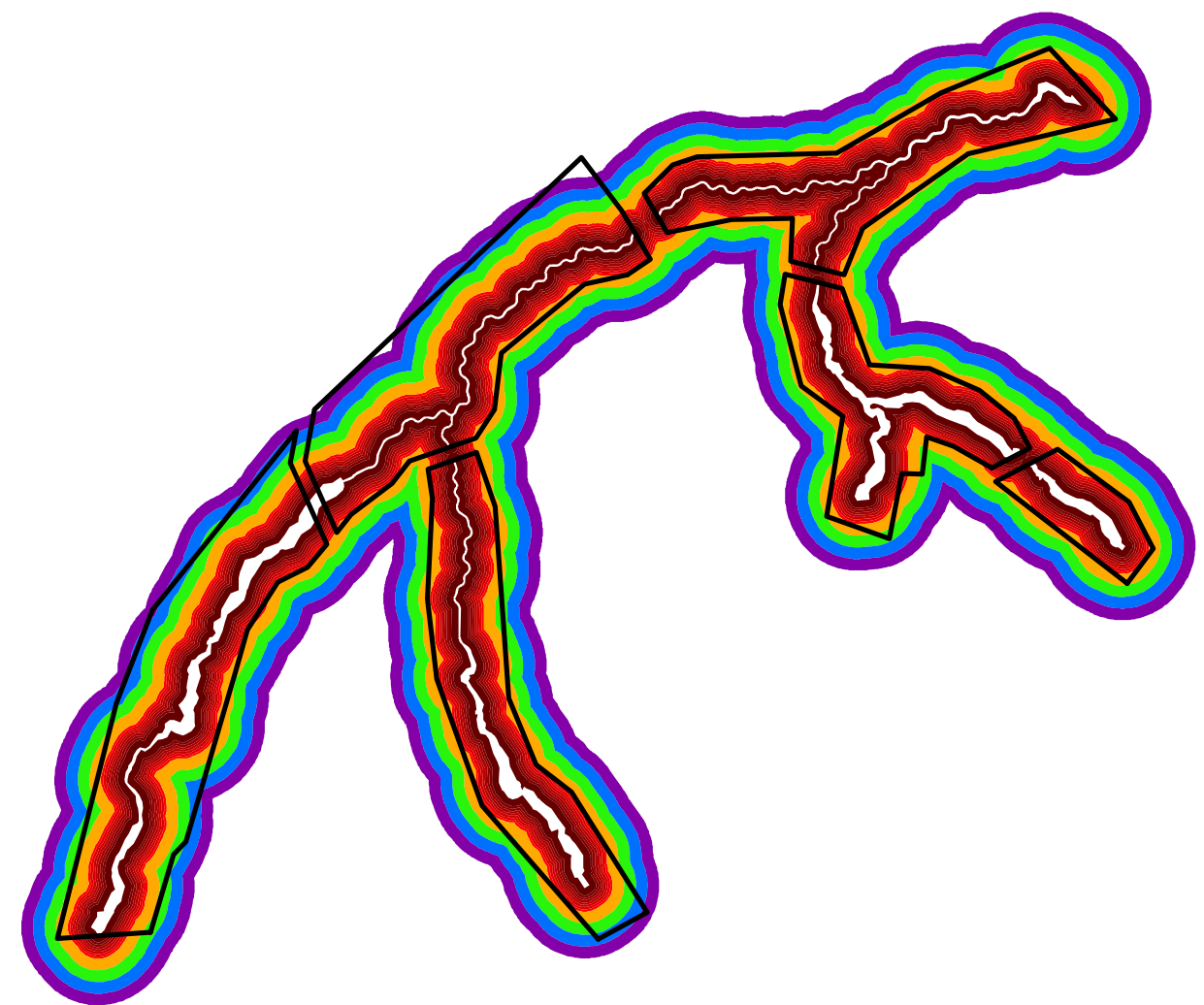
- Proposed Easement
- Ineligible Area

Buffer Zone (ft)

- 0-15
- 16-20
- 21-25
- 26-30
- 31-35
- 36-40
- 41-45
- 46-50
- 51-75
- 76-100
- 101-125
- 126-150



Ideal Buffers



Actual Buffers



Buffer Width Zone (feet from Ordinary High Water Mark)

Buffer Zones	less than 15 feet	>15 to 20 feet	>20 to 25 feet	>25 to 30 feet	>30 to 35 feet	>35 to 40 feet	>40 to 45 feet	>45 to 50 feet	>50 to 75 feet	>75 to 100 feet	>100 to 125 feet	>125 to 150 feet
Max Possible Buffer (square feet)	183,870.00	61,290.00	61,290.00	61,290.00	61,290.00	61,290.00	61,290.00	61,290.00	306,450.00	306,450.00	306,450.00	306,450.00
Ideal Buffer (square feet)	188,128.56	61,134.62	60,381.99	59,959.04	59,479.94	59,160.10	58,916.46	58,784.56	292,268.62	290,179.54	289,501.99	289,893.89
Actual Buffer (square feet)	181,863.85	58,032.62	57,049.72	56,256.64	55,786.81	55,273.30	54,462.92	52,856.05	139,558.72	55,848.17	33,146.74	11,421.63
Zone Multiplier	50%	10%	10%	10%	5%	5%	5%	5%	7%	5%	4%	4%
Buffer Credit Equivalent	2,045.80	409.16	409.16	409.16	204.58	204.58	204.58	204.58	286.41	204.58	163.66	163.66
Percent of Ideal Buffer	97%	95%	94%	94%	94%	93%	92%	90%	48%	19%	11%	4%
Credit Adjustment	-68.13	-20.76	-22.58	-25.27	-12.70	-13.44	-15.46	-20.63	136.76	39.37	18.74	6.45
Total Baseline Credit	Credit Loss in Required Buffer		Credit Gain for Additional Buffer				Net Change in Credit from Buffers				Total Credit	
4,091.60	-198.97		201.32				2.35				4,093.95	

Document Path: \\GIS\BEE_GIS\Projects\GIS\Projects\Groundhog\Map_Series\Map_Series_10_IdealBuffers_Zone.mxd

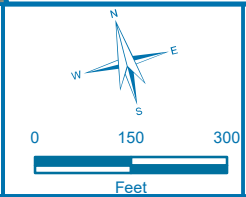
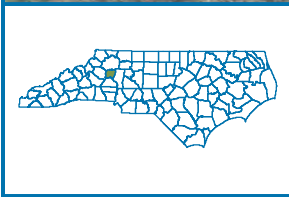
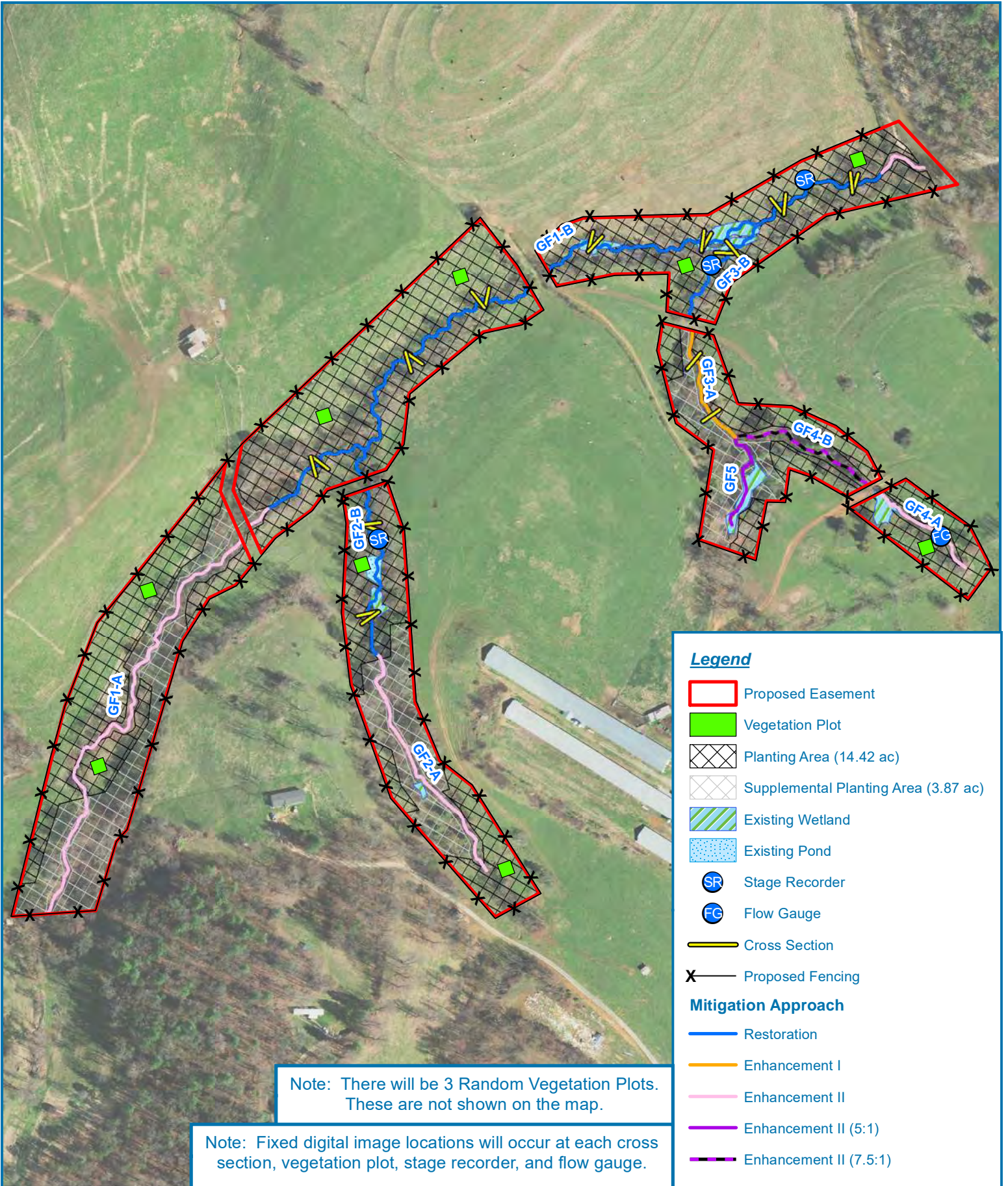


Figure 11 - Monitoring Plan
Groundhog Hollow Mitigation Project
 Alexander County, North Carolina

Date: 8/30/2019
 Drawn by: MDD
 Checked by: BPB
 1 inch = 300 feet



Appendix A - Plan Sheets

GROUNDHOG HOLLOW MITIGATION SITE

ALEXANDER COUNTY, NORTH CAROLINA

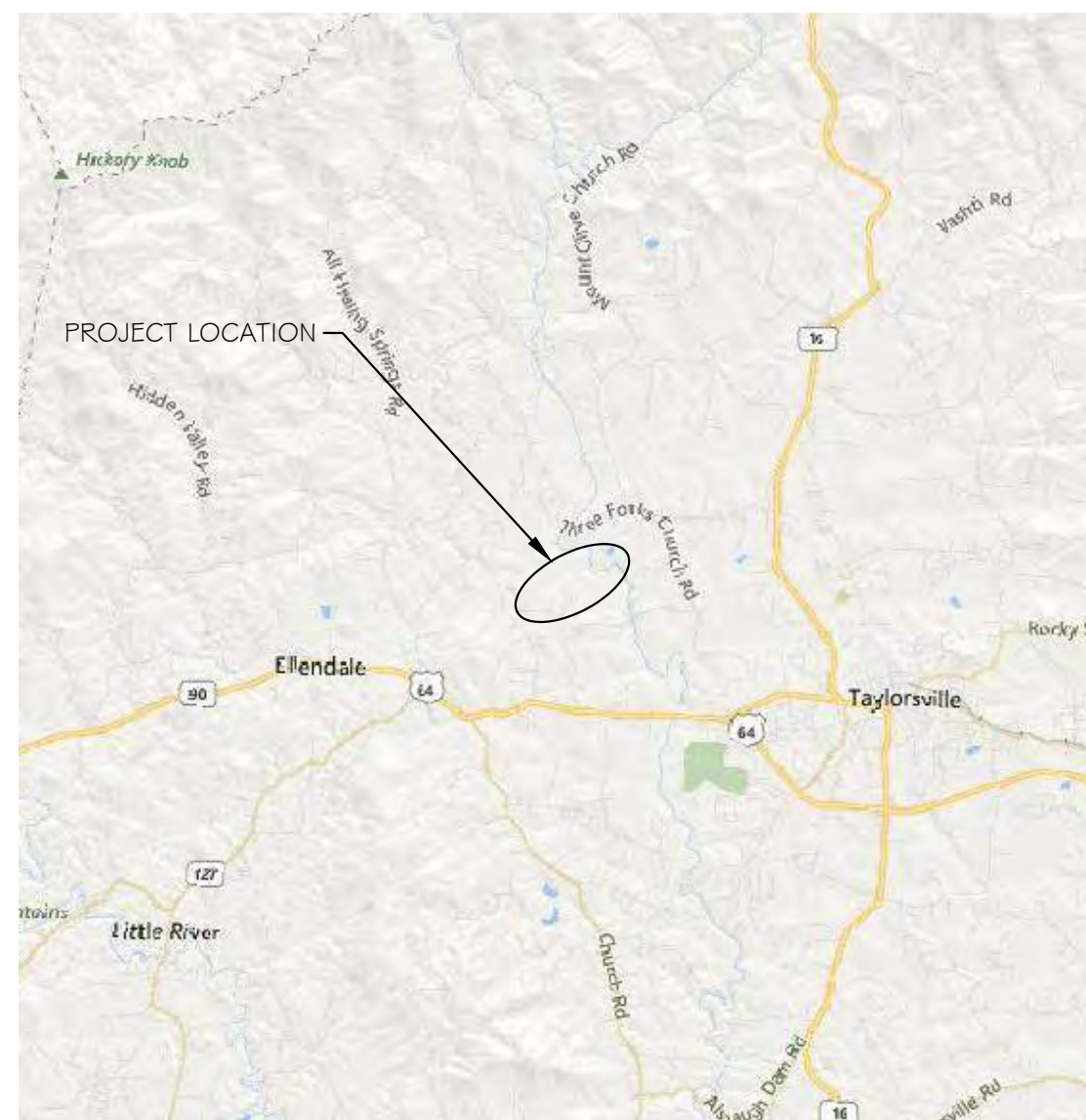
CATAWBA RIVER BASIN: HUC 03050101

SEPTEMBER 2019

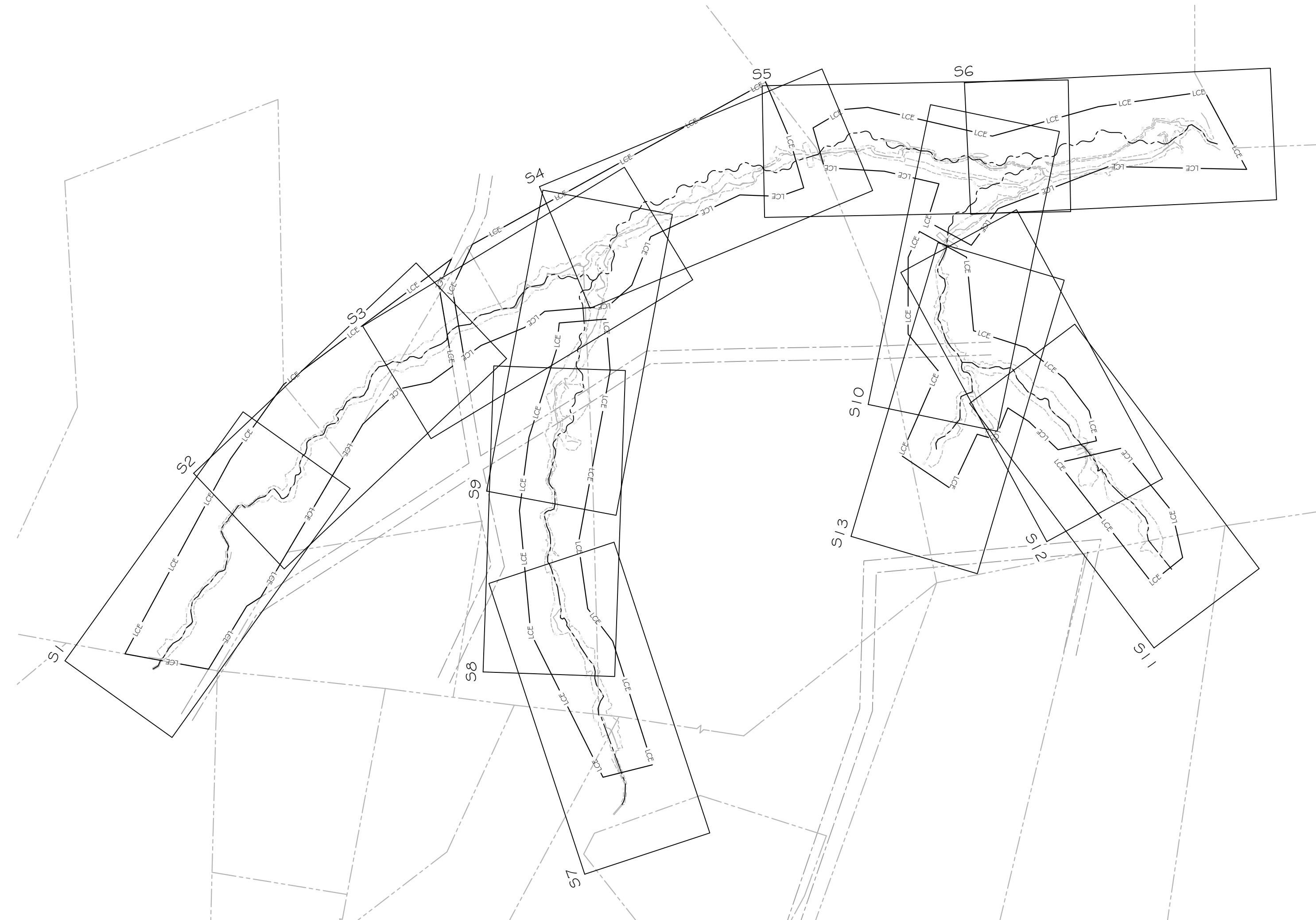
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

302 JEFFERSON ST, SUITE 110

RALEIGH, NC 27605



VICINITY MAP
NTS



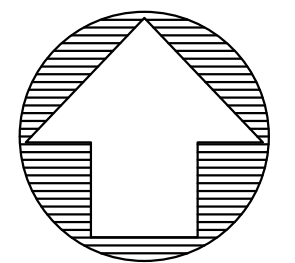
SITE MAP
NTS

Sheet List Table	
Sheet Number	Sheet Title
-	COVER
A1	OVERALL AERIAL VIEW
E1	NOTES
E2	EXISTING CONDITIONS
S1	REACH GF 1
S2	REACH GF 1
S3	REACH GF 1
S4	REACH GF 1
S5	REACH GF 1
S6	REACH GF 1
S7	REACH GF2
S8	REACH GF2
S9	REACH GF2
S10	REACH GF3
S11	REACH GF4
S12	REACH GF4
S13	REACH GF5
F1	FENCING PLAN
P1	PLANTING PLAN
EC1	EROSION CONTROL NOTES
D1	DETAILS
D2	DETAILS
D3	DETAILS
D4	DETAILS
D5	DETAILS
D6	DETAILS
D7	DETAILS



302 Jefferson Street, Suite 110
Raleigh, NC 27605
Main: 919.829.9909
Fax: 919.829.9913
www.res.us

SEAL



MARK | DATE | DESCRIPTION
REVISIONS:
RELEASED FOR: PRELIMINARY - NOT FOR CONSTRUCTION
PLOT DATE: 9/13/2019

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

SHEET NUMBER:

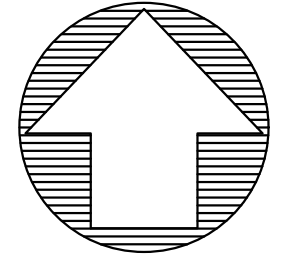
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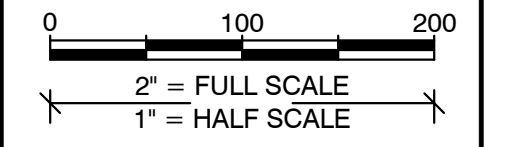


302 Jefferson Street, Suite 110
 Raleigh, NC 27605
 Main: 919.829.9909
 Fax: 919.829.9913
 www.res.us

SEAL



FULL SCALE: 1" = 100'



MARK	DATE	DESCRIPTION	PLOT DATE:
			09/13/2019
REVISIONS:			
RELEASED FOR:			
PRELIMINARY - NOT FOR CONSTRUCTION			

PROJECT NAME:
 GROUNDHOG HOLLOW MITIGATION SITE
 ALEXANDER COUNTY, NORTH CAROLINA

DRAWING TITLE:
 OVERALL AERIAL VIEW

PROJECT NUMBER: 0438
 PROJECT MANAGER: BPB
 DESIGNED: BRC
 DRAWN: TRS
 CHECKED: AFM

SHEET NUMBER:
A1

FILE NAME: S:\@RES GIS\Projects\NCGroundhog Hollow\CAD\DWG\0438_SHT_SITE.dwg SAVED BY: Bcarroll

STREAM CONSTRUCTION NOTES:

1. ALL PROPOSED CHANNELS AND TEMPORARY AND PERMANENT CROSSINGS SHALL BE CONSTRUCTED IN A DRY CONDITION VIA OFFLINE CONSTRUCTION WHERE POSSIBLE. PUMP AROUND OPERATIONS SHOULD BE LIMITED TO AREAS WHERE THE EXISTING AND PROPOSED CHANNEL ALIGNMENTS OVERLAP.
2. ALL IMPERVIOUS DIKES AND PUMPING APPARATUS SHALL BE REMOVED FROM THE STREAM AT THE END OF EACH DAY TO RESTORE NORMAL FLOW BACK TO THE CHANNEL UNLESS OTHERWISE APPROVED BY THE ENGINEER. WITH APPROVAL, A PUMP AROUND MAY BE ALLOWED TO RUN CONTINUOUSLY IF THERE IS NO FORECAST FOR RAIN OVERNIGHT, AND/OR THE PUMP APPARATUS IS MAINTAINED AND MONITORED CONTINUOUSLY.
3. CONSTRUCT UPSTREAM PORTION OF THE CHANNEL FIRST, WORKING IN AN UPSTREAM TO DOWNSTREAM DIRECTION, UNLESS OTHERWISE APPROVED BY THE ENGINEER.
4. REMOVE AND STOCKPILE TOPSOIL WITHIN AREAS THAT ARE TO BE CUT 9" OR MORE BELOW EXISTING GRADE. STOCKPILED TOPSOIL IS TO BE PLACED ALONG THE FLOODPLAIN BENCHES.
5. INSTALL STRUCTURES AS SHOWN ON PLANS AND DETAILS. PRIOR TO FINE GRADING, OBTAIN APPROVAL OF THE ENGINEER ON INSTALLATION OF STRUCTURES.
6. REMOVE AND STOCKPILE GRAVEL SUBSTRATE LOCATED WITHIN EXISTING CHANNELS. THIS MATERIAL SHALL BE INSTALLED ON THE PROPOSED BED OF SHALLOW/RIFLE CHANNEL SECTIONS. IN AREAS WHERE THERE IS NOT ENOUGH NATIVE SUBSTRATE TO PLACE A MINIMUM 6" LAYER ALONG PROPOSED SHALLOW/RIFLE SECTIONS, SUPPLEMENT THE NATIVE SUBSTRATE WITH A 50/50 MIX OF #57 AND #3 STONE, OR RIVER ROCK WITH A $D_{50} = 1.5'$.
7. IN-STREAM STRUCTURES PROPOSED ALONG THE OUTSIDE OF MEANDER BENDS (BRUSH TOES, LOG VANES, AND LOG TOES) MAY BE USED INTERCHANGEABLY THROUGHOUT THE PROJECT PER APPROVAL FROM DESIGNER.
8. UPON COMPLETION OF FINE GRADING, INSTALL STREAM BANK STABILIZATION INCLUDING, EROSION CONTROL MATTING OR SOD MATS ALONG CHANNEL BANKS.
9. FILL AND STABILIZE ABANDONED SEGMENTS OF THE EXISTING CHANNEL PER DIRECTION OF THE ENGINEER.

LEGEND

EXISTING CONTOUR MAJOR	
EXISTING CONTOUR MINOR	
PROPOSED CONTOUR MAJOR	
PROPOSED CONTOUR MINOR	
EXISTING WETLAND	
EXISTING STREAM	
EXISTING TOP OF BANK	
EXISTING BOTTOM OF BANK	
EXISTING OVERHEAD ELECTRIC UTILITY LINE	
PROPERTY LINE	
EXISTING FENCELINE	
EXISTING TREELINE	
EXISTING TREE	
PROPOSED BANKFULL	
PROPOSED CENTERLINE OF CHANNEL	
LIMITS OF PROPOSED CONSERVATION EASEMENT	
PROPOSED FENCELINE	
PROPOSED CHANNEL PLUG (SEE DETAIL D3)	
BRUSH TOE PROTECTION (SEE DETAIL D3)	
STONE TOE PROTECTION (SEE DETAIL D3)	
LOG SILL (SEE DETAIL D5)	
ROCK SILL (SEE DETAIL D6)	
LOG CROSS VANE (SEE DETAIL D5)	
STEP POOL (SEE DETAIL D6)	
ANGLED LOG STEP POOL (SEE DETAIL D4)	
ROCK CROSS VANE (SEE DETAIL D6)	
LOG VANE (SEE DETAIL D4)	
FLOODPLAIN SILL (SEE DETAIL D4)	
CULVERT CROSSING (SEE DETAIL D2)	
RIFLE GRADE CONTROL (SEE DETAIL D7)	
ENGINEERED SEDIMENT PACK (SEE DETAIL D7)	
LOG STRUCTURE (PROFILE)	
ROCK STRUCTURE (PROFILE)	



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SEAL

SCALE: AS SHOWN

MARK	DATE	DESCRIPTION	PLOT DATE:
			9/13/2019
REVISIONS:			RELEASED FOR:
			PRELIMINARY - NOT FOR CONSTRUCTION

PROJECT NAME:
**GROUNDHOG HOLLOW MITIGATION SITE
 ALEXANDER COUNTY, NORTH CAROLINA**

DRAWING TITLE:
NOTES

PROJECT NUMBER:	0438
PROJECT MANAGER:	BPB
DESIGNED:	BRC
DRAWN:	TRS
CHECKED:	AFM

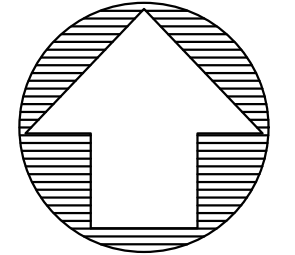
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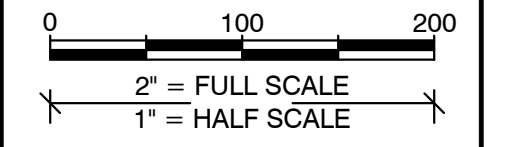


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SEAL



FULL SCALE: 1" = 100'



MARK	DATE	DESCRIPTION	PLOT DATE:
			09/13/2019
REVISIONS:			
RELEASED FOR:			
PRELIMINARY - NOT FOR CONSTRUCTION			

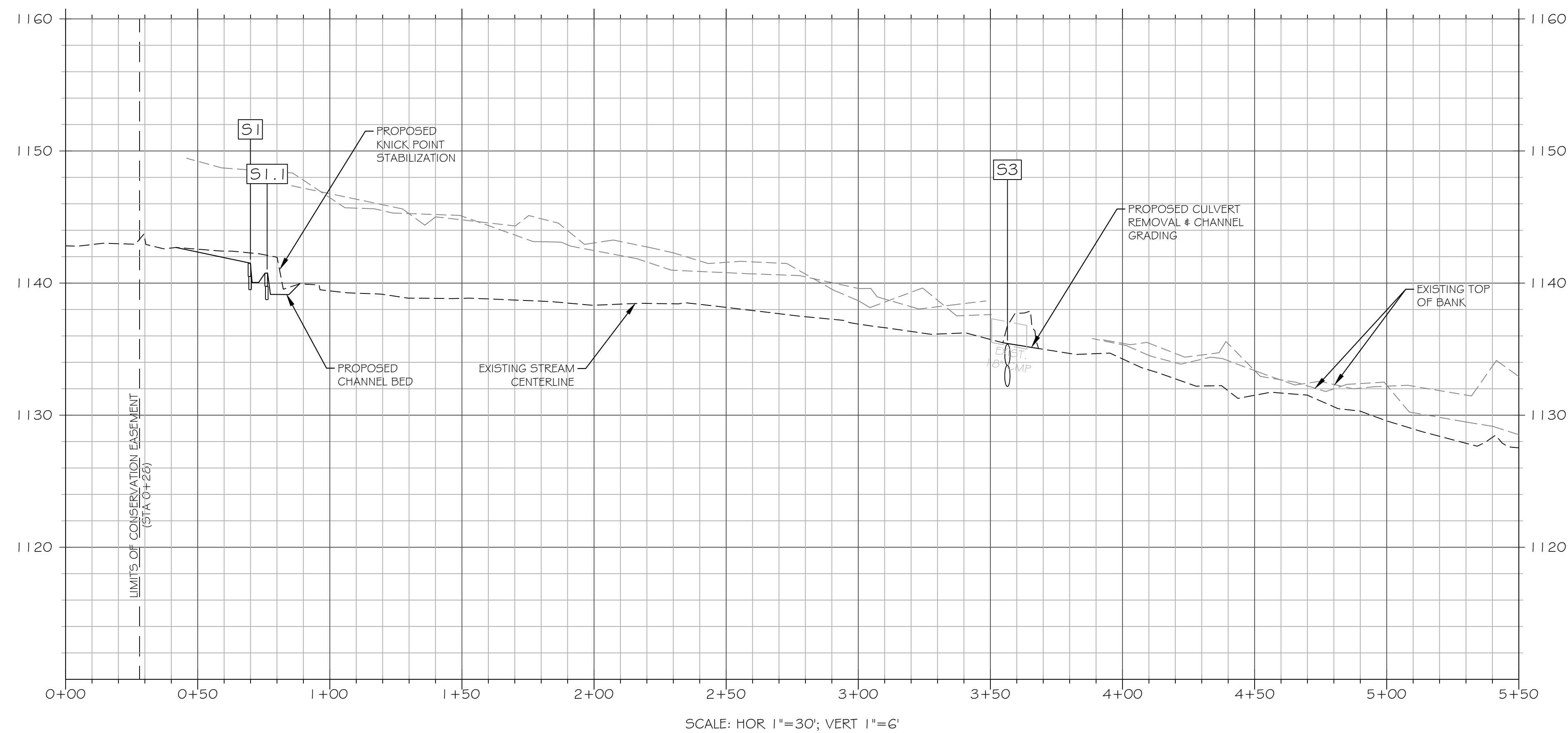
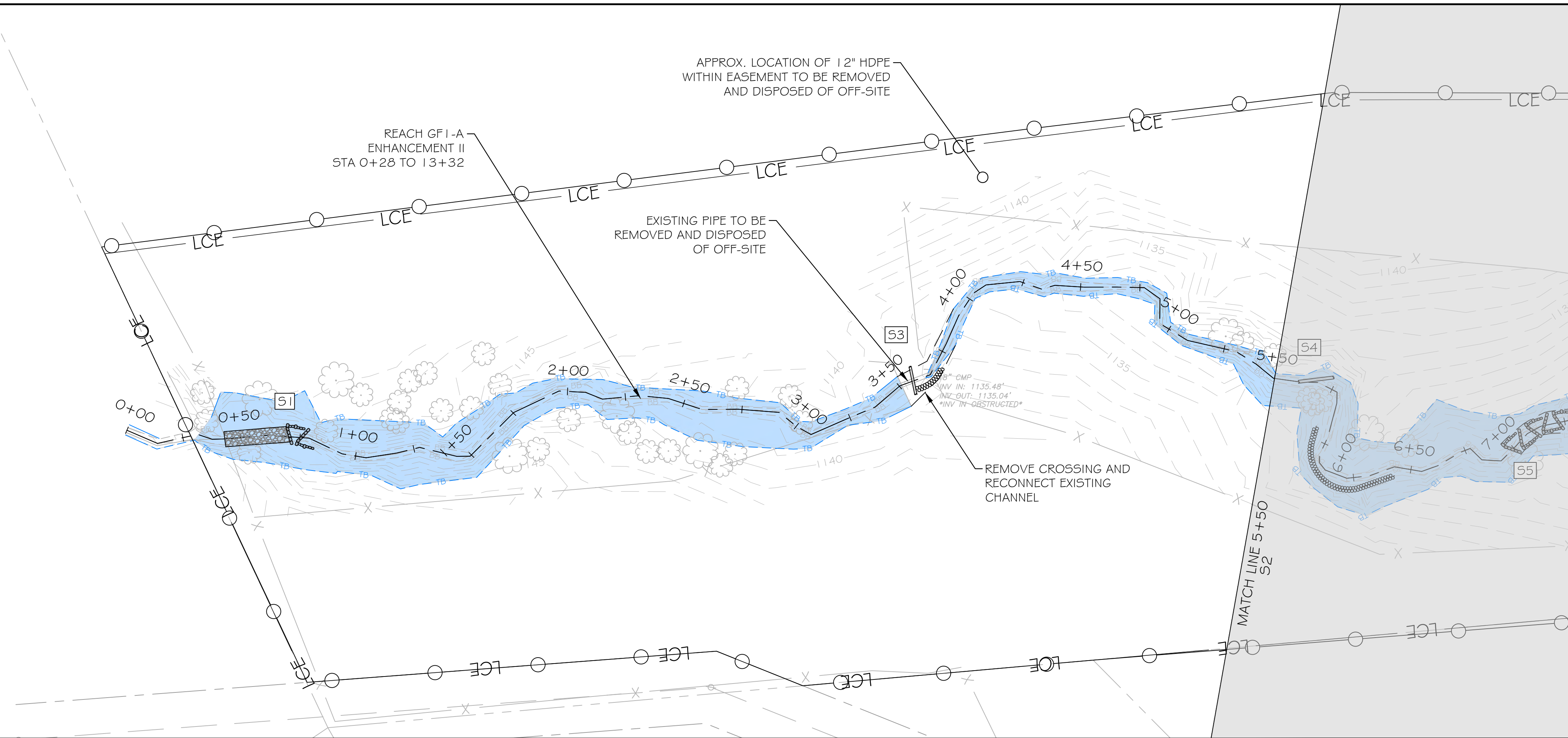
PROJECT NAME:
GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA

DRAWING TITLE:
EXISTING CONDITIONS

PROJECT NUMBER: 0438
 PROJECT MANAGER: BPB
 DESIGNED: BRC
 DRAWN: TRS
 CHECKED: AFM

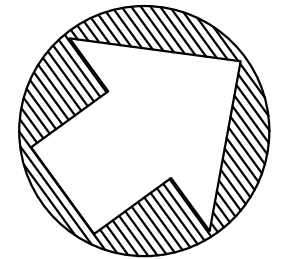
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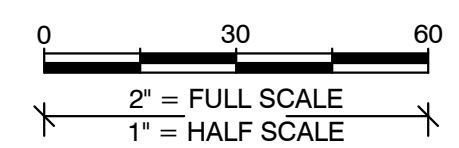


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SEAL



FULL SCALE: 1"=30'



MARK	DATE	DESCRIPTION	RELEASED FOR:	PLOT DATE:
			PRELIMINARY - NOT FOR CONSTRUCTION	09/13/2019

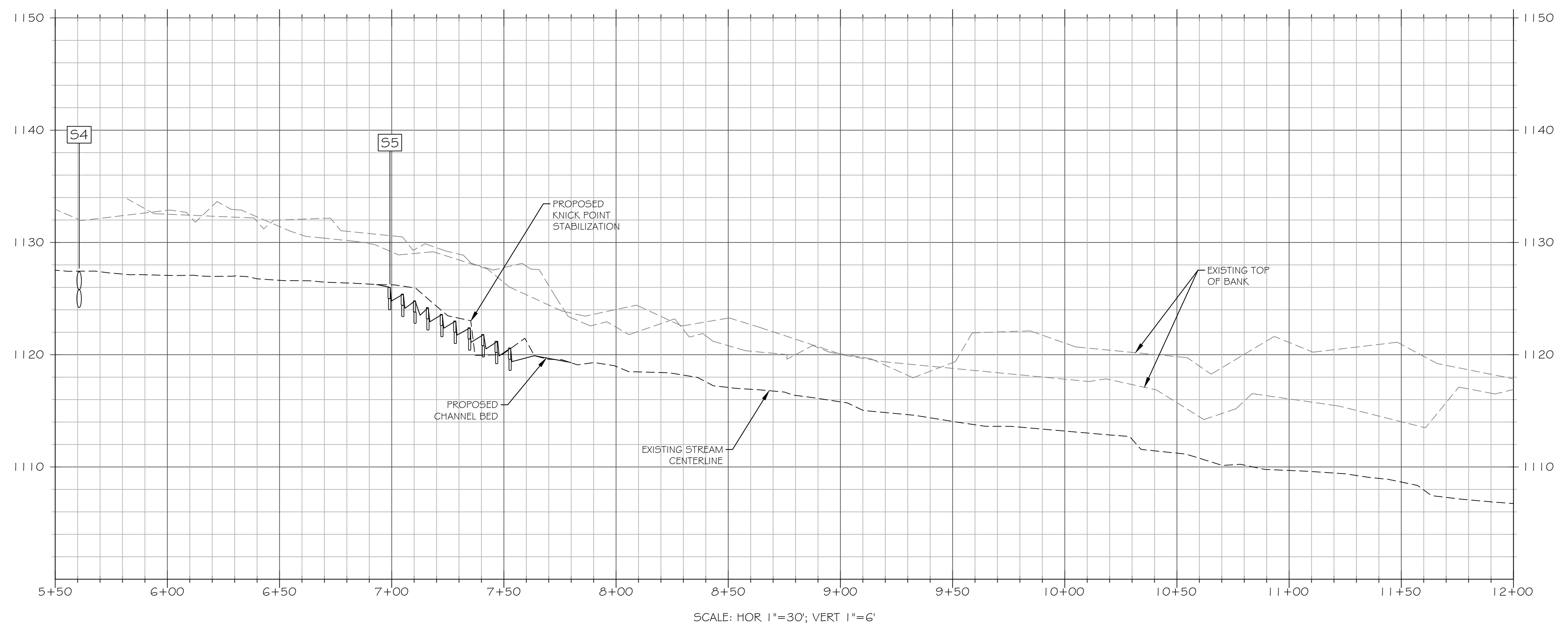
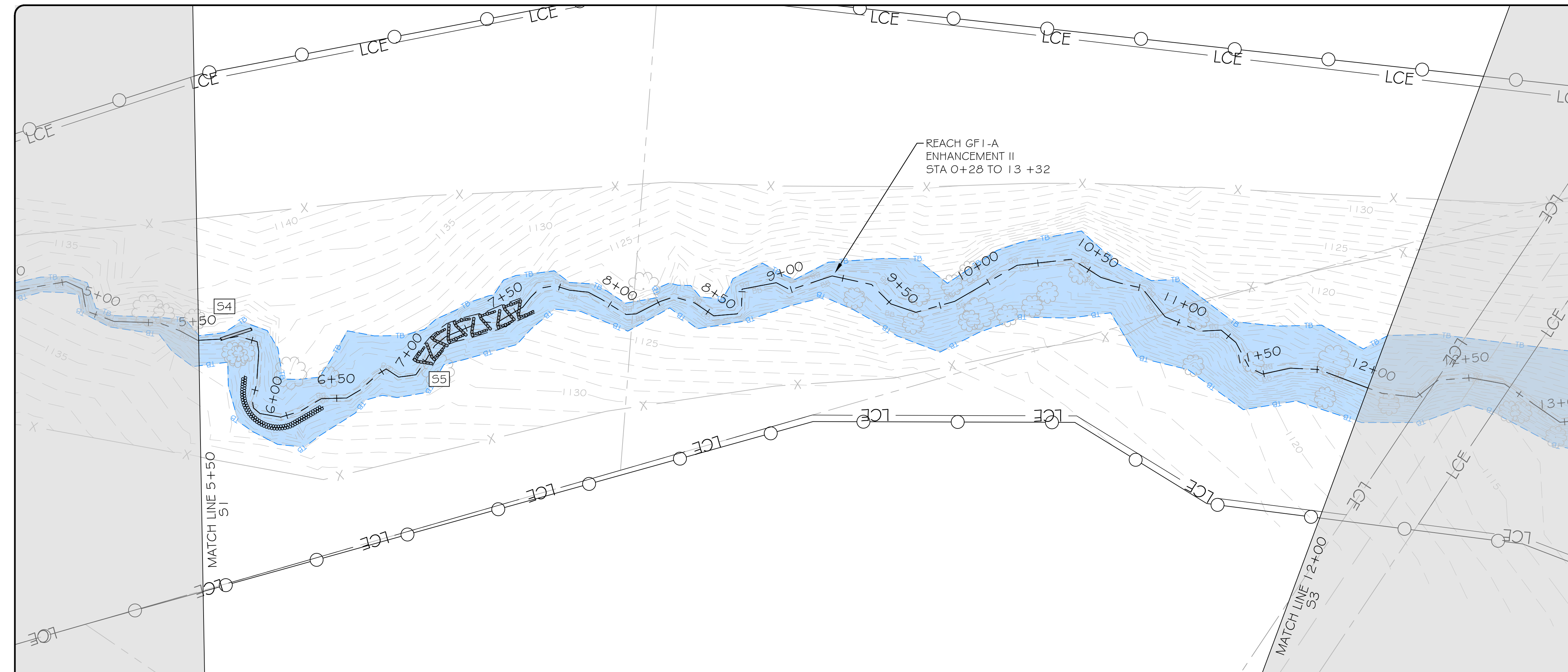
PROJECT NAME:
**GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA**

DRAWING TITLE:
REACH GF1

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

SHEET NUMBER:

S1

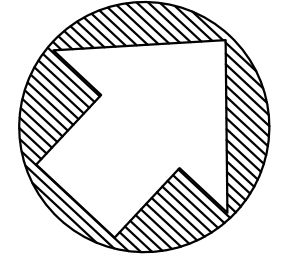


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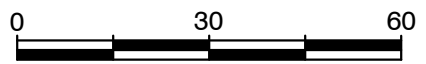


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SEAL



FULL SCALE: 1"=30'



2" = FULL SCALE
 1" = HALF SCALE

MARK	DATE	DESCRIPTION	PLOT DATE:
			09/13/2019
REVISIONS:			
RELEASED FOR:			
PRELIMINARY - NOT FOR CONSTRUCTION			

PROJECT NAME:
 GROUNDHOG HOLLOW MITIGATION SITE
 ALEXANDER COUNTY, NORTH CAROLINA

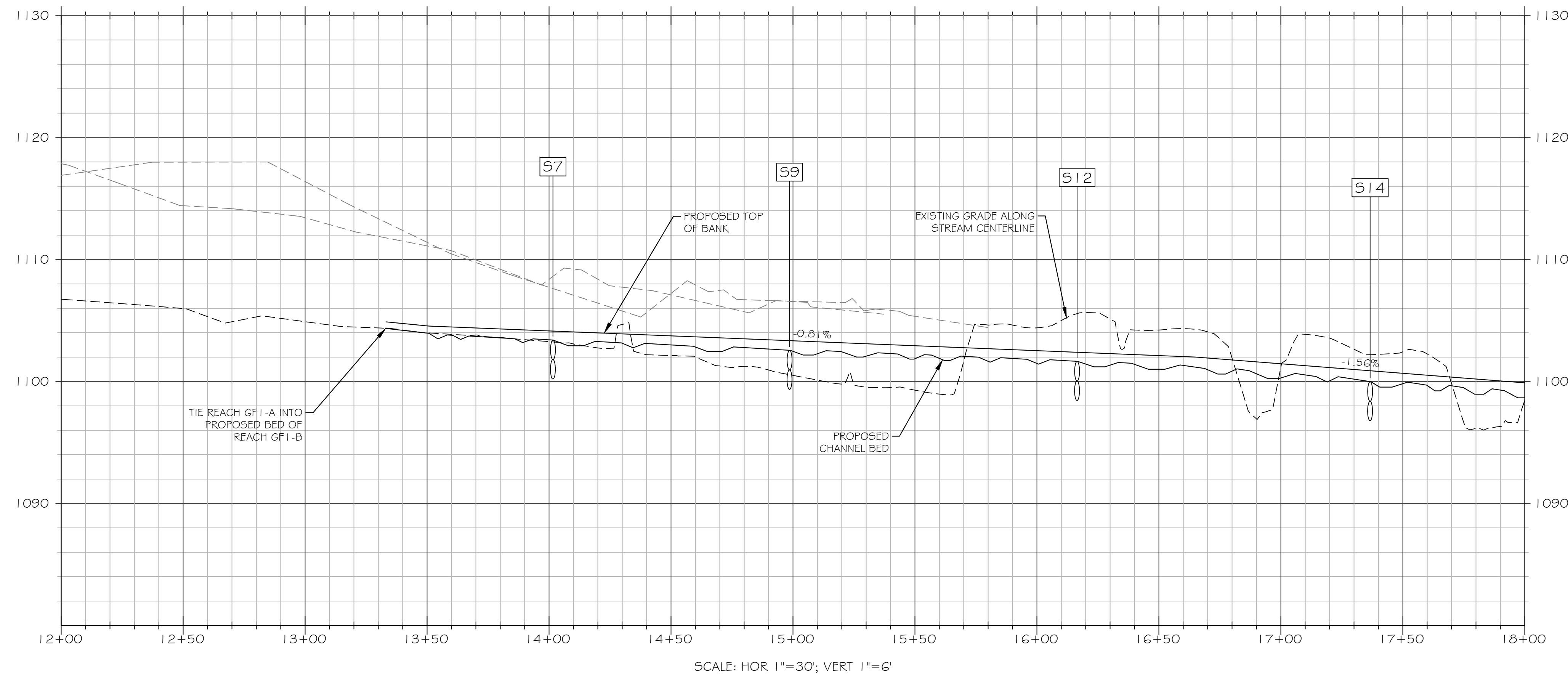
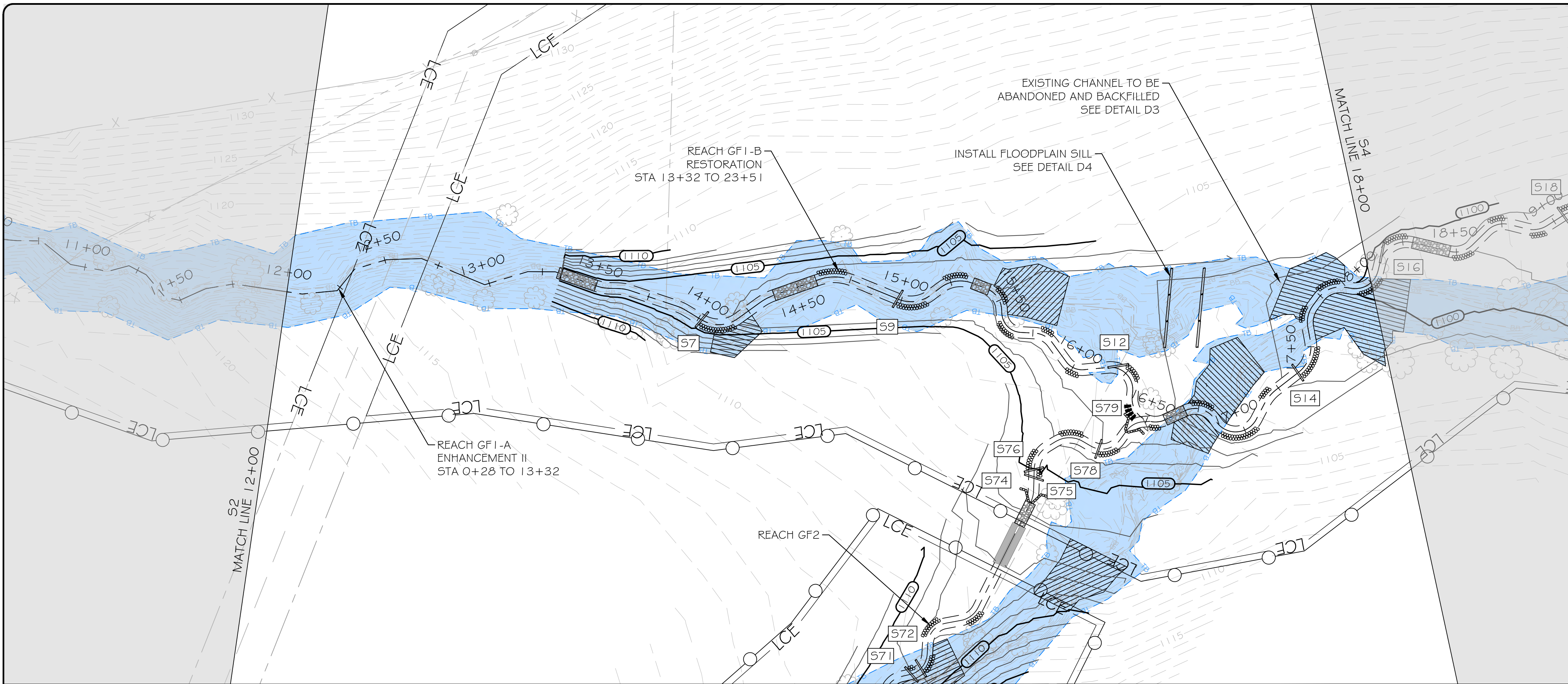
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 REACH GF1

PROJECT NUMBER: 0438
 PROJECT MANAGER: BPB
 DESIGNED: BRC
 DRAWN: TRS
 CHECKED: AFM

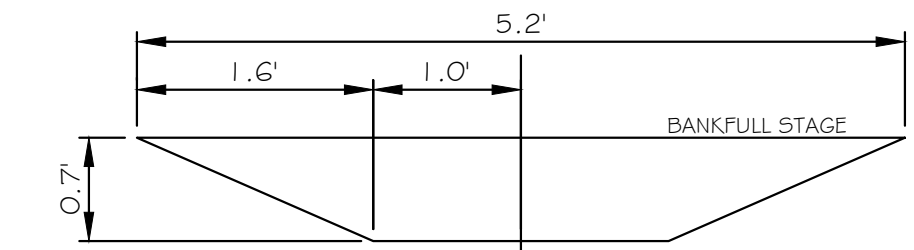
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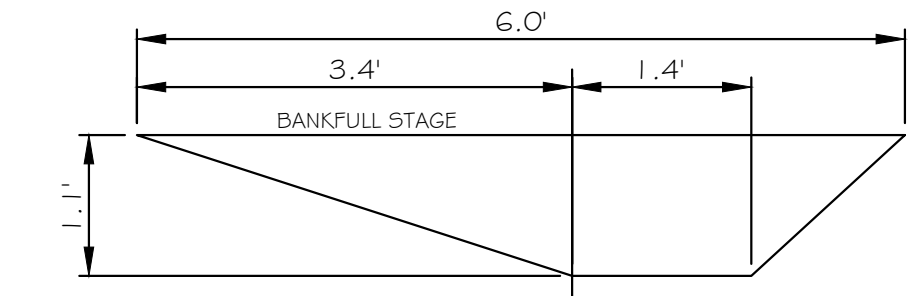
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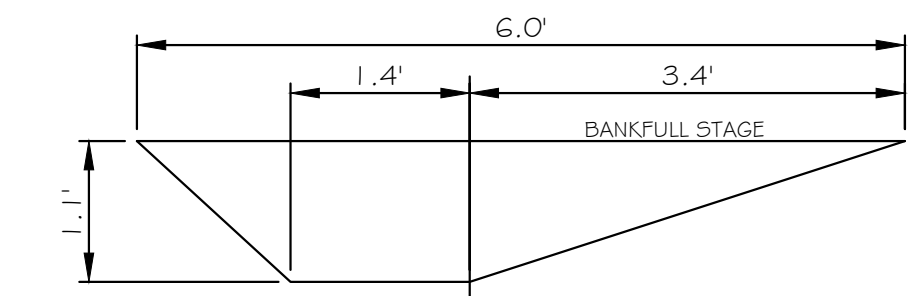
REACH GF1-B STA 13+32 TO STA 16+52



TYPICAL RIFFLE CROSS SECTION (SEE SHEET D7)

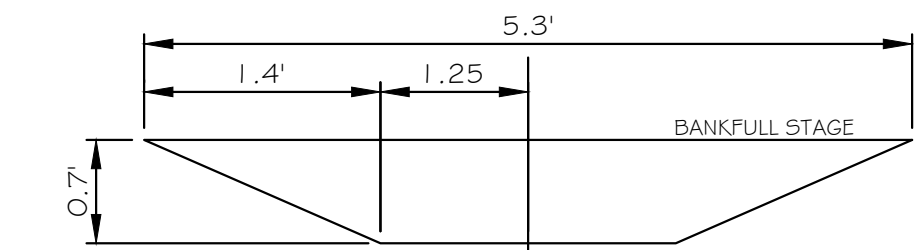


TYPICAL RIGHT MEANDER CROSS SECTION

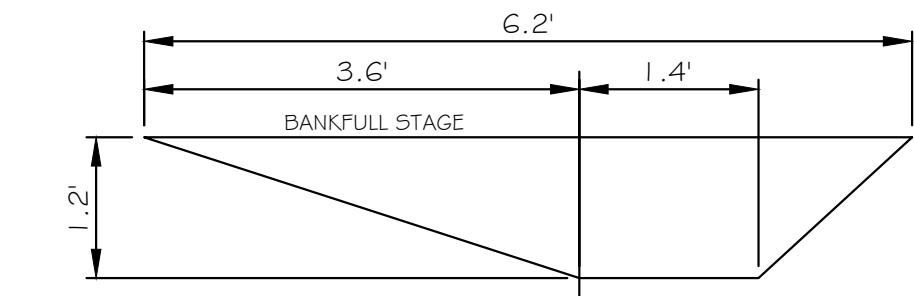


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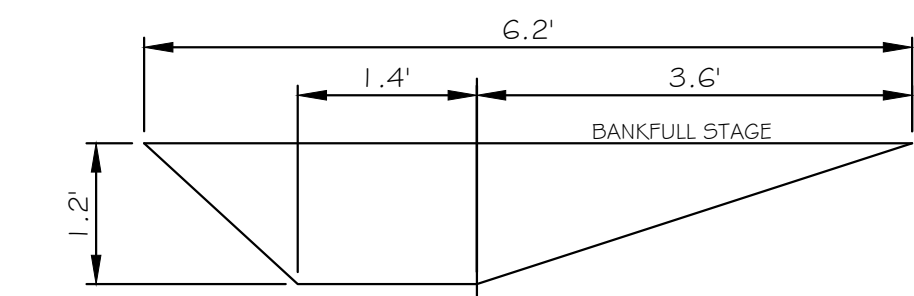
REACH GF1-B STA 16+52 TO STA 30+24



TYPICAL RIFFLE CROSS SECTION (SEE SHEET D7)



TYPICAL RIGHT MEANDER CROSS SECTION

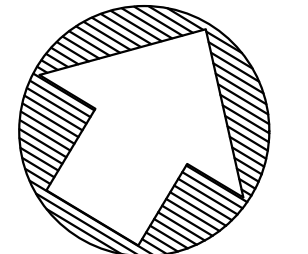


TYPICAL LEFT MEANDER CROSS SECTION

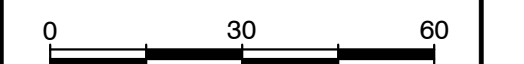


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FULL SCALE: 1"=30'



2" = FULL SCALE
1" = HALF SCALE

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			09/13/2019

RELEASED FOR: PRELIMINARY - NOT FOR CONSTRUCTION

PROJECT NAME:
GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA

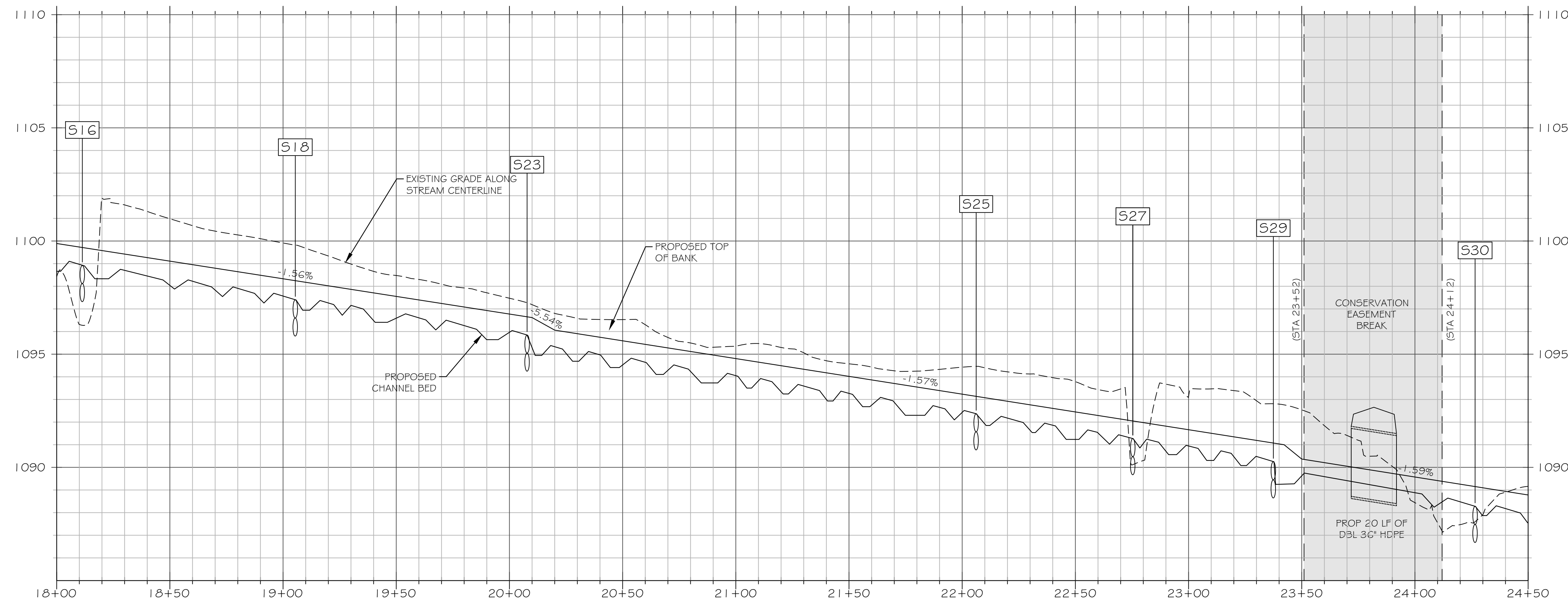
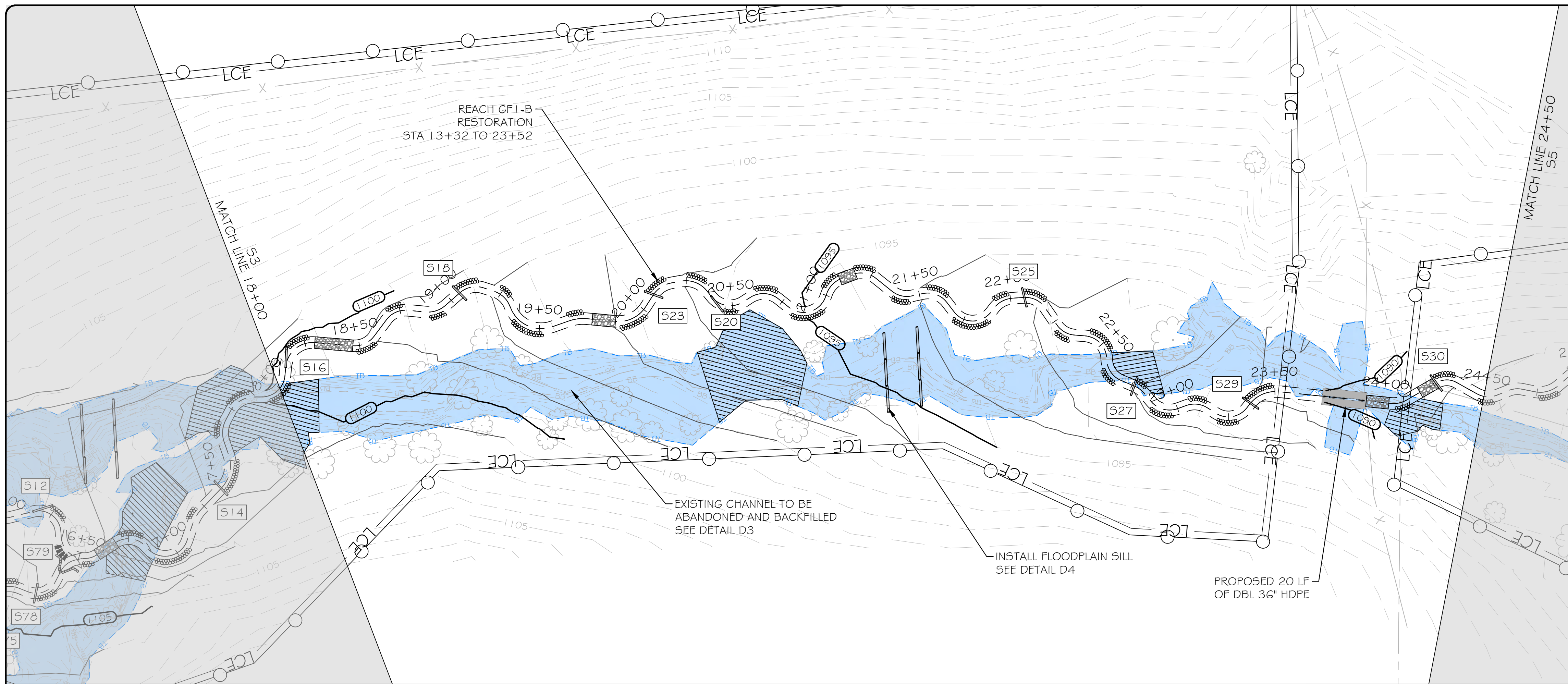
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PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

