

# MITIGATION PLAN

## LAUREL SPRINGS SITE

Avery County, North Carolina

DMS Project ID No. 100122

Full Delivery Contract No. 7890

USACE Action ID No. SAW-2019-00835

DWR Project No. 2019-0865

RFP No. 16-007725 (Issued: 11/13/2018)

French Broad River Basin

Cataloging Unit 06010108



**Prepared for:**

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

**February 2021**



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

February 11, 2021

Regulatory Division

Re: NCIRT Review and USACE Approval of the NCDMS Laurel Springs Mitigation Site / Avery Co./ SAW-2019-00835/ NCDMS Project # 100122

Mr. Tim Baumgartner  
North Carolina Division of Mitigation Services  
1652 Mail Service Center  
Raleigh, NC 27699-1652

Dear Mr. Baumgartner:

The purpose of this letter is to provide the North Carolina Division of Mitigation Services (NCDMS) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day comment period for the Laurel Springs Draft Mitigation Plan, which closed on January 10, 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 call me at 919-554-4884, ext 60.

Sincerely,

Kim Browning  
Mitigation Project Manager  
*for* Ronnie Smith, Deputy Chief  
USACE Regulatory Division

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List  
Paul Wiesner—NCDMS  
JD Hamby, Raymond Holz—RS



## Response to IRT Comments

DMS Project ID No. 100122  
Full Delivery Contract No. 7890  
USACE Action ID No. SAW-2019-01732  
DWR Project No. 2019-0865  
RFP No. 16-007725 (Issued: 11/13/2018)

### Comments Received (Black Text) & Responses (Blue Text)

#### ***WRC Comments, Andrea Leslie:***

1. 9.6 acres of wetland reestablishment and rehabilitation are proposed, and the majority of our comments focus on the planting strategy for this area.  
[Understood.](#)
2. The natural communities document used is the 3rd approximation (Classification of the Natural Communities of NC, Schafale and Weakley, 1990). There is a more recent document – the 4th approximation (Guide to the Natural Communities of NC, Schafale, 2012) that is more appropriate to use when identifying natural community types. Please note this for the future.  
[We will use the 4th approximation in the future.](#)
3. We are glad to see that two nearby wetland communities were identified as references. The plan notes that these are freshwater marshes, and species found at these sites are listed in Table 11, titled “Freshwater Marsh Ecosystem”. However, both woody and herbaceous species are included in the list. Please clarify if the list of species in Table 11 are those found at the reference sites; if so, it seems that these sites are not freshwater marshes but more complex communities. In addition, the text notes that plants in Table 11 will be used within the permanent seed mix for stabilization. Are the woody plants to be used for the site as well?  
[Section 4.3 and Table 11 have been changed to swamp forest-bog complex. In addition, verbiage in this section has been changed accordingly. A note was added indicating that herbaceous species in Table 11 will be included in the permanent seeding mix for stabilization.](#)
4. A ‘reference forest ecosystem’ (RFE) was used for the site, based on a forest in Stone Mountain State park, 53 miles from the site. We question if this reference is applicable for the site, as it is so far away from the project site and many of the RFE species are strictly upland species. Does the RFE occur in a similar broad floodplain setting?  
[The RFE is in a similar setting as the Site and has similar species expected to occur at the Site. Upland species were found on the margins of the Site in dry areas and will be planted accordingly.](#)
5. The planting list specifies 3 community types – acidic cove forest, montane alluvial forest, and streamside assemblage. Montane alluvial forest is specified for most of the proposed wetland area, with the exception of 20% of the wetland to be seeded in herbaceous and shrub species. Many of the species included in the montane alluvial forest are clearly upland species – e.g., white oak, white pine, red spruce. These and additional species specified may not withstand a hydroperiod of 12% (the wetland hydrology success criterion) or more. Given that the baseline well monitoring data already shows some sustained soil saturation and drain tile removal will further wet the site, we believe that the site has good potential to be very wet. We recommend reevaluating the community types and plant species specified for the wetland restoration area. Should a swamp forest bog system be more dominant on the site?  
[The planting list has been updated to include a diverse assemblage of species that may be more suitable for the wetland setting proposed at the Site.](#)



6. Please note that sycamore and river birch are more typical of larger stream systems; we recommend eliminating these species in favor of other species more typical of smaller systems (please use local references to inform the planting list). As much of the Eastern hemlock specimens across western NC are infected with hemlock wooly adelgid, we recommend limiting the number planted to 5% or less.  
Eastern Hemlock has been reduced to 2-3% of the planting in each zone. Sycamore and river birch are suitable for the Site, as Fork Creek is a relatively large stream system.
7. The shrubby herbaceous openings that are projected to become swamp forest bog are only being seeded with herbaceous and shrub seed. We recommend including some bare root or containerized plantings of woody species. Presumably, these openings would be in wetter areas on the site, but their placement is not at topographic low points; instead, there seems to be no difference topographically between where they are placed and the surrounding montane alluvial forest.  
The entire Site will be planted with woody bare root seedlings and the herbaceous openings are expected to develop naturally. Herbaceous species will be broadcast throughout the Site as part of the permanent seed mix.
8. We recommend that additional mid-story species be added to the planting list, as Amelanchier is the only lower story species included.  
Tag alder, buttonbush, elderberry, and silky dogwood have been added to the planting list as a lower story species. As shrubs are not included in the success criteria, understory species are expected to develop naturally over time.

We recommend eliminating the dissipator pad specified on page C8.09 in favor of an armored scour hole. Please note that C8.09 notes that specifications for the dissipator pad are included on C8.08, but they are not there.

The UT2 outlet dissipation device on sheet C8.09 has been revised from a typical riprap pad to a rock lined scour hole.

**DWR Comments, Erin Davis:**

1. Page 1, Section 1.3 – Please include a discussion of past/historic onsite and adjacent area land use.  
A paragraph has been added to this section to include the following. “Watershed and Site land use has remained consistent since 1993. Streams and wetlands were altered, and pastureland was grazed. Watershed land use has remained agricultural in nature, with sparse residential development in the low, lying areas. At the Site, a residence was constructed in 1994, with a driveway crossing installed across Fork Creek and barn established in the floodplain. Land use at the Site is characterized by disturbed forest and livestock pasture. Riparian zones are primarily composed of herbaceous vegetation that is sparse and disturbed due to livestock grazing, bush hogging, and regular land-management activities.”
2. Page 7, Section 2 – This section mentions potential development trends and land use changes. Have local/regional agencies and/or planning documents been consulted? Are there any anticipated land use changes adjacent to the project site?  
Other than the IRT, the only additional planning documents obtained for the Site revolved around mining rights. Mining rights have been purchased for the property. No additional changes to the Site, or adjacent properties are expected at this time.
3. Page 8, Section 3 – Please include a subsection on existing vegetation cover. Only 16.2 acres of the 29.19-acre easement is proposed for planting and “disturbed forest” was mentioned under land use. Please include a list of invasive species observed onsite.  
A section for existing vegetation, including invasive species has been added to the document as Section 3.2.
4. Page 11, Section 3.5 – Please provide more detail on existing stream conditions. While Table 4 provides an overall summary, it doesn’t identify why multiple approaches are proposed for each stream (e.g. UT3 broken into four reaches ranging from restoration to preservation quality).  
Two pages of text, with photographs were added to describe each individual reach.

5. Page 11, Section 3.5.2 – Are all site reaches classified as unstable? Also, reach substrate ranges from sand to what?  
Approximately 47 percent of the Site reaches are unstable (See description in the above section. Substrate descriptions are described in the added text.
6. Page 14, Section 3.6.3 – Please provide a brief description of the wetland preservation area.  
A paragraph was added with the following text. “Wetland preservation areas are located on slopes adjacent to the Fork Creek floodplain and are characterized by three distinct locations including 1) spring/seeps, 2) channel depressions, or 3) depressions adjacent to stream channels. Wetlands vary in vegetative structure between mature forest and disturbed herbaceous/shrub scrub assemblage. Wetlands in mature forest are generally in channel, or spring head in nature and frequently have cobble substrate with emergent vegetation interspersed between and around cobble material. Wetland preservation areas in maintained vegetative communities are located adjacent to channels, or spring heads and have sand/silt substrate with herbaceous to shrub scrub vegetation. Herbaceous vegetation is primarily characterized by rushes (*Juncus* sp.) and shrub scrub vegetation is frequently characterized by invasive species such as Chinese privet (*Ligustrum sinense*) and rose (*Rosa multiflora*). It should be noted that wetland preservation areas are non-credit generating and are proposed for enhance stream buffer credit.”
7. Page 18, Section 7 – DWR considers easement breaks as project constraints to be listed in this section as they fragment the project site and reduce the potential uplift. DWR appreciates that the utility corridor and road crossing were collocated to a single easement break, and that a setback for potential future DOT roadway maintenance was a planning consideration.  
A paragraph has been added to the document including the following text. “Three conservation easement breaks occur to allow access to portions of the Site isolated by the easement. Two of the breaks will have road crossings and a third is power line easement break. Care was taken to move a powerline into one of the road crossings to minimize impacts associated with the easement break. In addition, a setback for potential future DOT road maintenance was incorporated into the road crossings. Easement breaks do constitute a significant reduction of functional uplift at the Site.”
8. Page 24, Section 8.1.1 – Areas of good instream habitat were noted during the 2019 IRT site walk. Can you briefly discuss if/how you will be relocating and reusing onsite bed material.  
A paragraph has been added to the document including the following text. “It should be noted that some portions of the restoration and enhancement (level I) reaches are characterized by suitable bed material. Seeding the newly restored/enhanced reaches with on-site bed material provides the channel with appropriate bed material and benthic macroinvertebrates. Channels are to be constructed in the dry, with pump around or construction on new location. Once the channel has been constructed, suitable bed material from the abandoned channel will be seed into the newly constructed channel in a timely manner.”
9. Page 25, Marsh Treatment Area – Please confirm that no long-term maintenance is needed for this feature. Also, if feasible please discuss alternatives to a riprap outlet.  
A sentence was added to indicate that no long-term maintenance is required for these features of the project. In addition, options for other suitable material were included as (log sills, woody debris, or riffle bed material).
10. Page 25, Drop Structure – Please finalize the structure design in order to eliminate the “may be” in the final mitigation plan. Please make sure the description matches both Detail Sheet C8.03 and Figure 8B.  
The term “may” was changed to “will”. In addition, Figure 8B has been removed from the document. Text in the document refers to the construction plans Attached in Appendix L.
11. Page 27, Section 8.3 – Is any wetland grading proposed? If so, please identify areas that will be excavated beyond 12 inches. Also, ephemeral pools are noted in the text but not shown on the draft design sheets. If construction of ephemeral pools is proposed, a typical detail (with max. depth indicated) and approximate locations should be included in the final mitigation plan.  
No wetland grading is proposed. Wetlands will be restored/enhanced by backfilling ditches and conducting priority 1 stream restoration.

12. Page 27, Section 8.4 – DWR appreciates the inclusion of this subsection, but requests a sentence addressing soil compaction.  
A sentence was added indicating that areas of soil compaction would be deep ripped prior to Site planting.
13. Page 28, Table 18 –
  - a. Please check botanical name spelling and be consistent with common names (e.g. serviceberry/shadbush, sweet birch/cherry birch). It would be helpful to include a column with the wetland indicator status. Also, please indicate if any of the species will be installed as live stakes.  
Table 18 has been updated with indicator status. Common names have been reviewed, however, please note that scientific names are to be used for project purposes and common name are provided for discussion purposes.
  - b. DWR appreciates the species diversity provided, both in incorporating RFE species and not exceeding 20 percent per species in each planting zone. It appears the 9-acre Montane Alluvial Forest planting zone overlaps the 9.8 acres of proposed wetland area. Is this community type characteristic for wetland habitat? We question the appropriateness of planting white pine in a wetland restoration area. Also, we request that hemlock be capped at 5% due to woolly adelgid concerns with potential tree mortality. And were woody stem plantings of shrub species considered for the site?  
The planting list has been updated such that Eastern hemlock (*Tsuga canadensis*) is limited to 2 and 3 percent of each planting zone. Alluvial forest does overlap with wetland zones, as would be expected in an alluvial setting. The mix of species from FACU to OBL species ensures that various hydrologic settings across the floodplain are covered with the appropriate species. In addition, shrub species have been added to the planting table.
14. Page 29, Section 8.5.2 – DWR appreciates the discussion of the potential herbaceous dominated wetland. DWR generally supports mosaic communities, if appropriate for the site and with an area cap (which was noted at 20 percent). Please confirm whether the seed mix provided will be applied site wide. If not, please include a separate riparian seed mix for less saturated wetland and upland areas in the final plan.  
We do not intend to have a separate riparian seed mix. The riparian seed mix will be included in the permanent seed mix to be distributed Site wide.
15. Page 29, Section 9 – DWR recommends adding a sentence to this section stating that success criteria and monitoring will be completed in accordance with the 2016 NCIRT Guidance.  
A sentence has been added at the beginning of Section 9 indicating that “Monitoring and success criteria has been developed in accordance with 2016 NCIRT guidance.”
16. Page 31, Table 21 –
  - a. Please clarify that the wetland hydrology is an annual criterion.  
The sentence has been changed to read “Annual saturation or inundation within the upper 12 inches....”
  - b. DWR requests a species diversity success criterion for areas that establish as herbaceous dominated wetland areas.  
A sentence in the vegetation success criteria has been added to indicate the following. “Areas of herbaceous vegetation establishment will have a minimum of three species present.”
17. Page 30, Table 20 – Please confirm whether the one surface water gauge and one crest gauge proposed is the same monitoring device/location.  
The crest gauge and surface water gauges are the same monitoring device/location.
18. Page 31, Section 9.2 – DWR appreciates the inclusion of this section, especially the site specific detail provided for easement encroachment. Please note that some of the listed actions will require IRT review as adaptive management and may need USACE/DWR permit authorizations.  
A sentence was added to the document that reads as follows. “It should be noted that some aspects of adaptive management may require IRT review and USACE/DWR permit authorizations.”

19. Page 33, Section 9.2.2 – As noted, IRT consultation and approval will be necessary if any future earthwork is proposed. Depending on the depth of proposed ephemeral pools, the credit ratio may change to reflect wetland creation.  
[These statements have been added to Section 9.2.2.](#)
20. Page 33, Section 9.2.3 – Again, DWR appreciates this discussion. We recommend an additional sentence addressing any identified cause for observed veg issue(s) (e.g. beaver trapping, soil amendments).  
[The following was added to Section 9.2.3, “Possible scenarios which could cause the implementation of supplemental planting are beaver activity \(which would require trapping and removal of beavers\) and poor soil quality \(which may require the application of soil amendments\).”](#)
21. Page 35, Section 10 – Please specify DMS as the point of contact to notify the IRT of any site issues.  
[DMS has been listed as the point of contact.](#)
22. Figure 4 – Please shown existing utility lines. Also, can a property boundaries layer please be added to this figure or another figure.  
[Utility lines and property boundaries have been included on Figure 4.](#)
23. Figure 8A – Please make sure information provided in figures is consistent with design sheets (e.g. log vane detail).  
[Typical Details \(Figure 8A-8C\) have been removed from the detailed restoration plans. Descriptions of typical details \(e.g. log vanes\) now reference the construction plans in Appendix L.](#)
24. Figure 8C, Reinforced Riffle Step – Please identify where this feature is proposed on the plan view drawings. Please specify stone size. And what necessitates stone placement to top of bank? DWR is concerned whether bank armoring is warranted.  
[See reply to question 23 above.](#)
25. Figure 9 – DWR appreciates the level of detail provided with multiple planting zones. [Thank you.](#)
26. Figure 10 – DWR requests a minimum of two veg plots within the mapped potential freshwater marsh areas. DWR requests the UT2 downstream cross section be shifted south due to concerns of UT2 maintaining channel features within the Fork Creek floodplain. Also, please label reaches.  
[Two vegetation plots have been moved to the potential freshwater marsh areas. Please keep in mind that the potential freshwater marsh areas are expected to develop naturally, and the polygons depicted on the Monitoring Plan may not reflect the actual areas of freshwater marsh development. Cross sections on UT 2 have been moved downstream, as requested. Also, reaches have been labeled.](#)
27. Figures – DWR would welcome the inclusion of LiDAR and historic aerial figures, as well as drone and ground photos of existing site conditions. All of these items are helpful in our review.  
[A Lidar figure was added to the appendix as Figure 11.](#)
28. Appendix B –
  - a. Please include available pre-construction groundwater well data in the final plan.  
[Preconstruction groundwater gauge data has been added to Appendix B data.](#)
  - b. In the future, DWR would like more detail included in the site soil investigation, including a map indicating all soil check locations. (Note that Appendix D did not include wetland determination forms with soil data.)  
[Understood.](#)
29. Detail Sheets – Please add typical details for (1) bare root & live stake planting and (2) channel/ditch backfill & plugs. If partial backfilling is proposed, please specify the max depth from ground surface to fill. For channel plugs, please specify the minimum length.  
[Details for bare root and live stake planting have been added, see sheet L5.01. Channel plug details have been added and minimum length of 20’ has been specified, see sheet C6.13.](#)

30. Sheet C8.07, Marsh Treatment Area – Please provide the max. depth proposed for the deep pools. Please provide stone size and percent composition of riprap outlet, if an alternative non-hardened stabilized outlet is not feasible.  
Target depth of shallow pools within marsh treatment areas has been specified on the detail on sheet C8.07.
31. Sheet C8.09 – Please clarify whether the proposed aluminum box culvert will be a bottomless span, as called out on Sheet C5.01.  
The Fork Creek crossing will use a full invert aluminum box culvert that will be embedded a minimum of 1' as shown on C8.08.
32. Sheet C8.11 –
  - a. Please confirm the temporary seed species are annual rye and winter wheat.  
Temporary seed species are annual rye and winter wheat, sheet L5.02 has been updated.
  - b. Under construction sequence note #22, does stabilization include soil de-compaction and topsoil placement?  
Yes note #27 in the construction sequence on sheet C6.00 refers to vegetation installation per planting notes which describe seedbed preparation measures for permanent seeding.
  - c. Please include the permanent seed mixes.  
Permanent Seed Mixes have been provided on sheet L5.02.
33. General Design – There are no meander bend bank treatments proposed for stabilization or habitat (e.g. brush toe, boulder toe, vegetated/live lift). Are there any concerns about long-term bank stability? Is sufficient instream habitat enhancement expected from proposed step and vane structures?  
No bank stability issues are anticipated. We believe meander bend treatments lead to instability and that within two years adequate root mats, woody debris, and leaf matter develop naturally.
34. Overall, DWR believes this project has the potential for substantial resource functional uplift due in part by the inclusion of wider buffers. Thank you.

**USACE Comments, Kim Browning:**

1. The correct USACE Action ID for this project is SAW-2019-00835. Please correct the cover page.  
The SAW number has been updated on the cover sheet.
2. Figure 10: Please label the reaches.
  - a. At least two freshwater marsh areas should be represented in veg monitoring.  
Two vegetation plots have been moved to the potential freshwater marsh areas. Please keep in mind that the potential freshwater marsh areas are expected to develop naturally, and the polygons depicted on the Monitoring Plan may not reflect the actual areas of freshwater marsh development.
  - b. A flow gauge should be installed on UT2 due to the small drainage area and the concern that this tributary will not maintain channel characteristics. Photo documentation will also be helpful.  
An additional pressure transducer (crest and flow gauge) has been added in the lower reaches of UT 2.
3. Figure 11: Buffer Width Zones- Without being able to review the actual data spreadsheet, it's difficult to determine whether terminal ends were accounted for. In the table provided it appears you used the old version of the buffer tool. The new version allows terminal ends where the project enters or exits the property to be exempt from counting against you. Please re-run the buffer tool to account for the crossing terminal ends, clip creditable wetlands from the actual buffer, and correct the length entered in the spreadsheet. Please provide a printout of the actual spreadsheet. Also, please provide a map that depicts the idea buffers. I'm happy to meet with you if you need additional explanation. Please provide this information for review prior to submitting the final mitigation plan and 404 permit to avoid review delays.  
Files were provided to Kim B. on 02/05/2021. Attached to this comment response is her response, approving the revision.

a. Table 1 should be updated accordingly.

The buffer figure and table has been updated and included in the document and electronic submittal.

4. I appreciate the marsh treatment areas planned; however, these treatment areas should not be placed in existing or proposed wetlands. On Figure 6A it appears that one of these BMPs is located in a proposed jurisdictional area in Wetland GI. Please confirm that these treatment areas will not be constructed in proposed wetlands.

The marsh treatment area in Wetland GI has been removed from the project.

5. Appendix D: Supplemental groundwater gauge data provided January 11, 2021 indicates that gauges 1 & 4 malfunctioned so it's difficult to determine accurate current hydrology conditions, and gauge 3 in Wetland GB currently meets hydrology performance standards with 68 days. Given that wetland gauge 3 already meets hydrology performance standards, rehabilitation is not appropriate in this location since hydrologic functional uplift cannot be demonstrated. Please change this area to wetland enhancement. It's understood that this area is not being proposed for wetland credit and is proposed for buffer credit.

The wetland mitigation approach associated with gauge 3 was changed to enhancement. RS will continue to collect pre-construction wetland data during 2021, and will report all pre-construction gauge data in the Site's As-Built Report. We do expect to see an increase in the hydroperiod around gauge 3 because of the mitigation activities.

6. Section 3.5: This section should be expanded to include a narrative with more detail (similar to the detail given in Table 17) of existing conditions, and broken out to describe each reach separately. Photos of existing conditions would also be beneficial.

Two pages of text, with photographs were added to describe each individual reach.

7. Section 3.6: This section should also be expanded to include a more detailed narrative of existing wetland conditions, particularly those proposed for preservation.

A paragraph was added with the following text. "Wetland preservation areas are located on slopes adjacent to the Fork Creek floodplain and are characterized by three distinct locations including 1) spring/seeps, 2) channel depressions, or 3) depressions adjacent to stream channels. Wetlands vary in vegetative structure between mature forest and disturbed herbaceous/shrub scrub assemblage. Wetlands in mature forest are generally in channel, or spring head in nature and frequently have cobble substrate with emergent vegetation interspersed between and around cobble material. Wetland preservation areas in maintained vegetative communities are located adjacent to channels, or spring heads and have sand/silt substrate with herbaceous to shrub scrub vegetation. Herbaceous vegetation is primarily characterized by rushes (*Juncus* sp.) and shrub scrub vegetation is frequently characterized by invasive species such as Chinese privet (*Ligustrum sinense*) and rose (*Rosa multiflora*). It should be noted that wetland preservation areas are non-credit generating and are proposed for enhance stream buffer credit."

8. Table 14 discusses the functional uplift potential and references NCSAM/WAM, including the water quality and habitat uplift. These are benefits that are presumed and will not be measured by monitoring. Unless you intend to demonstrate actual uplift in these areas, I recommend that this section be reworded that uplift in these areas is implied. It is appreciated that RS used NCSAM/WAM to establish current conditions of the site and the potential for functional uplift.

Table 16 has been updated to depict goals and objectives that can be measured for success. Other functional uplift metrics are described as academically likely areas of functional uplift and are not tied to goals, monitoring, or success criteria.

9. It would be beneficial to add some coarse woody debris to the depressional areas in the buffers and throughout the adjacent wetlands for habitat, and to help store sediment, increase water storage/infiltration, and absorb water energy during overbank events.

Understood.

10. Table 21:

a. The wetland hydrology performance standard should be measured annually.

Wetland hydrology has been updated to read “Yearly with the growing season defined as March 1-October 22.”

b. Any volunteer species on the approved planting list must be established for at least 2 years to count towards success and will be subject to the average height standard.

A note has been added to Table 21 indicating these requirements.

c. Given that 20% of the site is expected to be herbaceous, please add a performance standard proposing a diversity of at least 4 species and over 75% cover.

Vegetation performance standards have added herbaceous vegetation requirements as follows. “Areas of herbaceous vegetation establishment will have a minimum of four species present.”

d. Please add a performance standard that intermittent streams will demonstrate at least 30-days consecutive flow.

This requirement has been added to the table.

11. Section 8.3: Ephemeral pools should be 8-14” depressions that dry up yearly so that predatory species cannot colonize, and should not be so numerous that trees do not grow in large areas of the buffer. Additionally, please indicate the number and location of these areas.

Text referencing ephemeral pools has been removed from the document.

-----Original Message-----

From: Browning, Kimberly D CIV USARMY CESA W (USA) <Kimberly.D.Browning@usace.army.mil>  
Sent: Monday, February 08, 2021 12:42 PM  
To: Kenan Jernigan <kjernigan@axiomenvironmental.org>  
Cc: Ray Holz <rholz@restorationsystems.com>; Grant Lewis <glewis@axiomenvironmental.org>  
Subject: RE: Laurel Springs (SAW-2019-00835) Buffer Calculation

Afternoon guys,

The revision looks good. Hopefully this will help earn some additional credits and encourage wider buffers. When you submit the final, please include the excel spreadsheet with the calculations, the revised map and asset tables, and a map with the ideal buffers.

Thanks

Kim

Kim Browning

Mitigation Project Manager, Regulatory Division | U.S. Army Corps of Engineers

-----Original Message-----

From: Kenan Jernigan <kjernigan@axiomenvironmental.org>  
Sent: Friday, February 05, 2021 3:38 PM  
To: Browning, Kimberly D CIV USARMY CESA W (USA) <Kimberly.D.Browning@usace.army.mil>  
Cc: Ray Holz <rholz@restorationsystems.com>; Grant Lewis <glewis@axiomenvironmental.org>  
Subject: [Non-DoD Source] Laurel Springs (SAW-2019-00835) Buffer Calculation

Hi Kim,

As part of your comments on the Laurel Springs Draft Mitigation Plan, you requested that the additional credit from wider buffers be calculated from the newest version of the buffer tool, which accounts for the terminal ends. I have attached the excel sheet and an updated figure for your review. This is our first shot at using the new tool, and we are happy to discuss any issues at your convenience. Have a nice weekend!

Thanks,

Kenan

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# MITIGATION PLAN

## LAUREL SPRINGS SITE

Avery County, North Carolina

DMS Project ID No. 100122

Full Delivery Contract No. 7890

USACE Action ID No. SAW-2019-00835

DWR Project No. 2019-0865

RFP No. 16-007725 (Issued: 11/13/2018)

French Broad River Basin

Cataloging Unit 06010108

### Prepared for:

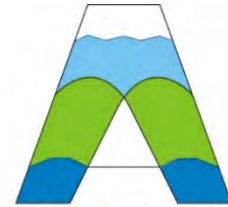
NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY  
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### Prepared by:



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And



Axiom Environmental, Inc.  
Axiom Environmental, Inc.  
218 Snow Avenue  
Raleigh, North Carolina 27603  
Contact: Grant Lewis  
919-215-1693 (phone)

**February 2021**

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

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

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

This document was assembled using the June 2017 DMS Stream and Wetland Mitigation Plan Template and Guidance and the October 24, 2016 NC Interagency Review Team Wilmington District Stream and Wetland Compensatory Mitigation Update.

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## 1. PROJECT INTRODUCTION

The Laurel Springs Stream & Wetland Mitigation Site (hereafter referred to as the "Site") encompasses 29.19 acres of disturbed forest and livestock pasture along cold water Fork Creek and unnamed tributaries to Fork Creek. The Site is located 8 miles southwest of Linville and 7 miles northeast of Spruce Pine in southern Avery County (Figures 1 and 2, Appendix A).

### 1.1 Directions to Site

Directions to the Site from Boone, North Carolina.

- Take NC-105 South and travel 16.9 miles,
- Turn right onto US-221 South, then stay left on US-221 South,
- After 9.3 miles, turn right on NC-194 South,
- After 2.3 miles, turn right onto Little Buck Hill Creek Road,
- The Site is on the right after approximately 0.6 mile.
  - Site Latitude, Longitude  
35.9913°N, 81.9837°W (WGS84)

### 1.2 USGS Hydrologic Unit Code and NCDWR River Basin Designation

The Site is located within the French Broad River Basin in 14-digit United States Geological Survey (USGS) Cataloging Unit and **Targeted Local Watershed 06010108010020** of the Tennessee Region (North Carolina Division of Water Resources [NCDWR] subbasin number 04-03-06) [Figures 1 and 2, Appendix A]. Site hydrology drains to cold water Fork Creek and unnamed tributaries to Fork Creek (Stream Index Numbers 7-2-25-1-(1) & 7-2-25-1-(2)), which have been assigned Best Usage Classifications of **C; Tr & WS-IV; Tr**, respectively (NCDWR 2013). Fork Creek is not listed on the NCDENR final 2016 or draft 2018 303(d) lists (NCDEQ 2018a, NCDEQ 2018b).

### 1.3 Physiography and Land Use

The Site is located in the Southern Crystalline Ridge and Mountains Ecoregion of the Blue Ridge Physiographic Province within Avery County, North Carolina. Regional physiography is characterized by low to high mountains, gently rounded to steep slopes, narrow valleys, and high gradient, bedrock/boulder-bottomed cool, clear streams (Griffith et al. 2002). On-site elevations range from a high of 3076 feet National Geodetic Vertical Datum (NGVD) at to a low of 2912 feet NGVD (USGS Linville Falls, North Carolina 7.5-minute topographic quadrangle) (Figures 1 and 3, Appendix A).

The Site provides water quality functions to an approximately 1.32-square mile (846.7-acre) watershed at the outfall; Site tributary watershed sizes range from 0.02-0.30 square miles (11.9-193.4 acres) (Figure 3, Appendix A). The watershed is dominated by pasture, forest, and sparse residential development. Impervious surfaces account for less than 2 percent of the upstream watershed land surface.

Watershed and Site land use has remained consistent since 1993. Streams and wetlands were altered, and pastureland was grazed. Watershed land use has remained agricultural in nature, with sparse residential development in the low, lying areas. At the Site, a residence was constructed in 1994, with a driveway crossing installed across Fork Creek and barn established in the floodplain. Land use at the Site is characterized by disturbed forest and livestock pasture. Riparian zones are primarily composed of herbaceous vegetation that is sparse and disturbed due to livestock grazing, bush hogging, and regular land-management activities.

Land use at the Site is characterized by disturbed forest and livestock pasture. Riparian zones are primarily composed of herbaceous vegetation that is sparse and disturbed due to livestock grazing, bush hogging, and regular land-management activities.

#### **1.4 Project Components and Structure**

The Site encompasses 29.19 acres of disturbed forest and livestock pasture along the cold water Fork Creek and unnamed tributaries to Fork Creek. In its current state, the Site includes 6325 linear feet of degraded stream channel (based on the approved PJD), 2.61 acre of degraded wetland, 8.3 acres of drained hydric soil (Figure 4, Appendix A).

Proposed Site restoration activities include the construction of meandering, E/C-type stream channel in flat floodplain areas and B-type channels on steep slopes, resulting in 3296 linear feet of Priority I stream restoration, 274 linear feet of stream enhancement (Level I), 446 linear feet of stream enhancement (Level II), 1245 linear feet of stream preservation, 7.656 acres of riparian wetland re-establishment, 1.845 acres of riparian wetland rehabilitation, 0.148 acres of wetland enhancement, and 0.198 acres of riparian wetland preservation (Table 1) (Figures 6A-6C, Appendix A).

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 1-4.

**Table 1. Project Components and Mitigation Credits  
Laurel Springs Site**

Reach ID	Stream Stationing/ Wetland Type	Existing Footage/ Acreage	Mitigation Plan Footage/ Acreage	Mitigation Level	Mitigation Ratio	Mitigation Credits	Comment
Fork Cr - A	00+00-00+91	91	91	Enhancement (Level I)	1.5:1	60.667	
Fork Cr - B	00+91-24+01	2229	2310-60= 2250	Restoration	1:1	2250.000	60 lf is located outside of the easement and therefore is not generating credit
UT 1	00+00-02+34	1360	234	Restoration	1:1	234.000	
UT 2A	00+00-00+25	25	25	Preservation	10:1	2.500	
UT 2 - A	00+00-01+84	184	184	Preservation	10:1	18.400	
UT 2 - B	01+84-03+82	198	198	Enhancement (Level II)	2.5:1	79.200	
UT 2 - C	03+82-09+26	398	544-77= 467	Restoration	1:1	467.000	77 lf is located outside of the easement and therefore is not generating credit
UT 3A	00+00-01+03	103	103	Preservation	10:1	10.300	
UT 3 - A	00+31-02+96	265	265	Preservation	10:1	26.500	
UT 3 - B	02+96-05+44	248	248	Enhancement (Level II)	5:1	49.600	
UT 3 – C	05+86-07+69	183	183	Enhancement (Level I)	1.5:1	122.000	
UT 3 - D	07+69-10+02	181	233	Restoration	1:1	233.000	
UT 4 - A	00+32-05+73	541	541	Preservation	10:1	54.100	
UT 4 - B	05+73-06+85	63	112	Restoration	1:1	112.000	
UT 5 - A	00+00-00+60	60	60	Preservation	10:1	6.000	
UT 5 - B	00+00-00+67	67	67	Preservation	10:1	6.700	
Wetland Reestablish	Riparian Riverine	--	7.656	Reestablishment	1:1	7.656	
Wetland Rehabilitation	Riparian Riverine	1.845	1.845*	Rehabilitation*	NA*	0	
Wetland Enhancement	Riparian Riverine	0.148	0.148*	Enhancement*	NA*	0	
Wetland P	Riparian Riverine	0.198	0.198*	Preservation*	NA*	0	

\*Wetland Rehabilitation, Enhancement, and Preservation acreage are not being included in credit calculations. These areas are being utilized by the wider buffer tool to generate additional stream credit Appendix A – Figure 6D (Asset Map).

**Table 1. Project Credits (continued)**

**Laurel Springs Site**

Restoration Level	Stream			Riparian Wetland		Non-riparian wetland	Coastal Marsh
	Warm	Cool	Cold	Riverine	Nonriverine		
Restoration	--	--	3296.000	--	--	--	--
Re-establishment	--	--	--	3.688***	--	--	--
Rehabilitation	--	--	--	0*	--	--	--
Enhancement	--	--	--	0*	--	--	--
Enhancement I	--	--	182.667	--	--	--	--
Enhancement II	--	--	128.800	--	--	--	--
Creation	--	--	--	--	--	--	--
Preservation	--	--	124.500	0*	--	--	--
Wider Buffer Tool**			499.860				
<b>Totals</b>	--	--	4231.827	3.688	--	--	--

\*Wetland Rehabilitation, Enhancement, and Preservation acreage are not being included in credit calculations. These areas are being utilized by the wider buffer tool to generate additional stream credit.

\*\*Wider buffer tool output is depicted in Figure 10 (Appendix A).

\*\*\*See Figure 6D (Appendix A) for creditable wetland areas.

**Table 2. Project Activity and Reporting History  
Laurel Springs Site**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Technical Proposal (RFP No. 16-007725)	March 2019	March 2019
Institution Date (NCDMS Contract No. 100122)	--	5/17/2019
Mitigation Plan	July 2020	December 2020
Construction Plans	--	December 2020

**Table 3. Project Contacts Table  
Laurel Springs Site**

Role	Firm
<b>Full Delivery Provider, Planting Contractor, General Contractor</b>	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 Raymond Holz 919-755-9490
<b>Designer</b>	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693
<b>Engineer</b>	The John R. McAdams Company, Inc. 2905 Meridian Parkway Durham, NC 27713 Rebecca Stubbs 336-339-1648
<b>Surveyor</b>	k2 Design Group 5688 U.S. Hwy. 70 East Goldsboro, NC 27534 John Rudolph (L-4194) 919-394-2547



**Table 4. Project Attribute Table  
Laurel Springs Site**

Project Information					
Project Name	Laurel Springs Site				
Project County	Avery County, North Carolina				
Project Area (acres)	29.19				
Project Coordinates (latitude & longitude)	35.9913, -81.9837				
Planted Area (acres)	16.2				
Project Watershed Summary Information					
Physiographic Province	Blue Ridge				
Project River Basin	French Broad				
USGS HUC for Project (14-digit)	06010108010020				
NCDWR Sub-basin for Project	04-03-06				
Project Drainage Area (acres)	846.7				
Percentage of Project Drainage Area that is Impervious	<2%				
CGIA Land Use Classification	Managed Herbaceous Cover & Hardwood Swamps				
Reach Summary Information					
Parameters	Fork Cr	UT 1	UT 2	UT 3	UT 4
Length of reach (linear feet)	2401	234	926	1002	685
Valley Classification & Confinement	Alluvial, moderately confined	Alluvial, moderately confined	Alluvial, confined	Alluvial, confined	Alluvial, confined
Drainage Area (acres)	847	193	12	23	13
NCDWR Stream ID Score	--	--	25.5	22.5	33.5
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial/ Intermittent	Perennial/ Intermittent	Perennial
Thermal Regime	Cold	Cold	Cold	Cold	Cold
NCDWR Water Quality Classification	WS-IV, Tr				
Existing Morphological Description (Rosgen 1996)	Cg 4	Eg 4	Bg 5/6	Bg 5	B 4
Proposed Stream Classification (Rosgen 1996)	Ce 3/4	Ce 3/4	B 3/4	B 3/4	B 4
Existing Evolutionary Stage (Simon and Hupp 1986)	II/III	II/III	IV	II	I/II
Underlying Mapped Soils	Nikwasi loam, Reddies fine sandy loam,	Nikwasi loam	Chandler-Micaville complex	Chandler-Micaville complex	Chandler-Micaville complex
Drainage Class	poorly, moderately well	poorly	somewhat excessively	somewhat excessively	somewhat excessively
Hydric Soil Status	hydric, nonhydric (may contain hydric inclusions)	hydric	nonhydric	nonhydric	nonhydric

**Table 4. Project Attribute Table (Continued)**

Parameters	Fork Cr	UT 1	UT 2	UT3	UT 4
Valley Slope	0.0271	0.0291	0.1047	0.0992	0.0992
FEMA Classification	NA	NA	NA	NA	NA
Native Vegetation Community	Montane Alluvial Forest and Swamp Forest-Bog Complex				
Watershed Land Use/Land Cover (Site)	87% forest, 11% agricultural land, <2% low density residential/impervious surface				
Watershed Land Use/Land Cover (Reference Channel)	95% forest, 3% agricultural land, <2% low density residential/impervious surface				
Percent Composition of Exotic Invasive Vegetation	<5%				
Wetland Summary Information					
Parameters	Wetlands				
Wetland acreage	8.3 acre drained & 2.61 acres degraded				
Wetland Type	Riparian riverine				
Mapped Soil Series	Nikwasi				
Drainage Class	Poorly drained				
Hydric Soil Status	Hydric				
Source of Hydrology	Groundwater, stream overbank				
Hydrologic Impairment	Incised streams, compacted soils, livestock, ditches, drain tile				
Native Vegetation Community	Montane Alluvial Forest and Swamp Forest-Bog Complex				
% Composition of Exotic Invasive Vegetation	<5%				
Restoration Method	Hydrologic, vegetative, livestock				
Enhancement Method	Vegetative, livestock				
Regulatory Considerations					
Regulation	Applicable?	Resolved?	Supporting Documentation		
Waters of the United States-Section 401	Yes	Yes	JD Package (App D)		
Waters of the United States-Section 404	Yes	Yes	JD Package (App D)		
Endangered Species Act	Yes	Yes	CE Document (App E)		
Historic Preservation Act	Yes	Yes	CE Document (App E)		
Coastal Zone Management Act	No	--	NA		
FEMA Floodplain Compliance	Yes	Yes	CE Document (App E)		
Essential Fisheries Habitat	No	--	CE Document (App E)		

## 2 WATERSHED APPROACH AND SITE SELECTION

Primary considerations for Site selection included the potential for water quality improvement within a region of North Carolina under livestock/agricultural pressure. More specifically, considerations included: desired aquatic resource functions; hydrologic conditions; soil characteristics; aquatic habitat diversity; habitat connectivity; compatibility with adjacent land uses; reasonably foreseeable effects the mitigation project will have on ecologically important aquatic and terrestrial resources; and potential development trends and land use changes.

Currently, the proposed Site is characterized by disturbed forest and livestock pasture. A summary of existing Site characteristics in favor of proposed stream and wetland activities includes the following.

- Streams and wetlands are accessible by livestock
- Stream banks are trampled by livestock
- Streams and wetlands have been cleared of forest vegetation
- The Site receives nonpoint source inputs, including agricultural chemicals and livestock waste
- Wetland soils have been compacted by livestock and agricultural equipment
- Wetland hydrology has been removed by stream channel entrenchment
- Streams are classified as Trout waters

In addition to the opportunity for ecological improvements at the Site, the use of the particular mitigation activities and methods proposed in the Design Approach & Mitigation Work Plan (Section 8.0) are expected to produce naturalized stream and wetland resources that will be ecologically self-sustaining, requiring minimal long-term management (Long-term Management Plan [Section 11.0]).

The *French Broad River Basin Restoration Priorities 2009* (RBRP) report (NCEEP 2009) documents restoration goals developed for the French Broad River Basin. RBRP goals that will be addressed by project mitigation activities are described in Table 5.

**Table 5. RBRP Goals**

RBRP Goal	Site Objectives Addressing RBRP Goals
Implement wetland and stream restoration projects that reduce sources of sediment and nutrients by restoring riparian buffer vegetation, stabilizing banks, excluding livestock, and restoring natural geomorphology, especially in headwater streams.	<ol style="list-style-type: none"> <li>1. Restoring 4065 SMUs and 7.656 WMUs</li> <li>2. Removing               <ol style="list-style-type: none"> <li>a. 587.4 tons of sediment/yr</li> <li>b. 1020.8 lbs Nitrogen/yr</li> <li>c. 84.6 lbs Phosphorus / yr</li> </ol> </li> <li>3. Planting ~16 acres of riparian buffer</li> <li>4. Removing ~20 acres of livestock from production.</li> </ol>
Restore and protect habitat for priority fish, mussel, snail, and crayfish species in the basin [see Wildlife Resource Commission (2015) for a complete list].	Restoring or enhancing habitat for numerous species on the 2015 Wildlife Action Plan.
Cooperate with land trusts and resource agencies to help leverage federal and state grant funding for watershed restoration and conservation efforts.	NA
Protect high-quality habitats, especially those prioritized by the Natural Heritage Program as Significant Natural Heritage Areas.	The NC DMS Threemile Stream & Wetland Mitigation Site is located approximately 0.5 miles south, immediately downstream of the Site.

Site specific mitigation goals and objectives have been developed by using the North Carolina Stream Assessment Method (NC SAM) and North Carolina Wetland Assessment Method (NC WAM). They are discussed further in Section 6.0 (Functional Uplift and Project Goals/Objectives).

### 3 BASELINE AND EXISTING CONDITIONS

#### 3.1 Soils and Land Form

Soils that occur within the Site, according to the *Web Soil Survey* (USDA 2017), are described in the following table.

**Table 6. Web Soil Survey Soils Mapped within the Site**

Map Unit Symbol	Map Unit Name (Classification)	Hydric Status	Description
CeE	Chandler-Micaville complex ( <i>Typic Dystrudepts</i> )	Non-hydric	This series consists of stony, somewhat excessively drained soils found on mountain slopes and ridges with 30-50 percent slopes. The parent material is affected by soil creep in the upper solum over residuum weathered from mica schist and/or micaceous gneiss and/or micaceous metamorphic rock. Depth to the water table and to restrictive features is more than 80 inches.
NkA	Nikwasi loam ( <i>Cumulic Humaquepts</i> )	Hydric	This series consists of frequently flooded, very poorly drained soils found in depressions on floodplains with 0-3 percent slopes. The parent material is loamy alluvium over sandy and gravelly alluvium. Depth to the water table 0-12 inches. Depth to restrictive features is 20-40 inches to strongly contrasting textural stratification.
ReA	Reddies fine sandy loam ( <i>Oxyaquic Humudepts</i> )	Non-hydric, may contain hydric inclusions	This series consists of frequently flooded, moderately well-drained soils found on floodplains with 0-3 percent slopes. The parent material is loamy alluvium over cobbly and gravelly alluvium derived from igneous and metamorphic rock. Depth to the water table 24-42 inches. Depth to restrictive features is 20-40 inches to strongly contrasting textural stratification.
SaC	Saunook loam ( <i>Humic Hapludults</i> )	Non-hydric	This series consists of well-drained soils found on coves, drainageways, and fans of mountain slopes with 8-15 percent slopes. The parent material is colluvium derived from igneous and metamorphic rock. Depth to the water table and to restrictive features is more than 80 inches.
WaD	Watauga sandy loam ( <i>Typic Hapludults</i> )	Non-hydric	This series consists of stony, well-drained soils found on mountain slopes and ridges with 15-30 percent slopes. The parent material is residuum weathered from mica schist and/or micaceous gneiss and/or micaceous metamorphic rock. Depth to the water table and to restrictive features is more than 80 inches.

### 3.2 Existing Vegetation Cover

Vegetative communities at the Site include managed herbaceous (pastureland) and forest land. Managed herbaceous areas are characterized by planted grasses for livestock grazing and hay production. These areas are in various conditions ranging from a near monoculture of planted grass to fallow fields. The condition largely is dependent on stocking rates and grazing rotations. Currently, the upstream pasture (above the driveway) is high quality grazing, and the farthest downstream pasture is nearly fallow with opportunistic species such as rose (*Rosa sp.*), crab grass (*Digitaria sp.*), red clover (*Trifolium pretense*), giant ironweed (*Vernonia gigantea*), and violet (*Viola sp.*). Wetter portions of the pasture have recruits of rush (*Juncus effusus*), bulrush (*Scirpus cyperinus*), and knotweed (*Polygonum spp.*).

Forest communities are subject to livestock intrusion as well; however, livestock do not seem to have as large an impact overall on the community, perhaps due to the large amount of forest available for shade

relief. Areas adjacent to pastureland, in low-lying landscape position, or in the vicinity of water seem to be more impacted than steeper, higher elevation forest patches. The Site has a western aspect and forested area are characterized by white pine (*Pinus strobus*), hemlock (*Tsuga canadensis*), American hazelnut (*Corylus americana*), tulip tree (*Liriodendron tulipifera*), pignut hickory (*Carya glabra*), and red maple (*Acer rubrum*). Near stream corridors and lower, toe slope areas a dense understory of mountain laurel (*Kalmia latifolia*) and Rhododendron (*Rhododendron catawbiense*) exists.

Invasive species identified at the Site include Chinese privet (*Ligustrum sinense*), honey suckle (*Lonicera japonica*), tree of heaven (*Ailanthus altissima*), and multiflora rose (*Rosa multiflora*).

### 3.3 Geology

The Site is located within the Blue Ridge Belt, or more specifically the Ashe Metamorphic Suite which consists of heated and deformed (metamorphic) volcanic rocks, specifically Muscovite and biotite gneiss. The Ashe Metamorphic Suite formed from layers of sediment mixed with volcanic ash and lava flows which were deposited on the ocean floor between the Piedmont and Avalon Terranes. These materials underwent a series of at least three major episodes of thrusting and faulting of rocks to its present configuration

Several areas of the Site exhibit bedrock contact; however, contact is confined to incised stream channels that will be backfilled. The proposed stream channels will be tied into the bedrock were feasible to hinder headcut migration through the Site. The Site is an alluvial valley that is characterized by relatively deep deposits; therefore, bedrock is not expected to pose as a hindrance to channel excavation.

### 3.4 Sediment Model

Sediment load modeling was performed using methodologies outlined in *A Practical Method of Computing Streambank Erosion Rate* (Rosgen 2009) along with *Estimating Sediment Loads using the Bank Assessment of Non-point Sources Consequences of Sediment* (Rosgen 2011). These models provide a quantitative prediction of streambank erosions by calculating Bank Erosion Hazard Index (BEHI) and Near-Bank Stress (NBS) along each Site reach. The resulting BEHI and NBS values are then compared to streambank erodibility graphs prepared for North Carolina by the NC Stream Restoration Institute and NC Sea Grant.

Streambank characteristics involve measurements of bank height, angles, materials, presence of layers, rooting depth, rooting density, and percent of the bank protected by rocks, logs, roots, or vegetation. Site reaches have been measured for BEHI and NBS characteristic and predicted lateral erosion rate, height, and length to calculate a cubic volume of sediment contributed by the reach each year. Data forms for the analysis are available upon request, and the data output is presented in Appendix B. Results of the model are shown in the following table.

**Table 7. BEHI and NBS Modeling Summary**

Stream Reach	Proposed Mitigation Treatment	Predicted Sediment Contribution (tons/year)
Fork Creek	Restoration and Enhancement (Levels I & II)	535.2
UT 1	Restoration	51.0
UT 2	Restoration, Enhancement (Level II), and Preservation	0.4
UT 3	Restoration, Enhancement (Levels I and II), and Preservation	0.8
UT 4	Preservation	0
<b>Total Sediment Contribution (tons/year)</b>		<b>587.4</b>

Based on this analysis, mitigation of Site streams will reduce streambank erosion and subsequent pollution of receiving waters.

### 3.5 Nutrient Model

Nutrient modeling was conducted using a method developed by NCDMS (NCDMS 2016) to determine nutrient and fecal coliform reductions from exclusion of livestock from the buffer.

The equation for nutrient reduction for this model includes the following:  
TN reduction (lbs/yr) = 51.04 (lbs/ac/yr) x Area (ac)  
TP reduction (lbs/yr) = 4.23 (lbs/ac/yr) x Area (ac)

Where:

TN – total nitrogen;  
TP – total phosphorus; and  
Area – total area of restored riparian buffers inside of livestock exclusion fences.

Equations for fecal coliform reduction for this model include the following:  
Fecal coliform reduction (col) = 2.2 x 1011 (col/AU/day) x AU x 0.085

Where:

Col - quantities of Fecal Coliform bacteria  
AU - animal unit (1000 lbs of livestock)

Results of the NCDMS analysis indicate approximately 1020.8 lbs/yr of nitrogen, 84.6 lbs/yr of phosphorus, and 3.74 x 1011 col of fecal coliform/day will be reduced due to the exclusion of livestock from the easement area.

### 3.6 Project Site Streams

Streams targeted for restoration include Fork Creek and unnamed tributaries to Fork Creek, which have been cleared, moved to the edge of the floodplain, dredged and straightened, trampled by livestock, eroded vertically and laterally, and receive extensive sediment and nutrient inputs from livestock. Approximately 47 percent of the existing stream channel has been degraded, contributing to sediment export from the Site resulting from mechanical processes from livestock hoof shear. In addition, streamside wetlands have been cleared and drained by channel downcutting, drain tile installation, and land uses. Current Site conditions have resulted in degraded water quality, a loss of aquatic habitat, reduced nutrient and sediment retention, and unstable channel characteristics (loss of horizontal flow vectors that maintain pools and an increase in erosive forces to channel bed and banks). Site restoration activities will restore riffle-pool morphology, aid in energy dissipation, increase aquatic habitat, stabilize channel banks, and significantly reduce channel bank sediment loss.

#### Reach Descriptions

Individual reach descriptions are as follows.

#### Fork Creek



Fork Creek, the main receiving stream within the Site, has been dredged and straightened through the entire reach of the Site and pushed to the edge of the valley. The channel is devoid of woody vegetation on its right bank and most of its left bank. Fork Creek is entrenched and oversized with frequent eroding banks. The channel becomes significantly more entrenched and oversized as it descends the valley with bank-height-ratios ranging from 1.09 at the upper extent of the Site to 2.75 near the

central driveway crossing. Substrate is a mixture of cobble and sand, with sand likely being contributed from eroding stream banks within and upstream from the Site.

### UT 1

Similar to Fork Creek, UT 1 has been dredged and straightened through the entire reach of the Site. The channel has been pushed to the opposite floodplain margin as Fork Creek, with a convergence of the two tributaries as the exit the Site. UT 1 is devoid of woody vegetation on both banks throughout the Site and



the channel seems to be eroding vertically. UT 1 is highly entrenched in the upper reaches with bank-height-ratios reaching 2.06 and as the channel descends the valley the channel becomes less entrenched. The reduction in entrenchment may result from the channel being extended down the valley through ditching and dredging, thereby reducing the slope of the channel. Substrate is a mixture of cobble and sand, with more extensive sand material than Fork Creek, possibly due to lower stream power in the channel.

### UT 2 and UT 2A

The upper reaches of UT 2 and all of UT 2A are situated in forested, steeply sloped, valleys at or immediately below the stream origin. These areas are accessible by livestock; however, the steeply sloping terrain and dense vegetation limit access by the livestock. Therefore, these reaches are primarily undisturbed and are suitable for preservation. These channels are shallow and wide (0.3 ft by 5.5 ft, approximately) and characterized by cobble substrate.

As UT 2 descends the valley slopes are reduced, and dense vegetation has been cleared on the right bank allowing livestock to access the stream. The channel remains stable with cobble substrate present; however, livestock frequent the stream in adequate densities to make the channel suitable for Enhancement (Level II). Eventually, the channel exits the forest vegetation and is immediately trampled and eroded into a mire. The channel becomes incised with bank-height ratios ranging from 1.25 to 2.0.

### UT 3 and UT 3A

Similar to UT 2 and UT 2A, the upper extent of UT 3 and all of UT 3A are located in portions of the Site that are not frequented by livestock. These channels are characterized by mature vegetation, cobble substrate, with little or no erosion. These upper reaches are suitable for preservation. As UT 3 flows towards a residential structure, a spring box, water line, roadbed, and water tank parallel the right bank of the channel. Although the channel through this reach is relatively stable, IRT members agreed that removal of the water line infrastructure and planting of the roadbed would constitute Enhancement (Level II).

Once UT 3 exits mature forest, a road crossing/powerline crosses the channel and immediately downstream from the crossing, the channel is characterized by a ditched, straightened reach lacking woody vegetation and cobble substrate. The modified channel appears stable, with no actively eroding banks; however, the channel is incised as evidenced by bank-height-ratios ranging from 1.43 to 2.63. This reach is suitable for Enhancement (Level I) activities.



Ultimately, UT 3 ties into Fork Creek at the Fork Creek floodplain margins. Once Fork Creek has been moved to its appropriate location, a section of UT 3 will be excavated to its convergence. This section connecting UT 3 with Fork Creek is suitable for restoration.



#### UT 4 and UT 5

The upper reaches of UT 4 and all of UT 5 are located in portions of the Site that are characterized by mature forest vegetation with little impact to the stream channels. UT 5 originates at a spring head, develops a channel, braids to a wetland, and reforms a channel prior to converging with UT 4. These reaches are suitable for Preservation. Similar to UT 3, UT 4 ties into Fork Creek at the Fork Creek floodplain margins. Once Fork Creek is moved to a suitable location, UT 4 will be excavated to its convergence. This connecting UT 4 with Fork Creek is suitable for restoration.





### **3.6.1 Existing Conditions Survey**

Site stream dimension, pattern, and profile were measured to characterize existing channel conditions. Locations of existing stream reaches are depicted in Figure 4 (Appendix A). Stream geometry measurements under existing conditions are summarized in Table 8 (Essential Morphology Parameters) and presented in detail in Table B1 (Appendix B).

### **3.6.2 Channel Classification and Morphology**

Stream geometry and substrate data have been evaluated to classify existing stream conditions based on a classification utilizing fluvial geomorphic principles (Rosgen 1996). Existing Site reaches are classified as unstable Cg-, Eg-, and Bg-type streams with variable sinuosity. Existing Site reaches are characterized by variable substrate ranging from sand substrate due to channel impacts, including livestock trampling, channel straightening, and riparian vegetation removal.

### **3.6.3 Channel Evolution**

Site streams targeted for restoration have been channelized and are continually trampled by livestock resulting primarily in channels classified as channelized (Class II), degraded (Class III), and degraded and widened (Class IV) channels throughout the Site (Simon and Hupp 1986).

### **3.6.4 Valley Classification**

Site Streams are characterized by two distinct valley types: 1) small stream, headwater, moderately confined to confined, alluvial valleys with approximately 20- to 50-foot floodplain valley widths, and 2) moderately sized, second-order, wide and flat alluvial valley with approximately 200-foot floodplain valley width. Valley slopes are typical for the Mountain region and range from 0.0271 on Fork Creek and 0.0291-0.1047 on UT1-UT3. Typical streams in this region include B-type step/pool streams in the steeply sloped headwater areas and C- and E-type streams with slightly entrenched, meandering channels with a riffle-pool sequence within wider, flatter valleys.

### **3.6.5 Discharge**

This hydrophysiographic region is characterized by moderate rainfall, with precipitation averaging approximately 62.8 inches per year (USDA 2005). Drainage basin sizes range from 0.02- to 0.30-square mile on UT1-UT4, and 1.32 square miles for Fork Creek.

The Site's discharge is dominated by a combination of upstream basin catchment, groundwater flow, and precipitation. Based on indicators of bankfull at reference reaches and on-site, the designed channel will equal approximately 85 percent of the channel size indicated by Mountain regional curves (Harman et al. 2001); this is discussed in Section 5.2 (Bankfull Verification). Based on bankfull studies, the bankfull discharge ranges from 5.4-41.1 cubic feet per second for UT1-UT4 and is 120.6 cubic feet per second for Fork Creek.

## **3.7 Project Site Wetlands**

Jurisdictional wetlands/hydric soils within the Site were delineated in the field following guidelines set forth in the Corps of Engineers Wetlands Delineation Manual and subsequent regional supplements and located using GPS technology with reported submeter accuracy (Environmental Laboratory 1987). A jurisdictional wetland delineation was completed and verbally approved by the United States Army Corps of Engineers (USACE) representative Amanda Jones Fuemmeler during a field meeting on October 2, 2019. Written confirmation of the determination is included in Appendix D. Existing jurisdictional wetlands are depicted in light blue, and drained hydric soils are depicted in a black cross-hatch in Figure 4 (Appendix A).

Wetland preservation areas are located on slopes adjacent to the Fork Creek floodplain and are characterized by three distinct locations including 1) spring/seeps, 2) channel depressions, or 3) depressions adjacent to stream channels. Wetlands vary in vegetative structure between mature forest and disturbed herbaceous/shrub scrub assemblage. Wetlands in mature forest are generally in channel, or spring head in nature and frequently have cobble substrate with emergent vegetation interspersed between and around cobble material. Wetland preservation areas in maintained vegetative communities are located adjacent to channels, or spring heads and have sand/silt substrate with herbaceous to shrub scrub vegetation. Herbaceous vegetation is primarily characterized by rushes (*Juncus* sp.) and shrub scrub vegetation is frequently characterized by invasive species such as Chinese privet (*Ligustrum sinense*) and rose (*Rosa multiflora*). It should be noted that wetland preservation areas are non-credit generating and are proposed for enhance stream buffer credit.

### **3.7.1 Hydrological Characterization**

Construction activities are expected to re-establish approximately 7.656 acres of drained riparian hydric soils, rehabilitate 1.845 acres of riparian wetlands, enhance 0.148 acres of riparian wetland, and preserve 0.198 acres of wooded wetlands. Areas of the Site targeted for riparian wetlands will receive hydrological inputs from periodic overbank flooding of restored tributaries, groundwater migration into wetlands, upland/stormwater runoff, and, to a lesser extent, direct precipitation. Hydrological impairment in drained soils has resulted from lateral draw-down of the water table adjacent to existing, incised stream channels and drain tile installation.

### **3.7.2 Soil Characterization**

Detailed soil mapping conducted by a North Carolina Licensed Soil Scientist (NCLSS) in August 2019 indicates that the Site is currently underlain by Nikwasi and Reddies soil series (Figure 4, Appendix A). Nikwasi soils are hydric in nature, and Reddies soils are not hydric. Soils have been disturbed by livestock grazing and cleared of vegetation within pastureland. Nikwasi soils have been effectively drained by stream channel incision, relocation of stream channels to the floodplain margins, and drain tile installation.

On-site hydric soils are grey to gley in color and are compacted and pockmarked by livestock trampling. Livestock trampling, grazing, and clearing have resulted in an herbaceous vegetative community. Groundwater springs and surface runoff contribute hydrology to these areas. However, the dominant hydrological influence is the lateral draw-down of the water table adjacent to incised stream channels or streams relocated to the floodplain margins. Eight detailed soil profiles conducted by a NCLSS are included in Appendix B. The location of soil profiles are depicted in Figure 4 (Appendix A). A representative soil profile for the Nikwasi soil series is provided in Table 9.

**Table 8. Essential Morphology Parameters**

Parameter	Existing				Reference		Proposed			
	Fork Cr	UT 1	UT 2	UT3	Stone Mountain	Cranberry Creek	Fork Cr	UT 1	UT 2	UT3
Valley Width (ft)	100	100	25	25	100	75	100	100	25	25
Contributing Drainage Area (sq. mi.)	1.01	0.29	0.03	0.04	7.46	0.70	1.01	0.29	0.03	0.04
Channel/Reach Classification	Cg4	Eg4	Bg 5/6	Bg5	Cb3	E4	Ce ¾	Ce ¾	B ¾	B ¾
Design Discharge Width (ft)	11.7-25.1	6.4-15.3	4.4-9.8	3.0-4.2	27.2-33.0	11.8-13.2	15.1-17.4	9.9-11.4	4.6-5.4	4.9-5.7
Design Discharge Depth (ft)	1.2-2.5	1.4-2.4	0.5-0.8	0.7-1.4	2.2-2.6	1.9	1.4-1.9	0.9-1.2	0.4-0.6	0.5-0.6
Design Discharge Area (ft <sup>2</sup> )	18.9-64.8	8.1-35.5	1.8-6.9	3.6-9.0	46.0	20.2	18.9	8.1	1.8	2.0
Design Discharge Velocity (ft/s)	2.4	1.8	1.8	1.4	1.6	1.4	5.2	4.9	4.3	4.4
Design Discharge (cfs)	99.0	39.5	7.7	8.7	75.3	28.7	99.0	39.5	7.7	8.7
Water Surface Slope	0.0258	0.0288	0.1026	0.0954	0.0121	0.0112	0.0236	0.0253	0.0997	0.0945
Sinuosity	1.05	1.01	1.02	1.04	1.20	1.04	1.15	1.15	1.05	1.05
Width/Depth Ratio	7.3-31.4	4.9-30.6	11.0-49.0	4.3-8.4	16.1-23.8	7.0-8.5	14.0	14.0	14.0	14
Bank Height Ratio	1.1.0-2.8	1.0-2.1	1.0-2.0	1.4-2.6	1.0-1.6	1.0	1.0	1.0	1.0	1.0
Entrenchment Ratio	0.9-8.5	2.0-15.6	2.0-4.5	1.5-11.9	3.0-3.7	5.7-6.4	6.1	9.4	5.0	4.7
Substrate	Gravel	Gravel	Sand/silt	Sand	Cobble	Gravel	Gravel/cobble	Gravel/cobble	Gravel/cobble	Gravel/cobble

**Table 9. Profile Description**

<b>Depth (inches)</b>	<b>Color</b>	<b>Texture</b>
0 - 2	10 YR 4/2	Loam
2 - 8	10 YR 4/2 10 YR 4/6 mottles	Clay loam
8 - 12	10 YR 4/2	Loam
12+	10 YR 4/2 10 YR 5/3 10 YR 4/6 mottles	Gravelly loam

### **3.7.3 Plant Community Characterization**

Areas proposed for wetland restoration and enhancement are primarily vegetated by fescue and opportunistic herbaceous species with very little vegetative diversity.

## **4 REFERENCE STUDIES**

### **4.1 Reference Streams**

Distinct bankfull indicators were present within the reference stream channels. In addition, dimension, pattern, and profile variables have not been altered or degraded, allowing for assistance with the proposed restoration reaches (Figure 5A-B, Appendix A).

#### **4.1.1 Stone Mountain Reference Reach**

##### **4.1.1.1 Watershed Characterization**

Stone Mountain is located in northern Wilkes County in Stone Mountain State Park, approximately 53 miles northeast of the Site. Alterations, development, and impervious surfaces within the watershed are minimal.

##### **4.1.1.2 Channel Classification**

Stream geometry and substrate data have been evaluated to classify the reference reach based on a classification utilizing fluvial geomorphic principles (Rosgen 1996a). This classification stratifies streams into comparable groups based on pattern, dimension, profile, and substrate characteristics. The reference reach is characterized as a Cb-type, low sinuosity (1.08) channel with a cobble-dominated substrate. Cb-type streams are characterized as slightly to moderately entrenched, riffle-pool channels exhibiting a moderate to high width-depth ratio. Cb-type streams often occur in narrower valleys with moderately-developed alluvial floodplains.

##### **4.1.1.3 Discharge**

The reference stream has an approximately 7.5-square mile watershed and a bankfull discharge of 271.7 cubic feet per second based on bankfull indicators.

##### **4.1.1.4 Channel Morphology**

Stream cross-sections and profiles were measured along the reference stream (Figure 5A, Appendix A). The stream reach is transporting its sediment supply while maintaining a stable dimension, pattern, and profile. Stream geometry measurements for the reference stream are summarized in the Morphological Stream Characteristics Table (Table 8).

Dimension: Data collected at the reference reach indicates a bankfull cross-sectional area of 46.0 square feet, a bankfull width of 30.1 feet, a bankfull depth of 1.6 feet, and a width-to-depth ratio of 20.0. Regional curves predict that the stream should exhibit a bankfull cross-sectional area of approximately 85.0 square feet for the approximate 7.5-square mile watershed (Harman et al. 2001), slightly above the 46.0-square feet displayed by channel bankfull indicators identified in the field. For a more detailed discussion on bankfull verification, see Section 5.2 (Bankfull Verification).

The reference reach exhibits a bank-height ratio averaging 1.3, which is slightly high for a stable Cb-type channel. In addition, the width of the flood-prone area is approximately 100 feet giving the channel an entrenchment ratio of 3.0 to 3.7, typical of a stable C-type channel.

Pattern: In-field measurements of the reference reach have yielded an average sinuosity of 1.2 (thalweg distance/straight-line distance). Other channel pattern attributes include an average pool-to-pool spacing ratio ( $L_p-p/W_{bkf}$ ) of 3.5, a meander wavelength ratio ( $L_m/W_{bkf}$ ) of 6.6, and a radius of curvature ratio ( $R_c/W_{bkf}$ ) of 3.1. These variables were measured within a stable, forested reach, which did not exhibit any indications of pattern instability such as shoot cutoffs, abandoned channels, or oxbows.

Profile: Based on elevational profile surveys, the reference reach is characterized by a valley slope of 0.0131 (rise/run). Ratios of the reference reach riffle, run, pool and glide slopes to average water surface slope are 0.98, 0.80, 0.70, and 0.34, respectively.

Substrate: The channel is characterized by a channel substrate dominated by cobble-sized particles.

## **4.1.2 Cranberry Creek Reference Reach**

### **4.1.2.1 Watershed Characterization**

Cranberry Creek is located approximately 6 miles east of the Site, in Burke County. Alterations, development, and impervious surfaces within the watershed are minimal.

### **4.1.2.2 Channel Classification**

The reference reach is characterized as an E-type, low sinuosity (1.04) channel with a cobble-dominated substrate. E-type streams are characterized as slightly entrenched, riffle-pool channels. In North Carolina, E-type streams often occur in narrow to wide valleys with well-developed alluvial floodplains (Valley Type VIII). E-type channels are typically considered stable; however, these streams are sensitive to upstream drainage basin changes and/or channel disturbance and may rapidly convert to other stream types.

### **4.1.2.3 Discharge**

The reference stream has an approximately 0.7-square mile watershed and a bankfull discharge of 103.5 cubic feet per second based on bankfull indicators.

### **4.1.2.4 Channel Morphology**

Stream cross-sections and profiles were measured along the reference stream (Figure 5B, Appendix A). The stream reach is transporting its sediment supply while maintaining a stable dimension, pattern, and profile. Stream geometry measurements for the reference stream are summarized in the Morphological Stream Characteristics Table (Table 8).

Dimension: Data collected at the reference reach indicates a bankfull cross-sectional area of 20.2 square feet, a bankfull width of 12.5 feet, a bankfull depth of 1.6 feet, and a width-to-depth ratio of 7.8. Regional curves predict that the stream should exhibit a bankfull cross-sectional area of approximately 17.4 square

feet for the approximate 0.7-square mile watershed (Harman et al. 2001), slightly below the 20.2-square feet displayed by channel bankfull indicators identified in the field. For a more detailed discussion on bankfull verification, see Section 5.2 (Bankfull Verification).

The reference reach exhibits a bank-height ratio of 1.0, which is representative of a stable E-type channel. In addition, the width of the flood-prone area is approximately 75 feet giving the channel an entrenchment ratio of 5.7 to 6.4, typical of a stable E-type channel.

Pattern: In-field measurements of the reference reach have yielded an average sinuosity of 1.04 (thalweg distance/straight-line distance). Other channel pattern attributes include an average pool-to-pool spacing ratio ( $Lp-p/Wb_{kf}$ ) of 4.4, a meander wavelength ratio ( $Lm/Wb_{kf}$ ) of 8.3 and a radius of curvature ratio ( $Rc/Wb_{kf}$ ) of 3.8. These variables were measured within a stable, forested reach, which did not exhibit any indications of pattern instability such as shoot cutoffs, abandoned channels, or oxbows.

Profile: Based on elevational profile surveys, the reference reach is characterized by a valley slope of 0.0116 (rise/run). Ratios of the reference reach riffle, run, pool and glide slopes to average water surface slope are 1.74, 0.13, 0, and 0.25, respectively.

Substrate: The channel is characterized by a channel substrate dominated by Cobble-sized particles.

#### 4.2 Reference Forest Ecosystem

A Reference Forest Ecosystem (RFE) is a forested area on which to model restoration efforts for soils and vegetation. RFEs should be ecologically stable climax communities and represent the restoration site as it likely existed before human disturbances. Data describing plant community composition and structure should be collected at the RFEs and subsequently applied as reference data to emulate a natural climax community.

The RFE for this project is located on the Stone Mountain Reference reach. The RFE supports plant community and landform characteristics that restoration efforts will attempt to emulate. Tree and shrub species identified within the reference forest and outlined in Table 10 will be used, in addition to other relevant species in appropriate Schafale and Weakley (1990) community descriptions.

**Table 10. Reference Forest Ecosystem**

Mountain Alluvial Forest	
Canopy Species	Understory Species
white pine ( <i>Pinus strobus</i> )	dogwood ( <i>Cornus florida</i> )
white oak ( <i>Quercus alba</i> )	ironwood ( <i>Carpinus caroliniana</i> )
sycamore ( <i>Platanus occidentalis</i> )	spice bush ( <i>Lindera benzoin</i> )
black locust ( <i>Robinia pseudoacacia</i> )	rhododendron ( <i>Rhododendron</i> sp.)
red maple ( <i>Acer rubrum</i> )	wild azalea ( <i>Rhododendron periclymenoides</i> )
red oak ( <i>Quercus</i> sp.)	strawberry bush ( <i>Euonymus americana</i> )
black cherry ( <i>Prunus serotina</i> )	
tulip poplar ( <i>Liriodendron tulipifera</i> )	
hemlock ( <i>Tsuga</i> sp.)	

### 4.3 Reference Swamp Forest-Bog Complex

Some portions of the Site are expected to be dominated by an open, herbaceous vegetative community characteristic of a Swamp Forest-Bog Complex, as described in Schafale and Weakley (1990). Two Swamp Forest-Bog Complex reference sites were identified near the Site, including one in Linville Gap (11 miles northeast of the Site) and one in Julian Price Park (17 miles northeast of the Site).

Both reference complexes are encompassed with expansive floodplains that are underlain by soils of the Nikwasi series. Hydrology appears to be driven by seepage along the floodplain margins and poor permeability of the underlying soils. Overbank flooding appears to occur but doesn't appear to be a main contributor to the hydrologic regime. The sites appear to have been affected by beaver in the past; however, the beaver activity appears to be relatively old. Species listed in Table 11 will be included in the permanent seeding mix for stabilization.

**Table 11. Swamp Forest-Bog Complex Ecosystem**

Swamp Forest – Bog Complex	
Canopy/Shrub Species	Herbaceous Species
Red maple ( <i>Acer rubrum</i> )	Cinnamon fern ( <i>Osmunda cinnamomea</i> )
Eastern hemlock ( <i>Tsuga canadensis</i> )	Round-leaf goldenrod ( <i>Solidago patula</i> )
Sweet birch ( <i>Betula lenta</i> )	New England aster ( <i>Symphotrichum novae-angliae</i> )
Yellow birch ( <i>Betula alleghaniensis</i> )	Broadleaf cattail ( <i>Typha latifolia</i> )
Serviceberry ( <i>Amelanchier arborea</i> )	Broadleaved arrowhead ( <i>Sagittaria latifolia</i> )
White pine ( <i>Pinus strobus</i> )	Robin runaway ( <i>Dalibarda repens</i> )
Tag alder ( <i>alnus serrulata</i> )	Whitegrass ( <i>leersia virginica</i> )
Rosebay rhododendron ( <i>Rhododendron maximum</i> )	Burr reed ( <i>Sparganium americanum</i> )
Mountain laurel ( <i>Kalmia latifolia</i> )	Bulrushes ( <i>Scirpus</i> spp.)
Silky willow ( <i>Salix sericea</i> )	Bushes ( <i>Juncus</i> spp.)
Mountain holly ( <i>Ilex montana</i> )	Northern long sedge ( <i>Carex folliculata.</i> )
Swamp rose ( <i>Rosa palustris</i> )	Nodding sedge ( <i>Carex gynarda</i> )
	Eastern rough sedge ( <i>Carex scabrata.</i> )
	Bristly-stalked sedge ( <i>Carex leptalea</i> )
	Tussock sedge ( <i>Carex stricta</i> )

## 5 CHANNEL ASSESSMENTS

### 5.1 Channel Stability Assessment

Stream power and shear stress were estimated for 1) existing dredged and straightened reaches, 2) the reference reaches, and 3) proposed Site conditions. Important input values and output results (including stream power, shear stress, and per unit shear power and shear stress) are presented in Table 12. Average stream velocity and bankfull discharge values were calculated for the existing Site stream reaches, the reference reach, and proposed conditions.

To maintain sediment transport functions of a stable stream system, the proposed channel should exhibit stream power and shear stress values so the channel is neither aggrading nor degrading. Results of the analysis indicate the proposed channel reaches are expected to maintain stream power as a function of width values of approximately 5.88-9.77 and shear stress values of approximately 1.05-1.95 (Table 10).

**Table 12. Stream Power ( $\Omega$ ) and Shear Stress ( $\tau$ ) Values**

	Bankfull Discharge (ft <sup>3</sup> /s)	Water surface Slope (ft/ft)	Total Stream Power ( $\Omega$ )	$\Omega/W$	Hydraulic Radius	Shear Stress ( $\tau$ )	Velocity (v)	$\tau_v$	$\tau_{max}$
<b>Existing Conditions</b>									
UT 1	39.5	0.0288	70.99	<b>8.76</b>	2.16	<b>3.88</b>	1.81	7.03	5.82
UT 2	7.7	0.1206	57.95	<b>9.99</b>	0.71	<b>5.36</b>	1.64	8.78	8.04
UT 3	8.7	0.0954	51.79	<b>14.00</b>	1.29	<b>7.65</b>	1.38	10.57	11.48
Fork Creek	99	0.0258	159.38	<b>9.27</b>	2.16	<b>3.48</b>	2.36	8.22	5.22
<b>Reference Conditions</b>									
<b>Stone Mountain</b>	271.7	0.0121	205.14	<b>6.73</b>	1.36	<b>1.03</b>	5.91	6.09	1.55
<b>Cranberry Creek</b>	103.5	0.0112	72.33	<b>5.79</b>	1.29	<b>0.90</b>	5.12	4.61	1.35
<b>Proposed Conditions</b>									
UT 1	39.5	0.0253	62.36	<b>5.88</b>	0.66	<b>1.05</b>	4.88	5.11	1.57
UT 2	7.7	0.0997	47.90	<b>9.58</b>	0.31	<b>1.93</b>	4.28	8.26	2.90
UT 3	8.7	0.0954	51.79	<b>9.77</b>	0.33	<b>1.95</b>	4.35	8.49	2.93
Fork Creek	99	0.0236	145.79	<b>8.94</b>	1.01	<b>1.49</b>	5.24	7.80	2.23

Reference reach values for stream power and shear stress are slightly lower than proposed on-site values due to less steep valley and water surface slopes, resulting in slightly lower stream power and shear stress values.

Existing, Site streams are characterized by a wide range of water surface slopes and varying degrees of degradation. In general, stream power values of existing streams are slightly elevated as compared to proposed values. Shear stress values of existing streams are significantly elevated as compared to proposed and reference reach values. Proposed stream power and shear stress values are adequate to mobilize and transport sediment through the Site, without aggradation or erosion on proposed stream banks.

## 5.2 Bankfull Verification

For this study, the bankfull channel is defined as the channel dimensions designed to support the "channel forming" or "dominant" discharge (Gordon et al. 1992).

Based on available Mountain regional curves, the predicted bankfull discharge for the reference reaches averages approximately 501.7 and 89.2 cubic feet per second (cfs) for Stone Mountain and Cranberry Creek Reference Reaches, respectively (Harmen et al. 2001).

Field indicators of bankfull, primarily topographic breaks identified on the banks, and riffle cross-sections were utilized to obtain an average bankfull cross-sectional area for the reference reaches. The Mountain regional curves were then utilized to plot the watershed area and discharge for the reference reach cross-sectional areas. Field indicators of bankfull approximate an average discharge of 271.7 and 103.5 cfs,



respectively for the reference reaches, which is approximately 54 and 116 percent of that predicted by the regional curves.

The USGS regional regression equation for the Mountain region indicates that bankfull discharge for the reference reaches at a 1.3-1.5 year return interval average approximately 385-410 and 65-80 cfs, respectively (USGS 2006), which is approximately 77-82 percent and 73-90 percent of that predicted by the regional curves.

Based on the above analysis of methods to determine bankfull discharge, proposed conditions at the Site will be based on an average of the Stone Mountain, and Cranberry Creek reference reaches, which is equivalent to indicators of bankfull on an on-site cross-section located in an undisturbed reach of UT2. Indicators of bankfull were used on the undisturbed reach of UT2 to compare the bankfull cross-sectional area to that predicted by the curves; however, a detailed reference reach analysis was not appropriate. Field indicators of bankfull on UT2 equaled 85 percent of the bankfull predicted by the regional curves. Therefore, designed on-site channel restoration area will equal approximately 85 percent of the channel size indicated by Mountain regional curves. Table B1 (Appendix B) provides the bankfull discharge for each reach. Table 13 summarizes all methods analyzed for estimating bankfull discharge.

**Table 13. Reference Reach Bankfull Discharge Analysis**

Method	Watershed Area (square miles)	Return Interval (years)	Discharge (cfs)	% Predicted by Curves*
<b>Stone Mountain Reference Reach</b>				
Mountain Regional Curves (Harman et al. 2001)	7.5	1.3-1.5	501.7	100%
Blue Ridge Regional Regression Model (USGS 2006)		1.3-1.5	385-410	77-82%
Field Indicators of Bankfull		1.3-1.5	271.7	54%
<b>Cranberry Creek Reference Reach</b>				
Mountain Regional Curves (Harman et al. 2001)	0.7	1.3-1.5	89.2	100%
Blue Ridge Regional Regression Model (USGS 2006)		1.3-1.5	65-80	73-90%
Field Indicators of Bankfull		1.3-1.5	103.5	116%
<b>UT2 Reference Reach (undisturbed reach on-site)</b>				
Mountain Regional Curves (Harman et al. 2001)	0.02	1.3-1.5	6.3	100%
Blue Ridge Regional Regression Model (USGS 2006)		1.3-1.5	5-6	80-95%
Field Indicators of Bankfull		1.3-1.5	5.4	85%

## 6 FUNCTIONAL UPLIFT AND PROJECT GOALS/OBJECTIVES

Project goals are based on the *French Broad River Basin Restoration Priorities 2009* (RBRP) report (NCEEP 2009) and on-site data collection of channel morphology and function observed during field investigations. The Site is located within the **Targeted Local Watershed (TLW) 06010108010020** (Figure 2, Appendix A). The project is not located in a Regional or Local Watershed Planning Area; however, RBRP goals are addressed by project activities as follows with Site specific information following the RBRP goals.

RBRP Goal	Site Objectives Addressing RBRP Goals
Implement wetland and stream restoration projects that reduce sources of sediment and nutrients by restoring riparian buffer vegetation, stabilizing banks, excluding livestock, and restoring natural geomorphology, especially in headwater streams.	<ol style="list-style-type: none"> <li>1. Restoring 4065 SMUs and 7.656 WMUs</li> <li>2. Removing               <ol style="list-style-type: none"> <li>a. 587.4 tons of sediment / yr</li> <li>b. 1020.8 lbs Nitrogen / yr</li> <li>c. 84.6 lbs Phosphorus / yr</li> </ol> </li> <li>3. Planting ~16 acres of riparian buffer Removing ~20 acres of livestock from production.</li> </ol>
Restore and protect habitat for priority fish, mussel, snail, and crayfish species in the basin [see Wildlife Resource Commission (2015) for a complete list].	Restoring or enhancing habitat for numerous species on the 2015 Wildlife Action Plan.
Cooperate with land trusts and resource agencies to help leverage federal and state grant funding for watershed restoration and conservation efforts.	NA
Protect high-quality habitats, especially those prioritized by the Natural Heritage Program as Significant Natural Heritage Areas.	The NCDMS Threemile Stream & Wetland Mitigation Site is located approximately 0.5 miles south, immediately downstream of the Site.

Site specific mitigation goals and objectives have been academically developed through the use of NC SAM and NC WAM analyses of existing and reference stream systems at the Site (NC SFAT 2015 and NC WFAT 2010). These methodologies rate functional metrics for streams and wetlands as high, medium, or low based on field data collected on forms and transferred into a rating calculator. Using Boolean logic, the rating calculator assigns a high, medium, or low value for each metric and overall function. Site functional assessment data forms are included in Appendix B.

Tables 14 through 16 summarize NC SAM and NC WAM metrics academically targeted for functional uplift and the corresponding mitigation activities proposed to provide functional uplift. Metrics academically targeted to meet the Site's goals and objectives are depicted in bold.

**Table 14. NC SAM Summary**

NC SAM Function Class Rating Summary	SAM 1 UT 2	SAM 2 Fork Creek	SAM 3 UT 3	SAM 4 UT 1
<b>(1) HYDROLOGY</b>	<b>LOW</b>	<b>LOW</b>	MEDIUM	<b>LOW</b>
(2) Baseflow	HIGH	HIGH	HIGH	MEDIUM
<b>(2) Flood Flow</b>	<b>LOW</b>	<b>LOW</b>	MEDIUM	<b>LOW</b>
<b>(3) Streamside Area Attenuation</b>	MEDIUM	<b>LOW</b>	MEDIUM	MEDIUM
<b>(4) Floodplain Access</b>	HIGH	<b>LOW</b>	HIGH	<b>LOW</b>
<b>(4) Wooded Riparian Buffer</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(4) Microtopography</b>	NA	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(3) Stream Stability</b>	<b>LOW</b>	<b>LOW</b>	MEDIUM	<b>LOW</b>
<b>(4) Channel Stability</b>	<b>LOW</b>	<b>LOW</b>	HIGH	<b>LOW</b>
<b>(4) Sediment Transport</b>	MEDIUM	MEDIUM	HIGH	MEDIUM
<b>(4) Stream Geomorphology</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(1) WATER QUALITY</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
(2) Baseflow	HIGH	HIGH	HIGH	MEDIUM
<b>(2) Streamside Area Vegetation</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(3) Upland Pollutant Filtration</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(3) Thermoregulation</b>	<b>LOW</b>	<b>LOW</b>	MEDIUM	<b>LOW</b>
(2) Indicators of Stressors	YES	YES	YES	YES
<b>(2) Aquatic Life Tolerance</b>	<b>LOW</b>	HIGH	MEDIUM	MEDIUM
<b>(1) HABITAT</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(2) In-stream Habitat</b>	<b>LOW</b>	<b>LOW</b>	MEDIUM	<b>LOW</b>
(3) Baseflow	HIGH	HIGH	HIGH	MEDIUM
<b>(3) Substrate</b>	<b>LOW</b>	MEDIUM	HIGH	MEDIUM
<b>(3) Stream Stability</b>	<b>LOW</b>	<b>LOW</b>	MEDIUM	<b>LOW</b>
<b>(3) In-Stream Habitat</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(2) Streamside Habitat</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(3) Streamside Habitat</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(3) Thermoregulation</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>OVERALL</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>

Based on NC SAM output, all three primary stream functional metrics (Hydrology, Water Quality, and Habitat)\ and 20 sub-metrics, are under-performing as exhibited by a LOW metric rating (see Figure 4, Appendix A for NC SAM data reaches). LOW performing metrics academically target functional uplift through mitigation activities, goals, objectives, monitoring, and success criteria.

**Table 15. NC WAM Summary**

NC WAM Sub-function Rating Summary	WAM 1	WAM 2	WAM 3	WAM 5	WAM 6*	WAM 7
Wetland Type	Headwater Forest					
<b>(1) HYDROLOGY</b>	<b>LOW</b>	<b>LOW</b>	MED	MED	HIGH	MED
<b>(2) Surface Storage &amp; Retention</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	HIGH	<b>LOW</b>
<b>(2) Sub-surface Storage and Retention</b>	<b>LOW</b>	<b>LOW</b>	HIGH	HIGH	HIGH	HIGH
<b>(1) WATER QUALITY</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	HIGH	<b>LOW</b>
<b>(2) Pathogen change</b>	MED	MED	MED	<b>LOW</b>	HIGH	<b>LOW</b>
<b>(2) Particulate Change</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	HIGH	<b>LOW</b>
<b>(2) Soluble change</b>	MED	MED	<b>LOW</b>	<b>LOW</b>	MED	<b>LOW</b>
<b>(2) Physical Change</b>	<b>LOW</b>	<b>LOW</b>	MED	<b>LOW</b>	HIGH	<b>LOW</b>
<b>(1) HABITAT</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(2) Physical Structure</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(2) Landscape Patch Structure</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>
<b>(2) Vegetative Composition</b>	MED	MED	<b>LOW</b>	MED	HIGH	<b>LOW</b>
<b>OVERALL</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	<b>LOW</b>	HIGH	<b>LOW</b>

\*Wetland 6 is in wooded areas adjacent to the floodplain.

Based on NC WAM output, all three primary wetland functional metrics (Hydrology, Water Quality, and Habitat) and 9 sub-metrics are under-performing as exhibited by a LOW metric rating. LOW performing metrics target functional uplift through mitigation activities, goals, objectives, monitoring, and success criteria.

Table 16 outlines stream and wetland functions targeted for functional uplift, goals tied to the specific functions, and objectives to be completed to achieve the proposed goals.

**Table 16. Targeted Functions, Goals, Objectives, and Uplift Evaluation**

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain. Remove overburden to reconnect with adjacent wetlands.	Dispersion of high flows on the floodplain, increase in biogeochemical cycling within the system, and recharging of riparian wetlands.	Four bankfull events and within monitoring period.	2 Crest gauges (pressure transducers) on Fork Creek and UT 2	To be determined
Improve stability of stream channels.	Construct stream channels that will maintain stable cross- sections, patterns, and profiles over time.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.	Bank height ratios remain below 1.2 over the monitoring period. Visual assessments showing progression towards stability.	16 Cross section surveys	To be determined
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zones and plant appropriate species on streambanks.	Reduction in floodplain sediment inputs from runoff, increased bank stability, increased LWD and organic material in streams, increased	Survival rate of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7.	16 veg plots	To be determined
Restore and enhance groundwater hydrology to drained or impacted hydric soil areas.	Reduce channel depth in incised stream reaches, remove drain tile, fill drainage ditches, and alleviate soil compaction from agriculture activities.	Particulate and pollution conversion, groundwater storage and reduced downstream flooding, habitat diversification, and vegetative composition conversion.	Groundwater saturation within 12 inches of the soil surface for 12 % of the growing season for reestablishment and improvement of hydrology in rehabilitation areas.	13 groundwater gauges	To be determined

Note: Soil temperature at the beginning of each monitoring period to verify the start of the growing season, groundwater and rain data for each monitoring period.

## **7 SITE DESIGN AND IMPLEMENTATION CONSTRAINTS**

The presence of conditions or characteristics that can hinder restoration activities on the Site was evaluated. The evaluation focused primarily on the presence of hazardous materials, utilities, restrictive easements, rare/threatened/endangered species or critical habitats, and hydrologic trespass potential. Existing information regarding Site constraints was acquired and reviewed. In addition, any Site conditions that can restrict the restoration design and implementation were documented during the field investigation.

Due to steep slopes, confined valleys, and the excavation of benches at the upper reaches of Fork Creek hydrologic trespass will not be an issue at the Site. Wider buffers have been acquired that encompass the entire floodplain. In addition, the property was purchased fee simple and an easement placed within the property boundaries, thereby alleviating lateral trespass issues.

Three conservation easement breaks occur to allow access to portions of the Site isolated by the easement. Two of the breaks will have road crossings and a third is power line easement break. Care was taken to move a powerline into one of the road crossings to minimize impacts associated with the easement break. In addition, a setback for potential future DOT road maintenance was incorporated into the road crossings. Easement breaks do constitute a significant reduction of functional uplift at the Site.

No known Site constraints that may hinder proposed mitigation activities were identified during field surveys. An Environmental Screening (Categorical Exclusion) document is included in Appendix E.

## **8 DESIGN APPROACH AND MITIGATION WORK PLAN**

### **8.1 Stream Design**

On-site streams targeted for restoration have endured significant disturbance from land use activities such as land clearing, livestock grazing, straightening and rerouting of channels, ditching within the floodplain, and other anthropogenic maintenance. Site streams will be restored to emulate historical conditions at the Site utilizing parameters from nearby, relatively undisturbed reference streams (see Section 4.1 Reference Streams).

Primary activities designed to restore Site streams include 1) stream restoration, 2) stream enhancement (Level I), 3) stream enhancement (Level II), 4) stream preservation, 5) wetland re-establishment, 6) wetland rehabilitation, 7) wetland preservation, 8) construction of marsh treatment areas and 9) vegetation planting (Figures 6A-6C, Appendix A).

The Wilmington District of the USACE includes Regional Conditions to Nationwide Permitting that Trout Waters are excluded from permitted activities between October 15 and April 15 without prior written approval from the North Carolina Wildlife Resources Commission. This moratorium will be observed for this project.

#### **8.1.1 Stream Restoration**

Stream restoration efforts are designed to restore a stable stream that approximates hydrodynamics, stream geometry, and local microtopography relative to reference conditions. Restoration at the Site will be Priority I restoration; therefore, bankfull elevations will be raised to meet the adjacent valley floodplain elevation.

Stream restoration is expected to entail 1) channel excavation to dimensions depicted in Figure 7 (Appendix A), 2) channel stabilization, 3) channel diversion, and 4) channel backfill.

It should be noted that some portions of the restoration and enhancement (level I) reaches are characterized by suitable bed material. Seeding the newly restored/enhanced reaches with on-site bed material provides the channel with appropriate bed material and benthic macroinvertebrates. Channels are to be constructed in the dry, with pump around or construction on new location. Once the channel has been constructed, suitable bed material from the abandoned channel will be seed into the newly constructed channel in a timely manner.

#### *In-stream Structures*

In-stream structures will be used for grade control, habitat, and to elevate local water surface profiles in the channel, flattening the water energy slope or gradient and directing stream energy into the center of the channel and away from banks. The structures will consist of log cross-vanes or log j-hook vanes; however, at the Engineer's discretion, rock cross-vanes or rock j-hook vanes may be substituted if dictated by field conditions. In addition, the structures will be placed in relatively straight reaches to provide secondary (perpendicular) flow cells during bankfull events. Steeply sloped sections of the Site characterized by step pool (B-type) channels will have sill step and step-pool structures installed.

#### *Piped Channel Crossing*

Landowner constraints will necessitate installing two piped channel crossings within breaks in the easement to allow access to portions of the property isolated by stream restoration activities Figures 6A-6C (Appendix A). The crossings are currently perched and serve as barriers to wildlife crossing. The crossings will be constructed with suitable sized pipes to allow for stormwater flows, with adjacent floodplain pipes to allow for overflow discharge onto the floodplain. Materials will include hydraulically stable rip-rap or suitable rock. The crossing will be large enough to handle anticipated vehicular traffic. Approach grades to the crossing will be at an approximate 10:1 slope and constructed of hard, scour-resistant crushed rock or other permeable material, which is free of fines.

#### *Marsh Treatment Area*

Three shallow wetland marsh treatment areas will be excavated in the floodplain to intercept surface waters draining through adjacent land use before discharging into Site tributaries. Marsh treatment areas are intended to improve the mitigation project and are not generating mitigation credit. The proposed marsh treatment area locations are depicted in Figures 6A-C (Appendix A). They will consist of shallow depressions that will provide treatment and attenuation of initial stormwater pulses. The outfall will be constructed of hydraulically stable rip-rap or other suitable material to protect against headcut migration into the constructed depression. It is expected that the treatment area will fill with sediment and organic matter over time. No long-term maintenance is need for these features of the project.

#### *Drop Structure*

A drop structure is proposed on Fork Creek at the Site outfall. The drop structure will be constructed out of log cross vanes and large cobble depending upon anticipated scour from the restored stream channels. The structure should be constructed to resist erosive forces associated with hydraulic drops proposed at the Site. A detailed depiction of the proposed cross section is included in Appendix L (Construction Plans).

### 8.1.2 Stream Enhancement (Level I)

Stream enhancement (level I) will entail stream dimension restoration, installation of habitat and grade control structures, easement markers, and planting riparian buffers with native forest vegetation to facilitate stream recovery and prevent further stream degradation.

### 8.1.3 Stream Enhancement (Level II)

Stream enhancement (level II) will entail installing easement markers, removing livestock, minor bank treatments, and planting riparian buffers with native forest vegetation to facilitate stream recovery and prevent further degradation of the stream.

### 8.1.4 Stream Preservation

Stream preservation will occur on the upstream reaches of UTs 2, 3, 4, and 5. These reaches are characterized by channels with mature riparian vegetation, suitable channel bed substrate, and little bank erosion. The reaches are not frequently accessed by livestock and are included in the project to protect the project's upstream and downstream ends from future impacts.

## 8.2 Individual Reach Discussions

Mitigation strategies proposed for each reach are presented below.

**Table 17. Individual Reach Descriptions and Functional Uplift**

Individual Reach	Mitigation Activities	Functional Uplift Provided for Identified Stressors
Fork Creek	<ul style="list-style-type: none"> <li>• Tie into upstream property boundary and elevate the stream bed with grade control/habitat structures and contour the channel banks to the appropriate dimension.</li> <li>• Move the channel away from a severely eroding slope.</li> <li>• Move the channel across the floodplain using Priority 1 stream restoration on a new location.</li> <li>• Install a piped channel crossing at the driveway.</li> <li>• Remove livestock from the property.</li> <li>• Remove drain tiles within the floodplain to restore wetland hydrology.</li> <li>• Plant a vegetative buffer within the entire floodplain.</li> <li>• Tie into downstream, off-site stream elevations with a drop structure.</li> </ul>	<ul style="list-style-type: none"> <li>• Non-functioning riparian buffer/wetland vegetation</li> <li>• Sediment</li> <li>• Nutrients</li> <li>• Fecal Coliform</li> <li>• Peak Flows</li> <li>• Ditching/Draining</li> <li>• Limited Bedform Diversity</li> <li>• Absence of Large Woody Debris</li> </ul>
UT-1	<ul style="list-style-type: none"> <li>• Tie to the upstream culvert and eliminate perched hydrologic step that may hinder wildlife passage.</li> <li>• Move the channel across the floodplain using Priority 1 stream restoration on a new location.</li> <li>• Tie the channel to Fork Creek in a natural location and eliminate parallel stream channels excavated to drain wetlands throughout the floodplain.</li> <li>• Remove livestock from the property.</li> <li>• Remove drain tiles within the floodplain to restore wetland hydrology.</li> <li>• Plant a vegetative buffer within the entire floodplain.</li> </ul>	<ul style="list-style-type: none"> <li>• Non-functioning riparian buffer/wetland vegetation</li> <li>• Sediment</li> <li>• Nutrients</li> <li>• Fecal Coliform</li> <li>• Peak Flows</li> <li>• Ditching/Draining</li> <li>• Limited Bedform Diversity</li> <li>• Absence of Large Woody Debris</li> </ul>



**Table 17. Individual Reach Descriptions and Functional Uplift (Continued)**

<p>UT-2</p>	<ul style="list-style-type: none"> <li>• Preserve the upper reaches of the channel, including spring head discharge locations.</li> <li>• Remove livestock from the property.</li> <li>• Enhance (Level II) wooded portions of the stream where increased livestock activity occurs.</li> <li>• Restore the lower reaches of stream channel by installing habitat/grade control structures, excavating a defined channel with adjacent floodplain bench, placing cobble bed material, and tie to channel to Fork Creek.</li> <li>• Maintain an existing piped stream crossing that is located beneath a power line.</li> </ul>	<ul style="list-style-type: none"> <li>• Non-functioning riparian buffer/wetland vegetation</li> <li>• Sediment</li> <li>• Nutrients</li> <li>• Fecal Coliform</li> <li>• Peak Flows</li> <li>• Limited Bedform Diversity</li> <li>• Absence of Large Woody Debris</li> </ul>
<p>UT-3</p>	<ul style="list-style-type: none"> <li>• Preserve the upper reaches of the channel, including spring head discharge locations.</li> <li>• Enhance (Level II) wooded portions of the stream by decommissioning and revegetating a forest road, removing a capped springhead with piped water supply, and planting forest vegetation.</li> <li>• Enhance (Level I) open portions of the stream by installing habitat/grade control structures, excavate channel to proper dimension, install cobble material, and restore wetlands adjacent to the channel.</li> <li>• Restore the stream's lower reaches through Priority 1 excavation of a channel on a new location and tie the channel into Fork Creek.</li> </ul>	<ul style="list-style-type: none"> <li>• Non-functioning riparian buffer/wetland vegetation</li> <li>• Sediment</li> <li>• Nutrients</li> <li>• Fecal Coliform</li> <li>• Peak Flows</li> <li>• Ditching/Draining</li> <li>• Limited Bedform Diversity</li> <li>• Absence of Large Woody Debris</li> </ul>
<p>UT-4</p>	<ul style="list-style-type: none"> <li>• Preserve the entire length of the channel, including spring head discharge locations.</li> <li>• Tie into Fork Creek using Priority 1 stream restoration techniques.</li> </ul>	<ul style="list-style-type: none"> <li>• Peak Flows</li> </ul>

**8.3 Wetland Reestablishment**

Alternatives for wetland re-establishment are designed to restore a fully functioning wetland system, provide surface water storage, nutrient cycling, removal of imported elements and compounds, and create a variety and abundance of wildlife habitat.

Portions of the Site underlain by hydric soils have been impacted by stream dredging, drain tile installation, vegetative clearing, agriculture plowing, and other land disturbances associated with land use management. Wetland re-establishment will focus on the restoration of vegetative communities, restoration of stream corridors, and historic groundwater tables, and the re-establishment of soil structure and microtopographic variations. These activities will re-establish 7.656 acres, rehabilitate 1.845 acres, enhance 0.148 acres, and preserve 0.198 acres of jurisdictional riparian riverine wetlands.

**8.4 Soil Restoration**

Soil grading will occur during stream restoration activities. Topsoils will be stockpiled during construction activities and spread on the soil surface once a subgrade has been established. The replaced topsoil will serve as a viable growing medium for community restoration to provide nutrients and aid in the survival of planted species. Areas of soil compaction from livestock or other land uses will be deep ripped to break up the soil surface prior to planting.

## **8.5 Natural Plant Community Restoration**

Restoration of floodplain forest and streamside habitat allows for the development and expansion of characteristic species across the landscape. Ecotonal changes between community types contribute to species diversity and provide secondary benefits, such as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife. Reference Forest Ecosystem (RFE) data, on-site observations, and community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990) were used to develop the primary plant community associations planted during community restoration activities.

### **8.5.1 Treatment of Fescue Grass**

Before construction activities, areas of the Site dominated by fescue and opportunistic herbaceous species will be mowed and treated with the appropriate herbicide by a licensed pesticide applicator (anticipated date, April/May 2021). If dense fescue areas are still present after construction, a second herbicide treatment will be made before planting and permeant seeding of the Site (anticipated date, September/October 2021).

### **8.5.2 Planting Plan**

Streamside trees and shrubs include species with high value for sediment stabilization, rapid growth rate, and the ability to withstand hydraulic forces associated with bankfull flow and overbank flood events. Streamside trees and shrubs will be planted within 15 feet of the channel top of bank throughout the meander belt-width. Shrub elements will be planted along the reconstructed stream banks, concentrated along outer bends. Montane Alluvial Forest is the target community for Site floodplains, and Acidic Cove Forest is the target community for upland side-slopes.

Bare-root seedlings within the Montane Alluvial and Acidic Cove Forests will be planted at a density of approximately 680 stems per acre on 8-foot centers. Shrub species in the streamside assemblage and Marsh Treatment Areas will be planted at a density of 2720 stems per acre on 4-foot centers.

Table 16 depicts the total number of stems and species distribution within each vegetation association (Figure 8, Appendix A). Planting will be performed between December 1 and March 15 to allow plants to stabilize during the dormant period and set root during the spring season.

**Table 18. Planting Plan**

Vegetation Association		Montane Alluvial Forest*		Acidic Cove Forest*		Stream-side Assemblage**		TOTAL
Area (acres)		9.0		4.7		2.5		16.2
Species	Indicator Status	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
Basswood ( <i>Tilia americana</i> )	FACU	100	2%	200	6%			300
Cherry birch ( <i>Betula lenta</i> )	FACU	100	2%	400	13%	500	7%	1000
Eastern hemlock ( <i>Tsuga canadensis</i> )	FACU	100	2%	100	3%	--	--	200
Red oak ( <i>Quercus rubra</i> )	FACU	--	--	300	9%	--	--	300
White Ash ( <i>Fraxinus americana</i> )	FACU	100	2%	300	9%	--	--	400
White Oak ( <i>Quercus alba</i> )	FACU	100	2%	400	13%	--	--	500
White pine ( <i>Pinus strobus</i> )	FACU	100	2%	400	13%	--	--	500
Yellow birch ( <i>Betula alleghaniensis</i> )	FACU	100	2%	300	9%	500	7%	900
Black Gum ( <i>Nyssa sylvatica</i> )	FAC	600	10%	100	3%	500	7%	1200
Persimmon ( <i>Diosporos virginiana</i> )	FAC	200	3%	300	9%	--	--	500
Scarlet Oak ( <i>Quercus imbricaria</i> )	FAC	200	3%	100	3%	--	--	300
Shadbush ( <i>Amelanchier arborea</i> )	FAC	100	2%	--	--	400	6%	500
Tulip poplar ( <i>Liriodendron tulipifera</i> )	FAC	600	10%	200	6%	500	7%	1300
American elm ( <i>Ulmus americana</i> )	FACW	600	10%	100	3%	500	7%	1200
Hackberry ( <i>Celtis laevigata</i> )	FACW	600	10%	--	--	500	7%	1100
River birch ( <i>Betula nigra</i> )	FACW	600	10%	--	--	500	7%	1100
Swamp Chestnut Oak ( <i>Quercus michauxii</i> )	FACW	600	10%	--	--	400	6%	1000
Sycamore ( <i>Platanus occidentalis</i> )	FACW	600	10%	--	--	500	7%	1100
Tag alder ( <i>Alnus serrulata</i> )	FACW	300	5%	--	--	400	6%	700
Silky Dogwood ( <i>Cornus amomum</i> )***	FACW	200	3%	--	--	400	6%	600
Black willow ( <i>Salix nigra</i> )***	OBL	300	5%	--	--	400	6%	700
Elderberry ( <i>Sambucus nigra</i> )***	OBL	--	--	--	--	400	6%	400
Buttonbush ( <i>Cephalanthus occidentalis</i> )***	OBL	--	--	--	--	400	6%	400
<b>TOTAL</b>	FACU	<b>6200</b>	<b>100%</b>	<b>3200</b>	<b>100%</b>	<b>6800</b>	<b>100%</b>	<b>16200</b>

\* Planted at a density of 680 stems/acre.

\*\* Planted at a density of 2720 stems/acre.

\*\*\* May be live staked.

Due to floodplain soils being of the Nikwasi series, scattered openings dominated by herbs and shrubs are likely to develop overtime. These areas are expected to be less than an acre in size and encompass less than 20% of the Site. The general location of expected herbaceous dominated wetlands is depicted in Figure 8 (Appendix A). As the wetland matures, poorly drained soils will make conditions favorable for species like those described in a Swamp Forest-Bog Complex to thrive. In addition, two reference wetlands have been identified near the Site (one in Banner Elk and one in Julian Price Park). These wetlands are underlain by Nikwasi soils and exhibit hydrologic and landscape characteristics similar to the Site. The proposed seed mix uses herbaceous and shrub species identified at the reference wetlands.

- |  |   |
|--|---|
| 1. Rough-leaved goldenrod ( <i>Solidago patula</i> ) | 8. New England aster ( <i>Aster novae-angliae</i> ) |
| 2. Golden ragwort ( <i>Senecio aureus</i> )          | 9. Mountain laurel ( <i>Kalmia latifolia</i> )      |
| 3. Bog clubmoss ( <i>Lycopodium inandatum</i> )      | 10. Mountain winterberry ( <i>Ilex montana</i> )    |
| 4. Bullrush ( <i>Scirpus sp.</i> )                   | 11. Silky willow ( <i>Salix sericea</i> )           |
| 5. Bur reed ( <i>Sparganium americanum</i> )         | 12. Male-berry ( <i>Lyonia ligustrina</i> )         |
| 6. Cinnamon fern ( <i>Osmunda cinnamomea</i> )       | 13. Sedges ( <i>Carex spp.</i> )                    |
| 7. Cranberry ( <i>Vaccinium macrocarpon</i> )        | 14. Rushes ( <i>Juncus spp.</i> )                   |

### 8.5.3 Nuisance Species Management

Invasive plant species will be observed and controlled mechanically and/or chemically as part of this project. No other nuisance species controls are proposed at this time. Inspections for beaver and other potential nuisance species will occur throughout the monitoring period. Appropriate actions may be taken to ameliorate any negative impacts regarding vegetation development and/or water management on an as-needed basis. The presence of other nuisance species will be monitored throughout the monitoring period. Appropriate actions will be taken to alleviate any negative impacts regarding vegetation development and/or water management on an as-needed basis.

## 9 MONITORING AND SUCCESS CRITERIA

Monitoring and success criteria has been developed in accordance with 2016 NCIRT guidance. Monitoring will be conducted by Axiom Environmental, Inc based on the schedule in Table 19. A summary of monitoring is outlined in Table 20 (Figure 9, Appendix A). Annual monitoring reports will be submitted to the North Carolina Division of Mitigation Services (NCDMS) by Restoration Systems no later than December 1 of each monitoring year data is collected.

**Table 19. Monitoring Schedule**

Resource	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Streams	x	x	x		x		x
Wetlands	x	x	x	x	x	x	x
Vegetation	x	x	x		x		x
Visual Assessment	x	x	x	x	x	x	x
Report Submittal	x	x	x	x	x	x	x

**Table 20. Monitoring Summary**

Stream Parameters				
Parameter	Method	Schedule/Frequency	Number/Extent	Data Collected/Reported
Stream Profile	Full longitudinal survey	As-built (unless otherwise required)	All restored stream channels	Graphic and tabular data.
Stream Dimension	Cross-sections	Years 1, 2, 3, 5, and 7	Total of 16 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern will be depicted on a plan view figure with a written assessment and photograph of the area included in the report.
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Bankfull Events	Continuous monitoring of surface water gauges and/or trail camera	Continuous recording through the monitoring period	One surface water gauge on Fork Creek	Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through the monitoring period	One crest gauge on Fork Creek	Visual evidence, photo documentation, and/or rain data.
Wetland Parameters				
Parameter	Method	Schedule/Frequency	Number/Extent	Data Collected/Reported
Wetland Reestablishment	Groundwater gauges	Yearly with the growing season defined as March 1-October 22	13 gauges spread throughout restored wetlands	Soil temperature at the beginning of each monitoring period to verify the start of the growing season, groundwater and rain data for each monitoring period
Vegetation Parameters				
Parameter	Method	Schedule/Frequency	Number/Extent	Data Collected/Reported
Vegetation establishment and vigor	Permanent vegetation plots 0.0247 acres (100 square meters) in size; <i>CVS-EEP Protocol for Recording Vegetation, Version 4.2</i> (Lee et al. 2008)	As-built, Years 1, 2, 3, 5, and 7	16 plots spread across the Site	Species, height, planted vs. volunteer, stems/acre

Note: Volunteer species on the approved planting list must be established for 2 years to count towards success and will be subject to height standards.

## 9.1 Success Criteria

Monitoring and success criteria for stream restoration should relate to project goals and objectives identified from on-site NC SAM and NC WAM data collection. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving success criteria. Table 21 summarizes Site success criteria.

**Table 21. Success Criteria**

<b>Streams</b>
<ul style="list-style-type: none"><li>• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05.</li><li>• Continuous surface flow must be documented in intermittent reaches each year for at least 30 consecutive days.</li><li>• Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section.</li><li>• BHR at any measure riffle cross-section should not change by more than 10% from baseline condition during any given monitoring period.</li><li>• The stream shall remain stable, and all other performance standards shall be met through four separate bankfull events, occurring in separate years, during the monitoring years 1-7.</li><li>• Intermittent streams will demonstrate at least 30-days consecutive flow.</li></ul>
<b>Wetland Hydrology</b>
<ul style="list-style-type: none"><li>• Annual saturation or inundation within the upper 12 inches of the soil surface for, at a minimum, 12 percent of the growing season during average climatic conditions.</li></ul>
<b>Vegetation</b>
<ul style="list-style-type: none"><li>• Within planted portions of the Site, a minimum of 320 stems per acre must be present at year 3; a minimum of 260 stems per acre must be present at year 5; and a minimum of 210 stems per acre must be present at year 7.</li><li>• Trees must average 6 feet in height at year 5 and 8 feet in height at year 7 in each plot.</li><li>• Planted and volunteer stems are counted, provided they are included in the approved planting list for the Site; natural recruits not on the planting list may be considered by the IRT on a case-by-case basis.</li><li>• Areas of herbaceous vegetation establishment will have a minimum of four species present.</li></ul>

## 9.2 Contingency

In the event that stream success criteria are not fulfilled, a mechanism for contingency will be implemented. It should be noted that some aspects of adaptive management may require IRT review and USACE/DWR permit authorizations.

### 9.2.1 Stream Contingency

Stream contingency may include, but may not be limited to 1) structure repair and/or installation; 2) repair of dimension, pattern, and/or profile variables; and 3) bank stabilization. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success, include 1) structure failure, 2) headcut migration through the Site, and/or 3) bank erosion.

#### Structure Failure

In the event that structures are compromised, the affected structure will be repaired, maintained, or replaced. Once the structure is repaired or replaced, it must function to stabilize adjacent stream banks and/or maintain grade control within the channel. Structures that remain intact, but exhibit flow around,

beneath, or through the header/footer will be repaired by excavating a trench on the upstream side of the structure and reinstalling filter fabric in front of the pilings. Structures that have been compromised, resulting in shifting or collapse of a header/footer, will be removed and replaced with a structure suitable for Site flows.

#### Headcut Migration Through the Site

If a headcut occurs within the Site (identified visually or through measurements [i.e., bank-height ratios exceeding 1.4]), provisions for impeding headcut migration and repairing damage caused by the headcut will be implemented. Headcut migration may be impeded by installing in-stream grade control structures (rip-rap sill and/or log cross-vane weir) and/or restoring stream geometry variables until channel stability is achieved. Channel repairs to stream geometry may include channel backfill with coarse material and stabilizing the material with erosion control matting, vegetative transplants, and/or willow stakes.

#### Bank Erosion

If severe bank erosion occurs within the Site, resulting in incision, lateral instability, and/or elevated width-to-depth ratios locally or systemically, contingency measures to reduce bank erosion and width-to-depth ratio will be implemented. Bank erosion contingency measures may include the installation of log-vane weirs and/or other bank stabilization measures. If the resultant bank erosion induces shoot cutoffs or channel abandonment, a channel may be excavated to reduce shear stress to stable values.

#### Beaver and other Invasive Species

Indications of beaver establishment will be monitored throughout the 7-year monitoring period. If beaver are identified in the Site, the dam's location will be depicted on CCPV mapping, and the beaver will be trapped. Once the beaver have been trapped, the dam will be removed. Removal of the dam is expected to occur by hand to minimized disturbance to the adjacent mitigation areas.

When invasive species controls are required by the IRT, species such as multiflora rose (*Rosa multiflora*), Russian olive (*Eleagnus angustifolium*), Chinese privet (*Ligustrum sinense*), and tree of heaven (*Ailanthus altissima*) will be treated by cutting and directly treating the stump with Garlon 4A (or other similar materials) to minimize re-sprouting. Appropriate actions to ameliorate any negative impacts regarding vegetation development and/or water management will occur on an as-needed basis. Additional monitoring or other contingency measures will be determined by consultation with the IRT.

#### Road/Culvert Maintenance

Observation of road crossings/culverts will occur during regular monitoring visits conducted at the Site. Culverts will be monitored primarily for blockage; however, it will also be noted if erosion is occurring. Once the seven-year monitoring period has expired, maintenance of the crossing will be the landowner's responsibility.

#### Development/Logging

Topographic re-entrants discharging into the conservation easement typically are directed into marsh treatment areas that treat the initial stormwater pulse to capture sediment and nutrients from adjacent runoff. These areas will naturalize over time into small wetland depressions. If the property adjacent to the Site is developed or logged such that excessive sediment enters the Site, the marsh treatment area may be re-excavated to capture additional drainage effluent. Maintenance of the marsh treatment area is not expected to occur over an extended period of time; however, short term maintenance may occur until stabilization of the adjacent landscape occurs.

### **9.2.2 Wetland Contingency**

Hydrological contingency will require consultation with hydrologists and regulatory agencies if wetland hydrology enhancement is not achieved. Floodplain surface modifications, including the construction of ephemeral pools, represent a likely mechanism to increase the floodplain area in support of jurisdictional wetlands. Recommendations for contingency to establish wetland hydrology will be implemented and monitored until Hydrology Success Criteria are achieved. IRT consultation and approval will be necessary if future earthwork is proposed. In addition, if the depth of ephemeral pools exceeds 1 foot, the credit ratio may be changed to reflect wetland creation.

### **9.2.3 Vegetation Contingency**

If vegetation success criteria are not achieved, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria. Possible scenarios which could cause the implementation of supplemental planting are beaver activity (which would require trapping and removal of beavers) and poor soil quality (which may require the application of soil amendments).

### **9.2.4 Easement Encroachment**

Site design, and particularly the size and placement of the conservation easement, make encroachment very unlikely. All adjacent agricultural uses have been removed from the project's parent fee-simple tract. 60-foot easement breaks provide access from the DOT road to the residential lots located adjacent to the Site and allow for ample room for maintenance outside of the easement. The Site is boarded by the NC DOT's Little Buck Hill Road to the west, a private drive to the south, an unnamed tributary to the north, and steep slopes to the east. Further, The Site's easement encompasses a vast majority of the area's upland buffer.

The entire easement area will be appropriately marked to identify the easement boundaries per United States Army Corps of Engineers (USACE) and Interagency Review Team (IRT) requirements. Within forested areas, tree marking via pant and signage will ensure a clearly delineated easement. Along open forest restoration areas of the Site, t-posts or treated wood posts will be used with easement signage to designate the easement boundaries.

In the event easement encroachment does take place, RS will work with the individual/s who caused the encroachment to further educate them about the project and the easement. As necessary, RS will add additional signage and re-establish any damaged vegetation.

## **9.3 Compatibility with Project Goals**

The following table outlines the compatibility of Site performance criteria described above to Site goals and objectives that will be utilized to evaluate if Site goals and objectives are achieved.



