  

MITIGATION PLAN
Final

March 2022

LAUREL VALLEY MITIGATION SITE
Burke County, NC
NCDEQ Contract No. 7875-02
DMS ID No. 100140

Catawba River Basin
HUC 03050101

USACE Action ID No. SAW-2020-00053
RFP #: 16-007875 (Issued 5/6/2019)
DWR#: 20200018

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center

Raleigh, NC 27699-1652

PREPARED BY:

1430 South Mint Street, Suite 104
Charlotte, NC 28203
Phone: (704) 332-7754

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

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

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

Contributing Staff:

Eric Neuhaus, PE, *Project Manager*
Shawn Wilkerson, *Principal in Charge*
Win Taylor, PWS, *Wetland Delineation*
Emily Reinicker, PE *Quality Assurance*
Jacob Wiseman, PE, CFM, *Assistant Project Manager*
Jordan Hessler, *Stream Design and Permitting*
Jeff Keaton, PE *Quality Assurance*
Noyes Harrigan, EI, CFM, *Field Assessment*

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

REPLY TO
ATTENTION OF:

November 18, 2021

Regulatory Division

Re: NCIRT Review and USACE Approval of the NCDMS Laurel Valley Mitigation Site / Burke Co./ SAW-2020-00053/ NCDMS Project # 100140

Mr. Paul Wiesner
North Carolina Division of Mitigation Services
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

Dear Mr. Wiesner:

The purpose of this letter is to provide the North Carolina Division of Mitigation Services (NCDMS) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day comment period for the Laurel Valley Draft Mitigation Plan, which closed on October 7, 2021. These comments are attached for your review.

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

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

Thank you for your prompt attention to this matter, and if you have any questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please contact me at Kimberly.d.browning@usace.army.mil or (919) 946-5107.

Sincerely,

Kim Browning
Mitigation Project Manager
for Tyler Crumbley, Deputy Chief
USACE Regulatory Division

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
Harry Tsomides—NCDMS
Eric Neuhaus—WEI

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

REPLY TO
ATTENTION OF:

CESAW-RG/Browning October 27, 2021

MEMORANDUM FOR RECORD

SUBJECT: NCDMS Laurel Valley Mitigation Project - NCIRT Comments during 30-day Mitigation Plan Review, Burke County, NC

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

USACE AID#: SAW-2020-00053
NCDMS #: 100140
30-Day Comment Deadline: October 7, 2021

USEPA Comments, Todd Bowers:

Note: It is understood that site visits have been made by IRT members during the development of site feasibility to provide mitigation credit. In that regard, I feel it necessary to denote that I have not been on-site during this process and that my comments may reflect a lack of on-site observation and evaluation.

1. General:
    - o I am somewhat disappointed that Wildlands is taking a “mountain” approach to requirements for site design and monitoring. Granted, Burke County is a “mountain” county per the 2016 Guidance. However, aside from the county in which this project is located, there are no other indications that this is a mountain type of site. The stated ecoregion is Northern Inner Piedmont, the elevation is well below 1,500 feet, the topography appears to be gently rolling hills, the slope of the streams is less than 2% across most of the project, all reference streams are located in the North Carolina piedmont and the design curves used are mainly Piedmont. I understand the IRT brought this up when considering buffer widths and the landowner was not interested in providing more acreage for establishing 50-foot-wide riparian zones. Wildlands has proceeded to develop a site that follows the 2016 Guidance for mountain projects.
2. Section 3.1/Page 19 Watershed Conditions:
    - o Based on the status of East Prong Hunting Creek (EPHC) as a Water Supply IV water and the proximity of potential livestock operations I recommend wider riparian buffers to provide more protection for these waters in the face of runoff from cattle.
    - o Is the historic flow of UT1 the basis for returning the stream to its tie-in with East Prong Hunting Creek?
3. Section 3.3.1/Page 23: UT1
    - o Is there any more information on the inactive quarry at the origin of UT1? What was mined and is there any mine spoil causing water quality issues for UT1?

- More information on the rerouting of UT1 Reach 2 and its current state as it leaves the site would be helpful.

4. Section 4.2/Page 29:
   - If Wetland F is positioned to continue providing hydrology to the offsite (and disconnected) portion of UT1, I recommend adding a gauge to monitor to ensure UT1 Reach 2 continues to provide hydrology to Wetland F.
5. Table 11/Page 32:
   - Recommend adding some language to address the rerouting of UT1 – Reach 2 as it pertains to alleviating stressors.
6. Section 6.2/Page 32:
   - All reference reaches are located in the Piedmont physiographic region supporting my conclusion that this is not a "mountain" stream.
7. Section 6.6.3/Page 38:
   - "…Wetland F along the left floodplain of the stream that receives hydrology from UT1 during flooding events. The priority 1 design will provide hydrology to these adjacent wetlands." Will this be verified by any monitoring?
8. Section 6.7/Page 39:
   - Recommend expanding the riparian buffers to 50 feet from the stream beltwidth. I know this is highly unlikely to change but I needed to get this recommendation on the record.
9. Table 18/Page 44:
   - Vegetation Performance Standards: For the reasons stated above, I recommend the sponsor consider using Piedmont performance standards for vegetation growth at MY 5 and MY 7. Some flexibility should be considered for monitoring plots located in Priority 2 floodplains due to know difficulty in establishing vegetation in those areas.
10. Table 19/Page 45:
    - I recommend adding some monitoring wells to confirm the wetlands currently on-site maintain their hydrology following the extensive stream works within wetlands adjacent to UT 1 and EPHC.
11. Section 11.2/Page 47:
    - I recommend additional buffer credit only if based on minimum buffer width of 50 feet. Application of the minimum standard is just that, a minimum, and is not suitable for a Piedmont stream site regardless of the county name. Ecologically, this is not a mountain site. I don't have issues with the calculation or desire for additional credit and this is taking advantage of a site that should have wider buffers but does not.

WRC Comments, Andrea Leslie:

1. Wildlands is using natural community types from the 1900 Third Approximation of the Natural Communities of North Carolina reference. As we've commented before, the more recent 2012 Fourth Approximation should be used to determine community type.
2. We appreciate the diversity of species presented in the planting plan. We call out a few plant choices and other issues here:
   a. Ulmus rubra (Slippery Elm) is included in the planting plan. (Note – in the planting plan, it is called Ulmus fulva and sometimes Ulmus rubra, but it appears that rubra is the specific epithet used in most references.) Is this a substitute for American Elm? American Elm is found in many wetland communities of NC, but Slippery Elm is not – in fact, it is an upland elm that is found on sites with basic soils. It doesn't seem like an appropriate substitute.
   b. River birch is included in the planting plan. Is it found in nearby sites? If it isn't, we encourage it to be eliminated. At the very least, we ask that river birch and boxelder be

kept to a small percentage of the stems planted (currently, they each range from 10-15% of the stems planted – this should not be increased).

c. The Open Area Buffer Planting list includes species that range from being FACW to UPL, which is fine. However, we strongly recommend that during the time of planting, that stems be sorted and planted in appropriate areas on the site (not just mixed up and planted indiscriminately). More attention to where particular species are planted should allow for better success and a more appropriate community.
d. Black gum is included in the wetland planting list – this is primarily an upland species, and it is unclear why it is included. If planted, it should only be in drier areas of the site. It would be more appropriate in the riparian planting plan.

<u>DWR Comments, Erin Davis:</u>

1. DMS comment page 3, bullet #3 – DWR echoes DMS' question/concern. We appreciate the discussion on the issue included in Section 4.2. At minimum DWR requires installation of a gauge or trail camera in Wetland F to demonstrate a sustained hydrologic connection during the project monitoring period. For the 401 application, please clearly describe the rationale for the stream relocation, and effort to be made to reduce the risk of any loss of state water resources as well as how that will be assessed/monitored.
2. Page 9, Section 3.3.2 – Was NCWAM completed for wetland areas proposed to be impacted?
3. Page 12, Section 4.3 – Due to the proposed stream relocation/realignment through existing wetland areas, DWR requests a re-delineation of wetlands onsite during monitoring year 7.
4. Page 18. Section 6.5 – The nearby quarry is described as abandoned and earlier as inactive. Please confirm the status of the quarry and discuss potential effect(s) on the project.
5. Page 22, Section 6.7 – Please briefly describe the proposed utility easement planting shown on Figure 10.
6. Page 27, Table 18 – DWR is ok with the proposed Wetland Planting Zone vigor standard.
7. Page 28, Table 19 – Please differentiate between fixed and random veg plots proposed per reach. DWR recommends a few random plots be included in the monitoring plan. Also, DWR requests that the overall trend in species survival of planted stems be tracked in the Partially Vegetated Planting Zone.
8. Figure 2 – Please callout the approximate locations of existing ditches/drainage outlets referenced in the text.
9. Figure 9 – Please show existing wetlands.
10. Figures – Please include a LiDAR figure in the final mitigation plan.
11. Design Sheets 2.1.1 – 2.3.4 –
    a. It was really helpful to see all of the existing tree points along each reach. Was there a minimum diameter threshold for a tree to be plotted? Also, for trees proposed to be saved along the streambank, was direct and/or indirect construction impacts to critical root zones a consideration?
    b. Will all abandoned channel sections be backfilled to surrounding surface grade? (with the exception of the proposed floodplain pool)
12. Sheet 2.1.3 – Are there any concerns about the long term stability at the UT1 confluence with the tributary angling toward the EPHC left bank brush toe treatment?
13. Sheet 2.2.1 – Please add callouts with station numbers of where stream credit begins and ends, and add a sheet match line.
14. Sheets 5.3 & 5.6 – Please confirm that the proposed outlet stabilizations and channels do not include rock placement.
15. General comment – I noticed multiple topics the IRT have been bringing up were captured in the plan. I liked the site-specific discussions in the site constraints, hydro trespass and project risk & uncertainties sections, as well as the Table 2 land use classification breakdown and paragraph-table-photos combo per reach in the existing conditions section. The proposed

species diversity, multiple planting zones, detailed invasive treatment plan, fencing plan and floodplain pool detail were all good to see included.

USACE Comments, Kim Browning:

1. The Corps agrees with EPA's comments regarding the Piedmont references for both stream design and planting plan development. Given that this site is located in the Piedmont physiographic region, and has been designed as such, the vegetative performance standard for height success criteria would be more appropriate as 7 feet at MY5 and 10 feet at MY7. Please adjust the vegetation performance standard in Table 18.
    a. Unfortunately, the designation as a mountain county and the Piedmont physiographic region were not discussed at the IRT site visits in 2019 and 2020, and we realize that the easement boundaries, and associated buffer widths, have already been determined at this stage of the plan development; however, we agree that wider buffers on portions of this site would have been beneficial.
    b. This situation is similar to the discussion we had during the review of the Huntsman site. Moving forward, the IRT would like to be notified at the Technical Proposal stage if you propose to use Piedmont references, and associated vegetative success standards and buffer widths, in a mountain county.
2. Section 3.3: I appreciate the detail provided that describes existing stream and wetland conditions. This is very helpful for the review and to demonstrate the potential functional uplift. It would be helpful to include a photo of the preservation reach for contrast.
3. Section 3.5: Please confirm that the utility easement along the northwest side of the property that is within the conservation easement is not included in the wider buffer credit calculation. I also have concerns that the fencing and vegetation within this utility easement may be jeopardized if/when utility maintenance is required. It is not standard to include existing easements within the CE.
4. Section 3.5: It was noted during the IRT site visit that the culvert at the upstream end of East Prong Hunting Creek is perched and there are no plans to replace it (as described in Section 6.6.1). Will this perched culvert be an obstruction to aquatic passage? Or will Priority 2 restoration address this concern? Please clarify in Section 3.5.
5. Table 8, page 11 and Appendix 5: Please include a copy of the Phase I Survey and all correspondence in the final mitigation plan for Section 106 documentation.
6. Appendix 5: The Cherokee Nation responded to the public notice for this project on May 4, 2020. Their response is attached. Please include this in the final mitigation plan and update the AIRFA section of Appendix 5.
7. Section 4.2, page 12: Re-aligning UT1 to drain to East Prong Hunting Creek will likely cause less base flow, and less storm flow to the adjacent property. To address IRT concerns, a gauge will need to be installed, close to the conservation easement boundary in Wetland F, prior to construction to monitor hydrology and ensure minimal negative impact (and hopefully positive impact) to existing wetland hydrology. Additionally, please add a photo point near the easement boundary that captures the wetlands along the field, which are off site. These wetlands were relatively low quality, and the site is likely to yield more, higher-quality wetlands.
8. Section 4.3: Stream relocation is estimated to impact existing wetlands within the easement. Though it is anticipated that the total wetland acreage, and quality, will likely increase as a result of stream restoration, the Corps must still ensure that there is no net loss of wetlands as a result of ecological restoration. If you do not plan to install gauges on all wetlands within the easement and monitor hydrology, please plan to reverify the extent of jurisdiction at the end of the monitoring period to document that wetland acreage was not lost.

9. Section 5: Please clarify which project outcomes are verifiable through measurement and/or visual assessment, and which outcomes are implied (i.e., will you be measuring biological uplift?).
10. Section 6.6.3: There is concern that UT1 Reach 2 across the floodplain will accumulate sediment and have problems maintaining a channel. An additional cross-section should be added to this reach, downstream of the ditch.
11. Section 6.6.4, page 22: The lower section of UT2 that is anticipated to be slightly entrenched and may have a BHR above 1.0. This section will need to be assessed and conditions documented during monitoring. If the channel becomes more entrenched, an additional cross-section in the lower section of this reach may be requested, particularly if aggradation occurs as described in Section 6.8.
12. Section 6.8: Please add a discussion on the corrective measures that will be taken if the lower reaches of UT1 and UT2, in the floodplain of East Prong Hunting Creek, do accumulate sediment. It would also be advisable to discuss the possibility that UT1 may revert back to its current preferential flow path, and how that will be addressed. The corrective measures should really be addressed in Section 10 (Adaptive Management), but it's acceptable to include them in this section.
13. Table 18: At least two random plots should be added annually to gain a better overall picture of vegetative success. Additionally, at least twice during monitoring, the partially vegetated planting zones should be captured in monitoring data.
14. Table 18: Given the recent Technical Workgroup Discussion regarding pebble counts, do you want to include this as a performance standard?

Kim Browning
Mitigation Project Manager
Regulatory Division

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Office of the Chief

Chuck Hoskin Jr.
Principal Chief

Bryan Warner
Deputy Principal Chief

May 4, 2020

Kim Browning
United States Army Corps of Engineers
Mitigation Field Office
3331 Heritage Trade Drive, Suite 105
Wake Forest, NC 27587

Re: SAW-2020-00053, Laurel Valley Mitigation

Ms. Kim Browning:

The Cherokee Nation (Nation) is in receipt of your correspondence about **SAW-2020-00053**, and appreciates the opportunity to provide comment upon this project. Please allow this letter to serve as the Nation's interest in acting as a consulting party to this proposed project.

The Nation maintains databases and records of cultural, historic, and pre-historic resources in this area. Our Historic Preservation Office reviewed this project, cross referenced the project's legal description against our information, and found no instances where this project intersects or adjoins such resources. Thus, the Nation does not foresee this project imparting impacts to Cherokee cultural resources at this time.

However, the Nation requests that the United States Army Corps of Engineers (USACE) halt all project activities immediately and re-contact our Offices for further consultation if items of cultural significance are discovered during the course of this project.

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

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

Wado,

Elizabeth Toombs

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

WILDLANDS
ENGINEERING

MEMORANDUM

TO: Kim Browning, USACE

FROM: Eric Neuhaus, PE

DATE: March 2, 2022

RE: Laurel Valley Mitigation Site
Catawba River Basin 03050101
Burke County, NC
DMS ID No. 100140
DEQ Contract Number 7875-02
RFP Number 16-007875
SAW-2020-00053
Response to NCIRT Mitigation Plan Comments

Wildlands thanks for the NCIRT for their detailed review of the Laurel Valley Mitigation Site, as documented in Kim Browning's October 27, 2021 letter. We have made the necessary revisions to the draft documents and we are submitting revised versions of the documents along with this memorandum. Below we provide your comments followed by our responses in bold italics.

USEPA Comments, Todd Bowers:

1) I am somewhat disappointed that Wildlands is taking a "mountain" approach to requirements for site design and monitoring. Granted, Burke County is a "mountain" county per the 2016 Guidance. However, aside from the county in which this project is located, there are no other indications that this is a mountain type of site. The stated ecoregion is Northern Inner Piedmont, the elevation is well below 1,500 feet, the topography appears to be gently rolling hills, the slope of the streams is less than 2% across most of the project, all reference streams are located in the North Carolina piedmont and the design curves used are mainly Piedmont. I understand the IRT brought this up when considering buffer widths and the landowner was not interested in providing more acreage for establishing 50-foot-wide riparian zones. Wildlands has proceeded to develop a site that follows the 2016 Guidance for mountain projects.

   a) ***While Wildlands agrees that wider buffers always offer greater protection, we have provided the required buffer widths as outlined in the governing rules and regulations (Wilmington District 2003 Stream Mitigation Guidelines and the October 24, 2016 Stream and Wetland Compensatory Mitigation Update). Our option agreements were set for a minimum 30-foot buffers based on this guidance during the proposal stage of the project. The easements for the site are recorded with a minimum 30-foot buffers presented in the plan; however, we were able to negotiate 100-150 foot buffers along the right bank of East Prong Hunting Creek to encompass existing floodplain wetlands. This negotiation added 1.17-acres to the originally proposed 13-acre easement.***

2) Section 3.1/Page 19 Watershed Conditions:

   a) Based on the status of East Prong Hunting Creek (EPHC) as a Water Supply IV water and the proximity of potential livestock operations I recommend wider riparian buffers to provide more protection for these waters in the face of runoff from cattle.

      i) ***Wildlands acknowledges your above considerations, and while greater than 30-foot buffers could not be negotiated along the left bank of East Prong Hunting Creek, 100-150-foot buffers were included along the right bank. Please see our response to comment #1 for additional discussion.***

   b) Is the historic flow of UT1 the basis for returning the stream to its tie-in with East Prong Hunting Creek?

      i) ***Wildlands has included additional discussion on UT1's proposed alignment to East Prong Hunting Creek to Section 6.6.3.***

3) Section 3.3.1/Page 23: UT1

   a) Is there any more information on the inactive quarry at the origin of UT1? What was mined and is there any mine spoil causing water quality issues for UT1?

      i) ***Wildlands reviewed Mining Permit Number 12-07 on the NC DEQ Online GIS system to learn more about the quarry. The mine produced crushed stone. The permit was listed as active, and the last permit revision occurred in November 2017. The last inspection date was listed as January 26, 2014. Mitigation plan comments about mine inactivity were based on conversations with the landowner who had not seen quarry traffic for several years. Wildlands has no knowledge of current or historical water quality issues related to the quarry. Please see revised discussion in Section 3.3.1.***

   b) More information on the rerouting of UT1 Reach 2 and its current state as it leaves the site would be helpful.

      i) ***Please find new discussion of UT1's existing condition after it leaves the Site in Section 3.3.1. Additional discussion of re-alignment design was also added to Section 6.6.3.***

4) Section 4.2/Page 29:

   a) If Wetland F is positioned to continue providing hydrology to the offsite (and disconnected) portion of UT1, I recommend adding a gauge to monitor to ensure UT1 Reach 2 continues to provide hydrology to Wetland F.

      i) ***Please see comment #37 below and Wildlands' response.***

5) Table 11/Page 32:

   a) Recommend adding some language to address the rerouting of UT1 – Reach 2 as it pertains to alleviating stressors.

      i) ***Additional language was added to Table 11 to address UT1-Reach 2 alignment re-routing.***

6) Section 6.2/Page 32:

   a) All reference reaches are located in the Piedmont physiographic region supporting my conclusion that this is not a "mountain" stream.

i) ***Wildlands acknowledges and appreciates this discussion and notes that reference reaches for the Site were chosen based on geomorphic parameters such as discharge, valley slope, sinuosity, and substrate size. While we did conduct reference reach searches nearer to the site, we could not find natural, unmodified reaches to survey which met the geomorphic requirements. In our experience, C-type reference streams in mountain valleys are near impossible to find due to the scarcity of flat land in this region and the tendency of farmers to take advantage of any wider, alluvial floodplains.***

7) Section 6.6.3/Page 38:

a) "…Wetland F along the left floodplain of the stream that receives hydrology from UT1 during flooding events. The priority 1 design will provide hydrology to these adjacent wetlands." Will this be verified by any monitoring?

i) Please see comment #37 below and Wildlands' response.

8) Section 6.7/Page 39:

a) Recommend expanding the riparian buffers to 50 feet from the stream beltwidth. I know this is highly unlikely to change but I needed to get this recommendation on the record.

i) Wildlands acknowledges your recommendations. As discussed in our response to comment #1, above, we were able to achieve a 100-150 foot right buffer on East Prong Hunting Creek. Please find more discussion around this issue in comment #1.

9) Table 18/Page 44:

a) Vegetation Performance Standards: For the reasons stated above, I recommend the sponsor consider using Piedmont performance standards for vegetation growth at MY 5 and MY 7. Some flexibility should be considered for monitoring plots located in Priority 2 floodplains due to know difficulty in establishing vegetation in those areas.

i) The vegetative performance standard was changed in Table 18 for Riparian Planting Zones. Priority 2 areas of the project are already included in Wetland Planting Zones, which have a shorter vigor standard than Open Buffer Planting areas.

10) Table 19/Page 45:

a) I recommend adding some monitoring wells to confirm the wetlands currently on-site maintain their hydrology following the extensive stream works within wetlands adjacent to UT 1 and EPHC.

i) In response to this comment and to DWR and USACE's comments (comments #17 and #38, respectively), Wildlands proposes to re-verify wetland extents at the end of Monitoring Year 7. Re-verifying wetland features within the conservation easement during Monitoring Year 7 has been added to Table 19: Monitoring Components.

11) Section 11.2/Page 47:

a) I recommend additional buffer credit only if based on minimum buffer width of 50 feet. Application of the minimum standard is just that, a minimum, and is not suitable for a Piedmont stream site regardless of the county name. Ecologically, this is not a mountain site. I don't have issues with the calculation or desire for additional credit and this is taking advantage of a site that should have wider buffers but does not.

i) ***Wildlands understands the expressed concerns. We completed the Wilmington District Stream Buffer Credit Calculator using the available instructions and applicable guidance (Wilmington District 2003 Stream Mitigation Guidelines and the October 24, 2016 Stream and Wetland Compensatory Mitigation Update). Wildlands will comply with the IRT's preferred crediting scheme, but we request further guidance/instructions on how to complete alternative crediting scenarios.***

<u>WRC Comments, Andrea Leslie:</u>

12) Wildlands is using natural community types from the 1900 Third Approximation of the Natural Communities of North Carolina reference. As we've commented before, the more recent 2012 Fourth Approximation should be used to determine community type.

   a) ***We apologize for using the old approximation and have revised the Mitigation Plan to use the most current approximation. We have also sent a company-wide email to ensure that, going forward, the Fourth Approximation will be used to classify community types.***

13) We appreciate the diversity of species presented in the planting plan. We call out a few plant choices and other issues here:

   a) Ulmus rubra (Slippery Elm) is included in the planting plan. (Note – in the planting plan, it is called Ulmus fulva and sometimes Ulmus rubra, but it appears that rubra is the specific epithet used in most references.) Is this a substitute for American Elm? American Elm is found in many wetland communities of NC, but Slippery Elm is not – in fact, it is an upland elm that is found on sites with basic soils. It doesn't seem like an appropriate substitute.

      i) ***Thank you for your review – we did intend to use rubra, and the planting tables have been updated to replace fulva with rubra. We selected slippery elm specifically and not as a substitute for American elm because we believe it is a good candidate for this site based off our field observations. In our review of the vascular plants of North Carolina website, slippery elm is noted to grow in a range of habitats including cove forests and basic mesic forests along with drier forests. Timothy Spira's Wildflowers & Plant Communities of the Southern Appalachian Mountains & Piedmont further supports the ability of slippery elm to inhabit areas with varied moisture regimes in its following habitat description: "Moist forest on lower slopes, floodplains, occasionally on drier upland sites, particularly on limestone soils, alluvial forest, basic mesic forest, and cover forests. Common in piedmont and lower mountains…."***

   b) River birch is included in the planting plan. Is it found in nearby sites? If it isn't, we encourage it to be eliminated. At the very least, we ask that river birch and boxelder be kept to a small percentage of the stems planted (currently, they each range from 10-15% of the stems planted – this should not be increased).

      i) ***River birch is a common volunteer species found at our Henry Fork Mitigation Site. Henry Fork is located approximately 19 aerial miles away from Laurel Valley Mitigation Site. River birch and boxelder are still included in the plans, but percentages have been adjusted – please see revised planting plan.***

c) The Open Area Buffer Planting list includes species that range from being FACW to UPL, which is fine. However, we strongly recommend that during the time of planting, that stems be sorted and planted in appropriate areas on the site (not just mixed up and planted indiscriminately). More attention to where particular species are planted should allow for better success and a more appropriate community.

   i) Wildlands acknowledges your recommendation. Our approach to planting is usually to evenly disperse the bare root species throughout a planting zone. Given the possible local variations in topography, soils, and hydrology that can occur on a site, we overplant so we are providing as many opportunities for colonization as possible. We will separate out large areas that warrant a specific planting condition into separate planting zones.

14) Black gum is included in the wetland planting list – this is primarily an upland species, and it is unclear why it is included. If planted, it should only be in drier areas of the site. It would be more appropriate in the riparian planting plan.

   a) Thank you for this comment - black gum was not intended for the wetland planting zone and has been removed.

<u>DWR Comments, Erin Davis:</u>

15) DMS comment page 3, bullet #3:

   a) DWR echoes DMS' question/concern. We appreciate the discussion on the issue included in Section 4.2. At minimum DWR requires installation of a gauge or trail camera in Wetland F to demonstrate a sustained hydrologic connection during the project monitoring period. For the 401 application, please clearly describe the rationale for the stream relocation, and effort to be made to reduce the risk of any loss of state water resources as well as how that will be assessed/monitored.

      i) See comment #37 below and Wildlands' response. Wildlands will include discussion of relocating UT1 and the off-Site resource in the 401 application.

16) Page 9, Section 3.3.2:

   a) Was NCWAM completed for wetland areas proposed to be impacted?

      i) NCWAM forms have now been completed for the Site and are included in Appendix 3.

17) Page 12, Section 4.3:

   a) Due to the proposed stream relocation/realignment through existing wetland areas, DWR requests a re-delineation of wetlands onsite during monitoring year 7.

      i) A re-verification of wetlands within the conservation easement has been included in Section 7.0 Performance Standards (Table 19). Language proposing wetland re-verification has also been included in Section 4.3.

18) Page 18. Section 6.5:

   a) The nearby quarry is described as abandoned and earlier as inactive. Please confirm the status of the quarry and discuss potential effect(s) on the project.

      i) See comment 3a above and Wildlands' response.

19) Page 22, Section 6.7:

    a) Please briefly describe the proposed utility easement planting shown on Figure 10.

        i) Additional discussion of plantings for the Utility Easement were included in Section 6.7.

20) Page 27, Table 18:

    a) DWR is ok with the proposed Wetland Planting Zone vigor standard.

        i) Thank you for your review – we will proceed with the proposed Wetland Planting Zones vigor standards. Please note that Riparian Planting Zones vigor standards have been updated.

21) Page 28, Table 19:

    a) Please differentiate between fixed and random veg plots proposed per reach. DWR recommends a few random plots be included in the monitoring plan. Also, DWR requests that the overall trend in species survival of planted stems be tracked in the Partially Vegetated Planting Zone.

        i) Table 19 now differentiates between fixed and random veg plots by reach. Two mobile vegetation plots are now included in the monitoring plan. Wildlands also added two photo points, one in each partially vegetated planting zones, to visually monitor species survival.

22) Figure 2: Please callout the approximate locations of existing ditches/drainage outlets referenced in the text.

    a) The ditch locations are now included on Figure 2.

23) Figure 9: Please show existing wetlands.

    a) Exiting wetlands are now shown on Figure 9.

24) Please include a LiDAR figure in the final mitigation plan.

    a) A LiDAR figure is now included as Figure 11.

25) Design Sheets 2.1.1 – 2.3.4:

    a) It was really helpful to see all of the existing tree points along each reach. Was there a minimum diameter threshold for a tree to be plotted? Also, for trees proposed to be saved along the streambank, was direct and/or indirect construction impacts to critical root zones a consideration?

        i) Locations of trees 12" diameter or greater were collected during the existing conditions survey. Construction impacts are considered when designating a Tree Save on the plans. Grading in the vicinity of a tree (both cut and fill areas), construction traffic, and ease of avoidance are all considered before proposing a Tree Save. Wildlands prefers not to leave trees damaged by construction in place (damaged trees may fall in stream and cause instability, pose safety concerns, etc). Occasionally, a tree that was designated as a proposed Tree Save is not feasible to save, or a designated Tree Removal may be avoided with only a slight tweak to the proposed design. These field fit decisions are typically left to the Wildlands Site Designer or Construction Administrator during the construction period.

b) Will all abandoned channel sections be backfilled to surrounding surface grade? (with the exception of the proposed floodplain pool)

   i) ***All abandoned channels will be backfilled to match the overall valley grading scheme of the respective reach. In Priority 1 reaches, this typically means backfilling to the surrounding surface grade.***

26) Sheet 2.1.3: Are there any concerns about the long-term stability at the UT1 confluence with the tributary angling toward the EPHC left bank brush toe treatment?

   a) ***Wildlands has had success with well-constructed brush toe treatments holding up to very large erosive forces found at stream confluences and in outside bend locations. Wildlands will make sure to evaluate the area during construction as well to ensure the structure is appropriate.***

27) Sheet 2.2.1: Please add callouts with station numbers of where stream credit begins and ends, and add a sheet match line.

   a) ***Callouts for stream reaches, easement breaks, design approach, and a matchline were added to the UT1 alignment on Sheet 2.2.1.***

28) Sheets 5.3 & 5.6: Please confirm that the proposed outlet stabilizations and channels do not include rock placement.

   a) ***Correct, the proposed Outlet Stabilization detail (Sheet 5.6) requires erosion control matting along the sides and bottom of disturbed areas of existing outlets as well as extensive planting and seeding. Wildlands believes this will stabilize these areas due to low slopes and observations of current stability in areas where they are vegetated but not accessible to cattle. The one exception is the outlet from the proposed Floodplain Pool, which does leave the possibility for the Site Designer or Construction Administrator to add a rock sill to the outlet if deemed necessary during construction.***

29) General comment: I noticed multiple topics the IRT have been bringing up were captured in the plan. I liked the site-specific discussions in the site constraints, hydro trespass and project risk & uncertainties sections, as well as the Table 2 land use classification breakdown and paragraph-table-photos combo per reach in the existing conditions section. The proposed species diversity, multiple planting zones, detailed invasive treatment plan, fencing plan and floodplain pool detail were all good to see included.

   a) ***Thank you for this acknowledgement and we will continue to make every effort to address recurring comments from the IRT in subsequent projects.***

<u>**USACE Comments, Kim Browning:**</u>

30) The Corps agrees with EPA's comments regarding the Piedmont references for both stream design and planting plan development. Given that this site is located in the Piedmont physiographic region, and has been designed as such, the vegetative performance standard for height success criteria would be more appropriate as 7 feet at MY5 and 10 feet at MY7. Please adjust the vegetation performance standard in Table 18.

   a) ***Wildlands has made these adjustments – please see Wildlands response to comment #9, above, for more detail.***

31) Unfortunately, the designation as a mountain county and the Piedmont physiographic region were not discussed at the IRT site visits in 2019 and 2020, and we realize that the easement boundaries, and associated buffer widths, have already been determined at this stage of the plan development; however, we agree that wider buffers on portions of this site would have been beneficial.

   a) ***Please see Wildlands' response to comment #1, above.***

32) This situation is similar to the discussion we had during the review of the Huntsman site. Moving forward, the IRT would like to be notified at the Technical Proposal stage if you propose to use Piedmont references, and associated vegetative success standards and buffer widths, in a mountain county.

   a) ***Wildlands notes this requirement and will include physiographic province and proposed vegetation monitoring success standards in the technical proposal stage of the project. Upon contract award, Wildlands completes full project site assessment, including geomorphic investigations and vegetation inventory, before settling on specific references. Since there are few reference-condition streams in broad, farmable valleys in the mountains, we often cannot find a stable lower sloped reference reach near our sites in mountain counties. We understand that lower elevation sites closer to Piedmont counties may be required to use Piedmont vegetation success standards.***

33) Section 3.3: I appreciate the detail provided that describes existing stream and wetland conditions. This is very helpful for the review and to demonstrate the potential functional uplift. It would be helpful to include a photo of the preservation reach for contrast.

   a) ***Thank you - a photo of UT1 Reach 1 preservation reach was added to Section 3.3.***

34) Section 3.5:

   a) Please confirm that the utility easement along the northwest side of the property that is within the conservation easement is not included in the wider buffer credit calculation. I also have concerns that the fencing and vegetation within this utility easement may be jeopardized if/when utility maintenance is required. It is not standard to include existing easements within the CE.

      i) ***The utility easement was not included in the Buffer Width Credit Adjustment calculations in Appendix 13. Buffer width was only measured to the edge of the existing utility easement. The utility easement will supersede the conservation easement and will allow utility and vegetation maintenance within the utility easement area. Conservation easement signs will be placed along the boundary of the utility easement to reduce the possibility of utility maintenance occurring outside of the utility easement.***

      Wildlands included the utility easement within the conservation easement to restrict access down the property line and across East Prong Hunting Creek. By including the utility easement within the conservation easement, non-utility traffic should be prevented from accessing this portion of the property.

   b) It was noted during the IRT site visit that the culvert at the upstream end of East Prong Hunting Creek is perched and there are no plans to replace it (as described in Section 6.6.1). Will this perched culvert be an obstruction to aquatic passage? Or will Priority 2 restoration address this concern? Please clarify in Section 3.5.

   i) ***Additional discussion was added to Section 3.5 related to the existing culvert constraints for aquatic organism passage and proposed efforts to mitigate these constraints.***

35) Table 8, page 11 and Appendix 5: Please include a copy of the Phase I Survey and all correspondence in the final mitigation plan for Section 106 documentation.

   a) ***The Phase I survey and The Cherokee Nation response are now included in Appendix 5***

36) Appendix 5: The Cherokee Nation responded to the public notice for this project on May 4, 2020. Their response is attached. Please include this in the final mitigation plan and update the AIRFA section of Appendix 5.

   a) ***The Cherokee Nation response is included in Appendix 5 and the AIRFA summary in Appendix 5 was updated.***

37) Section 4.2, page 12: Re-aligning UT1 to drain to East Prong Hunting Creek will likely cause less base flow, and less storm flow to the adjacent property. To address IRT concerns, a gauge will need to be installed, close to the conservation easement boundary in Wetland F, prior to construction to monitor hydrology and ensure minimal negative impact (and hopefully positive impact) to existing wetland hydrology. Additionally, please add a photo point near the easement boundary that captures the wetlands along the field, which are off site. These wetlands were relatively low quality, and the site is likely to yield more, higher-quality wetlands.

   a) ***An additional gage has been proposed to monitor flow in the off-site resource. Previously only temporary access was granted to the adjacent parcel for Wildlands to assess the off-site resources. However, since submittal of the Mitigation Plan draft, the adjacent parcel was acquired by a different landowner that has granted Wildlands permission to monitor the off-site resource for the monitoring period. Wildlands is proposing to install a pressure transducer on the adjacent parcel stream, slightly downstream of the existing pond, to directly measure baseflow hydrology and larger flow events occurring in the off-site resource. The additional gage has been added to Section 8.0 Monitoring Plan (see Table 19). Note that no performance standards are associated with this additional gage with the intent of the gage only to show that flow is continuing within the off-site resource. An additional photo point will also be added within the off-site resource area.***

38) Section 4.3: Stream relocation is estimated to impact existing wetlands within the easement. Though it is anticipated that the total wetland acreage, and quality, will likely increase as a result of stream restoration, the Corps must still ensure that there is no net loss of wetlands as a result of ecological restoration. If you do not plan to install gauges on all wetlands within the easement and monitor hydrology, please plan to reverify the extent of jurisdiction at the end of the monitoring period to document that wetland acreage was not lost.

   i) ***Please see comment #10 and #17 above and Wildands' response.***

39) Section 5: Please clarify which project outcomes are verifiable through measurement and/or visual assessment, and which outcomes are implied (i.e., will you be measuring biological uplift?).

   a) ***Expected Outcomes listed in Section 5.0 (Table 10) are the implied results of achieving the Objectives and Goals in the table. Wildlands does not plan to assess or measure the Expected Outcomes. A clarifying statement has been added to Section 5.0.***

40) Section 6.6.3: There is concern that UT1 Reach 2 across the floodplain will accumulate sediment and have problems maintaining a channel. An additional cross-section should be added to this reach, downstream of the ditch.

   a) An additional cross-section has been added to the downstream area of UT1 Reach 2. Table 19 (Monitoring Components) and Figure 9 (Monitoring Map) were updated to include these additional monitoring components.

41) Section 6.6.4, page 22: The lower section of UT2 that is anticipated to be slightly entrenched and may have a BHR above 1.0. This section will need to be assessed and conditions documented during monitoring. If the channel becomes more entrenched, an additional cross-section in the lower section of this reach may be requested, particularly if aggradation occurs as described in Section 6.8.

   a) The initial, post-construction conditions of the reach will be captured in the Baseline Monitoring Report and As-Built Survey. Any aggradation or degradation areas in project streams that are documented during subsequent monitoring years will be included in monitoring reports. If additional cross-sections are deemed necessary by DMS or IRT, they will be included in subsequent monitoring.

42) Section 6.8: Please add a discussion on the corrective measures that will be taken if the lower reaches of UT1 and UT2, in the floodplain of East Prong Hunting Creek, do accumulate sediment. It would also be advisable to discuss the possibility that UT1 may revert back to its current preferential flow path, and how that will be addressed. The corrective measures should really be addressed in Section 10 (Adaptive Management), but it's acceptable to include them in this section.

   a) Discussion of corrective measures for excessive stream aggradation was added to Section 6.8.

43) Table 18:

   a) At least two random plots should be added annually to gain a better overall picture of vegetative success. Additionally, at least twice during monitoring, the partially vegetated planting zones should be captured in monitoring data.

      i) Two mobile monitoring vegetation plots were added to the monitoring components. In addition, two photo points were added to monitor partially vegetated planted areas.

   b) Given the recent Technical Workgroup Discussion regarding pebble counts, do you want to include this as a performance standard?

      i) Thank you for this comment – we have removed pebble counts and substrate monitoring from the Performance Standards, and cited the IRT Technical Work Group Meeting on September 29, 2021, in Section 7.0.

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ROY COOPER
Governor
JOHN NICHOLSON
Interim Secretary
TIM BAUMGARTNER
Director

NORTH CAROLINA
Environmental Quality

June 30, 2021

Eric Neuhaus
Wildlands Engineering, Inc.
1430 S. Mint St, Suite 104
Charlotte, NC 28203

Subject: Laurel Valley Site
Mitigation Plan Report and Construction Plans
Catawba River Basin Cataloging Unit 03050101
DMS Project ID #100140

Dear Eric,

The NC Division of Mitigation Services (DMS) has reviewed the Draft Mitigation Plan and Preliminary Plans for the Laurel Valley Site. Following are DMS's comments on this Task 3 design deliverable:

Report

Report Cover - Add the DWR # and add the RFP issuance date (RFP 16-007875 issued 5/6/2019).

The final USACE approved Preliminary Jurisdictional Determination (PJD) and approved map/s should be included in the revised mitigation plan. Please be sure to update all figures and report text accordingly upon USACE approval, and include all approval correspondence.

Please provide a table summarizing impacts to existing wetlands.

The 5/19/2020 memo indicated that soil borings taken within the floodplain of East Prong Hunting Creek by the IRT indicated hydric soil indicators and while no wetland credit is being sought in this plan, Wildlands noted that groundwater gages would be installed within existing jurisdictionally delineated wetlands to monitor project effect on wetland hydrology and that locations of the gages will be shown within the mitigation plan. While there were gages observed on site, there was no apparent reference to or mapping of floodplain wetland hydrology devices in the plan. Please clarify.

Since there is some design in the preservation reach (culvert installation on internal crossing), this reach should be part of the plan discussion and description of culvert, similarly to UT2 culvert. In addition, it is recommended that some measure of visual monitoring (additional photos and/or VA table) be conducted on the preservation reach given the existing conditions and future culvert installation.

In the 5/19/2020 memo (Appendix 6) it was noted that the current culvert at the upstream end of East Prong Hunting Creek at the outlet from Laurelwood Rd. is perched and appears undersized; Wildlands indicated that this belonged to the adjacent landowner who was unwilling to allow a replacement, but that Wildlands would determine true land ownership during the survey. What was the result of the survey, and it there any possibility that Wildlands could install a properly sized and elevated crossing?

Appendix 9 table indicates the Invasives Treatment Plan is in Appendix 8 however it is Appendix 7. Please correct.

Invasives Treatment Plan (Appendix 7) does not mention fescue. Please indicate the fescue treatment plan, e.g. prior /during/after site construction. Early treatment is recommended if there is a risk of fescue impeding planted vegetation establishment and vigor.

Please describe the project fencing to be installed and reference the fencing plan provided in the plan set (appendices). Please also briefly describe how livestock will get drinking water when excluded from the project streams (well, livestock drinkers, etc).

Please indicate on the Figure 8 concept map, that the internal crossings #2 and #3 are going to be culvert installations, and that #1 (external) is an existing culvert (that will be left as-is).

Plan sheets 5.1 and beyond were upside down in the hard copy set. Please QAQC future hard copies.

The 5/19/2020 response memo indicated that given the concern about UT1 Reach 2 (downstream of the project limits) losing hydrology as the result of channel relocation, there would be some monitoring measure(s) along the abandoned segment of UT1 to ensure stream relocation does not result in a complete loss of hydrology. Can Wildlands specify if/what measures will be implemented, and show these on the monitoring map?

A recent field visit indicated that there is a ditch/ephemeral drainage feature on the right floodplain along UT2 – mid near STA 307+00 (approx.); on the plan sheets, there does not appear to be a treatment along this segment within the easement, to stabilize. Recommend adding floodplain drainage stabilization measure.

There is a moderately sized ditch in the floodplain that is draining the wetland area in between UT1 and UT2 (left floodplain of East Prong HC); there does not appear to be a treatment along this segment within the easement, to stabilize. Recommend adding floodplain ditch stabilization measure, at least within the easement and preferably extending up the ditch.

Section 6.6.1 East Prong Hunting Creek & Sheet 2.1.1: This section describes the plunge pool at the beginning of the project as an area with major erosion that may require additional rock as determined during construction. Please describe the potential rock stabilization method that could be applied to this area and label the plunge pool on Sheet 2.1.1 and consider adding a detail sheet for the potential rock stabilization structure.

Section 6.6.2 UT1 Reach 2; Appendix 6 IRT Post-Contract Meeting Minutes #4 Response; and Sheet 2.2.2: The meeting minutes indicate that "Wildlands will raise the stream grade, backing water up the culvert to help with culvert perching and aquatic organism passage. Wildlands will also add rock material to create roughness within the bed of the culvert to give aquatic species some refuge within the culvert". The channel modifications specified are not addressed in Section 6.6.2 or Sheet 2.2.2. Please indicate the proposed modifications in the design discussion and on the plan sheets.

Section 6.6.3 UT2 CMP Culvert: Thank you for specifying the CMP culvert is to be embedded 12-inches (minimum). Please indicate the proposed pipe diameter and state the benefits of embedding the culvert.

Internal culverts atop UT2 and UT1 – was woody debris passage considered in order to minimize risk of logjams and landowner maintenance burdens? Please consider adding discussion in risks and uncertainties section, or clarify otherwise,as there would appear to be risk of a substantial input of woody material from sections upstream.

Section 7.0 Performance Standards/ Section 8.0 Monitoring Plan: Please note that all volunteer stems or supplemental plantings must be present in the plot data for two years to be included as meeting the established vegetation performance standards.

Page 2. "Geomorphic ratios including low bank height ratio and entrenchment ratio for East Prong Hunting Creek…" Do you mean high BHR and Low ER?

Page 3, 6 and NCSAM documentation. Please note there are discrepancies in the grain size distributions in the document. Page 3 references sand and gravel, page 6 six mentions gravel and cobble in UT1 (no qualifier or quantity), but table indicates D50 sand. Please be specific when discussing grainsize distribution, dominant substrate and variability. Reviewers require this information as part of the technical review process.

Page 9 Uplift and constraints. The overall functional uplift section mentions upland sediment as a source on East Prong Hunting Creek. There is also an upstream source from bank erosion beyond the project limits as well, correct? If so, please address this sediment source as it relates to the restoration activities in this section. It is important to set up realistic expectations for the monitoring period.

Page 10. In list of uplift items, "Reduce bank erosion and associated pollutants." Is WEI referring to phosphorus associated with sediment or other pollutants besides sediment?

Please add represented particle size distributions to the report.

Tables

Table 1 Project Attribute Table Part 1 - Enter site coordinates in decimal degrees.

Table 2 Project Attribute Table Part 2 - Hyphenate the NCDWR Sub-basin (03-08-31).

Sheet 5.9 Details Part III - Consider adding a "Call Before You Dig" reference.

Table 13 - Please clarify why the expected D50 of Reach 1 and 2 of East Prong Hunting Creek is listed as >2mm. DMS is aware of the current condition parameters, but does WEI expect the constructed channel to have more coarse material?

Table 17 (Performance standards) - The performance standard for substrate states "Coarser material in riffles; finer particles in pools". Since WEI has described (in competency/sediment transport analysis, and text throughout the document) the amount of course sand in the channels, what is the differentiation between coarse and fine? Is WEI expecting to have a gravel bed stream with the this design?

The precautionary woody species footnote in Table 17 is confusing. Is Wildlands suggesting alternative criteria due to wetter conditions inhibiting woody growth in some areas? Or is Wildlands just expecting some wetter portions of the site to not meet criteria? Please clarify. If alternate criteria are being sought for certain wetter areas, it should be rationalized, defined clearly and additional details provided.

Table 18 (Monitoring) should distinguish CVS versus random plot quantities being proposed.

Digital Support Files

Reach-wide particle distribution data was submitted, but it does not appear to be included in the report. Cross section specific particle distributions were included in the report, but were not included with the digital deliverables. Please ensure all particle count data is submitted with the deliverables and included in the report.

Thank you in advance for addressing these comments. DMS will need a CD with a single PDF of the report/plans, and all updated digital support files in the correct file structure. Please send a revised PDF to me for final completeness review. Wildlands can then generate and send final bound hard copies to IRT contacts. Please include a copy of your response letter, bound inside the front cover of each hard copy report (and included in the final PDF).

If you have any questions, please let me know.

Sincerely,

Harry Tsomides

Harry Tsomides
Project Manager, NCDEQ-DMS

WILDLANDS
ENGINEERING

MEMORANDUM

TO: Harry Tsomides, NC DMS

FROM: Eric Neuhaus, PE

DATE: August 12, 2021

RE: Laurel Valley Mitigation Site
Catawba River Basin 03050101
Burke County, NC
DMS ID No. 100140
DEQ Contract Number 7875-02
RFP Number 16-007875
SAW-2020-00053
Response to NCDMS Mitigation Plan Comments

This memo documents NCDMS's initial Draft Mitigation Plan review comments (*in italics*) received from Harry Tsomides' letter dated June 30, 2021, the project team's responses, and where the revisions have been included in the final Mitigation Plan.

Mitigation Plan Comments:

Report:

- *Report Cover - Add the DWR # and add the RFP issuance date (RFP 16-007875 issued 5/6/2019).*

  The DWR # and RFP issuance date were added to the cover page.

- *The final USACE approved Preliminary Jurisdictional Determination (PJD) and approved map/s should be included in the revised mitigation plan. Please be sure to update all figures and report text accordingly upon USACE approval, and include all approval correspondence.*

  The USACE approved Preliminary Jurisdictional Determination (PJD), including the final map was included in Appendix 2 in lieu of the previously submitted package. Text within the report was updated to reflect that the approved PJD has been received.

- *Please provide a table summarizing impacts to existing wetlands.*

  Table 9 has been updated to include estimated permanent and temporary impacts to existing wetlands at the Site. Table numbering on subsequent report tables was updated accordingly.

- *The 5/19/2020 memo indicated that soil borings taken within the floodplain of East Prong Hunting Creek by the IRT indicated hydric soil indicators and while no wetland credit is being sought in this plan, Wildlands noted that groundwater gages would be installed within existing jurisdictionally delineated wetlands to monitor project effect on wetland hydrology and that locations of the gages will be shown within the mitigation plan. While there were gages observed on site, there was no apparent reference to or mapping of floodplain wetland hydrology devices in the plan. Please clarify.*

Three existing groundwater gages were installed along the boundary of the existing jurisdictional wetland areas in the right floodplain of E Prong Hunting Creek to evaluate current hydrology and further refine jurisdictional boundaries. The approximate locations of existing groundwater gages were added to Figure 2. Given that no wetland mitigation crediting is requested, data was not provided for the groundwater gages within the mitigation plan.

- *Since there is some design in the preservation reach (culvert installation on internal crossing), this reach should be part of the plan discussion and description of culvert, similarly to UT2 culvert. In addition, it is recommended that some measure of visual monitoring (additional photos and/or VA table) be conducted on the preservation reach given the existing conditions and future culvert installation.*

  Section 6.6.2 UT1 Reach 1 was added to the Mitigation plan narrative discussing the culvert crossing installation within the easement break of UT1 Reach 1. Three photo points are included along UT1 Reach 1 as shown in Figure 9 and tallied in Table 19.

- *In the 5/19/2020 memo (Appendix 6) it was noted that the current culvert at the upstream end of East Prong Hunting Creek at the outlet from Laurelwood Rd. is perched and appears undersized; Wildlands indicated that this belonged to the adjacent landowner who was unwilling to allow a replacement, but that Wildlands would determine true land ownership during the survey. What was the result of the survey, and it there any possibility that Wildlands could install a properly sized and elevated crossing?*

  The roadway lies within a 20-foot easement partially on upstream property owner Delores Hildebrand Stroupe. Given the crossings recent installation by the adjacent property owner, there was not interest in Wildlands replacing the crossing.

- *Appendix 9 table indicates the Invasives Treatment Plan is in Appendix 8 however it is Appendix 7. Please correct.*

  The Appendix reference has been corrected.

- *Invasives Treatment Plan (Appendix 7) does not mention fescue. Please indicate the fescue treatment plan, e.g. prior /during/after site construction. Early treatment is recommended if there is a risk of fescue impeding planted vegetation establishment and vigor.*

  A fescue treatment plan has been added to Appendix 7 Invasive Species Treatment Plan.

- *Please describe the project fencing to be installed and reference the fencing plan provided in the plan set (appendices). Please also briefly describe how livestock will get drinking water when excluded from the project streams (well, livestock drinkers, etc).*

  Additional language was added to Section 3.1, Site Constraints to Functional Uplift to provide more detail to the fencing plan. Please note that cattle exclusion may be achieved by either implementing the fencing plan or by removing livestock from the property. Additional livestock infrastructure beyond fencing and stream crossings is the Landowner's responsibility and is not a part of the mitigation project. All livestock infrastructure is required to be located outside of the easement.

- *Please indicate on the Figure 8 concept map, that the internal crossings #2 and #3 are going to be culvert installations, and that #1 (external) is an existing culvert (that will be left as-is).*

  Figure 8 was revised to includes callouts defining crossing information.

- *Plan sheets 5.1 and beyond were upside down in the hard copy set. Please QAQC future hard copies.*

- *The 5/19/2020 response memo indicated that given the concern about UT1 Reach 2 (downstream of the project limits) losing hydrology as the result of channel relocation, there would be some monitoring measure(s) along the abandoned segment of UT1 to ensure stream relocation does not result in a complete loss of hydrology. Can Wildlands specify if/what measures will be implemented, and show these on the monitoring map?*

  The previous property owner passed away and Wildlands does not currently have permission to monitor the potential resource on the downstream end of UT1. Wildlands will continue to attempt to acquire permission to install a stream flow gage downstream on UT1. Design features discussed within the mitigation plan were proposed to ensure downstream hydrology within the potential resource.

- *A recent field visit indicated that there is a ditch/ephemeral drainage feature on the right floodplain along UT2 – mid near STA 307+00 (approx.); on the plan sheets, there does not appear to be a treatment along this segment within the easement, to stabilize. Recommend adding floodplain drainage stabilization measure.*

  An outlet stabilization detail was added to Sheet 5.6 and areas identified in the Stream Plan and Profile sheets where drainage features will be stabilized.

- *There is a moderately sized ditch in the floodplain that is draining the wetland area in between UT1 and UT2 (left floodplain of East Prong HC); there does not appear to be a treatment along this segment within the easement, to stabilize. Recommend adding floodplain ditch stabilization measure, at least within the easement and preferably extending up the ditch.*

  An outlet stabilization detail was added to Sheet 5.6 and areas identified in the Stream Plan and Profile sheets where drainage features will be stabilized.

- *Section 6.6.1 East Prong Hunting Creek & Sheet 2.1.1: This section describes the plunge pool at the beginning of the project as an area with major erosion that may require additional rock as determined during construction. Please describe the potential rock stabilization method that could be applied to this area and label the plunge pool on Sheet 2.1.1 and consider adding a detail sheet for the potential rock stabilization structure.*

  If, during construction, it is determined that additional stabilization of the crossing embankment is required, Class 1 stone (or other approved stone) will be applied along the crossing embankment and around the existing pipe outlet or inlet. Stormwater runoff from the road often channelizes and enters the streams along the crossing embankment creating gullies or eroded areas. After re-grading the eroded area, stone will be applied to reduce the potential for the problem to re-occur. Note that the embankment areas that may receive this stone (the crossing at the beginning of East Prong Hunting Creek Reach 1 and the crossing at the beginning of UT1 Reach 2) are located outside the conservation easement. Stone will only be applied to the crossing embankment while erosion along the outer banks of the plunge pools will be addressed by grading, brushtoe/geolifts, and planting. The plunge pools throughout the project were labeled in the planset (Sheet 2.1.1 and 2.2.2) and additional notes were added that stone would only be applied to the crossing embankment. A detail was added to sheet 5.4 in the Plans.

- *Section 6.6.2 UT1 Reach 2; Appendix 6 IRT Post-Contract Meeting Minutes #4 Response; and Sheet 2.2.2: The meeting minutes indicate that "Wildlands will raise the stream grade, backing water up the culvert to help with culvert perching and aquatic organism passage. Wildlands will also add rock material to create roughness within the bed of the culvert to give aquatic species some refuge within the culvert". The channel modifications specified are not addressed in Section 6.6.2 or Sheet 2.2.2. Please indicate the proposed modifications in the design discussion and on the plan sheets.*

  The mitigation plan currently mentions "The plunge pool transitions to the typical meander pool dimensions and then a constructed riffle, the head of which was set at an elevation to increase the water surface through the culvert and reduce the perched condition of the culvert to improve aquatic organism passage." The elevation of the first head of riffle was set so that water would back into the existing culvert. Backwater surface profiles were added to Sheet 2.1.1 and 2.2.2.

- *Section 6.6.3 UT2 CMP Culvert: Thank you for specifying the CMP culvert is to be embedded 12-inches (minimum). Please indicate the proposed pipe diameter and state the benefits of embedding the culvert.*

  The proposed minimum pipe diameter of 54" was included in the Mitigation Plan and additional discussion of the benefits of pipe embedment were included in Sections 6.6.2 UT1 Reach 1 and 6.6.4 UT2.

- *Internal culverts atop UT2 and UT1 – was woody debris passage considered in order to minimize risk of logjams and landowner maintenance burdens? Please consider adding discussion in risks and uncertainties section, or clarify otherwise, as there would appear to be risk of a substantial input of woody material from sections upstream.*

  A paragraph was added to the Mitigation Plan in **Section 6.8 Project Risk and Uncertainties** discussing the risk of logjams at the proposed culverts.

- *Section 7.0 Performance Standards/ Section 8.0 Monitoring Plan: Please note that all volunteer stems or supplemental plantings must be present in the plot data for two years to be included as meeting the established vegetation performance standards.*

  The recommended note was added to the footnotes within the performance standards and monitoring tables.

- *Page 2. "Geomorphic ratios including low bank height ratio and entrenchment ratio for East Prong Hunting Creek…" Do you mean high BHR and Low ER?*

Yes, the sentence was corrected to state "high bank height ratio and low entrenchment ratio"

- *Page 3, 6 and NCSAM documentation. Please note there are discrepancies in the grain size distributions in the document. Page 3 references sand and gravel, page 6 six mentions gravel and cobble in UT1 (no qualifier or quantity), but table indicates D50 sand. Please be specific when discussing grainsize distribution, dominant substrate and variability. Reviewers require this information as part of the technical review process.*

  References to gravel and cobble for East Prong Hunting Creek and UT1 (Section 3.3.1) in the body of the narrative are qualitative assessments of the stream, mentioned to inform the reader that these size particles were present and relatively common in the reaches. The second part of these sentences explains why the assessed reachwide D50 of the streams are much smaller: " Channel substrate consist of gravel and cobble sized material that has been embedded with fine sediment from bank erosion." This is consistent with the NC SAM assessments which generally show that cobble and gravel are common on all reaches (one exception – UT1 Reach 2 upper which was assessed as cobbles only rarely being found), while sand was assessed as abundant for all reaches.

  To add clarity, a second sentence was added to the narrative stating "The abundance of these fine sediments contributed to the assessed reachwide D50 of …."

- *Page 9 Uplift and constraints. The overall functional uplift section mentions upland sediment as a source on East Prong Hunting Creek. There is also an upstream source from bank erosion beyond the project limits as well, correct? If so, please address this sediment source as it relates to the restoration activities in this section. It is important to set up realistic expectations for the monitoring period.*

  The Project Risk and Uncertainties section was revised, and additional discussion of upstream erosion risk was included in the Mitigation Plan

- *Page 10. In list of uplift items, "Reduce bank erosion and associated pollutants." Is WEI referring to phosphorus associated with sediment or other pollutants besides sediment?*

  "Associated pollutants" was a reference to sediment inputs into the stream. The bullet point in the Mitigation Plan has been changed to "Reducing bank erosion and direct sediment inputs to the stream."

- *Please add represented particle size distributions to the report.*

  Particle Size distribution reports and pebble counts have been added to Appendix 4.

Tables:

- *Table 1 Project Attribute Table Part 1 - Enter site coordinates in decimal degrees.*

  The coordinates have been converted and Table 1 has been updated

- *Table 2 Project Attribute Table Part 2 - Hyphenate the NCDWR Sub-basin (03-08-31).*

  Dashes have been added to the Sub-basin ID in Table 2

- *Sheet 5.9 Details Part III - Consider adding a "Call Before You Dig" reference.*

  A "Call Before You Dig" emblem is located on the Title Sheet of the Planset.

- *Table 13 - Please clarify why the expected D50 of Reach 1 and 2 of East Prong Hunting Creek is listed as >2mm. DMS is aware of the current condition parameters, but does WEI expect the constructed channel to have more coarse material?*

  Additional material is expected to be required to ensure riffle stability. The selected material may be found on-site or imported but will need to be larger than the current stream D50 and will likely be in the course gravel or cobble size range. Native material in the existing streambed will also be harvested and utilized in construction to the extent practical. In Table 13, the ">2.0 mm" proposed D50 refers to the bottom limit of the expected riffle D50 in the new stream, meaning the proposed stream should type out as a gravel bed stream or larger. The "greater than" sign also captures some of the unknowns on the availability and size of on-site rock material as well as how sediment inputs from the watershed above the project may affect the stream substrate size.

- *Table 17 (Performance standards) - The performance standard for substrate states "Coarser material in riffles; finer particles in pools". Since WEI has described (in competency/sediment transport analysis, and text throughout the document) the amount of course sand in the channels, what is the differentiation between coarse and fine? Is WEI expecting to have a gravel bed stream with this design?*

  Wildlands anticipates a gravel bed stream but also understands that the watershed has a high sand load which could result in minor riffle embedment and lower d50 100 counts. The performance standard outlined in the Table is stating that sediment counts performed in riffles will have a higher d50 than those performed in pools. This is a typical performance standard used in previous approved mitigation plans.

- *The precautionary woody species footnote in Table 17 is confusing. Is Wildlands suggesting alternative criteria due to wetter conditions inhibiting woody growth in some areas? Or is Wildlands just expecting some wetter portions of the site to not meet criteria? Please clarify. If alternate criteria are being sought for certain wetter areas, it should be rationalized, defined clearly and additional details provided.*

Wildlands is suggesting alternative criteria previously discussed with the NCIRT based on anticipated wetter conditions inhibiting woody growth. Table 18 (Revised Table 17) and were updated with more defined alternative criteria.

- *Table 18 (Monitoring) should distinguish CVS versus random plot quantities being proposed.*

  No random plots are being proposed for Laurel Valley Mitigation Site and the reference to random plots was removed from Table 18.

<u>Digital Support Files:</u>

- *Reach-wide particle distribution data was submitted, but it does not appear to be included in the report. Cross section specific particle distributions were included in the report, but were not included with the digital deliverables. Please ensure all particle count data is submitted with the deliverables and included in the report.*

  Cross section specific particle distributions were included in the folder named "4. Existing Conditions Data" in the revised digital deliverable. Reachwide sediment data is included within Tables 4, 5, and 6 within the report.

TABLES

FIGURES

APPENDICES

1.0 Introduction

The Laurel Valley Mitigation Site (Site) is in Burke County approximately 3.5 miles southeast of Morganton (Figure 1). The Site is within the NC Division of Mitigation Services (DMS) Hunting Creek targeted local watershed Hydrologic Unit Code (HUC) 03050101060050 and the NC Division of Water Resources (DWR) Subbasin 03-08-31. The Site will provide stream credits in the Catawba River Basin HUC 03050101 (Catawba 01). The project proposes to restore and preserve approximately 5,158 linear feet of streams (Figure 2). The work proposed on the Site will provide 4,836 warm stream credits and will be protected in perpetuity by approximately 14 acres of conservation easement.

Table 1: Project Attribute Table Part 1

Project Information	
Project Name	Laurel Valley Mitigation Site
County	Burke
Project Area (acres)	14
Project Coordinates (latitude and longitude)	35.702772 -81.642614
Planted Acreage (acres of woody stems planted)	13

2.0 Basin Characterization and Site Selection

The Catawba 01 Basin is dominated by forested land (62%) with sizable areas of agriculture (17%) and developed land (16%). The major developed areas include Morganton, Lenoir, the northern portions of Hickory, Huntersville, Gastonia, and outlying areas northwest of Charlotte. Its main roadways consist of I-77, I-40, and US-70. East Prong Hunting Creek and two of its unnamed tributaries (named for this project as UT1 and UT2) will be restored and preserved as part of this project. East Prong Hunting Creek is 303(d) listed as impaired for exceeding the criteria for fecal coliform bacteria for recreational use. East Prong Hunting Creek drains to Rhodhiss Lake on the Catawba River. Three municipalities, Granite Falls, Lenoir, and Valdese have public water intakes along the lake. Multiple conservation and watershed planning documents outline water quality goals and objectives for the broader Catawba River basin and the smaller hunting Creek basin as summarized below:

- The 2009 (amended 2018) Catawba River Basin Restoration Priorities (RBRP) lists restoring impaired waters by removing conditions causing sediment impairments and improving management to reduce direct cattle impacts to streams as goals for the watershed. The degree of degradation of Hunting Creek's riparian buffers (i.e. 41% non-forested) and negative effects of urbanization on stream health within the watershed are discussed specifically in the RBRP.
- The 2010 NC DWR Catawba River Basinwide Water Quality Plan notes that Hunting Creek provides significant annual nonpoint source nutrient loading (nitrogen and phosphorus) to Lake Rhodhiss.
- The 2015 North Carolina Wildlife Resource Commission's (NCWRC) Wildlife Action Plan (WAP) notes that riparian habitat loss, excessive sedimentation, and nutrient loading from poorly managed agricultural and development operations are widespread problems within the basin. The WAP discusses the importance of habitat conservation and restoration to address current problems affecting species and habitats.
- The 2009-2011 Hunting Creek Local Watershed Plan (LWP) documents identified major functional stressors in the watershed as urban development; stormwater runoff; stream bank

erosion; increased sedimentation within streams; degraded riparian buffers, including lack of woody vegetation; agricultural and residential land management practices; and fecal coliform and nutrient inputs. The Site was identified in the Hunting Creek LWP as site ID 14. Site ID 14 was ranked as a medium priority potential stream restoration project in the Hunting Creek watershed.

The Site was selected due to its ability to support local watershed objectives and goals by excluding livestock, creating stable stream banks, and restoring a forest in agriculturally maintained buffer areas. These actions will reduce fecal, nutrient, and sediment inputs to project streams, and ultimately to Hunting Creek, Rhodhiss Lake, and the Catawba River, as well as reconnect instream and terrestrial habitats on the Site. Restoration of the Site is directly in line with recommended management strategies outlined in the LWP and RBRP.

3.0 Baseline and Existing Conditions

3.1 Watershed Conditions

The Site watershed is located outside of the city limits of Morganton but almost entirely within the township of Morganton in Burke County, NC. The Site topography and relief are typical for the region, as illustrated in Figure 4. Generally, valleys onsite range from moderately confined and alluvial to unconfined and alluvial. Valley slopes flatten as elevations decrease and valley confinement reduces as the tributaries flow through the floodplain of East Prong Hunting Creek.

All onsite streams drain to East Prong Hunting Creek which is classified as Water Supply IV waters. Water Supply IV waters are a water supply source for drinking, culinary, or food processing purposes. Water Supply IV waters are also protected for Class C uses. Class C waters are protected for secondary recreation, fishing and fish consumption, wildlife, aquatic life, and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner.

The watershed to the Site streams includes a mix of forested, agriculture (pasture/hay fields), shrubland and some low-density residential land use. The East Prong Hunting Creek watershed is roughly bisected by Sam J Ervin Jr Hwy (NC-18) and encompasses the watersheds of UT1 and UT2. UT1 flows northward in a moderately sloped valley to join East Prong Hunting Creek downstream of the site boundary. UT2 flows north in a moderately sloped valley to join East Prong Hunting Creek within the Site boundary. Much of the East Prong Hunting Creek watershed lies offsite to the east and is bound by Back Bluff Drive to the Northeast and Hawkins Dr/Sawmill Road to the Southwest. The land within these watersheds is zoned for Residential, General Business, and Industrial use.

A review of historic aerials (Appendix 1) from 1947 to 2016 shows that East Prong Hunting Creek and UT2 have existed in their same approximate location and with the same pattern for over 72 years. Aerials potentially show that UT1 historically flowed into East Prong Hunting Creek within the Site boundary but was rerouted between 1976 and 1984 to leave the Site at its current location. Aerials show some changes to the agricultural management of the land. Open pastures were present between 1947 and 1964 that generally match the existing open pasture limits. Between 1976 and 1984, the open pastures were allowed to grow up substantially. By 1993 the woods had been cleared to reestablish open pastures as they currently exist.

Table 2: Project Attribute Table Part 2

Project Watershed Summary Information			
Physiographic Province	Piedmont		
Ecoregion	Northern Inner Piedmont		
River Basin	Catawba River		
USGS HUC (8 digit, 14 digit)	03050101, 03050101060050		
NCDWR Sub-basin	03-08-31		
NCDWR Water Quality Classification	WS-IV		
	East Prong Hunting Creek	UT1	UT2
Drainage Area (acres)	1274	136	155
2011 NLCD Land Use Classification			
Forest	75%	49%	82%
Agricultural	6%	13%	11%
Grassland	6%	3%	2%
Shrubland	1%	4%	1%
Developed	12%	31%	4%
Open Water	0%	0%	0%
% Impervious	2%	6%	0.6%

3.2 Landscape Characteristics

The Site is located in the Tugaloo and Cat Square terranes of the Piedmont physiographic province. The Piedmont province is characterized by rolling, well rounded hills and long low ridges, with elevations ranging from 300 to 1500 feet above sea level. The Tugaloo terrane is composed of metamorphosed sedimentary and volcanic rocks deposited on rifted continental and newly created oceanic crust off the coast of the ancient North American continent from about 480 to 570 million years ago. The Cat Square terrane is composed of deformed metamorphic rocks that have been intruded by younger granitic rocks. The underlying geology is mapped as migmatitic granitic gneiss (OCgm) and inequigranular biotite gneiss (CZpg). The migmatitic granitic gneiss from the Cambrian to Ordovician period (455 to 540 million years in age) is described as foliated to massive, granitic to quartz dioritic with biotite gneiss and amphibolite common. The inequigranular biotite gneiss from the Late Proterozoic to Cambrian period (500 to 900 million years in age) is described as weakly to massively foliated, containing plagioclase megacrysts, and rarely, larger megacrysts of quartz and feldspar.

Channel substrate ranged from silt and fine sand up to medium sized cobbles. The D50 for all streams was similar, ranging from 0.77-3.8mm, and was categorized as course sand or gravel stream beds. Field notes taken during the assessment period indicated that loads of finer sediment (silt and sand) were likely being introduced to the stream systems from upland areas and from streambank erosion. No exposed bedrock was identified in the stream or floodplain of the stream and is not expected to interfere with construction.

The predominant floodplain soils on site are described in Table 3 below and depicted in Figure 5. Wetland areas were delineated at the site using F3 and F19 soil indicators. All wetland hydrology at the

Site is thought to be influenced by groundwater seeps and occasional overbank flooding from the project tributaries. Geomorphic ratios including high bank height ratio and low entrenchment ratio for East Prong Hunting Creek provide evidence of disconnection from the current floodplain wetlands, primarily Wetland B. Additionally, overbank flow indicators were not observed during recent large rain events, further supporting the lack of floodplain connection anticipated based on the existing geomorphic ratios.

Table 3: Project Soil Types

Soil Name	Slopes	Description
AaA - Arkaqua Loam	0 to 2%, occasionally flooded	This series consists of somewhat occasionally flooded and poorly drained soil on floodplains. The permeability is high and low surface runoff. This soil is suited for woodland and poorly suited for cropland due to wetness and flooding. It is found along the majority of East Prong Hunting Creek and the downstream end of UT1.
CvA - Colvard Sandy Loam	0 to 3%, occasionally flooded	This series consists of well-drained soil on floodplains. The permeability is moderate and very low surface runoff. This soil is well suited for woodland and suited for cropland. It is found along the majority of UT1.
FaC2 - Fairview Sandy Clay	8 to 15%, moderately eroded	This series consists of well-drained soil on ridges and interfluves. This soil has moderate permeability and low surface runoff. It is found only in a relatively small portion of the East Prong Hunting Creek floodplain.
FaD2 - Fairview Sandy Clay Loam	15 to 25%, moderately eroded	This series consists of well-drained soil on ridges and interfluves. This soil has moderate permeability. It is found on a majority of UT2 and a portion of UT1.

Source: *Soil Survey of Burke County, North Carolina, USDA-NRCS,* https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

The Site is an active farm composed of cattle pastures, barns, and a house. Much of the Site, including East Prong Hunting Creek and UT2, is dominated by pasture grasses such as fescue (*Festuca spp*.) with scattered trees along the top of bank and adjacent floodplain. Canopy species within these areas are primarily black willow (*Salix nigra*), red maple (*Acer rubrum*), tag alder (*Alnus serrulata*), flowering dogwood (*Cornus florida*), sycamore (*Platanus occidentalis*), tulip poplar (*Liriodendron tulipifera*), box elder (*Acer negundo*), elderberry (*Sambucus nigra*), black walnut (*Juglans nigra*), and black cherry (*Prunus serotine*). In addition to pasture grasses, other herbaceous species include jewelweed (*Impatiens capensis*), soft rush (*Juncus effusus),* ironweed (*Vernonia fasciculata*), Carolina horsenettle (*Solanum carolinense*), pokeweed (*Phytolacca decandra*), spiderwort (*Murdannia keisak*), and smartweed (*Polygonum spp*.).

The wooded areas along one or both sides of UT1 consist of a mature forest. Canopy species in these areas include American beech (*Fagus grandifolia*), green ash (*Fraxinus pennsylvanica*), white oak (*Quercus alba*), red maple, tulip poplar, sourwood (*Oxydendrum arboretum*) and sweet gum (*Liquidambar styraciflua*). The understory layer primarily consists of small pockets of Chinese privet (*Ligustrum sinense*), American holly (*Ilex opaca*), and spicebush (*Lindera benzoin*), Japanese stiltgrass (*Microstegium vimineum*), Christmas fern (*Polystichum acrostichoides*), and greenbrier (*Smilax spp*.).

3.3 Project Resources

3.3.1 *Existing Streams*

In September 2019, Wildlands investigated on-site jurisdictional waters of the United State (US) within the proposed project area. East Prong Hunting Creek, UT1, and UT2 were scored perennial. Jurisdictional stream features are shown on Figure 2 and supporting documentation is provided in Appendices 2 and 3.

Geomorphic surveys were conducted on Site streams to characterize their existing condition. Existing streams and cross section locations are illustrated in Figure 2. NCDWR stream assessment forms are in Appendix 3 and reach specific cross sections and geomorphic summaries are provided in Appendix 4.

East Prong Hunting Creek

East Prong Hunting Creek flows west onto the Site through a 48" culvert under Laurelwood Road. Within the Site limits, cattle have access to the entire stream and its narrow, sporadic buffer. The pasture is actively grazed and the stream banks are devoid of stabilizing vegetation. Stream banks are severely eroded and exhibit rotational failure. The stream bed substrate is cobbles and gravels embedded with fines from bank erosion. The abundance of these fine sediments contributed to the assessed reachwide D50 of 0.95 mm (see Table 4 below). Instream habitat is limited to riffles, runs, and shallow pools with very little woody debris, leaf packs, or root mats. Incision along East Prong Hunting Creek is moderate to high with bank height ratios ranging from 1.6-2.0. A large woody debris jam is holding a 1-ft headcut in place just downstream of the UT2 confluence. Two existing field drains (ditches) have been dug in the left floodplain and currently tie to the existing channel alignment. Stream function was assessed on East Prong Hunting Creek using the North Carolina Stream Assessment Method (NCSAM) and found to be Low due to deficiencies in flood flow, water quality, in-stream habitat, and poor vegetative bank cover. Three cross sections were measured downstream of the confluence with UT2.

Table 4: East Prong Hunting Creek Attribute Table

Reach Summary Information	
Parameters	**East Prong Hunting Creek**
Length of Reach (Linear Feet)	1,356
Valley confinement (Confined, moderately confined, unconfined)	Unconfined
Drainage area (acres)	1,274
Perennial, Intermittent, Ephemeral	Perennial
NCSAM Score/Stream Function	Low
NCDWR Water Quality Classification	WS-IV
Width to Depth Ratio (ft/ft)	13.8-18.0
Bank Height Ratio (ft/ft)	1.6-2.0
Gradient (ft/ft)	0.00743
Reachwide d50 (mm)	0.95 (Coarse Sand)
Stream Classification (Existing and Proposed)	Existing: C5, B5c Proposed: C4
Evolutionary Trend	V. Aggradation and widening
FEMA Zone Classification	X


East Prong Hunting Creek – recent bank erosion and widening


East Prong Hunting Creek – bank erosion and channel deposition

UT1

UT1 originates offsite near a quarry as depicted on Figure 3. The quarry produced crushed stone and still has an active permit (NC DEQ Permit # 12-07), although conversations with the landowner indicated that there had been very little traffic to the quarry in the past few years. At the upstream limit within the site, UT1 flows through a narrow, steep, wooded valley with varied habitat including snags, roots mats, pools, and leaf packs. The stream continues in this condition for approximately 400 LF until it flows through a 36” driveway culvert. Cattle do not have access to the reach upstream of the culvert. The outlet end of the culvert is perched approximately one foot above base flow water surface and adjacent stream slopes are eroded. Downstream of the culvert, cattle have access to both sides of the stream. The channel is incised and disconnected from its floodplain while tortuous meanders have caused widespread bank erosion and undercut banks. The right buffer is wide and wooded while the left buffer consists of a narrow row of trees on the edge of an open pasture. Channel substrate consist of gravel and cobble sized material that has been embedded with fine sediment from bank erosion. The abundance of these fine sediments contributed to the assessed reachwide D50 of 0.77 mm (see Table 5 below). The stream leaves the project parcel under a cattle gate and becomes straight with a wooded buffer on the left floodplain and open pasture on the right floodplain. The stream capacity is currently overloaded with fine sediment which settles in the downstream portion of UT1 and has resulted in a braided channel in some sections of the off-property reach. UT1 then flows into a small, in-line pond, possibly the result of human or beaver manipulation, before continuing as a ditch to a culvert under Mt. Home Church Road. UT1 ends in a confluence with another small unnamed tributary a few hundred feet after passing under the road.

Table 5: UT1 Attribute Table

Reach Summary Information	
Parameters	**UT1**
Length of Reach (Linear Feet)	1,841
Valley confinement (Confined, moderately confined, unconfined)	Moderately confined
Drainage area (acres)	136
Perennial, Intermittent, Ephemeral	Perennial
NCSAM Score/Stream Function	Reach 1: High Reach 2: Low
NCDWR Water Quality Classification	WS-IV
Width to Depth Ratio (ft/ft)	6.7-14.3
Bank Height Ratio (ft/ft)	1.6-1.9
Gradient (ft/ft)	0.00879
Reachwide d50 (mm)	0.77 (Coarse sand)
Stream Classification (Existing and Proposed)	Existing: B5c, G5c Proposed: C4
Evolutionary Trend	IV. Degradation and widening
FEMA Zone Classification	X


UT1 – eroded and undercut left bank


UT1- narrow and straight


UT1- Preservation Reach – Stable

UT2

UT2 enters the Site from a wooded upstream parcel and is extensively impacted by cattle activity in the fringe of the woods. The stream then flows out of the woods through an open pasture with no buffer. The channel is moderately incised with alternating bank erosion caused by cattle trampling. The stream continues in this condition for approximately 600 LF before flowing through a perched 24” culvert used as a cattle crossing. Downstream of the culvert, the stream flows another 350 LF through open pasture before entering a narrow-wooded buffer for 150 LF. A considerable volume of sediment is input into the stream within the narrow buffer due to cattle trampling and wallow areas. Downstream of the narrow buffer, the left buffer widens, bank heights decrease, and the stream is relatively stable for approximately 100 LF. Downstream of the stable section, the buffer disappears, and the stream becomes more incised with eroding banks and multiple cattle wallows before connecting with East Prong Hunting Creek. UT2 exhibits low bedform diversity and high sedimentation due to cattle trampling and eroding banks. Incision ranges from low in the stable section to moderate in the rest of the reach. The valley is relatively narrow and moderately confined.

Table 6: UT2 Attribute Table

Reach Summary Information	
Parameters	**UT2**
Length of Reach (Linear Feet)	1371
Valley confinement (Confined, moderately confined, unconfined)	Moderately confined
Drainage area (acres)	155
Perennial, Intermittent, Ephemeral	Perennial
NCSAM Score/Stream Function	Low/Medium
NCDWR Water Quality Classification	WS-IV
Width to Depth Ratio (ft/ft)	8.4-18.7
Bank Height Ratio (ft/ft)	1.3-1.6
Gradient (ft/ft)	0.01767
Reachwide d50 (mm)	3.8 (Very Fine Gravel)
Stream Classification (Existing and Proposed)	Existing: B4, B4c Proposed: C4
Evolutionary Trend	IV. Degradation and widening
FEMA Zone Classification	X


UT2 – eroding banks due to cattle wallow


UT2 –nonexistent buffer

3.3.2 *Existing Wetlands*

Wildlands delineated potential wetland and waters of the United States within and immediately adjacent to the proposed project easement (assessment area) using the USACE Routine On-Site Determination method presented in the 1987 Corps of Engineers delineation manual and the subsequent Regional Supplement for the Eastern Mountain and Piedmont Region. The Preliminary Jurisdictional Determination (PJD) package was submitted on February 15, 2021. A site walk with USACE was performed on April 22, 2021 and no modifications to the PJD package were requested. A PJD approval was received on July 19, 2021. The PJD approval, including the associated resource map, is included in Appendix 2. Existing wetland data is summarized in Table 7.

A total of 7 existing jurisdictional wetland features (Wetlands A-G) were documented within the assessment area (Figure 2). On-site wetland features exhibit indicators of wetland hydrology, hydrophytic vegetation, and hydric soils. Indicators of wetland hydrology observed in existing wetlands include surface water, high water table, saturation, geomorphic position, crayfish burrows, drift deposits, and water-stained leaves. Dominant hydrophytic vegetation species within wetlands include common rush (*Junus effusus*), jewelweed (*Impatiens capensis)*, gray sedge *(Carex grayi),* New York ironweed *(Vernonia noveboracensis)*, and Seedbox (*Ludwigia alernifolia*). Soils within on-site wetlands exhibit one of the following hydric soil indicators: Depleted Below Dark Surface, Depleted Matrix, Redox Dark Surface, Umbric Surface.

Table 7: Project Attribute Table

Wetland	Size of Wetland (acres)	Wetland Type	Mapped Soil Series	Drainage Class	Soil Hydric Status	Source of Hydrology
A	0.020	Riverine	Arkaqua Loam	Poorly drained	No	Groundwater/ Overbank flow
B	2.784		Arkaqua Loam	Poorly drained	No	Groundwater/ Overbank flow
C	0.003		Fairview Sandy Clay Loam	Well drained	No	Groundwater
D	0.069		Fairview Sandy Clay Loam	Well drained	No	Groundwater
E	0.948		Arkarqua Loam/ Fairview Sandy Clay Loam,	Poorly drained/Well drained	No	Groundwater/Overbank flow
F	0.701		Colvard Sandy Loam/ Fairview Sandy Clay Loam	Well drained/Well drained	No	Groundwater/Overbank flow
G	0.095		Colvard Sandy Loam	Well drained	No	Groundwater

3.4 Overall Functional Uplift Potential

The primary stressors to Site streams are livestock trampling, lack of stabilizing stream bank and riparian vegetation, active erosion, upland erosion and sedimentation, incision, and fragmented aquatic habitat. These stressors led to Low NCSAM scores. Without intervention, East Prong Hunting Creek and its tributaries will continue to widen, which will further disconnect riparian wetland hydrology. Ultimately, functional uplift for this Site is linked to improvement and maintenance of hydrologic connectivity between streams and riparian wetlands. Additionally, establishing a riparian buffer will protect and enhance this connectivity. Functional uplift for the site will be achieved through the following:

- Restoring degraded stream channels to reduce erosion and reconnect streams to riparian wetlands to restore hydrologic connection.
- Reducing bank erosion and direct sediment inputs to the stream.
- Planting riparian buffers to shade streams, help stabilize streams, and promote woody debris in the system.
- Excluding livestock via cattle removal from the site or implementation of the fencing plan.
- Protecting the site with a conservation easement.

These project components are described in Section 5 in terms of goals, objectives, and outcomes for the project.

3.5 Site Constraints to Functional Uplift

The following potential Site constraints have been identified and will be addressed as part of this project.

One external easement break and two internal easement crossings are proposed to maintain future landowner access throughout the project parcel. An external easement break along UT1 allows for an existing driveway culvert crossing. Two internal easement breaks with proposed culvert crossings will be installed at the upstream extents of UT1 and UT2, respectively. The culverted crossings will facilitate cattle rotation and general site access. Cattle exclusion from the conservation easement will be achieved either via the removal of cattle from the site entirely or by the installation of fencing per the included fencing plan (Appendix 13 and Figure 8). The landowner will be required to maintain cattle exclusion for the entirety of the conservation easement through one of these methods. If cattle exclusion is achieved via removal, the property owner will be required to sign documentation that will require installation of fencing per the Wildlands' approved fencing plan if cattle are returned to the property. The fencing plan will prevent livestock entry to the conservation easement from all current or future pasture areas as delineated by the landowner. All newly proposed fencing will consist of 4-strands of properly tensioned high-tensile wire with appropriate bracing.

The external easement break at the end of UT1 Reach 1 and the crossing upstream of the project limits on East Prong Hunting Creek both contain existing culverts in perched conditions that likely limit aquatic organism passage. Negotiations with the landowner could not reach an amicable solution for replacing these culverts. To mitigate the aquatic organism passage issues at both of these locations, the initial head of riffle downstream was positioned to back water up through the entrance of the existing culverts.

The conservation easement includes a 40'-wide overhead utility easement that runs along the northwestern property line of the Site. The existing utility easement will supersede the requirements of the conservation easement; however, this area was included to reduce access to the downstream extents of East Prong Hunting Creek. Easement signage will be included along the utility easement boundary to reduce the chance of utility maintenance encroaching into the conservation easement. No other known utilities or easements are present within the conservation easement area.

Priority 2 restoration transition zones will be necessary based on the elevations and degree of incision onsite. These transition zones will occur at the upstream and downstream extents of East Prong Hunting Creek. The upstream areas of UT1 Reach 2 and UT2 will also require some length of priority 2 transition. Establishing vegetation on priority 2 stream restoration can be a challenge. Wildlands has prepared a Vegetation and Planting Plan (Section 5.7) to address this potential constraint. To ensure appropriate floodplain connection, Wildlands will construct floodplains that are at least 3 times bankfull width and have a slope that is flatter than 5:1 in all priority 2 transition zones.

4.0 Regulatory Considerations

Table 8, below, is a summary of regulatory considerations for the Site.

Table 8: Regulatory Considerations Attribute Table

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	No	PCN[1]
Water of the United States - Section 401	Yes	No	PCN[1]
Endangered Species Act	Yes	Yes	Appendix 5
Historic Preservation Act	Yes	Yes	Appendix 5
Coastal Zone Management Act	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

1. PJD submitted to USACE on 02/15/21 and approved on 7/19/2021. PCN to be provided to IRT with Final Mitigation Plan.

4.1 Biological and Cultural Resources

A Categorical Exclusion for the Site was approved on April 22, 2020. This document included investigation into the presence of threatened and endangered species on Site protected under the Endangered Species Act of 1973, as well as any historical resources protected under The National Historic Preservation Act of 1966. The biological conclusion for the northern long-eared bat per the Categorical Exclusion research and response by US Fish and Wildlife Service, is that "any incidental take that may results from the associated activities [from the project] is exempt under the 4(d) rule." The conclusion for cultural resources per the Categorical Exclusion research and response by the State Historic Preservation Office is that there are no historic resources that would be affected by this project. The signed Categorical Exclusion checklist and summary are provided in Appendix 5. As stated on the Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form provided in the Categorical Exclusion, approximately 3.3 acres of trees will be cleared during the construction of the project. A complete copy of the Categorical Exclusion document, including additional information and regulatory communications, is available upon request.

4.2 FEMA Floodplain Compliance and Hydrologic Trespass

The Site is represented on the Burke County Flood Insurance Rate Map Panel 2712, with an effective date of September 5, 2007. The entire Site is outside of a Special Flood Hazard Area (SFHA) regulatory floodplain and will not require a floodplain development permit.

The proposed design in the upper reaches of UT1 and UT2 have limited risk of potential hydrologic trespass since these areas consist of relatively steep streams. The proposed culverted crossings at the beginning of each stream will be positioned to eliminate potential hydrologic trespass onto the upstream properties and provide adequate aquatic organism passage upstream.

East Prong Hunting Creek is the primary stream with risk for backwater effects. The proposed stream profile ties to the existing streambed near the upstream and downstream property lines. Approximately the first 150 feet and last 100 feet of East Prong Hunting Creek will be constructed using a priority 2 restoration approach to match the existing streambed profile. The design will reduce the risk of hydrologic trespass by increasing floodplain capacity and eliminating any increase in elevation of the stream profile at the upstream and downstream extents.

The Site presents some risk to impacting existing wetland resources at the Site. The design incorporates risk management methodologies to limit potential impact to adjacent wetlands and downstream resources and enhance and protect these areas where possible. The proposed design increases stream access to the floodplain and adjacent riparian wetland areas for all streams. An increase of out-of-bank events is expected at the Site for all channels. Grading (cut and fill) is minimized in all wetland areas to the extent practicable with a major design goal to tie-out the proposed stream bankfull at nearly the same elevations as adjacent wetlands. Two existing field ditches identified within the NCIRT meeting minutes (Appendix 6) will be stabilized within the conservation easement and graded to proposed features to maintain positive drainage beyond the conservation easement but will not be filled as part of the project. Haul roads and staging areas are intentionally designated outside of areas of existing jurisdictional features where possible.

The IRT raised concerns about wetland areas adjacent to the lower reaches of UT1 (STA 214+00 to STA 222+00) as well as the stream, pond, and wetland resource that continues off-property where the existing UT1 alignment currently leaves the property (Appendix 6). Stream flow gauging was performed to investigate if the off-property resource receives hydrology from the adjacent floodplain wetlands (particularly Wetland F shown in Figures 2 and 9). It was determined that the off-property area receives partial flow from Wetland F and inputs hydrology into the downstream resource. Additional hydrology is likely supplied to the off-Site resource via toe of hill seeps and springs in the vicinity of the pond. To reduce the risk of dewatering this existing hydrologic flow path from UT1 to Wetland F, and eventually the off-property resource, the proposed design intentionally maintains the UT1 bankfull elevation at or slightly higher than adjacent Wetland F elevations to promote stream flooding into the wetland area.

4.3 401/404

Some wetlands within the floodplain adjacent to the existing streams will be partially impacted during realignment of the stream channel. Wetlands on the Site that are within the conservation easement and outside of the limits of disturbance will be specifically noted in the final construction plans and specifications to prevent unintended impacts. The permanent and temporary impacts included in Table 9 below are preliminary. The Pre-Construction Notification, including the final impact data, will be submitted to the North Carolina Interagency Review Team (NCIRT) with the Final Mitigation Plan. Wetland areas within the conservation easement will be re-verified during Monitoring Year 7. See Section 7.0 Performance Standards for more details.

Table 9: Estimated Impacts to Wetlands

Jurisdictional Feature	Classification	Acreage	Permanent (P) Impact		Temporary (T) Impact	
			Type of Activity	Impact Area (acres)	Type of Activity	Impact Area (acres)
Wetland A	Bottomland Hardwood Forest	0.020	Stream Restoration	0.002	Floodplain Grading	0.018
Wetland B	Bottomland Hardwood Forest	2.784	Stream Restoration	0.128	Floodplain Grading and construction activity	2.656
Wetland C	Bottomland Hardwood Forest	0.003	Stream Restoration	0.001	Floodplain Grading	0.002
Wetland D	Bottomland Hardwood Forest	0.069	Stream Restoration	0.003	Floodplain Grading and construction activity	0.066
Wetland E	Bottomland Hardwood Forest	0.948	Stream Restoration	0.065	Floodplain Grading and construction activity	0.883
Wetland F	Bottomland Hardwood Forest	0.701	Stream Restoration	0.040	Floodplain grading and construction activity	0.661
Wetland G	Bottomland Hardwood Forest	0.095	-	-	Minor Floodplain Grading	0.014
			Total P Impact	0.239	**Total T Impact**	4.300

5.0 Mitigation Site Goals and Objectives

The project will improve stream functions through stream restoration and the conversion of agricultural fields into riparian buffer within the floodplains of East Prong Hunting Creek and the project tributaries. Project goals are desired project outcomes and are verifiable through measurement and/or visual assessment. Objectives are activities that will result in the accomplishment of goals, and expected outcomes are the implied results of completing objectives and are not directly monitored The project will be monitored after construction to evaluate performance as described in Section 7 of this report. The project goals and related objectives are described in Table 10.

Table 10: Mitigation Goals and Objectives

Goal	Objective	Expected Outcomes	Functions Supported
Exclude livestock from stream channels.	Install livestock fencing as needed to exclude livestock from stream channels, wetlands, and riparian areas, or remove livestock from adjacent fields.	Reduce direct fecal coliform and nutrient inputs to the Site streams. Eliminate hoof shear on the stream bed and banks, which will reduce stream bank erosion and fine sediments in the stream channel. Eliminate cattle trampling of wetlands.	Geomorphology, Physicochemical, Biology
Restore and enhance native floodplain vegetation.	Convert active cattle pasture to forested riparian buffers along all Site streams, which will slow and treat sediment laden runoff from adjacent pastures before entering streams. Protect and enhance existing forested riparian buffers. Treat invasive species.	Reduce sediment inputs from pasture runoff. Reduce floodplain velocities and increase retention of flood flows on the floodplain, decreasing direct runoff and increasing storage and nutrient cycling within the watershed. Increase shading of stream channels, which will increase dissolved oxygen concentrations. Provide a source of LWD and organic material to Site streams for continued habitat. Support all stream functions.	Hydrology, Hydraulic, Geomorphology, Physicochemical, Biology
Improve the stability of stream channels.	Reconstruct stream channels slated for restoration with stable dimensions and appropriate depth relative to the existing floodplain and potential wetland re-establishment areas. Add bank revetments and instream structures to protect restored streams.	Reduce sediment inputs from bank erosion. Increase floodplain engagement, decreasing runoff and increasing infiltration. Decrease instream shear stresses. Diversify available habitats.	Hydraulic, Geomorphology, Physicochemical, Biology
Improve instream habitat.	Install habitat features such as constructed steps, cover logs, and brush toes on restored reaches. Add woody materials/ LWD to channel beds. Construct pools of varying depth.	Increase and diversify available habitats for macroinvertebrates, fish, and amphibians. Promote aquatic species migration and recolonization from refugia, leading to colonization and increase in biodiversity over time. Add complexity including LWD to the streams.	Geomorphology, Physicochemical, Biology
Permanently protect the project site from harmful uses.	Establish a conservation easement on the Site. Exclude livestock from Site streams and remove pasture from the riparian buffer.	Protect Site from encroachment on the riparian corridor and direct impact to streams and wetlands. Support all stream functions.	Hydrology, Hydraulic, Geomorphic, Physicochemical, Biology

6.0 Design Approach and Mitigation Work Plan

6.1 Stream Design Approach Overview

The stream design approach for this Site was developed to meet the goals and objectives described in Section 5 which were formulated based on the potential for uplift described in Section 3.4. The design is also intended to provide the expected outcomes in Section 4, though these are not tied to performance criteria.

The project streams planned for restoration will be reconnected with associated floodplains and the channels will be reconstructed with stable dimension, pattern, and profile that will transport the water and sediment delivered to the system. Where buffer restoration or enhancement is needed, the adjacent floodplains will be planted with native tree species. Instream structures will be built in the channels to help maintain stable channel morphology and improve aquatic habitat.

A combination of analog and analytical approaches for stream restoration were employed. Reference reaches were identified to serve as an acceptable range for design parameters. Channels were sized based on design discharge hydrologic analysis and empirical approaches including applying regional curve equations. Designs were then verified and/or modified based on a sediment transport analysis.

Table 11: Stream Stressors and Restoration Approach

Project Reach	Primary Stressors/Impairments	Approach	Mitigation Activities
East Prong Hunting Creek	Cattle access, incision, sparse/narrow buffers, severe erosion	R	Restoring dimension, pattern, and profile, planting buffers, protecting with conservation easement
UT1 - Reach 1	Perched culvert, invasive species	P	Protecting with conservation easement, invasive species treatment, eliminate culvert perch by raising stream bed
UT1 – Reach 2	Cattle access, poor buffer quality/lack of buffer, some incision, bank erosion, highly manipulated alignment contributing to active erosion and requires active management to maintain the channel	R	Restoring dimension, pattern, and profile, planting buffers, protecting with conservation easement, re-aligning with more natural flow direction
UT2	Cattle trampling, bank erosion, incision, sparse/narrow buffers, perched culvert	R	Restoring dimension, pattern, and profile, planting buffers, protecting with conservation easement, culvert removal and replacement

6.2 Reference Streams

Reference streams provide geomorphic parameters of a stable system, which can be used to inform design of stable channels of similar stream types in similar landscapes and watersheds. Six reference reaches were identified for this Site (Figure 7) and used to support the design of East Prong Hunting Creek and its tributaries. These reference reaches were chosen because of their similarities to the Site streams including drainage area, valley slope, morphology, and bed material. All reference reaches are located in the Piedmont physiographic province of North Carolina. A description of each reference reach is included in Table 12.

Two unnamed tributaries in the Catawba River basin were selected due to their proximity to the Site and similarity in drainage size and landscape position to East Prong Hunting Creek. Long Branch was also selected as a reference for East Prong Hunting Creek due to similarities in drainage size and landscape position, but with a slightly lower slope and more sinuous pattern than the other references.

Due to the similarities in drainage area, slope, and valley shape UT1 and UT2 were evaluated together and reference reaches were selected to inform the design for both. All three reference reaches selected for UT1 and UT2 design were picked based on similarities in drainage area, valley slope, and landscape position.

Table 12: Stream Reference Data Used in Development of Design Parameters

Reference Reach	Stream Type	Landscape Position	Chosen For	Used For	Used on streams
Long Branch	C/E4	Agricultural lands, and forest, unconfined valley	Gravel bed with examples of woody debris structures. Similar Landscape position and drainage area	Q, Dimension, Pattern, Profile	East Prong Hunting Creek
UT to Catawba River Reach1	E5	Unconfined valley, Flowing into larger mainstem	Proximity to Site. Similar landscape position, drainage area, and valley slope ranges	Q, Dimension, Pattern, Profile	East Prong Hunting Creek
UT to South Fork Catawba	B4c	Moderately confined valley, Flowing into larger mainstem	Gravel bed with examples of stable step-pool and meander pool patterns. Similar drainage area and valley slope ranges.	Q, Dimension, Pattern, Profile	East Prong Hunting Creek
Reedy Creek Nature Preserve – South Fork	B4c	Moderately confined valley, moderate valley slope	Examples of meander pools and in-line step pools. Similar landscape position.	Q, Dimension, Pattern, Profile	UT1 & UT2
Magnolia Tributary	B4c	Moderately confined valley, moderate valley slope	High width/depth ratio dimensions, stable meander and step-pool pattern, similar valley slopes and landscape position	Q, Dimension, Pattern, Profile	UT1 & UT2
Pilot Mountain Tributary	B4	Confined valley, relatively steep valley slope	Stable, steep step-pool pattern. Similar drainage area.	Q, Dimension, Pattern, Profile	UT1 & UT2

6.3 Design Discharge Analysis

Multiple methods were used to estimate bankfull discharges for restoration reaches including regional curve data (Harman et al. 1999 and 2000), a regional flood frequency analysis using U.S. Geological Survey (USGS) gage sites, and reference reach data. The methods were compared, and a design discharge was selected based on the results of the different methods. For smaller streams, (UT1 and UT2), the different discharge estimation methods were in close agreement and final design discharges were selected near the lower end of the predicted range. Discharge estimates for East Prong Hunting Creek were more variable, but final design discharges were again selected on the lower end of the predicted range. Discharges selected near the lower end of the estimated range and priority 1 restoration at the site should increase floodplain connectivity for the streams. Results of each method and the final design discharges are shown in Table 13 and illustrated in Figure 7.

Table 13: Summary of Design Bankfull Discharge Analysis

Discharge Estimate Method		East Prong Hunting Creek Reach 1 (977 ac)	East Prong Hunting Creek Reach 2 (1274 ac)	UT1 Reach 1 (37 ac)	UT1 Reach 2 (136 ac)	UT2 (155 ac)
NCSU Rural Piedmont Regional Curve (cfs)		121	135	11	29	32
NRCS Piedmont/Mountain Regional Curve		139	156	12	31	34
Regional Flood Frequency Analysis (cfs)	1.2-year event	106	119	10	25	27
	1.5-year event	150	167	14	36	39
Reference Reach Regional Curve (cfs)		88	95	18	34	36
Final Design Q		**116**	**129**	**12**	**29**	**33**

6.4 Design Channel Morphological Parameters

Reference reach data and designer experience were used to develop design morphologic parameters for each of the restoration reaches. Key morphological parameters are summarized in Tables 14 and 15. Complete design morphological parameters are included in Appendix 4.

Table 14: Summary of Design Morphologic Parameters for East Prong Hunting Creek Reach 1

Parameter	Existing Parameters	Reference Parameters			Proposed Parameters	
	East Prong Hunting Creek	Long Branch	UT to Catawba Reach 1	UT to South Fork Catawba	East Prong Hunting Creek Reach 1	East Prong Hunting Creek Reach 2
Contributing Drainage Area (acres)	1274	954	1024	576	977	1274
Channel/Reach Classification	C5	C/E4	E5	B4c	C4	C4
Design Discharge Width (ft)	20.1-23.5	14.8-18.6	9.7-12.4	8.2-11.2	24.5	24.5
Design Discharge Depth (ft)	1.3-1.5	1.3-2.1	1.7	1.0-1.4	2.0	2.0
Design Discharge Area (ft^2)	29.1-30.8	34.6	11.4-17.5	10.7-11.1	33.0	33.0
Design Discharge Velocity (ft/s)	3.4-3.5	3.6-4.0	5.5	2.7	3.5	4.1
Design Discharge (cfs)	116-129	101-124	80	54	116	129
Channel Slope (ft/ft)	0.0074	0.0040	0.0050	0.0070	0.0060	0.0090
Sinuosity	1.2	1.3	1.1	1.3	1.2	1.2
Width/Depth Ratio	13.8-18.0	7.9-13.8	8.1-8.9	6.0-11.7	18.2	18.2
Bank Height Ratio	1.6-2.0	1.2-1.5	0.9-1.4	1.8-2.1	1.0-1.1	1.0-1.1
Entrenchment Ratio	2.0-4.1	>3.4	5.4-6.4	1.5-1.9	>2.2	>2.2
d50 (mm)	0.95	41.6	1.8	38.0	>2.0	>2.0

Table 15: Summary of Design Morphologic Parameters for UT1 Reach 2 and UT2

Parameter	Existing Parameters		Reference Parameters			Proposed Parameters	
	UT1 Reach 2	UT2	Reedy Creek Nature Preserve – South Fork	Magnolia Tributary	Pilot Mountain Tributary	UT1 Reach 2	UT2
Contributing Drainage Area (acres)	136	155	128	198	173	136	155
Channel/Reach Classification	B5c, G5c	B4c	B4c	B4c	B4	C4	C4
Design Discharge Width (ft)	7.3-11.4	7.6-14.5	8.2-11.2	15.6	8.6	11.0	11.0
Design Discharge Depth (ft)	0.8-1.1	0.8-0.9	1.5-1.6	1.6	1.0	1.0	1.0
Design Discharge Area (ft^2)	7.4-8.8	6.9-8.4	10.7-11.1	16	6.0	8.0	8.0
Design Discharge Velocity (ft/s)	2.8-3.1	3.5-4.1	2.5-2.9	4.0	-	3.5	4.0
Design Discharge (cfs)	22-25.4	28.3-29.9	26-32	64	32	29	33
Channel Slope (ft/ft)	.0088	.0180	0.0070	0.0160	0.0380	0.0140	0.0185
Sinuosity	1.2	1.2	1.3	1.26	1.1	1.2	1.2
Width/Depth Ratio	6.7-14.3	8.4-18.7	6.0-11.7	15.2	12.5	15	15
Bank Height Ratio	1.6-1.9	1.3-1.6	1.8-2.1	1.6	1.0	1.0-1.1	1.0-1.1
Entrenchment Ratio	1.1-2.0	1.3-3.1	1.5-1.9	1.9	1.5	>1.8	>1.8
d50 (mm)	0.77	3.8	38.0	28.0	20.1	>2.0	>2.0

6.5 Sediment Transport Analysis

A qualitative assessment of sediment supply and sources in the project watershed was performed based on visual inspection and review of historic aerial photos. East Prong Hunting Creek, UT1, and UT2 watersheds have not changed considerably in recent decades. The most notable land change is a portion of each stream's watershed has been logged in the last few decades. East Prong Hunting Creek watershed is a mix of residential and agricultural land use in the lower valleys and low density residential and forested areas in the headwaters. In the past large tracks of land have been logged and allowed to reforest. The UT1 watershed is dominated by forest with some residential and pastureland. A quarry is located near the headwaters. A three-acre portion was recently logged and converted to pasture. The UT2 watershed is predominantly forested land with some agriculture.