SHEET NUMBER:

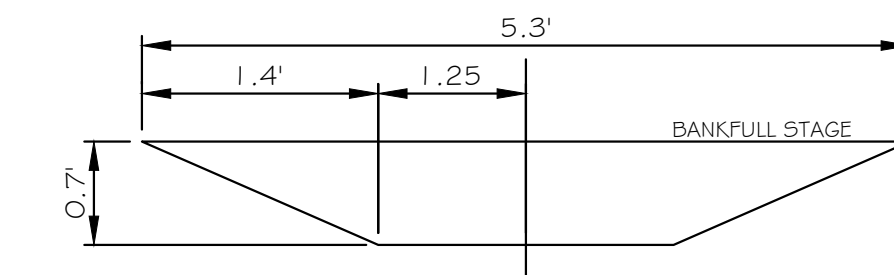
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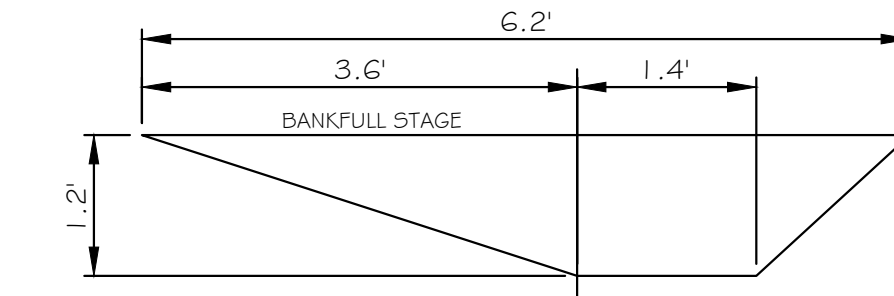


SCALE: HOR 1"=30'; VERT 1"=3'

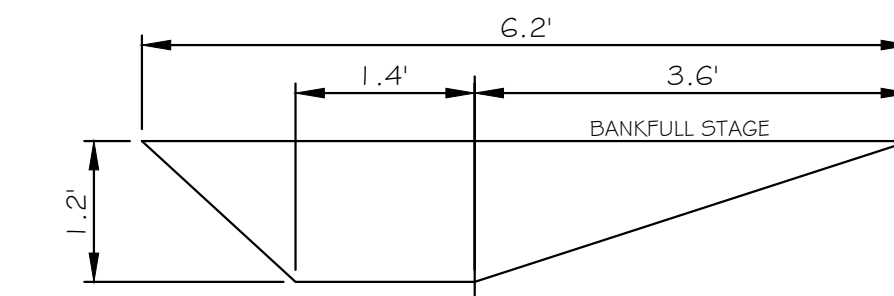
REACH GF1-B STA 16+52 TO STA 30+24



TYPICAL RIFFLE CROSS SECTION (SEE SHEET D7)



TYPICAL RIGHT MEANDER CROSS SECTION

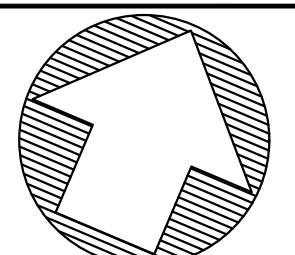


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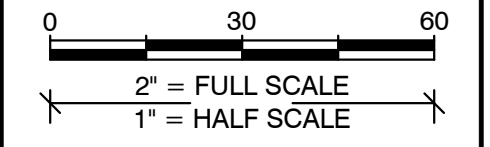


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FULL SCALE: 1"=30'



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PRELIMINARY - NOT FOR CONSTRUCTION			

PROJECT NAME:
GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA

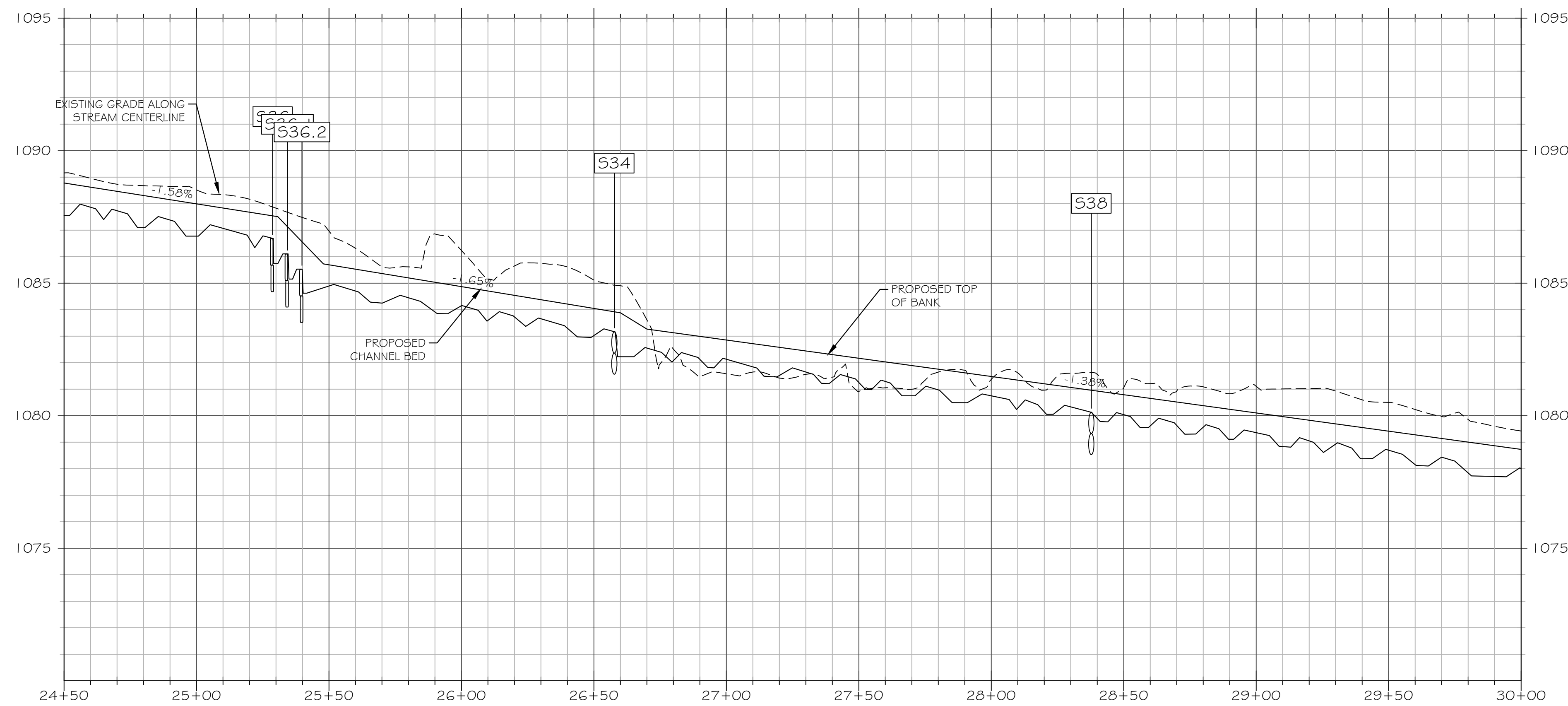
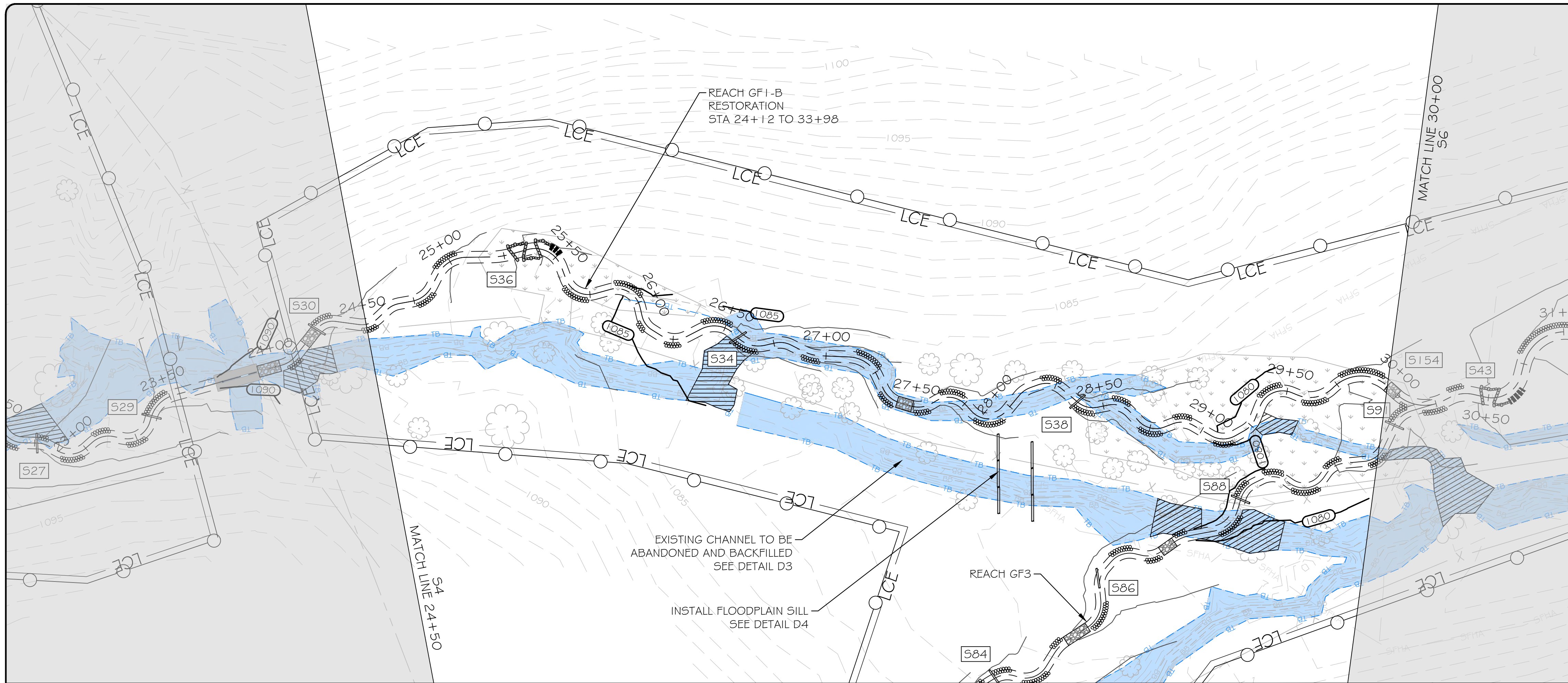
DRAWING TITLE:
REACH GF1

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

SHEET NUMBER:

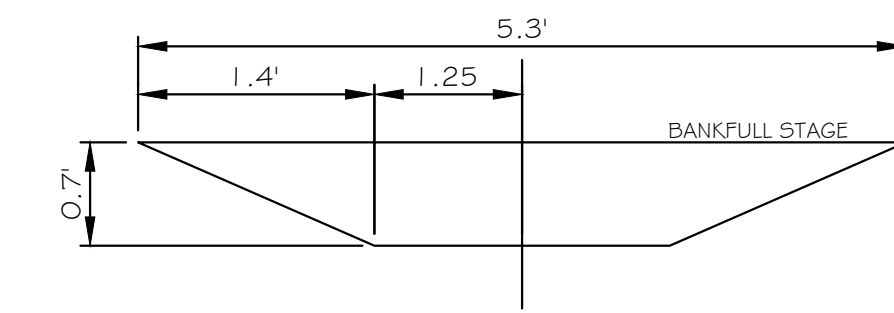
S4

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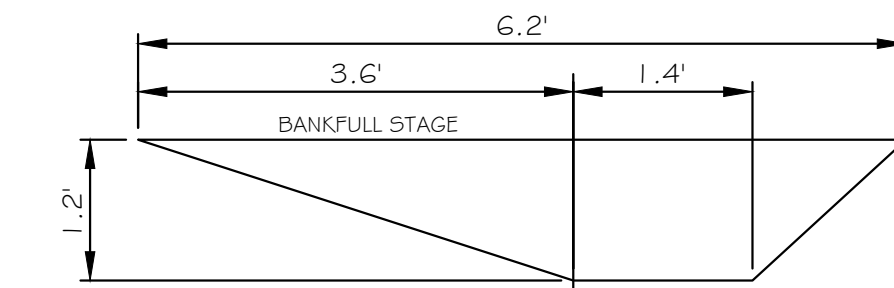


SCALE: HOR 1"=30'; VERT 1"=3'

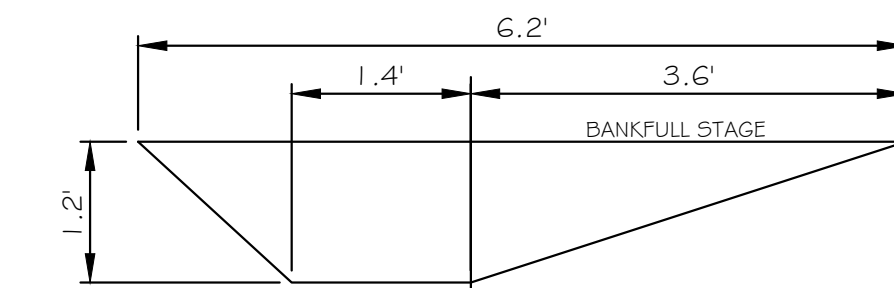
REACH GF1-B STA 16+52 TO STA 30+24



TYPICAL RIFFLE CROSS SECTION
(SEE SHEET D7)



TYPICAL RIGHT MEANDER CROSS SECTION

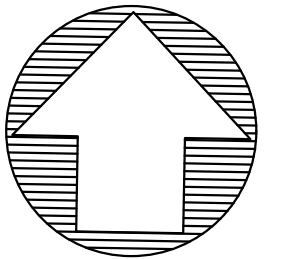


TYPICAL LEFT MEANDER CROSS SECTION

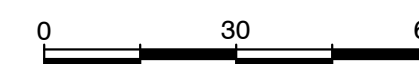


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FULL SCALE: 1"=30'



2" = FULL SCALE
1" = HALF SCALE

MARK | DATE | DESCRIPTION
REVISIONS:
RELEASED FOR: PRELIMINARY - NOT FOR CONSTRUCTION
PLOT DATE: 09/13/2019

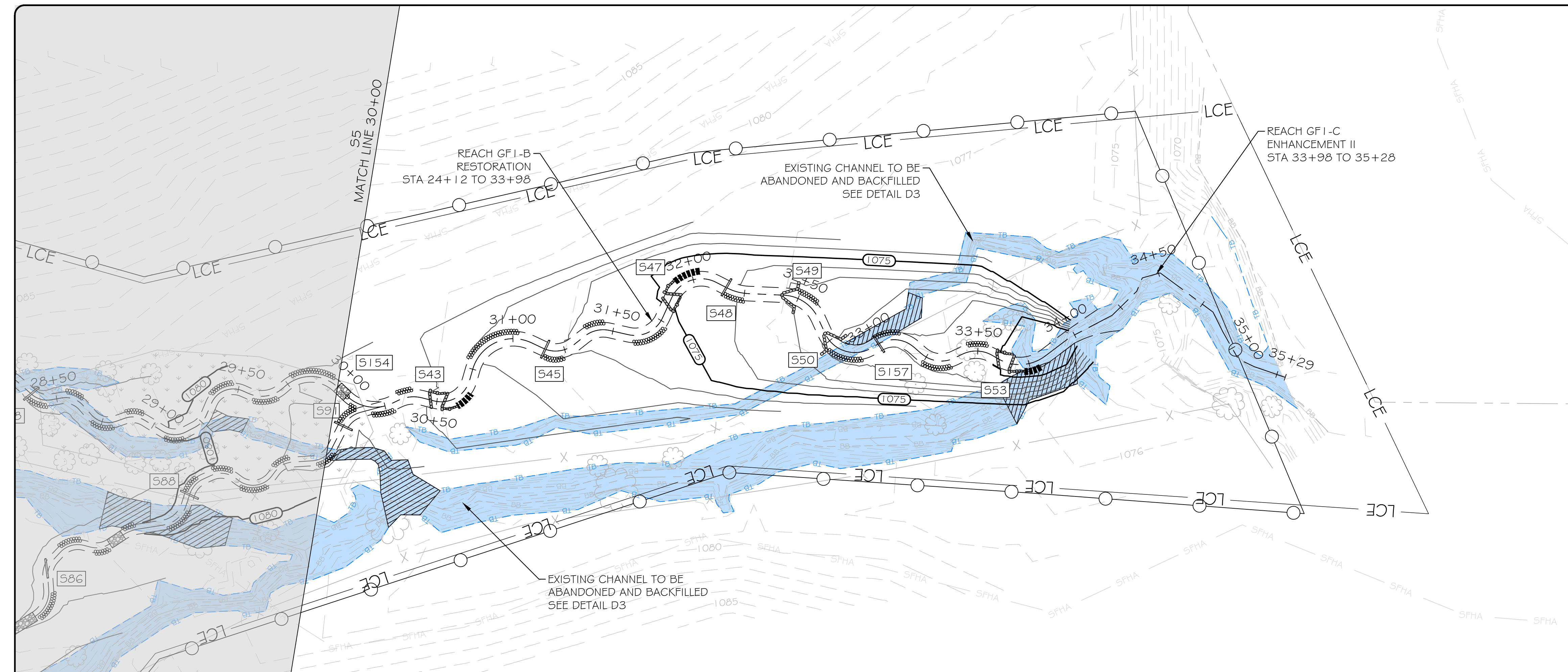
PROJECT NAME:
GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA

DRAWING TITLE:
REACH GF1

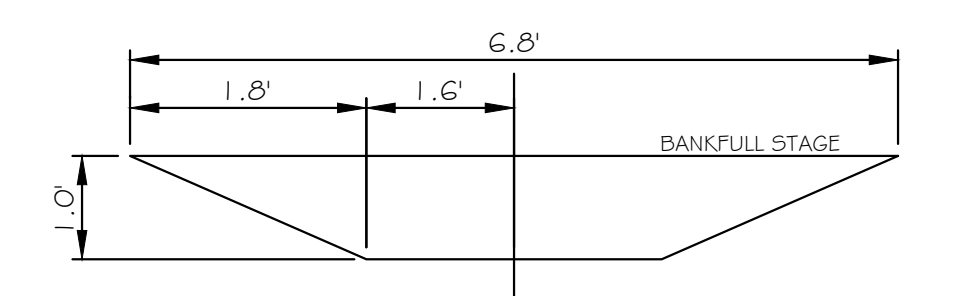
PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
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SHEET NUMBER:

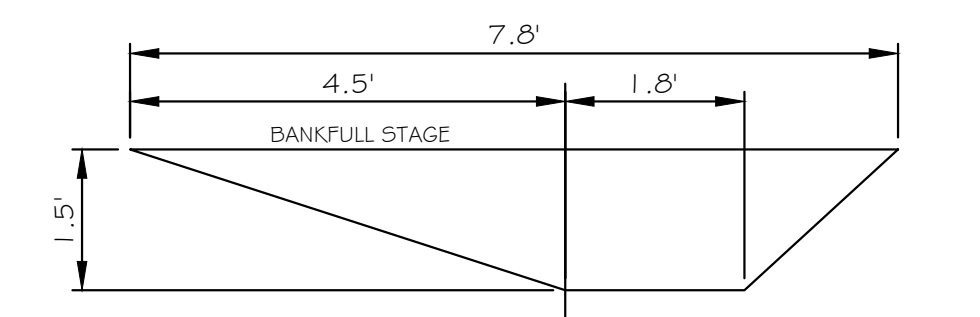
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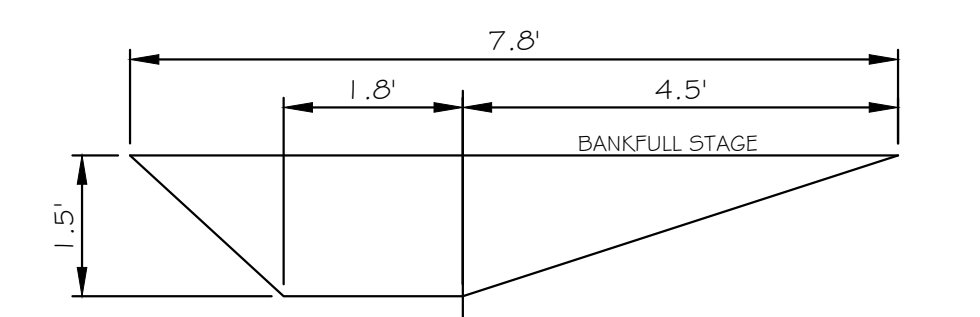
REACH GF1-B STA 30+24 TO STA 33+98



TYPICAL RIFFLE CROSS SECTION (SEE SHEET D7)



TYPICAL RIGHT MEANDER CROSS SECTION

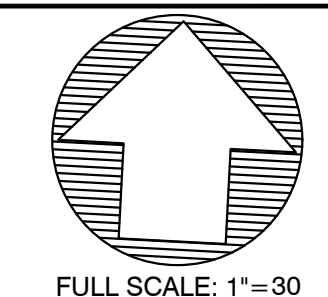


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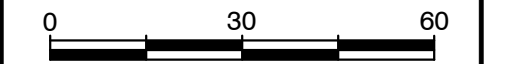


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SEAL



FULL SCALE: 1"=30'



2" = FULL SCALE
1" = HALF SCALE

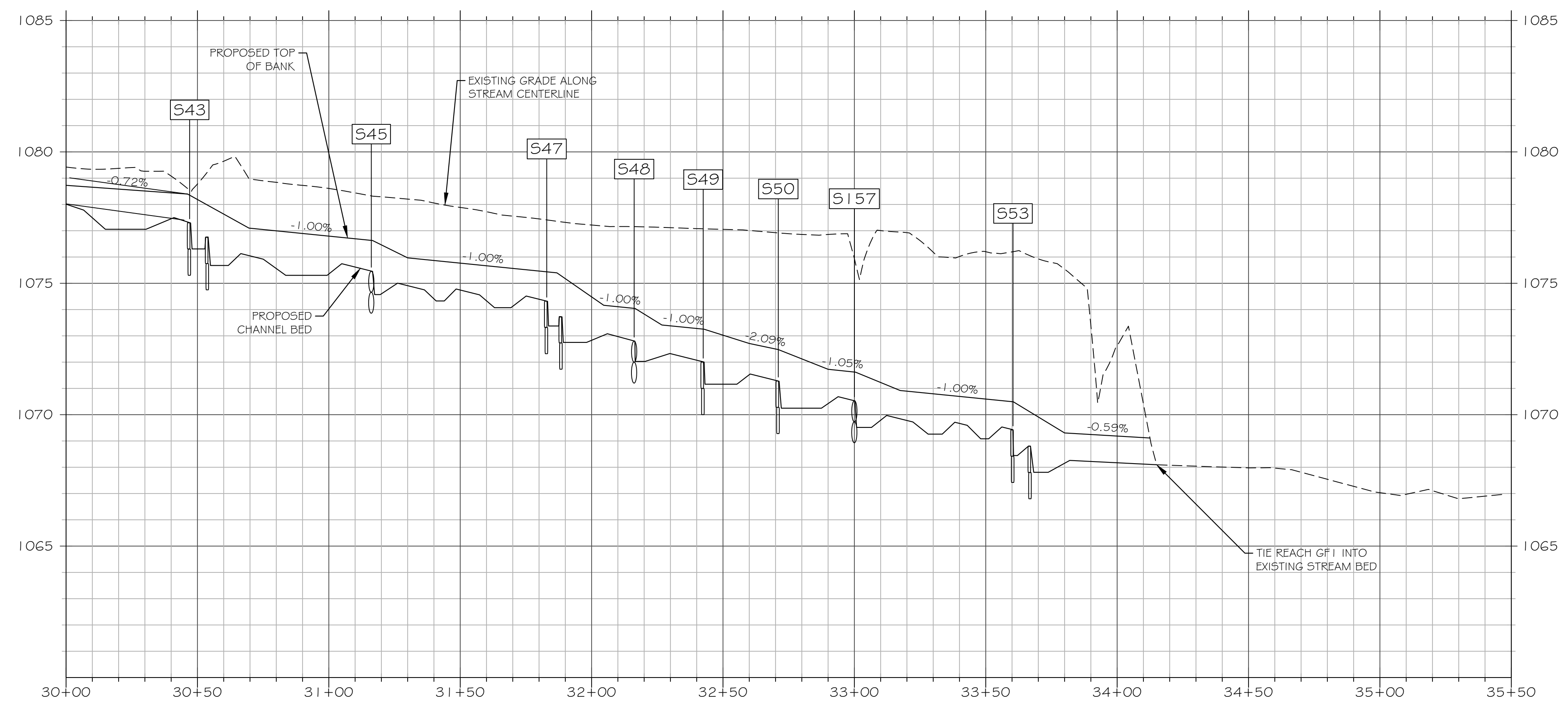
MARK	DATE	DESCRIPTION	REVISIONS:	RELEASED FOR:	PLOT DATE:
				PRELIMINARY - NOT FOR CONSTRUCTION	09/13/2019

PROJECT NAME:
**GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA**

DRAWING TITLE:
REACH GF1

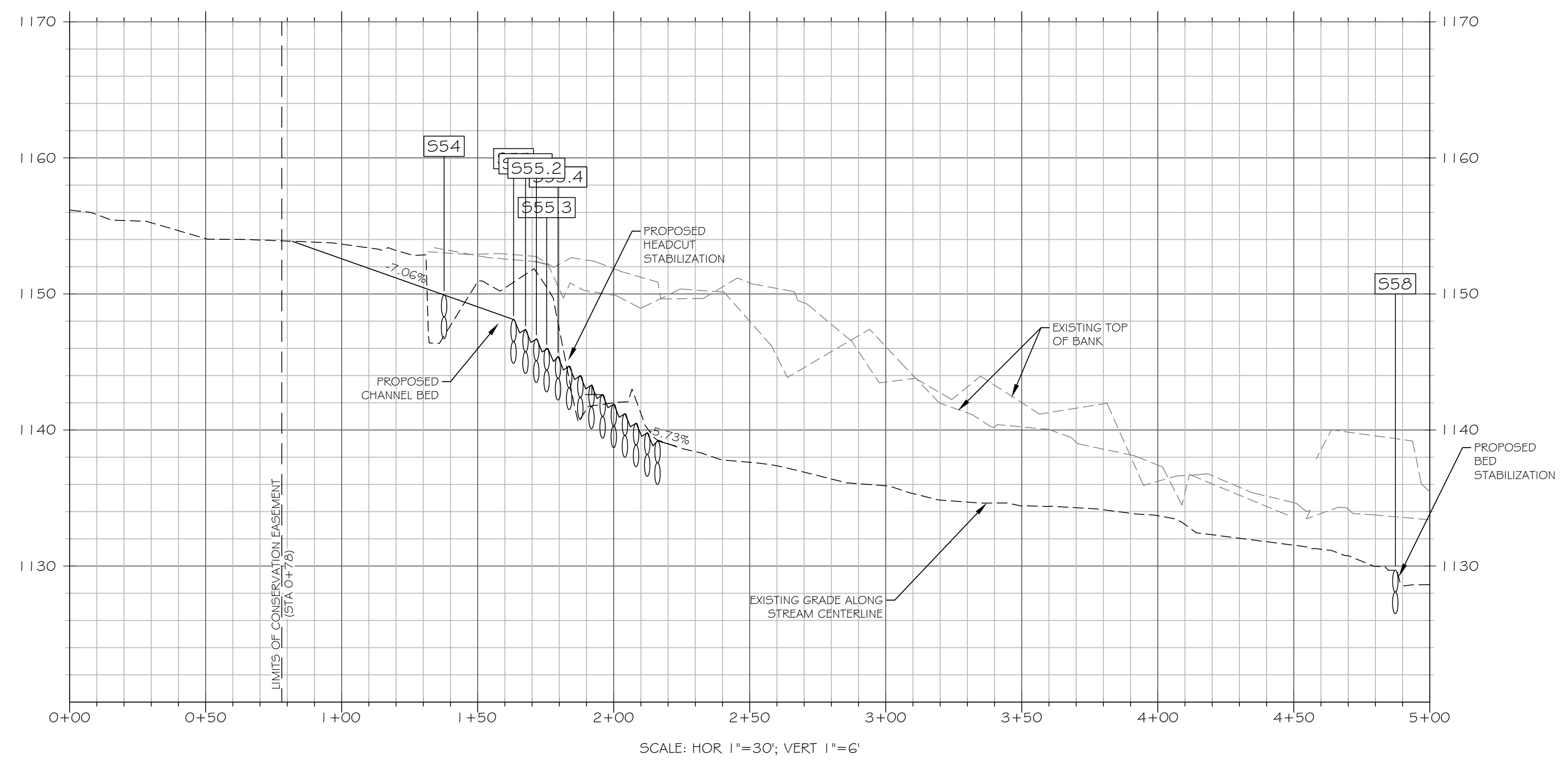
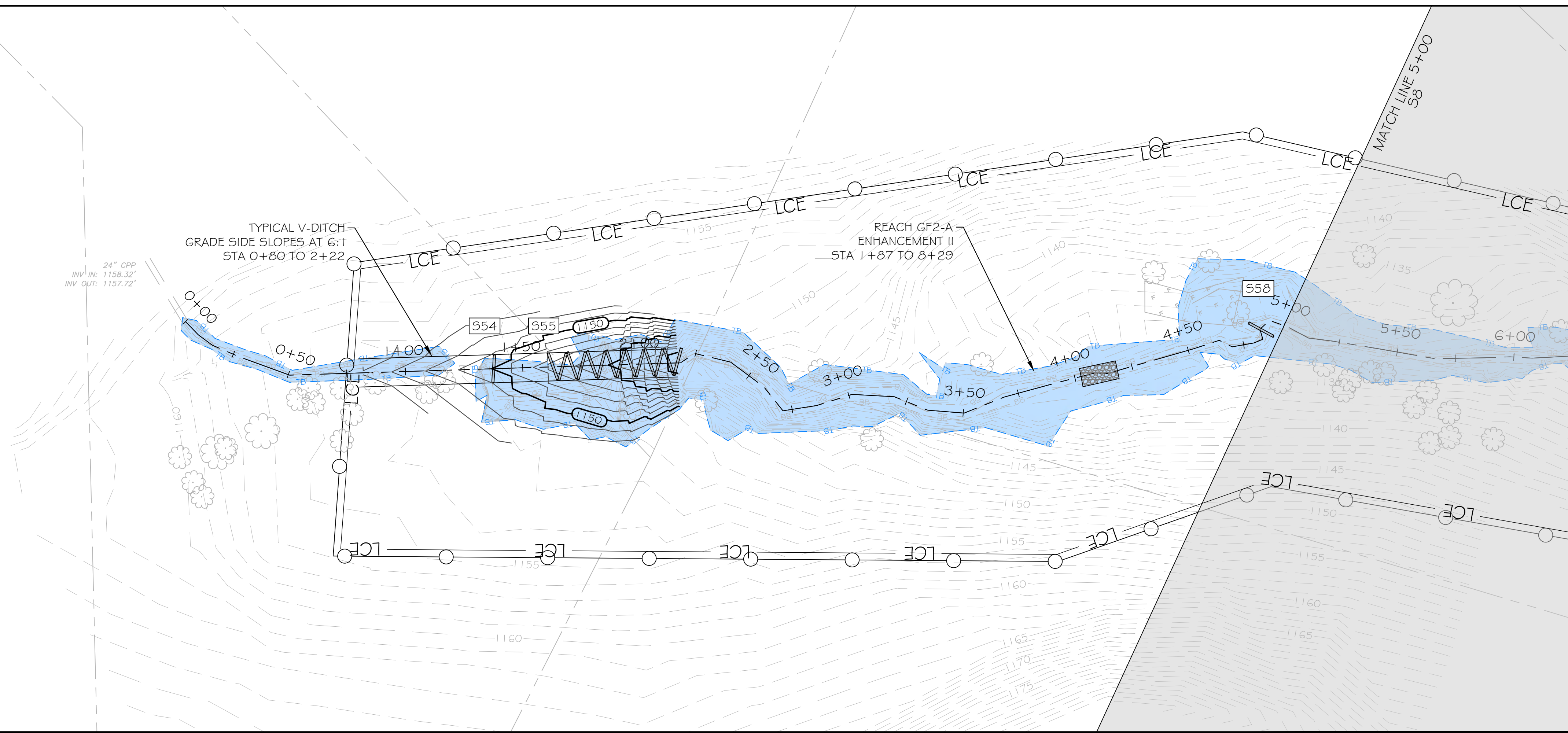
PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
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CHECKED: AFM

SHEET NUMBER:



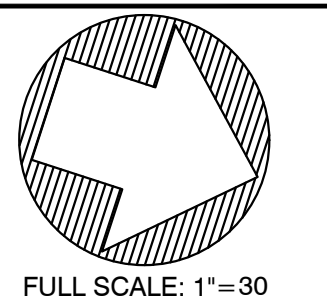
SCALE: HOR 1"=30'; VERT 1"=3'

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FULL SCALE: 1"=30'
 0 30 60
 2" = FULL SCALE
 1" = HALF SCALE

MARK	DATE	DESCRIPTION	PLOT DATE:
			09/13/2019
REVISIONS:			
RELEASED FOR:			PRELIMINARY - NOT FOR CONSTRUCTION

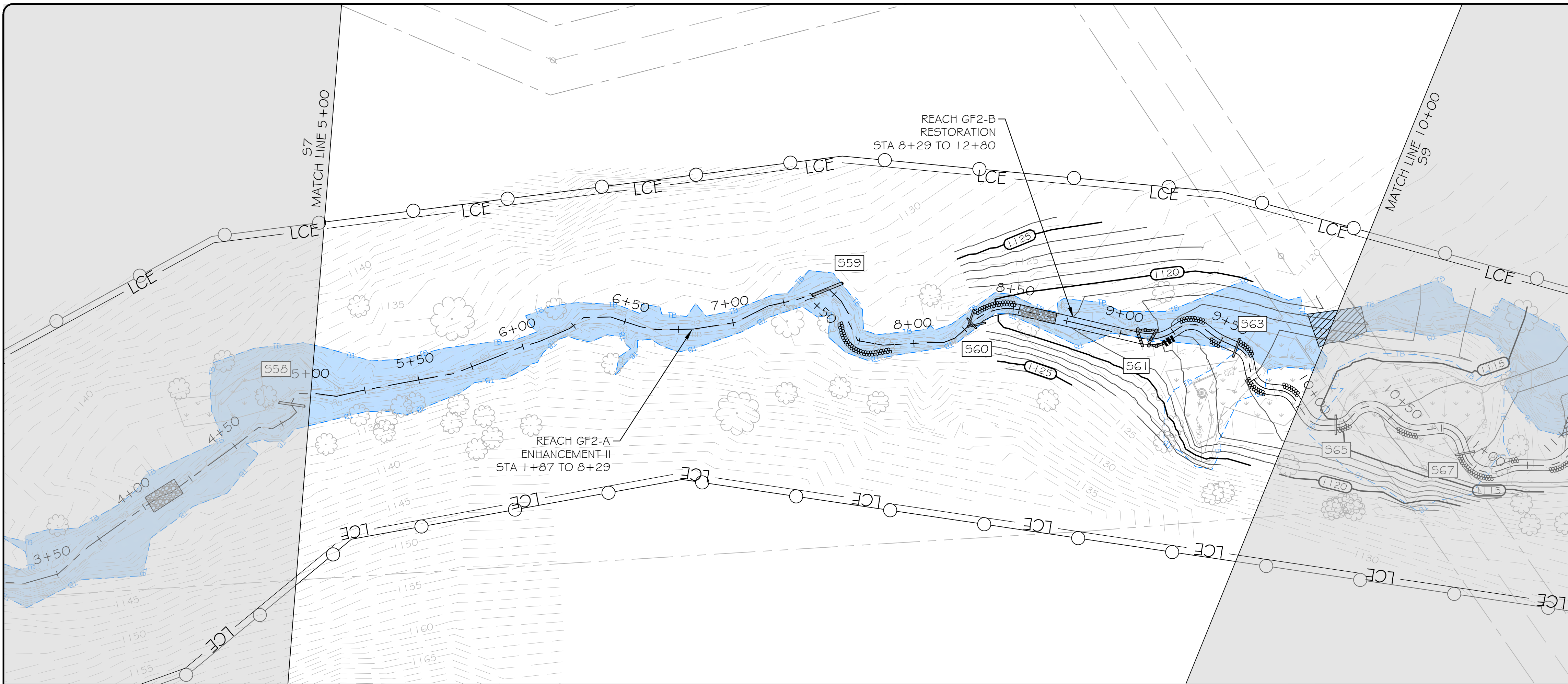
PROJECT NAME:
**GROUNDHOG HOLLOW MITIGATION SITE
 ALEXANDER COUNTY, NORTH CAROLINA**

DRAWING TITLE:
REACH GF2

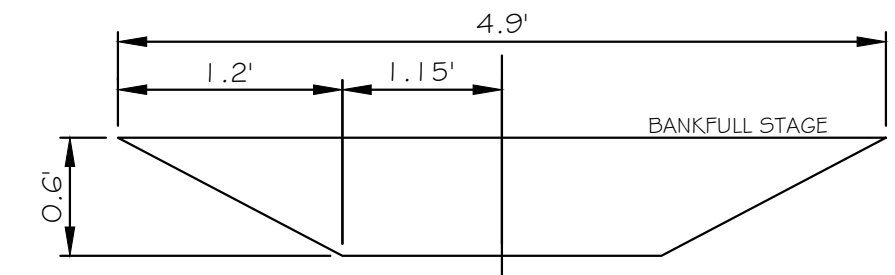
PROJECT NUMBER: 0438
 PROJECT MANAGER: BPB
 DESIGNED: BRC
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 CHECKED: AFM

SHEET NUMBER:
S7

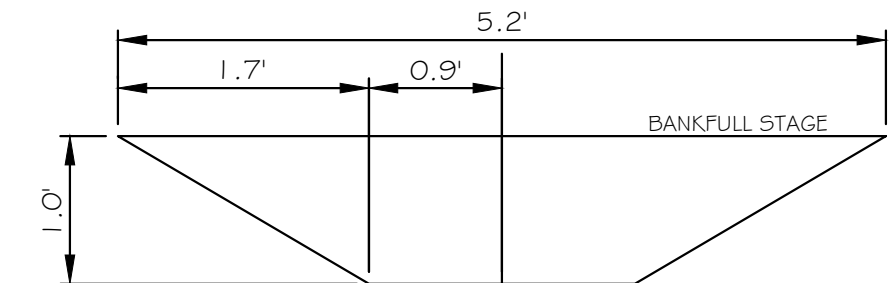
FILE NAME: S:\@RES GIS\Projects\Groundhog Hollow\CAD\DWG\0438_SHT_GF2.dwg SAVED BY: Bearroll



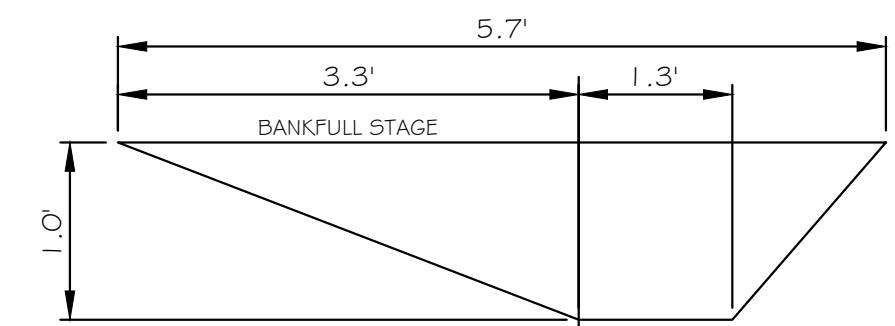
REACH GF2 STA 8+29 TO STA 13+93



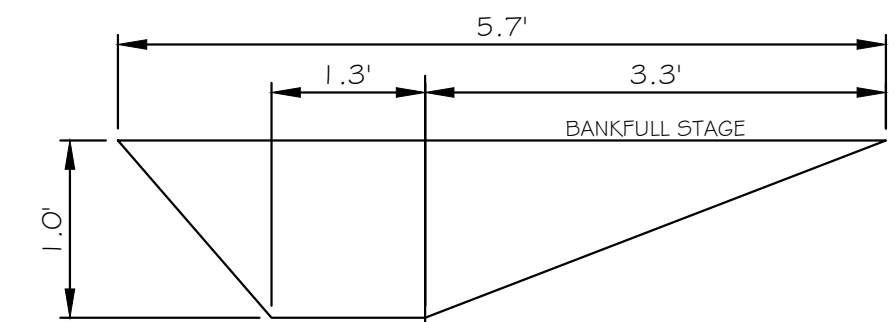
TYPICAL RIFFLE CROSS SECTION
(SEE SHEET D7)



TYPICAL POOL CROSS SECTION



TYPICAL RIGHT MEANDER CROSS SECTION

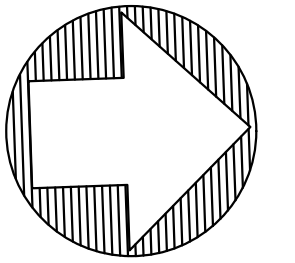


TYPICAL LEFT MEANDER CROSS SECTION

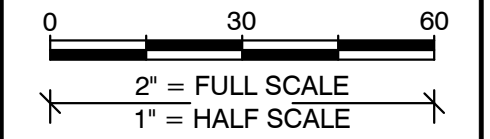


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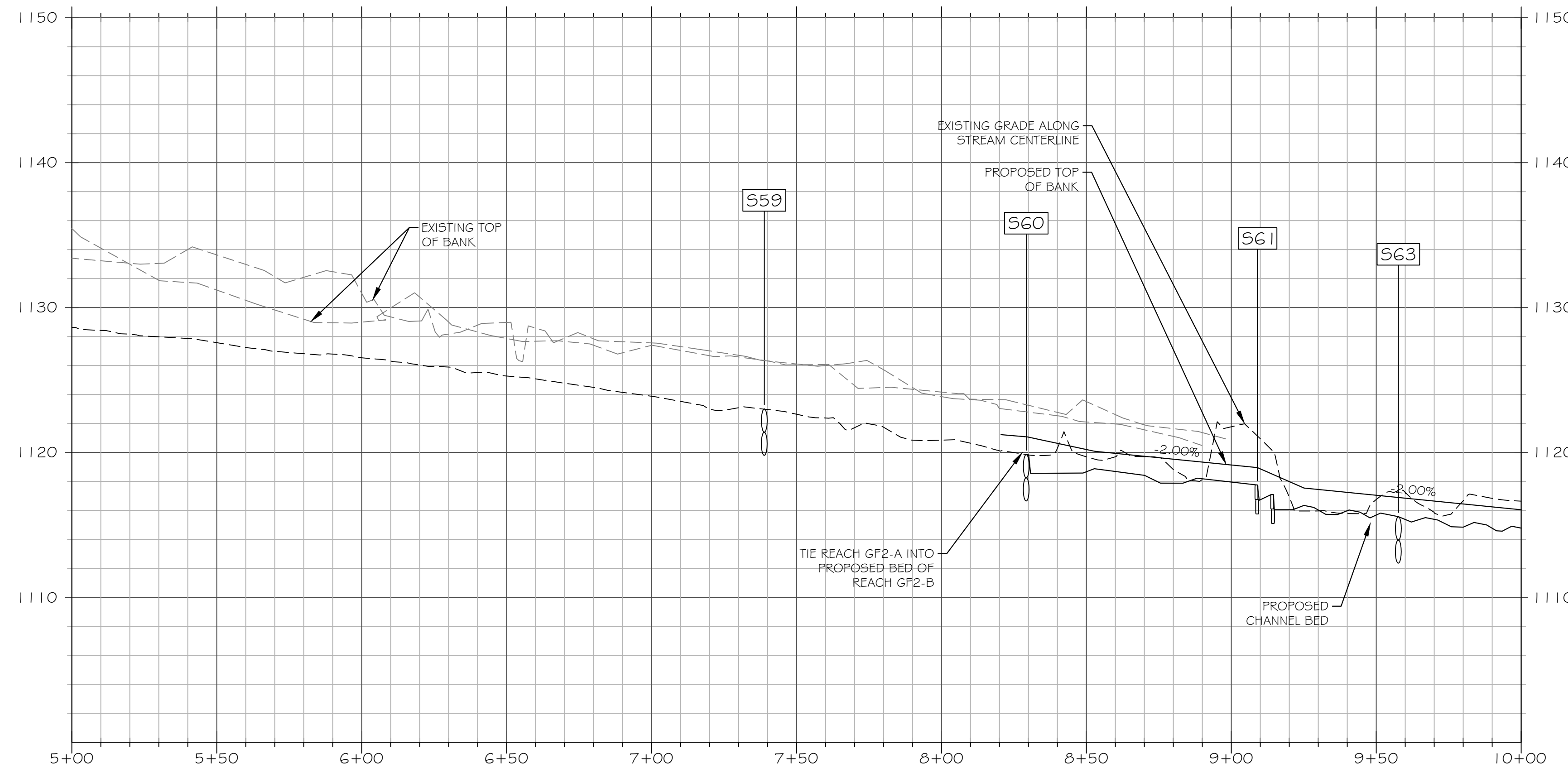


FULL SCALE: 1"=30'



2" = FULL SCALE
1" = HALF SCALE

MARK	DATE	DESCRIPTION	PLLOT DATE:
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SCALE: HOR 1"=30'; VERT 1"=6'

PROJECT NAME:
GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA

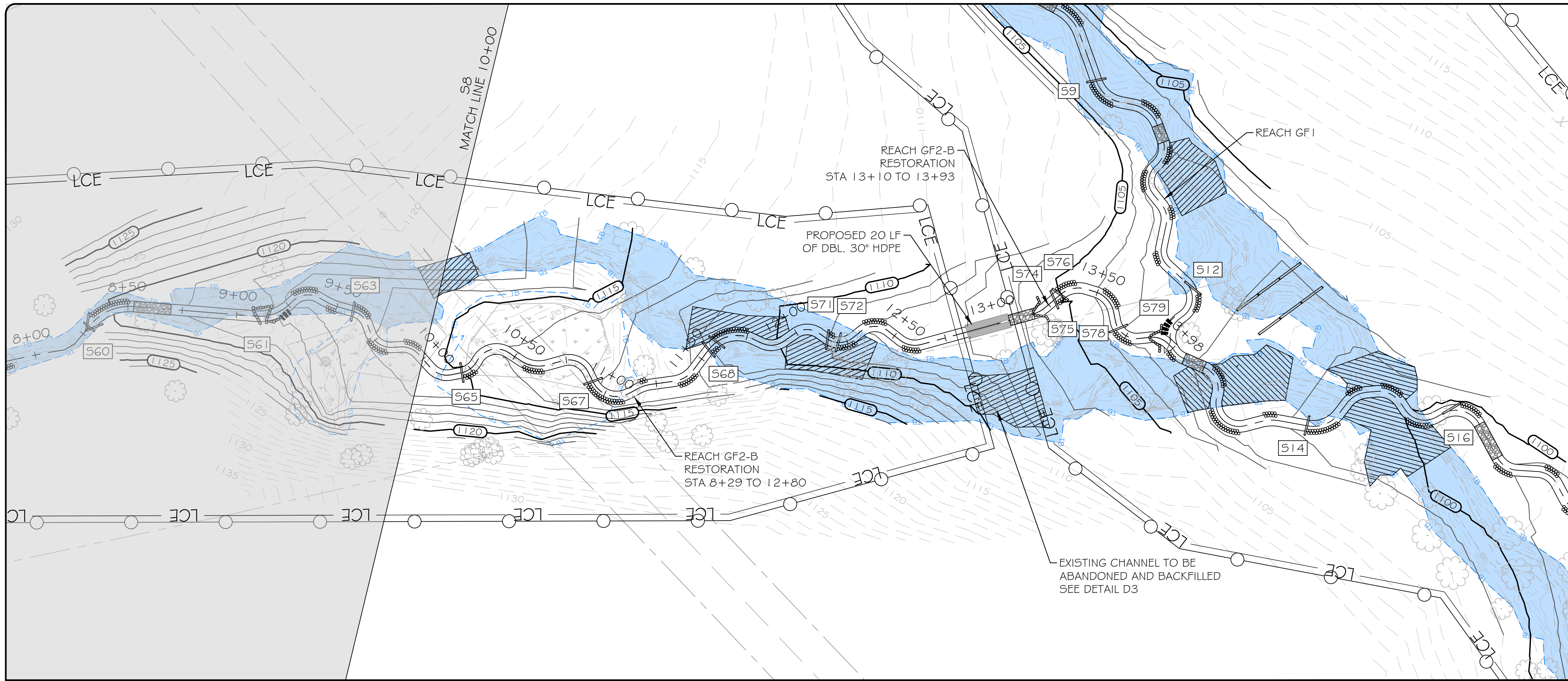
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REACH GF2

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

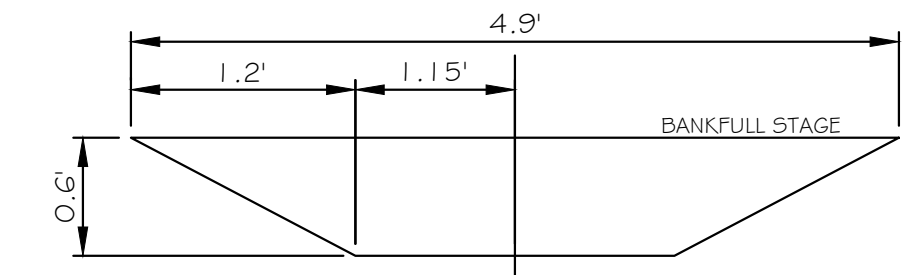
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S8

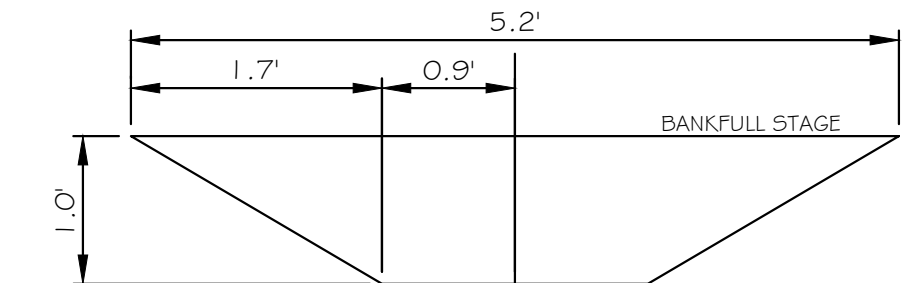
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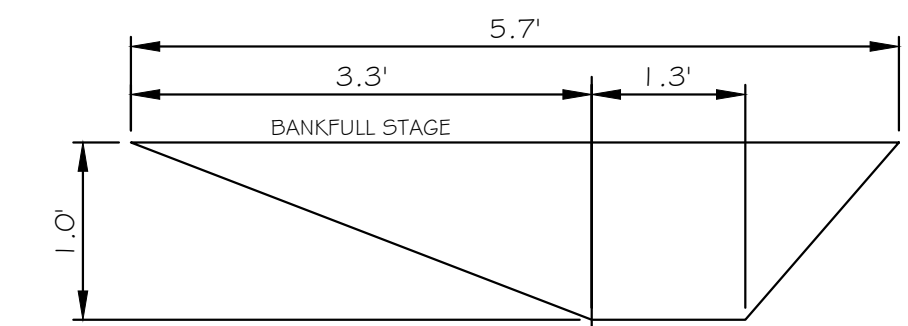
REACH GF2 STA 8+29 TO STA 13+93



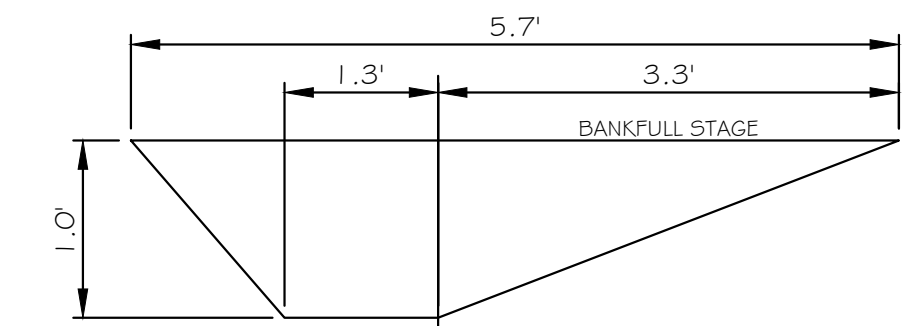
TYPICAL RIFFLE CROSS SECTION
(SEE SHEET D7)



TYPICAL POOL CROSS SECTION



TYPICAL RIGHT MEANDER CROSS SECTION

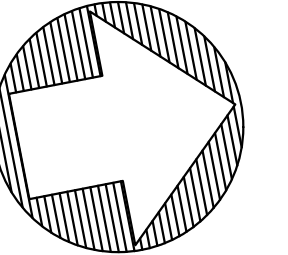


TYPICAL LEFT MEANDER CROSS SECTION

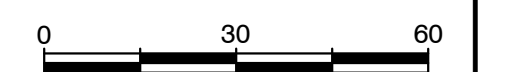


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SEAL

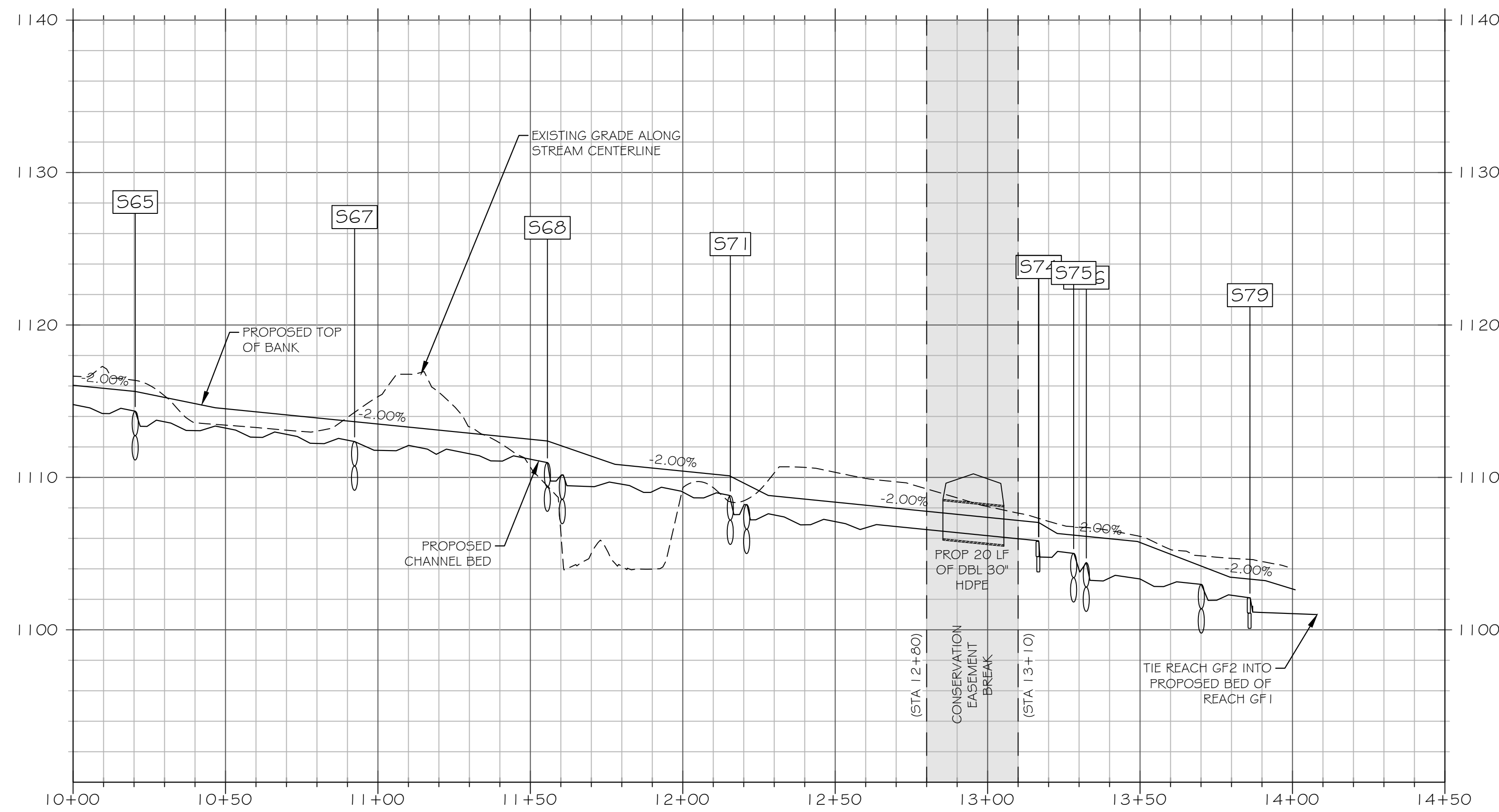


FULL SCALE: 1"=30'



2" = FULL SCALE
1" = HALF SCALE

MARK	DATE	DESCRIPTION	PLLOT DATE:
			09/13/2019
REVISIONS:			
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PRELIMINARY - NOT FOR CONSTRUCTION			



SCALE: HOR 1"=30'; VERT 1"=6'

PROJECT NAME:
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ALEXANDER COUNTY, NORTH CAROLINA

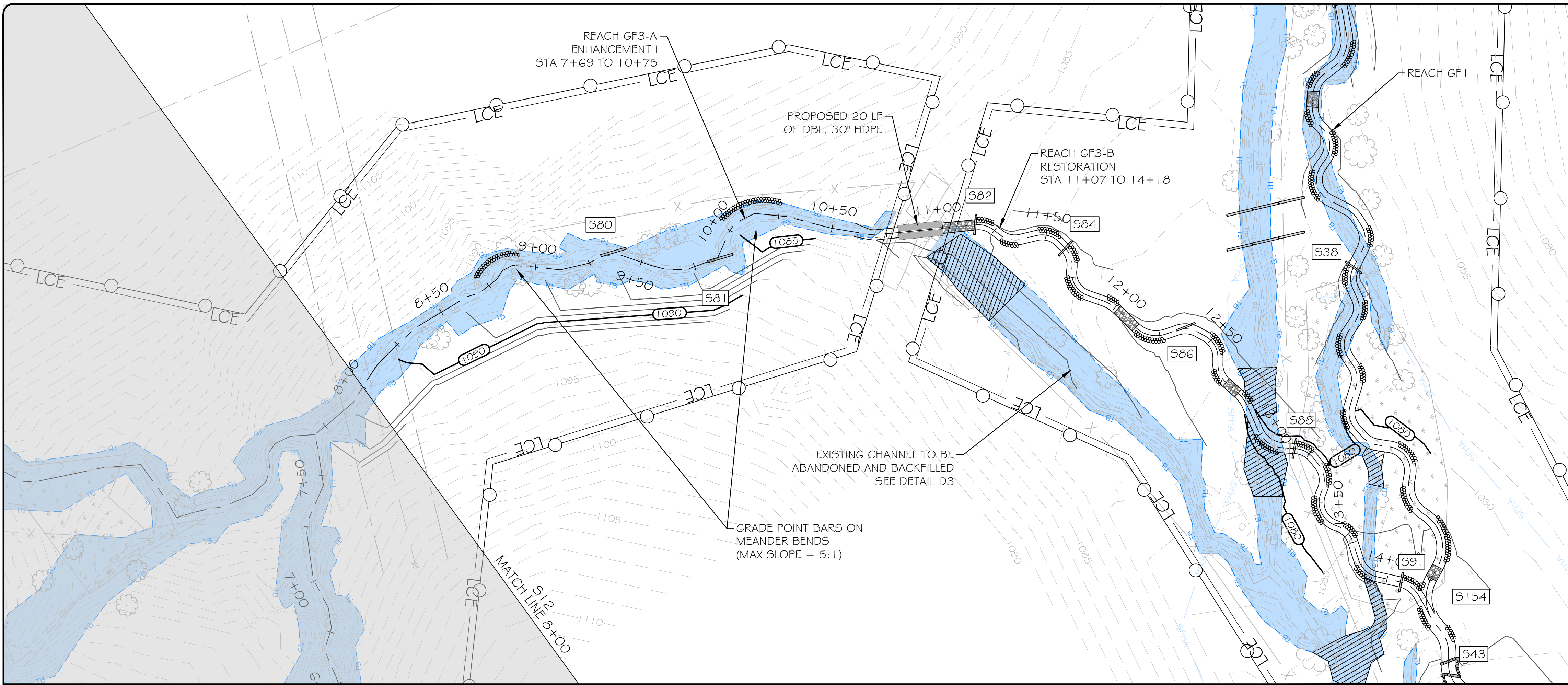
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REACH GF2

