FINAL MITIGATION PLAN
Seniard Creek Mitigation Site

Henderson County, NC
DMS Project Number: 100017
Contract Number: 7189
RFP: 16-006991
USACE Action ID: SAW-2017-01571
DWR Project Number: 20171160

French Broad River Basin
Cataloging Unit # 06010105

Prepared for:
North Carolina Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

May 27, 2020

Page left intentionally blank for printing purposes.

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

REPLY TO
ATTENTION OF:

June 15, 2020

Regulatory Division

Re: NCIRT Review and USACE Approval of the NCDMS Seniard Creek Mitigation Site / Henderson Co./ SAW-2017-01571/ NCDMS Project # 100062

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 Seniard Creek Draft Mitigation Plan, which closed on April 8, 2020. Additional information was requested May 28, 2020, and received June 5, 2020. These comments are attached for your review.

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

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

Thank you for your prompt attention to this matter, and if you have any questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please call me at 919-554-4884, ext 60.

Sincerely,

Kim Browning
Mitigation Project Manager
for Tyler Crumbley

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
Harry Tsomides, Paul Wiesner—NCDMS
David Tuch, Chris Engle, Grant Ginn, Danvey Walsh

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

REPLY TO
ATTENTION OF:

CESAW-RG/Browning May 1, 2020

MEMORANDUM FOR RECORD

SUBJECT: Seniard Creek Mitigation Site - NCIRT Comments during 30-day Mitigation Plan Review

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

NCDMS Project Name: Seniard Creek Mitigation Site, Henderson County, NC

USACE AID#: SAW-2017-01571
NCDMS #: 100017
30-Day Comment Deadline: April 8, 2020

DWR Comments, Mac Haupt:

1. In the future please do a thorough Qualtiy Control check of the document. There were a number of pages (in the text portion) out of order and it made the review more time consuming.
2. DWR likes the fact that fish sampling took place on Seniard Creek for the pre-construction phase, however; we did not see any mention of fish monitoring during the post-construction monitoring phase. DWR recommends fish sampling at some point to attempt to establish the work on Seniard reach 1A allowed fish passage through the culvert. In addition, this would help support the proposal for restoration credit being awarded for this reach, since it was initially proposed as EI.
3. Section 7.2- Design Approach-
    a. Seniard Creek- (1A)DWR can accept the proposed credit ratio for 1A provided the above fish monitoring occurs and a cross section is placed in the transition area mentioned below. DWR is not proposing success criteria for the fish monitoring, but it should be done to see if the fish populations are able or will move back and forth. DWR is concerned with the concept of a “threshold transition reach” as mentioned in the last paragraph on page 42 of the mitigation plan, for reach 1A. DWR requests that this section of reach 1A get monitored closely; DWR recommends adding the cross section mentioned above, photos, and periodic (more than once a year) on-site visual assessment.
    b. Sitton Reach- As you may recall, there were extensive discussions on site at this reach concerning the movement of this reach into the valley and removing it from some considerable amount of in stream habitat. DWR is willing to accept the design approach, however; we will require a couple of wetland monitoring gauges placed in the floodplain to verify the wetland hydrology has been restored/maintained.
    c. David Branch- DWR maintains its concern for the lower reach of this tributary and its probable transition to more of a linear wetland.

   d. DWR does not believe proposed cross-sections for both the Whitaker and Redmond Branches are necessary.
4. Section 8.1- Determination of Credits- recalling the site visit, and our response to the minutes, DWR does not believe the reaches Whitaker and Redmond Branches warrant a 5:1 credit ratio. DWR believes a credit ratio of 7.5:1 or 8:1 is more fitting given the likely functional uplift for these two reaches.
5. Appendix A- Photo Log- There were no photos of Whitaker or Redmond Branches.
6. Design sheets- Sheet 1A- it is likely that the riparian area between Sitton and Seniard will wet up considerably. In fact, it is likely to wet up outside the current easement lines. DWR suggests the easement be adjusted to account for this possible condition. In the past, the IRT has seen landowners come in a ditch immediately adjacent to the easement thereby decreasing the functional uplift of the adjacent wetlands. While DWR realizes there is not wetland credit on this site, one of the main reasons we are allowing the channel on Sitton to be moved is because of the restoration of the riparian wetlands.
7. Design sheet 3- DWR is concerned with the lack of a footer log for the Brush Run detail. Preventing undercutting and/or headcutting will be vital to the success of the above "threshold transition reach" on Seniard 1A.
8. Design sheet 10- Where is the existing bed elevation after station 210+85?
9. Design sheet 11- What is the purpose of the proposed groundwater curtain? Have you used these in the past and did they work? Are you expecting flow issues? DWR does not recall this reach's restoration approach being a headwater valley. Was the credit calculated as valley length?
10. Design sheets 12-14- these design sheets show David Branch being constructed as a headwater channel. There was no mention of this type of approach in Section 7.2, nor was this discussed on site. If this approach is to move forward DWR needs to be assured that the credit was calculated as a headwater valley and another stream gauge will need to be installed. Please install a stream gauge mid-reach on David Branch 1B. In addition, DWR will require two wetland gauges on David Branch, one installed at station 404+00, stream left, and the other at station 406+00 stream right. Moreover, it is likely that the reach may lose flow around station 407+00
11. Design sheet 16- We did not see any discussion of the water quality feature in the text of the document. However, we did find it in Appendix B in Grant Ginn's letter. This should have been in the primary text of the Mitigation Plan. Are the 4 pool features intended to dry out?
12. Given the time that has gone by since the initial IRT site visit and the changes proposed, typically, we would want another site visit to discuss and go over the changes. However, with the current pandemic situation, this will not be possible. So, DWR will expect a thorough response to our comments as well as others from the IRT. This may require a conference call or Teams meeting to facilitate sharing of information and discussion.

NCWRC Comments, Andrea Leslie:

- Rainbow Trout are found in the project vicinity, and there is a nice wild Brown Trout population in downstream North Mills River. To minimize impacts to trout reproduction, instream work should be avoided between October 15 and April 15.
- The project is just upstream of the Mills River Aquatic Habitat, a natural area rated Very High by the NC Natural Heritage Program due to the richness of rare species it contains. Near the project, the North Mills River hosts the Eastern Hellbender [*Cryptobranchus alleganiensis*, US Federal Species of Concern (FSC), NC Special Concern (SC)], Olive Darter (*Percina squamata*, NC SC), Slippershell (*Alasmidonta viridis*, US FSC, NC Endangered), French Broad Crayfish [*Cambarus reburrus*, US FSC, NC Significantly Rare (SR)], and Blotched Chub (*Erimystax insignis*, US FSC, NC SR).
- Excellent erosion and sediment control is needed on this project to minimize impacts to the important aquatic community the North Mills River.

- I'm very glad to see the attention given to wetland restoration and am especially appreciative of this, as there will be no wetland credit generated by the project.
- The woody species list for riparian and wetland planting is missing.

USACE Comments, Kim Browning:

1. When submitting the PCN, please include an estimate of the number of trees, or acres, to be cleared for the NLEB 4(d) Rule.
2. General Comments: In future mitigation plans, please locate all the maps/figures in one appendix for easier viewing. Also, please QC the document for errors and organization. Pages 51-58 and 65-66 appear to be missing.
3. Section 3.7: This section states that there are no anticipated land use changes that would influence this project; however, a portion of Seniard Reach 1A is adjacent to a road. Please discuss the potential for road maintenance. Additionally, overhead powerlines cross the project in many areas, please discuss the maintenance and potential affect on the easement.
4. There is a section of David Branch Reach 1C that has an overhead powerline, near the confluence with Sitton Creek. Please remove this section from credit and update Figure 4, and Talbe 18A if necessary.
5. During the IRT site visit Aug 29, 2017, a portion of Seniard Creek was proposed as EI, with benches and structures planned, but it was noted that were existing benches, pools and riffles. Please justify why it was changed to Restoration.
    a. I agree with DWR's comment #12.
6. It was noted during the site visit that David Branch Reach 1C was a wetland system and stream flow was questionable. It was proposed for restoration in the technical proposal. Constructing a channel through this area will impact existing wetlands. Wetland gauges will need to be installed in this area. This area is now proposed as a headwater channel, which is inappropriate considering it is in the middle of a restoration reach, and not the origin of the stream. A flow gauge will need to be installed in this area to demonstrate stream flow, and stream characteristics should be addressed in the performance standards (maintain an Ordinary High Water Mark).
7. Lee Branch was proposed as EII during the technical proposal. The IRT discussed the possibility for EI on the reach since it needed benches, and berm removal on one side. What is the justification for Restoration on this reach? Additionally, page 20 mentions that the stream flows subsurface for 75 feet. Is this the area that is piped and will have a groundwater barrier? Inconsistent data found in Table 14 and on page 39 suggest raising the channel with a Priority II. Please provide more justification for restoration in the narrative.
8. It is appreciated that you widened the buffers on Redmond and Whitaker Branch to capture more of the existing wetlands, but it would be beneficial to capture all of Wetland W01.
9. The technical proposal showed a BMP along the road, near Wetland W09, but this is not shown on the current figure 4 Assets Map.
10. Table 18B Buffer Credit Adjustment: Site wide, what percentage of the actual buffers do not meet the minimum 30 ft. buffers? (More than 5%?) It appears that using the buffer tool caused a loss of 244.06 credits. Please provide the Ideal buffer map and the buffer tool spreadsheet. The number of crossings (powerlines and roads) and terminal ends on this project is concerning.
11. A large part of the justification for Restoration on Sitton Creek was the functional uplift generated by raising the channel and enhancing the riparian wetlands. A gauge should be installed near the confluence of Sitton Creek with Seniard Creek, to demonstrate functional uplift (pre-data should be provided to compare to monitoring data).
12. Section 3.6: Given the fact that four archaeological sites were identified within the project boundaries, please provide the location of these sites on a map, and provide the correspondence with SHPO.

13. Page 19, Sitton Creek: Given the fact that the justification for Restoration on this reach is based on the reference reach data, a performance standard should be added that this reach will match the reference stream channel geometry/morphological data.
14. Section 7.2.7: 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.
15. Section 7.3: It’s suggested to expand this section to include potential risks such as road and powerline maintenance, beaver, easement encroachments or hydrologic trespass, as appropriate.
16. Table 19: The 30-day consecutive flow in tributaries is only applicable to intermittent streams. Nearly continuous flow is expected in perennial channels.
    a. Where bank migration does occur, it should not exceed 10% of the bankfull width. The 20% bank migration threshold applies over the duration of monitoring.
    b. Please add a height standard for vegetation for monitoring years 5 and 7.
17. Please show the location of vegetation monitoring plots on figure 6.
18. Although there was a section on reference vegetative communities, the plan narrative did not include a discussion on vegetation establishment, targeted communities, species or planting dates. Please update.
    a. The design sheets only lists herbaceous and temporary seeding mixes. Please include a planting list for the Montane Alluvial Forest target community referred to in Section 7.1.2.
19. Please discuss the plan for fescue removal in conjunction with vegetation establishment.
20. Please discuss the pond removal planned for David Branch and plans for sediment removal in the pond bottom.
21. Sheet 10: Was there an existing ditch to be filled near the confluence of Sitton and Seniard Creeks?
22. Secton 4.2, page 19: The investigation of fish species diversity is helpful. Please discuss future plans to monitor fish, and which monitoring years it will take place. Please label the sample areas on the monitoring map.
23. The proposed ratio for Redmond Branch 1A of 5:1 is only acceptable depending on the amount of riparian buffer being replanted, and the number of log sills being installed. Please provide this information for justification.
24. The proposed ratio for Whitaker Branch should be closer to 8:1. Some supplemental planting in an existing buffer does not provide enough functional uplift to justify 5:1. Invasive removal is expected on all reaches and does not provide justification.

BROWNING.KIMBERLY.DANIELLE.1527683510
Digitally signed by BROWNING.KIMBERLY.DANIELLE.1527683510
Date: 2020.05.01 09:50:59 -04'00'

Kim Browning
Mitigation Project Manager
Regulatory Division

Stantec Consulting Services
56 College Street, Suite 201
Asheville NC 28801

May 29, 2020
File: Seniard Creek Stream Mitigation Project
Henderson County
French Broad River CU 06010105
DMS Project ID No. 100017 / DEQ Contract #7189
A/E Project ID No. 172621103

Attention: Kim Browning, Mitigation Project Manager
U.S Army Corps Engineers
3331 Heritage Trade Dr, Ste. 105
Wake Forest, NC 27587

Dear Kim Browning,

Reference: Final Mitigation Plan

EW Solutions has addressed the comments provided by the IRT for the review of the Draft Mitigation Plan. The following is a description and explanation of revisions that have been completed to address the comments:

Mac Haupt, NCDWR, May 1, 2020

Comment: (1) In the future please do a thorough Qualtiy Control check of the document. There were a number of pages (in the text portion) out of order and it made the review more time consuming.

Response: Stantec has noted this concern and has conducted a thorough review of the document. The PDF was complete, and the missing/disordered pages occurred in the hard copies only. We recognize this is not acceptable; it is not up to our standard and we apologize for the oversight.

Comment: (2) DWR likes the fact that fish sampling took place on Seniard Creek for the pre-construction phase, however; we did not see any mention of fish monitoring during the post-construction monitoring phase. DWR recommends fish sampling at some point to attempt to establish the work on Seniard reach 1A allowed fish passage through the culvert. In addition, this would help support the proposal for restoration credit being awarded for this reach, since it was initially proposed as EI.

Response: Post-construction fish monitoring will be added to the proposed monitoring plan.

Comment: (3a) Section 7.2 Design Approach - Seniard Creek - (1A) DWR can accept the proposed credit ratio for 1A provided the above fish monitoring occurs and a cross section is placed in the transition area mentioned below. DWR is not proposing success criteria for the fish monitoring, but it should be done to see if the fish populations are able or will move back and forth. DWR is concerned with the concept of a "threshold transition reach" as mentioned in the last paragraph on page 42 of the mitigation plan, for reach 1A. DWR requests that this section of reach 1A get monitored closely; DWR recommends adding the cross section mentioned above, photos, and periodic (more than once a year) on-site visual assessment.

Response: A monitoring cross section will be added to the threshold transition reach, periodic, on-site visual assessment shall be conducted during annual monitoring and following significant storm events during the monitoring period.

Comment: (3b) Section 7.2 Design Approach - Sitton Reach - As you may recall, there were extensive discussions on site at this reach concerning the movement of this reach into the valley and removing it from some considerable amount of in stream habitat. DWR is willing to accept the design approach, however; we will require a couple of wetland monitoring gauges placed in the floodplain to verify the wetland hydrology has been restored/maintained.

Response: Groundwater monitoring wells will be installed along Sitton Branch in locations where hydric soils will be rehydrated to demonstrate wetland uplift.

Comment: (3c) Section 7.2 Design Approach - David Branch- DWR maintains its concern for the lower reach of this tributary and its probable transition to more of a linear wetland.

Response: Stantec notes DWR's concern and submits that this risk will be mitigated by the moderate channel slope (4.3-8.5%) and with the installation of closely spaced transplants along both banks of David Branch – Reach 1C. Live stake installation is the typical streamside revegetation protocol, but transplants (willow, alder and silky dogwood, harvested from Seniard Creek – Reach 1B) will provide more full and immediate shade to prevent herbaceous growth from establishing within the channel bed.

Comment: (3d) Section 7.2 Design Approach - DWR does not believe proposed cross-sections for both the Whitaker and Redmond Branches are necessary.

Response: Whitaker Branch and Redmond Branch – Reach 1A channel dimensions have been removed from Table 1 on the Typical Sections sheet (sheet 2) of the plan set.

Comment: (4) Section 8.1- Determination of Credits- recalling the site visit, and our response to the minutes, DWR does not believe the reaches Whitaker and Redmond Branches warrant a 5:1 credit ratio. DWR believes a credit ratio of 7.5:1 or 8:1 is more fitting given the likely functional uplift for these two reaches.

Response: The proposed credit ratio has been revised to 8:1 for Whitaker Branch and 7:1 for Redmond Branch.

Reference: Final Draft Mitigation Plan

Comment: (5) Appendix A- Photo Log- There were no photos of Whitaker or Redmond Branches.

Response: Photos of Whitaker and Redmond Branches have been added to the photo log.

Comment: (6) Design sheets- Sheet 1A- it is likely that the riparian area between Sitton and Seniard will wet up considerably. In fact, it is likely to wet up outside the current easement lines. DWR suggests the easement be adjusted to account for this possible condition. In the past, the IRT has seen landowners come in a ditch immediately adjacent to the easement thereby decreasing the functional uplift of the adjacent wetlands. While DWR realizes there is not wetland credit on this site, one of the main reasons we are allowing the channel on Sitton to be moved is because of the restoration of the riparian wetlands.

Response: The proposed conservation easement has already been recorded and represents the maximum footprint the property owners were willing to concede. It will not be possible to adjust the easement in this location to capture additional hydric soils. The location referenced in the above comment will be utilized as a waste location for excess soil. The grade outside of the conservation easement boundary will be raised and the likelihood of hydrologic trespass in that location will be reduced.

Comment: (7) Design sheet 3- DWR is concerned with the lack of a footer log for the Brush Run detail. Preventing undercutting and/or headcutting will be vital to the success of the above "threshold transition reach" on Seniard 1A.

Response: Stantec notes DWR's concern. This detail depicting a single log supporting the Brush Run represents the typical construction technique and has been implemented many times without adverse effects. The log in the detail serves the function of a footer to the structure, and the dimensions of the log/logs, the relative grade at which they are installed, the nature of the brush/cobble backfill material and the overall structure configuration reduce the risk of headcutting to the point where Stantec does not consider that to be a major concern with respect to profile stability.

Comment: (8) Design sheet 10- Where is the existing bed elevation after station 210+85?

Response: Existing Sitton Creek ends at its confluence with Seniard Creek at approximate proposed station 210+85, and is therefore nonexistent for the remainder of proposed Sitton Creek. The proposed abandoned channel depicted as proposed fill on sheet 10 is existing Seniard Creek; therefore, it would be inaccurate to depict the existing bed profile on the proposed Sitton Creek profile grid.

Comment: (9) Design sheet 11- What is the purpose of the proposed groundwater curtain? Have you used these in the past and did they work? Are you expecting flow issues? DWR does not recall this reach's restoration approach being a headwater valley. Was the credit calculated as valley length?

Reference: Final Draft Mitigation Plan

Response: At the upstream end of Lee Branch, upstream of the conservation easement, piping and subsurface flow were observed. A groundwater curtain is proposed to encourage the lifting of groundwater hydrology at the upstream reach of Lee Branch. This approach has been implemented successfully in the past to provide what amounts to a groundwater dam, forcing the subsurface hydrology closer to the surface upstream of the installation location.

The restoration approach for Lee (as well as David) Branch is **not headwater valley restoration** but represents the configuration of a small channel positioned at the upper extents of the watershed. "Headwater Channel" is simply the nomenclature selected by Stantec to indicate the implementation of a different channel construction technique utilized for building small channels positioned high in the watershed before a point at which alluvial process dominates (total drainage area not exceeding 0.1 mi^2 for this specific physiographic region). This restoration approach acknowledges that alluvial process is not the dominant channel forming process at this point in the watershed and calls for installation of woody material in the channel bed matrix to provide form roughness. As the restoration approach is to restore a small headwater stream, credit was calculated along the proposed stream centerline.

Comment: (10) Design sheets 12-14- these design sheets show David Branch being constructed as a headwater channel. There was no mention of this type of approach in Section 7.2, nor was this discussed on site. If this approach is to move forward DWR needs to be assured that the credit was calculated as a headwater valley and another stream gauge will need to be installed. Please install a stream gauge mid-reach on David Branch 1B. In addition, DWR will require two wetland gauges on David Branch, one installed at station 404+00, stream left, and the other at station 406+00 stream right. Moreover, it is likely that the reach may lose flow around station 407+00.

Response: As described in the previous comment response, the restoration approach on David Branch is **not headwater valley restoration**.

A groundwater curtain has been added to the plans on sheets 9 and 14 to mitigate against the potential loss of flow at station 407+00.

Comment: (11) Design sheet 16- We did not see any discussion of the water quality feature in the text of the document. However, we did find it in Appendix B in Grant Ginn's letter. This should have been in the primary text of the Mitigation Plan. Are the 4 pool features intended to dry out?

Response: Language has been added to section 7.2.4 indicating function and purpose of wetland pockets.

Comment: (12) Given the time that has gone by since the initial IRT site visit and the changes proposed, typically, we would want another site visit to discuss and go over the changes. However, with the current pandemic situation, this will not be possible. So, DWR will expect a thorough response to our comments as well as others from the IRT. This may require a conference call or Teams meeting to facilitate sharing of information and discussion.

Reference: Final Draft Mitigation Plan

Response: Agreed. We look forward to the opportunity to connect virtually.

Andrea Leslie, NCWRC, May 1, 2020

Comment: (1) Rainbow Trout are found in the project vicinity, and there is a nice wild Brown Trout population in downstream North Mills River. To minimize impacts to trout reproduction, instream work should be avoided between October 15 and April 15.

Response: Noted.

Comment: (2) The project is just upstream of the Mills River Aquatic Habitat, a natural area rated Very High by the NC Natural Heritage Program due to the richness of rare species it contains. Near the project, the North Mills River hosts the Eastern Hellbender [Cryptobranchus alleganiensis, US Federal Species of Concern (FSC), NC Special Concern (SC)], Olive Darter (Percina squamata, NC SC), Slippershell (Alasmidonta viridis, US FSC, NC Endangered), French Broad Crayfish [Cambarus reburrus, US FSC, NC Significantly Rare (SR)], and Blotched Chub (Erimystax insignis, US FSC, NC SR).

Response: Noted.

Comment: (3) Excellent erosion and sediment control is needed on this project to minimize impacts to the important aquatic community the North Mills River.

Response: We understand the sensitive nature of the receiving waters and are proposing an erosion and sediment control plan to protect these resources.

Comment: (4) I'm very glad to see the attention given to wetland restoration and am especially appreciative of this, as there will be no wetland credit generated by the project.

Response: Noted and appreciated.

Comment: (5) The woody species list for riparian and wetland planting is missing.

Response: The woody species list has been added to the planting plans.

Andrea Leslie, NCWRC, May 28, 2020

Comment: (1) There will be long sections of Seniard Creek (approx. 800 ft) and Sitton Creek (approx. 900 ft) that will be newly constructed channels. The mitigation plan notes harvesting substrate from Sitton Creek for the new channel but does not note this for Seniard Creek.

Response: Existing bed material harvest is planned to occur on both Sitton and Seniard Creeks.

Comment: (2) We would like to understand how this work will be staged. How and when will substrate from the existing channels be harvested and placed into the new channels? We would

Reference: Final Draft Mitigation Plan

like to better understand whether the substrate will be harvested from the old channels while flowing or not; if yes, we ask the designer to describe measures to control turbidity. In addition, it is necessary for the designer to rescue/move aquatic animals that are abandoned in the old channels. This can also aid in jumpstarting the biological community within the new channel segments.

Response: Language describing construction phasing can be found within the Phasing of Work section (Sheet EC-2A) of the Seniard Creek Final Plans – Revision 1, located within Appendix B of the Final Mitigation Plan. All channel construction, including existing bed material harvest, shall be performed in the dry using off-line construction techniques and/or pump-around operations.

When a portion of channel is dewatered for the first time, as well as immediately prior to the harvest of existing bed material, the contractor shall collect and relocate all stranded aquatic creatures observed within that dewatered reach to a protected location. A line item for Aquatic Animal Rescue and Relocation shall be included in the bid tab to ensure the contractor exercises proper diligence when dewatering reaches and rescuing stranded aquatic animals.

Kim Browning, USACE, May 1, 2020

Comment: (1) When submitting the PCN, please include an estimate of the number of trees, or acres, to be cleared for the NLEB 4(d) Rule.

Response: An estimated clearing area will be provided at the time of PCN submittal.

Comment: (2) General Comments: In future mitigation plans, please locate all the maps/figures in one appendix for easier viewing. Also, please QC the document for errors and organization. Pages 51-58 and 65-66 appear to be missing.

Response: We will modify the order and format of mitigation plans or any subsequent projects. We apologize for the page omissions in the hard copy. We recognize this is not acceptable; it is not up to our standard and we apologize for the oversight.

Comment: (3) Section 3.7: This section states that there are no anticipated land use changes that would influence this project; however, a portion of Seniard Reach 1A is adjacent to a road. Please discuss the potential for road maintenance. Additionally, overhead powerlines cross the project in many areas, please discuss the maintenance and potential affect on the easement.

Response: Two existing overhead utility lines have already been relocated to reduce the impact to the conservation easement boundary footprint, and we recognize this remains a concern. Language will be added to section 3.7 indicating potential utility maintenance incursions into the easement and steps that can be taken to minimize potential impacts.

Reference: Final Draft Mitigation Plan

Comment: (4) There is a section of David Branch Reach 1C that has an overhead powerline, near the confluence with Sitton Creek. Please remove this section from credit and update Figure 4, and Talbe 18A if necessary.

Response: This was an oversight in graphical representation only. We did not include the footage from that location in the credit calculations. Figure 4 will be revised to accurately depict creditable/excluded footage.

Comment: (5) During the IRT site visit Aug 29, 2017, a portion of Seniard Creek was proposed as EI, with benches and structures planned, but it was noted that were existing benches, pools and riffles. Please justify why it was changed to Restoration.

Response: We have elaborated on this justification in the narrative. Please see section 7.2.1.

Comment: (5a) I agree with DWR's comment #12.

Response: Noted.

Comment: (6) It was noted during the site visit that David Branch Reach 1C was a wetland system and stream flow was questionable. It was proposed for restoration in the technical proposal. Constructing a channel through this area will impact existing wetlands. Wetland gauges will need to be installed in this area. This area is now proposed as a headwater channel, which is inappropriate considering it is in the middle of a restoration reach, and not the origin of the stream. A flow gauge will need to be installed in this area to demonstrate stream flow, and stream characteristics should be addressed in the performance standards (maintain an Ordinary High Water Mark).

Response: Please refer to our response to DWR comments 9 and 10.

Comment: (7) Lee Branch was proposed as EII during the technical proposal. The IRT discussed the possibility for EI on the reach since it needed benches, and berm removal on one side. What is the justification for Restoration on this reach? Additionally, page 20 mentions that the stream flows subsurface for 75 feet. Is this the area that is piped and will have a groundwater barrier? Inconsistent data found in Table 14 and on page 39 suggest raising the channel with a Priority II. Please provide more justification for restoration in the narrative.

Response: Site constraints, indicated functional uplift potential and inadequate ability to provide buffer precluded enhancement of the channel in place and required relocation of the stream. The subsurface flow occurs immediately upstream of the project site. The groundwater curtain is proposed to provide hydrologic reconnection to the offsite reach, provided the channel profile is lifted onsite. Upon performing a functional assessment, results indicated the system to be functioning at a marginal level, due in part to past dredging, subsurface baseflow, an excessive fine fraction in the bed material, a lack of community connectivity and minimal buffer width.

Implementing the restoration approach allows for the uplift from Marginal to Optimal function. As such, EW is seeking restoration credit.

Comment: (8) It is appreciated that you widened the buffers on Redmond and Whitaker Branch to capture more of the existing wetlands, but it would be beneficial to capture all of Wetland W01.

Response: The easement is already recorded and cannot be adjusted. The property owner was not agreeable to increasing easement footprint at this location due to existing infrastructure requirements.

Comment: (9) The technical proposal showed a BMP along the road, near Wetland W09, but this is not shown on the current figure 4 Assets Map.

Response: This feature was originally intended to capture runoff from a roadway pipe that was thought to discharge in a manner that caused excessive erosion onsite. On further investigation, it was determined the pipe discharges into wetland W09 and that stabilizing the outfall, which currently is not producing excessive sedimentation, would impact wetland W09. In order to avoid disturbing W09, Stantec proposes to excavate the overburden adjacent to the existing wetland to increase the area available for settling any sediment generated by the road surface.

Comment: (10) Table 18B Buffer Credit Adjustment: Site wide, what percentage of the actual buffers do not meet the minimum 30 ft. buffers? (More than 5%?) It appears that using the buffer tool caused a loss of 244.06 credits. Please provide the Ideal buffer map and the buffer tool spreadsheet. The number of crossings (powerlines and roads) and terminal ends on this project is concerning.

Response: Total buffer widths less than the minimum 30-foot width comprise approximately 8% of the site. Stantec will submit the figure depicting sitewide buffer widths as well as the buffer tool spreadsheet with digital documentation.

Comment: (11) A large part of the justification for Restoration on Sitton Creek was the functional uplift generated by raising the channel and enhancing the riparian wetlands. A gauge should be installed near the confluence of Sitton Creek with Seniard Creek, to demonstrate functional uplift (pre-data should be provided to compare to monitoring data).

Response: At that location, a groundwater gauge will be added to the monitoring features figure.

Comment: (12) Section 3.6: Given the fact that four archaeological sites were identified within the project boundaries, please provide the location of these sites on a map, and provide the correspondence with SHPO.

Response: Correspondence with SHPO is now included in Appendix C, and the archeological locations are now provided on Figure 3.

Reference: Final Draft Mitigation Plan

Comment: (13) Page 19, Sitton Creek: Given the fact that the justification for Restoration on this reach is based on the reference reach data, a performance standard should be added that this reach will match the reference stream channel geometry/morphological data.

Response: The channels are designed based on reference data. As long as the channel maintains geometry and meets performance standards it will match reference parameters.

Comment: (14) Section 7.2.7: It would be beneficial to add some coarse woody debris to the depressional areas in the buffers and throughout the adjacent wetlands for habitat, and to help store sediment, increase water storage/infiltration, and absorb water energy during overbank events

Response: Agreed. Coarse woody debris will be placed at locations throughout the buffer to provide habitat, roughness and complexity to the system.

Comment: (15) Section 7.3: It's suggested to expand this section to include potential risks such as road and powerline maintenance, beaver, easement encroachments or hydrologic trespass, as appropriate.

Response: Section 7.3 has been expanded to include these potential risks.

Comment: (16) Table 19: The 30-day consecutive flow in tributaries is only applicable to intermittent streams. Nearly continuous flow is expected in perennial channels.

Response: Language has been corrected.

Comment: (16a) Where bank migration does occur, it should not exceed 10% of the bankfull width. The 20% bank migration threshold applies over the duration of monitoring.

Response: Language has been corrected.

Comment: (16b) Please add a height standard for vegetation for monitoring years 5 and 7.

Response: A height standard has been added for vegetation in monitoring years 5 and 7.

Comment: (17) Please show the location of vegetation monitoring plots on figure 6.

Response: Vegetation monitoring plots are now depicted on Figure 6.

Comment: (18) Although there was a section on reference vegetative communities, the plan narrative did not include a discussion on vegetation establishment, targeted communities, species or planting dates. Please update.

Reference: Final Draft Mitigation Plan

Response: Language has been updated to describe vegetation establishment, targeted communities, species and planting dates.

Comment: (18a) The design sheets only lists herbaceous and temporary seeding mixes. Please include a planting list for the Montane Alluvial Forest target community referred to in Section 7.1.2.

Response: A woody species planting schedule has been added to the plans.

Comment: (19) Please discuss the plan for fescue removal in conjunction with vegetation establishment.

Response: Language has been added to describe fescue removal.

Comment: (20) Please discuss the pond removal planned for David Branch and plans for sediment removal in the pond bottom.

Response: The pond breaching elevation will not go lower than existing sediment levels in the pond. The Intent is not to remove sediments from the pond, but to turn the pond bottom into a wetland with relocated hydric soils.

Comment: (21) Sheet 10: Was there an existing ditch to be filled near the confluence of Sitton and Seniard Creeks?

Response: The existing ditch is depicted on plan sheet 9.

Comment: (22) Section 4.2, page 19: The investigation of fish species diversity is helpful. Please discuss future plans to monitor fish, and which monitoring years it will take place. Please label the sample areas on the monitoring map.

Response: Language has been added to describe future fish monitoring efforts and sample locations have been added to the monitoring figure.

Comment: (23) The proposed ratio for Redmond Branch 1A of 5:1 is only acceptable depending on the amount of riparian buffer being replanted, and the number of log sills being installed. Please provide this information for justification.

Response: We are no longer proposing log sill installation on Redmond Branch – Reach 1A. The credit ratio is revised to 7:1.

Comment: (24) The proposed ratio for Whitaker Branch should be closer to 8:1. Some supplemental planting in an existing buffer does not provide enough functional uplift to justify 5:1. Invasive removal is expected on all reaches and does not provide justification.

Response: Credit ratio for Whitaker Branch has been revised to 8:1.

Reference: Final Draft Mitigation Plan

Thank you for the opportunity to respond to these comments. Please do not hesitate to reach out if any additional information is necessary.

Respectfully,

Christopher Engle
Associate
Phone: (828) 229-8446
chris.engle @stantec.com

Attachment: Seniard Creek Stream Mitigation Plan

c. C.C.

Page left intentionally blank for printing purposes.

SENIARD CREEK MITIGATION SITE
MITIGATION PLAN

Mitigation Plan Preparation

Mitigation Provider:

EW Solutions, LLC
37 Haywood Street, Suite 100
Asheville, NC 28778
(828) 253-6956

Project Manager: David Tuch

Design and Mitigation Plan Preparation Firm:

Stantec Consulting Services Inc.
56 College Street, Suite 201
Asheville, NC 28801
(828) 449-1930

Senior Engineer: Chris Engle, PE
Senior Scientist: J. Randall Walsh, MSc., CERP

Environmental Services Firm:

Equinox Environmental
37 Haywood Street, Suite 100
Asheville, NC 28778
(828)253-6856

Senior Scientist: Danvey Walsh

Regulatory Compliance

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.

Page left intentionally blank for printing purposes.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Page left intentionally blank for printing purposes.

1.0 INTRODUCTION

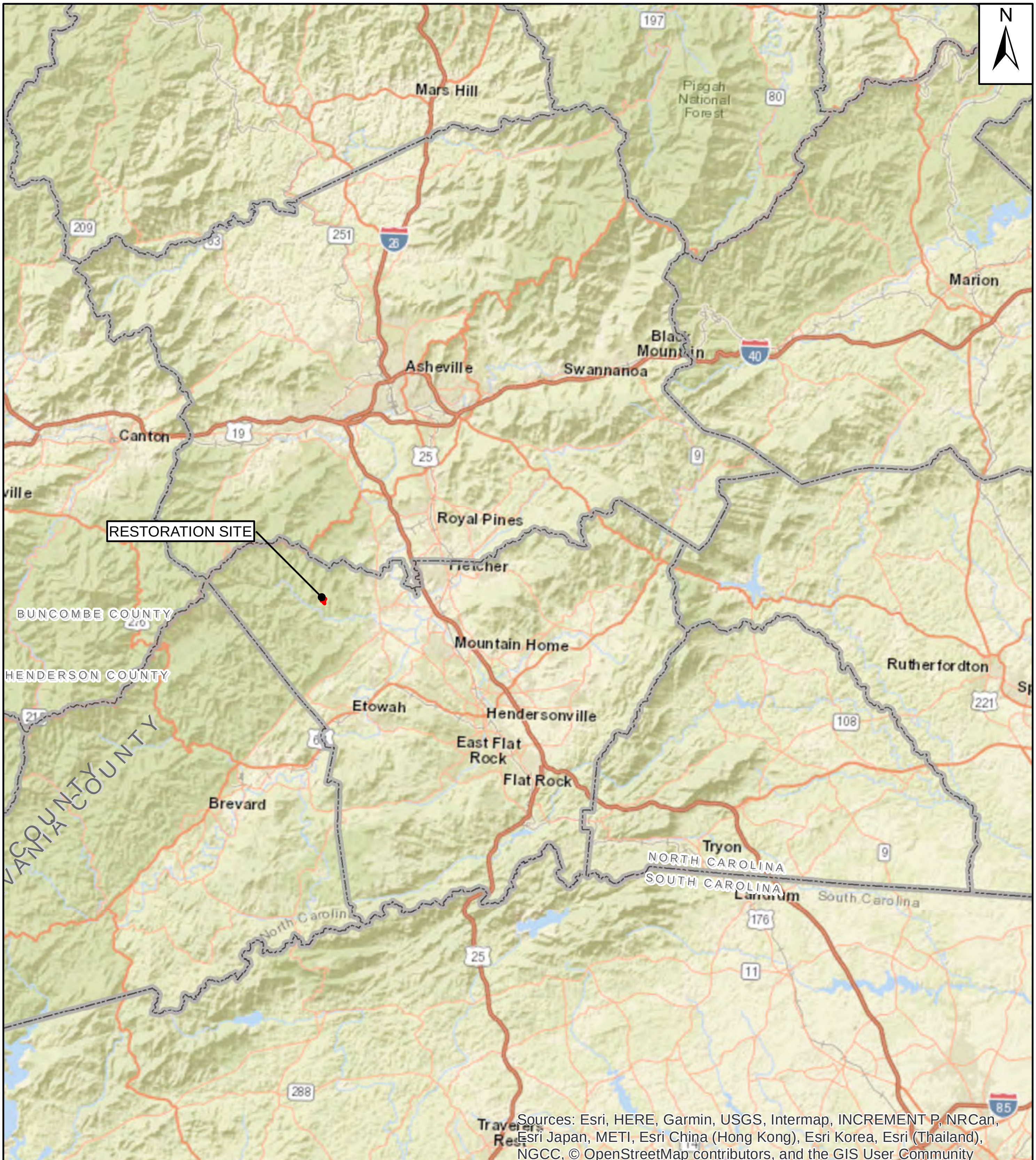
EW Solutions (EWS) proposes to restore and protect six streams and associated riparian corridors in Henderson County as a full-delivery mitigation project for the North Carolina Division of Mitigation Services (DMS). The Seniard Creek Stream Mitigation Site (the Site) is located approximately 1.7 miles north-northwest of the Town of Mills River, NC in Henderson County (Figure 1). The Site encompasses approximately 11.8 acres of agricultural and forested land and consists of portions of two named streams (Sitton Creek and Seniard Creek) along with four unnamed tributaries. Sitton Creek drains into Seniard Creek near the center of the project area, and Seniard Creek then flows southwestward off the Site before its confluence with the North Mills River. This mitigation plan describes the details, methods, and protocols to provide restoration, enhancement, and preservation activities of the project streams.

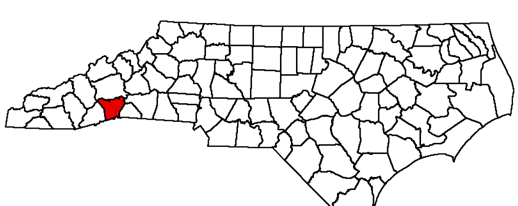
Historic land use at the Site has consisted primarily of agriculture and livestock grazing. Additional land use practices, including excavation of drainage ditches, maintenance and removal of riparian vegetation and relocation, dredging, and straightening of streams have contributed to the unstable channel characteristics, degraded water quality, and degradation of prior wetlands. Current stream conditions at the Site consist of incised channel with unstable banks and limited riparian buffers. Seniard Creek and Sitton Creek flow through active pastures with past livestock access to the streams. The terrace adjacent to Sitton Creek contains approximately 2.35 acres of mapped relict hydric soils that have been abandoned and isolated by the past relocation of the stream to the edge of the valley.

The goal of the project is to restore ecological function to the existing streams, floodplains and riparian corridors. Measures to promote functional uplift will include returning the degraded streams to a stable condition, restoring floodplain connectivity, removing invasive plant species, and revegetating the riparian area with native plant species appropriate for the given valley and watershed conditions. Benefits of grading activities will be to improve riparian hydrology and increase hydrologic access of the floodplain for overbank flows. Stream restoration activities will also yield improved water quality by re-establishment of a wooded riparian area and stabilized stream banks resulting in reduced downstream sediment load. Improvement of terrestrial and aquatic habitats will result from removal of invasive plant species, re-establishment of native vegetation in the riparian buffer, improved landform complexity associated with the floodplain grading, and improved stream habitat complexity.

TABLE 1 PROJECT DESCRIPTORS

Project Descriptors	
River Basin	French Broad
Hydrologic Unit Code (HUC)	06010105
Physiographic Region	Blue Ridge Mountains
EPA Level IV Ecoregion	Southern Crystalline Ridges and Mountains (66d)
Latitude/Longitude	35°24'32.6"N 82°37'39.6"W
Street Address	Dave Whitaker Rd., Mills River, NC 28742
Existing Stream Length (ft)	5,385 linear feet
Existing Wetland Area (ac)	0.823 acres
Expected Stream Mitigation Units (SMU)	3648.65 stream mitigation units





HENDERSON COUNTY, NC

FIGURE 1. SITE LOCATION MAP
SENIARD RESTORATION SITE

STREAMS: SITTON CREEK, SENIARD CREEK
RIVER BASIN: FRENCH BROAD
HUC (8 DIGIT): 06010105

0 1 2 4 6 8 Miles

Stantec

Date: 1/23/2019

Page left intentionally blank for printing purposes.

2.0 WATERSHED APPROACH AND SITE SELECTION

The Site was selected to support the DMS watershed planning approach to restoration activities. A product of the watershed planning by the DMS was the development of the River Basin Restoration Plans (RBRP) to identify restoration goals and targeted local watersheds (TLW). The Site lies in the North Fork Mills River watershed, which is identified as a Targeted Local Watershed according to the 2009 French Broad River Basin Restoration Priorities Plan (RBRP) (NCDMS 2009). The French Broad RBRP identifies several major stressors that are predominant in the watershed and are contributing to degradation of water quality and natural resources. A list of preliminary project goals has been developed to identify how the project will help to address the degrading factors of the overall watershed. The table below illustrates the linkage between the watershed stressors and the preliminary goals. These preliminary goals will be further defined and expanded in Section 6 of this report following the functional assessment of the existing site conditions.

TABLE 2 WATERSHED STRESSORS AND PRELIMINARY PROJECT GOALS

Stressors	Preliminary Goals
Streambank erosion Streambed scour Habitat degradation associated with sedimentation	Reduce sediment inputs from eroding stream banks Restore proper sediment transport Improve substrate quality
Excess fecal coliform Nutrient enrichment	Reduce pollutant inputs to the project streams (fecal coliform, nitrogen, phosphorus)
Habitat Fragmentation	Improve biological communities within the site Improve landscape connectivity

Page left intentionally blank for printing purposes.