Visual inspection of the streams revealed a high presence of fine sediment and sand in the streambeds, especially at valley breaks where slopes of UT1 and UT2 decrease as they enter the floodplain of East Prong Hunting Creek. The sources of this sediment were thought to have originated from actively eroding stream banks due to high shear/poor vegetation, cattle access to the streams, and recently deforested property. UT1 Reach 2 also likely received a large sediment load from the logging land use change in its immediate watershed. These sediment sources will be addressed by lowering stream bank slopes and establishing vegetation or revetment for stabilization, reducing shear stress in the stream channel, excluding cattle from the stream and riparian areas, removing existing alluvial sediment deposits in the stream, and establishing a riparian buffer to reduce sediment inputs from surrounding land use changes. By addressing existing sediment sources, sediment load should be reduced post-construction and allow sediment capacity of the constructed channel to function appropriately.

Additionally, while designing stream profiles, techniques to maintain higher stream powers were utilized to address potential aggradation issues at valley grade breaks along both reaches. Both streams were incised slightly as they approach the larger channel of East Prong Hunting Creek. This trend was implemented based on observation in many reference reaches where bankfull elevations adjust to the larger drainage creating incised geomorphic portions of stable channels with increased stream power. Flat pools with minimal drop were utilized on both channels to keep riffle slopes at a relative maximum, keeping fine sediment moving through the system. Increased sinuosity in the flatter portions of the reach create increased helical flow which should help scour pools and maintain pool habitat in flatter channels. Along the downstream extent of UT1 Reach 2 a priority 2 approach was used to generate stream slope and increase stream power through the floodplain of East Prong Hunting Creek. These adjusted stream parameters and profiles, along with local stabilization of streambanks and floodplain areas should reduce potential risk for aggradation at valley breaks along the two reaches.

The focus of the numerical sediment transport analysis outlined below was to verify that proposed channels will have the competence to pass any sediment that is delivered to the system by the watershed while still maintaining channel stability.

6.5.1 *Competence Analysis*

A competence analysis was performed for East Prong Hunting Creek Reach 1 and 2, UT1 Reach 2, and UT2 comparing existing and proposed shear stress, mean depth, and slope. The evaluation was performed to determine parameter requirements to move the maximum particle of the existing bed material sampled at the site. The data was used to evaluate whether channel shear stress exceeds required maximum values and could potentially cause channel degradation of the existing bed material. The analysis utilized standard equations based on a methodology using the Shields (1936) curve and Andrews (1984) equation described by Rosgen (2001). The results of the competence analysis are shown in Table 16. The competence analysis on these reaches indicates that the site streams will be able to transport the sediment supplied to them by the watersheds.

Table 16: Results of Competence Analysis

	East Prong Hunting Creek R1/R2	UT1 R2	UT2
Abkf (sq ft)	33	8	8
Wbkf (ft)	24.5	11	11
Dbkf (ft)	2.0	1.0	1.0
Schan (ft/ft)	0.009	0.0140	0.0185
Bankfull Velocity (fps)	3.5	3.5	4.0
Bankfull Shear Stress, t (lb/sq ft)	0.52	0.62	0.82
Movable particle size (mm)	37/91	47/107	63/131
Largest particle from bar sample (mm)	87	93	107

6.6 Stream Design Implementation

Wildlands' approach to improving the streams on the Site includes preservation and priority 1 restoration with priority 2 restoration limited to confluences and transition zones. The efforts will extend to the East Prong Hunting Creek, UT1, and UT2, representing all the major drainages at the Site. Livestock will be excluded from the entire conservation easement as part of the project.

Below are descriptions of the designs for the restoration reaches. The work along the lone preservation reach, UT1 Reach 1, will include supplemental planting with native tree species and invasive species treatment as needed as well as permanent protection in a conservation easement.

6.6.1 *East Prong Hunting Creek*

East Prong Hunting Creek will be constructed as a Rosgen C-type stream within the existing stream valley. The alignment will be constructed with a sinuous meander pattern and with the stream belt width placed in the existing low point of the valley. Priority 1 restoration is achieved through the mid-section of the stream with priority 2 areas limited to the stream tie outs at the upstream and downstream project boundaries.

The beginning of the reach currently ties to an existing culvert. The existing crossing and culvert were recently installed and were assessed to be stable. The existing culvert has experienced several large flow events since installation and has formed a large plunge pool area below the culvert with major erosion only occurring along the outer streambanks of the pool. Active streambank retreat and sloughing was noted during several field visits. The lack of root mass and vegetation at the top of bank in the outer walls is likely a major factor in the eroded condition. The toe of the plunge pool will be reconstructed at a location similar to the dimensions of the pool at the time of survey. The top of bank will be graded back and live staked or have geolifts installed as additional protection from bank erosion in this area. Additional rock may be applied along the embankments of the crossing and around the pipe if deemed necessary during the construction period. The plunge pool area will transition to the typical meander pool dimensions and then a constructed riffle. The head of this initial riffle will be set at elevations that slightly raise existing water surface elevations through the plunge pool and culvert to facilitate aquatic organism passage. Throughout Reach 1 of East Prong Hunting Creek, which extends from the culvert to the confluence with UT2, the design slope of the stream is flatter than the existing slope to gradually achieve a Priority 1 restoration. Floodplain benches will be constructed on both banks of Reach 1 to provide flood relief.

Below the confluence with UT2, Reach 2 achieves priority 1 restoration. Priority 1 restoration through this area will allow floodplain grading to be minimized within existing riparian floodplain wetlands along both sides of the stream. A levy, between 0.4 ft and 1.0 ft higher than surrounding areas, exists along the right bank of the stream. Beyond this levy is where the existing Wetland B was delineated. The bankfull elevation of the stream was set by the elevation of the wetland beyond the levy such that the levy will be removed from the floodplain to reconnect the riparian floodplain system with the proposed stream channel. The existing ditch in the left floodplain of the reach will be tied to a proposed vernal pool to maintain positive drainage and stabilized in place via planting and minor grading outside the proposed conservation easement.

At the end of Reach 2, the stream profile steepens to tie to the existing streambed located near the property line. The stream returns to the existing alignment to facilitate a smooth off-property transition of the project. Wide floodplain benches will be constructed in this area to provide appropriate floodplain width.

6.6.2 *UT1 Reach 1*

UT1 Reach 1 has been designated as a Preservation reach and no stream work will occur except the installation of a culvert crossing within a 50 ft internal easement break where UT1 Reach 1 first enters the property. The culvert design includes a minimum 54” diameter, corrugated metal pipe that will be embedded a minimum of 12”. This embeded depth will provide aquatic organism passage and additional protection from undermining of the culvert. Bank grading will be required to install the proposed culvert and to ensure stable stream banks downstream of the crossing. All grading is anticipated to occur within the easement break and all graded banks will be stabilized.

6.6.3 *UT1 Reach 2*

UT1 Reach 2 was designed as a C4 stream with moderate sinuosity and slope ranging from 0.8% to 1.7%. Grade control in the form of wood and rock stream structures are included in the design to reduce the potential for headcutting. The upper and lower transition areas of the reach will be priority 2 designs while the middle portion of the reach will achieve a priority 1 profile. A best management practice (BMP) was discussed during a field walk with the IRT to address sediment-laden run-off from an area just upstream of UT1 Reach 2. However, the field has since been stabilized with a dense stand of pasture grasses and a rock outlet where the field drains to UT1. With this stabilization in place the BMP was removed from the design.

The beginning of the reach ties to an existing culvert on the project property. Replacement of the existing culvert and crossing was discussed with the landowner but a mutually agreed solution was not able to be achieved. The existing toe of the plunge pool will remain essentially unchanged while the top of bank will be laid back and live staked or additional revetment will be applied in the form of geolifts or brush toe. Additional rock may be applied below the culvert or along the crossing embankments if deemed necessary during construction. Field swales along the left bank of the plunge pool will be stabilized and planted. The plunge pool transitions to the typical meander pool dimensions and then a constructed riffle, the head of which was set at an elevation to increase the water surface through the culvert and reduce the perched condition of the culvert to improve aquatic organism passage. The profile design gradually raises the thalweg of the stream above existing until priority 1 restoration is achieved. The priority 2 section of the reach was designed to tie to several inner berm features that were identified as stable and vegetated with mature hardwood trees and ferns. Benching along this section of stream will provide additional flood relief.

Throughout the mid-section of the reach, the stream design achieves priority 1 status or in some cases is slightly perched above the surrounding floodplain. This section of the reach is characterized by riparian Wetland F along the left floodplain of the stream that receives hydrology from UT1 during flooding events. The priority 1 design will provide hydrology to these adjacent wetlands.

The design continues beyond the riparian wetland into the floodplain of East Prong Hunting Creek. As the stream descends to the tie out with East Prong Hunting Creek, floodplain grading will be utilized to tie the two streams together and provide a functional floodplain. The existing ditch in the left floodplain of East Prong Hunting Creek will tie to the proposed alignment to maintain positive drainage and avoid increased inundation outside the proposed conservation easement.

A review of historic aerials of the Site show UT1 flowing along the current alignment for about the last 70 years and that agriculture has been practiced in the East Prong Hunting Creek floodplain for that same amount of time. A USGS topography map dated 1905 does show UT1 joining with East Prong Hunting Creek slightly downstream of where Wildlands has proposed the UT1 alignment. It was noted during assessment that small tributaries flowing parallel to much larger streams, within the larger stream floodplain, is very uncommon in natural systems, but is common in agricultural settings where the streams have been manipulated to improve field drainage. In addition, wrack lines after flooding events, in the area where UT1 leaves the project parcel, indicated that some flow was leaving the UT1 corridor and moving across the agricultural fields toward East Prong Hunting Creek. Given this evidence, it was inferred that before manipulation, UT1 likely flowed more directly toward East Prong Hunting Creek rather than the current parallel orientation.

6.6.4 *UT2*

UT2 was designed as a C4/C4b stream, is the steepest stream on the project (bankfull slopes ranging from 1.6% to 2.3%) and will require grade control in the form of both structures and constructed riffles. Given the range of slopes and the change in valley type as the stream approaches East Prong Hunting Creek, UT2 was evaluated to determine if a reach break and additional typical section were required for the proposed design. Ultimately it was decided that while the valley type widens and the slope decreases as UT2 flows towards East Prong Hunting Creek, it is not enough variation to require a reach break and new typical section based on the design discharge. However, the proposed stream design parameters including belt width, sinuosity, radius of curvature on meander bends, and meander lengths were adjusted to consider the change in valley and slope. The upper and lower extents of the proposed design parameters for the reach were utilized to match stream geomorphology to changing valley type and stream slope.

A culvert crossing will be constructed in a 50 ft internal easement break where UT2 first enters the property. The culvert design includes a minimum 54" diameter, corrugated metal pipe that will be embedded a minimum of 12". This embed depth will provide improved aquatic organism passage and additional protection from undermining of the culvert. Below the culvert the stream meanders where room is available in the valley. The valley floor will be benched out to provide floodplain access for the channel.

A short section of the stream (approximately STA 308+80 to 309+50) returns online with the existing stream alignment where the valley becomes steeper and more confined. This portion of the stream is partially shaded with mature hardwoods and the online design will reduce tree loss and will take advantage of the existing root mass along the banks. The stream profile will be raised above the existing bed grade by setting higher riffle and stream structure inverts while stream bedform will be enhanced with frequent step pools. Some benching will be graded along the right bank, where fewer trees currently exist.

The final section of UT2 meanders through the floodplain of East Prong Hunting Creek. As noted above, as the valley widens and the slope decreases, stream sinuosity and belt width increases. The stream profile will become slightly entrenched as UT2 approaches the confluence with the larger stream. A Bank Height Ratio above 1.0 will not be considered an indicator of instability in this area.

6.7 Vegetation, Planting Plan, and Land Management

Non-forested areas within the conservation easement will be planted, which includes additional buffer areas beyond the minimum requirement of 30 feet from top of bank. Riparian buffers will be planted with early successional native vegetation chosen to develop a forested wetland and riparian zone. The specific species composition to be planted was selected based on the community type, observation of occurrence of species in riparian buffers adjacent to the Site, availability of nursery stock and best professional judgement on species establishment and anticipated Site conditions in the early years following project implementation. Species chosen for the planting plan are listed on Table 17 below and on Sheet 3.1 of the preliminary plans located in Appendix 13. Wildlands used the following community types and associated species for section for the site:

- Piedmont/Montane Mountain Alluvial Forest

  Canopy trees include but not limited to *Betula nigra, Platanus occidentalis, Liquidambar styraciflua, Liriodendron tulipifera, Ulmus americana, Celtis laevigata, Juglans nigra, Fraxinus pennsylvanica, Carya cordiformis, Carya ovata, Quercus imbricaria,* and *Acer rubrum*. Subcanopy trees typically found in mesic mixed hardwood forest include *Acer negundo, Acer floridanum, Acer rubrum, Asimina triloba, Ilex opaca,* and *Carpinus caroliniana.*

- Mesic Mixed Hardwood Forest

  Canopy trees include but not limited to *Fagus grandifolia, Quercus rubra, Liridondron tulipifera, Acer rubrum, Acer saccharum*. Subcanopy trees in mixed hardwood forest include *Cornus florida, Ostrya virginiana, Evonymus americana, Kalmia latifolia*.

- Piedmont/Montane Bottomland Forest

  Canopy trees include but not limited to *Liriodendron tulipifera, Liquidambar styraciflua, Quercus pagoda, Quercus michauxii, Ulmus american, Celtis laevigata, Fraxinus pennsylvanica, Pinus taeda, Carya Ovata,* and *Craya cordiformus.* Subcanopy trees typically found in bottomland forest include *Carpinus caroliniana, Acer floridanum, Acer rubrum, Cornus florida, Ilex opaca,* and *Asimina triloba*.

- Dry – Mesic Oak – Hickory Forest
  Canopy trees include but not limited to *Quercus alba, rubra, velutina, and muehlenbergii, Carya alba (tomentosa), glabra, and ovalis, Liriodendron tulipifera, Liquidambar styraciflua* and various *Pinus species.* Subcanopy trees typically include *Acer rubrum, Cornus florida, Oxydendrum arborem, Ilex opaca, and Nyssa sylvatica.*

The riparian buffer and most wetland areas will be planted with bare root seedlings. Species chosen to be planted within wetland areas were selected based on above referenced community types as well as their ability to handle wetter ground conditions based on standing water and high groundwater levels observed in wetland areas at the Site. The stream banks will be planted with live stakes and the channel toe will be planted with multiple herbaceous species. Permanent herbaceous seed will be spread on streambanks, floodplain areas, and disturbed areas within the project easement. The utility easement located within the conservation easement will be planted with shrubs and sub-canopy bare root species only to reduce maintenance needs for the overhead utilities within the easement. Utility easement plantings will be the same as Wetland Area Zone small trees and shrubs. Bare root seedlings and live stakes will be planted in the dormant season between November 15 and March 15. Figure 10 illustrates the proposed planting zones throughout the site.

Land management activities on the site will largely focus on treating invasive plant populations and pasture grasses. Existing invasive plant populations on the site include Chinese privet (*Ligustrum sinense*), Japanese stiltgrass (*Microstegium vimineum*), and tree of heaven (*Ailanthus altissima*). Some of the existing invasive species and pasture grasses along restoration reaches will be treated preconstruction, while others will be treated primarily by mechanical removal during construction. The extent of invasive species coverage will be monitored, mapped, and controlled as necessary throughout the required monitoring period. Please refer to Appendix 7 for the post construction invasive species plan. Additional monitoring and maintenance issues regarding vegetation are in Sections 8 and 9 and Appendix 10.

Table 17: Planting List

Species	Common Name	Wetland Indicator
Open Buffer Planting Zone		
Acer negundo	Boxelder	FAC
Platanus occidentalis	Sycamore	FACW
Betula nigra	River Birch	FACW
Magnolia acuminata	Cucumber Tree	FACU
Fagus grandifolia	American Beech	FACU
Oxydendrum arboretum	Sourwood	UPL
Ulmus rubra	Slippery Elm	FAC
Morus rubra	Red Mullberry	FACU
Carya cordiformis	Bitternut Hickory	FACU
Quercus alba	White Oak	FACU
Quercus rubra	Northern Red Oak	FACU
Euonymus americanus	Strawberry Bush	FAC
Alnus serrulata	Tag Alder	OBL
Hamamelis virginiana	Witch Hazel	FACU
Cornus florida	Flowering Dogwood	FACU
Lindera benzoin	Spicebush	FAC
Amelanchier arborea	Serviceberry	FAC
Partially Vegetated Buffer Planting Zone		
Carpinus caroliniana	American Hornbeam	FAC
Euonymus americana	Strawberry Bush	FAC
Lindera benzoin	Spicebush	FAC
Fagus grandifolia	American Beech	FACU
Ulmus rubra	Slippery Elm	FAC
Hamamelis virginiana	Witchhazel	FACU
Calycanthus floridus	Sweetshrub	FACU
Cornus florida	Flowering Dogwood	FACU
Asima triloba	Pawpaw	FAC
Quercus rubra	Northern Red Oak	FACU
Ilex opaca	American Holly	FACU
Wetland Planting Zone		
Plantanus occidentalis	Sycamore	FACW
Betula nigra	River Birch	FACW
Salix nigra	Black Willow	FAC
Ulmus americana	American Elm	FACW
Acer negundo	Boxelder	FAC
Celtis laevigata	Sugarberry	FACW
Alnus serrulata	Tag Alder	OBL
Lindera benzoin	Spicebush	FAC
Cephalanthus occidentalis	Buttonbush	OBL
Sambucus canadensis	Elderberry	FAC
Salix sericea	Silky Willow	OBL

Species	Common Name	Wetland Indicator
Streambank Planting Zone		
Salix nigra	Black Willow	OBL
Cornus amomum	Silky Dogwood	FACW
Salix sericea	Silky Willow	OBL
Cephalanthus occidentalis	Buttonbush	OBL
Sambucus canadensis	Elderberry	FAC
Juncus effusus	Common Rush	FACW
Carex crinita	Fringed Sedge	OBL
Carex lurida	Lurid Sedge	OBL
Carex lupulina	Hop Sedge	OBL
Scirpus cyperinus	Woolgrass	FACW

6.8 Project Risk and Uncertainties

In general, this project is low risk. The landowners live in the immediate area and are active on the property. They will be able to repair damaged fences and/or remove stray livestock from the easement quickly.

The risk of hydraulic trespass from the project is low. On the two tributaries, the design will set the pipe inverts within the first 50 ft of the stream entering the property and reduce the chance of trespass upstream. The beginning of East Prong Hunting Creek ties to existing infrastructure and the design will only slightly raise water surface elevations through the pipe. The end of the stream will tie back to the existing stream bed before the property line.

The proposed culverts at the top of the tributaries do pose some risk of diminished flow due to woody debris clogging the pipe entrances, resulting in erosion around the crossing. Both culverts are relatively large (minimum 54" diameter) for the stream, which should allow the pipes to function even with some debris present at the entrance of the pipes. The Landowner will be responsible for long-term culvert crossing maintenance and clearing any significant debris jams from the pipes. All culvert infrastructure is located within internal conservation easement crossings or outside of the conservation easement with adequate room for the landowner to access and complete any necessary maintenance.

All of the streams exhibit large erosive areas along the stream banks. To address this the design incorporates relatively high width/depth ratios for the channel geometries of all the streams. Additional bank revetment in the form of brush toe and geolifts will be constructed in areas of concern.

Aggradation of sediment in stream channels is a possibility and has previously been observed at low slope areas of streams, at slope changes in the profiles, and in areas that experience frequent backwater conditions, for instance smaller streams near their confluence with larger systems. Areas of concern on the project include UT1 and UT2 near the confluence with East Prong Hunting Creek and the plunge pools areas of East Prong Hunting Creek and UT1. Total sediment loads for all project streams are expected to be much lower post-construction due to the exclusion of livestock, stabilization of stream banks, and establishment of the vegetated buffer reducing the risk of aggradation. Improved floodplain access along the streams will provide low velocity areas for sediment to deposit during flood events while stream channels continue to convey water, encouraging sediment deposition in the floodplain rather than the stream channels. The high width/depth ratio channel geometries should also allow any deposition to occur along stream banks rather than mid-channel of the stream. Stream aggradation significant enough to stop flow or cause a large diversion from the proposed alignment may be addressed by excavating excess sediment with hand tools or equipment if deemed necessary and appropriate.

Land use changes in the watersheds of UT1 and UT2 could pose some risk to the project resulting in higher peak flows and sediment loads. The East Prong Hunting Creek watershed, while very rural, will likely see some continued development as it contains a large section of Highway 18. A majority of this development is expected to remain as low-density residential for the immediate future and is not expected to greatly affect the hydrology at the Site location. Additionally, existing erosion areas upstream of the Site on any of the project streams may be a continued sediment input to the Site. Higher peak flow risk is reduced with the bank revetment and high width/depth ratio design considerations discussed above. Higher sediment loads and in-stream aggradation risk is reduced with the improved floodplain connection and high width/depth ratio design considerations discussed above.

Priority 2 restoration of streams have resulted in difficulty establishing vegetation on stream banks and floodplain benches when attempting to plant on subsoils. To address this the contractor will be required to harvest topsoil in these areas before grading and reapply the topsoil before seeding or planting.

All stream and wetland projects have some risk for beaver colonization. There is no onsite evidence of current or past beaver activity in the project limits. If beaver move into the project areas, Wildlands will follow the Maintenance Plan (Appendix 9) to address the issue. Similarly, should utility/roadway maintenance work occur in the future and encroach within the conservation easement, Wildlands will follow the Maintenance Plan to repair disturbed signage or damaged stream areas.

7.0 Performance Standards

The stream and wetland performance standards for the project will follow approved performance standards presented in the DMS Mitigation Plan Template (Version 2.3, June 2017), the Annual Monitoring Template (June 2017), and the Wilmington District Stream and Wetland Compensatory Mitigation Update issued October 2016 by the USACE and NCIRT. Note that no substrate monitoring will be performed at the Site unless requested by DMS or the IRT (IRT Technical Work Group - September 29, 2021). Annual monitoring and routine site visits will be conducted by a qualified scientist to assess the condition of the finished project. Specific performance standards that apply to this project are those described in the 2016 Compensatory Mitigation Update including Vegetation (Section V, B, Items 1 through 3) and Stream Channel Stability and Stream Hydrology Performance Standards (Section VI, B, Items 1 through 7). Performance standards are summarized in Table 18.

Table 18: Summary of Performance Standards

Parameter	Monitoring Feature	Performance Standard
STREAM SPECIFIC PERFOMANCE STANDARDS[1, 2]		
Dimension	Cross-Section Survey	BHR <1.2; ER >2.2 for C/E channels
Pattern and Profile	Visual Assessment	Should indicate stream stability
Photo Documentation	• Cross-Section Photos • Culvert Photos • Photo Points	No excessive erosion or degradation of banks No mid-channel bars, Stable grade control
Hydrology	Pressure Transducer	• Four bankfull events during the 7-year period; in separate years
SITE PERFOMANCE STANDARDS		
Vegetation	Vegetation Plots	MY3 success criteria: 320 planted stems per acre[3], MY5 success criteria: 260 planted stems per acre, average of 7 feet in height in each plot within Riparian Planting Zones and Partially Vegetated Planting Zones or 4 feet in height in Wetland Planting Zones as identified in Figure 10[4]. MY7 success criteria: 210 planted stems per acre, average of 10 feet in height in each plot within Riparian Planting Zones and Partially Vegetated Planting Zones or 7 feet in height in Wetland Planting Zones as identified in Figure 10[4].
Visual Assessment	CCPV	Signs of encroachment, instability, invasive species

1: BHR = bank height ratio, ER = entrenchment ratio
2: The tributaries are designed to incise as they approach the main streams, so this would not be considered a trend towards instability. Riffles may fine over the course of monitoring due to the stabilization of contributing watershed sediment sources.
3: All volunteer stems or supplemental plantings must be present in the plot data for 2 years to be included as meeting established vegetation performance standards.
4: The floodplain along East Prong Hunting Creek and UT1 Reach 2 contains standing water and high-water tables for much of the year. It is anticipated that increased inundation will inhibit some woody species growth and that some of these areas may have increased herbaceous and scrub/shrub vegetation. A reduced height vegetation performance standard is requested as shown in the table.

8.0 Monitoring Plan

Project monitoring components are listed in more detail in Table 19. Approximate locations of the proposed vegetation plots and cross section locations are illustrated in Figure 9.

Table 19: Monitoring Components

Parameter	Monitoring Feature	Quantity/Length by Reach					Frequency	Notes
		East Prong Hunting Creek Reach 1	East Prong Hunting Creek Reach 2	UT1 Reach 1	UT1 Reach 2	UT2		
Dimension	Riffle Cross-sections	1	1	N/A	3	2	Year 1, 2, 3, 5, and 7	1
	Pool Cross-sections	N/A	1	N/A	2	1		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	2
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	
Hydrology	Crest Gage (CG)	1 CG		N/A	1 CG	1 CG	Semi-Annual	3
Vegetation	CVS Level 2 (Permanent/Mobile)	5		N/A	3/1	2/1	Year 1, 2, 3, 5, and 7	4
Visual Assessment		Y	Y	N/A	Y	Y	Semi-Annual	
Exotic and nuisance vegetation							Semi-Annual	5
Project Boundary							Semi-Annual	6
Reference Photos	Photographs	3	3	3	8	6	Annual	
UT1 Reach 2 Off-Site Resource Hydrology	Crest Gage (CG) and/or Transducer (SG)					1 CG or 1 SG	Semi-Annual	7
Wetland Re-verification	Re-verify all wetlands	All wetland areas within Conservation Easement					Year 7	

1. Cross-sections will be permanently marked with rebar to establish location. Surveys will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.
2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only, unless observations indicate widespread lack of vertical stability (greater than 10% of reach is affected) and profile survey is warranted in additional years to monitor adjustments or survey repair work.
3. Crest gages will be monitored using automated pressure transducers. Transducers will be set to record bank full events at least twice a day and stream flow at least every 3 hours and will be inspected quarterly or semi-annually. Evidence of bankfull and stream flow events will be documented with a photo when possible.
4. Mobile and Permanent vegetation plots will be utilized to evaluate the vegetation performance for the open areas planted. 2% of the open planted acreage will be monitored with permanent and mobile plots. Permanent vegetation monitoring plot assessments will follow CVS Level 2 protocols. Planted supplemental areas will be visually assessed. All volunteer stems or supplemental plantings must be present in the plot data for 2 years to be included as meeting established vegetation performance standards. Mobile vegetation monitoring plot assessments will document number of planted stems and species using a circular or 100 m2 square/rectangular plot.
5. Locations of exotic and nuisance vegetation will be mapped
6. Locations of vegetation damage, boundary encroachments, etc. will be mapped.
7. An automated pressure transducer will be installed to record flow within the off-site resource. Transducers will be set to record stream flow at least every 3 hours and will be inspected quarterly or semi-annually. Evidence of flow events in the off-Site resource will be documented with a photo when possible. Note that no Performance Standards are associated with this monitoring parameter.

9.0 Long-Term Management Plan

The Site will be transferred to the North Carolina Department of Environmental Quality (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 the owner of the underlying fee to maintain.

The Site Protection Instrument can be found in Appendix 8.

Table 20: Long-term Management Plan

Long-Term Management Activity	Long-Term Manager Responsibility	Landowner Responsibility
Signage will be installed and maintained along the Site boundary to denote the area protected by the recorded conservation easement.	The long-term steward will be responsible for inspecting the Site boundary during periodic inspections (every one to three years) and for maintaining or replacing signage to ensure that the conservation easement area is clearly marked.	The landowner shall report damaged or missing signs to the long-term manager, as well as contact the long-term manager if a boundary needs to be marked, or clarification is needed regarding a boundary location. If land use changes in future and fencing is required to protect the easement, the landowner is responsible for installing appropriate approved fencing.
The Site will be protected in its entirety and managed under the terms outlined in the recorded conservation easement.	The long-term manager will be responsible for conducting periodic inspections (every one to three years) and for undertaking actions that are reasonably calculated to swiftly correct the conditions constituting a breach. The USACE, and their authorized agents, shall have the right to enter and inspect the Site and to take actions necessary to verify compliance with the conservation easement.	The landowner shall contact the long-term manager if clarification is needed regarding the restrictions associated with the recorded conservation easement.

10.0 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Sections 8 and 9. Project maintenance will be performed during the monitoring years to address minor issues as necessary (Appendix 9). If during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized in any other way, Wildlands and DMS will notify the members of the NCIRT and work with the NCIRT to develop contingency plans and remedial actions.

11.0 Determination of Credits

11.1 Determination of Credits Overview

Mitigation credits presented in Table 21 are projections based upon the proposed design.

The credit ratios proposed for the Site have been developed in consultation with the NCIRT as summarized in the included meeting minutes (Appendix 6).

1. The requested stream restoration credit ratio is 1:1 for mitigation activities that include reconstruction of the channels to a stable form and connection of the channels to the adjacent floodplain. This level of effort will occur on East Prong Hunting Creek Reach 1 and Reach 2, UT1 Reach 2, and UT2.
2. UT1 Reach 1 is proposed for preservation credit at a 15:1 ratio. Proposed work along this reach includes establishing the conservation easement and invasive species removal.

The credit release schedule is provided in Appendix 11.

11.2 Credit Calculations for Non-Standard Buffer Widths

To calculate functional uplift credit adjustments, the latest published version of the Wilmington District Stream Buffer Credit Calculator from the USACE was utilized. To perform this calculation, GIS analysis was performed to determine the area (in square feet) of ideal buffer zones and actual buffer zones around the Project stream. Minimum standard buffer widths are measured from the top of bank (30 feet in the mountain county of Burke). The ideal buffers are the maximum potential size (in square feet) of each buffer zone measured around all creditable stream reaches, calculated using GIS, including areas outside of the easement. The actual buffer is the square feet in each buffer zone, as measured by GIS, excluding non-forested areas, all other credit type (e.g., wetland, nutrient offset, buffer), easement exceptions, open water, areas failing to meet the vegetation performance standard, etc. The stream lengths, mitigation type, ideal buffer, and actual buffer are all entered into the calculator. This data is processed, and the resulting credit amounts are totaled for the whole project. Based on the credit analysis, the Buffer Credit Calculator computed a net gain of 104.840 credits; therefore, the total adjusted SMUs for the Project is 4,836.307. Appendix 12 contains details of the Non-Standard Buffer width calculation including the credit calculator spreadsheet result and buffer credit calculation figure.

Table 21: Project Asset Table

Project Components							
Project Component or Reach ID	**Existing Footage/ Acreage**	**Restoration Footage/ Acreage[1]**	**Mitigation Category**	**Restoration Level**	**Priority Level**	**Mitigation Ratio**	**Proposed Credit**
East Prong Hunting Creek Reach 1	416	498	Warm	R	P1, P2	1	498.000
East Prong Hunting Creek Reach 2	912	686	Warm	R	P1, P2	1	686.000
UT1 Reach 1	457	457	Warm	P	N/A	15	30.467
UT1 Reach 2	1,633	1,975	Warm	R	P1, P2	1	1,975.000
UT2	1,470	1,542	Warm	R	P1, P2	1	1,542.000
Total Stream LF	**4,888**	**5158**					

Project Credits							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Rip Wetland**	**Coastal Marsh**
	Warm	**Cool**	**Cold**	**Riverine**	**Non-Riv**		
Restoration	**4,701.000**						
Re-establishment							
Rehabilitation							
Enhancement							
Enhancement I							
Enhancement II							
Creation							
Preservation	**30.467**						
Totals	**4,731.467**						

Project Credit Adjustments[2]	
Type	**SMUs**
Total Base SMU	4,731.467
Credit Loss in Required Buffer	-256.640
Credit Gain in Required Buffer	361.480
Net Change in Credit Buffers	104.840
Total Adjusted SMUs	**4,836.307**

Notes: 1. Crossing lengths have been removed from restoration footage.
2. Credit adjustment for Non-standard Buffer Width calculation using the Wilmington District Stream Buffer Credit Calculator issued by the USACE in January 2018. See Section 11.2 for more information.

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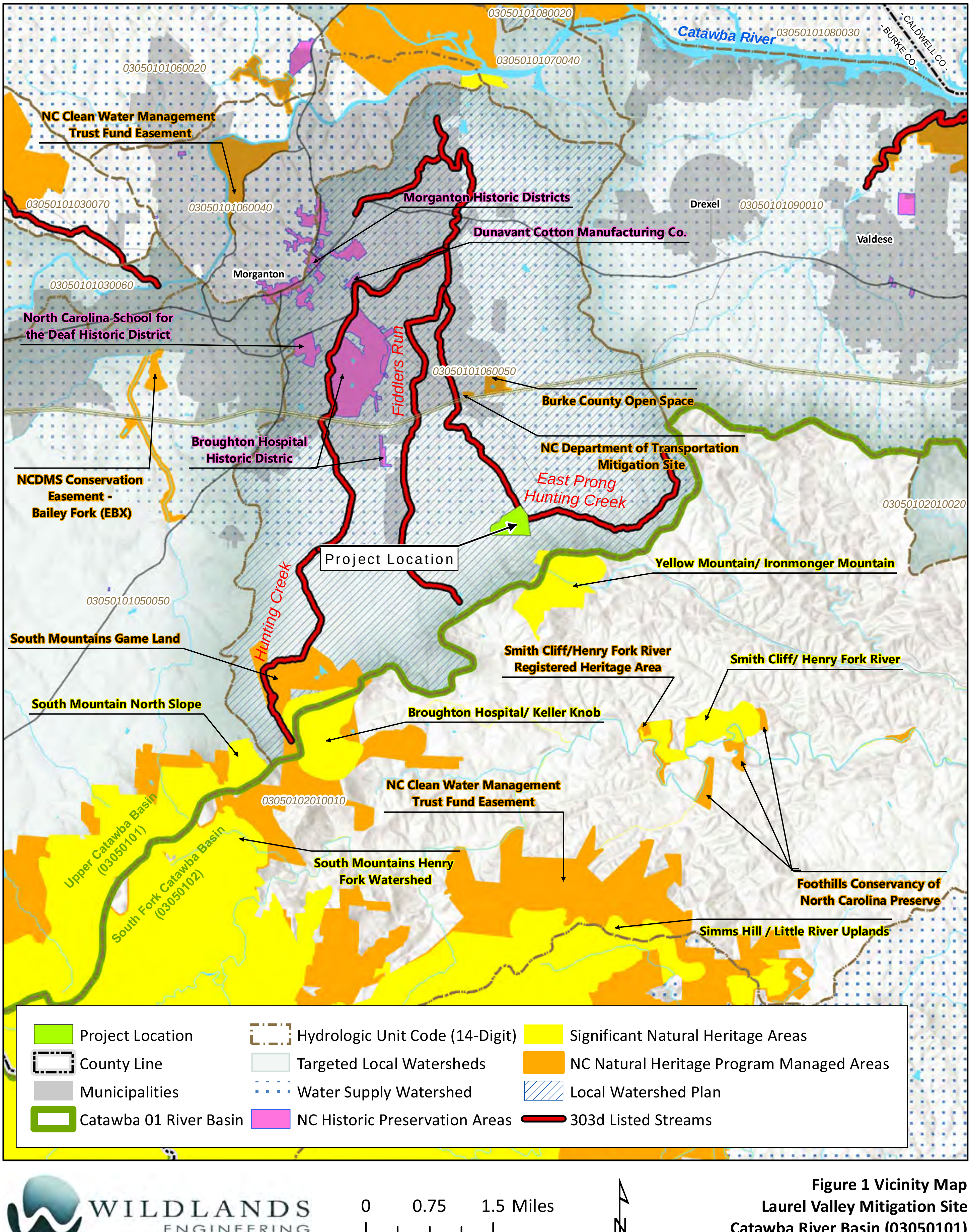
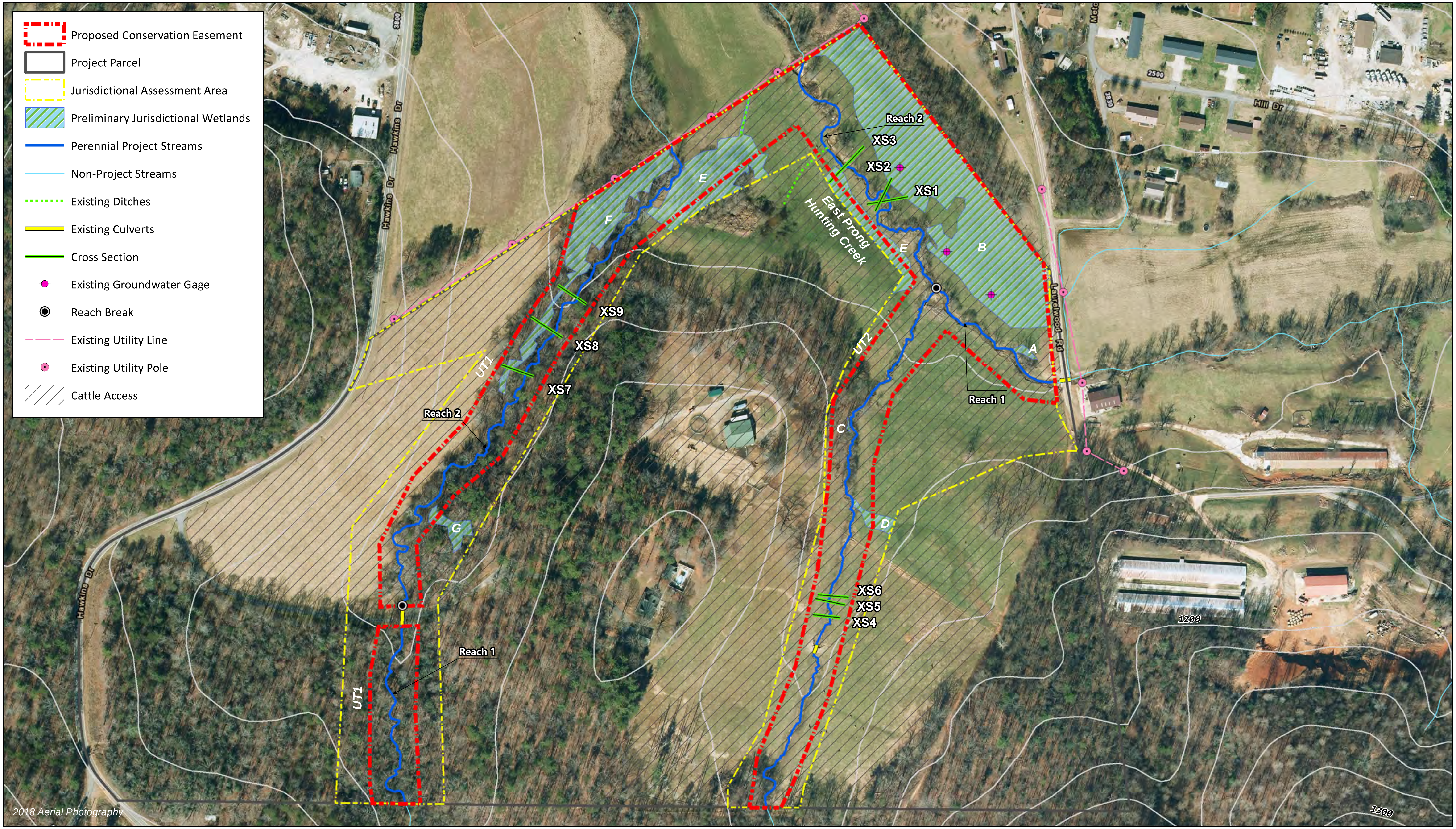
FIGURES



WILDLANDS ENGINEERING

Figure 1 Vicinity Map
Laurel Valley Mitigation Site
Catawba River Basin (03050101)

Burke County, NC



WILDLANDS ENGINEERING

Figure 2 Site Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

11/22/2021 jhessler

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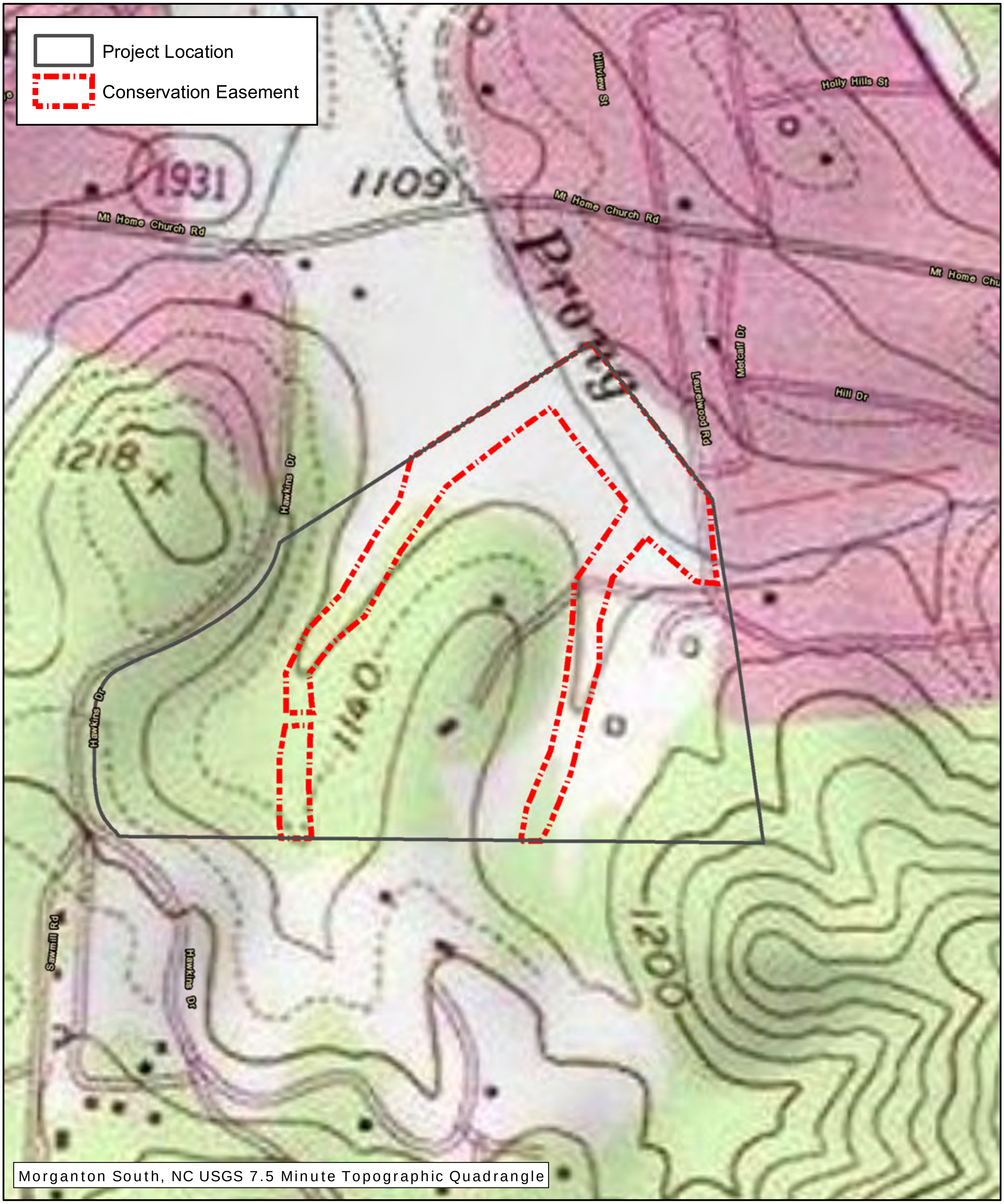
Figure 3 Watershed Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

5/19/2021 jhessler



WILDLANDS ENGINEERING

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Figure 4 USGS Topographic Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

jhessler 5/19/2021

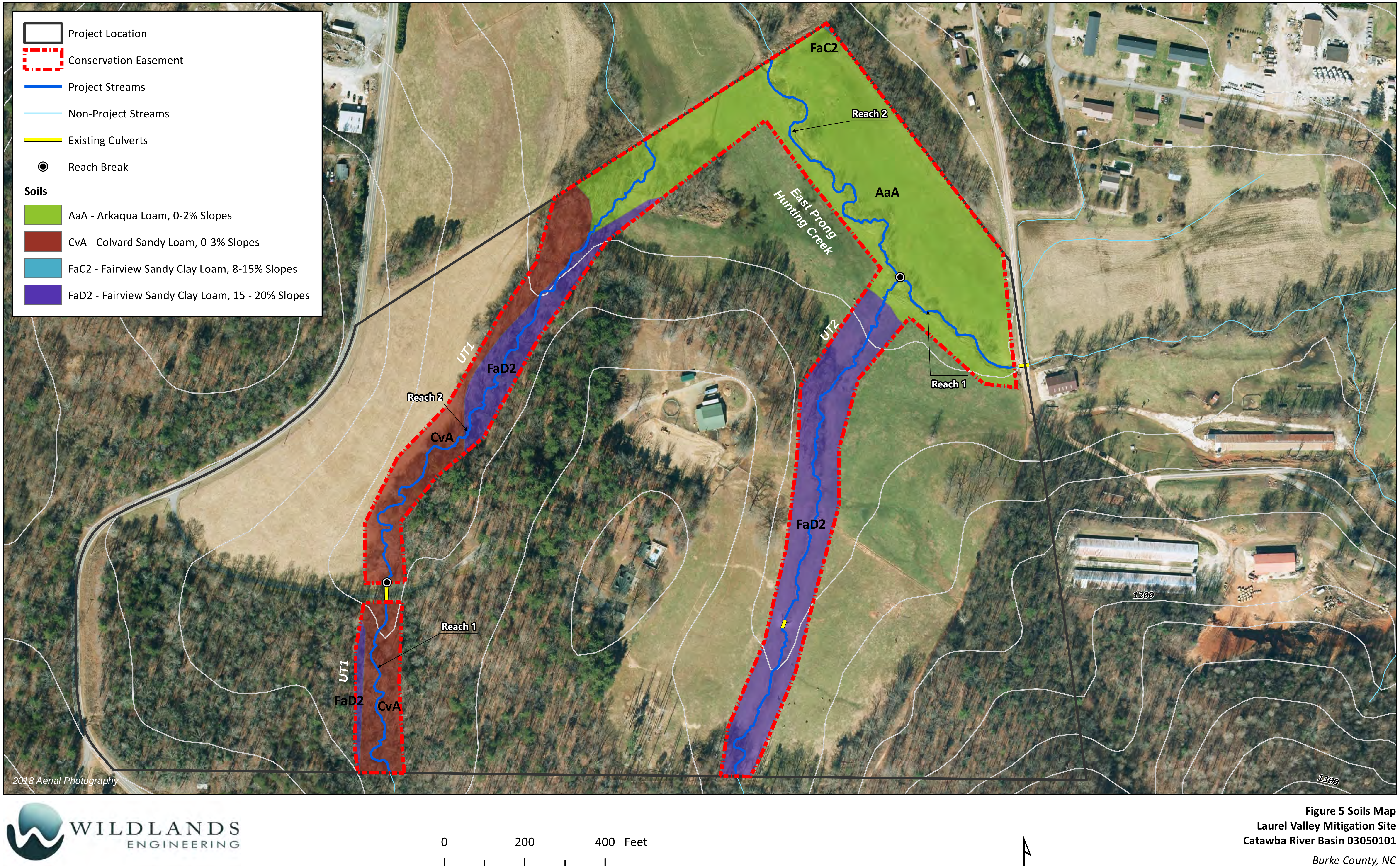

Figure 5 Soils Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101
Burke County, NC

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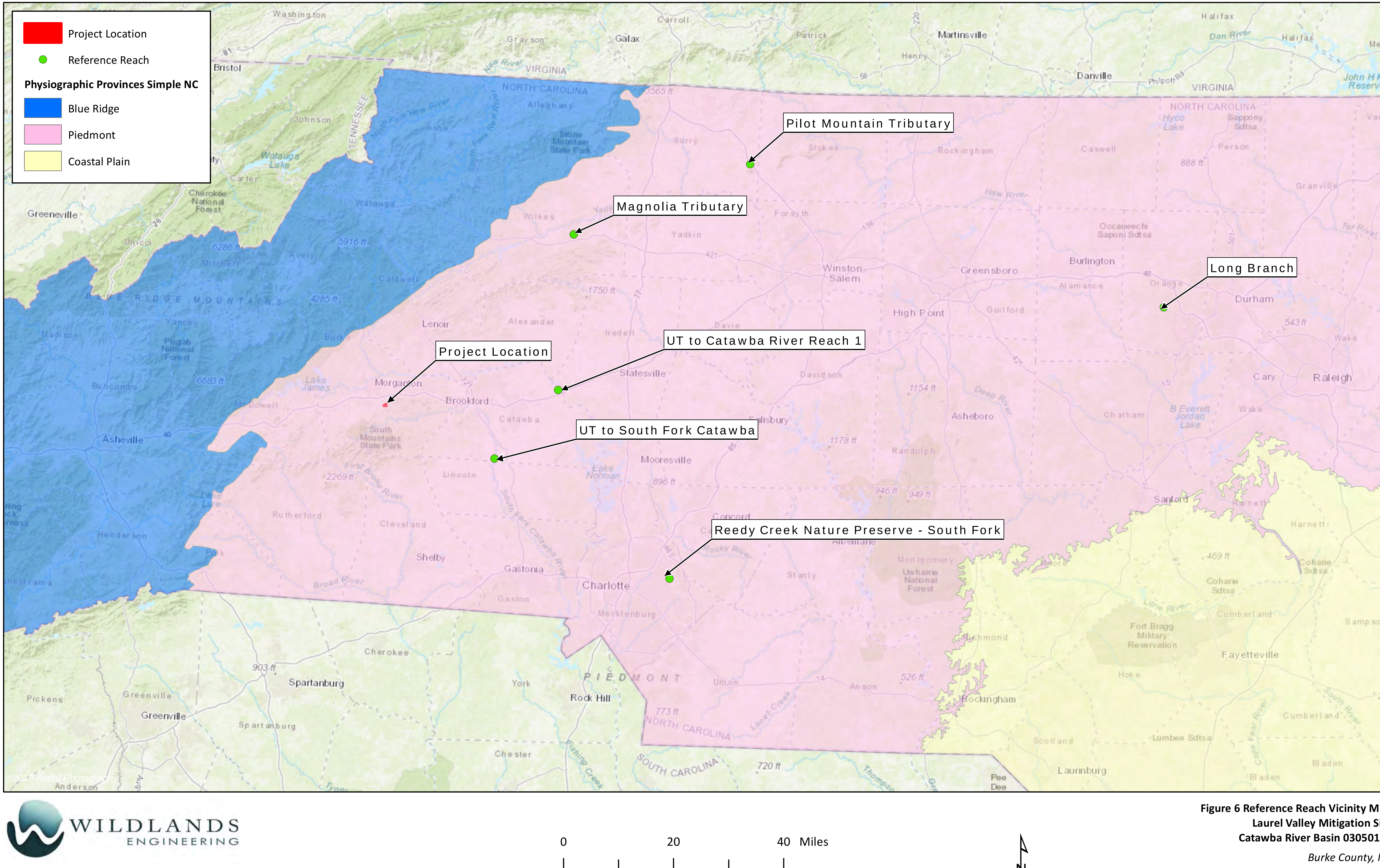

WILDLANDS ENGINEERING

Figure 6 Reference Reach Vicinity Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

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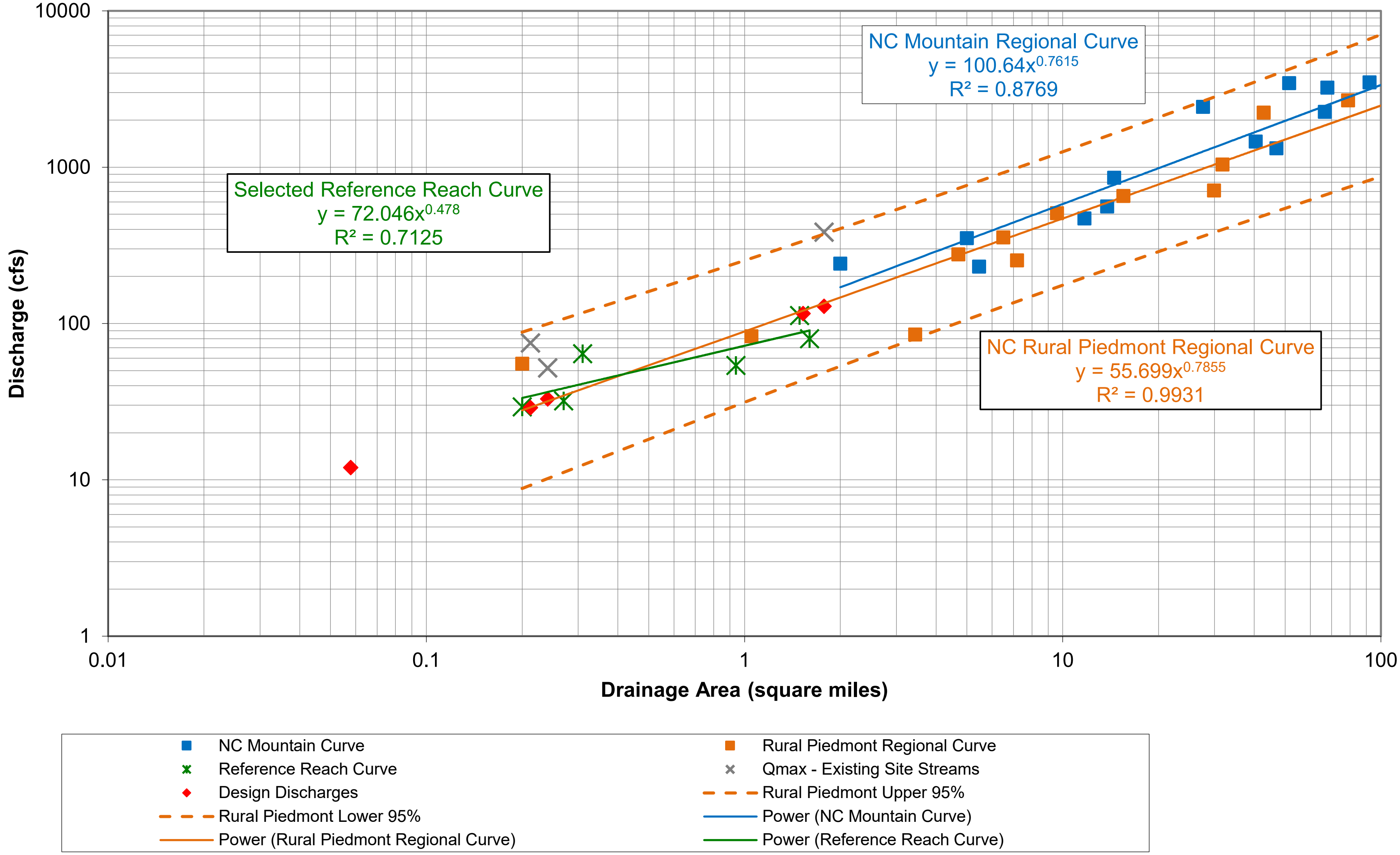
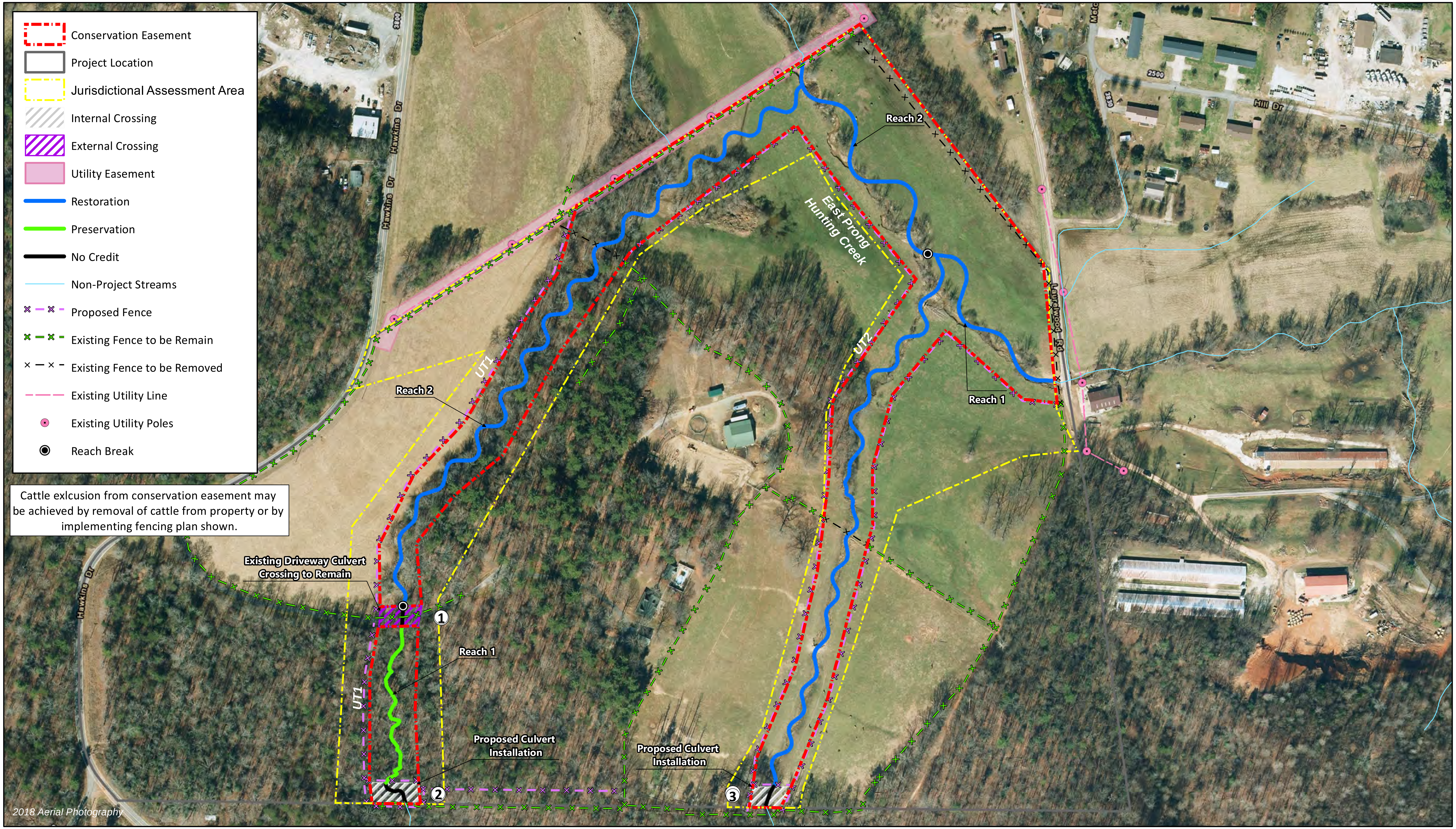
Laurel Valley Mitigation Site Design Discharge Analysis



WILDLANDS ENGINEERING

Figure 7 Design Discharge Analysis
Laurel Valley Mitigation Site
Catawba Basin (03050101)

Burke County, NC

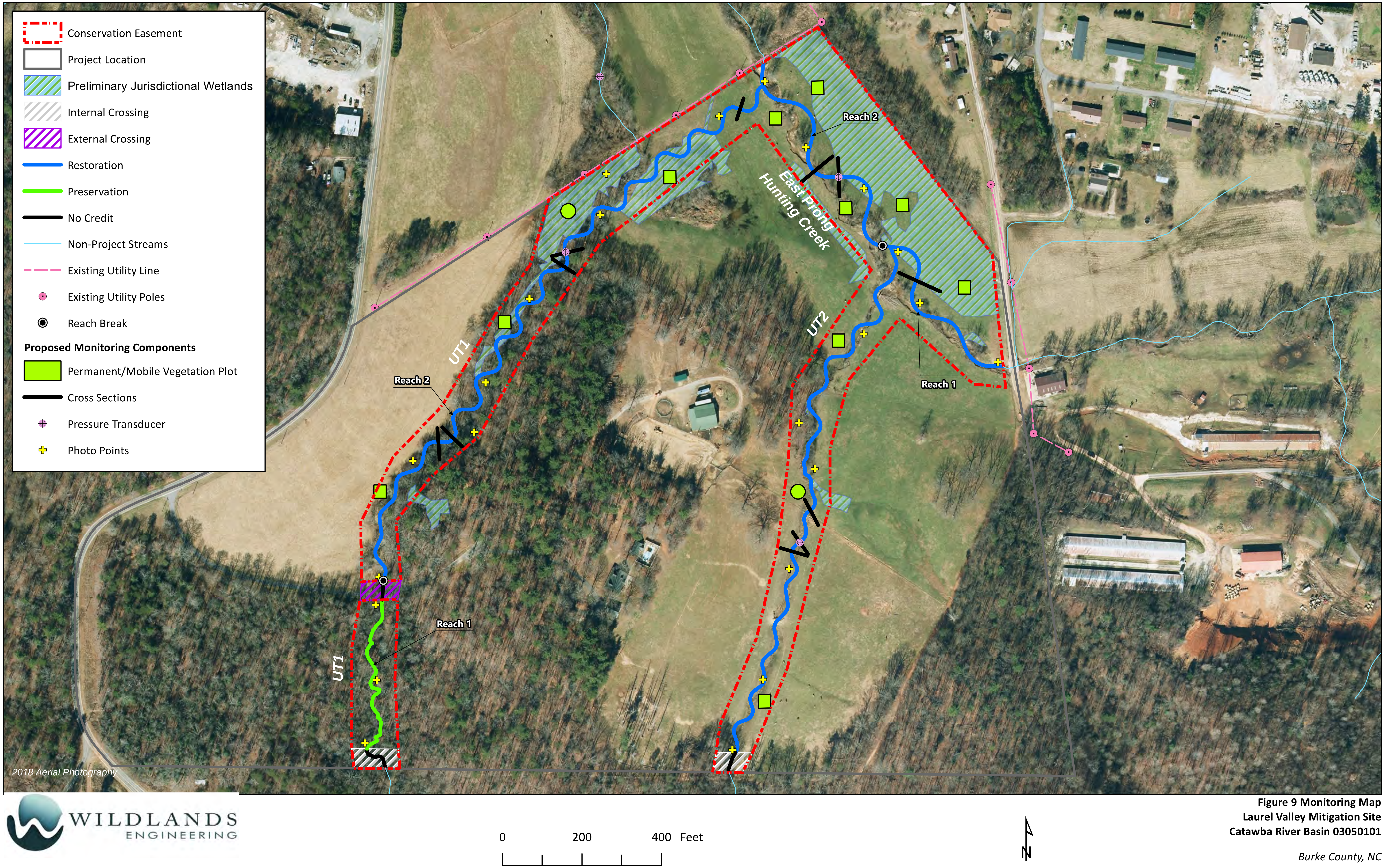


WILDLANDS ENGINEERING

Figure 8 Concept Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

8/12/2021 eneuhaus

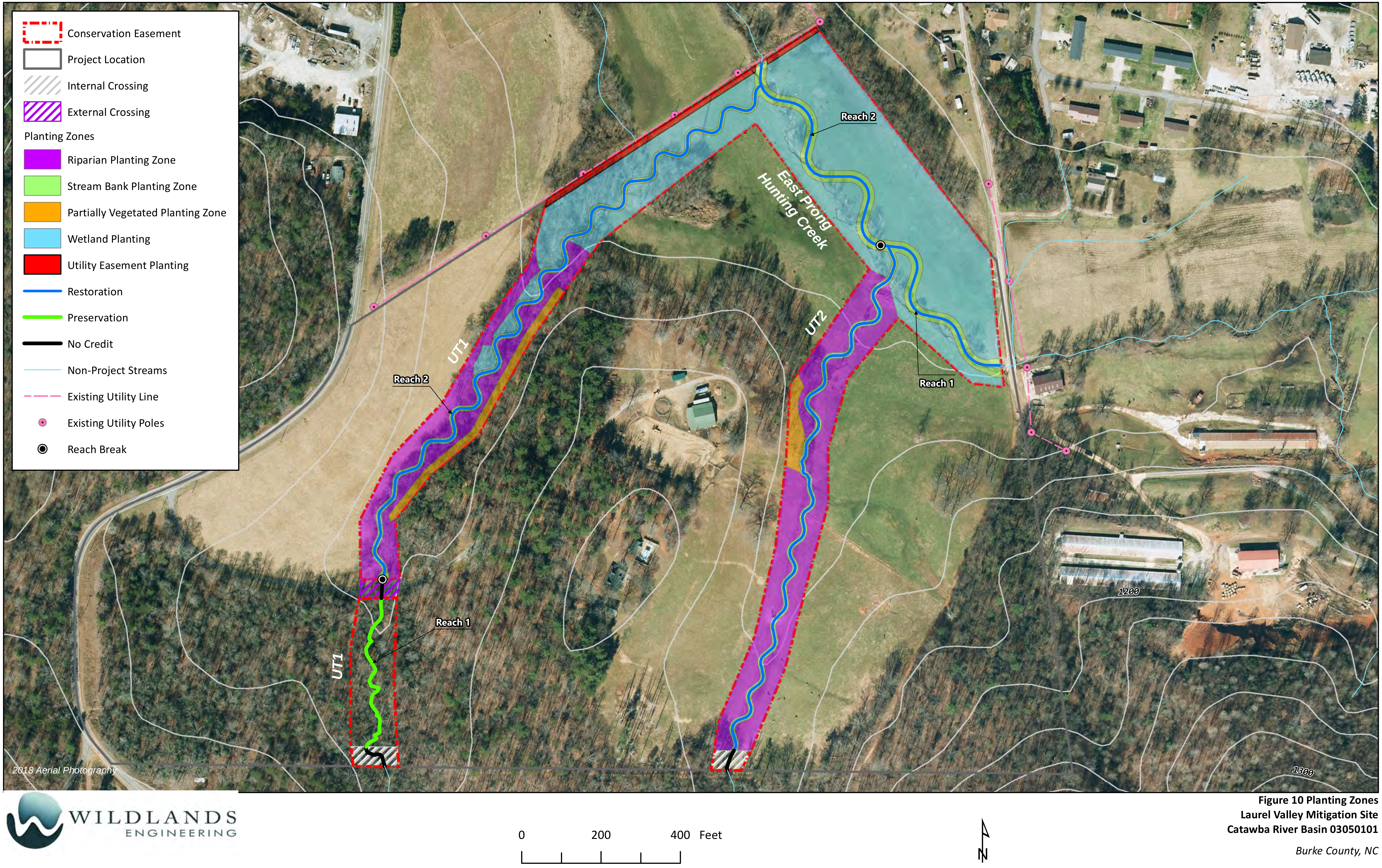


WILDLANDS ENGINEERING

Figure 9 Monitoring Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

11/22/2021 jhessler

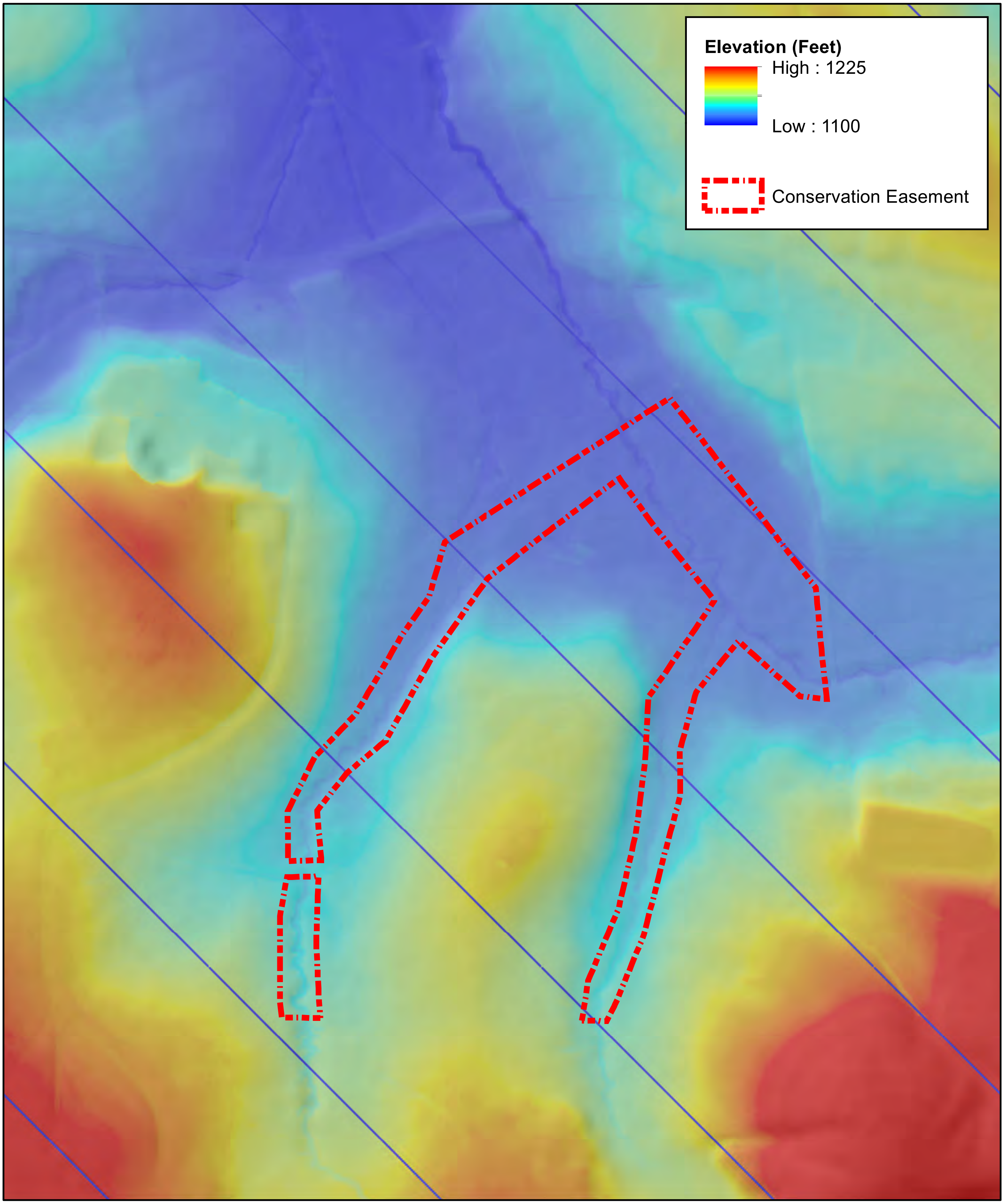


WILDLANDS ENGINEERING

Figure 10 Planting Zones
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

5/13/2021 jhessler



WILDLANDS ENGINEERING

Figure 11 LiDAR Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

APPENDIX 1
Historic Aerial Photos

Punch Buggy Mitigation Site

3923 Hawkins Drive

Morganton, NC 28655

Inquiry Number: 5733275.5

July 30, 2019

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

07/30/19

Site Name:	Client Name:
Punch Buggy Mitigation Site	Wildlands Eng, Inc.
3923 Hawkins Drive	1430 South Mint Street
Morganton, NC 28655	Charlotte, NC 28203
EDR Inquiry # 5733275.5	Contact: Andrea Eckardt

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	Scale	Details	Source
2016	1"=500'	Flight Year: 2016	USDA/NAIP
2012	1"=500'	Flight Year: 2012	USDA/NAIP
2009	1"=500'	Flight Year: 2009	USDA/NAIP
2006	1"=500'	Flight Year: 2006	USDA/NAIP
1998	1"=750'	Flight Date: March 15, 1998	USGS
1993	1"=500'	Acquisition Date: March 06, 1993	USGS/DOQQ
1984	1"=500'	Flight Date: February 02, 1984	USDA
1976	1"=500'	Flight Date: April 01, 1976	USGS
1964	1"=500'	Flight Date: October 24, 1964	USGS
1961	1"=500'	Flight Date: August 29, 1961	USGS
1950	1"=500'	Flight Date: November 14, 1950	USGS
1947	1"=500'	Flight Date: February 21, 1947	USGS

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

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INQUIRY #: 5733275.5
YEAR: 2016
= 500'
N
EDR

INQUIRY #: 5733275.5

YEAR: 2012

= 500'

N

EDR


INQUIRY #: 5733275.5
YEAR: 2009
= 500'
N
EDR


INQUIRY #: 5733275.5
YEAR: 2006
= 500'
N
EDR


INQUIRY #: 5733275.5
YEAR: 1998
= 750'
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EDR

INQUIRY #: 5733275.5

YEAR: 1993

= 500'

N


INQUIRY #: 5733275.5
YEAR: 1984
= 500'
N
EDR

INQUIRY #: 5733275.5

YEAR: 1976

= 500'

N

INQUIRY #: 5733275.5

YEAR: 1964

= 500'

N

Subject boundary not shown because it exceeds image extent or image is not georeferenced.


INQUIRY #: 5733275.5
YEAR: 1964
= 500'
N
EDR
Subject boundary not shown because it exceeds image extent or image is not georeferenced.

INQUIRY #: 5733275.5

YEAR: 1961

= 500'

N

EDR

INQUIRY #: 5733275.5

YEAR: 1950

= 500'

N

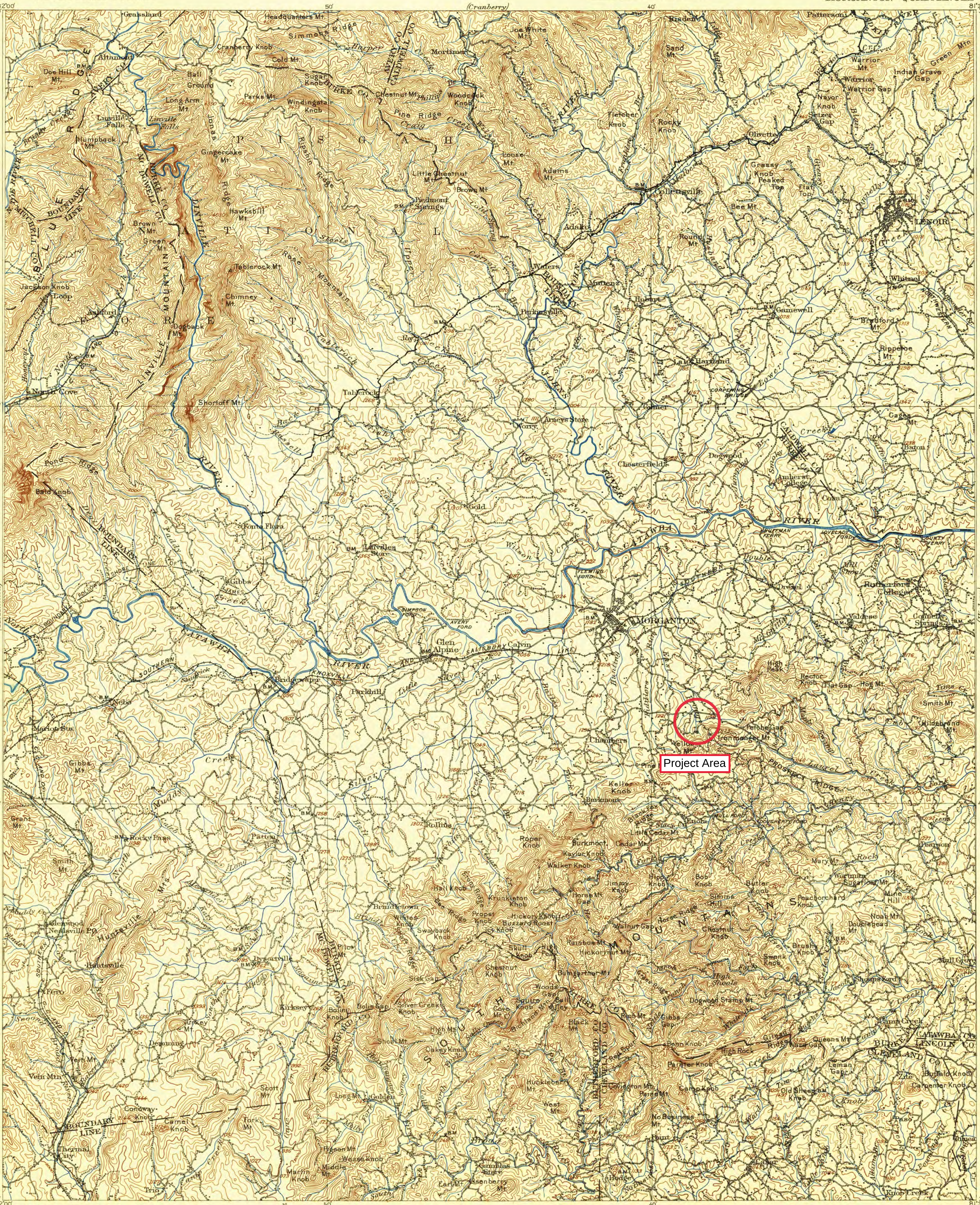
EDR


INQUIRY #: 5733275.5
YEAR: 1947
= 500'
N
EDR

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

U. S. G. S.
FILE COPY
Inspection and Editing.

NORTH CAROLINA
MORGANTON QUADRANGLE



H.M. Wilson, Geographer in charge.
Topography by W. Carvel Hall, Chas. E. Cooke, W. L. Miller, and L. S. Leopold.
Assistants W. N. Brown, and G. T. Ford.
Triangulation by U. S. Coast and Geodetic Survey and W. C. Kerr.
Surveyed in 1899 and 1903.

APPROXIMATE MEAN DECLINATION 1903.

Scale $\frac{1}{125000}$

Contour interval 100 feet.
Datum is mean sea level.

Edition of May 1905, reprinted 1941
Polyconic projection.

USGS
Historical File
Topographic Division
U. S. G. S.
FILE COPY
Inspection and Editing.

HISTORICAL

MORGANTON, N.C.

JUL 28 1941

1950

APPENDIX 2
Preliminary Jurisdictional
Determination Approval

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2020-00053** County: **Burke** U.S.G.S. Quad: **NC-Morganton South**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Requestor:	**Wildlands Engineering, Inc.**
	Win Taylor
Address:	**497 Bramson Court**
	Mt. Pleasant, SC 29464
Telephone Number:	**843-277-6221**
E-mail:	**wtaylor@wildlandseng.com**

Size (acres)	**24**	Nearest Town	**Morganton**
Nearest Waterway	**East Prong Hunting Creek**	River Basin	**Santee**
USGS HUC	**03050101**	Coordinates	Latitude: **35.703225**
			Longitude: **-81.642877**

Location description: **The Laurel Valley Mitigation Site is located at 3923 Hawkins Drive, Morganton, Burke County, North Carolina.**

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 **2/16/2021**. Therefore this preliminary jurisdiction determination may be used in the permit evaluation process, including determining compensatory mitigation. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.

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

B. Approved Determination

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

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

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

☐The **waters, including wetlands** on your project area/property have been delineated and the delineation has been verified by the Corps. The approximate boundaries of these waters are shown on the enclosed delineation map dated **DATE**. 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**DATE**. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

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

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

Placement of dredged or fill material within waters of the US, including wetlands, without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). Placement of dredged or fill material, construction or placement of structures, or work within navigable waters of the United States without a Department of the Army permit may constitute a violation of Sections 9 and/or 10 of the Rivers and Harbors Act (33 USC § 401 and/or 403). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **Steve Kichefski at 828-271-7980 ext. 4234 or steven.l.kichefski@usace.army.mil**.

C. Basis For Determination: Basis For Determination: See the preliminary jurisdictional determination form dated 07/19/2021.

D. Remarks: *See attached delineation map for verified resources.*

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.

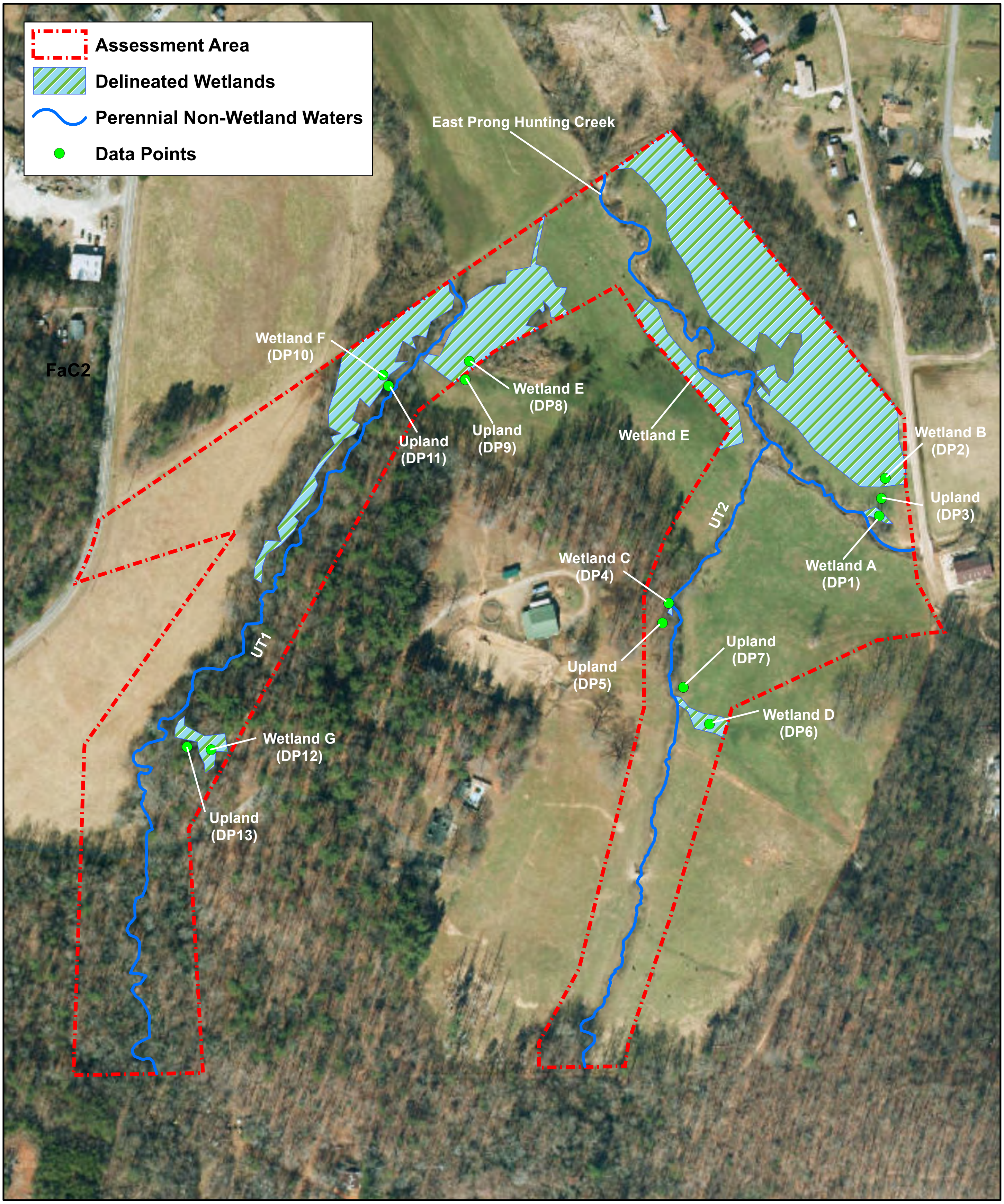
Corps Regulatory Official: ____

Date of JD: **07/19/2021** Expiration Date of JD: **Not applicable**

SAW-2020-00053
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 the Customer Satisfaction Survey located at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0

Copy furnished (via email):
Erin Davis (NCDWR)

Property Owner:	**John Hewat, Jr.**
Address:	**3923 Hawkins Drive**
	Morganton, NC 28655
Telephone Number:	**828-443-2093**
E-mail:	**j_hewat_2000@yahoo.com**



WILDLANDS ENGINEERING

Figure 3. Site Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **Wildlands Engineering, Inc.**, **Win Taylor**	File Number: **SAW-2020-00053**	Date: **07/19/2021**

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: **District Engineer, Wilmington Regulatory Division** **Attn: Steve Kichefski** **Asheville Regulatory Office** **U.S Army Corps of Engineers** **151 Patton Avenue, Room 208** **Asheville, North Carolina 28801**	If you only have questions regarding the appeal process you may also contact: MR. PHILIP A. SHANNIN ADMINISTRATIVE APPEAL REVIEW OFFICER CESAD-PDS-O 60 FORSYTH STREET SOUTHWEST, FLOOR M9 ATLANTA, GEORGIA 30303-8803 PHONE: (404) 562-5136; FAX (404) 562-5138 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.

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

For appeals on Initial Proffered Permits send this form to:

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

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

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

PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. **REPORT COMPLETION DATE FOR PJD:** 07/19/2021

B. **NAME AND ADDRESS OF PERSON REQUESTING PJD:** Wildlands Engineering, Inc., Win Taylor, 497 Bramson Court, Mt. Pleasant, SC 29464

C. **DISTRICT OFFICE, FILE NAME, AND NUMBER:** Wilmington District, DMS-Laurel Valley Mit Site, SAW-2020-00053

D. **PROJECT LOCATION(S) AND BACKGROUND INFORMATION:** The Laurel Valley Mitigation Site is located at 3923 Hawkins Drive, Morganton, Burke County, North Carolina.

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

State: NC County: Burke City: Morganton

Center coordinates of site (lat/long in degree decimal format): Latitude: 35.703225 Longitude: -81.642877

Universal Transverse Mercator:

Name of nearest waterbody: East Prong Hunting Creek

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

☐ Office (Desk) Determination. Date:

☒ Field Determination. Date(s):

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

Site Number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resources in review area (acreage and linear feet, if applicable	Type of aquatic resources (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
1	2	3	4	5	6

Table 1. Summary of On-Site Jurisdictional Waters

Feature	Latitude	Longitude	Cowardin Class	Estimated Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
East Prong Hunting Creek	35.70222	-81.64144	Riverine-Upper Perennial Streambed	1,345	Perennial Non-Wetland Waters of the US
UT1	35.69934	-81.64670	Riverine-Upper Perennial Streambed	2,216	Perennial Non-Wetland Waters of the US
UT2	35.69943	-81.64381	Riverine-Upper Perennial Streambed	1,475	Perennial Non-Wetland Waters of the US
Wetland A	35.702423	-81.641848	Palustrine Emergent	0.020	Non-Section 10 – Wetland
Wetland B	35.702692	-81.641806	Palustrine-Emergent	2.784	Non-Section 10 – Wetland
Wetland C	35.701883	-81.643216	Palustrine Forested	0.003	Non-Section 10 – Wetland
Wetland D	35.701306	-81.643043	Palustrine-Emergent	0.069	Non-Section 10 – Wetland
Wetland E	35.703589	-81.644518	Palustrine-Emergent	0.948	Non-Section 10 – Wetland
Wetland F	35.703221	-81.645380	Palustrine Forested	0.701	Non-Section 10 – Wetland
Wetland G	35.701208	-81.646506	Palustrine Forested	0.095	Non-Section 10 – Wetland

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

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

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

- ☒ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
  Map: ______.
- ☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report. Rationale: ______.
- ☐ Data sheets prepared by the Corps: ______.
- ☐ Corps navigable waters' study: ______.
- ☐ U.S. Geological Survey Hydrologic Atlas: ______.
  - ☐ USGS NHD data.
  - ☐ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 7.5 Minute South Morganton.
- ☒ Natural Resources Conservation Service Soil Survey. Citation: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.
- ☐ 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.
  or ☐ Other (Name & Date): ______.
- ☐ Previous determination(s). File no. and date of response letter: ______.
- ☐ Other information (please specify): ______.

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

KICHEFSKI.STEVEN.L.1386908539 Digitally signed by KICHEFSKI.STEVEN.L.1386908539 Date: 2021.07.19 07:12:45 -04'00'

Signature and date of Regulatory staff member completing PJD

2/12/21

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

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[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.

APPENDIX 3

DWR, NCSAM, and NCWAM

Identification Forms

NC DWQ Stream Identification Form Version 4.11

Date: 7/30/20	**Project/Site:** Laurel Valley	**Latitude:** 35.70222
Evaluator: M. Caddell	**County:** Burke	**Longitude:** -81.64144
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 45	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** East Prong *e.g. Quad Name:* Hunting Creek

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

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

B. Hydrology (Subtotal = 11.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 10.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

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

Notes: mayfly (3+), caddisfly (2+), crayfish (2), snail (2)

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/30/2019	**Project/Site:** Laurel Valley	**Latitude:** 35.69934
Evaluator: M. Caddell	**County:** Burke	**Longitude:** -81.64670
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 46	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name*: UT1

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

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

B. Hydrology (Subtotal = 11)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 12)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0 None			

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

Notes: caddisfly (3+), snails (7+)

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/30/2019	**Project/Site:** Laurel Valley	**Latitude:** 35.69943
Evaluator: M. Caddell	**County:** Burke	**Longitude:** -81.64381
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 42	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name:* UT2

A. Geomorphology (Subtotal = 19)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

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

B. Hydrology (Subtotal = 10.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 12.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

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

Notes: Mayfly (3), beetle, snails (10), Crayfish

Sketch:

NC SAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 2.1

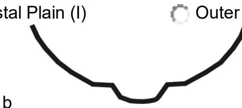
USACE AID #: NCDWR #:

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): Laurel Valley
2. Date of evaluation: 09/30/2020
3. Applicant/owner name: Wildlands Eng.
4. Assessor name/organization: Brandon R.
5. County: Burke
6. Nearest named water body on USGS 7.5-minute quad: East Prong Hunting Creek
7. River Basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.704275, -81.643651

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): East Prong Hunting Cre
10. Length of assessment reach evaluated (feet): 1354
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 - 4 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 20 - 23
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 mi^2) ○ Size 2 (0.1 to < 0.5 mi^2) ◉ Size 3 (0.5 to < 5 mi^2) ○ Size 4 (≥ 5 mi^2)

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 <u>and</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> 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: Laurel Valley
Date of Evaluation: 09/30/2020
Stream Category: Ma3
Assessor Name/Organization: Brandon R.

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
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	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**MEDIUM**	
(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	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**HIGH**	
(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): Laurel Valley
2. Date of evaluation: 09/30/2020
3. Applicant/owner name: Wildlands Eng.
4. Assessor name/organization: Brandon R.
5. County: Burke
6. Nearest named water body on USGS 7.5-minute quad: East Prong Hunting Creek
7. River Basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.700463, -81.646774

STREAM INFORMATION: (depth and width can be approximations)

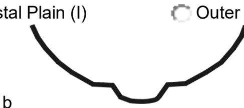
9. Site number (show on attached map): UT1 Preservation
10. Length of assessment reach evaluated (feet): 541
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 6 - 7 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 15 - 20
13. Is assessment reach a swamp 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 mi^2) ◉ Size 2 (0.1 to < 0.5 mi^2) ○ Size 3 (0.5 to < 5 mi^2) ○ Size 4 (≥ 5 mi^2)

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 <u>and</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> predominantly herbaceous species <u>or</u> 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 <u>or</u> communities with non-native invasive species present, but not dominant, over a large portion of the expected strata <u>or</u> communities missing understory but retaining canopy trees.
(•) C	( ) C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent <u>or</u> communities with non-native invasive species dominant over a large portion of expected strata <u>or</u> communities composed of planted stands of non-characteristic species <u>or</u> communities inappropriately composed of a single species <u>or</u> 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: Laurel Valley
Date of Evaluation: 09/30/2020
Stream Category: Mb2
Assessor Name/Organization: Brandon R.

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	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**HIGH**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	NA	
(3) Stream Stability	**HIGH**	
(4) Channel Stability	**HIGH**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**HIGH**	
(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	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**MEDIUM**	
(3) Thermoregulation	**HIGH**	
(2) Indicators of Stressors	**NO**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**HIGH**	
(2) In-stream Habitat	**HIGH**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**HIGH**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**HIGH**	
(3) Stream-side Habitat	**MEDIUM**	
(3) Thermoregulation	**HIGH**	
(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	**HIGH**	

NC SAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 2.1

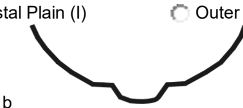
USACE AID #: NCDWR #:

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): Laurel Valley
2. Date of evaluation: 09/30/2020
3. Applicant/owner name: Wildlands Eng.
4. Assessor name/organization: Brandon R.
5. County: Burke
6. Nearest named water body on USGS 7.5-minute quad: East Prong Hunting Creek
7. River Basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.703689, -81.644714

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): UT1 R2 Lower
10. Length of assessment reach evaluated (feet): 242
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1 - 2 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 3 - 4
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 mi^2) (•) Size 2 (0.1 to < 0.5 mi^2) ( ) Size 3 (0.5 to < 5 mi^2) ( ) Size 4 (≥ 5 mi^2)

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)
- [x] 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)
- [x] B Multiple sticks and/or leaf packs and/or emergent vegetation
- [x] C Multiple snags and logs (including lap trees)
- [x] 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)
- [x] 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*)
[x]	[ ]	Crustacean (isopod/amphipod/crayfish/shrimp)
[ ]	[ ]	Damselfly and dragonfly larvae
[ ]	[ ]	Dipterans (true flies)
[x]	[ ]	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 <u>and</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> 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: Laurel Valley
Date of Evaluation: 09/30/2020
Stream Category: Ma2
Assessor Name/Organization: Brandon R.

Notes of Field Assessment Form (Y/N): NO
Presence of regulatory considerations (Y/N): YES
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	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**HIGH**	
(3) Streamside Area Attenuation	**HIGH**	
(4) Floodplain Access	**HIGH**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**HIGH**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**MEDIUM**	
(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	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**MEDIUM**	
(3) In-stream Habitat	**MEDIUM**	
(2) Stream-side Habitat	**MEDIUM**	
(3) Stream-side Habitat	**MEDIUM**	
(3) Thermoregulation	**MEDIUM**	
(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).

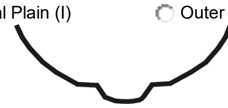
PROJECT / SITE INFORMATION:
1. Project name (if any): Laurel Valley
2. Date of evaluation: 09/30/2020
3. Applicant/owner name: Wildlands Eng.
4. Assessor name/organization: Brandon R.
5. County: Burke
6. Nearest named water body on USGS 7.5-minute quad: East Prong Hunting Creek
7. River Basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.703110, -81.645092

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): UT1 R2 Middle
10. Length of assessment reach evaluated (feet): 651
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 - 4 [ ] Unable to assess channel depth.
12. Channel width at top of bank (feet): 11 - 12
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 mi^2) (•) Size 2 (0.1 to < 0.5 mi^2) ( ) Size 3 (0.5 to < 5 mi^2) ( ) Size 4 (≥ 5 mi^2)

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
- [x] 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 <u>or</u> fill to the point of obstructing flow <u>or</u> a channel choked with aquatic macrophytes <u>or</u> ponded water <u>or</u> 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] <u>or</u> too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) <u>or</u> floodplain/intertidal zone unnaturally absent <u>or</u> 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 <u>and</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> 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 Laurel Valley
Date of Evaluation 09/30/2020
Stream Category Mb2
Assessor Name/Organization Brandon R.

Notes of Field Assessment Form (Y/N) NO
Presence of regulatory considerations (Y/N) YES
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	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**HIGH**	
(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	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**HIGH**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**HIGH**	
(3) Stream-side Habitat	**HIGH**	
(3) Thermoregulation	**HIGH**	
(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

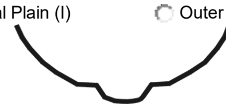
USACE AID #: NCDWR #:

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): Laurel Valley
2. Date of evaluation: 09/30/2020
3. Applicant/owner name: Wildlands Eng.
4. Assessor name/organization: Brandon R.
5. County: Burke
6. Nearest named water body on USGS 7.5-minute quad: East Prong Hunting Creek
7. River Basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.701813, -81.646055

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): UT1 R2 Upper
10. Length of assessment reach evaluated (feet): 699
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4-5 — [ ] Unable to assess channel depth.
12. Channel width at top of bank (feet): 8-10
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 mi^2) (•) Size 2 (0.1 to < 0.5 mi^2) ( ) Size 3 (0.5 to < 5 mi^2) ( ) Size 4 (≥ 5 mi^2)

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
- [x] 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 <u>or</u> fill to the point of obstructing flow <u>or</u> a channel choked with aquatic macrophytes <u>or</u> ponded water <u>or</u> 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] <u>or</u> too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) <u>or</u> floodplain/intertidal zone unnaturally absent <u>or</u> 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 <u>and</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> predominantly herbaceous species <u>or</u> 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 <u>or</u> communities with non-native invasive species present, but not dominant, over a large portion of the expected strata <u>or</u> communities missing understory but retaining canopy trees.
◉ C	○ C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent <u>or</u> communities with non-native invasive species dominant over a large portion of expected strata <u>or</u> communities composed of planted stands of non-characteristic species <u>or</u> communities inappropriately composed of a single species <u>or</u> 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 Laurel Valley — Date of Evaluation 09/30/2020
Stream Category Mb2 — Assessor Name/Organization Brandon R.

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
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	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**HIGH**	
(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	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**MEDIUM**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**MEDIUM**	
(3) Stream-side Habitat	**MEDIUM**	
(3) Thermoregulation	**MEDIUM**	
(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).

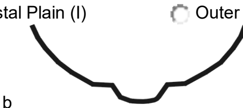
PROJECT / SITE INFORMATION:
1. Project name (if any): Laurel Valley
2. Date of evaluation: 09/30/2020
3. Applicant/owner name: Wildlands
4. Assessor name/organization: Brandon R.
5. County: Burke
6. Nearest named water body on USGS 7.5-minute quad: East Prong Hunting Creek
7. River Basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.702785, -81.642563

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): UT2 Lower
10. Length of assessment reach evaluated (feet): 304
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 - 4 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 6 - 8
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 mi^2) (•) Size 2 (0.1 to < 0.5 mi^2) ( ) Size 3 (0.5 to < 5 mi^2) ( ) Size 4 (≥ 5 mi^2)

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
[ ] [x] Snails
[x] [ ] 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 <u>and</u> 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)
[x] D Evidence of bank seepage or sweating (iron oxidizing bacteria in water indicates seepage)
[x] 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)
[x] 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> 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	Laurel Valley	Date of Evaluation	09/30/2020
Stream Category	Ma2	Assessor Name/Organization	Brandon R.

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
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	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**MEDIUM**	
(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	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**HIGH**	
(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

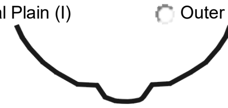
USACE AID #: NCDWR #:

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): Laurel Valley
2. Date of evaluation: 09/30/2020
3. Applicant/owner name: Wildlands Eng.
4. Assessor name/organization: Brandon R.
5. County: Burke
6. Nearest named water body on USGS 7.5-minute quad: East Prong Hunting Creek
7. River Basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.702162, -81.642982

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): UT2 Middle
10. Length of assessment reach evaluated (feet): 322
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 - 5 [ ] Unable to assess channel depth.
12. Channel width at top of bank (feet): 7 - 8
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 mi^2) (•) Size 2 (0.1 to < 0.5 mi^2) ( ) Size 3 (0.5 to < 5 mi^2) ( ) Size 4 (≥ 5 mi^2)

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
- [x] 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 <u>and</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> predominantly herbaceous species <u>or</u> 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 <u>or</u> communities with non-native invasive species present, but not dominant, over a large portion of the expected strata <u>or</u> communities missing understory but retaining canopy trees.
○ C	◉ C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent <u>or</u> communities with non-native invasive species dominant over a large portion of expected strata <u>or</u> communities composed of planted stands of non-characteristic species <u>or</u> communities inappropriately composed of a single species <u>or</u> 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: Laurel Valley
Date of Evaluation: 09/30/2020
Stream Category: Mb2
Assessor Name/Organization: Brandon R.

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	YES
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	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**MEDIUM**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	NA	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**HIGH**	
(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	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**MEDIUM**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**MEDIUM**	
(3) Stream-side Habitat	**MEDIUM**	
(3) Thermoregulation	**MEDIUM**	
(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	**MEDIUM**	

NC SAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

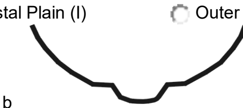
INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached 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): Laurel Valley
2. Date of evaluation: 09/30/2020
3. Applicant/owner name: Wildlands Eng.
4. Assessor name/organization: Brandon R.
5. County: Burke
6. Nearest named water body on USGS 7.5-minute quad: East Prong Hunting Creek
7. River Basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.699703, -81.643696

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): UT2 Upper 1
10. Length of assessment reach evaluated (feet): 157
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2 - 3 [ ] Unable to assess channel depth.
12. Channel width at top of bank (feet): 10 - 11
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 mi^2) (•) Size 2 (0.1 to < 0.5 mi^2) ( ) Size 3 (0.5 to < 5 mi^2) ( ) Size 4 ($\geq$ 5 mi^2)

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 <u>or</u> fill to the point of obstructing flow <u>or</u> a channel choked with aquatic macrophytes <u>or</u> ponded water <u>or</u> 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] <u>or</u> too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) <u>or</u> floodplain/intertidal zone unnaturally absent <u>or</u> 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 <u>and</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> 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 <u>or</u> predominantly herbaceous species <u>or</u> 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 <u>or</u> communities with non-native invasive species present, but not dominant, over a large portion of the expected strata <u>or</u> communities missing understory but retaining canopy trees.
( ) C	(•) C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent <u>or</u> communities with non-native invasive species dominant over a large portion of expected strata <u>or</u> communities composed of planted stands of non-characteristic species <u>or</u> communities inappropriately composed of a single species <u>or</u> 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: Laurel Valley
Date of Evaluation: 09/30/2020
Stream Category: Mb2
Assessor Name/Organization: Brandon R.