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

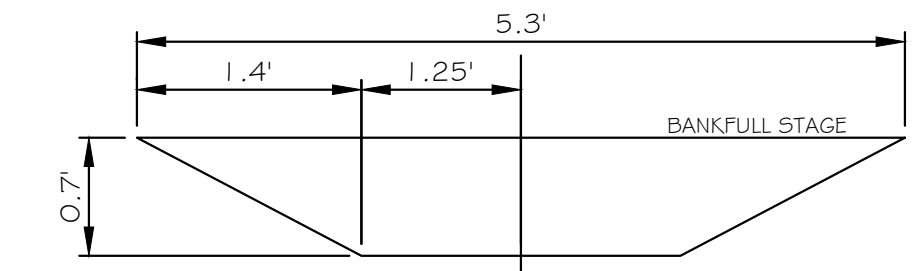
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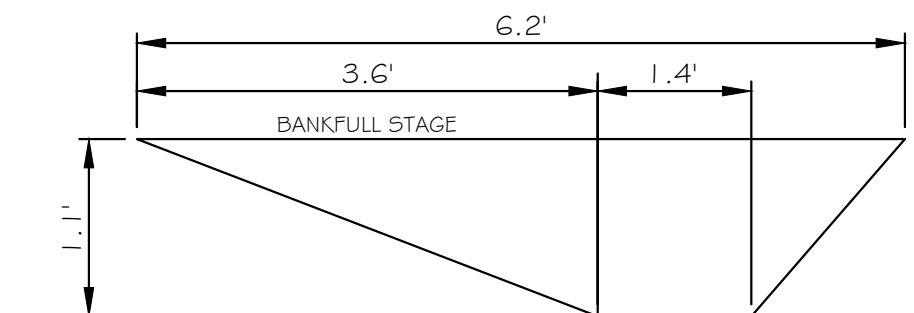
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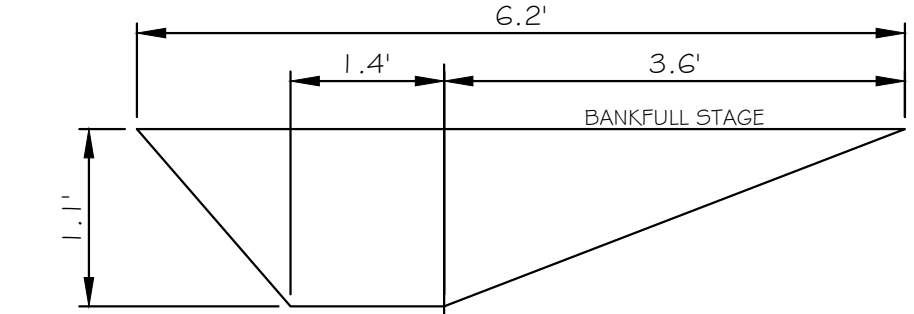
REACH GF3-B STA 11+20 TO STA 14+30



TYPICAL RIFFLE CROSS SECTION (SEE SHEET D7)



TYPICAL RIGHT MEANDER CROSS SECTION

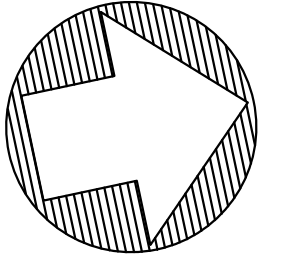


TYPICAL LEFT MEANDER CROSS SECTION

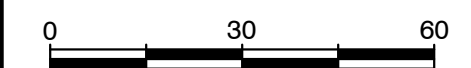


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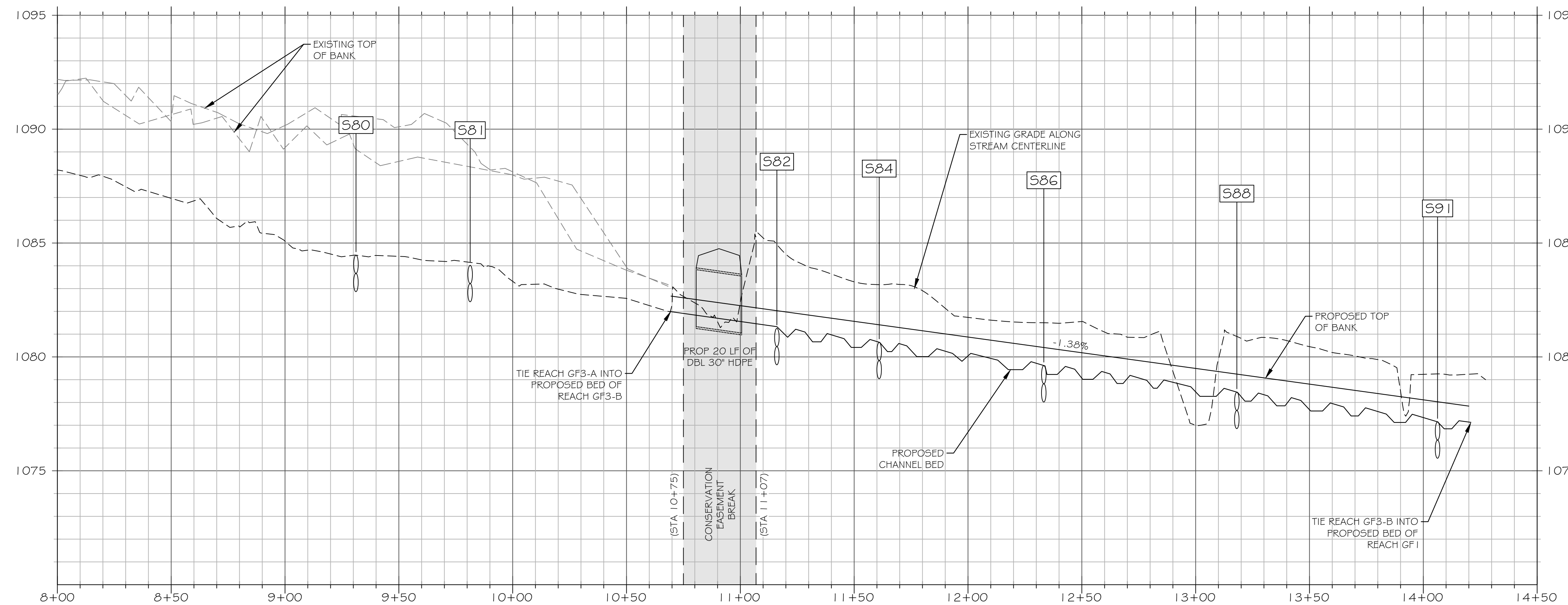


FULL SCALE: 1"=30'



2" = FULL SCALE
1" = HALF SCALE

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			09/13/2019
REVISIONS:			
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SCALE: HOR 1"=30'; VERT 1"=3'

PROJECT NAME:
GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA

DRAWING TITLE:
REACH GF3

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

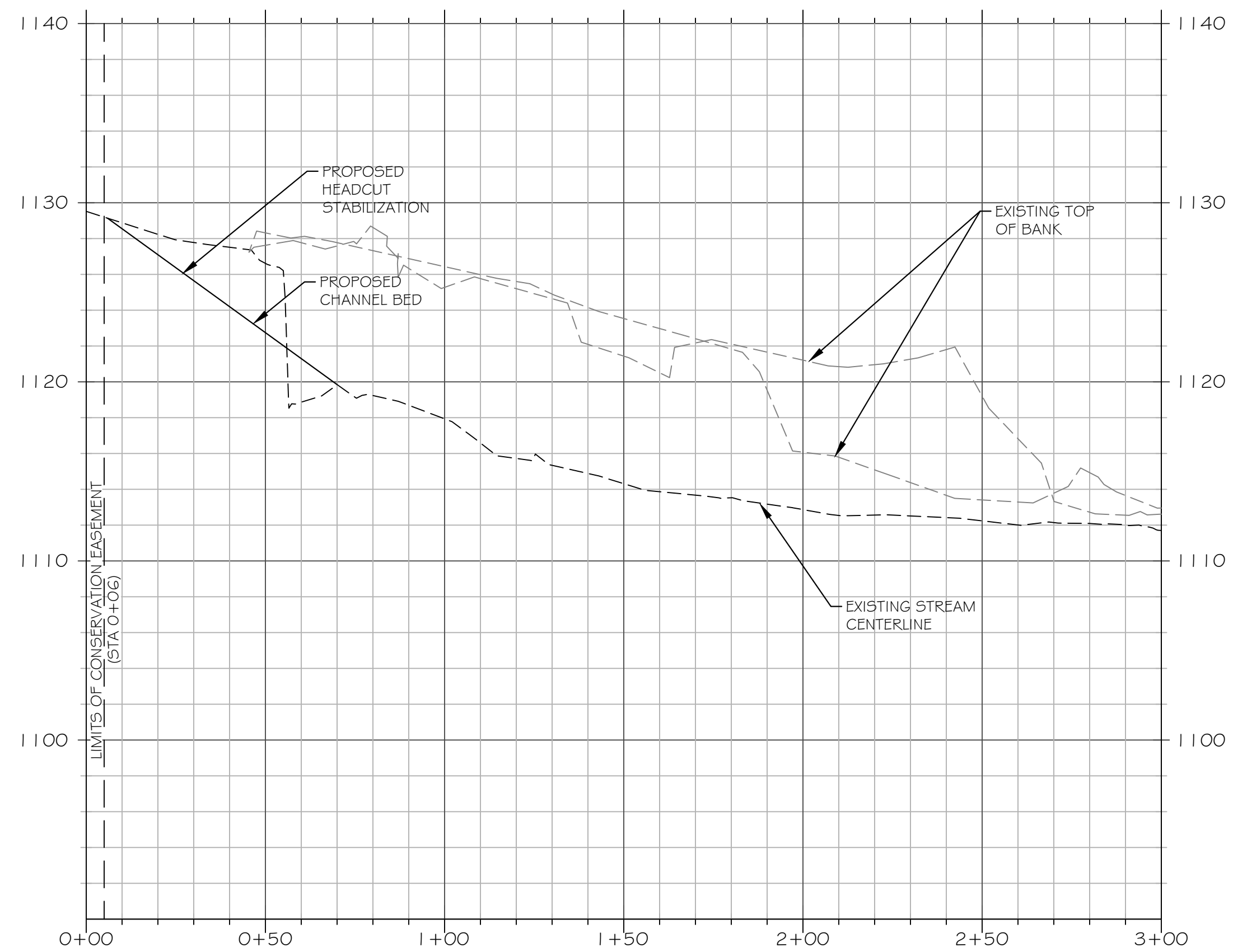
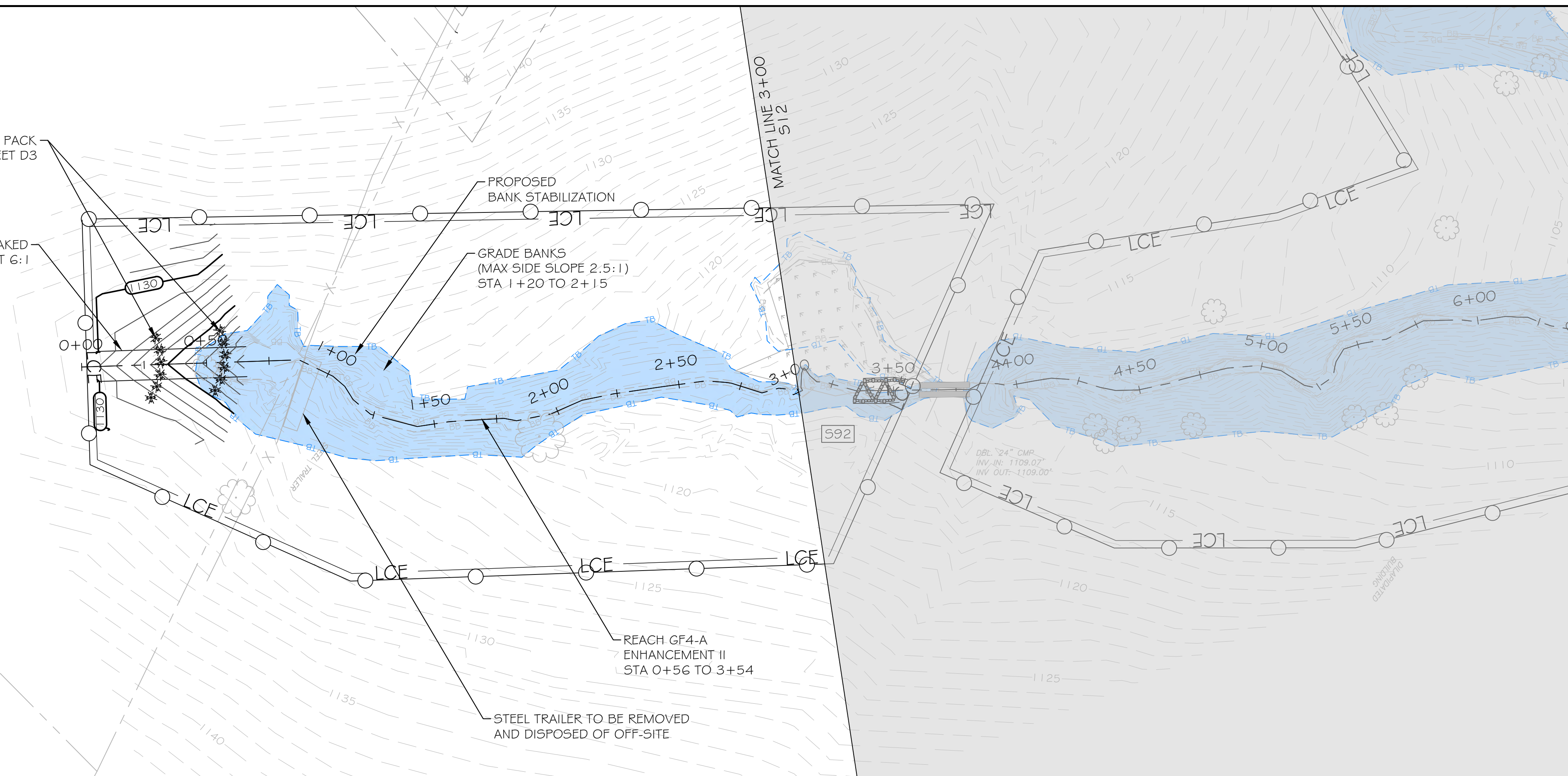
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S10

FILE NAME: S:\@RES GIS\Projects\NC\Groundhog Hollow\CAD\DWG\0438_SHT_GF4.dwg SAVED BY: Bearroll

ENGINEERED SEDIMENT PACK
SEE DETAIL SHEET D3

V-DITCH, MATTED AND STAKED
GRADE SIDE SLOPES AT 6:1

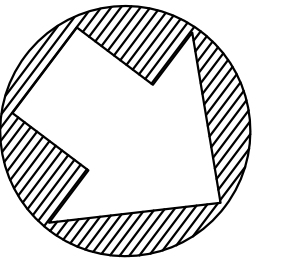


SCALE: HOR 1"=30'; VERT 1"=6'

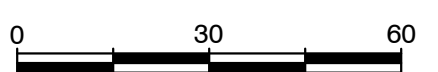


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FULL SCALE: 1"=30'



2" = FULL SCALE
1" = HALF SCALE

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ALEXANDER COUNTY, NORTH CAROLINA

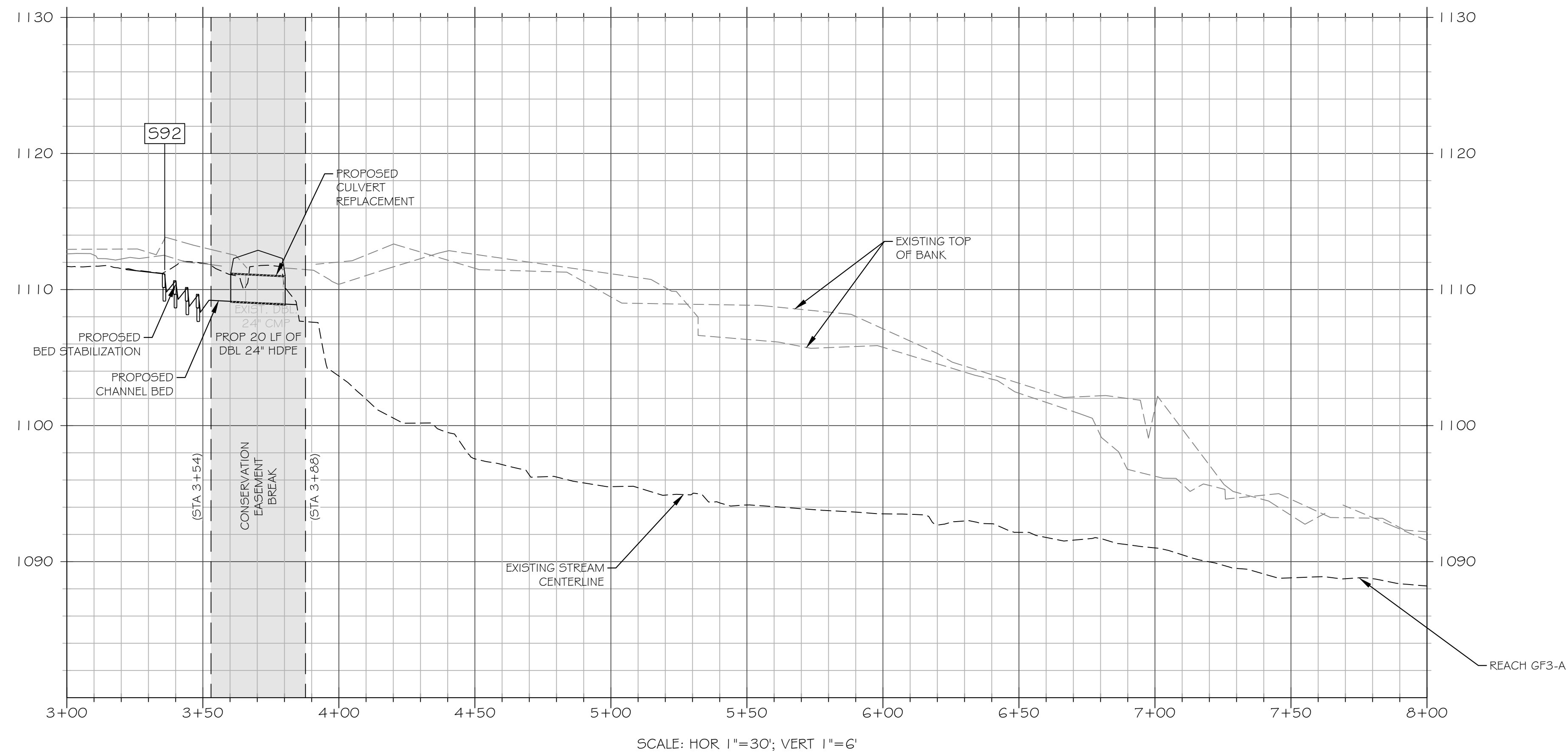
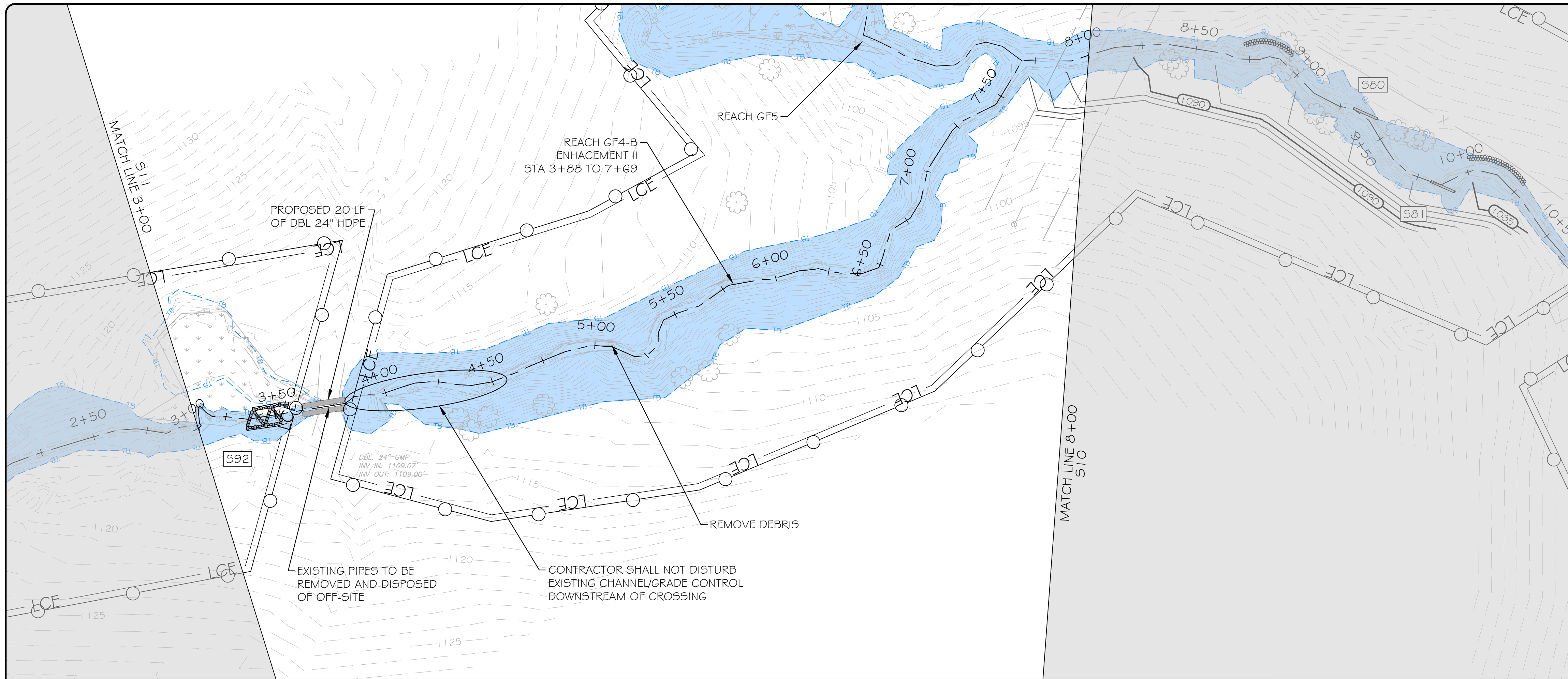
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REACH GF4

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

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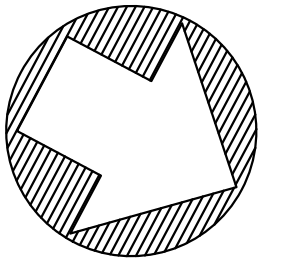
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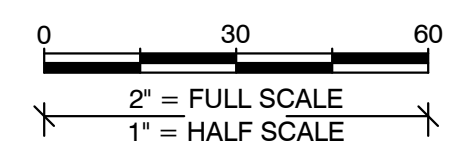


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FULL SCALE: 1"=30'



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PROJECT NAME:
**GROUNDHOG HOLLOW MITIGATION SITE
 ALEXANDER COUNTY, NORTH CAROLINA**

DRAWING TITLE:
REACH GF4

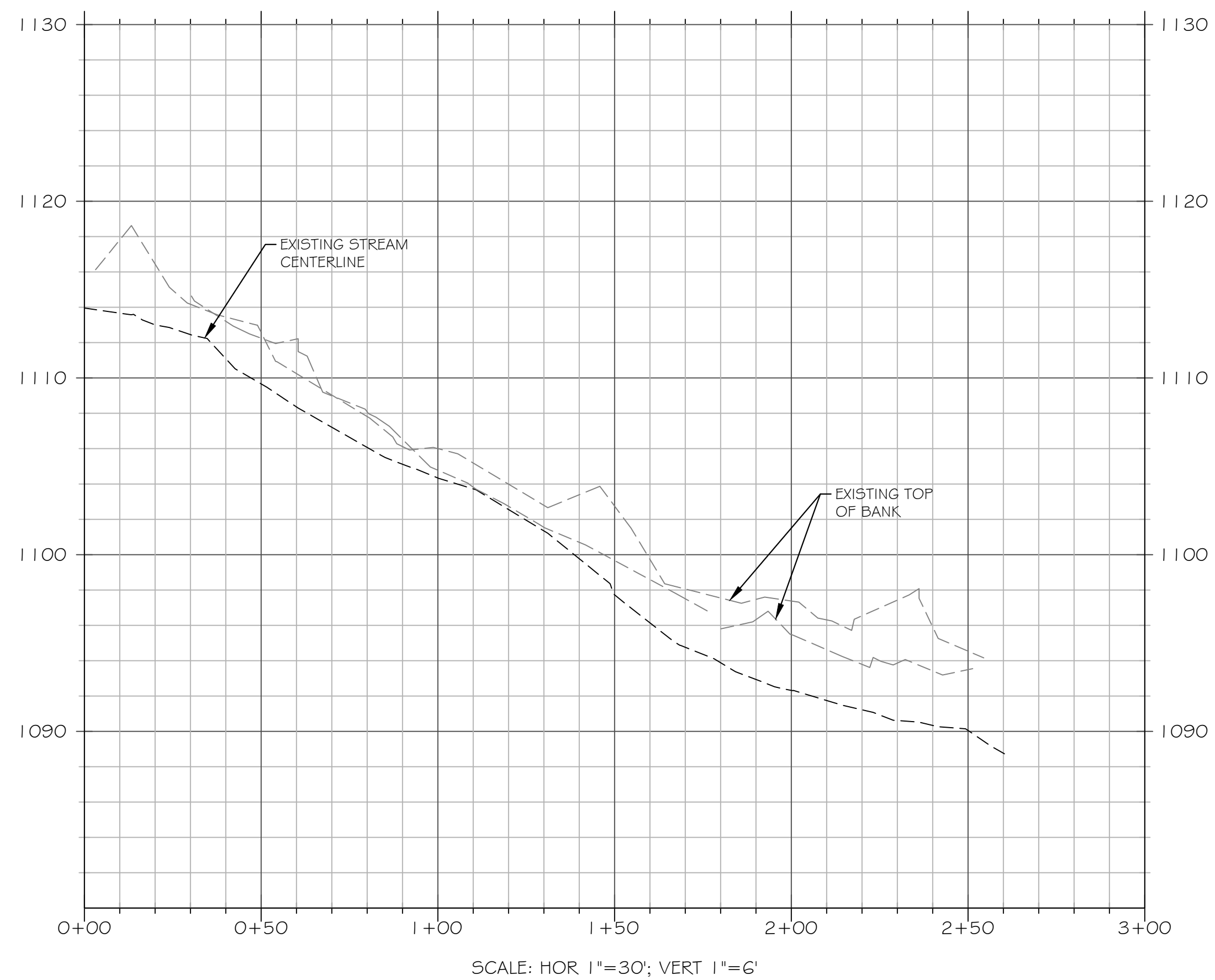
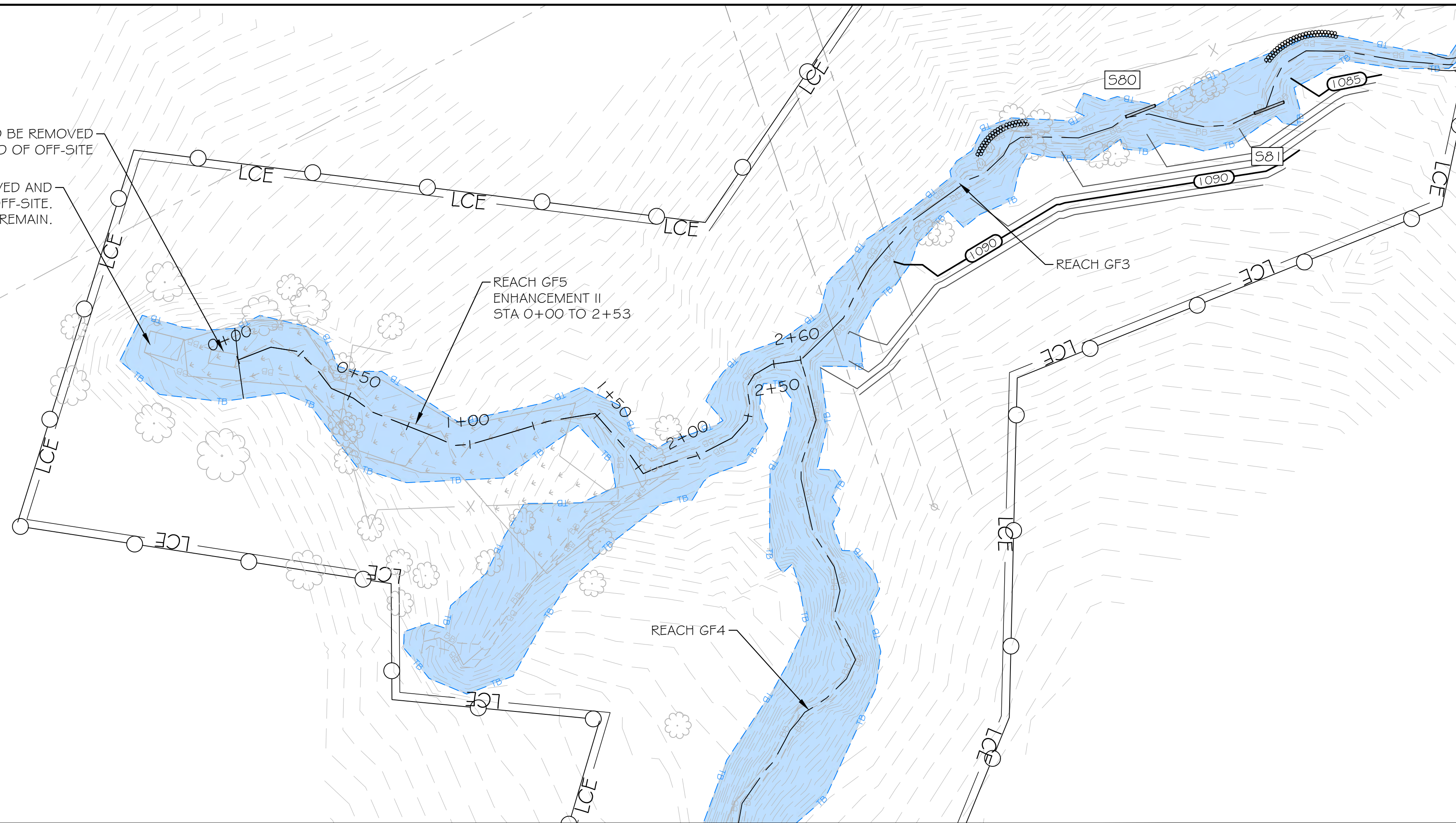
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 PROJECT MANAGER: BPB
 DESIGNED: BRC
 DRAWN: TRS
 CHECKED: AFM

SHEET NUMBER:

S12

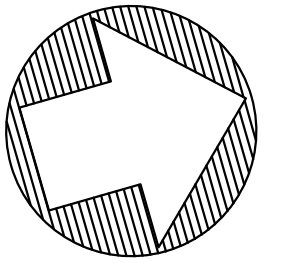
FILE NAME: S:\@RES GIS\Projects\NC\Groundhog Hollow\CAD\DWG\0438_SHT_GF5.dwg SAVED BY: Bearroll

CONCRETE TANK TO BE REMOVED AND DISPOSED OF OFF-SITE
 TIN ROOF TO BE REMOVED AND DISPOSED OF OFF-SITE. STRUCTURE TO REMAIN.

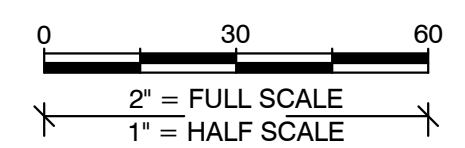


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FULL SCALE: 1"=30'



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			09/13/2019
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PROJECT NAME:
 GROUNDHOG HOLLOW MITIGATION SITE
 ALEXANDER COUNTY, NORTH CAROLINA

DRAWING TITLE:
 REACH GF5

PROJECT NUMBER: 0438
 PROJECT MANAGER: BPB
 DESIGNED: BRC
 DRAWN: TRS
 CHECKED: AFM

SHEET NUMBER:

S13

FILE NAME: S:\@RES GIS\Projects\NC\Groundhog Hollow\CAD\DWG\0438_SHT_SITE.dwg SAVED BY: Bcarroll

FENCING LEGEND

- LIMITS OF CONSERVATION EASEMENT ——— LCE ———
- EXISTING FENCELINE ———+———
- PROPOSED FENCELINE ———○———

INSTALL 11,993 LF OF
WOVEN WIRE FENCE
SEE DETAIL SHEET D2

1,698 LF OF FENCE TO
BE REMOVED AND
DISPOSED OF OFF-SITE

3,757 LF OF FENCE TO
BE REMOVED AND
DISPOSED OF OFF-SITE

527 LF OF FENCE TO
BE REMOVED AND
DISPOSED OF OFF-SITE

REACH GF1

REACH GF3

REACH GF4

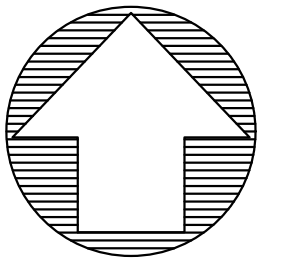
REACH GF5

REACH GF2

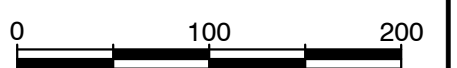


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SEAL



FULL SCALE: 1" = 100'



2" = FULL SCALE
1" = HALF SCALE

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REVISIONS:			
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PROJECT NAME:
GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA

DRAWING TITLE:
FENCING PLAN

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

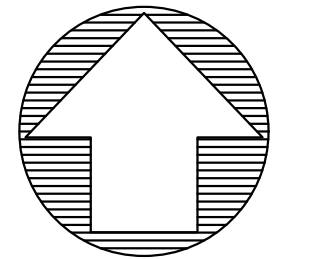
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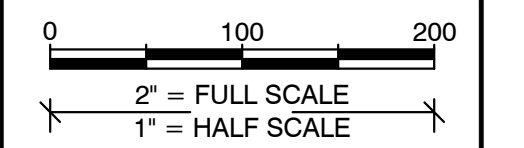


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SEAL



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MARK | DATE | DESCRIPTION | PLOT DATE:
 REVISIONS: | | | | 09/13/2019
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PROJECT NAME:
 GROUNDHOG HOLLOW MITIGATION SITE
 ALEXANDER COUNTY, NORTH CAROLINA

DRAWING TITLE:
 PLANTING PLAN

PROJECT NUMBER: 0438
 PROJECT MANAGER: BPB
 DESIGNED: BRC
 DRAWN: TRS
 CHECKED: AFM

SHEET NUMBER:

P1

PLANTING LEGEND

- LIMITS OF CONSERVATION EASEMENT — LCE —
- EXISTING TREELINE
- PROPERTY LINE
- RIPARIAN PLANTING (TOTAL AREA: 14.42 AC)
- SUPPLEMENTAL PLANTING/INVASIVES CONTROL (TOTAL AREA: 3.87 AC)

REACH GF1

REACH GF3

REACH GF4

REACH GF5

REACH GF2

PLANTING TABLE

Permanent Riparian Seed Mix		
Common Name	Scientific Name	Percent Composition
Virginia Wildrye	<i>Elymus virginicus</i>	25%
Indian Grass	<i>Sorghastrum nutans</i>	25%
Little Blue Stem	<i>Schizachyrium scoparium</i>	10%
Soft Rush	<i>Juncus effusus</i>	10%
Blackeyed susan	<i>Rudbeckia hirta</i>	10%
Deertongue	<i>Dichanthelium clandestinum</i>	10%
Common Milkweed	<i>Asclepius syriaca</i>	5%
Showy Goldenrod	<i>Solidago erecta</i>	5%

Live Staking and Live Cuttings Bundle Tree Species		
Common Name	Scientific Name	Percent Composition
Black Willow	<i>Salix nigra</i>	40%
Eastern Cottonwood	<i>Populus deltoides</i>	30%
Silky Dogwood	<i>Cornus amomum</i>	30%

Bare Root Planting Tree Species		
Common Name	Scientific Name	Percent Composition
White Oak	<i>Quercus alba</i>	15%
Willow oak	<i>Quercus phellos</i>	15%
River birch	<i>Betula nigra</i>	15%
American Sycamore	<i>Platanus occidentalis</i>	15%
Northern Red Oak	<i>Quercus rubra</i>	10%
Green Ash	<i>Fraxinus pennsylvanica</i>	10%
Yellow Poplar	<i>Liriodendron tulipifera</i>	10%
Persimmon	<i>Diospyros virginiana</i>	5%
Black Gum	<i>Nyssa sylvatica</i>	5%

PLANTING NOTES

ALL PLANTING AREAS

- EROSION CONTROL MEASURES SHALL BE PROPERLY MAINTAINED UNTIL PERMANENT VEGETATION IS ESTABLISHED AND FINAL APPROVAL HAS BEEN ISSUED. THE CONTRACTOR SHALL INSPECT EROSION CONTROL MEASURES AT THE END OF EACH WORKING DAY TO ENSURE MEASURES ARE FUNCTIONING PROPERLY.
- DISTURBED AREAS NOT AT FINAL GRADE SHALL BE TEMPORARILY VEGETATED WITHIN 10 WORKING DAYS. UPON COMPLETION OF FINAL GRADING, PERMANENT VEGETATION SHALL BE ESTABLISHED FOR ALL DISTURBED AREAS WITHIN 10 WORKING DAYS. SEEDING SHALL BE IN ACCORDANCE WITH EROSION CONTROL PLAN.
- ALL DISTURBED AREAS SHALL BE PREPARED PRIOR TO PLANTING BY DISC OR SPRING-TOOTH CHISEL PLOW TO MINIMUM DEPTH OF 1.2 INCHES. MULTIPLE PASSES SHALL BE MADE ACROSS PLANTING AREAS WITH THE IMPLEMENT AND THE FINAL PASS SHALL FOLLOW TOPOGRAPHIC CONTOURS.
- BARE ROOT PLANTINGS SHALL BE PLANTED ACCORDING TO DETAIL SHOWN ON SHEET D2. LIVE STAKES SHALL BE PLANTED ACCORDING TO DETAIL SHOWN ON SHEET D2.
- TREATMENT/REMOVAL OF INVASIVE SPECIES, PINES AND SWEET GUMS LESS THAN 6" DBH SHALL BE PERFORMED THROUGHOUT THE PLANTED AREA.
- SPECIES SHALL BE DISTRIBUTED SUCH THAT 3 TO 6 PLANTS OF THE SAME SPECIES ARE GROUPED TOGETHER.
- BARE ROOT PLANTING DENSITY IS APPROXIMATELY 800 STEMS PER ACRE.
- LIVE STAKES ARE PROPOSED ALONG THE OUTSIDE OF MEANDER BENDS AND ALONG BOTH BANKS OF STRAIGHT REACHES ADJACENT TO POOLS.
- TEMPORARY SEED MIX SHALL BE APPLIED AT A RATE OF 150 LBS/ACRE TO ALL DISTURBED AREAS WITH SLOPES EQUAL TO OR STEEPER THAN 3:1.
- PERMANENT RIPARIAN SEED MIX SHALL BE APPLIED TO ALL DISTURBED AREAS WITHIN THE CONSERVATION EASEMENT AT A RATE OF 15 LBS/ACRE.
- PERMANENT HERB SEED MIX SHALL BE APPLIED TO ALL DISTURBED AREAS WITHIN THE CONSERVATION EASEMENT BREAKS AT A RATE OF 15 LBS/ACRE.
- PERCENT COMPOSITION OF PLANTINGS MAY VARY BASED ON SPECIES AVAILABILITY AT TIME OF PLANTING.

TEMPORARY SEEDING SCHEDULE - FALL

SEEDING MIXTURE SPECIES RATE (LB/ACRE)

- RYE (GRAIN) 120

SEEDING DATES
• MOUNTAINS—AUG. 15 - DEC. 15
• COASTAL PLAIN AND PIEDMONT—AUG. 15 - DEC. 30

SOIL AMENDMENTS
FOLLOW SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 1,000 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR A MULCH ANCHORING TOOL.

MAINTENANCE
REPAIR AND REFERTILIZE DAMAGED AREAS IMMEDIATELY. TOPDRESS WITH 50 LB/ACRE OF NITROGEN IN MARCH.

EROSION CONTROL:

GENERAL NOTES

- 1. REVIEW CONSTRUCTION SEQUENCE FOR ADDITIONAL EROSION CONTROL MEASURES. ALL PERMANENT AND TEMPORARY EROSION CONTROL STRUCTURES...
2. CONSTRUCTION ACCESS AREAS SHOWN ARE TO GUIDE CONTRACTOR DURING CONSTRUCTION...
3. ALL AREAS DISTURBED BY THE CONTRACTOR SHALL BE SEEDED PER THE SPECIFICATIONS...
4. CONTRACTOR TO PERFORM SOIL TESTING TO DETERMINE VEGETATIVE VIABILITY...
5. MULCH: APPLY 2 TONS/ACRE GRAIN STRAW AND ANCHOR STRAW...
6. EROSION CONTROL:
A. INSTALL PERMANENT VEGETATIVE COVER AND THE LONG-TERM EROSION PROTECTION MEASURES...
B. PROVIDE FOR HANDLING THE INCREASED RUNOFF CAUSED BY CHANGED SOIL...
C. DURING CONSTRUCTION ACTIVITIES, ALL DISTURBED AREAS SHALL BE STABILIZED...
D. ALL SEDIMENT AND EROSION CONTROLS ARE TO BE INSPECTED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS...
E. STABILIZATION MEASURES SHALL BE INITIATED AT THE END OF EACH DAY...
F. CONTRACTOR MUST TAKE THE NECESSARY ACTION INCLUDING BUT NOT LIMITED TO TIRE WASHING STATIONS...
G. ALL EROSION CONTROL DEVICES SHALL BE PROPERLY MAINTAINED DURING ALL PHASES OF CONSTRUCTION...
H. EROSION CONTROL MATTING SHALL BE INSTALLED ALONG CONSTRUCTED CHANNEL BANKS...
I. SILT FENCING TO BE INSTALLED AROUND INDICATED STOCKPILE AREAS...
J. ASPHALT TACKIFIER SHALL NOT BE USED.
K. WETLANDS/STREAMS CANNOT BE ENCLOSED UNDER ANY CIRCUMSTANCES...
L. ACTIVITIES MUST AVOID DISTURBANCE OF WOODY RIPARIAN VEGETATION...
M. NO ONSITE BURIAL OF VEGETATION OR CONSTRUCTION DEBRIS WILL BE PERMITTED...
N. ANY GRADING BEYOND THE CONSTRUCTION LIMITS SHOWN ON THE PLAN...
O. PLEASE REFERENCE PLAN SHEET DETAILS AND NCDENR STANDARDS...
P. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL EROSION CONTROL MEASURES...
Q. THE LOCATIONS OF SOME EROSION CONTROL MEASURES MAY HAVE TO BE ALTERED...
R. IF IT IS DETERMINED DURING THE COURSE OF CONSTRUCTION THAT SIGNIFICANT SEDIMENT IS LEAVING THE SITE...

TEMPORARY SEEDING - LATE WINTER/EARLY SPRING

SEEDING MIXTURE SPECIES RATE (LB/ACRE)

- RYE (GRAIN) 120
• ANNUAL LESPEDEZA* (KOBE IN PIEDMONT AND COASTAL PLAIN, KOREAN IN MOUNTAINS) 50

*OMIT ANNUAL LESPEDEZA WHEN DURATION OF TEMPORARY COVER IS NOT TO EXTEND BEYOND JUNE.

SEEDING DATES
• MOUNTAINS (ABOVE 2,500 FT): FEB. 15 - MAY 15
• MOUNTAINS (BELOW 2,500 FT): FEB. 1 - MAY 1
• PIEDMONT: JAN. 1 - MAY 1
• COASTAL PLAIN: DEC. 1 - APR. 15

SOIL AMENDMENTS
FOLLOW RECOMMENDATION OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR A MULCH ANCHORING TOOL.

MAINTENANCE
REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

TEMPORARY SEEDING - LATE WINTER/EARLY SPRING

SEEDING MIXTURE SPECIES RATE (LB/ACRE)

- GERMAN MILLET* 40

*IN THE PIEDMONT AND MOUNTAINS, A SMALL-STEMMED SUDANGRASS MAY BE SUBSTITUTED AT A RATE OF 50 LB/ACRE.

SEEDING DATES
• MOUNTAINS: MAY 15 - AUG. 15
• PIEDMONT: MAY 1 - AUG. 15
• COASTAL PLAIN: APR. 15 - AUG. 15

SOIL AMENDMENTS
FOLLOW RECOMMENDATION OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH ASPHALT, NETTING, OR A MULCH ANCHORING TOOL.

MAINTENANCE
REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

CONSTRUCTION NOTES:

- 1. INSTALL EROSION CONTROL MEASURES AS DESCRIBED IN THE EROSION CONTROL PLAN AND NOTES. EROSION CONTROL MEASURES MAY BE PHASED-IN TO THOSE AREAS OF THE PROJECT CURRENTLY BEING WORKED ON...
2. EXISTING WETLANDS CANNOT BE ENCLOSED UNDER ANY CIRCUMSTANCES IF NOT APPROVED AS DESIGNATED IMPACT AREAS...
3. STOCKPILE AREAS AND TEMPORARY STREAM CROSSINGS MAY BE RELOCATED OR ADDED UPON THE APPROVAL OF THE ENGINEER...
4. THE WORK TO RESHAPE THE CHANNEL BANKS WILL BE PERFORMED USING EQUIPMENT WORKING FROM THE TOP OF THE EXISTING STREAM BANK...
5. CONSTRUCTION EQUIPMENT WILL NOT BE PLACED WITHIN THE ACTIVE CHANNEL TO PERFORM WORK IF POSSIBLE...
6. NO MORE CHANNEL SHALL BE DISTURBED THAN CAN BE STABILIZED BY THE END OF THE WORK DAY...
7. CONTRACTOR SHALL REMOVE ALL TEMPORARY CONTROL DEVICES ONCE CONSTRUCTION IS COMPLETE...
8. ALL EXCAVATED MATERIAL MUST BE PLACED WITHIN DESIGNATED STOCKPILE AREAS...
9. AT LOCATIONS IN WHICH THE EXISTING CHANNEL IS BEING MAINTAINED, TEMPORARY PUMP AROUND DAMS AND BYPASS PUMPING WILL BE USED...
10. WHEN THE PROPOSED CHANNEL HAS BEEN SUFFICIENTLY STABILIZED TO PREVENT EROSION, ALL TEMPORARY PUMP AROUND DAMS WILL BE REMOVED...
11. AT LOCATIONS IN WHICH LOG STRUCTURES, ROCK STRUCTURES, BOULDER TOE STABILIZATION, AND LOG TOE STABILIZATION ARE CALLED FOR...
12. MATERIAL THAT IS REMOVED FROM THE STREAM WILL BE RE-DEPOSITED OUTSIDE OF THE ACTIVE CHANNEL...
13. TEMPORARY AND PERMANENT STABILIZATION OF ALL DISTURBED GRASSED AREAS AT THE TOP OF THE CHANNEL BANKS...
14. RE-FERTILIZE AND RE-SEED DISTURBED AREAS IF NECESSARY...
15. CONTRACTOR SHALL COMPLETE SELF INSPECTIONS AND MONITORING AS OUTLINED IN THE SELF-INSPECTION AND SELF-MONITORING COMBINED FORM...

GROUND COVER SCHEDULE table with columns: SITE AREA DESCRIPTION, STABILIZATION TIME FRAME, STABILIZATION TIME FRAME EXCEPTIONS

Permanent Riparian Seed Mix table with columns: Common Name, Scientific Name, Percent Composition

STREAM CONSTRUCTION SEQUENCE:

- 1. CONDUCT PRE-CONSTRUCTION MEETING INCLUDING OWNER, ENGINEER, ASSOCIATED CONTRACTORS, AND OTHER AFFECTED PARTIES.
2. OBTAIN EROSION CONTROL PERMIT FROM COUNTY OFFICE AND ALL OTHER APPROVALS NECESSARY TO BEGIN AND COMPLETE THE PROJECT.
3. CONTRACTOR IS FULLY RESPONSIBLE FOR CONTACTING ALL APPROPRIATE PARTIES AND ASSURING THAT UTILITIES ARE LOCATED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION...
4. PRIOR TO CONSTRUCTION, STABILIZED GRAVEL ENTRANCE/EXIT AND ROUTES OF INGRESS AND EGRESS SHALL BE ESTABLISHED AS SHOWN ON THE PLANS AND DETAILS.
5. INSTALL TEMPORARY STREAM CROSSINGS AS SHOWN ON PLANS. TEMPORARY STREAM CROSSINGS SHOULD ONLY BE INSTALLED WHEN NECESSARY.
6. PREPARE STAGING AND STOCKPILING AREAS IN LOCATIONS AS SHOWN ON THE CONSTRUCTION PLANS OR AS APPROVED BY THE ENGINEER...
7. CONTRACTOR TO PERFORM SOIL TESTING TO DETERMINE VEGETATIVE VIABILITY PRIOR TO LAND DISTURBANCE.
8. ALL PROPOSED CHANNELS AND TEMPORARY AND PERMANENT CROSSINGS SHALL BE CONSTRUCTED IN A DRY CONDITION VIA OFFLINE CONSTRUCTION WHERE POSSIBLE...
9. INSTALL PUMP AROUND APPARATUS AND IMPERVIOUS DIKES AT UPSTREAM END OF PROJECT...
10. CONSTRUCT UPSTREAM PORTION OF THE CHANNEL FIRST, WORKING IN AN UPSTREAM TO DOWNSTREAM DIRECTION...
11. DOWN GRADING OF CHANNEL SHALL BE PERFORMED PRIOR TO INSTALLATION OF STRUCTURES.
12. INSTALL STRUCTURES AS SHOWN ON PLANS AND DETAILS. PRIOR TO FINE GRADING, OBTAIN APPROVAL OF THE ENGINEER ON INSTALLATION OF STRUCTURES.
13. UPON COMPLETION OF FINE GRADING, INSTALL STREAM BANK STABILIZATION INCLUDING, EROSION CONTROL MATTING OR SOD MATS ALONG CHANNEL BANKS.
14. FILL AND STABILIZE ABANDONED SEGMENTS OF THE EXISTING CHANNEL PER DIRECTION OF THE ENGINEER.
15. ALL IMPERVIOUS DIKES AND PUMPING APPARATUS SHALL BE REMOVED FROM THE STREAM AT THE END OF EACH DAY TO RESTORE NORMAL FLOW...
16. DURING STREAM CONSTRUCTION ACTIVITIES, THE WORK AREA SHALL BE STABILIZED IMMEDIATELY AFTER GRADING AND AT THE END OF EACH WORKING DAY.
17. INSTALL LIVE STAKE, BARE ROOT, AND CONTAINERIZED PLANTINGS AS SPECIFIED ON PLANTING PLANS.



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SEAL

SCALE: AS SHOWN

Table with columns: MARK, DATE, DESCRIPTION, REVISIONS, RELEASED FOR, DATE

PROJECT NAME: GROUNDHOG HOLLOW MITIGATION SITE, ALEXANDER COUNTY, NORTH CAROLINA
DRAWING TITLE: EROSION CONTROL NOTES

Table with columns: PROJECT NUMBER, PROJECT MANAGER, DESIGNED, DRAWN, CHECKED, values: 0438, BPB, BRC, TRS, AFM

SHEET NUMBER:

EC1

FILE NAME: S:\@RES GIS\Projects\NCGroundhog Hollow\CAD\DWG\0409_SHT_ESC.dwg SAVED BY: Bearroll

SEAL

SCALE: AS SHOWN

MARK	DATE	DESCRIPTION	PLOT DATE:
			9/13/2019

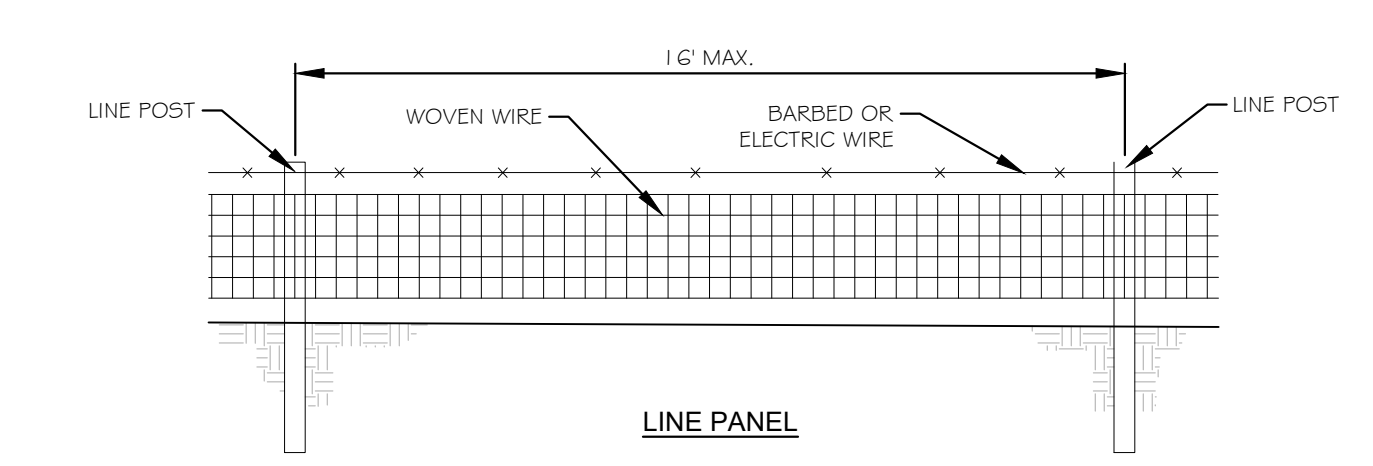
REVISIONS:
 RELEASED FOR:
 PRELIMINARY - NOT FOR CONSTRUCTION

PROJECT NAME:
**GROUNDHOG HOLLOW MITIGATION SITE
 ALEXANDER COUNTY, NORTH CAROLINA**

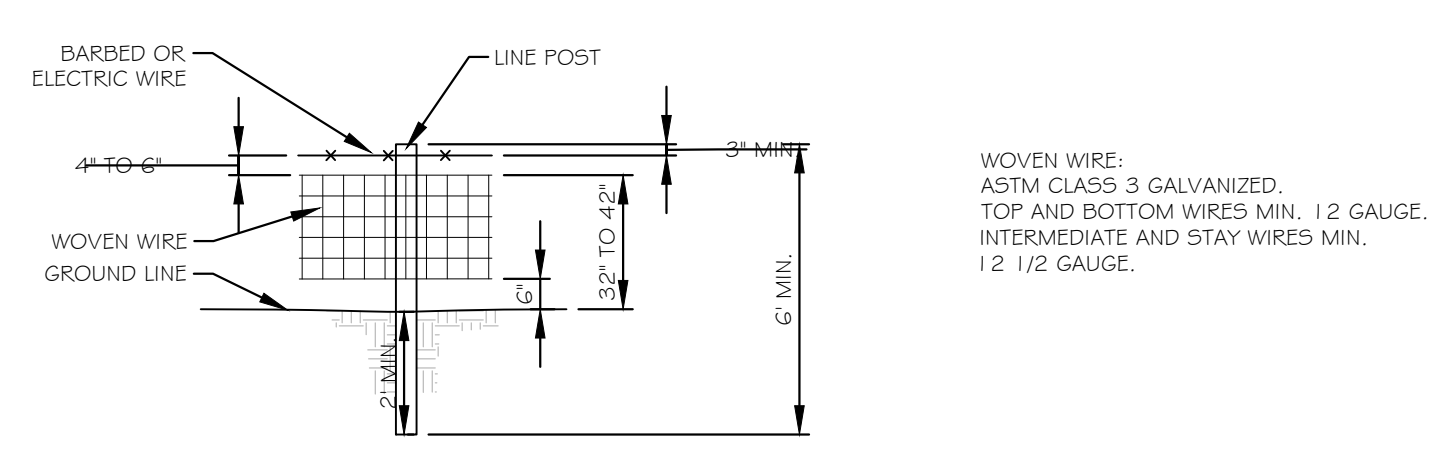
DRAWING TITLE:
DETAILS

PROJECT NUMBER: 0438
 PROJECT MANAGER: BPB
 DESIGNED: BRC
 DRAWN: TRS
 CHECKED: AFM

SHEET NUMBER:
D2



LINE PANEL

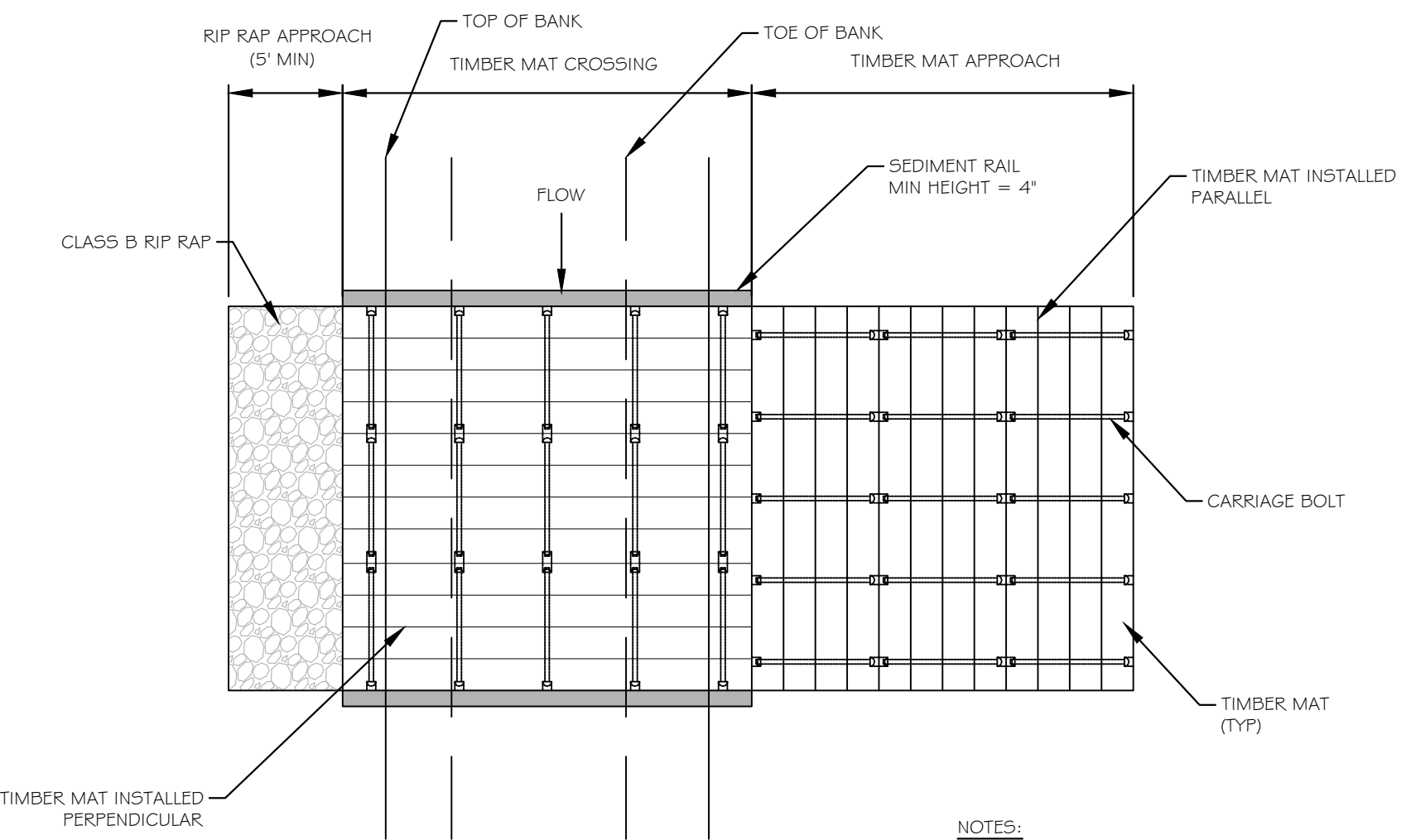


WOVEN WIRE WITH ONE BARB DETAIL

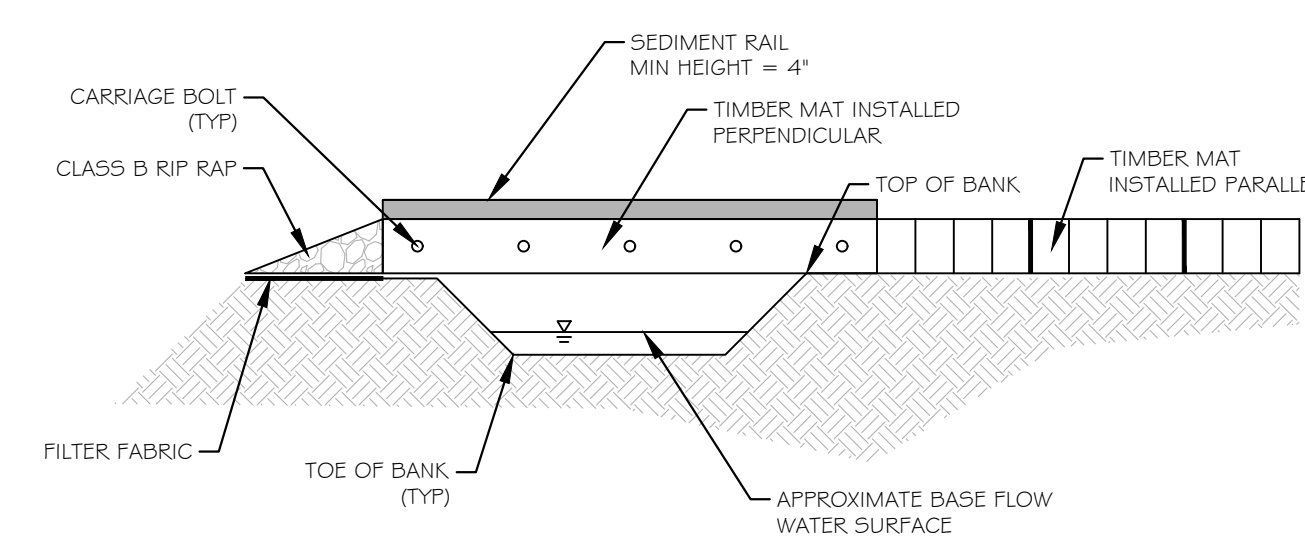
- NOTES:
1. LINE POSTS (WOODEN): MIN. 4 IN. DIAM. OR 4 IN. SQUARE.
 2. LINE POSTS (STEEL): STUDDED OR PUNCHED T, U, OR Y SHAPED, WITH ANCHOR PLATES.
 3. MIN. WEIGHT 1.3 LBS./FT. (EXCLUDING ANCHOR PLATE). POSTS SHALL BE DRIVEN A MINIMUM OF 18" DEEP AND MUST BE AT LEAST 5.5 FT IN LENGTH.
 4. SPECIES AND TREATMENT FOR ALL WOOD: USE UNTREATED DURABLE POSTS OF SPECIES SUCH AS RED CEDAR, BLACK LOCUST OR OSAGE-ORANGE WITH BARK REMOVED, OR NON-DURABLE WOOD THAT IS PRESERVATIVE PRESSURE TREATED (0.40 LBS./CUBIC FOOT CCA, OR EQUIVALENT NON-CCA TREATMENT). DO NOT USE RED PINE.