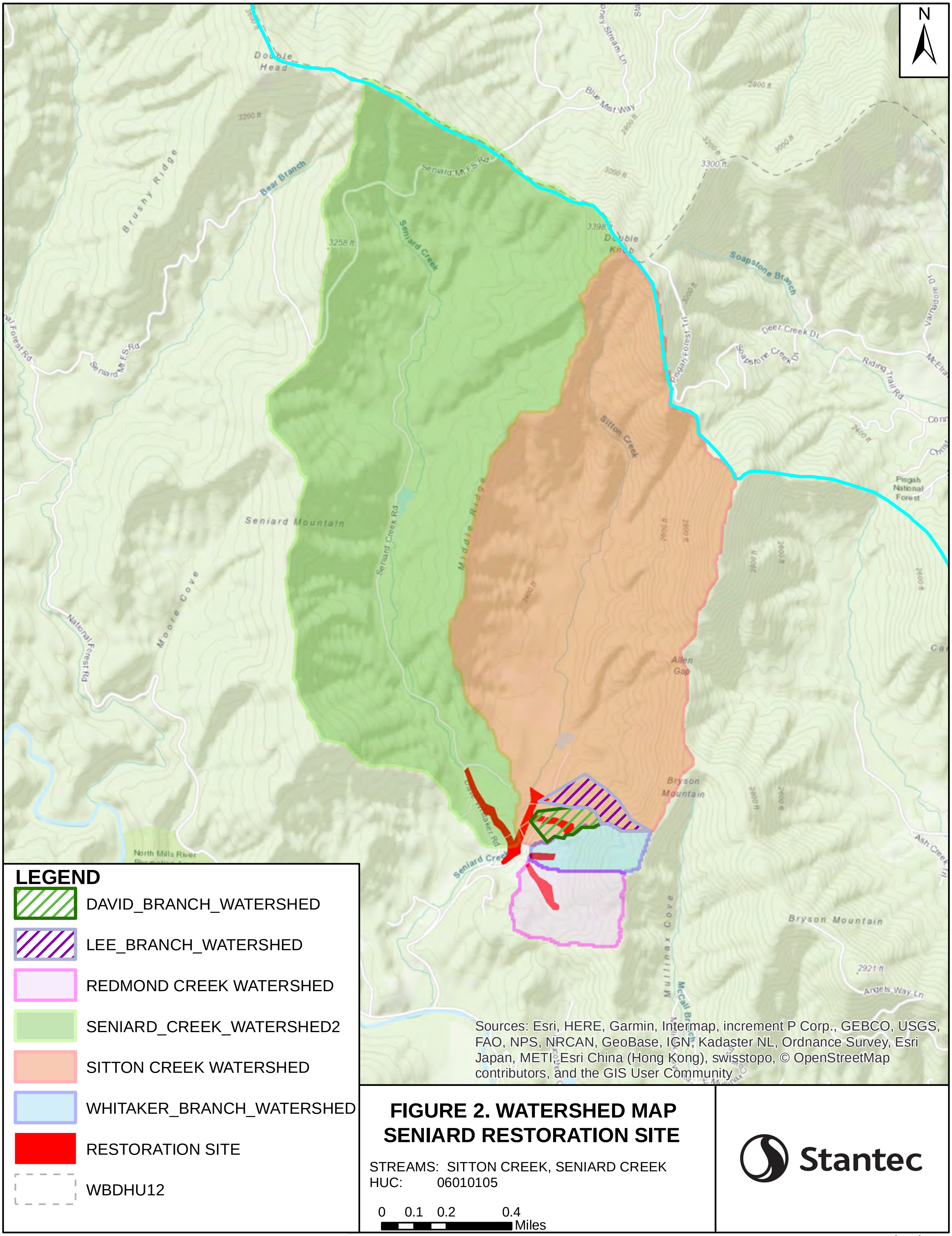


FIGURE 2. WATERSHED MAP
SENIARD RESTORATION SITE

STREAMS: SITTON CREEK, SENIARD CREEK
HUC: 06010105

Stantec

Date: 1/24/2019

Page left intentionally blank for printing purposes.

3.0 WATERSHED AND RESOURCE CONDITIONS

Investigations into the existing resource conditions were conducted as a part of the Environmental Resource Technical Report (ERTR), dated February 2018, prepared by Equinox Environmental. A summary of the findings from the ERTR are presented in the following sections and include jurisdictional determinations for aquatic resources and effects on threatened and endangered species. Investigations were conducted to evaluate historical land use and future development trends, which included review of available historical aerial and satellite imagery, interviews with local residents and property managers, and interviews with planning authorities. Additionally, investigations were conducted into the geology, physiography, and soil properties which included review of the geologic mapping by the NC Geologic Survey, topographic mapping of the Site, and the county Soil Survey. The following sections summarize these findings and their potential influence on the characteristics of the Site.

3.1 USGS HYDROLOGIC CODE AND NCDWR RIVER BASIN DESIGNATIONS

Sitton Creek Drains into Seniard Creek, which drains to the North Mills River, part of the French Broad River watershed. Table 3 lists the watershed designations for the Site.

TABLE 3 WATERSHED DESIGNATIONS

Watershed Designations	
River Basin	French Broad
DWR Sub-basin	04-03-03
Watershed	North Mills River
Hydrologic Unit Code (HUC)	060101050403
NCDWR Classification (1992)	WS-II; Tr; HQW
Thermal Regime	Cold
EPA 303(d) List	Not Listed

3.2 WATERSHED CHARACTERIZATION

A significant portion of this watershed is in the Pisgah National Forest and 94% of the watershed's landcover is forested. The remaining land uses are comprised of agriculture and rural residential use. There are no significant developments within the watershed that are altering the hydrologic regime. Henderson County receives moderate rainfall, having an annual precipitation averaging approximately 56 inches according to the NRCS National Water and Climate Center.

TABLE 4 WATERSHED CHARACTERIZATION

Watershed Characterization						
Reach	**DA (mi^2)**	**DA (ac)**	**Forest**	**Agriculture**	**Residential**	**Impervious**
Seniard Creek	2.47	1580	94%	4%	1%	<1%
Sitton Creek	0.99	633	93%	5%	1%	<1%
Redmond Branch	0.07	45	86%	13%	<1%	<1%
Whitaker Branch	0.04	26	77%	22%	<1%	<1%
David Branch	0.017	11	90%	9%	<1%	<1%
Lee Branch	0.023	15	94%	5%	<1%	<1%

3.3 PHYSIOGRAPHY, GEOLOGY, AND SOILS

The Site lies in the Southern Crystalline Ridges and Mountains (66d) Level IV ecoregion of the Blue Ridge Level III ecoregion (Griffith et al. 2002). This ecoregion contains the highest and wettest mountains in western North Carolina and are underlain by Precambrian aged igneous and high-grade metamorphic rocks. Soils are typically deep, well drained, loamy to clayey Fluventic Humudepts and Fluvaquentic Dystrudepts, with variation between upland and lowland terraces. The surrounding geology provides the underlying valley forms, soils and stream substrate but does not represent any unexpected constraints or limitations on the natural stream process.

The valleys associated with the project streams are generally moderate and gently-sloped, colluvial forms. These valleys present structurally influenced morphology which acts to limit channel belt-width development and support low sinuosity plan form. The depth to bedrock exposure does not prevent channel incision from becoming significant. A granitic bedrock outcrop was identified downstream of the project limits during site investigation and was determined to pose no risk to the project. Gravel is present in sufficient quantities throughout the soil profile to support primarily gravel bed streams.

TABLE 5 PHYSIOGRAPHIC AND GEOLOGIC CHARACTERIZATION

Physiography and Geology			
	Level IV Ecoregion	Southern Crystalline Ridges and Mountains	
	Local Lithology	Blue Ridge Belt - Gneiss and Schist	
	Soil Class	Codorus, Rosman, Brevard, Evard and Edneyville	
	Elevation Range	2,670-3,680 ft. msl.	
Reach	Valley Form	Cross Slope	Longitudinal Slope
Seniard Creek	Colluvial (moderate)	3% to 10%	2%
Sitton Creek	Colluvial (moderate)	3% to 10%	1.5%
Lee Branch	Colluvial	5% to 20%	6%
David Branch	Colluvial	10% to 40%	5% to 11%
Whitaker Branch	Colluvial	10% to 30%	10%
Redmond Branch	Colluvial	10% to 30%	5% to 10%

3.4 JURISDICTIONAL DETERMINATIONS

As documented in the ERTR, Seniard Creek, Sitton Creek, Redmond Branch, Whitaker Branch, Lee Branch, and David Branch all scored either perennial or intermittent with scores of 42, 44.5, 39.5, 35.75, 32.25, using the NCDWR rating methodology (see Appendix J for NCDWR Stream Classification Forms). Nine pocket wetlands were also verified during the jurisdictional determination process on Redmond Branch, Whitaker Branch, David Branch, Sitton Creek, and Seniard Creek totaling 0.79 acre. (see Figure 3). The preliminary JD (Action ID SAW-2017-01571) for the project site has been completed and can be found in Appendix K.

3.5 THREATENED AND ENDANGERED SPECIES

As documented in the ERTR, and as summarized in Table 6 below, the project is expected to have no effect on any threatened and endangered species listed in the USFWS ECOS database with the possible exception of the Northern Long-Eared Bat (NLEB). Follow-up consultation with the USFWS determined that the project could involve incidental take of the NLEB, however this is not prohibited by the final 4(d) rule.

TABLE 6 THREATENED AND ENDANGERED SPECIES LIST FOR THE SENIARD SITE

Species	Scientific Name	Federal Status	Biological Conclusion
Appalachian Elktoe	*Alasmidonta raveneliana*	Endangered	No Effect
Bunched Arrowhead	*Sagittaria fasciculata*	Endangered	No Effect
Mountain Sweet Pitcher Plant	*Sarracenia rubra ssp. jonesii*	Endangered	No Effect
Small Whorled Pogonia	*Isotria medeoloides*	Threatened	No Effect
Swamp Pink	*Helonia bullata*	Threatened	No Effect
White Irisette	*Sisyrinchium dichotomum*	Endangered	No Effect
Northern Long-eared Bat	*Myotis septentrionalis*	Threatened	May Affect
Gray Bat	*Myotis grisescens*	Endangered	No Effect
Carolina Northern Flying Squirrel	*Glaucomys sabrinus coloratus*	Endangered	No Effect
Bog Turtle	*Clemmys muhlenbergii*	Threatened/ SA*	No Effect

* Threatened due to Similarity of Appearance

3.6 CULTURAL RESOURCE INVESTIGATION

As documented in the ERTR, archaeological surveys were conducted for the Site on January 12, 2015, and again in August 2017. These studies were conducted to evaluate the presence and location of significant cultural resources within the Site in order to comply with Section 106 of the National Historic Preservation Act. A review of properties listed on the North Carolina National Register of Historic Places maintained by the North Carolina State Historic Preservation Office (NCSHPO 2017) was conducted for the Site and surrounding areas. No historic properties are known to have existed on the project parcels.

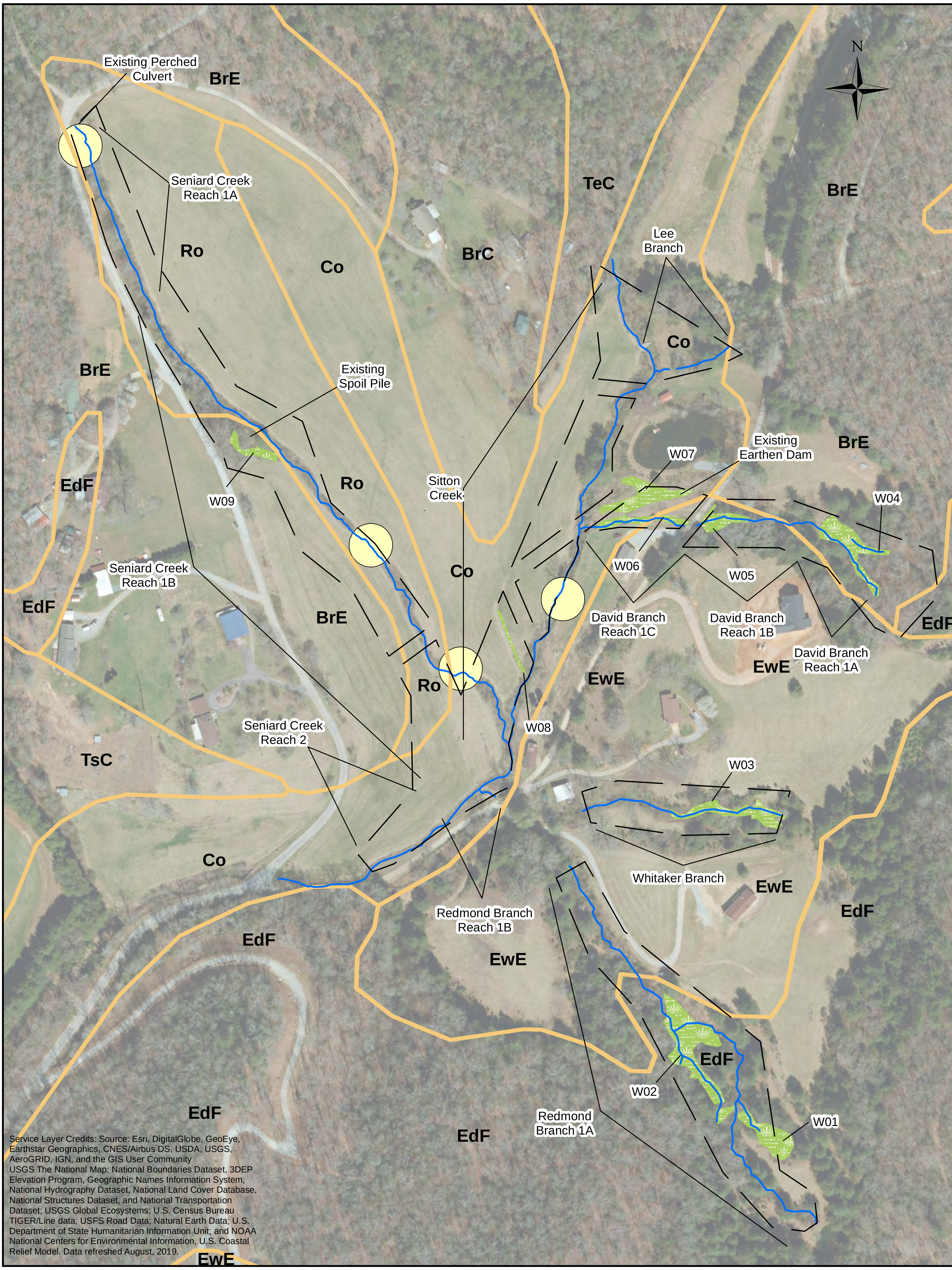
The 2017 survey did result in the identification of four archaeological sites within the project boundaries (see Figure 3). However, all four of these sites are recommended not eligible for the National Registry of Historic Places (NRHP) based on the low density of artifacts encountered. The findings of the archaeological report were sent to the SHPO office which concurred with the recommendation to continue with the project since the project will not involve any significant archaeological issues.

3.7 HISTORICAL LAND USE AND DEVELOPMENT TRENDS

Historical land use at the Site has consisted of agriculture and forestry. Additional land use practices, including the maintenance and removal of riparian vegetation and the relocating, dredging, and straightening of on-site streams have contributed to unstable channel characteristics and degraded water quality. Ditches have been excavated and maintained to facilitate drainage of the lower floodplains and to maximize agricultural use. Also, the upper reaches consisting of steep, forested headwaters have been subject to historic logging. The project area has been highly manipulated historically and portions have been under active agricultural management for at least 65 years as demonstrated in historical aerial photos.

Land use changes are not anticipated within the watershed and development pressure is relatively low, although one potential future stressor is utility maintenance. There are several utility easements and roadways adjacent to or crossing the conservation easement which will likely require some maintenance in the future. There exists the potential for future utility maintenance efforts to impact the stream system, and any impacts will likely have to be addressed via adaptive management throughout the life of the project.

Page left intentionally blank for printing purposes.



Legend

- Conservation Easement
- Existing Streams
- Soil Boundary
- Approximate Archaelogical Site Locations (See Appendix C - TRC Archaelogical Report)
- Existing Wetland

Henderson County Soil Map Units
BrC - Brevard loam, 7 -15% slopes
BrE - Brevard loam, 15-25% slopes
Co - Codorus loam (arkaqua)
EdF - Edneyville fine sandy loam, 25-45% slopes
EwE - Evard soils, 15-25% slopes
Ro - Rosman loam
TeC - Tate fine sandy loam, 7-15% slopes
TsC - Tusquitee loam, 7-15% slopes

Feet
0 80 160 320

Stantec

Figure 3: Existing Features & Soils Map

Seniard Creek Mitigation Site
Henderson Co., NC
May 2020

This map is not a survey and is not to be construed as such.

Page left intentionally blank for printing purposes.

4.0 SITE CONDITIONS

The following assessment of existing stream conditions consists of documentation of existing channel morphology and an evaluation of the channel stability. Assessment of existing wetland conditions consisted of performing jurisdictional determinations and USACE verification along with a soil survey of hydric soils.

4.1 EXISTING STREAM MORPHOLOGY

To assess existing geomorphic conditions, cross section measurements were taken at twenty (20) locations within the Site. These measurements were used to evaluate existing width-depth ratios, bank-height ratios, entrenchment ratios and stream classification (See Appendix C). Additionally, a bed-width index and a max-depth index were calculated to assess departure from reference conditions. Data collected from naturalized streams in the surrounding watersheds, the reference reach surveys and the regional curve sites were used to develop regional hydraulic geometry relationships for reference channel bed-width and reference maximum bankfull depth.

TABLE 7 MORPHOLOGIC TABLE

	Morphological Table						
Description	Seniard Creek R1A	Seniard Creek R1B	Seniard Creek R2	Sitton Creek R1	Lee Branch	David Branch R1B	David Branch R1C
Stream Type	G/F	G	G	G	G	G	F
Valley Type	II	II	II	II	II	II	II
W_{BKF} (ft)	10.7 – 13.0	8.0 – 11.4	10.0 – 10.2	6.4 – 11.4	1.8	6.0 – 8.4	7.8
D_{BKF} (ft)	0.8 – 1.2	1.0 – 1.3	1.0 – 1.3	0.8 – 2.2	0.7	0.5 – 0.6	0.3
A_{BKF} (ft^2)	8.3 – 15.3	8.7 – 13.7	10.6 – 13.1	7.2 – 10.8	1.3	2.9 – 4.7	2.6
V_{BKF} (fps)	5.43	4.71	4.91	4.20	-	-	-
Q_{BKF} (cfs)	68	70	113	55	3	1	1
$Slope_{WS}$ (ft/ft)	0.040	0.022	0.017	0.018	0.048	0.050	0.058
Sinuosity	1.03	1.08	1.13	1.09	1.04	1.04	1.03
W/D Ratio	11.1 – 13.8	6.0 – 9.8	7.6 – 9.8	5.7 – 14.6	2.5	12.6 – 15.2	23.3
Ent. Ratio	1.1 – 1.3	1.0 – 1.8	1.4 – 1.6	1.7 – 1.8	1.8	1.8 – 2.0	1.3
D_{50} (mm)	30	17	25	10	<1	<1	<1
D_{84} (mm)	100	33	75	35	<2	<2	<2

4.2 STREAM CONDITION ASSESSMENT

Vertical and lateral stability were evaluated by a departure analysis for channel bed width and maximum bankfull depth. The bed-width index (BWI) was calculated by dividing the channel bed-width measurements taken from the site by the reference bed-width, and the max-depth index (MDI) was calculated by dividing the measured maximum bankfull depth by the reference maximum bankfull depth. The reference dimensions are based on the hydraulic geometry relationships developed for the watershed (Appendix E, Section 3.1). BWI values less than 1.0 indicate that the bed is narrower than the natural bed width and there will be a tendency for the channel to widen resulting in scour at the toe of bank. MDI values greater than 1.0 indicate that the channel depth is greater than the natural channel depth and that the resulting increase in shear stress may cause scour in the bed.

Vertical and lateral stability were further evaluated by mapping existing erosional and depositional features throughout the site and calculating bank erosion hazard index (BEHI) and near-bank stress (NBS) rating. Table 8 below provides a summary of assessment findings for each stream reach along with a subjective determination of the general stability status for each reach. The detailed assessment data supporting this summary can be found in Appendix C.

TABLE 8 INSTABILITY INDICATORS

Instability Indicators						
Reach	BEHI	NBS	BWI	MDI	BHR	Status
Seniard R1A	Mod.	Mod.	0.9 - 1.1	0.9 - 1.1	1.4– 9.9	Unstable
Seniard R1B	High	Mod.	0.5 – 0.7	1.1 - 1.3	1.4 - 9.9	Severe
Seniard R2	High	Mod.	0.5 – 0.7	0.9 – 1.1	1.4 - 9.9	Severe
Sitton R1	High	Low	0.7 – 0.9	0.9 – 1.1	1.4– 9.9	Unstable
Lee Branch	High	Mod.	0.9 - 1.1	1.3 – 9.9	1.4– 9.9	Unstable
David Br. R1A	V. Low	V. Low	0.9 - 1.1	0.9 – 1.1	0.9– 1.1	Stable
David Br. R1B	Mod.	V. Low	0.9 - 1.1	1.3 – 9.9	1.4– 9.9	Unstable
David Br. R1C	High	Mod.	0.9 - 1.1	1.1 - 1.3	1.4– 9.9	Unstable
Whitaker Br.	V. Low	V. Low	0.9 - 1.1	0.9 – 1.1	0.9– 1.1	Stable
Redmond Br.	V. Low	V. Low	0.9 - 1.1	0.9 – 1.1	0.9– 1.1	Stable

Seniard Creek

Seniard Creek is generally unstable and incised throughout most of the Site. At the upstream end Seniard Creek enters the Site through a perched culvert with a hanging invert approximately 1.8 feet above the stream bed. Along this upper reach there are several more headcuts/grade-drops that result in the stream bed being approximately six feet below the terrace. The channel was likely relocated from the center of the valley to the right and adjacent to the roadway. Over time erosion has tended to occur primarily on the left bank and the channel has gradually migrated away from the roadway. This has resulted in the emergence of a more stable right slope.

An investigation of fish species diversity and relative abundance was conducted on Seniard Creek in order to better understand the effect of the perched upstream culvert on possible community isolation or fragmentation. Approximately 300 feet of Seniard Creek was sampled downstream of the culvert indicating an expected relatively low abundance. A total of 6 fish were collected including a young-of-the-year rainbow trout (*Oncorhynchus mykiss*). The other species included River Chub (*Nocomis micropogon*), Central Stoneroller (*Campostoma anomalum*), Mottled Sculpin (*Cottus bairdii*), and Rosyside Dace (*Clinostomus funduloides*).

Upstream of the culvert, approximately 250 feet of Seniard Creek was sampled. Contrary to expectations the reach yielded only 1 mottled sculpin even though this reach appears to be in reference condition with mature riparian vegetation, excellent bed habitat, and a forested watershed. This finding suggests fish populations have the ability to migrate from downstream reaches of Seniard Creek and North Mills River. However, further upstream migration is likely halted by the culvert. Resolving this barrier is potentially critical to connecting these populations to this rich upstream habitat.

As Seniard Creek flows through Reach 1B the degree of incision generally decreases in the downstream direction. Although the channel incision decreases, the channel narrows and bank erosion becomes more prevalent and active. This results in an increased tendency of channel migration and increased fines in the stream bed. Along the upper half of Reach 1B the channel and valley gradually depart from the roadway and runs through an open pasture. Exploratory pits were excavated into the terrace within this reach to verify the presence of an abandoned cobble/gravel layer. This layer was found to occur approximately 1.5 feet below existing grade. Samples taken from this material had a D50 of 48 mm and D84 of 110 mm.

Reach 2 of Seniard Creek begins at the confluence with Sitton Creek and ends at the downstream end of the Site where it passes under Whitaker Road. Along this reach the channel is incised and degraded and it has been relocated to flow adjacent to the road.

Sitton Creek

Sitton Creek is generally incised 4 to 5 feet below the terrace and was previously relocated from the low of the valley. The most severe and active erosion occurs along the upper reach where the channel is actively migrating and attempting to build a new lower floodplain. Within the upper middle portion, the channel passes through a stand of mature white pines where it is relatively stable and has some relief above bankfull. This stable reach is approximately 80 feet in length. Downstream of the white pines, the channel returns to a low width-depth and incised configuration. Herbaceous vegetation through this middle and lower reach has slowed the rate of degradation but has not changed the underlying deficiencies or trajectory.

In order to further understand and explore the constraints and potential for lower Sitton Creek, two additional detailed investigations were conducted. The first consisted of a morphological study and departure analysis of the existing channel geometry. A summary of this investigation is included in Appendix C. This study compared existing channel geometry to stable channel sections found upstream of the Site. The findings show that the existing channel bed-width is on average 5.4 ft. while the stable reference width is 8.5 to 9.0 ft. and the existing bankfull width is 6.7 ft. compared to 12.9 for the reference. The width-depth ratio is on average 5 compared to 19 for the reference, and the mean depth is 1.9 ft. compared to 0.8 to 1.0 ft. for the reference. This suggests that as riparian vegetation begins to shade out the herbaceous cover the channel will likely widen substantially to re-establish the natural form. Additionally, closer inspection of the channel geometry revealed that this process is already underway as evidenced by the undercutting banks below the waterline.

The emergence of a small bankfull bench is providing some relief for greater-than-bankfull flows. However, this bench is located approximately 2 ft. below the terrace and represents a disconnect between the natural valley form and potential functional values that a proper connection would provide. In order to further explore the potential functional lift that may be achieved with a proper reconnection to the valley, a soils investigation was conducted of the valley bottom. The detailed report of this investigation is included in Appendix C. The findings of this study conclude that approximately 2.35 acres of relict hydric soils occur along the Sitton Creek valley and lower Seniard Creek valley. Much of the soils appear to have a shallow layer of fill or deposition over a buried dark horizon. Raising the stream profile and reconnecting the channel to this horizon would be necessary to restore proper groundwater hydrology and wetland functions to the valley bottom.

Lee Branch

Lee Branch is a small spring-fed headwater stream that has been ditched and straightened. The upper bank slopes have remained fairly stable due to the small size of the watershed which does not consistently produce channel forming flows. However, since the initial ditching of the stream, the bed has continued to degrade under normal seasonal flows, which has further incised the channel. The extent of the downcutting has resulted in the low flow becoming subsurface at the upstream end, a condition that extends upstream for approximately 75 feet.

David Branch

David Branch begins 130 feet upstream of a small pond at a seep within a mature riparian area. This reach (1A) above the pond is a stable, high-functioning headwater system. Reach 1B begins at the pond impoundment and proceeds through an area that is buffered on the left side with rhododendron and then enters a small wetland area before passing into a pipe crossing at the downstream end. The pond was originally constructed to provide cold water to a larger downstream pond. The presence of the impoundment along with the flow diversion piping have a significant negative impact on the natural hydrology of this headwater system. Additionally, subsequent observations of this reach have identified ongoing degradation in the bed profile and increased fining of bed material from channel erosion.

Reach 1C of David Branch appears to have been ditched in an attempt to drain the adjacent wetlands. Although the channel is somewhat stable, in its present form it lacks natural morphology and serves to impact hydrology of the adjacent wetlands.

Whitaker Branch and Redmond Branch

Whitaker Branch begins within the project boundaries at a headwater, seep-wetland approximately 410 feet upstream of Redmond Branch. The flow originates from a spring box and then is dispersed in the upper reach before it concentrates as the gradient increases. The riparian buffer is generally forested but lacks an intact canopy and contains a significant portion of invasive exotic species including privet, multiflora rose, and Japanese honeysuckle.

Redmond Branch originates at a pond outfall approximately 962 feet above Seniard Creek. The upper reach flows through several riparian wetlands and the entire left bank is forested with native trees and shrubs. Gaps in the forest cover exist along the right bank as it interfaces with the adjacent managed fields. There are scattered, dense patches of mature invasive species that include privet and multiflora rose. At the downstream end Redmond Branch flows into a culvert under a private gravel road before its confluence with Seniard Creek.

4.3 WETLAND ASSESSMENT

Desktop analysis, jurisdictional determinations, and USACE verification were completed for the Site. Field investigations were conducted to assess the physical characteristics and jurisdictional status of streams using the NCDWQ Methodology for Identification of Intermittent and Perennial Streams and their Origins (NCDWQ 2010). Stream scoring was conducted more than 48 hours after rainfall to ensure baseflow conditions. Wetlands on the Site were also evaluated using the USACE wetland delineation methodology (USACE 1987).

Results of the wetland and stream assessments have been verified and confirmed by the USACE. Seniard Creek, Sitton Creek, Redmond Branch, Whitaker Branch, Lee Branch, and David Branch all scored either perennial or intermittent with scores of 42, 44.5, 39.5, 35.75, 32.25, and 28.25 respectively. Nine pocket wetlands were also verified during the jurisdictional determination process on Redmond Branch, Whitaker Branch, David Branch, Sitton Creek, and Seniard Creek totaling 0.82 acre.

5.0 FUNCTIONAL UPLIFT AND POTENTIAL

5.1 FUNCTIONAL ASSESSMENT

The functional assessment provided in this report is based on the functional objectives identified by Fischenich (2006). Fischenich summarizes stream functions into five categories with three key function/processes each for a total of fifteen stream functions. In order to provide a structure that facilitates the association of stream functions to project goals, objectives and outcomes, these fifteen functions have been reorganized into the following five primary functions:

- Provide water transport and storage
- Provide sediment transport and storage
- Provide organic material transport and storage
- Provide natural communities
- Provide landscape connectivity

The five primary functions are further divided into eighteen supported attributes that represent the functions identified by Fischenich and the functions identified by Harmon (2012) in pyramid levels 2 through 5 as follows:

- The function of providing water transport and storage supports proper seasonal flows, channel forming flows, overbank flows, hyporheic flow, and groundwater flow.
- The function of providing sediment transport and storage supports bed-form diversity, energy management, sediment continuity, and substrate quality.
- The function of providing organic material transport and storage supports bed-form diversity, energy management, and aquatic habitat.
- The function of providing natural communities supports temperature and oxygen regulation, processing of organic matter and nutrients, and biodiversity.
- The function of providing landscape diversity supports latitudinal connectivity of biotic and abiotic processes, longitudinal connectivity of biotic and abiotic processes, and sources and sinks for natural populations.

A detailed functional assessment form has been completed for each existing stream reach of the project and is included in Appendix D. This functional assessment form describes the condition of each of the eighteen supported attributes. The condition statement is provided in either qualitative or quantitative expressions as appropriate for the specified function. A brief "Cause/Association" statement is also provided to further identify the source of the impaired condition and/or site elements that are associated with the impairment. Each supported attribute is assigned a qualitative status of optimal, suboptimal, marginal, or poor which is intended to provide consistency with the terminology adopted by the EPA for rapid bioassessment protocols. The following tables collapse the detailed assessment form down to the five primary functions and provide a summary of the function condition and associated causes:

TABLE 9A FUNCTIONAL ASSESSMENT SUMMARY SENIARD CREEK REACH 1A

Functional Assessment Summary Seniard Creek Reach 1A			
Function	Status	Condition	Cause/Association
Water Transport and Storage		Elevated in-channel flow; disconnected floodplain	Entrenched; upstream culvert
Sediment Transport and Storage		Elevated shear stress levels; Disrupted bed form	Entrenched and somewhat confined; bank erosion
Organic Material Transport and Storage		Limited bed form complexity; organic storage lacking due to transport	Moderate gradient reach; some LWD supply available but not fully productive
Natural Communities		Partial shading; high shear and gradient routing organics	Narrow riparian corridor; Some LWD available but only small diameter
Landscape Connectivity		Narrow buffer; entrenchment limiting development	Entrenchment: Hanging culvert at upstream end
Optimal Suboptimal Marginal Poor			

TABLE 9B FUNCTIONAL ASSESSMENT SUMMARY SENIARD CREEK REACH 1B

Functional Assessment Summary Seniard Creek Reach 1B			
Function	Status	Condition	Cause/Association
Water Transport and Storage		Diminished baseflow; aggradation of fines	Entrenchment and accumulation of erosional fines
Sediment Transport and Storage		Elevated deposition; bank shear	Agricultural incursions and inputs of fines
Organic Material Transport and Storage		Few LWD forced pools; no wood riffle complexes; marginal organic storage potential	Limited LWD; adjacent agricultural activity
Natural Communities		Limited shading; elevated temperatures	lacks biomass/diversity; presence of invasive species
Landscape Connectivity		Discontinuous and fragmented connectivity	Poorly connected to forested watershed upstream; no connection downstream
Optimal Suboptimal Marginal Poor			

TABLE 9C FUNCTIONAL ASSESSMENT SUMMARY SENIARD CREEK REACH 2

Functional Assessment Summary Seniard Creek Reach 2			
Function	Status	Condition	Cause/Association
Water Transport and Storage	Marginal	Diminished baseflow; excessive fines	Entrenchment; bank erosion; aggradation
Sediment Transport and Storage	Marginal	Minimal riffle/pool form; excessive aggradation	Entrenchment; low gradient resulting in siltation
Organic Material Transport and Storage	Poor	No LWD supply; no leaf packs and low organic storage potential	Lack of riparian buffer; agricultural encroachment
Natural Communities	Poor	No shading; poor biomass and species diversity	Banks are mowed/maintained; poor woody species development
Landscape Connectivity	Poor	Fragmented connectivity with poor habitat	Disconnected from forested watershed upstream; lacks connection downstream
Optimal Suboptimal Marginal Poor			

TABLE 9D FUNCTIONAL ASSESSMENT SUMMARY SITTON CREEK REACH 1

Functional Assessment Summary Sitton Creek Reach 1			
Function	Status	Condition	Cause/Association
Water Transport and Storage	Marginal	Diminished baseflow; entrenched; bed aggradation	Entrenchment and significant bank erosion
Sediment Transport and Storage	Marginal	Minimal riffle/pool form; excessive aggradation	Bank scour; entrenchment
Organic Material Transport and Storage	Marginal	Limited LWD; some leaf packs; poor riparian vigor	Limited supply of LWD; adjacent agriculture
Natural Communities	Marginal	Partial shading; low biomass and diversity	Limited riparian buffers
Landscape Connectivity	Marginal	Limited connectivity to highly functional habitat	Poor, discontinuous buffer; agricultural incursions
Optimal Suboptimal Marginal Poor			

TABLE 9E FUNCTIONAL ASSESSMENT SUMMARY LEE BRANCH

Functional Assessment Summary Reach 1A			
Function	Status	Condition	Cause/Association
Water Transport and Storage	🟧	Normal baseflow; entrenched	Past ditching
Sediment Transport and Storage	🟥	No riffle/pool form; excessive fines	Past ditching and headcuts
Organic Material Transport and Storage	🟥	No forced pools, no wood-complex riffles	Limited supply of LWD
Natural Communities	🟨	Mostly full shading; limited species diversity	Riparian area dominated by mature stand of white pines
Landscape Connectivity	🟧	Habitat connectivity upstream only	No buffer; agricultural use adjacent and downstream
🟩Optimal 🟨 Suboptimal 🟧 Marginal 🟥 Poor			

TABLE 9F FUNCTIONAL ASSESSMENT SUMMARY DAVID BRANCH REACH 1A

Functional Assessment Summary Reach 1B			
Function	Status	Condition	Cause/Association
Water Transport and Storage	🟩	Normal baseflow	Relatively undisturbed headwaters
Sediment Transport and Storage	🟩	Appropriate for headwater stream	Relatively undisturbed headwaters
Organic Material Transport and Storage	🟩	Presence of LWD and leaf packs	Relatively undisturbed headwaters
Natural Communities	🟩	Near full shading; high biomass and species diversity	Forested watershed; adequate biomass/diversity
Landscape Connectivity	🟨	Fragmented connectivity with functioning habitat	Well connected to forested watershed upstream
🟩Optimal 🟨 Suboptimal 🟧 Marginal 🟥 Poor			

TABLE 9G FUNCTIONAL ASSESSMENT SUMMARY DAVID BRANCH REACH 1B

Functional Assessment Summary Reach 1A			
Function	Status	Condition	Cause/Association
Water Transport and Storage	■	Altered hydrology	Pond at upstream end attenuating peak discharge
Sediment Transport and Storage	■	Increased fines; limited bedform	Upstream sediment input; bed scour
Organic Material Transport and Storage	■	Lack of bed form; limited LWD	Incision and upstream pond affecting transport
Natural Communities	■	Partial shading; moderate biomass	Partial mature riparian vegetation coverage
Landscape Connectivity	■	Fragmented connectivity	Partial connection to upstream forested watershed
■ Optimal ■ Suboptimal ■ Marginal ■ Poor			

TABLE 9H FUNCTIONAL ASSESSMENT SUMMARY DAVID BRANCH REACH 1C

Functional Assessment Summary Reach 1A			
Function	Status	Condition	Cause/Association
Water Transport and Storage	■	Altered hydrology	Pond upstream
Sediment Transport and Storage	■	Increased fines	Upstream sediment supply: poor channel form
Organic Material Transport and Storage	■	Forced pools, wood-complex riffles limited	LWD not available; upstream culvert affecting transport
Natural Communities	■	Poor shading; low biomass	Mowed and managed riparian vegetation
Landscape Connectivity	■	Poor connectivity	No connections downstream or laterally
■ Optimal ■ Suboptimal ■ Marginal ■ Poor			

TABLE 9I FUNCTIONAL ASSESSMENT SUMMARY WHITAKER BRANCH

Functional Assessment Summary Whitaker Branch			
Function	Status	Condition	Cause/Association
Water Transport and Storage	🟩	Normal baseflow; no entrenchment	Forested watershed
Sediment Transport and Storage	🟨	Uniform sediment distribution; little erosion	Normal shear stress levels; riffle/pool complexes; some fines
Organic Material Transport and Storage	🟨	Forced pools, wood-complex riffles limited; organic storage available	Good channel/floodplain structure; LWD present but not fully utilized
Natural Communities	🟨	Full shading; high biomass though partially disturbed	Mature riparian vegetation, some patchiness
Landscape Connectivity	🟨	Lower reach mid-successional	Abundant riparian buffer; some invasive species present
🟩 Optimal 🟨 Suboptimal 🟧 Marginal 🟥 Poor			

TABLE 9J FUNCTIONAL ASSESSMENT SUMMARY REDMOND BRANCH

Functional Assessment Summary Redmond Branch			
Function	Status	Condition	Cause/Association
Water Transport and Storage	🟩	Normal baseflow; no entrenchment	Forested watershed
Sediment Transport and Storage	🟩	Uniform sediment distribution; little erosion	Normal shear stress levels; good riffle/pool complex
Organic Material Transport and Storage	🟨	Forced pools, wood-complex riffles limited; organic storage available	LWD present but not fully utilized
Natural Communities	🟨	Full shading; high biomass and species diversity	Mature riparian vegetation, some patchiness
Landscape Connectivity	🟨	Habitat connectivity and established population equilibrium	Abundant riparian buffer; Limited downstream connectivity
🟩 Optimal 🟨 Suboptimal 🟧 Marginal 🟥 Poor			

5.2 FUNCTIONAL UPLIFT POTENTIAL

The functional uplift potential for each stream reach is detailed in Table 10 which shows the lift associated with each of the five primary functions and then provides a summary of the overall functional lift in the last column. The functional potential is considered within the context of ultimate maturity of the site attributes and not limited to the potential that may be expected within the monitoring period. For the purposes of this summation the overall functional potential is assigned a description of optimal if four out of five primary functions are ranked as optimal.

Landscape connectivity of the Site is the only factor that will not potentially be uplifted to optimal conditions. Although landscape connectivity functions will improve with the establishment of a riparian buffer, upstream and downstream extents will retain some disconnection associated with roadways and culverted crossings.

Aside from this limiting factor, each of the five primary functions of water transport and storage, sediment transport and storage, organic material transport and storage, natural communities, and landscape connectivity will be addressed.

TABLE 10 FUNCTIONAL UPLIFT POTENTIAL

Functional Uplift Potential							
Reach	State	Water Transport and Storage	Sediment Transport and Storage	Organic Material Transport and Storage	Natural Communities	Landscape Connectivity	Overall Potential Lift
Seniard - R1A	Existing	Marginal	Marginal	Marginal	Marginal	Poor	Marginal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
Seniard - R1B	Existing	Marginal	Marginal	Marginal	Poor	Poor	Marginal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
Seniard – R2	Existing	Marginal	Marginal	Poor	Poor	Poor	Poor to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
Sitton - R1	Existing	Marginal	Marginal	Marginal	Marginal	Marginal	Marginal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
Lee Branch	Existing	Marginal	Poor	Poor	Suboptimal	Marginal	Marginal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
David Br. R1A	Existing	Optimal	Optimal	Optimal	Optimal	Suboptimal	Optimal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
David Br. R1B	Existing	Marginal	Marginal	Marginal	Suboptimal	Suboptimal	Marginal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
David Br. R1C	Existing	Marginal	Marginal	Marginal	Marginal	Poor	Marginal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
Whitaker Br.	Existing	Optimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
Redmond Br. R1A	Existing	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal to Optimal
	Potential	Optimal	Optimal	Optimal	Optimal	Suboptimal	
Redmond Br. R1B	Existing	—	—	—	—	—	Nonexistent to Optimal
	Potential	Optimal	Optimal	Suboptimal	Optimal	Suboptimal	

Optimal Suboptimal Marginal Poor

6.0 GOALS AND OBJECTIVES

The preliminary goals identified in Section 2 of this report are rearranged in Table 11 below to illustrate their association to the five primary stream functions. To more fully address the functional performance of the site, these preliminary goals are further expanded and defined into the listed project goals. These expanded project goals are then linked to specific objectives for the project in Table 12.

The assessment of site conditions and existing stream functions identified deficiencies in stream functions that are addressed in the following expansion of the project goals:

- Water Transport and Storage – goals have been expanded to address functional deficiencies associated with lack of natural, stable channel forms and groundwater hydrology.
- Sediment Transport and Storage – two additional goals have been added and expanded to address functional deficiencies associated with substrate quality, channel stability, and bed form diversity.
- Organic Material Transport and Storage – a goal has been added to address functional deficiencies associated with habitat diversity and quality.
- Natural Communities – the goals have been expanded to address functional deficiencies associated with nutrient cycles, temperature regulation, future organic inputs, and wetland communities.
- Landscape Connectivity – the goals have been expanded to address functional deficiencies associated with limited capacity for biotic and abiotic processes and to address future potential impacts on connectivity.

TABLE 11 STREAM FUNCTIONS AND PROJECT GOALS

Function	Preliminary Goals	Expanded Project
Water Transport and Storage	None identified in preliminary goals	Provide a network of streams with natural, stable forms that support proper stream functions Improve groundwater hydrology to support recovery of native riparian vegetation
Sediment Transport and Storage	Reduce sediment inputs from eroding stream banks Restore proper sediment transport Improve substrate quality	Reduce sediment inputs from eroding stream banks to reduce fine sediment loads and percentage of fines in the bed-material load Restore proper sediment transport to support channel stability and bedform diversity Improve substrate quality to facilitate proper hyporheic flow and support aquatic communities
Organic Material Transport and Storage	None identified in preliminary goals	Improve quantity, quality, and diversity of habitats to support healthy aquatic communities
Natural Communities	Reduce pollutant inputs to the project streams (fecal coliform, nitrogen, phosphorus) Improve biological communities within the site	Reduce pollutant inputs to the project streams (nitrogen, phosphorus) to restore a balance to proper nutrient cycles Improve riparian vegetation community to provide temperature regulation of the streams, provide a future source of organic inputs, and aid in long-term channel bank stability Restore former riparian areas so that the hydrology and soils support native vegetative communities and wildlife
Landscape Connectivity	Improve landscape connectivity	Improve landscape connectivity that allows space for biotic and abiotic process and provides a source and sink for natural populations Prevent the site from future impacts of development and agricultural uses

TABLE 12 GOALS AND OBJECTIVES

Goals	Objectives
Provide a stream with natural, stable forms that supports proper stream functions	Construct stream channels that will maintain proper dimension, pattern and profile
Improve groundwater hydrology to support recovery of native riparian vegetation	Construct streams with proper bankfull to floodplain relationship
Reduce sediment inputs from eroding stream banks to reduce fine sediment loads and percentage of fines in the bed-material load	Construct streams that provide naturally stable dimensions and stabilize constructed banks with appropriate bioengineering
Restore proper sediment transport to support channel stability and bedform diversity	Construct streams that maintain an appropriate sediment transport balance with the sediment that is supplied by the watershed so that the overall stream profile neither aggrades nor degrades over time
	Create and improve stream bedform diversity by constructing pools of varied depths and riffles of varied slopes
Improve substrate quality to facilitate hyporheic flow and support aquatic communities	Construct stable riffles that provide an improved diversity of bed material clast and a reduction in fines relative to existing conditions
Improve quantity, quality and diversity of habitats to support healthy aquatic communities	Construct in-stream habitat features from native material to provide a diversity of habitats
Reduce pollutant inputs to the project streams (nitrogen, phosphorus) to restore a balance to proper nutrient cycles	Provide a buffer from agricultural activities and row crops
Improve riparian vegetation community to provide temperature regulation of the streams, provide a future source of organic inputs, and aid in long-term channel bank stability	Plant native tree species and understory species in the riparian zone
Restore areas of former riparian areas so that the hydrology and soils will support native vegetative communities and wildlife	Reconstruct stream channels that are properly connected to the riparian areas
	Re-grade topography to eliminate ditches and drainage features
	Plant native wetland tree and shrub species

Goals	Objectives
Improve landscape connectivity that allows space for biotic and abiotic process and provides a source and sink for natural populations	Establish a conservation easement that provides a minimum buffer from future activities in the adjacent watershed and ensure aquatic organism passage by correcting perched culverts or removing other barriers within the easement
Prevent the site from future impacts of development and agricultural uses	

7.0 DESIGN APPROACH AND MITIGATION WORKPLAN

7.1 DESCRIPTION OF REFERENCE STREAM(S) AND VEGETATION COMMUNITIES

Reference streams were investigated to provide guidance for design. Although reference sites do not necessarily provide a direct correlation to potential restoration conditions they can be useful in providing guidance in developing the conceptual framework of the design and in setting targets in certain design elements, habitat components, and community compositions.