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	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**MEDIUM**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	NA	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**MEDIUM**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**HIGH**	
(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	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**MEDIUM**	
(2) In-stream Habitat	**HIGH**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**MEDIUM**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(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	**MEDIUM**	

NC SAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 2.1

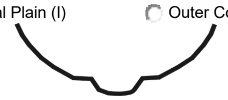
USACE AID #: NCDWR #:

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): Laurel Valley
2. Date of evaluation: 09/30/2020
3. Applicant/owner name: Wildlands Eng.
4. Assessor name/organization: Brandon R.
5. County: Burke
6. Nearest named water body on USGS 7.5-minute quad: East Prong Hunting Creek
7. River Basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.701333, -81.643169

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): UT2 Upper 2
10. Length of assessment reach evaluated (feet): 674
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 - 4 [ ] Unable to assess channel depth.
12. Channel width at top of bank (feet): 5 - 7
13. Is assessment reach a swamp stream? ( ) Yes ( ) No
14. Feature type: (x) Perennial flow ( ) Intermittent flow ( ) Tidal Marsh Stream

STREAM RATING INFORMATION:
15. NC SAM Zone: (x) 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)
(x) b  (less sinuous stream, steeper valley slope)

17. Watershed size: **(skip for Tidal Marsh Stream)** ( ) Size 1 (< 0.1 mi^2) (x) Size 2 (0.1 to < 0.5 mi^2) ( ) Size 3 (0.5 to < 5 mi^2) ( ) Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:
18. Were regulatory considerations evaluated? (x) 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 (x) No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - (x) 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 <u>or</u> fill to the point of obstructing flow <u>or</u> a channel choked with aquatic macrophytes <u>or</u> ponded water <u>or</u> impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
   - (x) B Not A

3. **Feature Pattern – assessment reach metric**
   - (x) 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).
   - (x) 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
   - (x) 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
(x) B	(x) 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] <u>or</u> too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) <u>or</u> floodplain/intertidal zone unnaturally absent <u>or</u> 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 <u>Excessive</u> sedimentation (burying of stream features or intertidal zone)
   - [ ] C Noticeable evidence of pollutant discharges entering the assessment reach <u>and</u> 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 <u>and</u> no rainfall or rainfall not exceeding 1 inch within the last 48 hours
( ) B Drought conditions <u>and</u> 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)**

- [x] A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- [x] B Multiple sticks and/or leaf packs and/or emergent vegetation
- [x] C Multiple snags and logs (including lap trees)
- [x] 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).**

- [x] A Riffle-run section (evaluate 11c)
- [x] 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
[ ]	[x]	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
[ ]	[ ]	Beetles (including water pennies)
[ ]	[ ]	Caddisfly larvae (Trichoptera [T])
[ ]	[ ]	Asian clam (*Corbicula*)
[ ]	[x]	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
[ ]	[x]	Salamanders/tadpoles
[ ]	[x]	Snails
[ ]	[x]	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 <u>and</u> 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 LB	Vegetated RB	Wooded LB	Wooded RB	
◉ A	◉ A	○ A	○ A	≥ 100-feet wide <u>or</u> 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 <u>or</u> 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 <u>or</u> 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 LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet 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 <u>or</u> predominantly herbaceous species <u>or</u> 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	Laurel Valley	Date of Evaluation	09/30/2020
Stream Category	Mb2	Assessor Name/Organization	Brandon R.

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	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**MEDIUM**	
(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	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**HIGH**	
(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 WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#: NCDWR #:

Project Name	Laurel Valley Mitigation Site	Date of Evaluation	11-23-21
Applicant/Owner Name	Wildlands Engineering Inc. (WE)	Wetland Site Name	Wetlands A,B,E
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	J.Hessler/WEI
Level III Ecoregion	Blue Ridge Mountains	Nearest Named Water Body	East Prong Hunting Creek
River Basin	Catawba	USGS 8-Digit Catalogue Unit	03050101
County	Burke	NCDWR Region	Mooresville
○ Yes ◉ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.702423/-81.641848

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations - Were regulatory considerations evaluated? ◉ Yes ○ No If Yes, check all that apply to the assessment area.

- ☐ Anadromous fish
- ☐ Federally protected species or State endangered or threatened species
- ☐ NCDWR riparian buffer rule in effect
- ☐ Abuts a Primary Nursery Area (PNA)
- ☐ Publicly owned property
- ☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
- ☑ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
- ☐ Designated NCNHP reference community
- ☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

- ○ Blackwater
- ◉ Brownwater
- ☐ Tidal (if tidal, check one of the following boxes) ○ Lunar ○ Wind ○ Both

Is the assessment area on a coastal island? ○ Yes ◉ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ○ Yes ◉ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ◉ Yes ○ No

1. **Ground Surface Condition/Vegetation Condition – assessment area condition metric**
Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence of an effect.

GS	VS	
○ A	○ A	Not severely altered
◉ B	◉ B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. **Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric**
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
○ A	○ A	Water storage capacity and duration are not altered.
◉ B	◉ B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
○ C	○ C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. **Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)**
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	○ A	○ A	Majority of wetland with depressions able to pond water > 1 foot deep
	○ B	○ B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	○ C	○ C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	◉ D	◉ D	Depressions able to pond water < 3 inches deep

3b.	○ A	Evidence that maximum depth of inundation is greater than 2 feet
	○ B	Evidence that maximum depth of inundation is between 1 and 2 feet
	◉ C	Evidence that maximum depth of inundation is less than 1 foot

4. **Soil Texture/Structure – assessment area condition metric (skip for all marshes)**
Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a.
- ○ A Sandy soil
- ● B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
- ○ C Loamy or clayey soils not exhibiting redoximorphic features
- ○ D Loamy or clayey gleyed soil
- ○ E Histosol or histic epipedon

4b.
- ● A Soil ribbon < 1 inch
- ○ B Soil ribbon ≥ 1 inch

4c.
- ● A No peat or muck presence
- ○ B A peat or muck presence

5. **Discharge into Wetland – opportunity metric**
Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
○ A	● A	Little or no evidence of pollutants or discharges entering the assessment area
● B	○ B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
○ C	○ C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. **Land Use – opportunity metric (skip for non-riparian wetlands)**
Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

WS	5M	2M	
☑ A	☑ A	☑ A	≥ 10% impervious surfaces
☐ B	☐ B	☐ B	Confined animal operations (or other local, concentrated source of pollutants)
☑ C	☑ C	☑ C	≥ 20% coverage of pasture
☐ D	☐ D	☐ D	≥ 20% coverage of agricultural land (regularly plowed land)
☐ E	☐ E	☑ E	≥ 20% coverage of maintained grass/herb
☐ F	☐ F	☑ F	≥ 20% coverage of clear-cut land
☐ G	☐ G	☐ G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed or hydrologic alterations that prevent dainage and/or overbank flow from affectio the assessment area.

7. **Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)**

7a. Is assessment area within 50 feet of a tributary or other open water?
● Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

7b. How much of the first 50 feet from the bank is weltand? (Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
- ● A ≥ 50 feet
- ○ B From 30 to < 50 feet
- ○ C From 15 to < 30 feet
- ○ D From 5 to < 15 feet
- ○ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
● ≤ 15-feet wide ○ > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
○ Yes ● No

7e. Is tributary or other open water sheltered or exposed?
- ● Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
- ○ Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. **Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)**
Check a box in each column. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
○ A	○ A	≥ 100 feet
○ B	○ B	From 80 to < 100 feet
○ C	○ C	From 50 to < 80 feet
○ D	○ D	From 40 to < 50 feet
○ E	● E	From 30 to < 40 feet
○ F	○ F	From 15 to < 30 feet
○ G	○ G	From 5 to < 15 feet
○ H	○ H	< 5 feet

9. Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)
Answer for assessment area dominant landform.
( ) A Evidence of short-duration inundation (< 7 consecutive days)
(•) B Evidence of saturation, without evidence of inundation
( ) C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)
Consider recent deposition only (no plant growth since deposition).
(•) A Sediment deposition is not excessive, but at approximately natural levels.
( ) B Sediment deposition is excessive, but not overwhelming the wetland.
( ) C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric
Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
( ) A	( ) A	( ) A	≥ 500 acres
( ) B	( ) B	( ) B	From 100 to < 500 acres
( ) C	( ) C	( ) C	From 50 to < 100 acres
( ) D	( ) D	( ) D	From 25 to < 50 acres
( ) E	( ) E	( ) E	From 10 to < 25 acres
( ) F	( ) F	( ) F	From 5 to < 10 acres
(•) G	(•) G	( ) G	From 1 to < 5 acres
( ) H	( ) H	( ) H	From 0.5 to < 1 acre
( ) I	( ) I	( ) I	From 0.1 to < 0.5 acre
( ) J	( ) J	( ) J	From 0.01 to < 0.1 acre
( ) K	( ) K	(•) K	< 0.01 acre or assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)
( ) A Pocosin is the full extent (≥ 90%) of its natural landscape size.
( ) B Pocosin is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric
13a. **Check appropriate box(es) (a box may be checked in each column). Involves a GIS effort with field adjustment.** This evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, fields (pasture open and agriculture), or water > 300 feet wide.

Well	Loosely	
( ) A	( ) A	≥ 500 acres
( ) B	( ) B	From 100 to < 500 acres
( ) C	( ) C	From 50 to < 100 acres
( ) D	( ) D	From 10 to < 50 acres
( ) E	(•) E	< 10 acres
(•) F	( ) F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.
( ) Yes ( ) No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)
May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directiions? If the assessment area is clear-cut, select option "C."
( ) A 0
( ) B 1 to 4
(•) C 5 to 8

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)
( ) A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
( ) B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
(•) C Vegetation severely altered from reference in composition, or expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species), or exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)
( ) A Vegetation diversity is high and is composed primarily of native species (<10% cover of exotics).
(•) B Vegetation diversity is low or has > 10% to 50% cover of exotics.
( ) C Vegetation is dominated by exotic species (>50% cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?

(•) Yes ( ) No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.

- ( ) A ≥ 25% coverage of vegetation
- ( ) B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	( ) A	( ) A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	( ) B	( ) B	Canopy present, but opened more than natural gaps
	(•) C	(•) C	Canopy sparse or absent
Mid-Story	( ) A	( ) A	Dense mid-story/sapling layer
	( ) B	( ) B	Moderate density mid-story/sapling layer
	(•) C	(•) C	Mid-story/sapling layer sparse or absent
Shrub	( ) A	( ) A	Dense shrub layer
	( ) B	( ) B	Moderate density shrub layer
	(•) C	(•) C	Shrub layer sparse or absent
Herb	( ) A	( ) A	Dense herb layer
	(•) B	(•) B	Moderate density herb layer
	( ) C	( ) C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

- ( ) A Large snags (more than one) are visible (> 12-inches DBH, or large relative to species present and landscape stability).
- (•) B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

- ( ) A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
- ( ) B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12-inch DBH.
- (•) C Majority of canopy trees are < 6 inches DBH or no trees.

20. Large Woody Debris – wetland type condition metric (skip for all marshes)

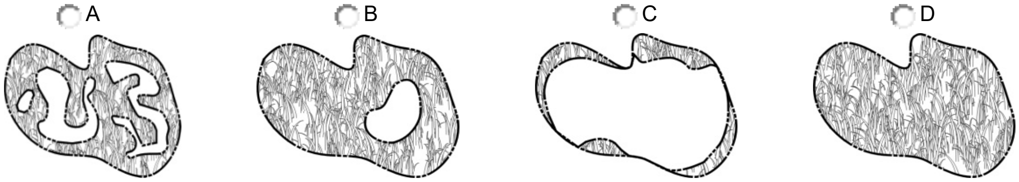
Include both natural debris and man-placed natural debris.

- ( ) A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
- (•) B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

( ) A ( ) B ( ) C ( ) D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.

- ( ) A Overbank <u>and</u> overland flow are not severely altered in the assessment area.
- (•) B Overbank flow is severely altered in the assessment area.
- ( ) C Overland flow is severely altered in the assessment area.
- ( ) D Both overbank <u>and</u> overland flow are severely altered in the assessment area.

Notes

Wetland is in an active cattle field that is maintained. Small ditches exist draining the wetlands East Prong Hunting Creek.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetlands A,B,E	Date	11-23-21
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	J.Hessler/WEI

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

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**MEDIUM**
Water Quality	Pathogen Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**NO**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**NO**
	Soluble Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**NO**
	Physical Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**NO**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**LOW**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence? (Y/N)	**NO**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#:	NCDWR #:
Project Name: Laurel Valley Mitigation Site	Date of Evaluation: 11-23-21
Applicant/Owner Name: Wildlands Engineering Inc. (WE)	Wetland Site Name: Wetlands C
Wetland Type: Headwater Forest	Assessor Name/Organization: J.Hessler/WEI
Level III Ecoregion: Blue Ridge Mountains	Nearest Named Water Body: East Prong Hunting Creek
River Basin: Catawba	USGS 8-Digit Catalogue Unit: 03050101
County: Burke	NCDWR Region: Mooresville
○ Yes ◉ No Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees): 35.701883/-81.643216

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations - Were regulatory considerations evaluated? ◉ Yes ○ No If Yes, check all that apply to the assessment area.

☐ Anadromous fish
☐ Federally protected species or State endangered or threatened species
☐ NCDWR riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☑ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)
○ Blackwater
◉ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ○ Lunar ○ Wind ○ Both

Is the assessment area on a coastal island? ○ Yes ◉ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ○ Yes ◉ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ○ Yes ◉ No

1. **Ground Surface Condition/Vegetation Condition – assessment area condition metric**
   Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence of an effect.

GS	VS	
○ A	◉ A	Not severely altered
◉ B	○ B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. **Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric**
   Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
○ A	◉ A	Water storage capacity and duration are not altered.
◉ B	○ B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
○ C	○ C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. **Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)**
   Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	○ A	○ A	Majority of wetland with depressions able to pond water > 1 foot deep
	○ B	○ B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	○ C	○ C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	◉ D	◉ D	Depressions able to pond water < 3 inches deep

3b.	○ A	Evidence that maximum depth of inundation is greater than 2 feet
	○ B	Evidence that maximum depth of inundation is between 1 and 2 feet
	◉ C	Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)
Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a.
- ○ A Sandy soil
- ◉ B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
- ○ C Loamy or clayey soils not exhibiting redoximorphic features
- ○ D Loamy or clayey gleyed soil
- ○ E Histosol or histic epipedon

4b.
- ◉ A Soil ribbon < 1 inch
- ○ B Soil ribbon ≥ 1 inch

4c.
- ◉ A No peat or muck presence
- ○ B A peat or muck presence

5. Discharge into Wetland – opportunity metric
Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
○ A	◉ A	Little or no evidence of pollutants or discharges entering the assessment area
◉ B	○ B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
○ C	○ C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric (skip for non-riparian wetlands)
Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles <u>and</u> within the watershed draining to the assessment area (5M), and within 2 miles <u>and</u> within the watershed draining to the assessment area (2M). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

WS	5M	2M	
☐ A	☑ A	☑ A	≥ 10% impervious surfaces
☐ B	☐ B	☐ B	Confined animal operations (or other local, concentrated source of pollutants)
☑ C	☑ C	☑ C	≥ 20% coverage of pasture
☐ D	☐ D	☐ D	≥ 20% coverage of agricultural land (regularly plowed land)
☐ E	☐ E	☑ E	≥ 20% coverage of maintained grass/herb
☐ F	☐ F	☑ F	≥ 20% coverage of clear-cut land
☐ G	☐ G	☐ G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed <u>or</u> hydrologic alterations that prevent dainage <u>and/or</u> overbank flow from affectio the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)

7a. Is assessment area within 50 feet of a tributary or other open water?
◉ Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

7b. How much of the first 50 feet from the bank is weltand? (Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
- ○ A ≥ 50 feet
- ○ B From 30 to < 50 feet
- ○ C From 15 to < 30 feet
- ○ D From 5 to < 15 feet
- ◉ E < 5 feet <u>or</u> buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
○ ≤ 15-feet wide ◉ > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
○ Yes ◉ No

7e. Is tributary or other open water sheltered or exposed?
- ◉ Sheltered – adjacent open water with width < 2500 feet <u>and</u> no regular boat traffic.
- ○ Exposed – adjacent open water with width ≥ 2500 feet <u>or</u> regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)
Check a box in each column. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
○ A	○ A	≥ 100 feet
○ B	○ B	From 80 to < 100 feet
○ C	○ C	From 50 to < 80 feet
○ D	○ D	From 40 to < 50 feet
○ E	○ E	From 30 to < 40 feet
○ F	○ F	From 15 to < 30 feet
○ G	○ G	From 5 to < 15 feet
○ H	◉ H	< 5 feet

9. **Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)**
Answer for assessment area dominant landform.
- ○ A Evidence of short-duration inundation (< 7 consecutive days)
- ◉ B Evidence of saturation, without evidence of inundation
- ○ C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. **Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)**
Consider recent deposition only (no plant growth since deposition).
- ◉ A Sediment deposition is not excessive, but at approximately natural levels.
- ○ B Sediment deposition is excessive, but not overwhelming the wetland.
- ○ C Sediment deposition is excessive and is overwhelming the wetland.

11. **Wetland Size – wetland type/wetland complex condition metric**
Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
○ A	○ A	○ A	≥ 500 acres
○ B	○ B	○ B	From 100 to < 500 acres
○ C	○ C	○ C	From 50 to < 100 acres
○ D	○ D	○ D	From 25 to < 50 acres
○ E	○ E	○ E	From 10 to < 25 acres
○ F	○ F	○ F	From 5 to < 10 acres
○ G	○ G	○ G	From 1 to < 5 acres
○ H	○ H	○ H	From 0.5 to < 1 acre
○ I	○ I	○ I	From 0.1 to < 0.5 acre
○ J	○ J	○ J	From 0.01 to < 0.1 acre
◉ K	◉ K	◉ K	< 0.01 acre <u>or</u> assessment area is clear-cut

12. **Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)**
- ○ A Pocosin is the full extent (≥ 90%) of its natural landscape size.
- ○ B Pocosin is < 90% of the full extent of its natural landscape size.

13. **Connectivity to Other Natural Areas – landscape condition metric**

13a. **Check appropriate box(es) (a box may be checked in each column). Involves a GIS effort with field adjustment.** This evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, fields (pasture open and agriculture), or water > 300 feet wide.

Well	Loosely	
○ A	○ A	≥ 500 acres
○ B	○ B	From 100 to < 500 acres
○ C	○ C	From 50 to < 100 acres
○ D	○ D	From 10 to < 50 acres
◉ E	◉ E	< 10 acres
○ F	○ F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.
○ Yes ○ No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. **Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)**
May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directiions? If the assessment area is clear-cut, select option "C."
- ○ A 0
- ◉ B 1 to 4
- ○ C 5 to 8

15. **Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)**
- ○ A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
- ◉ B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
- ○ C Vegetation severely altered from reference in composition, <u>or</u> expected species are unnaturally absent (planted stands of non-characteristic species <u>or</u> at least one stratum inappropriately composed of a single species), <u>or</u> exotic species are dominant in at least one stratum.

16. **Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)**
- ○ A Vegetation diversity is high and is composed primarily of native species (<10% cover of exotics).
- ◉ B Vegetation diversity is low or has > 10% to 50% cover of exotics.
- ○ C Vegetation is dominated by exotic species (>50% cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?

(•) Yes ( ) No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.

- ( ) A ≥ 25% coverage of vegetation
- ( ) B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	( ) A	( ) A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	(•) B	(•) B	Canopy present, but opened more than natural gaps
	( ) C	( ) C	Canopy sparse or absent
Mid-Story	( ) A	( ) A	Dense mid-story/sapling layer
	( ) B	( ) B	Moderate density mid-story/sapling layer
	(•) C	(•) C	Mid-story/sapling layer sparse or absent
Shrub	( ) A	( ) A	Dense shrub layer
	(•) B	( ) B	Moderate density shrub layer
	( ) C	(•) C	Shrub layer sparse or absent
Herb	( ) A	( ) A	Dense herb layer
	(•) B	(•) B	Moderate density herb layer
	( ) C	( ) C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

- ( ) A Large snags (more than one) are visible (> 12-inches DBH, or large relative to species present and landscape stability).
- (•) B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

- ( ) A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
- ( ) B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12-inch DBH.
- (•) C Majority of canopy trees are < 6 inches DBH or no trees.

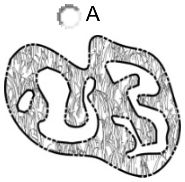
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

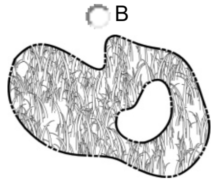
Include both natural debris and man-placed natural debris.

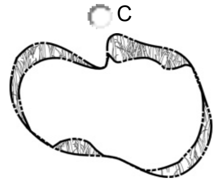
- ( ) A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
- (•) B Not A

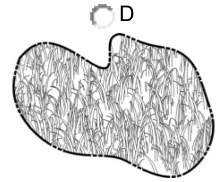
21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

( ) A


( ) B


( ) C


( ) D


22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.

- ( ) A Overbank <u>and</u> overland flow are not severely altered in the assessment area.
- ( ) B Overbank flow is severely altered in the assessment area.
- (•) C Overland flow is severely altered in the assessment area.
- ( ) D Both overbank <u>and</u> overland flow are severely altered in the assessment area.

Notes

Wetland is in an active cattle field that is maintained

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetlands C	Date	11-23-21
Wetland Type	Headwater Forest	Assessor Name/Organization	J.Hessler/WEI

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

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**NO**
	Particulate Change	Condition	**MEDIUM**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**NO**
	Physical Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**NO**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence? (Y/N)	**NO**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#: NCDWR #:

Project Name	Laurel Valley Mitigation Site	Date of Evaluation	11-23-21
Applicant/Owner Name	Wildlands Engineering Inc. (WE)	Wetland Site Name	Wetlands D
Wetland Type	Seep	Assessor Name/Organization	J.Hessler/WEI
Level III Ecoregion	Blue Ridge Mountains	Nearest Named Water Body	East Prong Hunting Creek
River Basin	Catawba	USGS 8-Digit Catalogue Unit	03050101
County	Burke	NCDWR Region	Mooresville
○ Yes ◉ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.701305/-81.643043

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations - Were regulatory considerations evaluated? ◉ Yes ○ No If Yes, check all that apply to the assessment area.

- ☐ Anadromous fish
- ☐ Federally protected species or State endangered or threatened species
- ☐ NCDWR riparian buffer rule in effect
- ☐ Abuts a Primary Nursery Area (PNA)
- ☐ Publicly owned property
- ☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
- ☑ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
- ☐ Designated NCNHP reference community
- ☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

- ○ Blackwater
- ◉ Brownwater
- ☐ Tidal (if tidal, check one of the following boxes) ○ Lunar ○ Wind ○ Both

Is the assessment area on a coastal island? ○ Yes ◉ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ○ Yes ◉ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ○ Yes ◉ No

1. **Ground Surface Condition/Vegetation Condition – assessment area condition metric**
Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence of an effect.

GS	VS	
○ A	○ A	Not severely altered
◉ B	◉ B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. **Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric**
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
○ A	◉ A	Water storage capacity and duration are not altered.
◉ B	○ B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
○ C	○ C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. **Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)**
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	○ A	○ A	Majority of wetland with depressions able to pond water > 1 foot deep
	○ B	○ B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	○ C	○ C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	◉ D	◉ D	Depressions able to pond water < 3 inches deep

3b.	○ A	Evidence that maximum depth of inundation is greater than 2 feet
	○ B	Evidence that maximum depth of inundation is between 1 and 2 feet
	◉ C	Evidence that maximum depth of inundation is less than 1 foot

4. **Soil Texture/Structure – assessment area condition metric (skip for all marshes)**
Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a. ○ A Sandy soil
◉ B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
○ C Loamy or clayey soils not exhibiting redoximorphic features
○ D Loamy or clayey gleyed soil
○ E Histosol or histic epipedon

4b. ◉ A Soil ribbon < 1 inch
○ B Soil ribbon ≥ 1 inch

4c. ◉ A No peat or muck presence
○ B A peat or muck presence

5. **Discharge into Wetland – opportunity metric**
Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
○ A	◉ A	Little or no evidence of pollutants or discharges entering the assessment area
◉ B	○ B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
○ C	○ C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. **Land Use – opportunity metric (skip for non-riparian wetlands)**
Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles <u>and</u> within the watershed draining to the assessment area (5M), and within 2 miles <u>and</u> within the watershed draining to the assessment area (2M). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

WS	5M	2M	
☐ A	☑ A	☑ A	≥ 10% impervious surfaces
☐ B	☐ B	☐ B	Confined animal operations (or other local, concentrated source of pollutants)
☑ C	☑ C	☑ C	≥ 20% coverage of pasture
☐ D	☐ D	☐ D	≥ 20% coverage of agricultural land (regularly plowed land)
☐ E	☐ E	☑ E	≥ 20% coverage of maintained grass/herb
☐ F	☐ F	☑ F	≥ 20% coverage of clear-cut land
☐ G	☐ G	☐ G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed <u>or</u> hydrologic alterations that prevent dainage <u>and/or</u> overbank flow from affectio the assessment area.

7. **Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)**

7a. Is assessment area within 50 feet of a tributary or other open water?
◉ Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

7b. How much of the first 50 feet from the bank is weltand? (Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
○ A ≥ 50 feet
○ B From 30 to < 50 feet
○ C From 15 to < 30 feet
◉ D From 5 to < 15 feet
○ E < 5 feet <u>or</u> buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
○ ≤ 15-feet wide ◉ > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
○ Yes ◉ No

7e. Is tributary or other open water sheltered or exposed?
◉ Sheltered – adjacent open water with width < 2500 feet <u>and</u> no regular boat traffic.
○ Exposed – adjacent open water with width ≥ 2500 feet <u>or</u> regular boat traffic.

8. **Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)**
Check a box in each column. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
○ A	○ A	≥ 100 feet
○ B	○ B	From 80 to < 100 feet
○ C	○ C	From 50 to < 80 feet
○ D	○ D	From 40 to < 50 feet
○ E	○ E	From 30 to < 40 feet
○ F	○ F	From 15 to < 30 feet
○ G	◉ G	From 5 to < 15 feet
○ H	○ H	< 5 feet

9. Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)

Answer for assessment area dominant landform.

○ A Evidence of short-duration inundation (< 7 consecutive days)
● B Evidence of saturation, without evidence of inundation
○ C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)

Consider recent deposition only (no plant growth since deposition).

● A Sediment deposition is not excessive, but at approximately natural levels.
○ B Sediment deposition is excessive, but not overwhelming the wetland.
○ C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select “K” for the FW column.

WT	WC	FW (if applicable)	
○ A	○ A	○ A	≥ 500 acres
○ B	○ B	○ B	From 100 to < 500 acres
○ C	○ C	○ C	From 50 to < 100 acres
○ D	○ D	○ D	From 25 to < 50 acres
○ E	○ E	○ E	From 10 to < 25 acres
○ F	○ F	○ F	From 5 to < 10 acres
○ G	○ G	○ G	From 1 to < 5 acres
○ H	○ H	○ H	From 0.5 to < 1 acre
○ I	○ I	○ I	From 0.1 to < 0.5 acre
● J	● J	○ J	From 0.01 to < 0.1 acre
○ K	○ K	● K	< 0.01 acre <u>or</u> assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

○ A Pocosin is the full extent (≥ 90%) of its natural landscape size.
○ B Pocosin is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column). Involves a GIS effort with field adjustment.** This evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, fields (pasture open and agriculture), or water > 300 feet wide.

Well	Loosely	
○ A	○ A	≥ 500 acres
○ B	○ B	From 100 to < 500 acres
○ C	○ C	From 50 to < 100 acres
○ D	○ D	From 10 to < 50 acres
○ E	○ E	< 10 acres
● F	● F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

○ Yes ○ No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directiions? If the assessment area is clear-cut, select option "C."

○ A 0
○ B 1 to 4
● C 5 to 8

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

○ A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
○ B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
● C Vegetation severely altered from reference in composition, <u>or</u> expected species are unnaturally absent (planted stands of non-characteristic species <u>or</u> at least one stratum inappropriately composed of a single species), <u>or</u> exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

○ A Vegetation diversity is high and is composed primarily of native species (<10% cover of exotics).
○ B Vegetation diversity is low or has > 10% to 50% cover of exotics.
● C Vegetation is dominated by exotic species (>50% cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?

◉ Yes ○ No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.

○ A ≥ 25% coverage of vegetation
○ B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	○ A	○ A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	○ B	○ B	Canopy present, but opened more than natural gaps
	◉ C	◉ C	Canopy sparse or absent
Mid-Story	○ A	○ A	Dense mid-story/sapling layer
	○ B	○ B	Moderate density mid-story/sapling layer
	◉ C	◉ C	Mid-story/sapling layer sparse or absent
Shrub	○ A	○ A	Dense shrub layer
	○ B	○ B	Moderate density shrub layer
	◉ C	◉ C	Shrub layer sparse or absent
Herb	○ A	○ A	Dense herb layer
	○ B	○ B	Moderate density herb layer
	◉ C	◉ C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

○ A Large snags (more than one) are visible (> 12-inches DBH, or large relative to species present and landscape stability).
◉ B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

○ A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
○ B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12-inch DBH.
◉ C Majority of canopy trees are < 6 inches DBH or no trees.

20. Large Woody Debris – wetland type condition metric (skip for all marshes)

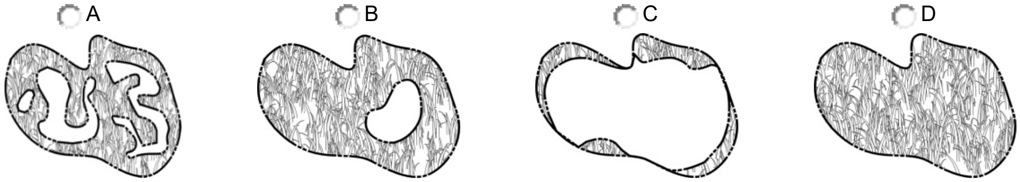
Include both natural debris and man-placed natural debris.

○ A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
◉ B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

○ A ○ B ○ C ○ D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.

○ A Overbank and overland flow are not severely altered in the assessment area.
○ B Overbank flow is severely altered in the assessment area.
◉ C Overland flow is severely altered in the assessment area.
○ D Both overbank and overland flow are severely altered in the assessment area.

Notes

Wetland is in an active cattle field that is maintained

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetlands D	Date	11-23-21
Wetland Type	Seep	Assessor Name/Organization	J.Hessler/WEI

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

Sub-function Rating Summary

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

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**LOW**
	Condition/Opportunity	NA
	Opportunity Presence? (Y/N)	NA
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#: NCDWR #:

Project Name	Laurel Valley Mitigation Site	Date of Evaluation	11-23-21
Applicant/Owner Name	Wildlands Engineering Inc. (WE)	Wetland Site Name	Wetlands F
Wetland Type	Headwater Forest	Assessor Name/Organization	J.Hessler/WEI
Level III Ecoregion	Blue Ridge Mountains	Nearest Named Water Body	East Prong Hunting Creek
River Basin	Catawba	USGS 8-Digit Catalogue Unit	03050101
County	Burke	NCDWR Region	Mooresville
( ) Yes (•) No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.7703221/-81.645380

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? (•) Yes ( ) No

Regulatory Considerations - Were regulatory considerations evaluated? (•) Yes ( ) No If Yes, check all that apply to the assessment area.

- [ ] Anadromous fish
- [ ] Federally protected species or State endangered or threatened species
- [ ] NCDWR riparian buffer rule in effect
- [ ] Abuts a Primary Nursery Area (PNA)
- [ ] Publicly owned property
- [ ] N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
- [x] Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
- [ ] Designated NCNHP reference community
- [ ] Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

( ) Blackwater
(•) Brownwater
[ ] Tidal (if tidal, check one of the following boxes) ( ) Lunar ( ) Wind ( ) Both

Is the assessment area on a coastal island? ( ) Yes (•) No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ( ) Yes (•) No

Does the assessment area experience overbank flooding during normal rainfall conditions? ( ) Yes (•) No

1. **Ground Surface Condition/Vegetation Condition – assessment area condition metric**
Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence of an effect.

GS	VS	
( ) A	(•) A	Not severely altered
(•) B	( ) B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. **Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric**
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
( ) A	(•) A	Water storage capacity and duration are not altered.
(•) B	( ) B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
( ) C	( ) C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. **Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)**
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	( ) A	( ) A	Majority of wetland with depressions able to pond water > 1 foot deep
	( ) B	( ) B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	(•) C	(•) C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	( ) D	( ) D	Depressions able to pond water < 3 inches deep

3b. ( ) A Evidence that maximum depth of inundation is greater than 2 feet
( ) B Evidence that maximum depth of inundation is between 1 and 2 feet
(•) C Evidence that maximum depth of inundation is less than 1 foot

4. **Soil Texture/Structure – assessment area condition metric (skip for all marshes)**
Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a.
- ○ A Sandy soil
- ● B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
- ○ C Loamy or clayey soils not exhibiting redoximorphic features
- ○ D Loamy or clayey gleyed soil
- ○ E Histosol or histic epipedon

4b.
- ● A Soil ribbon < 1 inch
- ○ B Soil ribbon ≥ 1 inch

4c.
- ● A No peat or muck presence
- ○ B A peat or muck presence

5. **Discharge into Wetland – opportunity metric**
Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
○ A	● A	Little or no evidence of pollutants or discharges entering the assessment area
● B	○ B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
○ C	○ C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. **Land Use – opportunity metric (skip for non-riparian wetlands)**
Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles <u>and</u> within the watershed draining to the assessment area (5M), and within 2 miles <u>and</u> within the watershed draining to the assessment area (2M). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

WS	5M	2M	
☐ A	☑ A	☑ A	≥ 10% impervious surfaces
☐ B	☐ B	☐ B	Confined animal operations (or other local, concentrated source of pollutants)
☑ C	☑ C	☑ C	≥ 20% coverage of pasture
☐ D	☐ D	☐ D	≥ 20% coverage of agricultural land (regularly plowed land)
☐ E	☐ E	☑ E	≥ 20% coverage of maintained grass/herb
☐ F	☐ F	☑ F	≥ 20% coverage of clear-cut land
☐ G	☐ G	☐ G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed <u>or</u> hydrologic alterations that prevent dainage <u>and/or</u> overbank flow from affectio the assessment area.

7. **Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)**

7a. Is assessment area within 50 feet of a tributary or other open water?
● Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

7b. How much of the first 50 feet from the bank is weltand? (Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
- ○ A ≥ 50 feet
- ○ B From 30 to < 50 feet
- ● C From 15 to < 30 feet
- ○ D From 5 to < 15 feet
- ○ E < 5 feet <u>or</u> buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
○ ≤ 15-feet wide ● > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
○ Yes ● No

7e. Is tributary or other open water sheltered or exposed?
- ● Sheltered – adjacent open water with width < 2500 feet <u>and</u> no regular boat traffic.
- ○ Exposed – adjacent open water with width ≥ 2500 feet <u>or</u> regular boat traffic.

8. **Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)**
Check a box in each column. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
○ A	○ A	≥ 100 feet
○ B	○ B	From 80 to < 100 feet
○ C	○ C	From 50 to < 80 feet
○ D	○ D	From 40 to < 50 feet
○ E	○ E	From 30 to < 40 feet
○ F	○ F	From 15 to < 30 feet
○ G	● G	From 5 to < 15 feet
○ H	○ H	< 5 feet

9. Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)

Answer for assessment area dominant landform.

- [ ] A Evidence of short-duration inundation (< 7 consecutive days)
- [x] B Evidence of saturation, without evidence of inundation
- [ ] C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)

Consider recent deposition only (no plant growth since deposition).

- [ ] A Sediment deposition is not excessive, but at approximately natural levels.
- [x] B Sediment deposition is excessive, but not overwhelming the wetland.
- [ ] C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
[ ] A	[ ] A	[ ] A	≥ 500 acres
[ ] B	[ ] B	[ ] B	From 100 to < 500 acres
[ ] C	[ ] C	[ ] C	From 50 to < 100 acres
[ ] D	[ ] D	[ ] D	From 25 to < 50 acres
[ ] E	[ ] E	[ ] E	From 10 to < 25 acres
[ ] F	[ ] F	[ ] F	From 5 to < 10 acres
[ ] G	[ ] G	[ ] G	From 1 to < 5 acres
[x] H	[x] H	[ ] H	From 0.5 to < 1 acre
[ ] I	[ ] I	[x] I	From 0.1 to < 0.5 acre
[ ] J	[ ] J	[ ] J	From 0.01 to < 0.1 acre
[ ] K	[ ] K	[ ] K	< 0.01 acre <u>or</u> assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

- [ ] A Pocosin is the full extent (≥ 90%) of its natural landscape size.
- [ ] B Pocosin is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column). Involves a GIS effort with field adjustment.** This evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, fields (pasture open and agriculture), or water > 300 feet wide.

Well	Loosely	
[ ] A	[ ] A	≥ 500 acres
[ ] B	[ ] B	From 100 to < 500 acres
[ ] C	[ ] C	From 50 to < 100 acres
[ ] D	[ ] D	From 10 to < 50 acres
[x] E	[x] E	< 10 acres
[ ] F	[ ] F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

[ ] Yes [ ] No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directiions? If the assessment area is clear-cut, select option "C."

- [ ] A 0
- [x] B 1 to 4
- [ ] C 5 to 8

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

- [ ] A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
- [x] B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
- [ ] C Vegetation severely altered from reference in composition, <u>or</u> expected species are unnaturally absent (planted stands of non-characteristic species <u>or</u> at least one stratum inappropriately composed of a single species), <u>or</u> exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

- [ ] A Vegetation diversity is high and is composed primarily of native species (<10% cover of exotics).
- [x] B Vegetation diversity is low or has > 10% to 50% cover of exotics.
- [ ] C Vegetation is dominated by exotic species (>50% cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?

◉ Yes ○ No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.

○ A ≥ 25% coverage of vegetation
○ B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	○ A	○ A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	◉ B	◉ B	Canopy present, but opened more than natural gaps
	○ C	○ C	Canopy sparse or absent
Mid-Story	○ A	○ A	Dense mid-story/sapling layer
	◉ B	◉ B	Moderate density mid-story/sapling layer
	○ C	○ C	Mid-story/sapling layer sparse or absent
Shrub	○ A	○ A	Dense shrub layer
	◉ B	◉ B	Moderate density shrub layer
	○ C	○ C	Shrub layer sparse or absent
Herb	○ A	○ A	Dense herb layer
	◉ B	◉ B	Moderate density herb layer
	○ C	○ C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

○ A Large snags (more than one) are visible (> 12-inches DBH, or large relative to species present and landscape stability).
◉ B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

○ A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
○ B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12-inch DBH.
◉ C Majority of canopy trees are < 6 inches DBH or no trees.

20. Large Woody Debris – wetland type condition metric (skip for all marshes)

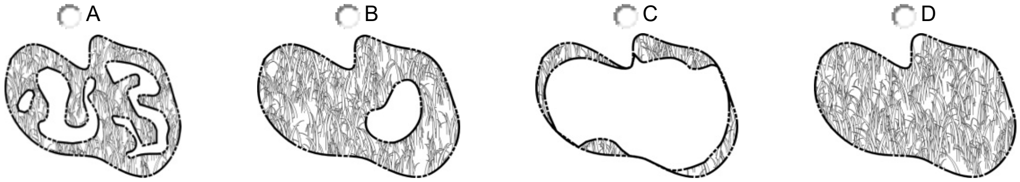
Include both natural debris and man-placed natural debris.

○ A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
◉ B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

○ A ○ B ○ C ○ D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.

◉ A Overbank and overland flow are not severely altered in the assessment area.
○ B Overbank flow is severely altered in the assessment area.
○ C Overland flow is severely altered in the assessment area.
○ D Both overbank and overland flow are severely altered in the assessment area.

Notes

Wetland is in an active cattle field that is maintained

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetlands F	Date	11-23-21
Wetland Type	Headwater Forest	Assessor Name/Organization	J.Hessler/WEI

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **MEDIUM**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#: NCDWR #:

Project Name	Laurel Valley Mitigation Site	Date of Evaluation	11-23-21
Applicant/Owner Name	Wildlands Engineering Inc. (WE)	Wetland Site Name	Wetlands G
Wetland Type	Headwater Forest	Assessor Name/Organization	J.Hessler/WEI
Level III Ecoregion	Blue Ridge Mountains	Nearest Named Water Body	East Prong Hunting Creek
River Basin	Catawba	USGS 8-Digit Catalogue Unit	03050101
County	Burke	NCDWR Region	Mooresville

○ Yes ◉ No Precipitation within 48 hrs? Latitude/Longitude (deci-degrees) 35.701208/-81.646506

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations - Were regulatory considerations evaluated? ◉ Yes ○ No If Yes, check all that apply to the assessment area.

- ☐ Anadromous fish
- ☐ Federally protected species or State endangered or threatened species
- ☐ NCDWR riparian buffer rule in effect
- ☐ Abuts a Primary Nursery Area (PNA)
- ☐ Publicly owned property
- ☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
- ☑ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
- ☐ Designated NCNHP reference community
- ☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

- ○ Blackwater
- ◉ Brownwater
- ☐ Tidal (if tidal, check one of the following boxes) ○ Lunar ○ Wind ○ Both

Is the assessment area on a coastal island? ○ Yes ◉ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ○ Yes ◉ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ○ Yes ◉ No

1. **Ground Surface Condition/Vegetation Condition – assessment area condition metric**
Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence of an effect.

GS	VS	
◉ A	◉ A	Not severely altered
○ B	○ B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. **Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric**
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
◉ A	◉ A	Water storage capacity and duration are not altered.
○ B	○ B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
○ C	○ C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. **Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)**
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	○ A	○ A	Majority of wetland with depressions able to pond water > 1 foot deep
	○ B	○ B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	○ C	○ C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	◉ D	◉ D	Depressions able to pond water < 3 inches deep

3b.	○ A	Evidence that maximum depth of inundation is greater than 2 feet
	○ B	Evidence that maximum depth of inundation is between 1 and 2 feet
	◉ C	Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)
Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a.
- ○ A Sandy soil
- ◉ B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
- ○ C Loamy or clayey soils not exhibiting redoximorphic features
- ○ D Loamy or clayey gleyed soil
- ○ E Histosol or histic epipedon

4b.
- ◉ A Soil ribbon < 1 inch
- ○ B Soil ribbon ≥ 1 inch

4c.
- ◉ A No peat or muck presence
- ○ B A peat or muck presence

5. Discharge into Wetland – opportunity metric
Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
○ A	◉ A	Little or no evidence of pollutants or discharges entering the assessment area
◉ B	○ B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
○ C	○ C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric (skip for non-riparian wetlands)
Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles <u>and</u> within the watershed draining to the assessment area (5M), and within 2 miles <u>and</u> within the watershed draining to the assessment area (2M). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

WS	5M	2M	
☐ A	☑ A	☑ A	≥ 10% impervious surfaces
☐ B	☐ B	☐ B	Confined animal operations (or other local, concentrated source of pollutants)
☐ C	☑ C	☑ C	≥ 20% coverage of pasture
☐ D	☐ D	☐ D	≥ 20% coverage of agricultural land (regularly plowed land)
☐ E	☐ E	☑ E	≥ 20% coverage of maintained grass/herb
☐ F	☐ F	☑ F	≥ 20% coverage of clear-cut land
☑ G	☐ G	☐ G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed <u>or</u> hydrologic alterations that prevent dainage <u>and/or</u> overbank flow from affectio the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)

7a. Is assessment area within 50 feet of a tributary or other open water?
◉ Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

7b. How much of the first 50 feet from the bank is weltand? (Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
- ○ A ≥ 50 feet
- ○ B From 30 to < 50 feet
- ◉ C From 15 to < 30 feet
- ○ D From 5 to < 15 feet
- ○ E < 5 feet <u>or</u> buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
○ ≤ 15-feet wide ◉ > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
○ Yes ◉ No

7e. Is tributary or other open water sheltered or exposed?
- ◉ Sheltered – adjacent open water with width < 2500 feet <u>and</u> no regular boat traffic.
- ○ Exposed – adjacent open water with width ≥ 2500 feet <u>or</u> regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)
Check a box in each column. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
○ A	○ A	≥ 100 feet
○ B	○ B	From 80 to < 100 feet
○ C	○ C	From 50 to < 80 feet
○ D	○ D	From 40 to < 50 feet
○ E	○ E	From 30 to < 40 feet
○ F	○ F	From 15 to < 30 feet
○ G	◉ G	From 5 to < 15 feet
○ H	○ H	< 5 feet

9. Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)
Answer for assessment area dominant landform.
- ( ) A Evidence of short-duration inundation (< 7 consecutive days)
- (•) B Evidence of saturation, without evidence of inundation
- ( ) C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)
Consider recent deposition only (no plant growth since deposition).
- (•) A Sediment deposition is not excessive, but at approximately natural levels.
- ( ) B Sediment deposition is excessive, but not overwhelming the wetland.
- ( ) C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric
Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select “K” for the FW column.

WT	WC	FW (if applicable)	
( ) A	( ) A	( ) A	≥ 500 acres
( ) B	( ) B	( ) B	From 100 to < 500 acres
( ) C	( ) C	( ) C	From 50 to < 100 acres
( ) D	( ) D	( ) D	From 25 to < 50 acres
( ) E	( ) E	( ) E	From 10 to < 25 acres
( ) F	( ) F	( ) F	From 5 to < 10 acres
( ) G	( ) G	( ) G	From 1 to < 5 acres
( ) H	( ) H	( ) H	From 0.5 to < 1 acre
( ) I	( ) I	( ) I	From 0.1 to < 0.5 acre
(•) J	(•) J	(•) J	From 0.01 to < 0.1 acre
( ) K	( ) K	( ) K	< 0.01 acre <u>or</u> assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)
- ( ) A Pocosin is the full extent (≥ 90%) of its natural landscape size.
- ( ) B Pocosin is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric
13a. **Check appropriate box(es) (a box may be checked in each column). Involves a GIS effort with field adjustment.** This evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, fields (pasture open and agriculture), or water > 300 feet wide.

Well	Loosely	
( ) A	( ) A	≥ 500 acres
( ) B	( ) B	From 100 to < 500 acres
( ) C	( ) C	From 50 to < 100 acres
(•) D	(•) D	From 10 to < 50 acres
( ) E	( ) E	< 10 acres
( ) F	( ) F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.
( ) Yes ( ) No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)
May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directiions? If the assessment area is clear-cut, select option "C."
- ( ) A 0
- (•) B 1 to 4
- ( ) C 5 to 8

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)
- ( ) A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
- (•) B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
- ( ) C Vegetation severely altered from reference in composition, <u>or</u> expected species are unnaturally absent (planted stands of non-characteristic species <u>or</u> at least one stratum inappropriately composed of a single species), <u>or</u> exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)
- (•) A Vegetation diversity is high and is composed primarily of native species (<10% cover of exotics).
- ( ) B Vegetation diversity is low or has > 10% to 50% cover of exotics.
- ( ) C Vegetation is dominated by exotic species (>50% cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?

(•) Yes ( ) No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.

( ) A ≥ 25% coverage of vegetation
( ) B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	(•) A	(•) A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	( ) B	( ) B	Canopy present, but opened more than natural gaps
	( ) C	( ) C	Canopy sparse or absent
Mid-Story	(•) A	(•) A	Dense mid-story/sapling layer
	( ) B	( ) B	Moderate density mid-story/sapling layer
	( ) C	( ) C	Mid-story/sapling layer sparse or absent
Shrub	( ) A	( ) A	Dense shrub layer
	(•) B	(•) B	Moderate density shrub layer
	( ) C	( ) C	Shrub layer sparse or absent
Herb	( ) A	( ) A	Dense herb layer
	(•) B	(•) B	Moderate density herb layer
	( ) C	( ) C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

( ) A Large snags (more than one) are visible (> 12-inches DBH, or large relative to species present and landscape stability).
(•) B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

( ) A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
( ) B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12-inch DBH.
(•) C Majority of canopy trees are < 6 inches DBH or no trees.

20. Large Woody Debris – wetland type condition metric (skip for all marshes)

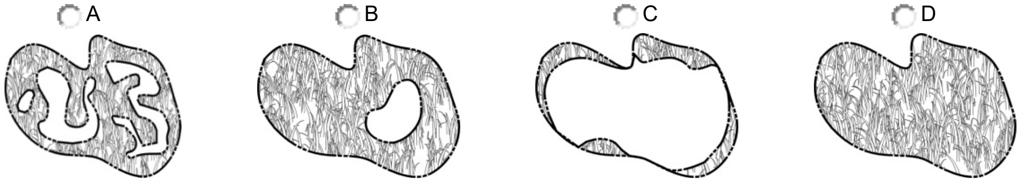
Include both natural debris and man-placed natural debris.

( ) A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
(•) B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

( ) A ( ) B ( ) C ( ) D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.

(•) A Overbank <u>and</u> overland flow are not severely altered in the assessment area.
( ) B Overbank flow is severely altered in the assessment area.
( ) C Overland flow is severely altered in the assessment area.
( ) D Both overbank <u>and</u> overland flow are severely altered in the assessment area.

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetlands G	Date	11-23-21
Wetland Type	Headwater Forest	Assessor Name/Organization	J.Hessler/WEI

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

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**HIGH**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Particulate Change	Condition	**HIGH**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Physical Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**NO**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

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

Overall Wetland Rating **HIGH**

APPENDIX 4
Supplementary Design Information

Table 1: E Prong Hunting Creek Reach 1

	Notation	Units	Designed Conditions			Notes
			min	max	design	
stream type			C4			
drainage area	DA	sq mi	1.53			
bankfull design discharge	Q_{bkf}	cfs	116.0			
Cross-Section Features						
bankfull cross-sectional area	A_{bkf}	SF	33.0			
side slopes	*H:V*	*ft/ft*	*4.0*			
channel bottom width	b_{bkf}	*feet*	*8.5*			
bankfull wetted perimeter	WP_{bkf}	*feet*	*25.0*			
bankfull hydraulic radius	r_{bkf}	*feet*	*1.3*			
mannings 'n'			*0.040*			
average velocity during bankfull event	v_{bkf}	fps	3.5			
width at bankfull	w_{bkf}	feet	24.5			
mean depth at bankfull	d_{bkf}	feet	1.3			
bankfull width to depth ratio	w_{bkf}/d_{bkf}		18			Design Parameters
maximum depth at bankfull	d_{max}	feet	1.6	2.0		
max depth ratio	d_{max}/d_{bkf}		1.2	1.5	1.5	Design Parameters
bank height ratio	BHR		1.0	1.0		Design Parameters
floodprone area width	w_{fpa}	feet	54	123		
entrenchment ratio	ER		2.2	5.0		
Slope						
valley slope	S_{valley}	feet/ foot	0.0075			
channel slope	$S_{channel}$	feet/ foot	0.0058	0.0068	0.0060	
Riffle Features						
riffle slope	S_{riffle}	feet/ foot	0.0069	0.0232		
riffle slope ratio	$S_{riffle}/S_{channel}$		1.2	3.4		Reference Range
Pool Features						
pool slope	S_{pool}	feet/ foot	0.0000	0.0027		
pool slope ratio	$S_{pool}l/S_{channel}$		0.00	0.40		Reference Range
pool-to-pool spacing	L_{p-p}	feet	39	152		
pool spacing ratio	L_{p-p}/w_{bkf}		1.6	6.2		Reference Range
maximum pool depth at bankfull	d_{pool}	feet	2.7	4.0		
pool depth ratio	d_{pool}/d_{bkf}		2.0	3.0		Reference Range
pool width at bankfull	w_{pool}	feet	24.5	39.2		
pool width ratio	w_{pool}/w_{bkf}		1.0	1.6		Reference Range
pool cross-sectional area at bankfull	A_{pool}	SF	36.3	82.5		
pool area ratio	A_{pool}/A_{bkf}		1.1	2.5		Design Parameters
Pattern Features						
sinuosity	K		1.10	1.30	1.20	Design Parameters
belt width	w_{blt}	feet	49	162		
meander width ratio	w_{blt}/w_{bkf}		2.0	6.6		Design Parameters
linear wavelength	LW	feet	147	294		
linear wavelength ratio	LW/w_{bkf}		6.0	12.0		Design Parameters
meander length	L_m	feet	184	368		
meander length ratio	L_m/w_{bkf}		7.5	15.0		Reference Range
radius of curvature	R_c	feet	49	74		
radius of curvature ratio	R_c/ w_{bkf}		2.0	3.0		Design Parameters

Table 1: East Prong Hunting Creek Reach 2

	Notation	Units	Designed Conditions			Notes
			min	max	design	
stream type			C4			
drainage area	DA	sq mi	1.99			
bankfull design discharge	Q_{bkf}	cfs	129.0			
Cross-Section Features						
bankfull cross-sectional area	A_{bkf}	SF	33.0			
side slopes	*H:V*	*ft/ft*	*4.0*			
channel bottom width	b_{bkf}	*feet*	*8.5*			
bankfull wetted perimeter	WP_{bkf}	*feet*	*25.0*			
bankfull hydraulic radius	r_{bkf}	*feet*	*1.3*			
mannings 'n'			*0.040*			
average velocity during bankfull event	v_{bkf}	fps	4.1			
width at bankfull	w_{bkf}	feet	24.5			
mean depth at bankfull	d_{bkf}	feet	1.3			
bankfull width to depth ratio	w_{bkf}/d_{bkf}		18			Design Parameters
maximum depth at bankfull	d_{max}	feet	1.6	2.0		
max depth ratio	d_{max}/d_{bkf}		1.2	1.5	1.5	Design Parameters
bank height ratio	BHR		1.0	1.0		Design Parameters
floodprone area width	w_{fpa}	feet	54	123		
entrenchment ratio	ER		2.2	5.0		
Slope						
valley slope	S_{valley}	feet/ foot	0.0105			
channel slope	$S_{channel}$	feet/ foot	0.0081	0.0095	0.0085	
Riffle Features						
riffle slope	S_{riffle}	feet/ foot	0.0097	0.0325		
riffle slope ratio	$S_{riffle}/S_{channel}$		1.2	3.4		Reference Range
Pool Features						
pool slope	S_{pool}	feet/ foot	0.0000	0.0038		
pool slope ratio	$S_{pool}l/S_{channel}$		0.00	0.40		Reference Range
pool-to-pool spacing	L_{p-p}	feet	39	152		
pool spacing ratio	L_{p-p}/w_{bkf}		1.6	6.2		Reference Range
maximum pool depth at bankfull	d_{pool}	feet	2.7	4.0		
pool depth ratio	d_{pool}/d_{bkf}		2.0	3.0		Reference Range
pool width at bankfull	w_{pool}	feet	24.5	39.2		
pool width ratio	w_{pool}/w_{bkf}		1.0	1.6		Reference Range
pool cross-sectional area at bankfull	A_{pool}	SF	36.3	82.5		
pool area ratio	A_{pool}/A_{bkf}		1.1	2.5		Design Parameters
Pattern Features						
sinuosity	K		1.10	1.30	1.20	Design Parameters
belt width	w_{blt}	feet	49	162		
meander width ratio	w_{blt}/w_{bkf}		2.0	6.6		Design Parameters
linear wavelength	LW	feet	147	294		
linear wavelength ratio	LW/w_{bkf}		6.0	12.0		Design Parameters
meander length	L_m	feet	184	368		
meander length ratio	L_m/w_{bkf}		7.5	15.0		Reference Range
radius of curvature	R_c	feet	49	74		
radius of curvature ratio	R_c/w_{bkf}		2.0	3.0		Design Parameters

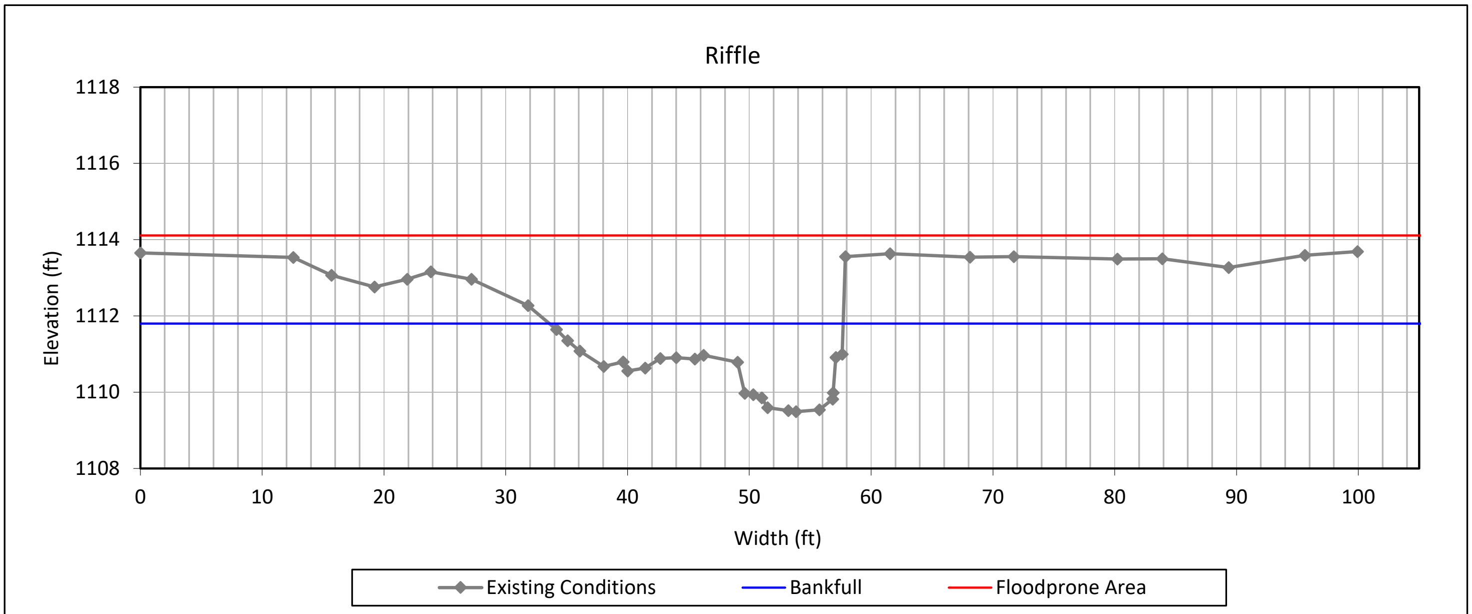
Table 1: UT1 Reach 2

	Notation	Units	Designed Conditions			Notes
			min	max	design	
stream type			C4			
drainage area	DA	sq mi	0.21			
bankfull design discharge	Q_{bkf}	cfs	29.0			
Cross-Section Features						
bankfull cross-sectional area	A_{bkf}	SF	8.0			
side slopes	*H:V*	*ft/ft*	*3.0*			
channel bottom width	b_{bkf}	*feet*	*5.0*			
bankfull wetted perimeter	WP_{bkf}	*feet*	*11.3*			
bankfull hydraulic radius	r_{bkf}	*feet*	*0.7*			
mannings 'n'			*0.040*			
average velocity during bankfull event	v_{bkf}	fps	3.5			
width at bankfull	w_{bkf}	feet	11.0			
mean depth at bankfull	d_{bkf}	feet	0.7			
bankfull width to depth ratio	w_{bkf}/d_{bkf}		15			Design Parameters
maximum depth at bankfull	d_{max}	feet	0.9	1.1		
max depth ratio	d_{max}/d_{bkf}		1.2	1.5	1.5	Design Parameters
bank height ratio	BHR		1.0	1.0		Design Parameters
floodprone area width	w_{fpa}	feet	24	55		
entrenchment ratio	ER		2.2	5.0		
Slope						
valley slope	S_{valley}	feet/ foot	0.0168			
channel slope	$S_{channel}$	feet/ foot	0.0129	0.0153	0.0140	
Riffle Features						
riffle slope	S_{riffle}	feet/ foot	0.0155	0.0519		
riffle slope ratio	$S_{riffle}/S_{channel}$		1.2	3.4		Reference Range
Pool Features						
pool slope	S_{pool}	feet/ foot	0.0000	0.0038		
pool slope ratio	$S_{pool}l/S_{channel}$		0.00	0.25		Reference Range
pool-to-pool spacing	L_{p-p}	feet	18	68		
pool spacing ratio	L_{p-p}/w_{bkf}		1.6	6.2		Reference Range
maximum pool depth at bankfull	d_{pool}	feet	1.5	2.2		
pool depth ratio	d_{pool}/d_{bkf}		2.0	3.0		Reference Range
pool width at bankfull	w_{pool}	feet	11.0	17.6		
pool width ratio	w_{pool}/w_{bkf}		1.0	1.6		Reference Range
pool cross-sectional area at bankfull	A_{pool}	SF	8.8	20.0		
pool area ratio	A_{pool}/A_{bkf}		1.1	2.5		Design Parameters
Pattern Features						
sinuosity	K		1.10	1.30	1.20	Design Parameters
belt width	w_{blt}	feet	22	73		
meander width ratio	w_{blt}/w_{bkf}		2.0	6.6		Design Parameters
linear wavelength	LW	feet	66	132		
linear wavelength ratio	LW/w_{bkf}		6.0	12.0		Design Parameters
meander length	L_m	feet	83	165		
meander length ratio	L_m/w_{bkf}		7.5	15.0		Reference Range
radius of curvature	R_c	feet	22	33		
radius of curvature ratio	R_c/ w_{bkf}		2.0	3.0		Design Parameters

Table 1: UT2

	Notation	Units	Designed Conditions			Notes
			min	max	design	
stream type			C4			
drainage area	DA	sq mi	0.24			
bankfull design discharge	Q_{bkf}	cfs	33.0			
Cross-Section Features						
bankfull cross-sectional area	A_{bkf}	SF	8.0			
side slopes	*H:V*	*ft/ft*	*3.0*			
channel bottom width	b_{bkf}	*feet*	*5.0*			
bankfull wetted perimeter	WP_{bkf}	*feet*	*11.3*			
bankfull hydraulic radius	r_{bkf}	*feet*	*0.7*			
mannings 'n'			*0.040*			
average velocity during bankfull event	v_{bkf}	fps	4.0			
width at bankfull	w_{bkf}	feet	11.0			
mean depth at bankfull	d_{bkf}	feet	0.7			
bankfull width to depth ratio	w_{bkf}/d_{bkf}		15			Design Parameters
maximum depth at bankfull	d_{max}	feet	0.9	1.1		
max depth ratio	d_{max}/d_{bkf}		1.2	1.5	1.5	Design Parameters
bank height ratio	BHR		1.0	1.0		Design Parameters
floodprone area width	w_{fpa}	feet	24	55		
entrenchment ratio	ER		2.2	5.0		
Slope						
valley slope	S_{valley}	feet/ foot	0.0230			
channel slope	$S_{channel}$	feet/ foot	0.0177	0.0209	0.0185	
Riffle Features						
riffle slope	S_{riffle}	feet/ foot	0.0212	0.0711		
riffle slope ratio	$S_{riffle}/S_{channel}$		1.2	3.4		Reference Range
Pool Features						
pool slope	S_{pool}	feet/ foot	0.0000	0.0052		
pool slope ratio	$S_{pool}l/S_{channel}$		0.00	0.25		Reference Range
pool-to-pool spacing	L_{p-p}	feet	18	68		
pool spacing ratio	L_{p-p}/W_{bkf}		1.6	6.2		Reference Range
maximum pool depth at bankfull	d_{pool}	feet	1.5	2.2		
pool depth ratio	d_{pool}/d_{bkf}		2.0	3.0		Reference Range
pool width at bankfull	w_{pool}	feet	11.0	17.6		
pool width ratio	w_{pool}/w_{bkf}		1.0	1.6		Reference Range
pool cross-sectional area at bankfull	A_{pool}	SF	8.8	20.0		
pool area ratio	A_{pool}/A_{bkf}		1.1	2.5		Design Parameters
Pattern Features						
sinuosity	K		1.10	1.30	1.20	Design Parameters
belt width	w_{blt}	feet	22	73		
meander width ratio	w_{blt}/w_{bkf}		2.0	6.6		Design Parameters
linear wavelength	LW	feet	66	132		
linear wavelength ratio	LW/w_{bkf}		6.0	12.0		Design Parameters
meander length	L_m	feet	83	165		
meander length ratio	L_m/w_{bkf}		7.5	15.0		Reference Range
radius of curvature	R_c	feet	22	33		
radius of curvature ratio	R_c/ w_{bkf}		2.0	3.0		Design Parameters

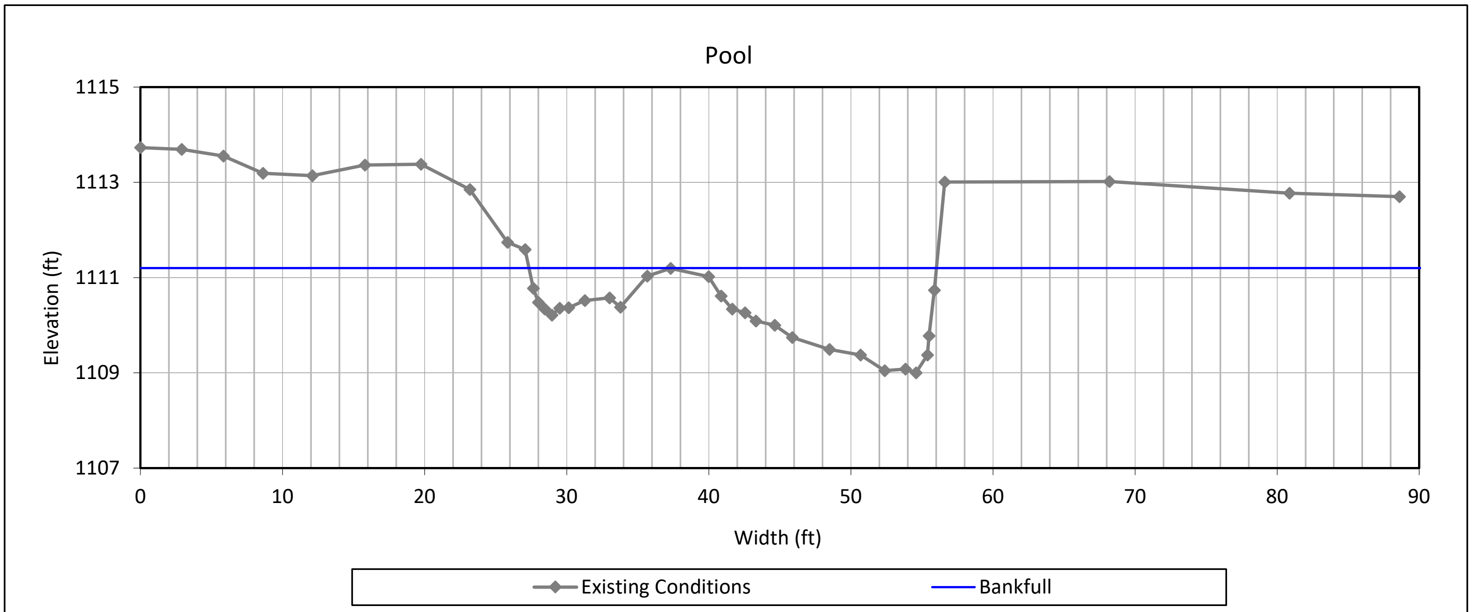
Cross Section 1, EPHC Reach 1



Bankfull Dimensions	
30.8	x-section area (ft.sq.)
23.5	width (ft)
1.3	mean depth (ft)
2.3	max depth (ft)
25.9	wetted perimeter (ft)
1.2	hyd radi (ft)
18.0	width-depth ratio
225.0	W flood prone area (ft)
9.6	entrenchment ratio
1.6	low bank height ratio

View Downstream

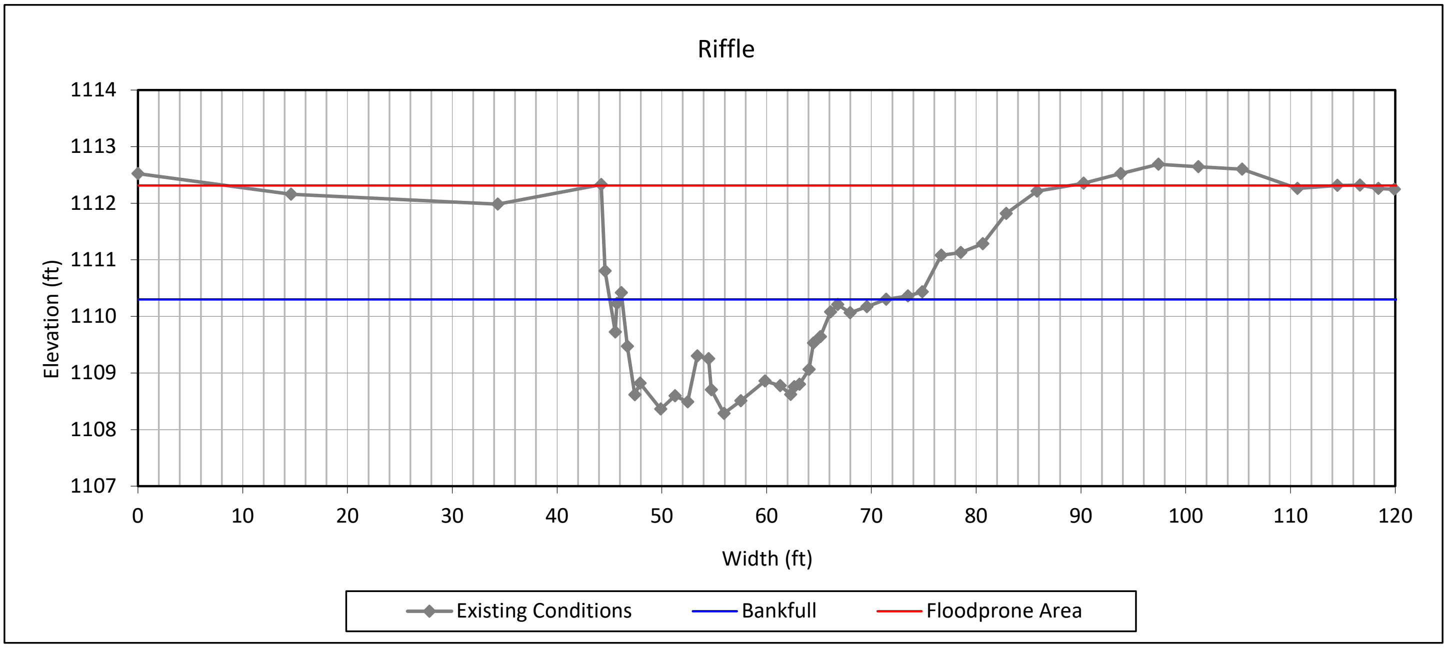
Cross Section 2, EPHC Reach 2



Bankfull Dimensions	
29.9	x-section area (ft.sq.)
28.5	width (ft)
1.0	mean depth (ft)
2.2	max depth (ft)
30.3	wetted perimeter (ft)
1.0	hyd radi (ft)
27.2	width-depth ratio
40.0	W flood prone area (ft)
1.4	entrenchment ratio
1.8	low bank height ratio

View Downstream

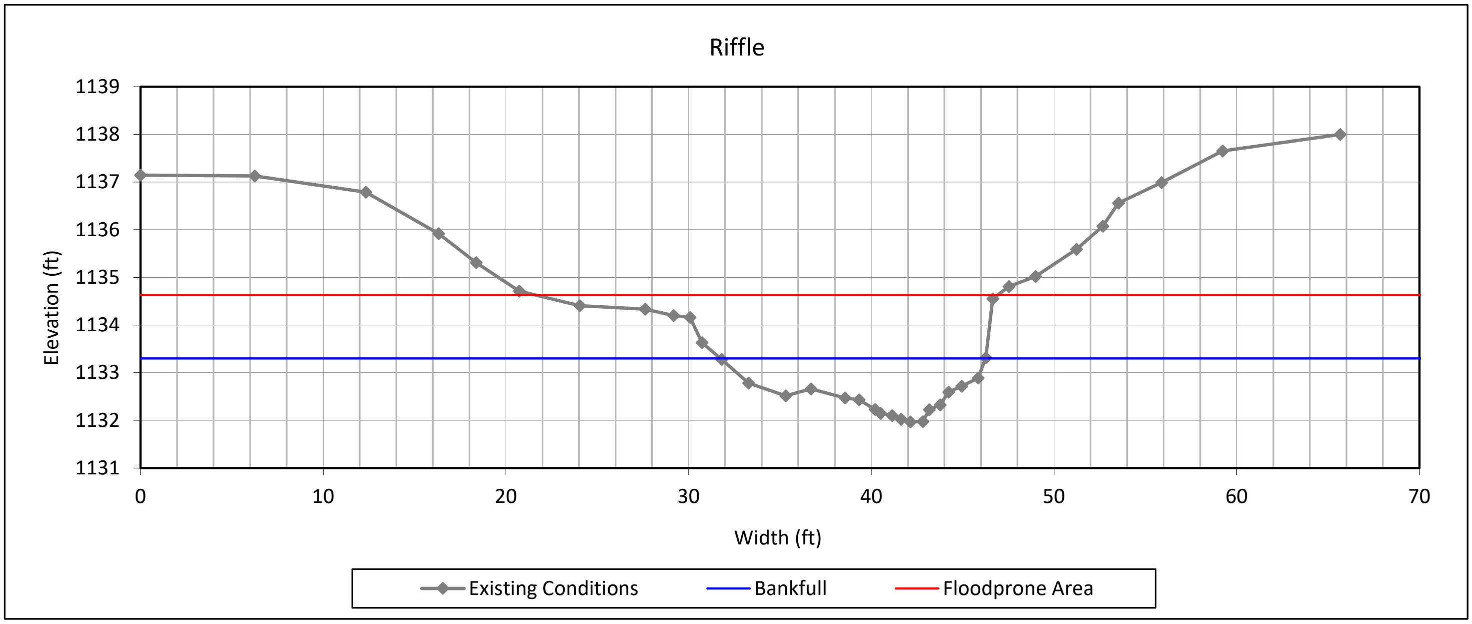
Cross Section 3, EPHC Reach 2



Bankfull Dimensions	
29.1	x-section area (ft.sq.)
20.1	width (ft)
1.5	mean depth (ft)
2.0	max depth (ft)
21.8	wetted perimeter (ft)
1.3	hyd radi (ft)
13.8	width-depth ratio
46.0	W flood prone area (ft)
2.3	entrenchment ratio
2.0	low bank height ratio

View Downstream

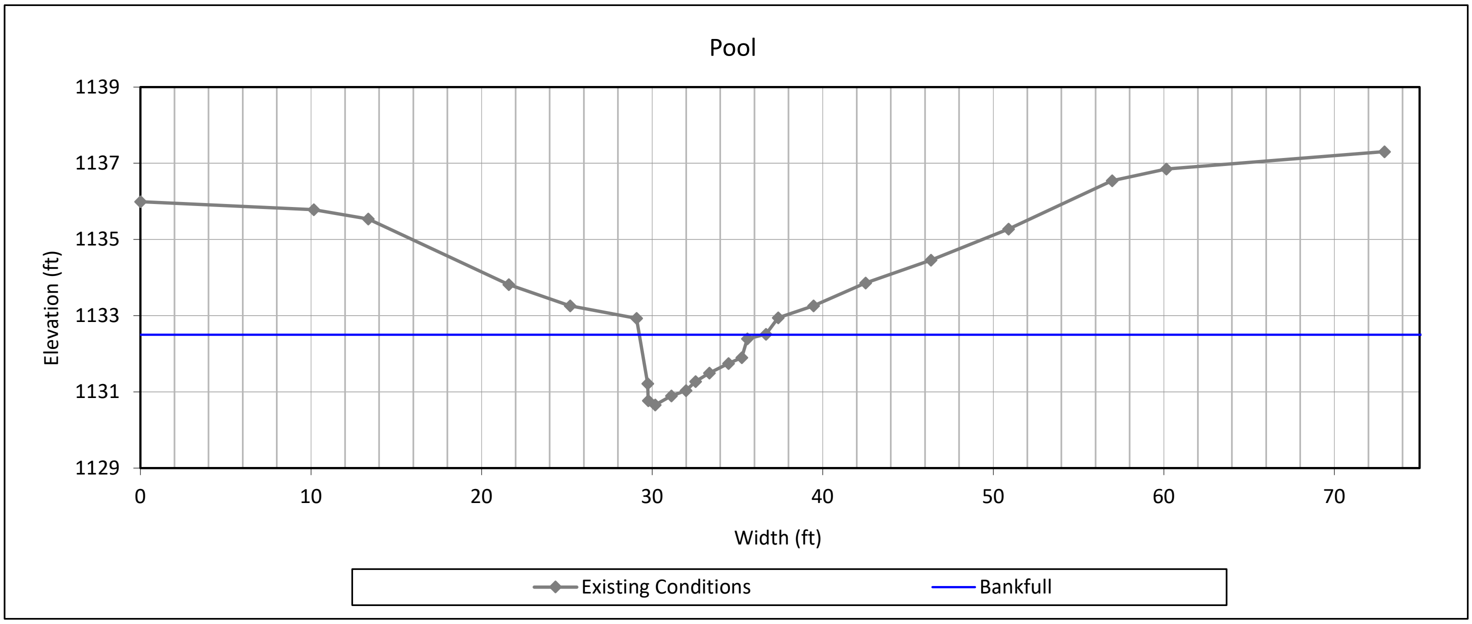
Cross Section 4, UT2



Bankfull Dimensions	
11.3	x-section area (ft.sq.)
14.5	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
15.0	wetted perimeter (ft)
0.7	hyd radi (ft)
18.7	width-depth ratio
1.6	low bank height ratio

View Downstream

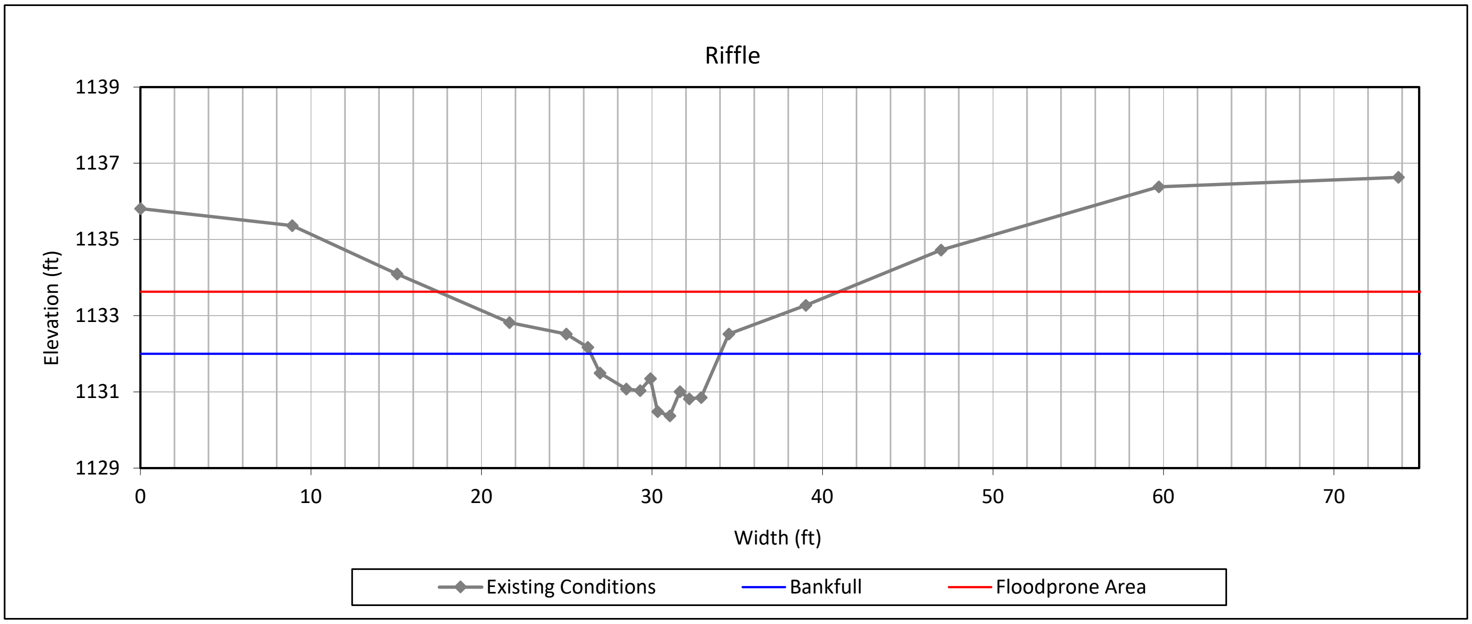
Cross Section 5, UT2



Bankfull Dimensions	
7.4	x-section area (ft.sq.)
7.3	width (ft)
1.0	mean depth (ft)
1.8	max depth (ft)
9.1	wetted perimeter (ft)
0.8	hyd radi (ft)
7.2	width-depth ratio
22.5	W flood prone area (ft)
3.1	entrenchment ratio
1.2	low bank height ratio

View Downstream

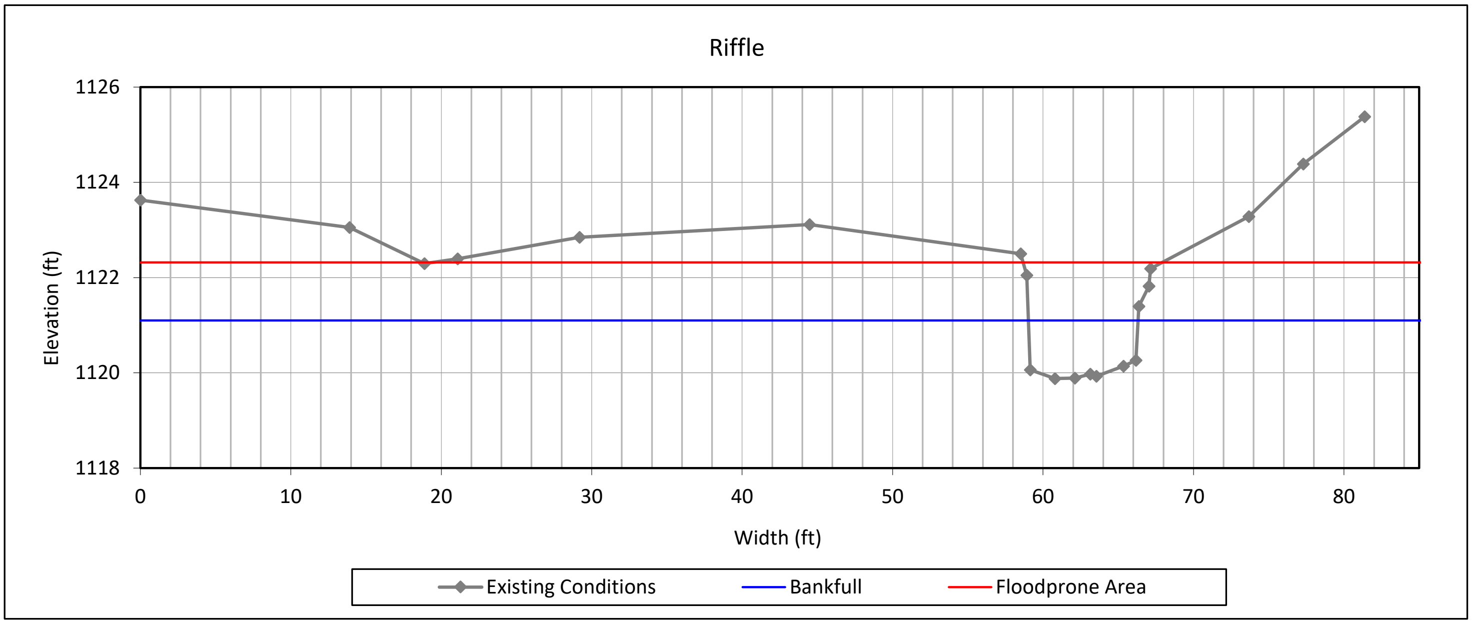
Cross Section 6, UT2



Bankfull Dimensions	
6.9	x-section area (ft.sq.)
7.6	width (ft)
0.9	mean depth (ft)
1.6	max depth (ft)
9.3	wetted perimeter (ft)
0.7	hyd radi (ft)
8.4	width-depth ratio
23.5	W flood prone area (ft)
3.1	entrenchment ratio
1.3	low bank height ratio

View Downstream

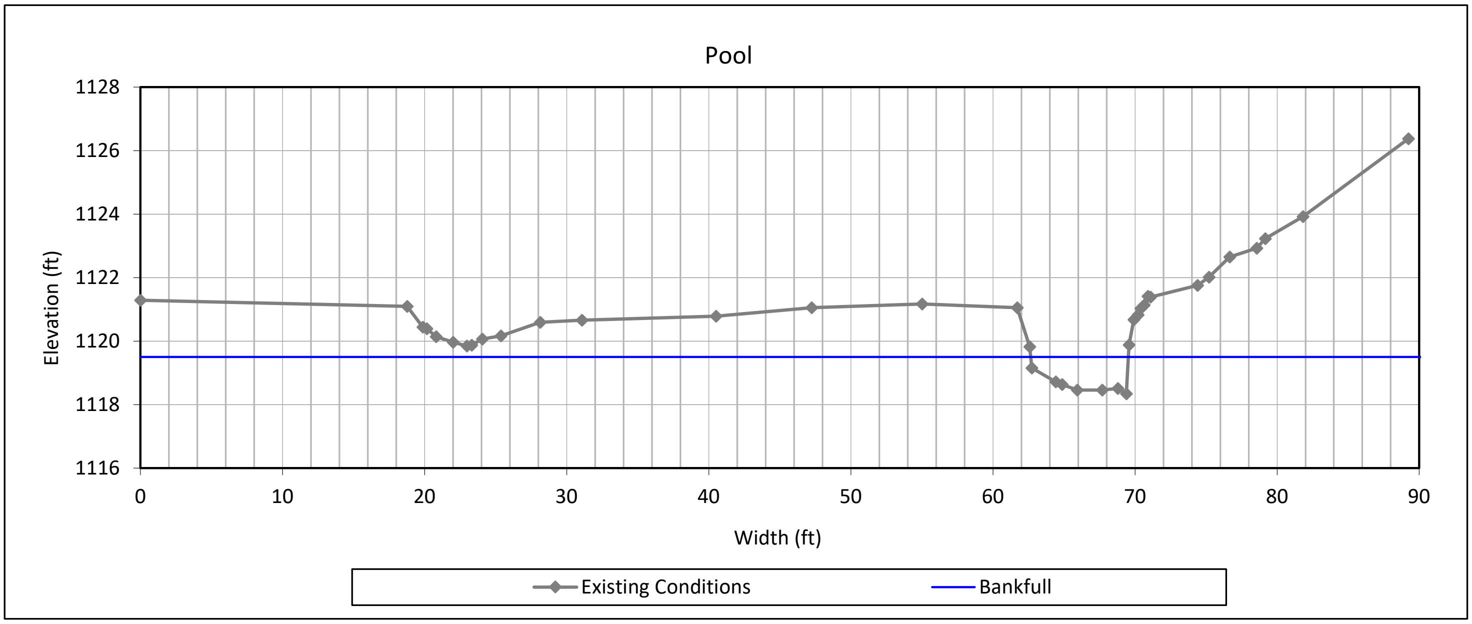
Cross Section 7, UT1 Reach 2



Bankfull Dimensions	
7.9	x-section area (ft.sq.)
7.3	width (ft)
1.1	mean depth (ft)
1.2	max depth (ft)
9.0	wetted perimeter (ft)
0.9	hyd radi (ft)
6.7	width-depth ratio
8.0	W flood prone area (ft)
1.1	entrenchment ratio
1.9	low bank height ratio

View Downstream

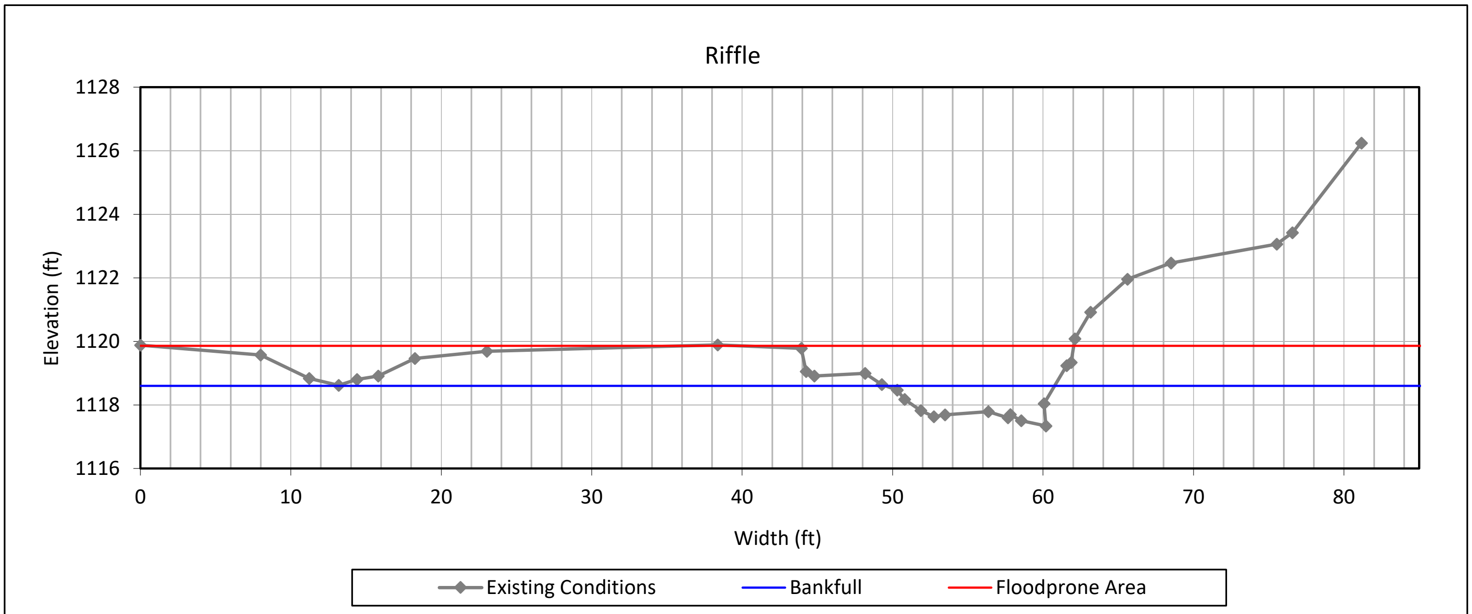
Cross Section 8, UT1 Reach 2



Bankfull Dimensions	
6.0	x-section area (ft.sq.)
6.9	width (ft)
0.9	mean depth (ft)
1.2	max depth (ft)
8.3	wetted perimeter (ft)
0.7	hyd radi (ft)
7.8	width-depth ratio
8.0	W flood prone area (ft)
1.2	entrenchment ratio
2.4	low bank height ratio

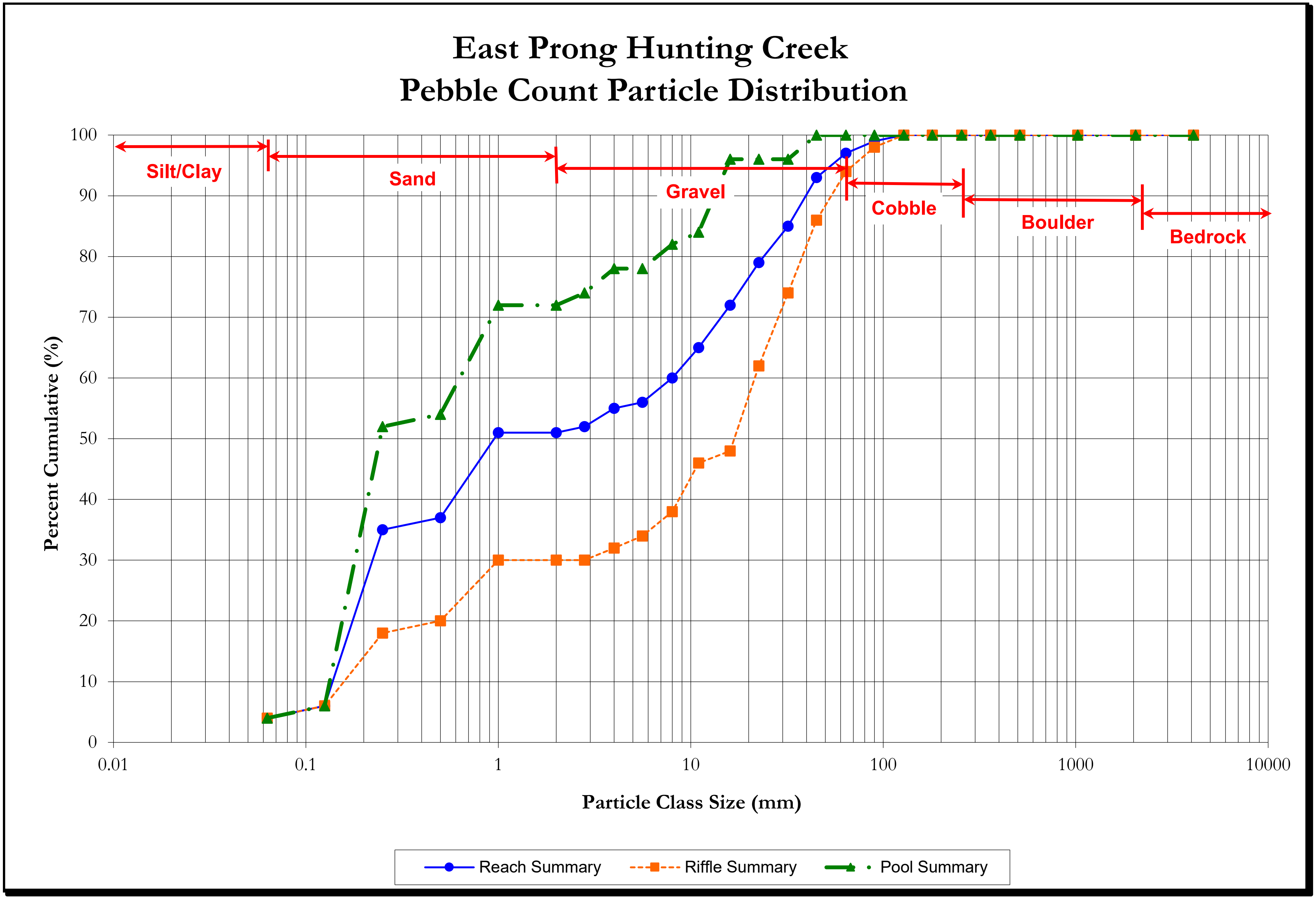
View Downstream

Cross Section 9, UT1 Reach 2

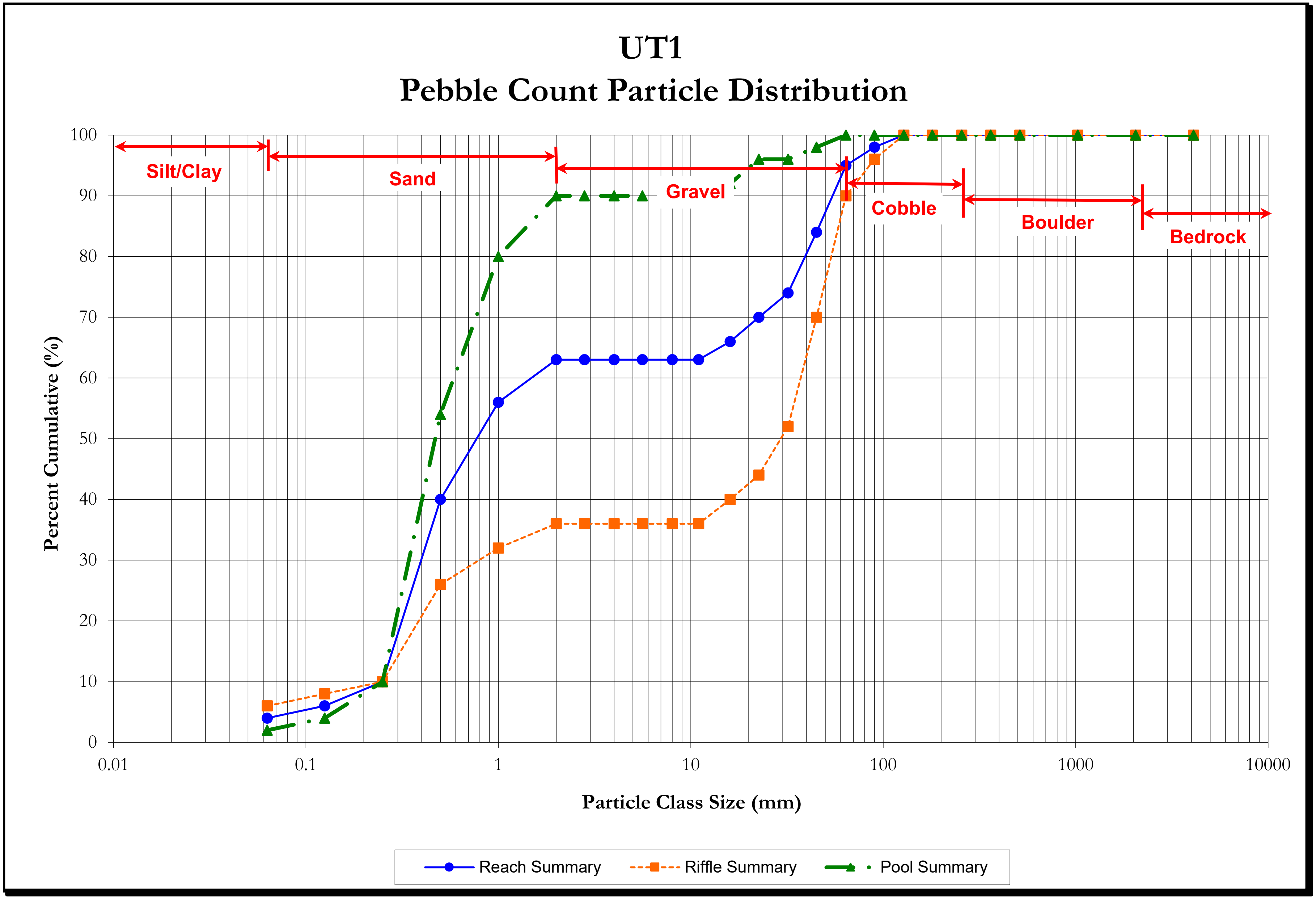


Bankfull Dimensions	
8.8	x-section area (ft.sq.)
11.3	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
12.5	wetted perimeter (ft)
0.7	hyd radi (ft)
14.3	width-depth ratio
22.0	W flood prone area (ft)
2.0	entrenchment ratio
1.6	low bank height ratio

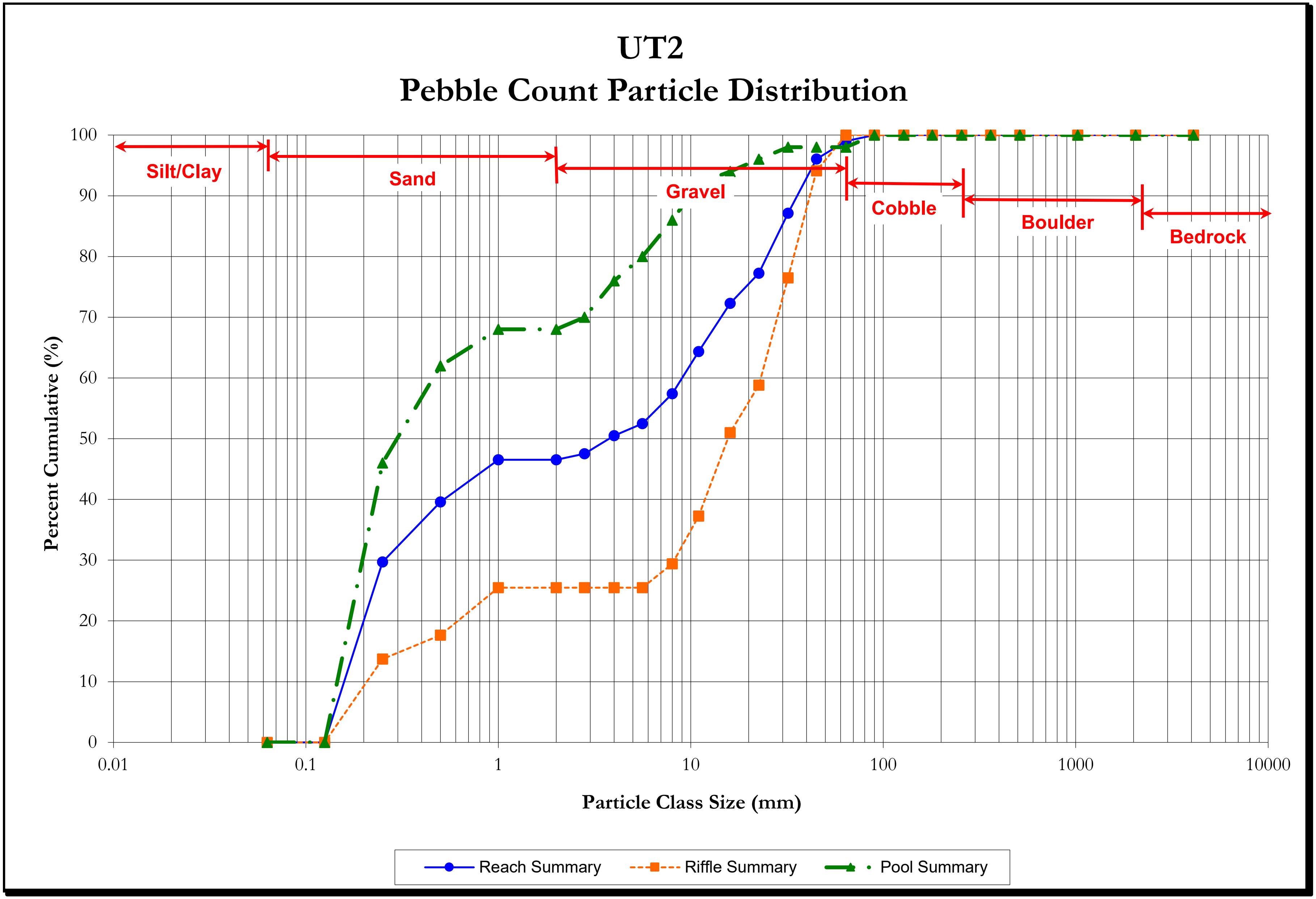
View Downstream



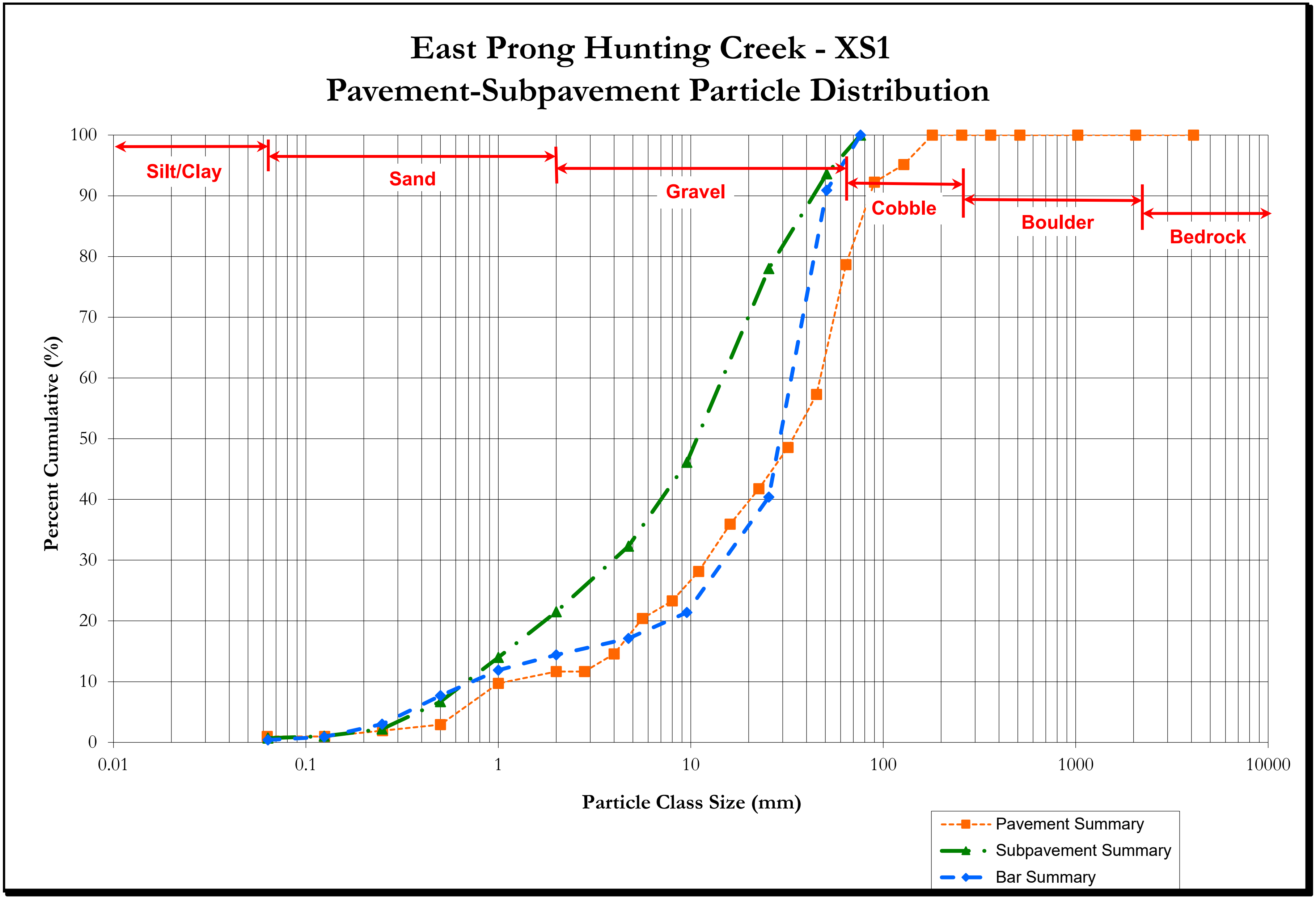
East Prong Hunting Creek
Pebble Count Particle Distribution
Silt/Clay
Sand
Gravel
Cobble
Boulder
Bedrock
Percent Cumulative (%)
Particle Class Size (mm)
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
Reach Summary
Riffle Summary
Pool Summary