WOVEN WIRE FENCE (NRCS DETAIL 382A)

NTS



PLAN VIEW

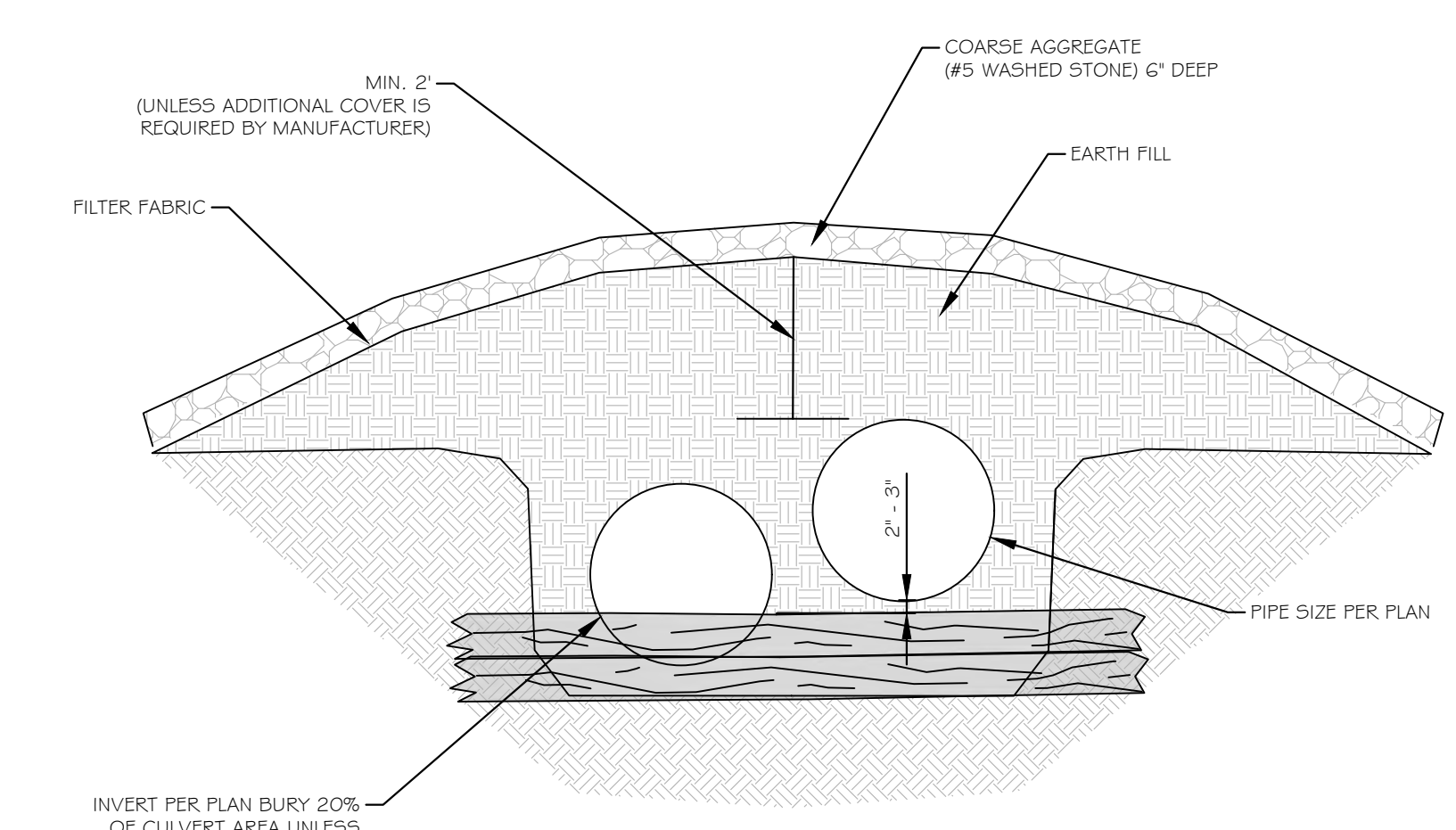


SECTION VIEW

TIMBER MAT TEMPORARY CROSSING

NTS

- NOTES:
1. TIMBER MATS SHALL BE USED FOR TEMPORARY CONSTRUCTION ACCESS TO TRAVERSE WET AND/OR MUDDY AREAS ADJACENT TO THE STREAM AND TO CROSS THE STREAM AND OTHER CONCENTRATED FLOW AREAS.
 2. THE STREAM CROSSING SHALL BE INSTALLED IN A DRY CONDITION WHEN FLOW IS LOW. THERE SHALL BE MINIMAL TO NO DISTURBANCE OF THE CHANNEL BED AND BANKS AS A RESULT OF INSTALLING THE APPROACHES OR CROSSING.
 3. THE LENGTH OF TIMBER MAT REQUIRED TO CROSS THE STREAM OR CONCENTRATED FLOW AREAS SHALL BE SUCH THAT THE TIMBER MAT EXTENDS PAST THE TOP OF BANK ON EACH SIDE OF THE CROSSING A SUFFICIENT DISTANCE TO SUPPORT THE MAXIMUM EQUIPMENT SIZE USING THE CROSSING.
 4. STREAM CROSSINGS SHALL BE INSTALLED WITH THE TIMBER MAT LENGTHS ORIENTED PERPENDICULAR TO THE TOPS OF THE STREAM BANKS. TIMBER MAT STREAM APPROACHES SHALL BE INSTALLED WITH THE TIMBER MAT LENGTHS ORIENTED PARALLEL TO THE TOPS OF THE STREAM BANKS.
 5. A 4" MINIMUM HEIGHT SEDIMENT RAIL SHALL BE PROVIDED AT STREAM CROSSINGS TO PREVENT TRACKED SEDIMENT FROM FALLING INTO THE STREAM BED.
 6. STREAM CROSSING APPROACHES FROM DRY AREAS SHALL BE CONSTRUCTED USING CLASS B RIP RAP PLACED OVER FILTER FABRIC.
 7. ALL TIMBER MATS, FILTER FABRIC, AND RIP RAP SHALL BE COMPLETELY REMOVED FROM THE SITE WHEN THE CROSSING IS REMOVED.

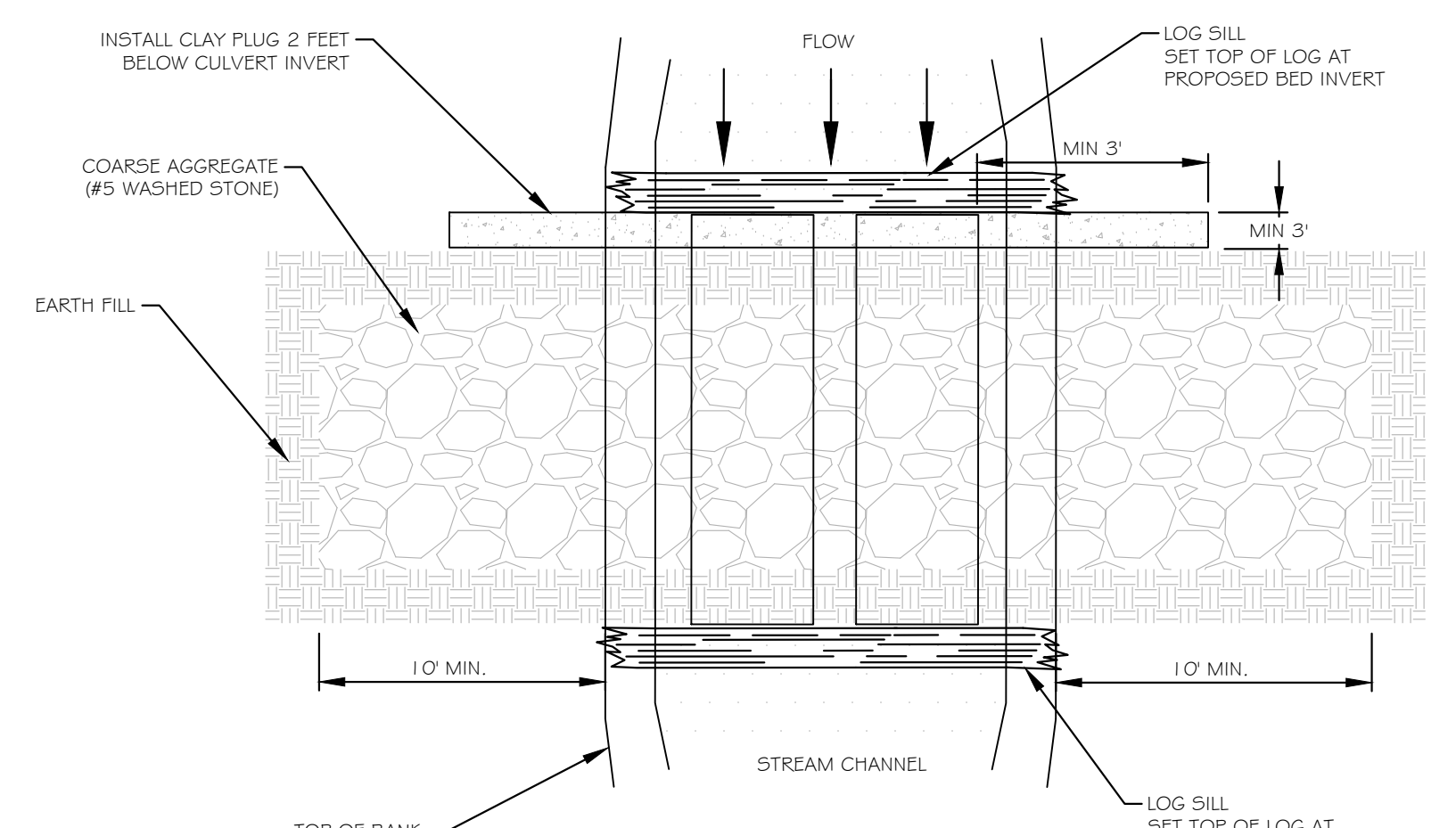


SECTION VIEW

PROPOSED CULVERT CROSSING

NTS

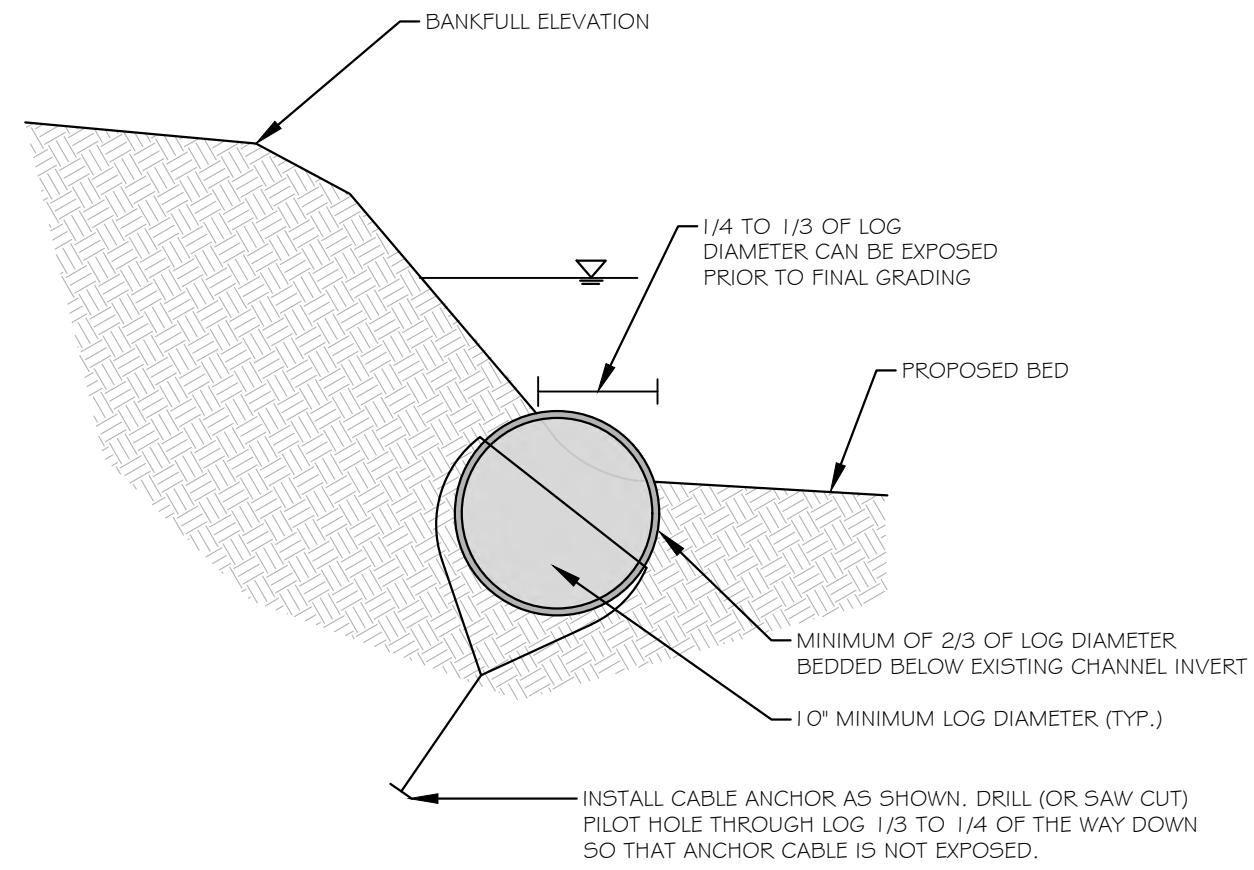
- NOTES:
1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
 2. INSTALL STREAM CROSSING PERPENDICULAR TO FLOW.
 3. CONTRACTOR TO COORDINATE APPROPRIATE BEDDING MATERIAL WITH MANUFACTURER.
 4. FILTER FABRIC USED SHALL BE NCDOT TYPE 2 ENGINEERING FABRIC OR EQUIVALENT.
 5. WIDTH OF TYPICAL FARM CROSSINGS SHALL BE PER PLAN OR A MINIMUM OF 12'.
 6. WHEN REQUIRED, CONTRACTOR TO ENSURE PIPE MATERIAL AND COVER MEET H-20 LOADING REQUIREMENTS.



PLAN VIEW

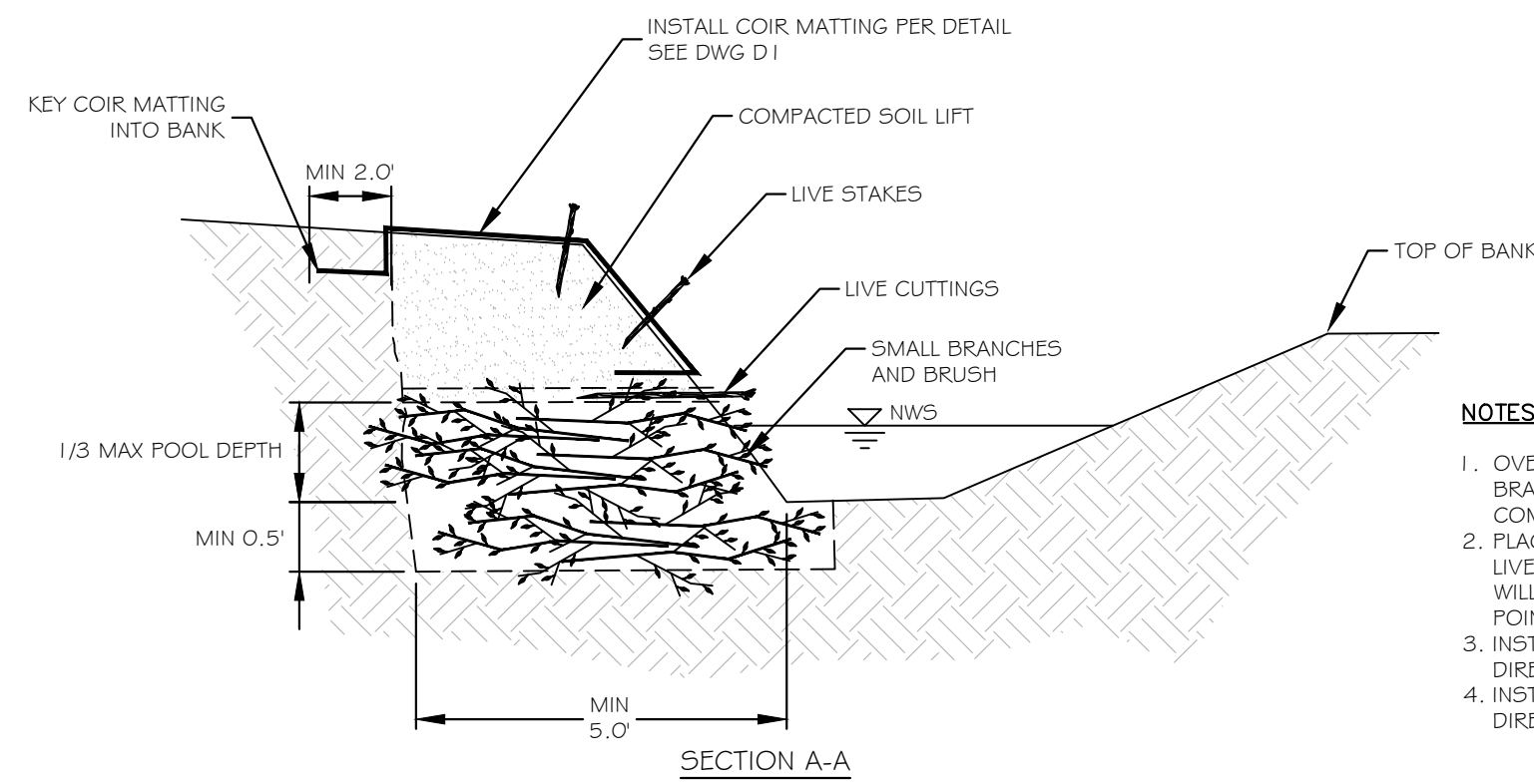
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- NOTES:
- LOGS SHOULD BE AT LEAST 10 INCHES IN DIAMETER, 5-8 FEET LONG, RELATIVELY STRAIGHT, AND HARDWOOD.
 - CABLE ANCHORS SHOULD BE PLACED 1' TO 3' FROM EACH END OF LOG. REBAR (5/8" MINIMUM DIAMETER 3' MIN. LENGTH TYPICAL) MAY BE USED AS A SUBSTITUTION FOR CABLE ANCHORS PER DIRECTION OF ENGINEER.
 - IF REBAR IS USED, PRE-DRILL HOLES WITH 5/8" DRILL BIT.



LOG (TOE PROTECTION)

NTS

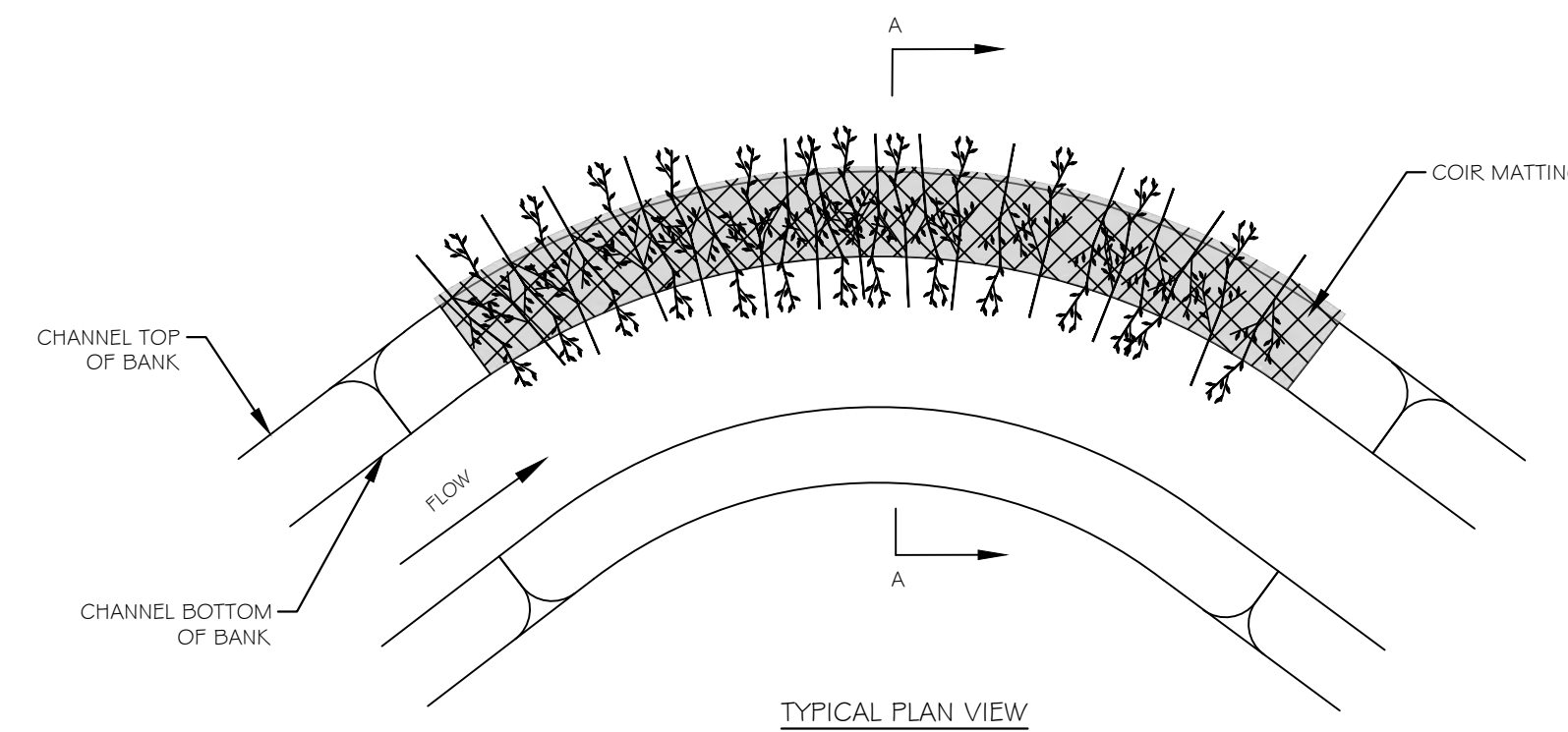


BRUSH TOE (SMALL CHANNEL)

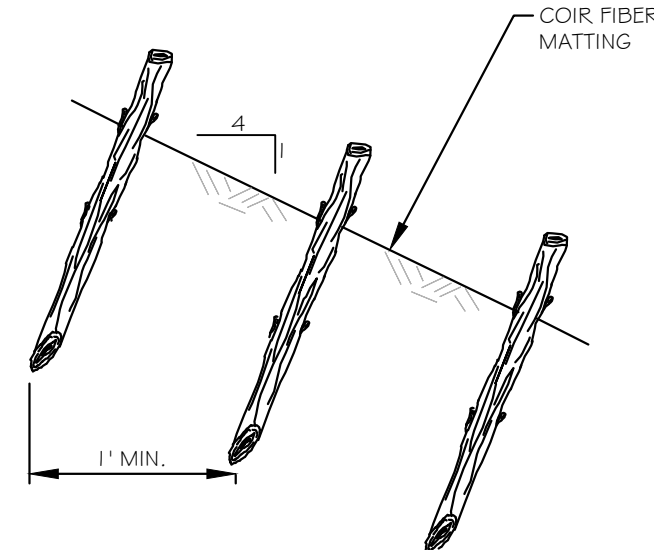
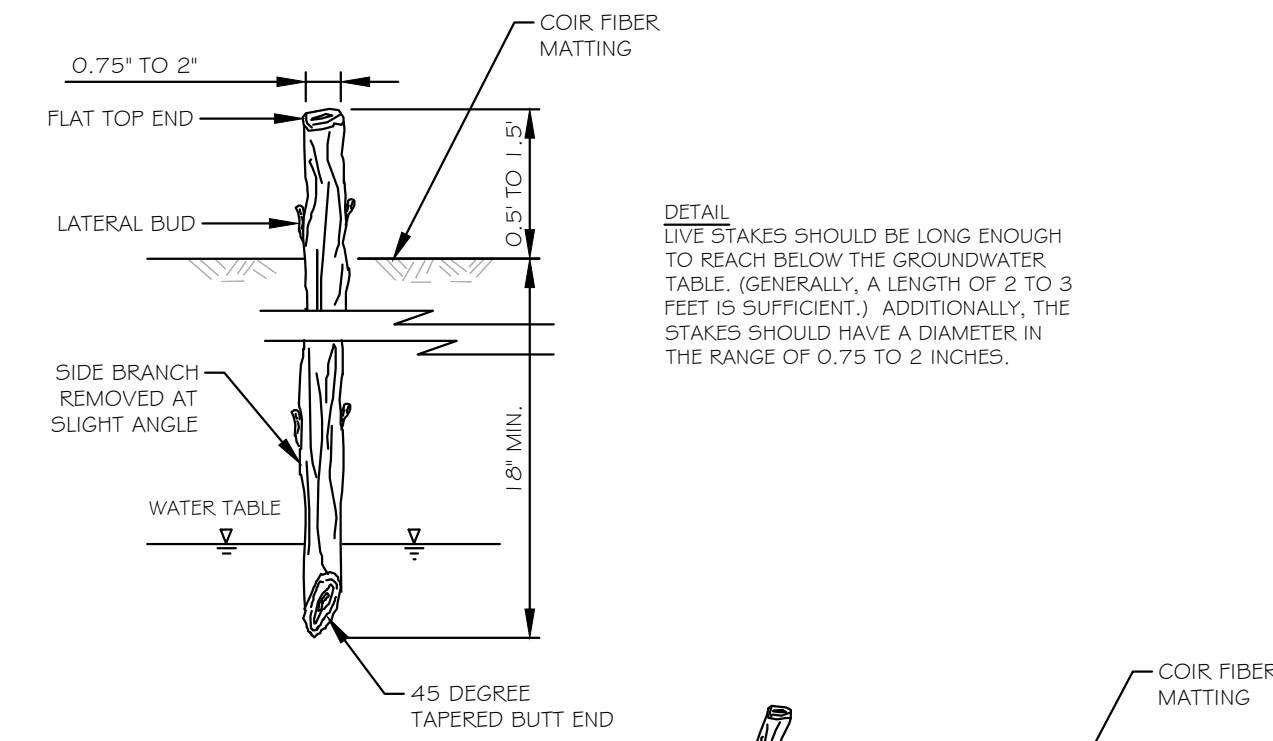
NTS

NOTES:

- OVER EXCAVATE THE OUTSIDE BEND OF THE CHANNEL. INSTALL SMALLER BRANCHES AND BRUSH AND COMPACT LIGHTLY TOGETHER. BACKFILL AND COMPACT TO LOCK IN PLACE.
- PLACE LIVE CUTTINGS OVER THE SMALL BRANCHES AND BRUSH. ACCEPTABLE LIVE CUTTINGS SPECIES INCLUDE BLACK WILLOW (SALIX NIGRA) AND SILKY WILLOW (SALIX SERICEA). WILLOW CUTTINGS SHOULD BE RINSED AT CUTTING POINT TO ALLOW BETTER ROOTING.
- INSTALL EROSION CONTROL (COIR) MATTING OVER COMPACTED SOIL PER DIRECTION OF ENGINEER. COIR MATTING SHOULD BE KEYS INTO TOP OF BANK.
- INSTALL 1 TO 3 ROWS OF LIVE STAKES ABOVE THE LIVE CUTTINGS LAYER PER DIRECTION OF ENGINEER.



TYPICAL PLAN VIEW



LIVE STAKE

NTS

- NOTE:
- ACCEPTABLE SPECIES INCLUDE BLACK WILLOW (SALIX NIGRA), EASTERN COTTONWOOD (POPULUS DELTOIDES) AND SILKY DOGWOOD (CORNUS AMMOCUMM).
 - LIVE STAKES SHALL BE PLANTED IN AN AREA EXTENDING 3 FEET OUT FROM TOP OF BANK TO JUST BELOW BANKFULL.
 - LIVE STAKES SHALL BE SPACED 3 FEET APART, ALTERNATE SPACING.

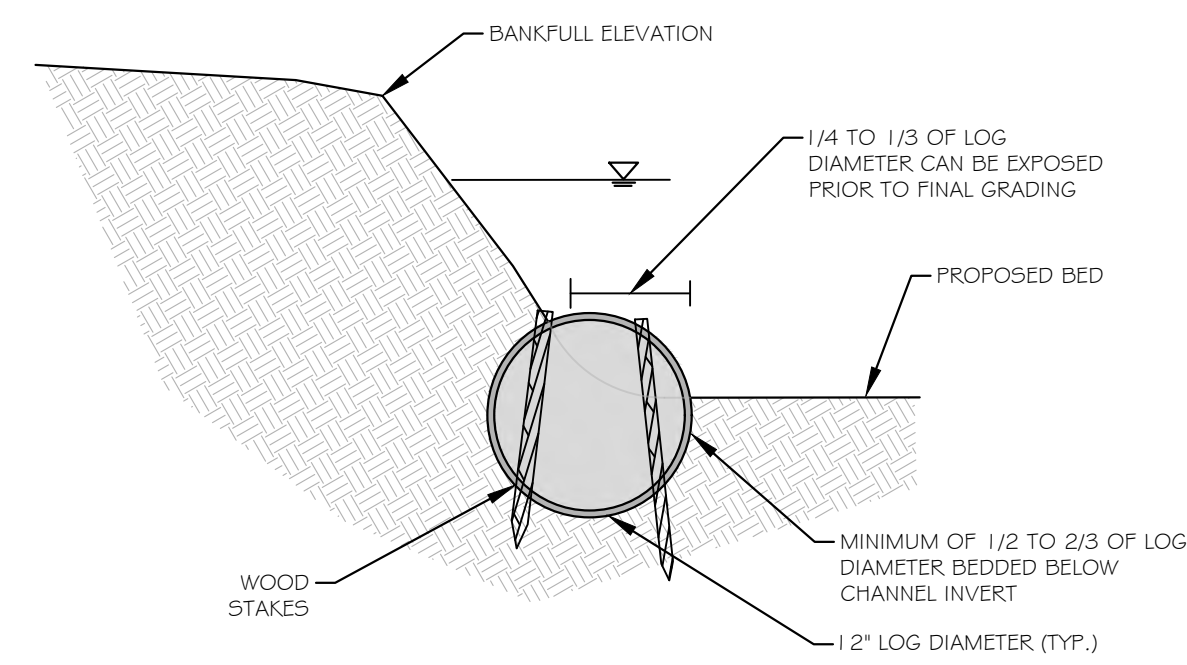


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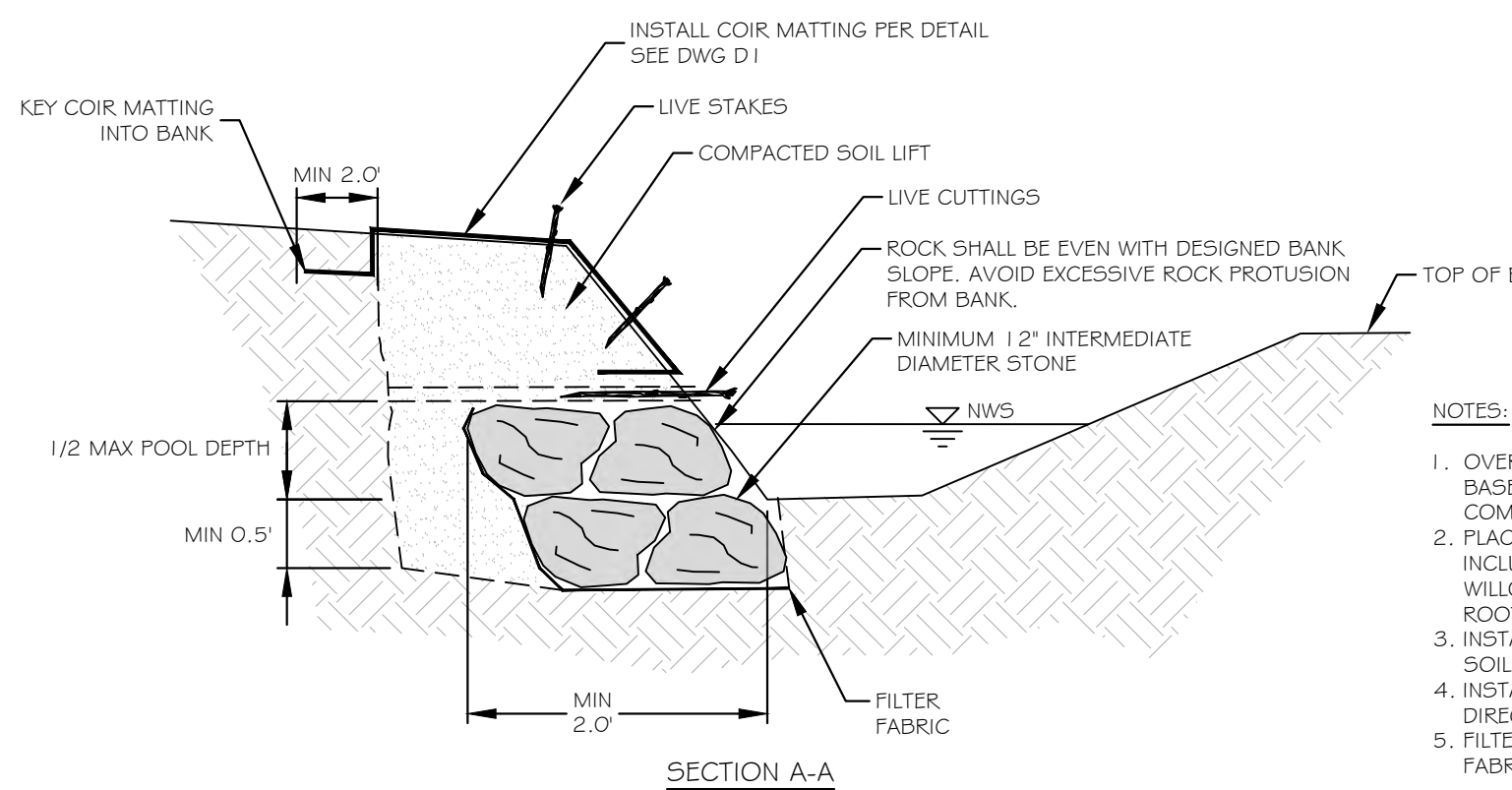
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COIR LOG (TOE PROTECTION)

NTS

- NOTES:
- INSTALL STAKES ON 3' CENTERS ON EACH SIDE OF ROLL. TOP OF STAKE SHOULD NOT EXTEND ABOVE ROLL.
 - EXCAVATE A SMALL TRENCH (DEPTH APPROX 1/2 TO 2/3 OF LOG DIAM) FOR PLACEMENT OF ROLL.
 - COIR LOGS SHALL BE 10 FT LONG AND HAVE A DIAMETER OF 12 IN.



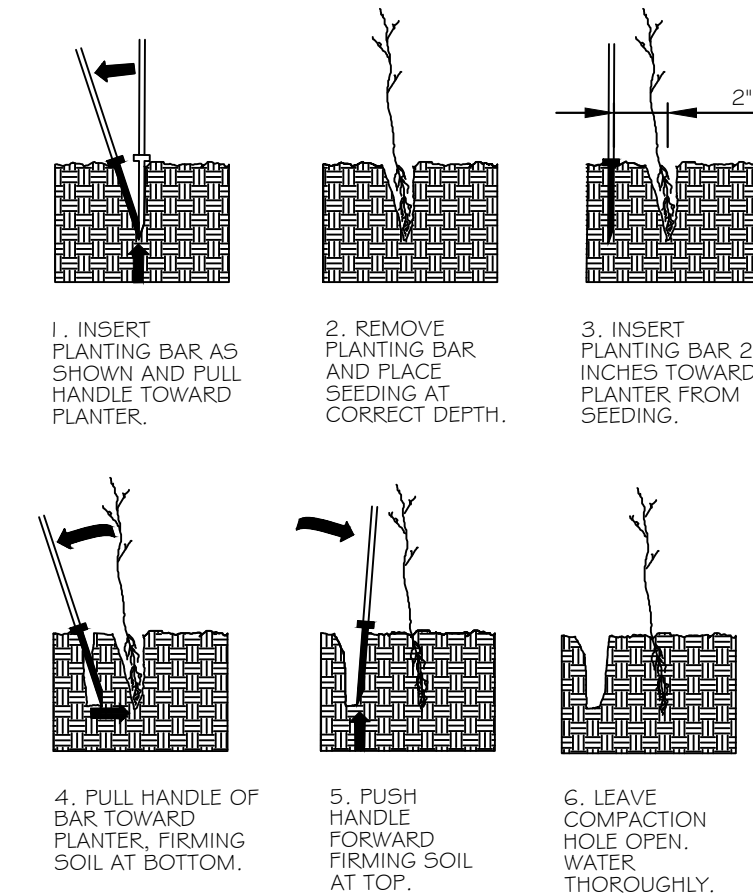
STONE TOE PROTECTION

NTS

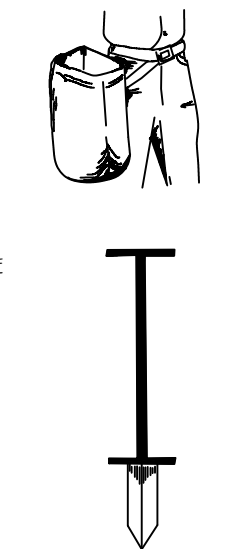
NOTES:

- OVER EXCAVATE THE OUTSIDE BEND OF THE CHANNEL. INSTALL FILTER FABRIC, BASE STONE LAYER AND COMPACT. INSTALL TOP STONE LAYER, BACKFILL AND COMPACT TO LOCK IN PLACE.
- PLACE LIVE CUTTINGS OVER THE RIPRAP. ACCEPTABLE LIVE CUTTINGS SPECIES INCLUDE BLACK WILLOW (SALIX NIGRA) AND SILKY WILLOW (SALIX SERICEA). WILLOW CUTTINGS SHOULD BE RINSED AT CUTTING POINT TO ALLOW BETTER ROOTING.
- INSTALL COMPACTED SOIL LIFT. COIR MATTING SHOULD BE WRAPPED UNDER SOIL LIFT AND KEYS INTO TOP OF BANK.
- INSTALL 1 TO 3 ROWS OF LIVE STAKES ABOVE THE LIVE CUTTINGS LAYER PER DIRECTION OF ENGINEER.
- FILTER FABRIC SHALL MEET SPECIFICATIONS FOR NCDOT WOVEN FILTER FABRIC.

DIBBLE PLANTING METHOD USING THE KBC PLANTING BAR

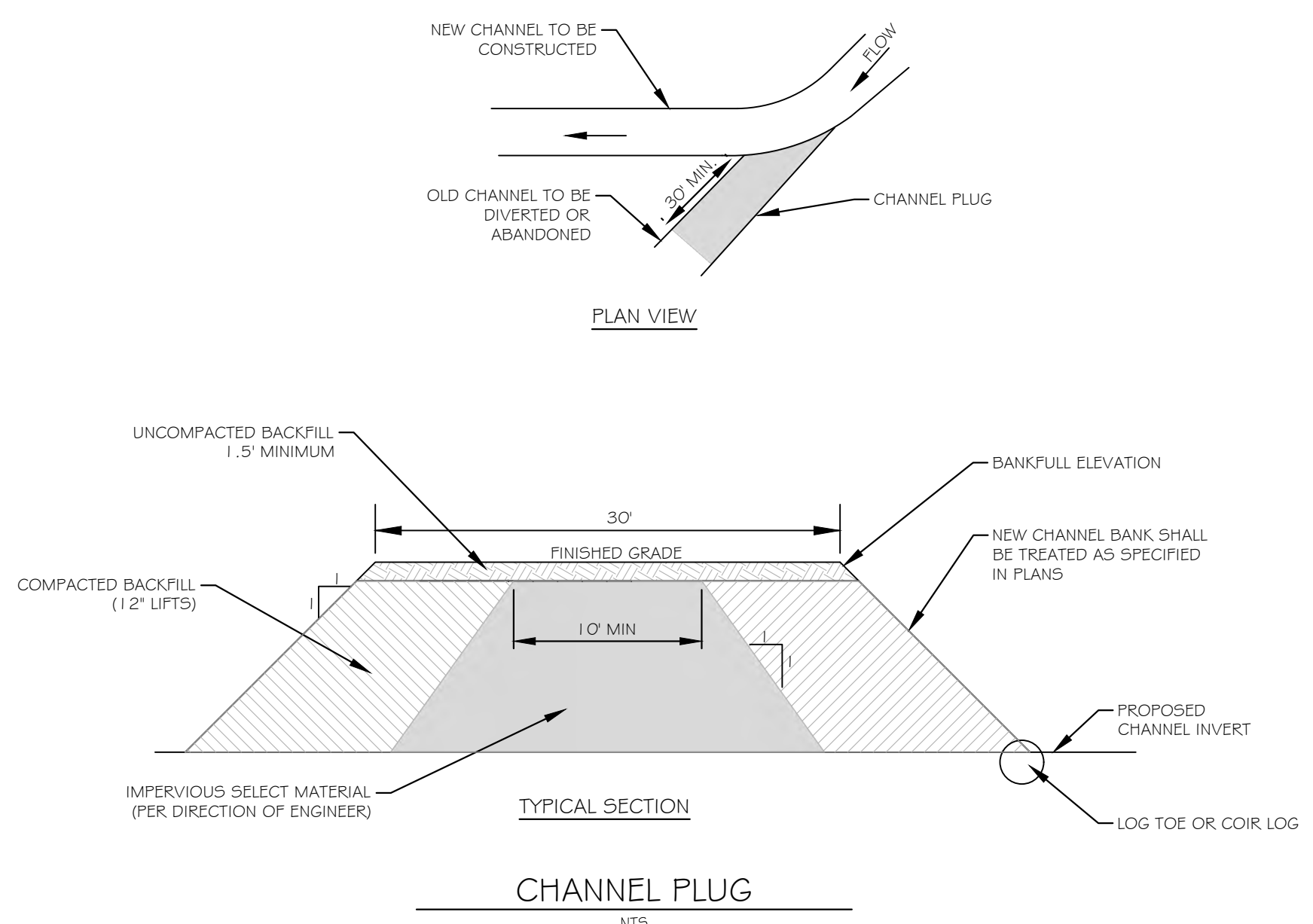


- PLANTING NOTES:
- PLANTING BAG DURING PLANTING, SEEDLINGS SHALL BE KEPT IN A MOIST CANVAS BAG OR SIMILAR CONTAINER TO PREVENT THE ROOT SYSTEMS FROM DRYING.
- KBC PLANTING BAR PLANTING BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS SECTION, AND SHALL BE 12 INCHES LONG, 4 INCHES WIDE AND 1 INCH THICK 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.
- NOTES: BARE ROOTS SHALL BE PLANTED 6 FT. TO 10 FT. ON CENTER. RANDOM SPACING, AVERAGING 8 FT. ON CENTER. APPROXIMATELY 680 PLANTS PER ACRE.



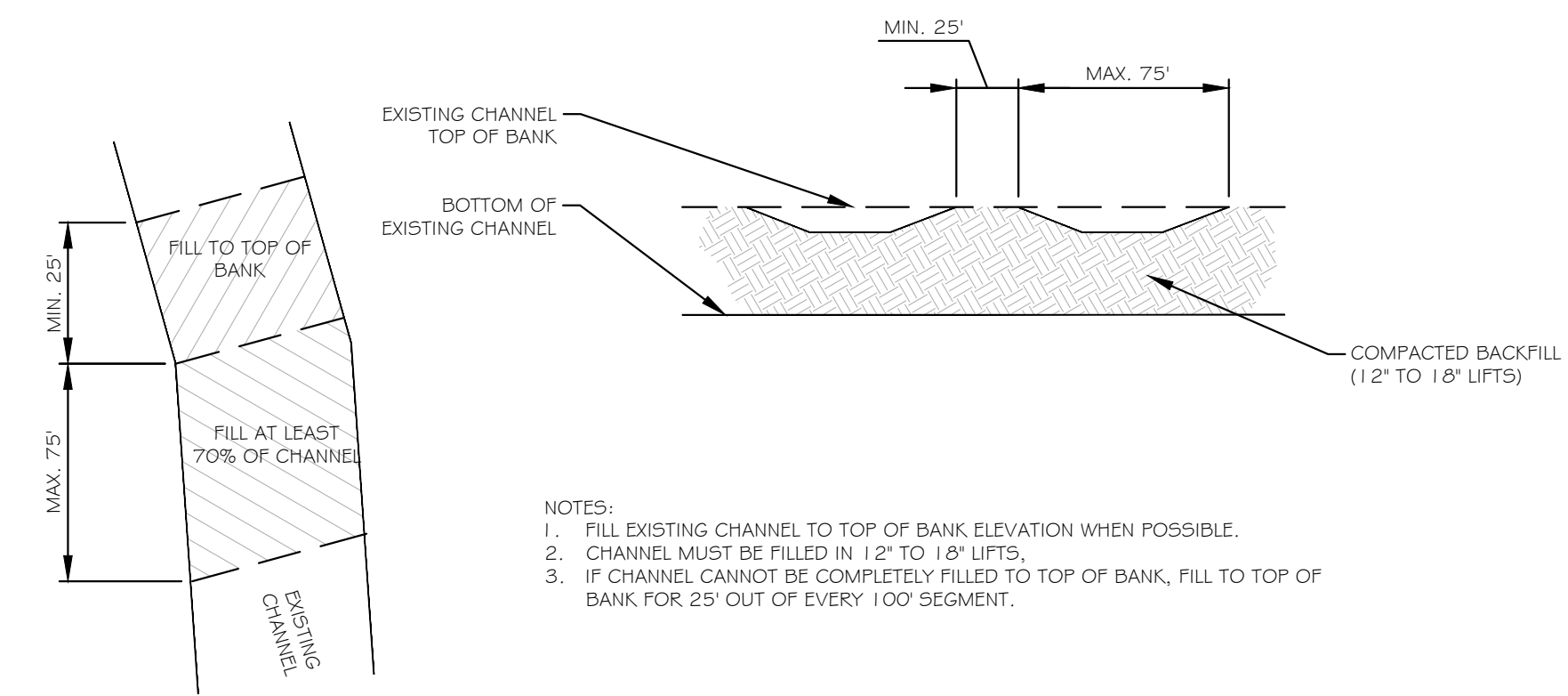
BARE ROOT PLANTING

NTS



CHANNEL PLUG

NTS



CHANNEL BACKFILL

NTS

- NOTES:
- FILL EXISTING CHANNEL TO TOP OF BANK ELEVATION WHEN POSSIBLE.
 - CHANNEL MUST BE FILLED IN 12" TO 18" LIFTS.
 - IF CHANNEL CANNOT BE COMPLETELY FILLED TO TOP OF BANK, FILL TO TOP OF BANK FOR 25' OUT OF EVERY 100' SEGMENT.

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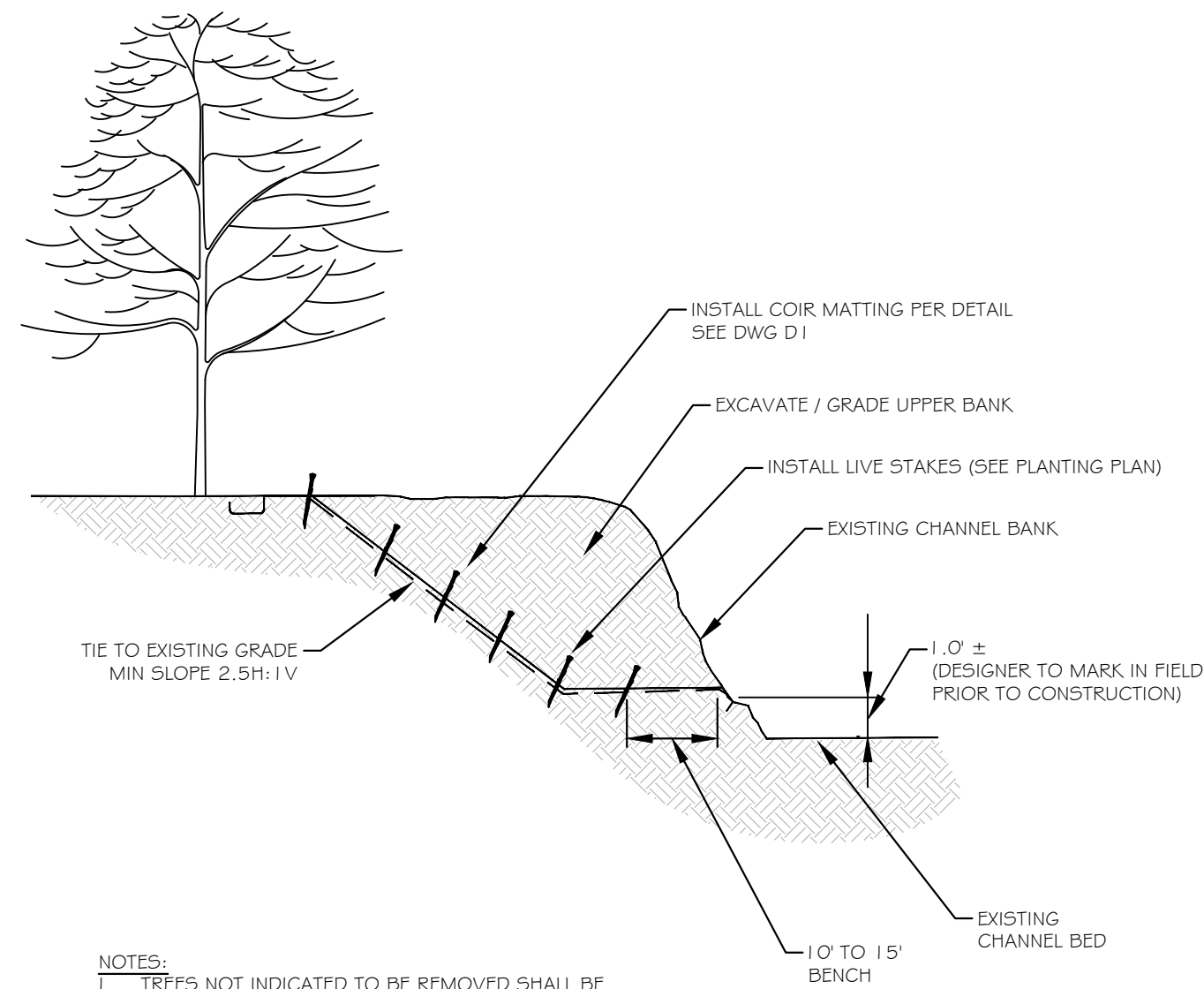
PROJECT NAME:
GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA

DRAWING TITLE:
DETAILS

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

SHEET NUMBER:

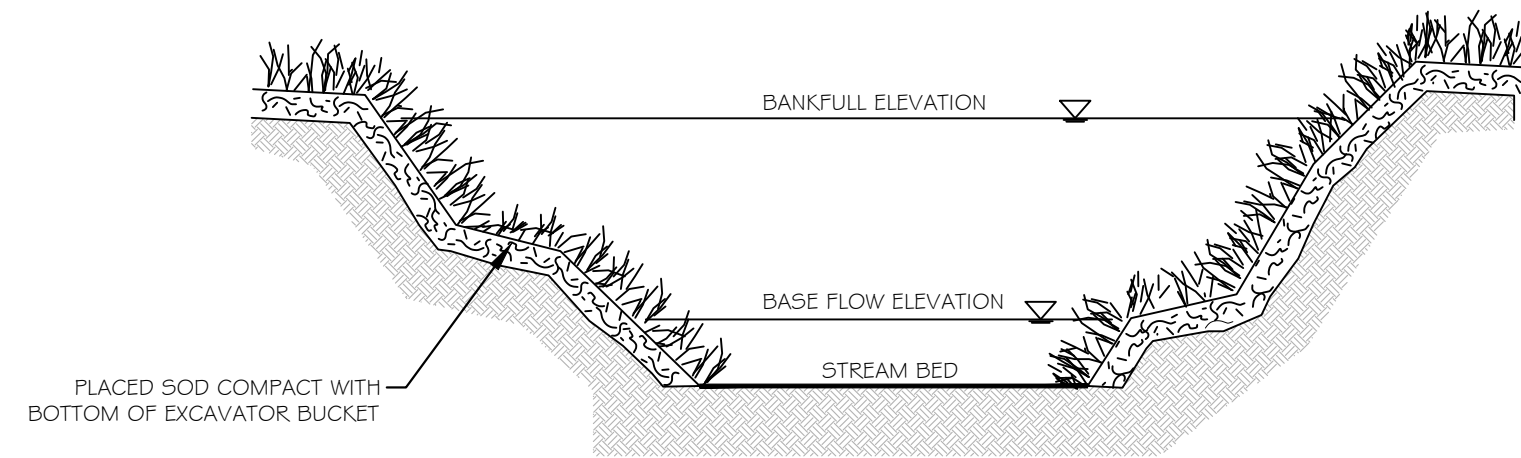
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- NOTES:
- TREES NOT INDICATED TO BE REMOVED SHALL BE PROTECTED DURING CONSTRUCTION IN ACCORDANCE WITH PLANS.
 - SEED AND MULCH ALL BANKS PRIOR TO INSTALLING COIR MATTING.

TYPICAL BANK GRADING

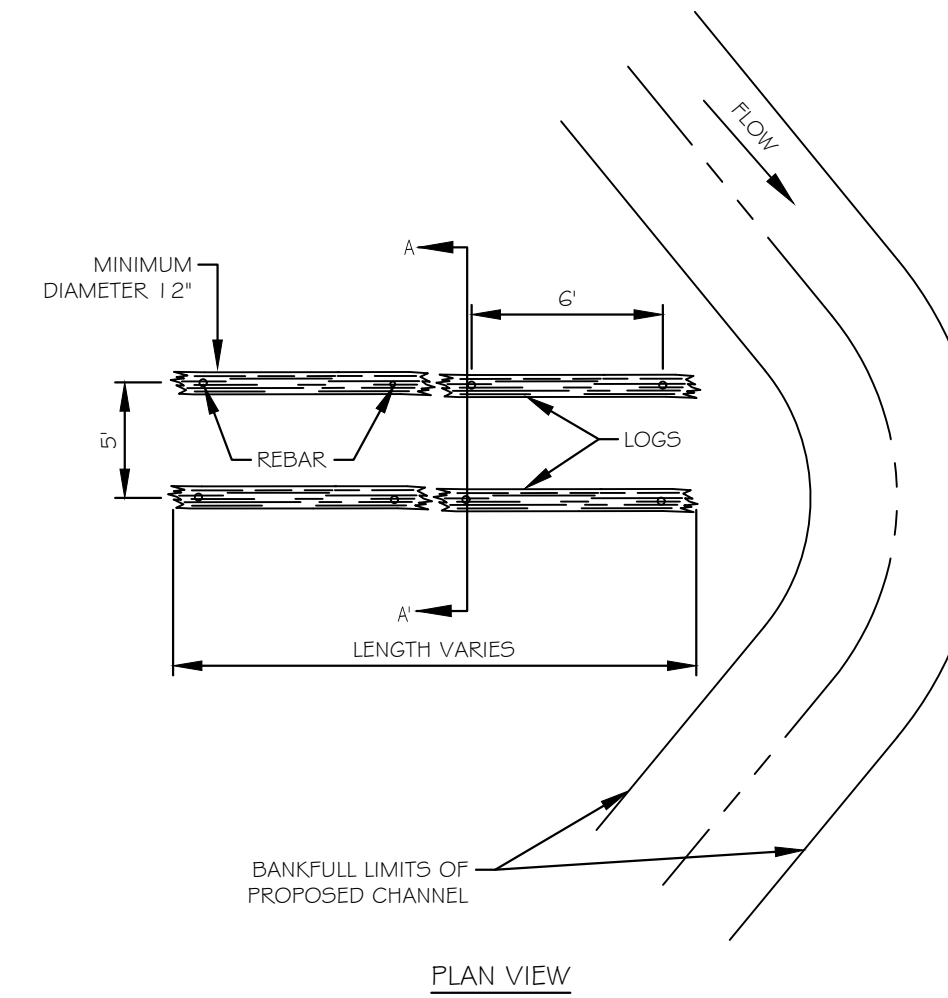
NTS



- NOTES:
- SOD MAT SHALL BE PLACED WITH TRACK HOE OR LOADER.
 - SOD MATS SHOULD BE HARVESTED ONSITE WITH A 0.50" MINIMUM THICKNESS.
 - SOD MATS SHOULD CONSIST OF NATIVE VEGETATION.

SOD MATS

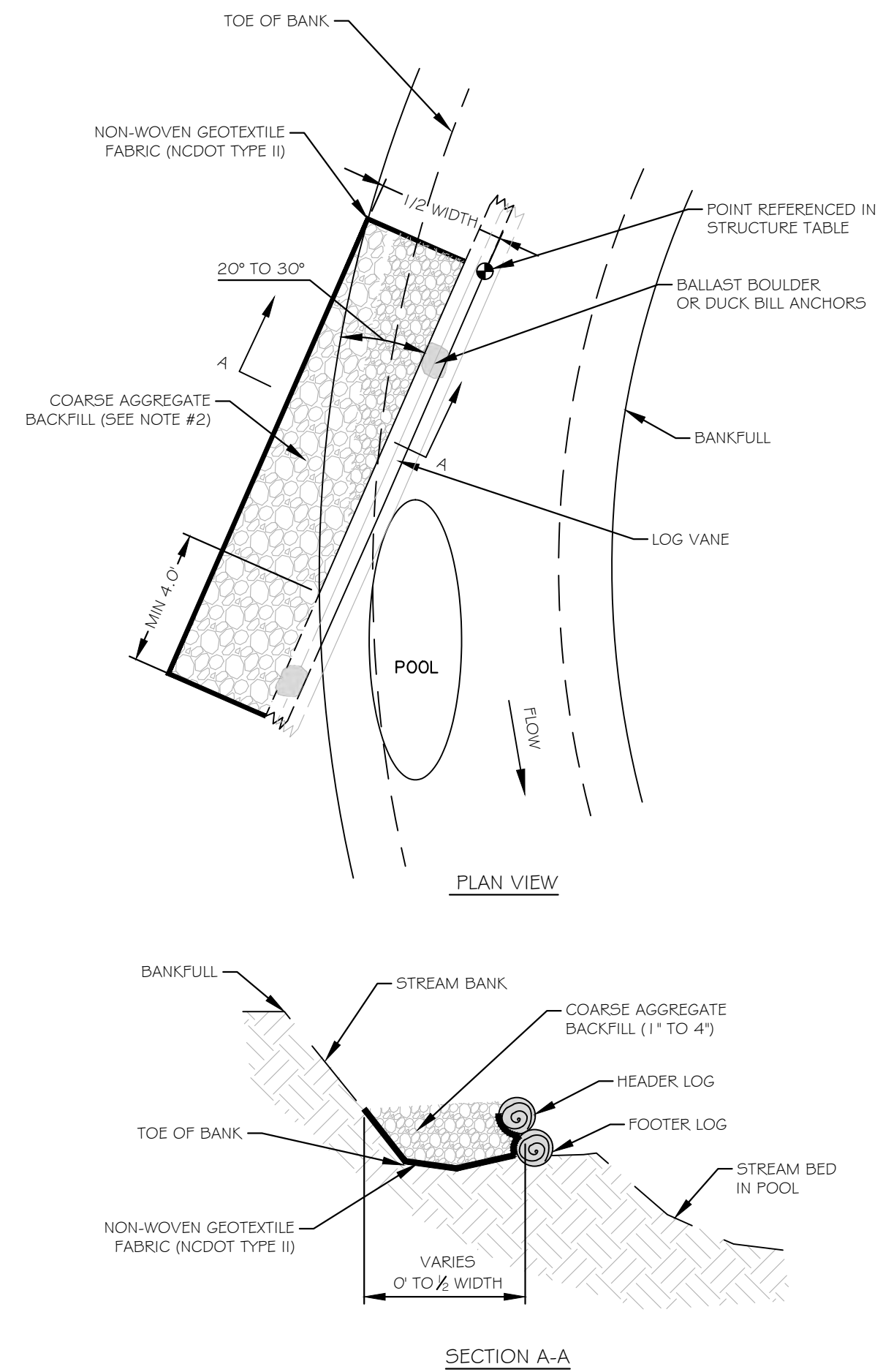
NTS



- NOTES:
- REBAR (1/2" MINIMUM DIAMETER 3' MIN. LENGTH TYPICAL) SHOULD BE PLACED 1" TO 3" FROM END OF LOG. ADDITIONAL REBAR TO BE PLACED AT 6' OFFSETS. LAST REBAR SHOULD BE PLACED 1' TO 3" FROM END OF LOG. DUCK BILL ANCHORS MAY BE USED AS A SUBSTITUTION FOR REBAR, 2 PER LOG. ADDITIONALLY, APPROPRIATELY SIZED BOULDERS MAY BE USED TO ANCHOR LOG SILLS AT THE DIRECTION OF THE ENGINEER.