7.1.1 Reference Stream Reaches

Searches were conducted first upstream and downstream of the Site and then into surrounding watersheds to find suitable references that contained comparable slope, bed material, and valley type. No reference reaches were identified immediately upstream or downstream of the site or in the surrounding watershed. Two references were eventually identified outside of the watershed but within the Blue Ridge hydrophysiographic region. The reference reaches were selected to represent the probable configurations for the downstream reaches of the proposed stream. Detailed geomorphic survey and Level II Rosgen classifications were conducted on each reach (See Appendix E).

Three type B4 stream references were located; one on Cold Springs Creek, a tributary to the Pigeon River in Haywood County, one on Bent Creek in Buncombe County and one on Bear Branch, a tributary of Mills River in Henderson County. The watersheds for these streams are predominantly forested but otherwise have many characteristics in common with the project streams including average annual rainfall, elevation changes and valley type. In particular, the Bent Creek watershed, part of the Bent Creek Experimental Forest, falls in a similarly low rainfall region as the project site. The Bear Branch watershed is located immediately adjacent to the Seniard Creek watershed. The Cold Springs Creek watershed is located in the Harmon Den Wildlife Management area of the Great Smokey Mountains National Park.

TABLE 13 REFERENCE REACH MORPHOLOGIC DATA

Reference Reach Morphological Table			
Description	Cold Springs	Bent Creek	Bear Branch
Stream Type	B4	B4	B4
Valley Type	II	II	II
D.A. (mi^2)	2.63	2.35	0.5
W_{BKF} (ft)	19.9 – 21.8	14.7 – 19.5	9.3 – 13.5
D_{BKF} (ft)	1.0 – 1.2	1.2 – 1.4	0.7 – 1.2
A_{BKF} (ft^2)	20.7 – 23.9	18.0 – 27.2	9.5 – 13.3
$Slope_{WS}$ (%)	2.3 – 3.2	1.1 – 1.8	2.5 – 7.3
Sinuosity	1.05 – 1.10	1.02 – 1.07	1.08
W/D Ratio	16 – 21	12 – 14	7.7 – 19.1
Ent. Ratio	1.3 – 2.7	1.4 – 1.5	1.4 – 1.7
D_{50} (mm)	20 – 46	18 – 33	20 – 55
D_{84} (mm)	84 – 168	60 - 125	97 - 200

7.1.2 Reference Wetlands and Vegetative Communities

To address the need to provide reference criteria for the proposed restoration the vegetation will be based on descriptions of natural mountain vegetation communities provided in the 4th Approximation of North Carolina Natural Communities (Schafale & Weakley 2012). It should be noted that while the wetlands onsite were classified using the North Carolina Wetland Assessment Method (NCWAM) for mitigation-related purposes, that method provides only coarse data on vegetative species found within each wetland type and thus is not suitable for use as a species specific reference.

Initial site assessments revealed the presence of two reference communities on adjoining lands:

- Swamp Forest-Bog Complex (Typic Subtype)
    - Dominant canopy species include Eastern red maple (*Acer rubrum var. rubrum*), Eastern white pine (*Pinus strobus*), Eastern hemlock (*Tsuga canadensis*), sweet birch (*Betula lenta*), and the occasional white oak (*Quercus alba*). Great laurel (*rhododendron maximum*), mountain laurel (*Kalmia latifolia*), and dog-hobble (*Leucothoe fontanesiana*) are ubiquitous elements in the understory, but boggy openings within the forest support greater shrub diversity including species like possum haw (*Viburnum nudum var. cassinoides*), tag alder (*Alnus serrulata*), silky dogwood (*Cornus amomum*), and American holly (*Ilex opaca*). Herbaceous plant diversity mirrors that of the shrub layer, with species like mannagrass (*Glyceria melicaria*), running cedar (*Dendrolycopodium sp.*), and New York fern (*Parathelypteris noveboracensis*) generally occurring but with openings that support great sedge (*Carex*) diversity as well as flowers like rough-leaf goldenrod

(*Solidago patula*), purplestem aster (*Symphyotrichum novae-angliae*) and ferns such as cinnamon fern (*Osmundastrum cinnamomeum*), netted chainfern (*Lorinseria areolata*), and sensitive fern (*Onoclea sensibilis*). Peat moss (*Sphagnum sp.*) occurs both in small patches as well as extensive mats,and is generally dependent upon close proximity to groundwater seepage.

- Montane Alluvial Forest (Small River Subtype).
  - o Dominant canopy species include sycamore (*Platanus occidentalis*), tulip poplar (*Liriodendron tulipifera*), Eastern red maple, river birch (*Betula nigra*), and Eastern hemlock. Characteristic understory species include ironwood (*Carpinus caroliniana*), black willow (*Salix nigra*), and witch hazel (*Hamamelis virginiana*), although sites with richer soils may include pawpaw (*Asimina triloba*). The primary shrub species associated with the forest include tag alder (*Alnus serrulata*), spicebush (*Lindera benzoin*), silky dogwood (*Cornus amomum*), dog-hobble, and yellowroot (*Xanthorrhiza simplicissima*). Herbaceous diversity is greatly dependent upon local soil types and frequency of flooding, but generally would include wood nettle (*Boehmeria cylindrica*), golden ragwort (*Packera aurea*), smartweeds (*Polygonum spp.*), mannagrass, jack-in-the-pulpit (*Arisaema triphyllum*), and many more.

The aforementioned community types were referenced in order to develop a species list of bare root plants to use during revegetation efforts. Sitton and Seniard Creeks both best fit the Montane Alluvial Forest (Small River Subtype), and existing canopy trees and understory species support this assertion: sycamore, river birch, tulip poplar, tag alder, black willow, and spicebush currently exist in the fragmented buffers surrounding the streams. Also found in these forests are trees from adjacent upland communities, such as blackgum, sourwood, sassafras, holly, and serviceberry.

Lee, David, Whitaker, and Redmond Branches each have many overlapping attributes with the Swamp Forest-Bog Complex (Typic Subytpe); their streams are generally low-gradient, slow-moving, and adjoined by or bisect boggy wetlands, some of which contain *Sphagnum* moss. These streams do not have a well-developed canopy due to their saturation and exclusion of most large trees, but rather are dominated by a shrub complex and dotted with trees from adjacent upland communities, such as blackgum, sourwood, sassafras, holly, and serviceberry.

The project's reaches will be revegetated at an approximate rate of 750 stems per acre; plant material will consist of one year old bare root trees sourced from within North Carolina and using regional ecotypes, whenever possible. Bare roots will be procured in advance of planting, which will occur in the dormant season, between the months of December 2020 and March 2021 when the soil is not frozen. Plant roots will be treated with a mycorrhizal inoculant prior to installation and will be installed using a dibble (planting) bar; watering in of trees will not be necessary. If any trees require onsite storage, they will be heeled in to ensure they do not desiccate.

7.2 DESIGN APPROACH

7.2.1 Stream Design Overview

The stream design approach is composed of three parts; conceptual design, stream component design, and design validation. The conceptual design consists of developing a conceptual framework for the restoration efforts. The stream component design establishes the channel parameters and channel configuration required to carry out the conceptual design. Finally, the validation phase consists of testing and refining the channel configuration using analytical tools.

Development of the conceptual framework begins with a determination of where restoration or enhancement efforts are warranted. Where restoration activities are proposed, it is then necessary to determine the appropriate stream type given the valley setting. Preferably the stream type can be matched to the natural valley but occasionally site constraints dictate that alterations to the valley form are required to provide an appropriate match with stream and valley. Table 14 provides a listing of the restoration approach for each stream reach and is followed by a narrative of the conceptual framework.

TABLE 14 RESTORATION APPROACH

Restoration Approach				
Reach	Restoration Level	Restoration Approach	Stream Type	Rationale
Seniard Creek - R1A	Restoration	Priority I & II	B4	Reconstruction required to address entrenchment and raise invert to reconnect to upstream culvert
Seniard Creek - R1B	Restoration	Priority I	B4	Reconstruction required to raise channel and address entrenchment and channel dimension, and reconnect to valley low
Seniard Creek - R1B	Restoration	Priority I	B4	Reconstruction required to raise channel and address entrenchment and channel dimensions
Sitton Creek - R1	Restoration	Priority I	B4	Reconstruction required to raise channel and address entrenchment and channel dimensions, and reconnect to valley low
Lee Branch – R1	Restoration	Priority I	B4	Reconstruction required to raise channel and address entrenchment and channel dimensions

David Branch – R1A	Preservation	N/A	B4	Stream has natural form and is stable
David Branch – R1B	Restoration	Priority I & II	B4	Restoration required to remove pond, restore hydrology, and restore channel stability
David Branch – R1C	Restoration	Priority I	B4	Reconstruction required to raise the channel and address entrenchment and dimensions
Whitaker Branch	Enhancement II	N/A	B4	Invasive species removal and replanting the riparian buffer
Redmond Branch – R1A	Enhancement II	N/A	B4	installation of log sills in a few key locations to stabilize the streambed, invasive species removal and, replanting the riparian buffer
Redmond Branch – R1B	Restoration	Priority I	B4	Reconstruction required to raise grade and convey flow to new confluence with Sitton Creek

Seniard Creek

The conceptual approach for Seniard Creek Reach 1A is to raise the stream grade at the upstream end in order to correct the hanging invert of the upstream culvert, to bench and lay back the left bank to reduce shear stress on the bed at greater-than-bankfull flows and to stabilize instances of headcuts and bed instabilities with in-stream structures. Existing conditions instability indicators suggest the reach is currently unstable and the functional assessment indicates the reach exhibits marginal function. Subsequent investigations into connectivity associated with the hanging culvert, including fish sampling, indicate that resolving this issue is critical to reestablishing fish passage and connectivity with upstream communities. In order to reduce the drop out of the culvert to an acceptable magnitude, the profile will be lifted to a point sufficient to form and hold a stabilized pool at the culvert outfall. To achieve this, the profile will be raised approximately 2 feet through the first 80 feet of Reach 1A, resulting in an increased channel slope (0.058 ft/ft) and the loss of existing bed and bank features. The steep overall slope of the downstream portion of reach 1A and the required close structure spacing will result in very few of the existing features remaining undisturbed. Construction activities will eliminate current instabilities and improve function from Marginal to Optimal. Restoration credit is being sought for Reach 1A, which represents a departure from the approach discussed at the IRT Post Contract Site Visit. The original concept discussed at the IRT Site Visit would have only addressed left bank instability.

Along Reach 1B the stream will be raised and reconnected to the low of the valley. Exploratory excavations revealed the presence of subsurface cobble that will be harvested and used to form the new stream bed. Abundant existing transplants shall be harvested from this reach and relocated throughout the project. Reach 2, which begins downstream of the confluence with Sitton Creek, will be a transition from the valley bottom back down to the existing stream grade at the downstream end.

Sitton Creek

The conceptual approach for Sitton Creek is to raise the stream and reconnect it to the low of the valley. A transition reach will be required at the upstream reach in order to make this grade connection. Although wetland restoration is not a stated goal of this restoration, the presence of hydric soils throughout the Sitton Creek valley floor provides the opportunity to restore hydrology and wetland functions by raising the stream grade. Restoration efforts will include salvaging bed material and vegetation for incorporation into the stream reconstruction.

Lee Branch

The conceptual approach for Lee Branch is to raise the stream throughout the reach and reconstruct the channel and valley to the right of the existing alignment. At the upstream end, the lifting of the channel will allow for the reestablishment of surface flow upstream of the project boundary. This will be accomplished by the removal of the existing, failed pipe at the property boundary, raising the stream bed to match the higher, abandoned stream bed located upstream of the project limits and installation of a groundwater barrier to prevent future subsurface piping. Through the middle portion of this reach, the channel and valley will be reconstructed to the right of the existing alignment to allow for the establishment of additional buffer and to form a more natural stream and valley form. Restoration credit is being sought for Lee Branch, which represents a departure from the approach discussed at the IRT Post Contract Site Visit. Existing conditions instability indicators suggest the reach is unstable and the functional assessment indicates the reach exhibits marginal function. Construction activities will result in the elimination of current instabilities and a functional uplift from Marginal to Optimal.

David Branch

The conceptual approach for David Branch is to remove the existing dam and impoundment at the upstream end and reestablish the channel through Reach 1A. The piping that has been installed to divert base flow into the downstream larger pond will be disconnected and removed so that the elimination of the diversion and the removal of the upstream impoundment will restore natural flow regimes to the downstream reaches. Through Reach 1B the channel will be raised and stabilized with installation of structural sills and channel bed reconstruction to address headcutting and degradation. The pipe crossing between Reach 1B and 1C will be replaced with a properly sized pipe crossing that maintains sediment and hydraulic transport. Reach 1C will be reconstructed in order to raise the channel and reconnect it to the valley floodplain, expanding the existing wetland footprint. Densely spaced, mature transplants will be installed along the banks of Reach 1C to provide shade for the proposed channel bed and reduce the likelihood of vegetative grow-in.

Redmond Branch

The conceptual approach for Redmond Branch is enhancement of Reach 1A and priority 1 restoration for the short downstream section (Reach 1B) where it emerges from a culvert and seeks confluence with Sitton Creek. Through Reach 1B, the channel will be raised and stabilized along a new course in a step-pool configuration on a 4% slope to its new confluence with Sitton Creek. Restoration credit is being sought for Reach 1B, which represents an addition to the concept discussed at the IRT Post-Contract Site Visit. No stability or functional assessments were performed due to the reach being nonexistent. Construction activities will result in functional uplift from Nonexistent to Optimal.

7.2.2 Stream Component Design

The stream component design involves establishing the proposed channel dimensions, laying out the channel alignment, and establishing the channel profile. The proposed channel dimensions are established initially through hydraulic geometry relationships of the stream bed-width and maximum riffle depth. Traditional natural channel design methods place the greatest emphasis on cross sectional area, width-depth ratio and bankfull discharge as the basis for design. Although these are important in the design process, they represent composite or derived values and are therefore more difficult to determine with necessary precision than the more simple and direct metrics of bed-width and max-depth. Additionally, bed-width and max-depth are more sensitive to the particular attributes of the local watershed and geology.

Four hydraulic geometry relationships have been developed and are included in Section 3 of the design calculations in Appendix E. Four curves are plotted on each of these graphs. The regional curve is plotted as a reference for the slope and position of published data. The dashed local curve is plotted to represent the data collected in the local and surrounding watersheds. The red design lines are adjusted off the local curve to reflect morphological target of the B-type stream.

Based on the initial selections of the design bed-width and max-depth, the remaining key channel dimensions and dimensionless ratios are calculated in Section 5 of Appendix E. These calculations are performed for specific locations within the project so that direct comparisons can be made to existing channel features that can provide confirmation of the appropriateness of the proposed configuration. Section 6 (Appendix E) then provides the calculations of design dimension for each stream reach based on the section design.

The design alignment is based partly on the results obtained from the section design but primarily on the topography of the site. The valley position, the nature of the cross slope of the valley, existing mature vegetation, and constraints and obstructions all play a determining factor in the plan form configuration. Although stream type, typical belt-width, meander ratios, and pool spacing are all important elements of the design alignment, ultimately it is the landscape form that is the primary influence on how and where the stream should run.

In the final step in the stream component design, the overall profile is established to set the proposed bankfull elevation to match the target elevations identified in the conceptual design. The target elevations may include abandoned floodplains, existing terraces, existing bankfull features, buried 'A' horizons, exposed tree bases, or proposed floodplain surfaces. Refinement of the overall profile to include riffle-pool or step-pool bedform features is accomplished in the design validation phase.

7.2.3 Stream Design Validation

Hydrologic and Hydraulic Analysis

The proposed channel sections were evaluated for their ability to convey the bankfull flows and the flood flows of the watershed by performing a hydraulic analysis. Flood flow hydrology was based on USGS Regional Regression equations for the Blue Ridge-Piedmont hydrologic area. Bankfull discharge was based on the NRCS revised regional curves for the North Carolina Mountain hydrologic area. The hydraulic analysis consisted of first modeling the existing conditions with the HEC-RAS water surface profile model. Cross sections were taken through the channel and the adjacent valley at representative locations throughout the project reach. Existing hydraulic conditions were evaluated, and the model calibrated based on available site data. (Appendix E, Section 8.0).

The ability to accurately verify bankfull discharge within the site is limited by the degraded channel conditions and the lack of clear bankfull indicators. On a coarse scale, the existing HEC-RAS model does indicate bankfull water surface elevations within the channel banks where the channel is incised and above inner berm features where present. Additional bankfull verification is provided through the hydraulic geometry curves assembled from locations on site, immediately adjacent to the site, within the watershed and the neighboring watersheds.

Proposed conditions were analyzed by revising the existing sections based on the proposed channel geometry and by revising the model to reflect proposed pattern conditions and anticipated future roughness coefficients (Appendix E, Section 8.1). Comparison of the existing and proposed HEC-RAS models provided assistance in the analysis of the sediment transport, bankfull flow capacity and confirmation that there will be no hydraulic trespass onto adjacent properties (Appendix E, Section 8.2).

Sediment Transport Analysis (Competence)

Data collection for sediment competence analyses included bar and bulk samples on the primary streams. For Seniard Creek and Sitton Creek the D_{50} ranges between 10mm and 30mm and the D_{84} ranges between 33mm and 100mm. The bed material values are reported in Appendix E, Section 4 and in Table 7 above. Additionally, a sediment regime inventory was conducted and the results are summarized with a qualitative judgement of the sediment load and potential sediment mobility (Appendix E, Section 4). Observations indicate a moderate sediment load with moderate-low mobility on both Seniard Creek and Sitton Creek. Based on this assessment the design particle sizes and dimensionless shear parameters were selected for the shear stress calculations. The results of the shear stress calculations are then adjusted to account for the sediment load regime so that low sediment load streams are designed with an upper mobility threshold and higher load streams are designed with an appropriate mobility range. The results of this analysis are summarized in Appendix E, Section 7.

Sediment Transport Analysis (Capacity)

In order to assist in evaluating the sediment capacity, a set of consecutive pit traps were installed in the stream bed at the upstream end of each of the main streams. Samples were collected from the pit traps following rainfall events. These samples were sieved and weighed, and the results were used to estimate the unit bedload for each flow event.

A flow duration hydrograph was constructed to simulate the sampling events in order to model sediment transport using the quasi-unsteady flow routine in HEC-RAS. The Meyer-Peter Müller (corrected by Wong) sediment transport function was selected as it most closely predicted the pit trap samples. The selected function was then calibrated in the existing conditions model to estimate reach supply. The Meyer-Peter Müller (corrected by Wong) sediment transport function predicted a unit supply of 0.27 ton/day/ft and 0.35 ton/day/ft for Seniard Creek and Sitton Creek, respectively.

Three quasi-unsteady simulations were run in HEC-RAS to evaluate the sediment transport capacity. The modeling consisted of using HEC-HMS to produce a discharge hydrograph to simulate a 24-hour storm for the bankfull, 2-year, and 10-year discharge on a 0.25-hour computational increment cycle. The proposed models were evaluated for their capacity to route the estimated sediment supplies by assessing changes in channel bed elevation and cumulative sediment output. The modeling results are tabulated in Appendix E, Section 9.

Design Refinement

The findings of the design validation procedures are used to adjust and refine the design of the various stream components. The sediment capacity analysis is used to identify potential deficiencies in the macro stream profile or stream cross sectional configuration. The analysis indicated multiple locations where capacity in the proposed condition exceeded the estimated sediment supply. In these locations, excess capacity in the proposed channel is down-regulated by the installation of brush enhanced riffle features to increase channel roughness.

The sediment competence analysis is used to establish and evaluate the design riffle slopes. These riffle slopes are then applied to the detailed bed form profile. Where significant incongruencies occur between design riffle slope and overall slope, attempts are first made to resolve them with adjustments to the channel profile. Occasionally, some incompatibilities in the profile design must be resolved with the design of a threshold transition reach. The overall slope of Seniard Creek – Reach 1A exceeds that which the available bed material can support, so a transition reach and boulder brush run structure is proposed in this location. Section 10 of Appendix E provides a summary of the transition reach calculations.

Finally, the channel bed material is designed to be consistent with results of the above design validation. It is anticipated that bed material in sufficient caliber and volume will be available onsite to construct all stream reaches without imported stone. The proposed bed material mixes are tabulated in Section 11 of Appendix E.

7.2.4 Wetland Design Overview

Although the project objectives do not include accounting for mitigation credits for wetland restoration, enhancement or preservation, these components are included in the design in order to maximize potential functional lift of the site. The wetland design approach is composed of two parts; conceptual design and wetland component design. The conceptual design consists of developing a conceptual framework for the restoration efforts. The wetland component design establishes the topographic alterations and configuration required to carry out the conceptual design.

Development of the conceptual framework begins with a determination of where restoration or enhancement efforts are warranted. Where restoration activities are proposed, it is then necessary to discern between re-establishment and rehabilitation; with re-establishment consisting of areas that contain hydric soils but that are not presently considered jurisdictional wetlands and rehabilitation consisting of areas of degraded jurisdictional wetlands. Table 15 provides a listing of the restoration approach for each wetland area and is followed by a narrative of the conceptual framework.

TABLE 15 WETLAND RESTORATION APPROACH

Wetland Restoration Approach				
Wetland Area ID	Location	Restoration Approach	Restoration Type	Rationale
W01	Redmond Branch	Preservation	N/A	Only supplemental plantings required.
W02	Redmond and UT Redmond Branch	Preservation	N/A	Only supplemental plantings required.
W03	Whitaker Branch	Preservation	N/A	Only supplemental plantings required.
W04	David Branch (1A)	Restoration and Preservation	Rehabilitation	Portion of wetland area subject to permanent impoundment.
W05	David Branch (1B)	Enhancement	N/A	Hydrology can be improved by removal of upstream diversion; supplemental plantings required.
W06 and W07	David Branch (1C)	Restoration	Rehabilitation / Re-establishment	Hydrology can be improved by raising stream; wetland area can be expanded by lowering higher ground between W06 and W07.
W08 and Sitton valley bottom	Sitton Creek	Restoration	Rehabilitation / Re-establishment	W08 can be converted from a ditch to a wetland connected to the valley bottom; Hydrology of the valley bottom can be restored by raising Sittton Creek.
W09	Seniard Creek	Enhancement	N/A	Supplemental plantings required; wetland area can be expanded with excavation of adjacent overburden.

The conceptual approach for Areas W01, W02, and W03 is preservation. These wetlands present functional and stable characteristics. Supplemental plantings will be installed in these areas, with the target community being Headwater Forest (NCWAM) (NCWFAT 2016).

The conceptual approach for Area W04 is to lower the existing earthen dam to eliminate the impoundment of a permanent pool but retain sufficient grade to maximize potential wetland hydrology. Upstream of the impounded area the existing wetland hydrology will be maintained and supplemental plantings will be installed. The target community for this area is also Headwater Forest (NCWAM) (NCWFAT 2016).

The conceptual approach for Area W05 is to improve base flow and restore the natural hydrologic regime by elimination of the upstream diversions and impoundments. Supplemental plantings will be installed in this area, with the target community being Headwater Forest (NCWAM) (NCWFAT 2016).

The conceptual approach for Areas W06 and W07 is to improve hydrology by raising and reconstructing David Brach between these two areas. Additionally, the area that separates these two wetlands is a slightly higher ridge which will be graded down to form a more natural valley and topographically connect these areas into one stream/wetland complex. Supplemental plantings will be installed in this area, with the target community being Headwater Forest (NCWAM) (NCWFAT 2016).

The conceptual approach for Area W08 and the Sitton Creek valley bottom is to restore hydrology by raising and relocating Sitton Creek to low of the valley. Area W08 is an existing ditch that was excavated to further drain the valley which will also be raised to be topographically connected to the valley bottom. Hydric soils were identified throughout the majority of the Sitton Creek valley floor which are currently disconnected from Sitton Creek. Reconstruction of Sitton Creek in the valley bottom and surface grading will be designed to intersect with and expose the buried hydric soils. This reestablishment will offset the permanent impacts tabulated in Table 16. The target community being Headwater Forest (NCWAM) (NCWFAT 2016).

The conceptual approach for Area W09 is to expand the wetland footprint by excavating overburden in the area immediately adjacent to W09. Supplemental plantings will be installed in this area, with the target community being Headwater Forest (NCWAM) (NCWFAT 2016).

The conceptual approach for the proposed pond outfall is to route the pond's discharge through pockets of placed hydric soils located in the abandoned channel footprint. The pond discharges near constant baseflow which routes directly into existing Sitton Creek. The concept proposes a small channel and brush run structures connecting four pockets which will be filled with hydric soils excavated incidental to the construction of proposed Sitton Creek. This feature is solely intended to provide habitat diversity. The shape of the wetland pockets will include scalloped edges to increase fringe interface area and coarse woody debris will be placed to add roughness and an energy source.

7.2.5 Wetland Component Design

The wetland component design consists of developing an approach to restore wetland hydrology and establishing the proposed wetland design surface. The proposed plan has been developed to address the deficiencies in wetland hydrology (Appendix B). The plan was developed in conjunction with an analysis of the soils mapping. The main elements of the plan provide for realignment of Sitton Creek into the valley low, raising of the existing ditch, and regrading of valley topography. The proposed configuration of Sitton Creek will provide a proper bankfull depth which will allow for more frequent overbank flooding, thus establishing a reconnection of hydrology. The proposed grading plan is designed to intersect and expose hydric soils that were identified and mapped in the soils investigation.

Mitigation guidance for common mountain soil series suggests a hydroperiod for the Toxaway soil (*Cumulic Humaquepts*) or Hemphill (*Fluventic Humudepts*) of 10-16 percent, during which the water table is within 12 inches of the surface. Within the upper reaches of the soil unit, a 9 – 12 percent hydroperiod may be expected.

The proposed removal of overburden and the regrading of the hydric soil area is estimated to result in approximately 1,000 CY of material. The depth of overburden removal is approximately 4 to 8 inches throughout the majority of the reach.

7.2.6 Impacts to Existing Wetlands

In some cases, grading operations will result in temporary or permanent impacts to jurisdictional wetlands. To mitigate against the impacts, where appropriate, the stream design is intended to improve hydrologic access to the reach's floodplain. This will be accomplished with grading that will enhance and expand these existing wetlands or restore dysfunctional hydric soils to conditions supportive of wetlands. Locations of wetland rehabilitation and re-establishment are outlined in Table 15. Construction methods shall be tailored to minimize and avoid impacts by implementing direct access routes, the use of natural materials, and avoiding land disturbance whenever possible.

Table 16 shows the impacted acreage for each wetland as well as outlining the type of each impact.

TABLE 16 WETLAND IMPACTS

Wetland Impacts							
Wetland Area ID	Location	Classification	Existing Acreage	Type of Activity	Temporary (T) or Permanent (P)	Impacted Acreage	Acreage of Tree Removal
W01	Redmond Branch	Riparian	0.103 ac	None	T	-	-
				None	P	-	-
W02	Redmond and UT Redmond Branch	Riparian	0.217 ac	None	T	-	-
				None	P	-	-
W03	Whitaker Branch	Riparian	0.108 ac	None	T	-	-
				None	P	-	-
W04	David Branch (1A, 1B)	Riparian	0.101 ac	Floodplain Grading	T	0.051 ac	0.019 ac
				Channel Construction	P	0.009 ac	0.009 ac
W05	David Branch (1B)	Riparian	0.052 ac	Floodplain Grading	T	0.020 ac	0.008 ac
				Channel Construction	P	0.015 ac	0.000 ac
W06	David Branch (1C)	Riparian	0.058 ac	Floodplain Grading	T	0.058 ac	0.045 ac
				Channel Construction	P	0.000 ac	0.000 ac
W07	David Branch (1C)	Riparian	0.125 ac	Floodplain Grading	T	0.073 ac	0.000 ac
				Channel Construction	P	0.011 ac	0.000 ac
W08	Sitton Creek	Riparian	0.021 ac	Floodplain Grading	T	0.017 ac	0.000 ac
				Channel Construction	P	0.004 ac	0.000 ac
W09	Seniard Creek (1B)	Riparian	0.038 ac	Floodplain Grading	T	0.038 ac	0.038 ac
				None	P	0.000 ac	0.000 ac
Totals	-	-	0.823 ac	-	T	0.257 ac	0.119 ac
					P	0.039 ac	

Permanently impacted wetland acreage totals 0.039 ac. An area of hydrologically abandoned hydric soils totaling approximately 1.29 acres shall be rehydrated along the Sitton Creek corridor which will serve to offset the permanent impacts. A Pre-Construction Notification and 401/404 submittal that includes this information will be submitted to the IRT with the Final Mitigation Plan.

7.2.7 Implementation Methods

Stream Restoration

An exploratory effort will be completed in proximity to the proposed channel work to access and harvest suitable bed material for installation in the proposed channel bed. Where the quantity of existing bed material is insufficient it will be supplemented with off-site material of appropriate size.

In some locations, topographic, profile, and lateral constraints as well as a preference to utilize existing stable channel features prevent Priority I restoration and it will be necessary to construct a bankfull bench. Along these reaches, topsoil will be removed prior to excavation and stockpiled. After completion of grading operations, topsoil will be redistributed across the floodplain bench to facilitate vegetation success.

Brush run structures will be used to provide vertical stability to the channel, assist in maintaining riffle, run and pool features and to provide increase stream bed habitat diversity. Run structures will generally be placed at the tail-of-riffle location to support the upstream riffle grade. Brush runs are constructed without synthetic materials (filter fabric) and function as an analog to debris jams frequently observed in natural systems. Depending on the overall channel slope and size, a varying combination of logs, brush, boulders, cobbles, gravels and soil shall be utilized in the construction of these bed features. Brush runs serve to increase the longitudinal distance over which the vertical drop that occurs at the tail-of-riffle location is managed, add channel bed roughness to the steeper run facet, increase woody debris incorporation and encourage hyporheic exchange. Brush toe structures will be installed on the outside of certain meander bends to provide bank stability, increase bank roughness, and provide aquatic habitat. Trees with diameters in the range of 12" to 24" will be harvested from the site or nearby property for use as in-stream structures. Small diameter (less than 6") woody plants suitable for transplanting will be harvested on-site where available.

Earthwork activities will include excavation of the proposed channels, partial or complete backfilling of existing channels and removal of existing spoil piles. Grading work is designed to restore or mimic natural contours.

Wetland Rehabilitation and Re-establishment

Re-establishment of the wetlands, where proposed, will involve the removal of any overburden material to expose the underlying buried hydric soils. Wetland hydrology will be restored by raising the stream bed elevations. Additional grading activities may include harvesting usable topsoil material for re-use on portions of the re-graded floodplain, removal of spoil piles, and grading off-channel depressional features to provide for additional retention of surface water and increased habitat diversity. Rehabilitation of existing wetlands, where proposed, will primarily involve stabilizing wetland hydrology and replanting. All Re-establishment areas will be ripped to remove effects of past compaction and planted with native wetland vegetation. Invasive species will be removed and a riparian wetland vegetation community with be established.

Planting Plan

The final stage of construction will consist of seeding and planting within the conservation easement to establish native forest and herbaceous communities. The riparian buffer along stream restoration reaches will be planted with native vegetation selected to create a Headwater Forest community throughout the Site. The planting plan figures and the species list are shown in the construction plans (Appendix B, sheets P1-P2). The riparian buffer area (approximately 11.8 acres) will be planted with bare root seedlings at a density of 680 stems per acre on an approximate spacing of 8 feet. Additionally, stream banks will be planted with live stakes according to the details and species list in the construction plan (Appendix B, Sheet P1).

Areas within the easement that contain fescue will be addressed using both mechanical and chemical control methods. Fescue containing areas that fall directly adjacent to or are contained within the limits of disturbance for channel or floodplain grading will be mechanically controlled, e.g. grubbed out, during the grading work. Areas containing fescue that will not be subject to grading will be chemically controlled via recurrent spot treatments prior to, during, and following construction, and will cease prior to revegetation of the site via woody bare roots. Following the site planting, the need for continued fescue control will be reevaluated. It is our opinion that the combination of mechanical and chemical control along with incidental shade from revegetation will be sufficient to eliminate fescue populations onsite.

The planted buffer will extend a minimum of 30 feet past either side of the stream top of bank, except in locations where existing structures, right-of-way or utilities prevent the full width from being established. While this project is not seeking buffer credits, the proposed design results in approximately 8% of the total stream side buffer width being less than 30 feet. Locations where buffer widths are less than 30 feet are included on Figure 5. To offset the reduction in credits where buffer widths are less than 30 feet, additional credit will be sought where planted buffer widths exceed 30 feet.

7.3 RISK EVALUATION

Although a formal risk assessment has not been conducted as a part of this project, the assessment and design process is structured to identify areas of concern and potential risk to the project success or liabilities that may develop in association with the project. These identified concerns are listed in Table 17 below along with a subjective risk assessment (Low, Moderate, High) and potential courses of action that could remedy or mitigate the issue.

TABLE 17 RISK EVALUATION

Risk Evaluation		
Identified Concern	**Risk Level**	**Potential Remedy**
Watershed buildout	Low	None
Groundwater hydrologic trespass	Low	Grading plan designed to minimize occurrence of hydrologic trespass.
Invasive or unwanted species colonization	Moderate	Treat any emergences of invasive or unwanted species during the monitoring period.
Stability of Constructed Channel	Low	Stream design configured to minimize risk of instabilities. Conduct morphological observations throughout monitoring period. Adhere to the conservation easement boundary.
Survival of Planted Vegetation	Moderate	Conduct observations on plant survival and growth during monitoring period. Replant and adjust plant species as needed.
Beaver encroachment	Low	Remove any structures created by beavers during the monitoring period. Seek other removal options if beavers become established.
Road and Utility Maintenance	Moderate	Adaptive management

8.0 CREDIT YIELD

8.1 DETERMINATION OF CREDITS

Mitigation credits presented in Table 18A are projections based upon site design and placed into the category of Stream Mitigation Units (SMUs). Credits have been calculated with regard to restoration level, mitigation ratio, and buffer width. Adjustments to credits due to buffer width were calculated using the Wilmington District Stream Buffer Credit Calculator tool from the USACE, version dated 1/19/2018. This process compares the ideal buffer area and actual buffer area for the proposed designed stream. The ideal buffer area is the maximum area measured from the top of bank along the designed stream. The actual buffer area is the area measured along the top of bank of the designed stream that falls within the conservation easement and is creditable. All areas were obtained from a GIS analysis and the calculations are presented in Table 18B.

When the project is constructed, An As-Built report will be produced detailing the finished project. The As-Built report will not re-calculate Mitigation Credits, but may be used as part of an addendum to petition a change in Project Credits.

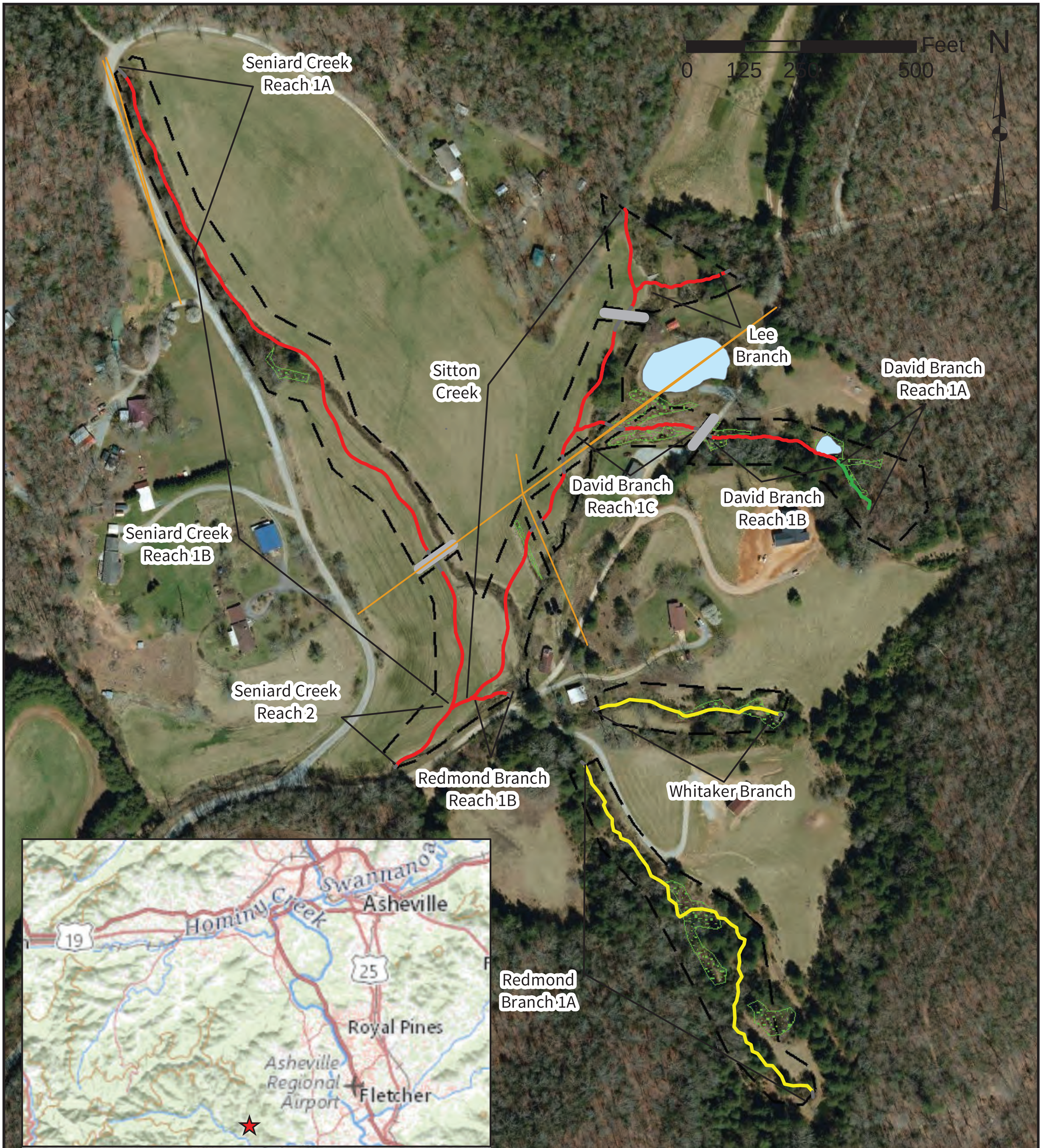
TABLE 18A PROJECT ASSETS

Stream Mitigation Components									
Component (Reach ID)	Existing Footage (ft)	Mitigation Plan Footage (ft)	Credit-able Footage (ft)	Mitigation Category	Restor-ation Level	Priority Level	Miti-gation Ratio (X:1)	Mitiga-tion Credits	Comments
Seniard Creek 1A	404	396	376	Cold	R	II	1:1	376	Less 20' for outlet protection
Seniard Creek 1B	1272	1274	1213	Cold	R	I	1:1	1213	Less 61' for crossing, outlet protection
Seniard Creek 2	422	176	176	Cold	R	I	1:1	176	
Sitton Creek 1	1105	1236	1095	Cold	R	I	1:1	1095	Less 141' for crossing, easement breaks
Lee Branch	129	226	212	Cold	R	II	1:1	212	Less 14' for out of easement and confluence
David Branch 1A	132	132	132	Cold	P	N/A	10:1	13	
David Branch 1B	224	335	296	Cold	R	I & II	1:1	296	Less 39' for crossing
David Branch 1C	165	273	226	Cold	R	I	1:1	226	Less 47' for easement
Whitaker Branch	426	426	416	Cold	EII	N/A	8:1	52	Less 10' for out of easement
Redmond Branch 1A	1066	1054	1046	Cold	EII	N/A	7:1	149	Less 8' for out of easement
Redmond Branch 1B	40	94	76	Cold	R	I	1:1	76	Less 18' for outlet and confluence

Mitigation Category Summation					
Restoration Level	Stream (linear feet)	Riparian Wetlands (ac)		Non-Riparian Wetlands (ac)	Credited Buffer (sqft)
		Riverine	Non-Riverine		
Restoration	3671	N/A	N/A	N/A	N/A
Re-establishment	N/A	N/A	N/A	N/A	N/A
Rehabilitation	N/A	N/A	N/A	N/A	N/A
Enhancement	N/A	N/A	N/A	N/A	N/A
Enhancement I	N/A	N/A	N/A	N/A	N/A
Enhancement II	1462	N/A	N/A	N/A	N/A
Creation	N/A	N/A	N/A	N/A	N/A
Preservation	132	N/A	N/A	N/A	N/A
High Quality (Pres)	N/A	N/A	N/A	N/A	N/A

Stream Credits	
Total Baseline Credit	3887.33
Credit Loss in Required Buffer	-441.36
Credit Gain for Additional Buffer	202.68
Net Change in Credit from Buffers	-238.68
Total Project Credits	**3648.65**

Overall Asset Summary			
Stream (SMUs)	**Riparian Wetland (WMUs)**	**Non-Riparian Wetland (WMUs)**	**Buffer**
3648.65	**0.0**	**0.0**	**N/A**



EQUINOX

Figure 4.
Assets Map
Seniard Creek
Stream Restoration Site
Henderson Co., NC
May 2020

Conservation Easement
Overhead Wire
Proposed Crossings
Existing Pond
Existing Wetland

Stream Restoration Type

Enhancement II	1,462 LF
Preservation	132 LF
Restoration	3,671 LF
Non-Creditable	

This map is not a survey and is not to be construed as such

Page left intentionally blank for printing purposes.

TABLE 18B BUFFER CREDIT ADJUSTMENT

Buffer Width Zone (feet from Ordinary High Water Mark)					
Buffer Zone	< 15 Feet	>15 Feet to 20 feet	>20 Feet to 25 feet	>25 Feet to 30 feet	
Max Possible Buffer (SQ FT)	157950.9	52650.3	52650.3	52650.3	
Ideal Buffer (SQ FT)	166023.16	56840.02	56931.3	57314.25	
Actual Buffer (SQ FT)	155308.09	49406.41	47410.19	45841.14	
Zone Multiplier	50%	20%	15%	15%	
Buffer Credit Equivalent	1943.66	777.47	583.1	583.1	
% of Ideal Buffer	94.0%	87.0%	83.0%	80.0%	
Credit Adjustment	-125.44	-101.68	-97.52	-116.72	
Buffer Zone	>30 Feet to 50 feet	> 50 Feet to 75 feet	>75 Feet to 100 feet	>100 Feet to 125 feet	>125Feet to 150 feet
Max Possible Buffer (SQ FT)	210601.2	263251.5	263251.5	263251.5	263251.5
Ideal Buffer (SQ FT)	228056.39	284697.99	287067.2	283209.29	278101.14
Actual Buffer (SQ FT)	109226.28	24906	10706.61	3716.03	170.76
Zone Multiplier	9%	7%	6%	5%	3%
Buffer Credit Equivalent	349.86	272.11	233.24	194.37	116.62
% of Ideal Buffer	48.0%	9.0%	4.0%	1.0%	0.0%
Credit Adjustment	167.56	23.8	8.7	2.55	0.07

Credit Totals				
Total Baseline Credit	Credit Loss in Required Buffer	Credit Gain for Additional Buffer	Net Change in Credit from Buffers	Total Credits
3887.33	-441.36	202.68	-238.68	3648.65

Page left intentionally blank for printing purposes.

