# Mitigation Plan

# Mushroom Meadow Mitigation Site

Caswell County, North Carolina
Roanoke River Basin HUC 03010104
DMS Project ID No. 100192
Full Delivery Contract No. 200204-01
USACE Action ID No. SAW-2021-00348
NCDWR No. 20210400, V1




Prepared For: North Carolina Division of Mitigation Services
Raleigh, North Carolina
January 2023

January 11, 2023

U.S. Army Corps of Engineers
Regulatory Division
Raleigh Field Office
3331 Heritage Trade Dr, Suite 105
Wake Forest, NC 27587

Attention: Kim Isenhour

Subject: Mitigation Plan
Mushroom Meadow Mitigation Project, Caswell County
Roanoke River Basin HUC 03010104
USACE Action ID SAW-2021-00348/NCDWR 20210400, V1

Dear Kim:

We have reviewed the IRT's comments on the Mushroom Meadow Mitigation Plan. We have made the requested changes and provided comment below.

*Todd Bowers, USEPA:*

1. General:
   - One of the largest benefits of this site is that is adjacent to an existing NCDMS site (River Bend) and will add to the larger habitat directly. Eco Terra has mentioned this in several locations in the document, however the River Bend site is not illustrated on any figures. I highly recommend that the River Bend site be included in the figures illustrating current conditions and proposed conditions/monitoring locations as well as some of the engineering diagrams in the Appendices. Some additional basic information should include wetland resources, age of the site and any other information that would support an adjacent site. Some information is in Section 3.7 and this could be expanded on. The River Bend site has been added to Figures 1 and 3. A link to the River Bend mitigation plan on NC Division of Mitigation Services website has been added to Section 3.7.
   - Inclusion of upland buffers around wetlands is an excellent approach and one that strengthens the long-term success for the site. Comment noted
   - I would like to have seen more ground level photographs highlighting some of the features noted in the existing conditions, especially since I have not been able to be on site during the scoping process. Added photos to Appendix B.
2. Table 3/Page 20: UT2 Reach 1 and 3 (middle of the table) should be UT3 Reach 1 and 2. Updated Table 3.
3. Table 8/Page 28: Recommend listing watershed sizes of reference streams in acreage for direct comparison to site streams. Watershed size changed to acreage.
4. Section 6.5.1/Page 34: I would like to see some more information on Dan River flooding frequency, duration, and river levels as it pertains to "major" flood events. The site wetland's hydrology appears to rely on significant input from the Dan River so a little more information would be helpful. The reference wetland in the adjacent property may provide some information to add here. Additional

text has been added to the narrative in Section 6.5.1 to further discuss the major flooding events as related to deposition. There is no data from the adjacent reference wetland to support flooding frequency from the Dan River. Anecdotally, wrack lines attributed to the Dan River were observed on the River Bend Site.

5. Section 6.7.1/Page 40: If there is no fencing proposed for this project, what is the plan to maintain cattle exclusion? Cattle are being removed from the site.
6. Table 13/Page 42 and Table 14/Page 43: Recommend a 2:1 ratio for rehabilitation work on Wetland 3. No direct work towards improving hydrology is begin implemented as in the other rehabilitation approach wetlands. Leaving ratio as 1.5:1.
7. Section 6.8/Page 43: Narrative lists two planting zones when there are three (wetland, streamside, upland riparian) named zones and three shown in the proposed planting plan of Table 15. Changed to three zones.
8. Table 15/Page 44: Include the wetland indicator status for each species and I recommend adding a couple more understory species in the upland riparian zone. Added the wetland indicator status and added two understory and canopy species to the wetland zone. Added two understory species to the upland riparian zone.
9. Table 16/Page 47: Cattle are to be excluded from the conservation easement and it says that the farmer is no longer placing cattle within the project site. What about adjacent to the project site? How is cattle being completely removed from site access? The portions of the property upstream of the project are forested, the eastern boundary is WRC land. The parcel in between the project portions is owned by a different landowner and doesn't currently have cattle. It will be the responsibility of that landowner to contain any cattle that may be placed on the site in the future.
10. Section 10.0/Page 51/Bullet 3: Recommend adding "in consultation with the North Carolina Mitigation Banking Inter-agency Review Team". Added to bullet 3 on Page 39 in Section 10.0.
11. Section 11/Page 51: Reiterating a 2:1 ratio for Wetland 3 rehabilitation. Leaving ratio as 1.5:1
12. Table 17/Page 52: How about we reduce some of the zeroes in the ratio column (and change Wetland 3 to 2.0)? Reduced zeroes in mitigation ratio. Leaving ratio as 1.5:1.
13. Figures 4-8/Pages 59-63: Great place to highlight the adjacent River Bend conservation easement. Added River Bend to Figures 1 and 3.

*Olivia Munzer, NCWRC:*

1. Sheet EC-02.5 (pg. 147) – The Temporary and Permanent Seed Mix table is very hard to read, especially the temporary mix. I think the temporary mix is the same as Sheet PLT-01 (pg. 135) so I am fine with the species. The plan sheet has been updated for clarity.
2. I would like to see one or more flowering herbaceous species in the upland, wetland, and riparian mixes (such as Eupatorium spp., Solidago spp, Rhexia spp., Monardia spp.). We have added *Helianthus angustifolis* to the seed mix.

*Erin Davis, NCDWR:*

1. Pages 7-8, Table 3 – Please QAQC the reach names (e.g., UT3 Reach 1 and UT3 Reach 2). Also, the design Sheets S-04 and EC-04 identify UT1 Reach 2b rather than simply Reach 2. Please make reach names consistent throughout the plan narrative and figures/drawings. Table 3 has been updated and all reach names on plans sheets have been correctly identified as Reach 2a and Reach 2. We will keep Reach 2 instead of Reach 2b due to the ubiquitous use throughout the Mitigation Plan and Construction Drawings.

2. Page 9, Section 3.6 – There is no corresponding discussion of UT1A in Section 6. It would be helpful to clarify that UT1A is a non-credit tributary/reach in Section 3 or Section 6. Added a footnote to table 2 showing that UT1A, Wetland 1A, and Wetland 2A don't generate credit. In Section 3.6, UT1A, added "This reach is not proposed for credit."
3. Page 12, Section 4 - As a reminder, if you haven't already submitted a pre-filing meeting request to DWR, please email 401PreFile@ncdenr.gov a minimum of 30 days before submitting the 401 application ePCN. An email was submitted on 12/20/2022 to email listed above.
4. Page 14, Table 7 – Since fencing is not proposed, please update to indicate cattle removal from the site. Changed the objective "Implement cattle exclusion measures" to "Remove cattle".
5. Page 27, Section 6.6.4 – Paragraph two notes three wetland reestablishment areas. In addition to Wetland 1 and 2, please clarify/identify the third reestablishment area. Changed to two wetland re-establishment areas.
6. Page 28, Table 12 – I'm a bit confused with the total months noted in parentheses, April-June (12 months) and April-December (3 months). Please clarify the number of months with wetland hydrology for the dry and normal modeled years. Updated 2007 months to 3 and updated 2017 to April to June.
7. Page 29, Section 6.7.2 – Please reiterate that Wetland 1A and 2A will be non-credit areas. Added a footnote to table 2 showing that UT1A, Wetland 1A, and Wetland 2A don't generate credit. Added Wetlands 1A and 2A are non-credit areas to the first paragraph of Section 6.7.2.
8. Page 30, Section 6.7.2 – Please consider rephrasing "negative impact" regarding establishing forest vegetation and wetland hydrology. Removed the word "negative".
9. Page 31, Section 6.8 – Please provide a brief description of proposed soil restoration to address previous land use and equipment/haul road compaction, low nutrients/organics, pH, etc. for planting medium suitability across the project easement area. Based on past project observations, priority 2 cut benches and side slopes can be challenging to establish vegetative cover and promote woody growth/vigor. Also, please confirm that pasture grasses will be treatment prior to or during project construction. There is no PII proposed for the project. The site will be machine planted and ripping will not be conducted. If machine planting doesn't occur the site will be ripped. Soil testing will be conducted to determine if additional soil amendments are needed. Pasture grasses will be treated prior to project construction.
10. Pages 31-32, Table 15 –
    a. There are several species discrepancies between this table and Sheet PLT-01. Please update tables to make consistent. Table 15 and PLT-01 are consistent.
    b. Please update Sheet PLT-01 to reflect the separate wetland and streamside zones and calculate the species stem count percent total separate for the wetland zone (not including live stakes). The planting table on PLT-01 has three zones with count totals per zone.
    c. Based on the PLT-01 table only seven species are proposed for wetland areas and nearly all canopy trees. DWR encourages increasing species diversity and adding a few understory/shrub species, ideally utilizing local reference wetland data. There are six understory species proposed.
    d. Please consider adding a few appropriate substitution species in case there are availability issues with the primary plant list. Please identify these species separately as potential supplemental/substitution species. Added two substitution species to Table 15 and placed an asterisk to indicate which ones are substitutions.

e. The PLT-01 wetland indicator status column is helpful, thanks for including.

11. Page 32, Section 6.9 – Either in this section or Appendix G, please provide more discussion on potential risks associated with being located in the Dan River floodplain, including flooding and sediment deposition affecting vegetation establishment and vigor withing stream buffer and wetland credit areas. Sediment deposition from the Dan River may affect vegetation establishment. Additional plantings of larger species will occur if sedimentation is an ongoing issue.
12. Page 33, Section 7.0 – DWR does not support early termination of the monitoring period. Removed statement about terminating after five years.
13. Page 33, Section 7.1.3 – Please include photos at easement crossings along UT1 Reach 2 and between UT2 Reach 1 and Reach 2. Added photos on UT1 Reach 2, and UT2 Reach 1/2.
14. Page 34, Section 7.2 – DWR supports a minimum hydroperiod threshold of 8 percent. Changed to 8% hydroperiod.
15. Page 34, Section 7.3 – Please update the vigor standard to 7 feet at year five and 10 feet at year seven. DWR does support a vigor exemption for shrub species and slow growing species, where appropriate. Changed to "The vegetation's average height must be seven feet at year five and 10 feet at year seven. These performance standards will apply to all riparian buffer and wetland planting areas, excluding shrubs and slow growing species".
16. Page 34, Section 7.4 – Please expand the scope of the visual assessment performance standard beyond veg plots and monitoring gauges. Updated to "Visual assessments will be used to evaluate the integrity of the conservation easement, vegetation plots, planted areas outside of the vegetation plots, stream stability, and monitoring gauges."
17. Pages 35-36, Table 16 – Please add the 30-day consecutive day flow and tree vigor requirements. As previously noted, DWR supports an 8% hydroperiod threshold. 30-day consecutive flow is in the table first row. Added average tree height of 10-feet and changed hydroperiod to 8%.
18. Page 37, Section 8.3 – What type of crest gauge is proposed? HOBO gauge or similar.
19. Page 39, Section 11 – Please confirm that the areas narrower than the standard 50-ft buffer width total less than 5 percent of the project. Approximately 2% of the stream credit length has less than a 50-foot buffer.
20. Page 40, Table 17 – There are two UT 1R2a listed, please correct the second to R2 or R2b.Updated second UT1 R2a to UT1 R2.
21. Figures – Please add reference sites and callout for the River Bend site on an included or new figure. Added River Bend site to Figure 1 and 3. Added a Figure 10 with reference site locations.
22. Figure 3 – Please callout UT1A, previous identified in Table 2. Also, please add a property boundaries layer to this figure (or another figure). Added UT1A callout and a parcel boundary.
23. Figure 8 – For the future projects and monitoring report CCPVs for this project, it would be helpful if the stream icon for restoration is color-coded blue and preservation is green. Please add the corresponding ratios to the figure legend. Changed the colors on Figures 8 and 9 and added ratios to legend.
24. Figure 9 -
    a. Please differentiate between crest and flow gauges. Changed symbology for crest and flow gauges.
    b. All flow gauges should be located within the upper one-third of the reach. Please shift the flow gauges upstream to UT1 Reach 2 and UT3 Reach 1. Moved flow gauges upstream.
    c. Please make sure that no groundwater gauges are installed over filled existing ditches or

stream channels. No gauges will be installed over filled ditches or stream channels.

d. DWR requests an additional groundwater gauge in Wetland 2 near the credit area/upland boundary. DWR also requests location shifts for four of the groundwater gauges and one veg plot (see figure markup). Moved four gauges, added one and moved one veg plot.
e. Please add a figure note regarding additional random veg plots and fixed photo points. Added note to Figure 9.

25. Sheet PSH-01.3 – Looking at the property boundary east of UT3 and Wetlands 3 & 4, why was the proposed easement setback from the property line? This appears to be a missed opportunity to capture additional wetland and stream on the site. The landowner specifically requested there be a setback from the property boundary.
26. Sheet PSH-02.1 – Please update table note to reference enhancement I. Also, as EI there should be some in-stream and bank improvements to the reach. Please confirm. The note has been updated on PSH-02.1 to reference EI. UT1 Reach 2A is classified as EI based on the change to channel dimension and profile with the use of the drop rock structure, benching, supplemental planting and cattle exclusion. (See Section 6.7.1)
27. Sheet PSH-02.2.3 Floodplain Depression – Based on the proposed 3-foot depth, DWR would anticipate these depressions to become open water areas. However, these areas are included in the proposed planting plan. What is the expected tree coverage within these areas? Generally, DWR encourages shallower depressions that seasonally dry for better vegetation establishment and wildlife habitat. Also, please confirm these features are not proposed to have outlets structures/paths. If outlets are proposed, please include details on material and dimensions, and show on plan view sheets. These features are being shown with a maximum depth of 3-feet and are used to help balance the cut/fill across the site. They are not designed as a specific wildlife habitat and it is expected that they will fill with sediment over time as there is no outlet proposed. Wetter species from the wetland zone will be planted in these areas and it is anticipated that they may be colonized by the obligate species on-site, *Salix nigra, Salix sericea, or Cephalanthus occidentalis*.
28. Sheet PSH-02.2.5 – Please consider aquatic passage in the max. depth determination and onsite construction of proposed drop structures. The aquatic passage has been considered in the design of all drop structures. No proposed drop structure that has perennial flow has a greater than 1.0' drop. The max depth is greater at the double drop vane on UT1 since it is intermittent flow, and not applicable in the case of the Embankment Stabilization to the Dan River.
29. Sheet PSH-02.2.6 – What is the proposed max. diameter of coir log? Will the coir log toes be planted with live stakes or herbaceous plugs? Please confirm that twine will not be plastic and log fill will not be straw. The diameter of the coir logs is minimum of 12.0", maximum of 20.0". The detail specifies coir twine and use of plant plugs. The detail has been updated to include a note that the log fill will not be straw and the maximum diameter of the coir log.
30. Sheet S-04 – Please add a callout to existing stream UT1A. Also, please callout existing fence within the site to be removed. A callout has been added to existing Stream UT1A. A note has been added on S-04 and S-05 to remove existing fence within the project site.
31. Sheets S-04 & S-05 – Please confirm that no riffles are proposed UT2 Reach 2 and only three riffles total are proposed along UT1 Reach 2 and Reach 3. Are there add concerns about long- term stream bed stability and/or bedform diversity enhancement? (Side note, it would be helpful to have more station labels along reaches.) Additional riffles have been added to UT1 R3 and UT2 R2. Begin and end construction labels have been added.

32. Sheet S-05 –
    a. Is there any risk that the proposed priority 2 bench cut along UT2 Reach 3 may adversely affect the Wetland 2b credit area hydrology? A gauge is shown on Figure 9 in this area and the hydrology will be monitored. There is no priority 2 planned for this project.
    b. What is the distance from the nearest floodplain depression to Wetland 1? With a 3-foot depth, is there any risk that the floodplain depression may adversely affect wetland hydrology within the proposed credit area? This is a closed depression that should not act as a drain. A gauge has been placed near the edge of Wetland 1 in this area. The nearest floodplain depression is 16.8 feet from the edge of Wetland 1.
33. Sheets G-01 – G-04 – Please add wetland credit area callouts (e.g., Wetland 1, 1B, 2, 2B, 3, 4). Wetland credit callouts have been added to the grading sheets.
34. Sheet G-03 – In addition to the callout, please show approximate areas where existing field crowns will be leveled to +/- 1 foot within proposed wetland credit areas. If any excavation greater than 1 foot is proposed, please estimate the total area and the precent of the proposed credit area. Note 2 states grading within the wetland will not be more than 6-inches (6").
35. Sheets PLT-04 & 05 – Please clarify if the buffers along UT1 Reach 1 and UT2 Reach 1 are proposed for full planting, supplemental/understory planting, or no planting? Based on Figure 9 veg plot locations, these areas are not proposed for monitoring. No planting is proposed along UT1 Reach 1 and UT2 Reach 1. This has been removed from the planting sheets.
36. Appendix G, #5 - DWR is concerned that the project tributaries may lose channel features within the larger, flatter floodplain of the Dan River and trend toward becoming wetland features. Please consider this concern in your risk analysis and adaptive management planning. And please note that channel maintenance (e.g., sediment and instream vegetation treatment/removal, hand grading) should be limited to early monitoring (pre-MY3) in order for the IRT to properly evaluate how these systems are trending. Added in information about vegetation and sediment removal and hand grading only in the first three years. UTs 1 and 2 have a steeper slope and have maintained a defined channel with cattle access therefore the loss of defined stream features is not as much of concern on these two channels. UT3 currently has a less defined channel and banks so coir logs are being used near the end of the restoration reach where the slope is less to facilitate and maintain bed and bank and bedform diversity. The coir logs provide time for the system to stabilize with mature vegetation while the channel naturally develops through on-going sedimentation. These coir logs, lack of cattle access, and growth of an appropriate streamside riparian buffer will help mitigate sedimentation from flooding events from the Dan River by optimizing the competence and capacity of the restored channels.
37. Appendix I – For future projects, please show all soil sample point locations on the boring figure, in part to illustrate process of wetland reestablishment credit area boundary determination. Comment noted.

*USACE Comments, Kim Isenhour:*

1. PSH-02.2.3: Floodplain depressions/vernal pools should be designed so that they are not inundated year-round, should dry up toward the end of spring to ensure that predatory species do not colonize in the pools, and should be no more than 14 inches deep. Do you anticipate that trees will establish in these areas? 3 ft depth seems excessive for floodplain depressions. Even

though these areas are not proposed for wetland credit, they are shown as areas that will be planted. These features are being shown with a maximum depth of 3-feet and are used to help balance the cut/fill across the site. They are not designed as a specific wildlife habitat, and it is expected that they will fill with sediment over time. Wetter species from the wetland zone will be planted in these areas and it is anticipated that they may be colonized by the obligate species on-site, *Salix nigra*, *Salix sericea*, or *Cephalanthus occidentalis*.

2. Appendix A: Is this the correct Conservation Easement template? I believe this is the template for private mitigation banks. The DMS conservation easement has been inserted into the mitigation plan. The conservation easement will be finalized near the end of January 2023.
3. Figure 9:
    a. Random veg plots should be shown differently from the permanent plots. Please plan to include a random plot along the northern border of the easement north of UT1 Reach 3 in the steeper area. Random veg plots are not shown on Figure 9 and will change each year. At least on random veg plot will be north of UT1 Reach 3.
    b. Several of the groundwater gauges in Wetland 1 should be moved to the outer edge of the wetland to capture the limits of jurisdiction. Moved three of the Wetland 1 gauges closer to the edge per comment and markup from Erin Davis.
    c. Wetland 2A on Figure 3 is an existing wetland, and I know this area is small, but this should be included for wetland rehabilitation credit rather than re-establishment. Wetland 2A appears to be within a wetland credit generating area. Wetland 2A is being permanently impacted by the restoration of UT1 Reach 3. No wetland credit is being generated by Wetland 2A. This 0.04-acre impact is shown in Table 6 and is listed on the PCN application.
    d. Please show the location of the rain gauge mentioned in Section 7.2. Added rain gauge.
    e. I'd like to see a random veg plot in the Priority 2 bench cut in Wetland 2. There is no Priority 2 on this project. A random plot will be placed between UT2 Reach 2 and Wetland 2 at some point during the monitoring.
4. Figure 5: Please amend the soils map to include the portion of the easement that includes UT2 Reach 1. Updated Figure 5 with entire conservation easement.
5. Section 3.7: It would be beneficial to include NCSAM data to support the need for functional uplift in hydrology, water quality and habitat. I was unable to locate the NCSAM forms in the appendix. NCSAM forms have been added to Appendix B.
6. For Section 7(a)(2) of the ESA, please confirm in iPac that the information received from USFWS on April 21, 2021 is still current. Many species have been listed since this letter was received. Please include a current species conclusion table if anything has changed. Added this to Section 4.1 "Since the finalization of the CE the official USFWS species list for the project site has changed. The tricolored bat (*Perimyotis subflavus*) has been added as proposed endangered and the James spinymussel has been removed. In the event that tricolored bat is fully listed prior to construction an additional self-certification package will be submitted to the USFWS Raleigh Field Office. An updated species table is found in Appendix E." Also added similar language to the PCN.
7. PSH-02.2.6: It appears that UT3 is located in a flat floodplain. Do you anticipate that this reach will lose channel features? If the intent of the coir logs is to help establish the proposed channel, will these be removed after year 2 of monitoring? Shouldn't the restoration of the channel accomplish the establishment of the channel? If these are left in place to degrade, there is potential that they

will cause erosion on the toe of the bank. Typically, we do not authorize manipulating the channel after MY2, to include removing in-stream vegetation or aggradation so that we can assess what the natural system will revert to. I also have concern that UT1 will not maintain channel features in the flatter areas. Please discuss this in the adaptive management section and Appendix G. Added in information about vegetation and sediment removal and hand grading only in the first three years. UTs 1 and 2 have a steeper slope and have maintained a defined channel with cattle access therefore the loss of defined stream features is not as much of concern on these two channels. UT3 currently has a less defined channel and banks so coir logs are being used near the end of the restoration reach where the slope is less to facilitate and maintain bed and bank and bedform diversity. The coir logs provide time for the system to stabilize with mature vegetation while the channel naturally develops through on-going sedimentation. These coir logs, lack of cattle access, and growth of an appropriate streamside riparian buffer will help mitigate sedimentation from flooding events from the Dan River by optimizing the competence and capacity of the restored channels.

8. Section 6.6.3: Is groundwater gauge data available for the reference wetland to compare to the site's data? There is no groundwater data available.
9. Page 28, Section 7.2, and Table 16: The minimum hydroperiod should be 8%. The hydroperiod has been changed to 8%.
10. Section 7.0: Please remove the statement that refers to terminating monitoring after five year. Removed statement about terminating after five years.
11. Section 7.1: Please include entrenchment ratios no less than 1.4 for B-type channels. No B-Type channels are proposed. Updated text to" Bank height ratios will not exceed 1.2 and entrenchment ratios will be at least 2.2 for restored C-Type channels."
12. Section 7.3: The veg height should be listed as at least 7 feet at year 5 and 10 feet at year 7. Height requirement has been changed.
13. When you include the IRT Meeting Summary in the Appendix, please also include the original proposed mitigation plan map for reference. Included the IRT Meeting Minutes and the Options 1 & 2 Map from the RFP in Appendix J.
14. The printed hard-copy version of the design sheets were printed on 8.5" x 11" paper, but the text was enlarged, so only a quarter of each design sheet was actually printed. Comment noted.
15. Tables 17, 18, 19: UT2 Reach 4 should be credited at 7:1 due to concerns that the channel will still be in a highly degraded condition post construction due to the connection of the stream to the Dan River. Cattle exclusion is not really an accurate functional uplift in this section because livestock is not currently accessing the channel due to the sheer walls. Additionally, only limited planting will occur on this reach. If you can justify additional functional uplift, perhaps above the drop structure, 5:1 would be acceptable above the drop structure, but 7:1 should be applied below the drop structure. The ratio for Reach 2 UT4 has been changed to 7:1.
16. Section 7.1.3: For fixed photo points, please capture all crossings, looking both upstream and downstream for culverts and looking across the crossing for fords. Also, please capture UT1 and UT3 to show defined channel features, and where UT2 connects with the Dan River. Section 7.1.3 now reads "Photos will be used to document morphological stability on an annual basis. Photos will be taken at each cross section, upstream and downstream, to document the presence/absence of erosion along the stream banks. Photos will be taken of any potential signs of instability around grade control structures. Photos will be taken at origin of each vegetation plot, the transition from UT2 Reach 3 to Reach 4, and the easement crossings on UT1 Reach 2, UT2, Reach1/2, and UT2

Reach 3. Channel features on UT1 and UT3, and the confluence of UT2 and the Dan River will be photographed. Channel photos will capture the formation and longevity of mid-channel bars and vertical incision.

17. It would be helpful to supplement Table 13 with a figure that shows grading zones. For example, polygons that depict grading 0-12", 12-18' and over 18". Added note to Table 13 that no grading within wetland credits will be greater than 6-inches. This statement is also on G-03 Note 2.
18. Considering that part of the project is in a FEMA flood-zone, do you anticipate scour/erosion in the floodplain along the Dan River or southern portions of the project? Please include visual observations of this area during monitoring. The effective FEMA model reports that the velocity in the 100-year event in the project site to be less than 1.5 fps which does not indicate a high risk for scour and erosion in the floodplain. The scour and erosion risk will be more prevalent due to the receding waters compared to the flooding waters of the Dan River. The proposed design includes structure and floodplain access to the tributaries to minimize scour and erosion risk. These areas will be observed during monitoring to determine if there is an issue that could impact the project. If this occurs a remedial plan to protect the project will be developed.
19. Table 15: It would be beneficial to include additional understory species to the upland riparian planting zone for diversity. There are three understory species proposed for the upland riparian zone.
20. Table 17: Just to confirm, the wider buffer tool was not utilized to generate additional stream credits on this project? The wider buffer tool was not used. A large portion of the wider buffer is being used for wetland credits.
21. Was a discussion added regarding the potential for hydrologic trespass on the adjacent property to the west? This remains a concern for the Corps. Reducing the risk of hydraulic trespass on the adjacent property to the west was identified as an early objective of the project. Surveys were obtained at the property line to aid in the development of the design approach and identify appropriate areas for fill. There are two swales draining from the west property onto the site. The lowest swale to the south will not be filled in order to maintain positive drainage from the adjoining property. The higher swale to the north will only be filled to an elevation to allow positive drainage from the adjoining property. These areas are identified on the grading plans and are set to not exceed the nearby natural ground elevations and will not exceed the surveyed elevations at the property line. A note has been added to the grading plans that states "fill existing swale to elevation to allow +/-0.5' freeboard from lowest elevation along property line" and further explanation has been added to the mitigation plan regarding hydraulic trespass.
22. I'd like to see riffles or more bedform diversity along UT2 Reach 2. Two additional woody riffles were added along UT2 Reach 2.
23. Please provide additional text on the drop structure to the Dan River. The stability of this structure remains a concern, particularly the use of wood and/or fabric. The embankment stabilization (ES) structure to the Dan River on S-05 has a detail provided on PSH-02.2.2. The purpose of the structure is to stabilize the highly entrenched existing channel where the floodwaters of the Dan River rise and recede. The existing channel in this area has been subjected to erosive flows and velocities that have created the entrenched channel due to the proximity to the Dan River. UT1 was restored to connect to UT2 at a higher elevation to provide floodplain connectivity and to avoid this entrenched area. The existing UT1 tributary will be filled in to promote wetland restoration. The raised elevations of existing UT1 created a grade separation where it ties to the Dan River tributary. To stabilize the

existing channel in this area, it will be backfilled with suitable material and covered with a layer of geotextile and 2.0' of Class I rip rap. To help control erosive velocities, it was designed with an area of flat slope to break up the 3:1 slope from the top of fill to the bottom of the existing channel. The detail has been updated to call for keying-in the geotextile to provide more stability. There is no wood called for to construct this structure.

# Mitigation Plan

Mushroom Meadow Site
Caswell County, North Carolina
RFQ# 16-20200204
DMS Project ID No. 100192
Full Delivery Contract No. 200204-01
USACE Action ID No. SAW-2021-00348
NCDWR No. 20210400, V1
Roanoke River Basin HUC 03010104
**Prepared For:** North Carolina Division of Mitigation Services
Raleigh, North Carolina

**Prepared By:**


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**January 2023**

**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 § 332.08 paragraphs (c)(2) through (c)(14).
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010

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


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## Tables

Appendices

# 1.0 Introduction

## 1.1 Site Description

The Mushroom Meadow Mitigation Site, consisting of the conservation easement, (hereinafter referred to as the Project Site or Site) is located in Caswell County, north of the Dan River at Milton along the Virginia/North Carolina border (Figure 1). The center latitude and longitude are 36.534037 °N, -79.243504 °W. It is part of the Roanoke River Basin within 14-digit Hydrologic Unit Code (HUC) 03010104021080 and NC Division of Water Resources (NCDWR) Subbasin 03-02-04. The Project Site was ultimately selected based on its potential for functional uplift opportunities to existing impaired streams and wetland resources resulting from previous and current land use activities. The project will provide a combination of stream and wetland mitigation credits in the Roanoke River Basin 8-digit Cataloging Unit 03010104 (a.k.a. Roanoke 04). Stream attributes include the restoration of approximately 2,980 linear feet (lf) of stream channel, enhancement I of 81 lf of stream channel, enhancement II of 412 lf of stream channel, and preservation of 742 lf of stream channel. The combined restoration and enhancement activities will generate a total of 3,190 Stream Mitigation Units (SMUs). In addition, wetland attributes include the rehabilitation of 0.386 acres of degraded wetland areas, and re-establishment of 7.861 acres of riparian wetlands. Wetland re-establishment, rehabilitation, and enhancement activities will generate 8.118 Wetland Mitigation Units (WMUs). The Site will be protected in perpetuity by a 32.6-acre conservation easement, which is provided in Appendix A.

# 2.0 Watershed Approach and Site Selection

The Dan River at the southern boundary of the project is classified by NCDWR as Water Supply IV (WS-IV). The river flows along the southern boundary of the Site, then heads north, crossing the Virginia/North Carolina State line into Virginia. The 2018 Roanoke River Basin Restoration Priorities (RBRP) does not specifically address this 14-digit HUC (03010104021080), but it does state for the 8-digit HUC (03010104) that cattle farming and other land uses are a source of non-point source pollution that need to be addressed. The site's 14-digit HUC is identified as part of all three types of Targeted Resource Areas (TRAs); water quality, habitat, and hydrology (Figure 2). Supplemental information provided by NC Division of Mitigation Services (NCDMS) to assist in preparation of this mitigation plan is also included. This information utilized the USEPA's Restoration Potential Screening Tool (RPS Tool) with NCDMS RPS Tool metrics. The Site is located in two catchments. The final index score for each of the two catchments was calculated by adding the Social, Ecological and Stressor Indexes from the RPS tool results together, with a double weight on the Stressor Index. Once these scores are run through the cluster analysis in Arc, the resulting clusters are utilized as starting points for TRA selection.

The watershed consists of a mixture of forest land and agriculture, both row crops and permitted animal operations. Caswell County remains mostly undeveloped aside from the areas in and surrounding Yanceyville and Roxboro. Land use in the area surrounding the Project Site is primarily agriculture/pasture along the river, silviculture, and single-family residential.

According to the Roanoke RBRP, HUC 03010104 land use is approximately 57% forested, 19% planted/cultivated, 1% wetlands, 5% shrublands, 5% developed, 10% herbaceous, 2% water, and less than 1% barren. The County's population decreased 4.7% since the 2010 census.

The project will directly and indirectly address stressors identified in the 2018 RBRP by removing livestock from the site, creating stable stream banks, restoring a forested buffer, restoring wetlands, and by conserving additional area adjacent to a DMS mitigation site, River Bend. These actions may reduce fecal, nutrient and sediment inputs into the Dan River.

## 2.1 Subbasin

The project is within the NCDWR Subbasin 03-02-04. The Roanoke River Basin Plan (RBP) serves as the watershed plan for this Subbasin. According to data provided in the RBP (2012), this subbasin has less than 5% development. An analysis of 2018 aerials of the watersheds of the three site tributaries, UT1, UT2, and UT3, shows that the watersheds consist of between 12% to 40% agricultural land use, and 59% to 87% forested area. The remaining 1% is classified as impervious area or developed.

The NC Department of Environmental Quality (NCDEQ) Roanoke River Basinwide Water Quality Plan (RBWQP) (2012) rates the Dan River as *impaired* for fecal coliform and not meeting the State turbidity standard. The Site contributes nutrients and sediment due to its approximately 50 head of cattle and their unrestricted access to the stream corridors.

The NCDMS RBRP (2018) further describes the 03010104 Cataloging Unit (CU) as having multiple impaired streams. Its goal for the watershed is to control non-point source pollution from forestry, cattle farming, and runoff from Yanceyville.

The Site supports the CU goal by removing cattle from the Site streams. It was selected for the opportunity to restore/enhance/preserve approximately 4,215 linear feet of stream channel, restrict livestock access to streams, restore/enhance riparian wetlands, and provide functional uplift upstream of the *impaired* Dan River.

Agricultural and forestry practices are two of the known stressors within the local watershed. These activities contribute nutrients, fecal coliform, and increased sediment to receiving waters. Project implementation will provide numerous ecological benefits within the Roanoke River Basin. Project benefits range from Site specific aquatic and terrestrial habitat improvements to those that extend beyond the immediate area and improve water quality in the river basin, including reduction of nutrient and sediment loads.

Stream and wetland restoration/enhancement activities will address the stressors identified in the RBWQP by stabilizing stream banks, removing cattle access to wetlands and streams, and planting forested riparian buffers. The project will increase retention times, reduce surface water temperatures, and increase floodplain connectivity.

# 3.0 Baseline and Existing Conditions

Table 1 summarizes watershed attributes associated with the Site. The existing conditions of the watershed (Figure 3) and watershed processes, including watershed disturbance and response, are described in the following sections. Existing conditions photos are provided in Appendix B.

**Table 1: Project Watershed Summary Information**

| Project Watershed Summary Information | |
|---|---|
| **Physiographic Province** | Piedmont |
| **Ecoregion** | Ecoregion 45e-Northern Inner Piedmont |
| **River Basin** | Roanoke River |
| **USGS HUC (8-digit, 14-digit)** | 03010104, 03010104021080 |
| **NCDWR Sub-basin** | 03-02-04 |
| **Project Drainage Area** | 0.12 sq. mi. (measured from downstream end at UT2 terminus) |
| **Project Drainage Area Percent Impervious Area** | <1% |
| **CGIA Land Use Classification** | 87% forested, 12% agriculture, <1% developed, <1% impervious |

## 3.1 Watershed Conditions

Very little change has occurred in the watershed of the Project Site over the past few decades. There have been some additional rural developments of small subdivisions or single-family homes, timber activities, and ongoing agricultural land uses, but these disturbances have been minor and do not appear to be the main source of degradation throughout the Project Site. The original land disturbances (70+ years ago) associated with conversion of the watershed to agricultural land use and ditching and draining of wetlands appear to be the driving factors for the degradation of Site streams and wetlands. The incision of the streams and ditching of wetlands resulted in degraded aquatic and terrestrial habitats, bare riparian zones, floodplain disconnection, and loss and degradation of wetland functions. Streambank erosion is ongoing and contributes to further resource degradation. The Site is predominately rural with little potential for significant additional impervious area.

## 3.2 Land Use/Land Cover

Land use activities associated with the Project Site center around livestock management, particularly cattle farming. The open fields serve as both pasture for livestock and associated hay production. Cattle have unrestricted access to all streams and wetland areas. They are periodically rotated between pastures to ensure good vegetative cover in the fields.

As previously noted, the watershed is approximately 87% forested, 12% agriculture, and 1% developed/impervious. The most common historical and current land uses in the watershed appear to be agriculture and rural development. A review of historic aerials shows that the Site has been in agricultural production in the existing configuration since at least 1948 (Figure 6). This consistency in land use within the project watershed over the past 74 years or more

indicates that watershed processes affecting hydrology, sediment supply, and nutrient and pollutant delivery have not varied widely in recent history.

## 3.3 Existing Conditions

The Site is located in the Piedmont physiographic province of North Carolina. Project implementation will address three unnamed tributaries to the Dan River. For the context of this document and the construction drawings, the tributaries have been labeled UT1 through UT3. Figure 3 depicts their locations, as well as other existing Site conditions.

Topography at and surrounding the Project Site is characterized as gently rolling towards the broad floodplain of the Dan River (Figure 4). The topography associated with the three Site UTs transitions from narrow, confined stream valleys to the broad floodplain of the Dan River. This transition affects the movement of sediment through the UTs. The average existing slope for UT1, UT2, and UT3 are 2.7%, 1.1%, and 1.2%, respectively. The slopes of the upstream-most, preservation portions of UT1 and UT2 are steeper, 3.2% and 4.2%, respectively, but flatten as they enter the Dan River floodplain.

Four wetland credit areas, labeled as Wetlands 1-4, are part of the overall project. Two of these wetlands (W1 and W2) are mostly drained with small pockets (W1A/W1B and W2A/W2B) of ditch bottoms considered jurisdictional wetlands (Figure 3). Wetlands 3 and 4 are considered jurisdictional (Figure 3). These areas are associated with the UTs, are located within the larger Dan River floodplain, and receive overbank flooding, surface runoff from the surrounding landscape, and groundwater infiltration.

The growth of native vegetation is highly restricted due to periodic and ongoing maintenance of the Site as pasture. Vegetation within the wetland areas is limited to a mix of grasses, sedges, and rushes. The jurisdictional wetland area in these pastures exhibits common vegetative species such as soft rush (*Juncus effusus)*, various sedges, marshpepper knotweed (*Persicaria hydropiper*), creeping buttercup (*Ranunculus repens*), Pennsylvania smartweed (*Persicaria pensylvanica*), and poverty rush (*Juncus tenuis*). Scattered canopy trees exist along portions of old fence lines and the boundaries of the conservation easement.

**Table 2: Project Resources Existing Conditions**

| Resource ID | Length (lf) /Area (ac) | Stream/Wetland Type | Existing Condition Impairment |
|---|---|---|---|
| UT1 | 2,099 lf | Intermittent | Incised in upper sections and aggrading lower sections of stream, lack of bedform diversity, straightened, lack of riparian vegetation, and direct livestock access. |
| UT1A* | 250 lf | Intermittent | Relic channel from UT1, direct livestock access, lack of riparian vegetation. |
| UT2 | 1,366 lf | Perennial | Incised, lack of riparian vegetation, direct livestock access, lack of bedform diversity, and straightened. |

**Table 2: Project Resources Existing Conditions (cont.)**

| Resource ID | Length (lf) /Area (ac) | Stream/Wetland Type | Existing Condition Impairment |
|---|---|---|---|
| UT3 | 577 lf | Intermittent | Incised, lack of riparian vegetation, direct livestock access, lack of bedform diversity, and straightened. |
| Wetland 1 | 0 | Riparian | Altered wetland hydrology, lack of mature forested vegetation, direct livestock access. |
| Wetland 1A* | 0.02 | Riparian | |
| Wetland 1B | 0.07 | Riparian | |
| Wetland 2 | 0 | Riparian | |
| Wetland 2A* | 0.04 | Riparian | |
| Wetland 2B | 0.01 | Riparian | |
| Wetland 3 | 0.13 | Riparian | |
| Wetland 4 | 0.31 | Riparian | |

* No credit reach/wetland

## 3.4 Geology and Soils

The Site is located in a portion of the Piedmont known as the Milton Belt (NCGS, 1985). As described by Horton and Zullo (1991), "The Milton belt is characterized by strongly foliated gneiss and schist, commonly with compositional layering and having felsic composition". The Milton Belt is considered an extension of the Charlotte Belt and is differentiated based on lithology rather than metamorphic grade. There is little information specific to the Milton Belt due to the disagreements among geologists whether to and how to classify it.

Codorus and Dan River loams are the dominant soils underlying the Project Area (Figure 5). These floodplain soils undergo conditions of frequent to occasional flooding, with the primary difference being landscape position. Dan River loam is topographically higher, reflecting more mesic habitat conditions. Only the Codorus series exhibits hydric characteristics (primarily from its minor soil, Hatboro silt loam).

According to the Natural Resource Conservation Service (NRCS) (2022), the Codorus and Dan River series consist of very deep, moderately well drained, and somewhat poorly drained soils. These soils formed in recently deposited alluvial materials derived from upland soils weathered from mostly metamorphic and crystalline rocks. Both soil series typically occur on floodplains with smooth, nearly level slopes of zero to three percent. Codorus loam occurs in the lower landforms and more poorly drained areas, while Dan River loam and its minor soils (Codorus and Comus loam) occur at slightly higher elevations and are more well drained. Saturated hydraulic conductivity is moderately high to high. The taxonomic classifications of both soil series are identified as Dystrudepts; however, the difference in order is fluvaquentic (Codorus) versus oxyaquic (Dan River).

Codorus soils exhibit deep profiles, are moderately well drained to somewhat poorly drained, have low runoff, and moderately high to high permeability. This soil unit includes the Hatboro silt loam series soils that is very deep and poorly drained. These soils are subject to periodic

stream overflow and inundation. The water table in an undrained Hatboro soil is found from the surface to a depth of 12 inches.

Apart from the Dan River and Codorus soil series, Fairview sandy loam and sandy clay loam comprise the remainder of the underlying soils. These very deep and well drained soils exhibit a moderate permeability and low shrink-swell potential. Slopes range from eight to nearly 25 percent. Fairview soils are upland soils classified as fine, kaolinitic, mesic Typic Kanhapludults.

The substrate of Site streams consists of sand with some very fine to very coarse gravel.

## 3.5 Site Access, Utilities, and Site Constraints

There are no existing utilities or easements that will impede the restoration of the Site. The Site can be accessed from River Bend Road and a farm road off of River Bend Road. The existing culvert on UT1 underneath the farm road will be removed. The culvert underneath the farm road at UT2 is in good condition and will remain as is.

## 3.6 Project Resources

Jurisdictional areas were delineated using the US Army Corps of Engineers (USACE) Routine On-Site Determination Method. This method is defined by the 1987 Corps of Engineers Wetlands Delineation Manual and the Eastern Mountain and Piedmont Regional Supplement. Jurisdictional wetlands and typical uplands were classified using the USACE Wetland Determination Data Form. Evaluation methods also utilized the NCDWR Stream Identification Form. Locations and extents of jurisdictional waters of the US (WOTUS) were surveyed for inclusion on plans and figures.

Three jurisdictional stream channels (UT1, UT2, and UT3), two drained wetland areas (W1 & W2), and two wetland areas (W3 & W4) comprise the aquatic resources at the Project Site. USACE Wetland Determination Data Forms and the submitted request for Preliminary Jurisdictional Determination (PJD) (USACE Action ID No. SAW-2021-00348) are provided in Appendix B. According to the NCDWR Stream Form classification method, UT2 meets the requirements of a perennial stream, while UT1 and UT3 are considered intermittent. Stream Identification Forms are provided in Appendices B and C. Table 2 (above) provides a summary of water resources within the Project Site and Table 3 provides project attributes. Reach specific cross sections and geomorphic summaries are provided in Appendix D.

**Table 3: Project Attribute Table**

| Project Attribute Table | |
|---|---|
| Project Name | Mushroom Meadow |
| County | Caswell |
| Project Area (acres) | 32.6 |
| Project Coordinates (latitude and longitude decimal degrees) | 36.534037 °N, -79.243504 °W |

**Table 3: Project Attribute Table (cont.)**

| Project Watershed Summary Information | | | | |
|---|---|---|---|---|
| Physiographic Province | Piedmont | | | |
| River Basin | Roanoke | | | |
| USGS Hydrologic Unit 8-digit | 3010104 | | | |
| DWR Sub-basin | 3/2/2004 | | | |
| Project Drainage Area (acres) | 76.8 | | | |
| Project Drainage Area Percentage of Impervious Area | <1% | | | |
| Land Use Classification | 87% forested, 12% agriculture, <1% developed, <1% impervious | | | |
| **Reach Summary Information** | | | | |
| **Parameters** | **UT1 Reach 1** | **UT1 Reach 2a** | **UT1 Reach 2** | **UT1 Reach 3** |
| Pre-project length (feet) | 435 | 81 | 458 | 1,125 |
| Post-project (feet) | 435 | 81 | 546 | 811 |
| Valley confinement (Confined, moderately confined, unconfined) | Unconfined | Unconfined | Unconfined | Unconfined |
| Drainage area (acres) | 18 | 24 | 24 | 29 |
| Perennial, Intermittent, Ephemeral | Intermittent | Intermittent | Intermittent | Intermittent |
| NCDWR Water Quality Classification | WS-IV | WS-IV | WS-IV | WS-IV |
| Dominant Stream Classification (existing) | N/A | Unstable B4 | Unstable B4 | Unstable C4 |
| Dominant Stream Classification (proposed) | N/A | B4 | C4 | C4 |
| Dominant Evolutionary class (Simon) if applicable | N/A | III: Degrading | II: Channelized | V: Aggrading & Widening |
| **Reach Summary Information** | | | | |
| **Parameters** | **UT2 Reach 1** | **UT2 Reach 2** | **UT2 Reach 3** | **UT2 Reach 4** |
| Pre-project length (feet) | 307 | 611 | 36 | 412 |
| Post-project (feet) | 307 | 693 | 217 | 412 |
| Valley confinement (Confined, moderately confined, unconfined) | Unconfined | Unconfined | Unconfined | Unconfined |
| Drainage area (acres) | 38 | 46 | 48 | 141 |
| Perennial, Intermittent, Ephemeral | Perennial | Perennial | Perennial | Perennial |
| NCDWR Water Quality Classification | WS-IV | WS-IV | WS-IV | WS-IV |

**Table 3: Project Attribute Table (cont.)**

| Reach Summary Information | | | | |
|---|---|---|---|---|
| **Parameters** | **UT2 Reach 1** | **UT2 Reach 2** | **UT2 Reach 3** | **UT2 Reach 4** |
| Dominant Stream Classification (existing) | N/A | G5c | G5c | N/A |
| Dominant Stream Classification (proposed) | N/A | C5 | C5 | N/A |
| Dominant Evolutionary class (Simon) if applicable | N/A | V: Aggrading & Widening | V: Aggrading & Widening | N/A |

| Reach Summary Information | | |
|---|---|---|
| **Parameters** | **UT3 Reach 1** | **UT3 Reach 2** |
| Pre-project length (feet) | 360 | 217 |
| Post-project (feet) | 390 | 323 |
| Valley confinement (Confined, moderately confined, unconfined) | Unconfined | Unconfined |
| Drainage area (acres) | 64 | 67 |
| Perennial, Intermittent, Ephemeral | Intermittent | Intermittent |
| NCDWR Water Quality Classification | WS-IV | WS-IV |
| Dominant Stream Classification (existing) | Unstable E5 | Unstable E5 |
| Dominant Stream Classification (proposed) | C5 | C5 |
| Dominant Evolutionary class (Simon) if applicable | V: Aggrading & Widening | V: Aggrading & Widening |

| Wetland Summary Information | | | | |
|---|---|---|---|---|
| **Parameters** | **Wetland 1** | **Wetland 1A** | **Wetland 1B** | **Wetland 2** |
| Pre-project (acres) | 0 | 0.02 | 0.10 | 0 |
| Post-project (acres) | 6.25 | 0.02 | 0.10 | 1.48 |
| Wetland Type (non-riparian, riparian) | Riparian | Riparian | Riparian | Riparian |
| Mapped Soil Series | Codorus | Codorus | Codorus | Codorus |
| Soil Hydric Status | Hydric | Hydric | Hydric | Hydric |

| Wetland Summary Information | | | | |
|---|---|---|---|---|
| **Parameters** | **Wetland 2A** | **Wetland 2B** | **Wetland 3** | **Wetland 4** |
| Pre-project (acres) | 0.04 | 0.02 | 0.09 | 0.18 |
| Post-project (acres) | 0 | 0.02 | 0.09 | 0.18 |
| Wetland Type (non-riparian, riparian) | Riparian | Riparian | Riparian | Riparian |
| Mapped Soil Series | Codorus | Codorus | Codorus | Codorus |
| Soil Hydric Status | Hydric | Hydric | Hydric | Hydric |

[1]The morphology of Site streams is affected by both upstream drainage and flooding events from the Dan River. Aggradation from deposition during Dan River flood events is natural for these streams.
[#]All areas are within FEMA Zone AE-Floodway for the Dan River. The Site streams do not have independent hydraulic engineering models. A no-rise certification for the Dan River is being prepared to develop within the 100-year floodplain and floodway associated with the Dan River.
*Will not generate credit

Unnamed Tributary 1 (UT1)

UT1 is an intermittent channel that originates approximately 550 feet north of the Site in a drainageway. UT1 enters the Site from the north via a forested corridor. The channel exhibits erosion along both stream banks and contains two existing head cuts within the forested area just upstream of where the riparian vegetation transitions from forest to pasture. Bank height ratios throughout UT1 range from 1.8 to 2.8. The upper sections of UT1 showed signs of incision while the lower sections showed aggradation. This is believed to be caused by steeper stream and valley slopes in the upper sections of UT1 and the flatter stream and valley slopes under the influence of the Dan River on the lower sections. Little to no riparian vegetation exists along this channel once it leaves the forested corridor. The channel is conveyed through a pipe underneath the farm road as it flows towards the Dan River floodplain. It appears to have been straightened and cuts across the natural grade of the land and eventually flows to the east towards UT2. UT1 is joined by UT2 approximately 1,350 feet downstream of the road crossing. After the confluence with UT2 the channel becomes much wider and deeper. The erosive forces from floodwaters from the Dan River appear to be the cause of the increased width and depth and are not considered unnatural. The valley slope upstream of the road is approximately 3.2%, while that downstream of the road is approximately 2.6%. The stream channel contains sand and some coarser material, but there are no riffles/pools to provide in-stream habitat.

Unnamed Tributary 1A (UT1A)

UT1A is an intermittent channel that appears to be a portion of the relic UT1. It originates approximately 250 feet north of the confluence with the existing UT1. This feature is heavily impacted by cattle and is disconnected from the historic watershed which currently drains into the relocated UT1. This reach is not proposed for credit.

Unnamed Tributary 2 (UT2)

UT2 is a perennial channel that originates approximately 1,550 feet northwest of the Site in a drainageway. This tributary enters the Site via a forested corridor through a pipe underneath River Bend Road (SR 1527). Within the Site, UT2 flows into a second pipe underneath the farm road as it enters the unforested Dan River floodplain, eventually joining UT1. UT2 is incised, with bank height ratios averaging 5.2. Erosion is obvious along the length of the channel and evidence of hoof shear is present in the unforested area. The valley slope is relatively steep upstream of the farm road, at approximately 4.2%, and decreases once UT2 enters the floodplain associated with the Dan River. Minimal bedform diversity was observed along this channel, consisting mainly of sand with small amounts of gravel. Riparian vegetation is limited to a single line of trees along the stream banks with sparse shrubs in the understory.

Unnamed Tributary 3 (UT3)

UT3 is an intermittent channel that originates approximately 2,100 feet north of the Site. This tributary enters the Site via a forested corridor through a pipe underneath River Bend Road. UT3 is incised, with bank height ratios averaging 1.8. As the channel enters the flat floodplain of the Dan River, it loses some morphological characteristics of a natural channel. Channel features have been further obscured by cattle impact. The channel flows towards an existing DMS mitigation site (River Bend) at the property boundary. There is no woody vegetation present along the tributary throughout the Site. The stream channel contains sand and some coarser material but there are no riffles/pools to provide in-stream habitat.

Wetlands (W1, W2, W3, and W4)

An on-site delineation of jurisdictional resources identified three drained wetland areas and one jurisdictional wetland within the proposed conservation easement. Table 3 (above) outlines specific details of the on-site wetland resources.

Drained wetland 1 (W1) is associated with UT1. UT1 was straightened through W1 in the past and is the major impairment to wetland hydrology. Additionally, there are four small drainage swales that negatively impact wetland hydrology. A small portion of one of these swales was deemed jurisdictional by the USACE and (Figure 3) and the main drainage ditch running east to west was considered jurisdictional. These areas are labeled as W1A and W1B, respectively. Drained wetland 2 (W2) is located between UT1 and UT2 and has been negatively impacted by stream relocation and swales. A portion of relic UT1 and a small portion of a drainage swale is considered a jurisdictional wetland (Figure 3). These are labeled at W2A and W2B respectively. All these wetlands in their current state are devoid of woody vegetation and are dominated by herbaceous plants. These areas have been heavily impacted by cattle and vegetation is dominated by pasture grasses and sporadic soft rush. NCWAM assessments were not completed due to the lack of all three wetland parameters in these areas.

Wetland 3 (W3) is a jurisdictional wetland located southwest of UT3 and is currently impacted by two ditches draining to the west. Wetland 4 (W4) is a jurisdictional wetland adjacent to UT3. These wetlands have been impacted by cattle and swales but still exhibit wetland hydrology in the form of oxidized rhizospheres and surface water. The vegetation in these wetlands is similar to the two drained wetlands. These wetlands scored Low on the NCWAM assessment form.

Hydric soils meeting the F3 (depleted matrix) and F19 (Piedmont floodplain soils) indicator were observed in the drained wetlands and W4. According to the USACE Antecedent Precipitation Tool, this area was experiencing "Wetter than Normal" conditions during the wetland investigations in October 2020 and July 2021 when wetlands W1 and W2 were evaluated. These areas did not exhibit any wetland hydrology indicators during a wetter than normal period. Wetlands 3 and 4 were evaluated in January 2022 during a drier than normal period. The ditches associated with Wetland 3 are more substantial than the ones within Wetland 4 and are providing better drainage. Table 4 summarizes the wetland area impairments.

**Table 4: Wetland Impairment**

| Wetland Name | Impairment | Reason for Impairment |
|---|---|---|
| Wetland 1 | Low hydrology function<br>Low water quality function<br>Low habitat function | **Hydrology:** Cattle compaction and land use activities<br>**Water Quality:** lack of floodplain connectivity to smaller unnamed tributaries, lack of woody vegetation, fecal coliform from cattle<br>**Habitat:** lack of diverse vegetation structure |
| Wetland 2 | Low hydrology function<br>Low water quality function<br>Low habitat function | **Hydrology:** Cattle compaction and land use activities<br>**Water Quality:** lack of floodplain connectivity to smaller unnamed tributaries, lack of woody vegetation, fecal coliform from cattle<br>**Habitat:** lack of diverse vegetation structure |
| Wetland 3 | Low hydrology function<br>Low water quality function<br>Low habitat function | **Hydrology:** Cattle compaction and land use activities<br>**Water Quality:** Fecal coliform from cattle<br>**Habitat:** lack of diverse vegetation structure |
| Wetland 4 | Low hydrology function<br>Low water quality function<br>Low habitat function | **Hydrology:** Cattle compaction and land use activities<br>**Water Quality:** Fecal coliform from cattle<br>**Habitat:** lack of diverse vegetation structure |

## 3.7 Potential for Functional Uplift

The primary stressors to Site streams are past straightening, livestock access, and a lack of riparian buffers. Without intervention, the streams will continue to exhibit a lack of bedform diversity from past relocation, lack of in-stream habitat and trampled banks by livestock which will contribute to downstream sediment and pollutant loads.

The wetlands within the Dan River floodplain have been compromised by conversion from forest to pasture. NC Wetland Assessment Methodology (NCWAM) was not conducted in areas not meeting all three wetland parameters however, based on reference wetlands it is likely these areas should be classified as a Bottomland Hardwood Forest. Wetland restoration will increase groundwater storage and residence time, improve hydrologic interactions with floodplain streams, and provide an expansion of habitat to the neighboring North Carolina Wildlife Resources Commission (NCWRC) property, approximately 193 acres, also known as the River Bend Mitigation Site. The River Bend Mitigation Plan can be found here.

# 4.0 Regulatory Considerations

Table 5 summarizes the regulatory considerations for the Site. Additional detail for each consideration is provided in Sections 4.1–4.3.

**Table 5: Regulatory Considerations**

| Federal Regulation | Applicable | Resolved | Supporting Documents |
|---|---|---|---|
| Water of the U.S. Section 404 | Yes | No | PCN[1] |
| Water of the U.S. Section 401 | Yes | No | PCN[1] |
| Endangered Species Act | Yes | Yes | Categorical Exclusion/Appendix E |
| Historic Preservation Act | Yes | Yes | Categorical Exclusion/Appendix E |
| Coastal Zone Management Act | No | N/A | N/A |
| FEMA Floodplain Compliance | Yes | Yes | Caswell County Floodplain Development Permit |
| Essential Fisheries Habitat | No | N/A | N/A |

[1]- PCN will be submitted to IRT with Final Mitigation Plan

## 4.1 Biological and Cultural Resources

A Categorical Exclusion (CE) for the Site was approved on September 14, 2021. The CE document detailing the findings outlined below is provided as Appendix E. An investigation into the presence of federally protected threatened and endangered species, protected under the Endangered Species Act 1973, as well as historical resources protected under the National Historic Preservation Act of 1966 was completed. Eco Terra requested comments on the project from the US Fish and Wildlife Service (USFWS) and the NCWRC. Both agencies responded that the proposed project is not likely to adversely affect federally listed or state listed species. The project was approved through the USFWS self-certification process. Since the finalization of the CE the official USFWS species list for the project site has changed. The tricolored bat (*Perimyotis subflavus*) has been added as proposed endangered and the James spinymussel has been removed. In the event that tricolored bat is fully listed prior to construction an additional self-certification package will be submitted to the USFWS Raleigh Field Office. An updated species table is found in Appendix E.

The State Historic Preservation Office (SHPO) concluded from the scoping letter that the site had a high probability of archaeological resources based on the location of nearby resources and the potential presence of prehistoric Native American settlements along the Dan River. It was recommended that an archaeological survey be conducted within all areas proposed for ground disturbance. A Phase I Archaeological Investigation was completed by SWCA Environmental Consultants in September 2021, and a non-diagnostic lithic biface fragment was encountered. Shovel tests did not reveal any other archaeologically significant materials. The isolated find was registered with the NC Office of State Archaeology, and the Site was determined not eligible for listing on the National Register of Historic Places. SHPO concurred with findings of the archaeological survey in a letter dated August 26, 2021.

## 4.2 FEMA Floodplain Compliance

The Site contains Federal Emergency Management Agency (FEMA) regulated areas. Site streams are located on Caswell County Flood Insurance Rate Maps (FIRM) 3711902100J and

3711903100J, both with an effective date of 9/28/2007. The Site is located within the Zone AE Special Flood Hazard Area (SFHA) regulatory floodplain associated with the Dan River. The majority of the Site streams are located within the Dan River Floodplain but do not have an independent hydraulic model. Effective FEMA mapping for the Site is shown on Figure 7. A Floodplain Development permit with a corresponding analysis and No-Rise Certification was approved by Caswell County and the documentation is in Appendix K.

## 4.3 Section 401/404

There are four stream channels and six wetland areas that are considered jurisdictional Waters of the US (WOTUS) on the Site. A request for PJD was submitted to the USACE and site visit was conducted on April 5, 2022. The Action ID number for the project is SAW-2019-02341. The USACE provided an email stating they are in agreement with existing jurisdictional features shown on Figure 3 (Appendix B). The PJD, once issued by the USACE, will be included with the final mitigation plan.

Impacts to jurisdictional streams and wetlands will be necessary for restoration and enhancement activities, but the overall result of these activities will be an uplift in aquatic function of these historically impacted resources. Appropriate levels of intervention were developed based on existing stream stability and functionality. Impacts will be minimized, where possible. Impacts will be quantified and submitted to the USACE, along with the Final Mitigation Plan, as part of documentation for a Pre-Construction Notification (PCN) for the project. Table 6 estimates impacts to jurisdictional resources.

**Table 6: Estimated Impacts to Jurisdictional Resources**

| Jurisdictional Resource | Classification | Existing | | Permanent Impact (P) | | Temporary Impacts (T) | |
|---|---|---|---|---|---|---|---|
| | | Length (lf) | Area (ac) | Activity | Impacts | Activity | Impacts (ac) |
| UT1 Reach 2a | Intermittent | 81 | | | | Enhancement | 81 |
| UT1 Reaches 2/3 | Intermittent | 1,583 | | Restoration | 1,583 lf | | |
| UT1A | Intermittent | 250 | | Restoration | 250 lf | | |
| UT2 Reaches 2/3 | Perennial | 647 | | Restoration | 681 lf | | |
| UT3 | Intermittent | 577 | | Restoration | 577 lf | | |
| W1A | Wetland | | 0.02 | | | Grading | 0.02 |
| W1B | Wetland | | 0.10 | | | Restoration | 0.08 |
| W2A | Wetland | | 0.04 | Grading | 0.04 ac | | |
| W2B | Wetland | | 0.02 | | | Restoration | 0.02 |
| W3 | Wetland | | 0.09 | | | Restoration | 0.04 |
| W4 | Wetland | | 0.18 | | | Restoration | 0.04 |
| | | | | **Total Impact (P) lf** | 3,091 | **Total Impact (T) lf** | 81 |
| | | | | **Total Impact (P) ac** | 0.04 | **Total Impact (T) ac** | 0.20 |

# 5.0 Mitigation Site Goals and Objectives

The overarching goal of the project is to provide stream and wetland credits, to offset unavoidable impacts, as compensatory mitigation. These credits will be developed through a combination of stream and wetland restoration activities. Project goals are desired project outcomes and are verified through measurement and/or visual assessment. Objectives are activities that will result in the accomplishment of goals. The project will be monitored after construction to evaluate performance as described in Section 8 of this report. The project goals and related objectives are described in Table 7.

**Table 7: Mitigation Goals and Objectives**

| Goal | Objective | Expected |
|---|---|---|
| Reconnect channels with historic floodplains and improve wetland hydrology in drained wetland areas. | Reconstruct stream channels for bankfull dimensions and depth relative to the existing floodplain. Fill ditches to increase wetland hydroperiod | Regular bankfull events with access to the floodplain. Higher groundwater table elevation |
| Improve the stability of stream channels | Construct stream channels that will maintain a stable pattern and profile. | Reduce sediment input from bank erosion. Reduce shear stress on channel boundary. |
| Exclude cattle from streams | Remove cattle from conservation easements. | Reduce sediment input, reduce fecal coliform, reduce nutrient input. |
| Improve stream habitat | Install habitat features such as constructed riffles, root wads, and woody debris in restored/enhanced stream channels. Construct pools of varying depth | Increase and diversify available habitats for macroinvertebrates, fish, and amphibians. |
| Restore wetland hydrology, soils, and plant communities. | Restore riparian wetlands and soils by raising stream bed elevations, filling ditches/swales, removing livestock, and planting native wetland plants. | Elevate groundwater elevation in drained wetlands and prolong elevated groundwater levels in enhanced wetlands. |
| Restore and enhance native floodplain and streambank vegetation | Plant native tree and understory species in riparian zone and plant appropriate streambank species. | Reduce sediment inputs from bank erosion and runoff. Increase nutrient cycling and storage in floodplains. Provide riparian habitat. Add woody debris to streams. |
| Permanently protect the Project Site from future development. | Establish conservation easement on the Site. | Protect Site from encroachment on the riparian corridor and direct impact to streams and wetlands. |

# 6.0 Design Approach and Mitigation Work Plan

## 6.1 Design Approach Overview

The proposed design involves the preservation, restoration and/or enhancement of three unnamed tributaries to the Dan River and restoration of four wetland areas. For design purposes, segments of channel were separated into nine distinct stream reaches: UT1 (three reaches), UT2 (four reaches), and UT3 (two reaches). These reaches were categorized by individual stream components such as contributing drainage area, channel slope, valley slope, and valley type, as well as the influence of the Dan River. It should be noted that most of the site is contained within the Dan River floodplain and is influenced by the inundation and receding of Dan River floodwaters. The overall design approach is similar across the entire Site and utilizes both analog and analytical approaches, as well as empirical data and prior experience. Construction drawings depict proposed implementation methods and methodologies. These drawings, as well as existing and proposed morphology data, are provided in Appendix D.

The design approach for the Site was developed to meet the goals and objectives described in Section 5. The project streams will be reconnected with their active floodplains and channels will be reconstructed with stable dimension, pattern, and profile that will transport the water and sediment delivered to the system. Wetlands will be restored by plugging and filling existing drainage ditches with special attention to not hydrologically trespass with adjacent properties. Floodplains and wetlands will be planted with native species to restore adequate buffer areas where necessary. In-stream structures were designed to provide stable channel morphology and improve aquatic habitat. The entire project area will be protected by a conservation easement.

The design criteria applied to this Project included the evaluation of a combination of reference reach data available online and via the NCDMS' website, past reference reach surveys, and prior designs and monitoring data from past successful stream restoration projects completed in the Piedmont Physiographic province of North Carolina. The design criteria were developed using Natural Channel Design (Rosgen 1996) as the standard approach, combined with hydrologic/hydraulic analysis information, sediment transport calculations, and comparison with available empirical data. The approach provides the optimum opportunity for successful uplift via the established goals and objectives for project implementation.

## 6.2 Reference Streams

There were no available reference streams within the Mushroom Meadows Mitigation Site. The use of multiple reference streams representing the characteristics of stable channels (including dimension, pattern, and profile) provides a comparison of data which can be very beneficial to the design of stable channels of similar character, nature, and location. Published data from three reference streams were evaluated and utilized in the design of UT1, UT2 and UT3. Parameters utilized in the selection included drainage areas less than one square mile,

watersheds of similar composition, valley types, and channel slopes, similar bed material, and stream systems originating in the Piedmont physiographic province of North Carolina.

Reference reach data, where applicable, are provided in Table 8 and locations are shown on Figure 10.

**Table 8. Stream Reference Data Utilized for Design Development**

| Site Stream Name | | | UT1 | | UT2 | | UT3 | |
|---|---|---|---|---|---|---|---|---|
| **Reference Stream Name** | **Watershed Size (ac)** | **Stream Type** | **R2** | **R3** | **R2** | **R3** | **R1** | **R2** |
| **UT to Richland Creek** | 179 | C4/E4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Spencer Creek 2** | 614 | E4 | | | ✓ | ✓ | | |
| **UT to Cedar Creek** | 70 | C4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

### 6.2.1 UT to Richland Creek

UT to Richland Creek is a perennial stream channel exhibiting a drainage area of approximately 0.28 square miles (179 acres). This reference stream is located in north-central Moore County west of Carthage, NC and classified as a C4/E4 stream type with low sinuosity. It was originally identified and surveyed by Wildlands Engineering for the Candy Creek Mitigation Site Mitigation Plan (NCDMS 2016). This reference reach has a comparable sediment regime and valley slope to the Site streams and was used to develop morphological criteria and hydraulic relationships, primarily with respect to dimension (W/d, Entrenchment and Bank Height) ratios. The portion of the stream used as a reference is found within a stable riffle/run sequence with a predominately timber regrowth land use in the watershed.

### 6.2.2 Spencer Creek Reach 2

Spencer Creek Reach 2 is a perennial stream channel exhibiting a drainage area of approximately 0.96 square miles (614 acres). This reference stream is located in western Montgomery County and classified as a narrow width/depth C5 stream type. It was originally identified and surveyed by Wildlands Engineering for the Candy Creek Mitigation Site Mitigation Plan (NCDMS 2016). The portion of the stream used as a reference is found near the Ophir, NC crossroads, flowing through a mature forest with a valley slope of 1.1% and a channel slope of 0.47%. It exhibits a riffle slope ratio of 2.8, a pool depth ratio of 2.0 and pool width ratio of 1.6 and was used to develop both dimension (Entrenchment and Bank Height) and pattern (Sinuosity and Meander Width) relationships

### 6.2.3 UT4 (UT to Cedar Creek)

UT to Cedar Creek is a perennial stream channel exhibiting a drainage area of approximately 0.11 square miles (70 acres). This reference stream is located in eastern Stanly County, NC just

upstream of Lake Tillery on the Pee Dee River. It was originally identified and surveyed by Environmental Banc & Exchange (EBX) for the Rockwell Pastures Stream and Wetland Restoration Site (NCDMS 2008). The Rosgen C4 stream exhibits a valley slope of 1.7% and a channel slope of 1.6% with a width to depth ratio of 12.6, sinuosity of 1.1 and an entrenchment ratio of greater than 2.2. This reference reach was primarily used to develop dimension (W/d, Entrenchment and Bank Height) relationships.

## 6.3 Design Channel Morphological Parameters

Key proposed morphological parameters (i.e., cross section, pattern, and profile) are shown in Table 9. Complete morphological tables for existing, reference, and proposed conditions are provided in Appendix D.

**Table 9: Select Proposed Morphological Parameters**

| Parameter | UT1 R2/R3 | | |
|---|---|---|---|
| | Existing Condition | Reference Condition | Proposed |
| | | UT to Richland/UT4 (UT to Cedar) | |
| Valley Width (ft) | 14.2/41.4 | 31.4/20.1 | >25/>25 |
| Contributing Drainage Area (acres) | 24/29 | 179/70 | 24/29 |
| Channel/Reach Classification | Unstable B4/Unstable C4 | C4/E4//C4 | C4/C4 |
| Discharge Width (ft) | 7/7.8 | 8.8/7.3 | 6/7 |
| Discharge Depth (ft) | 1/1.2 | 1.1/1.1 | 0.8/1.0 |
| Discharge Area ($ft^2$) | 3/4.3 | 7.8/4.2 | 3.2/4.6 |
| Discharge Velocity (ft/s) | 4.1/3.9 | 3.5/5.6 | 4.8/3.7 |
| Discharge (cfs) | 12.2/17.0 | 29.1/23.6 | 13.5/16.2 |
| Water Surface Slope | 0.0280/0.0123 | 0.0131/0.0016 | 0.0222/0.0078 |
| Sinuosity | 1.0/1.0 | 1.0/1.1 | 1.2/1.2 |
| Width/Depth Ratio | 17.5/13.0 | 10/12.6 | 12.0/10.0 |
| Bank Height Ratio | 2.7/1.8 | 1.4/1.0 | 1.0/1.0 |
| Entrenchment Ratio | 2.0/>2.2 | -/2.7 | >2.2/>2.2 |
| d16 / d35 / d50 / d84 / d95 / dip / disp (mm) | 0.62/1.8/6.1/30/56 | -/- | 0.44/0.76/1.8/4.9/7.5 |

**Table 9: Select Proposed Morphological Parameters (cont.)**

| Parameter | UT2 R2/R3 | | |
|---|---|---|---|
| | Existing Condition | Reference Condition | Proposed |
| | | UT to Richland/UT4 (UT to Cedar)/ Spencer Creek 2 | |
| Valley Width (ft) | 4.6 | 31.4/20.1/60 | >25 |
| Contributing Drainage Area (acres) | 48 | 179/70/614 | 46/48 |
| Channel/Reach Classification | G5c | C4/E4//C4//C5 | C5/C5 |
| Discharge Width (ft) | 4 | 8.8/7.3/10.7 | 7/9 |
| Discharge Depth (ft) | 0.8 | 1.1/1.1/2.1 | 1.0/1.3 |
| Discharge Area ($ft^2$) | 3.3 | 7.8/4.2/17.8 | 4.6/7.4 |
| Discharge Velocity (ft/s) | 5.3 | 3.5/5.6/4.9 | 5.4/4.2 |
| Discharge (cfs) | 26.5 | 29.1/23.6/97 | 26.3/38.1 |
| Water Surface Slope | 0.0113 | 0.0131/0.0016/.0047 | 0.0096/0.0058 |
| Sinuosity | 1 | 1.0/1.1/2.3 | 1.2/1.2 |
| Width/Depth Ratio | 6.7 | 10/12.6/5.8 | 10.0/11.3 |
| Bank Height Ratio | 5.9 | 1.4/1.0/1.0 | 1.0/1.0 |
| Entrenchment Ratio | 1.2 | -/2.7/5.5 | >2.2/>2.2 |
| d16 / d35 / d50 / d84 / d95 / dip / disp (mm) | 0.14/0.31/0.49/3.9/6.3 | -/-/- | 0.35/0.57/0.81/11/17 |

**Table 9: Select Proposed Morphological Parameters (cont.)**

| Parameter | UT3 R1/R2 | | |
|---|---|---|---|
| | Existing Condition | Reference Condition | Proposed |
| | | UT to Richland/UT4 (UT to Cedar) | |
| Valley Width (ft) | 15/30 | 31.4/20.1 | >25/>25 |
| Contributing Drainage Area (acres) | 64/67 | 179/70 | 64/67 |
| Channel/Reach Classification | Unstable E5/Unstable C5 | C4/E4//C4 | C5/C5 |
| Discharge Width (ft) | 5.4/10.2 | 8.8/7.3 | 7/10 |
| Discharge Depth (ft) | 1.3/1.2 | 1.1/1.1 | 1/1.2 |
| Discharge Area ($ft^2$) | 3.8/5.8 | 7.8/4.2 | 4.4/8.0 |
| Discharge Velocity (ft/s) | 5.6/4.0 | 3.5/5.6 | 5.3/2.8 |
| Discharge (cfs) | 27.7/27.3 | 29.1/23.6 | 26.2/26.2 |
| Water Surface Slope | 0.0146/0.0084 | 0.0131/0.0016 | 0.0137/0.0026 |
| Sinuosity | 1.0/1.0 | 1.0/1.1 | 1.2/1.2 |
| Width/Depth Ratio | 7.7/17 | 10/12.6 | 11.7/12.5 |
| Bank Height Ratio | 2.5/1.2 | 1.4/1.0 | 1.0/0.8 |
| Entrenchment Ratio | >2.2/>2.2 | -/2.7 | >2.2/>2.2 |
| d16 / d35 / d50 / d84 / d95 / dip / disp (mm) | 0.14/0.56/1.3/6.9/ 11 | -/- | 0.068/0.086/0.11/0.2 2/0.34 |

## 6.4 Bankfull Discharge Analysis

Several methods were used to develop bankfull discharge estimates for each restoration reach of the project: the NC Rural Piedmont Regional Curve (Harman et al., 1999), the continuity equation utilizing various velocity calculation methods described in section 6.4.2, and professional judgement. The discharges obtained from the above-mentioned methods were evaluated to determine applicability and compared to TR-55 and USGS regression methods to determine return intervals. Using multiple methods to estimate bankfull discharge helps to eliminate dependence on a single method as the basis of channel design. The different methods commonly produce varying results, so professional judgement was used to select the final design discharge for each restoration reach. For this analysis, there was some concurrence between the TR-55, NC Rural Piedmont Regional Curve, Dr. Richard Hey method, Shear Velocity (u*) method, and manning's n methods; however, the resistance equations by stream type and reference reach curve values were consistently lower than the other methods. Each of the methods used to estimate discharge are described in Section 6.4.2 and the results of the analysis are summarized in Table 10.

### 6.4.1 Published Regional Curve Data

The NC Rural Piedmont Regional Curve published by Harman et al. in 1999 was used to estimate discharges of each restoration reach. The Piedmont curves were deemed most applicable to the Site due to the project's physiographic location along with restoration reach drainage areas and slopes being within range of those used in the development of the Rural Piedmont Regional Curve. The computed values of this method can be viewed in Table 10.

### 6.4.2 Continuity Equation and Velocity Comparison Analysis

VHB utilized four methods of calculating bankfull velocity to input in the continuity equation to develop bankfull discharges for each restoration reach. To develop inputs for this analysis, VHB collected geomorphic data on each of the design reaches. A total of 10 cross sections were surveyed along with steam bed and bank profiles. Bankfull indicators were identified in the field and were included in the survey data collection. Dimension, slope, and bed material information were used as inputs for the velocity comparison analysis. The four methods of the velocity comparison analysis included:

1. Manning's equation using a manning's n value developed from velocity, slope, channel material, and hydraulic radius data, (Rosgen, Leopold, and Silvey 1998; Rosgen and Silvey 2005)
2. Shear Velocity (u*) using a friction factor back calculated from relative roughness (Rosgen, Leopold, and Silvey 1998; Rosgen and Silvey 2005)
3. Manning's equation using a manning's n based on specified stream type (Rosgen, Leopold, and Silvey 1998; Rosgen and Silvey 2005)
4. Dr. Richard Hey Method (derived from D'Arcy Weisbach equation)

Each of the specified methods produced varying ranges of velocities, which were then used in the continuity equation based on surveyed bankfull areas to develop bankfull discharges; however, greater emphasis was placed on Dr. Richard Hey's Method due to the predominantly gravel and sand bed material of the system. The computed values of each method can be viewed in Table 10.

### 6.4.3 Existing Bankfull Indicators (Manning's Equation)

Field-observed bankfull data points, including the uppermost scour lines, and in some cases, the backs of point bars, were surveyed and compared to data output from the continuity equation to determine the existing bankfull discharge. Bankfull elevations throughout the site were consistent with the 1.0-1.3-year storm, which is the common recurrence interval in North Carolina.

### 6.4.4 Design Discharge Analysis Summary

The results of the bankfull discharge analysis provided a range of values. The most obvious convergence in values was between the existing bankfull indicators (Dr. Hey's Method and Shear Velocity) and TR-55 analysis for all reaches within the Site. These values were consistently within 10% of each other. When comparing Hey and Shear Velocity methods, the range of discharges for these tributaries are within 6% of each other. These three methods were more heavily

weighted when determining the final design discharge for this site because they were thought to account for the in-situ site conditions.

Final design discharges were selected based on analysis of the methods discussed in this section. The final design discharges for all reaches weighted the TR-55 Discharges, Regional Curves and the existing bankfull indicators heavily to arrive at values that were in line with observed conditions and reflected return intervals between 1.0 and 1.3 years. The goal of the design was to achieve a balance between streams that would be highly connected to their floodplains and not create undersized channels to the point where vegetation and aggradation could choke the channel. Table 10 below gives a summary of the discharge analysis results.

**Table 10. Stream Design Discharge Analysis Summary**

| | | UT1 Reach 2 | UT1 Reach 3 | UT2 Reach 2 | UT2 Reach 3 | UT3 Reach 1 | UT3 Reach 2 |
|---|---|---|---|---|---|---|---|
| **Drainage Area (Sq. Mi.)** | | 0.035 | 0.044 | 0.073 | 0.118 | 0.105 | 0.106 |
| **Drainage Area (Ac)** | | 28.4 | 28.4 | 46.5 | 75.4 | 67 | 68.1 |
| **NC Rural Piedmont Regional Curve (cfs)** | | 8 | 9.5 | 13.5 | 19.1 | 17.5 | 17.7 |
| **USGS, 2011* (cfs.)** | | 12 | 14 | 19 | 27 | 25 | 25 |
| **TR-55* (cfs)** | | 15 | 15 | 26 | 37 | 25 | 25 |
| **Continuity Equation** | **U/U* Manning's Equation (cfs)** | 12.5 | 14.8 | 21.4 | 30.8 | 23.9 | 21.2 |
| | **U* (cfs)** | 12.7 | 15.4 | 25.3 | 36.7 | 25 | 25.6 |
| | **Stream Type Manning's n (cfs)** | 22.5 | 22.2 | 24.6 | 35.5 | 16.7 | 15.4 |
| | **Dr. Richard Hey Method** | 13.5 | 16.2 | 26.3 | 38.1 | 26.2 | 26.6 |
| **Reference Reach Curve (cfs)** | | 13.5 | 14.9 | 18.6 | 23.1 | 21.9 | 22.0 |
| **Design Discharge (cfs)** | | **13.5** | **16.2** | **26.3** | **38.1** | **26.2** | **26.6** |
| **Return Interval** | | **1.1** | **1.3** | **1.2** | **1.2** | **1.2** | **1.2** |

* 1.2-yr return interval used for bankfull validation analysis

## 6.5 Sediment Transport Analysis

VHB developed a qualitative assessment of the sediment supply and the sources in the project watershed to qualify the sediment supplied to the project streams and determine whether it is being transported. A competence analysis was also performed to analyze the capability of the

proposed streams to transport the necessary sediment size. The sediment supply and competence and capacity analysis are discussed in further detail in the following sections.

### 6.5.1 Sediment Supply

The past, present, and future conditions of the watershed were reviewed using the National Land Cover Database (NLCD) as well as historic and current aerial photography to identify past and present potential sediment sources. Aerial imagery shows that, historically, the watershed was predominantly forested and in agricultural production upstream of the Project Site and in livestock management within the Site and surrounding Dan River floodplain. Other land uses consist of low density single-family residential development. Relatively low-density residential development and forested areas are expected to continue to be the most important land uses in the watershed for the foreseeable future. The contributing areas upstream of the project are relatively stable and are not expected change the current sediment supply to the Site streams.

Visual inspections of the streams and bed material analysis revealed excess sediment and sand in the streams with some depositional areas in all reaches within the Dan River floodplain. Throughout the site, finer sediment deposits were observed on the lower reaches of the tributaries, while the upper reaches contained larger cobbles and gravel. Its apparent that UT2 and UT3 contained the largest sediment depositions.

There are two natural factors that are believed to contribute to the sediment supply to the site. First, the tributaries originate on hillsides where upper valley slopes range from one to four percent (1% for UT3, 3-4% for UT1&2) and bed material is cobble, gravel, and sand. Larger material is washed down from the hillsides and is present on the upper reaches. UT1 contained two head cuts within the proposed conservation easement, which is believed be one significant source of sediment. These will be stabilized with in-stream structures in the proposed condition. The second is due the site's location within the Dan River floodplain, a major source of finer sediment to the Site. As the Dan River rises and expands to its floodplain in major flood events, it creates opportunity for sediment deposition across the site as the floodwaters recede. The FEMA effective hydraulic model for the Dan River depicts and reports the stage of the 10-, 50-, 100- and 500-year events. The 1- through 5-year storm events are not analyzed in the model, however, the 10-year storm event provides up to 14' of inundation in the floodplain. This indicates ample opportunity for floodwater inputs and sediment deposition in the higher frequency events into the project site. The deposition was observed visually and numerically in pebble count and bar sample surveys across the Site. These natural processes are expected to continue following project implementation.

A third man-made factor contributing to instability and altered sediment regime is the current land use consisting of active pasture with cattle having unfettered access to the stream channels. Cattle frequently access the stream for drinking water, which damages the stream banks and causes sloughing, which adds finer sediments to the active channel. This land use has contributed to the excess fine sediment load through bank erosion, hoof shear and diminished riparian vegetation.