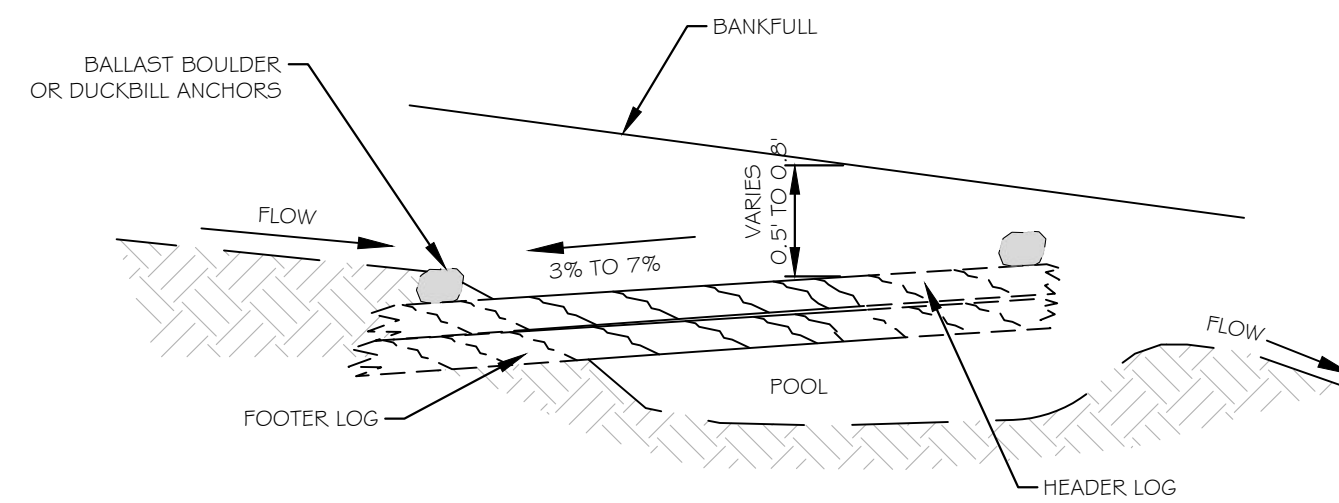
FLOODPLAIN SILL

NTS



NOTES:

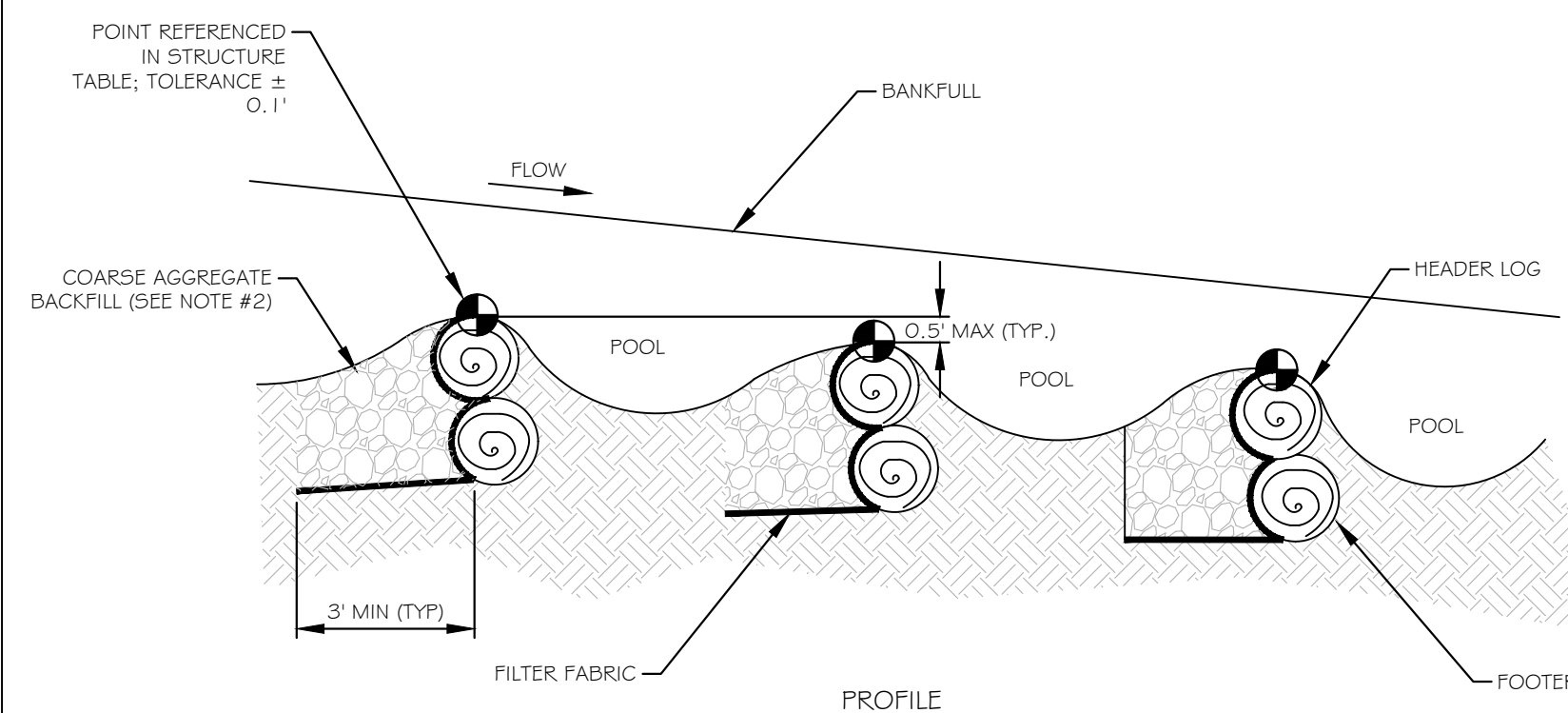
- LOG VANES SHALL BE CONSTRUCTED OF ONE OR MORE LOGS HELD IN PLACE BY EITHER BALLAST BOULDERS, DUCKBILL ANCHORS, OR REBAR. LOGS SHALL BE OF A LENGTH AND DIAMETER SPECIFIED BY THE DESIGNER AND BE RELATIVELY STRAIGHT HARDWOOD, RECENTLY HARVESTED. THE LENGTH SHALL BE SUCH THAT THE LOG IS BURIED INTO THE SOIL OF THE STREAM BANK (ON ONE END) AND STREAM BED (ON THE OTHER END) A MINIMUM DISTANCE OF 4.0'. FLAT-SIDED BALLAST BOULDERS SHALL BE OF SIZE 2' X 2' X 1.5' OR AS SPECIFIED BY THE DESIGNER.
- COARSE AGGREGATE BACKFILL SHALL CONSIST OF AN EQUAL MIX OF #57 STONE, SURGE STONE, AND CLASS A RIPRAP.
- THE VANE SHALL INTERCEPT THE STREAM BANK AT A HEIGHT EQUAL TO BETWEEN 1/2 BANKFULL STAGE AND BANKFULL STAGE. AN ELEVATION CONTROL POINT MAY BE ESTABLISHED AT THE LEFT OR RIGHT STREAM BANK/VANE INTERCEPT POINT. THE VANE INTERCEPT LOCATION MAY BE OTHERWISE DESCRIBED BY ITS RELATIONSHIP TO BANKFULL STAGE OR BY THE LENGTH AND SLOPE OF THE VANE ARM. BANKFULL IS NOT NECESSARILY THE TOP OF THE STREAM BANK SLOPE.
- FILTER FABRIC SHALL BE USED TO SEAL THE GAPS BETWEEN THE LOGS AND UNDER THE COARSE BACKFILL MATERIAL OF THE VANE. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED TUCKED, OR TRIMMED AS NEEDED.
- LOG VANES SHALL BE BUILT TYPICALLY AS FOLLOWS:
 - OVER-EXCAVATE STREAM BED TO A DEPTH EQUAL TO THE TOTAL THICKNESS OF THE HEADER (AND FOOTER IF SPECIFIED) LOGS.
 - PLACE FOOTER LOG OF THE VANE ARM IF SPECIFIED. THE SLOPE OF THE VANE ARM IS MEASURED ALONG THE VANE ARM WHICH IS INSTALLED AT AN ANGLE TO THE STREAM BANK AND PROFILE.
 - INSTALL HEADER LOG OF THE VANE ARM ON TOP OF AND SLIGHTLY FORWARD OR BACK FROM THE FOOTER LOG.
 - NAIL FILTER FABRIC TO THE HEADER LOG USING A GALVANIZED NAIL WITH A PLASTIC CAP. THE SIZE AND GAGE OF NAIL AND NAIL SPACING SHALL BE SPECIFIED BY THE DESIGNER.
 - PLACE BALLAST BOULDERS OR DUCKBILL ANCHOR ON THE VANE.
 - PLACE COARSE BACKFILL BEHIND LOGS ENSURING THAT ANY VOIDS BETWEEN THE LOGS ARE FILLED.
 - BACKFILL REMAINDER OF VANE WITH PREVIOUSLY EXCAVATED MATERIAL.
- IF ANY EROSION CONTROL MATTING IS SPECIFIED FOR USE IN THE VICINITY OF THE STREAM BANK/VANE INTERCEPT POINT THE MATTING EDGES SHALL BE NEATLY SECURED AROUND THE LOGS.



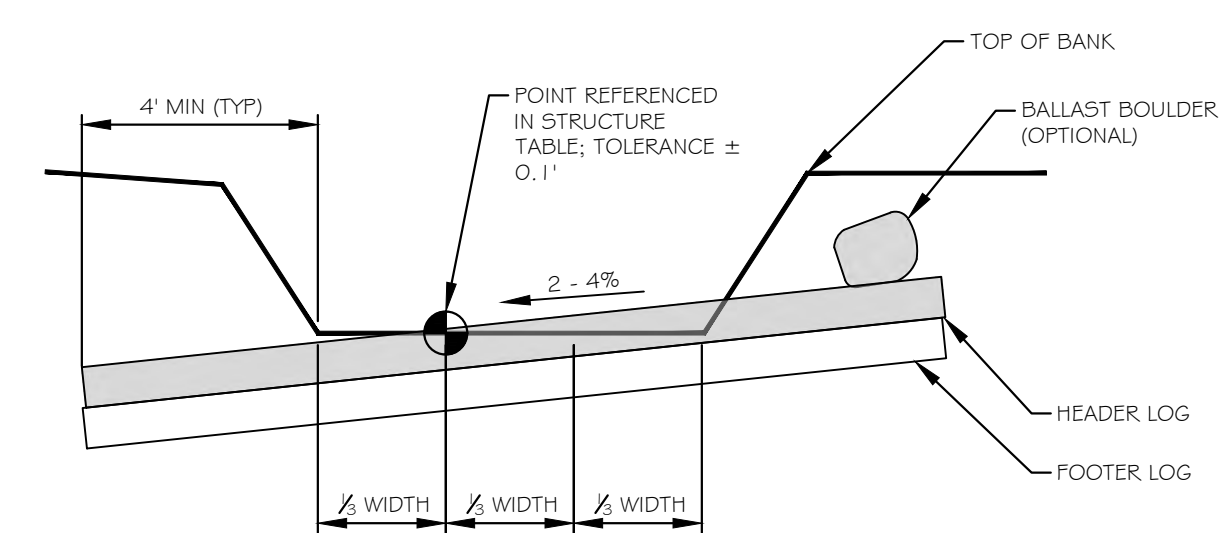
PROFILE VIEW

LOG VANE

NTS



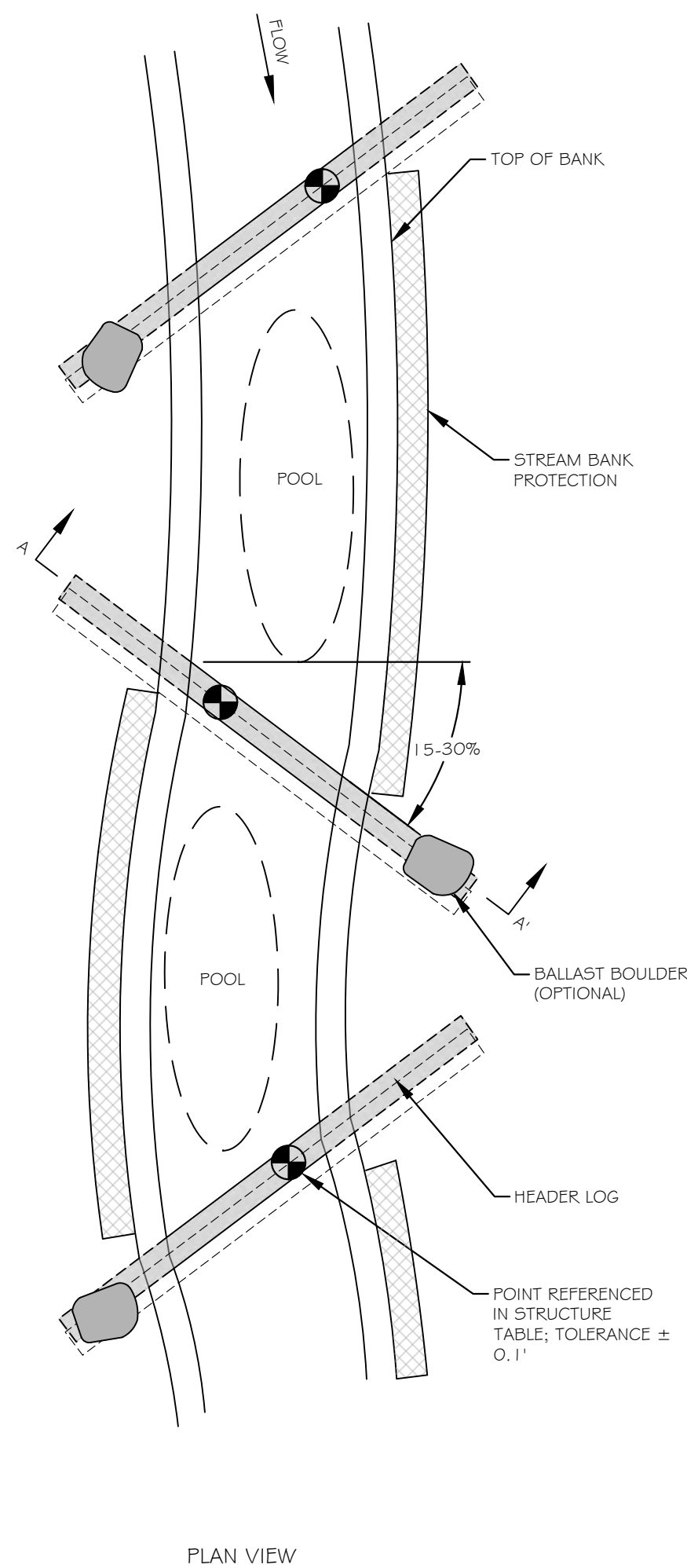
PROFILE



SECTION A-A'

ANGLED LOG STEP POOL

NTS



PLAN VIEW

NOTES:

- LOGS SHALL BE OF A MINIMUM OF 12" IN LENGTH AND 10" IN DIAMETER AND RELATIVELY STRAIGHT HARDWOOD, RECENTLY HARVESTED.
- COARSE AGGREGATE BACKFILL SHALL CONSIST OF AN EQUAL MIX OF #57 STONE, SURGE STONE, AND CLASS A RIPRAP.
- A SINGLE LOG MAY BE USED IN LIEU OF A HEADER/FOOTER LOG COMBINATION, PER APPROVAL OF DESIGNER.
- FILTER FABRIC SHALL BE USED TO SEAL THE GAPS BETWEEN THE LOGS) AND THE STREAM BED, UNDER THE COARSE BACKFILL MATERIAL. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
- COARSE BACKFILL SHALL BE PLACED TO A THICKNESS EQUAL TO THE DEPTH OF THE HEADER (AND ANY FOOTER) LOGS AND SHALL EXTEND OUT FROM THE VANE ARMS TO THE STREAM BANK AND UPSTREAM.
- DUCKBILL ANCHORS WITH GALVANIZED CABLE ATTACHED MAY BE USED TO SECURE LOGS INTO THE STREAM BED AND/OR BANKS. FLAT SIDED BOULDERS CAN BE USED IN LIEU OF THE LOG INVERT/DUCKBILL ANCHOR SYSTEM.



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GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA

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DETAILS

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

SHEET NUMBER:

D4

SEAL

SCALE: AS SHOWN

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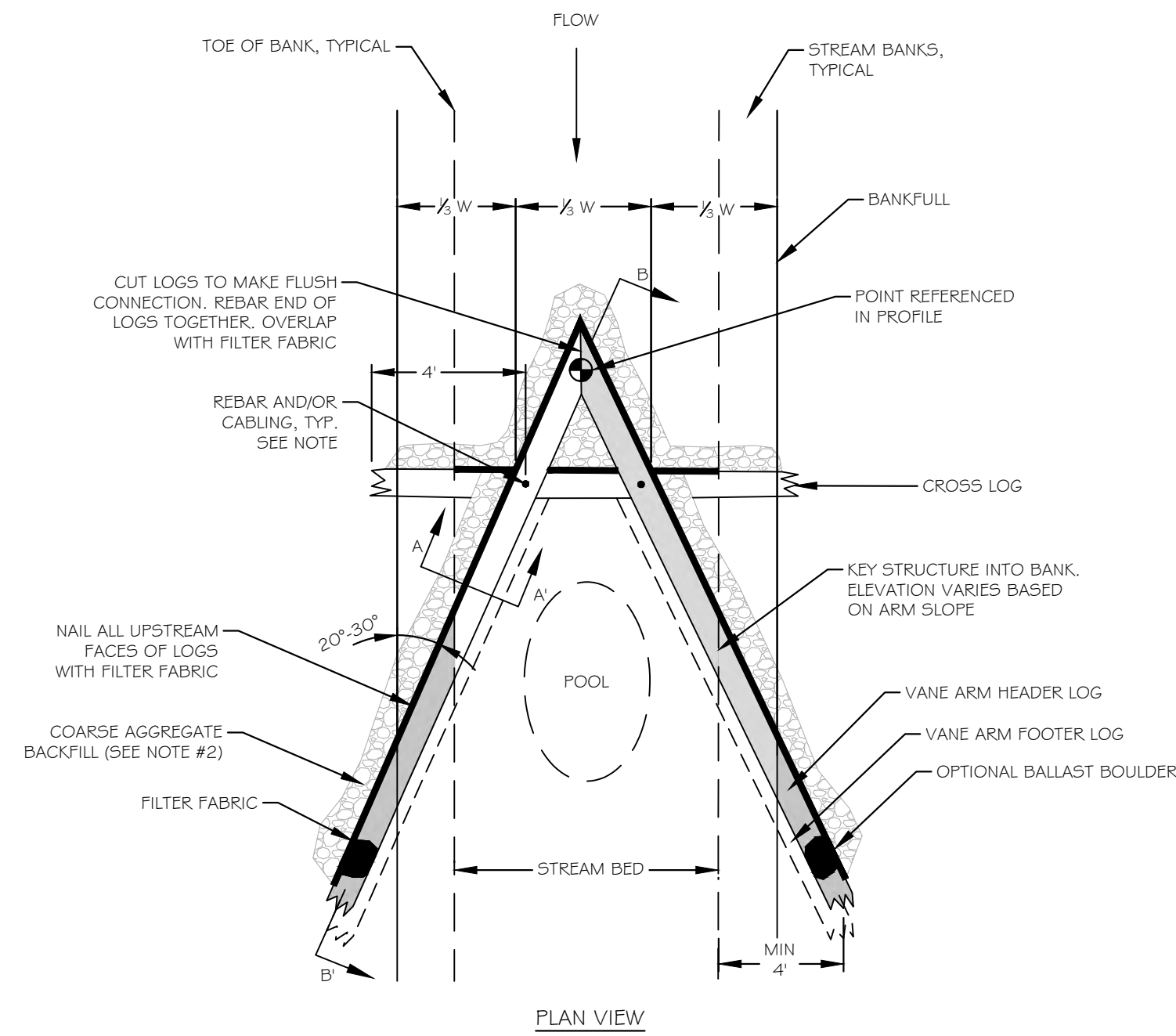
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DRAWING TITLE:
DETAILS

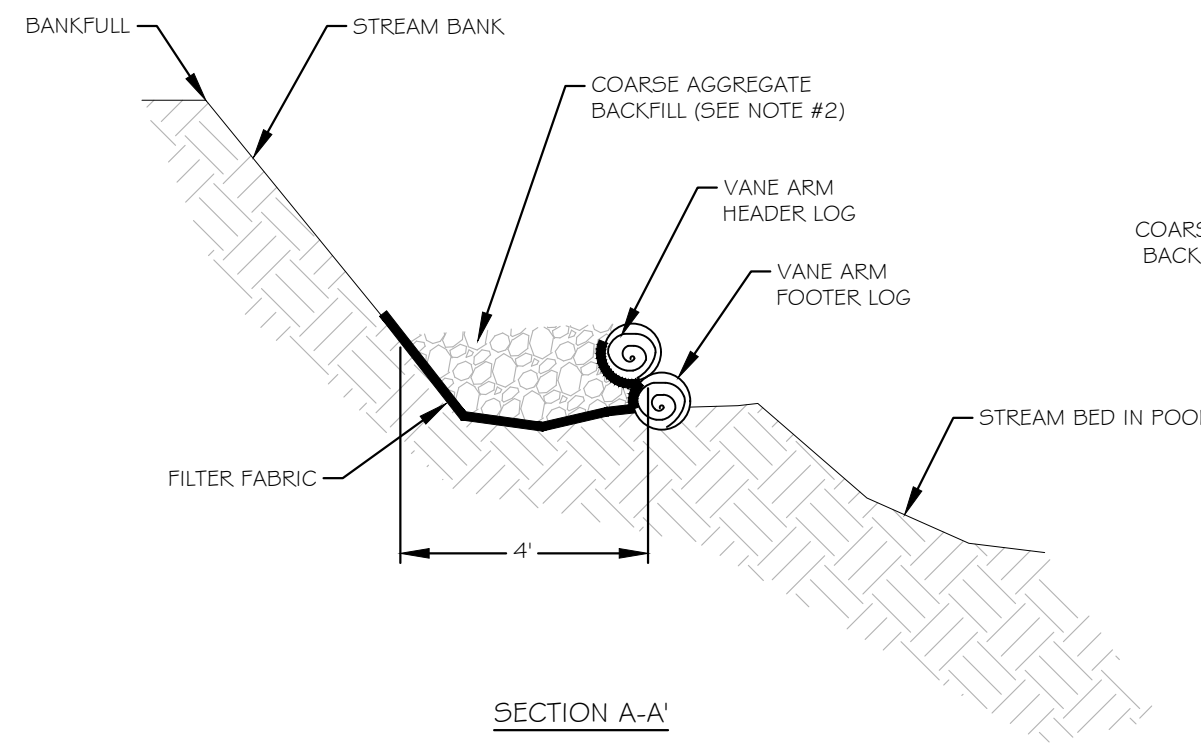
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 PROJECT MANAGER: BPB
 DESIGNED: BRC
 DRAWN: TRS
 CHECKED: AFM

SHEET NUMBER:

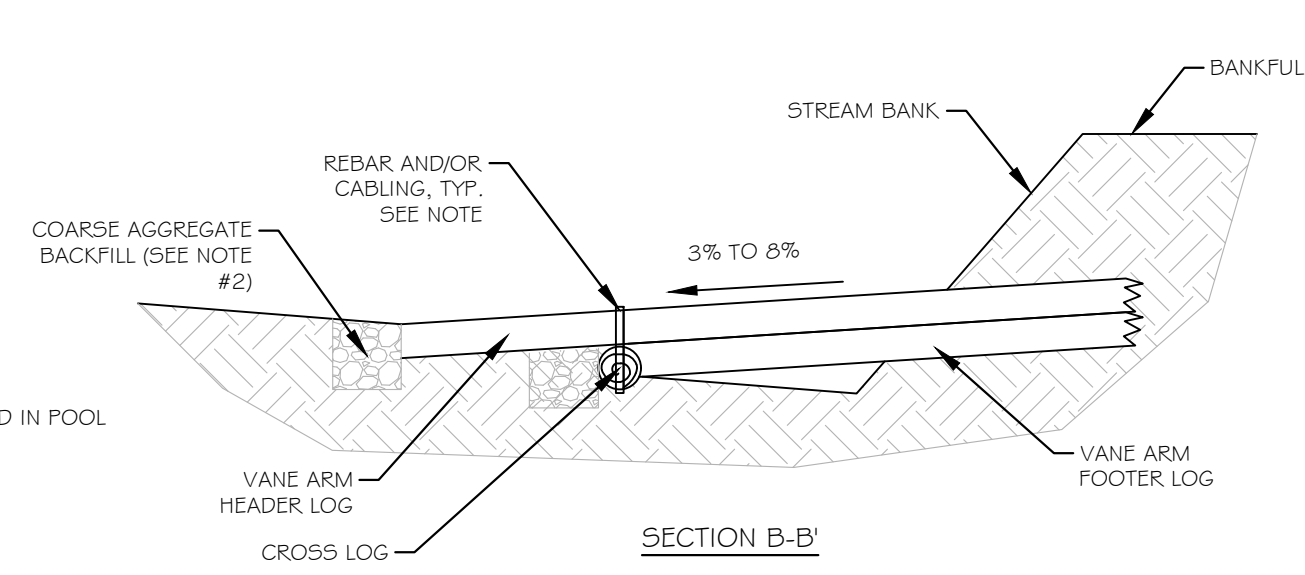
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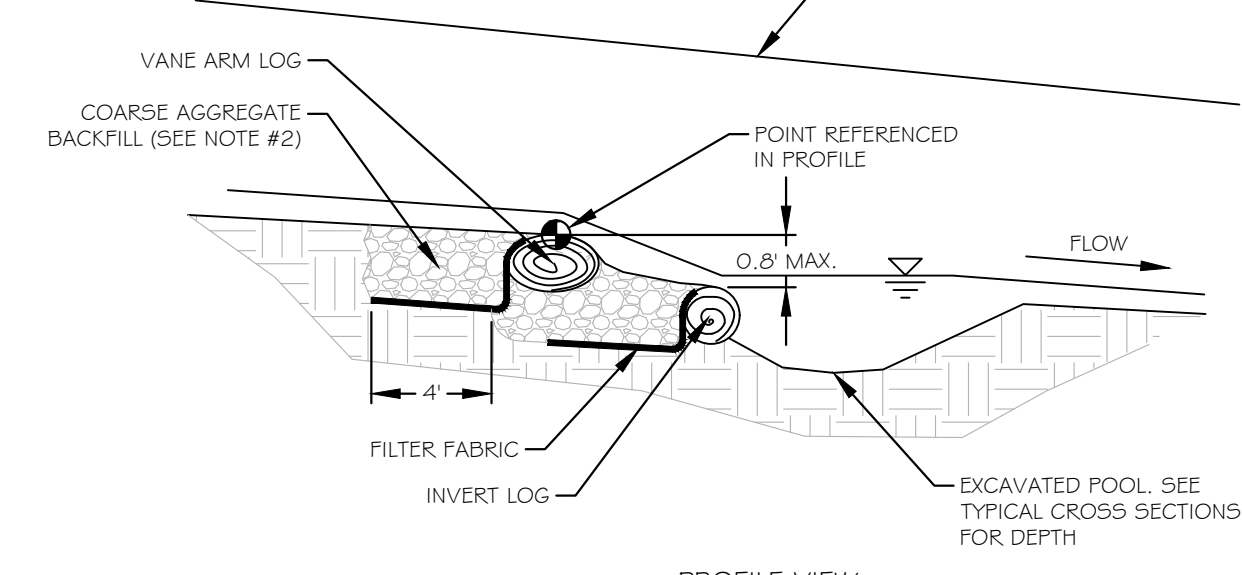
LOG CROSS VANE
 NTS



SECTION A-A



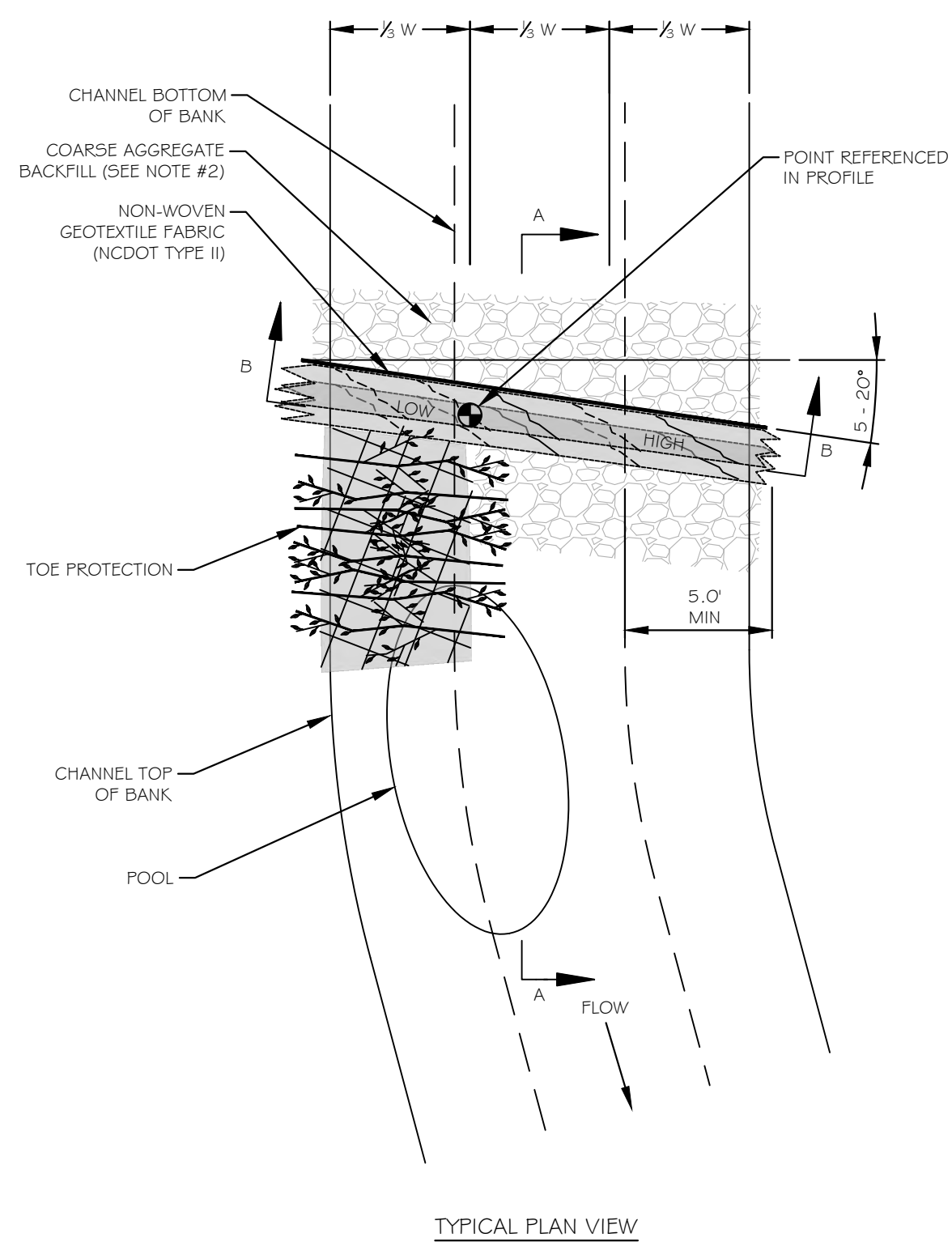
SECTION B-B



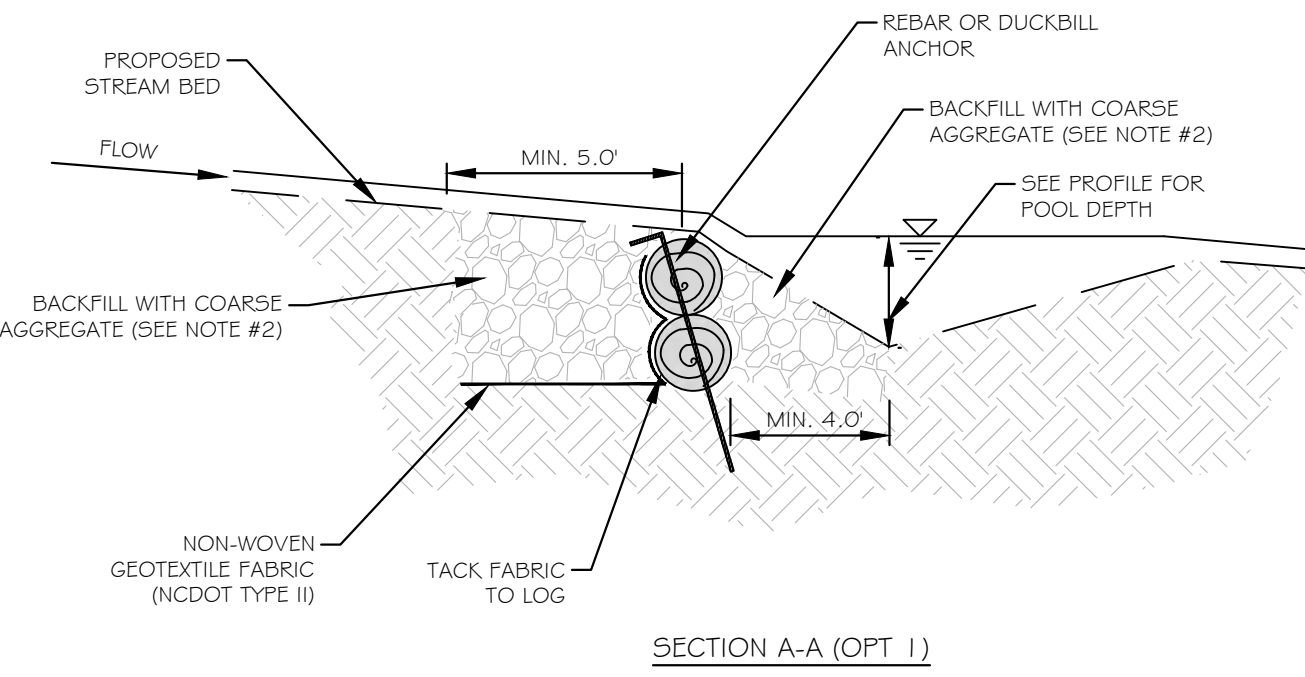
PROFILE VIEW

NOTES:

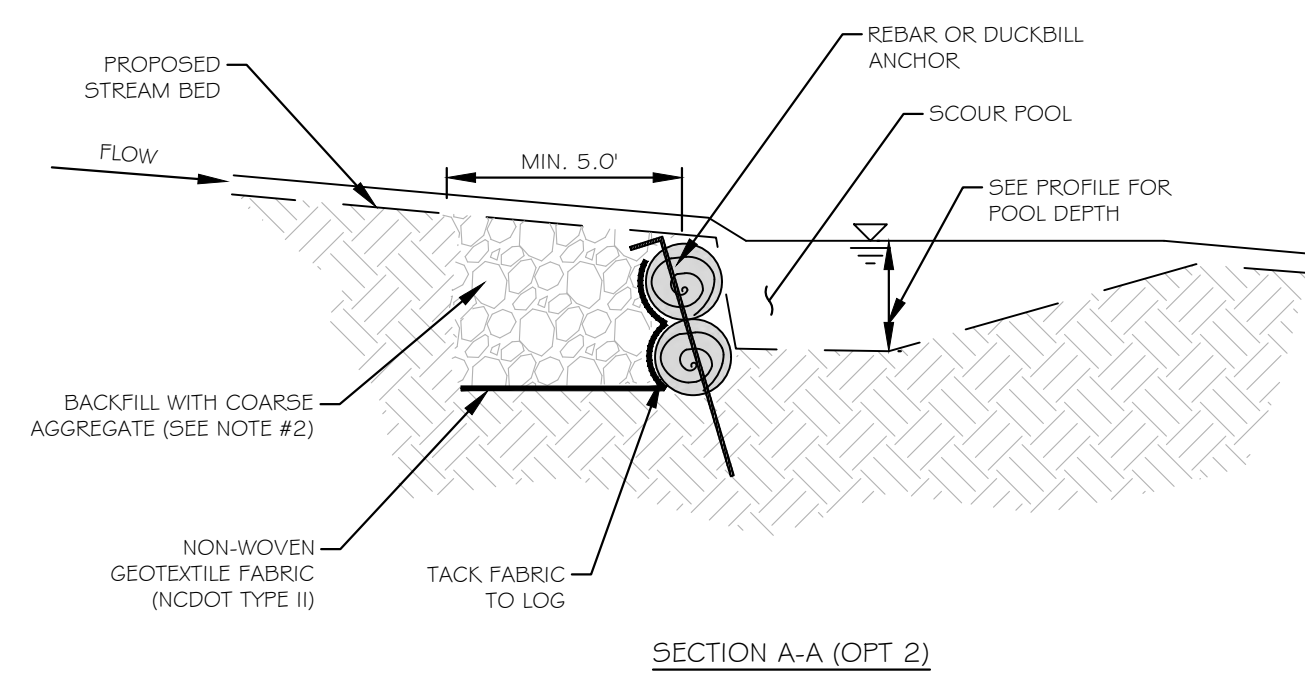
- LOGS SHALL BE OF A MINIMUM OF 12' IN LENGTH AND 10" IN DIAMETER AND RELATIVELY STRAIGHT HARDWOOD, RECENTLY HARVESTED.
- COARSE AGGREGATE BACKFILL SHALL CONSIST OF AN EQUAL MIX OF #57 STONE, SURGE STONE, AND CLASS A RIPRAP.
- FILTER FABRIC SHALL BE USED TO SEAL THE GAPS BETWEEN THE LOG(S) AND THE STREAM BED, UNDER THE COARSE BACKFILL MATERIAL. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
- COARSE BACKFILL SHALL BE PLACED TO A THICKNESS EQUAL TO THE DEPTH OF THE LOGS AND SHALL EXTEND OUT FROM THE VANE ARMS TO THE STREAM BANK AND UPSTREAM.
- AS AN OPTION, FLAT-SIDED BOULDERS MAY BE PLACED AS BALLAST ON TOP OF THE STREAM BANK SIDE OF THE EMBEDDED VANE ARMS. REBAR OR DUCKBILL ANCHORS MAY BE USED IN LIEU OF BALLAST BOULDERS.
- REBAR OR DUCKBILL ANCHORS WITH GALVANIZED CABLE ATTACHED MAY BE USED TO SECURE LOGS INTO THE STREAM BED AND/OR BANKS. FLAT SIDED BOULDERS CAN BE USED IN LIEU OF THE LOG INVERT/DUCKBILL ANCHOR SYSTEM.



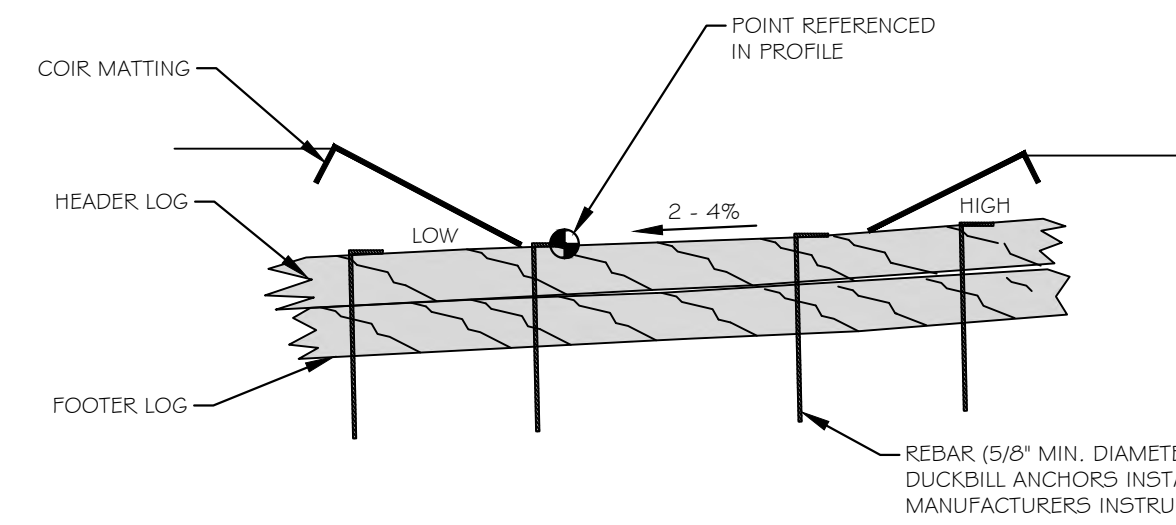
TYPICAL PLAN VIEW



SECTION A-A (OPT 1)



SECTION A-A (OPT 2)



SECTION B-B

LOG SILL
 NTS

NOTES:

- LOGS SHOULD BE RELATIVELY STRAIGHT HARDWOOD AND RECENTLY HARVESTED.
- COARSE AGGREGATE BACKFILL SHALL CONSIST OF AN EQUAL MIX OF #57 STONE, SURGE STONE, AND CLASS A RIPRAP.
- HIGH SIDE OF LOG SHALL BE APPROX. 0.2' HIGHER THAN LOW END.
- PROPOSED LOG DIAMETER:
 - REACH GF1 = 12' MIN.
 - REACHES GF2, GF3 = 10' MIN.
- NAIL FILTER FABRIC USING 3" O.D GALVANIZED COMMON NAIL EVERY 1.5' ALONG THE LOG.
- DUCKBILL ANCHORS MAY BE USED IN PLACE OF REBAR.

SEAL

SCALE: AS SHOWN

MARK	DATE	DESCRIPTION	PLOT DATE:
			9/13/2019
REVISIONS:			RELEASED FOR:
			PRELIMINARY - NOT FOR CONSTRUCTION

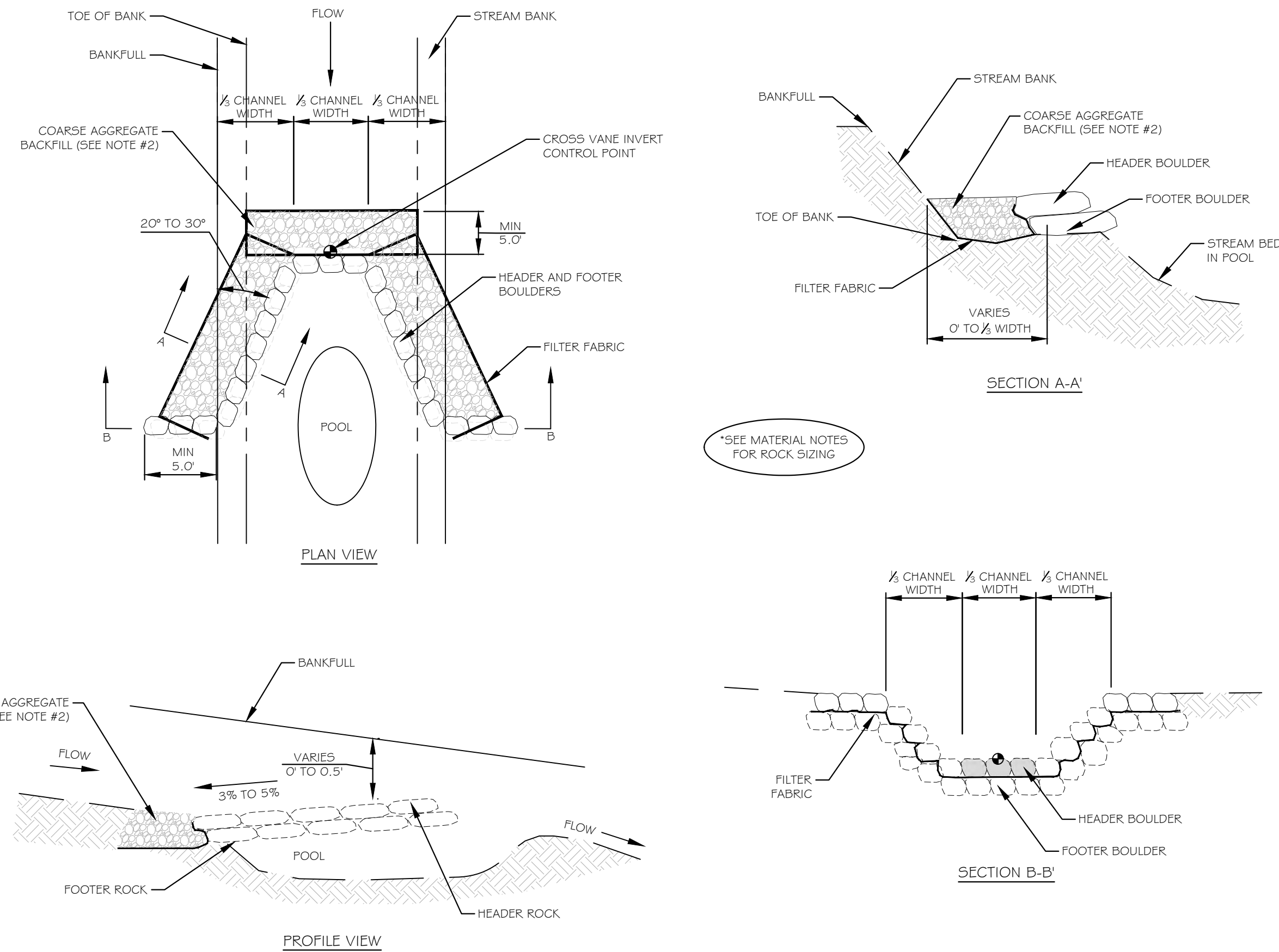
PROJECT NAME:
**GROUNDHOG HOLLOW MITIGATION SITE
 ALEXANDER COUNTY, NORTH CAROLINA**

DRAWING TITLE:
DETAILS

PROJECT NUMBER: 0438
 PROJECT MANAGER: BPB
 DESIGNED: BRC
 DRAWN: TRS
 CHECKED: AFM

SHEET NUMBER:

D6

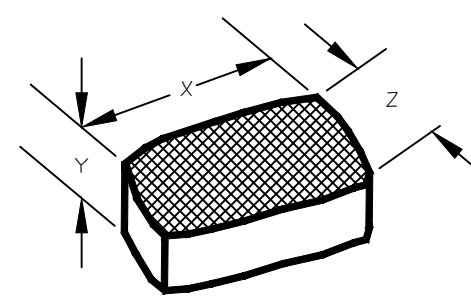


*SEE MATERIAL NOTES FOR ROCK SIZING

NOTES:

- SEE STRUCTURE BOULDER SIZE TABLE FOR APPROXIMATE DIMENSIONS OF BOULDERS. THE UPPER LIMIT FOR BOULDER SIZES SHALL BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION OF THE STRUCTURE.
- COARSE AGGREGATE BACKFILL SHALL CONSIST OF AN EQUAL MIX OF #57 STONE, SURGE STONE, AND CLASS A RIPRAP.
- CROSS VANES SHALL BE CONSTRUCTED SO THAT ADJOINING BOULDERS TAPE IN AN UPSTREAM DIRECTION. FROM THE BANKFULL ELEVATION TO THE STREAM INVERT. THE UPSTREAM END OF THE CROSS VANE IS SET AT AN ANGLE OF 20 TO 30 DEGREES TANGENT TO THE PROJECTED STREAM BANK DIRECTION. THE TOP ELEVATION OF BOTH VANES WILL DECREASE TOWARD THE CENTER OF THE CHANNEL.
- THE DOWNSTREAM END OF THE CROSS VANE SHALL BE KEYPED INTO THE STREAMBANK AT THE BANKFULL ELEVATION. THE CROSS VANE SHALL BE KEYPED A MINIMUM OF FIVE FEET INTO THE STREAMBANK. THE UPSTREAM END OF CROSS VANE SHALL BE KEYPED INTO THE STREAMBED INVERT ELEVATION.
- VANE BOULDERS SHALL BE PLACED IN A LINEAR FASHION SO AS TO PRODUCE THE SLOPING CROSS VANE, AND SHALL BE PLACED WITH TIGHT, CONTINUOUS SURFACE CONTACT BETWEEN ADJOINING BOULDER. BOULDER SHALL BE PLACED SO AS TO HAVE NO SIGNIFICANT GAPS BETWEEN ADJOINING BOULDER.
- VANE BOULDERS SHALL BE PLACED SO AS TO HAVE A FINAL SMOOTH SURFACE ALONG THE TOP PLANE OF THE CROSS VANE. NO VANE BOULDER SHALL PROTRUDE HIGHER THAN THE OTHER BOULDER IN THE BOULDER VANE. A COMPLETED CROSS VANE HAS A SMOOTH, CONTINUOUS FINISH GRADE FROM THE BANKFULL ELEVATION TO THE STREAMBED.
- AS THE CROSS VANE IS CONSTRUCTED, THE CONTRACTOR SHALL CHINK ALL VOIDS BETWEEN THE FOOTER BOULDERS, AND BETWEEN THE FOOTER BOULDERS AND VANE BOULDERS. VOIDS SHALL BE CHINKED WITH SMALLER ROCK SUCH THAT NO VOIDS GREATER THAN FOUR INCHES IN SIZE WILL BE PRESENT.

ROCK CROSS VANE
 NTS

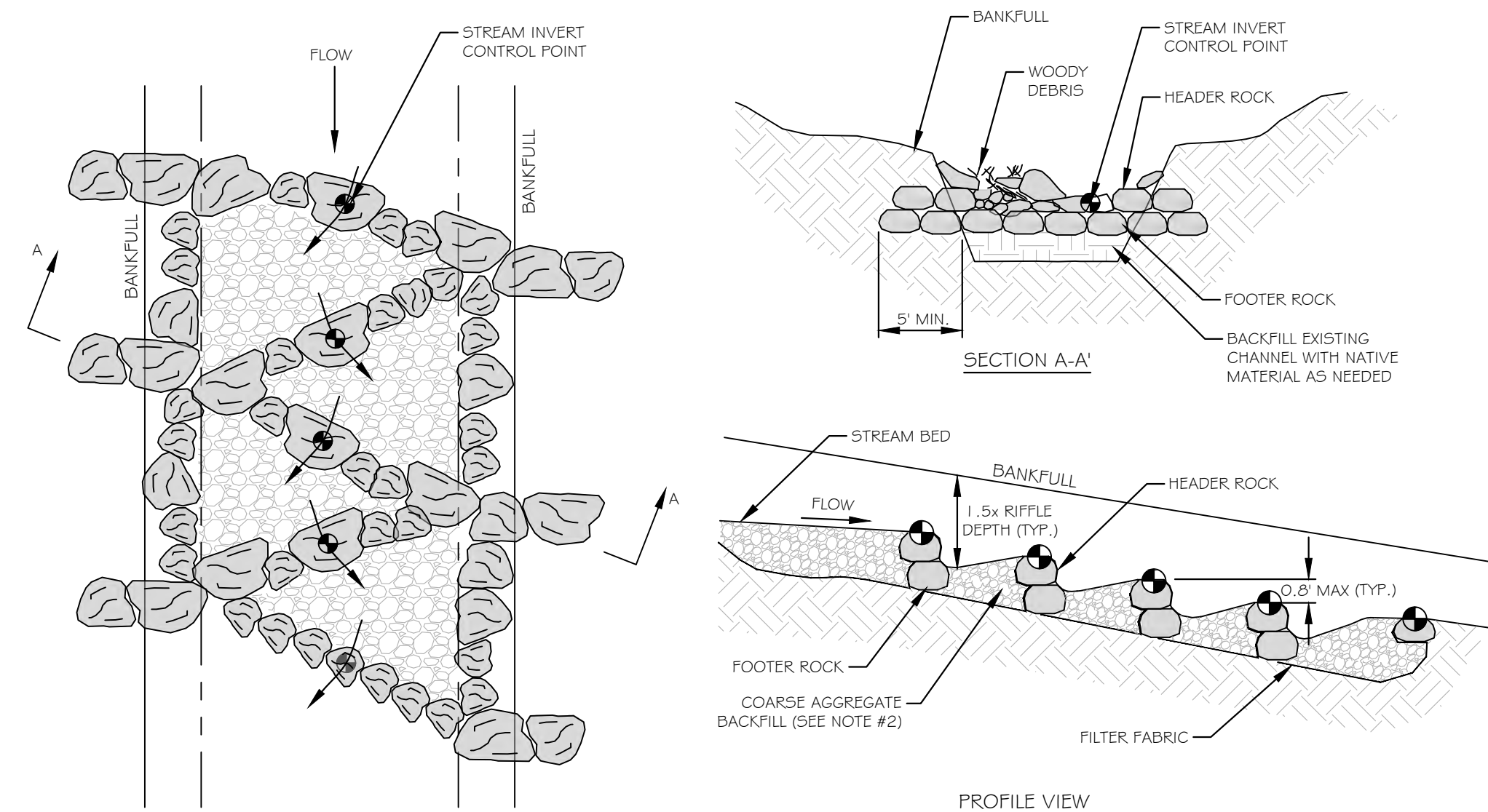


3 PRIMARY ROCK DIMENSIONS:
 X: LONGEST DIMENSION
 Y: SHORTEST DIMENSION
 Z: INTERMEDIATE DIMENSION

STRUCTURE BOULDER SIZE		
REACH	DIMENSION	LENGTH (IN.)
GF1, GF2, & GF3	X	18
	Y	12
	Z	18

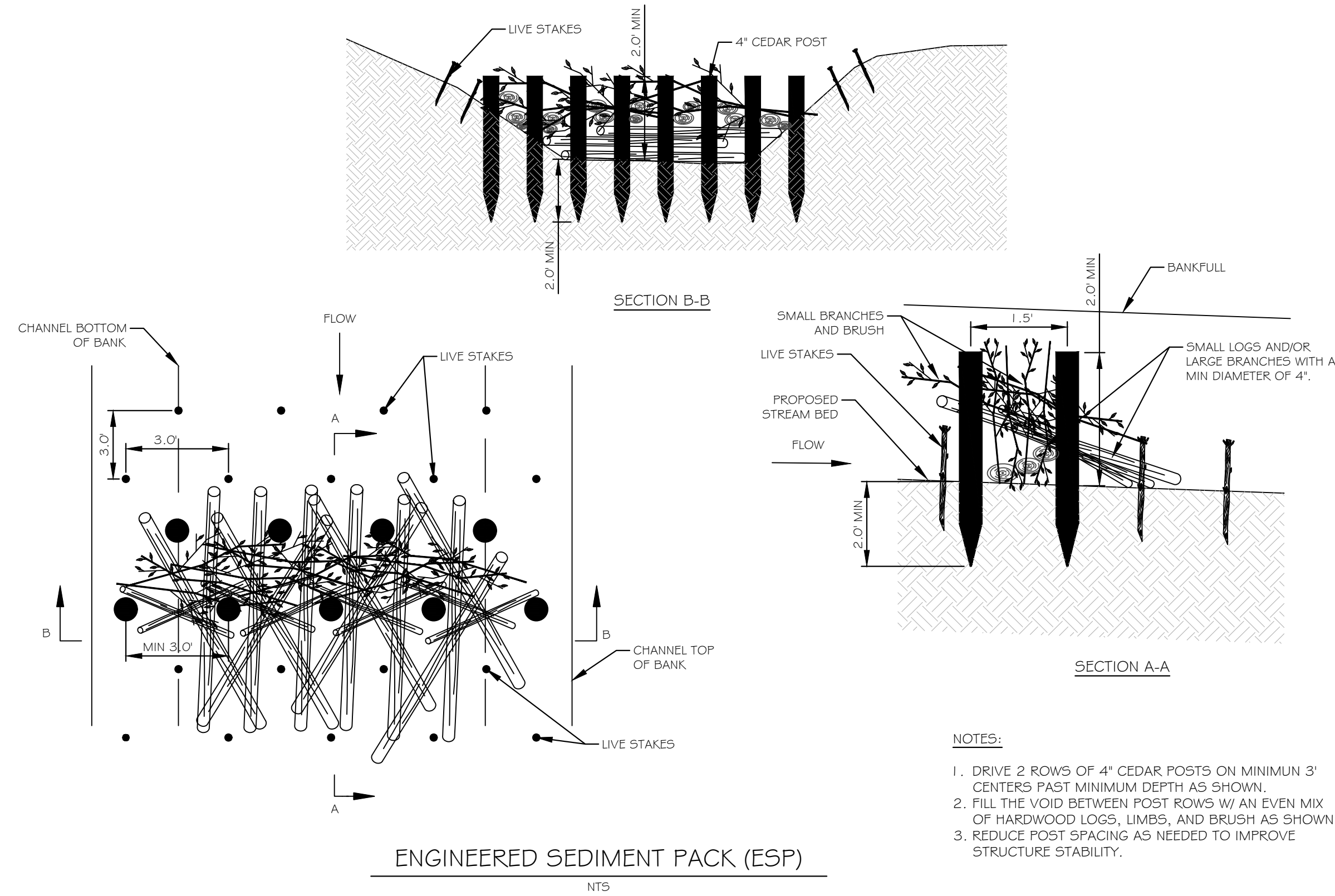
NOTES:

- SEE STRUCTURE BOULDER SIZE TABLE FOR APPROXIMATE DIMENSIONS OF BOULDERS. THE UPPER LIMIT FOR BOULDER SIZES SHALL BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION OF THE STRUCTURE.
- BACKFILL MATERIAL, IF NEEDED TO ESTABLISH A STEP-POOL SUBPAVEMENT AND/OR TO RAISE THE CHANNEL BED DUE TO SCOUR/INCISION, SHALL CONSIST OF AN EQUAL MIX OF #57 STONE, SURGE STONE, AND CLASS A RIPRAP. BACKFILL SHALL BE PLACED SUCH THAT THE ADDITION OF THE SPECIFIED THICKNESS OF STEP-POOL MATERIAL SHALL ACHIEVE THE DESIGNATED GRADES.
- STEP-POOL BED MATERIAL SHALL BE OF A TYPE, SIZE, AND GRADATION AS SPECIFIED BY THE DESIGNER TO BE MOBILE OR NON-MOBILE AS THE CONDITIONS IN THE CHANNEL WARRANT (I.E. - CLEAN-WATER DISCHARGE ENVIRONMENT, HIGH BEDLOAD SYSTEM, ETC.) BED MATERIAL SHALL BE EXCAVATED, STOCKPILED, AND RE-USED FROM ABANDONED CHANNEL SECTIONS WHEREVER PRACTICAL. OTHERWISE BED MATERIAL SHALL BE SLIGHTLY ROUNDED, "RIVER-TYPE" ROCK, UNLESS OTHER ROCK CHARACTERISTICS ARE APPROPRIATE FOR THE CHANNEL. LOGS AND OTHER WOODY DEBRIS MAY BE INCORPORATED INTO THE STEP-POOL BED MATERIALS.
- STEP-POOL INVERTS SHALL CONSIST OF BOULDERS OF AN INTERMEDIATE DIAMETER OF 12" TO 14" AND FOOTERS SHALL HAVE AN INTERMEDIATE DIAMETER OF 14" TO 18". INVERTS SHALL BE SET AT A DROPPRISE FROM THE ADJACENT UPSTREAM/DOWNSTREAM INVERT TO ACCOMMODATE THE PASSAGE OF FISH. THE INVERTS SHALL FORM THE THALWEG OF THE STEP POOL STRUCTURE. POOLS SHALL BE FORMED BETWEEN THE INVERTS TO THE DIMENSIONS SPECIFIED BY THE DESIGNER.
- THE BENCH OF THE STEP-POOL STRUCTURE SHALL BE FORMED BESIDE THE POOL AT THE DIMENSIONS SPECIFIED BY THE DESIGNER. THE BENCH SHALL BE FORMED OF STEP-POOL MATERIALS PLACED TO A DEPTH SUCH THAT THEIR SURFACE MATCHES THE STEP-POOL INVERT IMMEDIATELY UPSTREAM.
- USE CLASS A AND B RIPRAP TO FILL GAPS ON UPSTREAM SIDE OF STEP POOL ROCKS.
- AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH CLASS A AND B RIPRAP TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.
- FILTER FABRIC SHALL MEET SPECIFICATIONS FOR NCDOT WOVEN FILTER FABRIC.