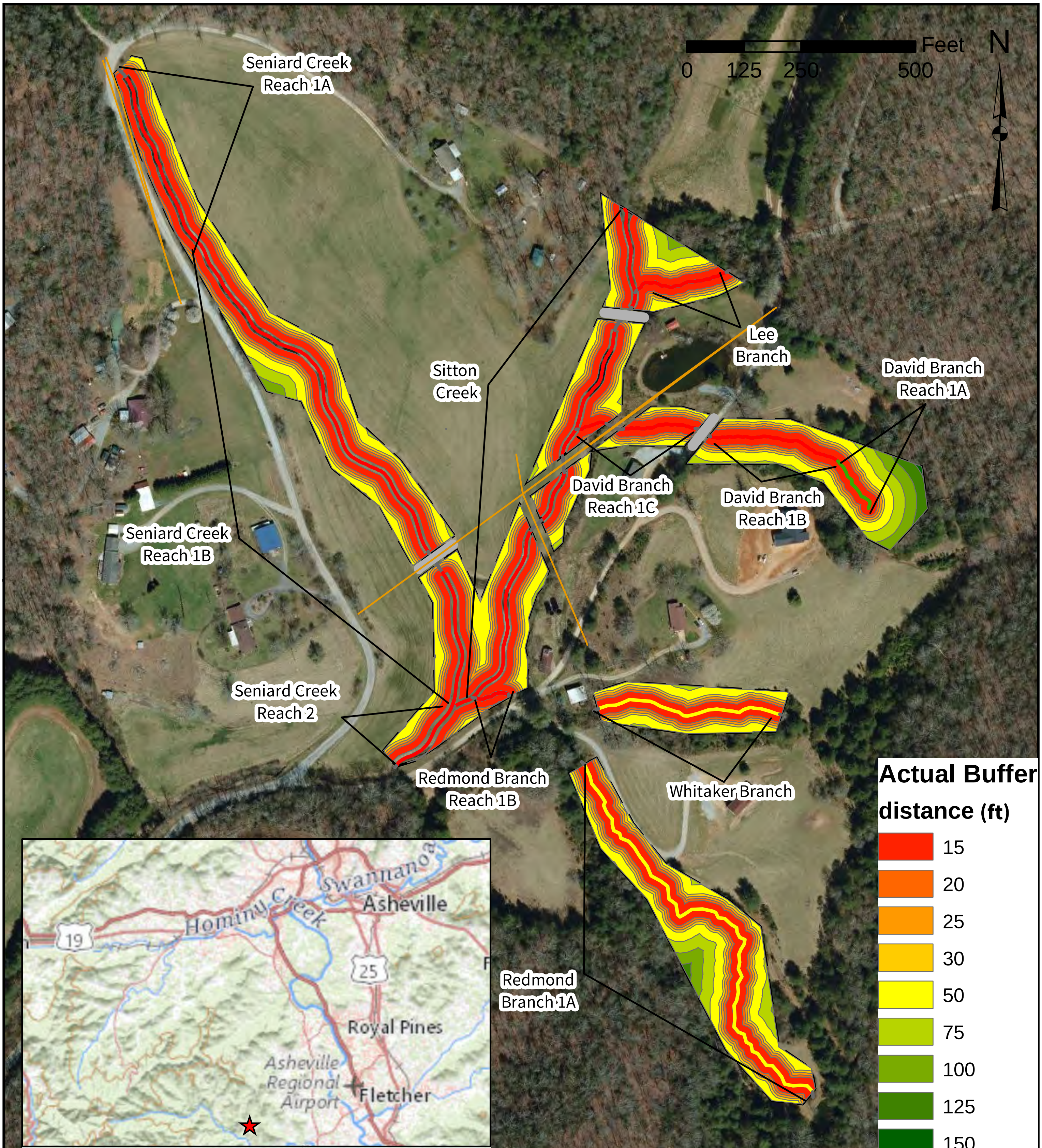


Figure 5.
Buffer Credit Adjustment
Seniard Creek
Stream Restoration Site
Henderson Co., NC
May 2020

EQUINOX

Conservation Easement
Overhead Wire
Proposed Crossings

Stream Restoration Type

Enhancement II	1,462 LF
Preservation	132 LF
Restoration	3,671 LF
Non-Creditable	

This map is not a survey and is not to be construed as such.

Page left intentionally blank for printing purposes.

9.0 PERFORMANCE STANDARDS

The stream and wetland performance standards will conform with the performance criteria provided in the DMS Stream and Wetland Mitigation Plan Template and Guidance (June 2017), the Annual Monitoring Template (June 2017), and the Closeout Report Template (v2.2 January 2016). The restoration and enhancement components are assigned specific performance standards for geomorphology, hydrology, and vegetation. Performance criteria is proposed to be evaluated throughout the seven-year monitoring period. Table 19 provides a list of the performance standards associated with each project objective along with a description of the monitoring approach.

TABLE 19 PERFORMANCE STANDARDS

Performance Standards		
Objective	**Performance Standard**	**Monitoring Approach**
Construct stream channels that will maintain proper dimension, pattern and profile.	• Riffle section W/D ratios should remain within the range of the appropriate stream type. • BHR should not exceed 1.2. BHR should not change more than 10% in any given monitoring interval. Changes that do occur should indicate a trend toward stability. • Entrenchment Ratios should be ≥ 2.2 for C/E channels and ≥ 1.4 for B Channels. • Document nearly continuous surface flow.	Survey of select cross sections and visual assessment. Continuous stage recorders for base flow.
Construct streams with proper bankfull to floodplain relationship.	Four bankfull events or greater, in separate years, will be documented during the monitoring period.	Crest gauges, continuous stage recorders, and debris lines.
Construct streams that provide naturally stable dimensions and stabilize constructed banks with appropriate bioengineering.	Channel banks should generally remain stable. Where bank migration does occur, it should not exceed 10% of the previous monitored bankfull width and 20% of the original design bankfull width.	Visual assessment and bank pin monitoring as necessary.

Performance Standards		
Objective	**Performance Standard**	**Monitoring Approach**
Construct streams that maintain an appropriate sediment transport balance with the sediment that is supplied by the watershed so that the overall stream profile neither aggrades nor degrades over time.	Profile adjustments should not indicate significant aggradation or degradation. BHR requirements as stated above.	Resurvey of longitudinal profile if visual assessment indicates potential instability.
Create and improve stream bedform diversity by constructing pools of varied depths and riffles of varied slopes.	Profile should maintain a diversity of depths expressed in riffle/pool forms.	Visual assessment
Construct stable riffles that provide an improved diversity of bed material clast and a reduction in fines relative to existing conditions.	Substrate material should progress towards or maintain coarser material in riffles and runs with finer material present in pools and glides.	Pebble count measurements at surveyed cross sections
Construct in-stream habitat features from native material to provide a diversity of habitats.	In-stream habitat structures should remain intact and functional.	Visual assessment
Provide improved fish passage through previous upstream impediments.	No standards have been set, but results should present trends in increased fish passage.	Electrofishing surveys
Provide a buffer from agricultural activities and row crops.	Record conservation easement prior to implementation.	Conservation Easement Compliance
Plant native climax tree species and understory species in the riparian zone.	At project initiation, a minimum of 680 stems/ac are to be planted. Minimum of 320 stems/ac present at MY-3. Minimum of 260 stems/ac present, measuring 6ft at MY-5. Minimum of 210 stems/ac present, measuring 8ft at MY-7.	Vegetation plots
Reconstruct stream channels that are properly connected to the riparian areas.	Bankfull elevations and profile should be consistent with valley grade.	Visual assessment

Performance Standards		
Objective	**Performance Standard**	**Monitoring Approach**
Re-grade topography to eliminate ditches and drainage features.	Floodplain topography should no longer contain lateral ditches or drainage features.	Visual assessment
Plant native wetland tree and shrub species.	At project initiation, a minimum of 680 stems/ac shall be planted. Minimum of 320 stems/ac present at MY-3. Minimum of 260 stems/ac present at MY-5. Minimum of 210 stems/ac present at MY-7.	Vegetation plots
Establish a conservation easement that provides a minimum buffer from future activities in the adjacent watershed.	Record conservation easement prior to implementation.	Conservation Easement Compliance

10.0 MONITORING PLAN

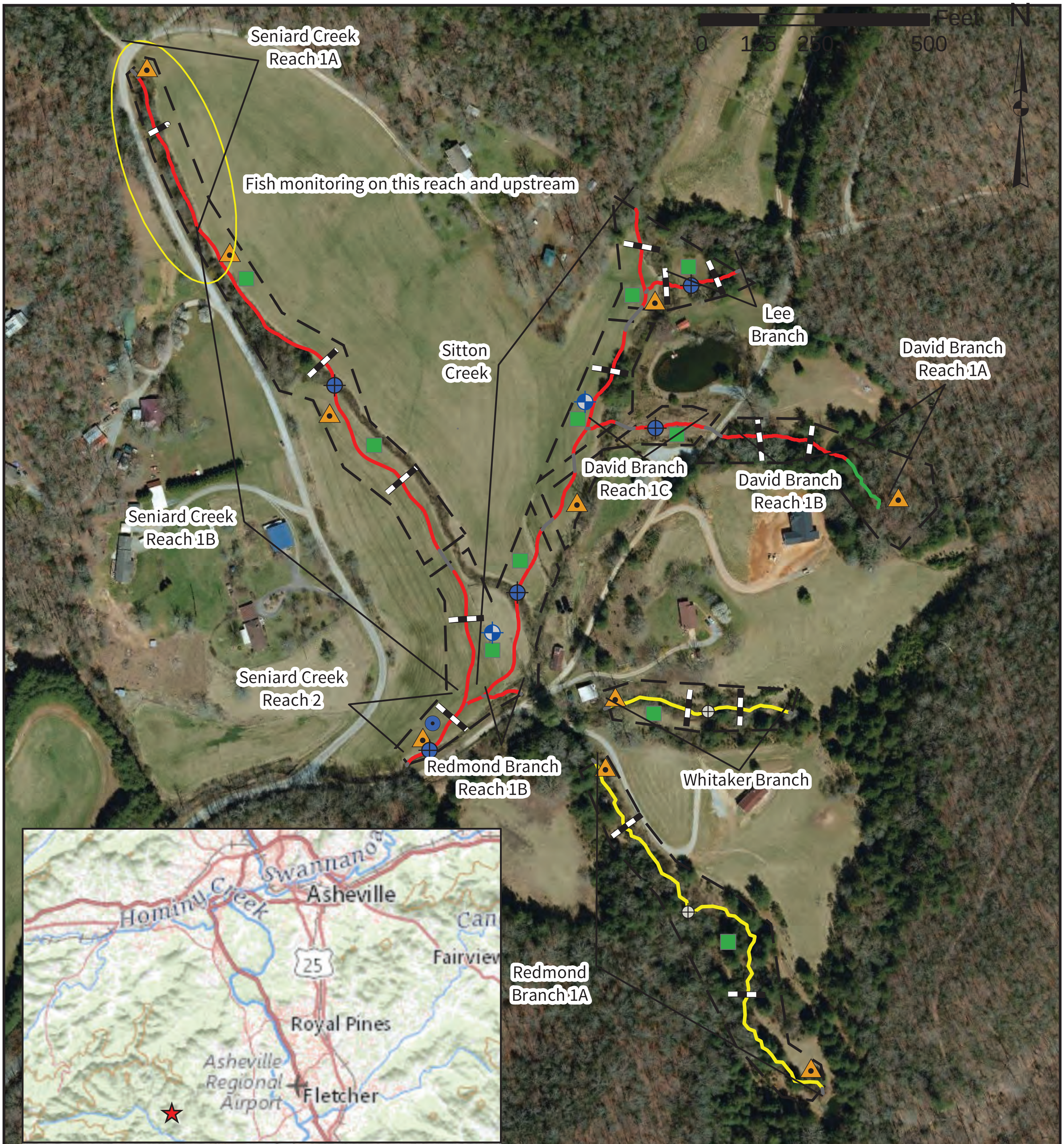
Monitoring data will be reported using the NCDMS monitoring template. The monitoring report shall provide a project data chronology that will facilitate an understanding of project status and trends, will provide population of NCDMS databases for analysis, research purposes, and will assist in decision making regarding project close-out.

TABLE 20 MONITORING PLAN COMPONENTS

Monitoring Plan Components				
Parameter	**Method**	**Quantity**	**Frequency**	**Notes**
Dimension	Riffle Cross Sections	Seniard Reach 1 (1) Seniard Reach 2 (1) Sitton Reach 1 (1) Lee Reach 1(1) David Reach 1 (1) Whitaker Reach 1 (1) Redmond Reach 1 (1)	Years 1, 2, 3, 5, & 7	Measured dimensions will be compared to reference dimensions to calculate bed-width index and max-depth index.
	Pool Cross Sections	Seniard Reach 1 (2) Sitton Reach 1 (1) Lee Reach 1(1) David Reach 1 (1) Whitaker Reach 1 (1) Redmond Reach 1 (1)	Years 1, 2, 3, 5, & 7	Measured dimensions will be compared to reference dimensions to calculate bed-width index and max-depth index.
Pattern	Visual Inspection	None	Bi-annual	Bank pins will be installed only in areas of concern.
Profile	Visual Inspection	None	Bi-annual	Additional profile measurements may be required if problems are identified during the monitoring period.
Substrate	Pebble Counts	7	Years 1, 2, 3, 5, & 7	
Surface Water Hydrology	Continuous Stage Recorder Crest Gauge	5 2	Semi-annual	The device will be inspected on a semi-annual basis to document the occurrence of bankfull events on the project.

Monitoring Plan Components				
Parameter	**Method**	**Quantity**	**Frequency**	**Notes**
Groundwater Hydrology	Groundwater Gauge	2	Annual	Data will be downloaded on a monthly basis during the growing season.
Vegetation	Vegetation Plots	10	Annual	Vegetation monitoring will follow CVS protocol.
Fish Passage	Electrofishing surveys	1	Annual	Measurements and sampling methods will follow recommendations in the Standard Methods for Sampling North American Freshwater Fishes, 2009 and Fisheries Techniques 3rd Ed, 2012.
Exotic and Nuisance Vegetation	Visual	N/A	Semi-annual	Approximate locations of exotic and nuisance vegetation and the occurrence of beaver dams will be mapped.
Project Boundary	Visual	N/A	Semi-annual	Locations of vegetation damage, boundary encroachments, etc. will be mapped.

Page left intentionally blank for printing purposes.



EQUINOX

Figure 6.
Monitoring Features Map
Seniard Creek
Stream Restoration Site
Henderson Co., NC
May 2020

Conservation Easement
Groundwater Gauge
Rain Gauge
Crest Gauge
Stream Gauge
Photo Points

Stream Restoration Type

Enhancement II	1,462 LF
Preservation	132 LF
Restoration	3,671 LF
Non-Creditable	
Vegetation Monitoring Plot	

This map is not a survey and is not to be construed as such

Page left intentionally blank for printing purposes.

11.0 MANAGEMENT PLAN

11.1 ADAPTIVE MANAGEMENT PLAN

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

11.2 LONG-TERM MANAGEMENT PLAN

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

Page left intentionally blank for printing purposes.

12.0 REFERENCES

Andrews, E.D. (1984) Bed-material entrainment and hydraulic geometry of gravel-bed rivers in Colorado. *Geological Society of America Bulletin*, 95, 371-378.

Equinox Environmental (2018). *Environmental Resources Technical Report, Seniard Creek Stream Mitigation Site*.

Faber-Langendoen, D., Rocchio, J., Schafale, M., Nordman, C., Pyne, M., Teague, J., Foti, T., Comer, P. (2006). *Ecological Integrity Assessment and Performance Measures for Wetland Mitigation*. NatureServe, Arlington, Virginia.

Fischenich, J.C. (2006). *Functional Objectives for Stream Restoration.* USAE Research and Development Center, Vicksburg, MS. ERDC TN-EMRRP SR-52.

Griffith, G.E., et. al. (2002). *Ecoregions of North Carolina and South Carolina*. Color poster with map, descriptive text, summary tables, and photographs.

Harmon, W., et. al. (2012). *A Function-Based Framework for Stream Assessments and Restoration Projects*. US Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds, Washington, DC. EPA 843-K-12-006.

Lamb, Michael P., Dietrich, W.E., Venditti, J. G. (2008). *Journal of Geophysical Research*, 113, 1-20.

Lankford, G.K. (2019). Site Hydric Soils Detailed Study, Seniard Mitigation Site, Henderson County, NC January 2019.

Lindenmayer, D.B., and J.F. Franklin. (2002). *Conserving forest biodiversity: A comprehensive multiscaled approach.* Island Press, Washington, DC.

North Carolina Division of Mitigation Services (NCDMS 2009). French Broad River Basin Restoration Priorities.
https://files.nc.gov/ncdeq/Mitigation%20Services/Watershed_Planning/Little_Tenn_River_Basin/RBRP_LTN_2008.pdf

North Carolina Division of Water Resources (NCDWR 2017). *Surface Water Classifications*. https://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications Raleigh, NC.

North Carolina Floodplain Mapping Program (NCFMP 2017) *Flood Risk Information System*. http://www.ncfloodmaps.com/ Raleigh, NC.

North Carolina Geological Survey (NCGS 1985). Geologic Map of North Carolina. North Carolina Department of Natural Resources and Community Development, Raleigh, NC.

North Carolina Wetland Functional Assessment Team (NCWFAT 2016). *North Carolina Wetland Assessment Method User Manual*, version 5.

Peet, R.K., Wentworth, T.S., and White, P.S. (1998). *A flexible, multipurpose method for recording vegetation composition and structure*. Castanea 63:262-274

Pope, B.F., Tasker, G.D. (1999). Estimating the magnitude and frequency of floods in rural basins of North Carolina. U.S. Geological Survey Water Resources Investigations Report 99-4114. U.S. Geological Survey, Raleigh, NC.

Rosgen, D. (1996). *Applied River Morphology, 2nd edition*, Wildland Hydrology, Pagosa Springs, CO.

Schafale, M.P. (2012). *Guide to the Natural Communities of North Carolina, Fourth Approximation*, NC Natural Heritage Program, Raleigh, NC

US Army Corps of Engineers (USACE 2016). *Wilmington District Stream and Wetland Compensatory Mitigation Update. North Carolina Interagency Review Team – October 24, 2016.* http://saw-reg.usace.army.mil/PN/2016/Wilmington-District-Mitigation-Update.pdf.

US Army Corps of Engineers (USACE 2003). *Stream Mitigation Guidelines, April 2003*. US Army Corps of Engineers Wilmington District.

US Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS 2013). Jackson County Soil Survey. https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Young, T.F. and Sanzone, S. (editors). (2002). *A framework for assessing and reporting on ecological condition*. Ecological Reporting Panel, Ecological Processes and Effects Committee. EPA Science Advisory Board. Washington, DC.

Bonar, Scott A., Hubert, Wayne A. and Willis, David W. eds., Standard Methods for Sampling North American Freshwater Fishes., American Fisheries Society, 2009.

Menhinick, Edward, F. (1991) The Freshwater Fishes of North Carolina, Larkin Distributors.

Zale, Alexander V., Parrish, Donna L., and Sutton, Trent M., eds. (2012) Fisheries Techniques 3rd Edition, American Fisheries Society.

APPENDICES

Appendix A PHOTO LOG

Page left intentionally blank for printing purposes.

Photo 1. Seniard Creek facing upstream to existing perched culvert @ Sta 100+00 Reach 1A 01-25-18

Photo 2. Seniard Creek facing downstream @ Sta 102+20 Reach 1A 01-25-18


Photo 3. Seniard Creek facing downstream @ Sta 104+50 Reach 1B 01-25-18


Photo 4. Seniard Creek looking downstream @ Sta 109+30 Reach 1B 01-25-18

Photo 5. Seniard Creek looking upstream @ Sta 115+50 Reach 1B 01-25-18

Photo 6. Seniard Creek looking upstream @ Sta 118+10 Reach 2 01-25-18


Photo 7. Seniard Creek looking downstream @ Sta 188+80 Reach 2 01-25-18


Photo 8. Seniard Creek looking downstream @ Sta 121+30 Reach 2 01-25-18


Photo 9. Sitton Creek looking upstream @ Sta 201+00 Reach 1 01-25-18


Photo 10. Sitton Creek looking downstream @ Sta 202+50 Reach 1 01-25-18


Photo 11. Sitton Creek looking downstream @ Sta 204+40 Reach 1   01-25-18


Photo 12. Sitton Creek looking downstream @ Sta 207+50 Reach 1 01-25-18

Photo 13. Lee Branch looking upstream @ Sta 301+00 Reach 1 01-25-18

Photo 14. David Branch looking downstream @ Sta 401+40 Reach 1A 01-25-18

Photo 15. David Branch looking upstream @ Sta 402+10 Reach 1A 01-25-18

Photo 16. David Branch looking downstream @ Sta 404+70 Reach 1A 01-25-18

Photo 17. Whitaker Branch looking upstream from lower end 01-25-18

Photo 18. Redmond Branch looking downstream from upper end 01-25-18

Photo 19. Redmond Branch looking upstream from lower end 01-25-18

Page left intentionally blank for printing purposes.

Appendix B PLAN SHEETS

Page left intentionally blank for printing purposes.

NC DMS PROJECT #100017

STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
NC	172621103	1	43

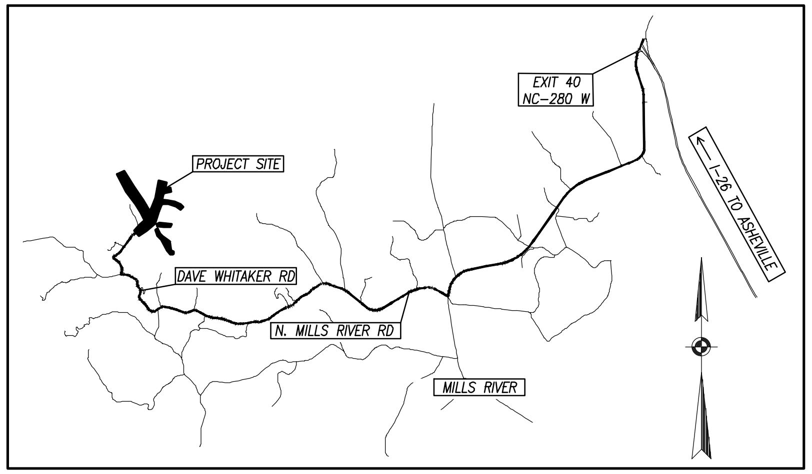
SYM.	DESCRIPTION	DATE	APPROVED
	FINAL PLANS	5/22/20	CME
1	SHEETS 1, EC-1, EC-2A	5/29/20	CME

REVISIONS

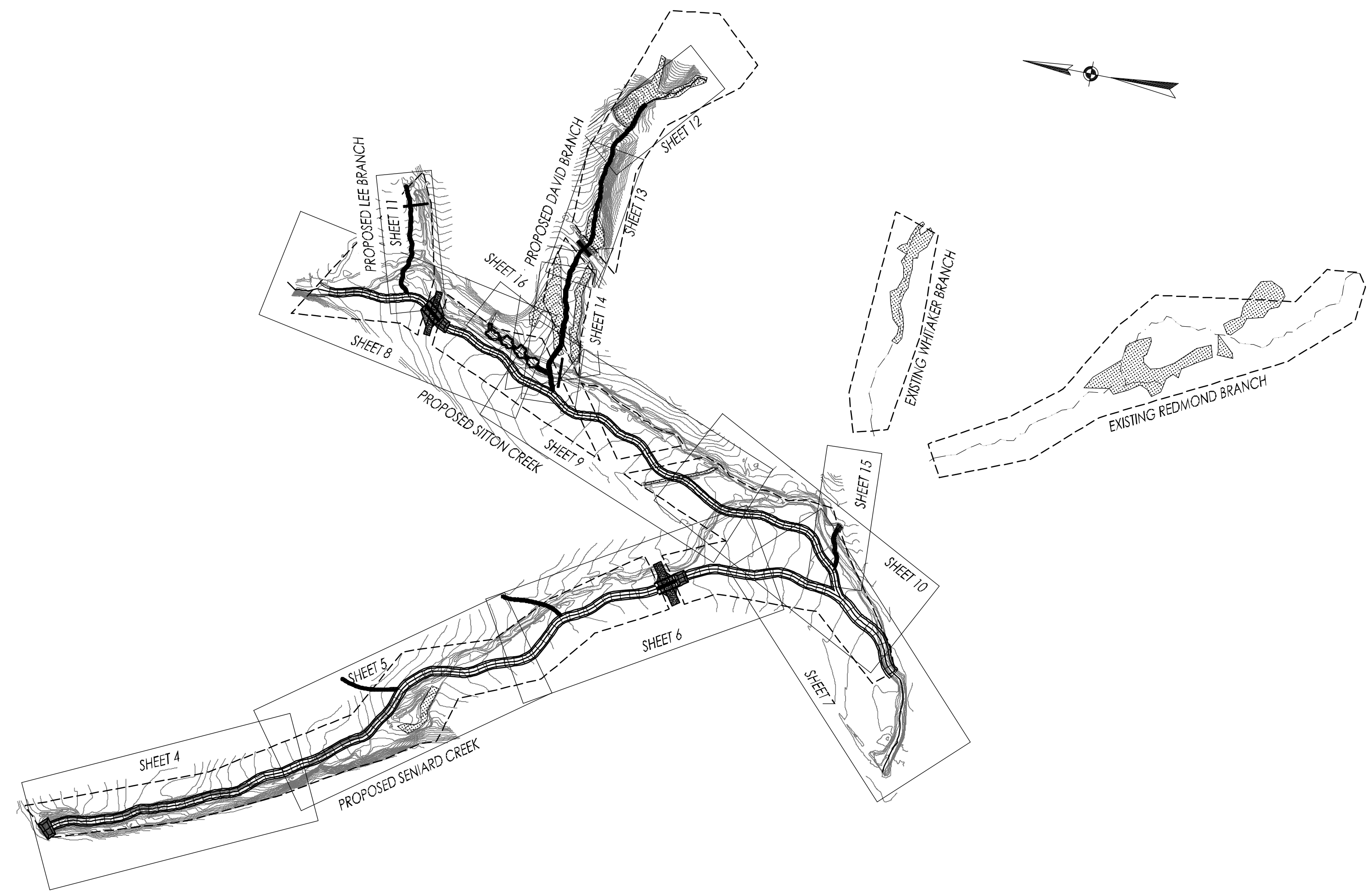
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION PROJECT

SENIARD CREEK
HENDERSON COUNTY, NORTH CAROLINA



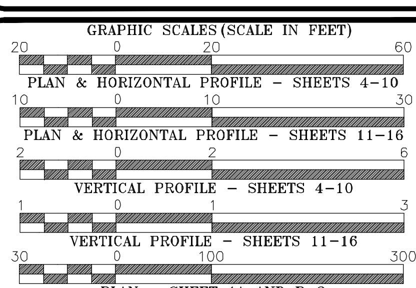
VICINITY MAP
NOT TO SCALE



SHEET INDEX

SHEET NO.	DESCRIPTION
1	TITLE SHEET
1A	SITE PLAN
2-2A	TYPICAL SECTIONS
3-3E	DETAILS
4-16	PLAN AND PROFILE
P1-P2	PLANTING PLAN
EC1-EC4	EROSION CONTROL PLANS
XS-1 - XS-12	CROSS SECTIONS

FINAL PLANS



PROJECT LENGTHS

PROPOSED RESTORATION:

SENIARD CREEK	= 1,846 FT
SITTON CREEK	= 1,236 FT
DAVID BRANCH	= 608 FT
LEE BRANCH	= 226 FT
REDMOND BRANCH	= 94 FT

PROPOSED ENHANCEMENT:

WHITAKER BRANCH	= 426 FT
REDMOND BRANCH	= 1,054 FT

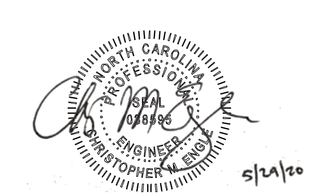
PROPOSED PRESERVATION:

DAVID BRANCH	= 132 FT
TOTAL LENGTH	= 5,622 FT

Prepared by:

Stantec

Stantec Consulting Services Inc.
56 College Street, Suite 201
Asheville, North Carolina 28801
www.stantec.com



PROJECT ENGINEER

Prepared for:

NC DMS

HARRY TSOMIDES
PROJECT MANAGER

NOTE: PROPERTY BOUNDARIES, FENCES AND UTILITIES NOT SURVEYED. APPROXIMATE LOCATIONS ONLY.

LOCATION KEY

LEGEND

- EXISTING WETLAND
- EXISTING HYDRIC SOILS
- EXISTING PROPERTY BOUNDARY
- EXISTING OVERHEAD UTILITY
- EXISTING FENCE
- PROPOSED CONSERVATION EASEMENT BOUNDARY
- PROPOSED STREAM RESTORATION
- FILL
- CUT
- PROPOSED DEBRIS PLACEMENT
- PRESERVE EXISTING TREE

Stantec
56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Client/Project
EW SOLUTIONS
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NORTH CAROLINA

Title
SITE PLAN

Permit-Seal

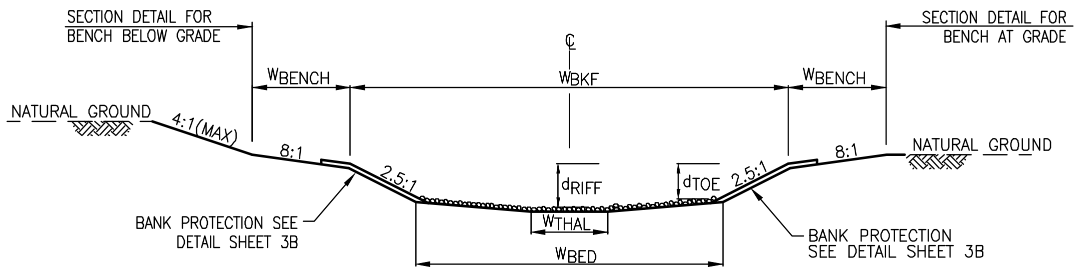
NORTH CAROLINA PROFESSIONAL SEAL 038555 ENGINEER CHRISTOPHER M. EBLE
5/27/20

Project Number: 172621103

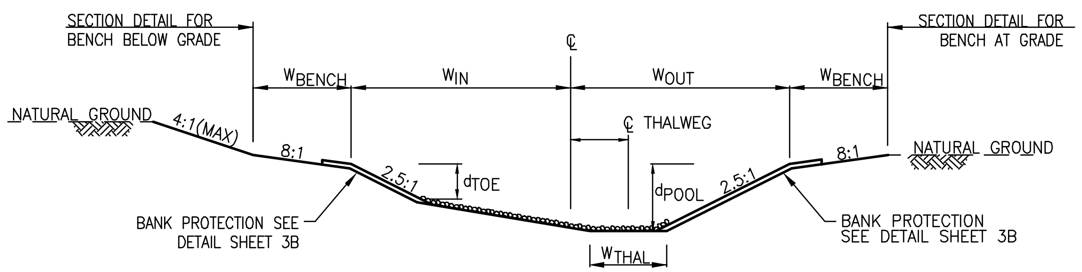
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0 Sheet 1A

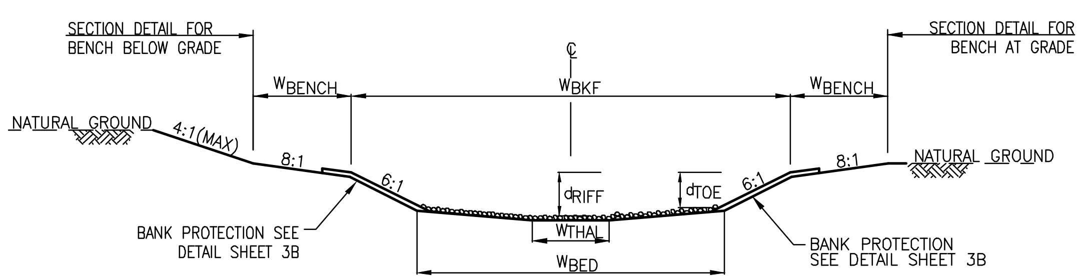
V:\1726\active\172621103\DWG\1103-01A-Site Plan.dwg
2020/05/27 11:25 AM By: Manner, Christina



SECTION 1
TYPICAL RIFFLE
NOT TO SCALE



SECTION 1
TYPICAL POOL
NOT TO SCALE



SECTION 2
TYPICAL HEADWATER CHANNEL
NOT TO SCALE

TABLE 1: SECTION DIMENSIONS

REACH	TYPICAL SECTION	STATION	RIFFLE DIMENSIONS						POOL DIMENSIONS			
			W_{BKF} (ft)	W_{BED} (ft)	W_{THAL} (ft)	W_{BENCH} (ft)	d_{RIFF} (ft)	d_{TOE} (ft)	W_{IN} (ft)	W_{OUT} (ft)	d_{POOL} (ft)	APPROX. POOL DEPTH (ft)
Seniard Creek - R1A	1	100+00 TO 103+96	17.4	11.8	3.6	12	1.38	1.11	10.42	8.68	2.07	0.5
Seniard Creek - R1B	1	103+96 TO 116+70	17.6	12.0	3.6	12	1.39	1.12	10.58	8.81	2.09	0.5
Seniard Creek - R2	1	116+70 TO 118+51	22.5	16.0	4.8	16	1.61	1.29	13.49	11.24	2.42	1
Sitton Creek - R1	1	200+55 TO 212+91	15.6	10.5	3.1	11	1.30	1.04	9.38	7.82	1.95	0.5
Lee Branch	2	300+00 TO 302+26	7.8	3.0	0.9	4	0.50	0.40	4.68	3.90	0.75	0.5
David Branch - R1A	2	400+00 TO 401+32	7.8	3.0	0.9	4	0.50	0.40	4.68	3.90	0.75	0.5
David Branch - R1B	2	401+32 TO 404+28	7.8	3.0	0.9	4	0.50	0.40	4.68	3.90	0.75	0.5
David Branch - R1C	2	404+28 TO 407+39	7.8	3.0	0.9	4	0.50	0.40	4.68	3.90	0.75	0.5
Redmond Branch 1B	1	610+66 TO 611+52	6.8	3.7	1.1	5	0.77	0.61	4.07	3.39	1.15	0.5

NOTE: APPROXIMATE POOL DEPTH IS DEPTH OF POOL RELATIVE TO DOWNSTREAM HEAD OF RIFFLE

TABLE 2: SUPPLEMENTAL BED MATERIAL (OFF-SITE MATERIAL)

REACH	PERCENT OF TOTAL MIX						DEPTH OF BED MATERIAL (FT)
	ON-SITE HARVEST MATERIAL	1/2" STONE (NO. 57)	3/4" STONE (NO. 5)	2" STONE (SURGE)	6" STONE NCDOT (CLASS A)	12" STONE NCDOT (CLASS B)	
Seniard Creek - R1A	100%	-	-	-	-	-	0.5
Seniard Creek - R1B	100%	-	-	-	-	-	0.5
Seniard Creek - R2	100%	-	-	-	-	-	0.5
Sitton Creek - R1	100%	-	-	-	-	-	0.5
Lee Branch	100%	-	-	-	-	-	VARIES
David Branch - R1A	100%	-	-	-	-	-	VARIES
David Branch - R1B	100%	-	-	-	-	-	VARIES
David Branch - R1C	100%	-	-	-	-	-	VARIES
Redmond Branch 1B	100%	-	-	-	-	-	0.5

NOTE: IT IS ANTICIPATED THAT ADEQUATE BED MATERIAL WILL BE AVAILABLE FOR HARVEST ON SITE, AND THAT NO QUARRY STONE WILL BE REQUIRED FOR USE AS BED MATERIAL. THE D_{50} OF INSTALLED BED MATERIAL SHALL BE APPROXIMATELY 60mm (MIN).

TABLE 3: MORPHOLOGIC TABLE

REACH	Seniard Creek - R1A	Seniard Creek - R1B	Seniard Creek - R2	Sitton Creek - R1	Lee Branch	David Branch - R1A	David Branch - R1B	David Branch - R1C	Whitaker Branch	Redmond Branch 1A	Redmond Branch 1B
STREAM TYPE	B	B	B	B	B	B	B	B	B	B	B
DRAINAGE AREA (mi^2)	1.29	1.34	2.46	0.99	0.02	0.01	0.01	0.04	0.04	0.07	0.11
W_{BKF} (ft)	17.4	17.6	22.5	15.6	7.8	7.8	7.8	7.8	7.8	7.8	6.8
XS_{BKF} (ft)	18.3	18.7	28.2	15.3	2.4	2.4	2.4	2.4	2.4	2.4	3.6
d_{MEAN} (ft)	1.1	1.1	1.3	1.0	0.3	0.3	0.3	0.3	0.3	0.3	0.5
d_{MAX} (ft)	1.4	1.4	1.6	1.3	0.5	0.5	0.5	0.5	0.5	0.5	0.8
S_{AVG} (ft/ft)	0.040	0.022	0.017	0.018	0.048	0.126	0.058	0.044	0.079	0.047	0.043
S_{VALLEY} (ft/ft)	0.026	0.020	0.032	0.015	0.029	0.135	0.070	0.051	0.082	0.055	0.046
W/D RATIO	16.5	16.6	17.9	16.0	25.8	25.8	25.8	25.8	25.8	25.8	12.8
ENTRENCHMENT RATIO	1.4	1.4	1.1	2.0	1.5	1.9	1.9	1.9	1.5	2.6	2.9
SINUOSITY	1.01	1.00	1.03	1.1	1.1	1.1	1.0	1.1	1.0	1.2	1.1
POOL-POOL RATIO	2.5 - 4.2	3.2 - 6.0	2.7 - 3.2	2.9 - 7.4	-	-	-	-	-	-	2.4
MEANDER WIDTH RATIO	1.6	2.0	1.8	2.1	1.7	1.5	1.4	1.4	2.0	2.5	1.7

Stantec
56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC
Title
TYPICAL SECTIONS

Permit-Seal

Project Number: 172621103

CEG SGG CME 20.05.22
Dwn. Chkd. Dsgn. YY.MM.DD

Revision 0 Sheet 2

CONSTRUCTION SEQUENCE

THE CONTRACTOR SHALL FOLLOW THE SEQUENCE OF CONSTRUCTION IN ACCORDANCE WITH THE PLANS AND AS DIRECTED BY THE ENGINEER.

THE CONTRACTOR SHALL CONDUCT STREAM WORK, INCLUDING INSTALLATION OF IN-STREAM STRUCTURES, GRADING, STABILIZATION MEASURES, AND SEEDING AND MULCHING, ON A SECTION OF STREAM THAT CAN BE ENTIRELY COMPLETED IN A SINGLE DAY.

1. THE CONTRACTOR SHALL IDENTIFY THE PROJECT BOUNDARY, LIMITS OF DISTURBANCE, SENSITIVE AREAS, STAGING AREAS, AND CONSTRUCTION ENTRANCES WITH THE ENGINEER.
2. THE CONTRACTOR SHALL PREPARE STABILIZED CONSTRUCTION ENTRANCES.
3. THE CONTRACTOR SHALL MOBILIZE EQUIPMENT, MATERIALS, PREPARE STAGING AREAS, AND STOCKPILE AREAS.
4. CONSTRUCTION TRAFFIC TO BE LIMITED TO 'LIMITS OF DISTURBANCE' AS INDICATED ON THE CONSTRUCTION PLANS OR AS DIRECTED BY THE ENGINEER.
5. THE CONTRACTOR SHALL INSTALL ALL TEMPORARY ROCK CHECK DAMS, SILT FENCE, AND MULCHING AROUND ALL CONSTRUCTION AREAS INCLUDING STAGING AND STOCKPILE AREAS AS INDICATED ON THE CONSTRUCTION PLANS OR AS DIRECTED BY THE ENGINEER.
6. THE CONTRACTOR SHALL INSTALL ALL TEMPORARY STREAM CROSSINGS. DITCHES AND STREAM REACHES WILL BE LEFT OPEN DURING INITIAL PHASES OF CONSTRUCTION TO ALLOW FOR DRAINAGE AND TO KEEP SITE ACCESSIBLE.
7. PUMP-AROUND OPERATION SHALL BE USED TO DIVERT FLOW DURING CONSTRUCTION EXCEPT AS ALLOWED BY THE ENGINEER. **ALL EXCAVATION SHALL BE PERFORMED IN THE DRY** OR IN ISOLATED REACHES EXCEPT AS ALLOWED BY THE ENGINEER.
8. THE CONTRACTOR SHALL BEGIN CLEARING, FLOODPLAIN EXCAVATION, AND GRADING WORK TO DESIGN GRADES AT THE UPSTREAM END OF THE CHANNEL AS INDICATED ON THE CONSTRUCTION PLANS. THE CONTRACTOR SHALL NOT DISTURB ANY MORE FLOODPLAIN AREA LARGER AND STREAM REACH LONGER THAN CAN STABILIZED IN ONE DAY.
9. ONCE A SECTION OF STREAM AND FLOODPLAIN HAVE BEEN EXCAVATED TO DESIGN GRADES, IN-STREAM STRUCTURES, MATTING, AND TRANSPLANTS SHALL BE INSTALLED IN THAT SECTION. EXISTING BED MATERIAL SHALL BE HARVESTED AND PLACED IN THE CONSTRUCTED CHANNEL.
10. THE CONTRACTOR SHALL BEGIN INSTALLING IN-STREAM STRUCTURES FROM THE UPSTREAM SECTION WORKING DOWNSTREAM. **ALL CONSTRUCTION WORK IS TO BE PERFORMED IN THE DRY** UNLESS OTHERWISE DIRECTED BY THE ENGINEER OR OTHER REGULATORY AGENCY. IF EXCESSIVE SEDIMENTATION DOWNSTREAM BECOMES A CONCERN, THE ENGINEER OR PROJECT MANAGER IN CHARGE MAY DIRECT THE CONTRACTOR TO INSTALL A TEMPORARY ROCK CHECK DAM AND SETTLING BASIN DOWNSTREAM. THIS AREA IS TO BE MAINTAINED ON A REGULAR BASIS BY THE CONTRACTOR.
11. ONCE A STREAM WORK PHASE IS COMPLETE, THE CONTRACTOR WILL APPLY TEMPORARY SEEDING, PERMANENT SEEDING, AND MULCH TO ALL AREAS DISTURBED DURING CONSTRUCTION. TEMPORARY AND PERMANENT SEEDING MIXTURES WILL BE APPLIED AS SHOWN ON THE PLANTING PLAN. TEMPORARY SEEDING WILL BE APPLIED IN ALL AREAS SUSCEPTIBLE TO EROSION SUCH THAT GROUND COVER IS ESTABLISHED WITHIN 7 WORKING DAYS FOLLOWING COMPLETION OF ANY GRADING PHASE. PERMANENT GROUND COVER WILL BE ESTABLISHED FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS FOLLOWING COMPLETION OF CONSTRUCTION.
12. ALL SEEDING AND MULCHING SHALL BE COMPLETED BEFORE LEAVING THE PROJECT SITE ALONG WITH REMOVAL OF ANY TEMPORARY STREAM CROSSINGS AND TEMPORARY CHECK DAMS.
13. THE CONTRACTOR OR OTHER QUALIFIED PERSONNEL SHALL PLANT ALL WOODY VEGETATION AND INSTALL LIVE STAKING ACCORDING TO THE PLANTING DETAILS AND SPECIFICATIONS. ALL PERMANENT SEEDING AND PLANTINGS SHALL BE PERFORMED DURING THE APPROPRIATE TIME OF YEAR.
14. THE CONTRACTOR SHALL ENSURE THAT THE SITE IS FREE OF TRASH AND LEFTOVER MATERIALS PRIOR TO DEMOBILIZATION OF EQUIPMENT FROM THE SITE.