**Table 22. Compatibility of Performance Criteria to Project Goals and Objectives**

Goals	Objectives	Success Criteria
<b>(1) HYDROLOGY</b>		
Minimize downstream flooding to the maximum extent possible.	<ul style="list-style-type: none"> <li>• Construct a new channel at historic floodplain elevation to restore overbank flows</li> <li>• Remove drain tiles and agriculture ditches</li> <li>• Plant woody riparian buffer</li> <li>• Deep rip floodplain soils to reduce compaction and increase soil surface roughness</li> <li>• Protect riparian buffers with a perpetual conservation easement</li> </ul>	<ul style="list-style-type: none"> <li>• BHR not to exceed 1.2</li> <li>• Document four overbank events in separate monitoring years</li> <li>• Livestock excluded from the easement</li> <li>• Attain Wetland Hydrology Success Criteria</li> <li>• Attain Vegetation Success Criteria</li> <li>• Conservation Easement recorded</li> </ul>
Increase stream stability within the Site so that channels are neither aggrading nor degrading.	<ul style="list-style-type: none"> <li>• Construct channels with the proper pattern, dimension, and longitudinal profile</li> <li>• Remove livestock from the property</li> <li>• Construct stable channels with the appropriate substrate</li> <li>• Upgrade piped channel crossings</li> <li>• Plant woody riparian buffer</li> <li>• Stabilize stream banks</li> </ul>	<ul style="list-style-type: none"> <li>• Cross-section measurements indicate a stable channel with the appropriate substrate</li> <li>• Visual documentation of stable channels and structures</li> <li>• BHR not to exceed 1.2</li> <li>• &lt; 10% change in BHR in any given year</li> <li>• Livestock excluded from the easement</li> <li>• Attain Vegetation Success Criteria</li> </ul>
<b>(1) WATER QUALITY</b>		
Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	<ul style="list-style-type: none"> <li>• Remove agricultural livestock and reduce agricultural land/inputs</li> <li>• Install marsh treatment areas</li> <li>• Plant woody riparian buffer</li> <li>• Restore/enhance jurisdictional wetlands adjacent to Site streams</li> <li>• Provide surface roughness and reduce compaction through deep ripping/plowing.</li> <li>• Restore overbank flooding by constructing channels at historic floodplain elevation.</li> </ul>	<ul style="list-style-type: none"> <li>• Livestock excluded from the easement</li> <li>• Attain Wetland Hydrology Success Criteria</li> <li>• Attain Vegetation Success Criteria</li> </ul>
<b>(1) HABITAT</b>		
Improve instream and streamside habitat.	<ul style="list-style-type: none"> <li>• Construct stable channels with the appropriate substrate</li> <li>• Plant woody riparian buffer to provide organic matter and shade</li> <li>• Construct a new channel at historic floodplain elevation to restore overbank flows</li> <li>• Protect riparian buffers with a perpetual conservation easement</li> <li>• Restore/enhance jurisdictional wetlands adjacent to Site streams</li> <li>• Stabilize stream banks</li> <li>• Install in-stream structures</li> </ul>	<ul style="list-style-type: none"> <li>• Cross-section measurements indicate a stable channel with the appropriate substrate</li> <li>• Visual documentation of stable channels and in-stream structures</li> <li>• Attain Wetland Hydrology Success Criteria</li> <li>• Attain Vegetation Success Criteria</li> <li>• Conservation Easement recorded</li> </ul>

## 10 ADAPTIVE MANAGEMENT PLAN

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

## 11 LONG-TERM MANAGEMENT PLAN

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

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## **APPENDIX A - FIGURES**

Figure 1. Site Location

Figure 2. Hydrologic Unit Map

Figure 3. Topography and Drainage Area

Figure 4. Existing Conditions and Soils

Figure 5A. Stone Mountain Reference Dimension, Pattern, and Profile

Figure 5B. Cranberry Creek Reference Reach Dimension, Pattern, and Profile

Figure 6. Proposed Conditions

Figures 6A-C. Restoration Plan

Figure 6D. Asset Map

Figure 7. Proposed Dimension, Pattern, and Profile

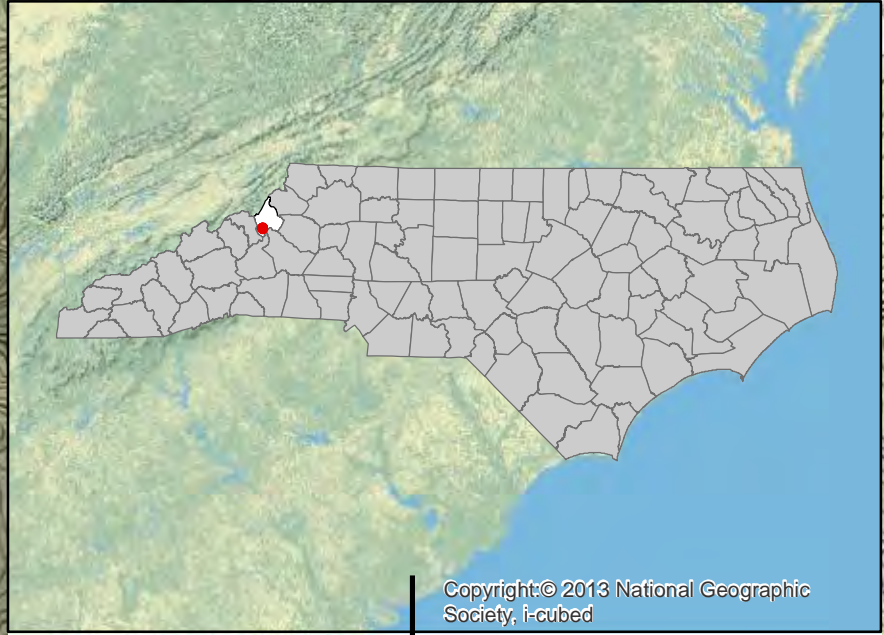
Figure 8. Planting Plan

Figure 9. Monitoring Plan

Figure 10. Stream Buffer Credit Adjustment Output

Figure 11. Lidar

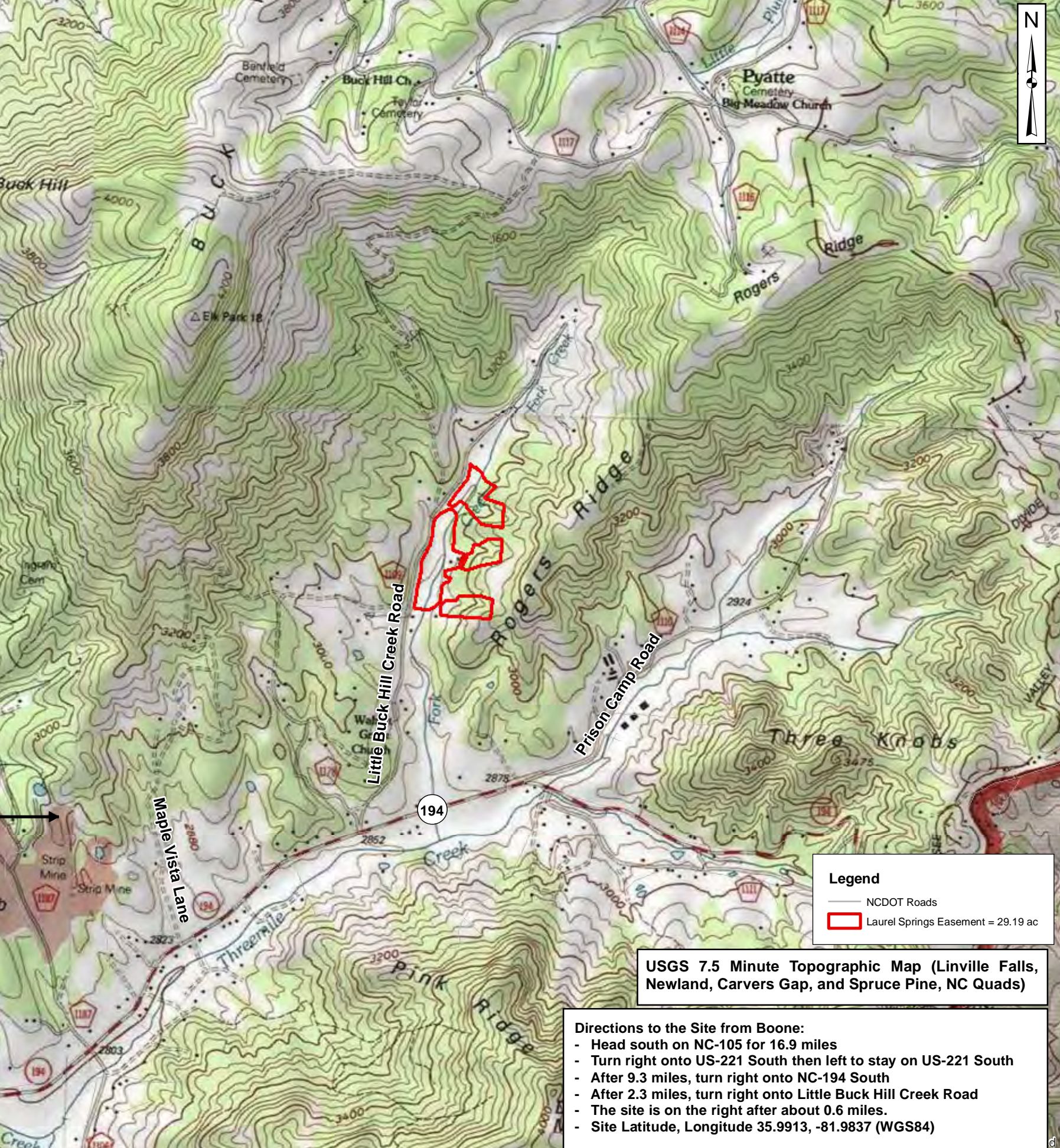




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**Legend**

- NCDOT Roads
- ▭ Laurel Springs Easement = 29.19 ac

USGS 7.5 Minute Topographic Map (Linville Falls, Newland, Carvers Gap, and Spruce Pine, NC Quads)

- Directions to the Site from Boone:**
- Head south on NC-105 for 16.9 miles
  - Turn right onto US-221 South then left to stay on US-221 South
  - After 9.3 miles, turn right onto NC-194 South
  - After 2.3 miles, turn right onto Little Buck Hill Creek Road
  - The site is on the right after about 0.6 miles.
  - Site Latitude, Longitude 35.9913, -81.9837 (WGS84)



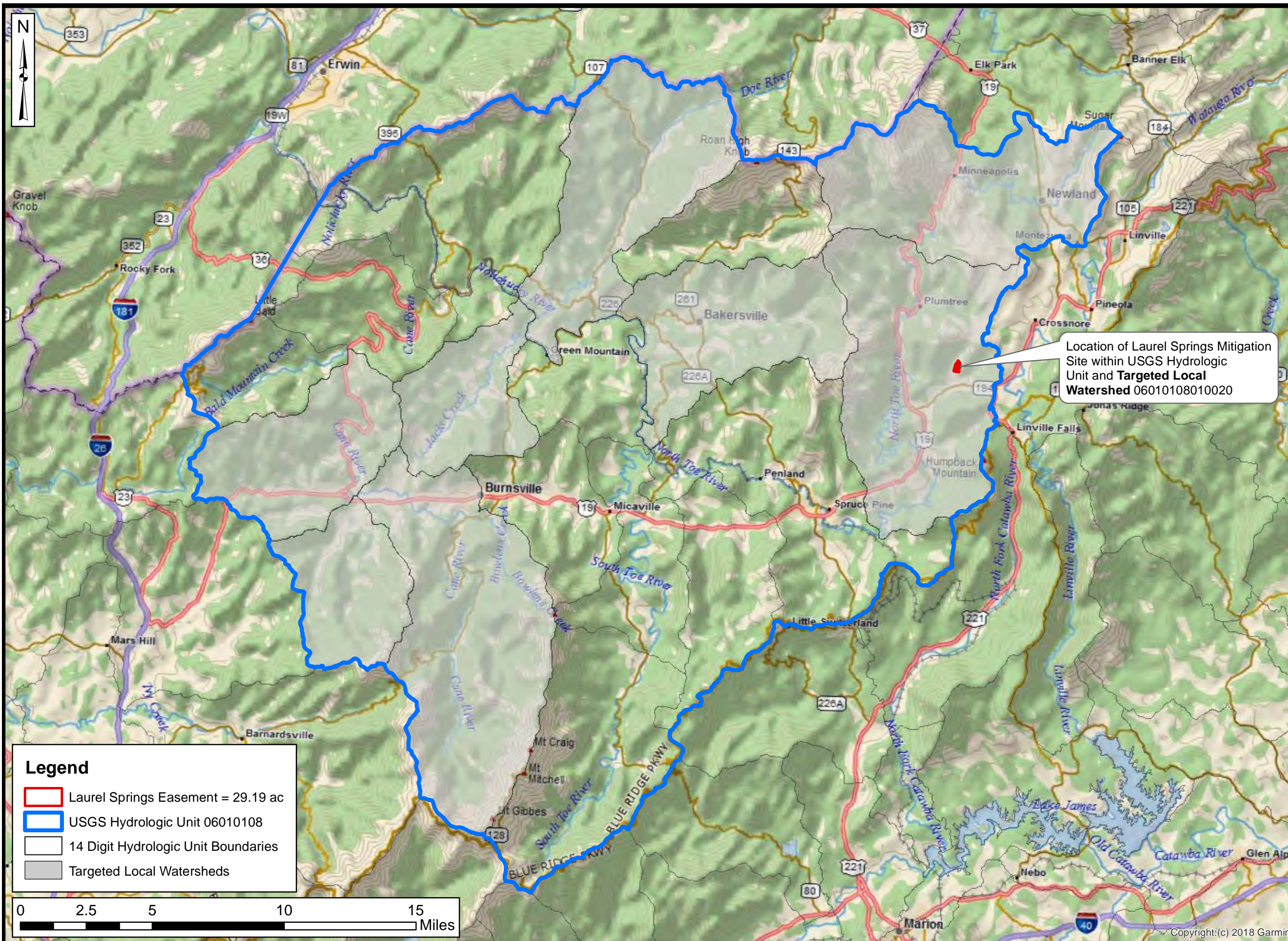
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**LAUREL SPRINGS MITIGATION SITE**  
  
Avery County, NC

Title:  
**SITE LOCATION**

Drawn by: KRJ  
Date: AUG 2019  
Scale: 1:20,000  
Project No.: 19-009

**FIGURE 1**





Axiom Environmental, Inc.

Prepared for:



Project:

**LAUREL SPRINGS MITIGATION SITE**

Avery County, NC

Title:

**HYDROLOGIC UNIT MAP**

Drawn by:

KRJ

Date:

AUG 2019

Scale:

1:220,000

Project No.:

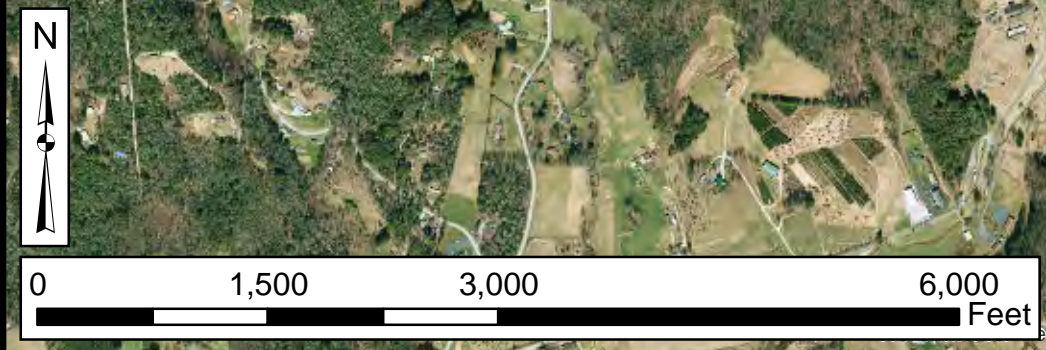
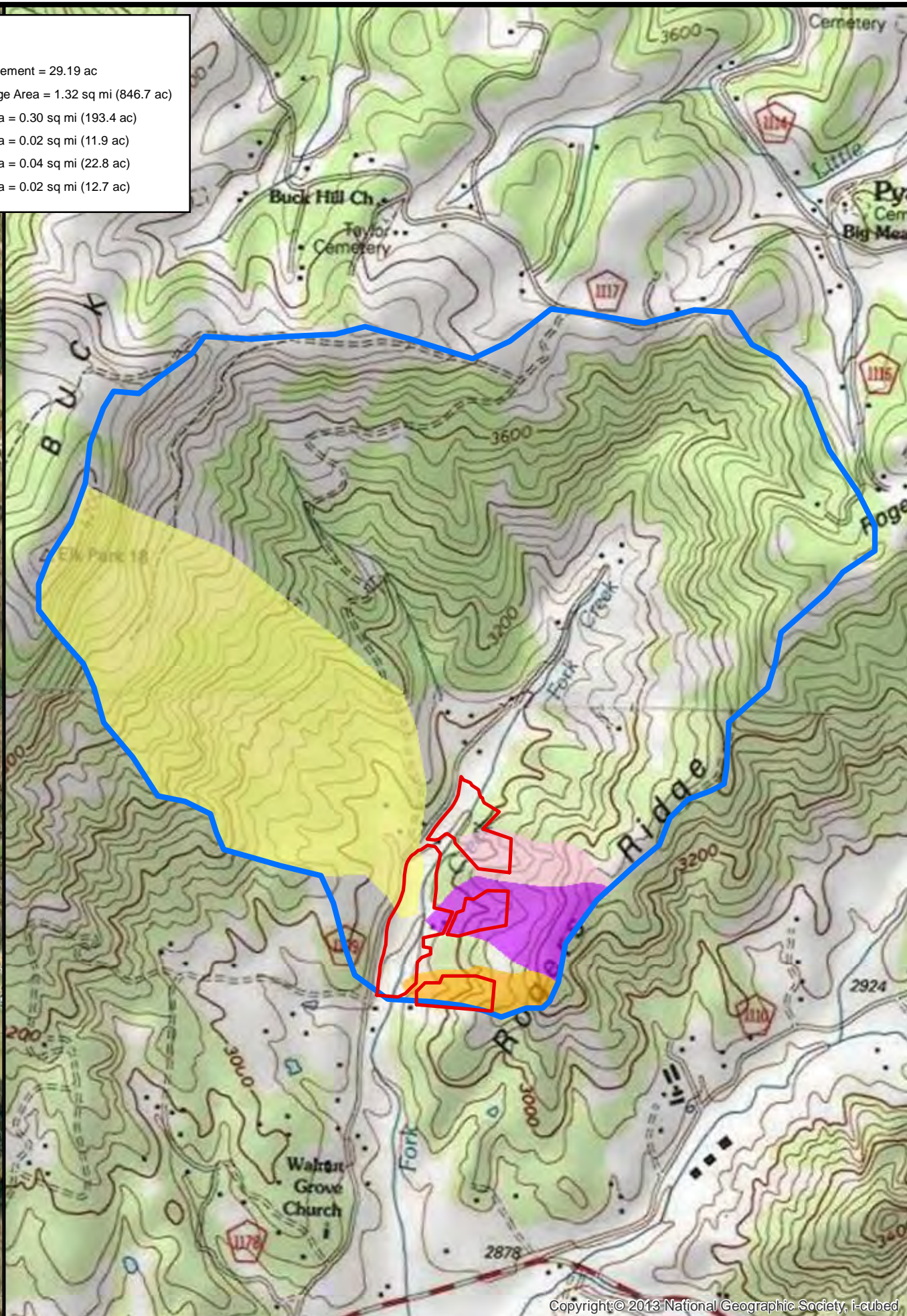
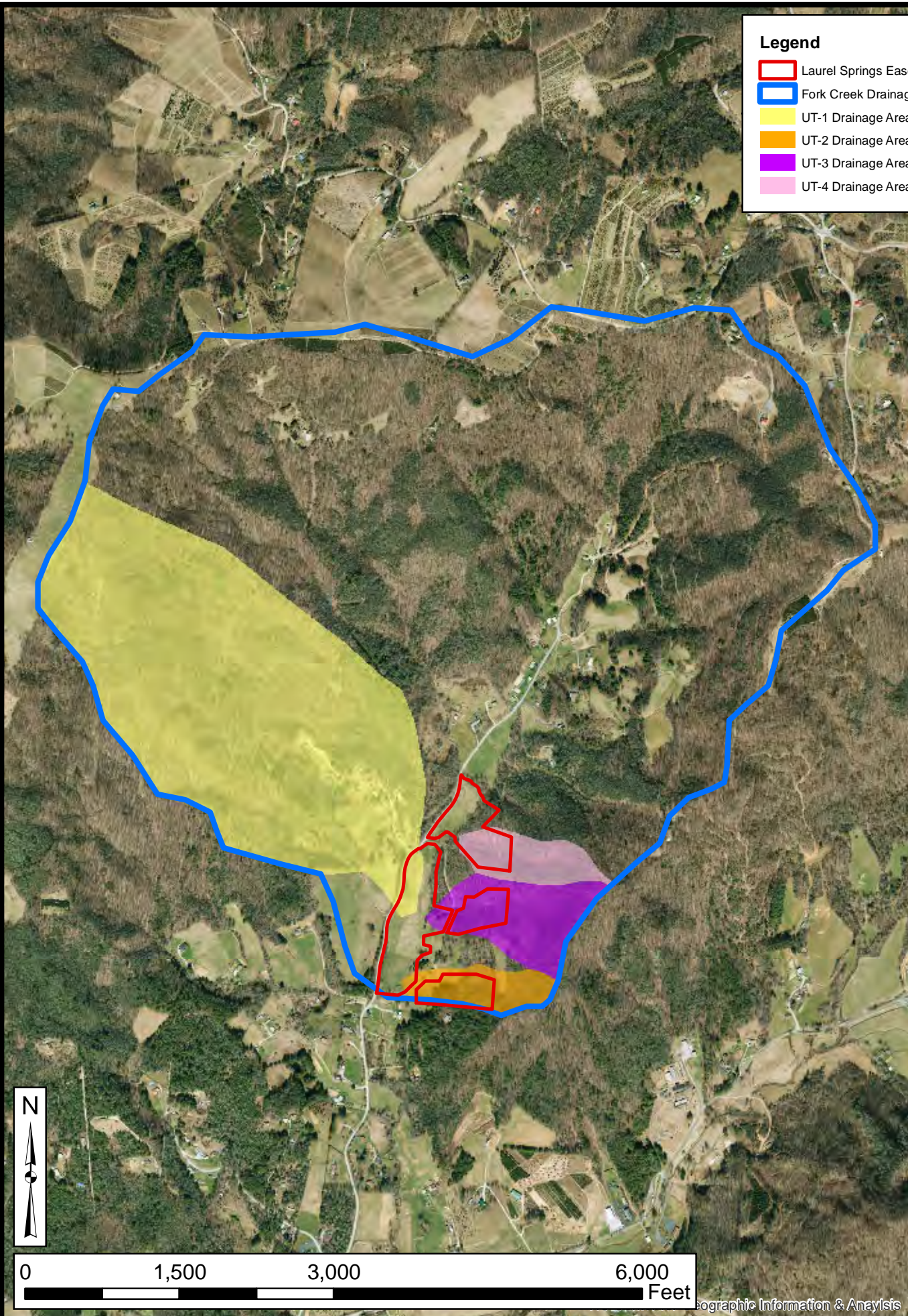
19-009

FIGURE

**2**



- Legend**
- Laurel Springs Easement = 29.19 ac
  - Fork Creek Drainage Area = 1.32 sq mi (846.7 ac)
  - UT-1 Drainage Area = 0.30 sq mi (193.4 ac)
  - UT-2 Drainage Area = 0.02 sq mi (11.9 ac)
  - UT-3 Drainage Area = 0.04 sq mi (22.8 ac)
  - UT-4 Drainage Area = 0.02 sq mi (12.7 ac)



Project:

**LAUREL SPRINGS MITIGATION SITE**

Avery County, NC

Title:

**TOPOGRAPHY AND DRAINAGE AREA**

Drawn by: KRJ

Date: AUG 2019

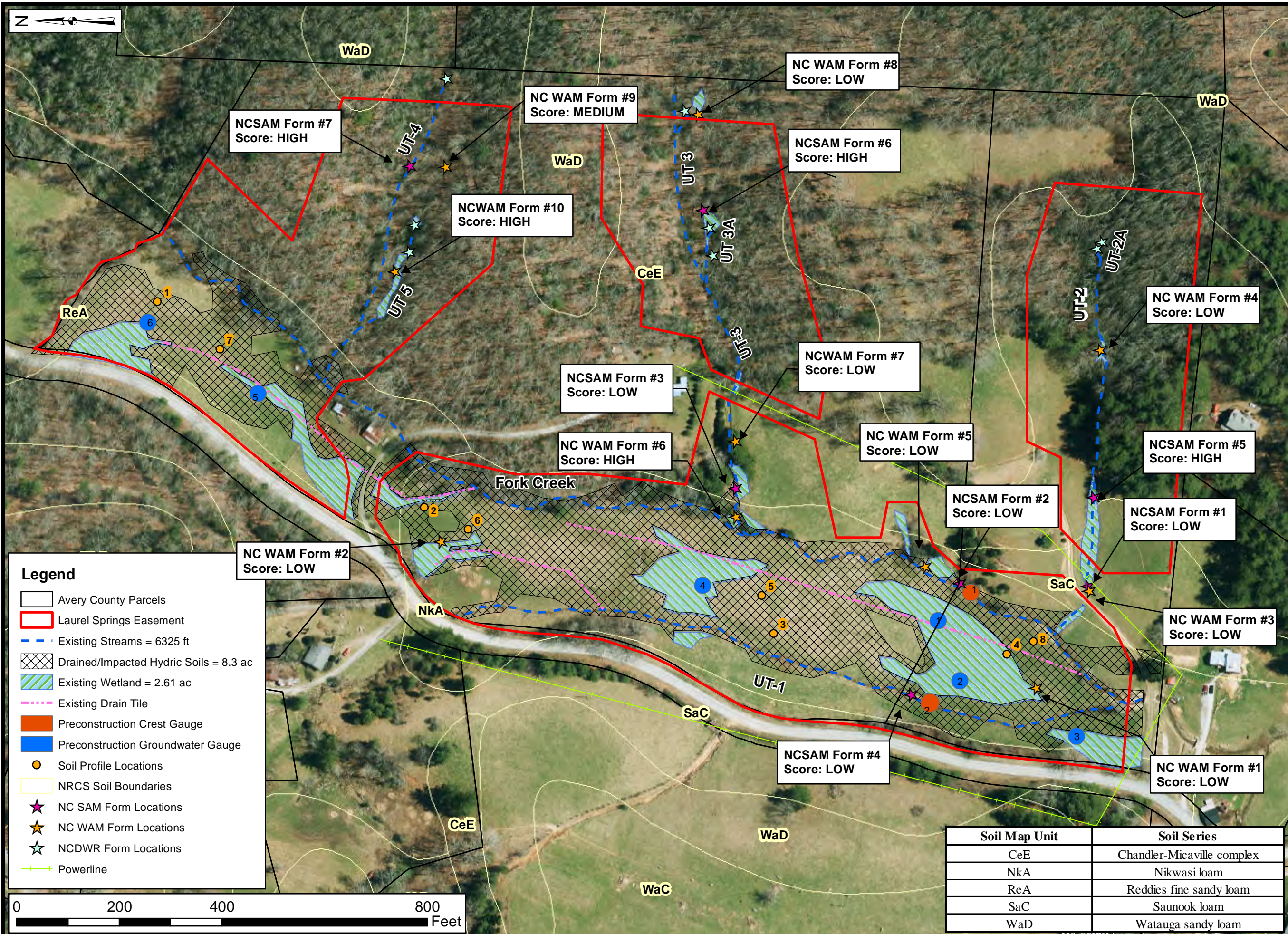
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Project No.: 19-009

FIGURE

**3**





Prepared for:  
**LAUREL SPRINGS MITIGATION SITE**  
 Avery County, NC

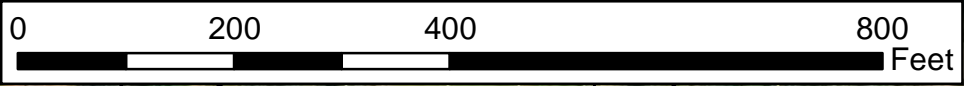
Title:  
**EXISTING CONDITIONS AND SOILS**

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 Date: SEPT 2019  
 Scale: 1:2200  
 Project No.: 19-001.01

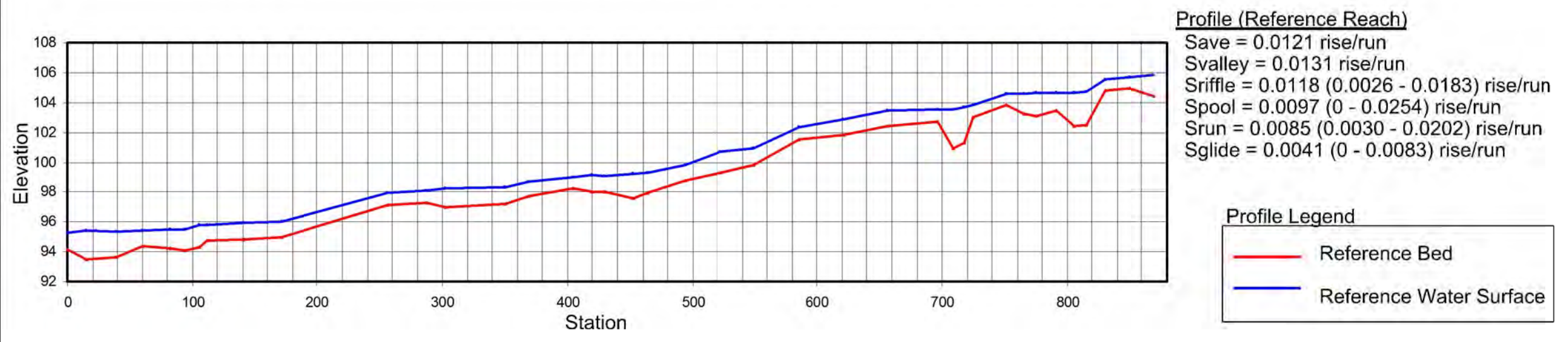
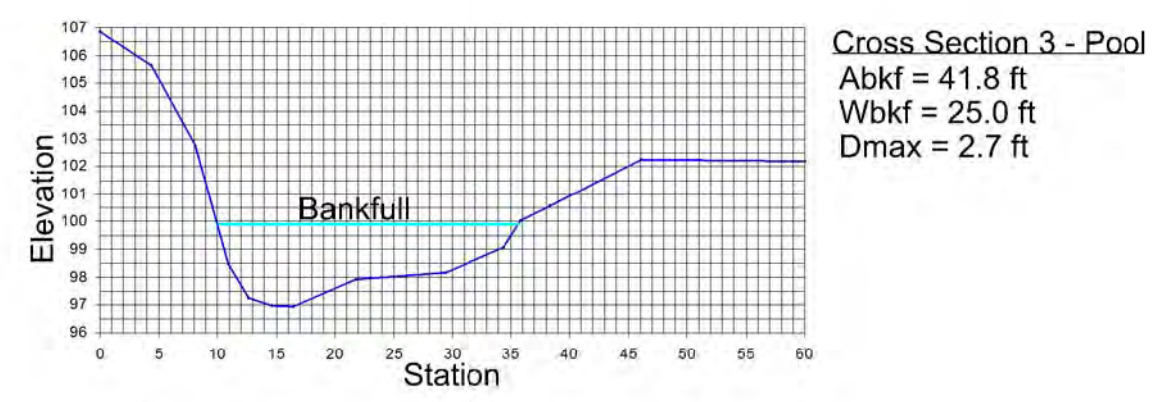
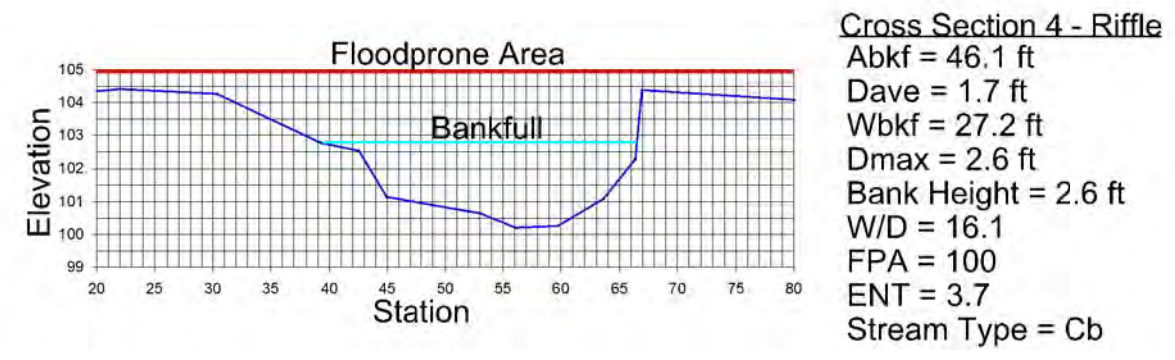
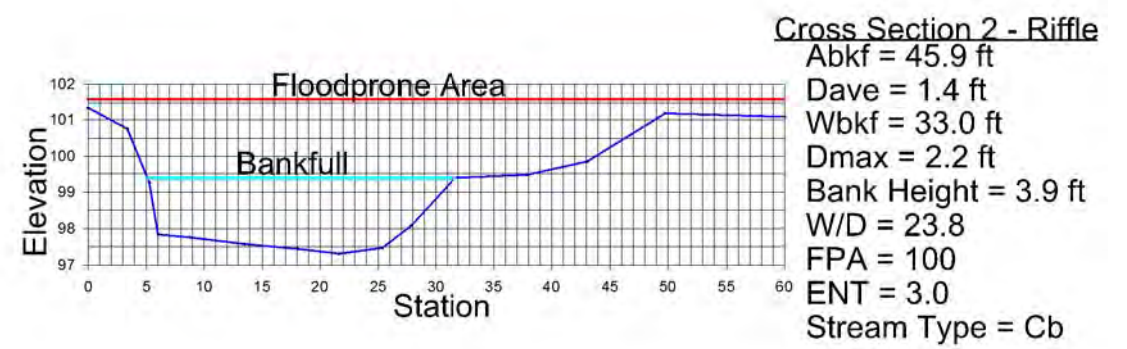
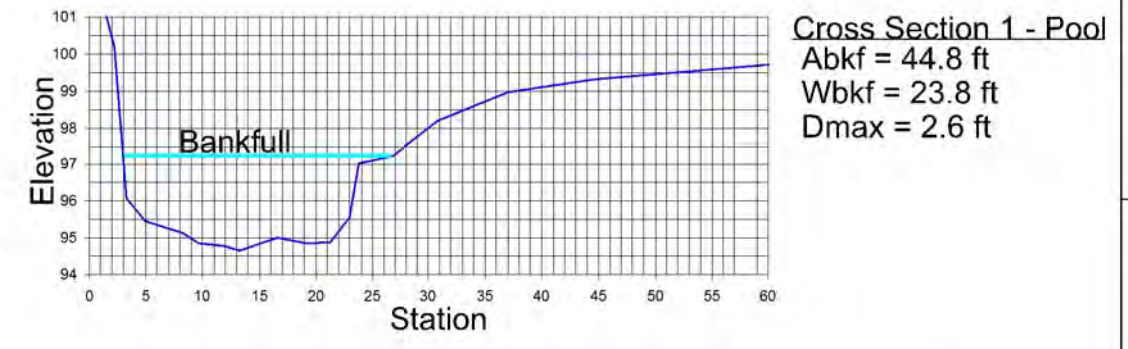
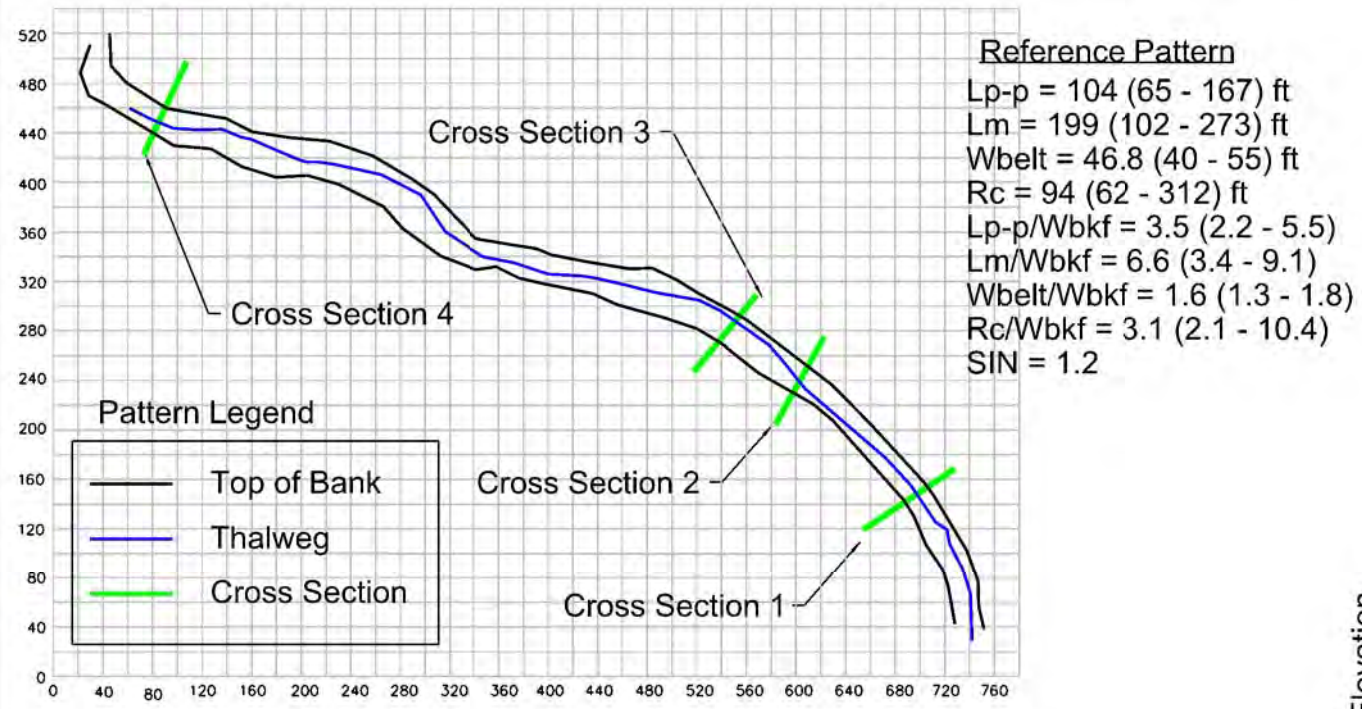
FIGURE  
**4**

- Legend**
- Avery County Parcels
  - Laurel Springs Easement
  - Existing Streams = 6325 ft
  - Drained/Impacted Hydric Soils = 8.3 ac
  - Existing Wetland = 2.61 ac
  - Existing Drain Tile
  - Preconstruction Crest Gauge
  - Preconstruction Groundwater Gauge
  - Soil Profile Locations
  - NRCS Soil Boundaries
  - ★ NC SAM Form Locations
  - ★ NC WAM Form Locations
  - ★ NCDWR Form Locations
  - Powerline

Soil Map Unit	Soil Series
CeE	Chandler-Micaville complex
NkA	Nikwasi loam
ReA	Reddies fine sandy loam
SaC	Saunook loam
WaD	Watauga sandy loam







NOTES/REVISIONS


Project:

Laurel Springs Mitigation Site

Avery County North Carolina

Title:  
 Stone Mountain Reference Dimension, Pattern, and Profile

Scale: NA	FIGURE NO. <b>5A</b>
Date: Sept 2019	
Project No.: 19-009	





NOTES/REVISIONS


Project:

**Laurel Springs  
Mitigation Site**

**Avery County  
North Carolina**

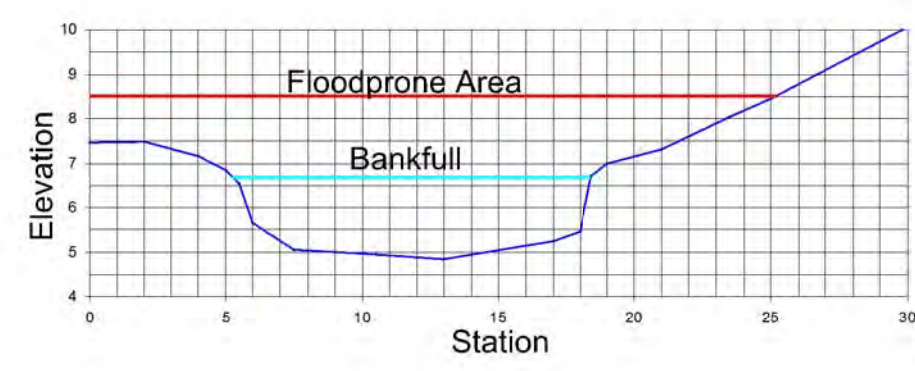
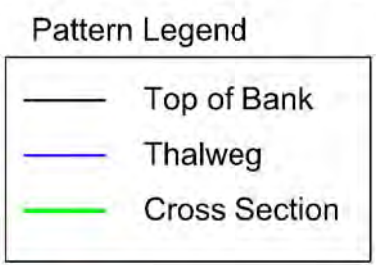
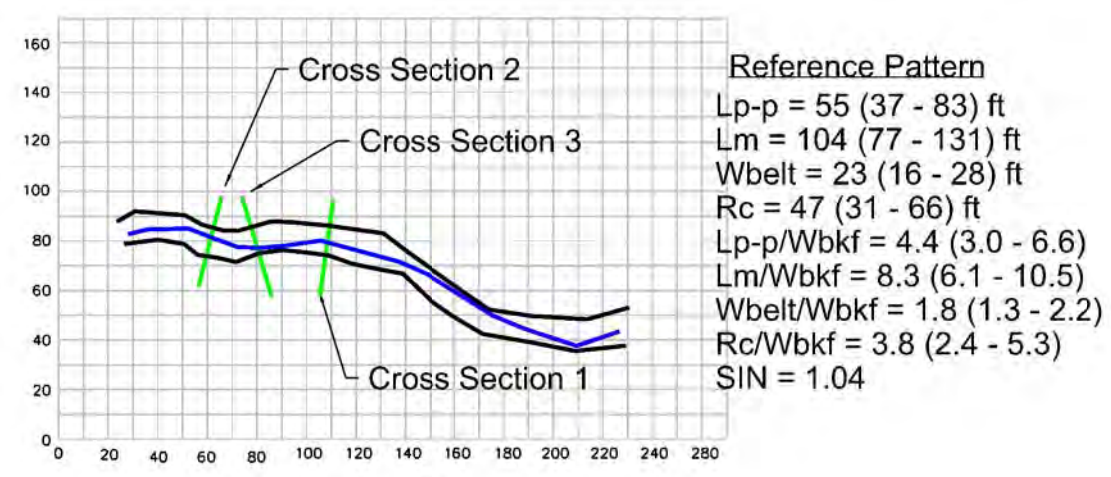
Title:  
**Cranberry Creek  
Reference  
Dimension, Pattern, and  
Profile**

Scale:  
**NA**

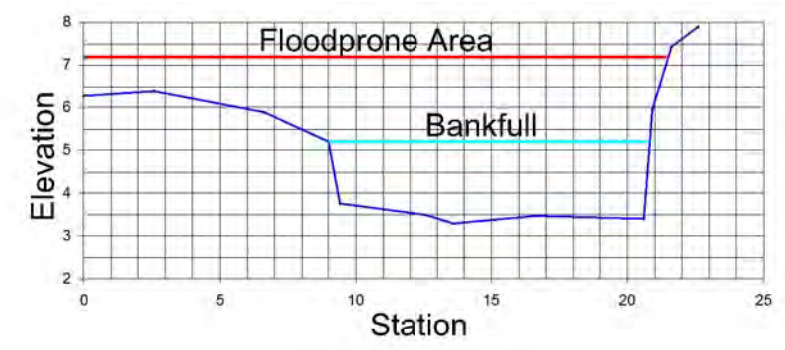
Date:  
**Sept 2019**

Project No.:  
**19-009**

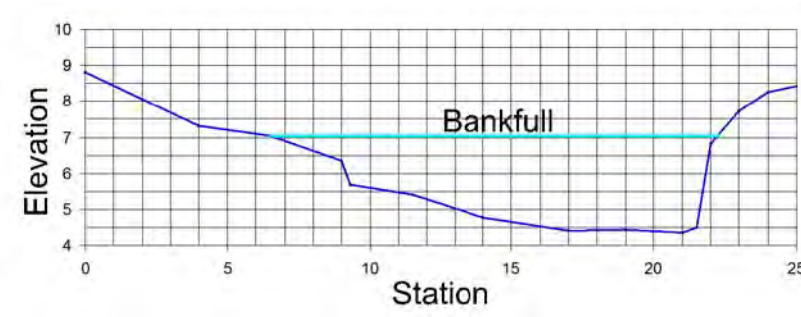
FIGURE NO.  
**5B**



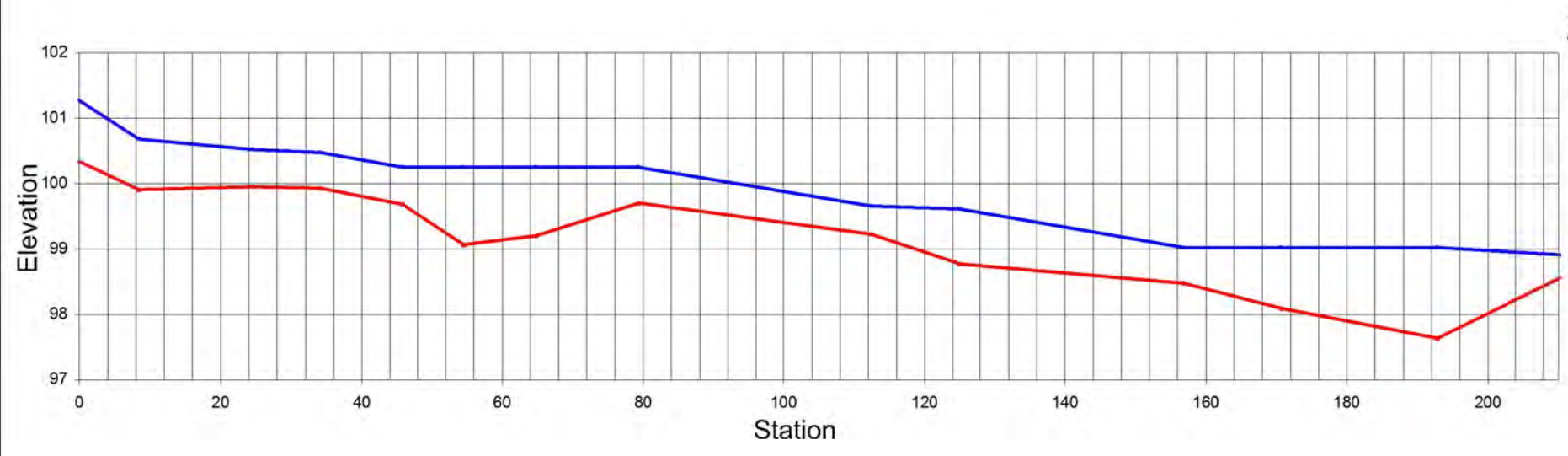
**Cross Section 1 - Riffle**  
 Abkf = 20.4 ft  
 Dave = 1.5 ft  
 Wbkf = 13.2 ft  
 Dmax = 1.9 ft  
 Bank Height = 1.9 ft  
 W/D = 8.5  
 FPA = 75  
 ENT = 5.7  
 Stream Type = E



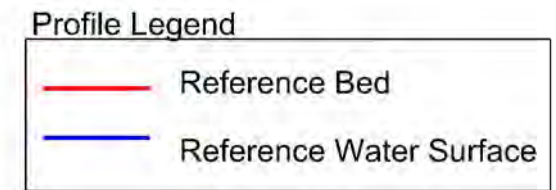
**Cross Section 2 - Riffle**  
 Abkf = 19.9 ft  
 Dave = 1.7 ft  
 Wbkf = 11.8 ft  
 Dmax = 1.9 ft  
 Bank Height = 1.9 ft  
 W/D = 7.0  
 FPA = 75  
 ENT = 6.3  
 Stream Type = E



**Cross Section 3 - Pool**  
 Abkf = 29.2 ft  
 Wbkf = 15.7 ft  
 Dmax = 2.7 ft



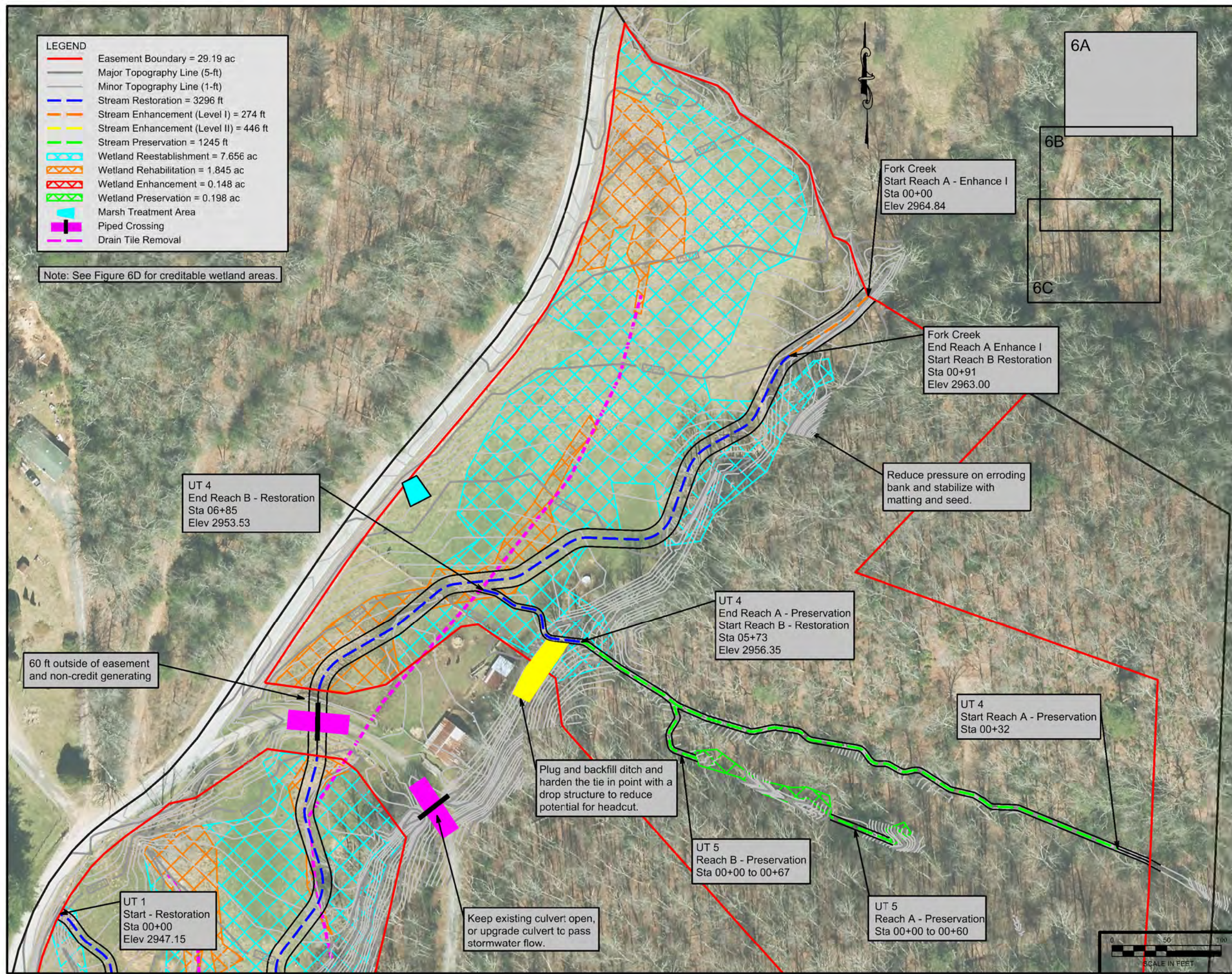
**Profile (Reference Reach)**  
 Save = 0.0112 rise/run  
 Svalley = 0.0116 rise/run  
 Sriffle = 0.0195 (0.0178 - 0.0225) rise/run  
 Spool = 0.0015 (0.0002 - 0.0036) rise/run  
 Srun = 0 (0 - 0) rise/run  
 Sglide = 0.0028 (0.0001 - 0.0054) rise/run





- LEGEND**
- Easement Boundary = 29.19 ac
  - Major Topography Line (5-ft)
  - Minor Topography Line (1-ft)
  - - - Stream Restoration = 3296 ft
  - - - Stream Enhancement (Level I) = 274 ft
  - - - Stream Enhancement (Level II) = 446 ft
  - Stream Preservation = 1245 ft
  - ▨ Wetland Reestablishment = 7.656 ac
  - ▨ Wetland Rehabilitation = 1.845 ac
  - ▨ Wetland Enhancement = 0.148 ac
  - ▨ Wetland Preservation = 0.198 ac
  - Marsh Treatment Area
  - Piped Crossing
  - Drain Tile Removal

Note: See Figure 6D for creditable wetland areas.



**NOTES/REVISIONS**


Project:

**Laurel Springs  
Mitigation Site**

**Avery County  
North Carolina**

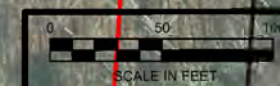
Title:

**MITIGATION  
PLAN**

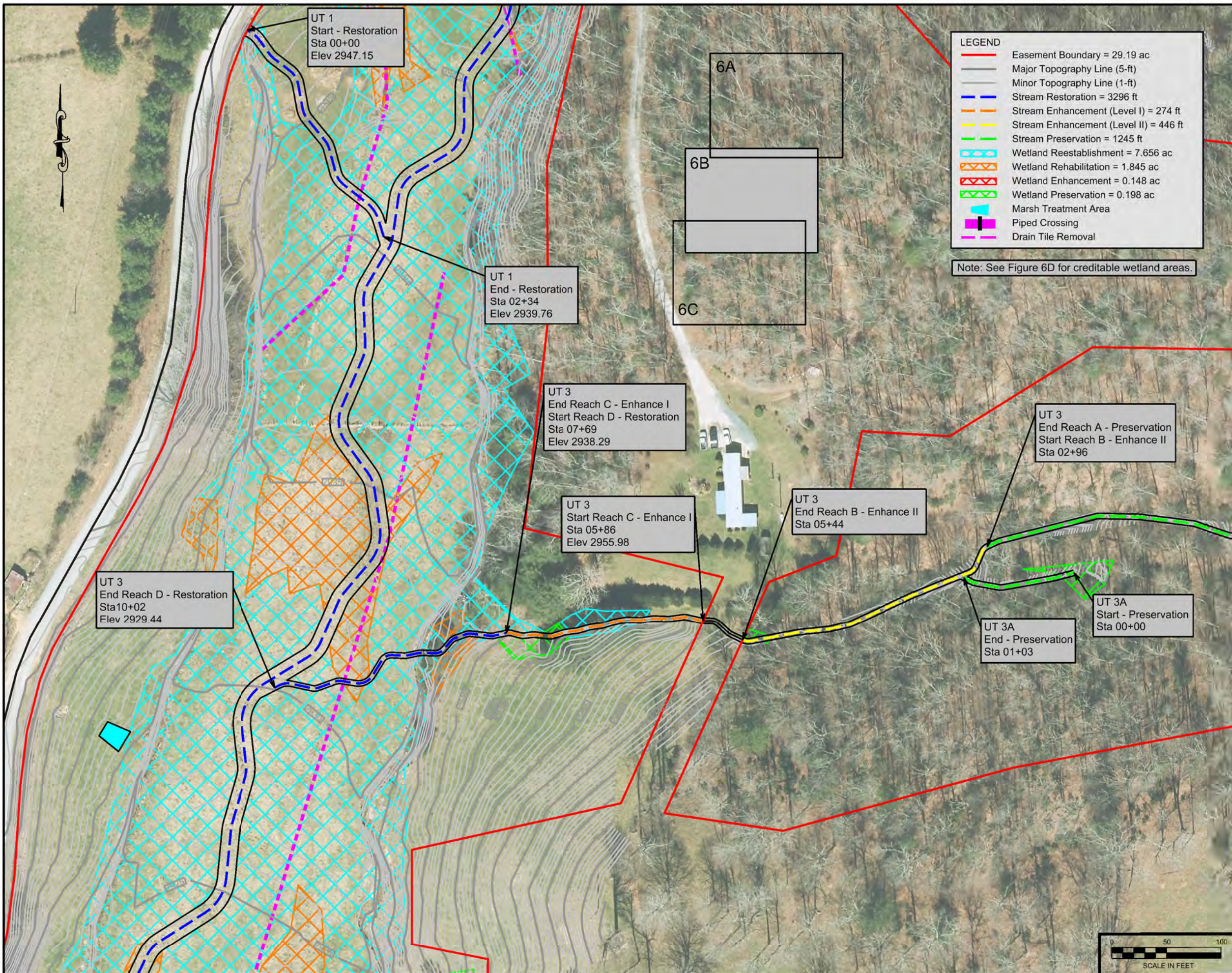
Scale:  
As Shown  
Date:  
Sept 2019  
Project No.:  
19-009

FIGURE NO.

**6A**







UT 1  
Start - Restoration  
Sta 00+00  
Elev 2947.15

UT 1  
End - Restoration  
Sta 02+34  
Elev 2939.76

UT 3  
End Reach C - Enhance I  
Start Reach D - Restoration  
Sta 07+69  
Elev 2938.29

UT 3  
Start Reach C - Enhance I  
Sta 05+86  
Elev 2955.98

UT 3  
End Reach B - Enhance II  
Sta 05+44

UT 3  
End Reach A - Preservation  
Start Reach B - Enhance II  
Sta 02+96

UT 3A  
End - Preservation  
Sta 01+03

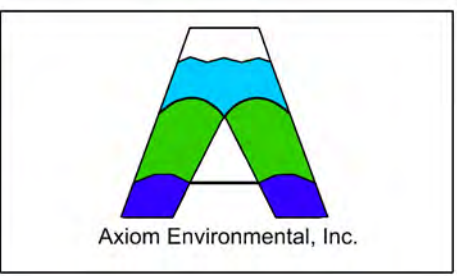
UT 3A  
Start - Preservation  
Sta 00+00

UT 3  
End Reach D - Restoration  
Sta 10+02  
Elev 2929.44

**LEGEND**

- Easement Boundary = 29.19 ac
- Major Topography Line (5-ft)
- Minor Topography Line (1-ft)
- Stream Restoration = 3296 ft
- Stream Enhancement (Level I) = 274 ft
- Stream Enhancement (Level II) = 446 ft
- Stream Preservation = 1245 ft
- ▨ Wetland Reestablishment = 7.656 ac
- ▨ Wetland Rehabilitation = 1.845 ac
- ▨ Wetland Enhancement = 0.148 ac
- ▨ Wetland Preservation = 0.198 ac
- Marsh Treatment Area
- |- Piped Crossing
- |- Drain Tile Removal

Note: See Figure 6D for creditable wetland areas.



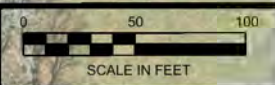
**NOTES/REVISIONS**


Project:  
**Laurel Springs Mitigation Site**  
  
Avery County  
North Carolina

Title:  
**MITIGATION PLAN**

Scale:  
As Shown  
Date:  
Sept 2019  
Project No.:  
19-009

FIGURE NO.  
**6B**







NOTES/REVISIONS


Project:

Laurel Springs Mitigation Site  
Avery County North Carolina

Title:

MITIGATION PLAN

Scale:

As Shown

Date:

Sept 2019

Project No.:

19-009

FIGURE NO.

6C

- LEGEND**
- Easement Boundary = 29.19 ac
  - Major Topography Line (5-ft)
  - Minor Topography Line (1-ft)
  - Stream Restoration = 3296 ft
  - Stream Enhancement (Level I) = 274 ft
  - Stream Enhancement (Level II) = 446 ft
  - Stream Preservation = 1245 ft
  - ▨ Wetland Reestablishment = 7.656 ac
  - ▨ Wetland Rehabilitation = 1.845 ac
  - ▨ Wetland Enhancement = 0.148 ac
  - ▨ Wetland Preservation = 0.198 ac
  - Marsh Treatment Area
  - Piped Crossing
  - Drain Tile Removal

Note: See Figure 6D for creditable wetland areas.

6A

6B

6C

UT 2  
End Reach C - Restoration  
Sta 09+26  
Elev 2914.02

UT 2  
Start Reach A - Preservation  
Sta 00+00

UT 2  
End Reach A - Preservation  
Start Reach B - Enhance II  
Sta 01+84

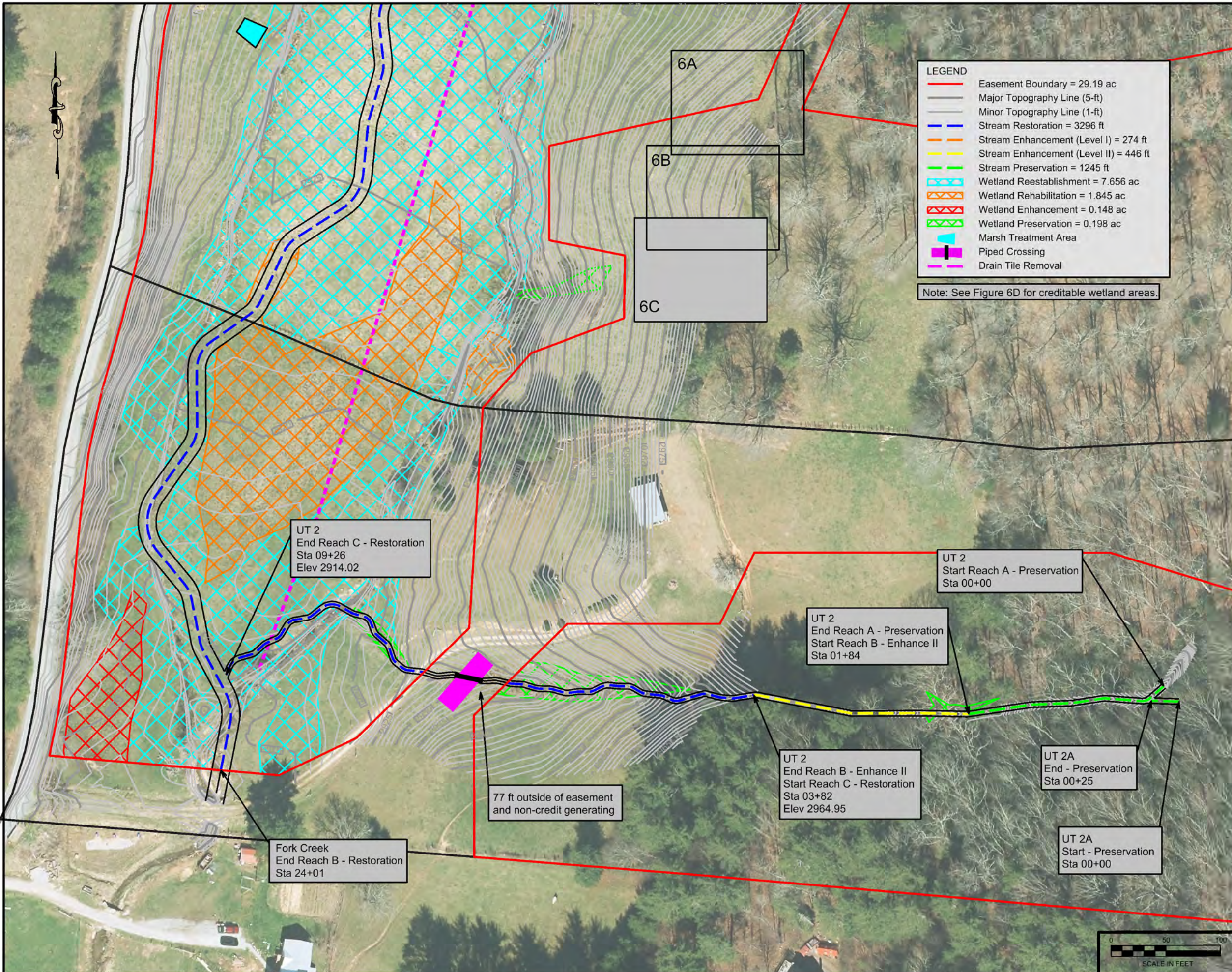
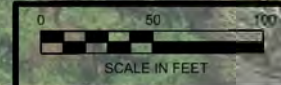
UT 2  
End Reach B - Enhance II  
Start Reach C - Restoration  
Sta 03+82  
Elev 2964.95

UT 2A  
End - Preservation  
Sta 00+25

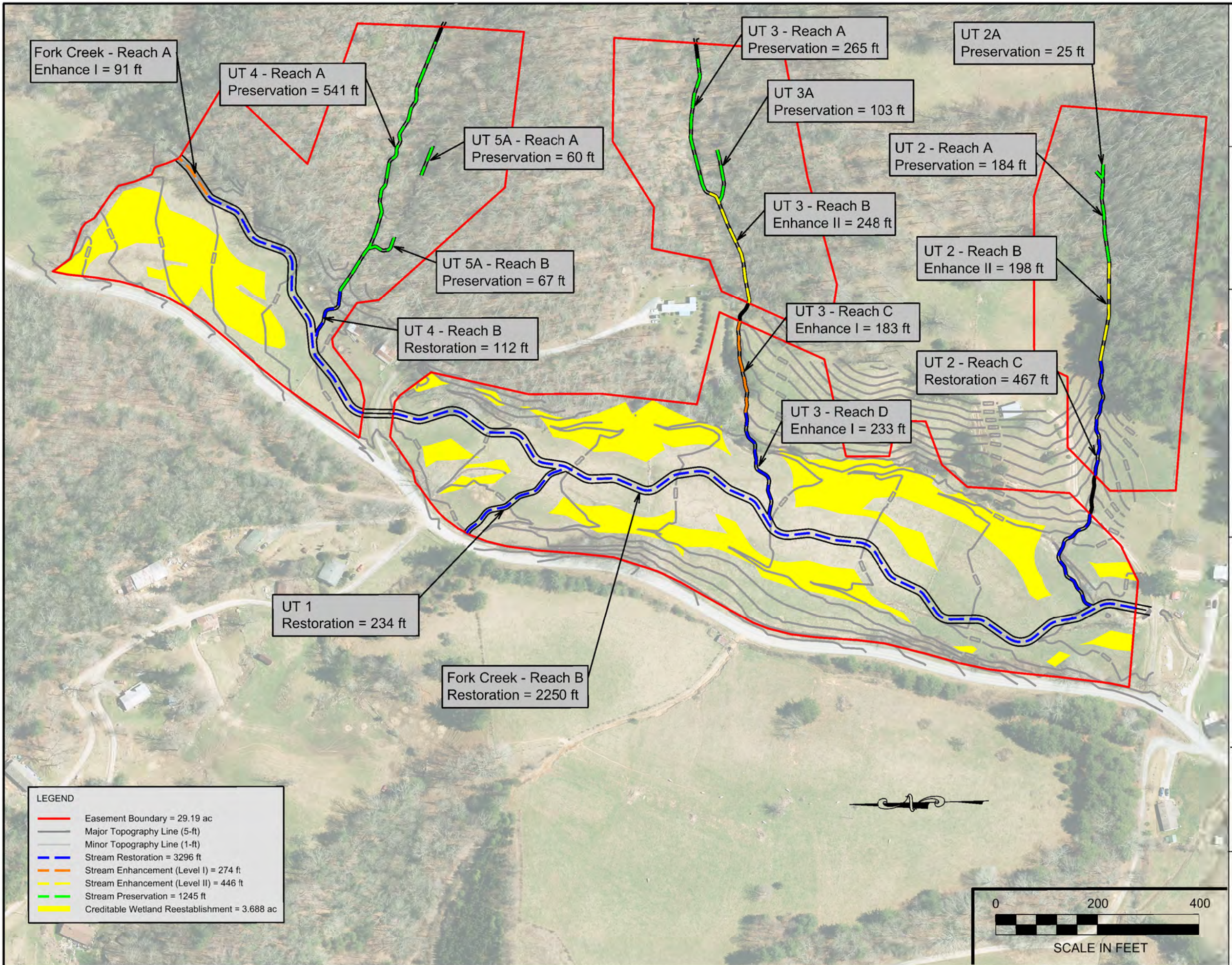
UT 2A  
Start - Preservation  
Sta 00+00

77 ft outside of easement  
and non-credit generating

Fork Creek  
End Reach B - Restoration  
Sta 24+01







Fork Creek - Reach A  
Enhance I = 91 ft

UT 4 - Reach A  
Preservation = 541 ft

UT 5A - Reach A  
Preservation = 60 ft

UT 3 - Reach A  
Preservation = 265 ft

UT 2A  
Preservation = 25 ft

UT 3A  
Preservation = 103 ft

UT 2 - Reach A  
Preservation = 184 ft

UT 5A - Reach B  
Preservation = 67 ft

UT 3 - Reach B  
Enhance II = 248 ft

UT 2 - Reach B  
Enhance II = 198 ft

UT 4 - Reach B  
Restoration = 112 ft

UT 3 - Reach C  
Enhance I = 183 ft

UT 2 - Reach C  
Restoration = 467 ft

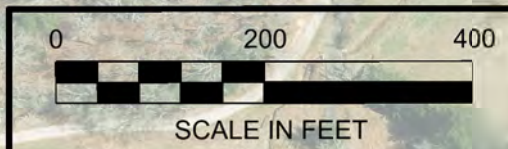
UT 3 - Reach D  
Enhance I = 233 ft

UT 1  
Restoration = 234 ft

Fork Creek - Reach B  
Restoration = 2250 ft

**LEGEND**

	Easement Boundary = 29.19 ac
	Major Topography Line (5-ft)
	Minor Topography Line (1-ft)
	Stream Restoration = 3296 ft
	Stream Enhancement (Level I) = 274 ft
	Stream Enhancement (Level II) = 446 ft
	Stream Preservation = 1245 ft
	Creditable Wetland Reestablishment = 3.688 ac



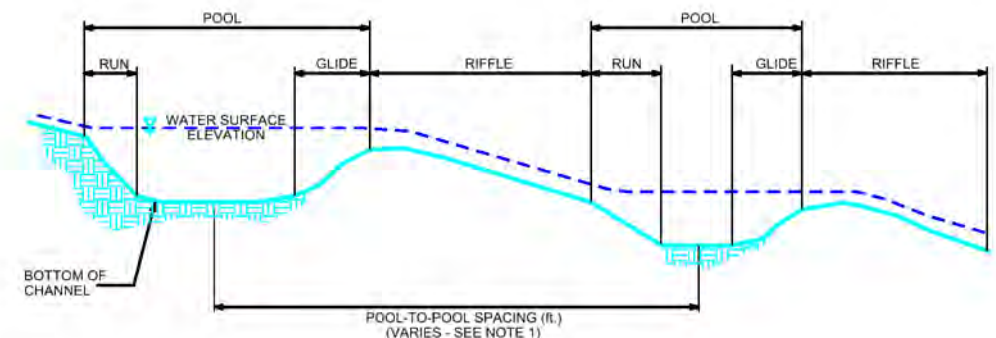
**NOTES/REVISIONS**


Project:  
**Laurel Springs  
Mitigation Site**  
  
**Avery County  
North Carolina**

Title:  
**ASSET  
MAP**

Scale: As Shown	<b>FIGURE NO.</b>  <b>6D</b>
Date: Sept 2019	
Project No.: 19-009	

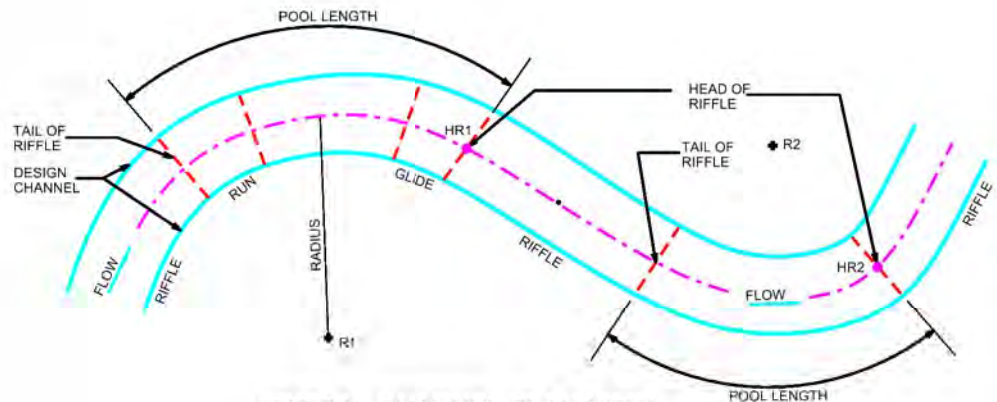




**TYPICAL CHANNEL PROFILE**

**NOTES:**

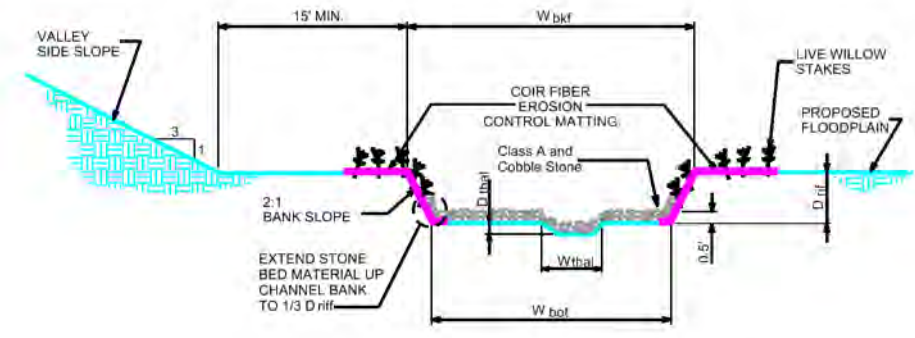
- 1. POOL-TO-POOL SPACING IS MEASURED FROM CENTER OF POOL BEND TO CENTER OF POOL BEND.



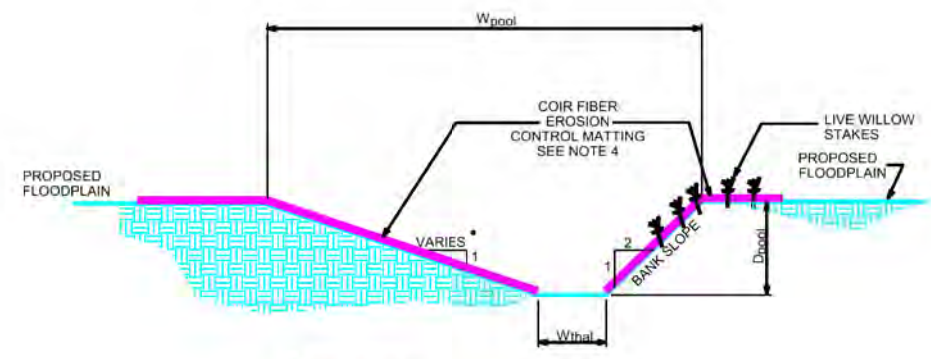
**TYPICAL CHANNEL PLAN VIEW**

**CHANNEL PLAN VIEW NOTES:**

- 1. THE CONTRACTOR SHALL LAYOUT THE CHANNEL ALIGNMENT BY LOCATING THE RADII AND SCRIBING THE CENTER LINE FOR EACH POOL BEND. THE CONNECTING TANGENT SECTIONS SHALL COMPLETE THE LAYOUT OF THE CHANNEL.
- 2. FIELD ADJUSTMENTS OF THE ALIGNMENT MAY BE REQUIRED TO SAVE TREES OR AVOID OBSTACLES. THE STAKE-OUT SHALL BE APPROVED BY THE CONSTRUCTION MANAGER BEFORE CONSTRUCTION OF THE CHANNEL.



**TYPICAL RIFFLE CROSS-SECTION**



**TYPICAL POOL CROSS-SECTION**

**CHANNEL CONSTRUCTION NOTES:**

- 1. MATERIAL EXCAVATED FROM CHANNEL AND FLOODPLAIN SHALL BE USED TO BACKFILL EXISTING CHANNEL.
- 2. BANK PROTECTION SHALL CONSIST OF NATURAL COIR FIBER MATTING.
- 3. THE CONTRACTOR SHALL SUPPLY BED MATERIAL FOR THE ENTIRE BED LENGTH OF EACH RIFFLE SECTION. THE BED MATERIAL SHALL CONSIST OF A MIX OF CLASS A AND SMALLER STONE.

CROSS-SECTION DIMENSIONS							
REACH	W <sub>bkf</sub> (ft.)	W <sub>bot</sub> (ft.)	Driff (ft.)	D <sub>thal</sub> (ft.)	D <sub>pool</sub> (ft.)	W <sub>pool</sub> (ft.)	W <sub>thal</sub> (ft.)
Fork Creek	16.3	10.3	1.4	0.1	2.0	21.1	9.1
UT 1	10.6	6.6	0.9	0.1	1.3	13.8	6.0
UT 2	5.0	3.0	0.4	0.1	0.6	6.5	2.9
UT 3 and 4	5.3	3.3	0.4	0.1	0.6	6.9	3.3



**NOTES/REVISIONS**


**Project:**

**Laurel Springs Mitigation Site**  
**Avery County North Carolina**

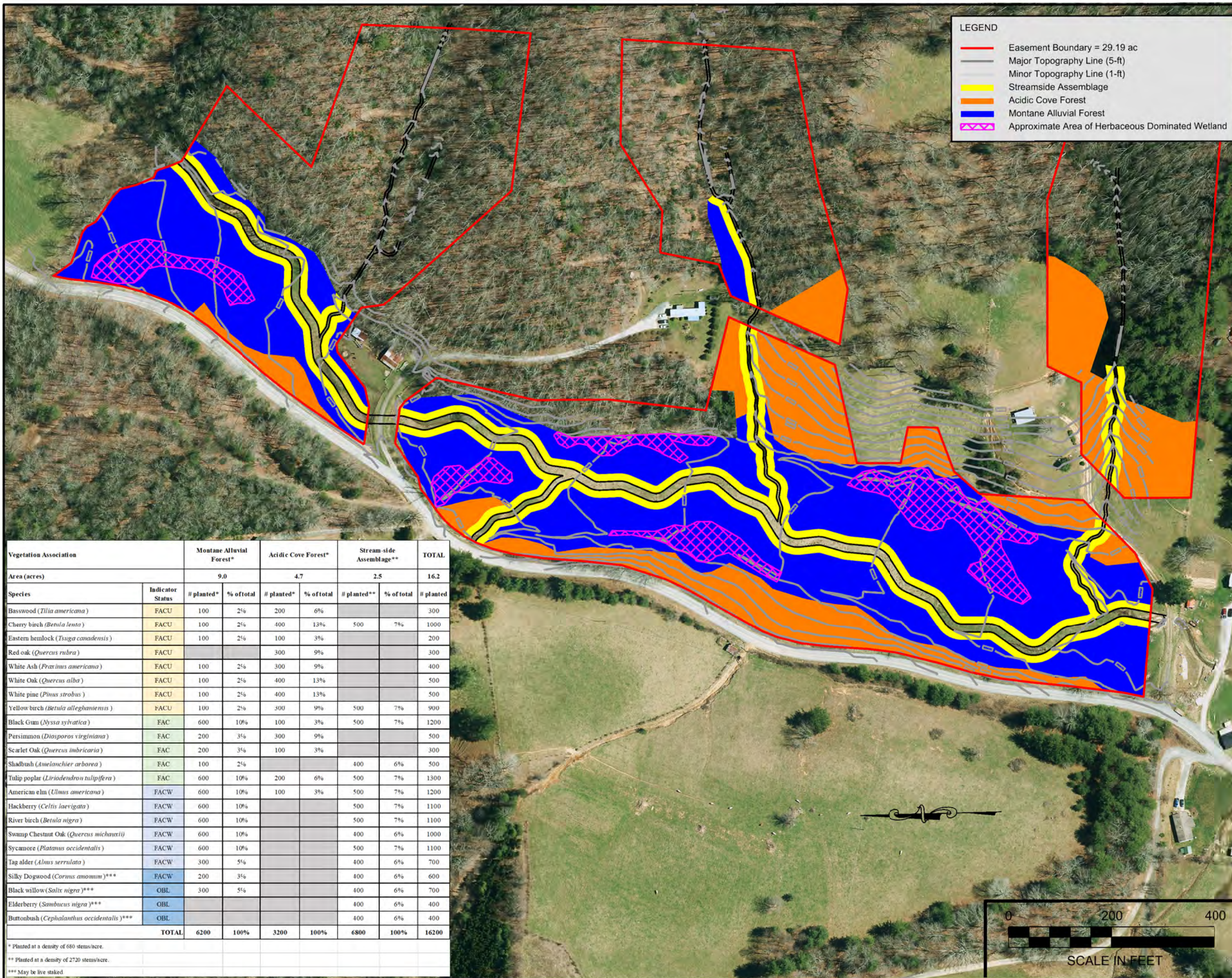
**Title:**

**PROPOSED DIMENSION, PATTERN, AND PROFILE**

Scale: NA  
Date: Sept 2019  
Project No.: 19-009

FIGURE NO.  
**7**





**LEGEND**

- Easement Boundary = 29.19 ac
- Major Topography Line (5-ft)
- Minor Topography Line (1-ft)
- █ Streamside Assemblage
- █ Acidic Cove Forest
- █ Montane Alluvial Forest
- ▨ Approximate Area of Herbaceous Dominated Wetland



**NOTES/REVISIONS**


Project:  
**Laurel Springs Mitigation Site**  
 Avery County North Carolina

Title:  
**PLANTING PLAN**

Vegetation Association		Montane Alluvial Forest*		Acidic Cove Forest*		Stream-side Assemblage**		TOTAL
Area (acres)		9.0		4.7		2.5		16.2
Species	Indicator Status	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
Basswood ( <i>Tilia americana</i> )	FACU	100	2%	200	6%			300
Cherry birch ( <i>Betula lenta</i> )	FACU	100	2%	400	13%	500	7%	1000
Eastern hemlock ( <i>Tsuga canadensis</i> )	FACU	100	2%	100	3%			200
Red oak ( <i>Quercus rubra</i> )	FACU			300	9%			300
White Ash ( <i>Fraxinus americana</i> )	FACU	100	2%	300	9%			400
White Oak ( <i>Quercus alba</i> )	FACU	100	2%	400	13%			500
White pine ( <i>Pinus strobus</i> )	FACU	100	2%	400	13%			500
Yellow birch ( <i>Betula alleghaniensis</i> )	FACU	100	2%	300	9%	500	7%	900
Black Gum ( <i>Nyssa sylvatica</i> )	FAC	600	10%	100	3%	500	7%	1200
Persimmon ( <i>Diospyros virginiana</i> )	FAC	200	3%	300	9%			500
Scarlet Oak ( <i>Quercus imbricaria</i> )	FAC	200	3%	100	3%			300
Shadbush ( <i>Amelanchier arborea</i> )	FAC	100	2%			400	6%	500
Tulip poplar ( <i>Liriodendron tulipifera</i> )	FAC	600	10%	200	6%	500	7%	1300
American elm ( <i>Ulmus americana</i> )	FACW	600	10%	100	3%	500	7%	1200
Hackberry ( <i>Celtis laevigata</i> )	FACW	600	10%			500	7%	1100
River birch ( <i>Betula nigra</i> )	FACW	600	10%			500	7%	1100
Swamp Chestnut Oak ( <i>Quercus michauxii</i> )	FACW					400	6%	1000
Sycamore ( <i>Platanus occidentalis</i> )	FACW	600	10%			500	7%	1100
Tag alder ( <i>Alnus serrulata</i> )	FACW	300	5%			400	6%	700
Silky Dogwood ( <i>Coranus amomum</i> )***	FACW	200	3%			400	6%	600
Black willow ( <i>Salix nigra</i> )***	OBL	300	5%			400	6%	700
Elderberry ( <i>Sambucus nigra</i> )***	OBL					400	6%	400
Buttonbush ( <i>Cephalanthus occidentalis</i> )***	OBL					400	6%	400
<b>TOTAL</b>		<b>6200</b>	<b>100%</b>	<b>3200</b>	<b>100%</b>	<b>6800</b>	<b>100%</b>	<b>16200</b>

\* Planted at a density of 680 stems/acre.  
 \*\* Planted at a density of 2720 stems/acre.  
 \*\*\* May be live staked.

Scale: As Shown	<b>FIGURE NO.</b>  <b>8</b>
Date: Sept 2019	
Project No.: 19-009	





NOTES/REVISIONS


Project:

Laurel Springs  
Mitigation Site

Avery County  
North Carolina

Title:

MONITORING  
PLAN

Scale:  
As Shown

Date:  
Sept 2019

Project No.:  
19-009

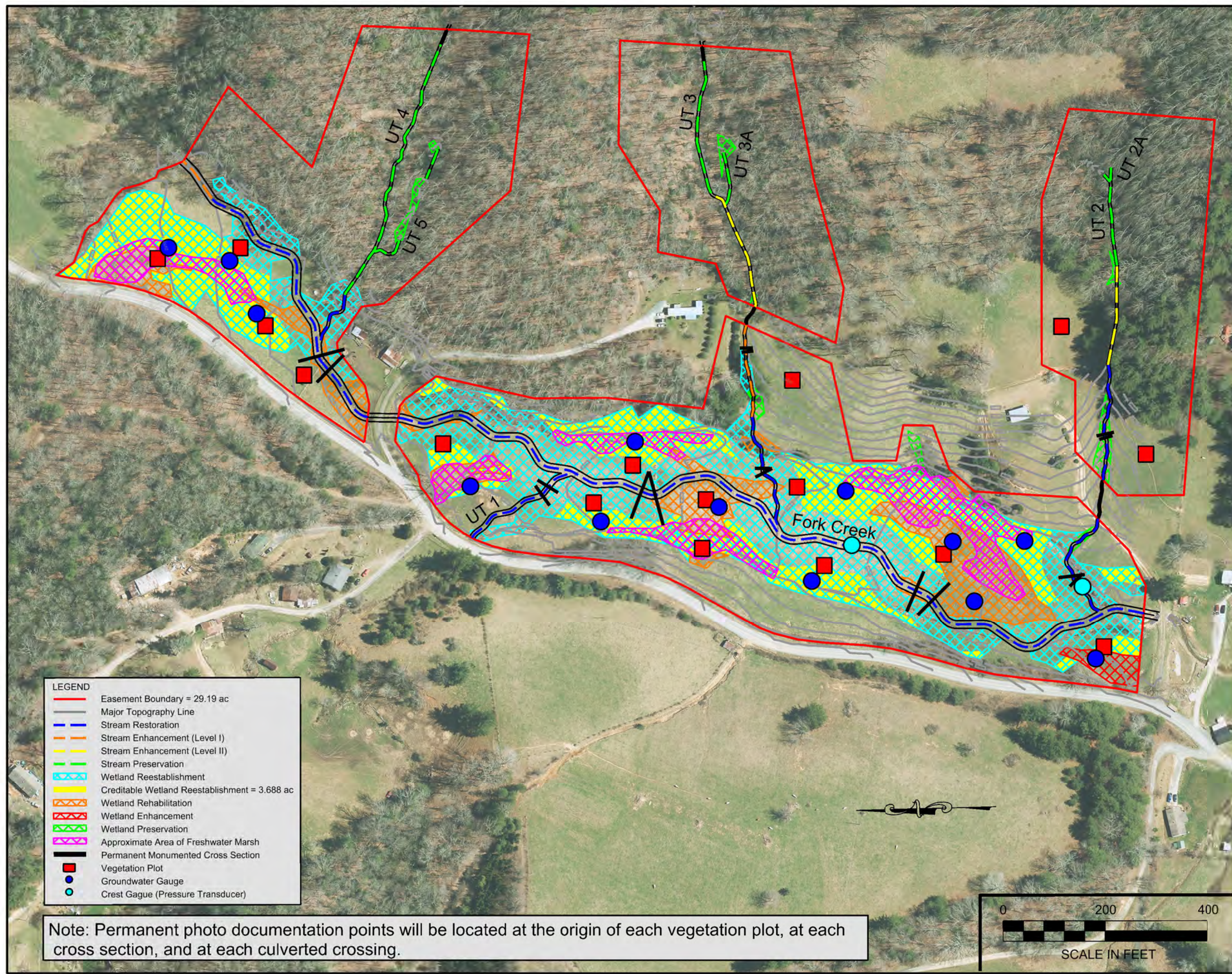
FIGURE NO.

9

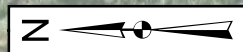
**LEGEND**

	Easement Boundary = 29.19 ac
	Major Topography Line
	Stream Restoration
	Stream Enhancement (Level I)
	Stream Enhancement (Level II)
	Stream Preservation
	Wetland Reestablishment
	Creditable Wetland Reestablishment = 3.688 ac
	Wetland Rehabilitation
	Wetland Enhancement
	Wetland Preservation
	Approximate Area of Freshwater Marsh
	Permanent Monumented Cross Section
	Vegetation Plot
	Groundwater Gauge
	Crest Gauge (Pressure Transducer)

Note: Permanent photo documentation points will be located at the origin of each vegetation plot, at each cross section, and at each culverted crossing.







Prepared for:



Project:

**LAUREL SPRINGS  
MITIGATION SITE**

Avery County, NC

Title:

**STREAM BUFFER  
CREDIT  
ADJUSTMENT  
OUTPUT**

Drawn by:

KRJ

Date:

FEB 2021

Scale:

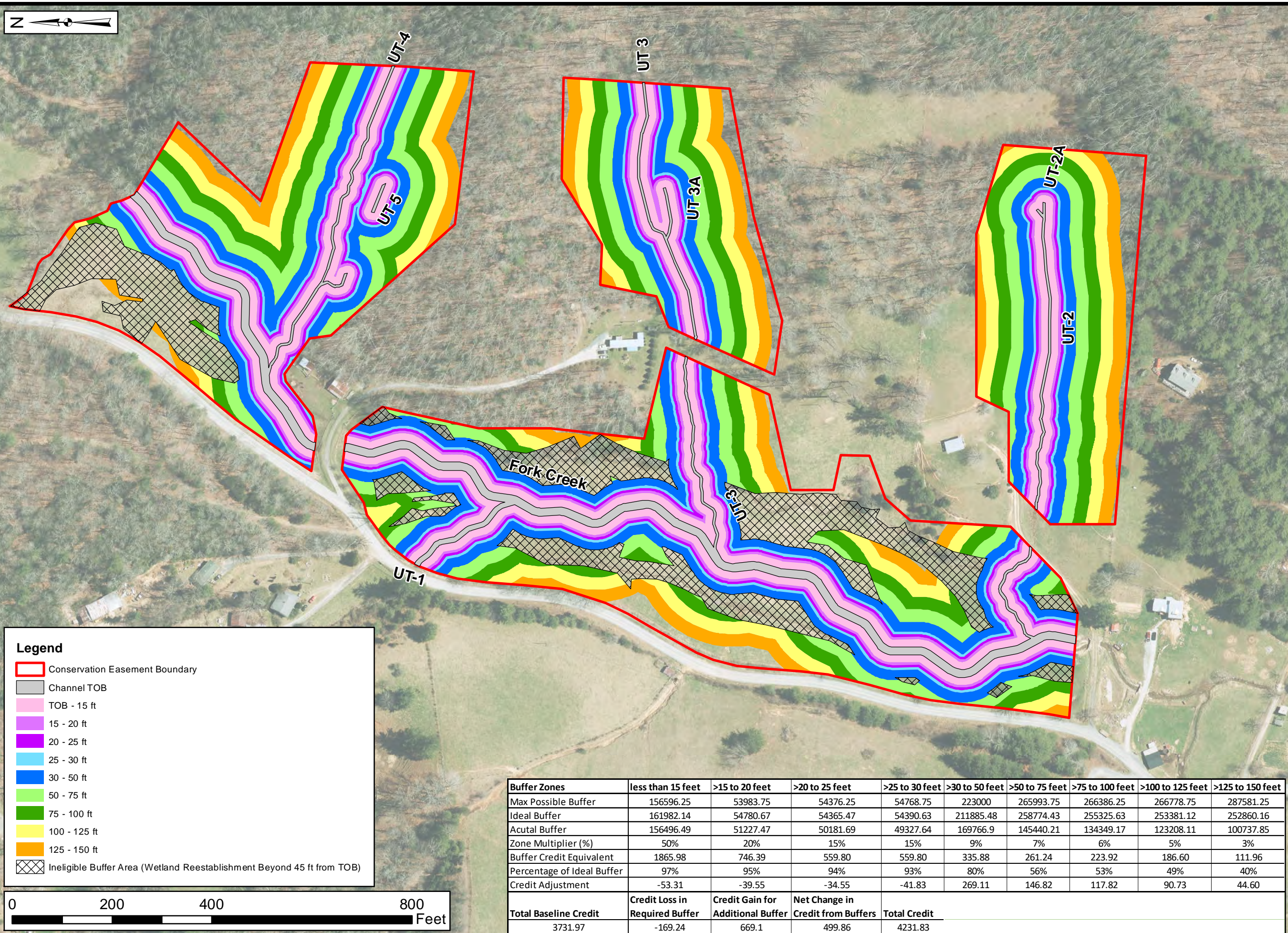
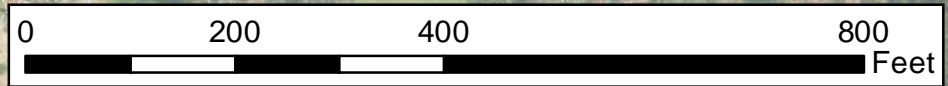
1:2200

Project No.:

19-009

**Legend**

- Conservation Easement Boundary
- Channel TOB
- TOB - 15 ft
- 15 - 20 ft
- 20 - 25 ft
- 25 - 30 ft
- 30 - 50 ft
- 50 - 75 ft
- 75 - 100 ft
- 100 - 125 ft
- 125 - 150 ft
- Ineligible Buffer Area (Wetland Reestablishment Beyond 45 ft from TOB)

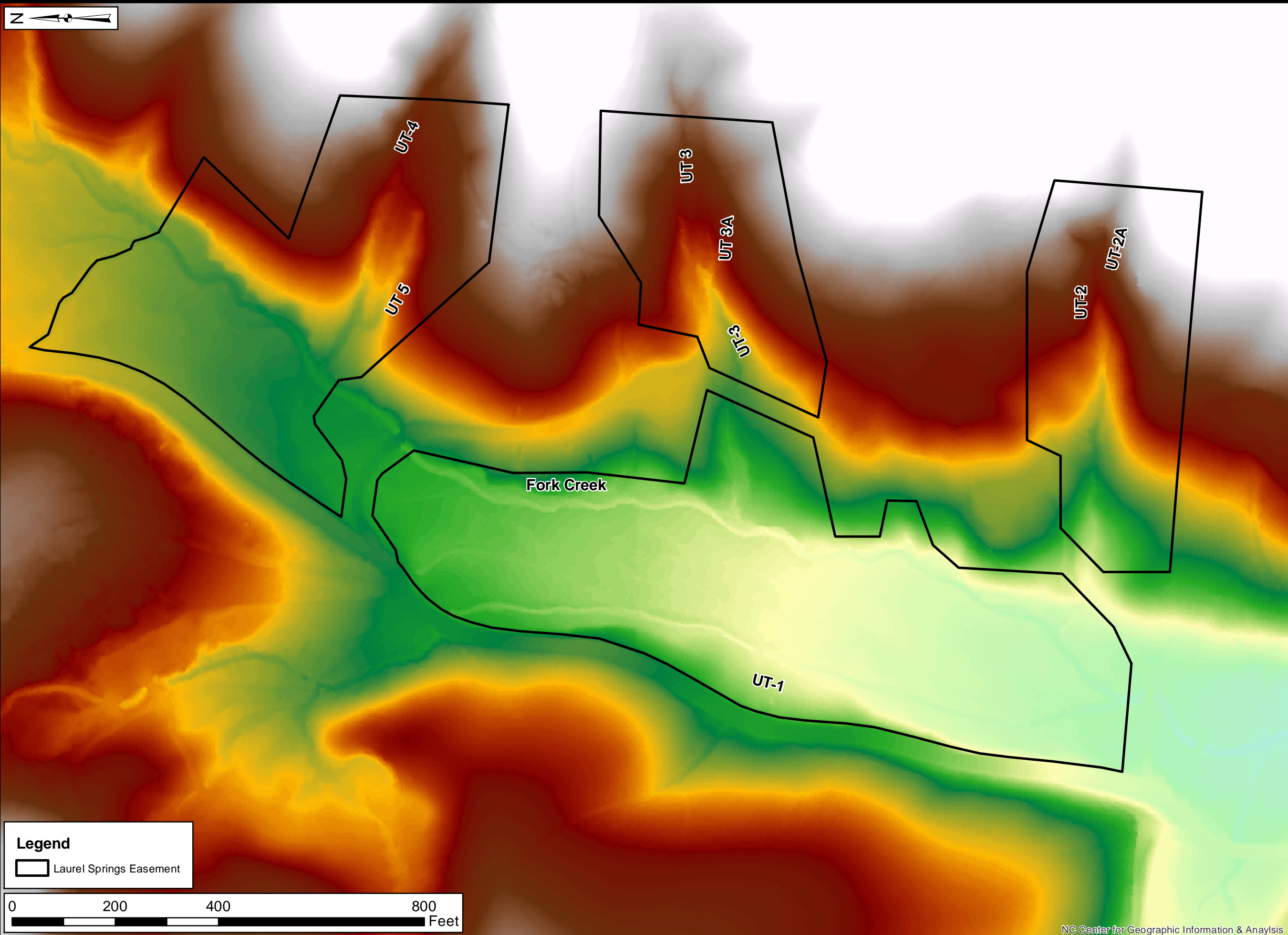


Buffer Zones	less than 15 feet	>15 to 20 feet	>20 to 25 feet	>25 to 30 feet	>30 to 50 feet	>50 to 75 feet	>75 to 100 feet	>100 to 125 feet	>125 to 150 feet
Max Possible Buffer	156596.25	53983.75	54376.25	54768.75	223000	265993.75	266386.25	266778.75	287581.25
Ideal Buffer	161982.14	54780.67	54365.47	54390.63	211885.48	258774.43	255325.63	253381.12	252860.16
Actual Buffer	156496.49	51227.47	50181.69	49327.64	169766.9	145440.21	134349.17	123208.11	100737.85
Zone Multiplier (%)	50%	20%	15%	15%	9%	7%	6%	5%	3%
Buffer Credit Equivalent	1865.98	746.39	559.80	559.80	335.88	261.24	223.92	186.60	111.96
Percentage of Ideal Buffer	97%	95%	94%	93%	80%	56%	53%	49%	40%
Credit Adjustment	-53.31	-39.55	-34.55	-41.83	269.11	146.82	117.82	90.73	44.60
<b>Total Baseline Credit</b>	<b>Credit Loss in Required Buffer</b>	<b>Credit Gain for Additional Buffer</b>	<b>Net Change in Credit from Buffers</b>	<b>Total Credit</b>					
3731.97	-169.24	669.1	499.86	4231.83					

FIGURE

**10**





Project:  
**LAUREL SPRINGS  
 MITIGATION SITE**  
 Avery County, NC

Title:  
**LIDAR  
 MAP**

Drawn by: KRJ

Date: FEB 2021

Scale: 1:2200

Project No.: 19-009

FIGURE  
**11**

**Legend**  
 □ Laurel Springs Easement

0 200 400 800  
 Feet

## **APPENDIX B - EXISTING STREAM & WETLAND DATA**

Table B1. Laurel Springs Mill Morphological Stream Characteristics

Figure B1. Cross Section Locations

Existing Stream Cross-section Data

NC SAM Forms

NC WAM Forms

NCDWQ Stream Forms

BEHI/NBS Data

Soil Boring Log

Precon Groundwater Gauge Graphs

**Table B1. Laurel Springs Site Morphological Stream Characteristics**

Variables	REFERENCE- STONE MTN	REFERENCE- CRANBERRY
Stream Type	Cb 3	E 4
Drainage Area (mi <sup>2</sup> )	7.46	0.70
Bankfull Discharge (cfs)	75.3	28.7

Dimension Variables		
Bankfull Cross-Sectional Area ( $A_{bkt}$ )	46.0	20.2
Existing Cross-Sectional Area ( $A_{existing}$ )	45.9 - 46.1	19.9 - 20.4
Bankfull Width ( $W_{bkt}$ )	Mean: 30.1 Range: 27.2 - 33.0	Mean: 12.5 Range: 11.8 - 13.2
Bankfull Mean Depth ( $D_{bkt}$ )	Mean: 1.6 Range: 1.4 - 1.7	Mean: 1.6 Range: 1.5 - 1.7
Bankfull Maximum Depth ( $D_{max}$ )	Mean: 2.4 Range: 2.2 - 2.6	Mean: 1.9 Range:
Pool Width ( $W_{pool}$ )	Mean: 24.4 Range: 23.8 - 25.0	Mean: 15.7 Range:
Maximum Pool Depth ( $D_{pool}$ )	Mean: 2.7 Range: 2.6 - 2.7	Mean: 2.7 Range:
Width of Floodprone Area ( $W_{fpa}$ )	Mean: 100.0 Range:	Mean: 75.0 Range:

Dimension Ratios		
Entrenchment Ratio ( $W_{fpa}/W_{bkt}$ )	Mean: 3.4 Range: 3.0 - 3.7	Mean: 6.0 Range: 5.7 - 6.4
Width / Depth Ratio ( $W_{bkt}/D_{bkt}$ )	Mean: 20.0 Range: 16.1 - 23.8	Mean: 7.8 Range: 7.0 - 8.5
Max. $D_{bkt}$ / $D_{bkt}$ Ratio	Mean: 1.6 Range: 1.5 - 1.6	Mean: 1.2 Range: 1.1 - 1.3
Low Bank Height / Max. $D_{bkt}$ Ratio	Mean: 1.3 Range: 1.0 - 1.6	Mean: 1.0 Range:
Maximum Pool Depth / Bankfull Mean Depth ( $D_{pool}/D_{bkt}$ )	Mean: 1.7 Range: 1.6 - 1.9	Mean: 1.7 Range: 1.6 - 1.8
Pool Width / Bankfull Width ( $W_{pool}/W_{bkt}$ )	Mean: 0.8 Range: 0.7 - 0.9	Mean: 1.3 Range: 1.2 - 1.3
Pool Area / Bankfull Cross Sectional Area	Mean: 0.9 Range: 0.9 - 1.0	Mean: 1.4 Range: 1.4 - 1.5

Variables	REFERENCE- STONE MTN	REFERENCE- CRANBERRY
Pattern Variables		
Pool to Pool Spacing ( $L_{p-p}$ )	Med: 104.3 Range: 65.2 - 166.7	Med: 54.8 Range: 37.0 - 82.6
Meander Length ( $L_m$ )	Med: 199.4 Range: 101.7 - 273.2	Med: 103.8 Range: 76.6 - 131.0
Belt Width ( $W_{belt}$ )	Med: 46.8 Range: 40.0 - 55.0	Med: 23.3 Range: 16.0 - 27.6
Radius of Curvature ( $R_c$ )	Med: 94.5 Range: 62.4 - 312.1	Med: 47.0 Range: 30.5 - 65.7
Sinuosity (Sin)	1.20	1.04

Pattern Ratios		
Pool to Pool Spacing/ Bankfull Width ( $L_{p-p}/W_{bkt}$ )	Med: 3.5 Range: 2.2 - 5.5	Med: 4.4 Range: 3.0 - 6.6
Meander Length/ Bankfull Width ( $L_m/W_{bkt}$ )	Med: 6.6 Range: 3.4 - 9.1	Med: 8.3 Range: 6.1 - 10.5
Meander Width Ratio ( $W_{belt}/W_{bkt}$ )	Med: 1.6 Range: 1.3 - 1.8	Med: 1.8 Range: 1.3 - 2.2
Radius of Curvature/ Bankfull Width ( $R_c/W_{bkt}$ )	Med: 3.1 Range: 2.1 - 10.4	Med: 3.8 Range: 2.4 - 5.3

Profile Variables		
Average Water Surface Slope ( $S_{ave}$ )	0.0121	0.0112
Valley Slope ( $S_{valley}$ )	0.0131	0.0116
Riffle Slope ( $S_{riffle}$ )	Mean: 0.0118 Range: 0.0026 - 0.0183	Mean: 0.0195 Range: 0.0178 - 0.0225
Pool Slope ( $S_{pool}$ )	Mean: 0.0097 Range: 0 - 0.0254	Mean: 0.0015 Range: 0.0002 - 0.0036
Run Slope ( $S_{run}$ )	Mean: 0.0085 Range: 0.0030 - 0.0202	Mean: 0 Range:
Glide Slope ( $S_{glide}$ )	Mean: 0.0041 Range: 0 - 0.0083	Mean: 0.0028 Range: 0.0001 - 0.0054

Profile Ratios		
Riffle Slope/ Water Surface Slope ( $S_{riffle}/S_{ave}$ )	Mean: 0.98 Range: 0.21 - 1.51	Mean: 1.74 Range: 1.59 - 2.01
Pool Slope/Water Surface Slope ( $S_{pool}/S_{ave}$ )	Mean: 0.80 Range: 0 - 2.10	Mean: 0.13 Range: 0.02 - 0.32
Run Slope/Water Surface Slope ( $S_{run}/S_{ave}$ )	Mean: 0.70 Range: 0.25 - 1.67	Mean: 0.00 Range:
Glide Slope/Water Surface Slope ( $S_{glide}/S_{ave}$ )	Mean: 0.34 Range: 0 - 0.69	Mean: 0.25 Range: 0.01 - 0.48

Existing (UT 1)	Proposed (UT 1)	Existing (Fork Creek)	Proposed (Fork Creek)
Eg 4	Ce 3/4	Cg 4	Ce 3/4
0.29	0.29	1.01	1.01
39.5	39.5	99.0	99.0

Dimension Variables			
8.1	8.1	18.9	18.9
8.1 - 35.5	8.1	18.9 - 64.8	18.9
Mean: 8.1 Range: 6.4 to 15.3	Mean: 10.6 Range: 9.9 to 11.4	Mean: 17.2 Range: 11.7 to 25.1	Mean: 16.3 Range: 15.1 to 17.4
Mean: 1.0 Range: 0.5 to 1.3	Mean: 0.8 Range: 0.7 to 0.8	Mean: 1.1 Range: 0.8 to 1.6	Mean: 1.2 Range: 1.1 to 1.3
Mean: 2.0 Range: 1.4 to 2.4	Mean: 1.0 Range: 0.9 to 1.2	Mean: 2.1 Range: 1.2 to 2.5	Mean: 1.5 Range: 1.4 to 1.9
No distinct repetitive pattern of riffles and pools due to straightening activities	Mean: 13.8 Range: 10.6 to 17.0 Mean: 1.3 Range: 1.1 to 1.5	No distinct repetitive pattern of riffles and pools due to straightening activities	Mean: 21.1 Range: 16.3 to 26.0 Mean: 2.0 Range: 1.7 to 2.3
Mean: 100 Range: 16 to 100	Mean: 100 Range: 50 to 150	Mean: 100 Range: 18 to 100	Mean: 100 Range: 50 to 150

Dimension Ratios			
Mean: 8.8 Range: 2.0 to 15.6	Mean: 9.4 Range: 5.1 to 13.2	Mean: 5.1 Range: 0.9 to 8.5	Mean: 6.1 Range: 3.3 to 8.6
Mean: 8.2 Range: 4.9 to 30.6	Mean: 14.0 Range: 12.0 to 16.0	Mean: 15.9 Range: 7.3 to 31.4	Mean: 14.0 Range: 12.0 to 16.0
Mean: 1.7 Range: 1.5 to 3.0	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.9 Range: 1.3 to 2.6	Mean: 1.3 Range: 1.2 to 1.5
Mean: 1.5 Range: 1.0 to 2.1	Mean: 1.0 Range: 1.0 to 1.3	Mean: 1.3 Range: 1.0 to 2.8	Mean: 1.0 Range: 1.0 to 1.3
No distinct repetitive pattern of riffles and pools due to straightening activities	Mean: 1.7 Range: 1.5 to 2.0 Mean: 1.3 Range: 1.0 to 1.6 Mean: 1.4 Range: 1.1 to 1.6	No distinct repetitive pattern of riffles and pools due to straightening activities	Mean: 1.7 Range: 1.5 to 2.0 Mean: 1.3 Range: 1.0 to 1.6 Mean: 1.4 Range: 1.1 to 1.6

Existing (UT 1)	Proposed (UT 1)	Existing (Fork Creek)	Proposed (Fork Creek)
Pattern Variables			
No distinct repetitive pattern of riffles and pools due to straightening activities	Med: 42.6 Range: 31.9 to 63.9 Med: 90.5 Range: 63.9 to 106.5 Med: 21.3 Range: 16.0 to 31.9 Med: 31.9 Range: 21.3 to 106.5	No distinct repetitive pattern of riffles and pools due to straightening activities	Med: 65.1 Range: 48.8 to 130.1 Med: 138.3 Range: 97.6 to 195.2 Med: 32.5 Range: 24.4 to 48.8 Med: 48.8 Range: 32.5 to 162.7
1.01	1.15	1.05	1.15

Pattern Ratios			
No distinct repetitive pattern of riffles and pools due to straightening activities	Med: 4.0 Range: 3.0 to 6.0 Med: 8.5 Range: 6.0 to 10.0 Med: 2.0 Range: 1.5 to 3.0 Med: 3.0 Range: 2.0 to 10.0	No distinct repetitive pattern of riffles and pools due to straightening activities	Med: 4.0 Range: 3.0 to 8.0 Med: 8.5 Range: 6.0 to 12.0 Med: 2.0 Range: 1.5 to 3.0 Med: 3.0 Range: 2.0 to 10.0

Profile Variables			
0.0288	0.0253	0.0258	0.0236
0.0291	0.0291	0.0271	0.0271
No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 0.0405 Range: 0.0304 to 0.0455 Mean: 0.0025 Range: 0.0000 to 0.0177 Mean: 0.0101 Range: 0.0000 to 0.0202 Mean: 0.0028 Range: 0.0000 to 0.0202	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 0.0377 Range: 0.0283 to 0.0424 Mean: 0.0024 Range: 0.0000 to 0.0165 Mean: 0.0094 Range: 0.0000 to 0.0189 Mean: 0.0026 Range: 0.0000 to 0.0189

Profile Ratios			
No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 1.60 Range: 1.2 to 1.8 Mean: 0.10 Range: 0.0 to 0.7 Mean: 0.40 Range: 0.0 to 0.8 Mean: 0.11 Range: 0.0 to 0.8	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 1.60 Range: 1.2 to 1.8 Mean: 0.10 Range: 0.0 to 0.7 Mean: 0.40 Range: 0.0 to 0.8 Mean: 0.11 Range: 0.0 to 0.8

**Table B1 continued. Laurel Springs Site Morphological Stream Characteristics**

Variables	REFERENCE- STONE MTN	REFERENCE- CRANBERRY
Stream Type	Cb 3	E 4
Drainage Area (mi <sup>2</sup> )	7.46	0.70
Bankfull Discharge (cfs)	75.3	28.7

Dimension Variables		
Bankfull Cross-Sectional Area ( $A_{bkt}$ )	46.0	20.2
Existing Cross-Sectional Area ( $A_{existing}$ )	45.9 - 46.1	19.9 - 20.4
Bankfull Width ( $W_{bkt}$ )	Mean: 30.1 Range: 27.2 - 33.0	Mean: 12.5 Range: 11.8 - 13.2
Bankfull Mean Depth ( $D_{bkt}$ )	Mean: 1.6 Range: 1.4 - 1.7	Mean: 1.6 Range: 1.5 - 1.7
Bankfull Maximum Depth ( $D_{max}$ )	Mean: 2.4 Range: 2.2 - 2.6	Mean: 1.9 Range:
Pool Width ( $W_{pool}$ )	Mean: 24.4 Range: 23.8 - 25.0	Mean: 15.7 Range:
Maximum Pool Depth ( $D_{pool}$ )	Mean: 2.7 Range: 2.6 - 2.7	Mean: 2.7 Range:
Width of Floodprone Area ( $W_{fpa}$ )	Mean: 100.0 Range:	Mean: 75.0 Range:

Dimension Ratios		
Entrenchment Ratio ( $W_{fpa}/W_{bkt}$ )	Mean: 3.4 Range: 3.0 - 3.7	Mean: 6.0 Range: 5.7 - 6.4
Width / Depth Ratio ( $W_{bkt}/D_{bkt}$ )	Mean: 20.0 Range: 16.1 - 23.8	Mean: 7.8 Range: 7.0 - 8.5
Max. $D_{bkt} / D_{bkt}$ Ratio	Mean: 1.6 Range: 1.5 - 1.6	Mean: 1.2 Range: 1.1 - 1.3
Low Bank Height / Max. $D_{bkt}$ Ratio	Mean: 1.3 Range: 1.0 - 1.6	Mean: 1.0 Range:
Maximum Pool Depth / Bankfull Mean Depth ( $D_{pool}/D_{bkt}$ )	Mean: 1.7 Range: 1.6 - 1.9	Mean: 1.7 Range: 1.6 - 1.8
Pool Width / Bankfull Width ( $W_{pool}/W_{bkt}$ )	Mean: 0.8 Range: 0.7 - 0.9	Mean: 1.3 Range: 1.2 - 1.3
Pool Area / Bankfull Cross Sectional Area	Mean: 0.9 Range: 0.9 - 1.0	Mean: 1.4 Range: 1.4 - 1.5

Variables	REFERENCE- STONE MTN	REFERENCE- CRANBERRY
Pattern Variables		
Pool to Pool Spacing ( $L_{p-p}$ )	Med: 104.3 Range: 65.2 - 166.7	Med: 54.8 Range: 37.0 - 82.6
Meander Length ( $L_m$ )	Med: 199.4 Range: 101.7 - 273.2	Med: 103.8 Range: 76.6 - 131.0
Belt Width ( $W_{belt}$ )	Med: 46.8 Range: 40.0 - 55.0	Med: 23.3 Range: 16.0 - 27.6
Radius of Curvature ( $R_c$ )	Med: 94.5 Range: 62.4 - 312.1	Med: 47.0 Range: 30.5 - 65.7
Sinuosity ( $S_{in}$ )	1.20	1.04

Pattern Ratios		
Pool to Pool Spacing/ Bankfull Width ( $L_{p-p}/W_{bkt}$ )	Med: 3.5 Range: 2.2 - 5.5	Med: 4.4 Range: 3.0 - 6.6
Meander Length/ Bankfull Width ( $L_m/W_{bkt}$ )	Med: 6.6 Range: 3.4 - 9.1	Med: 8.3 Range: 6.1 - 10.5
Meander Width Ratio ( $W_{belt}/W_{bkt}$ )	Med: 1.6 Range: 1.3 - 1.8	Med: 1.8 Range: 1.3 - 2.2
Radius of Curvature/ Bankfull Width ( $R_c/W_{bkt}$ )	Med: 3.1 Range: 2.1 - 10.4	Med: 3.8 Range: 2.4 - 5.3

Profile Variables		
Average Water Surface Slope ( $S_{ave}$ )	0.0121	0.0112
Valley Slope ( $S_{valley}$ )	0.0131	0.0116
Riffle Slope ( $S_{riffle}$ )	Mean: 0.0118 Range: 0.0026 - 0.0183	Mean: 0.0195 Range: 0.0178 - 0.0225
Pool Slope ( $S_{pool}$ )	Mean: 0.0097 Range: 0 - 0.0254	Mean: 0.0015 Range: 0.0002 - 0.0036
Run Slope ( $S_{run}$ )	Mean: 0.0085 Range: 0.0030 - 0.0202	Mean: 0 Range:
Glide Slope ( $S_{glide}$ )	Mean: 0.0041 Range: 0 - 0.0083	Mean: 0.0028 Range: 0.0001 - 0.0054

Profile Ratios		
Riffle Slope/ Water Surface Slope ( $S_{riffle}/S_{ave}$ )	Mean: 0.98 Range: 0.21 - 1.51	Mean: 1.74 Range: 1.59 - 2.01
Pool Slope/Water Surface Slope ( $S_{pool}/S_{ave}$ )	Mean: 0.80 Range: 0 - 2.10	Mean: 0.13 Range: 0.02 - 0.32
Run Slope/Water Surface Slope ( $S_{run}/S_{ave}$ )	Mean: 0.70 Range: 0.25 - 1.67	Mean: 0.00 Range:
Glide Slope/Water Surface Slope ( $S_{glide}/S_{ave}$ )	Mean: 0.34 Range: 0 - 0.69	Mean: 0.25 Range: 0.01 - 0.48

Existing (UT 2)	Proposed (UT 2)	Existing (UT 3)	Proposed (UT 3)
Bg 5/6	B 3/4	Bg 5	B 3/4
0.03	0.03	0.04	0.04
7.7	7.7	8.7	8.7

Dimension Variables			
1.8	1.8	2.0	2.0
1.8 - 6.9	1.8	3.6 - 9.0	2.0
Mean: 5.8 Range: 4.4 to 9.8	Mean: 5.0 Range: 4.6 to 5.4	Mean: 3.7 Range: 3.0 to 4.2	Mean: 5.3 Range: 4.9 to 5.7
Mean: 0.4 Range: 0.2 to 0.4	Mean: 0.4 Range: 0.3 to 0.4	Mean: 0.6 Range: 0.5 to 0.7	Mean: 0.4 Range: 0.4 to 0.4
Mean: 0.8 Range: 0.5 to 0.8	Mean: 0.5 Range: 0.4 to 0.6	Mean: 0.8 Range: 0.7 to 1.4	Mean: 0.5 Range: 0.5 to 0.6
No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 6.5 Range: 5.0 to 8.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 6.9 Range: 5.3 to 8.5
Mean: 17 Range: 11 to 22	Mean: 25 Range: 20 to 30	Mean: 6 Range: 5.5 to 50	Mean: 25 Range: 20 to 30

Dimension Ratios			
Mean: 2.3 Range: 2.0 to 4.5	Mean: 5.0 Range: 4.3 to 5.6	Mean: 2.0 Range: 1.5 to 11.9	Mean: 4.7 Range: 4.1 to 5.3
Mean: 17.4 Range: 11.0 to 49.0	Mean: 14.0 Range: 12.0 to 16.0	Mean: 6.2 Range: 4.3 to 8.4	Mean: 14.0 Range: 12.0 to 16.0
Mean: 2.3 Range: 1.8 to 2.7	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.4 Range: 1.3 to 2.0	Mean: 1.3 Range: 1.2 to 1.5
Mean: 1.5 Range: 1.0 to 2.0	Mean: 1.0 Range: 1.0 to 1.3	Mean: 1.7 Range: 1.4 to 2.6	Mean: 1.0 Range: 1.0 to 1.3
No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0
	Mean: 1.3 Range: 1.0 to 1.6		Mean: 1.3 Range: 1.0 to 1.6
	Mean: 1.4 Range: 1.1 to 1.6		Mean: 1.4 Range: 1.1 to 1.6

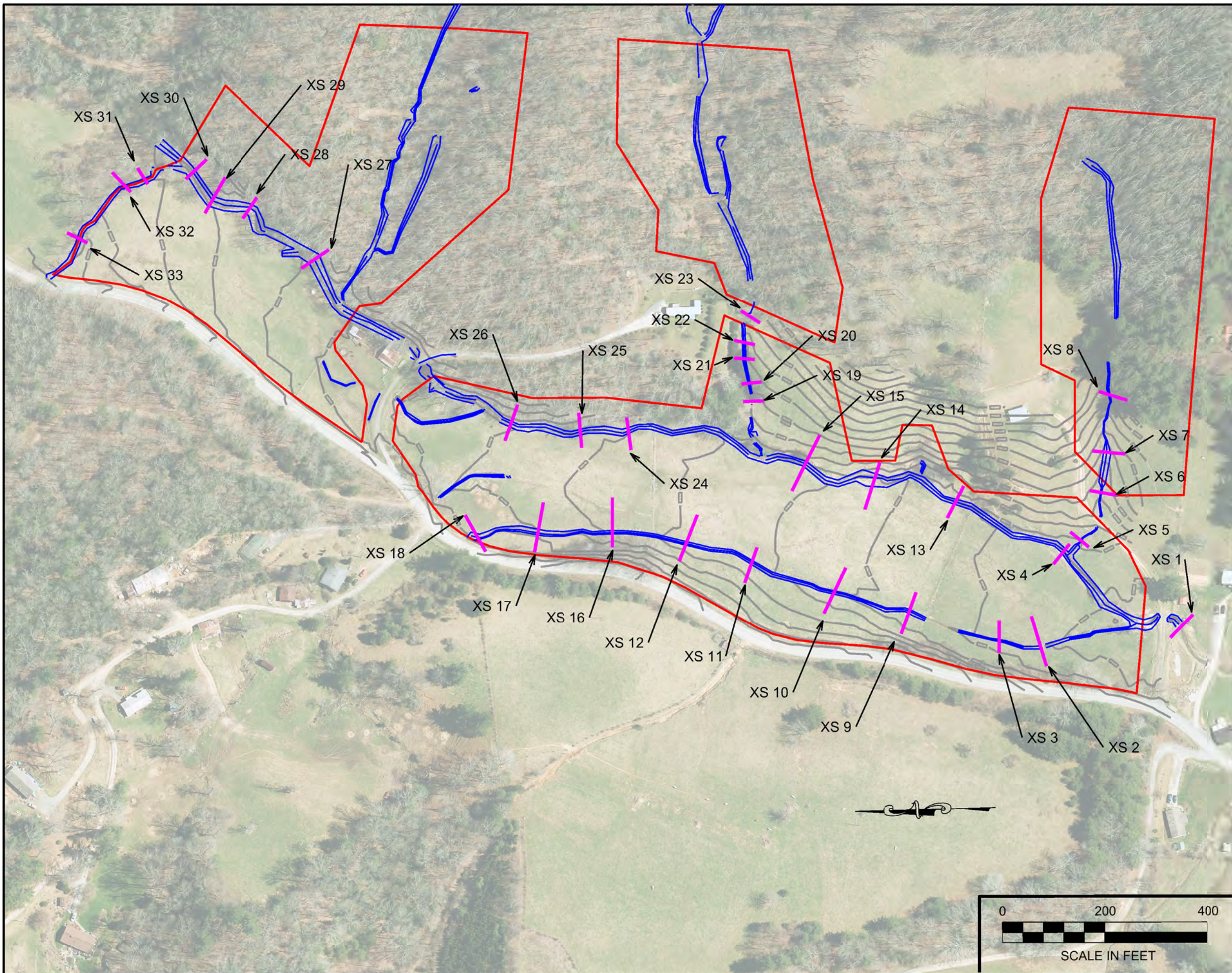
Existing (UT 2)	Proposed (UT 2)	Existing (UT 3)	Proposed (UT 3)
Pattern Variables			
No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 17.6 Range: 11.0 to 30.1	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 18.5 Range: 11.6 to 31.7
	Med: 37.6 Range: 17.1 to 60.2		Med: 39.7 Range: 18.0 to 63.5
	Med: 10.0 Range: 7.5 to 15.1		Med: 10.6 Range: 7.9 to 15.9
	Med: 15.1 Range: 10.0 to 25.1		Med: 15.9 Range: 10.6 to 26.5
1.02	1.05	1.04	1.05

Pattern Ratios			
No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 3.5 Range: 2.2 to 6.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 3.5 Range: 2.2 to 6.0
	Med: 7.5 Range: 3.4 to 12.0		Med: 7.5 Range: 3.4 to 12.0
	Med: 2.0 Range: 1.5 to 3.0		Med: 2.0 Range: 1.5 to 3.0
	Med: 3.0 Range: 2.0 to 5.0		Med: 3.0 Range: 2.0 to 5.0

Profile Variables			
0.1026	0.0997	0.0954	0.0945
0.1047	0.1047	0.0992	0.0992
No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.1595 Range: 0.1197 to 0.1795	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.1512 Range: 0.1134 to 0.1701
	Mean: 0.0100 Range: 0.0000 to 0.0698		Mean: 0.0094 Range: 0.0000 to 0.0661
	Mean: 0.0399 Range: 0.0000 to 0.0798		Mean: 0.0378 Range: 0.0000 to 0.0756
	Mean: 0.0110 Range: 0.0000 to 0.0798		Mean: 0.0104 Range: 0.0000 to 0.0756

Profile Ratios			
No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.60 Range: 1.2 to 1.8	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.60 Range: 1.2 to 1.8
	Mean: 0.10 Range: 0.0 to 0.7		Mean: 0.10 Range: 0.0 to 0.7
	Mean: 0.40 Range: 0.0 to 0.8		Mean: 0.40 Range: 0.0 to 0.8
	Mean: 0.11 Range: 0.0 to 0.8		Mean: 0.11 Range: 0.0 to 0.8



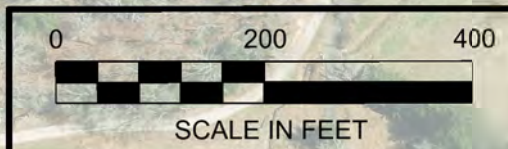


NOTES/REVISIONS

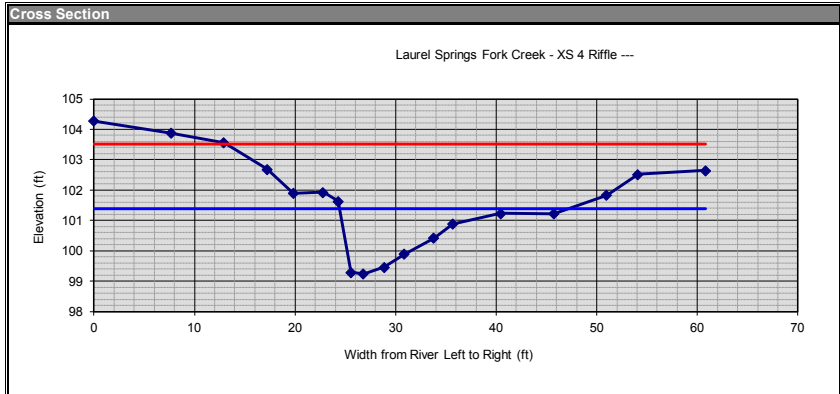
Project:  
**Laurel Springs Mitigation Site**  
 Avery County North Carolina

Title:  
**CROSS SECTION LOCATIONS**

Scale: As Shown	FIGURE NO. <b>B1</b>
Date: Sept 2019	
Project No.: 19-009	







section: Laurel Springs Fork Creek - XS 4  
 Riffle  
 ---  
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description: Laurel Springs Fork Creek - XS 4  
 height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-4.278872	104.2789	-1.383	-1.92	100.0		
		7.681899	-3.866986	103.867	101.383	101.92			
		12.94624	-3.557277	103.5573					
		17.22745	-2.677659	102.6777					
		19.84555	-1.89274	101.8927					
		22.79317	-1.926305	101.9263					
		24.30605	-1.633006	101.633					
		25.57054	0.703136	99.29686					
		26.81597	0.757932	99.24207					
		28.86995	0.536438	99.46356					
		30.874	0.11024	99.88976					
		33.80514	-0.415353	100.4154					
		35.68251	-0.885841	100.8858					
		40.44746	-1.229851	101.2299					
		45.75615	-1.214639	101.2146					
		50.98267	-1.825198	101.8252					
		54.11209	-2.514082	102.5141					
		60.85309	-2.640606	102.6406					