STEP POOL
 NTS

FILE NAME: S:\@RES GIS\Projects\Hollow\CAD\DWG\0408_SHT_DETAILS.dwg SAVED BY: Bearroll



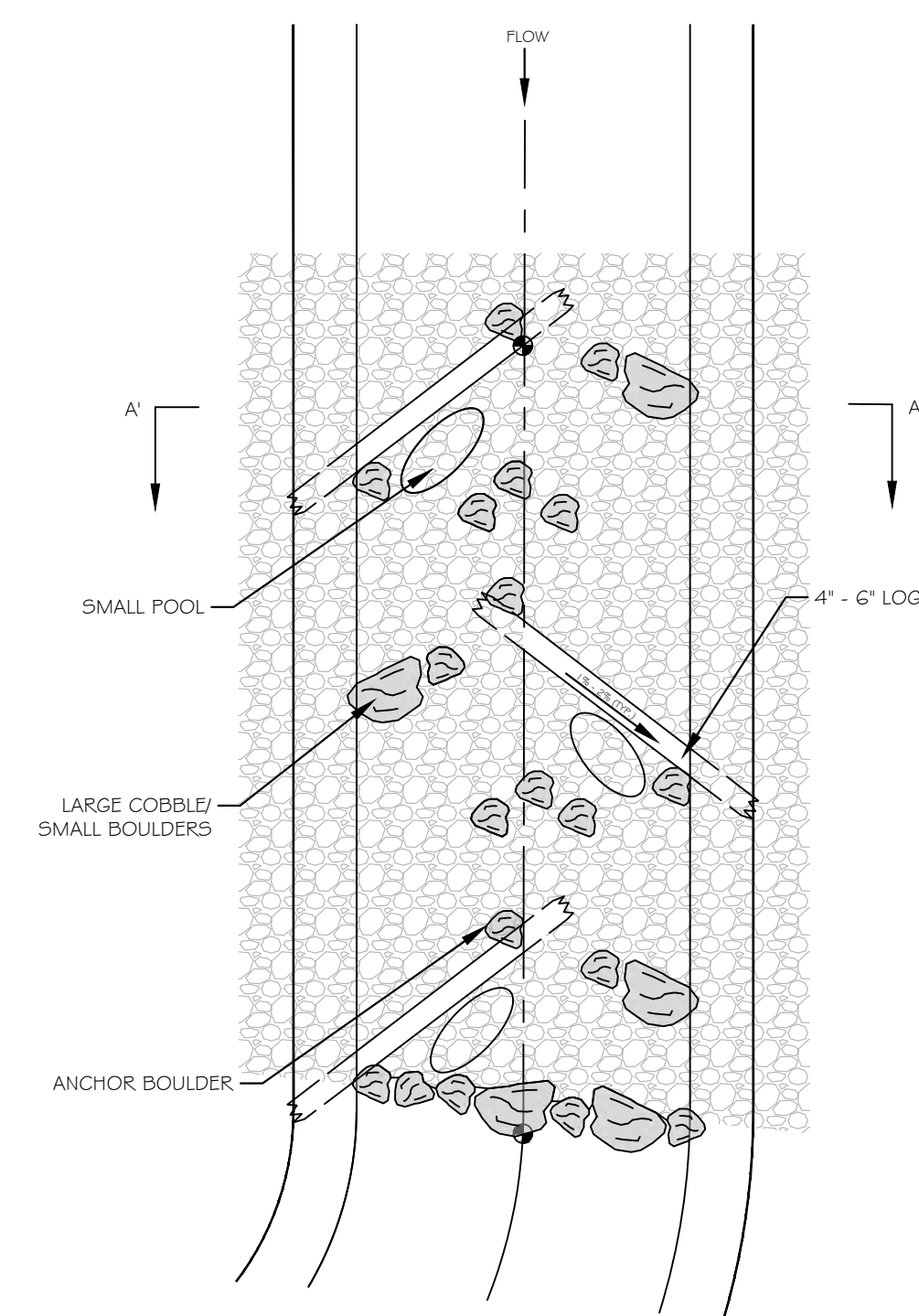
- NOTES:**
1. DRIVE 2 ROWS OF 4" CEDAR POSTS ON MINIMUM 3' CENTERS PAST MINIMUM DEPTH AS SHOWN.
 2. FILL THE VOID BETWEEN POST ROWS W/ AN EVEN MIX OF HARDWOOD LOGS, LIMBS, AND BRUSH AS SHOWN.
 3. REDUCE POST SPACING AS NEEDED TO IMPROVE STRUCTURE STABILITY.

ENGINEERED SEDIMENT PACK (ESP)

NTS

NOTES:

1. RIFFLE GRADE CONTROL STRUCTURES SHALL BE INSTALLED IN NEWLY GRADED CHANNEL SECTIONS, AS SPECIFIED ON THE PLAN SHEETS.
2. ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE BEGINNING AND END OF RIFFLE POINTS TO ESTABLISH PART OF THE PROFILE OF THE CHANNEL. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE RIFFLE INSTALLATION WITHIN A TOLERANCE OF $\pm 0.2'$.
3. GRADE CONTROL ROCK SHALL BE COMPRISED OF A 50/50 MIX OF CLASS A AND B RIPRAP. GRADE CONTROL ROCK SHALL BE PLACED SUCH THAT THE ADDITION OF THE SPECIFIED THICKNESS OF RIFFLE MATERIAL SHALL ACHIEVE THE DESIGNATED GRADES.
4. RIFFLE MATERIAL SHALL BE COMPRISED OF ROCKS AND LOGS. THE ROCK MATERIAL COMPOSITION SHALL MATCH TABLE 1. RIFFLE MATERIAL SHALL BE EXCAVATED, STOCKPILED, AND RE-USED FROM ABANDONED CHANNEL SECTIONS. ROCK RIFFLE MATERIAL OBTAINED OFFSITE SHALL BE SLIGHTLY ROUNDED, "RIVER-TYPE" ROCK, UNLESS OTHER ROCK CHARACTERISTICS ARE APPROPRIATE FOR THE CHANNEL.
5. SPACING AND NUMBER OF LOGS SHOULD BE BASED ON RIFFLE LENGTH AND MAY VARY BASED ON LOG AVAILABILITY. LOGS SHOULD BE SPACED EQUALLY AND ANCHORED TO THE CHANNEL BED WITH BOULDERS.
6. THE PLACEMENT OF GRADE CONTROL ROCK AND/OR RIFFLE MATERIAL SHALL BE DONE IN A MANNER TO CREATE A SMOOTH PROFILE, WITH NO ABRUPT "JUMP" (TRANSITION) BETWEEN THE UPSTREAM POOL-GUIDE AND THE RIFFLE, AND LIKEWISE NO ABRUPT "DROP" (TRANSITION) BETWEEN THE RIFFLE AND THE DOWNSTREAM RUN-POOL. THE FINISHED CROSS SECTION OF THE RIFFLE MATERIAL SHALL GENERALLY MATCH THE SHAPE AND DIMENSIONS SHOWN ON THE RIFFLE TYPICAL SECTION WITH SOME VARIABILITY OF THE THALWEG LOCATION AS A RESULT OF THE SMALL POOLS AND LOGS.
7. THE END OF RIFFLE CONTROL POINT MAY TIE IN TO ANOTHER IN-STREAM STRUCTURE (LOG SILL, J-HOOK, ETC.). NO LOGS SHOULD BE INCLUDED WITHIN THE FOOTPRINT OF THE PROPOSED STRUCTURE.
8. THE CONSTRUCTED RIFFLE SHALL BE KEED IN TO THE STREAM BANKS AND/OR BED AS DESIGNATED BY THE DESIGNER. THE "KEY" SHALL EXTEND BEYOND THE TOP OF BANK FOR THE LENGTH OF THE RIFFLE. WHERE PRESERVATION OF EXISTING STREAM BANK VEGETATION IS A PRIORITY A "KEY" MAY NOT BE USED (OR THE DIMENSIONS MAY BE ADJUSTED) TO LIMIT DISTURBANCE.

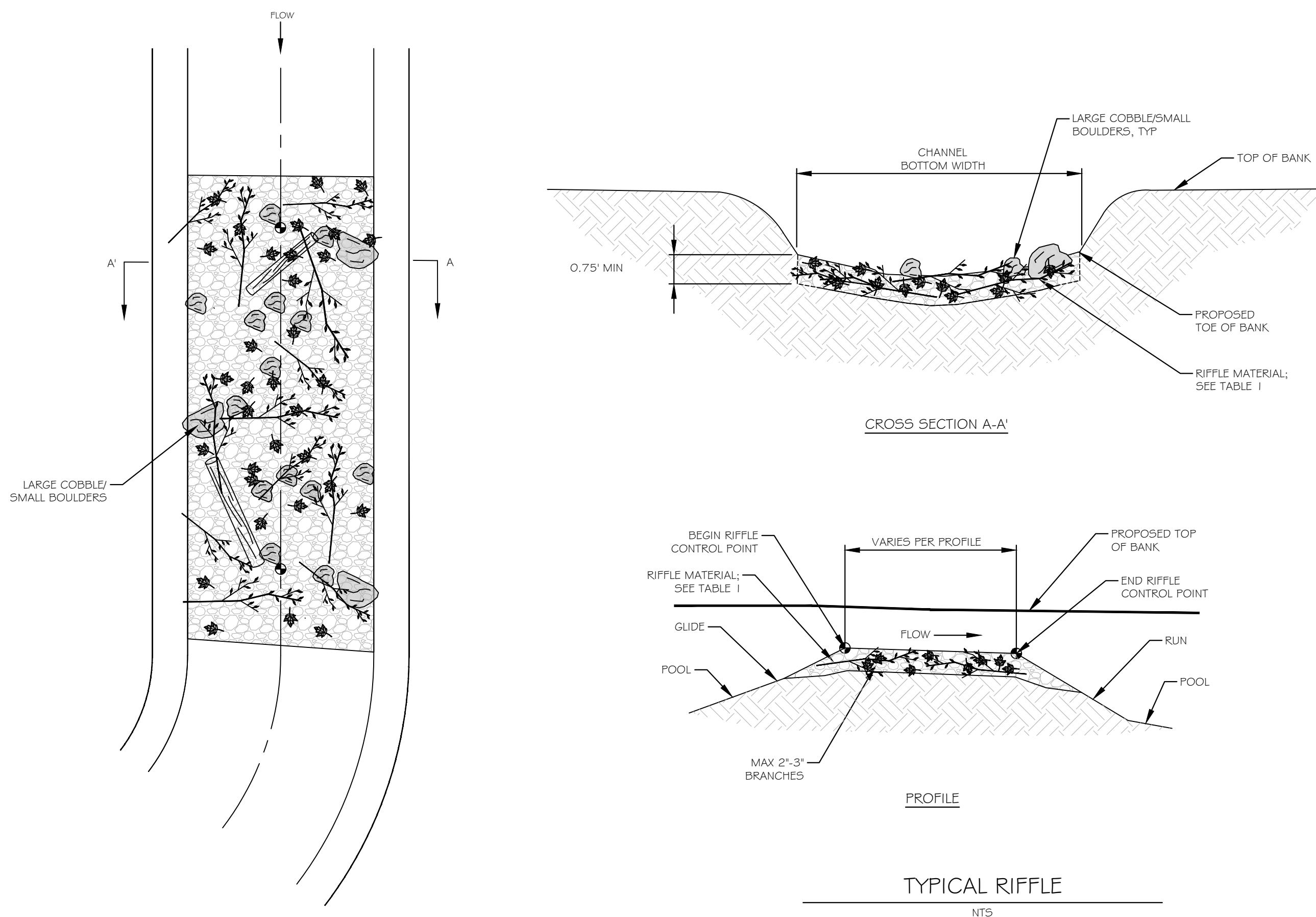


REACH	STONE SIZE	%
GF1-B (US)	#57	25
	#3	25
	NATIVE	50
GF1-B (DS), GF2-B, GF3-B	#57	25
	#3	50
	NATIVE	25

NOTES:

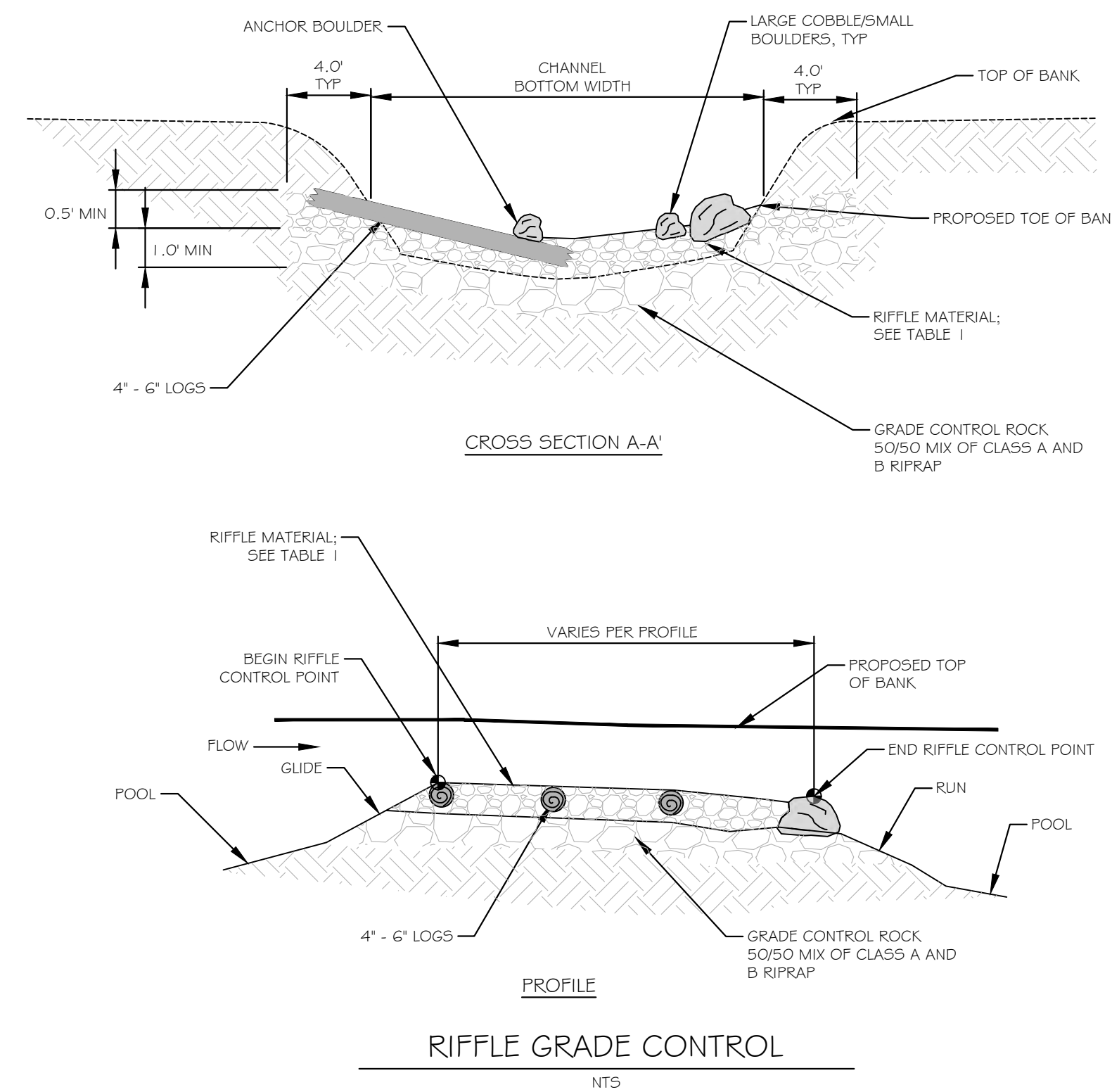
1. TYPICAL RIFFLES SHALL BE INSTALLED IN ALL NEWLY GRADED CHANNEL SECTIONS THROUGHOUT THE PROJECT UNLESS OTHERWISE SPECIFIED ON PLAN SHEETS.
2. ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE BEGINNING AND END OF RIFFLE POINTS TO ESTABLISH PART OF THE PROFILE OF THE CHANNEL. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE RIFFLE INSTALLATION WITHIN A TOLERANCE OF $\pm 0.2'$.
3. RIFFLE MATERIAL SHALL BE COMPRISED OF 75% ROCKS AND 25% WOODY MATERIAL. WOODY MATERIAL SHALL CONSIST OF LOGS, BRANCHES, AND BRUSH NO GREATER THAN 3' IN DIAMETER. THE ROCK MATERIAL SHALL CONSIST OF NATIVE SUBSTRATE MATERIAL WHEN POSSIBLE. NATIVE MATERIAL SHALL BE EXCAVATED, STOCKPILED, AND RE-USED FROM ABANDONED CHANNEL SECTIONS. IF A SUITABLE QUANTITY OF NATIVE SUBSTRATE MATERIAL CANNOT BE HARVESTED, CONTRACTOR MAY SUBSTITUTE THE RIFFLE MATERIAL WITH ROCK MATCHING THE COMPOSITION IN TABLE 1.
4. THE PLACEMENT OF RIFFLE MATERIAL SHALL BE DONE IN A MANNER TO CREATE A SMOOTH PROFILE, WITH NO ABRUPT "JUMP" (TRANSITION) BETWEEN THE UPSTREAM POOL-GUIDE AND THE RIFFLE, AND LIKEWISE NO ABRUPT "DROP" (TRANSITION) BETWEEN THE RIFFLE AND THE DOWNSTREAM RUN-POOL. THE FINISHED CROSS SECTION OF THE RIFFLE MATERIAL SHALL GENERALLY MATCH THE SHAPE AND DIMENSIONS SHOWN ON THE RIFFLE TYPICAL SECTION WITH SOME VARIABILITY OF THE THALWEG LOCATION AS A RESULT OF THE SMALL POOLS AND LOGS.
5. THE END OF RIFFLE CONTROL POINT MAY TIE IN TO ANOTHER IN-STREAM STRUCTURE (LOG SILL, J-HOOK, ETC.). NO LOGS SHOULD BE INCLUDED WITHIN THE FOOTPRINT OF THE PROPOSED STRUCTURE.
6. THE CONSTRUCTED RIFFLE SHALL BE KEED IN TO THE STREAM BANKS AND/OR BED AS DESIGNATED BY THE DESIGNER. THE "KEY" SHALL EXTEND BEYOND THE TOP OF BANK AT THE BEGINNING (CREST) AND END OF THE RIFFLE. WHERE PRESERVATION OF EXISTING STREAM BANK VEGETATION IS A PRIORITY A "KEY" MAY NOT BE USED (OR THE DIMENSIONS MAY BE ADJUSTED) TO LIMIT DISTURBANCE.

REACH	STONE SIZE	%
GF1-B (US)	#57	25
	#3	25
	NATIVE	50
GF1-B (DS), GF2-B, GF3-B	#57	25
	#3	50
	NATIVE	25



TYPICAL RIFFLE

NTS



RIFFLE GRADE CONTROL

NTS



302 Jefferson Street, Suite 110
Raleigh, NC 27605
Main: 919.829.9909
Fax: 919.829.9913
www.res.us

SEAL

SCALE: AS SHOWN

MARK	DATE	DESCRIPTION	RELEASED FOR:	PLOT DATE:
			PRELIMINARY - NOT FOR CONSTRUCTION	9/13/2019

PROJECT NAME:
GROUNDHOG HOLLOW MITIGATION SITE
ALEXANDER COUNTY, NORTH CAROLINA

DRAWING TITLE:
DETAILS

PROJECT NUMBER: 0438
PROJECT MANAGER: BPB
DESIGNED: BRC
DRAWN: TRS
CHECKED: AFM

SHEET NUMBER:

D7

Appendix B –
Data/Analysis/Supplementary Information

IRT Meeting Notes

MEMORANDUM



302 Jefferson Street, Suite 110

Raleigh, North Carolina 27605

919.209.1052 tel.

919.829.9913 fax

TO: Paul Wiesner, DMS

FROM: Brad Breslow, RES

DATE: May 8, 2018

RE: Groundhog Hollow Site Post-Contract IRT Site Visit Minutes

CU: 03050101

DMS Project No: 100049

DEQ Contract No: 7417

County: Alexander

Location; 35.932979, -81.236187

DMS Project Manager: Paul Wiesner

Meeting Summary:

Date/Time: March 29th, 2018- 9:30 am

IRT Attendees: Steve Kichefski (USACE), Mac Haupt (NCDWR), Alan Johnson (NCDWR), Olivia Munzer (NCWRC), Todd Bowers (EPA)

DMS Attendees: Paul Wiesner, Harry Tsomides, Kirsten Ullman

RES Attendees: Brad Breslow, Daniel Ingram, Frasier Mullen, David Godley, August James

General Summary: IRT members agreed that the Groundhog Hollow Site is suitable to provide compensatory stream mitigation and final credit ratios will be determined in the approved Mitigation Plan. In general, the Group agreed that the site would benefit from refining site treatments and ratios based on the discussions had in the field, but no adjustments to contracted credit amounts are expected. RES and DMS understand that final design approaches and crediting rationale (for all reaches) must be fully justified in the mitigation plan. Specific discussions related to each reach are discussed below.

Reach GF2-A: Group agreed that Enhancement II is the appropriate treatment for this reach and the main discussion was related to repairing the headcut/gully feature at the top of this reach. Because a portion of the gully would be considered non-jurisdictional, RES is proposing a BMP at the top transitioning to more traditional stream restoration that would likely involve raising the bed elevation and some minor bank grading. Group acknowledged that raising the bed elevation could lead to a loss of hydrology at the upper end, but this may be the best functional approach to repair the gully and limit sediment inputs to the rest of the project. Because the level of effort expected to treat the headcut is greater than a traditional Enhancement II approach, the IRT discussed potentially approving a ratio of 2:1.

Reach GF2-B and GF2-C: RES originally proposed Enhancement I for GF2-B but based on level of incision and amount of active erosion, the IRT recommended carrying Restoration throughout. Restoration activities will include raising the bed elevation, improving bedform, and stabilizing banks. An offline pond will also be removed and the footprint will be tied in to an existing wetland area along the right bank, likely leading to an overall increase in wetland area. WRC noted a root cellar in the hillside as potential for bat habitat. RES discussed with the landowner and learned that the cellar was dug in the early 1900s to be used for food storage. RES and WRC have scheduled survey for the end of April. *Update- WRC and RES staff surveyed cellar on April 20, 2018 and did not find any evidence of bats. WRC will need to conduct another*

hibernacula survey in the winter to make sure it is not being used. If bats are found using the potential hibernacula in either summer or winter, then the construction schedule may need to be discussed to avoid impacts to bats.

Reach GF1-A: The Group agreed with the Enhancement II approach and RES agreed that some areas will require more work, such as bank grading and headcut repair. Also, the bottom end of the reach will potentially be treated as Restoration because of the stream work necessary to tie-in with Reach GF2-C and GF1-B.

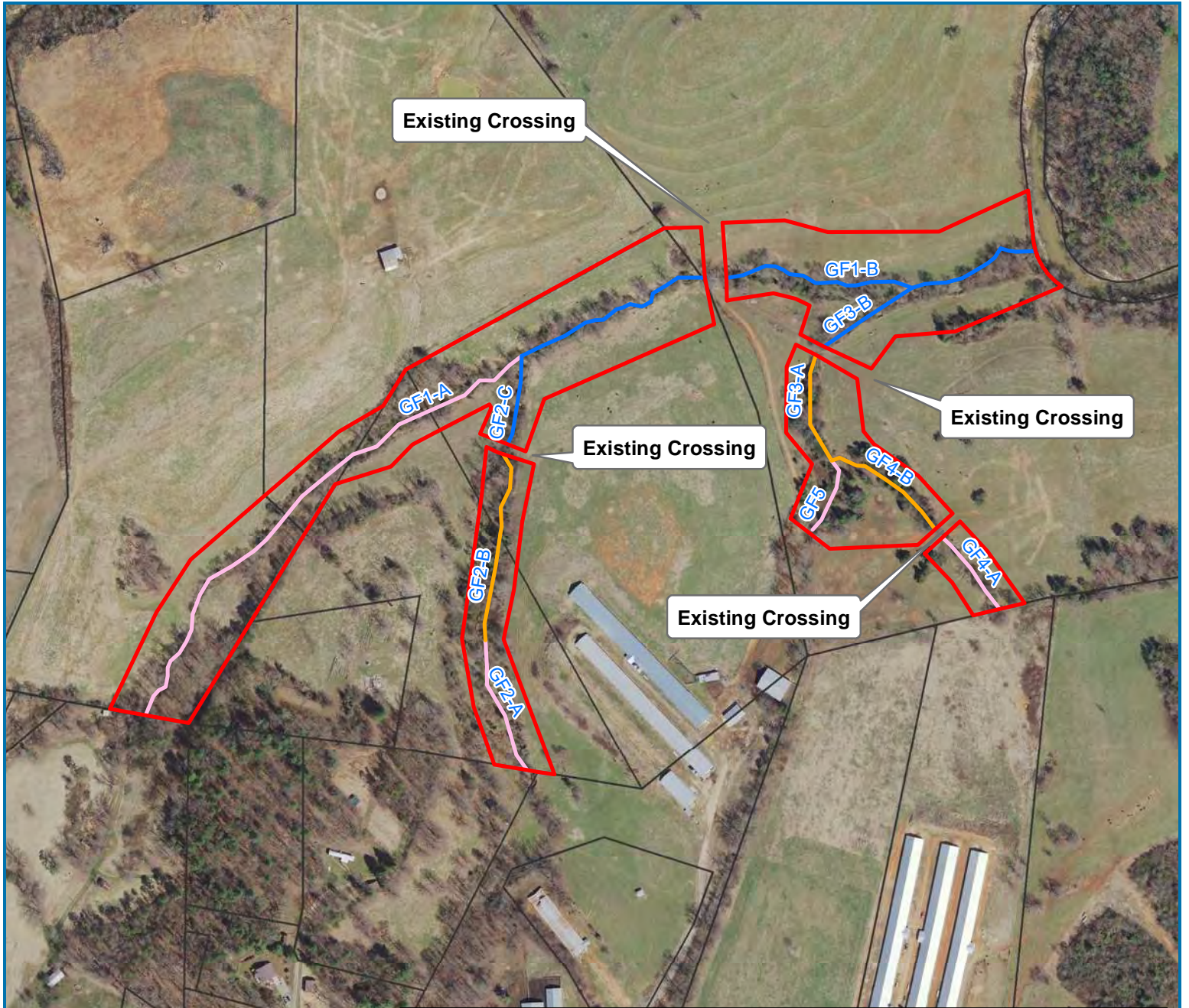
Reach GF1-B: Group agreed Restoration is appropriate treatment on this reach. Approach will be to raise bed elevation, address active erosion, and improve bedform diversity with structures. One concern discussed was the “secondary channel” that had formed along the downstream end which has left the channelized, relict ditch mostly dry. USACE and DWR mentioned that the relict ditch feature could be jurisdictional, and the backfilling of that feature could be viewed as a loss of jurisdictional waters. While a single thread system is likely the appropriate historical system, USACE/DWR said that this potential loss of channel should be discussed/justified in the mitigation plan. RES explained that the restoration approach would likely use the approximate alignment of the newly formed “secondary channel”, but the dimension and profile would be designed to reference conditions. This approach would likely facilitate some wetland re-habilitation/re-establishment, which will be uncredited. DWR asked about the design approach at the confluence with the Little Lower River. RES explained that this would be determined during the design phase of the project.

Reach GF3-A and GF3-B: Group agreed with Enhancement I and Restoration treatments which would mostly focus on raising bed elevation, bank stabilization, and riparian buffer improvements.

Reach GF4-A: RES has acquired an easement option for the headcut at the top of the reach which will allow a more active enhancement approach that will include stabilizing the gully feature and some bed/bank improvements. The Group agreed that Enhancement I ratio would make sense for that treatment within the first few hundred feet before transitioning back to Enhancement II.

Reach GF4-B: This reach begins just below the culvert crossing and drops quickly to a very deep gully. RES explained that the proposed treatment was to replace/rehab the culvert and install some bed structures to promote a more stable transition (e.g. riffle-step-pool) down to the existing bed elevation. Once in the gully section, RES had proposed very little active bed/bank work based on the steepness and depth of the gully through this small section. DWR expressed concerns with this, especially since it was shown as Enhancement I credit, and would prefer to see some grading and bank stabilization to limit sediment inputs and arrest active bank erosion. RES agreed to explore this approach, but also recommended potentially not doing any bed/bank work and planting the buffer for a reduced (EII/preservation) ratio or no credit at all. Downstream of the gully, the Group agreed that Enhancement I treatment was an appropriate treatment.

Reach GF-5: Group agreed to Enhancement II crediting based on the riparian improvements and permanent livestock exclusion. The easement will also capture the headwater spring at the origin of this reach and also include another adjacent spring/seep within the easement area.



Reach	Approach	Length	Ratio	Base SMUs	Adjusted SMUs
GF1-A	E II	1,492	2.5	597	638
GF1-B	Restoration	1,467	1	1,467	1,682
GF2-A	E II	380	2.5	152	152
GF2-B	E I	523	1.5	349	349
GF2-C	Restoration	245	1	245	245
GF3-A	E I	307	1.5	204	217
GF3-B	Restoration	289	1	289	289
GF4-A	E II	250	2.5	100	100
GF4-B	E I	358	1.5	239	247
GF5	E II	213	2.5	85	92
Totals		5,525		3,727	4,011

Legend

- Restoration
- Enhancement I
- Enhancement II
- Proposed Easement
- Parcels

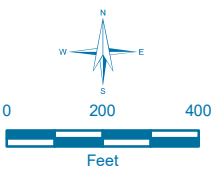


Figure 7 - Conceptual Map
Groundhog Hollow Mitigation Site
 Alexander County, North Carolina

Date: 9/18/2017
 Drawn by: ATP



Document Path: C:\Users\jdelid\OneDrive - RES\RES\GIS\Projects\Groundhog Hollow\MXD\DA5\Figure 7 - Conceptual - Ground.mxd

Morphological Parameters

Groundhog Hollow Morphological Parameters

Feature	Reference Reach		Existing ¹																	
	UT to Hauser Creek		GF1A		GF1B (US)		GF1B (MS)		GF1B (DS)		GF2A									
	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle	Pool								
Drainage Area (ac)	29		42		46		111		156		35									
Drainage Area (mi ²)	0.05		0.07		0.07		0.17		0.24		0.05									
NC Regional Curve Discharge (cfs) ²	9.3		12.2		13.1		24.8		31.7		10.6									
NC Regional Curve Discharge (cfs) ³	10.1		13.3		14.2		26.4		33.6		11.6									
VA Regional Curve Discharge (cfs) ⁴	2.3		3.3		3.6		8.3		11.5		2.8									
Design/Calculated Discharge (cfs)	5 - 7		-		-		-		-		-									
Dimension																				
BF Cross Sectional Area (ft ²)	2.1 - 2.8		3.5 - 3.9		1.8		3.8		2.6		4.5		9.4		6.8		1.6		3.3	
BF Width (ft)	4.4		5.7 - 6.6		5.3		5.2		4.4		8.3		12.1		6.3		5.4		3.2	
BF Mean Depth (ft)	0.5 - 0.6		0.6		0.3		0.7		0.6		0.5		0.8		1.1		0.3		1.0	
BF Max Depth (ft)	0.8 - 0.9		1.2 - 1.4		0.6		1.7		0.9		0.9		1.5		1.3		0.5		1.6	
Wetted Perimeter (ft)	4.7 - 4.8		7.0 - 7.1		5.5		7.3		5.0		8.8		13.5		7.9		5.7		5.1	
Hydraulic Radius (ft)	0.5 - 0.6		0.5 - 0.6		0.3		0.5		0.5		0.5		0.7		0.9		0.3		0.6	
Floodprone Width (ft)	12.0 - 20.0		13.8 - 16.1		7		9		6.5		22.5		19.3		8.3		8.9		7.7	
Width/Depth Ratio	6.9 - 9.2		9.3 - 10.9		15.9		7.1		7.6		15.2		15.7		5.9		18.2		3.1	
Entrenchment Ratio	2.7 - 4.5		2.4 - 2.5		1.4		1.8		1.5		2.9		1.6		1.3		1.6		2.4	
Bank Height Ratio	1.0 - 2.5		1.2 - 1.3		4.5		1.0		2.3		1.3		1.9		2.8		1.6		1.1	
Bed Material																				
Description (D50)	Sand / Gravel		Gravel		Gravel		Gravel		Gravel		Gravel		Gravel							
D16 (mm)	1.1		3		1.9		1.5		3		1.7									
D50 (mm)	3.7		6.9		4.8		11		11		17									
D84 (mm)	25		13		11		45		41		43									
Pattern																				
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max								
Channel Beltwidth (ft)	15	35	-	-	-	-	-	-	-	-	-	-								
Radius of Curvature (ft)	6	17	-	-	-	-	-	-	-	-	-	-								
Radius of Curvature Ratio	1.4	3.9	-	-	-	-	-	-	-	-	-	-								
Meander Wavelength (ft)	23	43	-	-	-	-	-	-	-	-	-	-								
Meander Width Ratio	3.4	8.0	-	-	-	-	-	-	-	-	-	-								
Profile																				
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max								
Riffle Length (ft)	4	18	-	-	-	-	-	-	-	-	-	-								
Run Length (ft)	3	8	-	-	-	-	-	-	-	-	-	-								
Pool Length (ft)	3	8	-	-	-	-	-	-	-	-	-	-								
Pool -to-Pool Spacing (ft)	12	35	-	-	-	-	-	-	-	-	-	-								
Additional Reach Parameters																				
Valley Length (ft)	842		1168		346		1077		379		776									
Channel Length (ft)	995		1350		417		1236		410		842									
Sinuosity	1.18		1.16		1.21		1.15		1.08		1.09									
Water Surface Slope (ft/ft)	-		-		-		-		-		-									
Channel Slope (ft/ft)	0.0033		0.024		0.019		0.017		0.016		0.031									
Rosgen Classification	E4/5		F4b		G4c		C4		G4c		F4b									

¹ Bankfull stage was estimated using NC Regional Curve equations and existing conditions data

² NC Piedmont Regional Curve equations source: Harman et al. (1999)

³ NC Piedmont Regional Curve equations source: Doll et al. (2002)

⁴ VA Regional Curve equation source: Lotspeich, R.R. (2009)

Feature	Existing ¹											
	GF2B		GF3A		GF3B		GF4A		GF4B		GF5	
	Riffle	Pool	Riffle	Pool	Riffle	Riffle	Run	Riffle	Pool	Riffle		
Drainage Area (ac)	45		36		39		16		23		9	
Drainage Area (mi ²)	0.07		0.06		0.06		0.02		0.04		0.01	
NC Regional Curve Discharge (cfs) ²	12.9		10.9		11.6		5.9		7.9		4.1	
NC Regional Curve Discharge (cfs) ³	14.0		11.9		12.6		6.6		8.6		4.6	
VA Regional Curve Discharge (cfs) ⁴	3.6		2.9		3.1		1.3		1.9		0.8	
Design/Calculated Discharge (cfs)	-		-		-		-		-		-	
Dimension												
BF Cross Sectional Area (ft ²)	4.0	3.7	3.0	8.6	2.9	1.3	1.2	1.7	3.4		0.6	
BF Width (ft)	7.7	4.5	5.0	6.8	4.1	4.2	4.2	5.9	7.3		4.5	
BF Mean Depth (ft)	0.5	0.8	0.6	1.3	0.7	0.3	0.3	0.3	0.5		0.1	
BF Max Depth (ft)	0.8	1.4	0.9	1.9	1.0	0.5	0.6	0.5	0.9		0.4	
Wetted Perimeter (ft)	8.3	5.8	5.6	8.7	5.0	4.4	4.5	6.2	8.3		4.7	
Hydraulic Radius (ft)	0.5	0.6	0.5	1.0	0.6	0.3	0.3	0.3	0.4		0.1	
Floodprone Width (ft)	8.1	4.7	8.0	11.0	6.2	6.7	16.7	8.1	7.6		>30	
Width/Depth Ratio	14.8	5.3	8.3	5.3	5.8	13.8	14.9	19.8	15.9		32.2	
Entrenchment Ratio	1.1	1.1	1.6	1.6	1.5	1.6	4.0	1.4	1.0		>2.2	
Bank Height Ratio	2.1	1.7	1.9	1.1	1.6	5.7	1.0	2.0	3.9		1.0	
Bed Material												
Description (D50)	Gravel		Gravel		Silt / Very Fine Sand		Gravel		Gravel		Sand / Gravel	
D16 (mm)	1.4		1.5		0.062		1.3		1.6		1.2	
D50 (mm)	20		13		0.062		8.9		24		2	
D84 (mm)	69		110		6.2		36		87		7.4	
Pattern												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Channel Beltwidth (ft)	-	-	-	-	-	-	-	-	-	-	-	-
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	-	-	-
Radius of Curvature Ratio	-	-	-	-	-	-	-	-	-	-	-	-
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	-	-	-
Meander Width Ratio	-	-	-	-	-	-	-	-	-	-	-	-
Profile												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-
Run Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-
Pool Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-
Pool -to-Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters												
Valley Length (ft)	573		283		253		250		342		220	
Channel Length (ft)	680		319		272		275		387		271	
Sinuosity	1.19		1.13		1.08		1.10		1.13		1.23	
Water Surface Slope (ft/ft)	-		-		-		-		-		-	
Channel Slope (ft/ft)	0.031		0.022		0.021		0.016		0.027		0.102	
Rosgen Classification	F4b		G4		G5/6		G4		F4b		C4/5	

¹ Bankfull stage was estimated using NC Regional Curve equations and existing conditions data

² NC Piedmont Regional Curve equations source: Harman et al. (1999)

³ NC Piedmont Regional Curve equations source: Doll et al. (2002)

⁴ VA Regional Curve equation source: Lotspeich, R.R. (2009)

Feature	Design									
	GF1B (US)		GF1B (MS)		GF1B (DS)		GF2B		GF3B	
	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle	Pool	Riffle	Pool
Drainage Area (ac)	46		111		156		45		39	
Drainage Area (mi ²)	0.07		0.17		0.24		0.07		0.06	
NC Regional Curve Discharge (cfs) ²	13.1		24.8		31.7		12.9		11.6	
NC Regional Curve Discharge (cfs) ³	14.2		26.4		33.6		14.0		12.6	
VA Regional Curve Discharge (cfs) ⁴	3.6		8.3		11.5		3.6		3.1	
Design/Calculated Discharge (cfs)	4		8		12		6		7	
Dimension										
BF Cross Sectional Area (ft ²)	2.5	4.1	2.7	4.6	5.0	7.2	2.2	3.5	2.7	4.2
BF Width (ft)	5.2	6.0	5.3	6.2	6.8	7.8	4.9	5.7	5.3	6.2
BF Mean Depth (ft)	0.5	0.7	0.5	0.7	0.7	0.9	0.4	0.6	0.5	0.7
BF Max Depth (ft)	0.7	1.1	0.7	1.2	1.0	1.5	0.6	1.0	0.7	1.1
Wetted Perimeter (ft)	5.5	6.6	5.6	6.9	7.3	8.7	5.2	6.2	5.6	6.8
Hydraulic Radius (ft)	0.5	0.6	0.5	0.7	0.7	0.8	0.4	0.6	0.5	0.6
Floodprone Width (ft)	19.2	20.0	19.3	20.2	26.8	21.8	16.9	19.7	19.3	9.2
Width/Depth Ratio	10.7	8.8	10.3	8.4	9.2	8.5	11.1	9.3	10.3	20.2
Entrenchment Ratio	3.7	3.3	3.6	3.3	3.9	2.8	3.4	3.5	3.6	3.3
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bed Material										
Description (D50)	Gravel		Gravel		Gravel		Gravel		Gravel	
D16 (mm)	-		-		-		-		-	
D50 (mm)	26		39		39		41		36	
D84 (mm)	-		-		-		-		-	
Pattern										
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Channel Beltwidth (ft)	15	35	15	36	20	46	14	33	13	31
Radius of Curvature (ft)	6	17	6	17	8	22	6	16	5	15
Radius of Curvature Ratio	1.15	3.27	1.15	3.27	1.15	3.27	1.15	3.27	1.00	2.84
Meander Wavelength (ft)	23	43	23	44	30	56	30	56	20	38
Meander Width Ratio	4.42	8.27	4.42	8.27	4.42	8.27	6.14	11.48	3.84	7.18
Profile										
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Riffle Length (ft)	3.5	17.9	3.6	18.2	4.6	23.4	3.3	16.9	3.1	15.8
Run Length (ft)	2.9	8.1	3.0	8.3	3.8	10.6	2.7	7.6	2.6	7.2
Pool Length (ft)	2.9	9.6	3.0	9.8	3.8	12.6	2.7	9.0	2.6	8.5
Pool -to-Pool Spacing (ft)	11.8	35.0	12.0	35.7	15.4	45.8	11.1	33.0	10.4	31.0
Additional Reach Parameters										
Valley Length (ft)	278		1151		319		492		294	
Channel Length (ft)	320		1372		374		563		343	
Sinuosity	1.15		1.19		1.17		1.14		1.17	
Water Surface Slope (ft/ft)	-		-		-		-		-	
Channel Slope (ft/ft)	0.008		0.015		0.010		0.020		0.013	
Rosgen Classification	C4/E4		C4/E4		E4		C4/E4		C4/E4	

¹ Bankfull stage was estimated using NC Regional Curve equations and existing conditions data

² NC Piedmont Regional Curve equations source: Harman et al. (1999)

³ NC Piedmont Regional Curve equations source: Doll et al. (2002)

⁴ VA Regional Curve equation source: Lotspeich, R.R. (2009)

Mitigation Type	E2	P1	P1	P1	E2	P1	E1	P1	E2	E1	E2
Reach	GF1-A	GF1-B (US)	GF1-B (MS)	GF1-B (DS)	GF2-A	GF2-B	GF3-A	GF3-B	GF4-A	GF4-B	GF5
DA (ac)	42.08	46.28	110.93	155.76	34.69	45.23	35.98	39.09	15.61	23.04	9.47
DA (sqmi)	0.07	0.07	0.17	0.24	0.05	0.07	0.06	0.06	0.02	0.04	0.01
Ex. Conds XSs											
~ Q _{BKF}	3 - 5	6 - 10	8 - 10	12 - 15	3 - 5	6 - 13	8 - 11	9 - 17	1 - 3	3 - 5	
FFQ Analysis											
Q _{1.1}	19	20	32	38	17	19	17	18	11	13	8
Q _{1.5}	28	30	49	60	25	29	26	27	16	20	12
Q ₂	38	40	65	78	34	39	35	36	22	27	17
Q ₁₀	75	79	135	166	67	78	68	72	41	52	30
Rural Piedmont Regional Curves											
NC-Q _{BKF} orig	12	13	25	32	11	13	11	12	6	8	4
NC-Q _{BKF} rev	13	14	26	34	12	14	12	13	7	9	5
~ BKF _{CSA}	3.5	3.8	6.8	8.5	3.1	3.7	3.2	3.4	1.8	2.4	1.3
VA-Q _{BKF}	3	4	8	12	3	4	3	3	1	2	1
SCS (Hydraflow Hydrographs with 6 hour duration and a PSF of 484)											
Q ₁	3	3	14	22	5	6	7	7	3	5	2
Q ₂	8	9	29	45	10	13	13	14	6	8	4
Q ₅	18	19	59	88	20	25	24	26	11	15	7
Q ₁₀	27	30	87	128	29	37	34	36	15	21	10
Q ₂₅	42	47	133	193	44	56	49	53	22	31	15
Q ₅₀	57	63	173	251	57	74	63	68	28	40	19
SCS (Hydraflow Hydrographs with 6 hour duration and a PSF of 384)											
Q ₁	3	3	12	19	4	5	6	7	3	4	2
Q ₂	7	8	26	40	9	11	12	12	6	7	4
Q ₅	16	17	53	79	18	23	21	23	10	14	7
Q ₁₀	24	27	79	117	26	34	31	33	14	20	9
Q ₂₅	39	43	120	176	40	51	45	49	21	29	13
Q ₅₀	52	57	158	230	52	67	58	63	26	37	17
USGS RR Eqns (Region 1)											
Q _{2(1996 EQNS)}	22	23	43	54	19	23	20	21	11	14	8
Q _{2(2001 EQNS)}	20	21	39	50	17	21	18	19	10	13	7
Q ₂	27	29	51	63	24	28	24	26	14	18	10
Q ₅	54	57	98	122	47	56	49	51	29	37	21
Q ₁₀	74	79	135	166	66	78	67	71	40	51	30
Q ₂₅	103	109	186	228	92	108	94	99	57	72	42
Q ₅₀	129	137	231	283	115	135	118	124	71	90	53
Recommended Design Flows =											
Q _{bnkfull}		4	8	12		6		7			

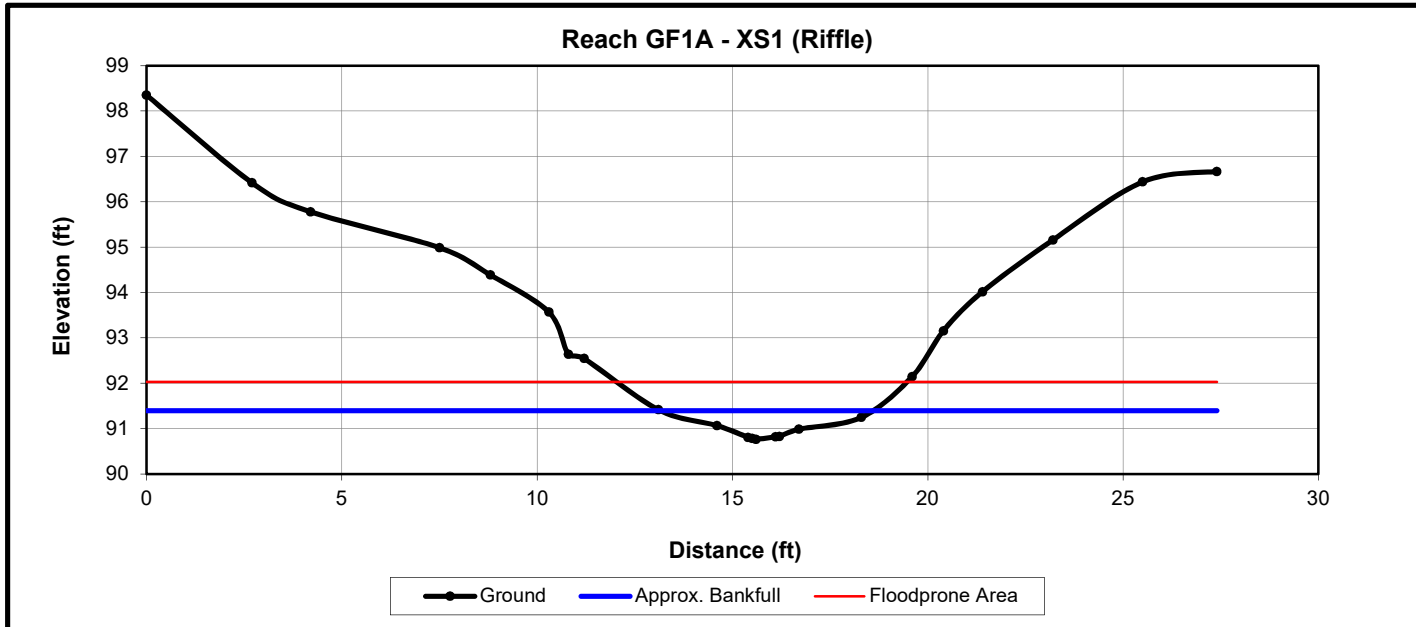
Cross Sections of Current Conditions
& Reference Reaches