GENERAL NOTES:

1. CONTRACTOR SHALL PERFORM ALL NECESSARY SUBSURFACE UTILITY INVESTIGATIONS PRIOR TO COMMENCING CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFICATION OF EXISTING CONDITIONS, OBSTRUCTIONS, AND UTILITIES WHICH MAY AFFECT PROPOSED WORK.
2. ALL MECHANIZED EQUIPMENT OPERATED IN OR NEAR THE STREAM OR ITS TRIBUTARIES SHALL BE INSPECTED REGULARLY AND MAINTAINED TO PREVENT CONTAMINATION OF STREAM WATERS FROM FUELS, LUBRICANTS, HYDRAULIC FLUIDS, OR OTHER TOXIC MATERIALS. A CONTINGENCY PLAN SHALL BE DEVELOPED FOR THE USE OF THESE MATERIALS, INCLUDING SPILL CONTAINMENT, CLEAN UP, AND NOTIFICATION TO THE APPROPRIATE AGENCIES. SPILL KITS, SORBENTS, AND CONTAINERS FOR DISPOSAL SHALL BE RETAINED ON SITE.
3. ALL EQUIPMENT MAINTENANCE SHALL BE PERFORMED AT LEAST 50 FT FROM THE STREAM OR ITS TRIBUTARIES.
4. CLEARING AND GRUBBING SHALL BE LIMITED TO THAT WHICH IS NECESSARY FOR CONSTRUCTION OF THE PROPOSED CHANNEL AND SHALL BE APPROVED BY THE ENGINEER.
5. CONTRACTOR IS RESPONSIBLE FOR PROVIDING SAFE INGRESS AND EGRESS FROM SITE FOR ALL VEHICLES INCLUDING, BUT NOT LIMITED TO, TRAFFIC ON ADJACENT PUBLIC ROADS AFFECTED BY CONSTRUCTION TRAFFIC.
6. CONTRACTOR SHALL DISPOSE OF ALL WASTE MATERIALS GENERATED BY CONSTRUCTION ACTIVITIES IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRS TO EXISTING FACILITIES FROM DAMAGES OCCURRING AS A RESULT OF CONSTRUCTION ACTIVITIES.
8. THE INSTALLATION OF EROSION CONTROL MEASURES AND PRACTICES SHALL OCCUR PRIOR TO LAND DISTURBING ACTIVITIES.

CHANNEL CONSTRUCTION NOTES:

1. CONSTRUCTION SHALL BEGIN AT THE UPSTREAM END OF EACH CHANNEL REACH AND PROCEED DOWNSTREAM UNLESS APPROVED OTHERWISE BY THE ENGINEER.
2. BED MATERIAL ON RIFFLE SECTIONS SHALL CONSIST OF BED MATERIAL EXCAVATED FROM EXISTING CHANNEL. WHERE INSUFFICIENT BED MATERIAL IS PRESENT IT SHALL BE SUPPLEMENTED WITH MATERIAL ACCORDING TO TABLE 2 AND AS DIRECTED BY THE ENGINEER.
3. THE CHANNEL BANKS SHALL BE STABILIZED ACCORDING TO THE BANK PROTECTION DETAILS ON SHEET 3B.
4. DIMENSION TOLERANCES SHALL BE AS FOLLOWS:
   - WIDTH: +/- 0.5 FT
   - DEPTH: +/- 0.1 FT
   - RIFFLE ELEVATIONS: +/- 0.1 FT
   - POOL ELEVATIONS: + 0.1 FT, - 0.5 FT
   - STRUCTURE ELEVATIONS: +/- 0.1 FT
5. EXISTING CHANNEL INDICATED TO BE FILLED ON PLANS SHALL BE BACKFILLED WITH 1-FOOT LIFTS AND COMPACTED TO IN-SITU SOIL DENSITY. CHANNEL SHALL BE FREE FROM BRUSH AND ORGANIC DEBRIS PRIOR TO BACKFILLING.
6. PUMP AROUND OPERATION SHALL BE USED TO DIVERT FLOW DURING CONSTRUCTION UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

TREE SURVEY/HARVEST/PROTECTION NOTES:

1. WOODY MATERIAL WILL BE HARVESTED ON-SITE FOR USE AS IN-STREAM STRUCTURES FOR STREAMBANK STABILITY, GRADE CONTROL, AND AQUATIC HABITAT ENHANCEMENT/RESTORATION. WOODY MATERIAL INCLUDES BOTH LARGE AND SMALL SIZE DIAMETER TREES INCLUDING STEM AND ROOT MASS. TREES WILL BE HARVESTED FROM UPLAND AREAS AS WELL AS ALONG RECONSTRUCTED STREAM BANKS DURING THE RESTORATION CONSTRUCTION PROCESS.
2. PREFERRED HARVEST TREES TO BE SELECTED FOR RESTORATION PURPOSES SHALL FIRST INCLUDE ALL DISEASED, DAMAGED, HAZARD, AND UNDESIRABLE TREE SPECIES UNTIL THE QUANTITIES NEEDED FOR STREAM RESTORATION ARE MET. AREAS SELECTED FOR HARVEST SHALL OCCUR WITHIN THE LIMITS OF DISTURBANCE AND DELINEATED BY A CERTIFIED ARBORIST OR OTHER PROFESSIONAL ECOLOGIST/BIOLOGIST.
3. TRANSPLANTS WILL BE SELECTED AND RELOCATED AS DIRECTED BY THE ENGINEER.
4. ALL WOODY MATERIALS WILL BE STOCKPILED IN THE APPROVED STAGING AND STOCKPILE AREAS.
5. IN ALL AREAS WHERE TREES ARE HARVESTED PROPER BMP AND EROSION AND SEDIMENT CONTROL WILL BE IMPLEMENTED AND THE AREA IMMEDIATELY STABILIZED WITH TEMPORARY AND PERMANENT SEEDING/MULCH AS HARVESTING OCCURS.

SURVEY:

THE COORDINATE SYSTEM IS THE NAD83 NORTH CAROLINA STATE PLANE GRID.

THE VERTICAL DATUM IS NAVD88.

Stantec
56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
TYPICAL SECTIONS

Permit-Seal

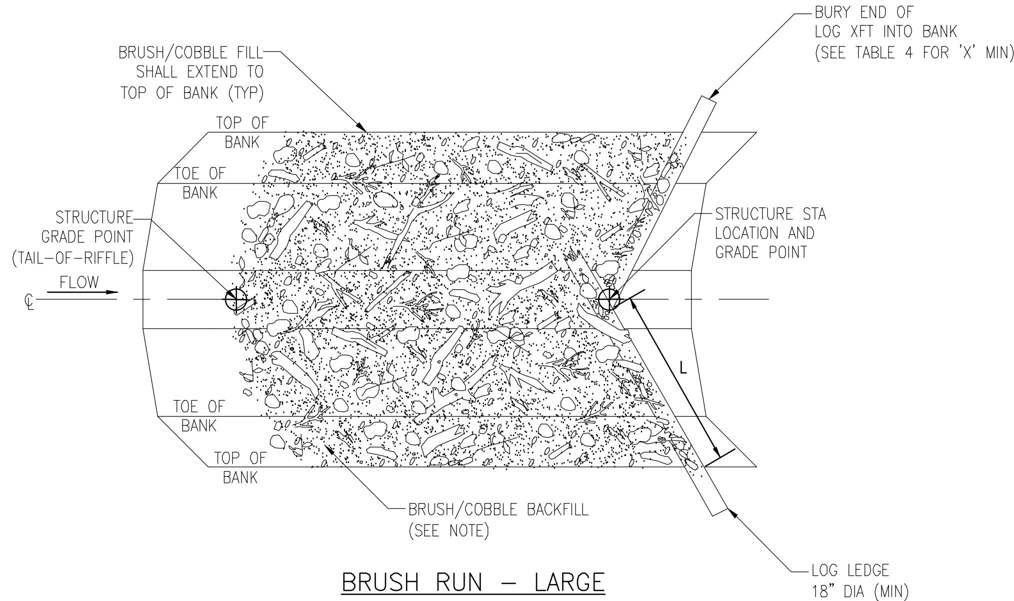
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038596 CHRISTOPHER M. ENGLE

5/27/20

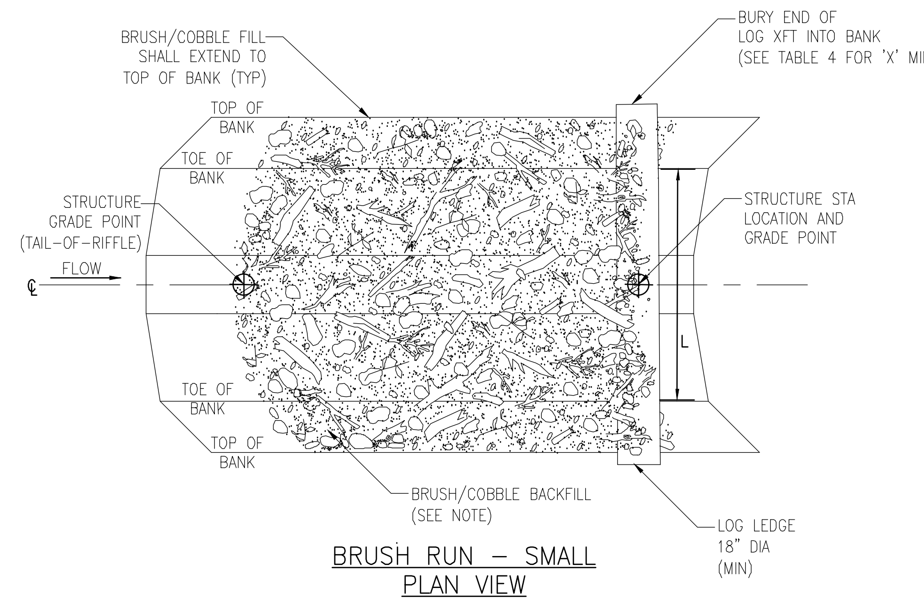
Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

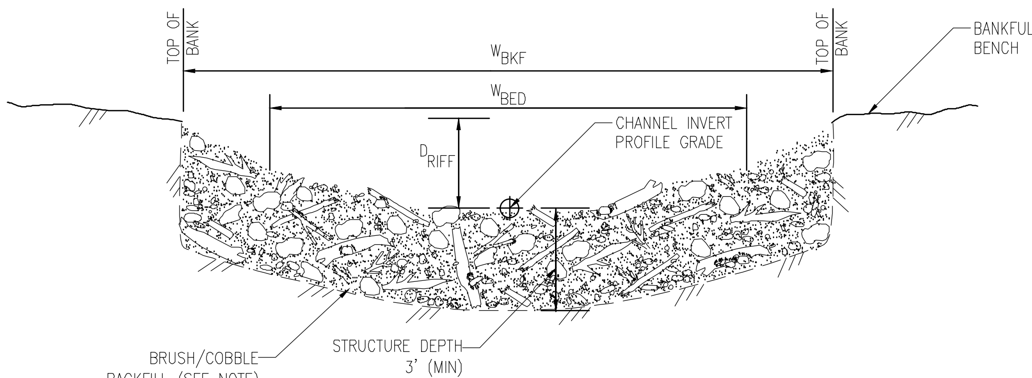
Revision 0 Sheet 2A



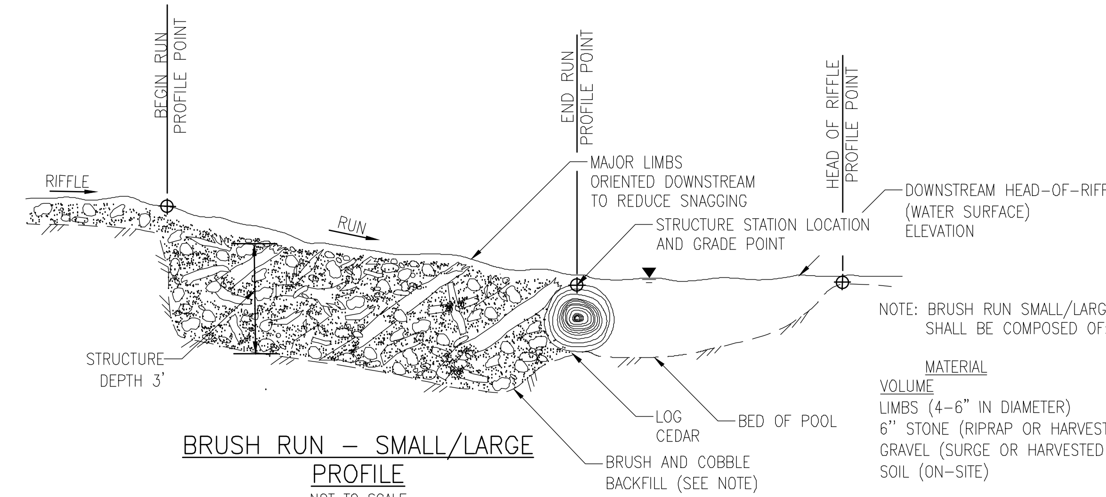
BRUSH RUN – LARGE
PLAN VIEW
NOT TO SCALE



BRUSH RUN – SMALL
PLAN VIEW
NOT TO SCALE



BRUSH RUN SMALL/LARGE
SECTION
NOT TO SCALE



BRUSH RUN – SMALL/LARGE
PROFILE
NOT TO SCALE

NOTE: BRUSH RUN SMALL/LARGE BACKFILL MATERIAL SHALL BE COMPOSED OF:

MATERIAL	COMPOSITION BY VOLUME
LIMBS (4-6" IN DIAMETER)	30%
6" STONE (RIPRAP OR HARVESTED ON-SITE)	30%
GRAVEL (SURGE OR HARVESTED ON-SITE)	30%
SOIL (ON-SITE)	10%

TABLE 4: STRUCTURE DIMENSIONS

REACH	STRUCTURES		BOULDERS			TOTAL LOG LENGTH (FT)
	L (FT)	X (FT)	LENGTH (FT)	WIDTH (FT)	DEPTH (FT)	
Seniard Creek - R1A	19	6				31
Seniard Creek - R1B	19	6				31
Seniard Creek - R2	26	8				42
Sitton Creek - R1	17	6				29
Lee Branch	5	3				11
David Branch - R1A	5	3				11
David Branch - R1B	5	3				11
David Branch - R1C	5	3				11
Whitaker Branch	5	3				11
Redmond Branch 1A	5	3				11
Redmond Branch 1B	6	3				12

TABLE 5: LOG DIAMETERS

TOTAL LOG LENGTH (FT)	MIN DIAMETER (IN)	MAX DIAMETER (IN)
< 20	12	18
20-40	18	24
40-60	24	30

Stantec
56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision By Appd. YY.MM.DD

Issued By Appd. YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
DETAILS

Permit-Seal
NORTH CAROLINA PROFESSIONAL SEAL 038596 ENGINEER CHRISTOPHER M. ENGLE
5/27/20

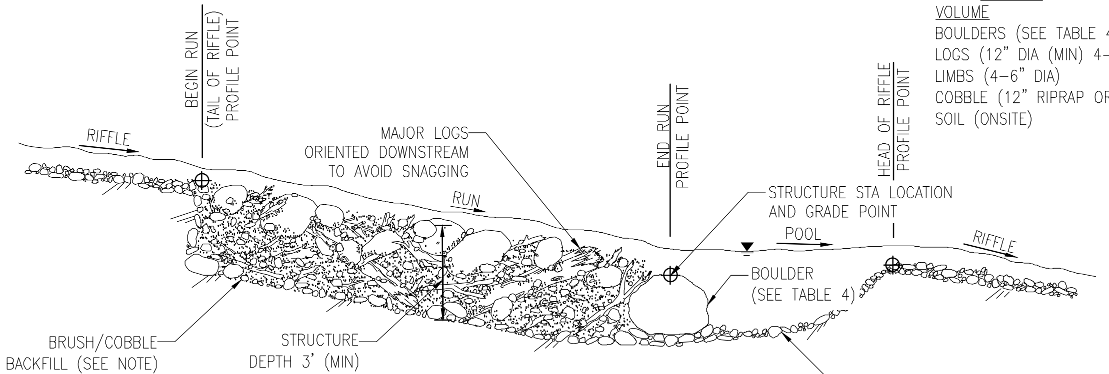
Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

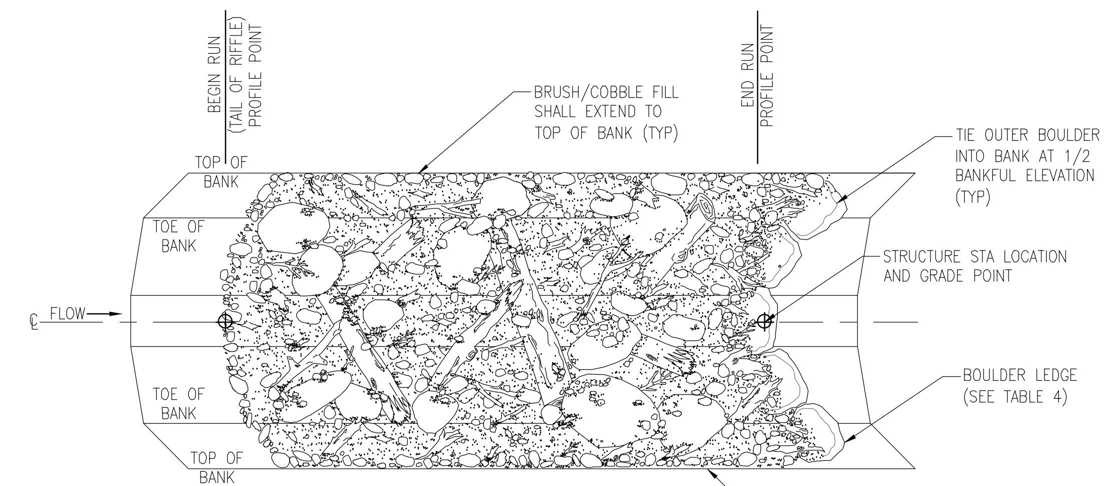
Revision 0 Sheet 3

NOTE: BOULDER BRUSH RUN BACKFILL MATERIAL SHALL BE COMPOSED OF:

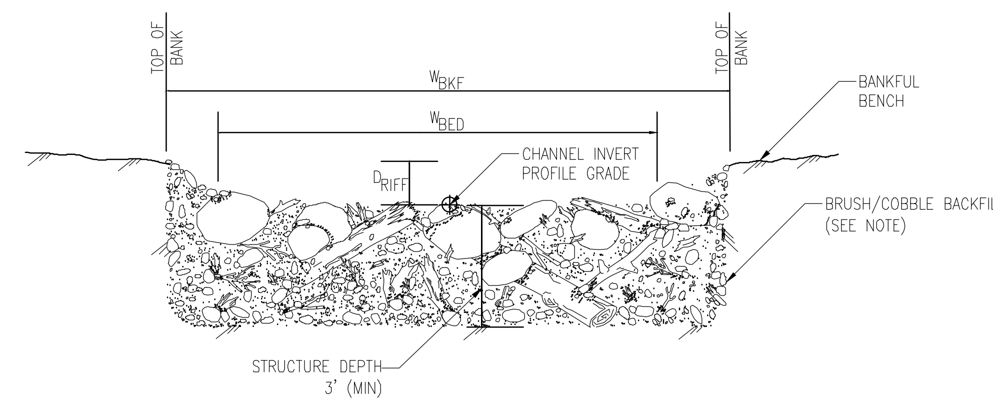
MATERIAL	COMPOSITION BY VOLUME
BOULDERS (SEE TABLE 4)	15%
LOGS (12" DIA (MIN) 4-6' LENGTH)	15%
LIMBS (4-6" DIA)	30%
COBBLE (12" RIPRAP OR HARVESTED ONSITE)	30%
SOIL (ONSITE)	10%



BOULDER BRUSH RUN
PROFILE VIEW
NOT TO SCALE



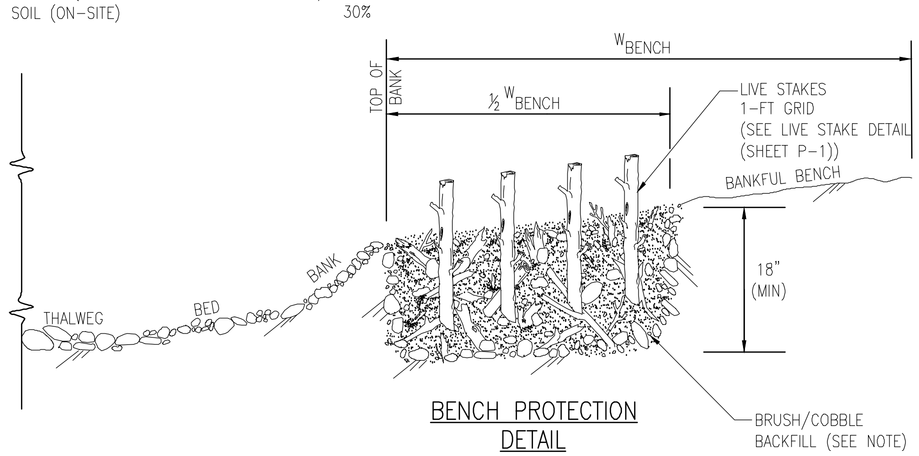
BOULDER BRUSH RUN
PLAN VIEW
NOT TO SCALE



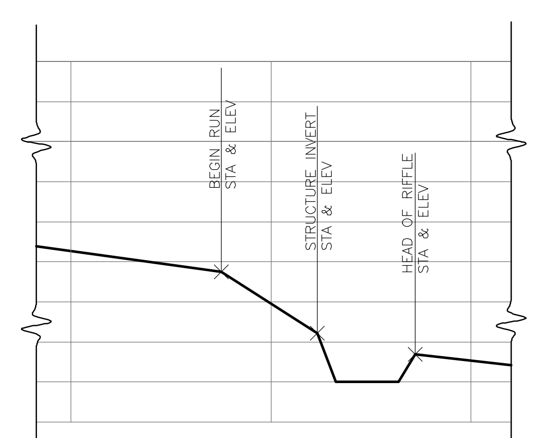
BOULDER BRUSH RUN
SECTION VIEW
NOT TO SCALE

NOTE: BENCH PROTECTION BACKFILL MATERIAL SHALL BE COMPOSED OF:

MATERIAL	COMPOSITION BY VOLUME
BRUSH (3-6" DIAMETER)	50%
COBBLE (6" STONE OR HARVESTED ONSITE)	20%
SOIL (ON-SITE)	30%



BENCH PROTECTION
DETAIL
NOT TO SCALE



BRUSH RUN
PROFILE REPRESENTATION
NOT TO SCALE

Stantec
56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
DETAILS

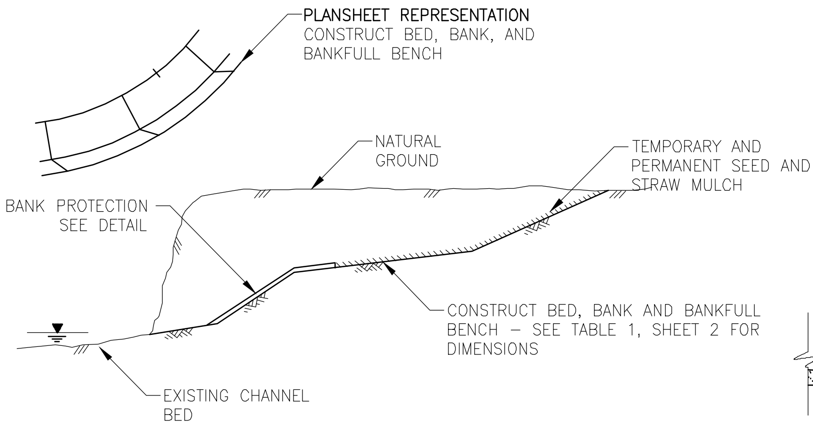
Permit-Seal

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038595 CHRISTOPHER M. ENGLE
5/27/20

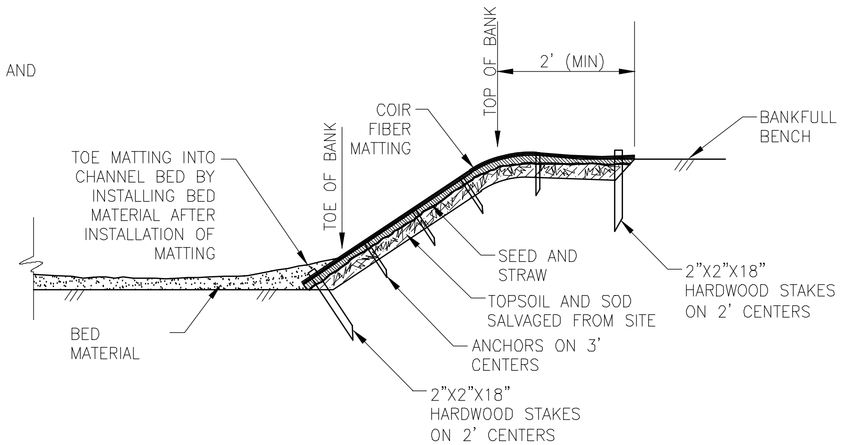
Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

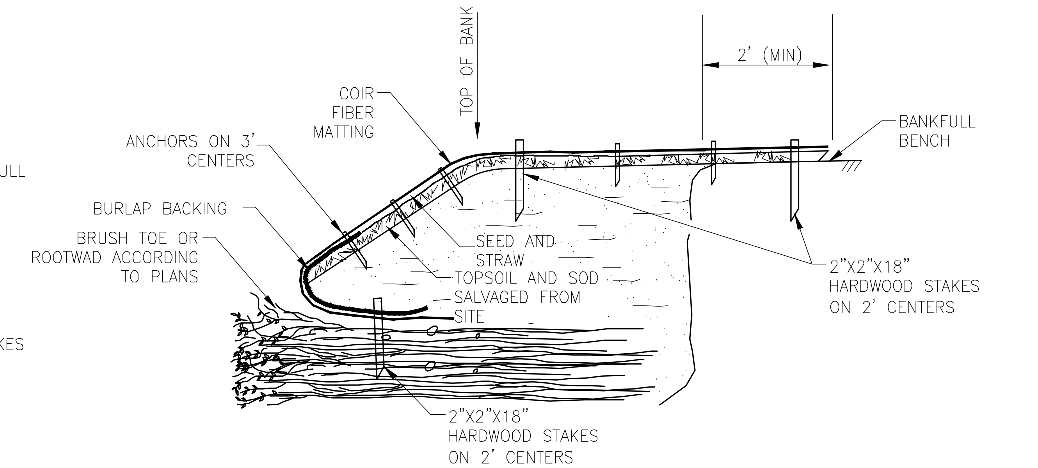
Revision 0 | Sheet 3A



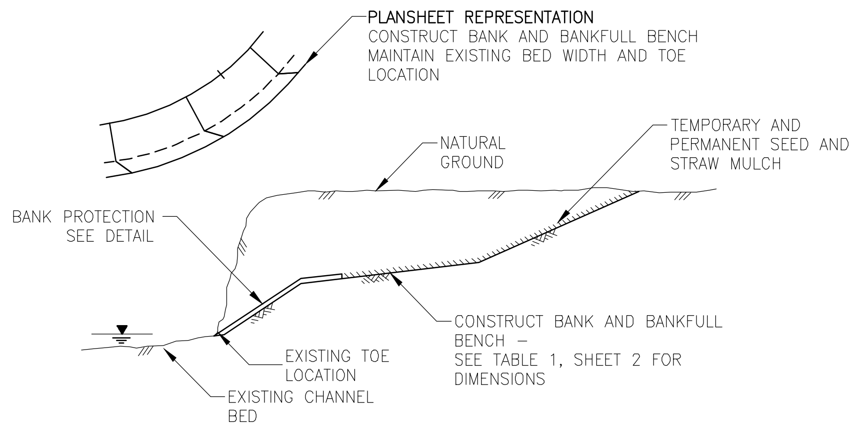
CONSTRUCT BED, BANK AND BANKFULL BENCH (ABANDON EXISTING BANK FEATURE)
NOT TO SCALE



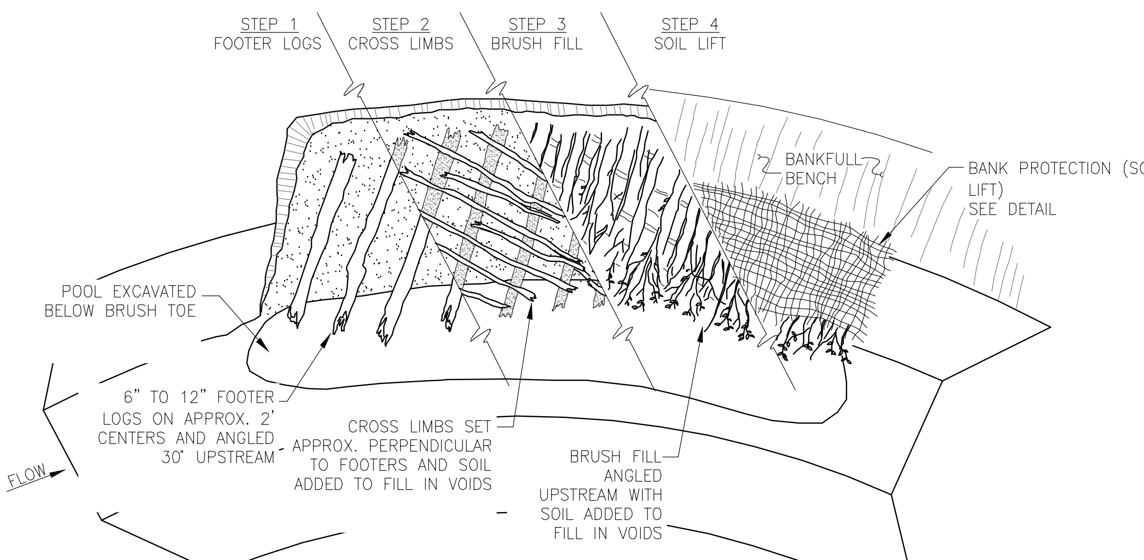
BANK PROTECTION – METHOD 1
SOD AND MAT
NOT TO SCALE



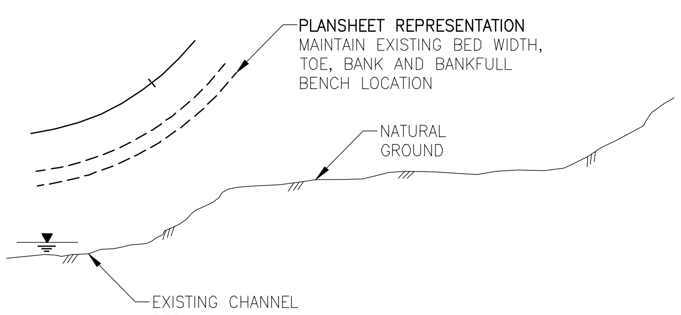
BANK PROTECTION – METHOD 2
SOIL LIFT
NOT TO SCALE



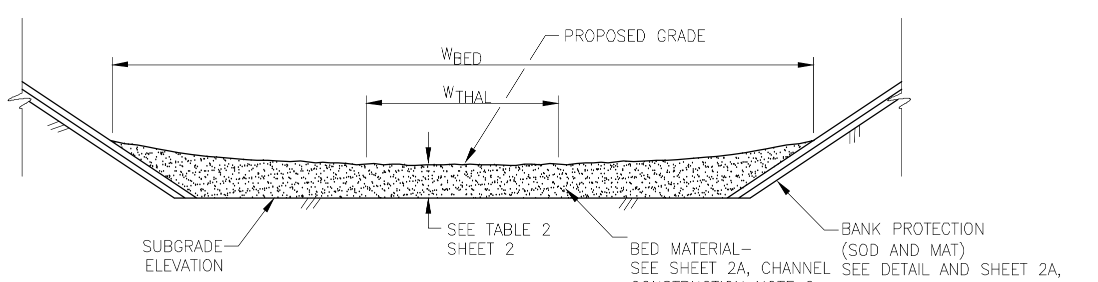
CONSTRUCT BANK AND BANKFULL BENCH (MAINTAIN EXISTING BED WIDTH)
NOT TO SCALE



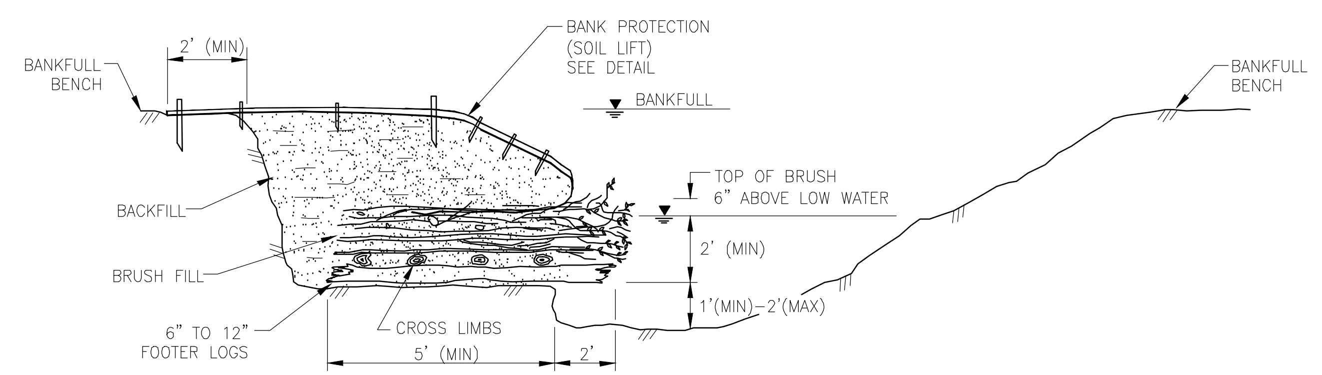
BRUSH TOE PLAN
NOT TO SCALE



MAINTAIN EXISTING CHANNEL AND BANKFULL BENCH
NOT TO SCALE



BED MATERIAL DETAIL
NOT TO SCALE



BRUSH TOE SECTION
NOT TO SCALE

Stantec

56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
DETAILS

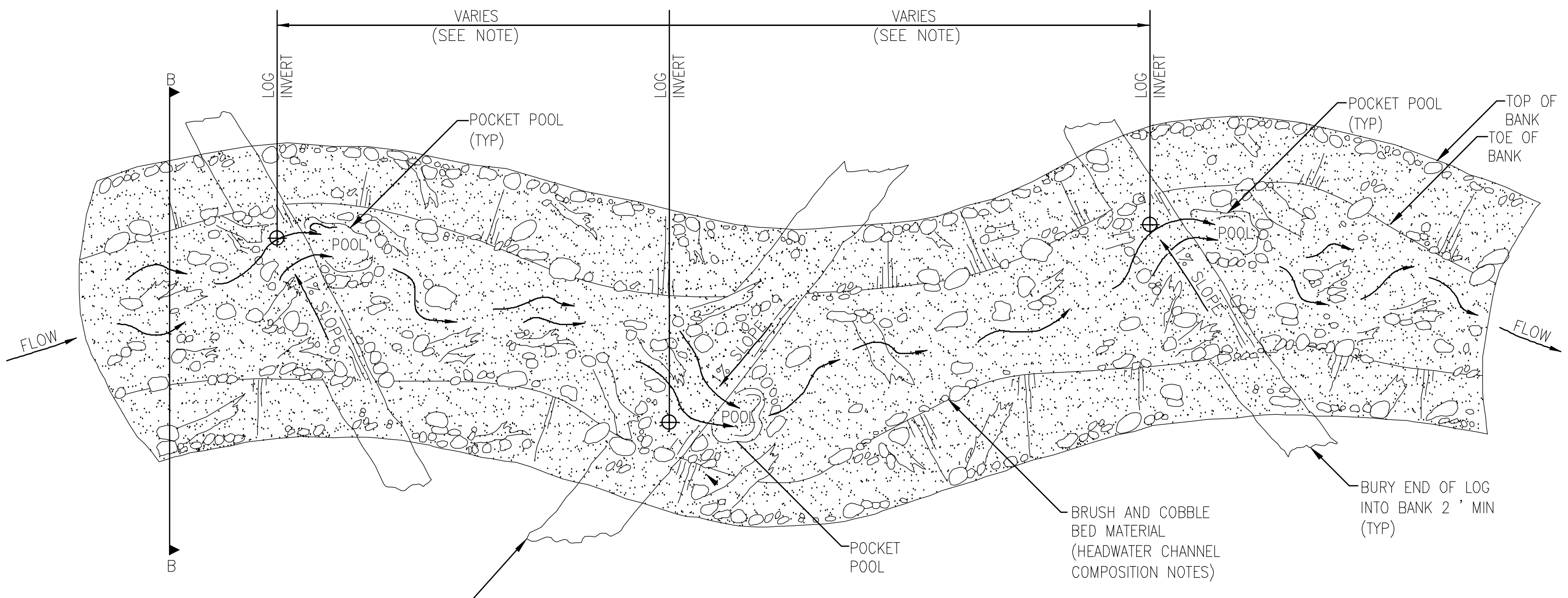
Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE
5/27/20

Project Number: 172621103

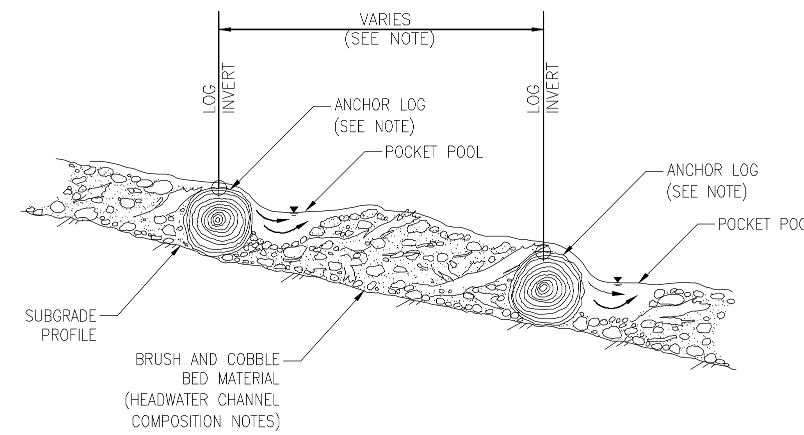
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0
Sheet 3B



HEADWATER CHANNEL PLAN

NOT TO SCALE



HEADWATER CHANNEL PROFILE

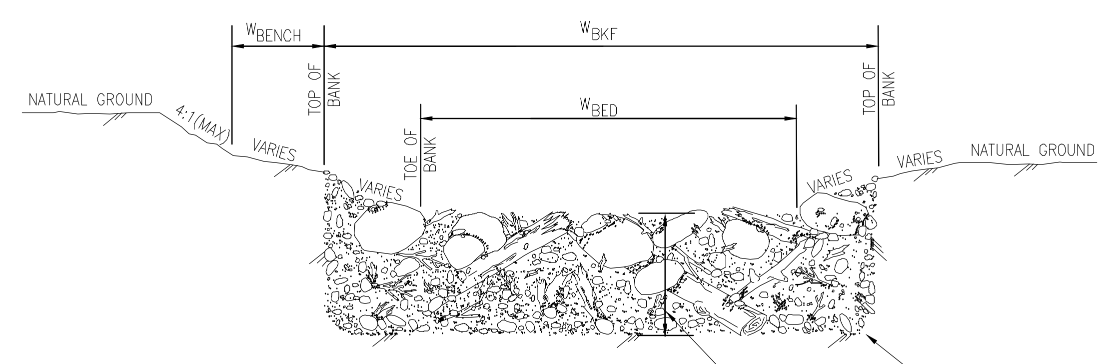
NOT TO SCALE

HEADWATER CHANNEL SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING PROPORTIONS OR AS DIRECTED BY THE ENGINEER :

PROFILE REPRESENTATION	CLASSIFICATION AND SLOPE	LOG SPACING AND DIAMETER	DEPTH	COMPOSITION BY VOLUME	
	LIGHT (<4%)	16FT @18"	1.5FT	SOIL (ONSITE) BRUSH (MIN 3-6' LENGTH) 2" STONE (RIPRAP OR HARVESTED ONSITE) 6" STONE (RIPRAP OR HARVESTED ONSITE)	10% 50% 20% 20%
	MODERATE	12FT @18"	1.5FT	SOIL (ONSITE) BRUSH (MIN 3-6' LENGTH) 6" STONE (RIPRAP OR HARVESTED ONSITE)	10% 40% 50%
	HEAVY (>10%)	8FT @24"	2FT	SOIL (ONSITE) BRUSH (MIN 3-6' LENGTH) 6" STONE (RIPRAP OR HARVESTED ONSITE 12" COBBLE (RIPRAP OR HARVESTED ONSITE)	10% 30% 30% 30%

HEADWATER CHANNEL COMPOSITION NOTES

NOT TO SCALE



HEADWATER CHANNEL SECTION B-B

NOT TO SCALE

DESIGN BED MATERIAL (HEADWATER CHANNEL COMPOSITION NOTES)

SUBGRADE ELEVATION

Stantec
56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
DETAILS

Permit-Seal

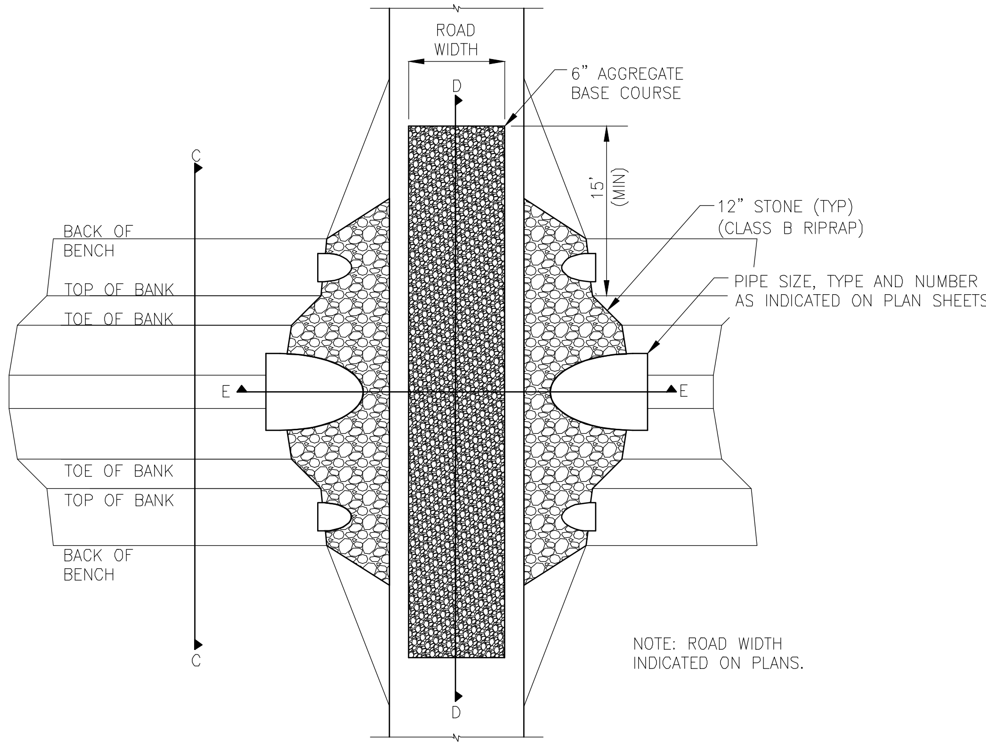
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038596 CHRISTOPHER M. ENGLE