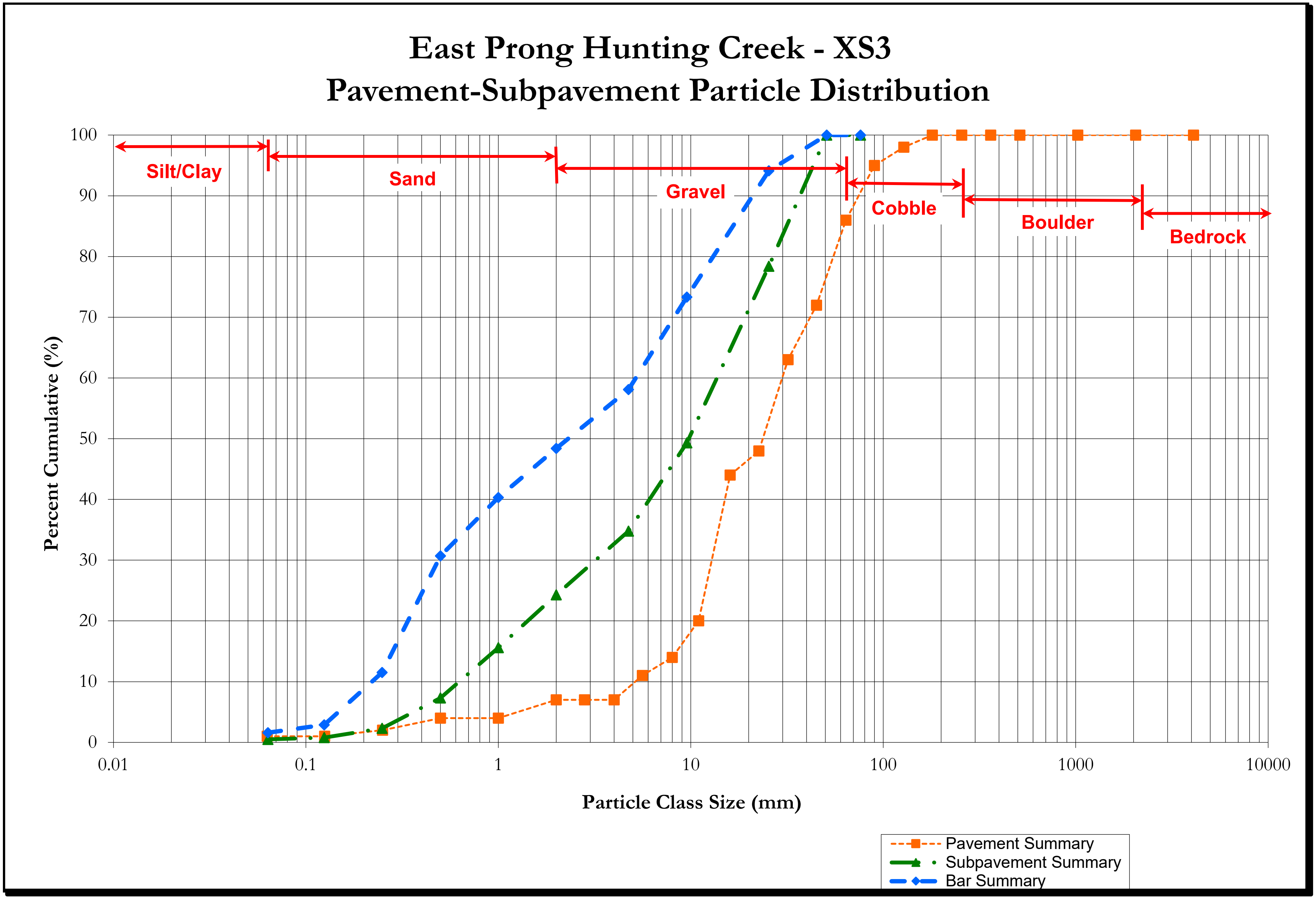
UT1
Pebble Count Particle Distribution
Silt/Clay
Sand
Gravel
Cobble
Boulder
Bedrock
Percent Cumulative (%)
Particle Class Size (mm)
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
Reach Summary
Riffle Summary
Pool Summary

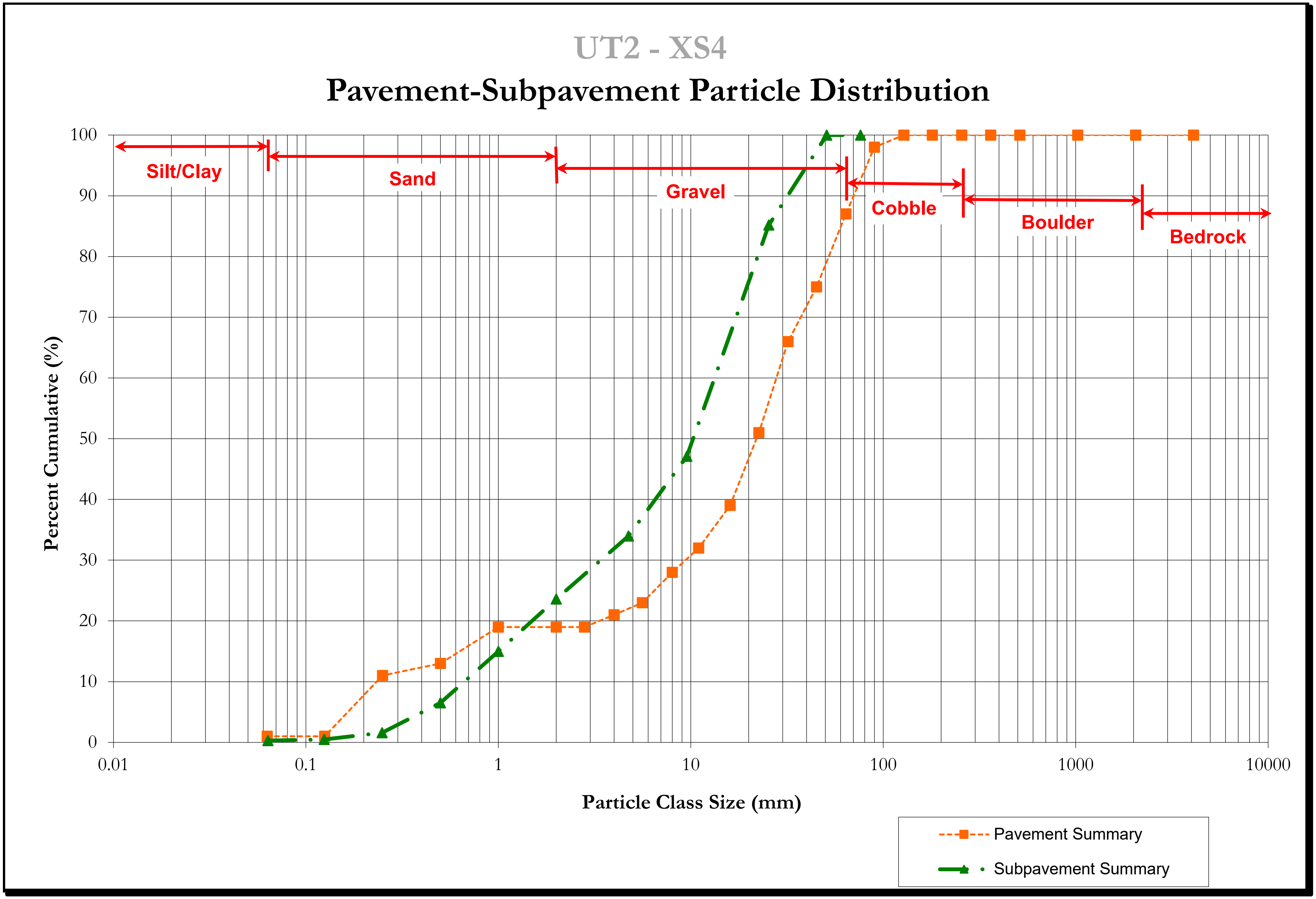


UT2
Pebble Count Particle Distribution
Percent Cumulative (%)
Particle Class Size (mm)
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
Silt/Clay
Sand
Gravel
Cobble
Boulder
Bedrock
Reach Summary
Riffle Summary
Pool Summary

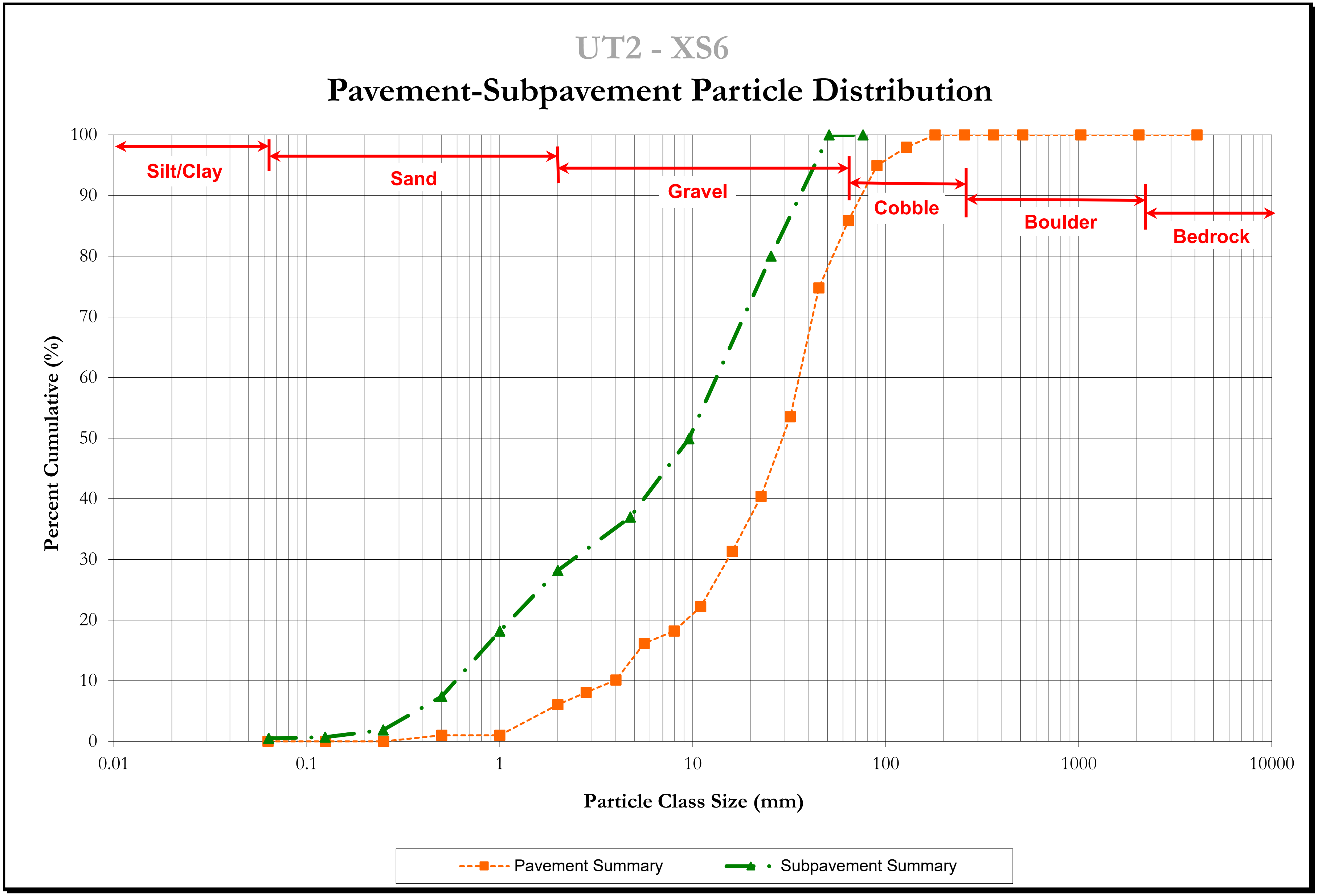


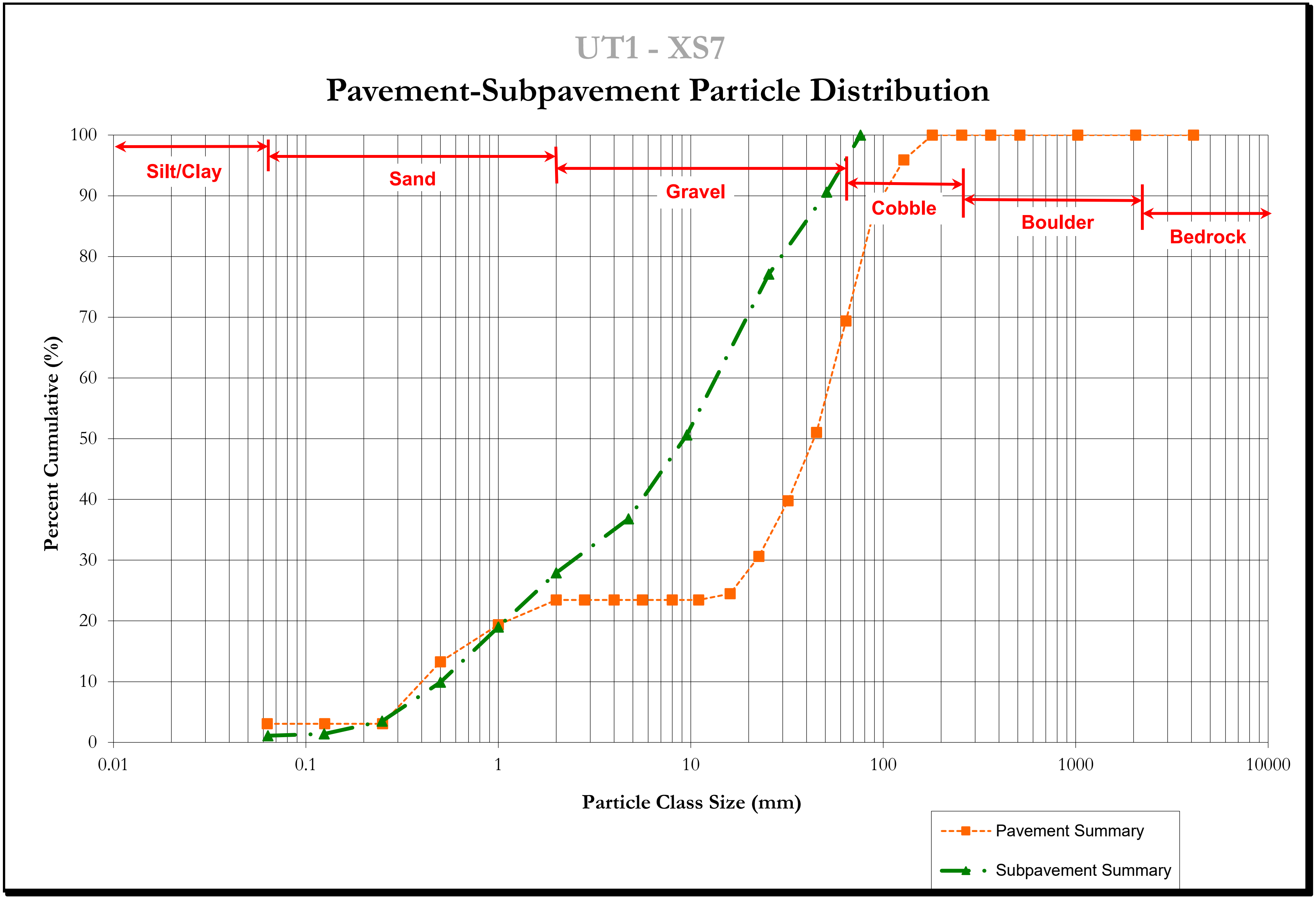
East Prong Hunting Creek - XS1
Pavement-Subpavement Particle Distribution
Percent Cumulative (%)
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Particle Class Size (mm)
Silt/Clay
Sand
Gravel
Cobble
Boulder
Bedrock
Pavement Summary
Subpavement Summary
Bar Summary


East Prong Hunting Creek - XS3
Pavement-Subpavement Particle Distribution
Percent Cumulative (%)
Particle Class Size (mm)
Silt/Clay
Sand
Gravel
Cobble
Boulder
Bedrock
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
Pavement Summary
Subpavement Summary
Bar Summary

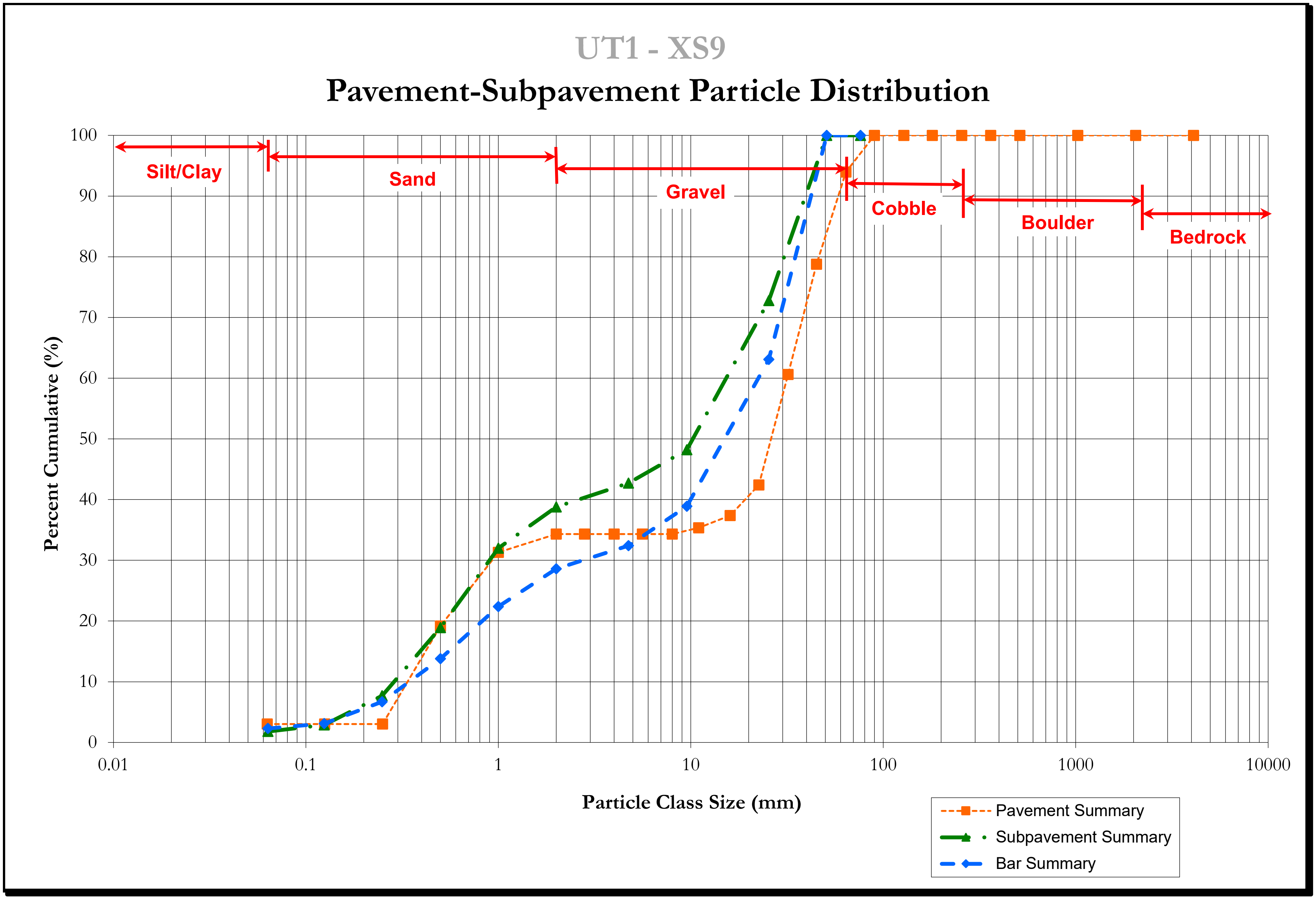


UT2 - XS4
Pavement-Subpavement Particle Distribution
Percent Cumulative (%)
Particle Class Size (mm)
Silt/Clay
Sand
Gravel
Cobble
Boulder
Bedrock
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
Pavement Summary
Subpavement Summary


UT2 - XS6
Pavement-Subpavement Particle Distribution
Silt/Clay
Sand
Gravel
Cobble
Boulder
Bedrock
Percent Cumulative (%)
Particle Class Size (mm)
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
Pavement Summary
Subpavement Summary



UT1 - XS7
Pavement-Subpavement Particle Distribution
Percent Cumulative (%)
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
Particle Class Size (mm)
Silt/Clay
Sand
Gravel
Cobble
Boulder
Bedrock
Pavement Summary
Subpavement Summary


UT1 - XS9
Pavement-Subpavement Particle Distribution
Silt/Clay
Sand
Gravel
Cobble
Boulder
Bedrock
Percent Cumulative (%)
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
Particle Class Size (mm)
Pavement Summary
Subpavement Summary
Bar Summary

N

PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	**Data Collected By:**	NBH / ST
Location:	E. Prong - Hunting Creek XS 1	**Data Collected On:**	7/24/20
Job #:		**Reach:**	2
Date:	7/24/20	**Cross Section #:**	XS 1

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle
SILT/CLAY	Silt/Clay	0.000	0.062	I
SAND	Very fine	0.062	0.125	
	Fine	0.125	0.250	I
	Medium	0.250	0.500	I
	Coarse	0.5	1.0	~~IIII~~ II
	Very Coarse	1.0	2.0	II
	Very Fine	2.0	2.8	
	Very Fine	2.8	4.0	III
	Fine	4.0	5.7	~~IIII~~ I
	Fine	5.7	8.0	III
	Medium	8.0	11.3	~~IIII~~
	Medium	11.3	16.0	~~IIII~~ III
	Coarse	16.0	22.6	~~IIII~~ I
	Coarse	22.6	32	~~IIII~~ II
	Very Coarse	32	45	~~IIII~~ IIII
	Very Coarse	45	64	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ II
COBBLE	Small	64	90	~~IIII~~ ~~IIII~~ IIII
	Small	90	128	III
	Large	128	180	~~IIII~~
	Large	180	256	
	Small	256	362	
	Small	362	512	
	Medium	512	1024	
	Large/Very Large	1024	2048	
BEDROCK	Bedrock	2048	>2048	
			Total:	

Largest Particle (mm): 150

Total

~~IIII~~ ~~IIII~~

~~IIII~~ ~~IIII~~

~~IIII~~ ~~IIII~~ (50)

~~IIII~~ ~~IIII~~

~~IIII~~ ~~IIII~~

~~IIII~~ ~~IIII~~

~~IIII~~ ~~IIII~~

~~IIII~~ ~~IIII~~

~~IIII~~ ~~IIII~~

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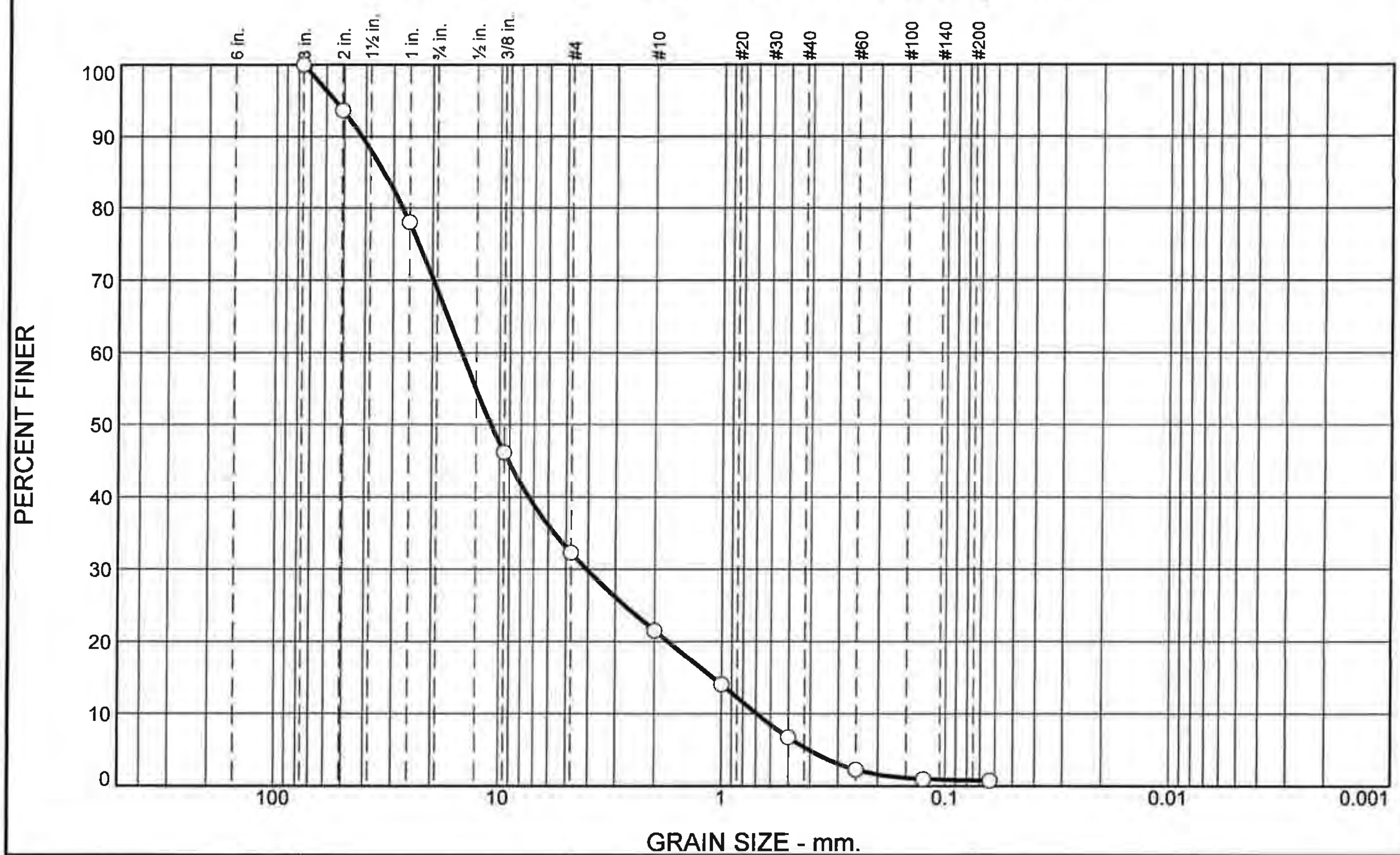
Largest particle pavement 90mm

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	31.2	36.5	10.8	16.2	4.5	0.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	93.6		
1	78.0		
0.375	46.1		
#4	32.3		
#10	21.5		
#18	14.0		
#35	6.7		
#60	2.2		
#120	1.0		
#230	0.7		

* (no specification provided)

Material Description

XS-1 Subpavement, CDB, NBH, SNT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 41.7027 D_{85}= 33.0813 D_{60}= 14.7465
D_{50}= 10.8829 D_{30}= 4.0487 D_{15}= 1.0925
D_{10}= 0.6940 C_u= 21.25 C_c= 1.60

Classification

USCS= GW AASHTO=

Remarks

Total Weight: 7631.86g
Secondary Axis: 3.30", 2.70"

Location: Stream E: Prong Hunting Creek

Date: 08-21-20

Summit Engineering

Ft. Mill, South Carolina

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project No: 6565.L0002 **Figure**

Tested By: JC **Checked By:** MH

GRAIN SIZE DISTRIBUTION TEST DATA

8/28/2020

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project Number: 6565.L0002
Location: Stream E: Prong Hunting Creek
Material Description: XS-1 Subpavement, CDB, NBH, SNT
Date: 08-21-20
USCS Classification: GW
Testing Remarks: Total Weight: 7631.86g
Secondary Axis: 3.30", 2.70"

Tested by: JC **Checked by:** MH

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
7631.86	0.00	0.00	3	0.00	100.0
			2	486.10	93.6
			1	1676.00	78.0
			0.375	4110.90	46.1
			#4	5168.20	32.3
			#10	5989.20	21.5
			#18	6561.10	14.0
			#35	7119.20	6.7
			#60	7460.40	2.2
			#120	7558.90	1.0
			#230	7575.60	0.7

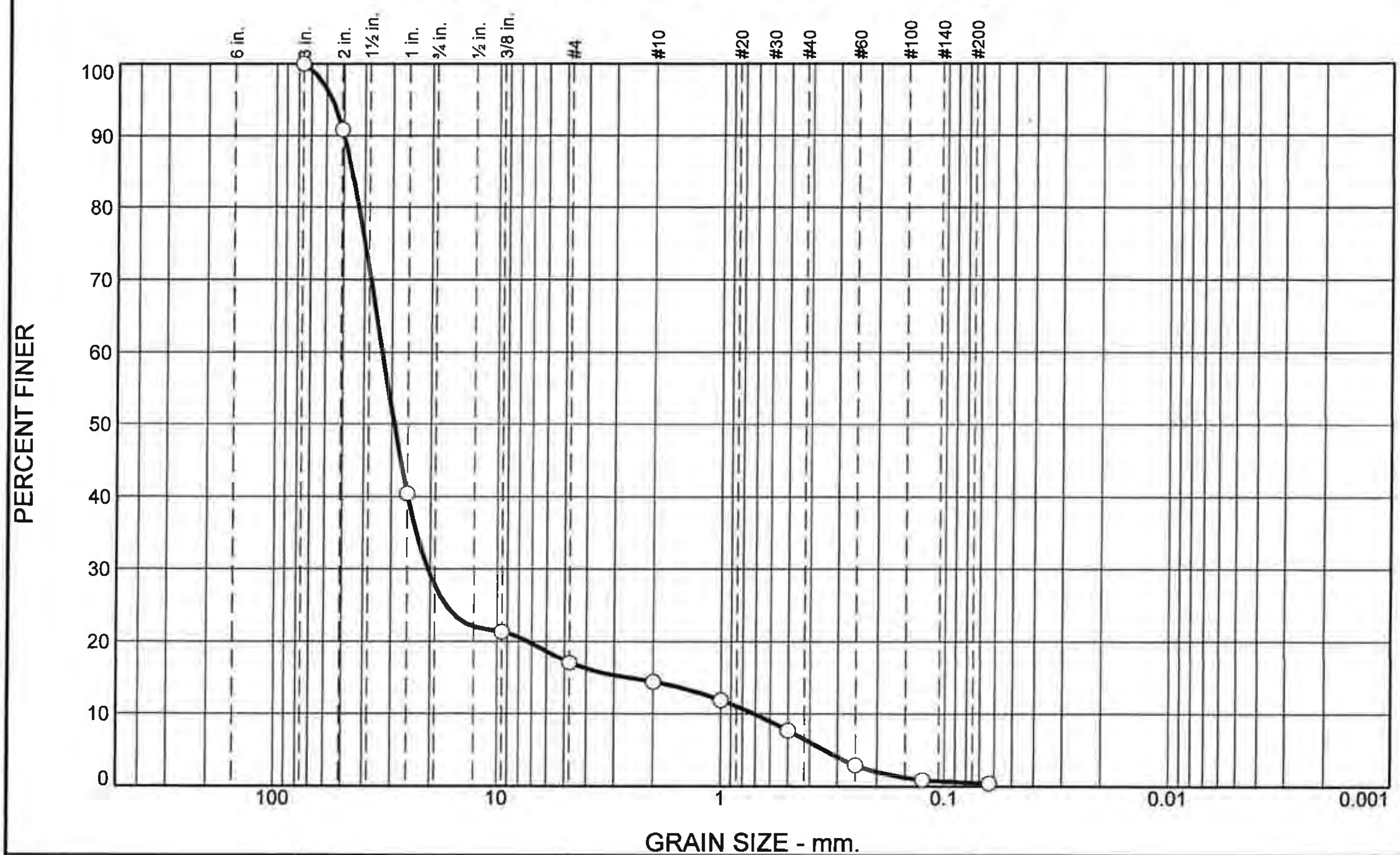
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	31.2	36.5	67.7	10.8	16.2	4.5	31.5			0.8

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.4063	0.6940	1.0925	1.7380	4.0487	7.3799	10.8829	14.7465	27.2104	33.0813	41.7027	55.1207

Fineness Modulus	C_u	C_c
6.13	21.25	1.60

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	72.2	10.7	2.7	7.9	6.0	0.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	90.9		
1	40.4		
0.375	21.4		
#4	17.1		
#10	14.4		
#18	11.9		
#35	7.7		
#60	3.0		
#120	0.9		
#230	0.4		

* (no specification provided)

Material Description

XS-1 Bar Sample, CDB, NBH, SNT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 49.8790 D_{85}= 45.7033 D_{60}= 33.0277
D_{50}= 29.1436 D_{30}= 20.4362 D_{15}= 2.6416
D_{10}= 0.7119 C_u= 46.39 C_c= 17.76

Classification

USCS= GP AASHTO=

Remarks

Total Weight: 5771.89g
Secondary Axis: 3.41", 3.06"

Location: East Prong Hunting Creek

Date: 08-21-20

Summit Engineering

Ft. Mill, South Carolina

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project No: 6565.L0002 **Figure**

Tested By: FG **Checked By:** MH

GRAIN SIZE DISTRIBUTION TEST DATA

8/28/2020

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project Number: 6565.L0002
Location: East Prong Hunting Creek
Material Description: XS-1 Bar Sample, CDB, NBH, SNT
Date: 08-21-20
USCS Classification: GP
Testing Remarks: Total Weight: 5771.89g
Secondary Axis: 3.41", 3.06"

Tested by: FG **Checked by:** MH

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
5771.89	0.00	0.00	3	0.00	100.0
			2	525.85	90.9
			1	3439.70	40.4
			0.375	4539.20	21.4
			#4	4787.40	17.1
			#10	4941.40	14.4
			#18	5087.60	11.9
			#35	5328.70	7.7
			#60	5600.70	3.0
			#120	5720.80	0.9
			#230	5748.10	0.4

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	72.2	10.7	82.9	2.7	7.9	6.0	16.6			0.5

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.3456	0.7119	2.6416	7.2873	20.4362	25.2321	29.1436	33.0277	42.4644	45.7033	49.8790	56.5945

Fineness Modulus	C_u	C_c
7.21	46.39	17.76

PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	**Data Collected By:**	NBH / ST
Location:	E. Prong Hunting	**Data Collected On:**	7/24/20
Job #:		**Reach:**	2
Date:		**Cross Section #:**	XS3

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle
SILT/CLAY	Silt/Clay	0.000	0.062	ǀ
SAND	Very fine	0.062	0.125	
	Fine	0.125	0.250	ǀ
	Medium	0.250	0.500	ǀǀ
	Coarse	0.5	1.0	
	Very Coarse	1.0	2.0	ǀǀǀ
	Very Fine	2.0	2.8	
	Very Fine	2.8	4.0	
	Fine	4.0	5.7	ǀǀǀǀ
	Fine	5.7	8.0	ǀǀǀ
	Medium	8.0	11.3	卌 ǀ
	Medium	11.3	16.0	卌 卌 卌 卌 ǀǀǀǀ
	Coarse	16.0	22.6	ǀǀǀǀ
	Coarse	22.6	32	卌 卌 卌
	Very Coarse	32	45	卌 ǀǀǀǀ
	Very Coarse	45	64	卌 卌 ǀǀǀǀ
COBBLE	Small	64	90	卌 ǀǀǀǀ
	Small	90	128	ǀǀǀ
	Large	128	180	ǀǀ
	Large	180	256	
	Small	256	362	
	Small	362	512	
	Medium	512	1024	
	Large/Very Large	1024	2048	
BEDROCK	Bedrock	2048	>2048	
			Total:	

Largest Particle (mm): 180

Total

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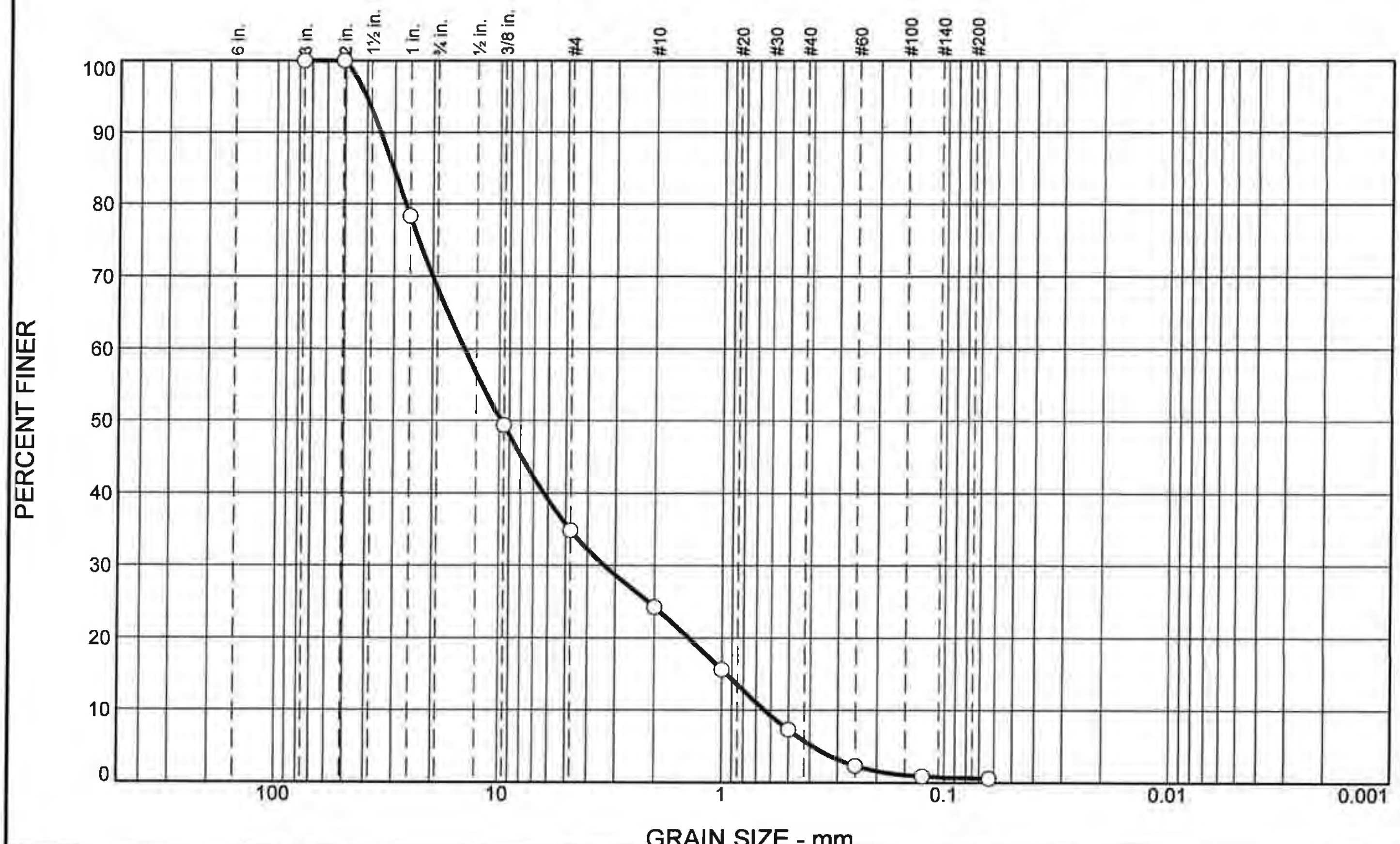
Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	31.6	33.6	10.5	18.6	5.1	0.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	78.4		
0.375	49.3		
#4	34.8		
#10	24.3		
#18	15.6		
#35	7.3		
#60	2.3		
#120	0.8		
#230	0.5		

* (no specification provided)

Material Description

Downstream Subpavement, XS-3, CDB, NBH, SNT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 34.5886 D_{85}= 30.2384 D_{60}= 14.3732
D_{50}= 9.7943 D_{30}= 3.3543 D_{15}= 0.9551
D_{10}= 0.6410 C_u= 22.42 C_c= 1.22

Classification

USCS= GW AASHTO=

Remarks

Total Dry Weight: 6456.34g
Secondary Axis: 3.60", 2.82"

Location: East Prong Hunting Creek

Date: 08-21-20

Summit Engineering

Ft. Mill, South Carolina

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project No: 6565.L0002 **Figure**

Tested By: FG **Checked By:** MH

GRAIN SIZE DISTRIBUTION TEST DATA

8/28/2020

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project Number: 6565.L0002
Location: East Prong Hunting Creek
Material Description: Downstream Subpavement, XS-3, CDB, NBH, SNT
Date: 08-21-20
USCS Classification: GW
Testing Remarks: Total Dry Weight: 6456.34g
Secondary Axis: 3.60", 2.82"

Tested by: FG **Checked by:** MH

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
6456.34	0.00	0.00	3	0.00	100.0
			2	0.00	100.0
			1	1397.50	78.4
			0.375	3272.00	49.3
			#4	4208.60	34.8
			#10	4889.00	24.3
			#18	5449.20	15.6
			#35	5986.60	7.3
			#60	6307.70	2.3
			#120	6402.00	0.8
			#230	6421.60	0.5

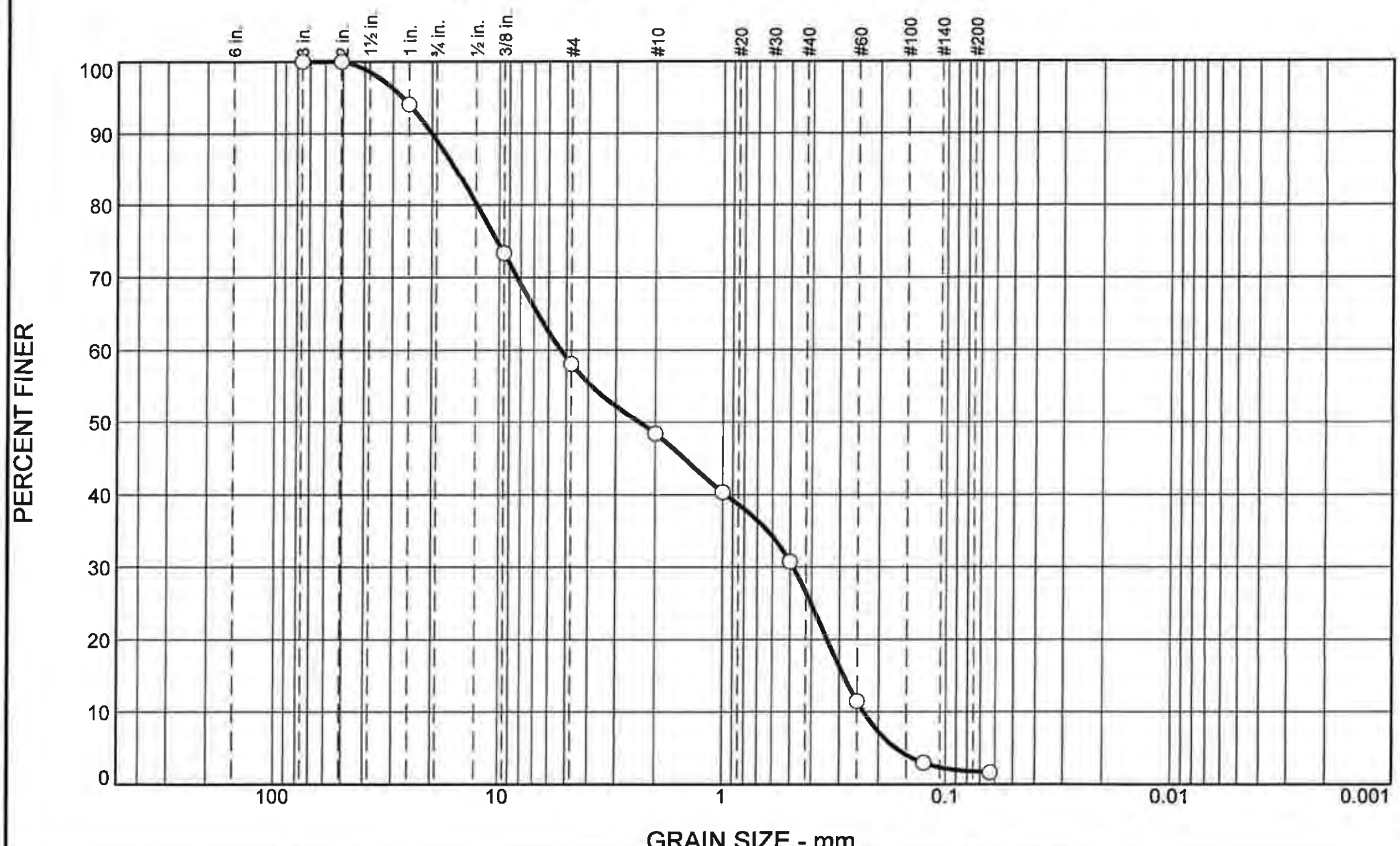
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	31.6	33.6	65.2	10.5	18.6	5.1	34.2			0.6

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.3885	0.6410	0.9551	1.4045	3.3543	6.2968	9.7943	14.3732	26.5371	30.2384	34.5886	40.2840

Fineness Modulus	C_u	C_c
5.97	22.42	1.22

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.9	31.0	9.7	21.8	24.9	1.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	94.1		
0.375	73.3		
#4	58.1		
#10	48.4		
#18	40.3		
#35	30.7		
#60	11.5		
#120	2.9		
#230	1.6		

* (no specification provided)

Material Description

Downstream Bar Sample, CDB, NBH, SNT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 19.9916 D_{85}= 15.6443 D_{60}= 5.2931
D_{50}= 2.3577 D_{30}= 0.4846 D_{15}= 0.2869
D_{10}= 0.2337 C_u= 22.65 C_c= 0.19

Classification

USCS= SP AASHTO=

Remarks

Total Weight: 4068.54g
Secondary Axis: 2.23", 1.89"

Location: East Prong Hunting Creek

Date: 08-21-20

Summit Engineering

Ft. Mill, South Carolina

Client: Wildlands Engineering, Inc.
Project: Laurel Valley

Project No: 6565.L0002 **Figure**

Tested By: FG **Checked By:** MH

GRAIN SIZE DISTRIBUTION TEST DATA

8/28/2020

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project Number: 6565.L0002
Location: East Prong Hunting Creek
Material Description: Downstream Bar Sample, CDB, NBH, SNT
Date: 08-21-20
USCS Classification: SP
Testing Remarks: Total Weight: 4068.54g
Secondary Axis: 2.23", 1.89"

Tested by: FG **Checked by:** MH

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
4068.54	0.00	0.00	3	0.00	100.0
			2	0.00	100.0
			1	241.80	94.1
			0.375	1084.40	73.3
			#4	1706.00	58.1
			#10	2100.30	48.4
			#18	2427.50	40.3
			#35	2818.20	30.7
			#60	3601.80	11.5
			#120	3948.70	2.9
			#230	4001.70	1.6

Fractional Components

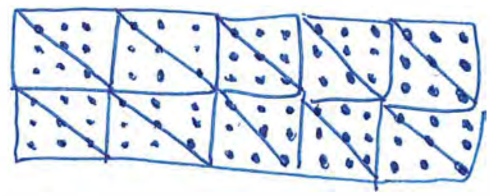
Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	10.9	31.0	41.9	9.7	21.8	24.9	56.4			1.7

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.1671	0.2337	0.2869	0.3404	0.4846	0.9692	2.3577	5.2931	12.5538	15.6443	19.9916	27.1342

Fineness Modulus	C_u	C_c
4.34	22.65	0.19

PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	Data Collected By:	NH - CDB Record
Location:	UT2 - XS4	Data Collected On:	
Job #:		Reach:	
Date:	9/1/20	Cross Section #:	



Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle
SILT/CLAY	Silt/Clay	0.000	0.062	I
SAND	Very fine	0.062	0.125	
	Fine	0.125	0.250	IIII̸ IIII̸
	Medium	0.250	0.500	II
	Coarse	0.5	1.0	IIII̸ I
	Very Coarse	1.0	2.0	
GRAVEL	Very Fine	2.0	2.8	
	Very Fine	2.8	4.0	II
	Fine	4.0	5.7	II
	Fine	5.7	8.0	IIII̸
	Medium	8.0	11.3	IIII
	Medium	11.3	16.0	IIII̸ II
	Coarse	16.0	22.6	IIII̸ IIII̸ II
	Coarse	22.6	32	IIII̸ IIII̸ IIII̸
	Very Coarse	32	45	IIII̸ IIII
	Very Coarse	45	64	IIII̸ IIII̸ II
COBBLE	Small	64	90	IIII̸ IIII̸ I
	Small	90	128	II
	Large	128	180	
	Large	180	256	
BOULDER	Small	256	362	
	Small	362	512	
	Medium	512	1024	
	Large/Very Large	1024	2048	
BEDROCK	Bedrock	2048	>2048	
			Total:	

Largest Particle (mm): 110

pavement
V
largest particle off
subpavement
was 95 mm

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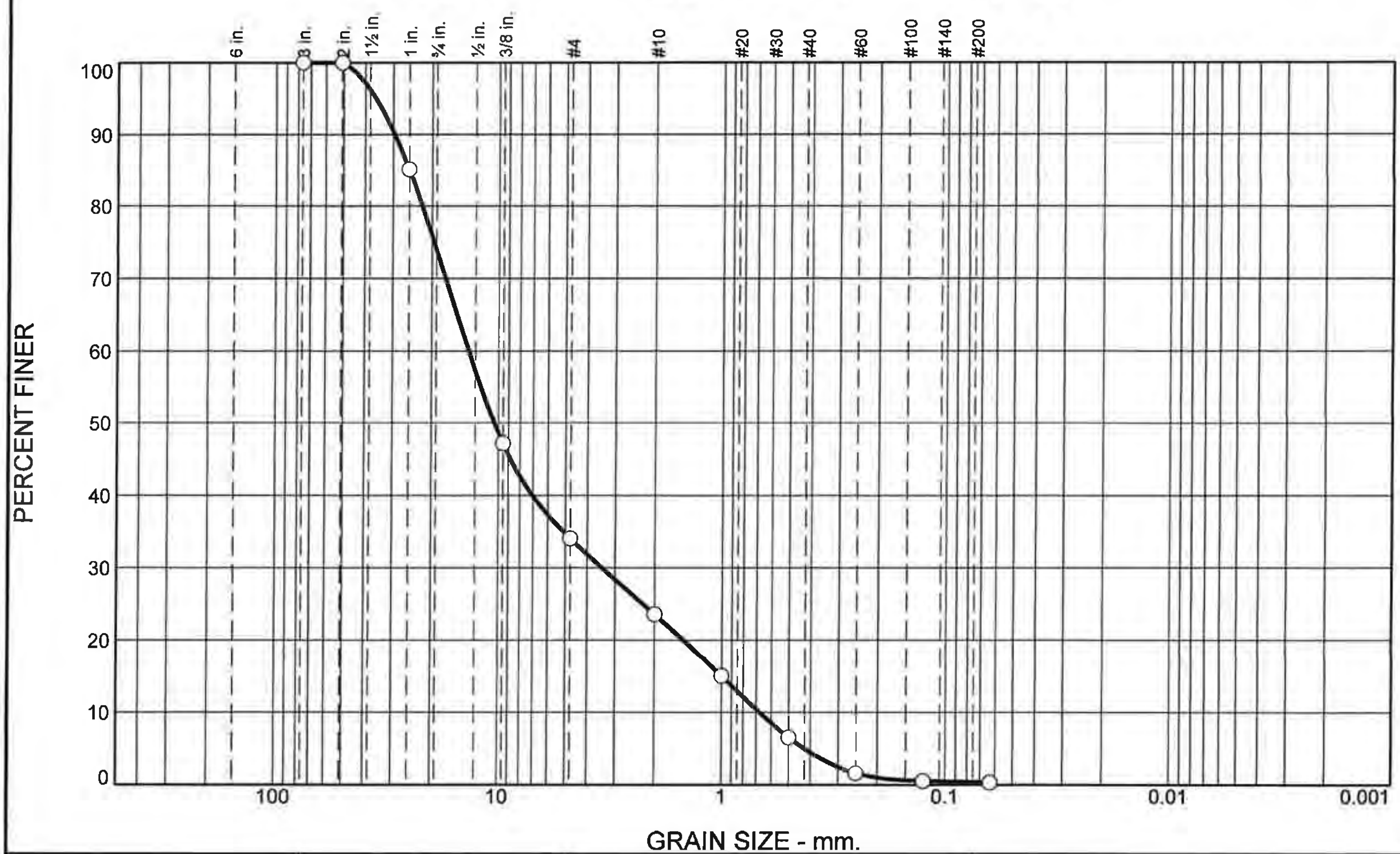
Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	25.9	40.1	10.4	18.6	4.6	0.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	85.2		
0.375	47.1		
#4	34.0		
#10	23.6		
#18	15.0		
#35	6.5		
#60	1.6		
#120	0.5		
#230	0.3		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 29.4805 D_{85}= 25.2519 D_{60}= 13.6107
D_{50}= 10.4275 D_{30}= 3.4350 D_{15}= 0.9987
D_{10}= 0.6761 C_u= 20.13 C_c= 1.28

Classification

USCS= GW AASHTO=

Remarks

Total Weight: 3065.10g
Secondary Axis: 4.20", 2.55"

Location: UT2, XS-4, Subpavement CDB/NH 09-01-20

Date: 10-29-20

Summit Engineering

Ft. Mill, South Carolina

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project No: 6565.L0002 **Figure**

Tested By: FG **Checked By:** MH

GRAIN SIZE DISTRIBUTION TEST DATA

10/29/2020

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project Number: 6565.L0002
Location: UT2, XS-4, Subpavement CDB/NH 09-01-20
Date: 10-29-20
USCS Classification: GW
Testing Remarks: Total Weight: 3065.10g
Secondary Axis: 4.20", 2.55"

Tested by: FG **Checked by:** MH

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
3065.10	0.00	0.00	3	0.00	100.0
			2	0.00	100.0
			1	453.50	85.2
			0.375	1620.30	47.1
			#4	2021.81	34.0
			#10	2343.02	23.6
			#18	2604.81	15.0
			#35	2864.81	6.5
			#60	3016.44	1.6
			#120	3049.50	0.5
			#230	3055.66	0.3

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	25.9	40.1	66.0	10.4	18.6	4.6	33.6			0.4

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.4264	0.6761	0.9987	1.4890	3.4350	7.0575	10.4275	13.6107	22.0690	25.2519	29.4805	35.8101

Fineness Modulus	C_u	C_c
5.94	20.13	1.28

PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	Data Collected By:	WH - CDB
Location:	UT2 - XS6	Data Collected On:	
Job #:		Reach:	
Date:	9/1/20	Cross Section #:	

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle
SILT/CLAY	Silt/Clay	0.000	0.062	
SAND	Very fine	0.062	0.125	
	Fine	0.125	0.250	
	Medium	0.250	0.500	|
	Coarse	0.5	1.0	
	Very Coarse	1.0	2.0	~~||||~~
GRAVEL	Very Fine	2.0	2.8	||
	Very Fine	2.8	4.0	||
	Fine	4.0	5.7	~~||||~~ |
	Fine	5.7	8.0	||
	Medium	8.0	11.3	||||
	Medium	11.3	16.0	~~||||~~ ||||
	Coarse	16.0	22.6	~~||||~~ ||||
	Coarse	22.6	32	~~||||~~ ~~||||~~ |||
	Very Coarse	32	45	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |
	Very Coarse	45	64	~~||||~~ ~~||||~~ |
COBBLE	Small	64	90	~~||||~~ ||||
	Small	90	128	|||
	Large	128	180	||
	Large	180	256	
BOULDER	Small	256	362	
	Small	362	512	
	Medium	512	1024	
	Large/Very Large	1024	2048	
BEDROCK	Bedrock	2048	>2048	
			Total:	

Largest Particle (mm): 155

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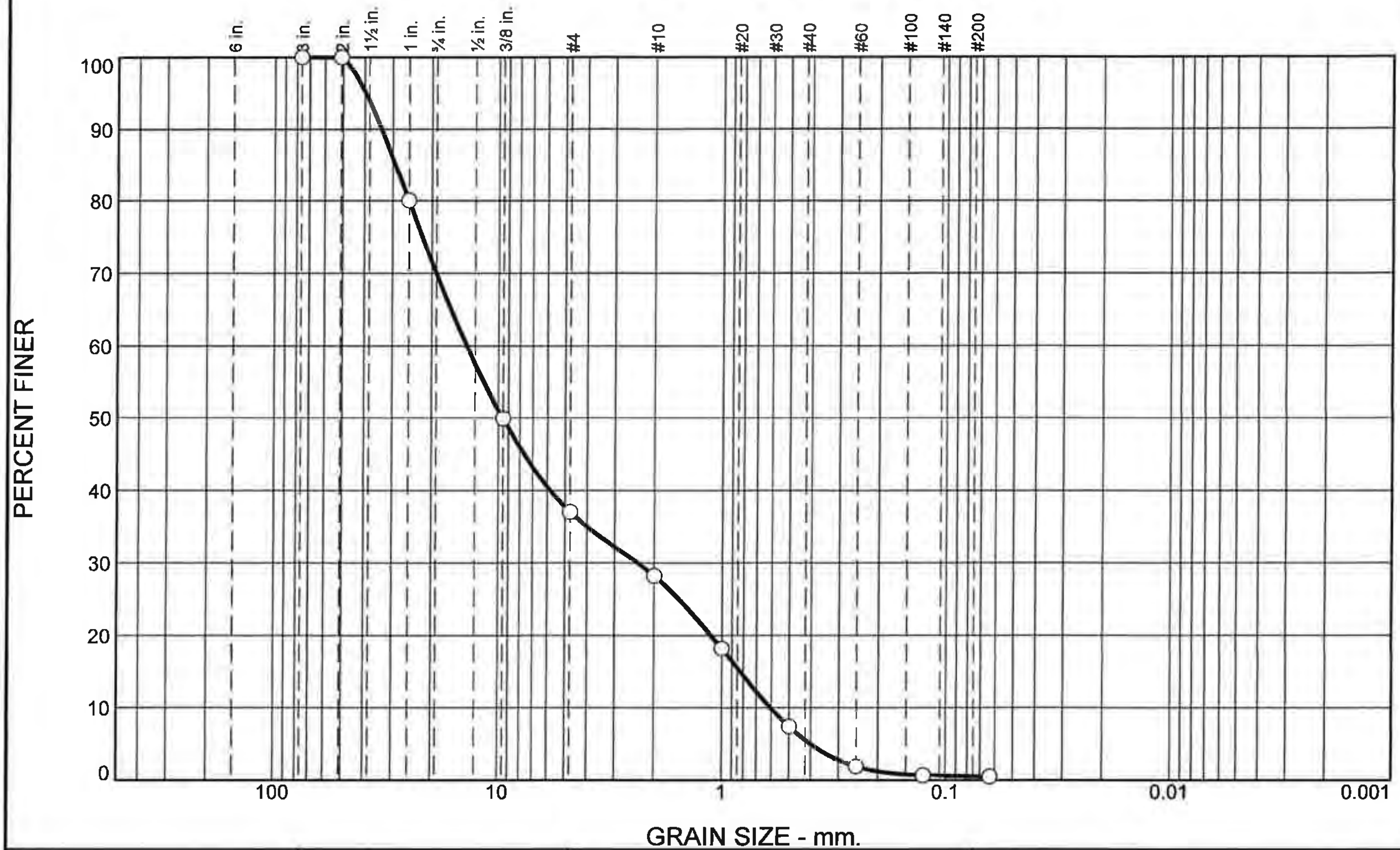
Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.0	33.0	8.8	22.7	5.0	0.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	80.0		
0.375	49.9		
#4	37.0		
#10	28.2		
#18	18.2		
#35	7.4		
#60	1.9		
#120	0.7		
#230	0.5		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 33.5666 D_{85}= 29.1076 D_{60}= 13.8662
D_{50}= 9.5680 D_{30}= 2.3714 D_{15}= 0.8282
D_{10}= 0.6058 C_u= 22.89 C_c= 0.67

Classification

USCS= GP AASHTO=

Remarks

Total Weight: 3173.90g
Secondary Axis: 2.46", 2.66"

Location: UT2, XS-6, Subpavement CDB/NBH 09-01-20

Date: 10-29-20

Summit Engineering

Ft. Mill, South Carolina

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project No: 6565.L0002 **Figure**

Tested By: FG **Checked By:** MH

GRAIN SIZE DISTRIBUTION TEST DATA

10/29/2020

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project Number: 6565.L0002
Location: UT2, XS-6, Subpavement CDB/NBH 09-01-20
Date: 10-29-20
USCS Classification: GP
Testing Remarks: Total Weight: 3173.90g
Secondary Axis: 2.46", 2.66"

Tested by: FG **Checked by:** MH

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
3173.90	0.00	0.00	3	0.00	100.0
			2	0.00	100.0
			1	633.40	80.0
			0.375	1590.40	49.9
			#4	1999.49	37.0
			#10	2278.46	28.2
			#18	2597.74	18.2
			#35	2940.20	7.4
			#60	3114.67	1.9
			#120	3153.26	0.7
			#230	3159.59	0.5

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	30.0	33.0	63.0	8.8	22.7	5.0	36.5			0.5

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.4026	0.6058	0.8282	1.1192	2.3714	5.8314	9.5680	13.8662	25.3695	29.1076	33.5666	39.4946

Fineness Modulus	C_u	C_c
5.85	22.89	0.67

PEBBLE COUNT FIELD FORM

Project Name:	Laurel Vally	Data Collected By:	NBH/JS
Location:		Data Collected On:	9/22/20
Job #:		Reach:	UT1
Date:	9/22/20	Cross Section #:	XS 7

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle
SILT/CLAY	Silt/Clay	0.000	0.062	III
SAND	Very fine	0.062	0.125	
	Fine	0.125	0.250	
	Medium	0.250	0.500	卌 卌
	Coarse	0.5	1.0	卌 I
	Very Coarse	1.0	2.0	IIII
GRAVEL	Very Fine	2.0	2.8	
	Very Fine	2.8	4.0	
	Fine	4.0	5.7	
	Fine	5.7	8.0	
	Medium	8.0	11.3	I
	Medium	11.3	16.0	卌 I
	Coarse	16.0	22.6	卌 IIII
	Coarse	22.6	32	卌 卌 I
	Very Coarse	32	45	卌 卌 卌 III
	Very Coarse	45	64	卌 卌 卌 III
COBBLE	Small	64	90	卌 III
	Small	90	128	IIII
	Large	128	180	
	Large	180	256	
BOULDER	Small	256	362	
	Small	362	512	
	Medium	512	1024	
	Large/Very Large	1024	2048	
BEDROCK	Bedrock	2048	>2048	
			Total:	

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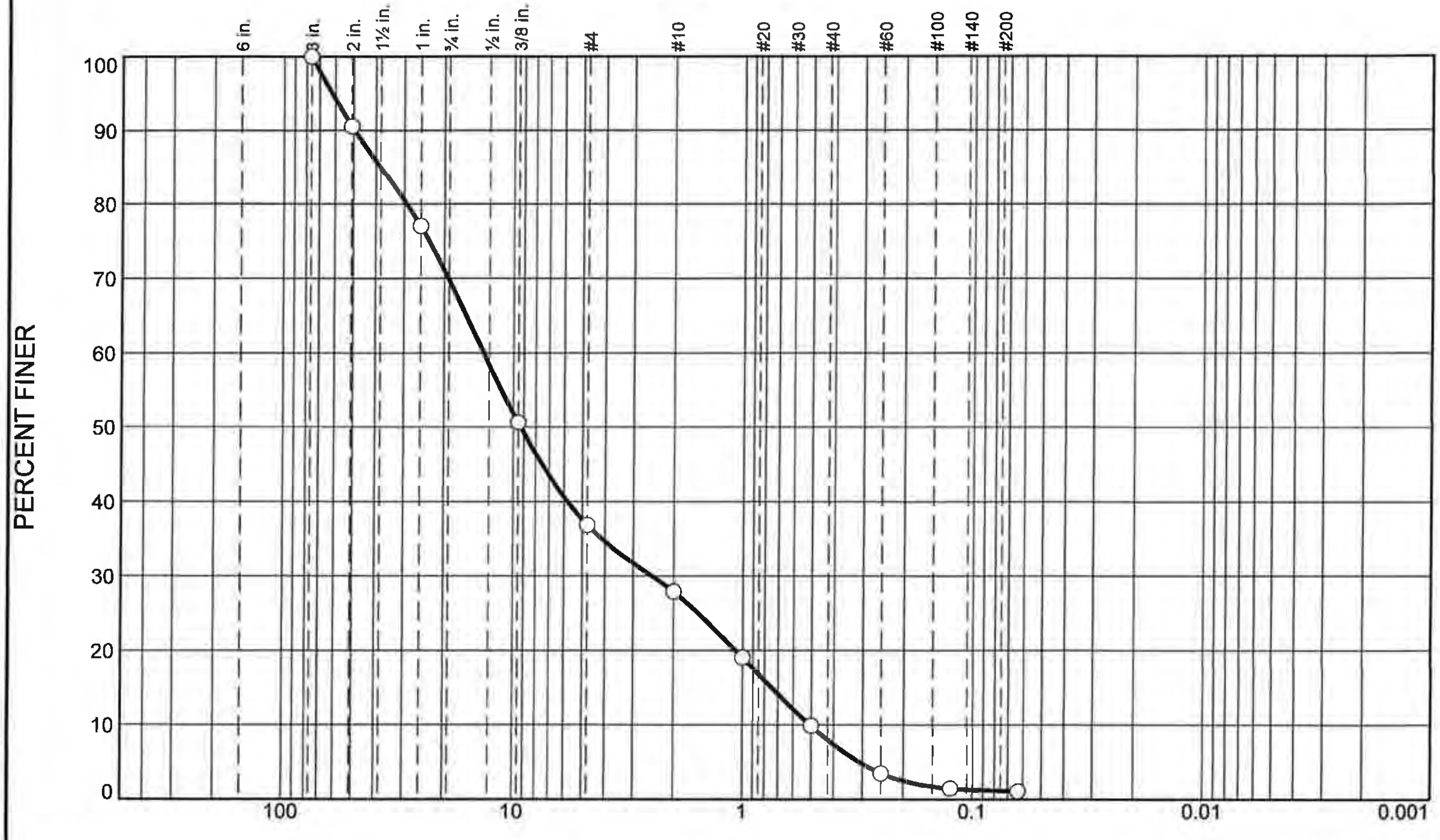
Largest Particle (mm): 100

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.1	33.1	8.9	19.9	6.9	1.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	90.6		
1	77.1		
0.375	50.6		
#4	36.8		
#10	27.9		
#18	19.0		
#35	9.9		
#60	3.5		
#120	1.4		
#230	1.1		

* (no specification provided)

Material Description

11-15-20

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 49.4119 D_{85}= 38.0360 D_{60}= 13.4189
D_{50}= 9.2881 D_{30}= 2.4801 D_{15}= 0.7463
D_{10}= 0.5062 C_u= 26.51 C_c= 0.91

Classification

USCS= GP AASHTO=

Remarks

Total Dry Weight: 3682.40g
Secondary Axis: 3.66", 3.10"

Location: UT1, XS-7, Subpavement, NBH JMS

Date:

Summit Engineering

Ft. Mill, South Carolina

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project No: 6565.L0002 **Figure**

Tested By: FG **Checked By:** MH

GRAIN SIZE DISTRIBUTION TEST DATA

11/23/2020

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project Number: 6565.L0002
Location: UT1, XS-7, Subpavement, NBH JMS
Material Description: 11-15-20
USCS Classification: GP
Testing Remarks: Total Dry Weight: 3682.40g
Secondary Axis: 3.66", 3.10"

Tested by: FG
Checked by: MH

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
3682.40	0.00	0.00	3	0.00	100.0
			2	347.10	90.6
			1	844.60	77.1
			0.375	1817.80	50.6
			#4	2326.21	36.8
			#10	2654.99	27.9
			#18	2980.99	19.0
			#35	3319.56	9.9
			#60	3552.65	3.5
			#120	3629.37	1.4
			#230	3643.18	1.1

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	30.1	33.1	63.2	8.9	19.9	6.9	35.7			1.1

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.3089	0.5062	0.7463	1.0709	2.4801	5.8098	9.2881	13.4189	29.1808	38.0360	49.4119	61.9204

Fineness Modulus	C_u	C_c
5.88	26.51	0.91

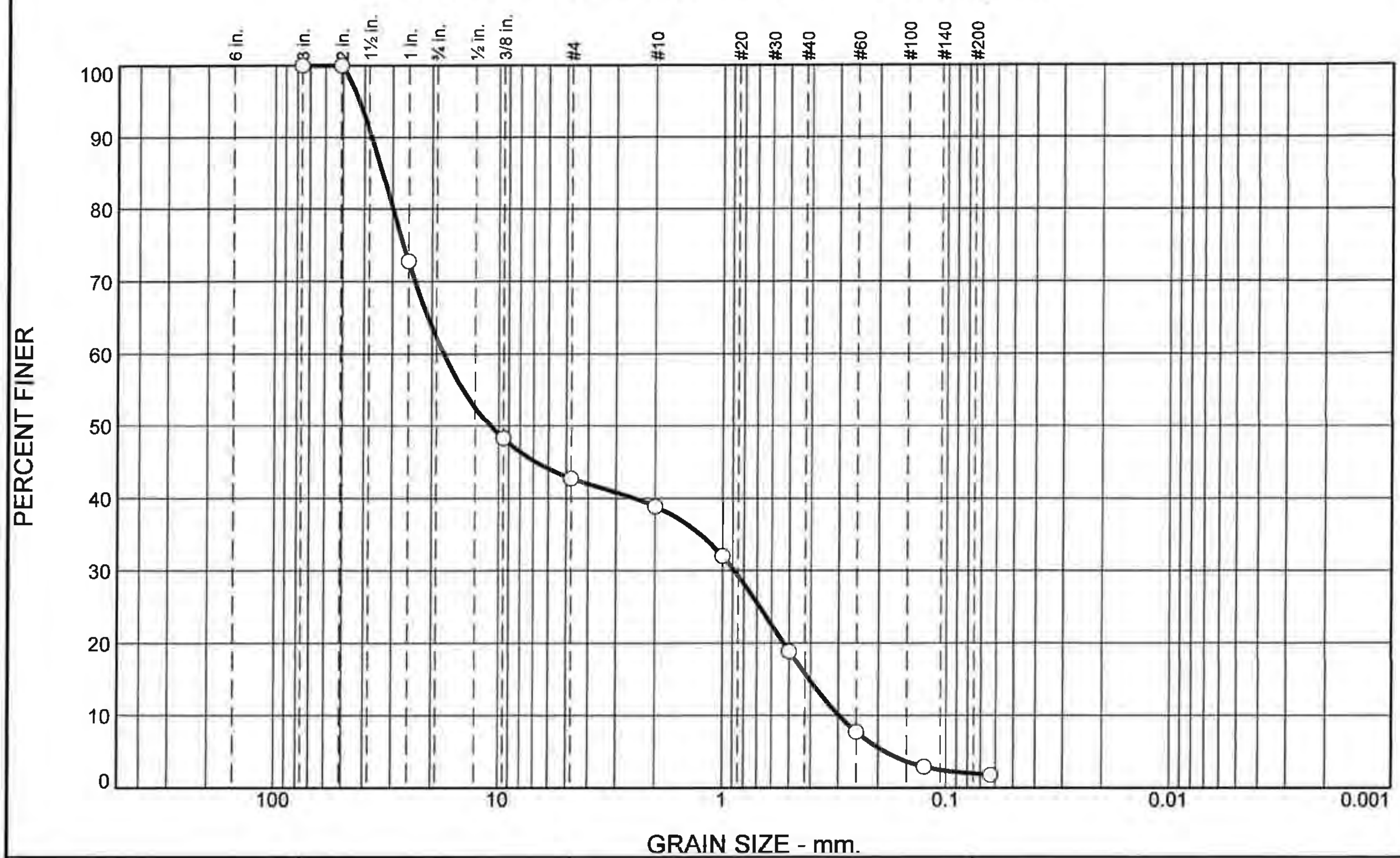
PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	Data Collected By:	NBH/JS
Location:		Data Collected On:	9/22/20
Job #:		Reach:	UT1
Date:	9/22/20	Cross Section #:	XS 9

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle
SILT/CLAY	Silt/Clay	0.000	0.062	
SAND	Very fine	0.062	0.125	
	Fine	0.125	0.250	
	Medium	0.250	0.500	
	Coarse	0.5	1.0	
	Very Coarse	1.0	2.0	
GRAVEL	Very Fine	2.0	2.8	
	Very Fine	2.8	4.0	
	Fine	4.0	5.7	
	Fine	5.7	8.0	
	Medium	8.0	11.3	
	Medium	11.3	16.0	
	Coarse	16.0	22.6	
	Coarse	22.6	32	
	Very Coarse	32	45	
	Very Coarse	45	64	
COBBLE	Small	64	90	
	Small	90	128	
	Large	128	180	
	Large	180	256	
BOULDER	Small	256	362	
	Small	362	512	
	Medium	512	1024	
	Large/Very Large	1024	2048	
BEDROCK	Bedrock	2048	>2048	
			Total:	

Largest Particle (mm): 80

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	37.7	19.6	3.9	23.0	13.9	1.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	72.8		
0.375	48.2		
#4	42.7		
#10	38.8		
#18	32.0		
#35	18.9		
#60	7.7		
#120	2.9		
#230	1.8		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 37.0400 D_{85}= 33.1331 D_{60}= 17.6209
D_{50}= 10.8588 D_{30}= 0.8837 D_{15}= 0.4069
D_{10}= 0.2983 C_u= 59.07 C_c= 0.15

Classification

USCS= GP AASHTO=

Remarks

Total Dry Weight: 3522.60g
Secondary Axis: 5.01", 2.81"

Location: UT1, XS-9, Subpavement, NBH JMS

Date: 11-17-20

Summit Engineering

Ft. Mill, South Carolina

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project No: 6565.L0002 **Figure**

Tested By: FG **Checked By:** MH

GRAIN SIZE DISTRIBUTION TEST DATA

11/23/2020

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project Number: 6565.L0002
Location: UT1, XS-9, Subpavement, NBH JMS
Date: 11-17-20
USCS Classification: GP
Testing Remarks: Total Dry Weight: 3522.60g
Secondary Axis: 5.01", 2.81"

Tested by: FG **Checked by:** MH

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
3522.60	0.00	0.00	3	0.00	100.0
			2	0.00	100.0
			1	958.70	72.8
			0.375	1823.00	48.2
			#4	2016.81	42.7
			#10	2154.18	38.8
			#18	2394.53	32.0
			#35	2858.10	18.9
			#60	3250.50	7.7
			#120	3420.06	2.9
			#230	3459.30	1.8

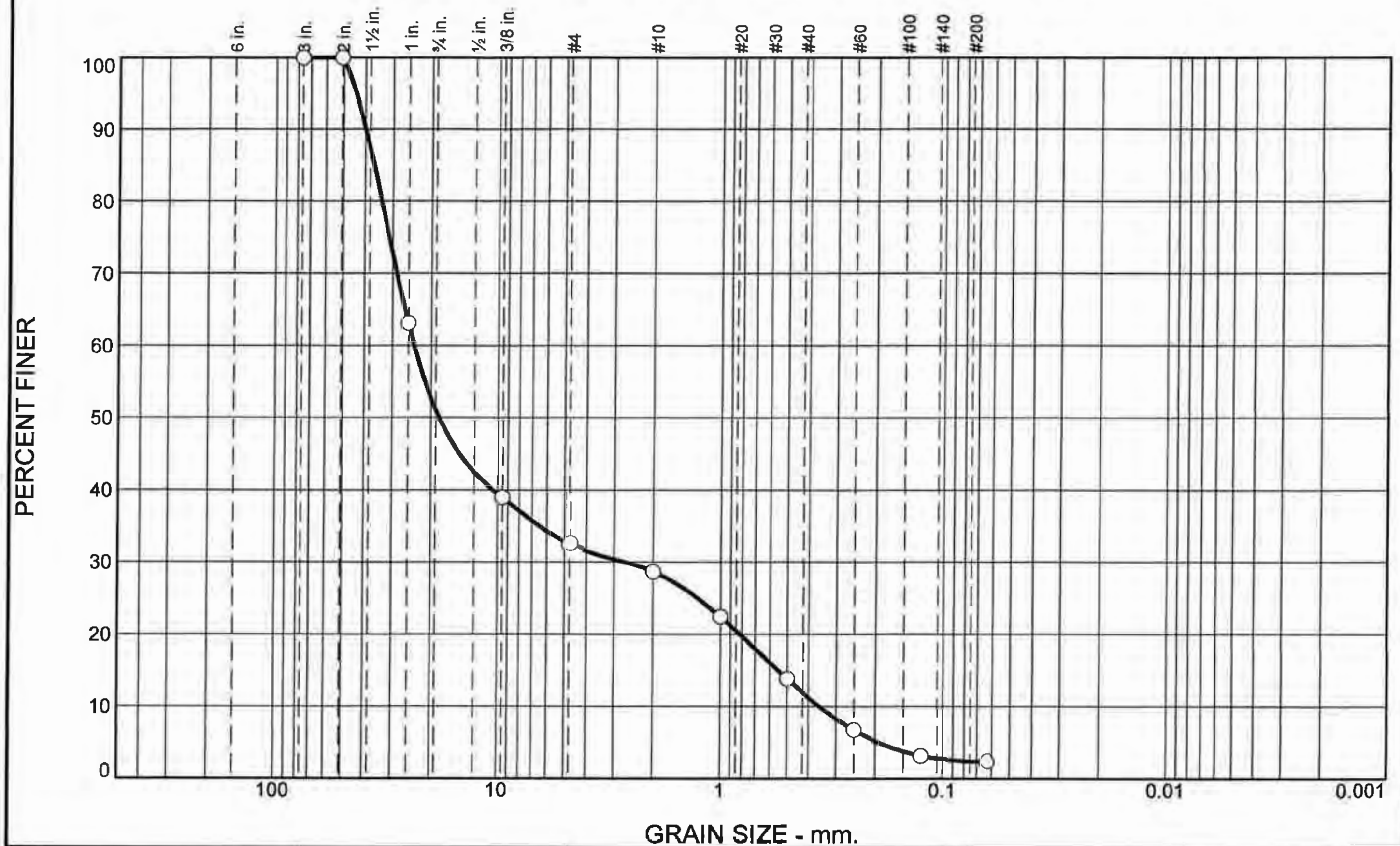
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	37.7	19.6	57.3	3.9	23.0	13.9	40.8			1.9

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.1869	0.2983	0.4069	0.5296	0.8837	2.4970	10.8588	17.6209	29.7822	33.1331	37.0400	42.0654

Fineness Modulus	C_u	C_c
5.45	59.07	0.15

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	48.9	18.7	3.8	16.7	9.5	2.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1	63.1		
0.375	38.9		
#4	32.4		
#10	28.6		
#18	22.4		
#35	13.8		
#60	6.7		
#120	3.1		
#230	2.3		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 39.7678 D_{85}= 36.4598 D_{60}= 23.9067
D_{50}= 18.4028 D_{30}= 2.7129 D_{15}= 0.5510
D_{10}= 0.3577 C_u= 66.83 C_c= 0.86

Classification

USCS= GP AASHTO=

Remarks

Total Dry Weight: 3701.00g
Secondary Axis: 3.11", 2.73"

Location: UT1, XS-9, BAR, NRH JMH

Date: 11-15-20

Summit Engineering

Ft. Mill, South Carolina

Client: Wildlands Engineering, Inc.
Project: Laurel Valley

Project No: 6565.L0002 **Figure**

Tested By: FG **Checked By:** MH

GRAIN SIZE DISTRIBUTION TEST DATA

11/23/2020

Client: Wildlands Engineering, Inc.
Project: Laurel Valley
Project Number: 6565.L0002
Location: UT1, XS-9, BAR, NRH JMH
Date: 11-15-20
USCS Classification: GP
Testing Remarks: Total Dry Weight: 3701.00g
Secondary Axis: 3.11", 2.73"

Tested by: FG   **Checked by:** MH

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
2701.00	0.00	0.00	3	0.00	100.0
			2	0.00	100.0
			1	997.80	63.1
			0.375	1649.50	38.9
			#4	1825.11	32.4
			#10	1927.50	28.6
			#18	2095.30	22.4
			#35	2328.20	13.8
			#60	2520.04	6.7
			#120	2617.23	3.1
			#230	2639.92	2.3

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	48.9	18.7	67.6	3.8	16.7	9.5	30.0			2.4

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.1951	0.3577	0.5510	0.8179	2.7129	10.5261	18.4028	23.9067	33.6216	36.4598	39.7678	43.9655

Fineness Modulus	C_u	C_c
6.08	66.83	0.86

PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	**Data Collected By:**	NY (COB Recording)
Location:	E. Prong Hunting	**Data Collected On:**	
Job #:		**Reach:**	
Date:	9/1/20	**Cross Section #:**	

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle	Particle Count Pool
SILT/CLAY	Silt/Clay	0.000	0.062	2	2
SAND	Very fine	0.062	0.125	1	1
	Fine	0.125	0.250	6	23
	Medium	0.250	0.500	1	1
	Coarse	0.5	1.0	5	8
	Very Coarse	1.0	2.0		
	Very Fine	2.0	2.8		1
	Very Fine	2.8	4.0	1	2
	Fine	4.0	5.7	1	
	Fine	5.7	8.0	2	2
	Medium	8.0	11.3	4	1
	Medium	11.3	16.0	1	6
	Coarse	16.0	22.6	7	
	Coarse	22.6	32	6	
	Very Coarse	32	45	5	3
	Very Coarse	45	64	4	
COBBLE	Small	64	90	2	
	Small	90	128	1	
	Large	128	180		
	Large	180	256		
	Small	256	362		
	Small	362	512		
	Medium	512	1024		
	Large/Very Large	1024	2048		
BEDROCK	Bedrock	2048	>2048		
			Total:		

Largest Particle (mm): 128 45

R 5

P 5

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PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	**Data Collected By:**	NBH/JS
Location:		**Data Collected On:**	9/22/20
Job #:		**Reach:**	UT1
Date:	9/22/20	**Cross Section #:**	

50/50

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle	Particle Count Pool
SILT/CLAY	Silt/Clay	0.000	0.062		
SAND	Very fine	0.062	0.125		
	Fine	0.125	0.250		
	Medium	0.250	0.500		
	Coarse	0.5	1.0		
	Very Coarse	1.0	2.0		
GRAVEL	Very Fine	2.0	2.8		
	Very Fine	2.8	4.0		
	Fine	4.0	5.7		
	Fine	5.7	8.0		
	Medium	8.0	11.3		
	Medium	11.3	16.0		
	Coarse	16.0	22.6		
	Coarse	22.6	32		
	Very Coarse	32	45		
	Very Coarse	45	64		
COBBLE	Small	64	90		
	Small	90	128		
	Large	128	180		
	Large	180	256		
BOULDER	Small	256	362		
	Small	362	512		
	Medium	512	1024		
	Large/Very Large	1024	2048		
BEDROCK	Bedrock	2048	>2048		
			Total:	50	50

Largest Particle (mm): ________ ________

Riffle

Pool

PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	Data Collected By:	NH (CDB record)
Location:	UT2 - Reachwide	Data Collected On:	
Job #:		Reach:	
Date:	9/1/20	Cross Section #:	

Particle Class		Diameter (mm)		Particle Count	
		min	max	Riffle	Pool
SILT/CLAY	Silt/Clay	0.000	0.062		
SAND	Very fine	0.062	0.125		
	Fine	0.125	0.250	卌 II	卌 卌 卌 卌 III
	Medium	0.250	0.500	II	卌 III
	Coarse	0.5	1.0	IIII	III
	Very Coarse	1.0	2.0		
GRAVEL	Very Fine	2.0	2.8		I
	Very Fine	2.8	4.0		III
	Fine	4.0	5.7		II
	Fine	5.7	8.0	II	III
	Medium	8.0	11.3	IIII	III
	Medium	11.3	16.0	卌 II	I
	Coarse	16.0	22.6	IIII	I
	Coarse	22.6	32	卌 IIII	I
	Very Coarse	32	45	卌 III	
	Very Coarse	45	64	III	
COBBLE	Small	64	90		I
	Small	90	128		
	Large	128	180		
	Large	180	256		
BOULDER	Small	256	362		
	Small	362	512		
	Medium	512	1024		
	Large/Very Large	1024	2048		
BEDROCK	Bedrock	2048	>2048		
			Total:		

Largest Particle (mm): ________ 90

R 50% 卌

P 50% 卌

PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	**Data Collected By:**	NY (COB Recording)
Location:	E. Prong Hunting	**Data Collected On:**	
Job #:		**Reach:**	
Date:	9/1/20	**Cross Section #:**	

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle	Particle Count Pool
SILT/CLAY	Silt/Clay	0.000	0.062	||	||
SAND	Very fine	0.062	0.125	|	|
	Fine	0.125	0.250	卌 |	卌 卌 卌 卌 |||
	Medium	0.250	0.500	|	|
	Coarse	0.5	1.0	卌	卌 ||||
	Very Coarse	1.0	2.0		
	Very Fine	2.0	2.8		|
	Very Fine	2.8	4.0	|	||
	Fine	4.0	5.7	|	
	Fine	5.7	8.0	||	||
	Medium	8.0	11.3	||||	|
	Medium	11.3	16.0	|	卌 |
	Coarse	16.0	22.6	卌 ||	
	Coarse	22.6	32	卌 |	
	Very Coarse	32	45	卌	|||
	Very Coarse	45	64	||||	
COBBLE	Small	64	90	||	
	Small	90	128	|	
	Large	128	180		
	Large	180	256		
	Small	256	362		
	Small	362	512		
	Medium	512	1024		
	Large/Very Large	1024	2048		
BEDROCK	Bedrock	2048	>2048		
			Total:		

Largest Particle (mm): 128 45

R 卌

P 卌

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PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	**Data Collected By:**	NBH/JS
Location:		**Data Collected On:**	9/22/20
Job #:		**Reach:**	UT1
Date:	9/22/20	**Cross Section #:**	

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle	Particle Count Pool
SILT/CLAY	Silt/Clay	0.000	0.062	|||	|
SAND	Very fine	0.062	0.125	|	|
	Fine	0.125	0.250	|	|||
	Medium	0.250	0.500	||||| |||	||||| |||||
	Coarse	0.5	1.0	|||	||||| |||||
	Very Coarse	1.0	2.0	||||	|||||
GRAVEL	Very Fine	2.0	2.8		
	Very Fine	2.8	4.0		
	Fine	4.0	5.7		
	Fine	5.7	8.0		
	Medium	8.0	11.3		|
	Medium	11.3	16.0	||	||
	Coarse	16.0	22.6	||	
	Coarse	22.6	32	||||	
	Very Coarse	32	45	||||| ||||	|
	Very Coarse	45	64	||||| |||||	|
COBBLE	Small	64	90	|||	
	Small	90	128	||	
	Large	128	180		
	Large	180	256		
BOULDER	Small	256	362		
	Small	362	512		
	Medium	512	1024		
	Large/Very Large	1024	2048		
BEDROCK	Bedrock	2048	>2048		
			Total:	50	50

Largest Particle (mm): ________ ________

50/50

Riffle | Pool

PEBBLE COUNT FIELD FORM

Project Name:	Laurel Valley	Data Collected By:	NH (CDB record)
Location:	UT2 - Reachwide	Data Collected On:	
Job #:		Reach:	
Date:	9/1/20	Cross Section #:	

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle	Particle Count Pool
SILT/CLAY	Silt/Clay	0.000	0.062		
SAND	Very fine	0.062	0.125		
	Fine	0.125	0.250	7	23
	Medium	0.250	0.500	2	9
	Coarse	0.5	1.0	4	3
	Very Coarse	1.0	2.0		
GRAVEL	Very Fine	2.0	2.8		1
	Very Fine	2.8	4.0		3
	Fine	4.0	5.7		2
	Fine	5.7	8.0	2	3
	Medium	8.0	11.3	4	3
	Medium	11.3	16.0	7	1
	Coarse	16.0	22.6	4	1
	Coarse	22.6	32	9	1
	Very Coarse	32	45	8	
	Very Coarse	45	64	3	
COBBLE	Small	64	90		1
	Small	90	128		
	Large	128	180		
	Large	180	256		
BOULDER	Small	256	362		
	Small	362	512		
	Medium	512	1024		
	Large/Very Large	1024	2048		
BEDROCK	Bedrock	2048	>2048		
			Total:		

Largest Particle (mm): ________ 90

R 50%

P 50%

APPENDIX 5

Categorical Exclusion Checklist and Summary

Appendix A

Categorical Exclusion Form for Ecosystem Enhancement Program 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:	Laurel Valley Mitigation Site
County Name:	Burke County
DMS Number:	100140
Project Sponsor:	Wildlands Engineering, Inc.
Project Contact Name:	Kirsten Gimbert
Project Contact Address:	1430 S. Mint Street, Suite 104, Charlotte, NC 28203
Project Contact E-mail:	kgimbert@wildlandseng.com
DMS Project Manager:	Harry Tsomides

Project Description

The Laurel Valley Mitigation Site is a stream mitigation project involving stream preservation and restoration within the Catawba River Basin. The adjacent land use is currently an active farm composed of cattle pastures, barns, and a house. The project will provide ecological and water quality enhancements while creating a functional riparian corridor at the site level by excluding livestock from stream channels, restoring and enhancing native floodplain vegetation, improving the stability of stream channels, improving instream habitat, and permanently protecting and preserving the project site through establishing a conservation easement.

For Official Use Only

Reviewed By:

4/20/2020
Date

Harry Tsomides
DMS Project Manager

Conditional Approved By:

Date

For Division Administrator FHWA

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

Final Approval By:

4-22-20
Date

Donald W. Brew
For Division Administrator FHWA

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

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

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

Laurel Valley Mitigation Site
Categorical Exclusion

SUMMARY

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a Federal “Superfund” to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment.

As the Laurel Valley Mitigation Site is a full-delivery project; an EDR Radius Map Report with Geocheck was ordered for the site through Environmental Data Resources, Inc on July 19, 2019. Neither the target property nor the adjacent properties were listed in any of the Federal, State, or Tribal environmental databases searched by the EDR. The EDR Radius Map Report identified three sites within 0.5 mile from the target property: one site having a leaking underground storage tank (LUST) and an active NPDES permit (National Pollutant Discharge Elimination System) and two sites having a recorded report in the Incident Management Database (IMD). These sites are all located outside of the target property or any adjacent properties. Overall, the assessment revealed no evidence of any “recognized environmental conditions” in connection with the target property.

The Executive Summary of the EDR report is included in the Appendix. The full report is available if needed.

National Historic Preservation Act (Section 106)

The National Historic Preservation Act declares a national policy of historic preservation to protect, rehabilitate, restore, and reuse districts, sites, buildings, structures, and objects significant in American architecture, history, archaeology, and culture, and Section 106 mandates that federal agencies take into account the effect of an undertaking on a property that is included in, or is eligible for inclusion in, the National Register of Historic Places.

The State Historic Preservation Office (SHPO) responded to a scoping letter requesting comment on the Laurel Valley Mitigation Site on January 28, 2020. Based on the topographical and hydrological situation within the project area, SHPO stated that there was a high probability for the presence of prehistoric or historic archaeological sites. SHPO recommended an archaeological survey be completed to identify and evaluate the significance of archaeological sites and cemeteries.

A Phase I Identification Survey of the Laurel Valley Mitigation Site was performed by Archaeological Consultants of the Carolinas, Inc. (ACC) on February 17, 2020 and submitted to SHPO on February 24, 2020. Based on the survey, ACC determined that “no significant cultural resources will be impacted by the proposed restoration activities”. SHPO was provided a copy of the Phase I survey. SHPO responded on April 16, 2020 that they concur with the findings and recommendations in the report and accept the report as final. A copy of the Phase I Survey and all correspondence is available upon request. All correspondence related to Section 106 is included in the Appendix.

Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)

These acts, collectively known as the Uniform Act, provide for uniform and equitable treatment of persons displaced from their homes, businesses, non-profit associations, or farms by federal and federally-assisted programs, and establish uniform and equitable land acquisition policies.

Laurel Valley Mitigation Site is a full-delivery project that includes land acquisition. Notification of the fair market value of the project property and the lack of condemnation authority by Wildlands was included in the signed Option Agreements for the project properties. A copy of the relevant section of each of the Option Agreements are included in the Appendix.

American Indian Religious Freedom Act (AIRFA)

The American Indian Religious Freedom Act provides for the protection and preservation of places of religious importance to American Indians, Eskimos, and Native Hawaiians.

NCDMS requested review and comment from the Cherokee Nation Tribal Historic Preservation Office (THPO), the Eastern Band of Cherokee Indians THPO and the United Keetoowah Band of Cherokee THPO with respect to any archeological or religious resources related to the Laurel Valley Mitigation Site on January 17, 2020. DMS received a response from the Cherokee Nation Tribal Historic Preservation Office dated May 4, 2020.

All correspondence related to AIRFA is included in the Appendix.

Endangered Species Act (ESA)

Section 7 of the ESA requires federal agencies, in consultation with and with the assistance of the Secretary of the Interior or of Commerce, as appropriate, to ensure that actions they authorize, fund or carry out are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for these species.

The Burke County listed endangered and threatened species includes the bog turtle (*Glyptemys muhlenbergii*), the northern long-eared bat (NLEB) (*Myotis septentrionalis*), the dwarf-flowered heartleaf (*Hexastylis naniflora*), the heller's blazing star (*Liatris helleri),* the mountain golden heather (*Hudsonia montana),* the small whorled pogonia *(Isotria medeoloides),* the white irisette (*Sisyrinchium dichotomum)*, and the rock gnome lichen (*Gymnoderma lineare)*. The United States Fish and Wildlife Service (USFWS) does not currently list any Critical Habitat Designations for the Federally listed species within Burke County, nor are there any current known occurrences of the above listed species within a 2-mile radius of the project site. The project site is located approximately 19 miles from the nearest known hibernaculum for the NLEB. (https://www.fws.gov/asheville/htmls/project_review/NLEB_in_WNC.html).

Results of a pedestrian survey conducted on January 3, 2020, indicated that the project area provides areas of suitable habitat for the bog turtle, the dwarf-flowered heartleaf, the small whorled pogonia, and the white irisette along with potential summer roosting for the NLEB. No individuals or populations of the five above referenced species were documented on-site.

Bog Turtle

Bog turtle habitat consists of mud, grass and sphagnum moss of bogs, swamps, and marshy meadows. These wetlands are usually fed by cool springs flowing slowly over the land, creating the wet, muddy soil needed by the turtles (https://www.fws.gov/southeast/wildlife/reptiles/bog-turtle/#habitat-section). Wildlands surveyed the project area and determined the project "may affect, not likely to adversely affect" the bog turtle; however, it is listed due to similarity of appearance and is not subject to Section 7 consultation.

Dwarf-flowered heartleaf, the Small Whorled Pogonia, and the White Irisette

The dwarf-flowered heartleaf grows in acidic soils along bluffs and adjacent slopes, in boggy areas next to streams and creek heads, and along the slopes of nearby hillsides and ravines. (https://www.fws.gov/southeast/pdf/fact-sheet/dwarf-flowered-heartleaf.pdf).

The small whorled pogonia can be limited by shade and appears to require small light gaps, or canopy breaks, and generally grows in areas with sparse to moderate ground cover. Too many other plants in an area can be harmful to this plant. This orchid typically grows under canopies that are relatively open or near features that create long-persisting breaks in the forest canopy such as a road or a stream. It grows in mixed-deciduous or mixed-deciduous/coniferous forests that are generally in second- or third-growth successional stages. The soils in which it lives are usually acidic, moist, and have very few nutrients. (https://www.fws.gov/southeast/wildlife/plants/small-whorled-pogonia/)

The white irisette species is found on mid-elevation slopes, characterized by open, dry-to-moderate-moisture oak-hickory forests. White irisette usually grows in shallow soils on regularly disturbed sites (such as woodland edges and roadsides) and over rocky, steep terrain. (https://www.fws.gov/southeast/wildlife/plants/white-irisette/)

Wildlands determined the project will have "no effect" on the three listed plant species (the dwarf-flowered heartleaf, the small whorled pogonia, and the white irisette). Though the survey was performed outside of the blooming season for these three listed plant species, no populations resembling the species were found on-site, therefore Wildlands is confident with the determination of "no effect" outside of the blooming season for that species.

NLEB

Forested habitats containing trees at least 3-inch dbh in the project area provide suitable habitat for NLEB. Due to the decline of the NLEB population from the White Nose Syndrome (WNS), the United States Fish and Wildlife Service (USFWS) has issued the finalization of a special rule under section 4(d) of the ESA that addresses the effects to the NLEB resulting from purposeful and incidental take based on the occurrence of WNS. Because the project is located within a WNS zone and will include the removal/clearing of trees, it is subject to the final 4(d) ruling. As previously stated, a review of NCNHP records did not indicate any known NLEB populations within 2.0 mile of the study area; therefore, the project is eligible to use the NLEB 4(d) Rule Streamlined Consultation Form to meet regulatory requirements for section 7(a)(2) compliance 4(d) consultation. The completed NLEB 4(d) Consultation Form was submitted to the USFWS by the Federal Highway Administration (FHWA) on January 20, 2020.

To meet regulatory requirements, a scoping letter requesting comment from the USFWS was sent on December 20, 2019. No response from the USFWS was received within the 45-day response period. Therefore, the signing of the NLEB 4(d) Rule Streamlined Consultation Form by the FHWA determines that this project may affect the NLEB, but that any resulting incidental take of the NLEB is not prohibited by the final 4(d) rule. A FHWA signed 4(d) Consultation Form and the correspondence associated with the above determinations are included in the Appendix.

Farmland Protection Policy Act (FPPA)

The FPPA requires that, before taking or approving any federal action that would result in conversion of farmland, the agency must examine the effects of the action using the criteria set forth in the FPPA, and, if there are adverse effects, must consider alternatives to lessen them.

Laurel Valley Mitigation Site includes the conversion of prime farmland. As such, Form AD-1006 has been completed and submitted to the Natural Resources Conservation Service (NRCS). The completed form and correspondence documenting its submittal is included in the Appendix.

Fish and Wildlife Coordination Act (FWCA)

The FWCA requires consultation with the USFWS and the appropriate state wildlife agency on projects that alter or modify a water body. Reports and recommendations prepared by these agencies document project effects on wildlife and identify measures that may be adopted to prevent loss or damage to wildlife resources.

The Laurel Valley Mitigation Site includes stream restoration. Wildlands requested comment on the project from both the USFWS and the North Carolina Wildlife Resources Commission (NCWRC) on

December 20, 2019. No response from the USFWS was received within the 45-day response period. Therefore, Wildlands assumes USFWS has no comments regarding associated laws and do not have any information relevant to the project at the current time. NCWRC responded to the scoping letter on January 21, 2020 that they provided comments on the proposed design comment during the agency site visit on January 14, 2020 (meeting notes are available upon request).

1. It was noted by Wildlife Resource Commission that the existing driveway culvert at the upstream end of UT1 Reach 2 would need to be replaced to eliminate the current aquatic organism blockage (perching). Additionally, it was requested that the existing plastic pipe be replaced with a different material culvert which will mimic a more natural stream bed, allowing for easier upstream passage of aquatics.