By establishing stable riparian buffers, removing cattle from the stream, and providing improved profile, pattern, and dimension to streams during restoration, the fine sediment load within the site will be reduced. The channels were designed to remain stable and pass the sediment delivered from the watershed. The focus of the sediment transport analysis is therefore based on an evaluation of stream competence.

### 6.5.2 Competence and Capacity Analysis

Sediment analyses are generally divided into measurements of bedload and suspended sediment, changes in sediment storage, size distributions and source areas. Sediment plays a major role in channel stability and morphology (Rosgen, 1996). A stable stream has the capacity to move its sediment load without aggrading or degrading. Washload is normally composed of fine sands, silts and clays transported in suspension at a rate that is determined by availability and not hydraulically controlled. Bedload is transported by rolling, sliding, or hopping (saltating) along the bed. At higher discharges, some portion of the bedload can be suspended, especially controlled by the size and nature of the bed material and hydraulic conditions (Hey and Rosgen, 1997).

Two measures are used to calculate sediment loads for natural channel design projects: sediment transport competency and sediment transport capacity. Competency is a stream's ability to move particles of a given size. It is expressed as a measure of force (lbs/ft$^2$). Capacity is a stream's ability to move a quantity of sediment and is a measurement of stream power expressed in units of lbs/ft·sec. These analyses are conducted to ensure that the design streambeds do not aggrade or degrade during bankfull conditions. Brief descriptions of these two analyses are presented below.

Boundary shear stresses were calculated and compared with Shield's Curve to predict sediment competency. The shear stress placed on the sediment particles represents the force that entrains and moves the particles downstream. The equation for shear stress is presented below.

$$\tau = \gamma RS$$

where,

$\tau$ = shear stress (lb/ft$^2$ )

$\gamma$ = specific gravity of water (62 lb/ft$^3$ )

R = hydraulic radius (ft)

S = average channel slope (ft/ft)

The critical shear for the proposed channel must be sufficient to move the D50 of the bed material. The critical shear stress was calculated and plotted on Shield's Curve to determine the approximate size of particles that will be moved. Based on Shield's Curve, a range of sediment sizes and predicted shear stresses were developed to determine the necessary shear stress to

move the bed material. The D50, D100, Shield values, and shear stresses of all the reaches can be viewed in Table 11.

It is apparent, based on existing bed material surveys on each tributary, that surface bed material on average decreases in size from upstream to downstream within the project area. This finding likely explains the stream aggradation caused by sediment settling out when the Dan River's floodplain is accessed, the receding waters of the Dan River causing banks to slough, and the cattle farm contributing to bank erosion on the downstream portion of the project. Based on visual and physical inspection of the tributaries, it is not believed the tributaries are moving significant sediment through normal rainfall events. Instead, it is believed that the combination of the Dan River receding waters, the settling of the Dan River flooding events, and cattle access are the leading causes of observed stream instability.

**Table 11. Results of Competence Analysis**

| | UT1 Reach 2 | UT1 Reach 3 | UT2 Reach 2 | UT2 Reach 3 | UT3 Reach 1 | UT3 Reach 2 |
|---|---|---|---|---|---|---|
| **D50 (mm)** | 13 | 2.5 | 6.6 | 6.6 | 2 | 1 |
| **D100 (mm)** | 70 | 26 | 40 | 40 | 30 | 35 |
| **Movable Particle Size from Shields Curve (mm)** | 30-60 | 18-40 | 15-25 | 10-20 | 20-40 | 10-20 |
| **Value from Shields curve (lb/ft2)** | 0.25-0.60 | 0.25-0.60 | 0.25-0.60 | 0.25-0.60 | 0.50-0.60 | 0.50-0.60 |
| **Existing Bankfull shear stress (lb/ft2)** | 0.70 | 0.40 | 0.50 | 0.50 | 0.55 | 0.29 |
| **Proposed Bankfull shear stress (lb/ft2)** | 0.70 | 0.30 | 0.37 | 0.28 | 0.51 | 0.12 |

VHB performed a competence analysis using the proposed stream dimensions and existing bed material determined from riffle pebble counts and subpavement samples. The goal of the analysis is to evaluate the potential stability of the channels post construction and determine if bed material will need to be supplemented with coarser material to prevent instability. Much of the bed material for UT1 and UT2 is coarse sand and gravel, while UT3 contained more sands. The results of the analysis indicate that there is enough shear stress to move the sampled bed material in UT1 Reach 3, UT2 Reach 2, UT2 Reach 3, and UT3 Reach 1. The range of particle sizes that will become mobile during a bankfull event is within the size range of course sands and small gravel. The competence analysis shows proposed shear stresses out of range for UT1 Reach 2 and UT3 Reach 2.

For the tributaries which fall within range of required shear stresses (UT1 Reach 3, UT2 Reach 2, UT2 Reach 3, and UT3 Reach 1) the proposed shear stresses are on the lower end of the required range and returned lower than existing shear stresses. It is our understanding that

these results were influenced by the Dan River and sediment deposition that occurs during floodplain access events as larger material was not observed further up the channel reaches outside the head cuts on UT1. Large bed material found in the channel beds is believed to be moved by the reoccurring Dan River flood waters instead of the tributary's normal rainfall events. This larger bed material skewed the sediment analysis by reporting these tributaries do not exhibit enough shear stress to move these larger materials. Establishing appropriate riparian vegetation on the Site will dissipate the flood water velocities from the Dan River, thereby reducing the amount of large sediment it can convey. Grade control in-stream structures placed at the upstream extent of UT1 and at the downstream extent of UT2 will help stabilize the newly graded profiles and maintain pool features during the Dan River Flooding events.

The tributaries which fell out of range of required shear stresses (UT1 Reach 2 and UT3 Reach 2) indicate there will be higher than required shear stress on UT1 Reach 2 and not be enough shear stress to move existing bed material on UT3 Reach 2, however, these results are influenced by the Dan River. For UT1 Reach 2 the existing channel shear stress is maintained and two grade control structures will be installed at existing head cut locations to help stabilize the stream and prevent further channel degradation. To help maintain pools and protect banks through UT1 Reach 2 with the potential for out-of-range shear stress, log vanes at meander bends are designed through this reach. UT3 Reach 2 will be supplemented with coir fiber logs to help establish channel banks where channel slopes were required to be minimized to connect with the existing reach downstream. The downstream channel section of UT3 Reach 2 was wider and flatter in the existing conditions. Cattle access is believed to have contributed to channel over-widening, as a more defined channel was observed downstream of the conservation easement on the adjacent mitigation site. This channel establishment will provide a conveyance that can be planted for additional stabilization and allow floodplain connectivity to help any excess sediment settle out. Minimum in-stream structures were proposed in this area to maintain the observed finer bed material in the existing conditions.

While this competence analysis could indicate the potential for aggradation, it is understood that these results are more influenced by the Dan River and not related to normal rainfall and sediment transport regimes associated with the contributing watershed. Grade control structures, log vanes, and brush toe stabilization will be installed along the reaches to help maintain pools and bedform diversity while still providing adequate sediment transport. The revegetation of the site and the removal of cattle will also contribute to minimizing the impact of the Dan River on the sediment load of the tributaries.

By improving width/depth ratios and providing access to a floodplain at the bankfull stage, the proposed designs will equalize both stream power and velocity, thus reducing capacity to only that needed to move the sediment supplied by the watershed. In summary, the calculations for competency, aggradation, degradation, and capacity, bankfull conditions in the design channels for UT1, UT2, and UT3 will entrain particles ranging from 18 to 60 mm, 10 to 25 mm, and 10 to 40 mm, respectively. UT1, UT2, and UT3 exhibit a D100 ranging from 26-40 mm, with the

exception of UT1 Reach 2 which exhibits a D100 of 70 mm. The design channels are predicted to remain stable over time based on the establishment of proper dimension, pattern, profile and an active floodplain. The addition of riparian vegetation will further enhance the long-term stability of the entire system.

A detailed capacity analysis was not performed for the Site due to the expected stability of the watershed. There is no indication that sediment yield will be altered by rapidly changing land use or otherwise modified without the use of proper erosion control measures. Based on the watershed assessment described in Section 3.0 and field data collections, the Site streams generally indicate the capacity to move a sediment load required for the sediment supply. Most of the restoration reaches have been designed to maintain the competency of the existing channels with the use of grade control structures and in-stream structures to prevent future channel instability.

## 6.6 Wetland Design

### 6.6.1 Wetland Design Overview

The proposed design includes restoring 8.25 acres (7.86 acres re-establishment and 0.39 acres rehabilitation) of historically altered wetlands. Wetlands proposed for restoration have altered wetland hydrology due to ditches and lack of connection to Site streams. VHB reviewed the proposed wetland areas to understand the effects of past and current land use on wetland hydrology and hydric soils.

### 6.6.2 Hydric Soils within Wetland Restoration/Enhancement Areas

A licensed soil scientist (LSS) performed a hydric soil evaluation after reviewing the web soil survey mapping, and on-site conditions. A total of 25 soil borings were performed throughout the Site. Borings were located based on the existing topography, ditching, and existing wetland vegetation. Each soil boring was classified based on soil characteristics indicating the hydric soil status. The soils report is located in Appendix I.

Borings classified as hydric soils met either the depleted matrix (F3) or the piedmont floodplain soils hydric soil indicator (F19). The areas meeting the F19 indicator exhibited brighter chromas (3 and 4 compared to 1 and 2) as compared with the F3 indicator.

Based on the results from the LSS findings, existing groundwater gauge data, and existing hydrologic alterations made to the site; zones of potential wetland restoration and enhancement were developed. Areas not currently jurisdictional were classified as restoration via re-establishment (Wetlands 1 and 2). Areas that are currently jurisdictional but with altered hydrology were classified as restoration via rehabilitation (Wetlands 1B, 2B, 3, and 4).

### 6.6.3 Reference Wetlands

Two reference wetlands were identified, one on the adjacent NCWRC property, east of UT3, and one west of UT1. The eastern reference wetland area is a NCDMS restoration site. The western reference wetland has a mature canopy and resembles a Piedmont Bottomland Forest (High

subtype) (Schafale 2012). The area does not appear to have been ditched or manipulated in the recent past. The NCWRC property has a closed canopy, but the forest is not mature. Trees were planted approximately 12 years ago. This area is characterized as a Piedmont Levee Forest (Typic subtype) (Schafale 2012). Historic aerials show the western reference wetland has been forested since at least 1948. The vegetation at the reference site will be used as a basis to develop the planting plan for the wetland restoration and enhancement on the project site. Other factors will also be considered in developing the planting plan, such as commercial availability, potential to transport invasive insect species, and likelihood of success.

The reference wetland system is located in the floodplain of the Dan River and is inundated during large overbank events and from hillside seepage. The soils are mapped as Codorus loam, frequently flooded. The soil profile met the F3 indicator and had wetland hydrology within 12 inches of the soil surface. Hydrology indicators were water-stained leaves, saturation at the surface, and a water table at the soil surface. Wrack lines were also evident throughout the wetland due to a large rain event.

### 6.6.4 Hydrologic Modeling

VHB analyzed the existing and proposed conditions for groundwater hydrology using Wetbud. The model was run for the re-establishment areas, Wetlands 1, and 2 using a normal (2017), wet (2020), and dry (2007) year condition. Climatic data was retrieved from the closest weather station with daily precipitation and evapotranspiration rates in Reidsville, NC.

One existing conditions water budget model, representative of the two wetland re-establishment areas, was developed based on current site conditions. Water inputs included precipitation and runoff. Daily precipitation values were retrieved from the station noted above and runoff was calculated using the SCS/NRCS curve number method. Existing model outputs included potential evapotranspiration (PET), groundwater out, and surface outflow. PET was obtained from the Reidsville weather station and was calculated using the Penman-Monteith Method. Existing conditions assumed no surface water outflow, and groundwater out was assumed to be all water draining to the site via the drainage ditches. A copy of the model hydrographs is included in Appendix F.

The proposed condition model was developed to predict the length of time groundwater levels would be within 12 inches of the soil surface. This was evaluated for the same three normal, wet, and dry years. In order to show long-term recharge of the wetland hydrology, three years of the proposed condition model were run for the dry years, assuming climatic conditions during the second and third year would be normal.

The proposed condition model was updated to incorporate the wetland restoration design, plugging and filling drainage ditches. The most significant change from the existing condition is the groundwater out. The existing model assumes all groundwater leaves the Site via the drainage ditches. Proposed conditions keep a significant portion of groundwater on-site. The model results support that proposed Site changes will increase overall hydrology within the

proposed wetland areas and bring the water table to within 12 inches of the soil surface for multiple months within the growing season, March 28 to November 4.

**Table 12: Water Budget Analysis of Wetlands 1 and 2**

| Modeled Year | Hydrology Classification | Number of Months with Wetland Hydrology (within 12 inches of soil surface) | |
|---|---|---|---|
| | | Existing Conditions Model | Proposed Conditions Model |
| **Re-establishment Wetlands (1 and 2)** | | | |
| 2007 | Dry Year | No months | No months-1st & 2nd run<br>April-June-3rd run<br>(3 months) |
| 2017 | Normal Year | No months | April-June<br>(3 months) |
| 2020 | Wet Year | No months | February-December<br>(11 months) |

Existing well data for Wetlands 1 and 2 was compared to the existing conditions model output and regulatory requirements for hydrology for a jurisdictional wetland. According to the Antecedent Precipitation Tool the site was experiencing "Normal" and "Drier than Normal" precipitation conditions during the timeframe the existing well data was collected. The Wetland 1 and 2 gauges demonstrated the groundwater has been consistently below 12 inches even during the wet winter season. The groundwater levels came within 12 inches of the ground surface for short periods of time after a rainfall event but had a quick drawdown effect shortly thereafter. The gauge data did not show a hydroperiod of 16 days (8%) within the growing season. The 8% hydroperiod was developed using the USACE Wilmington District Stream and Wetland Compensatory Mitigation Update (2016) for Codorus soils. Complete hydrographs for the model and existing gauge data can be found in Appendix F.

## 6.7 Project Implementation

### 6.7.1 Stream Restoration, Enhancement, and Preservation

Physical impairments to the Site streams include bank erosion, incision, lack of riparian buffer, cattle access, and lack of bedform diversity. Chemical impairments are due to water quality, primarily via nutrient loading and the unrestricted access of cattle and the ongoing presence of fecal coliform bacteria. The project will restore a total of six reaches in three stream channels, enhance two reaches of UT1 and UT2, and preserve two reaches of UT1 and UT2. Riparian buffers, extending a minimum of 50-feet outward from the stream banks along either side of the channels, will be planted throughout the Site. Cattle will be excluded from the conservation easement in its entirety.

All six restoration reaches will be restored using methodologies consistent with a Priority Level I approach with the exception of a short section of UT2 Reach 3 that transitions back into the

original UT2 channel near the downstream end of the Site, for which an approach consistent with Priority Level II is more appropriate. Bedform diversity and habitat uplift will be achieved through riffle-pool sequences with log vanes and constructed riffles. Landowner access across UT1 will be provided via the existing farm crossing with an at-grade crossing. The easement break will be gated and only accessible during active use by the landowner for equipment or to re-locate cattle.

UT1 Reaches 2 and 3 will be restored via Priority I methodologies in order to reconnect the stream to the floodplain and relocate the channel to its natural valley. Restoration of pattern, profile, and dimension will result in a new channel which incorporates stabilizing features such as log vanes, brush toes, supplemental plantings, and constructed riffles. An at-grade crossing will allow the landowner to access fields on either side of UT1. UT1 Reach 2a will be enhanced via benching, rock cross vanes, supplemental planting, and cattle exclusion.

UT2 Reaches 2 and 3 will be restored via Priority I methodologies in order to reconnect the stream to the floodplain and relocate the channel to its natural valley. Restoration of pattern, profile, and dimension will result in a new channel which incorporates stabilizing features such as log vanes, brush toes, rock j-hooks, rock cross vanes, supplemental plantings, and constructed riffles. UT2 Reach 4 will be enhanced via supplemental planting and cattle exclusion.

UT3 Reaches 1 and 2 will be restored via Priority I methodologies in order to reconnect the stream to the floodplain and restore pattern, dimension, and profile. Restoration of pattern, profile, and dimension will result in a new channel which incorporates stabilizing features such as coir logs, brush toes, supplemental plantings, and constructed riffles.

### 6.7.2 Wetland Mitigation Activities

Wetland mitigation activities will include restoration via re-establishment and rehabilitation. There are currently six jurisdictional wetlands, Wetlands 1A, 1B, 2A, 2B, 3, and 4 within the proposed conservation easement. Two additional areas, Wetlands 1 and 2, are currently non-jurisdictional. Table 13 describes wetland mitigation activities and ratios; Wetlands 1A and 2A are non-credit areas.

**Table 13: Proposed Wetland Mitigation Activities and Credit Ratios**

| Wetland Name | Approach* | Ratio | Approach Description |
|---|---|---|---|
| Wetland 1 | Re-establishment | 1:1 | Fill in existing drainage swales and reconnect overbank flows from UT1 to the wetland. Plant area in appropriate woody vegetation to accompany the existing herbaceous wetland vegetation. Exclude cattle from wetland. A portion Wetland 1B will be considered rehabilitation. The areas that are a definitive ditch will be considered restoration. |
| Wetland 1B | Rehabilitation | 1.5:1 | This area will be filled to remove the ditch characteristics and planted with appropriate vegetation. The hydrology will be enhanced through filling of the channelized portion of UT1. |
| Wetland 2 | Re-establishment | 1:1 | Fill in existing drainage swales and reconnect overbank flows from UT1 & UT2 to the wetland. Plant area in appropriate woody vegetation to accompany the existing herbaceous wetland vegetation. Exclude cattle from wetland. |
| Wetland 2B | Rehabilitation | 1.5:1 | This area will be graded as part of the removal of the swales in Wetland 2 and planted with appropriate vegetation. The hydrology will be enhanced through overbank events from UT2. |
| Wetland 3 | Rehabilitation | 1.5:1 | Headwater wetland currently planted in pasture grasses will be enhanced through planted native woody stems, stabilization of UT3 along northern boundary, and exclusion of cattle. |
| Wetland 4 | Rehabilitation | 1.5:1 | Jurisdictional wetland currently planted in pasture grasses will be restored by filling drainage swales and stabilizing UT3, planting native woody stems, and exclusion of cattle. |

* No grading within wetland credit areas will be greater than 6".

Wetlands 1 and 2, which exhibit altered hydrology due to existing ditching and disconnection of the associated streams from their floodplains, will be restored through re-establishment efforts. Restoration efforts will focus on locations where wetland hydrology is being negatively impacted by small ditches and/or drainage conveyances. The areas will be planted with native hardwood trees and the ditches/conveyances will be plugged to increase the time water remains on-site. This will allow the groundwater table to recharge and provide wetland hydrology within these three areas during the growing season.

Wetlands 3 and 4 will be restored through rehabilitation efforts focusing on locations where wetland hydrology is being negatively impacted by small ditches and/or drainage conveyances. The area will be planted with native hardwood trees and the ditches/conveyances will be filled and plugged to increase the time water remains on-site. Similar to the re-establishment

wetlands, this increase in time will help to offset any impacts to wetland hydrology that will come from establishing forest vegetation (e.g., evapotranspiration). The introduction of forest species over time has the potential to reduce the existing hydroperiod in the wetland, but the channel work and plugging of drainage ditches will offset this potential reduction in hydroperiod.

Figure 8 shows the proposed wetland mitigation areas. Table 14 shows the breakdown of wetland mitigation units.

**Table 14: Wetland Mitigation Units**

| Wetland Name | Mitigation Category | Credit Ratio | Area (acres) | Wetland Mitigation Units (WMUs) |
|---|---|---|---|---|
| Wetland 1 | Riparian | 1:1 | 6.257 | 6.257 |
| Wetland 1B | Riparian | 1.5:1 | 0.099 | 0.066 |
| Wetland 2 | Riparian | 1:1 | 1.604 | 1.604 |
| Wetland 2B | Riparian | 1.5:1 | 0.020 | 0.013 |
| Wetland 3 | Riparian | 1.5:1 | 0.086 | 0.057 |
| Wetland 4 | Riparian | 1.5:1 | 0.181 | 0.121 |
| | | | **Total WMUs** | **8.118** |

## 6.8 Vegetation and Planting Plan

The objective of the planting plan is to establish, over time, a thriving riparian buffer composed of native tree species. The planting plan will be based on an appropriate nearby reference community and will be developed to restore appropriate strata (canopy, understory, shrub, and herbaceous layers). Based on site conditions there will be three planting zones, a low stream, wetland, and an upland riparian buffer zone. Based on initial observation of the Site, the Piedmont Bottomland Forest (High subtype) defined by Schafale (2012) is the appropriate target community for the low stream and wetland zones. The upland riparian buffer zone will be based on the Schafale (2012) Piedmont Levee Forest (Typic subtype) community. The canopy will be restored through planting of bare root seedlings of tree species. The understory and shrub layers will be restored through a combination of planting bare root seedlings of low stature species and installing live stakes of shrub species. The herbaceous layer will be restored by seeding the disturbed area with a native seed mix with an emphasis placed on creating good soil contact to encourage germination. Species chosen for the planting plan are listed in Table 15 below. The Construction Plans, Appendix D, also contain additional guidance on planting zones, Site preparation, and Site stabilization during construction. Invasive species will be treated and removed during construction. Invasive species will continue to be identified, mapped, and treated throughout monitoring on an as-needed basis.

**Table 15: Proposed Planting Plan**

| Location | Scientific Name | Common Name | Stratum | Wetland Indicator Status |
|---|---|---|---|---|
| Wetland Zone | *Betula nigra* | River birch | Canopy | FACW |
| | *Carpinus caroliniana* | Ironwood | Understory | FAC |
| | *Cornus amomum* | Silky dogwood | Understory | FACW |
| | *Ulmus americana* | American elm | Canopy | FAC |
| | *Quercus michauxii* | Swamp chestnut oak | Canopy | FACW |
| | *Quercus nigra* | Water oak | Canopy | FAC |
| | *Quercus pagoda* | Cherrybark oak | Canopy | FAC |
| | *Quercus bicolor* | Swamp white oak | Canopy | FACW |
| | *Quercus lyrata* | Overcup oak* | Canopy | OBL |
| | *Quercus laurifolia* | Laurel oak* | Canopy | FACW |
| | *Nyssa sylvatica* | Blackgum | Canopy | FAC |
| | *Platanus occidentalis* | American sycamore | Canopy | FACW |
| | *Alnus serrulata* | Tag alder | Understory | FACW |
| | *Cephalanthus occidentalis* | Common buttonbush | Understory | OBL |
| | *Vaccinium corymbosum* | Highbush blueberry | Understory | FACW |
| | *Salix nigra* | Black willow | Understory | OBL |
| | *Quercus phellos* | Willow oak | Canopy | FACW |
| Upland Riparian Buffer Zone | *Quercus phellos* | Willow oak | Canopy | FACW |
| | *Quercus nigra* | Water oak | Canopy | FAC |
| | *Quercus shumardii* | Shumard oak | Canopy | FAC |
| | *Quercus rubra* | Red oak | Canopy | FACU |
| | *Quercus alba* | White oak | Canopy | FACU |
| | *Celtis laevigata* | Sugar berry | Canopy | FACW |
| | *Liriodendron tulipifera* | Tulip poplar | Canopy | FACU |
| | *Nyssa sylvatica* | Blackgum | Canopy | FAC |
| | *Fagus grandifolia* | American beech | Canopy | FACU |
| | *Ilex opaca* | American holly | Understory | FACU |
| | *Diospyros virginiana* | Persimmon | Understory | FAC |
| | *Asimina triloba* | Common pawpaw | Understory | FAC |

* Substitute species

## 6.9 Project Risk and Uncertainties

This project includes risk associated with constructing new stream channels in an unforested area. The site has the potential for bank failures to occur during flooding events from the Dan River prior to vegetation stabilizing the soil. This will be addressed using live stakes where appropriate and allowing for diffuse flow from the upland and wetland areas into the stream channels. Sediment deposition from the Dan River may affect vegetation establishment. Additional plantings of larger species will occur if sedimentation is an ongoing issue. Reducing

the risk of hydraulic trespass on the adjacent property to the west was identified as an early objective of the project. Surveys were obtained at the property line to aid in the development of the design approach and identify appropriate areas for fill. There are two swales draining from the west property onto the site. The lowest swale to the south will not be filled in order to maintain positive drainage from the adjoining property. The higher swale to the north will only be filled to an elevation to allow positive drainage from the adjoining property. These areas are identified on the grading plans and are set to not exceed the nearby natural ground elevations and will not exceed the surveyed elevations at the property line. The conservation easement includes areas greater than 50-feet from the top of the proposed stream channels in an effort to maximize the uplift of the aquatic resources within the project and remove wet areas from potential impacts by cattle.

### 6.10 Proposed Crossings

Three easement crossings are proposed within the project area. These crossings will provide the landowner with access to adjoining property. Two of the crossings, upstream on UT1 and one upstream of the confluence of UT1 and UT2, will be at grade. The third easement crossing is the existing pipe underneath the farm road on UT2. The site can be accessed from the farm path and River Bend Road for monitoring and long-term stewardship. The crossings will not be fenced due to flood flows from the Dan River. Cattle will not be present on the Site.

## 7.0 Performance Standards

The stream and wetland performance standards for the project will follow the 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation Update (2016). Annual monitoring and semi-annual site visits will be conducted to assess the Site condition. Each project component has specific performance standards: stream morphology, hydrology, and vegetation. Wetland rehabilitation and re-establishment areas will be assigned specific performance criteria for wetland hydrology and vegetation. Performance standards will be evaluated throughout the seven-year post-construction monitoring period. An outline of the performance criteria is detailed below.

### 7.1 Streams

#### 7.1.1 Dimension

Successful riffle cross sections on restoration reaches should be stable and show little change in bankfull area, bank height ratio, and width-to-depth ratio. Bank height ratios will not exceed 1.2 and entrenchment ratios will be at least 2.2 for restored C-Type channels. Channel dimensions, specifically, riffle cross sections, should be within the parameters for the channels of the designed stream type. In the event that dimensions fall outside the accepted range for a stream type, the channel will be evaluated for signs of instability. Indicators of instability include vertical incision of the thalweg and eroding stream banks. Remedial actions will be taken to address any signs of instability that are indicative of a systemic issue.

### 7.1.2 Pattern and Profile

Visual assessments and photo documentation should indicate that streams remain stable and do not indicate a trend toward vertical or lateral instability. As-built surveys will include a longitudinal profile survey which will not be completed for subsequent monitoring years. In the event that instability, vertical or lateral, is noted, a longitudinal profile survey will be necessary for the affected reaches. The survey will follow the standards described in the Stream Channel Reference Sites; An Illustrated Guide to Field Technique (Harrelson et. al., 1994).

### 7.1.3 Photo Documentation

Photos will be used to document morphological stability on an annual basis. Photos will be taken at each cross section, upstream and downstream, to document the presence/absence of erosion along the stream banks. Photos will be taken of any potential signs of instability around grade control structures. Photos will be taken at origin of each vegetation plot, the transition from UT2 Reach 3 to Reach 4, and the easement crossings on UT1 Reach 2, UT2, Reach1/2, and UT2 Reach 3. Channel features on UT1 and UT3, and the confluence of UT2 and the Dan River will be photographed. Channel photos will capture the formation and longevity of mid-channel bars and vertical incision.

### 7.1.4 Continuous Flow and Bankfull Events

All Site restoration reaches on intermittent channels, UT1 and UT3, must demonstrate a minimum of 30 days of continuous flow on an annual basis during the monitoring period. UT1 and UT3 will be subject to the 30 days of continuous flow requirement. All restoration reaches must demonstrate a minimum of four bankfull events in separate monitoring years. These will be measured using continuous stage recorders.

## 7.2 Wetlands

Areas designated as re-establishment and rehabilitation will be continuously monitored throughout the monitoring period. A total of 11 groundwater monitoring gauges will be installed to record groundwater levels on a daily basis. The approximate locations of the groundwater gauges are shown on Figure 9.

Eco Terra installed an on-site rain gauge to determine on-going rainfall conditions. This rain gauge will remain on the Site during the post-construction monitoring period. In the event of a malfunction resulting in lost data, rainfall data from the nearest weather station with available precipitation data will be used in lieu of on-site data.

The estimated growing season for Caswell County based on WETS data for the Rockingham and Person County stations, located west and east of Caswell County, respectively, is approximately 223 days (March 26 through November 4). There is no available growing season data specific to Caswell County. This growing season is based on air temperatures of 28 degrees F or higher and 50 percent chance of growing season occurring between beginning and ending dates.

The USACE Wilmington District Stream and Wetland Compensatory Mitigation Update issued in October 2016 by the USACE and NCIRT states the wetland hydroperiod for Codorus soils is 7-9%. The proposed wetland hydrology performance standard will be groundwater levels within 12 inches of the soil surface for 8 percent of the growing season (16 days) for Caswell County under normal precipitation conditions.

### 7.3 Vegetation

The final vegetative performance standard for the stream restoration and enhancement areas will be the survival of 210 planted stems per acre within the planted area at the end of the monitoring period. The interim success criteria will be the survival of 320 stems per acre at the end of the third monitoring year and 260 stems at the end of the fifth monitoring year. No single planted or volunteer species should comprise more than 50% of the total stem density within any plot. The vegetation's average height must be seven feet at year five and 10 feet at year seven. These performance standards will apply to all riparian buffer and wetland planting areas, excluding shrubs and slow growing species. Invasive species will be monitored and treated as needed to promote success of native hardwood stems. Photos will be taken at the origin of each vegetation monitoring plot each year.

### 7.4 Visual Assessments

Visual assessments will be used to evaluate the integrity of the conservation easement, vegetation plots, planted areas outside of the vegetation plots, stream stability, and monitoring gauges. The assessments will identify any issues with the above-mentioned items and a plan to repair or prevent future problems will be developed.

## 8.0 Monitoring Plan

Eco Terra will use the DMS As-Built Baseline Monitoring Report Template (October 2020). A baseline monitoring document and as-built record drawing of the project will be completed after planting and monitoring equipment is installed. Monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS by November 30. These reports will be based on the DMS Annual Monitoring Template (October 2020).). Full monitoring reports will be submitted to DMS in monitoring years 1, 2, 3, 5, and 7. Monitoring reports will also be submitted in years 4 and 6, but these reports will be abbreviated. The closeout monitoring period will be seven years beyond completion of construction or until performance standards are met. Table 16, below, describes how the monitoring plan will verify project goals and objectives have been achieved.

**Table 16: Monitoring Plan**

| Goal | Treatment | Performance Standard | Monitoring Metric | Likely Functional Uplift |
|---|---|---|---|---|
| Reconnect channels with historic floodplains and improve wetland hydrology in existing and drained wetland areas. | Post construction channels will have appropriate bankfull dimensions and depth to allow flooding of the floodplain. | Demonstrate 30-days of consecutive flow and 4 bankfull events in separate years. | Pressure transducers on intermittent channels and bankfull events on perennial channels. | Longer resident time of flood flows on floodplain to recharge riparian wetlands. |
| Improve the stability of stream channels | Construct stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, landscape setting, and watershed conditions. | Entrenchment ratio stays over 2.2 for C and E channels and bank height ratio is below 1.2. | Visual inspection and cross section monitoring | Reduce sediment inputs to downstream waters by reducing shear stress and bank erosion. |
| Exclude cattle from streams | Farmer is no longer placing cattle within the Project Site | Cattle excluded from the conservation easement. | Visual inspection for signs of cattle. | Reduce fecal coliform and sediment inputs to downstream drinking waters. |
| Improve stream habitat | Construct stream to have variety of stream habitats, varying depth pools, riffles, woody debris, cover logs, and root wads. | N/A | N/A | Provide varied habitat for macroinvertebrates and other aquatic species, allowing for an increase in biodiversity. |
| Restore wetland hydrology, soils, and plant communities. | Restore wetlands by filling ditches and reconnecting streams to floodplains. Plant native trees. | Have water table within 12 inches of soil surface for 8% of the growing season. Have 210 planted stems after seven years. | Eleven groundwater gauges in wetlands 1, 2, 3, and 4. Vegetation plots in wetlands. | Increase recharge of the wetlands and provide cover for wildlife. |

**Table 16: Monitoring Plan (cont.)**

| Goal | Treatment | Performance Standard | Monitoring Metric | Likely Functional Uplift |
|---|---|---|---|---|
| Restore and enhance native floodplain and streambank vegetation | Plant a riparian buffer with a minimum width of 50-feet with native tree species. Control invasives. | Final survival rate of 210 planted stems/acre after 7 years with an average height of 10-feet. | Two percent of the planted area will be monitored in 100m$^2$ vegetation plots. | Improved riparian habitat, eventual increase in large woody debris, stabilization of banks from roots, decreased sediment runoff from floodplain, and increased resident time of floodwaters. |
| Permanently protect the project site from future development. | Place a permanent conservation easement on the project site. | Identify and correct any easement encroachments. | Inspect the easement boundary on a bi-annual basis. | Protection from encroachment. |

## 8.1 As-Built Survey

An as-built survey will be completed after construction to document channel dimensions and new location. The survey will include a complete longitudinal profile including thalweg, water surface, bankfull, and top of bank. This information will be used for comparison to determine whether the stream dimensions remain stable. Longitudinal profiles will not be completed on an annual basis unless required to demonstrate stream stability.

## 8.2 Visual Monitoring

Visual monitoring of all mitigation areas will be conducted a minimum of twice per year. Visual assessments will include vegetation survival, documentation of invasive plant species, streambank stability, structure integrity, easement integrity, and hydrology gauge and pressure transducer integrity. Eight permanent photo stations, not including those associated with vegetation plots or stream cross sections, will be set up to document the site.

## 8.3 Hydrology Monitoring

Pressure transducers will be installed to document a minimum of 30 days of consecutive flow on all restored intermittent channels. Crest gauges will be installed on each channel to record overbank events.

Wetland hydrology will be monitored using 11 groundwater gauges. These will take a daily reading and will be downloaded on a quarterly basis.

USGS gauge data will be reviewed to determine overbank flooding events from the Dan River. This information will be compared with on-site gauge data to determine if the overbank event recorded was from stream on the site or the Dan River.

## 8.4 Cross Sections

Permanent cross sections will be installed on restoration reaches at a minimum of one per 20 bankfull widths with half in pools and half in riffles. Morphological data and upstream/downstream photos will be collected for the cross sections. Riffle cross sections will include bank height ratios and entrenchment ratios, which will not be collected for the pool cross sections. Cross sections will be monitored in years 1, 2, 3, 5, and 7.

## 8.5 Vegetation Monitoring

Two percent of the planted area, approximately 32.6 acres, will be sampled using 0.0247-acre size vegetation plots. Twenty permanent and six random vegetation plots are proposed for measurement of tree height, species, and location. A minimum of one random and one permanent will be outside of the wetland credit and stream buffer areas. Photos of each plot will be taken from the origin of the plot each year. Vegetation monitoring will follow the CVS-EEP Protocol for Recording Vegetation (2008). 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 September 1st and the end of the growing season, November 4th. Invasive species will be monitored and removed if they hinder native vegetation growth or become the dominant species. In the event that invasive species need to be removed, Eco Terra will develop a treatment plan.

## 8.6 Scheduling and Reporting

A baseline monitoring report and as-built drawings will be submitted to the NCDMS within 60 days of site planting. The report will include constructed elevations, photographs, and mapping showing the locations of vegetation plots, groundwater gauges, and stream hydrology gauges. A list of species planted, and planting density will be provided. Subsequent annual monitoring reports will be prepared in the fall and submitted to the NCDMS no later than November 30th.

# 9.0 Long-Term Management Plan

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

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

The Site protection instrument can be found in Appendix A.

## 10.0 Adaptive Management Plan

Following construction, the site will be monitored as described in Section 8.0. Minor corrective actions are expected. These include but are not limited to invasive species treatment and replanting. In the event that large scale instability occurs and threatens the success of the project, an Adaptive Management Plan may be needed. Eco Terra will notify NCDMS to coordinate the best approach to remediate any major issues. An Adaptive Management Plan, if needed, will be submitted to the NCDMS for approval prior to the commencement of any work within the site. Eco Terra will be responsible for funding any future work and securing all permits required to complete the work.

An integral part of a successful compensatory mitigation project is early detection of problems during implementation, determining the cause(s) of those problems, and attempting to correct those problems so that the compensatory mitigation project achieves its objectives and ecological performance standards. Interim performance standards are crucial to ensuring that compensatory mitigation performance follows a trajectory to attain final compensatory mitigation success.

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 NCDMS and work with NCDMS to develop contingency plans and remedial actions. Large scale corrective measures may require an Adaptive Management Plan. Large scale corrective measures may include, but are not limited to, re-grading part of the mitigation site, replanting more than 20% of the site to improve composition or species diversity, or the addition of stabilization structures.

Once the Adaptive Management plan is prepared, the sponsor will:

1. Notify the USACE as required by the Nationwide Permit 27 general conditions.
2. Notify NCDWR if necessary for 401 conditions.
3. Revise performance standards, maintenance requirements, and monitoring requirements as necessary, in consultation with the North Carolina Mitigation Banking Inter-Agency Review Team.
4. Obtain other permits as necessary.
5. Submit the Adaptive Management Plan for NCDMS review and approval.
6. Implement the Adaptive Management Plan.
7. Provide the NCDMS a Record Drawing/As-Built of corrective actions.

The Final Mitigation Plan should include:

1. Identify responsible parties who will identify problems.
2. Potential problems that may arise during the monitoring period, particularly if performance standards are not met.
3. Potential causes of those problems.
4. Identify a process for determining measures to correct deficiencies in compensatory mitigation projects, such as site modifications, design changes, revisions to maintenance requirements, and revisions to monitoring requirements (see 33 CFR § 332.7(c)(3)).

## 11.0 Determination of Credits

Final stream and wetland credits are shown in Tables 17 through 19 below. The mitigation ratios are 1:1 for stream restoration, 1.5:1 for stream enhancement I, 5:1 for stream enhancement II, and 10:1 for stream preservation. Wetland re-establishment and rehabilitation have ratios of 1:1 and 1.5:1 respectively.

All stream buffers will be a minimum of 50 feet from the top of bank, with a few exceptions near the beginning or end of the stream reach. The credit release schedule is in Appendix H.

**Table 17: Project Mitigation Quantities and Credits**

| Project Segment | Original Mitigation Plan Ft/Ac | Original Mitigation Category | Original Restoration Level | Original Mitigation Ratio (X:1) | Credits |
|---|---|---|---|---|---|
| **Stream** | | | | | |
| UT1R1 | 435 | Warm | P | 10.0 | 43.500 |
| UT1R2a | 81 | Warm | EI | 1.5 | 54.000 |
| UT1R2 | 546 | Warm | R | 1.0 | 546.000 |
| UT1R3 | 811 | Warm | R | 1.0 | 811.000 |
| UT2R1 | 211 | Warm | P | 10.0 | 21.100 |
| UT2R2 | 693 | Warm | R | 1.0 | 693.000 |
| UT2R3 | 217 | Warm | R | 1.0 | 217.000 |
| UT2R4 | 412 | Warm | EII | 7.0 | 58.8 |
| UT3R1 | 390 | Warm | R | 1.0 | 390.000 |
| UT3R2 | 323 | Warm | R | 1.0 | 323.000 |
| | | | | **Total:** | **3,157.400** |
| **Wetland** | | | | | |
| Wetland 1 | 6.257 | R | R | 1.0 | 6.257 |
| Wetland 1B | 0.099 | R | RH | 1.5 | 0.066 |
| Wetland 2 | 1.604 | R | R | 1.0 | 1.604 |
| Wetland 2B | 0.020 | R | RH | 1.5 | 0.013 |
| Wetland 3 | 0.086 | R | RH | 1.5 | 0.057 |
| Wetland 4 | 0.181 | R | RH | 1.5 | 0.121 |
| | | | | Total: | **8.118** |

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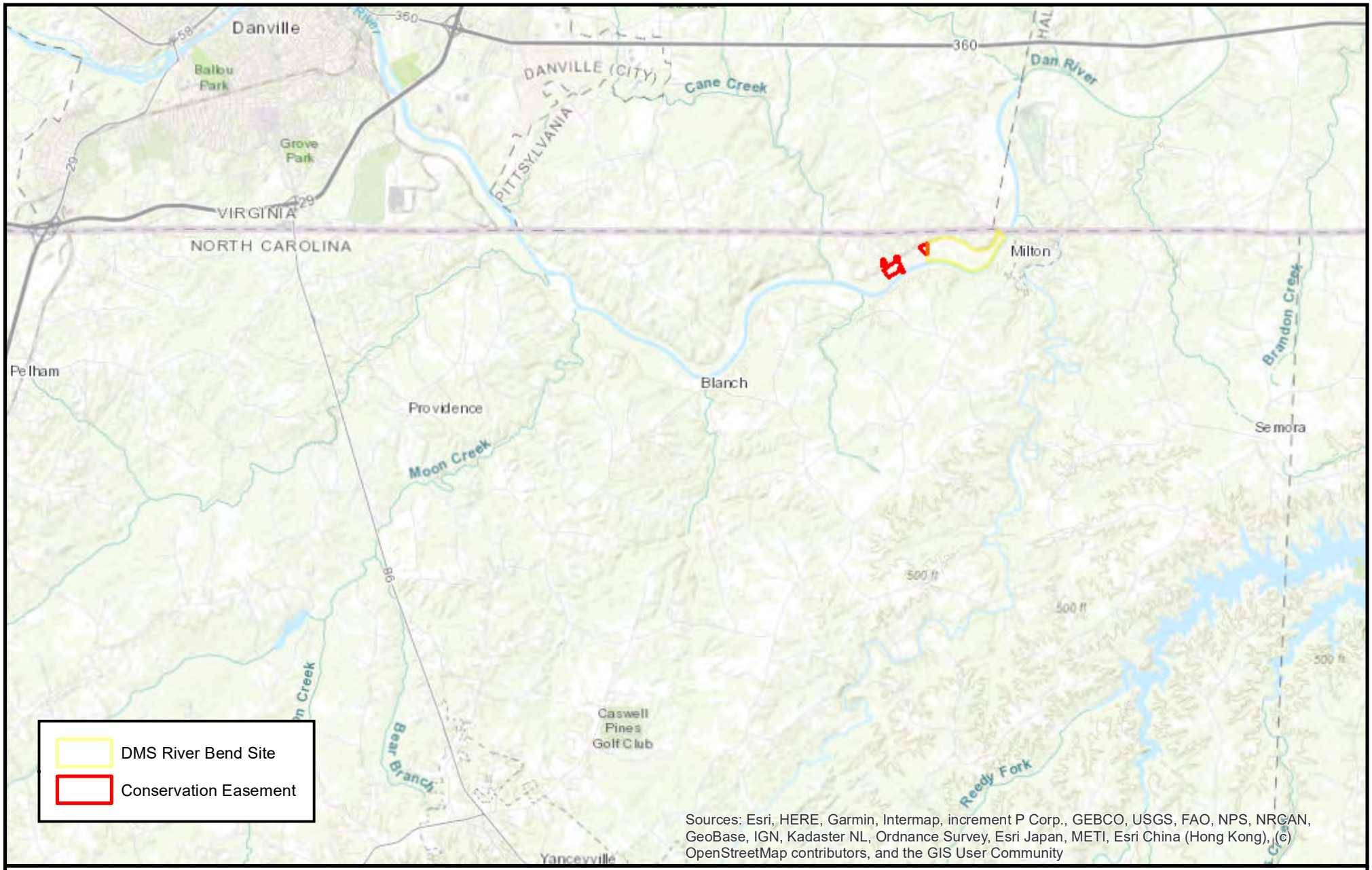



**Figure 1: Vicinity Map**
**Mushroom Meadow Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**December 2022**

ESRI Topographic Basemap

2 1 0 2
Miles

N

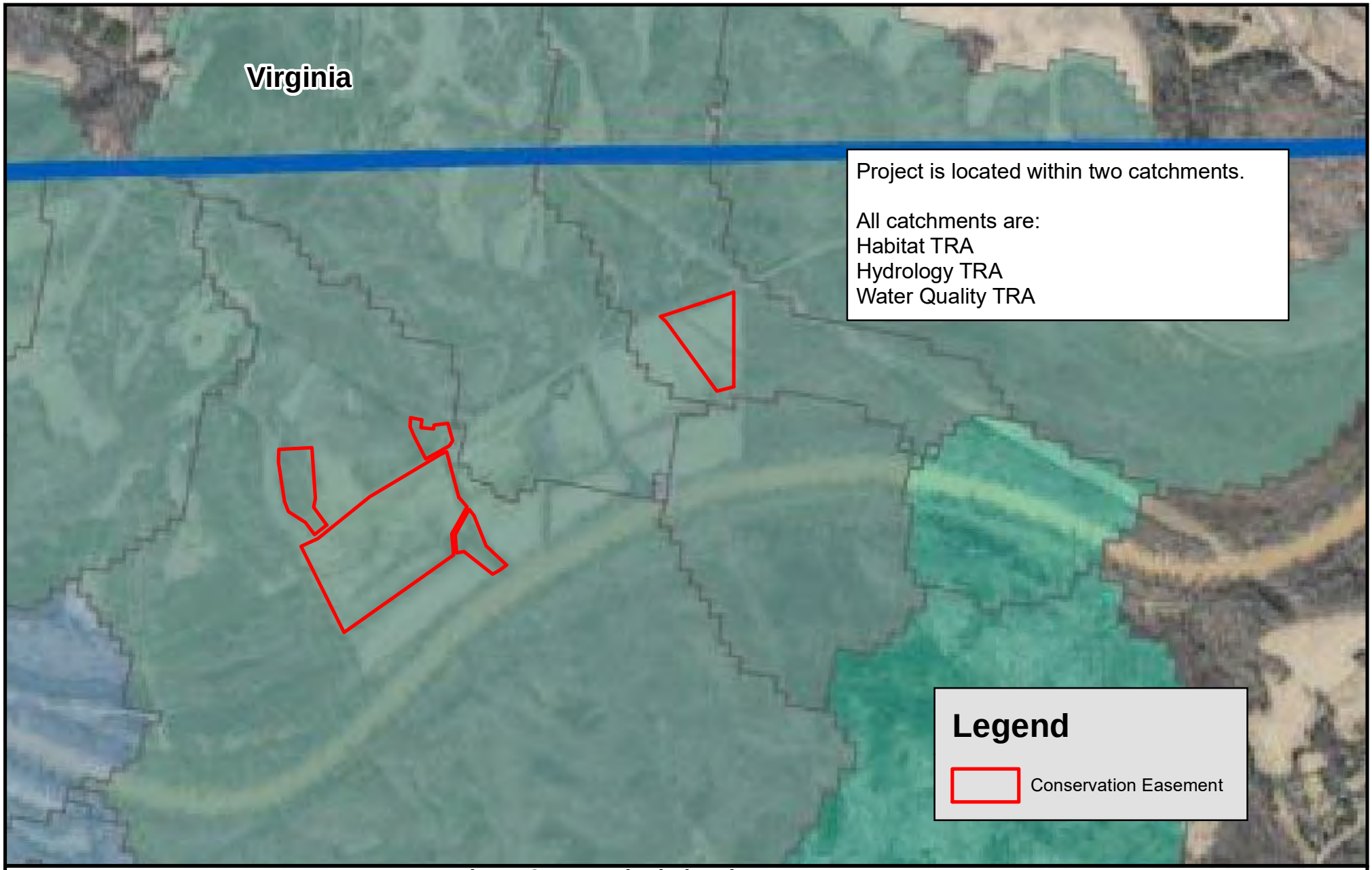



**Figure 2: Watershed Planning**
**Mushroom Meadow Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**December 2022**

NCDMS RFP-16-20200204 TRA Maping

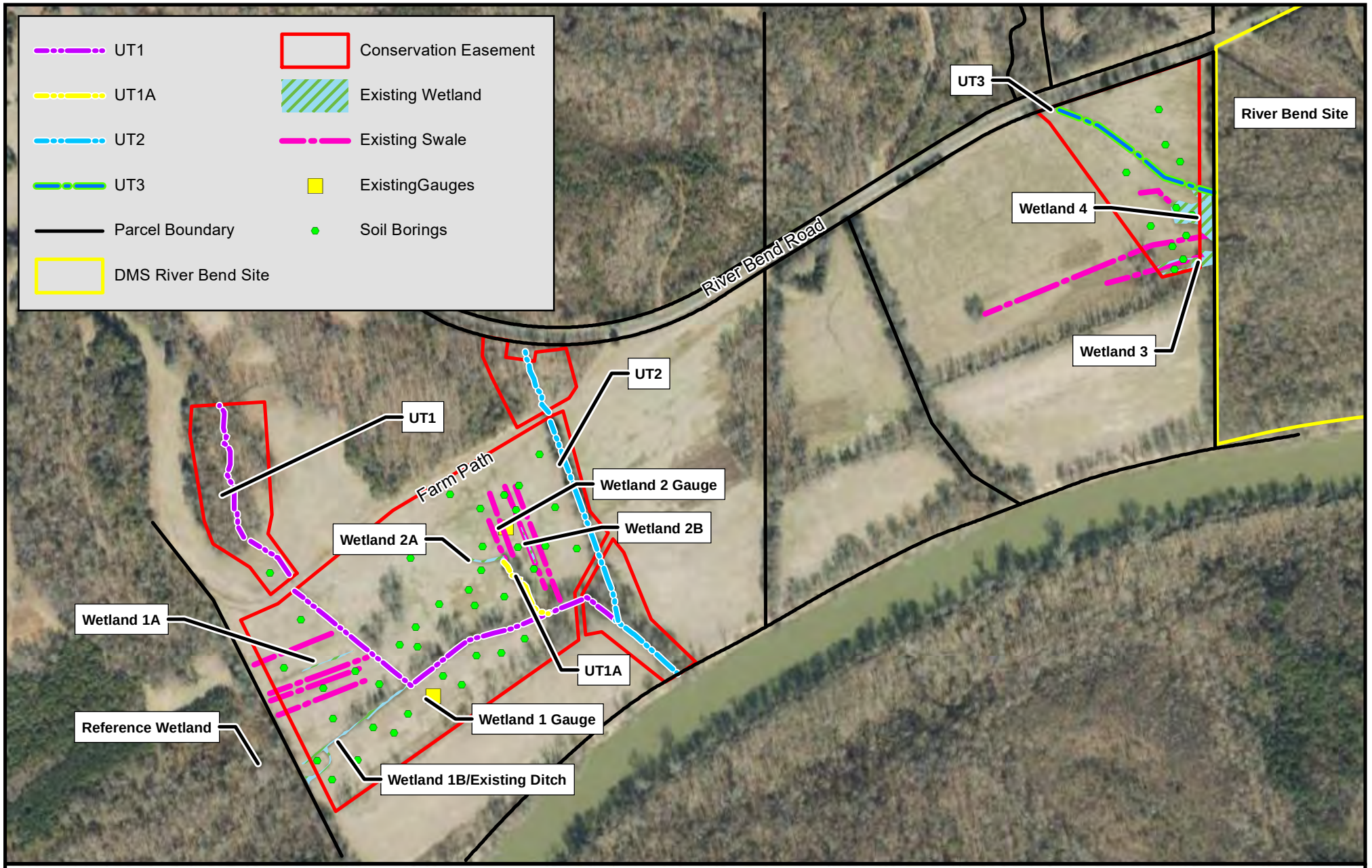



**Figure 3: Existing Conditions**
**Mushroom Meadow Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**December 2022**

NC Onemap 2021 Aerial

N

450 225 0 450
Feet

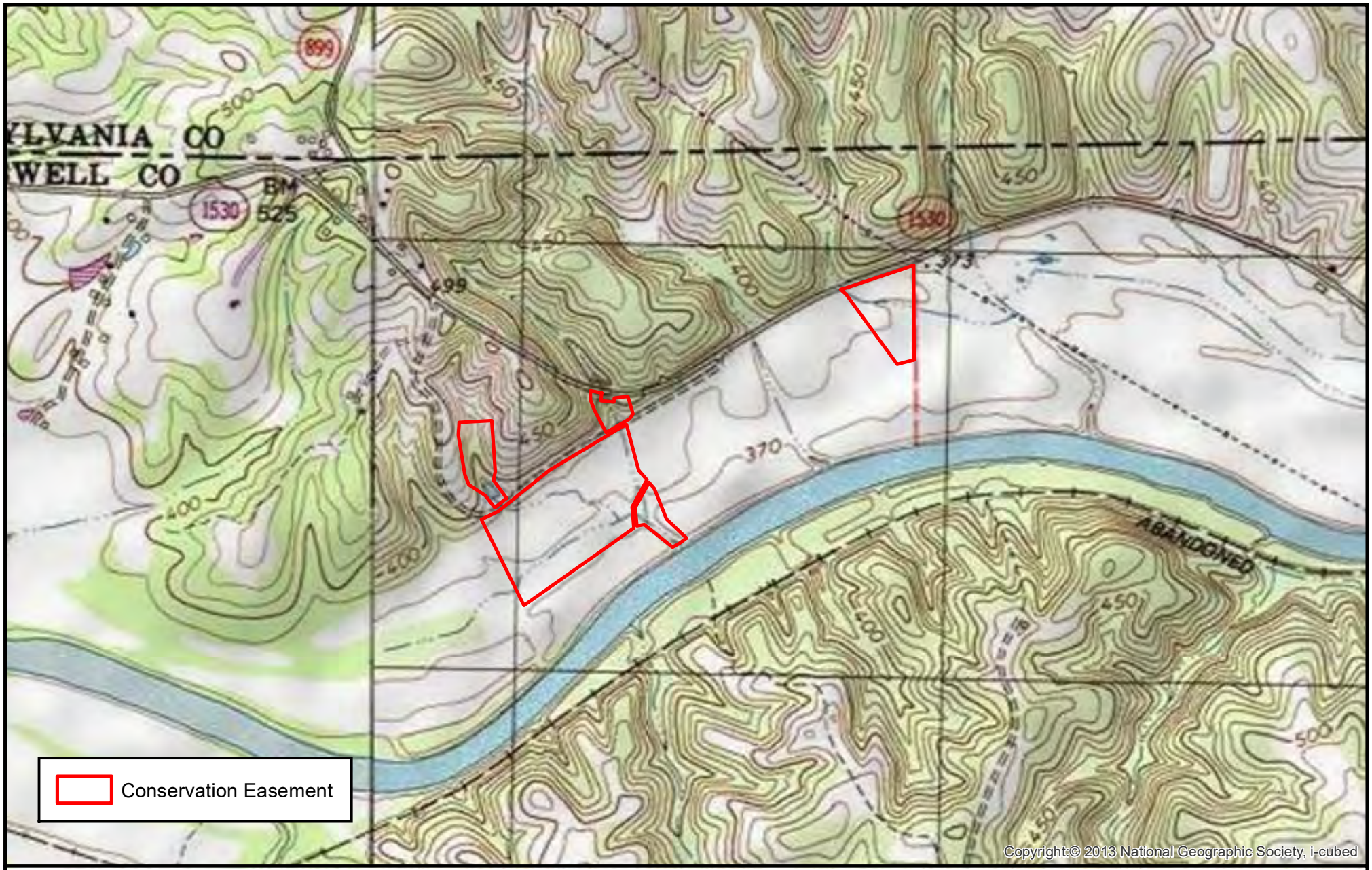


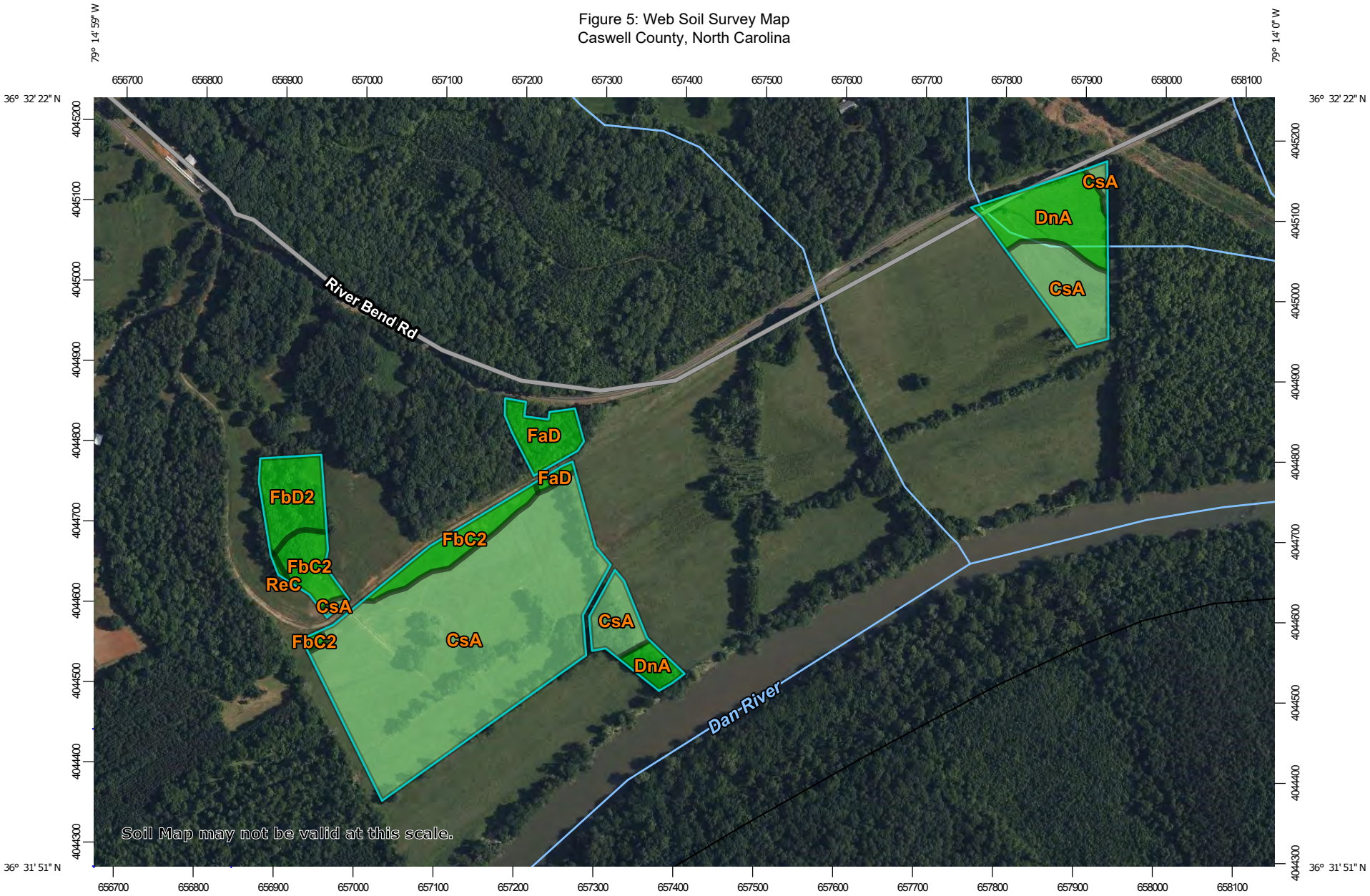

**Figure 4: USGS Topographic Map**
**Mushroom Meadow Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**December 2022**

USA Topo Maps Basemap

0.2 0.1 0 0.2
Miles

N

Figure 5: Web Soil Survey Map
Caswell County, North Carolina




Map Scale: 1:6,760 if printed on A landscape (11" x 8.5") sheet.

N

0 100 200 400 600 Meters

0 300 600 1200 1800 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Hydric (100%)
- Hydric (66 to 99%)
- Hydric (33 to 65%)
- Hydric (1 to 32%)
- Not Hydric (0%)
- Not rated or not available

**Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads Local
- Roads

**Background** Aerial Photography

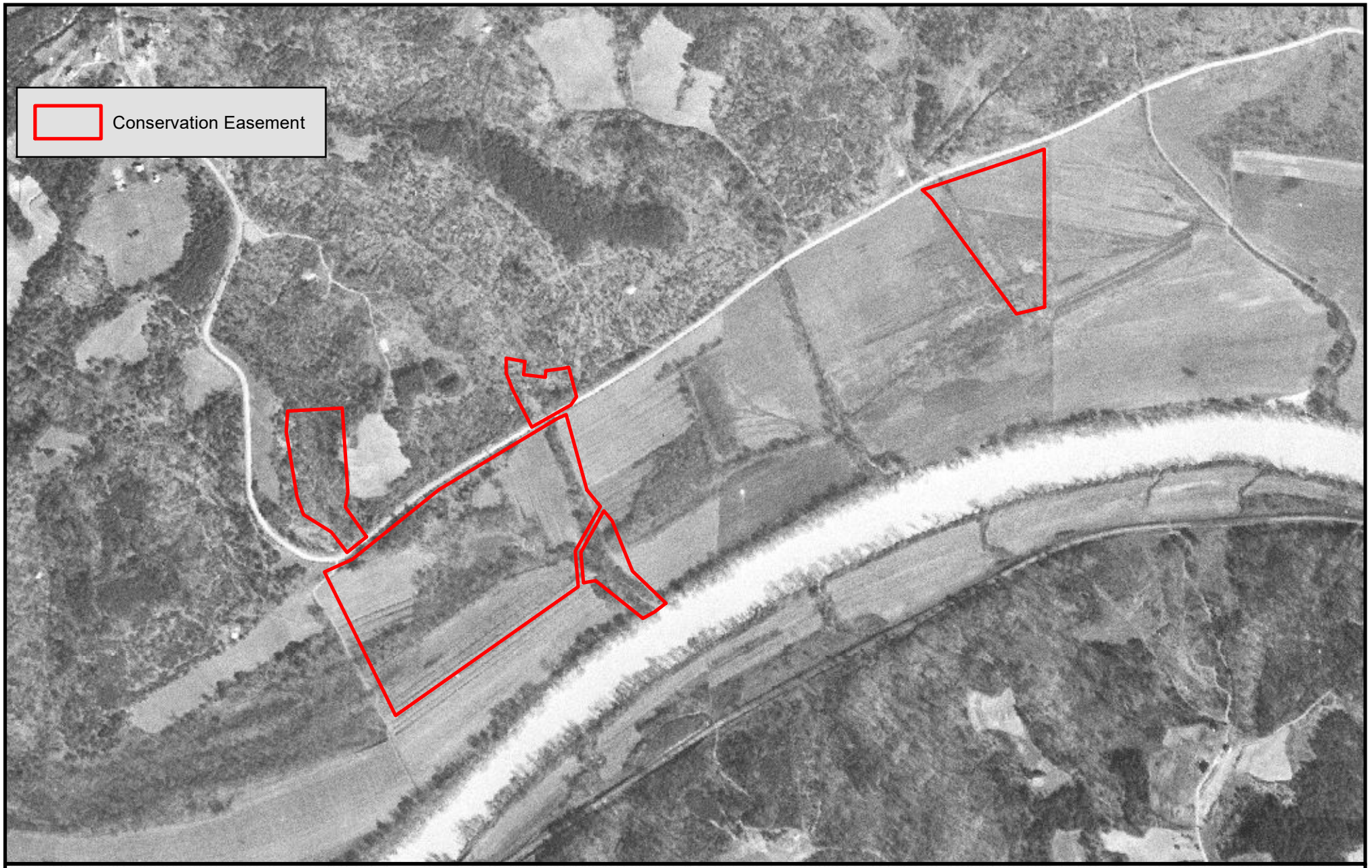



**Figure 6: 1948 Historical Aerial**
**Mushroom Meadow Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**December 2022**
USGS Explorer Single Frame Aerial

600 300 0 600
Feet

N

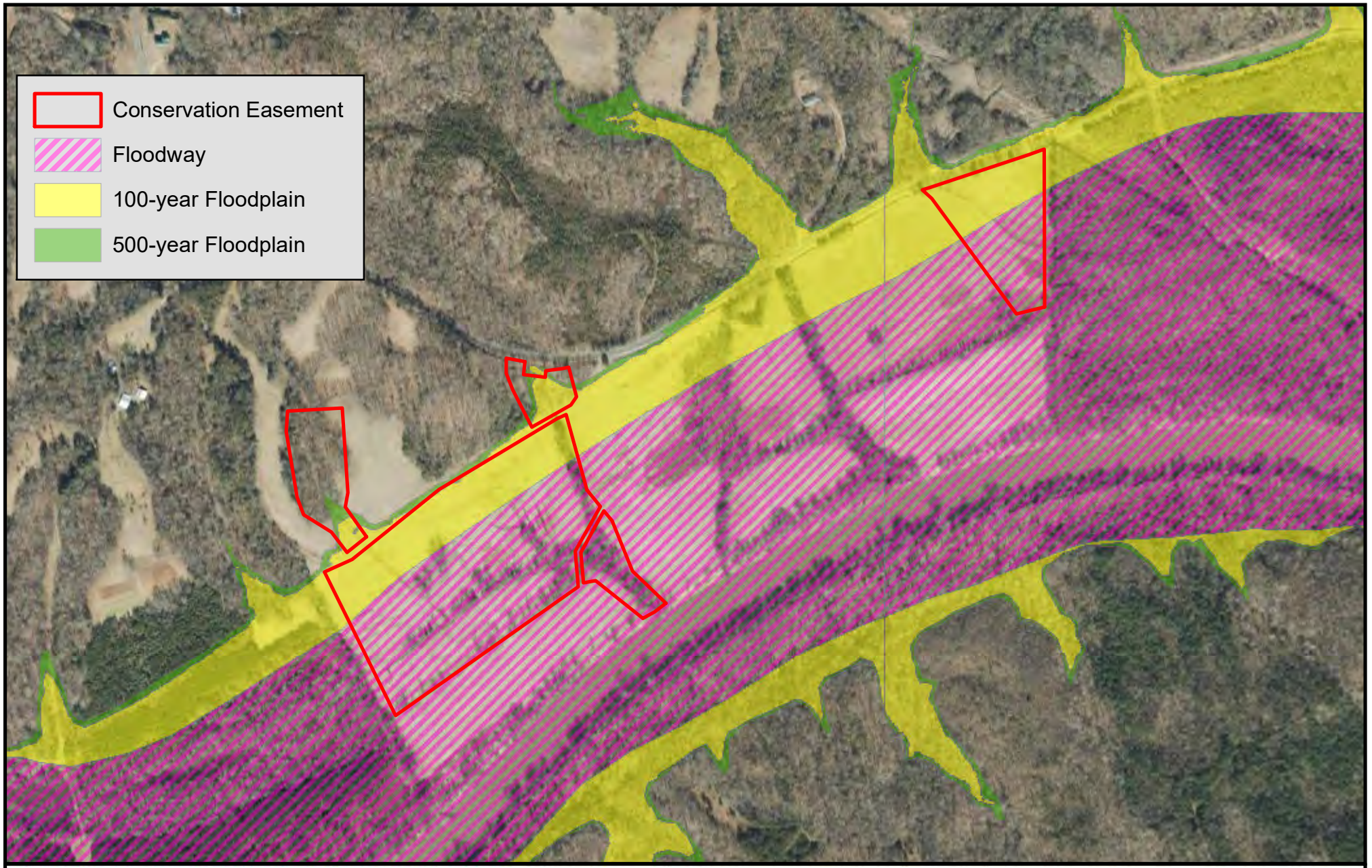



**Figure 7: FEMA Mapped Areas**
**Mushroom Meadow Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**December 2022**

NC Onemap 2021 Aerial

600 300 0 600
Feet

N

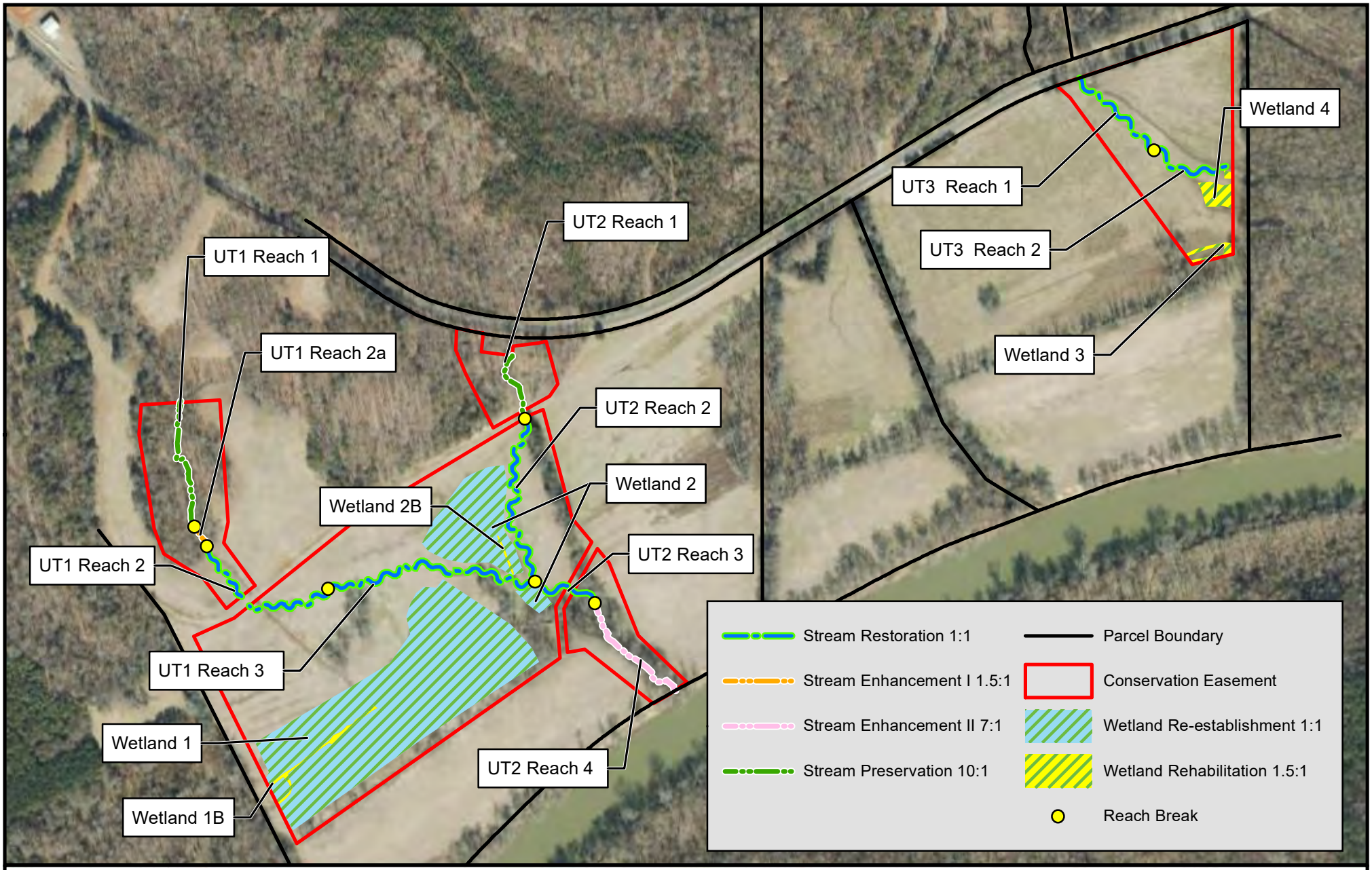



**Figure 8: Mitigation Areas**
**Mushroom Meadow Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**December 2022**
NC Onemap 2021 Aerial

N

400 200 0 400
Feet

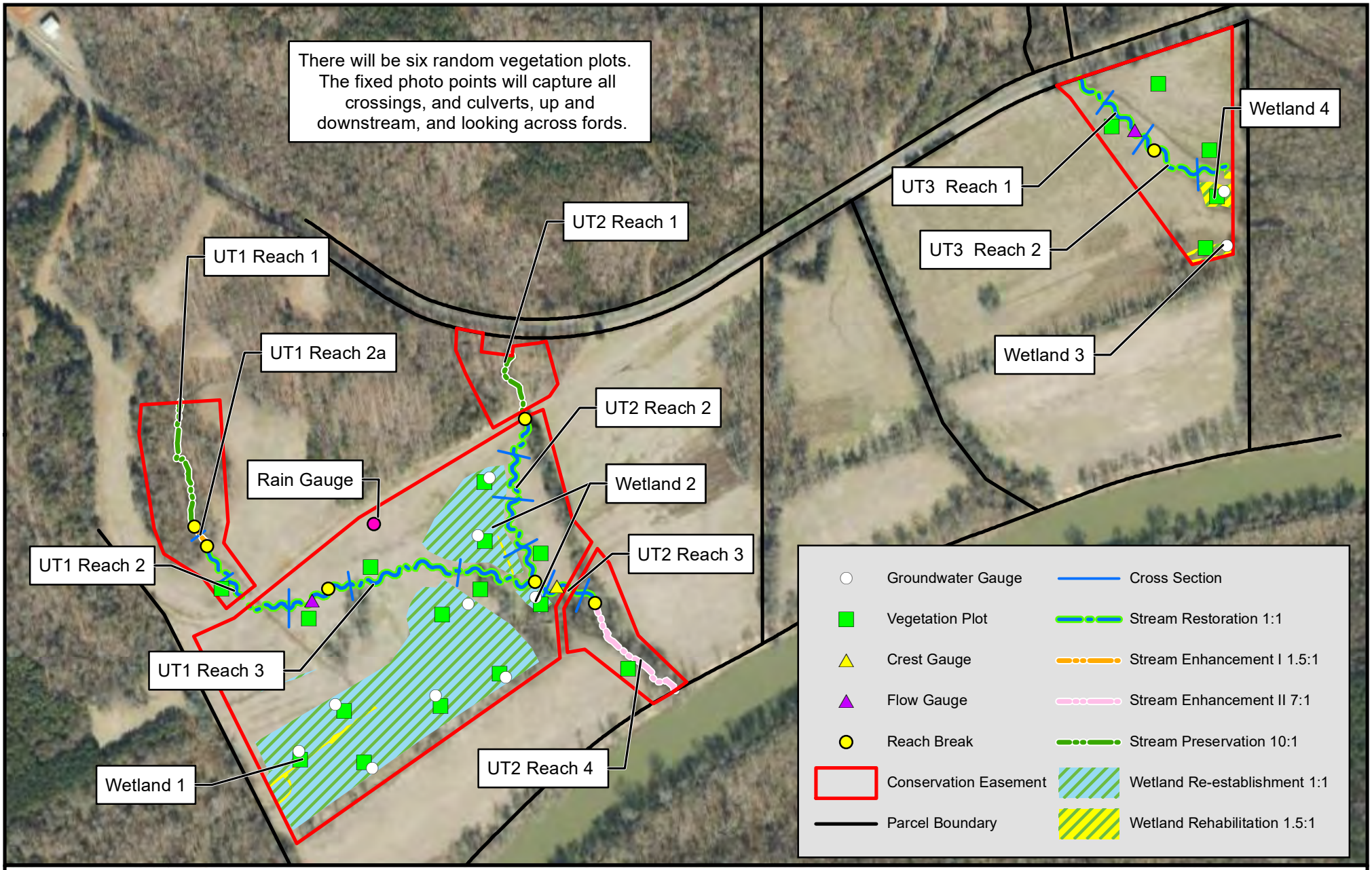



**Figure 9: Monitoring Plan**
**Mushroom Meadow Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**December 2022**
NC Onemap 2021 Aerial

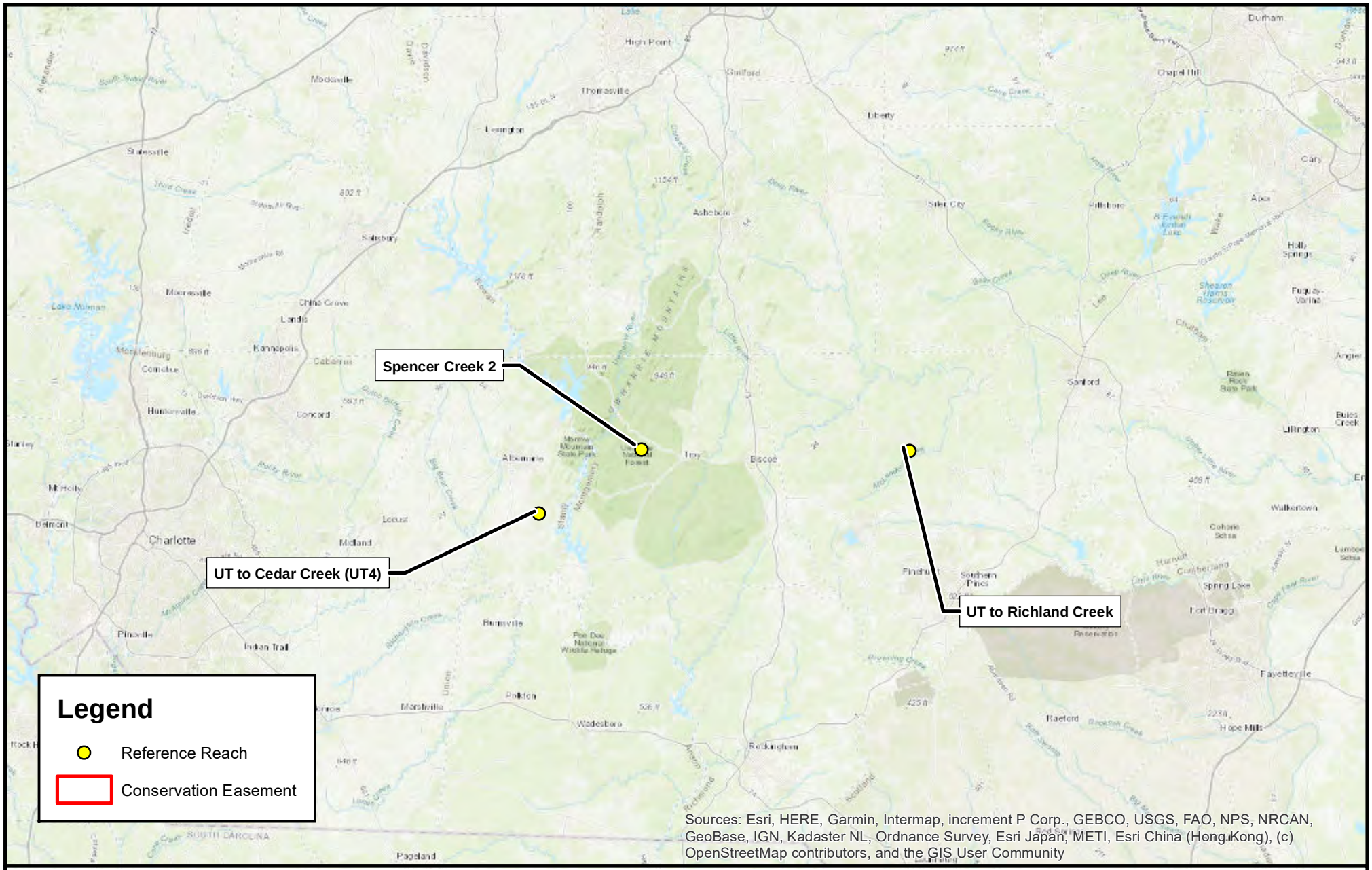



**Figure 10: Reference Reach Map**
**Mushroom Meadow Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**December 2022**

ESRI Topographic Basemap

10 5 0 10
Miles

N

# Appendix A: Conservation Easement Information

**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 Environment and Natural Resources, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environment and Natural Resources Purchase and Services Contract Number _____.

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

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

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

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

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

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

**WHEREAS,** Grantor owns in fee simple certain real property situated, lying, and being in _____ 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 and Right of Access together with an access easement to and from the Conservation Easement Area described below.

The Conservation Easement Area consists of the following:

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._____, DMS 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. ACCESS EASEMENT

*choose one option based on survey and deed, delete other*

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

[GENERAL LOCATION OPTION] Grantor hereby grants and conveys unto Grantee, its employees, agents, successors and assigns, a perpetual, non-exclusive easement for ingress and egress over and upon the Property at all reasonable times and at such location as practically necessary to access the Conservation Easement Area for the purposes set forth herein ("Access Easement"). This grant of easement shall not vest any rights in the public and shall not be construed as a public dedication of the Access Easement. Grantor covenants, represents and warrants that it is the sole owner of and is seized of the Property in fee simple and has the right to grant and convey this Access Easement.

## III. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

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

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

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

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

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

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

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

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

H. **Roads and Trails.** There shall be no construction or maintenance of new roads, trails, walkways, or paving in the Conservation Easement.

All existing roads, trails and crossings within the Conservation Easement Area shall be shown on the recorded survey plat.

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

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

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

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

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

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

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

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

## IV. GRANTEE RESERVED USES

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

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

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

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

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

## V. ENFORCEMENT AND REMEDIES

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

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

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

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

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

## VI. MISCELLANEOUS

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

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

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

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

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

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

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

and

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

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

## VII. QUIET ENJOYMENT

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

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

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

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

_____ (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 B: USACE PJD Email, USACE Wetland/Upland Forms, Site Photographs, and NCSAM Forms

# U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2021-00348** County: **Caswell** U.S.G.S. Quad: **NC-Milton**

## NOTIFICATION OF JURISDICTIONAL DETERMINATION

Requestor: **VHB**
**Attn: Heather Smith**
Address: **940 Main Campus Drive, Suite 500**
**Raleigh, NC 27606**

Size (acres) **~32** Nearest Town **Milton**
Nearest Waterway **UT to Dan River** River Basin **Roanoke**
USGS HUC **03010104** Coordinates **36.5334, -79.2446**
Location description: **The property is located between the Dan River and River Bend Road, approximately 1.75 miles west of NC Highway 62, in Milton, Caswell County, North Carolina. The Review Area is shown as the red-outlined "Proposed Conservation Easement" on the attached map entitled "Figure 3: Potential Jurisdictional Resources, Mushroom Meadow Wetland & Stream Mitigation Site."**

## Indicate Which of the Following Apply:

### A. Preliminary Determination

☒ **There appear to be waters, including wetlands on the above described project area/property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). The waters, including wetlands have been delineated, and the delineation has been verified by the Corps to be sufficiently accurate and reliable. The approximate boundaries of these waters are shown on the enclosed delineation map dated April 2022. Therefore this preliminary jurisdiction determination may be used in the permit evaluation process, including determining compensatory mitigation. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.**

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

### B. Approved Determination

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

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

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

☐The waters, including wetlands on your project area/property have been delineated and the delineation has been verified by the Corps. The approximate boundaries of these waters are shown on the enclosed delineation map dated _. We strongly suggest you

have this delineation surveyed. Upon completion, this survey should be reviewed and verified by the Corps. Once verified, this survey will provide an accurate depiction of all areas subject to CWA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

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

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

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

Placement of dredged or fill material within waters of the US, including wetlands, without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). Placement of dredged or fill material, construction or placement of structures, or work within navigable waters of the United States without a Department of the Army permit may constitute a violation of Sections 9 and/or 10 of the Rivers and Harbors Act (33 USC § 401 and/or 403). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **David E. Bailey at (919) 817-2436 or David.E.Bailey2@usace.army.mil**.