5/27/20

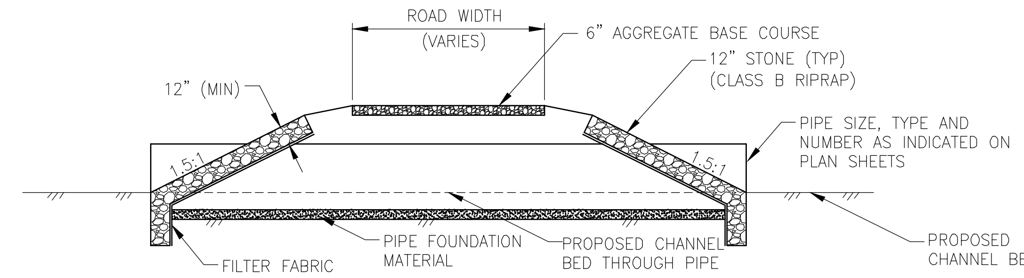
Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

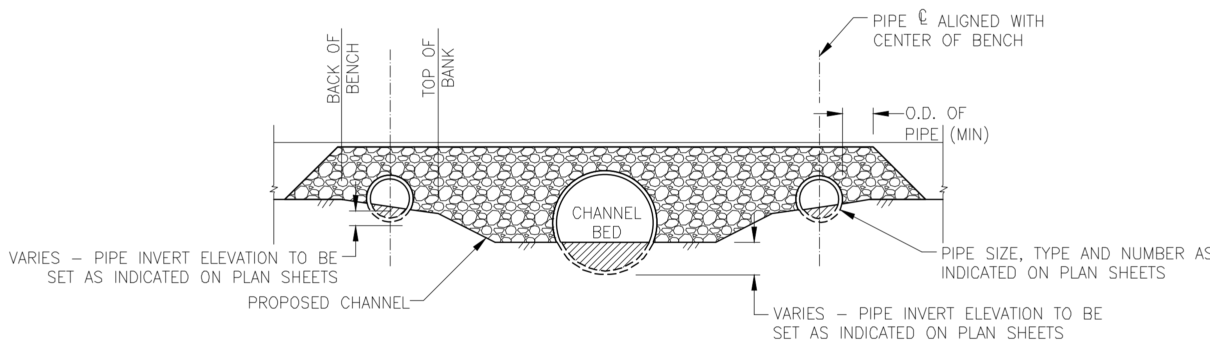
Revision	Sheet
0	3C



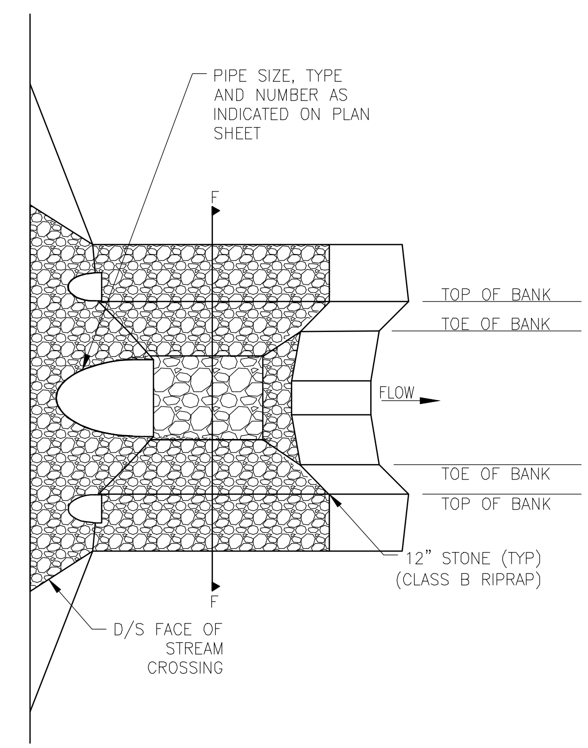
PERMANENT CROSSING (PIPE)
PLAN VIEW
NOT TO SCALE



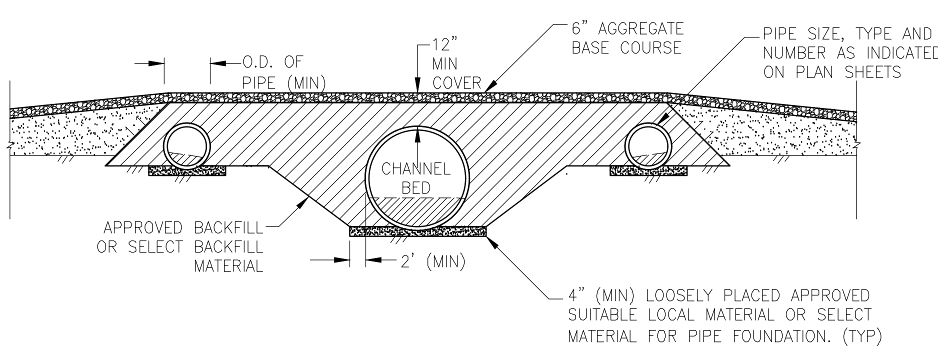
PERMANENT CROSSING (PIPE)
SECTION E–E
NOT TO SCALE



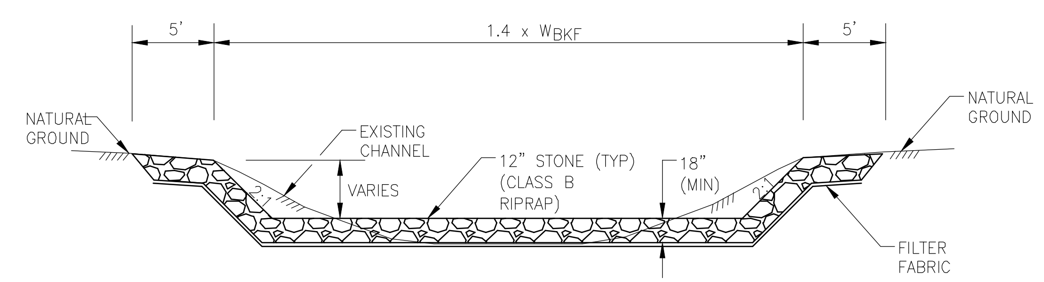
PERMANENT CROSSING (PIPE)
ELEVATION C–C
NOT TO SCALE



RIPRAP OUTLET PROTECTION – PLAN
NOT TO SCALE



PERMANENT CROSSING (PIPE)
SECTION D–D
NOT TO SCALE



RIPRAP OUTLET PROTECTION – SECTION F–F
NOT TO SCALE

Stantec

56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
DETAILS

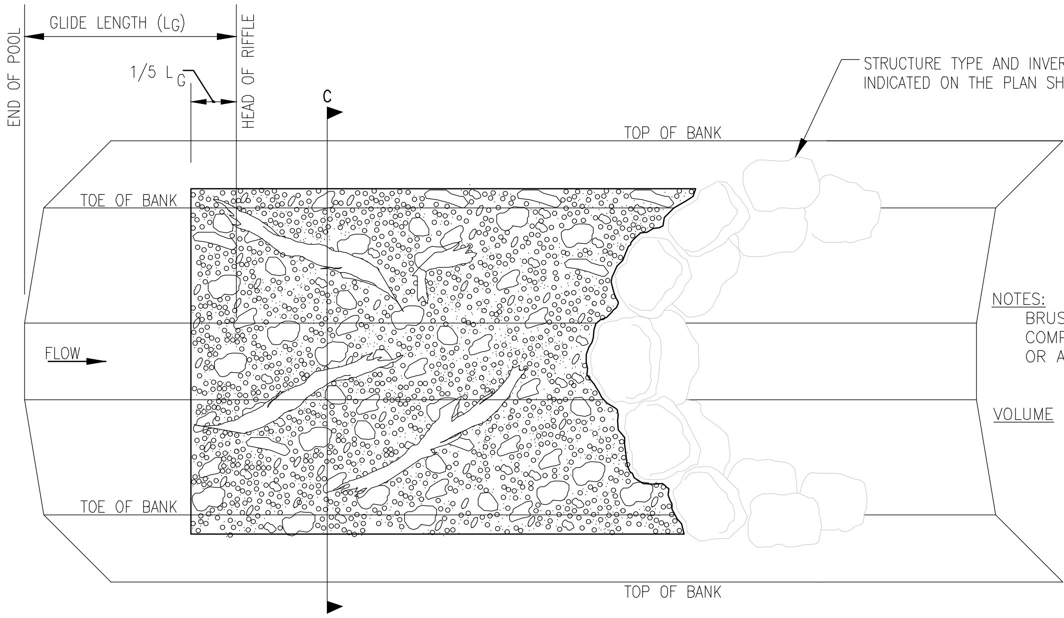
Permit-Seal

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038595 CHRISTOPHER M. ENGLE
5/27/20

Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0
Sheet 3D

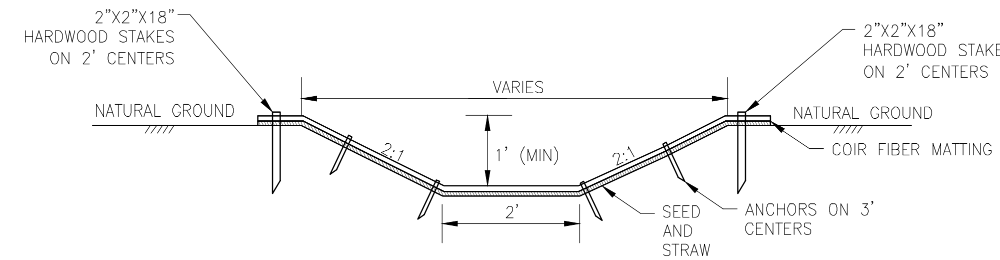


NOTES:
BRUSH ENHANCED RIFFLE BED MATERIAL SHALL BE COMPOSED OF MATERIAL IN THE FOLLOWING PROPORTIONS OR AS DIRECTED BY THE ENGINEER:

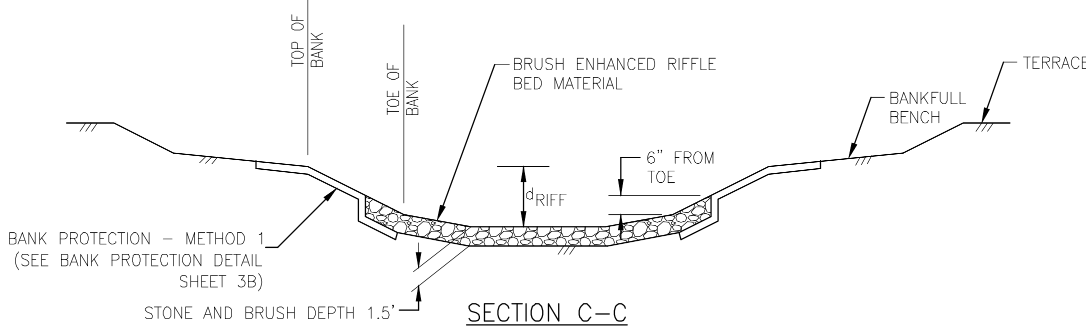
VOLUME

MATERIAL	COMPOSITION BY
SOIL (ON-SITE)	10%
LIMBS (4-6" DIA)	20%
12" STONE (CLASS B RIPRAP)	70%

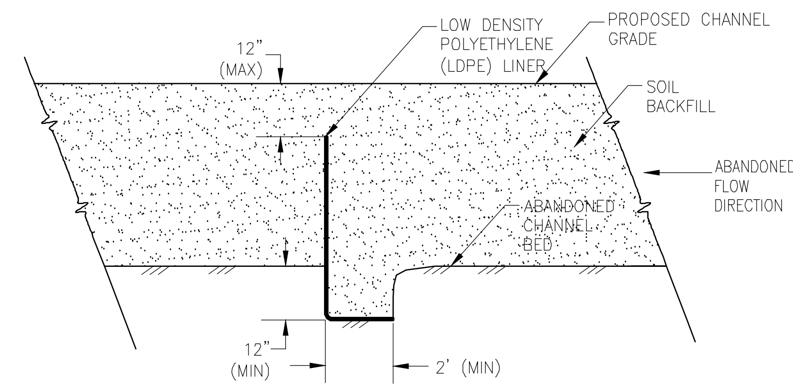
BRUSH ENHANCED RIFFLE
PLAN
NOT TO SCALE



2-FT BASE DITCH WITH COIR
NOT TO SCALE

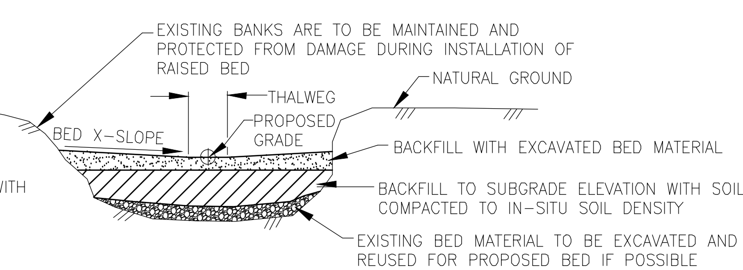


SECTION C–C
NOT TO SCALE

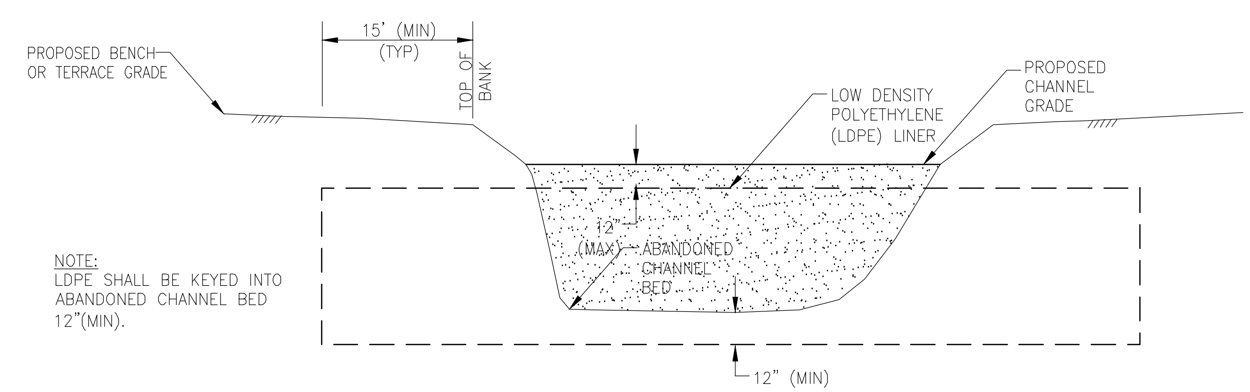


GROUNDWATER CURTAIN
SECTION
NOT TO SCALE

NOTES:
1. WHERE THERE IS INSUFFICIENT EXISTING BED MATERIAL, MATERIAL WILL BE SUPPLEMENTED WITH MATERIAL CONSISTENT WITH TABLE 2 OR AS DIRECTED BY THE ENGINEER.
2. THE BED FORM AND DIMENSIONS WILL BE ACCORDING TO THE DESIGN TYPICAL SECTION.
3. THE INSTALLED BED MATERIAL SHALL BE AT A MINIMUM DEPTH OF 5 INCHES.
4. BACKFILL MATERIAL SHALL CONSIST OF 30% CLAY (MINIMUM). WHERE SUFFICIENT MATERIAL IS NOT AVAILABLE, CLAY PLUGS SHALL BE INSTALLED TO RESTRICT LOSS OF BASE FLOW.



RAISED RIFFLE
NOT TO SCALE



NOTE:
LDPE SHALL BE KEYED INTO ABANDONED CHANNEL BED 12"(MIN).

GROUNDWATER CURTAIN
ELEVATION
NOT TO SCALE

Stantec
56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
DETAILS

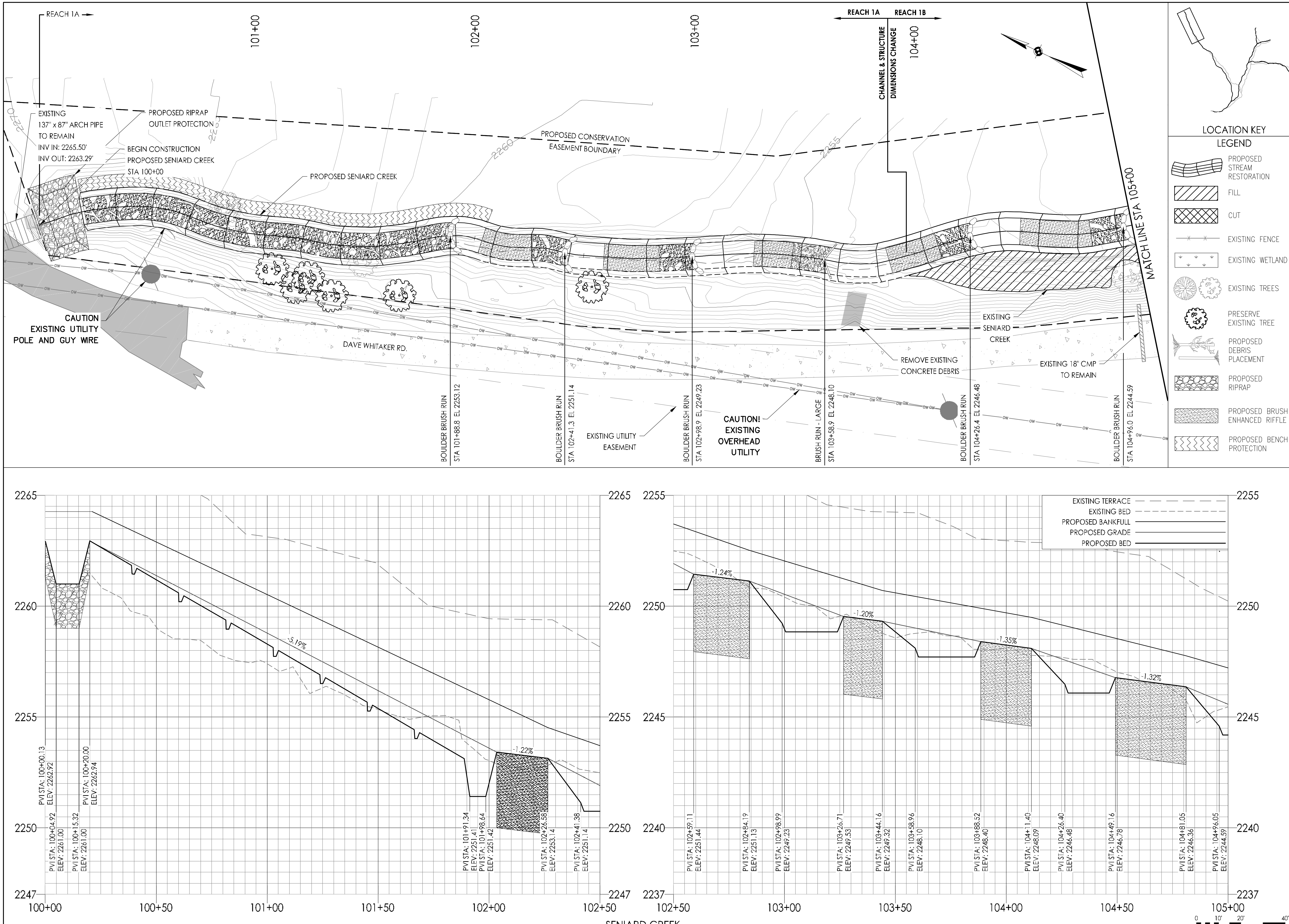
Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE 5/27/20

Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0
Sheet 3E



Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE

5/27/20

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
SENIARD CREEK - PLAN & PROFILE
STA 100+00 - 105+00

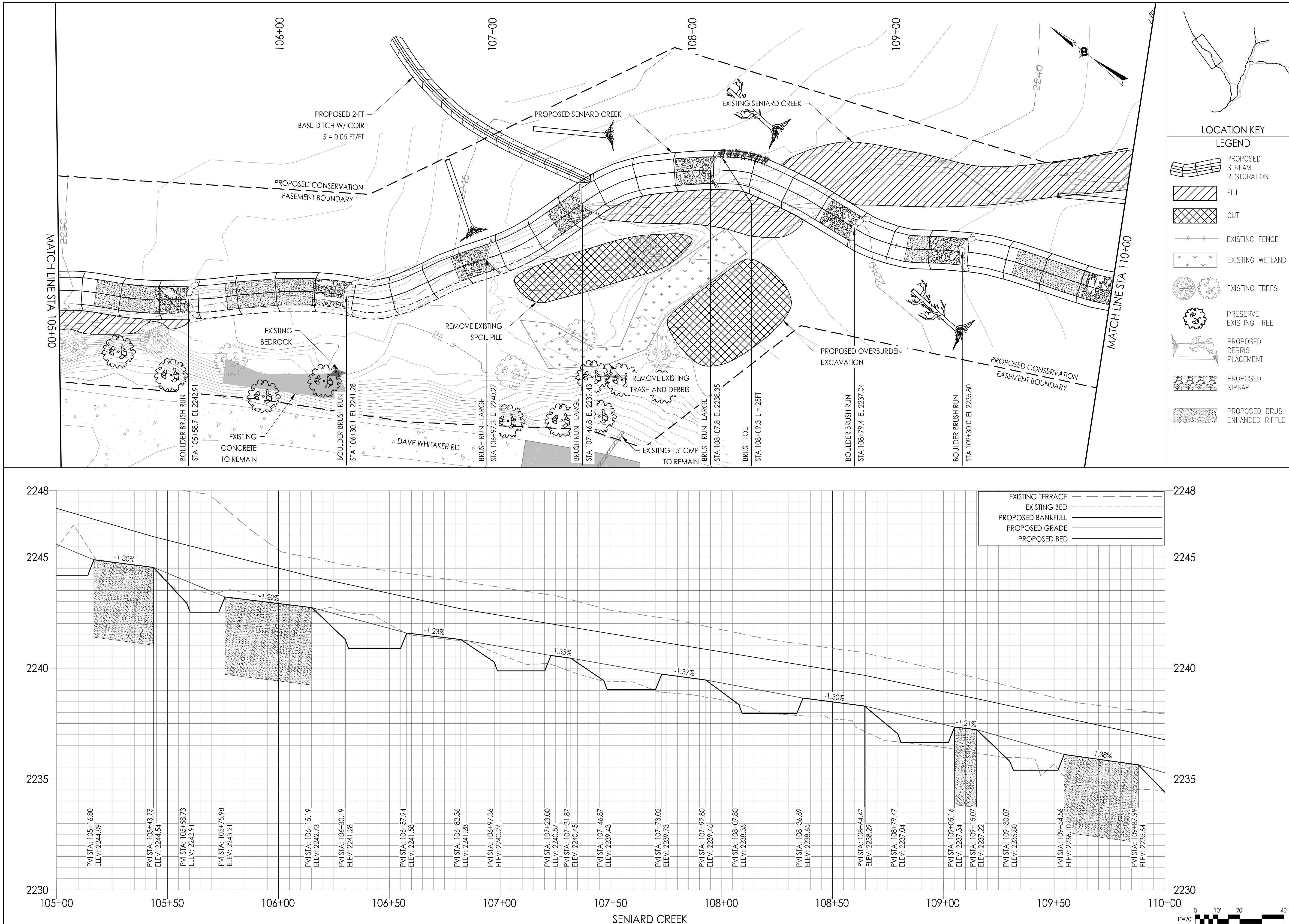
Project Number: 172621103

File Name: 1103-04-Seniard PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No.

Revision	Sheet
0	4 of 22



Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
SENIARD CREEK - PLAN & PROFILE
STA 105+00 - 110+00

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038895 ENGINEER CHRISTOPHER M. ENGLE
3/27/20

Project Number: 172621103

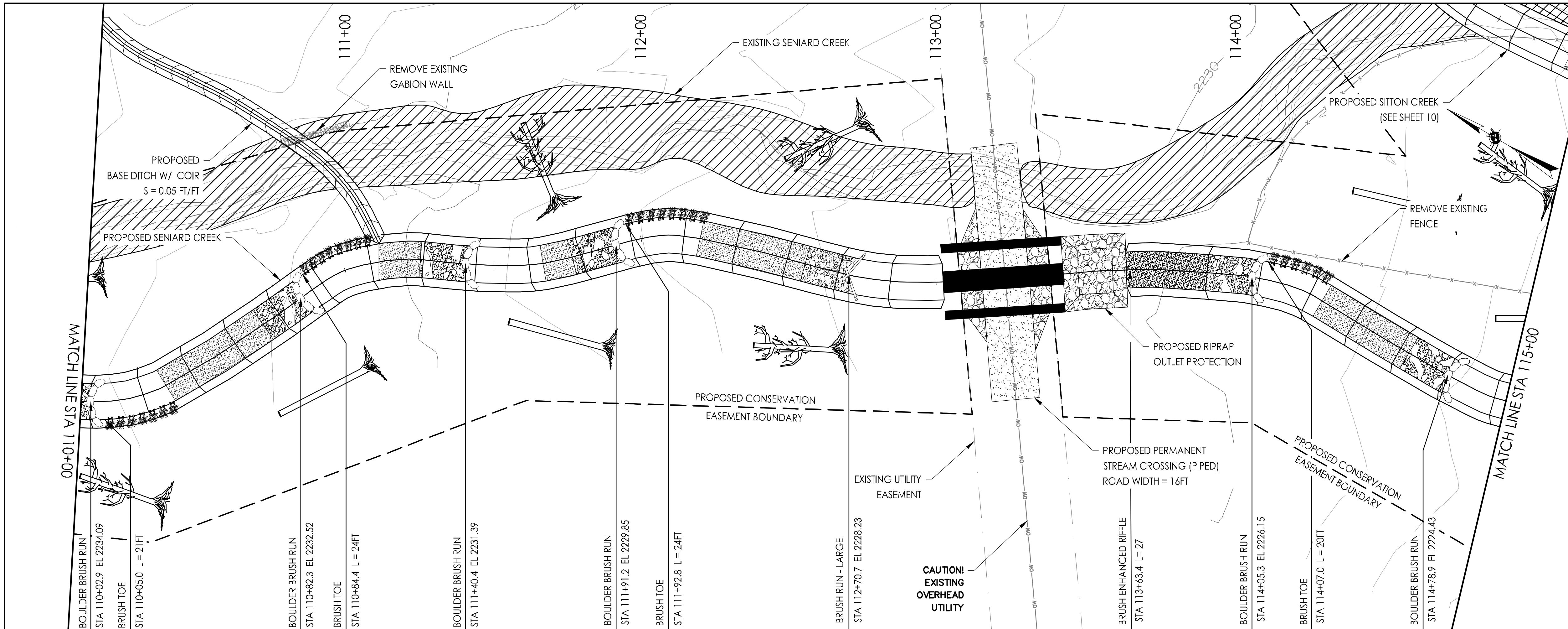
File Name: 1103-04-Seniard PLANPRO.dwg

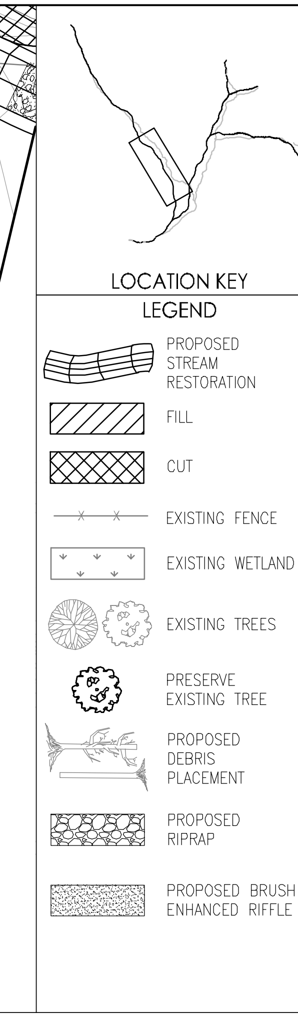
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

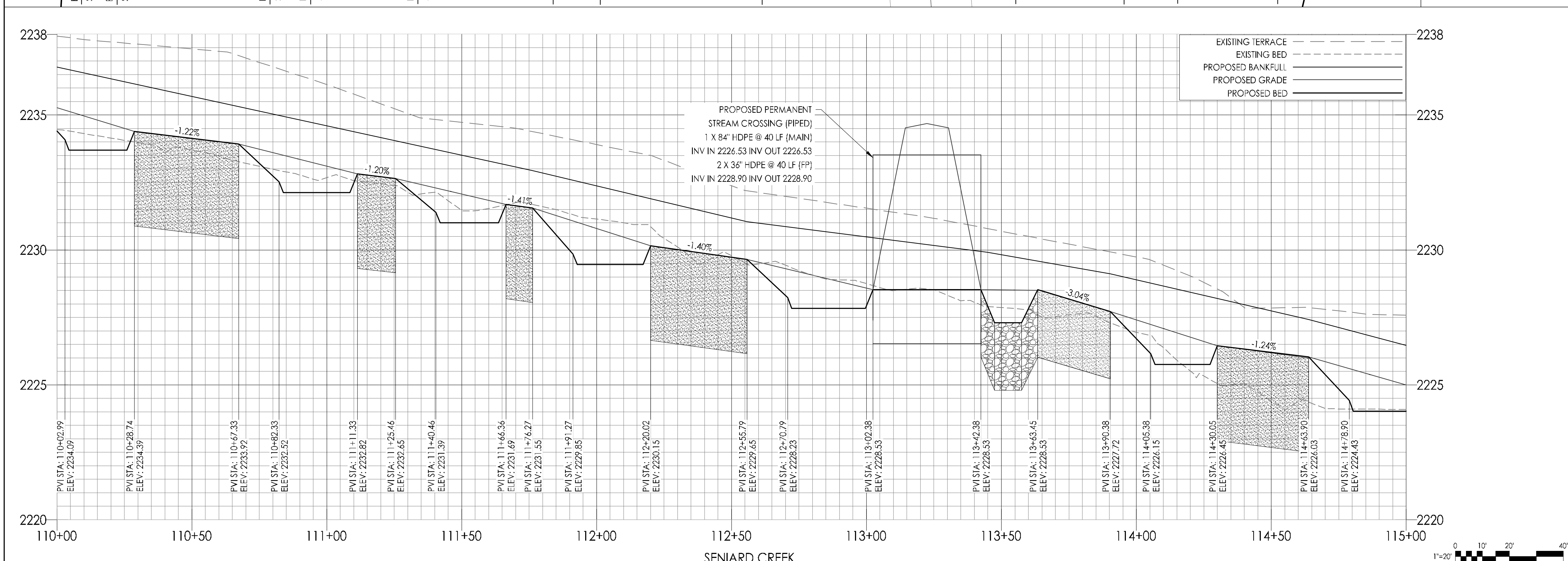
Drawing No.

Revision	Sheet
0	5 of 22

SaveDate: 2020/03/27 12:54 PM Login: Mcmer, Christina
v:\1726\active\172621103\dwg\1103-04-seniard planpro.dwg







Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
SENIARD CREEK - PLAN & PROFILE
STA 110+00 - 115+00

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE
3/27/20

Project Number: 172621103

File Name: 1103-04-Seniard PLANPRO.dwg

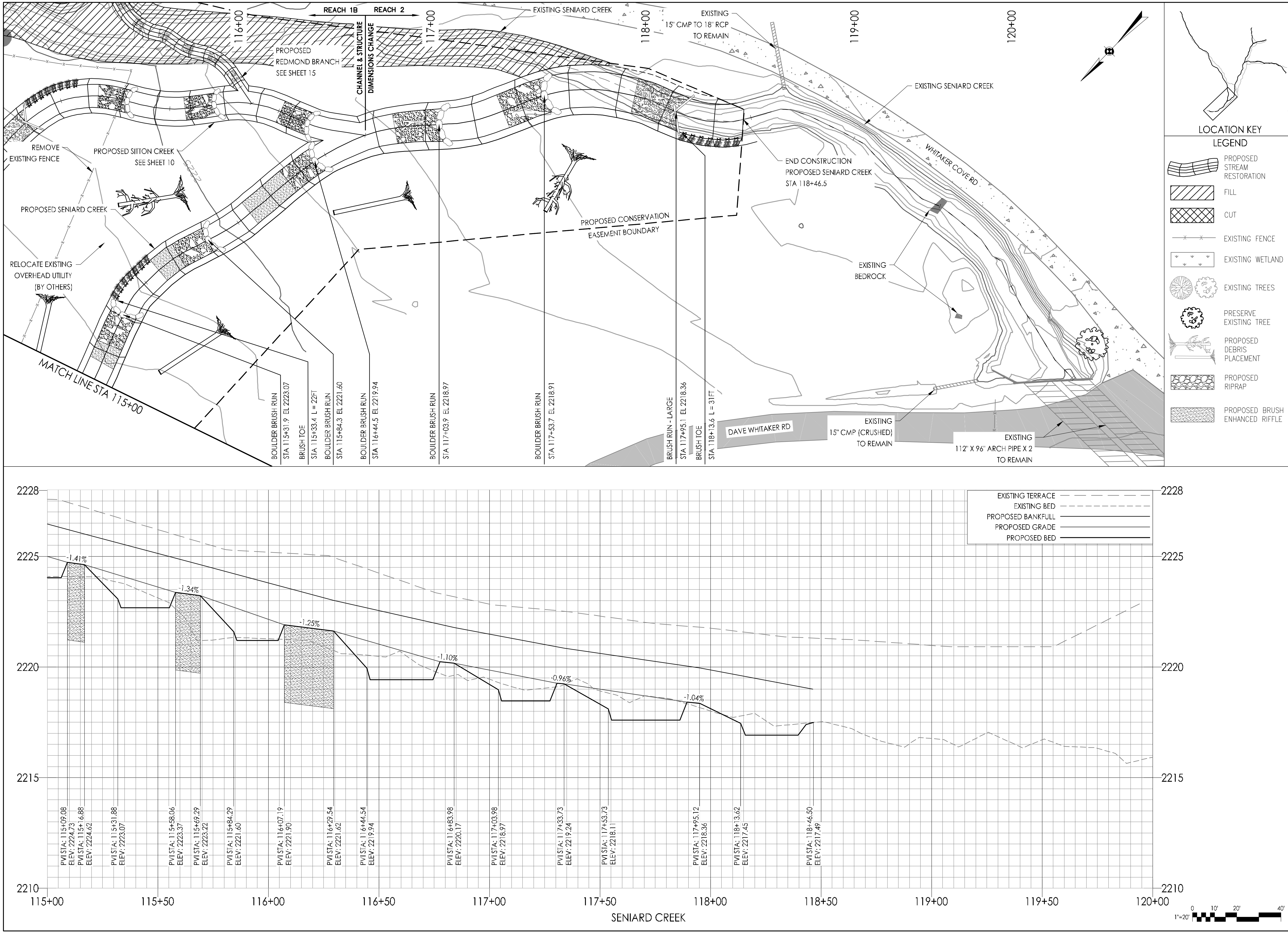
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No.

Revision 0

Sheet 6 of 22

SaveDate: 2020/05/27 12:54 PM Login: Mcmee, Christina
v:\1726\active\172621103\dwg\1103-04-seniard planpro.dwg



Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
SENIARD CREEK - PLAN & PROFILE
STA 115+00 - 120+00

Permit-Seal

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038893 CHRISTOPHER M. ENG...
5/27/20

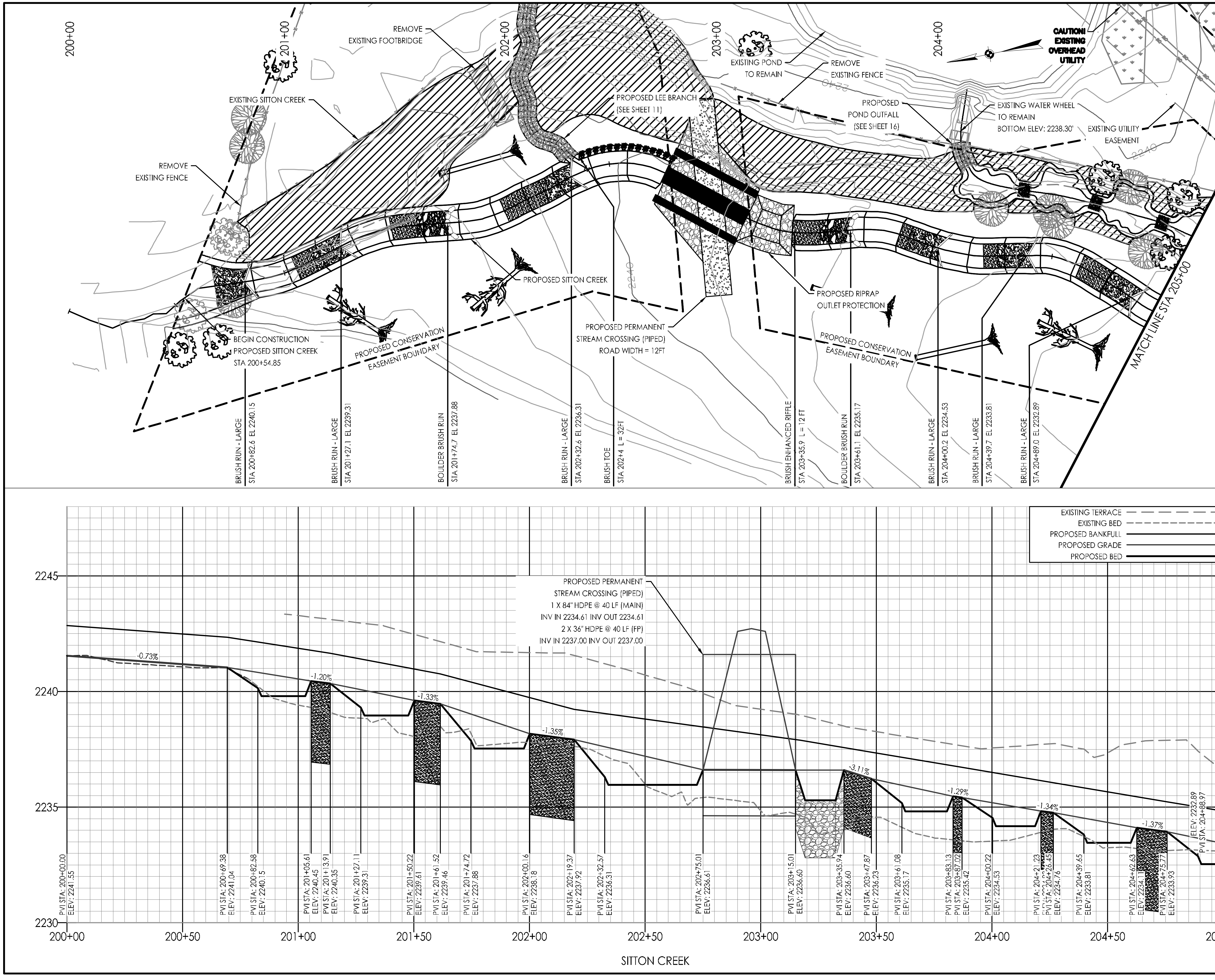
Project Number: 172621103

File Name: 1103-04-Seniard PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No.

Revision	Sheet
0	7 of 22



Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
SITTON CREEK - PLAN & PROFILE
STA 200+00 - 205+00

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE
5/27/20

Project Number: 172621103

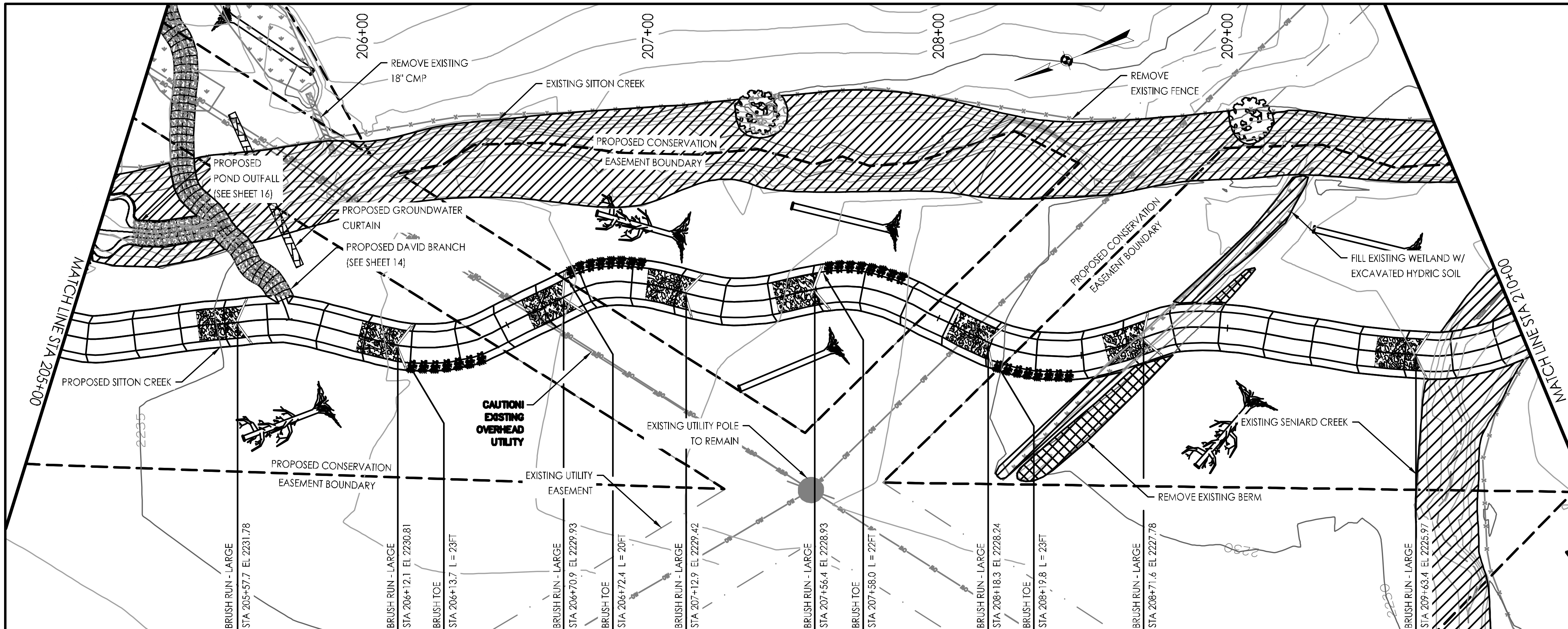
File Name: 1103-05-Sitton PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No.