   Wildlands agreed to these requests regarding the replaced culvert.

2. Project activities do not need to be avoided during a trout moratorium. We recommend that riparian buffers that are to be reestablished be 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.

   All project streams will have adequate riparian buffers.

No known records of state or federally-listed rare, threatened, or endangered species within or near the project area. All correspondence with the two agencies is included in the appendix.

Migratory Bird Treaty Act (MBTA)

The MBTA makes it unlawful for anyone to kill, capture, collect, possess, buy, sell, trade, ship, import, or export any migratory bird. The indirect killing of birds by destroying their nests and eggs is covered by the MBTA, so construction in nesting areas during nesting seasons can constitute a taking.

Wildlands requested comment on the Laurel Valley Mitigation Site from the USFWS in regard to migratory birds on December 20, 2019. The USFWS has not responded at this time. All correspondence with USFWS is included in the Appendix.

Laurel Valley Mitigation Site
Categorical Exclusion

APPENDIX

Punch Buggy Mitigation Site
3923 Hawkins Drive
Morganton, NC 28655

Inquiry Number: 5733275.2s
July 29, 2019

The EDR Radius Map™ Report with GeoCheck®

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.

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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

3923 HAWKINS DRIVE
MORGANTON, NC 28655

COORDINATES

Latitude (North):	35.7012190 - 35˚ 42' 4.38''
Longitude (West):	81.6433400 - 81˚ 38' 36.02''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	441797.6
UTM Y (Meters):	3950801.2
Elevation:	1120 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5947887 MORGANTON SOUTH, NC
Version Date:	2013
East Map:	5947052 VALDESE, NC
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140618
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
3923 HAWKINS DRIVE
MORGANTON, NC 28655

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	STROUPE'S SEPTIC TAN	2698 MOUNT HOME CHUR	LUST, NPDES	Higher	1976, 0.374, NE
A2	STROUPE'S SEPTIC TAN	2698 MTN HOME CHURCH	IMD	Higher	1976, 0.374, NE
3	TIME SAVER MARKET	3280 NC HIGHWAY 18 S	IMD	Higher	2514, 0.476, NE

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-CESQG - RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS - Land Use Control Information System
US ENG CONTROLS - Engineering Controls Sites List

EXECUTIVE SUMMARY

US INST CONTROL - - - - - - - - - Sites with Institutional Controls

Federal ERNS list

ERNS - Emergency Response Notification System

State- and tribal - equivalent NPL

NC HSDS - - - - - - - - - - - - - - - - - - Hazardous Substance Disposal Site

State- and tribal - equivalent CERCLIS

SHWS - Inactive Hazardous Sites Inventory

State and tribal landfill and/or solid waste disposal site lists

SWF/LF - List of Solid Waste Facilities
OLI - Old Landfill Inventory
DEBRIS - Solid Waste Active Disaster Debris Sites Listing
LCID - Land-Clearing and Inert Debris (LCID) Landfill Notifications

State and tribal leaking storage tank lists

LAST - Leaking Aboveground Storage Tanks
INDIAN LUST - - - - - - - - - - - - - - - Leaking Underground Storage Tanks on Indian Land
LUST TRUST - - - - - - - - - - - - - - - - State Trust Fund Database

State and tribal registered storage tank lists

FEMA UST - - - - - - - - - - - - - - - - - Underground Storage Tank Listing
UST - Petroleum Underground Storage Tank Database
AST - AST Database
INDIAN UST - - - - - - - - - - - - - - - - Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

INST CONTROL - - - - - - - - - - - - - No Further Action Sites With Land Use Restrictions Monitoring

State and tribal voluntary cleanup sites

VCP - Responsible Party Voluntary Action Sites
INDIAN VCP - - - - - - - - - - - - - - - - Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS - - - - - - - - - - - - - Brownfields Projects Inventory

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS - - - - - - - - - A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

SWRCY - Recycling Center Listing

EXECUTIVE SUMMARY

HIST LF	Solid Waste Facility Listing
INDIAN ODI	Report on the Status of Open Dumps on Indian Lands
DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations
ODI	Open Dump Inventory
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
SPILLS	Spills Incident Listing
SPILLS 90	SPILLS 90 data from FirstSearch
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

EXECUTIVE SUMMARY

US MINES	Mines Master Index File
ABANDONED MINES	Abandoned Mines
FINDS	Facility Index System/Facility Registry System
ECHO	Enforcement & Compliance History Information
UXO	Unexploded Ordnance Sites
DOCKET HWC	Hazardous Waste Compliance Docket Listing
FUELS PROGRAM	EPA Fuels Program Registered Listing
AIRS	Air Quality Permit Listing
ASBESTOS	ASBESTOS
COAL ASH	Coal Ash Disposal Sites
DRYCLEANERS	Drycleaning Sites
Financial Assurance	Financial Assurance Information Listing
NPDES	NPDES Facility Location Listing
UIC	Underground Injection Wells Listing
AOP	Animal Operation Permits Listing
PCSRP	Petroleum-Contaminated Soil Remediation Permits
SEPT HAULERS	Permitted Septage Haulers Listing
CCB	Coal Ash Structural Fills (CCB) Listing

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

RGA HWS	Recovered Government Archive State Hazardous Waste Facilities List
RGA LF	Recovered Government Archive Solid Waste Facilities List
RGA LUST	Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

STANDARD ENVIRONMENTAL RECORDS

State and tribal leaking storage tank lists

LUST: The Leaking Underground Storage Tank Incidents Management Database contains an inventory of reported leaking underground storage tank incidents. The data come from the Department of Environment, & Natural Resources' Incidents by Address.

A review of the LUST list, as provided by EDR, and dated 05/03/2019 has revealed that there is 1 LUST site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
STROUPE'S SEPTIC TAN Incident Phase: Response Incident Number: 24386 Current Status: File Located in House	***2698 MOUNT HOME CHUR***	***NE 1/4 - 1/2 (0.374 mi.)***	***A1***	***8***

ADDITIONAL ENVIRONMENTAL RECORDS

Records of Emergency Release Reports

IMD: Incident Management Database.

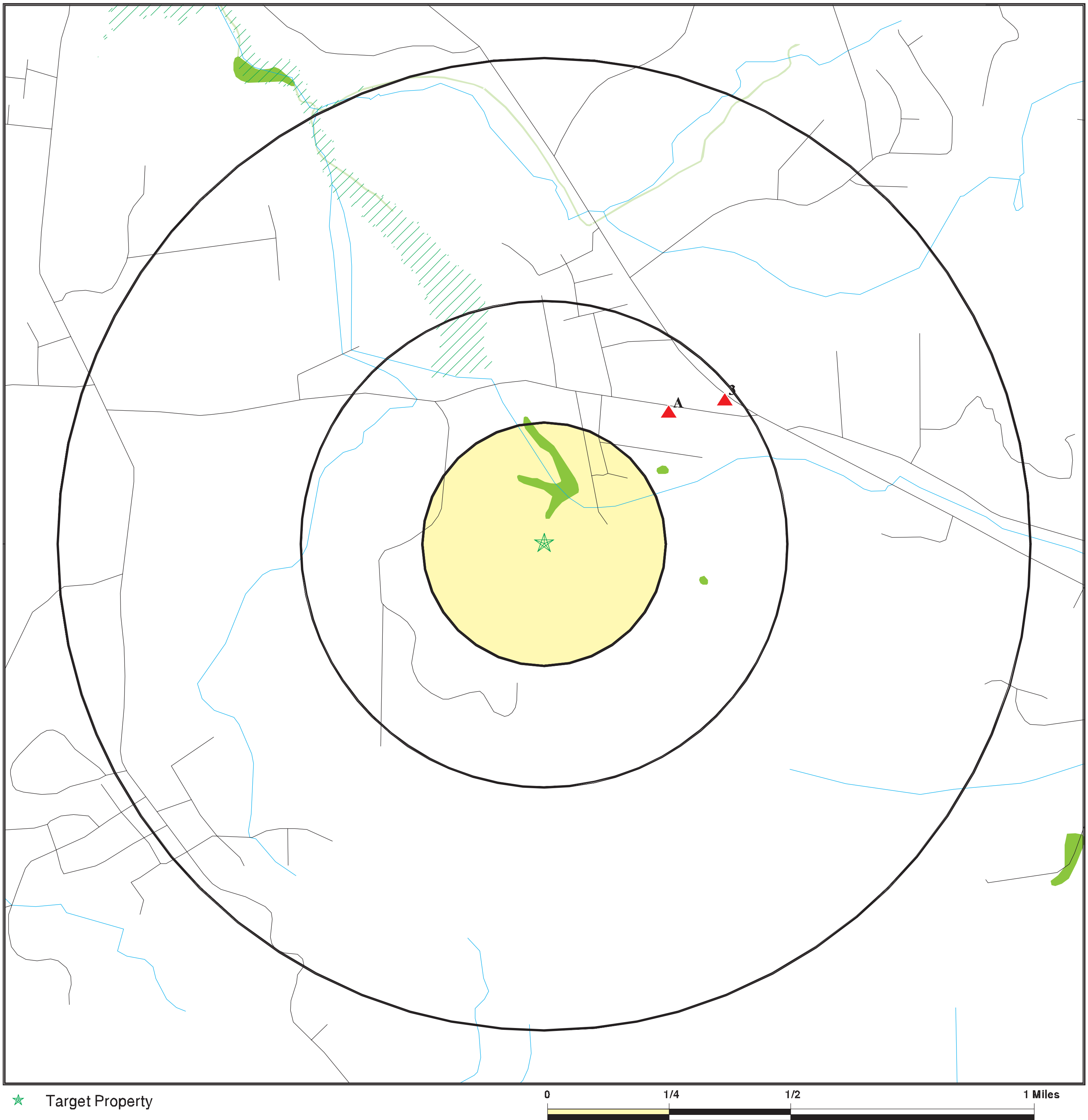
A review of the IMD list, as provided by EDR, and dated 07/21/2006 has revealed that there are 2 IMD sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
STROUPE'S SEPTIC TAN Facility Id: 24386	2698 MTN HOME CHURCH	NE 1/4 - 1/2 (0.374 mi.)	A2	10
TIME SAVER MARKET Facility Id: 28221	3280 NC HIGHWAY 18 S	NE 1/4 - 1/2 (0.476 mi.)	3	11

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 5733275.2S



- 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
- Indian Reservations BIA
- 100-year flood zone
- 500-year flood zone
- 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: Punch Buggy Mitigation Site	CLIENT: Wildlands Eng, Inc.
ADDRESS: 3923 Hawkins Drive Morganton NC 28655	CONTACT: Andrea Eckardt
	INQUIRY #: 5733275.2s
LAT/LONG: 35.701219 / 81.64334	DATE: July 29, 2019 5:37 pm

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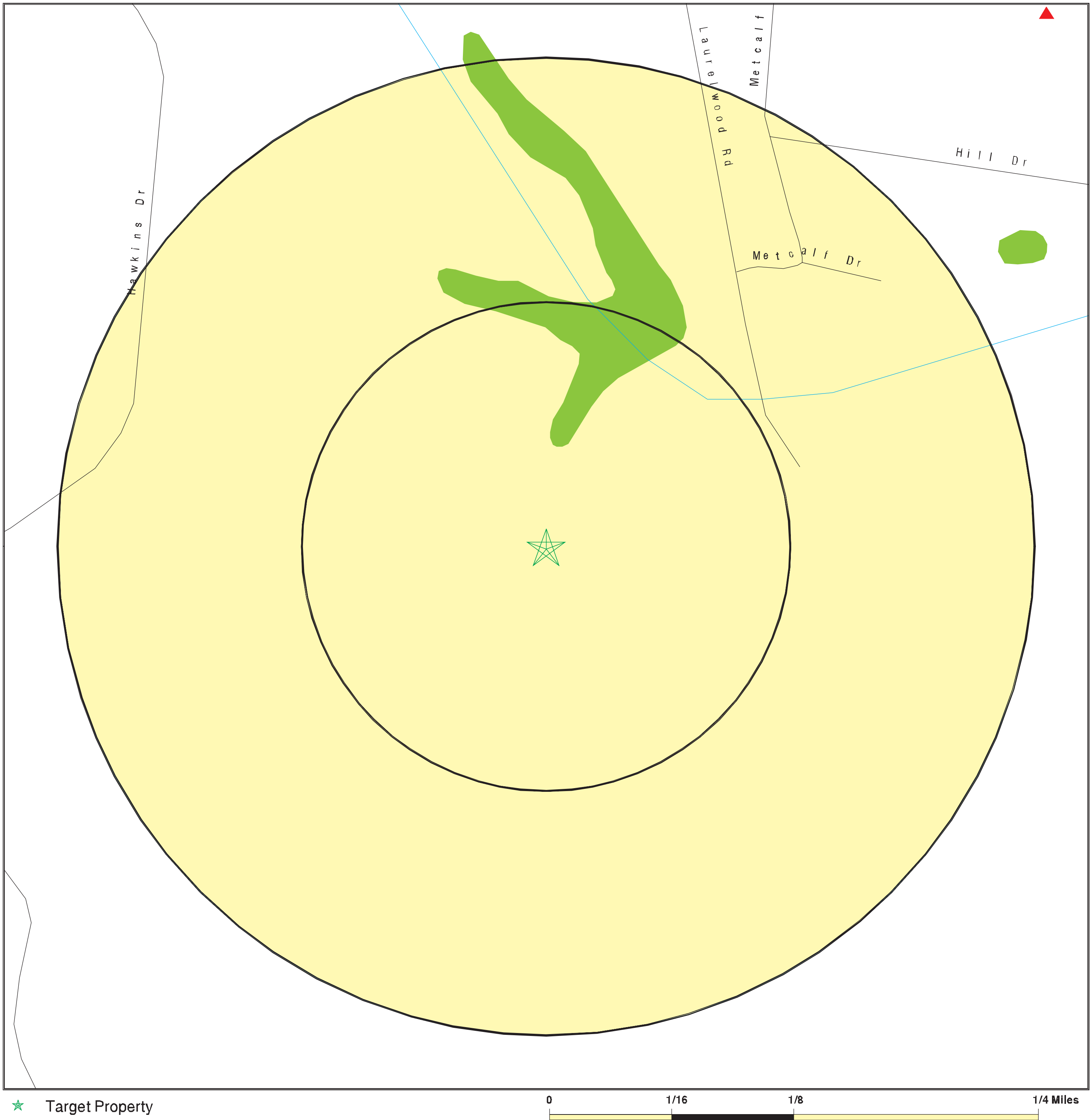
DETAIL MAP - 5733275.2S



- 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
- Indian Reservations BIA
- 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:	Punch Buggy Mitigation Site	CLIENT:	Wildlands Eng, Inc.
ADDRESS:	3923 Hawkins Drive	CONTACT:	Andrea Eckardt
	Morganton NC 28655	INQUIRY #:	5733275.2s
LAT/LONG:	35.701219 / 81.64334	DATE:	July 29, 2019 5:41 pm

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December 23, 2019

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

Subject: Laurel Valley Mitigation Site
Burke County, North Carolina

Dear Ms. Gledhill-Earley,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with a potential stream restoration project on the Laurel Valley Mitigation Site located in Burke County, NC. A USGS Topographic Map and a Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Morganton South, 7.5-Minute USGS Topographic Quadrangle, and the site is located at latitude 35.702, longitude -81.642.

The Laurel Valley Mitigation Site is being developed to provide stream mitigation in the Catawba River Basin. The project streams, East Prong Hunting Creek and two of its unnamed tributaries, will be restored and preserved as part of this project. East Prong Hunting Creek drains to Rhodhiss Lake on the Catawba River. The area surrounding the streams and channels proposed for stream mitigation is currently an active farm composed of cattle pastures, barns, and a house.

The major goals of the stream mitigation project are to provide ecological and water quality enhancements to the Catawba River Basin while creating a functional riparian corridor at the site level. This will be accomplished by excluding livestock from stream channels, restoring and enhancing native floodplain vegetation, improving the stability of stream channels, improving instream habitat, and permanently protecting and preserving the project site through establishing a conservation easement. These actions will reduce fecal, nutrient, and sediment inputs to project streams, and ultimately to Rhodhiss Lake and the Catawba River, as well as reconnect instream and terrestrial habitats on the project site.

No architectural structures or archaeological artifacts are listed on the National Register with the State Historic Preservation Office within one mile of the Site. In addition, no architectural structures were observed or noted within the project area during preliminary surveys of the site for restoration purposes.

We ask that you review the site based on the attached information to determine the presence of any historic properties. We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Kirsten Y. Gimbert

Kirsten Gimbert, *Senior Environmental Scientist*
kgimbert@wildlandseng.com
704.941.9093

Attachment:
Figure 1 Site Map
Figure 2 USGS Topographic Map

North Carolina Department of Natural and Cultural Resources
State Historic Preservation Office
Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

January 28, 2020

Kristen Gimbert
1460 South Mint Street
Suite 104
Charlotte, NC 28203

Re: Laurel Valley Mitigation Site, Burke County, ER 20-0049

Dear Ms. Gimbert:

Thank you for your December 23, 2019, submission concerning the above-referenced project. We have reviewed the materials provided and offer the following comments.

There are no previously recorded archaeological sites located within the proposed project area. However, the project area has never been systematically surveyed to determine the location or significance of archaeological resources. Based on the topographical and hydrological situation there is a high probability for the presence of prehistoric or historic archaeological sites in the project area.

We recommend that prior to any ground disturbing activities within the project area, a comprehensive archaeological survey be conducted by an experienced archaeologist. The purpose of this survey is to identify and evaluate the significance of archaeological sites and cemeteries that may be damaged or destroyed by the proposed project.

Please note that our office now requests consultation with the Office of State Archaeology Review Archaeologist to discuss appropriate field methodologies prior to the archaeological field investigation. 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.

One paper and one digital copy of all resulting archaeological reports, as well as one digital copy of the North Carolina site form for each site recorded, should be forwarded to the Office of State Archaeology through this office for review and comment as soon as they are available and in advance of any construction or ground disturbance activities.

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 comments, please contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above-referenced tracking number.

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

Ramona Bartos, Deputy

for State Historic Preservation Officer

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

April 16, 2020

Brooke Brilliant
121 East First Street
Clayton, NC 27520

brookebrilliant@archcon.org

Re: Archaeological Survey Report of the Laurel Valley Mitigation Site, Burke County, ER 20-0049

Dear Ms. Brilliant:

Thank you for your submission of February 26, 2020, concerning the above-referenced undertaking. We have reviewed the materials submitted and offer the following comments.

The Phase I archaeological survey report prepared by Archaeology Consultants of the Carolinas, Inc., (ACC), documented the investigation of approximately 16.5 ac that included the excavation of 120 shovel test pits. No archaeological resources or artifacts were identified. ACC recommends the proposed project will not impact any significant archaeological resources and no additional archaeological work is necessary. We concur with the findings and recommendations and accept the report as final.

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

of any assignment of this agreement by Buyer.

3.8 **Value of Conservation Easement; No Power of Eminent Domain.** In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Buyer hereby notifies Seller that: (i) Buyer believes that the fair market value of the Conservation Easement is an amount equal to the Purchase Price; and (ii) Buyer does not have the power of eminent domain.

3.9 **Modification; Waiver.** No amendment of this agreement will be effective unless it is in writing and signed by the parties. No waiver of satisfaction of a condition or failure to comply with an obligation under this agreement will be effective unless it is in writing and signed by the party granting the waiver, and no such waiver will constitute a waiver of satisfaction of any other condition or failure to comply with any other obligation.

3.10 **Attorneys' Fees.** If either party commences an action against the other to interpret or enforce any of the terms of this agreement or because of the breach by the other party of any of the terms of this agreement, the losing party shall pay to the prevailing party reasonable attorneys' fees, expenses, court costs, litigation costs and any other expenses incurred in connection with the prosecution or defense of such action, whether or not the action is prosecuted to a final judgment.

3.11 **Memorandum of Option Agreement.** Concurrently with the signing of this agreement, Buyer and Seller agree to sign a Memorandum of Option that will be recorded against the Property in the Register of Deeds in the County stated in paragraph A within five days after the Effective Date.

3.12 **Tax Deferred Exchange.** If Seller desires to effect a tax-deferred exchange (the "**Exchange**") in connection with Buyer's purchase of the Conservation Easement, the parties agree to cooperate in effecting the Exchange. Seller is responsible for all additional costs associated with the Exchange and Buyer shall not have any additional liability with respect to the Exchange. The parties will execute any additional documents required for the Exchange at no cost to Buyer.

3.13 **Brokers**. Shawn D. Wilkerson, Robert W. Bugg and Ian Hazelhoff are North Carolina Real Estate Brokers. Neither Buyer nor Seller has incurred any liability for any brokerage fee, commission or finder's fee in connection with this agreement or the transactions contemplated by this agreement.

3.14 **Entire Agreement.** Each party acknowledges they are not relying on any statements made by the other party, other than in this agreement, regarding the subject matter of this agreement. Neither party will have a basis for bringing any claim for fraud in connection with any such statements.

3.15 **Mutual Agreement.** This is a mutually negotiated agreement and regardless of which party was more responsible for its preparation, this agreement shall be construed neutrally between the parties.

3.16 **Governing Law.** The laws of the State of North Carolina, without giving effect to its principles of conflicts of law, govern all matters arising out of this agreement.

3.17 **Counterparts.** This agreement may be signed in counterparts, each of which shall be deemed an original, but all of which, together, constitute one and the same instrument. A signed copy of this agreement delivered by electronic mail in portable document format (".pdf" format) shall have the same legal effect as delivery of an original signed copy of this agreement.

Each party is signing this agreement on the date stated below that party's signature.

_____ Buyer
_____ Seller

BUYER:

WILDLANDS ENGINEERING, INC., a North Carolina corporation

By: ______________________
Shawn D. Wilkerson, President

Date: 7/31/2019

SELLER:

JOHN HEWAT, JR.

By: ______________________
John Hewat, Jr.

Date: 7-29-19

____ Buyer
____ Seller

NORTH CAROLINA
Environmental Quality

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
TIM BAUMGARTNER
Director

Elizabeth Toombs 1/17/2020
Cherokee Nation
Tribal Historic Preservation Office
P.O. Box 948
Tahlequah, OK 74465
elizabeth-toombs@cherokee.org

Dear Ms. Toombs,

The North Carolina Department of Environmental Quality (NCDEQ) – Division of Mitigation Services (DMS) requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with the proposed stream restoration project on the Laurel Valley Mitigation Site. The Federal Highway Administration (FHWA) is the lead federal agency for this proposed mitigation project. A USGS Topographic Map and a proposed project conceptual map showing the project area are enclosed. The topographic figure was prepared from the Morganton South, 7.5-Minute USGS Topographic Quadrangle. The project location (Latitude and Longitude) is as follows: 35.702, -81.642.

The Laurel Valley Mitigation Site is being developed to provide stream mitigation in the Catawba River Basin. The project streams, East Prong Hunting Creek and two of its unnamed tributaries, will be restored and preserved as part of this project. East Prong Hunting Creek drains to Rhodhiss Lake on the Catawba River. The area surrounding the streams and channels proposed for stream mitigation is currently an active farm composed of cattle pastures, barns, and a house. The major goals of the stream mitigation project are to provide ecological and water quality enhancements to the Catawba River Basin while creating a functional riparian corridor at the site level. This will be accomplished by excluding livestock from stream channels, restoring and enhancing native floodplain vegetation, improving the stability of stream channels, improving instream habitat, and permanently protecting and preserving the project site through establishing a conservation easement. These actions will reduce fecal, nutrient, and sediment inputs to project streams, and ultimately to Rhodhiss Lake and the Catawba River, as well as reconnect instream and terrestrial habitats on the project site.

We ask that you review this site based on the attached information to determine the presence of any known historic properties. We respectfully request a response within 30 days of receipt of this letter/ email in an effort to implement this necessary stream restoration/ mitigation project.

Please feel free to contact us with any questions that you may have concerning this project.

Respectfully,

Paul Wiesner

Paul Wiesner
Western Regional Supervisor
North Carolina Department of Environmental Quality
Division of Mitigation Services

828-273-1673 Mobile
paul.wiesner@ncdenr.gov

Western DMS Field Office
5 Ravenscroft Drive
Suite 102
Asheville, N.C. 28801

Attachments:
Figure 1: USGS Topographic Map
Figure 2: Proposed Project Conceptual Map

cc: Donnie Brew, FHWA

NORTH CAROLINA
Environmental Quality

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
TIM BAUMGARTNER
Director

1/17/2020

Russell Townsend
Tribal Historic Preservation Officer
Tribal Historic Preservation Office
Eastern Band of the Cherokee Indians
russtown@nc-cherokee.com

Stephen Yerka
Historic Preservation Specialist
Tribal Historic Preservation Office
Eastern Band of the Cherokee Indians
syerka@nc-cherokee.com

Dear Mr. Townsend and Mr. Yerka,

The North Carolina Department of Environmental Quality (NCDEQ) – Division of Mitigation Services (DMS) requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with the proposed stream restoration project on the Laurel Valley Mitigation Site. The Federal Highway Administration (FHWA) is the lead federal agency for this proposed mitigation project. A USGS Topographic Map and a proposed project conceptual map showing the project area are enclosed. The topographic figure was prepared from the Morganton South, 7.5-Minute USGS Topographic Quadrangle. The project location (Latitude and Longitude) is as follows: 35.702, -81.642.

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Please feel free to contact us with any questions that you may have concerning this project.

Respectfully,

Paul Wiesner

Paul Wiesner
Western Regional Supervisor
North Carolina Department of Environmental Quality
Division of Mitigation Services

828-273-1673 Mobile
paul.wiesner@ncdenr.gov

Western DMS Field Office
5 Ravenscroft Drive
Suite 102
Asheville, N.C. 28801

Attachments:
Figure 1: USGS Topographic Map
Figure 2: Proposed Project Conceptual Map

cc: Donnie Brew, FHWA

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
TIM BAUMGARTNER
Director

NORTH CAROLINA
Environmental Quality

1/17/2020

Ms. Whitney Warrior
Environmental Services & Historic Preservation Director
Tribal Historic Preservation Office
United Keetoowah Band of Cherokee Indians in Oklahoma
P. O. Box 746
Tahlequah, OK 74465
wwarrior@ukb-nsn.gov
CC: kpritchett@ukb-nsn.gov

Dear Ms. Warrior,

The North Carolina Department of Environmental Quality (NCDEQ) – Division of Mitigation Services (DMS) requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with the proposed stream restoration project on the Laurel Valley Mitigation Site. The Federal Highway Administration (FHWA) is the lead federal agency for this proposed mitigation project. A USGS Topographic Map and a proposed project conceptual map showing the project area are enclosed. The topographic figure was prepared from the Morganton South, 7.5-Minute USGS Topographic Quadrangle. The project location (Latitude and Longitude) is as follows: 35.702, -81.642.

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We ask that you review this site based on the attached information to determine the presence of any known historic properties. We respectfully request a response within 30 days of receipt of this letter/ email in an effort to implement this necessary stream restoration/ mitigation project.

Please feel free to contact us with any questions that you may have concerning this project.

Respectfully,

Paul Wiesner

Paul Wiesner
Western Regional Supervisor
North Carolina Department of Environmental Quality
Division of Mitigation Services

828-273-1673 Mobile
paul.wiesner@ncdenr.gov

Western DMS Field Office
5 Ravenscroft Drive
Suite 102
Asheville, N.C. 28801

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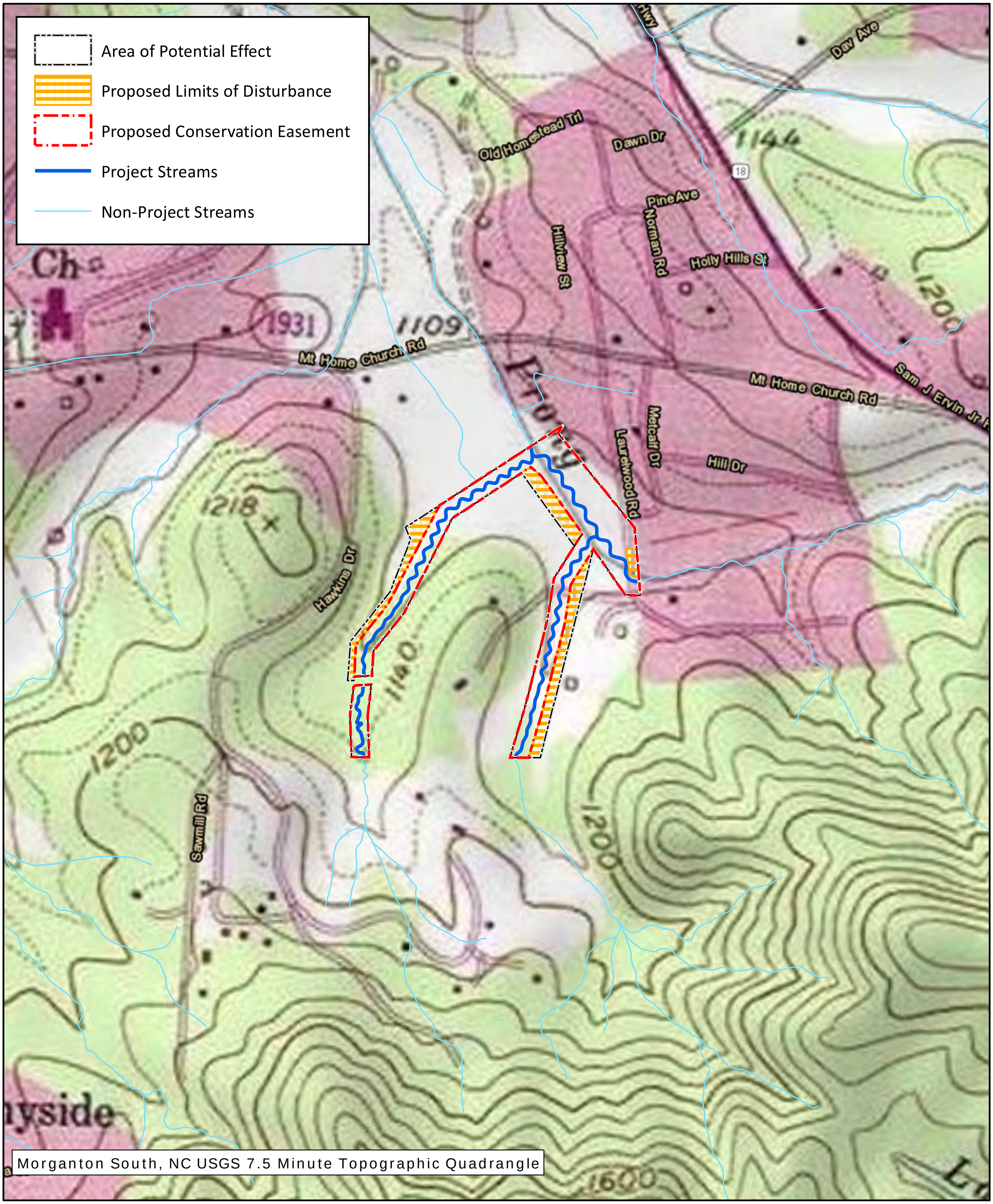
Figure 2: Proposed Project Conceptual Map

cc: Donnie Brew, FHWA



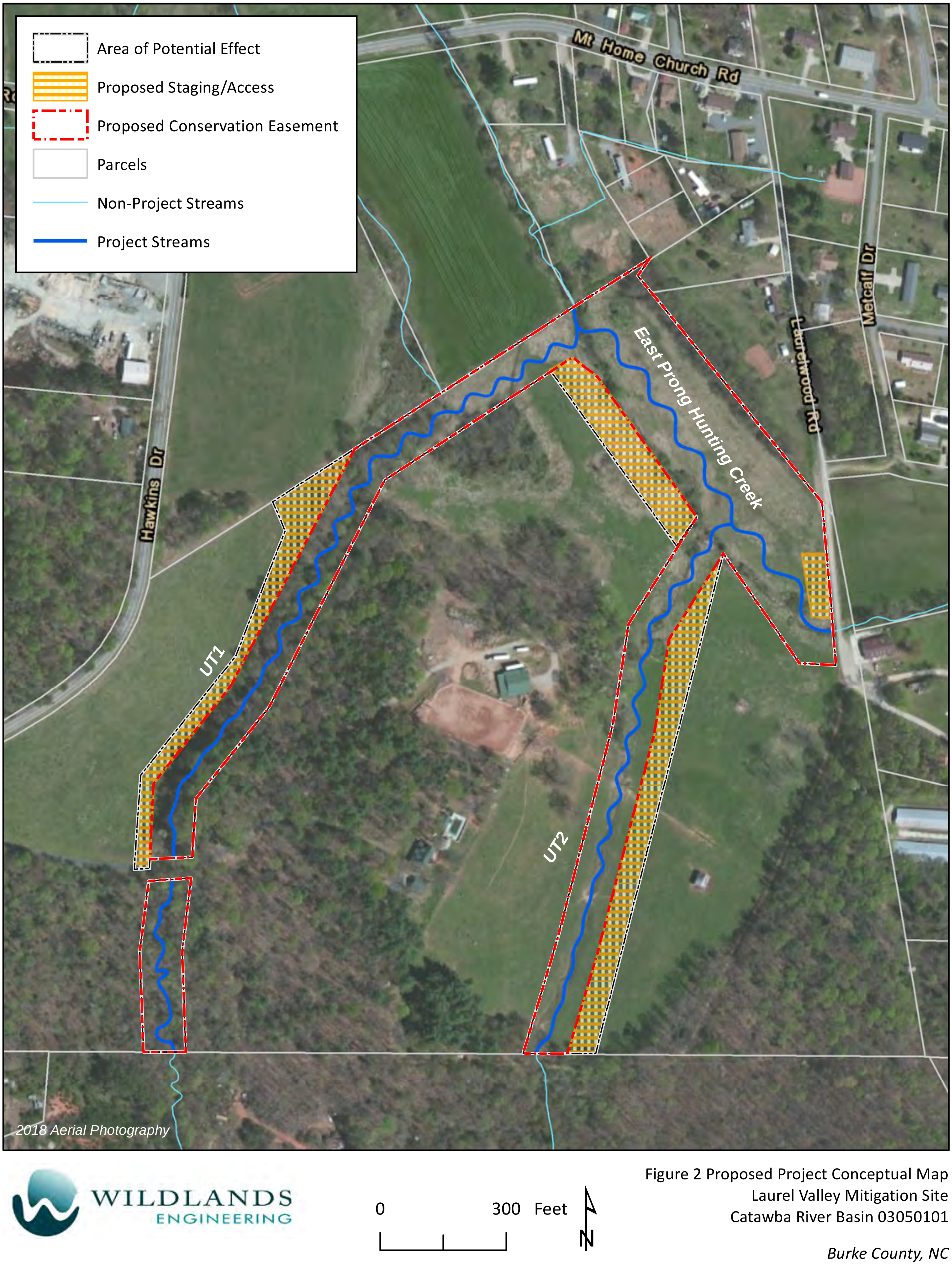
WILDLANDS ENGINEERING

0 750 Feet

N

Figure 1 USGS Topographic Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC



WILDLANDS ENGINEERING

Figure 2 Proposed Project Conceptual Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

December 20, 2019

Claire Ellwanger
US Fish and Wildlife Service
Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801

Subject: Laurel Valley Mitigation Site
Burke County, North Carolina

Dear Ms. Ellwanger,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to endangered species, migratory birds, or other trust resources associated with a potential stream restoration project on the Laurel Valley Mitigation Site located in Burke County, NC. A USGS Topographic Map and a Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Morganton South, 7.5-Minute USGS Topographic Quadrangle, and the site is located at latitude 35.702, longitude -81.642.

The Laurel Valley Mitigation Site is being developed to provide stream mitigation in the Catawba River Basin. The project streams, East Prong Hunting Creek and two of its unnamed tributaries, will be restored and preserved as part of this project. East Prong Hunting Creek drains to Rhodhiss Lake on the Catawba River. The area surrounding the streams and channels proposed for stream mitigation is currently an active farm composed of cattle pastures, barns, and a house.

The major goals of the stream mitigation project are to provide ecological and water quality enhancements to the Catawba River Basin while creating a functional riparian corridor at the site level. This will be accomplished by excluding livestock from stream channels, restoring and enhancing native floodplain vegetation, improving the stability of stream channels, improving instream habitat, and permanently protecting and preserving the project site through establishing a conservation easement. These actions will reduce fecal, nutrient, and sediment inputs to project streams, and ultimately to Rhodhiss Lake and the Catawba River, as well as reconnect instream and terrestrial habitats on the project site.

According to your website, Information for Planning and Consultation database (IPaC), the threatened or endangered species listed within the project area located in Burke County, NC consists of six species; the dwarf-flowered heartleaf (Hexastylis naniflora), the heller's blazingstar (*Liatris helleri*), the mountain golden heather (*Hudsonia montana*), the small whorled pogonia (*Isotria medeoloides*), the white irisette (*Sisyrinchium dichotomum*) and the rock gnome lichen (*Gymnoderma lineare*). If we have not heard from you in 45 days, we will assume that you do not have any comments regarding associated laws and that you do not have any information relevant to this project at the current time.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Kirsten Y. Gimbert

Kirsten Gimbert, *Senior Environmental Scientist*
kgimbert@wildlandseng.com
704.941.9093

Attachment:
Figure 1 Site Map
Figure 2 USGS Topographic Map

Kirsten Gimbert

From: Brew, Donnie (FHWA) <Donnie.Brew@dot.gov>
Sent: Thursday, January 23, 2020 8:01 AM
To: claire_ellwanger (claire_ellwanger@fws.gov)
Cc: harry.tsomides@ncdenr.gov; Wiesner, Paul; Kirsten Gimbert; Andrea Eckardt
Subject: NLEB 4(d) rule consultation - Laurel Valley mitigation site, Burke County
Attachments: Laurel Valley site- NLEB Consultation Form_FHWA.pdf; Laurel Valley-USGS Map.pdf; Laurel Valley-Concept Map.pdf

Good morning Claire,

The purpose of this message is to notify your office that FHWA will use the streamlined consultation framework for the Laurel Valley mitigation site in Burke County, NC.

Attached is a completed NLEB 4(d) Rule Streamlined Consultation form along with site maps/figures.

Thank you,

Donnie

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

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

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

(1) notify the field office that an action agency will use the streamlined framework;

(2) describe the project with sufficient detail to support the required determination; and

(3) enable the USFWS to track effects and determine if reinitiation of consultation for the 4(d) rule is required. This form requests the minimum amount of information required for the Service to be able to track this information.

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

Donnie Brew
Preconstruction & Environment Engineer
Federal Highway Administration

310 New Bern Ave, Suite 410
Raleigh, NC 27601
donnie.brew@dot.gov
919-747-7017

Please consider the environment before printing this email.

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

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

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

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

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

Agency and Applicant[3] (Name, Email, Phone No.): FHWA, Donnie Brew, Donnie.brew@dot.gov, 919-747-7017

Project Name: Laurel Valley Mitigation Site

Project Location (include coordinates if known): latitude 35.702, longitude -81.642

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

The Laurel Valley Mitigation Site is being developed to provide stream mitigation in the Catawba River Basin. The project streams, East Prong Hunting Creek and two of its unnamed tributaries, will be restored and preserved as part of this project. East Prong Hunting Creek drains to Rhodhiss Lake on the Catawba River. The area surrounding the streams and channels proposed for stream mitigation is currently an active farm composed of cattle pastures, barns, and a house.
The major goals of the stream mitigation project are to provide ecological and water quality enhancements to the Catawba River Basin while creating a functional riparian corridor at the site level. This will be accomplished by excluding livestock from stream channels, restoring and enhancing native floodplain vegetation, improving the stability of stream channels, improving instream habitat, and permanently protecting and preserving the project site through establishing a conservation easement. These actions will reduce fecal, nutrient, and sediment inputs to project streams, and ultimately to Rhodhiss Lake

[1] http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf
[2] See http://www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html
[3] If applicable - only needed for federal actions with applicants (e.g., for a permit, etc.) who are party to the consultation.

and the Catawba River, as well as reconnect instream and terrestrial habitats on the project site. Construction of the stream restoration project will include some tree removal (>3"DBH) – approximately 3.33 acres.

General Project Information	YES	NO
Does the project occur within 0.25 miles of a known hibernaculum? (19 miles)	☐	☒
Does the project occur within 150 feet of a known maternity roost tree?	☐	☒
Does the project include forest conversion[4]? (if yes, report acreage below)	☒	☐
Estimated total acres of forest conversion	3.33 ac	
If known, estimated acres[5] of forest conversion from April 1 to October 31		
If known, estimated acres of forest conversion from June 1 to July 31[6]		
Does the project include timber harvest? (if yes, report acreage below)	☐	☒
Estimated total acres of timber harvest		
If known, estimated acres of timber harvest from April 1 to October 31		
If known, estimated acres of timber harvest from June 1 to July 31		
Does the project include prescribed fire? (if yes, report acreage below)	☐	☒
Estimated total acres of prescribed fire		
If known, estimated acres of prescribed fire from April 1 to October 31		
If known, estimated acres of prescribed fire from June 1 to July 31		
Does the project install new wind turbines? (if yes, report capacity in MW below)	☐	☒
Estimated wind capacity (MW)		

Agency Determination:

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

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

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

Signature: ____________________________ Date Submitted: 1-23-20

[4] Any activity that temporarily or permanently removes suitable forested habitat, including, but not limited to, tree removal from development, energy production and transmission, mining, agriculture, etc. (see page 48 of the BO).
[5] If the project removes less than 10 trees and the acreage is unknown, report the acreage as less than 0.1 acre.
[6] If the activity includes tree clearing in June and July, also include those acreage in April to October.

Kirsten Gimbert

From: Kirsten Gimbert
Sent: Friday, February 21, 2020 8:31 AM
To: Cortes, Milton - NRCS, Raleigh, NC
Subject: Laurel Valley AD1006_FPPA
Attachments: FPPA_AD1006 Laurel Valley.pdf

Milton,

Please find attached to the email the completed FPPA AD1006 Form for the Laurel Valley Mitigation Site.

Thank You,

Kirsten Gimbert | *Senior Environmental Scientist*
M: 704.941.9093

Wildlands Engineering, Inc.
1430 S. Mint St, Suite 104
Charlotte, NC 28203

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 1/3/20
Name Of Project Laurel Valley Mitigation Site	Federal Agency Involved FHWA
Proposed Land Use Stream Restoration	County And State Burke County, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

	Yes	No	Acres Irrigated	Average Farm Size
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).*	☑	☐	none	71 acres

Major Crop*(s)* CORN	Farmable Land In Govt. Jurisdiction Acres: 164,189 acres % 50	Amount Of Farmland As Defined in FPPA Acres: 124,626 acres % 38
Name Of Land Evaluation System Used Burke County, NC LESA	Name Of Local Site Assessment System N/A	Date Land Evaluation Returned By NRCS February 13, 2020 by eMail

PART III *(To be completed by Federal Agency)*		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		13.0			
B. Total Acres To Be Converted Indirectly					
C. Total Acres In Site		13.0	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland		9.3			
B. Total Acres Statewide And Local Important Farmland		3.7			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted		0.0104			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value		6.0			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*					
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	12			
2. Perimeter In Nonurban Use	10	0			
3. Percent Of Site Being Farmed	20	14			
4. Protection Provided By State And Local Government	20	20			
5. Distance From Urban Builtup Area	15	10			
6. Distance To Urban Support Services	15	10			
7. Size Of Present Farm Unit Compared To Average	10	0			
8. Creation Of Nonfarmable 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				
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100				
Total Site Assessment *(From Part VI above or a local site assessment)*	160				
TOTAL POINTS *(Total of above 2 lines)*	260	153	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side)

This form was electronically produced by National Production Services Staff

Clear Form

Form AD-1006 (10-83)

WILDLANDS
ENGINEERING

December 20, 2019

Andrea Leslie
North Carolina Wildlife Resource Commission
Mountain Coordinator
645 Fish Hatchery Road
Marion, NC 28752

Subject: Laurel Valley Mitigation Site
Burke County, North Carolina

Dear Ms. Leslie,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with a potential stream restoration project on the Laurel Valley Mitigation Site located in Burke County, NC. A USGS Topographic Map and a Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Morganton South, 7.5-Minute USGS Topographic Quadrangle, and the site is located at latitude 35.702, longitude -81.642.

The Laurel Valley Mitigation Site is being developed to provide stream mitigation in the Catawba River Basin. The project streams, East Prong Hunting Creek and two of its unnamed tributaries, will be restored and preserved as part of this project. East Prong Hunting Creek drains to Rhodhiss Lake on the Catawba River. The area surrounding the streams and channels proposed for stream mitigation is currently an active farm composed of cattle pastures, barns, and a house.

The major goals of the stream mitigation project are to provide ecological and water quality enhancements to the Catawba River Basin while creating a functional riparian corridor at the site level. This will be accomplished by excluding livestock from stream channels, restoring and enhancing native floodplain vegetation, improving the stability of stream channels, improving instream habitat, and permanently protecting and preserving the project site through establishing a conservation easement. These actions will reduce fecal, nutrient, and sediment inputs to project streams, and ultimately to Rhodhiss Lake and the Catawba River, as well as reconnect instream and terrestrial habitats on the project site.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Kirsten Y. Gimbert

Kirsten Gimbert, *Senior Environmental Scientist*
kgimbert@wildlandseng.com
704.941.9093

Attachment:
Figure 1 Site Map
Figure 2 USGS Topographic Map

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

January 21, 2020

Kirsten Gimbert
Wildlands Engineering
1430 South Mint Street, Suite 104
Charlotte, NC 28203

SUBJECT: Laurel Valley Mitigation Site

Dear Ms. Gimbert:

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) received your December 20, 2019 letter regarding plans for a stream mitigation project on East Prong Hunting Creek and two unnamed tributaries in Burke County. You requested that we review and comment on any possible issues that might emerge with respect to fish and wildlife from the potential stream restoration project. Our comments on this project are offered for your consideration under provisions of the Clean Water Act of 1977 (33 U.S.C. 466 et. seq.) and Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667d).

The project is proposed as a mitigation project and will involve stream restoration and preservation. No other information is provided. NCWRC provided comments on the proposed design concept during the agency site visit on January 14, 2020.

Project activities do not need to be avoided during a trout moratorium. We recommend that riparian buffers that are to be reestablished be 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.

Thank you for the opportunity to review and comment on this project. Please contact me at (828) 803-6054 if you have any questions about these comments.

Sincerely,

Andrea Leslie

Andrea Leslie
Mountain Region Coordinator
Habitat Conservation Program

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

Office of the Chief

Chuck Hoskin Jr.
Principal Chief

Bryan Warner
Deputy Principal Chief

May 4, 2020

Kim Browning
United States Army Corps of Engineers
Mitigation Field Office
3331 Heritage Trade Drive, Suite 105
Wake Forest, NC 27587

Re: SAW-2020-00053, Laurel Valley Mitigation

Ms. Kim Browning:

The Cherokee Nation (Nation) is in receipt of your correspondence about **SAW-2020-00053**, and appreciates the opportunity to provide comment upon this project. Please allow this letter to serve as the Nation's interest in acting as a consulting party to this proposed project.

The Nation maintains databases and records of cultural, historic, and pre-historic resources in this area. Our Historic Preservation Office reviewed this project, cross referenced the project's legal description against our information, and found no instances where this project intersects or adjoins such resources. Thus, the Nation does not foresee this project imparting impacts to Cherokee cultural resources at this time.

However, the Nation requests that the United States Army Corps of Engineers (USACE) halt all project activities immediately and re-contact our Offices for further consultation if items of cultural significance are discovered during the course of this project.

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

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

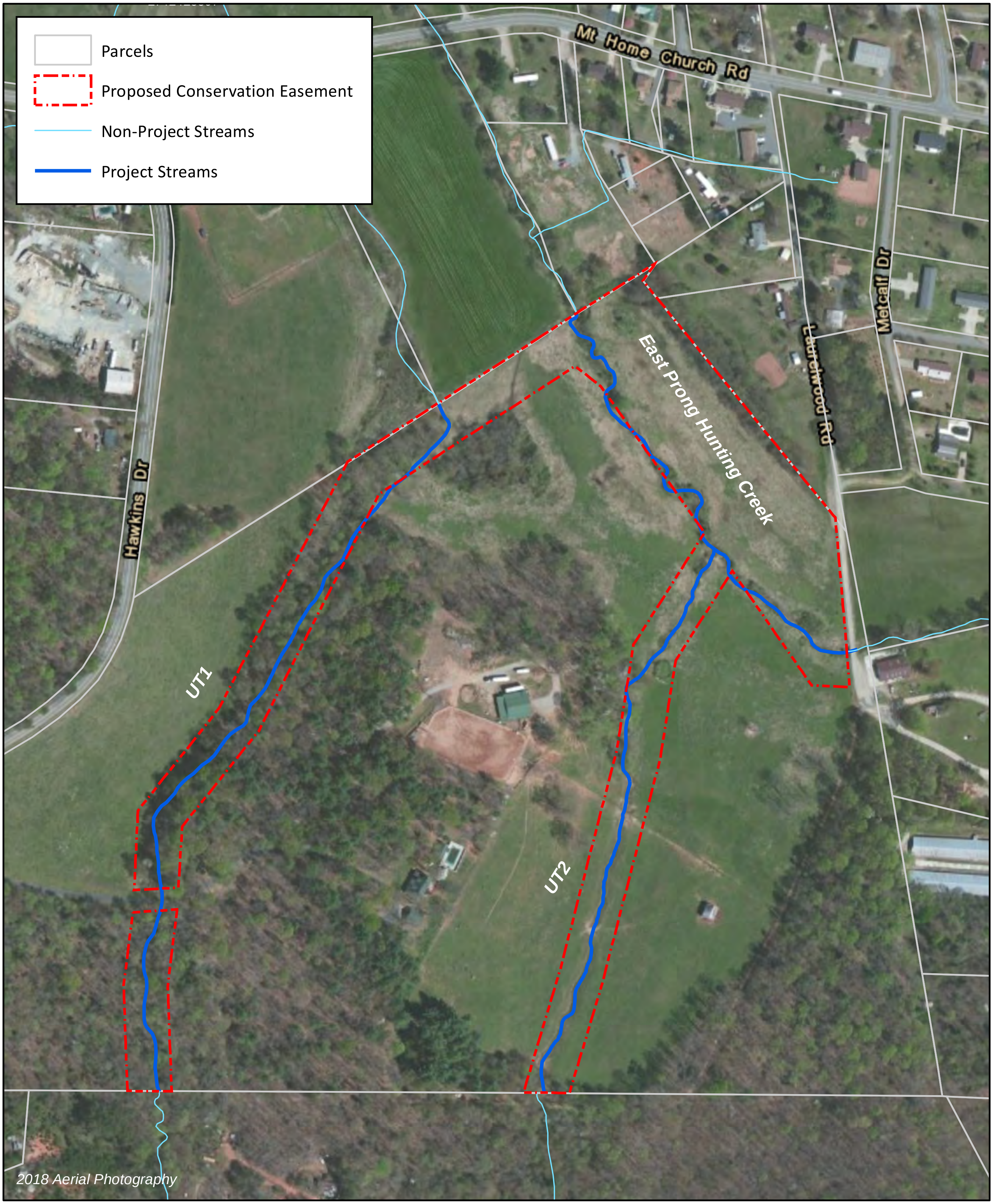
Wado,

Elizabeth Toombs

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

Laurel Valley Mitigation Site
Categorical Exclusion

FIGURES



WILDLANDS ENGINEERING

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Figure 1 Site Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

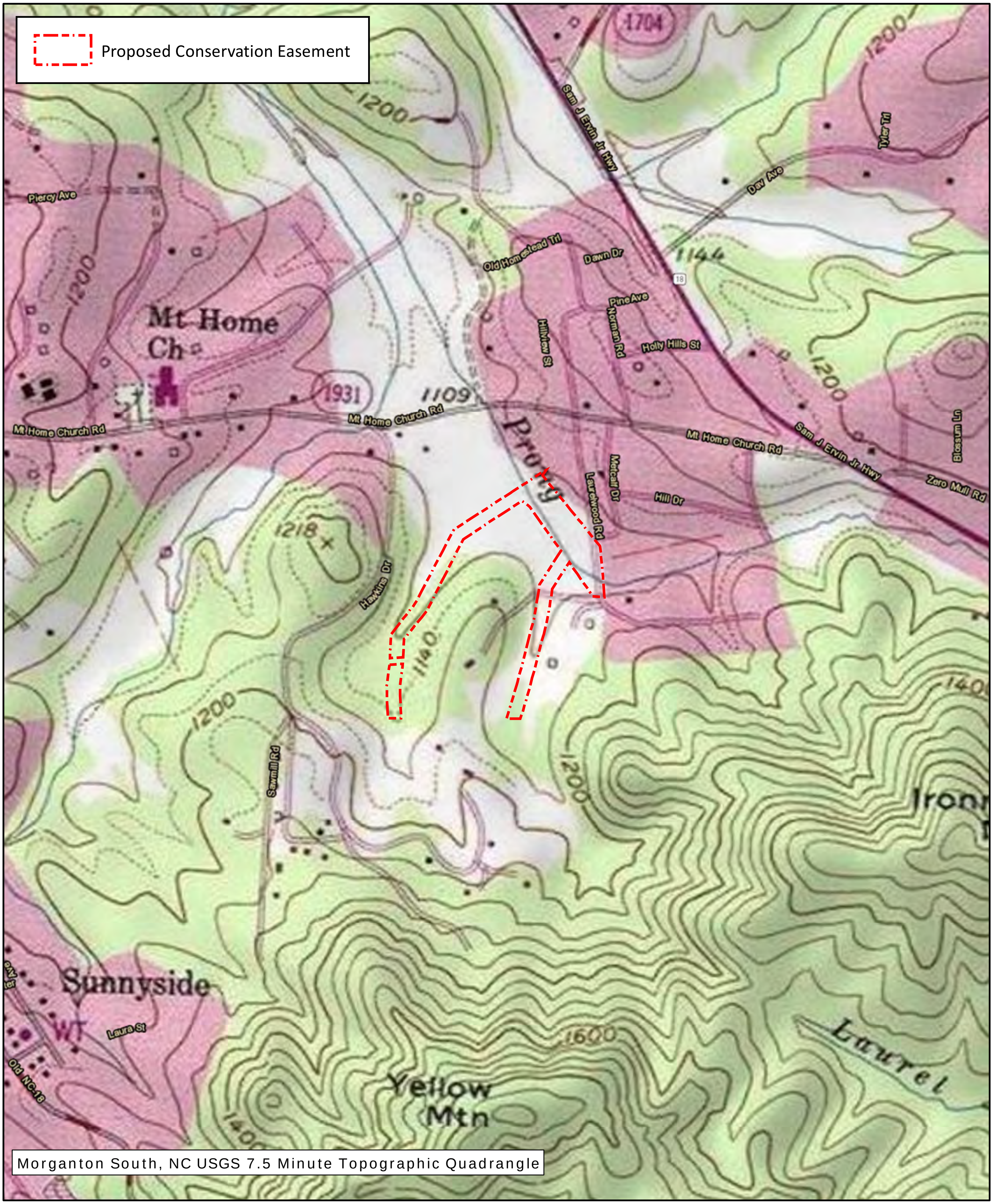

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Figure 2 USGS Topographic Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

Archaeological Survey of the Laurel Valley Mitigation Site Burke County, North Carolina

ER 20-0049

Archaeological Consultants of the Carolinas, Inc.

February 2020

Archaeological Survey of the Laurel Valley Mitigation Site Burke County, North Carolina

ER 20-0049

Prepared for

Wildlands Engineering, Inc.
Charlotte, North Carolina

by

Abigail McCoy
Archaeologist

under the supervision of

Dawn Reid
Principal Investigator

Management Summary

In February 2020, Archaeological Consultants of the Carolinas, Inc., conducted a Phase I archaeological survey of the proposed Laurel Valley mitigation site in Burke County, North Carolina. This investigation was undertaken on behalf of Wildlands Engineering, Inc., in compliance with state and federal regulations addressing the identification and management of significant cultural resources. These regulations include Section 106 of the National Historic Preservation Act of 1966 (16 USC 470), as amended, and the Advisory Council on Historic Preservation Regulations for Compliance (36 CFR Part 800). A letter from the State Historic Preservation Office (SHPO) dated 28 January 2020 (ER 20-0049) requested that an archaeological survey of the project's impact areas be conducted. The primary goals of this investigation were to identify all archaeological resources located within the project's Area of Potential Effect (APE), assess those resources for eligibility to the National Register of Historic Places (NRHP), and advance management recommendations, as appropriate.

The project APE is an approximately 16.5-acre (6.7 ha) area 3.4 miles southeast of the town of Morganton in Burke County, North Carolina. The tract situated between Hawkins Drive and Laurelwood Road and consists largely of the floodplain of East Prong Hunting Creek and two unnamed tributaries currently used as cow pastures. Restoration activities will include non-invasive vegetation clearing, enhancement of the waterways' channels, and closure of an access road. All areas with slopes of less than 15 percent were surveyed with 20-meter interval shovel tests excavated along parallel transects spaced 20 meters apart. The entire APE was walked, exposed ground surfaces were examined, and judgmentally placed shovel tests were excavated in areas deemed appropriate.

Background research was conducted at the Office of State Archaeology (OSA) located in Raleigh and included a review of archaeological site forms, cultural resource reports, and historic maps of the APE and a 1.0-mile (1.6 km) radius of the APE. No previously recorded archaeological sites are located within the APE. However, the 1956 historic topographic map showed one structure near the proposed staging area; the same building is on the 1993 topographic map but is shown further away from the APE. Five historic resources have been recorded within 1.0-mile (1.6 km) of the APE. Two of these resources, the Thomas Duckworth House and the Jerome Duckworth house, are no longer extant. The remaining three resources are the Burke Youth Center, the Mull School, and the Yellow Gap Tourist Buildings, however they will not be adversely affected by this project.

No archaeological sites were identified during this survey. No evidence of the structure shown on the 1956 and 1993 historic topographic maps was identified during this survey. Based on the results of this investigation, no significant cultural resources will be impacted by the proposed restoration activities.

Table of Contents

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Chapter 1. Introduction and Methods of Investigation

Introduction

On February 17 through 19, 2020, Archaeological Consultants of the Carolinas, Inc., conducted a Phase I archaeological survey of the Laurel Valley mitigation site in Burke County, North Carolina (Figure 1.1). This archaeological investigation was undertaken on behalf of Wildlands Engineering, Inc., in compliance with state and federal permit regulations addressing the identification and management of significant cultural resources. These regulations include Section 106 of the National Historic Preservation Act of 1966 (16 USC 470), as amended, and the Advisory Council on Historic Preservation Regulations for Compliance (36 CFR Part 800). A letter from the State Historic Preservation Office (SHPO) dated 28 January 2020 (ER 20-0049) requested that an archaeological survey of the project's impact areas be conducted. The primary goals of this investigation were to identify all archaeological resources located within the project's Area of Potential Effect (APE), assess those resources for eligibility to the National Register of Historic Places (NRHP), and advance management recommendations, as appropriate. Ms. Dawn Reid served as Principal Investigator. Ms. Abigail McCoy served as the field crew. This project required two person days to complete.

Project Area

The project area is an approximately 16.5-acre (6.7 ha) parcel in central Burke County (Figure 1.2). The tract is located between Hawkins Drive and Laurelwood Road, approximately 3.4 miles southeast of Morganton. The APE consists largely of the floodplain of East Prong Hunting Creek and two unnamed tributaries currently used for cow pastures. Restoration activities will include non-invasive vegetation clearing, enhancement of the waterways' channels, and closure of an access road. The project area contains pasture and wooded areas (Figure 1.3 - Figure 1.5). East Prong Hunting Creek traverses the APE along the northern boundary; the eastern and western boundaries follow unnamed tributaries of East Prong Hunting Creek, with staging and access areas following the waterways (Figure 1.6 - Figure 1.8).

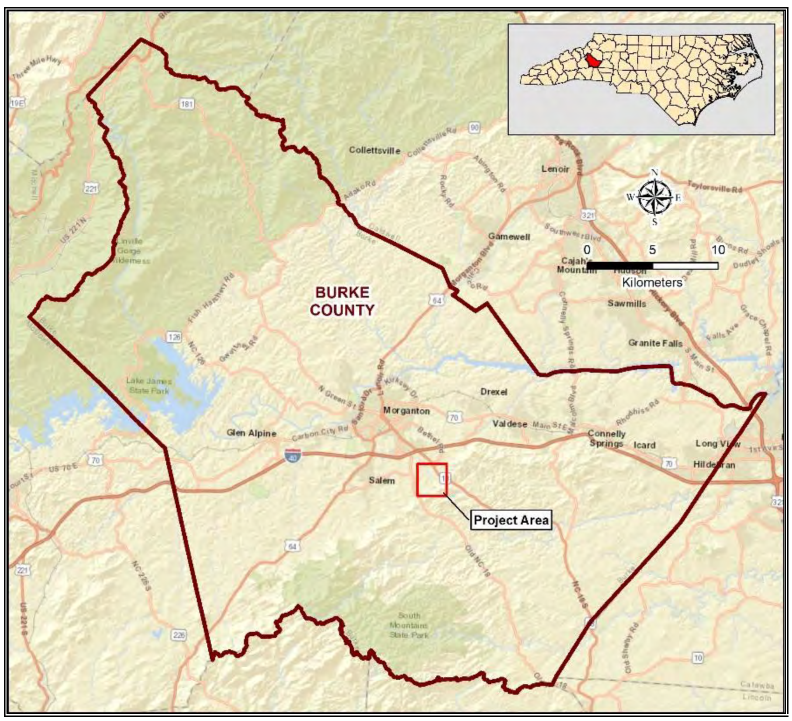

Figure 1.1. Location of project area within Burke County.

Methods of Investigation

This investigation was comprised of three separate tasks: Background Research, Field Survey, and Report Production. As no artifacts were recovered, no laboratory analysis was necessary. Each of these tasks is described below.

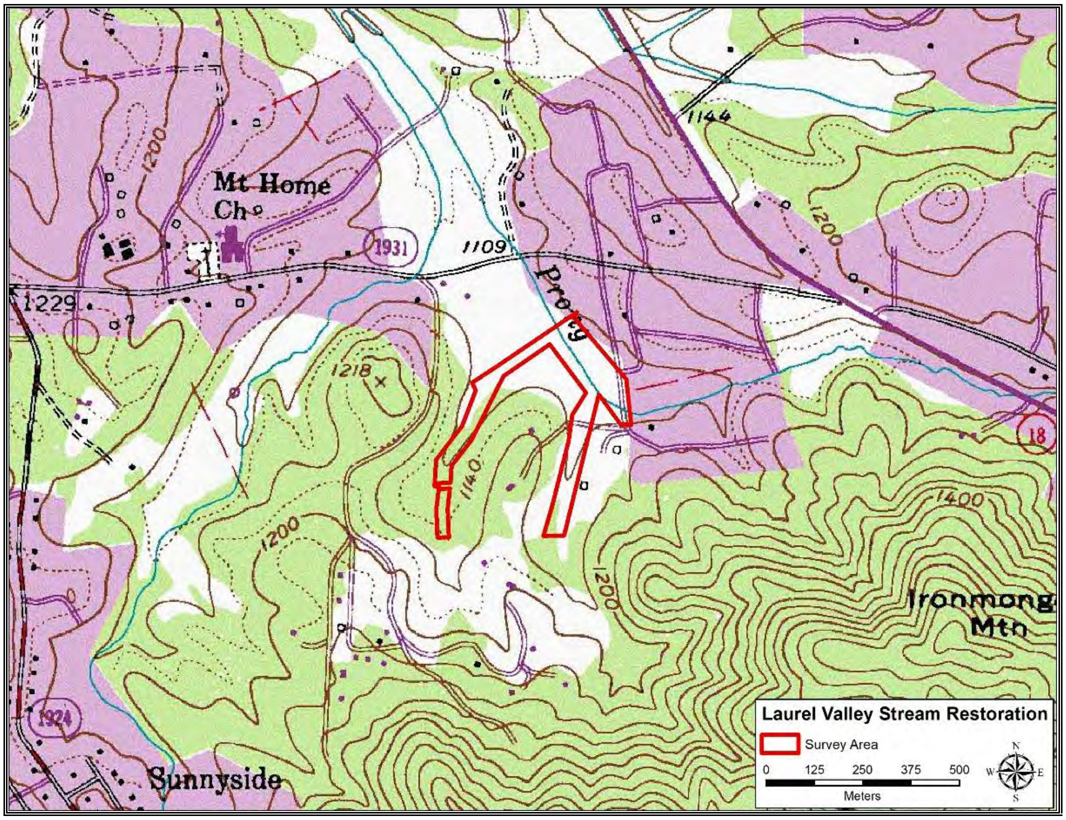

Figure 1.2. Topographic map showing the location of the APE (1993 *Morganton South, NC* USGS 7.5 minute topographic quadrangle).

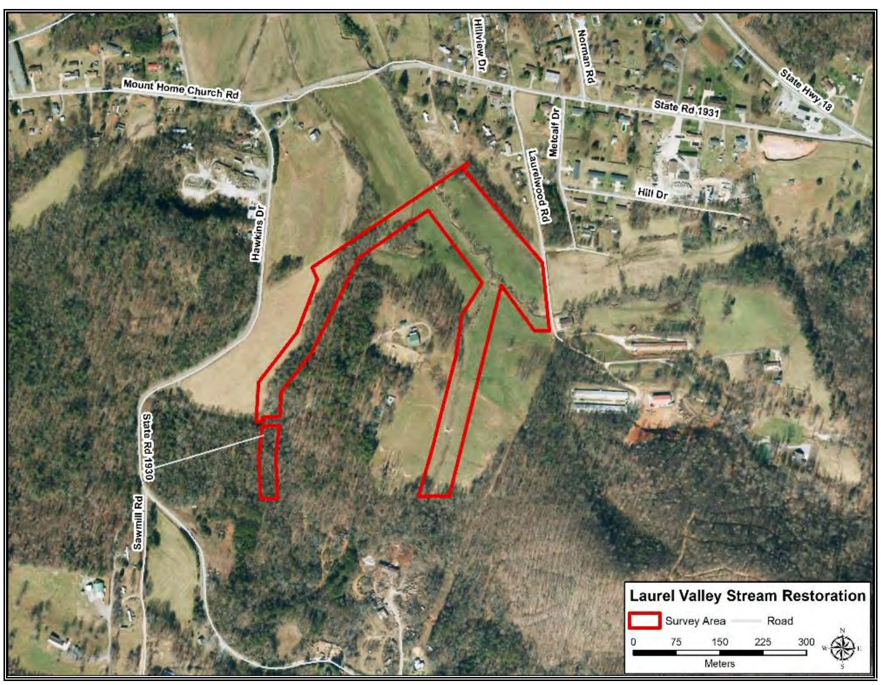

Figure 1.3. Aerial view of the project APE.

Figure 1.4. Pasture in the southwest portion of the APE, facing west.

Figure 1.5. Wooded portion of the tract, facing south.

Figure 1.6. Unnamed western tributary of East Prong Hunting Creek, facing north.

Figure 1.7. East Prong Hunting Creek, facing north.

Figure 1.8. Unnamed eastern tributary of East Prong Hunting Creek, facing south.

Background Research

Background research began with a review of archaeological site forms, maps, and reports on file at the North Carolina Office of State Archaeology (OSA) in Raleigh. This review served to identify previously recorded archaeological resources in the APE and within a 1.0-mile (1.6 km) radius of the APE and provided data on the prehistoric and historic context of the project tract. Records on historic resources recorded within 1.0-mile (1.6 km) of the project area were examined on the Survey and Planning Department's online HPOWeb portal. The Burke County soil survey (on-line version) was consulted to determine soil types and general environmental information of the project area. Historic maps of the county were examined to determine historic land use in the project vicinity. These maps included topographic maps dating to 1956 and1993, and the 1938 county highway map. Aerial images of the project area dating from 1947 to 2016 were also examined.

Field Survey

The field survey requested by the SHPO was to focus on portions of the tract with 15 percent slope or less where ground disturbing activities were slated to occur. The survey area included the floodplain of the three waterways in the APE (see Figure 1.2) and totaled approximately 16.5 acres (6.7 ha). Survey coverage consisted of the excavation of shovel tests at 20-meter intervals along parallel transects spaced 20 meters apart. When possible, transects were conducted on both sides of each waterway. The entire tract was walked over and areas with exposed surface were examined for artifacts. Supplemental shovel tests were excavated in areas deemed appropriate.

Shovel tests measured approximately 30 centimeters in diameter and were excavated into culturally sterile subsoil, bedrock, or to the water table. All soil fill was screened through 0.25-inch (6.4-mm) hardware cloth. Shovel tests were backfilled upon completion. Shovel tests were not excavated in standing water. Records of each shovel test location were kept in field notebooks, including information on content (e.g., presence or absence of artifacts, artifact descriptions) and context (i.e., soil color and texture descriptions, depth of definable levels, observed features).

An archaeological site is defined as an area yielding one or multiple artifacts or where surface or subsurface cultural features are present. Artifacts and/or features less than 50 years in age would not be considered a site without a specific research or management reason. One of the goals of this project was to provide sufficient data to the State Historic Preservation Office (SHPO) to determine whether any archaeological resources identified were significant. However, no archaeological sites were identified in the project tract during this survey.

Report Production

Report production involved the compilation of all data gathered during the previous tasks. The following chapter will provide environmental and cultural overviews for the project area. This information allows us to place identified archaeological resources, when identified, into a context and relate them to the prehistory or history of the area. Next, the results of the field investigation are discussed. Finally, a summary of the overall project is presented along with management recommendations, as appropriate.

Chapter 2. Environmental and Cultural Overview

The natural environment, technological development, and ideological values are all intertwined in shaping the way humans live. In this chapter, details about the local environment and cultural development in the region are presented.

Environmental Overview

Burke County lies at the interface between the Piedmont and Blue Ridge physiographic provinces (Figure 2.1). The Blue Ridge is approximately 885 kilometers (550 miles) long, extending from south-central Pennsylvania to northeastern Georgia and contains the highest peaks in the Appalachian system. In North Carolina, there are 43 peaks that exceed 6,000 feet in elevation and 82 peaks that are between 5,000 and 6,000 feet (NCDEQ 1985). Mt. Mitchell, located in Buncombe County, North Carolina is the highest point in the Blue Ridge, with its peak rising over 2 kilometers (1.2 miles) in elevation (Powell 1989). The Piedmont province extends from Pennsylvania through South Carolina. This province is characterized by rolling hills with moderate slopes (Kovacik and Winberry 1987).

The Blue Ridge is primarily underlain by metamorphic and intrusive igneous (plutonic) rocks. Metamorphic crystalline schists and gneisses are dominant in the region. Mineral resources include small scattered deposits of gold, silver, lead, mica, feldspar, asbestos, marble, and clay (Barry 1980). Also, outcrops of quartz and quartzite occur near the project tract, both of which were utilized extensively as raw materials for Native American tools. Other materials found on prehistoric archaeological sites, especially chert, are not found in the region. The nearest sources of these materials are the Ridge and Valley region of eastern Tennessee and perhaps the Coastal Plain of South Carolina. The Piedmont province is underlain by metamorphic and granitic rock and has experienced severe loss of topsoil due to human land use practices (Kovacik and Winberry 1987). The topography of Burke County ranges from rolling hills and broader valleys in the east of the county to foothills and mountains in the west of the county, and elevations within the county range between 138 meters to 430 meters (453 to 1,411 feet amsl).

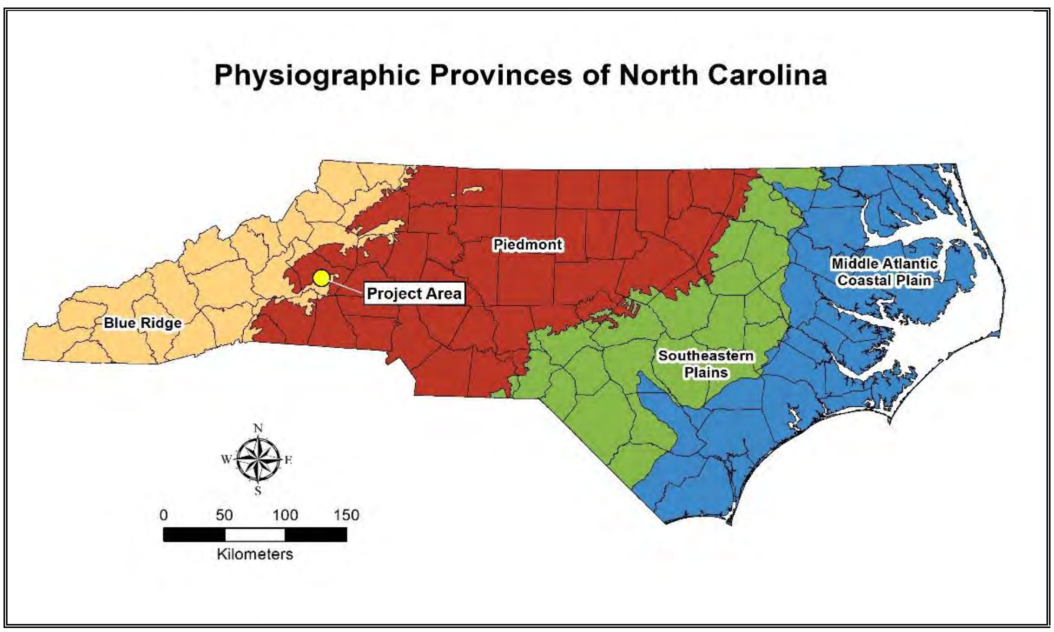

Figure 2.1. Physiographic map of North Carolina showing the location of the project area.

Climate

The climate of western North Carolina is influenced by a variety of factors, such as elevation, latitude, local topography, and wind and storm patterns. In general, as the elevation of an area increases so does the amount of rainfall while the temperature generally decreases. Temperatures can dramatically fluctuate over the course of a day and it is possible to have cooler or warmer periods throughout the year. During the winter, the average temperature is about 40 degrees Fahrenheit, while in the summer the average temperature is about 75 degrees Fahrenheit (Knight 2006). The total average precipitation that occurs during a year is approximately 50 inches, with about 30 inches of that falling from April to October. Snow is common during the winter months, with the average seasonal snowfall being approximately nine inches.

Flora and Fauna

Plant communities in the Blue Ridge region are highly diverse in their species composition, productivity, and availability as resources for human use. Significant variability in topography, elevation, microclimates, soils, and lithology is responsible for this diversity (Purrington 1983). Within historic times, the vegetation of the Blue Ridge was originally classified as an oak-chestnut forest, and trees of these species dominated the native stands. During the first decade of the twentieth century, a fungus called the Oriental Chestnut Blight reached the United States and ravaged the chestnut trees in the eastern part of the country. As the chestnut disappeared, oaks (especially the chestnut oak) and the tulip poplar competed to replace it as the dominant canopy species (Kovacik and Winberry 1987).

Various species of oak and pine tend to dominate ridge tops and uplands (Barry 1980). Most ridge tops are dominated by scarlet oak, white oak, and hickory, although beech, hemlock, and tulip poplar may be present. Understory species include dogwood, sourwood, persimmon, and serviceberry. Ground cover shrubs are not dense, but blueberry, mountain laurel, and fringetree are common. The canopy is relatively open. When combined with the moderate shrub layer, this provides opportunity for an abundance of herbaceous plants. Ferns may be present, but they are not abundant. The pine/oak/hickory ridge tops would have provided numerous types of nuts, berries, and wild fruits commonly utilized by the Cherokees (Simpkins 1986).

Some ridge tops and uplands are dominated by pines (Barry 1980). They are most often found on the crest of knobs, the slope leading between two adjacent coves, and the main ridge separating two parallel gorges. Pine stands commonly consist of pitch pine, although scarlet oak may also be present. A southern exposure is preferred regarding pine-dominated ridge tops and uplands. Understory species and shrubs include sassafras, horse-sugar, and sparkleberry. Ground cover includes deerberry, huckleberry, spotted wintergreen, and greenbrier. Although the pine ridges do not produce as much mast or fruit as ridges with hardwoods, the pine ridges support economic items such as berries and greenbrier.

Prior to European settlement, the project area would have had faunal resources from both deep forest and river and creek floodplains to rely upon. These animal resources would have included both large and small mammals, a variety of birds, and various freshwater fish species. Many of these animals are still active in the project vicinity, although the degree of development has limited their respective ranges. Most of the region has been utilized for agricultural purposes. Fallow and active fields extend to the river and creek banks. A wide variety of crops were grown in the project vicinity, including corn, cotton, and various grains.

Drainage

The project area lies within the Catawba River Basin (Figure 2.2). The Catawba River has always been an important component of life in the region. The Catawba Indians and their predecessors used the

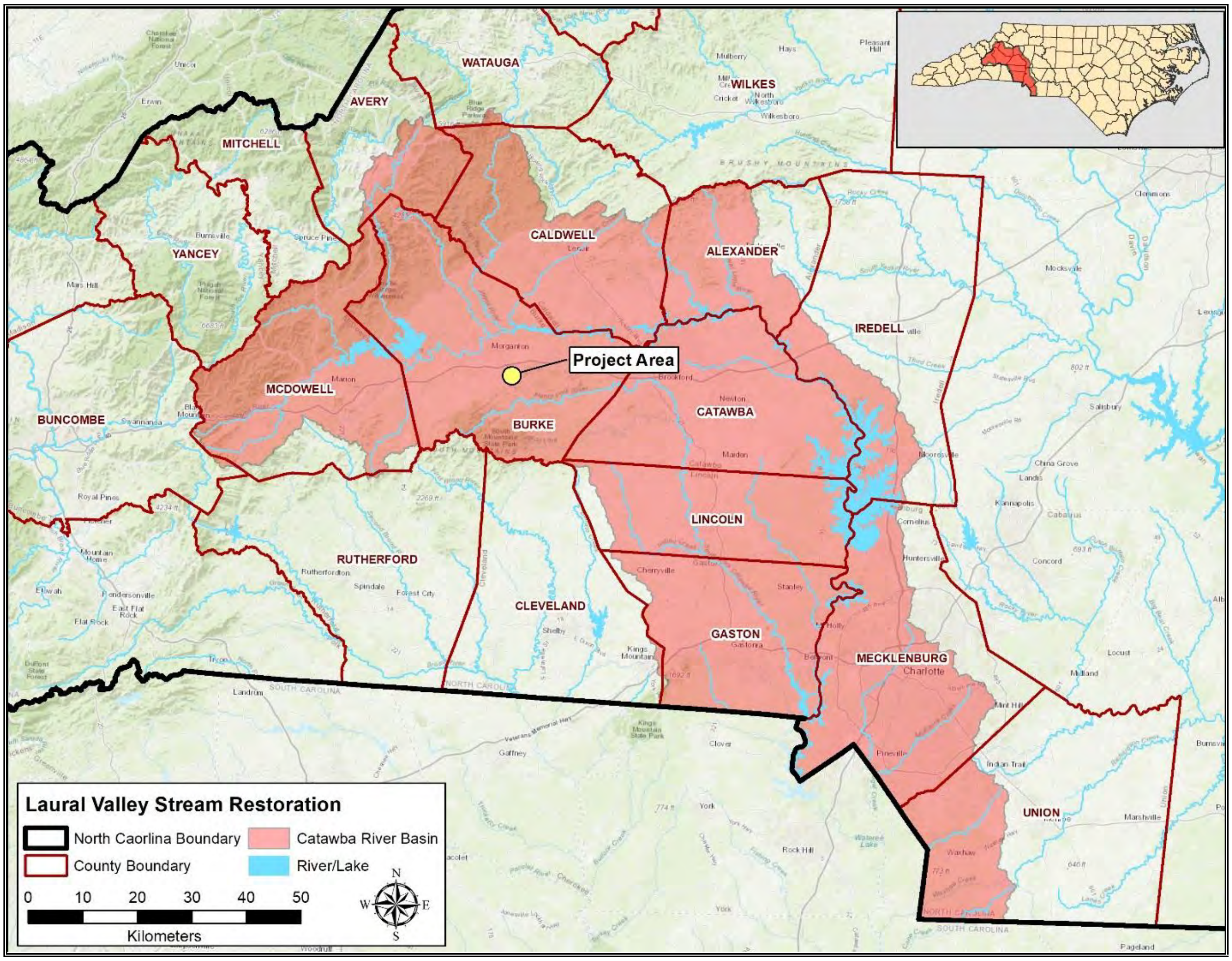

Figure 2.2. Map of the Catawba River basin showing the location of the project area.

river for thousands of years, and it is currently used in the extraction of power, for drinking water and irrigation, and the removal of waste (Yorktech 2002). The Catawba River originates in the mountains of western North Carolina and flows through a series of lakes and free-flowing stretches for over 322 kilometers (206 miles), ending where it meets Big Wateree Creek to form the Wateree River below Lake Wateree in South Carolina. The Wateree and Congaree rivers join to form the Santee River, which empties into the Atlantic Ocean approximately 72 kilometers (45 miles) northeast of Charleston, South Carolina.

There are three large lakes within Burke County: Lake James, Lake Rhodhiss, and Lake Hickory. Burke County has an abundance of rivers, streams, and creeks flowing throughout. East Prong Hunting Creek originates from Hunting Creek which drains from the Catawba River, northeast of Morganton. East Prong Hunting Creek runs through the northern portion of the survey area and two unnamed tributaries of the creek are near the eastern and western boundaries of the project area.

Geology/Physiography

Burke County lies at the interface between the Piedmont and Blue Ridge physiographic provinces of North Carolina (see Figure 2.1). This area is generally composed of metamorphosed sedimentary and volcanic rocks that have been intensely deformed over time (NCDEQ 1985). There are igneous intrusions known as plutons that often contain deposits of feldspar, mica, kaolin, semi-precious gemstones, and quartz

(NCDEQ 1985). Less-common deposits include marble, copper, olivine, and some gold deposits. There are also some granitic intrusions which contain emeralds and Hiddenite.

Soil

There are four soil types present in the survey area (Figure 2.3;Table 2.1). The most prevalent soil type is Arkaqua loam. This soil type is found on slopes of up to two percent and is occasionally flooded. It forms in the floodplains of Piedmont river valleys, is somewhat poorly drained, and its parent material is alluvium. Fairview sandy clay loam is the next most common soil type. Two subtypes of Fairview sandy clay loam are present in the project area. This soil type forms on ridges in the Piedmont uplands and is derived from residuum weathered from felsic high-grade metamorphic or igneous rock. The first subtype is moderately eroded and has a slope range of 15 to 25 percent, while the second subtype has a slope range of eight to 15 percent. Both subtypes are well-drained. Lastly, Colvard sandy loam is found on up to three percent slopes and is occasionally flooded. It is found in the floodplains of Piedmont river valleys, is well-drained, and its parent material is recent alluvium (USDA 2020).

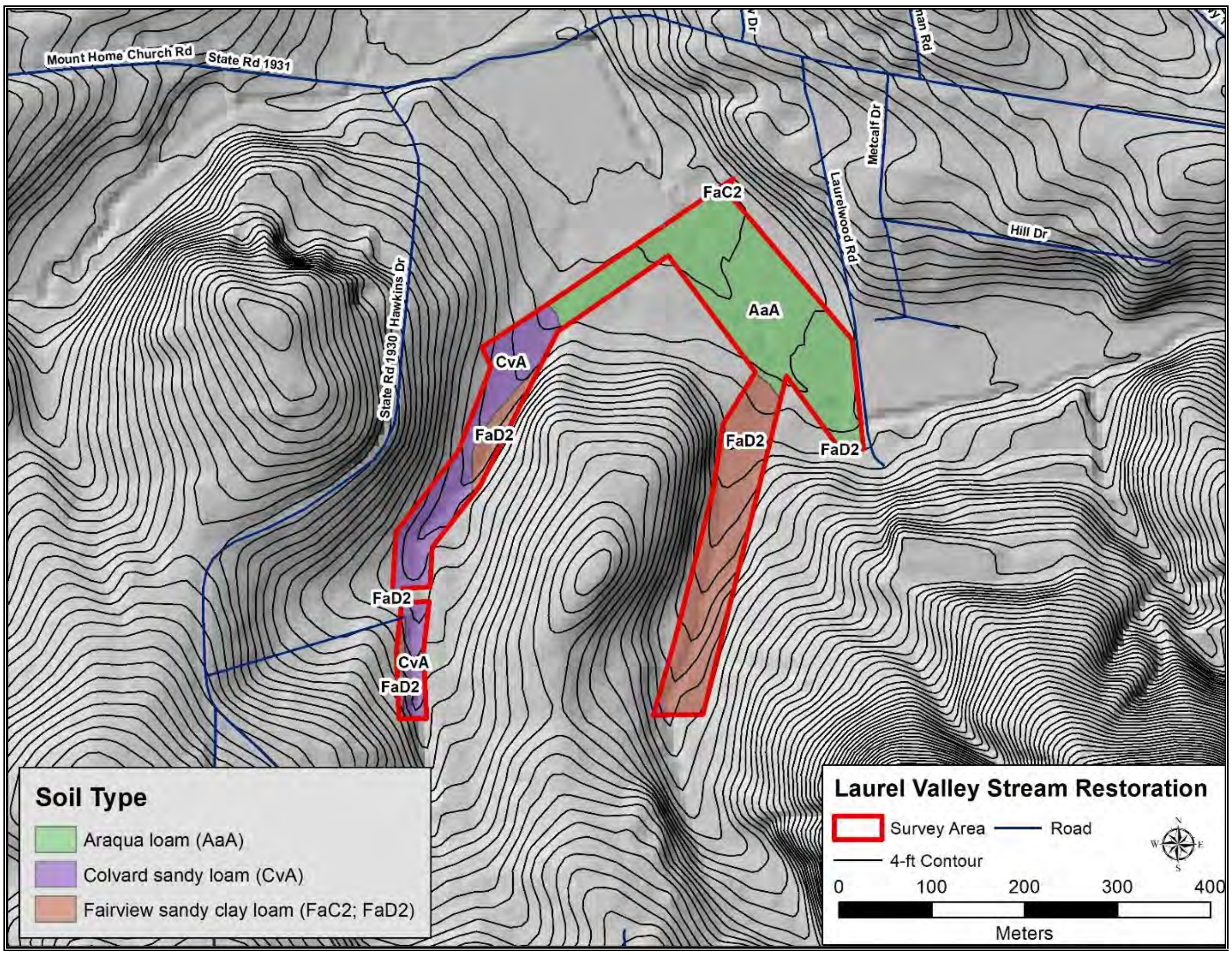

Figure 2.3. Soils located within the project area.

Table 2.1. Summary of Soils Present in the Project Area (USDA 2020).

Soil Type	Description	Percent Area
Arkaqua loam (AaA)	0-2% slopes, somewhat poorly drained	45.4
Fairview sandy clay loam (FaD2)	15-25% slopes, well-drained	31.8
Fairview sandy clay loam (FaC2)	8-15% slopes, well-drained	0.2
Colvard sandy loam (CvA)	0-3% slopes, well-drained	22.6

Paleoenvironment

Paleoclimatological research has documented major environmental changes over the last 20,000 years (the time of potential human occupation of the Southeast) including a general warming trend, melting of the large ice sheets of the Wisconsin glaciation, and an associated rise in sea level. About 12,000 years ago the ocean was located 50 to 100 miles east of its present position. During the last 5,000 years there has apparently been a 400 to 500-year cycle of sea level fluctuations of about two meters (Brooks et al. 1989; Colquhoun et al. 1981).

The general warming trend that led to the melting of glacial ice and the rise in sea level greatly affected vegetation communities in the Southeast. During the late Wisconsin glacial period, until about 12,000 years ago, boreal forest dominated by pine and spruce covered most of the Southeast. Approximately 10,000 years ago, a modern, somewhat xeric, forest developed and covered much of the Southeastern United States (Kuchler 1964; Wharton 1989). As the climate continued to warm, increased moisture augmented the northward advance of the oak-hickory forest (Delcourt 1979). In a study by Sheehan et al. (1985), palynological evidence suggests that spruce, pine, fir, and hemlock rapidly decreased in importance between 9,000 and 4,000 years before present (BP). By the mid-Holocene, the oak-hickory forest was gradually being replaced by a pine dominated woodland (Wharton 1989).

From 4,000 years BP to the present, the upland vegetation of the Southeast was characterized by a thinning of the deciduous forests (Delcourt and Delcourt 1981). Hickory and gums were generally less important, with alder and ragweed increasing in representation in the palynological record (Delcourt 1979; Sheehan et al. 1985). This forest thinning suggests an increase in human related landscape modifications (i.e., timbering, farming). Similarly, the importance and overall increase in pine species in the forest during this time would have depended on several factors, including fire, land clearing, and soil erosion (Plummer 1975; Sheldon 1983). Since that time, the general climatic trend in the Southeast has been toward slightly cooler and moister conditions, leading to the development of the present Southern Mixed Hardwood Forest as defined by Quarterman and Keever (1962).

Faunal communities have also changed dramatically over time. A number of large mammal species (e.g., mammoth, mastodon, horse, camel, giant sloth) became extinct towards the end of the glacial period 12,000 to 10,000 years ago. Human groups, which for subsistence had focused on hunting these large mammals, readapted their strategy to exploitation of smaller mammals, primarily deer in the Southeast.

Cultural Overview

In evaluating cultural resources, determining their ability to provide data about the lifeways of past inhabitants of the region is key. The cultural history of North America can be divided into three general eras: Pre-Contact, Contact, and Post-Contact. The Pre-Contact era includes primarily the Native American groups and cultures that were present for at least 12,000 years prior to the arrival of Europeans. The Contact era is the time of exploration and initial European settlement on the continent. The Post-Contact era is the time after the establishment of European settlements, when Native American populations were generally in rapid decline. Within these eras, finer temporal and cultural subdivisions have been defined to permit discussions of particular events and the lifeways of the peoples who inhabited North America at that time. The following discussion summarizes the various periods of Native American occupation in the western half of North Carolina, emphasizing cultural change, settlement, and site function throughout prehistory. Table 2.2 provides a summary of the chronological sequence of Native American occupation of the region.

Table 2.2. Native American Archaeological Chronology for the Western Foothills in North Carolina (Ward and Davis 1999).

Temporal Period	Phase	Diagnostic Artifacts	Settlement	Subsistence
Paleoindian (10,000-8,000 BC)	Clovis	large, triangular, fluted or side-notched projectile points	small, seasonal camps	intensive foraging, focus on large fauna
	Hardaway			
Archaic (8,000-1,000 BC)	Palmer St. Albans LeCroy	smaller side-notched projectile points with U-shaped notches	larger, seasonal camps; base camps	intensive foraging
	Kirk	larger corner-notched projectile points		
	Stanly Morrow Mtn. Guilford Halifax	stemmed points stemmed with shallow side notches		
	Savannah River	large Savannah River points with square stems soapstone bowls	mostly seasonal camps with some evidence for larger, more permanent occupations	intensive foraging and focus on riverine resources
Early and Middle Woodland (1,000 BC- 800 AD)	Swannanoa/Badin?	crushed quartz- or coarse sand-tempered, thick vessel walls; cordmarked, fabric-impressed, some check and simple stamped small, stemmed points (Swannanoa Stemmed, Plott Stemmed, Gypsy)	small, dispersed villages; ridge tops within upland valleys and floodplains	intensive foraging; introduction of bow and arrow
	Pigeon? / Yadkin?	crushed quartz-tempered ceramics; check stamped and some plain, simple stamped, brushed, and complicated-stamped; large tetrapodal supports on vessel base; iridescent sheen on interior small triangular and side-notched points	Floodplains; upland valleys, coves, and ridgetops, likely small hunting camps	increased reliance on horticulture supplemented by foraging
	Connestee/ Yadkin?	thin-walled vessels, mostly fine sand temper and some crushed quartz; some small tetrapodal supports; plain, brushed, or simple stamped, some cordmarked and fabric impressed. Hopewell artifacts	some low platform mounds, rock-filled hearth pits; generally larger and more intensive occupations, floodplains of major streams; some smaller, temporary camps	
Late Woodland/South Appalachian Mississippian (800 AD – 1710 AD)	Late Connestee	Sand and some crushed quartz temper; plain, smoothed or burnished surfaces with some fabric impressed, simple stamped, or check stamped; rims often notched and some incising present		
	McDowell	crushed steatite, crushed quartz, and fine sand for temper; rectilinear complicated-stamped; collared rim	some low mounds with substructure platforms; floodplains near major streams	intensive agriculture supplemented by foraging and horticulture
	Burke	crushed steatite temper; curvilinear complicated-stamped, burnished surface; notched rim folds		

Pre-Contact Overview

Paleoindian Period (12,000 - 8,000 BC). The Paleoindian Period refers to the earliest human occupations of the New World, the origins and age of which remain a subject of debate. The most accepted theory dates the influx of migrant bands of hunter-gathers to approximately 12,000 years ago. This time period corresponds to the exposure of a land bridge collecting Siberia to the North American continent during the last ice age (Driver 1998; Jackson et al. 1997). Research conducted over the past few decades has begun to cast doubt on this theory.

In the past two decades, investigations at Paleoindian sites have produced radiocarbon dates predating 12,000 years. The Monte Verde site in South America has been dated to 10,500 BC (Dillehay 1997; Meltzer et al. 1997). In North America, the Meadowcroft Rockshelter in Pennsylvania had deposits dating to 9,500 BC. Current research conducted at the Topper Site indicates occupations dating between 15,000 and 19,000 (or more) years ago (Goodyear 2005). Two sites, 44SM37 and Cactus Hill, in Virginia, have yielded similar dates. One contentious point about these early sites is that the occupations predate what has been recognized as the earliest New World culture, Clovis. Artifacts identified at pre-Clovis sites include flake tools and blades, prismatic blades, bifaces, and lanceolate-like points (Adovasio et al. 1998; Goodyear 2005; Johnson 1997; McAvoy and McAvoy 1997; and McDonald 2000).

The major artifact marker for the Clovis period is the Clovis lanceolate-fluted point (Gardner 1974, 1989; Griffin 1967). First identified in New Mexico, Clovis fluted points have been recovered throughout the United States. However, most of the identified Clovis points have been found in the eastern United States (Ward and Davis 1999). Most Clovis points have been recovered from surface contexts, although some sites (e.g., Cactus Hill and Topper sites) have contained well-defined subsurface Clovis contexts.

The identification of pre-Clovis sites, higher frequencies of Clovis points on the east coast of the United States (the opposing side of the continent where the land bridge was exposed during the last glaciation), and the lack of predecessors to the Clovis point type has led some researchers to hypothesize other avenues of New World migration (see Bonnichsen et al. 2006). These alternative migration theories contend that the influx of people to the Americas occurred prior to the ice-free corridor 12,000 years ago and that multiple migration episodes took place. These theories include overland migrations similar to the one presumed to have occurred over the Bering land bridge and water migrations over both the Atlantic Ocean and the Pacific rim (see Stanford 2006). Coastal migration theories envision seafaring people using boats to make the journey, evidence for which has not been identified (Adovasio and Page 2002).

In the southeastern United States, Clovis was followed by smaller fluted and nonfluted lanceolate spear points, such as Dalton and Hardaway point types, that are characteristic of the later Paleoindian Period (Goodyear 1982). The Hardaway point, first described by Coe (1964), is seen as a regional variant of Dalton (Oliver 1985; Ward 1983). Most Paleoindian materials occur as isolated surface finds in the eastern United States (Ward and Davis 1999); this indicates that population density was extremely low during this period and that groups were small and highly mobile (Meltzer 1988). It has been noted that group movements were probably well scheduled, and that some semblance of territories was maintained to ensure adequate arrangements for procuring mates and maintaining population levels (Anderson and Joseph 1988).

O'Steen (1996) analyzed Paleoindian settlement patterns in the Oconee River valley in northeastern Georgia and noted a pattern of decreasing mobility throughout the Paleoindian period. Sites of the earliest portion of the period seem to be restricted to the floodplains, while later sites were distributed widely in the uplands, showing an exploitation of a wider range of environmental resources. If this pattern holds true for the Southeast in general, it may be a result of changing environments trending toward increased deciduous forest and decreasing availability of Pleistocene megafauna and the consequent increased reliance on smaller mammals for subsistence; population growth may have also been a factor.

Archaic Period (8000 - 1000 BC). The Archaic period has been the focus of considerable research in the Southeast. Sites dating to this period are ubiquitous in the North Carolina Piedmont (Coe and McCormick 1970). Two major areas of research have dominated: (1) the development of chronological subdivisions for the period based on diagnostic artifacts, and (2) the understanding of settlement/subsistence trends for successive cultures. Coe's excavations at several sites in the North Carolina Piedmont established a chronological sequence for the period based on diagnostic projectile points. The Archaic period has been divided into three subperiods: Early (8000 - 6000 BC), Middle (6000 - 3500 BC), and Late (3500 - 1000 BC). Coe (1964) defined the Early Archaic subperiod based on the presence in site assemblages of Palmer and Kirk Corner Notched projectile points. More recent studies have defined other Early Archaic corner notched points, such as Taylor, Big Sandy, and Bolen types. Generally similar projectile points (e.g., LeCroy points), but with commonly serrated edges and characteristic bifurcated bases, have also been identified as representative of the Early Archaic subperiod (Broyles 1971; Chapman 1985). The Early Archaic points of the North Carolina Piedmont are typically produced with metavolcanic material, although occasional chert, quartz, or quartzite examples have been recovered.

Claggett et al. (1982) use a settlement/subsistence typology developed by Binford (1980), to classify late Paleoindian and Early Archaic populations as "logistical." Logistical task groups, in this definition, target a particular resource or set of subsistence or technological resources for collection and use at a residential base camp. Their analysis identifies an increase in residential mobility beginning in the Early Archaic and extending into the Middle Archaic (Claggett et a1. 1982). Early Archaic peoples transitioned from logistical orientation to foraging. Foraging refers to a generalized resource procurement strategy enacted in closer proximity to a base camp. Subsistence remains recovered from Early Archaic sites in southern Virginia include fish, turtle, turkey, small mammals, and deer, as well as a wide variety of nuts (McAvoy and McAvoy 1997).

Sassaman (1993) hypothesizes that actual group residential mobility increased during the Middle Archaic although it occurred within a more restricted range. Range restriction is generally a result of increased population in the Southeast and crowding with group territories; this increase in population led to increasing social fluidity during the Middle Archaic and a lower need for scheduled aggregation for mate exchange. In Sassaman's view, technology during the Middle Archaic is highly expedient; this is reflected in an almost exclusive use of local resources, especially lithic material. The appearance/introduction of Stanly points, a broad-bladed stemmed form defines the transition to the Middle Archaic subperiod. These were followed by Morrow Mountain points, which are characteristically manufactured from quartz, and have been recovered from numerous small sites throughout Virginia, the Carolinas, and Georgia. Guilford points, also often made of quartz, follow Morrow Mountain in the Middle Archaic sequence.

The Late Archaic subperiod can be divided into two phases (Savannah River and Terminal Archaic [Otarre phase]) and are represented by a gradual change in diagnostic projectile points and a slight shift in settlement focus. The Savannah River phase (3,000 to 2,000 BC) is recognized by large, broad-bladed, straight-stemmed points made of quartzite commonly known as the Savannah River or Appalachian Stemmed points (Coe 1964; Purrington 1983). Steatite bowls, groundstone axes and gorgets, and other flaked stone tools can also be attributed to this phase. Purrington (1983:125) states that "the remains of this phase are among the most abundant in the Appalachian Summit which may suggest increased population density as well as increased visibility of archaeological remains." In the Great Smoky Mountains, Bass (1977) found evidence of three Savannah River site categories: base camps in the major valleys; seasonally dispersed smaller camps in coves and benches; and short term extractive sites on ridges and saddles, which were visited from a valley base camp. In contrast, Purrington (1983:127-129) found that the Savannah River phase sites of the upper Watauga Valley are less common in the flood plains than sites of the preceding phase.

The diagnostic artifact of the Otarre phase (2,000-1,000 BC) is the small to medium stemmed projectile point, the Otarre Stemmed type. Keel (1976) identifies this type as exhibiting a wider range of variability than Savannah River points, suggesting perhaps a greater localization of populations. Most of the

Late Archaic sites in the Great Smokey Mountains are located in the floodplains of large rivers near quartzite outcrops. Quartzite was the predominant raw material for the production of Late Woodland projectile points (Ward and Davis 1999). Savannah River phase settlement and subsistence patterns continue in the Otarre phase (Purrington 1983:130-131). Evidence suggests that the Otarre phase is a legitimate temporal division based on minor stylistic changes in projectile points which occurred in the absence of major cultural shifts.

Subsistence during the Late Archaic focused on hunting, fishing, and gathering of vast amounts of acorn and hickory nuts. Fish, turtle, and other riverine sources were important parts of the Late Archaic diet. By the end of the Late Archaic period, squash, gourds, sunflower, maygrass, and chenopodium were being domesticated (Ward and Davis 1999).

Woodland Period (1000 BC - 1600 AD). A transition between the predominantly preceramic Archaic cultures and the Woodland cultures has been identified by Oliver (1985). Stemmed point types, like the Gypsy triangular point, continue in the Early Woodland subperiod (1000 BC - 300 AD). Unlike Oliver, Miller (1962) notes little change in the cultural makeup of groups at the Archaic/Woodland transition other than the addition of pottery. Coe (1964), although noting a stratigraphic break between Archaic and Woodland occupations, also describes little technological or subsistence change other than ceramics.

The Woodland period of this area was a time of increasing cultural diversity stimulated by ideas from outside the region (Ward and Davis 1999). The Early Woodland period is characterized by the Swannanoa phase (1,000-300 BC). The pottery series from this phase, as defined by Keel (1976), has crushed quartz or coarse sand temper, and relatively thick walls. Small, stemmed projectile points called Swannanoa Stemmed, Plott Stemmed, and Gypsy points are found in the mountains at this time. These points are stratigraphically associated with a larger triangular point type called “Transylvania Triangular” that appears to be in connection with the introduction of the bow and arrow during the Swannanoa phase. Available settlement data also suggests a continuation of Archaic lifestyles (Ward and Davis 1999).