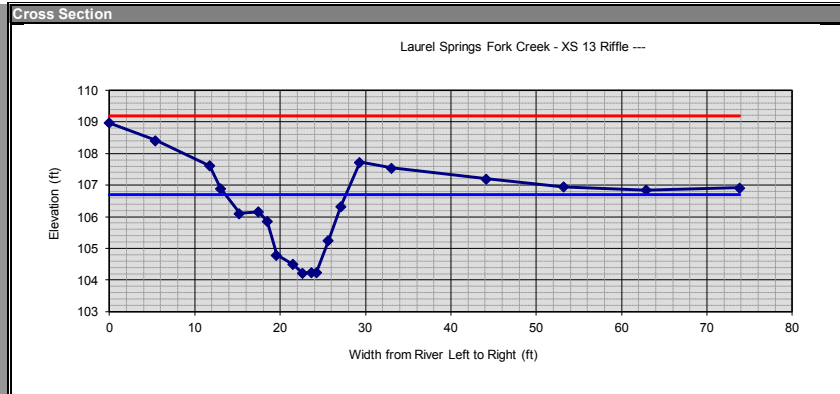
dimensions			
18.9	x-section area	0.8	d mean
22.8	width	24.2	wet P
2.1	d max	0.8	hyd radi
2.7	bank ht	27.4	w/d ratio
100.0	W flood prone area	4.4	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
3.1	relative roughness	5.6	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs Fork Creek - XS 13  
 Riffle  
 ---  
 ---

description: Laurel Springs Fork Creek - XS 13  
 height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-8.973179	108.9732	-6.715	-7.7	100.0		
		5.406628	-8.413459	108.4135	106.715	107.7			
		11.76721	-7.619042	107.619					
		13.00889	-6.894594	106.8946					
		15.2463	-6.111757	106.1118					
		17.50049	-6.163315	106.1632					
		18.48883	-5.853527	105.8535					
		19.59216	-4.7906	104.7906					
		21.51463	-4.49483	104.4948					
		22.67259	-4.226931	104.2269					
		23.67612	-4.244633	104.2446					
		24.27073	-4.244436	104.2444					
		25.65112	-5.254313	105.2543					
		27.1193	-6.334642	106.3346					
		29.34537	-7.726352	107.7264					
		33.05071	-7.539997	107.54					
		44.13201	-7.202436	107.2024					
		53.22159	-6.950973	106.951					
		62.88966	-6.843214	106.8432					
		73.8366	-6.915668	106.9157					

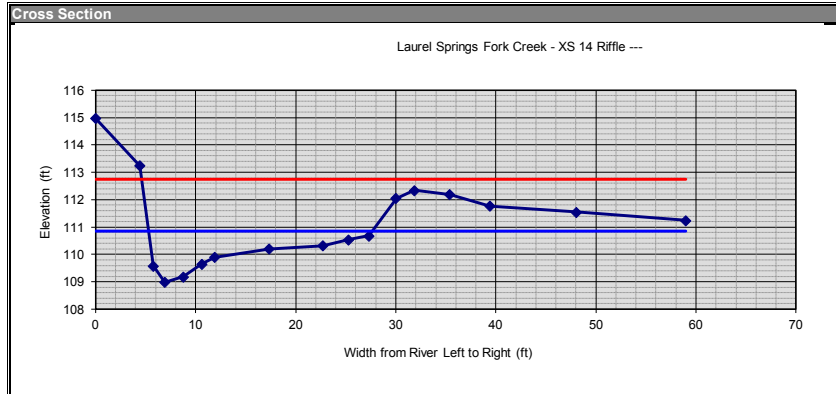
dimensions			
18.9	x-section area	1.3	d mean
14.2	width	15.6	wet P
2.5	d max	1.2	hyd radi
3.5	bank ht	10.7	w/d ratio
100.0	W flood prone area	7.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
4.9	relative roughness	6.8	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs Fork Creek - XS 14  
Riffle  
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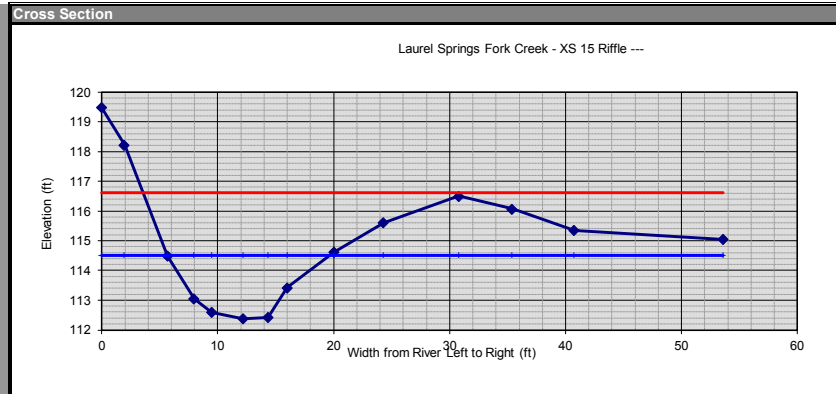
description: Laurel Springs Fork Creek - XS 14  
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-14.9773	114.9773	-10.87	-12.05	100.0		
		4.423263	-13.24435	113.2443	110.87	112.05			
		5.769878	-9.577126	109.5771					
		6.91477	-8.981494	108.9815					
		8.796547	-9.184513	109.1845					
		10.63306	-9.658149	109.6581					
		11.90312	-9.902256	109.9023					
		17.35858	-10.2072	110.2072					
		22.73141	-10.32401	110.324					
		25.30912	-10.54398	110.544					
		27.33639	-10.68349	110.6835					
		30.05226	-12.04925	112.0493					
		31.849	-12.34119	112.3412					
		35.41793	-12.19375	112.1938					
		39.41715	-11.77139	111.7714					
		48.08046	-11.54673	111.5467					
		58.99704	-11.24562	111.2456					

dimensions			
18.9	x-section area	0.8	d mean
22.4	width	23.6	wet P
1.9	d max	0.8	hyd radi
3.1	bank ht	26.6	w/d ratio
100.0	W flood prone area	4.5	ent ratio

hydraulics			
0.0	velocity (ft/sec)		
0.0	discharge rate, Q (cfs)		
0.00	shear stress ((lbs/ft sq)		
0.00	shear velocity (ft/sec)		
0.000	unit stream power (lbs/ft/sec)		
0.00	Froude number		
0.0	friction factor u/u*		
0-0	threshold grain size (mm)		

check from channel material			
82	measured D84 (mm)		
3.1	relative roughness	5.7	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs Fork Creek - XS 15  
Riffle  
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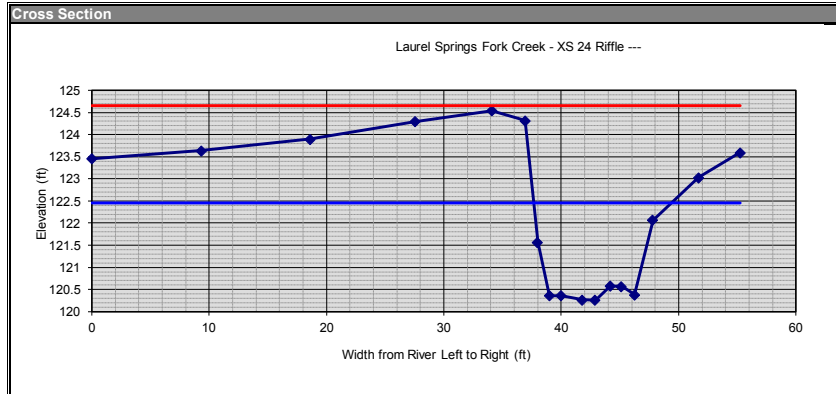
description: Laurel Springs Fork Creek - XS 15  
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-19.48469	119.4847	-14.505	-16.5	100.0		
		1.949791	-18.22708	118.2271	114.505	116.5			
		5.683596	-14.48527	114.4853					
		7.96508	-13.04508	113.0451					
		9.494098	-12.58695	112.587					
		12.17727	-12.37799	112.378					
		14.35324	-12.42243	112.4224					
		16.01386	-13.41889	113.4189					
		20.04183	-14.61936	114.6194					
		24.30899	-15.61328	115.6133					
		30.80239	-16.50282	116.5028					
		35.39747	-16.07468	116.0747					
		40.74726	-15.35308	115.3531					
		53.61921	-15.04832	115.0483					

dimensions			
18.9	x-section area	1.3	d mean
14.0	width	14.9	wet P
2.1	d max	1.3	hyd radi
4.1	bank ht	10.4	w/d ratio
100.0	W flood prone area	7.1	ent ratio

hydraulics			
0.0	velocity (ft/sec)		
0.0	discharge rate, Q (cfs)		
0.00	shear stress ((lbs/ft sq)		
0.00	shear velocity (ft/sec)		
0.000	unit stream power (lbs/ft/sec)		
0.00	Froude number		
0.0	friction factor u/u*		
0-0	threshold grain size (mm)		

check from channel material			
82	measured D84 (mm)		
5.0	relative roughness	6.8	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs Fork Creek - XS 24  
Riffle  
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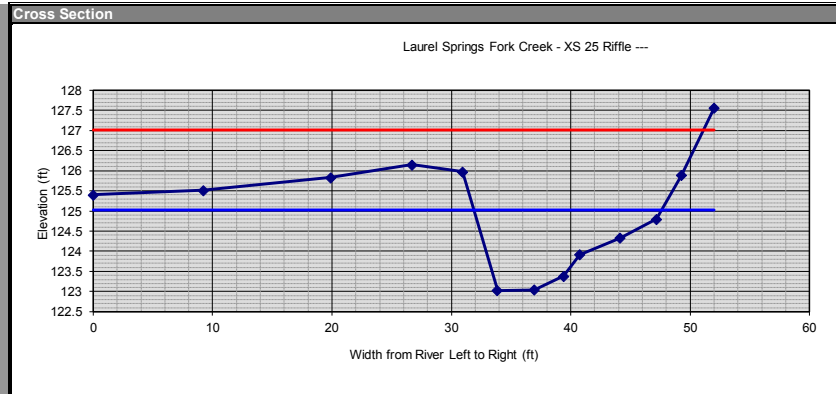
description: Laurel Springs Fork Creek - XS 24  
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-23.45936	123.4594	-22.46	-23.03	100.0		
		9.337844	-23.63559	123.6356	122.46	123.03			
		18.59962	-23.89924	123.8992					
		27.53473	-24.29658	124.2966					
		34.07897	-24.54422	124.5442					
		36.93791	-24.31395	124.3139					
		37.991	-21.57227	121.5723					
		39.01361	-20.36044	120.3604					
		40.01267	-20.36333	120.3633					
		41.78919	-20.26976	120.2698					
		42.89861	-20.26177	120.2618					
		44.16636	-20.57617	120.5762					
		45.1279	-20.57196	120.572					
		46.25434	-20.38207	120.3821					
		47.80235	-22.06599	122.066					
		51.70716	-23.03233	123.0323					
		55.24077	-23.59386	123.5939					

dimensions			
18.9	x-section area	1.6	d mean
11.7	width	13.8	wet P
2.2	d max	1.4	hyd radi
2.8	bank ht	7.3	w/d ratio
100.0	W flood prone area	8.5	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
6.0	relative roughness	7.3	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs Fork Creek - XS 25  
Riffle  
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description: Laurel Springs Fork Creek - XS 25  
height of instrument (ft): 100.00

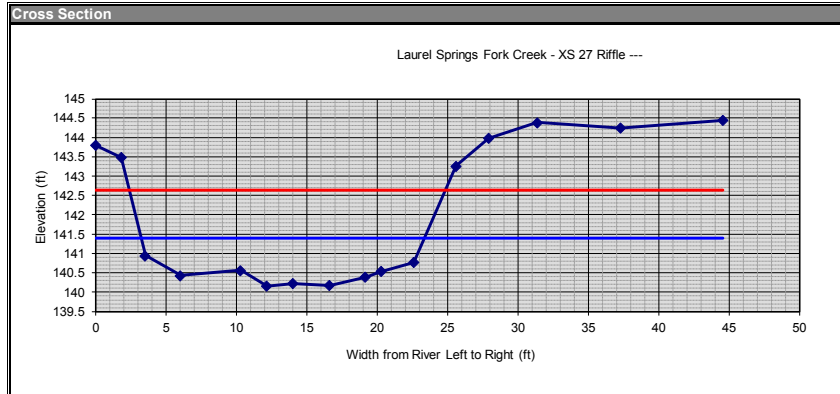
notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-25.40377	125.4038	-25.03	-25.97	100.0		
		9.224396	-25.51472	125.5147	125.03	125.97			
		19.89526	-25.82915	125.8291					
		26.71348	-26.15449	126.1545					
		30.94894	-25.97333	125.9733					
		33.85983	-23.03507	123.0351					
		36.93577	-23.04232	123.0423					
		39.38885	-23.38243	123.3824					
		40.73169	-23.92019	123.9202					
		44.14191	-24.33323	124.3332					
		47.18865	-24.80292	124.8029					
		49.281	-25.88721	125.8872					
		52.0174	-27.56622	127.5662					

dimensions			
18.9	x-section area	1.2	d mean
15.7	width	16.8	wet P
2.0	d max	1.1	hyd radi
2.9	bank ht	13.1	w/d ratio
100.0	W flood prone area	6.4	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
4.5	relative roughness	6.5	fric. factor
0.000	Manning's n from channel material		





section: Laurel Springs Fork Creek - XS 27  
 Riffle  
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description: Laurel Springs Fork Creek - XS 27  
 height of instrument (ft): 100.00

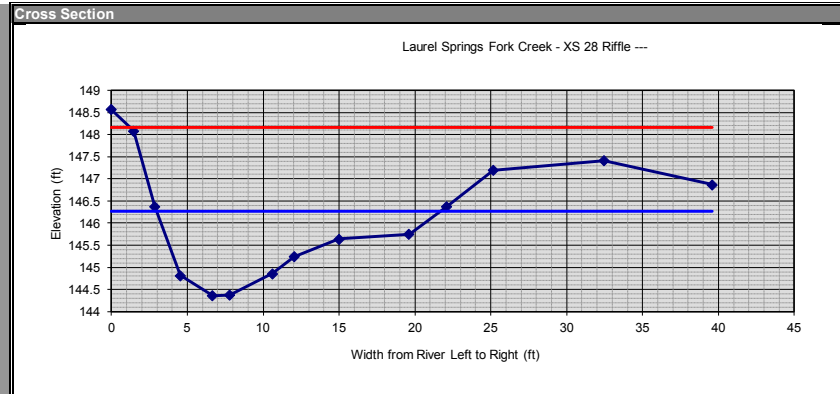
notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	-43.79977	143.7998
		1.807272	-43.48171	143.4817
		3.516794	-40.94676	140.9468
		6.0194	-40.43175	140.4318
		10.29296	-40.56188	140.5619
		12.14651	-40.16904	140.169
		14.00896	-40.22566	140.2257
		16.61011	-40.18089	140.1809
		19.15525	-40.39567	140.3957
		20.28501	-40.53933	140.5393
		22.58342	-40.77172	140.7717
		25.56816	-43.26113	143.2611
		27.89714	-43.97683	143.9768
		31.34758	-44.38398	144.384
		37.24857	-44.24254	144.2425
		44.53269	-44.43967	144.4397

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-41.405	-43.48	18.0		
141.405	143.48			

dimensions			
18.9	x-section area	0.9	d mean
20.1	width	20.7	wet P
1.2	d max	0.9	hyd radi
3.3	bank ht	21.4	w/d ratio
18.0	W flood prone area	0.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
3.5	relative roughness	5.9	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs Fork Creek - XS 28  
 Riffle  
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description: Laurel Springs Fork Creek - XS 28  
 height of instrument (ft): 100.00

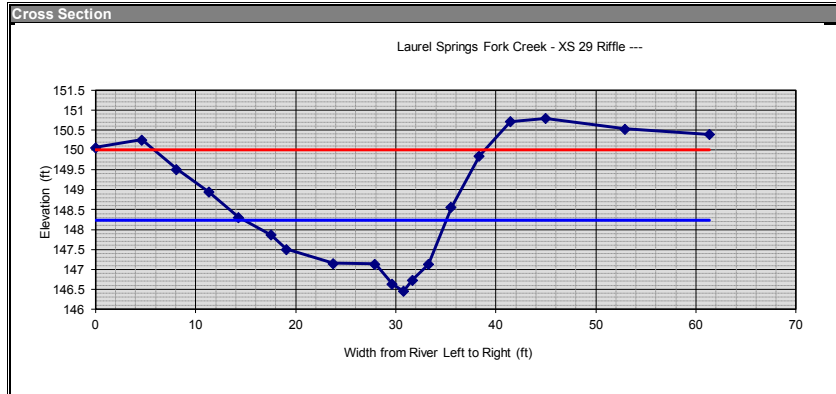
notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	-48.57801	148.578
		1.462983	-48.08654	148.0865
		2.865707	-46.38221	146.3822
		4.544129	-44.82082	144.8208
		6.674258	-44.37018	144.3702
		7.795834	-44.37359	144.3736
		10.62862	-44.85976	144.8598
		12.04106	-45.24741	145.2474
		15.00642	-45.63983	145.6398
		19.62184	-45.75007	145.7501
		22.08113	-46.36892	146.3689
		25.17355	-47.19501	147.195
		32.47207	-47.41163	147.4116
		39.60277	-46.87327	146.8733

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-46.27	-47.2	100.0		
146.27	147.2			

dimensions			
18.9	x-section area	1.0	d mean
18.7	width	19.5	wet P
1.9	d max	1.0	hyd radi
2.8	bank ht	18.5	w/d ratio
100.0	W flood prone area	5.3	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
3.7	relative roughness	6.1	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs Fork Creek - XS 29

Riffle  
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description: Laurel Springs Fork Creek - XS 29

height of instrument (ft): 100.00

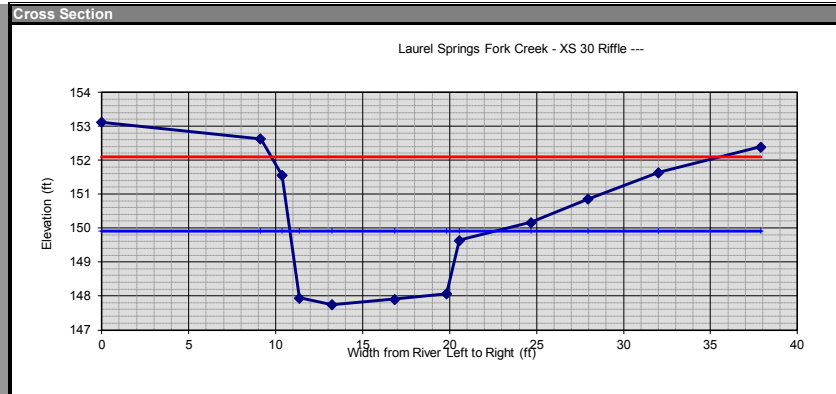
notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	-50.05841	150.0584
		4.633046	-50.25759	150.2576
		8.106288	-49.51404	149.514
		11.32149	-48.9477	148.9477
		14.2892	-48.30602	148.306
		17.53609	-47.87079	147.8708
		19.08527	-47.50321	147.5032
		23.75997	-47.15171	147.1517
		27.92333	-47.13416	147.1342
		29.66111	-46.62802	146.628
		30.77479	-46.46414	146.4641
		31.66988	-46.73175	146.7317
		33.28017	-47.13075	147.1307
		35.54825	-48.55882	148.5588
		38.36482	-49.85343	149.8534
		41.47354	-50.71195	150.7119
		44.99573	-50.79124	150.7912
		52.89948	-50.53136	150.5314
		61.38613	-50.39125	150.3913

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-48.235	-48.94	34.0		
148.235	148.94			

dimensions			
18.9	x-section area	0.9	d mean
20.2	width	20.8	wet P
1.8	d max	0.9	hyd radi
2.5	bank ht	21.6	w/d ratio
34.0	W flood prone area	1.7	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
3.5	relative roughness	5.9	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs Fork Creek - XS 30

Riffle  
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description: Laurel Springs Fork Creek - XS 30

height of instrument (ft): 100.00

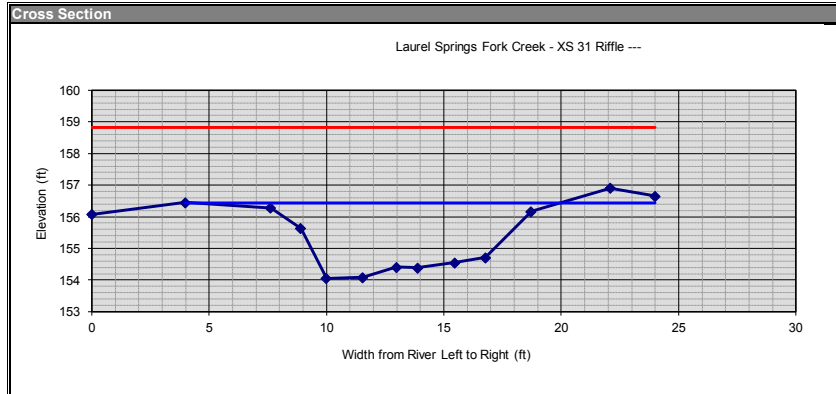
notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	-53.11336	153.1134
		9.138112	-52.62212	152.6221
		10.38314	-51.55415	151.5541
		11.37232	-47.94703	147.947
		13.253	-47.74392	147.7439
		16.85114	-47.90725	147.9073
		19.84064	-48.06193	148.0619
		20.56609	-49.6371	149.6371
		24.67688	-50.1643	150.1643
		27.95879	-50.85626	150.8563
		32.03152	-51.6359	151.6359
		37.89107	-52.39357	152.3936

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-49.925	-50.16	25.0		
149.925	150.16			

dimensions			
18.9	x-section area	1.6	d mean
12.0	width	14.5	wet P
2.2	d max	1.3	hyd radi
2.4	bank ht	7.6	w/d ratio
25.0	W flood prone area	2.1	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
5.9	relative roughness	7.2	fric. factor
0.000	Manning's n from channel material		



section: **Laurel Springs Fork Creek - XS 31**  
Riffle  
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description: **Laurel Springs Fork Creek - XS 31**  
height of instrument (ft): **100.00**

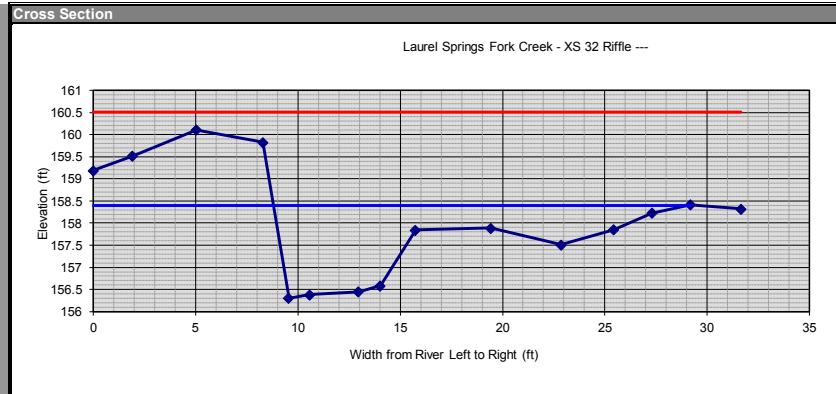
notes	omit pt.	distance (ft)	FS (ft)	elevation
	<input checked="" type="checkbox"/>	0	-56.07544	156.0754
	<input type="checkbox"/>	3.978358	-56.45356	156.4536
	<input type="checkbox"/>	7.624238	-56.28336	156.2834
	<input type="checkbox"/>	8.908549	-55.62852	155.6285
	<input type="checkbox"/>	9.995167	-54.05233	154.0523
	<input type="checkbox"/>	11.55386	-54.07928	154.0793
	<input type="checkbox"/>	12.97364	-54.40461	154.4046
	<input type="checkbox"/>	13.89117	-54.38469	154.3847
	<input type="checkbox"/>	15.45462	-54.54851	154.5485
	<input type="checkbox"/>	16.77904	-54.71611	154.7161
	<input type="checkbox"/>	18.72567	-56.1637	156.1637
	<input type="checkbox"/>	22.08742	-56.90426	156.9043
	<input type="checkbox"/>	23.98894	-56.65451	156.6545

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-56.44	-56.44	100.0		
156.44	156.44			

dimensions			
18.9	x-section area	1.2	d mean
15.7	width	17.3	wet P
2.4	d max	1.1	hyd radi
2.4	bank ht	13.0	w/d ratio
100.0	W flood prone area	6.4	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress (lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
4.5	relative roughness	6.5	fric. factor
0.000	Manning's n from channel material		



section: **Laurel Springs Fork Creek - XS 32**  
Riffle  
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description: **Laurel Springs Fork Creek - XS 32**  
height of instrument (ft): **100.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	<input checked="" type="checkbox"/>	0	-59.18811	159.1881
	<input type="checkbox"/>	1.915287	-59.51519	159.5152
	<input type="checkbox"/>	5.031726	-60.10401	160.104
	<input type="checkbox"/>	8.304333	-59.82688	159.8269
	<input type="checkbox"/>	9.562187	-56.30325	156.3033
	<input type="checkbox"/>	10.67282	-56.38351	156.3835
	<input type="checkbox"/>	12.96945	-56.44634	156.4463
	<input type="checkbox"/>	14.03313	-56.58879	156.5888
	<input type="checkbox"/>	15.75068	-57.84674	157.8467
	<input type="checkbox"/>	19.42582	-57.88764	157.8876
	<input type="checkbox"/>	22.85397	-57.51335	157.5133
	<input type="checkbox"/>	25.43623	-57.84889	157.8489
	<input type="checkbox"/>	27.30251	-58.23034	158.2303
	<input type="checkbox"/>	29.17764	-58.41828	158.4183
	<input checked="" type="checkbox"/>	31.6683	-58.32251	158.3225

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-58.41	-58.41	100.0		
158.41	158.41			

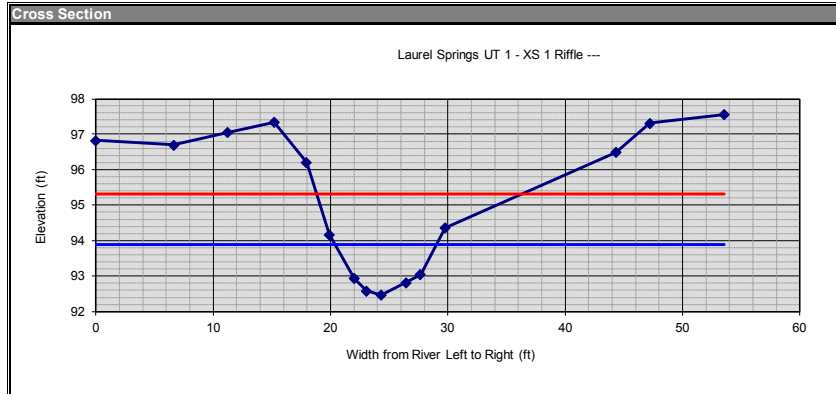
dimensions			
18.9	x-section area	0.9	d mean
20.3	width	22.3	wet P
2.1	d max	0.8	hyd radi
2.1	bank ht	21.8	w/d ratio
100.0	W flood prone area	4.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress (lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
3.5	relative roughness	5.9	fric. factor
0.000	Manning's n from channel material		







section: Laurel Springs UT 1 - XS 1  
 Riffle  
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 ---  
 description: Laurel Springs UT 1 - XS 1  
 height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	3.176827	96.82317
		6.646595	3.302464	96.69754
		11.21116	2.952162	97.04784
		15.21719	2.657969	97.34203
		17.94965	3.79855	96.20145
		19.89297	5.826776	94.17322
		22.01751	7.066006	92.93399
		23.06243	7.412436	92.58756
		24.32381	7.526443	92.47356
		26.44612	7.18426	92.81574
		27.65713	6.951501	93.0485
		29.76383	5.63401	94.36599
		44.32827	3.509436	96.49056
		47.22807	2.688416	97.31158
		53.5817	2.441193	97.55881

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
6.1	5.63	17.0		
93.9	94.37			

dimensions

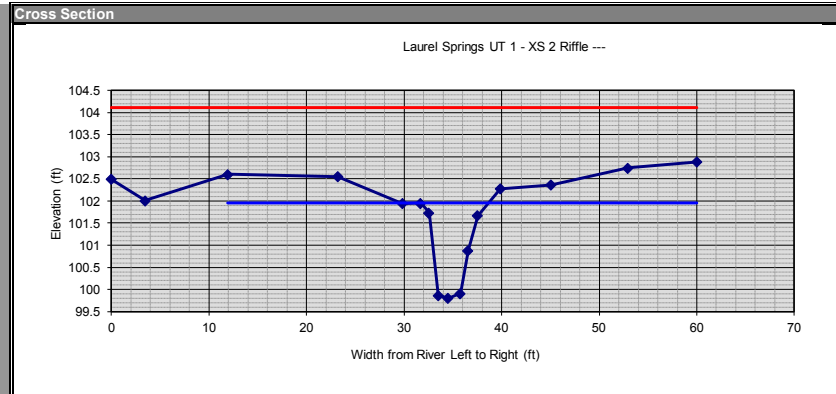
8.1	x-section area	0.9	d mean
8.7	width	9.3	wet P
1.4	d max	0.9	hyd radi
1.9	bank ht	9.2	w/d ratio
17.0	W flood prone area	2.0	ent ratio

hydraulics

0.0	velocity (ft/sec)		
0.0	discharge rate, Q (cfs)		
0.00	shear stress (lbs/ft sq)		
0.00	shear velocity (ft/sec)		
0.000	unit stream power (lbs/ft/sec)		
0.00	Froude number		
0.0	friction factor u/u*		
0-0	threshold grain size (mm)		

check from channel material

82	measured D84 (mm)		
3.5	relative roughness	5.9	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 1 - XS 2  
 Riffle  
 ---  
 ---  
 description: Laurel Springs UT 1 - XS 2  
 height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	-2.493465	102.4935
		3.461465	-2.005759	102.0058
		11.95137	-2.604041	102.604
		23.20925	-2.554416	102.5544
		29.83916	-1.940644	101.9406
		31.71202	-1.950915	101.9509
		32.5477	-1.730858	101.7309
		33.50478	0.132302	99.8677
		34.52336	0.194688	99.80531
		35.7766	0.086977	99.91302
		36.54688	-0.88436	100.8844
		37.53542	-1.667959	101.668
		39.85519	-2.277598	102.2776
		45.06309	-2.360295	102.3603
		52.95567	-2.747847	102.7478
		60.04899	-2.883634	102.8836

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-1.96	-1.96	100.0		
101.96	101.96			

dimensions

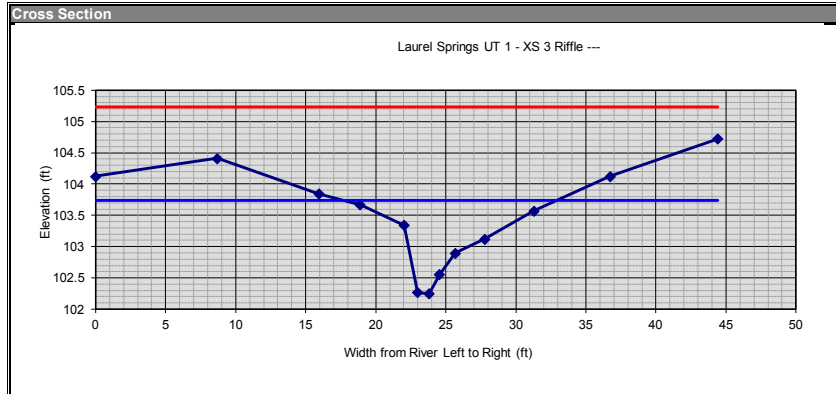
8.1	x-section area	0.9	d mean
9.0	width	11.0	wet P
2.2	d max	0.7	hyd radi
2.2	bank ht	10.1	w/d ratio
100.0	W flood prone area	11.1	ent ratio

hydraulics

0.0	velocity (ft/sec)		
0.0	discharge rate, Q (cfs)		
0.00	shear stress (lbs/ft sq)		
0.00	shear velocity (ft/sec)		
0.000	unit stream power (lbs/ft/sec)		
0.00	Froude number		
0.0	friction factor u/u*		
0-0	threshold grain size (mm)		

check from channel material

82	measured D84 (mm)		
3.3	relative roughness	5.8	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 1 - XS 3  
Riffle  
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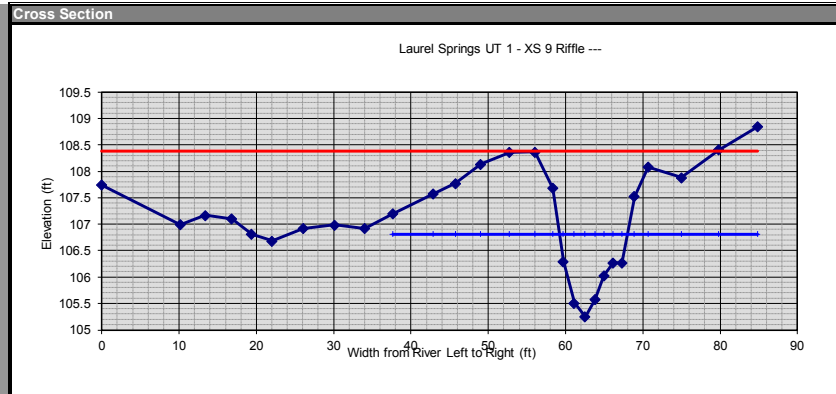
description: Laurel Springs UT 1 - XS 3  
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-4.124474	104.1245	-3.74	-3.84	100.0		
		8.680985	-4.410539	104.4105	103.74	103.84			
		15.94852	-3.845943	103.8459					
		18.90955	-3.667814	103.6678					
		22.01688	-3.34392	103.3439					
		22.98618	-2.268302	102.2683					
		23.81029	-2.247386	102.2474					
		24.57299	-2.559976	102.56					
		25.68839	-2.896319	102.8963					
		27.79521	-3.122105	103.1221					
		31.3075	-3.571562	103.5716					
		36.74941	-4.126062	104.1261					
		44.43033	-4.725292	104.7253					

dimensions			
8.1	x-section area	0.5	d mean
15.3	width	15.9	wet P
1.5	d max	0.5	hyd radi
1.6	bank ht	28.7	w/d ratio
100.0	W flood prone area	6.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress (lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
2.0	relative roughness	4.5	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 1 - XS 9  
Riffle  
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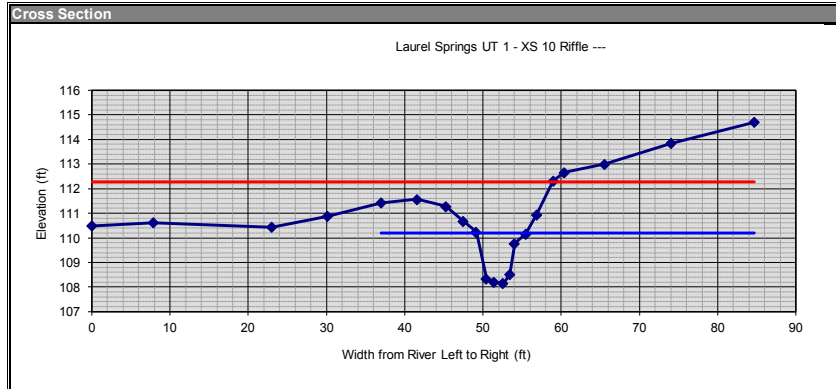
description: Laurel Springs UT 1 - XS 9  
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-7.745525	107.7455	-6.82	-7.5	22.0		
		10.14386	-6.994393	106.9944	106.82	107.5			
		13.40317	-7.171226	107.1712					
		16.82686	-7.101162	107.1012					
		19.40365	-6.808793	106.8088					
		22.04303	-6.684675	106.6847					
		26.07024	-6.919466	106.9195					
		30.14167	-6.985532	106.9855					
		33.99095	-6.92061	106.9206					
		37.66011	-7.199831	107.1998					
		42.85096	-7.576724	107.5767					
		45.78155	-7.776257	107.7763					
		49.04384	-8.137126	108.1371					
		52.77396	-8.362486	108.3625					
		56.0118	-8.368116	108.3681					
		58.37169	-7.684099	107.6841					
		59.72004	-6.290061	106.2901					
		61.13299	-5.510879	105.5109					
		62.54083	-5.251152	105.2512					
		63.84729	-5.573195	105.5732					
		64.96314	-6.032494	106.0325					
		66.18022	-6.269459	106.2695					
		67.32266	-6.263683	106.2637					
		68.92428	-7.524856	107.5249					
		70.70543	-8.08324	108.0832					
		75.014	-7.88574	107.8857					
		79.83782	-8.409354	108.4094					
		84.86925	-8.85002	108.85					

dimensions			
8.1	x-section area	0.9	d mean
8.8	width	9.6	wet P
1.6	d max	0.8	hyd radi
2.2	bank ht	9.6	w/d ratio
22.0	W flood prone area	2.5	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress (lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
3.4	relative roughness	5.9	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 1 - XS 10

Riffle  
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description: Laurel Springs UT 1 - XS 10

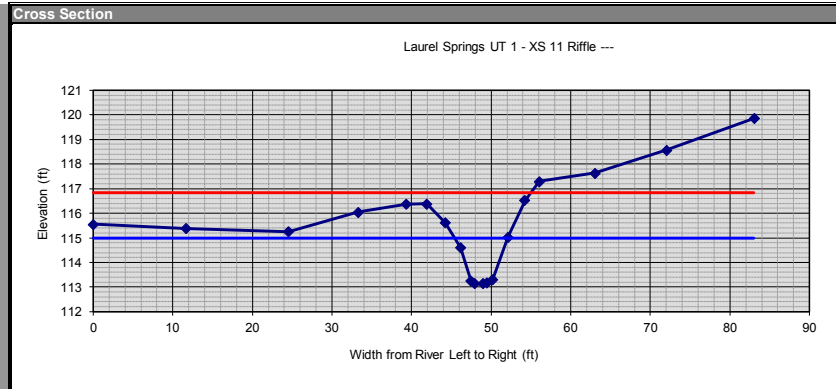
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-10.49391	110.4939	-10.22	-11.5	100.0		
	☑	7.842531	-10.62118	110.6212	110.22	111.5			
	☑	22.98295	-10.43908	110.4391					
	☑	30.13153	-10.88313	110.8831					
	☑	37.00019	-11.42565	111.4257					
	☑	41.56376	-11.5688	111.5688					
	☑	45.26337	-11.28133	111.2813					
	☑	47.43117	-10.67821	110.6782					
	☑	49.13293	-10.23837	110.2384					
	☑	50.43655	-8.334043	108.334					
	☑	51.40576	-8.211932	108.2119					
	☑	52.5722	-8.156666	108.1567					
	☑	53.43847	-8.513886	108.5139					
	☑	54.03314	-9.766802	109.7668					
	☑	55.46918	-10.16477	110.1648					
	☑	56.87247	-10.94245	110.9425					
	☑	58.98449	-12.31789	112.3179					
	☑	60.42003	-12.65633	112.6563					
	☑	65.57106	-12.99773	112.9977					
	☑	74.03103	-13.85031	113.8503					
	☑	84.65457	-14.70495	114.7049					

dimensions			
8.1	x-section area	1.3	d mean
6.4	width	8.4	wet P
2.1	d max	1.0	hyd radi
3.3	bank ht	5.1	w/d ratio
100.0	W flood prone area	15.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
4.7	relative roughness	6.7	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 1 - XS 11

Riffle  
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description: Laurel Springs UT 1 - XS 11

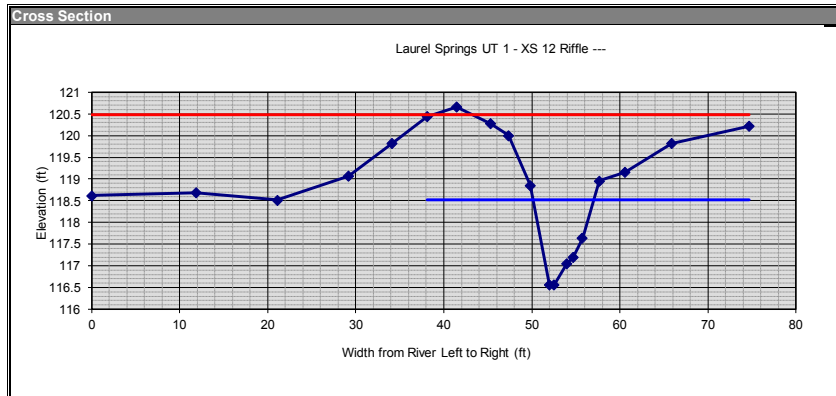
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-15.55643	115.5564	-15	-16.38	100.0		
	☑	11.64577	-15.38997	115.39	115	116.38			
	☑	24.52743	-15.25875	115.2588					
	☑	33.32661	-16.05299	116.053					
	☑	39.32669	-16.37415	116.3742					
	☑	41.9051	-16.38971	116.3897					
	☑	44.22332	-15.62219	115.6222					
	☑	46.1904	-14.60231	114.6023					
	☑	47.47402	-13.26549	113.2655					
	☑	47.92735	-13.14674	113.1467					
	☑	48.97019	-13.15265	113.1526					
	☑	49.46986	-13.16908	113.1691					
	☑	50.18062	-13.30094	113.3009					
	☑	52.14834	-15.03168	115.0317					
	☑	54.2428	-16.52611	116.5261					
	☑	56.04045	-17.3017	117.3017					
	☑	63.07879	-17.6394	117.6394					
	☑	72.04807	-18.57368	118.5737					
	☑	83.04577	-19.86864	119.8686					

dimensions			
8.1	x-section area	1.2	d mean
6.7	width	8.0	wet P
1.9	d max	1.0	hyd radi
3.2	bank ht	5.5	w/d ratio
100.0	W flood prone area	15.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
4.5	relative roughness	6.5	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 1 - XS 12  
 Riffle  
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description: Laurel Springs UT 1 - XS 12  
 height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	<input checked="" type="checkbox"/>	0	-18.61852	118.6185
	<input checked="" type="checkbox"/>	11.88215	-18.68546	118.6855
	<input checked="" type="checkbox"/>	21.1028	-18.51441	118.5144
	<input checked="" type="checkbox"/>	29.15288	-19.06845	119.0685
	<input checked="" type="checkbox"/>	34.09204	-19.82199	119.822
	<input type="checkbox"/>	38.08861	-20.44475	120.4447
	<input type="checkbox"/>	41.46089	-20.66336	120.6634
	<input type="checkbox"/>	45.30951	-20.28075	120.2808
	<input type="checkbox"/>	47.37968	-20.00499	120.005
	<input type="checkbox"/>	49.81666	-18.85528	118.8553
	<input type="checkbox"/>	51.97844	-16.56531	116.5653
	<input type="checkbox"/>	52.54543	-16.56894	116.5689
	<input type="checkbox"/>	53.94361	-17.0475	117.0475
	<input type="checkbox"/>	54.70319	-17.19929	117.1993
	<input type="checkbox"/>	55.74315	-17.63675	117.6368
	<input type="checkbox"/>	57.64242	-18.95672	118.9567
	<input type="checkbox"/>	60.60353	-19.15707	119.1571
	<input type="checkbox"/>	65.88532	-19.82234	119.8223
	<input type="checkbox"/>	74.71315	-20.22377	120.2238

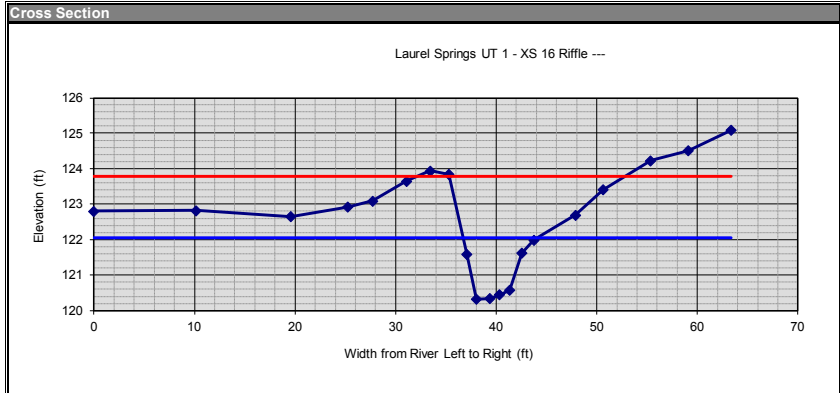
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-18.53	-18.95	100.0		
118.53	118.95			

dimensions			
8.1	x-section area	1.2	d mean
6.9	width	8.2	wet P
2.0	d max	1.0	hyd radi
2.4	bank ht	5.9	w/d ratio
100.0	W flood prone area	14.5	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress (lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
4.4	relative roughness	6.5	fric. factor
0.000	Manning's n from channel material		

For additional cross sections make a copy of the "Dimension" worksheet. To create a copy "right click" on the dimension tab below.



section: Laurel Springs UT 1 - XS 16  
 Riffle  
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 description: Laurel Springs UT 1 - XS 16  
 height of instrument (ft): 100.00

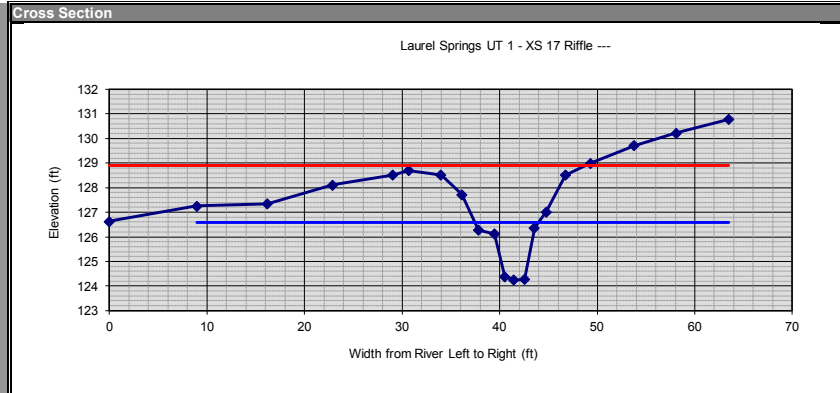
notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	-22.80247	122.8025
		10.16625	-22.81969	122.8197
		19.58936	-22.64722	122.6472
		25.23634	-22.91885	122.9189
		27.73967	-23.09574	123.0957
		31.10803	-23.65055	123.6506
		33.44191	-23.93877	123.9388
		35.29414	-23.84352	123.8435
		37.07709	-21.59679	121.5968
		38.03069	-20.32682	120.3268
		39.37364	-20.34388	120.3439
		40.35948	-20.44621	120.4462
		41.36081	-20.57237	120.5724
		42.55087	-21.61954	121.6195
		43.76635	-21.99126	121.9913
		47.89573	-22.69303	122.693
		50.64007	-23.41217	123.4122
		55.36689	-24.22791	124.2279
		59.10937	-24.50929	124.5093
		63.38093	-25.09614	125.0961

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-22.06	-23.84	16.0		
122.06	123.84			

dimensions			
8.1	x-section area	1.1	d mean
7.5	width	8.8	wet P
1.7	d max	0.9	hyd radi
3.5	bank ht	6.9	w/d ratio
16.0	W flood prone area	2.1	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
4.0	relative roughness	6.3	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 1 - XS 17  
 Riffle  
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 description: Laurel Springs UT 1 - XS 17  
 height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
		0	-26.62969	126.6297
		8.969608	-27.25393	127.2539
		16.17591	-27.34388	127.3439
		22.91438	-28.11709	128.1171
		29.04458	-28.51602	128.516
		30.70719	-28.6994	128.6994
		34.00882	-28.52121	128.5212
		36.12589	-27.72791	127.7279
		37.83906	-26.2824	126.2824
		39.46555	-26.11833	126.1183
		40.5297	-24.394	124.394
		41.48648	-24.26479	124.2648
		42.57202	-24.27482	124.2748
		43.58054	-26.37093	126.3709
		44.78668	-27.02484	127.0248
		46.78032	-28.51762	128.5176
		49.35873	-29.00351	129.0035
		53.82598	-29.72101	129.721
		58.12283	-30.21618	130.2162
		63.51385	-30.78238	130.7824

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-26.59	-28.6	100.0		
126.59	128.6			

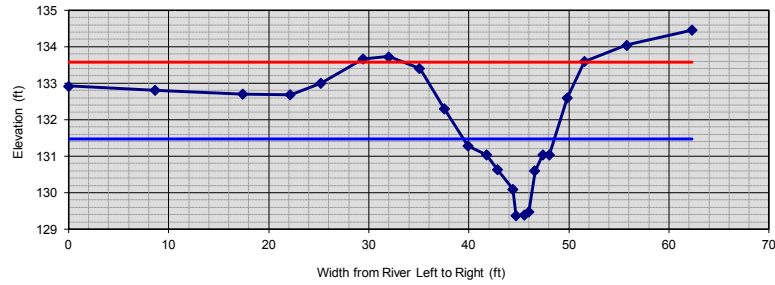
dimensions			
8.1	x-section area	1.2	d mean
6.5	width	9.0	wet P
2.3	d max	0.9	hyd radi
4.3	bank ht	5.2	w/d ratio
100.0	W flood prone area	15.4	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
4.6	relative roughness	6.6	fric. factor
0.000	Manning's n from channel material		

Cross Section

Laurel Springs UT 1 - XS 18 Riffle ---



section: Laurel Springs UT 1 - XS 18

Riffle

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description: Laurel Springs UT 1 - XS 18

height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
	<input type="checkbox"/>	0	-32.92101	132.921	-31.48	-33.6	18.0		
	<input type="checkbox"/>	8.660708	-32.80947	132.8095	131.48	133.6			
	<input type="checkbox"/>	17.40438	-32.70175	132.7017					
	<input type="checkbox"/>	22.17044	-32.69059	132.6906					
	<input type="checkbox"/>	25.20502	-33.00606	133.0061					
	<input type="checkbox"/>	29.44983	-33.67008	133.6701					
	<input type="checkbox"/>	32.0127	-33.72635	133.7263					
	<input type="checkbox"/>	35.08575	-33.40292	133.4029					
	<input type="checkbox"/>	37.5569	-32.30007	132.3001					
	<input type="checkbox"/>	39.91241	-31.28495	131.2849					
	<input type="checkbox"/>	41.79392	-31.03377	131.0338					
	<input type="checkbox"/>	42.84661	-30.63025	130.6303					
	<input type="checkbox"/>	44.40331	-30.09936	130.0994					
	<input type="checkbox"/>	44.70965	-29.37688	129.3769					
	<input type="checkbox"/>	45.58557	-29.39559	129.3956					
	<input type="checkbox"/>	45.98123	-29.4732	129.4732					
	<input type="checkbox"/>	46.61063	-30.59863	130.5986					
	<input type="checkbox"/>	47.4035	-31.04796	131.048					
	<input type="checkbox"/>	48.04228	-31.03958	131.0396					
	<input type="checkbox"/>	49.82553	-32.59896	132.599					
	<input type="checkbox"/>	51.56826	-33.59516	133.5952					
	<input type="checkbox"/>	55.77669	-34.04787	134.0479					
	<input type="checkbox"/>	62.34335	-34.45625	134.4562					
	<input type="checkbox"/>								
	<input type="checkbox"/>								

dimensions			
8.1	x-section area	0.9	d mean
9.1	width	10.7	wet P
2.1	d max	0.8	hyd radi
4.2	bank ht	10.2	w/d ratio
18.0	W flood prone area	2.0	ent ratio

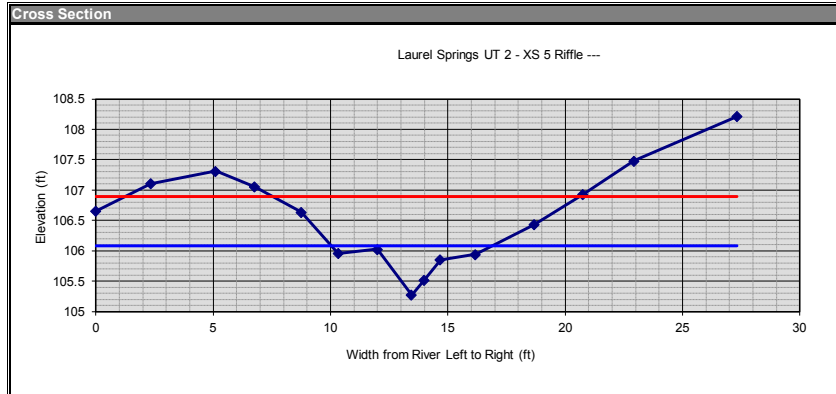
  

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress (lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
3.3	relative roughness	5.8	fric. factor
0.000	Manning's n from channel material		





section: Laurel Springs UT 2 - XS 5  
 Riffle  
 ---  
 ---  
 description: Laurel Springs UT 2 - XS 5  
 height of instrument (ft): 100.00

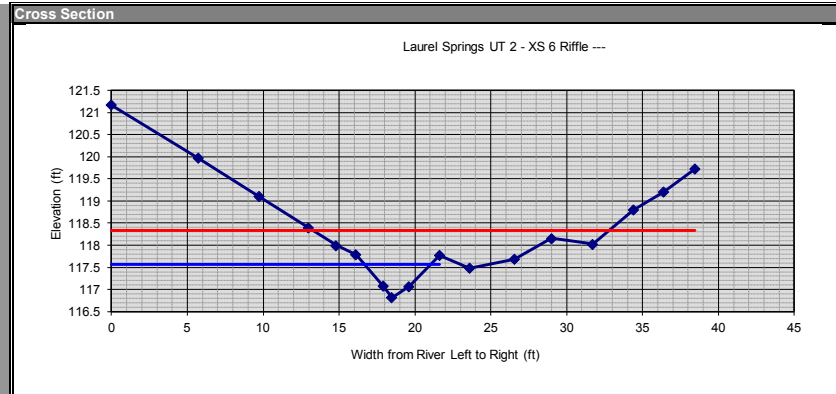
notes	omit pt.	distance (ft)	FS (ft)	elevation
	<input type="checkbox"/>	0	-6.652776	106.6528
	<input type="checkbox"/>	2.344407	-7.106356	107.1064
	<input type="checkbox"/>	5.108068	-7.311611	107.3116
	<input type="checkbox"/>	6.773636	-7.049685	107.0497
	<input type="checkbox"/>	8.747941	-6.633262	106.6333
	<input type="checkbox"/>	10.33706	-5.959161	105.9592
	<input type="checkbox"/>	11.9947	-6.027009	106.027
	<input type="checkbox"/>	13.45438	-5.279966	105.28
	<input type="checkbox"/>	13.98806	-5.51437	105.5144
	<input type="checkbox"/>	14.67549	-5.849796	105.8498
	<input type="checkbox"/>	16.177	-5.939954	105.94
	<input type="checkbox"/>	18.67242	-6.42856	106.4286
	<input type="checkbox"/>	20.74374	-6.922389	106.9224
	<input type="checkbox"/>	22.93639	-7.478608	107.4786
	<input type="checkbox"/>	27.32325	-8.212214	108.2122

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-6.09	-6.63	14.0		
106.09	106.63			

dimensions			
1.8	x-section area	0.3	d mean
6.9	width	7.3	wet P
0.8	d max	0.3	hyd radi
1.4	bank ht	26.3	w/d ratio
14.0	W flood prone area	2.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
1.0	relative roughness	2.8	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 2 - XS 6  
 Riffle  
 ---  
 ---  
 description: Laurel Springs UT 2 - XS 6  
 height of instrument (ft): 100.00

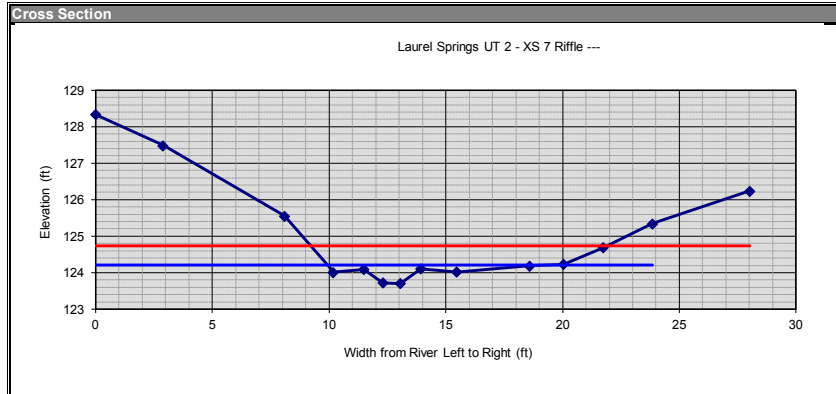
notes	omit pt.	distance (ft)	FS (ft)	elevation
	<input type="checkbox"/>	0	-21.17573	121.1757
	<input type="checkbox"/>	5.727443	-19.96804	119.968
	<input type="checkbox"/>	9.731957	-19.10287	119.1029
	<input type="checkbox"/>	12.99516	-18.39766	118.3977
	<input type="checkbox"/>	14.80825	-18.00031	118.0003
	<input type="checkbox"/>	16.11607	-17.78451	117.7845
	<input type="checkbox"/>	17.90742	-17.0788	117.0788
	<input type="checkbox"/>	18.4832	-16.81647	116.8165
	<input type="checkbox"/>	19.62129	-17.06952	117.0695
	<input type="checkbox"/>	21.62996	-17.77543	117.7754
	<input type="checkbox"/>	23.61143	-17.48464	117.4846
	<input type="checkbox"/>	26.56436	-17.68545	117.6855
	<input type="checkbox"/>	29.01297	-18.15879	118.1588
	<input type="checkbox"/>	31.73268	-18.02499	118.025
	<input type="checkbox"/>	34.39393	-18.80068	118.8007
	<input type="checkbox"/>	36.38456	-19.20357	119.2036
	<input type="checkbox"/>	38.44562	-19.7228	119.7228

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
-17.58	-17.77	20.0		
117.58	117.77			

dimensions			
1.8	x-section area	0.4	d mean
4.4	width	4.7	wet P
0.8	d max	0.4	hyd radi
1.0	bank ht	11.1	w/d ratio
20.0	W flood prone area	4.5	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
1.5	relative roughness	3.8	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 2 - XS 7  
 Riffle  
 ---  
 ---

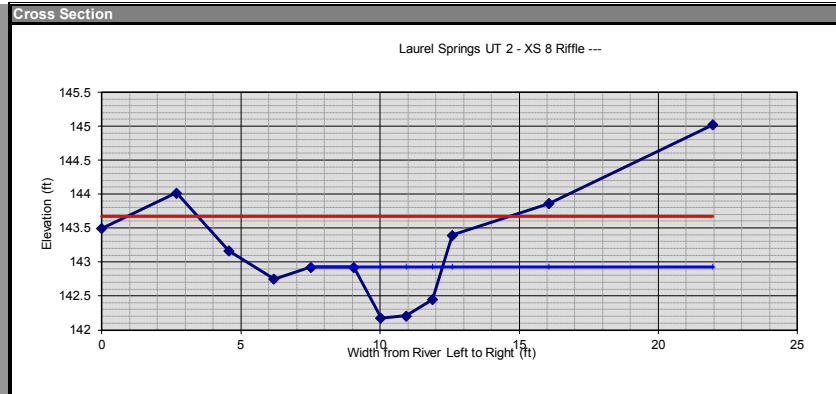
description: Laurel Springs UT 2 - XS 7  
 height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-28.34401	128.344	-24.22	-24.68	22.0		
		2.903019	-27.48117	127.4812	124.22	124.68			
		8.084681	-25.55899	125.559					
		10.18515	-24.01066	124.0107					
		11.48494	-24.09497	124.095					
		12.31928	-23.71875	123.7188					
		13.05314	-23.70204	123.702					
		13.93723	-24.10781	124.1078					
		15.48424	-24.02193	124.0219					
		18.58618	-24.18987	124.1899					
		20.03608	-24.23076	124.2308					
		21.74082	-24.68898	124.689					
		23.85561	-25.34669	125.3467					
		28.03548	-26.23977	126.2398					

dimensions			
1.8	x-section area	0.2	d mean
9.8	width	10.0	wet P
0.5	d max	0.2	hyd radi
1.0	bank ht	53.7	w/d ratio
22.0	W flood prone area	2.3	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
0.7	relative roughness	1.9	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 2 - XS 8  
 Riffle  
 ---  
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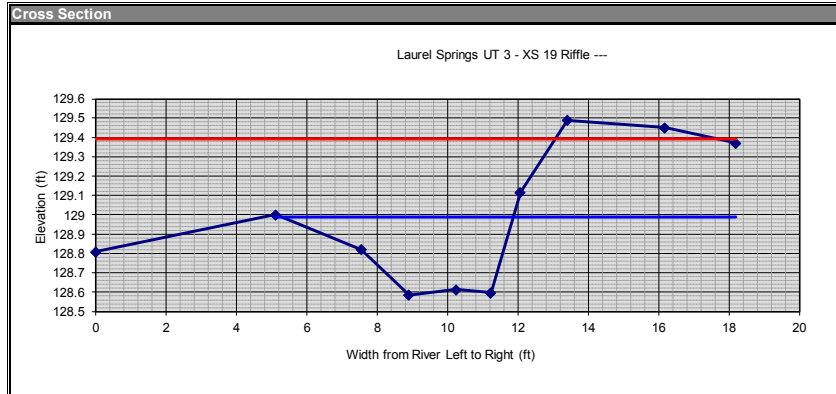
description: Laurel Springs UT 2 - XS 8  
 height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-43.49583	143.4958	-42.926	-42.926	11.0		
		2.694047	-44.01699	144.017	142.926	142.926			
		4.579732	-43.16312	143.1631					
		6.198105	-42.74739	142.7474					
		7.511928	-42.92588	142.9259					
		9.053722	-42.9215	142.9215					
		10.03613	-42.17868	142.1787					
		10.94433	-42.20565	142.2057					
		11.88402	-42.44672	142.4467					
		12.6073	-43.39659	143.3966					
		16.06832	-43.86223	143.8622					
		21.95977	-45.02489	145.0249					

dimensions			
1.7	x-section area	0.4	d mean
4.7	width	5.3	wet P
0.7	d max	0.3	hyd radi
0.7	bank ht	13.3	w/d ratio
11.0	W flood prone area	2.3	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
1.3	relative roughness	3.5	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 3 - XS 19  
 Riffle  
 ---  
 ---  
 description: Laurel Springs UT 3 - XS 19  
 height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-28.80832	128.8083	-28.99	-28.99	50.0		
		5.108324	-29.00082	129.0008	128.99	128.99			
		7.538862	-28.82034	128.8203					
		8.894375	-28.58566	128.5857					
		10.22868	-28.61421	128.6142					
		11.22136	-28.59709	128.5971					
		12.06116	-29.1159	129.1159					
		13.39447	-29.4882	129.4882					
		16.15608	-29.45111	129.4511					
		18.17733	-29.3711	129.3711					

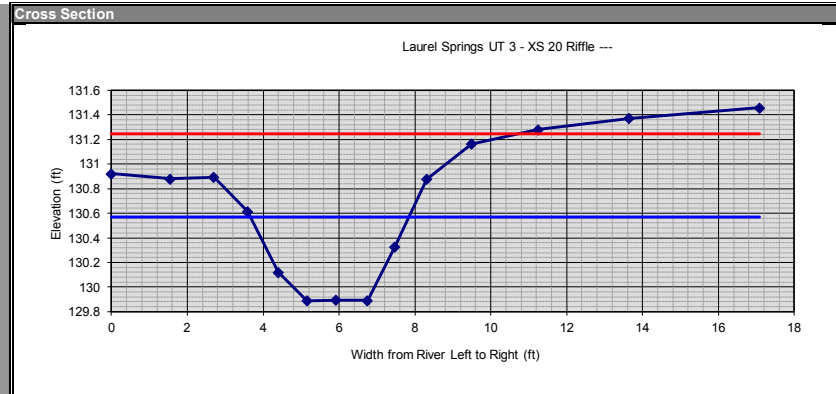
dimensions			
1.6	x-section area	0.2	d mean
6.6	width	6.7	wet P
0.4	d max	0.2	hyd radi
0.4	bank ht	27.1	w/d ratio
50.0	W flood prone area	7.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
0.9	relative roughness	2.6	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 3 - XS 20  
 Riffle  
 ---  
 ---  
 description: Laurel Springs UT 3 - XS 20  
 height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-30.92292	130.9229	-30.57	-30.89	50.0		
		1.553832	-30.88047	130.8805	130.57	130.89			
		2.705946	-30.89421	130.8942					
		3.588176	-30.61416	130.6142					
		4.401283	-30.12171	130.1217					
		5.157488	-29.88951	129.8895					
		5.923188	-29.89501	129.895					
		6.752029	-29.891	129.891					
		7.465623	-30.32574	130.3257					
		8.316483	-30.87648	130.8765					
		9.497234	-31.16402	131.164					
		11.25592	-31.28122	131.2812					
		13.65292	-31.37155	131.3716					
		17.09319	-31.4591	131.4591					

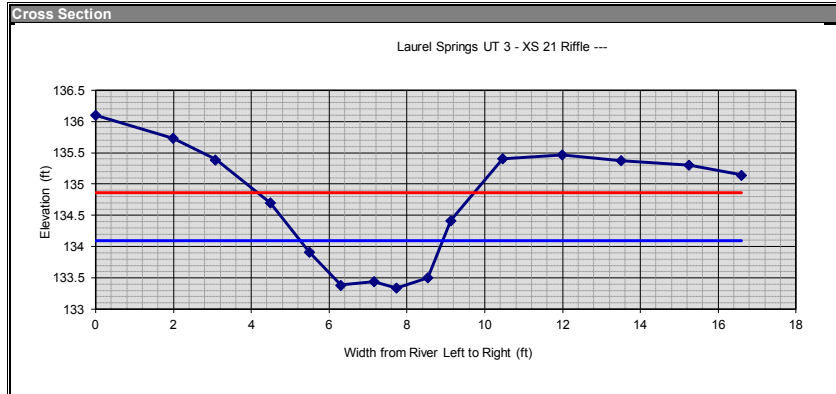
dimensions			
2.0	x-section area	0.5	d mean
4.2	width	4.5	wet P
0.7	d max	0.5	hyd radi
1.0	bank ht	8.5	w/d ratio
50.0	W flood prone area	12.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
1.8	relative roughness	4.3	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 3 - XS 21  
Riffle  
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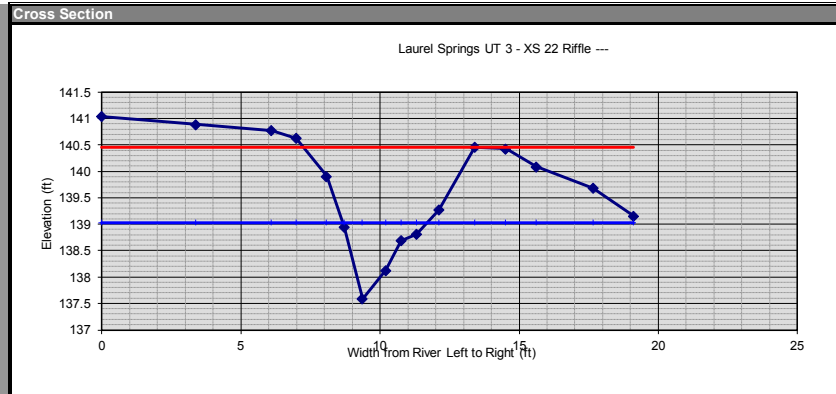
description: Laurel Springs UT 3 - XS 21  
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-36.10732	136.1073	-34.1	-35.4	5.5		
		1.992193	-35.73147	135.7315	134.1	135.4			
		3.090311	-35.3913	135.3913					
		4.494911	-34.7003	134.7003					
		5.499655	-33.91052	133.9105					
		6.29764	-33.38471	133.3847					
		7.154435	-33.44042	133.4404					
		7.73043	-33.3386	133.3386					
		8.537251	-33.50198	133.502					
		9.127079	-34.4195	134.4195					
		10.46455	-35.40813	135.4081					
		11.99503	-35.47	135.47					
		13.50669	-35.37713	135.3771					
		15.25658	-35.3061	135.3061					
		16.59861	-35.14372	135.1437					

dimensions			
2.0	x-section area	0.6	d mean
3.7	width	4.2	wet P
0.8	d max	0.5	hyd radi
2.1	bank ht	6.6	w/d ratio
5.5	W flood prone area	1.5	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
2.1	relative roughness	4.6	fric. factor
0.000	Manning's n from channel material		



section: Laurel Springs UT 3 - XS 22  
Riffle  
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description: Laurel Springs UT 3 - XS 22  
height of instrument (ft): 100.00

notes	omit pt.	distance (ft)	FS (ft)	elevation	FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
		0	-41.04152	141.0415	-39.03	-40	6.0		
		3.375769	-40.89123	140.8912	139.03	140			
		6.105248	-40.773	140.773					
		6.981615	-40.62956	140.6296					
		8.077763	-39.90701	139.907					
		8.716919	-38.95104	138.951					
		9.36638	-37.59241	137.5924					
		10.20016	-38.12505	138.125					
		10.76133	-38.69061	138.6906					
		11.30737	-38.81012	138.8101					
		12.11149	-39.26934	139.2693					
		13.39832	-40.45971	140.4597					
		14.52184	-40.43223	140.4322					
		15.61606	-40.08693	140.0869					
		17.65705	-39.68502	139.685					
		19.10085	-39.1587	139.1587					

dimensions			
2.0	x-section area	0.7	d mean
3.0	width	4.4	wet P
1.4	d max	0.5	hyd radi
2.4	bank ht	4.6	w/d ratio
6.0	W flood prone area	2.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0-0	threshold grain size (mm)

check from channel material			
82	measured D84 (mm)		
2.5	relative roughness	5.1	fric. factor
0.000	Manning's n from channel material		



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

Stream Site Name Laurel Springs - UT 2 - SAM#1 Date of Assessment 2/4/19  
 Stream Category Mb1 Assessor Name/Organization AXE/WGL

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

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



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

Stream Site Name Laurel Springs - Fork Cr - Sam #2 Date of Assessment 2/4/19  
 Stream Category Ma3 Assessor Name/Organization AXE/WGL

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

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

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

Stream Site Name Laurel Springs - UT 3 - SAM #3 Date of Assessment 2/4/19  
 Stream Category Ma1 Assessor Name/Organization AXE/WGL

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

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

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

Stream Site Name Laurel Springs - UT1 - SAM #4 Date of Assessment 2/4/19  
 Stream Category Ma1 Assessor Name/Organization AXE/WGL

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

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

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

Stream Site Name	Laurel Springs - UT2	Date of Assessment	8/21/2019
	Forested - SAM #5		
Stream Category	Mb1	Assessor Name/Organization	Perkinson - Axiom

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

<b>Function Class Rating Summary</b>	<b>USACE/ All Streams</b>	<b>NCDWR Intermittent</b>
(1) Hydrology	<b>HIGH</b>	<b>HIGH</b>
(2) Baseflow	<b>HIGH</b>	<b>HIGH</b>
(2) Flood Flow	<b>HIGH</b>	<b>HIGH</b>
(3) Streamside Area Attenuation	<b>HIGH</b>	<b>HIGH</b>
(4) Floodplain Access	<b>HIGH</b>	<b>HIGH</b>
(4) Wooded Riparian Buffer	<b>HIGH</b>	<b>HIGH</b>
(4) Microtopography	NA	NA
(3) Stream Stability	<b>HIGH</b>	<b>HIGH</b>
(4) Channel Stability	<b>HIGH</b>	<b>HIGH</b>
(4) Sediment Transport	<b>LOW</b>	<b>LOW</b>
(4) Stream Geomorphology	<b>HIGH</b>	<b>HIGH</b>
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	<b>HIGH</b>	<b>HIGH</b>
(2) Baseflow	<b>HIGH</b>	<b>HIGH</b>
(2) Streamside Area Vegetation	<b>HIGH</b>	<b>HIGH</b>
(3) Upland Pollutant Filtration	<b>HIGH</b>	<b>HIGH</b>
(3) Thermoregulation	<b>MEDIUM</b>	<b>MEDIUM</b>
(2) Indicators of Stressors	<b>NO</b>	<b>NO</b>
(2) Aquatic Life Tolerance	<b>HIGH</b>	NA
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	<b>HIGH</b>	<b>HIGH</b>
(2) In-stream Habitat	<b>HIGH</b>	<b>HIGH</b>
(3) Baseflow	<b>HIGH</b>	<b>HIGH</b>
(3) Substrate	<b>HIGH</b>	<b>HIGH</b>
(3) Stream Stability	<b>HIGH</b>	<b>HIGH</b>
(3) In-stream Habitat	<b>HIGH</b>	<b>HIGH</b>
(2) Stream-side Habitat	<b>HIGH</b>	<b>HIGH</b>
(3) Stream-side Habitat	<b>HIGH</b>	<b>HIGH</b>
(3) Thermoregulation	<b>HIGH</b>	<b>HIGH</b>
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone	NA	NA
<b>Overall</b>	<b>HIGH</b>	<b>HIGH</b>

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

Stream Site Name	Laurel Springs - UT3	Date of Assessment	8/21/19
	Forested - SAM #6		
Stream Category	Mb2	Assessor Name/Organization	Perkinson - Axiom

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

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

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

Stream Site Name	Laurel Springs - UT4	Date of Assessment	8.21/2019
	Forested -SAM #7		
Stream Category	Mb2	Assessor Name/Organization	Perkinson - Axiom

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

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



**NC WAM Wetland Rating Sheet  
Accompanies User Manual Version 5.0**

Wetland Site Name GA, GB, GC-08 - WAM #1 Date of Assessment 8/21/2019  
 Wetland Type Bottomland Hardwood Forest Assessor Name/Organization Radecki/Lewis - Axiom

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 Sub-surface Storage and Retention	Condition	<b>LOW</b>
		Condition	<b>LOW</b>
Water Quality	Pathogen Change	Condition	<b>MEDIUM</b>
		Condition/Opportunity	<b>MEDIUM</b>
		Opportunity Presence (Y/N)	<b>NO</b>
	Particulate Change	Condition	<b>LOW</b>
		Condition/Opportunity	<b>LOW</b>
		Opportunity Presence (Y/N)	<b>NO</b>
	Soluble Change	Condition	<b>MEDIUM</b>
		Condition/Opportunity	<b>MEDIUM</b>
		Opportunity Presence (Y/N)	<b>NO</b>
	Physical Change	Condition	<b>LOW</b>
		Condition/Opportunity	<b>LOW</b>
		Opportunity Presence (Y/N)	<b>NO</b>
Pollution Change	Condition	NA	
	Condition/Opportunity	NA	
	Opportunity Presence (Y/N)	NA	
Habitat	Physical Structure	Condition	<b>LOW</b>
	Landscape Patch Structure	Condition	<b>LOW</b>
	Vegetation Composition	Condition	<b>MEDIUM</b>

**Function Rating Summary**

Function	Metrics	Rating
Hydrology	Condition	<b>LOW</b>
Water Quality	Condition	<b>LOW</b>
	Condition/Opportunity	<b>LOW</b>
	Opportunity Presence (Y/N)	<b>NO</b>
Habitat	Condition	<b>LOW</b>

**Overall Wetland Rating** LOW

**NC WAM Wetland Rating Sheet  
Accompanies User Manual Version 5.0**

Wetland Site Name GF-05 -WAM #2 Date of Assessment 8/21/2019  
 Wetland Type Bottomland Hardwood Forest Assessor Name/Organization Radecki/Lewis - Axiom

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) NO  
 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 Sub-surface Storage and Retention	Condition	<b>LOW</b>
		Condition	<b>LOW</b>
Water Quality	Pathogen Change	Condition	<b>MEDIUM</b>
		Condition/Opportunity	<b>MEDIUM</b>
		Opportunity Presence (Y/N)	<b>NO</b>
	Particulate Change	Condition	<b>LOW</b>
		Condition/Opportunity	<b>LOW</b>
		Opportunity Presence (Y/N)	<b>NO</b>
	Soluble Change	Condition	<b>MEDIUM</b>
		Condition/Opportunity	<b>MEDIUM</b>
		Opportunity Presence (Y/N)	<b>NO</b>
	Physical Change	Condition	<b>LOW</b>
		Condition/Opportunity	<b>LOW</b>
		Opportunity Presence (Y/N)	<b>NO</b>
Pollution Change	Condition	NA	
	Condition/Opportunity	NA	
	Opportunity Presence (Y/N)	NA	
Habitat	Physical Structure	Condition	<b>LOW</b>
	Landscape Patch Structure	Condition	<b>LOW</b>
	Vegetation Composition	Condition	<b>MEDIUM</b>

**Function Rating Summary**

Function	Metrics	Rating
Hydrology	Condition	<b>LOW</b>
Water Quality	Condition	<b>LOW</b>
	Condition/Opportunity	<b>LOW</b>
	Opportunity Presence (Y/N)	<b>NO</b>
Habitat	Condition	<b>LOW</b>

**Overall Wetland Rating** LOW

**NC WAM Wetland Rating Sheet  
Accompanies User Manual Version 5.0**

Wetland Site Name PA-104 -WAM #3 Date of Assessment 8/21/19  
 Wetland Type Headwater Forest Assessor Name/Organization Perkingson - Axiom

Notes on Field Assessment Form (Y/N) YES  
 Presence of regulatory considerations (Y/N) NO  
 Wetland is intensively managed (Y/N) NO  
 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 Sub-surface Storage and Retention	Condition	<b>LOW</b>
		Condition	<b>HIGH</b>
Water Quality	Pathogen Change	Condition	<b>MEDIUM</b>
		Condition/Opportunity	<b>MEDIUM</b>
		Opportunity Presence (Y/N)	<b>NO</b>
	Particulate Change	Condition	<b>LOW</b>
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
	Soluble Change	Condition	<b>LOW</b>
		Condition/Opportunity	<b>LOW</b>
		Opportunity Presence (Y/N)	<b>NO</b>
	Physical Change	Condition	<b>MEDIUM</b>
		Condition/Opportunity	<b>MEDIUM</b>
		Opportunity Presence (Y/N)	<b>NO</b>
Pollution Change	Condition	NA	
	Condition/Opportunity	NA	
	Opportunity Presence (Y/N)	NA	
Habitat	Physical Structure	Condition	<b>LOW</b>
	Landscape Patch Structure	Condition	<b>LOW</b>
	Vegetation Composition	Condition	<b>LOW</b>

**Function Rating Summary**

Function	Metrics	Rating
Hydrology	Condition	<b>MEDIUM</b>
Water Quality	Condition	<b>LOW</b>
	Condition/Opportunity	<b>LOW</b>
	Opportunity Presence (Y/N)	<b>NO</b>
Habitat	Condition	<b>LOW</b>

**Overall Wetland Rating** LOW

**NC WAM Wetland Rating Sheet  
Accompanies User Manual Version 5.0**

Wetland Site Name PB-03 - WAM #4 Date of Assessment 190821  
 Wetland Type Headwater Forest Assessor Name/Organization Perkinson-Axiom

Notes on Field Assessment Form (Y/N) YES  
 Presence of regulatory considerations (Y/N) NO  
 Wetland is intensively managed (Y/N) NO  
 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 Sub-surface Storage and Retention	Condition	<b>LOW</b>	
		Condition	<b>HIGH</b>	
Water Quality	Pathogen Change	Condition	<b>LOW</b>	
		Condition/Opportunity	<b>LOW</b>	
		Opportunity Presence (Y/N)	<b>NO</b>	
	Particulate Change	Condition	<b>LOW</b>	
		Condition/Opportunity	NA	
		Opportunity Presence (Y/N)	NA	
	Soluble Change	Condition	Condition	<b>LOW</b>
			Condition/Opportunity	<b>LOW</b>
			Opportunity Presence (Y/N)	<b>NO</b>
		Physical Change	Condition	<b>LOW</b>
			Condition/Opportunity	<b>LOW</b>
			Opportunity Presence (Y/N)	<b>NO</b>
Pollution Change	Condition	NA		
	Condition/Opportunity	NA		
	Opportunity Presence (Y/N)	NA		
Habitat	Physical Structure	Condition	<b>LOW</b>	
	Landscape Patch Structure	Condition	<b>LOW</b>	
	Vegetation Composition	Condition	<b>HIGH</b>	

**Function Rating Summary**

Function	Metrics	Rating
Hydrology	Condition	<b>MEDIUM</b>
Water Quality	Condition	<b>LOW</b>
	Condition/Opportunity	<b>LOW</b>
	Opportunity Presence (Y/N)	<b>NO</b>
Habitat	Condition	<b>LOW</b>

**Overall Wetland Rating** LOW



**NC WAM Wetland Rating Sheet  
Accompanies User Manual Version 5.0**

Wetland Site Name PC-07/PD - WAM #5 Date of Assessment 190821  
 Wetland Type Headwater Forest Assessor Name/Organization Perkinson-Axiom

Notes on Field Assessment Form (Y/N) YES  
 Presence of regulatory considerations (Y/N) YES  
 Wetland is intensively managed (Y/N) NO  
 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 Sub-surface Storage and Retention	Condition	<b>LOW</b>	
		Condition	<b>HIGH</b>	
Water Quality	Pathogen Change	Condition	<b>LOW</b>	
		Condition/Opportunity	<b>LOW</b>	
		Opportunity Presence (Y/N)	<b>NO</b>	
	Particulate Change	Condition	<b>LOW</b>	
		Condition/Opportunity	NA	
		Opportunity Presence (Y/N)	NA	
	Soluble Change	Condition	Condition	<b>LOW</b>
			Condition/Opportunity	<b>LOW</b>
			Opportunity Presence (Y/N)	<b>NO</b>
		Physical Change	Condition	<b>LOW</b>
			Condition/Opportunity	<b>LOW</b>
			Opportunity Presence (Y/N)	<b>NO</b>
Pollution Change	Condition	NA		
	Condition/Opportunity	NA		
	Opportunity Presence (Y/N)	NA		
Habitat	Physical Structure	Condition	<b>LOW</b>	
	Landscape Patch Structure	Condition	<b>LOW</b>	
	Vegetation Composition	Condition	<b>MEDIUM</b>	

**Function Rating Summary**

Function	Metrics	Rating
Hydrology	Condition	<b>MEDIUM</b>
Water Quality	Condition	<b>LOW</b>
	Condition/Opportunity	<b>LOW</b>
	Opportunity Presence (Y/N)	<b>NO</b>
Habitat	Condition	<b>LOW</b>

**Overall Wetland Rating** LOW

**NC WAM Wetland Rating Sheet  
Accompanies User Manual Version 5.0**

Wetland Site Name PF-01/PE - WAM #6 Date of Assessment 190821  
 Wetland Type Headwater Forest Assessor Name/Organization Perkinson-Axiom

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

**Sub-function Rating Summary**

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

**Function Rating Summary**

Function	Metrics	Rating
Hydrology	Condition	<b>HIGH</b>
Water Quality	Condition	<b>HIGH</b>
	Condition/Opportunity	<b>HIGH</b>
	Opportunity Presence (Y/N)	<b>NO</b>
Habitat	Condition	<b>LOW</b>

**Overall Wetland Rating**     HIGH

**NC WAM Wetland Rating Sheet  
Accompanies User Manual Version 5.0**

Wetland Site Name PG-05,PH-mowed - WAM #7 Date of Assessment 190821  
 Wetland Type Headwater Forest Assessor Name/Organization Perkinson-Axiom

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

**Sub-function Rating Summary**

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

**Function Rating Summary**

Function	Metrics	Rating
Hydrology	Condition	<b>MEDIUM</b>
Water Quality	Condition	<b>LOW</b>
	Condition/Opportunity	<b>LOW</b>
	Opportunity Presence (Y/N)	<b>NO</b>
Habitat	Condition	<b>LOW</b>

**Overall Wetland Rating** LOW

**NC WAM Wetland Rating Sheet  
Accompanies User Manual Version 5.0**

Wetland Site Name PJ-03, PI - WAM #8 Date of Assessment 190821  
 Wetland Type Headwater Forest Assessor Name/Organization Perkinson - Axiom

Notes on Field Assessment Form (Y/N) YES  
 Presence of regulatory considerations (Y/N) NO  
 Wetland is intensively managed (Y/N) NO  
 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	<b>HIGH</b>	
		Sub-surface Storage and Retention	<b>HIGH</b>	
Water Quality	Pathogen Change	Condition	<b>LOW</b>	
		Condition/Opportunity	<b>LOW</b>	
		Opportunity Presence (Y/N)	<b>NO</b>	
	Particulate Change	Condition	<b>HIGH</b>	
		Condition/Opportunity	NA	
		Opportunity Presence (Y/N)	NA	
	Soluble Change	Condition	Condition	<b>MEDIUM</b>
			Condition/Opportunity	<b>MEDIUM</b>
			Opportunity Presence (Y/N)	<b>NO</b>
		Physical Change	Condition	<b>HIGH</b>
			Condition/Opportunity	<b>HIGH</b>
			Opportunity Presence (Y/N)	<b>NO</b>
Pollution Change	Condition	NA		
	Condition/Opportunity	NA		
	Opportunity Presence (Y/N)	NA		
Habitat	Physical Structure	Condition	<b>LOW</b>	
	Landscape Patch Structure	Condition	<b>HIGH</b>	
	Vegetation Composition	Condition	<b>MEDIUM</b>	

**Function Rating Summary**

Function	Metrics	Rating
Hydrology	Condition	<b>HIGH</b>
Water Quality	Condition	<b>HIGH</b>
	Condition/Opportunity	<b>HIGH</b>
	Opportunity Presence (Y/N)	<b>NO</b>
Habitat	Condition	<b>LOW</b>

**Overall Wetland Rating**     **HIGH**



**NC WAM Wetland Rating Sheet  
Accompanies User Manual Version 5.0**

Wetland Site Name PK-06 - WAM #9 Date of Assessment 190821  
 Wetland Type Headwater Forest Assessor Name/Organization Perkinson - Axiom

Notes on Field Assessment Form (Y/N) YES  
 Presence of regulatory considerations (Y/N) NO  
 Wetland is intensively managed (Y/N) NO  
 Assessment area is located within 50 feet of a natural tributary or other open water (Y/N) NO  
 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 Sub-surface Storage and Retention	Condition	<b>LOW</b>	
		Condition	<b>HIGH</b>	
Water Quality	Pathogen Change	Condition	<b>MEDIUM</b>	
		Condition/Opportunity	<b>MEDIUM</b>	
		Opportunity Presence (Y/N)	<b>NO</b>	
	Particulate Change	Condition	<b>LOW</b>	
		Condition/Opportunity	NA	
		Opportunity Presence (Y/N)	NA	
	Soluble Change	Condition	Condition	<b>LOW</b>
			Condition/Opportunity	<b>LOW</b>
			Opportunity Presence (Y/N)	<b>NO</b>
		Physical Change	Condition	<b>LOW</b>
			Condition/Opportunity	<b>LOW</b>
			Opportunity Presence (Y/N)	<b>NO</b>
Pollution Change	Condition	NA		
	Condition/Opportunity	NA		
	Opportunity Presence (Y/N)	NA		
Habitat	Physical Structure	Condition	<b>HIGH</b>	
	Landscape Patch Structure	Condition	<b>HIGH</b>	
	Vegetation Composition	Condition	<b>HIGH</b>	

**Function Rating Summary**

Function	Metrics	Rating
Hydrology	Condition	<b>MEDIUM</b>
Water Quality	Condition	<b>LOW</b>
	Condition/Opportunity	<b>LOW</b>
	Opportunity Presence (Y/N)	<b>NO</b>
Habitat	Condition	<b>HIGH</b>

**Overall Wetland Rating** MEDIUM

**NC WAM Wetland Rating Sheet  
Accompanies User Manual Version 5.0**

Wetland Site Name PM-106/PL - WAM #10 Date of Assessment 190821  
 Wetland Type Headwater Forest Assessor Name/Organization Perkinson - Axiom

Notes on Field Assessment Form (Y/N) YES  
 Presence of regulatory considerations (Y/N) NO  
 Wetland is intensively managed (Y/N) NO  
 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 Sub-surface Storage and Retention	Condition	<b>HIGH</b>	
		Condition	<b>HIGH</b>	
Water Quality	Pathogen Change	Condition	<b>HIGH</b>	
		Condition/Opportunity	<b>HIGH</b>	
		Opportunity Presence (Y/N)	<b>NO</b>	
	Particulate Change	Condition	<b>HIGH</b>	
		Condition/Opportunity	NA	
		Opportunity Presence (Y/N)	NA	
	Soluble Change	Condition	Condition	<b>MEDIUM</b>
			Condition/Opportunity	<b>MEDIUM</b>
			Opportunity Presence (Y/N)	<b>NO</b>
		Physical Change	Condition	<b>HIGH</b>
			Condition/Opportunity	<b>HIGH</b>
			Opportunity Presence (Y/N)	<b>NO</b>
Pollution Change	Condition	NA		
	Condition/Opportunity	NA		
	Opportunity Presence (Y/N)	NA		
Habitat	Physical Structure	Condition	<b>HIGH</b>	
	Landscape Patch Structure	Condition	<b>HIGH</b>	
	Vegetation Composition	Condition	<b>HIGH</b>	

**Function Rating Summary**

Function	Metrics	Rating
Hydrology	Condition	<b>HIGH</b>
Water Quality	Condition	<b>HIGH</b>
	Condition/Opportunity	<b>HIGH</b>
	Opportunity Presence (Y/N)	<b>NO</b>
Habitat	Condition	<b>HIGH</b>

**Overall Wetland Rating**     HIGH

NC DWQ Stream Identification Form Version 4.11

UT-2 RP

Date: 190821	Project/Site: Level Spring	Latitude: 35.992403
Evaluator: PTP	County: Avery	Longitude: 81.979751
Total Points: 25.5 Stream is at least intermittent if $\geq 19$ or perennial if $\geq 30^*$	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other Lewisville Falls e.g. Quad Name:

A. Geomorphology (Subtotal = 9)

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . 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	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)

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

C. Biology (Subtotal = 9.5)

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

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

Notes:

Sketch: stream was incised near headcut @ large 1-2' large salamander and abundant benthos, one crawfish much stronger than here

NC DWQ Stream Identification Form Version 4.11

PUT2-Let's move

Date: 190621	Project/Site: Laurel Springs	Latitude: 35.992429
Evaluator: P. Aye	County: Auer	Longitude: 81.979799
Total Points: 24.5 Stream is at least intermittent if $\geq 19$ or perennial if $\geq 30$ *	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other Lwville Calls e.g. Quad Name:

A. Geomorphology (Subtotal = 9.5)

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . 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	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)

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

C. Biology (Subtotal = 7.5)

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

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

Notes:

Sketch: stream drains from spring and has been used for water source. Growth from water table 48 hours - salamanders at 1 creek - low energy hole - several visible cases of fish located in water

o- woody debris



**NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11**

**NC DWQ Stream Identification Form Version 4.11**

UT-3 upper

Date: 190821	Project/Site: Laurel Springs	Latitude: 35.994653
Evaluator: PHP-Axiom	County: Avery	Longitude: -81.979976
Total Points: Stream is at least intermittent if $\geq 19$ or perennial if $\geq 30^*$ 33	Stream Determination (circle one) Ephemeral Intermittent <b>Perennial</b>	Other Linville Falls e.g. Quad Name:

**A. Geomorphology (Subtotal = 15)**

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . 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	

<sup>a</sup>artificial ditches are not rated; see discussions in manual

**B. Hydrology (Subtotal = 9)**

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

**C. Biology (Subtotal = 9)**

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

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

**Notes:**

Sketch: abundant cadaver fly larvae, stonefly, one caddisfly nymph observed, 2 salamander - can have access

**NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11**

**NC DWQ Stream Identification Form Version 4.11**

3A Upper

Date: 190821	Project/Site: Laurel Springs	Latitude: 35.994506
Evaluator: Parkinson	County: Auer	Longitude: 78.979736
Total Points: <small>Stream is at least intermittent if <math>\geq 19</math> or perennial if <math>\geq 30</math>*</small> 22.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other Little Lills <small>e.g. Quad Name:</small>

**A. Geomorphology (Subtotal = 6.5)**

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . 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	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

**B. Hydrology (Subtotal = 9)**

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

**C. Biology (Subtotal = 7)**

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

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

Notes:

Sketch: strong flow from springs being used for watering cows - poor water pool in stream, cattail holes, salamander invertebrates found @ rocks

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**NC DWQ Stream Identification Form Version 4.11**

3A mid

Date: 190821	Project/Site: Laurel Springs	Latitude: 35.994480
Evaluator: PHP	County: Avery	Longitude: 81.979919
Total Points: 24 <i>Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*</i>	Stream Determination (circle one) Ephemeral <u>Intermittent</u> Perennial	Other <u>Leville Falls</u> e.g. Quad Name:

**A. Geomorphology (Subtotal = 7.5)**

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . 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	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

**B. Hydrology (Subtotal = 8.5)**

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

**C. Biology (Subtotal = 8)**

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

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

Notes:

Sketch: several caddisfly casings, crayfish exuviae and salamander



NC DWQ Stream Identification Form Version 4.11

UT-3B

Date: 19 08 21	Project/Site: Laurel Springs	Latitude: 35 944506
Evaluator: Parkinson	County: Avery	Longitude: 81.979736
Total Points: 21.5 <i>Stream is at least intermittent if ≥ 19 or perennial if ≥ 30*</i>	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other: Crowsville Falls e.g. Quad Name:

A. Geomorphology (Subtotal = 6.5)

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . Continuity of channel bed and bank	0	0	2	3
2. Sinuosity of channel along thalweg	0	0	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	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)

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

C. Biology (Subtotal = 8)

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

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

Notes:

Sketch: Large hillside seep (HWF<sub>sum</sub>) with abundant up-land vegetation, upper portion of 3b @ bottom of PJ has more re-terrestrial flow and less has more

UT-4 - upper

NC DWQ Stream Identification Form Version 4.11

Date: 190821	Project/Site: Laurel Springs	Latitude: 35.995934
Evaluator: PHP-Avrom	County: Avery	Longitude: 81.978609
Total Points: Stream is at least intermittent if $\geq 19$ or perennial if $\geq 30^*$ 33.5	Stream Determination (circle one) Ephemeral Intermittent <u>Perennial</u>	Other Linnello Falls e.g. Quad Name:

A. Geomorphology (Subtotal = 14)

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> 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	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9.5)

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

C. Biology (Subtotal = 10)

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

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

Notes:

Sketch: Rte 5 water runoff observed. Salamanders abundant reddish (using, stone etc - (perulation extends well above project downward)

**NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11**

**NC DWQ Stream Identification Form Version 4.11**

UT-49 upper

Date: 1908 21	Project/Site: Laurel Springs	Latitude: 35.996019
Evaluator: PHP	County: AVERY	Longitude: 78.979778
<b>Total Points:</b> Stream is at least intermittent if $\geq 19$ or perennial if $\geq 30^*$ 22	<b>Stream Determination (circle one)</b> Ephemeral Intermittent Perennial	Other Linville Falls e.g. Quad Name:

**A. Geomorphology (Subtotal = 6.5)**

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . 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	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

**B. Hydrology (Subtotal = 7.5)**

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

**C. Biology (Subtotal = 6)**

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

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

**Notes:**

Sketch: Stream may wetland above - herbaceous easily located,



**NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11**

**NC DWQ Stream Identification Form Version 4.11**

4749 @ PM

<b>Date:</b> 190821	<b>Project/Site:</b> Laurel Springs	<b>Latitude:</b> 35.996105
<b>Evaluator:</b> PUP	<b>County:</b> Avery	<b>Longitude:</b> -81.979957
<b>Total Points:</b> Stream is at least intermittent if $\geq 19$ or perennial if $\geq 30^*$ 17.5	<b>Stream Determination (circle one)</b> Ephemeral Intermittent <u>Perennial</u>	<b>Other</b> Linville Falls e.g. Quad Name:

**A. Geomorphology (Subtotal = 5.5)**

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . 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	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

**B. Hydrology (Subtotal = 7)**

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

**C. Biology (Subtotal = 6)**

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

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

**Notes:**

Sketch: stream wide-s and then becomes less defined O4W/M, still has macro, abundance of herbaceous; woods, below wetland w/m.

Site		Laurel Springs Steam Mitigation Site						
Stream		Fork Creek			Bank Length		4134	
Observers		WGL			Date		4-Feb-19	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	445	right	Low	Low	0	445	3	0.0
2	585	right	Mod	Mod	0.05	140	2	14.0
3	660	right	High	High	0.2	75	3	45.0
4	720	right	Low	Low	0	60	3	0.0
5	805	right	High	High	0.2	85	3	51.0
6	960	right	Low	Low	0	155	4	0.0
7	1050	right	High	High	0.2	90	3	54.0
8	1710	right	Extreme	High	4	660	4	10560.0
9	1780	right	Low	Low	0	70	3	0.0
10	1990	right	High	High	0.2	210	3	126.0
11	2100	right	Mod	Mod	0.05	110	3	16.5
12								
13	445	left	Low	Low	0	445	3	0.0
14	560	left	Mod	Mod	0.05	115	2	11.5
15	594	left	High	High	0.2	34	3	20.4
16	649	left	Low	Low	0	55	2	0.0
17	704	left	High	High	0.2	55	3	33.0
18	984	left	Mod	Mod	0.05	280	3	42.0
19	1644	left	Low	Low	0	660	3	0.0
20	1714	left	Low	Low	0	70	3	0.0
21	1924	left	High	High	0.2	210	3	126.0
22	2034	left	Mod	Mod	0.05	110	3	16.5
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		11115.9
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		411.7
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		535.2
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.129

Site		Laurel Springs Steam Mitigation Site						
Stream		UT 1			Bank Length		2728	
Observers		WGL			Date		4-Feb-19	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	454	right	High	Low	0.1	454	4	181.6
2	924	right	High	High	0.2	470	3	282.0
3	1364	right	Mod	Mod	0.05	440	3	66.0
4								
5	454	left	High	Low	0.1	454	4	181.6
6	924	left	High	High	0.2	470	3	282.0
7	1364	left	Mod	Mod	0.05	440	3	66.0
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft <sup>3</sup> /yr)		1059.2
Divide total erosion (ft <sup>3</sup> ) by 27						Total Erosion (yd/yr)		39.2
Multiply Total erosion (yard <sup>3</sup> ) by 1.3						Total Erosion (tons/yr)		51.0
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.019



Site		Laurel Springs Steam Mitigation Site						
Stream		UT 2			Bank Length		1540	
Observers		WGL			Date		4-Feb-19	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	75	right	Low	Low	0	75	0.5	0.0
2	145	right	Low	Low	0	145	0.5	0.0
3	75	right	Mod	Mod	0.05	75	1	3.8
4	475	right	Low	Low	0	475	2	0.0
5								
6	75	left	Low	Low	0	75	0.5	0.0
7	145	left	Low	Low	0	145	0.5	0.0
8	75	left	Mod	Mod	0.05	75	1	3.8
9	475	left	Low	Low	0	475	2	0.0
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft <sup>3</sup> /yr)		7.5
Divide total erosion (ft <sup>3</sup> ) by 27						Total Erosion (yd/yr)		0.3
Multiply Total erosion (yard <sup>3</sup> ) by 1.3						Total Erosion (tons/yr)		0.4
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.000

Site		Laurel Springs Steam Mitigation Site						
Stream		UT 3			Bank Length		1800	
Observers		WGL			Date		4-Feb-19	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	75	left	Mod	Low	0.02	75	1.5	2.3
2	190	left	Low	Low	0	115	0.5	0.0
3	310	left	Mod	Mod	0.05	120	1	6.0
4	900	left	Low	Low	0	590	1	0.0
5								
6	75	right	Mod	Low	0.02	75	1.5	2.3
7	190	right	Low	Low	0	115	0.5	0.0
8	310	right	Mod	Mod	0.05	120	1	6.0
9	900	right	Low	Low	0	590	1	0.0
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft <sup>3</sup> /yr)		16.5
Divide total erosion (ft <sup>3</sup> ) by 27						Total Erosion (yd/yr)		0.6
Multiply Total erosion (yard <sup>3</sup> ) by 1.3						Total Erosion (tons/yr)		0.8
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.000

Site		Laurel Springs Steam Mitigation Site						
Stream		UT 4			Bank Length		1330	
Observers		WGL			Date		4-Feb-19	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	665	left	Low	Low	0	665	1	0.0
2								
3	665	right	Low	Low	0	665	1	0.0
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft <sup>3</sup> /yr)		0.0
Divide total erosion (ft <sup>3</sup> ) by 27						Total Erosion (yd/yr)		0.0
Multiply Total erosion (yard <sup>3</sup> ) by 1.3						Total Erosion (tons/yr)		0.0
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.000



Laurel Springs  
BEHI/NBS Summary

<b>Stream Reach</b>	<b>Erosion Rate (tons/year)</b>
Fork Cr	535.2
UT 1	51.0
UT 2	0.4
UT 3	0.8
UT 4	0.0
<b>Total</b>	<b>587.4</b>

**AXIOM ENVIRONMENTAL, INC**

218 Snow Avenue  
 Raleigh, North Carolina 27603  
 919-215-1693



# SOIL BORING LOG

Date: 8/21/2019

Project/Site: Laurel Springs Mitigation Site

County, State: Avery County, NC

Sampling Point/  
 Coordinates: Soil Profile # 1 (35.99744,-81.98033)

Investigator: W. Grant Lewis

Soil Series: Reddies fine sandy loam

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling				Texture
	Color	%	Color	%	Type	Location	
0-2	10 YR 4/2	100					loam
2-8	10 YR 4/2	95	10 YR 4/6	5	C	PL	clay loam
8-12	10 YR 4/2	100					loam
12+	10 YR 4/2	60	10 YR 4/6	10	C	M	gravely loam
	10 YR 5/3	30					

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

North Carolina Licensed Soil Scientist

Number: 1233

Signature: *W Grant Lewis*

Name/Print: W. Grant Lewis

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 919-215-1693



# SOIL BORING LOG

Date: 8/21/2019

Project/Site: Laurel Springs Mitigation Site

County, State: Avery County, NC

Sampling Point/  
 Coordinates: Soil Profile # 2 (35.99598, -81.981629)

Investigator: W. Grant Lewis

Soil Series: Nikwasa Loam

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling				Texture
	Color	%	Color	%	Type	Location	
0-2	10 YR 4/2	90	10 YR 4/4	10	C	PL	loamy sand
2-4	10 YR 4/1	80	10 YR 4/2	15	D	M	fine sandy loam
			10 YR 4/4	5	C	PL	
4-10	10 YR 4/3	80	10 YR 5/2	15	D	M	loamy sand
			10 YR 4/6	5	C	M	
10-18+	10 YR 4/1	90	10 YR 4/4	10	C	M	sandy loam

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

North Carolina Licensed Soil Scientist

Number: 1233

Signature: *W Grant Lewis*

Name/Print: W. Grant Lewis



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# SOIL BORING LOG

Date: 8/21/2019

Project/Site: Laurel Springs Mitigation Site

County, State: Avery County, NC

Sampling Point/  
 Coordinates: Soil Profile # 3 (35.99409, -81.982389)

Investigator: W. Grant Lewis

Soil Series: Nikwasa Loam

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling				Texture
	Color	%	Color	%	Type	Location	
0-2	10 YR 4/3	100					loam
2-7	10 YR 4/2	90	10 YR 6/2	5	D	M	fine sandy loam
			10 YR 4/6	5	C	PL	
7-10	10 YR 4/2	80	10 YR 4/6	5	C	M	fine sandy loam
			10 YR 3/3	5	C	M	
			10 YR 6/3	10	D	M	
10-18+	10 YR 3/2	60	10 YR 4/2	30	D	M	sandy loam
			10 YR 4/4	10	C	M	

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

North Carolina Licensed Soil Scientist

Number: 1233

Signature: *W Grant Lewis*

Name/Print: W. Grant Lewis

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 919-215-1693



# SOIL BORING LOG

Date: 2/4/2019

Project/Site: Laurel Springs Mitigation Site

County, State: Avery County, NC

Sampling Point/  
 Coordinates: Soil Profile # 4 (35.992838, -81.982478)

Investigator: W. Grant Lewis

Soil Series: Nikwasa Loam

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-2	10 YR 4/2	100			silt loam
2-13	10 YR 4/2	90	10 YR 6/1 10 YR 5/6	5 5	fine sandy loam
13-15	10 YR 4/2	90	10 YR 5/1 10 YR 5/6	5 5	sandy loam
15+	10 YR 3/2	90	10 YR 5/3	10	fine sandy loam

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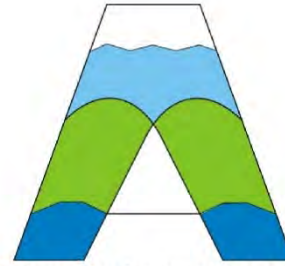
Number: 1233

Signature: *W Grant Lewis*

Name/Print: W. Grant Lewis

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 919-215-1693



Axiom Environmental, Inc.

# SOIL BORING LOG

Date: 2/4/2019

Project/Site: Laurel Springs Mitigation Site

County, State: Avery County, NC

Sampling Point/  
 Coordinates: Soil Profile # 5 (35.99416, -81.982142)

Investigator: W. Grant Lewis

Soil Series: Nikwasa Loam

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-4	10 YR 4/2	95	10 YR 5/1	5	silt loam
4-12	10 YR 5/1	95	10 YR 5/6	5	sandy loam
12-16	10 YR 5/1	95	10 YR 5/6	5	loam
16+	10 YR 3/1	90	10 YR 5/6	10	sandy loam

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Number: 1233

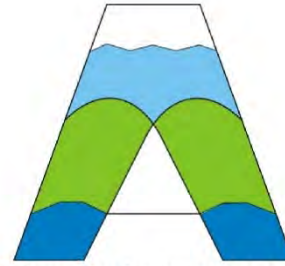
Signature: *W Grant Lewis*

Name/Print: W. Grant Lewis



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 919-215-1693



Axiom Environmental, Inc.

# SOIL BORING LOG

Date: 2/4/2019

Project/Site: Laurel Springs Mitigation Site

County, State: Avery County, NC

Sampling Point/  
 Coordinates: Soil Profile # 6 (35.995741, -81.981765)

Investigator: W. Grant Lewis

Soil Series: Reddies fine sandy loam

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-3	10 YR 4/2	95	10 YR 5/6	5	loam
3-18	10 YR 4/1	90	10 YR 6/1 10 YR 5/6	5 5	sandy loam
18+	10 YR 3/1	95	10 YR 5/6	5	loam

North Carolina Licensed Soil Scientist

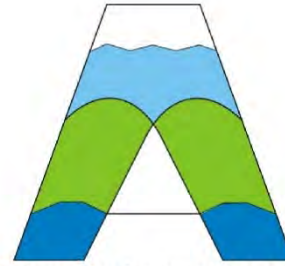
Number: 1233

Signature: *W Grant Lewis*

Name/Print: W. Grant Lewis

**AXIOM ENVIRONMENTAL, INC**

218 Snow Avenue  
 Raleigh, North Carolina 27603  
 919-215-1693



Axiom Environmental, Inc.

# SOIL BORING LOG

Date: 2/4/2019

Project/Site: Laurel Springs Mitigation Site

County, State: Avery County, NC

Sampling Point/  
 Coordinates: Soil Profile # 7 (35.997098, -81.980631)

Investigator: W. Grant Lewis

Soil Series: Nikwasa Loam

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-4	10 YR 4/2	90	10 YR 4/6	10	silt loam
4-16	10 YR 3/1	95	10 YR 4/6	5	sandy loam
16+	10 YR 3/1	100			sand

North Carolina Licensed Soil Scientist

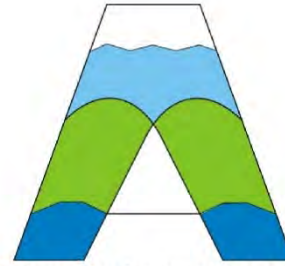
Number: 1233

Signature: *W Grant Lewis*

Name/Print: W. Grant Lewis

**AXIOM ENVIRONMENTAL, INC**

218 Snow Avenue  
 Raleigh, North Carolina 27603  
 919-215-1693



Axiom Environmental, Inc.