Revision 0

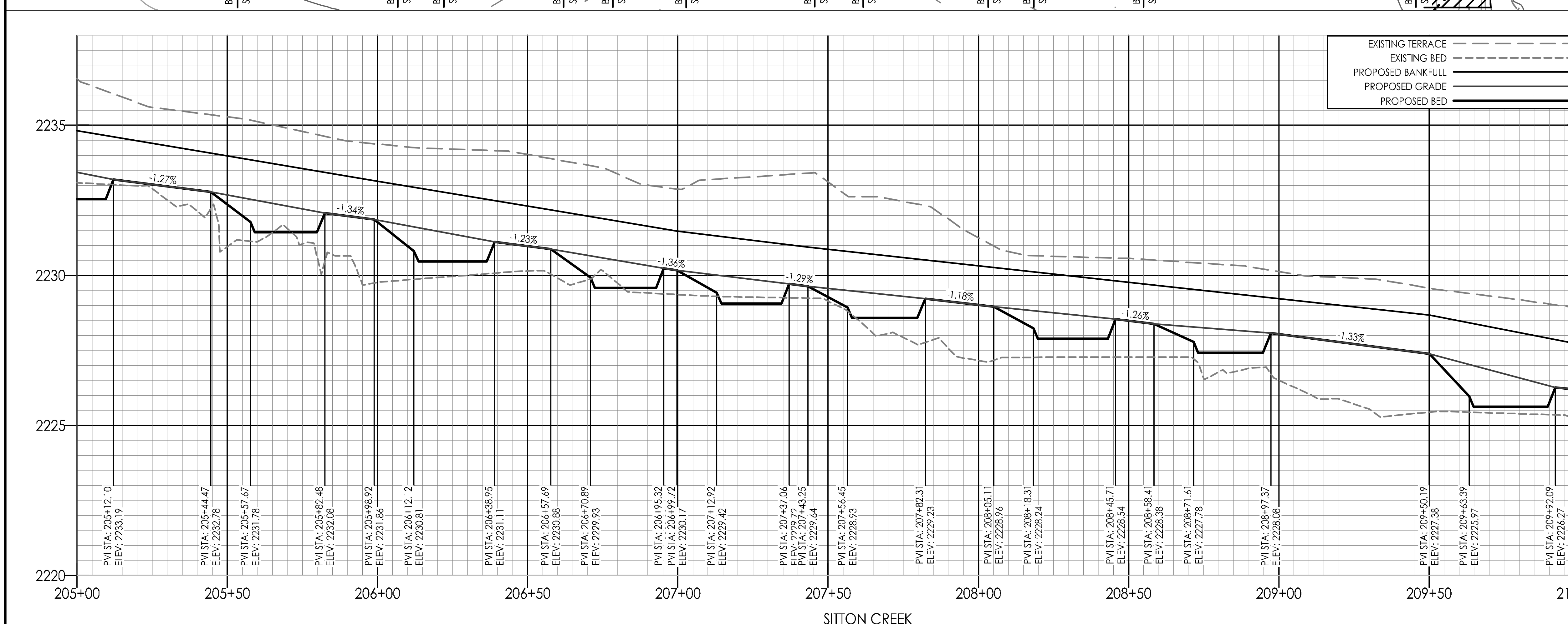
Sheet 8 of 22



LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- FILL
- CUT
- EXISTING FENCE
- EXISTING WETLAND
- EXISTING TREES
- PRESERVE EXISTING TREE
- PROPOSED DEBRIS PLACEMENT
- PROPOSED RIPRAP
- PROPOSED BRUSH ENHANCED RIFFLE



Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
SITTON CREEK - PLAN & PROFILE
205+00 - 210+00

Permit-Seal

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038595 CHRISTOPHER M. ENGLE 5/27/20

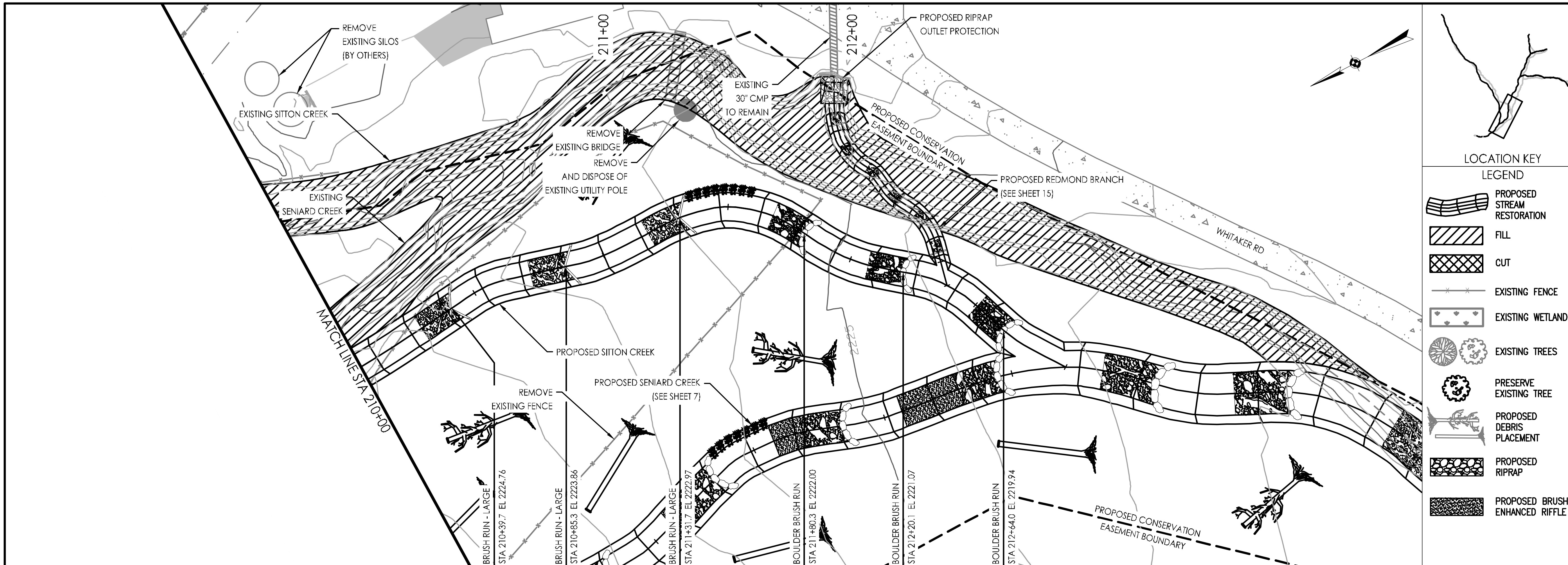
Project Number: 172621103

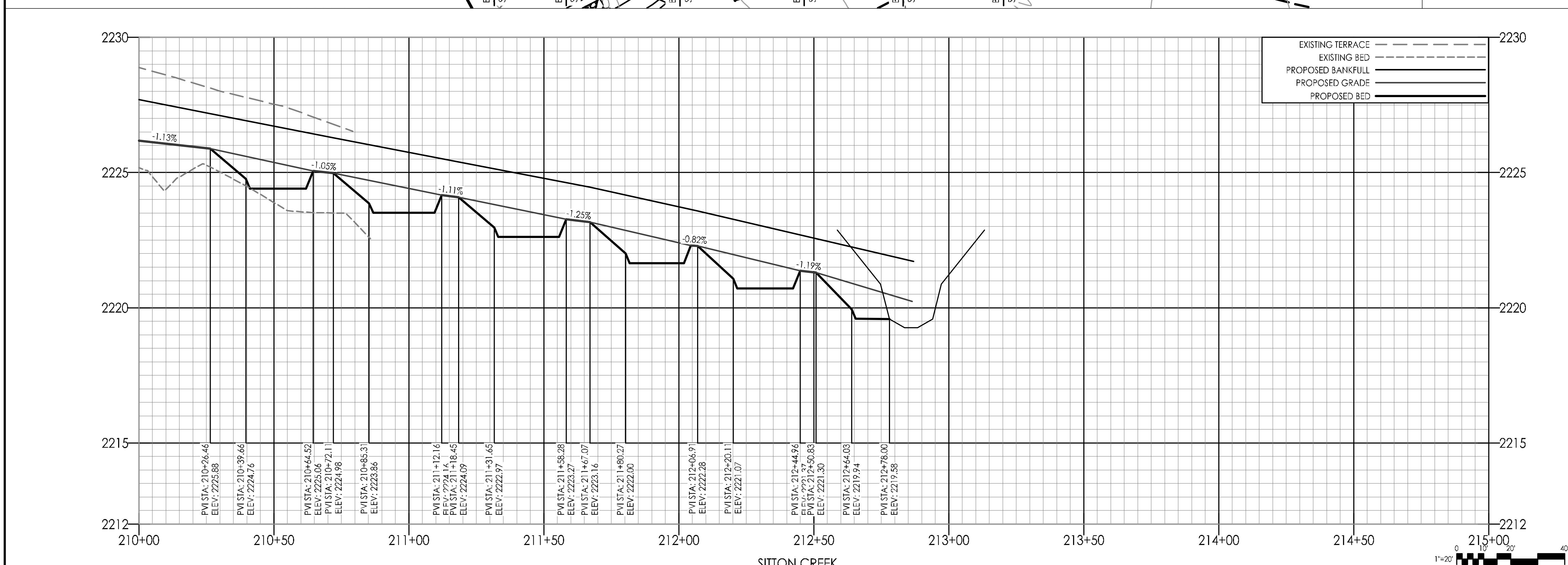
File Name: 1103-05-Sitton PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No.

Revision 0 Sheet 9 of 22





Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
SITTON CREEK - PLAN & PROFILE
STA 210+00 - 215+00

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE 5/27/20

Project Number: 172621103

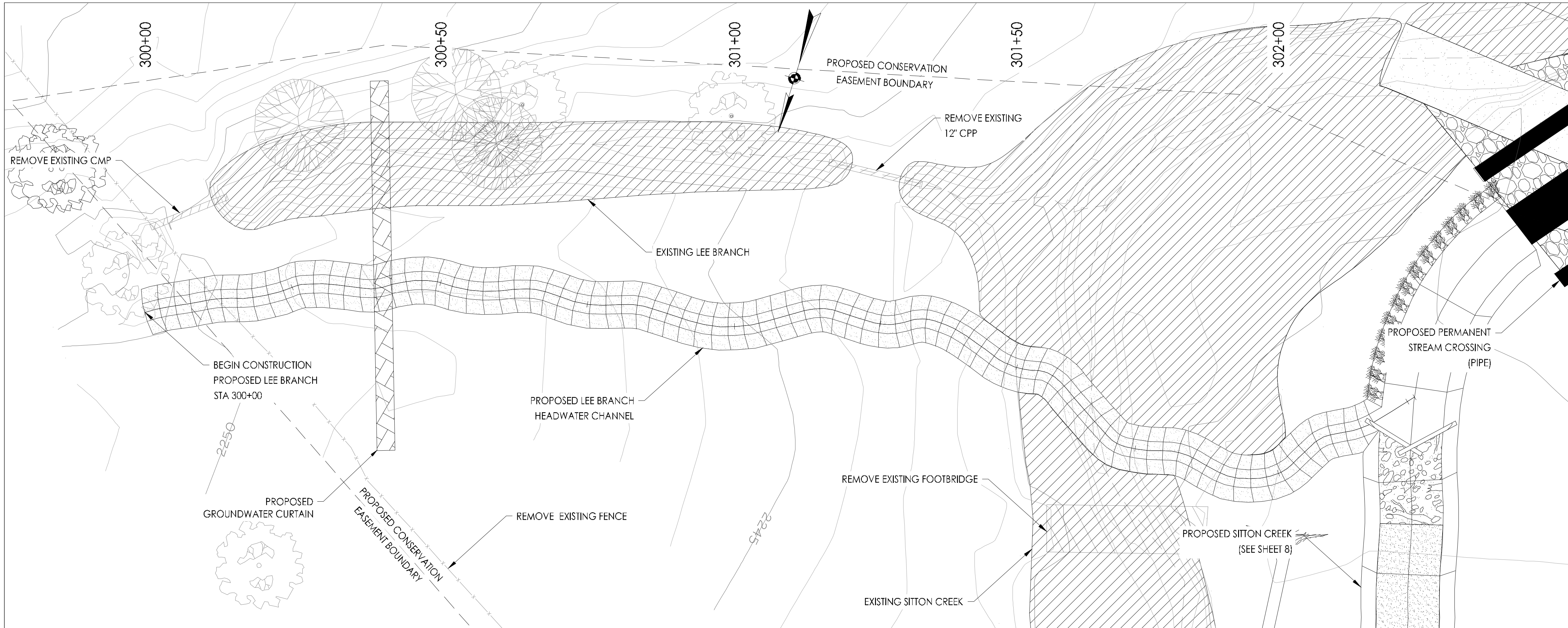
File Name: 1103-05-Sitton PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No.

Revision 0

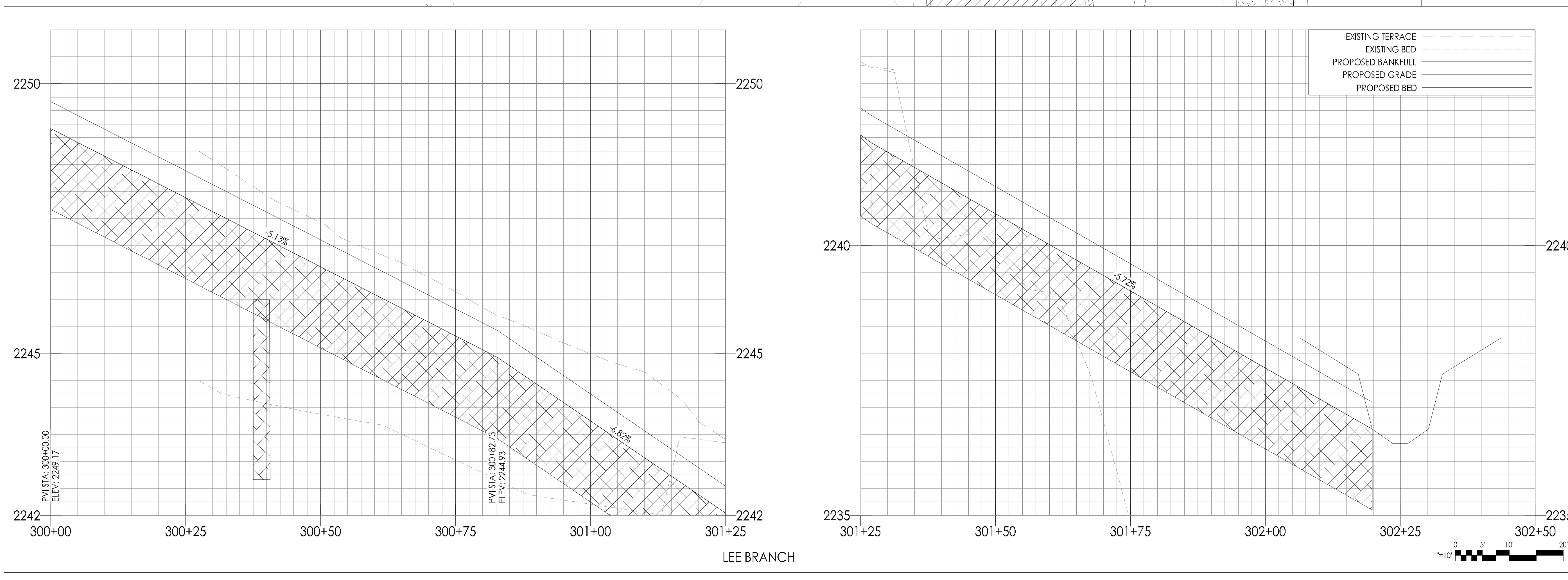
Sheet 10 of 22



LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- FILL
- CUT
- EXISTING FENCE
- EXISTING WETLAND
- EXISTING TREES
- PRESERVE EXISTING TREE
- PROPOSED DEBRIS PLACEMENT
- PROPOSED RIPRAP
- PROPOSED BRUSH ENHANCED RIFFLE



Stantec
56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
LEE BRANCH - PLAN & PROFILE
STA 300+00 -302+50

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE
5/27/20

Project Number: 172621103

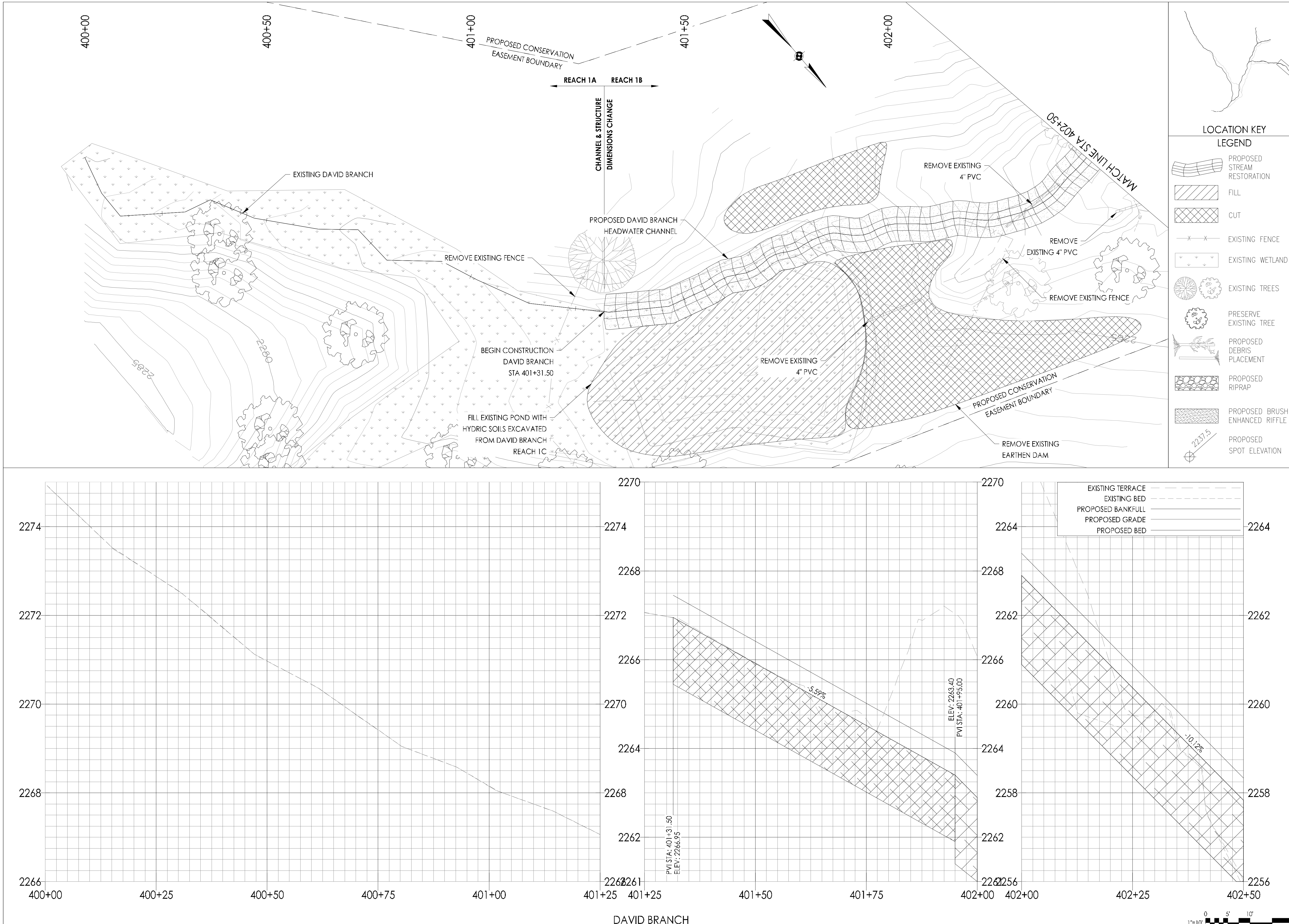
File Name: 1103-06-Lee PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. LEE - (1)

Revision 0

Sheet 11 of 22



Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Revision	By	Appd.	YY.MM.DD
Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
DAVID BRANCH - PLAN & PROFILE
STA 400+00 - 402+50

Permit-Seal

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038595 CHRISTOPHER M. ENGLE
5/27/20

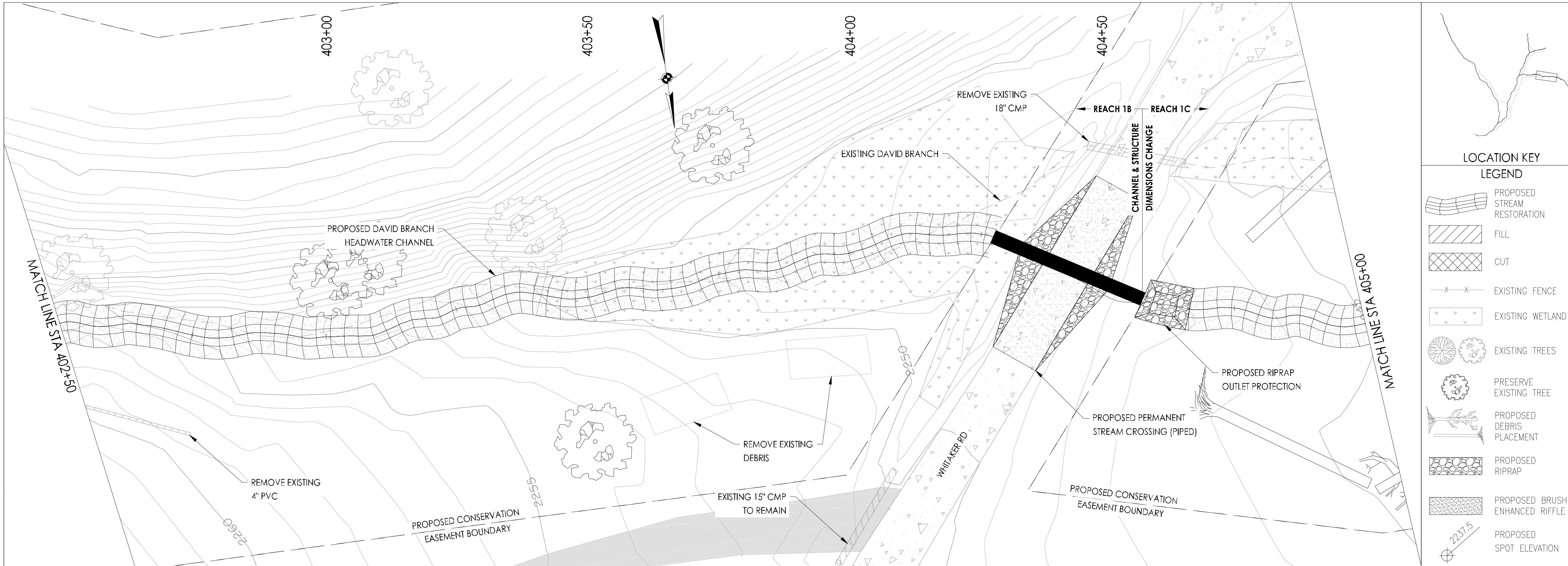
Project Number: 172621103

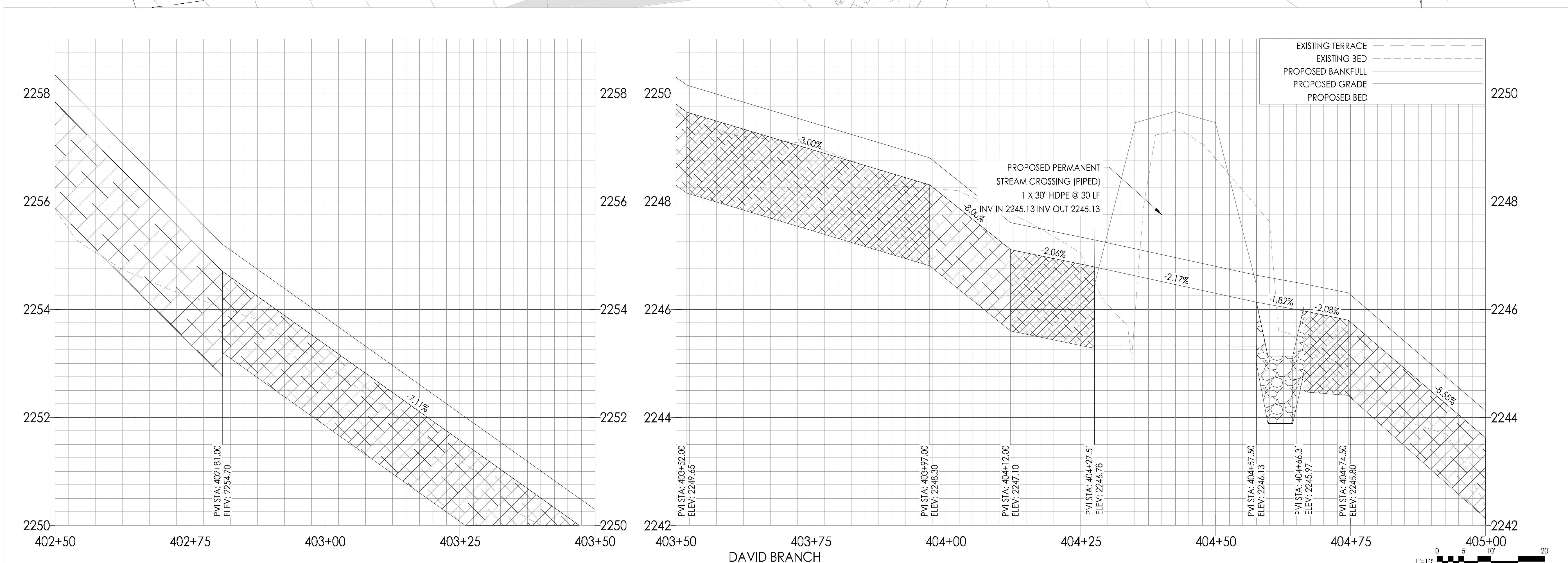
File Name: 1103-07-David PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. DAVID - (1)

Revision	Sheet
0	12 of 22





Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
DAVID BRANCH - PLAN & PROFILE
STA 402+50 - 405+00

Permit-Seal

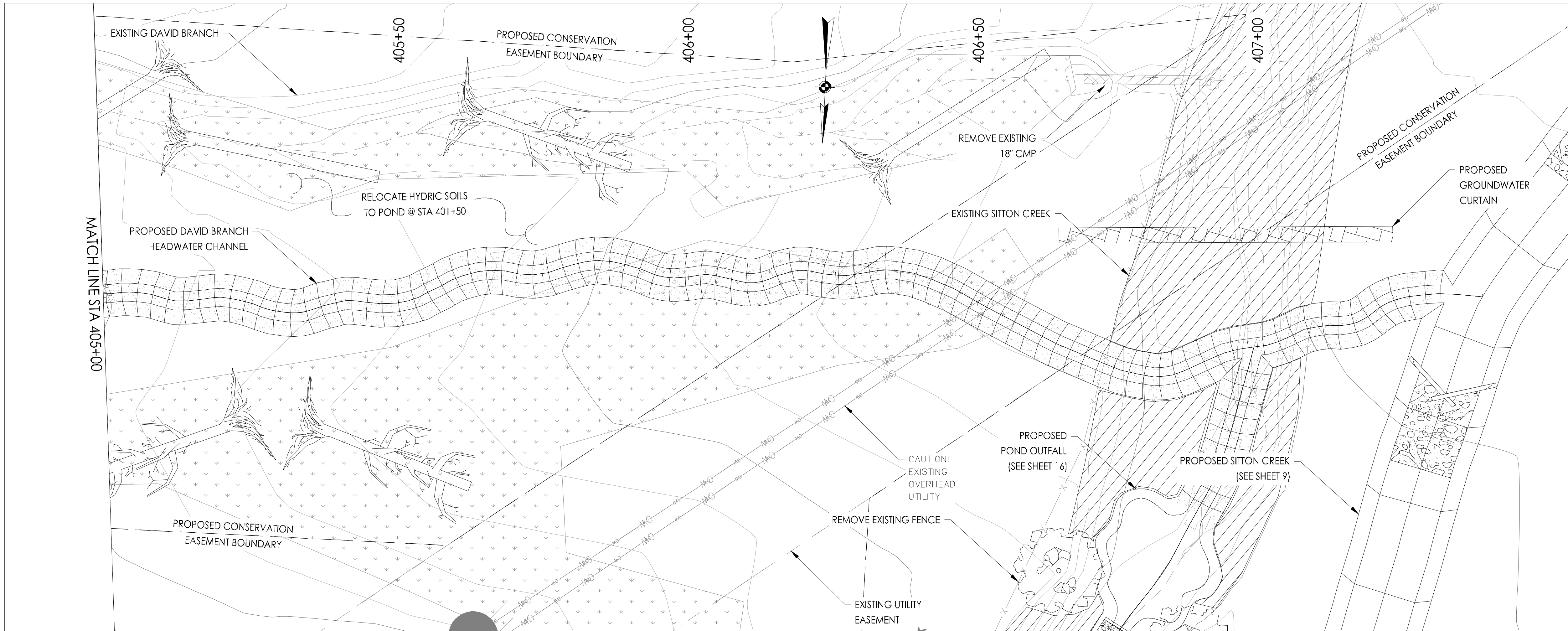
Project Number: 172621103

File Name: 1803-07-David PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. DAVID - (2)

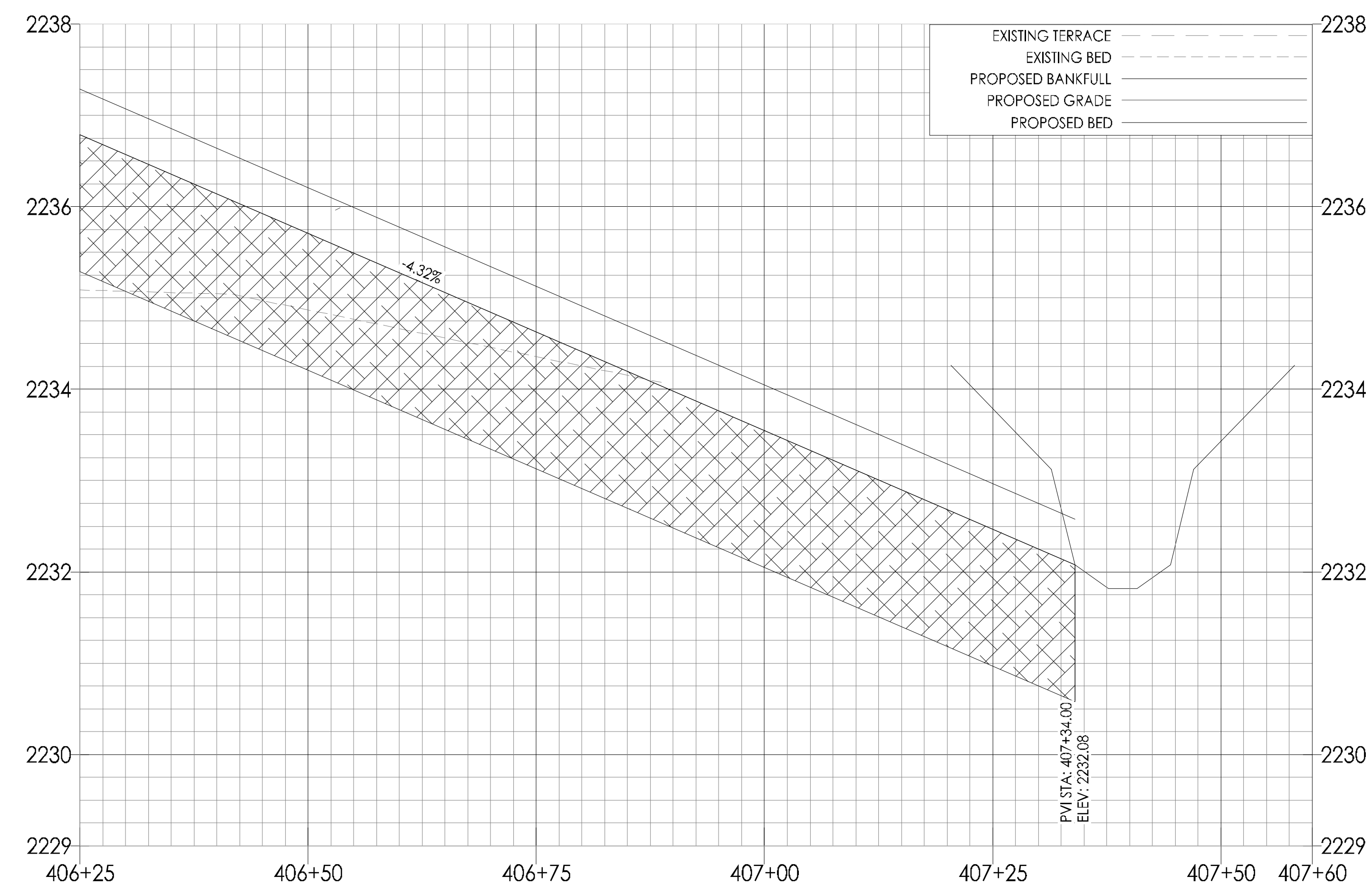
Revision 0 Sheet 13 of 22



LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- FILL
- CUT
- EXISTING FENCE
- EXISTING WETLAND
- EXISTING TREES
- PRESERVE EXISTING TREE
- PROPOSED DEBRIS PLACEMENT
- PROPOSED RIPRAP
- PROPOSED BRUSH ENHANCED RIFFLE
- PROPOSED SPOT ELEVATION



DAVID BRANCH

1"=10' 0 5' 10' 20'

Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
DAVID BRANCH - PLAN & PROFILE
STA 405+00 - 407+50

Permit-Seal

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 035595 CHRISTOPHER M. ENGLE 5/27/20

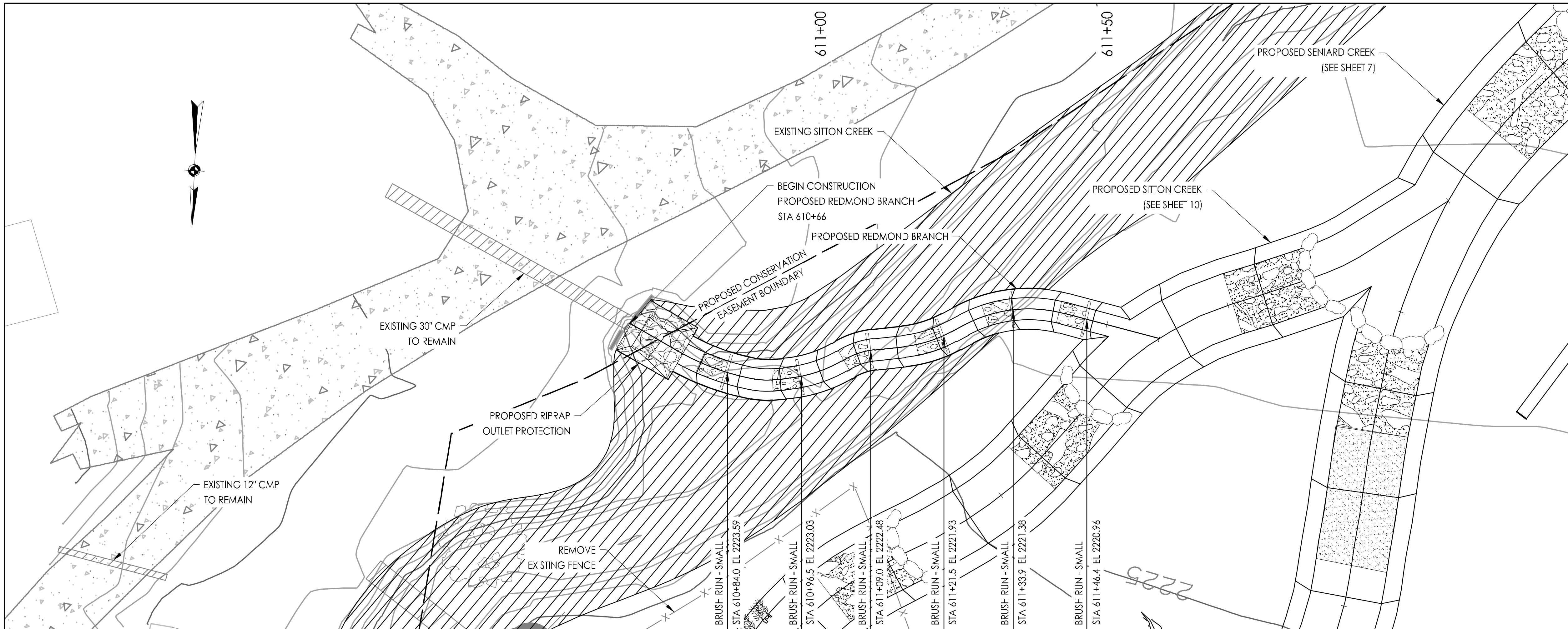
Project Number: 172621103

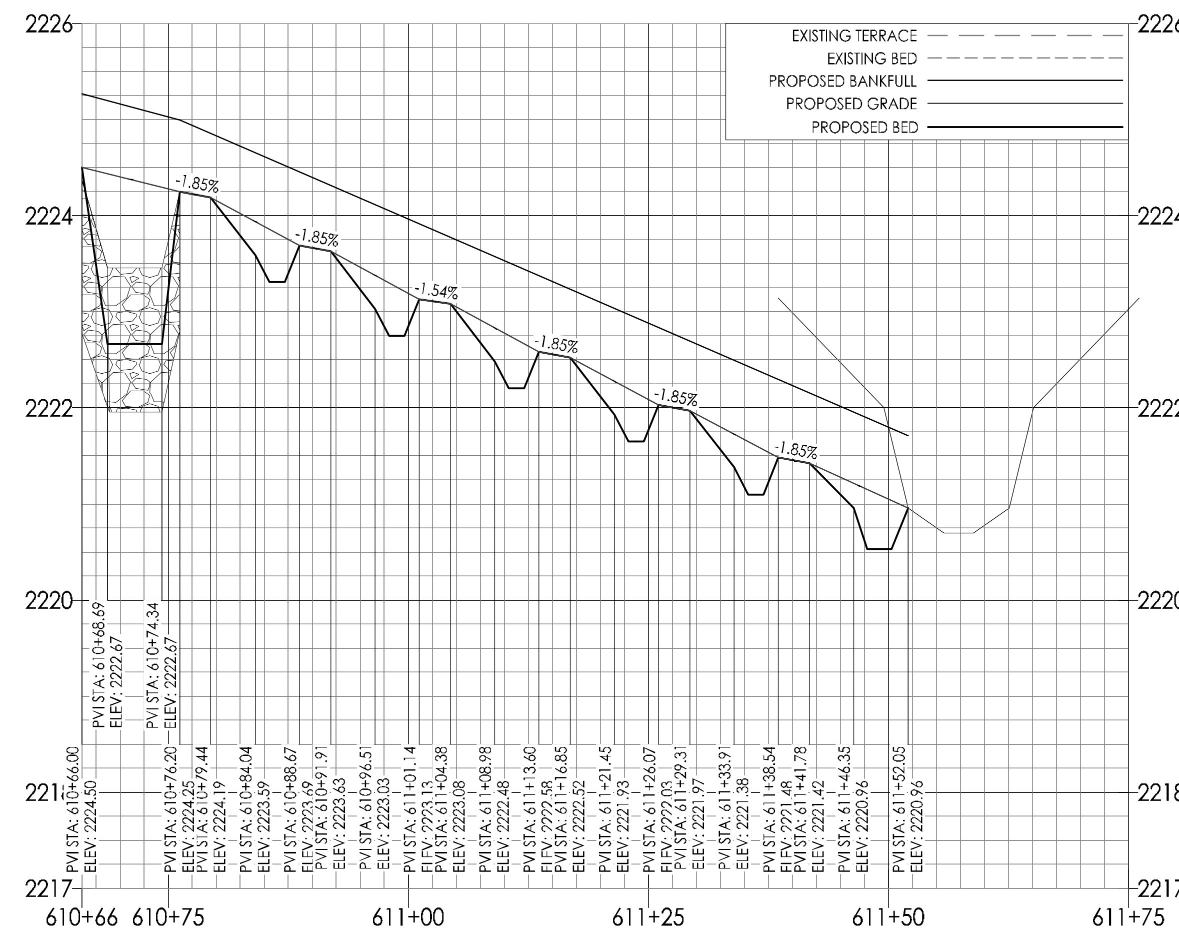
File Name: 1803-07-David PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. DAVID - (3)

Revision 0 Sheet 14 of 22





REDMOND BRANCH

LOCATION KEY

LEGEND

- PROPOSED STREAM RESTORATION
- FILL
- CUT
- EXISTING FENCE
- EXISTING WETLAND
- EXISTING TREES
- PRESERVE EXISTING TREE
- PROPOSED DEBRIS PLACEMENT
- PROPOSED RIPRAP
- PROPOSED BRUSH ENHANCED RIFFLE
- PROPOSED SPOT ELEVATION (2237.5)

1"=10' 0 5' 10' 20'

Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
REDMOND BRANCH - PLAN & PROFILE
STA 405+00 - 407+50

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE

5/27/20

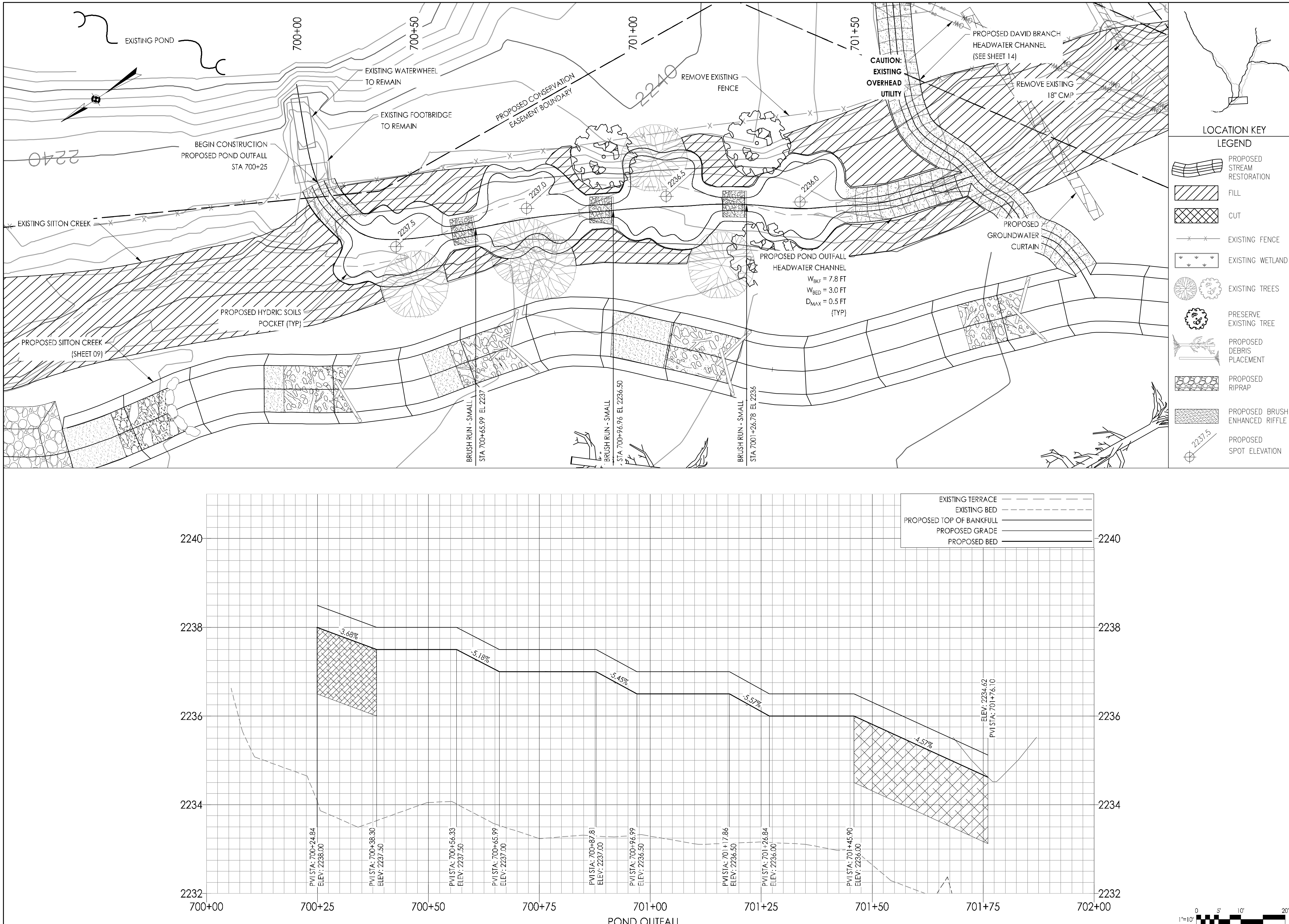
Project Number: 172621103

File Name: 1103-07-David PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. REDMOND (1)