## C. Basis For Determination: See the Preliminary Jurisdictional Determination form dated 01/13/2023.

## D. Remarks:

## 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)**

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: Mr. Philip A. Shannin
Administrative Appeal Review Officer
60 Forsyth Street SW, Floor M9
Atlanta, Georgia 30303-8803
**AND**
PHILIP.A.SHANNIN@USACE.ARMY.MIL

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

Corps Regulatory Official:  Date: 2023.01.13 12:00:32 -05'00'

Date of JD: **01/13/2023** Expiration Date of JD: **Not applicable**

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete our Customer Satisfaction Survey, located online at https://regulatory.ops.usace.army.mil/customer-service-survey/.

Copies Furnished Electronically:
Sue Homewood, NCDWR, Sue.Homewood@ncdenr.gov

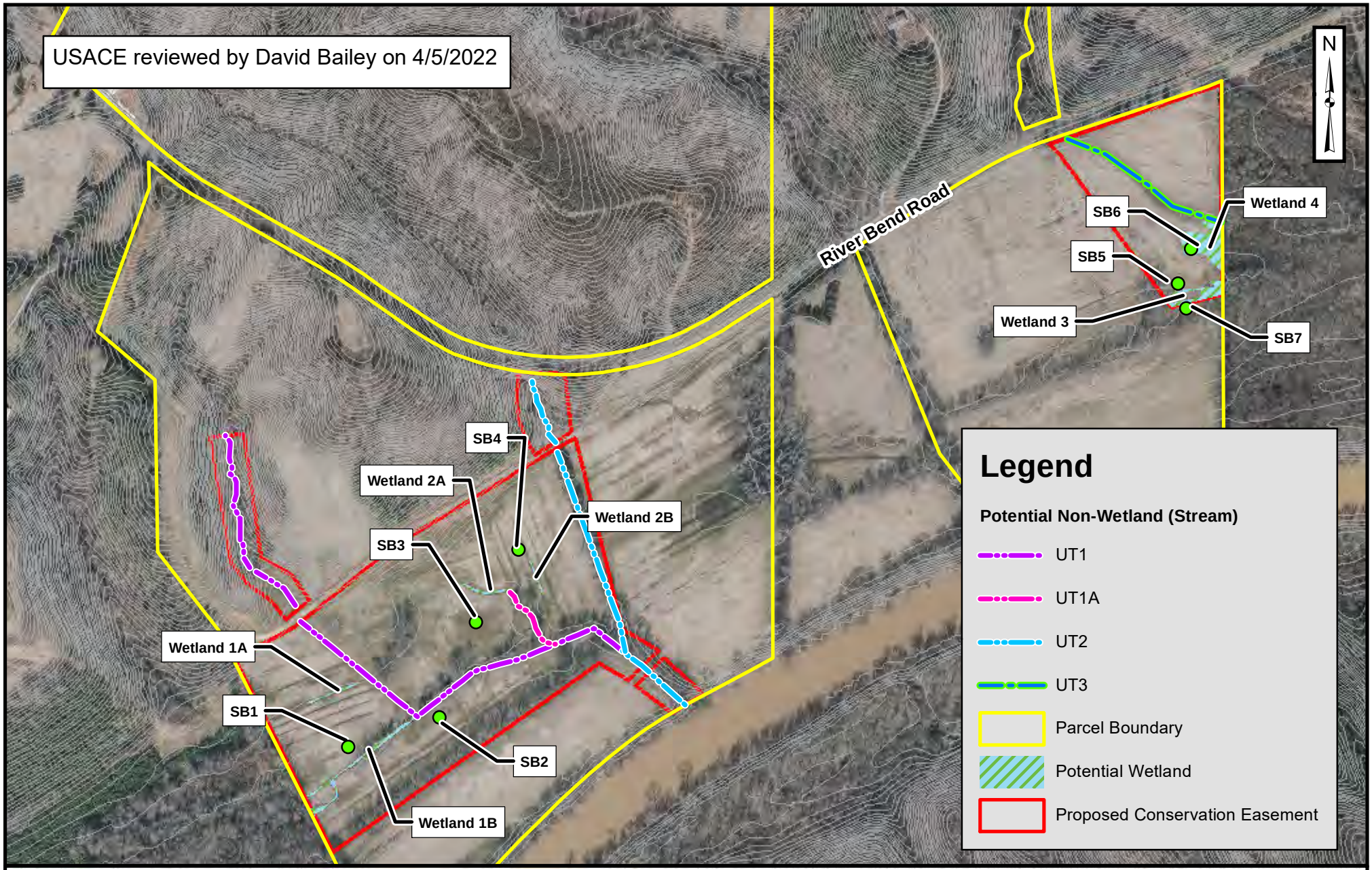



**Figure 3:Potential Jurisdictional Resources**
**Mushroom Meadow Wetland & Stream Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**April 2022**
2018 NC Onemap Aerial

450 225 0 450
Feet

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

| Applicant: **VHB (Attn: Heather Smith)** | File Number: **SAW-2021-00348** | Date: **01/13/2023** |
|---|---|---|

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

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at or http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or the 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:<br>**District Engineer, Wilmington Regulatory Division**<br>**Attn: David E. Bailey**<br>**Raleigh Regulatory Office**<br>**U.S Army Corps of Engineers**<br>**3331 Heritage Trade Drive, Suite 105**<br>**Wake Forest, North Carolina 27587** | If you only have questions regarding the appeal process you may also contact:<br>MR. PHILIP A. SHANNIN<br>ADMINISTRATIVE APPEAL REVIEW OFFICER<br>CESAD-PDS-O<br>60 FORSYTH STREET SOUTHWEST, FLOOR M9<br>ATLANTA, GEORGIA 30303-8803<br><br>PHONE: (404) 562-5136; FAX (404) 562-5138<br>EMAIL: PHILIP.A.SHANNIN@USACE.ARMY.MIL |

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.

| | | |
|---|---|---|
| _____<br>Signature of appellant or agent. | Date: | Telephone number: |

***For appeals on Initial Proffered Permits send this form to:***

**District Engineer, Wilmington Regulatory Division, Attn: David E. Bailey, 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. Philip Shannin, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801**
**Phone: (404) 562-5137**

Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

## BACKGROUND INFORMATION

A. **REPORT COMPLETION DATE FOR PJD:** 13-JAN-2023

B. **NAME AND ADDRESS OF PERSON REQUESTING PJD:**
Heather Smith, VHB, 940 Main Campus Dr. Suite 500 Raleigh NC 27606

C. **DISTRICT OFFICE, FILE NAME, AND NUMBER:**
SAW, NCDMS Mushroom Meadow Mitigation Site, SAW-2021-00348

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

State: NC County/parish/borough: Caswell County City: Milton

Center coordinates of site (lat/long in degree decimal format):
Lat.: 36.59608° Long.: -79.640139°
Universal Transverse Mercator: 17

Name of nearest waterbody: East Branch Cascade Creek

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

☐ Office (Desk) Determination. Date:
☒ Field Determination. Date(s): 4/5/2022

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

| Site Number | Latitude (decimal degrees) | Longitude (decimal degrees) | Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable) | Type of aquatic resource (i.e., wetland vs. non-wetland waters) | Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404) |
|---|---|---|---|---|---|
| UT1 | 36.53401 | -79.246498 | 2254 feet | Non-wetland waters | Section 404 |
| UT1A | 36.533942 | -79.243766 | 247 feet | Non-wetland waters | Section 404 |
| UT2 | 36.535086 | -79.243245 | 929 feet | Non-wetland waters | Section 404 |
| UT3 | 36.538313 | -79.237036 | 660 feet | Non-wetland waters | Section 404 |
| Wetland 1A | 36.533152 | -79.2459 | 0.02 acres | Wetland | Section 404 |
| Wetland 1B | 36.532684 | -79.245364 | 0.12 acres | Wetland | Section 404 |
| Wetland 2A | 36.534092 | -79.244182 | 0.02 acres | Wetland | Section 404 |
| Wetland 2B | 36.534246 | -79.243601 | 0.04 acres | Wetland | Section 404 |
| Wetland 3 | 36.536958 | -79.235643 | 0.13 acres | Wetland | Section 404 |
| Wetland 4 | 36.537406 | -79.235719 | 0.31 acres | Wetland | Section 404 |

[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.

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:

[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.

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

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

- [■] Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
  Map: Delineation Flagging Maps, and aerial, soils, and topo maps (VHB).
- [■] Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - [x] Office concurs with data sheets/delineation report.
  - [ ] Office does not concur with data sheets/delineation report. Rationale: _____.
- [ ] Data sheets prepared by the Corps: _____.
- [ ] Corps navigable waters' study: _____.
- [ ] U.S. Geological Survey Hydrologic Atlas: _____.
  - [ ] USGS NHD data.
  - [ ] USGS 8 and 12 digit HUC maps.
- [■] U.S. Geological Survey map(s). Cite scale & quad name: 1:24,000 Milton, NC.
- [■] Natural Resources Conservation Service Soil Survey. Citation: Web Soil Survey.
- [ ] National wetlands inventory map(s). Cite name: _____.
- [ ] State/local wetland inventory map(s): _____.
- [ ] FEMA/FIRM maps: _____.
- [ ] 100-year Floodplain Elevation is: _____.(National Geodetic Vertical Datum of 1929)
- [■] Photographs: [■] Aerial (Name & Date): 2018 NCOneMap.
  or [■] Other (Name & Date): Site Photographs.
- [ ] Previous determination(s). File no. and date of response letter: _____.
- [x] Other information (please specify): QL2 LiDAR (NC Floodmaps).

**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.**

Date: 2023.01.13 11:37:18 -05'00'

Signature and date of Regulatory staff member completing PJD

Smith, Heather Digitally signed by Smith, Heather Date: 2022.02.14 08:47:29 -05'00'

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

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

**U.S. Army Corps of Engineers**

**WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region**

See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

*OMB Control #: 0710-xxxx, Exp: Pending*
*Requirement Control Symbol EXEMPT:*
*(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Mushroom Meadow City/County: Milton/Caswell Sampling Date: 10/14/20

Applicant/Owner: Eco Terra Partners State: NC Sampling Point: SB1

Investigator(s): S. Frederick Section, Township, Range:

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0-2%

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.532604 Long: -79.245823 Datum:

Soil Map Unit Name: Hatboro silt loam NWI classification: Not mapped

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area within a Wetland?** **Yes** ____ **No** X |
| Hydric Soil Present? | Yes X | No ____ | |
| Wetland Hydrology Present? | Yes ____ | No X | |

Remarks:
The site is in an active cattle pasture and has been ditched/manipulated in the past. The Antecedent Precipitation Tool states the area was experiencing "Wetter than Normal" conditions at the time of the site visit. The mapped soil is Codorus but the soil found on-site more closely resembles Hatboro silt loam, an inclusion found within Codorus.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No X | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No X | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION (Four Strata)** – Use scientific names of plants. Sampling Point: SB1

| Tree Stratum (Plot size: 9.1 m) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *No rooted trees* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Sapling/Shrub Stratum** (Plot size: 9.1 m) | | | |
| 1. *No rooted shrubs* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Herb Stratum** (Plot size: 5 m) | | | |
| 1. *Juncus effusus* | 20 | Yes | FACW |
| 2. *Juncus tenuis* | 20 | Yes | FAC |
| 3. *Persicaria hydropiper* | 5 | No | OBL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 45 =Total Cover | | |
| 50% of total cover: 23 | 20% of total cover: 9 | | |
| **Woody Vine Stratum** (Plot size: 5 m) | | | |
| 1. *No rooted vines* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 5 | x 1 = | 5 |
| FACW species | 20 | x 2 = | 40 |
| FAC species | 20 | x 3 = | 60 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 45 (A) | | 105 (B) |

Prevalence Index = B/A = 2.33

**Hydrophytic Vegetation Indicators:**

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Four Vegetation Strata:**

**Tree** – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/Shrub** – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody Vine** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: SB1

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-9 | 10YR 5/3 | 100 | | | | | Loamy/Clayey | |
| 9-16 | 10YR 6/2 | 60 | 10YR 5/8 | 40 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 16-24 | 10YR 6/1 | 98 | 10YR 5/8 | 2 | C | PL | Loamy/Clayey | Prominent redox concentrations |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

**U.S. Army Corps of Engineers**

**WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region**

See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

*OMB Control #: 0710-xxxx, Exp: Pending*
*Requirement Control Symbol EXEMPT:*
*(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Mushroom Meadow City/County: Milton/Caswell Sampling Date: 10/14/20

Applicant/Owner: Eco Terra Partners State: NC Sampling Point: SB2

Investigator(s): S. Frederick Section, Township, Range:

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0-2%

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.532889 Long: -79.244734 Datum:

Soil Map Unit Name: Hatboro silt loam NWI classification: Not mapped

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area within a Wetland?** **Yes** ____ **No** X |
| Hydric Soil Present? | Yes X | No ____ | |
| Wetland Hydrology Present? | Yes ____ | No X | |

Remarks:
The site is in an active cattle pasture and has been ditched/manipulated in the past. The Antecedent Precipitation Tool states the area was experiencing "Wetter than Normal" conditions at the time of the site visit. The mapped soil is Codorus but the soil found on-site more closely resembles Hatboro silt loam, an inclusion found within Codorus.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ True Aquatic Plants (B14)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No X | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No X | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION (Four Strata)** – Use scientific names of plants. Sampling Point: SB2

| Tree Stratum (Plot size: 9.1 m) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *No rooted trees* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Sapling/Shrub Stratum** (Plot size: 9.1 m) | | | |
| 1. *No rooted shrubs* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Herb Stratum** (Plot size: 5 m) | | | |
| 1. *Juncus effusus* | 25 | Yes | FACW |
| 2. *Juncus tenuis* | 5 | No | FAC |
| 3. *Persicaria hydropiper* | 20 | Yes | OBL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 50 =Total Cover | | |
| 50% of total cover: 25 | 20% of total cover: 10 | | |
| **Woody Vine Stratum** (Plot size: 5 m) | | | |
| 1. *No rooted vines* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 20 | x 1 = | 20 |
| FACW species | 25 | x 2 = | 50 |
| FAC species | 5 | x 3 = | 15 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 50 (A) | | 85 (B) |

Prevalence Index = B/A = 1.70

**Hydrophytic Vegetation Indicators:**

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Four Vegetation Strata:**

**Tree** – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/Shrub** – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody Vine** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: SB2

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-5 | 10YR 5/2 | 70 | 10YR 5/8 | 30 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 5-14 | 10YR 6/2 | 60 | 10YR 5/8 | 40 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 14-24 | 10YR 6/1 | 98 | 10YR 5/8 | 2 | C | PL | Loamy/Clayey | Prominent redox concentrations |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

**U.S. Army Corps of Engineers**

**WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region**

See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

*OMB Control #: 0710-xxxx, Exp: Pending*
*Requirement Control Symbol EXEMPT:*
*(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Mushroom Meadow City/County: Milton/Caswell Sampling Date: 10/14/20

Applicant/Owner: Eco Terra Partners State: NC Sampling Point: SB3

Investigator(s): S. Frederick Section, Township, Range:

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0-2%

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.533815 Long: -79.244319 Datum:

Soil Map Unit Name: Hatboro silt loam NWI classification: Not mapped

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area within a Wetland?** **Yes** ____ **No** X |
| Hydric Soil Present? | Yes X | No ____ | |
| Wetland Hydrology Present? | Yes ____ | No X | |

Remarks:
The site is in an active cattle pasture and has been ditched/manipulated in the past. The Antecedent Precipitation Tool states the area was experiencing "Wetter than Normal" conditions at the time of the site visit. The mapped soil is Codorus but the soil found on-site more closely resembles Hatboro silt loam, an inclusion found within Codorus.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ True Aquatic Plants (B14)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No X | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No X | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION (Four Strata)** – Use scientific names of plants. Sampling Point: SB3

| Tree Stratum (Plot size: 9.1 m) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *No rooted trees* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Sapling/Shrub Stratum** (Plot size: 9.1 m) | | | |
| 1. *No rooted shrubs* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Herb Stratum** (Plot size: 5 m) | | | |
| 1. *Juncus effusus* | 25 | Yes | FACW |
| 2. *Juncus tenuis* | 5 | No | FAC |
| 3. *Persicaria hydropiper* | 5 | No | OBL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 35 =Total Cover | | |
| 50% of total cover: 18 | 20% of total cover: 7 | | |
| **Woody Vine Stratum** (Plot size: 5 m) | | | |
| 1. *No rooted vines* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 5 | x 1 = | 5 |
| FACW species | 25 | x 2 = | 50 |
| FAC species | 5 | x 3 = | 15 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 35 (A) | | 70 (B) |

Prevalence Index = B/A = 2.00

**Hydrophytic Vegetation Indicators:**

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Four Vegetation Strata:**

**Tree** – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/Shrub** – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody Vine** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: SB3

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-9 | 10YR 5/2 | 80 | 10YR 5/8 | 20 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 9-16 | 10YR 5/2 | 60 | 10YR 5/8 | 40 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 16-24 | 10YR 6/1 | 98 | 10YR 5/8 | 2 | C | PL | Loamy/Clayey | Prominent redox concentrations |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

**U.S. Army Corps of Engineers**

**WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region**

See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

*OMB Control #: 0710-xxxx, Exp: Pending*
*Requirement Control Symbol EXEMPT:*
*(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Mushroom Meadow City/County: Milton/Caswell Sampling Date: 10/14/20

Applicant/Owner: Eco Terra Partners State: NC Sampling Point: SB4

Investigator(s): S. Frederick Section, Township, Range:

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0-2%

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.534475 Long: -79.243765 Datum:

Soil Map Unit Name: Hatboro silt loam NWI classification: Not mapped

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area within a Wetland?** **Yes** ____ **No** X |
| Hydric Soil Present? | Yes X | No ____ | |
| Wetland Hydrology Present? | Yes ____ | No X | |

Remarks:
The site is in an active cattle pasture and has been ditched/manipulated in the past. The Antecedent Precipitation Tool states the area was experiencing "Wetter than Normal" conditions at the time of the site visit. The mapped soil is Codorus but the soil found on-site more closely resembles Hatboro silt loam, an inclusion found within Codorus.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ True Aquatic Plants (B14)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No X | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No X | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION (Four Strata)** – Use scientific names of plants. Sampling Point: SB4

| Tree Stratum (Plot size: 9.1 m) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *No rooted trees* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Sapling/Shrub Stratum** (Plot size: 9.1 m) | | | |
| 1. *No rooted shrubs* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Herb Stratum** (Plot size: 5 m) | | | |
| 1. *Juncus effusus* | 25 | Yes | FACW |
| 2. *Juncus tenuis* | 10 | Yes | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 35 =Total Cover | | |
| 50% of total cover: 18 | 20% of total cover: 7 | | |
| **Woody Vine Stratum** (Plot size: 5 m) | | | |
| 1. *No rooted vines* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 25 | x 2 = | 50 |
| FAC species | 10 | x 3 = | 30 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 35 (A) | | 80 (B) |

Prevalence Index = B/A = 2.29

**Hydrophytic Vegetation Indicators:**

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Four Vegetation Strata:**

**Tree** – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/Shrub** – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody Vine** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: SB4

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-2 | 10YR 5/2 | 80 | 10YR 5/8 | 20 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 2-16 | 10YR 5/1 | 60 | 10YR 5/8 | 40 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 16-24 | 10YR 6/1 | 98 | 10YR 5/8 | 2 | C | PL | Loamy/Clayey | Prominent redox concentrations |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

**U.S. Army Corps of Engineers**

**WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region**

See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

*OMB Control #: 0710-xxxx, Exp: Pending*
*Requirement Control Symbol EXEMPT:*
*(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Mushroom Meadow City/County: Milton/Caswell Sampling Date: 10/14/20

Applicant/Owner: Eco Terra Partners State: NC Sampling Point: SB5

Investigator(s): S. Frederick Section, Township, Range:

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0-2%

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.537043 Long: -79.236056 Datum:

Soil Map Unit Name: Hatboro silt loam NWI classification: Not mapped

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area within a Wetland?** **Yes** ____ **No** X |
| Hydric Soil Present? | Yes X | No ____ | |
| Wetland Hydrology Present? | Yes ____ | No X | |

Remarks:
The site is in an active cattle pasture and has been ditched/manipulated in the past. The Antecedent Precipitation Tool states the area was experiencing "Wetter than Normal" conditions at the time of the site visit. The mapped soil is Codorus but the soil found on-site more closely resembles Hatboro silt loam, an inclusion found within Codorus.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ True Aquatic Plants (B14)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No X | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No X | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION (Four Strata)** – Use scientific names of plants. Sampling Point: SB5

| Tree Stratum (Plot size: 9.1 m) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *No rooted trees* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Sapling/Shrub Stratum** (Plot size: 9.1 m) | | | |
| 1. *No rooted shrubs* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Herb Stratum** (Plot size: 5 m) | | | |
| 1. *Juncus effusus* | 25 | Yes | FACW |
| 2. *Juncus tenuis* | 10 | No | FAC |
| 3. *Persicaria pensylvanica* | 20 | Yes | FACW |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 55 =Total Cover | | |
| 50% of total cover: 28 | 20% of total cover: 11 | | |
| **Woody Vine Stratum** (Plot size: 5 m) | | | |
| 1. *No rooted vines* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 45 | x 2 = | 90 |
| FAC species | 10 | x 3 = | 30 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 55 (A) | | 120 (B) |

Prevalence Index = B/A = 2.18

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Four Vegetation Strata:**

**Tree** – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/Shrub** – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody Vine** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: SB5

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-2 | 10YR 5/2 | 80 | 10YR 5/8 | 20 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 2-16 | 10YR 5/1 | 60 | 10YR 5/8 | 40 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 16-24 | 10YR 6/1 | 98 | 10YR 5/8 | 2 | C | PL | Loamy/Clayey | Prominent redox concentrations |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

**U.S. Army Corps of Engineers**

**WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region**

See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

*OMB Control #: 0710-xxxx, Exp: Pending*
*Requirement Control Symbol EXEMPT:*
*(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Mushroom Meadow City/County: Milton/Caswell Sampling Date: 1/10/22

Applicant/Owner: Eco Terra Partners State: NC Sampling Point: SB6

Investigator(s): H. Smith Section, Township, Range:

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0-2%

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.537366 Long: -79.235936 Datum:

Soil Map Unit Name: Hatboro silt loam NWI classification: Not mapped

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area within a Wetland?** **Yes** X **No** ____ |
| Hydric Soil Present? | Yes X | No ____ | |
| Wetland Hydrology Present? | Yes X | No ____ | |

Remarks:
This area was evaluated at a later date than the other five data sheets. The site is in an active cattle pasture and has been ditched/manipulated in the past. The Antecedent Precipitation Tool states the area was experiencing "Drier than Normal" conditions at the time of the site visit. The mapped soil is Codorus but the soil found on-site more closely resembles Hatboro silt loam, an inclusion found within Codorus.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ True Aquatic Plants (B14)
- ____ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes X | No ____ | Depth (inches): 4 |
| Water Table Present? | Yes ____ | No X | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No X | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** X **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Some portions of the wetland had surface water and others only had oxidized rhizosphere.

**VEGETATION (Four Strata)** – Use scientific names of plants. Sampling Point: SB6

| Tree Stratum (Plot size: 9.1 m) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *No rooted trees* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Sapling/Shrub Stratum** (Plot size: 9.1 m) | | | |
| 1. *No rooted shrubs* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Herb Stratum** (Plot size: 5 m) | | | |
| 1. *Juncus effusus* | 30 | Yes | FACW |
| 2. *Bowlesia incana* | 15 | Yes | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 45 =Total Cover | | |
| 50% of total cover: 23 | 20% of total cover: 9 | | |
| **Woody Vine Stratum** (Plot size: 5 m) | | | |
| 1. *No rooted vines* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 30 | x 2 = | 60 |
| FAC species | 15 | x 3 = | 45 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 45 (A) | | 105 (B) |

Prevalence Index = B/A = 2.33

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Four Vegetation Strata:**

**Tree** – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/Shrub** – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody Vine** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: SB6

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR 5/2 | 75 | 7.5YR 4/6 | 25 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 6-14 | 10YR 5/3 | 65 | 7.5YR 4/6 | 35 | C | M | Loamy/Clayey | Prominent redox concentrations |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

**U.S. Army Corps of Engineers**

**WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region**

See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

*OMB Control #: 0710-xxxx, Exp: Pending*
*Requirement Control Symbol EXEMPT:*
*(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Mushroom Meadow City/County: Milton/Caswell Sampling Date: 1/10/22

Applicant/Owner: Eco Terra Partners State: NC Sampling Point: SB7

Investigator(s): H. Smith Section, Township, Range:

Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0-2%

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 36.536777 Long: -79.235951 Datum:

Soil Map Unit Name: Hatboro silt loam NWI classification: Not mapped

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ | **Is the Sampled Area within a Wetland?** **Yes** X **No** ____ |
| Hydric Soil Present? | Yes X | No ____ | |
| Wetland Hydrology Present? | Yes X | No ____ | |

Remarks:
This area was evaluated at a later date than the other five data sheets. The site is in an active cattle pasture and has been ditched/manipulated in the past. The Antecedent Precipitation Tool states the area was experiencing "Drier than Normal" conditions at the time of the site visit. The mapped soil is Codorus but the soil found on-site more closely resembles Hatboro silt loam, an inclusion found within Codorus.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ True Aquatic Plants (B14)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- ____ Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No X | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No X | Depth (inches): ____ |

**Wetland Hydrology Present?** **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION (Four Strata)** – Use scientific names of plants. Sampling Point: SB7

| Tree Stratum (Plot size: 9.1 m) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *No rooted trees* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Sapling/Shrub Stratum** (Plot size: 9.1 m) | | | |
| 1. *No rooted shrubs* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |
| **Herb Stratum** (Plot size: 5 m) | | | |
| 1. *Juncus effusus* | 10 | Yes | FACW |
| 2. *Bowlesia incana* | 10 | Yes | FAC |
| 3. *Persicaria pensylvanica* | 30 | Yes | FACW |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| | 50 =Total Cover | | |
| 50% of total cover: 25 | 20% of total cover: 10 | | |
| **Woody Vine Stratum** (Plot size: 5 m) | | | |
| 1. *No rooted vines* | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | =Total Cover | | |
| 50% of total cover: | 20% of total cover: | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 40 | x 2 = | 80 |
| FAC species | 10 | x 3 = | 30 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 50 (A) | | 110 (B) |

Prevalence Index = B/A = 2.20

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Four Vegetation Strata:**

**Tree** – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/Shrub** – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody Vine** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

**SOIL** Sampling Point: SB7

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| 0-6 | 10YR 5/3 | 70 | 7.5YR 4/6 | 30 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 6-14 | 10YR 5/4 | 70 | 7.5YR 4/6 | 30 | C | M | Loamy/Clayey | Distinct redox concentrations |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

**Indicators for Problematic Hydric Soils[3]:**

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- X Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: _____

Depth (inches): _____

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

# Mushroom Meadow Stream and Wetland Mitigation Site
## Site Photographs

UT 1

UT 1

UT 2

UT 2

UT 3

UT 3

Wetland near SB6

Wetland near SB6

**NC SAM FIELD ASSESSMENT FORM**
**Accompanies User Manual Version 2.1**

USACE AID #: NCDWR #:

**INSTRUCTIONS:** Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if any supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.
**NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).**

**PROJECT / SITE INFORMATION:**

1. Project name (if any): Mushroom Meadow Mitigation Site UT 1
2. Date of evaluation: 7/28/2021
3. Applicant/owner name: Eco Terra Partners, LLC
4. Assessor name/organization: H. Smith VHB
5. County: Caswell
6. Nearest named water body on USGS 7.5-minute quad: Dan River
7. River Basin: Roanoke
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.53401, -79.246498

**STREAM INFORMATION: (depth and width can be approximations)**

9. Site number (show on attached map): UT 1
10. Length of assessment reach evaluated (feet): 50
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2.0 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 4.0
13. Is assessment reach a swamp stream? ☐ Yes ☐ No
14. Feature type: ☒ Perennial flow ☐ Intermittent flow ☐ Tidal Marsh Stream

**STREAM RATING INFORMATION:**

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape **(skip for Tidal Marsh Stream):** ☒ a (more sinuous stream, flatter valley slope) ☐ b (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream)** ☒ Size 1 (< 0.1 mi²) ☐ Size 2 (0.1 to < 0.5 mi²) ☐ Size 3 (0.5 to < 5 mi²) ☐ Size 4 (≥ 5 mi²)

**ADDITIONAL INFORMATION:**

18. Were regulatory considerations evaluated? ☐ Yes ☐ No If Yes, check all that appy to the assessment area.
- ☐ Section 10 water
- ☐ Classified Trout Waters
- ☐ Water Supply Watershed ( ☐ I ☐ II ☐ III ☐ IV ☐ V)
- ☐ Essential Fish Habitat
- ☐ Primary Nursery Area
- ☐ High Quality Waters/Outstanding Resource Waters
- ☐ Publicly owned property
- ☐ NCDWR riparian buffer rule in effect
- ☐ Nutrient Sensitive Waters
- ☐ Anadromous fish
- ☐ 303(d) List
- ☐ CAMA Area of Environmental Concern (AEC)
- ☐ Documented presence of a federal and/or state listed protected species within the assessment area. List species:
- ☐ Designated Critical Habitat (list species):

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐ Yes ☒ No

**1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
- ☐ A Water throughout assessment reach.
- ☒ B No flow, water in pools only.
- ☐ C No water in assessment reach.

**2. Evidence of Flow Restriction – assessment reach metric**
- ☐ A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ☒ B Not A

**3. Feature Pattern – assessment reach metric**
- ☒ A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
- ☐ B Not A.

**4. Feature Longitudinal Profile – assessment reach metric**
- ☒ A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
- ☐ B Not A

**5. Signs of Active Instability – assessment reach metric**
**Consider only current instability, not past events from which the stream has currently recovered**. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
- ☐ A < 10% of channel unstable
- ☒ B 10 to 25% of channel unstable
- ☐ C > 25% of channel unstable

**6. Streamside Area Interaction – streamside area metric**
**Consider for the Left Bank (LB) and the Right Bank (RB).**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Little or no evidence of conditions that adversely affect reference interaction |
| ☐ B | ☐ B | Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching]) |
| ☒ C | ☒ C | Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide |

**7. Water Quality Stressors – assessment reach/intertidal zone metric**
**Check all that apply.**
- ☐ A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐ B Excessive sedimentation (burying of stream features or intertidal zone)

- [ ] C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- [ ] D Odor (not including natural sulfide odors)
- [ ] E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in the "Notes/Sketch" section.
- [x] F Livestock with access to stream or intertidal zone
- [ ] G Excessive algae in stream or intertidal zone
- [ ] H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc.)
- [ ] I Other: _____ (explain in "Notes/Sketch" section)
- [ ] J Little to no stressors

**8. Recent Weather – watershed metric**

For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ( ) A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ( ) B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- (•) C No drought conditions

**9 Large or Dangerous Stream – assessment reach metric**

[ ] Yes (•) No Is stream is too large or dangerous to assess? **If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).**

**10. Natural In-stream Habitat Types – assessment reach metric**

10a. ( ) Yes [ ] No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- [ ] A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- [ ] B Multiple sticks and/or leaf packs and/or emergent vegetation
- [ ] C Multiple snags and logs (including lap trees)
- [ ] D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- [x] E Little or no habitat

Check for Tidal Marsh Streams only

- [ ] F 5% oysters or other natural hard bottoms
- [ ] G Submerged aquatic vegetation
- [ ] H Low-tide refugia (pools)
- [ ] I Sand bottom
- [ ] J 5% vertical bank along the marsh
- [ ] K Little or no habitat

**********REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS**********

**11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ( ) Yes [•] No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- [x] A Riffle-run section (evaluate 11c)
- [ ] B Pool-glide section (evaluate 11d)
- [ ] C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffles sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain Streams and Tidal Marsh Streams).** Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

| NP | R | C | A | P | |
|---|---|---|---|---|---|
| [•] | [ ] | [ ] | [ ] | [ ] | Bedrock/saprolite |
| [•] | [ ] | [ ] | [ ] | [ ] | Boulder (256 – 4096 mm) |
| [•] | [ ] | [ ] | [ ] | [ ] | Cobble (64 – 256 mm) |
| [ ] | [ ] | [•] | [ ] | [ ] | Gravel (2 – 64 mm) |
| [ ] | [ ] | [ ] | [•] | [ ] | Sand (.062 – 2 mm) |
| [ ] | [ ] | [ ] | [ ] | [ ] | Silt/clay (< 0.062 mm) |
| [ ] | [•] | [ ] | [ ] | [ ] | Detritus |
| [•] | [ ] | [ ] | [ ] | [ ] | Artificial (rip-rap, concrete, etc.) |

11d. [ ] Yes [ ] No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

**12. Aquatic Life – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12a. (•) Yes [ ] No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. [ ] No Water [ ] Other: _____

12b. ( ) Yes [•] No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

| 1 | >1 | |
|---|---|---|
| | | Numbers over columns refer to "individuals" for size 1 and 2 streams and "taxa" for size 3 and 4 streams. |
| [ ] | [ ] | Adult frogs |
| [ ] | [ ] | Aquatic reptiles |
| [ ] | [ ] | Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats) |
| [ ] | [ ] | Beetles (including water pennies) |
| [ ] | [ ] | Caddisfly larvae (Trichoptera [T]) |
| [ ] | [ ] | Asian clam (*Corbicula*) |
| [ ] | [ ] | Crustacean (isopod/amphipod/crayfish/shrimp) |
| [ ] | [ ] | Damselfly and dragonfly larvae |
| [ ] | [ ] | Dipterans (true flies) |
| [ ] | [ ] | Mayfly larvae (Ephemeroptera [E]) |
| [ ] | [ ] | Megaloptera (alderfly, fishfly, dobsonfly larvae) |
| [ ] | [ ] | Midges/mosquito larvae |
| [ ] | [ ] | Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea)* |
| [ ] | [ ] | Mussels/Clams (not *Corbicula*) |
| [ ] | [ ] | Other fish |
| [ ] | [ ] | Salamanders/tadpoles |
| [ ] | [ ] | Snails |
| [ ] | [ ] | Stonefly larvae (Plecoptera [P]) |
| [ ] | [ ] | Tipulid larvae |

☐ ☐ Worms/leeches

**13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
**Consider for the Left Bank (LB) and the Right Bank (RB).** Consider storage capacity with regard to both overbank flow and upland runoff.

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Little or no alteration to water storage capacity over a majority of the streamside area |
| ☐ B | ☐ B | Moderate alteration to water storage capacity over a majority of the streamside area |
| ☒ C | ☒ C | Severe alteration to water storage capacity over a majority of the streamside area (examples include: ditches, fill, soil, compaction, livestock disturbance, buildings, man-made levees, drainage pipes) |

**14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
**Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Majority of streamside area with depressions able to pond water ≥ 6 inches deep |
| ☐ B | ☐ B | Majority of streamside area with depressions able to pond water 3 to 6 inches deep |
| ☒ C | ☒ C | Majority of streamside area with depressions able to pond water < 3 inches deep |

**15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
**Consider for the Left Bank (LB) and the Right Bank (RB).** Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

| LB | RB | |
|---|---|---|
| ☐ Y | ☐ Y | Are wetlands present in the streamside area? |
| ☒ N | ☒ N | |

**16. Baseflow Contributors – assessment reach metric (skip for size 4 streams and Tidal Marsh Streams)**
**Check all contributors within the assessment reach or within view of and draining to the assessment reach.**

- ☐ A Streams and/or springs (jurisdictional discharges)
- ☐ B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐ C Obstruction that passes some flow during low-flow periods within assessment area (beaver dam, bottom-release dam)
- ☐ D Evidence of bank seepage or sweating (iron oxidizing bacteria in water indicates seepage)
- ☐ E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☑ F None of the above

**17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
**Check all that apply.**

- ☐ A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐ B Obstruction not passing flow during low flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐ C Urban stream (≥ 24% impervious surface for watershed)
- ☑ D Evidence that the stream-side area has been modified resulting in accelerated drainage into the assessment reach
- ☑ E Assessment reach relocated to valley edge
- ☐ F None of the above

**18. Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.

- ☐ A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐ B Degraded (example: scattered trees)
- ☒ C Stream shading is gone or largely absent

**19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
**Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.**

| Vegetated | | Wooded | | |
|---|---|---|---|---|
| LB | RB | LB | RB | |
| ☐ A | ☐ A | ☐ A | ☐ A | ≥ 100-feet wide or extends to the edge of the watershed |
| ☐ B | ☐ B | ☐ B | ☐ B | From 50 to < 100-feet wide |
| ☐ C | ☐ C | ☐ C | ☐ C | From 30 to < 50-feet wide |
| ☐ D | ☐ D | ☐ D | ☐ D | From 10 to < 30-feet wide |
| ☒ E | ☒ E | ☒ E | ☒ E | < 10-feet wide or no trees |

**20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
**Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Mature forest |
| ☐ B | ☐ B | Non-mature woody vegetation or modified vegetation structure |
| ☐ C | ☐ C | Herbaceous vegetation with or without a strip of trees < 10 feet wide |
| ☐ D | ☐ D | Maintained shrubs |
| ☒ E | ☒ E | Little or no vegetation |

**21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
**Check all appropriate boxes for left bank (LB) and right bank (RB).** Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
**If none of the following stressors occurs on either bank, check here and skip to Metric 22:** ☐

| Abuts | | < 30 feet | | 30-50 feet | | |
|---|---|---|---|---|---|---|
| LB | RB | LB | RB | LB | RB | |
| ☐ A | ☐ A | ☐ A | ☐ A | ☐ A | ☐ A | Row crops |
| ☐ B | ☐ B | ☐ B | ☐ B | ☐ B | ☐ B | Maintained turf |
| ☐ C | ☐ C | ☐ C | ☐ C | ☐ C | ☐ C | Pasture (no livestock)/commercial horticulture |
| ☒ D | ☒ D | ☐ D | ☐ D | ☐ D | ☐ D | Pasture (active livestock use) |

**22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
**Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Medium to high stem density |
| ☐ B | ☐ B | Low stem density |
| ☒ C | ☒ C | No wooded riparian buffer or predominantly herbaceous species or bare ground |

**23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10-feet wide.

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | The total length of buffer breaks is < 25 percent. |
| ☐ B | ☐ B | The total length of buffer breaks is between 25 and 50 percent. |
| ☉ C | ☉ C | The total length of buffer breaks is > 50 percent. |

**24. Vegetative Composition – First 100 feet of streamside area metric (skip for Tidal Marsh Streams)**

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse. |
| ☐ B | ☐ B | Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees. |
| ☉ C | ☉ C | Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation. |

**25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)**

25a. ☐ Yes ☉ No Was a conductivity measurement recorded?

If No, select one of the following reasons. ☐ No Water ☐ Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).

☐ A <46 ☐ B 46 to < 67 ☐ C 67 to < 79 ☐ D 79 to < 230 ☐ E ≥ 230

Notes/Sketch:

**NC SAM Stream Rating Sheet**
**Accompanies User Manual Version 2.1**

| | | | |
|---|---|---|---|
| Stream Site Name | Mushroom Meadow Mitigation Site UT 1 | Date of Evaluation | 7/28/2021 |
| Stream Category | Pa1 | Assessor Name/Organization | H. Smith VHB |

| | |
|---|---|
| Notes of Field Assessment Form (Y/N) | NO |
| Presence of regulatory considerations (Y/N) | NO |
| Additional stream information/supplementary measurements included (Y/N) | NO |
| NC SAM feature type (perennial, intermittent, Tidal Marsh Stream) | Perennial |

| Function Class Rating Summary | USACE/ All Streams | NCDWR Intermittent |
|---|---|---|
| (1) Hydrology | **LOW** | |
| (2) Baseflow | **LOW** | |
| (2) Flood Flow | **LOW** | |
| (3) Streamside Area Attenuation | **LOW** | |
| (4) Floodplain Access | **LOW** | |
| (4) Wooded Riparian Buffer | **LOW** | |
| (4) Microtopography | **LOW** | |
| (3) Stream Stability | **LOW** | |
| (4) Channel Stability | **MEDIUM** | |
| (4) Sediment Transport | **LOW** | |
| (4) Stream Geomorphology | **LOW** | |
| (2) Stream/Intertidal Zone Interaction | NA | |
| (2) Longitudinal Tidal Flow | NA | |
| (2) Tidal Marsh Stream Stability | NA | |
| (3) Tidal Marsh Channel Stability | NA | |
| (3) Tidal Marsh Stream Geomorphology | NA | |
| (1) Water Quality | **LOW** | |
| (2) Baseflow | **LOW** | |
| (2) Streamside Area Vegetation | **LOW** | |
| (3) Upland Pollutant Filtration | **LOW** | |
| (3) Thermoregulation | **LOW** | |
| (2) Indicators of Stressors | **YES** | |
| (2) Aquatic Life Tolerance | **HIGH** | |
| (2) Intertidal Zone Filtration | NA | |
| (1) Habitat | **LOW** | |
| (2) In-stream Habitat | **LOW** | |
| (3) Baseflow | **LOW** | |
| (3) Substrate | **LOW** | |
| (3) Stream Stability | **MEDIUM** | |
| (3) In-stream Habitat | **LOW** | |
| (2) Stream-side Habitat | **LOW** | |
| (3) Stream-side Habitat | **LOW** | |
| (3) Thermoregulation | **LOW** | |
| (2) Tidal Marsh In-stream Habitat | NA | |
| (3) Flow Restriction | NA | |
| (3) Tidal Marsh Stream Stability | NA | |
| (4) Tidal Marsh Channel Stability | NA | |
| (4) Tidal Marsh Stream Geomorphology | NA | |
| (3) Tidal Marsh In-stream Habitat | NA | |
| (2) Intertidal Zone Habitat | NA | |
| Overall | **LOW** | |

**NC SAM FIELD ASSESSMENT FORM**
**Accompanies User Manual Version 2.1**

USACE AID #: NCDWR #:

**INSTRUCTIONS:** Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if any supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.
**NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).**

**PROJECT / SITE INFORMATION:**

1. Project name (if any): Mushroom Meadow Mitigation Site UT 2
2. Date of evaluation: 7/28/2021
3. Applicant/owner name: Eco Terra Partners, LLC
4. Assessor name/organization: H. Smith VHB
5. County: Caswell
6. Nearest named water body on USGS 7.5-minute quad: Dan River
7. River Basin: Roanoke
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.535086, -79.243245

**STREAM INFORMATION: (depth and width can be approximations)**

9. Site number (show on attached map): UT 1
10. Length of assessment reach evaluated (feet): 50
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2.0 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 4.0
13. Is assessment reach a swamp stream? ☐ Yes ☐ No
14. Feature type: ☉ Perennial flow ☐ Intermittent flow ☐ Tidal Marsh Stream

**STREAM RATING INFORMATION:**

15. NC SAM Zone: ☐ Mountains (M) ☉ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape **(skip for Tidal Marsh Stream):** ☉ a (more sinuous stream, flatter valley slope) ☐ b (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream)** ☉ Size 1 (< 0.1 mi²) ☐ Size 2 (0.1 to < 0.5 mi²) ☐ Size 3 (0.5 to < 5 mi²) ☐ Size 4 (≥ 5 mi²)

**ADDITIONAL INFORMATION:**

18. Were regulatory considerations evaluated? ☐ Yes ☐ No If Yes, check all that appy to the assessment area.
- ☐ Section 10 water
- ☐ Classified Trout Waters
- ☐ Water Supply Watershed ( ☐ I ☐ II ☐ III ☐ IV ☐ V)
- ☐ Essential Fish Habitat
- ☐ Primary Nursery Area
- ☐ High Quality Waters/Outstanding Resource Waters
- ☐ Publicly owned property
- ☐ NCDWR riparian buffer rule in effect
- ☐ Nutrient Sensitive Waters
- ☐ Anadromous fish
- ☐ 303(d) List
- ☐ CAMA Area of Environmental Concern (AEC)
- ☐ Documented presence of a federal and/or state listed protected species within the assessment area. List species:
- ☐ Designated Critical Habitat (list species):

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐ Yes ☉ No

**1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
- ☉ A Water throughout assessment reach.
- ☐ B No flow, water in pools only.
- ☐ C No water in assessment reach.

**2. Evidence of Flow Restriction – assessment reach metric**
- ☐ A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ☉ B Not A

**3. Feature Pattern – assessment reach metric**
- ☉ A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
- ☐ B Not A.

**4. Feature Longitudinal Profile – assessment reach metric**
- ☉ A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
- ☐ B Not A

**5. Signs of Active Instability – assessment reach metric**
**Consider only current instability, not past events from which the stream has currently recovered**. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
- ☐ A < 10% of channel unstable
- ☉ B 10 to 25% of channel unstable
- ☐ C > 25% of channel unstable

**6. Streamside Area Interaction – streamside area metric**
**Consider for the Left Bank (LB) and the Right Bank (RB).**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Little or no evidence of conditions that adversely affect reference interaction |
| ☐ B | ☐ B | Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching]) |
| ☉ C | ☉ C | Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide |

**7. Water Quality Stressors – assessment reach/intertidal zone metric**
**Check all that apply.**
- ☐ A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐ B Excessive sedimentation (burying of stream features or intertidal zone)

- [ ] C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- [ ] D Odor (not including natural sulfide odors)
- [ ] E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in the "Notes/Sketch" section.
- [x] F Livestock with access to stream or intertidal zone
- [ ] G Excessive algae in stream or intertidal zone
- [ ] H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc.)
- [ ] I Other: _____ (explain in "Notes/Sketch" section)
- [ ] J Little to no stressors

**8. Recent Weather – watershed metric**

For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ( ) A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ( ) B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- (•) C No drought conditions

**9 Large or Dangerous Stream – assessment reach metric**

[ ] Yes (•) No Is stream is too large or dangerous to assess? **If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).**

**10. Natural In-stream Habitat Types – assessment reach metric**

10a. ( ) Yes [ ] No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- [ ] A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- [ ] B Multiple sticks and/or leaf packs and/or emergent vegetation
- [ ] C Multiple snags and logs (including lap trees)
- [ ] D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- [x] E Little or no habitat

Check for Tidal Marsh Streams only

- [ ] F 5% oysters or other natural hard bottoms
- [ ] G Submerged aquatic vegetation
- [ ] H Low-tide refugia (pools)
- [ ] I Sand bottom
- [ ] J 5% vertical bank along the marsh
- [ ] K Little or no habitat

**********REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS**********

**11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ( ) Yes [•] No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- [x] A Riffle-run section (evaluate 11c)
- [ ] B Pool-glide section (evaluate 11d)
- [ ] C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffles sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain Streams and Tidal Marsh Streams).** Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

| NP | R | C | A | P | |
|---|---|---|---|---|---|
| [•] | [ ] | [ ] | [ ] | [ ] | Bedrock/saprolite |
| [•] | [ ] | [ ] | [ ] | [ ] | Boulder (256 – 4096 mm) |
| [•] | [ ] | [ ] | [ ] | [ ] | Cobble (64 – 256 mm) |
| [ ] | [ ] | [•] | [ ] | [ ] | Gravel (2 – 64 mm) |
| [ ] | [ ] | [ ] | [•] | [ ] | Sand (.062 – 2 mm) |
| [ ] | [ ] | [ ] | [ ] | [ ] | Silt/clay (< 0.062 mm) |
| [ ] | [•] | [ ] | [ ] | [ ] | Detritus |
| [•] | [ ] | [ ] | [ ] | [ ] | Artificial (rip-rap, concrete, etc.) |

11d. [ ] Yes [ ] No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

**12. Aquatic Life – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12a. (•) Yes [ ] No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. [ ] No Water [ ] Other: _____

12b. ( ) Yes [•] No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

| 1 | >1 | |
|---|---|---|
| | | Numbers over columns refer to "individuals" for size 1 and 2 streams and "taxa" for size 3 and 4 streams. |
| [ ] | [ ] | Adult frogs |
| [ ] | [ ] | Aquatic reptiles |
| [ ] | [ ] | Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats) |
| [ ] | [ ] | Beetles (including water pennies) |
| [ ] | [ ] | Caddisfly larvae (Trichoptera [T]) |
| [ ] | [ ] | Asian clam (*Corbicula*) |
| [ ] | [ ] | Crustacean (isopod/amphipod/crayfish/shrimp) |
| [ ] | [ ] | Damselfly and dragonfly larvae |
| [ ] | [ ] | Dipterans (true flies) |
| [ ] | [ ] | Mayfly larvae (Ephemeroptera [E]) |
| [ ] | [ ] | Megaloptera (alderfly, fishfly, dobsonfly larvae) |
| [ ] | [ ] | Midges/mosquito larvae |
| [ ] | [ ] | Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea)* |
| [ ] | [ ] | Mussels/Clams (not *Corbicula*) |
| [ ] | [ ] | Other fish |
| [ ] | [ ] | Salamanders/tadpoles |
| [ ] | [ ] | Snails |
| [ ] | [ ] | Stonefly larvae (Plecoptera [P]) |
| [ ] | [ ] | Tipulid larvae |

☐ ☐ Worms/leeches

**13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
**Consider for the Left Bank (LB) and the Right Bank (RB).** Consider storage capacity with regard to both overbank flow and upland runoff.

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Little or no alteration to water storage capacity over a majority of the streamside area |
| ☐ B | ☐ B | Moderate alteration to water storage capacity over a majority of the streamside area |
| ☉ C | ☉ C | Severe alteration to water storage capacity over a majority of the streamside area (examples include: ditches, fill, soil, compaction, livestock disturbance, buildings, man-made levees, drainage pipes) |

**14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
**Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Majority of streamside area with depressions able to pond water ≥ 6 inches deep |
| ☐ B | ☐ B | Majority of streamside area with depressions able to pond water 3 to 6 inches deep |
| ☉ C | ☉ C | Majority of streamside area with depressions able to pond water < 3 inches deep |

**15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
**Consider for the Left Bank (LB) and the Right Bank (RB).** Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

| LB | RB | |
|---|---|---|
| ☐ Y | ☐ Y | Are wetlands present in the streamside area? |
| ☉ N | ☉ N | |

**16. Baseflow Contributors – assessment reach metric (skip for size 4 streams and Tidal Marsh Streams)**
**Check all contributors within the assessment reach or within view of and draining to the assessment reach.**

- ☐ A Streams and/or springs (jurisdictional discharges)
- ☐ B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐ C Obstruction that passes some flow during low-flow periods within assessment area (beaver dam, bottom-release dam)
- ☐ D Evidence of bank seepage or sweating (iron oxidizing bacteria in water indicates seepage)
- ☐ E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☑ F None of the above

**17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
**Check all that apply.**

- ☐ A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐ B Obstruction not passing flow during low flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐ C Urban stream (≥ 24% impervious surface for watershed)
- ☑ D Evidence that the stream-side area has been modified resulting in accelerated drainage into the assessment reach
- ☐ E Assessment reach relocated to valley edge
- ☐ F None of the above

**18. Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.

- ☐ A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐ B Degraded (example: scattered trees)
- ☉ C Stream shading is gone or largely absent

**19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
**Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.**

| Vegetated | | Wooded | | |
|---|---|---|---|---|
| LB | RB | LB | RB | |
| ☐ A | ☐ A | ☐ A | ☐ A | ≥ 100-feet wide or extends to the edge of the watershed |
| ☐ B | ☐ B | ☐ B | ☐ B | From 50 to < 100-feet wide |
| ☐ C | ☐ C | ☐ C | ☐ C | From 30 to < 50-feet wide |
| ☐ D | ☐ D | ☐ D | ☐ D | From 10 to < 30-feet wide |
| ☉ E | ☉ E | ☉ E | ☉ E | < 10-feet wide or no trees |

**20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
**Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Mature forest |
| ☐ B | ☐ B | Non-mature woody vegetation or modified vegetation structure |
| ☐ C | ☐ C | Herbaceous vegetation with or without a strip of trees < 10 feet wide |
| ☐ D | ☐ D | Maintained shrubs |
| ☉ E | ☉ E | Little or no vegetation |

**21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
**Check all appropriate boxes for left bank (LB) and right bank (RB).** Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
**If none of the following stressors occurs on either bank, check here and skip to Metric 22:** ☐

| Abuts | | < 30 feet | | 30-50 feet | | |
|---|---|---|---|---|---|---|
| LB | RB | LB | RB | LB | RB | |
| ☐ A | ☐ A | ☐ A | ☐ A | ☐ A | ☐ A | Row crops |
| ☐ B | ☐ B | ☐ B | ☐ B | ☐ B | ☐ B | Maintained turf |
| ☐ C | ☐ C | ☐ C | ☐ C | ☐ C | ☐ C | Pasture (no livestock)/commercial horticulture |
| ☉ D | ☉ D | ☐ D | ☐ D | ☐ D | ☐ D | Pasture (active livestock use) |

**22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
**Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Medium to high stem density |
| ☐ B | ☐ B | Low stem density |
| ☉ C | ☉ C | No wooded riparian buffer or predominantly herbaceous species or bare ground |

**23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10-feet wide.

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | The total length of buffer breaks is < 25 percent. |
| ☐ B | ☐ B | The total length of buffer breaks is between 25 and 50 percent. |
| ☉ C | ☉ C | The total length of buffer breaks is > 50 percent. |

**24. Vegetative Composition – First 100 feet of streamside area metric (skip for Tidal Marsh Streams)**

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse. |
| ☐ B | ☐ B | Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees. |
| ☉ C | ☉ C | Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation. |

**25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)**

25a. ☐ Yes ☉ No Was a conductivity measurement recorded?

If No, select one of the following reasons. ☐ No Water ☐ Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).

☐ A <46 ☐ B 46 to < 67 ☐ C 67 to < 79 ☐ D 79 to < 230 ☐ E ≥ 230

Notes/Sketch:

**NC SAM Stream Rating Sheet**
**Accompanies User Manual Version 2.1**

Stream Site Name: Mushroom Meadow Mitigation Site UT 2
Date of Evaluation: 7/28/2021
Stream Category: Pa1
Assessor Name/Organization: H. Smith VHB

| | |
|---|---|
| Notes of Field Assessment Form (Y/N) | NO |
| Presence of regulatory considerations (Y/N) | NO |
| Additional stream information/supplementary measurements included (Y/N) | NO |
| NC SAM feature type (perennial, intermittent, Tidal Marsh Stream) | Perennial |

| Function Class Rating Summary | USACE/ All Streams | NCDWR Intermittent |
|---|---|---|
| (1) Hydrology | **LOW** | |
| (2) Baseflow | **MEDIUM** | |
| (2) Flood Flow | **LOW** | |
| (3) Streamside Area Attenuation | **LOW** | |
| (4) Floodplain Access | **LOW** | |
| (4) Wooded Riparian Buffer | **LOW** | |
| (4) Microtopography | **LOW** | |
| (3) Stream Stability | **LOW** | |
| (4) Channel Stability | **MEDIUM** | |
| (4) Sediment Transport | **LOW** | |
| (4) Stream Geomorphology | **LOW** | |
| (2) Stream/Intertidal Zone Interaction | NA | |
| (2) Longitudinal Tidal Flow | NA | |
| (2) Tidal Marsh Stream Stability | NA | |
| (3) Tidal Marsh Channel Stability | NA | |
| (3) Tidal Marsh Stream Geomorphology | NA | |
| (1) Water Quality | **LOW** | |
| (2) Baseflow | **MEDIUM** | |
| (2) Streamside Area Vegetation | **LOW** | |
| (3) Upland Pollutant Filtration | **LOW** | |
| (3) Thermoregulation | **LOW** | |
| (2) Indicators of Stressors | **YES** | |
| (2) Aquatic Life Tolerance | **HIGH** | |
| (2) Intertidal Zone Filtration | NA | |
| (1) Habitat | **LOW** | |
| (2) In-stream Habitat | **LOW** | |
| (3) Baseflow | **MEDIUM** | |
| (3) Substrate | **LOW** | |
| (3) Stream Stability | **MEDIUM** | |
| (3) In-stream Habitat | **LOW** | |
| (2) Stream-side Habitat | **LOW** | |
| (3) Stream-side Habitat | **LOW** | |
| (3) Thermoregulation | **LOW** | |
| (2) Tidal Marsh In-stream Habitat | NA | |
| (3) Flow Restriction | NA | |
| (3) Tidal Marsh Stream Stability | NA | |
| (4) Tidal Marsh Channel Stability | NA | |
| (4) Tidal Marsh Stream Geomorphology | NA | |
| (3) Tidal Marsh In-stream Habitat | NA | |
| (2) Intertidal Zone Habitat | NA | |
| Overall | **LOW** | |

**NC SAM FIELD ASSESSMENT FORM**
**Accompanies User Manual Version 2.1**

USACE AID #: NCDWR #:

**INSTRUCTIONS:** Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if any supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.
**NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).**

**PROJECT / SITE INFORMATION:**

1. Project name (if any): Mushroom Meadow Mitigation Site UT 3
2. Date of evaluation: 7/28/2021
3. Applicant/owner name: Eco Terra Partners, LLC
4. Assessor name/organization: H. Smith VHB
5. County: Caswell
6. Nearest named water body on USGS 7.5-minute quad: Dan River
7. River Basin: Roanoke
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.538313, -79.237036

**STREAM INFORMATION: (depth and width can be approximations)**

9. Site number (show on attached map): UT 1
10. Length of assessment reach evaluated (feet): 50
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2.0 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 4.0
13. Is assessment reach a swamp stream? ☐ Yes ☐ No
14. Feature type: ☉ Perennial flow ☐ Intermittent flow ☐ Tidal Marsh Stream

**STREAM RATING INFORMATION:**

15. NC SAM Zone: ☐ Mountains (M) ☉ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape **(skip for Tidal Marsh Stream):** ☉ a (more sinuous stream, flatter valley slope) ☐ b (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream)** ☉ Size 1 (< 0.1 mi²) ☐ Size 2 (0.1 to < 0.5 mi²) ☐ Size 3 (0.5 to < 5 mi²) ☐ Size 4 (≥ 5 mi²)

**ADDITIONAL INFORMATION:**

18. Were regulatory considerations evaluated? ☐ Yes ☐ No If Yes, check all that appy to the assessment area.
- ☐ Section 10 water
- ☐ Classified Trout Waters
- ☐ Water Supply Watershed ( ☐ I ☐ II ☐ III ☐ IV ☐ V)
- ☐ Essential Fish Habitat
- ☐ Primary Nursery Area
- ☐ High Quality Waters/Outstanding Resource Waters
- ☐ Publicly owned property
- ☐ NCDWR riparian buffer rule in effect
- ☐ Nutrient Sensitive Waters
- ☐ Anadromous fish
- ☐ 303(d) List
- ☐ CAMA Area of Environmental Concern (AEC)
- ☐ Documented presence of a federal and/or state listed protected species within the assessment area. List species:
- ☐ Designated Critical Habitat (list species):

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐ Yes ☉ No

**1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
- ☉ A Water throughout assessment reach.
- ☐ B No flow, water in pools only.
- ☐ C No water in assessment reach.

**2. Evidence of Flow Restriction – assessment reach metric**
- ☐ A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ☉ B Not A

**3. Feature Pattern – assessment reach metric**
- ☉ A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
- ☐ B Not A.

**4. Feature Longitudinal Profile – assessment reach metric**
- ☉ A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
- ☐ B Not A

**5. Signs of Active Instability – assessment reach metric**
**Consider only current instability, not past events from which the stream has currently recovered**. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
- ☐ A < 10% of channel unstable
- ☉ B 10 to 25% of channel unstable
- ☐ C > 25% of channel unstable

**6. Streamside Area Interaction – streamside area metric**
**Consider for the Left Bank (LB) and the Right Bank (RB).**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Little or no evidence of conditions that adversely affect reference interaction |
| ☐ B | ☐ B | Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching]) |
| ☉ C | ☉ C | Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide |

**7. Water Quality Stressors – assessment reach/intertidal zone metric**
**Check all that apply.**
- ☐ A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☑ B Excessive sedimentation (burying of stream features or intertidal zone)

- ☐ C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐ D Odor (not including natural sulfide odors)
- ☐ E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in the "Notes/Sketch" section.
- ☑ F Livestock with access to stream or intertidal zone
- ☐ G Excessive algae in stream or intertidal zone
- ☐ H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc.)
- ☐ I Other: _____ (explain in "Notes/Sketch" section)
- ☐ J Little to no stressors

**8. Recent Weather – watershed metric**

For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ○ A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ○ B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ◉ C No drought conditions

**9 Large or Dangerous Stream – assessment reach metric**

☐ Yes ◉ No Is stream is too large or dangerous to assess? **If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).**

**10. Natural In-stream Habitat Types – assessment reach metric**

10a. ○ Yes ☐ No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐ A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐ B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐ C Multiple snags and logs (including lap trees)
- ☐ D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☑ E Little or no habitat

Check for Tidal Marsh Streams only

- ☐ F 5% oysters or other natural hard bottoms
- ☐ G Submerged aquatic vegetation
- ☐ H Low-tide refugia (pools)
- ☐ I Sand bottom
- ☐ J 5% vertical bank along the marsh
- ☐ K Little or no habitat

**********REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS**********

**11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ○ Yes ◉ No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☑ A Riffle-run section (evaluate 11c)
- ☐ B Pool-glide section (evaluate 11d)
- ☐ C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffles sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain Streams and Tidal Marsh Streams).** Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

| NP | R | C | A | P | |
|---|---|---|---|---|---|
| ◉ | ☐ | ☐ | ☐ | ☐ | Bedrock/saprolite |
| ◉ | ☐ | ☐ | ☐ | ☐ | Boulder (256 – 4096 mm) |
| ◉ | ☐ | ☐ | ☐ | ☐ | Cobble (64 – 256 mm) |
| ☐ | ◉ | ☐ | ☐ | ☐ | Gravel (2 – 64 mm) |
| ☐ | ☐ | ☐ | ◉ | ☐ | Sand (.062 – 2 mm) |
| ☐ | ☐ | ☐ | ☐ | ◉ | Silt/clay (< 0.062 mm) |
| ☐ | ◉ | ☐ | ☐ | ☐ | Detritus |
| ◉ | ☐ | ☐ | ☐ | ☐ | Artificial (rip-rap, concrete, etc.) |

11d. ☐ Yes ☐ No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

**12. Aquatic Life – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12a. ◉ Yes ☐ No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐ No Water ☐ Other: _____

12b. ○ Yes ◉ No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

| 1 | >1 | |
|---|---|---|
| | | Numbers over columns refer to "individuals" for size 1 and 2 streams and "taxa" for size 3 and 4 streams. |
| ☐ | ☐ | Adult frogs |
| ☐ | ☐ | Aquatic reptiles |
| ☐ | ☐ | Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats) |
| ☐ | ☐ | Beetles (including water pennies) |
| ☐ | ☐ | Caddisfly larvae (Trichoptera [T]) |
| ☐ | ☐ | Asian clam (*Corbicula*) |
| ☐ | ☐ | Crustacean (isopod/amphipod/crayfish/shrimp) |
| ☐ | ☐ | Damselfly and dragonfly larvae |
| ☐ | ☐ | Dipterans (true flies) |
| ☐ | ☐ | Mayfly larvae (Ephemeroptera [E]) |
| ☐ | ☐ | Megaloptera (alderfly, fishfly, dobsonfly larvae) |
| ☐ | ☐ | Midges/mosquito larvae |
| ☐ | ☐ | Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea)* |
| ☐ | ☐ | Mussels/Clams (not *Corbicula*) |
| ☐ | ☐ | Other fish |
| ☐ | ☐ | Salamanders/tadpoles |
| ☐ | ☐ | Snails |
| ☐ | ☐ | Stonefly larvae (Plecoptera [P]) |
| ☐ | ☐ | Tipulid larvae |

☐ ☐ Worms/leeches

**13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
**Consider for the Left Bank (LB) and the Right Bank (RB).** Consider storage capacity with regard to both overbank flow and upland runoff.

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Little or no alteration to water storage capacity over a majority of the streamside area |
| ☐ B | ☐ B | Moderate alteration to water storage capacity over a majority of the streamside area |
| ☉ C | ☉ C | Severe alteration to water storage capacity over a majority of the streamside area (examples include: ditches, fill, soil, compaction, livestock disturbance, buildings, man-made levees, drainage pipes) |

**14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
**Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Majority of streamside area with depressions able to pond water ≥ 6 inches deep |
| ☉ B | ☉ B | Majority of streamside area with depressions able to pond water 3 to 6 inches deep |
| ☐ C | ☐ C | Majority of streamside area with depressions able to pond water < 3 inches deep |

**15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
**Consider for the Left Bank (LB) and the Right Bank (RB).** Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

| LB | RB | |
|---|---|---|
| ☉ Y | ☉ Y | Are wetlands present in the streamside area? |
| ☐ N | ☐ N | |

**16. Baseflow Contributors – assessment reach metric (skip for size 4 streams and Tidal Marsh Streams)**
**Check all contributors within the assessment reach or within view of and draining to the assessment reach.**

- ☐ A Streams and/or springs (jurisdictional discharges)
- ☐ B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐ C Obstruction that passes some flow during low-flow periods within assessment area (beaver dam, bottom-release dam)
- ☐ D Evidence of bank seepage or sweating (iron oxidizing bacteria in water indicates seepage)
- ☐ E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☑ F None of the above

**17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
**Check all that apply.**

- ☐ A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐ B Obstruction not passing flow during low flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐ C Urban stream (≥ 24% impervious surface for watershed)
- ☑ D Evidence that the stream-side area has been modified resulting in accelerated drainage into the assessment reach
- ☐ E Assessment reach relocated to valley edge
- ☐ F None of the above

**18. Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.

- ☐ A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐ B Degraded (example: scattered trees)
- ☉ C Stream shading is gone or largely absent

**19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
**Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.**

| Vegetated | | Wooded | | |
|---|---|---|---|---|
| LB | RB | LB | RB | |
| ☐ A | ☐ A | ☐ A | ☐ A | ≥ 100-feet wide or extends to the edge of the watershed |
| ☐ B | ☐ B | ☐ B | ☐ B | From 50 to < 100-feet wide |
| ☐ C | ☐ C | ☐ C | ☐ C | From 30 to < 50-feet wide |
| ☐ D | ☐ D | ☐ D | ☐ D | From 10 to < 30-feet wide |
| ☉ E | ☉ E | ☉ E | ☉ E | < 10-feet wide or no trees |

**20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
**Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Mature forest |
| ☐ B | ☐ B | Non-mature woody vegetation or modified vegetation structure |
| ☐ C | ☐ C | Herbaceous vegetation with or without a strip of trees < 10 feet wide |
| ☐ D | ☐ D | Maintained shrubs |
| ☉ E | ☉ E | Little or no vegetation |

**21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
**Check all appropriate boxes for left bank (LB) and right bank (RB).** Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
**If none of the following stressors occurs on either bank, check here and skip to Metric 22:** ☐

| Abuts | | < 30 feet | | 30-50 feet | | |
|---|---|---|---|---|---|---|
| LB | RB | LB | RB | LB | RB | |
| ☐ A | ☐ A | ☐ A | ☐ A | ☐ A | ☐ A | Row crops |
| ☐ B | ☐ B | ☐ B | ☐ B | ☐ B | ☐ B | Maintained turf |
| ☐ C | ☐ C | ☐ C | ☐ C | ☐ C | ☐ C | Pasture (no livestock)/commercial horticulture |
| ☉ D | ☉ D | ☐ D | ☐ D | ☐ D | ☐ D | Pasture (active livestock use) |

**22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
**Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).**

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Medium to high stem density |
| ☐ B | ☐ B | Low stem density |
| ☉ C | ☉ C | No wooded riparian buffer or predominantly herbaceous species or bare ground |

**23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10-feet wide.

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | The total length of buffer breaks is < 25 percent. |
| ☐ B | ☐ B | The total length of buffer breaks is between 25 and 50 percent. |
| ☉ C | ☉ C | The total length of buffer breaks is > 50 percent. |

**24. Vegetative Composition – First 100 feet of streamside area metric (skip for Tidal Marsh Streams)**

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

| LB | RB | |
|---|---|---|
| ☐ A | ☐ A | Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse. |
| ☐ B | ☐ B | Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees. |
| ☉ C | ☉ C | Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation. |

**25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)**

25a. ☐ Yes ☉ No Was a conductivity measurement recorded?

If No, select one of the following reasons. ☐ No Water ☐ Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).

☐ A <46 ☐ B 46 to < 67 ☐ C 67 to < 79 ☐ D 79 to < 230 ☐ E ≥ 230

Notes/Sketch:

**NC SAM Stream Rating Sheet**
**Accompanies User Manual Version 2.1**

| | | | |
|---|---|---|---|
| Stream Site Name | Mushroom Meadow Mitigation Site UT 3 | Date of Evaluation | 7/28/2021 |
| Stream Category | Pa1 | Assessor Name/Organization | H. Smith VHB |

| | |
|---|---|
| Notes of Field Assessment Form (Y/N) | NO |
| Presence of regulatory considerations (Y/N) | NO |
| Additional stream information/supplementary measurements included (Y/N) | NO |
| NC SAM feature type (perennial, intermittent, Tidal Marsh Stream) | Perennial |

| Function Class Rating Summary | USACE/ All Streams | NCDWR Intermittent |
|---|---|---|
| (1) Hydrology | **LOW** | |
| (2) Baseflow | **MEDIUM** | |
| (2) Flood Flow | **LOW** | |
| (3) Streamside Area Attenuation | **LOW** | |
| (4) Floodplain Access | **LOW** | |
| (4) Wooded Riparian Buffer | **LOW** | |
| (4) Microtopography | **LOW** | |
| (3) Stream Stability | **LOW** | |
| (4) Channel Stability | **MEDIUM** | |
| (4) Sediment Transport | **LOW** | |
| (4) Stream Geomorphology | **LOW** | |
| (2) Stream/Intertidal Zone Interaction | NA | |
| (2) Longitudinal Tidal Flow | NA | |
| (2) Tidal Marsh Stream Stability | NA | |
| (3) Tidal Marsh Channel Stability | NA | |
| (3) Tidal Marsh Stream Geomorphology | NA | |
| (1) Water Quality | **LOW** | |
| (2) Baseflow | **MEDIUM** | |
| (2) Streamside Area Vegetation | **LOW** | |
| (3) Upland Pollutant Filtration | **LOW** | |
| (3) Thermoregulation | **LOW** | |
| (2) Indicators of Stressors | **YES** | |
| (2) Aquatic Life Tolerance | **HIGH** | |
| (2) Intertidal Zone Filtration | NA | |
| (1) Habitat | **LOW** | |
| (2) In-stream Habitat | **LOW** | |
| (3) Baseflow | **MEDIUM** | |
| (3) Substrate | **LOW** | |
| (3) Stream Stability | **MEDIUM** | |
| (3) In-stream Habitat | **LOW** | |
| (2) Stream-side Habitat | **LOW** | |
| (3) Stream-side Habitat | **LOW** | |
| (3) Thermoregulation | **LOW** | |
| (2) Tidal Marsh In-stream Habitat | NA | |
| (3) Flow Restriction | NA | |
| (3) Tidal Marsh Stream Stability | NA | |
| (4) Tidal Marsh Channel Stability | NA | |
| (4) Tidal Marsh Stream Geomorphology | NA | |
| (3) Tidal Marsh In-stream Habitat | NA | |
| (2) Intertidal Zone Habitat | NA | |
| Overall | **LOW** | |

# Appendix D: 60% Design Plans

5/14/99

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

# MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE

## CASWELL COUNTY, NORTH CAROLINA

DEVELOPMENT REFERENCE

| | |
|---|---|
| OWNER/DEVELOPER | ECO TERRA PARTNERS, LLC |
| APPLICANT: | MICHAEL BEINENSON<br>117 CENTREWEST COURT<br>CARY, NC 27513<br>(404) 913–0020 |
| CIVIL ENGINEER: | REID B. ROBOL, PE<br>VHB ENGINEERING NC, P.C.<br>940 MAIN CAMPUS DR. SUITE 500<br>RALEIGH, NC 27606<br>(919) 754–5005 |
| SURVEYS: | BRAD KEE<br>KEE MAPPING & SURVEYING<br>88 CENTRAL AVENUE<br>ASHEVILLE, NC 28802<br>(828) 575–9021 |
| NCDMS: | JEREMIAH DOW<br>1652 MAIL SERVICE CENTER<br>RALEIGH, NC 27699<br>(919) 791–4248 |

| | |
|---|---|
| NCDMS CONTRACT: | 200204–01 |
| NCDMS PROJECT NUMBER: | 100192 |

24 HOUR CONTACT:

LANE SAULS
VHB ENGINEERING NC, P.C.
PHONE: (919) 210–4834

PROJECT PROPOSED LENGTHS

RESTORATION:
UT 1: 1,357 LF
UT 2: 910 LF
UT 3: 713 LF

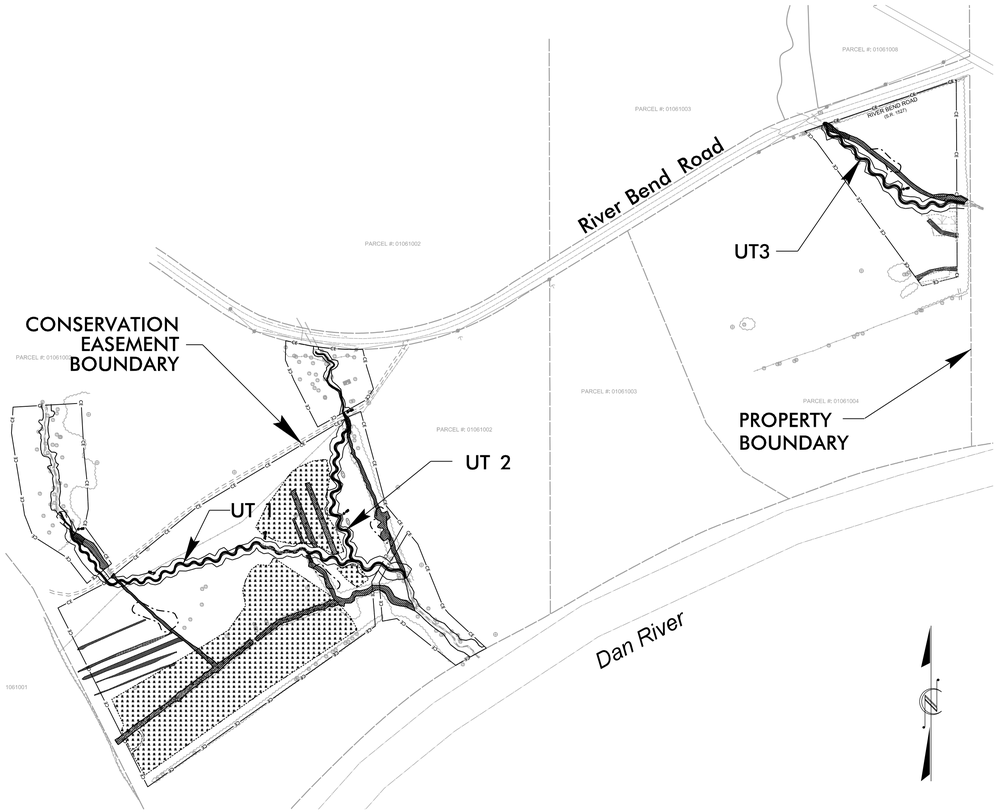
TOTAL RESTORATION: 2,980 LF

ENHANCEMENT/PRESERVATION:

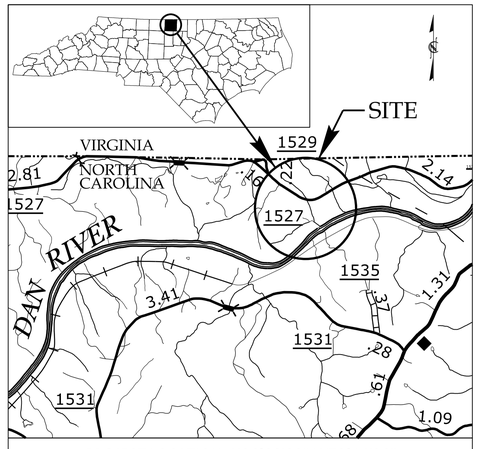
UT 1: 435 LF (PRES)
UT 1: 81 LF (ENHA I)
UT 2 307 (PRES)
UT 2 412 (ENHA II)

TOTAL ENHANCEMENT I: 81 LF
TOTAL ENCHANCEMENT II: 412 LF
TOTAL PRESERVATION: 742 LF

TOTAL DISTURBED AREA: 33 ACRES




VICINITY MAP




PROJECT LOCATION: N36°32'08" W79°14'26"

INDEX OF SHEETS



# 60% PLANS
# NOT FOR CONSTRUCTION

40 20 0 40 80

811 Know what's below. Call before you dig.

**IMPORTANT**
CONSTRUCTION CANNOT BEGIN UNTIL UTILITIES ARE PROTECTED.
CALL BEFORE YOU DIG. 1.800.632.4949

TITLE SHEET
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | PSH-01.1 |
|---|---|---|
| DATE | PROJECT NO. | SHEET |


VHB Engineering NC, P.C. (C-3705)
940 Main Campus Drive, Suite 500
Raleigh, NC 27606


1/11/2023
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USER:Reid.Robol

5/14/99

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# LEGEND

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- 5/8" REBAR/CAP "CONTROL POINT"
- BENCHMARK
- UTILITY POLE
- UTILITY POLE GUY ANCHOR
- GROUNDWATER GAUGE
- DECIDUOUS TREE
- ASPHALT
- DAN RIVER — JS
- SOIL ROAD
- EXISTING PROPERTY BOUNDARY
- LIMITS OF DISTURBANCE — LOD
- EXISTING STREAM BED
- EXISTING TOP OF BANK — TB
- OVERHEAD WIRE
- FENCE LINE
- SPECIAL FLOOD HAZARD AREA — 100YR FP
- PROPOSED WETLAND BOUNDARY — WLB
- GUARD RAIL
- TREE LINE
- REBAR WITH ID CAP SET IN CONCRETE — RBCC
- NORTH AMERICAN DATUM 1983 — NAD
- NORTH AMERICAN VERTICAL DATUM — NAVD
- INVERT — INV
- ELEVATION — ELEV
- CORRUGATED PLASTIC PIPE — CPP
- CORRUGATED METAL PIPE — CMP
- REINFORCED CONCRETE PIPE — RCP
- PROPOSED GRADING LIMITS
- MAJOR CONTOURS — 365
- MINOR CONTOURS
- PROPOSED CONSERVATION EASEMENT — CE
- EXISTING DITCH FILL
- STREAM PLUG
- BANKFULL
- PROPOSED THALWEG
- PROPOSED VERTICAL BANKFULL ELEVATION
- PROPOSED VERTICAL PROFILE GRADE
- EXISTING VERTICAL PROFILE GROUND

## *PROPOSED STREAM WORK:*

- ROCK CROSSVANE
- CONSTRUCTED RIFFLE
- LOG VANE
- FORD CROSSING
- DOUBLE DROP ROCK CROSSVANE
- BRUSH TOE STABILIZATION
- ROCK J–HOOK
- FLOODPLAIN DEPRESSION
- BANK SCOUR HOLE STABILIZATION
- COIR LOG

## *EROSION CONTROL FEATURES:*

- TEMPORARY CONSTRUCTION ENTRANCE/EXIT
- SEDIMENT BARRIER/SILT FENCE
- TEMPORARY BRIDGE MAT
- STRAW WATTLE — EW

## *PLANTING ZONES:*

- RIPARIAN WET
- UPLANDS
- STREAMSIDE

## *WETLAND AREAS:*

- EXISTING WETLAND
- PROPOSED WETLAND

LEGEND SHEET
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
PREPARED FOR
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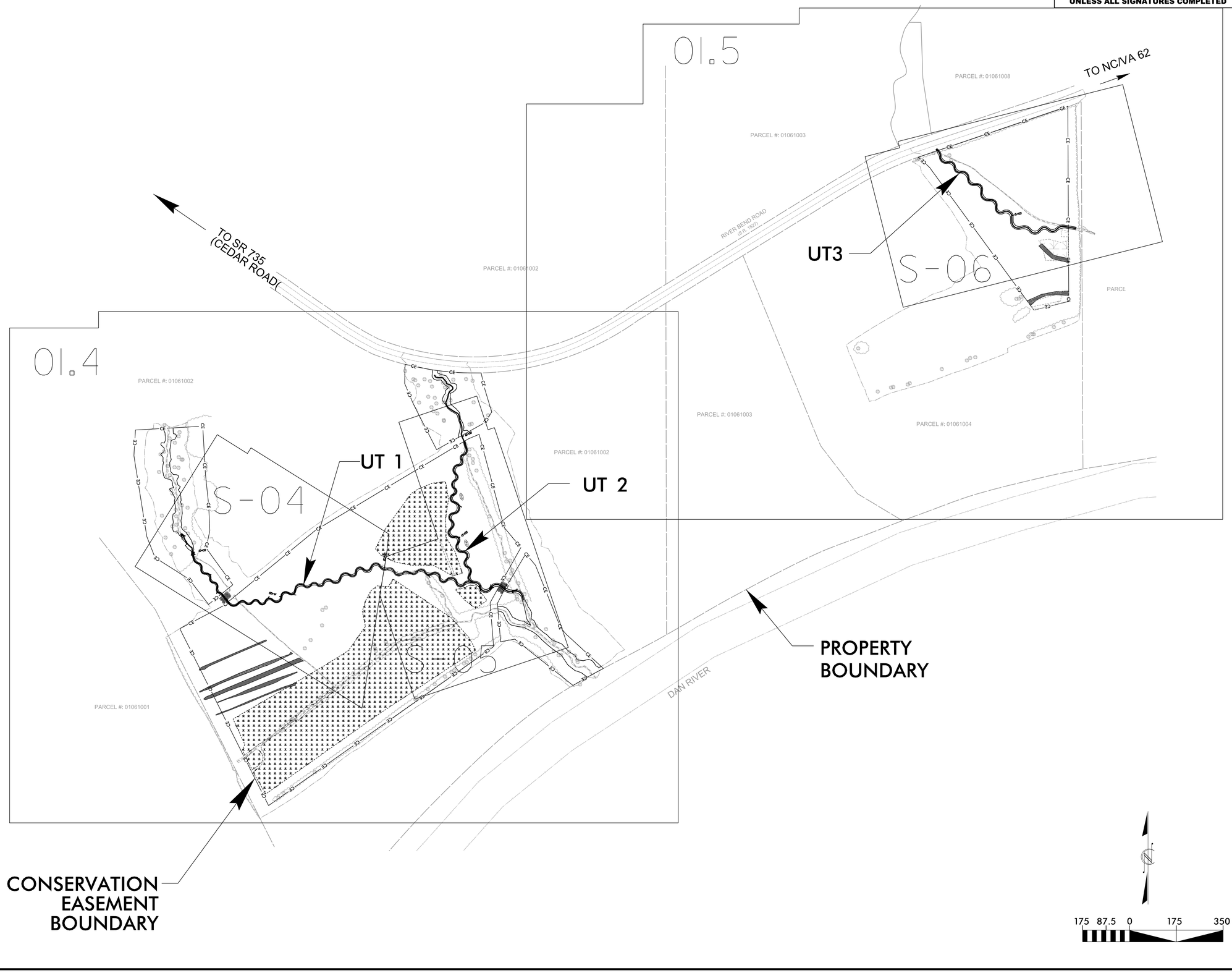


# LAYOUT SHEET
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
PREPARED FOR
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USER: Brad Pruitt

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100 50 0 100 200

PARCEL #: 01061002

CONTROL POINT #351
RBCC "KEE"
GROUND COORDINATES
N: 1013940.54'
E: 1927533.87'
ELEV: 437.97'

CONTROL POINT #350
RBCC "KEE"
GROUND COORDINATES
N: 1013762.34'
E: 1927565.14'
ELEV: 430.30'

CONTROL POINT #300
RBCC "KEE"
GROUND COORDINATES
N: 1013727.11'
E: 1928072.62'
ELEV: 386.88'

CONTROL POINT #501
RBCC "KEE"
GROUND COORDINATES
N: 1013443.66'
E: 1927751.15'
ELEV: 380.11'

CONTROL POINT #301
RBCC "KEE"
GROUND COORDINATES
N: 1013983.69'
E: 1928569.84'
ELEV: 373.00'

PARCEL #: 01061002

CONTROL POINT #302
RBCC "KEE"
GROUND COORDINATES
N: 1013671.54'
E: 1928677.24'
ELEV: 365.25'

UT 1

UT 2

CONTROL POINT #303
RBCC "KEE"
GROUND COORDINATES
N: 1013384.24'
E: 1928764.46'
ELEV: 364.40'

CONTROL POINT #370
RBCC "KEE"
GROUND COORDINATES
N: 1013127.47'
E: 1929037.97'
ELEV: 369.88'

CONTROL POINT #304
RBCC "KEE"
GROUND COORDINATES
N: 1013300.43'
E: 1928343.11'
ELEV: 362.73'

CONTROL POINT #305
RBCC "KEE"
GROUND COORDINATES
N: 1013121.72'
E: 1928045.71'
ELEV: 363.58'

PARCEL #: 01061001

CONTROL POINT #500
RBCC "KEE"
GROUND COORDINATES
N: 1012931.06'
E: 1927705.14'
ELEV: 364.37'

# CONSERVATION EASEMENT PLANSHEET 1 OF 2

CONSERVATION EASEMENT
FOR THE
MUSHROOM MEADOW STREAM AND
WETLAND MITIGATION SITE
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | PSH-01.4 |
|---|---|---|
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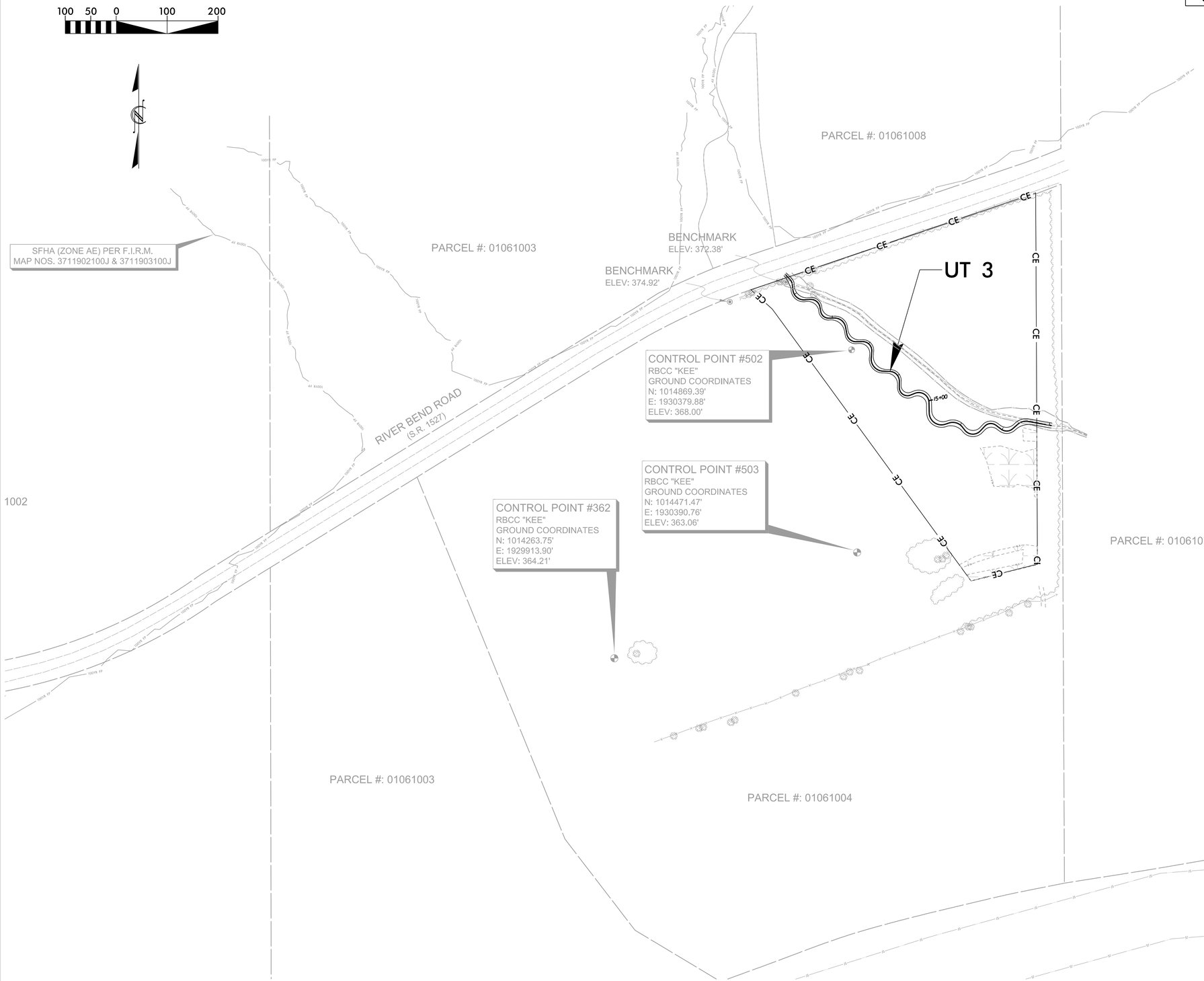


# CONSERVATION EASEMENT PLANSHEET 2 OF 2

CONSERVATION EASEMENT
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | PSH-01.5 |
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940 Main Campus Drive, Suite 500
Raleigh, NC 27606


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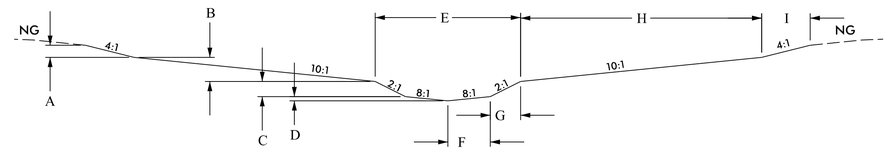
USER:gmiller

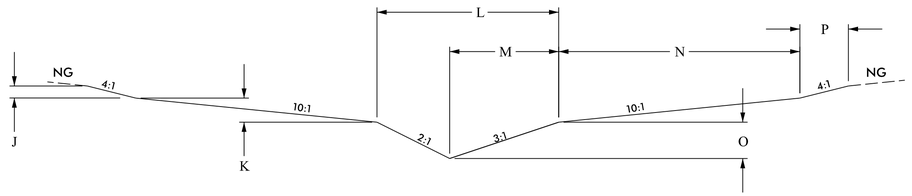
# TYPICAL SECTIONS

NOT TO SCALE

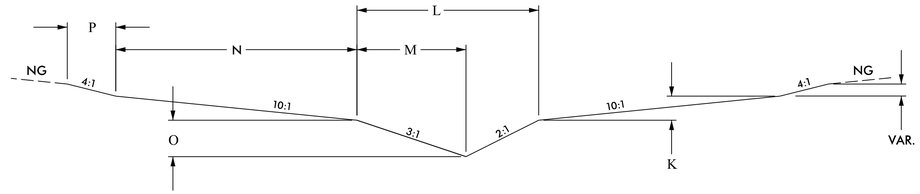
## RIFFLE




## POOL LEFT




## POOL RIGHT




| STREAM | REACH | STATION RANGE | DIMENSION | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
| UT 1 | 2A* | 9+14 to 9+95 | VAR. | 0.5' | +/- 0.8' | VAR. | +/- 6.0' | VAR. | VAR. | 0.0' - 5.0' | VAR. | VAR. | 0.5' | VAR. | VAR. | 0.0' - 5.0' | VAR. | VAR. |
| | 2 | 9+95 to 15+80 | VAR. | 1.0' | 0.6' | 0.2' | 6.0' | 1.9' | 1.1' | 10.0' | VAR. | VAR. | 2.0' | 7.5' | 4.5' | 10.0' | 1.5' | VAR. |
| | 3 | 15+80 to 24+02 | VAR. | 1.0' | 0.75' | 0.25' | 7.0' | 2.0' | 1.5' | 10.0' | VAR. | VAR. | 1.0' | 10.0' | 6.0' | 10.0' | 2.0' | VAR. |
| UT 2 | 2 | 10+00 to 17+14.9 | VAR. | 1.0' | 0.75' | 0.25' | 7.0' | 2.0' | 1.5 | 10.0' | VAR. | VAR. | 1.0' | 10.0' | 6.0' | 10.0' | 2.0' | VAR. |
| | 3 | 17+14.9 to 19+60.9 | VAR. | 2.0' | 0.9' | 0.3' | 9.0' | 2.7' | 1.8' | 20.0' | VAR. | VAR. | 2.0' | 12.0' | 7.2' | 20.0' | 2.4' | VAR. |
| UT 3 | 1 | 10+54.8 to 14+52.4 | VAR. | 1.0' | 0.6' | 0.4' | 7.0' | 2.3' | 1.3' | 10.0' | VAR. | VAR. | 1.0' | 10.0' | 6.0' | 10.0' | 2.0' | VAR. |
| | 2 | 14+52.4 to 18+05 | VAR. | 1.0' | 0.8' | 0.4' | 10.0' | 3.5' | 1.5' | 10.0' | VAR. | VAR. | 1.0' | 12.0' | 7.2' | 10.0' | 2.4' | VAR. |

*NOTE: UT1 REACH 2A IS ENCHANCEMENT I. EXISTING CHANNEL GENERALLY REMAINS UNCHANGED. BENCHING TO OCCUR FROM TOP OF BANK TO NG, AS SPECIFIED.