Upstream



Downstream

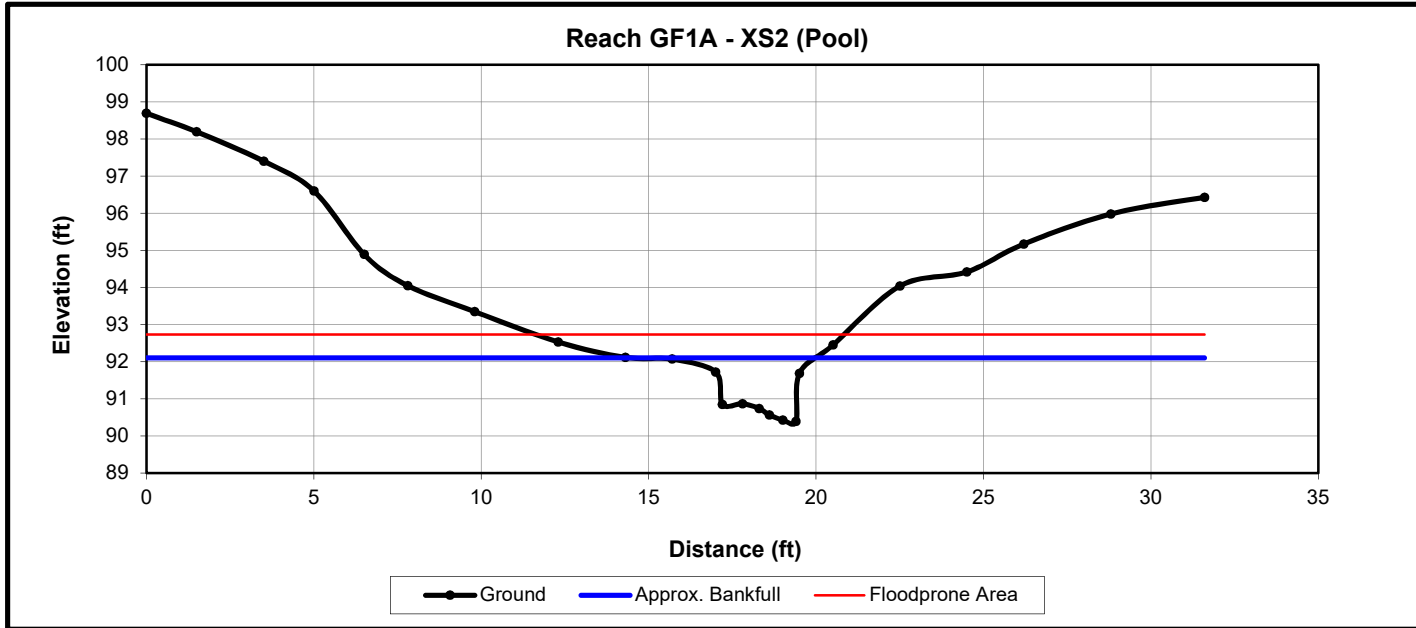




Upstream



Downstream

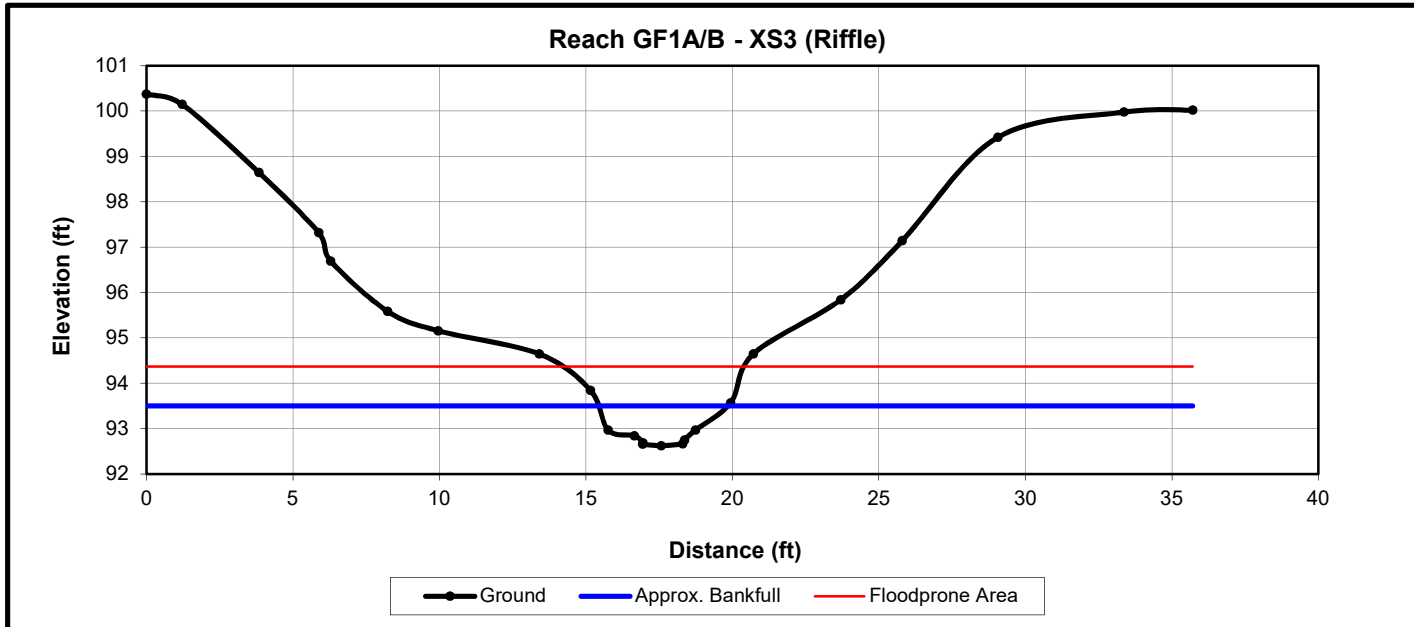




Upstream



Downstream

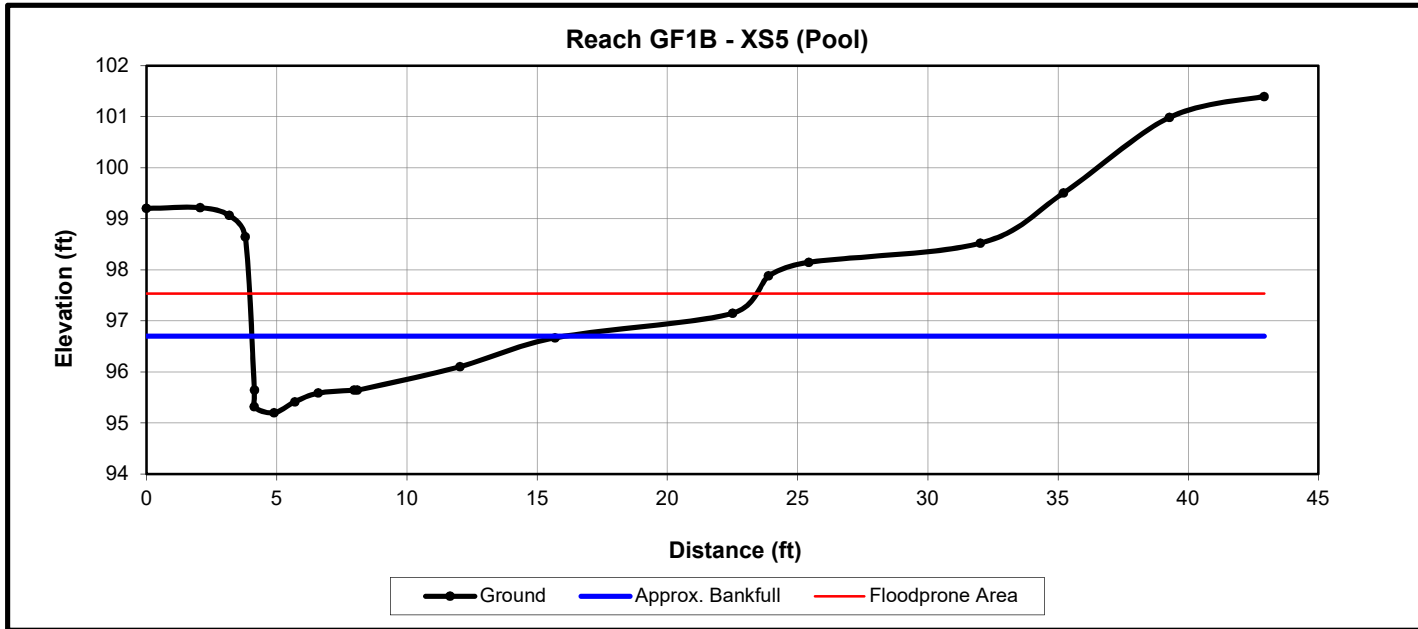




Upstream



Downstream

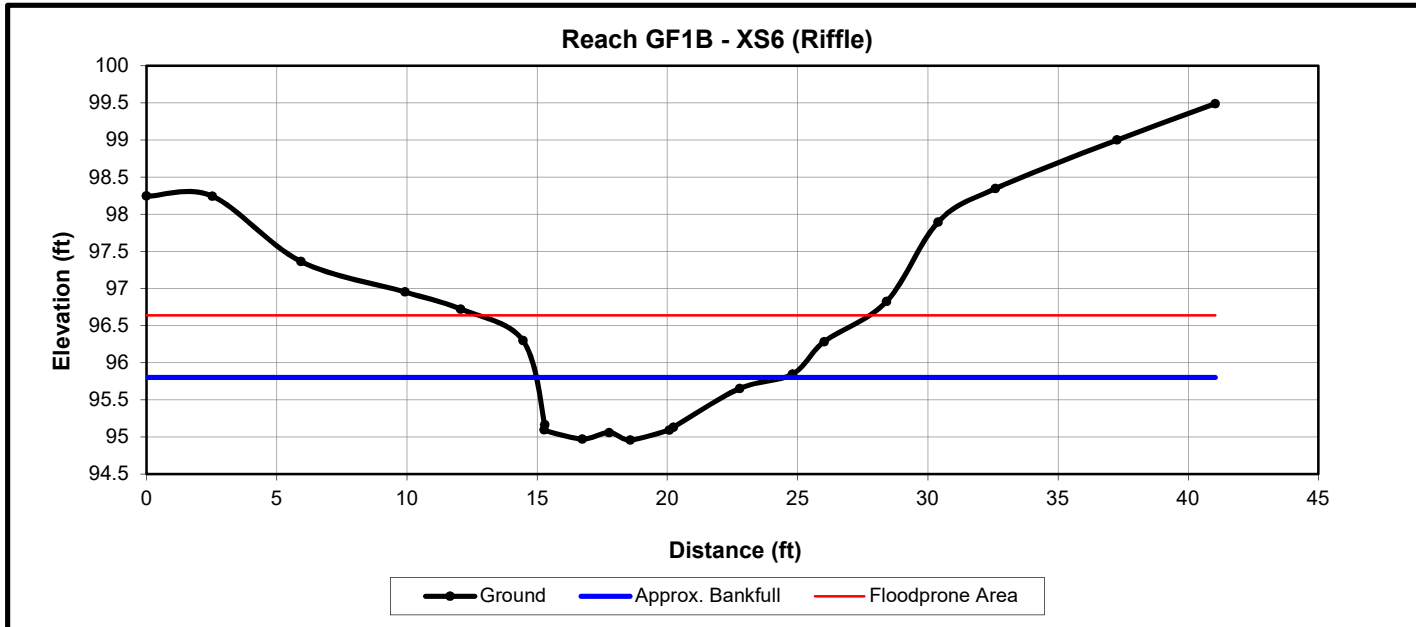




Upstream



Downstream

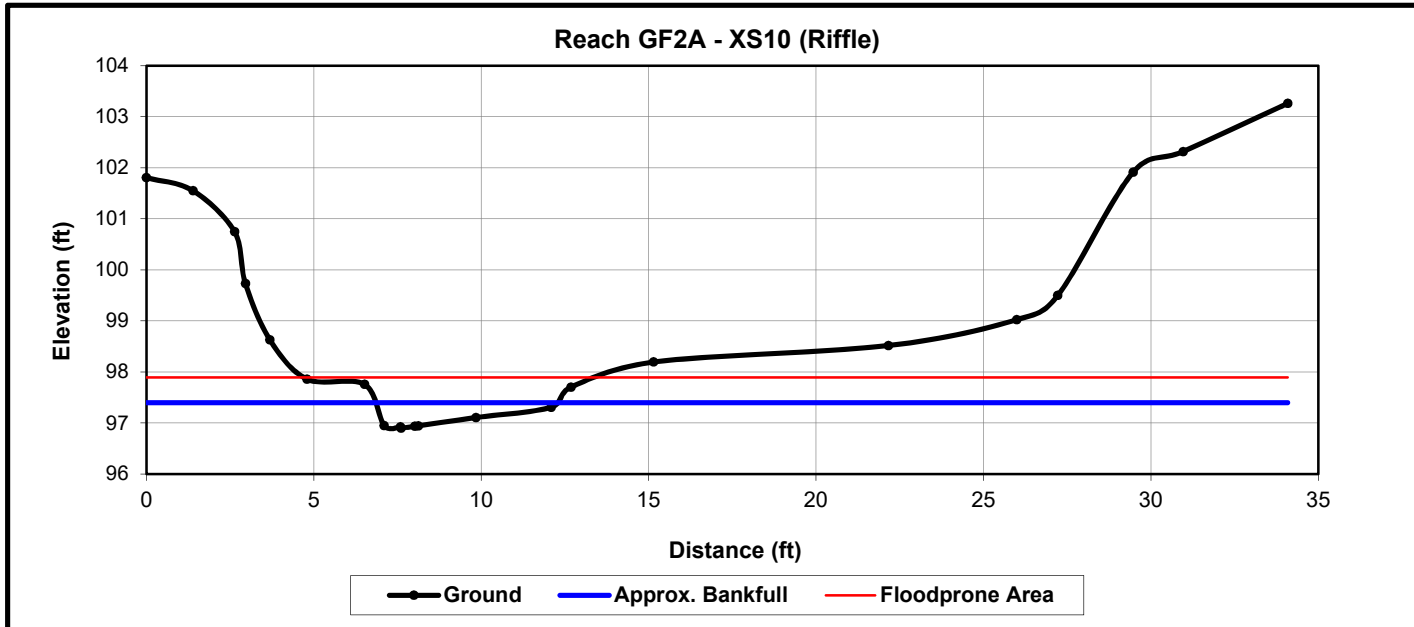




Upstream



Downstream

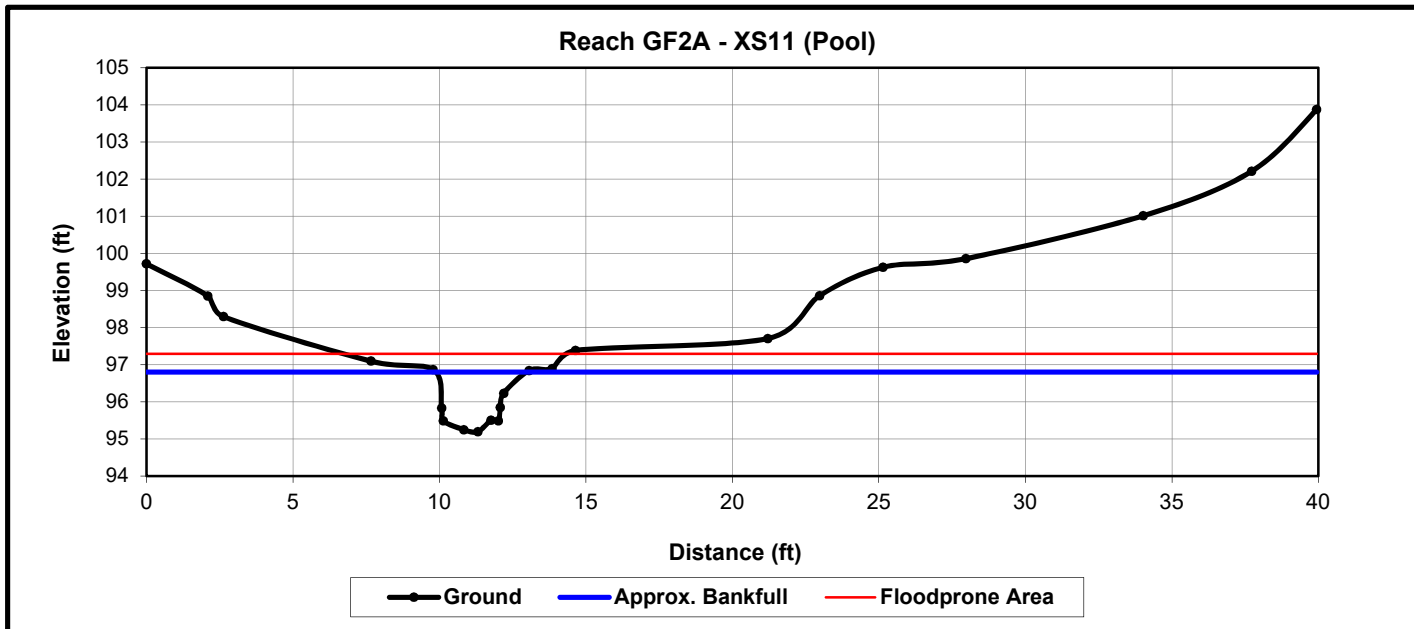




Upstream



Downstream

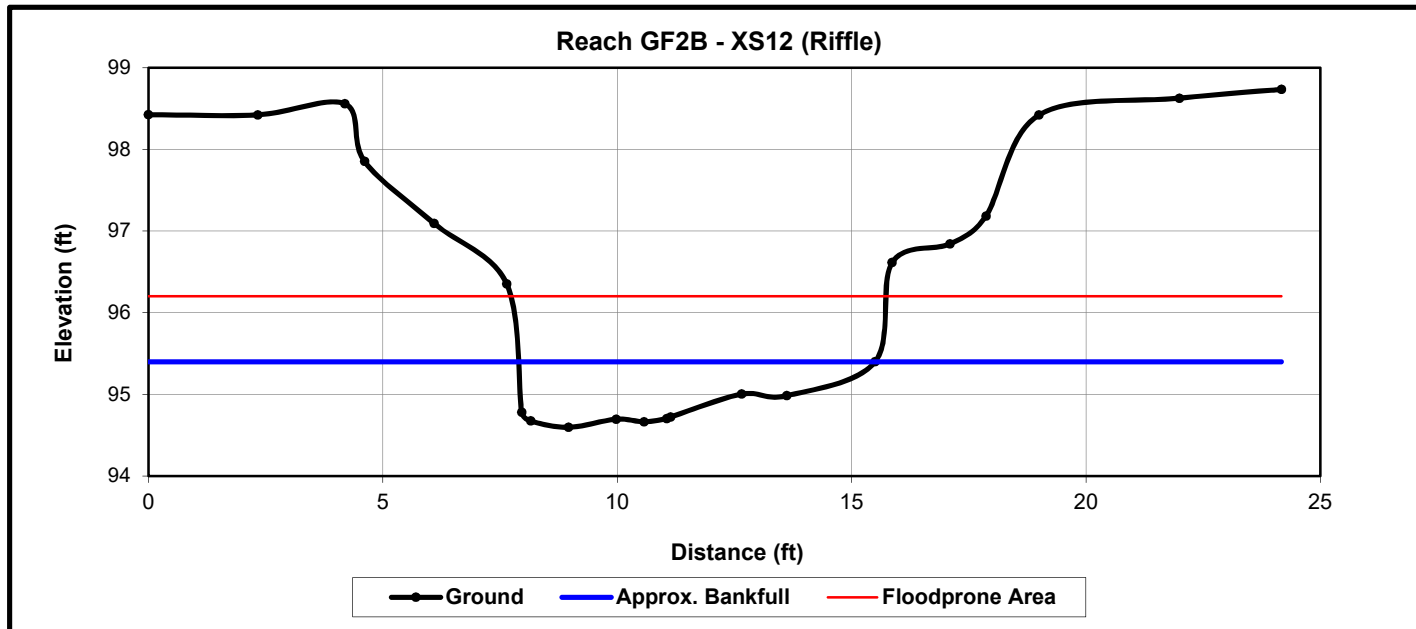




Upstream



Downstream

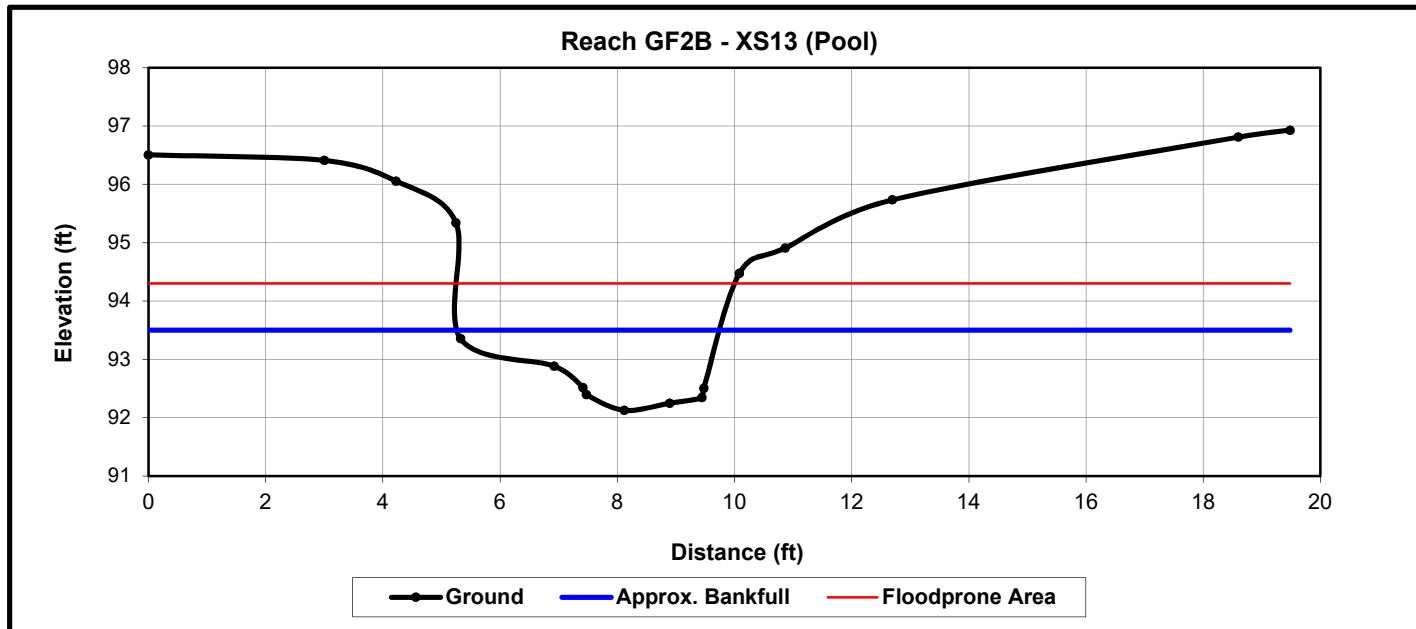




Upstream



Downstream

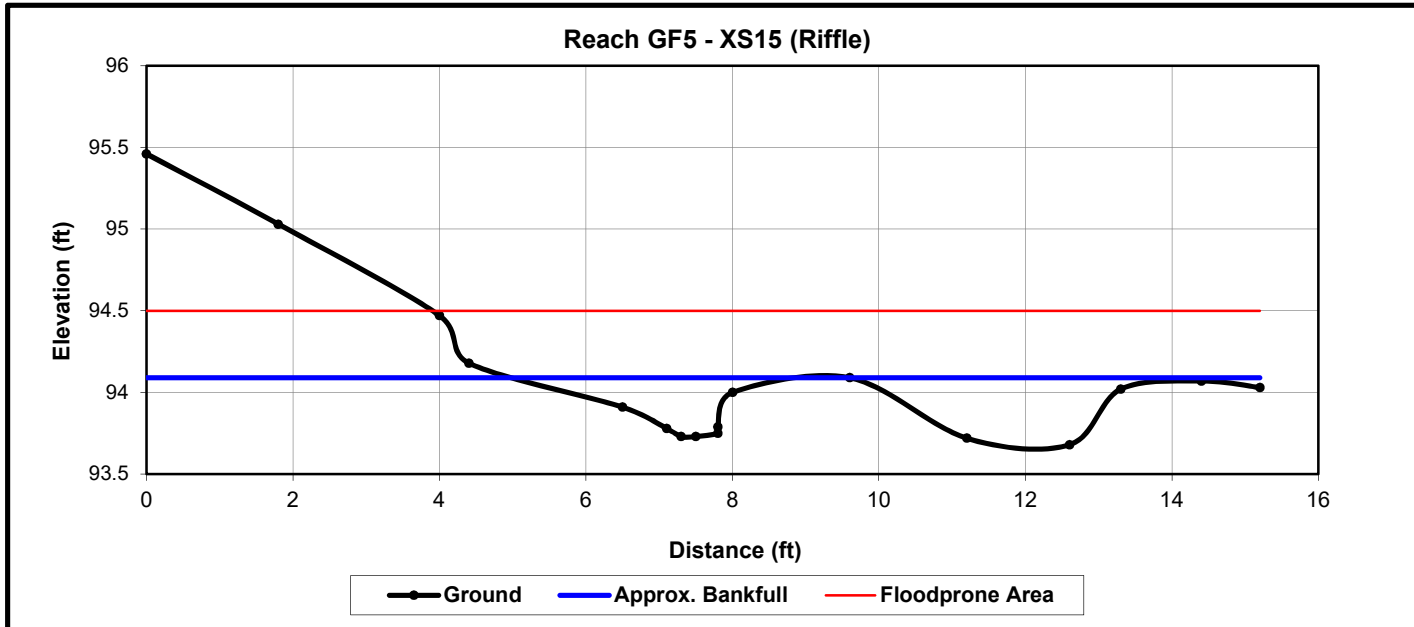




Upstream



Downstream

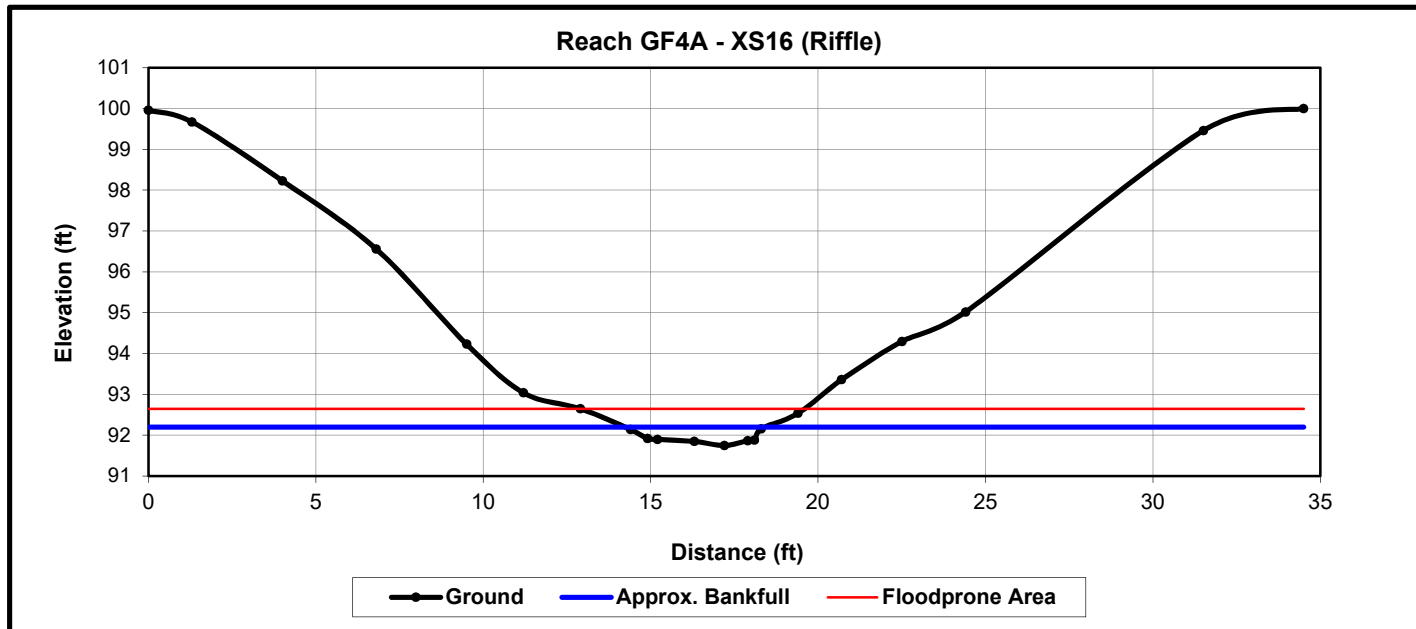




Upstream



Downstream

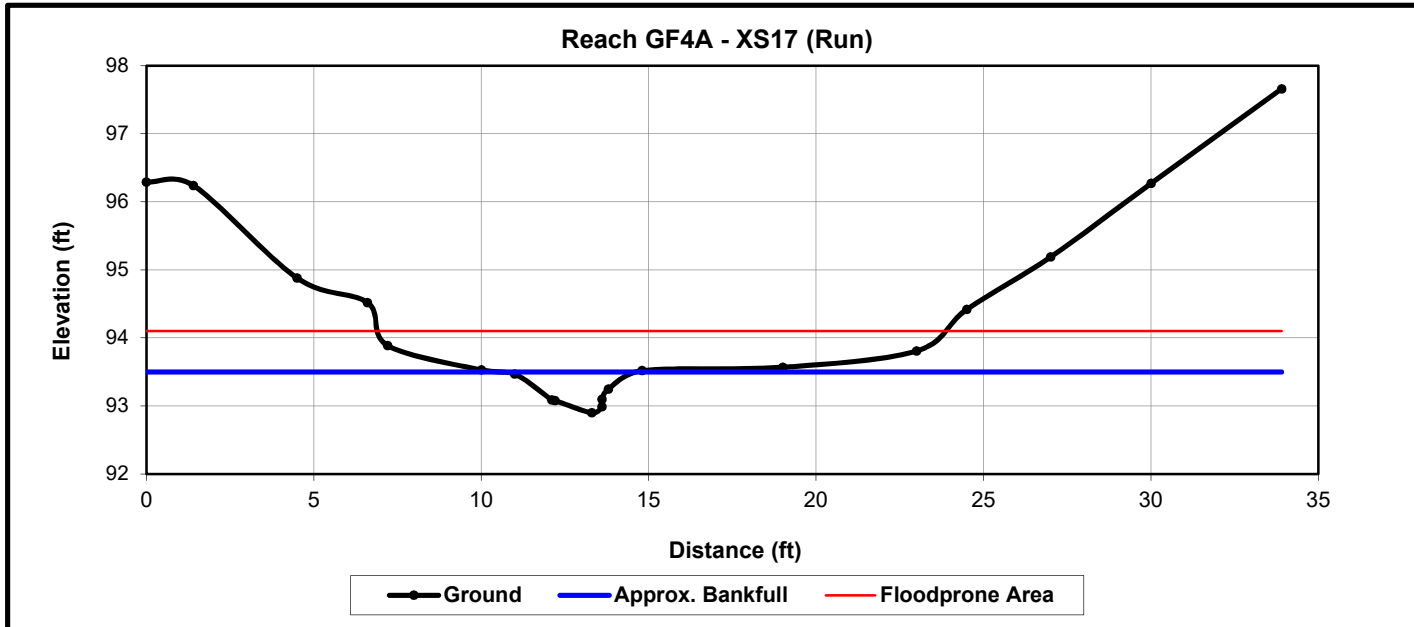




Upstream



Downstream

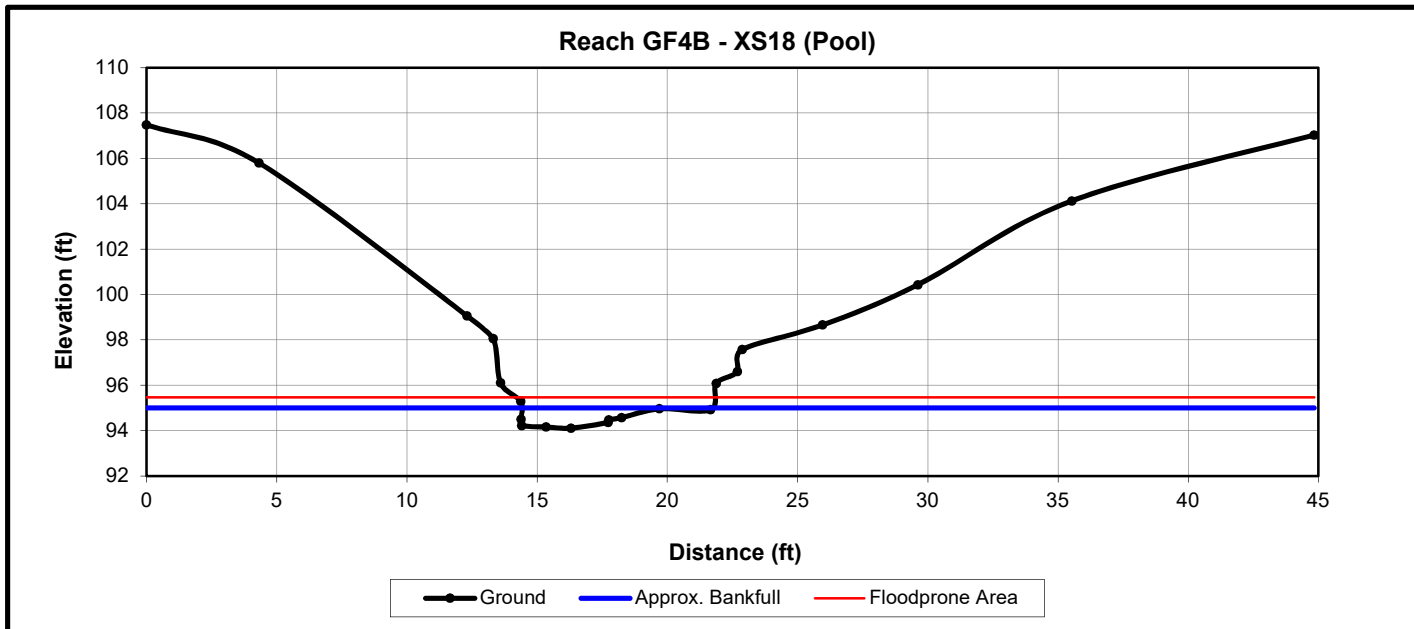




Upstream



Downstream

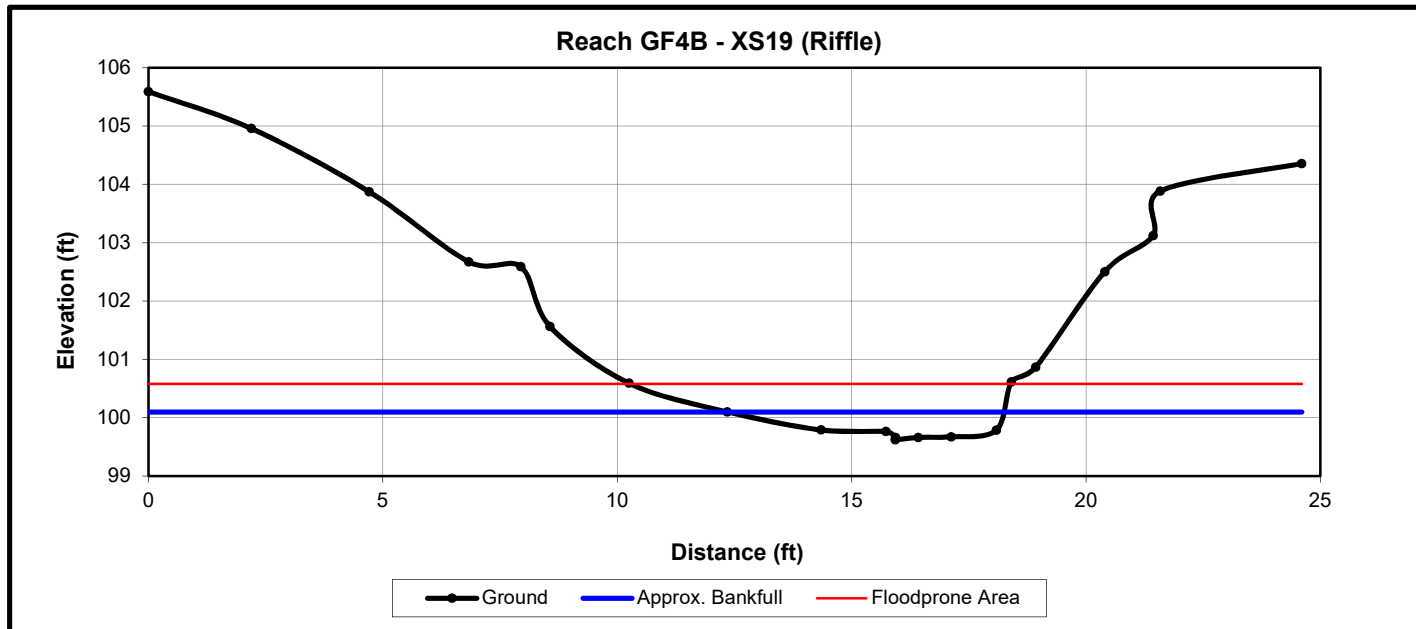




Upstream



Downstream

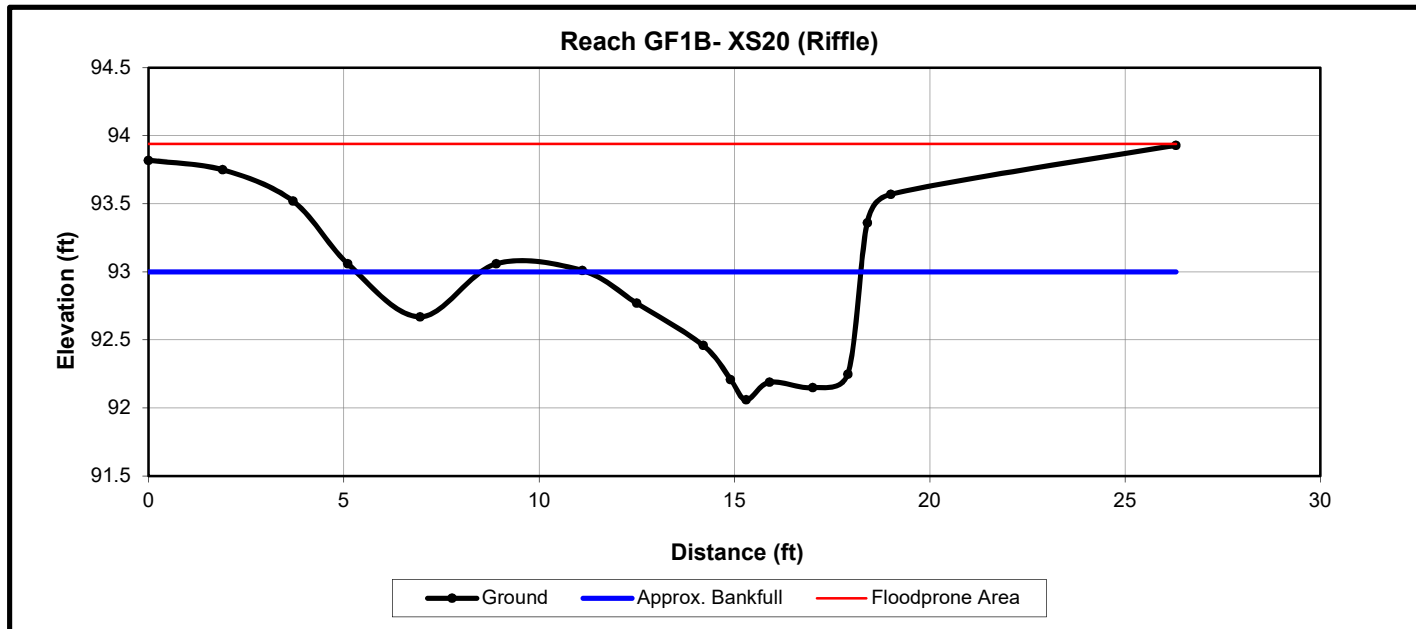




Upstream



Downstream

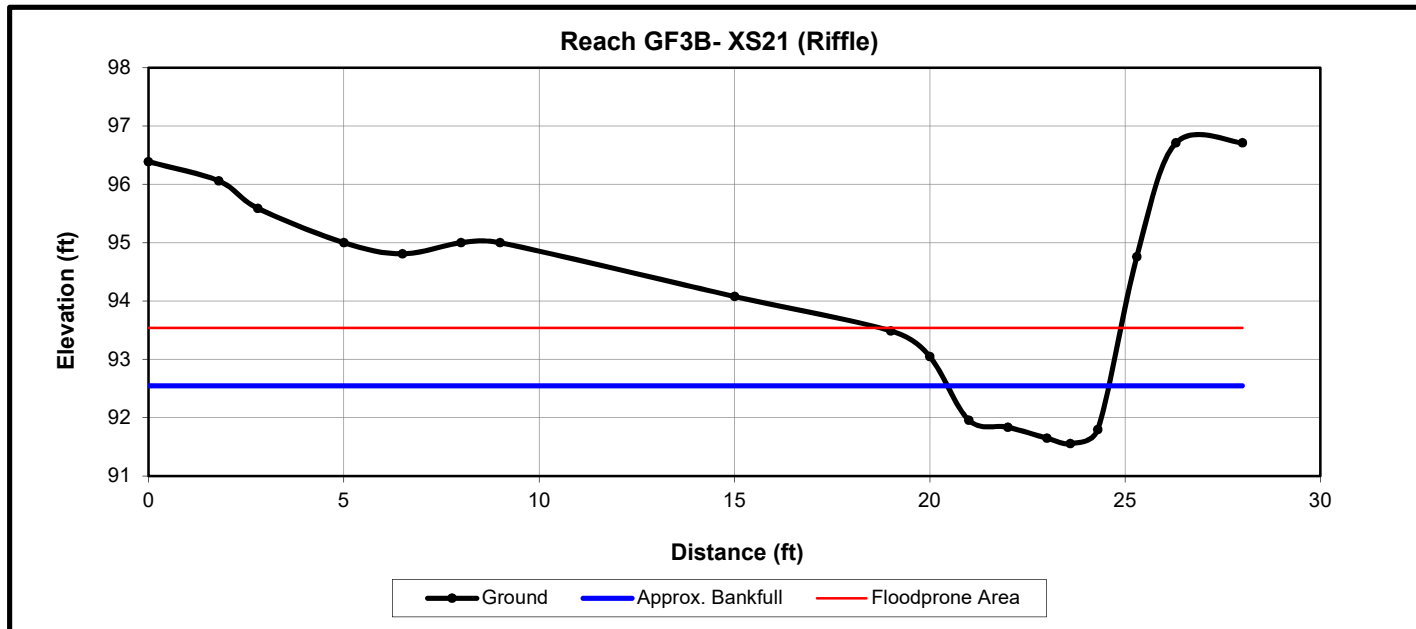




Upstream



Downstream

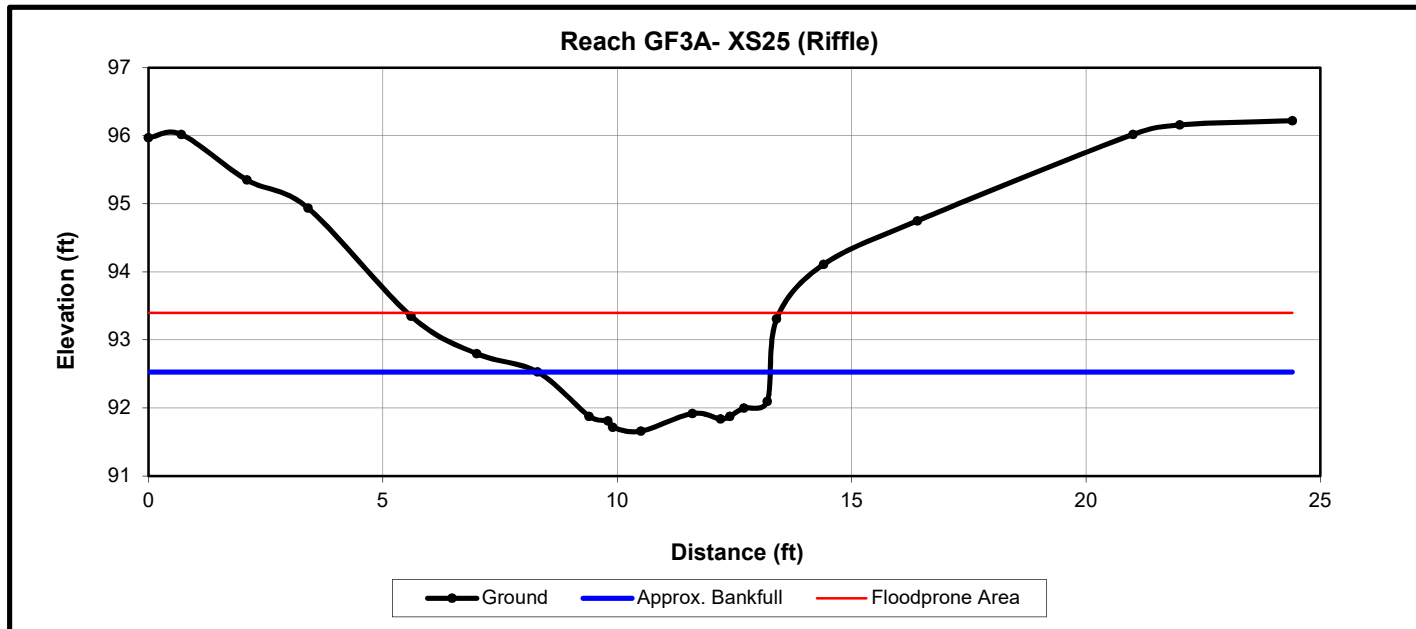




Upstream



Downstream

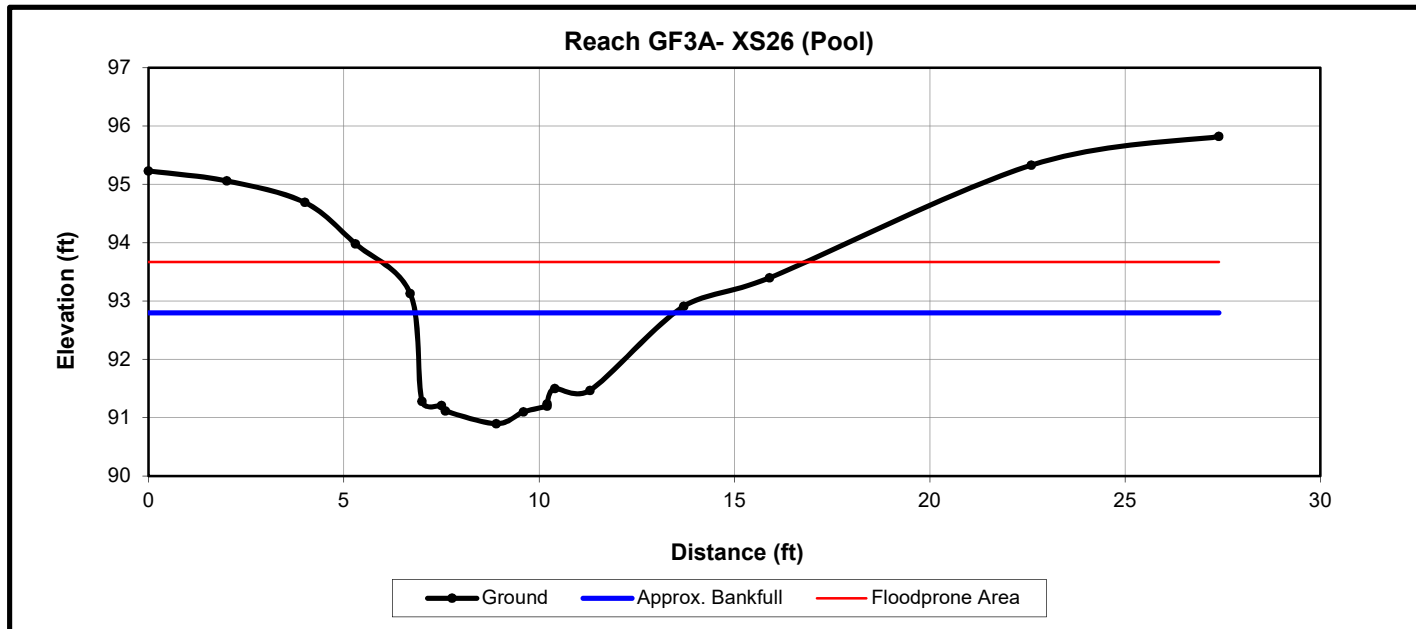




Upstream



Downstream

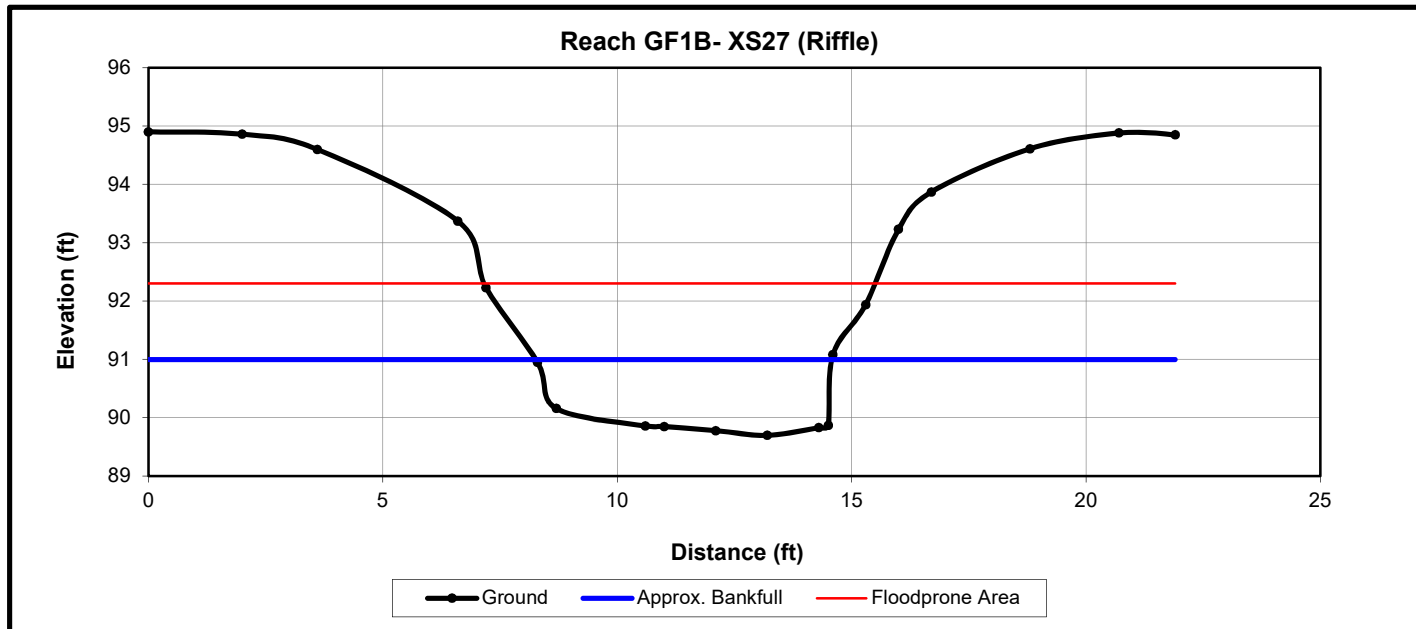




Upstream



Downstream



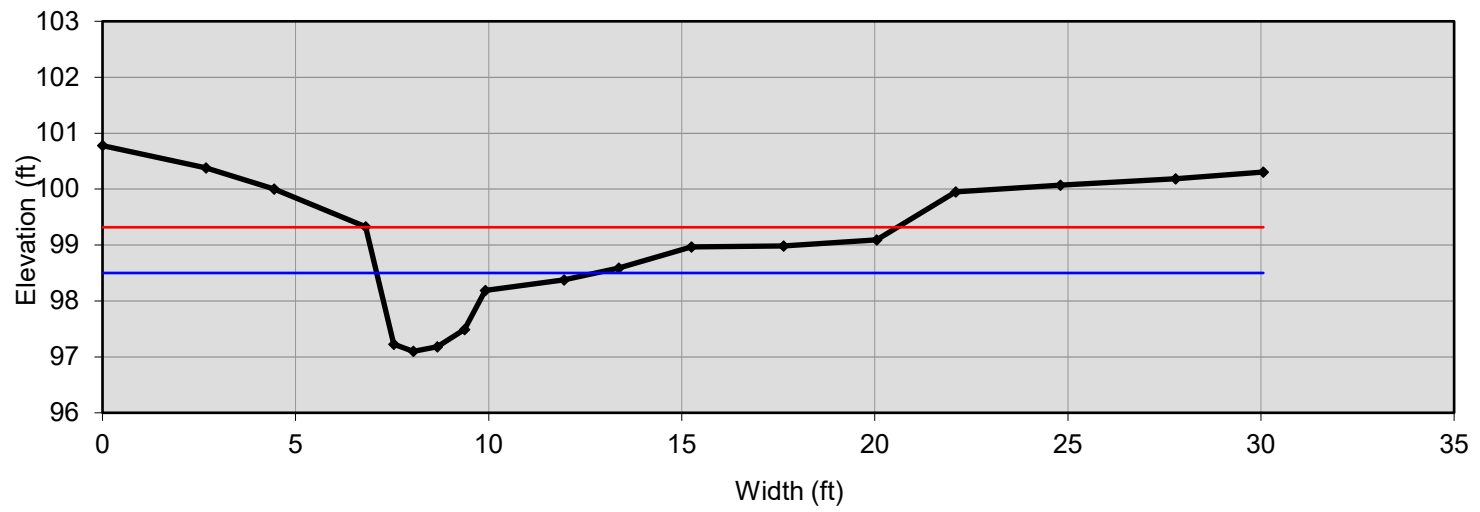
Cross Section 1 – UT to Hauser Creek - Pool



Downstream



Upstream



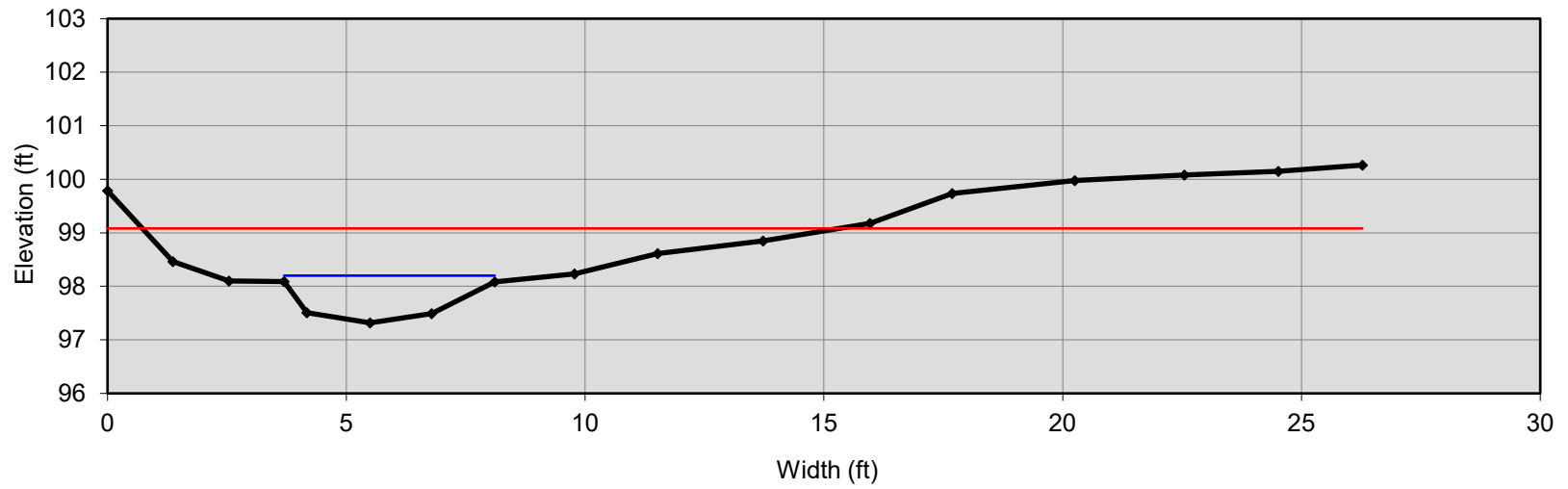
Cross Section 2 – UT to Hauser Creek – Riffle



Downstream



Upstream



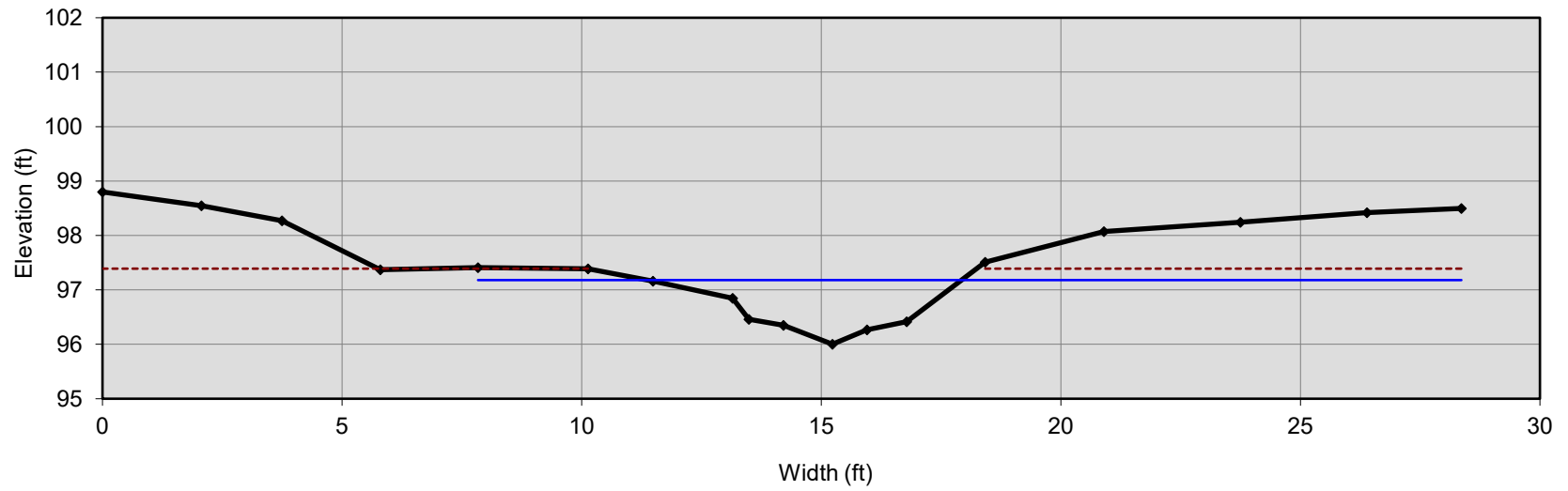
Cross Section 3 – UT to Hauser Creek – Pool



Downstream



Upstream



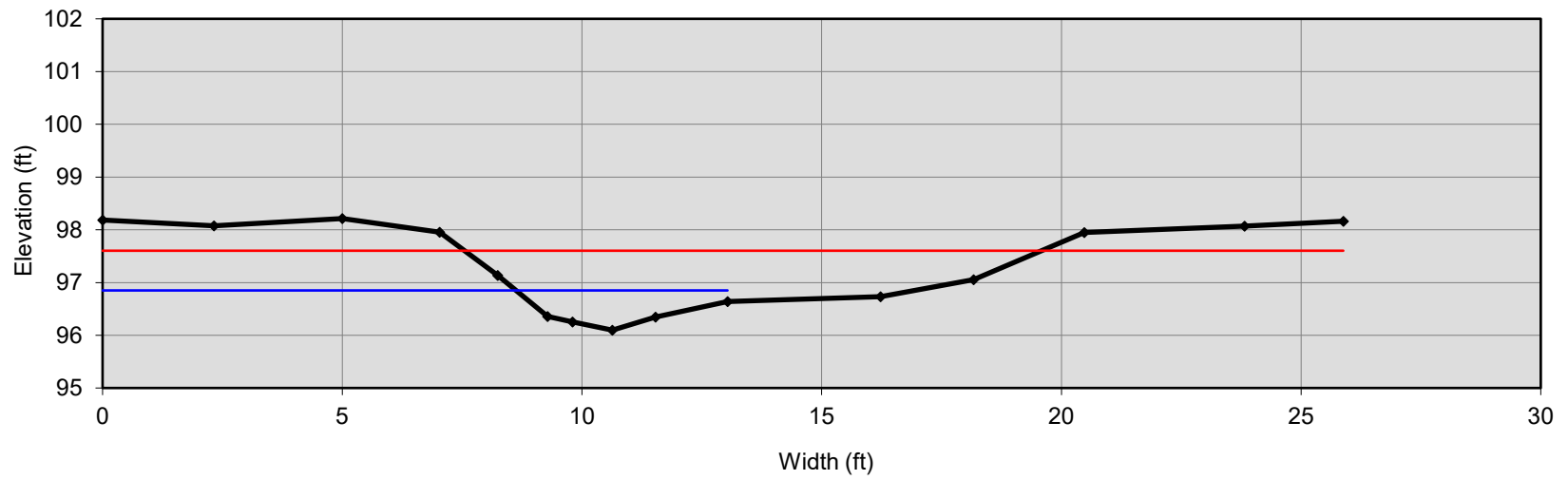
Cross Section 4 – UT to Hauser Creek – Riffle



Downstream



Upstream



Project Attribute Table

Table 4. Project Background Information

Project Name		Groundhog Hollow							
County		Alexander							
Project Area (acres)		20.58							
Project Coordinates (latitude and longitude)		35.937201° N, -81.237783° W							
Planted Acreage (Acres of Woody Stems Planted)		14.42							
Project Watershed Summary Information									
Physiographic Province		45e - Northern Inner Piedmont							
River Basin		Catawba							
USGS Hydrologic Unit 8-digit	3050101	USGS Hydrologic Unit 14-digit	3050101120030						
DWR Sub-basin		03-08-32							
Project Drainage Area (Acres and Square Miles)		156							
Project Drainage Area Percentage of Impervious Area		<1%							
CGIA Land Use Classification		Managed Herbaceous Cover, Mixed Upland Hardwoods							
Reach Summary Information									
Parameters	Reach GF1-A	Reach GF1-B	Reach GF2-A	Reach GF2-B	Reach GF3-A	Reach GF3-B	Reach GF4-A	Reach GF4-B	Reach GF5
Length of reach (existing) (within proposed easement) (linear feet)	1,254	2,100	642	609	311	270	283	381	253
Valley confinement (Confined, moderately confined, unconfined)	Moderately confined	Moderately confined/Unconfined	Confined	Moderately confined	Moderately confined	Unconfined	Moderately confined/Unconfined	Confined	Moderately confined
Drainage area (Acres and Square Miles)	42 (0.07)	156 (0.24)	35 (0.05)	45 (0.07)	36 (0.06)	39 (0.06)	16 (0.02)	23 (0.04)	9 (0.01)
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial	Perennial	Perennial	Intermittent	Intermittent	Perennial
NCDWR Water Quality Classification	C	C	C	C	C	C	C	C	C
Stream Classification (existing)	F4b	G4c/C4	F4b	F4b	G4	G5/6	G4	F4b	C4/5a
Stream Classification (proposed)	F4b	C4/E4	F4b	C4/E4	G4	C4/E4	G4	F4b	C4/5a
Evolutionary trend (Simon)	III / IV	II / III	IV	III	III / IV	III	IV / V	IV	I
FEMA classification	Zone X	Zone X and Zone AE	Zone X	Zone X	Zone X	Zone X	Zone X	Zone X	Zone X
Wetland Summary Information									
Parameters	WA	WB	WC	WD	WE	WF			
Size of Wetland (acres)	0.06	0.09	0.05	0.15	0.04	0.01			
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian riverine	Riparian riverine	Riparian riverine	Riparian riverine	Riparian riverine	Riparian riverine			
Mapped Soil Series	Fairview sandy loam	Fairview sandy loam	Codus loam	Codus loam	Fairview sandy loam	Fairview sandy loam			
Drainage class	Well	Well	Somewhat poorly	Somewhat poorly	Well	Well			
Soil Hydric Status	Nonhydric	Nonhydric	Predominantly nonhydric	Predominantly nonhydric	Nonhydric	Nonhydric			
Source of Hydrology	Groundwater, seepage	Groundwater, overland	Groundwater, flooding	Groundwater, flooding	Groundwater, seepage	Groundwater, seepage			
Restoration or enhancement method (hydrologic, vegetative etc.)	N/A	N/A	N/A	N/A	N/A	N/A			
Regulatory Considerations									
Parameters	Applicable?	Resolved?	Supporting Docs?						
Water of the United States - Section 404	Yes	No	Appendix K						
Water of the United States - Section 401	Yes	No	Appendix K						
Endangered Species Act	Yes	Yes	Appendix K						
Historic Preservation Act	Yes	Yes	Appendix K						
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A						
FEMA Floodplain Compliance	Yes	No	Appendix L						
Essential Fisheries Habitat	No	N/A	N/A						

Appendix C – Site Protection Instrument

SITE PROTECTION INSTRUMENT

Site Protection Instrument(s) Summary Information

The land required for the construction, management, and stewardship of this mitigation project includes portions of the parcels listed below in Table C1. EBX-Neuse I, LLC (an entity of RES) has obtained a conservation easement from the current landowners for the project area. The easement deed and survey plat will be submitted to DMS and State Property Office (SPO) for approval and will be held by the State of North Carolina. The easement deed will follow the NCDMS Full Delivery Conservation Easement Template dated May 5, 2017 and included in this appendix. Once recorded, the secured easement will allow EBX-Neuse I, LLC to proceed with the project development and protect the mitigation assets in perpetuity. Once finalized, a copy of the land protection instrument(s) will be included in **Appendix C**.

Table C1. Project Parcel and Landowner Information

Owner of Record	Tax Parcel ID #	County	Site Protection Instrument	Deed Book and Page Numbers	Acreage Protected
Gene Lynn & Donna S Fox	3830-84-9704 3830-84-1058 3830-73-5760 3830-82-0800	Alexander	Conservation Easement	246/469 195/886 579/2161 313/618	15.977
Herman Farms	3830-64-8068 3830-75-5090	Alexander	Conservation Easement	237/58	3.899
Jeffrey Walker	3830-82-9684	Alexander	Conservation Easement	583/2485	0.198

STATE OF NORTH CAROLINA

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

_____ COUNTY

SPO File Number:

DMS Project Number:

Prepared by: Office of the Attorney General
Property Control Section
Return to: NC Department of Administration
State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS, made this _____ day of _____, 20__, by _____ *Landowner name goes here*, (“**Grantor**”), whose mailing address is _____ *Landowner address goes here* _____, to the State of North Carolina, (“**Grantee**”), whose mailing address is 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 (insert name and address of full delivery contract provider) and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number _____.

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 Environmental Quality, 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 _____ Township, _____ County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately _____ acres and being conveyed to the Grantor by deed as recorded in **Deed Book** _____ **at Page** _____ of the _____ 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 ***if known, insert name of stream, branch, river or waterway here.***

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 along with a general Right of Access.

The Conservation Easement Area consists of the following:

Tracts Number _____ containing a total of _____ **acres** as shown on the plats of survey entitled "Final Plat, Conservation Easement for North Carolina Division of Mitigation Services, Project Name: _____, SPO File No. _____, EEP Site No. _____, Property of _____," dated _____, 20__ by ***name of surveyor,*** PLS Number _____ and recorded in the _____ County, North Carolina Register of Deeds at **Plat Book** _____ **Pages** _____.

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. 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.

III. GRANTEE RESERVED USES

A. Right of Access, Construction, and Inspection. The Grantee, its employees and agents, successors and assigns, receive a perpetual Right of Access to the Conservation Easement Area over the Property at reasonable times to undertake any activities on the property to restore, construct, manage, maintain, enhance, protect, and monitor the stream, wetland and any other riparian resources in the Conservation Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

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 subterranean 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.

IV. 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.

V. 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 said premises 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.

_____ (SEAL)

NORTH CAROLINA
COUNTY OF _____

I, _____, a Notary Public in and for the County and State aforesaid, do hereby certify that _____, 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 _____ day of _____, 20__.

Notary Public

My commission expires:

Exhibit A

[INSERT LEGAL DESCRIPTION]

Appendix D – Credit Release Schedule

CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported in the approved final mitigation plan, unless there are major discrepancies and then a mitigation plan addendum will be submitted. 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 IRT, will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to be restarted or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows in **Tables D1**.

Table D1. Stream Credit Release Schedule

Credit Release Milestone	Release Activity	Interim Release	Total Release
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met	5%	65% (75%**)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%**)
6*	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%**)
7	Seventh year monitoring report demonstrates performance standards are being met and project has received closeout approval	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 IRT.*

***10% reserve of credits to be held back until the bankfull event performance standard has been met.*

Initial Allocation of Released Credits

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

- 1) Approval of the final Mitigation Plan.
- 2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
- 3) Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; per the DMS Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
- 4) Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

Subsequent Credit Releases

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

Appendix E – Financial Assurance

FINANCIAL ASSURANCE

Pursuant to Section IV H and Appendix III of the NCDEQ DMS (formerly Ecosystem Enhancement Program) In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environmental Quality (NCDEQ) has provided the USACE-Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by NCDEQ DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

Appendix F – Maintenance Plan

MAINTENANCE PLAN

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

F1. Maintenance Plan

Component/Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting. Stream maintenance activities will be documented and reported in annual monitoring reports. Stream maintenance will continue through the monitoring period.
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 treated by mechanical and/or chemical methods. Any vegetation requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations. Vegetation maintenance activities will be documented and reported in annual monitoring reports. Vegetation maintenance will continue through the monitoring period.
Project Boundary	Project boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries will be marked with signs identifying the property as a mitigation site, and will include the name of the long-term steward and a contact number. 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. Easement monitoring and staking/signage maintenance will continue in perpetuity as a stewardship activity.
Road Crossing	Road crossings within the site may be maintained only as allowed by conservation easement or existing easement, deed restrictions, rights of way, or corridor agreements. Any culvert crossing maintenance will be the responsibility of RES through completion of monitoring. Once the Project has completed monitoring and the Project is closed out, all crossings will be the responsibility of the landowner(s).
Livestock Fencing	Livestock fencing is to be placed outside the easement limits. Maintenance of fencing is the responsibility of the landowner after the project has closed out.
Beaver	Routine site visits and monitoring will be used to determine if beaver management is needed. If beaver activity poses a threat to project stability or vegetative success, RES will trap beavers and remove impoundments as needed. All beaver management activities will be documented and included in annual monitoring reports. Beaver monitoring and management will continue through the monitoring period.

Appendix G – DWR Stream ID Forms

NC DWQ Stream Identification Form Version 4.11

Date: 9/13/2017	Project/Site: GH GF1-A	Latitude:
Evaluator: DPF	County: Alexander	Longitude:
Total Points: Stream is at least intermittent if ≥ 19 or perennial if $\geq 30^*$ 39	Stream Determination (circle one) Ephemeral Intermittent <u>Perennial</u>	Other e.g. Quad Name:

A. Geomorphology (Subtotal = 18.5)

	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 = 9.5)

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 = 0	

C. Biology (Subtotal = 11)

18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macroinvertebrates (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:

NC DWQ Stream Identification Form Version 4.11

Date: 9/13/2017	Project/Site: GH GFI-B	Latitude:
Evaluator: DPI	County: Alexander	Longitude:
Total Points: 40.5 <small>Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*</small>	Stream Determination (circle one) Ephemeral Intermittent <u>Perennial</u>	Other e.g. Quad Name:

A. Geomorphology (Subtotal = 21.5)

	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 = 9)

12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	1.5	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 = 10)

18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macroinvertebrates (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	1.5	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:

NC DWQ Stream Identification Form Version 4.11

Date: 9/13/2017	Project/Site: GH GF-2	Latitude:
Evaluator: DPF	County: Alexander	Longitude:
Total Points: 31 <i>Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*</i>	Stream Determination (circle one) Ephemeral Intermittent <u>Perennial</u>	Other e.g. Quad Name:

A. Geomorphology (Subtotal = 13)

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

^a artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8.5)

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 = 9.5)

18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macroinvertebrates (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:

NC DWQ Stream Identification Form Version 4.11

Date: 9/13/2017	Project/Site: GH - GF3	Latitude:
Evaluator: DPI	County: Alexander	Longitude:
Total Points: Stream is at least intermittent if ≥ 19 or perennial if ≥ 30 * 34.5	Stream Determination (circle one) Ephemeral Intermittent <u>Perennial</u>	Other e.g. Quad Name:

A. Geomorphology (Subtotal = 17)

	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 = 8)

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 = 9.5)

18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macroinvertebrates (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:

NC DWQ Stream Identification Form Version 4.11

Date: <u>9/13/2017</u>	Project/Site: <u>EH GF4</u>	Latitude:
Evaluator: <u>DPF</u>	County: <u>Alexander</u>	Longitude:
Total Points: Stream is at least intermittent if ≥ 19 or perennial if $\geq 30^*$ <u>25.75</u>	Stream Determination (circle one) Ephemeral <u>Intermittent</u> Perennial	Other e.g. Quad Name:

A. Geomorphology (Subtotal = 11)

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

^a artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)

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

C. Biology (Subtotal = 7.25)

18. Fibrous roots in streambed	3	<u>2</u>	1	0
19. Rooted upland plants in streambed	<u>3</u>	2	1	0
20. Macroinvertebrates (note diversity and abundance)	0	<u>1</u>	2	3
21. Aquatic Mollusks	<u>0</u>	1	2	3
22. Fish	<u>0</u>	0.5	1	1.5
23. Crayfish	<u>0</u>	0.5	1	1.5
24. Amphibians	<u>0</u>	<u>0.5</u>	1	1.5
25. Algae	<u>0</u>	0.5	1	1.5
26. Wetland plants in streambed	FAOW = 0.75; OBL = 1.5 Other = 0			

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 9/13/2017	Project/Site: GH GF5	Latitude:
Evaluator: DPF	County:	Longitude:
Total Points: 31.5 <i>Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*</i>	Stream Determination (circle one) Ephemeral Intermittent <u>Perennial</u>	Other e.g. Quad Name:

A. Geomorphology (Subtotal = 15)

	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 = 8)

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. Macroinvertebrates (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:

Appendix H – USACE District Assessment Forms

GFI-A

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	2
	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	1
	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	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	2
	15	Impact by agriculture, livestock, or timber production (substantial impact = 0; no evidence = max points)	0 – 5	0 – 4	0 – 5	1
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	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	2
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	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	2
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						41

* These characteristics are not assessed in coastal streams.

GFI-B

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	1
	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	3
	7	Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	2
	8	Presence of adjacent wetlands (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	3
	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	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	2
	15	Impact by agriculture, livestock, or timber production (substantial impact = 0; no evidence = max points)	0 – 5	0 – 4	0 – 5	1
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	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	2
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	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	2
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						44

* These characteristics are not assessed in coastal streams.

GFZ-A

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	1
	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	2
	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	1
	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	0
	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	1
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	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	2
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	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	2
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						38

* These characteristics are not assessed in coastal streams.

GFZ-B

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	0
	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	2
	7	Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	2
	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	1
	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	2
	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	1
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	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	2
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	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	2
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						41

* These characteristics are not assessed in coastal streams.

643-A

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	2
	7	Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	2
	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	1
	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	2
	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	1
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	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	2
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	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	2
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						43

* These characteristics are not assessed in coastal streams.

643-B

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	1
	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	2
	7	Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	2
	8	Presence of adjacent wetlands (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	1
	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	1
	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	2
	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	1
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	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	2
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	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	2
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						41

* These characteristics are not assessed in coastal streams.

GF4-A

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	1
	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	2
	7	Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	2
	8	Presence of adjacent wetlands (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	1
	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	0
	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	0
	13	Presence of major bank failures (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	0
	14	Root depth and density on banks (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	1
	15	Impact by agriculture, livestock, or timber production (substantial impact = 0; no evidence = max points)	0 – 5	0 – 4	0 – 5	1
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	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	2
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	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	2
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						34

* These characteristics are not assessed in coastal streams.