Two distinct phases of occupation are recognized for the Middle Woodland in the mountains of North Carolina: the Pigeon phase (300 BC – 200 AD) and the Connestee phase (200 AD – 800 AD). Pigeon phase pottery is identified by the use of fairly large amounts of crushed quartz temper, surface treatments of check stamping (in addition to plain, simple stamped, brushed, and complicated stamped treatments), the use of tetrapodal supports on the vessel base, and an “iridescent sheen” on the interior surface (Ward and Davis 1999). Vessel forms include simple bowls and necked jars. Small side-notched and triangular projectile points, expanded-center bar gorgets, grooved axes, celts, flake scrapers, ceramic popes, and a variety of hammerstones are also probably associated with the Pigeon phase (Ward and Davis 1999). There may have been an increasing reliance on horticulture resulting in a shift toward greater use of fertile bottomlands (Purrington 1983). Connestee series pottery consists of thin-walled vessels that are fine sand tempered with an occasional crushed quartz fragment. Vessel forms include flat-bottomed jars that sometimes have small tetrapodal supports, and bowls and jars without supports. The surface of these pots is usually plain, brushed or simple stamped, but also include cord marking, fabric marking, check stamping, and complicated stamping (Ward and Davis 1999). Other artifacts from the Connestee phase include clay figurines, stone blades, and copper sheets and beads.

Horticulture was still in its infancy during this period so subsistence strategies remained focused on hunting animals and gathering wild plants. In the study area, the Late Woodland subperiod (1000 – 1600 AD) is represented by the Uwharrie and Donnaha Phases. The Uwharrie Phase projectile points have small triangular forms. Uwharrie ceramics are heavily tempered with crushed quartz and predominantly net impressed with scraped interiors (Eastman 1991). Woodall (1988) notes an increased emphasis on cooking and the use of ceramic decoration to differentiate social standing at Yadkin village sites he investigated on the Yadkin River, east of the project area. The Donnaha Phase appears to be related to the Dan River Phase of the North-Central Piedmont, as seen through the artifact assemblage, especially in regard to the shell and bone tools recovered (Ward and Davis 1999).

Agriculture was initially a supplement to Native American subsistence strategies during this period but became increasingly important over time. Corn, beans, squash, sunflowers, and fruit were cultivated with the aid of stone hoes and wooden implements, and settlement patterns indicate conditions favorable to agriculture were significant to decision-making (i.e. broad floodplains; Hantman and Klein 1992; Ward 1983; Ward and Davis1993).

Mississippian Period (1100 - 1600 AD). Overall, the Mississippian Period is characterized by complicated stamped ceramics, small triangular projectile points, a reliance on farming, and elaborate ceremonialism. Sites from this time frame include large village sites, often with at least one earthen mound, and small, scattered farmsteads. Site locations tend to be located on floodplains and rises overlooking river and stream valleys (Hargrove 1991; Keel 1976; May 1989; Oliver 1992; and Ward 1965).

In the Catawba Valley, the Mississippian Period is distinctly represented by regional phases referred to as the McDowell and Burke phases (Moore 2006; Ward and Davis 1999). Sites associated with the Burke phase are located in the upper reaches of the Catawba and Yadkin rivers. The Berry site in Burke County is one of the key Mississippian sites in the Catawba River Valley. The ceramics associated with the Burke phase are distinct because they tend to be soapstone tempered. These soapstone tempered sherds occur almost exclusively in Burke, Caldwell, and Catawba counties. Few of this ceramic type have been identified in McDowell County but this may be due to the limited number of in-depth investigations that have been conducted. Exterior surface treatments are typical for the Mississippian Period in other parts of the Southeast, with plain, burnished, and complicated stamped surfaces. There is a contemporaneous pottery type called Cowans Ford series. This pottery has the same surface treatments as Burke pottery, but has sand and/or crushed quartz as temper instead of soapstone (Moore 2006).

Historic Indian / Protohistoric Period

The first European exploration along the coast of North Carolina was in 1524 by Giovanni da Verrazano, who sailed under the flag of France. He commented on the Native Americans he encountered but made no attempt at settlement in the area. In 1526, Luis Vasquez de Ayllon led a Spanish expedition attempting to establish a settlement near the River Jordan, which is believed to be in the vicinity of the Cape Fear River. His party included approximately 500 men, women, and children, a few slaves, and 90 horses. Bad weather, hunger, and malaria took a toll on the settlers. Upon Ayllon's death, the 150 surviving settlers returned to Santo Domingo.

Spain initiated the exploration of the southeastern United States in the hopes of preserving their claims to American lands west of the Treaty of Tordesillas line of demarcation. Hernando de Soto (1539-1543) and Juan Pardo (1566-1568) led military expeditions into the western Piedmont and mountains of North Carolina during the mid-sixteenth century (Hudson 1990, 1994). These parties visited Indian villages near the present- day towns of Charlotte, Lincolnton, Hickory, and Maiden, visiting the Catawba, Wateree, and Saxapahaw Native Americans (Moore 2006).

Spanish exploration of western North Carolina began in the middle sixteenth century. In 1540, Hernando de Soto entered the area during his march through the Southeast. Swanton (1979:110) believed that Guasili, an Indian town visited by de Soto, was located on the Hiwassee River at the mouth of Peachtree Creek, near Murphy (Cherokee County), North Carolina. More recently, Hudson et al. (1984:74) have determined that Guasili was located near present-day Marshall, in Madison County. It is generally believed that the inhabitants of this town may have been Cherokee. The Native Americans furnished de Soto and his party with various food items, including 300 dogs for the men to eat, and corn for the horses. In 1567, Juan

Pardo and his party passed through the project region, following much the same path as de Soto's expedition (Hudson 1990). Recent work at the Burke Site in Burke County has identified a sixteenth century Native American site with a Spanish component that is believed to be associated with Pardo's explorations.

Spanish presence in the Carolinas could not be sustained despite their best attempts to establish a permanent presence with interior outposts and coastal settlements. Mounting pressure from hostile Native Americans and English privateers also contributed to their withdrawal to St. Augustine in 1587 (South 1980). Diseases introduced by these explorers wrought disastrous effects on contemporary Native American peoples, causing populations to collapsed and entire communities to disappear.

The project area falls within historic Catawba territory. For the most part, this area was without European contact after the initial Spanish expeditions. Some trade and raiding took place but not to the same degree that occurred in the eastern part of North Carolina.

Sir Walter Raleigh heavily promoted England's interest in the New World. In 1585, Raleigh used his position in the court of Queen Elizabeth I to secure backing to outfit an English attempt at colonizing the Atlantic coast (Powell 1989). Although this effort failed, Raleigh's single-minded ambition led to the establishment of a colony on the James River in 1607 (Noël Hume 1994).

The first years of settlement at Jamestown were hampered by disastrous mismanagement resulting in starvation, loss of life, and hostilities with neighboring Powhatan. In 1624 the Crown revoked the Virginia Company's charter and established a royal government (Noël Hume 1994). Preoccupied with the civil war between Royalist and Parliamentarian forces in the 1640s, these authorities showed little interest in the area that was to become North Carolina until the 1650s. During this period traders, hunters, trappers, rogues, and tax evaders began living in the area around the Albemarle Sound in northeastern North Carolina (Powell 1989). Even then, North Carolina was becoming notorious as a refuge for the independent and self-reliant.

Historic Period

Charles II was restored to the throne in 1660 and distributed rewards to loyal Royalist supporters. Seven supporters were awarded the charter to establish a proprietary colony south of Virginia. The boundaries of this deed were set to include the Albemarle Sound settlement of Charles Town south to the frontier of Spanish-held La Florida. Proprietors maintained control over a single Carolina until 1712, when the colonies were separated. After the Yamasee War, the colonists pleaded with the crown to take over the settlement of the colony. The proprietors subsequently forfeited control to the Crown. That divestment forced the Proprietors' sale of their North Carolina charter to King George II in 1729 (Powell 1989).

John Lederer, a German doctor, was the first recorded European explorer to visit the project area. In 1669, Lederer was commissioned by the governor of Virginia to find a westward route to the Pacific Ocean (Cumming 1958). Lederer traveled through Virginia south to present day Camden, South Carolina. During this trip, he visited with several Native American tribes, including the Saura, Catawba and Waxhaw. The Catawba Indians are historically linked to the Catawba River Valley in North and South Carolina. Inspired by Lederer, John Lawson traveled from Charleston, South Carolina through the North Carolina Piedmont to Pamlico Sound. Lawson's 1700-1701 excursion followed a well-established Native American trading path that passed near present day Charlotte, Concord, and Salisbury (Lawson 1967). Lawson's journey took him through Esaw, Sugaree, Catawba, and Waxhaw territory, four tribes who would soon come into close contact with European colonists.

The principle economic focus of the Carolinas during the early colonial era was the Indian trade. This trade revolved around the exchange of European manufactured goods and alcohol for skins and slaves. It drew

Native American groups into an Atlantic economy and had the added effect of increasing intertribal hostilities. Itinerant traders based in Charleston (South Carolina), and Virginia vied for clients among the North Carolina Piedmont settlements (Oberg and Moore 2017; Powell 1989).

By the late seventeenth century, the Native Americans who inhabited the Catawba River Valley had increasing contact with the Europeans as the settlers pushed west. The British developed trade relations with the Cherokee during the late seventeenth century and English traders operating out of Virginia and Charleston developed an ongoing trade with the Cherokee by the early eighteenth century. The location of the Catawba made it possible to trade with Europeans from both Virginia and South Carolina, creating well-established trading paths. During the trading wars that took place between 1690 and 1710, the Catawba were able to maintain neutrality, controlling the trade paths and inviting several other smaller tribes to join them for protection.

Severe fighting between North Carolinian settlers and Tuscarora Indians broke out in 1711 after the death of the colony's Surveyor General (John Lawson) at the hands of the Tuscarora. In 1713, the Catawba gave up their neutrality and joined the Yamassee in an organized attack against South Carolina settlers. Cherokee from the Lower Towns (along the Savannah and Keowee Rivers, now in Georgia and South Carolina) were involved to a limited extent in the Yamassee War, aligning with the Catawba in attacks on western Carolina settlements. The war ended in 1712, leaving the Carolina colonies in dire financial straits. The Catawba retreated to their northern settlements and their numbers grew as they accepted refugees from defeated tribes. The strain on the colony's financial conditions persisted until the Lords Proprietors were forced to sell their holdings in the Carolinas to the Crown in 1729 (Powell 1989).

As the number of settlers began to multiply in the Northeast, many began to look to the wilderness of the South and the West to build new lives. German and Scotch-Irish settlers first walked the Indian footpaths connecting present-day Pennsylvania and Georgia (Rouse 2001). Pilot Mountain in Surry County was named Jomeokee by the Saura, meaning "great guide" or "pilot." Northern immigrants who traveled the Great Wagon Road witnessed the mountain as they traveled into the North Carolina colony.

In 1744, a series of treaties allowed the colonies to formally take over the trail, then known as the Warrior Path, from the Five Nations of the Iroquois (NCOAH 2004; Rouse 2001). Dubbed the Great Wagon Road, settlers from northern colonies used the route to populate the farmlands and new towns of the Carolinas and Georgia well into the 1800's. The varied European interests competing for territory and the expansion of Europeans into Native American territory escalated into the French and Indian War which lasted from 1754-1763. North Carolina supplied men to fight in Virginia and New York but later the troops were needed to defend North Carolina settlers from the Cherokee. The Cherokee were initially allied with the colony of North Carolina and helped fight the French and the Shawnee in exchange for supplies and fortifications but grew dissatisfied and angry with their treatment during the campaign and turned on the English. The Catawba allied with the British, but after losing much of their population to disease and conflicts with other tribes, they were few in numbers. Eventually the conflict ended with the French surrendering to the British and many of the refugees who had fled to North Carolina stayed and settled (Cashion 1979).

In 1759, the Catawba re-organized and abandoned many of their established towns to create a unified settlement at Twelve Mile Creek, negotiating a deal with South Carolina to establish a small reservation there. As their numbers were greatly decreased, they were no longer major players in the colonial conflicts that took place. At this time, tensions were high between the Cherokee and settlers in Virginia, North Carolina, and South Carolina; raids and skirmishes were a common occurrence.

The Regulator movement began in the late 1760s due to backcountry farmers' frustrations with county government's administration. The majority of the county's population were engaged in agriculture and resented the rapid ascension of lawyers and "Scotch" merchants to positions of influence over the county's court. General dissatisfaction with newcomers' meddling coalesced into a backcountry crusade against a corrupt appointee of Governor Dobbs and frequent office holder, Edward Fanning (Whittenburg 1997). Backcountry "Regulators" obstructed sheriffs from tax collection and prevented courts from operating. Tensions between the Regulators and the colonial administration began to boil, bordering on conflict. The increased prominence of the Baptist movement, which had popular appeal with the Regulators because of its democratic religious policies, provided a divisive threat to the traditional Anglican beliefs held by many British Tories, paralleling the mounting political discontent (Powell 1989). This ultimately culminated in the start of the War of Regulation, in which the Regulators mounted a rebellion against the North Carolina colonial government in an effort to rid the colony of British oppression.

Hillsborough riots in October 1770 resulted in an escalation of the dispute. Led by Governor William Tryon, an armed expedition of an eastern county militia routed the Regulators on May 16, 1771 at Alamance. The skirmish took place along Alamance Creek, just a few short miles south of the city of Burlington in Randolph County. The North Carolina provincial militia put down the rebellion, leading to the end of the War of Regulation. However, these hostilities between the Regulators and British rule are considered an early step down the road to the American Revolution (Powell 1989).

Less than four years after the battle of Alamance, the Atlantic colonies allied themselves against King George's government. North Carolinians were divided between the Tory and Whig causes. Tories supported royal prerogatives and many former Regulators suspicious of local authority were assumed to be sympathetic to the Tory cause. In 1775, the Catawba declared their allegiance to the colonies and participated in battles against the Cherokee and British forces. As British forces move north through South Carolina, the Catawba fled into North Carolina to their traditional lands; when they returned to South Carolina, they found their settlement razed and plundered.

At the time of the American Revolution, the residents of the area were divided in their loyalties. Some supported the rebel Americans, and others, the British. British forces came into the area in 1780 and were joined by many of the Tories in a fight against the Whig militia at Ramsour's Mill (Powell 1989). The combatants, who were both neighbors and relatives, engaged in a fierce battle for more than an hour, resulting in at least 200 casualties evenly divided between two factions (Powell 1989).

The rebel Whigs finally prevailed, and Tories in the area were never a threat after that time. At the Battle of Kings Mountain, a force of Tory Loyalists, led by British Captain Patrick Ferguson, was defeated by rebel militia units commanded by Frederick Hambright (Powell 1989). The Overmountain Victory National Historic Trail commemorates the route taken by the "Overmountain men" on the way to the Battle of Kings Mountain and gained national trail status in 1980. The trail starts in Virginia and travels through Tennessee and North Carolina before ending in South Carolina. In Burke County, the commemorative motor route follows Route 126 on the north side of Lake James heading toward Morganton. Route 18, northeast of Morganton, and U.S. Highway 64, southwest of Morganton, are also part of the motor route in Burke County. It is possible the Overmountain men used various routes through the area.

After the Revolutionary War, many improvements were made in transportation, leading to increased wealth as cash crops for shipment to other areas, along with manufactured items, became important economically. In the early nineteenth century, cotton production increased in the county, and the number of slaves increased dramatically. The number of slave owners, however, remained nearly the same (Crutchfield 1986).

Slave owners were few in western North Carolina, and most owners only had one or two. The economy of the area was not based on large farms or plantations requiring a large labor force. As a result, the relative social status of the residents was not dependent on the number of slaves owned. The financial difficulties of local planters were quickly overshadowed by distant battles in Virginia.

The General Assembly created Burke County out of Rowan County in 1777 (Corbitt 2000). It was named after Thomas Burke, who would later become the first governor of North Carolina. Morganton became the county seat in 1784 (Corbitt 2000). It was named after General Daniel Morgan, who led the Continental Army in the Battle of Cowpens during the Revolutionary War (Burke County Chamber of Commerce 2014). Before 1800, most of the area's residents lived in log houses, but the wealthy merchants and planters were able to build large brick houses and contribute funds to upgrade the older log churches and build new schools. Burke County's first school, Morganton Academy, was established in 1783.

The major markets for goods produced in the area were the North Carolina towns of Salisbury, Hillsborough, Greensboro, and Wadesboro, and Camden, Cheraw, and Charleston in South Carolina. Merchants and traders from the west brought cloth, leather, and food to the area to trade for local products. During the early 1800s, the discovery of gold caused North Carolina to become the leading gold state in the Union. Large gold deposits were found in parts of Burke County in the 1820s (Burke County Chamber of Commerce 2014). Gold coins were minted in Charlotte between 1837 and 1861 (Powell 1989).

New roads were built connecting the project region to markets in Charlotte and the northern Piedmont, and to cities in South Carolina. In the early 1800s, the old stagecoach road followed Mill Creek to the mouth of the Little Swannanoa River, into Swannanoa Gap. In 1849, work began on the Western Turnpike in the Catawba River Valley, including roads through Old Fort and Ridgecrest. The new roads also made travel easier. With the new roads, goods could be taken to Charleston by wagon. Cotton, skins, cattle, hams, and butter were taken to market and the wagons returned laden with goods which could not be produced on family farms, such as coffee, tea, salt, sugar, cloth, and manufactured items.

North Carolina separated from the Union on 20 May 1861, at approximately 5:30 in the afternoon (Murray 1983). Minutes later, the Secession Convention ratified the provisional constitution of the Confederate States of America. Within a few weeks, North Carolinians were arriving at 21 regimental training camps throughout the state (Barrett 1963). From the beginning of the Civil War, Confederate soldiers from Burke County served with the First Regiment of North Carolina. Several other companies of the North Carolina State Troops were created throughout 1861 and 1862. In all, Burke County (which still at this time included McDowell County) contributed 1,258 soldiers to the war effort, losing an estimated 490 of them to wounds and disease (Phifer 2000). No major battles took place in Burke County; however, there were a few small skirmishes (Phifer 2000). In one instance Union troops plundered the county seat at Morganton, burning the courthouse records (Phifer 2000).

Despite the fact that North Carolina was a Confederate state, loyalties in western North Carolina were divided. Generally, farms in the area were small, and the local economy depended less on slave labor than other areas of the South. In addition, the loss of head of household to military service placed a tremendous strain on local farms, families, and communities. As the war progressed, disloyalty to the Confederacy grew in the area. According to Barrett (1987:74), by 1864:

> Disaffection and disloyalty in the [Western North Carolina] area had multiplied by leaps and bounds. The mountains were so full of deserters that very little social stigma was attached to desertion, and the warm welcome accorded many a deserter caused the area to fill up with the disloyal from all the southern States. Formed into bands and heavily armed, these deserters plundered, murdered, and carried out every sort of outrage.

U.S. troops were housed in Morganton to supervise the region until the Fourteenth Amendment, giving civil liberties to freed slaves, was ratified in 1867. In addition, the regional post of the Freedman's Bureau, organized to assist the newly free slaves, was housed in Morganton (Phifer 2000).

Following Reconstruction, much of North Carolina went through a period of dramatic industrialization and urbanization. Much of this process was driven by the expansion of railroads. At the turn of the century, industrial expansion came to Burke County. From 1901 until the beginning of World War I in 1917, numerous hosiery and textile mills and furniture factories were built in the county, resulting in a population increase (Burke County Chamber of Commerce 2014).

Lumbering, textiles, and furniture manufacturing were important industries in the region in the twentieth century. Distilleries, which had been an important part of the local economy, were closed due to the advent of prohibition. In 1927, the company that was to become Duke Energy Progress completed the Rhodhiss Dam (then called the Oxford Dam) over the Catawba River. The dam and associated hydro-electric substation provide power for the surrounding area, and the lake provides drinking water to the area, as well as serving as a recreational facility.

Today, the major industries remain textiles, apparel, and furniture. Agriculture still plays a large role in the county's economic production though nursery crops rather than traditional farm crops are now the focus. The abundance of hardwood forests fueled the furniture industry in the region allowing central and western North Carolina to be known as the "Furniture Capital of the World". Other products now being produced in Burke County include anti- lock brakes, pharmaceutical glass, ceramic tile, lithium batteries, link chains, medical appliances, truck axles, and heavy equipment parts (Burke County Chamber of Commerce 2014).

Chapter 3. Results of the Investigation

Background Research Results

Archaeological background research was conducted at the North Carolina site files located at the Office of State Archaeology (OSA) in Raleigh. No previously recorded archaeological sites are present in the survey area. Five historic resources have been recorded within 1.0-mile (1.6 km) of the project area (Figure 3.1). The Thomas Duckworth House (BK0165) and Jerome Duckworth House (BK0166) are no longer extant. The Burke Youth Center (BK0135), the Mull School (BK0231), and the Yellow Gap Tourist Cabins (BK0271) are still standing. All of these resources have a surveyed only status for the National Register of Historic Places (NRHP), and none will be adversely affected by the proposed mitigation activities.

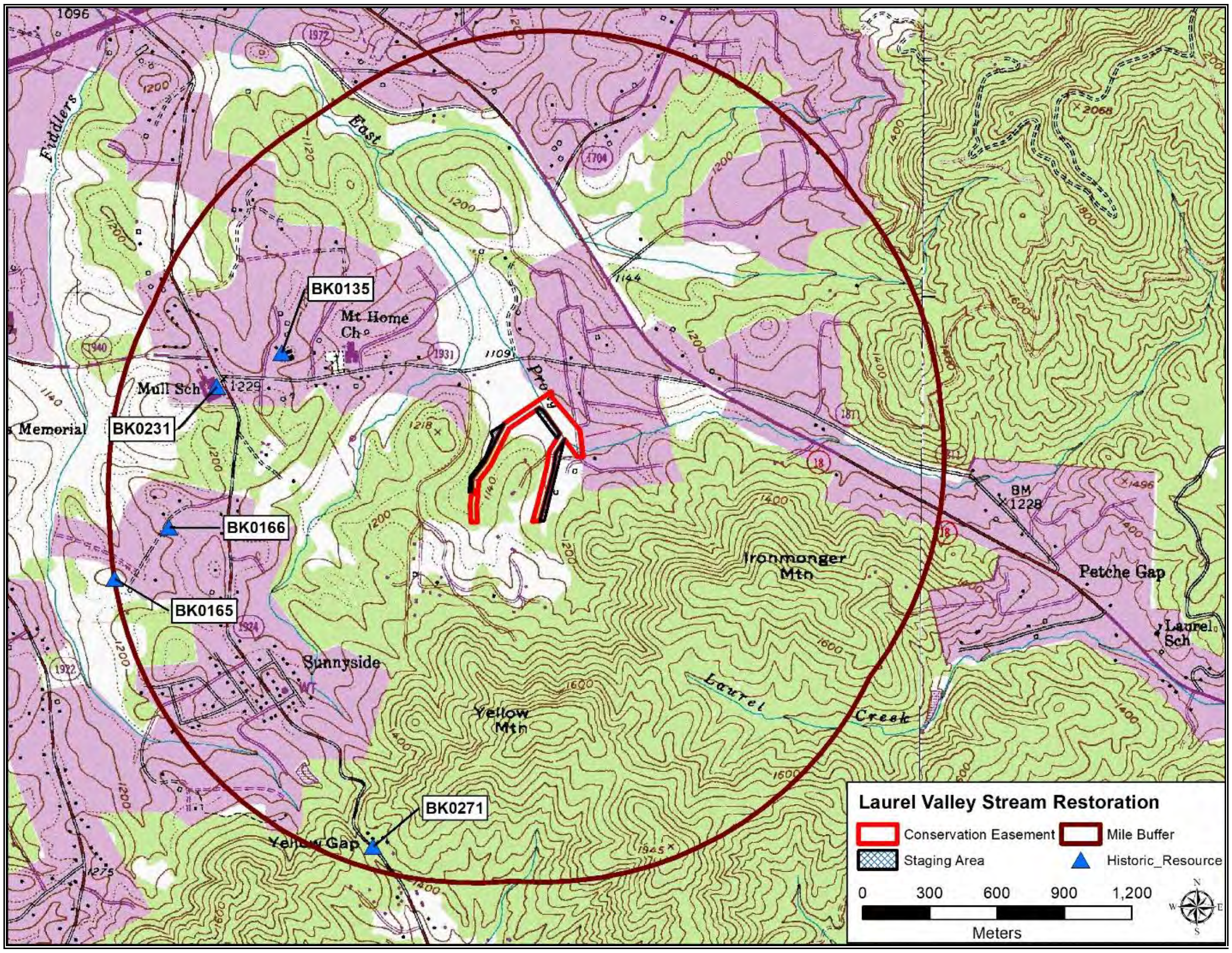

Figure 3.1. Map showing previously recorded historic resources in the project vicinity (1993 *Morganton South, NC* USGS 7.5 minute topographic quadrangle).

Archaeological Survey Results

The project Area of Potential Effect (APE) was surveyed with 20-meter interval shovel testing. Areas that had surface visibility were also visually inspected. The entire APE was walked over, and supplemental shovel tests were excavated when deemed necessary. Several areas with standing water were present in the northern portion of the APE (Figure 3.2). There were areas of steep slope throughout the APE, particularly in the southwestern wooded portion and along the southeastern pasture portion (Figure 3.3). There were several small drainages within the APE (Figure 3.4 and Figure 3.5).

A total of 167 shovel test locations were examined in the project APE. Forty-seven of these shovel tests were not excavated due to standing water or steep slope. Figure 3.6 shows the survey coverage in the APE. The location of the structure located on the 1956 and 1993 historic topographic maps was investigated, but no shovel tests were excavated as the location is outside of the APE. No evidence of the structure or its remains were identified.

Shovel tests in the western wooded area of the APE generally exposed soil profiles comprised of 1 to 5 centimeters of gray (10YR5/1) sandy loam overlying 10 to 15 centimeters of brownish yellow (10YR6/6) sandy loam overlying reddish yellow (7.5YR6/6) loamy clay (Figure 3.7). Elsewhere in the APE, two different soil profiles were generally exposed. The first consisted of approximately 10 to 20 centimeters of dark grayish brown (10YR4/2) sandy loam overlying strong brown (7.5YR5/6) loamy clay (Figure 3.8). The second was comprised of approximately 10 to 20 centimeters of dark yellowish brown (10YR4/4) sandy loam overlying brown (7.5YR4/4) loamy clay (Figure 3.9). These two soil profiles were encountered consistently throughout the APE. In the areas of the APE close to standing water, soil profiles generally consisted of mottled dark gray (10YR4/1) and brown (10YR4/3) sandy loam which terminated in standing water below approximately 15 centimeters (Figure 3.10).

No archaeological sites were located during this investigation. A structure was shown on the 1956 and 1993 historic topographic maps near the eastern portion of the APE; however, no remains were identified during this survey.

Figure 3.2. Standing water in the northeast portion of the APE, facing east.

Figure 3.3. Steep slope in the wooded portion of the APE, facing south.

Figure 3.4. Small drainage in wooded portion of APE, facing east.

Figure 3.5. Small drainage in northeast portion of the APE, facing east.

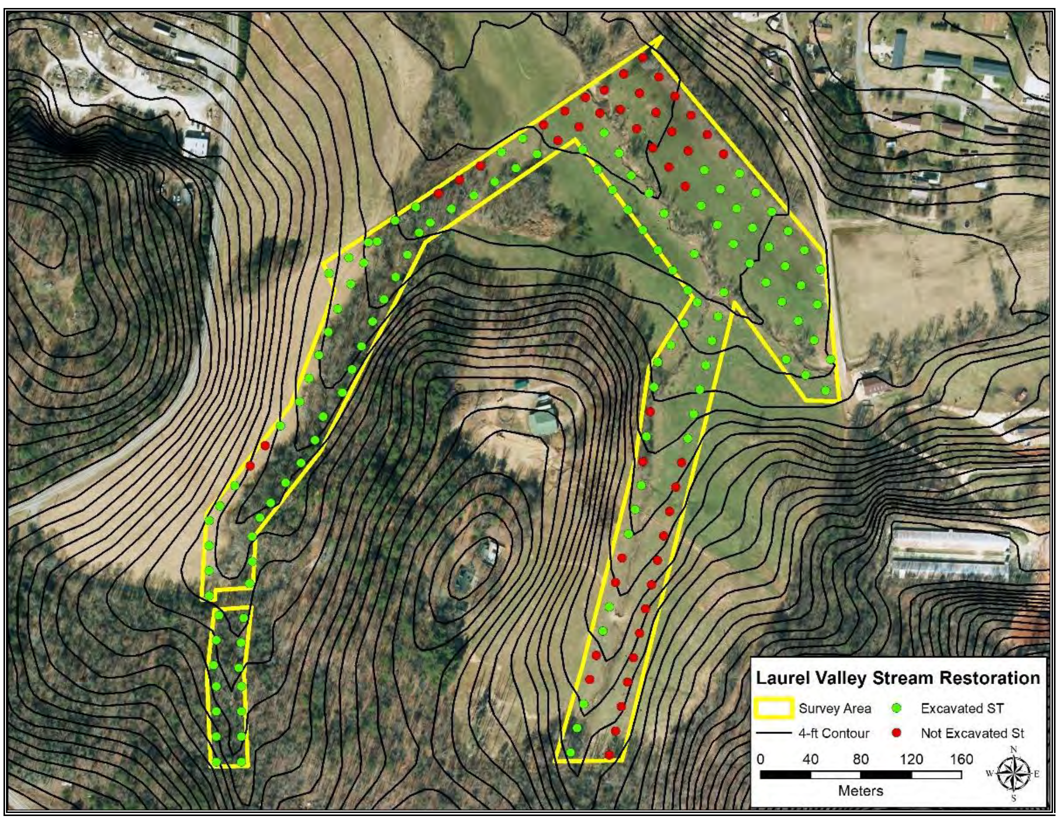

Figure 3.6. Map showing survey coverage in the APE.

Figure 3.7. Shovel test profile typical of the wooded area, facing west.

Figure 3.8. Representative shovel test profile from the APE, facing north.

Figure 3.9. Representative shovel test profile from the APE, facing west.

Figure 3.10. Shovel test profile typical of saturated areas, facing east.

Summary and Recommendations

In February of 2020, Archaeological Consultants of the Carolinas, Inc. conducted an archaeological survey of the approximately 16.5-acre (6.7 ha) APE for the proposed Laurel Valley mitigation site in Burke County, North Carolina. No previously recorded archaeological sites are present in the project tract and no new archaeological sites were identified. As the proposed restoration activities will not impact any significant archaeological resources, clearance to proceed is recommended.

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President, Archaeological Consultants of the Carolinas, Inc. - July 2008 to present
Vice President, Archaeological Consultants of the Carolinas, Inc. - 2003 to July 2008
President, Heritage Partners, LLC. - 2007 to present
Senior Archaeologist/Principal Investigator, Brockington and Associates, Inc. - 1993 to 2003

EDUCATION
B.S. in Anthropology, University of California, Riverside, 1992
M.A. in Geography, University of Georgia, Athens, 1999

AREAS OF SPECIALIZATION
Client and Agency Consultations for Planning and Development
Vertebrate Faunal Analysis

PROFESSIONAL ORGANIZATION MEMBERSHIP
Register of Professional Archaeologists (ROPA)
Southeastern Archaeological Conference
Archaeological Society of South Carolina
North Carolina Archaeological Society
Society for American Archaeology
Mid-Atlantic Archaeology Conference
Council of South Carolina Professional Archaeologists
North Carolina Council of Professional Archaeologists

Cultural Resource Surveys (Phase I) and Archaeological Site Testing (Phase II) - Representative Examples

- **Airport Expansions** for Concord Regional Airport (Cabarrus County), Hickory Regional Airport (Burke County)
- **Greenways** for Appomattox County, Virginia (Appomattox Heritage Trail), Isle of Wight County (Fort Huger)
- **Utility Corridors** for Duke Energy (Charlotte), FPS (Charlotte), BREMCO (Asheville), SCE&G (Columbia), Georgia Power Company (Atlanta), Transco Pipeline (Houston), ANR Pipeline (Detroit), and others
- **Transportation Corridors** for Georgia Department of Transportation (Atlanta), South Carolina Department of Transportation (Columbia), North Carolina Department of Transportation (Raleigh)
- **Development Tracts** for numerous independent developers, engineering firms, and local and county governments throughout Georgia, North Carolina, South Carolina, and Virginia, and federal agencies including the USFS (South Carolina) and the USACE (Mobile and Wilmington Districts)

Archaeological Data Recovery (Phase III) - Representative Examples

- Civil War encampment (44IW0204) for Isle of Wight County, Isle of Wight, VA
- Prehistoric village (31ON1578) and late 18th/early 19th century plantation (31ON1582) for R.A. Management, Charlotte, NC

- 18th century residence (38BU1650) for Meggett, LLC, Bluffton, SC

- Prehistoric camps/villages (38HR243, 38HR254, and 38HR258) for Tidewater Plantation and Golf Club, Myrtle Beach, SC

EXPERIENCE AT MILITARY FACILITIES

Fort Benning, Columbus, Georgia; Townsend Bombing Range, McIntosh County, Georgia; Fort Bragg, Fayetteville, North Carolina; Camp Lejeune, Jacksonville, North Carolina; Fort Jackson, Columbia, South Carolina; Fort Buchanan, Puerto Rico; Milan Army Ammunition Plant, TN

FEDERAL ENERGY REGULATORY COMMISSION RELATED INVESTIGATIONS

Georgia Power Company -Flint River Hydroelectric Project
Duke Energy - Lake James and Lake Norman, North Carolina; Fishing Creek, South Carolina

*A detailed listing of individual projects and publications is available upon request

APPENDIX 6
NCIRT Communications

WILDLANDS ENGINEERING

MEETING MINUTES

MEETING:	Post Contract IRT Site Visit **LAUREL VALLEY Mitigation Site** Catawba River Basin 03050101: Burke County, NC NCDMS Project No. 100140 USACE ID: SAW-2020-00053 NCDEQ Contract No. 7875-02 Wildlands Project No. 005-02187
DATE:	*On-site Meeting:* Tuesday, January 14, 2020, 1:00 pm *Meeting Notes Distributed:* Wednesday, January 22, 2020 *Meeting Notes Revised and Redistributed:* Tuesday, January 28, 2020. Revisions shown in red
LOCATION:	3925 Hawkins Drive Morganton, NC 28655

Attendees
Todd Tugwell, USACE
Mac Haupt, NC Department of Environmental Quality
Erin Davis, NC Department of Environmental Quality
Andrea Leslie, NC Wildlife Resources Commission
Paul Wiesner, Division of Mitigation Services (NCDMS)
Kirsten Ullman, NCDMS
Harry Tsomides, NCDMS Project Manager
Casey Haywood, NCDMS
Shawn Wilkerson, Wildlands Engineering
Eric Neuhaus, Wildlands Engineering

Materials

- Wildlands Engineering Technical Proposal dated 8/13/2019 in response to NCDMS RFP #16-007875

Overall Site Notes/Comments

1. It was noted that the Site is located within the Hunting Creek targeted local watershed and that East Prong Hunting Creek is 303(d) listed as impaired for fecal coliform bacteria.
2. The property owner had cleared approximately 7.5-acres beyond the left floodplain of UT1 Reach 1. Wildlands noted that they would discuss best management practices with the property owner and have them install erosion and sediment control measures (likely check dams) to minimize sediment induction into existing UT1.

Meeting Notes

1. Wildlands gave a brief site overview before the walk which discussed overall site conditions and general stream approach.
2. The walk began at the upstream end of East Prong Hunting Creek at the outlet from Laurelwood Rd. The current culvert is perched and undersized based on initial observation. Wildlands will discuss the possibility of removing and replacing the existing culvert to improve its current condition and facilitate the transition to a priority 1 restoration approach with the property owner.
3. Standing water was observed along most of the entire right floodplain of East Prong Hunting Creek. The stream is proposed for priority 1 restoration, which will raise the existing water table. The IRT noted that while the pocket wetland habitat is positive for ecological uplift, it could inhibit woody species growth. As such, Wildlands will include discussion in the mitigation plan outlining expected reductions in woody size and quantity and increased herbaceous vegetation within this area and other wetter areas around the site.
4. The walk continued along UT2 working upstream. Wildlands noted that they would attempt to save mature vegetation along the left bank of UT2 by pulling the stream away from the existing hill slope and relocating it into the valley with minimal disturbance to the left bank.
5. It was discussed that UT2 will likely be broken into two separate reaches based on slope and stream type.
6. It was noted that an internal crossing with a proposed culvert crossing will be installed at the upstream end of UT2.
7. The IRT commented that Wildlands needs to be aware of the reduction in stream power at the valley break along UT1 and UT2 and ensure sediment doesn't settle within flatter portions of the constructed channels.
8. The IRT also commented that if wetlands were needed by DMS, they would like to see a larger scale stream and wetland project at this site. Soil borings taken within the floodplain of East Prong Hunting Creek by the IRT (Mac Haupt) indicated hydric soil indicators.
9. Two drainage outlets (shown in Figure 2 of the proposal) have been implemented by the property owner to reduce ponded water in the fields adjacent to East Prong Hunting Creek. Wildlands indicated that these drainage features would be stabilized within the work area, but would not be addressed beyond the limits of the proposed conservation easement unless a larger wetland restoration component is added to the project.
10. The walk continued to the downstream end of the current UT1 Reach 2 alignment. Wildlands proposal includes the re-alignment of UT1 Reach 2 to drain to East Prong Hunting Creek. The IRT noted that the realignment could have potential drainage effects on the downstream property owner and to be aware of how changes in stream pattern would change downstream hydrology.
11. The IRT noted that the portion of UT1 Reach 2 which will be re-aligned will run through a broad, flat floodplain. Subsequently the channel may require minor maintenance during the monitoring period to ensure upstream sediment and vegetation don't choke channel flow. Wildlands will include information in the adaptive management plan discussing these plans and associated potential maintenance. The IRT noted that they would not want to see instream channel maintenance except in the first two years of monitoring.
12. The walk continued upstream along UT1 Reach 2. It was noted that the channel will be relocated to the left, and mature vegetation along the right (eastern) boundary will be saved along the hillslope. In sections where UT1 Reach 2 is stable (specifically, between the driveway culvert and the existing S-shaped meander in the existing stream), Wildlands will consider enhancement style approaches if feasible with grading and design limitations or ensure justification of restoration in mitigation plan. The IRT noted that credit ratios would be evaluated and assigned based on the proposed level of work and may differ from ratios originally presented in the proposal.
13. It was noted by Wildlife Resources Commission that the existing driveway culvert at the upstream end of UT1 Reach 2 would need to be replaced to eliminate the current aquatic organism blockage (perching). Additionally, it was requested that the existing plastic pipe be replaced with a different material culvert

which will mimic a more natural stream bed, allowing for easier upstream passage of aquatics. Wildlands agreed to these requests regarding the replaced culvert.

14. The IRT requested that Wildlands explore options to expand the buffer along UT1 Reach 1, specifically in the right floodplain. Wildlands will follow up with the property owner and provide a memorandum outlining the potential expansion of the buffer and any associated requested changes to the proposed credit ratio.

MEMORANDUM

MEETING: Post Contract IRT Site Visit Memorandum
LAUREL VALLEY Mitigation Site
Catawba River Basin 03050101: Burke County, NC
NCDMS Project No. 100140
USACE ID: SAW-2020-00053
NCDEQ Contract No. 7875-02
Wildlands Project No. 005-02187

DATE: *On-site IRT Meeting:* Tuesday, January 14, 2020, 1:00 pm
IRT Meeting Notes Revised and Redistributed: Tuesday, January 28, 2020.
Memorandum Distributed: Wednesday, April 22, 2020
Memorandum Revised and Redistributed, May 19, 2020

The following items were discussed at the Post Contract IRT Site Visit and required further investigation from Wildlands Engineering. Original comments are shown in black while Wildlands responses are shown in blue.

1. The property owner had cleared approximately 7.5-acres beyond the left floodplain of UT1 Reach 1. Wildlands noted that they would discuss best management practices with the property owner and have them install erosion and sediment control measures (likely check dams) to minimize sediment induction into existing UT1.

   Wildlands discussed this with the property owner. Check dams were placed in the drainage ditch just upstream of the driveway crossing and the property owner has sewn hay to stabilize the cleared area.

2. The walk began at the upstream end of East Prong Hunting Creek at the outlet from Laurelwood Rd. The current culvert is perched and undersized based on initial observation. Wildlands will discuss the possibility of removing and replacing the existing culvert to improve its current condition and facilitate the transition to a priority 1 restoration approach with the property owner.

   Wildlands discussed this with the property owner, but the adjacent property owner recently replaced the road crossing and is not interested in allowing Wildlands to replace the crossing. Wildlands will confirm that the culvert is not on our landowner's property once survey data is received. As much is possible without hydrologic trespass, Wildlands will attempt to raise the baseflow water surface at the crossing to improve aquatic organism passage and facilitate transition to a priority 1 approach.

3. The IRT also commented that if wetlands were needed by DMS, they would like to see a larger scale stream and wetland project at this site. Soil borings taken within the floodplain of East Prong Hunting Creek by the IRT (Mac Haupt) indicated hydric soil indicators.

Wildlands inquired if there was a wetland need in this basin but NCDMS does not currently have a wetland need within the basin. Wildlands will not pursue wetland crediting for the project. Groundwater gages will be installed within existing jurisdictionally delineated wetlands to monitor project effect on wetland hydrology. Locations of the gages will be shown within the mitigation plan.

4. It was noted by Wildlife Resources Commission that the existing driveway culvert at the upstream end of UT1 Reach 2 would need to be replaced to eliminate the current aquatic organism blockage (perching). Additionally, it was requested that the existing plastic pipe be replaced with a different material culvert which will mimic a more natural stream bed, allowing for easier upstream passage of aquatics. Wildlands agreed to these requests regarding the replaced culvert.

   Wildlands inquired about replacing the culvert with the property owner. The property owner recently replaced the culvert. Additionally, the property owner noted that there is an existing underground electric utility line that runs along the crossing. Due to these issues, Wildlands will not be able to replace the crossing. However, Wildlands will raise the stream grade, backing water up the culvert to help with culvert perching and aquatic organism passage. Wildlands will also add rock material to create roughness within the bed of the culvert to give aquatic species some refuge within the culvert.

5. The IRT requested that Wildlands explore options to expand the buffer along UT1 Reach 1, specifically in the right floodplain. Wildlands will follow up with the property owner and provide a memorandum outlining the potential expansion of the buffer and any associated requested changes to the proposed credit ratio.

   Wildlands asked the property owner if he would consider a wider buffer along UT1 Reach 1 and he declined. Wildlands still intends to place the required minimum buffer along each side of UT1 Reach 1 and has revised the proposed credit ratio to 15:1 along the reach based on proposed work (invasive species, implementation of a conservation easement).

6. The IRT expressed concern that hydrology of UT1 Reach 2 downstream of the project limits would be completely removed based on the realignment of the proposed channel.

   Wildlands will attempt to monitor UT1 Reach 2 as best possible to ensure stream relocation does not result in a complete loss of hydrology downstream of the project.

WILDLANDS ENGINEERING

MEETING MINUTES

MEETING: IRT Digital Meeting
LAUREL VALLEY Mitigation Site
Catawba River Basin 03050101: Burke County, NC
NCDMS Project No. 100140
USACE ID: SAW-2020-00053
NCDEQ Contract No. 7875-02
Wildlands Project No. 005-02187

DATE: *Digital Meeting:* Tuesday, July 14, 2020, 10:00 am
Meeting Notes Including Previous Correspondence Distributed:
Wednesday, July 15, 2020

Attendees
Todd Tugwell, USACE
Casey Haywood, USACE
Kim Browning, USACE
Erin Davis, NC Department of Environmental Quality
Andrea Leslie, NC Wildlife Resources Commission
Travis Wilson, NC Wildlife Resources Commission
Paul Wiesner, NC Division of Mitigation Services
Harry Tsomides, NC Division of Mitigation Services
Shawn Wilkerson, Wildlands Engineering
Eric Neuhaus, Wildlands Engineering
Christine Blackwelder, Wildland Engineering

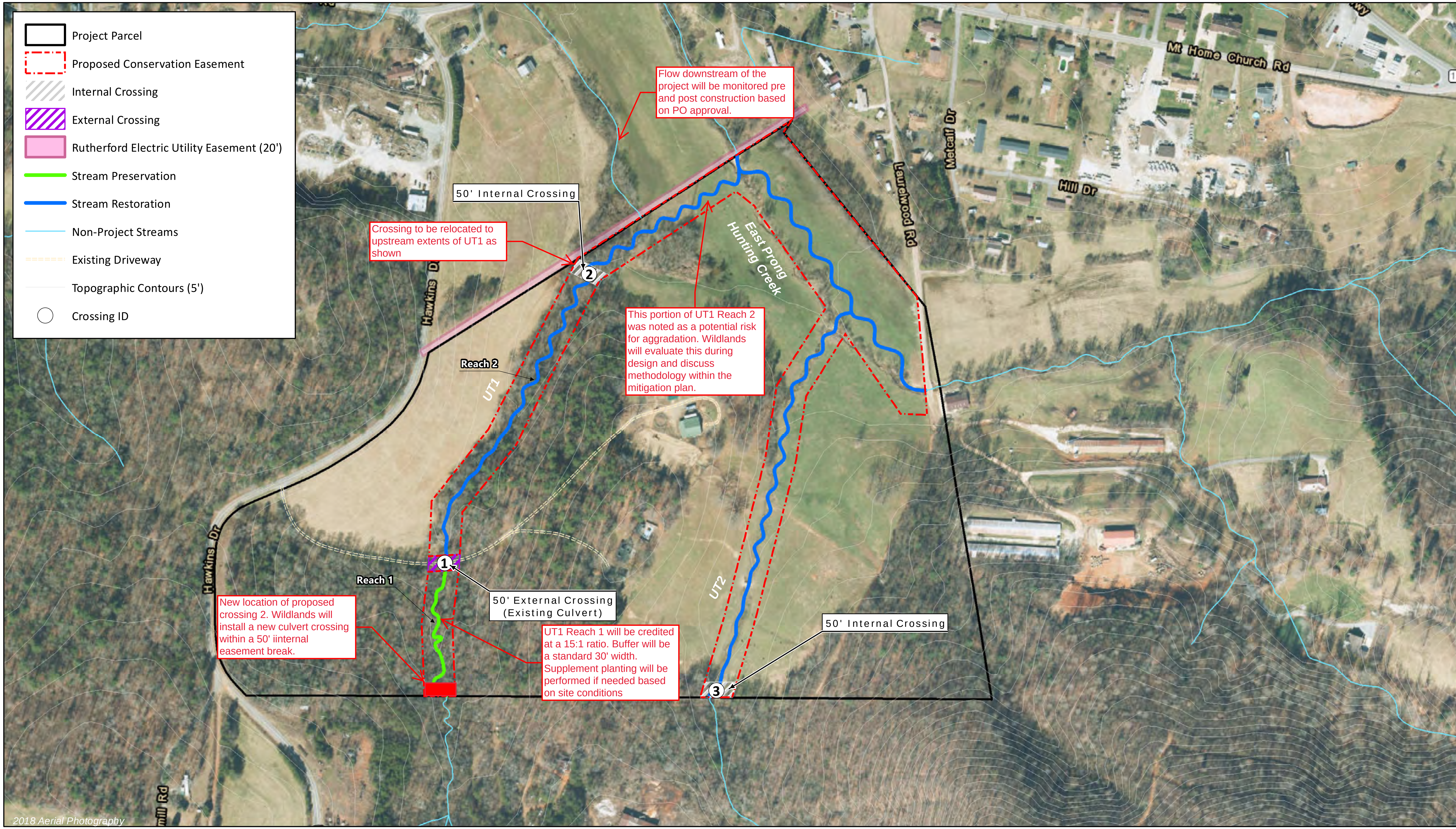
Materials
- Final Post Contract IRT Site Visit Meeting Minutes Distributed 1/28/2020
- Final Post Contract IRT Site Visit Memorandum Distributed 5/19/2020
- Concept Map of the site with revision notes from virtual meeting on 7/15/2020.

Summary
- A virtual meeting was held to finalize outstanding items regarding the Laurel Valley Mitigation Site. Previous finalized correspondence listed above is included with these meeting minutes for documentation. All correspondence, including these minutes, will be included with the project mitigation plan submittal within the Appendix.

Meeting Notes
1. Wildlands will place the required minimum buffer along each side of UT1 Reach 1. A proposed credit ratio of 15:1 along the reach was agreed upon based on the preservation approach (invasive species treatment, implementation of a conservation easement, potential supplemental planning). Wildlands will evaluate if supplemental planting is required along the outer most edge of the proposed conservation easement based on previous clearing by the property owner and will establish an approach within the mitigation plan if required.

2. A preliminary fencing plan will be included with the mitigation plan submittal based on the potential of cattle along UT1 Reach 1.
3. Crossing #2 (shown in the included map) will be relocated to the upstream extent of UT1 Reach 1. It is anticipated that the proposed crossing will be a newly installed culvert within a 50' internal easement break.
4. The hydrology of UT1 Reach 2 downstream of the project limits and the potential impact of rerouting the existing channel during design was discussed. Wildlands noted that it is hypothesized hydrology from the spring fed, small pond downstream from the property line will continue to provide flow downstream of the project after the channel is rerouted, and we will attempt to monitor this for the mitigation plan. Wildlands will install a pressure transducer to monitor hydrology on the downstream reach and evaluate results pre and post construction. These monitoring efforts will be discussed within the submitted mitigation plan.
5. The IRT expressed concern about the downstream extents of proposed UT1 Reach 2 as a potential risk for aggradation. Wildlands will evaluate this during design and discuss methodology to mitigate this risk within the mitigation plan. Potential adaptive management regarding this issue will also be presented in the mitigation plan.
6. The IRT noted that fields around East Prong Hunting Creek could experience a potential hydrologic increase based on the stream restoration proposed at the Site. Wildland noted that they will evaluate this risk during design and present design considerations and potential adaptive management within the mitigation plan.

Revised Concept Map



WILDLANDS ENGINEERING

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Figure 6a Concept Map - Option 1
Laurel Valley Mitigation Site
Catawba River Basin 03050101

Burke County, NC

Revision from 7/14/2020 Virtual Meeting are Denoted in RED

Previous IRT Correspondence

MEETING MINUTES

MEETING:	Post Contract IRT Site Visit **LAUREL VALLEY Mitigation Site** Catawba River Basin 03050101: Burke County, NC NCDMS Project No. 100140 USACE ID: SAW-2020-00053 NCDEQ Contract No. 7875-02 Wildlands Project No. 005-02187
DATE:	*On-site Meeting:* Tuesday, January 14, 2020, 1:00 pm *Meeting Notes Distributed:* Wednesday, January 22, 2020 *Meeting Notes Revised and Redistributed:* Tuesday, January 28, 2020. Revisions shown in red
LOCATION:	3925 Hawkins Drive Morganton, NC 28655

Attendees
Todd Tugwell, USACE
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Materials
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Overall Site Notes/Comments
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MEMORANDUM

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6. The IRT expressed concern that hydrology of UT1 Reach 2 downstream of the project limits would be completely removed based on the realignment of the proposed channel.

   Wildlands will attempt to monitor UT1 Reach 2 as best possible to ensure stream relocation does not result in a complete loss of hydrology downstream of the project.

APPENDIX 7
Invasive Species Treatment Plan

Appendix 7 Invasive Species Plan

Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. These site inspections may identify the presence of invasive vegetation. If, during the monitoring period, invasive species threaten the survivability of planted woody vegetation in an area that exceeds 1% of the planted easement acreage, the invasive species shall be treated. Smaller areas may be treated at the discretion of the project engineer and biologist, if deemed in the best interest of the Site. Generally, the treatment plan shall follow the below guidelines in Table 1 for common invasive species found in riparian areas; however, the treatment may be changed based on the professional judgement of the project engineer and biologist. For invasive species not listed in the below table that threaten the survivability of the planted woody vegetation, Wildlands shall notify DMS of the invasive species observed and the plan for treatment prior to treating the species. All invasive species treatment will be reported in the following year's monitoring plan.

Table 1. Invasive Species Treatment – *Laurel Valley Mitigation Site*

Invasive Species	Recommended Removal Technique
Multiflora Rose *(Rosa multiflora)*	Foliar treatment of large populations with 4% glyphosate solution. Cut stump treatment is time consuming, though effective. Treat in spring/summer. Biocontrol using viral pathogen of rose-rosette disease transmitted by European Rose Chalcid wasp is an option. Rose-rosette disease is also vectored by native mites.
Tree of Heaven (*Ailanthus altissima*)	Large trees - Make stem injections and then apply Garlon 3A when safety to surrounding vegetation is desired, or Pathway* or Arsenal AC* in dilutions and cut-spacings specified on the herbicide label (midsummer best, late winter somewhat less effective). For felled trees, apply the herbicides to stem and stump tops immediately after cutting. Seedlings and saplings - Thoroughly wet all leaves with the following herbicide in water with a surfactant (July to October): Garlon 4 as a 1- to 2-percent solution (4 to 8 ounces per 3-gallon mix) or Garlon 3A as a 2-percent solution (8 ounces per 3-gallon mix).
Chinese Privet (*Ligustrum sinense*)	Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: a glyphosate herbicide as a 3-percent solution (12 ounces per 3-gallon mix) in the late fall or early winter when safety to surrounding vegetation is desired, or elsewhere, Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix). Backpack mist blowers can broadcast glyphosate as a 3-percent solution (12 ounces per 3-gallon mix) or Escort XP* at 1 ounce per acre (0.2 dry ounces per 3-gallon mix and 10 gallons per acre) during winter for safety to dormant hardwoods. Summer applications of glyphosate may not be as effective as other times and require a higher percent solution. The best time for Arsenal AC* and Escort XP* is summer to fall. For stems too tall for foliar sprays and when safety to surrounding vegetation is desired, apply a basal spray of Garlon 4 as a 20-percent solution (5 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant, or fuel oil or diesel fuel (where permitted); or undiluted Pathfinder II. Elsewhere, apply Stalker* as a 6- to 9-percent solution (1.5 to 2 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant, or fuel oil or diesel fuel (where permitted) to young bark as a basal spray making certain to treat all stems in a clump; or cut and immediately treat the stump tops with Arsenal AC* as a 5-percent solution (20 ounces per 3-gallon mix) or Velpar L* as a 10-percent solution in water (1 quart per 3-gallon mix) with a surfactant. When safety to surrounding vegetation is desired, immediately treat stump tops and sides with Garlon 3A or with a glyphosate herbicide as a 20-percent solution (5 pints per 3-gallon mix) in water with a surfactant. ORTHO Brush-B-Gon and Enforcer Brush Killer are effective undiluted for treating cut-stumps and available in retail garden stores (safe to surrounding plants). For large stems, make stem injections

Invasive Species	Recommended Removal Technique
	using Arsenal AC* or when safety to surrounding vegetation is desired, Garlon 3A or a glyphosate herbicide using dilutions and cut-spacings specified on the herbicide label (anytime except March and April). An EZ-Ject tree injector can help to reach the lower part of the main stem; otherwise, every branching trunk must be hack-and-squirt injected.
Fescue (*Festuca spp.)* and other Pasture Grasses.	Pasture grasses may be pre-treated before construction or up to one week before permanent seeding of the invasive area. Mow grasses to very low height, near ground level. Broadcast spray, but not to the point of runoff, with non-selective herbicide at rates recommended by manufacturer (Preferred 5%-8% Torched* solution). Re-treat if rainfall occurs within 24 hours of application or as directed by manufacturer.

APPENDIX 8

Site Protection Instrument

Appendix 8 Site Protection Instrument

The land required for construction, management, and stewardship of this mitigation project includes portions of the Hewat parcel listed in Table 1. This property is optioned for purchase of a conservation easement by Wildlands Engineering, Inc. (Wildlands). Wildlands will record a conservation easement on the parcels to encompass the streams being restored, enhanced, created and preserved along with their corresponding buffers.

Table 1: Site Protection Instrument – *Laurel Valley Mitigation Site*

Property Owner	Parcel ID Number	County	Under Option to Purchase by Wildlands?	Memorandum of Option Deed Book (DB) and Page Number (PG)	Acreage to be Protected
Hewat, John	2712409543	Gaston	Yes	DB: 2418 PG: 120 - 123	14

All site protection instruments require 60-day advance notification to the USACE and or DMS prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

APPENDIX 9

Maintenance Plan

Appendix 9 Maintenance Plan

The site shall be visited semi-annually and a physical inspection of the site shall be conducted a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

Table 1. Maintenance Plan – *Laurel Valley Mitigation Site*

Component/ Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel – these shall be conducted where success criteria are threatened or at the discretion of the Designer. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting. Beaver activity will be monitored and beaver dams on project streams will typically be removed, at the discretion of the Designer, during the monitoring period to allow for bank stabilization and stream development outside of this type of influence.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species requiring treatment per the Invasive Species Treatment Plan (Appendix 7) shall be treated in accordance with that plan and with NC Department of Agriculture (NCDA) rules and regulations.
Site boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis.

APPENDIX 10
Financial Assurance

Appendix 10 - Financial Assurances

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

APPENDIX 11
Credit Release Schedule

Appendix 11 - Credit Release Schedule and Supporting Information

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

Table A: Credit Release Schedule – Stream Credits – *Laurel Valley Mitigation Site*

Credit Release Milestone	Monitoring Year	Credit Release Activity	Interim Release	Total Released
1	0	Site Establishment	0%	0%
2	0	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan – see requirements below	30%	30%
3	1	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%
4	2	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%
5	3	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%
6	4*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)
7	5	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)
8	6*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)
9	7	Year 7 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	90% (100%**)

*Vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

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

1.1 Initial Allocation of Released Credits

For this NCDMS project, no initial release of credits is provided. To account for this, the 15% credit release typically associated with the site establishment is held until completion of all initial physical and biological improvements made pursuant to the Mitigation Plan. In order for NCDMS to receive the 30% release (shown in Tables A and B as Milestone 2), they must comply with the credit release requirements stated in Section IV(I)(3) of the approved NCDMS instrument.

1.2 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.

The following conditions apply to credit release schedules:

a. A reserve of 10% of site's total stream credits will be release after four bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than four bankfull events occur during the monitoring period, release of these reserve credits is at the discretion of the NCIRT.
b. After the second milestone, the credit releases are scheduled to occur on an annual basis, assuming that the annual monitoring report has been provided to the USACE in accordance with Section IV (General Monitoring Requirements) of this document, and that the monitoring report demonstrates that interim performance standards are being met and that no other concerns have been identified on-site during the visual monitoring. All credit releases require written approval from the USACE.
c. The credits associated with the final credit release milestone will be released only upon a determination by the USACE, in consultation with the NCIRT, of functional success as defined in the Mitigation Plan.

As projects approach milestones associated with credit release, the DMS will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

APPENDIX 12
Buffer Width Credit Adjustment

Wilmington District Stream Buffer Credit Calculator

Site Name:	Laurel Valley Mitigation Site
USACE Action ID:	
NCDWR Project Number:	
Sponsor:	
Number of Exempt Terminal Stream Ends[1]:	4
County:	Burke
Minimum Required Buffer Width[2]:	30

Mitigation Type	Mitigation Ratio Multiplier[3]	Creditable Stream Length[4]	Include in Buffer Calculations	Baseline Stream Credit	Buffered Stream Length	Credit From Buffered Streams
Restoration (1:1)	1	4701	Yes	4701.00	4701.00	4701.00
Enhancement I (1.5:1)	1.5					
Enhancement II (2.5:1)	2.5					
Preservation (5:1)	5					
Other (7.5:1)	7.5					
Other (10:1)	10					
Custom Ratio 1	15	457	Yes	30.47	457.00	30.47
Custom Ratio 2						
Custom Ratio 3						
Custom Ratio 4						
Custom Ratio 5						
Totals		**5158.00**		4731.47	5158.00	4731.47

	Buffer Width Zone (feet from Ordinary High Water Mark)								
Buffer Zones	**less than 15 feet**	**>15 to 20 feet**	**>20 to 25 feet**	**>25 to 30 feet**	**>30 to 50 feet**	**>50 to 75 feet**	**>75 to 100 feet**	**>100 to 125 feet**	**>125 to 150 feet**
Max Possible Buffer (square feet)[5]	156153	52679	52993	53307	216368	260255	260569	260883	277525
Ideal Buffer (square feet)[6]	161365.37	53582.85	52657.88	52083.44	202109.55	245424.09	242616.33	242309.57	243303.84
Actual Buffer (square feet)[7]	152561.46	50148.42	48923.18	48004.49	116627.19	41062.89	25287.66	21731.75	16336.76
Zone Multiplier	50%	20%	15%	15%	9%	7%	6%	5%	3%
Buffer Credit Equivalent	2365.73	946.29	709.72	709.72	425.83	331.20	283.89	236.57	141.94
Percent of Ideal Buffer	95%	95%	94%	94%	58%	17%	10%	9%	7%
Credit Adjustment	-119.24	-51.48	-41.37	-44.55	245.73	55.41	29.59	21.22	9.53

Total Baseline Credit	Credit Loss in Required Buffer	Credit Gain for Additional Buffer	Net Change in Credit from Buffers	Total Credit
4731.47	**-256.64**	**361.48**	**104.84**	**4836.31**

[1]Number of terminal stream ends, including all points where streams enter or exit the project boundaries, but not including internal crossings even if they are not protected by the easement.

[2]Minimum standard buffer width measured from the top of bank (50 feet in piedmont and coastal plain counties or 30 feet in mountain counties)

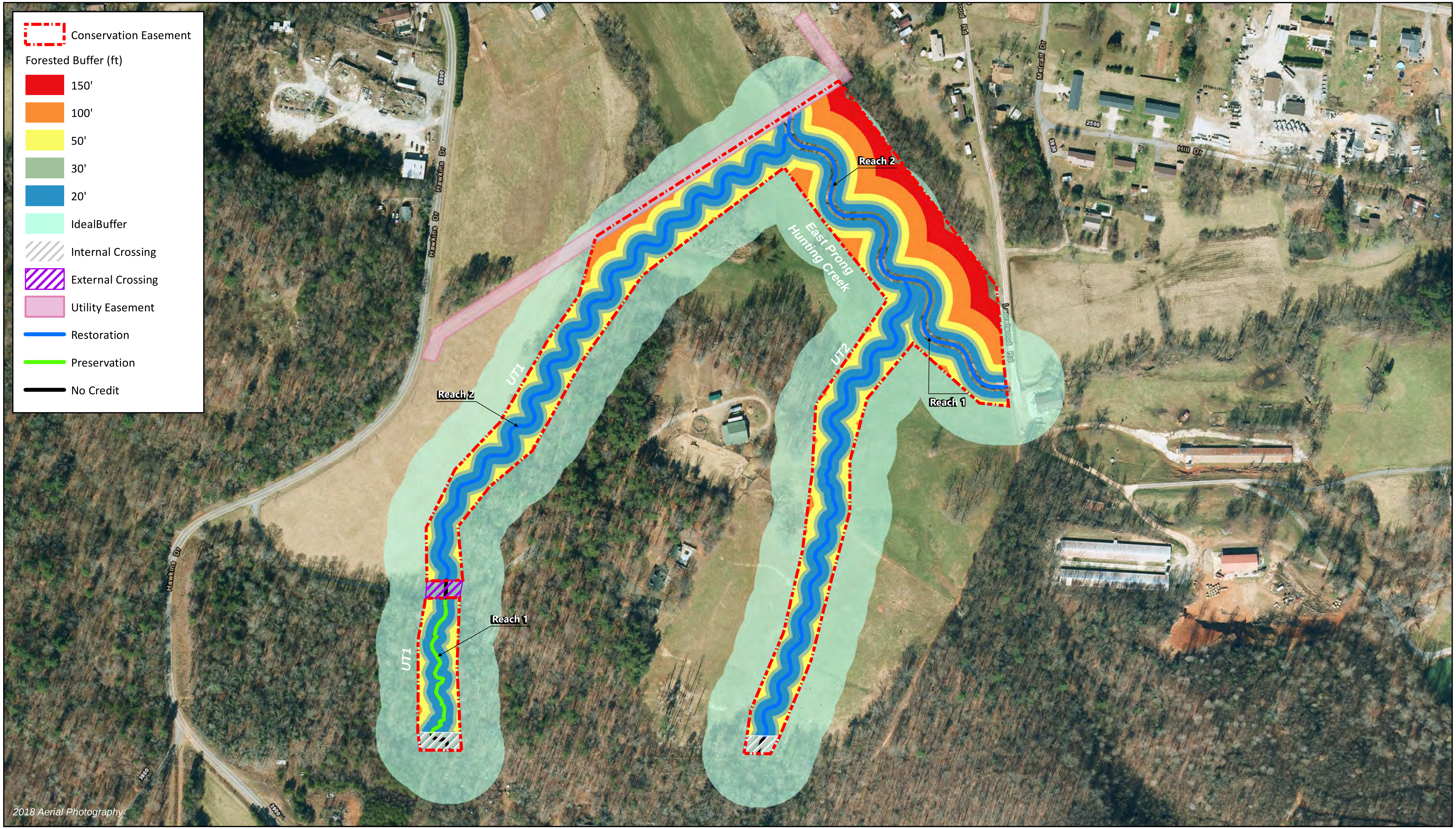
[3]Use the Custom Ratio fields to enter non-standard ratios, which are equal to the number of feet in the feet-to-credit mitigation ratio (e.g., for a perservation ratio of 8 feet to 1 credit, the multiplier would be 8).

[4]Equal to the number of feet of stream in each Mitigation Type. If stream reaches are not creditable, they should be excluded from this measurement, even if they fall within the easement.

[5]This amount is the maximum buffer area possible based on the linear footage of stream length if channel were perfectly straight with full buffer width and no internal crossings. This number is not used in calculations, but is provided as a reference.

[6]Maximum potential size (in square feet) of each buffer zone measured around all creditable stream reaches, calculated using GIS, including areas outside of the easement. The inner zone (0-15') should be measured from the top of the OHWM or the edge of the average stream width if OHWM is not known. Non-creditable stream reaches within the easement should be removed prior to calculating this area wtih GIS.

[7]Square feet in each buffer zone, as measured by GIS, excluding non-forested areas, all other credit type (e.g., wetland, nutrient offset, buffer), easement exceptions, open water, areas failing to meet the vegetation performance standard, etc. Additional credit is given to 150 feet in buffer width, so areas within the easement that are more than 150 feet from creditable streams should not be included in this measurement. Non-creditable stream reaches within the easement should be removed prior to calculating this area wtih GIS.

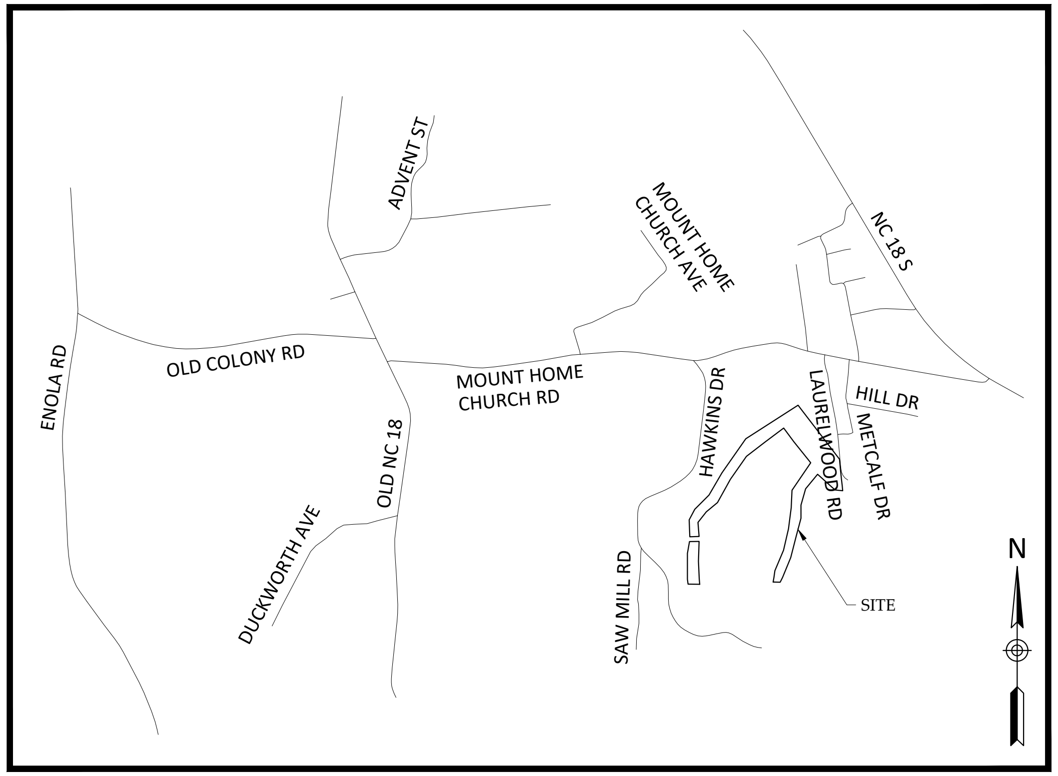


Buffer Credit Calculation Map
Laurel Valley Mitigation Site
Catawba River Basin 03050101
Burke County, NC

APPENDIX 13

Preliminary Plans

Laurel Valley Mitigation Site
Burke County, North Carolina
for
NCDEQ
Division of Mitigation Services



Vicinity Map
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BEFORE YOU DIG!
CALL 1-800-632-4949
N.C. ONE-CALL CENTER
IT'S THE LAW!

ISSUED WITH FINAL
MITIGATION PLAN
MARCH 2, 2022

Sheet Index

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828-645-8275

Owner:
NCDEQ
Division of Mitigation Services
5 Ravenscroft Drive, Ste 102
Asheville, NC 28801
Harry Tsomides

DMS Project No. 100140
Catawba River Basin 03050101

USACE Action ID
No. SAW-2020-00053

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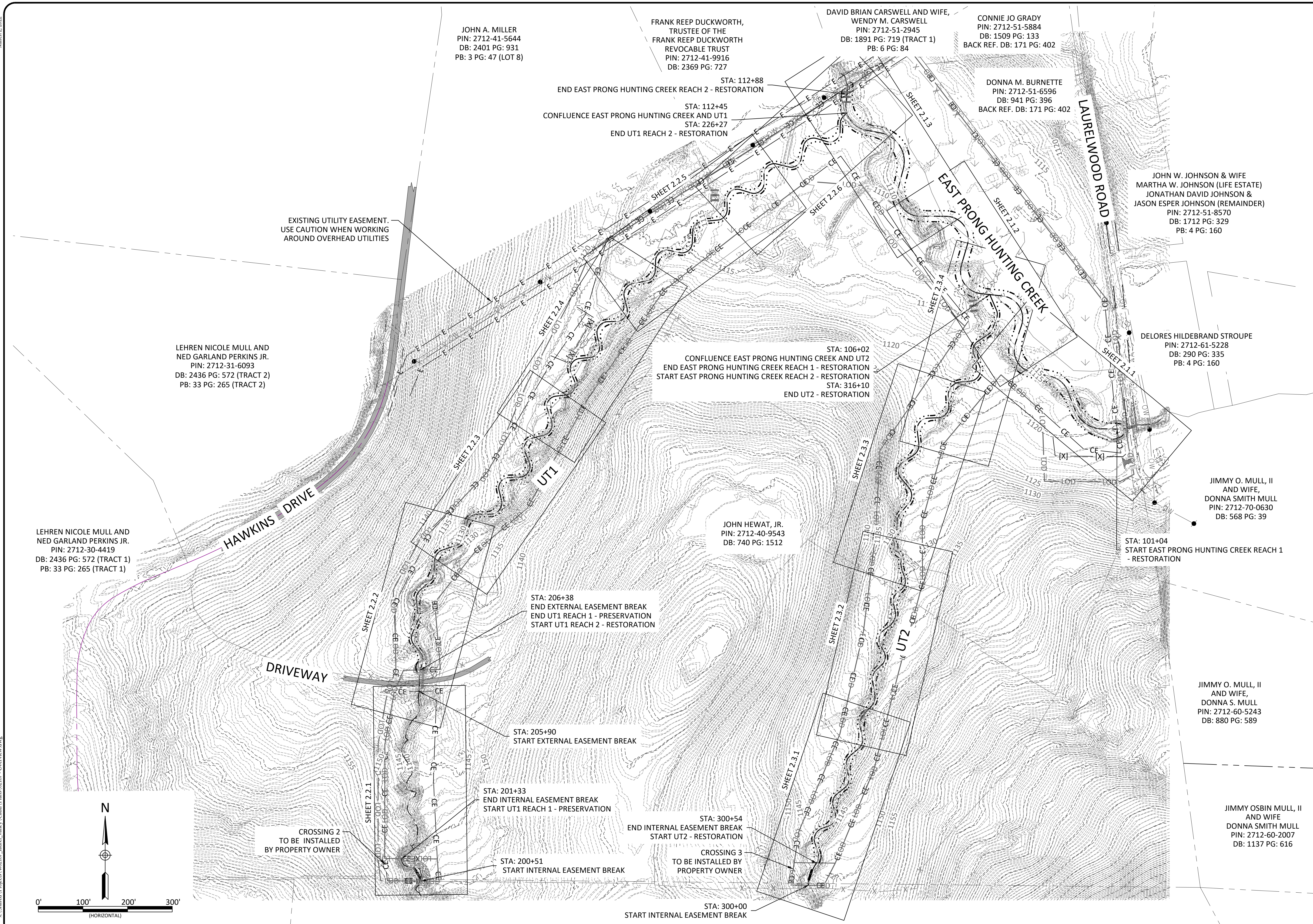
Burke County, North Carolina

Title Sheet

Date: March 3, 2022
Job Number: W02187
Project Engineer: EN
Drawn By: JW
Checked By: JK

0.1
Sheet



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Laurel Valley Mitigation Site
Burke County, North Carolina

Project Overview

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Project Engineer:	EN
Drawn By:	JW
Checked By:	JK

Sheet 0.2

March 2, 2022

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Construction sequence to be included with final plans

Existing Features

- Existing Property Line
- Existing Thalweg
- Existing Major Contour
- Existing Minor Contour
- Existing Fence (X — X — X — X)
- Existing Power Line (OW — OW)
- Existing Power Line Easement (E — E — E — E)
- Existing Tree Line
- Existing Wetlands
- Existing Road
- Existing Soil Road
- Existing Pipe
- Existing Power Pole
- Existing Tree

Proposed Features

- Proposed Conservation Easement (CE — CE — CE — CE)
- Proposed Internal Conservation Easement Crossing (CE-IX — CE-IX — CE-IX)
- Proposed Thalweg Alignment (10+00)
- Proposed Bankfull
- Proposed Major Contour (100)
- Proposed Minor Contour
- Proposed Fence with Gate
  See Detail 3-4, Sheet 6.8
- Proposed Fence Removal (X — X — X — X)
- Proposed Culvert Crossing
- Proposed Tree Removal
- Proposed Tree Save (SAF)

Proposed Structures

- Proposed Constructed Riffle
  See Details 1-4, Sheet 6.1
- Proposed Brushtoe
  See Details 2-3, Sheet 6.3
- Proposed Floodplain Pool
  See Detail 1, Sheet 6.3
- Proposed Outlet Stabilization
  See Detail 4, Sheet 6.6
- Proposed Log Sill
  See Detail 3, Sheet 6.2
- Proposed Rock Sill (or)
  See Detail 2, Sheet 6.2
- Proposed Log J-hook
  See Detail 4, Sheet 6.2
- Proposed Cover Log
  See Detail 1, Sheet 6.2

Erosion Control Features

- Limits of Disturbance (LOD — LOD)
- Temporary Construction Easement (TCE — TCE — TCE)
- Silt Fence ([X] — [X] — [X])
  See Detail 4, Sheet 6.4
- Safety Fence (SAF — SAF — SAF)
  See Detail 1, Sheet 6.7
- Haul Road
- Temporary Construction Entrance
  See Detail 1, Sheet 6.5
- Temporary Timber Mat Crossing (M)
  See Detail 4, Sheet 6.7
- Temporary Ford Crossing (F)
  See Detail 3, Sheet 6.7
- Temporary Rock Sediment Dam
  See Detail 2, Sheet 6.6
- Silt Fence Gravel Outlet
  See Detail 2, Sheet 6.4
- Pump Around System
  See Detail 2, Sheet 6.5

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General Notes and Symbols

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Sheet 0.3

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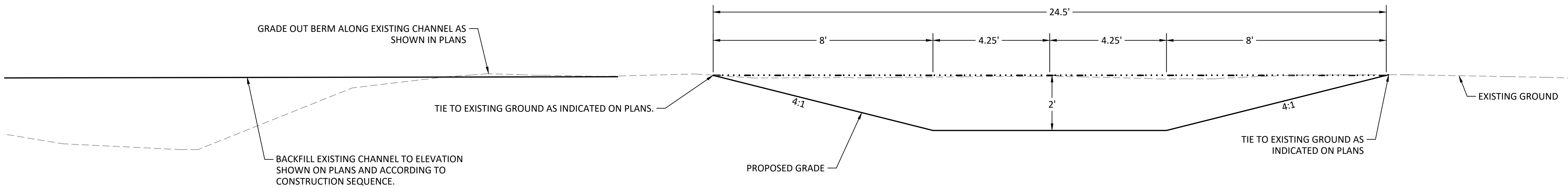

EAST PRONG HUNTING CREEK REACH 1 AND 2 - RIFFLE
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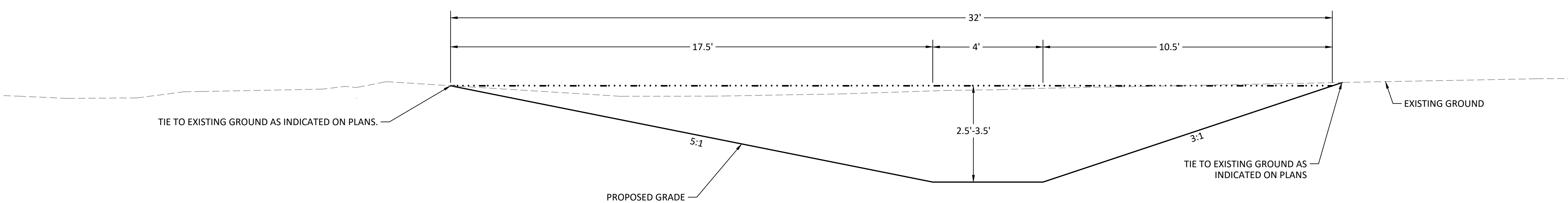

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East Prong Hunting Creek
Typical Sections

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Drawn By: JW
Checked By: JK

Sheet 1.1

March 2, 2022
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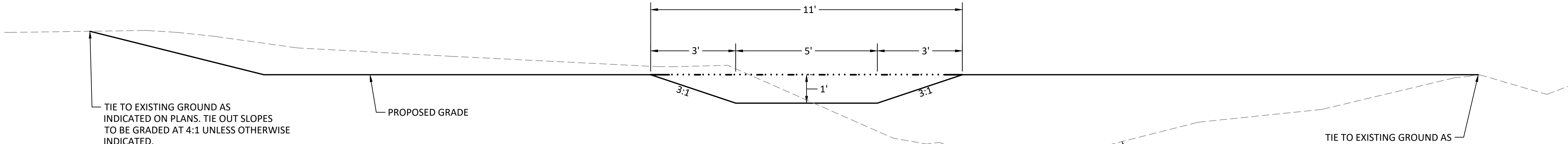

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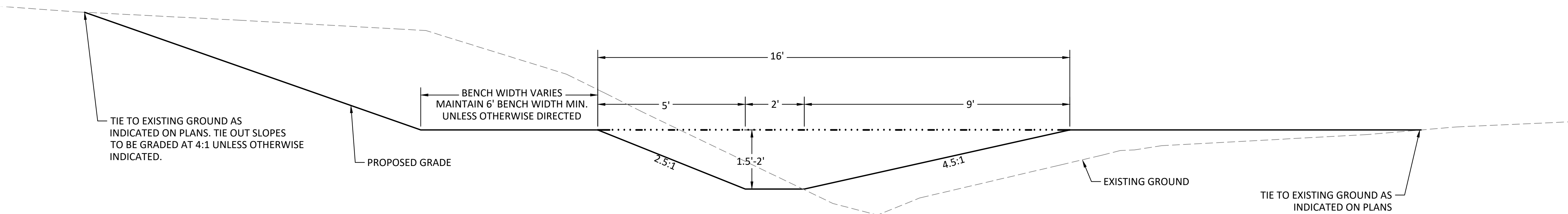

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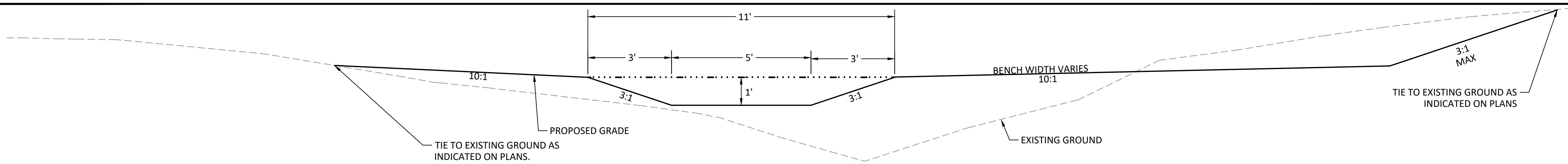

UT2 - RIFFLE
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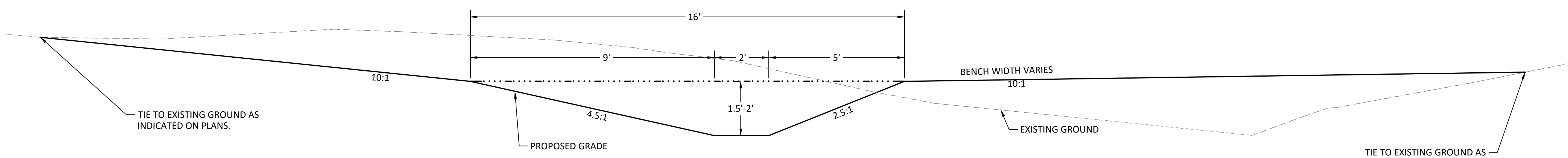

UT2 - POOL
Sta: 300+54 to 316+10
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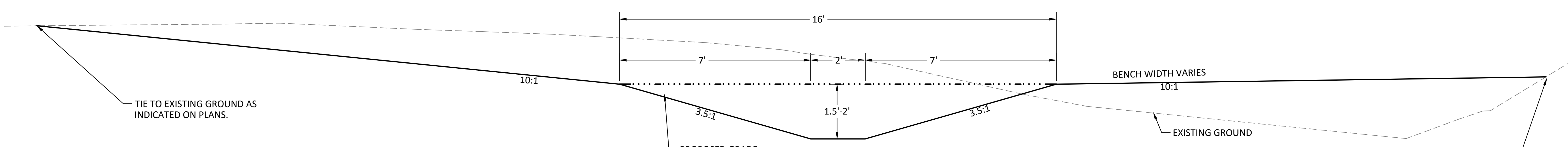

UT2 - IN-LINE POOL
Sta: 300+54 to 316+10
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UT1 & UT2
Typical Sections

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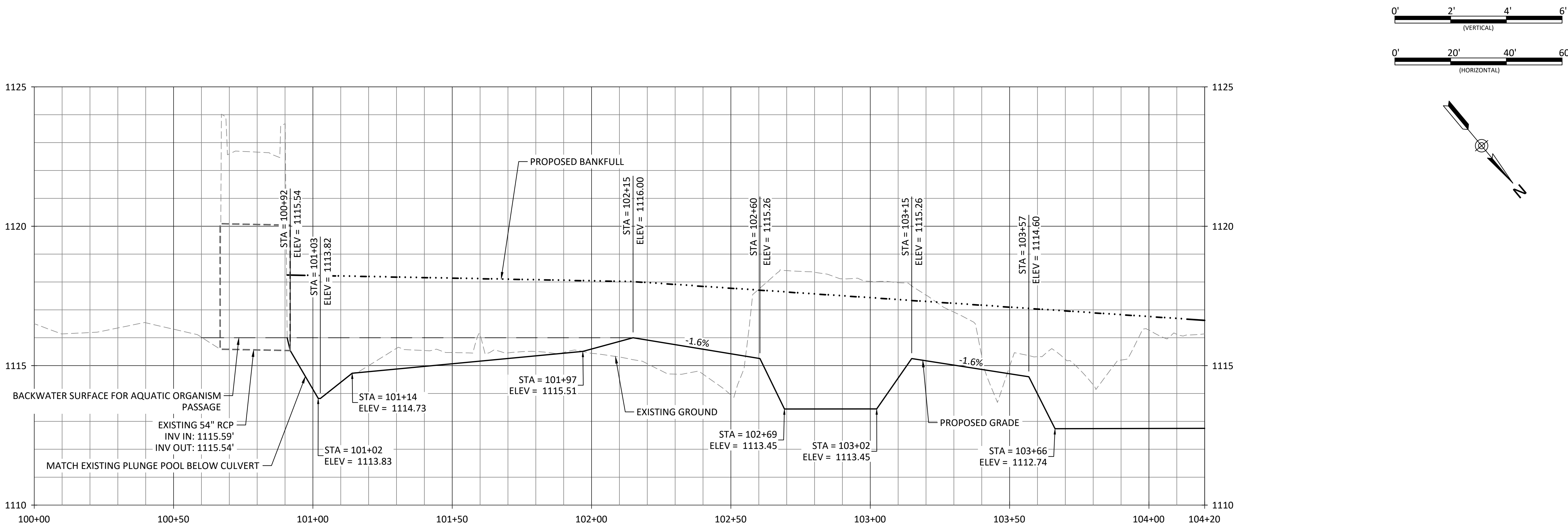

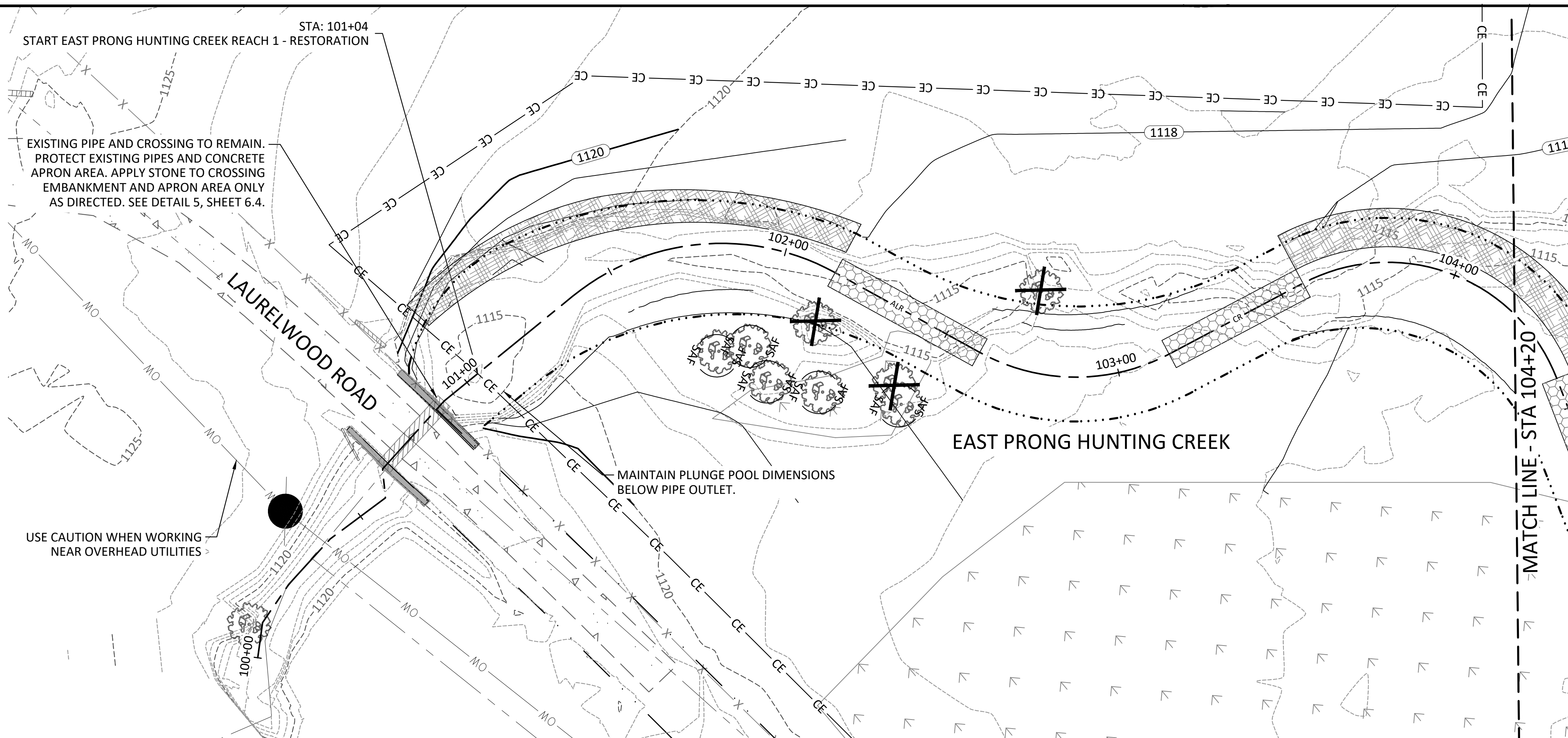

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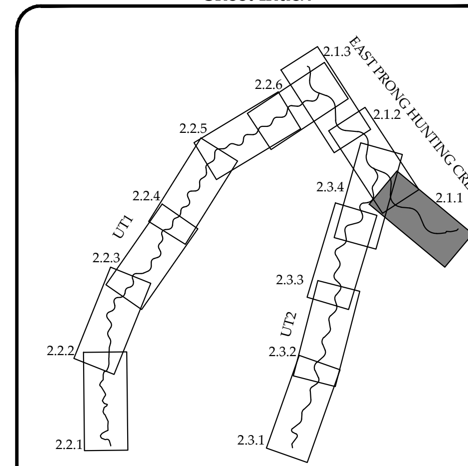

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East Prong Hunting Creek
Stream Plan and Profile

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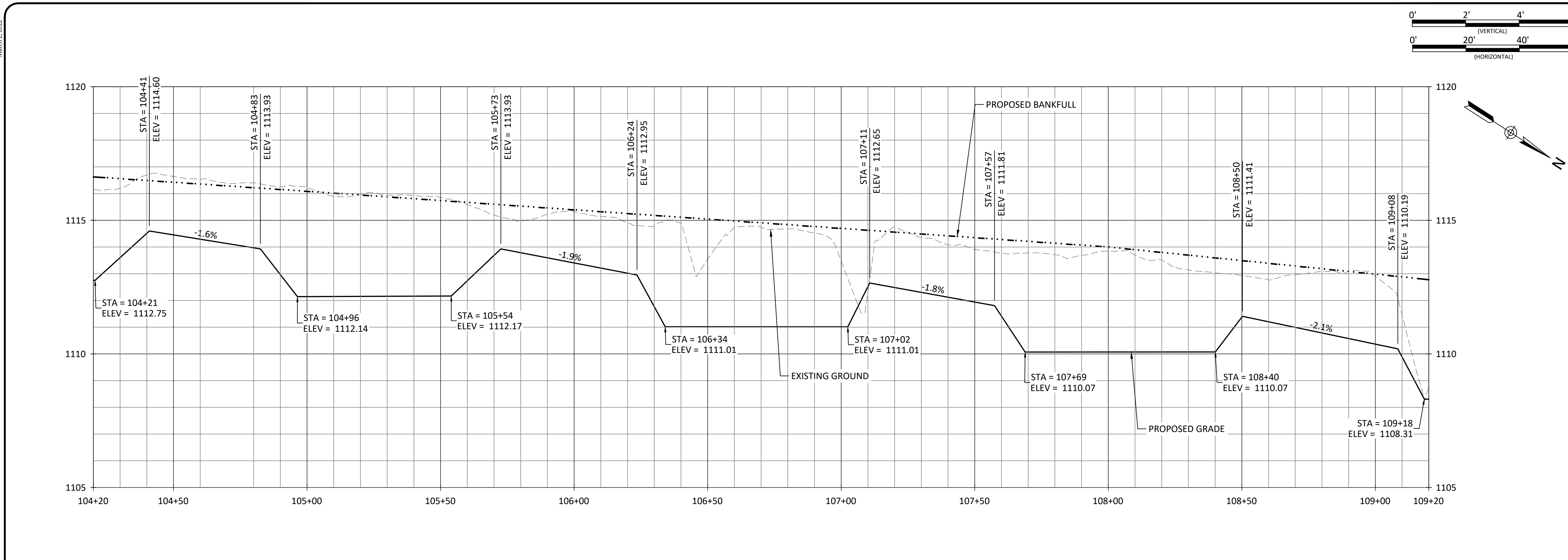

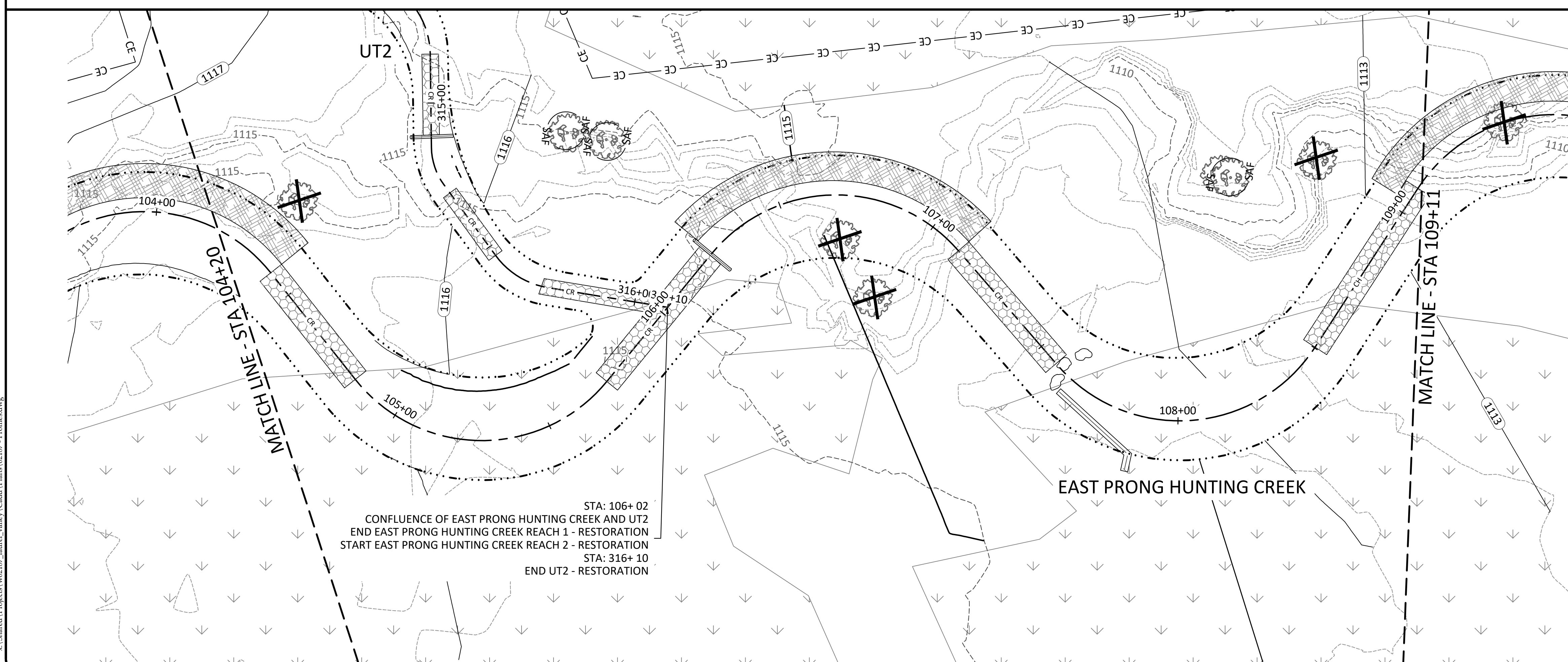

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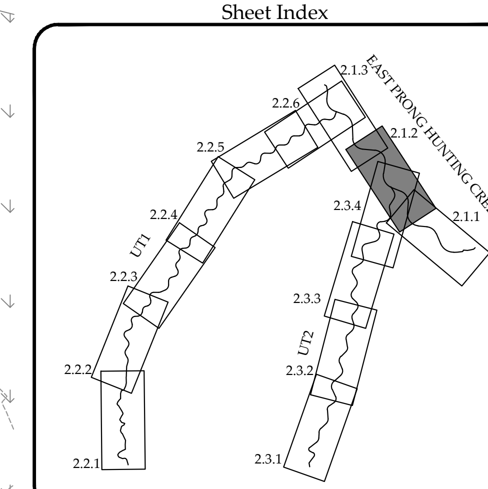

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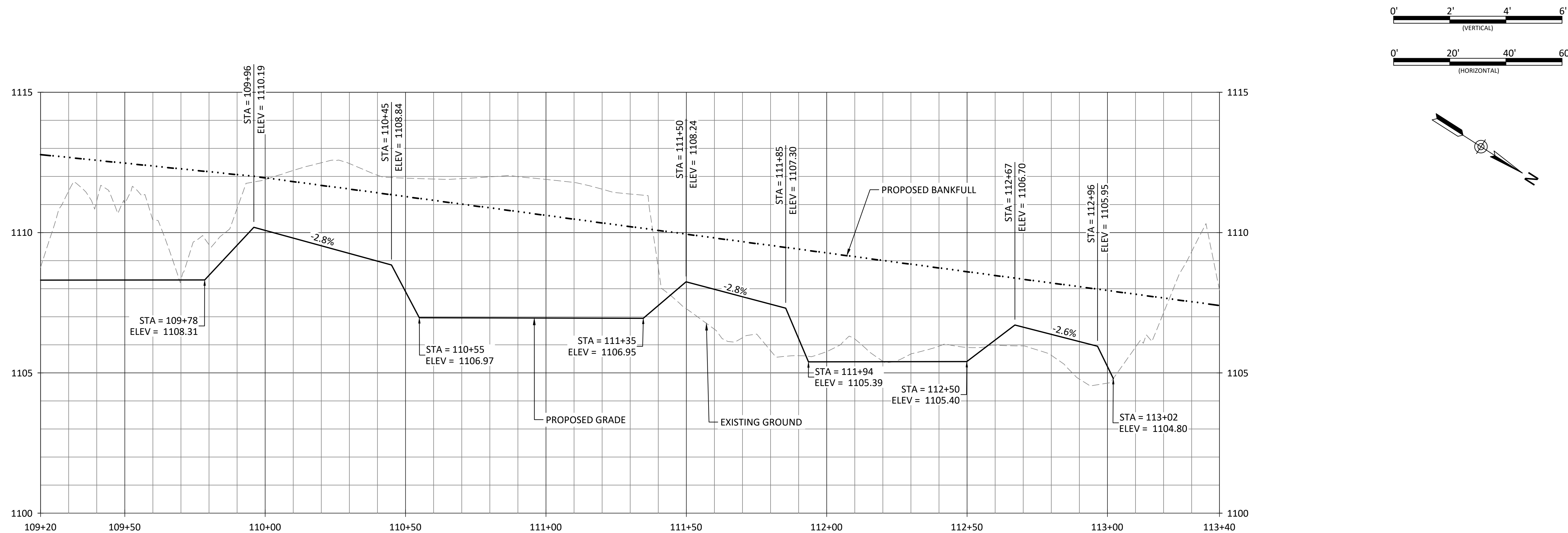

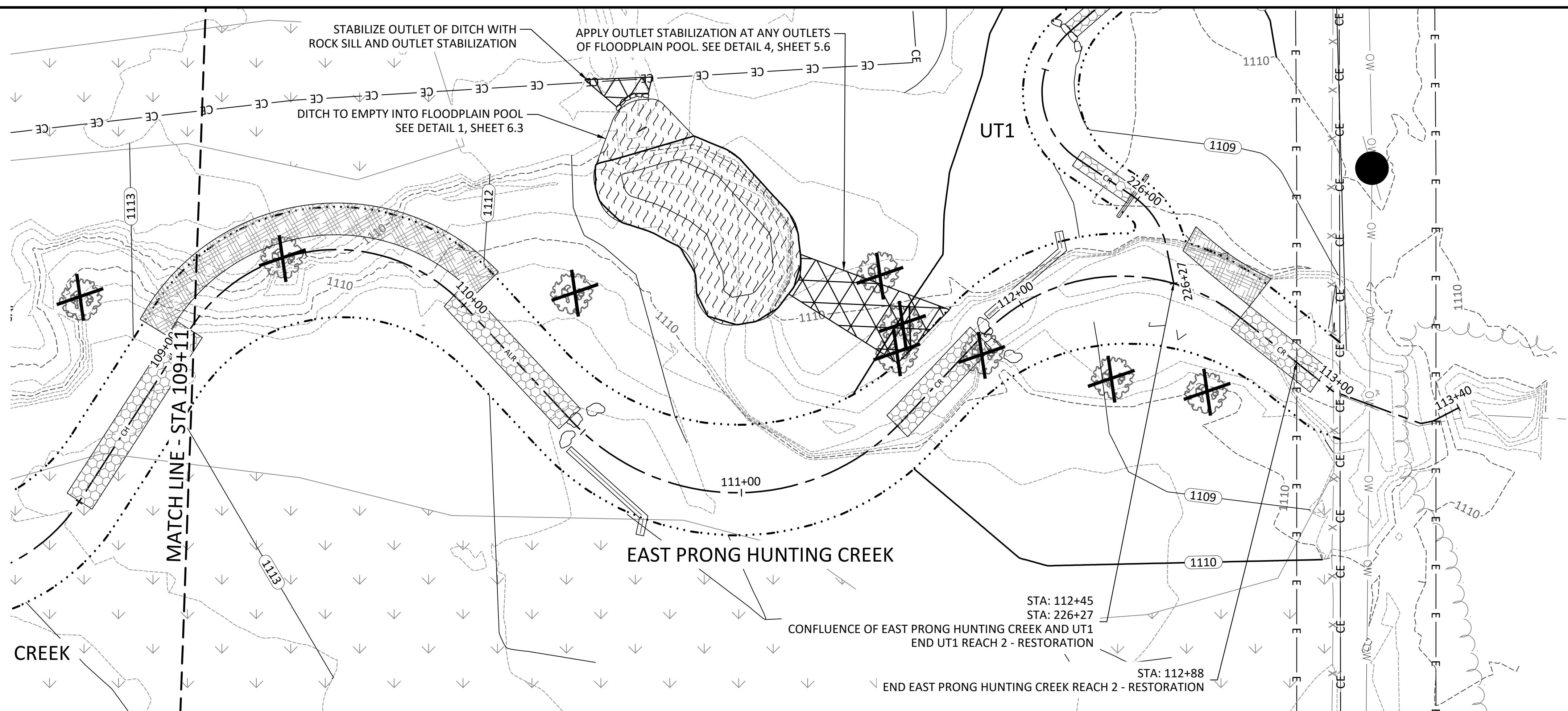

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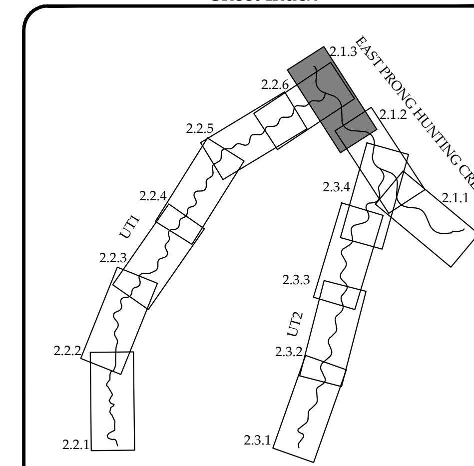