# SOIL BORING LOG

Date: 8/21/2019

Project/Site: Laurel Springs Mitigation Site

County, State: Avery County, NC

Sampling Point/  
 Coordinates: Soil Profile # 8 (35.992699, -81.982389)

Investigator: W. Grant Lewis

Soil Series: Nikwasa Loam

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-7	7.5 YR 4/3	100			silt loam
7-10	7.5 YR 4/2	100			silt loam
10-15	10 YR 4/2	95	10 YR 4/6	5	silt loam
15-25	10 YR 4/2	90	10 YR 4/6	10	silt loam

North Carolina Licensed Soil Scientist

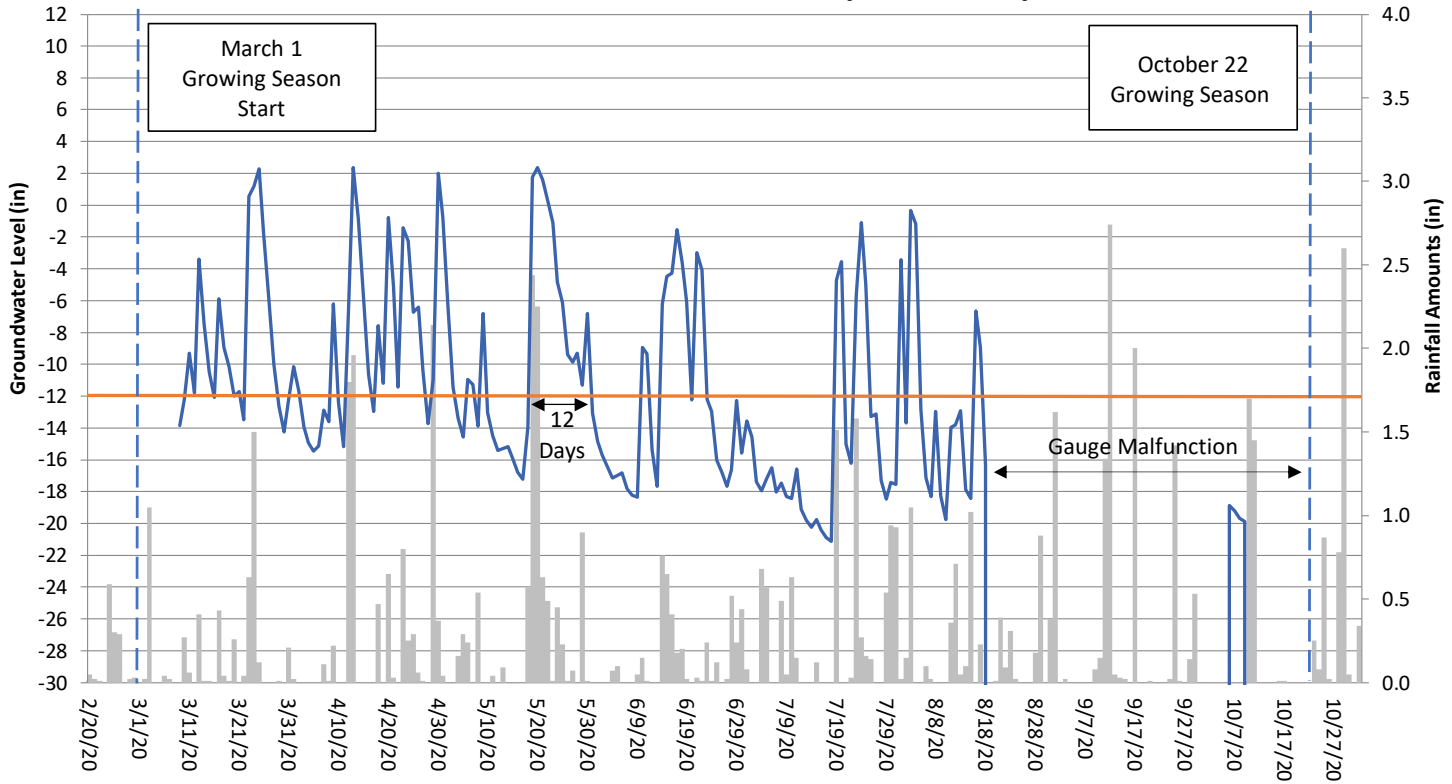
Number: 1233

Signature: *W Grant Lewis*

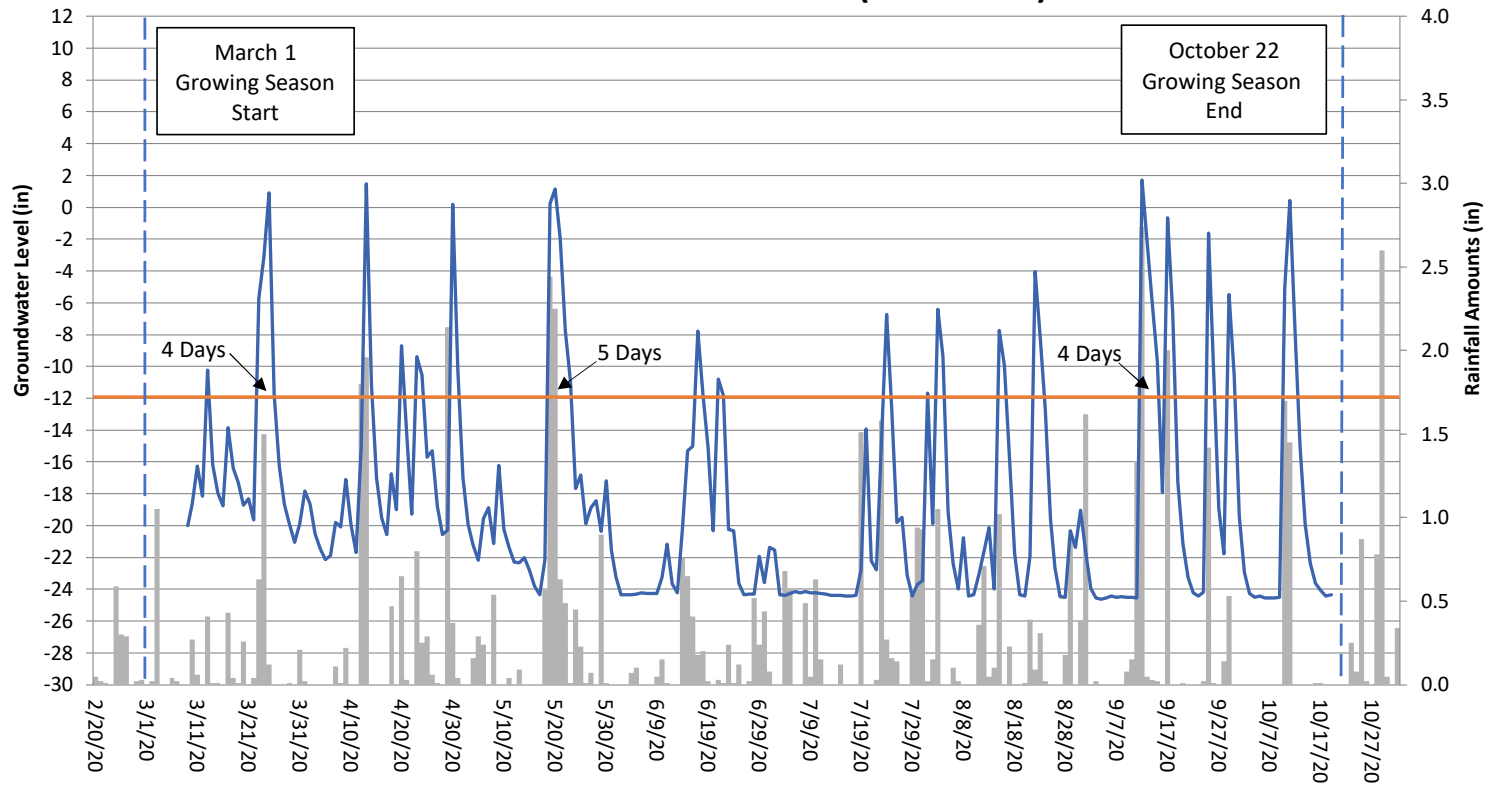
Name/Print: W. Grant Lewis



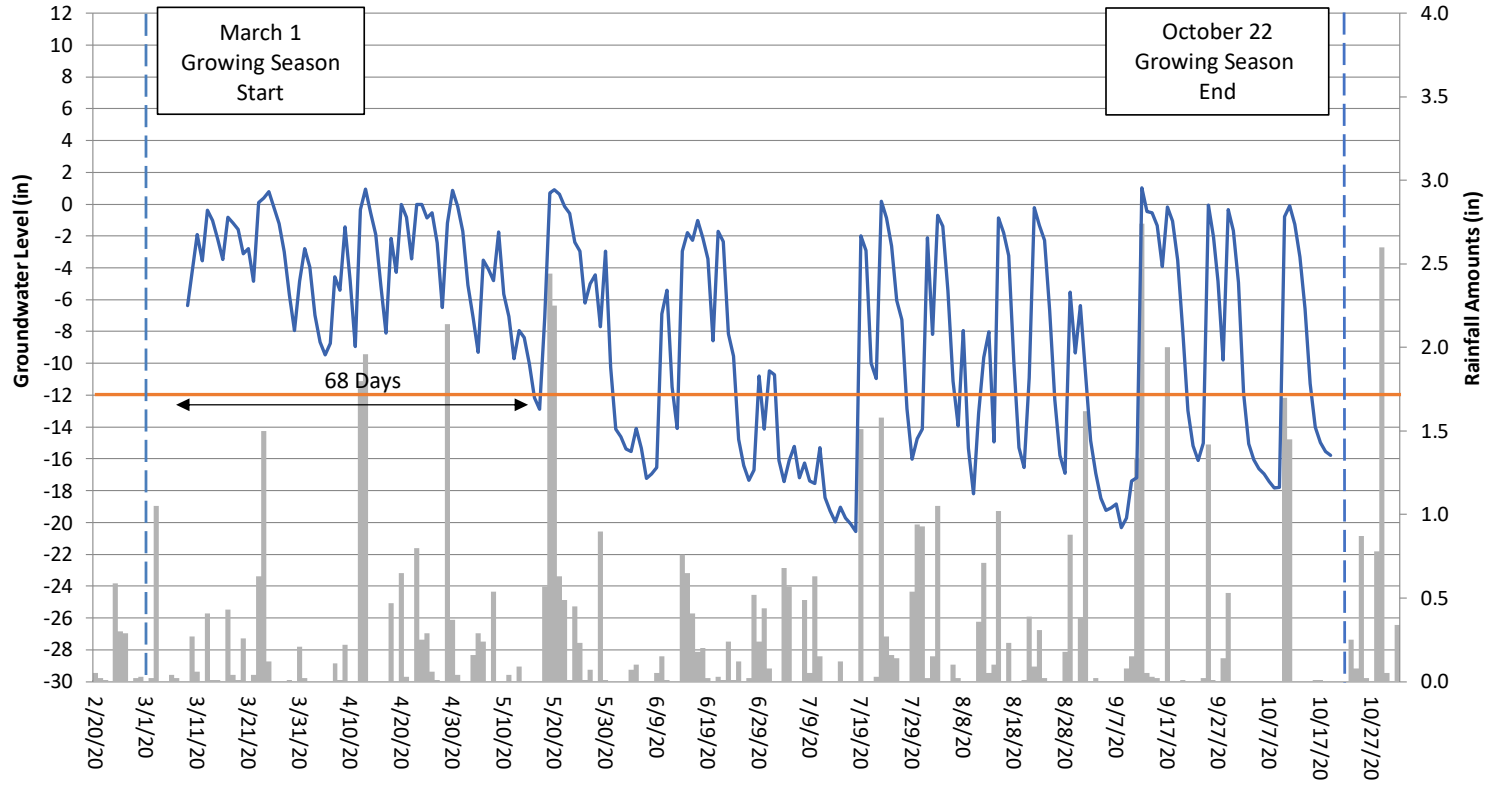
# Laurel Springs Groundwater Gauge 1 Preconstruction (2020 Data)



### Laurel Springs Groundwater Gauge 2 Preconstruction (2020 Data)

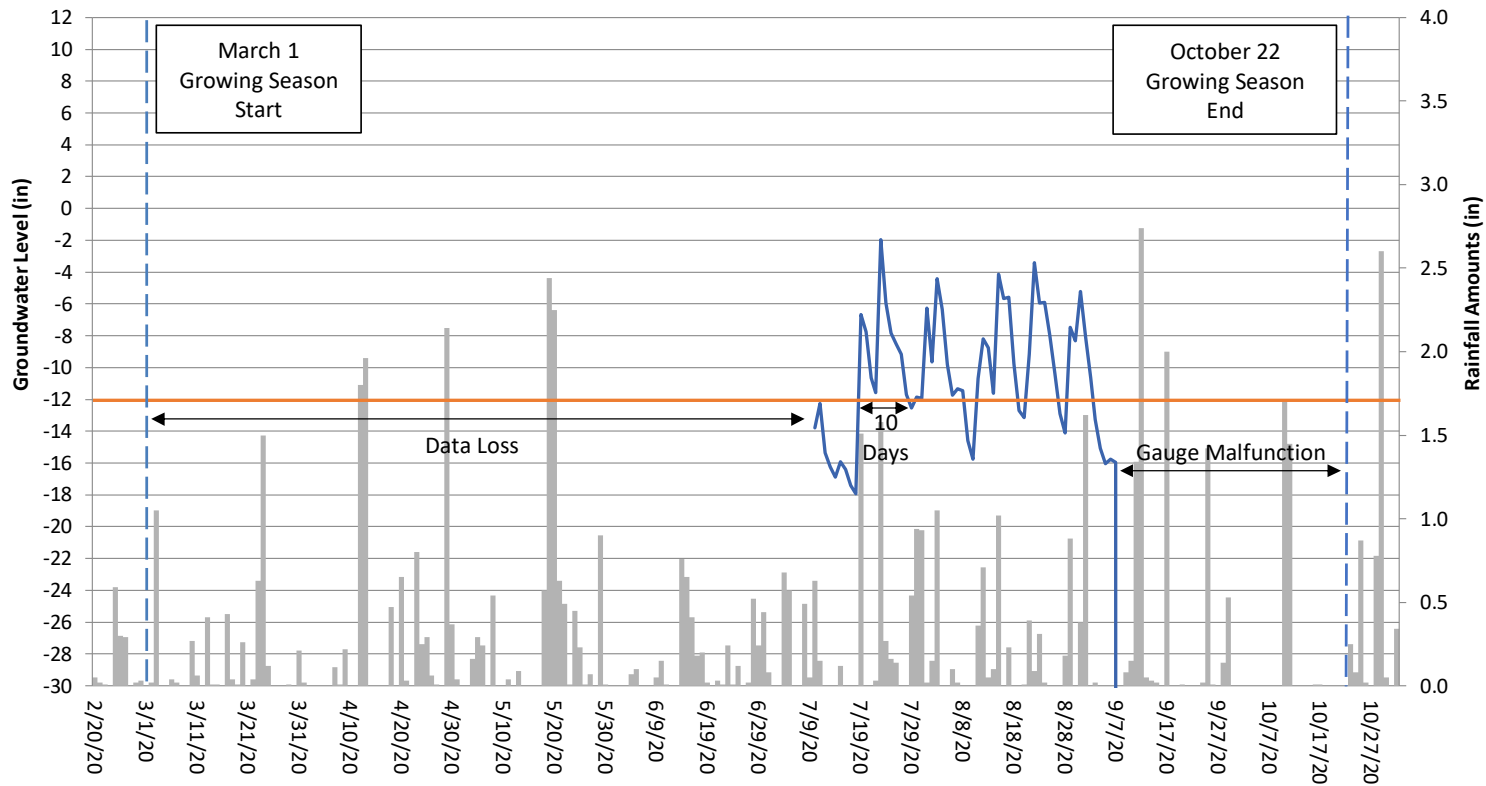


### Laurel Springs Groundwater Gauge 3 Preconstruction (2020 Data)

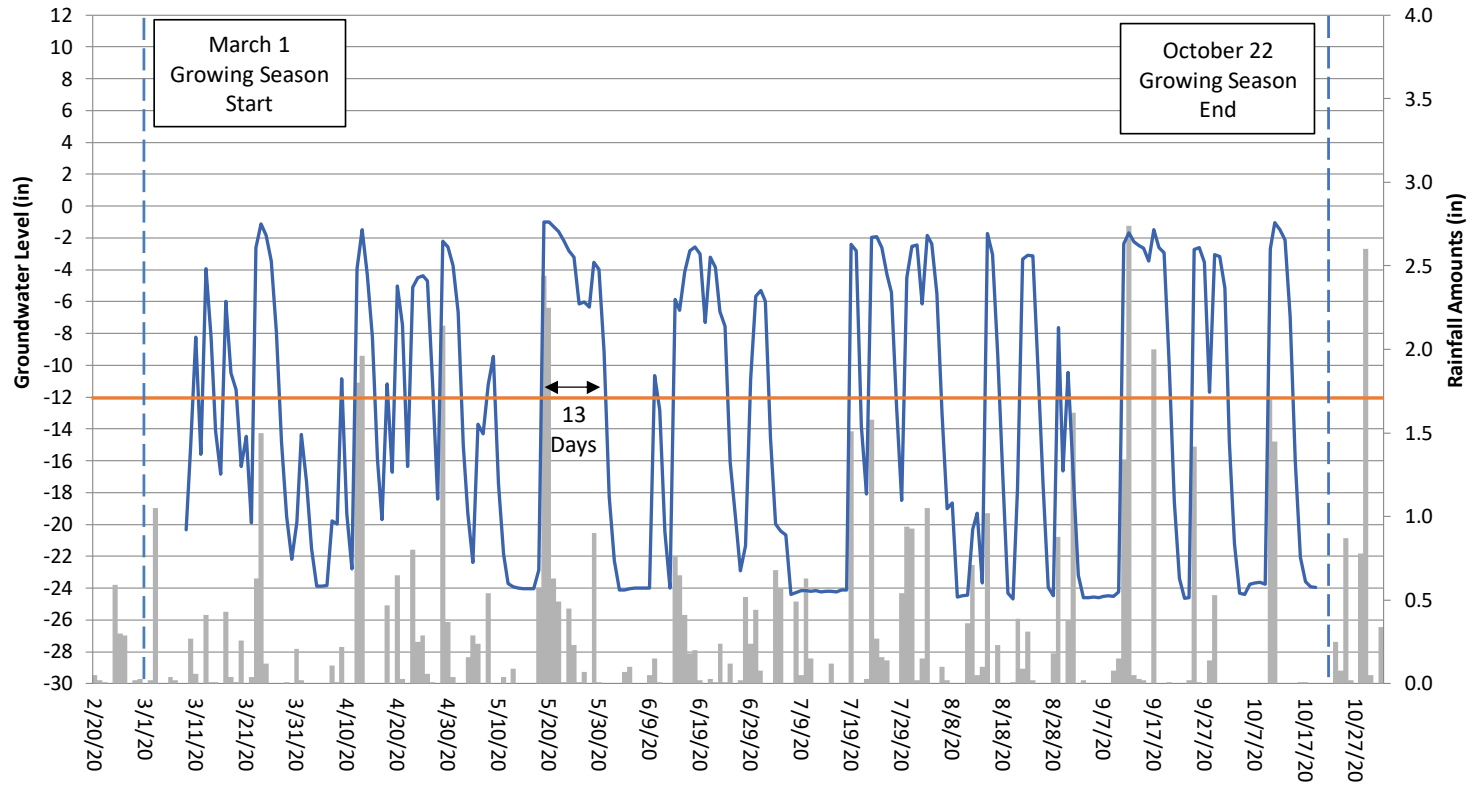




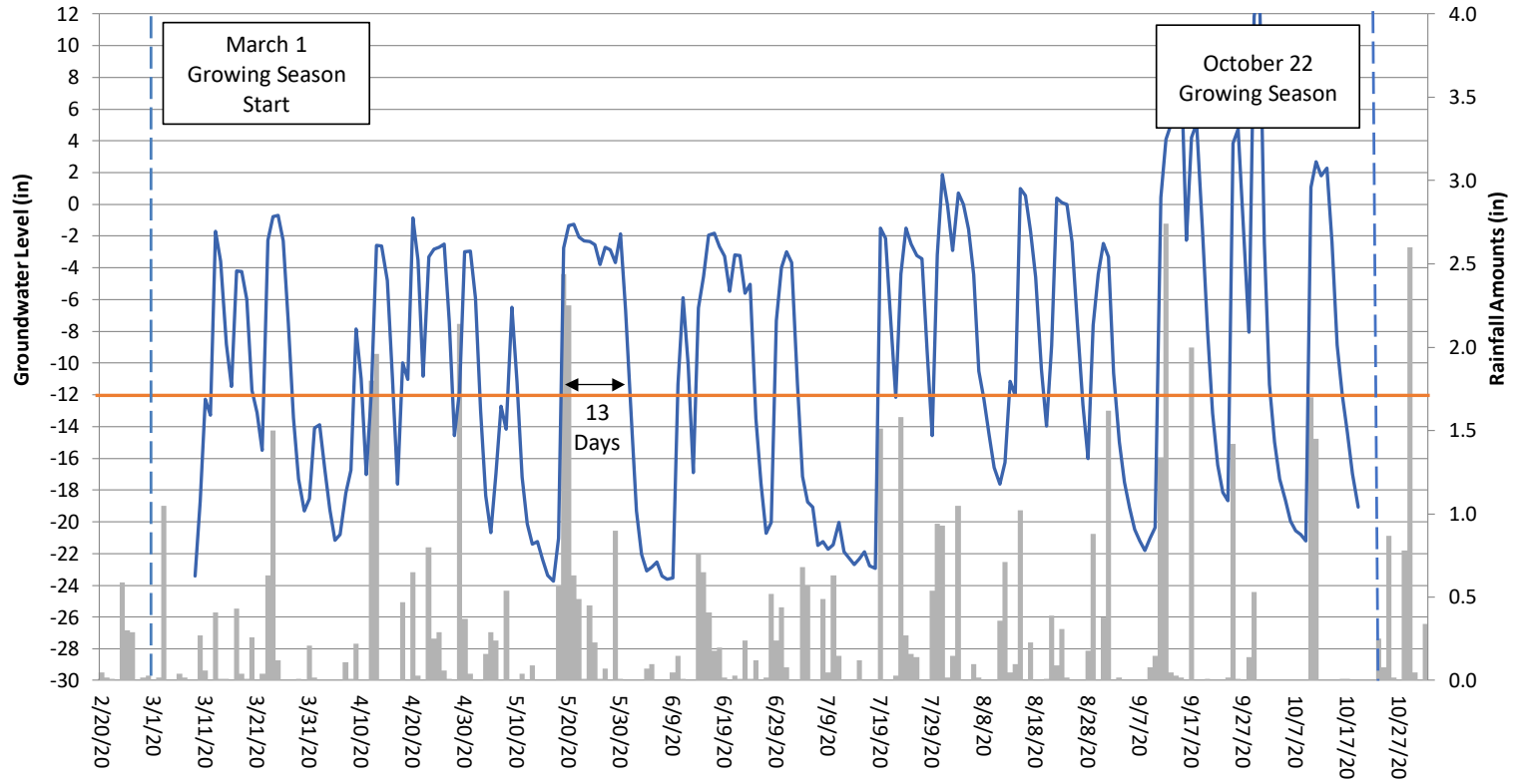
### Laurel Springs Groundwater Gauge 4 Preconstruction (2020 Data)



# Laurel Springs Groundwater Gauge 5 Preconstruction (2020 Data)

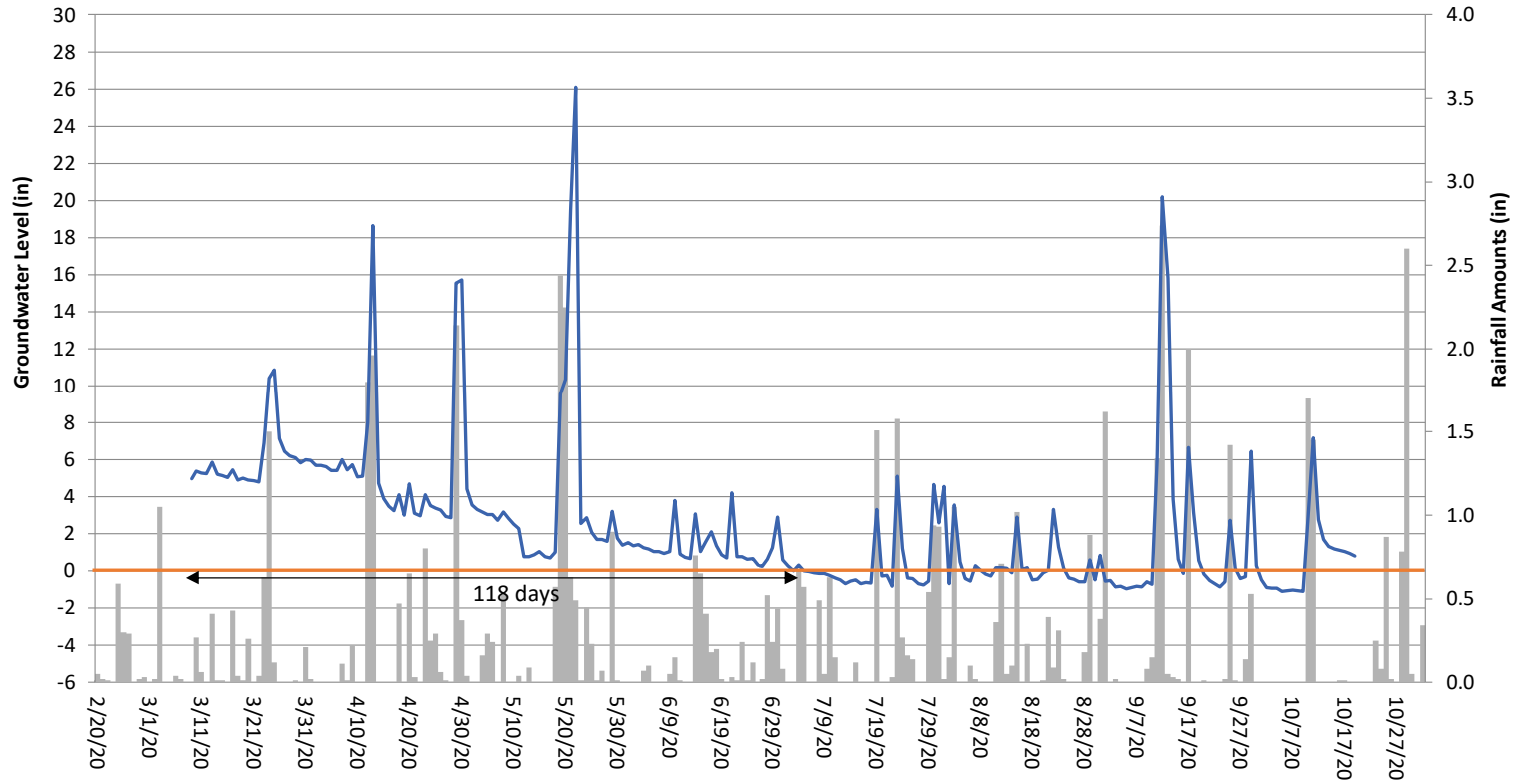


### Laurel Springs Groundwater Gauge 6 Preconstruction (2020 Data)

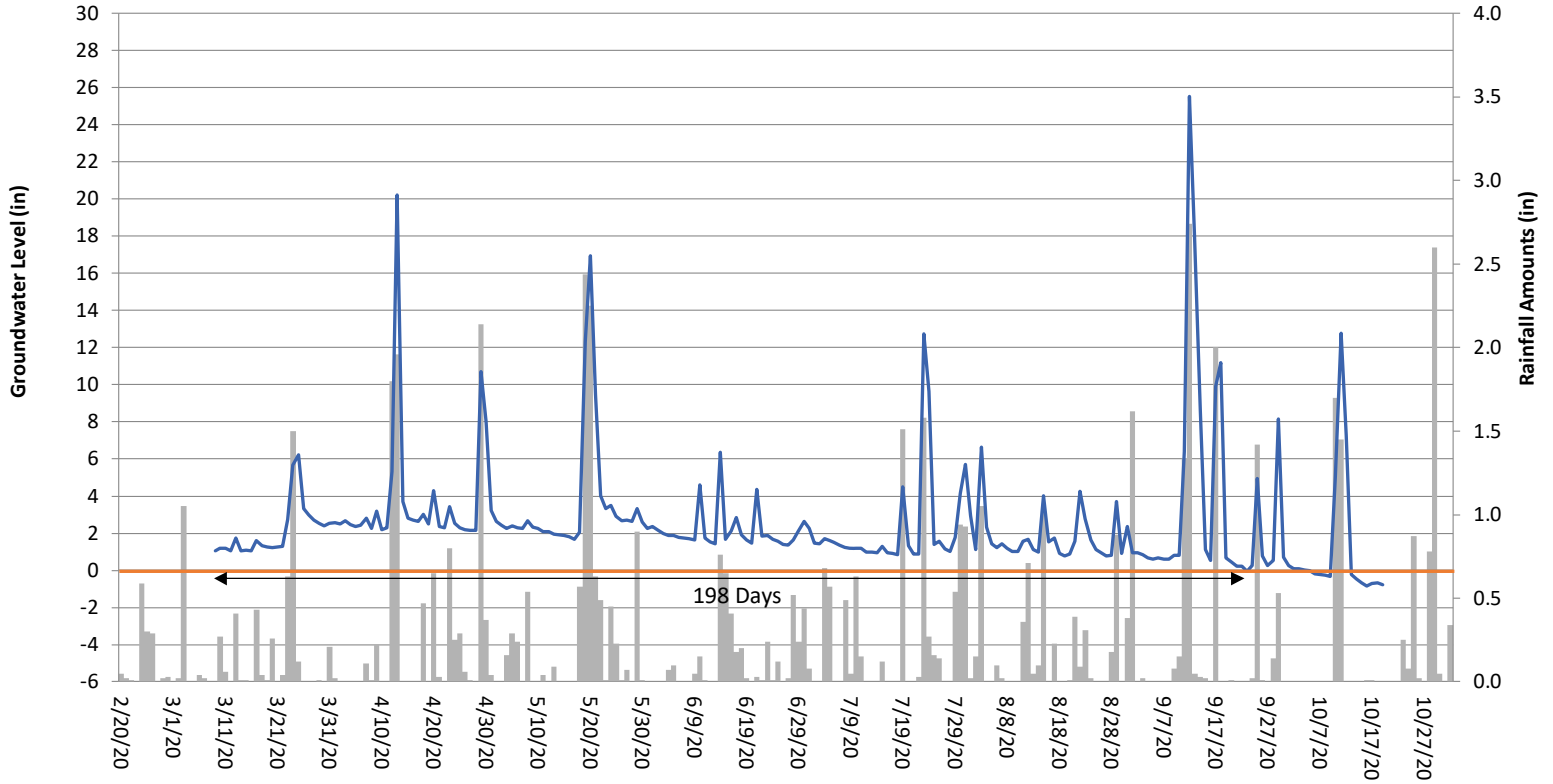




### Laurel Springs Flow Gauge Fork Creek Preconstruction (2020 Data)



### Laurel Springs Flow Gauge UT1 Preconstruction (2020 Data)



## APPENDIX C - FLOOD FREQUENCY ANALYSIS DATA

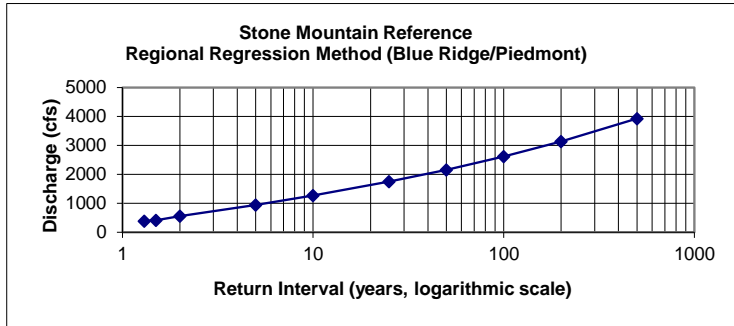
## Regional Regression Method Threemile Creek Restoration Studies

### Stone Mountain Reference (DA = 7.5 square miles)

Region: Blue Ridge/Piedmont

Return Interval (years)	Discharge (cfs)
1.3	<b>385</b>
1.5	<b>410</b>
2	555
5	947
10	1270
25	1750
50	2160
100	2620
200	3140
500	3930

Bold indicates interpolated data.

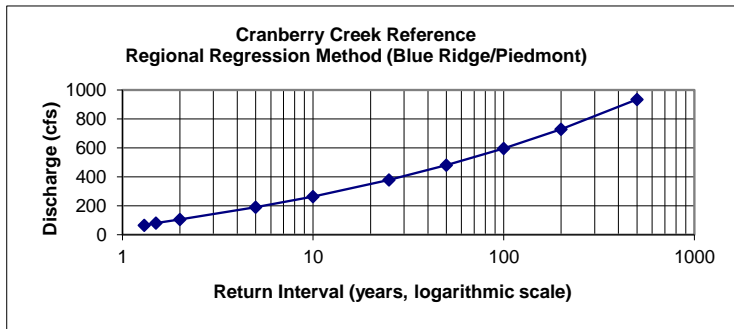


### Cranberry Creek Reference (DA = 0.7 square mile)

Region: Blue Ridge/Piedmont

Return Interval (years)	Discharge (cfs)
1.3	<b>65</b>
1.5	<b>80</b>
2	105
5	190
10	264
25	378
50	480
100	596
200	729
500	935

Bold indicates interpolated data.

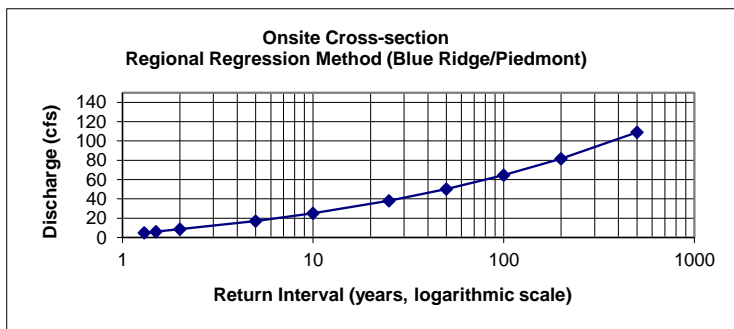


### Undisturbed Reach of UT2 (DA = 0.02 square miles)

Region: Blue Ridge/Piedmont

Return Interval (years)	Discharge (cfs)
1.3	<b>5</b>
1.5	<b>6</b>
2	8.66
5	17.1
10	25.1
25	38.2
50	50.2
100	64.6
200	81.6
500	109

Bold indicates interpolated data.





## APPENDIX D - JURISDICTIONAL DETERMINATION INFO

**U.S. ARMY CORPS OF ENGINEERS**  
**WILMINGTON DISTRICT**

Action Id. 2019-01732 County: Avery U.S.G.S. Quad: NC- Linville Falls

**NOTIFICATION OF JURISDICTIONAL DETERMINATION**

Requestor: Restoration Systems, LLC  
JD Hamby  
Address: 1101 Haynes Street, Suite 211  
Raleigh, NC 27604  
Telephone Number: 919-755-9490  
E-mail: jhamby@restorationsystems.com

Size (acres)	<u>26</u>	Nearest Town	<u>Newland</u>
Nearest Waterway	<u>Fork Creek</u>	River Basin	<u>French Broad-Holston</u>
USGS HUC	<u>06010108</u>	Coordinates	Latitude: <u>35.9913</u> Longitude: <u>-81.9837</u>

Location description: The proposed mitigation bank is located at 676 and 964 Little Buck Hill Road, near Newland, NC.

**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 October 2019. Therefore this preliminary jurisdiction determination may be used in the permit evaluation process, including determining compensatory mitigation. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.
- There appear to be **waters, including wetlands** on the above described project area/property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). However, since the **waters, including wetlands** have not been properly delineated, this preliminary jurisdiction determination may not be used in the permit evaluation process. Without a verified wetland delineation, this preliminary determination is merely an effective presumption of CWA/RHA jurisdiction over all of the **waters, including wetlands** at the project area, which is not sufficiently accurate and reliable to support an enforceable permit decision. We recommend that you have the **waters, including wetlands** on your project area/property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

**B. Approved Determination**

- There are Navigable Waters of the United States within the above described project area/property subject to the permit requirements of Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403) and Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.
- There are **waters, including wetlands** on the above described project area/property subject to the permit requirements of Section 404 of the Clean Water Act (CWA) (33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.
- We recommend you have the **waters, including wetlands** on your project area/property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

**2019-01732**

- 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 **Amanda Jones at 828-271-7980 ext. 4225 or amanda.jones@usace.army.mil**.

**C. Basis for Determination: See the preliminary jurisdictional determination form dated 11/22/2019.**

**D. Remarks:** A site visit was conducted on October 02, 2019 in which streams and wetlands on the site were verified and amended as depicted on the attached map labeled Figure 3 dated October 2019.

### **E. Attention USDA Program Participants**

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

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

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

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

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

**\*\*It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.\*\***

Corps Regulatory Official: FUEMMELE.AMAND  
A.JONES.1242835090

Digitally signed by  
FUEMMELE.AMANDA.JONES.12428  
35090  
Date: 2019.11.22 07:43:55 -05'00'

Date of JD: **11/22/2019** Expiration Date of JD: **Not applicable**

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

Applicant: <b>Restoration Systems, LLC, JD Hamby</b>	File Number: <b>2019-01732</b>	Date: <b>11/22/2019</b>
Attached is:	See Section below	
<input type="checkbox"/> INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A	
<input type="checkbox"/> PROFFERED PERMIT (Standard Permit or Letter of permission)	B	
<input type="checkbox"/> PERMIT DENIAL	C	
<input type="checkbox"/> APPROVED JURISDICTIONAL DETERMINATION	D	
<input checked="" type="checkbox"/> PRELIMINARY JURISDICTIONAL DETERMINATION	E	

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at <http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx> or 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: Amanda Jones**  
**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. Phillip Shannin, Administrative Appeal Review Officer  
CESAD-PDO  
U.S. Army Corps of Engineers, South Atlantic Division  
60 Forsyth Street, Room 10M15  
Atlanta, Georgia 30303-8801  
Phone: (404) 562-5137

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

<hr/> Signature of appellant or agent.	Date:	Telephone number:
---	-------	-------------------

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

**District Engineer, Wilmington Regulatory Division, Attn: Amanda Jones, 69 Darlington Avenue, Wilmington, North Carolina 28403**

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

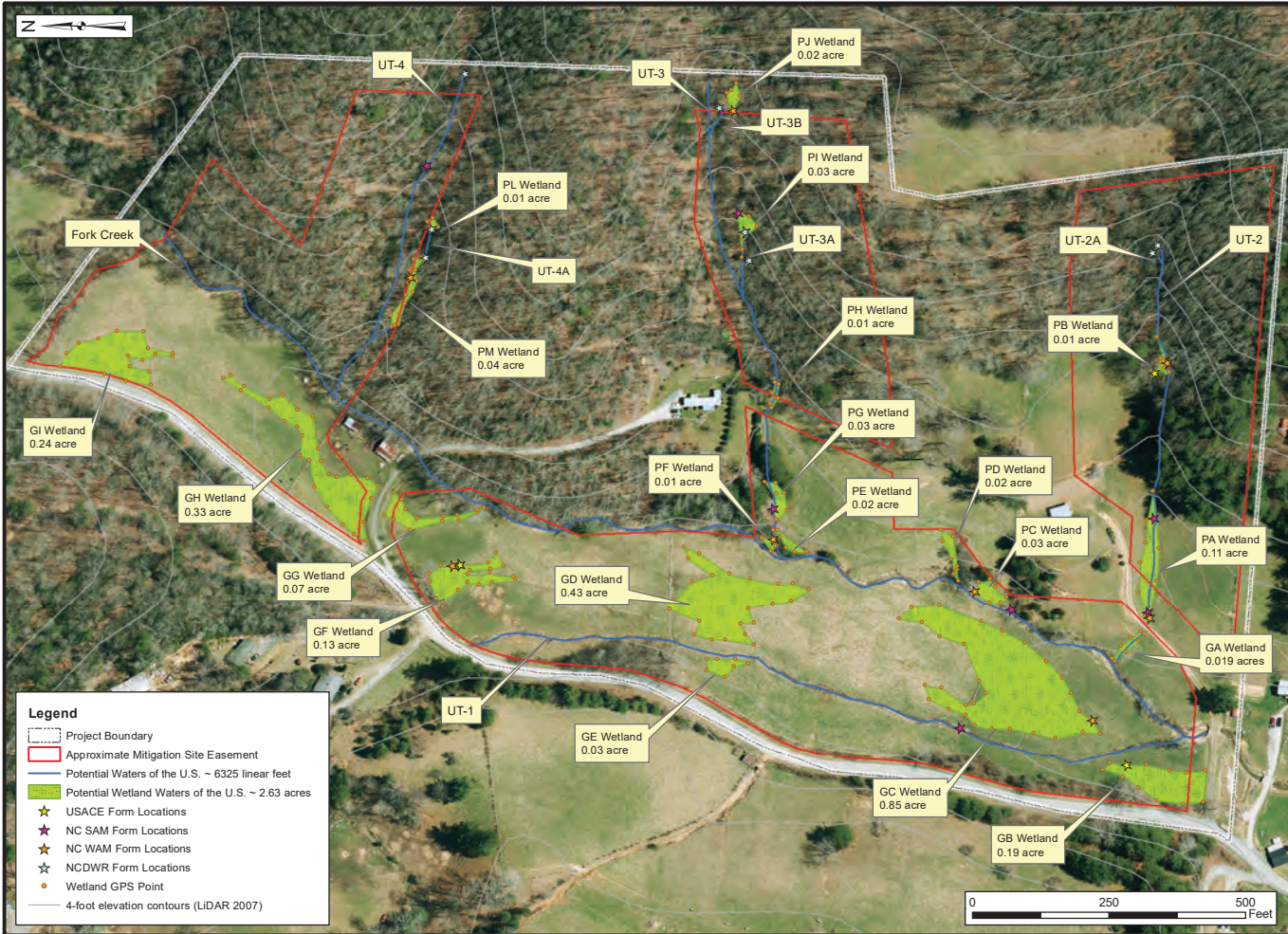
**Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Phillip Shannin, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801**  
**Phone: (404) 562-5137**

Copies Furnished to property owners (without map):

Axiom Environmental, Inc. / Attn: Grant Lewis (via email)

Jerry Willis et al (owner)  
3719 Snow Creek Road  
Bakersville, NC 28705

Eugene Wise (owner)  
964 Little Buck Hill Road  
Newland, NC 28657



Prepared for:



Project:

**LAUREL SPRINGS  
MITIGATION SITE**

Avery County, NC

Title:

**JURISDICTIONAL  
AREAS**

Notes:  
1. Background Imagery Source:  
2018 - aerial photography  
provided by the NC OneMap  
program (online, provided by  
the NC Geographic Information  
Coordination Council)

Drawn by: AEK

Date: OCT 2019

Scale: 1:2000

Project No.: 19-006

FIGURE

**3**

**0ATTACHMENT**

**PRELIMINARY JURISDICTIONAL DETERMINATION FORM**

**BACKGROUND INFORMATION**

**A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD):** 11/22/2019

**B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:**  
Grant Lewis- Axiom Environmental, Inc.  
218 Snow Ave  
Raleigh, NC 27603

**C. DISTRICT OFFICE, FILE NAME, AND NUMBER:** CESAW-RG-A / Laurel Springs  
Mitigation Site / AID 2019-01732

**D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:**  
Laurel Springs Stream and Wetland Mitigation Site.

**(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)**

State: North Carolina County/parish/borough: Avery County City: Spruce Pine

Center coordinates of site (lat/long in degree decimal format):  
Lat 35.9913°N °, Long. 81.9837°W °

Name of nearest waterbody: Fork Creek

Identify (estimate) amount of waters in the review area:

Non-wetland waters: 6325 linear feet: 2-8 width (ft)

Cowardin Class: R3UB1/2, R4SB3/4

Stream Flow: Perennial/intermittent

Wetlands: 2.63 acres

Cowardin Class: PFO1/PSS1

Surface waters: 0 acres

Name of any water bodies on the site that have been identified as Section 10 waters:

Tidal: 0

Non-Tidal: 0

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

Office (Desk) Determination. Date:

Field Determination. Date(s): 10/02/2019

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

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 approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that 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) that 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) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (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 preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes 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 approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, 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, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable. This preliminary JD finds that there "*may be*" waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:



**SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply**

- checked items should be included in case file and, where checked and requested, appropriately reference sources below):


- Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant:
- Data sheets prepared/submitted by or on behalf of the applicant/consultant.
- Office concurs with data sheets/delineation report.
- Office does not concur with data sheets/delineation report.
- 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: Linville Falls, NC (1994) 7.5-minute topographic quadrangle.
- USDA Natural Resources Conservation Service Soil Survey. Citation: Web Soil Survey (online at <http://websoilsurvey.nrcs.usda.gov>), and Soil Survey of Avery County (2005)
- 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): NC OneMap 2018 Orthoimagery. or  Other (Name & Date):
- Previous determination(s). File no. and date of response letter:
- Other information (please specify):

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

FUEMMELER.AM  
ANDAJONES.124  
2835090

Digitally signed by  
FUEMMELER.AMANDA.JONES  
.1242835090  
Date: 2019.11.13 11:40:13  
-05'00'

Signature and date of  
Regulatory Project Manager  
(REQUIRED)

 9/5/19  
Signature and date of  
person requesting preliminary JD  
(REQUIRED, unless obtaining  
the signature is impracticable)

Site number	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resource
1. Fork Creek	35.997371	-81.979919	R3UB1/2	2320 feet length, 6-8 feet avg width	non-section 10 – non-wetland
2. UT-1	35.995729	-81.982313	R3UB1/2	1360 feet length, 4-7 feet avg width	non-section 10 – non-wetland
3. UT-2	35.992413	-81.979663	R3UB1/2 R4SB3/4	780 feet length, 2-6 feet avg width	non-section 10 – non-wetland
4. UT-2A	35.992319	-81.979704	R4SB3/4	21 feet length, 2-3 feet avg width	non-section 10 – non-wetland
5. UT-3	35.994711	-81.978815	R3UB1/2	918 feet length, 3-4 feet avg width	non-section 10 – non-wetland
6. UT 3A	35.994506	-81.979736	R4SB3/4	121 feet length, 2-3 feet avg width	non-section 10 – non-wetland
7. UT-3B	35.994622	-81.978978	R4SB3/4	56 feet length, 2-3 feet avg width	non-section 10 – non-wetland
8. UT-4	35.995934	-81.978809	R3UB1/2	647 feet length, 3-4 feet avg width	non-section 10 – non-wetland
9. UT-4A	35.996079	-81.979778	R4SB3/4	102 feet length, 2-3 feet avg width	non-section 10 – non-wetland
10. Wetland GA	35.992450	-81.982136	PSS1	0.02 acre	non-section 10 wetland
11. Wetland GB	35.992504	-81.982968	PSS1	0.19 acre	non-section 10 wetland
12. Wetland GC	35.993271	-81.982748	PSS1	0.85 acre	non-section 10 wetland
13. Wetland GD	35.994540	-81.982266	PSS1	0.43 acre	non-section 10 wetland
14. Wetland GE	35.994629	-81.982455	PSS1	0.03 acre	non-section 10 wetland
15. Wetland GF	35.995997	-81.982063	PSS1	0.13 acre	non-section 10 wetland
16. Wetland GG	35.995773	-81.981491	PSS1	0.07 acre	non-section 10 wetland
17. Wetland GH	35.996476	-81.981621	PSS1	0.33 acre	non-section 10 wetland
18. Wetland GI	35.997483	-81.980572	PSS1	0.24 acre	non-section 10 wetland
19. Wetland PA	35.992431	-81.982039	PSS1	0.11 acre	non-section 10 wetland
20. Wetland PB	35.992414	-81.980312	PFO1	0.01 acre	non-section 10 wetland
21. Wetland PC	35.993217	-81.981987	PSS1	0.03 acre	non-section 10 wetland
22. Wetland PD	35.993402	-81.981817	PFO1	0.02 acre	non-section 10 wetland
23. Wetland PE	35.994143	-81.981706	PFO1	0.02 acre	non-section 10 wetland
24. Wetland PF	35.994316	-81.981634	PFO1	0.01 acre	non-section 10 wetland

<b>Site number</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Cowardin Class</b>	<b>Estimated amount of aquatic resource in review area</b>	<b>Class of aquatic resource</b>
25. Wetland PG	35.994300	-81.981513	PFO1	0.03 acre	non-section 10 wetland
26. Wetland PH	35.994308	-81.980675	PFO1	0.01 acre	non-section 10 wetland
27. Wetland PI	35.994506	-81.979784	PFO1	0.03 acre	non-section 10 wetland
28. Wetland PJ	35.994566	-81.978819	PFO1	0.02 acre	non-section 10 wetland
29. Wetland PL	35.996041	-81.979765	PFO1	0.01 acre	non-section 10 wetland
30. Wetland PM	35.996107	-81.979959	PFO1	0.04 acre	non-section 10 wetland

## APPENDIX E - CATEGORICAL EXCLUSION DOCUMENT



# Laurel Springs Stream & Wetland Mitigation Site

Avery County, North Carolina

DMS Project No. 100122

## Categorical Exclusion/ERTR



### Prepared for:

North Carolina Department of Environmental Quality

Division of Mitigation Services

1652 Mail Service Center

Raleigh, NC 27699-1652

July 2019



### Task 1 a.) Inter-Agency Post Contract Site Visit: Site Visit Notes

As specified within RFP #16-007725, an on-site meeting with regulatory agencies and DMS staff was conducted on July 24<sup>th</sup>, 2019. Below is a list of attendees and general site visit notes.

#### Attendees:

##### USACE:

- Todd Tugwell
- Kim Browning

##### NC DWR:

- Mac Haupt
- Erin Davis

##### NC WRC:

Andrea Leslie

##### Restoration Systems:

- Raymond Holz
- Worth Creech

##### NC DMS:

- Paul Wiesner
- Matthew Reid
- Periann Russell
- Kirsten Ullman

##### Axiom Environmental

- Grant Lewis

#### Site Visit Notes:

- The Project can proceed as proposed
- Mitigation credit cannot be gained beneath powerlines located on the site. RS will remove the existing powerline easement from the conservation easement and excluded the break from the wider buffer tool GIS analysis.
- RS plans to align the dirt road which crosses UT-4 under the existing Powerline Easement to minimize encroachment on the Project.
- All culverts which outfall into the project or are within the project will be reconnected to streambed elevations to allow for aquatic species passage. Where required, culverts will be removed, replaced, and inlets/outfalls buried for aquatic species passage.
- Riparian wetland credits are not currently contracted with DMS. RS will approach DMS and propose to add wetland credit to the site (and DMS contract) upon receipt and review of the project's USACE jurisdictional determination.

#### Stream Notes:

- A detailed topographic survey will be conducted to determine the practicality of restoring Fork Creek to the valley center within the upper 1/3 of the project. The approach was approved in theory by the IRT, though both the IRT and DMS voiced concerns of habitat loss from a relatively high functioning reach of Fork Creek located immediately upstream of the existing barn. This is not how the project was proposed, and any deviation from the proposal will be vetted and approved by DMS before IRT review.

RS discussed the potential of restoring a 5th unnamed tributary located along the western property boundary of the Project. Restoration would be achieved through priority 1, new channel design within the valley footprint. The additional hydrology would help restore drained hydric soils within the upper 1/3 of the Project. Detailed topo work would determine if the stream would tie back into Fork creek above the existing barn, or stay within the valley and connect below the upper crossing. The Project was not proposed with this option, and any deviation from the proposal will be vetted and approved by DMS.

- IRT members noted historical issues with maintaining channels within the floodplain of larger systems. In this case, the restoration of UT-3 and UT-4 within Fork Creek's floodplain.
- UT-1: crediting and approach approved as proposed.
- UT-2: crediting and approach approved as proposed with further justification on approach required. Given the high amount of sedimentation within the system immediately above and below the existing crossing, DWR Rep. Mac Hault raised concerns regarding the mitigation approach in this area. During the detailed topographic survey of the Site, these areas will be probed and surveyed to determine the most suitable mitigation approach, paying particular attention to the existing wetlands and the stabilization of those wetlands.

The alignment of the existing road will be altered to fit within the existing powerline easement, minimizing long-term impacts to the project.

- UT-3: approved as proposed with the removal of stream credit under the existing powerline easement.
- UT-4: approved as proposed.

**Wetland Notes:**

- The appropriate wetland type (forested vs. scrub-shrub) for the project was discussed throughout the site. RS will attempt to locate reference wetlands within the area to determine an appropriate balance of forested and scrub-shrub wetland for the site. Detailed topography of the valley will aid in this determination. A habitat description, restoration approach, monitoring standard, etc. will be completed for each type within the Mitigation Plan.
- Existing Wetlands (labeled as Enhancement in Figure 5 of the Technical Proposal) are suitable for Rehabilitation (1.5:1 ratio) if groundwater gauges are installed to survey a baseline, and monitoring shows an increase in the hydroperiod.

Ray Holz

---

**From:** Leslie, Andrea J <andrea.leslie@ncwildlife.org>  
**Sent:** Friday, August 02, 2019 2:44 PM  
**To:** Wiesner, Paul; Tugwell, Todd J CIV USARMY CESAW (US); Kim Browning; Haupt, Mac; Davis, Erin B  
**Cc:** Ray Holz; Worth Creech; Reid, Matthew; Russell, Periann; Ullman, Kirsten J; Lewis, Grant; Ray Holz; Worth Creech  
**Subject:** RE: Meeting Minutes- Laurel Springs-DMS# 100122 - Post Contract IRT Site Visit - July 24, 2019

Thanks Paul. The wetland notes start with the following:

The appropriate wetland type (forested vs. scrub-shrub) for the project was discussed throughout the site. RS will attempt to locate reference wetlands within the area to determine an appropriate balance of forested and scrub-shrub wetland for the site.

I want to emphasize that the wetlands may also include herbaceous areas, and a mosaic of herbaceous and shrub-scrub may be more appropriate for this area. An emphasis on forested wetlands may be inappropriate. However, I'll let Grant, Ray, Matthew, and others do their work to determine an appropriate set of references for this site.

Andrea

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Andrea Leslie  
Mountain Habitat Conservation Coordinator  
NC Wildlife Resources Commission  
645 Fish Hatchery Rd., Building B  
Marion, NC 28752  
828-803-6054 (office)  
828-400-4223 (cell)  
[www.ncwildlife.org](http://www.ncwildlife.org)



Get [NC Wildlife Update](#) delivered to your inbox from the N.C. Wildlife Resources Commission.

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**From:** Wiesner, Paul <paul.wiesner@ncdenr.gov>  
**Sent:** Thursday, August 01, 2019 2:23 PM  
**To:** Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>; Kim Browning <Kimberly.D.Browning@usace.army.mil>; Haupt, Mac <mac.haupt@ncdenr.gov>; Davis, Erin B <erin.davis@ncdenr.gov>; Leslie, Andrea J <andrea.leslie@ncwildlife.org>  
**Cc:** Raymond Holz <rholz@restorationsystems.com>; Worth Creech <worth@restorationsystems.com>; Reid, Matthew <matthew.reid@ncdenr.gov>; Russell, Periann <periann.russell@ncdenr.gov>; Ullman, Kirsten J <Kirsten.Ullman@NCDENR.gov>; Lewis, Grant <glewis@axiomenvironmental.org>; Raymond Holz <rholz@restorationsystems.com>; Worth Creech <worth@restorationsystems.com>  
**Subject:** Meeting Minutes- Laurel Springs-DMS# 100122 - Post Contract IRT Site Visit - July 24, 2019

All:

Please see the attached Laurel Springs Post Contract IRT site visit meeting minutes. Please let us know if you have any additional comments or concerns.



The final memo will also be included in the mitigation plan for IRT review.

Thanks

**Paul Wiesner**

Western Regional Supervisor  
North Carolina Department of Environmental Quality  
Division of Mitigation Services

828-273-1673 Mobile  
[paul.wiesner@ncdenr.gov](mailto:paul.wiesner@ncdenr.gov)

Western DMS Field Office  
5 Ravenscroft Drive  
Suite 102  
Asheville, N.C. 28801



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**TASK 1 b.) Categorical Exclusion Summary:**

**Appendix A: Categorical Exclusion Form V. 2**

**Appendix B: Project Maps, Scoping Letters and Responses, & Categorical Exclusion Form Citations**

**Summary of Part 2 - Categorical Exclusion Form V. 2**

**Regulation/Questions regarding The Area of Potential Effect**

Coastal Zone Management Act

Not applicable – the project is not located within a CAMA county.

CERCLA

No Issue – please see the attached Executive Summary from a Limited Phase 1 Site Assessment performed by Environmental Data Resources, Inc. on July 1st, 2019.

National Historic Preservation Act (Section 106)

No Issue – please see attached letter from Ramona M. Bartos - State of the Historic Preservation Office.

Uniform Act

Please see the attached letter, sent to the landowners June 5th, 2019.

**Summary of Part 3 - Categorical Exclusion Form V. 2**

**Ground-Disturbing Activities Regulation/Questions Regarding the Area of Potential Effect**

American Indian Religious Freedom Act (AIRFA)

No Issue – please see attached letter from the Cherokee Nation dated July 17th, 2019. DEQ-DMS sent letters (via email) to all three (3) applicable Cherokee tribes on June 18, 2019. The project scoping letters were sent to the Cherokee Nation, Eastern Band of the Cherokee Indians, and United Keetoowah Band of Cherokee Indians in Oklahoma. A letter from the Cherokee Nation (included in the Appendix) was received in reply, but responses were NOT received from the Eastern Band of the Cherokee Indians or United Keetoowah Band of Cherokee Indians in Oklahoma during the requested 30-day review period.

Antiquities Act (AA)

Not applicable – the project is not located on Federal land.

Archaeological Resources Protection Act (ARPA)

Not applicable – the project is not located on federal or Indian lands.

Endangered Species Act (ESA)

Ten (10) federally protected species (detailed in Appendix B) occur in Avery County, NC with suitable habitat present for three (3) species (the Gray, Northern long-eared, and Virginia big-eared bat). Multiple site surveys of the Property have been conducted and the conclusions are summarized in Table 1 below. The response from the Asheville Office regarding these determinations can be found in the appendix.

**Table 1. Threatened and Endangered Species**

Common Name (Scientific Name)	Biological Conclusion	ESA Section 7/ Eagle Determination Act	Summary
Carolina northern flying squirrel ( <i>Glaucomys sabrinus coloratus</i> )	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.
Gray Bat ( <i>Myotis grisescens</i> )	Suitable habitat present, species not present	May Affect, not likely to adversely affect	Foraging habitat present within the Site; however, no roosting habitat with the Site boundaries or near the Site. Foraging habitat will not be disturbed during summer months.
Northern long-eared bat ( <i>Myotis septentrionalis</i> )	Suitable habitat present, species not present	May Affect, not likely to adversely affect	*(See Northern long-eared information below)
Virginia big-eared bat ( <i>Corynorhinus townsendii virginianus</i> )	Suitable habitat present, species not present	May Affect, not likely to adversely affect	Foraging habitat present within the Site; however, no roosting habitat with the Site boundaries or near the Site. Foraging habitat will not be disturbed during summer months.
Spruce-fir moss spider ( <i>Microhexura montivaga</i> )	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.
Blue Ridge goldenrod ( <i>Solidago spithamea</i> )	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.
Roan mountain bluet ( <i>Hedyotis purpurea var. montana</i> )	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.
Heller's blazing star ( <i>Liatris helleri</i> )	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.

Spreading avens ( <i>Geum radiatum</i> )	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.
Rock gnome lichen ( <i>Gymnoderma lineare</i> )	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.

**\*Northern Long-Eared Bat**

A review of the United States Fish and Wildlife Service (USFWS) Asheville Ecological Services Field Office web page ([https://www.fws.gov/asheville/pdfs/NLEB-4DRule-AveryUpdate\\_June1\\_2016.pdf](https://www.fws.gov/asheville/pdfs/NLEB-4DRule-AveryUpdate_June1_2016.pdf)) on February 8, 2019, indicated the Site's watershed has no confirmed hibernation or maternity sites for this species. Further coordination with the USFWS will occur throughout the project in support of this species; however, at this time no additional surveys are expected for the Northern Long-Eared Bat.

Executive Order 13007 (Indian Sacred Sites)

No Issue – the site is not located on Federal lands. Please see attached letter from the Cherokee Nation dated July 17th, 2019.

Farmland Protection Policy Act (FPPA)

Please find the attached Form AD-1006 dated July 16<sup>th</sup>, 2019 and email from Milton Cortes of the NRCS.

Fish and Wildlife Coordination Act (FWCA)

No Issue- A review of the United States Fish and Wildlife Service (USFWS) Asheville Ecological Services Field Office web page on February 8, 2019, indicated the Site's watershed has NO confirmed hibernation or maternity sites for the Northern Long-Eared Bat. Both the USFWS and the NCWRC have been consulted.

Land & Water Conservation Fund Act (Section 6(f))

Not applicable

Magnuson-Stevens Fishery Conservation and management Act (Essential Fish Habitat)

Not applicable – project is not located within an estuarine system

Migratory Bird Treaty Act (MBTA)

USFWS has no recommendation with the project relative to the MBTA

Wilderness Act

Not applicable – the project is not located within a Wilderness area.



Appendix A

Categorical Exclusion Form for Division of Mitigation Services Projects  
Version 2

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

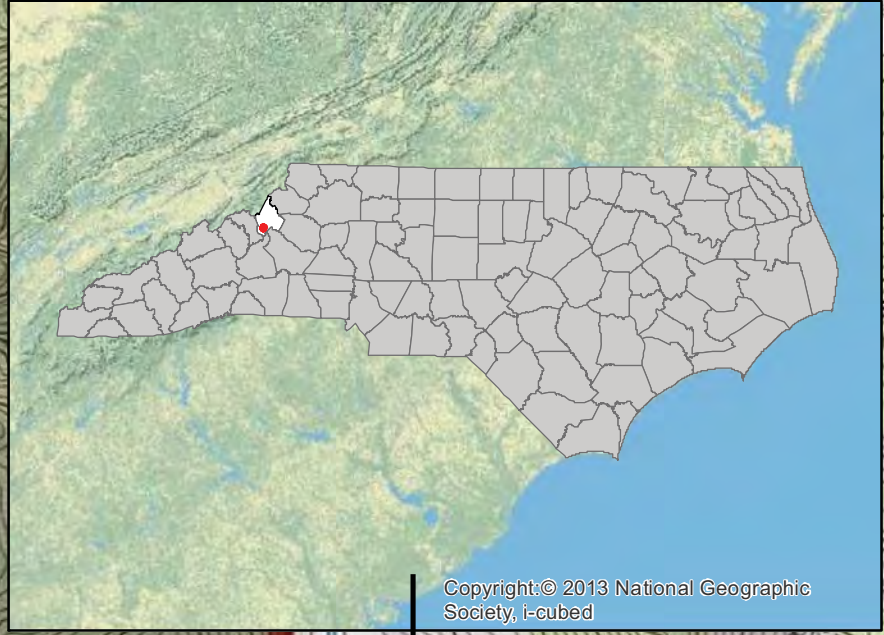
Part 1: General Project Information	
<b>Project Name:</b>	Laurel Springs Stream & Wetland Mitigation Site
<b>County Name:</b>	Avery County
<b>DMS Number:</b>	100122
<b>Project Sponsor:</b>	Restoration Systems, LLC
<b>Project Contact Name:</b>	John "JD" Hamby
<b>Project Contact Address:</b>	1101 Haynes St. Suite 211, Raleigh NC, 27604
<b>Project Contact E-mail:</b>	jhamby@restorationsystems.com
<b>DMS Project Manager:</b>	Paul Wiesner
Project Description	
<p>Located within the NC DWR Targeted Local Watershed (TLW) 06010108-010020 and NC DWR subbasin 04-03-06, the Site streams have a Best Use Classification of C; Tr &amp; WS-IV; Tr. Restoration Systems developed specific mitigation goals and objectives through the use of the North Carolina Stream Assessment Method (NC SAM), the North Carolina Wetland Assessment Method (NC WAM), and the French Broad River Basin Restoration Priorities 2009 report. Site species and adjacent land use consists of disturbed forest and livestock pasture within a watershed that contains less than 2% impervious surfaces. Within the Project's +/- 26 ac. footprint, are four unnamed tributaries totaling 3,575 l. ft. which drain directly into Fork Creek, and 2,300 l. ft. of Fork Creek itself. Fork Creek enters Threemile Creek, a trout and drinking water supply watershed, ½ mile downstream of the Project. The proposed mitigation approach is a combination of new channel restoration, in-channel enhancement level I and II, and preservation. The Project will also result in restoration/enhancement of approximately 7.8 acres of wetlands.</p>	
For Official Use Only	
<b>Reviewed By:</b>	
<div style="font-size: 1.2em; font-weight: bold; margin-bottom: 5px;">9/13/19</div> <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <b>Date</b>	<div style="font-family: cursive; font-size: 1.2em; margin-bottom: 5px;">Paul Wiesner</div> <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <b>DMS Project Manager</b>
<b>Conditional Approved By:</b>	
<hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <b>Date</b>	<hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <b>For Division Administrator FHWA</b>
<input type="checkbox"/> <b>Check this box if there are outstanding issues</b>	
<b>Final Approval By:</b>	
<div style="font-size: 1.2em; font-weight: bold; margin-bottom: 5px;">9-16-19</div> <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <b>Date</b>	<div style="font-family: cursive; font-size: 1.2em; margin-bottom: 5px;">Donald W. Brew</div> <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <b>For Division Administrator FHWA</b>

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

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

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

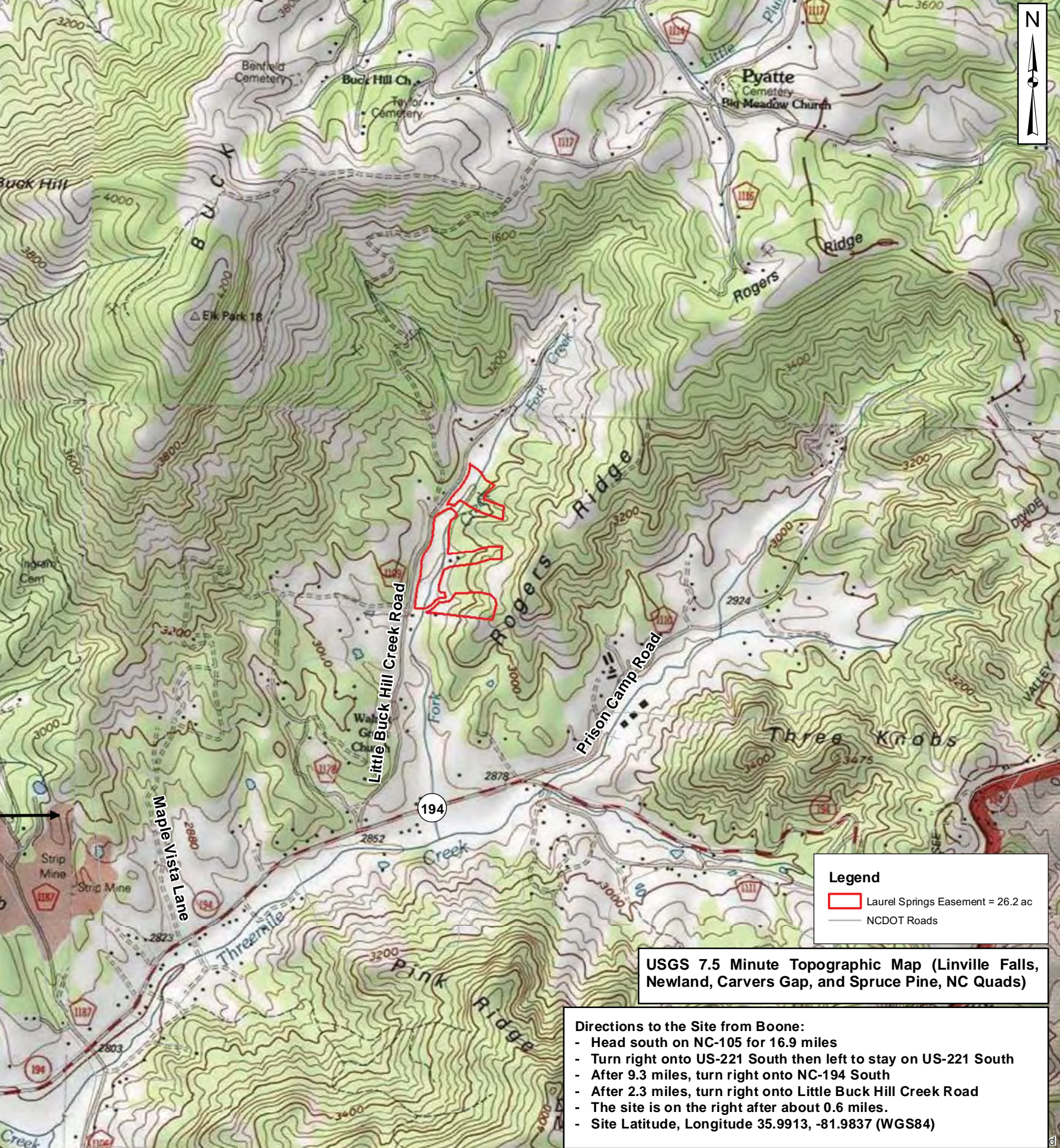




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**Legend**

- Laurel Springs Easement = 26.2 ac
- NCDOT Roads

USGS 7.5 Minute Topographic Map (Linville Falls, Newland, Carvers Gap, and Spruce Pine, NC Quads)

- Directions to the Site from Boone:**
- Head south on NC-105 for 16.9 miles
  - Turn right onto US-221 South then left to stay on US-221 South
  - After 9.3 miles, turn right onto NC-194 South
  - After 2.3 miles, turn right onto Little Buck Hill Creek Road
  - The site is on the right after about 0.6 miles.
  - Site Latitude, Longitude 35.9913, -81.9837 (WGS84)



Project:  
**LAUREL SPRINGS MITIGATION SITE**  
  
Avery County, NC

Title:  
**SITE LOCATION**

Drawn by: KRJ

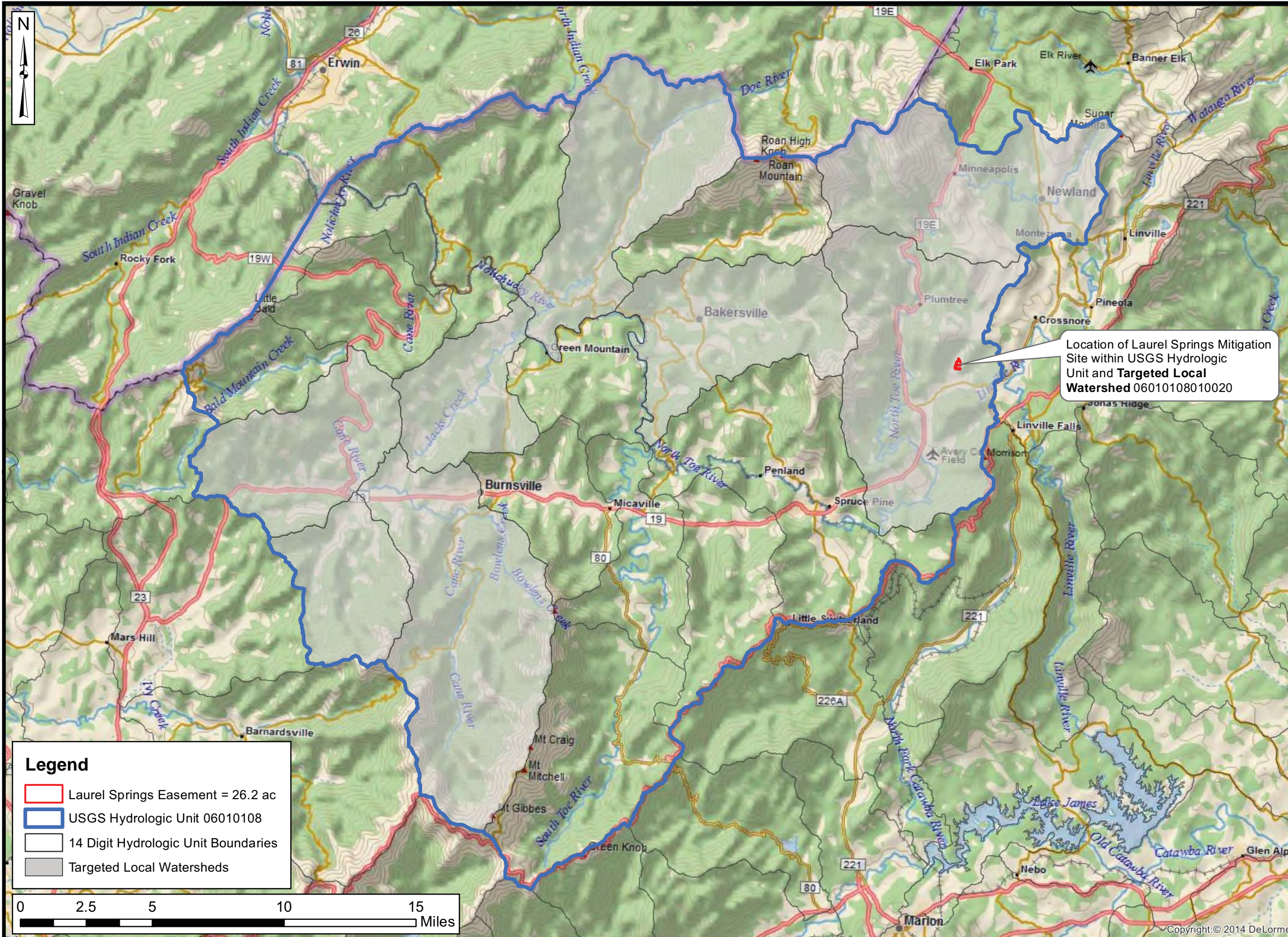
Date: FEB 2019

Scale: 1:20,000

Project No.: 19-001.01

**FIGURE 1**





Project:  
**LAUREL SPRINGS  
 MITIGATION SITE**

Avery County, NC

Title:  
**HYDROLOGIC  
 UNIT MAP**

Drawn by: KRJ

Date: FEB 2019

Scale: 1:220,000

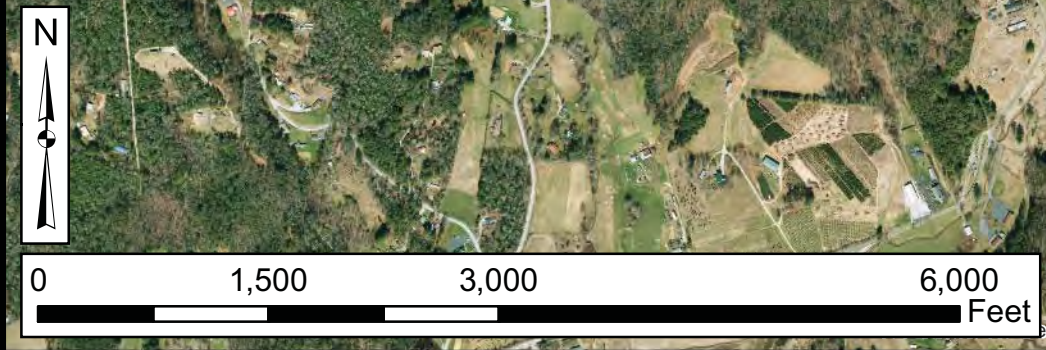
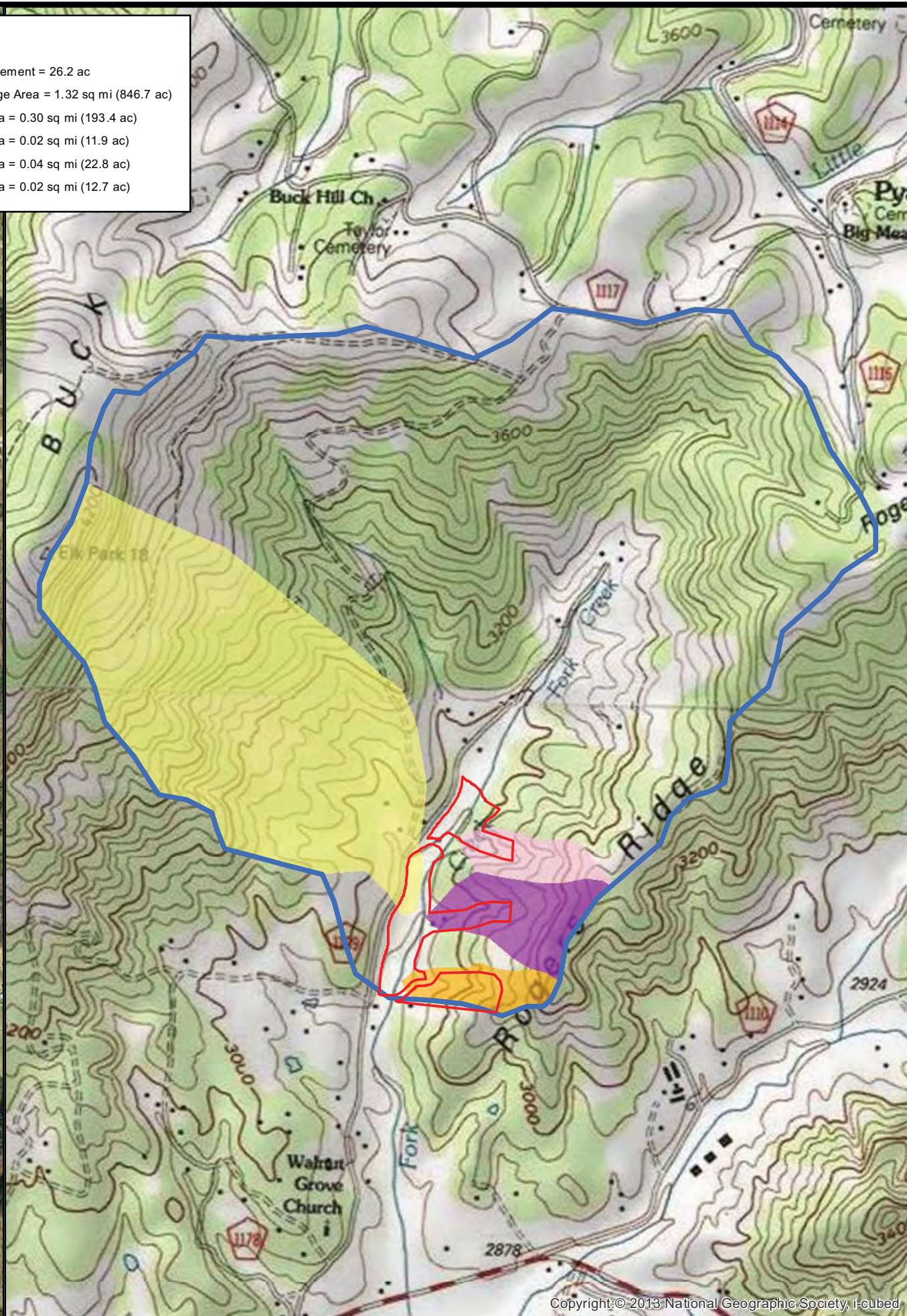
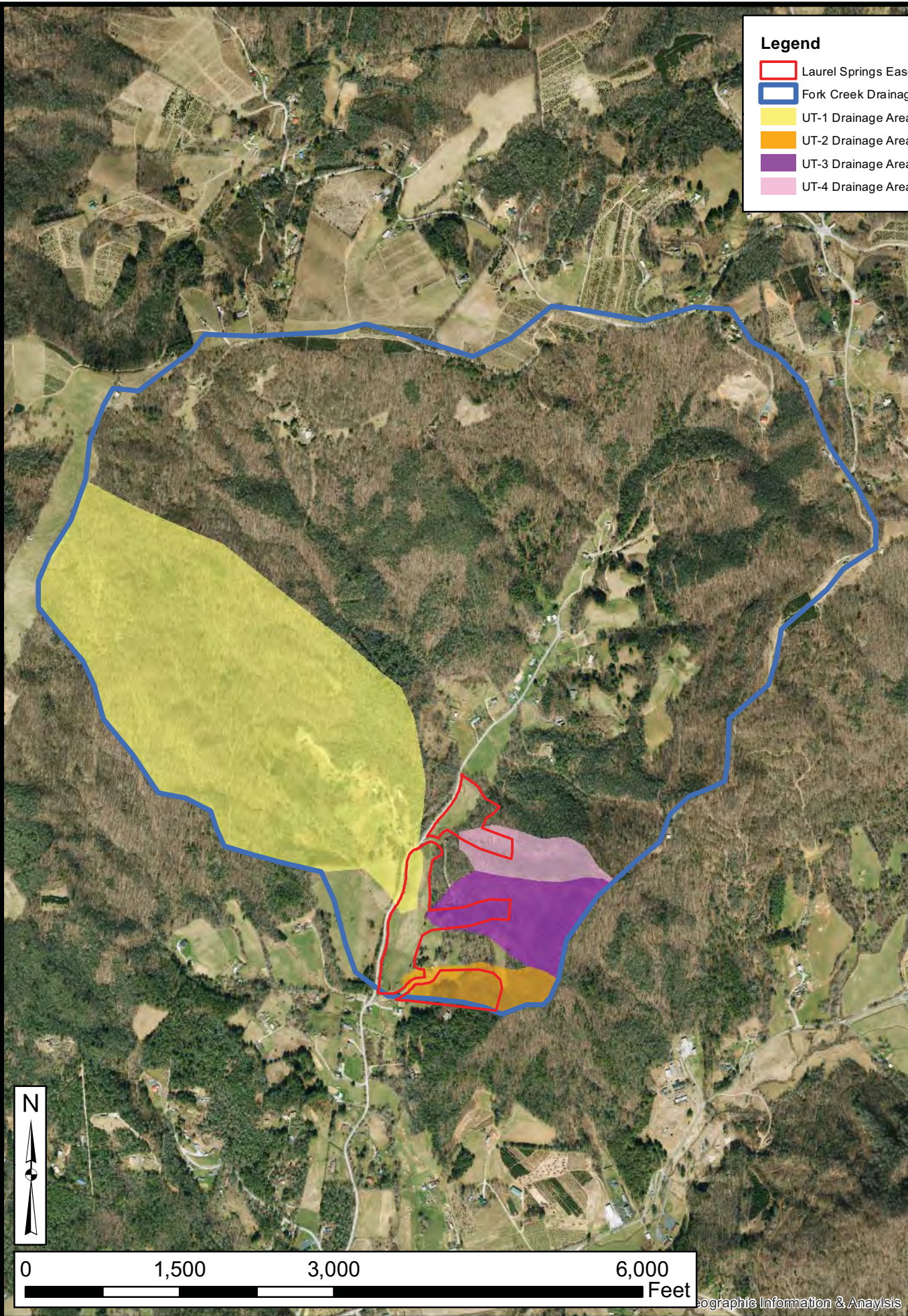
Project No.: 19-001.01

FIGURE  
**2**



**Legend**

- Laurel Springs Easement = 26.2 ac
- Fork Creek Drainage Area = 1.32 sq mi (846.7 ac)
- UT-1 Drainage Area = 0.30 sq mi (193.4 ac)
- UT-2 Drainage Area = 0.02 sq mi (11.9 ac)
- UT-3 Drainage Area = 0.04 sq mi (22.8 ac)
- UT-4 Drainage Area = 0.02 sq mi (12.7 ac)



Project:

**LAUREL SPRINGS MITIGATION SITE**

Avery County, NC

Title:

**TOPOGRAPHY AND DRAINAGE AREA**

Drawn by: KRJ

Date: FEB 2019

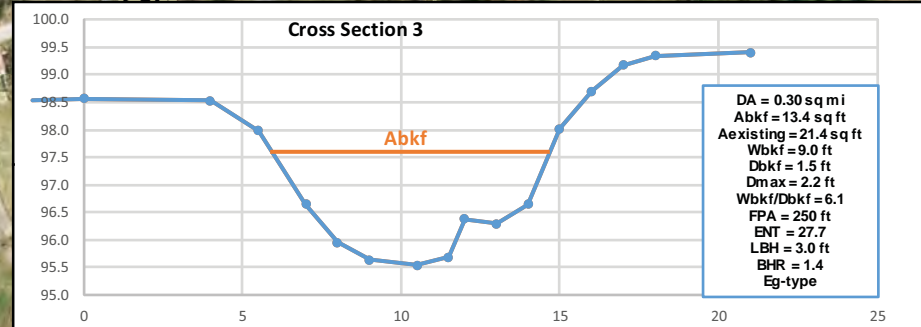
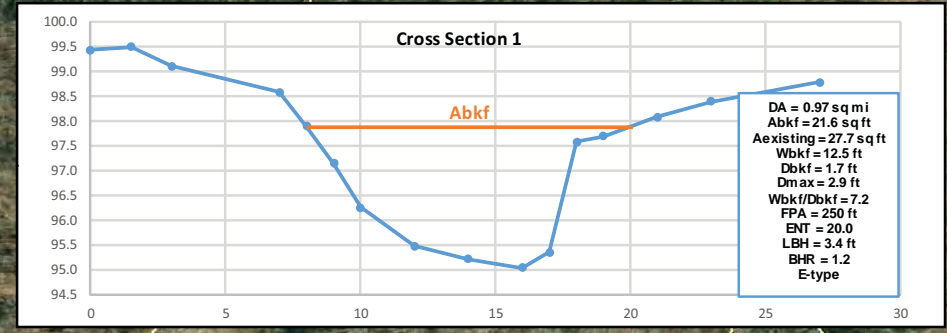
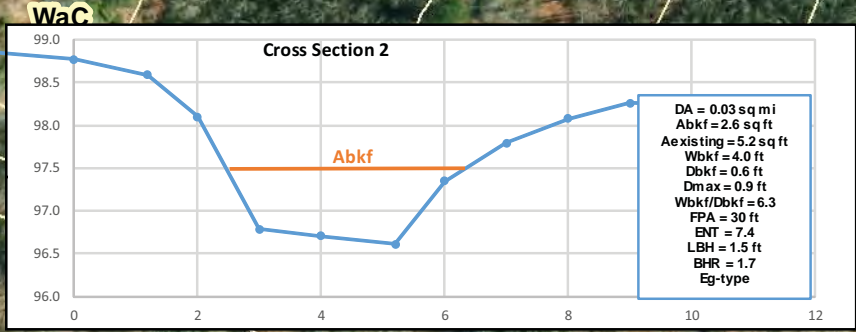
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Project No.: 19-001.01

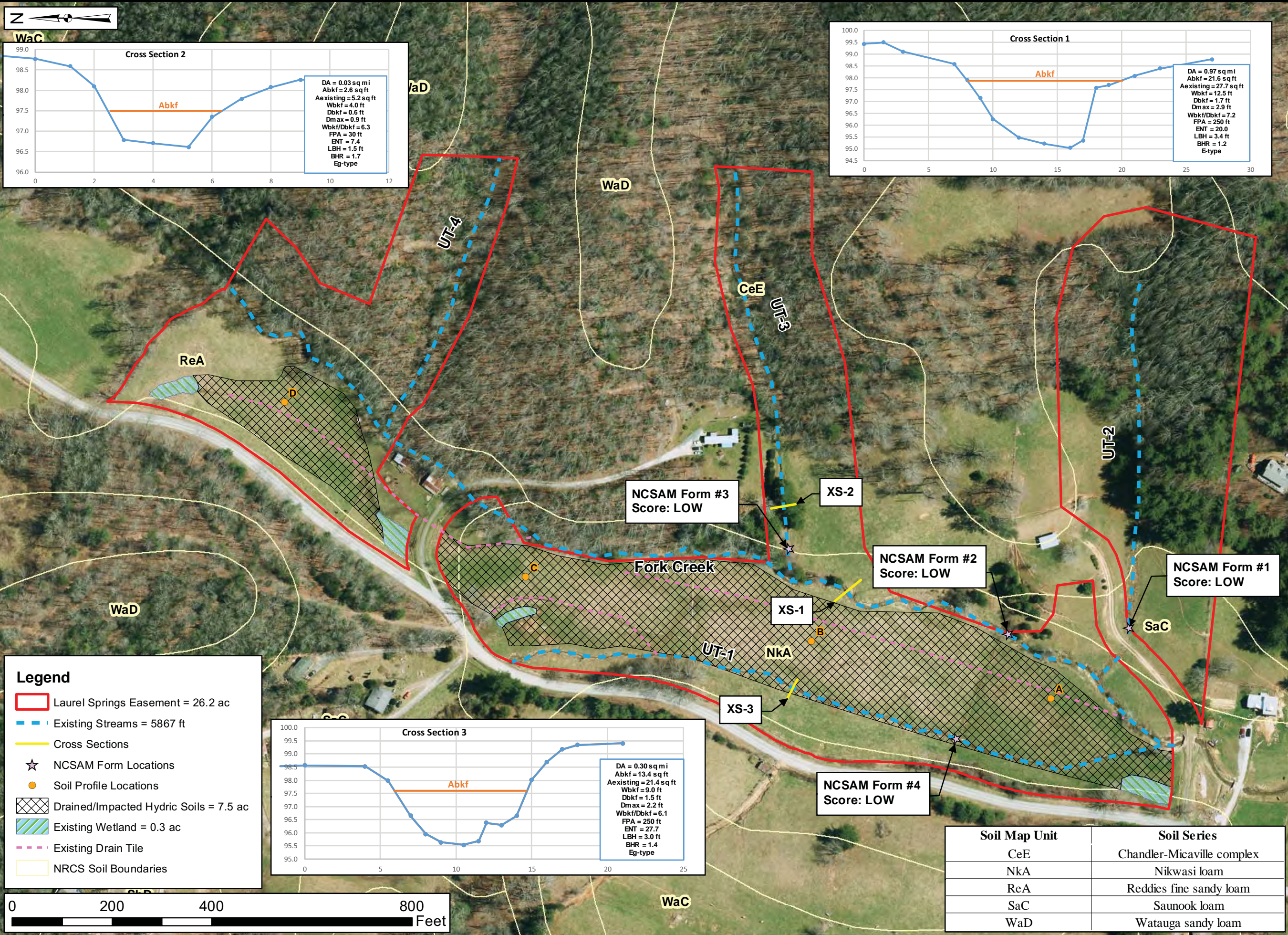
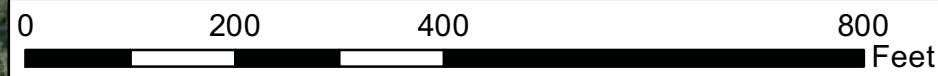
FIGURE

**3**





- Legend**
- Laurel Springs Easement = 26.2 ac
  - Existing Streams = 5867 ft
  - Cross Sections
  - ☆ NCSAM Form Locations
  - Soil Profile Locations
  - Drained/Impacted Hydric Soils = 7.5 ac
  - Existing Wetland = 0.3 ac
  - Existing Drain Tile
  - NRCS Soil Boundaries



Prepared for:  
**LAUREL SPRINGS MITIGATION SITE**

Avery County, NC

Title:  
**EXISTING CONDITIONS AND SOILS**

Drawn by: KRJ

Date: FEB 2019

Scale: 1:2200

Project No.: 19-001.01

Soil Map Unit	Soil Series
CeE	Chandler-Micaville complex
NkA	Nikwasi loam
ReA	Reddies fine sandy loam
SaC	Saunook loam
WaD	Watauga sandy loam

FIGURE  
**4**





Prepared for:



Project:

**LAUREL SPRINGS  
MITIGATION SITE**

Avery County, NC

Title:

**PROPOSED  
CONDITIONS**

Drawn by:

KRJ

Date:

FEB 2019

Scale:

1:2200

Project No.:

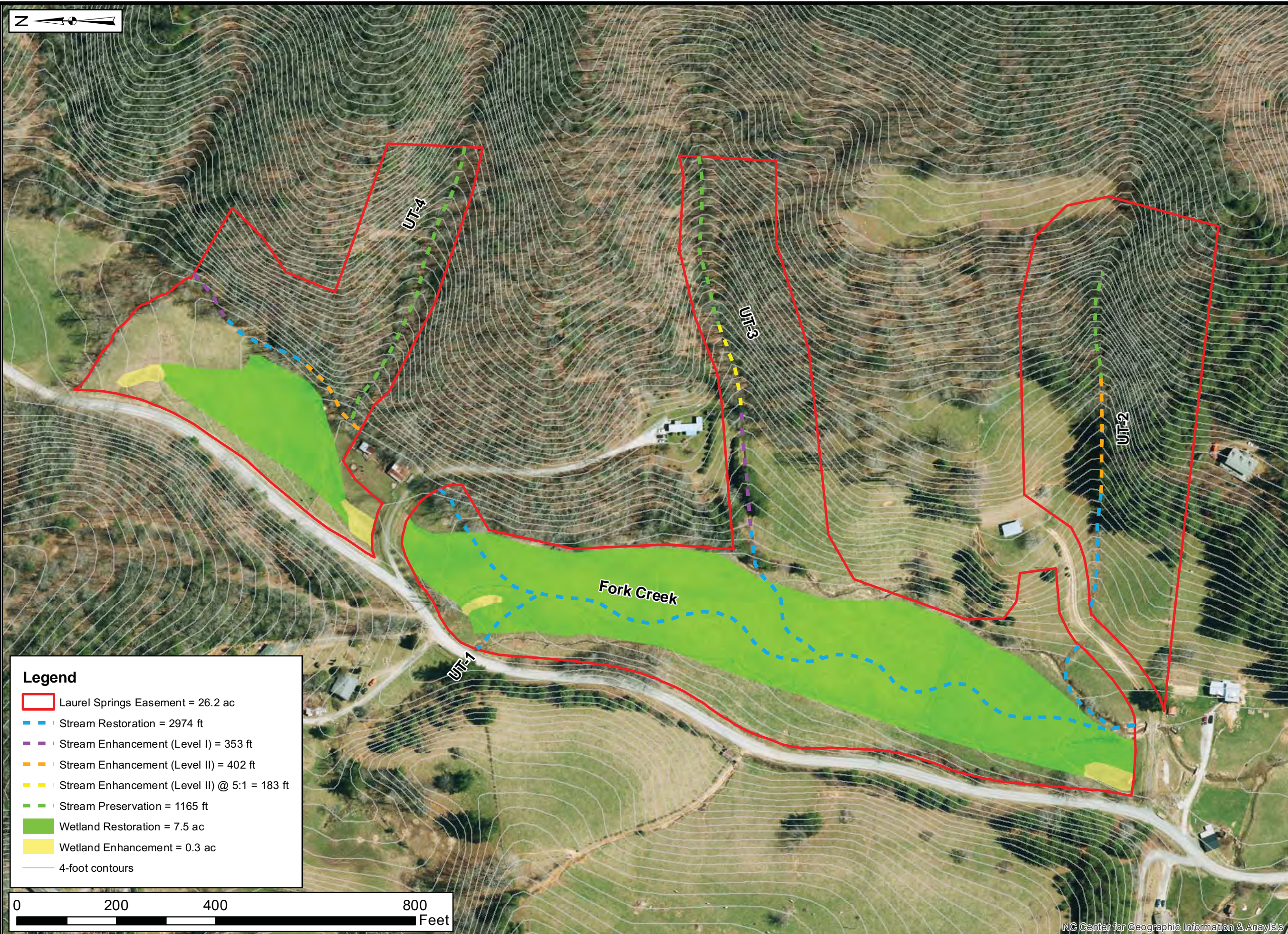
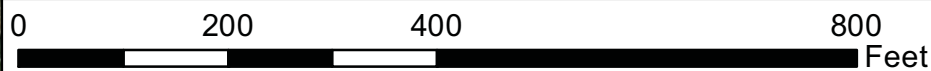
19-001.01

FIGURE

**5**

**Legend**

- Laurel Springs Easement = 26.2 ac
- Stream Restoration = 2974 ft
- Stream Enhancement (Level I) = 353 ft
- Stream Enhancement (Level II) = 402 ft
- Stream Enhancement (Level II) @ 5:1 = 183 ft
- Stream Preservation = 1165 ft
- Wetland Restoration = 7.5 ac
- Wetland Enhancement = 0.3 ac
- 4-foot contours







**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

July 12, 2019

JD Hamby  
Restoration Systems, LLC  
1101 Haynes Street, Suite 211  
Raleigh, NC 27604

Re: Laurel Springs Mitigation Site, Avery County, ER 19-1900

Dear Mr. Hamby:

Thank you for your letter of June 6, 2019, concerning the above project.

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

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

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

Sincerely,

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

*for* Ramona Bartos, Deputy  
State Historic Preservation Officer



6/5/2019

Mr. and Mrs. Willis  
3719 Snow Creek Rd  
Bakersville, NC 28705

Dear Mr. & Mrs. Willis:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Avery County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490.

Sincerely,

A handwritten signature in black ink that reads 'JD Hamby'.

JD Hamby  
Project Manager





6/5/2019

Mr. and Mrs. Wise  
964 Little Buck Hill Rd  
Newland, NC 28657

Dear Mr. & Mrs. Wise:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Avery County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490.

Sincerely,

A handwritten signature in black ink that reads 'JD Hamby'.

JD Hamby  
Project Manager



NORTH CAROLINA  
Environmental Quality

ROY COOPER  
Governor

MICHAEL S. REGAN  
Secretary

TIM BAUMGARTNER  
Director

6/18/19

Elizabeth Toombs  
Cherokee Nation  
Tribal Historic Preservation Office  
P.O. Box 948  
Tahlequah, OK 74465  
[elizabeth-toombs@cherokee.org](mailto: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 concerning archaeological or cultural resources associated with the proposed Laurel Springs Stream Mitigation Site (Project). 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 USGS 7.5 Minute Topographic Map (Linville Falls, Newland, Carvers Gap, and Spruce Pine, NC Quads). The project location (Latitude and Longitude) is as follows: 35.99446, -81.98238.

Located in southern Avery County, the Site is 8 miles southwest of Linville and 7 miles northeast of Spruce Pine. The Project will help restore and protect water quality in the 14-digit Cataloging Unit and Targeted Local Watershed 06010108010020; along Fork Creek and unnamed tributaries to Fork Creek.

Currently, the site consists of open grassy fields used for livestock grazing and pasture. Disturbed and managed forest do exist along the edge of the pasture and sloped areas of the property. Historic channelization, unrestricted livestock access, and the management/removal of riparian buffers have impacted Project streams. As a result, Project streams are incised, unstable, and exhibit areas of active bank erosion from high flows, hoof shear, and raw banks. Riparian buffer vegetation varies from areas with no woody buffer vegetation to areas with large trees but at low density and without any significant understory. Sparse residential development and similar landuse conditions as those found within the Project, comprise the surrounding area.

The Project will include restoration, enhancement, and preservation of 5,077 linear feet stream channel along with an undetermined amount of reestablished riparian wetlands. Site



alterations include the cessation of livestock grazing in the riparian zone and access to stream channels, restoration of streams and wetlands, and planting native, woody vegetation within the entire Project. A conservation easement will preserve the Project in perpetuity, protecting the property from future development and agricultural uses.

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](mailto: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







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**CHEROKEE NATION**<sup>®</sup>  
P.O. Box 948 • Tahlequah, OK 74465-0948 • 918-453-5000 • [cherokee.org](http://cherokee.org)

**Office of the Chief**

Bill John Baker  
*Principal Chief*  
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S. Joe Crittenden  
*Deputy Principal Chief*  
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July 17, 2019

Paul Weisner  
North Carolina Department of Environmental Quality  
Western DMS Field Office  
5 Ravenscroft Drive, Suite 102  
Asheville, NC 28801

Re: Laurel Springs Stream Mitigation Site

Mr. Paul Weisner:

The Cherokee Nation (Nation) is in receipt of your correspondence about **Laurel Springs Stream Mitigation Site**, 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 North Carolina Department of Environmental Quality (NCDEQ) 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 NCDEQ conduct appropriate inquiries with other pertinent Tribal and Historic Preservation Offices regarding historic and prehistoric resources not included in the Nation's databases or records.

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

Wado,

Elizabeth Toombs, Tribal Historic Preservation Officer  
Cherokee Nation Tribal Historic Preservation Office  
[elizabeth-toombs@cherokee.org](mailto:elizabeth-toombs@cherokee.org)  
918.453.5389



NORTH CAROLINA  
Environmental Quality

ROY COOPER  
Governor

MICHAEL S. REGAN  
Secretary

TIM BAUMGARTNER  
Director

6/18/19

Russell Townsend  
Tribal Historic Preservation Officer  
Tribal Historic Preservation Office  
Eastern Band of the Cherokee Indians  
[russtown@nc-chokeee.com](mailto:russtown@nc-chokeee.com)

Stephen Yerka  
Historic Preservation Specialist  
Tribal Historic Preservation Office  
Eastern Band of the Cherokee Indians  
[syerka@nc-chokeee.com](mailto:syerka@nc-chokeee.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 concerning archaeological or cultural resources associated with the proposed Laurel Springs Stream Mitigation Site (Project). 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 USGS 7.5 Minute Topographic Map (Linville Falls, Newland, Carvers Gap, and Spruce Pine, NC Quads). The project location (Latitude and Longitude) is as follows: 35.99446, -81.98238.

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Currently, the site consists of open grassy fields used for livestock grazing and pasture. Disturbed and managed forest do exist along the edge of the pasture and sloped areas of the property. Historic channelization, unrestricted livestock access, and the management/removal of riparian buffers have impacted Project streams. As a result, Project streams are incised, unstable, and exhibit areas of active bank erosion from high flows, hoof shear, and raw banks. Riparian buffer vegetation varies from areas with no woody buffer vegetation to



areas with large trees but at low density and without any significant understory. Sparse residential development and similar landuse conditions as those found within the Project, comprise the surrounding area.

The Project will include restoration, enhancement, and preservation of 5,077 linear feet stream channel along with an undetermined amount of reestablished riparian wetlands. Site alterations include the cessation of livestock grazing in the riparian zone and access to stream channels, restoration of streams and wetlands, and planting native, woody vegetation within the entire Project. A conservation easement will preserve the Project in perpetuity, protecting the property from future development and agricultural uses.

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](mailto: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

6/18/19

Tribal Historic Preservation Office  
United Keetoowah Band of Cherokee Indians in Oklahoma  
P. O. Box 746  
Tahlequah, OK 74465  
kpritchett@ukb-nsn.gov

To Whom it May Concern,

The North Carolina Department of Environmental Quality (NCDEQ) – Division of Mitigation Services (DMS) requests review and comment on any possible issues that might emerge concerning archaeological or cultural resources associated with the proposed Laurel Springs Stream Mitigation Site (Project). 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 USGS 7.5 Minute Topographic Map (Linville Falls, Newland, Carvers Gap, and Spruce Pine, NC Quads). The project location (Latitude and Longitude) is as follows: 35.99446, -81.98238.

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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](mailto: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 Wildlife Resources Commission ☒

---

Gordon Myers, Executive Director

June 28, 2019

JD Hamby  
Restoration Systems  
1101 Haynes St. Suite 211  
Raleigh, NC 27604

**SUBJECT:** Laurel Springs Mitigation Project

Dear Mr. Hamby:

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) received your June 6, 2019 letter regarding plans for a stream mitigation project on Fork Creek and unnamed tributaries in Avery County. You requested that we review and comment on any possible issues that might emerge with respect to the Fish and Wildlife Coordination Act 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 preservation, enhancement, and restoration on 5,077 ft of stream that will result in 4,000 ft of coldwater stream mitigation. An undetermined area of riparian wetland will also be restored.

Project activities should be avoided during the trout moratorium period of October 15 to April 15 in order to minimize impacts to Brown Trout and Rainbow Trout reproduction. 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  
Mountain Region Coordinator  
Habitat Conservation Program





Byron Hamstead  
160 Zillicoa St.  
Asheville, NC 28801

Dear Byron,

My name is JD Hamby, a project manager for Restoration Systems (RS), based in Raleigh, NC. We have been awarded a contract by the NC Division of Mitigation Services (DMS) to restore/enhance/preserve 5,077 feet of impaired stream channels in the French Broad 08 River Basin (Avery County).

One of the earliest tasks to be performed by RS is completion of an environmental screening and preparation/submittal of a Categorical Exclusion (CE) document. This document is specifically required by the Federal Highway Administration (FHWA) to ensure compliance with various federal environmental laws and regulations. The DMS must demonstrate that its projects comply with federal mandates as a precondition to FHWA reimbursement of compensatory mitigation costs borne by the North Carolina Department of Transportation to offset its projects' unavoidable impacts to streams and wetlands.

Since financial support of certain DMS operational budgets derives, in part, from federal authorizations, it is necessary to conduct an informal Section 7 consultation with the U.S. Fish and Wildlife Service (Service). As well as coordinate with your office on behalf of the Fish and Wildlife Coordination Act (FWCA) & the Migratory Bird Treaty Act (MBTA). This letter provides you with certain details about the Laurel Springs Mitigation Site, including the project's location, a general description of its physiography, hydrography and existing land uses, as well as the intended modifications to the site proposed by RS. In addition, should the project be located in a geographic area in which federally-listed species may be present (based on element occurrences, as reflected in Service listings), and if scientifically-sound practices have been used to confirm the presence of suitable habitat for any listed species within the project area, the results of appropriate surveys for each listed species and separate biological conclusions for each will be provided for your review and consideration. You are asked to review the information provided and determine if it is sufficient to enable you to concur with our biological conclusions.

Thank you for your time.

Best,

JD

**Threatened & Endangered Species**

Listed federally protected species are listed are summarized in the following table along with potential habitat and a preliminary biological conclusion for each (USFWS 2018).

**Table 7. Threatened and Endangered Species**

<b>Common Name (Scientific Name)</b>	<b>Biological Conclusion</b>	<b>ESA Section 7/ Eagle Determination Act</b>	<b>Summary</b>
Carolina northern flying squirrel <i>(Glaucomys sabrinus coloratus)</i>	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.
Gray Bat <i>(Myotis grisescens)</i>	Suitable habitat present, species not present	May Affect, not likely to adversely affect	Foraging habitat present within the Site; however, no roosting habitat with the Site boundaries or near the Site. Foraging habitat will not be disturbed during summer months.
Northern long-eared bat <i>(Myotis septentrionalis)</i>	Suitable habitat present, species not present	May Affect, not likely to adversely affect	*(See Northern long-eared information below)
Virginia big-eared bat <i>(Corynorhinus townsendii virginianus)</i>	Suitable habitat present, species not present	May Affect, not likely to adversely affect	Foraging habitat present within the Site; however, no roosting habitat with the Site boundaries or near the Site. Foraging habitat will not be disturbed during summer months.
Spruce-fir moss spider <i>(Microhexura montivaga)</i>	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.
Blue Ridge goldenrod <i>(Solidago spithamea)</i>	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.

Roan mountain bluet <i>(Hedyotis purpurea var. montana)</i>	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.
Heller's blazing star <i>(Liatris helleri)</i>	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.
Spreading avens <i>(Geum radiatum)</i>	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.
Rock gnome lichen <i>(Gymnoderma lineare)</i>	No suitable habitat present	No Effect	No habitat exists in or near the project boundaries.

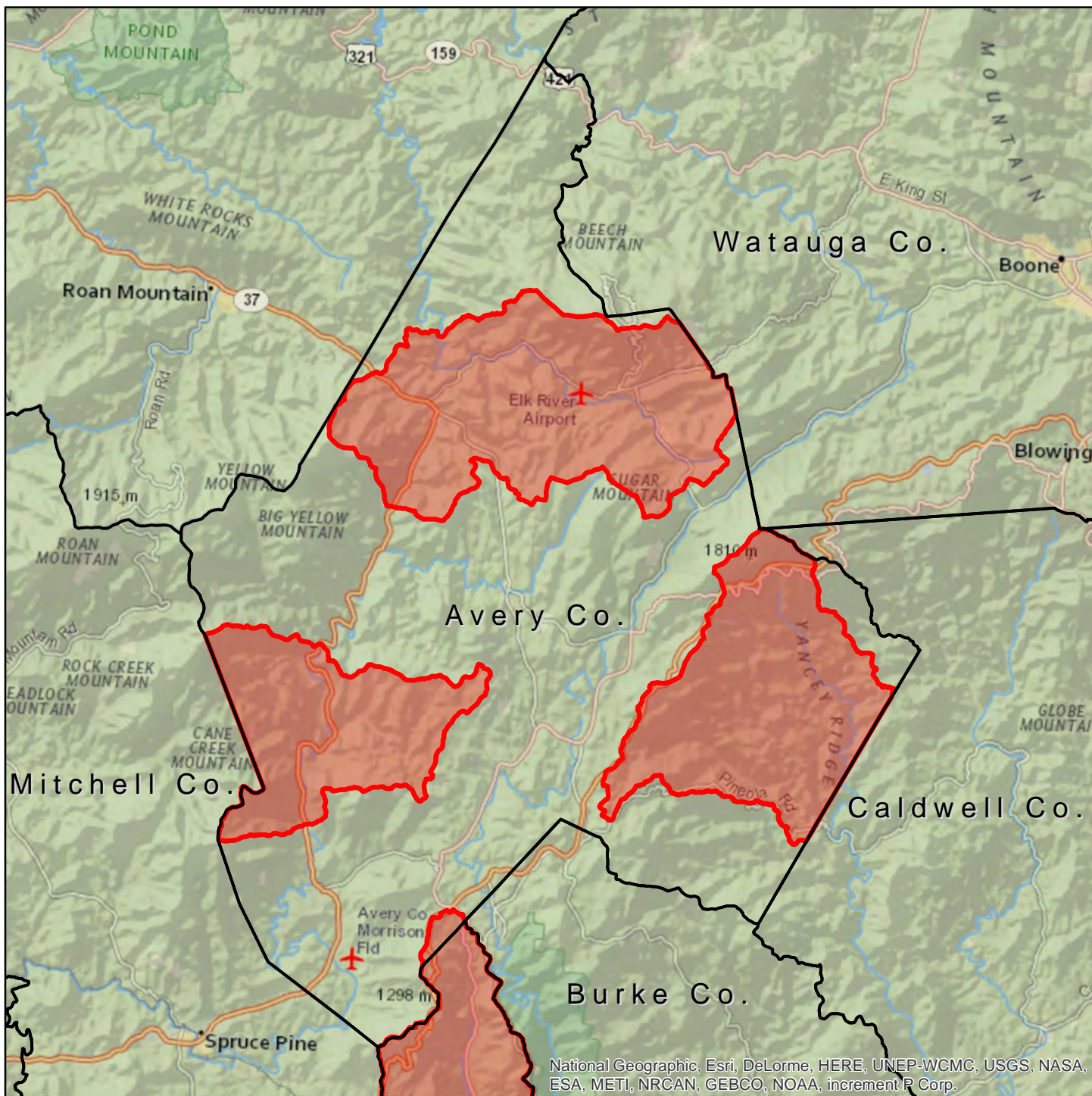
\*Northern Long-Eared Bat

A review of the United States Fish and Wildlife Service (USFWS) Asheville Ecological Services Field Office web page ([https://www.fws.gov/asheville/pdfs/NLEB-4DRule-AveryUpdate\\_June1\\_2016.pdf](https://www.fws.gov/asheville/pdfs/NLEB-4DRule-AveryUpdate_June1_2016.pdf)) on February 8, 2019, indicated the Site's watershed has no confirmed hibernation or maternity sites for this species. Further coordination with the USFWS will occur throughout the project in support of this species; however, at this time no additional surveys are expected for the Northern Long-Eared Bat.







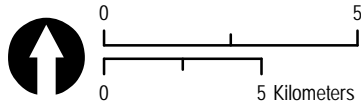
U.S. Fish & Wildlife Service  
**Northern Long-Eared Bat Consultation Areas**  
 Avery County



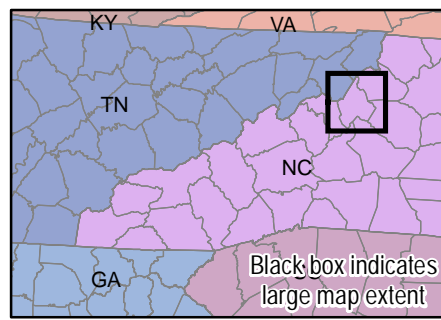
National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

-  North Carolina County Boundary
-  Watersheds with Known NLEB Maternity Trees or Hibernation Sites

**If your project falls within the red areas identified in Avery County, please contact the USFWS Asheville Field Office.**



USFWS Ecological Services  
 Asheville, North Carolina  
 Map Date: 6/1/2016



Black box indicates large map extent



# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

Asheville Field Office  
160 Zillicoa Street  
Asheville, North Carolina 28801

September 4, 2019

John Hamby  
Restoration Systems, LLC  
1101 Haynes Street, Suite 211  
Raleigh, North Carolina 27604

Dear Mr. Hamby:

Subject: Laurel Springs Mitigation Project; Avery County, North Carolina  
Log No. 4-2-19-358

The U.S. Fish and Wildlife Service (Service) has reviewed the information provided in your updated correspondence received via email on September 4, 2019, wherein you solicit comments regarding potential impacts to federally protected species that may result from the proposed project. We submit the following comments in accordance with the provisions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e); the National Environmental Policy Act (42 U.S.C. §4321 et seq.); and section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) (Act).

### Project Description

According to the information provided, the proposed project aims to restore, enhance, and/or preserve approximately 5,077 linear feet of stream channel (Fork Creek and its unnamed tributaries) near Crossnore, North Carolina. The proposed work area and adjacent uplands are dominated by agricultural land cover, and some successional forest adjacent to pasture. Instream habitats appear to be highly disturbed from associated land uses and ranked “low” according to NCSAM at four locations onsite. Approximately 0.3 acre of unforested wetlands also occur within the 26.2 acre easement area.

### Federally Listed Endangered and Threatened Species

According to Service records, suitable summer roosting habitat may be present in the project area for the federally threatened northern long-eared bat (*Myotis septentrionalis*), and multiple mist net captures of this animal occur in the project vicinity. However, the project would occur at a location where any incidental take that may result from associated activities is exempt under the 4(d) rule for this species<sup>1</sup>. Although not required, we encourage you to avoid associated tree clearing activities during the maternity roosting season from May 15 – August 15, and particularly during the pup season for this species (**June 1 – July 31**).

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<sup>1</sup> The Service believes that the apparently minor extent of tree clearing and your commitment to ensure that roosting habitats would not be disturbed during summer months reduces the probability for take of this species to a level we would consider insignificant and discountable. Therefore, we would alternatively concur with an action agency determination that the proposed project “may affect, but is not likely to adversely affect” this species.

Service records indicate no known occurrences of the federally endangered gray bat (*Myotis grisescens*), and Virginia big-eared bat (*Corynorhinus townsendii virginianus*) in the vicinity of the proposed project, although potential suitable forage habitat is present onsite. We appreciate your commitment to ensure that these habitats would not be disturbed during summer months. Therefore, we would concur with an action agency determination that the proposed project “may affect, but is not likely to adversely affect these species.”

In the interest of protecting habitats for bat species, tree removal should be selective and clearing of vegetation should be minimized to what is necessary to provide healthy streambank and bed habitats. Reaches with well-vegetated riparian areas should be first considered for preservation, rather than for restoration or enhancement activities to preclude unwarranted disturbances to existing habitats.

According to our records and a review of the information you provided, no other federally listed species or their habitats occur onsite. Therefore, we believe the requirements under section 7 of the Act are fulfilled and we require no further action at this time. However, obligations under section 7 of the Act must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered, (2) this action is subsequently modified in a manner that was not considered in this review, or (3) a new species is listed or critical habitat is determined that may be affected by the identified action.

We offer the following general recommendations in the interest of protecting natural resources:  
Stream Channel and Bank Restoration

A natural, stable stream system is one that is able to transport a wide range of flows and associated sediment bed load while maintaining channel features and neither degrading nor aggrading. Alterations to the dimension, pattern, or profile of the stream channel as well as changes to streambank vegetation, floodplains, hydrology, or sediment input can significantly alter this equilibrium. We understand that this stream reach is highly modified, and restoring the site to a natural state may not be feasible. Still we offer the following recommendations:

1. Only the absolute minimum amount of work should be done within stream channels to accomplish necessary reconstruction. **The amount of disturbance to in-stream and riparian areas should not exceed what will be stabilized by the end of the workday.** Restoration plans should account for the constraints of the site and the opportunities to improve stream pattern, dimension, and profile with minimal disturbance.
2. Reconstruction work should follow natural channel design methodologies that are based on the bank-full, or channel-forming, stage of the stream. Bank-full stage maintains the natural channel dimensions and transports the bulk of sediment over time. Natural channel conditions should be identified using a reference reach (nearby stream reaches that exemplify restoration goals). Restoration design should match the pattern, dimension, and profile of the reference reach to ensure the project’s success.
3. All work in or adjacent to stream waters should be conducted in a dry work area to the extent possible. Sandbags, cofferdams, bladder dams, or other diversion structures



should be used to prevent excavation in flowing water. These diversion structures should be removed as soon as the work area is stable.

4. Equipment should not be operated in the stream unless absolutely necessary. Machinery should be operated from the banks in a fashion that minimizes disturbance to woody vegetation. Equipment should be: (a) washed to remove any contaminant residue prior to project construction, (b) in good working order, and (c) checked to ensure there are no leaks of potential contaminants (such as oil or other lubricants) prior to and during construction.
5. Streambanks with deep-rooted woody vegetation are the most stable, and stream restoration efforts should incorporate the use of native vegetation adapted to the site conditions. Live dormant stakes may be used to reestablish root structure in riparian areas. In areas where banks are severely undercut, high, and steep, whole-tree revetment or rock may be used as a stabilization treatment (small rock, gravel, sand, and dirt are not recommended due to their erosive nature), and it should not extend above the bank-full elevation (the elevation of the channel where the natural floodplain begins). Deep-rooting woody vegetation should be established along banks where any channel work is accomplished. Tree and shrub plantings should be spaced at intervals no greater than 10 feet along banks. Vegetated riparian zone widths should be as wide as practical but should extend at least 30 feet from the stream channel.
6. Adequate measures to control sediment and erosion must be implemented prior to any ground-disturbing activities in order to minimize effects on downstream aquatic resources. In North Carolina, non-cohesive and erosion-prone soils are most common in the felsic-crystalline terrains of the mountain and upper piedmont regions. Therefore, reconstruction work should be staged such that disturbed areas would be stabilized with seeding, mulch, and/or biodegradable (coir) erosion-control matting prior to the end of each workday. **No erosion-control matting or blankets should contain synthetic (netting) materials as they trap animals and can persist in the environment beyond their intended purpose.** Matting should be secured in place with staples; stakes; or, wherever possible, live stakes of native trees. If rain is expected prior to temporary seed establishment, additional measures should be implemented to protect water quality along slopes and overburden stockpiles (for example, stockpiles may be covered with plastic or other geotextile material and surrounded with silt fencing).

The Service appreciates the opportunity to provide these comments. Please contact Mr. Byron Hamstead of our staff at 828/258-3939, Ext. 42225, if you have any questions. In any future correspondence concerning this project, please reference our Log Number 4-2-19-358.

Sincerely,  
-- original signed --  
Janet Mizzi  
Field Supervisor



# United States Department of the Interior



FISH AND WILDLIFE SERVICE  
Asheville Ecological Services Field Office  
160 Zillicoa Street  
Asheville, NC 28801-1082  
Phone: (828) 258-3939 Fax: (828) 258-5330  
<http://www.fws.gov/nc-es/es/countyfr.html>

In Reply Refer To:  
Consultation Code: 04EN1000-2019-SLI-0357  
Event Code: 04EN1000-2019-E-00928  
Project Name: Laurel Springs

May 21, 2019

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

## To Whom It May Concern:

The attached species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. Although not required by section 7, many agencies request species lists to start the informal consultation process and begin their fulfillment of the requirements under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

This list, along with other helpful resources, is also available on the U.S. Fish and Wildlife Service (Service) Asheville Field Office's (AFO) website: [https://www.fws.gov/raleigh/species/cntylist/nc\\_counties.html](https://www.fws.gov/raleigh/species/cntylist/nc_counties.html). The AFO website list includes “species of concern” species that could potentially be placed on the federal list of threatened and endangered species in the future. Also available are:

Design and Construction Recommendations  
[https://www.fws.gov/asheville/htmls/project\\_review/Recommendations.html](https://www.fws.gov/asheville/htmls/project_review/Recommendations.html)

Optimal Survey Times for Federally Listed Plants  
[https://www.fws.gov/nc-es/plant/plant\\_survey.html](https://www.fws.gov/nc-es/plant/plant_survey.html)

Northern long-eared bat Guidance  
[https://www.fws.gov/asheville/htmls/project\\_review/NLEB\\_in\\_WNC.html](https://www.fws.gov/asheville/htmls/project_review/NLEB_in_WNC.html)

Predictive Habitat Model for Aquatic Species  
<https://www.fws.gov/asheville/htmls/Maxent/Maxent.html>

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could require modifications of these lists. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of the species lists should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website or the AFO website (the AFO website dates each county list with the day of the most recent update/change) at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list or by going to the AFO website.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a Biological Evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12 and on our office's website at [https://www.fws.gov/asheville/htmls/project\\_review/assessment\\_guidance.html](https://www.fws.gov/asheville/htmls/project_review/assessment_guidance.html).

If a Federal agency (or their non-federal representative) determines, based on the Biological Assessment or Biological Evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species, and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at: <http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>.

Though the bald eagle is no longer protected under the Endangered Species Act, please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require additional consultation (see <https://www.fws.gov/southeast/our-services/permits/eagles/>). Wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds (including bald and golden eagles) and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://>

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[www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm](http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm);  
<http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
  - Migratory Birds
  - Wetlands
-

# Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

**Asheville Ecological Services Field Office**

160 Zillicoa Street

Asheville, NC 28801-1082

(828) 258-3939

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## Project Summary

Consultation Code: 04EN1000-2019-SLI-0357

Event Code: 04EN1000-2019-E-00928

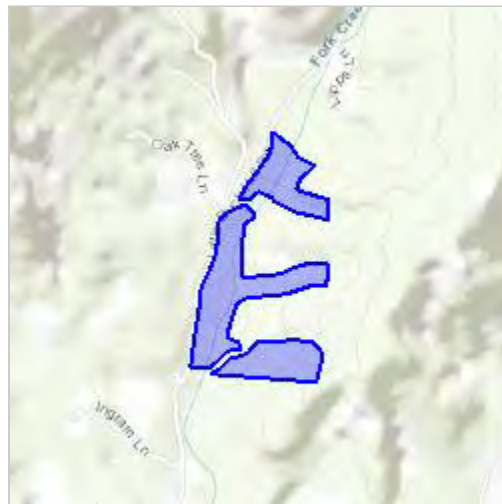
Project Name: Laurel Springs

Project Type: STREAM / WATERBODY / CANALS / LEVEES / DIKES

Project Description: Stream and wetland restoration project for NC DMS

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/place/35.9942010055465N81.98124359630691W>



Counties: Avery, NC

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## Endangered Species Act Species

There is a total of 10 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries<sup>1</sup>, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

### Mammals

NAME	STATUS
Carolina Northern Flying Squirrel <i>Glaucomys sabrinus coloratus</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/2657">https://ecos.fws.gov/ecp/species/2657</a>	Endangered
Gray Bat <i>Myotis grisescens</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/6329">https://ecos.fws.gov/ecp/species/6329</a>	Endangered
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/9045">https://ecos.fws.gov/ecp/species/9045</a>	Threatened
Virginia Big-eared Bat <i>Corynorhinus (=Plecotus) townsendii virginianus</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. Species profile: <a href="https://ecos.fws.gov/ecp/species/8369">https://ecos.fws.gov/ecp/species/8369</a>	Endangered

### Arachnids

NAME	STATUS
Spruce-fir Moss Spider <i>Microhexura montivaga</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. Species profile: <a href="https://ecos.fws.gov/ecp/species/4801">https://ecos.fws.gov/ecp/species/4801</a>	Endangered

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## Flowering Plants

NAME	STATUS
Blue Ridge Goldenrod <i>Solidago spithamaea</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/5821">https://ecos.fws.gov/ecp/species/5821</a>	Threatened
Heller's Blazingstar <i>Liatris helleri</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/5962">https://ecos.fws.gov/ecp/species/5962</a>	Threatened
Roan Mountain Bluet <i>Hedyotis purpurea var. montana</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/1087">https://ecos.fws.gov/ecp/species/1087</a>	Endangered
Spreading Avens <i>Geum radiatum</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/6854">https://ecos.fws.gov/ecp/species/6854</a>	Endangered

## Lichens

NAME	STATUS
Rock Gnome Lichen <i>Gymnoderma lineare</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/3933">https://ecos.fws.gov/ecp/species/3933</a>	Endangered

## Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

# Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act<sup>1</sup> and the Bald and Golden Eagle Protection Act<sup>2</sup>.

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

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1. The [Migratory Birds Treaty Act](#) of 1918.
  2. The [Bald and Golden Eagle Protection Act](#) of 1940.
  3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle <i>Haliaeetus leucocephalus</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. <a href="https://ecos.fws.gov/ecp/species/1626">https://ecos.fws.gov/ecp/species/1626</a>	Breeds Sep 1 to Aug 31
Canada Warbler <i>Cardellina canadensis</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10

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NAME	BREEDING SEASON
Prairie Warbler <i>Dendroica discolor</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Wood Thrush <i>Hylocichla mustelina</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

## Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ “Proper Interpretation and Use of Your Migratory Bird Report” before using or attempting to interpret this report.

### Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is  $0.25/0.25 = 1$ ; at week 20 it is  $0.05/0.25 = 0.2$ .
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

### Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

### Survey Effort (|)

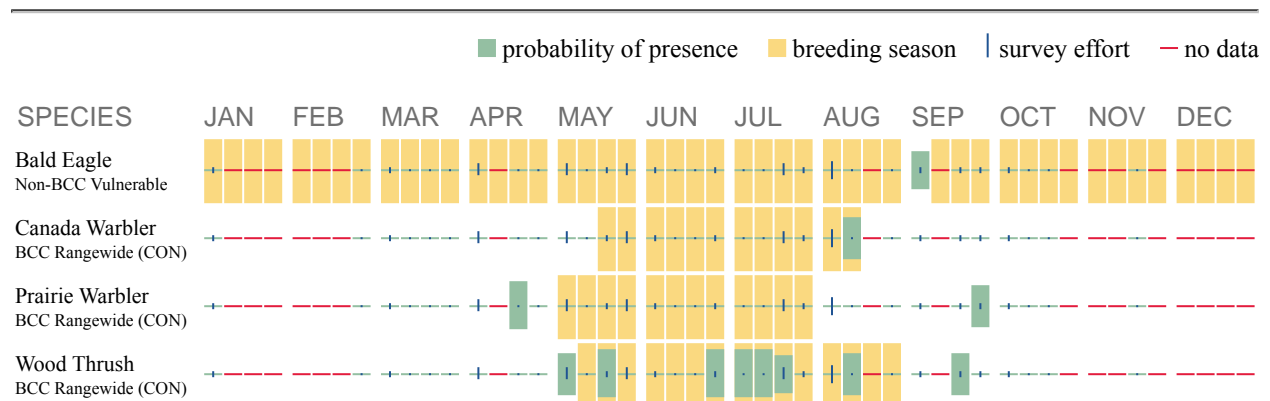
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

### No Data (-)

A week is marked as having no data if there were no survey events for that week.

### Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
- Measures for avoiding and minimizing impacts to birds <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
- Nationwide conservation measures for birds <http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf>

## Migratory Birds FAQ

**Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.**

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) and/or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

### **What does IPaC use to generate the migratory birds potentially occurring in my specified location?**

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [AKN Phenology Tool](#).

### **What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?**

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

### **How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?**

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: [The Cornell Lab of Ornithology All About Birds Bird Guide](#), or (if you are unsuccessful in locating the bird of interest there), the [Cornell Lab of Ornithology Neotropical Birds guide](#). If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your



project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

### **What are the levels of concern for migratory birds?**

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

### **Details about birds that are potentially affected by offshore projects**

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

### **What if I have eagles on my list?**

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

### **Proper Interpretation and Use of Your Migratory Bird Report**

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location?". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that

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overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the “no data” indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ “Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds” at the bottom of your migratory bird trust resources page.

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# Wetlands

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

## RIVERINE

- [R5UBH](#)
  - [R4SBC](#)
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## United States Department of the Interior



FISH AND WILDLIFE SERVICE  
Asheville Ecological Services Field Office  
160 Zillicoa Street  
Asheville, NC 28801-1082  
Phone: (828) 258-3939 Fax: (828) 258-5330  
<http://www.fws.gov/nc-es/es/countyfr.html>

In Reply Refer To:

May 21, 2019

Consultation Code: 04EN1000-2019-SLI-0357

Event Code: 04EN1000-2019-E-00928

Project Name: Laurel Springs

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The attached species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. Although not required by section 7, many agencies request species lists to start the informal consultation process and begin their fulfillment of the requirements under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

This list, along with other helpful resources, is also available on the U.S. Fish and Wildlife Service (Service) Asheville Field Office's (AFO) website: [https://www.fws.gov/raleigh/species/cntylist/nc\\_counties.html](https://www.fws.gov/raleigh/species/cntylist/nc_counties.html). The AFO website list includes “species of concern” species that could potentially be placed on the federal list of threatened and endangered species in the future. Also available are:

Design and Construction Recommendations

[https://www.fws.gov/asheville/htmls/project\\_review/Recommendations.html](https://www.fws.gov/asheville/htmls/project_review/Recommendations.html)

Optimal Survey Times for Federally Listed Plants

[https://www.fws.gov/nc-es/plant/plant\\_survey.html](https://www.fws.gov/nc-es/plant/plant_survey.html)

Northern long-eared bat Guidance

[https://www.fws.gov/asheville/htmls/project\\_review/NLEB\\_in\\_WNC.html](https://www.fws.gov/asheville/htmls/project_review/NLEB_in_WNC.html)

Predictive Habitat Model for Aquatic Species

<https://www.fws.gov/asheville/htmls/Maxent/Maxent.html>

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could require modifications of these lists. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of the species lists should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website or the AFO website (the AFO website dates each county list with the day of the most recent update/change) at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list or by going to the AFO website.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a Biological Evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12 and on our office's website at [https://www.fws.gov/asheville/htmls/project\\_review/assessment\\_guidance.html](https://www.fws.gov/asheville/htmls/project_review/assessment_guidance.html).

If a Federal agency (or their non-federal representative) determines, based on the Biological Assessment or Biological Evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species, and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at: <http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>.

Though the bald eagle is no longer protected under the Endangered Species Act, please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require additional consultation (see <https://www.fws.gov/southeast/our-services/permits/eagles/>). Wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds (including bald and golden eagles) and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://>

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[www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm](http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm);  
<http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
  - Migratory Birds
  - Wetlands
-

# Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

**Asheville Ecological Services Field Office**

160 Zillicoa Street

Asheville, NC 28801-1082

(828) 258-3939

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## Project Summary

Consultation Code: 04EN1000-2019-SLI-0357

Event Code: 04EN1000-2019-E-00928

Project Name: Laurel Springs

Project Type: STREAM / WATERBODY / CANALS / LEVEES / DIKES

Project Description: Stream and wetland restoration project for NC DMS

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/place/35.9942010055465N81.98124359630691W>



Counties: Avery, NC

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## Endangered Species Act Species

There is a total of 10 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries<sup>1</sup>, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

### Mammals

NAME	STATUS
Carolina Northern Flying Squirrel <i>Glaucomys sabrinus coloratus</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/2657">https://ecos.fws.gov/ecp/species/2657</a>	Endangered
Gray Bat <i>Myotis grisescens</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/6329">https://ecos.fws.gov/ecp/species/6329</a>	Endangered
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/9045">https://ecos.fws.gov/ecp/species/9045</a>	Threatened
Virginia Big-eared Bat <i>Corynorhinus (=Plecotus) townsendii virginianus</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. Species profile: <a href="https://ecos.fws.gov/ecp/species/8369">https://ecos.fws.gov/ecp/species/8369</a>	Endangered

### Arachnids

NAME	STATUS
Spruce-fir Moss Spider <i>Microhexura montivaga</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. Species profile: <a href="https://ecos.fws.gov/ecp/species/4801">https://ecos.fws.gov/ecp/species/4801</a>	Endangered

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## Flowering Plants

NAME	STATUS
Blue Ridge Goldenrod <i>Solidago spithamaea</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/5821">https://ecos.fws.gov/ecp/species/5821</a>	Threatened
Heller's Blazingstar <i>Liatris helleri</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/5962">https://ecos.fws.gov/ecp/species/5962</a>	Threatened
Roan Mountain Bluet <i>Hedyotis purpurea var. montana</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/1087">https://ecos.fws.gov/ecp/species/1087</a>	Endangered
Spreading Avens <i>Geum radiatum</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/6854">https://ecos.fws.gov/ecp/species/6854</a>	Endangered

## Lichens

NAME	STATUS
Rock Gnome Lichen <i>Gymnoderma lineare</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/3933">https://ecos.fws.gov/ecp/species/3933</a>	Endangered

## Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

# Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act<sup>1</sup> and the Bald and Golden Eagle Protection Act<sup>2</sup>.

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

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1. The [Migratory Birds Treaty Act](#) of 1918.
  2. The [Bald and Golden Eagle Protection Act](#) of 1940.
  3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle <i>Haliaeetus leucocephalus</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. <a href="https://ecos.fws.gov/ecp/species/1626">https://ecos.fws.gov/ecp/species/1626</a>	Breeds Sep 1 to Aug 31
Canada Warbler <i>Cardellina canadensis</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10

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NAME	BREEDING SEASON
Prairie Warbler <i>Dendroica discolor</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Wood Thrush <i>Hylocichla mustelina</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

## Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ “Proper Interpretation and Use of Your Migratory Bird Report” before using or attempting to interpret this report.

### Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is  $0.25/0.25 = 1$ ; at week 20 it is  $0.05/0.25 = 0.2$ .
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

### Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

### Survey Effort (|)

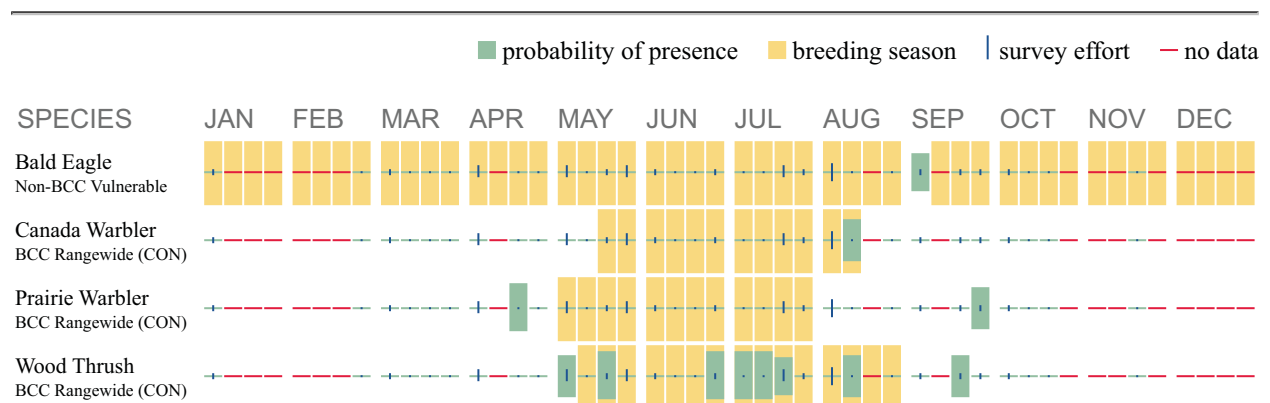
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

### No Data (-)

A week is marked as having no data if there were no survey events for that week.

### Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
- Measures for avoiding and minimizing impacts to birds <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
- Nationwide conservation measures for birds <http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf>

## Migratory Birds FAQ

**Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.**

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) and/or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

### **What does IPaC use to generate the migratory birds potentially occurring in my specified location?**

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [AKN Phenology Tool](#).

### **What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?**

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

### **How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?**

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: [The Cornell Lab of Ornithology All About Birds Bird Guide](#), or (if you are unsuccessful in locating the bird of interest there), the [Cornell Lab of Ornithology Neotropical Birds guide](#). If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your

project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

### **What are the levels of concern for migratory birds?**

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

### **Details about birds that are potentially affected by offshore projects**

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

### **What if I have eagles on my list?**

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

### **Proper Interpretation and Use of Your Migratory Bird Report**

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that

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overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the “no data” indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ “Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds” at the bottom of your migratory bird trust resources page.

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# Wetlands

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

## RIVERINE

- [R5UBH](#)
  - [R4SBC](#)
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**FARMLAND CONVERSION IMPACT RATING**

<b>PART I</b> (To be completed by Federal Agency)		Date Of Land Evaluation Request 06/07/2019				
Name of Project Laurel Springs Mitigation		Federal Agency Involved FHWA				
Proposed Land Use Mitigation site		County and State Avery County, North Carolina				
<b>PART II</b> (To be completed by NRCS)		Date Request Received By NRCS 06/07/2019		Person Completing Form: Milton Cortes, NRCS, NC		
Does the site contain Prime, Unique, Statewide or Local Important Farmland? (If no, the FPPA does not apply - do not complete additional parts of this form)		YES <input type="checkbox"/>	NO <input type="checkbox"/>	Acres Irrigated none	Average Farm Size 58 acres	
Major Crop(s) <b>CORN</b>	Farmable Land In Govt. Jurisdiction Acres: 31,938 acres 20.2%	Amount of Farmland As Defined in FPPA Acres: 22,925 acres 14.5%				
Name of Land Evaluation System Used Avery County, NC LESA	Name of State or Local Site Assessment System N/A	Date Land Evaluation Returned by NRCS , 2019 by eMail				
<b>PART III</b> (To be completed by Federal Agency)		Alternative Site Rating				
		Site A	Site B	Site C	Site D	
A. Total Acres To Be Converted Directly		26.10				
B. Total Acres To Be Converted Indirectly		-				
C. Total Acres In Site		26.10				
<b>PART IV</b> (To be completed by NRCS) Land Evaluation Information						
A. Total Acres Prime And Unique Farmland		3.40				
B. Total Acres Statewide Important or Local Important Farmland		2.30				
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted		0.0249				
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value		18.1				
<b>PART V</b> (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)		25				
<b>PART VI</b> (To be completed by Federal Agency) Site Assessment Criteria (Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)		<b>Maximum Points</b>	Site A	Site B	Site C	Site D
1. Area In Non-urban Use		(15)	15			
2. Perimeter In Non-urban Use		(10)	10			
3. Percent Of Site Being Farmed		(20)	11			
4. Protection Provided By State and Local Government		(20)	20			
5. Distance From Urban Built-up Area		(15)	15			
6. Distance To Urban Support Services		(15)	0			
7. Size Of Present Farm Unit Compared To Average		(10)	3			
8. Creation Of Non-farmable Farmland		(10)	0			
9. Availability Of Farm Support Services		(5)	4			
10. On-Farm Investments		(20)	4			
11. Effects Of Conversion On Farm Support Services		(10)	0			
12. Compatibility With Existing Agricultural Use		(10)	0			
TOTAL SITE ASSESSMENT POINTS		160	82	0	0	0
<b>PART VII</b> (To be completed by Federal Agency)						
Relative Value Of Farmland (From Part V)		100	25	0	0	0
Total Site Assessment (From Part VI above or local site assessment)		160	82	0	0	0
<b>TOTAL POINTS (Total of above 2 lines)</b>		260	107	0	0	0
Site Selected: Yes		Date Of Selection 7/16/2019		Was A Local Site Assessment Used? YES <input type="checkbox"/> NO <input type="checkbox"/>		
Reason For Selection: Fits stream and wetland restoration need for the watershed						
Name of Federal agency representative completing this form: JD Hamby					Date: 7/16/2019	

## STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

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

## INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

*(For Federal Agency)*

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

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

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

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

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

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

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

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

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

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



**Laurel Springs**

964 Little Buck Hill Rd.

Newland, NC 28657

Inquiry Number: 5704627.2s

July 01, 2019

# The EDR Radius Map™ Report with GeoCheck®



6 Armstrong Road, 4th floor  
Shelton, CT 06484  
Toll Free: 800.352.0050  
[www.edrnet.com](http://www.edrnet.com)

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***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

964 LITTLE BUCK HILL RD.  
NEWLAND, NC 28657

#### COORDINATES

Latitude (North): 35.9913000 - 35° 59' 28.68"  
Longitude (West): 81.9837000 - 81° 59' 1.32"  
Universal Tranverse Mercator: Zone 17  
UTM X (Meters): 411328.2  
UTM Y (Meters): 3983230.5  
Elevation: 2903 ft. above sea level

### USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5948454 LINVILLE FALLS, NC
Version Date:	2013
Northeast Map:	5947565 NEWLAND, NC
Version Date:	2013
Southwest Map:	5948528 SPRUCE PINE, NC
Version Date:	2013
Northwest Map:	5946509 CARVERS GAP, NC
Version Date:	2013

### AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140702, 20141019
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:  
964 LITTLE BUCK HILL RD.  
NEWLAND, NC 28657

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
--------	-----------	---------	-------------------	--------------------	----------------------------

NO MAPPED SITES FOUND



# EXECUTIVE SUMMARY

## TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

## DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

## STANDARD ENVIRONMENTAL RECORDS

### ***Federal NPL site list***

NPL..... National Priority List  
Proposed NPL..... Proposed National Priority List Sites  
NPL LIENS..... Federal Superfund Liens

### ***Federal Delisted NPL site list***

Delisted NPL..... National Priority List Deletions

### ***Federal CERCLIS list***

FEDERAL FACILITY..... Federal Facility Site Information listing  
SEMS..... Superfund Enterprise Management System

### ***Federal CERCLIS NFRAP site list***

SEMS-ARCHIVE..... Superfund Enterprise Management System Archive

### ***Federal RCRA CORRACTS facilities list***

CORRACTS..... Corrective Action Report

### ***Federal RCRA non-CORRACTS TSD facilities list***

RCRA-TSDF..... RCRA - Treatment, Storage and Disposal

### ***Federal RCRA generators list***

RCRA-LQG..... RCRA - Large Quantity Generators  
RCRA-SQG..... RCRA - Small Quantity Generators  
RCRA-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***

LUST..... Regional UST Database

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***

INDIAN VCP..... Voluntary Cleanup Priority Listing

VCP..... Responsible Party Voluntary Action Sites

### ***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
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### **Records of Emergency Release Reports**

HMIRS.....	Hazardous Materials Information Reporting System
SPILLS.....	Spills Incident Listing
IMD.....	Incident Management Database
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

## EXECUTIVE SUMMARY

US AIRS.....	Aerometric Information Retrieval System Facility Subsystem
US MINES.....	Mines Master Index File
ABANDONED MINES.....	Abandoned Mines
FINDS.....	Facility Index System/Facility Registry System
ECHO.....	Enforcement & Compliance History Information
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 not identified.

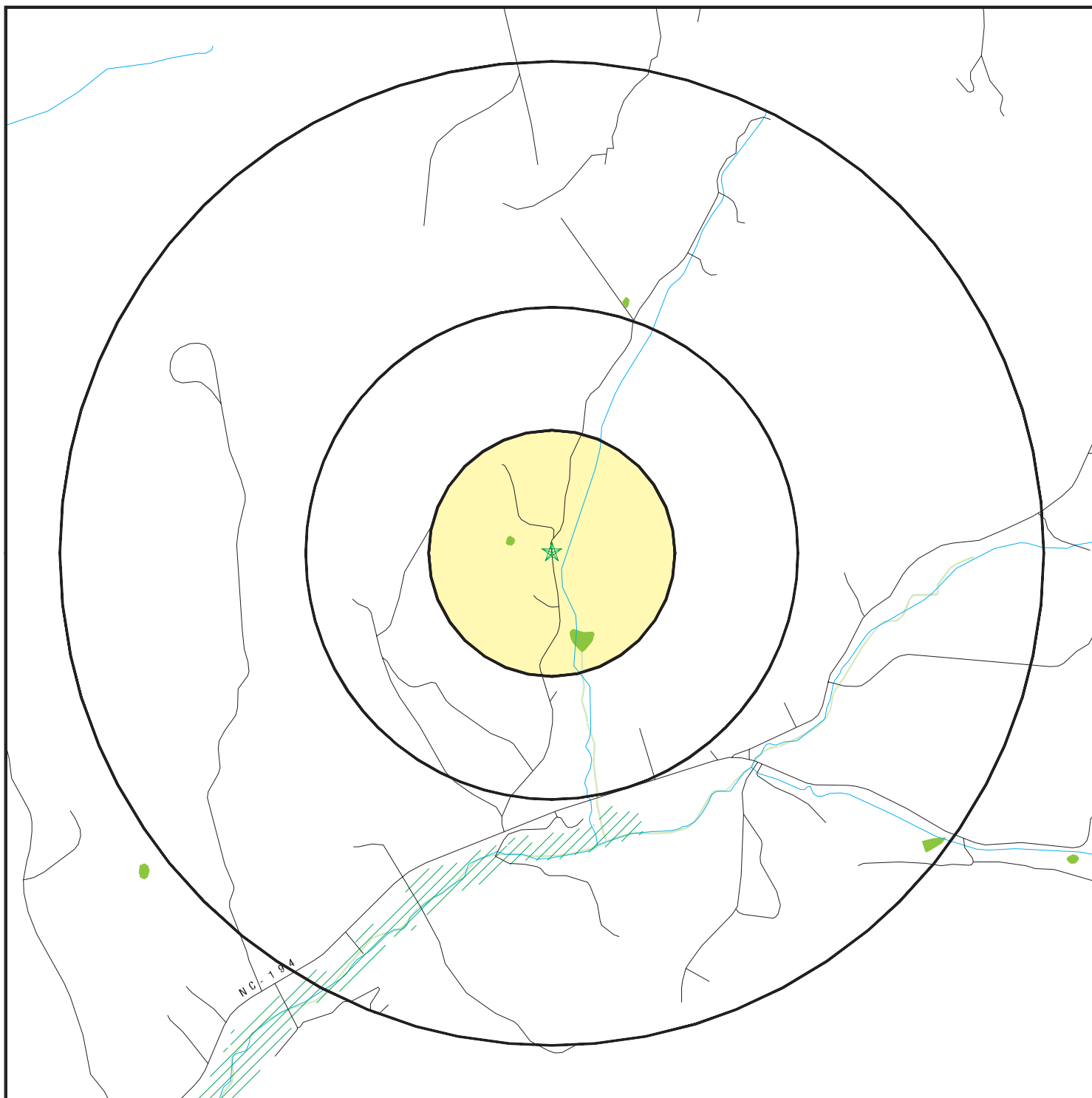
Unmappable (orphan) sites are not considered in the foregoing analysis.



## EXECUTIVE SUMMARY

There were no unmapped sites in this report.

# OVERVIEW MAP - 5704627.2S



- ★ 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

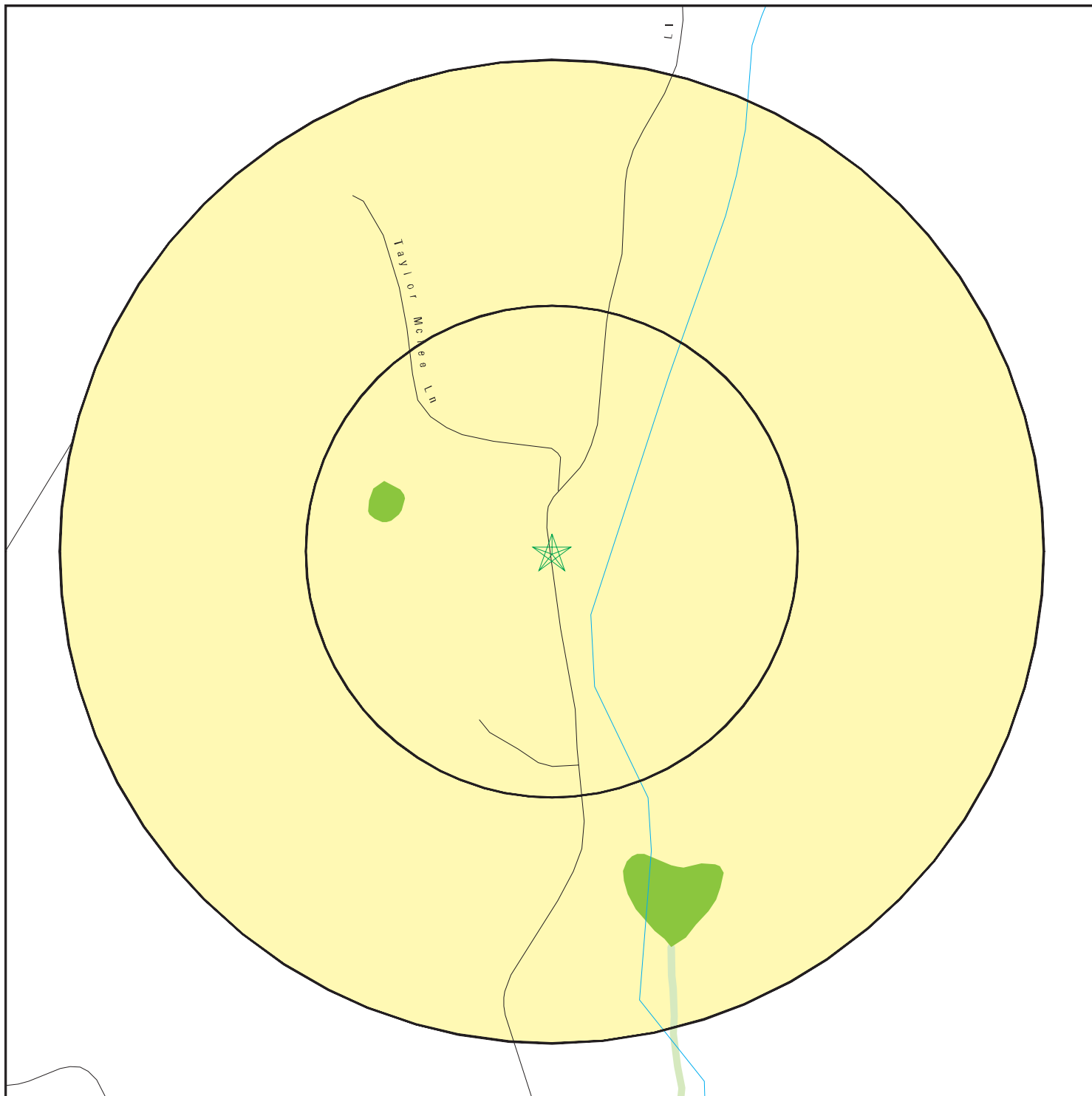


This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Laurel Springs  
 ADDRESS: 964 Little Buck Hill Rd.  
 Newland NC 28657  
 LAT/LONG: 35.9913 / 81.9837

CLIENT: Restoration Systems, LLC  
 CONTACT: JD Hamby  
 INQUIRY #: 5704627.2s  
 DATE: July 01, 2019 5:02 pm

# DETAIL MAP - 5704627.2S



- ★ 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: Laurel Springs  
 ADDRESS: 964 Little Buck Hill Rd.  
 Newland NC 28657  
 LAT/LONG: 35.9913 / 81.9837

CLIENT: Restoration Systems, LLC  
 CONTACT: JD Hamby  
 INQUIRY #: 5704627.2s  
 DATE: July 01, 2019 5:04 pm

## MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
<b>STANDARD ENVIRONMENTAL RECORDS</b>								
<b><i>Federal NPL site list</i></b>								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	1.000		0	0	0	0	NR	0
<b><i>Federal Delisted NPL site list</i></b>								
Delisted NPL	1.000		0	0	0	0	NR	0
<b><i>Federal CERCLIS list</i></b>								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
<b><i>Federal CERCLIS NFRAP site list</i></b>								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
<b><i>Federal RCRA CORRACTS facilities list</i></b>								
CORRACTS	1.000		0	0	0	0	NR	0
<b><i>Federal RCRA non-CORRACTS TSD facilities list</i></b>								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
<b><i>Federal RCRA generators list</i></b>								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
<b><i>Federal institutional controls / engineering controls registries</i></b>								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
<b><i>Federal ERNS list</i></b>								
ERNS	TP		NR	NR	NR	NR	NR	0
<b><i>State- and tribal - equivalent NPL</i></b>								
NC HSDS	1.000		0	0	0	0	NR	0
<b><i>State- and tribal - equivalent CERCLIS</i></b>								
SHWS	1.000		0	0	0	0	NR	0
<b><i>State and tribal landfill and/or solid waste disposal site lists</i></b>								
SWF/LF	0.500		0	0	0	NR	NR	0
OLI	0.500		0	0	0	NR	NR	0
DEBRIS	0.500		0	0	0	NR	NR	0
LCID	0.500		0	0	0	NR	NR	0



## MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
<b>State and tribal leaking storage tank lists</b>								
LUST	0.500		0	0	0	NR	NR	0
LAST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
LUST TRUST	0.500		0	0	0	NR	NR	0
<b>State and tribal registered storage tank lists</b>								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
<b>State and tribal institutional control / engineering control registries</b>								
INST CONTROL	0.500		0	0	0	NR	NR	0
<b>State and tribal voluntary cleanup sites</b>								
INDIAN VCP	0.500		0	0	0	NR	NR	0
VCP	0.500		0	0	0	NR	NR	0
<b>State and tribal Brownfields sites</b>								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
<b><u>ADDITIONAL ENVIRONMENTAL RECORDS</u></b>								
<b>Local Brownfield lists</b>								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
<b>Local Lists of Landfill / Solid Waste Disposal Sites</b>								
SWRCY	0.500		0	0	0	NR	NR	0
HIST LF	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
<b>Local Lists of Hazardous waste / Contaminated Sites</b>								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
<b>Local Land Records</b>								
LIENS 2	TP		NR	NR	NR	NR	NR	0
<b>Records of Emergency Release Reports</b>								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
IMD	0.500		0	0	0	NR	NR	0

## MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
SPILLS 90	TP		NR	NR	NR	NR	NR	0
SPILLS 80	TP		NR	NR	NR	NR	NR	0
<b>Other Ascertainable Records</b>								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
AIRS	TP		NR	NR	NR	NR	NR	0
ASBESTOS	TP		NR	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
AOP	TP		NR	NR	NR	NR	NR	0
PCSRP	0.500		0	0	0	NR	NR	0
SEPT HAULERS	TP		NR	NR	NR	NR	NR	0

## MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
CCB	0.500		0	0	0	NR	NR	0
<b><u>EDR HIGH RISK HISTORICAL RECORDS</u></b>								
<b><i>EDR Exclusive Records</i></b>								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
<b><u>EDR RECOVERED GOVERNMENT ARCHIVES</u></b>								
<b><i>Exclusive Recovered Govt. Archives</i></b>								
RGA HWS	TP		NR	NR	NR	NR	NR	0
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	0	0	0	0	0	0

**NOTES:**

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

Map ID  
Direction  
Distance  
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number  
EPA ID Number

NO SITES FOUND



Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
NO SITES FOUND					

## APPENDIX F - FEMA COORDINATION



***Axiom Environmental, Inc.***

218 Snow Avenue, Raleigh, North Carolina 27603 919-215-1693

June 26, 2020

Tom Burleson  
 Avery County Local Floodplain Administrator  
 200 Montezuma Street  
 Newland, NC 28657

Re: Laurel Springs Stream and Wetland mitigation project Avery County  
 FEMA Floodplain Requirements Checklist

**19-009**

Dear Mr. Burleson:

The purpose of this letter is to request concurrence from the Avery County concerning a stream and wetland restoration site located in Avery County. The Site encompasses approximately 30 acres of agricultural land used for livestock grazing and hay production. Existing Site streams have been cleared, dredged of cobble substrate, trampled by livestock, eroded vertically and laterally, and receive extensive sediment and nutrient inputs from livestock. Proposed activities at the Site include the restoration of perennial and intermittent stream channels, enhancement of perennial stream channel, and restoration of riparian wetlands.

Stream reaches are depicted on the attached figures and lengths/priority are as follows:

<b>Reach</b>	<b>Length</b>	<b>Priority</b>
Fork Creek	2401	Priority 1 Restoration and Enhancement (Level I)
UT 1	234	Priority 1 Restoration
UT 2A	25	Preservation
UT 2	926	Priority 1 Restoration, Enhancement (Level I and II), and Preservation
UT 3A	103	Preservation
UT 3	1002	Enhancement (Level II)
UT 4	685	Priority 1 Restoration and Preservation
UT 5	127	Preservation

FEMA mapping was reviewed to determine if the project is located in a FEMA study area (DFIRM panel numbers 1812 and 1813). Based on existing floodplain mapping, the Site is not located in a Special Flood Hazard Area. Therefore, a “Conditional Letter of Map Revision” (CLOMR), and a subsequent “Letter of Map Revision” (LOMR) are not expected for the project.

We thank you in advance for your timely response and cooperation. Please feel free to contact the below referenced NC DMS Project Manager with any questions that you may have concerning the

extent of site disturbance associated with this project.

Yours truly,

AXIOM ENVIRONMENTAL



W. Grant Lewis  
Senior Project Manager

Attachments

- Figure 1 Project Location
- Figure 2 Hydrologic Unit Map
- Figure 3 Topography and Drainage Area
- Figure 4 Existing Conditions
- Figures 5A and 5B Reference Stream Data
- Figures 6A through 6C Restoration Plan
- EEP Floodplain Requirements Checklist





## EEP Floodplain Requirements Checklist

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

### Project Location

Name of project:	Laurel Springs Stream and Wetland Restoration Site
Name if stream or feature:	Fork Creek
County:	Avery
Name of river basin:	French Broad
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Newland/Avery
DFIRM panel number for entire site:	1812 and 1813
Consultant name:	Axiom Environmental, Inc.
Phone number:	919-215-1693
Address:	218 Snow Avenue Raleigh, NC 27603

## Design Information

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

Summarize stream reaches or wetland areas according to their restoration priority.  
(See Attached)

*Example*

Reach	Length	Priority
<i>Example: Reach A</i>	<i>1000</i>	<i>One (Restoration)</i>
<i>Example: Reach B</i>	<i>2000</i>	<i>Three (Enhancement)</i>

## Floodplain Information

<p>Is project located in a Special Flood Hazard Area (SFHA)?</p> <p><input type="checkbox"/> Yes                      <input checked="" type="checkbox"/> No</p>
<p>If project is located in a SFHA, check how it was determined:</p> <p><input type="checkbox"/> Redelineation</p> <p><input type="checkbox"/> Detailed Study</p> <p><input type="checkbox"/> Limited Detail Study</p> <p><input type="checkbox"/> Approximate Study</p> <p><input type="checkbox"/> Don't know</p>
<p>List flood zone designation:</p> <p>Check if applies:</p> <p><input type="checkbox"/> AE Zone</p> <p style="padding-left: 20px;"><input checked="" type="checkbox"/> Floodway</p> <p style="padding-left: 20px;"><input checked="" type="checkbox"/> Non-Encroachment</p> <p style="padding-left: 20px;"><input checked="" type="checkbox"/> None</p> <p><input type="checkbox"/> A Zone</p> <p style="padding-left: 20px;"><input checked="" type="checkbox"/> Local Setbacks Required</p> <p style="padding-left: 20px;"><input checked="" type="checkbox"/> No Local Setbacks Required</p>
<p>If local setbacks are required, list how many feet:</p>
<p>Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?</p> <p><input type="checkbox"/> Yes                      <input checked="" type="checkbox"/> No</p>

<p>Land Acquisition (Check)</p> <p><input type="checkbox"/> State owned (fee simple)</p> <p><input type="checkbox"/> Conservation easment (Design Bid Build)</p> <p><input checked="" type="checkbox"/> Conservation Easement (Full Delivery Project)</p> <p>Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)</p>
<p>Is community/county participating in the NFIP program?</p> <p style="text-align: center;"><input checked="" type="checkbox"/> Yes                      <input checked="" type="checkbox"/> No</p> <p>Note: if community is not participating, then all requirements should be addressed to NFIP (attn: State NFIP Engineer, (919) 715-8000)</p>
<p>Name of Local Floodplain Administrator: Tom Burleson</p> <p>Phone Number: 828-733-8208</p>

### **Floodplain Requirements**

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

- No Action
- No Rise
- Letter of Map Revision
- Conditional Letter of Map Revision (CLMR)
- Other Requirements

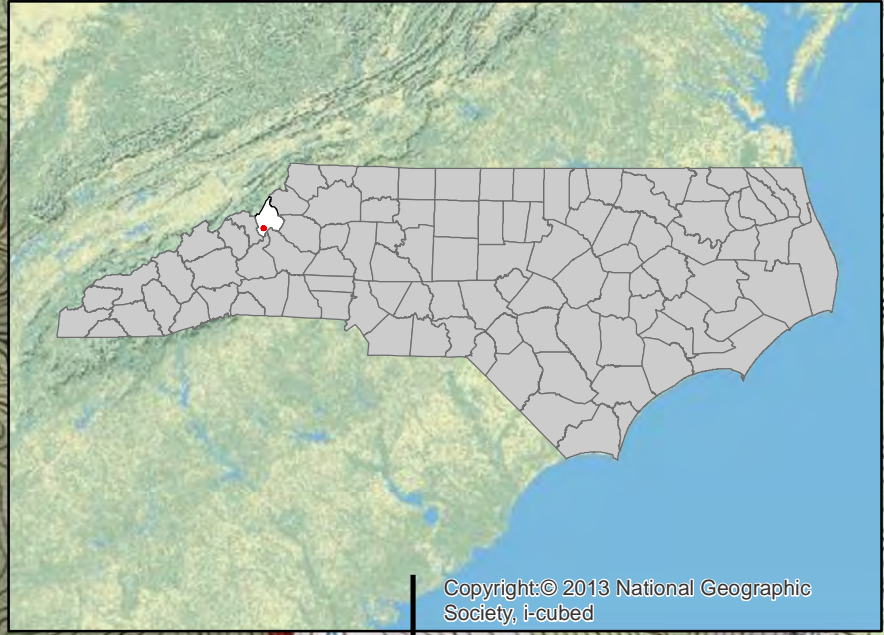
<p>List other requirements:</p>
---------------------------------

<p>Comments:</p>
------------------

Name: W. Grant Lewis                      Signature: \_\_\_\_\_

Title: President                      Date: \_\_\_\_\_

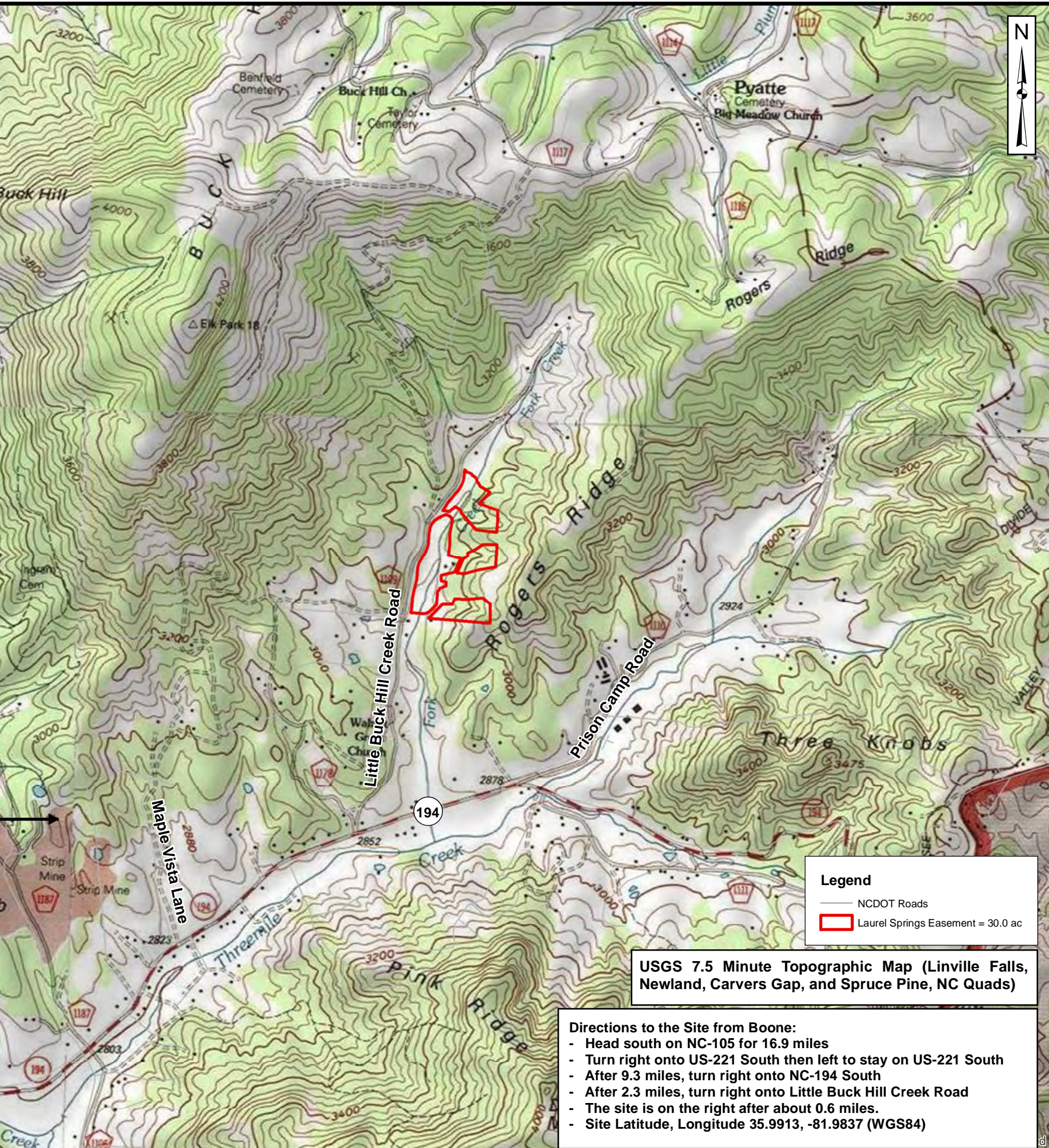




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Copyright © 2013 National Geographic Society, i-cubed



**Legend**

- NCDOT Roads
- Laurel Springs Easement = 30.0 ac

USGS 7.5 Minute Topographic Map (Linville Falls, Newland, Carvers Gap, and Spruce Pine, NC Quads)

- Directions to the Site from Boone:**
- Head south on NC-105 for 16.9 miles
  - Turn right onto US-221 South then left to stay on US-221 South
  - After 9.3 miles, turn right onto NC-194 South
  - After 2.3 miles, turn right onto Little Buck Hill Creek Road
  - The site is on the right after about 0.6 miles.
  - Site Latitude, Longitude 35.9913, -81.9837 (WGS84)



Project:  
**LAUREL SPRINGS MITIGATION SITE**

Avery County, NC

Title:  
**SITE LOCATION**

Drawn by:  
KRJ

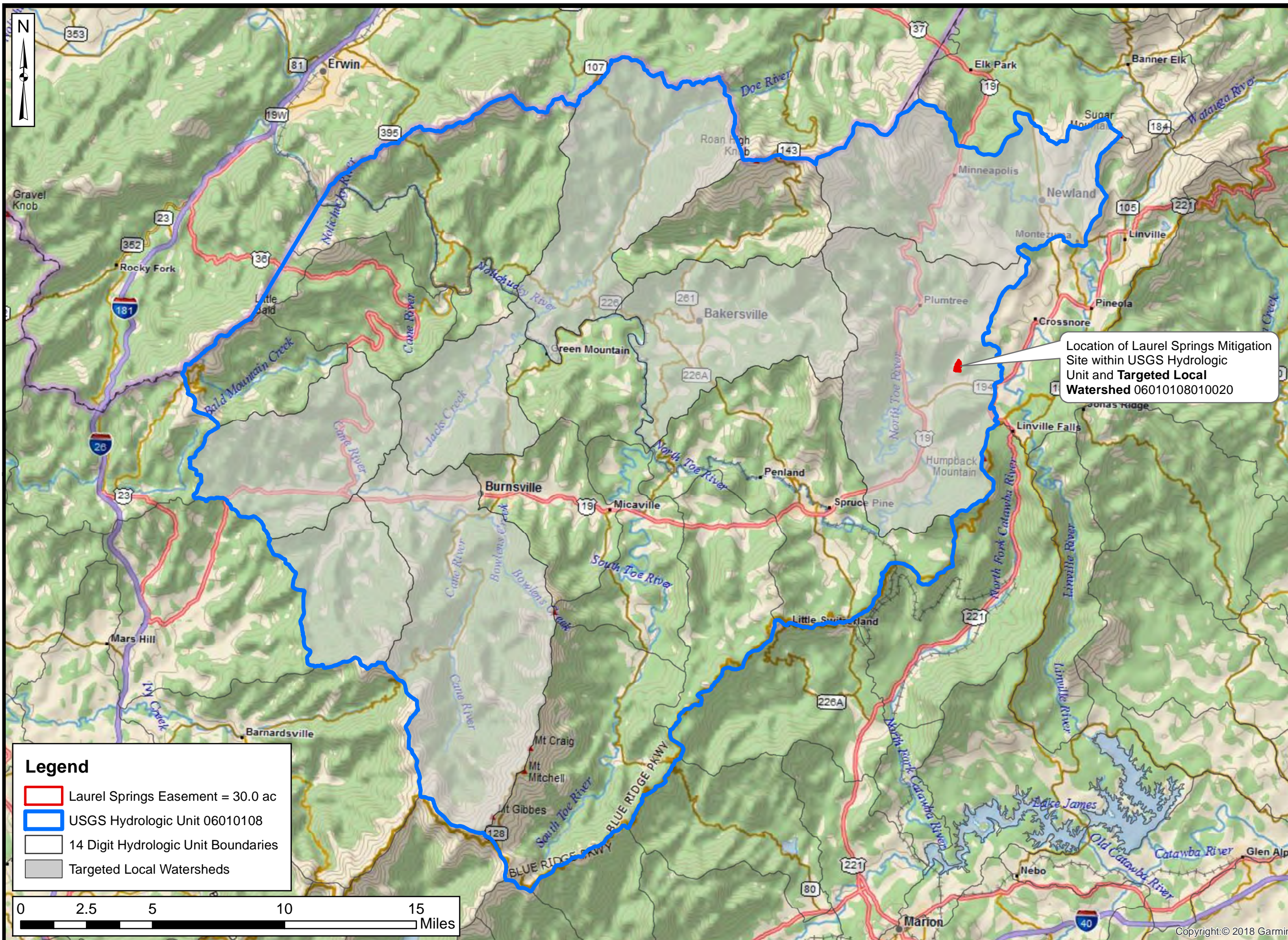
Date:  
AUG 2019

Scale:  
1:20,000

Project No.:  
19-009

**FIGURE**  
**1**





Project:

**LAUREL SPRINGS MITIGATION SITE**

Avery County, NC

Title:

**HYDROLOGIC UNIT MAP**

Drawn by: KRJ

Date: AUG 2019

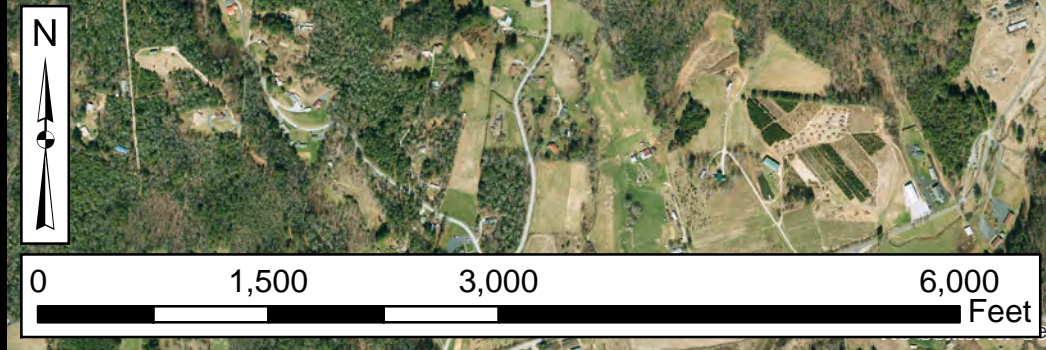
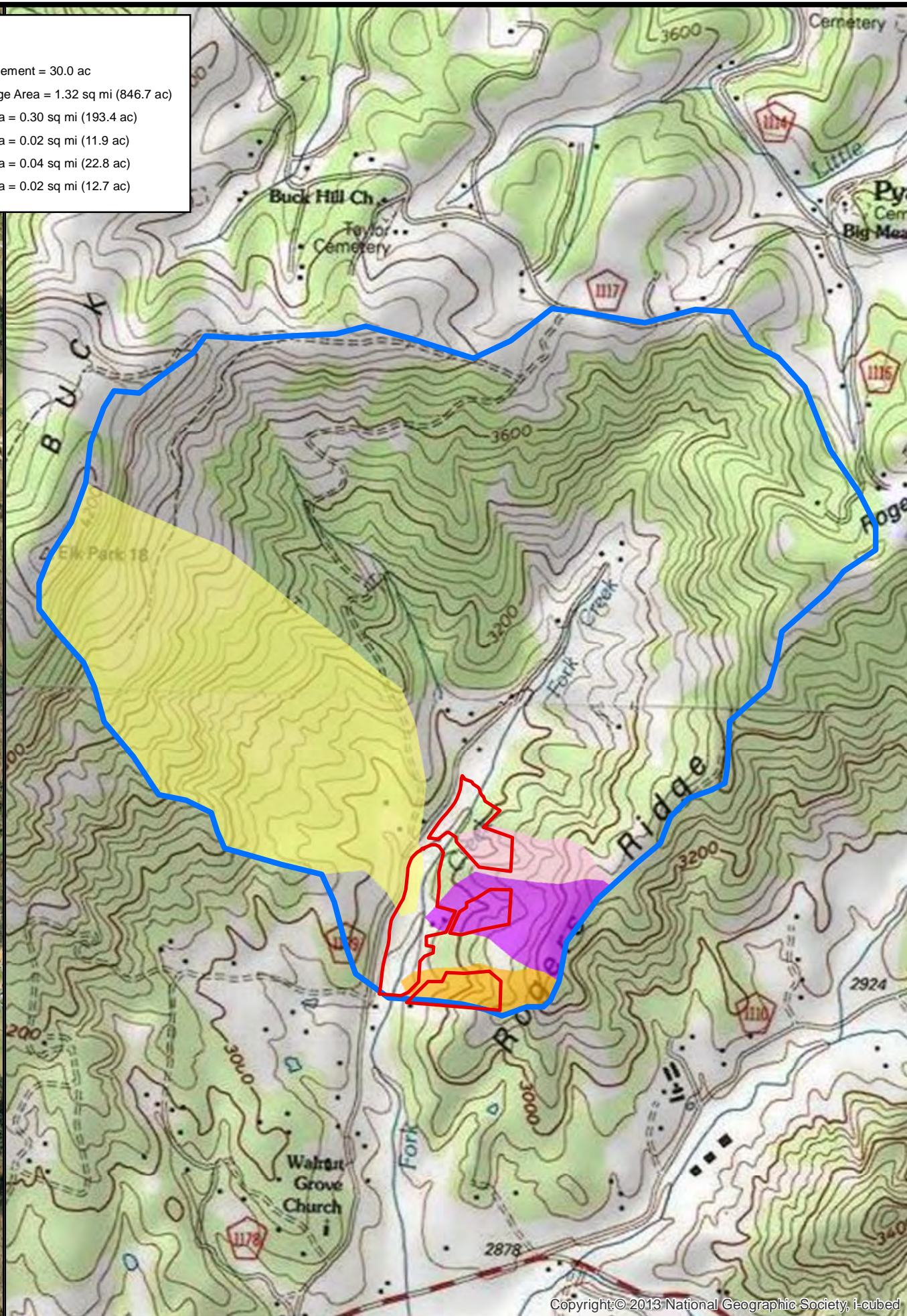
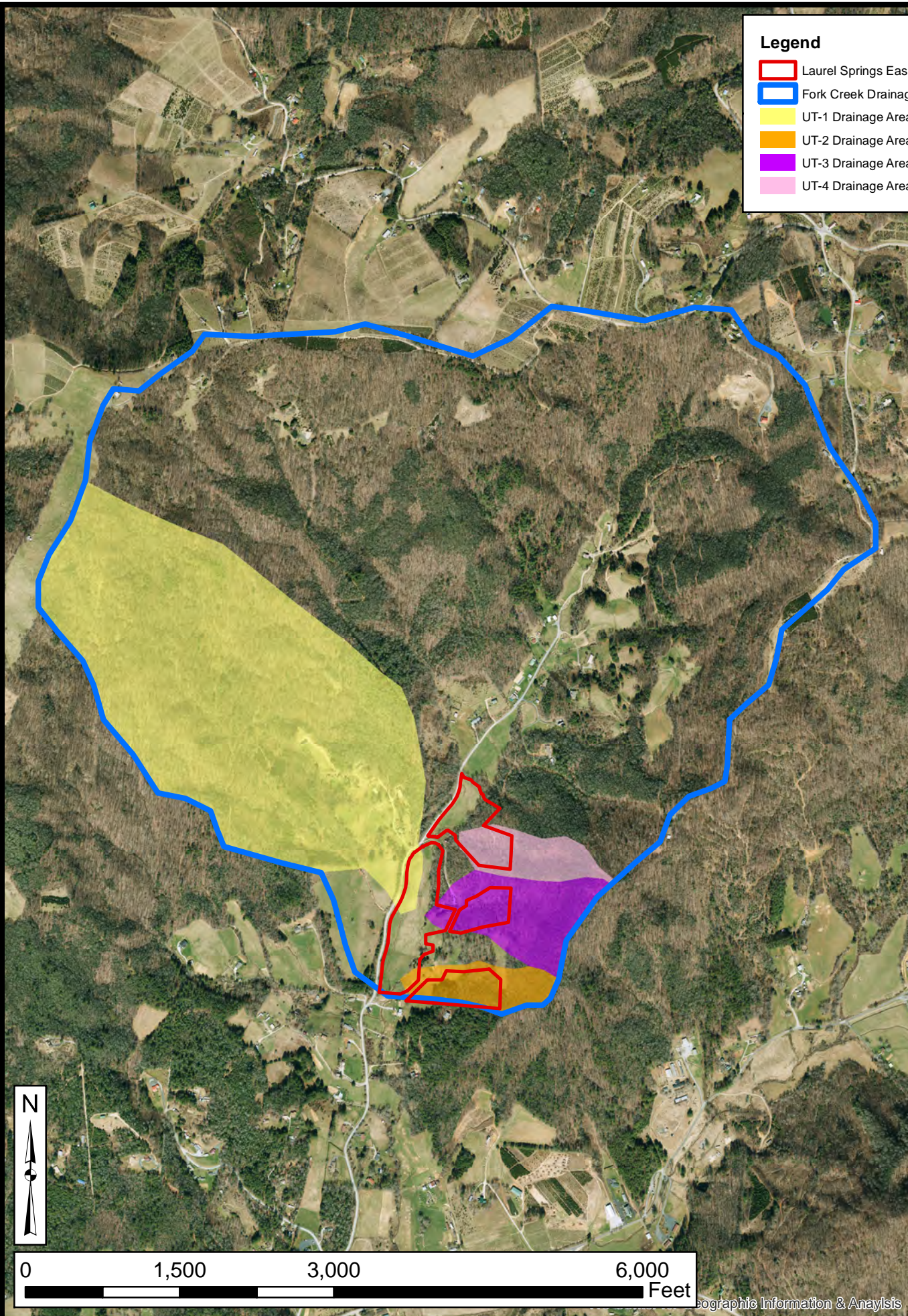
Scale: 1:220,000

Project No.: 19-009

**FIGURE 2**



- Legend**
- Laurel Springs Easement = 30.0 ac
  - Fork Creek Drainage Area = 1.32 sq mi (846.7 ac)
  - UT-1 Drainage Area = 0.30 sq mi (193.4 ac)
  - UT-2 Drainage Area = 0.02 sq mi (11.9 ac)
  - UT-3 Drainage Area = 0.04 sq mi (22.8 ac)
  - UT-4 Drainage Area = 0.02 sq mi (12.7 ac)



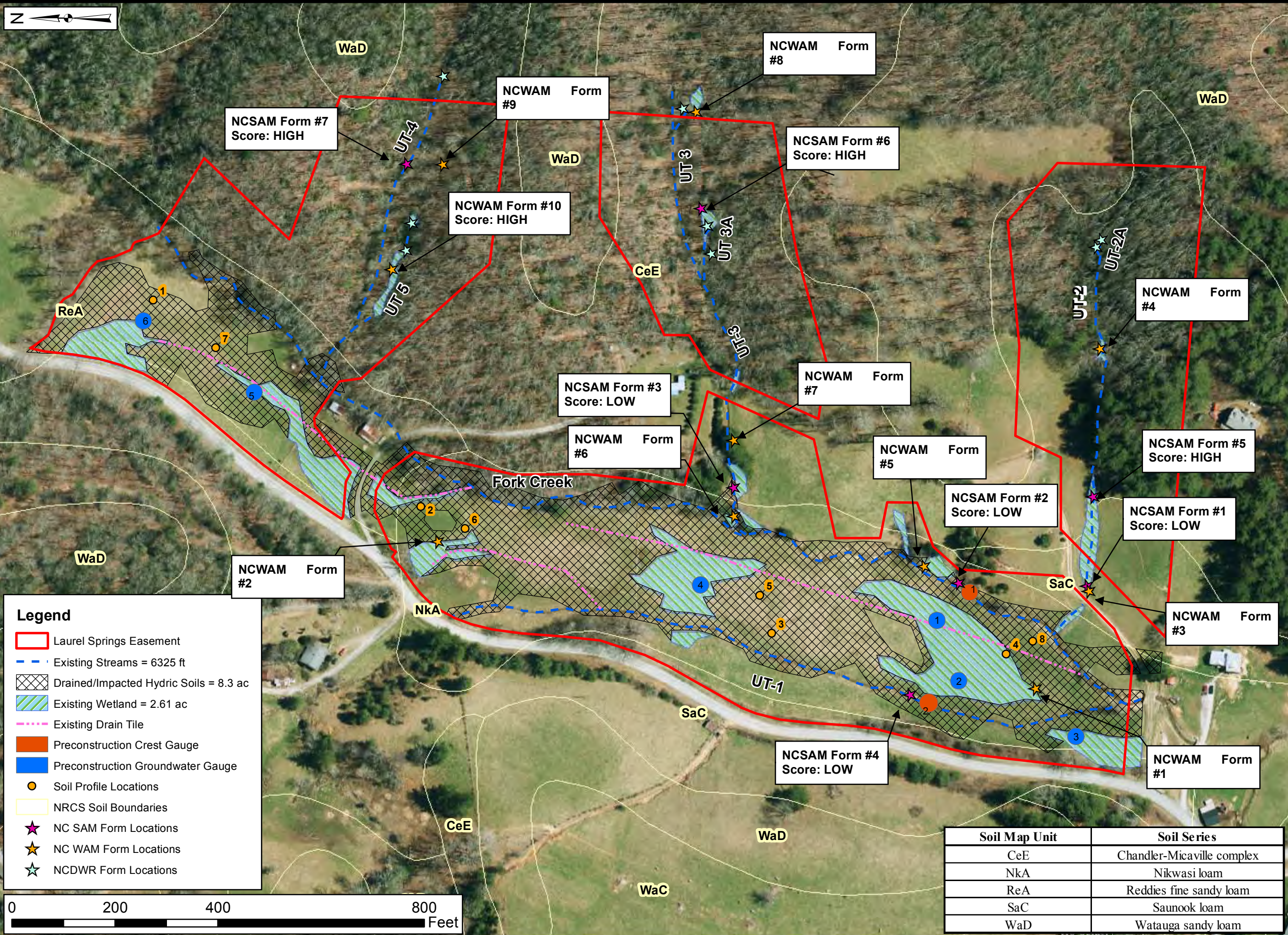
Project:  
**LAUREL SPRINGS MITIGATION SITE**  
 Avery County, NC

Title:  
**TOPOGRAPHY AND DRAINAGE AREA**

Drawn by: KRJ  
 Date: AUG 2019  
 Scale: 1:15,000  
 Project No.: 19-009

FIGURE  
**3**





Prepared for:  
**LAUREL SPRINGS MITIGATION SITE**  
 Avery County, NC

Title:  
**EXISTING CONDITIONS AND SOILS**

Drawn by: AEK

Date: SEPT 2019

Scale: 1:2200

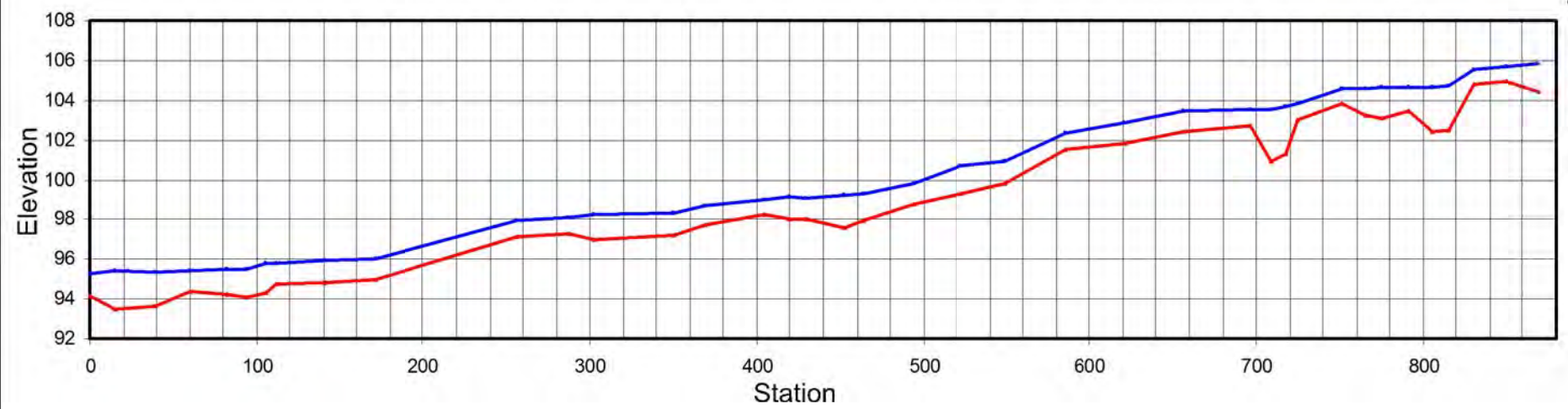
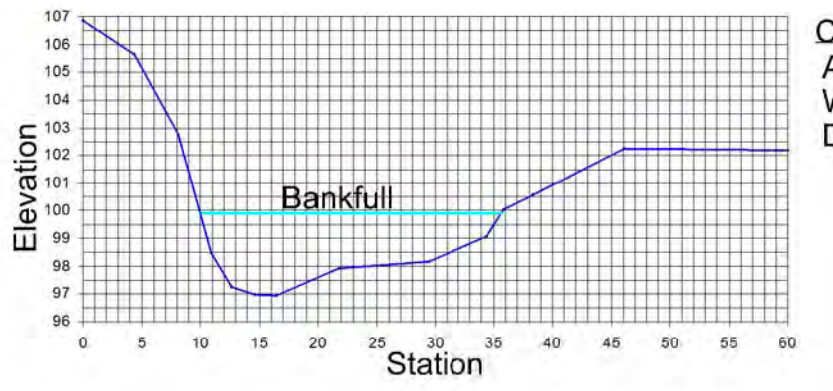
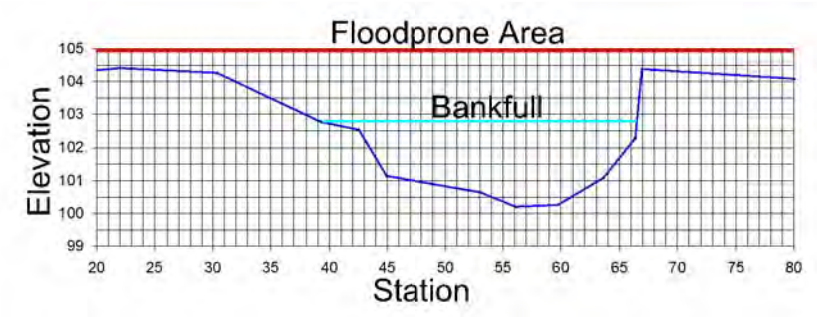
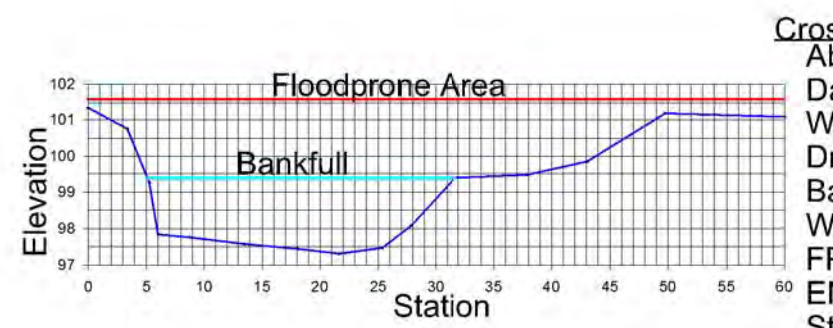
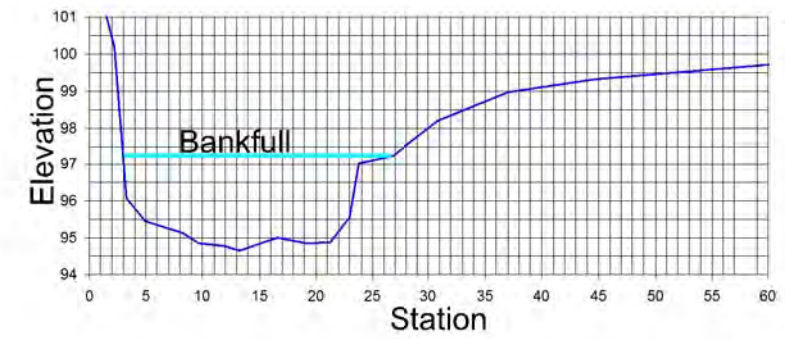
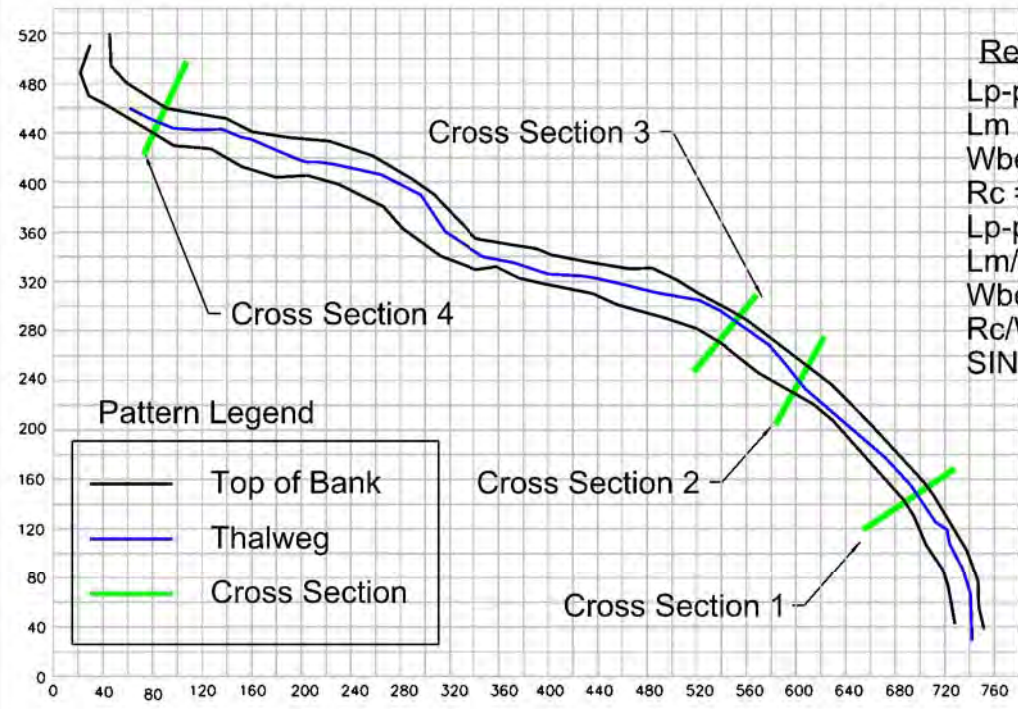
Project No.: 19-001.01

FIGURE  
**4**

- Legend**
- Laurel Springs Easement
  - Existing Streams = 6325 ft
  - Drained/Impacted Hydric Soils = 8.3 ac
  - Existing Wetland = 2.61 ac
  - Existing Drain Tile
  - Preconstruction Crest Gauge
  - Preconstruction Groundwater Gauge
  - Soil Profile Locations
  - NRCS Soil Boundaries
  - ★ NC SAM Form Locations
  - ★ NC WAM Form Locations
  - ★ NCDWR Form Locations

Soil Map Unit	Soil Series
CeE	Chandler-Micaville complex
NkA	Nikwasi loam
ReA	Reddies fine sandy loam
SaC	Saunook loam
WaD	Watauga sandy loam





NOTES/REVISIONS


Project:

Laurel Springs Mitigation Site

Avery County North Carolina

Title:  
 Stone Mountain Reference Dimension, Pattern, and Profile

Scale: NA	FIGURE NO. <b>5A</b>
Date: Sept 2019	
Project No.: 19-009	





NOTES/REVISIONS


Project:

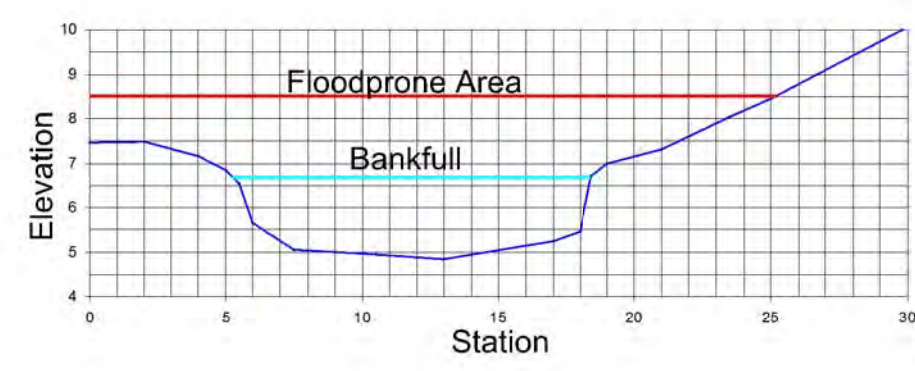
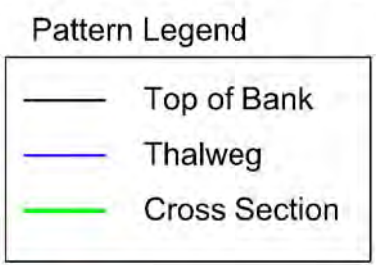
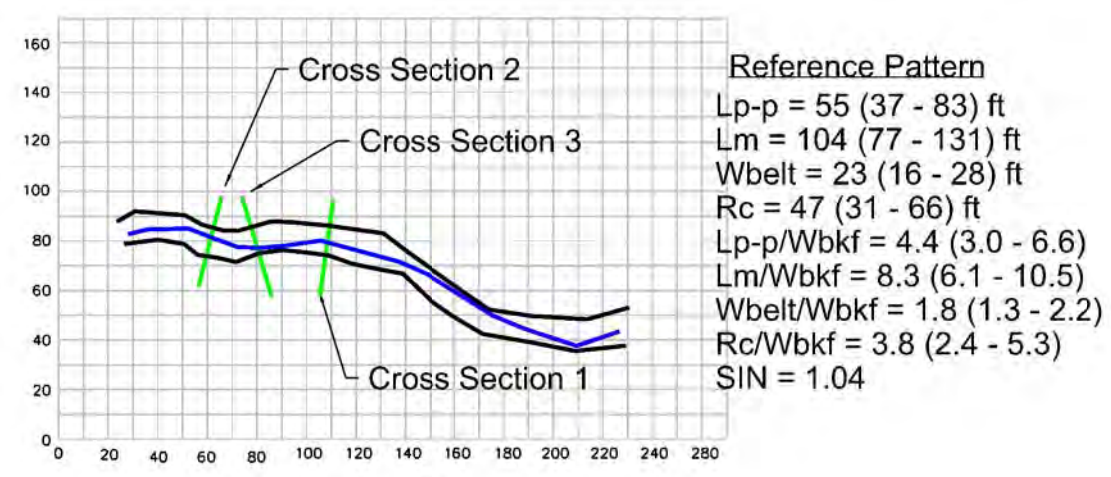
Laurel Springs Mitigation Site

Avery County North Carolina

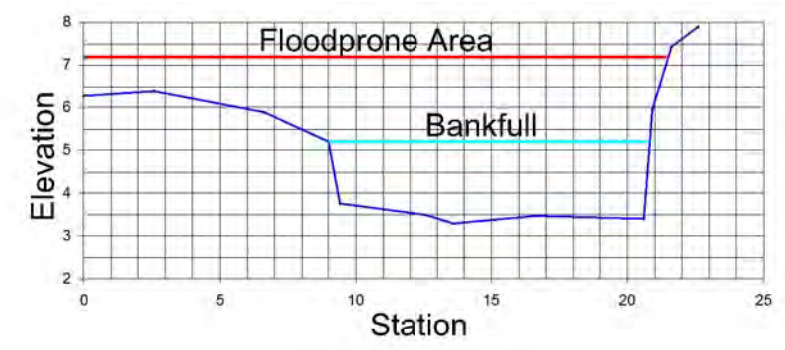
Title:  
Cranberry Creek Reference  
Dimension, Pattern, and Profile

Scale: NA  
Date: Sept 2019  
Project No.: 19-009

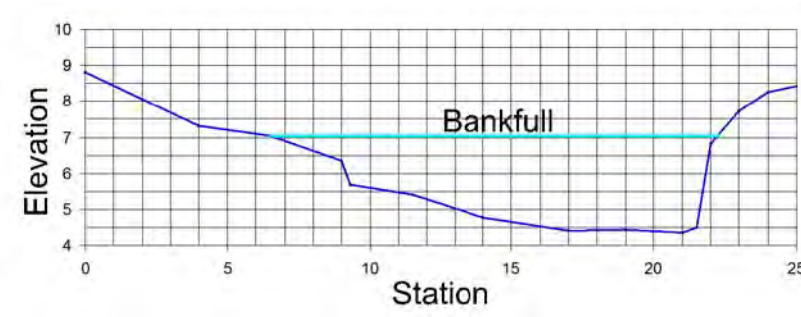
FIGURE NO.  
**5B**



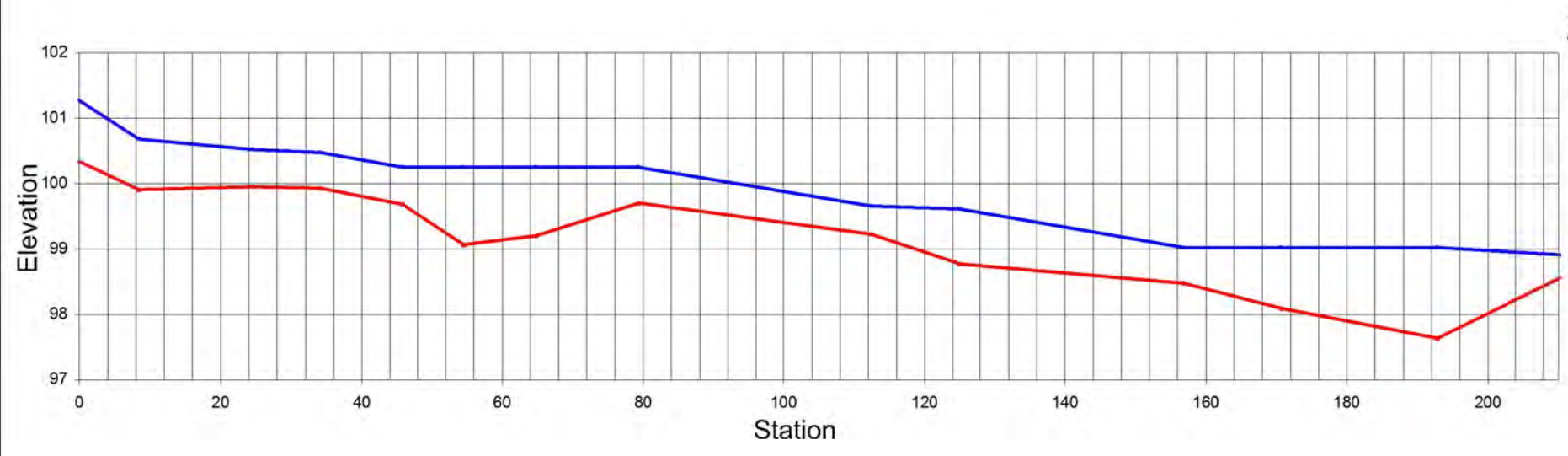
**Cross Section 1 - Riffle**  
 Abkf = 20.4 ft  
 Dave = 1.5 ft  
 Wbkf = 13.2 ft  
 Dmax = 1.9 ft  
 Bank Height = 1.9 ft  
 W/D = 8.5  
 FPA = 75  
 ENT = 5.7  
 Stream Type = E



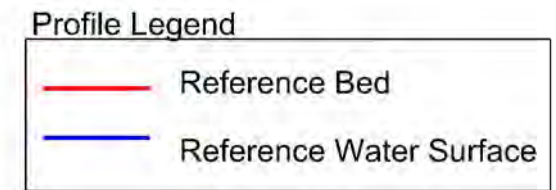
**Cross Section 2 - Riffle**  
 Abkf = 19.9 ft  
 Dave = 1.7 ft  
 Wbkf = 11.8 ft  
 Dmax = 1.9 ft  
 Bank Height = 1.9 ft  
 W/D = 7.0  
 FPA = 75  
 ENT = 6.3  
 Stream Type = E



**Cross Section 3 - Pool**  
 Abkf = 29.2 ft  
 Wbkf = 15.7 ft  
 Dmax = 2.7 ft



**Profile (Reference Reach)**  
 Save = 0.0112 rise/run  
 Svalley = 0.0116 rise/run  
 Sriffle = 0.0195 (0.0178 - 0.0225) rise/run  
 Spool = 0.0015 (0.0002 - 0.0036) rise/run  
 Srun = 0 (0 - 0) rise/run  
 Sglide = 0.0028 (0.0001 - 0.0054) rise/run







NOTES/REVISIONS


Project:

Laurel Springs  
Mitigation Site

Avery County  
North Carolina

Title:

MITIGATION  
PLAN

Scale:

As Shown

Date:

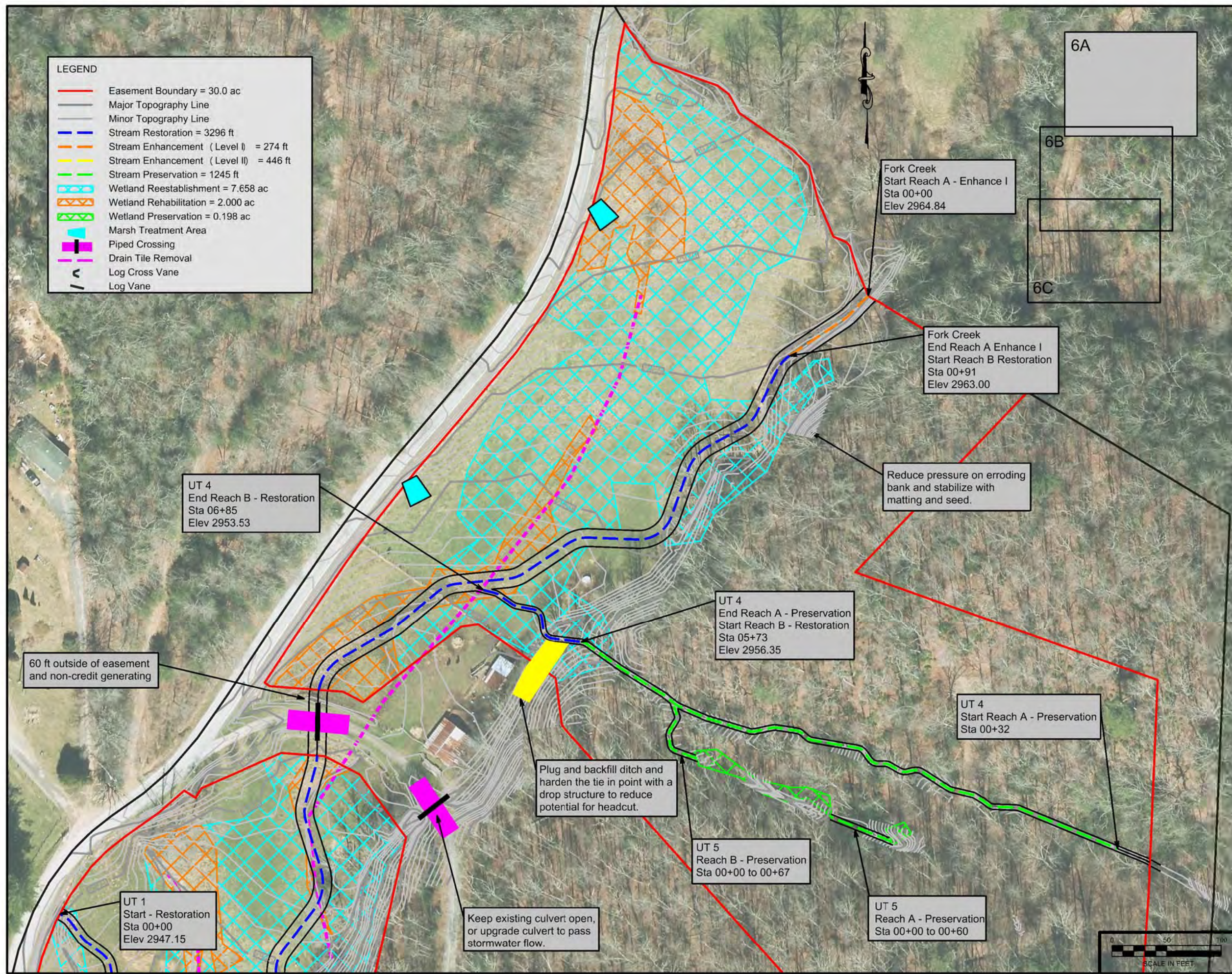
Sept 2019

Project No.:

19-009

FIGURE NO.

6A







NOTES/REVISIONS


Project:

Laurel Springs Mitigation Site

Avery County North Carolina

Title:

MITIGATION PLAN

Scale:

As Shown

Date:

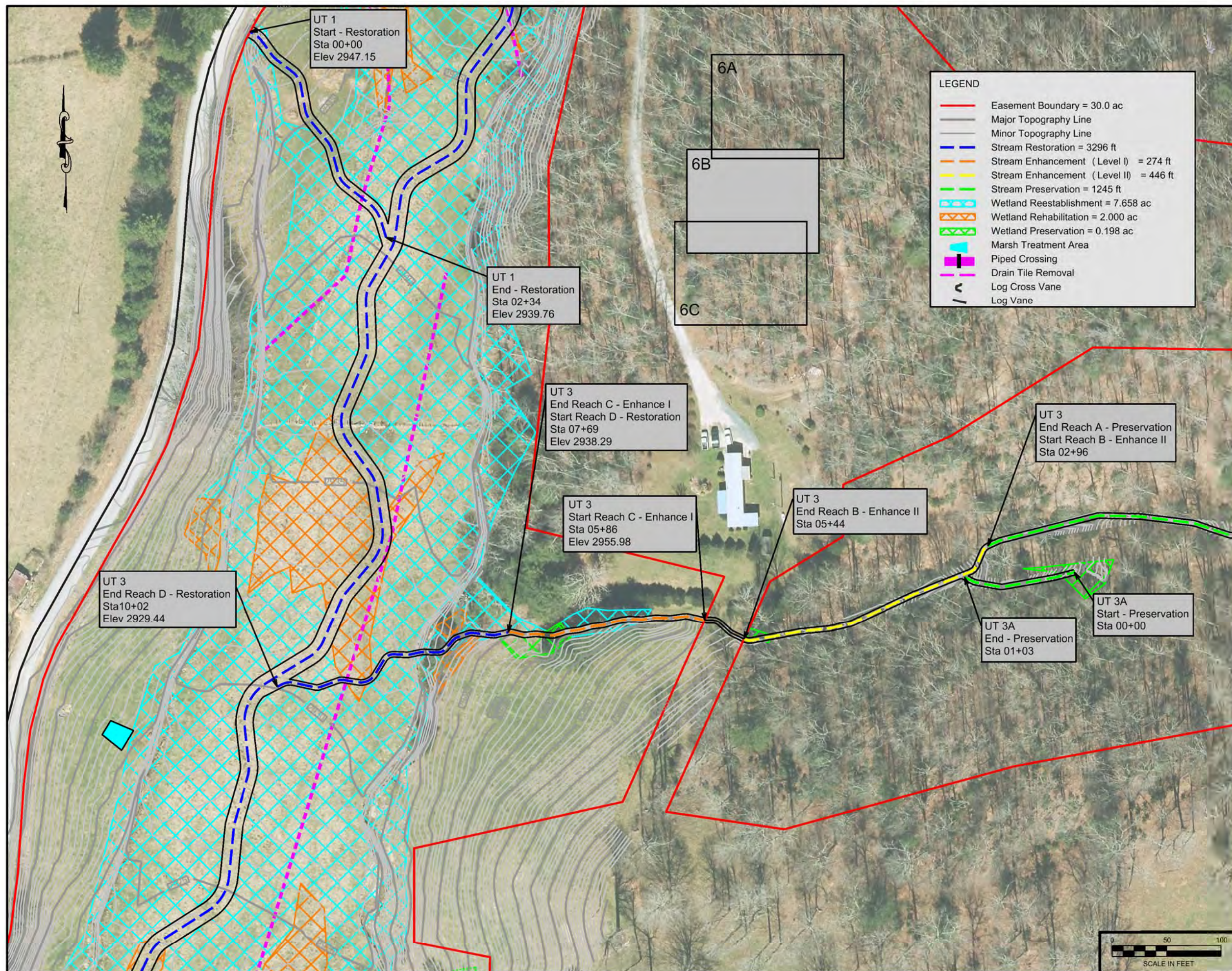
Sept 2019

Project No.:

19-009

FIGURE NO.

6B



**LEGEND**

- Easement Boundary = 30.0 ac
- Major Topography Line
- Minor Topography Line
- Stream Restoration = 3296 ft
- Stream Enhancement (Level I) = 274 ft
- Stream Enhancement (Level II) = 446 ft
- Stream Preservation = 1245 ft
- Wetland Reestablishment = 7.658 ac
- Wetland Rehabilitation = 2.000 ac
- Wetland Preservation = 0.198 ac
- Marsh Treatment Area
- Piped Crossing
- Drain Tile Removal
- Log Cross Vane
- Log Vane

UT 1  
Start - Restoration  
Sta 00+00  
Elev 2947.15

UT 1  
End - Restoration  
Sta 02+34  
Elev 2939.76

UT 3  
End Reach C - Enhance I  
Start Reach D - Restoration  
Sta 07+69  
Elev 2938.29

UT 3  
Start Reach C - Enhance I  
Sta 05+86  
Elev 2955.98

UT 3  
End Reach B - Enhance II  
Sta 05+44

UT 3  
End Reach A - Preservation  
Start Reach B - Enhance II  
Sta 02+96

UT 3A  
End - Preservation  
Sta 01+03

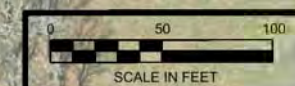
UT 3A  
Start - Preservation  
Sta 00+00

UT 3  
End Reach D - Restoration  
Sta 10+02  
Elev 2929.44

6A

6B

6C







NOTES/REVISIONS


Project:

Laurel Springs Mitigation Site

Avery County North Carolina

Title:

MITIGATION PLAN

Scale:  
As Shown

Date:  
Sept 2019

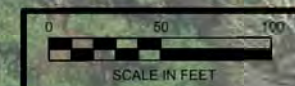
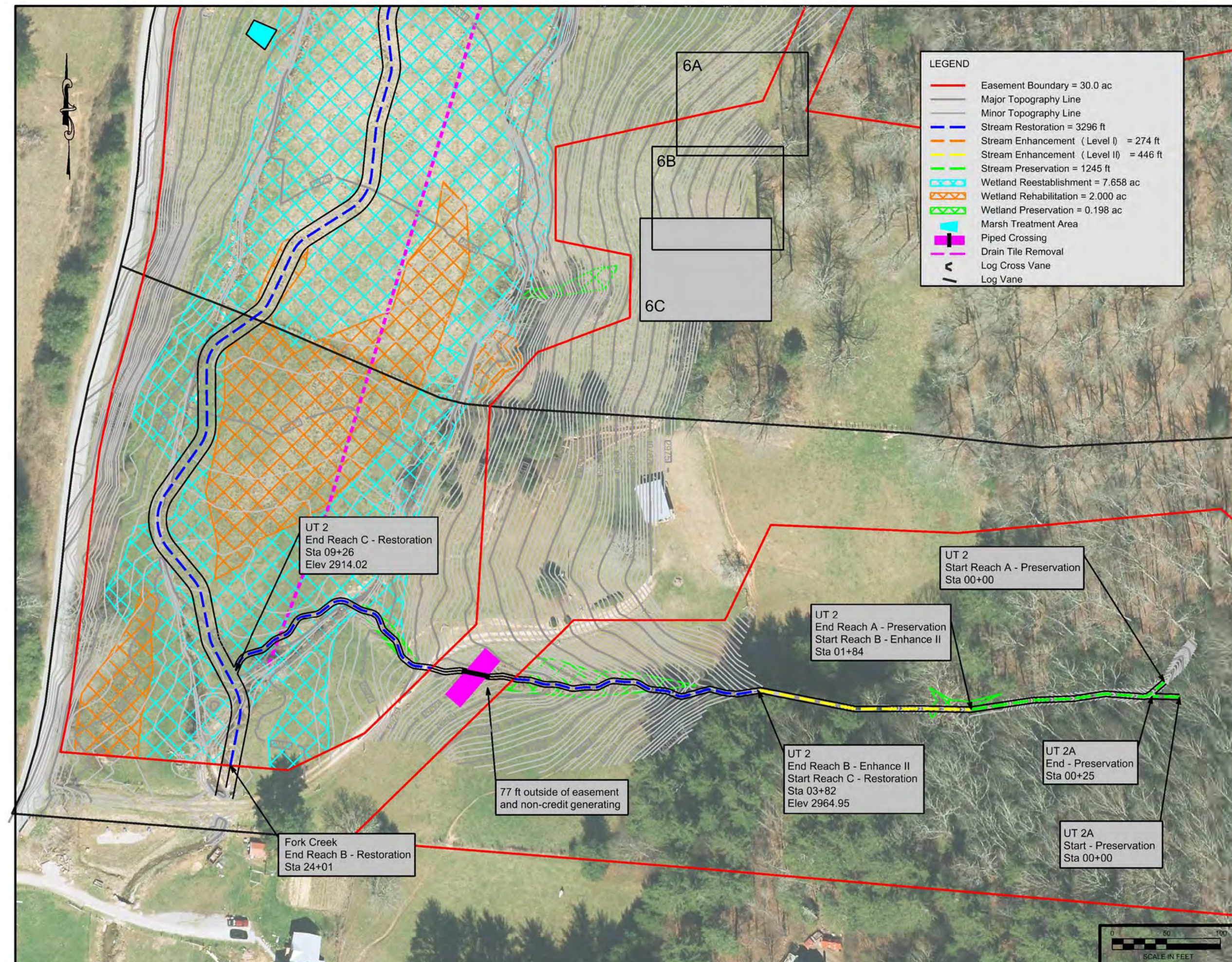
Project No.:  
19-009

FIGURE NO.

6C

**LEGEND**

- Easement Boundary = 30.0 ac
- Major Topography Line
- Minor Topography Line
- Stream Restoration = 3296 ft
- Stream Enhancement (Level I) = 274 ft
- Stream Enhancement (Level II) = 446 ft
- Stream Preservation = 1245 ft
- Wetland Reestablishment = 7.658 ac
- Wetland Rehabilitation = 2.000 ac
- Wetland Preservation = 0.198 ac
- Marsh Treatment Area
- Piped Crossing
- Drain Tile Removal
- Log Cross Vane
- Log Vane

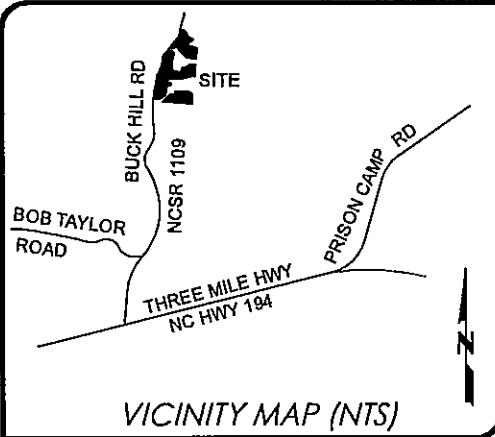




## **APPENDIX G - FINANCIAL ASSURANCES**

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

## APPENDIX H - SITE PROTECTION INSTRUMENT



**DEED REFERENCE(S):**  
BEING A PORTION OF THE PROPERTY RECORDED IN D B 550, PG. 723-728 OF THE AVERY COUNTY REGISTER OF DEEDS.

**RIGHT-OF-WAY REFERENCE(S):**  
D.B. 306, PG. 1058 (CP & L)

D.B. 257, PG. 824 (NCDOT)

**MAP REFERENCE(S):**  
PB 45, PG 129

M.B. P-45, PG. 129

M B 21, PG 101

**FEMA FLOOD STATEMENT:**  
THE AREA REPRESENTED BY THIS PLAT IS NOT LOCATED IN A FLOOD HAZARD BOUNDARY ACCORDING TO FEMA MAP NUMBER(S) 3710181200J, ZONE(S) X, DATED, DECEMBER 02, 2008.

**2020005697**  
AVERY CO, NC FEE \$21.00  
PRESENTED & RECORDED  
10-15-2020 08:13:32 AM  
RENEE DELLINGER  
REGISTER OF DEEDS  
BY: CHERYL CARLAND  
DEPUTY

**BK: P 45**  
**PG: 136-136**

**LEGEND:**

- ISS - IRON STAKE SET
- ECM - EXISTING CONCRETE MARKER
- EIP - EXISTING IRON PIPE
- EN - EXISTING NAIL
- MNS - MAG NAIL SET
- EIS - EXISTING IRON STAKE
- EPP - EXISTING PUMP PIPE
- EIB - EXISTING IRON BAR
- PPS - PUMP PIPE SET
- NMC - NON-MONUMENTED CORNER
- R/W - RIGHT OF WAY
- EOP - EDGE OF PAVEMENT
- E/B - EASEMENT BOUNDARY
- CL - CENTERLINE
- UP - UTILITY POLE
- PB - PLAT BOOK
- D B - DEED BOOK
- PG - PAGE
- CMP - CORRUGATED METAL PIPE
- - NON-MONUMENTED CORNER

No. 5 REBAR FLUSH WITH GRADE WITH AN ALUMINUM 3 1/4" CAP INSCRIBED. "STATE OF NORTH CAROLINA CONSERVATION EASEMENT"

--- CONSERVATION EASEMENT LINE  
--- TIE DOWN LINE  
--- RIGHT OF WAY LINE OR ADJOINER LINE  
--- EASEMENT LINE  
--- UTILITY LINE

**CERTIFICATION OF EXEMPTION:**

I (We) hereby certify that I am (We are) the Owner(s) of the property shown and described hereon, which was conveyed to me (us) by deeds recorded in Deed Book 550, Page 723-728, and that we hereby adopt the plan of conservation easement shown on this plat and that the conservation easement shown is an exception to the Subdivision Ordinance of Avery County, North Carolina

10-14-2020  
Date  
Representative of Restoration Systems, LLC

STATE OF NORTH CAROLINA  
COUNTY OF AVERY

Filed for registration at \_\_\_\_\_ M \_\_\_\_\_, 2020 in the Register of Deeds

Office. Recorded in P.B. \_\_\_\_\_, PG. \_\_\_\_\_.

Register of Deeds \_\_\_\_\_ By \_\_\_\_\_

STATE OF NORTH CAROLINA  
COUNTY OF AVERY

I, Tommy Burleson, Review Officer of Avery County, certify that the map or plat to which this certification is affixed meets all statutory requirements for recording.

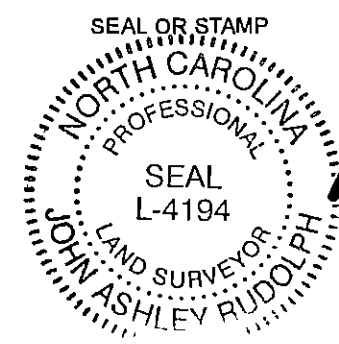
10-15-2020  
Date  
Review Officer

**SURVEYORS CERTIFICATION(S)**

Surveyor's disclaimer: No attempt was made to locate any cemeteries, wetlands, hazardous material sites, underground utilities or any other features above, or below ground or other than those shown. However, no visible evidence of cemeteries or utilities, aboveground or otherwise, was observed by the undersigned (other than those shown)

I certify that the survey is of another category such as the recombination of existing parcels, a court-ordered survey, or other exception to the definition of subdivision (conservation easement).

I, JOHN A RUDOLPH, certify that this plat was drawn under my supervision from an actual survey made under my supervision (deed description recorded in Book SEE, Page REFS, etc.) (other); that the boundaries not surveyed are clearly indicated as drawn from information found in Book \_\_\_\_\_, page \_\_\_\_\_; that the ratio of precision or positional accuracy as calculated is 1/10,000+; that this plat was prepared in accordance with G S 47-30 as amended. Witness my original signature, license number and seal this 12th day of October, A.D., 2020.



John Ashley Rudolph  
Professional Land Surveyor License Number L-4194



CORNER #	DESCRIPTION
①	NON-MONUMENTED CORNER
②	No. 5 REBAR FLUSH 0' ABOVE GRADE
③ THRU ⑥⑨	No. 5 REBAR FLUSH WITH GRADE WITH AN ALUMINUM 3 1/4" CAP INSCRIBED. "STATE OF NORTH CAROLINA CONSERVATION EASEMENT"
⑥⑩	1.0' x 0.2" IRON BAR 1' 0" ABOVE GRADE
⑥⑩ THRU ⑥⑩③	No. 5 REBAR FLUSH WITH GRADE WITH AN ALUMINUM 3 1/4" CAP INSCRIBED. "STATE OF NORTH CAROLINA CONSERVATION EASEMENT"
⑩①	No. 5 REBAR WITH PLASTIC CAP INSCRIBED "K2 DESIGN CONTROL POINT" FLUSH WITH GRADE SUITABLE FOR GNSS OBSERVATIONS
⑩②	1' 0" O.D. IRON STAKE 1.5' ABOVE GRADE
⑩③	5"x5" CONCRETE MARKER 1' 2" ABOVE GRADE
⑩④	IRON STAKE WITH CAP INSCRIBED WITH "PAT TEN DEUT 18.14"
⑩⑤	No. 5 REBAR FLUSH WITH GRADE
⑩⑥	IRON STAKE WITH CAP INSCRIBED WITH "CARPENTER" 0.7' ABOVE GRADE
⑩⑦	IRON STAKE WITH CAP INSCRIBED WITH "CARPENTER" 0.5' ABOVE GRADE
⑩⑧	MAG NAIL AT CENTERLINE INTERSECTION OF TAYLOR McFEE LANE AND BUCK HILL ROAD (N.C.S.R. 1109).
⑩⑨	MAG NAIL FLUSH WITH GRADE
⑩⑩	MAG NAIL AT CENTERLINE INTERSECTION OF OAK TREE LANE AND BUCK HILL ROAD (N.C.S.R. 1109).
⑩⑪ AND ⑩⑫	No. 5 REBAR FLUSH WITH GRADE

**GENERAL NOTES:**

NO HORIZONTAL CONTROL EXISTS WITHIN 2000 FEET.

NOTE: NO ABSTRACT OF TITLE, NOR TITLE COMMITMENT, OR RESULTS OF TITLE SEARCH WERE FURNISHED TO THE SURVEYOR. ALL DOCUMENTS OF RECORD REVIEWED ARE NOTED HEREON (SEE REFERENCES). THERE MAY EXIST OTHER DOCUMENTS OF RECORD THAT MAY AFFECT THIS SURVEYED PARCEL.

ALL DISTANCES SHOWN ARE HORIZONTAL GROUND DISTANCES.

COORDINATES SHOWN ARE BASED ON LOCALIZED GROUND DISTANCES OTHER THAN ISS (10)

SEE DATUM DESCRIPTION.

RIGHT-OF-WAY D.B. 257, PG. 827 NAMES THE ROAD AS "BUCK HILL ROAD" WHEREAS AVERY COUNTY GIS WEBSITE NAMES THE ROAD AS "LITTLE BUCK HILL ROAD". SURVEYOR HAS USED THE NAME "BUCK HILL ROAD" ON THE MAP

ALL EXISTING ADJOINERS' BUILDINGS SHOWN ARE ALL LOCATED MORE THAN 15' FROM THE CONSERVATION EASEMENTS

Point	Northing	Easting
1	831439.6308	118432.9706
2	831186.2451	118662.2051
3	831101.9106	118801.5574
4	830937.0403	118643.7599
5	830838.1324	118920.4520
6	830643.0985	118912.1987
7	830510.3350	118803.2040
8	830548.2489	118596.7955
9	830796.8027	118374.8905
10	830839.9483	118369.0748
11	830889.0655	118298.2478
12	830886.8867	118282.7190
13	830833.8707	118213.8315
14	830825.5817	118176.9088
15	830835.5407	118102.8443
16	830876.7610	118130.1303
17	830845.3280	118177.5708
18	830885.8844	118206.3755
19	831028.2780	118240.1297
20	831076.7208	118281.4815
21	831138.8558	118333.5730
22	831178.0949	118361.6674
23	831220.9471	118384.5093
24	831265.1140	118401.2350
25	831305.8224	118412.6288
26	831355.0091	118420.7730
27	831411.0398	118429.9420
28	830725.2022	118015.2823
29	830730.4201	118039.3145
30	830775.0683	118105.2845
31	830765.8239	118173.7345
32	830755.6714	118186.9887
33	830694.1671	118232.2403
34	830501.4587	118188.4903
35	830357.7087	118189.1848
36	830169.9420	118168.3218
37	830125.2153	118181.7444
38	829918.9056	118256.6382
39	829876.5238	118065.4304
40	829790.4127	118055.4304
41	829776.5238	118134.8749
42	829718.8649	118134.1804
43	829686.9877	118048.7938
44	829637.2551	118004.8419
45	829435.9148	117992.3340
46	829335.8400	117888.6247
47	829301.7862	117818.7444
48	829318.5242	117808.8913
49	829359.9139	117817.4871
50	829455.1730	117829.1991
51	829538.5685	117837.5880
52	829596.0982	117844.8989
53	829652.7150	117857.0528
54	829718.5735	117875.7102
55	829781.4898	117888.3722
56	829800.4281	117899.0459
57	829854.9949	117929.8298
58	829934.2574	117970.0920
59	829984.4577	117974.1487
60	830031.1426	117975.9854
61	830060.1849	117973.5180
62	830157.7186	117972.2180
63	830202.0239	117971.6104
64	830247.0280	117939.4551
65	830333.8468	117867.4047
66	830407.5709	117875.3236
67	830484.4285	117881.1744
68	830543.5204	117888.7845
69	830584.0462	117898.9322
70	830617.3346	117911.5803
71	830641.1847	117924.6208
72	830667.5232	117943.9995
73	830678.3893	117955.6811
74	830695.7266	117975.7326
75	830716.9072	118005.7475
76	830720.8934	118031.6938
77	830744.8141	118053.3548
78A	830258.3525	118476.4509
78B	830253.8892	118557.0668
79	830335.0525	118687.2751
80	830331.6797	118891.1029
81	829998.9789	118868.5626
82	829951.2634	118864.8839
83	829893.8723	118804.6416
84	829908.8443	118826.4341
85	829438.7183	118802.2145
86	829439.7183	118821.5936
87	829505.1447	118823.0189
88	829504.8373	118878.1534
89	829450.7708	118755.9312
90	829164.7443	118733.4746
91	829211.8275	118192.2888
92	829227.4004	117996.9344
93	829356.4798	117996.7848

LINE	BEARING	DISTANCE
L1	S31°22'38"E	7.28'
L2	S36°24'21"E	35.59'
L3	S68°07'57"E	35.51'
L4	S70°17'07"E	28.40'
L5	S52°47'25"E	12.99'
L6	S29°09'52"E	19.74'
L7	S55°13'53"E	58.85'
L8	S46°5'11"E	20.95'
L9	S14°33'11"E	33.27'
L10	S23°02'11"E	35.88'
L11	S67°02'22"E	12.69'
L12	S43°17'38"E	4.53'
L13	S17°39'58"E	22.02'
L14	S22°46'08"E	27.09'
L15	S58°49'05"E	7.64'
L16	S58°49'05"E	152.88'
L17	S43°44'39"W	228.22'
L18	S70°19'47"E	293.84'
L19	S02°25'23"W	195.21'
L20	S03°52'33"W	133.07'
L21	N82°56'46"W	308.74'
L22	N41°45'30"W	333.20'
L23	N07°40'36"W	43.54'
L24	N55°15'34"W	86.19'
L25	S82°00'48"W	15.68'
L26	S52°25'05"W	86.93'
L27	S77°20'49"W	37.84'
L28	N82°20'30"W	74.73'
L29	N33°29'24"E	49.45'
L30	N34°17'58"E	84.19'
L31	N36°03'42"E	46.93'
L32	N38°31'38"E	54.19'
L33	N40°29'05"E	63.69'
L34	N39°58'30"E	81.08'
L35	N34°55'20"E	49.08'
L36	N28°37'29"E	47.68'
L37	N20°44'29"E	47.23'
L38	N15°36'00"E	42.37'
L39	N09°14'08"E	50.74'
L40	N08°23'46"E	55.38'
L41	N11°54'24"E	29.22'

LINE	BEARING	DISTANCE
L90	N68°45'55"E	66.95'
L91	N11°32'48"E	115.88'
L92	S86°49'52"E	80.74'
L93	N58°03'48"E	153.43'
L94	S89°03'07"E	253.86'
L95	S03°52'33"W	333.46'
L96	S70°21'20"W	258.32'
L97	S74°43'04"W	217.74'
L98	N61°36'12"W	109.39'
L99	N24°17'33"E	231.65'

LINE	BEARING	DISTANCE
L100	N50°00'00"E	139.38'
L101	N25°39'20"E	172.58'
L102	S89°57'48"E	325.13'
L103	S73°03'17"E	185.85'
L104	S04°29'21"W	286.91'
L105	N85°01'40"W	543.23'
L106	N55°26'27"W	195.97'
L107	N00°03'39"W	129.08'
L108	N45°44'39"E	119.28'

LINE	BEARING	DISTANCE
L109	S75°50'38"W	81.05'
L110	N61°46'35"W	70.74'
L111	N22°08'01"W	64.23'
L112	N15°02'56"W	88.02'
L113	N01°10'20"W	67.36'
L114	N03°53'19"E	114.21'
L115	N09°00'28"W	52.75'
L116	N32°26'43"W	61.31'
L117	N57°02'07"W	77.41'
L118	N78°33'44"W	34.53'
L119	S73°05'44"W	70.68'

LINE	BEARING	DISTANCE
L42	N77°45'00"E	24.59'
L43	N55°54'36"E	79.66'
L44	S82°18'31"E	69.07'
L45	S52°32'55"E	16.70'
L46	S36°20'37"E	76.36'
L47	S12°47'27"W	197.61'
L48	S00°16'35"E	143.75'
L49	S06°20'25"W	188.92'
L50	S16°09'07"E	186.87'
L51	S24°17'33"W	228.35'
L52	S77°30'08"W	195.85'
L53	S00°00'00"E	86.11'
L54	S78°41'24"E	70.82'
L55	S00°41'25"W	57.64'
L56	S89°30'58"W	81.15'
L57	S41°28'17"W	66.37'
L58	S03°33'17"W	201.73'
L59	S45°44'39"W	143.40'
L60	S64°20'54"W	78.54'
L61	N85°06'57"W	210.26'
L62	N11°35'11"E	41.05'
L63	N07°00'33"E	95.98'
L64	N05°45'04"E	83.82'
L65	N07°13'57"E	57.99'
L66	N12°06'57"E	57.91'
L67	N15°49'02"E	66.45'
L68	N13°57'07"E	44.22'
L69	N13°57'07"E	40.12'
L70	N07°12'16"E	54.09'
L71	N03°45'21"E	80.34'
L72	N06°52'46"E	50.56'
L73	N14°13'42"E	48.16'
L74	N21°38'57"E	31.26'
L75	N29°17'15"E	111.82'
L76	N29°49'05"E	51.07'
L77	N25°53'30"E	50.03'
L78	N17°50'42"E	91.21'
L79	N05°07'51"E	74.15'
L80	N04°14'36"E	79.07'
L81	N07°35'33"E	57.60'
L82	N14°03'28"E	41.78'
L83	N20°46'16"E	35.61'
L84	N28°40'07"E	27.18'
L85	N36°20'39"E	32.70'
L86	N44°34'32"E	16.66'
L87	N50°48'50"E	25.88'
L88	N54°47'26"E	36.74'
L89	N48°59'40"E	12.64'

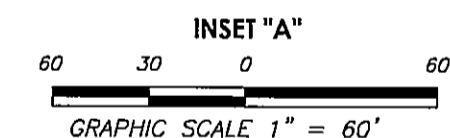
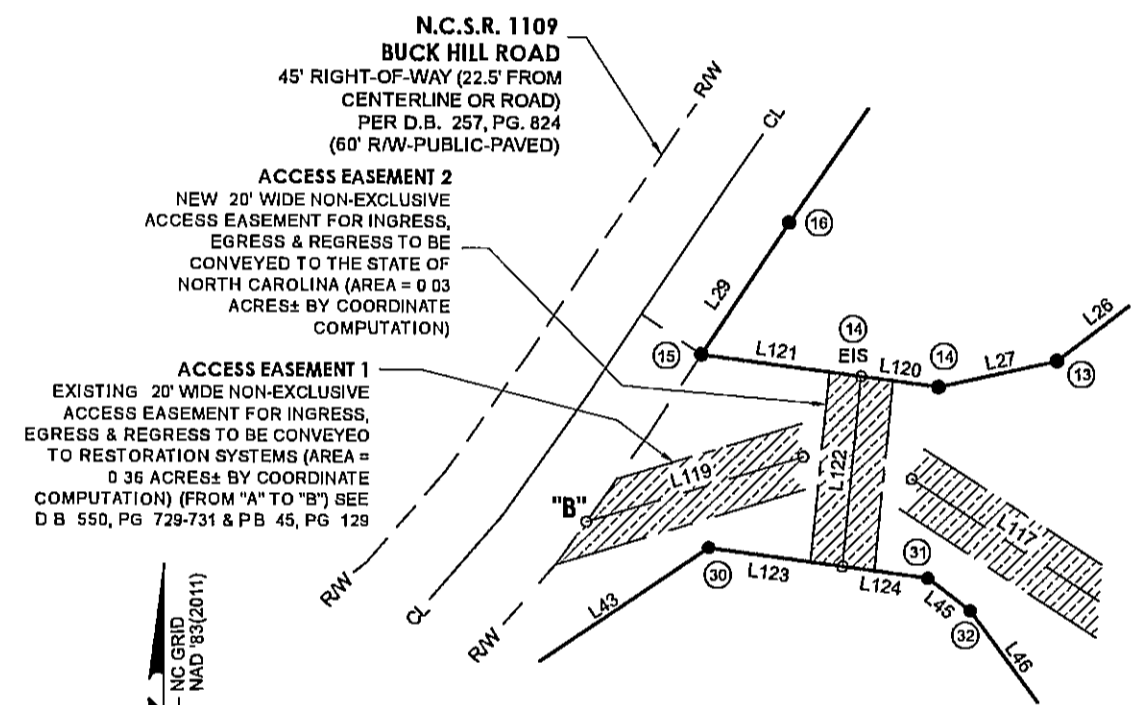
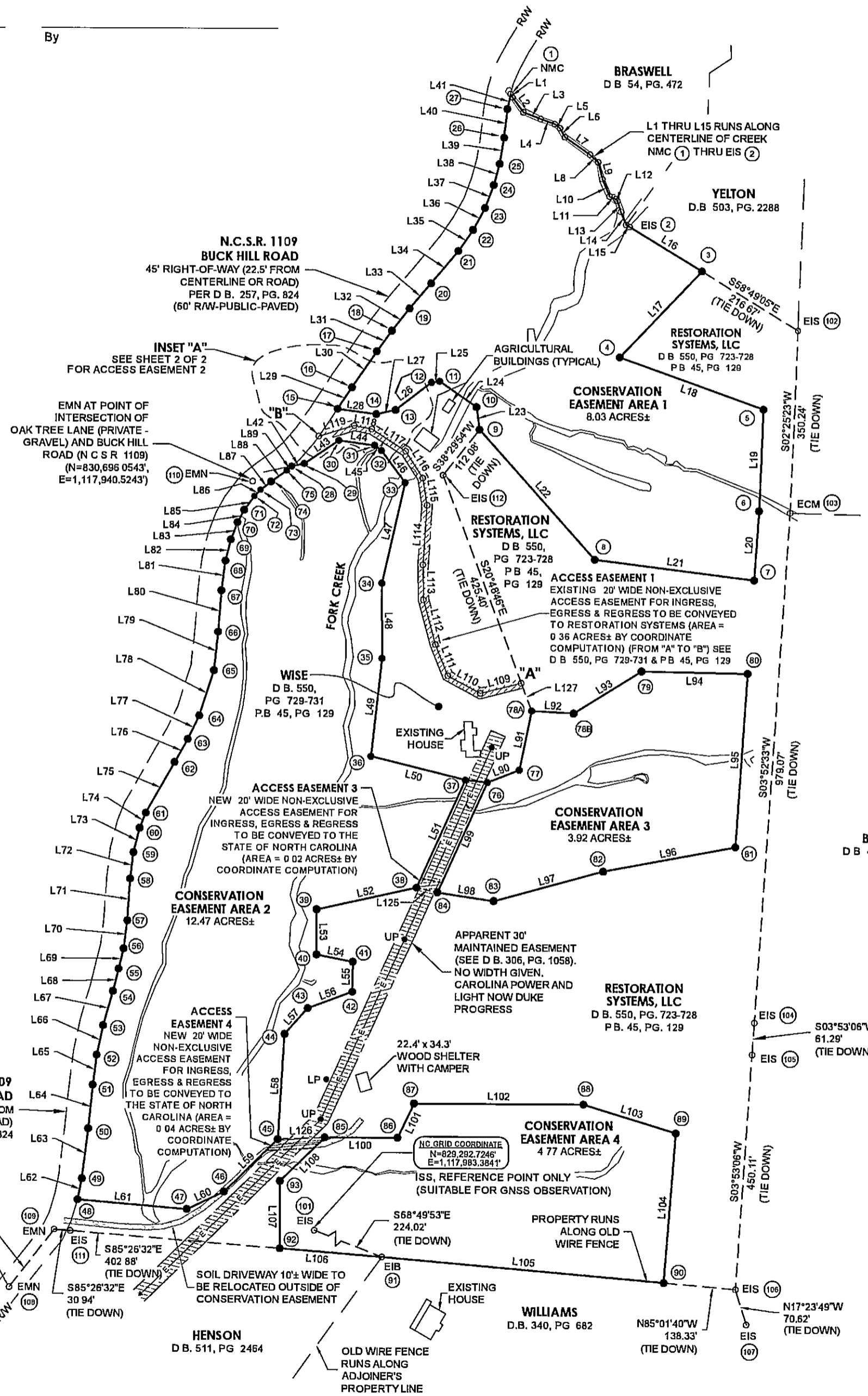
CONSERVATION EASEMENT AREA	RESTORATION SYSTEMS, LLC	ACREAGE DATA:	
CONSERVATION EASEMENT AREA 1	D B 550, PG 723-728		



- LEGEND:**
- ISS - IRON STAKE SET
  - ECM - EXISTING CONCRETE MARKER
  - EIP - EXISTING IRON PIPE
  - EN - EXISTING NAIL
  - MNS - MAG NAIL SET
  - EIS - EXISTING IRON STAKE
  - EPP - EXISTING PUMP PIPE
  - EIB - EXISTING IRON BAR
  - PPS - PUMP PIPE SET
  - NMC - NON-MONUMENTED CORNER
  - R/W - RIGHT OF WAY
  - EOP - EDGE OF PAVEMENT
  - E/B - EASEMENT BOUNDARY
  - CL - CENTERLINE
  - UP - UTILITY POLE
  - P.B. - PLAT BOOK
  - D.B. - DEED BOOK
  - PG. - PAGE
  - CMP - CORRUGATED METAL PIPE
  - - NON-MONUMENTED CORNER
  - No 5 REBAR FLUSH WITH GRADE WITH AN ALUMINUM 3 1/4" CAP INSCRIBED: STATE OF NORTH CAROLINA CONSERVATION EASEMENT
  - CONSERVATION EASEMENT LINE
  - TIE DOWN LINE
  - RIGHT OF WAY LINE OR ADJOINER LINE
  - EASEMENT LINE
  - UTILITY LINE

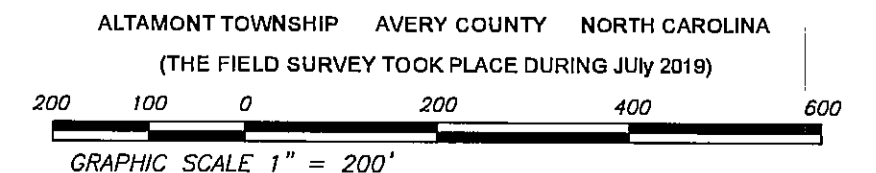


**2020005698**  
 AVERY CO, NC FEE \$21.00  
 PRESENTED & RECORDED  
 10-15-2020 08:13:33 AM  
 RENEE DELLINGER  
 REGISTER OF DEEDS  
 BY CHERYL GARLAND  
 DEPUTY  
**BK: P 45**  
**PG: 137-137**



*10/12/2020*

SHEET 2 OF 2  
**CONSERVATION EASEMENT**  
**FOR THE STATE OF NORTH CAROLINA**  
**DIVISION OF MITIGATION SERVICES**  
**OVER A PORTION OF THE LANDS OF**  
**RESTORATION SYSTEMS, LLC**  
**(CURRENT OWNER PER D.B. 550, PG. 723-728**  
**DMS PROJECT ID# 100122**  
**SPO NUMBERS 06-CD**  
**LAUREL SPRINGS**



**2020005809**

AVERY COUNTY NC FEE \$26.00  
STATE OF NC REAL ESTATE EXT

**\$746.00**

PRESENTED & RECORDED  
10/19/2020 01:24:01 PM

**RENEE DELLINGER**  
REGISTER OF DEEDS  
BY: RENEE DELLINGER  
REGISTER OF DEEDS

**BK: RE 550**

**PG: 2073 - 2086**

**Excise Tax: \$746.00**

**STATE OF NORTH CAROLINA**

**AVERY COUNTY**

**SPO File Number: 06-CD**

**DMS Project Number: 100122**

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

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

**THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS**, made this 19<sup>th</sup> day of October, 2020, by **RESTORATION SYSTEMS, LLC**, a North Carolina limited liability company, ("**Grantor**"), whose mailing address is 1101 Haynes Street, Suite 211, Raleigh, NC 27604 to the **STATE OF NORTH CAROLINA** ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

**WITNESSETH:**

**WHEREAS**, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the

3323914v5.JBB.26275.T28813

NCDMS Full Delivery Conservation Easement Template adopted 5 May 2017

Page 1 of 14

Submitted electronically by "Manning Fulton & Skinner, P.A."  
in compliance with North Carolina statutes governing recordable documents  
and the terms of the submitter agreement with the Avery County Register of Deeds.

protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

**WHEREAS**, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between **RESTORATION SYSTEMS, LLC**, a North Carolina limited liability company, 1101 Haynes Street, Suite 211, Raleigh, NC 27604 and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number 7890.

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

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

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

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

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

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



**WHEREAS**, Grantor owns in fee simple certain real property situated, lying, and being in Altamont Township, Avery County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 47.27 acres and being conveyed to the Grantor by deed as recorded in **Deed Book 533 at Page 422, Deed Book 533 at Page 429, and Deed Book 550 at Page 723**, each of the Avery County Registry, North Carolina; and

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

**NOW, THEREFORE**, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement along with a general Right of Access.

The Conservation Easement Area consists of the following:

BEING ALL of Conservation Easement Area 1 containing a total of **8.03 acres**; Conservation Easement Area 2 containing a total of **12.47 acres**; Conservation Easement Area 3 containing a total of **3.92 acres**; and Conservation Easement Area 4 containing a total of **4.77 acres**; as shown on the plat of survey entitled "Conservation Easement for the State of North Carolina Division of Mitigation Services over a Portion of the Lands of Restoration Systems, LLC (Current Owner per D.B. 550, Pg. 723-728) DMS Project ID #100122, SPO File No. 06-CD, Laurel Springs" dated October 12, 2020 by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded in the Avery County, North Carolina Register of Deeds at **Plat Book 45 Pages 136 through 137**.

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

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

#### **I. DURATION OF EASEMENT**

Pursuant to law, including the above referenced statutes, this Conservation Easement and Right of Access shall be perpetual and it shall run with, and be a continuing restriction upon the

use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

## II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is not inconsistent with the purposes of this Conservation



Easement, and the Grantor obtains advance written approval from the Division of Mitigation Services, 1652 Mail Services Center, Raleigh, NC 27699-1652.

### III. GRANTEE RESERVED USES

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

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

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

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

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

### IV. ENFORCEMENT AND REMEDIES

**A. Enforcement.** To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features in the Conservation Easement Area that may have been damaged by such unauthorized activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, the Grantee shall, except as provided below, notify the Grantor in writing of such breach and the Grantor shall have ninety (90) days after receipt of such notice to correct the damage caused by

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

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

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

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

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

## V. MISCELLANEOUS

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

**B.** Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Property. Grantee shall not be responsible for any costs or liability of any kind related to the

ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

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

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

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

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

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

and

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

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



## VI. QUIET ENJOYMENT

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

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

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

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

RESTORATION SYSTEMS, LLC,  
a North Carolina limited liability company

By: John Preyer (SEAL)  
Name: John Preyer  
Title: President

NORTH CAROLINA  
COUNTY OF Wake

I, John Duncan Hamby, a Notary Public in and for the County and State aforesaid, do hereby certify that John Preyer, on behalf of Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 19th day of October, 2020.

John Duncan Hamby  
Notary Public  
Printed Name: John Duncan Hamby

My commission expires:  
11-15-21



**Exhibit A****Legal Description**

**CONSERVATION EASEMENT  
OF LAUREL SPRINGS  
(DMS Site ID Number 100122, SPO File Number 06-CD)**

**Conservation Easement Area 1**

BEING ALL OF Conservation Easement Area 1 of Laurel Springs (DMS Site ID Number 100122, SPO File Number 06-CD) over a portion of the land of Restoration System, LLC, lying and being situated in Altamont Township, Avery County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 15 and being the Southwestern most corner of the Conservation Easement Area 1 and being located North 04°25'39" East 1547.43 feet from an iron stake with a blue cap (Point No. 101) with N.C. Grid Coordinates N=829,292.7246, E=1,117,983.3841 (NAD '83, 2011).

Thence from the Point of Beginning (Point No.15), North 33°29'24" East 49.45' to an iron stake; thence North 34°17'58" East 84.19' to an iron stake thence North 36°03'42" East 48.93' to an iron stake; thence North 38°31'38" East 54.19' to an iron stake; thence North 40°29'05" East 63.69' to an iron stake; thence North 39°58'30" East 81.08' to an iron stake; thence North 34°55'20" East 49.08' to an iron stake; thence North 28°37'29" East 47.68' to an iron stake; thence North 20°44'29" East 47.23' to an iron stake; thence North 15°36'00" East 42.37' to an iron stake; thence North 09°14'08" East 50.74' to an iron stake; thence North 06°23'46" East 55.38' to an iron stake; thence North 11°54'24" East 29.22' to a non-monumented corner; thence South 31°22'38" East 7.28' to a non-monumented corner; thence South 36°24'21" East 35.59' to a non-monumented corner; thence South 69°07'57" East 35.51' to a non-monumented corner thence South 70°17'07" East 28.40' to a non-monumented corner; thence South 52°47'25" East 12.89' to a non-monumented corner; thence South 29°09'52" East 19.74' to a non-monumented corner; thence South 55°13'53" East 58.85' to a non-monumented corner; thence South 46°51'14" East 20.95' to a non-monumented corner; thence South 14°33'11" East 33.27' to a non-monumented corner; thence South 23°02'11" East 35.88' to a non-monumented corner; thence South 67°02'22" East 12.69' to a non-monumented corner; thence South 43°17'38" East 4.53' to a non-monumented corner; thence South 17°39'58" East 22.02' to a non-monumented corner; thence South 22°46'08" East 27.09' to a non-monumented corner; thence South 58°49'05" East 7.64' to an iron stake; thence South 58°49'05" East 162.88' to an iron stake; thence South 43°44'39" West 228.22' to an iron stake; thence South 70°19'47" East 293.84' to an iron stake; thence South 02°25'23" West 195.21' to an iron stake; thence South 03°52'33" West 133.07' to an iron stake; thence North 82°56'46" West 308.74' to an iron stake; thence North 41°45'30" West 333.20' to an iron stake; thence North 07°40'36" West 43.54' to an iron stake; thence North 55°15'34" West 86.19' to an iron stake; thence South 82°00'48" West 15.68' to an iron stake; thence South 52°25'05" West 86.93' to an iron stake; thence South 77°20'49" West 37.84' to an iron stake;



thence North 82°20'30" West 74.73' to an iron stake, which is the Point of Beginning (Point No. 15), having an area of approximately 8.03 acres.

### **Conservation Easement Area 2**

BEING ALL OF Conservation Easement Area 2 of Laurel Springs (DMS Site ID Number 100122, SPO File Number 06-CD) over a portion of the land of Restoration System, LLC, lying and being situated in Altamont Township, Avery County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 48 and being the Southwestern most corner of the Conservation Easement Area 2 and being located North 85°52'36" West 375.11 feet from an iron stake with a blue cap (Point No. 101) with N.C. Grid Coordinates N=829,292.7246, E=1,117,983.3841 (NAD '83, 2011).

Thence from the Point of Beginning (Point No.48), thence North 11°35'11" East 41.05' to an iron stake; thence North 07°00'33" East 95.98' to an iron stake; thence North 05°45'04" East 83.82' to an iron stake; thence North 07°13'57" East 57.99' to an iron stake; thence North 12°06'57" East 57.91' to an iron stake; thence North 15°49'02" East 68.45' to an iron stake; thence North 13°57'07" East 44.22' to an iron stake; thence North 13°57'07" East 40.12' to an iron stake; thence North 07°12'16" East 54.09' to an iron stake; thence North 03°45'21" East 80.34' to an iron stake; thence North 06°52'46" East 50.56' to an iron stake; thence North 14°13'42" East 48.16' to an iron stake; thence North 21°38'57" East 31.26' to an iron stake; thence North 29°17'15" East 111.82' to an iron stake; thence North 29°49'05" East 51.07' to an iron stake; thence North 25°53'30" East 50.03' to an iron stake; thence North 17°50'42" East 91.21' to an iron stake; thence North 06°07'51" East 74.15' to an iron stake; thence North 04°14'36" East 79.07' to an iron stake; thence North 07°35'33" East 57.60' to an iron stake; thence North 14°03'28" East 41.78' to an iron stake; thence North 20°48'16" East 35.61' to an iron stake; thence North 28°40'07" East 27.18' to an iron stake; thence North 36°20'39" East 32.70' to an iron stake; thence North 44°34'32" East 16.66' to an iron stake; thence North 50°48'50" East 25.86' to an iron stake; thence North 54°47'26" East 36.74' to an iron stake; thence North 48°58'40" East 12.64' to an iron stake; thence North 77°45'00" East 24.59' to an iron stake; thence North 55°54'36" East 79.66' to an iron stake; thence South 82°18'31" East 69.07' to an iron stake; thence South 52°32'55" East 16.70' to an iron stake; thence South 36°20'37" East 76.36' to an iron stake; thence South 12°47'27" West 197.61' to an iron stake; thence South 00°16'36" East 143.75' to an iron stake; thence South 06°20'25" West 188.92' to an iron stake; thence South 76°09'07" East 186.87' to an iron stake; thence South 24°17'33" West 226.35' to an iron stake; thence South 77°30'08" West 195.85' to an iron stake; thence South 00°00'00" East 86.11' to an iron stake; thence South 78°41'24" East 70.82' to an iron stake; thence South 00°41'25" West 57.64' to an iron stake; thence South 69°30'58" West 91.15' to an iron stake; thence South 41°28'17" West 66.37' to an iron stake; thence South 03°33'17" West 201.73' to an iron stake; thence South 45°44'39" West 143.40' to an iron stake; thence South 64°20'54" West 78.64' to an iron stake; thence North 85°06'57" West 210.26' to an iron stake, which is the Point of Beginning (Point No. 48), having an area of approximately 12.47 acres.

### Conservation Easement Area 3

BEING ALL OF Conservation Easement Area 3 of Laurel Springs (DMS Site ID Number 100122, SPO File Number 06-CD) over a portion of the land of Restoration System, LLC, lying and being situated in Altamont Township, Avery County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 84 and being the Southwestern most corner of the Conservation Easement Area 3 and being located North 26°53'51" East 691.98 feet from an iron stake with a blue cap (Point No. 101) with N.C. Grid Coordinates N=829,292.7246, E=1,117,983.3841 (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 84), North 24°17'33" East 231.55' to an iron stake; thence North 68°45'55" East 66.05' to an iron stake; thence North 11°32'48" East 115.88' to an iron stake; thence South 86°49'52" East 80.74' to an iron stake; thence North 58°03'48" East 153.43' to an iron stake; thence South 89°03'07" East 203.86' to an iron stake; thence South 03°52'33" West 333.46' to an iron stake; thence South 79°21'20" West 258.32' to an iron stake; thence South 74°43'04" West 217.74' to an iron stake; thence North 81°36'12" West 109.38' to an iron stake, which is the Point of Beginning (Point No. 84), having an area of approximately 3.92 acres.

### Conservation Easement Area 4

BEING ALL OF Conservation Easement Area 4 of Laurel Springs (DMS Site ID Number 100122, SPO File Number 06-CD) over a portion of the land of Restoration System, LLC, lying and being situated in Altamont Township, Avery County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 92 and being the Southwestern most corner of the Conservation Easement Area 4 and being located South 11°43'07" East 66.71 feet from an iron stake with a blue cap (Point No. 101) with N.C. Grid Coordinates N=829,292.7246, E=1,117,983.3841 (NAD '83, 2011).

Thence from the Point of Beginning (Point No.92), North 00°03'59" West 129.08' to an iron stake; thence North 45°44'39" East 119.28' to an iron stake; thence North 90°00'00" East 139.38' to an iron stake; thence North 25°39'20" East 72.58' to an iron stake; thence South 89°57'48" East 325.13' to an iron stake; thence South 73°03'17" East 185.85' to an iron stake; thence South 04°29'21" West 286.91' to an iron stake; thence North 85°01'40" West 543.23' to an iron stake; thence North 85°26'32" West 195.97' to an iron stake, which is the Point of Beginning (Point No. 92), having an area of 4.77 approximately acres.

ALL OF THE FOREGOING CONSERVATION EASEMENT AREAS as shown on plat of survey titled "Conservation Easement Survey for the State of North Carolina, Division of Mitigation Services, over a Portion of the Lands of Restoration Systems, LLC (Current Owner per DB 550, Pg. 723-728), DMS Project ID No. 10012, SPO File Number 06-CD, Laurel Springs, Altamount Township, Avery County, North Carolina" dated October 12, 2020, by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded in Plat Book 45, Pages 136 through 137, Avery County Register of Deeds.

ALL SUCH CONSERVATION EASEMENT AREAS TOGETHER WITH those certain new twenty (20) feet-wide non-exclusive access easements labeled as "ACCESS EASEMENT 1", "ACCESS EASEMENT 3", and "ACCESS EASEMENT 4", as well as any other access easements shown on the plat hereinafter referenced, all for ingress, egress, and regress and all as shown on the plat of survey recorded in Plat Book 45, Pages 136 through 137, Avery County Register of Deeds.