GF4-B

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	1
	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	1
	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	0
	8	Presence of adjacent wetlands (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	1
	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	0
	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	0
	13	Presence of major bank failures (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	0
	14	Root depth and density on banks (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	1
	15	Impact by agriculture, livestock, or timber production (substantial impact = 0; no evidence = max points)	0 – 5	0 – 4	0 – 5	1
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	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	2
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	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	2
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						29

* These characteristics are not assessed in coastal streams.

645

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	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	4
	6	Presence of adjacent floodplain (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	4
	7	Entrenchment / floodplain access (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	4
	8	Presence of adjacent wetlands (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	4
	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	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	3
	13	Presence of major bank failures (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	4
	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	1
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	1
BIOLOGY	20	Presence of stream invertebrates (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	2
	21	Presence of amphibians (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	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	2
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						55

* These characteristics are not assessed in coastal streams.

Appendix I – Wetland JD Forms and Maps

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action ID: SAW-2018-00450 County: Alexander U.S.G.S. Quad: Taylorsville

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: Jeremy Schmid
Address: 302 Jefferson Street, Suite 110
Raleigh, NC 27605
Telephone Number: 919-926-1473

Size (acres): 23 acres Nearest Town: Taylorsville
Nearest Waterway: Beaver Branch Coordinates: 35.9383, -81.23825
River Basin/ HUC: Upper Catawba

Location description: The project is located at Groundhog Hollow Drive near Taylorsville, NC Pin # 0001175, 0001176, 0001589, 0001029, 0014092

Indicate Which of the Following Apply:

A. Preliminary Determination

- 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 16, 2018 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

Issue Date of JD: **January 31, 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:

David Lee Herman, 374 David Herman Rd Taylorsville, NC 28681,

Gene Lynn Fox & Donna S. Fox, 1444 Zeb Watts Rd. Taylorsville, NC 28681

**NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND
REQUEST FOR APPEAL**

Applicant: Jeremy Schmid	File Number: SAW-SAW-2018-00450	Date: January 31, 2019
Attached is:	See Section below	
<input type="checkbox"/> INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A	
<input type="checkbox"/> PROFFERED PERMIT (Standard Permit or Letter of permission)	B	
<input type="checkbox"/> PERMIT DENIAL	C	
<input type="checkbox"/> APPROVED JURISDICTIONAL DETERMINATION	D	
<input checked="" type="checkbox"/> 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.

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

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 (JD) FORM
U.S. Army Corps of Engineers**

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JD: January 31, 2019

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:

Jeremy Schmid
302 Jefferson Street. Suite 110
Raleigh, NC 27605

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:

CESAW-RG-A, SAW-2018-00450,

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:

The project is located at Groundhog Hollow Drive near Taylorsville, NC Pin # 0001175, 0001176, 0001589, 0001029, 0014092

State: NC County/parish/borough: **Alexander** City: Taylorsville
Center coordinates of site (lat/long in degree decimal format): 35.9384, -81.2340
Universal Transverse Mercator: N/A
Name of nearest waterbody: **Beaver Branch**

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

- Office (Desk) Determination. Date: **January 31, 2019**
- Field Determination. Date(s): **May 16, 2018**

Use the table below to document aquatic resources and/or aquatic resources at different sites

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

WA	Centered Coordinates (decimal degrees)		Estimated Amount of Aquatic Resource in Review Area (linear feet or acre)	Type of Aquatic Resources	Geographic Authority to Which Aquatic Resource "May Be" Subject
	Latitude	Longitude			
WA	35.938472	-81.233017	0.05	<input checked="" type="checkbox"/> Wetland <input type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404
WB	-81.234016	35.938822	0.11	<input checked="" type="checkbox"/> Wetland <input type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404
WC	-81.234712	35.940558	0.05	<input checked="" type="checkbox"/> Wetland <input type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404
WD	-81.233755	35.940426	0.17	<input checked="" type="checkbox"/> Wetland <input type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404
WE	-81.237211	35.938574	0.05	<input checked="" type="checkbox"/> Wetland <input type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404
WF	-81.237236	35.937302	0.01	<input checked="" type="checkbox"/> Wetland <input type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404
Pond	-81.237179	35.938764	0.04	<input type="checkbox"/> Wetland <input checked="" type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404

GF-1	-81.23747	35.939553	3058	<input type="checkbox"/> Wetland <input checked="" type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404
GF-2	-81.237333	35.937708	1186	<input type="checkbox"/> Wetland <input checked="" type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404
GF-3	-81.234288	35.939363	597	<input type="checkbox"/> Wetland <input checked="" type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404
GF-4	-81.233243	35.938697	673	<input type="checkbox"/> Wetland <input type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404
GF-5	-81.234126	35.93881	244	<input type="checkbox"/> Wetland <input checked="" type="checkbox"/> Non-wetland Waters	<input checked="" type="checkbox"/> Section 404 <input type="checkbox"/> Section 10/404

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 preliminary JD (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 preliminary JD requester: **Vicinity, USGS, NWI, Existing Condition, WOUS**
- Data sheets prepared/submitted by or on behalf of preliminary JD requester.
 - Office concurs with data sheets/delineation report.
 - Office does not concur with data sheets/delineation report. Rational:
- Data sheets prepared by the Corps:
- Corps navigable waters' study:
- U.S. Geological Survey (USGS) Hydrologic Atlas:
 - USGS NHD data.
 - USGS 8 and 12 digit HUC maps.
- USGS map(s). Cite scale & quad name: **Taylorville.**
- Natural Resources Conservation Service (NRCS) Soil Survey.
 - Citation: **Alexander County, NC**
- National wetlands inventory (NWI) map(s). Cite name:
- State/Local wetland inventory map(s):
- Federal Emergency Management Agency (FEMA) / Flood Insurance Rate Map (FIRM) maps:
- 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- Photographs: Aerial (Name & Date):
 - or Other (Name & Date):
- Previous determination(s). File no. and date of response letter:
- Applicable/supporting scientific literature:
- 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.

On File

William Elliott, January 31, 2019
Signature and date of Regulatory
staff member completing
preliminary JD

Jeremy Schmid
Signature and date of person requesting
preliminary JD (REQUIRED, unless obtaining the
signature is impracticable)

Two copies of this Preliminary JD Form have been provided. Please sign both copies. Keep one signed copy for your record and return a signed copy to the Asheville Regulatory Field Office by mail or e-mail.

*US Army Corps of Engineers-Wilmington District
Asheville Regulatory Field Office
151 Patton Avenue, Room 208
Asheville, NC 28801-5006*

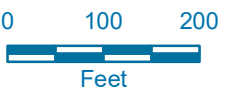
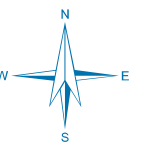
¹ Districts may establish timeframes for requester to return signed PJD forms. If the requester does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

Legend

- Study Area
- ⊗ Wetland Data Points
- ⊗ Upland Data Points
- Potential Non-Wetland Waters of the US
- Potential Wetland Waters of the US
- Pond



Potential Wetland or Non-Wetland Waters of the U.S. Map
Groundhog Hollow Mitigation Site
 Alexander County, North Carolina



PROJECT MANAGER:	
DRAWN:	ATP
JOB NUMBER:	#####
DATE:	09/29/2017
REVISIONS:	
MDE 05/16/2018	

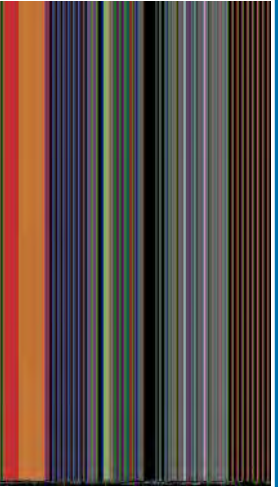
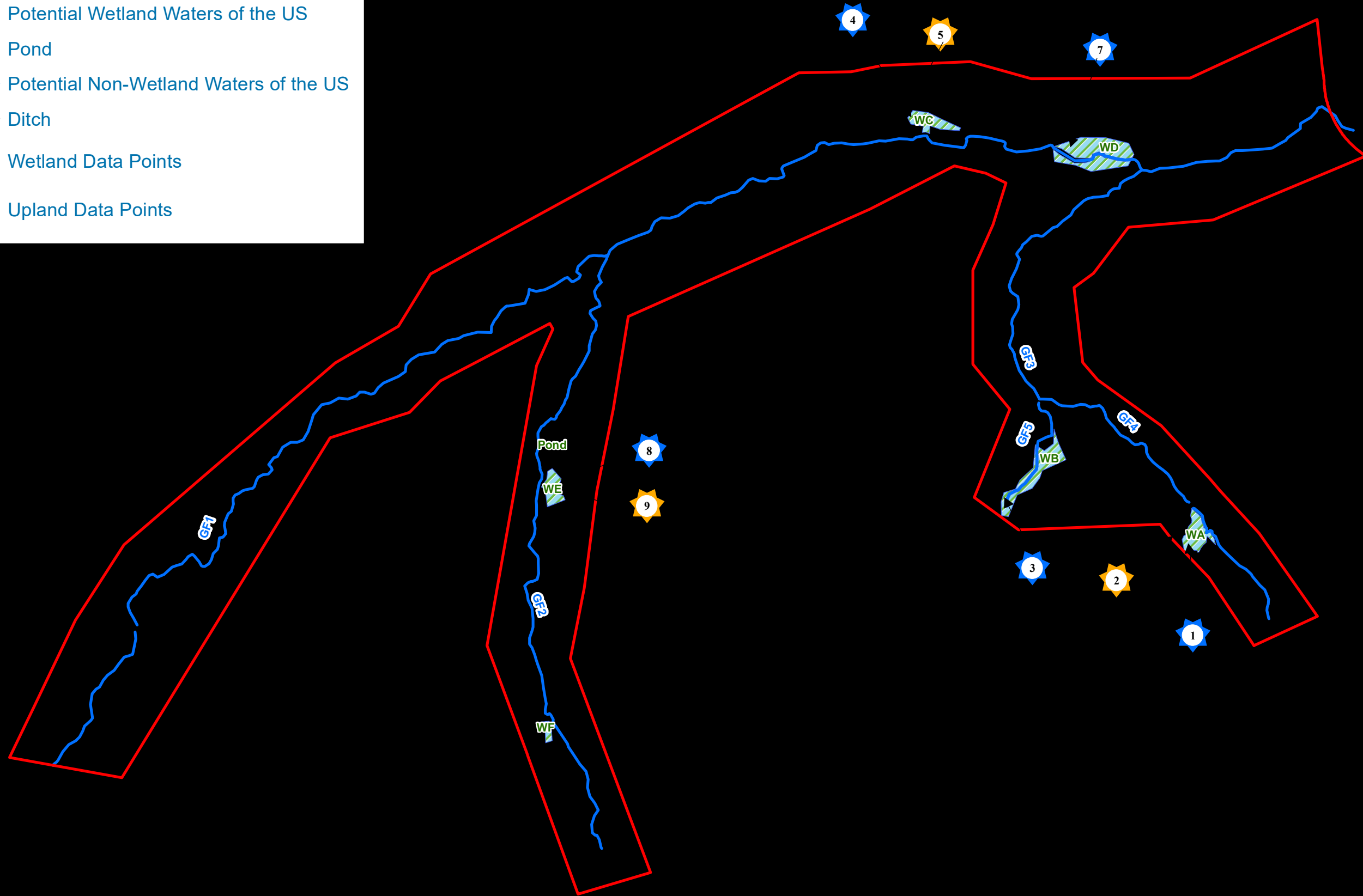
UPDATED AQUATIC RESOURCE INVENTORY TABLE (based on final project design)

Site	Reach/Wetland ID	Latitude	Longitude	Length (LF) /Area (ac)
Groundhog Hollow	WA	-81.233017	35.938472	0.06
Groundhog Hollow	WB	-81.234016	35.938822	0.09
Groundhog Hollow	WC	-81.234712	35.940558	0.05
Groundhog Hollow	WD	-81.233755	35.940426	0.15
Groundhog Hollow	WE	-81.237211	35.938574	0.04
Groundhog Hollow	WF	-81.237236	35.937302	0.01
Groundhog Hollow	Pond	-81.237179	35.938764	0.04
Groundhog Hollow	GF1	-81.23747	35.939553	3,354
Groundhog Hollow	GF2	-81.237333	35.937708	1,251
Groundhog Hollow	GF3	-81.234288	35.939363	581
Groundhog Hollow	GF4	-81.233243	35.938697	664
Groundhog Hollow	GF5	-81.234126	35.93881	253

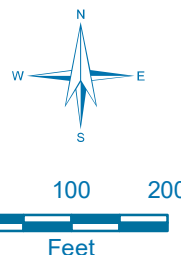
Legend

-  Study Area
-  Potential Wetland Waters of the US
-  Pond
-  Potential Non-Wetland Waters of the US
-  Ditch
-  Wetland Data Points
-  Upland Data Points

* UPDATED Potential Waters of the U.S. Map (based on final project design) and to be submitted with PCN application



Potential Wetland or Non-Wetland Waters of the U.S. Map
Groundhog Hollow Mitigation Site
 Alexander County, North Carolina



PROJECT MANAGER:	
DRAWN:	MDD
JOB NUMBER:	#####
DATE:	08/26/2019
REVISIONS:	
MDD 08/26/2019	



Appendix J – Invasive Species Plan

INVASIVE SPECIES PLAN

Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. These site inspections may identify the presence of invasive vegetation. RES will treat invasive species vegetation within the project area and provide remedial action on a case by- case basis. Common invasive species vegetation, such as Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*), tree-of-heaven (*Ailanthus altissima*), and Japanese honeysuckle (*Lonicera japonica*), will be treated to allow native plants to become established within the conservation easement. Invasive species vegetation will be treated by approved mechanical and/or chemical methods such that the percent composition of exotic/invasive species is less than 5% of the total riparian buffer area. Any control methods requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations. If areas of invasive species exist within the easement, they will be monitored yearly as part of the monitoring protocol, and treated if necessary. If required, problem areas will continue to be treated until the project easement shows overall trending towards meeting all monitoring requirements.

Appendix K – Approved FHWA
Categorical Exclusion Form

Categorical Exclusion Form for Division of Mitigation Services
Projects
Version 1.4

Part 1: General Project Information	
Project Name:	Groundhog Hollow
County Name:	Alexander
DMS ID Number:	
Project Sponsor:	Resource Environmental Solutions LLC
Project Contact Name:	Brad Breslow
Project Contact Address:	302 Jefferson Street Suite 110, Raleigh, NC 27605
Project Contact E-mail:	bbreslow.res.us
DMS Project Manager:	Paul Wiesner
Project Description	
<p>The Groundhog Hollow site is located in the Catawba River Basin within Cataloging Unit 03050101, TLW 03050101120030, and NC Division of Water Resources (DWR) subbasin 03-08-32. The Project's watershed is primarily forested and mixed agricultural land, and has historically served this purpose. Water quality stressors currently affecting the site include livestock production, agricultural production, and lack of riparian buffer. This project presents the opportunity to provide up to 4,011 warm stream mitigation units. These will be derived from 2,001 linear feet of Priority I Restoration, 830 linear feet of Enhancement I, and 2,684 linear feet of Enhancement II.</p>	
For Official Use Only	
Reviewed By:	
<p style="font-size: 1.5em; text-align: center;">6/22/18</p> <hr style="width: 80%; margin: auto;"/> <p>Date</p>	 <hr style="width: 80%; margin: auto;"/> <p>DMS Project Manager</p>
Conditional Approved By:	
<hr style="width: 80%; margin: auto;"/> <p>Date</p>	<hr style="width: 80%; margin: auto;"/> <p>For Division Administrator FHWA</p>
<input type="checkbox"/> Check this box if there are outstanding issues	
Final Approval By:	
<p style="font-size: 1.5em; text-align: center;">6-22-18</p> <hr style="width: 80%; margin: auto;"/> <p>Date</p>	 <hr style="width: 80%; margin: auto;"/> <p>For Division Administrator FHWA</p>

Part 2: All Projects Regulation/Question		Response
Coastal Zone Management Act (CZMA)		
1. Is the project located in a CAMA county?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. Has a CAMA permit been secured?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
4. Has NCDRCM agreed that the project is consistent with the NC Coastal Management Program?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)		
1. Is this a "full-delivery" project?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> 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?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> 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?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
6. Is there an approved hazardous mitigation plan?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> 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?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Does the project affect such properties and does the SHPO/THPO concur?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. If the effects are adverse, have they been resolved?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)		
1. Is this a "full-delivery" project?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Does the project require the acquisition of real estate?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
3. Was the property acquisition completed prior to the intent to use federal funds?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> 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?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> 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?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Is the site of religious importance to American Indians?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
4. Have the effects of the project on this site been considered?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Antiquities Act (AA)		
1. Is the project located on Federal lands?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. Will a permit from the appropriate Federal agency be required?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
4. Has a permit been obtained?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Archaeological Resources Protection Act (ARPA)		
1. Is the project located on federal or Indian lands (reservation)?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Will there be a loss or destruction of archaeological resources?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. Will a permit from the appropriate Federal agency be required?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
4. Has a permit been obtained?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Endangered Species Act (ESA)		
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Is Designated Critical Habitat or suitable habitat present for listed species?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> 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?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Have the USFWS and the NCWRC been consulted?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> 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?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Has the NPS approved of the conversion?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Is suitable habitat present for EFH-protected species?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
4. Will the project adversely affect EFH?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
5. Has consultation with NOAA-Fisheries occurred?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Have the USFWS recommendations been incorporated?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Wilderness Act	
1. Is the project in a Wilderness area?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A

Correspondence with Agencies



302 Jefferson Street, Suite 110
Raleigh, NC 27605

Corporate Headquarters
5020 Montrose Blvd. Suite 650
Houston, TX 77006
Main: 713.520.5400

March 28, 2018

Mrs. Janet Mizzi
US Fish and Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801

Subject: Project Scoping for Groundhog Hollow Mitigation Project in Alexander County

Dear Mrs. Mizzi,

Resource Environmental Solutions (RES) requests review and comment from the United States Fish and Wildlife Service (USFWS) on any possible concerns they may have with regards to the implementation of the Groundhog Hollow Mitigation Project. Please note that this request is in support of the development of the Categorical Exclusion (CE) for the referenced project. The proposed project involves the restoration and enhancement of 5,525 linear feet of stream. The Site is currently in agricultural use, specifically as pasture.

The USFWS database (updated 11 April 2017) lists two threatened species for Alexander County, North Carolina: Dwarf-flowered heartleaf (*Hexastylis naniflora*) and Northern long-eared bat (NLEB) (*Myotis septentrionalis*). Potential habitat may exist on-site for dwarf-flowered heartleaf and NLEB. Also, a review of the NC Natural Heritage Program (NHP) GIS database was consulted to determine whether previously cataloged occurrences of protected species were mapped within one mile of the project site. Results from NHP on January 4, 2018, indicated that there were no known occurrences of protected species within a one-mile radius of the project area. Results did indicate an occurrence of the Federal Species of Concern, the Carolina foothills crayfish (*Cambarus johni*) within the proposed project area in the Lower Little River, directly downstream of proposed restoration stream reaches. Based on initial site investigations, no impacts to federally protected species are anticipated as a result of the proposed project. Additionally, NCDMS will submit the NLEB consultation form as part of the CE process.

Please provide comments on any possible issues that might emerge with respect to endangered species, migratory birds, or other trust resources from the earthwork and planting of a wetland restoration project on the subject property. A detailed project description along with maps showing the location and approximate limits of the conservation easement are enclosed.

We thank you in advance for your timely response and cooperation. You may return the comment to my attention at the address below. Please feel free to contact me at mdeangelo@res.us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

A handwritten signature in black ink that reads 'Matt DeAngelo'.

Matt DeAngelo | Ecologist



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Asheville Field Office
160 Zillicoa Street
Asheville, North Carolina 28801



April 27, 2018

Mr. Matt DeAngelo
Resource Environmental Solutions
302 Jefferson Street, Suite 110
Raleigh, North Carolina 27605

Dear Mr. DeAngelo:

Subject: Groundhog Hollow Mitigation Site; Alexander County, North Carolina
Log No. 4-2-18-238

The U.S. Fish and Wildlife Service (Service) has reviewed the information provided in your correspondence received via email dated March 28, 2018 wherein you requested our scoping comments for the proposed project. We submit the following comments in accordance with the provisions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e); the National Environmental Policy Act (42 U.S.C. §4321 et seq.); and section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) (Act).

Project Description

According to your correspondence, you are seeking our scoping comments to inform a NEPA document for a proposed mitigation bank near Taylorsville, North Carolina. The proposed project would entail restoration and enhancement of approximately 5,525 linear feet of an unnamed tributary to Lower Little River. Adjacent land use is dominated by pasture and what appear to be poultry houses.

Federally Listed Endangered and Threatened Species

According to Service records, suitable summer roosting habitat may be present in the project area for the federally threatened northern long-eared bat (*Myotis septentrionalis*). However, the final 4(d) rule (effective as of February 16, 2016), exempts incidental take of northern long-eared bat associated with activities that occur greater than 0.25 miles from a known hibernation site, and greater than 150 feet from a known, occupied maternity roost during the pup season (June 1 – July 31). Based on the information provided, the project (which may or may not require tree clearing) would occur at a location where any incidental take that may result from associated activities is exempt under the 4(d) rule. **Although not required, we encourage you to avoid any associated tree clearing activities during the maternity roosting season from May 15 – August 15 if possible.**

You indicated that potential habitat for the federally threatened dwarf-flowered heartleaf exists onsite, but that “*no impacts are anticipated as a result of the proposed project.*” Targeted surveys for this species in areas that contain suitable habitat are required to make an informed effect determination. The optimal survey window for this species is March-May. However, members of this genus retain their diagnostic evergreen year-round.

We offer the following comments in the interest of protecting fish and wildlife resources:

Stream Channel and Bank Restoration

A natural, stable stream system is one that is able to transport a wide range of flows and associated bed load (sediment) while maintaining channel features and neither degrading (accelerating the erosion of banks and scour of the channel bed) nor aggrading (accelerating the deposition of sediment within the channel). Alterations to the dimension (cross-sectional view of the channel), pattern (the sinuosity of the channel), or profile (longitudinal slope) of the stream channel as well as changes to streambank vegetation, floodplains, hydrology, or sediment input can significantly alter this equilibrium. Accordingly, we recommend the following:

1. Only the absolute minimum amount of work should be done within stream channels to accomplish necessary reconstruction. The amount of disturbance to in-stream and riparian areas should not exceed what can be stabilized by the end of the workday. Restoration plans should account for the constraints of the site and the opportunities to improve stream pattern, dimension, and profile with minimal disturbance.
2. All reconstruction work should follow natural channel design methodologies that are based on the bank-full, or channel-forming, stage of the stream. Bank-full stage maintains the natural channel dimensions and transports the bulk of sediment over time (Doll et al. 2003). Natural channel conditions should be identified using a reference reach (nearby stream reaches that exemplify restoration goals). Restoration design should match the pattern, dimension, and profile of the reference reach to ensure the project's success. The Service is available to assist with the identification of reference reaches.
3. All work in or adjacent to stream waters should be conducted in a dry work area to the extent possible. Sandbags, cofferdams, bladder dams, or other diversion structures should be used to prevent excavation in flowing water. These diversion structures should be removed as soon as the work area is stable. When practical, a pump-around operation shall be used to divert flow during construction.
4. Equipment should not be operated in the stream unless absolutely necessary. Machinery should be operated from the banks in a fashion that minimizes disturbance to woody vegetation. Equipment should be: (a) washed to remove any contaminant residue prior to project construction, (b) in good working order, and (c) checked to ensure there are no leaks of potential contaminants (such as oil or other lubricants) prior to and during construction.

5. Streambanks with deep-rooted woody vegetation are the most stable, and stream restoration efforts should incorporate the use of native vegetation adapted to the site conditions. Biodegradable erosion-control materials may be incorporated into bank-restoration design in order to stabilize soils as vegetation becomes established. Live dormant stakes (such as black willow) may be used to reestablish root structure in riparian areas. In areas where banks are severely undercut, high, and steep, whole-tree revetment or rock may be used as a stabilization treatment (small rock, gravel, sand, and dirt are not recommended due to their erosive nature), and it should not extend above the bank-full elevation (the elevation of the channel where the natural floodplain begins). Deep-rooting woody vegetation should be established along banks where any channel work is accomplished. Tree and shrub plantings should be spaced at intervals no greater than 10 feet along banks. Vegetated riparian zone widths should be as wide as practical but should extend at least 30 feet from the stream channel.
6. Adequate measures to control sediment and erosion must be implemented prior to any ground-disturbing activities in order to minimize effects on downstream aquatic resources. In North Carolina, non-cohesive and erosion-prone soils are most common in the felsic-crystalline terrains of the mountain and upper piedmont regions (Miller and Kochel 2010). Therefore, reconstruction work should be staged such that disturbed areas would be stabilized with seeding, mulch, and/or biodegradable (coir) erosion-control matting prior to the end of each workday. No erosion-control matting or blankets should contain synthetic (netting) materials. Matting should be secured in place with staples; stakes; or, wherever possible, live stakes of native trees. If rain is expected prior to temporary seed establishment, additional measures should be implemented to protect water quality along slopes and overburden stockpiles (for example, stockpiles may be covered with plastic or other geotextile material).
7. Woody debris, detritus, and other vegetative materials are the main sources of nutrients and carbon necessary for primary productivity in stream ecosystems. Removal of this material can impact the production of higher trophic levels, including fish. The Service does not recommend the removal of woody debris within the stream channel or floodplain unless it is causing a debris blockage (logjam) or will affect the ability to achieve bank stability along a specific reach of stream. Woody debris that must be removed should be chipped on the site.
8. At each restoration site, cross-sections (at intervals based on restoration reach size), longitudinal profiles, and stream-pattern plans should be measured and mapped prior to and immediately following any channel work. In addition, photographs should be taken to document the condition of the project site prior to initiating the work and upon completion of the work. However, since a project's restoration success does not necessarily equate to biological success, the ecological goals of the project should be clearly defined and assessed for improvement after construction is completed (Palmer et al. 2005).

The Service appreciates the opportunity to provide these comments. Please contact Mr. Byron Hamstead of our staff at 828/258-3939, Ext. 225, if you have any questions. In any future correspondence concerning this project, please reference our Log Number 4-2-18-238.

Sincerely,

-- original signed --

Janet Mizzi
Field Supervisor

References

- Doll, B.A., G.L. Grabow, K.R. Hall, J. Halley, W.A. Harman, G.D. Jennings, and D.E. Wise. 2003. Stream Restoration: A Natural Channel Design Handbook. North Carolina Stream Restoration Institute, North Carolina State University. 128 pp.
- Hall, K. 2003. Recommended Native Plant Species for Stream Restoration in North Carolina. Raleigh: North Carolina Stream Restoration Institute, North Carolina State University.
- Miller, J.R., and Kochel, R.C. 2010. Assessment of channel dynamics, in-stream structures and post-project channel adjustments in North Carolina and its implications to effective stream restoration. Environmental Earth Sciences, 59(8), pp. 1681-1692.
- Palmer, M.A., E.S. Bernhardt, J.D. Allan, P.S. Lake, G. Alexander, S. Brooks, J. Carr, S. Clayton, C.N. Dahm, J. Follstad Shah, and D.L. Galat. 2005. Standards for ecologically successful river restoration. Journal of Applied Ecology, 42(2), pp. 208-217.

From: [Matthew DeAngelo](#)
To: [Brad Breslow](#)
Subject: FW: USFWS Response (18-238): Groundhog Hollow Mitigation Site (Scoping); Alexander
Date: Tuesday, May 22, 2018 8:22:55 AM

From: Matthew DeAngelo
Sent: Thursday, May 17, 2018 2:52 PM
To: 'Hamstead, Byron' <byron_hamstead@fws.gov>
Subject: RE: USFWS Response (18-238): Groundhog Hollow Mitigation Site (Scoping); Alexander

Byron,

As per your guidance in the letter, RES performed a survey for dwarf-flowered heartleaf (*hexastylis naniflora*) on May 16, 2018 at the Groundhog Hollow site. Myself and Jeremy Schmid, PWS, walked the areas of potential habitat on-site, but determined that suitable habitat was not actually present, and therefore no individuals were found. The sight has been heavily disturbed by livestock and no mature, open forest occurs within the survey area. The understory is dense with invasive species such as Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*), and Japanese honeysuckle (*Lonicera japonica*). Even in the most promising, open understory areas along streams, the herbaceous layer was heavily and actively grazed by cattle. We searched for any evidence of other *Hexastylis* (*Hexastylis spp.*) species, but none were observed. Therefore, due to the lack of suitable habitat on site, we have determined that the Groundhog Hollow Mitigation Site will have “No Effect” on the threatened dwarf flowered-heartleaf.

RES generously requests your concurrence regarding this determination.

Please feel free to contact me with any questions or comments.

Also, moving forward, should we address future scoping letters to you, or should we continue sending them to Mrs. Mizzi?

Thank you,

From: Hamstead, Byron [mailto:byron_hamstead@fws.gov]
Sent: Friday, April 27, 2018 2:49 PM
To: Matthew DeAngelo <mdeangelo@res.us>
Subject: USFWS Response (18-238): Grounhog Hollow Mitigation Site (Scoping); Alexander

Hi Matt,

Attached are our scoping comments for the proposed project. Please let me know if you have any q's.

Regards,

Byron

Byron Hamstead
Fish and Wildlife Biologist
USFWS Asheville Field Office
160 Zillicoa St., Suite B
Asheville, NC, 28801

828-258-3939 ext. 225

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302 Jefferson Street, Suite 110
Raleigh, NC 27605

Corporate Headquarters
5020 Montrose Blvd. Suite 650
Houston, TX 77006
Main: 713.520.5400

March 28, 2018

Mr. Vann Stancil
Habitat Conservation Biologist
North Carolina Wildlife Resources Commission
215 Jerusalem Church Road
Kenly, NC 27542

Subject: Project Scoping for Groundhog Hollow Mitigation Project in Alexander County

Dear Mr. Stancil,

The purpose of this letter is to request review and comment on any possible issues that might emerge with respect to fish and wildlife associated with a potential stream restoration project on the attached site (USGS site map with approximate property lines and areas of potential ground disturbance are enclosed). The Groundhog Hollow Site has been identified by Resource Environmental Solutions, LLC (RES) to provide compensatory mitigation for unavoidable stream impacts. The proposed project involves the restoration and enhancement of approximately 5,525 linear feet of stream. Land use at the site generally consists of disturbed riparian forest, pasture, and animal operations.

A detailed project description along with maps showing the location and approximate limits of the conservation easement are enclosed.

We thank you in advance for your timely response and cooperation. You may return the comment to my attention at the address below. Please feel free to contact me at mdeangelo@res.us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

A handwritten signature in black ink that reads "Matt DeAngelo".

Matt DeAngelo | Ecologist

Matthew DeAngelo

From: Stancil, Vann F <vann.stancil@ncwildlife.org>
Sent: Friday, April 20, 2018 3:54 PM
To: Matthew DeAngelo
Subject: RE: [External] Project Scoping for Groundhog Hollow Mitigation Project in Alexander County

Matt,

I've reviewed the Groundhog Hollow Mitigation Site. It is located on an unnamed, intermittent tributary of the Lower Little River in Alexander County, northwest of Taylorsville. The unnamed stream has a narrow riparian zone that separates it from pasture. There are no records of any state or federally listed species at the site nor any in the immediate vicinity of the site.

Regarding terrestrial species, the U.S. Fish and Wildlife Service (USFWS) recently listed the northern long-eared bat (*Myotis septentrionalis*) as threatened under the Endangered Species Act. Alexander County is within the range (<https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf>) of the northern long-eared bat and may be present or in the vicinity of the project site. As such, consultation with the USFWS may be required. For more information, please see <https://www.fws.gov/midwest/endangered/mammals/nleb/> or https://www.fws.gov/raleigh/NLEB_RFO.html or contact the Asheville office of the USFWS to ensure that potential issues related to this species are addressed.

Thanks for the opportunity to review this mitigation project for issues related to fish and wildlife. Please let me know if I can assist further.

Vann

From: Matthew DeAngelo [mailto:mdeangelo@res.us]
Sent: Wednesday, March 28, 2018 3:59 PM
To: Stancil, Vann F <vann.stancil@ncwildlife.org>
Subject: [External] Project Scoping for Groundhog Hollow Mitigation Project in Alexander County

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Dear Mr. Stancil,

The Groundhog Hollow Stream Mitigation Site has been identified by Resource Environmental Solutions, LLC (RES) to provide compensatory mitigation for unavoidable stream impacts in Alexander County, North Carolina.

The purpose of this letter is to request, review, and comment on any possible issues that might emerge with respect to fish and wildlife associated with a potential stream restoration project on the attached site. A detailed project description along with maps showing the location and approximate limits of the conservation easement are attached along with a KMZ file.

We thank you in advance for your timely response and cooperation. You may return the comment to my attention at the address listed in the attached letter or via email. Please feel free to contact me at mdeangelo@res.us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Matt DeAngelo

Ecologist

RES | res.us

Direct: 984.255.9133 | Mobile: 757.202.4471

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302 Jefferson Street, Suite 110
Raleigh, NC 27605

Corporate Headquarters
5020 Montrose Blvd. Suite 650
Houston, TX 77006
Main: 713.520.5400

March 28, 2018

Renee Gledhill-Earley
North Carolina State Historic Preservation Office
4617 Mail Service Center
Raleigh NC 27699-4617

Subject: Project Scoping for Groundhog Hollow Mitigation Project in Alexander County

Dear Ms. Gledhill-Earley,

The Groundhog Hollow Site has been identified by Resource Environmental Solutions, LLC (RES) to provide compensatory mitigation for unavoidable stream impacts. The proposed project involves the restoration and enhancement of 5,525 linear feet of stream.

RES requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with a potential stream mitigation project on the Groundhog Hollow Site (a USGS site map with approximate limits of conservation easement is attached).

A review of the N.C. State Historic Preservation Office (SHPO) HPOWEB GIS Service database (<http://gis.ncdcr.gov/hpoweb/>; accessed January 4, 2018) was performed as part of the site due diligence evaluation. The database did not reveal any listed or potentially eligible historic or archeological resources on the proposed properties. The Zeb Watts House (AX0038) is located within a 0.5-mile radius of the project area. The Project will not threaten or impact this historic location. In addition, the majority of the site has historically been disturbed due to agricultural practices, specifically pastureland.

We ask that you review this site based on the attached information to determine the presence of any historic properties. We thank you in advance for your timely response and cooperation. You may return the comment to my attention at the address below, or via email. Please feel free to contact me at mdeangelo@res.us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

A handwritten signature in black ink that reads "Matt DeAngelo".

Matt DeAngelo | Ecologist

Matthew DeAngelo

From: Brad Breslow
Sent: Wednesday, February 13, 2019 11:54 AM
To: Matthew DeAngelo
Subject: FW: [External] Re: Groundhog Hollow Mitigation Site - Root Cellar - Alexander County

Brad Breslow

Regulatory Manager

RES | res.us

Direct: 919.209.1062 | Mobile: 847.774.8404

From: Munzer, Olivia [mailto:olivia.munzer@ncwildlife.org]
Sent: Wednesday, January 23, 2019 8:59 AM
To: David Godley <dgodley@res.us>; Brad Breslow <bbreslow@res.us>
Cc: Caldwell, Katherine <katherine.caldwell@ncwildlife.org>
Subject: [EXTERNAL] RE: [External] Re: Groundhog Hollow Mitigation Site - Root Cellar - Alexander County

Thank you David and Brad.

Olivia Munzer

Western Piedmont Habitat Conservation Coordinator
NC Wildlife Resources Commission

From: David Godley <dgodley@res.us>
Sent: Tuesday, January 22, 2019 7:17 PM
To: Brad Breslow <bbreslow@res.us>
Cc: Munzer, Olivia <olivia.munzer@ncwildlife.org>; Caldwell, Katherine <katherine.caldwell@ncwildlife.org>
Subject: [External] Re: Groundhog Hollow Mitigation Site - Root Cellar - Alexander County

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Brad,

I'll be happy to clear it when we begin our invasives and clearing work out there or if I have some extra time during the next visit I make. If it doesn't get written into the plan a friendly reminder might be helpful.

David Godley

Operations Manager

RES | Mobile: [919.723.8350](tel:919.723.8350)

Sent from mobile device

On Jan 22, 2019, at 6:15 PM, Brad Breslow <bbreslow@res.us> wrote:

Hi Olivia,

I will talk to David Godley(copied here) and the landowner about potentially clearing the smilax and get back to you asap. If nothing else, we will definitely plan to clear it out as we get closer to beginning the construction of the restoration activities. Thanks,

Brad Breslow
Project Manager

RES | res.us
Direct: 919.209.1062 | Mobile: 847.774.8404

From: Munzer, Olivia [<mailto:olivia.munzer@ncwildlife.org>]
Sent: Tuesday, January 22, 2019 3:37 PM
To: Brad Breslow <bbreslow@res.us>
Cc: Caldwell, Katherine <katherine.caldwell@ncwildlife.org>
Subject: [EXTERNAL] Groundhog Hollow Mitigation Site - Root Cellar - Alexander County

Hi Brad,

As we discussed on the phone today, there were no bats in the root cellar; however, it is likely they are excluded from entering the cellar because smilax has grown over the entrance. Since it looks like bats would likely use it as a hibernaculum, could either the landowner or RES cut back the smilax. It would be great to have bats begin using it, especially once it is included in the conservation easement. If cutting it back is an issue, I can always run out there when I am in the area and cut it way back. Let me know what works best for you. Oh, there were chunks of fur of what was likely a skunk scattered throughout the cellar.

Thank you,
Olivia

*****Please Note New Office Address and Number*****

Olivia Munzer
Western Piedmont Habitat Conservation Coordinator
Certified Wildlife Biologist ®

NC Wildlife Resources Commission
Rogers Depot, 1718 NC Hwy 56
Creedmoor, NC 27522
Office: 919.707.0364 // Cell: 336.269.0074
olivia.munzer@ncwildlife.org

www.ncwildlife.org

<image001.jpg><image002.jpg><image003.jpg><image004.jpg>

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North Carolina Department of Natural and Cultural Resources
State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

May 1, 2018

Matt DeAngelo
RES
302 Jefferson Street, Suite 110
Raleigh, NC 27605

Re: Groundhog Hollow Mitigation Site, Alexander County, ER 187-0664

Dear Mr. DeAngelo:

Thank you for your letter of March 28, 2018, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

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

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

Sincerely,

A handwritten signature in blue ink that reads "Renee Gledhill-Earley".

for Ramona M. Bartos

From: Brew, Donnie (FHWA)
To: Marella_Buncick@fws.gov
Cc: [Brad Breslow](#); [Wiesner, Paul](#)
Subject: [External] Groundhog Hollow_mitigation project_Alexander County_NLEB 4(d) rule consultation
Date: Tuesday, June 19, 2018 9:32:29 AM
Attachments: [Groundhog Hollow_NLEB Consultation Form signed 6-19-18.pdf](#)

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Good morning Marella,

The purpose of this message is to notify your office that FHWA will use the streamlined consultation framework for the Groundhog Hollow Mitigation Site in Alexander County, NC.

Attached is a completed NLEB 4(d) Rule Streamlined Consultation form, in addition site maps/figures.

Thank you and have a great day,

Donnie

Notifying the Service Under the Framework

Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form

Federal agencies (or designated non-federal representatives) should use the Northern Long-Eared Bat 4(d) Rule Streamlined Consultation form to notify the Service of their project and meet the requirements of the framework.

[Northern Long-Eared Bat 4\(d\) Rule Streamlined Consultation Form](#) (Word document)

Information requested in the Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form serves to

- (1) notify the field office that an action agency will use the streamlined framework;
- (2) describe the project with sufficient detail to support the required determination; and
- (3) enable the USFWS to track effects and determine if reinitiation of consultation for the 4(d) rule is required. This form requests the minimum amount of information required for the Service to be able to track this information.

Providing information in the Streamlined Consultation Form does not address section 7(a)(2) compliance for any other listed species.

Donnie Brew
Preconstruction & Environment Engineer
Federal Highway Administration
310 New Bern Ave, Suite 410
Raleigh, NC 27601
donnie.brew@dot.gov
919-747-7017

Please consider the environment before printing this email.

Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form

Federal agencies should use this form for the optional streamlined consultation framework for the northern long-eared bat (NLEB). This framework allows federal agencies to rely upon the U.S. Fish and Wildlife Service's (USFWS) January 5, 2016, intra-Service Programmatic Biological Opinion (BO) on the final 4(d) rule for the NLEB for section 7(a)(2) compliance by: (1) notifying the USFWS that an action agency will use the streamlined framework; (2) describing the project with sufficient detail to support the required determination; and (3) enabling the USFWS to track effects and determine if reinitiation of consultation is required per 50 CFR 402.16.

This form is not necessary if an agency determines that a proposed action will have no effect to the NLEB or if the USFWS has concurred in writing with an agency's determination that a proposed action may affect, but is not likely to adversely affect the NLEB (i.e., the standard informal consultation process). Actions that may cause prohibited incidental take require separate formal consultation. Providing this information does not address section 7(a)(2) compliance for any other listed species.

Information to Determine 4(d) Rule Compliance:	YES	NO
1. Does the project occur wholly outside of the WNS Zone ¹ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Have you contacted the appropriate agency ² to determine if your project is near known hibernacula or maternity roost trees?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3. Could the project disturb hibernating NLEBs in a known hibernaculum?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4. Could the project alter the entrance or interior environment of a known hibernaculum?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5. Does the project remove any trees within 0.25 miles of a known hibernaculum at any time of year?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
6. Would the project cut or destroy known occupied maternity roost trees, or any other trees within a 150-foot radius from the maternity roost tree from June 1 through July 31.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

You are eligible to use this form if you have answered yes to question #1 **or** yes to question #2 **and** no to questions 3, 4, 5 and 6. The remainder of the form will be used by the USFWS to track our assumptions in the BO.

Agency and Applicant³ (Name, Email, Phone No.):

Donnie Brew, Donnie.brew@dot.gov, (919)747-7017
Federal Highway Administration

Brad Breslow, bbreslow@res.us, (919)209-1062
Resource Environmental Solutions

¹ <http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf>

² See <http://www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html>

³ If applicable - only needed for federal actions with applicants (e.g., for a permit, etc.) who are party to the consultation.

Project Name: Groundhog Hollow Mitigation Project, DMS Project #: 100049

Project Location (include coordinates if known): 35.932979, -81.236187

The Project is located in Alexander County approximately 3.5 miles northwest of Taylorsville, North Carolina (**Figure 1**). From Taylorsville, proceed west on W Main Ave (NC-90) and then turn right onto US-64 W. In approximately 1 mile, turn right on Ned Herman Road and proceed until the “T” intersection with Zeb Watts Road. Turn left on Zeb Watts Road and turn at the second right onto Groundhog Hollow Drive. The Site headwaters begin at the end of the road. Coordinates for the site are as follows: 35.937201 N, -81.237783 W.

Basic Project Description (provide narrative below or attach additional information):

The Project is located in the Catawba River Basin within Cataloging Unit 03050101, TLW 03050101120030, and NC Division of Water Resources (DWR) subbasin 03-08-32. The Project area includes four unnamed tributaries that drain directly to the Little Lower River downstream of the project parcel. The current State classification for Little Lower Creek is Class C. Class C waters are suitable for aquatic life, secondary recreation, and agricultural usage. Primary land use within the watershed is composed of pasture, disturbed riparian forest, animal operations, and low-density residential land.

The Site will include Priority Level I Restoration and stream Enhancement Levels I and II. Priority Level I Restoration will incorporate the design of a single-thread meandering channel, with parameters based on data taken from reference sites to be identified later, published empirical relationships, regional curves developed from existing project streams, and NC Regional Curves. Analytical design techniques will also be an important element of the project and will be used to determine the design discharge and to verify the design as a whole.

The goal of the Project is to restore ecological function to the existing stream and riparian corridor by returning the existing streams to a stable condition. This will be accomplished by constructing an E/C type stream with appropriate dimensions and pattern, reconnecting the channel to the floodplain, and backfilling the abandoned channel. In-stream structures such as log sills and brush toes will be installed for vertical stability and to improve habitat. Buffer improvements will filter runoff from agricultural fields, thereby reducing nutrient and sediment loads to the channel. The widening and restoration of the riparian areas will also provide wildlife corridors throughout the project area. Benefits to be accrued from these activities include improved water quality and terrestrial and aquatic habitat.

The following objectives are proposed for accomplishing project goals:

- a. The Project presents the opportunity to provide up to 4,011 warm stream mitigation units. These will be derived from 2,001 linear feet of Priority I Restoration, 830 linear feet of Enhancement I, and 2,684 linear feet of Enhancement II.
- b. Restore stable channel morphology and proper sediment transport capacity.
- c. Create and improve stream bed form and improve aquatic and benthic macroinvertebrate habitat.
- d. Construct a floodplain bench that is accessible at the proposed bankfull channel elevation.
- e. Improve channel and stream bank stabilization by integrating in-stream structures and native bank vegetation.

Proposed Mitigation

Reach ID	Stream Classification	Mitigation Type	Linear Feet	Ratio	Base SMUs	Adjusted SMUs
GF1-A	Perennial	Enhancement II	1,492	2.5	597	638
GF1-B	Perennial	Restoration	1,467	1	1,467	1,682
GF2-A	Perennial	Enhancement II	380	2.5	152	152
GF2-B	Perennial	Enhancement I	523	1.5	349	349
GF2-C	Perennial	Restoration	245	1	245	245
GF3-A	Perennial	Enhancement I	307	1.5	204	217
GF3-B	Perennial	Restoration	289	1	289	289
GF4-A	Intermittent	Enhancement II	250	2.5	100	100
GF4-B	Intermittent	Enhancement II	358	1.5	239	247
GF5	Perennial	Enhancement II	213	2.5	85	92
Total			5,525		3,727	*4,011

*Project estimated to generate 4,011 SMUs, but EBX is bidding 4,000 SMUs

General Project Information	YES	NO
Does the project occur within 0.25 miles of a known hibernaculum?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the project occur within 150 feet of a known maternity roost tree?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Does the project include forest conversion ⁴ ? (if yes, report acreage below)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Estimated total acres of forest conversion	< 3.0 acres	
If known, estimated acres ⁵ of forest conversion from April 1 to October 31	<3.0 acres	
If known, estimated acres of forest conversion from June 1 to July 31 ⁶		
Does the project include timber harvest? (if yes, report acreage below)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Estimated total acres of timber harvest		
If known, estimated acres of timber harvest from April 1 to October 31		
If known, estimated acres of timber harvest from June 1 to July 31		
Does the project include prescribed fire? (if yes, report acreage below)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Estimated total acres of prescribed fire		
If known, estimated acres of prescribed fire from April 1 to October 31		
If known, estimated acres of prescribed fire from June 1 to July 31		
Does the project install new wind turbines? (if yes, report capacity in MW below)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Estimated wind capacity (MW)		

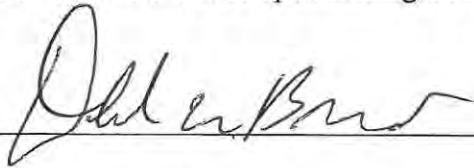
Agency Determination:

By signing this form, the action agency determines that this project may affect the NLEB, but that any resulting incidental take of the NLEB is not prohibited by the final 4(d) rule.

If the USFWS does not respond within 30 days from submittal of this form, the action agency may presume that its determination is informed by the best available information and that its project responsibilities under 7(a)(2) with respect to the NLEB are fulfilled through the USFWS January 5, 2016, Programmatic BO. The action agency will update this determination annually for multi-year activities.

The action agency understands that the USFWS presumes that all activities are implemented as described herein. The action agency will promptly report any departures from the described activities to the appropriate USFWS Field Office. The action agency will provide the appropriate USFWS Field Office with the results of any surveys conducted for the NLEB. Involved parties will promptly notify the appropriate USFWS Field Office upon finding a dead, injured, or sick NLEB.

Signature: _____



Date Submitted: _____

6-19-18

⁴ Any activity that temporarily or permanently removes suitable forested habitat, including, but not limited to, tree removal from development, energy production and transmission, mining, agriculture, etc. (see page 48 of the BO).

⁵ If the project removes less than 10 trees and the acreage is unknown, report the acreage as less than 0.1 acre.

⁶ If the activity includes tree clearing in June and July, also include those acreage in April to October.



302 Jefferson Street, Suite 110
Raleigh, NC 27605

Corporate Headquarters
5020 Montrose Blvd. Suite 650
Houston, TX 77006
Main: 713.520.5400

February 16, 2018

Milton Cortes
Natural Resources Conservation Service
4407 Bland Rd., Suite 117
Raleigh, NC 27609

Subject: AD-1006 Request for the Groundhog Hollow Mitigation Site in Alexander County

Dear Mr. Cortes,

Resource Environmental Solutions (RES) requests review and comment from the Natural Resources Conservation Service on any possible concerns that may emerge with respect to farmland resources including prime, unique, statewide or local important farmland associated with the Groundhog Hollow stream mitigation project. This project is being developed for the North Carolina Division of Mitigation Services. Please note that this request is in support of the development of the Categorical Exclusion (CE) and an Environmental Resource Technical Report for the referenced project.

The Groundhog Hollow Site has been identified for the purposes of providing mitigation for unavoidable stream impacts in the Catawba River Basin. RES has been awarded the contract to design and implement the Groundhog Hollow project. A requirement of the project is to prepare an Environmental Resource Technical Document that describes resources present on the project site.

The Project is located in the Catawba River Basin within Cataloging Unit 03050101, in the Muddy Fork Creek local watershed (TLW 03050101120030). The Project supports many of the Catawba River Basin Restoration Priorities (RBRP) goals and presents an opportunity to restore and enhance 5,525 linear feet of stream. The Project will provide numerous ecological and water quality benefits within the Catawba River Basin. These benefits are not limited to the project area, but have more far-reaching effects throughout the Catawba River Basin. The Project will provide improvements to water quality, hydrologic function, and habitat. Coordinates for the site are as follows: 35.9400031 N, -81.236105 W.

An inventory of soils data was completed by RES utilizing Web Soil Survey to determine prime farmland classifications for the 21.86 acre project area. One soil map unit in the project area is classified as farmland of state importance, making up approximately 2.6% of the site (Fairview sandy clay loam on a C slope). One soil map unit in the project area is classified as farmland of local importance, making up approximately 77.8% of the site (Fairview sandy clay loam on a D slope). One soil map unit in the project area is classified as prime farmland if drained, making up 15.2% of the site (Codus loam). One soil map unit in the project area is classified as not prime farmland, making up 4.3% of the site (Ronda loamy sand).

Enclosed is Form AD-1006 with Parts I and III Completed and maps of the Groundhog Hollow Site. We ask that you review the site information and complete Parts II, IV, and V as required by NRCS. Please email (mengel@res.us), or mail your reply to the our office on 302 Jefferson Street, Suite 100, Raleigh, NC 27605.



Natural Resources
Conservation Service

North Carolina
State Office

4407 Bland Road
Suite 117
Raleigh, NC 27609
Voice 919-873-2171
Fax (844) 325-2156

April 9, 2018

Megan D. Engel
Field Ecologist
RES
302 Jefferson Street, Suite 110
Raleigh, NC 27605

Subject: AD-1006 Request for the Groundhog Hollow Mitigation Site in
Alexander County

Dear Megan D. Engel:

The following guidance is provided for your information.

Projects are subject to the Farmland Protection Policy Act (FPPA) requirements if they may irreversibly convert farmland (directly or indirectly) to non-agricultural use and are completed by a federal agency or with assistance from a federal agency. Farmland means prime or unique farmlands as defined in section 1540(c)(1) of the FPPA or farmland that is determined by the appropriate state or unit of local government agency or agencies with concurrence of the Secretary of Agriculture to be farmland of statewide local importance.

For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forestland, pastureland, cropland, or other land, but not water or urban built-up land.

Farmland does not include land already in or committed to urban development or water storage. Farmland *already in* urban development or water storage includes all such land with a density of 30 structures per 40-acre area. Farmland already in urban development also includes lands identified as *urbanized area* (UA) on the Census Bureau Map, or as urban area mapped with a *tint overprint* on the United States Geological Survey (USGS) topographical maps, or as *urban-built-up* on the United States Department of Agriculture (USDA) Important Farmland Maps.

The area in question meets one or more of the above criteria for Farmland. Farmland area will be affected or converted. Enclosed is the Farmland Conversion Impact Rating form AD1006 with PARTS II, IV and V completed by NRCS. The corresponding agency will need to complete the evaluation, according to the Code of Federal Regulation 7CFR 658, Farmland Protection Policy Act.

Megan D. Engel
Page 2

If you have any questions, please contact Milton Cortes, Acting State Soil Scientist at 919-873-2171 or by email: milton.cortes@nc.usda.gov.

Again, thank you for inquiry. If we can be of further assistance, please do not hesitate to contact us.

Sincerely,

A handwritten signature in black ink that reads "Milton Cortes". The signature is written in a cursive style with a large initial 'M'.

Milton Cortes
Acting State Soil Scientist

FARMLAND CONVERSION IMPACT RATING

PART I (To be completed by Federal Agency)		Date Of Land Evaluation Request February 16, 2018			
Name of Project Groundhog Hollow		Federal Agency Involved Federal Highway Admin (FWHA)			
Proposed Land Use Conservation Easement		County and State Alexander County			
PART II (To be completed by NRCS)		Date Request Received By NRCS February 16, 2018		Person Completing Form: Milton Cortes, NRCS NC	
Does the site contain Prime, Unique, Statewide or Local Important Farmland? <i>(If no, the FPPA does not apply - do not complete additional parts of this form)</i>		YES <input checked="" type="checkbox"/>	NO <input type="checkbox"/>	Acres Irrigated none	Average Farm Size 97 acres
Major Crop(s) CORN	Farmable Land In Govt. Jurisdiction Acres: 25.53 % 43,024 acres	Amount of Farmland As Defined in FPPA Acres: 25.25 % 42,562 acres			
Name of Land Evaluation System Used Alexander Co., NC LESA	Name of State or Local Site Assessment System N/A	Date Land Evaluation Returned by NRCS April 9, 2018 by email			
PART III (To be completed by Federal Agency)		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		21.86			
B. Total Acres To Be Converted Indirectly					
C. Total Acres In Site		21.86			
PART IV (To be completed by NRCS) Land Evaluation Information					
A. Total Acres Prime And Unique Farmland		3.30			
B. Total Acres Statewide Important or Local Important Farmland		17.6			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted		0.0491			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value		22.5			
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)		41			
PART VI (To be completed by Federal Agency) Site Assessment Criteria <i>(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)</i>		Maximum Points	Site A	Site B	Site C
1. Area In Non-urban Use		(15)	15		
2. Perimeter In Non-urban Use		(10)	10		
3. Percent Of Site Being Farmed		(20)	20		
4. Protection Provided By State and Local Government		(20)	0		
5. Distance From Urban Built-up Area		(15)	15		
6. Distance To Urban Support Services		(15)	15		
7. Size Of Present Farm Unit Compared To Average		(10)	10		
8. Creation Of Non-farmable Farmland		(10)	8		
9. Availability Of Farm Support Services		(5)	3		
10. On-Farm Investments		(20)	15		
11. Effects Of Conversion On Farm Support Services		(10)	0		
12. Compatibility With Existing Agricultural Use		(10)	0		
TOTAL SITE ASSESSMENT POINTS		160	111	0	0
PART VII (To be completed by Federal Agency)					
Relative Value Of Farmland (From Part V)		100	41	0	0
Total Site Assessment (From Part VI above or local site assessment)		160	111	0	0
TOTAL POINTS (Total of above 2 lines)		260	152	0	0
Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES <input type="checkbox"/> NO <input type="checkbox"/>			
Reason For Selection:					
Name of Federal agency representative completing this form:					Date:

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

- Step 1 - Federal agencies (or Federally funded projects) involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form. For Corridor type projects, the Federal agency shall use form NRCS-CPA-106 in place of form AD-1006. The Land Evaluation and Site Assessment (LESA) process may also be accessed by visiting the FPPA website, <http://fppa.nrcs.usda.gov/lesa/>.
- Step 2 - Originator (Federal Agency) will send one original copy of the form together with appropriate scaled maps indicating location(s) of project site(s), to the Natural Resources Conservation Service (NRCS) local Field Office or USDA Service Center and retain a copy for their files. (NRCS has offices in most counties in the U.S. The USDA Office Information Locator may be found at http://offices.usda.gov/scripts/ndISAPI.dll/oip_public/USA_map, or the offices can usually be found in the Phone Book under U.S. Government, Department of Agriculture. A list of field offices is available from the NRCS State Conservationist and State Office in each State.)
- Step 3 - NRCS will, within 10 working days after receipt of the completed form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland. (When a site visit or land evaluation system design is needed, NRCS will respond within 30 working days.
- Step 4 - For sites where farmland covered by the FPPA will be converted by the proposed project, NRCS will complete Parts II, IV and V of the form.
- Step 5 - NRCS will return the original copy of the form to the Federal agency involved in the project, and retain a file copy for NRCS records.
- Step 6 - The Federal agency involved in the proposed project will complete Parts VI and VII of the form and return the form with the final selected site to the servicing NRCS office.
- Step 7 - The Federal agency providing financial or technical assistance to the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

(For Federal Agency)

Part I: When completing the "County and State" questions, list all the local governments that are responsible for local land use controls where site(s) are to be evaluated.

Part III: When completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them or other major change in the ability to use the land for agriculture.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities planned build out capacity) that will cause a direct conversion.

Part VI: Do not complete Part VI using the standard format if a State or Local site assessment is used. With local and NRCS assistance, use the local Land Evaluation and Site Assessment (LESA).

1. Assign the maximum points for each site assessment criterion as shown in § 658.5(b) of CFR. In cases of corridor-type project such as transportation, power line and flood control, criteria #5 and #6 will not apply and will, be weighted zero, however, criterion #8 will be weighed a maximum of 25 points and criterion #11 a maximum of 25 points.
2. Federal agencies may assign relative weights among the 12 site assessment criteria other than those shown on the FPPA rule after submitting individual agency FPPA policy for review and comment to NRCS. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total points at 160. For project sites where the total points equal or exceed 160, consider alternative actions, as appropriate, that could reduce adverse impacts (e.g. Alternative Sites, Modifications or Mitigation).

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, convert the site assessment points to a base of 160.

Example: if the Site Assessment maximum is 200 points, and the alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site A}$$

For assistance in completing this form or FPPA process, contact the local NRCS Field Office or USDA Service Center.

NRCS employees, consult the FPPA Manual and/or policy for additional instructions to complete the AD-1006 form.

Appendix L – DMS Floodplain Requirements Checklist



EEP Floodplain Requirements Checklist

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

Project Location

Name of project:	Groundhog Hollow Site
Name if stream or feature:	Lower Little River
County:	Alexander
Name of river basin:	Catawba
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Alexander County
DFIRM panel number for entire site:	3820
Consultant name:	Environmental Banc & Exchange, LLC
Phone number:	336-514-0927
Address:	302 Jefferson Street, Suite 110; Raleigh, NC 27605

Design Information

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

The Groundhog Hollow Site ("Project") is located within a rural watershed in Alexander County, North Carolina approximately three and a half miles northwest of Taylorsville. The Project lies within the Catawba River Basin, North Carolina Division of Water Resources (NCDWR) sub-basin 03-08-32, and United States Geological Survey (USGS) 14-digit hydrologic unit code (HUC) 03050101120030 (Figure 1). The Project proposes to restore 2,848 linear feet (LF), enhance 2,978 LF, and provide water quality benefit for 167 acres of drainage area. The Project is in the Northern Inner Piedmont Level IV ecoregion. The Project area is comprised of a 19.97-acre easement involving four unnamed tributaries, totaling 6,219 existing LF, which drain directly into the Lower Little River which eventually drains into the Catawba River. The stream mitigation components are summarized in Table 1 and Figure 9. The Project is accessible from Groundhog Hollow Drive off of Zeb Watts Road. Coordinates for the Project areas are as follows: 35.937201° N, -81.237783° W.

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

Example

Reach	Length	Priority
<i>GF1-A</i>	<i>1321</i>	<i>Enhancement II</i>
<i>GF1-B</i>	<i>2134</i>	<i>Restoration / Enhancement II</i>
<i>GF2-A</i>	<i>647</i>	<i>Enhancement II</i>
<i>GF2-B</i>	<i>534</i>	<i>Restoration</i>
<i>GF3-A</i>	<i>312</i>	<i>Enhancement I</i>
<i>GF3-B</i>	<i>310</i>	<i>Restoration</i>
<i>GF4-A</i>	<i>297</i>	<i>Enhancement II</i>
<i>GF5</i>	<i>271</i>	<i>Enhancement II</i>

Floodplain Information

<p>Is project located in a Special Flood Hazard Area (SFHA)?</p> <p><input checked="" type="radio"/> Yes <input type="radio"/> No</p>
<p>If project is located in a SFHA, check how it was determined:</p> <p><input type="checkbox"/> Redelineation</p> <p><input type="checkbox"/> Detailed Study</p> <p><input checked="" type="checkbox"/> Limited Detail Study</p> <p><input type="checkbox"/> Approximate Study</p> <p><input type="checkbox"/> Don't know</p>

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? No

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: Jon Pilkenton

Phone Number: 828-632-1000

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
(CLOMR)
- Other Requirements

List other requirements: None

Comments:

All proposed channel work is anticipated to remain outside of the Non-Encroachment Area.

Name:

BENTON CARROLL

Signature:



Title:

ENGINEER

Date:

3-22-19