TYPICAL SECTIONS
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
PREPARED FOR
ECO TERRA PARTNERS, LLC

01/11/2023 DATE
39077.34 PROJECT NO.
PSH-02.1 SHEET

VHB Engineering NC, P.C. (C-3705)
940 Main Campus Drive, Suite 500
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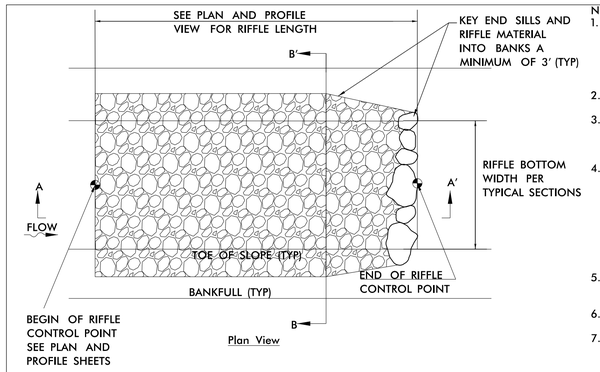
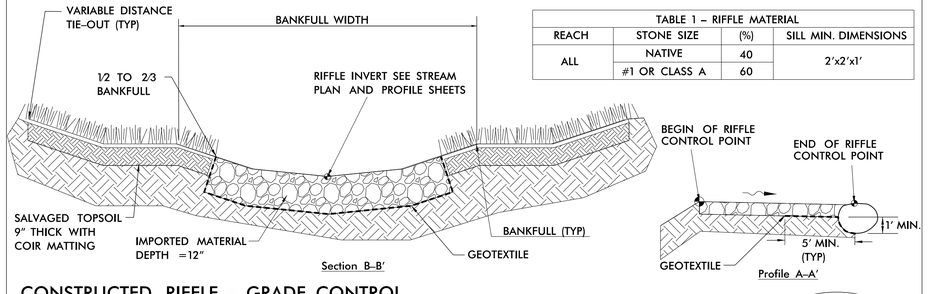


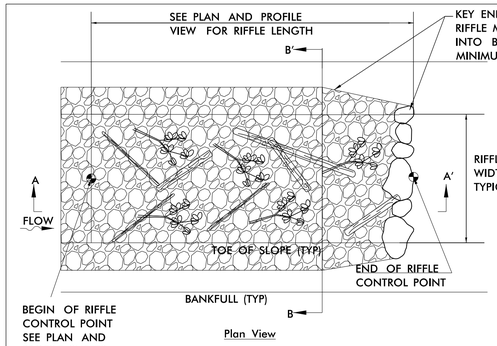

NOTES:
1. CONTROL POINTS SHALL BE DESIGNATED AT BEGIN AND END OF RIFFLE SECTIONS TO ESTABLISH PROFILE OF THE CHANNEL. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE RIFFLE INSTALLATION WITHIN A TOLERANCE OF +/- 0.2'.
2. RIFFLE MATERAL SHALL BE COMPRISED OF MATERIAL PER TABLE 1.
3. IF NATIVE MATERIAL IS CALLED FOR, IT SHALL BE EXCAVATED, STOCKPILED, AND REUSED FROM ABANDONDED CHANNEL SECTIONS PER RIFFLE MATERIAL TABLE
4. RIFFLE MATERIAL SHALL BE KEYED IN TO THE STREAM BANKS AND BED. RIFFLE MATERIAL SHALL CREATE A SMOOTH PROFILE AND SHALL NOT CREATE ABRUPT TRANSITIONS BETWEEN UPSTREAM POOL AND GLIDES OR DOWNSTREAM RUN AND POOLS. THE CONSTRUCTED CROSS SECTION OF THE RIFFLE MATERIAL SHALL GENERALLY MATCH THE GEOMETRY AND DIMENSIONS SHOWN ON THE RIFFLE TYPICAL SECTION.
5. COIR MATTING ANCHORED WITH U SHAPED WIRE STAPLES (11 GAUGE MIN. 6IN TO 12IN LONG) TO ANCHOR MATTING TO GROUND
6. KEY END SILLS A MINIMUM OF 3.0' INTO BANKS AND 1.0' INTO BED (DEPTH).
7. THE END OF RIFFLE CONTROL POINT MAY TIE IN TO ANOTHER IN-STREAM STRUCTURE (J-HOOK, CROSS VANE, ETC.)

| TABLE 1 – RIFFLE MATERIAL | | | |
|---|---|---|---|
| REACH | STONE SIZE | (%) | SILL MIN. DIMENSIONS |
| ALL | NATIVE | 40 | 2'x2'x1' |
| | #1 OR CLASS A | 60 | |



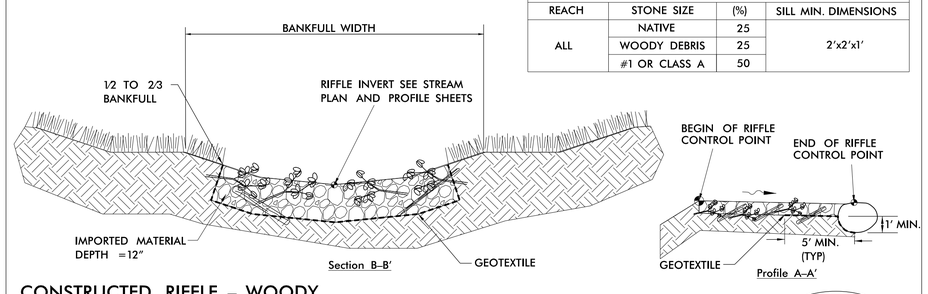

## CONSTRUCTED RIFFLE – GRADE CONTROL

CR–GC



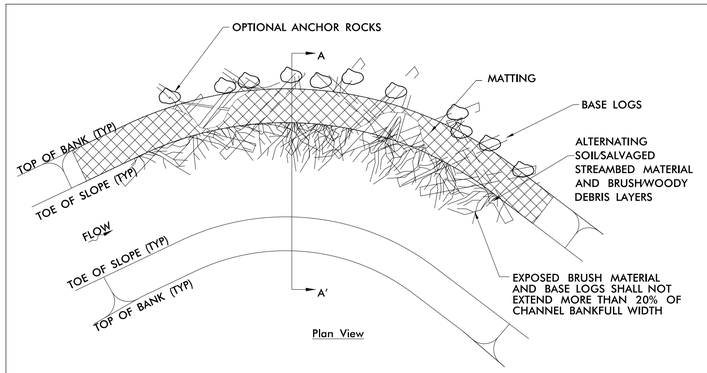

NOTES:
1. CONTROL POINTS SHALL BE DESIGNATED AT BEGIN AND END OF RIFFLE SECTIONS TO ESTABLISH PROFILE OF THE CHANNEL. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE RIFFLE INSTALLATION WITHIN A TOLERANCE OF +/- 0.2'.
2. RIFFLE MATERAL SHALL BE COMPRISED OF MATERIAL PER TABLE 2. WOODY MATERIAL SHALL CONSIST OF LOGS, BRANCHES, AND BRUSH NO GREATER THAN 4" IN DIAMETER.
3. IF NATIVE MATERIAL IS CALLED FOR, IT SHALL BE EXCAVATED, STOCKPILED, AND REUSED FROM ABANDONDED CHANNEL SECTIONS PER RIFFLE MATERIAL TABLE
4. RIFFLE MATERIAL SHALL BE KEYED IN TO THE STREAM BANKS AND BED. RIFFLE MATERIAL SHALL CREATE A SMOOTH PROFILE AND SHALL NOT CREATE ABRUPT TRANSITIONS BETWEEN UPSTREAM POOL AND GLIDES OR DOWNSTREAM RUN AND POOLS. THE CONSTRUCTED CROSS SECTION OF THE RIFFLE MATERIAL SHALL GENERALLY MATCH THE GEOMETRY AND DIMENSIONS SHOWN ON THE RIFFLE TYPICAL SECTION.
5. KEY END SILLS A MINIMUM OF 3.0' INTO BANKS AND 1.0' INTO BED (DEPTH).
6. THE END OF RIFFLE CONTROL POINT MAY TIE IN TO ANOTHER IN-STREAM STRUCTURE (J-HOOK, CROSS VANE, ETC.)

| TABLE 2 – RIFFLE MATERIAL | | | |
|---|---|---|---|
| REACH | STONE SIZE | (%) | SILL MIN. DIMENSIONS |
| ALL | NATIVE | 25 | 2'x2'x1' |
| | WOODY DEBRIS | 25 | |
| | #1 OR CLASS A | 50 | |

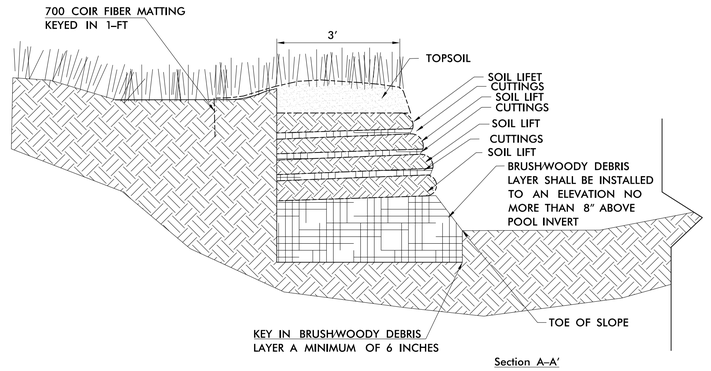



## CONSTRUCTED RIFFLE – WOODY

CR–W




1. OVEREXCAVATE 3' OUTSIDE OF TOP OF BANK(BANKFULL).
2. INSTALL A DENSE LAYER OF BRUSH/WOODY DEBRIS, WHICH SHALL CONSIST OF SMALL LOGS, LIMBS, TREE TOPS AND BRUSH COLLECTED ON-SITE LIGHLY COMPACT BRUSH/WOODY DEBRIS LAYER. THIS LAYER SHALL BE INSTALLED TO AN ELEVATION NO MORE THAN 8" ABOVE THE POOL INVERT AND A MINIMUM OF 6 INCHES THICK.
3. TOP BRUSH/WOODY DEBRIS LAYER WITH 700 COIR FIBER MATTING AND 8-12 INCHES OF SOIL. TAMP SOIL MATERIAL AND WRAP WITH MATTING TO DEVELOP SOIL LIFT. AVOID HEAVY COMPACTION TO PREVENT DAMAGE TO THE BRUSH/WOODY DEBRIS. FINISHED SOIL LIFT SHALL BE A MINIMUM OF 6 INCHES THICK. USE 2' WOODEN STAKES OR U SHAPED WIRE TO ANCHOR MATTING.
4. INSTALL A LAYER OF LIVE CUTTINGS WHICH CONSISTS OF FACINES BUNDLES/LIVE CUTTINGS THAT INCLUDE EASY TO ROOT SPECIES SUCH AS WILLOW, DOGWOOD, AND POPLAR BRUSHY/WOODY DEBRIS.
5. INSTALL ALTERNATING SOIL LIFTS AND LIVE CUTTING LAYER TO AN ELEVATION 6 INCHES ABOVE DOWNSTREAM RIFFLE INVERT ELEVATION. THE NUMBER OF LIFTS WILL VARY BASED ON SITE CONDITIONS.
6. INSTALL SOIL LIFTS A MINIMUM OF 6" THICK AFTER COMPACTION TO WITHIN 8" OF BANKFULL ELEVATION.
7. INSTALL 700 COIR FIBER MATTING OVER THE FINAL SOIL LIFT WITH AN AMPLE AMOUNT OF MATTING OVERHANING TO WRAP OVER THE TOPSOIL LAYER ONCE IT IS PLACED.
8. INSTALL TOPSOIL OVER FINAL SOIL LIFT LAYER TO ACHIEVE FINISHED GRADE.
9. PREPARE SEEDBED, APPLY SEED, AND WRAP COIR FIBER MATTING OVER THE FINISHED TOPSOIL AND KEY INTO EXISTING BANK




## BRUSH TOE STABILIZATION

BTS

IN-STREAM DETAILS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

01/11/2023 DATE
39077.34 PROJECT NO.
PSH-02.2.1 SHEET

ecoterra®

VHB Engineering NC, P.C. (C-3705)
940 Main Campus Drive, Suite 500
Raleigh, NC 27606

5/14/99

1/11/2023
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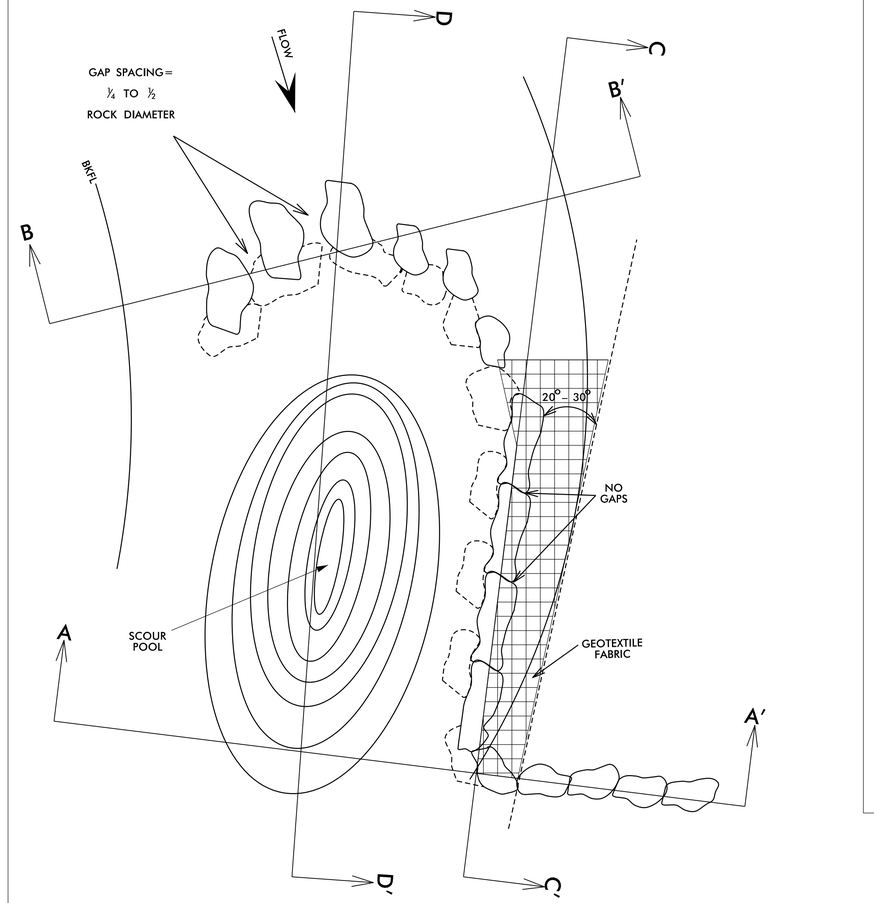
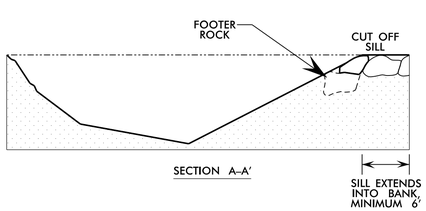
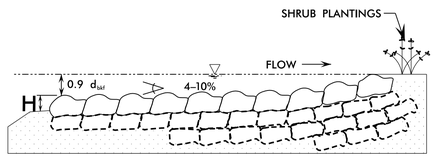
USER: rdavis




SECTION A–A'

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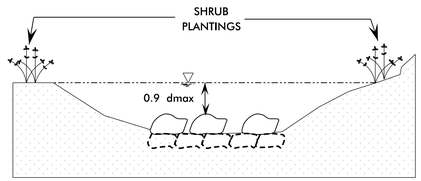
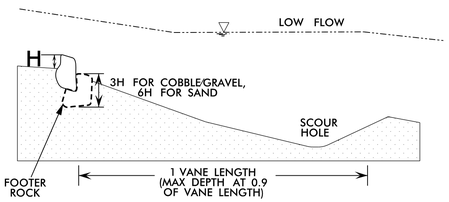



SECTION B–B'

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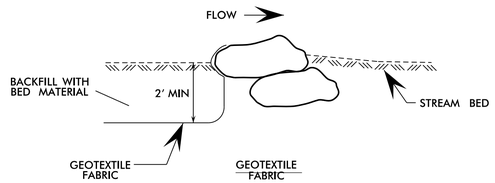
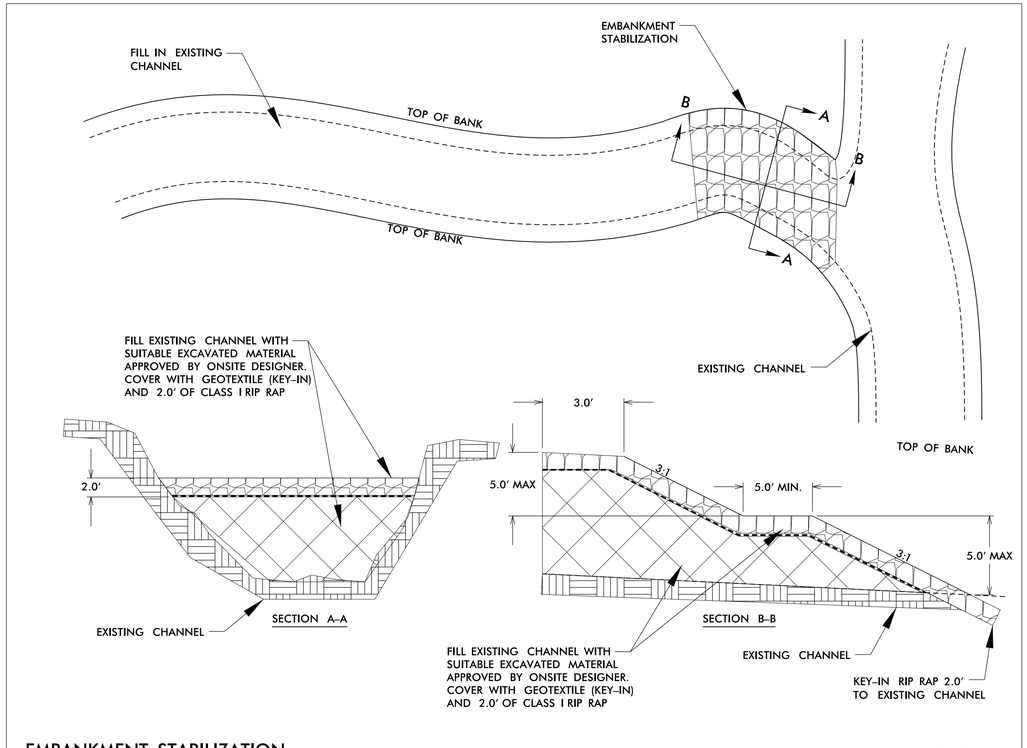



NOTES:

1. BOULDERS SHOULD BE NATIVE QUARRIED ROCK OR LOCALLY SHOT ROCK, ANGULAR AND OBLONG WITH THE FOLLOWING DIMENSION: 3'x2'x1' (APPROX. 1200 LB)
2. ROCKS SHOULD FIT TIGHTLY WITH MINIMAL SPACES.
3. FOOTER ROCKS SHOULD BE A MINIMUM OF 6 TIMES 'H' IN SAND BED STREAMS.
4. GEOTEXTILE FABRIC SHOULD BE PLACED ON UPSTREAM SIDE OF BOULDERS. FABRIC SHOULD BE OVERLAIN ON EXPOSED BOULDERS AND BURIED TO A MINIMUM DEPTH OF 2 FT. OR AS DIRECTED BY ON SITE DESIGNER. FABRIC SHOULD EXTEND UPSTREAM A MINIMUM LENGTH OF OF 6 FT. OR AS DIRECTED BY ON SITE DESIGNER. FABRIC SHOULD BE BACKFILLED WITH 3" STONE.
5. H = MIN. OF 0.5'
6. ARMS OF STRUCTURE MAY BE REPLACED WITH LOG AT CONTRACTOR'S DISCRETION WITH APPROVAL FROM ENGINEER.
7. SILL SHOULD EXTEND INTO THE STREAMBANK A MINIMUM OF 6 FT.

## ROCK J–HOOK

R–J




## EMBANKMENT STABILIZATION

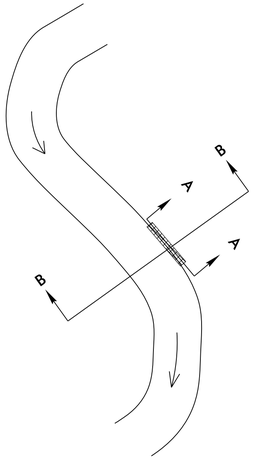
ES

IN-STREAM DETAILS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

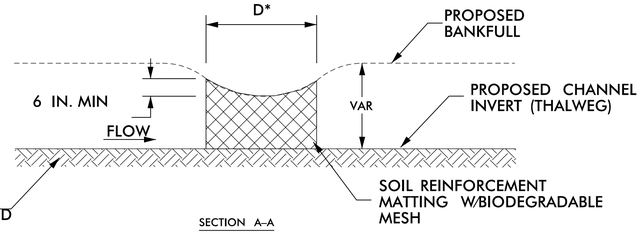
| 01/11/2023 | 39077.34 | PSH-02.2.2 |
|---|---|---|
| DATE | PROJECT NO. | SHEET |

VHB Engineering NC, P.C. (C-3705)
940 Main Campus Drive, Suite 500
Raleigh, NC 27606

5/14/99

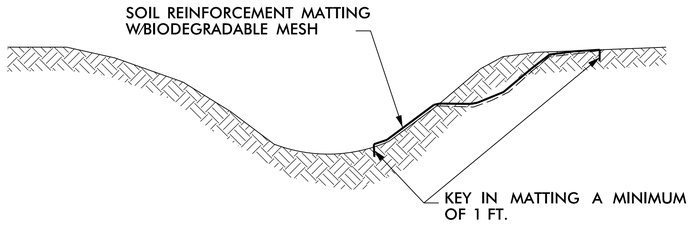



PLAN VIEW




SECTION A–A

| D* | | | |
|---|---|---|---|
| STREAM | STATION | MIN | MAX |
| UT1 | 21+50 | 3.0′ | 7.0′ |



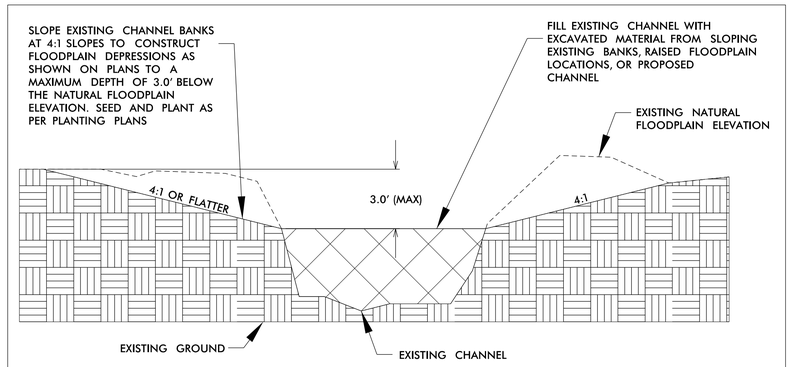

SECTION B–B

## FLOODPLAIN INTERCEPTOR — FI

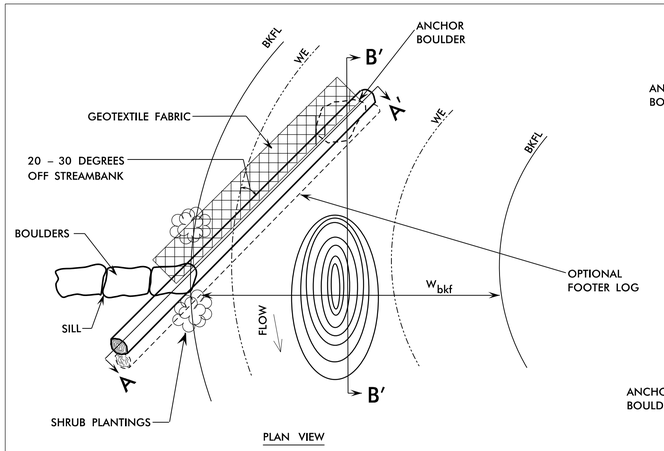
1. CONTRACTOR WILL PROVIDE FABRIC TO MEET OR EXCEED THE FOLLOWING SPECIFICATIONS.
2. THE BELOW SPECIFICATIONS ARE CONSISTENT WITH A POLYPROPYLENE NONWOVEN NEEDLE-PUNCHED FABRIC.
3. ENGINEER RECOMMENDS GRAY OR BLACK-COLORED FABRIC FOR USE WITH VANE STRUCTURES.

| PHYSICAL SPECIFICATION (ROLL) | |
|---|---|
| PROPERTY | MIN. AVERAGE ROLL VALUE |
| GRAB TENSILE | 160 LBS. |
| GRAB ELONGATION | 50% |
| MULLEN BURST | 315 PSI |
| PUNCTURE | 90 LBS. |
| TRAPEZOIDAL TEAR | 65 LBS. |
| UV RESISTANCE | 70% AT 500 HRS |
| AOS | 70 SIEVE |
| PERMITTIVITY | 1.5 $SEC.^{-1}$ |
| FLOW RATE | 110 $GAL./MIN./FT.^2$ |

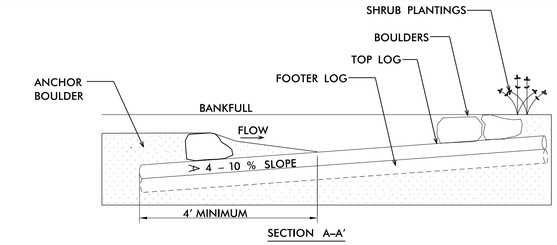
## GEOTEXTILE FABRIC



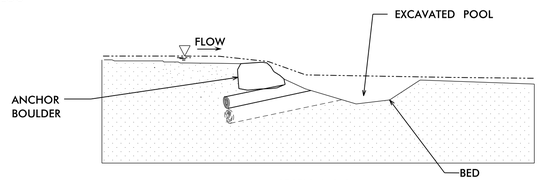

## FLOODPLAIN DEPRESSION — FD



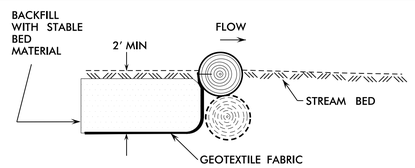

PLAN VIEW




SECTION A–A′




SECTION B–B′




GEOTEXTILE FABRIC

NOTES:

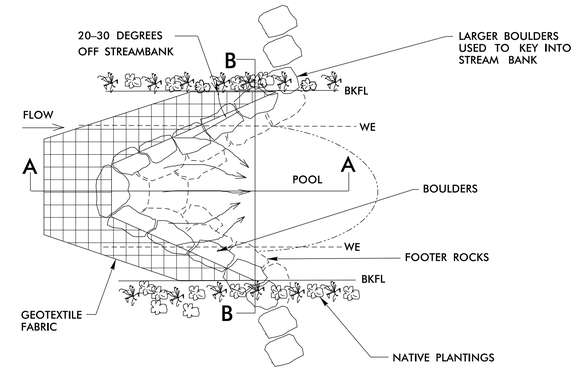
1. LOGS SHOULD BE FROM NATIVE TREES WITH DIAMETER NO LESS THAN 12 INCHES. MINIMUM LENGTH IS 8 FEET.
2. BOULDERS SHOULD BE NATIVE QUARRIED ROCK OR LOCALLY SHOT ROCK, ANGULAR AND OBLONG WITH THE FOLLOWING DIMENSION: AVERAGE SIZE IS 3′ x 2′ x 1′ (APPROX. 1200 LBS.)
3. IF OPTIONAL FOOTER LOG IS USED, IT SHOULD FIT TIGHTLY AGAINST TOP LOG WITH MINIMAL SPACES/VOIDS.
4. AN OPTIONAL BOULDER MAY BE USED TO SECURE END OF LOG BELOW CHANNEL OR STREAMBANK. THE ON SITE DESIGNER WILL MAKE FINAL DETERMINATION.
5. GEOTEXTILE FABRIC SHOULD BE PLACED ON UPSTREAM SIDE OF LOG. FABRIC SHOULD BE SECURED TO LOG VIA MINIMUM 1–1/2″ LONG ROOFING NAILS WITH PLASTIC WASHERS, NO GREATER THAN 16″ APART. FABRIC IS TO BE SECURED IN A MANNER WHEREBY IT IS NOT VISIBLE ONCE THE STRUCTURE IS COMPLETE. FABRIC SHALL BE BURIED TO A MINIMUM DEPTH OF 2 FEET OR AS DIRECTED BY ON SITE DESIGNER. FABRIC SHOULD EXTEND A MINIMUM LENGTH OF 6 FEET OR AS DIRECTED BY ON SITE DESIGNER. FABRIC SHALL BE BACKFILLED WITH 3″ STONE OR SUITABLE MATERIAL AS DETERMINED BY ON SITE DESIGNER.

## LOG VANE — LV

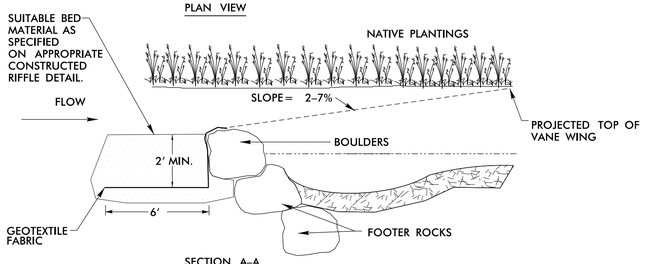
# IN-STREAM DETAILS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

01/11/2023 DATE
39077.34 PROJECT NO.
PSH-02.2.3 SHEET

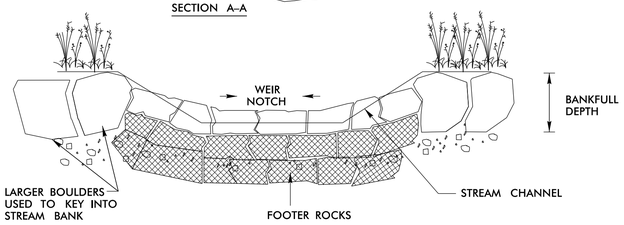
VHB Engineering NC, P.C. (C-3705)
940 Main Campus Drive, Suite 500
Raleigh, NC 27606




PLAN VIEW




SECTION A–A



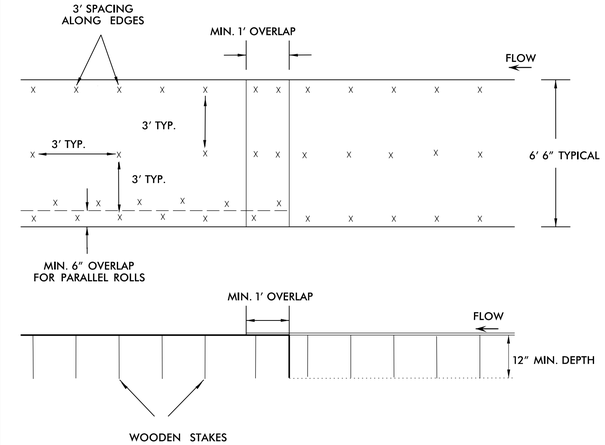

SECTION B–B

NOTES:

1. BOULDERS SHOULD BE NATIVE QUARRIED ROCK OR LOCALLY SHOT ROCK, ANGULAR AND OBLONG WITH THE FOLLOWING DIMENSION: AVERAGE SIZE IS 3'x2'x1' (APPROX. 1200 LB)
2. ROCKS SHOULD FIT TIGHTLY WITH MINIMAL SPACES/VOIDS.
3. GEOTEXTILE FABRIC SHOULD BE PLACED ON UPSTREAM SIDE OF BOULDERS. FABRIC SHOULD BE OVERLAIN ON EXPOSED BOULDERS AND BURIED TO A MINIMUM DEPTH OF 2 FT. OR AS DIRECTED BY ON SITE DESIGNER. FABRIC SHOULD EXTEND UPSTREAM A MINIMUM LENGTH OF OF 6 FT. OR AS DIRECTED BY ON SITE DESIGNER. FABRIC SHOULD BE BACKFILLED WITH SUITABLE MATERIAL SPECIFIED IN THE CONSTRUCTED RIFFLE DETAIL OR AS DETERMINED BY ON SITE DESIGNER.
4. ARMS OF STRUCTURE MAY BE REPLACED WITH BRUSH TOE OR LOG AT CONTRACTOR'S DISCRETION WITH APPROVAL FROM ENGINEER.

## ROCK CROSS VANE

RCV




STAKING PATTERN

NOTES:

1. INSTALL COIR BLANKET ACCORDING TO MANUFACTURER'S GUIDELINES.
2. PLACE PARALLEL ROLLS IN SHINGLE FASHION (UPPER ROLL LAPS OVER LOWER ROLL). LAP UPPERMOST ROLL AT LEAST 1/2 ROLL WIDTH BEYOND TOE OF TERRACE SLOPE (ABOVE BANKFULL BENCH).
3. UPPER ROLL SHALL BE KEYED IN ALONG TERRACE TO PREVENT UNDERMINING FROM SHEET FLOWS FROM SLOPE.
4. LOWER ROLL SHALL BE STAKED USING MIN. 24" WOODEN STAKES WITH SMALL GALVANIZED NAIL PLACED IN TOP END OF STAKE AND BENT OVER TO SECURE MATTING FIRMLY. STAKES OCCURING ALONG THE TOE AND THROUGHOUT THE MATTING SHALL BE MINIMUM OF 3' APART.

SPECIFICATIONS

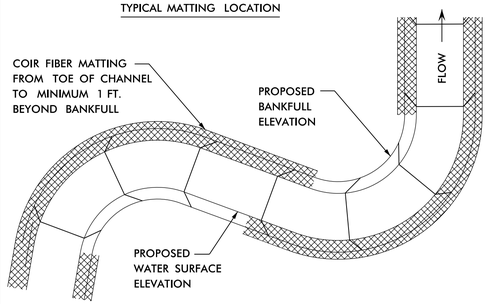
COIR FIBER 700 GRAM MATTING

1. CONTRACTOR WILL PROVIDE MATTING TO MEET OR EXCEED THE FOLLOWING SPECIFICATIONS.
2. STAKES:
   WOODEN STAKES NOT SHORTER THAN 12" SHALL BE USED TO SECURE COIR MATTING. 24" WOODEN STAKES SHALL BE USED ALONG THE TOE OF THE SLOPE.

PHYSICAL SPECIFICATION (ROLL)

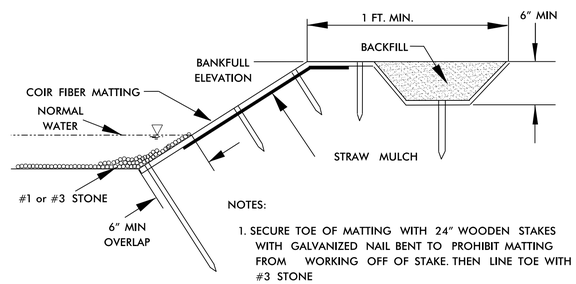
| | |
|---|---|
| MATRIX | COCONUT 700 GRAM BLANKET |
| COMPOSITION | 100% COCONUT FIBERS |
| WIDTH | MIN 6.5 FEET |
| LENGTH | MIN 165 FEET |
| TENSILE STRENGTH (1488 MD x 1032 CD) | WET – 55 LBS<br>DRY – 40 LBS |
| BLANKET LIFE (AVG. MONTHS) | 24–36 |
| ELONGATION (WET) | 35% x 38% |
| OPEN AREA | 48% |
| THICKNESS | 0.35 INCH |
| RECOMMENDED SLOPE | > 1:1 |
| RECOMMENDED FLOW | 12 FPS |
| RECOMMENDED SHEAR STRESS | 4.5 LBS/SQ. FT. |

TYPICAL MATTING LOCATION




NOTES:
COIR FIBER MATTING SHALL BE PLACED ALONG THE OUTSIDE BANK OF ALL BENDS AND ALONG BOTH SIDES OF THE CHANNEL IN TANGENT AREAS.

COIR MATTING CROSS SECTION




NOTES:

1. SECURE TOE OF MATTING WITH 24" WOODEN STAKES WITH GALVANIZED NAIL BENT TO PROHIBIT MATTING FROM WORKING OFF OF STAKE. THEN LINE TOE WITH #3 STONE
2. USE 12" WOODEN STAKES ON 5' CENTERS OR AS DIRECTED BY MANUFACTURER'S RECOMMENDATIONS.
3. MINIMUM 1' WIDE, 6" DEEP TRENCH OVER TOP OF BANK WITH MATTING LAID FLAT AND STAKED. TRENCH TO BE BACKFILLED WITH EXCAVATED MATERIAL.

## COIR FIBER MATTING

CF

# IN-STREAM DETAILS

FOR THE

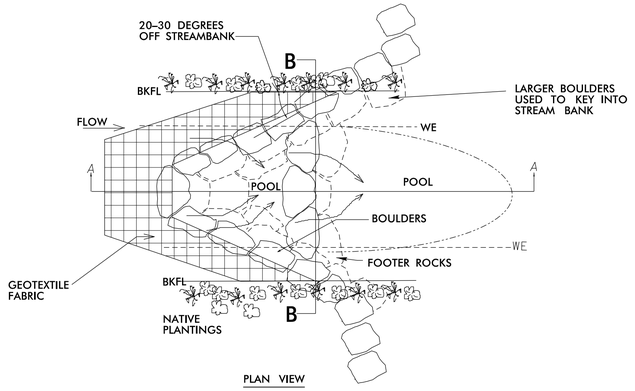
MUSHROOM MEADOW MITIGATION BANK

PREPARED FOR

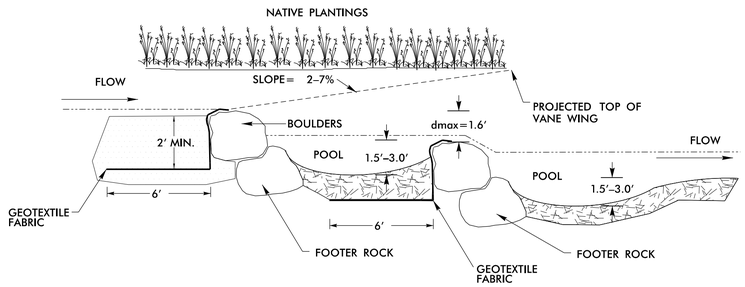
ECO TERRA PARTNERS, LLC

01/11/2023 DATE
39077.34 PROJECT NO.
PSH-02.2.4 SHEET

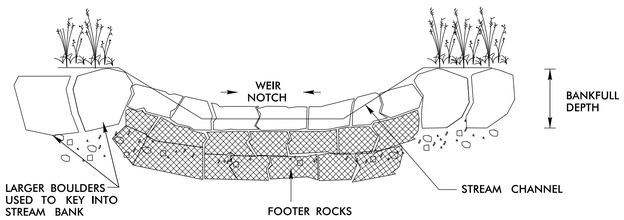
VHB Engineering NC, P.C. (C-3705)
940 Main Campus Drive, Suite 500
Raleigh, NC 27606




PLAN VIEW




SECTION A–A



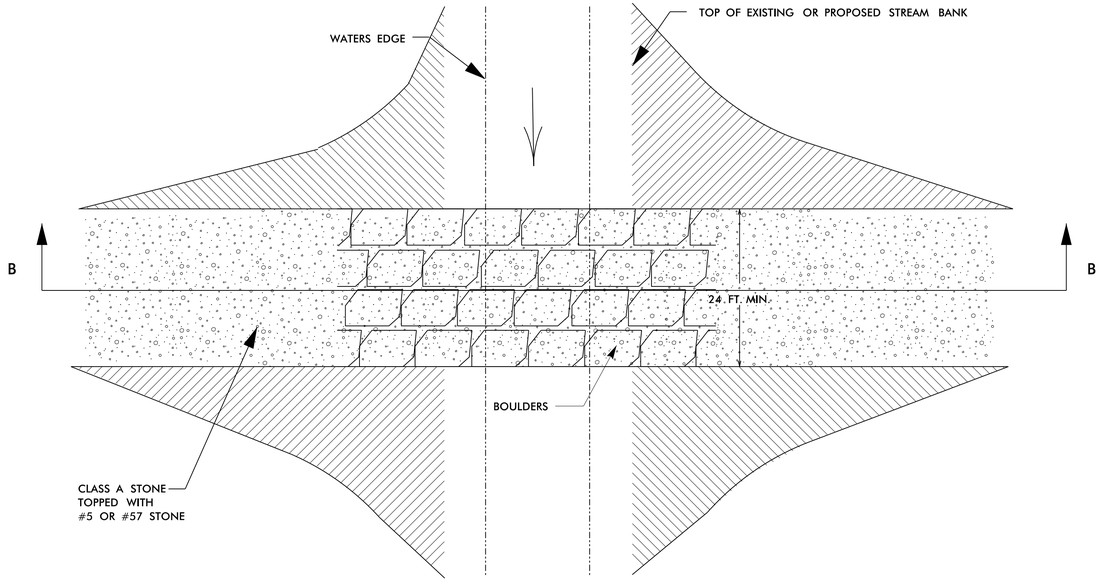

SECTION B–B

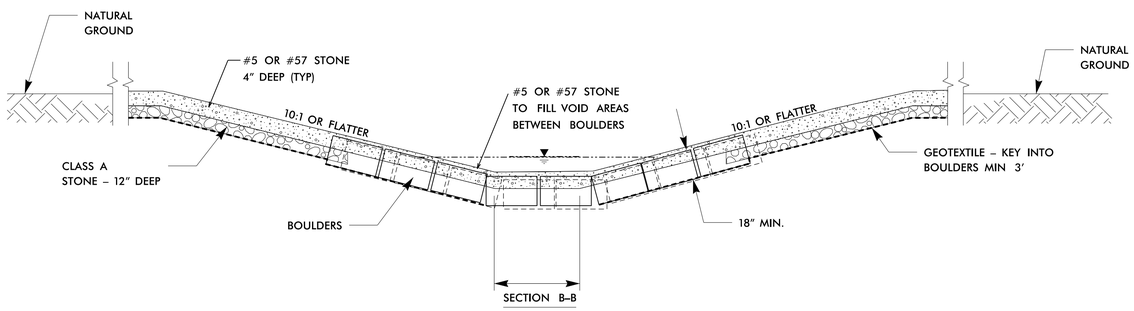
NOTES:

1. BOULDERS SHOULD BE NATIVE QUARRIED ROCK OR LOCALLY SHOT ROCK, ANGULAR AND OBLONG WITH THE FOLLOWING DIMENSION: AVERAGE SIZE IS 3'x2'x1' (APPROX. 1200 LB)
2. ROCKS SHOULD FIT TIGHTLY WITH MINIMAL SPACES/VOIDS.
3. GEOTEXTILE FABRIC SHOULD BE PLACED ON UPSTREAM SIDE OF BOULDERS. FABRIC SHOULD BE OVERLAIN ON EXPOSED BOULDERS AND BURIED TO A MINIMUM DEPTH OF 2 FT. OR AS DIRECTED BY ON SITE DESIGNER. FABRIC SHOULD EXTEND UPSTREAM A MINIMUM LENGTH OF OF 6 FT. OR AS DIRECTED BY ON SITE DESIGNER. FABRIC SHOULD BE BACKFILLED WITH SUITABLE MATERIAL SPECIFIED IN THE CONSTRUCTED RIFFLE DETAIL OR AS DETERMINED BY ON SITE DESIGNER.
4. ARMS OF STRUCTURE MAY BE REPLACED WITH BRUSH TOE OR LOG AT CONTRACTOR'S DISCRETION WITH APPROVAL FROM ENGINEER.

## DOUBLE DROP ROCK CROSS VANE

DDV



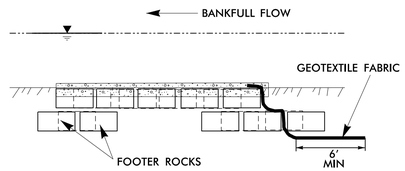




SECTION B–B

NOTES:

1. STONE APPROACH SECTION 10:1, SLOPE ON ROAD.
2. KEEP CLEARING AND EXCAVATION OF STREAM BANKS, BED, AND APPOACH SECTIONS TO A MINIMUM.
3. DIVERT ALL SURFACE RUNOFF FROM THE CONSTRUCTION SITE ONTO UNDISTURBED AREAS ADJOINING THE STREAM.
4. KEEP STREAM CROSSINGS AT RIGHT ANGLES TO THE STREAM FLOW.
5. ALIGN ROAD APPROACHES WITH THE CENTER LINE OF THE CROSSING FOR A MINIMUM DISTANCE OF 30 FEET.
6. STABILIZE ALL DISTURBED AREAS SUBJECT TO FLOWING WATER, INCLUDING PLANNED OVERFLOW AREAS.
7. SIDE SLOPES WHERE CROSSING CONNECTS TO EXISTING STREAMBANKS SHOULD BE A MAXIMUM OF 2:1.
8. INSPECT STREAM CROSSINGS AFTER RUNOFF-PRODUCING RAINS TO CHECK FOR BLOCKAGE IN CHANNEL, EROSION OF BANKS, CHANNEL SCOUR, STONE DISPLACEMENT, OR PIPING. MAKE ALL REPAIRS IMMEDIATELY TO PREVENT FURTHER DAMAGE TO THE INSTALLATION.

MATCH APPROACHING STREAM BASE WIDTH




PROFILE VIEW

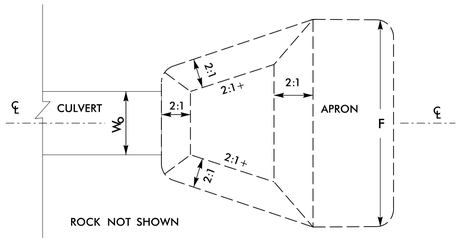
## PERMANENT AT GRADE STREAM CROSSING

AG

# IN-STREAM DETAILS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | PSH-02.2.5 |
|---|---|---|
| DATE | PROJECT NO. | SHEET |

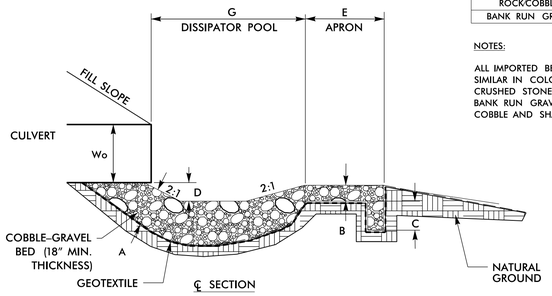
VHB Engineering NC, P.C. (C-3705)
940 Main Campus Drive, Suite 500
Raleigh, NC 27606




PLAN

| DIM. (ft) | BCHS # | |
|---|---|---|
| | 1 | 2 |
| A | 2.0′ | 2.0′ |
| B | 1.5′ | 2.0′ |
| C | 4.0′ | 4.0′ |
| D | 1.0′ | 1.0′ |
| E | 10.0′ | 10.0′ |
| F | 20.0′ | 25.0′ |
| G | 20.0′ | 26.0′ |

ALL DIMENSIONS APPROXIMATE




℄ SECTION

STREAMBED MATERIAL

THE COBBLE–GRAVEL BED MATERIAL SPECIFIED BELOW MUST BE APPROVED BY THE ENGINEER AT THE CONTRACTOR'S PROPOSED SOURCE PRIOR TO BEING PLACED IN THE BSHS CHANNEL.

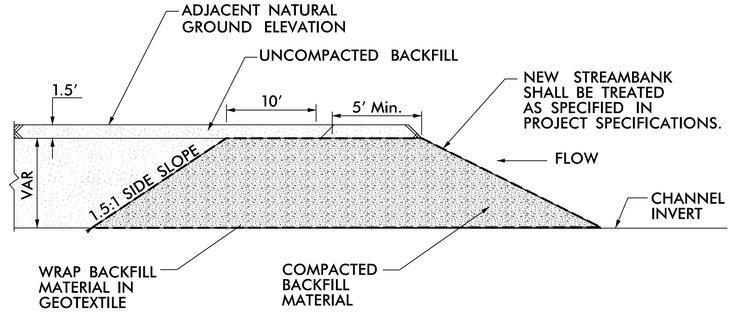
| DESCRIPTION | PARTICLE SIZE (inches) | BUCKETS | PERCENT |
|---|---|---|---|
| ROCK/COBBLE | CLASS I RIPRAP (12 – 18" DIA) | 3 | 55–65% |
| BANK RUN GRAVEL | 0.08 – 2.5" | 2 | 35–45% |

NOTES:

ALL IMPORTED BEDDING MATERIAL SHALL CONSIST OF FIELD STONE OR NATURAL RIVER ROCK SIMILAR IN COLOR AND APPEARANCE TO IN–SITU MATERIALS.
CRUSHED STONE SHALL NOT BE PERMITTED.
BANK RUN GRAVEL MAY INCLUDE UP TO 5% CLAY, SILT, AND/OR SAND, AND UP TO 25% COBBLE AND SHALL HAVE NATURAL COLOR (BROWN, TAN, YELLOW, OR WHITE)

## BANK & SCOUR HOLE STABILIZATION

BSHS

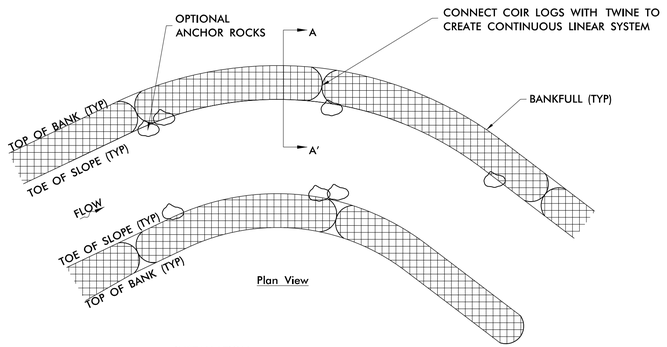



NOTES:

1. CHANNEL PLUGS TO BE LOCATED AS SHOWN ON THE PLANS AND AT OTHER LOCATIONS AS NOTED BY THE DESIGNER.
2. SIDE SLOPE THAT IS ADJACENT TO NEW CHANNEL NEEDS TO MATCH PROPOSED CROSS–SECTION IN THAT LOCATION.
3. WRAP THE COMPACTED BACKFILL MATERIAL IN GEOTEXTILE.
4. THIS STRUCTURE SHALL BE PLACED AS SHOWN ON PLANS OR AS DIRECTED BY ONSITE ENGINEER.
5. KEY THE CHANNEL PLUG INTO THE BED AND BANK A MINIMUM OF 1 FOOT.
6. GEOTEXTILE MAY BE OMITTED IF CLAY MATERIAL IS AVAILABLE TO SUBSTITUTE FOR CORE MATERIAL.
7. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.

## STREAM PLUG

SP




INSTALLATION:

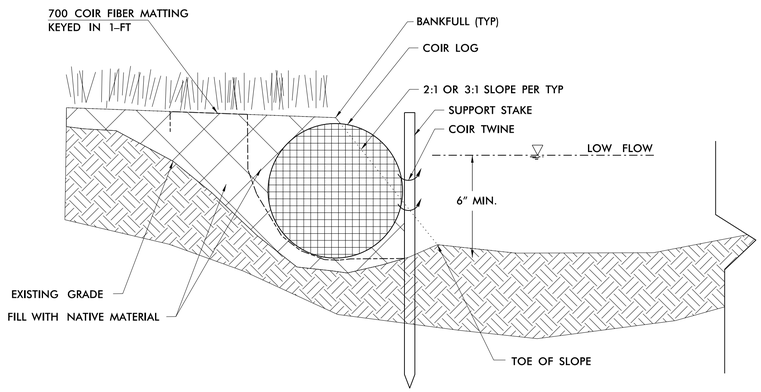
1. INSTALL COIL LOG INTO THE WATER AT THE TOE OF SLOPE TO A DEPTH OF 6" (1/2 THE HEIGHT OF THE WATTLE)
2. TIE THE ENDS OF THE COIR LOGS WITH TWINE TO PROVIDE A CONTINUOUS LINEAR SYSTEM.
3. DRIVE A 36" WOODEN STAKE INTO THE WATER NEXT TO COIR LOG, WITH 8" EXTENDING ABOVE THE WATER LEVEL. TIE THE STAKETO THE COIR LOG WITH TWINE THROUGH THE NETTING ON THE COIR LOG. STAKES SHOULD BE INSTALLED EVERY 3′.
4. TRENCH BOTH ENDS OF THE LINEAR COIR LOG SYSTEM PERPENDICULAR TO THE SYSTEM, AT LEAST 3′ INTO THE BANK AND COVER WITH COMPACTED SOIL.
5. BACKFILL ON THE UPSLOPE SIDE WITH 4" OF NATIVE SOIL AND STABILIZE WITH VEGETATION. PLANT PLUGS MAY BE INSERTED DIRECTLY INTO THE COIL LOG.

## COIR LOG

CL

NOTE:

COIR LOGS MUST BE, AT MINIMUM, 12" DIAMETER. (MAX = 20.0")
DO NOT USE COIR LOGS WITH STRAW FILL.




IN-STREAM DETAILS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | PSH-02.2.6 |
|---|---|---|
| DATE | PROJECT NO. | SHEET |

VHB Engineering NC, P.C. (C-3705)
940 Main Campus Drive, Suite 500
Raleigh, NC 27606

5/14/99

...\Mushroom Meadow Hyd_PSH02.2_Details.dgn
1/11/2023
Mushroom Meadow
USER Robert Hunt

5/14/99

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

# MORPHOLOGICAL DATA

| Variables | | REFERENCE | | | UT 1 | | | | UT2 | | | UT 3 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Reference UT to Richland | Reference Spencer Creek 2 | Reference UT4 (UT to | Existing UT 1 Reach 2 | Proposed UT 1 Reach 2 | Existing UT 1 Reach 3 | Proposed UT 1 Reach 3 | Existing UT 2 | Proposed UT 2 Reach 2 | Proposed UT 2 Reach 3 | Existing UT 3 Reach 1 | Proposed UT 3 Reach 1 | Proposed UT 3 Reach 2 |
| 1. Stream Type | | C4/E4 | E4 | C4 | unstable B4 | C4 | unstable C4 | C4 | G5c | C5 | C5 | unstable E5 | C5 | C5 |
| 2. Drainage Area (sq. mi) | | 0.3 | 0.96 | 0.11 | 0.0 | 0.0 | 0.05 | 0.04 | 0.07 | 0.07 | 0.12 | 0.10 | 0.11 | 0.11 |
| 3. Bankfull Width (Wbkf) ft | Mean: | -- | -- | 7.3 | 7.0 | 6.0 | 7.8 | 7.0 | 4.0 | 7.0 | 9.0 | 5.4 | 7.0 | 10.0 |
| | Minimum: | 8.8 | 10.7 | -- | - | - | - | - | - | - | - | - | - | - |
| | Maximum: | 10.4 | 11.2 | -- | - | - | - | - | - | - | - | - | - | - |
| 4. Bankfull Mean Depth (dbkf) ft | Mean: | -- | -- | 0.6 | 0.4 | 0.5 | 0.6 | 0.7 | 0.6 | 0.7 | 0.8 | 0.7 | 0.6 | 0.8 |
| | Minimum: | 0.8 | 1.6 | -- | - | - | - | - | - | - | - | - | - | - |
| | Maximum: | 0.9 | 1.8 | -- | - | - | - | - | - | - | - | - | - | - |
| 5. Width/Depth Ratio (Wbkf/dbkf) | Mean: | -- | -- | 12.6 | 17.5 | 12.0 | 13.0 | 10.0 | 6.7 | 10.0 | 11.3 | 7.7 | 11.7 | 12.5 |
| | Minimum: | 10.0 | 5.8 | -- | - | - | - | - | - | - | - | - | - | - |
| | Maximum: | 12.8 | 7.1 | -- | - | - | - | - | - | - | - | - | - | - |
| 6. Bankfull Cross-Sectional Area (Abkf) sq ft | Mean: | -- | -- | 4.2 | 3.0 | 3.2 | 4.3 | 4.6 | 3.3 | 4.6 | 7.4 | 3.8 | 4.4 | 8.0 |
| | Minimum: | 7.8 | 17.8 | -- | - | - | - | - | - | - | - | - | - | - |
| | Maximum: | 8.5 | 19.7 | -- | - | - | - | - | - | - | - | - | - | - |
| 7. Bankfull Mean Velocity (Vbkf) fps | Mean: | -- | -- | 5.6 | 4.1 | 4.8 | 3.9 | 3.7 | 5.3 | 5.4 | 4.2 | 5.6 | 5.3 | 2.8 |
| | Minimum: | 3.5 | 4.9 | 5.2 | - | 3.9 | 3.1 | 3.2 | 3.2 | 4.6 | 2.2 | 4.1 | 3.8 | 1.9 |
| | Maximum: | 4.1 | 5.4 | 6.2 | - | 7.0 | 5.3 | 4.8 | 6.2 | 5.7 | 5.2 | 6.6 | 5.9 | 3.3 |
| 8. Bankfull Discharge (Qbkf) cfs | Mean: | -- | 97.0 | 23.6 | 12.2 | 15.0 | 17.0 | 16.5 | 26.5 | 23.3 | 33.6 | 21.3 | 23.4 | 22.8 |
| | Minimum: | 29.1 | -- | 21.7 | - | 12.5 | - | 14.0 | - | 19.0 | 27.0 | 15.4 | 16.7 | 15.4 |
| | Maximum: | 32.0 | -- | 25.8 | - | 22.5 | - | 22.2 | - | 26.3 | 38.1 | 25.0 | 26.2 | 26.6 |
| 9. Maximum Bankfull Depth (dmax) ft | Mean: | -- | -- | 1.1 | 1.0 | 0.8 | 1.2 | 1.0 | 0.9 | 1.0 | 1.3 | 1.3 | 1.0 | 1.2 |
| | Minimum: | 1.1 | 2.1 | -- | - | - | - | - | 0.8 | - | - | - | - | - |
| | Maximum: | 1.3 | 2.6 | -- | - | - | - | - | 1.1 | - | - | - | - | - |
| 10. Ratio of Low Bank Height to Maximum Bankfull Depth (lbh/dmax) | Mean: | -- | 1.0 | 1.0 | 2.8 | 1.0 | 1.8 | 1.0 | 5.2 | 1.0 | 1.0 | 2.5 | 1.0 | 1.0 |
| | Minimum: | 1.4 | -- | -- | - | - | - | - | 5.9 | - | - | - | - | - |
| | Maximum: | 2.1 | -- | -- | - | - | 41.4 | - | 4.3 | - | - | - | - | - |
| 11. Width of Flood Prone Area (Wfpa) ft | Mean: | -- | -- | 20.1 | 14.2 | >25.0 | 41.4 | >25.0 | 4.6 | >25.0 | >25.0 | 15.0 | >25.0 | >25.0 |
| | Minimum: | 27.6 | 60.0 | -- | - | - | - | - | - | - | - | - | - | - |
| | Maximum: | 31.4 | >114 | -- | - | - | - | - | - | - | - | - | - | - |
| 12. Entrenchment Ratio (Wfpa/Wbkf) | Mean: | - | -- | 2.7 | 2.0 | >2.2 | 5.3 | >2.2 | 1.2 | >2.2 | >2.2 | >2.2 | >2.2 | >2.2 |
| | Minimum: | - | 5.5 | -- | - | - | - | - | - | - | - | - | - | - |
| | Maximum: | - | >10.2 | -- | - | - | - | - | - | - | - | - | - | - |
| 13. Meander Length (Lm) ft | Mean: | - | -- | 13.6 | -- | 55.3 | -- | 56.6 | -- | 58.9 | 79.7 | -- | 69.5 | 72.4 |
| | Minimum: | - | 46.0 | 10.2 | -- | 38.0 | -- | 45.0 | -- | 45.0 | 68.0 | -- | 63.0 | 64.0 |
| | Maximum: | - | 48.0 | 17.0 | -- | 83.0 | -- | 69.0 | -- | 71.0 | 88.0 | -- | 79.0 | 82.0 |
| 14. Ratio of Meander Length to Bankfull Width (Lm/Wbkf) | Mean: | - | -- | 1.9 | -- | 9.2 | -- | 8.1 | -- | 8.4 | 8.9 | -- | 9.9 | 7.2 |
| | Minimum: | - | 4.1 | 1.4 | -- | 6.3 | -- | 6.4 | -- | 6.4 | 7.6 | -- | 9.0 | 6.4 |
| | Maximum: | - | 4.4 | 2.3 | -- | 13.8 | -- | 9.9 | -- | 10.1 | 9.8 | -- | 11.3 | 8.2 |
| 15. Radius of Curvature (Rc) ft | Mean: | - | -- | 9.0 | -- | 17.8 | -- | 19.0 | -- | 17.9 | 24.8 | -- | 22.0 | 26.6 |
| | Minimum: | - | 11.0 | 5.3 | -- | 15.0 | -- | 16.0 | -- | 15.0 | 21.0 | -- | 19.0 | 22.0 |
| | Maximum: | - | 15.0 | 12.6 | -- | 23.0 | -- | 23.0 | -- | 23.0 | 28.0 | -- | 27.0 | 31.0 |
| 16. Ratio of Radius of Curvature to Bankfull Width (Rc/Wbkf) | Mean: | - | -- | 1.2 | -- | 3.0 | -- | 2.7 | -- | 2.6 | 2.8 | -- | 3.1 | 2.7 |
| | Minimum: | - | 1.3 | 0.7 | -- | 2.5 | -- | 2.3 | -- | 2.1 | 2.3 | -- | 2.7 | 2.2 |
| | Maximum: | - | 1.4 | 1.7 | -- | 3.8 | -- | 3.3 | -- | 3.3 | 3.1 | -- | 3.9 | 3.1 |
| 17. Belt Width (Wblt) ft | Mean: | - | -- | 4.4 | -- | 19.6 | -- | 23.4 | -- | 25.9 | 33.8 | -- | 25.4 | 30.4 |
| | Minimum: | - | 38.0 | 3.2 | -- | 13.0 | -- | 12.0 | -- | 17.0 | 26.0 | -- | 17.0 | 22.0 |
| | Maximum: | - | 41.0 | 5.7 | -- | 27.0 | -- | 31.0 | -- | 40.0 | 40.0 | -- | 32.0 | 41.0 |
| 18. Meander Width Ratio (Wblt/Wbkf) | Mean: | - | -- | 0.6 | -- | 3.3 | -- | 3.3 | -- | 3.7 | 3.8 | -- | 3.6 | 4.3 |
| | Minimum: | - | 3.4 | 0.4 | -- | 2.2 | -- | 1.7 | -- | 2.4 | 2.9 | -- | 2.4 | 3.1 |
| | Maximum: | - | 3.6 | 0.8 | -- | 4.5 | -- | 4.4 | -- | 5.7 | 4.4 | -- | 4.6 | 5.9 |
| 19. Sinuosity (Stream length/valley distance) (K) | Mean: | 1.0 | 2.3 | 1.1 | 1.0 | 1.2 | 1.0 | 1.2 | 1.0 | 1.2 | 1.2 | 1.0 | 1.2 | 1.2 |
| | Minimum: | - | -- | -- | - | - | - | - | - | - | - | - | - | - |
| | Maximum: | - | -- | -- | - | - | - | - | - | - | - | - | - | - |
| 20. Valley Slope (ft/ft) | Mean: | - | 0.0109 | 0.0017 | 0.0280 | 0.0266 | 0.0120 | 0.0093 | 0.0110 | 0.0115 | 0.0070 | 0.0150 | 0.0165 | 0.0031 |
| | Minimum: | - | -- | -- | - | - | - | - | - | - | - | - | - | - |
| | Maximum: | - | -- | -- | - | - | - | - | - | - | - | - | - | - |
| 21. Average Water Surface Slope for Reach (Savg) | Mean: | 0.0131 | 0.0047 | 0.0016 | 0.0280 | 0.0222 | 0.0123 | 0.0078 | 0.0113 | 0.0096 | 0.0058 | 0.0146 | 0.0137 | 0.0026 |
| | Minimum: | - | -- | -- | - | - | - | - | - | - | - | - | - | - |
| | Maximum: | - | -- | -- | - | - | - | - | - | - | - | - | - | - |
| 22. Pool Slope (Spool) ft/ft | Mean: | - | -- | 0.0100 | -- | 0.0000 | -- | 0.0000 | -- | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | Minimum: | - | 0.0007 | 0.0078 | -- | -- | -- | - | -- | 0.0000 | - | - | - | - |
| | Maximum: | - | 0.0009 | 0.0136 | -- | -- | -- | - | -- | 0.0000 | - | - | - | - |
| 23. Ratio of Pool Slope to Average Slope (Spool/Savg) | Mean: | - | -- | 0.6 | -- | 0.0 | -- | 0.0 | -- | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Minimum: | - | 0.2 | 0.5 | -- | - | -- | - | -- | 0.0 | - | - | - | - |
| | Maximum: | - | 0.2 | 0.9 | -- | - | -- | - | -- | 0.0 | - | - | - | - |
| 24. Maximum Pool Depth (dpool) ft | Mean: | - | 3.3 | 1.5 | -- | 1.5 | -- | 2.0 | -- | 2.0 | 2.4 | 1.0 | 2.0 | 2.4 |
| | Minimum: | - | -- | 1.4 | -- | - | -- | - | -- | - | - | - | - | - |
| | Maximum: | - | -- | 1.5 | -- | - | -- | - | -- | - | - | - | - | - |
| 25. Ratio of Maximum Pool Depth to Bankfull Mean Depth (dpool/dbkf) | Mean: | - | -- | 2.5 | -- | 3.0 | -- | 2.9 | -- | 2.9 | 3.0 | -- | 3.3 | 3.0 |
| | Minimum: | - | 1.8 | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| | Maximum: | - | 2.0 | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| 26. Pool Width (Wpool) ft | Mean: | - | 17.5 | 4.1 | -- | 7.5 | -- | 10.0 | -- | 10.0 | 12.0 | -- | 10.0 | 12.0 |
| | Minimum: | - | -- | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| | Maximum: | - | -- | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| 27. Ratio of Pool Width to Bankfull Width (Wpool/Wbkf) | Mean: | - | 1.6 | 0.6 | -- | 1.3 | -- | 1.4 | -- | 1.4 | 1.3 | -- | 1.4 | 1.2 |
| | Minimum: | - | -- | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| | Maximum: | - | -- | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| 28. Bankfull Cross-sectional Area at Pool (Apool) sq ft | Mean: | - | 24.5 | 4.4 | -- | 5.6 | -- | 10.0 | -- | 10.0 | 14.4 | -- | 10.0 | 14.4 |
| | Minimum: | - | -- | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| | Maximum: | - | -- | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| 29. Ratio of Pool Area to Bankfull Area (Apool/Abkf) | Mean: | - | -- | 1.0 | -- | 1.8 | -- | 2.2 | -- | 2.2 | 1.9 | -- | 2.3 | 1.8 |
| | Minimum: | - | 1.2 | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| | Maximum: | - | 1.4 | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| 30. Pool to Pool Spacing (p-p) ft | Mean: | - | 71.0 | 20.8 | -- | 37.9 | -- | 37.6 | -- | 37.3 | 0.0 | - | 42.1 | 42.8 |
| | Minimum: | - | -- | 17.6 | -- | 23.0 | -- | 28.0 | -- | 23.0 | 0.0 | 24.0 | 32.0 | 36.0 |
| | Maximum: | - | -- | 24.1 | -- | 76.0 | -- | 62.0 | -- | 55.0 | 0.0 | 32.0 | 51.0 | 61.0 |
| 31. Ratio of Pool-to-Pool Spacing to Bankfull Width (p-p/Wbkf) | Mean: | - | -- | 2.9 | -- | 6.3 | -- | 5.4 | -- | 5.3 | 0.0 | ** | 6.0 | 4.3 |
| | Minimum: | - | 6.3 | 2.4 | -- | 3.8 | -- | 4.0 | -- | 3.3 | 0.0 | ** | 4.6 | 3.6 |
| | Maximum: | - | 6.6 | 3.3 | -- | 12.7 | -- | 8.9 | -- | 7.9 | 0.0 | ** | 7.3 | 6.1 |
| 32. Pool Length (Lp) ft | Mean: | - | -- | -- | -- | 14.1 | -- | 16.0 | -- | 14.8 | 14.0 | 4.2 | 17.1 | 19.5 |
| | Minimum: | - | -- | -- | -- | 8.0 | -- | 13.0 | -- | 8.0 | 14.0 | - | 12.0 | 12.0 |
| | Maximum: | - | -- | -- | -- | 24.0 | -- | 22.0 | -- | 30.0 | 14.0 | - | 24.0 | 36.0 |
| 33. Ratio of Pool Length to Bankfull Width (Lp/Wbkf) | Mean: | - | -- | -- | -- | 2.4 | -- | 2.3 | -- | 2.1 | 1.6 | 0.8 | 2.4 | 2.0 |
| | Minimum: | - | -- | -- | -- | 1.3 | -- | 1.9 | -- | 1.1 | 1.6 | - | 1.7 | 1.2 |
| | Maximum: | - | -- | -- | -- | 4.0 | -- | 3.1 | -- | 4.3 | 1.6 | - | 3.4 | 3.6 |
| 34. Riffle Slope (Sriff) ft/ft | Mean: | -- | 0.0130 | -- | -- | 0.0443 | -- | 0.0156 | -- | 0.0192 | 0.0116 | -- | 0.0275 | 0.0052 |
| | Minimum: | 0.0210 | -- | -- | -- | -- | -- | - | -- | - | - | -- | - | 0.0000 |
| | Maximum: | 0.0450 | -- | -- | -- | -- | -- | - | -- | - | - | -- | - | 0.0000 |
| 35. Ratio of Riffle Slope to Average Slope (Sriff/Savg) | Mean: | -- | 2.8 | -- | -- | 2.0 | -- | 2.0 | -- | 2.0 | 2.0 | -- | 2.0 | 2.0 |
| | Minimum: | 1.2 | -- | -- | -- | - | -- | - | -- | - | - | -- | - | 0.0 |
| | Maximum: | 3.4 | -- | -- | -- | - | -- | - | -- | - | - | -- | - | 0.0 |
| 36. Maximum Riffle Depth (driff) ft | Mean: | -- | -- | -- | -- | 0.8 | -- | 1.0 | -- | 1.0 | 1.3 | -- | 1.0 | 1.2 |
| | Minimum: | 1.1 | 2.1 | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| | Maximum: | 1.3 | 2.6 | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| 37. Ratio of Maximum Riffle Depth to Bankfull Mean Depth (driff/dbkf) | Mean: | 1.4 | -- | -- | -- | 1.6 | -- | 1.4 | -- | 1.4 | 1.6 | -- | 1.7 | 1.5 |
| | Minimum: | - | 1.3 | -- | -- | - | -- | - | -- | - | - | -- | - | - |
| | Maximum: | - | 1.4 | -- | -- | - | -- | - | -- | - | - | -- | - | - |

*The existing stream has been channelized and does not have natural pattern and profile features
-no information available

MORPHOLOGY TABLES
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

01/11/2023 DATE
39077.34 PROJECT NO.
PSH-03.1 SHEET

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# STRUCTURE TABLES

| UT1 Structure Invert Table | | | | |
|---|---|---|---|---|
| **Structure Number** | **Structure Type** | **Station (UT1)** | **Invert Elevation (ft)** | **Bankfull Elevation (ft)** |
| 1 | Double Drop Rock Cross Vane (Begin) | 09+14 | 384.6 | 385.4 |
| 2 | Double Drop Rock Cross Vane (2nd Drop) | 09+22 | 383.0 | 383.8 |
| 3 | Rock Cross Vane | 09+95 | 379.9 | 380.5 |
| 4 | Constructed Riffle - Grade Control | 10+10 | 379.4 | 380.2 |
| 5 | Log Vane | 10+99 | 377.4 | 378.2 |
| 6 | Log Vane | 11+79 | 375.6 | 376.4 |
| 7 | At Grade Stream Crossing | 12+14 | 374.8 | 375.6 |
| 8 | Constructed Riffle - Grade Control | 12+92 | 373.1 | 373.9 |
| 9 | Log Vane | 14+23 | 370.2 | 371.0 |
| 10 | Log Vane | 15+42 | 367.3 | 368.4 |
| 11 | Constructed Riffle - Woody | 17+36 | 365.2 | 366.2 |
| 12 | Constructed Riffle - Grade Control | 18+95 | 364.0 | 365.0 |
| 13 | Constructed Riffle - Woody | 21+34 | 362.1 | 363.1 |
| 14 | Log Vane | 21+70 | 361.8 | 362.8 |
| 15 | Constructed Riffle - Grade Control | 23+67 | 360.3 | 361.3 |

| UT2 Structure Invert Table | | | | |
|---|---|---|---|---|
| **Structure Number** | **Structure Type** | **Station (UT2)** | **Invert Elevation (ft)** | **Bankfull Elevation (ft)** |
| 16 | Constructed Riffle - Woody | 10+42 | 366.5 | 367.5 |
| 17 | Constructed Riffle - Woody | 12+62 | 364.4 | 365.4 |
| 18 | Log Vane | 13+15 | 363.7 | 364.9 |
| 19 | Constructed Riffle - Woody | 15+13 | 362.0 | 363.0 |
| 20 | Constructed Riffle - Grade Control | 17+01 | 360.2 | 361.4 |
| 21 | Rock J-Hook | 17+42 | 359.5 | 360.7 |
| 22 | Rock Cross Vane | 17+42 | 359.5 | 360.7 |
| 23 | At Grade Crossing | 18+35 | 358.4 | 359.7 |
| 24 | Rock J-Hook | 18+94 | 357.3 | 358.6 |
| 25 | Constructed Riffle - Grade Control | 19+33 | 357.0 | 358.3 |

| UT3 Structure Invert Table | | | | |
|---|---|---|---|---|
| **Structure Number** | **Structure Type** | **Station (UT3)** | **Invert Elevation (ft)** | **Bankfull Elevation (ft)** |
| 26 | Constructed Riffle - Grade Control | 10+81 | 369.4 | 370.4 |
| 27 | Constructed Riffle - Woody | 11+93 | 367.9 | 368.9 |
| 28 | Constructed Riffle - Grade Control | 12+74 | 366.8 | 367.8 |
| 29 | Constructed Riffle - Woody | 14+65 | 364.1 | 365.3 |
| 30 | Coir Log - RT | 15+23 | 363.8 | 365.1 |
| 31 | Coir Log - LT | 15+59 | 363.7 | 365.0 |
| 32 | Constructed Riffle - Woody | 17+57 | 363.3 | 364.5 |

STRUCTURE TABLES
FOR THE
MUSHROOM MEADOW MITIGATION BANK
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| MUSHROOM MEADOW PRELIMINARY QUANTITIES* | | | | |
|---|---|---|---|---|
| **Item Number** | **Item** | **Quantity** | **Unit Measure** | **Pay Unit** |
| 1 | Excavation | 4,500 | CY | LS |
| 2 | Fill | 5,500 | CY | LS |
| 3 | Clearing | 2 | AC | AC |
| 2 | Constructed Riffle- Grade Control | 8 | Each | Each |
| 3 | Constructed Riffle - Woody | 8 | Each | Each |
| 4 | Rock Cross Vane | 2 | Each | Each |
| 3 | Rock J-Hook | 2 | Each | Each |
| 4 | Log Vane | 6 | Each | Each |
| 5 | Double Rock Cross Vane | 1 | Each | Each |
| 4 | At Grade Stream Crossing | 2 | Each | Each |
| 5 | Bank and Scour Hole Stabilization | 2 | Each | Each |
| 6 | Embankment Stabilization | 1 | Each | Each |
| 7 | Brush Toe Stabilization | 656 | LF | LF |
| 8 | Coir Log | 522 | LF | LF |
| 9 | Construction Entrance | 4 | Each | Each |
| 10 | Silt Fence | 781 | LF | LF |
| 11 | Tree Protection Fence | 4,000 | LF | LF |
| 12 | Stream Plug | 256 | CY | LS |
| 13 | Pump Around | 1 | Each | LS |
| 14 | Straw Wattles | 650 | LF | LF |
| 15 | Temporary Bridge Mat | 4 | Each | Each |
| 16 | Special Stilling Basin | 7 | Each | Each |
| 17 | Impervious Dike | 10 | LF | LF |
| 18 | Temporary Streambank Seeding | 3 | AC | AC |
| 19 | Permanent Streambank Seeding | 3 | AC | AC |
| 20 | Streambank Mulching | 3 | AC | AC |
| 21 | Live Stakes | 10,100 | Each | Each |
| 22 | Transplants | 25 | Each | Each |
| 23 | Reforestation | 22 | AC | AC |
| 24 | Riparian Wet | 9 | AC | AC |

**Quantites are based on 60% design plans and are subject to change. These values are to be used as preliminary engineering estimates only and are not final.*

QUANTITIES
FOR THE
MUSHROOM MEADOW MITIGATION BANK
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## GENERAL NOTES

1. This plan is based on the principles of natural channel design.

2. Proposed constructed stream features and structures shown on these plans are shown in their approximate location and shall be field located and dimensioned to insure proper channel dimension.