## APPENDIX I - CREDIT RELEASE SCHEDULE

The schedules below list the updated credit release schedules for stream and wetland mitigation projects developed by bank and ILF sites in North Carolina:

<b>Credit Release Schedule and Milestones for Wetlands</b>					
<b>Credit Release Milestone</b>	<b>Release Activity</b>	<b>Banks</b>		<b>ILF/NCDCMS</b>	
		<b>Interim Release</b>	<b>Total Released</b>	<b>Interim Release</b>	<b>Total Released</b>
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that interim performance standards have been met	10%	50%	10%	50%
5	Year 3 monitoring report demonstrates that interim performance standards have been met	15%	65%	15%	65%
6*	Year 4 monitoring report demonstrates that interim performance standards have been met	5%	70%	5%	70%
7	Year 5 monitoring report demonstrates that interim performance standards have been met	15%	85%	15%	85%
8*	Year 6 monitoring report demonstrates that interim performance standards have been met	5%	90%	5%	90%
9	Year 7 monitoring report demonstrates that performance standards have been met	10%	100%	10%	100%

\*Please note that vegetation plot data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

Credit Release Schedule and Milestones for Streams					
Credit Release Milestone	Release Activity	Banks		ILF/NCDMS	
		Interim Release	Total Released	Interim Release	Total Released
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%	10%	50%
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%	10%	60%
6*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75% <sup>**</sup> )	5%	65% (75% <sup>**</sup> )
7	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85% <sup>**</sup> )	10%	75% (85% <sup>**</sup> )
8*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90% <sup>**</sup> )	5%	80% (90% <sup>**</sup> )
9	Year 7 monitoring report demonstrates that channels are stable, performance standards have been met	10%	90% (100% <sup>**</sup> )	10%	90% (100% <sup>**</sup> )

\*Please note that vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

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



## APPENDIX J - MAINTENANCE PLAN

## Maintenance Plan

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

<b>Component/Feature</b>	<b>Maintenance through project close-out</b>
Stream	Routine channel maintenance and repair activities may include securing of loose coir matting and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Beaver	Beaver and associated dams are to be removed as they colonize and until the project is closed.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree- blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.
Road Crossing	Road crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.

## APPENDIX K - IRT SITE VISIT COMMENTS





### Task 1 a.) Inter-Agency Post Contract Site Visit: Site Visit Notes

As specified within RFP #16-007725, an on-site meeting with regulatory agencies and DMS staff was conducted on July 24<sup>th</sup>, 2019. Below is a list of attendees and general site visit notes.

#### Attendees:

##### USACE:

- Todd Tugwell
- Kim Browning

##### NC DWR:

- Mac Haupt
- Erin Davis

##### NC WRC:

Andrea Leslie

##### Restoration Systems:

- Raymond Holz
- Worth Creech

##### NC DMS:

- Paul Wiesner
- Matthew Reid
- Periann Russell
- Kirsten Ullman

##### Axiom Environmental

- Grant Lewis

#### Site Visit Notes:

- The Project can proceed as proposed
- Mitigation credit cannot be gained beneath powerlines located on the site. RS will remove the existing powerline easement from the conservation easement and excluded the break from the wider buffer tool GIS analysis.
- RS plans to align the dirt road which crosses UT-4 under the existing Powerline Easement to minimize encroachment on the Project.
- All culverts which outfall into the project or are within the project will be reconnected to streambed elevations to allow for aquatic species passage. Where required, culverts will be removed, replaced, and inlets/outfalls buried for aquatic species passage.
- Riparian wetland credits are not currently contracted with DMS. RS will approach DMS and propose to add wetland credit to the site (and DMS contract) upon receipt and review of the project's USACE jurisdictional determination.

#### Stream Notes:

- A detailed topographic survey will be conducted to determine the practicality of restoring Fork Creek to the valley center within the upper 1/3 of the project. The approach was approved in theory by the IRT, though both the IRT and DMS voiced concerns of habitat loss from a relatively high functioning reach of Fork Creek located immediately upstream of the existing barn. This is not how the project was proposed, and any deviation from the proposal will be vetted and approved by DMS before IRT review.

RS discussed the potential of restoring a 5th unnamed tributary located along the western property boundary of the Project. Restoration would be achieved through priority 1, new channel design within the valley footprint. The additional hydrology would help restore drained hydric soils within the upper 1/3 of the Project. Detailed topo work would determine if the stream would tie back into Fork creek above the existing barn, or stay within the valley and connect below the upper crossing. The Project was not proposed with this option, and any deviation from the proposal will be vetted and approved by DMS.

- IRT members noted historical issues with maintaining channels within the floodplain of larger systems. In this case, the restoration of UT-3 and UT-4 within Fork Creek's floodplain.
- UT-1: crediting and approach approved as proposed.
- UT-2: crediting and approach approved as proposed with further justification on approach required. Given the high amount of sedimentation within the system immediately above and below the existing crossing, DWR Rep. Mac Hault raised concerns regarding the mitigation approach in this area. During the detailed topographic survey of the Site, these areas will be probed and surveyed to determine the most suitable mitigation approach, paying particular attention to the existing wetlands and the stabilization of those wetlands.

The alignment of the existing road will be altered to fit within the existing powerline easement, minimizing long-term impacts to the project.

- UT-3: approved as proposed with the removal of stream credit under the existing powerline easement.
- UT-4: approved as proposed.

**Wetland Notes:**

- The appropriate wetland type (forested vs. scrub-shrub) for the project was discussed throughout the site. RS will attempt to locate reference wetlands within the area to determine an appropriate balance of forested and scrub-shrub wetland for the site. Detailed topography of the valley will aid in this determination. A habitat description, restoration approach, monitoring standard, etc. will be completed for each type within the Mitigation Plan.
- Existing Wetlands (labeled as Enhancement in Figure 5 of the Technical Proposal) are suitable for Rehabilitation (1.5:1 ratio) if groundwater gauges are installed to survey a baseline, and monitoring shows an increase in the hydroperiod.

## APPENDIX L - CONSTRUCTION PLANS

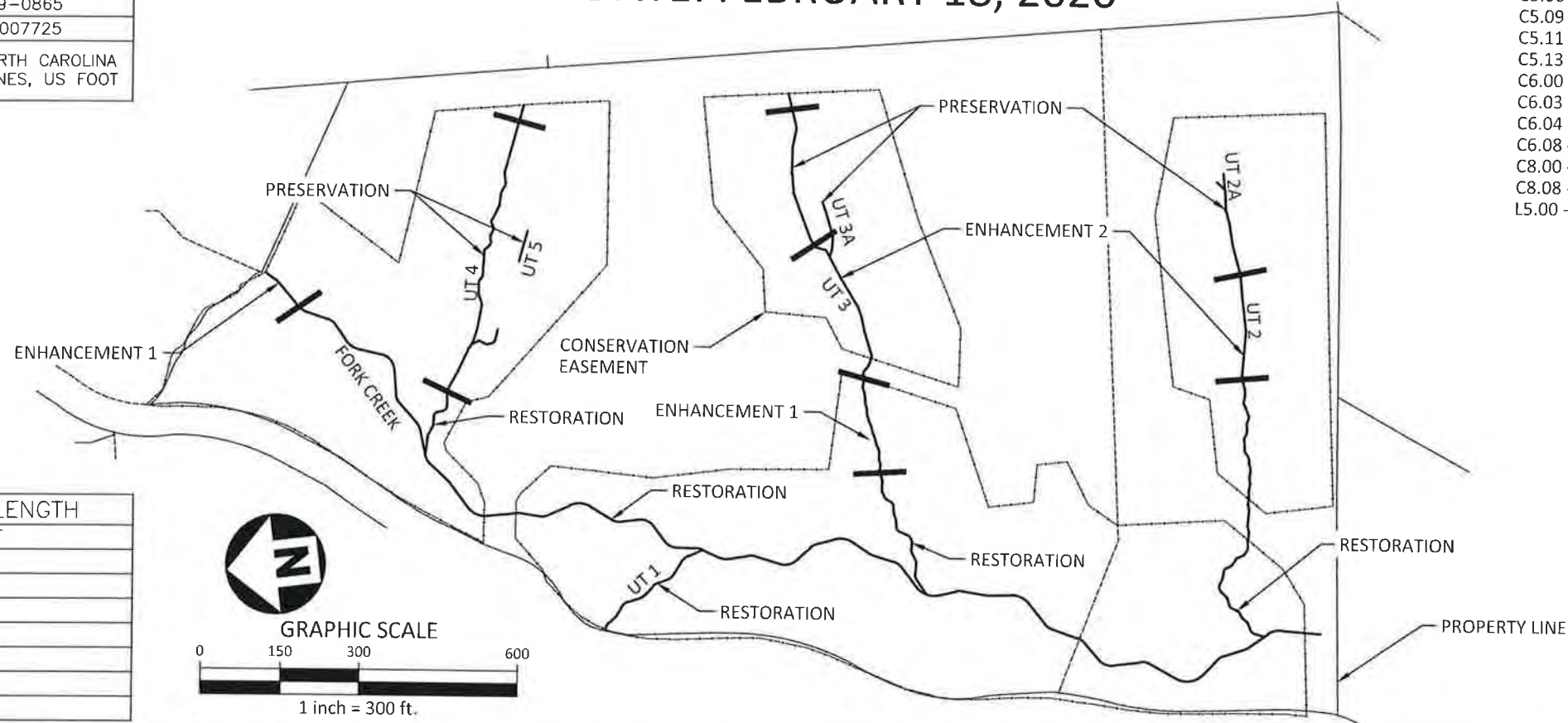


# NC DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISION OF MITIGATION SERVICES

## CONSTRUCTION PLANS LAUREL SPRINGS SITE AVERY COUNTY DATE: FEBRUARY 18, 2020

SITE DATA TABLE	
RIVER BASIN	FRENCH BROAD
8-DIGIT HUC	6010108
TOTAL DISTURBED AREA	27.53 AC
DMS PROJECT ID NO.	100122
FULL DELIVERY CONTRACT NO.	7890
USACE ACTION ID NO.	SAW-2019-00835
DWR PROJECT NO.	2019-0865
RFP NO.	16-007725
COORDINATE SYSTEM	NAD83 NORTH CAROLINA STATE PLANES, US FOOT

SHEET INDEX	
C1.00	EASEMENT AND CONTROL POINTS EXHIBIT
C1.01	INDEX OF SYMBOLS
C1.02	PROJECT OVERVIEW
C5.00 - C5.04	FORK CREEK PLAN AND PROFILE
C5.05	UT 1 PLAN AND PROFILE
C5.06 - C5.08	UT 2 PLAN AND PROFILE
C5.09 - C5.10	UT 3 PLAN AND PROFILE
C5.11 - C5.12	UT 4 PLAN AND PROFILE
C5.13	DRIVEWAY GRADING
C6.00 - C6.02	EROSION CONTROL NOTES
C6.03	EROSION CONTROL OVERVIEW
C6.04 - C6.07	EROSION CONTROL PLAN
C6.08 - C6.16	EROSION CONTROL DETAILS
C8.00 - C8.07	STREAM DETAILS
C8.08 - C8.09	CULVERT DETAILS
L5.00 - L5.02	PLANTING



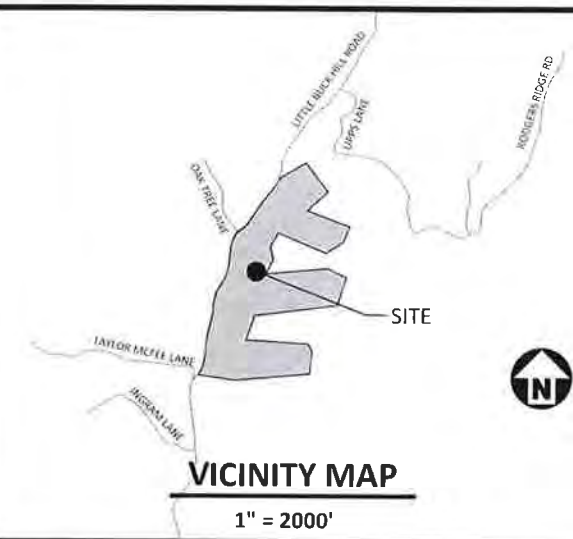
TOTAL DISTURBED AREA = 27.53 AC.

### MITIGATION SUMMARY

TRIBUTARY	PROPOSED LENGTH
FORK CREEK	2,341 LF
UT1	234 LF
UT2	858 LF
UT2A	25 LF
UT3	930 LF
UT3A	103 LF
UT4	653 LF
UT5	127 LF

RESTORATION LEVEL	STREAM (LF)	RIPARIAN WETLAND (AC)	NON-RIPARIAN WETLAND (AC)
RESTORATION	3,296	-	-
ENHANCEMENT I	274	-	-
ENHANCEMENT II	446	-	-
PRESERVATION	1,245	0.198*	-
REESTABLISHMENT	-	7.656	-
REHABILITATION	-	1.845*	-
ENHANCEMENT	-	0.148*	-
TOTALS	5,261	9.847	-
MITIGATION UNITS	4,231*	3.688	-

\*TOTAL STREAM MITIGATION UNITS INCLUDE UNITS FROM THE WIDER BUFFER TOOL  
\*WETLAND REHABILITATION, ENHANCEMENT, PRESERVATION, AND SOME RE-ESTABLISHMENT ARE NOT CREDIT GENERATING.



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www.mcadamsco.com

AXIOM ENVIRONMENTAL, INC.  
218 SNOW AVENUE  
RALEIGH, NC 27603  
CONTACT: GRANT LEWIS  
PHONE: 919. 215. 1693



CLIENT  
RESTORATION SYSTEMS, LLC  
1101 HAYNES ST, SUITE 211  
RALEIGH, NC 27604  
CONTACT: WORTH CREECH  
PHONE: 919. 389. 3888

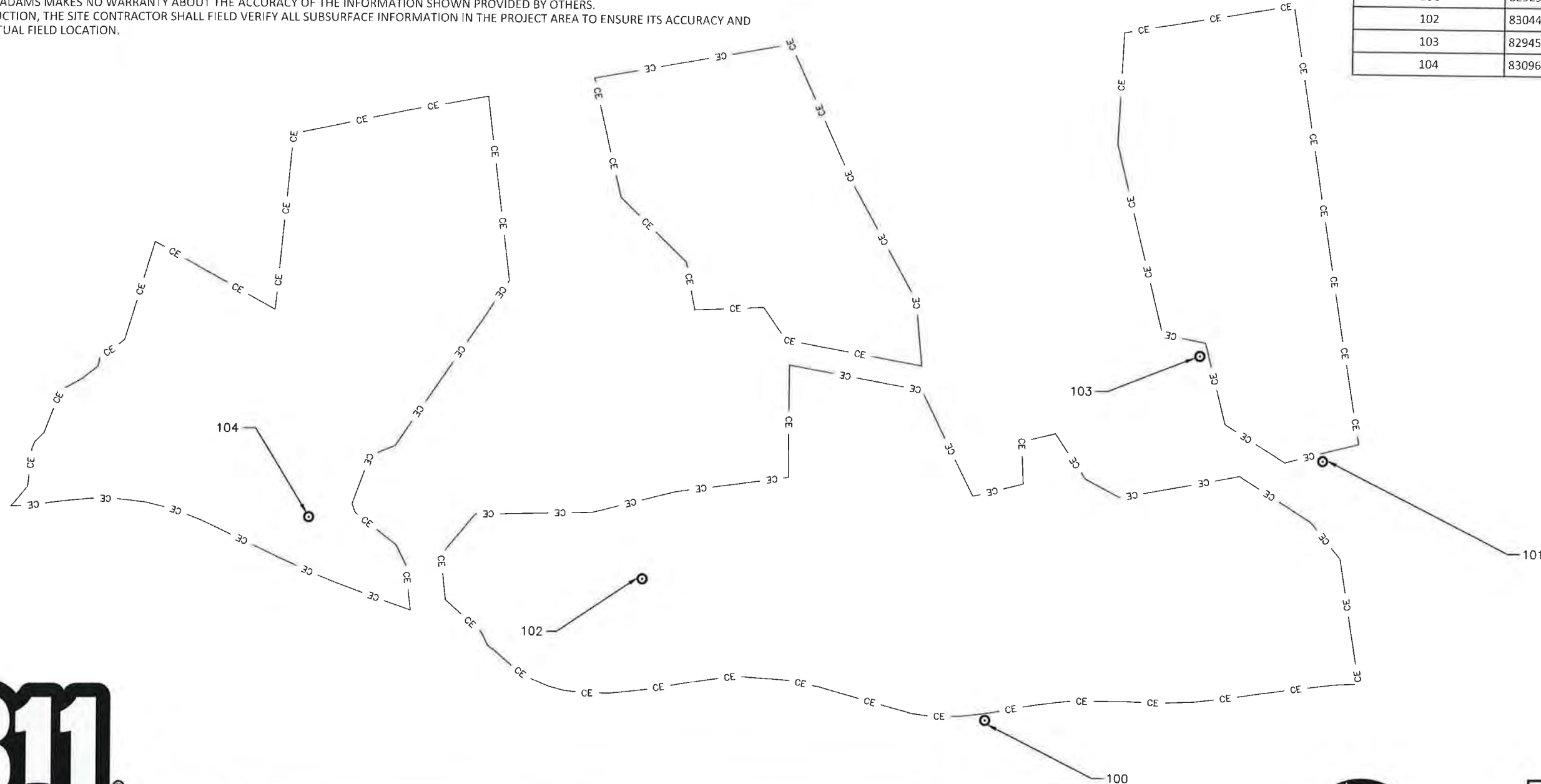




**GENERAL NOTES:**

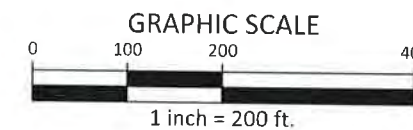
1. COORDINATE SYSTEM: NAD83 NORTH CAROLINA STATE PLANES, US FOOT
2. TOPOGRAPHY AND SPOT ELEVATIONS SHOWN ARE FROM AN ACTUAL FIELD SURVEY COMPLETED BY K2 DESIGN GROUP.
3. PLANIMETRICS, UTILITIES, INVERTS AND BUILDING INFORMATION (SHOWN FOR REFERENCE) WAS COMPILED FROM AUTOCAD FILES PROVIDED TO MCADAMS FROM OTHERS. MCADAMS MAKES NO WARRANTY ABOUT THE ACCURACY OF THE INFORMATION SHOWN PROVIDED BY OTHERS.
4. PRIOR TO CONSTRUCTION, THE SITE CONTRACTOR SHALL FIELD VERIFY ALL SUBSURFACE INFORMATION IN THE PROJECT AREA TO ENSURE ITS ACCURACY AND DETERMINE ITS ACTUAL FIELD LOCATION.

CONTROL POINT LOCATIONS			
CONTROL POINT	NORTHING	EASTING	ELEVATION
100	829943.8048	1117697.5263	2951.36
101	829292.7246	1117983.3841	2948.17
102	830447.4092	1118061.3990	2941.26
103	829453.9034	1118202.3079	2973.08
104	830965.0697	1118294.5656	2958.02



**Know what's below.  
Call before you dig.**

CONTRACTOR SHALL NOTIFY "NC811" (811) OR (1-800-632-4949) AT LEAST 3 FULL BUSINESS DAYS PRIOR TO BEGINNING CONSTRUCTION OR EXCAVATION TO HAVE EXISTING UTILITIES LOCATED. CONTRACTOR SHALL CONTACT ANY LOCAL UTILITIES THAT PROVIDE THEIR OWN LOCATOR SERVICES INDEPENDENT OF "NC811". REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY.



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**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



**PLAN INFORMATION**

PROJECT NO. AXI-19000  
FILENAME AXI19010-ESMT  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE 1" = 60'  
DATE 02.18.2020

CONSERVATION EASEMENT  
AND CONTROL POINTS EXHIBIT

**C1.00**

## LEGEND AND SYMBOLS

	LIMITS OF DISTURBANCE
	EXISTING PROPERTY LINE
	DEMOLITION LINE
	PROPOSED CONSERVATION EASEMENT
	EXISTING STORM DRAINAGE
	EXISTING STREAM CENTERLINE
	EXISTING DRAINAGE TILE
	PROPOSED STREAM CENTERLINE
	MAJOR CONTOUR
	MINOR CONTOUR
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	PROPOSED LOG CROSS VANE
	PROPOSED LOG VANE
	PROPOSED STEP SILL
	PROPOSED STEP POOL
	PROPOSED DROP STRUCTURE
	CONSTRUCTED RIFFLE
	WETLAND REHABILITATION AREA
	WETLAND RE-ESTABLISHMENT AREA
	WETLAND PRESERVATION AREA
	MARSH TREATMENT AREA

## EROSION CONTROL LEGEND

	CONSTRUCTION ENTRANCE
	HAUL ROAD
	SILT FENCE
	STAGING/STOCKPILE AREA
	SILT FENCE OUTLET
	PUMP AROUND PUMP
	CHANNEL PLUG
	ROCK FLOODPLAIN OUTLET



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# LAUREL SPRINGS MITIGATION PLAN

## CONSTRUCTION DRAWINGS

AVERY COUNTY, NORTH CAROLINA

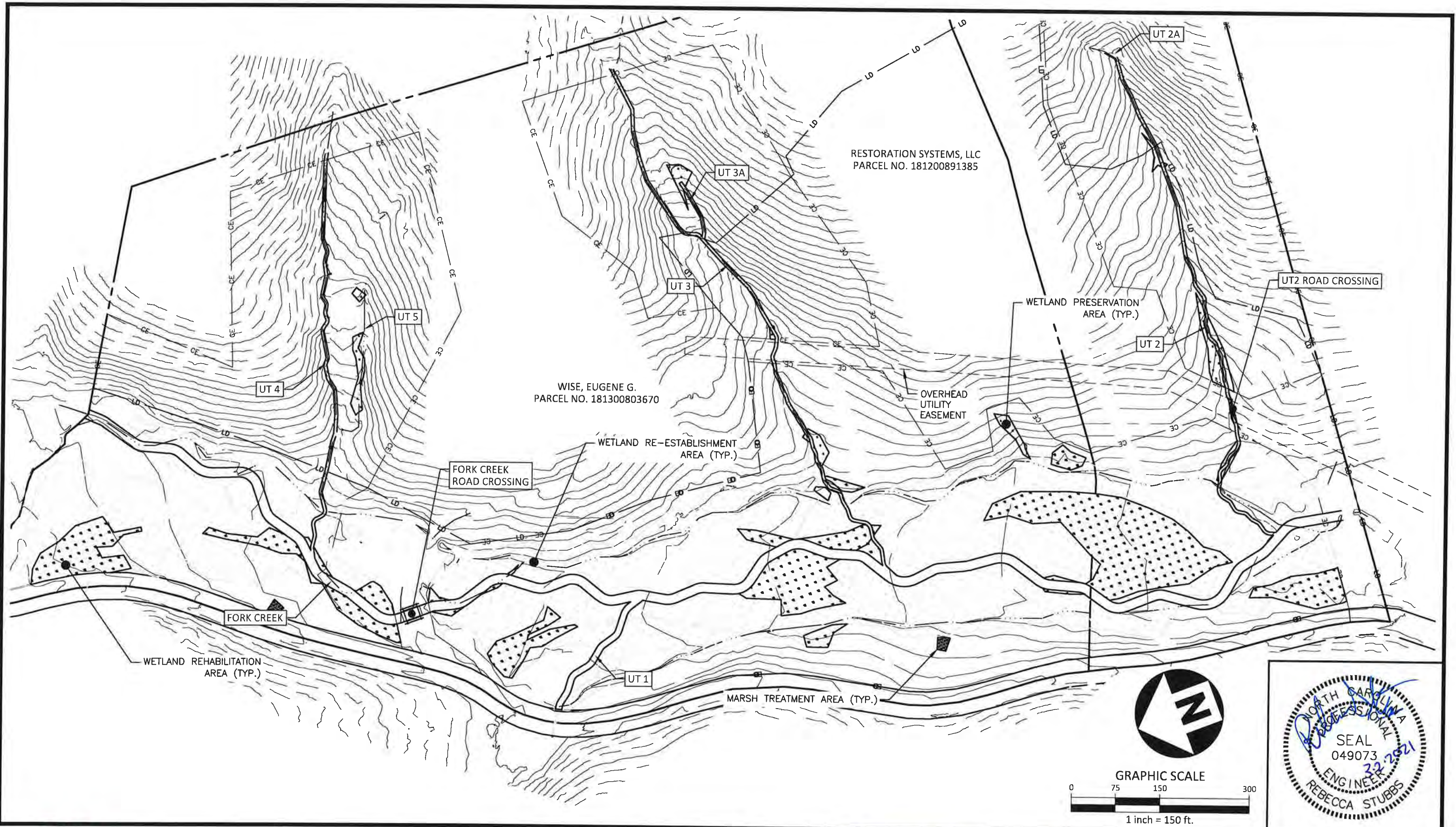


<b>PLAN INFORMATION</b>	
PROJECT NO.	AXI-19000
FILENAME	AXI19000-P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	02.18.2020

## LEGEND AND SYMBOLS

# C1.01





  
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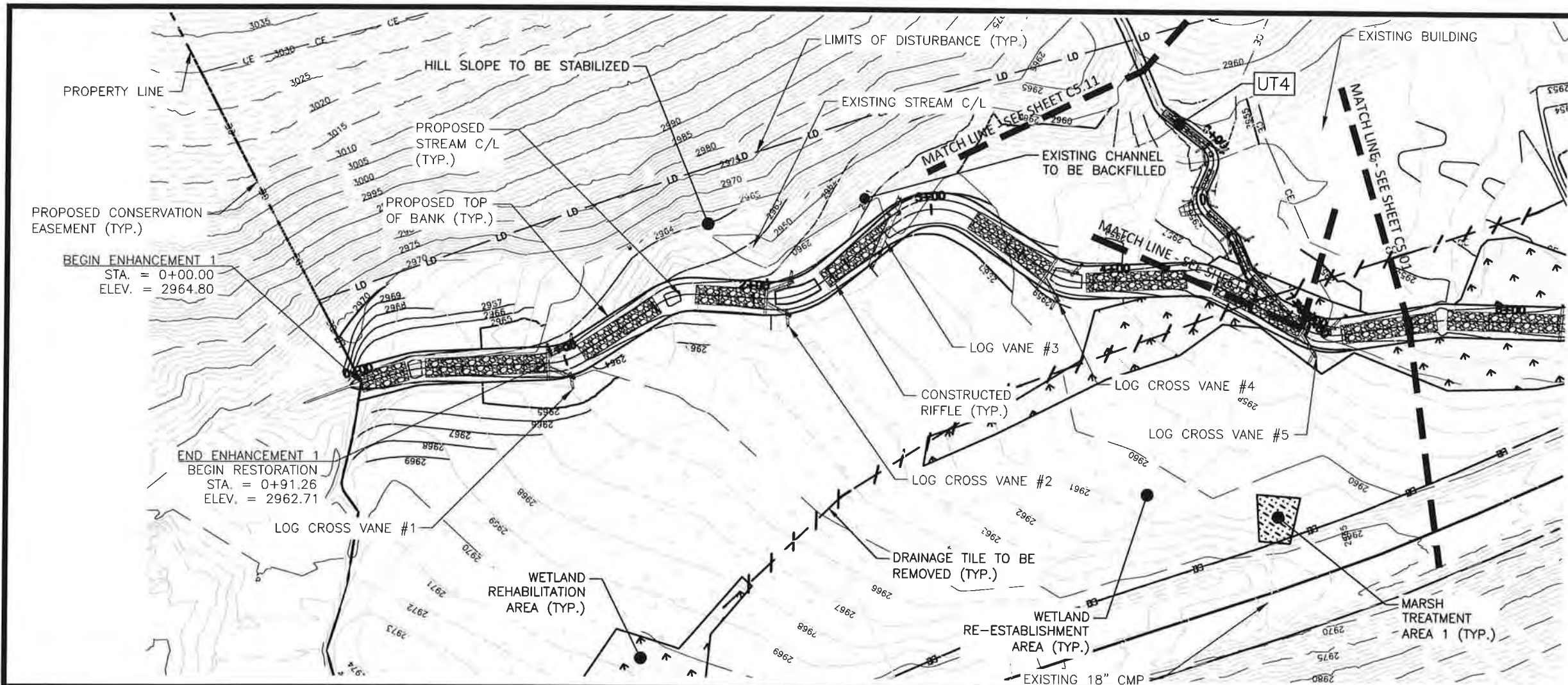
**LAUREL SPRINGS MITIGATION PLAN**  
**CONSTRUCTION DRAWINGS**  
 AVERY COUNTY, NORTH CAROLINA



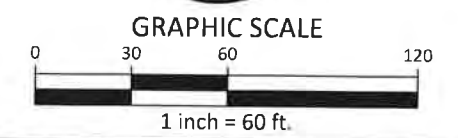
PLAN INFORMATION	
PROJECT NO.	AXI-19000
FILENAME	AXI19000-P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1" = 150'
DATE	02.18.2020

**PROJECT OVERVIEW**  
**C1.02**

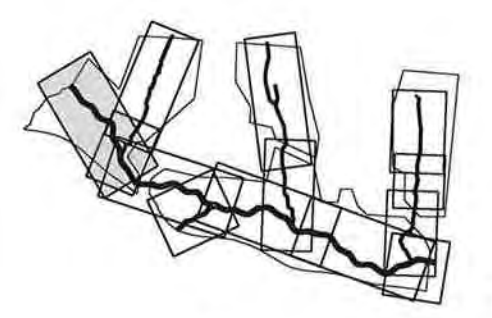




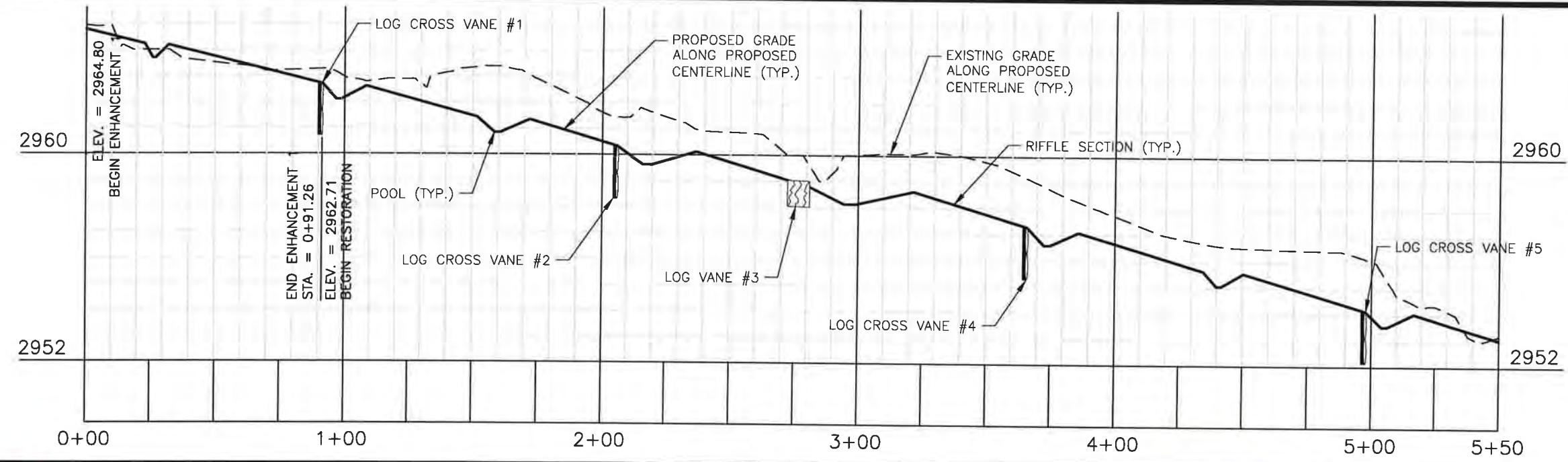
FORK CREEK STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #1	0+91.26	2962.71
LOG CROSS VANE #2	2+05.98	2960.32
LOG VANE #3	2+80.98	2958.79
LOG CROSS VANE #4	3+65.85	2957.30
LOG CROSS VANE #5	4+97.62	2954.15



TOTAL DISTURBED AREA = 27.53 AC.



VICINITY MAP  
1" = 1000'



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# LAUREL SPRINGS MITIGATION PLAN

## CONSTRUCTION DRAWINGS

AVERY COUNTY, NORTH CAROLINA

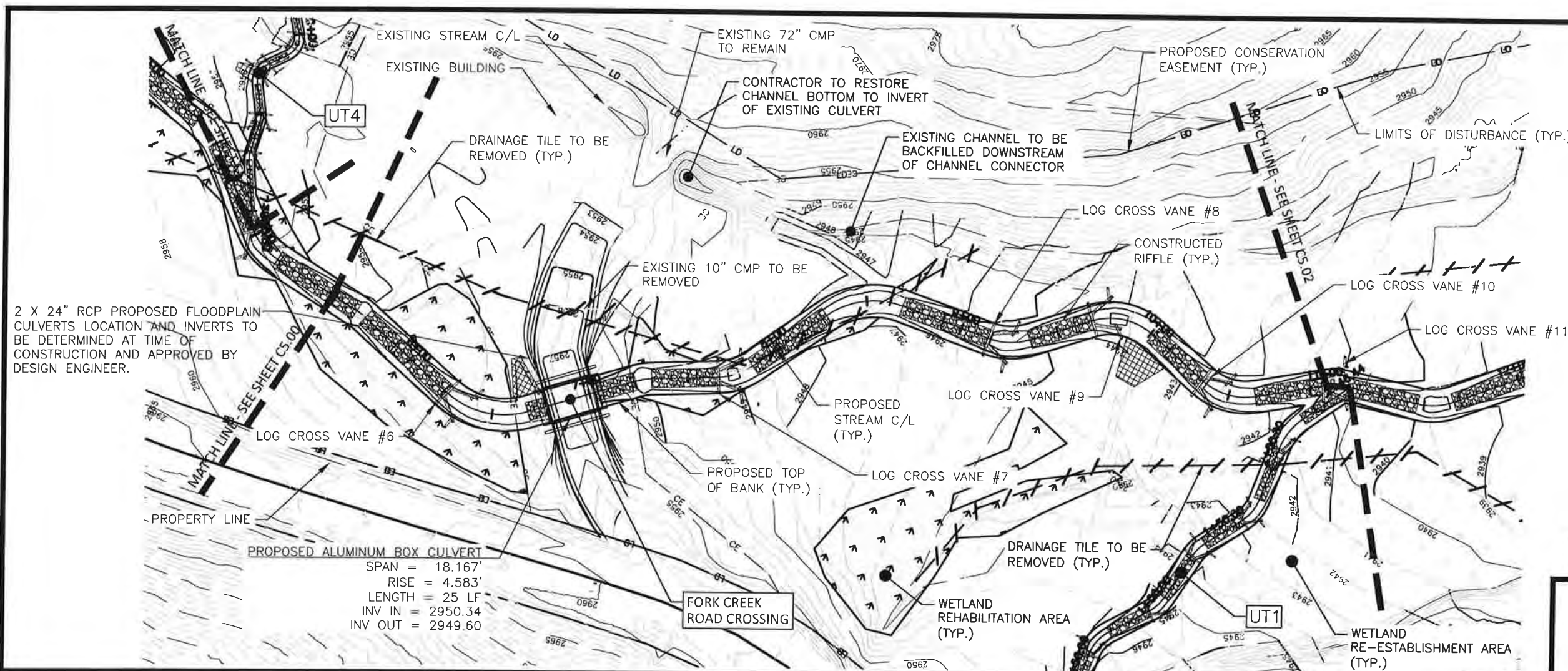
**PLAN INFORMATION**

PROJECT NO. AXI-19000  
FILENAME AXI19000-P1  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE 1"=60' / 1"=50'  
DATE 02.18.2020

**PLAN AND PROFILE**

FORK CREEK  
STA. 00+00 THRU STA. 5+50  
**C5.00**

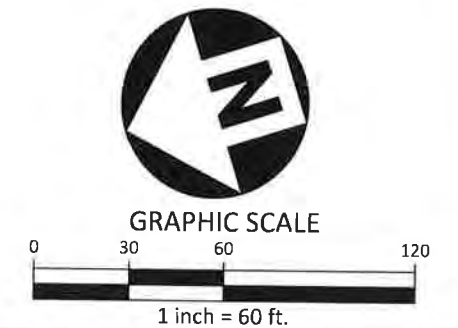




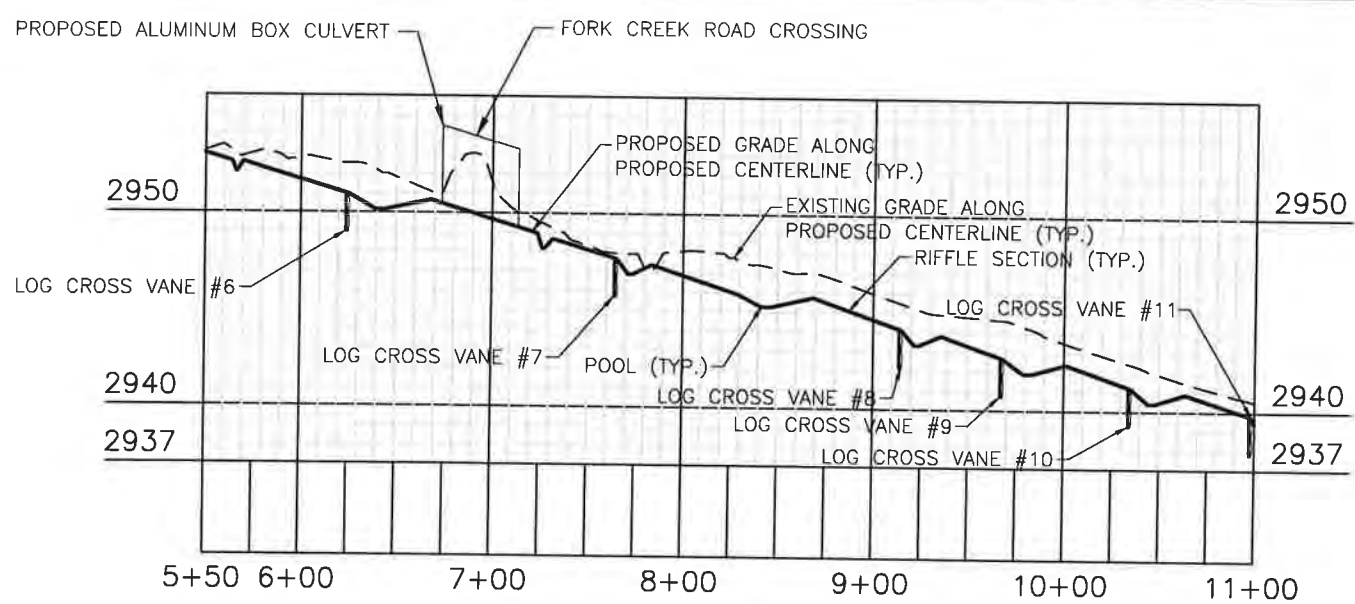
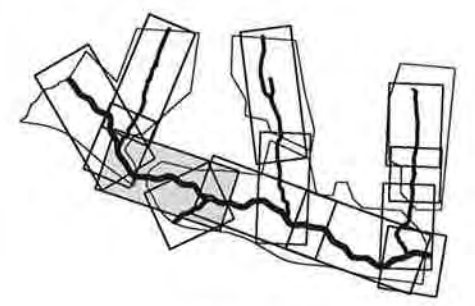
2 X 24" RCP PROPOSED FLOODPLAIN CULVERTS LOCATION AND INVERTS TO BE DETERMINED AT TIME OF CONSTRUCTION AND APPROVED BY DESIGN ENGINEER.

**PROPOSED ALUMINUM BOX CULVERT**  
SPAN = 18.167'  
RISE = 4.583'  
LENGTH = 25 LF  
INV IN = 2950.34  
INV OUT = 2949.60

FORK CREEK STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #6	6+24.77	2950.95
LOG CROSS VANE #7	7+65.04	2947.68
LOG CROSS VANE #8	9+14.60	2944.14
LOG CROSS VANE #9	9+67.85	2942.70
LOG CROSS VANE #10	10+34.80	2941.22
LOG CROSS VANE #11	10+98.31	2939.79



TOTAL DISTURBED AREA = 27.53 AC.



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**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

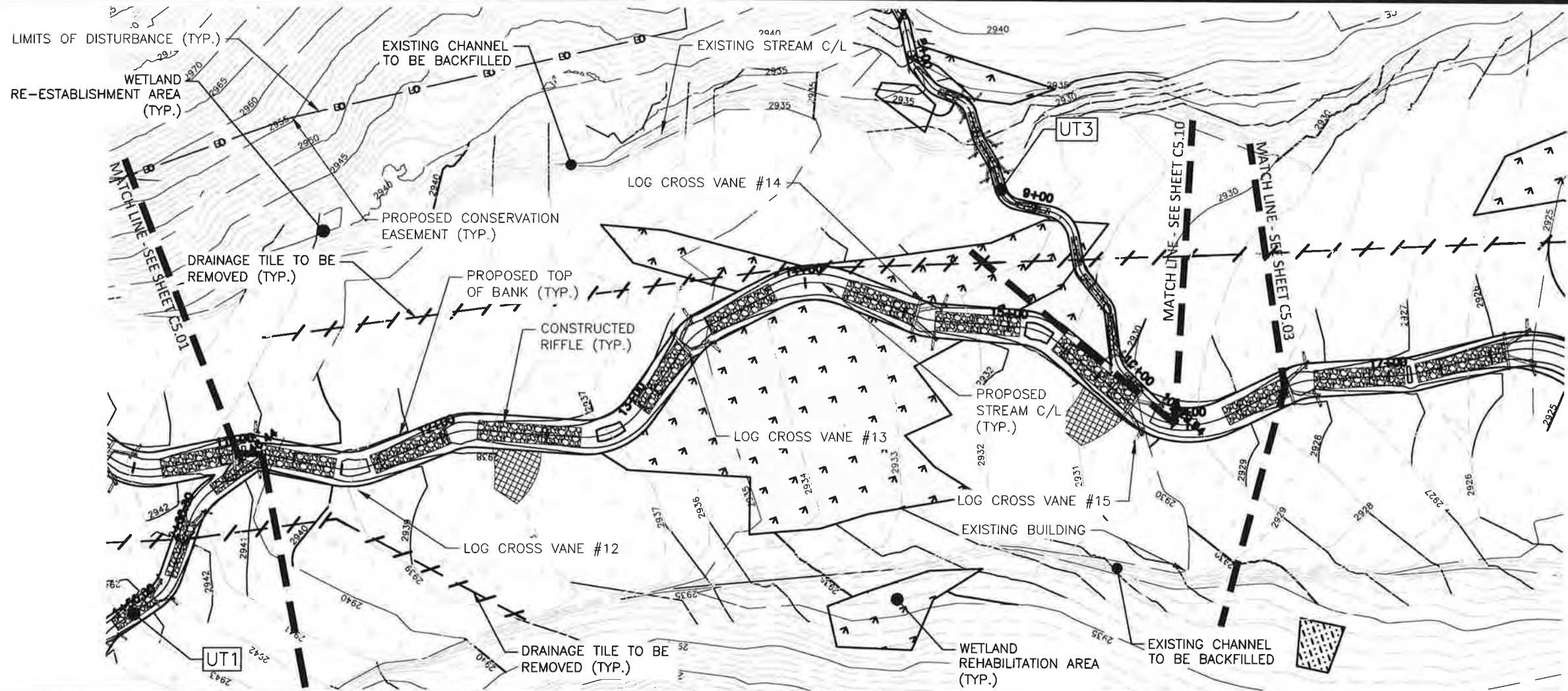
Axiom Environmental, Inc.

**PLAN INFORMATION**  
PROJECT NO. AXI-19000  
FILENAME AXI19000-P1  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE 1"=60' / 1"=100'  
DATE 02.18.2020

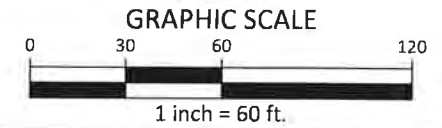
**PLAN AND PROFILE**  
FORK CREEK  
STA. 05+00 THRU STA. 11+00  
**C5.01**

SEAL  
049073  
3-2-2021  
ENGINEER  
REBECCA STUBBS

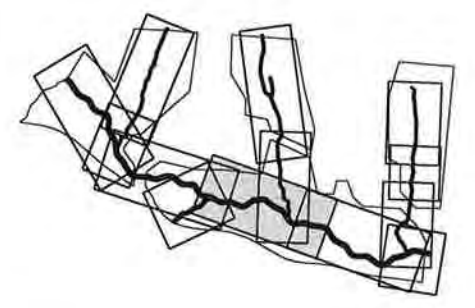




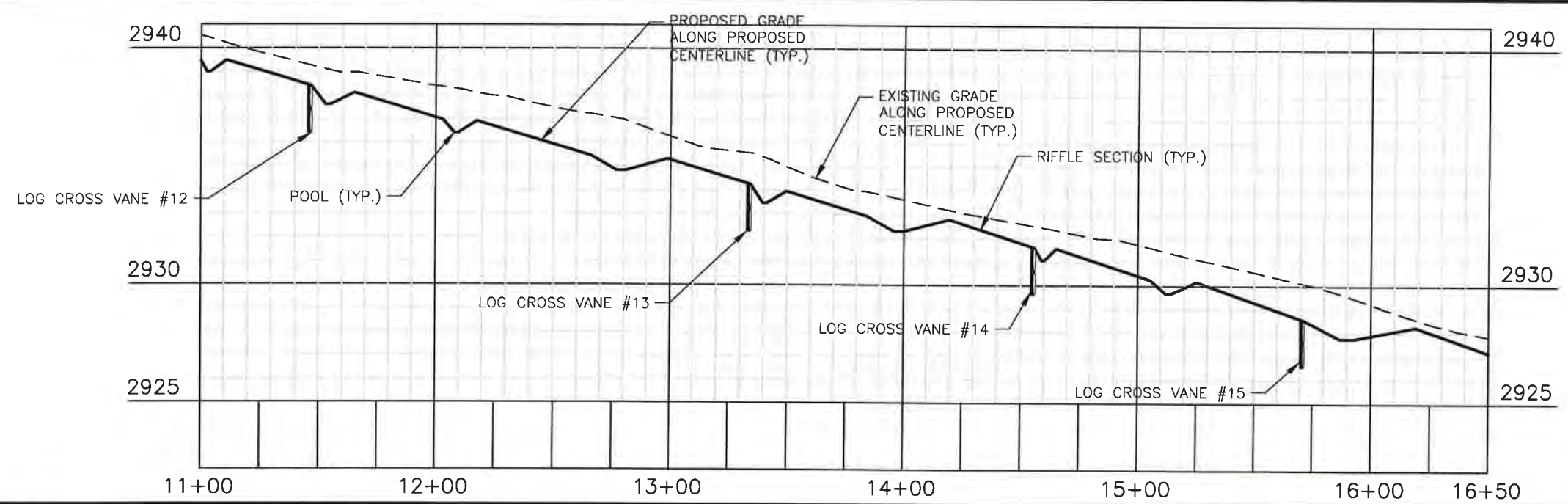
FORK CREEK STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #12	11+46.66	2938.41
LOG CROSS VANE #13	13+34.14	2934.26
LOG CROSS VANE #14	14+55.76	2931.61
LOG CROSS VANE #15	15+71.19	2928.57



TOTAL DISTURBED AREA = 27.53 AC.



VICINITY MAP  
1" = 1000'



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# LAUREL SPRINGS MITIGATION PLAN

## CONSTRUCTION DRAWINGS

AVERY COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

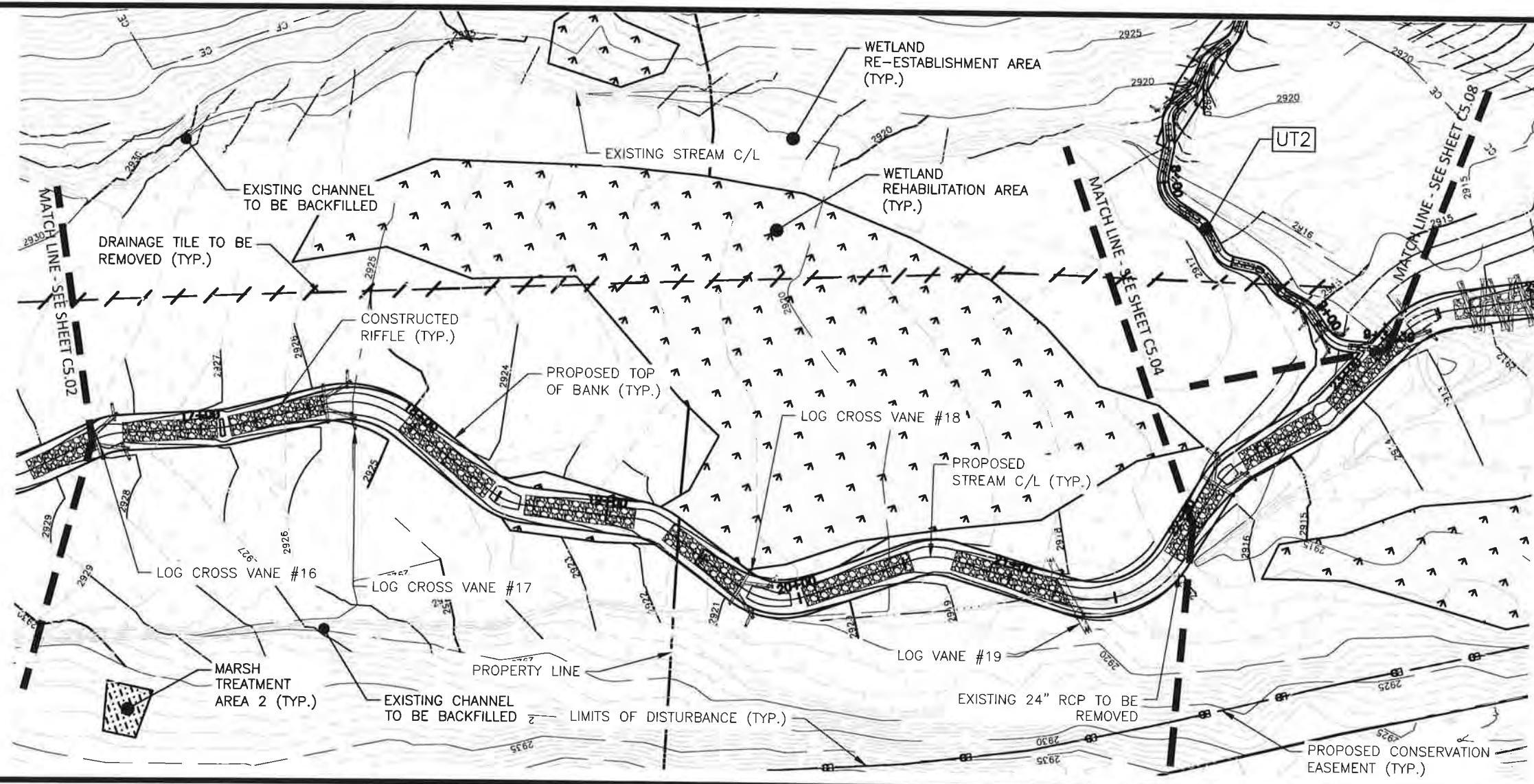
Axiom Environmental, Inc.

**PLAN INFORMATION**

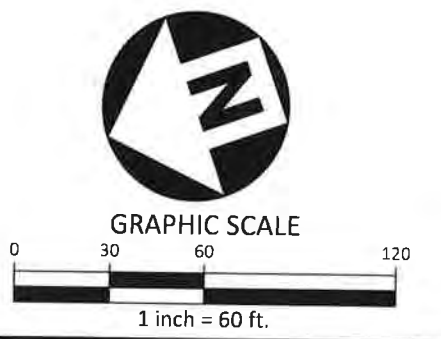
PROJECT NO.	AXI-19000
FILENAME	AXI19000-P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=60' / 1"=60'
DATE	02.18.2020

**PLAN AND PROFILE**  
FORK CREEK  
STA. 11+00 THRU STA. 16+50  
**C5.02**

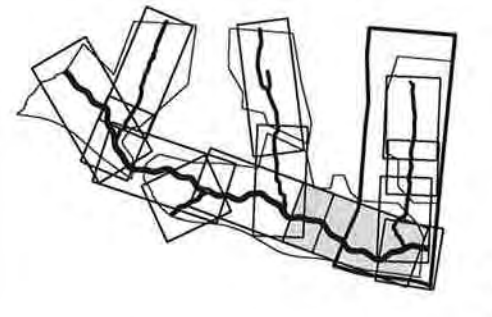




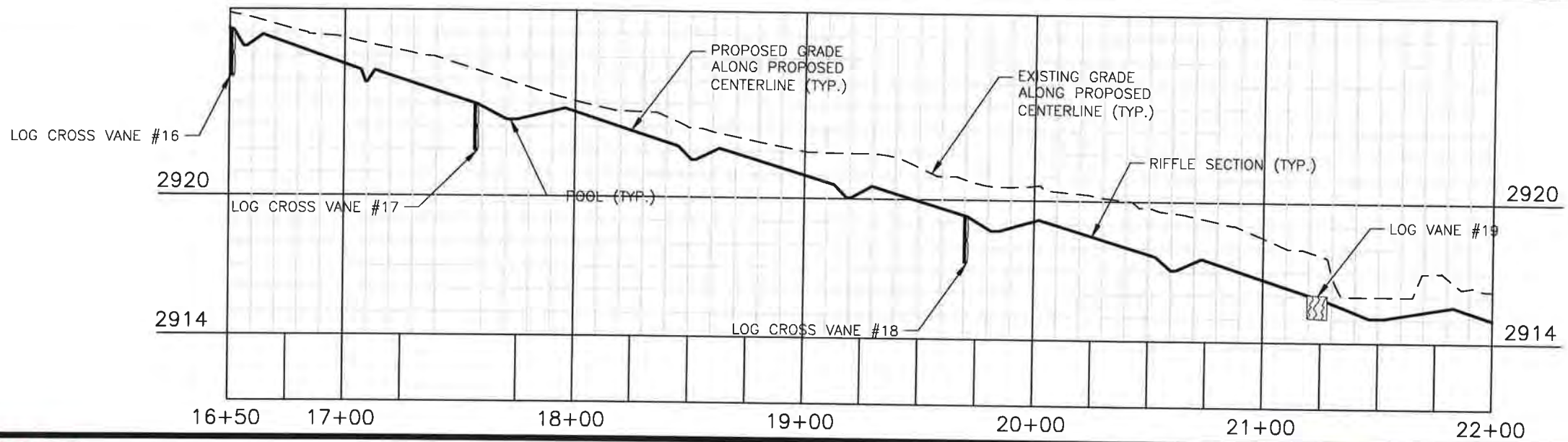
FORK CREEK STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #16	16+51.85	2927.11
LOG CROSS VANE #17	17+57.52	2923.95
LOG CROSS VANE #18	19+71.06	2919.30
LOG VANE #19	21+27.89	2915.79



TOTAL DISTURBED AREA = 27.53 AC.



VICINITY MAP  
1" = 1000'



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# LAUREL SPRINGS MITIGATION PLAN

## CONSTRUCTION DRAWINGS

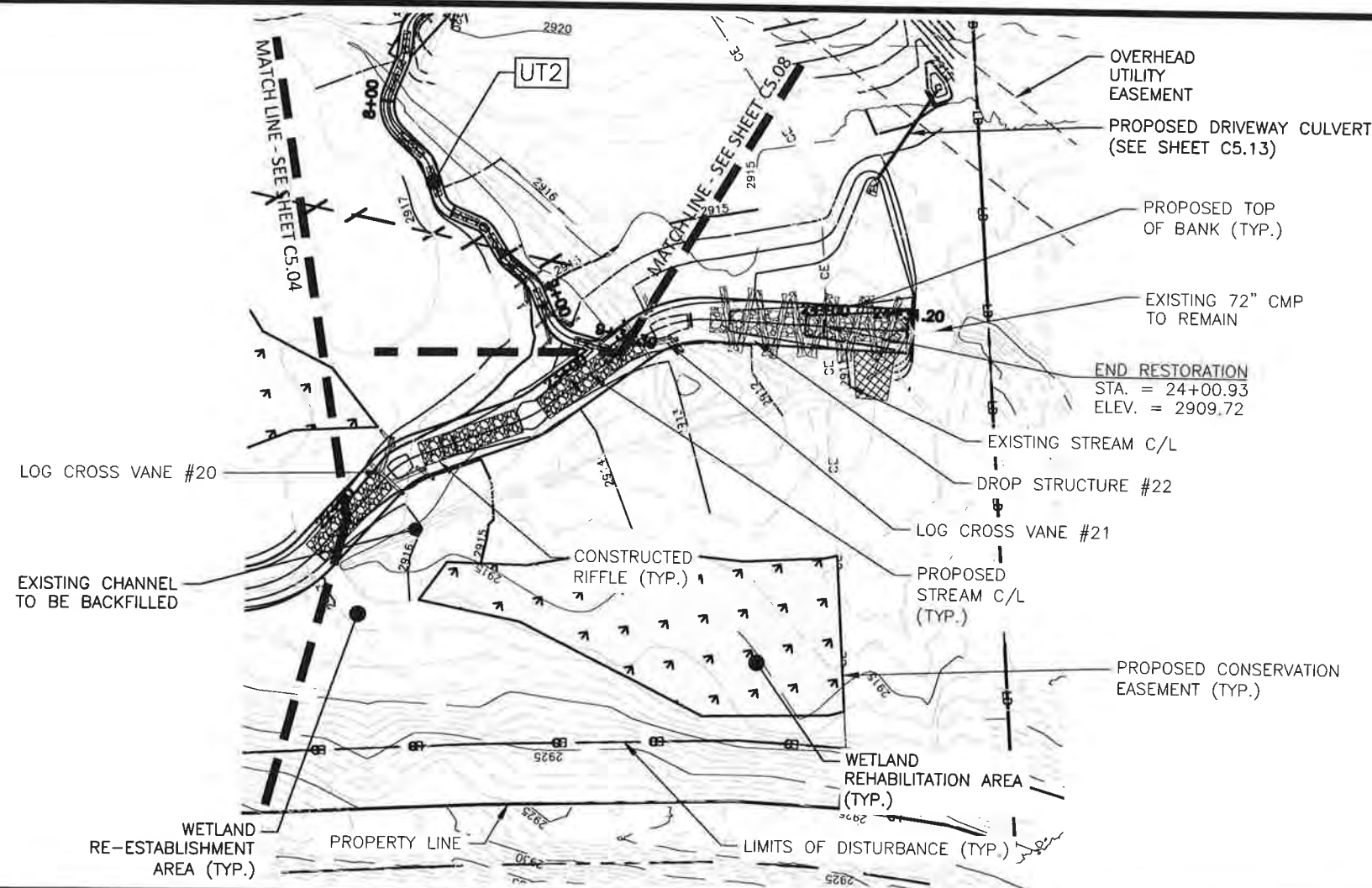
AVERY COUNTY, NORTH CAROLINA



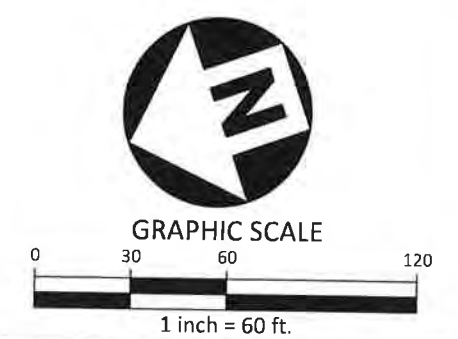
**PLAN INFORMATION**  
PROJECT NO. AXI-19000  
FILENAME AXI19000-P1  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE 1"=60' / 1"=60'  
DATE 02.18.2020

**PLAN AND PROFILE**  
FORK CREEK  
STA. 16+50 THRU STA. 22+00  
**C5.03**

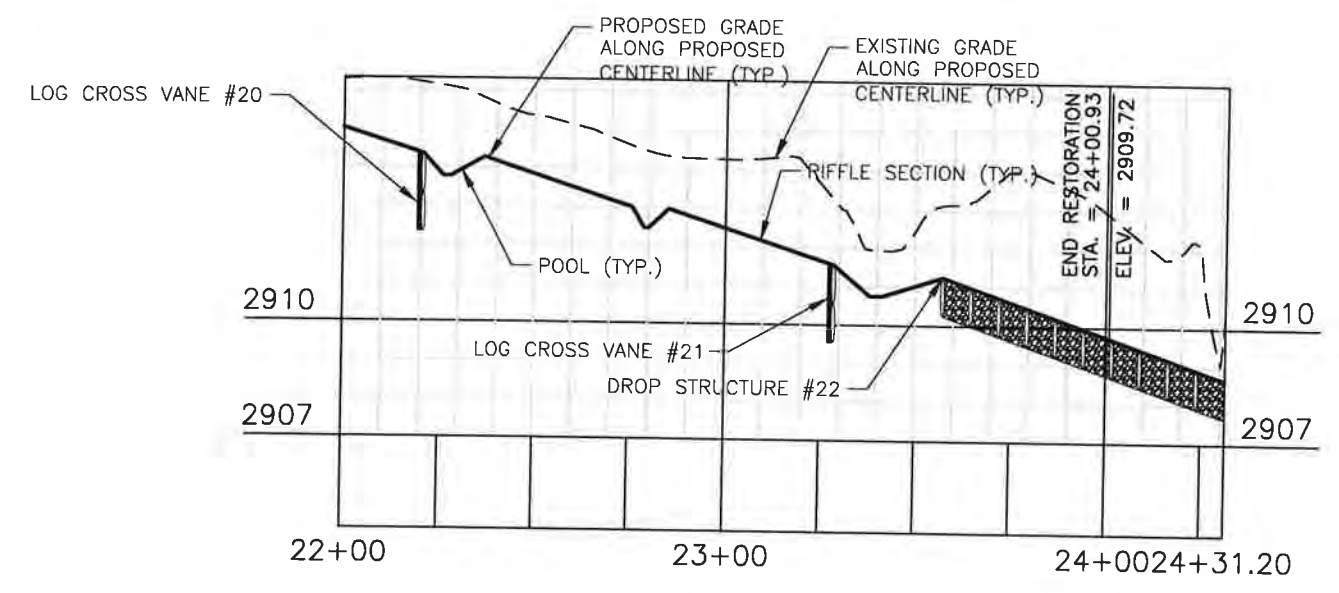
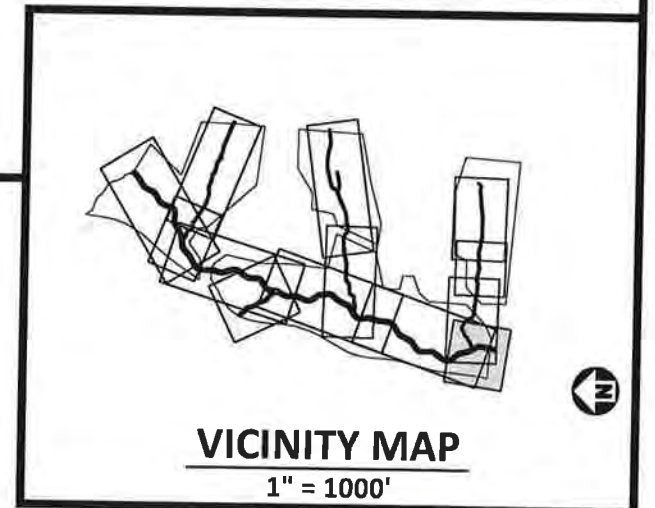




FORK CREEK STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #20	22+20.69	2914.34
LOG CROSS VANE #21	23+28.47	2911.26
DROP STRUCTURE #22	23+57.16	2911.26



TOTAL DISTURBED AREA = 27.53 AC.



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**LAUREL SPRINGS MITIGATION PLAN**  
 CONSTRUCTION DRAWINGS  
 AVERY COUNTY, NORTH CAROLINA

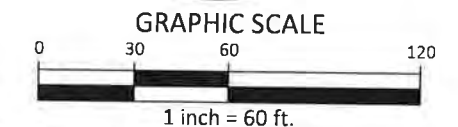


**PLAN INFORMATION**  
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 FILENAME AXI19000-P1  
 CHECKED BY RAS  
 DRAWN BY RHW  
 SCALE 1"=60' / 1"=50'  
 DATE 02.18.2020

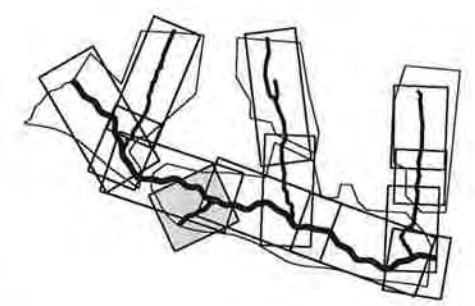
**PLAN AND PROFILE**  
 FORK CREEK  
 STA. 22+00 THRU STA. 24+31.20  
**C5.04**



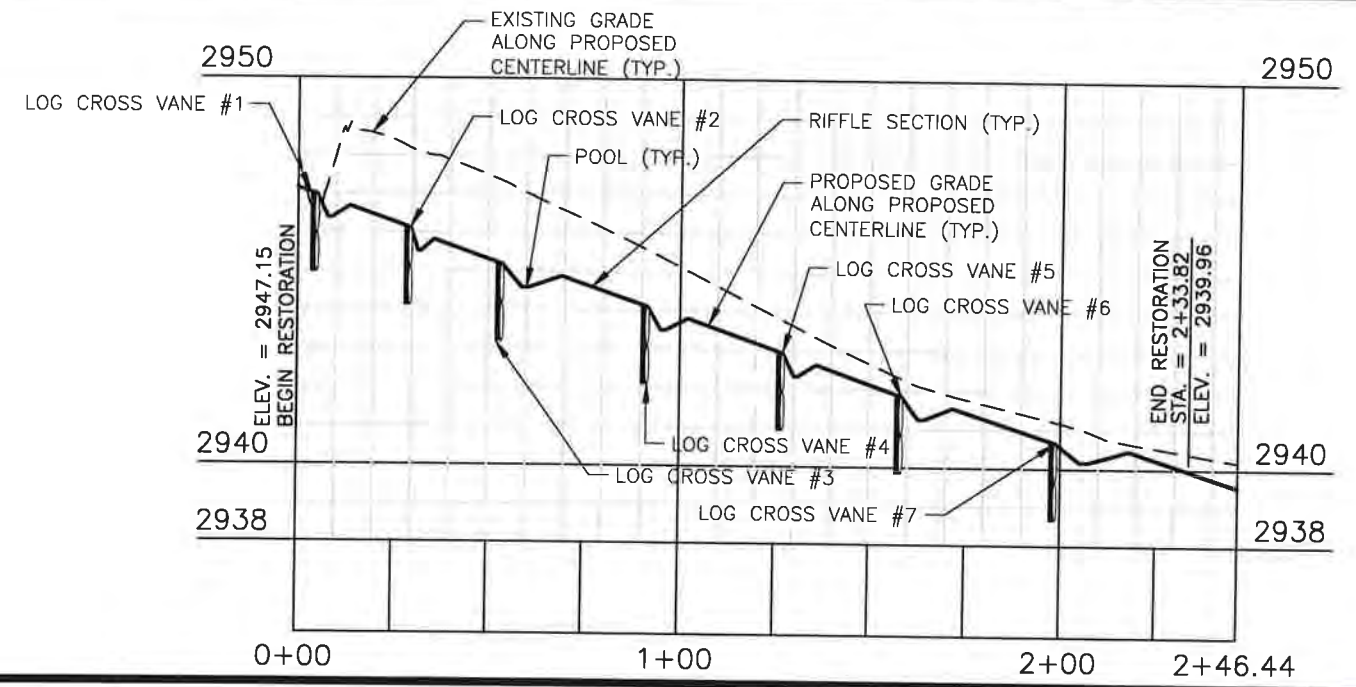
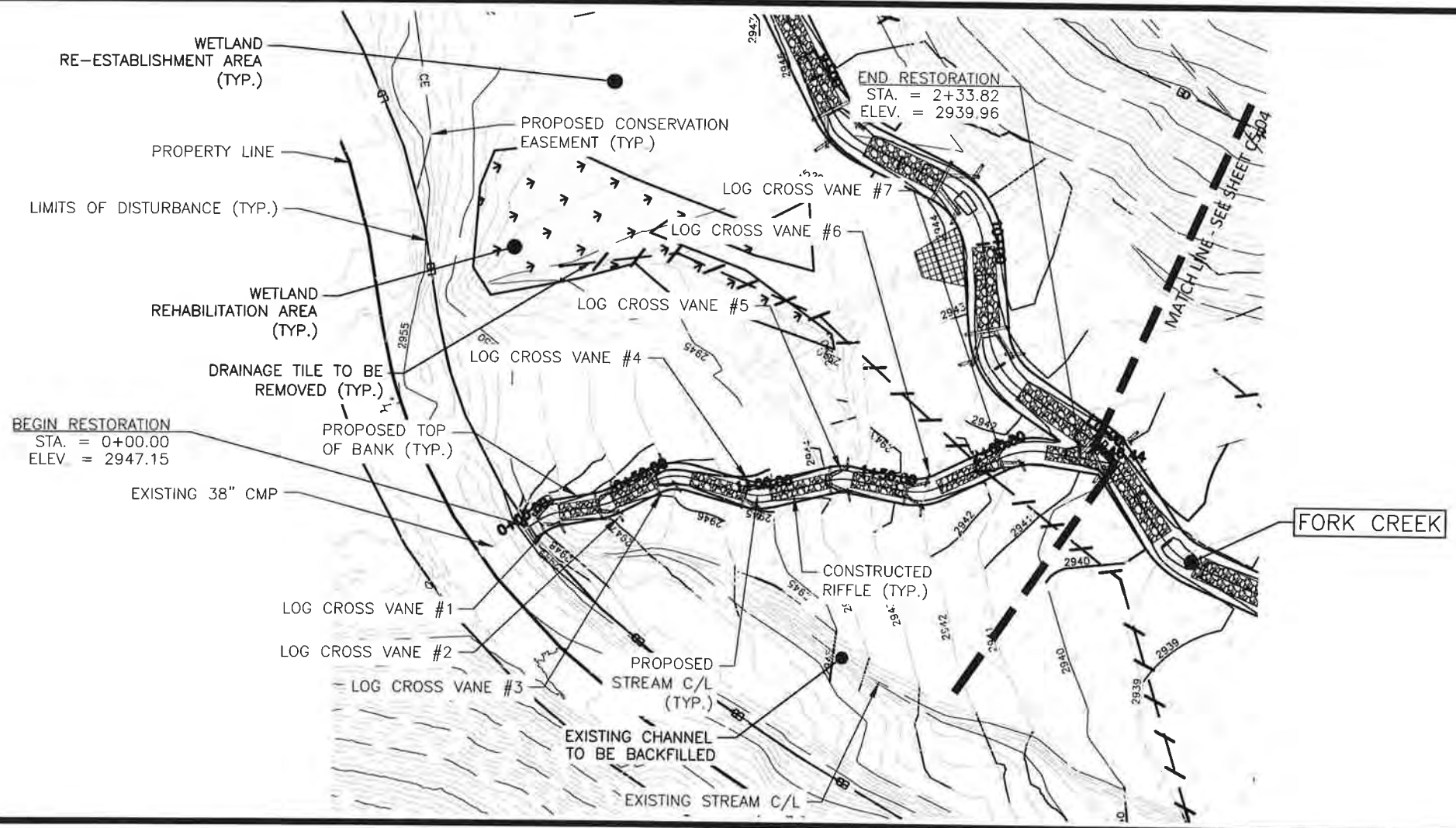
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #1	0+04.95	2946.98
LOG CROSS VANE #2	0+29.40	2946.12
LOG CROSS VANE #3	0+53.52	2945.19
LOG CROSS VANE #4	0+91.44	2944.11
LOG CROSS VANE #5	1+26.99	2942.94
LOG CROSS VANE #6	1+58.26	2941.85
LOG CROSS VANE #7	1+98.64	2940.67



**TOTAL DISTURBED AREA = 27.53 AC.**



**VICINITY MAP**  
1" = 1000'



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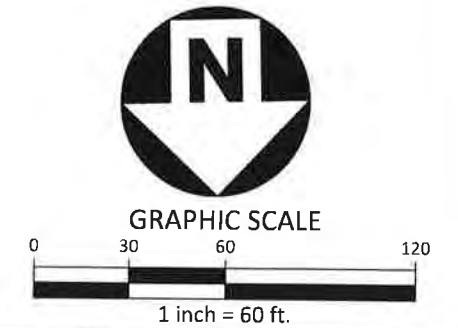
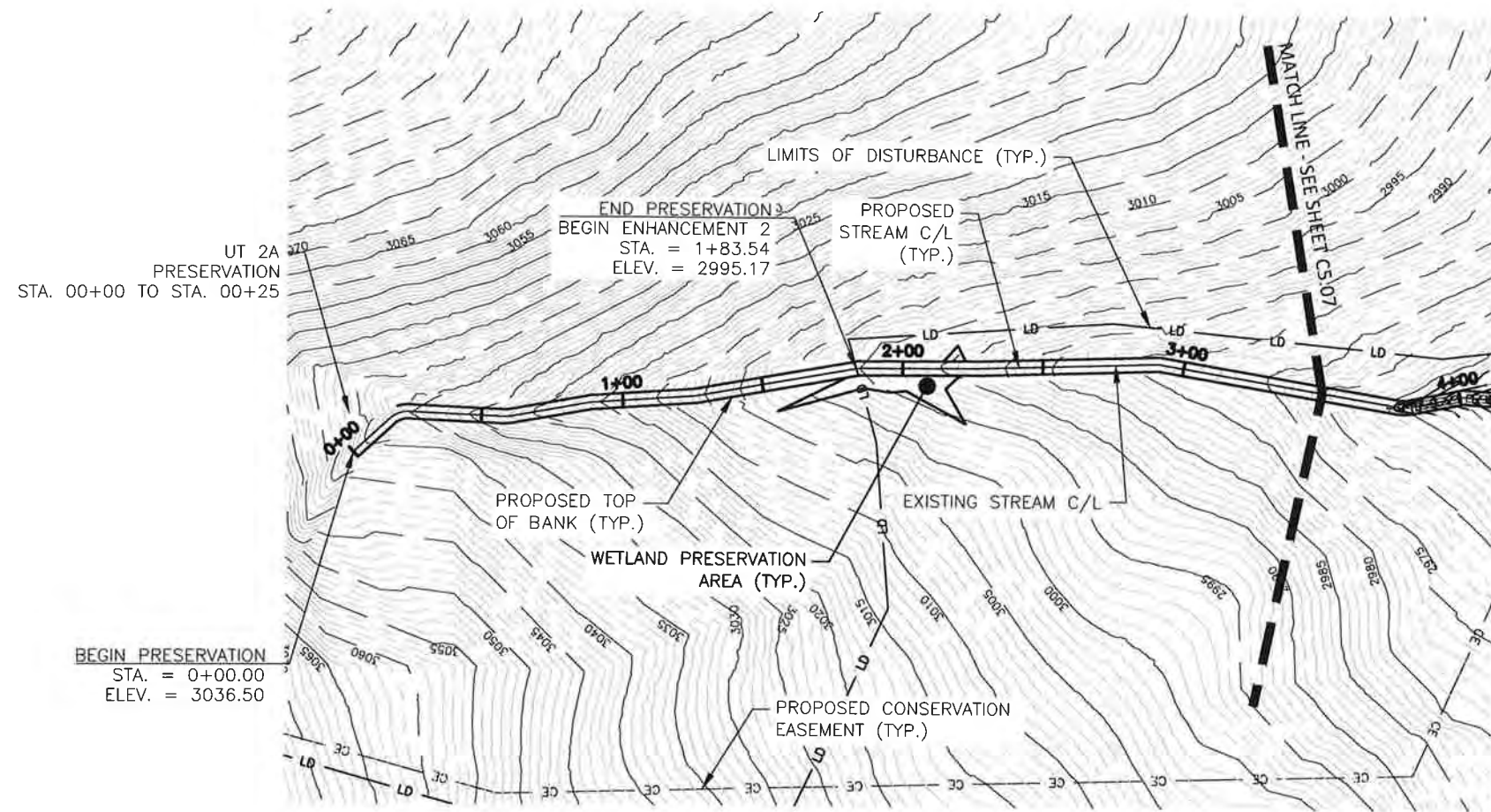
**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



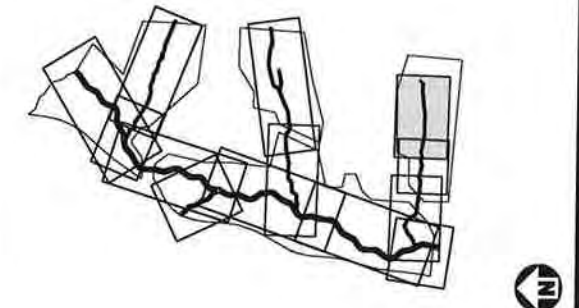
**PLAN INFORMATION**  
PROJECT NO. AXI-19000  
FILENAME AXI19000-P1  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE 1"=60' / 1"=50'  
DATE 02.18.2020

**PLAN AND PROFILE**  
UT1  
STA. 00+00 THRU STA. 2+46.66  
**C5.05**



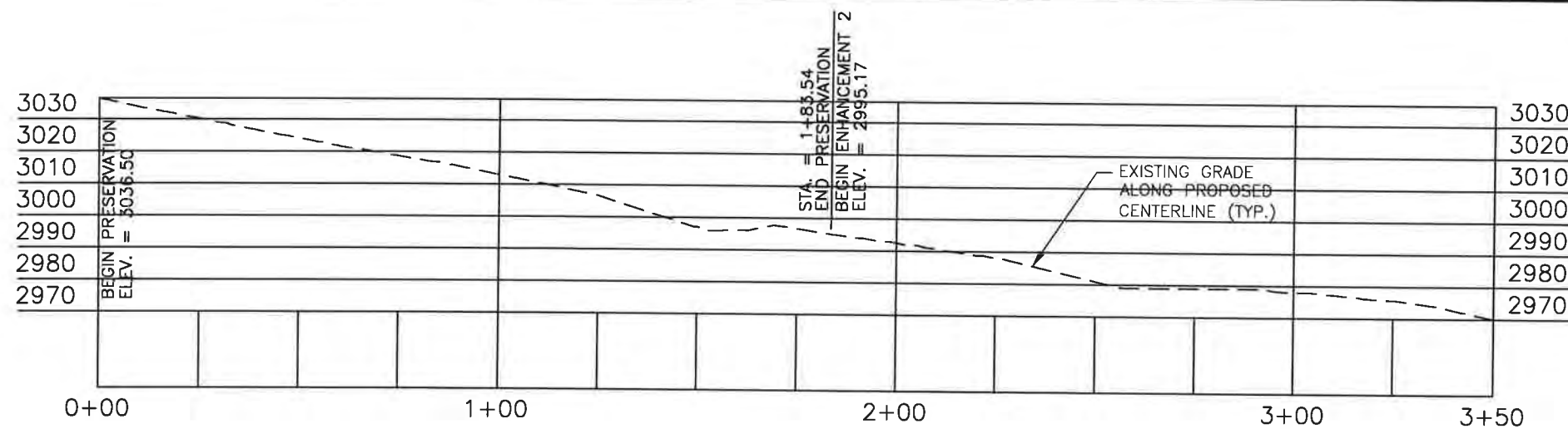


TOTAL DISTURBED AREA = 27.53 AC.

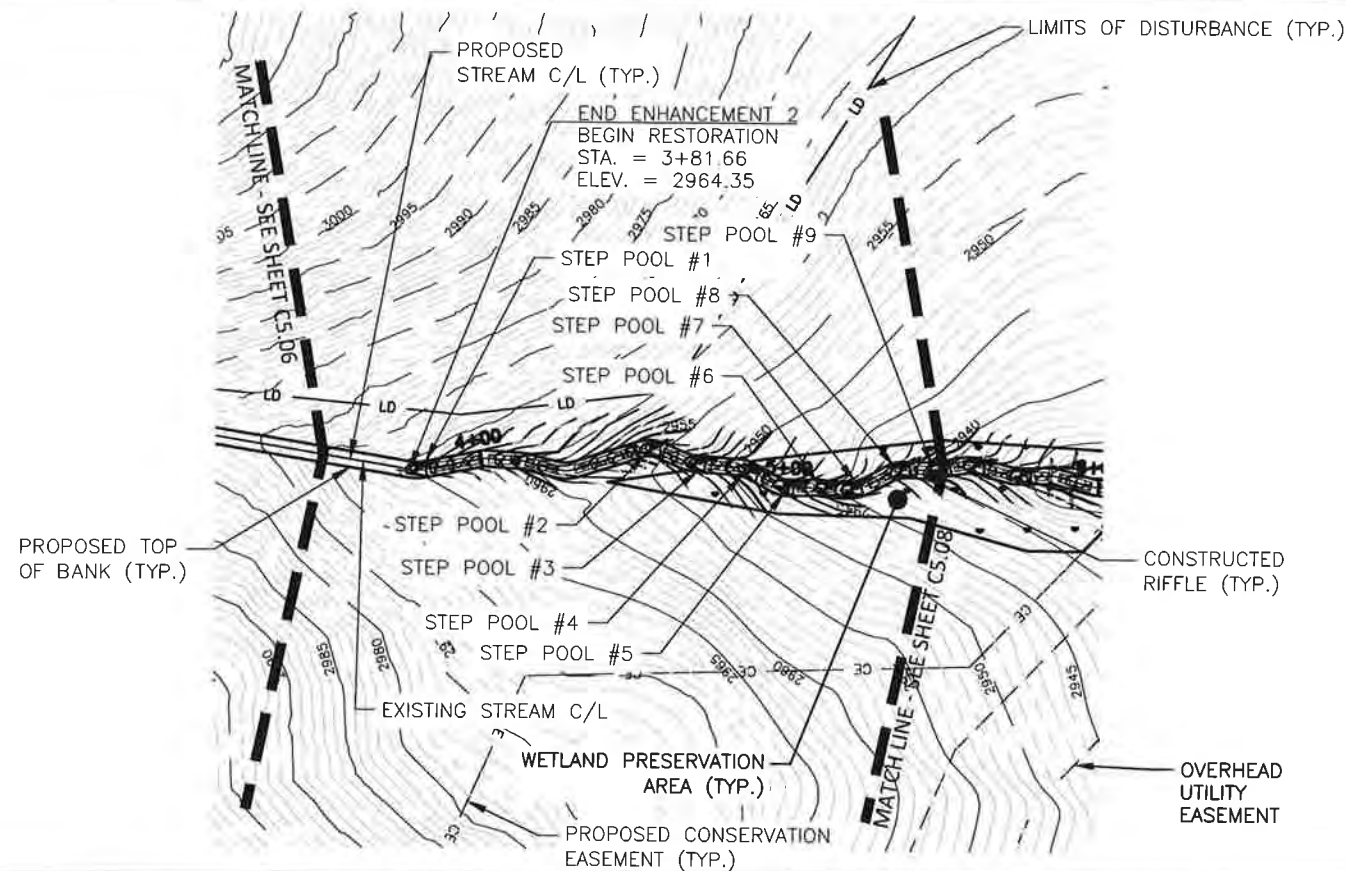


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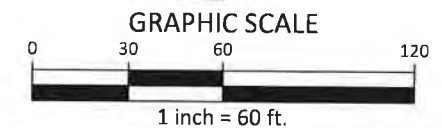
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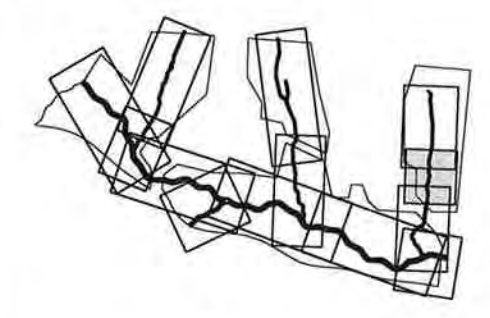
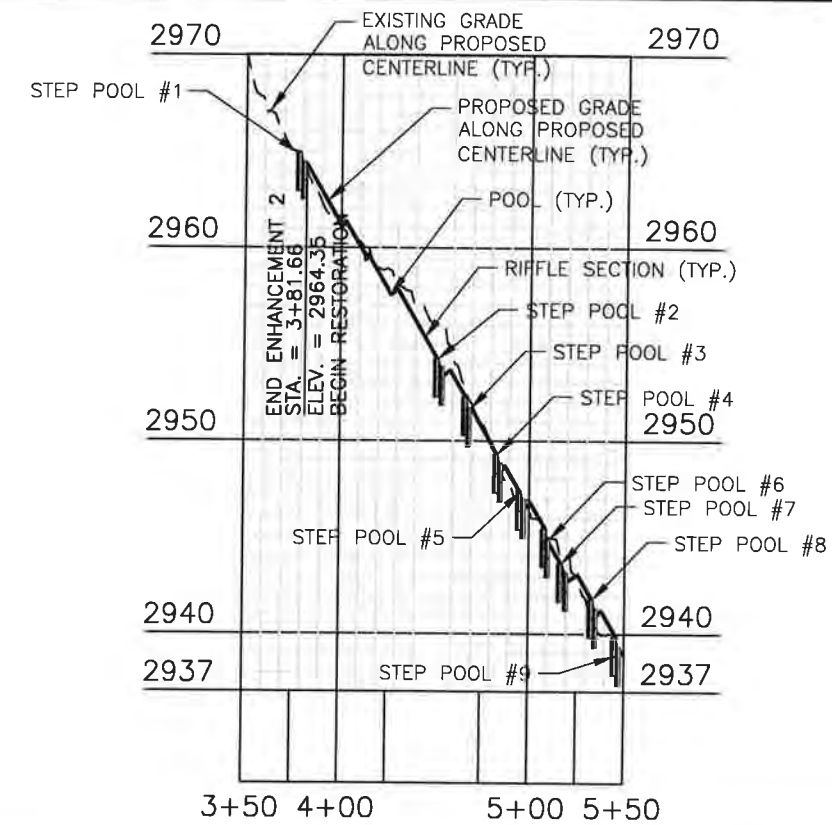




UT2 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
STEP POOL #1	3+78.06	2964.95
STEP POOL #2	4+51.14	2954.27
STEP POOL #3	4+66.26	2952.28
STEP POOL #4	4+83.20	2949.34
STEP POOL #5	4+95.32	2947.41
STEP POOL #6	5+08.43	2945.47
STEP POOL #7	5+16.62	2943.68
STEP POOL #8	5+32.89	2941.83
STEP POOL #9	5+45.81	2939.89



TOTAL DISTURBED AREA = 27.53 AC.



VICINITY MAP  
1" = 1000'



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# LAUREL SPRINGS MITIGATION PLAN

## CONSTRUCTION DRAWINGS

AVERY COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19000
FILENAME	AXI19000-P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=60' / 1"=100'
DATE	02.18.2020

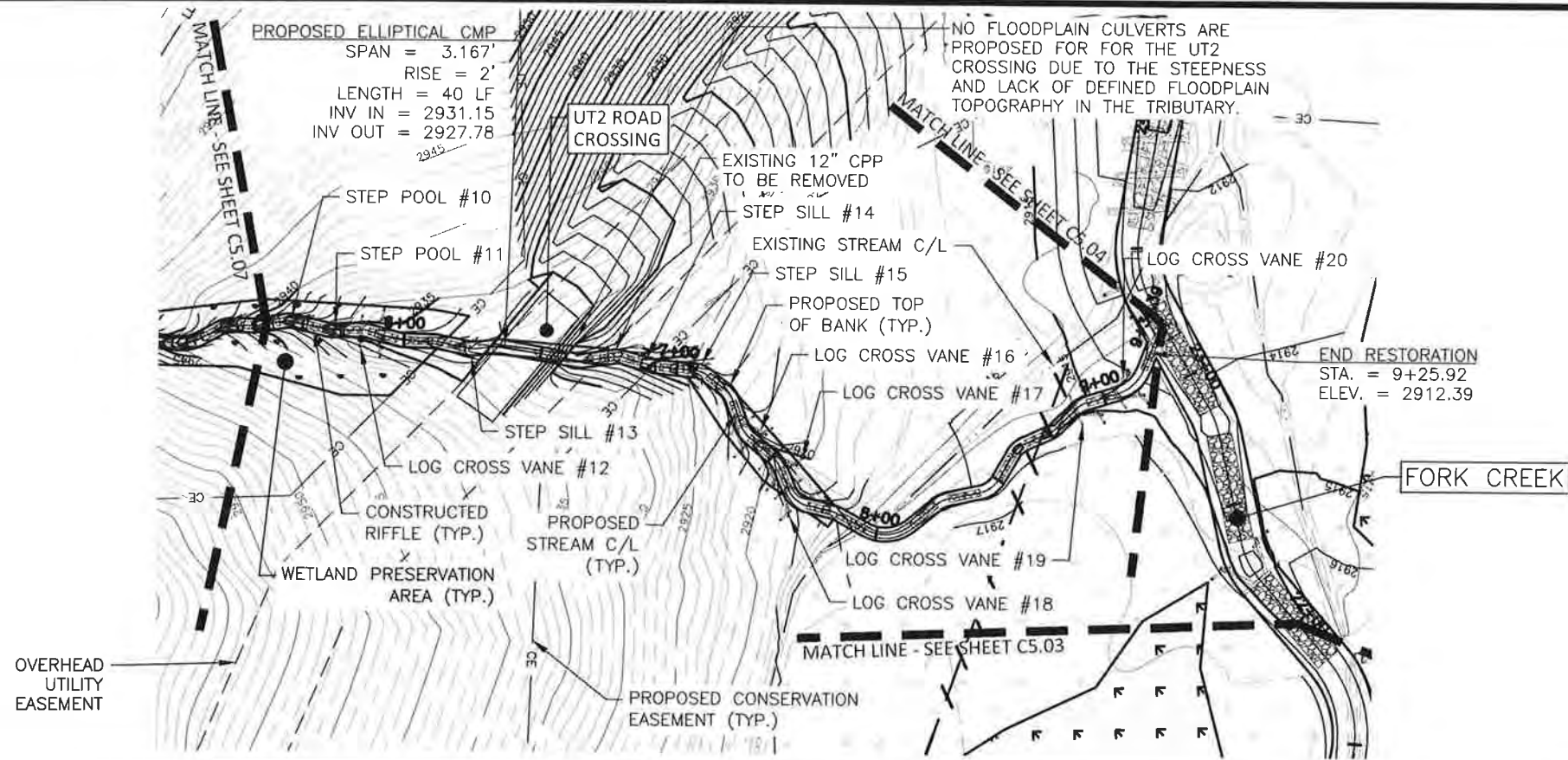
PLAN AND PROFILE

UT2

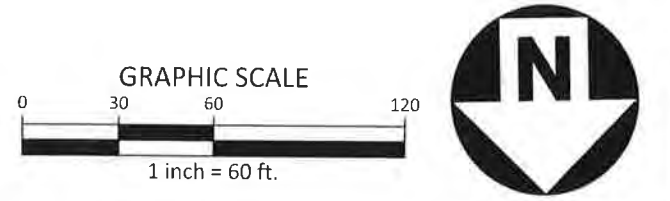
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# C5.07

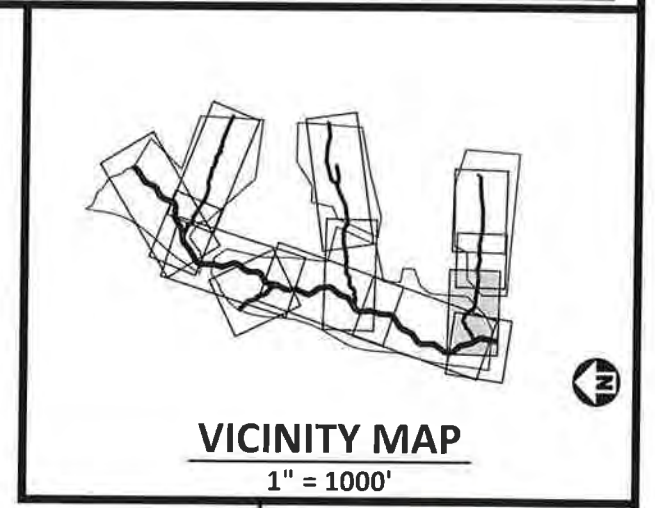
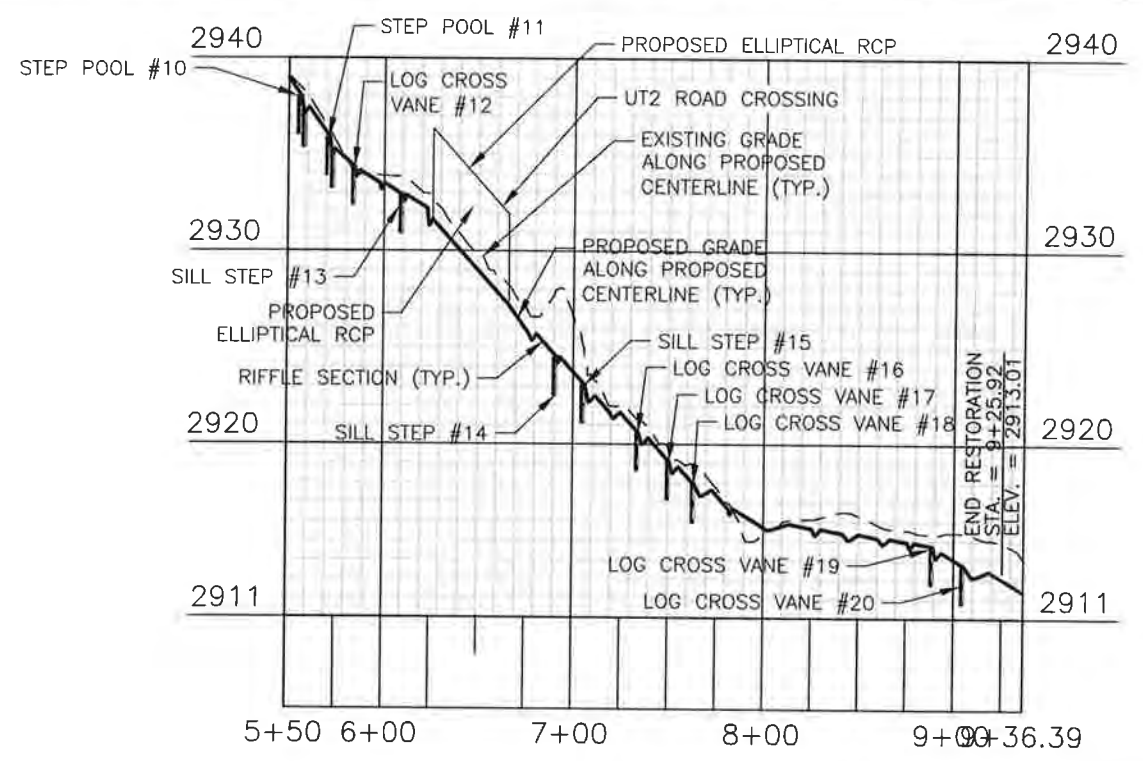




UT2 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
STEP POOL #10	5+56.48	2938.02
STEP POOL #11	5+71.61	2935.87
LOG CROSS VANE #12	5+84.29	2934.35
SILL STEP #13	6+22.88	2932.22
SILL STEP #14	6+91.20	2924.52
SILL STEP #15	7+05.87	2923.09
LOG CROSS VANE #16	7+34.03	2920.62
LOG CROSS VANE #17	7+50.18	2919.12
LOG CROSS VANE #18	7+63.23	2917.93
LOG CROSS VANE #19	8+88.87	2914.75
LOG CROSS VANE #20	9+04.98	2913.76



TOTAL DISTURBED AREA = 27.53 AC.



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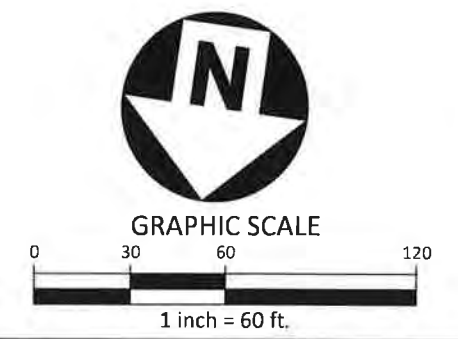
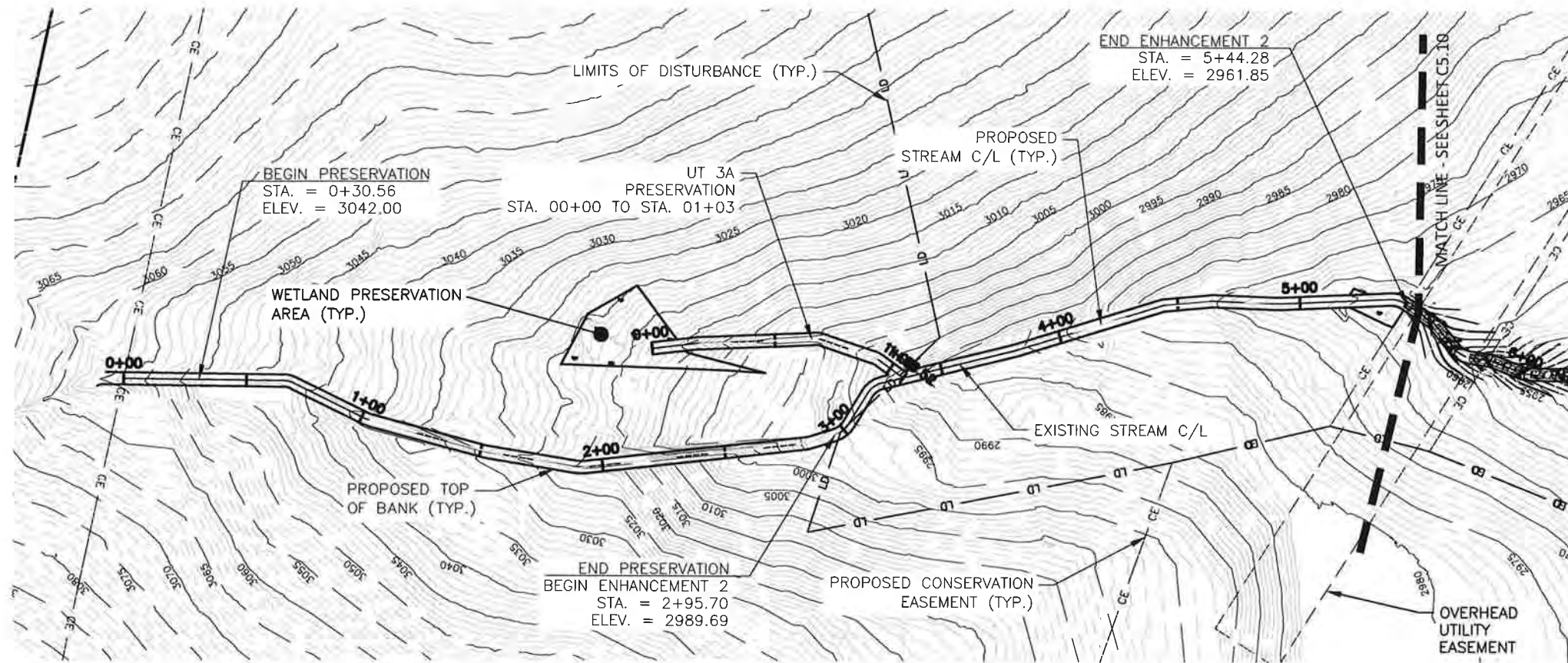
**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



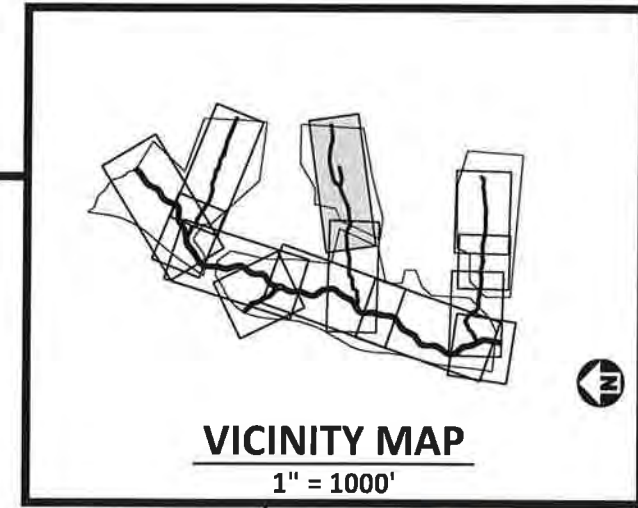
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PROJECT NO. AXI-19000  
FILENAME AXI19000-P1  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE 1"=60' / 1"=100'  
DATE 02.18.2020

**PLAN AND PROFILE**  
UT2  
STA. 05+50 THRU STA. 9+36.39  
**C5.08**

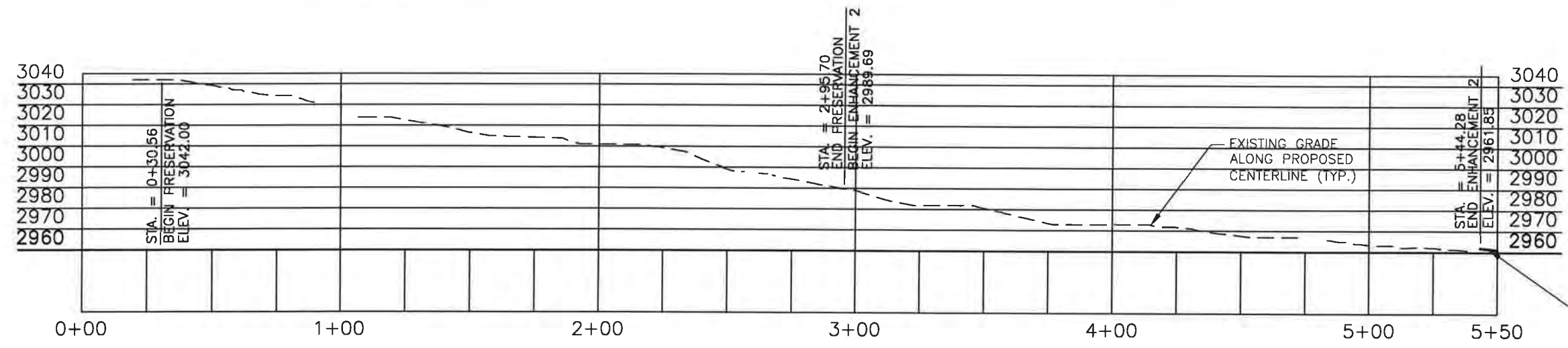




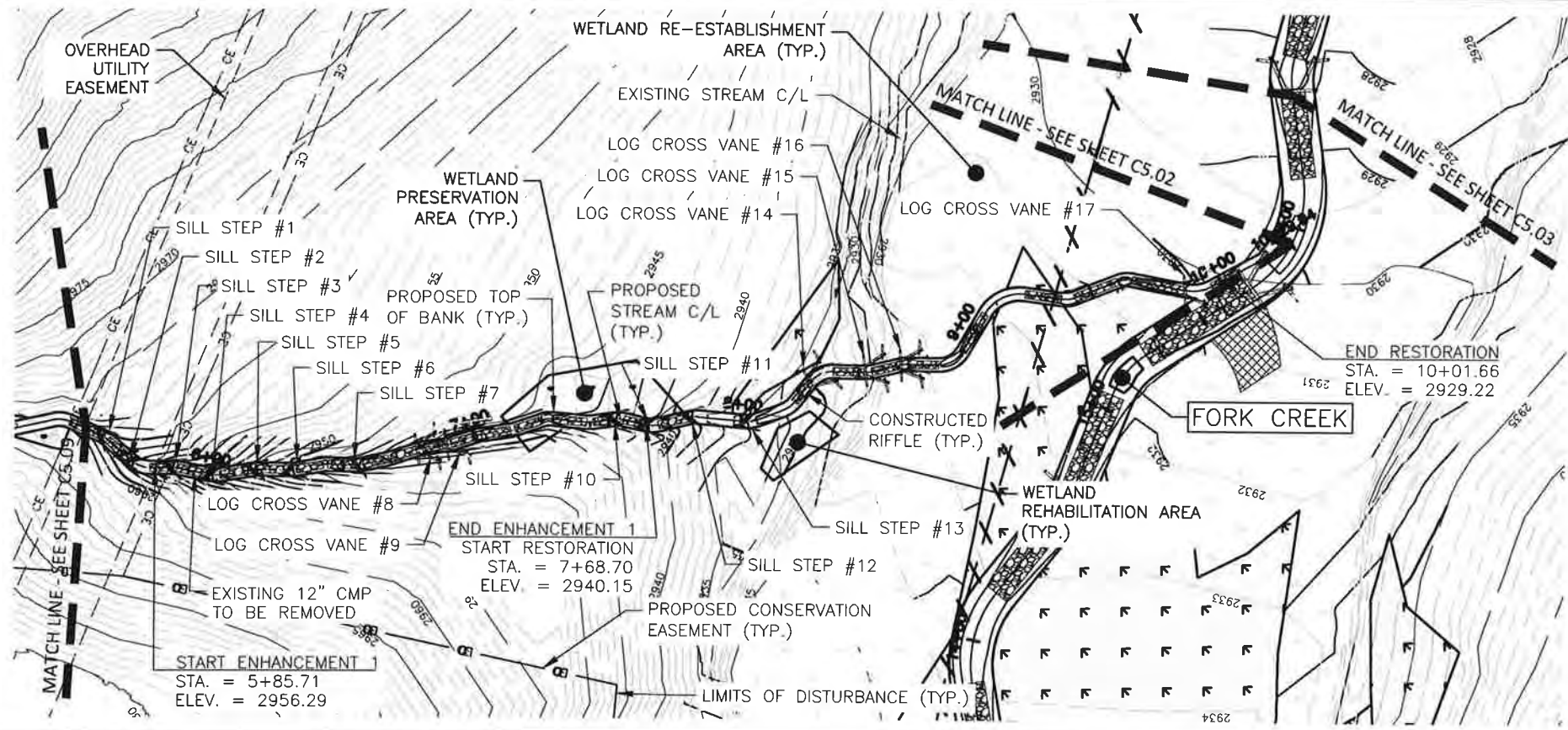
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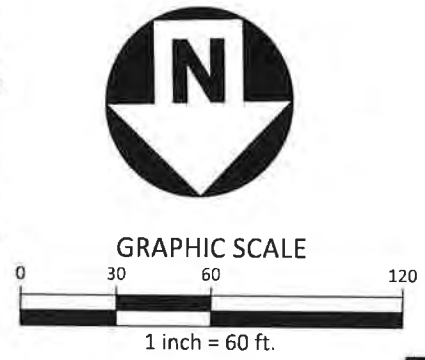
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1" = 1000'



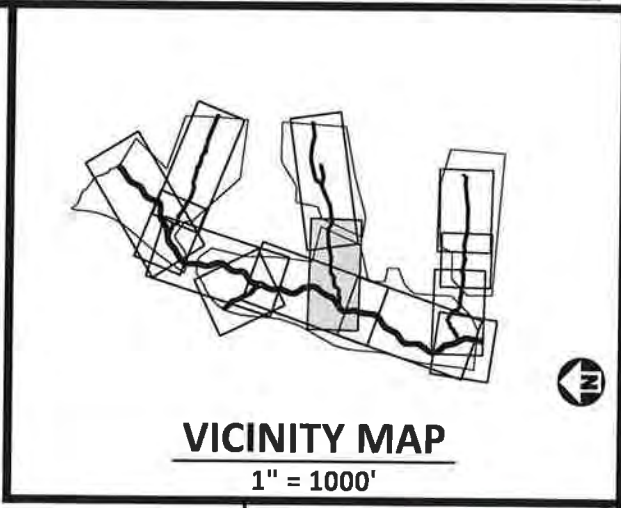
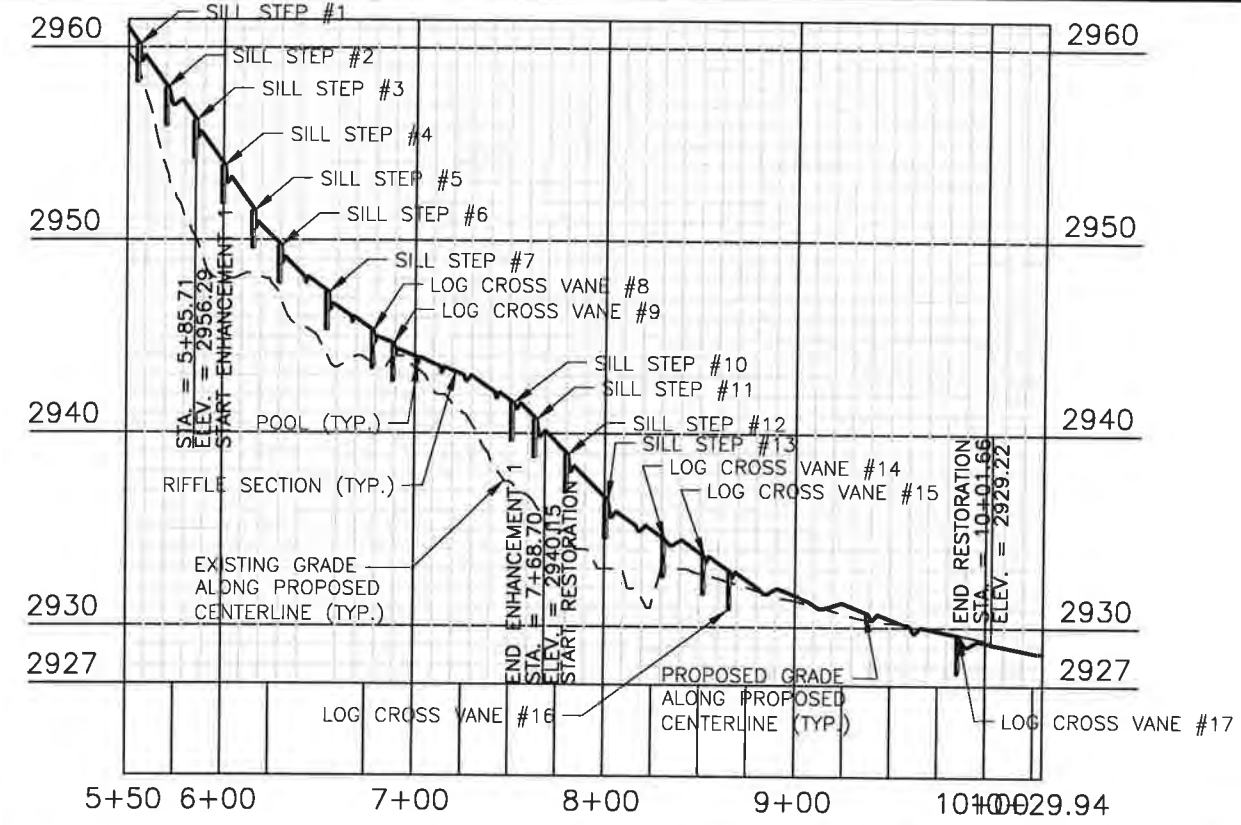




UT3 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
SILL STEP #1	5+56.11	2960.19
SILL STEP #2	5+71.11	2957.91
SILL STEP #3	5+86.10	2956.23
SILL STEP #4	6+00.88	2953.87
SILL STEP #5	6+16.77	2951.55
SILL STEP #6	6+30.53	2949.74
SILL STEP #7	6+55.33	2947.33
LOG CROSS VANE #8	6+78.62	2945.33
LOG CROSS VANE #9	6+89.29	2944.67
SILL STEP #10	7+52.10	2941.60
SILL STEP #11	7+64.16	2940.75
SILL STEP #12	7+80.77	2938.94
SILL STEP #13	8+01.55	2936.58
LOG CROSS VANE #14	8+31.37	2934.56
LOG CROSS VANE #15	8+55.02	2933.67
LOG CROSS VANE #16	8+68.64	2932.88
LOG CROSS VANE #17	9+85.95	2929.63



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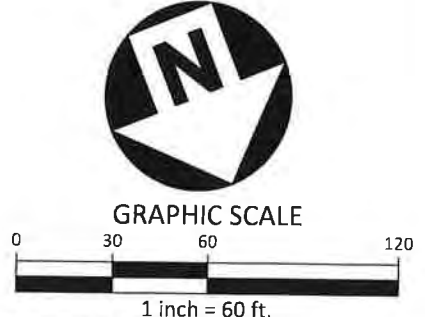
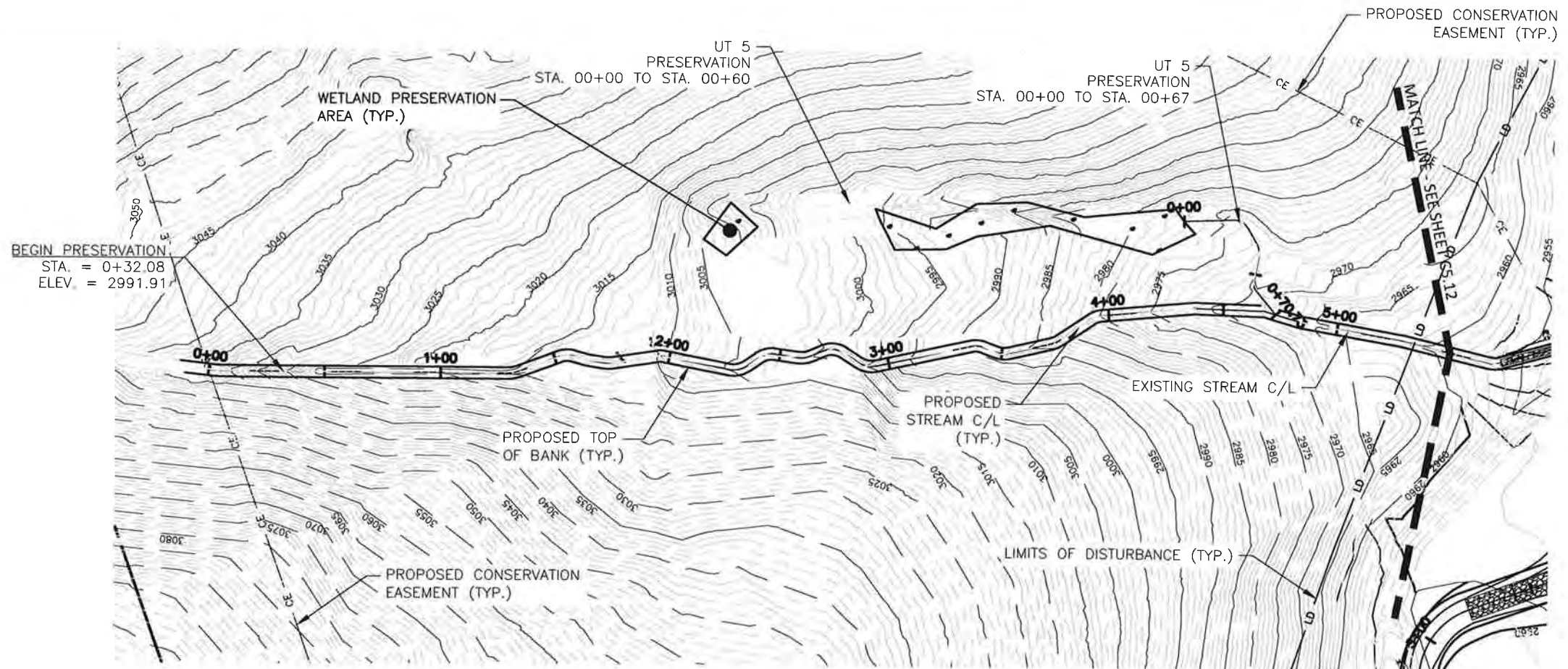
**LAUREL SPRINGS MITIGATION PLAN**  
**CONSTRUCTION DRAWINGS**  
 AVERY COUNTY, NORTH CAROLINA



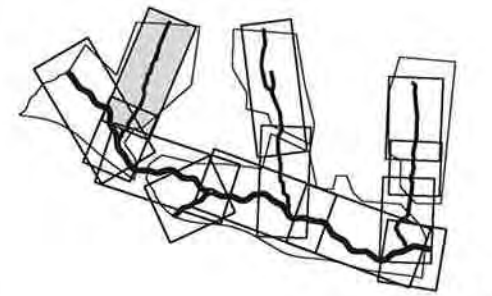
**PLAN INFORMATION**  
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 CHECKED BY RAS  
 DRAWN BY RHW  
 SCALE 1"=60' / 1"=100'  
 DATE 02.18.2020

**PLAN AND PROFILE**  
 UT3  
 STA. 05+50 THRU STA. 10+29.94  
**C5.10**

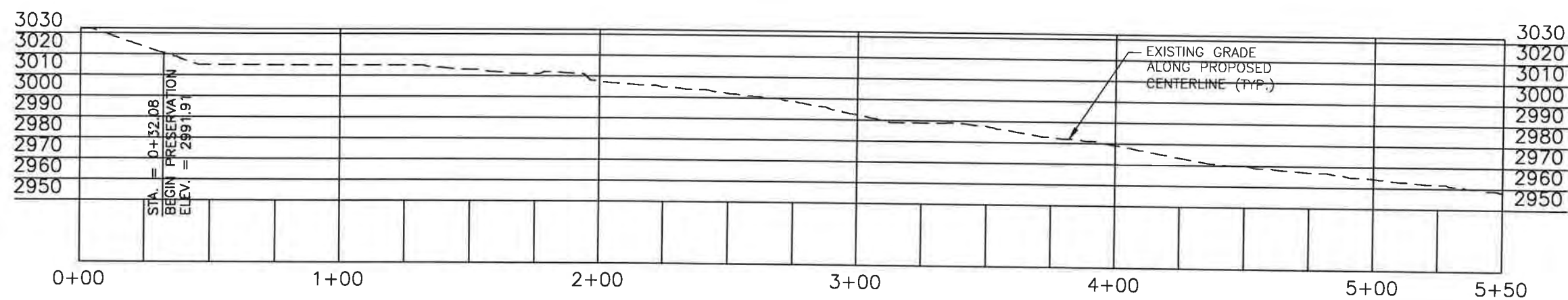




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**VICINITY MAP**  
1" = 1000'



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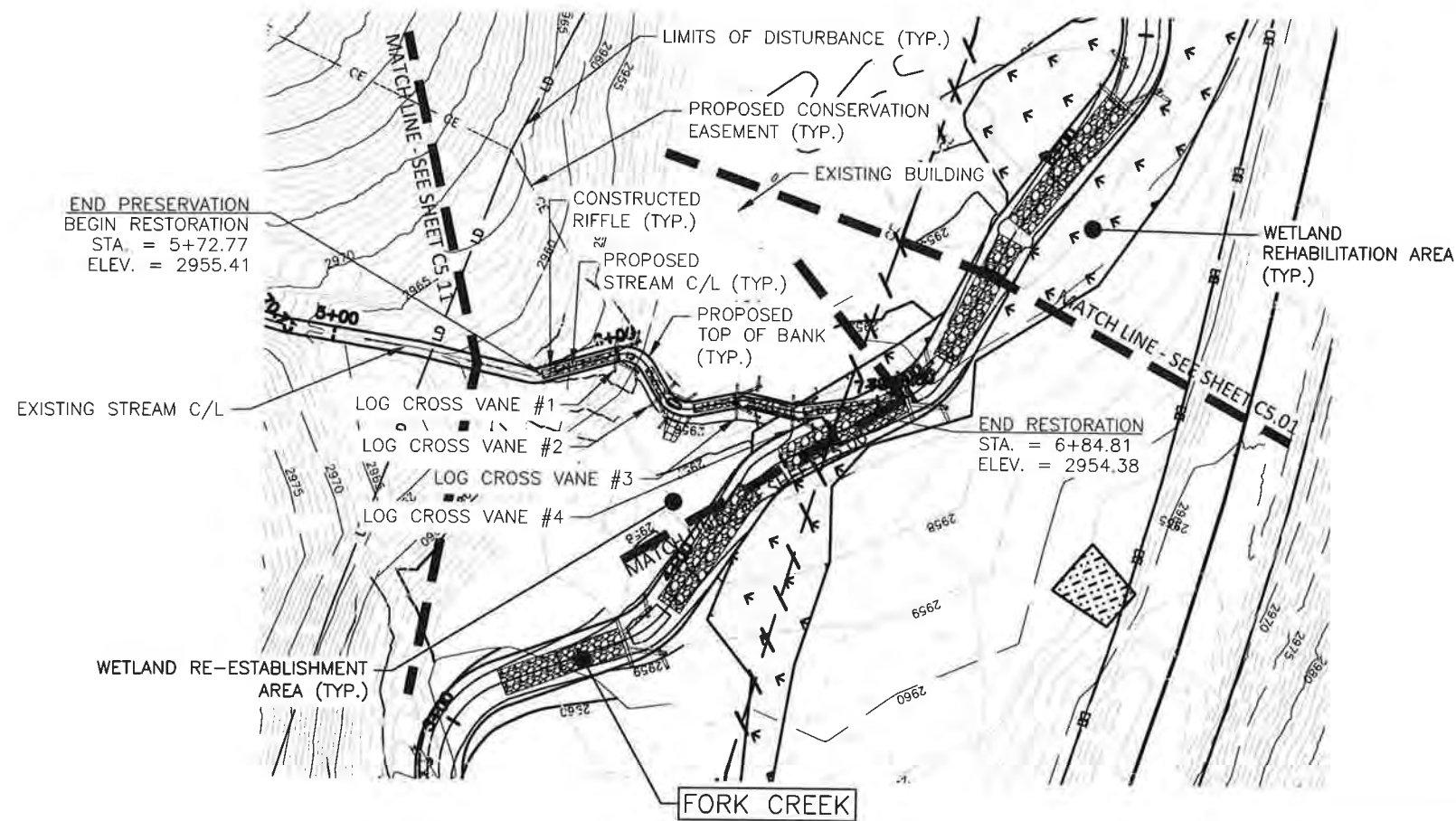
**LAUREL SPRINGS MITIGATION PLAN**  
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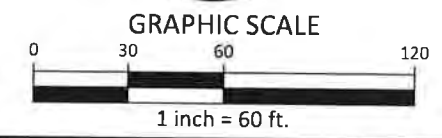
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FILENAME AXI19000-P1  
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SCALE 1"=60' / 1"=50'  
DATE 02.18.2020

**PLAN AND PROFILE**  
UT4  
STA. 00+00 THRU STA. 05+50  
**C5.11**

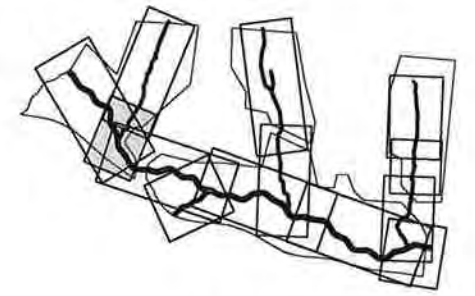




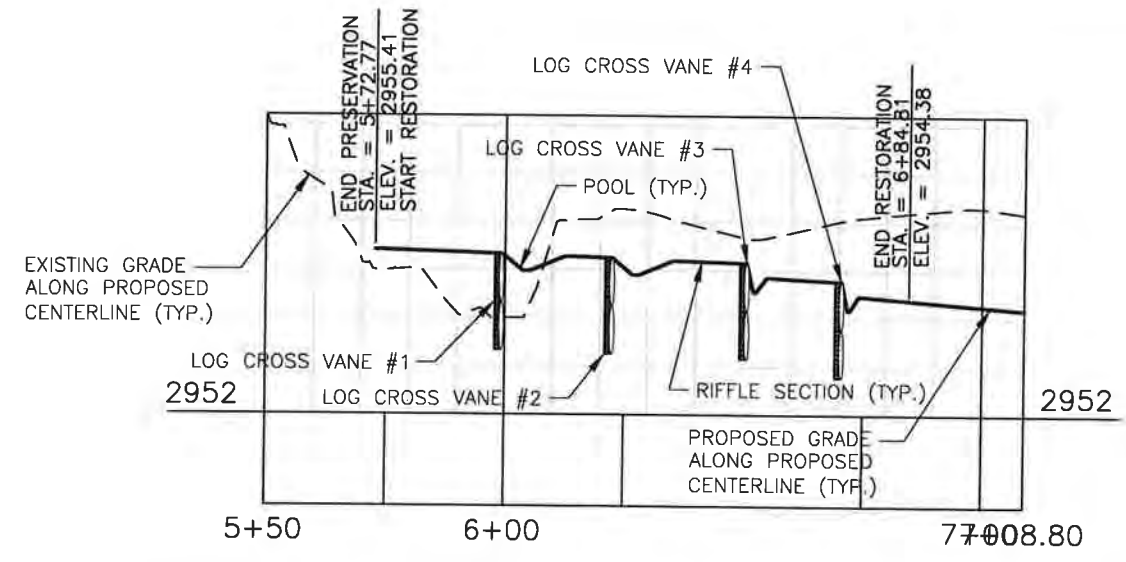
UT4 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #1	5+99.33	2955.33
LOG CROSS VANE #2	6+22.41	2955.25
LOG CROSS VANE #3	6+50.54	2955.15
LOG CROSS VANE #4	6+70.50	2954.77



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VICINITY MAP  
1" = 1000'




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# LAUREL SPRINGS MITIGATION PLAN

## CONSTRUCTION DRAWINGS

AVERY COUNTY, NORTH CAROLINA



**PLAN INFORMATION**

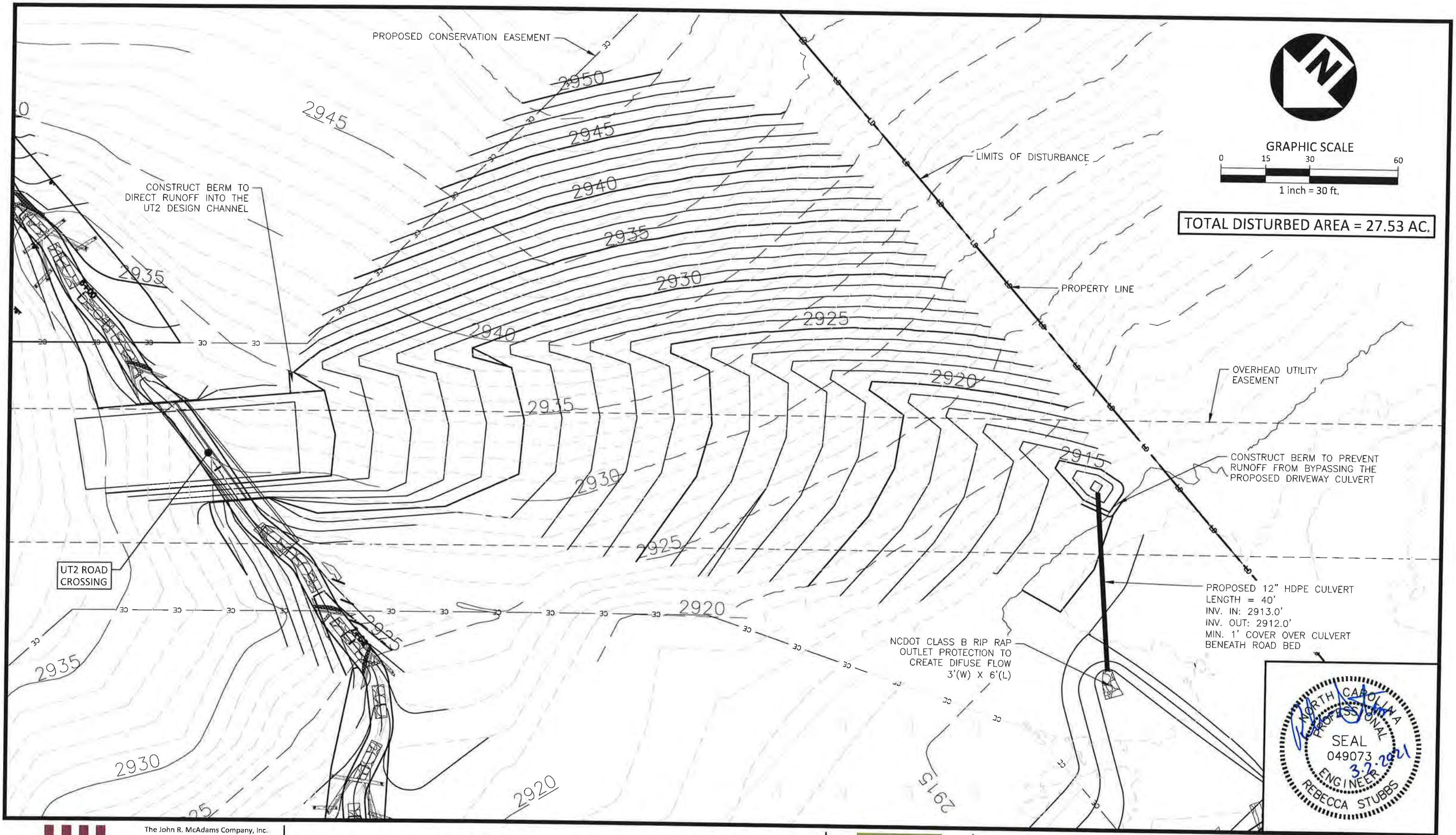
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**PLAN AND PROFILE**

UT4  
 STA. 05+50 THRU STA. 07+08.80

# C5.12





  
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**LAUREL SPRINGS MITIGATION PLAN**  
**CONSTRUCTION DRAWINGS**  
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**PLAN INFORMATION**

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**DRIVEWAY GRADING**  
**C5.13**



**GENERAL NOTES:**

1. CONTRACTOR SHALL OBTAIN ALL NECESSARY LICENSES AND PERMITS REQUIRED TO COMPLETE THE WORK INCLUDED IN THE CONTRACT DOCUMENTS AT THE CONTRACTOR'S EXPENSE.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THAT THEY AND THEIR SUBCONTRACTOR'S HAVE THE CORRECT/MOST UP-TO-DATE PLANS AVAILABLE.
3. CONTRACTOR SHALL GIVE MINIMUM 72 HOURS NOTICE TO AVERY COUNTY AND THE PROJECT ENGINEER PRIOR TO CONSTRUCTION.
4. ALL WORK WITHIN JURISDICTIONAL BOUNDARIES (WETLAND AND STREAMS) SHALL BE PERFORMED IN STRICT ACCORDANCE WITH APPROVED NATIONWIDE PERMIT NO. SAW-2019-00835.
5. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED.
6. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING BUFFER VEGETATION AND CONSTRUCTION CORRIDOR TO THE MAXIMUM EXTENT PRACTICAL.
7. THERE MAY BE WETLANDS WITHIN THIS SITE. IT IS THE OWNER'S RESPONSIBILITY FOR WETLANDS JURISDICTION AND PERMIT DISTURBANCE PRIOR TO ANY GRADING ACTIVITY.
8. IF THE CONTRACTOR, IN THE COURSE OF WORK, FINDS ANY DISCREPANCIES IN THE PLANS OR NOTES GIVEN BY THE PROJECT ENGINEER, IT SHALL BE HIS/HER DUTY TO IMMEDIATELY INFORM THE PROJECT ENGINEER, IN WRITING, AND THE PROJECT ENGINEER WILL PROMPTLY VERIFY THE SAME. ANY WORK DONE AFTER SUCH DISCOVERY, UNTIL AUTHORIZED, WILL BE AT THE CONTRACTOR'S RISK.
9. ANY DAMAGE TO PRIVATE PROPERTY AND/OR EXISTING UTILITIES INCURRED DURING CONSTRUCTION ACTIVITIES SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
10. ALL MECHANIZED EQUIPMENT OPERATED NEAR SURFACE WATERS SHALL BE INSPECTED AND MAINTAINED REGULARLY TO PREVENT CONTAMINATION OF SURFACE WATERS FROM FUELS, LUBRICANTS, HYDRAULIC FLUIDS, OR OTHER TOXIC MATERIALS. CONSTRUCTION SHALL BE STAGED IN ORDER TO MINIMIZE THE EXPOSURE OF EQUIPMENT TO SURFACE WATERS TO THE MAXIMUM EXTENT PRACTICABLE. FUELING, LUBRICATION, AND GENERAL EQUIPMENT MAINTENANCE SHALL BE PERFORMED IN A MANNER TO PREVENT, TO THE MAXIMUM EXTENT PRACTICABLE, CONTAMINATION OF SURFACE WATERS BY FUELS AND OILS.
11. HEAVY EQUIPMENT WORKING IN WETLANDS SHALL BE PLACED ON MATS OR OTHER MEASURES SHALL BE TAKEN TO MINIMIZE SOIL DISTURBANCE.