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East Prong Hunting Creek
Stream Plan and Profile

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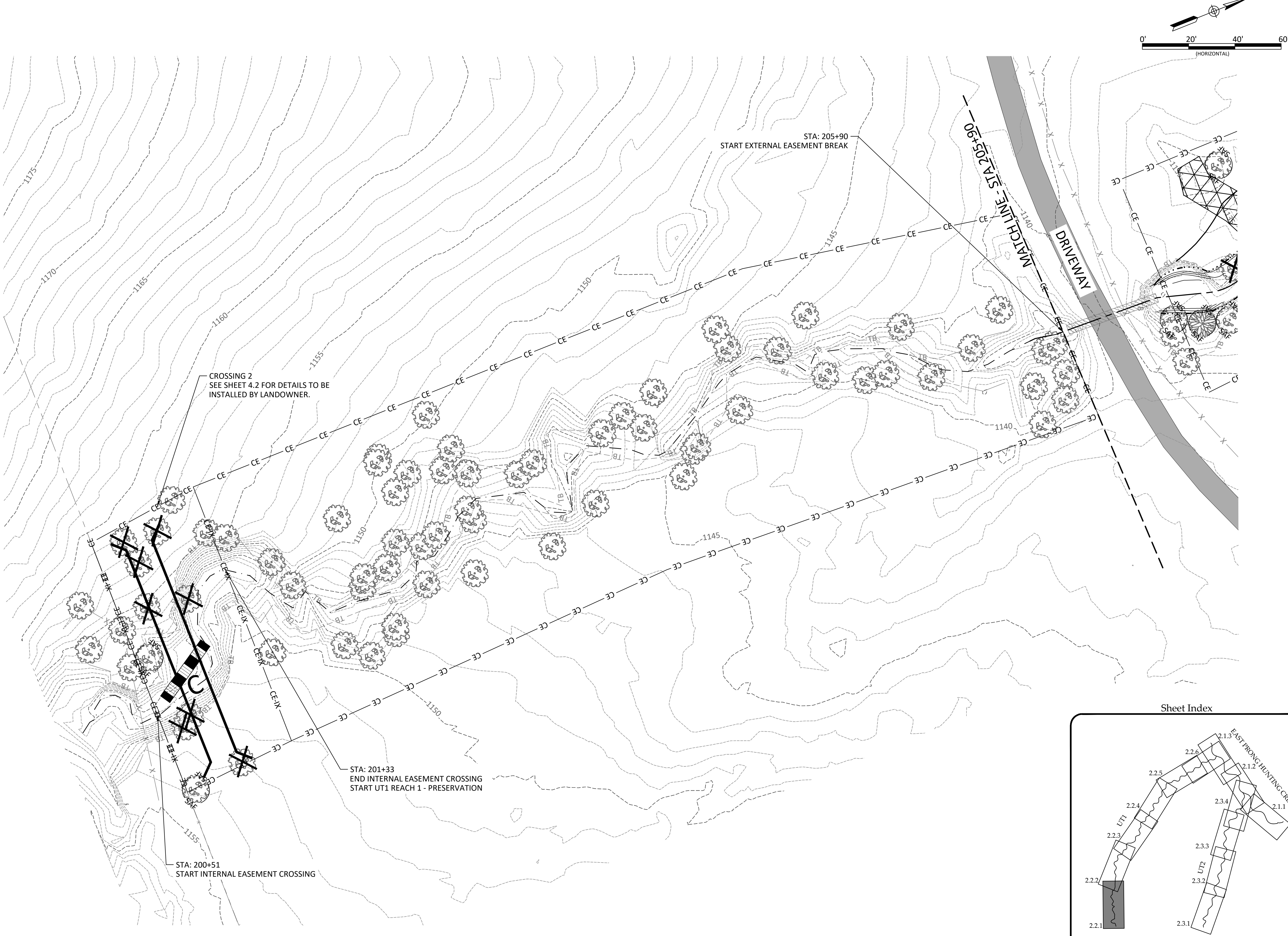

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UT1
Stream Plan and Profile

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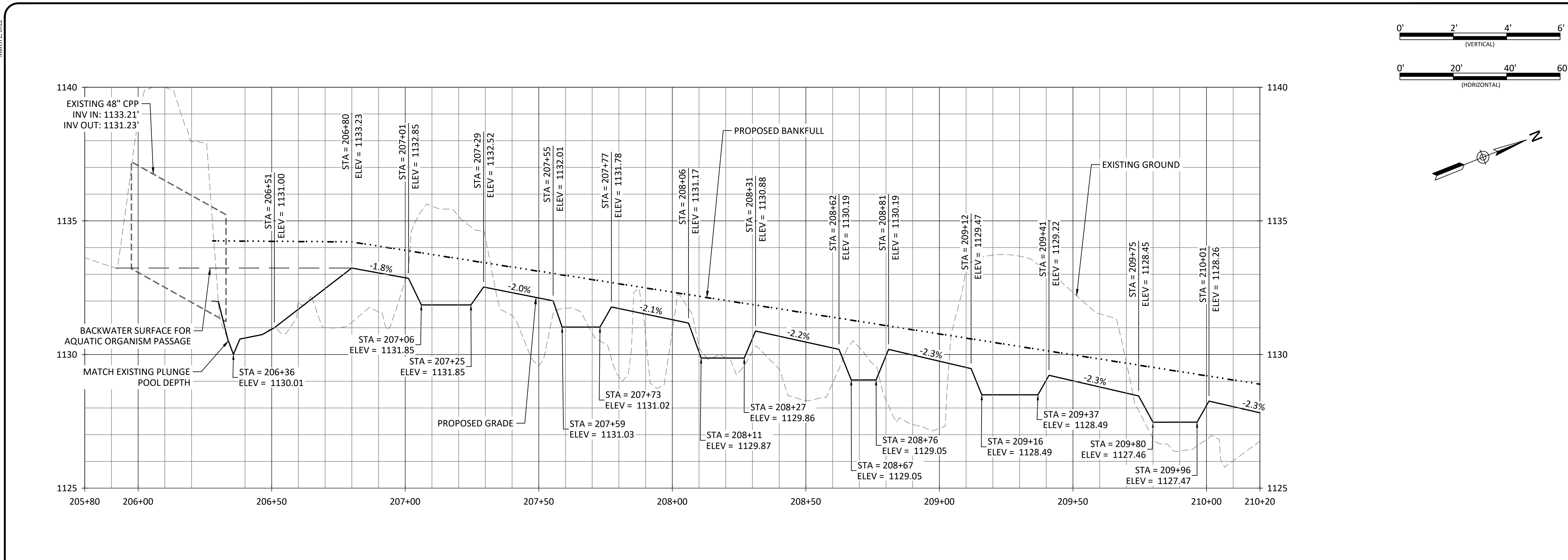

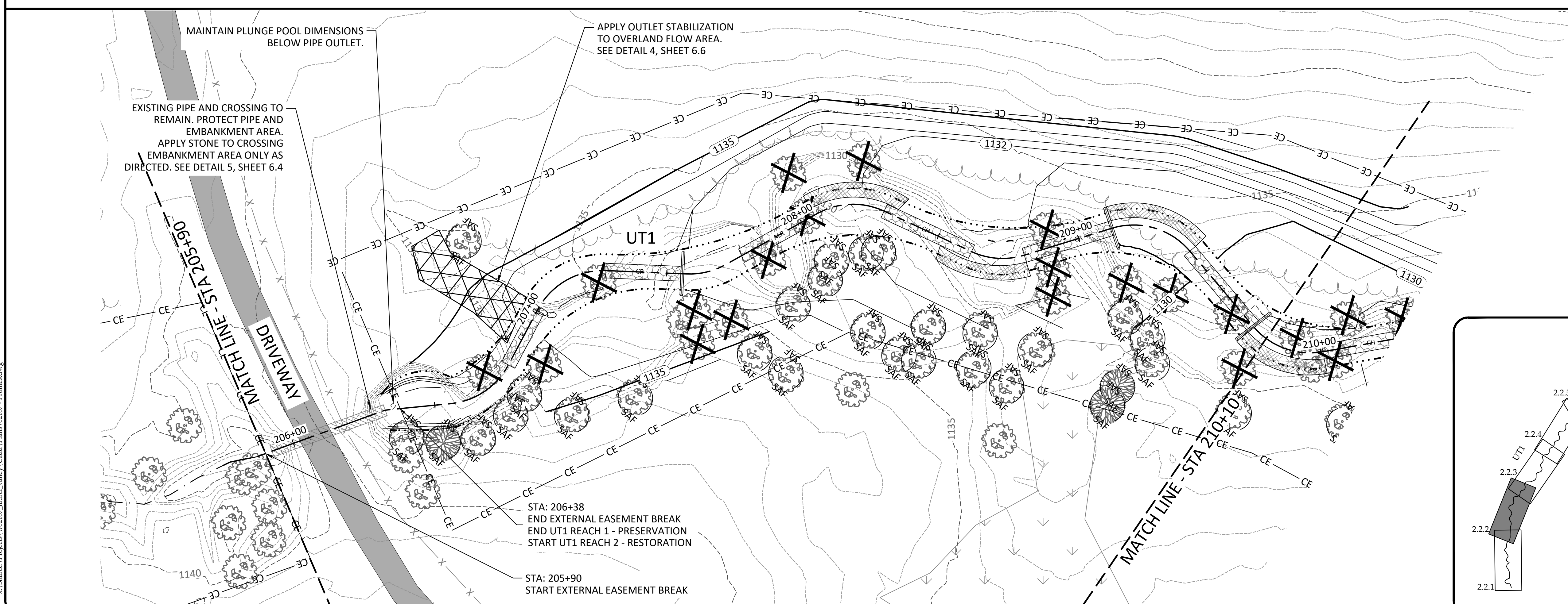

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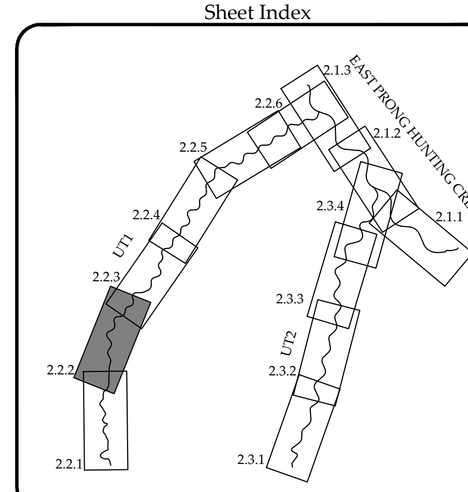

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UT1
Stream Plan and Profile

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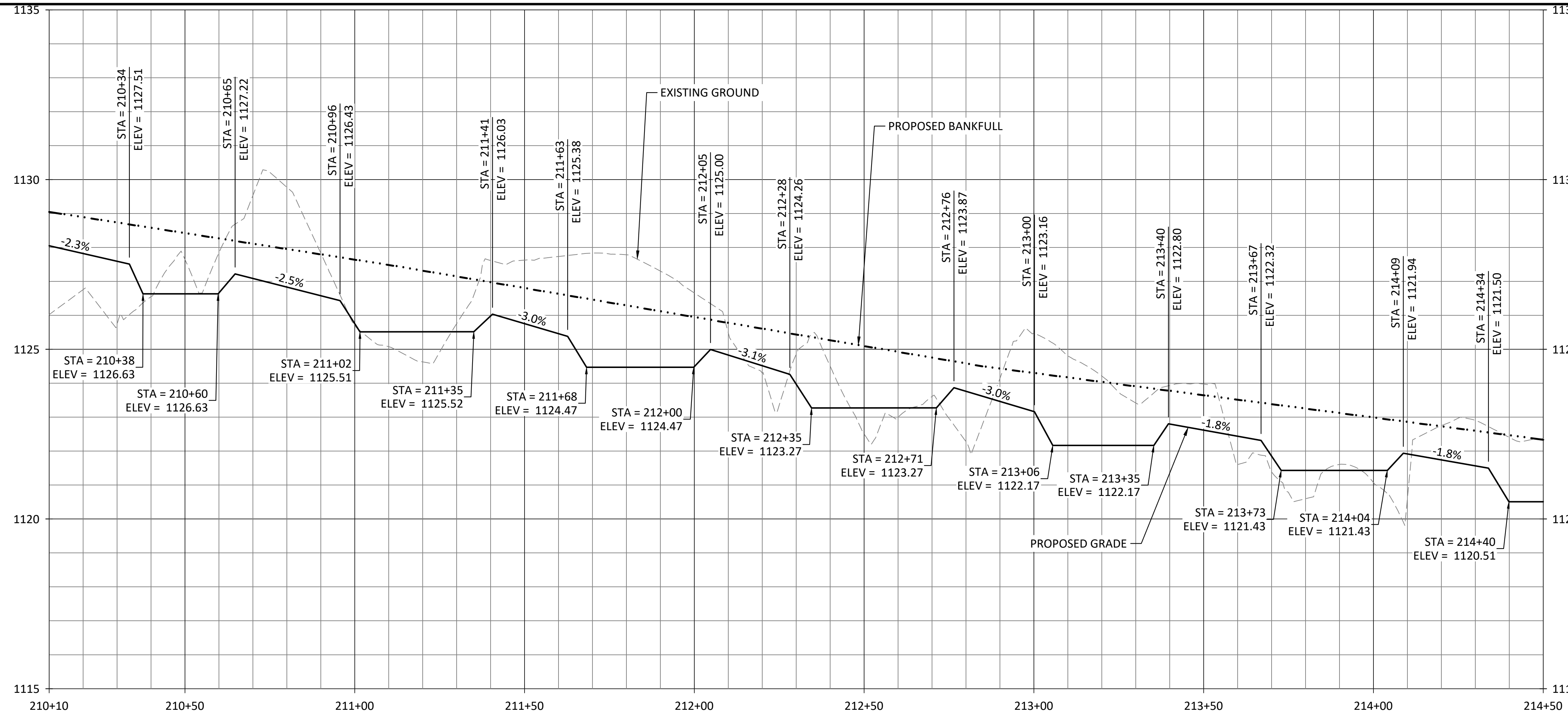
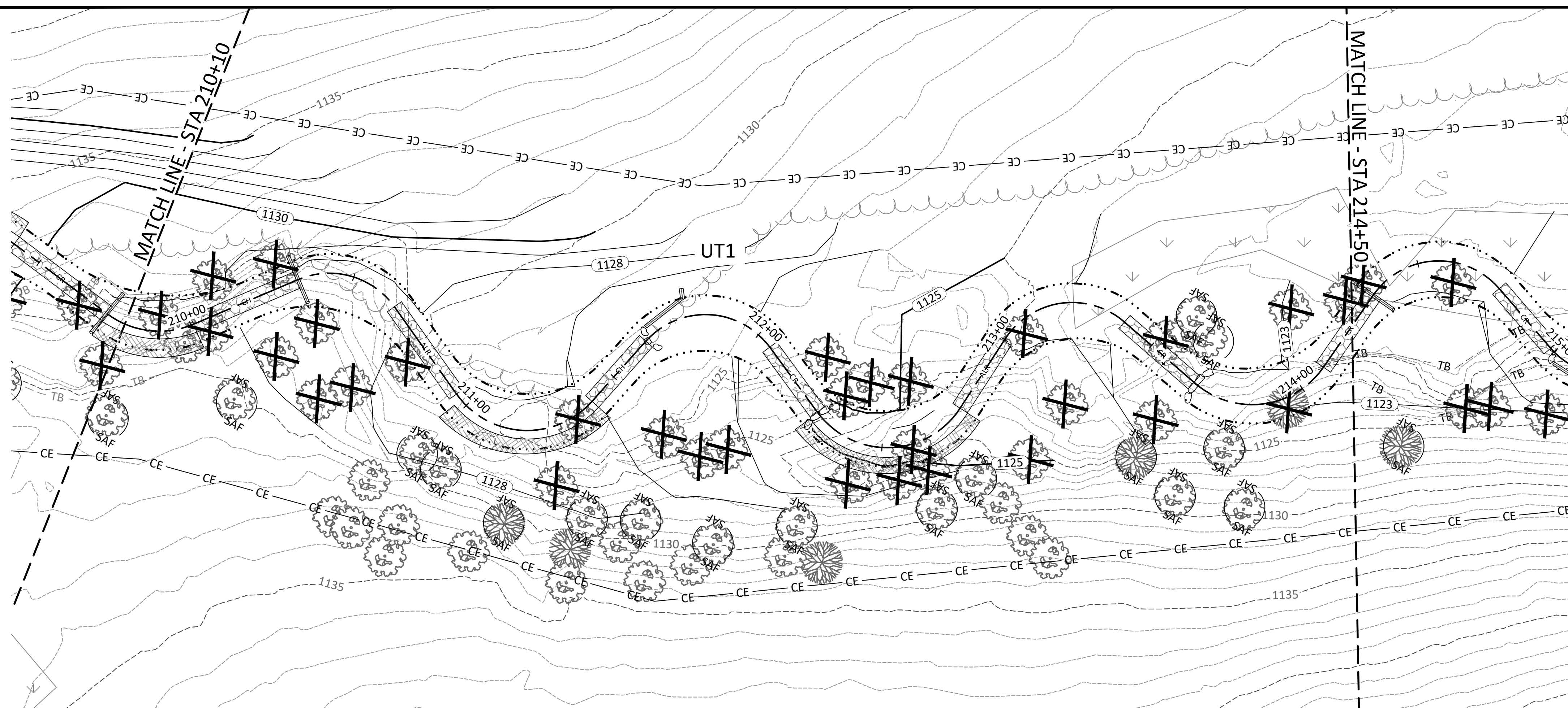


0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)



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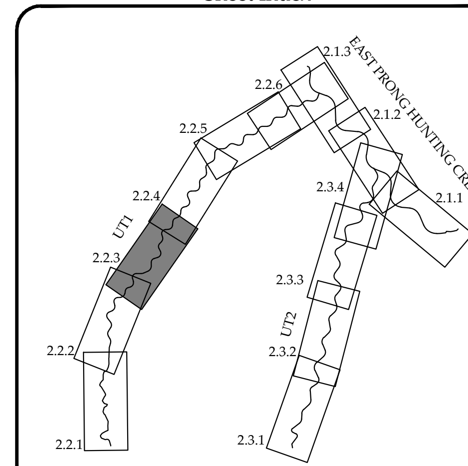

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Burke County, North Carolina

UT1
Stream Plan and Profile

Revisions:

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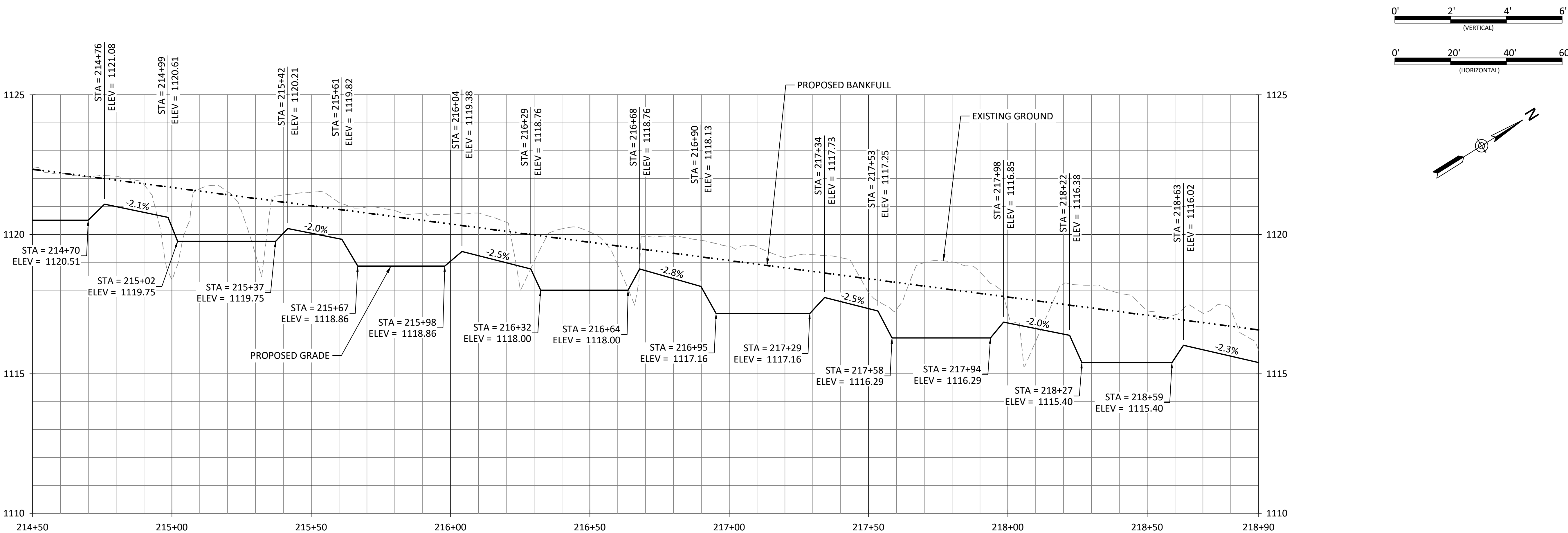

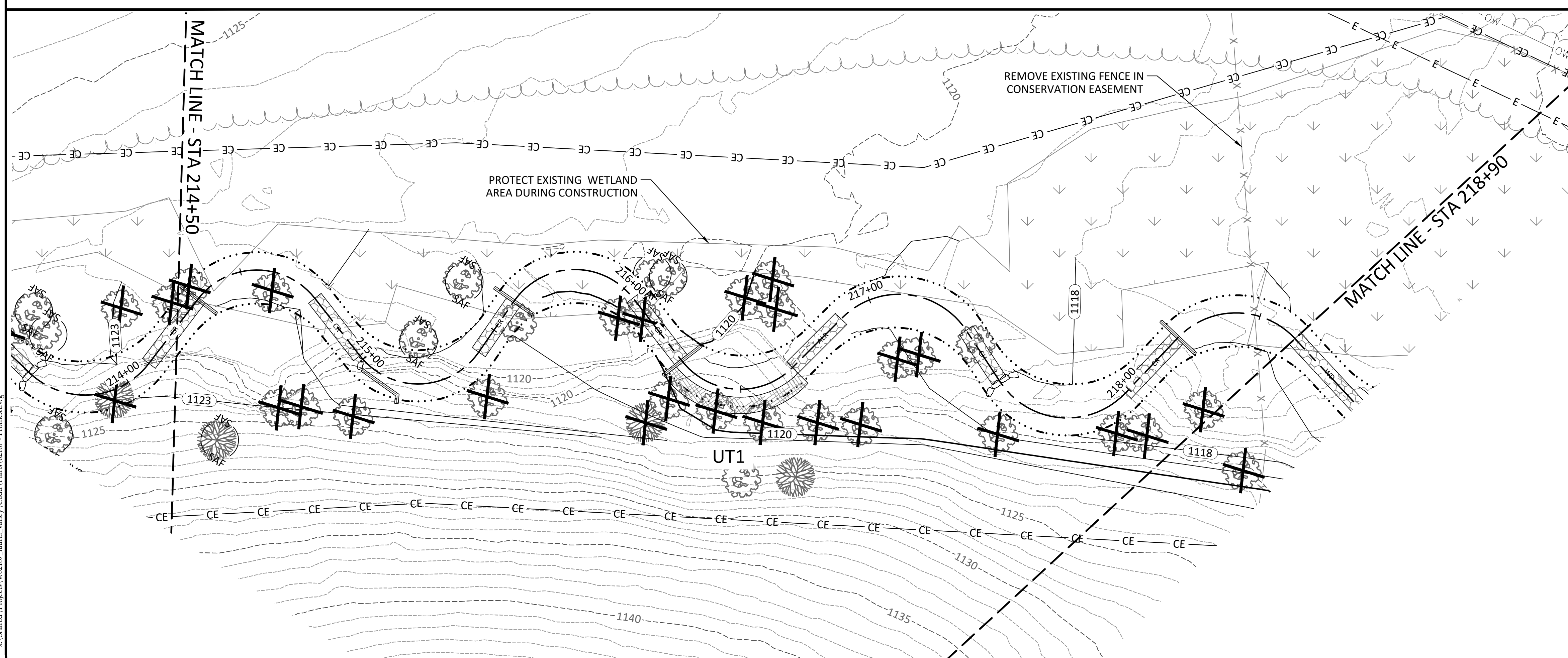

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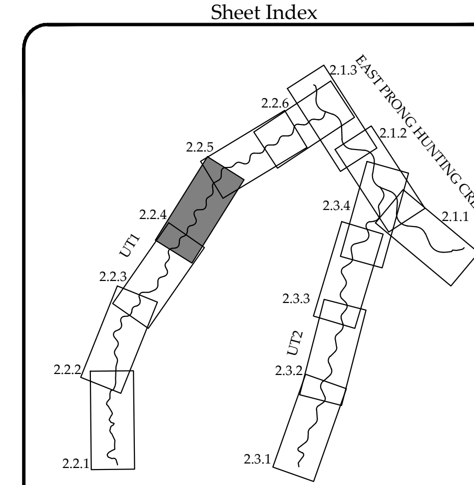

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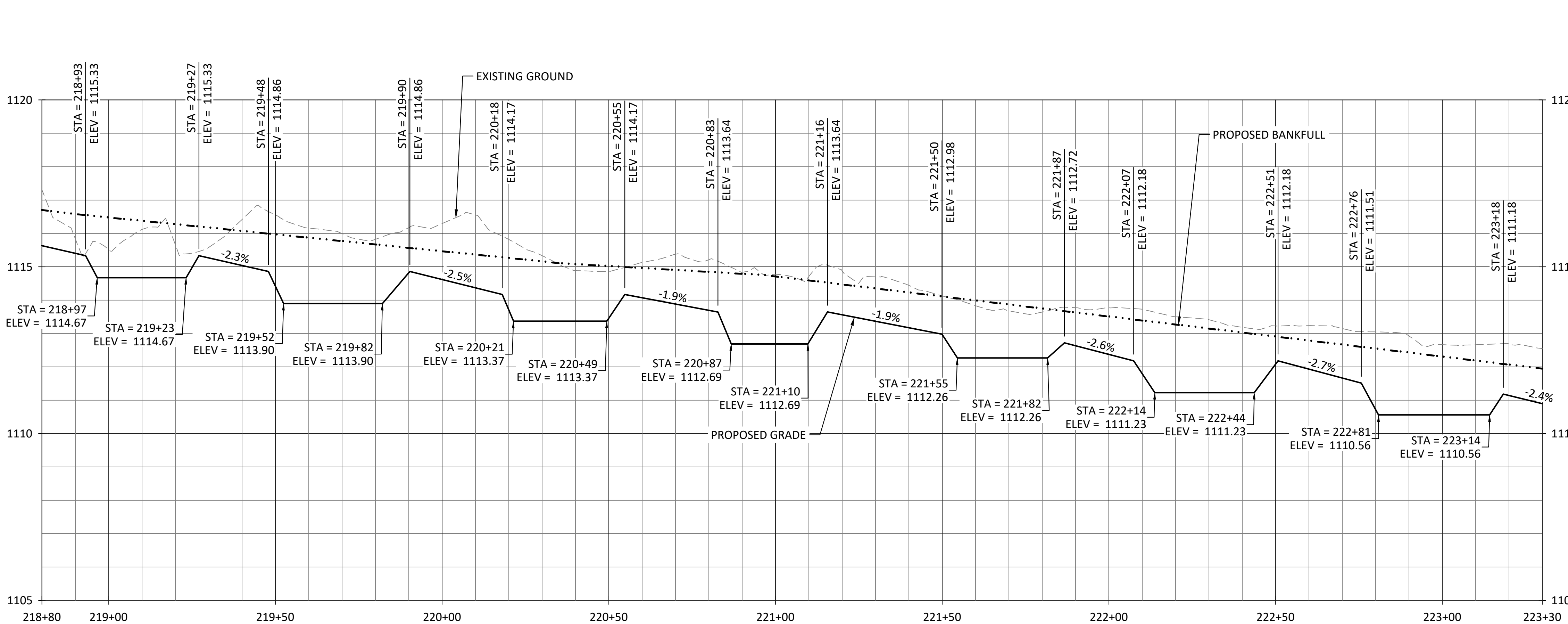

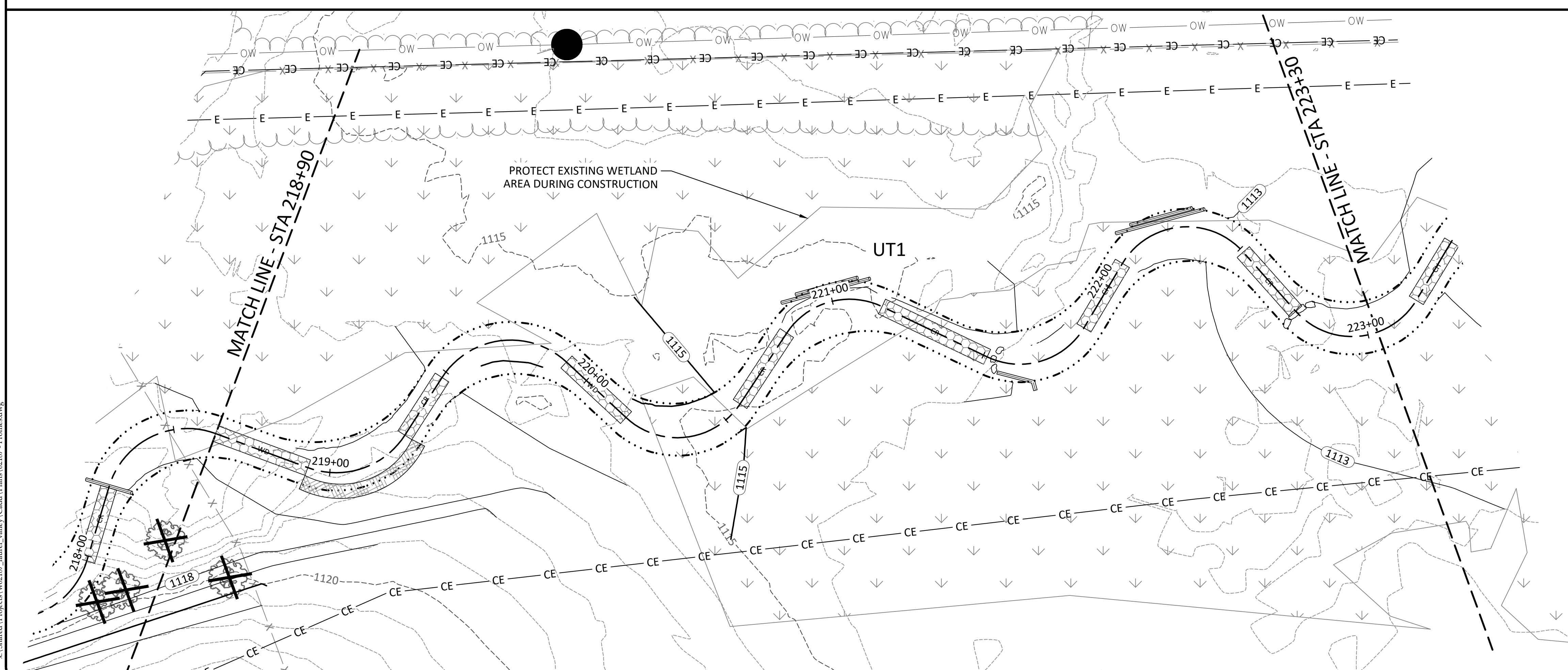

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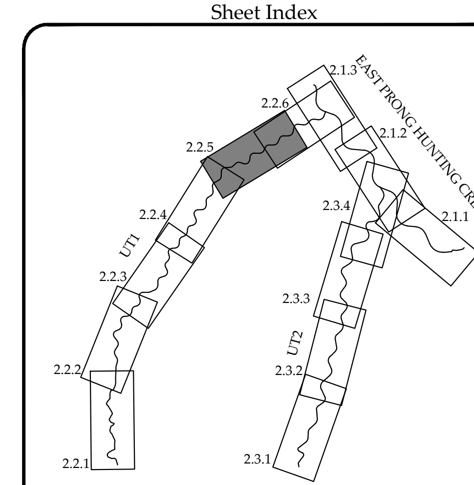

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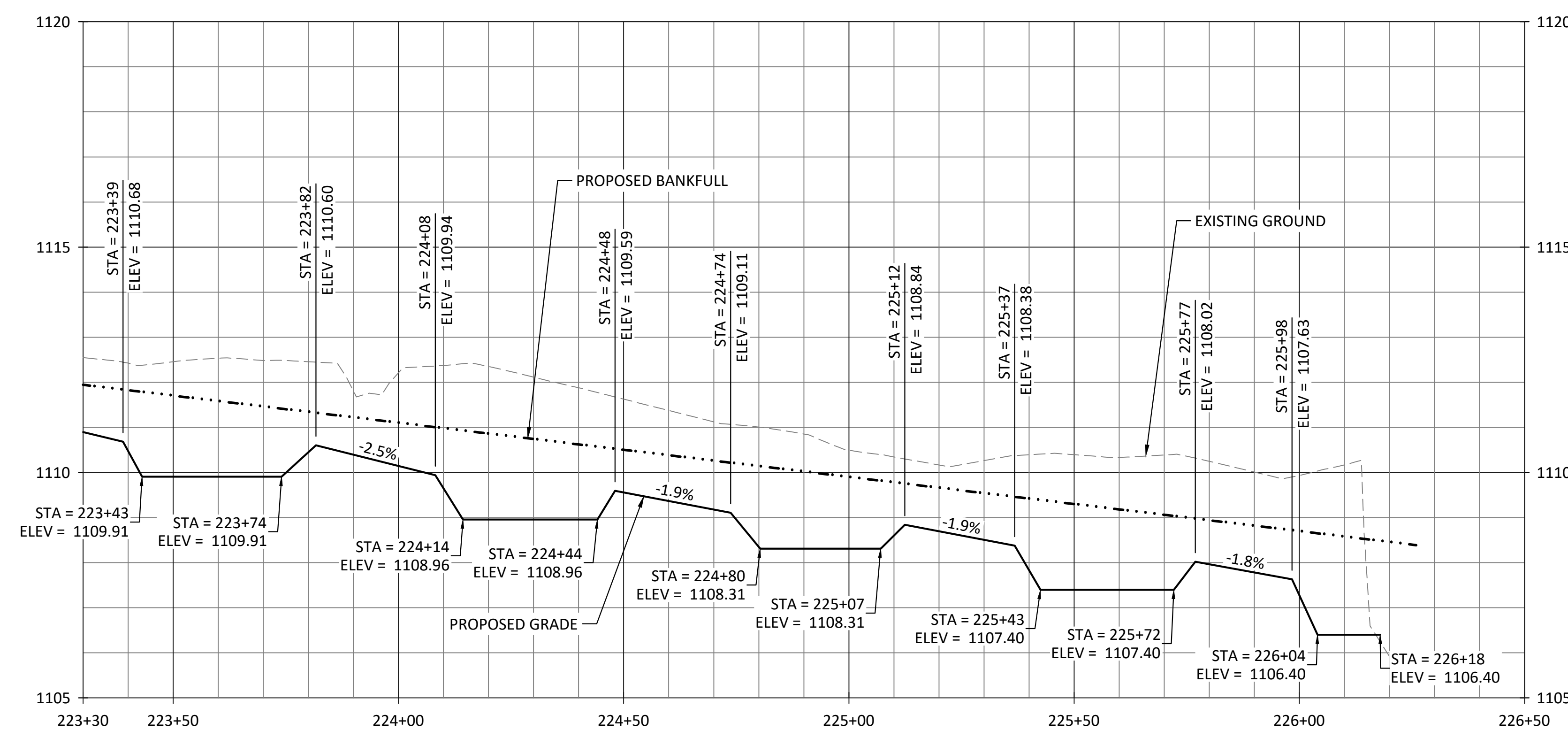

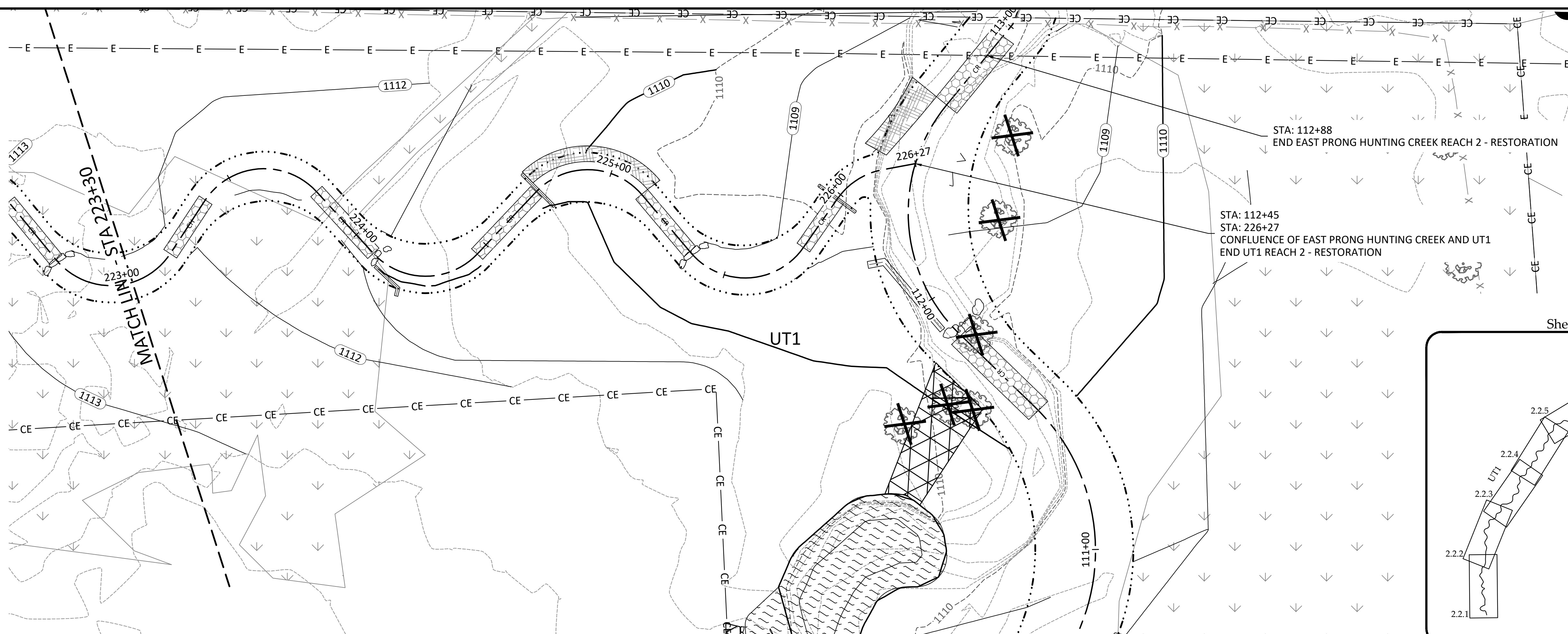

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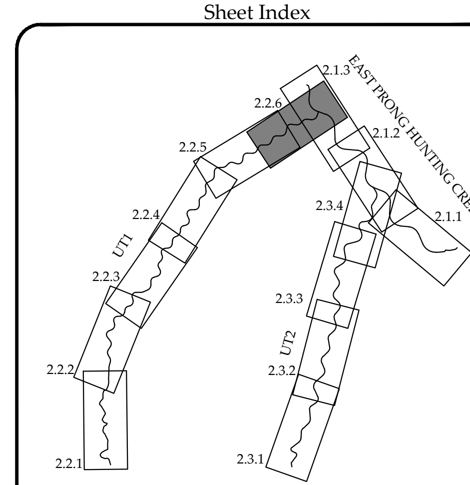

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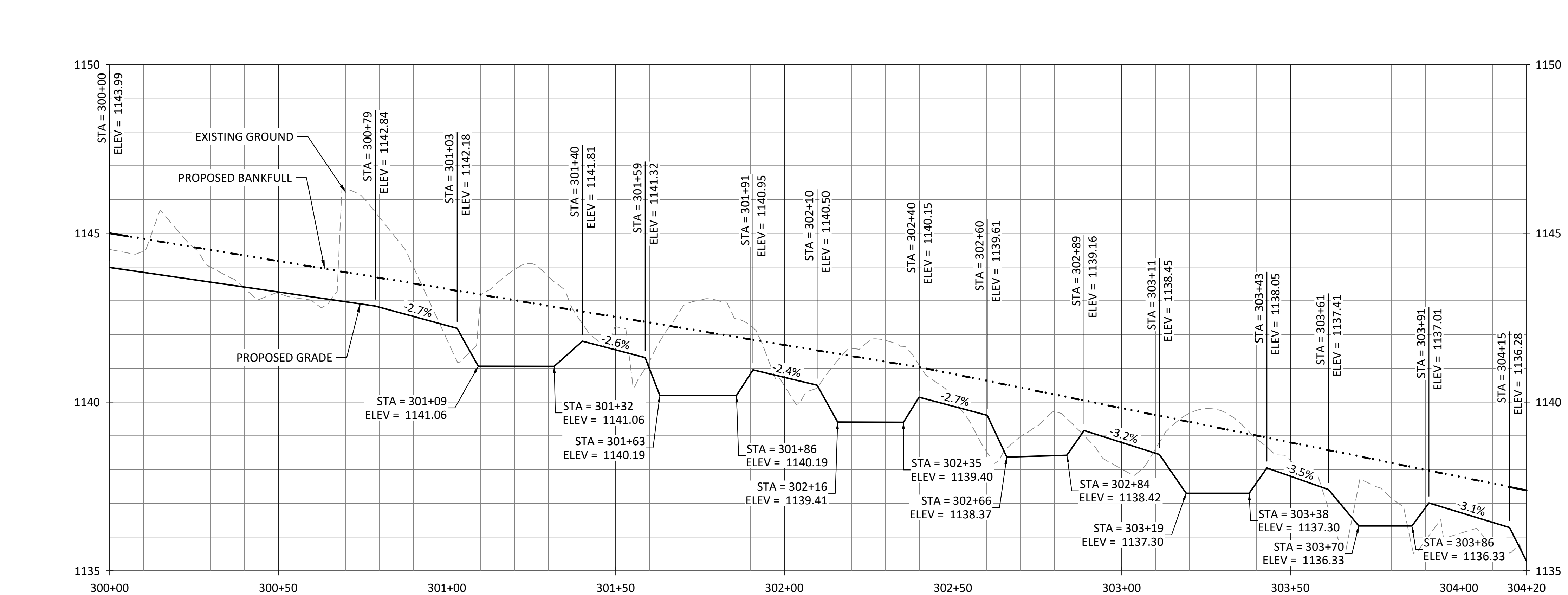

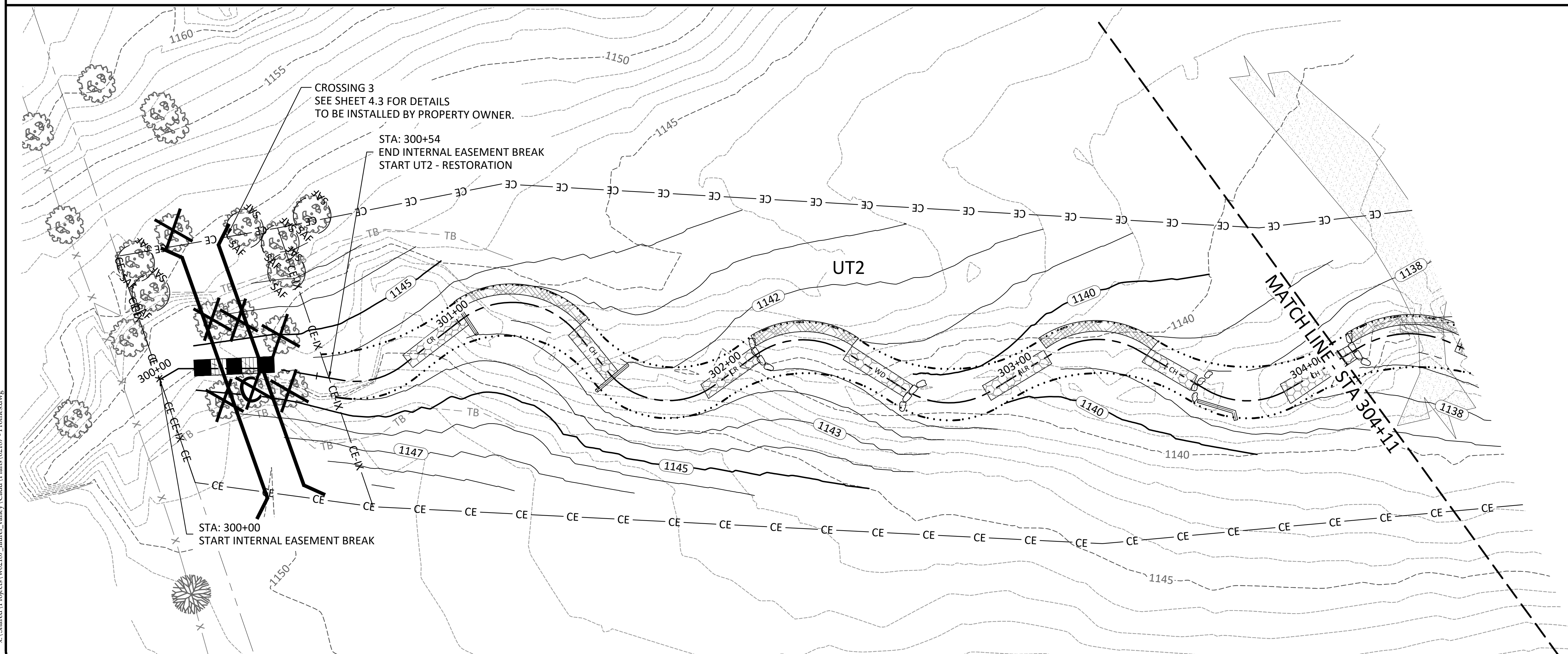

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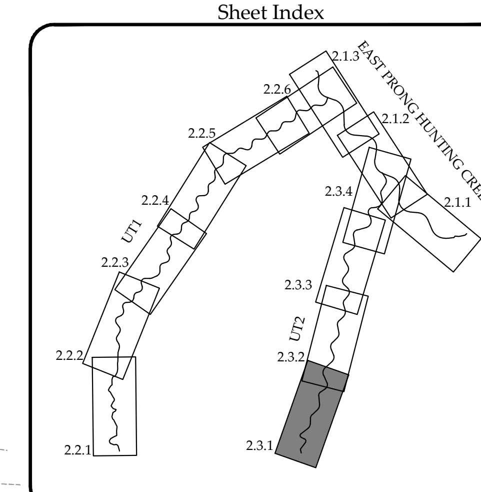

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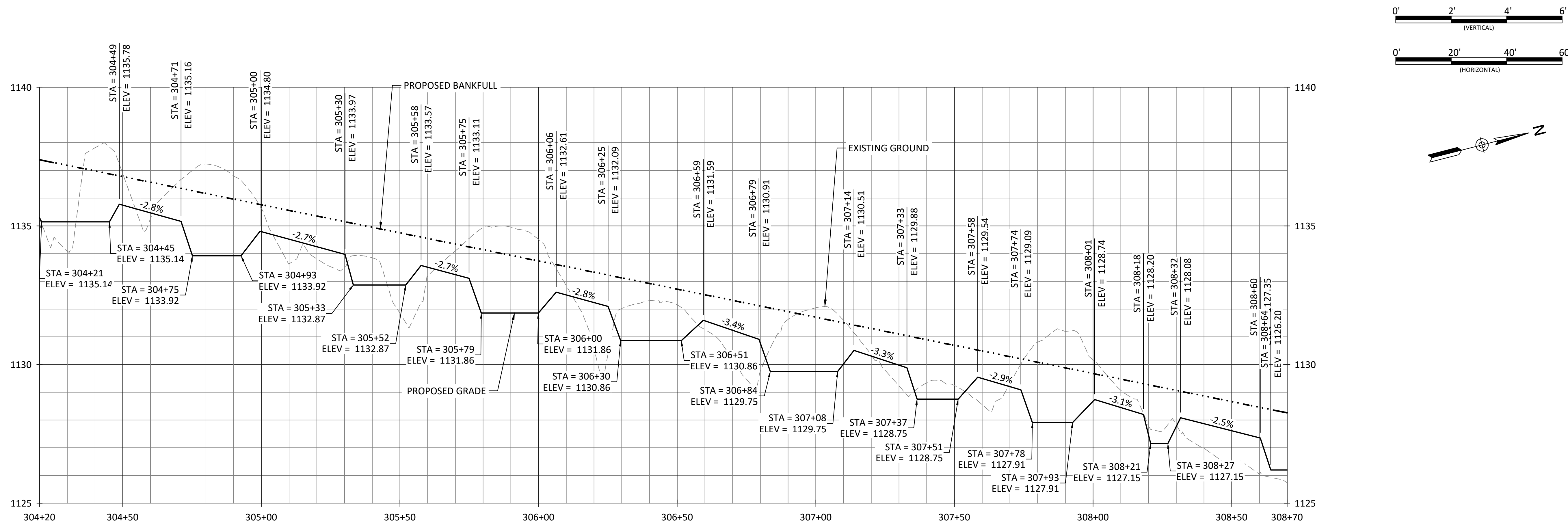

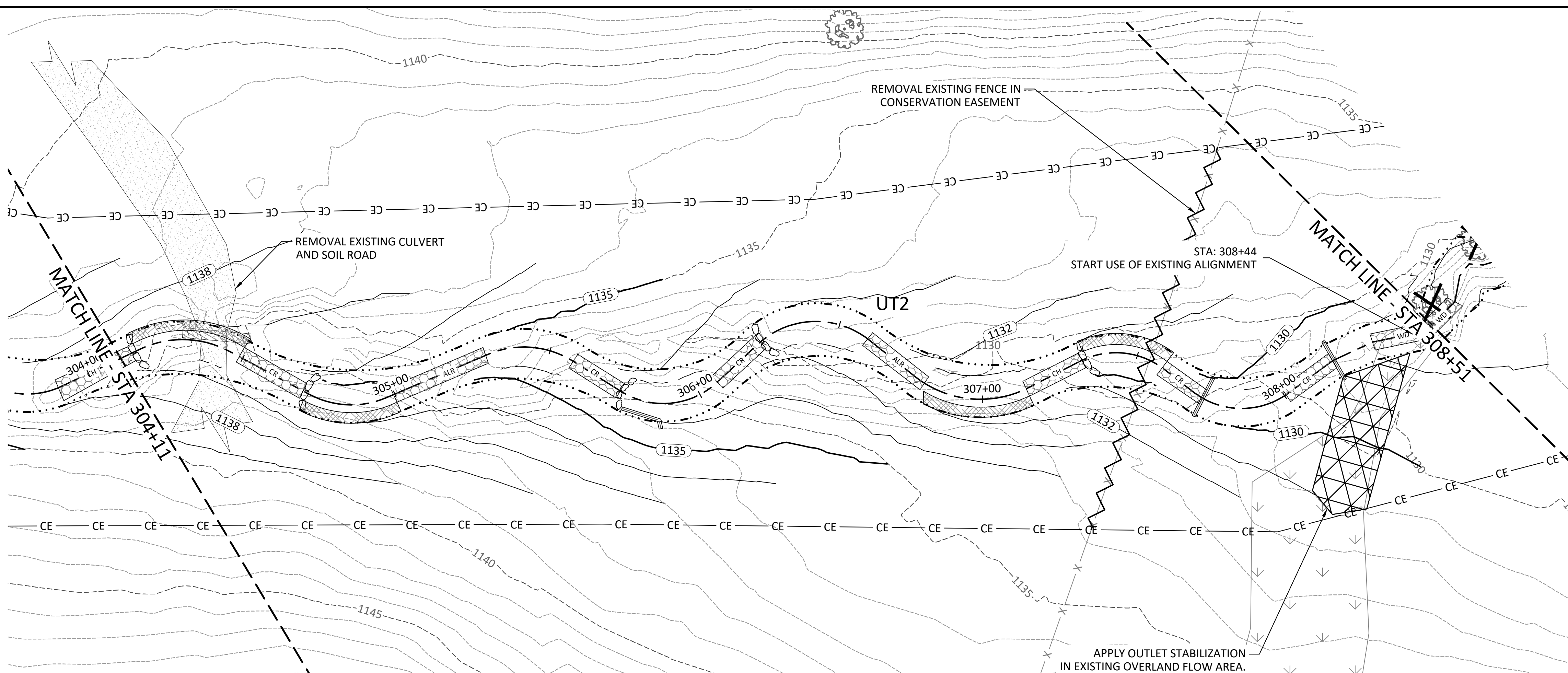

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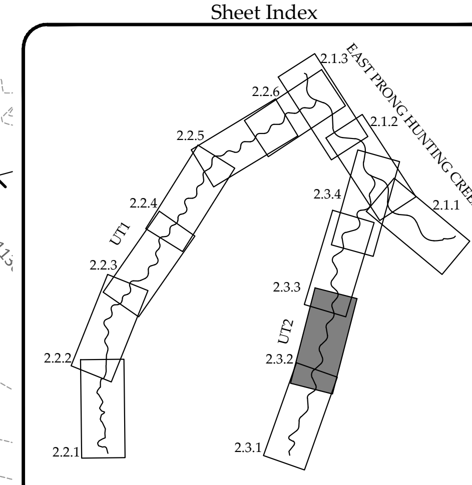

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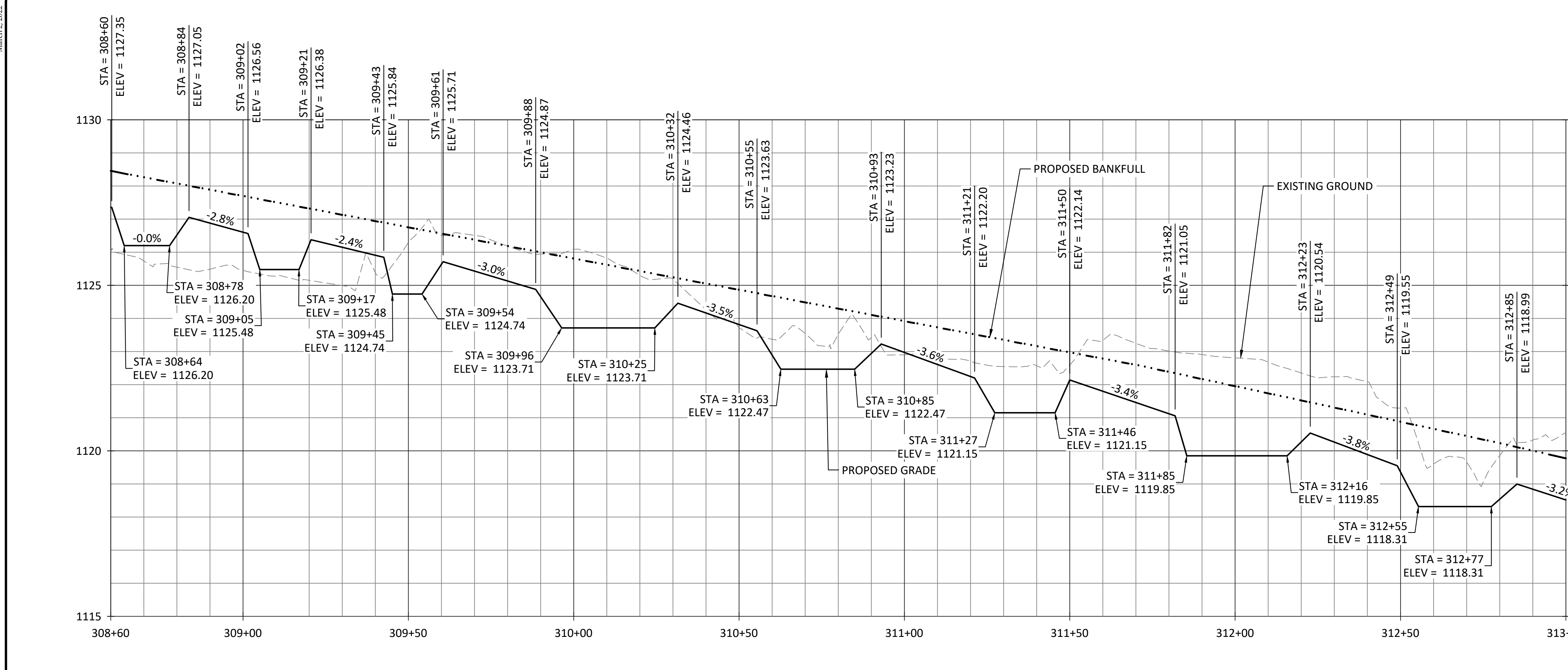

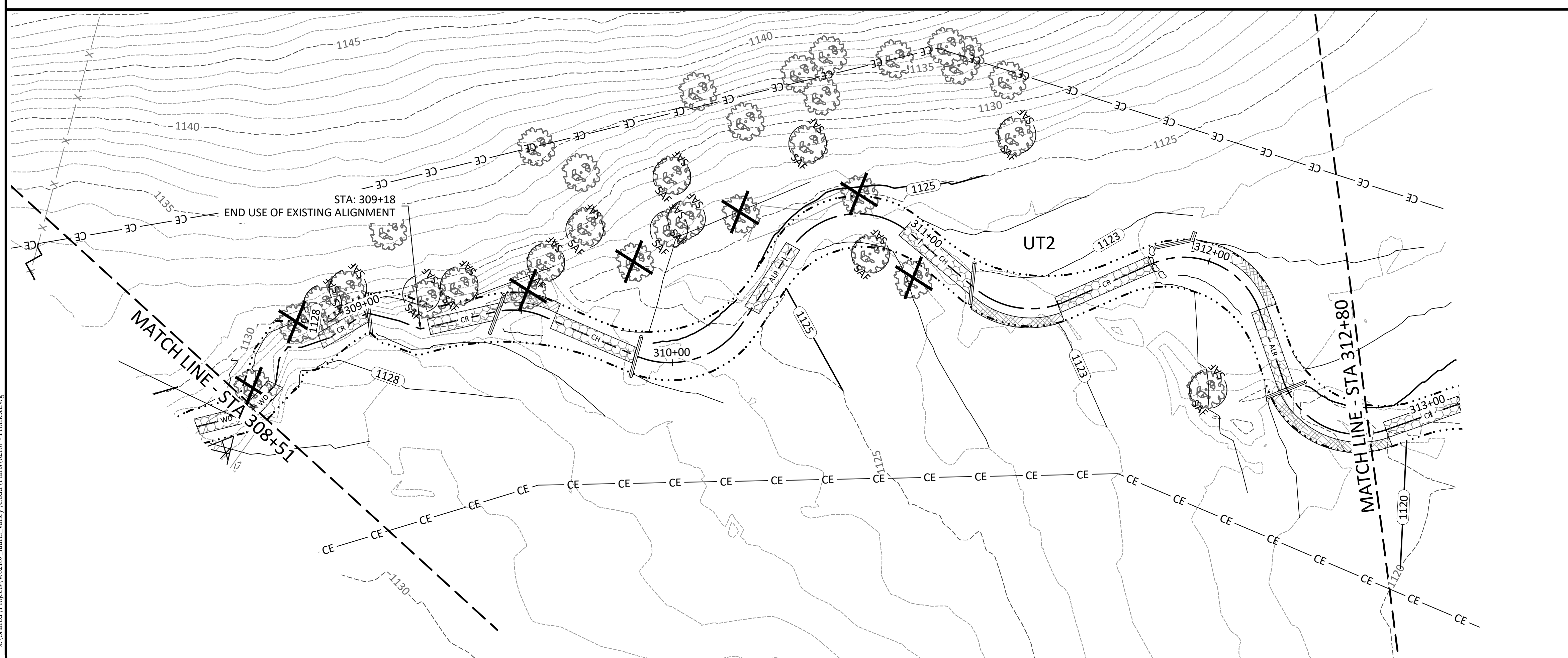

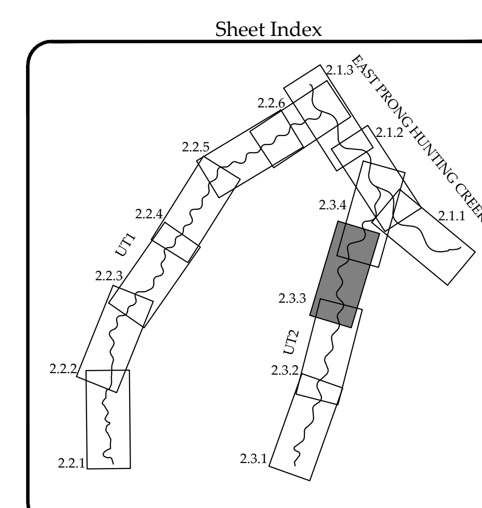

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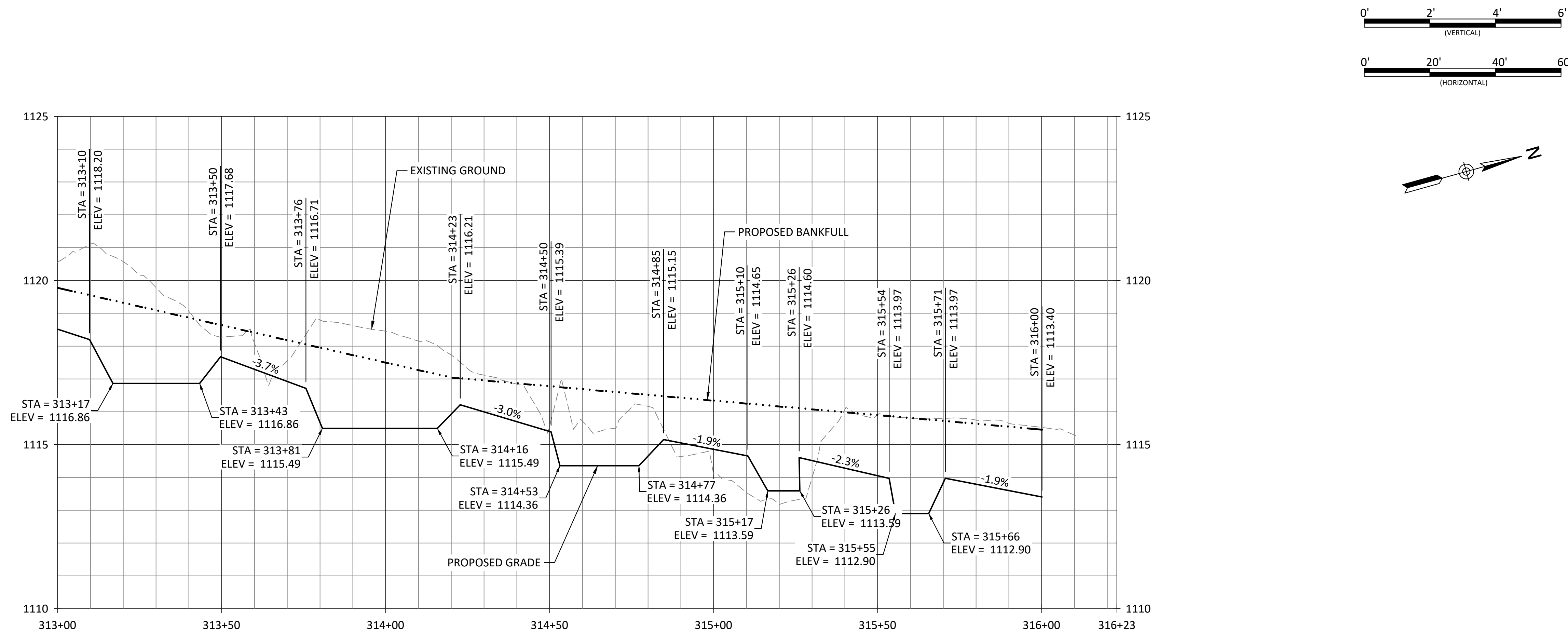

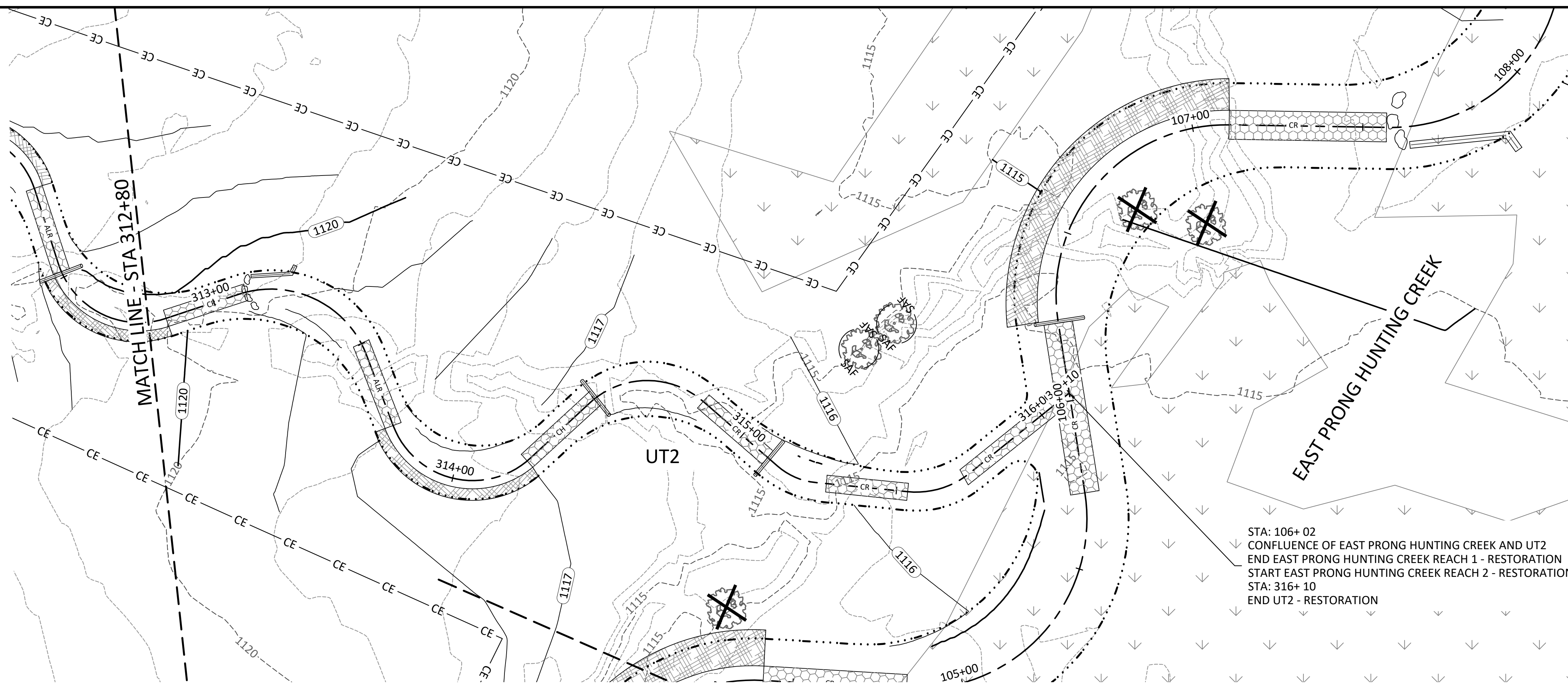

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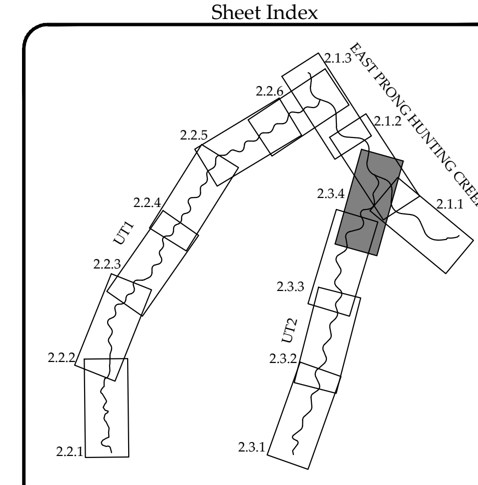

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Open Area Buffer Planting

Open Buffer Planting Zone Trees							
Bare Root							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Wetland Indicator	# of Stems
Acer negundo	Boxelder	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	5%
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	15%
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	5%
Morus rubra	Red Mullberry	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	5%
Oxydendrum arboreum	Sourwood	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	UPL	5%
Fagus grandifolia	American Beech	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
Carya cordiformis	Bitternut Hickory	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
Quercus alba	White Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
Quercus rubra	Northern Red Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
Ulmus rubra	Slippery Elm	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	10%
Magnolia acuminata	Cucumber Tree	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	5%
					Total		**90%**

Open Buffer Planting Zone Small Trees / Shrubs							
Bare Root							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Wetland Indicator	# of Stems
Euonymus americanus	Strawberry Bush	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	2%
Hamamelis virginiana	Witch Hazel	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FACU	2%
Cornus florida	Flowering Dogwood	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FACU	2%
Lindera benzoin	Spicebush	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	2%
Amelanchier arborea	Serviceberry	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	2%
					Total		**10%**

Notes:
(1) Substitute species: American Basswood and Sweetshrub
(2) Transplants from on-site to be used at Designer's discretion for streambank and floodplain planting.
(3) Percentages of each species may be varied at Designer's discretion but shall not exceed 20% per each species.
(4) Designer may substitute container plantings or other plantings for bare roots.

Partially Vegetated Buffer Area Planting

Partially Vegetated Buffer Planting Zone Trees							
Bare Root							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Wetland Indicator	# of Stems
Carpinus caroliniana	American Hornbeam	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FAC	10%
Euonymus americana	Strawberry Bush	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	10%
Lindera benzoin	Spicebush	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FAC	10%
Fagus grandifolia	American Beech	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
Ulmus rubra	Slippery Elm	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	10%
Hamamelis virginiana	Witchhazel	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FACU	10%
Calycanthus floridus	Sweetshrub	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FACU	10%
Cornus florida	Flowering Dogwood	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FACU	10%
Asimina triloba	Pawpaw	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FAC	10%
Quercus rubra	Northern Red Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	5%
Ilex opaca	American Holly	12 ft	6-12 ft.	0.25"-1.0"	Sub-Canopy	FACU	5%
					Total		**100%**

Wetland Planting

Wetland Planting Zone Trees							
Bare Root							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Wetland Indicator	# of Stems
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	15%
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	5%
Salix nigra	Black Willow	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	18%
Ulmus americana	American Elm	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	17%
Acer negundo	Boxelder	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	5%
Celtis laevigata	Sugarberry	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	15%
					Total		**75%**

Wetland Planting Zone Small Trees/Shrubs							
Bare Root							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Wetland Indicator	# of Stems
Alnus serrulata	Tag Alder	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	OBL	5%
Lindera benzoin	Spicebush	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	5%
Cephalanthus occidentalis	Buttonbush	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	OBL	5%
Sambucus canadensis	Elderberry	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	5%
Salix sericea	Silky Willow	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	OBL	5%
					Total		**25%**

Notes:
(1) Substitute species: Silky Dogwood and Carolina Silverbell
(2) Transplants from on-site to be used at Designer's discretion for streambank and floodplain planting.
(3) Percentages of each species may be varied at Designer's discretion but shall not exceed 20% per each species.
(4) Designer may substitute container plantings or other plantings for bare roots.
(5) Use the Wetland Planting Zone Small Tree/Shrubs to plant the Utility Easement

Utility Easement Planting

Notes:
(1) Use the Wetland Planting Zones Small Tree/Shrubs to plant the Utility Easement

Temporary Seeding

TEMPORARY SEEDING		
APPROVED DATE	TYPE	PLANTING RATE (lbs/acre)
Jan 1 – May 1	Rye Grain (Secale Cereale)	120
	Ladino Clover (Trifolium Repens)	5
	Crimson Clover (Trifolium incarnatum)	5
	Straw Mulch	4,000
May 1 – Aug 15	German Millet (*Setaria italica*)	40
	Ladino Clover (Trifolium Repens)	5
	Crimson Clover (Trifolium incarnatum)	5
	Straw Mulch	4,000
Aug 15 – Dec 31	Rye Grain (*Secale Cereale*)	120
	Ladino Clover (Trifolium Repens)	5
	Crimson Clover (Trifolium incarnatum)	5
	Straw Mulch	4,000

Note:
Rates of fertilizer and lime if necessary can be found in the site preparation plan included in the specification documents.

Riparian Corridor Planting (Streambanks)

Streambank Planting Zone							
Live Stakes							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Size	Stratum	Wetland Indicator	% of Stems
Salix nigra	Black Willow	8 ft.	6-8 ft.	0.5"-1.5" cal.	Shrub	OBL	50%
Cornus amomum	Silky Dogwood	8 ft.	6-8 ft.	0.5"-1.5" cal.	Shrub	FACW	10%
Salix sericea	Silky Willow	8 ft.	6-8 ft.	0.5"-1.5" cal.	Shrub	OBL	20%
Cephalanthus occidentalis	Buttonbush	8 ft.	6-8 ft.	0.5"-1.5" cal.	Shrub	OBL	10%
Sambucus canadensis	Elderberry	8 ft.	6-8 ft.	0.5"-1.5" cal.	Shrub	FAC	10%
					Total		**100%**
Herbaceous Plugs							
Juncus effusus	Common Rush	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	FACW	40%
Carex crinita	Fringed Sedge	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	OBL	10%
Carex lurida	Lurid Sedge	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	OBL	20%
Carex lupulina	Hop Sedge	5 ft.	3-5 ft.	1.0"-2.0" plug	Herb	OBL	15%
Scirpus cyperinus	Woolgrass	5 ft	3-5 ft.	1.0"-2.0" plug	Herb	FACW	15%
					Total		**100%**

Note:
See live staking and herbaceous plugs detail.

Permanent Seeding

Riparian Seeding - Open Canopy					
Pure Live Seed (20 lbs/ acre)					
Approved Date	Species Name	Common Name	Stratum	Wetland Indicator	Density (lbs/acre)
All Year	*Schizachyrium scoparium*	Little Bluestem	Herb	FACU	3.0
All Year	*Panicum virgatum*	Switchgrass	Herb	FAC	2.0
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	FACW	1.0
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	FACU	1.0
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	FACU	1.0
All Year	*Panicum clandestinum*	Deertongue	Herb	FAC	2.0
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	FACW	3.0
All Year	*Sorghastrum nutans*	Indiangrass	Herb	FACU	3.0
All Year	*Bidens aristosa*	Bur-Marigold	Herb	FACW	1.0
All Year	*Helianthus angustifolia*	Narrowleaf Sunflower	Herb	FACW	1.0
All Year	*Coreopsis tinctoria*	Plains Corepsis	Herb	FAC	1.0
All Year	Achillea millefolium	Common Yarrow	Herb	FACU	1.0

Wetland Seeding - Open Canopy					
Pure Live Seed (20 lbs/ acre)					
Approved Date	Species Name	Common Name	Stratum	Wetland Indicator	Density (lbs/acre)
All Year	*Coleataenia anceps*	Beaked Panicgrass	Herb	FAC	3.0
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	OBL	2.0
All Year	Carex frankii	Frank's Sedge	Herb	OBL	2.0
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	FACW	3.0
All Year	*Bidens aristosa*	Bur-Marigold	Herb	FACW	2.0
All Year	*Panicum cirgatum*	Switchgrass	Herb	FAC	2.0
All Year	*Juncus effusus*	Common Rush	Herb	OBL	2.0
All Year	*Panicum dichotomiflorum*	Smooth Panicgrass	Herb	FACW	2.0
All Year	Tripsacum dactylodies	Eastern Gamagrass	Herb	FACW	1.0
All Year	Peltandra virginica	Arrow Arum	Herb	OBL	1.0

Notes:
(1) Apply Permanent seeding in all disturbed areas within Conservation Easement.

Stabilization Seeding

Stabilization Seeding		
Pure Live Seed (32 lbs/ac)		
Species Name	Common Name	lbs/acre
Festuca arundinacea	Fescue (KY 31)	20
Dactylis glomerata	Orchard Grass	12

Notes:
(1) Apply Stabilization Seeding for grading outside Conservation Easement, utility easements, and stream crossings.
(2) Install temporary seed and mulch with all permanent seed.

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Planting Plan Overview

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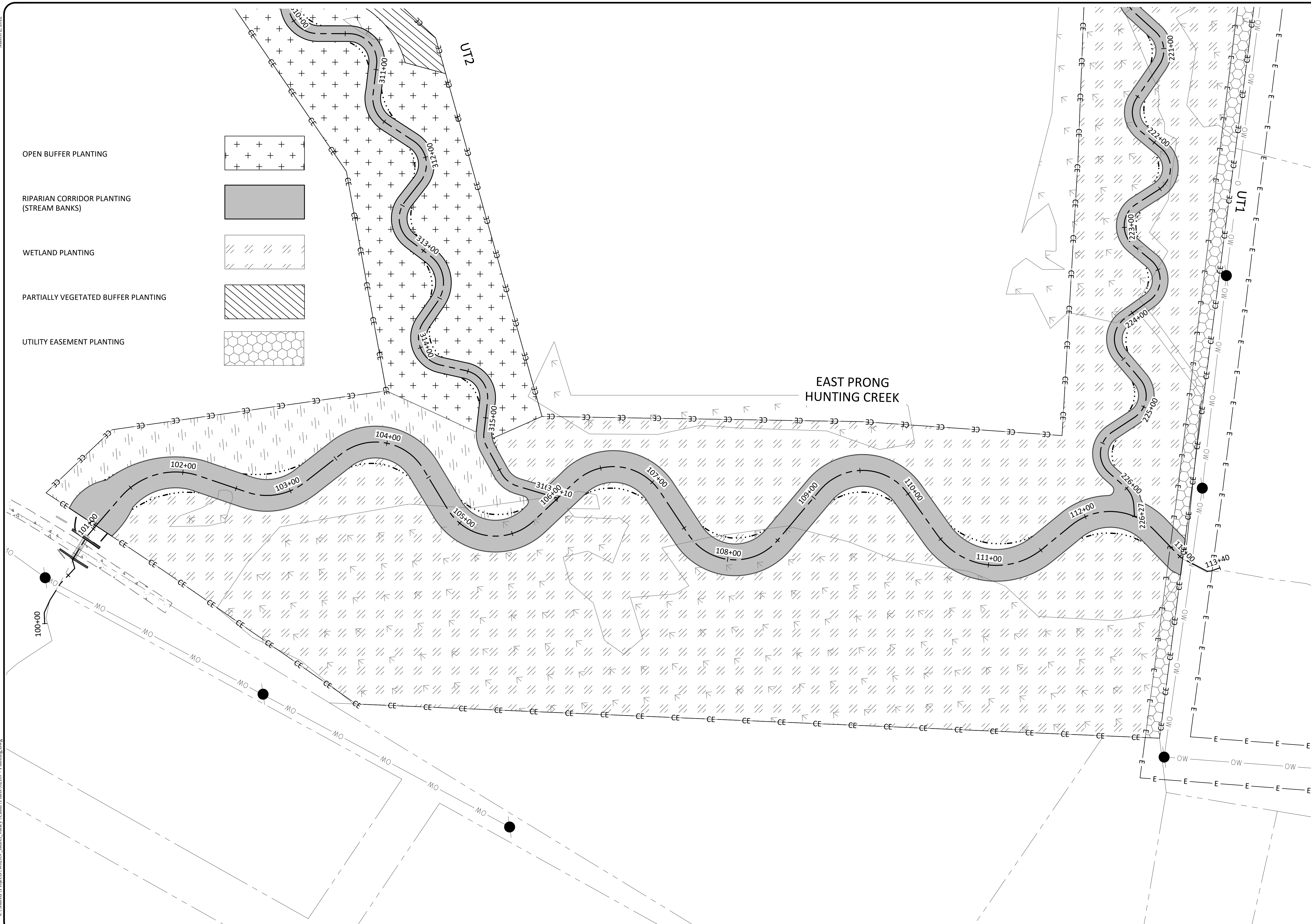

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Laurel Valley Mitigation Site
Burke County, North Carolina

East Prong Hunting Creek Planting

Revisions:

Date:	March 3, 2022
Job Number:	W02187
Project Engineer:	EN
Drawn By:	JW
Checked By:	JK

Sheet 3.3

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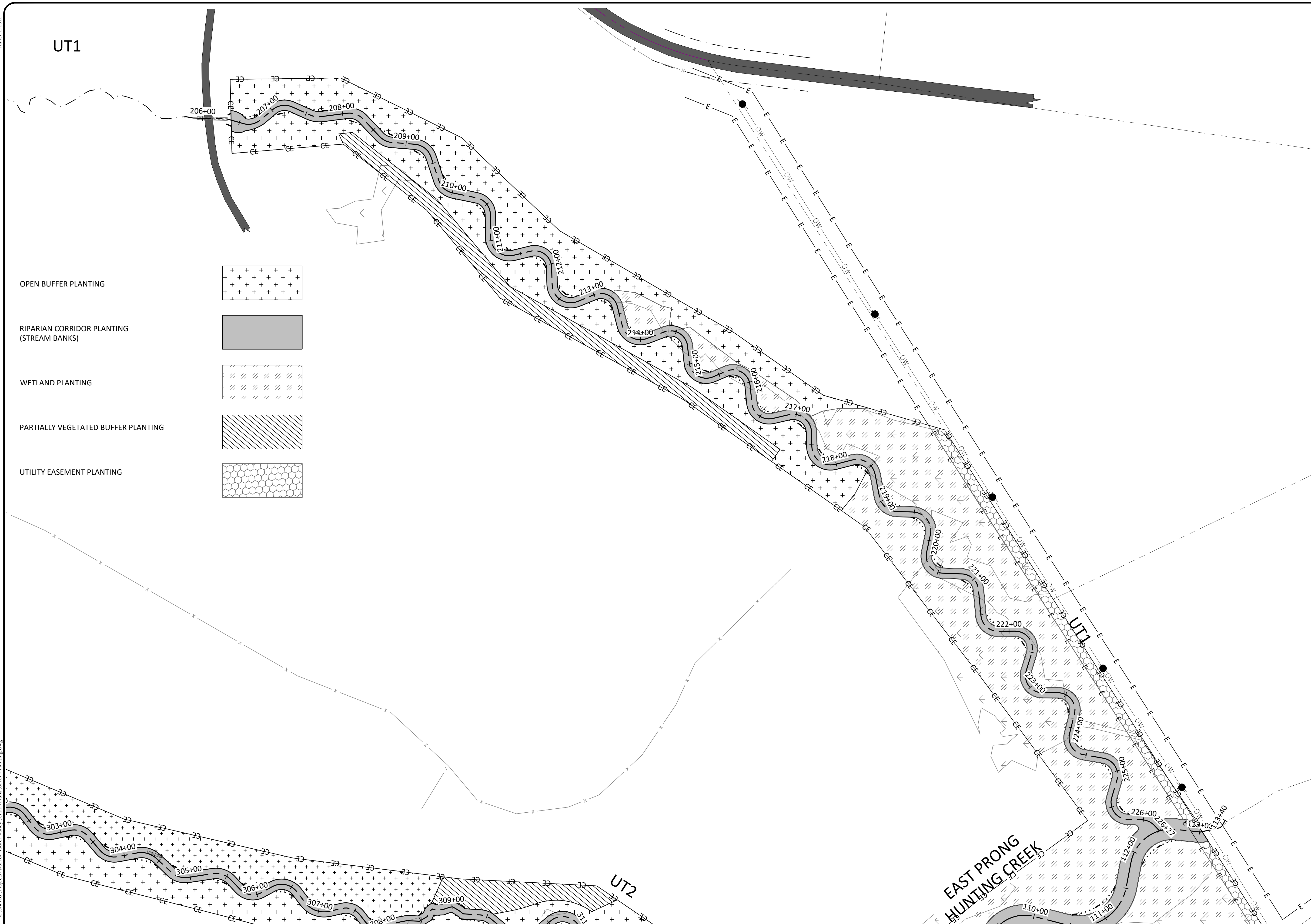

OPEN BUFFER PLANTING

RIPARIAN CORRIDOR PLANTING (STREAM BANKS)

WETLAND PLANTING

PARTIALLY VEGETATED BUFFER PLANTING

UTILITY EASEMENT PLANTING

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Laurel Valley Mitigation Site
Burke County, North Carolina

UT1 Planting

Revisions:

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Project Engineer:	EN
Drawn By:	JW
Checked By:	JK

Sheet 3.4

March 2, 2022
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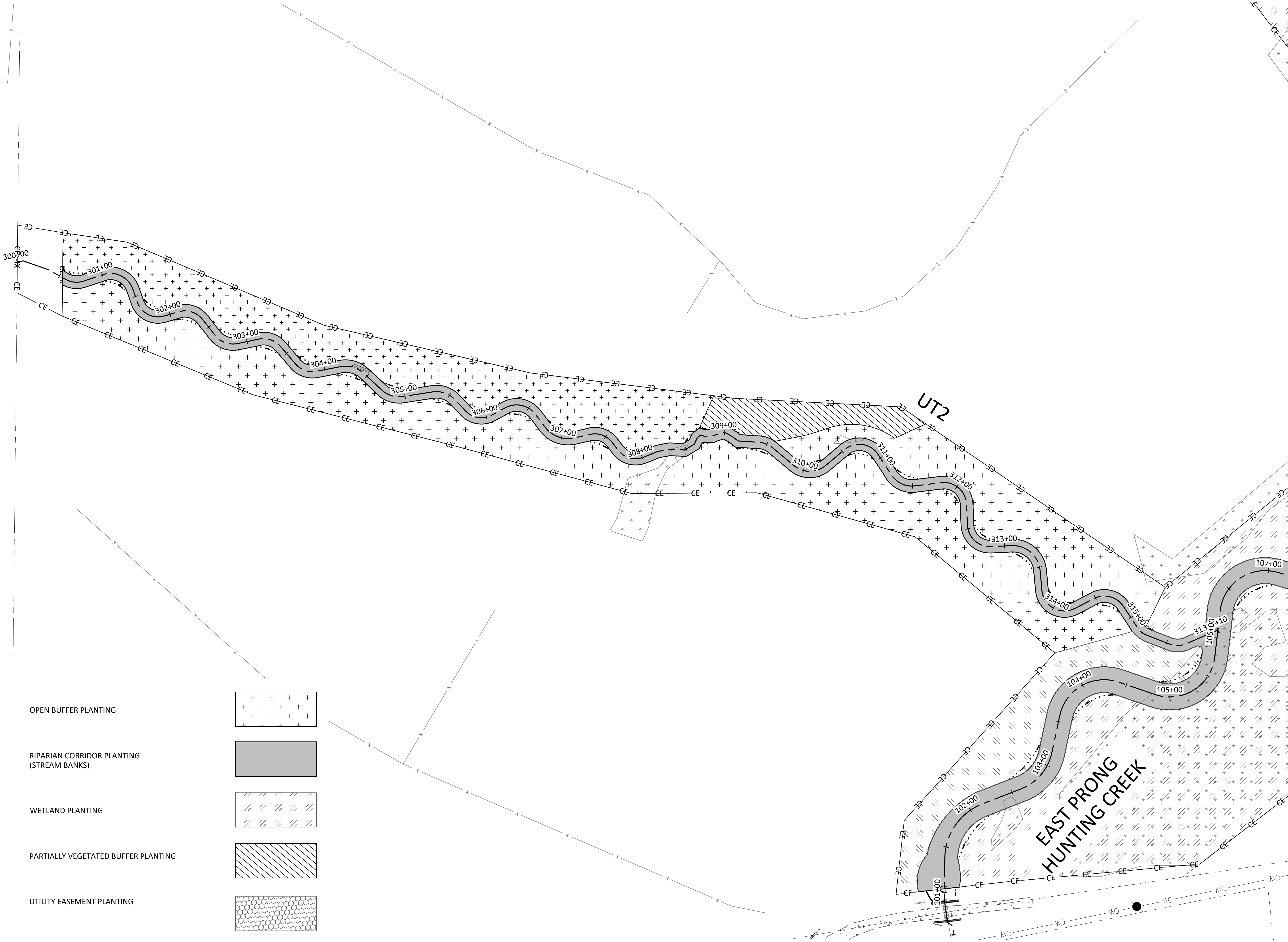
March 2, 2022



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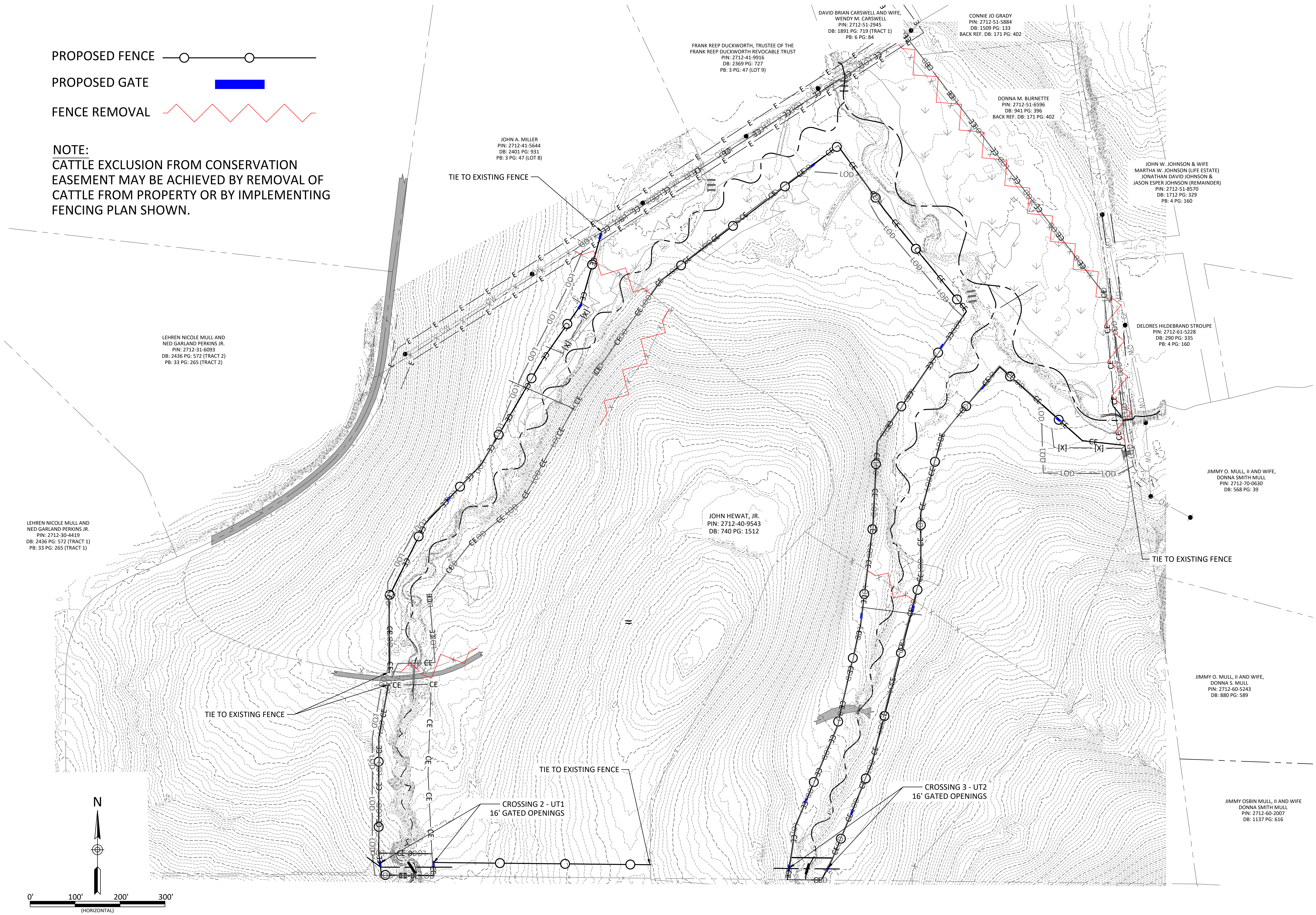
UT2 Planting

Revisions:

Date:	March 3, 2022
Job Number:	W02187
Project Engineer:	EN
Drawn By:	JW
Checked By:	JK

Sheet 3.5



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Laurel Valley Mitigation Site
Burke County, North Carolina

Fencing Plan
Farm Plan

Date:	March 3, 2022
Job Number:	W02187
Project Engineer:	EN
Drawn By:	JW
Checked By:	JK

Revisions:

Sheet 5.1

March 2, 2022

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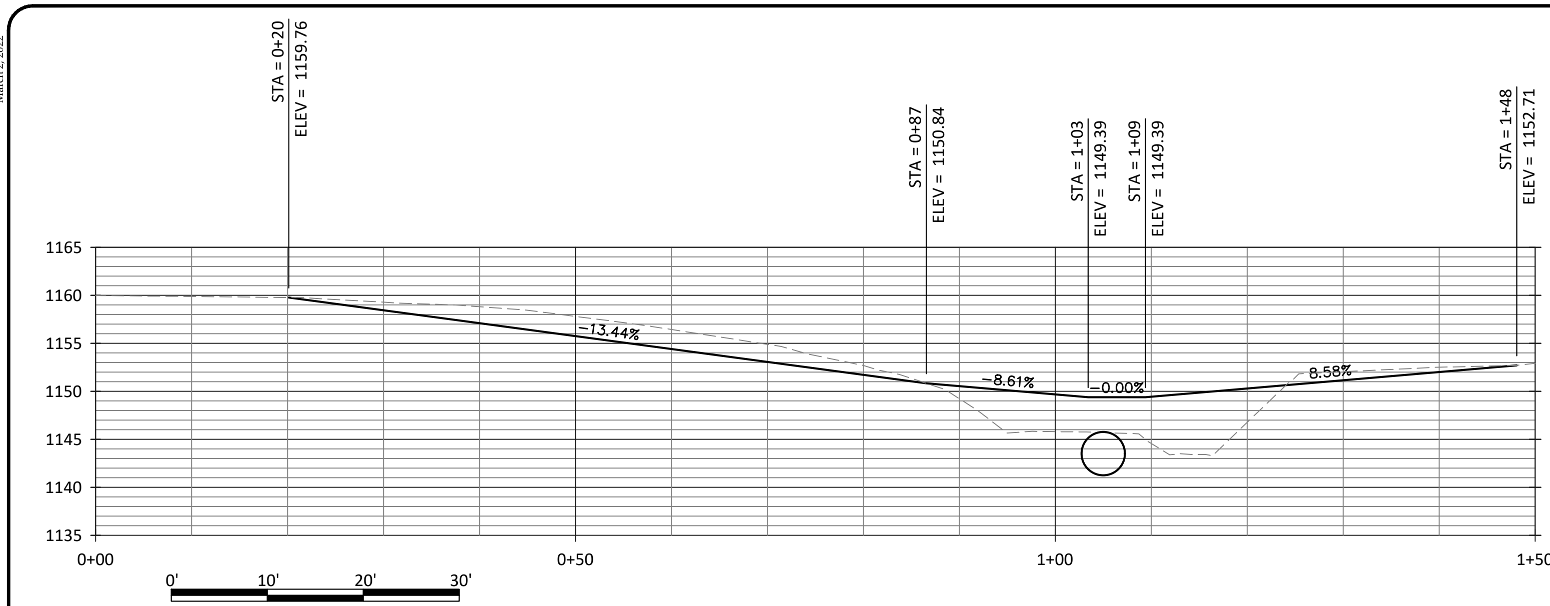
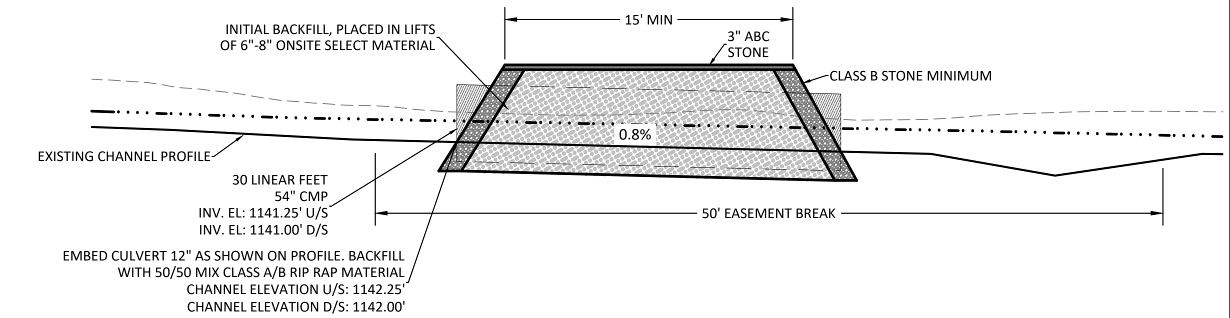
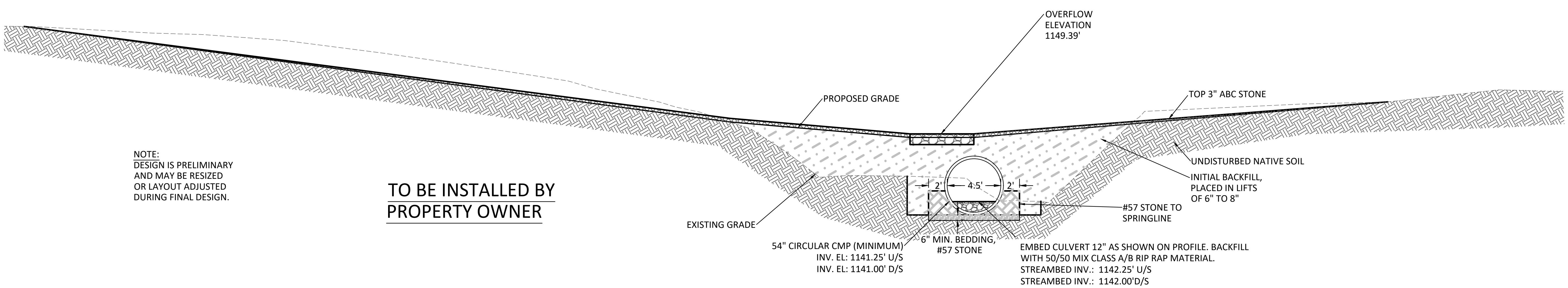
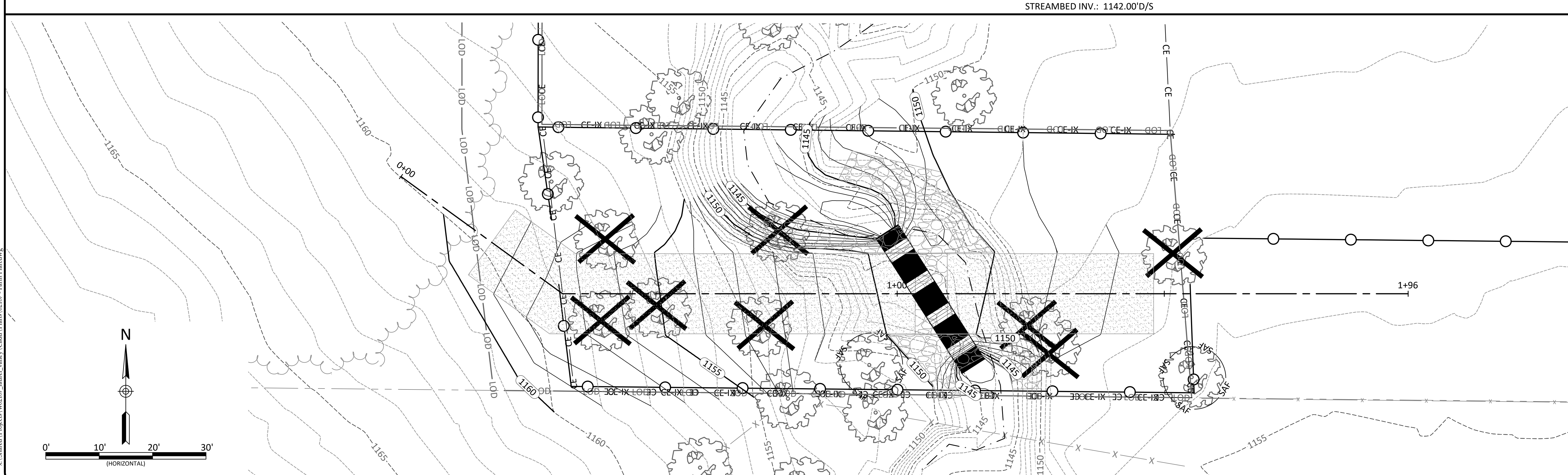
March 2, 2022









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Laurel Valley Mitigation Site
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Crossing 2 (UT1)
Farm Plan

Date:	March 3, 2022
Job Number:	W02187
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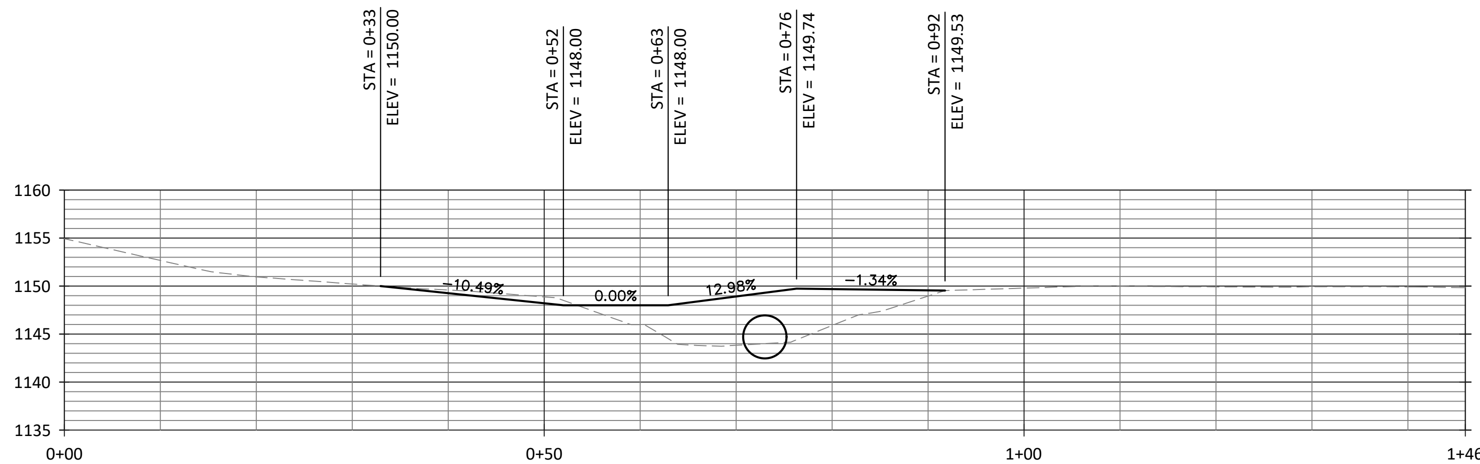
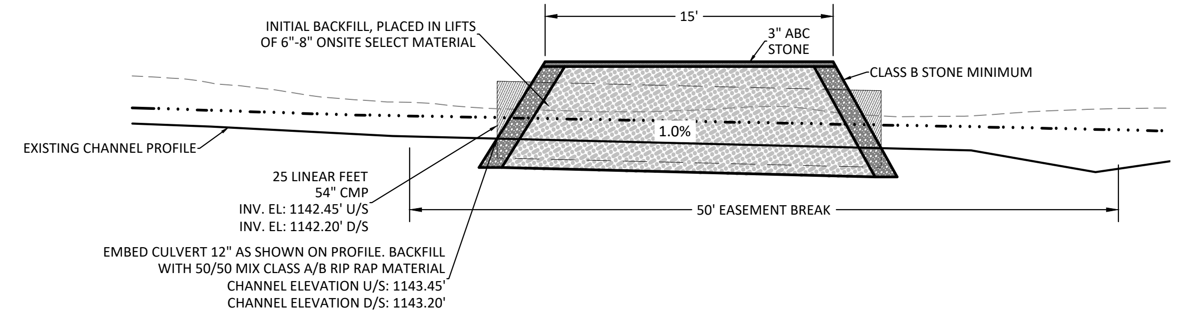
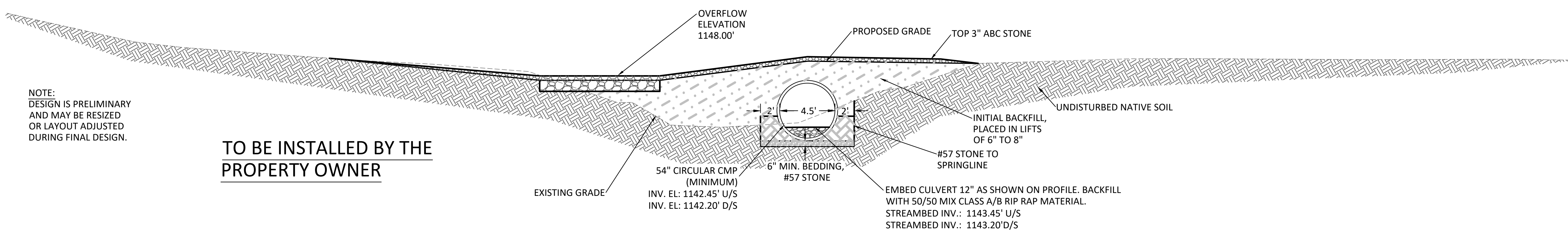
March 2, 2022

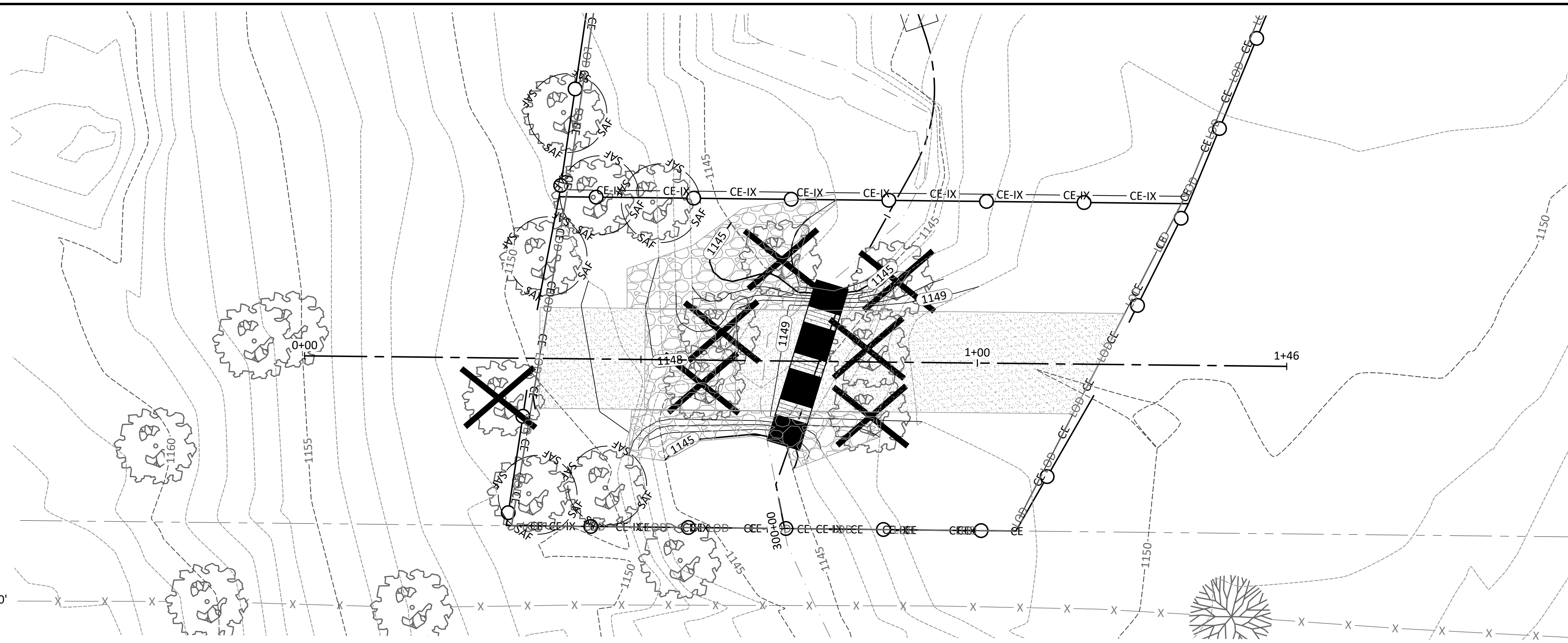


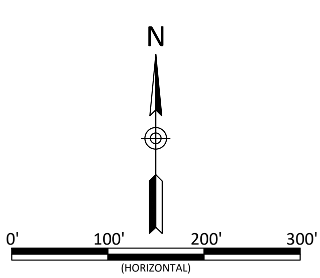


NOTE:
DESIGN IS PRELIMINARY AND MAY BE RESIZED OR LAYOUT ADJUSTED DURING FINAL DESIGN.