3. All elevations shown on these plans are referenced to a NAVD 88 datum.

4. The location of all equipment and material staging areas, haul roads and access points to be located as noted on these plans. Limits of silt fencing, construction staging areas and construction access roads are shown as approximate on plans. Limits and locations will be coordinated with the designer.

5. Boulders will be staged in construction staging areas upon delivery. Existing boulders will also be utilized in formation of boulder vanes, where feasible.

6. Construction activities shall progress downstream, unless otherwise noted on these plans or as directed by the designer.

7. Equipment will remain outside of channel for the majority of construction. Minimal in-stream work is anticipated for successful placement of structures and channel excavation.

8. All mechanized equipment operated in or near the stream or its tributaries shall be inspected regularly and maintained to prevent contamination of stream waters from fuels, lubricants, hydraulic fluids or other toxic materials. Any equipment repairs, maintenance or refueling activities shall not be done while the equipment is in the stream or its tributaries.

9. Contractor to dispose of all waste material off-site and in accordance with all federal, state and local regulations.

10. All appropriately sized on-site trees removed during the stream restoration construction to be used on-site for log vanes, rootwads, footer logs, etc., where feasible and as directed by the designer.

11. All disturbed areas will be seeded immediately, as specified in the project specifications.

12. Apply temporary and permanent seed and erosion control fiber matting to bankfull bench and cut banks daily as excavation progresses. Erosion control fiber matting will be keyed into the top of slope and at the ends of each mat to prevent undercutting from sheetflow. Additional silt fencing may be necessary, as directed by the designer.

13. Unless otherwise directed by the designer, a 50-foot minimum width permanently vegetated buffer shall be planted on each side of channel.

14. The Contractor will use rootwads, topsoil and transplant vegetation generated on-site for the proposed stream construction as close as possible to the existing location from where these items are removed in order to minimize hauling distance and storage duration.

15. Unless otherwise directed by the designer, where feasible, when beginning construction on a given reach, where clearing is required, use the following sequence:

    a. Remove transplant vegetation and stockpile as specified on the plans.
    b. Remove larger trees that can be used on-site for rootwads, footer logs, log vanes or floodplain habitat structures and stockpile as specified on the plans.
    c. Remove remaining vegetation and dispose of or stockpile as specified on the plans.
    d. Remove topsoil and stockpile as specified on the plans.
    e. Remove remaining soil materials as required and stockpile as specified on the plans.

16. Existing non-native vegetation within the proposed limits of construction will be removed as specified in the project specifications.

17. Contractor to provide temporary plant bedding area on site for temporary storage of vegetation transplants. Transplants to be kept watered, mulched and shaded at all times as specified in the project specifications.

18. Construction staging areas to be of adequate size to provide safe and organized storage for boulders, rootwads and logs to be used for in-stream structures, mulch, topsoil and other soil material, temporary plant beds for vegetation transplant material, as well as all other related construction materials and equipment.

19. Construction personnel should park all vehicles within the limits of the designated construction staging areas. All other construction equipment and vehicles should be parked within the construction staging areas when not in use.

20. Contractor to be responsible for repairs to any damage to existing utilities, including but not limited to, overhead and underground utilities, curb and gutter, pavement, sidewalks, storm drainage systems, sanitary sewer systems or fencing. Any required repairs to be made in accordance with any and all applicable state and or local municipality or utility agency standards.

21. Contractor shall keep all topsoil stockpiled on site separately from other soil materials.



GENERAL NOTES
FOR THE
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## CONSTRUCTION SEQUENCE

1. Staging areas, stockpile areas, construction entrances and access roads will be identified and located according to the Construction Documents. Variances will be allowed assuming both the Contractor and Designer verbally agree.

2. The primary construction entrances (as shown on the Erosion Control Plans) from State Route 1527 (River Bend Road) will be installed for access to the property.

3. The Contractor will install silt fencing, as noted on the Erosion Control Plans, at applicable staging and stockpile areas.

4. The proposed stream alignment and structure locations will be staked for -UT1-, -UT2-, and -UT3-. Staking will be restricted to riffle elevations only, to establish and maintain grade for the entire system. Pools will be excavated once structures are installed.

5. The Contractor will install temporary stream crossings on an as-needed basis only, pending agreement between both the Designer and Contractor once implementation begins.

6. The Contractor will begin stockpiling materials in designated staging areas. The project will be divided into 4 distinct sections. Upon approval from the Designer, sections may be constructed in a different sequence than indicated below or concurrently. General details associated with all sections include:

    a. Sediment bags will be used to filter the groundwater and placed within areas of newly excavated channel that are offline from the existing flow. These bags will be utilized as the Contractor or Designer deem necessary.
    b. At the end of each working day, the Contractor will be responsible for the application of temporary and permanent seed mixes and straw (mulch), as applicable, to the newly established stream banks and disturbed areas. Erosion control matting will be installed on top of the seed and straw according to the Construction Documents
    c. Excavated material that is stockpiled, will follow erosion and sediment control guidelines as they relate to material storage and stockpiling.
    d. All remaining disturbed areas are to be seeded and covered according to the Construction Documents.
    e. Riprap aprons will be constructed to impede any erosion of the channel and streambanks by the water diverted from the pumping-around procedure.

7. Boulders and materials used for stream structures will be delivered through the primary construction entrance and stockpiled in appropriate areas.

8. This project may require pumping for channels during construction. Work will proceed in a manner that is most conducive with site conditions.

9. Generally, offline channels will be constructed and stabilized prior to connections with the existing flow pattern. Once the new channel is fully stabilized, all excavated material will be placed in segments of the existing channel that are to be abandoned. When feasible, the bed material will be transferred between the existing channel to the new channel.

10. Live staking can begin on the completed sections of the -UT- channels, as criteria for live staking are met in the Construction Documents.

11. Once channel construction and seeding are complete, bare rooted seedlings will be installed.

**Section 1: UT 1 Stations 9+14 to 12+90 +/- -UT1- and 13+15 +/- to 24+01.95 (End Construction) -UT1-**

12. The Contractor will excavate the proposed UT 1 floodplain followed by the bankfull channel based on the typical sections. Structures will be installed according to the details presented in the Construction Documents and initial grading will be completed to riffle elevations only. Excavation of the proposed connection from 12+90+/- to 13+15 +/- will be completed once UT1 has been stabilized. Water will be diverted by a pump and directed through flexible hose, where necessary, to minimize erosion and sedimentation during connection procedures. Once the new channel is fully stabilized, all excavated material will be placed in segments of the existing channel that are to be abandoned. Pools will be established once structures and channel alignments have been completed.

13. Clay plugs will be installed along the existing channel at (-UT1-) Stations 9+95 +/-, 13+00 +/-, and 21+75 +/-.

14. All remaining disturbed areas along UT 1 are to be seeded and mulched according to the Construction Documents.

**Section 2: UT 2 Stations 10+75+/- to 19+50 (End Construction) +/- -UT2-**

15. The Contractor will excavate the proposed UT 2 channel based on the typical sections. Structures will be installed according to the details presented in the Construction Documents and initial grading will be completed to riffle and drop structure elevations only. Pools will be established once structures and channel alignments have been completed. Water will be diverted by a pump and directed through flexible hose where necessary, to minimize erosion and sedimentation during connection procedures. Once the new channel is fully stabilized, all excavated material will be placed in segments of the existing channel that are to be abandoned.

16. A clay plug will be installed along the existing channel at (-UT2-) Station 10+00 +/-.

17. All remaining disturbed areas between UT 2 Stations 10+75+/- and End Construction are to be seeded and mulched according to the Construction Documents.

**Section 3: UT 3 Stations 10+54.8 to 18+05 +/- (End Construction)**

18. The Contractor will excavate the proposed UT 3 channel based on the typical sections. Structures will be installed according to the details presented in the Construction Documents and initial grading will be completed to riffle elevations only. Water will be diverted by a pump and directed through flexible hose, where necessary, to minimize erosion and sedimentation during connection procedures. Once the new channel is fully stabilized, all excavated material will be placed in segments of the existing channel that are to be abandoned. Pools will be established once structures and channel alignments have been completed.

19. A clay plug will be installed along the existing channel at (-UT1-) Station 10+55 +/-.

20. All remaining disturbed areas along UT 3 are to be seeded and mulched according to the Construction Documents.

**Section 4: Floodplain Wetland**

21. The Contractor will level existing crowns and fill existing swales and channels to create a Floodplain Wetland south of the proposed UT 1 channel. The Floodplain Wetland will be installed according to the Construction Documents.

CONSTRUCTION SEQUENCE
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

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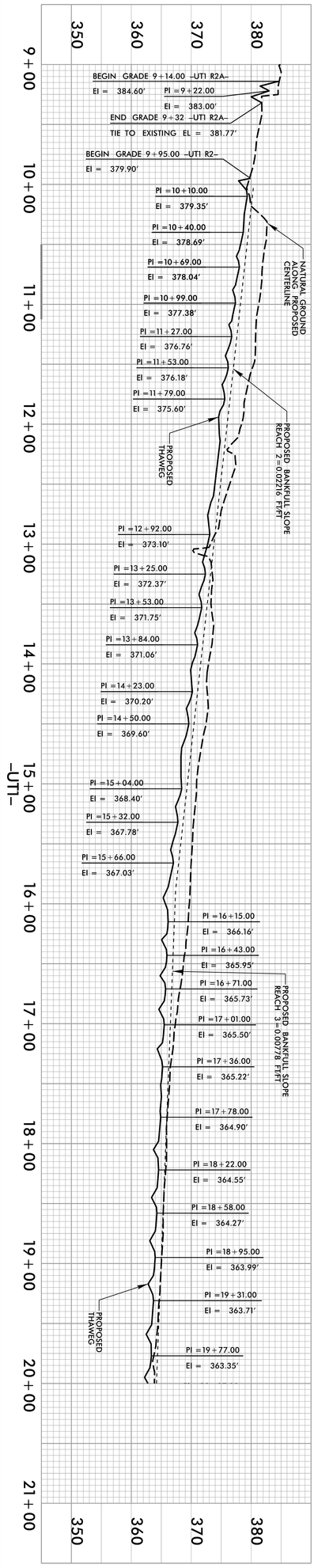


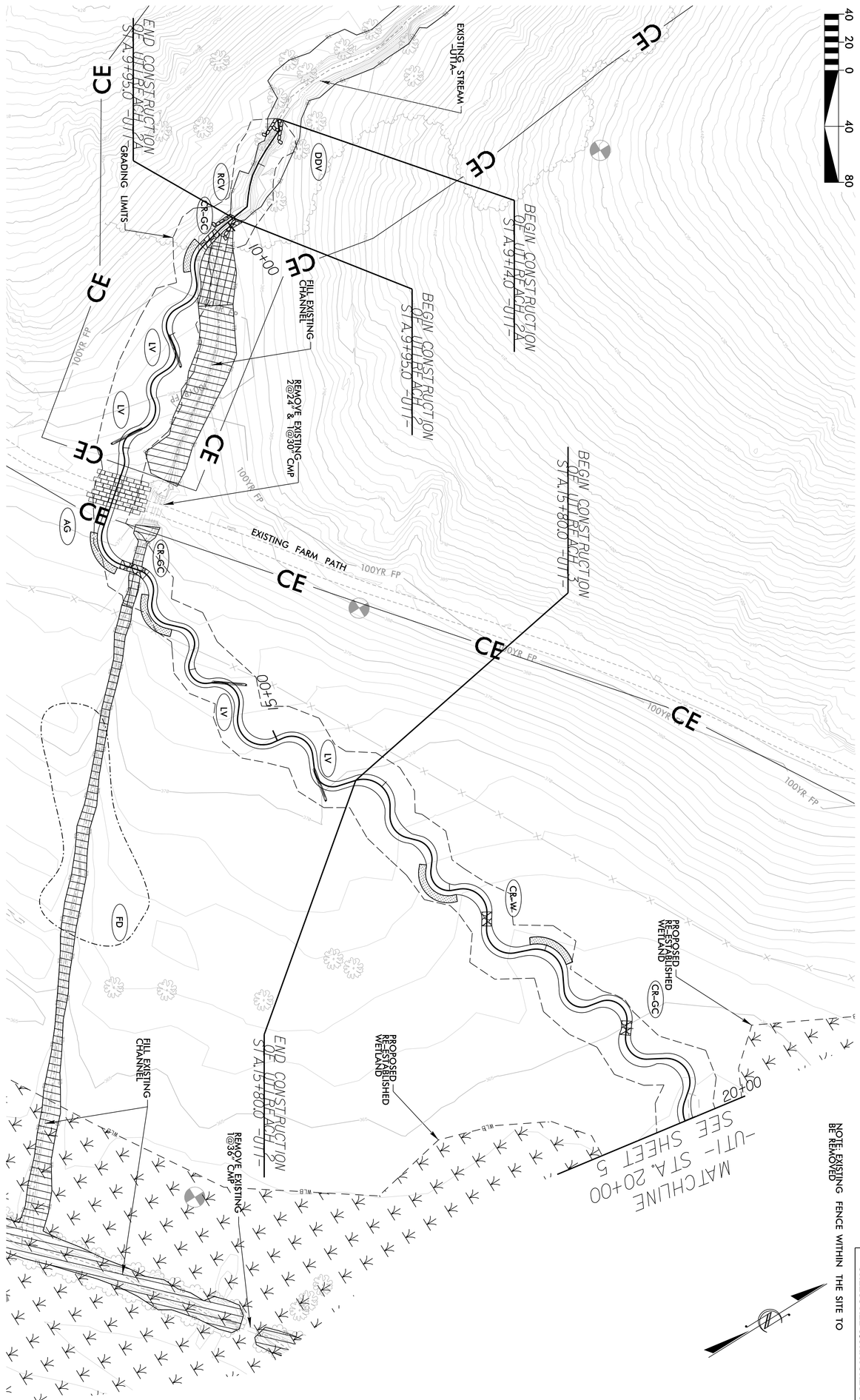


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PLAN AND PROFILE
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
PREPARED FOR
ECO TERRA PARTNERS, LLC

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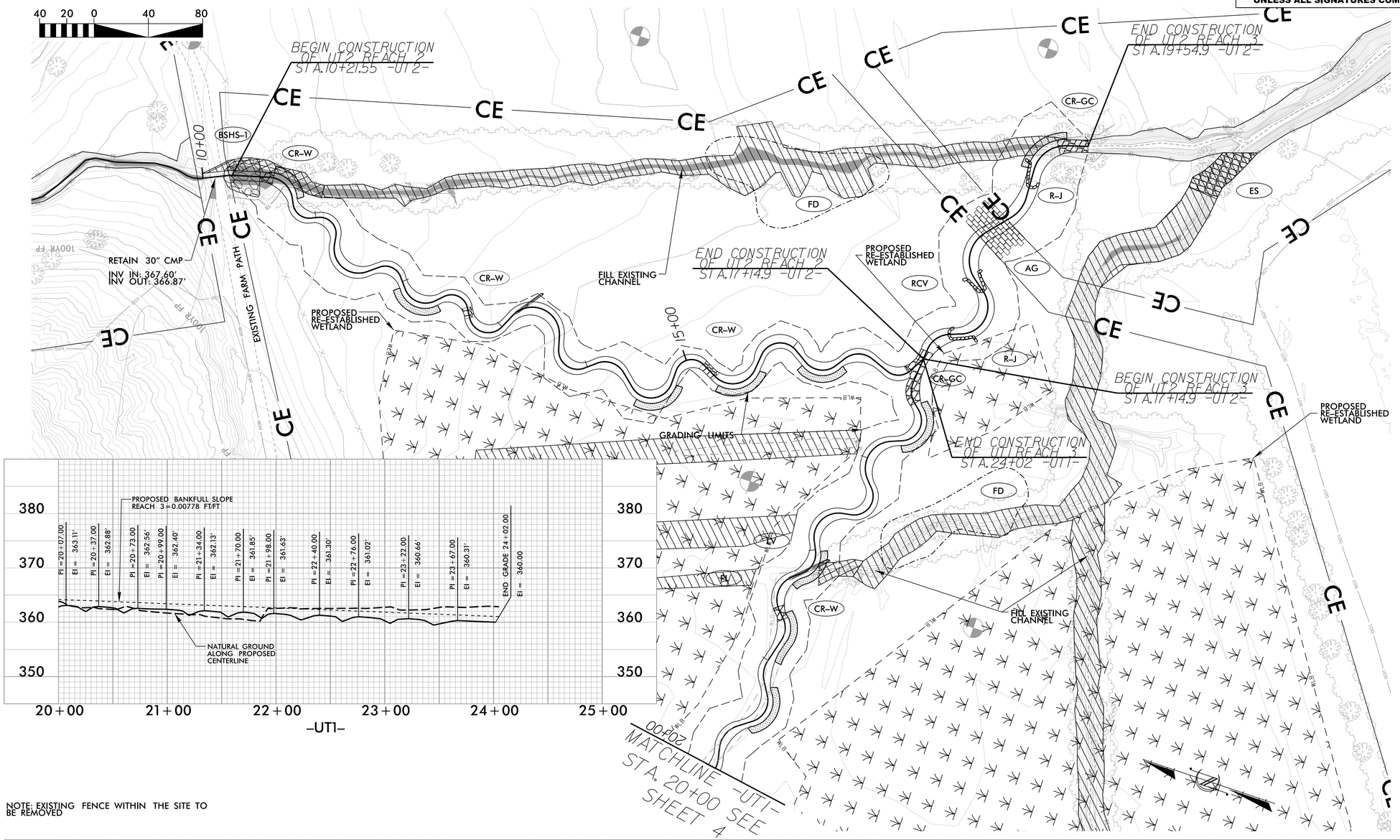
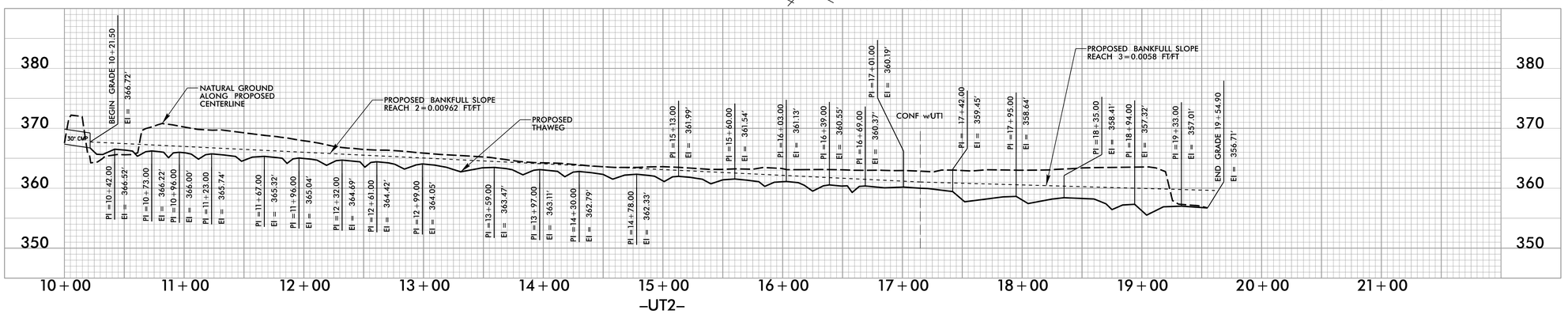






NOTE: EXISTING FENCE WITHIN THE SITE TO BE REMOVED




PLAN AND PROFILE
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
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5/14/99

40 20 0 40 80

BEGIN CONSTRUCTION OF UT3 REACH 1 STA.10+54.8 -UT3-

100YR FP

RIVER BEND ROAD (S.R. 1527)

RETAIN 36" RCP
INV IN: 370.75'
INV OUT: 369.71'

CE

BSHS-2

CR-GC

FILL EXISTING CHANNEL

CR-W

BEGIN CONSTRUCTION OF UT3 REACH 2 STA.14+52.4 -UT3-

FD

CR-GC

CR-W

15+00

END CONSTRUCTION OF UT3 REACH 1 STA.14+52.4 -UT3-

CL

CL

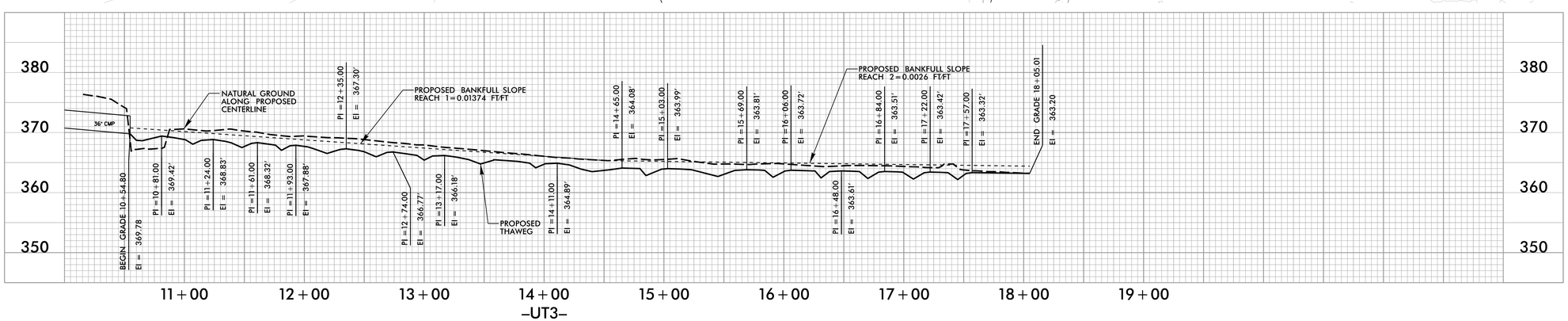
CR-W

GRADING LIMITS

JURISDICTIONAL WETLAND

END CONSTRUCTION OF UT3 REACH 2 STA.18+05 -UT3-

ENTIRE CONSERVATION EASEMENT AREA ON THIS SHEET IS CONTAINED WITHIN THE 100-YR FLOODPLAIN




PLAN AND PROFILE
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
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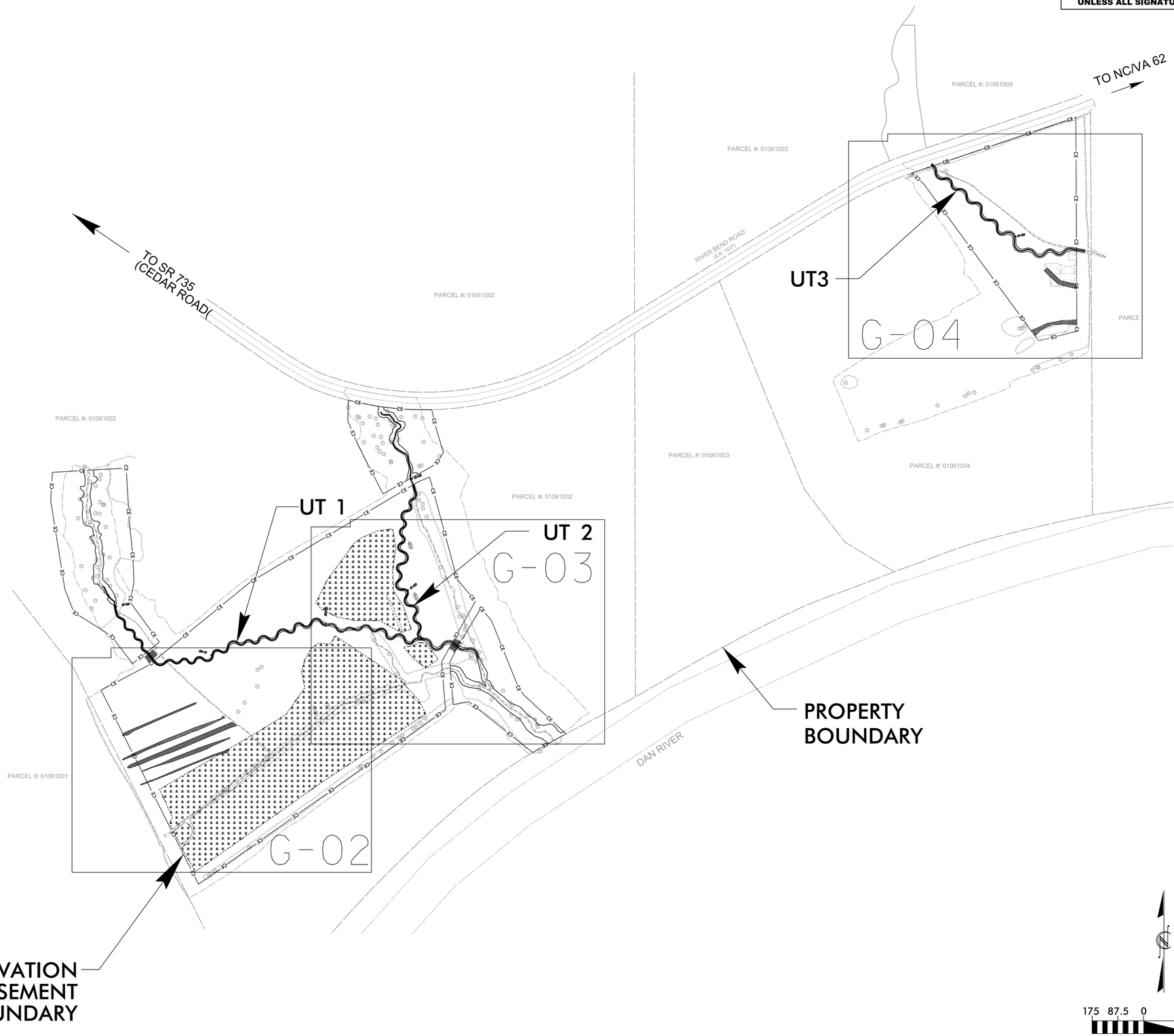


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User: Rachel Hall

# GRADING LAYOUT SHEET
FOR THE
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PREPARED FOR
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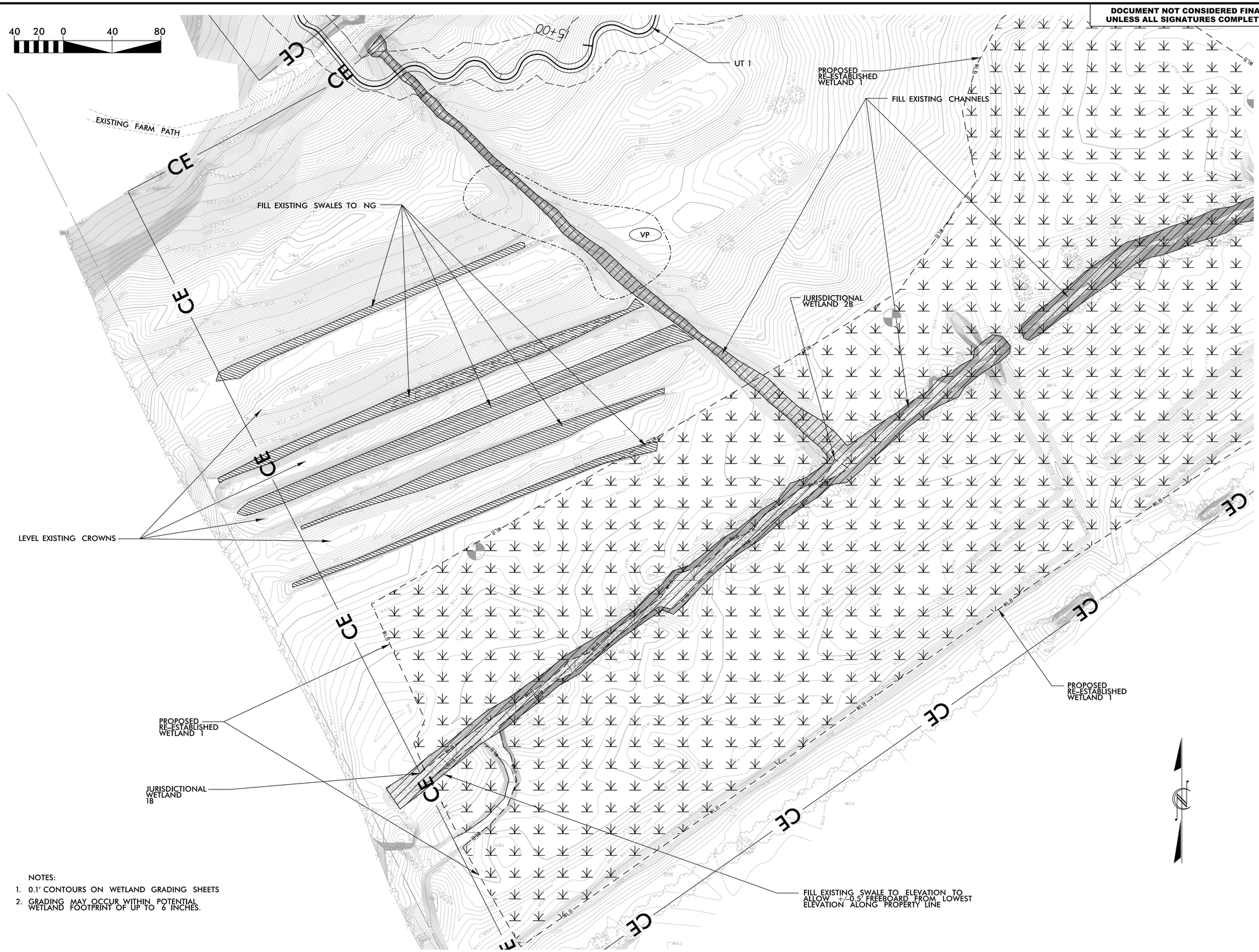


NOTES:

1. 0.1' CONTOURS ON WETLAND GRADING SHEETS
2. GRADING MAY OCCUR WITHIN POTENTIAL WETLAND FOOTPRINT OF UP TO 6 INCHES.

# WETLAND GRADING PLAN

WETLAND GRADING PLAN
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

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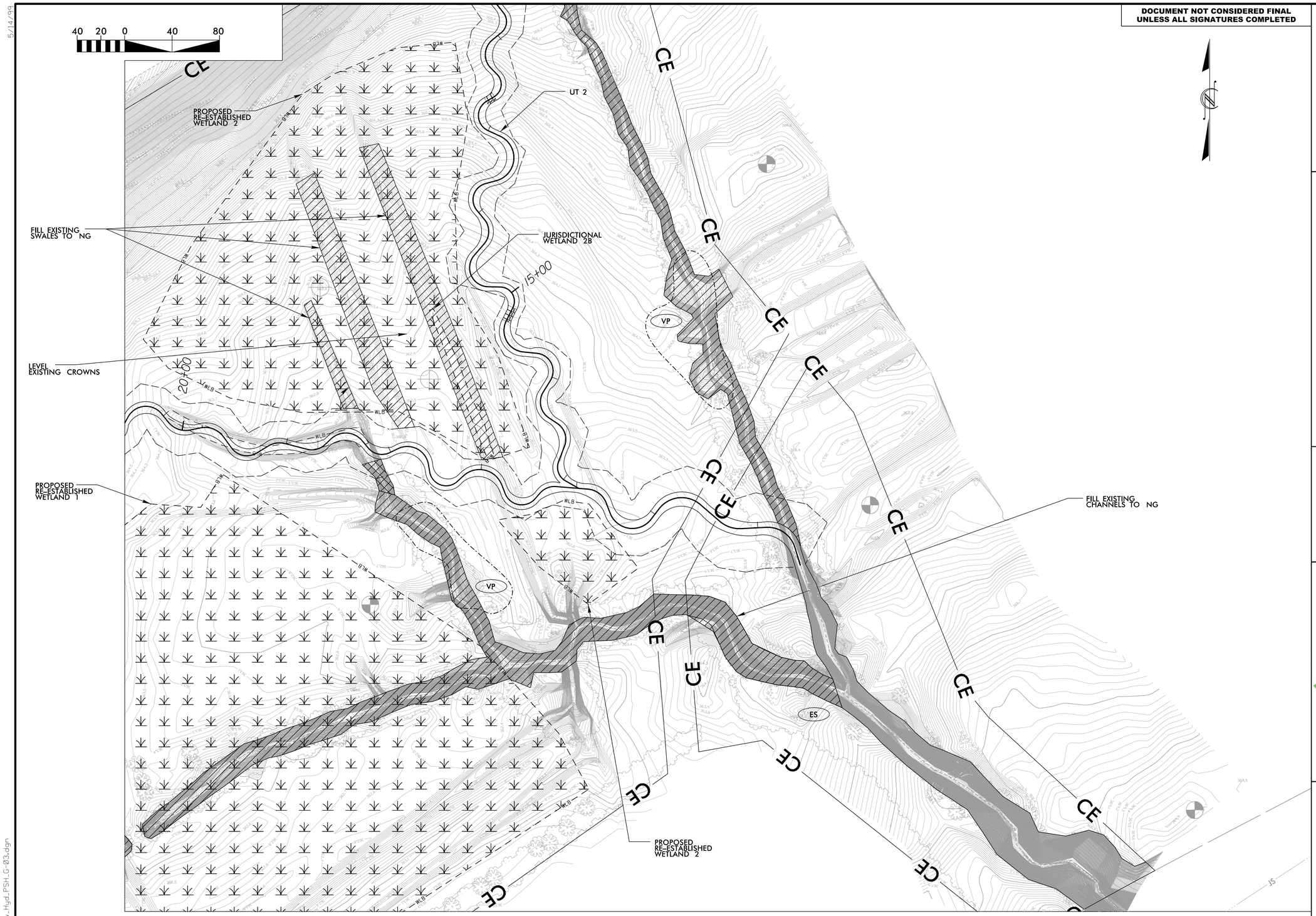


NOTES:
1. 0.1' CONTOURS ON WETLAND GRADING SHEETS
2. GRADING MAY OCCUR WITHIN POTENTIAL WETLAND FOOTPRINT OF UP TO 6 INCHES.

# WETLAND GRADING PLAN

WETLAND GRADING PLAN
FOR THE
MUSHROOM MEADOW MITIGATION BANK
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User: Paul Hill

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40 20 0 40 80

100YR FP

BEGIN CONSTRUCTION
OF UT3 REACH 1
STA.10+54.8 -UT3-

RIVER BEND ROAD
(S.R. 1527)

CE

BEGIN CONSTRUCTION
OF UT3 REACH 2
STA.14+52.4 -UT3-

VP

UT 1

15+00

END CONSTRUCTION
OF UT3 REACH 1
STA.14+52.4 -UT3-

END CONSTRUCTION
OF UT3 REACH 2
STA.18+05 -UT3-

FILL EXISTING SWALES TO NG

JURISDICTIONAL
WETLANDS 4 & 3

NOTES:
1. 0.1' CONTOURS ON WETLAND GRADING SHEETS
2. GRADING MAY OCCUR WITHIN POTENTIAL WETLAND FOOTPRINT OF UP TO 6 INCHES.

# WETLAND GRADING PLAN

WETLAND GRADING PLAN
FOR THE
MUSHROOM MEADOW STREAM AND
WETLAND MITIGATION SITE
PREPARED FOR
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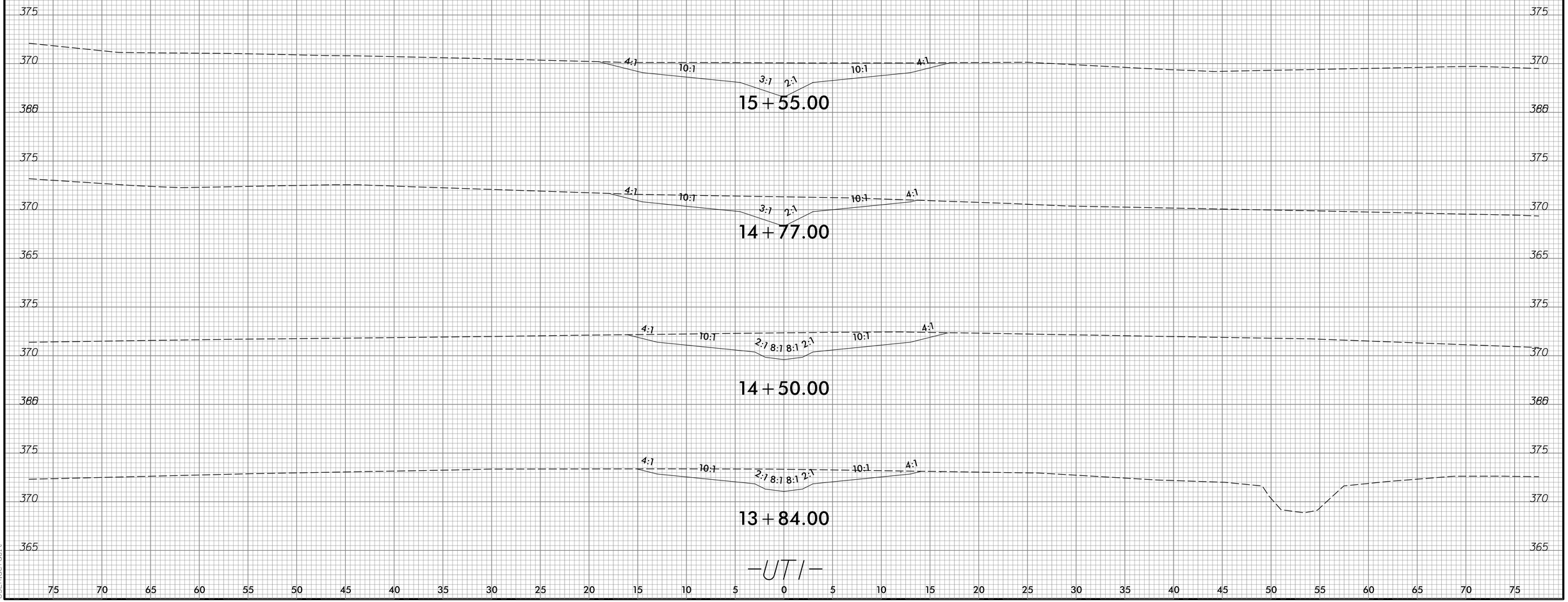
6/23/16

| 0 2.5 5 | PROJ. REFERENCE NO. | SHEET NO. |
|---|---|---|
| | MUSHROOM MEADOW | X-1 |

75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

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| | MUSHROOM MEADOW | X-2 |

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365 360 355 370 365 360 365 370 365 375 370 365

10:1 3:1 2:1 10:1 10:1

22+61.00

10:1 2:1 3:1 10:1

18+05.00

4:1 10:1 3:1 2:1 10:1 4:1

16+30.00

4:1 10:1 2:1 8:1 8:1 2:1 10:1 4:1

16+15.00

—UT1—

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| | MUSHROOM MEADOW | X-3 |

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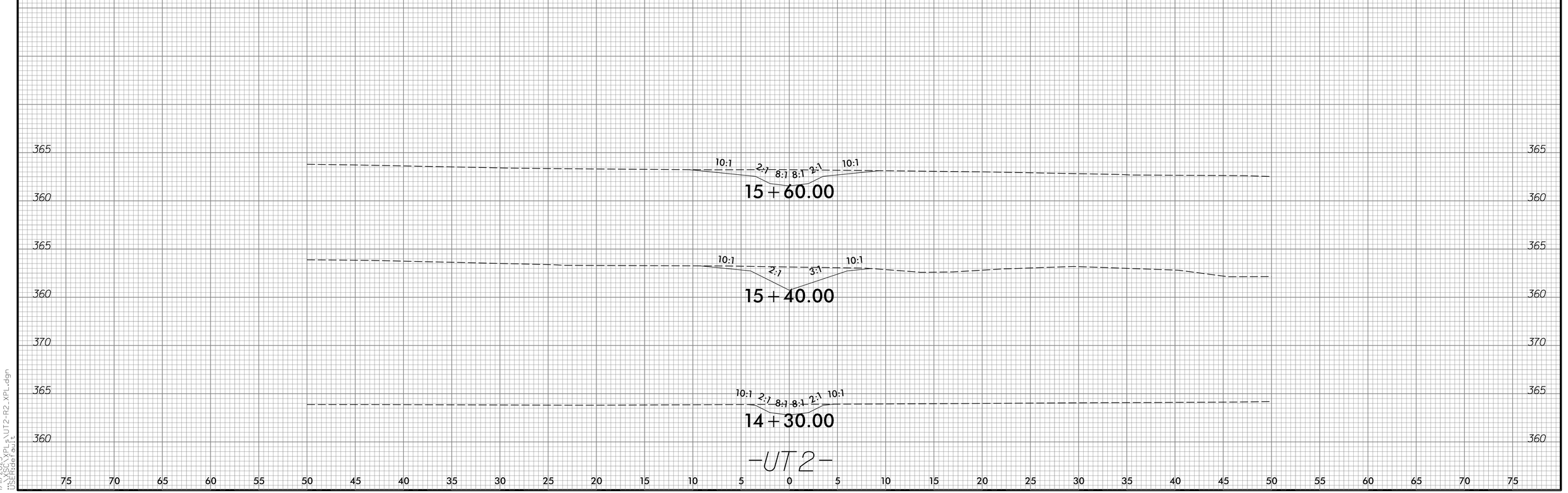


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| | MUSHROOM MEADOW | X-4 |

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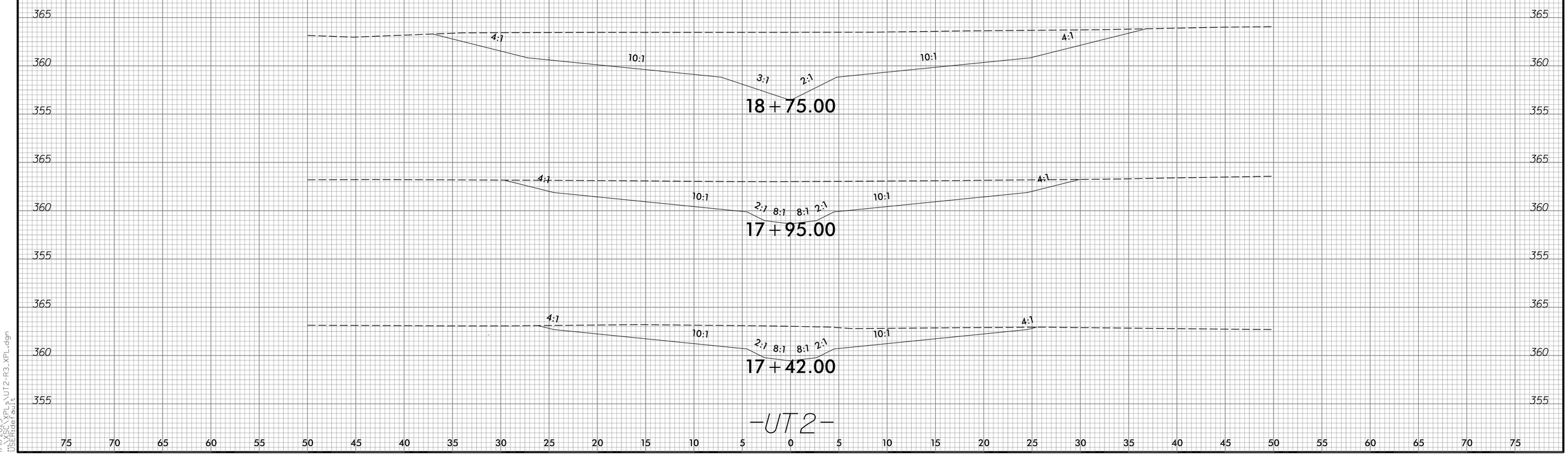


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| | MUSHROOM MEADOW | X-5 |

75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

370
365
375
370
365
375
370
365
375
370
365

10:1 2:1 3:1 10:1

**13+00.00**

4:1 10:1 3:1 2:1 10:1

**12+60.00**

10:1 2:1 8:1 8:1 2:1 10:1

**12+35.00**

4:1 10:1 2:1 8:1 8:1 2:1 10:1

**11+24.00**

*-UT3-*

75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

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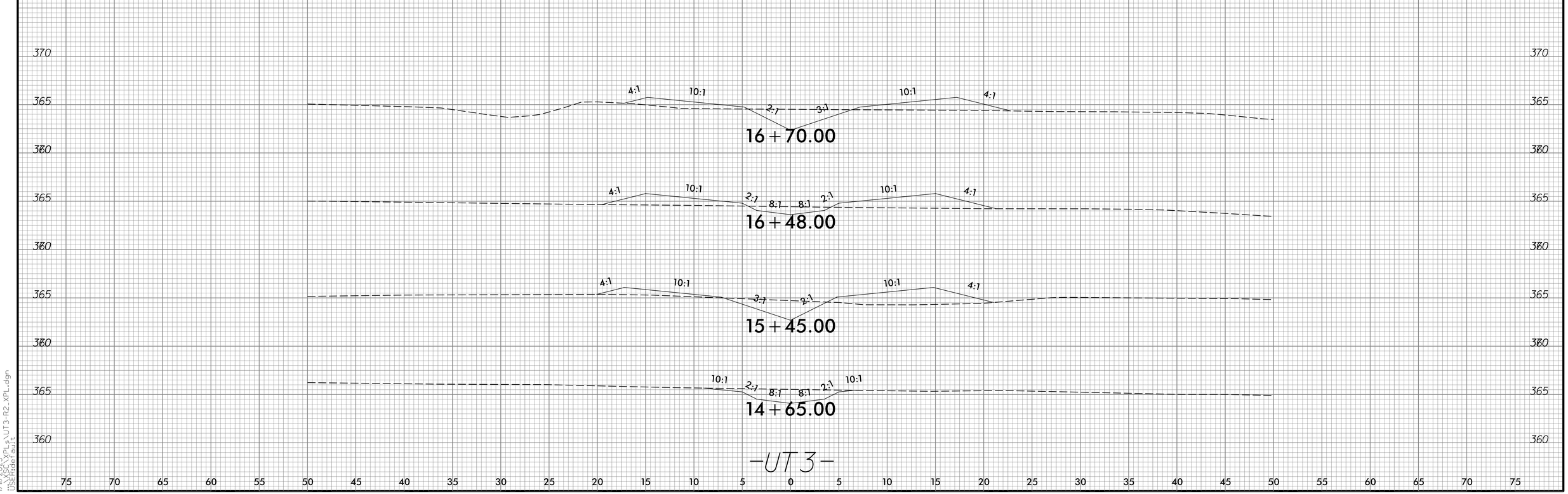
| | MUSHROOM MEADOW | X-6 |

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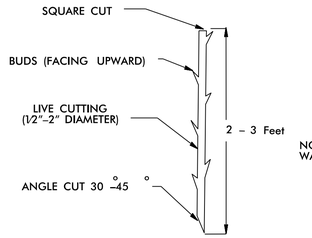
# PLANTING DETAILS

NOTES:

1. STREAMBANK REFORESTATION USING LIVE STAKES AND TUBLINGS SHALL BE PLANTED 2–FOOT ON CENTER, RANDOM SPACING THROUGHOUT THE OUTSIDES OF THE MEANDERBENDS (APPROXIMATELY 10,890 PLANTS PER ACRE). IN OTHER AREAS, PLANTING WILL AVERAGE 8 FEET ON CENTER (APPROXIMATELY 680 PLANTS PER ACRE).
2. THE LOCATION OF STREAMBANK REFORESTATION SHALL BE CONCENTRATED TO THE FLOODPLAIN AREA NEAR THE BANKFULL ELEVATION. THE WIDTH OF THE REFORESTATION AREA SHALL RANGE BETWEEN 5 FT AND 15 FT DEPENDING ON FLOODPLAIN WIDTH, SLOPE AND OVERALL EXISTING VEGETATIVE COMPOSITION

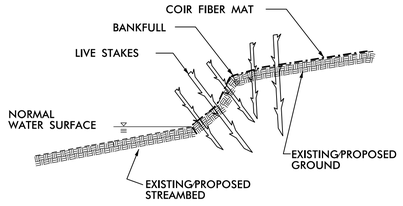
SEE PLAN SHEETS FOR AREAS TO BE PLANTED




LIVE STAKE SCHEMATIC

BANK STABILIZATION WITH LIVE STAKES

1. LIVE STAKES SHALL BE SPACED APPROXIMATELY 3 FEET ON CENTER
2. LIVE STAKES SHALL BE DRIVEN UNTIL APPROXIMATELY 3/4 OF LIVE STAKE IS WITHIN GROUND




CROSS SECTIONAL VIEW

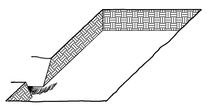
## LIVE STAKES

| COMMON NAME | SCIENTIFIC NAME | TYPE | COUNT | PERCENTAGE OF TOTAL | WETLAND INDICATOR STATUS | SPACING (FT O.C.)[1] | LOCATION (ZONE) |
|---|---|---|---|---|---|---|---|
| **WETLAND ZONE REFORESTATION** | | | | | | | |
| RIVER BIRCH | *BETULA NIGRA* | BARE ROOT | 306 | 5% +/- | FACW | 8x8 | WETLAND |
| IRONWOOD | *CARPINUS CAROLINIANA* | BARE ROOT | 612 | 10% +/- | FAC | 8x8 | WETLAND |
| SILKY DOGWOOD | *CORNUS AMOMUM* | BARE ROOT | 306 | 5% +/- | FACW | 8x8 | WETLAND |
| AMERICAN ELM | *ULMUS AMERICANA* | BARE ROOT | 306 | 5% +/- | FAC | 8x8 | WETLAND |
| SWAMP CHESTNUT OAK | *QUERCUS MICHAUXII* | BARE ROOT | 306 | 5% +/- | FACW | 8x8 | WETLAND |
| WATER OAK | *QUERCUS NIGRA* | BARE ROOT | 612 | 10% +/- | FAC | 8x8 | WETLAND |
| CHERRYBARK OAK | *QUERCUS PAGODA* | BARE ROOT | 306 | 5% +/- | FAC | 8x8 | WETLAND |
| SWAMP WHITE OAK | *QUERCUS BICOLOR* | TUBLING | 306 | 5% +/- | FACW | 8X8 | WETLAND |
| OVERCUP OAK* | *QUERCUS LYRATA* | BARE ROOT | N/A | N/A | OBL | 8X8 | WETLAND |
| LAUREL OAK* | *QUERCUS LAURIFOLIA* | BARE ROOT | N/A | N/A | FACW | 8X8 | WETLAND |
| BLACKGUM | *NYSSA SYLVATICA* | BARE ROOT | 612 | 10% +/- | FAC | 8X8 | WETLAND |
| AMERICAN SYCAMORE | *PLATANUS OCCIDENTALIS* | BARE ROOT | 612 | 10% +/- | FACW | 8X8 | WETLAND |
| TAG ALDER | *ALNUS SERRULATA* | TUBLING | 306 | 5% +/- | FACW | 8X8 | WETLAND |
| COMMON BUTTONBUSH | *CEPHALANTHUS OCCIDENTALIS* | BARE ROOT | 306 | 5% +/- | OBL | 8X8 | WETLAND |
| HIGHBUSH BLUEBERRY | *VACCINIUM CORYMBOSUM* | BARE ROOT | 306 | 5% +/- | FACW | 8X8 | WETLAND |
| BLACK WILLOW | *SALIX NIGRA* | BARE ROOT | 306 | 5% +/- | OBL | 8X8 | WETLAND |
| WILLOW OAK | *QUERCUS PHELLOS* | BARE ROOT | 612 | 10% +/- | FACW | 8X8 | WETLAND |
| ***Substitute species** | | **TOTAL (9 acres)** | 6,120 | 100% | | | |
| **LOW STREAM REFORESTATION** | | | | | | | |
| SILKY DOGWOOD | *CORNUS AMOMUM* | 2-3' LIVE STAKE | **817** | 25% +/- | FACW | 2x2 | STREAMSIDE |
| TAG ALDER | *ALNUS SERRULATA* | TUBLING | **817** | 25% +/- | FACW | 2x2 | STREAMSIDE |
| BLACK WILLOW | *SALIX NIGRA* | 2-3' LIVE STAKE | **817** | 25% +/- | OBL | 2x2 | STREAMSIDE |
| SILKY WILLOW | *SALIX SERICEA* | 2-3' LIVE STAKE | **817** | 25% +/- | OBL | 2x2 | STREAMSIDE |
| | | **TOTAL (0.3 acres)** | 3,268 | 100% | | | |
| **UPLAND BUFFER ZONE REFORESTATION** | | | | | | | |
| WILLOW OAK | *QUERCUS PHELLOS* | BARE ROOT | 1,496 | 10% +/- | FACW | 8x8 | UPLAND BUFFER |
| WATER OAK | *QUERCUS NIGRA* | BARE ROOT | 1,496 | 10% +/- | FAC | 8x8 | UPLAND BUFFER |
| SHUMARD OAK | *QUERCUS SHUMARDII* | BARE ROOT | 748 | 5% +/- | FAC | 8x8 | UPLAND BUFFER |
| RED OAK | *QUERCUS RUBRA* | BARE ROOT | 1,496 | 10% +/- | FACU | 8x8 | UPLAND BUFFER |
| WHITE OAK | *QUERCUS ALBA* | BARE ROOT | 1,496 | 10% +/- | FACU | 8x8 | UPLAND BUFFER |
| SUGAR BERRY | *CELTIS LAEVIGATA* | BARE ROOT | 1,496 | 10% +/- | FACW | 8x8 | UPLAND BUFFER |
| TULIP POPLAR | *LIRIODENDRON TULIPIFERA* | BARE ROOT | 1,496 | 10% +/- | FACU | 8x8 | UPLAND BUFFER |
| BLACKGUM | *NYSSA SYLVATICA* | BARE ROOT | 1,496 | 10% +/- | FAC | 8x8 | UPLAND BUFFER |
| AMERICAN BEECH | *FAGUS GRANDIFOLIA* | BARE ROOT | 1,496 | 10% +/- | FACU | 8x8 | UPLAND BUFFER |
| AMERICAN HOLLY | *ILEX OPACA* | BARE ROOT | 748 | 5% +/- | FACU | 8x8 | UPLAND BUFFER |
| PERSIMMON | *DIOSPYROS VIRGINIANA* | BARE ROOT | 748 | 5% +/- | FAC | 8x8 | UPLAND BUFFER |
| COMMON PAWPAW | *ASIMINA TRILOBA* | BARE ROOT | 748 | 5% +/- | FAC | 8x8 | UPLAND BUFFER |
| [1]O.C. - ON CENTER | | **TOTAL (22 acres)** | 14,960 | 100% | | | |

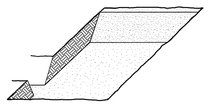
## REFORESTATION

## HEELING IN

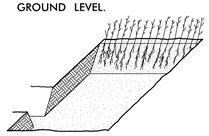
1. LOCATE A HEELING–IN SITE IN A SHADY, WELL PROTECTED AREA.
2. EXCAVATE A FLAT BOTTOM TRENCH 12 INCHES DEEP AND PROVIDE DRAINAGE.



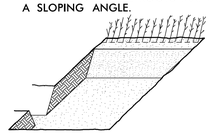
3. BACKFILL THE TRENCH WITH 2 INCHES WELL ROTTED SAWDUST. PLACE A 2 INCH LAYER OF WELL ROTTED SAWDUST AT A SLOPING ANGLE AT ONE END OF THE TRENCH.



4. PLACE A SINGLE LAYER OF PLANTS AGAINST THE SLOPING END SO THAT THE ROOT COLLAR IS AT HIGHER GROUND LEVEL.



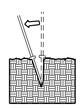
5. PLACE A 2 INCH LAYER OF WELL ROTTED SAWDUST OVER THE ROOTS MAINTAINING A SLOPING ANGLE.



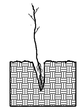
6. REPEAT LAYERS OF PLANTS AND SAWDUST AS NECESSARY AND WATER THOROUGHLY.

## DIBBLE PLANTING METHOD

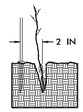
(USING THE KBC PLANTING BAR)



1. INSERT PLANTING BAR AS SHOWN AND PULL HANDLE TOWARDS PLANTER.



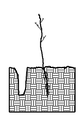
2. REMOVE PLANTING BAR AND PLACE SEEDLING AT CORRECT DEPTH.




3. INSERT PLANTING BAR 2 INCHES TOWARD PLANTER FROM SEEDLING.

4. PULL HANDLE OF BAR TOWARDS PLANTER, FIRMING SOIL AT BOTTOM.

5. PUSH HANDLE FORWARD FIRMING SOIL AT TOP.



6. LEAVE COMPACTION HOLE OPEN. WATER THOROUGHLY.

NOTES:

PLANTING BAG

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

KBC PLANTING BAR

2. 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

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

## BAREROOTED SEEDLINGS

*Conceptual Permanent Seed Mix*

| Scientific Name | Common Name | Approximate Percent of Mix | Application Rate |
|---|---|---|---|
| *Agrostis perennans* | Autumn bentgrass | 15 | 20 to 25 lbs/ acre |
| *Andropogon gerardii* | Big bluestem | 10 | |
| *Coreopsis lanceolata* | Lanceleaf coreopsis | 10 | |
| *Elymus virginicus* | Virginia wildrye | 20 | |
| *Panicum virgatum* | Switchgrass | 20 | |
| *Rudbeckia hirta* | Black-eyed susan | 10 | |
| *Schizachyrium scoparium* | Little bluestem | 5 | |
| *Sorghastrum nutans* | Indian grass | 5 | |
| *Tripsacum dactyloides* | Eastern gammagrass | 5 | |

*Conceptual Wetland Permanent Seed Mix*

| Scientific Name | Common Name | Approximate Percent of Mix | Application Rate |
|---|---|---|---|
| *Juncus effusus* | Soft rush | 15 | 10 to 15 lbs/ acre |
| *Carex lurida* | Shallow sedge | 15 | |
| *Carex vulpinoidec* | Fox sedge | 15 | |
| *Juncus coriaceous* | Leathery rush | 15 | |
| *Leersia oryzoides* | Rice cutgrass | 5 | |
| *Panicum anceps* | Beaked panicgrass | 15 | |
| *Helianthus angustifolius* | Swamp sunflower | 5 | |
| *Agrostis scabra* | Rough bentgrass | 15 | |

*Conceptual Temporary Riparian Seed Mix*

| Scientific Name | Common Name | Application Period | Application Rate |
|---|---|---|---|
| *Hordeum sp.* | Barley | Winter | 130 lbs/ acre |
| *Secale cereal* | Winter rye | Winter | 25 lbs/ acre |
| *Panicum ramosum* | Browntop millet | Summer | 40 lbs/ acre |
| *Pennisetum glaucum* | Pearl millet | Summer | 25 lbs/ acre |
| *Setaria italica* | German foxtail millet | Summer | 25 lbs/ acre |

## SEEDING SCHEDULE

PLANTING DETAILS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

01/11/2023 DATE
39077.34 PROJECT NO.
PLT-01 SHEET

ecoterra®


VHB Engineering NC, P.C. (C-3705)
940 Main Campus Drive, Suite 500
Raleigh, NC 27606

# PLANTING NOTES

## BARE ROOT SEEDLINGS

**Plant Selection**

- Species listed for the project should be grown from stock that corresponds to the same physiographic province in which they will be used.
- The designer reserves the right to reject any plant stock due to inferior qualities.

**Planting & Handling**

- Bare root seedlings will be planted according to vegetation details or as directed by the designer.
- All vegetation will be planted during the dormant season (December to March). Temperatures ranging from 36 to 60 degrees Fahrenheit are ideal for planting. Planting will not take place during periods exceeding this range of temperature. Planting will not take place during excessively windy conditions or other extreme conditions which may reduce vigor of the planting material.
- The designer reserves the right to reject any bare root seedling due to inferior quality. The designer also reserves the right to have any plant replanted due to improper planting techniques.
- All vegetation designated for a particular planting zone will be culled for inferior quality before being loaded into planting bags. Furthermore, these species will be thoroughly mixed prior to loading the planting bag, such that each planting zone will be planted in a random manner.
- All vegetation will be reviewed by the designer to ensure the highest quality of planting material throughout the entire process.

**Storage**

- Plant stock will be stored at temperatures between 36 to 40 degrees Fahrenheit in appropriate bags supplied by the plant producer when long-term storage is necessary.
- Only the necessary quantities of plant stock will be transported to the site on a daily basis. Large quantities of planting material will not be stored on-site during the planting process unless proper refrigeration is provided by the planting contractor.

## LIVE STAKING

**Plant Selection**

- All plant species used for live staking should conform to the specifications set forth in the vegetation details.
- Plant species listed for use as live stakes will be selected from plants found on the project site or as directed by the designer.
- Plant species used as live stakes will be collected during the dormant season (December to March) and during normal average daily temperatures for this period.

**Preparation & Handling**

- Plant species will be collected to conform to sizes specified in the vegetation details.
- Live stakes will be prepared by making a straight cut at the narrow end of the plant material forming a blunt end. The thicker end (toward the trunk) of the plant will be formed into a point.
- Live stake preparation will be done according to vegetation details unless otherwise specified by the designer.

**Planting**

- Live stakes should be prepared and planted immediately following collection. Proper storage techniques should be followed to ensure the highest rate of survival.
- Live stakes will be planted with the point of the live stake going into the soil and the blunt end facing up.
- Live stakes will be placed as deep as possible and as close to the water table as possible.
- Live staking will be done according to the vegetation details unless otherwise specified by the designer. The designer reserves the right to reject any live stake due to inferior quality. Likewise, any improperly planted live stake will be corrected by the planting contractor.

**Storage**

- Live stakes will be bundled and stored completely submerged in the stream channel in the event immediate staking is not permissible. Temporary storage will not exceed a three-week period.

## TRANSPLANT VEGETATION

**Selection & Handling**

- Transplant vegetation will be selected and flagged by the designer for use on the project site. The designer reserves the right to select any vegetation for transplant during any point of the project.
- Transplant vegetation will be planted within 1 day of being moved from its original location. If planting in desired location is not feasible, the transplant will be replanted or stored in a manner as to ensure its long-term survival. The designer will provide guidance throughout the process.

**NOTE:**

**ALL PLANTING SHALL OCCUR BY MARCH 15TH. ANY LATE PLANTING EXTENSION REQUESTS NEED TO BE APPROVED BY THE IRT AND MAY INVOLVE A POSTPONEMENT OF THE MY1 MONITORING PERIOD.**

PLANTING NOTES
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | PLT-02 |
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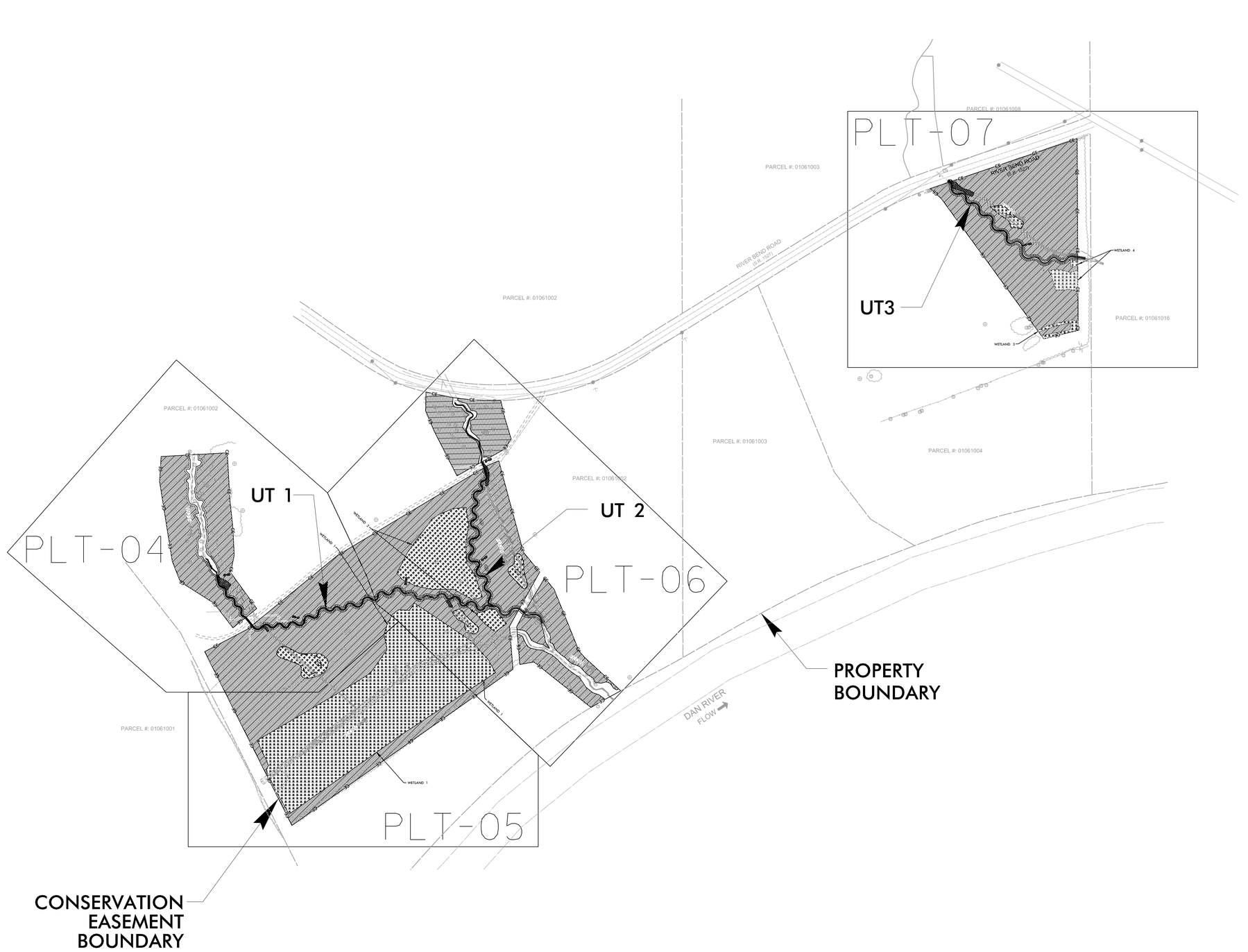


# PLANTING LAYOUT
FOR THE
# MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | PLT-03 |
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50 25 0 50 100

PARCEL #: 01061002

WETLAND 1

UT 1

MATCHLINE
-UT1- STA. 18+45
SEE PLT-05

CE

100YR FP

FLOODPLAIN
DEPRESSION

MATCHLINE
SEE PLT-06

***PLANTING ZONES:***

RIPARIAN WET

UPLANDS

STREAMSIDE

# PLANTING PLANS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
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| 01/11/2023 | 39077.34 | PLT-04 |
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\\vhb.com\Projects\Mushroom Meadow\Hyd\PLT04.dgn
User:Brad.Smith

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5/14/99

50 25 0 50 100

PARCEL #: 010610

100YR FP

CE

FLOODPLAIN DEPRESSION

UT 2

UT 1

WETLAND 2

WETLAND 1

MATCHLINE -UT1- STA. 18+45 SEE PLT-04

MATCHLINE SEE PLT-06

***PLANTING ZONES:***

RIPARIAN WET

UPLANDS

STREAMSIDE

# PLANTING PLANS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | PLT-05 |
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MATCHLINE
SEE PLT-04

MATCHLINE
SEE PLT-05

CE

WETLAND 1

***PLANTING ZONES:***

RIPARIAN WET

UPLANDS

STREAMSIDE

RIPARIAN WET

UPLANDS

STREAMSIDE

# PLANTING PLANS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | PLT-06 |
|---|---|---|
| DATE | PROJECT NO. | SHEET |

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Raleigh, NC 27606

1/11/2023
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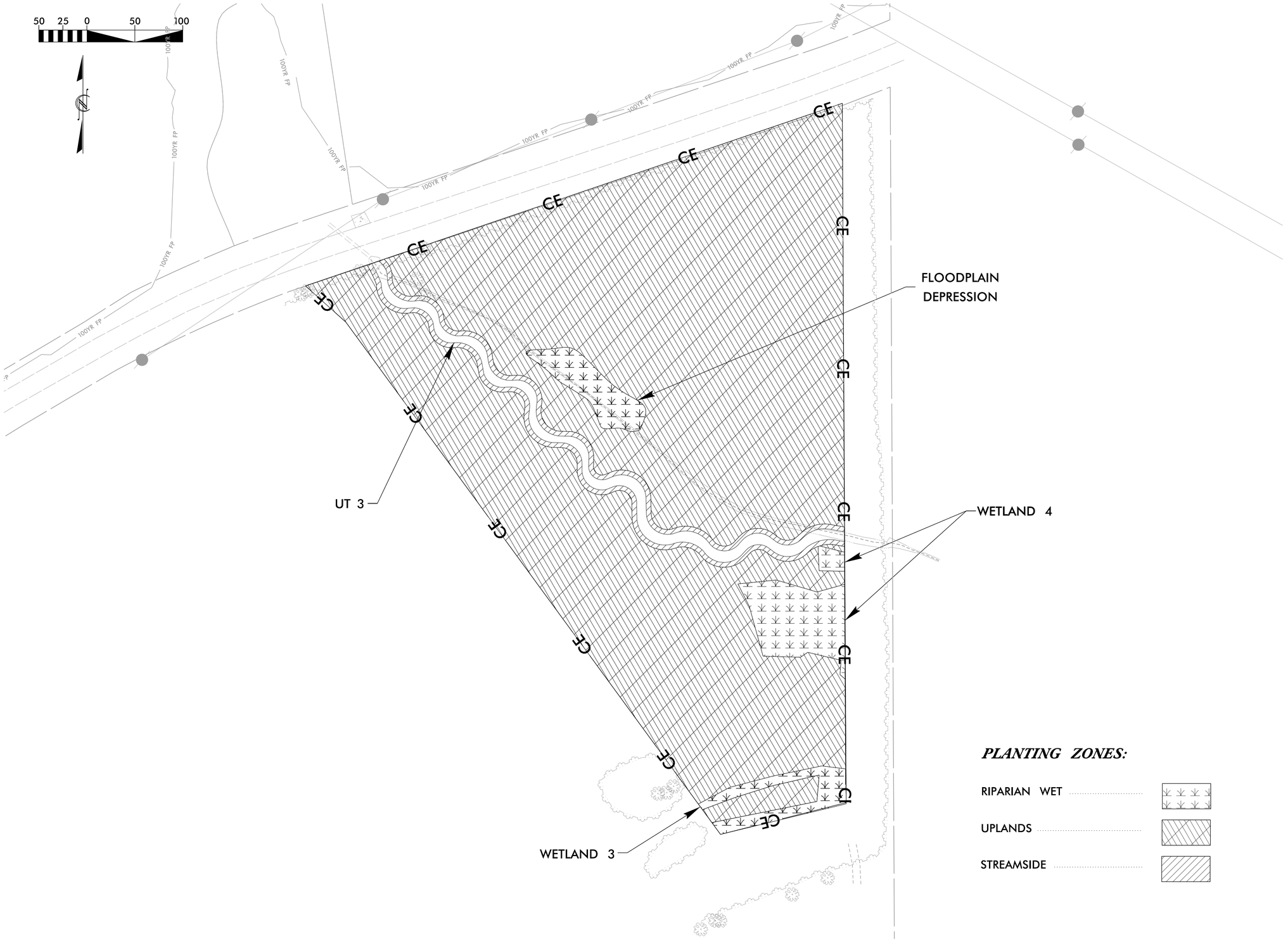


# PLANTING PLANS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | PLT-07 |
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# MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE

## SEDIMENTATION AND EROSION CONTROL PLAN

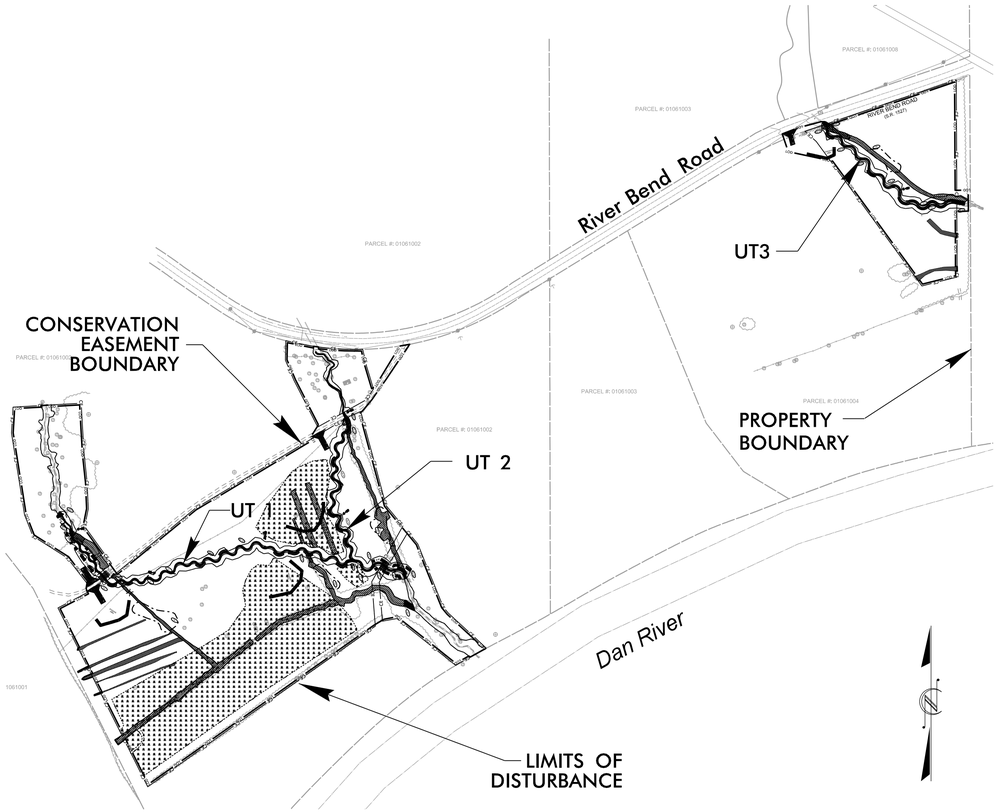
### CASWELL COUNTY, NORTH CAROLINA

DEVELOPMENT REFERENCE

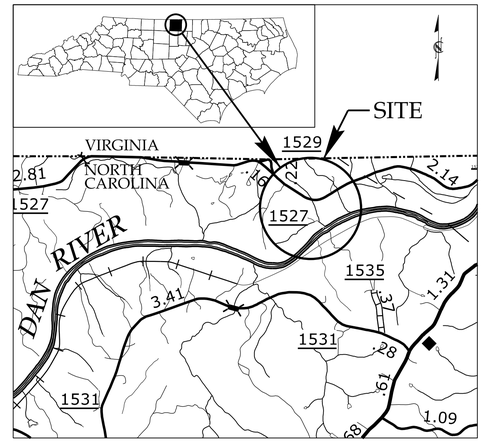
| | |
|---|---|
| OWNER/DEVELOPER | ECO TERRA PARTNERS, LLC |
| APPLICANT: | MICHAEL BEINENSON<br>1328 DEKALB AVE NE<br>ATLANTA, GA 30307<br>(404) 913–0020 |
| CIVIL ENGINEER: | REID B. ROBOL, PE<br>VHB ENGINEERING NC, P.C.<br>940 MAIN CAMPUS DR. SUITE 500<br>RALEIGH, NC 27606<br>(919) 754–5005 |
| SURVEYS: | BRAD KEE<br>KEE MAPPING & SURVEYING<br>88 CENTRAL AVENUE<br>ASHEVILLE, NC 28802<br>(828) 575–9021 |

***THESE EROSION AND SEDIMENT CONTROL PLANS COMPLY WITH THE REGULATIONS SET FORTH BY THE NCG–010000 GENERAL CONSTRUCTION PERMIT EFFECTIVE APRIL 1, 2019 AND ISSUED BY THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISION OF WATER RESOURCES.***

***TOTAL DISTURBED AREA = 33 ACRES***




VICINITY MAP




# 60% PLANS
# NOT FOR CONSTRUCTION

40 20 0 40 80

*GRAPHIC SCALE*

811 Know what's below. Call before you dig.

**IMPORTANT**
CONSTRUCTION CANNOT BEGIN UNTIL UTILITIES ARE PROTECTED.
CALL BEFORE YOU DIG. 1.800.632.4949

EROSION CONTROL TITLE SHEET
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
PREPARED FOR
ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | EC-01 |
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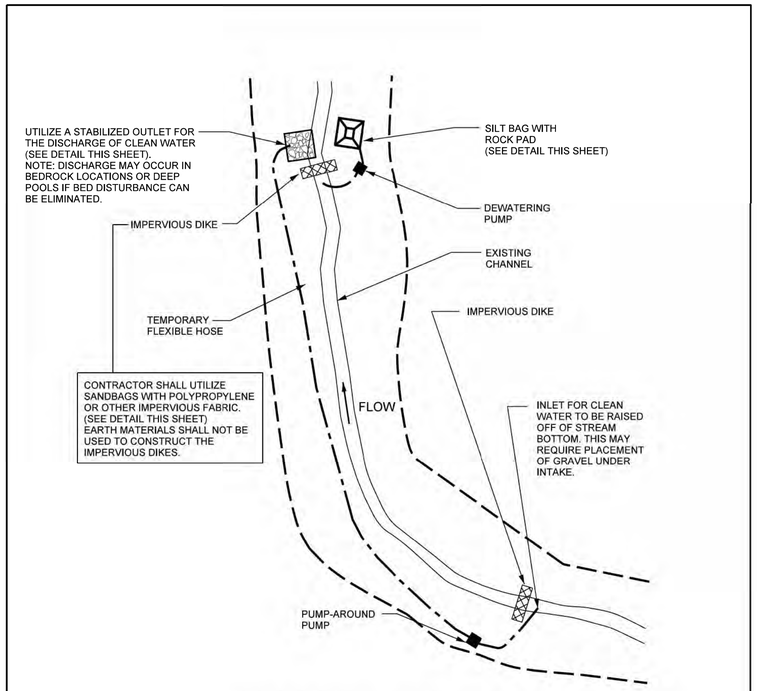


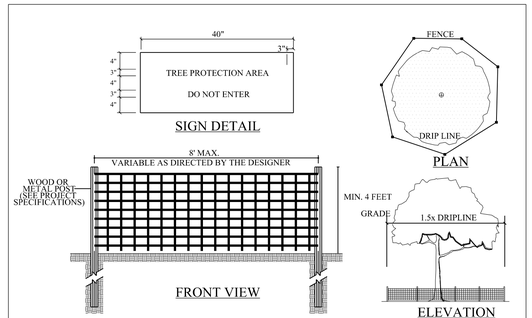

SEQUENCE OF DEWATERING OPERATIONS

* ANY DEVIATION FROM ABOVE DEWATERING PLAN WILL REQUIRE DESIGNER APPROVAL.