**CONSTRUCTION SEQUENCE:**

1. OBTAIN PLAN APPROVAL AND OTHER APPLICABLE PERMITS.
2. OBTAIN AN APPROVED (STAMPED) EROSION & SEDIMENT CONTROL PLAN AND KEEP IT ON-SITE EITHER IN THE INSPECTION BOX, CONSTRUCTION OFFICE, OR WITH THE CONTRACTOR.
3. PROJECT IS LOCATED AMONG SURFACE WATERS WITH TROUT WATER (TR) CLASSIFICATION PER NC DWR. AS SUCH, CONSTRUCTION PRACTICES SHALL BE CONDUCTED IN ACCORDANCE WITH THE APPROVED EROSION CONTROL PLAN AND IN SUCH A MANNER AS TO MINIMIZE THE EXTENT AND DURATION OF DISTURBANCE OF THE STREAM CHANNEL.
4. SCHEDULE AND HOLD AN ON-SITE PRE-CONSTRUCTION CONFERENCE AT LEAST ONE WEEK PRIOR TO BEGINNING ANY LAND-DISTURBING ACTIVITIES. THE CONFERENCE SHOULD BE ATTENDED BY THE AVERY COUNTY EROSION CONTROL INSPECTOR, THE GENERAL CONTRACTOR, ANY SUBCONTRACTORS, THE ENGINEER, AND A REPRESENTATIVE OF THE OWNER.
5. CONTRACTOR SHALL NOTIFY "NC811" (811) OR (1-800-632-4949) AT LEAST 3 FULL BUSINESS DAYS PRIOR TO BEGINNING CONSTRUCTION OR EXCAVATION TO HAVE EXISTING UTILITIES LOCATED. CONTRACTOR SHALL CONTACT ANY LOCAL UTILITIES THAT PROVIDE THEIR OWN LOCATOR SERVICES INDEPENDENT OF "NC811". REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY.
6. ALL DIMENSIONS AND GRADES SHOWN ON THE PLANS SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. CONTRACTOR SHALL NOTIFY THE ENGINEER IF ANY DISCREPANCIES EXIST PRIOR TO PROCEEDING WITH CONSTRUCTION, FOR NECESSARY PLAN OR GRADE CHANGES. NO EXTRA COMPENSATION SHALL BE PAID TO THE CONTRACTOR FOR ANY WORK DONE DUE TO DIMENSIONS OR GRADES SHOWN INCORRECTLY ON THESE PLANS IF SUCH NOTIFICATION HAS NOT BEEN GIVEN.
7. ESTABLISH CONSTRUCTION ENTRANCE (SEE DETAIL ON SHEET C6.13) AND STAGING AREAS ACCORDING TO THE EROSION CONTROL PLANS. IF NECESSARY, TEMPORARY DRIVEWAY PERMIT FOR CONSTRUCTION ENTRANCES IN NCDOT RIGHT OF WAY MUST BE PRESENTED AT PRE-CONSTRUCTION MEETING. THE CONTRACTOR SHOULD DOCUMENT, VISUALLY AND IN WRITING, THE EXISTING CONDITIONS OF ANY PERMANENT SITE ACCESS LOCATIONS AND ACCESS ROUTES TO BE USED DURING CONSTRUCTION.
8. ALL EROSION CONTROL MEASURES SHALL BE CONSTRUCTED IN ACCORDANCE WITH AVERY COUNTY EROSION AND SEDIMENT CONTROL REQUIREMENTS.
9. INSTALL SILT FENCE, INLET PROTECTION, SEDIMENT TRAPS, DIVERSION DITCHES, TREE PROTECTION, AND OTHER MEASURES AS SHOWN ON PLANS, CLEARING ONLY AS NECESSARY TO INSTALL THESE DEVICES.
10. LIMITS OF DISTURBANCE SHALL BE MARKED BY SAFETY FENCING EITHER WITH SILT FENCE OR ORANGE TREE PROTECTION FENCE (SEE DETAIL ON SHEET C6.14).
11. USE THE AREAS DESIGNATED ON THE PLANS FOR ALL STAGING ACTIVITIES RELATED TO THE PROJECT.
12. PARK ALL CONSTRUCTION EQUIPMENT, INCLUDING TRUCKS AND HEAVY EQUIPMENT WITHIN THE LIMITS OF DISTURBANCE.
13. WHEN ACCESS TO A CONSTRUCTION AREA REQUIRES CROSSING A DELINEATED JURISDICTIONAL FEATURE, IMPACTS SHALL BE MINIMIZED BY PLACING A TEMPORARY STREAM/WETLAND CROSSING ACROSS THE FEATURE PRIOR TO ACCESSING THE AREA WITH HEAVY EQUIPMENT PER APPROVED PLANS AND SPECIFICATIONS. SEE DETAIL SHEETS C6.13 AND C6.17 FOR TEMPORARY STREAM AND WETLAND CROSSINGS.
14. INSTALL REMAINING EROSION CONTROL MEASURES AS SHOWN ON SHEETS C6.04 THROUGH C6.07. CLEAR AND GRUB ONLY AS NECESSARY TO INSTALL THESE DEVICES.
15. BEGIN GRADING ACTIVITIES. IN GENERAL, THE CONTRACTOR SHALL WORK FROM UPSTREAM TO DOWNSTREAM AND CONSTRUCTION IN A LIVE CHANNEL UTILIZE A PUMP-AROUND OR FLOW DIVERSION MEASURE AS SHOWN ON THE PLANS. MAINTAIN AND ADJUST E&S MEASURES AS GRADING PROGRESSES. SEE TABLE 1 - WORKING SECTIONS ON SHEET C6.01 FOR PROGRESSION OF SITE GRADING AS DETERMINED BY THE ENGINEER. CHANGES TO THE SITE GRADING SEQUENCE MAY BE MADE WITH APPROVAL OF THE ENGINEER.
16. CONTRACTOR SHALL EXCAVATE THE PROPOSED CHANNEL AND MODIFY PORTIONS OF THE EXISTING CHANNEL BASED ON RIFLE ELEVATIONS IN SECTIONS NO GREATER THAN 300' IN LENGTH AT A TIME (EXCEPT WHERE LONGER SECTIONS ARE NECESSARY TO MAINTAIN CONSTRUCTABILITY).
17. AT THE END OF EACH WORKING DAY, THE CONTRACTOR WILL BE RESPONSIBLE FOR THE APPLICATION OF SEED AND STRAW, AS APPLICABLE, TO NEWLY ESTABLISHED STREAMBANKS AND DISTURBED AREAS. EROSION CONTROL MATTING WILL BE INSTALLED ON TOP OF THE SEED AND STRAW IN ACCORDANCE WITH THE EROSION CONTROL CONSTRUCTION SEQUENCE.
18. WORK SECTIONS THAT INVOLVE THE CONSTRUCTION OF A CONFLUENCE OF TWO OR MORE REACHES MAY REQUIRE THE USE OF TWO OR MORE PUMP-AROUND OPERATIONS.
19. GRADING OF SOME PORTIONS OF THE PROPOSED FLOODPLAIN MAY NEED TO BE DELAYED UNTIL AFTER WORK IN SUBSEQUENT SECTIONS HAS BEEN COMPLETED, ESPECIALLY NEAR THE CONFLUENCES. HAUL ROADS AND TEMPORARY SILT FENCE MAY ALSO NEED TO BE REMOVED BEFORE THE PROPOSED FLOODPLAIN CAN BE COMPLETED AND/OR UNUSED EXISTING CHANNEL BE FILLED.
20. AFTER EXCAVATING THE CHANNEL TO DESIGN GRADES, INSTALLING IN-STREAM STRUCTURES, SEED AND MULCH, MATTING, AND TRANSPLANTS, THE NEW CHANNEL CAN RECEIVE FLOW AFTER APPROVAL BY THE ENGINEER.
21. WATER WILL BE TURNED INTO THE CONSTRUCTED CHANNEL ONCE THE AREA IN AND AROUND THE NEW CHANNEL HAS BEEN STABILIZED. NO WATER SHALL BE TURNED INTO ANY SECTION OF CHANNEL PRIOR TO THE CHANNEL BEING COMPLETELY STABILIZED WITH ALL STRUCTURES INSTALLED.
22. ANY GRADING ACTIVITIES ADJACENT TO THE STREAM CHANNEL SHALL BE COMPLETED PRIOR TO TURNING WATER INTO THE NEW STREAM CHANNEL SEGMENTS. THE CONTRACTOR SHALL NOT GRADE OR ROUGHEN ANY AREAS WHERE EXCAVATION ACTIVITIES HAVE NOT BEEN COMPLETED.
23. CONTRACTOR SHALL IMPROVE AND CONSTRUCT THE FARM ROADS AND PERMANENT CROSSINGS BY INSTALLING CULVERTS, STABILIZING SIDE SLOPES, AND MODIFYING THE FARM ROAD BED ACCORDING TO THE PLANS AND SPECIFICATIONS. PERMANENT STREAM CROSSINGS WILL BE INSTALLED WHILE THE WORKING SECTION CONTAINING THE CROSSING HAS BEEN DEWATERED. ADJUST HAUL ROADS AND ASSOCIATED SILT FENCE AS NECESSARY WHEN PERMANENT STREAM CROSSINGS ARE INSTALLED. THE CONTRACTOR MAY PLACE A TEMPORARY STREAM CROSSING (I.E. LOG MAT) IN THE LOCATION OF THE PERMANENT CROSSING PRIOR TO INSTALLATION OF THE PERMANENT STRUCTURE.
24. THE CONTRACTOR SHALL DILIGENTLY AND CONTINUOUSLY MAINTAIN ALL EROSION CONTROL DEVICES AND STRUCTURES.
25. FOR PHASED EROSION CONTROL PLANS, CONTRACTOR SHALL MEET WITH EROSION CONTROL INSPECTOR PRIOR TO COMMENCING WITH EACH PHASE OF EROSION CONTROL MEASURES.
26. WHEN APPLICABLE, THE LAND DEVELOPMENT INSPECTOR SHOULD BE CALLED TO CONDUCT INSPECTIONS ON STORM DRAINAGE, SIDEWALKS, DRIVE WAY IMPROVEMENTS, AND ALL ASPECTS OF ROAD CONSTRUCTION.
27. STABILIZE THE SITE AS AREAS ARE BROUGHT TO FINISHED GRADE. AT THE CONCLUSION OF GRADING AND CONSTRUCTION OR IF LAND-DISTURBING ACTIVITY STOPPED FOR MORE THAN 14 CONSECUTIVE CALENDAR DAYS, PERMANENT VEGETATIVE COVER SHALL BE INSTALLED PER SHEETS L5.00 - L5.02.
28. CONTRACTOR SHALL PLANT WOODY VEGETATION AND LIVE STAKES, ACCORDING TO PLANTING DETAILS AND SPECIFICATIONS. THE CONTRACTOR SHALL COMPLETE THE LIVE STAKING AND REFORESTATION (BARE-ROOT PLANTING) PHASE OF THE PROJECT AND APPLY PERMANENT SEEDING AT THE APPROPRIATE TIME OF YEAR.
29. COORDINATE WITH THE EROSION CONTROL INSPECTOR PRIOR TO REMOVAL OF ANY EROSION CONTROL MEASURES.
30. STABILIZE ALL DISTURBED AREAS. REMOVE STAGING AREA AND CONSTRUCTION ENTRANCE.
31. REMOVE ALL EROSION CONTROL MEASURES AND CONTACT AVERY COUNTY FOR FINAL INSPECTION ONCE PERMANENT VEGETATION HAS BEEN ESTABLISHED.
32. PERMANENT SITE ACCESS LOCATIONS AND ACCESS ROUTES USED DURING CONSTRUCTION SHALL BE RETURNED TO EQUAL OR BETTER CONDITION THAN THEY EXISTED PRIOR TO THE BEGINNING OF CONSTRUCTION ACTIVITIES BEFORE DEMOBILIZING FROM THE SITE.
33. DEMOBILIZE ALL EQUIPMENT AND MATERIALS FROM SITE.




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CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION	
PROJECT NO.	AXI-19000
FILENAME	AXI19000-EC1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	02.18.2020

**EROSION CONTROL NOTES**  
**C6.00**



**TABLE 1 - WORKING SECTIONS**

Order of Progress	Reach	Upstream Pump Station	Downstream Pump Station	Notes
1	UT2	3+80	6+80	Construct the proposed channel, install proposed structures, and construct permanent crossing.
2	UT2	6+20	7+80	Construct the proposed channel and install proposed structures. Allow the constructed channel to safely discharge to the existing Fork Creek channel.
3	UT3	5+40	8+00	Construct the proposed channel east of existing Fork Creek. Allow the constructed channel to safely discharge to the existing Fork Creek channel.
4	Fork Creek, UT1, UT2, UT3, UT4			Construct Fork Creek where the proposed channel is off-line of the existing channel. Construct each tributary and the confluence where the proposed channel is off-line of the existing channel. When necessary, pump stream flow from UT1 to existing Fork Creek.
5	Fork Creek	0+00	2+00	Construct the upstream tie-in of Fork Creek. Pump stream flow around the area where construction is occurring, discharging the diverted flow back into the existing channel downstream of the area of work.
6	Fork Creek	23+00	24+30	Construct the downstream tie-in of Fork Creek. Pump stream flow around the area where construction is occurring, discharging the diverted flow back into the existing channel downstream of the area of work.
7	Fork Creek			Remove pump around upstream of the constructed channel.
8	UT2	7+80	8+50	Fill the existing Fork Creek channel and construct the remaining proposed channel and install proposed structures.
9	UT3	8+00	9+00	Fill the existing Fork Creek channel and construct the remaining proposed channel and install proposed structures.
10	UT1	0+00	0+50	Construct the upstream tie-in of UT1. When the constructed channel is stable, remove the pump around.
11	UT4	5+70	7+10	Fill the existing Fork Creek channel and construct the remaining proposed channel and install proposed structures.

**Notes:**

1. Pump stations are approximate and may be changed at the discretion of the contractor.
2. Construction sequencing may be changed at the discretion of the engineer.
3. If multiple construction crews are on site, the above sequencing may occur simultaneously.

**CHANNEL CONSTRUCTION (PUMP AROUND):**

1. INSTALL PUMP AROUND ALONG 200' TO 300' OF STREAM CHANNEL, OR NO MORE THAN CAN BE CONSTRUCTED IN ONE (1) WORKING DAY (DEWATERING AND PUMP AROUND DETAILS ON SHEETS C6.10 AND C.11). SUGGESTED CONSTRUCTION SEQUENCE PROVIDED ON TABLE 1 - WORKING SECTIONS.
2. RIPRAP APRONS WILL BE CONSTRUCTED TO IMPEDE ANY EROSION OF THE CHANNEL AND STREAM BANKS BY THE WATER DIVERTED FROM THE PUMP-AROUND PROCEDURE.
3. WORK SECTIONS THAT INVOLVE THE CONSTRUCTION OF A CONFLUENCE OR TWO REACHES MAY REQUIRE THE USE OF TWO PUMP-AROUND OPERATIONS.
4. HARVEST MATERIAL FROM THE BOTTOM OF THE EXISTING CHANNEL TO BE PLACED IN THE BOTTOM OF THE PROPOSED CHANNEL. THIS SHALL INCLUDE THE SURFACE MATERIAL AND UP TO ONE (1) FOOT BELOW TO INCLUDE THE HYPORHEIC ZONE. ADDITIONAL RIVER STONE SHALL BE MIXED WITH EXISTING CHANNEL MATERIAL AS NECESSARY.
5. IN-STREAM STRUCTURES WILL BE INSTALLED ACCORDING TO THE DETAILS PRESENTED ON SHEETS C8.01 THRU C8.06.
6. FILL EXISTING CHANNEL ON THE SAME WORKING DAY AS COMPLETING THE PROPOSED CHANNEL WHERE THE CONSTRUCTION SEQUENCING ALLOWS. IN NO EVENT SHALL THE EXISTING CHANNEL BE FILLED PRIOR TO THE COMPLETE CONSTRUCTION OF THE CORRESPONDING PROPOSED CHANNEL.
7. ANY EXCAVATED MATERIAL CONTAINING MANMADE MATERIAL IS NOT SUITABLE MATERIAL FOR CHANNEL FILL AND MUST BE DISPOSED OF OFFSITE UNLESS OTHERWISE DIRECTED BY OWNER.
8. IN ANY SECTION WHERE THE NEW CHANNEL ALIGNMENT CROSSES THE EXISTING CHANNEL A CLAY PLUG WILL BE INSTALLED IN THE EXISTING CHANNEL AS PER DETAIL ON SHEET C6.13.
9. THE PROPOSED CHANNEL BANKS SHALL BE STABILIZED WITH EROSION CONTROL MATTING AND TEMPORARY SEEDING UPON COMPLETION OF EACH SECTION AS PER DETAIL ON SHEETS C6.14 AND L5.02.
10. COMPLETE ALL EARTHWORK, STRUCTURE INSTALLATION, AND STABILIZATION IN THE PUMP AROUND AREA.
11. FILL THE EXISTING CHANNEL AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. PLACE CHANNEL PLUGS AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER ON SITE.
12. CONTRACTOR SHALL NOTIFY ENGINEER UPON DISCOVERY OF ANY CONSTRAINTS DISCOVERED IN THE CONSTRUCTION OF THE PROPOSED CHANNEL OR STRUCTURE PLACEMENT AND ADJUSTMENTS CAN BE MADE ON SITE.
13. GRADING OF THE PROPOSED FLOODPLAIN MAY NEED TO BE DELAYED UNTIL AFTER WORK IN SUBSEQUENT SECTIONS HAS BEEN COMPLETED, ESPECIALLY NEAR CONFLUENCES. HAUL ROADS AND TEMPORARY SILT FENCE MAY ALSO NEED TO BE REMOVED BEFORE THE PROPOSED FLOODPLAIN CAN BE COMPLETED AND/OR UNUSED EXISTING CHANNEL CAN BE FILLED.

**EXISTING CONDITION & DEMOLITION NOTES:**

1. THERE SHALL BE NO DEMOLITION ACTIVITIES UNTIL AFTER A PRE-CONSTRUCTION MEETING HAS TAKEN PLACE.
2. ALL MATERIAL TO BE DEMOLISHED SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT A PERMITTED SITE IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL LAWS.
3. EXISTING UTILITIES AND STRUCTURES SHOWN, BOTH UNDERGROUND AND ABOVE GROUND, ARE BASED ON A FIELD SURVEY AND THE BEST AVAILABLE RECORD DRAWINGS. THE CONTRACTOR SHALL VERIFY FIELD CONDITIONS PRIOR TO BEGINNING RELATED CONSTRUCTION. ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER IMMEDIATELY.

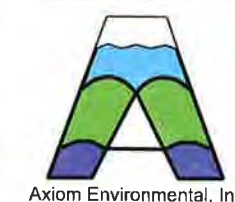
**SITE PREPARATION: CLEARING & TOPSOIL/SUBSOIL EXCAVATION**

1. ALL SHRUBS AND SMALL TREES DESIGNATED BY THE ENGINEER WILL BE SAVED FOR TRANSPLANTING. PLANTS THAT ARE TO BE TRANSPLANTED WILL BE MARKED WITH HIGHLY VISIBLE TAPE.
2. ANY UNUSABLE TREES & BRUSH REMOVED DURING CLEARING & GRUBBING OF SITE SHALL BE CHIPPED AND HAULED OFF SITE FOR DISPOSAL OR BURNED.
3. CONTRACTOR SHALL MANAGE EXCAVATED TOPSOIL SEPARATELY FROM EXCAVATED SUBSOIL. EXCAVATED TOPSOIL SHALL BE PLACED WITHIN THE DESIGNATED TEMPORARY STOCKPILE AREAS AWAY FROM THE CHANNEL TO BE FILLED (SEE PLANS). TOPSOIL SHALL BE FREE OF STONES OVER 1" IN DIAMETER, ROOTS, STICKS, RUBBISH, STIFF CLAY, AND EXTRANEIOUS MATTER.
4. EXCAVATED SUBSOIL SHALL BE PLACED NEAR THE CHANNEL TO BE FILLED. ONCE THE NEW STREAM IS CONSTRUCTED, SUBSOIL SHALL BE USED TO FILL THE EXISTING CHANNEL FIRST, THEN STOCKPILED TOPSOIL SHALL BE USED FOR THE FINAL 6 INCHES OF FILL TO ACHIEVE DESIGN GRADES AND CREATE A SOIL BASE FOR VEGETATION.
5. IMPORTED TOPSOIL SHALL HAVE A LOAMY TEXTURE AND HAVE SAND, SILT, AND CLAY PERCENTAGES THAT MEET THE U.S. DEPARTMENT OF AGRICULTURE CHARACTERISTICS OF A LOAMY SOIL. ORGANIC CONTENT SHALL NOT BE LESS THAN 1.5% BY WEIGHT. PH RANGE SHALL BE FROM 6-7.5. IF PH IS LESS THAN 6, LIME SHALL BE ADDED. SOLUBLE SALTS SHALL NOT EXCEED 500PPM. IMPORTED TOPSOIL SHALL BE FREE OF DEBRIS, ROOTS, PLANTS, STICKS, RUBBISH, STIFF CLAYS, AND STONES OVER 1 INCH IN DIAMETER.
6. CONTRACTOR SHALL HARVEST AND STOCKPILE NATIVE CHANNEL SUBSTRATE (COBBLE, STONE, ETC.) FOR USE IN PROPOSED IN-STREAM STRUCTURES.




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**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION	
PROJECT NO.	AXI-19000
FILENAME	AXI19000-EC1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
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**EROSION CONTROL NOTES**  
**C6.01**

**EROSION & SEDIMENT CONTROL NOTES:**

1. GRADING AND EROSION CONTROL METHODS SHALL ADHERE TO THE AVERY COUNTY STANDARDS AND SPECIFICATIONS.
2. EROSION AND SEDIMENT CONTROL (E&SC) PERMIT AND A CERTIFICATE OF COVERAGE (COC) MUST BE OBTAINED BEFORE ANY LAND DISTURBANCE ACTIVITIES.
3. WHEN PROJECT IS COMPLETE, THE PERMITEE SHALL VISIT DEQ.NC.GOV/NCG01 TO SUBMIT AN ELECTRONIC NOTICE OF TERMINATION (E-NOT). A \$100 ANNUAL GENERAL FEE WILL BE CHARGED UNTIL THE E-NOT HAS BEEN FILLED OUT.
4. E&SC DEVICES MUST BE INSTALLED AND INSPECTED PRIOR TO ANY GRADING ON SITE. THE CONTRACTOR SHALL CALL FOR AN INSPECTION BY AVERY COUNTY ONCE INITIAL MEASURES ARE IN PLACE.
5. A COPY OF THE APPROVED EROSION CONTROL PLAN MUST BE ON FILE AT THE JOB SITE AT ALL TIMES. FAILURE TO FOLLOW THE APPROVED PLAN SEQUENCE AND DETAILS COULD SUBJECT THE CONTRACTOR TO FINES AND PENALTIES ISSUED BY AVERY COUNTY.
6. CONSTRUCTION, MAINTENANCE, AND REMOVAL OF ALL EROSION CONTROL DEVICES ARE THE RESPONSIBILITY OF THE GRADING CONTRACTOR UNLESS OTHERWISE NOTED.
7. ANY GRADING BEYOND THE DENUDED LIMITS SHOWN ON THE PLAN IS A VIOLATION OF THE APPROVED EROSION CONTROL PLAN AND IS SUBJECT TO A FINE BY AVERY COUNTY.
8. DISTURBANCE OUTSIDE OF THE SITE PROPERTY LIMITS OR PUBLIC R/W SHALL ONLY BE ALLOWED BY SIGNED GRADING AGREEMENTS AND/OR EASEMENTS BETWEEN THE DEVELOPER AND OFFSITE PROPERTY OWNER.
9. THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN SAFE OPEN ACCESS TO ALL ADJACENT PROPERTIES DURING THE CONSTRUCTION PERIOD FOR IMPROVEMENTS.
10. STAGING AREAS, STOCKPILE AREAS, CONSTRUCTION ENTRANCES, AND ACCESS ROADS WILL BE IDENTIFIED AND LOCATED ACCORDING TO THE EROSION CONTROL PLANS AND LANDOWNER. VARIANCES WILL BE ALLOWED ASSUMING BOTH THE CONTRACTOR AND THE ENGINEER VERBALLY AGREE.
11. CONTRACTOR SHALL SEED AND STABILIZE ALL STEEP SLOPES (GREATER THAN 3H:1V) WITHIN 7 DAYS, 10 DAYS FOR MODERATE SLOPES (3H:1V OR LESS) AND WITHIN 14 CALENDAR DAYS EVERYWHERE ELSE ACCORDING TO THE TEMPORARY SEEDING SCHEDULE ON SHEET L5.02.
12. FOR ANY LAND DISTURBING ACTIVITY WHERE GRADING ACTIVITIES HAVE BEEN COMPLETED, TEMPORARY OR PERMANENT GROUND COVER (SHEET L5.02) SUFFICIENT TO RESTRAIN EROSION SHALL BE PROVIDED AS SOON AS PRACTICAL, BUT IN NO CASE LATER THAN SEVEN (7) DAYS AFTER COMPLETING THE WORK. STABILIZATION IS THE BEST FORM OF EROSION CONTROL. TEMPORARY SEEDING IS NECESSARY TO ACHIEVE EROSION CONTROL ON LARGE DENUDED AREAS AND ESPECIALLY WHEN SPECIFICALLY REQUIRED AS PART OF THE CONSTRUCTION SEQUENCE ON THE PLAN. THE EROSION CONTROL INSPECTOR MAY REQUIRE ADDITIONAL FIELD MEASURES AS NECESSARY TO PROVIDE ADEQUATE PROTECTION FROM RECEIVING WATER COURSES.
14. PROTECTION OF EXISTING VEGETATION: AT THE START OF GRADING INVOLVING THE STRIPPING OF TOPSOIL OR LOWERING OF EXISTING GRADE AROUND A TREE, A CLEAN, SHARP, VERTICAL CUT SHALL BE MADE AT THE EDGE OF THE TREE SAVE AREA AT THE SAME TIME AS OTHER EROSION CONTROL MEASURES ARE INSTALLED. THE TREE PROTECTION FENCING SHALL BE INSTALLED ON THE SIDE OF THE CUT FARTHEST AWAY FROM THE TREE TRUNK AND SHALL REMAIN IN PLACE UNTIL ALL CONSTRUCTION IN THE VICINITY OF THE TREES IS COMPLETE. NO STORAGE OF MATERIALS, FILL, OR EQUIPMENT AND NO TRESPASSING SHALL BE ALLOWED WITHIN THE BOUNDARY OF THE PROTECTED AREA AND SHALL BE POSTED ON THE PROTECTION FENCE. A PROTECTION FENCE CONSTRUCTED OF MATERIAL RESISTANT TO DEGRADATION BY SUN, WIND, AND MOISTURE FOR THE DURATION OF THE CONSTRUCTION, SHALL BE INSTALLED AT THE SAME TIME AS THE EROSION CONTROL MEASURES AND SHALL BE IN PLACE UNTIL ALL CONSTRUCTION IN THE VICINITY OF THE TREES IS COMPLETE.
15. A CONSTRUCTION SEQUENCE HAS BEEN PROVIDED (SEE SHEET C6.00 AND C6.01). INSTALLATION OF ALL PROPOSED E&SC MEASURES IN THE SEQUENCE(S) PROVIDED AND MAINTENANCE OF THOSE DEVICES IS REQUIRED. THE CONTRACTOR MAY BE ALLOWED, WITH PRIOR APPROVAL FROM THE OWNER, TO COORDINATE CHANGES TO THE PLAN WITH THE ON-SITE E&SC INSPECTOR AND THE ENGINEER.
16. CONTRACTOR SHALL INSPECT AND REPAIR ALL EROSION CONTROL DEVICES AT LEAST ONCE PER WEEK AND AFTER EVERY SIGNIFICANT RAINFALL EVENT. EACH DEVICE IS TO BE MAINTAINED OR REPLACED IF SEDIMENT ACCUMULATION HAS REACHED ONE HALF THE CAPACITY OF THE DEVICE.
17. CONTRACTOR WILL FIELD LOCATE ALL SILT FENCE OUTLETS AT LOW POINTS IN SILT FENCE AND A MINIMUM OF EVERY 100 LINEAR FEET TO PROVIDE RELIEF FROM CONCENTRATED FLOWS. SILT FENCE OUTLETS SHOWN ON THESE PLANS ARE BASED ON THE BEST TOPOGRAPHIC INFORMATION AVAILABLE AT THE TIME OF DESIGN. CONTRACTOR TO FIELD VERIFY AND ADJUST LOCATIONS OF SILT FENCE OUTLETS AND/OR PLACE ADDITIONAL OUTLETS TO INSURE THAT ALL LOW SPOTS ALONG THE SILT FENCE HAVE AN OUTLET.
18. WASHED STONE AND WIRE BACKING SHALL BE USED WITH SILT FENCE WHENEVER SILT FENCE IS PLACED AT THE TOE OF A SLOPE >10' VERTICAL OR ALONG ANY CHANNEL OR WATER COURSE WHERE 50' OF BUFFER IS NOT PROVIDED.
19. ALL DIMENSIONS AND GRADES SHOWN ON THE PLANS SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. CONTRACTOR SHALL NOTIFY THE OWNER IF ANY DISCREPANCIES EXIST PRIOR TO PROCEEDING WITH CONSTRUCTION FOR NECESSARY PLAN OR GRADE CHANGES. NO EXTRA COMPENSATION SHALL BE PAID TO THE CONTRACTOR FOR ANY WORK DONE DUE TO DIMENSIONS OR GRADES SHOWN INCORRECTLY ON THESE PLANS IF SUCH NOTIFICATION HAS NOT BEEN GIVEN.
20. NO DEBRIS SHALL BE TRACKED ONTO PUBLIC RIGHT OF WAY. IF THE SITUATION OCCURS WHERE MUD, ROCKS AND DEBRIS IS TRACKED ONTO PAVEMENT, THE CONTRACTOR SHALL CLEAN THE PAVEMENT AND INSTALL ADDITIONAL MEASURES TO PREVENT FUTURE OCCURRENCES.
21. INSTALL SILT FENCE FOR ALL STAGING AND STOCKPILE AREAS (SEE DETAIL ON SHEET C6.09). ANY STOCKPILE AREAS SHALL USE TWO (2) ROWS OF SILT FENCE.
22. IF CONCRETE WASHOUTS ARE UTILIZED, THESE AREAS ARE TO BE WITHIN THE LIMITS OF DISTURBANCE AND SHOULD BE LOCATED AT LEAST 50 FT. AWAY FROM STORM DRAIN INLETS AND SURFACE WATER.

**EROSION & SEDIMENT CONTROL MAINTENANCE PLAN:**

1. QUALIFIED PERSONNEL, ON A DAILY BASIS WILL EVALUATE ALL TEMPORARY EROSION AND SEDIMENT CONTROL PRACTICES FOR STABILITY AND OPERATION.
2. INSPECT AND MAINTAIN ALL EROSION CONTROL MEASURES EVERY 7 DAYS AND AFTER EACH SIGNIFICANT RAINFALL (0.5" OR GREATER) AND DOCUMENT WITH INSPECTION REPORTS AND WRITTEN LOGS SHALL BE KEPT.
3. A RAIN GAUGE WILL ALSO BE KEPT ON-SITE AND DAILY RAINFALL AMOUNTS WILL BE RECORDED.
4. ANY REPAIRS NEEDED WILL BE PERFORMED IMMEDIATELY TO MAINTAIN ALL PRACTICES AS DESIGNED.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF TEMPORARY ON-SITE E&SC MEASURES.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING AND FOLLOWING THE APPROVED E&SC PLAN.
7. A COPY OF THE COMBINED SELF-INSPECTION MONITORING FORM CAN BE FOUND ON THE NC DEMLR WEBSITE AT: [HTTPS://DEQ.NC.GOV/ABOUT/DIVISIONS/ENERGY-MINERAL-LAND-RESOURCES/EROSION-SEDIMENT-CONTROL/FORMS](https://deq.nc.gov/about/divisions/energy-mineral-land-resources/erosion-sediment-control/forms)




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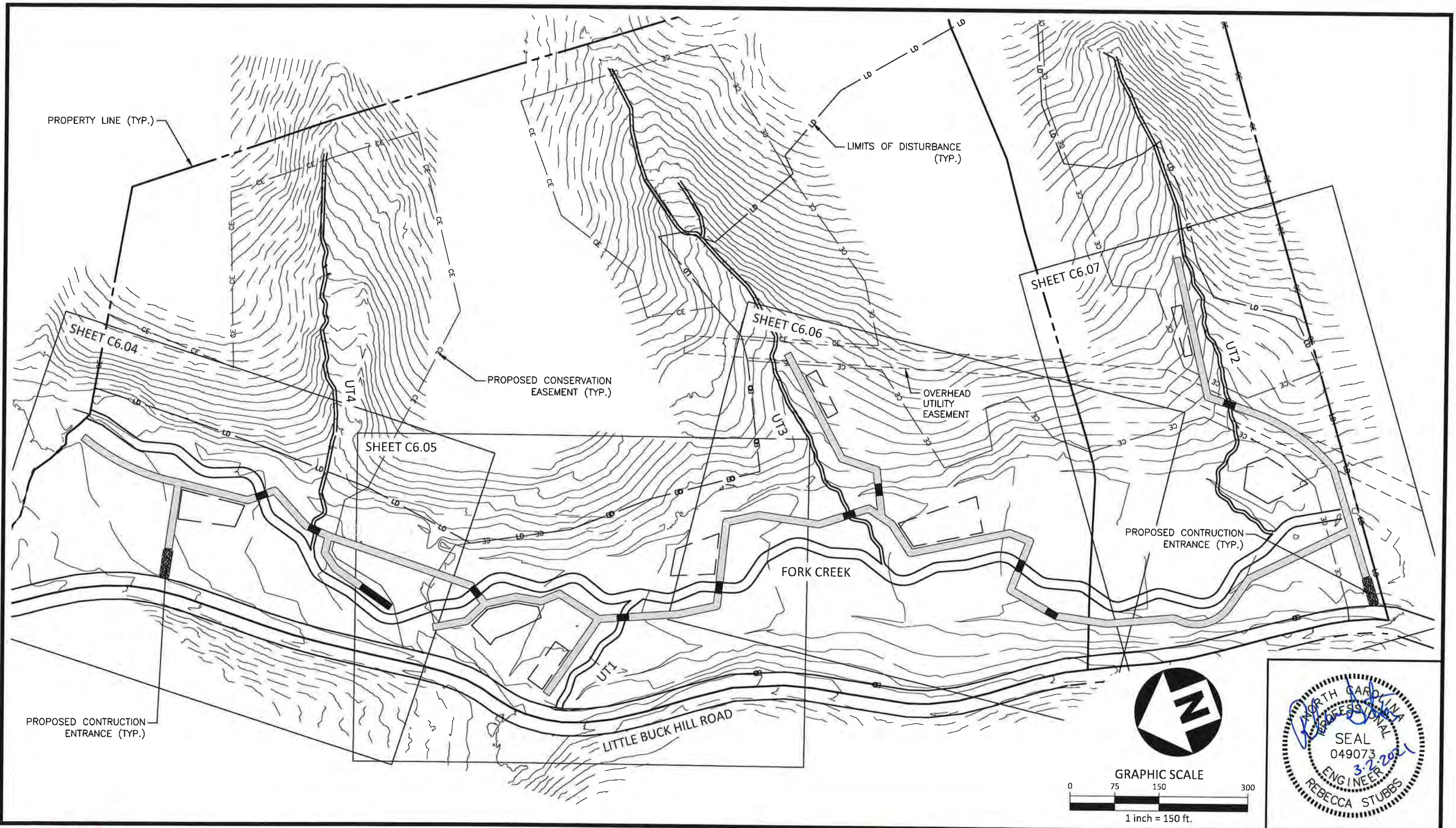
**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



PLAN INFORMATION	
PROJECT NO.	AXI-19000
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**EROSION CONTROL NOTES**  
**C6.02**





  
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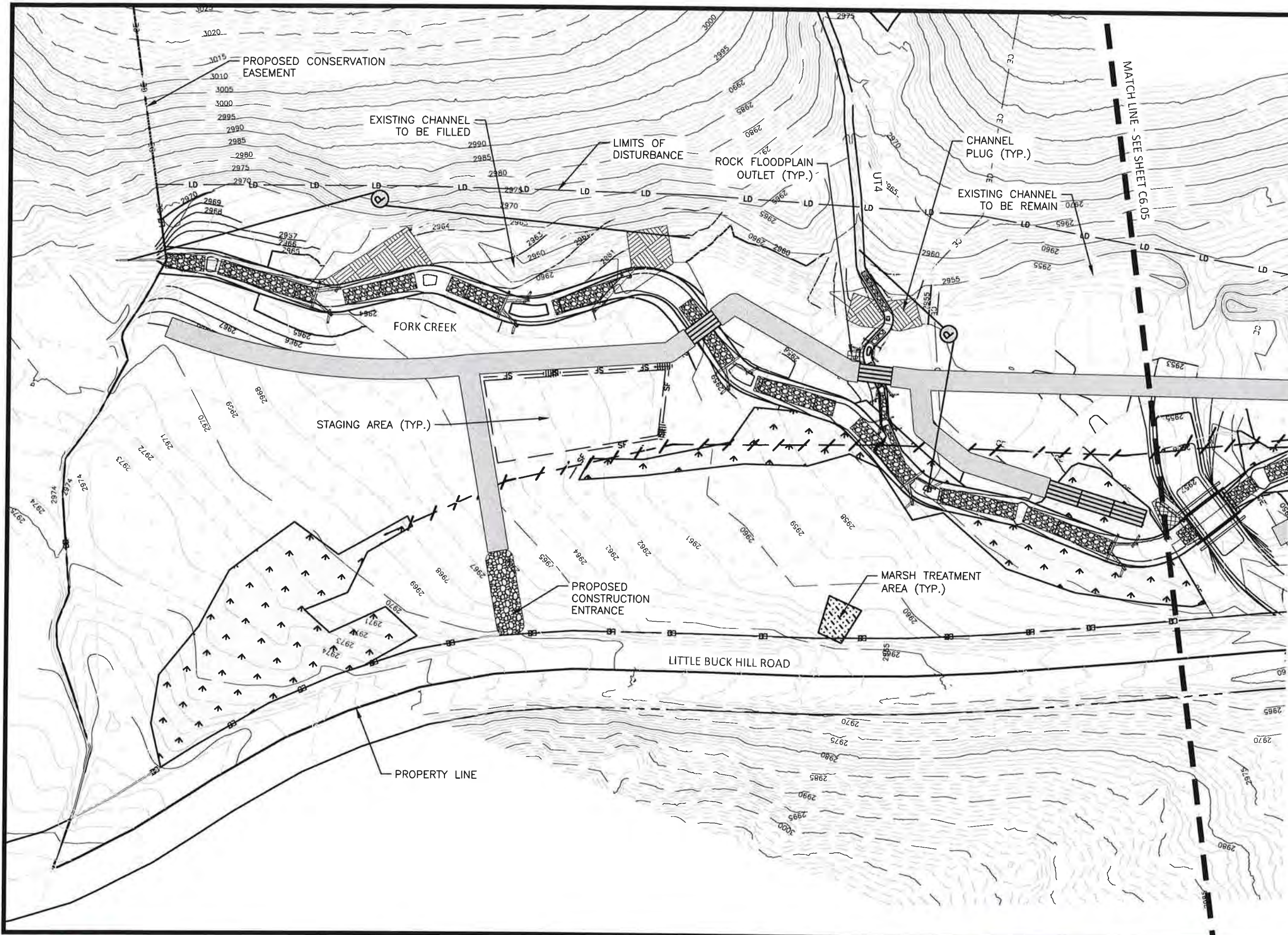
**LAUREL SPRINGS MITIGATION PLAN**  
**CONSTRUCTION DRAWINGS**  
 AVERY COUNTY, NORTH CAROLINA



**PLAN INFORMATION**  
 PROJECT NO. AXI-19000  
 FILENAME AXI19000-EC1  
 CHECKED BY RAS  
 DRAWN BY RHW  
 SCALE 1" = 150'  
 DATE 02.18.2020

**EROSION CONTROL OVERVIEW**  
**C6.03**





NOTE:  
TWO ROWS OF SILT FENCE SHALL BE INSTALLED AROUND STAGING/STOCKPILE AREAS PER THE E&SC NOTES.

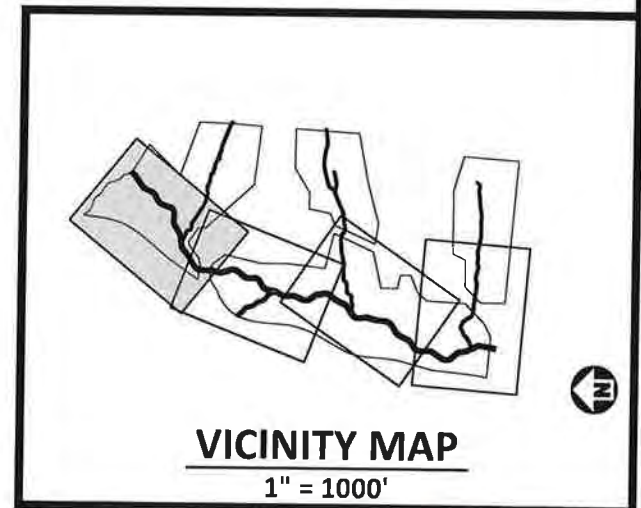


GRAPHIC SCALE



1 inch = 60 ft.

TOTAL DISTURBED AREA = 27.53 AC.




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# LAUREL SPRINGS MITIGATION PLAN

## CONSTRUCTION DRAWINGS

AVERY COUNTY, NORTH CAROLINA



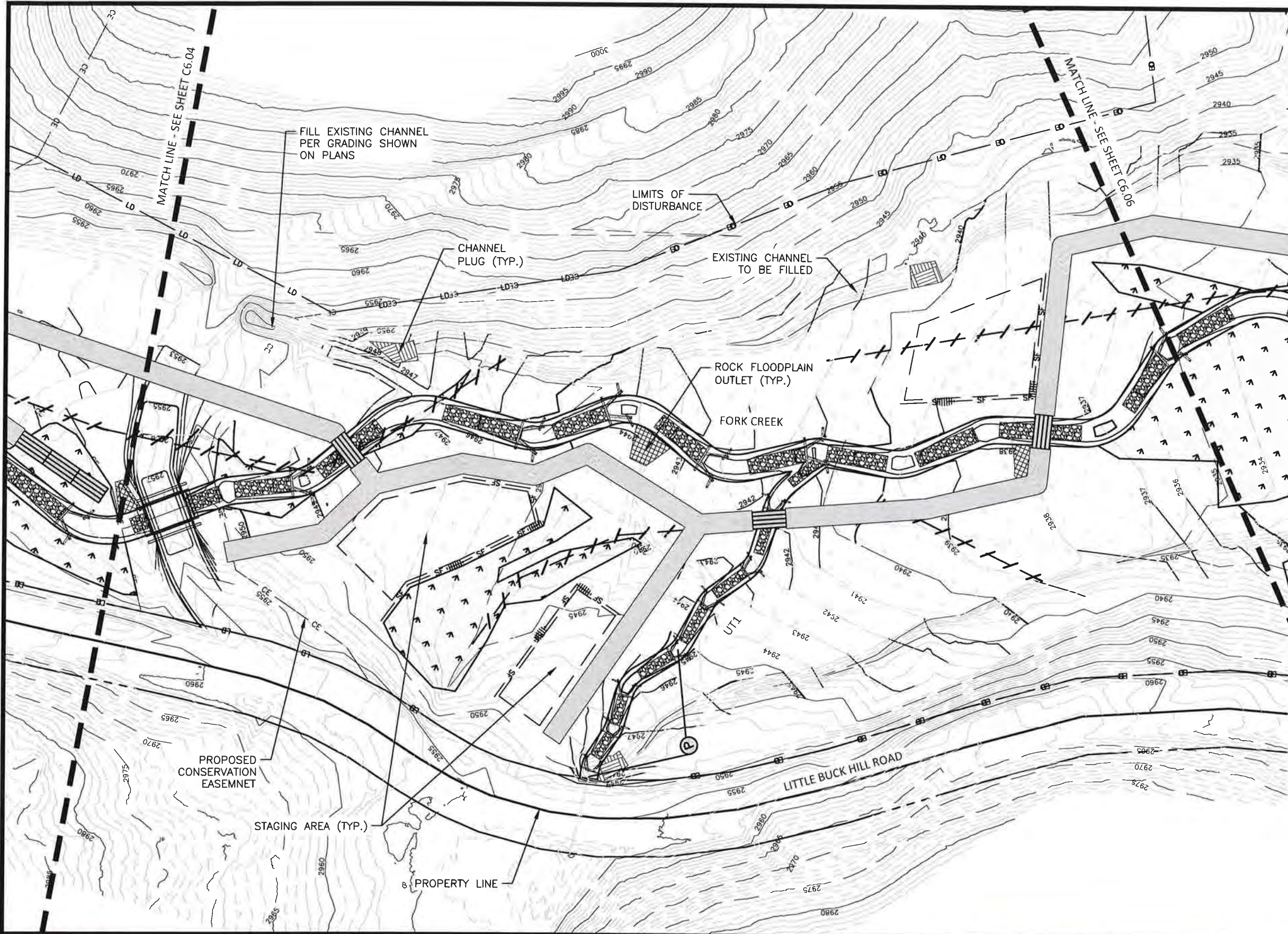
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FILENAME AXI19000-EC1  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE 1"=60'  
DATE 02.18.2020

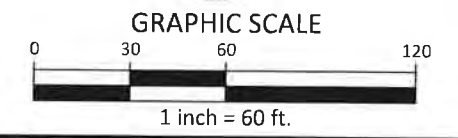
**EROSION CONTROL PLAN**

# C6.04

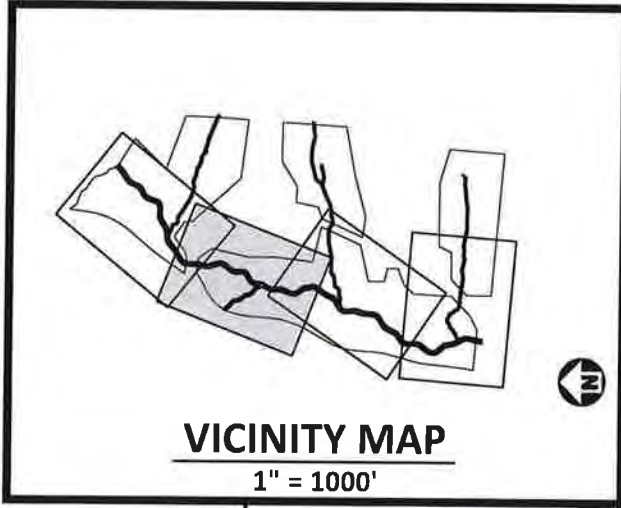




NOTE:  
TWO ROWS OF SILT FENCE SHALL BE INSTALLED AROUND STAGING/STOCKPILE AREAS PER THE E&SC NOTES.



TOTAL DISTURBED AREA = 27.53 AC.



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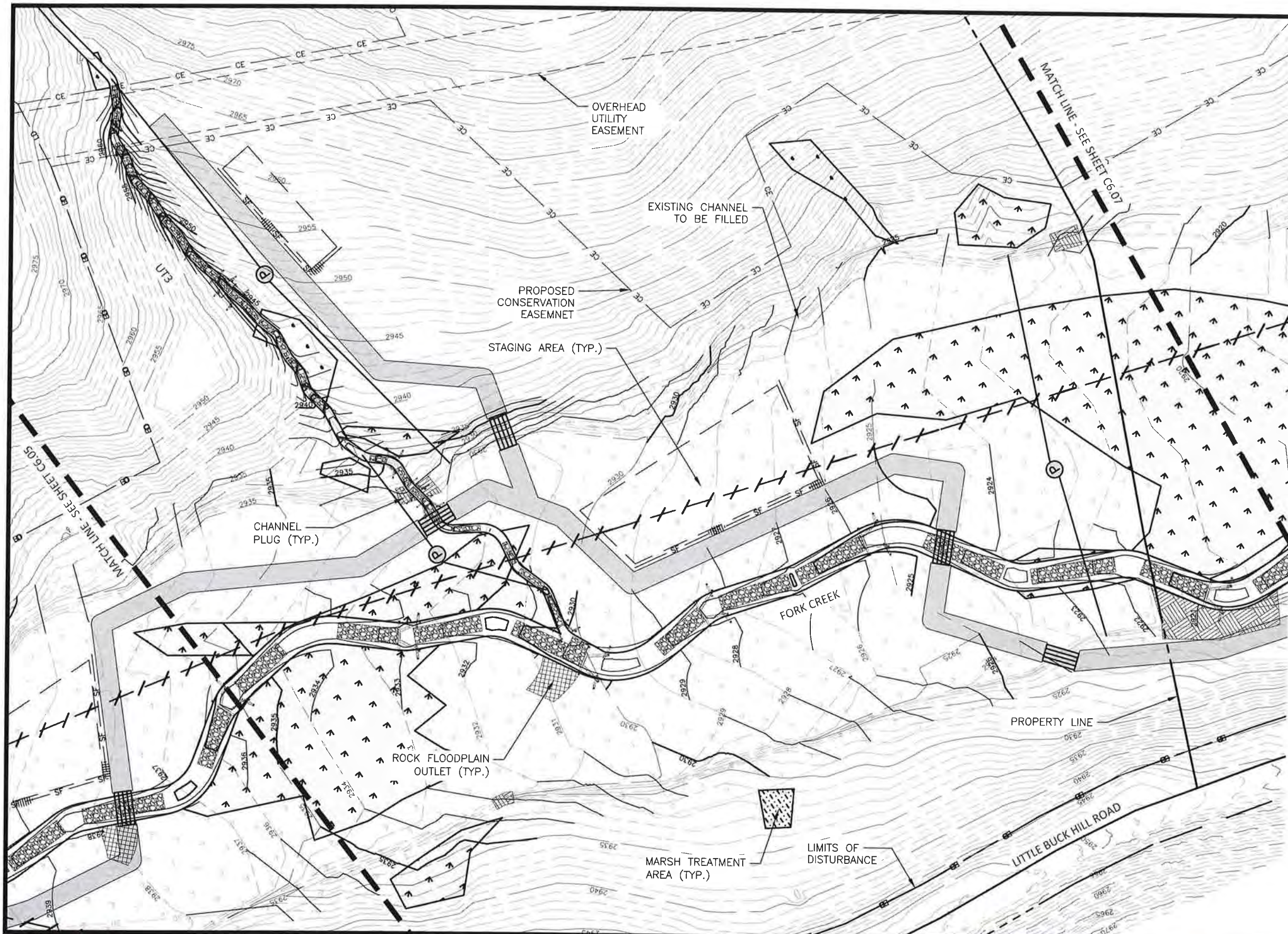
**PLAN INFORMATION**

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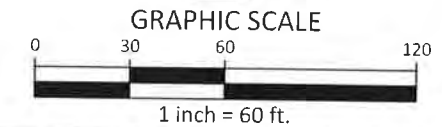
**EROSION CONTROL PLAN**

**C6.05**

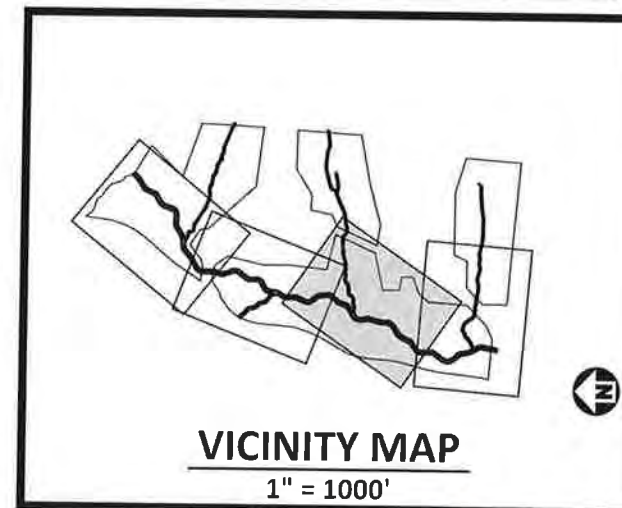




NOTE:  
TWO ROWS OF SILT FENCE SHALL BE INSTALLED AROUND STAGING/STOCKPILE AREAS PER THE E&SC NOTES.



TOTAL DISTURBED AREA = 27.53 AC.




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# LAUREL SPRINGS MITIGATION PLAN

## CONSTRUCTION DRAWINGS

AVERY COUNTY, NORTH CAROLINA



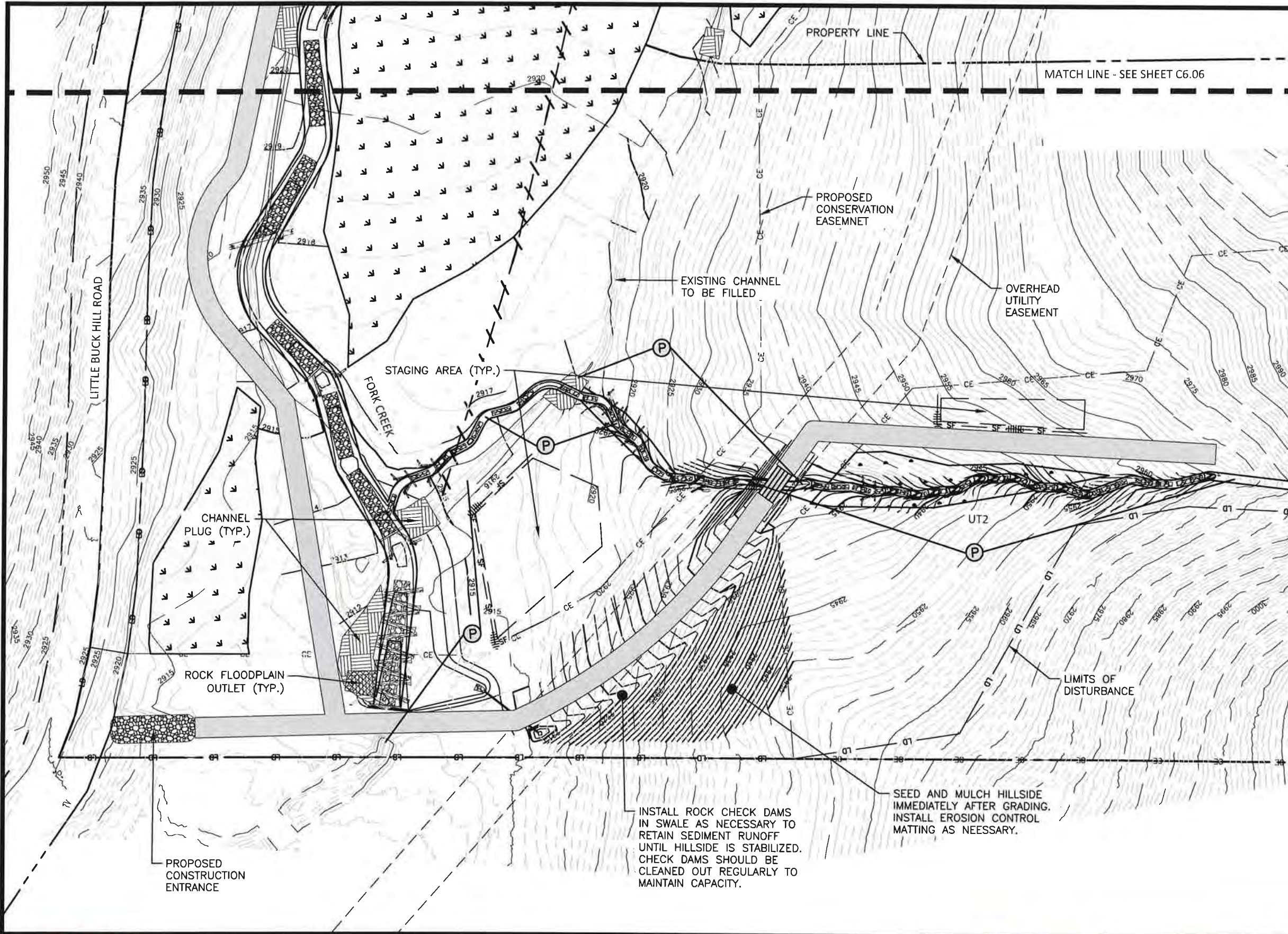
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# EROSION CONTROL PLAN

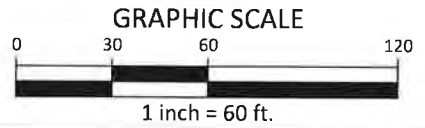
## C6.06



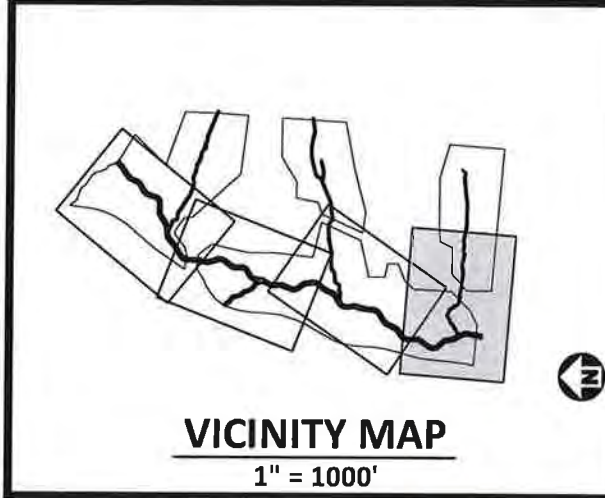


NOTE:  
TWO ROWS OF SILT FENCE SHALL BE INSTALLED AROUND STAGING/STOCKPILE AREAS PER THE E&SC NOTES.

MATCH LINE - SEE SHEET C6.06



TOTAL DISTURBED AREA = 27.53 AC.



INSTALL ROCK CHECK DAMS IN SWALE AS NECESSARY TO RETAIN SEDIMENT RUNOFF UNTIL HILLSIDE IS STABILIZED. CHECK DAMS SHOULD BE CLEANED OUT REGULARLY TO MAINTAIN CAPACITY.

SEED AND MULCH HILLSIDE IMMEDIATELY AFTER GRADING. INSTALL EROSION CONTROL MATTING AS NECESSARY.



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# LAUREL SPRINGS MITIGATION PLAN

## CONSTRUCTION DRAWINGS

AVERY COUNTY, NORTH CAROLINA

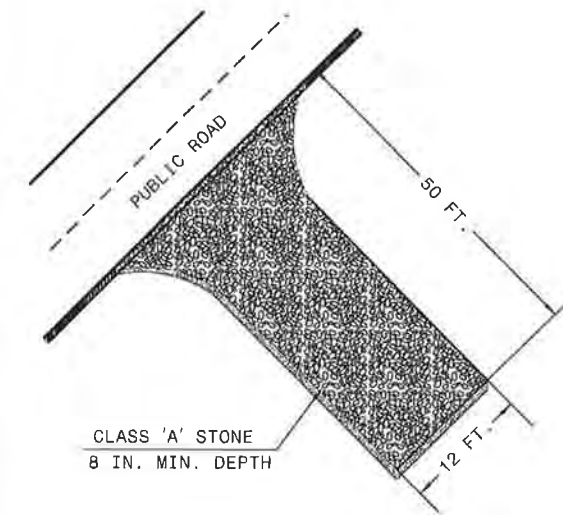


PLAN INFORMATION	
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EROSION CONTROL PLAN

# C6.07





**NOTES**

1. PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
2. LOCATE ENTRANCES TO PROVIDE FOR UTILIZATION BY ALL CONSTRUCTION VEHICLES.
3. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOPDRESSING WITH STONE WILL BE NECESSARY. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED UP IMMEDIATELY.
4. LOCATE GRAVEL CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
5. NUMBER AND LOCATION OF CONSTRUCTION ENTRANCES TO BE DETERMINED BY THE ENGINEER.
6. USE CLASS 'A' STONE OR OTHER COARSE AGGREGATE APPROVED BY THE ENGINEER.
7. INSTALL CONSTRUCTION ENTRANCES IN A WAY TO PREVENT VEHICLES FROM BYPASSING CONSTRUCTION ENTRANCE LEAVING PROJECT SITE.

NOTE: PLACE GEOTEXTILE FOR DRAINAGE BENEATH STONE

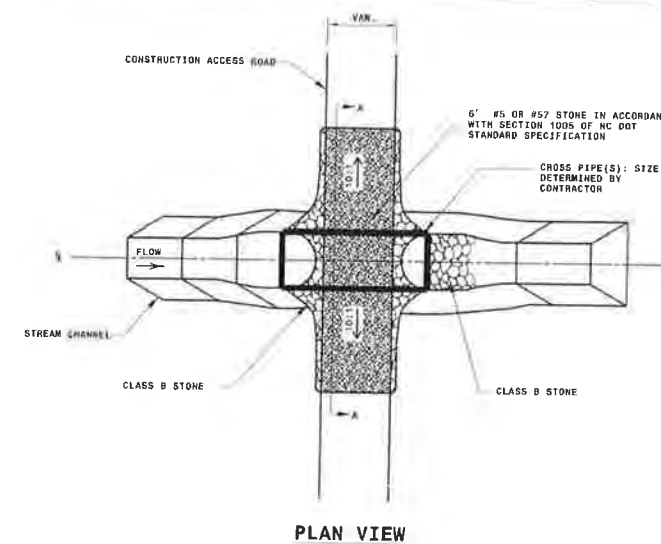
STATE OF NORTH CAROLINA  
DEPT. OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
RALEIGH, N.C.

ROADWAY STANDARD DRAWING FOR  
**GRAVEL CONSTRUCTION ENTRANCE**

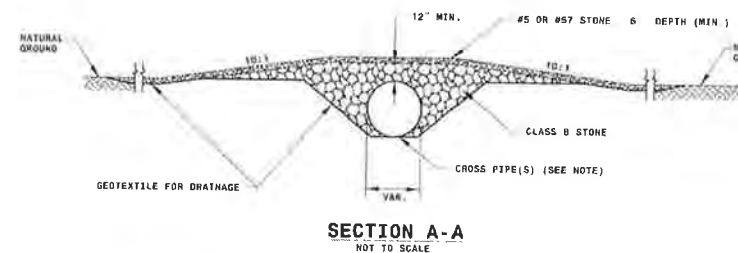
SHEET 1 OF 1  
**1607.01**

**CONSTRUCTION ENTRANCE**

N.T.S.



**PLAN VIEW**



**SECTION A-A**  
NOT TO SCALE

**NOTES**

PIPE(S) FOR TEMPORARY STREAM CROSSING SHALL BE DESIGNED TO PASS THE PEAK OR BANKFULL FLOW, WHICHEVER IS LESS, FROM A 2-YEAR PEAK STORM, WITHOUT OVER TOPPING.

STATE OF NORTH CAROLINA  
DEPT. OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
RALEIGH, N.C.

ROADWAY STANDARD DRAWING FOR  
**TEMPORARY STREAM CROSSING**

SHEET 1 OF 1  
**1645.01**

**TEMPORARY STREAM CROSSING**

N.T.S.

NOTE:  
LOG MATS MAY BE USED IN PLACE OF TEMPORARY CULVERT STREAM CROSSINGS WHERE APPROPRIATE.



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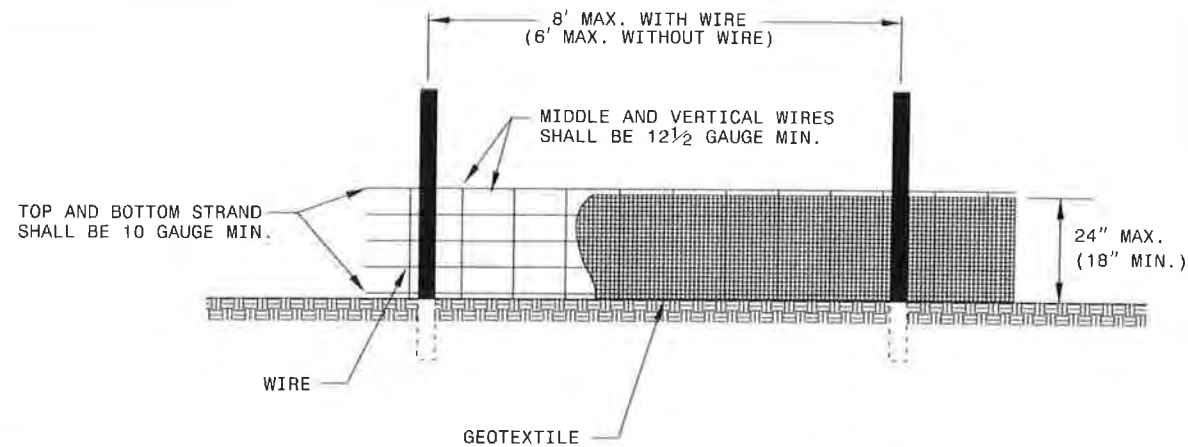
**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



**PLAN INFORMATION**  
PROJECT NO. AXI-19000  
FILENAME AXI19000-EC2  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE N.T.S.  
DATE 02.18.2020

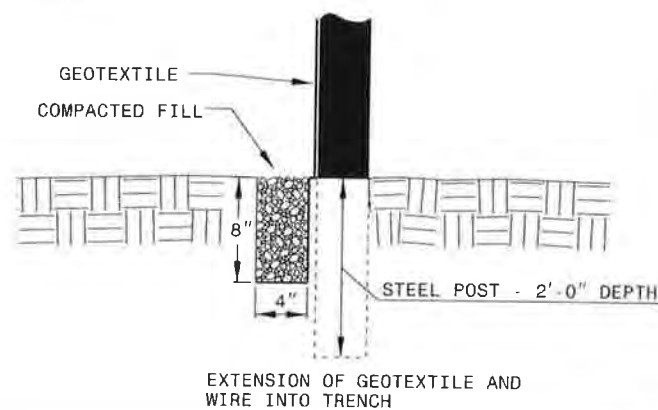
**EROSION CONTROL  
DETAILS**  
**C6.08**





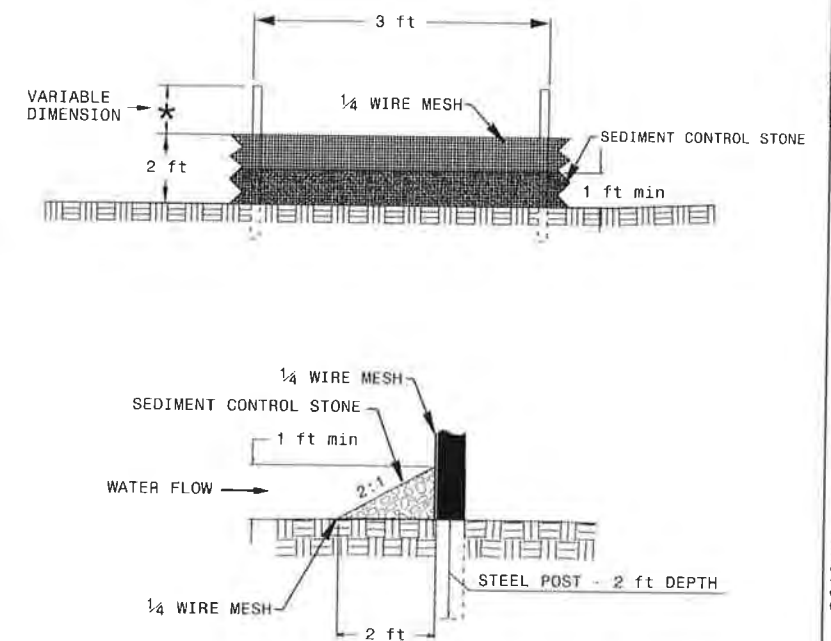
NOTES

USE GEOTEXTILE A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE POSTS AND WIRE AS DIRECTED.  
 USE WIRE A MINIMUM OF 32" IN WIDTH AND WITH A MINIMUM OF 5 LINE WIRES WITH 12" VERTICAL SPACING.  
 PROVIDE 5'-0" STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE.  
 FOR MECHANICAL SLICING METHOD INSTALLATION, GEOTEXTILE SHALL BE A MAXIMUM OF 18" ABOVE GROUND SURFACE.



1-18] STATE OF NORTH CAROLINA DEPT. OF TRANSPORTATION DIVISION OF HIGHWAYS RALEIGH, N.C.  
 ROADWAY STANDARD DRAWING FOR  
**TEMPORARY SILT FENCE**  
 SHEET 1 OF 1  
**1605.01**

TEMPORARY SILT FENCE  
 N.T.S.



NOTES

USE NO. 5 OR NO. 57 STONE FOR SEDIMENT CONTROL STONE.  
 USE HARDWARE CLOTH 24 GAUGE WIRE MESH WITH 1/4 INCH MESH OPENINGS.  
 INSTALL 5 FT. SELF FASTENER ANGLE STEEL POST 2 FT. DEEP MINIMUM.  
 ATTACH HARDWARE CLOTH TO POSTS WITH WIRE STAPLE OR OTHER ACCEPTABLE METHODS.  
 SPACE POSTS A MAXIMUM OF 3 FT.  
 FOR INSTALLATION BETWEEN SECTIONS OF SILT FENCE, EXTEND SEDIMENT CONTROL STONE A MINIMUM OF 12" ON EACH SIDE OF SPECIAL SEDIMENT CONTROL FENCE SECTION.

1-18] STATE OF NORTH CAROLINA DEPT. OF TRANSPORTATION DIVISION OF HIGHWAYS RALEIGH, N.C.  
 ROADWAY STANDARD DRAWING FOR  
**SPECIAL SEDIMENT CONTROL FENCE**  
 SHEET 1 OF 1  
**1606.01**

SILT FENCE OUTLET  
 N.T.S.



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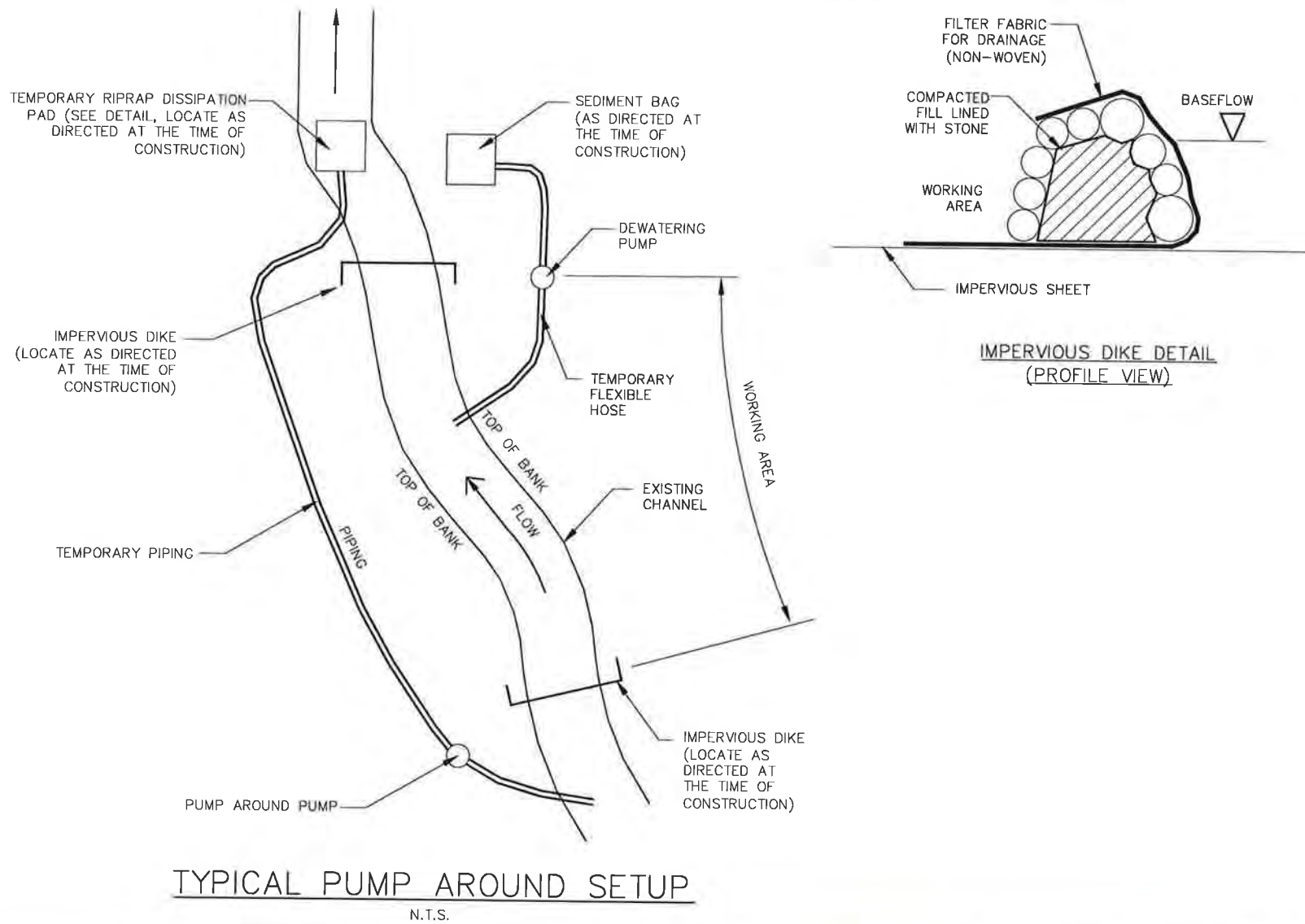
**EROSION CONTROL DETAILS**  
**C6.09**

**NOTES:**

1. EXCAVATION SHALL BE PERFORMED IN ONLY DRY SECTIONS OF CHANNEL UNLESS DRAINAGE AREA EXCEEDS 6 SQUARE MILES.
2. IMPERVIOUS DIKES SHOULD BE USED TO ISOLATE WORK AREAS FROM STREAM FLOW.
3. THE CONTRACTOR SHALL NOT DISTURB MORE AREA THAN CAN BE STABILIZED IN ONE WORKING DAY.
4. EACH PUMP AROUND PUMP SHOULD ADEQUATELY CONVEY BASE FLOW VOLUMES.
5. PUMP AROUND OPERATIONS SHOULD NOT BE UNDERTAKEN IF SIGNIFICANT RAINFALL IS FORECAST IN THE CONSTRUCTION PERIOD.

**SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP AROUND**

1. INSTALL SEDIMENT BAG AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR WILL INSTALL THE PUMP AROUND PUMP AND THE TEMPORARY PIPING THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK SITE TO THE SEDIMENT BAG.
3. INSTALL UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. INSTALL THE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS IF NEEDED TO DEWATER THE ENTRAPPED AREA. THE PUMP AND HOSE FOR THIS PURPOSE SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. THIS WATER WILL ALSO FLOW INTO A SEDIMENT BAG.
5. THE CONTRACTOR WILL PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLAN AND FOLLOWING THE GENERAL CONSTRUCTION SEQUENCE.
6. THE CONTRACTOR WILL EXCAVATE ANY ACCUMULATED SEDIMENT AND DEWATER BEFORE REMOVAL OF THE IMPERVIOUS DIKE. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE/PIPING STARTING WITH THE DOWNSTREAM DIKE FIRST.
7. ONCE THE WORKING AREA IS COMPLETED, REMOVE THE STILLING BASINS AND STABILIZE DISTURBED AREAS TO SPECIFICATIONS AS SHOWN ON PLANS.




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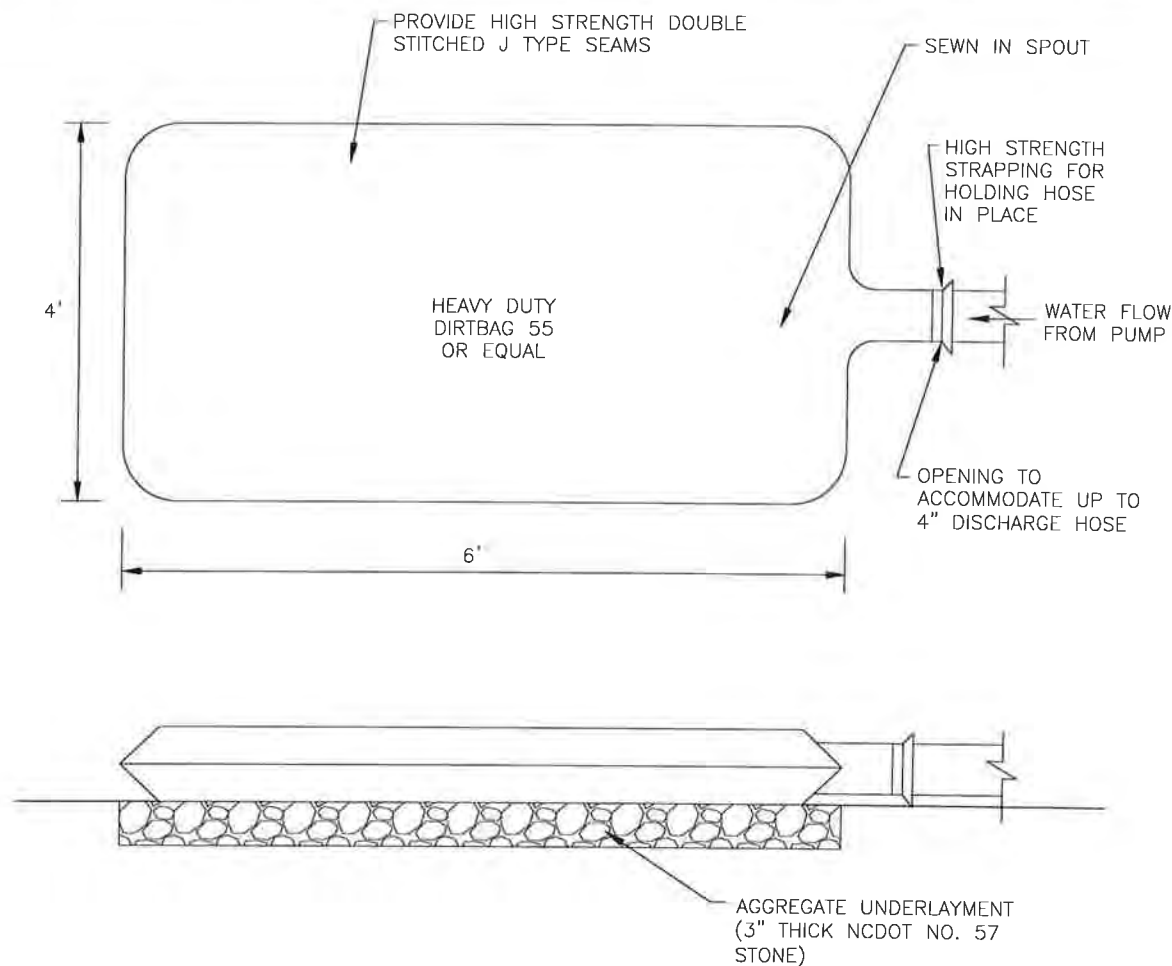


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**EROSION CONTROL  
DETAILS**  
**C6.10**





**NOTES**

1. THE DEWATERING BAG SHALL BE MADE OF NON-WOVEN GEOTEXTILE WITH A MIN. SURFACE AREA OF 225 SQUARE FEET PER SIDE.
2. ALL STRUCTURAL SEAMS SHALL BE SEWN WITH A DOUBLE STITCH USING A DOUBLE NEEDLE MACHINE WITH HIGH STRENGTH THREAD
3. THE SEAM STRENGTH SHALL WITHSTAND 100 LB/IN USING ASTM D-4884 TEST METHOD.
4. THE GEOTEXTILE FABRIC SHALL BE 10 OZ NON-WOVEN FABRIC.
5. DISCHARGE FROM THE DEWATERING BAG SHALL BE DIRECTED SUCH THAT PRE-DISTURBANCE HYDROLOGY IS NOT CHANGED
6. TRANSPORT AND PLACE DEWATERING BAGS WITH CARE TO PREVENT RIPPING OR TEARING THE FABRIC
7. AVOID INSTALLING ON STEEP SLOPES AS THE BAG MAY ROLL, CAUSING FAILURE.
8. INSERT THE DISCHARGE HOSE A MINIMUM OF 1-FOOT INSIDE THE DEWATERING BAG. DO NOT INSERT MORE THAN ONE DISCHARGE HOSE INTO THE DEWATERING BAG.
9. AVOID USE OF EXCESSIVE FLOW RATES OR OVERFILLING THE DEWATERING BAG. THIS MAY CAUSE THE BAG TO RUPTURE OR CAUSE FAILURE TO THE HOSE TO BAG CONNECTION.

**MAINTENANCE**

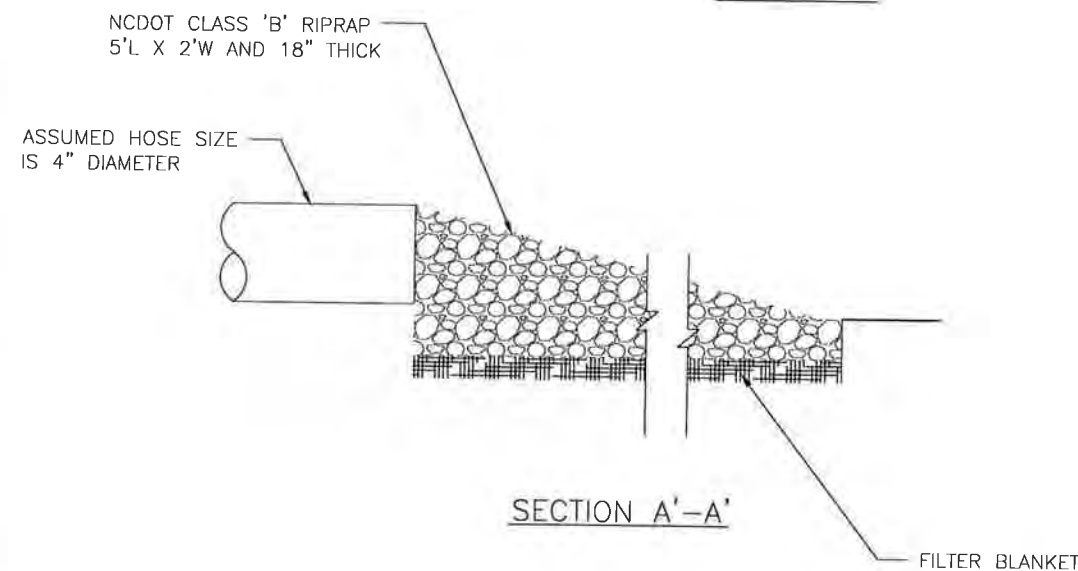
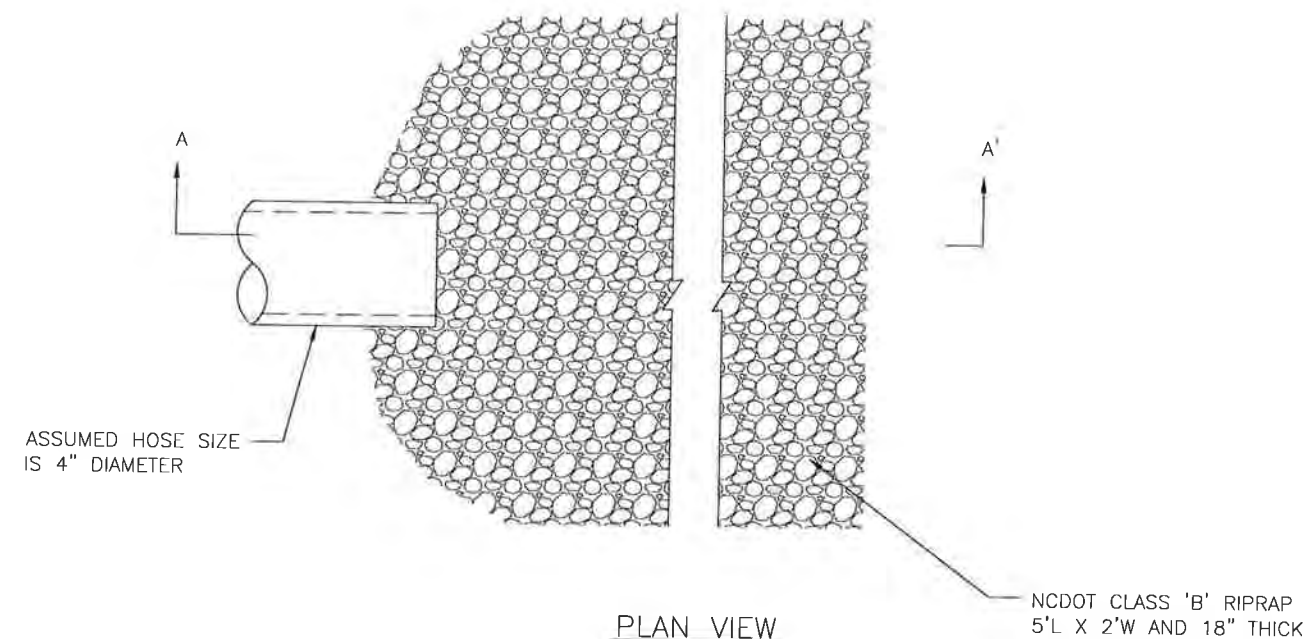
1. FOLLOW ALL MANUFACTURER RECOMMENDATIONS FOR INSPECTION AND MAINTENANCE GUIDELINES. REPLACE DEWATERING BAGS WHEN TRAPPED SEDIMENT HAS ACCUMULATED TO 50% OF THE BAG CAPACITY OR IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
2. DEWATERING BAGS ARE FULL WHEN THEY NO LONGER EFFICIENTLY FILTER SEDIMENT OR PASS WATER AT A REASONABLE RATE.

**SEDIMENT FILTER BAG DETAIL**

N.T.S.

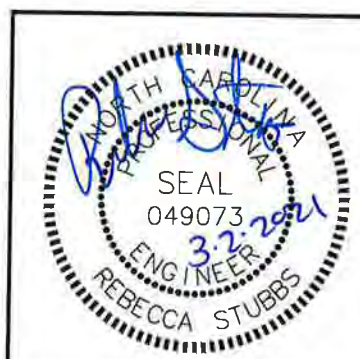
**NOTES**

1. IN WELL-DEFINED CHANNEL, EXTEND THE RIPRAP APRON UP THE CHANNEL BANKS TO AN ELEVATION OF 6" ABOVE THE MAXIMUM TAILWATER DEPTH OR TO THE TOP OF BANK WHICHEVER IS LESS.
2. A FILTER BLANKET AND NON-WOVEN GEOTEXTILE FABRIC SHOULD BE INSTALLED BETWEEN THE RIPRAP AND SOIL FOUNDATION. FILTER BLANKET SHALL CONSIST OF MINIMUM 4" THICK LAYER OF STONE (NCDOT #57) UNDERLAIN WITH NON-WOVEN GEOTEXTILE FABRIC.



**TEMPORARY RIPRAP DISSIPATION PAD**

N.T.S.



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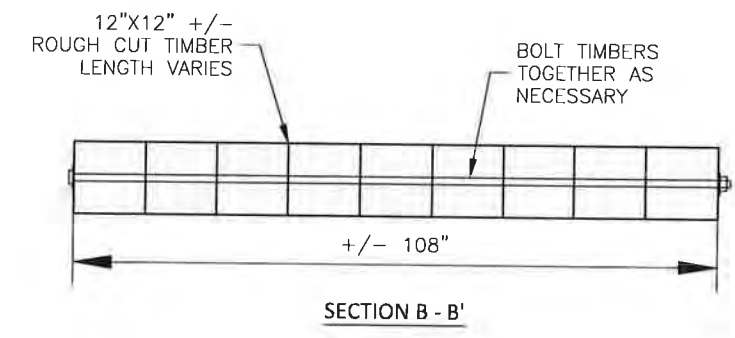
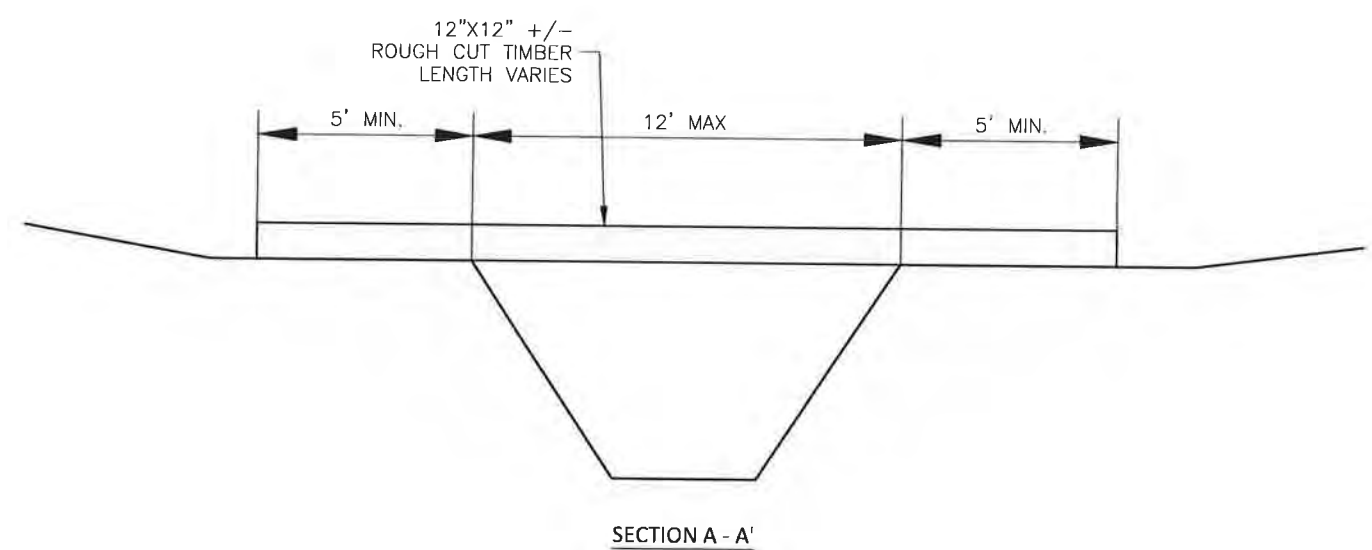
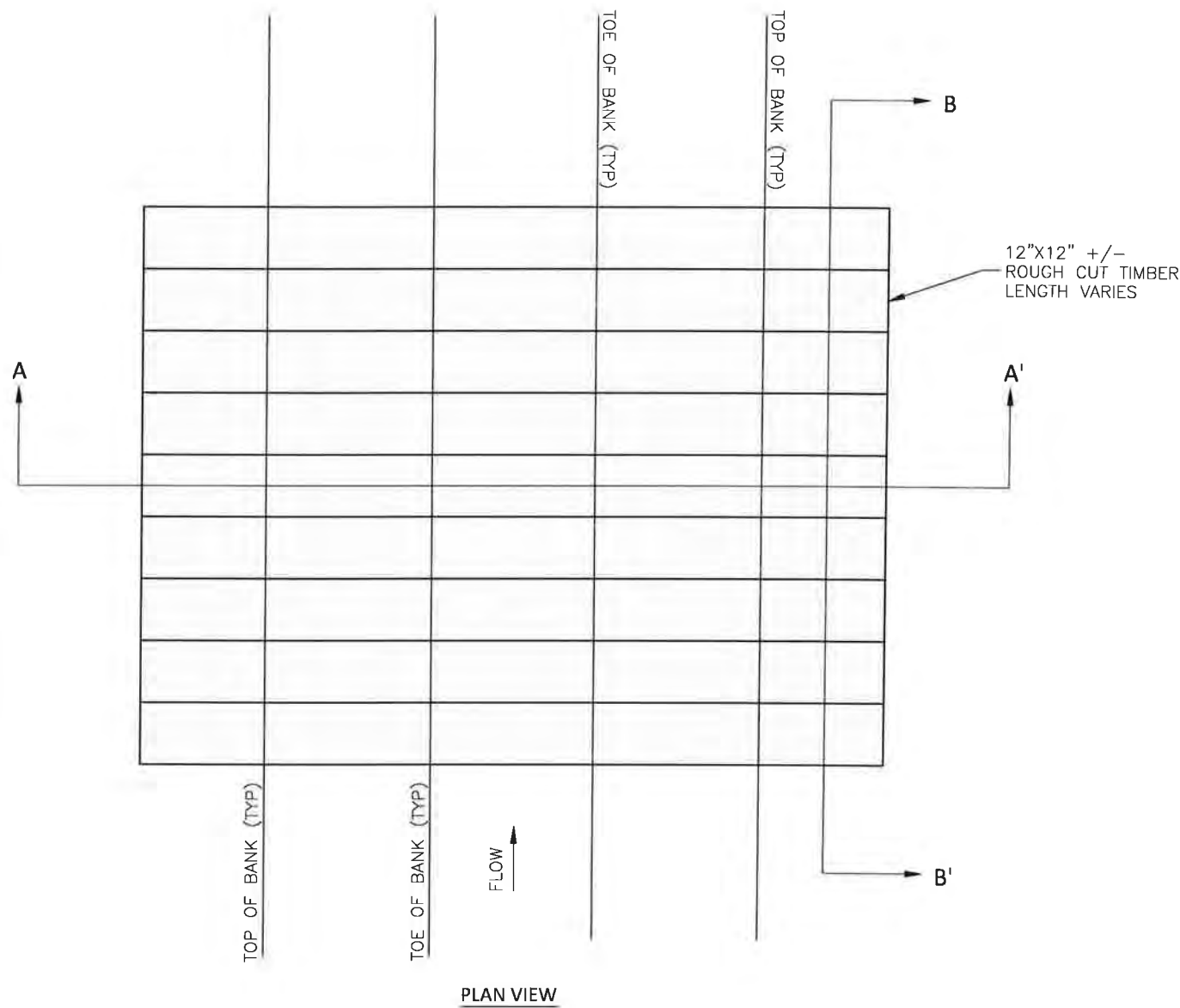
**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA

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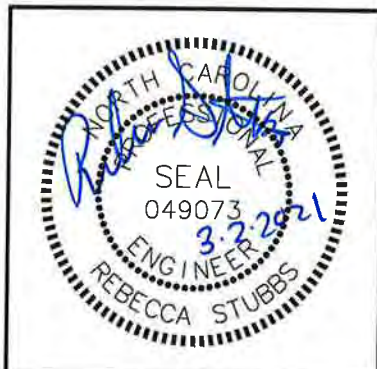
**EROSION CONTROL  
DETAILS**  
**C6.11**





NOTE:  
 DETAIL PROVIDED FOR INFORMATIONAL PURPOSES.  
 USE OF LOG MAT IS AT THE CONTRACTORS DISCRETION.

**LOG MAT**  
 N.T.S.




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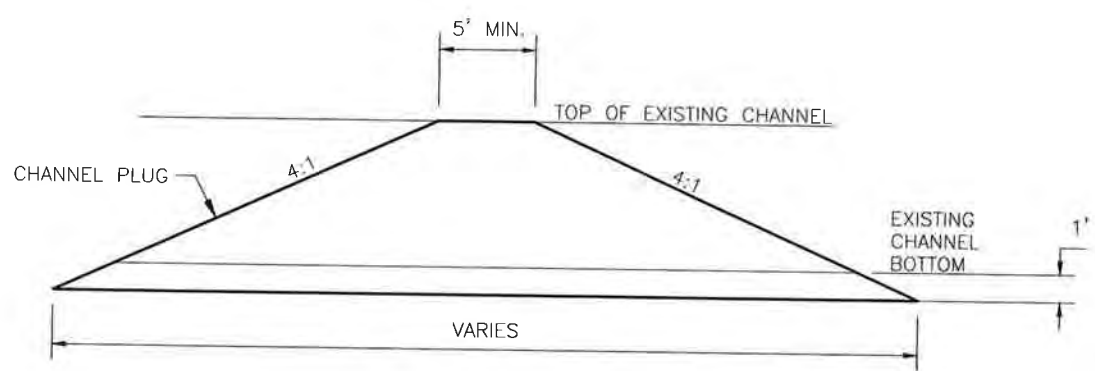
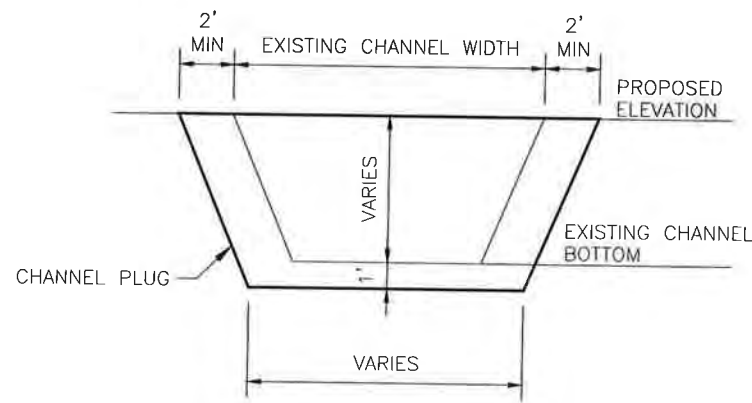
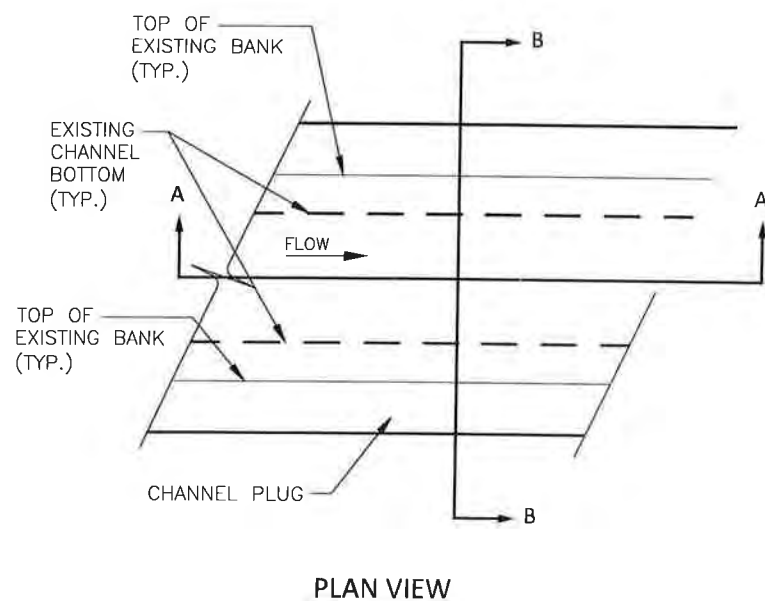
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**EROSION CONTROL  
 DETAILS**

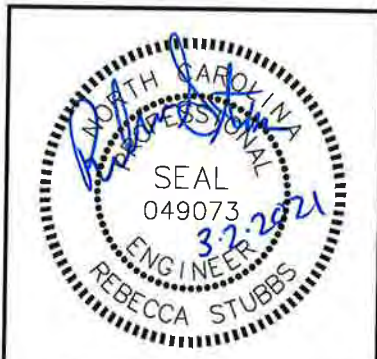
**C6.12**

**CHANNEL PLUG NOTES:**

1. CHANNEL PLUGS TO BE LOCATED AS SHOWN ON PLAN SHEETS C6.04 THROUGH C6.07 AND AT OTHER LOCATIONS AS DIRECTED BY THE CONSTRUCTION MANAGER.
2. CHANNEL PLUG MATERIAL SHALL BE CLAY SOIL HARVESTED ON SITE OR BROUGHT INTO THE SITE AS WELL AS MATERIAL USED IN REMOVED ROCK CHECK DAMS IF SUITABLE.
3. CHANNEL MATERIAL SHALL BE FREE OF ALL VISIBLE ORGANIC DEBRIS SUCH AS ROOTS AND LIMBS. SOILS WITH ORGANIC MATTER CONTENT EXCEEDING 5% BY WEIGHT SHALL NOT BE USED.
4. ROCKS AND STONES WITH A DIAMETER GREATER THAN 3 INCHES (IN ANY DIRECTION) SHALL BE REMOVED FROM FILL PRIOR TO COMPACTION.
5. FILL MATERIAL PLACED AT DENSITIES LOWER THAN SPECIFIED MINIMUM DENSITIES OR AT MOISTURE CONTENTS OUTSIDE THE SPECIFIED RANGES OR OTHERWISE NOT CONFORMING TO THE SPECIFIED REQUIREMENTS SHALL BE REMOVED AND REWORKED AND REPLACED WITH ACCEPTABLE MATERIALS.
6. TOPSOIL SHALL BE PLACED ON TOP OF THE SOIL LIFTS IN THE SAME MANOR AS THE REST OF THE GRADED CONSTRUCTION SITE
7. CHANNEL PLUGS WILL BE PLANTED ACCORDING TO THE PLANTING PLAN ON SHEETS L5.00 - L5.02.
8. MINIMUM CHANNEL PLUG LENGTH TO BE 20 LINEAR FEET.



**IMPERVIOUS CHANNEL PLUG DETAILS**  
N.T.S.




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**EROSION CONTROL  
DETAILS**  
**C6.13**



**NOTES:**

1. AN EROSION CONTROL BLANKET SHALL BE USED TO STABILIZE THE NEWLY CONSTRUCTED CHANNEL FROM THE TOP OF BANK TO TOE OF SLOPE AND SHALL BE 100% BIODEGRADABLE.
2. THE CHANNEL SIDE SLOPES SHALL BE FINE GRADED, SEEDED, FERTILIZED, AND LIMED PRIOR TO INSTALLING THE EROSION CONTROL BLANKET. REMOVE ROOTS, TWIGS, AND OTHER DEBRIS WHICH WOULD CAUSE BULGES IN THE MATTING AS WELL AS PREVENT THE MATTING FROM BEING LAID FLUSH TO THE FINISHED SURFACE.
3. KEY-IN EDGES OF MATTING A MINIMUM OF 6 INCHES INTO FINISHED GRADE. LAY MATTING SHINGLED DOWNSTREAM TO UPSTREAM, OVERLAPPING AT EDGES A MINIMUM OF 1 FOOT.
4. INSTALL STAKES TO ENSURE GOOD GROUND CONTACT OF THE MATTING TO WITHSTAND MEDIUM TO HIGH FLOWS. STAKES SHALL BE 100% BIODEGRADABLE AND INSTALLED PER THE MANUFACTURER'S SPECIFICATIONS INCLUDING, BUT NOT LIMITED TO, THE MANUFACTURER'S RECOMMENDED DENSITY AND PATTERN.
5. KEY-IN EDGES OF MATTING A MINIMUM OF 6 INCHES, PARTICULARLY NEAR RESTORATION STRUCTURES, BOULDERS, LOGS, ETC. CHECK MATTING FOR LOOSE ENDS, FLAPS, OR OTHER WEAKNESSES OR DAMAGE WHICH MAY CAUSE IT TO BECOME LOOSE UNDER FLOW CONDITIONS.
6. MATTING SHALL BE PLACED ALONG THE OUTSIDE BANK OF ALL BENDS AND ALONG BOTH SIDES OF THE CHANNEL IN TANGENT AREAS.
7. FIELD ADJUSTMENTS TO MATTING LOCATION MAY BE MADE AT THE DISCRETION OF THE DESIGNER.
8. THE EROSION CONTROL BLANKET SHALL CONSIST OF A MACHINE-PRODUCED BLANKET MADE OF COCONUT FIBER AND BE EQUIVALENT OR BETTER THAN THE FOLLOWING SPECIFICATION. SOIL STABILIZATION MATTING WHICH USES PLASTICS, METALS, OR OTHER MAN-MADE MATERIALS IN THE CONSTRUCTION OF THE MATERIAL WILL NOT BE PERMITTED.

WEIGHT = 13.6 OZ/SY

TENSILE STRENGTH DRY (ASTM D 4595) = 780 LBS/FT MACHINE DIRECTION  
744 LBS/FT CROSS DIRECTION

TENSILE STRENGTH WET (ASTM D 4595) = 672 LBS/FT MACHINE DIRECTION  
648 LBS/FT CROSS DIRECTION

ELONGATION FAILURE WET (ASTM D 4595) = 30% MACHINE DIRECTION  
28% CROSS DIRECTION

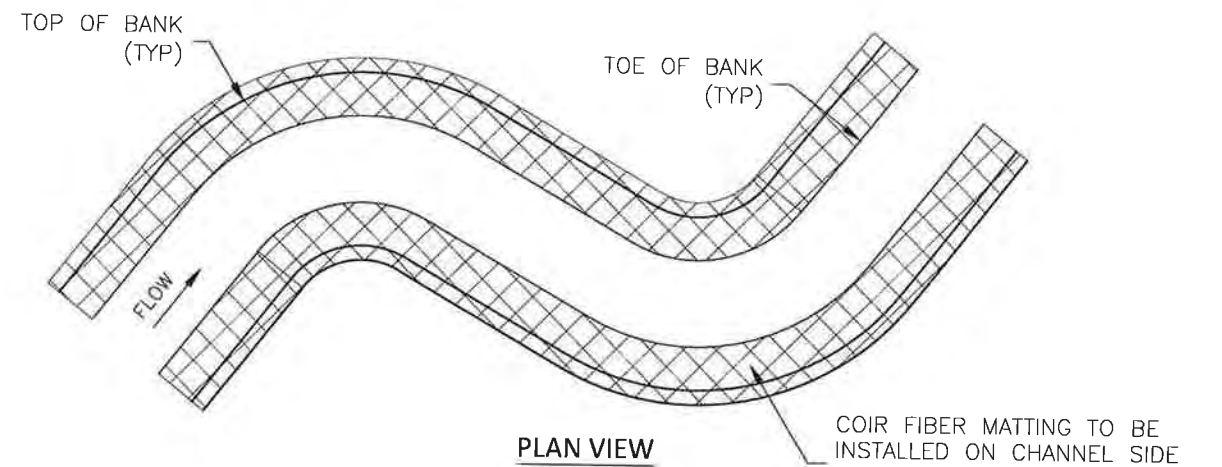
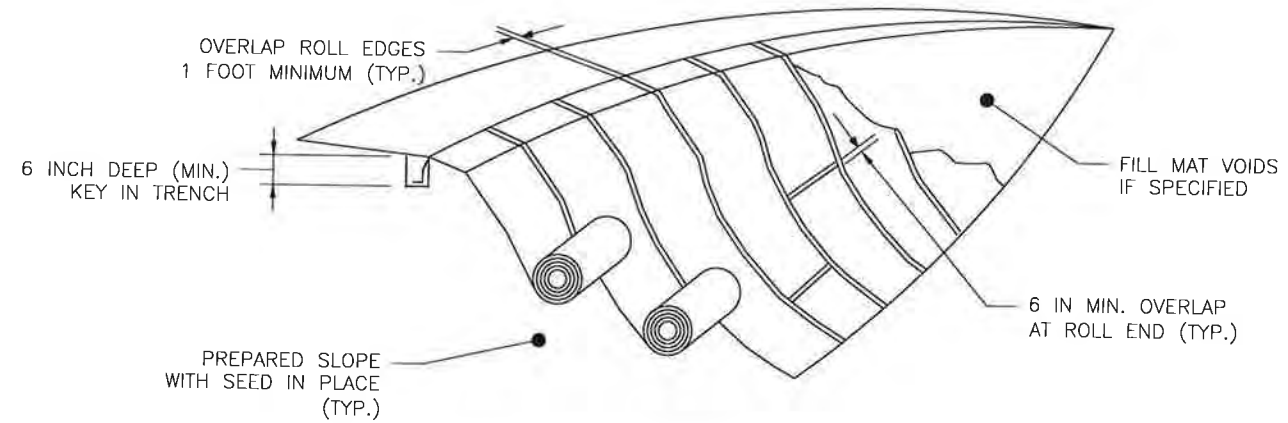
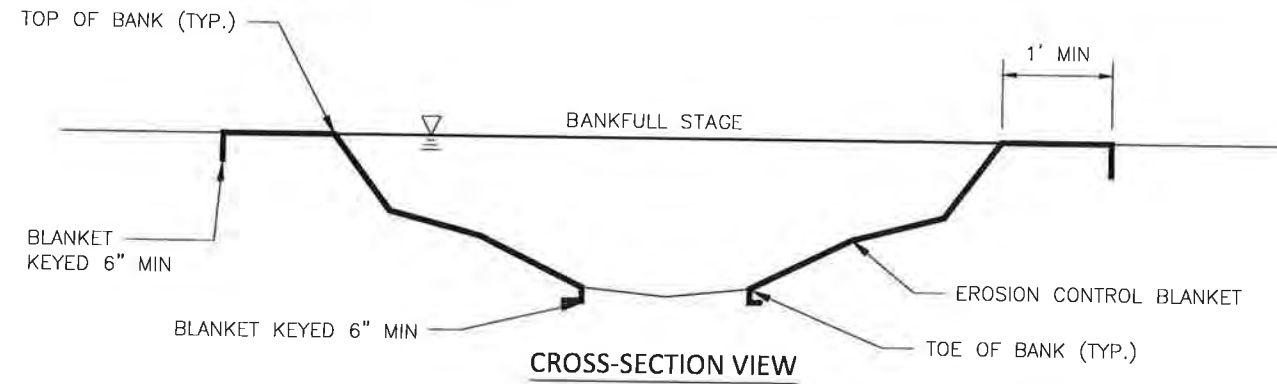
OPEN AREA = 65%

RECOMMENDED SHEAR STRESS = 3LBS/SQ.FT

RECOMMENDED FLOW = 8FT/S

RECOMMENDED SLOPE <math>\leq 1:1</math>

MINIMUM TWINE COUNT PER FOOT = 15X14



**EROSION CONTROL BLANKET DETAILS**

N.T.S.