TO BE INSTALLED BY THE PROPERTY OWNER







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Laurel Valley Mitigation Site
Burke County, North Carolina

Crossing 3 (UT2)
Farm Plan

Date:	March 3, 2022
Job Number:	W02187
Project Engineer:	EN
Drawn By:	JW
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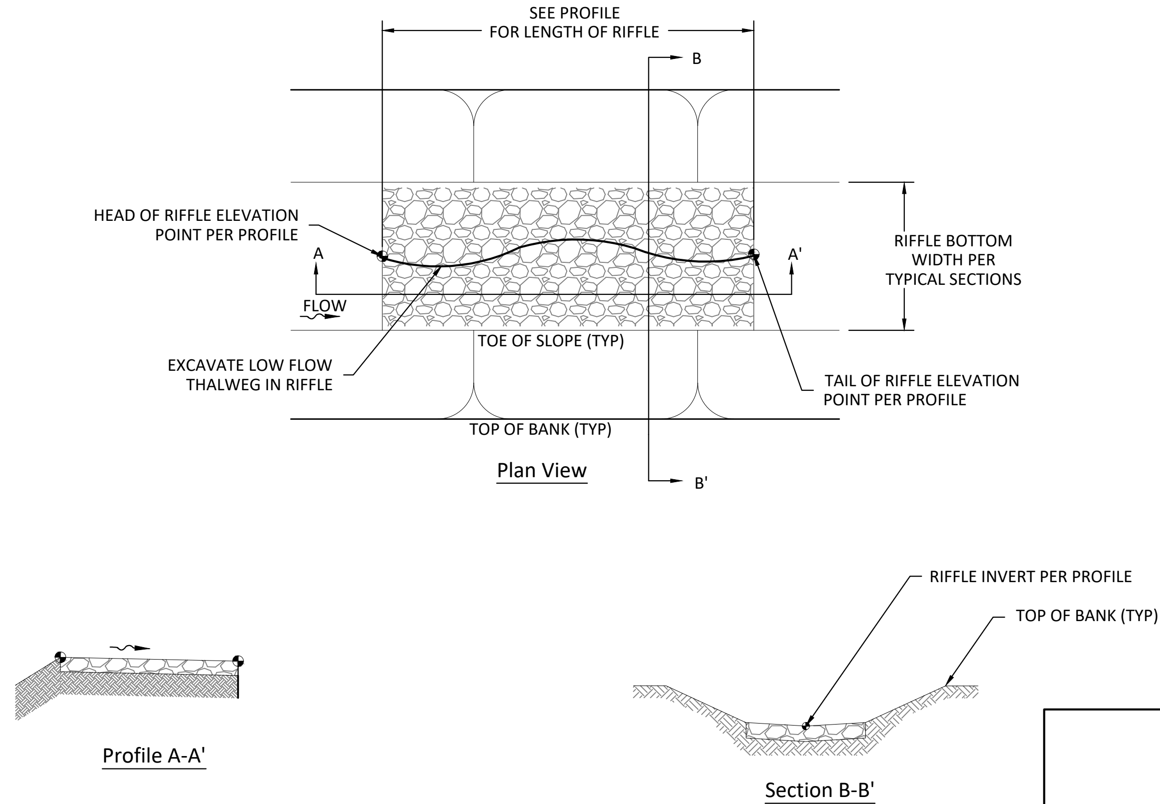
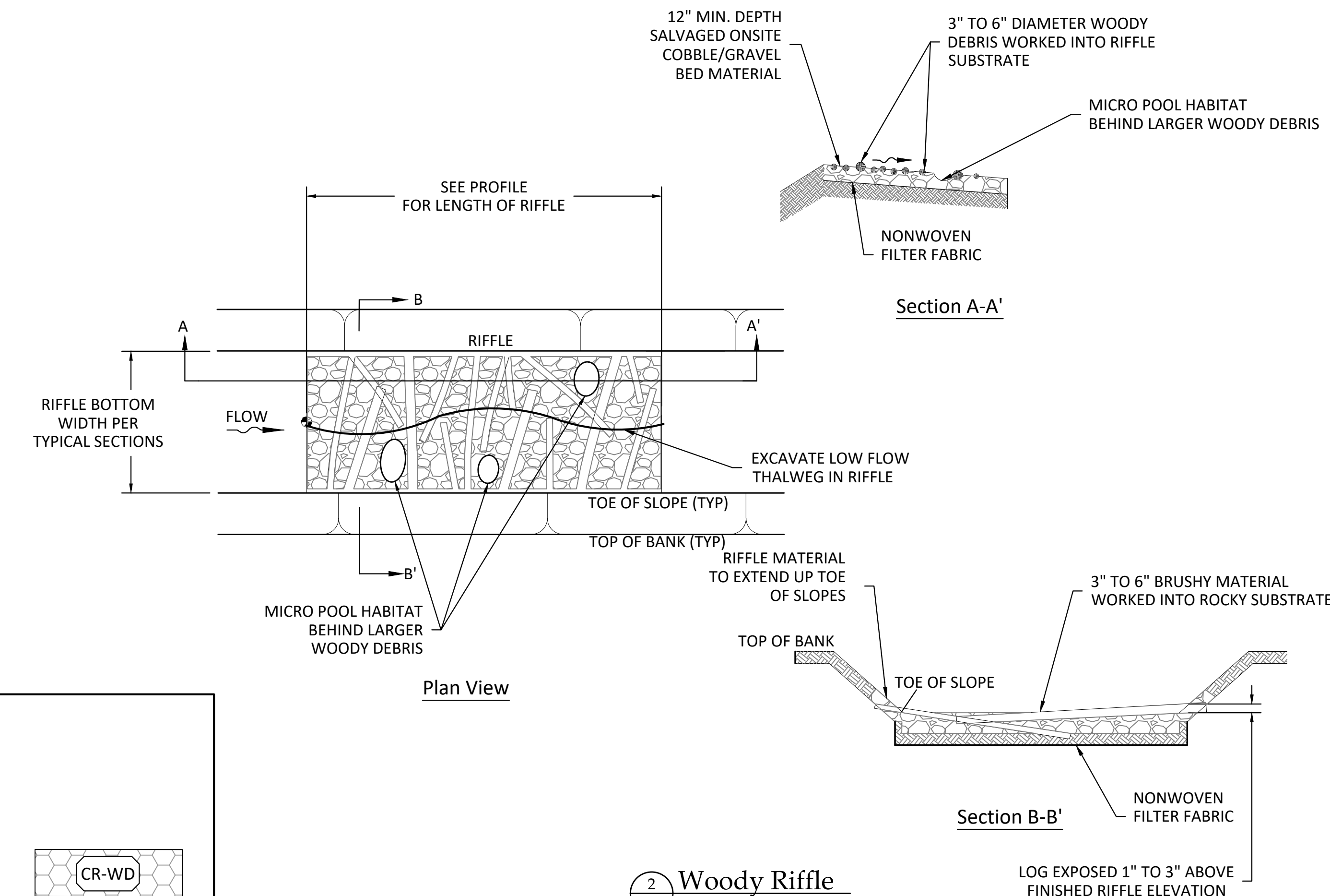
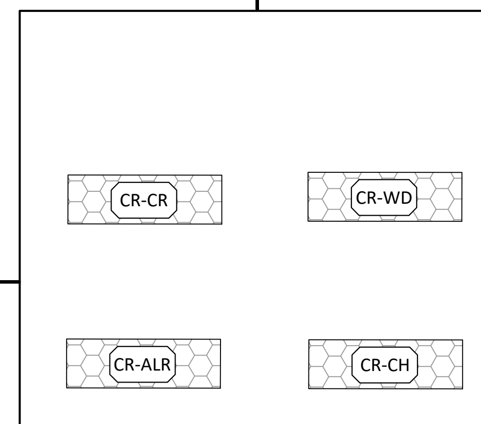
March 7, 2012

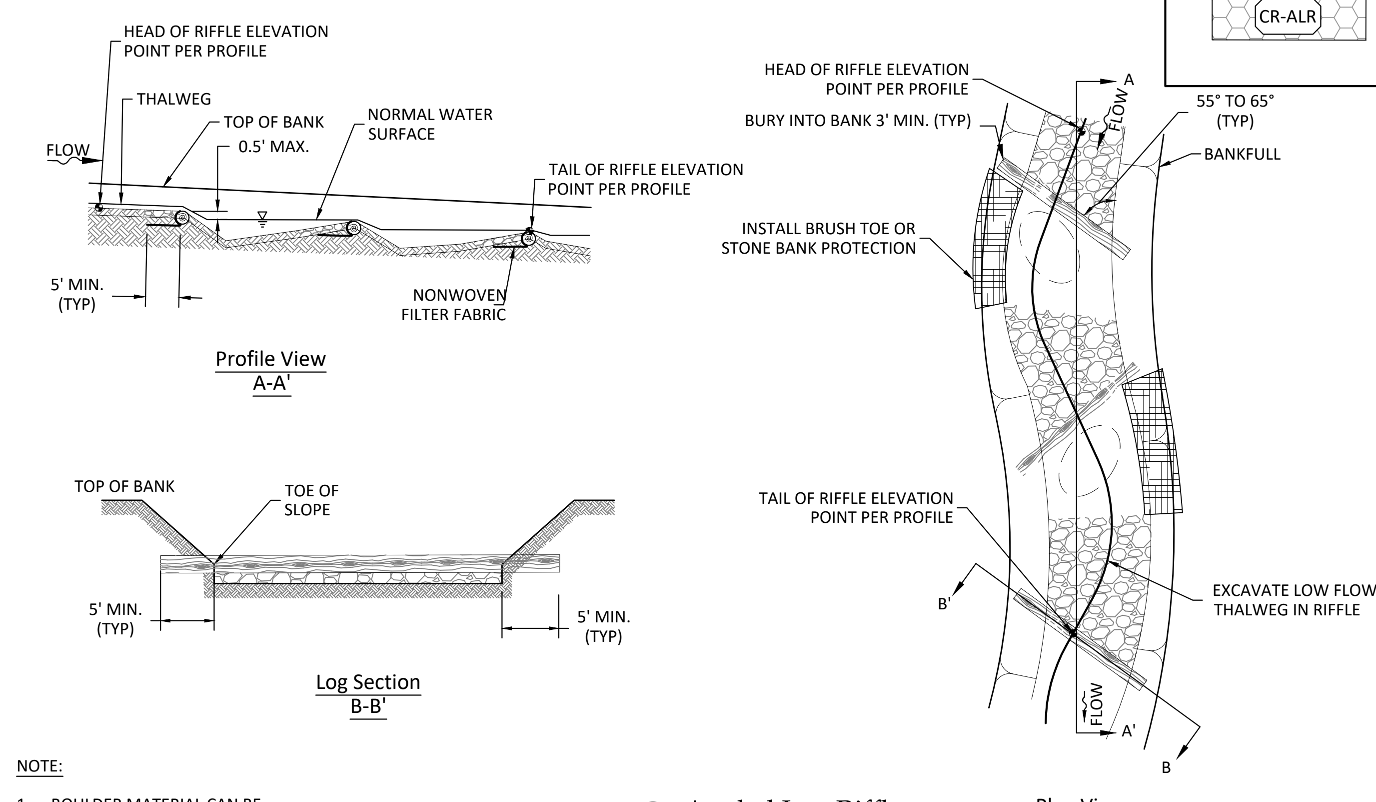


1
6.1 Constructed Riffle
Not to Scale



2
6.1 Woody Riffle
Not to Scale

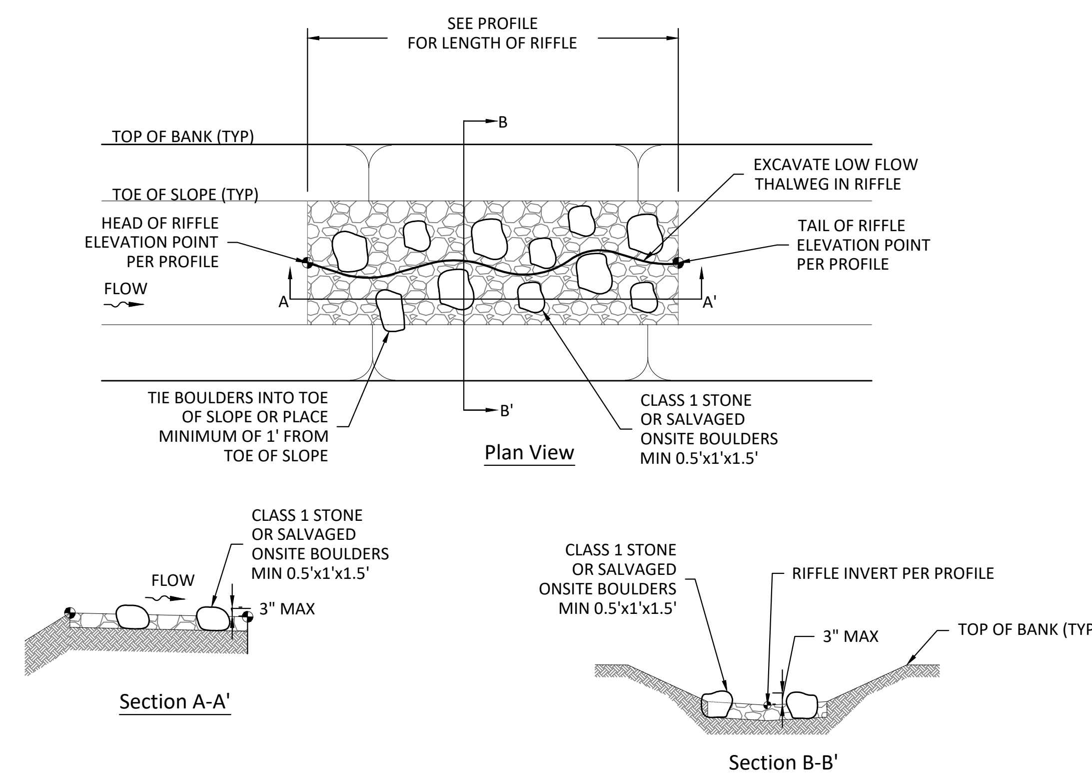




NOTE:

1. BOULDER MATERIAL CAN BE SUBSTITUTED IN PLACE OF ANGLED LOGS WITH APPROVAL OF ENGINEER.

3
6.1 Angled Log Riffle
Not to Scale



4
6.1 Chunky Riffle
Not to Scale

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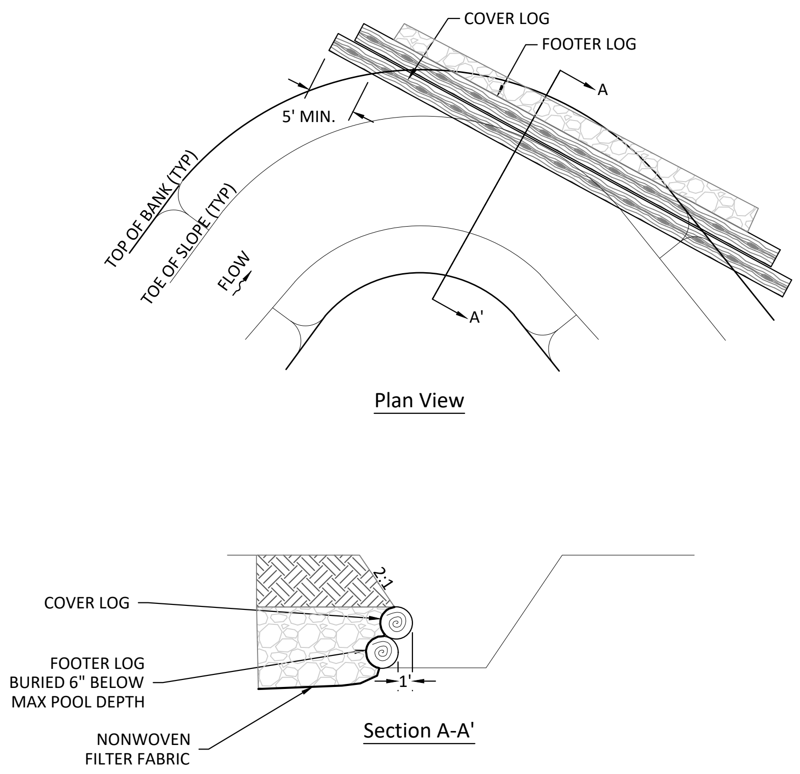
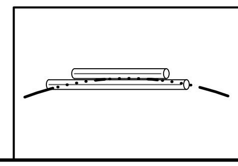
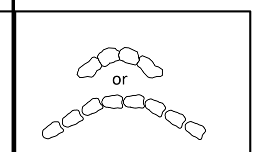
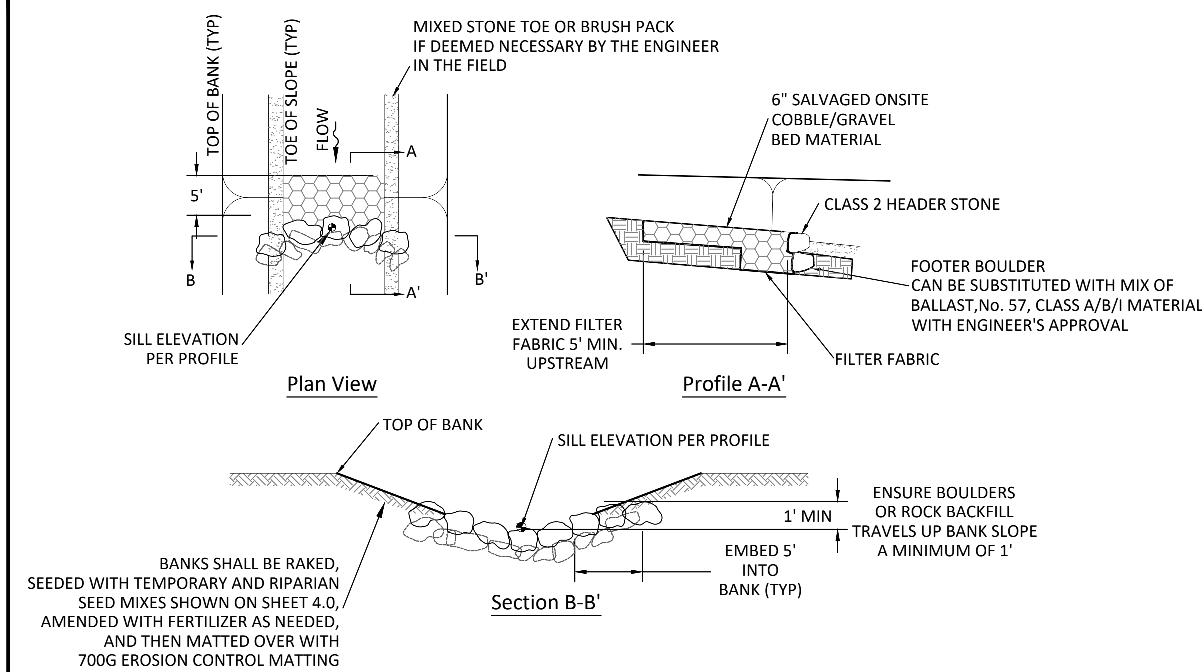
March 7, 2012



1/6.2 Cover Log
Not to Scale







2/6.2 Rock Sill
Not to Scale

Log Dimensions		
	East Prong Hunting Creek	UT1 / UT2
Length (ft)	14.5	11.0
Diameter of Log If Footered (IN)	18.0	12.0
Diameter of Log Un-Footered (IN)	N/A	24.0

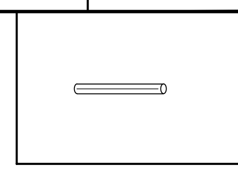
Vane Arm Dimensions		
	East Prong Hunting Creek	UT1 / UT2
W (FT)	2.6	1.7
H (FT)	0.6	0.3
X (FT)	14.2	7.0
° (Degree)	25	25
S (%)	3-5%	3-5%

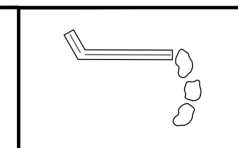
Boulder Dimensions		
	East Prong Hunting Creek	UT1 / UT2
Length (ft)	3.0	1.5
Width (ft)	2.0	1.0
Height (ft)	1.5	1.0

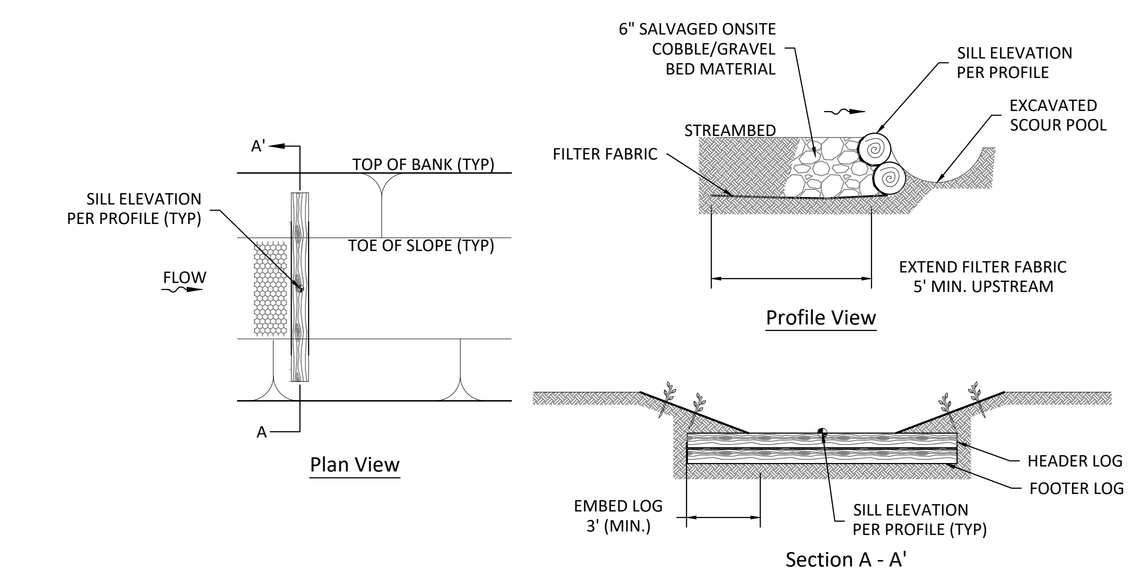
Reach	Riffle Composition	Min. Riffle Depth
East Prong Hunting Creek	60% Class A, 40% Class B	18"
UT1 / UT2	70% Class A, 30% #4 Stone	12"

NOTES:

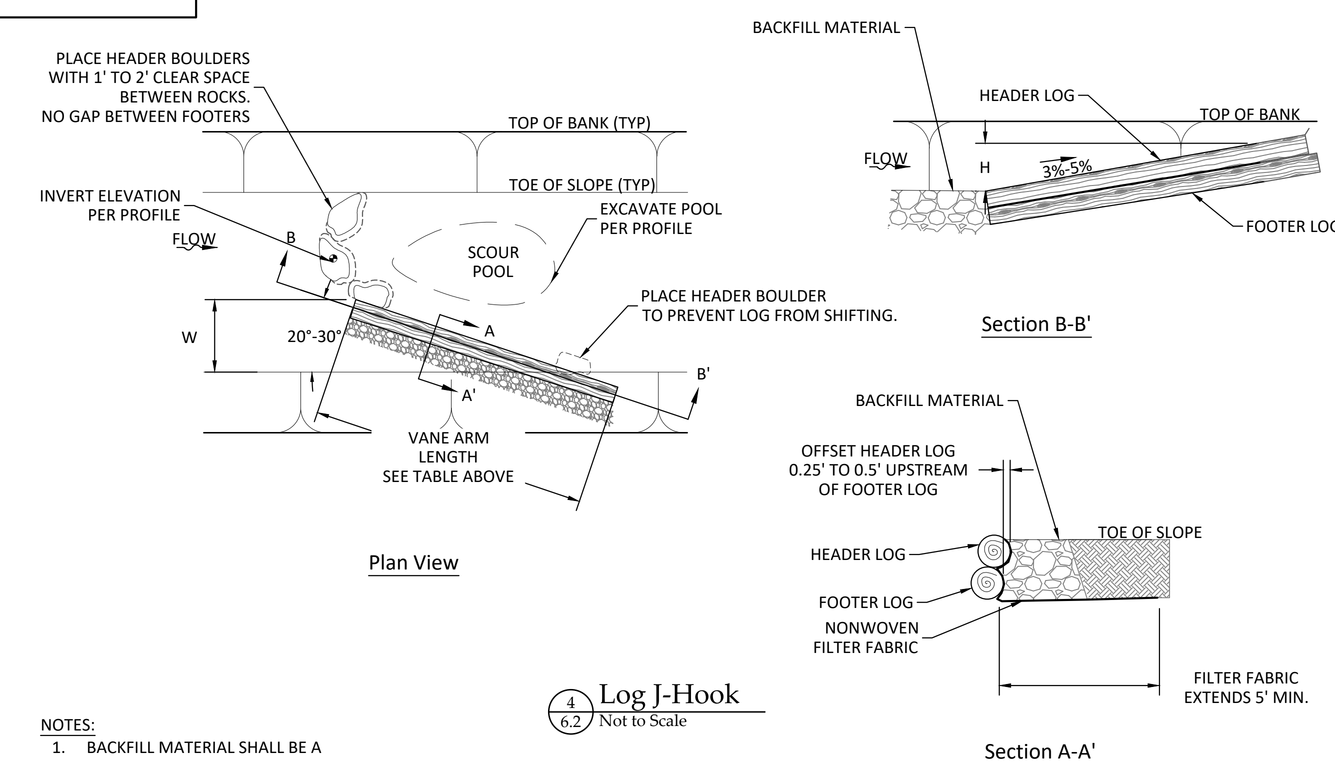
1. ON-SITE MATERIAL MAY BE USED UPON ENGINEER APPROVAL OF MATERIAL.







3/6.2 Log Sill
Not to Scale



NOTES:

1. BACKFILL MATERIAL SHALL BE A WELL-GRADED MIX OF STONE: SIZING TBD

4/6.2 Log J-Hook
Not to Scale

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Burke County, North Carolina
Details

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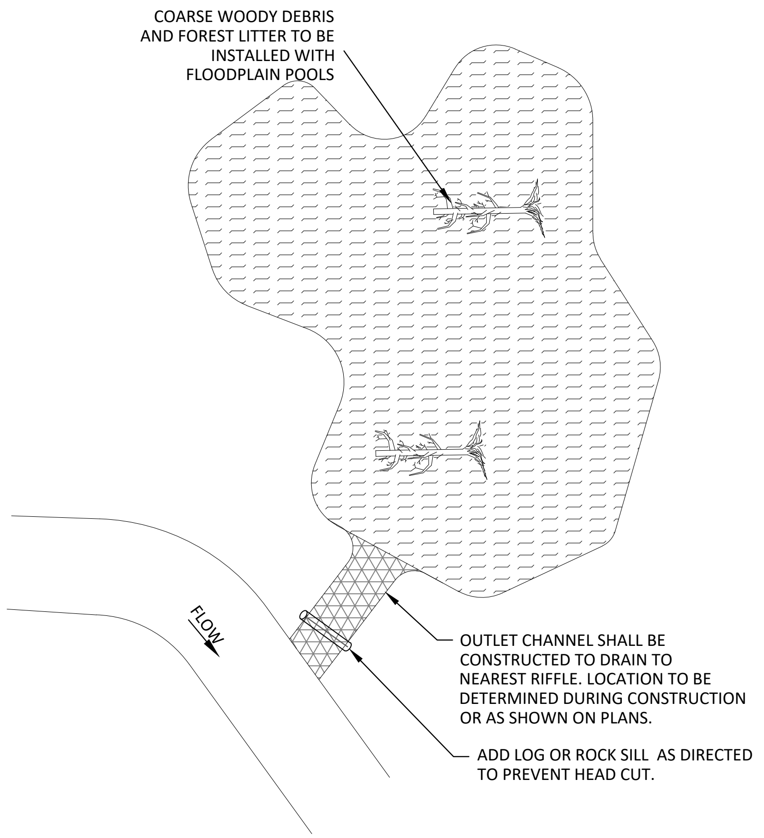
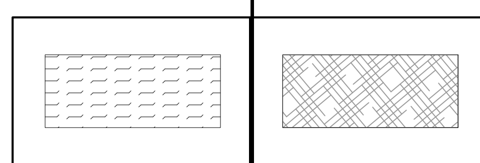
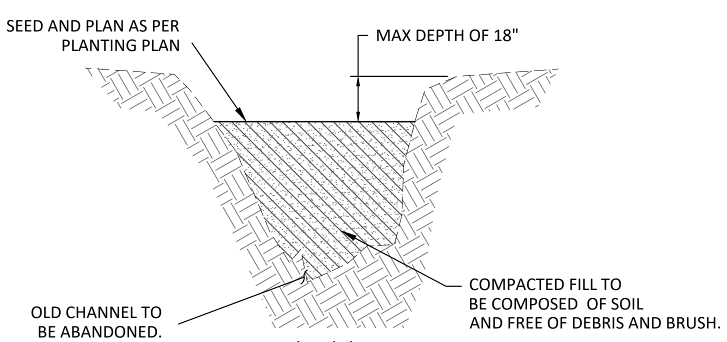
Checked By: JK

Sheet 6.2

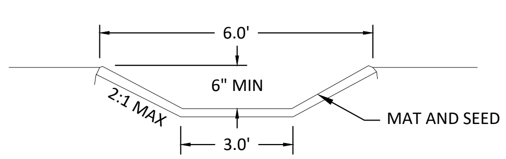
March 7, 2012





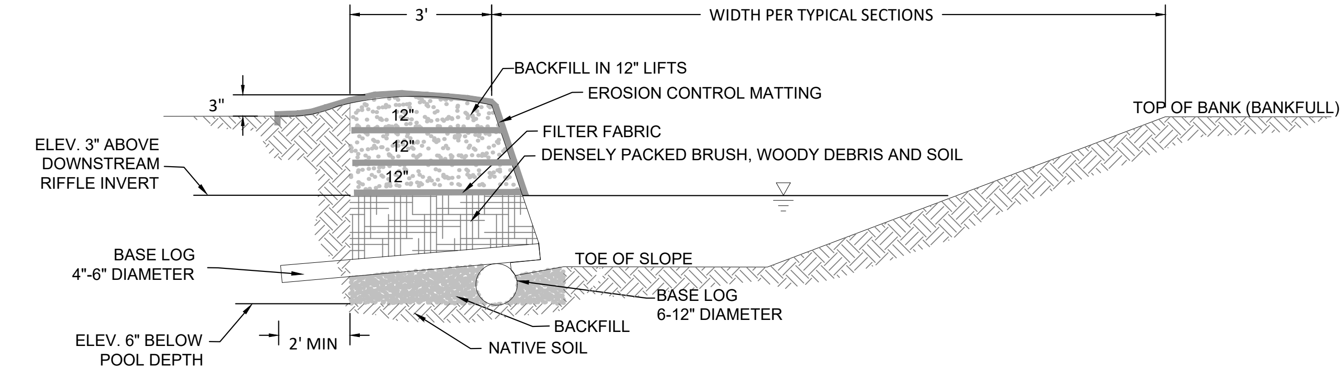


Floodplain Pool Section

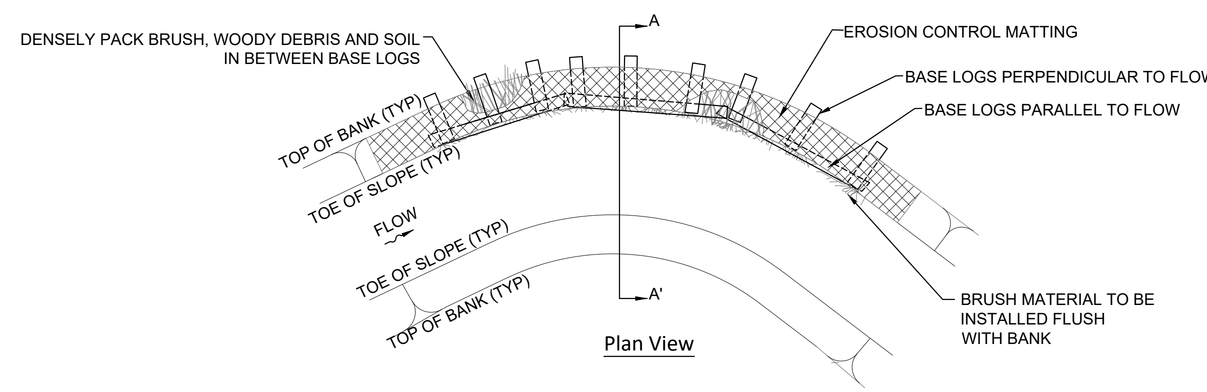


Outlet Channel Section

1 / 6.3 Floodplain Pool
Not to Scale



Section A-A'

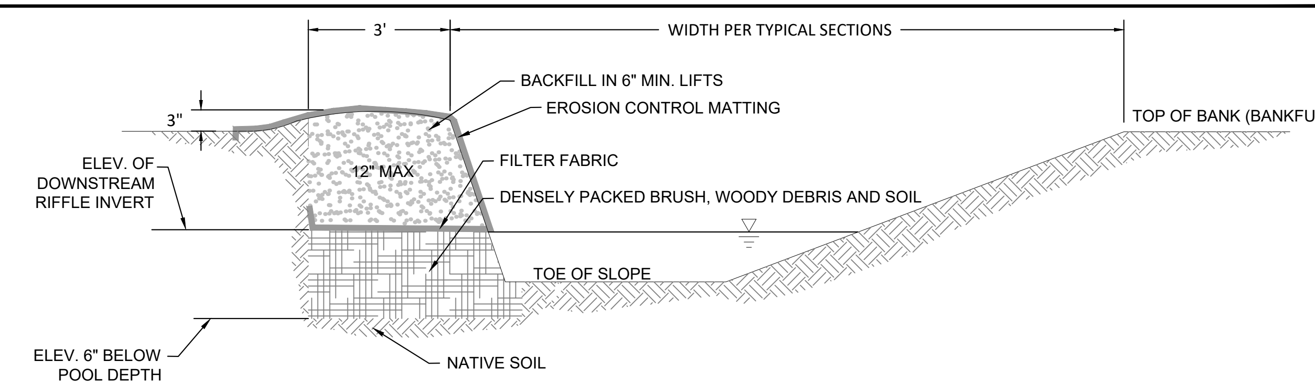


Plan View

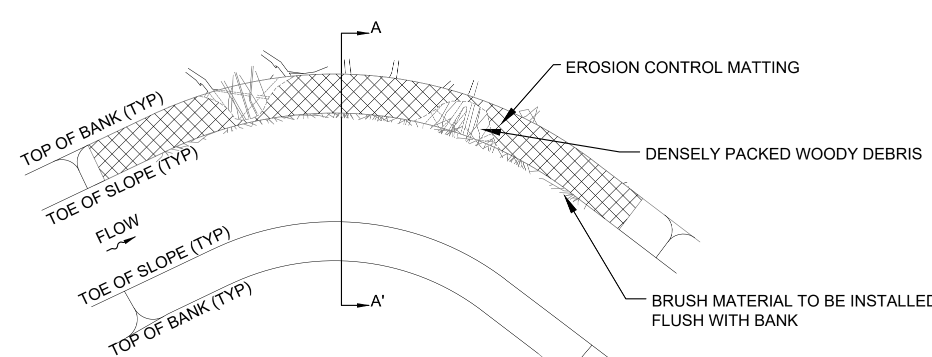
NOTES:

1. OVEREXCAVATE 3' OUTSIDE OF TOP OF BANK (BANKFULL).
2. INSTALL BASE LOGS PARALLEL TO FLOW AT TOE OF SLOPE. DIAMETER 6"-12".
3. TOP LIFT CAN BE SUBSTITUTED WITH SOD MAT.
4. INSTALL BASE LOGS PERPENDICULAR TO FLOW AT INTERVALS ALONG BANK, RESTING ON TOP OF PARALLEL BASE LOGS. BASE LOGS SHALL BE 6"-12" DIAMETER.
5. INSTALL A DENSE LAYER OF BRUSH/WOODY DEBRIS, WHICH SHALL CONSIST OF SMALL BRANCHES AND ROOTS COLLECTED ON-SITE AND SOIL TO FILL ANY VOID SPACE. LIGHTLY COMPACT BRUSH/WOODY DEBRIS LAYER.
6. BRUSH SHOULD BE ALIGNED SO STEMS ARE ROUGHLY PARALLEL AND IS INSTALLED POINTING SLIGHTLY UPSTREAM.
7. INSTALL FILTER FABRIC OVER BRUSH/WOODY DEBRIS.
8. INSTALL EARTH BACKFILL OVER BRUSH/WOODY LAYER ACCORDING TO TYPICAL SECTION DIMENSIONS.
9. SEED, MULCH AND INSTALL EROSION CONTROL MATTING AND BANK STABILIZATION PER PLANS.

2 / 6.3 Brush Toe - East Prong Hunting Creek (Large)
Not to Scale



Section A-A'



Plan View

NOTES:

1. OVEREXCAVATE 3' OUTSIDE OF TOP OF BANK (BANKFULL).
2. INSTALL A DENSE LAYER OF BRUSH/WOODY DEBRIS, WHICH SHALL CONSIST OF SMALL BRANCHES AND ROOTS COLLECTED ON-SITE AND SOIL TO FILL ANY VOID SPACE. LIGHTLY COMPACT BRUSH/WOODY DEBRIS LAYER.
3. TOP LIFE CAN BE SUBSTITUTED FOR SOD MAT
4. BRUSH SHOULD BE ALIGNED SO STEMS ARE ROUGHLY PARALLEL AND IS INSTALLED POINTING SLIGHTLY UPSTREAM.
5. INSTALL FILTER FABRIC OVER BRUSH/WOODY DEBRIS.
6. INSTALL EARTH BACKFILL OVER BRUSH/WOODY LAYER ACCORDING TO TYPICAL SECTION DIMENSIONS.
7. SEED, MULCH AND INSTALL EROSION CONTROL MATTING AND BANK STABILIZATION PER PLANS.

3 / 6.3 Brush Toe - UT1, UT2 (Small)
Not to Scale

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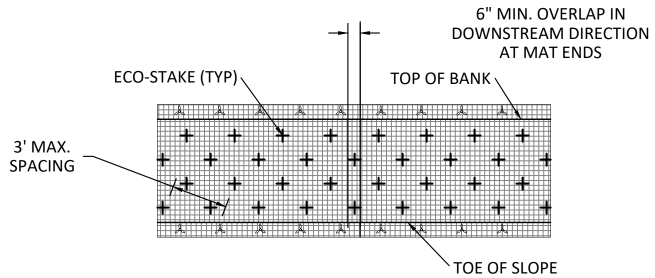
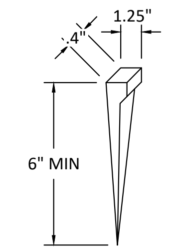
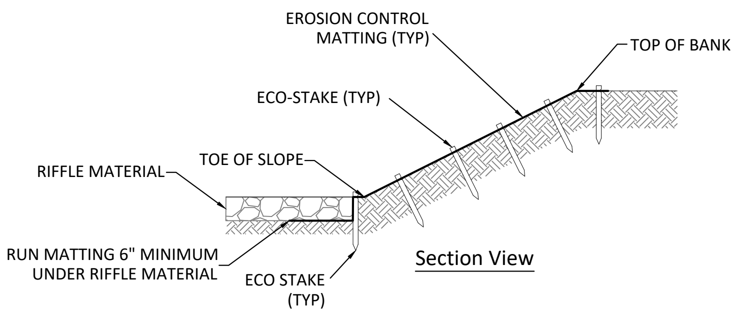
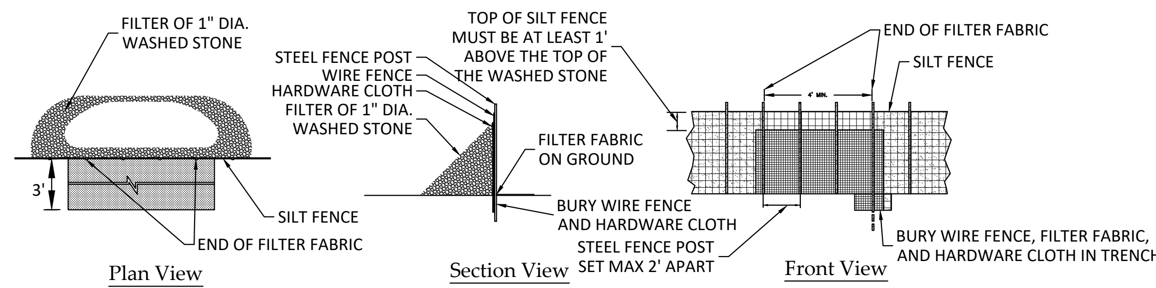






1/6.4 **Erosion Control Matting**
Not to Scale

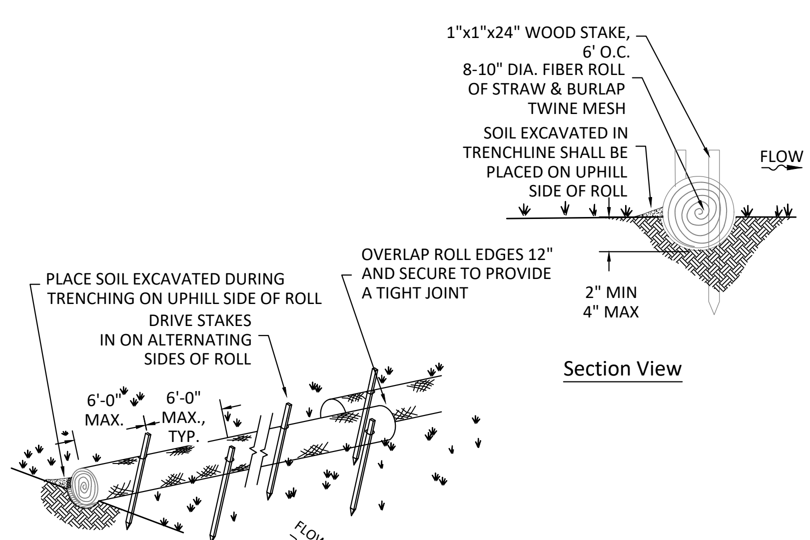


INSTALLATION:
REFER TO THE PLANS FOR LOCATIONS AND SPECIFICATIONS. DURING INSTALLATION OF THE SILT BARRIER OR SILT FENCE, INSPECT THE INSTALLATION TO DETERMINE IF OUTLETS ARE NEEDED ACCORDING TO THE CRITERIA SET FORTH IN THE SPECIFICATIONS FOR THE BARRIER AND FENCE. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER, ARCHITECT, OR RESPONSIBLE PERSONNEL ON THE SITE FOR ASSISTANCE. EROSION CONTROL PERSONNEL HAVE COPIES OF INSTRUCTIONS AND MAY HAVE PHOTOGRAPHS OF PROPERLY INSTALLED OUTLETS AS AN AID TO INSTALLATION.
IF THE SILT FENCE OUTLET IS NOT INSTALLED CORRECTLY THE FIRST TIME, IT WILL HAVE TO BE REBUILT.
DETERMINE THE EXACT LOCATION ON THE GROUND BEFORE COMPLETING INSTALLATION OF THE SILT FENCE, TAKING INTO CONSIDERATION:
INSTALL THE OUTLET AT THE LOWEST POINT (S) IN THE BARRIER OR FENCE WHERE WATER WILL POND.
INSTALL THE OUTLET WHERE IT IS ACCESSIBLE FOR INSTALLATION, MAINTENANCE, AND REMOVAL.
ALLOW AT LEAST:
15 FEET BETWEEN THE BARRIER OR FENCE AND SINGLE-STORY BUILDINGS.
25 FEET FOR FORK LIFTS BETWEEN THE BARRIER OR FENCE AND MULTIPLE-STORY BUILDINGS.
10 FEET BETWEEN THE BARRIER OR FENCE AND THE TOE OF FILL SLOPES.
PLACE THE OUTLET SO THAT WATER FLOWING THROUGH IT WILL NOT CREATE AN EROSION HAZARD BELOW: AVOID STEEP SLOPES BELOW THE OUTLET AND AREAS WITHOUT PROTECTIVE VEGETATION. USE SLOPE DRAINS IF NECESSARY.
DETERMINE THE LOCATION OF THE OUTLET: FOR A SILT BARRIER, WHEN THE TRENCH IS DUG TO BURY THE BOTTOM OF THE FABRIC BECAUSE THE BARRIER WILL BE OMITTED AT THE OUTLET; FOR A SILT FENCE, WHEN THE WIRE FENCE IS IN PLACE BECAUSE THE FILTER FABRIC WILL BE OMITTED AT THE OUTLET.
REFER TO THE ILLUSTRATIONS OF THE OUTLET IN THE PLAN.
CLEAR STUMPS AND ROOTS FROM THE LOCATION OF THE OUTLET. CLEAR ADEQUATE ACCESS FOR THE EQUIPMENT NEEDED FOR INSTALLATION, MAINTENANCE, AND REMOVAL.

FOR A SILT BARRIER:
JUST BELOW THE GAP IN THE BARRIER, PLACE A LAYER OF FILTER FABRIC ON THE GROUND TO PROTECT THE SOIL FROM EROSION BY OUTFLOW FROM THE OUTLET; PLACE 6 INCHES OF THE UPPER EDGE IN THE TRENCH. STAKE THE REMAINING EDGES OF THE FABRIC TO HOLD IT IN PLACE.
ALONG THE GAP WHERE THE OUTLET WILL GO, PLACE STEEL FENCE POSTS FOR STRENGTH. THE POSTS MUST BE A MAXIMUM OF 2 FEET APART AND DRIVEN INTO SOLID GROUND AT LEAST 18 INCHES.
PLACE HARDWARE CLOTH (WELDED GALVANIZED SCREEN WITH SQUARE 1/4 - 1/2-INCH HOLES) ON THE UPHILL SIDE OF THE POSTS TO HOLD THE WASHED STONE IN PLACE. PUT 6 INCHES OF THE BOTTOM OF THE CLOTH IN THE TRENCH AND FASTEN IT TO THE POSTS WITH LENGTHS OF WIRE.
BURY THE BOTTOM OF THE HARDWARE CLOTH AND THE UPPER EDGE OF THE FILTER FABRIC BELOW THE OUTLET IN THE TRENCH AND COMPACT THE FILL.
PLACE A FILTER OF 1-INCH DIAMETER WASHED STONE ON THE UPHILL SIDE OF THE OUTLET. PILE THE STONE UP TO THE TOP OF THE HARDWARE CLOTH AND OVER THE JOINT BETWEEN THE OUTLET AND THE BARRIER.

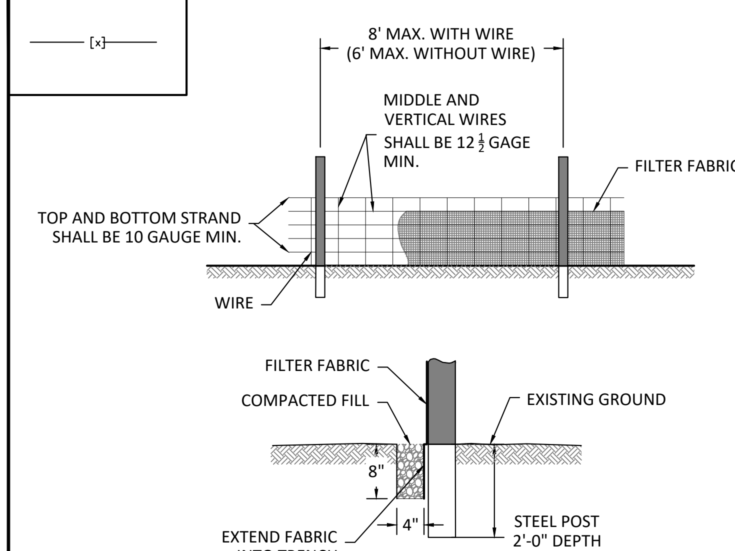
FOR A SILT FENCE:
JUST BELOW THE GAP IN THE BARRIER, PLACE A LAYER OF FILTER FABRIC ON THE GROUND TO PROTECT THE SOIL FROM EROSION BY OUTFLOW FROM THE OUTLET; PLACE 6 INCHES OF THE UPPER EDGE IN THE TRENCH. STAKE THE OTHER EDGES OF THE FABRIC TO HOLD IT IN PLACE.
ALONG THE GAP WHERE THE OUTLET WILL GO, PLACE ADDITIONAL STEEL FENCE POSTS FOR STRENGTH. THE POSTS MUST BE A MAXIMUM OF 2 FEET APART AND DRIVEN INTO SOLID GROUND AT LEAST 18 INCHES.
PLACE HARDWARE CLOTH (WELDED GALVANIZED SCREEN WITH SQUARE 1/4 - 1/2-INCH HOLES) ON THE UPHILL SIDE OF THE POSTS TO HOLD THE WASHED STONE IN PLACE. PUT 6 INCHES OF THE BOTTOM OF THE CLOTH IN THE TRENCH AND FASTEN IT TO THE POSTS WITH LENGTHS OF WIRE.
BURY THE BOTTOM OF THE HARDWARE CLOTH, THE UPPER EDGE OF THE FILTER FABRIC BELOW THE OUTLET, AND THE WIRE FENCE IN THE TRENCH AND COMPACT THE FILL.
PLACE A FILTER OF 1-INCH DIAMETER WASHED STONE ON THE UPHILL SIDE OF THE OUTLET. PILE THE STONE UP TO THE TOP OF THE HARDWARE CLOTH AND OVER THE JOINT BETWEEN THE OUTLET AND THE SILT FENCE.

2/6.4 **Temporary Silt Fence Gravel Outlet**
Not to Scale



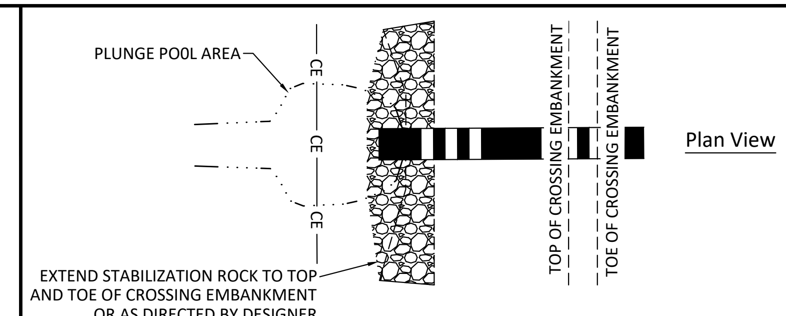
NOTES:
1. INSTALL FIBER ROLL ALONG CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.
2. INSPECT STRAW WATTLES ON A REGULAR BASIS AND AFTER EACH RAINFALL EVENT.
3. WATTLES SHOULD BE MAINTAINED TO ALLOW THE WATER TO FLOW THROUGH, REDUCE VELOCITY AND ALLOW SEDIMENTATION TO OCCUR.
4. WATTLES SHOULD BE REPLACED IF FIBER BECOMES TOO SATURATED.
5. STAKES SHOULD BE USED TO ANCHOR THE STRAW WATTLE TO THE GROUND TO PREVENT SCOURING AND WASHOUT.

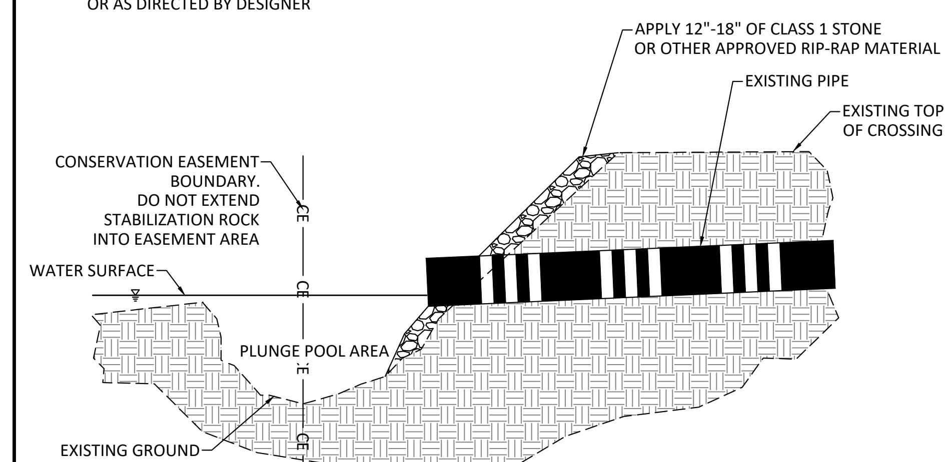
3/6.4 **Straw Wattle**
Not to Scale



NOTES:
1. USE WIRE A MINIUM OF 32" IN WIDTH AND WITH A MINIMUM OF 6 LINES OF WIRES WITH 12" STAY SPACING.
2. USE FILTER FABRIC A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE WIRES AS DIRECTED BY THE ENGINEER.
3. PROVIDE 5' STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE. ANGLE STEEL TYPE.

4/6.4 **Silt Fence**
Not to Scale





NOTES:
1. ONLY CONSTRUCT CROSSING EMBANKMENT STABILIZATION WITH APPROVAL FROM DESIGNER
2. APPLICATION OF STONE MAY REQUIRE RE-GRADING OR SMOOTHING OF THE EXISTING EMBANKMENT

5/6.4 **Crossing Embankment Stabilization**
Not to Scale

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Checked By: JK

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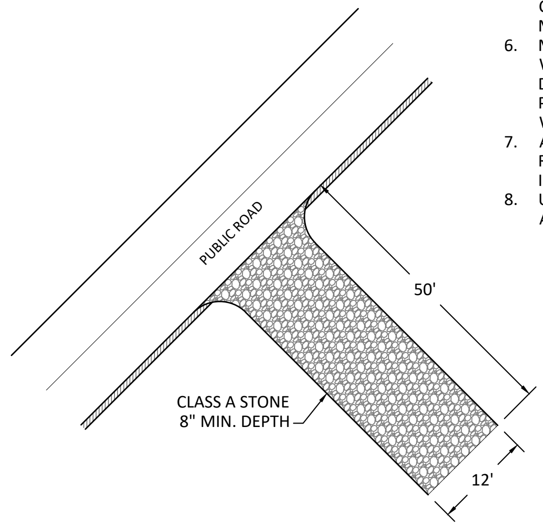
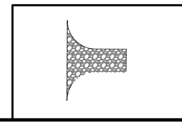
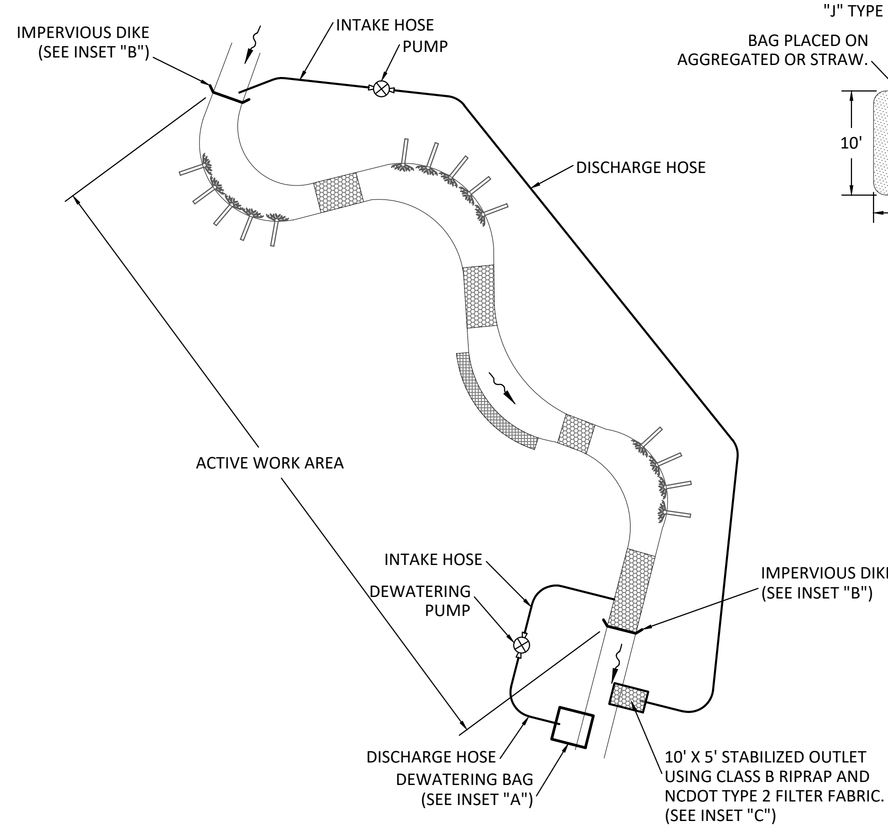
NOTES:

1. PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
5. LOCATE CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
6. 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.
7. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED IMMEDIATELY.
8. USE CLASS A STONE OR OTHER COARSE AGGREGATE APPROVED BY THE ENGINEER.

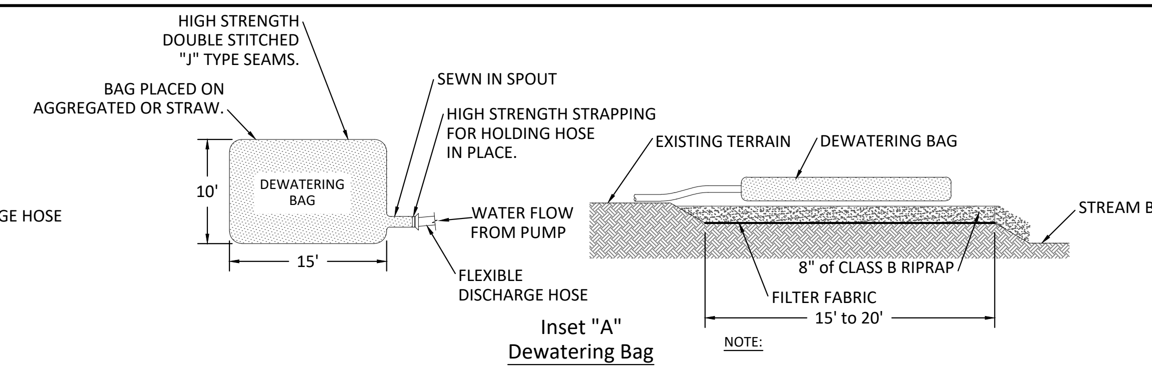


1
6.5
Construction Entrance
Not to Scale





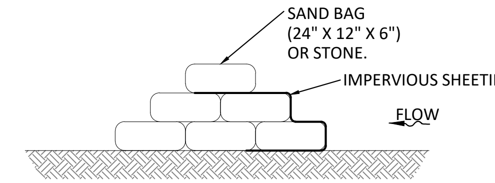
Plan View



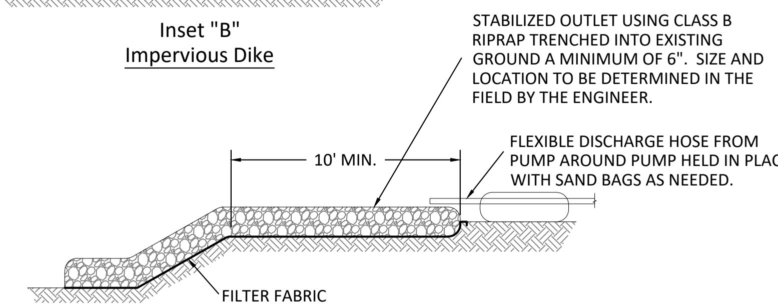
Inset "A"
Dewatering Bag

NOTE:

1. PROVIDE STABILIZED OUTLET TO STREAMBED.



Inset "B"
Impervious Dike



Inset "C"
Stabilized Outlet

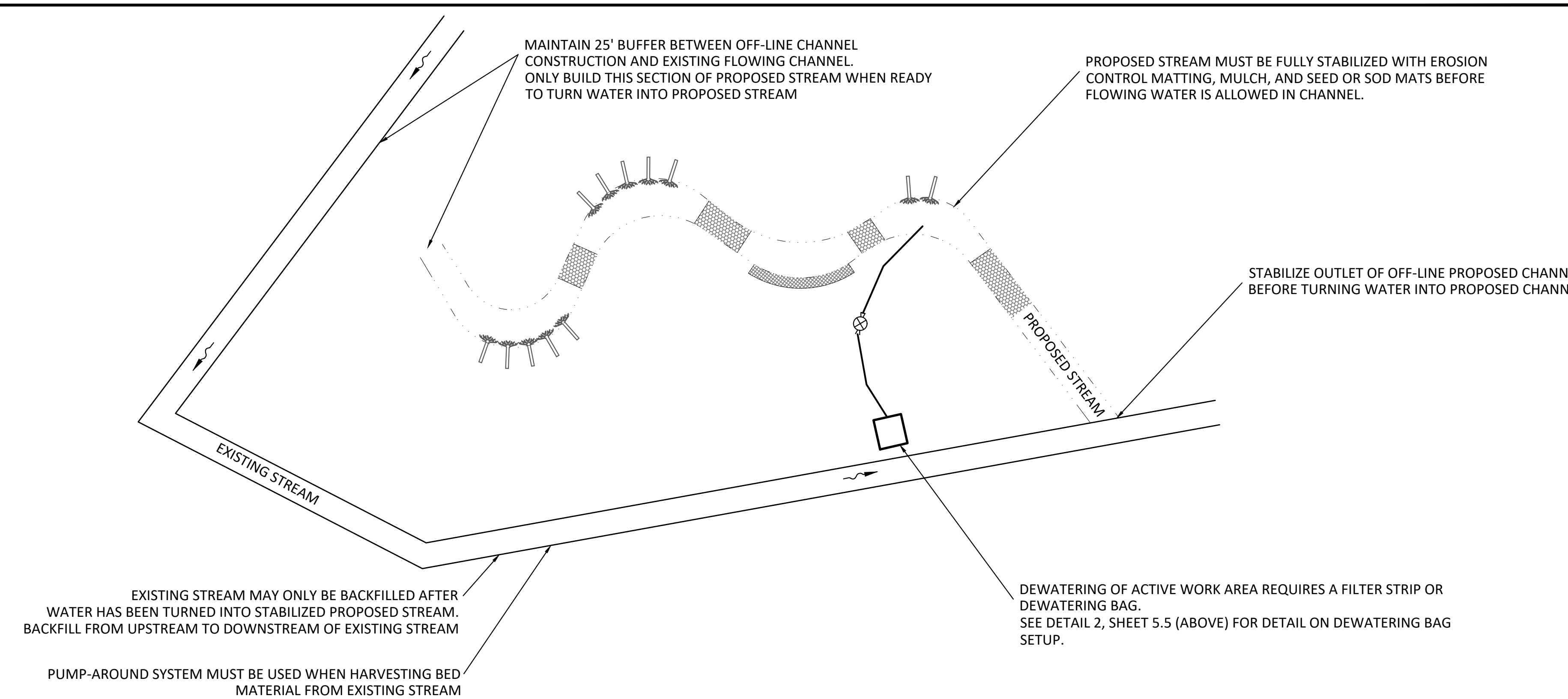
2
6.5
Pump Around System
Not to Scale

SURFACE WATER DIVERSION SEQUENCE:

1. IMPLEMENT SURFACE WATER DIVERSION WHERE REQUIRED BY THE SPECIFICATIONS OR AS DIRECTED BY THE DESIGNER.
2. IDENTIFY THE EXPECTED ACTIVE WORK AREA OF THE STREAM FOR EACH WORK DAY. THE CONTRACTOR SHALL DISTURB ONLY AS MUCH CHANNEL AS CAN BE STABILIZED WITH SEEDING, MULCH, AND EROSION CONTROL MATTING BY THE END OF EACH WORK DAY.
3. CONSTRUCT OFF-LINE CHANNEL ACCORDING TO THE PLANS AND IN THE DRY WHILE WATER CONTINUES DOWN THE EXISTING STREAM. USE CARE NEAR ACTIVE STREAM TO PREVENT SEDIMENT SPILLAGE INTO STREAM. MAINTAIN 25' BETWEEN THE BEGINNING OF ACTIVE CONSTRUCTION AND THE UPSTREAM TIE OUT POINT UNTIL SECTION OF PROPOSED OFF-LINE STREAM IS FULLY CONSTRUCTED AND STABILIZED.
4. IDENTIFY WHERE OFF-LINE PORTION OF STREAM WILL TIE BACK INTO THE EXISTING DITCH/STREAM. PROCEED WITH OFF-LINE CONSTRUCTION UNTIL REACHING THIS DOWNSTREAM TIE OUT POINT. CONSULT DESIGNER OR CONSTRUCTION SEQUENCE TO DETERMINE TIE OUT POINTS. STABILIZE THE DOWNSTREAM TIE OUT POINT.
5. HARVEST MATERIAL FROM EXISTING DITCH/STREAM BY UTILIZING THE PUMP-AROUND SYSTEM DETAIL (DETAIL 2, SHEET 6.5). APPLY HARVESTED MATERIAL TO PROPOSED STREAM.
6. WHILE STILL PUMPING AROUND, CONSTRUCT THE LAST 25' OF PROPOSED STREAM TO COMPLETE THE UPSTREAM TIE OUT TO THE EXISTING DITCH/STREAM.
7. AFTER WATER HAS BEEN TURNED INTO PROPOSED STREAM, BEGIN BACKFILLING EXISTING STREAM FROM UPSTREAM TO DOWNSTREAM.

NOTES:

- ACTIVE WORK AREAS THAT ARE OFF-LINE MUST BE DEWATERED USING A GRASSED FILTER STRIP OR DEWATERING BAG.
- SURFACE WATER DIVERSION MAY ONLY BE USED IN LOCATIONS WHERE PROPOSED STREAM IS FULLY OFF-LINE OF EXISTING STREAM



3
6.5
Surface Water Diversion
Not to Scale

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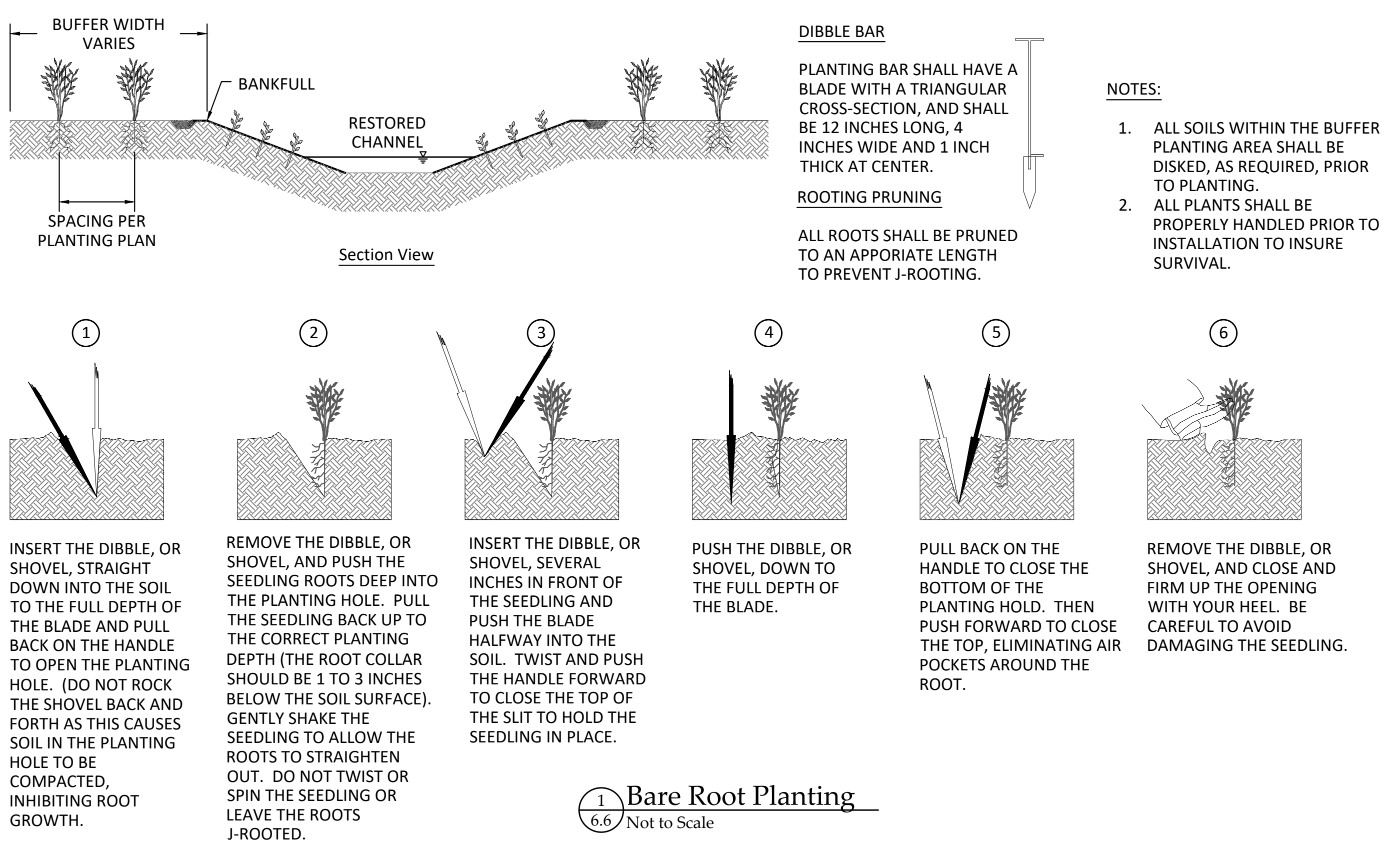
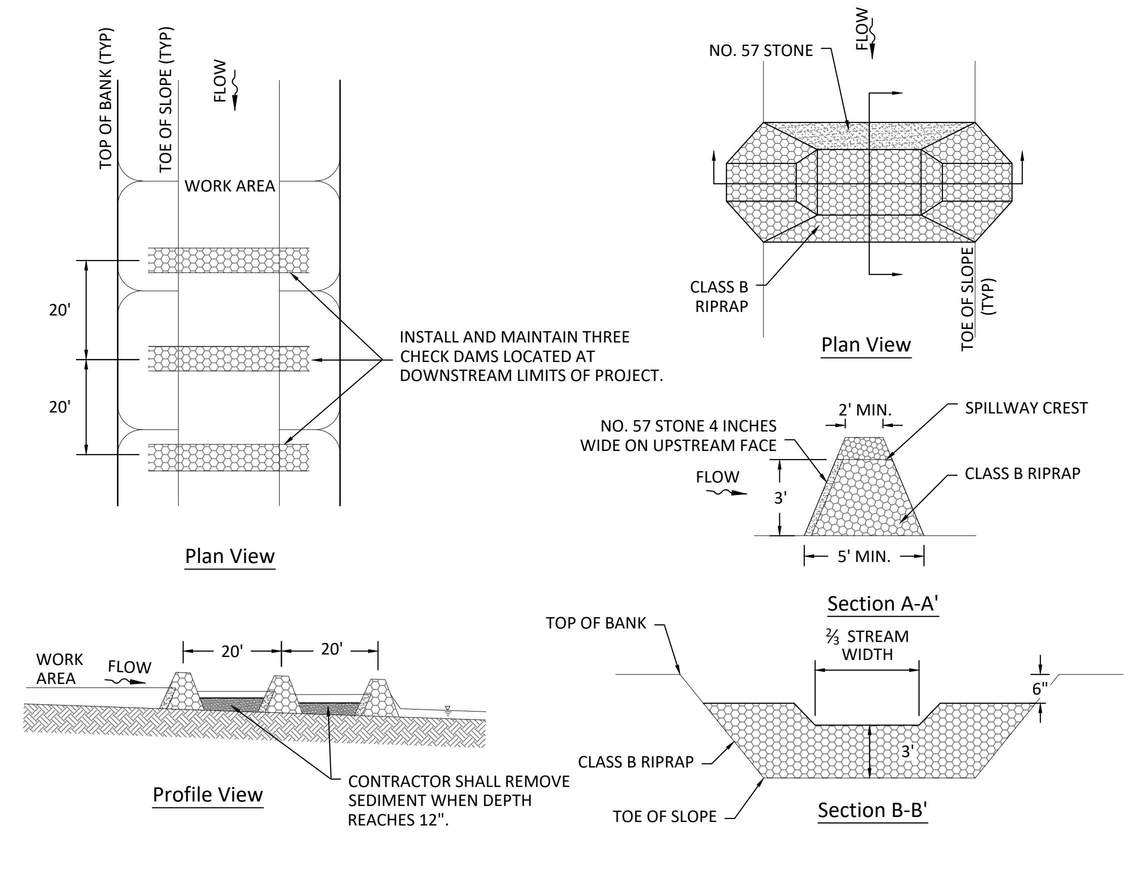
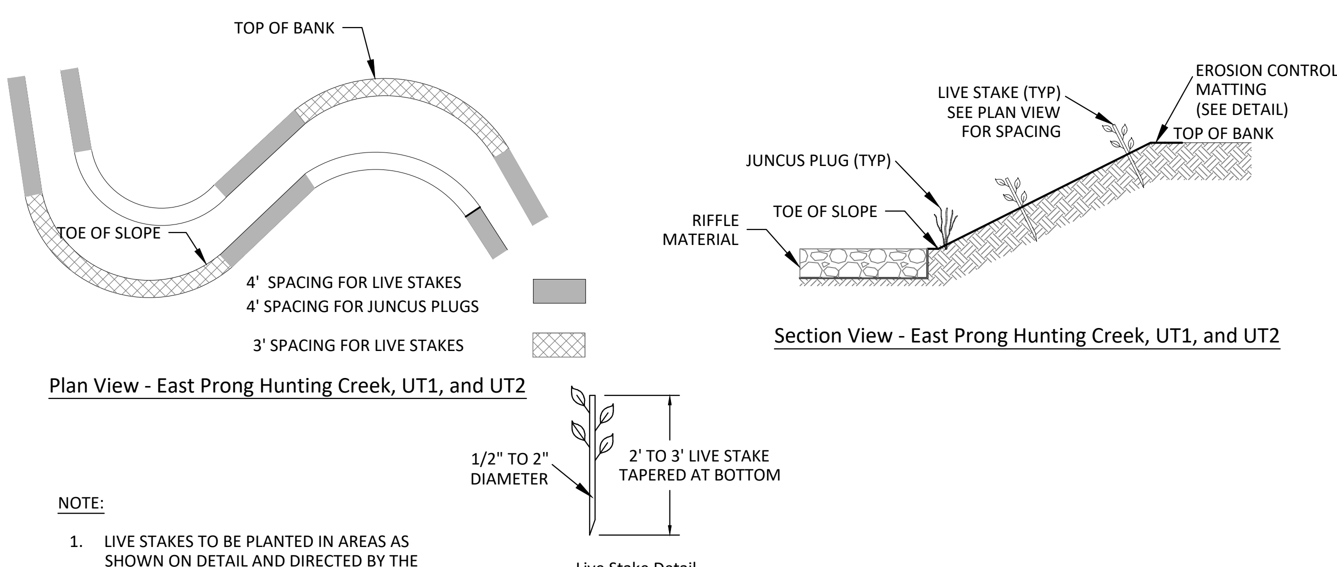


1/6.6 Bare Root Planting
Not to Scale



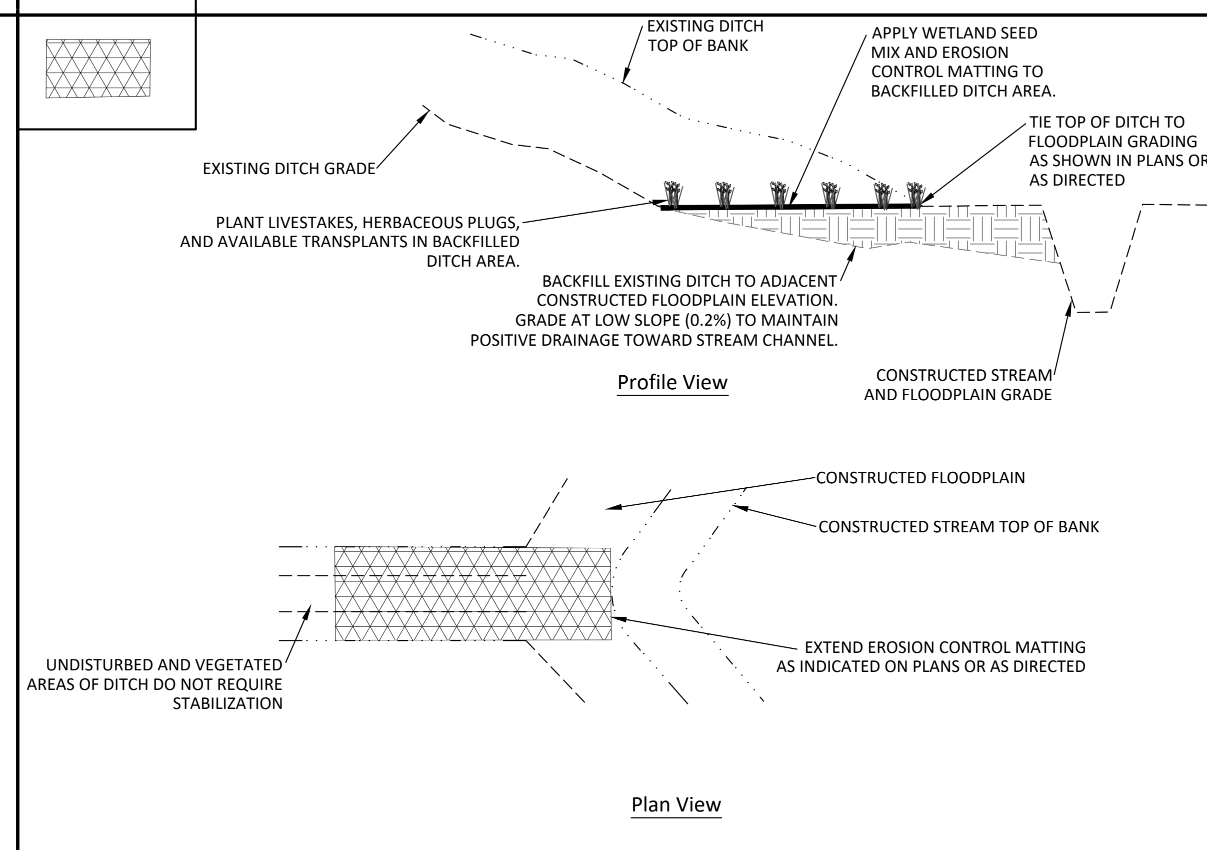
2/6.6 Temporary Rock Sediment Dam
Not to Scale



NOTE:

1. LIVE STAKES TO BE PLANTED IN AREAS AS SHOWN ON DETAIL AND DIRECTED BY THE ENGINEER.

3/6.6 Streambank Planting
Not to Scale



4/6.6 Outlet Stabilization
Not to Scale

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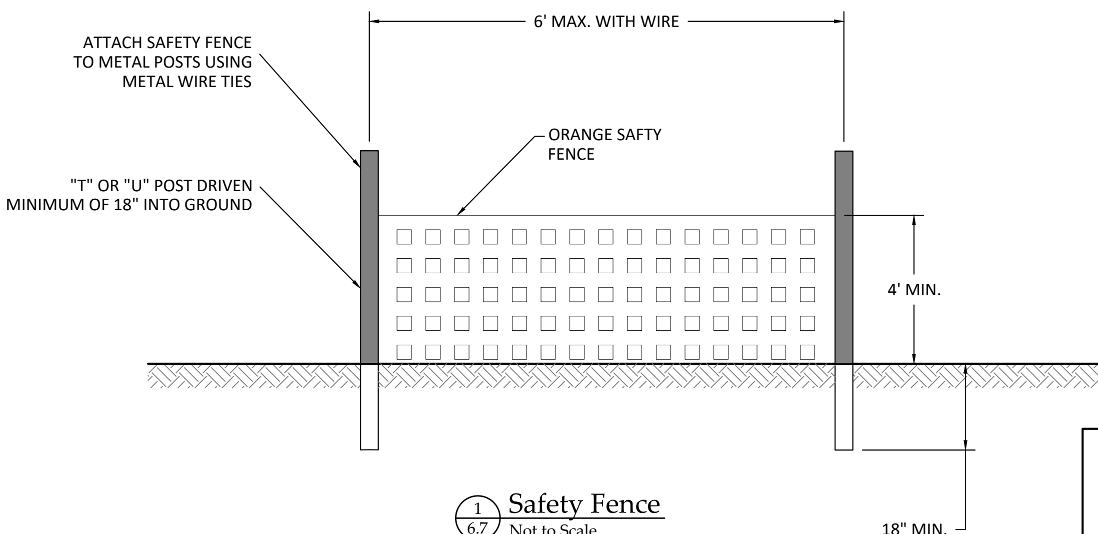
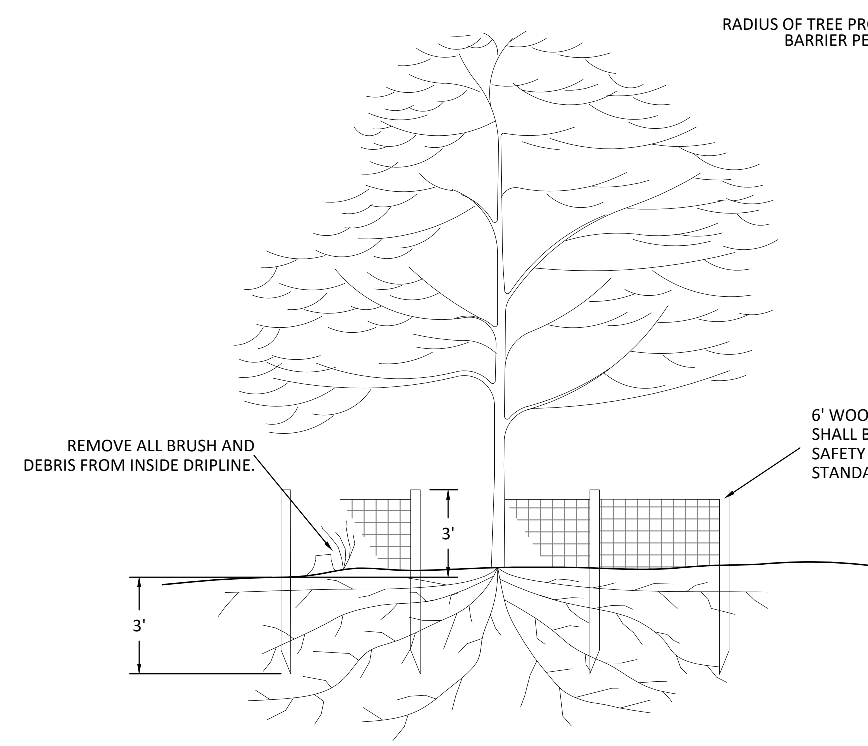
MATERIAL SPECIFICATIONS		
PHYSICAL PROPERTY	TESTS	REQUIREMENTS
MATERIAL	N/A	POLYETHYLENE
RECOMENDED COLOR	N/A	"INTERNATIONAL ORANGE"
TENSILE YIELD	ASTM D638	AVE. 2000 LBS. PER 4' WIDE
ULTIMATE TENSILE STRENGTH	ASTM D638	AVE. 2900 LBS. PER 4' WIDE
ELONGATION AT BREAK (%)	ASTM D638	GREATER THAN 1000%
CHEMICAL RESISTANCE	N/A	INERT TO MOST CHEMICALS AND ACIDS

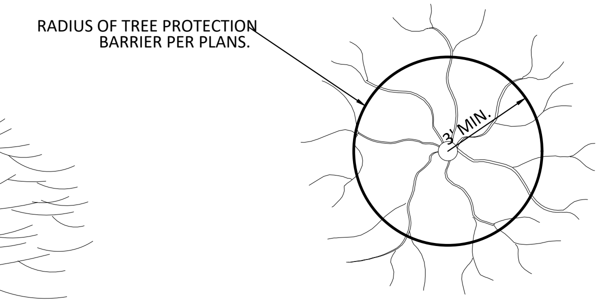


1 / 6.7 Safety Fence
Not to Scale

SAF



Section View

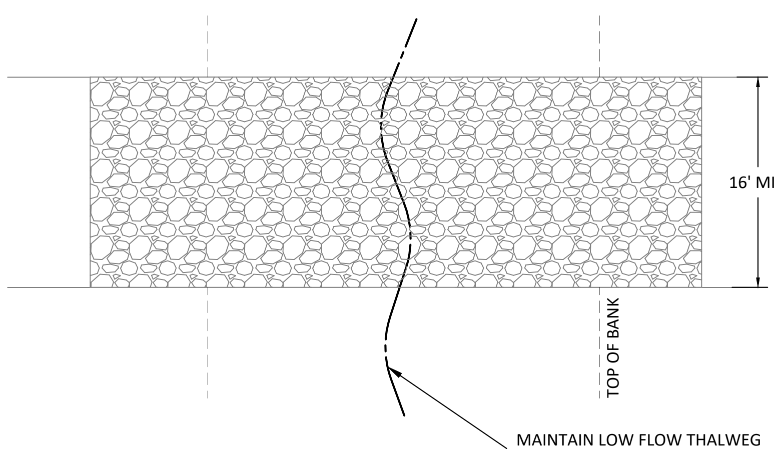


Plan View

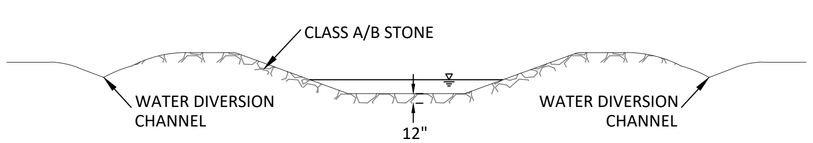
NOTES:

1. ALL TREE PROTECTION BARRIERS SHALL BE REMOVED PRIOR TO CONTRACTOR DEMOBILIZATION.
2. SEE PLANS FOR LOCATION OF ALL TREE PROTECTION BARRIERS.

2 / 6.7 Tree Protection
Not to Scale



Plan View



NOTES:

1. FORD CROSSING SHALL BE INSTALLED PERPENDICULAR TO CHANNEL BANKS.
2. MAINTAIN DIVERSION CHANNEL TO INSURE RUNOFF DOES NOT ENTER CHANNEL.
3. CONTRACTOR SHALL DISCUSS APPROPRIATE FORD DIMENSIONS WITH DESIGNER.

3 / 6.7 Temporary Stream Crossing - Ford
Not to Scale

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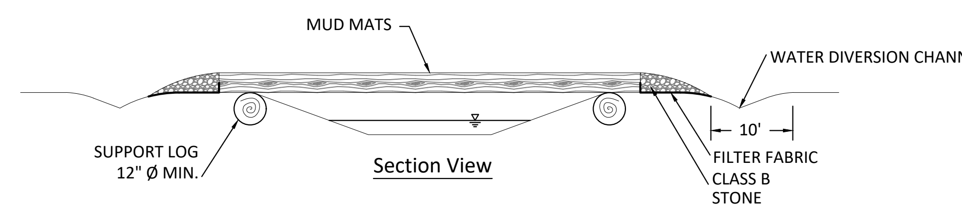
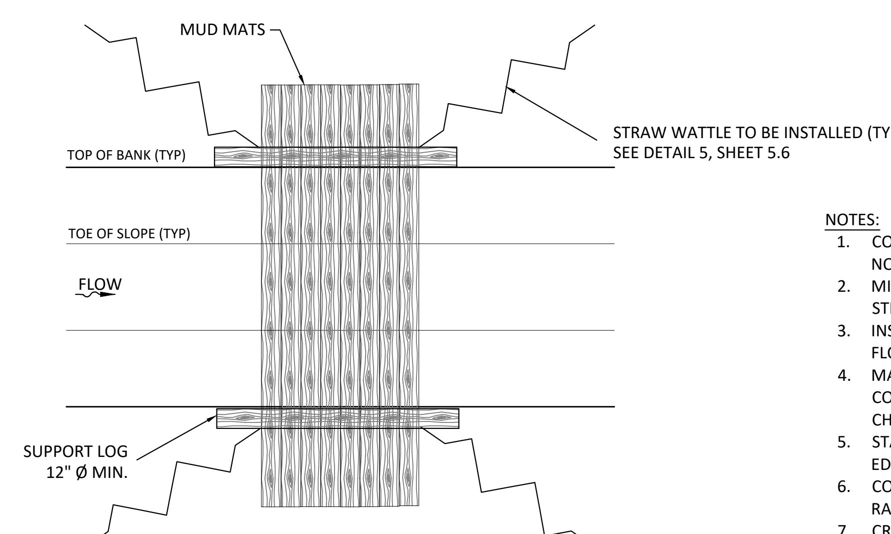


Section View



Plan View

NOTES:

1. CONSTRUCT STREAM CROSSING WHEN FLOW IS AT NORMAL BASEFLOW.
2. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM.
3. INSTALL STREAM CROSSING PERPENDICULAR TO THE FLOW.
4. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
5. STABILIZE AN ACCESS RAMP OF CLASS B STONE TO THE EDGE OF THE MUD MAT.
6. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.
7. CROSSINGS SHOULD BE MONITORED TO ASSURE CORRECT FUNCTIONING OF MATS, LOOKING FOR ANY DEFECTS OR STRUCTURAL PROBLEMS.
8. CROSSINGS COVERED IN SOIL OR DEBRIS SHOULD BE CLEANED AND THE MATERIALS REMOVED AND DISPOSED OF IN A STABLE LOCATION.

4 / 6.7 Temporary Stream Crossing - Timber
Not to Scale

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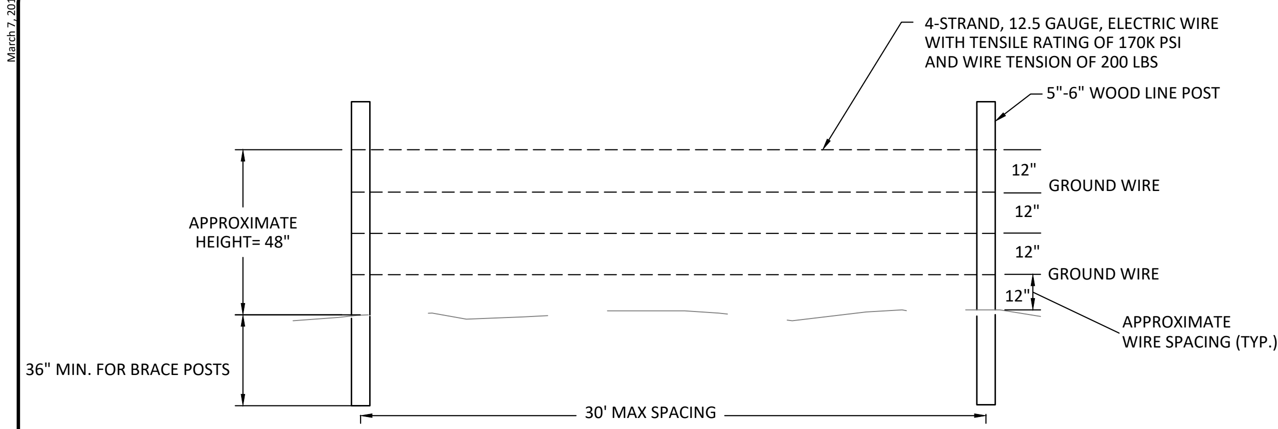
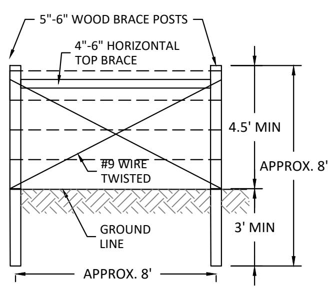


TYPICAL FENCING



H-BRACE OR GATE BRACE

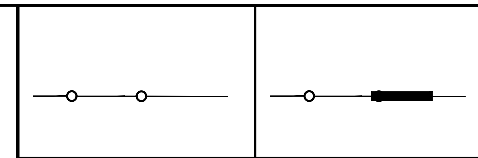
NOTES:

1. WIRE SHALL BE 12.5 GAUGE, CLASS 3 GALVANIZED ZINC (ASTM-116 STANDARD) WITH 170,000 PSI TENSILE STRENGTH. WIRE SHALL BE INSTALLED ON THE LIVESTOCK SIDE OF THE FENCE.
2. LINE POSTS SHALL BE 5"-6" PRESSURE TREATED WOOD WITH A MAXIMUM SPACING OF 30 FEET AND A MINIMUM POST HEIGHT OF 68".
3. BRACE POSTS SHALL BE 5"-6" PRESSURE TREATED WOOD AND SET 36" INTO THE GROUND. HORIZONTAL BRACE POSTS SHALL BE 4"-6" PRESSURE TREATED WOOD. BRACING SHALL BE ACCORDING TO THE TABLE BELOW:

PULL DISTANCE	END/CORNER/GATE BRACE SPECIFICATION	INLINE BRACE SPECIFICATION
< 660 FEET	SINGLE H OR SINGLE DIAGONAL ASSEMBLY	NOT REQUIRED
660 - 2,000 FEET	SINGLE H OR SINGLE DIAGONAL ASSEMBLY	SINGLE H OR SINGLE DIAGONAL ASSEMBLY
> 2,000 FEET	DOUBLE H OR DOUBLE DIAGONAL ASSEMBLY	SINGLE H OR SINGLE DIAGONAL ASSEMBLY

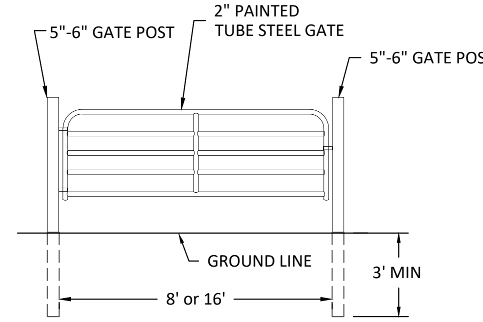
4. REFER TO THE SPECIFICATIONS FOR MORE INFORMATION ON FENCING.

1 / 6.8 High Tensile Electric Wire Fence
Not to Scale

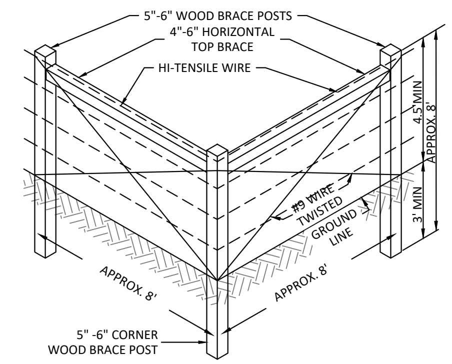


FENCE TO BE INSTALLED BY PROPERTY OWNER

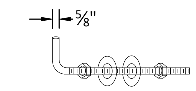
FENCE TO BE INSTALLED BY PROPERTY OWNER



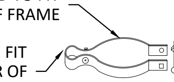
Access Gate



CORNER BRACE
USE WHEN CORNER ANGLE IS 15° OR GREATER



Bolt Hinge
(2 Required)



Hinge Clamp
(2 Required)

NOTES:

1. DIMENSIONS SHOWN ARE THE DIAMETER OF ROUND POSTS AND BRACES.
2. NOTCH BRACE POSTS 1" MINIMUM FOR HORIZONTAL BRACES. PLACE TWO GALVANIZED 12d OR THREE GALVANIZED 10d NAILS AT EACH END OF ALL BRACES.
3. PLACE THE BRACE WIRE AROUND THE POST. DRAW ALL BRACE WIRE TAUT BY RATCHETING BETWEEN EACH POST.
4. INSTALL THE FENCE FACING THE PROPERTY OWNER EXCEPT THAT ON HORIZONTAL CURVES GREATER THAN THREE DEGREES (3°) INSTALL THE FENCE TO PULL AGAINST ALL POSTS.
5. USE LATCH DEVICE APPROVED BY THE ENGINEER. HINGE ASSEMBLY AS SHOWN IS SUGGESTED. SUBSTITUTION MAY BE SUBJECT TO APPROVAL BY THE ENGINEER. USED 2" PAINTED STEEL PIPE FOR GATE FRAME EXCEPT AS SHOWN HERE.
6. ANY COMBINATION OF GATE AND FENCE TYPE MEETING THE APPROVAL OF THE ENGINEER IS ACCEPTABLE AND IS NOT LIMITED TO THE EXAMPLES SHOWN HEREON.

2 / 6.8 Tubesteel Gate
Not to Scale

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