1. INSTALL SILT BAGS(S) AND ROCK PAD(S) AND STABILIZED OUTLET.
2. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
3. PLACE UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. PLACE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS. DEWATER ENTRAPPED AREA.
5. PERFORM REPAIR WORK IN ACCORDANCE WITH THE PLANS.
6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF IMPERVIOUS DIKES. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE (DOWNSTREAM IMPERVIOUS DIKES FIRST).
7. REMOVE SILT BAG(S) AND STABILIZE DISTURBED AREA WITH SEED AND MULCH.

## EXAMPLE OF PUMP-AROUND OPERATION

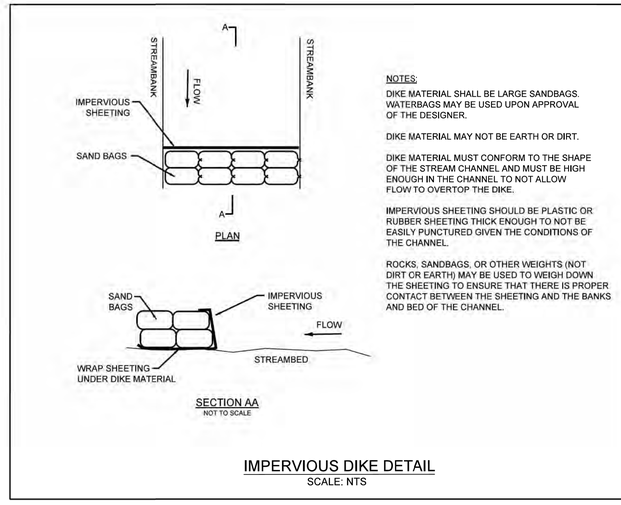
SCALE: NTS




NOTES:

TREE PROTECTION FENCE TO BE CONSTRUCTED OF POLYETHYLENE LAMINAR FENCING

## TREE PROTECTION FENCE (BLAZE ORANGE FENCE) Tp




NOTES:

DIKE MATERIAL SHALL BE LARGE SANDBAGS. WATERBAGS MAY BE USED UPON APPROVAL OF THE DESIGNER.

DIKE MATERIAL MAY NOT BE EARTH OR DIRT.

DIKE MATERIAL MUST CONFORM TO THE SHAPE OF THE STREAM CHANNEL AND MUST BE HIGH ENOUGH IN THE CHANNEL TO NOT ALLOW FLOW TO OVERTOP THE DIKE.

IMPERVIOUS SHEETING SHOULD BE PLASTIC OR RUBBER SHEETING THICK ENOUGH TO NOT BE EASILY PUNCTURED GIVEN THE CONDITIONS OF THE CHANNEL.

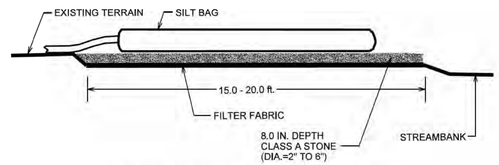
ROCKS, SANDBAGS, OR OTHER WEIGHTS (NOT DIRT OR EARTH) MAY BE USED TO WEIGH DOWN THE SHEETING TO ENSURE THAT THERE IS PROPER CONTACT BETWEEN THE SHEETING AND THE BANKS AND BED OF THE CHANNEL.

## IMPERVIOUS DIKE DETAIL

SCALE: NTS

STILLING BASIN MAINTENANCE:

1. SEDIMENT BAGS SHALL BE REPLACED AND DISPOSED OF WHEN IT IS THREE-QUARTERS FULL OF SEDIMENT OR WHEN IT IS IMPRACTICAL FOR THE BAG TO FILTER THE SEDIMENT OUT AT A REASONABLE FLOW RATE.
2. ACCUMULATED SEDIMENT SHOULD BE DISPOSED OF IN A DESIGNATED DISPOSAL AREA.
3. SPENT BAGS SHOULD BE DISPOSED OF PROPERLY AND NOT BURIED.
4. GRAVEL PADS SHOULD BE CHECKED DAILY DURING USE TO ENSURE THAT GRAVEL HAS NOT BEEN WASHED AWAY OR BEEN CHOKED BY EXCESSIVE SEDIMENTATION.
5. REPLACE PAD WITH CLEAN GRAVEL, AS NEEDED.




NOTE: PROVIDE STABILIZED OUTLET DOWN BANK TO STREAM

## SPECIAL STILLING BASIN (SILT BAG) WITH ROCK PAD

SCALE: NTS

# EROSION CONTROL DETAILS

FOR THE

MUSHROOM MEADOW MITIGATION BANK

PREPARED FOR

ECO TERRA PARTNERS, LLC

| 01/11/2023 | 39077.34 | EC-02.1 |
|---|---|---|
| DATE | PROJECT NO. | SHEET |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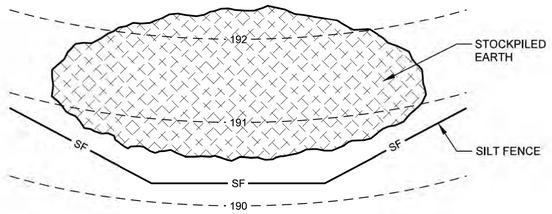



NOTES:

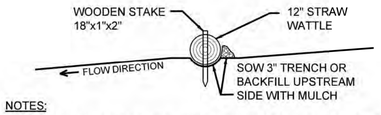
TEMPORARY SEEDING MUST BE APPLIED TO STOCKPILES IF NOT RELOCATED WITHIN 7 DAYS.

ALL STOCKPILES SHALL BE WITHIN LIMITS OF DISTURBANCE.

SILT FENCE SHALL BE INSTALLED DOWN GRADIENT OF ALL STOCK-PILES.

STOCKPILE LOCATIONS DEPICTED ON SITE PLANS ARE APPROXIMATE AND ARE SUBJECT TO CHANGE DEPENDING ON THE AREA THAT IS BEING WORKED UPON. EXACT LOCATION AND QUANTITY OF STOCKPILES WILL BE DETERMINED BY DESIGN REPRESENTATIVE IN THE FIELD.

## TEMPORARY STOCKPILE DETAIL
SCALE: NTS




NOTES;

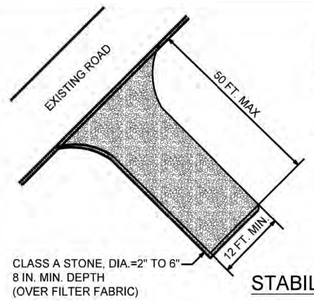
WATTLES SHALL BE INSTALLED IN ALL LOCATIONS SHOWN ON PLANS; AND ALSO ON TOP OF ANY FINISHED BANK OR TERRACE TIE-OUTS THAT ARE SUBJECT TO RILLING - EXAMPLE UT3.

WATTLES SHALL BE INSTALLED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.

ALL WATTLE JUNCTIONS SHALL BE OVERLAPPED AND STAKED TO ENSURE CONTINUOUS PROTECTION.

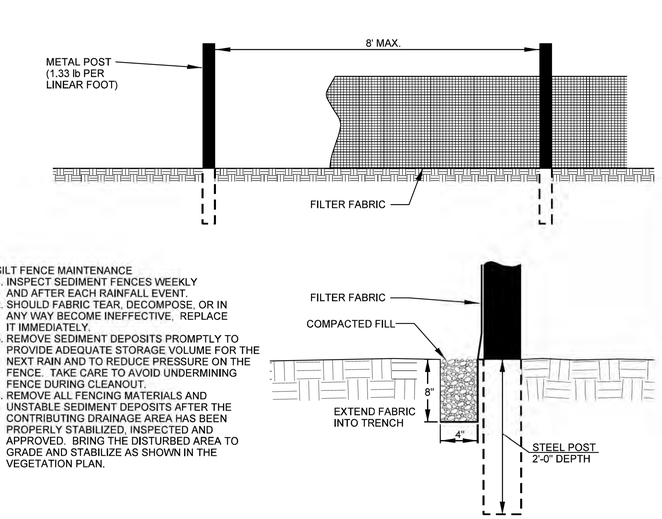
STAKES SHALL BE INSTALLED ALONG WATTLES AT 5 FEET SPACING.

## STRAW WATTLE DETAIL
NOT TO SCALE




NOTES:
1. TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS SHALL BE PROVIDED.
2. ENTRANCE(S) SHOULD BE LOCATED TO PROVIDE FOR UTILIZATION BY ALL CONSTRUCTION VEHICLES.
3. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOP DRESSING WITH STONE WILL BE NECESSARY.
4. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED UP IMMEDIATELY.
5. GRAVEL CONSTRUCTION ENTRANCE SHALL BE LOCATED AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE MUST BE PROVIDED.

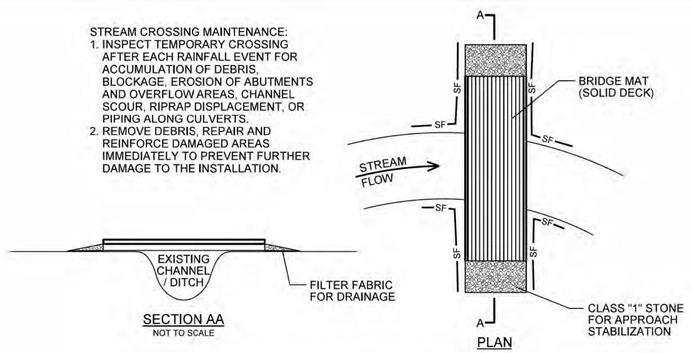
## STABILIZED CONSTRUCTION ENTRANCE DETAIL
SCALE: NTS




SILT FENCE MAINTENANCE
1. INSPECT SEDIMENT FENCES WEEKLY AND AFTER EACH RAINFALL EVENT.
2. SHOULD FABRIC TEAR, DECOMPOSE, OR IN ANY WAY BECOME INEFFECTIVE, REPLACE IT IMMEDIATELY.
3. REMOVE SEDIMENT DEPOSITS PROMPTLY TO PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAIN AND TO REDUCE PRESSURE ON THE FENCE. TAKE CARE TO AVOID UNDERMINING FENCE DURING CLEANOUT.
4. REMOVE ALL FENCING MATERIALS AND UNSTABLE SEDIMENT DEPOSITS AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED, INSPECTED AND APPROVED. BRING THE DISTURBED AREA TO GRADE AND STABILIZE AS SHOWN IN THE VEGETATION PLAN.

## SILT FENCE DETAIL
SCALE: NTS

STREAM CROSSING MAINTENANCE:
1. INSPECT TEMPORARY CROSSING AFTER EACH RAINFALL EVENT FOR ACCUMULATION OF DEBRIS, BLOCKAGE, EROSION OF ABUTMENTS AND OVERFLOW AREAS, CHANNEL SCOUR, RIPRAP DISPLACEMENT, OR PIPING ALONG CULVERTS.
2. REMOVE DEBRIS, REPAIR AND REINFORCE DAMAGED AREAS IMMEDIATELY TO PREVENT FURTHER DAMAGE TO THE INSTALLATION.




1. BRIDGE LOCATIONS DEPICTED ON SITE PLANS ARE APPROXIMATE AND ARE SUBJECT TO CHANGE DEPENDING ON THE AREA THAT IS BEING WORKED UPON. EXACT LOCATION AND QUANTITY OF STOCK PILES WILL BE DETERMINED BY DESIGN REPRESENTATIVE IN THE FIELD.
2. WIDTH OF EACH MAT IS DEPENDENT ON THE SIZE OF THE EQUIPMENT MEANT TO CROSS IT.
3. APPROACH STABILIZATION, COMPOSED OF CLASS 1 STONE, WILL BE REQUIRED FOR EACH SECTION OF THE BRIDGE.
4. BRIDGE SHALL BE CONSTRUCTED OF A SOLID DECK.

## TEMPORARY BRIDGE MAT CROSSING
SCALE: NTS

# EROSION CONTROL DETAILS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

01/11/2023 DATE
39077.34 PROJECT NO.
EC-02.2 SHEET

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Raleigh, NC 27606

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**GROUND STABILIZATION AND MATERIALS HANDLING PRACTICES FOR COMPLIANCE WITH THE NCG01 CONSTRUCTION GENERAL PERMIT**

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

**SECTION E: GROUND STABILIZATION**

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

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

**GROUND STABILIZATION SPECIFICATION**

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

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

**POLYACRYLAMIDES (PAMS) AND FLOCCULANTS**

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

**EQUIPMENT AND VEHICLE MAINTENANCE**

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

**LITTER, BUILDING MATERIAL AND LAND CLEARING WASTE**

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

**PAINT AND OTHER LIQUID WASTE**

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

**PORTABLE TOILETS**

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

**EARTHEN STOCKPILE MANAGEMENT**

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

NORTH CAROLINA *Environmental Quality*

**HERBICIDES, PESTICIDES AND RODENTICIDES**

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

**HAZARDOUS AND TOXIC WASTE**

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

# NCG01 GROUND STABILIZATION AND MATERIALS HANDLING

EFFECTIVE: 04/01/19

EROSION CONTROL DETAILS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

01/11/2023 DATE
39077.34 PROJECT NO.
EC-02.3 SHEET

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940 Main Campus Drive, Suite 500
Raleigh, NC 27606

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## PART III
## SELF-INSPECTION, RECORDKEEPING AND REPORTING

**SECTION A: SELF-INSPECTION**

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

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

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

## PART III
## SELF-INSPECTION, RECORDKEEPING AND REPORTING

**SECTION B: RECORDKEEPING**

**1. E&SC Plan Documentation**

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

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

**2. Additional Documentation to be Kept on Site**

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

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

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

**3. Documentation to be Retained for Three Years**

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

## PART III
## SELF-INSPECTION, RECORDKEEPING AND REPORTING

**SECTION C: REPORTING**

**1. Occurrences that Must be Reported**

Permittees shall report the following occurrences:

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

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

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

(d) Anticipated bypasses and unanticipated bypasses.

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

**2. Reporting Timeframes and Other Requirements**

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

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

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

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

(a) The E&SC plan authority has been provided with documentation of the non-surface withdrawal and the specific time periods or conditions in which it will occur. The non-surface withdrawal shall not commence until the E&SC plan authority has approved these items,
(b) The non-surface withdrawal has been reported as an anticipated bypass in accordance with Part III, Section C, Item (2)(c) and (d) of this permit,
(c) Dewatering discharges are treated with controls to minimize discharges of pollutants from stormwater that is removed from the sediment basin. Examples of appropriate controls include properly sited, designed and maintained dewatering tanks, weir tanks, and filtration systems,
(d) Vegetated, upland areas of the sites or a properly designed stone pad is used to the extent feasible at the outlet of the dewatering treatment devices described in Item (c) above,
(e) Velocity dissipation devices such as check dams, sediment traps, and riprap are provided at the discharge points of all dewatering devices, and
(f) Sediment removed from the dewatering treatment devices described in Item (c) above is disposed of in a manner that does not cause deposition of sediment into waters of the United States.

NORTH CAROLINA *Environmental Quality*

# NCG01 SELF-INSPECTION, RECORDKEEPING AND REPORTING

EFFECTIVE: 04/01/19

EROSION CONTROL DETAILS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

01/11/2023 DATE
39077.34 PROJECT NO.
EC-02.4 SHEET

ecoterra®

VHB Engineering NC, P.C. (C-3705)
940 Main Campus Drive, Suite 500
Raleigh, NC 27606

1/11/2023
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USER:rdavis

5/14/99

## PROJECT DESCRIPTION

THE PROJECT SITE IS LOCATED IN CASWELL COUNTY WITHIN THE TOWN OF MILTON AND IS WITHIN THE ROANOKE RIVER BASIN. THE PROPOSED PROJECT INCLUDES A STREAM RESTORATION OF APPROXIMATELY 2980 FEET SOUTH OF RIVER BEND ROAD. THE LIMITS OF DISTURBANCE WERE CALCULATED BASED ON COORDINATION WITH CONTRACTOR, LANDOWNER, AND ENGINEER FOR ANTICIPATED AREA THAT IS APPOXIMATELY 33 ACRES FOR THIS SITE. ALL DISTURBED AREAS WILL BE STABILIZED WITH VEGETATION BY SEEDING AND MULCHING.

THE PROJECT DESIGN SHALL COMPLY WITH NORTH CAROLINA LAND QUALITY GUIDELINES AND PROCEDURES AND ALL APPLICABLE FEDERAL, STATE, AND CITY REQUIREMENTS AND STANDARDS; IDENTIFYING AREAS WHERE RIGHT–OF–WAY OR EASEMENT ACQUISITION MAY BE NECESSARY TO ACCOMMODATE THE STREAM RESTORATION CONSTRUCTION.

## GENERAL NOTES

1. ANY STAGING, MATERIAL LAY DOWN, PARKING AREAS, OR WASTE PILES WILL BE LOCATED WITHIN THE ESTABLISHED LIMITS OF DISTURBANCE AND A MINIMUM OF 50' FROM ANY STORM DRAIN INLET, TEMPORARY DIVERSIONS, CHANNELS, OR SURFACE WATER BODIES. THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING ADEQUATE EROSION CONTROL MEASURES FOR ANY SUCH AREAS. IF ANY ADDITIONAL STAGING AREAS ARE REQUIRED BY THE CONTRACTOR, ANY ADDITIONAL EASEMENTS AND REGULATORY PERMITS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
2. ALL MATERIALS AND EQUIPMENT STORAGE AREAS WILL BE CONTAINED WITHIN LIMITS OF DISTURBANCE AND WILL BE LOCATED A MINIMUM OF 50' FROM ANY WATERCOURSE OR DRAINAGE STRUCTURES.
3. NO CONCRETE TRUCK WASHOUT IS ALLOWED WITHIN THE CONSTRUCTION LIMITS AND MUST BE PERFORMED AT AN APPROVED OFFSITE LOCATION.
4. PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL NOTIFY THE NCDEMLR REGIONAL OFFICE 48 HOURS IN ADVANCE TO SCHEDULE AN ON–SITE PRE–CONSTRUCTION MEETING WITH THE ENGINEER AND NCDEMLR STAFF.
5. UTILITIES ARE SHOWN IN APPROXIMATE MANNER ONLY. CONTRACTOR SHALL VERIFY LOCATION AND ELEVATION OF EXISTING UTILITIES PRIOR TO BEGINNING DEMOLITION, CONSTRUCTION OR LAND DISTURBING ACTIVITIES.
6. ALL CHANNEL AND STABILIZATION WORK SHALL OCCUR IN DRY WORKING CONDITIONS. A TEMPORARY PUMP AROUND SYSTEM SHALL BE UTILIZED TO MAINTAIN DRY WORKING CONDITIONS.
7. THE WORK SITE SHALL BE "STORM READY" AT THE END OF EACH WORK DAY.
8. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IMPLEMENTED ACCORDING TO THE NCDEMLR EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL.
9. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES MAY BE REQUIRED TO KEEP ALL SEDIMENT FROM ENTERING SURFACE WATERS.

## NURSE CROP SEEDING

PREPERATION FOR PRIMARY/PERMANENT STABILIZATION SHALL NOT BEGIN UNTIL ALL CONSTRUCTION AND UTILITY WORK WITHIN THE PREPARATION AREA IS COMPLETE. HOWEVER, IT MAY BE NECESSARY TO PREPARE FOR NURSE CROPS PRIOR TO COMPLETION OF CONSTRUCTION AND INSTALLATION OF UTILITIES.

A QUICKLY GERMINATING NURSE CROP OF NON–INVASIVE, NON–COMPETITIVE ANNUAL GRASS SPECIES SHOULD BE USED ALONG WITH NATIVE SEEDING AND/OR MATTING. THESE TEMPORARY MEASURES SHOULD BE PLANTED AT MINIMUM DENSITY AS TO NOT INHIBIT THE GROWTH AND ESTABLISHMENT OF THE PERMANENT, NATIVE SPECIES. REFER TO THE TEMPORARY SEEDING SCHEDULE FOR SPECIFIC NURSE CROP SPECIES AND SEEDING RATES.

## TEMPORARY SEEDING SCHEDULE

FERTILIZER SHALL BE THE SAME ANALYSIS AS SPECIFIED FOR PERMANENT SEEDING AND APPLIED AT THE RATE OF 400 POUNDS AND SEEDED AT THE RATE SPECIFIED IN THE TEMPORARY AND PERMANENT SEED MIX TABLE

## PERMANENT SEEDING SCHEDULE

SOIL AMENDMENTS

APPLY LIME AND FERTILIZER ACCORDING TO SOIL TESTS, OR APPLY A MINIMUM OF 2 TONS/ACRE GROUND AGRICULTURAL LIMESTONE AND 3 TONS/ACRE IN CLAY SOILS, AND 500 LB/ACRE 10–20–20 FERTILIZER. A DIFFERENT ANALYSIS OF FERTILIZER MAY BE USED PROVIDED THE 1–2–2 RATIO IS MAINTAINED AND THE RATE OF APPLICATION ADJUSTED TO PROVIDE THE SAME AMOUNT OF PLANT FOOD AS A 10–20–20 ANALYSIS AND AS DIRECTED.

MULCH

APPLY 4,000 LB/ACRE SMALL GRAIN STRAW OR EQUIVALENT COVER OF ANOTHER SUITABLE MULCH.

MAINTENANCE

REFERTILIZE IN THE SECOND YEAR UNLESS GROWTH IS FULLY ADEQUATE. MAY BE MOWED ONCE OR TWICE A YEAR, BUT MOWING IS NOT NECESSARY. THE MINIMUM MOWING HEIGHT SHALL BE 4". RESEED, FERTILIZE, AND MULCH DAMAGED AREAS IMMEDIATELY.

## TEMPORARY AND PERMANENT SEED MIX

**PERMANENT WETLAND HERBACEOUS SEED**

**(WITHIN BANKFULL CHANNEL TO END OF BUFFER)**

Permanent herbaceous seeds containing a custom mix of the following forbs and grasses will be used from within the wetland and floodplain depressions. The application timeframe for the mix is March through June and the minimum rate is 20 lbs/acre. This mix will also be used to plant the staging and stockpile areas and any other areas as directed by the designer.

| Common Name | Scientific Name | Mix Percentage | Wetland Status |
|---|---|---|---|
| BIG BLUESTEM | *ANDROPOGON GERARDII* | 10% +/- | FAC* |
| VIRGINIA WILDRYE | *ELYMUS VIRGINICUS* | 15% +/- | FACW |
| SOFT RUSH | *JUNCUS EFFUSUS* | 10% +/- | FACW |
| SWITCHGRASS | *PANICUM VIRGATUM* | 10% +/- | FAC |
| EASTERN GAMMAGRASS | *TRIPSACUM DACTYLOIDES* | 5% +/- | FACW |
| DICHANTHELIUM CLANDESTINUM | *DEERTONGUE* | 5% +/- | FAC |
| SWAMP SUNFLOWER | *HELIANTHUS ANGUSTIFOLIUS* | 5% +/- | FACW |
| BLUE VERVAIN | *VERBENA HASTATA* | 5% +/- | FACW |
| WOOLGRASS | *SCIRPUS CYPERINUS* | 10% +/- | FACW |
| FOX SEDGE | *CAREX VULPINOIDEA* | 15% +/- | OBL |
| BLUNT BROOMSEDGE | *CAREX SCOPARIA* | 10% +/- | FACW |
| | Total | 100% | |

**PERMANENT UPLAND HERBACEOUS SEED**

**(WITHIN BANKFULL CHANNEL TO END OF BUFFER)**

Permanent herbaceous seeds containing a custom mix of the following forbs and grasses will be used from within the bankfull channel to the limits of the riparian buffer. The application timeframe for the mix is March through June and the minimum rate is 20 lbs/acre. This mix will also be used to plant the staging and stockpile areas and any other areas as directed by the designer.

| Common Name | Scientific Name | Mix Percentage | Wetland Status |
|---|---|---|---|
| AUTUMN BENTGRASS | *AGROSTIS PERENNANS* | 10% +/- | FACU |
| BIG BLUESTEM | *ANDROPOGON GERARDII* | 10% +/- | FAC |
| LANCELEAF COREOPSIS | *COREOPSIS LANCEOLATA* | 10% +/- | FACU |
| SWITCHGRASS | *PANICUM VIRGATUM* | 10% +/- | FAC |
| BLACK-EYED SUSAN | *RUDBECKIA HIRTA* | 10% +/- | FACU |
| LITTLE BLUESTEM | *SCHIZACHYRIUM SCOPARIUM* | 10% +/- | FACU |
| INDIAN GRASS | *SORGHASTRUM NUTANS* | 10% +/- | FACU |
| DICHANTHELIUM CLANDESTINUM | *DEERTONGUE* | 10% +/- | FAC |
| PARTRIDGE PEA | *CHAMAECRISTA FASCICULATA* | 10%+/- | FACU |
| BUTTERFLY WEED | *ASCLEPIAS TUBEROSA* | 10% +/- | UPL |
| | Total | 100% | |

**TEMPORARY RIPARIAN SEED MIX**

| Scientific Name | Common Name | Application Period | Application Rate |
|---|---|---|---|
| *Hordeum sp.* | Barley | Winter | 130 lbs/ acre |
| *Secale cereal* | Winter rye | Winter | 25 lbs/ acre |
| *Panicum ramosum* | Browntop millet | Summer | 40 lbs/ acre |
| *Pennisetum glaucum* | Pearl millet | Summer | 25 lbs/ acre |
| *Setaria italica* | German foxtail millet | Summer | 25 lbs/ acre |

## CONSTRUCTION SEQUENCE

GENERAL SITE NOTES:

1. THE CONTRACTOR IS RESPONSIBLE FOR FOLLOWING THE SEQUENCE OF CONSTRUCTION IN ACCORDANCE WITH THE PLANS AND THE FOLLOWING PROVISIONS, AS DIRECTED BY THE DESIGNER. CONSTRUCTION SHALL PROCEED IN THE SPECIFIED MANNER UNLESS OTHERWISE DIRECTED OR APPROVED BY THE DESIGNER. THE FOLLOWING PROVISIONS, ALONG WITH THE INSTRUCTION CONTAINED IN THE PLANS, CONSTITUTE THE SEQUENCE OF CONSTRUCTION.
2. SUBMIT DOCUMENTATION REQUIRED UNDER THE SITE NPDES STORMWATER PERMIT FOR CONSTRUCTION ACTIVITY (NCG010000) TO STORMWATER INSPECTIONS THROUGHOUT THE PROJECT.
3. PRIOR TO STARTING CONSTRUCTION, CALL THE NCDEQ DIVISION OF LAND QUALITY AT (336) 776–9800 TO SCHEDULE AN ON–SITE PRE–CONSTRUCTION MEETING.
4. EROSION AND SEDIMENT CONTROL (ES&C) PERMIT AND A CERTIFICATE OF COVERAGE (COC) MUST BE OBTAINED BEFORE ANY LAND DISTURBING ACTIVITIES OCCUR. A COPY OF THE E&SC PERMIT, THE COC, AND A COPY OF THE PLAN MUST BE KEPT ON SITE, PREFERABLY IN A PERMITS BOX, AND ACCESSIBLE DURING INSPECTION.
5. THE CONTRACTOR SHALL ONLY CONDUCT STREAM WORK, INCLUDING ALL IN–STREAM STRUCTURES, GRADING, STABILIZATION MEASURES, AND SEEDING, MULCHING, AND MATTING WORK, ON A SECTION OF STREAM THAT SHALL BE ENTIRELY COMPLETED WITHIN A SINGLE DAY. EACH SECTION OF COMPLETED STREAM MUST BE STABILIZED AND MATTED BEFORE FLOW CAN BE RETURED INTO THE CHANNEL.
6. WHEN WORKING IN STREAM WITH NO ACTIVE FLOW THE CONTRACTOR IS REQUIRED TO HAVE APPROPRIATELY SIZED PUMPS AND MATERIALS TO INSTALL AND MAINTAIN A TEMPORARY STREAM DIVERSION IN ANTICIPATION OF POSSIBLE STORM EVENTS. WORKING IN A DRY CHANNEL DOES NOT PRECLUDE THE CONTRACTOR FROM HAVING TO COMPLY WITH NOTES ABOVE.
7. UPON APPROVAL FROM THE DESIGNER THE CONTRACTOR MAY PHASE CONSTRUCT SECTIONS OF STREAM AS DEEMED APPROPRATE USING THE GENERAL SITE NOTES, GENERAL PHASING NOTES AND GUIDANCE PROVIDED IN THE PLANS.
8. ALL CONSTRUCTION WORK SHALL BE DONE DURING PERIODS OF DRY WEATHER.
9. ALL STREAM CROSSINGS WILL BE LOCATED IN AREAS OF THE STREAM WHERE LEFT AND RIGHT BANK HEIGHTS ARE SIMILAR OR CAN BE GRADED TO PROVIDE A LEVEL, OR NEAR LEVEL CROSSING SURFACE. BRIDGE MATS CAN BE MADE OF WOOD OR STEEL, BUT MUST BE CAPABLE OF SUPPORING THE GROUND PRESSURE OF THE EQUIPMENT THAT WILL BE UTILIZING THE CROSSING. UPON ENSURING A LEVEL CROSSING SURFACE, THE BRIDGE MATS WILL BE LAID ACROSS THE CHANNEL IN A MATTER THAT DOES NOT DISRUPT STREAM FLOW OR CAUSE EROSION IN THE CHANNEL. THIS IS TYPICALLY ACHIEVED USING AN EXCAVATOR TO LIFT THE MATS ACROSS THE CHANNEL WITH CHAINS AND GUIDED AND SET BY A GROUND CREW. THE MATS MUST BE CONTINUOUS ACROSS THE CHANNEL, WITH NO GAPS THAT COULD ALLOW SEDIMENT TO ENTER THE STREAM.

## CONSTRUCTION SEQUENCE (CONTINUED)

10. SELF–INSPECTIONS FOR EROSION AND SEDIMENTATION CONTROL MEASURES ARE TO BE PERFORMED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN 24 HOURS OF EVERY RAIN EVENT OF GREATER THAN 0.5 INCH. ANY NEEDED REPAIRS SHALL BE MADE IMMEDIATELY TO MAINTAIN MEASURES AS DESIGNED. ALL ESC MEASURES SHALL BE MAINTAINED AS SPECIFIED IN THE CONSTRUCTION DETAILS ON THIS PLAN. A RAIN GAUGE SHALL BE INSTALLED AT THE PROJECT SITE FOR MONITORING.
11. ANY OFF–SITE BORROW AND WASTE REQUIRED FOR THIS PROJECT MUST COME FROM A SITE WITH AN APPROVED EROSION CONTROL PLAN, A SITE REGULATED UNDER THE MINING ACT OF 1971, OR A LANDFILL REGULATED BY THE DIVISION OF SOLID WASTE MANAGEMENT. TRASH/DEBRIS FROM DEMOLITION ACTIVITIES OR GENERATED BY ANY ACTIVITIES ON SITE MUST BE DISPOSED OF AT A FACILITY REGULATED BY THE DIVISION OF SOLID WASTE MANAGEMENT OR PER DIVISION OF SOLID WASTE MANAGEMENT OR DIVISION OF WATER RESOURCES RULES AND REGULATIONS.
12. EROSION CONTROL MEASURES MAY NOT BE REMOVED UNTIL PERMANENT GROUND COVER HAS BEEN WELL ESTABLISHED. ONCE PERMANENT GROUND COVER HAS BEEN ESTABLISHED THROUGHOUT THE SITE, ALL EROSION CONTROL MEASURES MAY BE REMOVED.
13. CONTACT THE DEMLR WINSTON SALEM REGIONAL OFFICE AT LEAST 48 HOURS PRIOR TO COMMENCING THE LAND DISTURBING ACTIVITY (336) 776–9800 TO CLOSE OUT THE E&SC PLAN.

GENERAL PHASING NOTES:

1. IDENTIFY THE PROJECT BOUNDARY, LIMITS OF DISTURBANCE, SENSITIVE AREAS, STAGING AREAS, STABILIZED ENTRANCES, TEMPORARY CROSSING AND ACCESS POINTS WITH THE DESIGNER.
2. CONSTRUCT ENTRANCE AND STAGING AREAS AND THEIR ASSOCIATED SEDIMENT AND EROSION CONTROL DEVICES IN A MANNER TO SUPPORT THE RESTORATION IN PHASES.
3. ENSURE THAT ALL SEDIMENT AND EROSION CONTROL MEASURES HAVE BEEN INSTALLED ALONG EXISTING AND NEW CHANNEL AND ARE IN WORKING CONDITION PRIOR TO CONDUCTING ANY LAND DISTURBING ACTIVITY.
4. ESTABLISH AN ISOLATED WORK AREA BY INSTALLING IMPERVIOUS DIKES AND TEMPORARY CHANNEL DIVERSION AND DIVERT FLOWS AROUND THE DESIGNATED WORK AREA.
5. COMPLETE CHANNEL OR WETLAND GRADING AS DIRECTED IN THE PLANS, INSTALL ANY BANK STABILIZATION TREATMENTS AND IN–STREAM STRUCTURES.
6. APPLY A BROADCAST HERBICIDE, GLYPHOSATE (ROUNDUP) OR SULFOMETURON (OUST), PRIOR TO PLANTING IN AREAS WHERE FESCUE IS PRESENT.
7. SEED AND MULCH COMPLETED WORK AREAS.

## MAINTENANCE REQUIREMENTS

1. EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CHECKED FOR STABILITY AND OPERATION FOLLOWING EVERY RUNOFF–PRODUCING RAINFALL OR AT A MINIMUM ONCE A WEEK. IF REPAIRS ARE NEEDED THEY WILL BE DONE SO IMMEDIATELY.
2. SEDIMENT WILL BE REMOVED FROM BEHIND SILT FENCING WHEN IT BECOMES 0.5 FT DEEP OR GREATER. SILT FENCING WILL BE REPLACED AS NECESSARY TO MAINTAIN AN ADEQUATE BARRIER.
3. EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CLEANED OUT AS NECESSARY.
4. ALL SEEDED AREAS WILL BE FERTILIZED, RESEEDED AS NECESSARY, AND MULCHED ACCORDING TO THE SPECIAL PROVISIONS IN ORDER TO MAINTAIN A VIGOROUS, DENSE VEGETATIVE COVER.

SOIL AMENDMENTS
In lieu of a soil test:

| | |
|---|---|
| Fertilizer | 10 – 10 – 10<br>1000 lb./acre |
| Lime * | 4000 lb./acre |

** Use ground, agricultural limestone, or pelletized dolomitic limestone

Mulch

Small grain mulch must be applied at a rate of 2 tons/acre to all seeded areas.

## SOIL PREPARATION

FOR AREAS THAT ARE TO BE SEEDED ALL STONES LARGER THAN 3 INCHES, STICKS, ROOTS, AND OTHER MATERIALS SHALL BE REMOVED. AREAS TO BE SEEDED OR PLANTED SHALL BE TILLED OR RIPPED TO A MINIMUM DEPTH OF 4 INCHES. LIME AND FERTILIZER SHALL BE APPLIED AS SPECIFIED IN THE SEEDING SCHEDULE.

EROSION CONTROL DETAILS
FOR THE
MUSHROOM MEADOW MITIGATION BANK
PREPARED FOR
ECO TERRA PARTNERS, LLC

01/11/2023
DATE

39077.34
PROJECT NO.

EC-02.5
SHEET

ecoterra®

VHB Engineering NC, P.C. (C–3705)
940 Main Campus Drive, Suite 500
Raleigh, NC 27606

5/14/99

**DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED**

# EC LAYOUT SHEET
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
PREPARED FOR
ECO TERRA PARTNERS, LLC

TO SR 735 (CEDAR ROAD)

RIVER BEND ROAD (S.R. 1927)

TO NC/VA 62

PARCEL #: 01061001

PARCEL #: 01061002

PARCEL #: 01061003

PARCEL #: 01061004

PARCEL #: 01061008

UT 1

UT 2

UT3

EC-04

EC-05

EC-06

FLOW

DAN RIVER FLOW

LIMITS OF DISTURBANCE

PROPERTY BOUNDARY

175 87.5 0 175 350

| 01/11/2023 | 39077.34 | EC-03 |
|---|---|---|
| DATE | PROJECT NO. | SHEET |

VHB Engineering NC, P.C. (C-3705)
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1/11/2023
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IISE Base Plot

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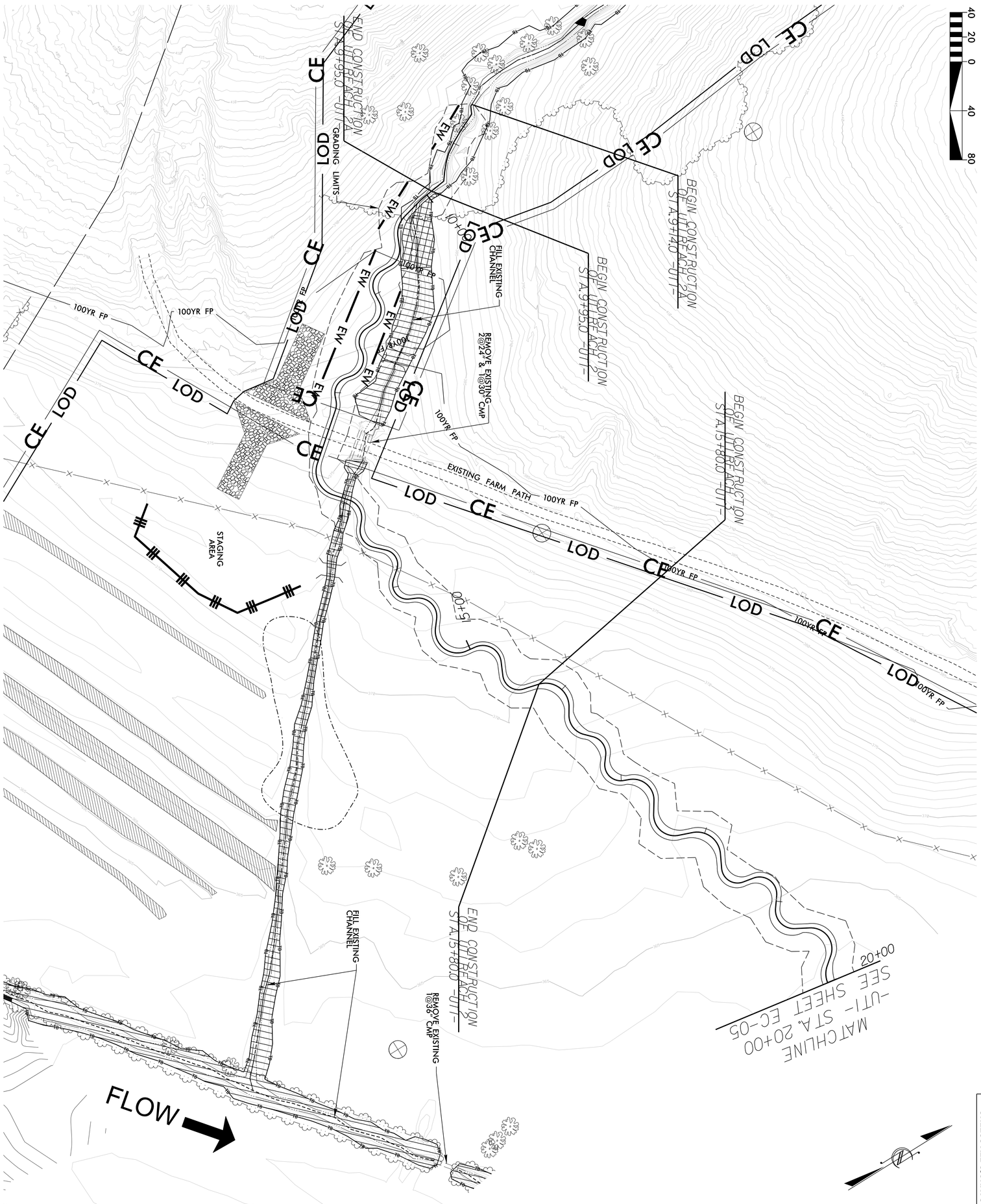


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Raleigh, NC 27606


| | |
|---|---|
| DATE | 01/11/2023 |
| PROJECT NO. | 39077.34 |
| SHEET | EC-04 |

EROSION CONTROL
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
PREPARED FOR
ECO TERRA PARTNERS, LLC

DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

40 20 0 40 80

BEGIN CONSTRUCTION
OF UT2 REACH 2
STA.10+21.55 –UT2–

END CONSTRUCTION
OF UT2 REACH 3
STA.19+54.9 –UT2–

FLOW

END CONSTRUCTION
OF UT2 REACH 2
STA.17+14.9 –UT2–

BEGIN CONSTRUCTION
OF UT2 REACH 3
STA.17+14.9 –UT2–

END CONSTRUCTION
OF UT1 REACH 3
STA.24+02 –UT1–

RETAIN 30" CMP
INV IN: 367.60'
INV OUT: 366.87'

FILL EXISTING CHANNEL

EXISTING FARM PATH

GRADING LIMITS

STAGING AREA

MATCHLINE –UT1–
STA. 20+00 SEE
SHEET EC-04

10+01

15+00

100YR FP

CE LOD EW CR-W

5/14/99

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EROSION CONTROL
FOR THE
MUSHROOM MEADOW STREAM AND
WETLAND MITIGATION SITE
PREPARED FOR
ECO TERRA PARTNERS, LLC

01/11/2023
DATE

39077.34
PROJECT NO.

EC-05
SHEET

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1/11/2023
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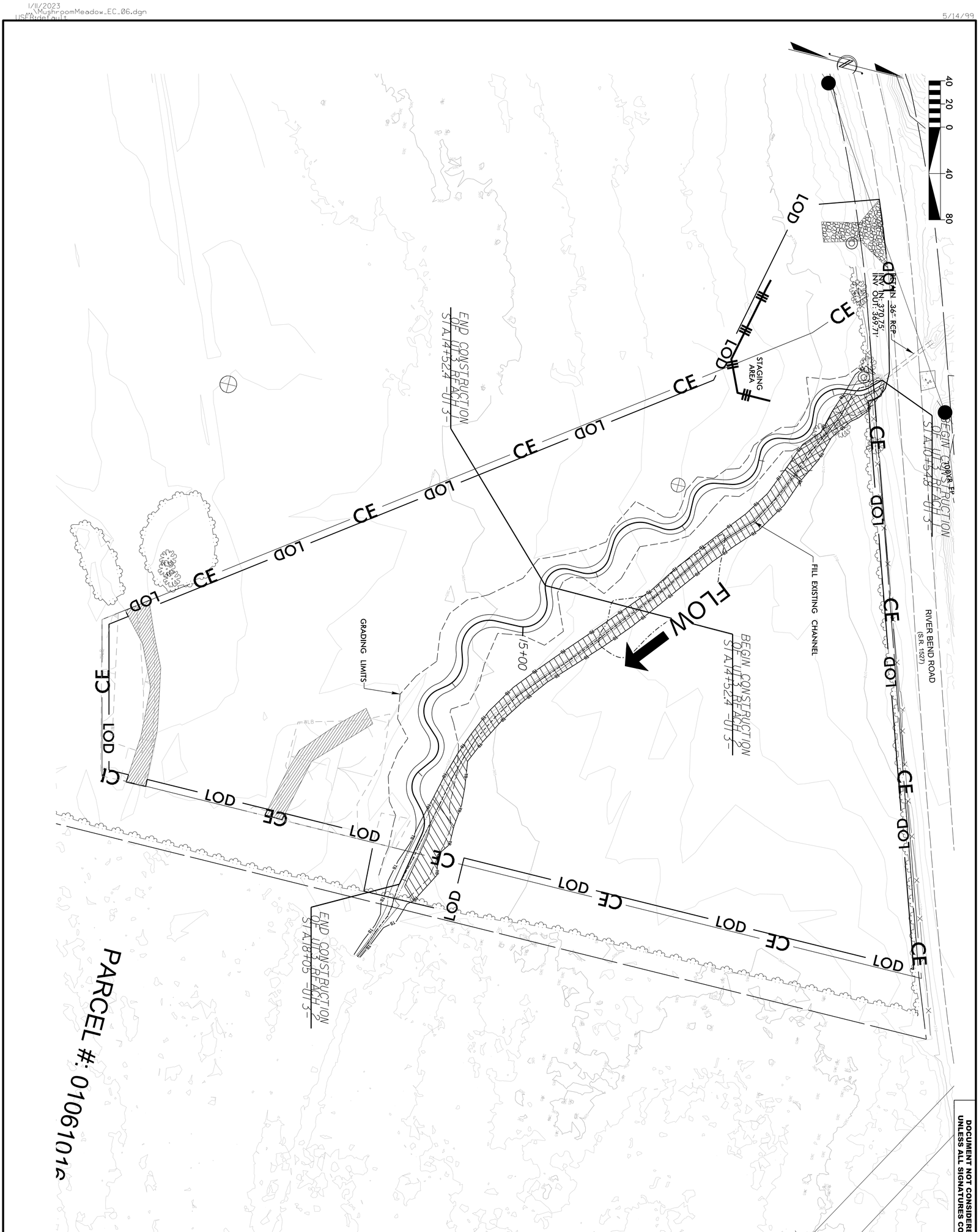
5/14/99

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| 01/11/2023 | DATE |
| 39077.34 | PROJECT NO. |
| EC-06 | SHEET |

EROSION CONTROL
FOR THE
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
PREPARED FOR
ECO TERRA PARTNERS, LLC

# Appendix E: Categorical Exclusion and Updated Species Table

# Categorical Exclusion Form for Division of Mitigation Services Projects
## Version 2

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

| Part 1: General Project Information | |
|---|---|
| **Project Name:** | Mushroom Meadow Stream & Wetland Mitigation Site |
| **County Name:** | Caswell |
| **DMS Number:** | 100192 |
| **Project Sponsor:** | Eco Terra Partners |
| **Project Contact Name:** | Norton Webster |
| **Project Contact Address:** | 1328 Dekalb Ave Atlanta, GA 30307 |
| **Project Contact E-mail:** | Norton@ecoterra.com |
| **DMS Project Manager:** | Jeremiah Dow |

**Project Description**

**For Official Use Only**

**Reviewed By:**

9/15/2021 — **Date**

 — **DMS Project Manager**

**Conditional Approved By:**

**Date**

**For Division Administrator FHWA**

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

**Final Approval By:**

9-14-21 — **Date**

Donald W Brew — **For Division Administrator FHWA**

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

| Part 3: Ground-Disturbing Activities<br>Regulation/Question | Response |
|---|---|
| **American Indian Religious Freedom Act (AIRFA)** | |
| 1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians? | ☐ Yes<br>☒ No |
| 2. Is the site of religious importance to American Indians? | ☐ Yes<br>☐ No<br>☒ N/A |
| 3. Is the project listed on, or eligible for listing on, the National Register of Historic Places? | ☐ Yes<br>☐ No<br>☒ N/A |
| 4. Have the effects of the project on this site been considered? | ☐ Yes<br>☐ No<br>☒ N/A |
| **Antiquities Act (AA)** | |
| 1. Is the project located on Federal lands? | ☐ Yes<br>☒ No |
| 2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity? | ☐ Yes<br>☐ No<br>☒ N/A |
| 3. Will a permit from the appropriate Federal agency be required? | ☐ Yes<br>☐ No<br>☒ N/A |
| 4. Has a permit been obtained? | ☐ Yes<br>☐ No<br>☒ N/A |
| **Archaeological Resources Protection Act (ARPA)** | |
| 1. Is the project located on federal or Indian lands (reservation)? | ☐ Yes<br>☒ No |
| 2. Will there be a loss or destruction of archaeological resources? | ☐ Yes<br>☐ No<br>☒ N/A |
| 3. Will a permit from the appropriate Federal agency be required? | ☐ Yes<br>☐ No<br>☒ N/A |
| 4. Has a permit been obtained? | ☐ Yes<br>☐ No<br>☒ N/A |
| **Endangered Species Act (ESA)** | |
| 1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county? | ☒ Yes<br>☐ No |
| 2. Is Designated Critical Habitat or suitable habitat present for listed species? | ☐ Yes<br>☒ No<br>☐ N/A |
| 3. Are T&E species present or is the project being conducted in Designated Critical Habitat? | ☐ Yes<br>☐ No<br>☒ N/A |
| 4. Is the project "likely to adversely affect" the specie and/or "likely to adversely modify" Designated Critical Habitat? | ☐ Yes<br>☐ No<br>☒ N/A |
| 5. Does the USFWS/NOAA-Fisheries concur in the effects determination? | ☐ Yes<br>☐ No<br>☒ N/A |
| 6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination? | ☐ Yes<br>☐ No<br>☒ N/A |

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

# National Historic Preservation Act (Section 106) NC SHPO Coordination

# North Carolina Department of Natural and Cultural Resources

**State Historic Preservation Office**

Ramona M. Bartos, Administrator

Governor Roy Cooper | Secretary D. Reid Wilson


March 24, 2021

Jamey O'Shaughnessey jamey@ecoterra.com
EcoTerra
1117 Peachtree Walk Northeast, Suite 126
Atlanta, GA 30309

RE: Mushroom Meadow stream and wetland mitigation site, Milton, Caswell County, ER 21-0575

Dear Mr. O'Shaughnessey,

Thank you for your February 12, 2021, letter concerning the above-referenced undertaking. We have reviewed the materials submitted and offer the following comments.

The proposed area of disturbance has never been systematically surveyed for archaeological resources. There are several nearby archaeological sites that have been determined eligible or potentially eligible for the National Register of Historic Places based on their ability to provide significant information about prehistoric Native American settlements. Given the nature of this landscape along the Dan River and proximity to other archaeological resources, we have determined that there is a high probability that additional archaeological resources may be present within the proposed area of disturbance.

Prior to initiation of any ground disturbing activities within the project area, we recommend that a comprehensive archaeological survey of the proposed area of disturbance be conducted by an experienced archaeologist to identify and evaluate the significance of any archaeological remains that may be damaged or destroyed by the proposed project.

This work should be conducted by an experienced archaeologist that meets the Secretary of the Interior professional qualification standards. A list of archaeological consultants who have conducted or expressed an interest in contract work in North Carolina is available at https://archaeology.ncdcr.gov/archaeological-consultant-list. The archaeologists listed, or any other experienced archaeologist, may be contacted to conduct the recommended survey. **Please note that our office requests consultation with the Office of State Archaeology Review Archaeologist to discuss appropriate field methodologies prior to the archaeological field investigation.**

One paper copy and one digital copy (PDF) of all resulting archaeological reports, as well as a digital copy (PDF) of the North Carolina Site Form for each site recorded, should be forwarded to the Office of State Archaeology (OSA) through this office, for review and comment as soon as they are available and in advance of any construction or ground disturbance activities. OSA's Archaeological Standards and Guidelines for Background Research, Field Methodologies, Technical Reports, and Curation can be found online at: https://archaeology.ncdcr.gov/osa-guidelines.

We have determined that the project as proposed will not have an effect on any historic structures.

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 919-814-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona Bartos, Deputy
State Historic Preservation Officer

# North Carolina Department of Natural and Cultural Resources

**State Historic Preservation Office**

Ramona M. Bartos, Administrator

Governor Roy Cooper | Secretary D. Reid Wilson


August 26, 2021

Jonathan Libbon jlibbon@swca.com
SWCA Environmental Consultants
80 Emerson Lane, Suite 1306
Bridgeville, Pennsylvania 15017

Re: Mushroom Meadow stream and wetland mitigation site, 36°32'11.12"N 79°14'14.53"W, River Bend Road, Milton, Caswell County, ER 21-0575

Dear Mr. Libbon:

Thank you for your July 22, 2021, letter transmitting the report for the above-referenced undertaking. We have reviewed the report and offer the following comments.

We concur that the following property is not eligible for the National Register for the reasons outlined in the report:

• Site 31CS121 does not have the potential to yield significant information pertaining to prehistory.

We ask that you make the following revisions to the draft report:

Individual site descriptions within the report should include a site map, showing site boundaries, shovel test locations, features if present, and relevant landmarks; at least one representative photograph of the site vicinity; and site stratigraphy with reference to shovel test profiles and at least one representative photograph.

Please note that digital copies of site forms and reports should be submitted on a CD or USB flash drive through this office.

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 919-814-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona Bartos, Deputy
State Historic Preservation Officer

cc: Jamey O'Shaughnessey jamey@ecoterra.com
Casey M. Haywood Casey.m.haywood@usace.army.mil

# PHASE I ARCHAEOLOGICAL INVESTIGATION OF THE MUSHROOM MEADOW STREAM AND WETLAND MITIGATION PROJECT, CASWELL COUNTY, NORTH CAROLINA

SEPTEMBER 2021

PREPARED FOR

**EcoTerra**

PREPARED BY

**SWCA Environmental Consultants**

# PHASE I ARCHAEOLOGICAL INVESTIGATION OF THE MUSHROOM MEADOW STREAM AND WETLAND MITIGATION PROJECT, CASWELL COUNTY, NORTH CAROLINA

*ER# 21-0575*

Prepared for

**EcoTerra**
1117 Peachtree Walk NE
Atlanta, Georgia 30309
Attn: Norton Webster

Prepared by

**SWCA Environmental Consultants**
201 Chatham Street, Suite 3
Sanford, NC 27330
(919) 292-2200
www.swca.com

SWCA Project No. 00066864-000-RDU

SWCA Cultural Resources Report No. 21-388

September 2021

# ABSTRACT

EcoTerra is proposing to construct the Mushroom Meadow Stream and Wetland Mitigation Project (project) in Caswell County, North Carolina. The project will provide mitigation for unavoidable stream and wetland impacts in the Roanoke River Basin. The full project area consists of a 31.6-acre (12.8-hectare) parcel located adjacent to the Dan River, west of Milton, North Carolina. For the purposes of the Phase I archaeological survey, the area of potential effects (APE) for the project is 16.5 acres (12.8 hectares) within the larger project parcel and consists of the area where all ground disturbance will take place. The North Carolina Division of Mitigation Services is the lead agency for the project.

Survey activities were conducted in accordance with Section 106 of the National Historic Preservation Act and its implementing regulations, found at 36 Code of Federal Regulations (CFR) 800. The Phase I survey was also conducted in accordance with applicable federal and state guidelines and requirements, including the North Carolina Office of State Archaeology (OSA) *Archaeological Investigations Standards and Guidelines* (OSA 2017).

SWCA Environmental Consultants (SWCA) conducted the Phase I archaeological fieldwork between June 21 and June 24, 2021. Fieldwork consisted of a visual inspection and shovel testing of the APE. No previously recorded archaeological sites are located within the APE. During the survey, investigators identified a non-diagnostic lithic biface fragment within the APE. Radial shovel testing did not identify any associated cultural material. The isolated find was registered with the North Carolina OSA and given the resource number 31CS121. The isolated find is not eligible for listing on the National Register of Historic Places. SWCA recommends that the proposed development will have no effect on any historic properties, and construction should be allowed to proceed as planned.

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# CONTENTS



## Appendices

# Figures



# Tables

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# INTRODUCTION

SWCA Environmental Consultants (SWCA) conducted a Phase I archaeological investigation on behalf of Eco Terra in support of the Mushroom Meadows Wetland and Stream Mitigation Project (project) (Figure 1). EcoTerra is proposing to place a conservation easement on a 31.6 acres (12.8-hectare) parcel located adjacent to the Dan River. The project will restore streams and wetland hydrology within the project parcel and establish native hardwood trees, for the purpose of providing mitigation for unavoidable steam and wetland impacts in the Roanoke River Basin. The area of potential effects (APE) for the Phase I archaeology survey consists of 16.5 acres (12.8 hectares) within the larger project parcel and consists of the area where all ground disturbance will take place.

The project is located 1.9 miles (3.1 kilometers [km]) west of Milton, North Carolina, on privately owned land, as shown on the 1997 Milton, Virginia, and North Carolina, 7.5-minute U.S. Geological Survey (USGS) quadrangle (Figure 2). At the time of the survey, the APE consisted of pasture with dense scrub and mature tree vegetation along established stream channels (Figure 3).

SWCA conducted the Phase I survey between June 21 and 24, 2021. Heather Adams, RPA and Evan Flannery conducted the fieldwork. Jonathan R. Libbon, RPA, is the principal investigator for the project, and oversaw the fieldwork and report preparation. During the survey investigators identified an isolated find (31CS121), consisting of a precontact non-diagnostic biface. Based on the results of the survey, no further archaeological work is recommended by SWCA at this time.

This report outlines the results of the Phase I survey for the project. This report is structured in accordance with the North Carolina Office of the State Archaeology (OSA) *Archaeological Investigations Standards and Guidelines* (OSA 2017) (Guidelines). The following section provides the environmental context for the project and is followed by the archaeological and cultural background of the project area. The methodology utilized during the fieldwork is then presented. Following the methodology section, results of the survey are provided, as well as project recommendations.

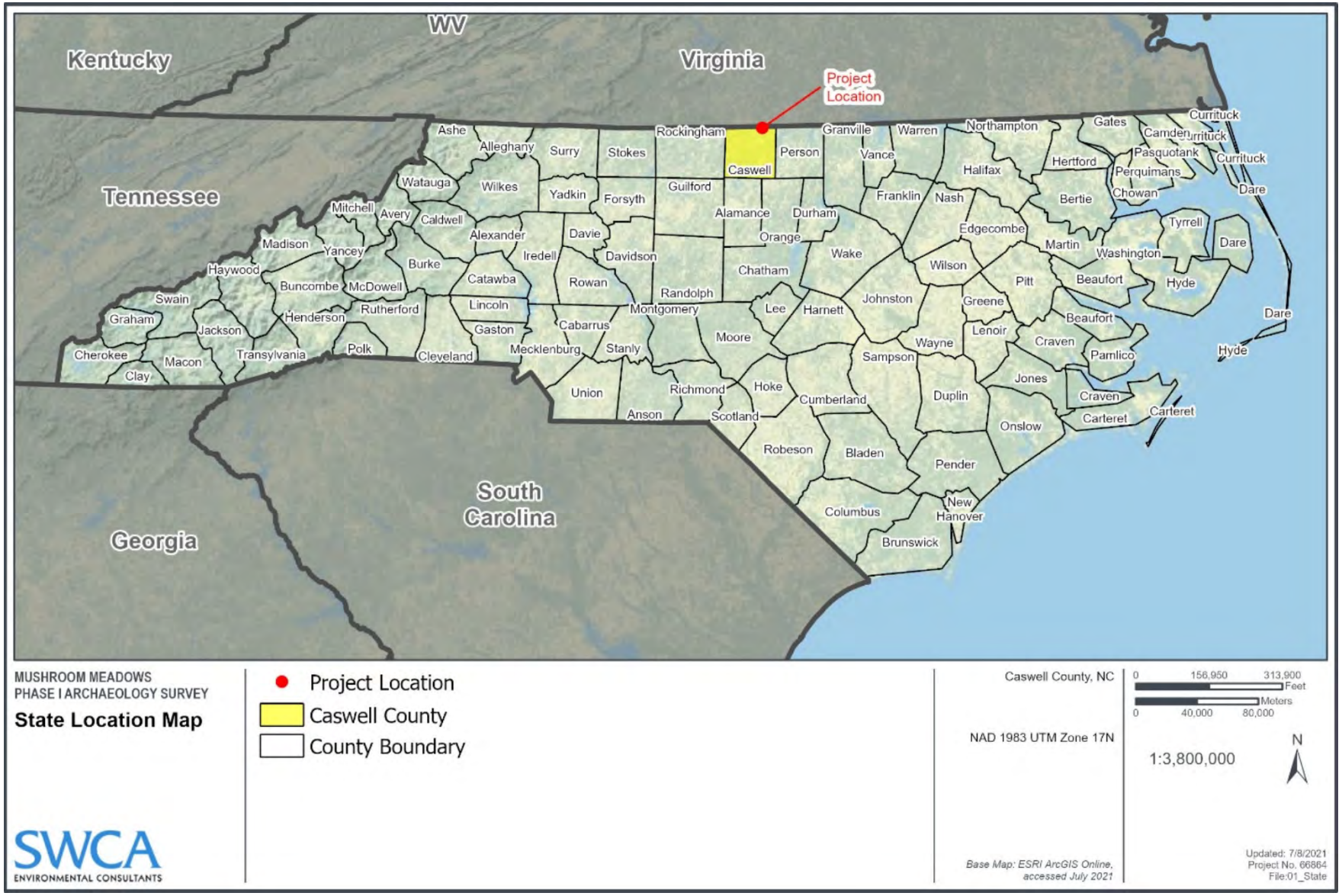


**Figure 1. Proposed location of the project within Caswell County, North Carolina.**

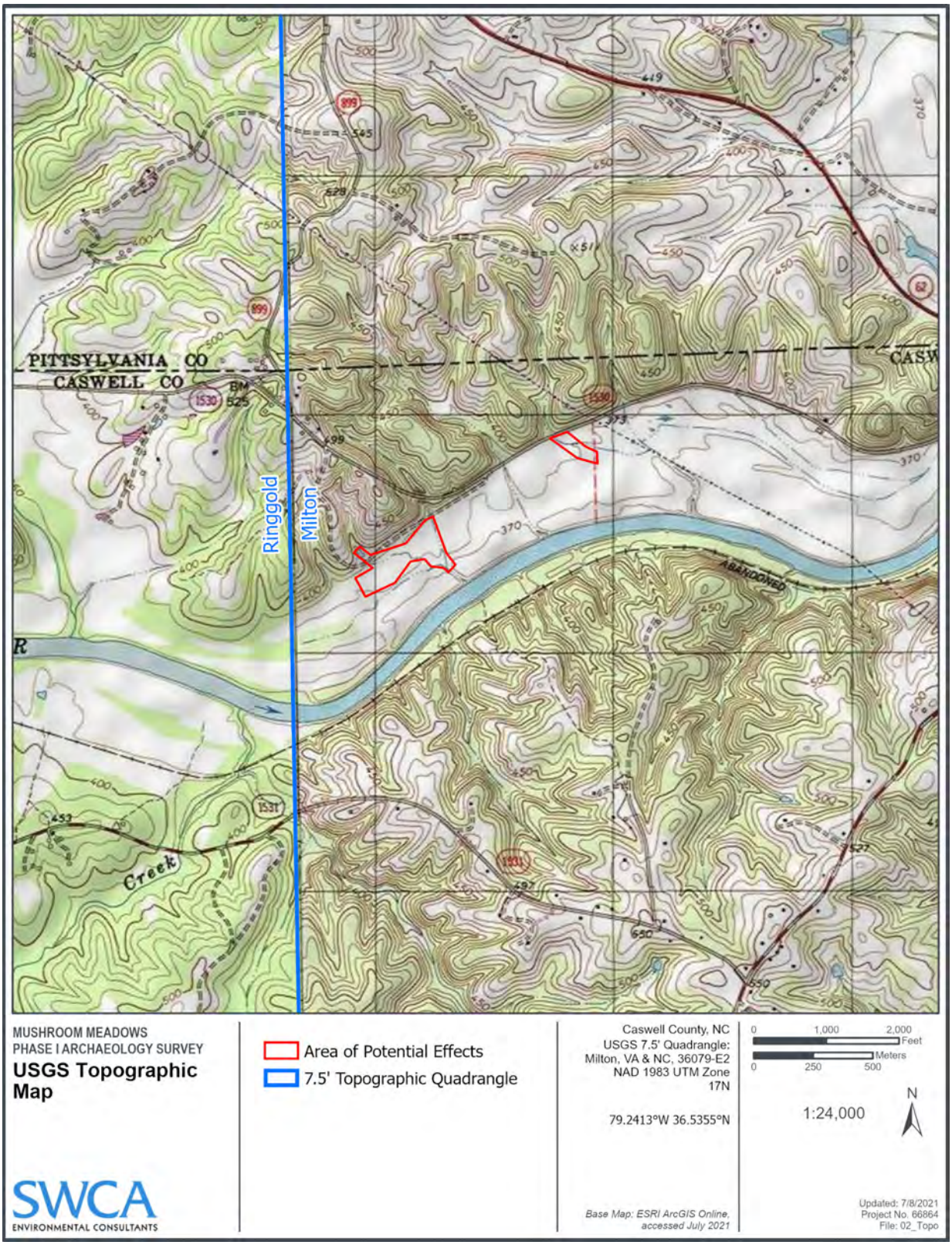


**Figure 2. Project APE shown on the 1997 USGS 7.5-Minute Topographic Milton, NC and VA Quadrangle.**


**Figure 3. Project APE shown on aerial imagery.**

# ENVIRONMENTAL SETTING

The focus of this chapter will be to show the factors of the environment that have influenced the historic and precontact occupation of the project area. A discussion of relevant factors such as physiography, geology, topography, soils, hydrology, climate, flora and fauna, and current and past land use will help provide an understanding of the local environment. This information will then be synthesized with the cultural context of the region, provided in the following section, to facilitate a discussion of archaeological probability in the project area and help guide the field methodology.

## Physiography

The project is located within the Piedmont physiographic province. The Piedmont province lies between the Coastal Plain and the Blue Ridge Mountains. The province is characterized by gently rolling, well-rounded hills and long low ridges with a few hundred feet of elevation difference between the hills and valleys (North Carolina Department of Environmental Quality 2020).

The Fall Line, which is located east of the APE, was a major landmark in the precontact landscape, as it represented a boundary between the Coastal Plain region and the Piedmont region. For precontact groups, key lithic resources such as quartz and quartzite are typically abundant near the Fall Line. Due to the prevalence of this key resource, precontact site density is much higher in proximity to the Fall Line (Abbot et al. 2011).

## Geology

The Piedmont Province was a gently sloping plain until uplift raised the region to its present elevation and streams consequently incised into the bedrock to form the hilly terrain present today. The exposed bedrock of the Piedmont has been physically and chemically weathered so that a moderately deep zone of reddish soil and soft, decayed rock is characteristic of the region (Billingsley et al. 1957:3).

According to the North Carolina Geological Survey (1985), the region is mapped as being underlain by Metamorphic Rocks, which consists of biotite gneiss and schist intruded by numerous sills and dikes of granite, pegmatite, and aplite.

## Soils

A review of the Natural Resources Conservation Service (NRCS) Web Soil Survey Database (NRCS 2020) identified multiple soil types within the project APE (Table 1). Soils found in the project area have a relatively shallow soil profile for alluvium, but typically lack buried horizons. The majority of the APE is mapped as Codorus loam, which has a mapped soil profile of the following:

- Ap Horizon: 0 to 23 centimeters [cm] (0 to 9 inches)
- Bw1 Horizon: 23 to 46 cm (9 to 18 inches)
- Bw2 Horizon: 46 to 76 cm (18 to 30 inches)
- C Horizon: 76 to 165 cm (30 to 65 inches)

**Table 1. Soils within the Area of Potential Effects**

| Map Unit Symbol | Map Unit Name | Percentage of APE | Landform | Drainage Class | Parent Material |
|---|---|---|---|---|---|
| CsA | Codorus loam, 0 to 2 percent slopes, frequently flooded | 89% | Flood plains | Somewhat poorly drained | Loamy alluvium derived from igneous and metamorphic rock |
| DnA | Dan River loam, 0 to 2 percent slopes, occasionally flooded | 6% | Flood plains | Well drained | Loamy alluvium derived from igneous and metamorphic rock |
| FaD | Fairview sandy loam, 15 to 25 percent slopes | 1% | Interfluves | Well drained | Residuum weathered from gneiss and/or schist |
| FbC2 | Fairview sandy clay loam, 8 to 15 percent slopes, moderately eroded | 4% | Interfluves | Well drained | Residuum weathered from gneiss and/or schist |

Source: NRCS (2021)

# Hydrology

The project area drains to the south into the Dan River, which is part of the larger Roanoke River Basin. The Dan River flows to the northeast, where it joins the Roanoke River, north of Buffalo Springs, Virginia. The Roanoke River then flows to the southeast, eventually flowing into the Albemarle Sound near Plymouth, North Carolina.

# Climate

The region receives on average 37 to 45 inches of rain per year. While the precipitation is generally evenly distributed throughout the year, the most rainfall occurs during high-intensity convective thunderstorms during mid-summer. The average freeze-free period is 230 days, and the average annual temperature ranges between 53 and 64 degrees Fahrenheit (NRCS 2006:440).

# Flora and Fauna

The region supports mixed hardwood-pine vegetation. This vegetative community is primarily composed of loblolly pine, slash pine, white oak, red oak, sweetgum, yellow poplar, and sycamore. The understory includes dogwood, honeysuckle, pinehill bluestem, and briars. Biotic communities found in the region consist of white-tailed deer, cottontail, squirrel, bobwhite quail, and mourning dove (NRCS 2006:440–441).

# Paleoenvironment

Large paleoenvironmental studies across much of the Southeast have provided detailed information on climate and vegetative communities in the Pleistocene and the early to mid-Holocene epochs (Anderson et al. 1996:4). The project area, during the Pleistocene, was located close to the border of the full glacial boreal forest, which was dominated by jack pine and spruce (Delcourt and Delcourt 1983). Coniferous forests, during the late Pleistocene, were probably park-like and not as homogeneous as modern forests in the region. Around 10,500 B.C., modern plant communities started to develop, often creating complex ecosystems where modern flora and fauna interacted with extinct species (Delcourt 1978). At the start of the Holocene, there was an increase in precipitation and the climate became warmer. This shift facilitated the establishment of modern plant communities and the extinction of numerous

Pleistocene species. Homogeneous oak and hickory woodlands replaced the park-like spruce and jack pine forests (Bryson et al. 1970; Watts 1975). The warmer and wetter climate of the early Holocene came to an end with the hypsithermal. The hypsithermal lasted from 6000 to 3000 B.C. and is characterized by a decrease in precipitation.

Environmental reconstructions using tree rings in Sampson County, North Carolina, have provided information on more recent environmental conditions. Stahle et al. (1988) sampled bald cypress trees along the Black River in Sampson County, which are considered to be the oldest trees in eastern North America. The trees' estimated age is believed to be 1,700 years old. The results of the dendroclimatology study showed that between 1000 A.D. and 1300 A.D. there were several long droughts. These droughts were followed by wetter conditions in the Little Ice Age (1300–1600 A.D.). Stahle et al. (1988) also identified oscillating rainfall patterns that switch between heavier levels of annual precipitation and lighter levels, approximately every 30 years.

# Current Land Use

Currently the project APE is undeveloped and used as an active cattle pasture. Aerial imagery from 1985 to present shows a consistent land use, with well-established tree lines separating unimproved pasture or fallow agricultural fields. Figures 4 through 6 depict the current land use across the project area.

**Figure 4. Overview of project area, facing northeast.**

**Figure 5. Overview of the eastern portion of the project area, facing northwest.**

**Figure 6. View of established creek channel in the southern portion of the project area, facing west.**

# ARCHAEOLOGICAL AND CULTURAL BACKGROUND

This section provides an overview of the precontact and historic period occupation of the project area. This cultural context will be used to better understand the results of the survey and how they fit into what is known about the past. Following this section, a summary of previous archaeological investigations will be provided. Building on what is known about the past and research conducted in proximity to the project, a probability assessment of the project area will be provided.

## Cultural Context

### *Paleoindian Period (16,500 B.P.–CA. 10,000/9000 B.P.)*

Where and when the first humans arrived in the Western Hemisphere has been the subject of much debate amongst archaeologists. The temporal boundary associated with the Clovis tradition in eastern North America typically dates to approximately 11,500 B.C. (Anderson et al. 2007; Goodyear 2006). The few sites that have been reported to contain early deposits, often referred to as 'Pre-Clovis', have come under fierce scrutiny by the archaeological community. Monte Verde, in South America, represents one of the oldest generally accepted sites in the Western Hemisphere (Dillehay 2000:160-168). The Pre-Clovis discussion in eastern North America has focused on a handful of sites. Meadowcroft Rockshelter in southwestern Pennsylvania is considered by many archaeologists to be a Pre-Clovis site (Carr and Adovasio 2002:4). The Cactus Hill site in southeastern Virginia recovered lithic artifacts such as bifaces, polyhedral cores, and prismatic blades below intact Clovis horizons as early as 17,000 radiocarbon years before present, significantly earlier than the conventional Clovis temporal boundary. Additionally, the Topper site in South Carolina's Piedmont region has also produced evidence of Pre-Clovis occupation below Clovis-age sediments (Goodyear 1999, 2000). The Cactus Hill and Topper sites both have the potential to be considered Pre-Clovis and could show that early groups were in the general region of the project, but further work on these sites is still needed to verify if Pre-Clovis deposits are present. Increased programs of survey and testing of landforms with Pleistocene-aged deposits are still needed in the region to better understand the Pre-Clovis tradition (Goodyear 2006). Within North Carolina, archaeologists have yet to find any evidence of Pre-Clovis groups (Meltzer 2009:131).

The first widely accepted human presence in North Carolina was during the Paleoindian period. During this period, the project area went through a massive environmental shift. The much colder climate of the Pleistocene gave way to a warmer and wetter Holocene climate. Large megafauna were replaced with a variety of smaller more adaptable mammals. Groups during this time had to master a changing and dynamic landscape. Traditionally, this period has been broken up into three sub-periods: Early (12,500–10,900 B.P.), Middle (10,900–10,500 B.P.), and Late (10,500–10,000 B.P.) (Anderson et al. 1996:7). These sub-periods are based on projectile point typologies. Throughout the Early Paleoindian period, projectile points were large with distinct fluting. During the Middle and Late Paleoindian period, projectile points were smaller, and the distinctive fluting of the Early Paleoindian Period was replaced by basal thinning (McNett et al. 1977). This shift in lithic technology likely relates to the changing resources that Paleoindian groups were encountering, with megafauna slowly going extinct and groups relying on small game and plant resources.

Daniel and Goodyear (2006), building off a wide-ranging survey of fluted points across the state, have developed a settlement system based on patterns in the distribution of Paleoindian fluted points. They argue that fluted point densities show two Paleoindian settlement clusters, the first being centered on the eastern piedmont and the high-quality sources of metavolcanic stone, and the second settlement cluster being focused in the mountains. Daniel and Goodyear (2006) argue that the settlement pattern and movement of Paleoindian groups was restricted by lithic sources, with groups being basically tethered

to these resources. This essentially mirrors Gardner's (1983) model of Paleoindian groups in the Northern Shenandoah Valley. Gardner hypothesizes that Paleoindian mobility was dictated based on the groups' distance from lithic resources.

A few sites in the Piedmont region and adjacent Coastal Plain region of North Carolina have been investigated, providing researchers with some preliminary data on Paleoindian groups. Researchers at the Pasquotank Site (31PK1) in the northeastern Coastal Plain region have recovered a large lithic assemblage from the Paleoindian occupation (Daniel et al. 2007). Analysis of the assemblage has led to a greater understanding of the Paleoindian toolkit, as well as how Paleoindians used the landscape (Daniel et al. 2007:86). One of the most important sites in North Carolina yielding evidence of Paleoindian occupation is the Hardaway site (31ST4), which is located in the adjacent Piedmont region. Discovered in the Uwharrie Mountain Range on the west bank of the Yadkin River, the Hardaway site represents one of the oldest known sites in North Carolina. The stratified deposits at the Hardaway site were first reported by Coe (1964); from this data, the Hardaway Complex was formed. Fluted points, classified as Clovis or Redstone types, recovered from the Hardaway site represent the early and middle Paleoindian periods in North Carolina. Hardaway-Dalton points recovered from the site are believed to be associated with the Dalton complex of the midwestern United States and are diagnostic of the Late Paleoindian period and the Early Archaic period (Ward and Davis 1999:42). Archaeological investigations of the Hardaway site form the framework for the Paleoindian and Early Archaic sequences defined by Coe (1964) for the Piedmont region of North Carolina.

## *Archaic (8000–1000 B.C.)*

The Archaic period in the North Carolina Piedmont region is characterized by an increase in population from the Paleoindian period and efficient adaptation to new Holocene biotic communities. The Archaic period was a time of major climatic change. Holocene environments continued to expand until the start of the Hypsithermal Climatic period (6000 B.C.), at which point the modern environment of the Piedmont region was almost fully developed. Traditionally, the Archaic period has been divided into three sub-periods: the Early Archaic (8000–6000 B.C.), the Middle Archaic (6000–3000 B.C.), and the Late Archaic (3000–1000 B.C.) (Ward and Davis 1999). These periods roughly correspond to changes in lithic technology and resource extraction. Many Paleoindian technological traits were used throughout the Early Archaic. The main identifiers of the sub-period are an increase in population and a shift in subsistence patterns that were better suited to the early Holocene environment. During this period, modern environmental conditions continued to develop, and northern hardwoods replaced the full glacial boreal forests (Bryson et al. 1970; Watts 1975). The shift in climate provided favorable environmental conditions for groups to increase in size. With the growing population, new settlement strategies needed to be developed. Early Archaic groups were focused on major river systems, with the Fall Line being an especially important environment, as evidenced by the number of sites located in this area. During the Early Archaic, populations were still relatively low, and groups were still highly mobile, spending most of their time in small scattered bands. Stone tools were still highly curated, with a reliance on high-quality lithics. There is a visible shift to smaller game, but larger animals were still being hunted. The Hardaway site demonstrates that during this sub-period groups adapted to the changing environment by establishing larger seasonal camps (Phelps 1983:23). Anderson and Sassaman (1996), in their band-macroband model, postulate that groups of 50 to 150 individuals utilized drainage systems by establishing base camps in the Piedmont or Upper Coastal Plain in the winter and then radiating out in smaller groups toward the coast during the late spring through the early fall. The Palmer projectile point is viewed as the first true Early Archaic projectile point and is typified by a small corner-notched blade with pronounced serrations and a ground base. The earlier Kirk Corner-Notched represents the transition between the Paleoindian and Early Archaic periods (Coe 1964:81; Phelps 1983:23). Additionally, the use of hafted end scrapers and other formal tools such as perforators, drills, and gravers increased during the Early Archaic period (Coe 1964; Davis and Daniel 1990; Ward and Davis 1999).

The Middle Archaic (6000–3000 B.C.) coincides with the Hypsithermal Climatic period. The Middle Archaic toolkit is characterized by a reliance on largely expedient lithic technology, a less formalized toolkit, and groundstone artifacts becoming prevalent. Bifurcate projectile points are diagnostic of the change between the Early and Middle Archaic. Stanley Stemmed projectile points are diagnostic of the early Middle Archaic, with Morrow Mountain projectile points being emblematic of the middle and late portions of the sub-period. Stanley points have a broad Christmas tree–shaped blade along with a square stem and basal notching. Morrow Mountain stemmed projectile points are relatively small with a short and tapering stem (Davis and Daniel 1990). Phelps (1983) points out that the only apparent relation to resources necessary for Middle Archaic occupation appears to be access to streams. Two distinct site types become apparent during the Middle Archaic: base camps and temporary procurement camps (Ward and Davis 1999:73). Temporary procurement camps are found throughout the landscape, but base camps are usually located near stream confluences.

Site densities in the Late Archaic period decreased slightly from the Middle Archaic. The highly mobile groups of earlier periods were replaced with more sedentary settlements at strategic locations on the landscape, which led to the emergence of pottery and horticulture (Ward 1983; Ward and Davis 1999). Many of the key settlement strategies utilized in the Woodland period were established during the Late Archaic period. Groups focused on the major drainages and abandoned many of the smaller tributary streams (Ward and Davis 1999:74). Many of the larger Late Archaic sites have been found in Georgia, Tennessee, Kentucky, and Alabama where major streams are characterized by broad shoals (Ward 1983:67). Higher population densities forced Late Archaic groups to restrict their mobility, as evidenced by the appearance of sites that were reoccupied through time. Late Archaic groups developed more efficient food processing techniques, such as thermally resilient containers. Soapstone vessels and early pottery first appear during this sub-period. Stallings Ware, one of the first pottery wares created in eastern North America, has been found in the Southern Coastal Plain of North Carolina as early as 2500 B.C. (Phelps 1983:26). Late Archaic pottery was not widely used and possibly does not represent a major technological revolution in cooking (Herbert 2011:4-1). The Late Archaic toolkit shows a greater investment in the curation of tools and the expedient use of debitage and cores. Savannah River Stemmed, Halifax (Coe 1964) and Otarre Stemmed (Oliver 1985) projectile points, are the most common diagnostic artifacts on Late Archaic sites.