**GROUND STABILIZATION AND MATERIALS HANDLING PRACTICES FOR COMPLIANCE WITH THE NCG01 CONSTRUCTION GENERAL PERMIT**

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

**SECTION E: GROUND STABILIZATION**

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

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

**GROUND STABILIZATION SPECIFICATION**

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

Temporary Stabilization	Permanent Stabilization
<ul style="list-style-type: none"> <li>Temporary grass seed covered with straw or other mulches and tackifiers</li> <li>Hydroseeding</li> <li>Rolled erosion control products with or without temporary grass seed</li> <li>Appropriately applied straw or other mulch</li> <li>Plastic sheeting</li> </ul>	<ul style="list-style-type: none"> <li>Permanent grass seed covered with straw or other mulches and tackifiers</li> <li>Geotextile fabrics such as permanent soil reinforcement matting</li> <li>Hydroseeding</li> <li>Shrubs or other permanent plantings covered with mulch</li> <li>Uniform and evenly distributed ground cover sufficient to restrain erosion</li> <li>Structural methods such as concrete, asphalt or retaining walls</li> <li>Rolled erosion control products with grass seed</li> </ul>

**POLYACRYLAMIDES (PAMS) AND FLOCCULANTS**

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

**EQUIPMENT AND VEHICLE MAINTENANCE**

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

**LITTER, BUILDING MATERIAL AND LAND CLEARING WASTE**

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

**PAINT AND OTHER LIQUID WASTE**

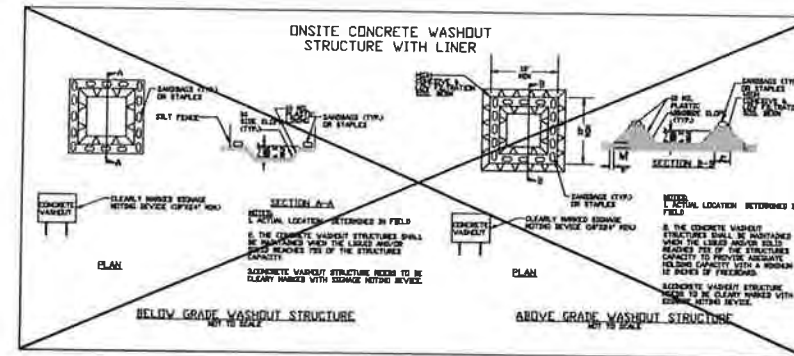
- Do not dump paint and other liquid waste into storm drains, streams or wetlands.
- Locate paint washouts at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
- Contain liquid wastes in a controlled area.
- Containment must be labeled,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

**PORTABLE TOILETS**

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

**EARTHEN STOCKPILE MANAGEMENT**

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



**CONCRETE WASHOUTS**

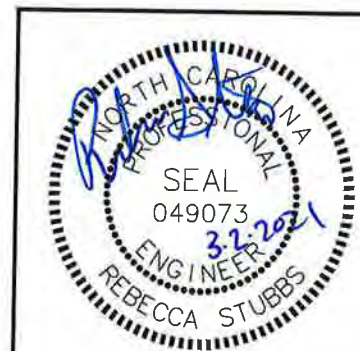
- Do not discharge concrete or cement slurry from the site.
- Dispose of, or recycle settled, hardened concrete residue in accordance with local and state solid waste regulations and at an approved facility.
- Manage washout from mortar mixers in accordance with the above item and in addition place the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

**HERBICIDES, PESTICIDES AND RODENTICIDES**

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

**HAZARDOUS AND TOXIC WASTE**

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



**NCG01 GROUND STABILIZATION AND MATERIALS HANDLING**

EFFECTIVE: 04/01/19



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**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



**PLAN INFORMATION**  
PROJECT NO. AXI-19000  
FILENAME AXI19000-EC2  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE N.T.S.  
DATE 02.18.2020

**EROSION CONTROL DETAILS**

**C6.15**



**PART III  
SELF-INSPECTION, RECORDKEEPING AND REPORTING**

**SECTION A: SELF-INSPECTION**

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

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

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

**PART III  
SELF-INSPECTION, RECORDKEEPING AND REPORTING**

**SECTION B: RECORDKEEPING**

**1. E&SC Plan Documentation**

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

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

**2. Additional Documentation to be Kept on Site**

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

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

**3. Documentation to be Retained for Three Years**

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

**PART III  
SELF-INSPECTION, RECORDKEEPING AND REPORTING**

**SECTION C: REPORTING**

**1. Occurrences that Must be Reported**

Permittees shall report the following occurrences:

- (a) Visible sediment deposition in a stream or wetland.
- (b) Oil spills if:
  - They are 25 gallons or more,
  - They are less than 25 gallons but cannot be cleaned up within 24 hours,
  - They cause sheen on surface waters (regardless of volume), or
  - They are within 100 feet of surface waters (regardless of volume).
- (c) Releases of hazardous substances in excess of reportable quantities under Section 311 of the Clean Water Act (Ref: 40 CFR 110.3 and 40 CFR 117.3) or Section 102 of CERCLA (Ref: 40 CFR 302.4) or G.S. 143-215.85.
- (d) Anticipated bypasses and unanticipated bypasses.
- (e) Noncompliance with the conditions of this permit that may endanger health or the environment.

**2. Reporting Timeframes and Other Requirements**

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

Occurrence	Reporting Timeframes (After Discovery) and Other Requirements
(a) Visible sediment deposition in a stream or wetland	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification.</li> <li>• <b>Within 7 calendar days</b>, a report that contains a description of the sediment and actions taken to address the cause of the deposition. Division staff may waive the requirement for a written report on a case-by-case basis.</li> <li>• If the stream is named on the <a href="#">NC 303(d) list</a> as impaired for sediment-related causes, the permittee may be required to perform additional monitoring, inspections or apply more stringent practices if staff determine that additional requirements are needed to assure compliance with the federal or state impaired waters conditions.</li> </ul>
(b) Oil spills and release of hazardous substances per Item 1(b)-(c) above	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification. The notification shall include information about the date, time, nature, volume and location of the spill or release.</li> </ul>
(c) Anticipated bypasses [40 CFR 122.41(m)(3)]	<ul style="list-style-type: none"> <li>• <b>A report at least ten days before the date of the bypass, if possible.</b> The report shall include an evaluation of the anticipated quality and effect of the bypass.</li> </ul>
(d) Unanticipated bypasses [40 CFR 122.41(m)(3)]	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification.</li> <li>• <b>Within 7 calendar days</b>, a report that includes an evaluation of the quality and effect of the bypass.</li> </ul>
(e) Noncompliance with the conditions of this permit that may endanger health or the environment [40 CFR 122.41(i)(7)]	<ul style="list-style-type: none"> <li>• <b>Within 24 hours</b>, an oral or electronic notification.</li> <li>• <b>Within 7 calendar days</b>, a report that contains a description of the noncompliance, and its causes; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time noncompliance is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. [40 CFR 122.41(i)(6)].</li> <li>• Division staff may waive the requirement for a written report on a case-by-case basis.</li> </ul>

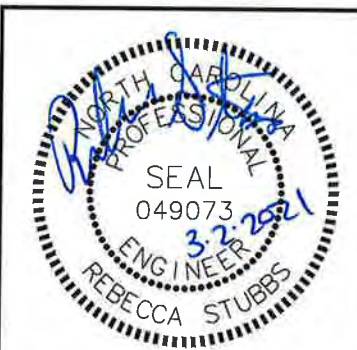
**PART II, SECTION G, ITEM (4)  
DRAW DOWN OF SEDIMENT BASINS FOR MAINTENANCE OR CLOSE OUT**

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

- (a) The E&SC plan authority has been provided with documentation of the non-surface withdrawal and the specific time periods or conditions in which it will occur. The non-surface withdrawal shall not commence until the E&SC plan authority has approved these items,
- (b) The non-surface withdrawal has been reported as an anticipated bypass in accordance with Part III, Section C, Item (2)(c) and (d) of this permit,
- (c) Dewatering discharges are treated with controls to minimize discharges of pollutants from stormwater that is removed from the sediment basin. Examples of appropriate controls include properly sited, designed and maintained dewatering tanks, weir tanks, and filtration systems,
- (d) Vegetated, upland areas of the sites or a properly designed stone pad is used to the extent feasible at the outlet of the dewatering treatment devices described in Item (c) above,
- (e) Velocity dissipation devices such as check dams, sediment traps, and riprap are provided at the discharge points of all dewatering devices, and
- (f) Sediment removed from the dewatering treatment devices described in Item (c) above is disposed of in a manner that does not cause deposition of sediment into waters of the United States.

**NCG01 SELF-INSPECTION, RECORDKEEPING AND REPORTING**

EFFECTIVE: 04/01/19



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**LAUREL SPRINGS MITIGATION PLAN  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA**



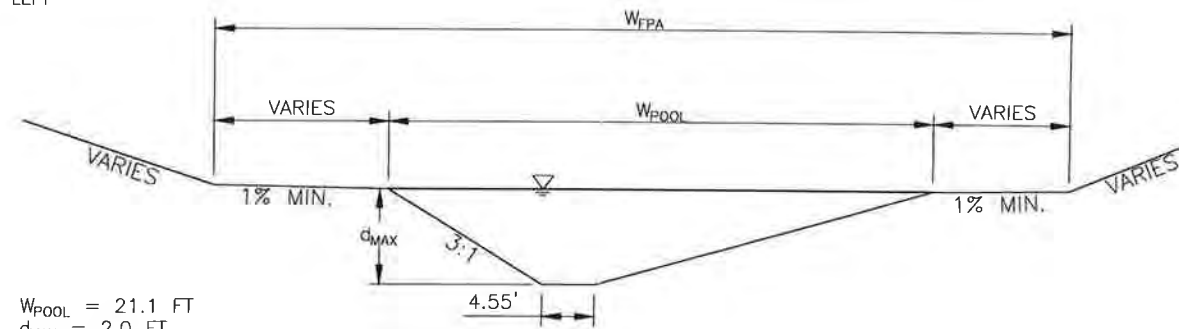
**PLAN INFORMATION**

PROJECT NO.	AXI-19000
FILENAME	AXI19000-EC2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	N.T.S.
DATE	02.18.2020

**EROSION CONTROL  
DETAILS  
C6.16**

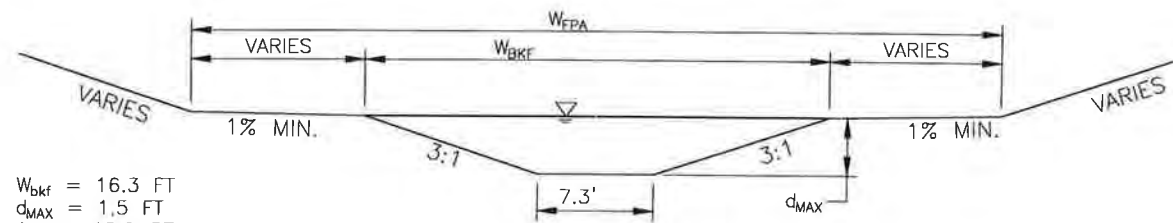


\*TYPICAL POOL CROSS-SECTION ORIENTATION IS FOR A MEANDER BEND TOWARD STREAM RIGHT AND SHALL BE MIRRORED FOR MEANDER BENDS TOWARDS STREAM LEFT\*



$W_{POOL} = 21.1$  FT  
 $d_{MAX} = 2.0$  FT  
 $W_{FPA} = 100$  FT

TYPICAL POOL

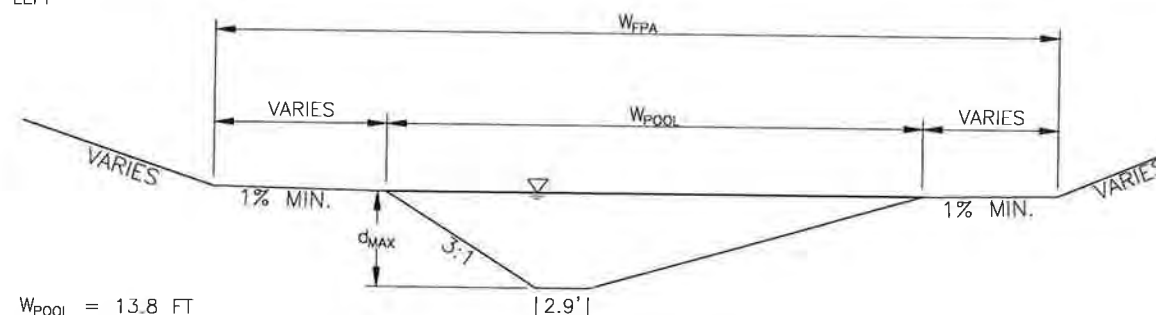


$W_{bkf} = 16.3$  FT  
 $d_{MAX} = 1.5$  FT  
 $A_{bkf} = 18.9$  SF  
 $d_{MEAN} = 1.2$  FT  
 $W_{FPA} = 100$  FT

TYPICAL RIFFLE  
**FORK CREEK**

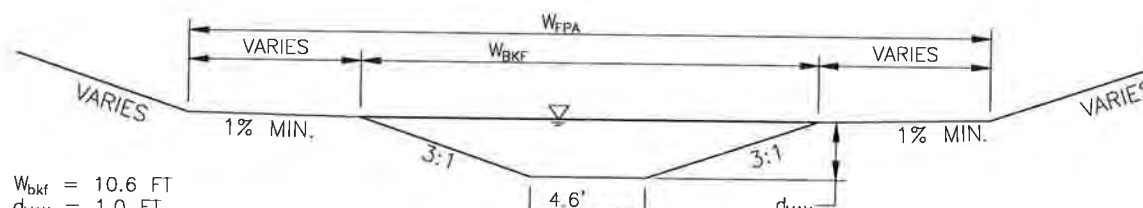
N.T.S.

\*TYPICAL POOL CROSS-SECTION ORIENTATION IS FOR A MEANDER BEND TOWARD STREAM RIGHT AND SHALL BE MIRRORED FOR MEANDER BENDS TOWARDS STREAM LEFT\*



$W_{POOL} = 13.8$  FT  
 $d_{MAX} = 1.3$  FT  
 $W_{FPA} = 100$  FT

TYPICAL POOL



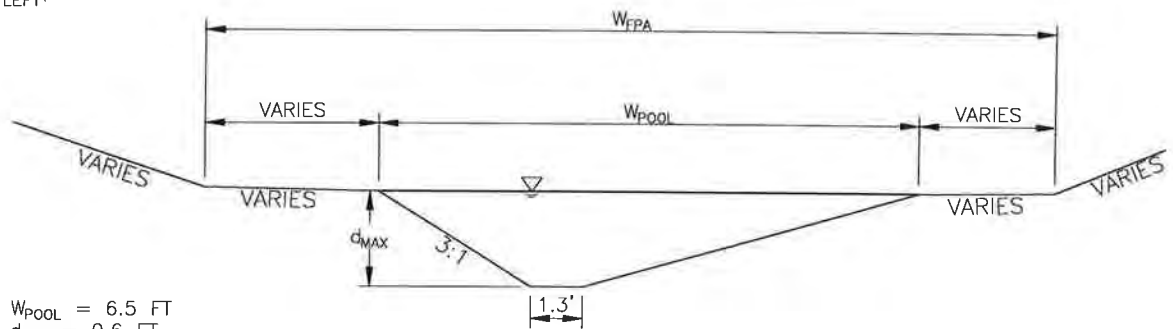
$W_{bkf} = 10.6$  FT  
 $d_{MAX} = 1.0$  FT  
 $A_{bkf} = 8.1$  SF  
 $d_{MEAN} = 0.8$  FT  
 $W_{FPA} = 100$  FT

TYPICAL RIFFLE

**UT 1**

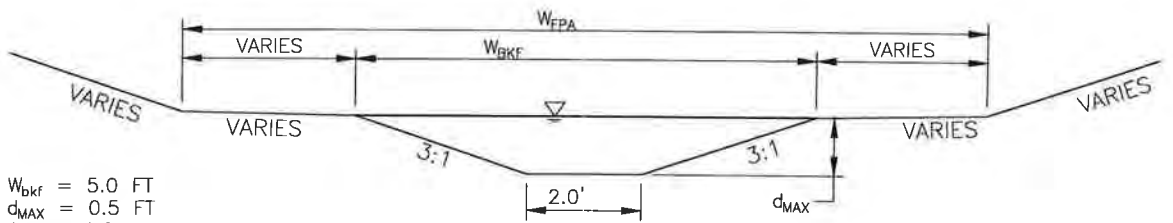
N.T.S.

\*TYPICAL POOL CROSS-SECTION ORIENTATION IS FOR A MEANDER BEND TOWARD STREAM RIGHT AND SHALL BE MIRRORED FOR MEANDER BENDS TOWARDS STREAM LEFT\*



$W_{POOL} = 6.5$  FT  
 $d_{MAX} = 0.6$  FT  
 $W_{FPA} = 25$  FT

TYPICAL POOL



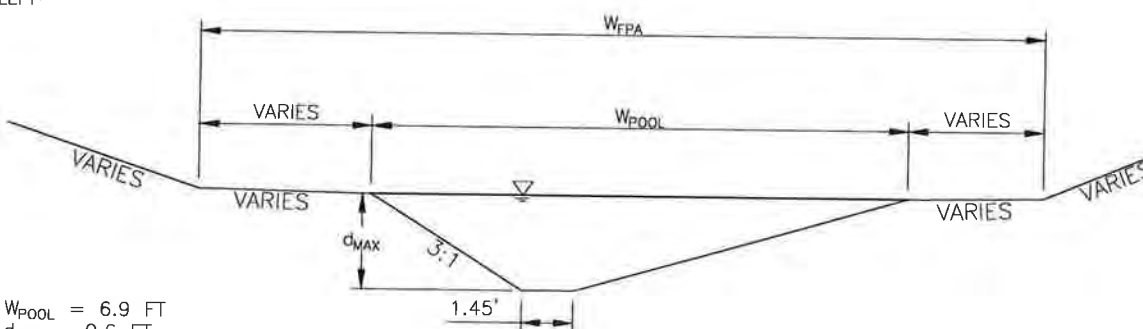
$W_{bkf} = 5.0$  FT  
 $d_{MAX} = 0.5$  FT  
 $A_{bkf} = 1.8$  SF  
 $d_{MEAN} = 0.4$  FT  
 $W_{FPA} = 25$  FT

TYPICAL RIFFLE

**UT 2**

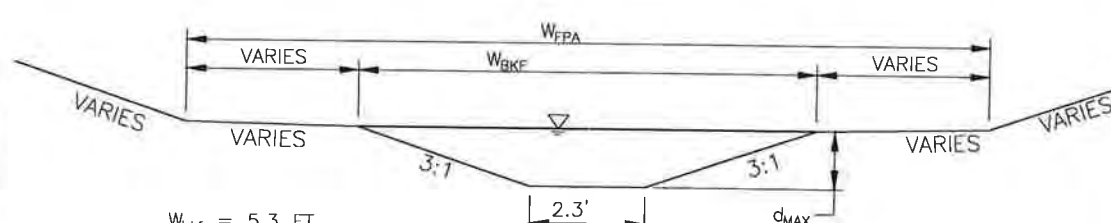
N.T.S.

\*TYPICAL POOL CROSS-SECTION ORIENTATION IS FOR A MEANDER BEND TOWARD STREAM RIGHT AND SHALL BE MIRRORED FOR MEANDER BENDS TOWARDS STREAM LEFT\*



$W_{POOL} = 6.9$  FT  
 $d_{MAX} = 0.6$  FT  
 $W_{FPA} = 25$  FT

TYPICAL POOL



$W_{bkf} = 5.3$  FT  
 $d_{MAX} = 0.5$  FT  
 $A_{bkf} = 2.0$  SF  
 $d_{MEAN} = 0.4$  FT  
 $W_{FPA} = 25$  FT

TYPICAL RIFFLE

**UT 3 & 4**

N.T.S.



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**LAUREL SPRINGS MITIGATION PLAN**  
 CONSTRUCTION DRAWINGS  
 AVERY COUNTY, NORTH CAROLINA



**PLAN INFORMATION**

PROJECT NO. AXI-19000  
 FILENAME AXI19000-D1  
 CHECKED BY RAS  
 DRAWN BY RHW  
 SCALE N.T.S.  
 DATE 02.18.2020

**STREAM  
 DETAILS**

**C8.00**



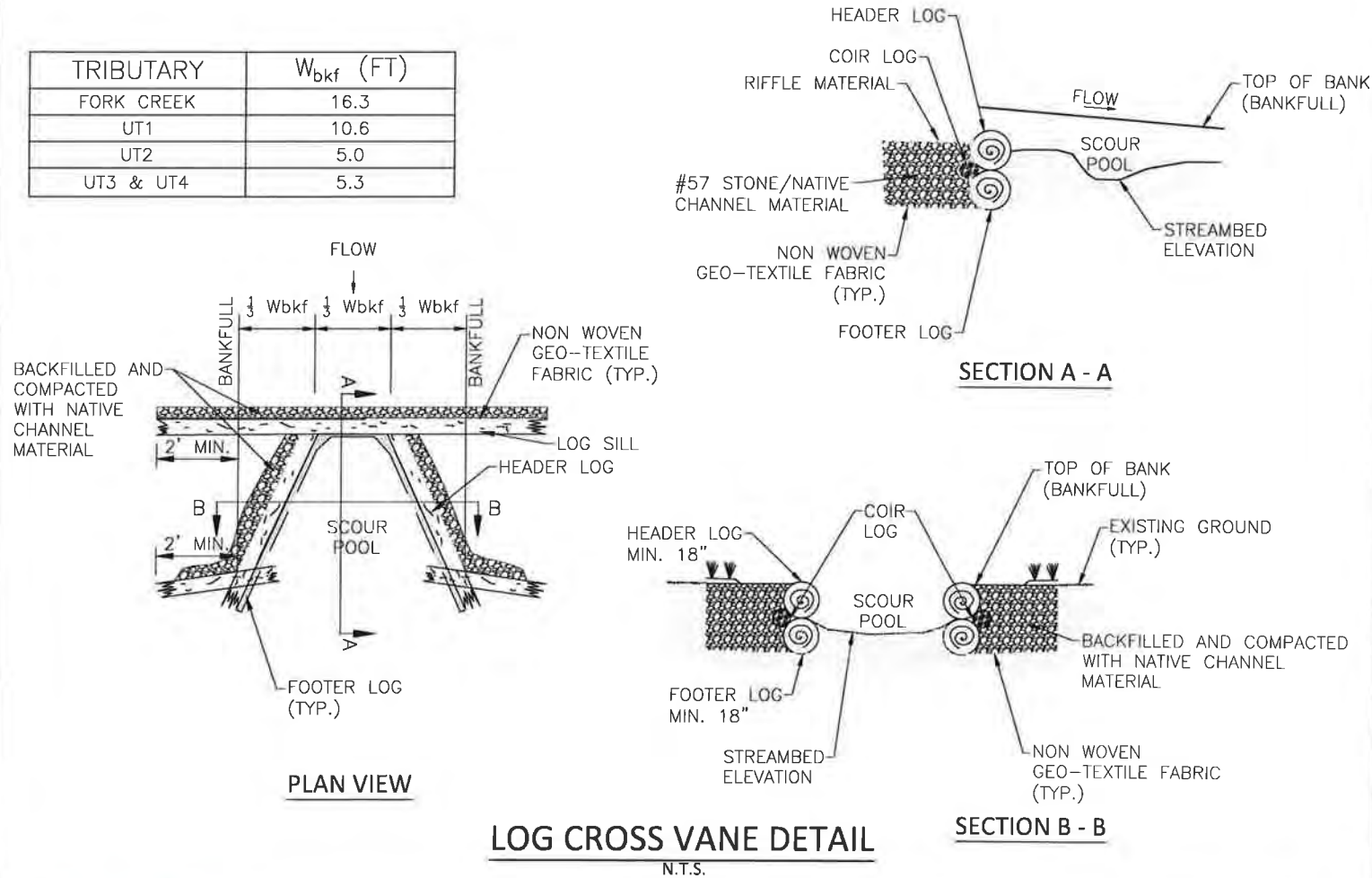
**GENERAL NOTES:**

1. A LOG CROSS VANE IS A GRADE CONTROL, IN-STREAM STRUCTURE THAT DIRECTS STREAM FLOW AWAY FROM THE STREAM BANKS AND IN TOWARD THE CENTER OF THE CHANNEL.
2. ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE UPSTREAM INVERT (CENTER) OF THE CROSS VANE TO ESTABLISH PART OF THE PROFILE. A NOTCH MAY BE CUT INTO THE LOG AT THE INVERT LOCATION. POOL ELEVATION CONTROL POINTS OR EXCAVATION TO A SPECIFIED MAXIMUM POOL DEPTH SHALL BE DESIGNATED TO ESTABLISH THE REMAINING PROFILE. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE INSTALLATION WITHIN THE TOLERANCE SPECIFIED BY THE DESIGNER.
3. THE VANE ARM SHALL BE SLOPED 3-5% AND INTERCEPT THE STREAM BANK AT A HEIGHT EQUAL TO BETWEEN 1/2 BANKFULL STAGE AND BANKFULL STAGE. ELEVATION CONTROL POINTS MAY BE ESTABLISHED AT THE LEFT AND RIGHT STREAM BANK/VANE ARM INTERCEPT POINTS. THE VANE ARM INTERCEPT LOCATION MAY BE OTHERWISE DESCRIBED BY ITS RELATIONSHIP TO BANKFULL STAGE OR BY THE LENGTH AND SLOPE OF THE VANE ARM. BANKFULL IS NOT NECESSARILY THE TOP OF THE STREAM BANK SLOPE.
4. IF THE PLANS DESIGNATE THE USE OF MULTIPLE LOG CROSS VANES A TABLE OF ALL STATION LOCATIONS AND CONTROL POINT ELEVATIONS SHALL BE PROVIDED IN THIS DETAIL OR PROVIDED ELSEWHERE IN THE PLANS AND REFERENCED HEREIN.
5. TYPICAL RIFFLE AND POOL CROSS SECTIONS SHALL BE PROVIDED ELSEWHERE IN THE PLANS TO ESTABLISH THE DIMENSIONS OF THE CHANNEL GRADING INTO WHICH THE LOG CROSS VANES ARE TO BE INSTALLED.
6. LOGS SHALL BE RELATIVELY STRAIGHT HARDWOOD, RECENTLY HARVESTED AND BE A MINIMUM OF 18" DIAMETER. THE LENGTH SHALL BE SUCH THAT THE LOG IS BURIED INTO THE SOIL OF THE STREAM BANK (ON ONE END) AND STREAM BED (ON THE OTHER END) A MINIMUM DISTANCE AS SPECIFIED BY THE DESIGNER. THE INVERT LOG SHALL BE KEYED INTO THE BANK A MINIMUM 2 FEET PAST TOP OF BANK WIDTH.
7. A SINGLE LOG MAY BE USED IN LIEU OF A HEADER/FOOTER LOG COMBINATION. A DOUBLE FOOTER LOG MAY BE REQUIRED IN SAND BED STREAMS.
8. NON-WOVEN GEOTEXTILE FABRIC OF A TYPE AND SIZE SPECIFIED BY THE DESIGNER SHALL BE USED TO SEAL THE GAPS BETWEEN THE LOG(S) AND THE STREAM BED, UNDER THE COARSE BACKFILL MATERIAL. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
9. COARSE BACKFILL OF THE LOG CROSS VANE SHALL BE OF A TYPE, SIZE, AND GRADATION AS SPECIFIED BY THE DESIGNER. COARSE BACKFILL SHALL BE PLACED TO A THICKNESS EQUAL TO THE DEPTH OF THE HEADER (AND ANY FOOTER) LOGS AND SHALL EXTEND OUT FROM THE VANE ARMS TO THE STREAM BANK AND UPSTREAM A DISTANCE SPECIFIED BY THE DESIGNER.
10. AS AN OPTION, FLAT-SIDED BOULDERS OF A SIZE (LENGTH, WIDTH, AND THICKNESS) AS SPECIFIED BY THE DESIGNER MAY BE PLACED AS BALLAST ON TOP OF THE STREAM BANK SIDE OF THE EMBEDDED VANE ARMS. DUCK BILL ANCHORS MAY BE USED IN LIEU OF BALLAST BOULDERS.
11. DUCKBILL ANCHORS WITH GALVANIZED CABLE ATTACHED (OF A GAGE ADEQUATE TO SECURE THE SPECIFIED DIAMETER LOG) MAY BE USED TO SECURE LOGS INTO THE STREAM BED AND/OR BANKS TO THE SPECIFIED DEPTH. FLAT SIDED BOULDERS (LENGTH, WIDTH, AND THICKNESS SPECIFIED BY DESIGNER) CAN BE USED IN LIEU OF THE LOG INVERT/DUCKBILL ANCHOR SYSTEM.

**CONSTRUCTION GUIDELINES:**

1. THE VANE ARMS OF THE LOG CROSS VANE SHALL BE CONSTRUCTED FIRST, FOLLOWED BY THE LOG INVERT.
2. OVER-EXCAVATE STREAM BED TO A DEPTH EQUAL TO THE TOTAL THICKNESS OF THE HEADER (AND FOOTER IF SPECIFIED) LOGS.
3. PLACE VANE ARM FOOTER LOGS, IF SPECIFIED. THE SLOPE OF THE VANE ARM IS MEASURED ALONG THE VANE ARM WHICH IS INSTALLED AT AN ANGLE TO THE STREAM BANK AND PROFILE.
4. INSTALL VANE ARM HEADER LOG ON TOP OF AND SET SLIGHTLY FORWARD OR BACK FROM THE FOOTER LOG.
5. INSTALL INVERT LOG AND DUCKBILL ANCHOR.
6. NAIL FILTER FABRIC TO THE HEADER LOG USING A GALVANIZED NAIL WITH A PLASTIC CAP. THE SIZE AND GAGE OF NAIL AND NAIL SPACING SHALL BE SPECIFIED BY THE DESIGNER.
7. PLACE COARSE BACKFILL BEHIND LOG(S) ENSURING THAT ANY VOIDS BETWEEN THE LOGS ARE FILLED.
8. IF ANY EROSION CONTROL MATTING IS SPECIFIED FOR USE IN THE VICINITY OF THE VANE ARM INTERCEPT POINTS, ALL MATTING EDGES SHALL BE NEATLY SECURED AROUND THE LOGS.

TRIBUTARY	W <sub>bkf</sub> (FT)
FORK CREEK	16.3
UT1	10.6
UT2	5.0
UT3 & UT4	5.3



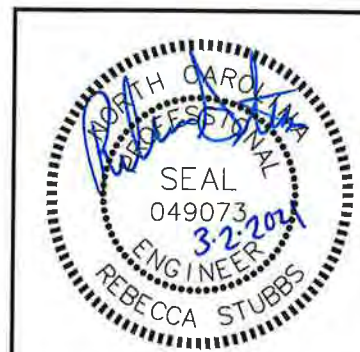
NOTE: GEOTEXTILE FABRIC (NON-WOVEN) SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS.

MECHANICAL PROPERTIES	TEST METHOD	UNIT	MINIMUM AVERAGE ROLL VALUE	
			MD	CD
GRAB TENSILE STRENGTH	ASTM D 4632	N (lbs)	912 (205)	912 (205)
GRAB TENSILE ELONGATION	ASTM D 4632	%	50	50
TRAPEZOID TEAR STRENGTH	ASTM D 4533	N (lbs)	356 (80)	356 (80)
CBR PUNCTURE STRENGTH	ASTM D 6241	N (lbs)	2225 (500)	
APPARENT OPENING SIZE (AOS) <sup>1</sup>	ASTM D 4751	mm (U.S. SIEVE)	0.18 (80)	
PERMITTIVITY	ASTM D 4491	sec -1	1.1	
FLOW RATE	ASTM D 4491	l/min/m <sup>2</sup> (gal/min/ft <sup>2</sup> )	3870 (95)	
UV RESISTANCE (AT 500 HOURS)	ASTM D 4355	% STRENGTH RETAINED	70	

<sup>1</sup>ASTM D 4751: AOS IS A MAXIMUM OPENING DIAMETER VALUE

PHYSICAL PROPERTIES	TEST METHOD	UNIT	TYPICAL VALUE	
WEIGHT	ASTM D 5261	g/m <sup>2</sup> (oz/yd <sup>2</sup> )	271 (8.0)	
THICKNESS	ASTM D 5199	mm (mils)	1.8 (72)	
ROLL DIMENSIONS (WIDTH X LENGTH)	-	ft	12.5 X 360	15 X 300
ROLL AREA	-	m <sup>2</sup> (yd <sup>2</sup> )	418 (500)	
ESTIMATED ROLL WEIGHT	-	kg (lb)	120 (265)	

**NON-WOVEN GEOTEXTILE FABRIC MATERIAL SPECIFICATIONS**



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**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



**PLAN INFORMATION**  
PROJECT NO. AXI-19000  
FILENAME AXI19000-D1  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE N.T.S.  
DATE 02.18.2020

**STREAM DETAILS**  
**C8.01**

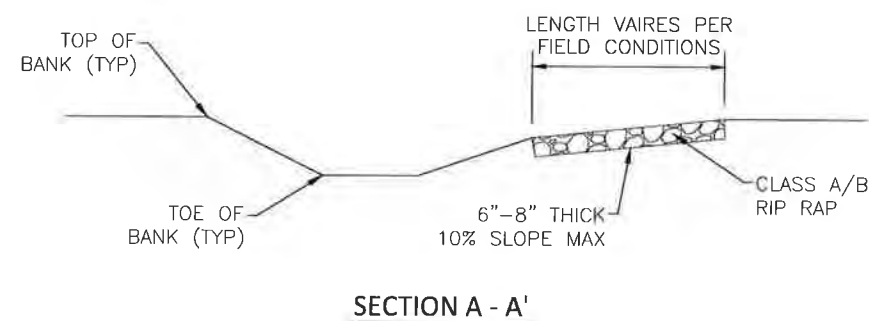
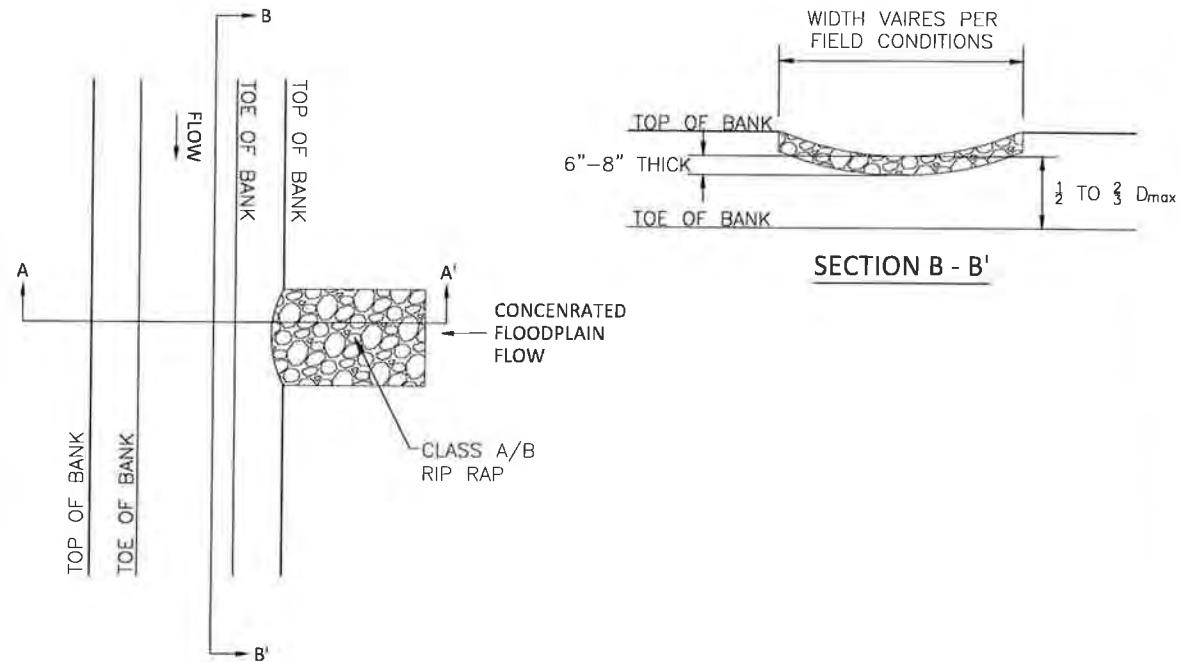
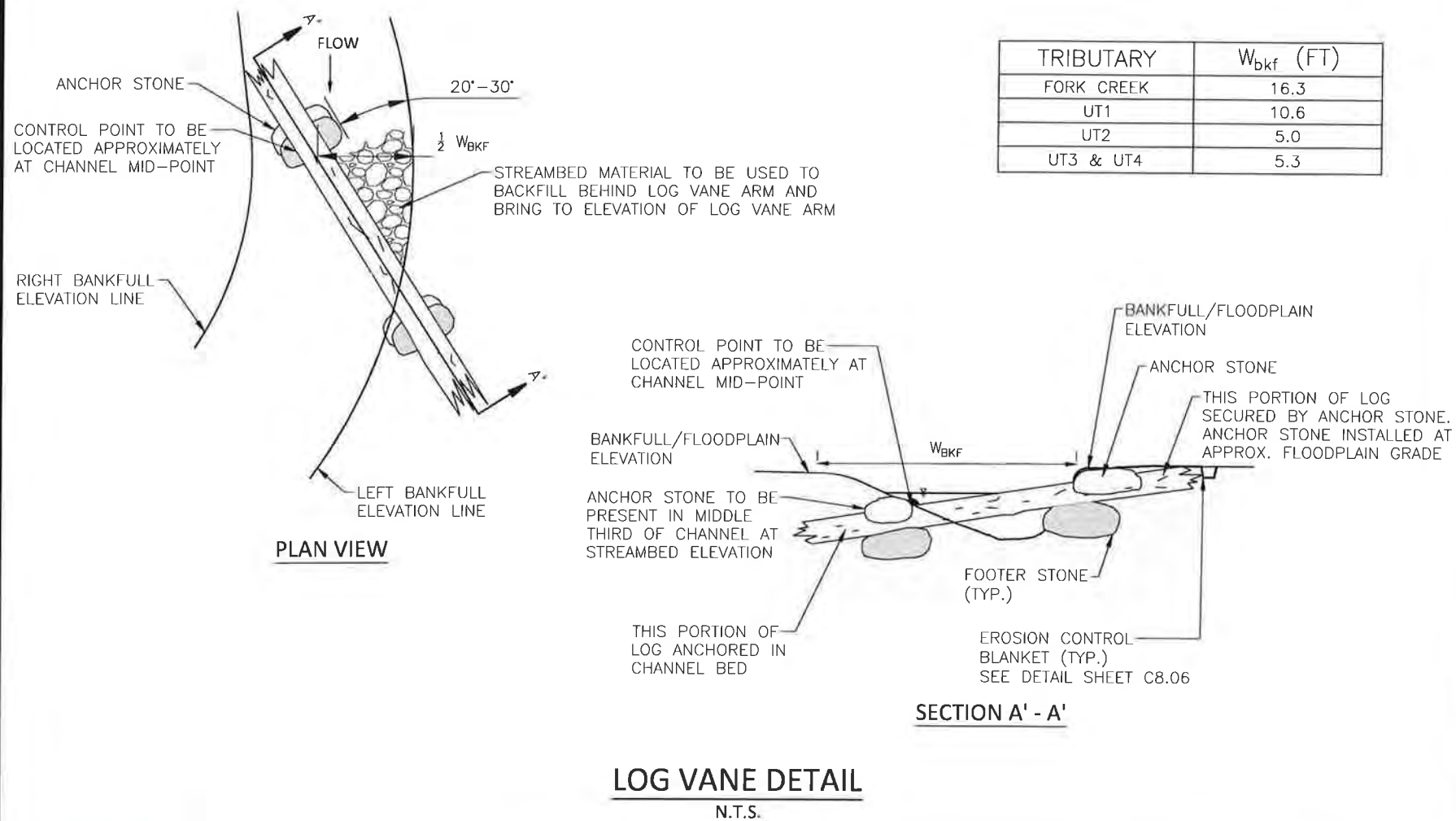


**GENERAL NOTES**

- LOG VANES WILL BE ANGLED @20-30° FROM STREAM BANK.
- FLOW FROM THE STREAM SHOULD BE DIVERTED AWAY FROM THE WORK AREA IN ACCORDANCE WITH THE APPROVED E&SC PLAN AND THE SITE SHOULD BE DEWATERED.
- LOG VANE WILL BE SLOPED AT 3-5%.
- SEED AND SOIL STABILIZATION MATTING WILL BE PLACED ALONG STREAM BANKS FOR STABILIZATION PURPOSES WHERE DISTURBANCES HAS OCCURRED AS A RESULT STRUCTURE INSTALLATION.
- DESIGN ENGINEER SHALL CONSIDER IMPLEMENTATION OF OTHER STREAM BANK PROTECTION MEASURES IN CONJUNCTION WITH LOG VANE STRUCTURE.

**CONSTRUCTION GUIDELINES**

- ALL EROSION AND SEDIMENT CONTROL DEVICES SHOULD BE INSTALLED IN ACCORDANCE WITH AN APPROVED EROSION AND SEDIMENT CONTROL (E&SC) PLAN.
- FLOW FROM THE STREAM SHOULD BE DIVERTED AWAY FROM THE WORK AREA IN ACCORDANCE WITH THE APPROVED E&SC PLAN AND THE SITE SHOULD BE DEWATERED.
- LOG VANES SHOULD BE ANGLED 20 TO 30 DEGREES FROM THE UPSTREAM BANK. LOG VANE ARMS SHOULD BE INSTALLED WITH A VERTICAL ANGLE ALONG THE VANE ARM RANGING FROM 3 TO 5 PERCENT. LOG VANES SHOULD SPAN APPROXIMATELY ONE-HALF TO TWO-THIRDS OF THE BANKFULL CHANNEL WIDTH.
- EXCAVATE THE TRENCH AND PREPARE THE AREA ALONG THE STREAMBANK AND IN THE STREAMBED FOR PLACEMENT OF FOOTER ROCKS. FOOTER ROCKS SHOULD BE INSTALLED AT BOTH THE STREAMBANK AND THALWEG LOCATIONS TO ENSURE PROPER FOOTING OF THE LOG VANE STRUCTURE AND TO ELIMINATE SCOUR AT KEY TIE-IN POINTS.
- PLACE LOG ONTO THE FOOTER ROCKS SUCH THAT THE LOG VANE ARM THAT TIES INTO THE STREAMBANK WILL BE INSTALLED AT THE BANKFULL ELEVATION AND THE OTHER END OF THE LOG VANE ARM WILL BE EMBEDDED INTO THE STREAMBED AT THE THALWEG ELEVATION AND WILL BE LOCATED WITHIN THE MIDDLE THIRD OF THE BANKFULL CHANNEL WIDTH.
- ANCHOR ROCKS SHOULD BE INSTALLED ON TOP OF BOTH ENDS OF THE LOG VANE. ANCHOR STONES IN THE STREAMBED WILL BE OFFSET TO THE UPSTREAM SIDE OF THE LOG VANE AND PLACED TO MINIMIZE ROLLING OF ANCHOR STONE AND WILL NOT PROTRUDE FROM THE STREAMBED ELEVATION MORE THAN ONE-THIRD THE THICKNESS OF THE ANCHOR ROCK. ANCHOR ROCKS WILL BE PLACED ALONG THE STREAMBANK POSITION OF THE LOG VANE ARM IN SIMILAR FASHION AND WILL NOT EXTEND MORE THAN ONE-THIRD THE THICKNESS OF THE ANCHOR ROCK.
- THE LOG VANE ARM THAT TIES INTO THE STREAMBANK SHOULD EXTEND A MINIMUM OF 5 TO 6 FEET INTO THE STREAMBANK. ADDITIONALLY THE THALWEG END OF THE STRUCTURE SHOULD BE EMBEDDED A MINIMUM OF 2 TO 3 FEET. WHEN TWO LOGS ARE USED TO ACCOMPLISH THE DESIGN SPECIFICATION OF THE LOG VANE, THE LOGS SHOULD BE SECURED TOGETHER WITH CABLES OR REBAR MATERIAL BASED UPON MANUFACTURING SPECIFICATIONS. LOG VANES SHOULD BE ANCHORED INTO THE STREAMBED WITH SUPPORT PILINGS AND/OR DUCKBILL ANCHORS WITH LENGTHS EXCEEDING THE POTENTIAL OF LONG-TERM BED DEGRADATION AND/OR SCOUR DEPTHS.
- PLACEMENT OF SALVAGED STREAMBED MATERIAL OBTAINED DURING TRENCH EXCAVATIONS WILL BE PLACED ALONG THE UPSTREAM SIDE OF THE LOG VANE ARM AND BETWEEN THE STREAMBANK TO CREATE A UNIFORM SLOPE BETWEEN THE LOG VANE ARM AND THE STREAMBANK. AT THE MINIMUM, STREAMBED GRAVEL WILL BE PLACED TO THE ELEVATION OF THE SLOPING LOG VANE ARM ON THE UPSTREAM SIDE OF THE LOG VANE.
- SOIL STABILIZATION MATTING WILL BE INSTALLED ALONG THE STREAMBANKS IN THE AREA OF DISTURBANCES AND SHOULD BE SEEDED, MULCHED, AND PLANTED WITH APPROVED LANDSCAPING.
- REMOVE THE APPROVED E&SC PLAN DEVICES UPON STABILIZATION OF THE CHANNEL IN ACCORDANCE WITH THE APPROVED PLAN.



**ROCK FLOODPLAIN OUTLET**  
N.T.S.

- NOTE:
- CONSTRUCT ROCK FLOODPLAIN OUTLETS WHERE CONCENTRATED FLOWS IN THE FLOODPLAIN ENTER THE DESIGN CHANNEL.
  - MAKE ADJUSTMENT TO THE LOCATION OF ROCK FLOODPLAIN OULETS SHOWN IN THE PLANS BASED ON FIELD CONDITIONS AT THE TIME OF CONSTRUCTION.
  - THE ENGINEER ON SITE MAY MAKE CHANGES TO THE QUANTITY AND LOCATION OF ROCK FLOODPLAIN OUTLETS BASED ON FIELD CONDITIONS AT THE TIME OF CONSTRUCTION.



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**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

**PLAN INFORMATION**

PROJECT NO.	AXI-19000
FILENAME	AXI19000-D1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	N.T.S.
DATE	02.18.2020

**STREAM DETAILS**  
**C8.02**

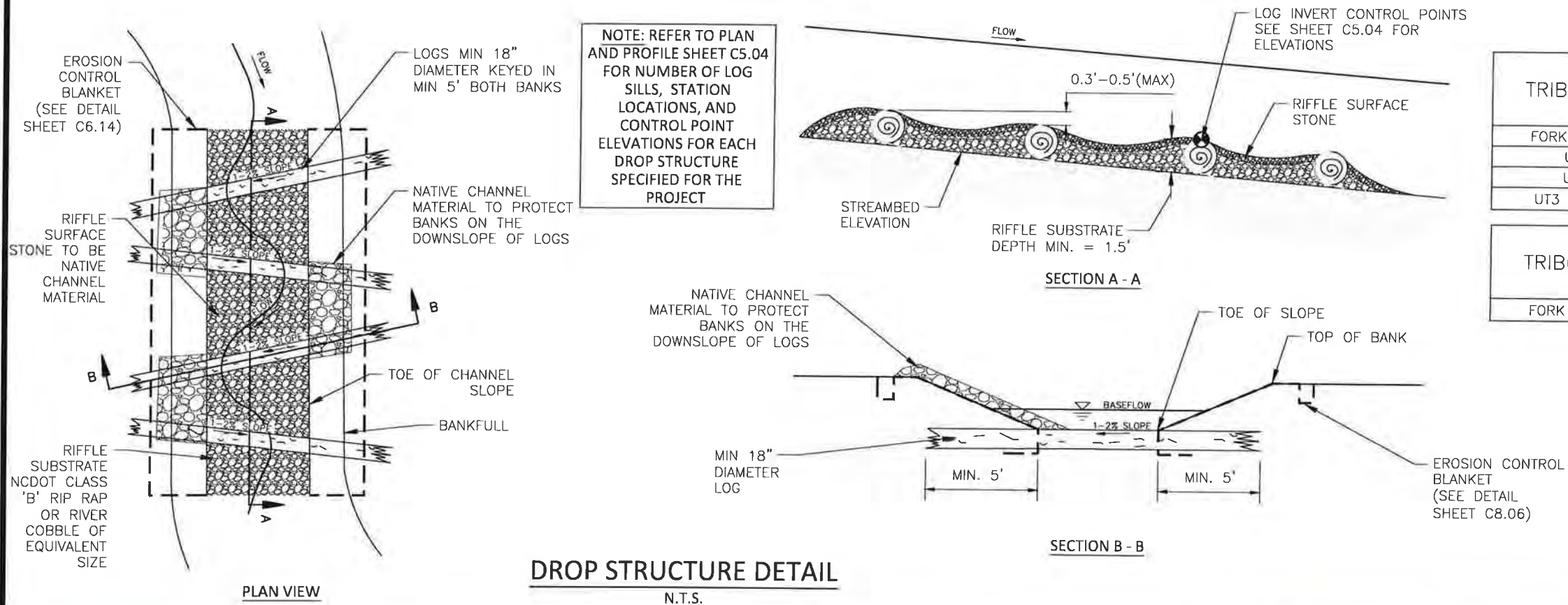


**GENERAL NOTES:**

1. A DROP STRUCTURE IS A LOG SILL COUPLED WITH A CONSTRUCTED RIFFLE TO PROVIDE GRADE CONTROL.
2. AN ELEVATION CONTROL POINT SHALL BE DESIGNATED AT THE CENTER OF THE LOG TO ESTABLISH PART OF THE PROFILE. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE INSTALLATION WITHIN THE TOLERANCE SPECIFIED BY THE DESIGNER.
3. NO PART OF THE LOG SHALL BE PLACED ABOVE THE ELEVATION OF THE STREAM BED.
4. MAXIMUM ELEVATION DROP BETWEEN EACH LOG STEP SHALL BE 0.3' - 0.5'.
5. REFER TO THE PLAN-PROFILE FOUND ON SHEET C5.04 FOR THE STATION LOCATIONS AND CONTROL POINT ELEVATIONS OF EACH LOG SILL SPECIFIED FOR THE PROJECT.
6. LOGS SHALL BE OF A LENGTH AND DIAMETER SPECIFIED BY THE DESIGNER AND BE ROT-RESISTANT, RELATIVELY STRAIGHT HARDWOOD, RECENTLY HARVESTED. USE LOGS HARVESTED FROM THE PROJECT SITE WITHIN THE LIMITS OF DISTURBANCE. THE LENGTH OF THE LOG EMBEDDED INTO EACH BANK SHALL EQUAL OR EXCEED THE DIMENSIONS SHOWN IN SECTION B'-B' OF THIS DETAIL.
7. NON-WOVEN GEOTEXTILE FABRIC OF A TYPE AND SIZE SPECIFIED BY THE DESIGNER SHALL BE USED TO SEAL THE GAPS BETWEEN THE LOG(S) AND THE STREAM BED, UNDER THE COARSE BACKFILL MATERIAL. THE FABRIC SHALL BE NAILED TO THE ENTIRE LENGTH OF THE LOG USING A GALVANIZED NAIL WITH A PLASTIC CAP. THE SIZE AND GAGE OF NAIL AND NAIL SPACING SHALL BE SPECIFIED BY THE DESIGNER. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
8. COARSE BACKFILL OF THE LOG SILL SHALL BE OF A TYPE, SIZE, AND GRADATION AS SPECIFIED BY THE DESIGNER. COARSE BACKFILL SHALL BE PLACED TO A THICKNESS EQUAL TO THE DEPTH OF THE HEADER (AND ANY FOOTER) LOG AND SHALL EXTEND UPSTREAM FROM THE SILL A DISTANCE SPECIFIED BY THE DESIGNER.
9. SOIL WHERE THE LOGS ARE KEYED IN SHOULD BE COMPACTED. LARGER BOULDERS CAN BE USED TO KEEP THE LOGS IN PLACE WHERE NECESSARY.
10. EXCAVATED CHANNEL MATERIAL DEEMED SUITABLE FOR USE (FREE OF WASTE AND DEBRIS) IS PLACED AROUND THE LOGS TO BRING THE RIFFLE TO FINAL GRADE.
11. RIFFLE ARMOR DEPTH SHALL BE A MINIMUM OF 1.5 FEET.
12. EXTEND RIFFLE ARMOR UP TO HALF BANKFULL DEPTH MAINTAINING DESIGN CHANNEL DIMENSIONS.
13. RIFFLE SURFACE STONE SHALL BE NATIVE CHANNEL MATERIAL. RIFFLE SUBGRADE MATERIAL SHALL BE NCDOT CLASS 'B' RIPRAP OR RIVER COBBLE OF EQUIVALENT SIZE AND HAVE AN AVERAGE DIAMETER OF 8". NATIVE CHANNEL MATERIAL FROM THE EXISTING CHANNEL SHALL BE USED WHENEVER POSSIBLE.
14. GRAVEL SUBSTRATE FROM THE EXISTING CHANNEL SHALL BE STOCKPILED AND REUSED AS SURFACE STONE IN THE NEW CHANNEL. GRAVEL SHALL BE PLACED AT EACH RIFFLE LOCATION IN ACCORDANCE WITH THE GRADATION SHOWN ON THESE PLANS. SOME EXCAVATION OF CHANNEL BED MATERIAL MAY BE NECESSARY PRIOR TO PLACEMENT OF RIFFLE TO ENSURE PROPER CROSS-SECTIONAL DIMENSIONS ONCE RIFFLE IS CONSTRUCTED. RE-DRESSING OF CHANNEL AND BANKS MAY BE REQUIRED FOLLOWING CONSTRUCTION OF RIFFLES AND CHANNEL.

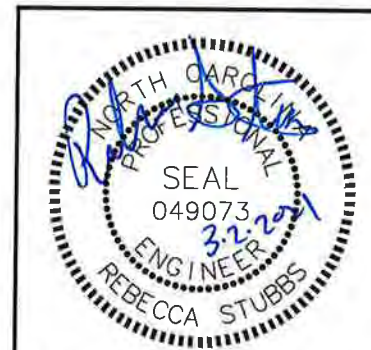
**CONSTRUCTION GUIDELINES:**

1. STREAM SHALL BE DIVERTED AWAY FROM THE WORK AREA AND THE SITE SHALL BE DEWATERED
2. OVER-EXCAVATE STREAM BED TO A DEPTH EQUAL TO THE TOTAL THICKNESS AND LENGTH OF THE HEADER LOGS.
3. PLACE HEADER LOGS AS SHOWN IN THIS DETAIL WITHIN THE EXCAVATED TRENCH. PLACE LOGS AT ANGLES ALONG THE LENGTH OF THE RIFFLE (MAX 2% SLOPE), KEYED INTO THE BANKS INTO EACH BANK SHALL EQUAL OR EXCEED THE DIMENSIONS SHOWN IN SECTION B'-B' OF THIS DETAIL. A LAYER OF BEDDING MATERIAL UNDER THE LOG MAY BE SPECIFIED BY THE DESIGNER. THE TOP OF THE HEADER LOG SHALL CONFORM TO THE STREAM BED ELEVATION AT THE LOCATION WHICH IT IS PLACED. SET LOG INVERTS AT ELEVATIONS SHOWN ON THE PLAN AND PROFILE SHEETS. NO ELEVATIONS OF THE LOGS MAY VARY FROM THE PLAN SHEETS WITHOUT DIRECTION FROM THE ENGINEER.
4. SECURE LOG(S) WITH ANCHORS AT MAXIMUM SPACING OF 2 FEET ON CENTER. ANCHORS SHALL BE 3/4" DIAMETER MINIMUM REBAR OR DRIFT PIN. ANCHOR MUST HAVE SUFFICIENT LENGTH TO PASS THROUGH BOTH LOGS AND ENTER THE GROUND AT LEAST 6 INCHES.
5. PLACE FILTER FABRIC BEHIND LOG SILL AND ALONG THE BOTTOM OF THE STREAM BED. NAIL FILTER FABRIC TO THE HEADER LOG.
6. PLACE COARSE BACKFILL BEHIND LOG(S) ENSURING THAT ANY VOIDS BETWEEN THE LOGS ARE FILLED.
7. TRIM ANY EXPOSED FILTER FABRIC AROUND THE SILL INSTALLATION. CHECK PROPER FUNCTION/FLOW PATH BY OBSERVING FLOW OVER STRUCTURE. REPAIR AS NEEDED TO ENSURE PROPER FUNCTION.
8. ENSURE NO LEAKAGE/FLOW UNDER OR AROUND STRUCTURE BY PROPERLY GRADING, SEALING, AND COMPACTING UNDER AND AROUND THE STRUCTURE.
9. REPEAT STEPS FOR ALL LOG INSTALLATION, THEN INSTALL RIFFLE SUBSTRATE PER THE DIMENSIONS SHOWN ON THE DETAIL. RIFFLE MATERIAL SHALL BE PLACED AT A UNIFORM THICKNESS SUCH THAT, IN CROSS SECTION, ITS LOWEST ELEVATION OCCURS IN THE CENTER OF THE CHANNEL. RIFFLE MATERIAL SHALL BE COMPACTED USING AN EXCAVATOR BUCKET SUCH THAT FUTURE SETTLEMENT OF THE MATERIAL IS KEPT TO A MINIMUM.
10. EROSION CONTROL BLANKET SHALL BE INSTALLED IN AREAS SHOWN ON THIS DETAIL AND IN COMPLIANCE WITH INSTALLATION INSTRUCTIONS ON THE EROSION CONTROL DETAIL ON SHEET C6.14. ENSURE EROSION CONTROL BLANKET WRAPS THE TOE OF THE STREAM BED ON EACH BANK IN THE AREA AND ALL MATTING EDGES SHALL BE NEATLY SECURED AROUND THE LOGS.
11. INSTALL NATIVE CHANNEL MATERIAL ON THE DOWN SLOPE OF EACH LOG. NATIVE CHANNEL MATERIAL TO BE FLUSH WITH THE CHANNEL BANK FACE.



TRIBUTARY	BOTTOM CHANNEL WIDTH (FT)	W <sub>bkf</sub> (FT)	MIN. LOG LENGTH (FT)
FORK CREEK	9.1	16.3	20.0
UT1	5.8	10.6	16.0
UT2	2.6	5.0	13.0
UT3 & UT4	2.9	5.3	13.0

TRIBUTARY	DROP STRUCTURE	NUMBER OF LOG SILLS	PLAN SHEET
FORK CREEK	#22	10	C5.04



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**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



**PLAN INFORMATION**

PROJECT NO.	AXI-19000
FILENAME	AXI19000-D1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	N.T.S.
DATE	02.18.2020

**STREAM DETAILS**  
**C8.03**



**GENERAL NOTES:**

1. A BOULDER OR LOG SILL MAY BE USED ALONE OR IN COMBINATION WITH A CONSTRUCTED RIFFLE. CONTRACTOR TO CONSULT DESIGN ENGINEER FOR FINAL MATERIAL SPECIFICATIONS.
2. AN ELEVATION CONTROL POINT SHALL BE DESIGNATED AT THE CENTER OF THE SILL TO ESTABLISH PART OF THE PROFILE. POOL ELEVATION CONTROL POINTS OR EXCAVATION TO A SPECIFIED MAXIMUM POOL DEPTH SHALL BE DESIGNATED TO ESTABLISH THE REMAINING PROFILE. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE INSTALLATION WITHIN THE TOLERANCE SPECIFIED BY THE DESIGNER.
3. NO PART OF THE SILL SHALL BE PLACED ABOVE THE ELEVATION OF THE STREAM BED.
4. REFER TO THE PLAN-PROFILE FOUND ON SHEETS C5.08 AND C5.10 FOR THE STATION LOCATIONS AND CONTROL POINT ELEVATIONS OF EACH BOULDER SILL SPECIFIED FOR THE PROJECT.
5. ALL BOULDERS SHALL CONSIST OF ANGULAR, TABULAR, FLAT ROCK WITH MINIMUM OF TWO PARALLEL SIDES, AND HAVE A NATURAL APPEARANCE AND COLOR. ROUNDED EDGES ARE ACCEPTABLE SO LONG AS ROUNDED EDGES ARE NOT BEARING OR SUPPORTING. APPROXIMATE DIMENSIONS OF BOULDERS SHALL MEASURE IN LENGTH, WIDTH, AND HEIGHT SPECIFIED IN THE TABLE BELOW. ALL STONE SHALL BE FREE FROM LAMINATION AND WEAK CLEAVAGES. THE STONE SHOULD NOT DISINTEGRATE SIGNIFICANTLY FROM THE ACTION OF AIR, WATER, OR IN HANDLING AND PLACING. STONE WITH TOOL MARKS, DRILL HOLES, AND OTHER BLASTING EVIDENCE SHALL NOT BE UTILIZED IN EXPOSED LOCATIONS.
6. FILTER FABRIC OF A TYPE AND SIZE SPECIFIED BY THE DESIGNER SHALL BE USED TO SEAL THE GAPS BETWEEN THE BOULDERS AND THE STREAM BED, UNDER THE COARSE BACKFILL MATERIAL. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
7. BACKFILL ROCK ON THE UPSTREAM SIDE OF THE STRUCTURE SHALL BE NATIVE CHANNEL MATERIAL OR RIVER COBBLE OF EQUIVALENT SIZE AND HAVE AN AVERAGE DIAMETER OF 8". SMALLER AGGREGATE (I.E. NO. #57) OR COBBLE STONES SHALL BE USED TO FILL VOIDS SUCH THAT EACH BOULDER RESTS SOLIDLY ON THE PREVIOUS ROCK LAYER WITH MINIMAL OPPORTUNITY FOR MOVEMENT.

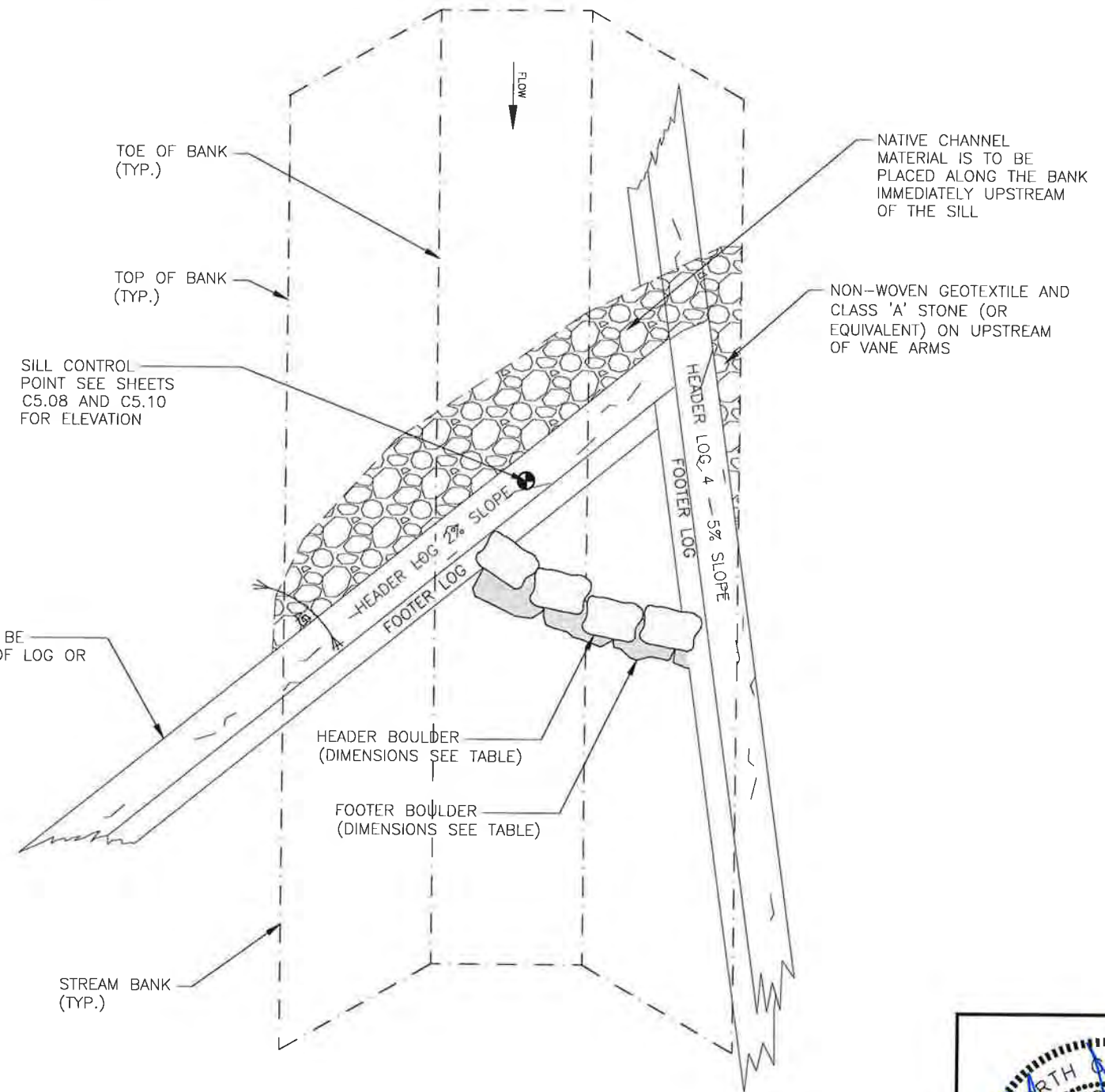
**CONSTRUCTION GUIDELINES:**

1. STREAM SHALL BE DIVERTED AWAY FROM THE WORK AREA AND THE SITE SHALL BE DEWATERED.
2. EXCAVATE TRENCH FOR FOOTER ROCKS TO THE ELEVATION AND GRADES NECESSARY FOR PLACEMENT OF BOTH FOOTER AND HEADER BOULDER SO THAT THE DESIRED ELEVATION OF THE HEADER BOULDER MEETS THE LINES AND GRADES OF THE STRUCTURE SCHEDULED IN ACCORDANCE WITH THE PLANS AND PROFILES.
3. PLACE FOOTER BOULDERS IN EXCAVATED TRENCH WITH ADJACENT BOULDERS ABUTTING EACH OTHER. FOOTER BOULDERS SHALL BE PLACED NEATLY SO THAT THE HEADER BOULDERS CAN REST SECURELY ON TWO FOOTER BOULDERS. SMALLER ROCK SHALL BE USED TO FILL VOID SPACES SO THAT EACH BOULDER RESTS SOLIDLY ON THE PREVIOUS BOULDER WITH MINIMAL OPPORTUNITY FOR MOVEMENT.
4. BOULDER SILL ROCKS WILL TIE INTO THE CHANNEL BOTTOM ELEVATION AT THE LOCATION OF EACH SILL AND EXTEND INTO THE STREAMBANK A MINIMUM OF 5' UNLESS OTHERWISE SPECIFIED BY THE DESIGNER.
5. PLACE FILTER FABRIC BEHIND BOULDER SILL AND ALONG THE BOTTOM OF THE STREAM BED.
6. PLACE COARSE BACKFILL BEHIND BOULDERS ENSURING THAT ANY VOIDS BETWEEN THE ROCKS ARE FILLED.
7. TRIM ANY EXPOSED FILTER FABRIC AROUND THE SILL INSTALLATION. CHECK PROPER FUNCTION/FLOW PATH BY OBSERVING FLOW OVER STRUCTURE. REPAIR AS NEEDED TO ENSURE PROPER FUNCTION.
8. ENSURE NO LEAKAGE/FLOW UNDER OR AROUND STRUCTURE BY PROPERLY GRADING, SEALING, AND COMPACTING UNDER AND AROUND THE STRUCTURE.
9. EROSION CONTROL BLANKET SHALL BE INSTALLED IN AREAS SHOWN ON THIS DETAIL AND IN COMPLIANCE WITH INSTALLATION INSTRUCTIONS ON THE EROSION CONTROL DETAIL ON SHEET C6.14.

TRIBUTARY	BOTTOM CHANNEL WIDTH (FT)	W <sub>bkf</sub> (FT)	MIN. SILL LENGTH (FT)
FORK CREEK	9.1	16.3	20.0
UT1	5.8	10.6	16.0
UT2	2.6	5.0	13.0
UT3 & UT4	2.9	5.3	13.0

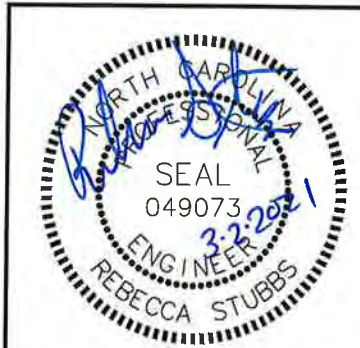
TRIBUTARY	BOULDER LENGTH* (FT)	BOULDER WIDTH* (FT)	BOULDER HEIGHT* (IN)
FORK CREEK	3.5	3.5	12.0
UT1	3.0	3.0	12.0
UT2	3.5	3.5	12.0
UT3 & UT4	3.5	3.5	12.0

\*MINIMUM DIMENSIONS SHOWN



**SILL STEP DETAIL**

N.T.S.



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**LAUREL SPRINGS MITIGATION PLAN**  
 CONSTRUCTION DRAWINGS  
 AVERY COUNTY, NORTH CAROLINA



**PLAN INFORMATION**

PROJECT NO.	AXI-19000
FILENAME	AXI19000-D1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	N.T.S.
DATE	02.18.2020

**STREAM DETAILS**  
**C8.04**



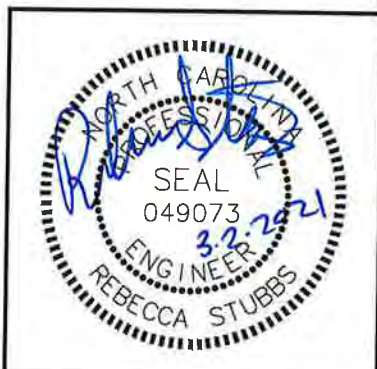
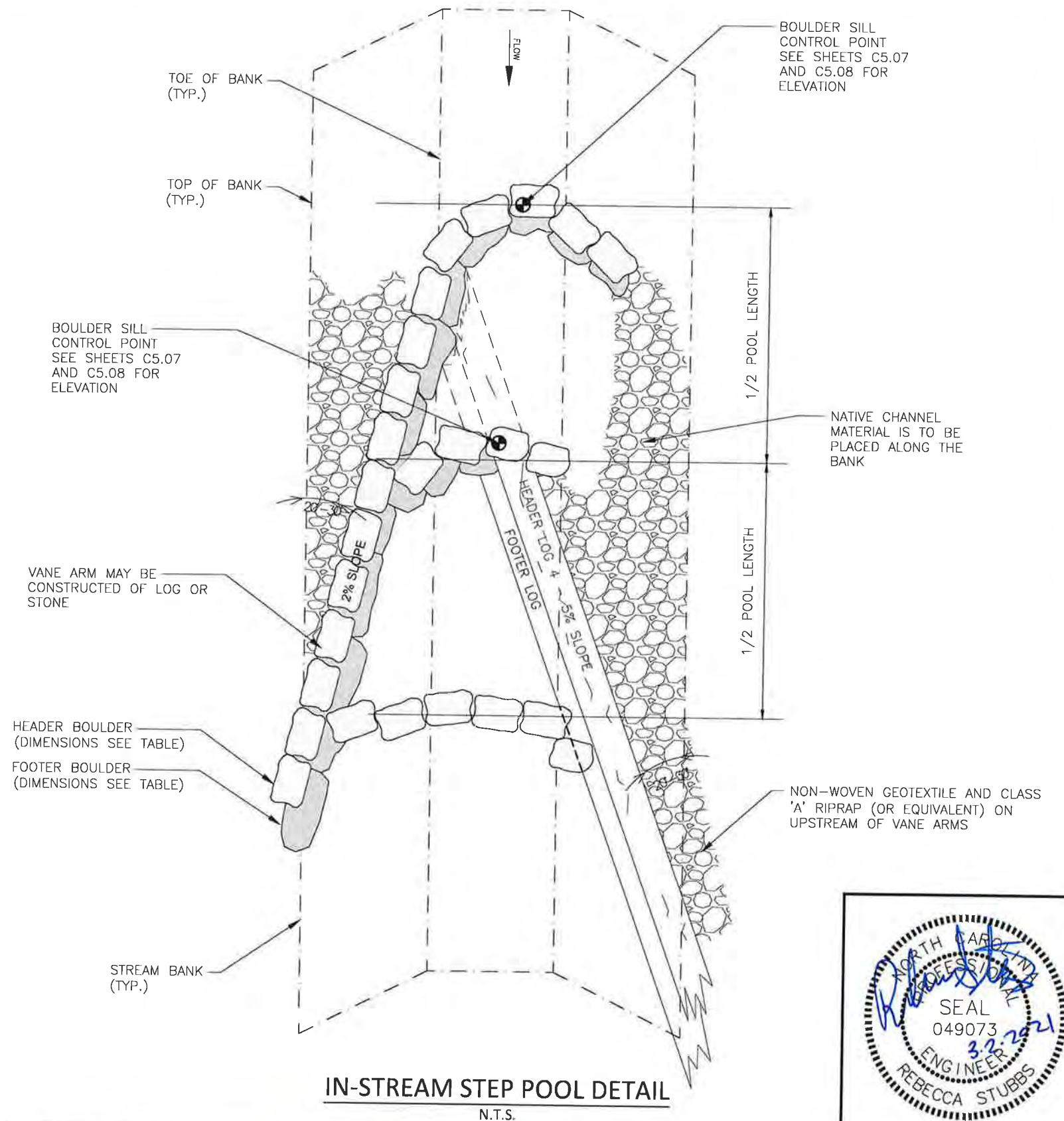
**GENERAL NOTES:**

1. A BOULDER SILL MAY BE USED ALONE OR IN COMBINATION WITH A CONSTRUCTED RIFFLE. CONTRACTOR TO CONSULT DESIGN ENGINEER FOR FINAL MATERIAL SPECIFICATIONS.
2. AN ELEVATION CONTROL POINT SHALL BE DESIGNATED AT THE CENTER OF THE SILL TO ESTABLISH PART OF THE PROFILE. POOL ELEVATION CONTROL POINTS OR EXCAVATION TO A SPECIFIED MAXIMUM POOL DEPTH SHALL BE DESIGNATED TO ESTABLISH THE REMAINING PROFILE. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE INSTALLATION WITHIN THE TOLERANCE SPECIFIED BY THE DESIGNER.
3. NO PART OF THE SILL SHALL BE PLACED ABOVE THE ELEVATION OF THE STREAM BED.
4. REFER TO THE PLAN-PROFILE FOUND ON SHEETS C5.07 AND C5.08 FOR THE STATION LOCATIONS AND CONTROL POINT ELEVATIONS OF EACH BOULDER SILL SPECIFIED FOR THE PROJECT.
5. ALL BOULDERS SHALL CONSIST OF ANGULAR, TABULAR, FLAT ROCK WITH MINIMUM OF TWO PARALLEL SIDES, AND HAVE A NATURAL APPEARANCE AND COLOR. ROUNDED EDGES ARE ACCEPTABLE SO LONG AS ROUNDED EDGES ARE NOT BEARING OR SUPPORTING. APPROXIMATE DIMENSIONS OF BOULDERS SHALL MEASURE IN LENGTH, WIDTH, AND HEIGHT AS SPECIFIED IN THE TABLE BELOW. ALL STONE SHALL BE FREE FROM LAMINATION AND WEAK CLEAVAGES. THE STONE SHOULD NOT DISINTEGRATE SIGNIFICANTLY FROM THE ACTION OF AIR, WATER, OR IN HANDLING AND PLACING. STONE WITH TOOL MARKS, DRILL HOLES, AND OTHER BLASTING EVIDENCE SHALL NOT BE UTILIZED IN EXPOSED LOCATIONS.
6. FILTER FABRIC OF A TYPE AND SIZE SPECIFIED BY THE DESIGNER SHALL BE USED TO SEAL THE GAPS BETWEEN THE BOULDERS AND THE STREAM BED, UNDER THE COARSE BACKFILL MATERIAL. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
7. BACKFILL ROCK ALONG THE STREAM BANK SHALL BE NATIVE CHANNEL MATERIAL OR RIVER COBBLE OF EQUIVALENT SIZE AND HAVE AN AVERAGE DIAMETER OF 8". SMALLER AGGREGATE (I.E. NO. #57) OR COBBLE STONES SHALL BE USED TO FILL VOIDS SUCH THAT EACH BOULDER RESTS SOLIDLY ON THE PREVIOUS ROCK LAYER WITH MINIMAL OPPORTUNITY FOR MOVEMENT.
8. DETAIL SHOWS TWO STEP POOLS IN SERIES; HOWEVER, NUMBER OF STEP POOLS MAY VARY BY DESIGN. REFERENCE SHEETS C5.07 AND C5.08.

**CONSTRUCTION GUIDELINES:**

1. STREAM SHALL BE DIVERTED AWAY FROM THE WORK AREA AND THE SITE SHALL BE DEWATERED.
2. EXCAVATE TRENCH FOR FOOTER ROCKS TO THE ELEVATION AND GRADES NECESSARY FOR PLACEMENT OF BOTH FOOTER AND HEADER BOULDER SO THAT THE DESIRED ELEVATION OF THE HEADER BOULDER MEETS THE LINES AND GRADES OF THE STRUCTURE SCHEDULE IN ACCORDANCE WITH THE PLANS AND PROFILES.
3. PLACE FOOTER BOULDERS IN EXCAVATED TRENCH WITH ADJACENT BOULDERS ABUTTING EACH OTHER. FOOTER BOULDERS SHALL BE PLACED NEATLY SO THAT THE HEADER BOULDERS CAN REST SECURELY ON TWO FOOTER BOULDERS. SMALLER ROCK SHALL BE USED TO FILL VOID SPACES SO THAT EACH BOULDER RESTS SOLIDLY ON THE PREVIOUS BOULDER WITH MINIMAL OPPORTUNITY FOR MOVEMENT.
4. BOULDER SILL ROCKS WILL TIE INTO THE CHANNEL BOTTOM ELEVATION AT THE LOCATION OF EACH SILL AND EXTEND INTO THE STREAMBANK A MINIMUM OF 5' UNLESS OTHERWISE SPECIFIED BY THE DESIGNER.
5. PLACE FILTER FABRIC BEHIND BOULDER SILL AND ALONG THE BOTTOM OF THE STREAM BED.
6. PLACE COARSE BACKFILL BEHIND BOULDERS ENSURING THAT ANY VOIDS BETWEEN THE ROCKS ARE FILLED.
7. TRIM ANY EXPOSED FILTER FABRIC AROUND THE SILL INSTALLATION. CHECK PROPER FUNCTION/FLOW PATH BY OBSERVING FLOW OVER STRUCTURE. REPAIR AS NEEDED TO ENSURE PROPER FUNCTION.
8. ENSURE NO LEAKAGE/FLOW UNDER OR AROUND STRUCTURE BY PROPERLY GRADING, SEALING, AND COMPACTING UNDER AND AROUND THE STRUCTURE.
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RESTORATION SYSTEMS | LLC



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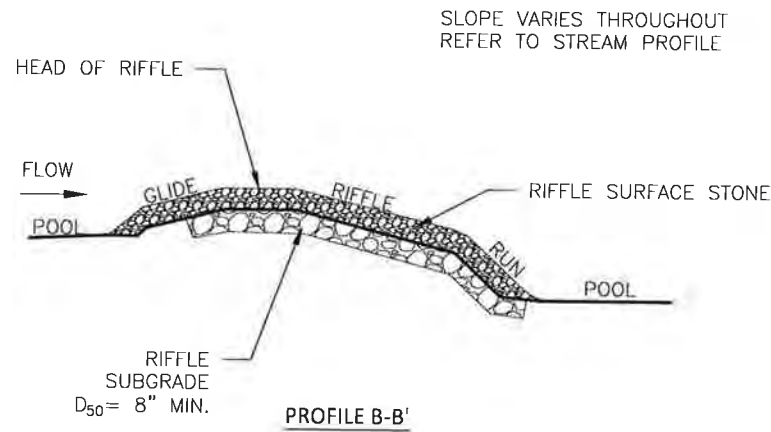
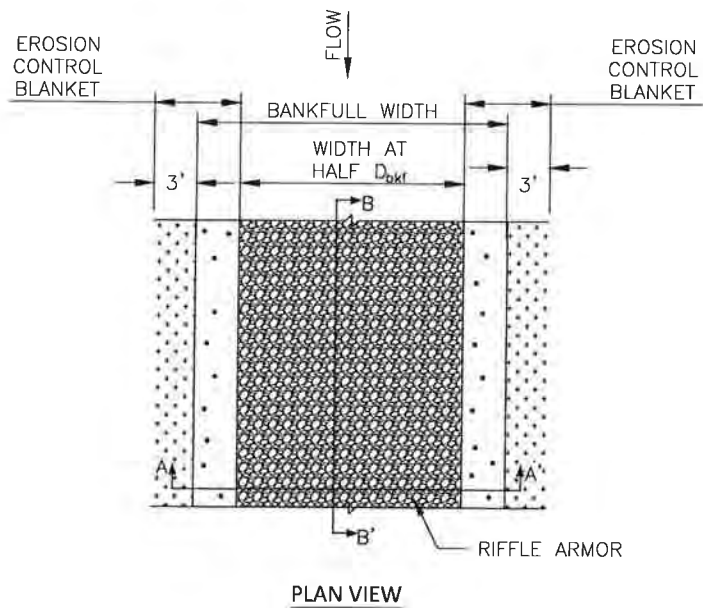
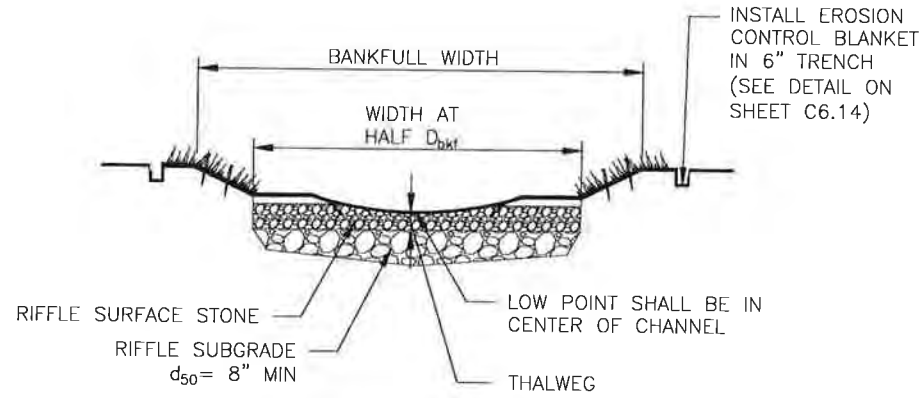
**STREAM DETAILS**  
**C8.05**



**GENERAL NOTES**

1. RIFFLE ARMOR DEPTH SHALL BE A MINIMUM OF 6 INCHES.
2. EXTEND RIFFLE ARMOR UP TO HALF BANKFULL DEPTH.
3. LOW POINT (THALWEG) SHALL BE IN THE CENTER OF CHANNEL.
4. RIFFLE SUBGRADE MATERIAL SHALL BE NCDOT CLASS 'B' RIPRAP OR RIVER COBBLE OF EQUIVALENT SIZE AND HAVE AN AVERAGE DIAMETER OF 8". NATIVE CHANNEL MATERIAL FROM THE EXISTING CHANNEL SHALL BE USED WHENEVER POSSIBLE.
5. GRAVEL SUBSTRATE FROM THE EXISTING CHANNEL SHALL BE STOCKPILED AND REUSED AS SURFACE STONE IN THE NEW CHANNEL. GRAVEL SHALL BE PLACED AT EACH RIFFLE LOCATION IN ACCORDANCE WITH THE GRADATION SHOWN ON THESE PLANS. SOME EXCAVATION OF CHANNEL BED MATERIAL MAY BE NECESSARY PRIOR TO PLACEMENT OF RIFFLE TO ENSURE PROPER CROSS-SECTIONAL DIMENSIONS ONCE RIFFLE IS CONSTRUCTED. RE-DRESSING OF CHANNEL AND BANKS MAY BE REQUIRED FOLLOWING CONSTRUCTION OF RIFFLES AND CHANNEL.

TRIBUTARY	BOTTOM CHANNEL WIDTH (FT)	W <sub>bkf</sub> (FT)	WIDTH AT HALF D <sub>bkf</sub> (FT)
FORK CREEK	9.1	16.3	12.7
UT1	5.8	10.6	8.2
UT2	2.6	5.0	3.8
UT3	2.9	5.3	4.1



**CONSTRUCTED RIFFLE DETAIL**  
N.T.S.




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**LAUREL SPRINGS MITIGATION PLAN**  
CONSTRUCTION DRAWINGS  
AVERY COUNTY, NORTH CAROLINA



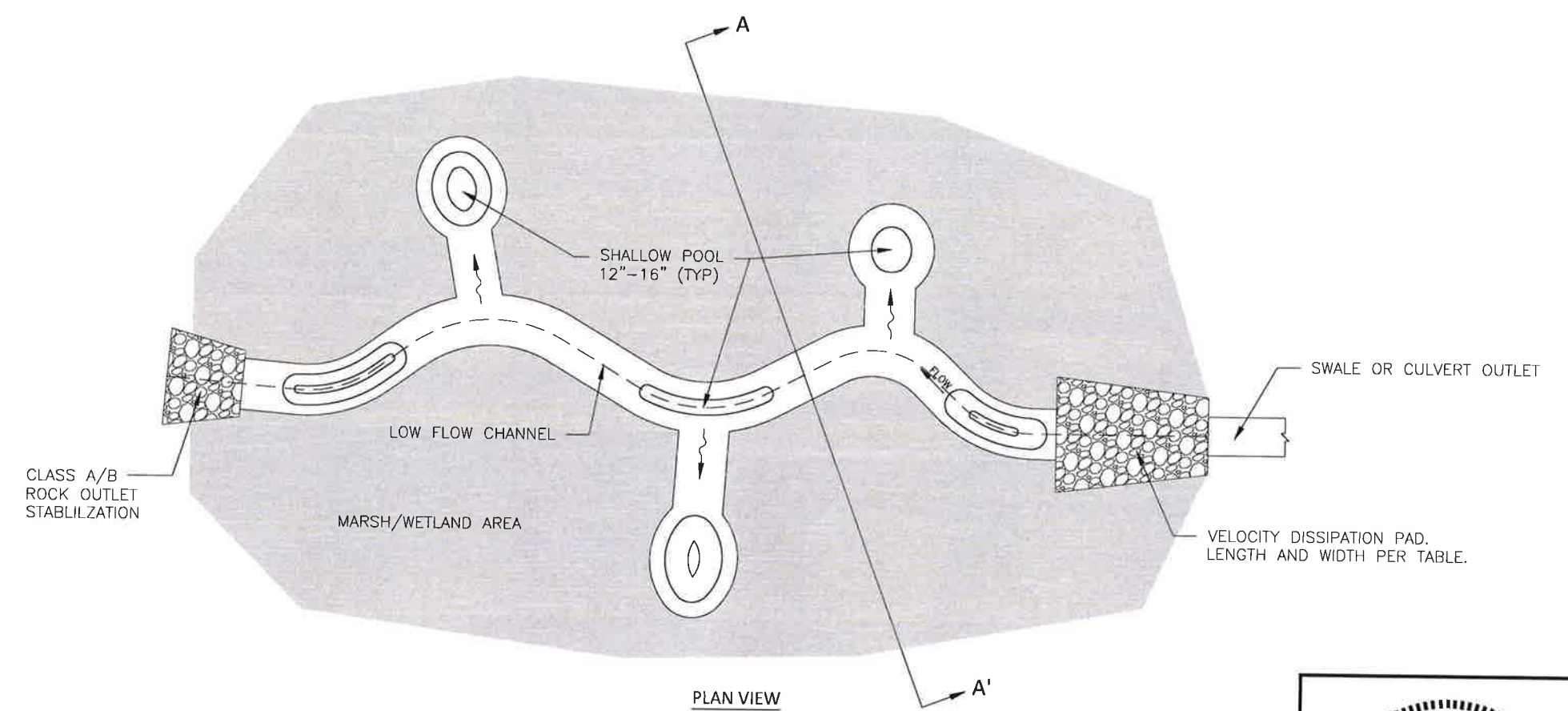
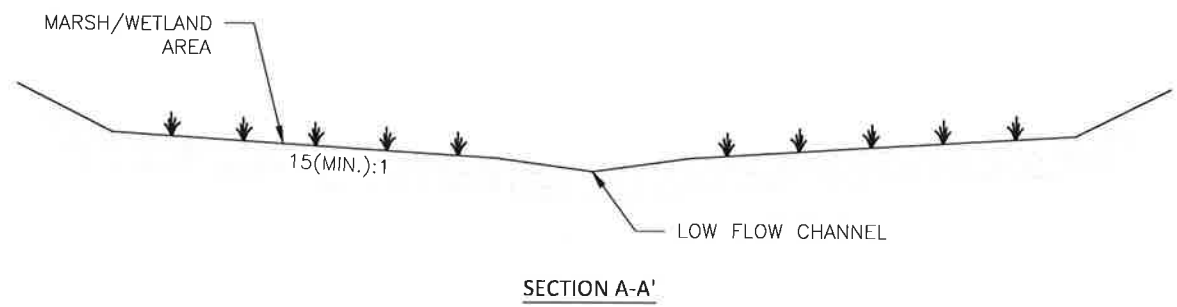
**PLAN INFORMATION**

PROJECT NO.	AXI-19000
FILENAME	AXI19000-D1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	N.T.S.
DATE	02.18.2020

**STREAM DETAILS**  
**C8.06**



VELOCITY DISSIPATION PAD SIZES			
Location	Stone Size	Length (ft)	Width (ft)
Marsh Treatment Area 1	Class B	9.0	4.5
Marsh Treatment Area 2	Class I	12.0	4.5



NOTE:  
CONSTRUCT ROCK OUTLET TO PROVIDE DIFFUSE FLOW.

MARSH TREATMENT AREA  
N.T.S.




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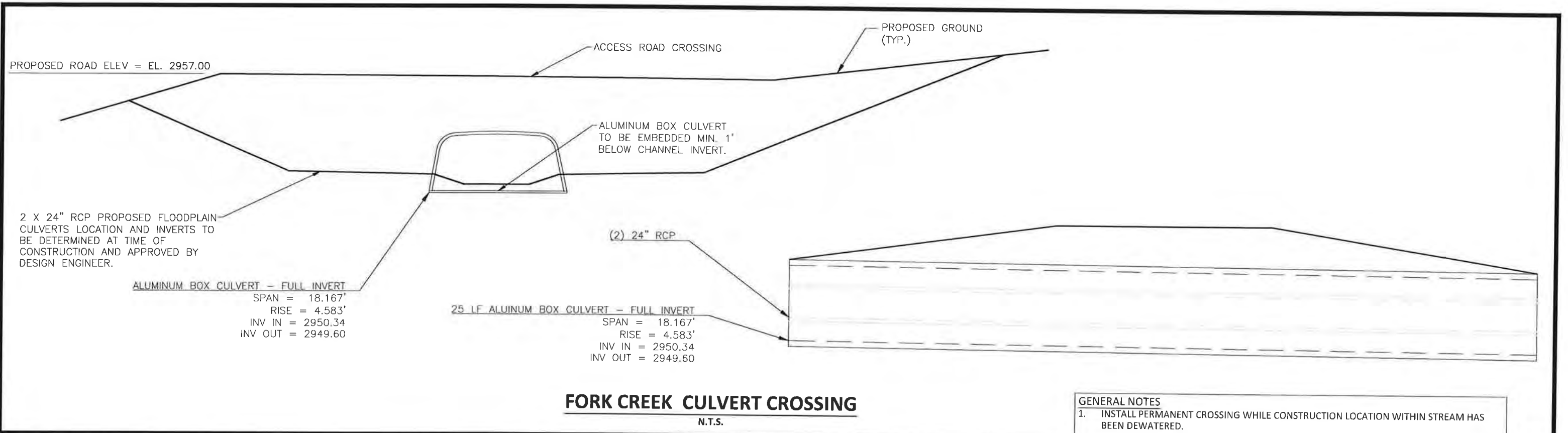


**PLAN INFORMATION**

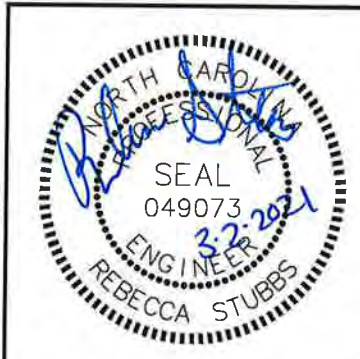
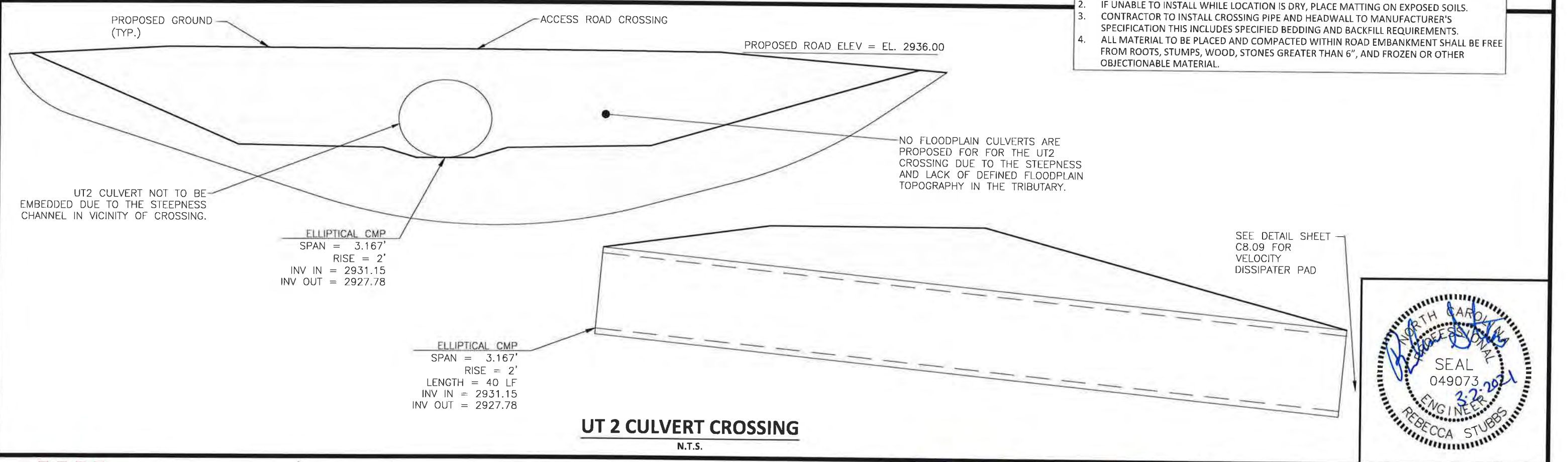
PROJECT NO. AXI-19000  
FILENAME AXI19000-D1  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE N.T.S.  
DATE 02.18.2020

**STREAM  
DETAILS**

**C8.07**



- GENERAL NOTES**
1. INSTALL PERMANENT CROSSING WHILE CONSTRUCTION LOCATION WITHIN STREAM HAS BEEN DEWATERED.
  2. IF UNABLE TO INSTALL WHILE LOCATION IS DRY, PLACE MATTING ON EXPOSED SOILS.
  3. CONTRACTOR TO INSTALL CROSSING PIPE AND HEADWALL TO MANUFACTURER'S SPECIFICATION THIS INCLUDES SPECIFIED BEDDING AND BACKFILL REQUIREMENTS.
  4. ALL MATERIAL TO BE PLACED AND COMPACTED WITHIN ROAD EMBANKMENT SHALL BE FREE FROM ROOTS, STUMPS, WOOD, STONES GREATER THAN 6", AND FROZEN OR OTHER OBJECTIONABLE MATERIAL.




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**PLAN INFORMATION**

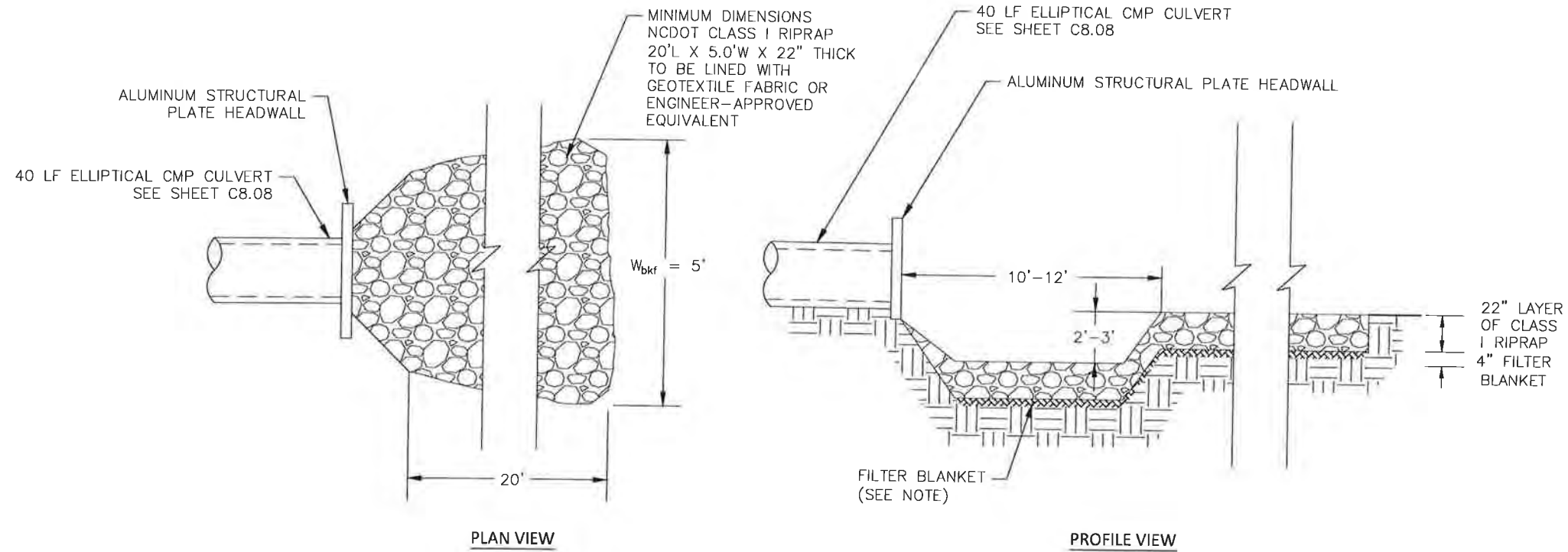
PROJECT NO.	AXI-19000
FILENAME	AXI19000-D1
CHECKED BY	RAS
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SCALE	N.T.S.
DATE	02.18.2020

**CULVERT DETAILS**  
**C8.08**

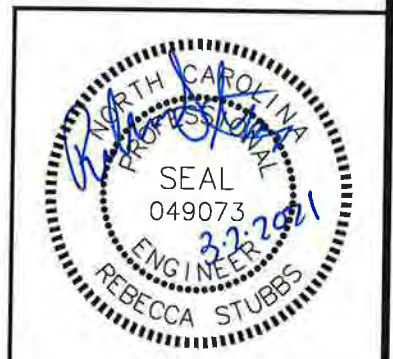


**NOTES:**

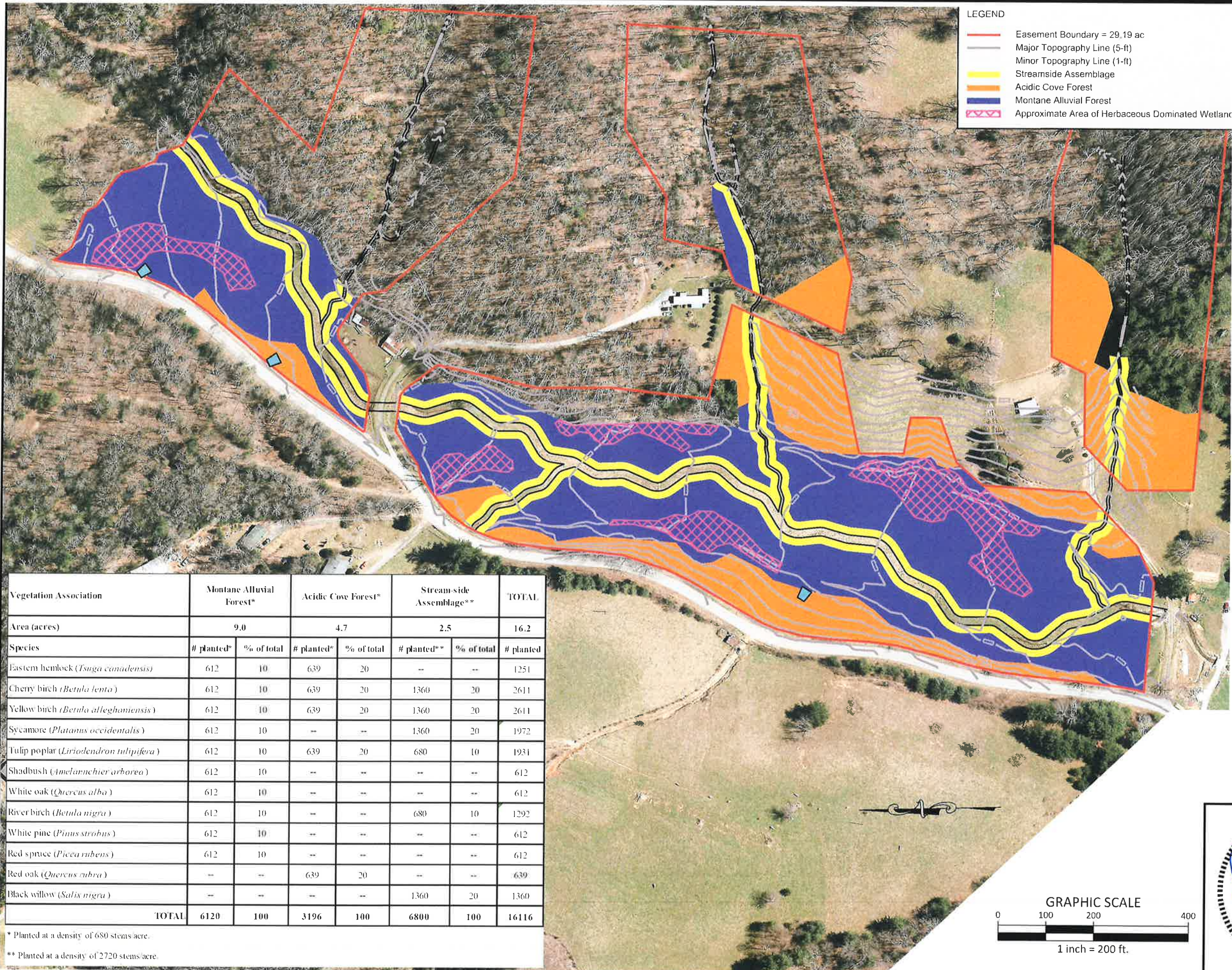
1. A FILTER BLANKET IS TO BE INSTALLED BETWEEN THE RIPRAP AND SOIL FOUNDATION. THE FILTER BLANKET WILL CONSIST OF A MINIMUM 4" THICK LAYER OF STONE (NCDOT #57) UNDERLAIN WITH MIRAFI FILTER WEAVE 700 OR ENGINEER-APPROVED EQUIVALENT.
2. RIPRAP TO EXTEND TO TOP OF CHANNEL WITH 2:1 SIDE SLOPES THROUGHOUT THE EXTENT OF CHANNEL.



**UT2 CULVERT VELOCITY DISSIPATER**  
N.T.S.



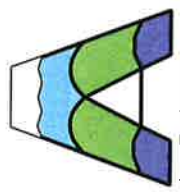





- LEGEND**
- Easement Boundary = 29.19 ac
  - Major Topography Line (5-ft)
  - Minor Topography Line (1-ft)
  - Streamside Assemblage
  - Acidic Cove Forest
  - Montane Alluvial Forest
  - ▨ Approximate Area of Herbaceous Dominated Wetland

Vegetation Association	Montane Alluvial Forest*		Acidic Cove Forest*		Stream-side Assemblage**		TOTAL
Area (acres)	9.0		4.7		2.5		16.2
Species	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
Eastern hemlock ( <i>Tsuga canadensis</i> )	612	10	639	20	--	--	1251
Cherry birch ( <i>Betula lenta</i> )	612	10	639	20	1360	20	2611
Yellow birch ( <i>Betula alleghaniensis</i> )	612	10	639	20	1360	20	2611
Sycamore ( <i>Platanus occidentalis</i> )	612	10	--	--	1360	20	1972
Tulip poplar ( <i>Liriodendron tulipifera</i> )	612	10	639	20	680	10	1931
Shadbush ( <i>Amelanchier arborea</i> )	612	10	--	--	--	--	612
White oak ( <i>Quercus alba</i> )	612	10	--	--	--	--	612
River birch ( <i>Betula nigra</i> )	612	10	--	--	680	10	1292
White pine ( <i>Pinus strobus</i> )	612	10	--	--	--	--	612
Red spruce ( <i>Picea rubens</i> )	612	10	--	--	--	--	612
Red oak ( <i>Quercus rubra</i> )	--	--	639	20	--	--	639
Black willow ( <i>Salix nigra</i> )	--	--	--	--	1360	20	1360
<b>TOTAL</b>	<b>6120</b>	<b>100</b>	<b>3196</b>	<b>100</b>	<b>6800</b>	<b>100</b>	<b>16116</b>


\* Planted at a density of 680 stems/acre.  
 \*\* Planted at a density of 2720 stems/acre.



Axiom Environmental, Inc.



RS  
RESTORATION  
SYSTEMS LLC

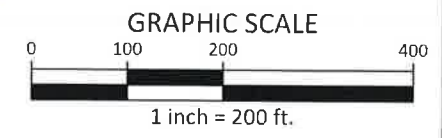


MCADAMS

**LAUREL SPRINGS MITIGATION PLAN**  
 CONSTRUCTION DRAWINGS  
 AVERY COUNTY, NORTH CAROLINA

**PLANTING PLAN**  
**L5.00**

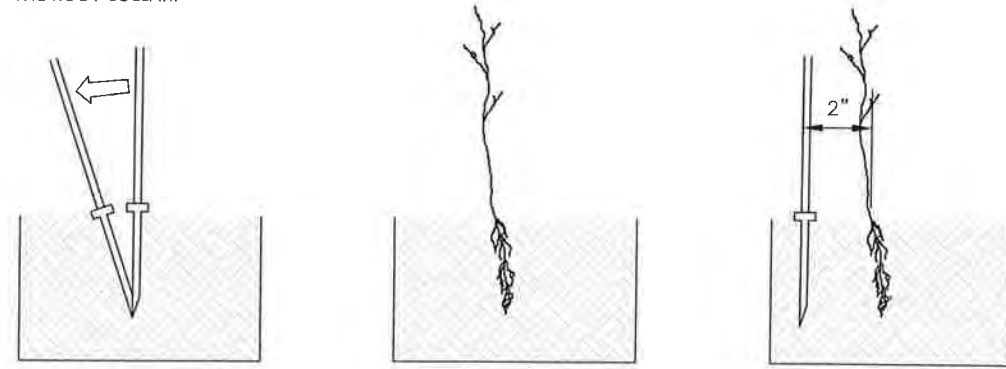
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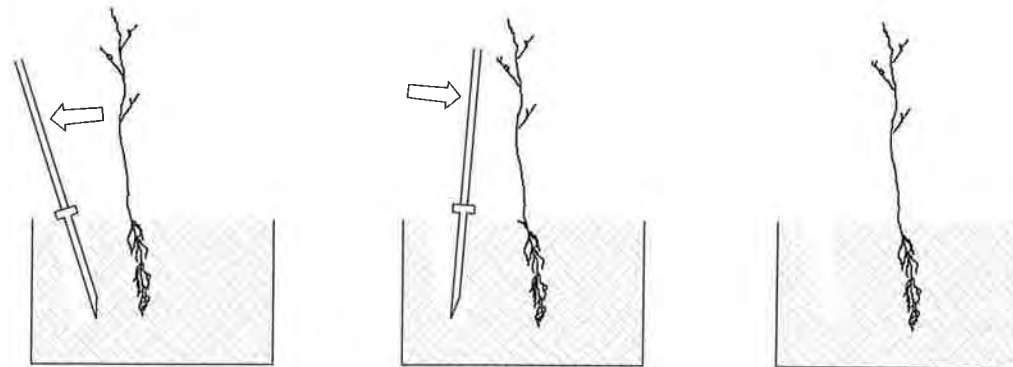


**NOTES:**

1. AREAS NOTED AS BARE ROOT PLANTINGS WITHIN THE PLANTING ZONE SHALL BE PLANTED WITH SPECIES LISTED ON SHEET L5.00.
2. DURING PLANTING, SEEDLINGS SHALL BE KEPT IN A MOIST CANVAS BAG OR SIMILAR CONTAINER TO PREVENT ROOT SYSTEMS FROM DRYING.
3. PLANTING BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS SECTION, AND SHALL BE 12 INCHES LONG, 4 INCHES WIDE AND 1 INCH THICK AT CENTER.
4. ALL SEEDLINGS SHALL BE ROOT PRUNED, IF NECESSARY, SO THAT NO ROOTS EXTEND MORE THAN 10 INCHES BELOW THE ROOT COLLAR.



1. INSERT PLANTING BAR 12" INTO THE GROUND AS SHOWN AND PULL HANDLE TOWARD PLANTER.
2. REMOVE PLANTING BAR AND PLACE SEEDING AT CORRECT DEPTH.
3. INSERT PLANTING BAR 2 INCHES TOWARD PLANTER FROM SEEDING.

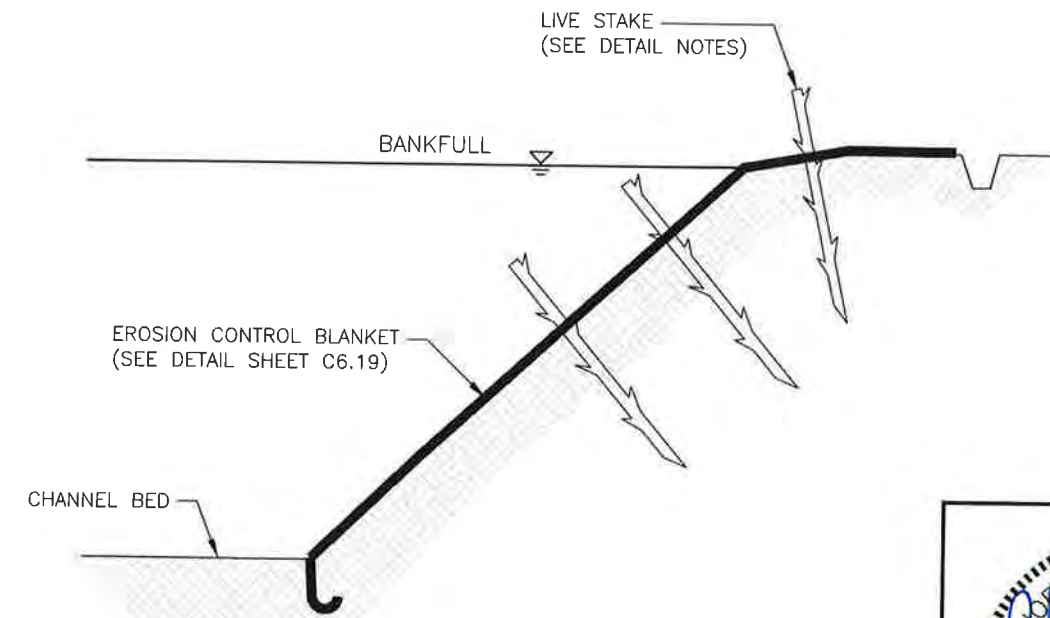


4. PULL HANDLE OF BAR TOWARD PLANTER, FIRING SOIL AT BOTTOM.
5. PUSH HANDLE FORWARD FIRING SOIL AT TOP
6. LEAVE COMPACTION HOLE OPEN WATER THOROUGHLY.

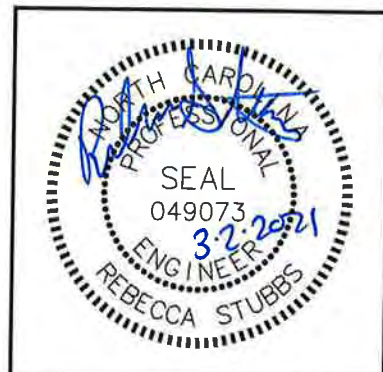
**BARE ROOT PLANTING DETAIL**  
N.T.S.

**NOTES:**

1. AREAS NOTED AS LIVE STAKES WITHIN THE PLANTING ZONE SHALL BE PLANTED WITH SPECIES LISTED ON SHEET L5.00.
2. ONE LIVE STAKE SPECIES PER LIVE STAKE AREA. ALTERNATE SPECIES PER LIVE STAKE AREA.
3. ALL LIVE STAKES SHALL BE DORMANT AT TIME OF ACQUISITION AND PLANTING.
4. LIVE STAKES SHALL BE 1/2-2" IN DIAMETER. LIVE STAKES SHALL ALSO BE 2 - 4 FEET IN LENGTH.
5. DURING PREPARATION, THE BASAL ENDS OF THE LIVE STAKES SHALL BE CLEANLY CUT AT AN ANGLE TO FACILITATE EASY INSERTION INTO THE SOIL, WHILE THE TOPS SHALL BE CUT SQUARE OR BLUNT FOR TAMPING. ALL LIMBS SHALL BE REMOVED FROM THE SIDES OF THE LIVE CUTTING PRIOR TO INSTALLATION.
6. CUTTINGS FOR LIVE STAKES SHALL BE HARVESTED IN A MANNER SUCH THAT THEY ARE CUT, IMMEDIATELY PUT INTO WATER TO BE SOAKED FOR 10 DAYS, AND THEN PLANTED IMMEDIATELY AFTER THE 10 DAYS ARE COMPLETED. CUTTINGS SHALL REMAIN WET UNTIL THEY ARE PLANTED. OUTSIDE STORAGE LOCATIONS SHOULD BE CONTINUALLY SHADED AND PROTECTED FROM WIND AND DIRECT SUNLIGHT.
7. LIVE STAKES SHALL BE TAMPED AT AN ANGLE INTO THE GROUND SURFACE WITH A DEAD BLOW HAMMER, WITH BUDS ORIENTED IN AN UPWARD DIRECTION. STAKES SHOULD BE TAMPED UNTIL APPROXIMATELY 3/4 OF THE STAKE LENGTH IS WITHIN THE GROUND. ANY STAKES THAT ARE SPLIT OR DAMAGED DURING INSTALLATION SHALL BE REMOVED AND REPLACED.
8. THE AREA AROUND EACH LIVE STAKE SHALL BE COMPACTED BY FOOT AFTER THE LIVE STAKE HAS BEEN INSTALLED.
9. ONE TO TWO INCHES SHALL BE CUT CLEANLY OFF OF THE TOP OF EACH LIVE STAKE (WITH LOPPERS) AT AN ANGLE OF APPROXIMATELY 15 DEGREES FOLLOWING INSTALLATION.



**LIVE STAKE DETAIL**  
N.T.S.



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**PLAN INFORMATION**  
PROJECT NO. AXI-19000  
FILENAME AXI19000-LS  
CHECKED BY RAS  
DRAWN BY RHW  
SCALE N.T.S.  
DATE 02.18.2020

**PLANTING DETAILS**  
**L5.01**

**TEMPORARY SEEDING SCHEDULE:**

TEMPORARY SEEDING SHALL BE APPLIED AS NEEDED DURING CONSTRUCTION TO STABILIZE BARE OR DISTURBED AREAS OF SOIL AND AT THE COMPLETION OR ALL GRADING AND EARTHWORK ACTIVITIES WITHIN A PARTICULAR AREA OF THE SITE. PERMANENT SEED MAY BE DISTRIBUTED WITH TEMPORARY SEED UPON THE FINAL APPLICATION OF TEMPORARY SEED.

SEEDING DATE	SEEDING MIXTURE	APPLICATION RATE
AUG 15 - MAY 15	ANNUAL RYE (GRAIN)	30 LBS/AC
AUG 15 - MAY 15	WINTER WHEAT	30 LBS/AC
MAY 15 - AUG 15	GERMAN MILLET	10 LBS/AC
MAY 15 - AUG 15	BROWNTOP MILLET	10 LBS/AC

**SEEDING METHODS**

1. EVENLY APPLY SEED USING A CYCLONE SEEDER, DRILL, CULTIPACKER SEEDER, OR HYDROSEEDER. THIS MUST BE DONE WITHIN 48 HOURS OF LAND DISTURBING ACTIVITIES.
2. MULCH WITH CLEAN WHEAT STRAW.
3. AFTER SEEDING, APPLY MULCH TO AREAS UNDER HARSH CONDITIONS SUCH AS AREAS THAT HAVE BEEN GRADED, OR THOSE WHICH WILL RECEIVE CONCENTRATED FLOWS. AREAS CONSIDERED TO BE UNDER HARSH CONDITIONS WILL BE CONSIDERED THE AREAS GRADED FOR THE WETLAND VALLEY.
4. RESEED AND MULCH AREAS WHERE SEEDLING EMERGENCE IS LESS THAN 80% COVERAGE, OR WHERE EROSION OCCURS, AS SOON AS POSSIBLE. DO NOT MOW. PROTECT FROM TRAFFIC AS MUCH AS POSSIBLE.

**NOTES**

1. TEMPORARY ANNUAL SEED SELECTION SHOULD BE BASED ON SEASON OF PROJECT INSTALLATION.
2. A SINGLE SPECIES FOR TEMPORARY COVER IS ACCEPTABLE.
3. IN SOME CASES WHERE SEASONS OVERLAP, A MIXTURE OF TWO OR MORE SPECIES MAY BE NECESSARY. HOWEVER, APPLICATION RATES SHOULD NOT EXCEED THE TOTAL RECOMMENDED RATE PER ACRE.
4. TEMPORARY SEED SHOULD BE MIXED AND APPLIED SIMULTANEOUSLY WITH THE PERMANENT SEED MIX IF OPTIMAL PLANTING DATES ALLOW.

**PERMANENT SEEDING SCHEDULE:**

**PLANT MATERIAL SELECTION**

1. REFER TO THE TABLES ON THIS SHEET FOR APPROPRIATE SELECTION OF NATIVE PERMANENT SEEDS.
2. PERMANENT SEED MIXTURE SHOULD BE APPLIED USING AN APPLICATION RATE AND METHOD RECOMMENDED BY THE NURSERY.

**SEEDBED PREPARATION**

1. DISTURBED SOILS WITHIN THE RIPARIAN AREAS MUST BE AMENDED TO PROVIDE AN OPTIMUM ENVIRONMENT FOR SEED GERMINATION AND SEEDLING GROWTH.
2. THE pH OF THE SOIL MUST BE SUCH THAT IT IS NOT TOXIC AND NUTRIENTS ARE AVAILABLE.
3. SOIL ANALYSIS SHOULD BE PERFORMED TO DETERMINE NUTRIENT AND LIME NEEDS OF EACH SITE.
4. APPROPRIATE pH LEVELS ARE BETWEEN 5.5 AND 7.0.
5. RIPARIAN BUFFERS REGULATED FOR NUTRIENT MANAGEMENT MAY BE LIMITED TO A SINGLE APPLICATION OF FERTILIZER.
6. SUITABLE MECHANICAL MEANS SUCH AS DISKING, RAKING, AND HARROWING MUST BE EMPLOYED TO LOOSEN COMPACTED SOILS PRIOR TO SEEDING.

**PLANTING**

1. APPLY SEED UNIFORMLY WITH A CYCLONE SEEDER, DROP-TYPE SPREADER, DRILL, OR HYDROSEEDER ON A FIRM, FRIABLE SEEDBED.
2. IN FINE SOILS, SEEDS SHOULD BE DRILLED 0.25-0.5 INCHES. IN COURSE SAND SOILS, SEEDS SHOULD BE PLANTED NO MORE THAN 0.75 INCHES.

**MULCH**

1. MULCH ALL PLANTING AREAS IMMEDIATELY AFTER SEEDING.
2. IF PLANTING ON STREAMBANKS STEEPER THAN 10% OR OTHER AREAS SUBJECT TO FLOODING, A BIODEGRADABLE ROLLED EROSION CONTROL PRODUCT IS RECOMMENDED TO HOLD SEED AND SOIL IN PLACE.

**MAINTENANCE**

1. THE RECOMMENDED PERMANENT GRASS SPECIES MAY REQUIRE TWO YEARS FOR ESTABLISHMENT DEPENDING ON SITE CONDITIONS.
2. INSPECT SEEDED AREAS FOR FAILURE AND MAKE NECESSARY REPAIRS, SOIL AMENDMENTS, AND RE-SEEDINGS.
3. IF WEEDY EXOTIC SPECIES HAVE TAKEN OVER AREAS AFTER THE FIRST GROWING SEASON, THE INVASIVE SPECIES MUST BE ERADICATED TO ALLOW NATIVE SPECIES TO GROW.
4. MONITORING THE SITE UNTIL LONG-TERM STABILITY HAS BEEN ESTABLISHED.

PERMANENT SEEDING MIXTURE (2 LB/ACRE)	
Name	Percent of Seed Mix
<i>Agrostis alba</i>	20
<i>Tridens flavus</i>	20
<i>Agrostis hyemalis</i>	5
<i>Agrostis stolonifera</i>	5
<i>Chrysanthemum leucanthemum</i>	5
<i>Coreopsis lanceolata</i>	5
<i>Coreopsis tinctoria</i>	5
<i>Elymus virginicus</i>	5
<i>Panicum clandestinum</i>	5
<i>Rudbeckia hirta</i>	5
<i>Echinacea purpurea</i>	3
<i>Eupatorium perfoliatum</i>	3
<i>Chamaecrista fasciculata</i>	2
<i>Chamaecrista nictitans</i>	1
<i>Cosmos bipinnatus</i>	1
<i>Desmodium canadense</i>	1
<i>Helianthus angustifolius</i>	1
<i>Heliopsis helianthoides</i>	1
<i>Hibiscus moscheutos</i>	1
<i>Lespedeza capitata</i>	1
<i>Lespedeza virginica</i>	1
<i>Liatris spicata</i>	1
<i>Silphium perfoliatum</i>	1
<i>Verbena hastata</i>	1
<i>Eupatorium coelestinum</i>	0.5
<i>Monarda fistulosa</i>	0.25
<i>Pycnanthemum tenuifolium</i>	0.25

\*ERNST SEEDS "ERNMX-305, NC FACW MIX"

PERMANENT STREAM BANK SEEDING MIXTURE (4 LB/ACRE)	
Name	Percent of Seed Mix
<i>Panicum rigidulum</i>	35
<i>Panicum anceps</i>	23
<i>Elymus virginicus</i>	20
<i>Carex lurida</i>	12
<i>Juncus effusus</i>	3
<i>Helenium flexuosum</i>	2
<i>Hibiscus moscheutos</i>	2
<i>Scirpus cyperinus</i>	2
<i>Juncus tenuis</i>	1




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DRAWN BY	RHW
SCALE	N.T.S.
DATE	02.18.2020

**PLANTING NOTES**

**L5.02**