## *Woodland Period (1000 B.C.–A.D. 1650)*

The Woodland period is defined by an increase in sedentism, improvements in pottery technology, increased use of groundstone tools, the development of an increase in horticulture, and the intensification of the domestication of wild cultigens (Ward and Davis 1999:3-4). Groups also start to take on regional identities within the Piedmont Region. The Woodland cultures of the Piedmont region generally evolved along an unbroken continuum and were only marginally influenced by other cultural traditions that evolved elsewhere in the eastern United States (i.e., Hopewell, Swift Creek, Mississippian chiefdoms) (Ward and Davis 1999:78). Woodland societies became more internally complex, developed elaborate mortuary rituals, and on occasion constructed earthen burial mounds and house platforms, and engaged in far-reaching trade and exchange of exotic items. However, the degree to which Woodland peoples engaged in these activities varies greatly from the mountains to the coast (Ward and Davis 1999:3). Traditionally, archaeologists have divided the Woodland period into three sub-periods: Early (1000–300 B.C.), Middle (300 B.C.– 800 A.D.), and Late (800–1650 A.D.).

The Early Woodland period is characterized by the continuation of Archaic cultural patterns across the Piedmont region, as well as the widespread use of pottery. The majority of large precontact sites in the Piedmont region generally contain both Archaic remains and Woodland pottery (Ward 1983:70). While pottery-making, semisedentary villages, and horticulture originated in the Late Archaic period, these innovations became the norm rather than the exception during the Early Woodland period (Ward and

Davis 1999:76). The Badin ceramic series, as identified by Coe (1964:27–29), is associated with one of the earliest ceramic traditions in the Piedmont region. Badin pottery has characteristics of, and possible relationships with, southern coastal ware types such as Thom's Creek and northern ware types in Virginia such as Accokeek and Stony Creek (Ward and Davis (1999: 97). The Badin series, first recognized at the Doerschuk site, consists of well-made pottery tempered with sand and the occasional pebble. Badin pottery is usually finished with a cord-wrapped or fabric-wrapped paddle. In conjunction with the appearance of Badin pottery, crudely flaked triangular Badin projectile points are also first observed in the archaeological record. Badin projectile points represent a departure from the large, stemmed spear points identified in the Savannah River phase, and are thought to mark the beginning of a tradition of triangular points associated with the bow and arrow (Ward and Davis 1999:80). The subsequent Middle and Late Woodland periods are characterized by the acceleration of cultural trends widely adopted during the Early Woodland period.

During the Middle Woodland, horticulture assumed a greater importance than during the preceding periods. Groups still practiced some hunting and gathering, but the cultivation of native plants and the advent of maize took on an increased importance during this sub-period. Middle Woodland sites are generally larger than Early Woodland sites. Yadkin pottery is generally thought to temporally follow the Badin ceramic series based on evidence from the Doerschuk site excavations. Yadkin pottery is similar to Badin pottery, with the exception that it is generally tempered with crushed quartz and exhibits new surface treatments, which consist of check stamping, linear check stamping, and simple stamping (Ward and Davis 1999:82). Projectile points associated with Yadkin pottery are typically large triangular projectile points that resemble Badin projectile points but are more finely flaked (Ward and Davis 1999:84). Yadkin phase sites occur more frequently than Early Woodland Badin phase sites, especially in the southern Piedmont and South Carolina Coastal Plain. While subsistence evidence and relating to Yadkin phase lifestyles is rare, evidence of prolonged Yadkin site occupations was observed at the Town Creek site (Ward and Davis 1999:85).

The beginning of the Late Woodland period in the Piedmont region is not distinguished by any glaring technological innovations; however, major cultural changes took place across the Piedmont as regional manifestations of the Piedmont Village Tradition began to emerge. Populations began to consolidate, and the beginning of intertribal conflicts began to emerge, as evidenced by stockades surrounding large villages (Ward and Davis 1999:98). These developments did not take place uniformly across the Piedmont. In some areas of the Piedmont region, scattered hamlet-like settlements were more common than compact villages. However, the trend towards larger more prevalent villages is distinct in the Late Woodland period. Late Woodland groups in the Piedmont region can usually be related to specific Native American groups through ethnohistoric accounts by early European settlers and explorers. In the north-central portion of the Piedmont, along the Eno River, the Late Woodland Hillsboro phase may be related to the Historic Eno, Shakori, and Occaneechi tribes (Ward and Davis 1999:99). The earliest Late Woodland phase defined in the Piedmont is called the Uwharrie phase (A.D. 800–1200). While initially discovered in the southern North Carolina Piedmont, Uwharrie phase pottery has a wide distribution throughout central North Carolina (Ward and Davis 1999:100). Ward and Davis (1999:100) note how the Uwharrie phase is the "mother" of all succeeding phases that compromise the Piedmont Village Tradition. The Haw River phase (A.D. 1000–1400), which is restricted to the north-central Piedmont region, has typologically similar pottery styles in its first half of the phase to Uwharrie phase pottery. Haw River phase excavations at the Hogue and Wall sites on the Eno River demonstrate the transition from small, scattered settlements to compact palisaded villages during the Late Woodland period (Ward and Davis 1999:100). As with the Haw River phase, the Hillsboro phase (A.D. 1400–1600) was defined by excavations in the north-central Piedmont. During the first half of the Hillsboro phase, small scattered settlements similar to the Haw River phase continued to persist across the landscape. However, several sites identified during the first half of the phase, such as the Wall site, represent compact, nucleated villages with relatively large populations (Ward and Davis 1999:112). Sites from the latter half of the

Hillsboro phase sites tend to become more similar to Haw River phase sites, which tend to have a dispersed population and lack evidence of stockades. While similar to Haw River phase sites, later Hillsboro phase sites generally have larger feature and artifact densities, which reflect a more intense occupation (Ward and Davis 1999:115–116).

## *Historic Period*

Europeans first reached North Carolina in the mid-1520s, when passing ships would make landfall along the Outer Banks to replenish supplies or get fresh water (Heath and Swindell 2011:10-5). In 1526, Luis Vasquez de Ayllon sailed up the Cape Fear River and established a colony for the Spanish Crown (Ready 2005:18). The Spanish colony was soon abandoned and moved to the coast of South Carolina. In 1540, Hernando De Soto reached western North Carolina, but never reached the Piedmont or Coastal Plain regions. English ambitions toward the New World were first realized by Sir Walter Raleigh, who sent two ships under the command of Arthur Barlowe and Philip Amadas to find a suitable place for an English colony (Ordahl-Kupperman 1984:16). The expedition reached the Outer Banks on July 13, 1584. Returning to England, Barlowe and Amadas reported that the sheltered island of Roanoke would be an ideal location for a colony. Soon after their return, Raleigh sent out another expedition in the spring of 1585 (Ready 2005:21). This expedition was under the control of Ralph Lane and Sir Richard Grenville. The second expedition left 107 colonists under the direction of Ralph Lane to start a settlement. Grenville returned to England to gather additional supplies. The new settlement soon grew short on supplies and the colony was abandoned on June 19, 1586 (Ready 2005:24).

Raleigh attempted a third expedition with the explicit purpose of creating a colony. John White was appointed the governor of the proposed colony. White reached Roanoke Island on July 22, 1587 (Ordahl-Kupperman 1984:107). Arriving too late to plant crops, the colonists soon ran out of supplies and White was forced to return to England. White was delayed in England by preparations to fight the Spanish Armada and could not return until August 16, 1590 (Ready 2005:27). White found the colony abandoned, surrounded by a log palisade, and the word CROATOAN carved into a tree. After the failure of Raleigh and the Roanoke Colony, no attempt at colonization was made in North Carolina until King Charles II gave the area to his supporters. The supporters, known as the Lords Proprietors, were given a royal charter for the lands between the Albemarle Sound and Florida (Powell 1989:53). The Lords Proprietors grant was largely unknown territory and was seen by the English Crown as primarily a buffer between the Spanish in Florida and the English colonies in Virginia and New England (Ready 2005:40). In 1700, John Lawson was commissioned by the Lords Proprietors to survey the Carolina Lands. Starting in Charleston, South Carolina, Lawson visited much of the Piedmont and the Coastal Plain of North Carolina (Lawson 1967 [1709]).

The Lord Proprietors were given considerable leeway in controlling their land. The government set up by the Proprietors tried to combine elements of monarchical, aristocratic, and democratic governments, but was mostly ignored by colonists. The chaotic nature of colonial North Carolina resulted in multiple rebellions (Ready 2005:43). By the first decade of the eighteenth century, English attitude toward Native American groups in the Coastal Plain region of North Carolina changed from viewing them as viable trade partners to people who were in the way of the westward European expansion (Ready 2005:32). Relationships further declined with the rapid increase in the Indian slave trade. Through the mid-seventeenth and early eighteenth centuries, relations with Native American groups deteriorated rapidly, as evidenced by the Third Anglo-Powhatan War, Bacon's Rebellion, Chowanoke Wars, and Coree Wars (Heath and Swindell 2011:10–12). This undercurrent of discontent among Native American groups in North Carolina would manifest itself in the Tuscarora War.

During the early post-contact period, Tuscarora groups had started to reorganize themselves into nascent chiefdoms (Heath and Swindell 2011:10-11). Groups in the Tar-Pamlico and Roanoke basins were under

the influence of King Blunt and were known as the Upper Tuscarora, while King Hancock had sway over towns in the central Coastal Plain. In 1710, King Hancock allied with Algonquian and Siouan groups from the Coastal Plain and directed attacks on European settlements located in the lower Neuse and Tar-Pamlico basins (Heath and Swindell 2011:10-11). After a brief but fierce series of engagements, the Lower Tuscarora groups entered into diplomatic negotiations to halt hostilities, which were readily agreed upon by the colonial government. These agreements were broken repeatedly by the colonists who launched devastating campaigns into the Lower Tuscarora territory. Upper Tuscarora were largely spared from the violence and destruction associated with the Tuscarora War, but by 1802, virtually all of the Upper Tuscarora had migrated to lands under the control of the Five Nations of the Iroquoian Confederation in New York and eastern Canada.

The Lower Tuscarora were the clear victims of the Tuscarora War, but European groups were also devastated. After living through the Tuscarora War, one colonist remarked that all of the colonists in North Carolina should be removed to the South and the region abandoned (Ready 2005:37). Seeing the chaos enveloping the colonies, the Lords Proprietors decided to divide the Carolina Lands to provide better governance. Edward Hyde was appointed as the first governor of the newly established northern part of the Carolina Grant on January 24, 1712.

The mid-eighteenth century in the Piedmont region is characterized by the growth of the population through waves of immigration often caused by hard living conditions in Europe. Groups such as the Highland Scots, Germans, English, and Irish, fleeing overcrowding, endemic wars, and religious persecution, saw North Carolina as an ideal location to start over (Ready 2005:54). This increase in population was not concentrated in colonial ports or cities, but was widespread and dispersed across the landscape. Immigrants also came from other parts of the New World seeking cheap land and temperate climates. The flow of Europeans to the New World pushed the frontier back rapidly.

The economy in North Carolina during the mid- to late eighteenth century was focused on land and slaves (Powell 1989:131). Naval stores and lumber products from the rich Carolina forests were key colonial industries (Margulies 2006:42). As large swaths of the colony were cleared, agriculture started to take on an increasingly important role in the economy. The vast majority of colonial North Carolina farmers were subsistence farmers, but corn, tobacco, wheat, beef, and pork were produced for export. Settlement was often focused on waterways, due to the lack of roads.

Slavery was present in the early days of the colony but did not become widespread until the 1720s. Slavery was mostly confined to the Lower Cape Fear basin in the early eighteenth century, but by the time of the American Revolution, it had become widespread throughout the colony. The 1790 census listed the white population as 288,204 and the slave population as 100,572 (Ready 2005:69). Until the Civil War, slaves would consistently make up approximately a third of the population. Unlike South Carolina, North Carolina never developed the large slave plantations. The population in North Carolina was spread out, with farmers often owning only a few slaves. It was common practice in North Carolina for masters to work directly with slaves. The harsh slave codes of South Carolina were never adopted in North Carolina (Ready 2005:71).

Caswell County was formed in 1777 from Orange County. The county was named after the first governor of North Carolina, Richard Caswell. The county seat is Yanceyville. The historic and modern economy is founded on agricultural pursuits, such as the growing of corn, tobacco, soybeans, wheat, as well as livestock and poultry. Additionally, the mining industry in the county exports mica, microcline, beryl, graphite, corundum, and soapstone (Powell 1977)

The Federal period was a time of growth for the Piedmont region of North Carolina. The slave system developed more slowly in the Piedmont region compared to the Coastal plain region. North Carolina's eastern counties continually had a larger slave population. None of North Carolina's western counties

ever had a slave population that was larger than the Euro-American population. The slave system in the western portion of North Carolina was primarily associated with the small farmer, rather than with large plantations (Boyd 1919: 204).

During the Antebellum period, the region initially was in decline, but eventually many key institutions and practices were developed that would revolutionize life in North Carolina. At the start of the period, a number of factors, such as destructive agricultural practices leaving depleted soils, the lack of educational opportunities, the need for transportation and communication networks, and the lack of strong commercial and industrial bases, led to a decline in the standard of living in North Carolina (Powell 1989). These factors often fueled westward immigration. Between 1815 and 1850, approximately a third of the population of North Carolina left the state (Powell 1989:249). It was not until the mid-nineteenth century that local groups started to address these issues. A focus on better farming methods, the development of private schools, and the connection to the larger national railroad network helped improve the economic situation in North Carolina.

North Carolina was one of the last states to join the Confederacy at the outset of the Civil War. Culturally, North Carolina did not share many of the institutions that much of the South had in common, such as the plantation system and large slave populations. This caused a division amongst North Carolinians about whether to secede or not. Wilmington and the Cape Fear region became a hotbed for secessionists, while areas in the western portion of the state favored staying in the Union (Barrett 1963:7). North Carolina remained neutral until Fort Sumter was taken by secessionists in South Carolina. A wave of allegiance to the southern cause swept across North Carolina, and shortly after, on May 20, 1861, North Carolina overwhelmingly passed an ordinance of secession (Barrett 1963:15).

North Carolina was fully committed to the Southern cause. By population, North Carolina only made up one-ninth of the Confederacy, while one-sixth to one-seventh of all Confederate forces were made up of men from North Carolina (Barrett 1963:28). The Union Army soon saw North Carolina as a key objective. After establishing a foothold on the North Carolina coast, Union forces directed their attention to the Confederate supply routes connecting Virginia and the Deep South.

The Civil War caused major economic and cultural disruption throughout North Carolina. The occupation of the state by Union forces had left the landscape devastated (Hardy 2011:115). Union troops were stationed throughout North Carolina until the summer of 1866, and it was not until June 25, 1868, that North Carolina was readmitted into the Union (Hardy 2011:124).

Reconstruction was a period of great distress for North Carolina, as it was for much of the South. The freeing of African American slaves resulted in the disruption of many key industries that were labor-intensive. The distress and destruction caused by the Civil War was soon replaced with growth, prosperity, and wealth. This was partially due to the industrialization of much of the South with the advent of textile mills and southern iron works. This industrialization caused the population in urban areas to grow by 5 million people between 1880 and 1910 (Ayers 1992:55).

As much of the South grew and modernized, the view toward African Americans changed little. Between the end of the Civil War and 1941, 168 African Americans were lynched in North Carolina (Newkirk 2009:3). Schools and many areas were segregated, and African Americans would remain marginalized politically for much of the twentieth century (Berry 1978). It was not until the advent of the Civil Rights Movement and the struggle to desegregate the South that African Americans would gain a voice in society.

North Carolina in the early twentieth century would continue to grow and develop economically. During World War I, North Carolina was a major textile supplier to the U.S. Army (Rafle 2002). Starting in the 1920s, North Carolina's main industry, the production of textiles, started to decline, foreshadowing the

general economic decline of the United States economy in the 1930s. With changing styles brought on by the Jazz culture of the 1920s, clothing changed rapidly. A women's dress in 1910 took approximately 10 to 11 yards of fabric; in 1920 it only took 2 yards (Davis 2003:4). North Carolina textile mills ignored the changing fashions, and the result was overproduction, layoffs, and the merging of mills. Agriculture, a major industry in Caswell County, was heavily affected by the Great Depression, but like the textile mills, farmers started to feel the effects of the economic downturn in the 1920s with the plummeting price of agricultural goods (Davis 2003:10). By 1930, the economy of North Carolina was in the downward spiral that characterized the general U.S. economy during the Great Depression. Through New Deal programs like the Civilian Conservation Corps, and eventually the onset of World War II, North Carolina's economic position gradually improved. The post-war years were a time of advancement for many North Carolinians. In the Raleigh-Durham area, the University of North Carolina at Chapel Hill, Duke University, and North Carolina State University established Research Triangle Park, with the goal of increasing and supporting North Carolina's economic prosperity. Innovations such as Astroturf and AIDS medicine were created inside Research Triangle Park (Rafle 2002).

## Previous Archaeological Investigations

A research request filed with the OSA on June 9, 2021, identified two archaeological sites (31CS0073 and 31C00S80) within 1-mile (1.6-km) of the APE, and one previous archaeological investigation. There are no previously recorded archaeological sites within or directly adjacent to the APE, nor has any portion of the APE been surveyed for archaeological resources. The previous archaeological investigation in proximity to the project was a 2002 Phase I survey for the River Bend Tract 1 Wetland Mitigation Site. The survey identified and evaluated 31CS0073, which is described below. The report for the 2002 survey was not available digitally, and due to COVID-19 restrictions, inperson research at the OSA Research Library in Raleigh, North Carolina, was not feasible.

The two archaeological sites within 1-mile (1.6 km) of the project area consist of precontact archaeological resources. Site 31CS0073, located 0.2-mile (0.3 km) southeast of the project area, is a Late Woodland, early Dan River phase household or hamlet and is considered eligible for the National Register of Historic Places (NRHP) under Criterion D. The other site in proximity to the APE is 31CS0080, located 0.3-mile (0.4 km) southeast of the project. 31CS0080 consists of a potential precontact fish weir within the Dan River. The site was identified through a review of aerial imagery and has not been field verified or evaluated for listing in the NRHP.

# METHODOLOGY

The Phase I archaeological methodology was developed in accordance with the OSA's *Archaeological Investigation Standards and Guidelines* (2017), relevant federal regulations and guidelines, and the background research conducted for the project. In general, the methodology utilized was designed to identify and assess possible effects to potentially significant archaeological sites eligible for inclusion in the NRHP that are present within the project area.

## Background Research

Background research was conducted prior to fieldwork to determine the likelihood of encountering archaeological resources. The background research was used to determine areas of past disturbance and historic occupation in the project area and to establish a land-use history of the APE. SWCA placed a research request with the OSA in Raleigh, North Carolina, on June 9, 2021, and staff at the OSA

provided SWCA with information regarding previously recorded resources in the APE or within 1-mile (1.6 km) of the project area on May 10, 2020. Various online databases and historic cartographic sources were reviewed by SWCA to better understand the likelihood of encountering archaeological sites within the project area as well as unique environmental conditions that may influence the preservation of archaeological deposits.

# Field Methodology

The field methodology used during the Phase I survey was designed to ensure that the archaeological survey provided a detailed investigation of the project APE. As the majority of the APE consisted of pasture that lacked the proper ground visibility, systematic shovel testing and a full visual inspection of the test area were conducted.

Shovel testing was undertaken on a 30-meter [m] (98-foot) grid across the test area. All shovel tests were at a minimum 30 cm (12 inches) in diameter and were excavated by natural strata, at least 10 cm into archaeologically sterile sediments. Excavated soils were screened using standard 0.25-inch hardware cloth. Soil data was documented for each shovel test pit, and profile maps were created for representative shovel test pits. If artifacts were identified, radial shovel test pits were excavated around the initial find in a cruciform pattern at 5-m (16.4-foot) intervals. A site boundary was defined through shovel testing by the presence of two subsequent shovel test pits that did not contain artifacts.

SWCA conducted subsurface testing based on the vertical level of disturbance anticipated during the construction of the project. For the 12.5 acres (5.1 hectares) where ground disturbance will be limited to less than one meter, investigators excavated shovel tests to Pleistocene aged soils, which was interpreted as the Bw horizon, or 1 meter below ground surface, whichever was encountered first. In a 2-acre (0.8 hectare) portion of the APE where the vertical limit of disturbance would be more than 1 meter below ground surface, SWCA excavated shovel tests to Pleistocene aged soils, which was interpreted as the Bw horizon, or 1 meter below ground surface. If Pleistocene aged soils were not reached by 1 meter, a hand auger was used to excavate up to one meter below the base of the shovel test, totaling 2 meters below ground surface, to identify any deeply buried soil horizons that may contain intact archaeological deposits.

The field methodology outlined above was submitted to the OSA for approval on June 9, 2021. In e-mail correspondence dated June 16, 2021, the OSA approved SWCA's proposed field methodology.

# Laboratory Methods

Cultural material and associated documents were transported to SWCA's Pittsburgh, Pennsylvania, office for processing and analysis. Recovered cultural material was recorded on a standard bag log prior to cleaning and cataloging. Prehistoric lithic materials were washed and dried. Historic artifacts were cleaned following a similar procedure, with the exception of metal artifacts, which were dry-brushed to prevent corrosion. Once the artifacts were cleaned and dried, they were placed into clean plastic bags and recorded in a Master Artifact Catalog.

## *Precontact Artifacts*

After the cleaning and initial cataloging of precontact cultural material, all artifacts were separated into analytical class (e.g., bone, pottery, lithic). The lithic assemblage from the site was further separated based on material class (e.g., hafted biface, biface, debitage, shatter) and raw material. Debitage was classified to better understand the reduction sequence taking place at the site and was conducted based

on the percentage of cortex present. Referred to as the Triple Cortex Approach (Andrefsky 1998), this method was designed to analyze the amount of cortex on the dorsal side of the flake in order to place the individual artifact in the reduction sequence. Primary flakes, considered the earliest stage of the lithic reduction sequence, have cortex covering 50 to 100 percent of the dorsal side of the flake, secondary flakes have cortex present on less than 50 percent of the dorsal side of the flake, and tertiary flakes have no cortex present. Hafted bifaces were analyzed and placed into existing typologies, where feasible. Overall lithic raw material was weighed to better categorize the usage of the material.

To assist with the identification of lithic material during the analysis phase, investigators relied heavily on lithic material described at the Hardaway site (Daniel 1998:38-48), as well as other work conducted in the region (Bamann et al. 2011:Appendix B; Hanna and Bradley 2019).

Quartz is commonly found throughout the Piedmont region of North Carolina, with cobbles occurring in rivers within the Coastal Plain region, especially in proximity to the Fall Line. The quality of quartz, as a lithic material, ranges from white vein quartz that is abundant in the region but lacking the cryptocrystalline structure to quartz crystal, which is characterized as colorless with little to no internal impurities.

Quartzite is typically defined by a sugary texture that ranges in color and lithic quality and consists of metamorphosed sandstone with a high amount of quartz. Like quartz, quartzite is abundant in the form of cobbles within the rivers that cross the Coastal Plain.

Metavolcanic lithic material is common throughout the Piedmont Region. Metavolcanic stone is broadly defined as metamorphosed igneous stone. Within this larger category, rhyolite consists of a fine-grained igneous rock primarily made up of feldspar and quartz. Rhyolite is further categorized by aphyric rhyolite and prophyritic rhyolite. Aphyric Rhyolite is characterized as being dark gray in color, having a homogeneous texture and flow banding. prophyritic Rhyolite typically lacks the flow banding found in Aphyric Rhyolite and has a sugary texture that is light to dark grey in color. During analysis, when metavolcanic stone was identified, analysis focused on identifying if the lithic source was rhyolite, and if so, whether it was phrophyrtic or aphyric rhyolite.

# RESULTS

SWCA conducted the field survey from June 21 and 24, 2021. As outlined in the methodology sections above, the entire 16.5 acres (12.8 hectares) of the APE for the Phase I archaeological survey was investigated (Figure 7). Due to the poor ground visibility present within the project area, systematic shovel testing was the primary survey method utilized during the Phase I survey. During the Phase I survey, 79 shovel tests were excavated (Appendix A). The typical soil profile consisted of one stratum overlying subsoil. Stratum I, the Ap horizon, consisted of a brown (10YR4/4) sandy loam. Subsoil for the area was a dark yellowish brown (10YR4/6) sandy clay. Overall, the soil profile identified through shovel testing matched closely with the USDA mapped soil units for the area. In the portion of the project area where construction will result in ground disturbance that will exceed 1 meter (see Figure 3), shovel testing identified Pleistocene aged soils (i.e., the Bw horizon) between 35 and 43 cm (14 and 17 inches) below ground surface. No evidence of deeply buried soil horizons was identified within the project APE.


**Figure 7. Project APE shown on aerial map with shovel test locations depicted.**

# 31CS121

During the Phase I survey, investigators identified an isolated find consisting of an aphyric rhyolite biface fragment (Figure 8). The isolate is located within a grass-covered field approximately 0.4 km (0.2 mile) north of the Dan River (Figure 9). The find was identified in Stratum I, the Ap horizon, of Shovel Test A-20 between 0 and 34 cm (0 and 13 inches) below ground surface. The soil profile of Shovel Test A-20 consisted of one stratum over subsoil. Stratum I consisted of a brown (10YR4/3) loam and Stratum II, subsoil, consisted of a yellowish brown (10YR5/6) sandy loam (Figure 10). A total of 8 radial shovel tests were excavated around Shovel Test A-20 (Figure 11). No additional cultural material was recovered. The isolated find is not eligible for listing on the NRHP. The biface fragment will be returned to the landowner, per their request.

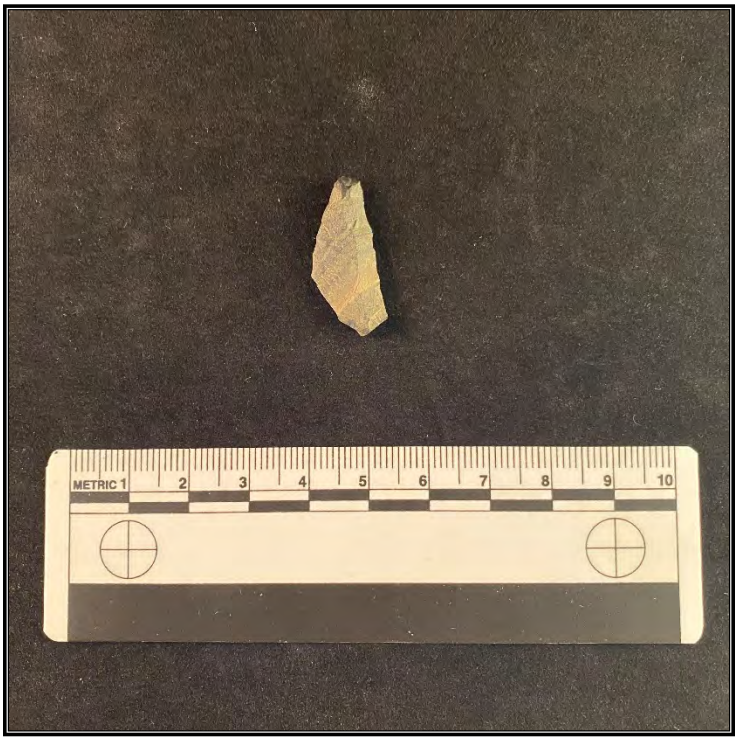


**Figure 8. Rhyolite biface fragment recovered from Shovel Test A-20.**

**Figure 9. Overview of 31CS121, facing east.**

**Figure 10. Shovel Test A-20 soil profile.**

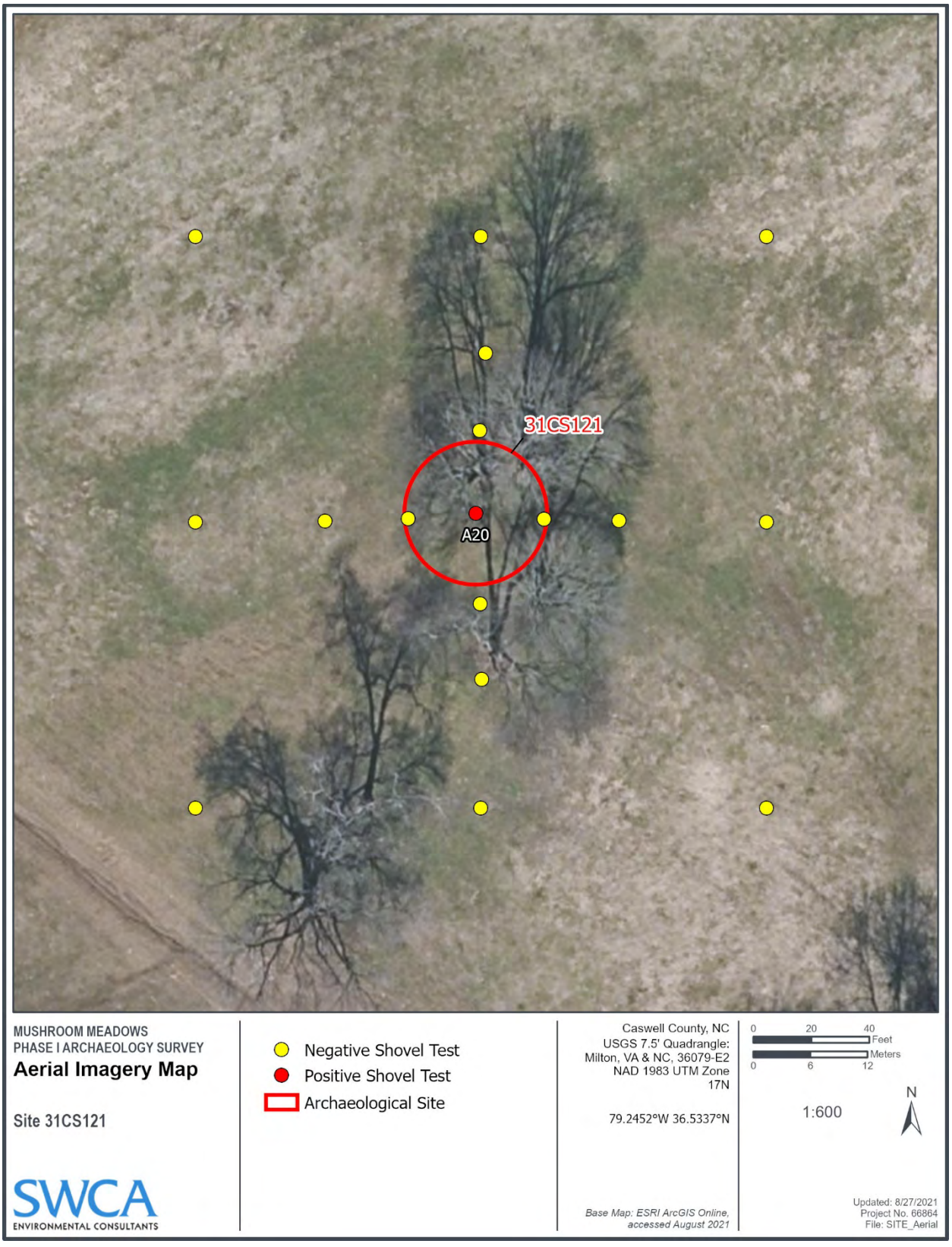


**Figure 11. 31CS121 site map.**

# CONCLUSION

This report details the background research and methodology of the Phase I archaeological survey conducted on behalf of EcoTerra in support of the Mushroom Meadow Stream and Wetland Mitigation Project. The entirety of the APE was investigated for archaeological resources. During the survey, SWCA identified a precontact isolated find (31CS121) consisting of a biface fragment. No other artifacts were identified associated with the isolated find. Based on the results of the survey, no further archaeological work is recommended by SWCA at this time. Construction of the project should be allowed to proceed as planned.

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# APPENDIX A

## Representative Excavation Profiles and Descriptions

# APPENDIX B

## 31CS121 Artifact Catalog

# Endangered Species Act (ESA)

# United States Department of the Interior

FISH AND WILDLIFE SERVICE

Raleigh Field Office
P.O. Box 33726
Raleigh, NC 27636-3726

Date: 3/29/2021

**Self-Certification Letter**

Project Name Mushroom Meadow Stream and Wetland Mitigation Site

Dear Applicant:

Thank you for using the U.S. Fish and Wildlife Service (Service) Raleigh Ecological Services online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the project named above in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA), and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended (Eagle Act). This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

The species conclusions table in the enclosed project review package summarizes your ESA and Eagle Act conclusions. Based on your analysis, mark all the determinations that apply:

- [x] "no effect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- [ ] "may affect, not likely to adversely affect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- [ ] "may affect, likely to adversely affect" determination for the Northern long-eared bat (Myotis septentrionalis) and relying on the findings of the January 5, 2016, Programmatic Biological Opinion for the Final 4(d) Rule on the Northern long-eared bat;
- [x] "no Eagle Act permit required" determinations for eagles.

We certify that use of the online project review process in strict accordance with the instructions provided as documented in the enclosed project review package results in reaching the appropriate determinations. Therefore, we concur with the “no effect” or “not likely to adversely affect” determinations for proposed and listed species and proposed and designated critical habitat; the “may affect” determination for Northern long-eared bat; and/or the “no Eagle Act permit required” determinations for eagles. Additional coordination with this office is not needed. Candidate species are not legally protected pursuant to the ESA. However, the Service encourages consideration of these species by avoiding adverse impacts to them. Please contact this office for additional coordination if your project action area contains candidate species. Should project plans change or if additional information on the distribution of proposed or listed species, proposed or designated critical habitat, or bald eagles becomes available, this determination may be reconsidered. This certification letter is valid for 1 year. Information about the online project review process including instructions, species information, and other information regarding project reviews within North Carolina is available at our website http://www.fws.gov/raleigh/pp.html. If you have any questions, you can write to us at Raleigh@fws.gov or please contact Leigh Mann of this office at 919-856-4520, ext. 10.

Sincerely,

/s/Pete Benjamin

Pete Benjamin
Field Supervisor
Raleigh Ecological Services

Enclosures - project review package

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
Phone: (919) 856-4520 Fax: (919) 856-4556

In Reply Refer To: March 29, 2021
Consultation Code: 04EN2000-2021-SLI-0920
Event Code: 04EN2000-2021-E-02019
Project Name: Mushroom Meadows Stream and Wetland Mitigation Site

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The species list generated pursuant to the information you provided identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the species' life histories and habitats and information on completing a biological assessment or

evaluation and can be found on our web page at http://www.fws.gov/raleigh. Please check the web site often for updated information or changes

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

Not all Threatened and Endangered Species that occur in North Carolina are subject to section 7 consultation with the U.S Fish and Wildlife Service. Atlantic and shortnose sturgeon, sea turtles,when in the water, and certain marine mammals are under purview of the National Marine Fisheries Service. If your project occurs in marine, estuarine, or coastal river systems you should also contact the National Marine Fisheries Service, http://www.nmfs.noaa.gov/

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office. If you have any questions or comments, please contact John Ellis of this office at john_ellis@fws.gov.

Attachment(s):

- Official Species List

# Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

**Raleigh Ecological Services Field Office**
Post Office Box 33726
Raleigh, NC 27636-3726
(919) 856-4520

# Project Summary

Consultation Code: 04EN2000-2021-SLI-0920
Event Code: 04EN2000-2021-E-02019
Project Name: Mushroom Meadows Stream and Wetland Mitigation Site
Project Type: LAND - RESTORATION / ENHANCEMENT
Project Description: Mushroom Meadows Stream and Wetland Mitigation Site is a stream and riparian wetland restoration project in Caswell county. The project involves restoring pattern and profile of streams, plugging ditches to restore wetland hydrology, and planting native hardwood trees.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@36.53360255,-79.24454138878605,14z


Counties: Caswell County, North Carolina

# Endangered Species Act Species

There is a total of 3 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

## Fishes

| NAME | STATUS |
|---|---|
| Roanoke Logperch *Percina rex*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/1134 | Endangered |

## Clams

| NAME | STATUS |
|---|---|
| Atlantic Pigtoe *Fusconaia masoni*<br>There is **proposed** critical habitat for this species. The location of the critical habitat is not available.<br>Species profile: https://ecos.fws.gov/ecp/species/5164 | Proposed Threatened |
| James Spinymussel *Pleurobema collina*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/2212 | Endangered |

## Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

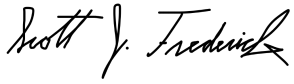
Species Conclusions Table

Project Name: Mushroom Meadows Stream and Wetland Mitigation Site

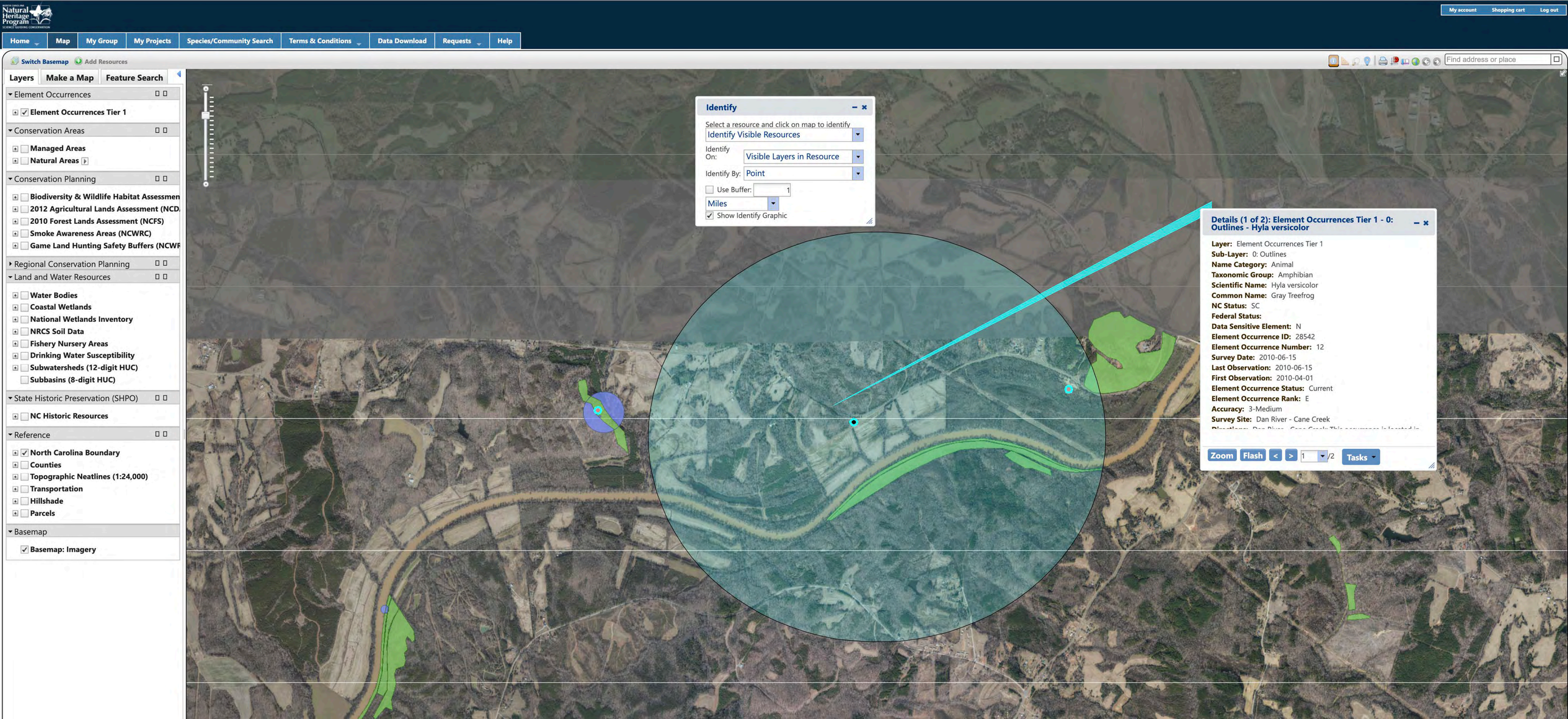
Date: 3/29/2021

| Species / Resource Name | Conclusion | ESA Section 7 / Eagle Act Determination | Notes / Documentation |
|---|---|---|---|
| Roanoke Logperch *Percina rex* | No suitable habitat | No effect | The Roaoke logperch prefers large sized warm clear streams per FWS. The streams that will be altered in this project are too small to support critical habitat. |
| Atlantic Pigtoe *Fusconaia masoni* | No suitable habitat | No effect | Suitable substrate not present, stream flow not suitable, water quality not supportive. |
| James Spinymussel *Pleurobema collina* | No suitable habitat | No effect | Per FWS, this species lives in streams that are 10-75 ft wide and .5 – 3 ft deep. The streams that will be altered in this project are too small to support critical habitat. |
| Critical Habitat | No critical habitat present | No effect | n/a |
| Bald Eagle | Unlikely to disturb nesting bald eagles | No Eagle Act Permit Required | No nesting trees have been noted. Furthermore, very few trees will be impacted by the project. |
| Northern Long-eared Bat | No suitable habitat present | No effect | No tree cutting or removal. Furthermore, Caswell county is not listed as a county that is known to FWS to contain the bat. |
| | | | |
| | | | |
| | | | |

Acknowledgement: I agree that the above information about my proposed project is true. I used all of the provided resources to make an informed decision about impacts in the immediate and surrounding areas.

Scott J Frederick / Environmental Scientist  3/30/2021

Signature /Title Date


Natural Heritage Program
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Shopping cart
Log out
Home
Map
My Group
My Projects
Species/Community Search
Terms & Conditions
Data Download
Requests
Help
Switch Basemap
Add Resources
Find address or place
Layers
Make a Map
Feature Search
Element Occurrences
Element Occurrences Tier 1
Conservation Areas
Managed Areas
Natural Areas
Conservation Planning
Biodiversity & Wildlife Habitat Assessmen
2012 Agricultural Lands Assessment (NCD
2010 Forest Lands Assessment (NCFS)
Smoke Awareness Areas (NCWRC)
Game Land Hunting Safety Buffers (NCWF
Regional Conservation Planning
Land and Water Resources
Water Bodies
Coastal Wetlands
National Wetlands Inventory
NRCS Soil Data
Fishery Nursery Areas
Drinking Water Susceptibility
Subwatersheds (12-digit HUC)
Subbasins (8-digit HUC)
State Historic Preservation (SHPO)
NC Historic Resources
Reference
North Carolina Boundary
Counties
Topographic Neatlines (1:24,000)
Transportation
Hillshade
Parcels
Basemap
Basemap: Imagery
Identify
Select a resource and click on map to identify
Identify Visible Resources
Identify On:
Visible Layers in Resource
Identify By:
Point
Use Buffer:
1
Miles
Show Identify Graphic
Details (1 of 2): Element Occurrences Tier 1 - 0: Outlines - Hyla versicolor
Layer: Element Occurrences Tier 1
Sub-Layer: 0: Outlines
Name Category: Animal
Taxonomic Group: Amphibian
Scientific Name: Hyla versicolor
Common Name: Gray Treefrog
NC Status: SC
Federal Status:
Data Sensitive Element: N
Element Occurrence ID: 28542
Element Occurrence Number: 12
Survey Date: 2010-06-15
Last Observation: 2010-06-15
First Observation: 2010-04-01
Element Occurrence Status: Current
Element Occurrence Rank: E
Accuracy: 3-Medium
Survey Site: Dan River - Cane Creek
Zoom
Flash
1
/2
Tasks

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Raleigh ES Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

April 21, 2021

Jamey O'Shaughnessey
Eco Terra
1328 Dekalb Ave NE
Atlanta, GA 30307

Re: Mushroom Meadow Stream and Wetland Mitigation Site – Caswell County, NC

Dear Mr. O'Shaughnessey:

This is in response to your request for comments from the U.S. Fish and Wildlife Service, (Service) concerning whether a federally-listed species or designated critical habitat may be affected by your proposed compensatory mitigation project. Our comments are submitted pursuant to, and in accordance with, provisions of the Endangered Species Act. Comments under the Fish and Wildlife Coordination Act and Migratory Bird Treaty Act (as appropriate) will be provided at a future date, as more information is made available to us during the North Carolina Interagency Review Team (NC IRT) review process.

Based on the information provided and other information available, it appears that the proposed action is not likely to adversely affect any other federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act at these sites. We believe that the requirements of section 7(a)(2) of the Act have been satisfied for your project. Please remember that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

We look forward to further coordination on this project as it moves through the NC IRT review process. If you have any questions or comments, please contact Kathy Matthews of this office at (919) 856-4520 ext. 27 or kathryn_matthews@fws.gov.

Sincerely,

for Pete Benjamin
Field Supervisor

# Uniform Relocation Assistance and Real Property Acquisition Polices Act (Uniform Act)

March 8, 2021

Larry Thomas Burnett Sr.
2400 Cavalier Rd.
Ringgold, VA 24586

Re: Mushroom Meadow Stream and Wetland Mitigation Site: Division of Mitigation Services Project in Caswell County

Dear Larry,

In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Buyer herby notifies Seller that: (i) Buyer believes that the fair market value of the Mitigation Values of the Mitigation Property is an amount equal to the Purchase Price; and (ii) Buyer does not have the power of eminent domain.

The purpose of this letter is to notify you that Eco Terra Partners, LLC and The State of North Carolina, in offering to purchase your property in Caswell county, North Carolina, does not have the power to acquire it by eminent domain. Also, Eco Terra Partners, LLC's offer to purchase your property is based on what we believe to be its fair market value.

Sincerely,

Jamey O'Shaughnessey

Assistant Project Manager
Jamey@ecoterra.com
W: 984-222-5116

# Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

**Mushroom Meadow Stream and Wetland Mitigation Site**
Mushroom Meadow Stream and Wetland Mitigation Site
Milton, NC  27305

Inquiry Number: 6396141.14s
March 08, 2021

# The EDR Radius Map™ Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

# TABLE OF CONTENTS



***Thank you for your business.***
Please contact EDR at 1-800-352-0050
with any questions or comments.

# EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

## TARGET PROPERTY INFORMATION

### ADDRESS

MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
MILTON, NC 27305

### COORDINATES

| | |
|---|---|
| Latitude (North): | 36.5337830 - 36° 32' 1.61'' |
| Longitude (West): | 79.2425890 - 79° 14' 33.32'' |
| Universal Tranverse Mercator: | Zone 17 |
| UTM X (Meters): | 657328.1 |
| UTM Y (Meters): | 4044390.0 |
| Elevation: | 372 ft. above sea level |

## USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

| | |
|---|---|
| Target Property Map: | 5947933 MILTON, NC |
| Version Date: | 2013 |
| Northwest Map: | 5947525 RINGGOLD, VA |
| Version Date: | 2013 |

## AERIAL PHOTOGRAPHY IN THIS REPORT

| | |
|---|---|
| Portions of Photo from: | 20140619 |
| Source: | USDA |

## MAPPED SITES SUMMARY

Target Property Address:
MUSHROOM MEADOW STREAM AND WETLAND MITIGATION SITE
MILTON, NC 27305

Click on Map ID to see full detail.

| MAP ID | SITE NAME | ADDRESS | DATABASE ACRONYMS | RELATIVE ELEVATION | DIST (ft. & mi.) DIRECTION |
|---|---|---|---|---|---|

NO MAPPED SITES FOUND

# EXECUTIVE SUMMARY

## TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

## DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

## STANDARD ENVIRONMENTAL RECORDS

### *Federal NPL site list*

NPL ---------- National Priority List
Proposed NPL ---------- Proposed National Priority List Sites
NPL LIENS ---------- Federal Superfund Liens

### *Federal Delisted NPL site list*

Delisted NPL ---------- National Priority List Deletions

### *Federal CERCLIS list*

FEDERAL FACILITY ---------- Federal Facility Site Information listing
SEMS ---------- Superfund Enterprise Management System

### *Federal CERCLIS NFRAP site list*

SEMS-ARCHIVE ---------- Superfund Enterprise Management System Archive

### *Federal RCRA CORRACTS facilities list*

CORRACTS ---------- Corrective Action Report

### *Federal RCRA non-CORRACTS TSD facilities list*

RCRA-TSDF ---------- RCRA - Treatment, Storage and Disposal

### *Federal RCRA generators list*

RCRA-LQG ---------- RCRA - Large Quantity Generators
RCRA-SQG ---------- RCRA - Small Quantity Generators
RCRA-VSQG ---------- RCRA - Very Small Quantity Generators (Formerly Conditionally Exempt Small Quantity Generators)

### *Federal institutional controls / engineering controls registries*

LUCIS ---------- Land Use Control Information System

US ENG CONTROLS..... Engineering Controls Sites List
US INST CONTROLS..... Institutional Controls Sites List

***Federal ERNS list***

ERNS..... Emergency Response Notification System

***State- and tribal - equivalent NPL***

NC HSDS..... Hazardous Substance Disposal Site

***State- and tribal - equivalent CERCLIS***

NC SHWS..... Inactive Hazardous Sites Inventory
VA SHWS..... This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

***State and tribal landfill and/or solid waste disposal site lists***

NC SWF/LF..... List of Solid Waste Facilities
VA SWF/LF..... Solid Waste Management Facilities
NC DEBRIS..... Solid Waste Active Disaster Debris Sites Listing
NC OLI..... Old Landfill Inventory
NC LCID..... Land-Clearing and Inert Debris (LCID) Landfill Notifications

***State and tribal leaking storage tank lists***

NC LAST..... Leaking Aboveground Storage Tanks
NC LUST..... Regional UST Database
VA LUST..... Leaking Underground Storage Tank Tracking Database
INDIAN LUST..... Leaking Underground Storage Tanks on Indian Land
NC LUST TRUST..... State Trust Fund Database

***State and tribal registered storage tank lists***

FEMA UST..... Underground Storage Tank Listing
NC UST..... Petroleum Underground Storage Tank Database
VA UST..... Registered Petroleum Storage Tanks
NC AST..... AST Database
VA AST..... Registered Petroleum Storage Tanks
INDIAN UST..... Underground Storage Tanks on Indian Land

***State and tribal institutional control / engineering control registries***

NC INST CONTROL..... No Further Action Sites With Land Use Restrictions Monitoring
VA INST CONTROL..... Voluntary Remediation Program Database

***State and tribal voluntary cleanup sites***

NC VCP..... Responsible Party Voluntary Action Sites
VA VCP..... Voluntary Remediation Program
INDIAN VCP..... Voluntary Cleanup Priority Listing

***State and tribal Brownfields sites***

NC BROWNFIELDS..... Brownfields Projects Inventory

VA BROWNFIELDS ..... Brownfields Site Specific Assessments

**ADDITIONAL ENVIRONMENTAL RECORDS**

***Local Brownfield lists***

US BROWNFIELDS ..... A Listing of Brownfields Sites

***Local Lists of Landfill / Solid Waste Disposal Sites***

NC HIST LF ..... Solid Waste Facility Listing
NC SWRCY ..... Recycling Center Listing
INDIAN ODI ..... Report on the Status of Open Dumps on Indian Lands
ODI ..... Open Dump Inventory
DEBRIS REGION 9 ..... Torres Martinez Reservation Illegal Dump Site Locations
IHS OPEN DUMPS ..... Open Dumps on Indian Land

***Local Lists of Hazardous waste / Contaminated Sites***

US HIST CDL ..... Delisted National Clandestine Laboratory Register
US CDL ..... National Clandestine Laboratory Register

***Local Land Records***

LIENS 2 ..... CERCLA Lien Information

***Records of Emergency Release Reports***

HMIRS ..... Hazardous Materials Information Reporting System
NC SPILLS ..... Spills Incident Listing
VA SPILLS ..... Prep/Spills Database Listing
NC IMD ..... Incident Management Database
NC SPILLS 90 ..... SPILLS 90 data from FirstSearch
VA SPILLS 90 ..... SPILLS 90 data from FirstSearch
NC SPILLS 80 ..... SPILLS 80 data from FirstSearch

***Other Ascertainable Records***

RCRA NonGen / NLR ..... RCRA - Non Generators / No Longer Regulated
FUDS ..... Formerly Used Defense Sites
DOD ..... Department of Defense Sites
SCRD DRYCLEANERS ..... State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR ..... Financial Assurance Information
EPA WATCH LIST ..... EPA WATCH LIST
2020 COR ACTION ..... 2020 Corrective Action Program List
TSCA ..... Toxic Substances Control Act
TRIS ..... Toxic Chemical Release Inventory System
SSTS ..... Section 7 Tracking Systems
ROD ..... Records Of Decision
RMP ..... Risk Management Plans
RAATS ..... RCRA Administrative Action Tracking System
PRP ..... Potentially Responsible Parties
PADS ..... PCB Activity Database System
ICIS ..... Integrated Compliance Information System

| | |
|---|---|
| FTTS | FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act) |
| MLTS | Material Licensing Tracking System |
| COAL ASH DOE | Steam-Electric Plant Operation Data |
| COAL ASH EPA | Coal Combustion Residues Surface Impoundments List |
| PCB TRANSFORMER | PCB Transformer Registration Database |
| RADINFO | Radiation Information Database |
| HIST FTTS | FIFRA/TSCA Tracking System Administrative Case Listing |
| DOT OPS | Incident and Accident Data |
| CONSENT | Superfund (CERCLA) Consent Decrees |
| INDIAN RESERV | Indian Reservations |
| FUSRAP | Formerly Utilized Sites Remedial Action Program |
| UMTRA | Uranium Mill Tailings Sites |
| LEAD SMELTERS | Lead Smelter Sites |
| US AIRS | Aerometric Information Retrieval System Facility Subsystem |
| US MINES | Mines Master Index File |
| ABANDONED MINES | Abandoned Mines |
| FINDS | Facility Index System/Facility Registry System |
| ECHO | Enforcement & Compliance History Information |
| DOCKET HWC | Hazardous Waste Compliance Docket Listing |
| UXO | Unexploded Ordnance Sites |
| FUELS PROGRAM | EPA Fuels Program Registered Listing |
| NC AIRS | Air Quality Permit Listing |
| VA AIRS | Permitted Airs Facility List |
| NC ASBESTOS | ASBESTOS |
| VA NPDES | Comprehensive Environmental Data System |
| NC COAL ASH | Coal Ash Disposal Sites |
| VA COAL ASH | Coal Ash Disposal Sites |
| NC DRYCLEANERS | Drycleaning Sites |
| VA DRYCLEANERS | Drycleaner List |
| NC Financial Assurance | Financial Assurance Information Listing |
| VA Financial Assurance | Financial Assurance Information Listing |
| NC NPDES | NPDES Facility Location Listing |
| NC UIC | Underground Injection Wells Listing |
| VA UIC | Underground Injection Control Wells |
| NC AOP | Animal Operation Permits Listing |
| NC SEPT HAULERS | Permitted Septage Haulers Listing |
| NC PCSRP | Petroleum-Contaminated Soil Remediation Permits |
| NC CCB | Coal Ash Structural Fills (CCB) Listing |
| MINES MRDS | Mineral Resources Data System |

**EDR HIGH RISK HISTORICAL RECORDS**

***EDR Exclusive Records***

| | |
|---|---|
| EDR MGP | EDR Proprietary Manufactured Gas Plants |
| EDR Hist Auto | EDR Exclusive Historical Auto Stations |
| EDR Hist Cleaner | EDR Exclusive Historical Cleaners |

**EDR RECOVERED GOVERNMENT ARCHIVES**

***Exclusive Recovered Govt. Archives***

| | |
|---|---|
| NC RGA HWS | Recovered Government Archive State Hazardous Waste Facilities List |

NC RGA LF Recovered Government Archive Solid Waste Facilities List
VA RGA LF Recovered Government Archive Solid Waste Facilities List
NC RGA LUST Recovered Government Archive Leaking Underground Storage Tank
VA RGA LUST Recovered Government Archive Leaking Underground Storage Tank

**SURROUNDING SITES: SEARCH RESULTS**

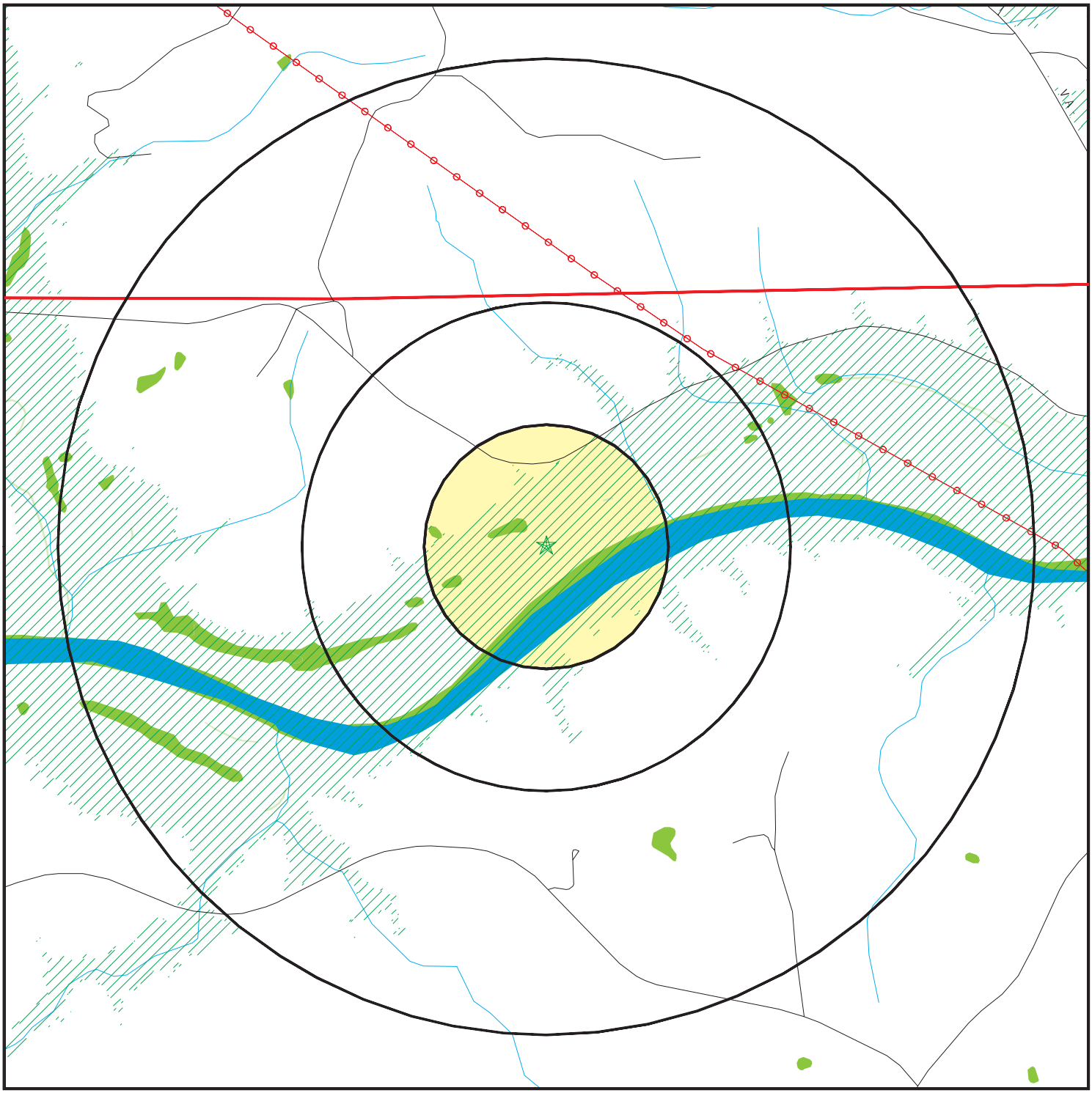
Surrounding sites were not identified.

Unmappable (orphan) sites are not considered in the foregoing analysis.

# EXECUTIVE SUMMARY

There were no unmapped sites in this report.

# OVERVIEW MAP - 6396141.14S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites

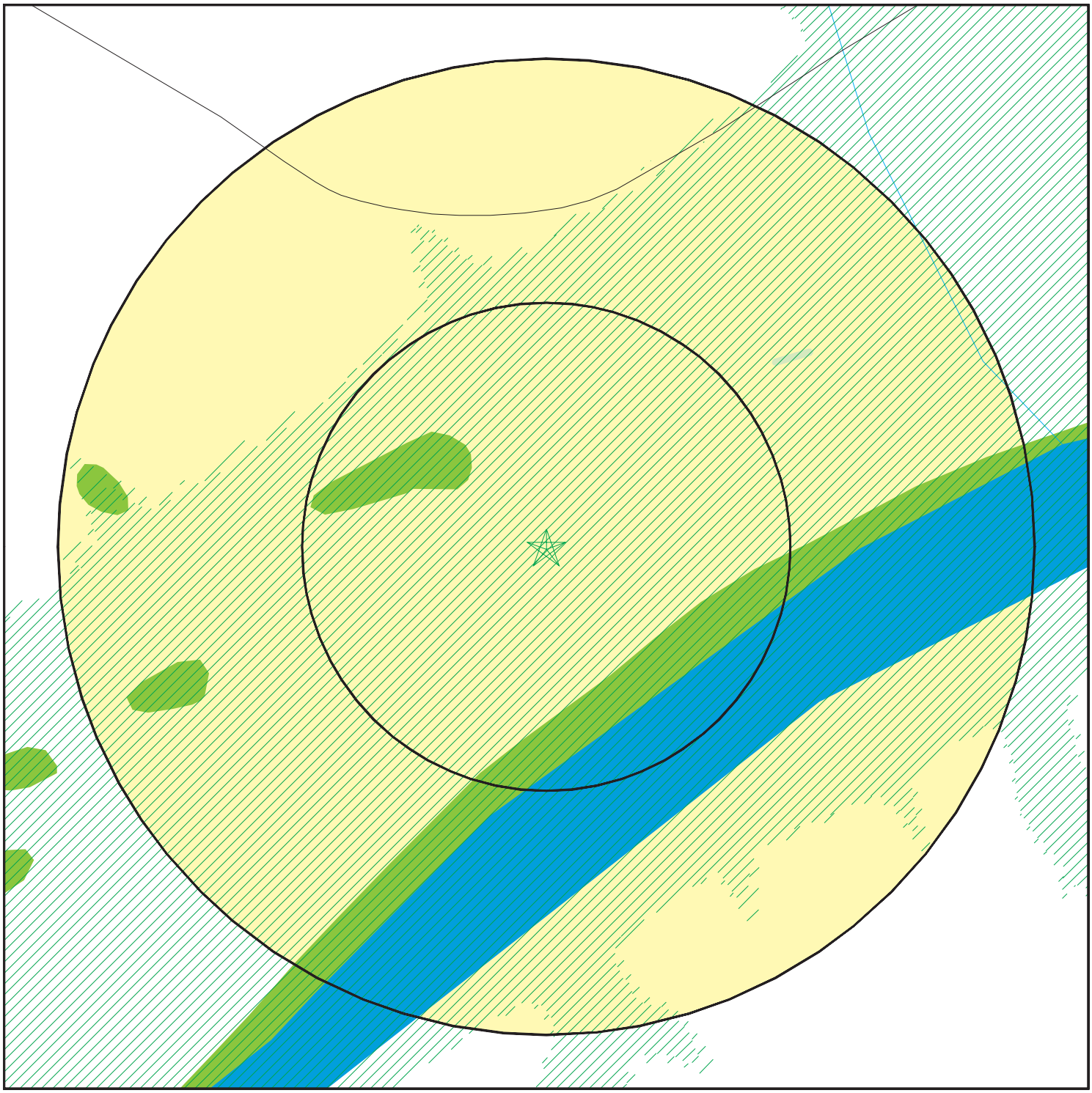
0 1/4 1/2 1 Miles

- Indian Reservations BIA
- County Boundary
- Power transmission lines
- Special Flood Hazard Area (1%)
- 0.2% Annual Chance Flood Hazard
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

| | | | |
|---|---|---|---|
| SITE NAME: | Mushroom Meadow Stream and Wetland Mitigation Site | CLIENT: | Eco Terra Management, LLC |
| ADDRESS: | Mushroom Meadow Stream and Wetland Mitigation Site<br>Milton NC 27305 | CONTACT: | Jamey Oshaughnessey |
| | | INQUIRY #: | 6396141.14s |
| LAT/LONG: | 36.533783 / 79.242589 | DATE: | March 08, 2021 4:27 pm |

# DETAIL MAP - 6396141.14S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites

0 1/16 1/8 1/4 Miles

- Indian Reservations BIA
- Special Flood Hazard Area (1%)
- 0.2% Annual Chance Flood Hazard
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

N

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

| | | | |
|---|---|---|---|
| SITE NAME: | Mushroom Meadow Stream and Wetland Mitigation Site | CLIENT: | Eco Terra Management, LLC |
| ADDRESS: | Mushroom Meadow Stream and Wetland Mitigation Site<br>Milton NC 27305 | CONTACT: | Jamey Oshaughnessey |
| LAT/LONG: | 36.533783 / 79.242589 | INQUIRY #: | 6396141.14s |
| | | DATE: | March 08, 2021 4:30 pm |

# Farmland Protection Policy Act (FPPA)

USDA
United States Department of Agriculture

Natural Resources
Conservation Service

North Carolina
State Office

4407 Bland Rd.
Suite 117
Raleigh
North Carolina 27609
Voice (704) 680-3541
Fax (844) 325-2156

March 10, 2021

Jamey O'Shaughnessey
Environmental Associate
Eco Terra Management LLC
1117 Peachtree Walk NE; Suite 126
Atlanta, GA 30309

Dear Jamey O'Shaughnessey;

The following information is in response to your request soliciting comments regarding the Proposed Mushroom Meadows Stream and Wetland Restoration Site in Caswell County, NC.

Projects are subject to Farmland Protection Policy Act (FPPA) requirements if they may irreversibly convert farmland (directly or indirectly) to nonagricultural use and are completed by a Federal agency or with assistance from a Federal agency.

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 forest land, pastureland, cropland, or other land, but not water or urban built-up land. Farmland means prime or unique farmlands as defined in section 1540(c)(1) of the Act or farmland that is determined by the appropriate state or unit of local government agency or agencies with concurrence of the Secretary to be farmland of statewide of local importance.

"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 USGS topographical maps, or as ``urban-built-up'' on the USDA Important Farmland Maps. See over for more information.

The area in question includes land classified as Prime Farmland. In accordance with the Code of Federal Regulations 7CFR 658, Farmland Protection Policy Act, the AD-1006 was initiated. NRCS Completed Parts II, IV, V of the form and returned for completion by the requesting agency.

If you have any questions, please feel free to call me at (704) 680-3541 office or (704) 754-6734 cell.

Sincerely,

Kristin L May

Kristin L May
Acting State Soil Scientist

cc:
Brandon King, supervisory soil conservationist, NRCS, Burlington, NC

U.S. Department of Agriculture

# FARMLAND CONVERSION IMPACT RATING

| | |
|---|---|
| **PART I** *(To be completed by Federal Agency)* | Date Of Land Evaluation Request 02/18/2021 |
| Name of Project Mushroom Meadows Stream and Wetlar | Federal Agency Involved NC DOT / FHWA |
| Proposed Land Use Stream and Wetland Restoration | County and State Caswell County North Carolina |
| **PART II** *(To be completed by NRCS)* | Date Request Received By NRCS 2/18/2021 / Person Completing Form: Kristin Mav |

| Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)* | YES | NO | Acres Irrigated | Average Farm Size |
|---|---|---|---|---|
| | ✔ | | None | 213 |

| Major Crop(s) | Farmable Land In Govt. Jurisdiction | Amount of Farmland As Defined in FPPA |
|---|---|---|
| Corn | Acres: 82.24 % 226032 ac. | Acres: 82.24 % 226032 ac |

| Name of Land Evaluation System Used | Name of State or Local Site Assessment System | Date Land Evaluation Returned by NRCS |
|---|---|---|
| Caswell Co. LESA | NA | 3/10/2021 |

| **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 | 31.6 | | | |
| B. Total Acres To Be Converted Indirectly | | | | |
| C. Total Acres In Site | 31.6 | | | |
| **PART IV** *(To be completed by NRCS)* Land Evaluation Information | | | | |
| A. Total Acres Prime And Unique Farmland | 0 | | | |
| B. Total Acres Statewide Important or Local Important Farmland | 2.6 | | | |
| C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted | 0.013 | | | |
| D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value | 18.7 | | | |
| **PART V** (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points) | 69 | | | |

| **PART VI** *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)* | **Maximum Points** | Site A | Site B | Site C | Site D |
|---|---|---|---|---|---|
| 1. Area In Non-urban Use | (15) | 13 | | | |
| 2. Perimeter In Non-urban Use | (10) | 9 | | | |
| 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) | 5 | | | |
| 6. Distance To Urban Support Services | (15) | 0 | | | |
| 7. Size Of Present Farm Unit Compared To Average | (10) | 8 | | | |
| 8. Creation Of Non-farmable Farmland | (10) | 0 | | | |
| 9. Availability Of Farm Support Services | (5) | 5 | | | |
| 10. On-Farm Investments | (20) | 0 | | | |
| 11. Effects Of Conversion On Farm Support Services | (10) | 0 | | | |
| 12. Compatibility With Existing Agricultural Use | (10) | 0 | | | |
| TOTAL SITE ASSESSMENT POINTS | 160 | 60 | 0 | 0 | 0 |
| **PART VII** ***(To be completed by Federal Agency)*** | | | | | |
| Relative Value Of Farmland *(From Part V)* | 100 | 69 | 0 | 0 | 0 |
| Total Site Assessment *(From Part VI above or local site assessment)* | 160 | 60 | 0 | 0 | 0 |
| **TOTAL POINTS *(Total of above 2 lines)*** | 260 | 129 | 0 | 0 | 0 |

| Site Selected: | Date Of Selection | Was A Local Site Assessment Used? YES ☐ NO ☐ |
|---|---|---|

Reason For Selection:

| Name of Federal agency representative completing this form: | Date: |
|---|---|

***(See Instructions on reverse side)*** **Form AD-1006 (03-02)**

## 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:

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

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.

# Fish & Wildlife Coordination Act (FWCA)
# NC Wildlife Resources Commission

# North Carolina Wildlife Resources Commission

Cameron Ingram, Executive Director

13 May 2021

Jamey O'Shaughnessey
EcoTerra
1117 Peachtree Walk NE, STE 126
Atlanta, Georgia 30309

SUBJECT: Environmental Review of the Mushroom Meadow Mitigation Site in Caswell County, North Carolina.

Dear Jamey O'Shaughnessey,

Biologists with the North Carolina Wildlife Resource Commission (NCWRC) received your request for review and comments on any possible concerns regarding the Mushroom Meadow Mitigation Site. Comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) and North Carolina General Statutes (G.S. 113-131 et seq.).

The Mushroom Meadow Mitigation Site is located on River Bend Road near Milton, Caswell County, North Carolina. The current land use is pastureland. The proposed project would restore, enhance, and/or preserve unnamed tributaries to the Dan River in the Roanoke River basin.

We have records for the state endangered dwarf Chinquapin oak (*Quercus prinoides*), state special concern gray treefrog (*Hyla versicolor*), and state significantly rare James's sedge (*Carex jamesii*) at or near the site. Based upon the information provided to NCWRC, it is unlikely that stream and wetland mitigation will adversely affect any state-listed species. However, if these species are observed or heard, please NCWRC or NC Plant Conservation Program for plants.

Stream restoration projects often improve water quality and aquatic habitat. Establishing native, forested buffers in riparian areas will help protect water quality, improve aquatic and terrestrial habitats, and provide a travel corridor for wildlife species. We offer the following general recommendations to minimize impacts to aquatic and terrestrial wildlife resources:

1. We recommend riparian buffers are as wide as possible, given site constraints and landowner needs. NCWRC generally recommends a woody buffer of 100 feet on perennial streams to maximize the benefits of buffers, including bank stability, stream shading, treatment of overland runoff, and wildlife habitat.
2. We recommend a plant list that consists of species typically found in reference streams and the appropriate natural vegetation community, as described by M.P. Schafale in The Guide To The Natural Communities of North Carolina, Fourth Approximation (https://www.ncnhp.org/references/nhp-publications/fourth-approximation-descriptions).

**Mailing Address:** Habitat Conservation • 1721 Mail Service Center • Raleigh, NC 27699-1721
**Telephone:** (919) 707-0220 • **Fax:** (919) 707-0028

3. Avoid using orchard grass, tall fescue, or cereal rye, which exhibits allelopathic characteristics, for soil stabilization.
4. The use of biodegradable and wildlife-friendly sediment and erosion control devices is strongly recommended. Silt fencing, fiber rolls and/or other products should have loose-weave netting that is made of **natural fiber materials with movable joints** between the vertical and horizontal twines. Silt fencing that has been reinforced with plastic or metal mesh should be avoided as it impedes the movement of terrestrial wildlife species. Excessive silt and sediment loads can have detrimental effects on aquatic resources including destruction of spawning habitat, suffocation of eggs, and clogging of gills.

Thank you for the opportunity to provide comments. If I can be of additional assistance, please call (336) 269-0074 or email olivia.munzer@ncwildlife.org.

Sincerely,

Olivia Munzer
Western Piedmont Habitat Conservation Coordinator
Habitat Conservation Program

Updated Species Conclusions Table

Project Name: Mushroom Meadow

Date: December 30, 2022

| Species / Resource Name | Conclusion | ESA Section 7 / Eagle Act Determination | Notes / Documentation |
|---|---|---|---|
| Tricolored bat/*Perimyotis subflavus* | Not required | Not required | A North Carolina Natural Heritage Program data explorer report, dated January 9, 2023, indicates no known occurrences within one mile. The site has limited tree coverage, trees are limited to a single line along UT2. The trees within the project site are spaced out and are not part of a contiguous forested stand. |
| Roanoke logperch/*Percina rex* | No suitable habitat present | No effect | A North Carolina Natural Heritage Program data explorer report, dated January 9, 2023, indicates no known occurrences within one mile. The Roanoke logperch prefers large sized warm clear stream per USFWS. The streams that will be altered in this project are too small to support the Roanoke logperch. |
| Atlantic pigtoe *Fusconaia masoni* | No suitable habitat present | No Effect | A North Carolina Natural Heritage Program data explorer report, dated January 9, 2023, indicates no known occurrences within one mile. Suitable substrate is not present and stream flow is intermittent in UT1 and UT3. Water quality is negatively impacted by cattle access. |
| Critical habitat | No critical habitat present | No Effect | No critical habitats were identified by IPaC, accessed on 5/4/2022. |

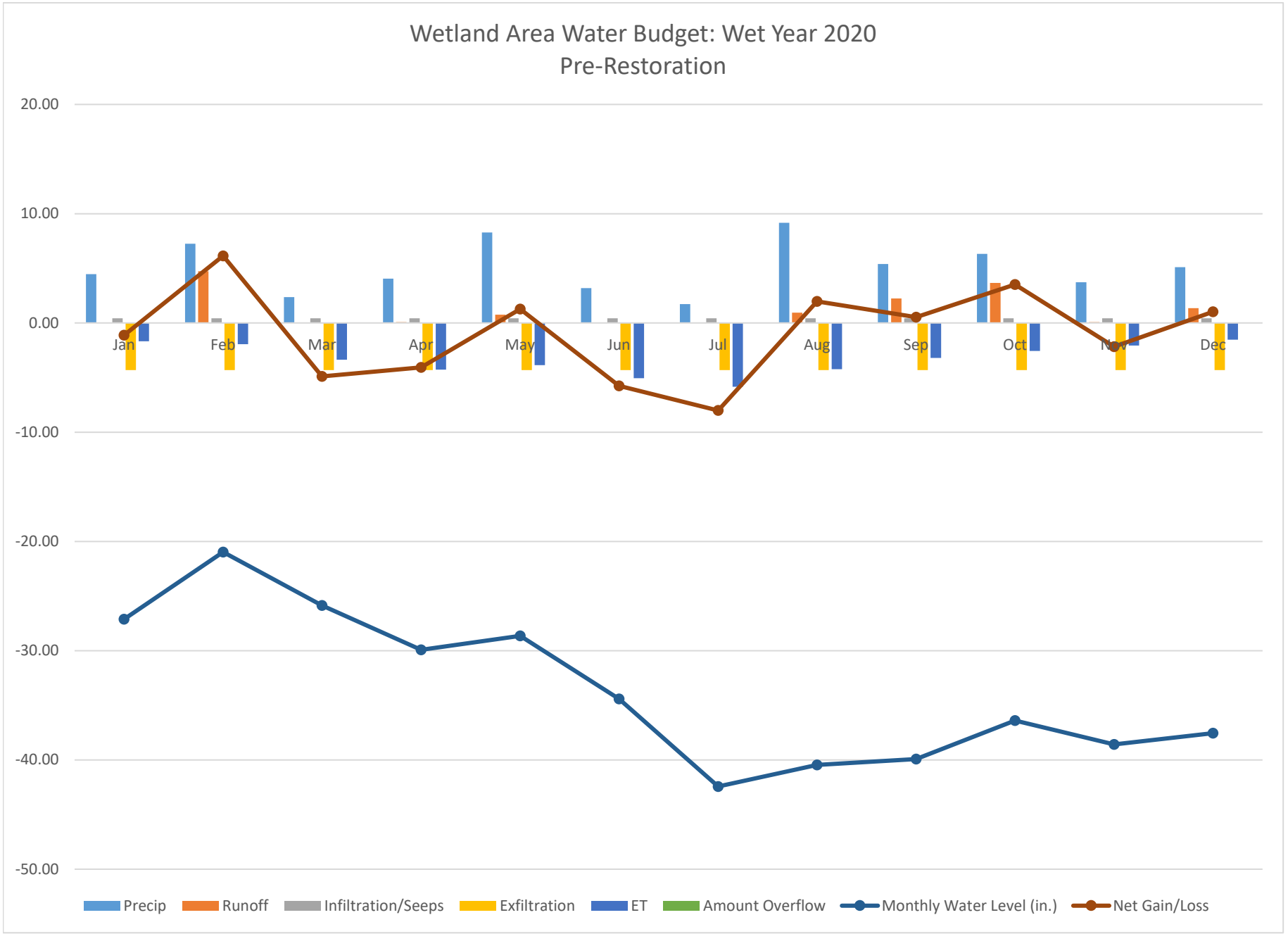
Acknowledgement: I agree that the above information about my proposed project is true. I used all of the provided resources to make an informed decision about impacts in the immediate and surrounding areas.

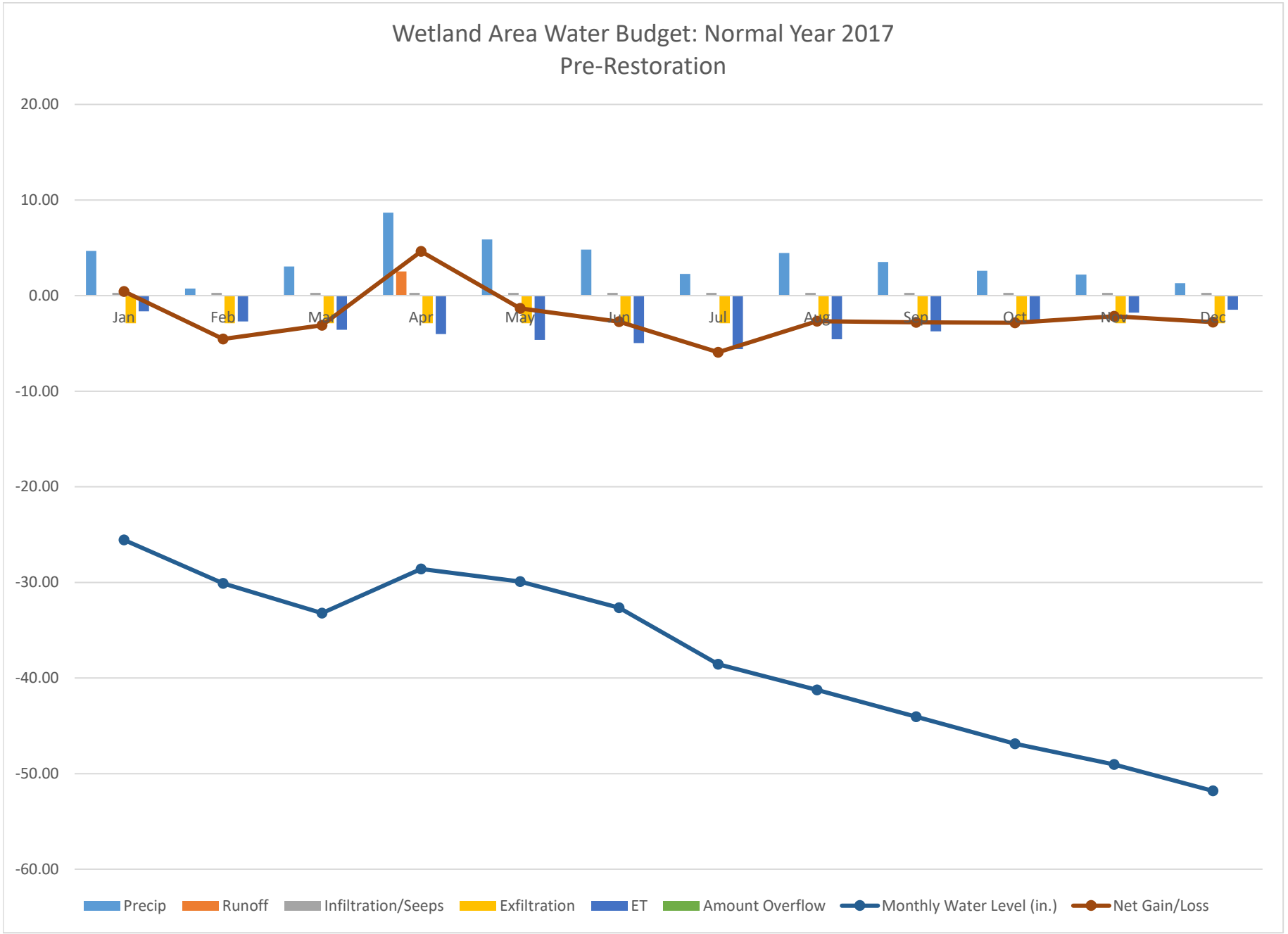
Signature /Title

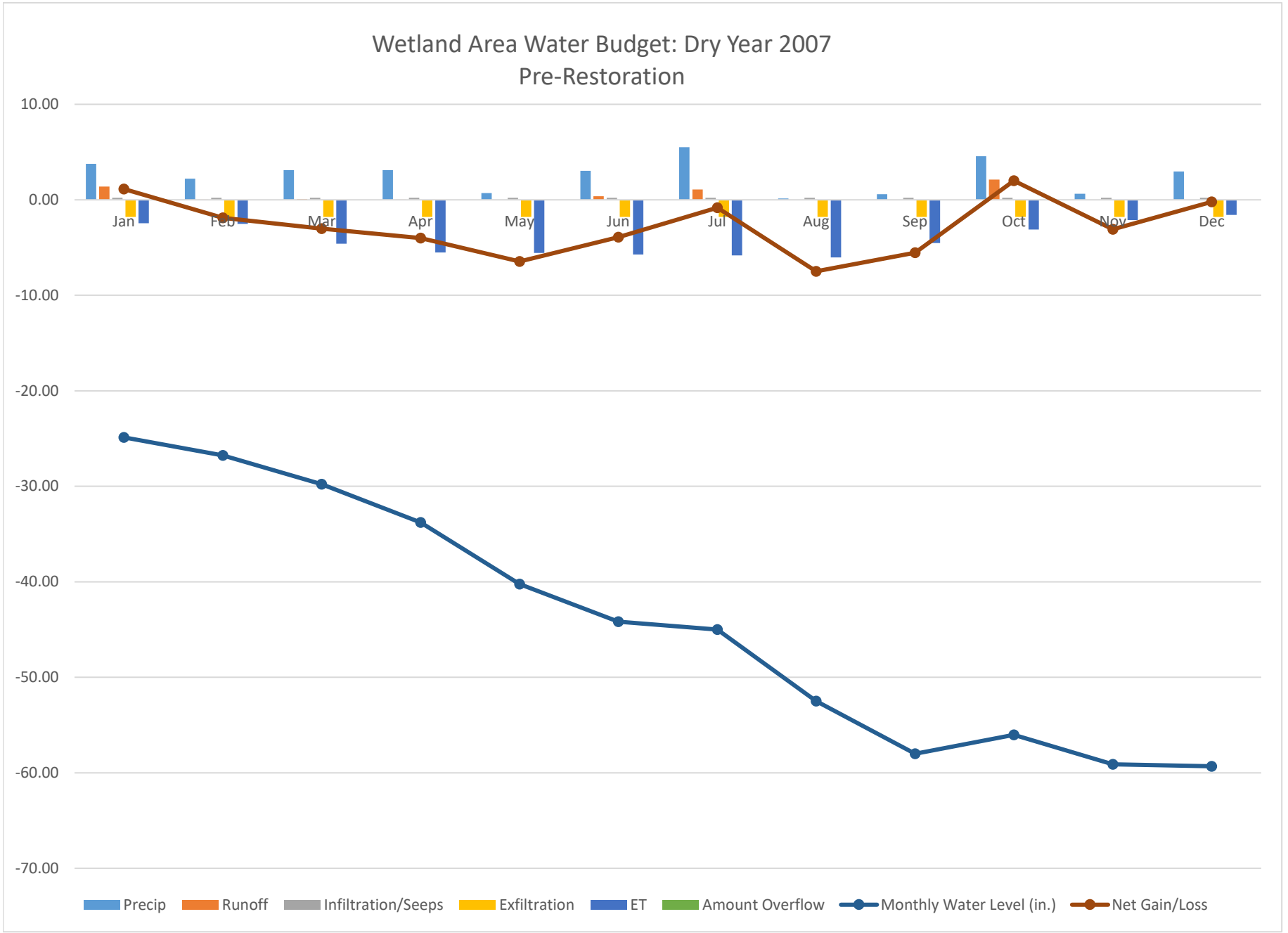
1/9/2023

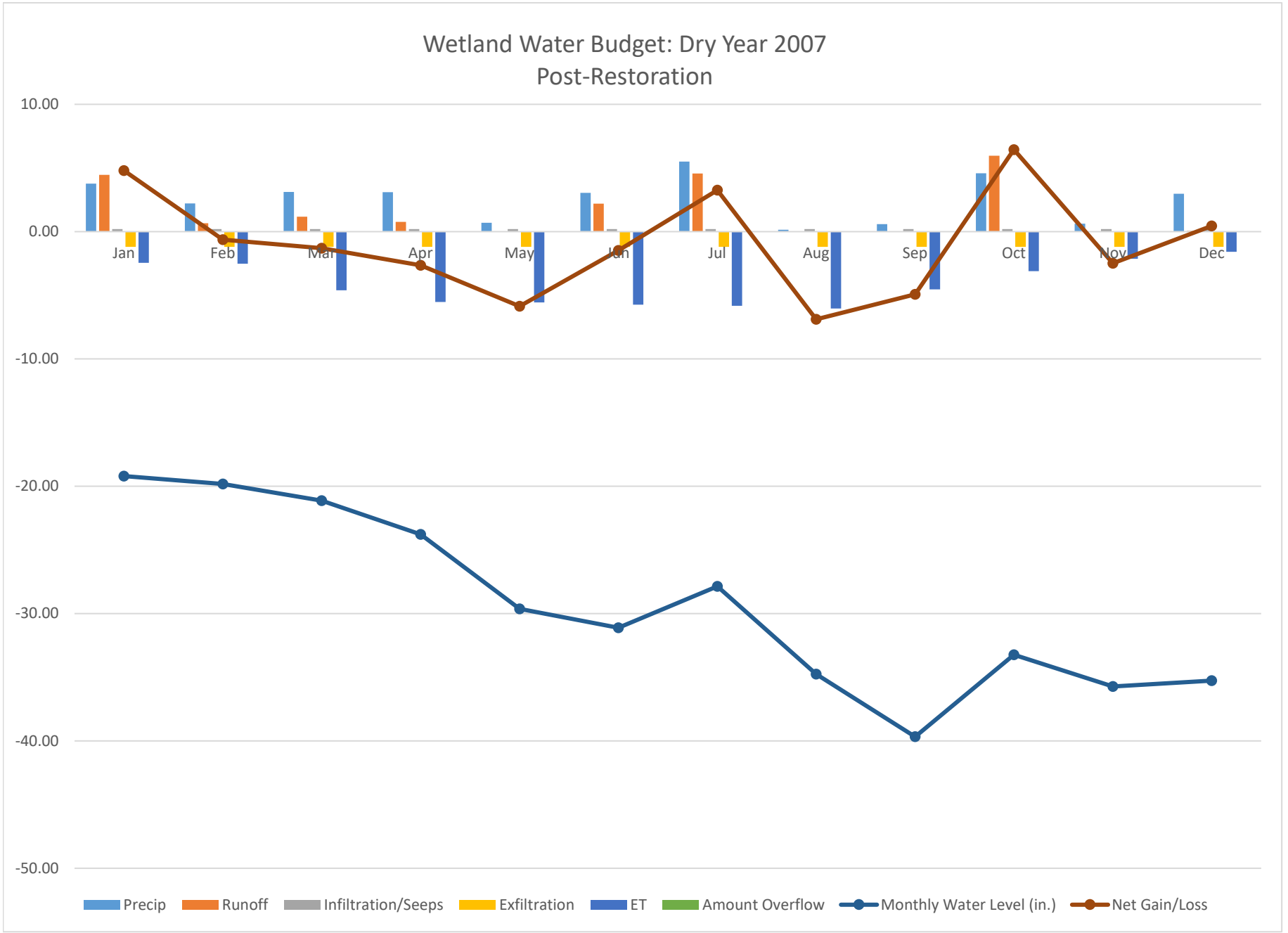
Date

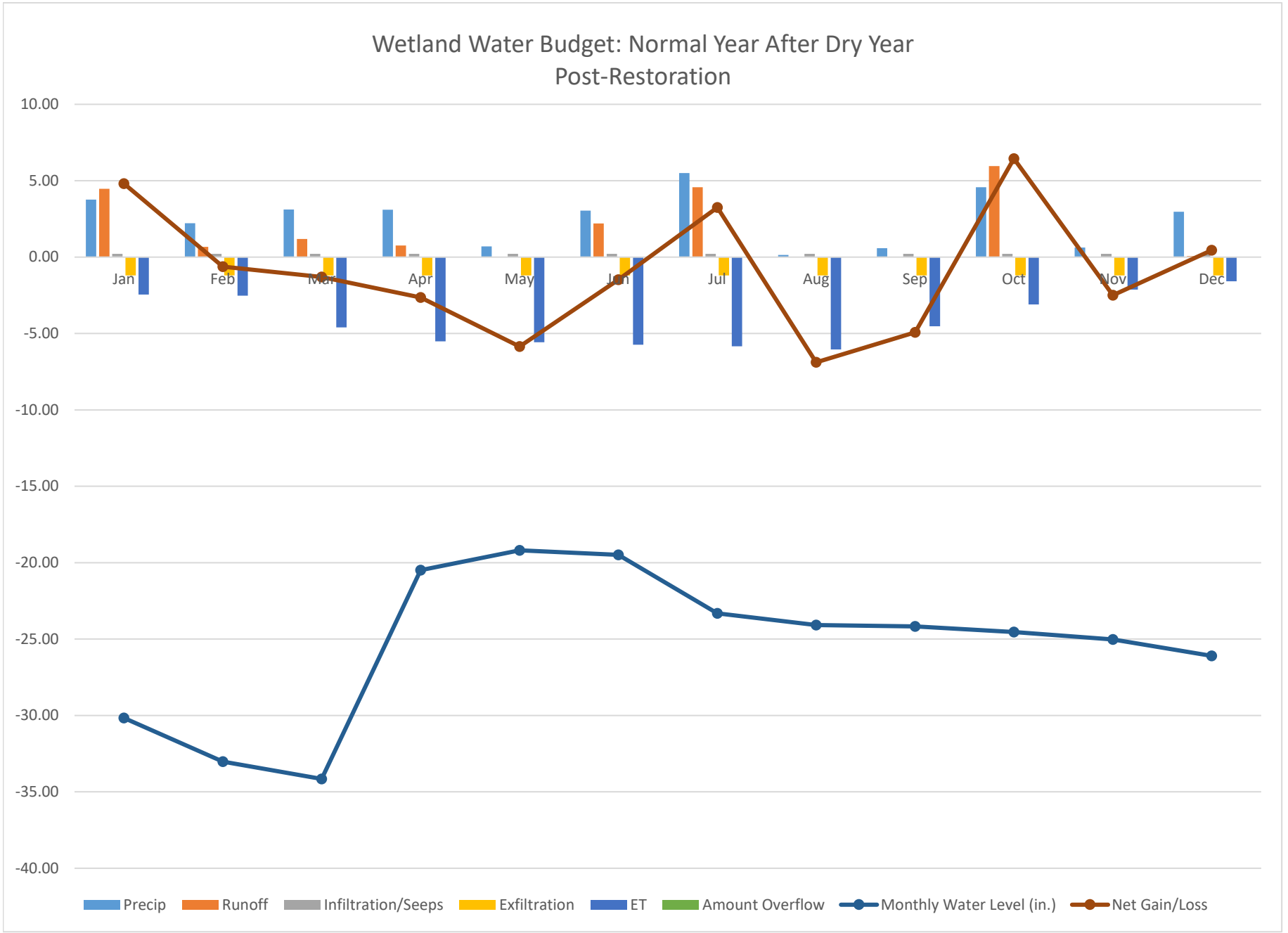
# Appendix F: Wetland Hydrologic Modeling Charts

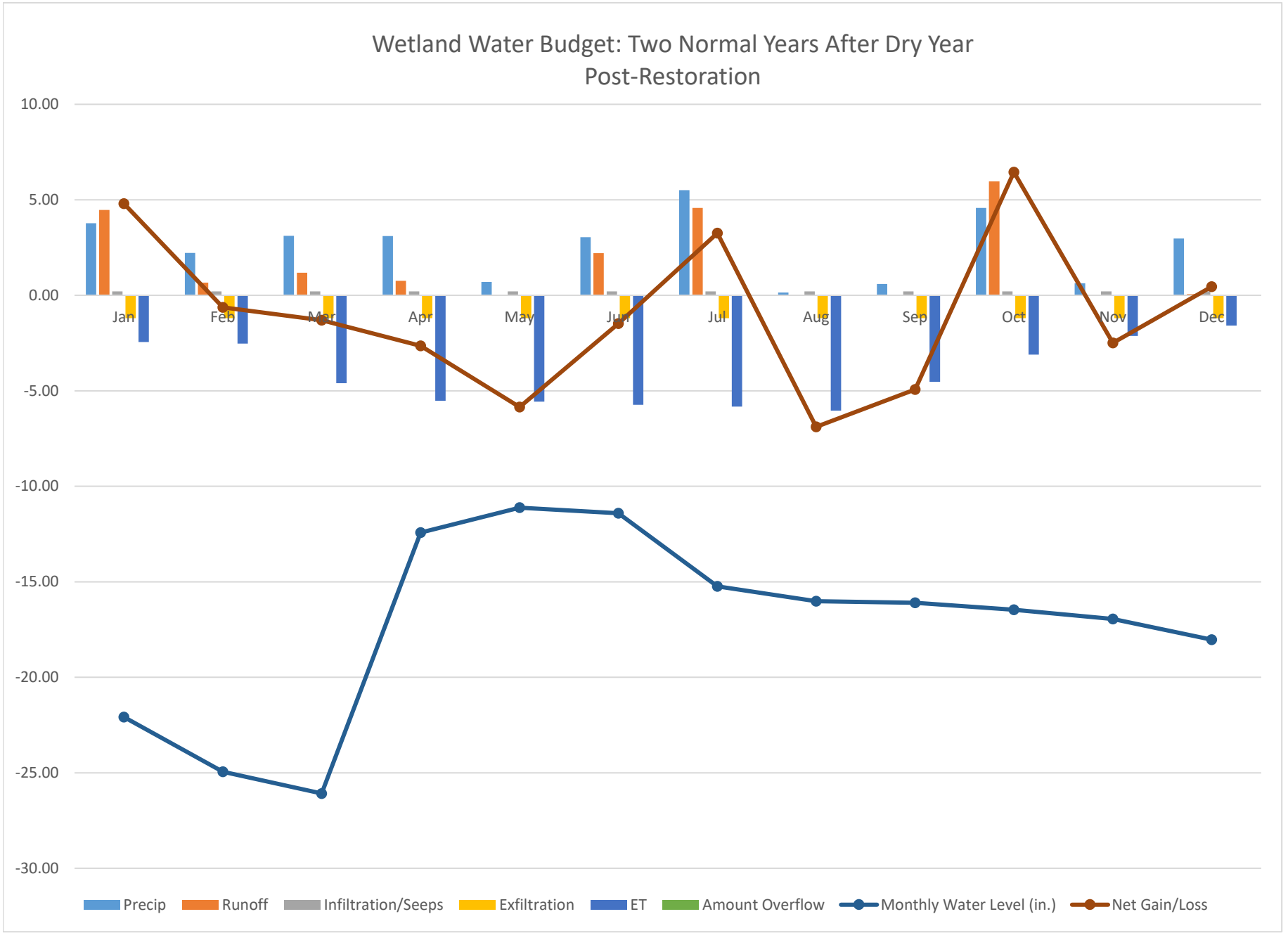

Wetland Area Water Budget: Wet Year 2020
Pre-Restoration
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Precip
Runoff
Infiltration/Seeps
Exfiltration
ET
Amount Overflow
Monthly Water Level (in.)
Net Gain/Loss

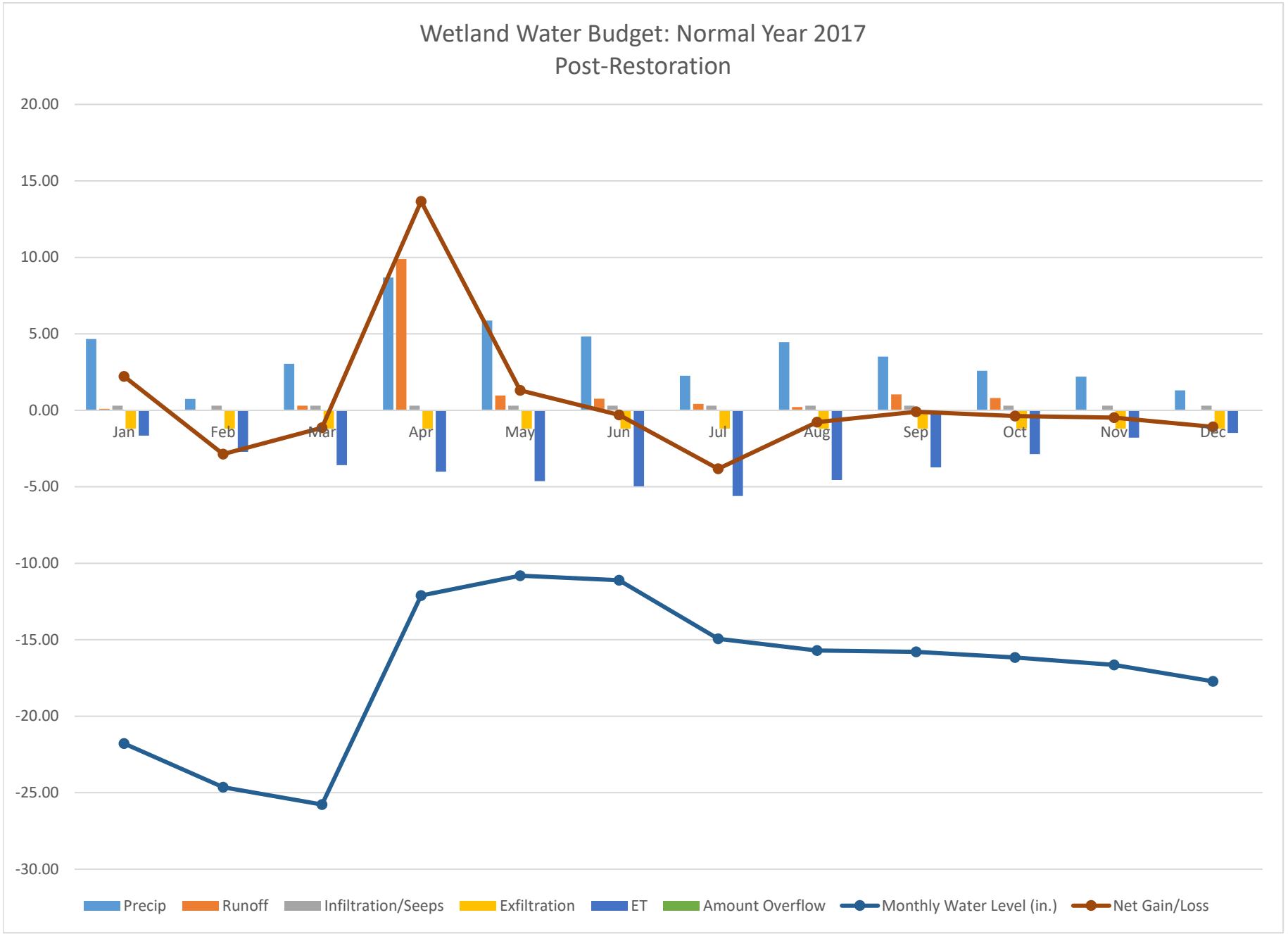

Wetland Area Water Budget: Normal Year 2017
Pre-Restoration
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Precip
Runoff
Infiltration/Seeps
Exfiltration
ET
Amount Overflow
Monthly Water Level (in.)
Net Gain/Loss

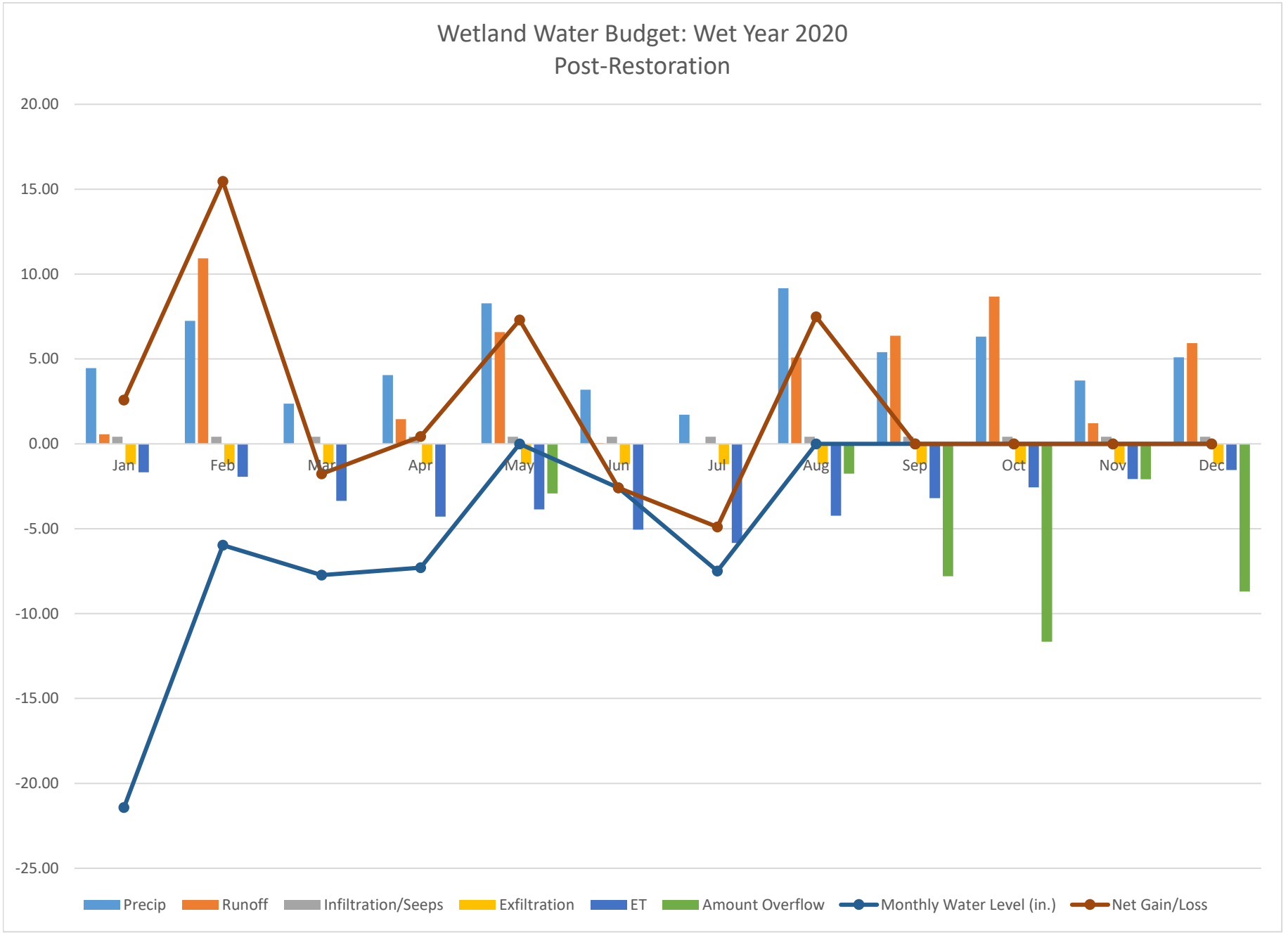

Wetland Area Water Budget: Dry Year 2007
Pre-Restoration
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Precip
Runoff
Infiltration/Seeps
Exfiltration
ET
Amount Overflow
Monthly Water Level (in.)
Net Gain/Loss

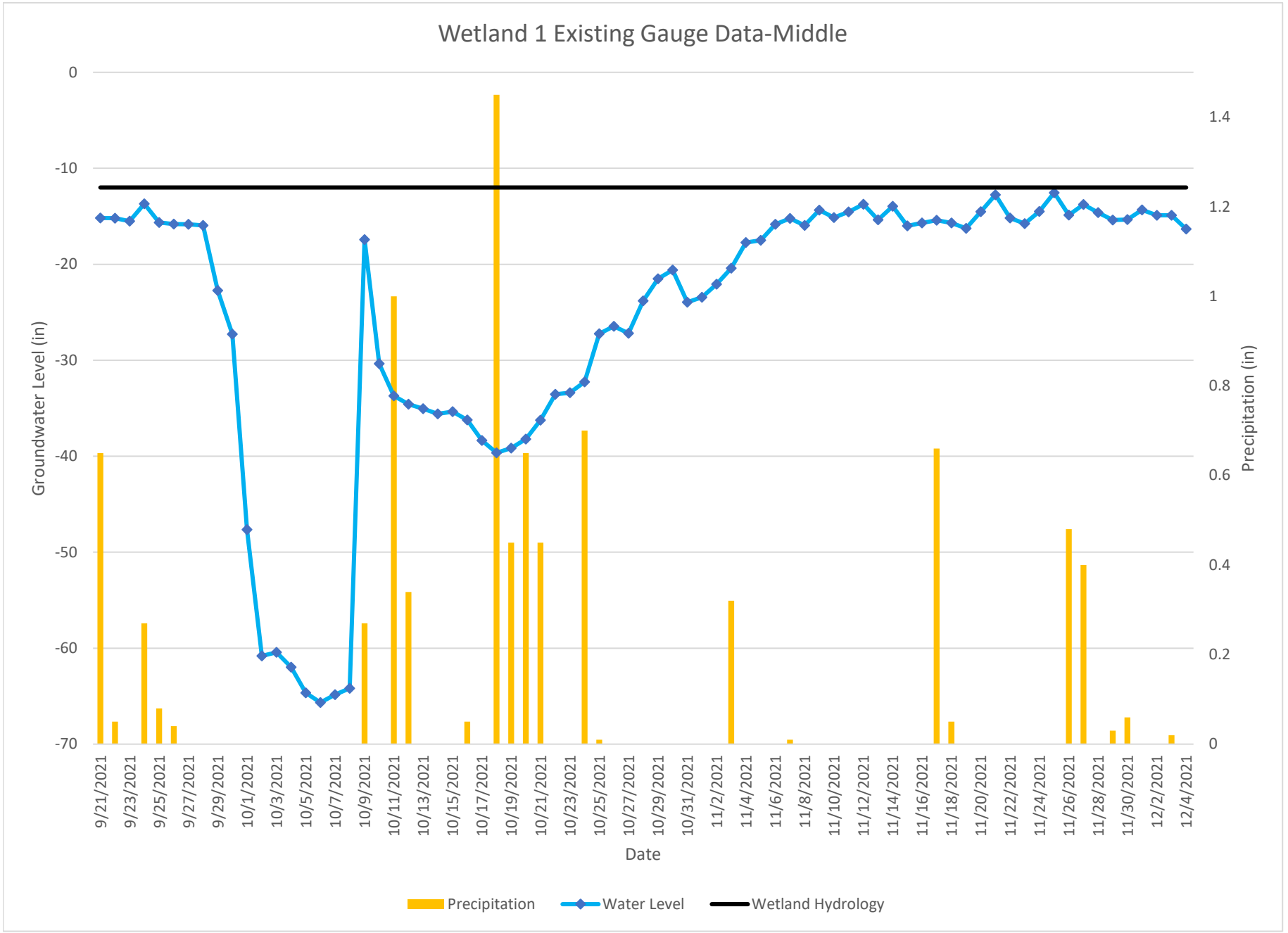

Wetland Water Budget: Dry Year 2007
Post-Restoration
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Precip
Runoff
Infiltration/Seeps
Exfiltration
ET
Amount Overflow
Monthly Water Level (in.)
Net Gain/Loss

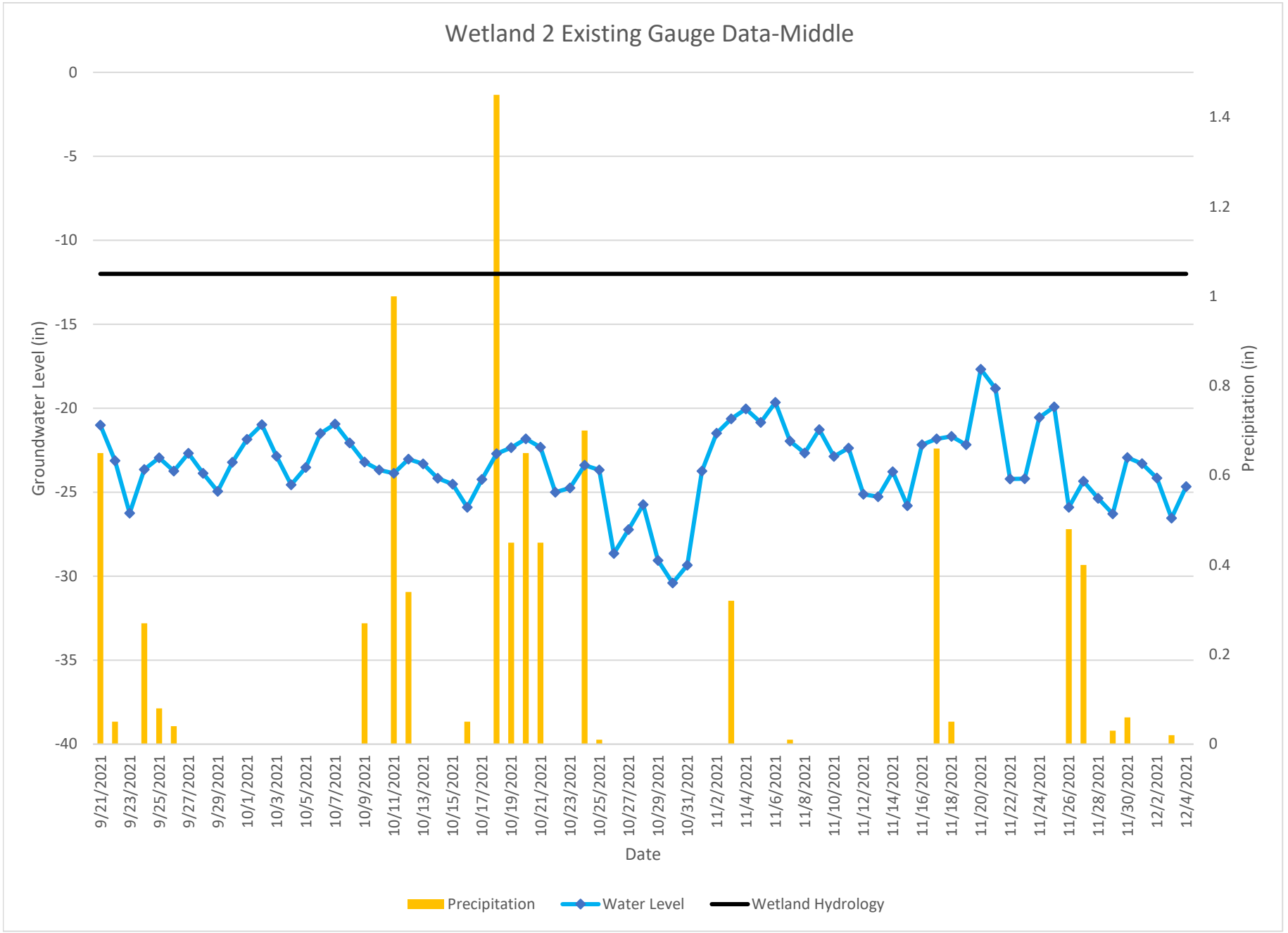

Wetland Water Budget: Normal Year After Dry Year
Post-Restoration
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Precip
Runoff
Infiltration/Seeps
Exfiltration
ET
Amount Overflow
Monthly Water Level (in.)
Net Gain/Loss


Wetland Water Budget: Two Normal Years After Dry Year
Post-Restoration
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Precip
Runoff
Infiltration/Seeps
Exfiltration
ET
Amount Overflow
Monthly Water Level (in.)
Net Gain/Loss


Wetland Water Budget: Normal Year 2017
Post-Restoration
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Precip
Runoff
Infiltration/Seeps
Exfiltration
ET
Amount Overflow
Monthly Water Level (in.)
Net Gain/Loss


Wetland Water Budget: Wet Year 2020
Post-Restoration
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Precip
Runoff
Infiltration/Seeps
Exfiltration
ET
Amount Overflow
Monthly Water Level (in.)
Net Gain/Loss


Wetland 1 Existing Gauge Data-Middle
Groundwater Level (in)
Precipitation (in)
Date
0
-10
-20
-30
-40
-50
-60
-70
1.4
1.2
1
0.8
0.6
0.4
0.2
0
9/21/2021
9/23/2021
9/25/2021
9/27/2021
9/29/2021
10/1/2021
10/3/2021
10/5/2021
10/7/2021
10/9/2021
10/11/2021
10/13/2021
10/15/2021
10/17/2021
10/19/2021
10/21/2021
10/23/2021
10/25/2021
10/27/2021
10/29/2021
10/31/2021
11/2/2021
11/4/2021
11/6/2021
11/8/2021
11/10/2021
11/12/2021
11/14/2021
11/16/2021
11/18/2021
11/20/2021
11/22/2021
11/24/2021
11/26/2021
11/28/2021
11/30/2021
12/2/2021
12/4/2021
Precipitation
Water Level
Wetland Hydrology


Wetland 2 Existing Gauge Data-Middle
Groundwater Level (in)
Precipitation (in)
0
-5
-10
-15
-20
-25
-30
-35
-40
1.4
1.2
1
0.8
0.6
0.4
0.2
0
9/21/2021
9/23/2021
9/25/2021
9/27/2021
9/29/2021
10/1/2021
10/3/2021
10/5/2021
10/7/2021
10/9/2021
10/11/2021
10/13/2021
10/15/2021
10/17/2021
10/19/2021
10/21/2021
10/23/2021
10/25/2021
10/27/2021
10/29/2021
10/31/2021
11/2/2021
11/4/2021
11/6/2021
11/8/2021
11/10/2021
11/12/2021
11/14/2021
11/16/2021
11/18/2021
11/20/2021
11/22/2021
11/24/2021
11/26/2021
11/28/2021
11/30/2021
12/2/2021
12/4/2021
Date
Precipitation
Water Level
Wetland Hydrology

# Appendix G: Project Risk and Uncertainties

## Project Risks and Uncertainties

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

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

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

2. **Easement Encroachment:** Any encroachment to the conservation easement. (Including road widening, culvert maintenance, utility easements, etc.)

• **Methods to Address:** The sponsor has had considerable discussions with the landowner regarding the project requirements and limitations of easement access and is confident that the landowner fully understands and will maintain the easement protections. The landowner has agreed to remove cattle from the project.

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

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

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

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

5. **Sediment Load:** Potential for aggradation to occur in the constructed pools.

**Methods to Address:** The project has been designed with appropriate channel dimensions and shear stress to move the sediment load entering the system. Grade control structures have been incorporated to maintain pools and channel bed elevation. In the event this becomes an issue, existing conditions will be reviewed to determine where the problem is located, and a repair plan will be produced and presented to the NCIRT. Coir logs are placed near the end of UT3 to help form bed and bank in wet soils that have been impacted by hoof shear.  The coir logs will be left in place and rooting from livestakes

and herbaceous vegetation will assist in bank cohesion as the coir logs degrade. The removal of cattle and development of an appropriate streamside riparian buffer will help the restored stream retain channel features in the flatter portions. Possible remedies to loss of stream features are sediment and vegetation removal or hand grading within the first three years.

6. **Invasive/Nuisance Species:** Chinese privet, the main invasive species present on-site, currently exists in the easement area. There is potential for these species to jeopardize buffer vegetation establishment.

• **Methods to Address:** The sponsor will locate invasive vegetation. It will be visually assessed, photographed, and mapped. These areas will be treated by mechanical or chemical methods, so that invasive species are no more than 5% of the easement acreage. Any vegetation requiring herbicide application will be performed in accordance with NC Department of Agriculture rules and regulations.

# Appendix H: Credit Release Schedule

## Credit Release Schedule

Credit release will be determined from the total credit generated by the as-built survey of the Site. Authorization from the DA will be required prior to any debits to the mitigation project. Monitoring reports will be submitted to the NCIRT for determination on whether success criteria have been met. If it is determined the Site is meeting the success criteria credits may be released.

| **Wetland Credit Release Schedule** | | | |
|---|---|---|---|
| **Credit Release Milestone** | **Credit Release Activity** | **Interim Release** | **Total Released** |
| 1 | Site establishment | 0% | 0% |
| 2 | Completion of an initial physical and biological improvements made pursuant to the mitigation plan | 30% | 30% |
| 3 | First year monitoring report demonstrates interim performance standards are being met | 10% | 40% |
| 4 | Second year monitoring report demonstrates interim performance standards are being met | 10% | 50% |
| 5 | Third year monitoring report demonstrates interim performance standards are being met | 15% | 65% |
| 6* | Fourth year monitoring report demonstrates interim performance standards are being met | 5% | 70% |
| 7 | Fifth year monitoring report demonstrates interim performance standards are being met | 15% | 85% |
| 8* | Sixth year monitoring report demonstrates interim performance standards are being met | 5% | 90% |
| 9 | Seventh year monitoring report demonstrates interim performance standards are being met | 10% | 100% |

*Please note that vegetation plot data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the NCIRT.

| **Stream Credit Release Schedule** | | | |
|---|---|---|---|
| **Credit Release Milestone** | **Credit Release Activity** | **Interim Release** | **Total Released** |
| 1 | Site establishment | 0% | 0% |
| 2 | Completion of an initial physical and biological improvements made pursuant to the mitigation plan | 30% | 30% |
| 3 | First year monitoring report demonstrates interim performance standards are being met | 10% | 40% |
| 4 | Second year monitoring report demonstrates interim performance standards are being met | 10% | 50% |
| 5 | Third year monitoring report demonstrates interim performance standards are being met | 10% | 60% |

| Credit Release Milestone | Credit Release Activity | Interim Release | Total Released |
|---|---|---|---|
| 6* | Fourth year monitoring report demonstrates interim performance standards are being met | 5% | 65% (75%) |
| 7 | Fifth year monitoring report demonstrates interim performance standards are being met | 10% | 75% (85%) |
| 8* | Sixth year monitoring report demonstrates interim performance standards are being met | 5% | 80% (90%) |
| 9 | Seventh year monitoring report demonstrates interim performance standards are being met | 10% | 90% (100%) |

*10% of credits will be reserved and subsequently released after hydrology success criteria have occurred in separate monitoring years, provided the channel is stable and all other performance standards are being met.

**Initial Allocation of Released Credits**

For NCDMS projects, there is no initial credit release. This is accounted for by releasing an additional 15% after the completion of all physical and biological improvements made pursuant to the Mitigation Plan. In order for NCDMS to receive the 30% release as shown above, they must comply with the credit release requirements stated in Section IV(I)(3) of the approved NCDMS instrument.

**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 fewer 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 the credit release, NCDMS 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 I: Soils Report

Soil, Water, & Environment Group, PLLC
3216 Byers Drive, Suite B
Raleigh, NC 27607
Ph# (919) 831-1234 • Fax# (919) 899-9100 • http://www.swegrp.com

October 23, 2020

Mr. Ted Griffith
Eco-Terra Management, LLC
117 Peachtree Walk NE
STE 126
Atlanta, GA 30309

**Re: Soil Analysis and Evaluation for the Mushroom Meadow Stream and Wetland Restoration Mitigation Site, Caswell County, NC**

Dear Mr. Griffith,

Soil, Water, and Environment Group, PLLC was requested by Eco-Terra to provide a hydric soil determination at a proposed stream and wetland mitigation site is approximately 2.0 miles east of the Town of Milton and south of Riverbend Road in Caswell County, North Carolina (Figure 1). The soil investigation was conducted in accordance with the RFP #16-20200204 requesting stream and riparian wetland mitigation credits for the Roanoke River Basin (HUC 03010104) from the NC Department of Environment and Natural Resources, Division of Mitigation Services. The site is located in LRR P, MLRA 136A within the Piedmont physiographic region. Currently the site investigated is in pasture agriculture.

Prior to going to the site, background data, maps, and online resources were researched to familiarize staff with the area, regional soils, as well as the landscape setting of the project. The following is a description of the data set included with this correspondence related to the Mushroom Meadow Stream and Wetland Mitigation Site:

***Hydric Soil Investigation***

On September 11 and October 22, 2020, SWE Group personnel investigated the Mushroom Meadow Stream and Wetland Mitigation Site to confirm published NRCS soil survey mapping data, record detailed soil descriptions for selected areas representing different landscape positions across the site, and to determine the extent of hydric soils for the purpose of wetland restoration site criteria.

The proposed wetland restoration area is located in the geomorphic floodplain of the Dan River and adjacent to several unnamed tributaries. This landscape

position supports hydric soils in depressional features receiving subsurface lateral flows from upslope contributing watersheds, as well as periodic overbank flooding and backwaters from the Dan River. Substantial site drainage and land-forming activities have drained these soils resulting in their present-day condition.

A series of approximately 25 hand augerings was accomplished across approximately 15 acres of the proposed wetland restoration site at maximum depths of approximately 24-30 in. Detailed soil descriptions including depth of horizon, color, texture, structure, and consistence were recorded (Figure 2: Soil Boring Map).

The site-specific soil descriptions included in this report are most similar to Hatboro silt loam series soils as described by the Web Soil Survey for Caswell County (NRCS Web Soil Survey, 2020) with variations in texture, color, and thickness. The site has been in agriculture and cleared for well over 50 years and hydric soils have been modified and effectively drained. Landscape positions include flats and depressions on the active geomorphic floodplain of the Dan River.

Hydric soils found on the site occurred generally in the same landscape positions described above. Slopes on site are flat to nearly flat and the site generally slopes from north to south. Flood flows appear to move across the site from west to east, traveling through historic wetland areas and a ditch system before exiting the site in the Dan River. The seasonal high water table on undrained site soils is found between 0-12 inches. Due to active and on-going drainage, the observed water table ranged from 14-24 inches in the latter growing season.

***NRCS Mapped Soils***

Hatboro (Ha) silt loam soils are very deep and poorly drained soils found on floodplains in depressions and flats. These soils formed in alluvium derived from metamorphic and crystalline rock and have moderately high to high hydraulic conductivity. Soils are subject to periodic overbank flooding and inundation. Slopes are generally 0-2%. An image of the NRCS Web Soil Survey with the proposed Project is shown in Figure 3. Geologically, the Project Site is located within the Piedmont physiographic province and Southern Piedmont ecoregion.

Hatboro soils are classified as hydric and found on the National Hydric Soils List (NRCS, 1995). These soils are a minor group associated with the soil map unit Codorus soil also found on floodplains. Hatboro soils typically have a dark grayish brown, 10YR 4/2 silt loam Ap surface horizon ( 0-9 in), and a gray 10YR 5/1, Bg1 horizon ( 9-27in), followed by a grayish brown 2.5Y 5/2, Bg2 subsurface horizon (27-44 in). (NRCS, 2008).

A series of soil borings were accomplished across the site and soil descriptions were completed on representative samples. Hydric soil indicators were used in

accordance with the manual *Field Indicators of Hydric Soils in the United States, 2018*, USDA Natural Resources Conservation Service.

Hydric indicators utilized on this site were as follows:

*F3. Depleted Matrix*
A layer that has a depleted matrix with 60% or more chroma of 2 or less and that has a minimum thickness of either:

a. 2 inches if it starts at a depth less than or equal to 4 inches from the soil surface, or
b. 6 inches, starting at a depth of 10 inches from the soil surface.

*User Notes:* A depleted matrix requires a value of 4 or more and chroma of 2 or less. Redox concentrations, including soft iron-manganese masses and/or pore linings, are required in soils with matrix colors of 4/1, 4/2, or 5/2. A, E, and calcic horizons may have low chromas and high values and may therefore be mistaken for a deplete matrix; however, they are excluded from the concept of depleted matrix unless the soil has common or many distinct or prominent redox concentrations occurring as soft masses or pore linings. The low-chroma matrix must be the result of wetness and not a weathering or parent material feature.

And/Or,

*F19. Piedmont Flood Plain Soils*
On flood plains, a mineral layer at least 15 cm (6 inches) thick, starting at a depth less than or equal to 25 cm (10 inches) from the soil surface, with a matrix (60% or more of the volume) chroma of less than 4 and 20% or more distinct or prominent redox concentrations occurring as soft masses or pore linings:

*User Notes:* This indicator is for use or testing on flood plains in the Mid-Atlantic and Southern Piedmont Provinces and areas where sediments derived from the Piedmont are being deposited on flood plains on the Coastal Plain. This indicator does not apply to stream terraces, which are associated with a historic stream level and are representative of an abandoned flood plain. While these soils are found on flood plains, flooding may be rare and groundwater is often the source of hydrology.

Soils mapped within the proposed restoration area have layers at least 10 inches down and at least 6 inches thick with a matrix of 60% or more chroma of 2 or less. Soils mapped within the proposed restoration area are hydric and are further described in the representative soil borings. (Attached Soil Borings).

Overall, it is my professional opinion the project area proposed and investigated has hydric soils with hydric soil characteristics suitable for wetland restoration (re-establishment) most similar to Hatboro series soils.

Further, the areas investigated for the presence of hydric soils considered for wetland restoration consist predominantly of hydric soils, are devoid of hydric vegetation, and wetland hydrology, and are not currently jurisdictional wetlands, as defined by the U.S. Army Corps of Engineers (USACE) 1987 Wetland Delineation Manual and the 2010 USACE Atlantic Gulf and Coastal Plain Regional Supplement.

Please let us know if you have any questions concerning the enclosed soil data and site investigation report. We look forward to working with you further on this project.

Sincerely,


**Scott J. Frederick, EI, NCLSS #1236**
Environmental Scientist
Soil, Water, & Environment Group
sjfrederick@swegrp.com
Encl: figures, soils data, and photos

## References

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff. 2002. Field book for describing and sampling soils, Version 2.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

United States Department of Agriculture, Natural Resources Conservation Service. 2018. Field Indicators of Hydric Soils in the United States. A Guide for Identifying and Delineating Hydric Soils, V. 8.2. L.M. Vasilas, G.W. Hurt, and J.F. Berkowitz (eds.). USDA, NRCS in cooperation with the National Technical Committee for Hydric Soils.

United States Department of Agriculture, Soil Conservation Service. 2020. GIS Web Soil Survey of Caswell County, North Carolina.

## Attachments

**Soil Descriptions/Photos**
**Figure 1: USGS Vicinity**
**Figure 2: Soil Boring Locations**
**Figure 3: NRCS Soil Map**

Soil, Water, & Environment Group

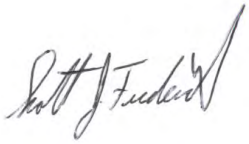
**Soil Investigation Data Sheet**

| | | | |
|---|---|---|---|
| Soil Boring: | SB1 hydric (F19) | | |
| Location: | Mushroom Meadow | Date: | 10/14/20 |
| County: | Caswell NC | Investigator(s): | SJF |
| Lat./Long.: | 36.532500, -79.245833 | Elev.: | 366 ft |

| | | | |
|---|---|---|---|
| Parent Material: | alluvium from metamorphic and acid crystalline rock | Drainage (Wetness) Class: | poorly drained effective drainage in place |
| Moisture Status: | moist | Slope (%): | < 2% |
| Classification: | Fine-loamy, mixed, active, nonacid, mesic Fluvaquentic Endoaquepts | Vegetative Cover: | pasture |
| Soil Series: | Hatboro | Water Table: | >24" |
| Aspect: | SE | SHWT: | <12 " |
| Landscape Position: | depression/flat/floodplain | | |

| | | | | | Structure | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Horiz.** | **Depth (in.)** | **Main Colors (moist)** | **Mottles** | **Texture** | **Grade** | **Class** | **Type** | **Moist & Wet Consist.** | **Ped Coatings** | **Hoizon Boundary** | **Other Remarks** |
| Ap | 0-9 | grayish brown (10YR 5/3) | | st loam | weak | fine | granular | friable, slt stk/plst | - | - | fine roots |
| Btg1 | 9-16 | light brownish gray (10YR 6/2) | | st loam | weak | med | sub. blk. | friable, slt stk/plst | - | - | evidence of water movement 60% chroma 2 |
| Btg2 | 16-24+ | gray (10YR 6/1) | prom (10YR 5/8) | st loam | weak | med | sub. blk. | firm, slt stk/plst | - | - | |

License Seal:

Date: 10/23/20

Soil, Water, & Environment Group

**Soil Investigation Data Sheet**

| | | | |
|---|---|---|---|
| Soil Boring: | SB2 hydric (F3 &F19) | | |
| Location: | Mushroom Meadow | Date: | 10/14/20 |
| County: | Caswell NC | Investigator(s): | SJF |
| Lat./Long.: | 36.532778, -79.244817 | Elev.: | 364 ft |

| | | | |
|---|---|---|---|
| Parent Material: | alluvium from metamorphic and acid crystalline rock | Drainage (Wetness) Class: | poorly drained effective drainage in place |
| Moisture Status: | moist | Slope (%): | < 2% |
| Classification: | Fine-loamy, mixed, active, nonacid, mesic Fluvaquentic Endoaquepts | Vegetative Cover: | pasture |
| Soil Series: | Hatboro | Water Table: | >24" |
| Aspect: | NW | SHWT: | <14 " |
| Landscape Position: | depression/flat/floodplain | | |

| | | | | | Structure | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Horiz.** | **Depth (in.)** | **Main Colors (moist)** | **Mottles** | **Texture** | **Grade** | **Class** | **Type** | **Moist & Wet Consist.** | **Ped Coatings** | **Hoizon Boundary** | **Other Remarks** |
| Ap | 0-5 | grayish brown (10YR 5/2) | | st loam | weak | fine | granular | friable, slt stk/plst | - | - | fine roots |
| Btg1 | 5-14 | light brownish gray (10YR 6/2) | | st loam | weak | med | sub. blk. | friable, slt stk/plst | - | - | evidence of water movement 60% chroma 2 |
| Btg2 | 14-24+ | gray (10YR 6/1) | prom (10YR 5/8) | st loam | weak | med | sub. blk. | firm, slt stk/plst | - | - | |

License Seal:


Date: 10/23/20

Soil, Water, & Environment Group

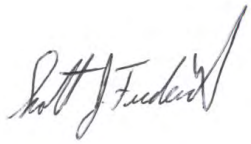
**Soil Investigation Data Sheet**

| | | | |
|---|---|---|---|
| Soil Boring: | SB3 hydric (F3 &F19) | | |
| Location: | Mushroom Meadow | Date: | 10/14/20 |
| County: | Caswell NC | Investigator(s): | SJF |
| Lat./Long.: | 36.533900, -79.244125 | Elev.: | 365 ft |

| | | | |
|---|---|---|---|
| Parent Material: | alluvium from metamorphic and acid crystalline rock | Drainage (Wetness) Class: | poorly drained effective drainage in place |
| Moisture Status: | moist | Slope (%): | < 2% |
| Classification: | Fine-loamy, mixed, active, nonacid, mesic Fluvaquentic Endoaquepts | Vegetative Cover: | pasture |
| Soil Series: | Hatboro | Water Table: | >24" |
| Aspect: | SW | SHWT: | <12" |
| Landscape Position: | depression/flat/floodplain | | |

| | | | | | Structure | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Horiz.** | **Depth (in.)** | **Main Colors (moist)** | **Mottles** | **Texture** | **Grade** | **Class** | **Type** | **Moist & Wet Consist.** | **Ped Coatings** | **Hoizon Boundary** | **Other Remarks** |
| Ap | 0-9 | grayish brown (10YR 5/2) | | st loam | weak | fine | granular | friable, slt stk/plst | - | - | fine roots, oxidized root channels |
| Btg1 | 9-16 | gray (10YR 5/1) | prom (10YR 5/8) | st loam | weak | med | sub. blk. | friable, slt stk/plst | - | - | evidence of water movement 60% chroma 2, oxidized root channels |
| Btg2 | 16-24+ | gray (10YR 6/1) | prom (10YR 5/8) | st loam | weak | med | sub. blk. | firm, slt stk/plst | - | - | |

License Seal:

Date: 10/23/20

Soil, Water, & Environment Group

**Soil Investigation Data Sheet**

| | | | |
|---|---|---|---|
| Soil Boring: | SB4 hydric (F3 &F19) | | |
| Location: | Mushroom Meadow | Date: | 10/14/20 |
| County: | Caswell NC | Investigator(s): | SJF |
| Lat./Long.: | 36.534125, -79.243531 | Elev.: | 366 ft |

| | | | |
|---|---|---|---|
| Parent Material: | alluvium from metamorphic and acid crystalline rock | Drainage (Wetness) Class: | poorly drained effective drainage in place |
| Moisture Status: | moist | Slope (%): | < 2% |
| Classification: | Fine-loamy, mixed, active, nonacid, mesic Fluvaquentic Endoaquepts | Vegetative Cover: | pasture |
| Soil Series: | Hatboro | Water Table: | >24" |
| Aspect: | SW | SHWT: | <12 " |
| Landscape Position: | depression/flat/floodplain | | |

| | | | | | Structure | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Horiz.** | **Depth (in.)** | **Main Colors (moist)** | **Mottles** | **Texture** | **Grade** | **Class** | **Type** | **Moist & Wet Consist.** | **Ped Coatings** | **Hoizon Boundary** | **Other Remarks** |
| Ap | 0-2 | grayish brown (10YR 5/2) | | st loam | weak | fine | granular | friable, slt stk/plst | - | - | fine roots |
| Btg1 | 2-16 | gray (10YR 5/1) | prom (10YR 5/8) | st loam | weak | med | sub. blk. | friable, slt stk/plst | - | - | evidence of water movement 60% chroma 2, oxidized root channels |
| Btg2 | 16-24+ | gray (10YR 6/1) | prom (10YR 5/8) | st loam | weak | med | sub. blk. | firm, slt stk/plst | - | - | |

License Seal:

LICENSED SOIL SCIENTIST
Scott J. Frederick
1236
STATE OF NORTH CAROLINA

Scott J. Frederick

Date: 10/23/20

**Soil Investigation Data Sheet**

| | | | |
|---|---|---|---|
| Soil Boring: | SB5 hydric (F3 &F19) | | |
| Location: | Mushroom Meadow | Date: | 10/14/20 |
| County: | Caswell NC | Investigator(s): | SJF |
| Lat./Long.: | 36.537025, -79.236167 | Elev.: | 364 ft |

| | | | |
|---|---|---|---|
| Parent Material: | alluvium from metamorphic and acid crystalline rock | Drainage (Wetness) Class: | poorly drained effective drainage in place |
| Moisture Status: | moist | Slope (%): | < 2% |
| Classification: | Fine-loamy, mixed, active, nonacid, mesic Fluvaquentic Endoaquepts | Vegetative Cover: | pasture |
| Soil Series: | Hatboro | Water Table: | 14-20" |
| Aspect: | E | SHWT: | <12 " |
| Landscape Position: | depression/flat/floodplain | | |

| | | | | | Structure | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Horiz. | Depth (in.) | Main Colors (moist) | Mottles | Texture | Grade | Class | Type | Moist & Wet Consist. | Ped Coatings | Hoizon Boundary | Other Remarks |
| Ap | 0-2 | grayish brown (10YR 5/2) | | st loam | weak | fine | granular | friable, slt stk/plst | - | - | fine roots |
| Btg1 | 2-16 | light brownish gray (5/1YR) | | st loam | weak | med | sub. blk. | friable, slt stk/plst | - | - | evidence of water movement 60% chroma 2 |
| Btg2 | 16-24+ | gray (10YR 6/1) | prom (10YR 5/8) | st loam | weak | med | sub. blk. | firm, slt stk/plst | - | - | |

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Scott J. Frederick
1236
STATE OF NORTH CAROLINA

Date:
10/23/20

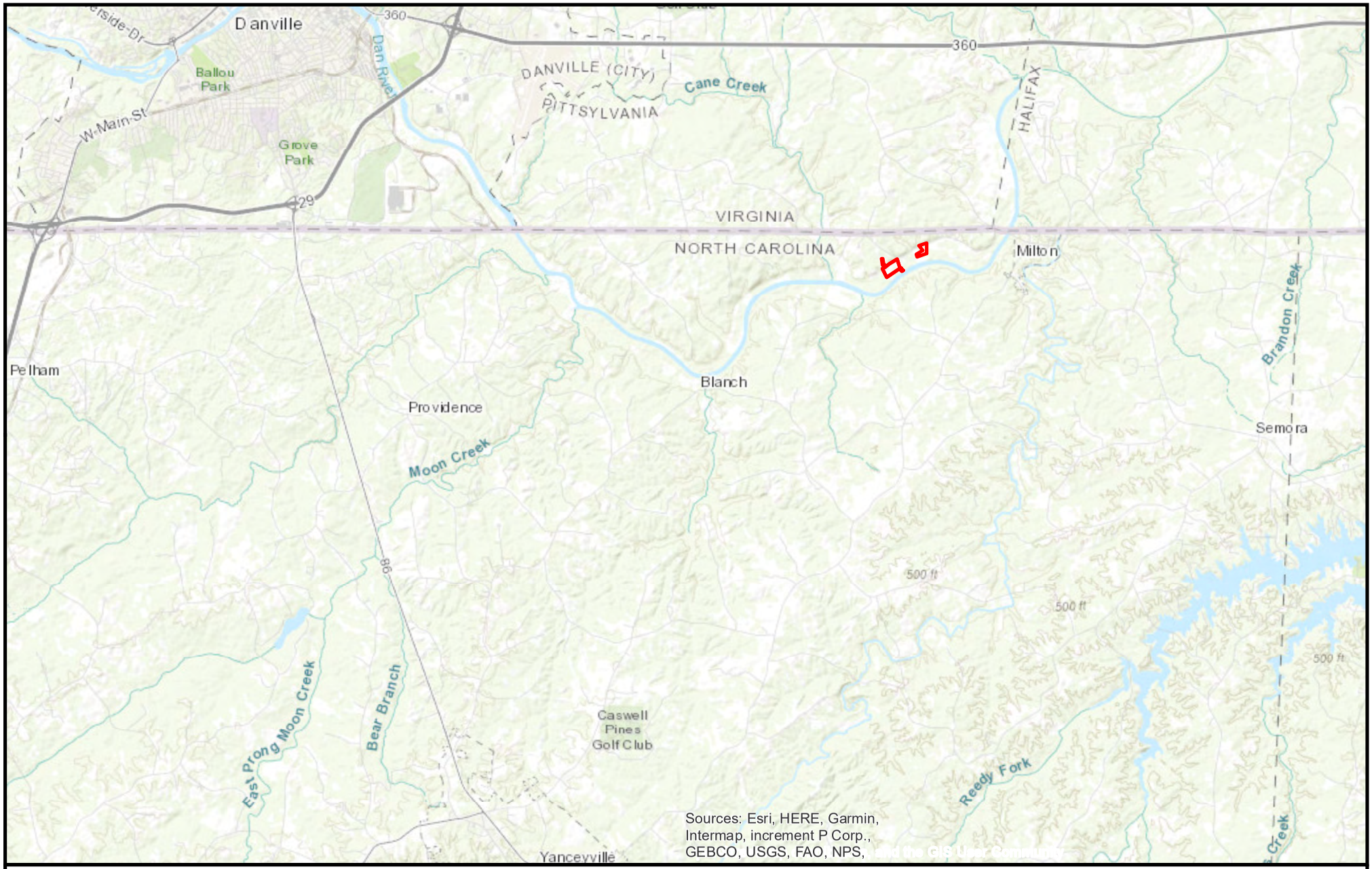
SB1

SB2

SB3

SB4

SB5

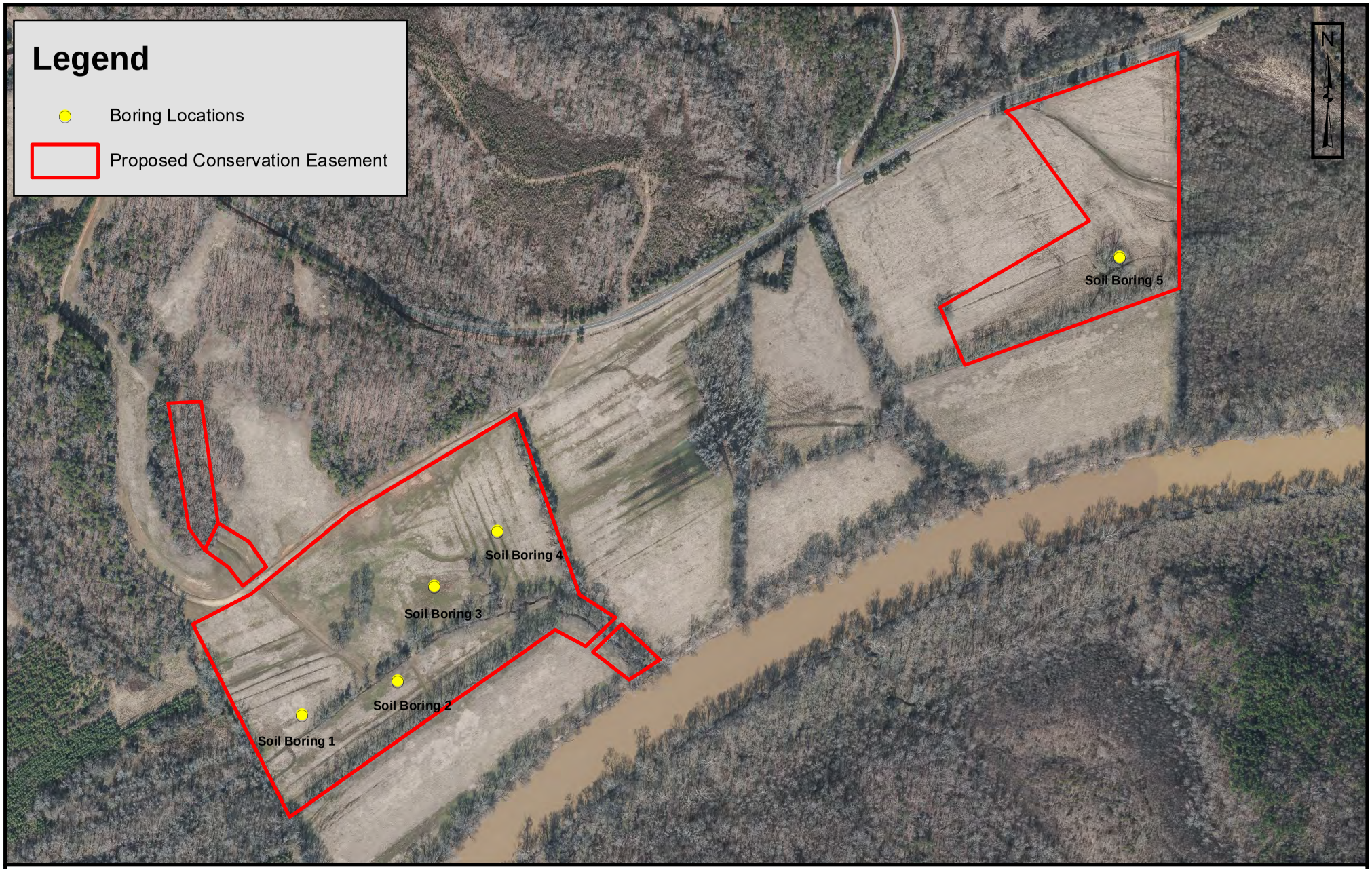



Soil, Water, & Environment Group

**Figure 1: Vicinity Map**
**Mushroom Meadow Wetland & Stream Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**October 2020**
ESRI Topographic Basemap

2 1 0 2
Miles

N

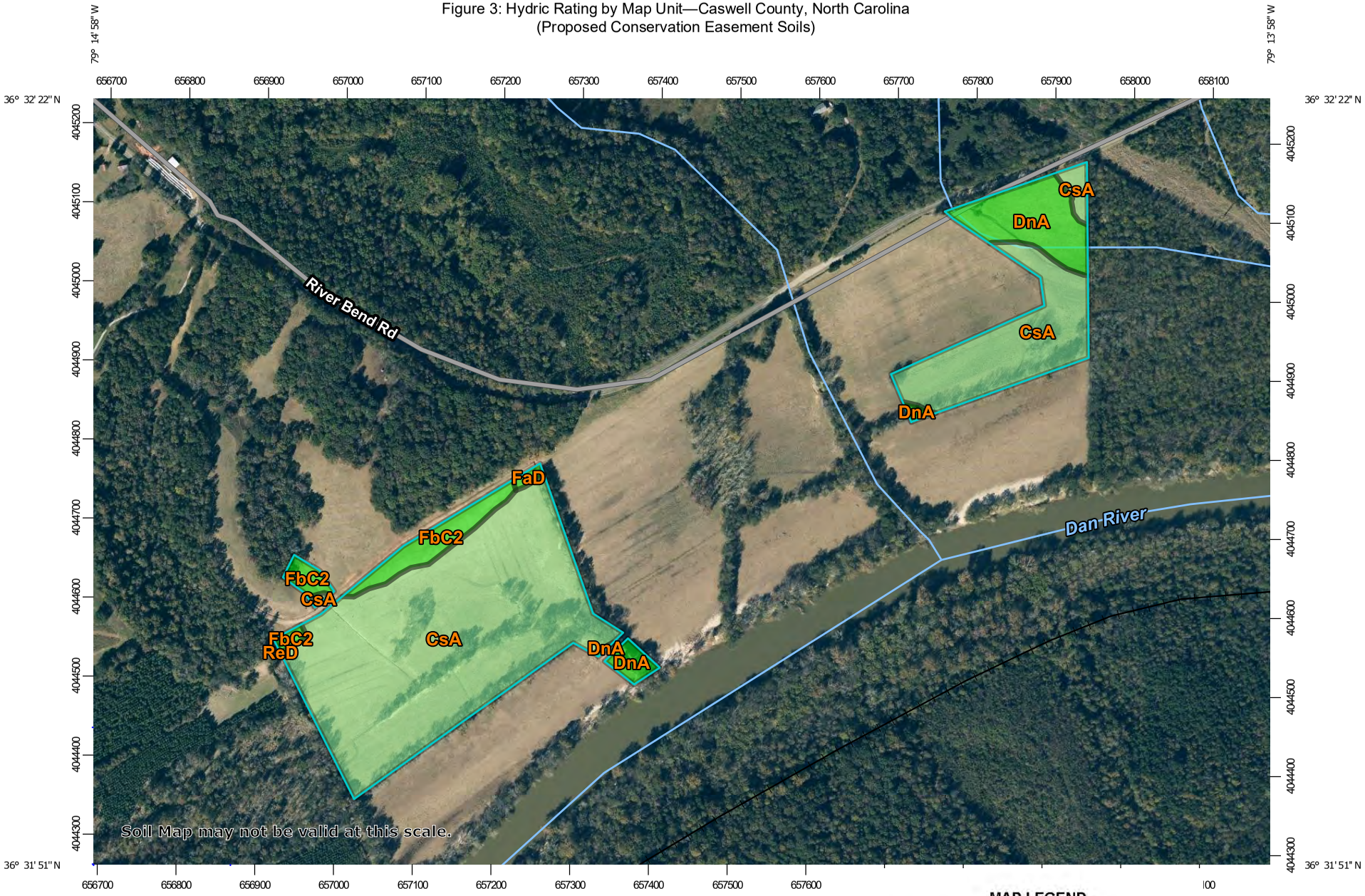



Soil, Water, & Environment Group

**Figure 2: Boring Map**
**Mushroom Meadow Wetland & Stream Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**October 2020**
NC Onemap 2018 Aerial

450 225 0 450
Feet

Figure 3: Hydric Rating by Map Unit—Caswell County, North Carolina
(Proposed Conservation Easement Soils)




Map Scale: 1:6,830 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

**MAP LEGEND**

- **Area of Interest (AOI)**
  - Area of Interest (AOI)
- **Soils**
  - **Soil Rating Polygons**
    - Hydric (100%)
    - Hydric (66 to 99%)
    - Hydric (33 to 65%)
    - Hydric (1 to 32%)
    - Not Hydric (0%)
    - Not rated or not available
- **Transportation**
  - Rails
  - Interstate Highways
  - US Routes
  - Major Roads
  - Local Roads
- **Background**
  - Aerial Photography

USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

10/5/2020

# Appendix J: Post Contract Meeting Minutes

# MEETING MINUTES

**Mushroom Meadow Stream and Wetland Mitigation Site**
**Roanoke River Basin CU 03010104**
**NCDMS Contract: 200204-01**
**NCDMS Project Number: 100192**
**Re: Post Contract Award IRT Site Visit April 20, 2021**

**Attendees**

Todd Tugwell - USACE
Casey Haywood - USACE
Erin Davis - NCDWR
Travis Wilson - NCWRC
Jeremiah Dow - NCDMS
Lane Sauls - VHB
Reid Robol - VHB
Ted Griffith - Eco Terra Partners
Michael Beinenson - Eco Terra Partners
Scott Frederick - SWE Group
Norton Webster - Eco Terra Partners

The following information presents a summary of the in-person meeting that occurred at the Mushroom Meadow Stream and Wetland Mitigation Site on April 20, 2021. The minutes are provided in sequential order according to each asset discussed. Overall, the IRT offered no objections to the mitigation approach provided.

Meeting Notes

Unnamed Tributary (UT) 1

- The IRT agreed with the overall proposed design approach for this tributary.
- The first recommendation by the IRT was that Eco Terra should consider increasing the restoration portion of this tributary further upstream (north) and into the existing tree line, connecting it with the next major headcut. Further upstream and for the proposed EII section, it was suggested that Eco Terra consider extending the easement boundary northward to capture an increased amount of channel, as well as additional property adjacent to the existing pastures along either side. The northward extent could be as far as Riverbend Road. Any understory planting should exhibit specific success criteria such as species diversity, because height, diameter at breast height (dbh), and vigor may not be the best measure due to the existing amount of shade present.
- The IRT recommended that smooth HDPE culvert pipe not be utilized for road crossings. Increased channel roughness is preferred in these areas. The IRT emphasized that channel morphology reflect riffle conditions at the upstream invert of the culvert pipe and pool (or scour hole) conditions at the downstream invert to provide stability and maximize macrofauna passage. In general, the use of culvert pipes on smaller channels similar to those at the Site is preferred, as compared with ford-like crossings on channels with multiple square-mile drainage areas.

- The IRT recommended the use of a flow gauge on this channel. Expectations and associated monitoring protocols and parameters should be clearly detailed in the Mitigation Plan. Monitoring via remote camera is also optional.
- Any risks of flooding from the Dan River that may adversely impact the restored channel(s) in the Mitigation Plan should be discussed in detail. In addition, proposed streamside vegetation and treatment for invasives should also be identified in the document. The IRT concurred that invasive densities and composition are minimal within the Site.
- Concerns were noted and discussed regarding the outlet connecting UT 1 and UT 2 and the Dan River. This transitional area captures the majority of both the surface and sub-surface runoff from the site, as well as backflows from the Dan River. Special design considerations and additional discussions should be provided in the Mitigation Plan regarding the approach, implementation, and associated monitoring necessary to ensure successful uplift. Questions remain on the appropriate amount of stream credits through this section. Because it is integral to the project, credits will be provided at an agreed upon ratio, which is to be determined later. There was no concern regarding fish passage in this area and these deep channel conditions are important resting and feeding areas of large anadromous fish like striped bass and shade during high flows. The IRT recommended that a memo addressing this issue be prepared and provided for review prior to the submittal of the Mitigation Plan.

Wetland Areas

- The updated and current hydroperiod guidance for Cordurus soils is 7%-9%; however, the IRT will allow lower percentages for the first couple of years during monitoring. Internally, the IRT is discussing removing ranges on soil hydroperiods and basing success criteria on one value. In this case, 8% would constitute attainment for the majority of the mapped Cordurus soils. A detailed wetland delineation of the area should be included in the Mitigation Plan due to the variability of the soils from ongoing flood deposition. It was also suggested by the IRT that the F19 indicators may be utilized in this area to some extent, but they are typically intended for depressional areas. The ETP soil scientist noted this is not how the F19 indicator reads in the 2018 Hydric Soil Indicators reference. The indicator may be used for Piedmont floodplain soils on floodplains subject to deposition. Depressional areas would be more appropriately matched to a different soil series and hydric indicator, such as F3.
- Swales will be filled and crowns removed on the site in the wetland work areas. Concern remains regarding the potential for cultural resources and excavation efforts should be limited, to the maximum extent practicable.
- The IRT appreciated Eco Terra installing wells prior to the site meeting to gather pre-growing season data. A suggestion was made to "over monitor" the site with wells to provide backup credit areas, if necessary.

- The IRT suggested that wetland creation could be viable in certain areas and this aspect should be included in the Mitigation Plan if allowed following State Historic Preservation Office (SHPO) analysis.
- Any permanent pools as a result of project implementation and lack of available fill material should be noted in the Mitigation Plan, particularly in wetland areas. For vernal pools, complete evaporation is necessary at some point during the year to discourage habitat for fish species. These pools are normally 14" deep or less.
- The Mitigation Plan should specify multiple planting zones for the proposed wetland complex and stream corridor and include data from a local reference site.

UT2

- The IRT was in agreement with the proposed design approach throughout its length. No additional comments were noted.
- Any understory planting should exhibit specific success criteria such as species diversity, because height, dbh, and vigor may not be the best measure due to the existing amount of shade present.

UT3

- The IRT was in agreement with the proposed design approach throughout its length.
- The IRT expressed minor concerns over sedimentation in the channel for long term success. This information should be discussed in the Mitigation Plan.
- The IRT noted the berm present and asked if it would be removed. The berm will be removed through channel construction and up to the interface with the abutting Riverbend property stream channel to the east.
- The IRT also recommended installation of a flow gauge along this reach. Monitoring via remote camera is also an option.
- For monitoring, cross sections and photo points are helpful for the IRT. In addition, periodic maintenance may occur, as needed, in areas of recent channel disturbance from project implementation during the first several years.
- Photo documentation should be completed during the winter months to ensure a clear visual of the stream channel, flow, and geomorphology characteristics.

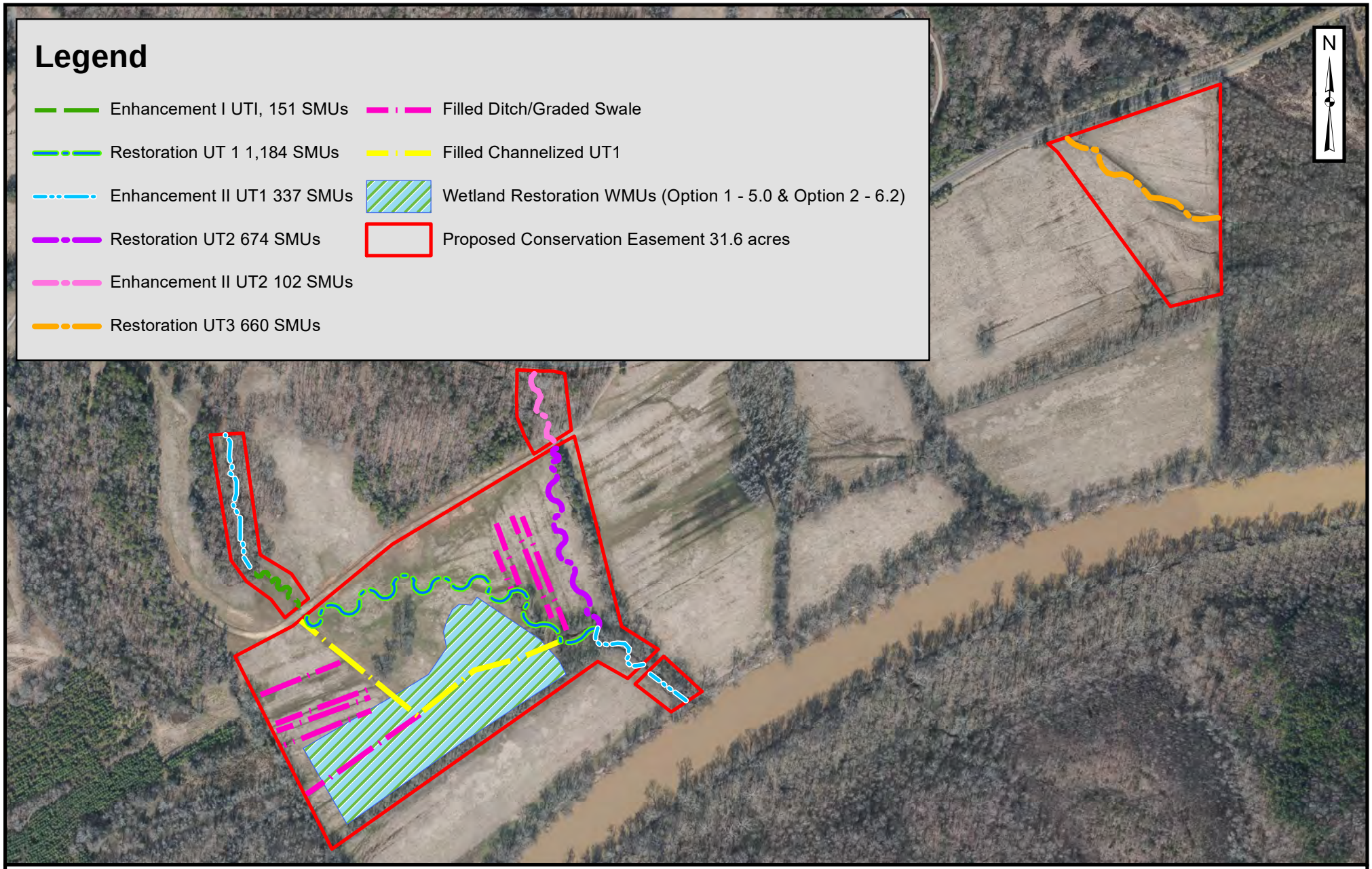



**Figure 11A: Proposed Credit Options 1 & 2**
**Mushroom Meadow Wetland & Stream Mitigation Site**
**Roanoke 03010104**
**Caswell County, North Carolina**
**October 2020**
2018 NC Onemap Aerial

450 225 0 450
Feet

# Appendix K: Caswell County Floodplain Development Permit

# CASWELL COUNTY PLANNING DEPARTMENT

144 Main Street, Yanceyville, NC 27379 | Office: 336-694-9731 | Fax: 336-694-5547 | E-Mail: mhoagland@caswellcountync.gov

## FLOODPLAIN DEVELOPMENT PERMIT APPLICATION

Date: November 3, 2022 Permit Number: _____

Received by: Matthew Hoagland Tax Map & Parcel #: 01061002 & 01061004

Location of Property: 36.534037 °N, 79.243504 °W

Type of Development:
Excavation: X_ Fill: __ Grading: X_____ Utility Construction: __ Road Construction: ___
Residential Construction: __ Nonresidential Construction: ___ Addition: __
Renovation: ___ Other (specify): Planting

Size of Development: Total Disturbed Area = 33 acres

FIRM Data: Map Panel No.: 3711302100 and 3711903100 Suffix J Map Panel Date: 9/28/2007

Flood Zone: AE Map Index Date: 11/17/2017

Regulatory Floodway/Non-Encroachment Area Info: ***(Check correct option below)***
Inside Regulatory Floodway/Non-encroachment area _X_ No Regulatory Floodway/Non-encroachment area provided___

Development Standards Data:

1. If located within a Regulatory Floodway or Non-encroachment area as noted above, attach engineering certification and supporting data as required. **Included**

2. Base flood elevation (BFE) per FIRM at development site **BFE = 381'-382'** (NGVD 1929 or NAVD 1988). ***Circle correct datum.***

3. Regulatory flood elevation at development site (BFE + locally adopted freeboard)**:** **382'-383'** (NGVD 1929 or NAVD 1988). ***Circle correct datum.***

4. Elevation in relation to mean sea level (MSL) at or above which the lowest floor (including basement) must be constructed **N/A** (NGVD 1929 or NAVD 1988). ***Circle correct datum.***

5. Elevation in relation to mean sea level (MSL) at or above which all attendant utilities to include, but not limited to, all heating, air conditioning and electrical equipment must be installed **N/A** (NGVD 1929 or NAVD 1988). ***Circle correct datum.***

6. Will garage (if applicable) be used for any purpose other than parking vehicles, building access, or storage? (Yes/No) **N/A**. **If yes**, then the garage must be used in determining the lowest floor elevation.

7. Proposed method of elevating the structure: **N/A**
   (a) If foundation wall is used - provide minimum of 2 openings
   (b) Total area of openings required:_____ (1 sq. inch per sq. foot of enclosed footprint area below BFE)

8. Will any watercourse be altered or relocated as a result of the proposed development? **Yes- see attached Construction Drawings**

If yes, attach a description of the extent of the alteration or relocation.

9. Floodproofing information (if applicable): N/A
Elevation in relation to mean sea level (MSL) to which structure shall be floodproofed N/A (NGVD 1929 or NAVD 1988). ***Circle correct datum.***

Applicant acknowledgment: I the undersigned understand that the issuance of a floodplain development permit is contingent upon the above information being correct and that the plans and supporting data have been or shall be provided as required. I also understand that prior to occupancy of the structure being permitted, an elevation and/or floodproofing certificate signed by a professional engineer or registered land surveyor must be on file with the ***Caswell County Planning Department*** indicating the "as built" elevations in relation to mean sea level (MSL).

Print or Type Name of Applicant

Miranda L Salzler, PE, CFM

Signature of Agent & Date

Address & Telephone Number

Venture 1
940 Main Campus Drive, Suite 500
Raleigh, NC 27606-5217
919.754.5009

Print or Type Name of Agent

Signature of Applicant & Date

Address & Telephone Number

Foundation Inspection Date: _____

Inspector: _____

---

**OFFICE USE ONLY**

NOTES: Please also provide copy of NC Soil & Erosion Control Permit. Please schedule periodic inspections of the site with Planning Director during construction.

DECISION: Plans approved pending notes above and final confirmation of as-built site completion.

Floodplain Administrator

5 December 2022
Date