Revision 0 Sheet 15 of 22



Stantec

56 College Street, Suite 201
Asheville, North Carolina
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
DAVID BRANCH - PLAN & PROFILE
STA 405+00 - 407+50

Permit-Seal

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038535 CHRISTOPHER M. ENGLE

5/27/20

Project Number: 172621103

File Name: 1103-07-David PLANPRO.dwg

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. POND OUTFALL

Revision 0

Sheet 16 of 22

NC DMS PROJECT #100017

STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
NC	172621103	1	6

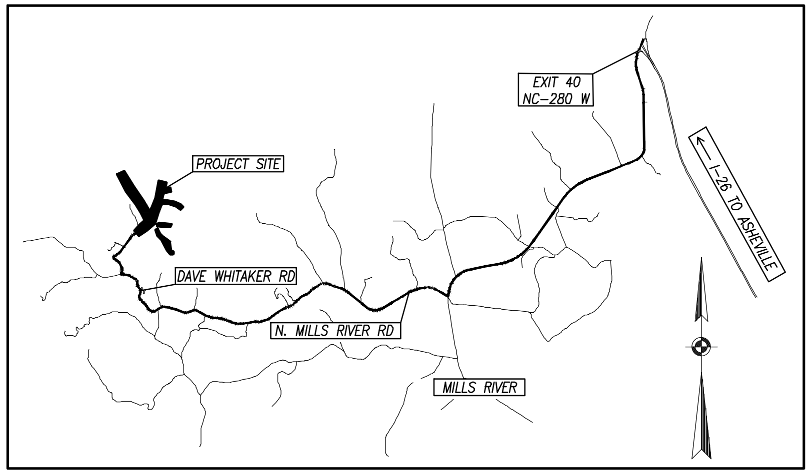
SYM.	DESCRIPTION	DATE	APPROVED
	FINAL PLANS	5/22/20	CME
1	SHEETS EC-1, EC-2A	5/29/20	CME

REVISIONS

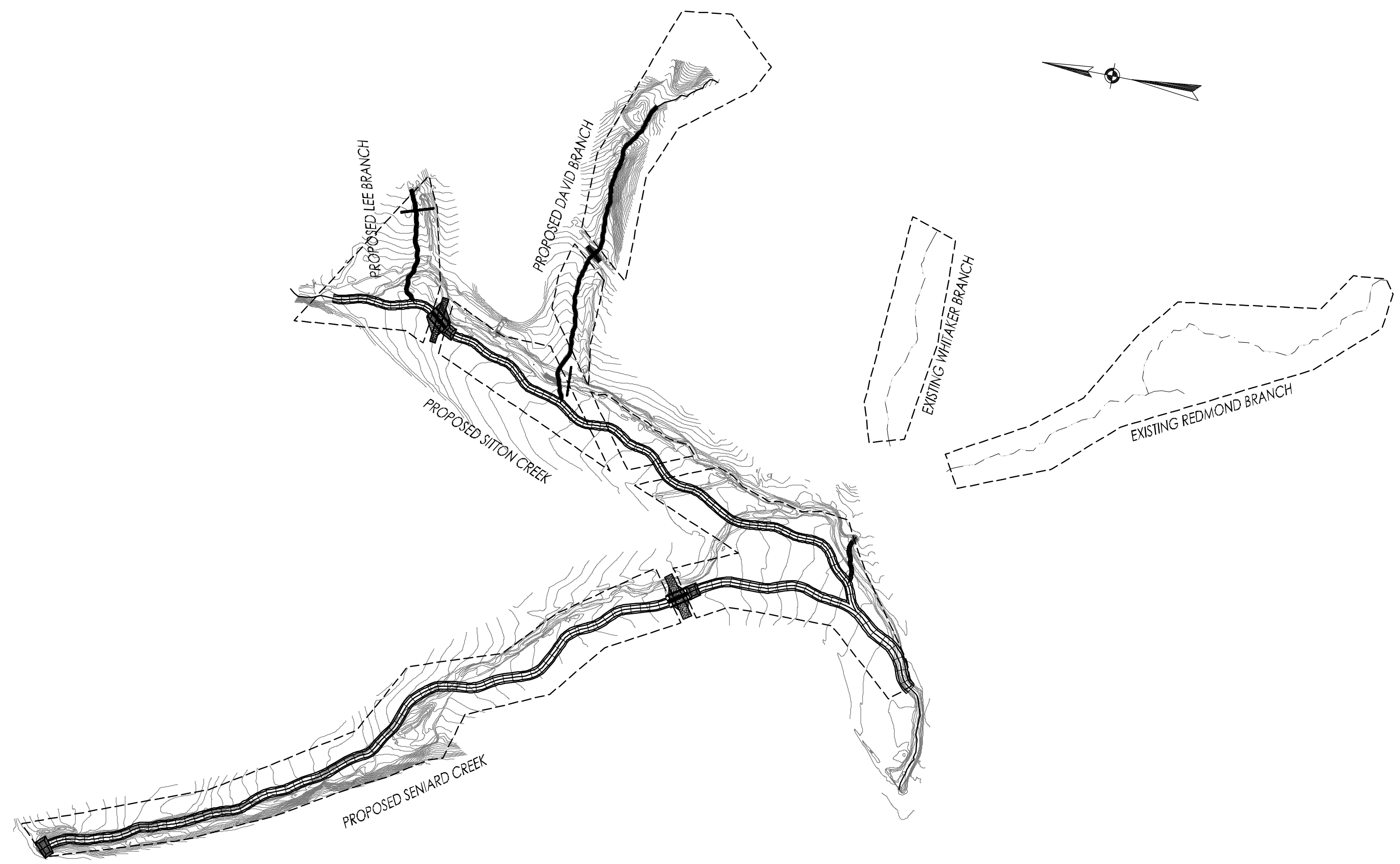
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION PROJECT

SENIARD CREEK
HENDERSON COUNTY, NORTH CAROLINA



VICINITY MAP
NOT TO SCALE

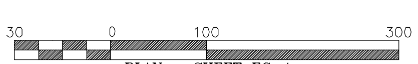


SHEET INDEX

SHEET NO.	DESCRIPTION
EC-1	TITLE SHEET
EC-2 - EC-2A	NOTES
EC-3 - EC-3A	DETAILS
EC-4	PLAN

EROSION CONTROL PLANS

GRAPHIC SCALES (SCALE IN FEET)



PLAN – SHEET EC-4

PROJECT LENGTHS

PROPOSED RESTORATION:

SENIARD CREEK	= 1,846 FT
SITTON CREEK	= 1,236 FT
DAVID BRANCH	= 608 FT
LEE BRANCH	= 226 FT
REDMOND BRANCH	= 94 FT

PROPOSED ENHANCEMENT:

WHITAKER BRANCH	= 426 FT
REDMOND BRANCH	= 1,054 FT

PROPOSED PRESERVATION:

DAVID BRANCH	= 132 FT
TOTAL LENGTH	= 5,622 FT

Prepared by:

Stantec

Stantec Consulting Services Inc.
56 College Street, Suite 201
Asheville, North Carolina 28801
www.stantec.com

NORTH CAROLINA PROFESSIONAL SEAL ENGINEER CHRISTOPHER ... ENGLE

5/29/20

PROJECT ENGINEER

Prepared for:

NC DMS

HARRY TSOMIDES
PROJECT MANAGER

GENERAL NOTES:

DISTURBED ACREAGE: 18.12 ACRES INCLUDING CONSTRUCTION EASEMENT

1. **SITE SOILS:** CODORUS LOAM, ROSMAN LOAM, EVARD SOILS.
2. **RECEIVING WATERS:** NORTH FORK OF MILLS RIVER, CLASSIFIED AS A WS–II; Tr, HQW STREAM.
3. THE CONTRACTOR SHALL INSTALL AND MAINTAIN THROUGHOUT THE DURATION OF CONSTRUCTION ALL EROSION CONTROL MEASURES IN ACCORDANCE WITH THESE PLANS AND IN ACCORDANCE WITH APPLICABLE EROSION AND SEDIMENT CONTROL REGULATIONS.
4. ALL EROSION CONTROL MEASURES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE NORTH CAROLINA EROSION AND SEDIMENT CONTROL REGULATIONS, U.S. DEPARTMENT OF AGRICULTURE, AND U.S. NATURAL RESOURCES CONSERVATION SERVICE REGULATIONS.
5. THE CONTRACTOR SHALL CONTINUOUSLY MAINTAIN ALL EROSION CONTROL DEVICES AND STRUCTURES TO MINIMIZE EROSION.
6. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED CONTINUOUSLY, RELOCATED WHEN AND AS NECESSARY, AND SHALL BE CHECKED AFTER EVERY RAINFALL. SEEDED AREAS SHALL BE CHECKED REGULARLY AND SHALL BE WATERED, FERTILIZED, RE–SEEDED, AND MULCHED AS NECESSARY TO OBTAIN A DENSE STAND OF GRASS. IF ANY MEASURE IS FOUND TO BE DAMAGED, DEFICIENT, OR UNSTABLE IT SHALL BE REPAIRED IMMEDIATELY.
7. DISTURBED AREAS THAT ARE NOT OTHERWISE STABILIZED SHALL BE AMENDED AND SEEDED, TEMPORARILY OR PERMANENTLY IN ACCORDANCE WITH THE NORTH CAROLINA SEDIMENT CONTROL REGULATIONS. PERMANENT SEEDING AND GRASS ESTABLISHMENT ARE REQUIRED PRIOR TO PROJECT COMPLETION AND ACCEPTANCE.
8. ALL PERIMETER DIKES, SWALES, DITCHES, PERIMETER SLOPES AND ALL SLOPES STEEPER THAN 3:1 SHALL BE PROVIDED TEMPORARY OR PERMANENT STABILIZATION WITH GROUND COVER WITHIN 7 DAYS OF ANY LAND–DISTURBING ACTIVITY.
9. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 14 DAYS AFTER FINAL SITE STABILIZATION OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED. TRAPPED SEDIMENT AND DISTURBED SOIL AREAS RESULTING FROM THE DISPOSITION OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED TO PREVENT FURTHER EROSION AND SEDIMENTATION.
10. WHERE SEDIMENT IS TRANSPORTED ONTO A PAVED OR PUBLIC ROAD SURFACE, THE ROAD SURFACE SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY. SEDIMENT SHALL BE REMOVED FROM THE ROADS BY SHOVELING OR SWEEPING AND TRANSPORTED TO A SEDIMENT CONTROL DISPOSAL AREA. STREET WASHING SHALL BE ALLOWED ONLY AFTER SEDIMENT IS REMOVED IN THIS MANNER.
11. A CONSTRUCTION ENTRANCE SHALL BE INSTALLED AT ALL ACCESS POINTS FROM ANY PUBLIC ROAD. WHEN A CRUSHED STONE CONSTRUCTION ENTRANCE HAS BEEN COVERED WITH SOIL OR HAS BEEN PUSHED INTO THE SOIL BY CONSTRUCTION TRAFFIC, IT SHALL BE REPLACED WITH A DEPTH OF STONE EQUAL TO THAT OF THE ORIGINAL APPLICATION.
12. ALL DRAINAGE INLETS SHALL BE PROTECTED FROM SILTATION. INEFFECTIVE PROTECTION DEVICES SHALL BE IMMEDIATELY REPLACED AND THE INLET CLEANED. FLUSHING IS NOT AN ACCEPTABLE METHOD OF CLEANING.
13. DURING CONSTRUCTION OF THE PROJECT, SOIL STOCKPILES SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE TEMPORARY PROTECTION AND PERMANENT STABILIZATION OF ALL SOIL STOCKPILES ON SITE AS WELL AS SOIL INTENTIONALLY TRANSPORTED FROM THE PROJECT SITE.
14. SEDIMENT BASINS AND TRAPS, PERIMETER DIKES, SEDIMENT BARRIERS, AND OTHER MEASURES INTENDED TO TRAP SEDIMENT SHALL BE CONSTRUCTED AS A FIRST STEP IN ANY LAND DISTURBING ACTIVITY AND SHALL BE MADE FUNCTIONAL BEFORE UPSLOPE LAND DISTURBANCE TAKES PLACE.
15. STABILIZATION MEASURES SHALL BE APPLIED TO STRUCTURES SUCH AS DAMS, DIKES, AND DIVERSIONS, IMMEDIATELY AFTER INSTALLATION.
16. ALL SILT BASINS, SILT TRAPS, AND SEDIMENT BASINS SHALL BE CLEANED OUT WHEN HALF OF THE CAPACITY HAS BEEN REACHED.
17. CONSTRUCTION ACTIVITIES SHALL BE LIMITED TO AREA INSIDE THE CONSERVATION EASEMENT AND THE TEMPORARY CONSTRUCTION EASEMENT.

CONSTRUCTION SEQUENCE

THE CONTRACTOR SHALL FOLLOW THE SEQUENCE OF CONSTRUCTION IN ACCORDANCE WITH THE PLANS AND AS DIRECTED BY THE ENGINEER.

THE CONTRACTOR SHALL CONDUCT STREAM WORK, INCLUDING INSTALLATION OF IN–STREAM STRUCTURES, GRADING, STABILIZATION MEASURES, AND SEEDING AND MULCHING, ON A SECTION OF STREAM THAT CAN BE ENTIRELY COMPLETED IN A SINGLE DAY. THE AFOREMENTIONED CONSTITUTES SAME–DAY–STABILIZATION PROTOCOL.

1. THE CONTRACTOR SHALL IDENTIFY THE PROJECT BOUNDARY, LIMITS OF DISTURBANCE, SENSITIVE AREAS, STAGING AREAS, AND CONSTRUCTION ENTRANCES WITH THE ENGINEER.
2. THE CONTRACTOR SHALL SUBMIT A PRE–DISTURBANCE NOTIFICATION TO THE ASHEVILLE AREA OFFICE INSPECTOR.
3. THE CONTRACTOR SHALL PREPARE STABILIZED CONSTRUCTION ENTRANCES AS INDICATED ON THE PLAN.
4. THE CONTRACTOR SHALL MOBILIZE EQUIPMENT, MATERIALS, PREPARE STAGING AREAS, AND STOCKPILE AREAS AS SHOWN ON THE PLANS.
5. CONSTRUCTION TRAFFIC TO BE LIMITED TO 'LIMITS OF DISTURBANCE' AS INDICATED ON THE CONSTRUCTION PLANS AND AS DIRECTED BY THE ENGINEER.
6. THE CONTRACTOR SHALL INSTALL ALL TEMPORARY ROCK CHECK DAMS, SILT FENCE, TREE PROTECTION FENCE, AND MULCHING AROUND ALL CONSTRUCTION AREAS INCLUDING STAGING AND STOCKPILE AREAS AS INDICATED ON THE CONSTRUCTION PLANS AND AS DIRECTED BY THE ENGINEER.
7. THE CONTRACTOR SHALL INSTALL ALL TEMPORARY STREAM CROSSINGS AS SHOWN ON THE PLANS. DITCHES AND STREAM REACHES WILL BE LEFT OPEN DURING INITIAL PHASES OF CONSTRUCTION TO ALLOW FOR DRAINAGE AND TO KEEP SITE ACCESSIBLE.
8. PUMP–AROUND OPERATION SHALL BE USED TO DIVERT FLOW DURING CONSTRUCTION EXCEPT AS ALLOWED BY THE ENGINEER. ALL EXCAVATION SHALL BE PERFORMED IN THE DRY OR IN ISOLATED REACHES EXCEPT AS ALLOWED BY THE ENGINEER.
9. THE CONTRACTOR SHALL BEGIN CLEARING, FLOODPLAIN EXCAVATION, AND GRADING WORK TO DESIGN GRADES AT THE UPSTREAM END OF EACH CHANNEL AS INDICATED ON THE CONSTRUCTION PLANS. THE CONTRACTOR SHALL NOT DISTURB ANY MORE FLOODPLAIN AREA LARGER AND STREAM REACH LONGER THAN CAN STABILIZED IN ONE DAY.
10. ONCE A SECTION OF STREAM AND FLOODPLAIN HAVE BEEN EXCAVATED TO DESIGN GRADES, IN–STREAM STRUCTURES, MATTING, AND TRANSPLANTS SHALL BE INSTALLED IN THAT SECTION. EXISTING BED MATERIAL SHALL BE HARVESTED AND PLACED IN THE CONSTRUCTED CHANNEL DURING PUMP–AROUND OPERATIONS SO THAT BOTH CHANNELS ARE IN THE DRY DURING CONSTRUCTION ACTIVITIES.
11. THE CONTRACTOR SHALL BEGIN INSTALLING IN–STREAM STRUCTURES FROM THE UPSTREAM SECTION WORKING DOWNSTREAM. ALL CONSTRUCTION WORK IS TO BE PERFORMED IN THE DRY UNLESS OTHERWISE DIRECTED BY THE ENGINEER OR OTHER REGULATORY AGENCY. IF EXCESSIVE SEDIMENTATION DOWNSTREAM BECOMES A CONCERN, THE ENGINEER OR PROJECT MANAGER IN CHARGE MAY DIRECT THE CONTRACTOR TO INSTALL A TEMPORARY ROCK CHECK DAM AND SETTLING BASIN DOWNSTREAM. THIS AREA IS TO BE MAINTAINED ON A REGULAR BASIS BY THE CONTRACTOR.
12. ONCE A STREAM WORK PHASE IS COMPLETE, THE CONTRACTOR WILL APPLY TEMPORARY SEEDING, PERMANENT SEEDING, AND MULCH TO ALL AREAS DISTURBED DURING CONSTRUCTION. TEMPORARY AND PERMANENT SEEDING MIXTURES WILL BE APPLIED AS SHOWN ON THE PLANTING PLAN. TEMPORARY SEEDING WILL BE APPLIED IN ALL AREAS SUSCEPTIBLE TO EROSION SUCH THAT GROUND COVER IS ESTABLISHED WITHIN 7 WORKING DAYS FOLLOWING COMPLETION OF ANY GRADING PHASE. PERMANENT GROUND COVER WILL BE ESTABLISHED FOR ALL DISTURBED AREAS WITHIN 15 WORKING DAYS FOLLOWING COMPLETION OF CONSTRUCTION.
13. ALL SEEDING AND MULCHING SHALL BE COMPLETED BEFORE LEAVING THE PROJECT SITE ALONG WITH REMOVAL OF ANY TEMPORARY STREAM CROSSINGS AND TEMPORARY CHECK DAMS.
14. THE CONTRACTOR OR OTHER QUALIFIED PERSONNEL SHALL PLANT ALL WOODY VEGETATION AND INSTALL LIVE STAKING ACCORDING TO THE PLANTING DETAILS AND SPECIFICATIONS. ALL PERMANENT SEEDING AND PLANTINGS SHALL BE PERFORMED DURING THE APPROPRIATE TIME OF YEAR.
15. THE CONTRACTOR SHALL SUBMIT A POST–STABLIZATION NOTIFICATION TO THE ASHEVILLE AREA OFFICE INSPECTOR.
16. THE CONTRACTOR SHALL ENSURE THAT THE SITE IS FREE OF TRASH AND LEFTOVER MATERIALS PRIOR TO DEMOBILIZATION OF EQUIPMENT FROM THE SITE.

SITE PRESERVATION AGREEMENT:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE BY THE CONTRACTOR TO EXISTING FACILITIES INCLUDING BUT NOT LIMITED TO ROADS, GATES, FENCES, CURBS, AND UTILITIES. CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT ALL ACCESS LOCATIONS PER THE PLANS AND SPECIFICATIONS.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY IMPROVEMENT TO THE ROAD CONDITION, GATES, AND FENCES, REQUIRED FOR ACCESS DURING CONSTRUCTION.

EROSION CONTROL MEASURES DURING CONSTRUCTION:
DURING CONSTRUCTION THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ADDITIONAL EROSION CONTROL MEASURES NOT SHOWN ON THE PLANS BUT NECESSARY TO CONTROL EXCESS SEDIMENT, IF DETERMINED BY THE ENGINEER.

STOCKPILE AND STAGING AREAS:
STOCKPILE AREAS FOR STORING MATERIALS WILL BE PRE–APPROVED AND IDENTIFIED PRIOR TO WORK BEGINNING TO ENSURE PROTECTION OF THE SITE STREAMS FROM EXCESSIVE SEDIMENTATION. ALL STOCKPILE AND STAGING AREAS SHALL BE LOCATED 25 FT (MIN) FROM TOP OF STREAM BANKS. SPECIFIED AREAS SHOWN ON THE PLANS HAVE BEEN ESTABLISHED AS STAGING AREAS. THE CONTRACTOR MAY ESTABLISH ADDITIONAL STAGING AREAS ALONG THE PROJECT, AS NECESSARY, TO CARRY OUT THE WORK. ALL STAGING AREAS MUST BE INSIDE THE LIMITS OF DISTURBANCE AND APPROVED BY THE ENGINEER. SILT FENCE SHALL BE REQUIRED IN AREAS WHERE LOOSE SOIL HAS BEEN PLACED IN THE STAGING OR STOCKPILE AREAS.

MISCELLANEOUS:
THE CONTRACTOR SHALL BE RESPONSIBLE FOR HAVING A RAIN GAUGE ON THE PROJECT SITE AND FOR RECORDING DAILY RAINFALL AMOUNTS DURING CONSTRUCTION.

MAJOR ELEMENTS OF DWR CONSTRUCTION GENERAL PERMIT

1) GROUND STABILIZATION

SITE AREA DESCRIPTION	STABILIZATION TIME FRAME	STABILIZATION TIME FRAME EXCEPTIONS
PERIMETER DIKES, SWALES, DITCHES AND SLOPES	7 DAYS	NONE
HIGH QUALITY WATER (HQW) ZONES	7 DAYS	NONE
SLOPES STEEPER THAN 3:1	7 DAYS	FOR SLOPES ≤ 10' IN LENGTH AND NOT STEEPER THAN 2:1, 14 DAYS ALLOWED
SLOPES 3:1 OR FLATTER	14 DAYS	7 DAYS FOR SLOPES > 50' IN LENGTH
ALL OTHER AREAS WITH SLOPES FLATTER THAN 4:1	14 DAYS	NONE (EXCEPT FOR PERIMETERS AND HQW ZONES)

2) BUILDING WASTE HANDLING

NO PAINT OR LIQUID WASTES IN STREAM OR STORM DRAINS
DEDICATED AREAS FOR DEMOLITION, CONSTRUCTION AND OTHER WASTES MUST BE LOCATED 50' FROM STORM DRAINS AND STREAMS UNLESS NO REASONABLE ALTERNATIVES AVAILABLE
EARTHEN–MATERIAL STOCKPILES MUST BE LOCATED 50' FROM STORM DRAINS AND STREAMS UNLESS NO REASONABLE ALTERNATIVES AVAILABLE
CONCRETE MATERIALS MUST BE CONTROLLED TO AVOID CONTACT WITH SURFACE WATERS, WETLANDS OR BUFFERS

3) DISCHARGES TO FEDERALLY–LISTED WATERS

REQUIREMENTS ARE THE SAME AS IN PREVIOUS PERMIT.
THE PERMIT ALLOWS REDUCTION FROM THE 20–ACRE MINIMUM IF THE DIRECTOR OF DWQ DETERMINES THAT OTHER BMPs PROVIDE EQUIVALENT PROTECTION.

4) CONDITIONS IN EROSION & SEDIMENTATION CONTROL PLANS

DESIGNATION ON THE PLANS WHERE THE 7– AND 14–DAY GROUND STABILIZATION REQUIREMENTS OF THE NPDES PERMIT APPLY
DESIGNATION ON THE PLANS WHERE BASINS THAT COMPLY WITH THE SURFACE–WITHDRAWAL REQUIREMENTS OF THE NPDES PERMIT ARE LOCATED

5) SEDIMENT BASINS

OUTLET STRUCTURES MUST WITHDRAW FROM BASIN SURFACE UNLESS DRAINAGE AREA IS LESS THAN 1 ACRE.
USE ONLY DWQ–APPROVED FLOCCULANTS.

6) IMPLEMENTATION OF NEW PERMIT CONDITIONS

PROJECTS PERMITTED UNDER THE PREVIOUS PERMIT CAN CONTINUE TO FOLLOW THE PREVIOUSLY–PERMITTED CONDITIONS.
COMPLETE APPLICATIONS RECEIVED PRIOR TO AUGUST 3, 2011 CAN FOLLOW CONDITIONS OF APPROVED APPLICATION.
APPLICATIONS RECEIVED AFTER AUGUST 2, 2011 MUST COMPLY WITH NEW PERMIT CONDITIONS.

7) SELF–INSPECTIONS

RAINFALL DATA
DAILY RAINFALL AMOUNTS SHALL BE RECORDED. RECORD "ZERO" IF NO RAINFALL OCCURRED. IF NO DAILY RAIN GAUGE OBSERVATIONS ARE MADE DURING WEEKEND OR HOLIDAY PERIODS, AND NO INDIVIDUAL–DAY RAINFALL INFORMATION IS AVAILABLE, THE CUMULATIVE RAIN MEASUREMENT FOR THOSE UN–ATTENDED DAYS WILL DETERMINE IF A SITE INSPECTION IS NEEDED.

GROUND STABILIZATION AND GRADING
GROUND STABILIZATION MEASURES SHALL BE RECORDED AFTER EACH PHASE OF GRADING AND INSPECTED TO ENSURE GROUND COVER IS SUFFICIENT TO RESIST EROSION WITHIN THE ALLOTTED TIME FRAME GIVEN THE AREA DESCRIPTION.

EROSION AND SEDIMENTATION CONTROL MEASURES
EROSION CONTROL MEASURES SHALL BE INSPECTED TO ENSURE THAT THEY ARE OPERATING CORRECTLY. INSPECTION RECORDS MUST BE MAINTAINED FOR EACH INSPECTION EVENT AND FOR EACH MEASURE.

STORMWATER DISCHARGE OUTFALLS
STORMWATER RUNOFF DISCHARGE OUTFALLS SHALL BE INSPECTED BY OBSERVATION FOR EROSION, SEDIMENTATION AND OTHER STORMWATER DISCHARGE CHARACTERISTICS SUCH AS CLARITY, FLOATING SOLIDS, AND OIL SHEENS. REPORT ANY VISIBLE SEDIMENT BEING DEPOSITED IN ANY STREAM OR WETLAND OR ANY NONCOMPLIANCE WHICH MAY ENDANGER HEALTH OR THE ENVIRONMENT TO THE DIVISION OF LAND QUALITY OR THE APPROPRIATE REGIONAL OFFICE WITHIN 24 HOURS OF INSPECTION.

INSPECTIONS
INSPECTIONS OF SEDIMENT AND EROSION CONTROL MEASURES AND STORMWATER DISCHARGE OUTFALLS SHALL BE MADE AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN 24 HOURS AFTER ANY STORM EVENT OF GREATER THAN 0.50 INCHES OF RAIN PER 24 HOUR PERIOD. INSPECTIONS ARE ONLY REQUIRED TO BE MADE DURING NORMAL BUSINESS HOURS AND TO BE CERTIFIED BY THE FINANCIAL RESPONSIBLE PARTY / PERMITEE OR AGENT / DESIGNEE.

RECORDS OF INSPECTIONS
RECORDS OF INSPECTIONS MADE DURING THE PREVIOUS 30 DAYS SHALL REMAIN ON THE SITE AND AVAILABLE FOR AGENCY INSPECTORS AT ALL TIMES DURING NORMAL WORKING HOURS. OLDER RECORDS MUST BE MAINTAINED FOR A PERIOD OF THREE YEARS AFTER PROJECT COMPLETION AND MADE AVAILABLE UPON REQUEST. THE RECORDS MUST PROVIDE THE DETAILS OF EACH INSPECTION INCLUDING OBSERVATIONS, AND ACTIONS TAKEN. USE OF ELECTRONICALLY–AVAILABLE RECORDS, IN LIEU OF THE REQUIRED PAPER COPIES FOR INSPECTION WILL BE ALLOWED IF SHOWN TO PROVIDE EQUAL ACCESS AND UTILITY AS THE HARD–COPY RECORDS.

SELF–INSPECTION FORMS CAN FOUND AT
HTTPS://DEQ.NC.GOV/ABOUT/DIVISIONS/ENERGY–MINERAL–LAND–RESOURCES/EROSION–SEDIMENT–CONTROL/FORMS

Stantec
56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay.

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
NOTES

Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE
5/27/20

Project Number: 172621103

RTS	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0
Sheet EC-2

PHASING OF WORK:

PHASE 1 – SITE PREPARATION

1. INSTALL CONSTRUCTION ENTRANCE PAD AT SITE ENTRANCE OFF DAVE WHITAKER ROAD.
2. INSTALL TEMPORARY EROSION CONTROL MEASURES FOR SITE PREPARATION AND PREPARE LOCATION OF TEMPORARY STAGING AREA AT APPROXIMATE STATION 118+00.
3. INSTALL TEMPORARY STREAM CROSSING AT APPROXIMATE STA 114+00
4. INSTALL PROTECTION FENCE AROUND ANY SENSITIVE AREAS.
5. ESTABLISH BORROW SITE ADJACENT TO SENIARD CREEK – REACH 1B (RIGHT FLOODPLAIN) FOR COBBLE/GRAVEL HARVEST. EXCAVATE AND STOCKPILE MATERIAL FOR USE IN CONSTRUCTION OF DAVID AND LEE BRANCHES. ONCE COMPLETE, FILL BORROW SITE WITH SOIL AND STABILIZE WITH TEMPORARY SEED/MULCH.

PHASE 2 – BUILD DAVID BRANCH

1. INSTALL TEMPORARY EROSION CONTROL MEASURES FOR THE NEXT PHASE OF WORK. PRIOR TO ADVANCING TO ANY SUBSEQUENT PHASE OF WORK, ALL TEMPORARY EROSION CONTROL MEASURES MUST BE INSTALLED FOR THAT PHASE.
2. INSTALL TEMPORARY STREAM CROSSING AT APPROXIMATE STATION 205+25 ON EXISTING SITTON CREEK.
3. UTILIZE PUMP–AROUND OPERATION P1–S1. UTILIZE RIDGE AS HAUL ROAD BETWEEN EXISTING WETLANDS FOR ACCESS, AND EXCAVATE HYDRIC SOILS FROM APPROXIMATE STATION 405+25 TO 406+50. DEWATER POND AND REMOVE EXISTING EARTHEN DAM AT APPROXIMATE STATION 402+00. RELOCATE EXCAVATED HYDRIC SOILS TO FILL EXISTING POND AREA AND CONSTRUCT WETLAND BENCH FROM APPROXIMATE STATION 401+25 TO 402+00.
4. UTILIZE PUMP–AROUND OPERATION P1–S1. CONSTRUCT PROPOSED CHANNEL AND INSTALL IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 401+30 TO 403+00.
5. UTILIZE PUMP–AROUND OPERATION P2–S2. CONSTRUCT PROPOSED CHANNEL AND INSTALL IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 403+00 TO 404+30. REMOVE EXISTING 18" CMP FROM UNDER WHITAKER COVE RD. INSTALL PROPOSED PERMANENT STREAM CROSSING (PIPED) UNDER WHITAKER COVE RD., OUTLET PROTECTION AND TEMPORARY DIVERSION CHANNEL AT APPROXIMATE STATION 404+65.
6. UTILIZE PUMP–AROUND OPERATION P2–S2. CONSTRUCT PROPOSED CHANNEL AND INSTALL IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 404+65 TO 407+00, UTILIZING TEMPORARY DIVERSION CHANNELS TO STABILIZE STREAM AT LEADING EDGE OF PROGRESS AT THE END OF EVERY WORK DAY UNTIL CONSTRUCTION IS COMPLETE TO EXISTING SITTON CREEK. STABILIZE TEMPORARY OUTFALL INTO EXISTING SITTON CREEK.
7. STABILIZE DISTURBED AREA WITH TEMPORARY AND PERMANENT SEED AND MULCH AND REMOVE TEMPORARY EROSION CONTROL MEASURES.

PHASE 3 – BUILD LEE BRANCH AND UPSTREAM SITTON CREEK

1. INSTALL TEMPORARY EROSION CONTROL MEASURES FOR THE NEXT PHASE OF WORK.
2. INSTALL TEMPORARY STREAM CROSSING AT APPROXIMATE STATION 201+50
3. UTILIZE PUMP–AROUND OPERATION P3–S3. CONSTRUCT PROPOSED CHANNEL AND INSTALL IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 300+00 TO 301+50. STABILIZE TEMPORARY OUTFALL INTO EXISTING SITTON CREEK.
4. UTILIZE PUMP–AROUND OPERATION P4–S4. HARVEST EXISTING BED MATERIAL FROM SITTON CREEK AND STOCKPILE FOR LATER INSTALLATION. CONSTRUCT PROPOSED CHANNEL AND INSTALL IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 200+55 TO 202+75 AND 301+50 TO 302+20 TO MAKE TIE–IN. CONSTRUCT TEMPORARY DIVERSION CHANNEL FROM PROPOSED SITTON CREEK AT APPROXIMATE STATION 202+75 TO EXISTING SITTON CREEK.
5. UTILIZE PUMP–AROUND OPERATION P4–S4. INSTALL PROPOSED PERMANENT STREAM CROSSING (PIPED), OUTLET PROTECTION AND BRUSH ENHANCED RIFFLE FROM APPROXIMATE STATION 202+75 TO 203+75. CONSTRUCT TEMPORARY DIVERSION CHANNEL FROM PROPOSED SITTON CREEK AT APPROXIMATE STATION 203+75 TO EXISTING SITTON CREEK.
6. UTILIZE PUMP–AROUND OPERATION P5A–S5A AND P5B–S5B. HARVEST EXISTING BED MATERIAL FROM SITTON CREEK AND STOCKPILE FOR LATER INSTALLATION. CONSTRUCT PROPOSED CHANNEL AND INSTALL IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 203+75 TO 206+75. CONSTRUCT POND OUTFALL WETLAND COMPLEX AND STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 700+30 TO 701+75. CONSTRUCT TEMPORARY DIVERSION CHANNEL FROM PROPOSED SITTON CREEK AT APPROXIMATE STATION 206+75 TO EXISTING SITTON CREEK.
7. UTILIZE PUMP–AROUND OPERATION P5C–S5C. CONSTRUCT PROPOSED CHANNEL AND INSTALL IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 407+00 TO 407+35.
8. UTILIZE PUMP–AROUND OPERATION P6–S6. HARVEST EXISTING BED MATERIAL FROM SITTON CREEK AND STOCKPILE FOR LATER INSTALLATION. CONSTRUCT PROPOSED CHANNEL AND INSTALL IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 206+75 TO 209+75. STABILIZE TEMPORARY OUTFALL INTO EXISTING SENIARD CREEK.
9. STABILIZE DISTURBED AREA WITH TEMPORARY AND PERMANENT SEED AND MULCH AND REMOVE TEMPORARY EROSION CONTROL MEASURES.

PHASE 4 – BUILD SENIARD CREEK – REACH 1A

1. INSTALL TEMPORARY EROSION CONTROL MEASURES FOR THE NEXT PHASE OF WORK.
2. UTILIZE PUMP–AROUND OPERATION P7–S7. HARVEST EXISTING BED MATERIAL FROM SENIARD CREEK AND STOCKPILE FOR LATER INSTALLATION. CONSTRUCT PROPOSED CHANNEL AND IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 100+00 TO 102+00.
3. UTILIZE PUMP–AROUND OPERATION P8–S8. HARVEST EXISTING BED MATERIAL FROM SENIARD CREEK AND STOCKPILE FOR LATER INSTALLATION. CONSTRUCT PROPOSED CHANNEL AND IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 102+00 TO 108+50. REMOVE EXISTING SPOIL PILE BETWEEN SENIARD AND EXISTING WETLAND AT APPROXIMATE STATION 107+50. STABILIZE TEMPORARY OUTFALL INTO EXISTING SENIARD CREEK.
4. STABILIZE DISTURBED AREA WITH TEMPORARY AND PERMANENT SEED AND MULCH AND REMOVE TEMPORARY EROSION CONTROL MEASURES.

PHASE 5 – BUILD SENIARD CREEK – REACH 1B & REACH 2

1. INSTALL TEMPORARY EROSION CONTROL MEASURES FOR THE NEXT PHASE OF WORK.
2. EXCAVATE MATERIAL ADJACENT TO EXISTING WETLAND TO EXPAND FOOTPRINT.
3. CONSTRUCT PROPOSED CHANNEL AND IN–STREAM STRUCTURES IN–THE–DRY AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 107+50 TO 112+00. STABILIZE TEMPORARY OUTFALL INTO EXISTING SENIARD CREEK.
4. UTILIZE PUMP–AROUND OPERATION P9–S9. CONSTRUCT PROPOSED CHANNEL TIE–IN AT APPROXIMATE STATION 108+50. HARVEST EXISTING BED MATERIAL FROM ABANDONED SENIARD CREEK AND STOCKPILE FOR LATER INSTALLATION.
5. CONSTRUCT PROPOSED CHANNEL AND IN–STREAM STRUCTURES IN–THE–DRY AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 114+25 TO 116+00.
6. UTILIZE PUMP–AROUND OPERATION P10–S10. CONSTRUCT PROPOSED CHANNEL AND IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 116+00 TO 118+50, INCLUDING SITTON CREEK CONFLUENCE STRUCTURE AT STATION 212+64.
7. UTILIZE PUMP–AROUND OPERATION P11–S11. CONSTRUCT PROPOSED CHANNEL AND IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 112+00 TO 114+25 TO MAKE CONNECTION.
8. STABILIZE DISTURBED AREA WITH TEMPORARY AND PERMANENT SEED AND MULCH AND REMOVE TEMPORARY EROSION CONTROL MEASURES.

PHASE 6 – BUILD DOWNSTREAM SITTON CREEK AND REDMOND BRANCH

1. INSTALL TEMPORARY EROSION CONTROL MEASURES FOR THE NEXT PHASE OF WORK.
2. UTILIZE PUMP–AROUND OPERATION P12A–S12A AND P12B–S12B. CONSTRUCT PROPOSED CHANNEL AND IN–STREAM STRUCTURES AT LOCATIONS SPECIFIED IN PLANS FROM APPROXIMATE STATION 209+75 TO 212+50 AND 610+66 TO 611+50 TO MAKE CONNECTION.
3. STABILIZE DISTURBED AREA WITH TEMPORARY AND PERMANENT SEED AND MULCH AND REMOVE TEMPORARY EROSION CONTROL MEASURES.

PHASE 7 – REMOVE TEMPORARY EROSION CONTROL MEASURES AND DEMOBILIZE

1. REMOVE DEBRIS AND UNUSED MATERIALS FROM TEMPORARY STAGING AREA.
2. STABILIZE ALL DISTURBED AREAS WITH TEMPORARY AND PERMANENT SEED AND MULCH AND REMOVE TEMPORARY EROSION CONTROL MEASURES.
3. DEMOBILIZE EQUIPMENT.

Stantec
56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

REV-1 - PHASING OF WORK CME CME 20.05.29
Revision By Appd. YY.MM.DD
Issued By Appd. YY.MM.DD

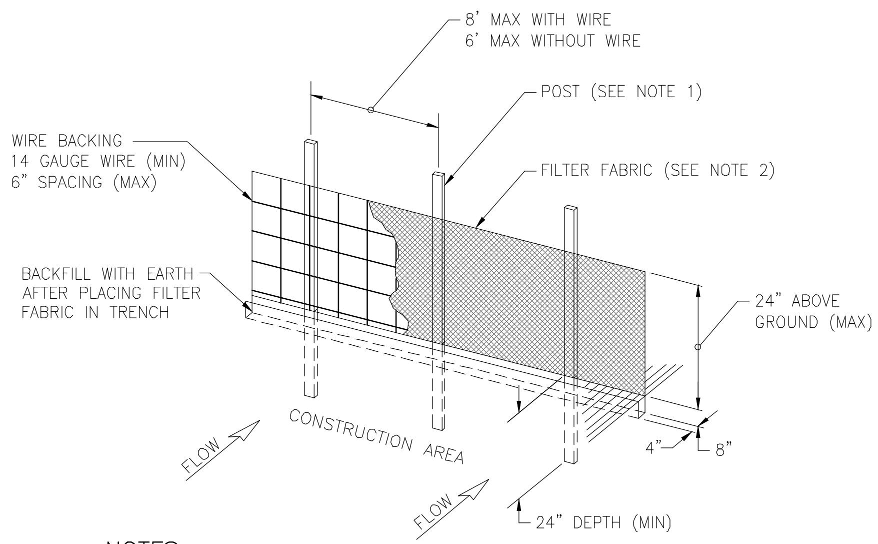
Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC
Title
NOTES

Permit-Seal
NORTH CAROLINA PROFESSIONAL ENGINEER CHRISTOPHER M. ENGLE 5/29/20

Project Number: 172621103

RTS SGG CME 20.05.22
Dwn. Chkd. Dsgn. YY.MM.DD

Revision 0 Sheet EC-2A



NOTES:

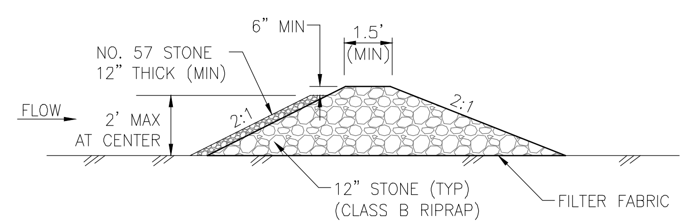
1. POSTS SHALL BE 1.25 LB/LF STEEL AT A MINIMUM AND HAVE A MINIMUM LENGTH OF 5-FT. POSTS SHALL ALSO HAVE PROJECTIONS TO FACILITATE FASTENING FABRIC.
2. FILTER FABRIC SHALL MEET THE FOLLOWING:
   A) MINIMUM WIDTH OF 36 INCHES.
   B) EOS NOT LARGER THAN U.S. STANDARD SIEVE NO. 30
   C) GRAB STRENGTH 90 LB.
   D) CONFORM TO ASTM D-6461
3. WIRE OR PLASTIC ZIP TIES WITH A TENSILE STRENGTH OF 50 LB. SHALL BE USED TO ATTACH FABRIC TO POSTS.
4. SILT FENCE INSTALLATION SHALL CONFORM WITH ASTM D 6462.
5. SILT FENCE TO BE INSTALLED IN LOCATIONS AS SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN AND AS DIRECTED BY THE ENGINEER PRIOR TO BEGINNING OF CONSTRUCTION TO CONTROL SEDIMENT.
6. SILT FENCE TO BE INSTALLED AROUND STOCKPILE LOCATIONS SHALL BE SET A MINIMUM DISTANCE OF 5-FT FROM TOE OF SLOPE.

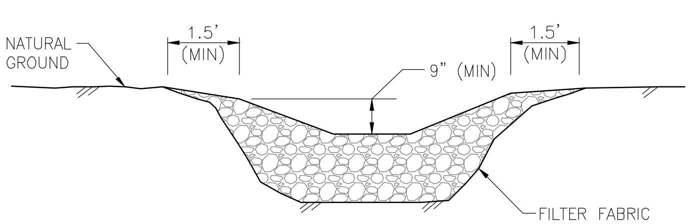
MAINTENANCE:

1. SILT FENCE SHALL BE INSPECTED AT LEAST ONCE A WEEK AND AFTER EACH RAINFALL EVENT.
2. REPLACE ANY PORTION OF SILT FENCE THAT HAS COLLAPSED, TEARS, OR BECOMES INEFFECTIVE.
3. REMOVE SEDIMENT AS NECESSARY TO PROVIDE ADEQUATE STORAGE VOLUME.
4. SILT FENCE TO BE REMOVED AND THE AREA TO BE RESTORED TO ITS NATURAL CONDITION WHEN PERMANENT EROSION AND SEDIMENT CONTROL PROCEDURES ARE EFFECTIVE.

TEMPORARY SILT FENCE

NOT TO SCALE





MAINTENANCE:

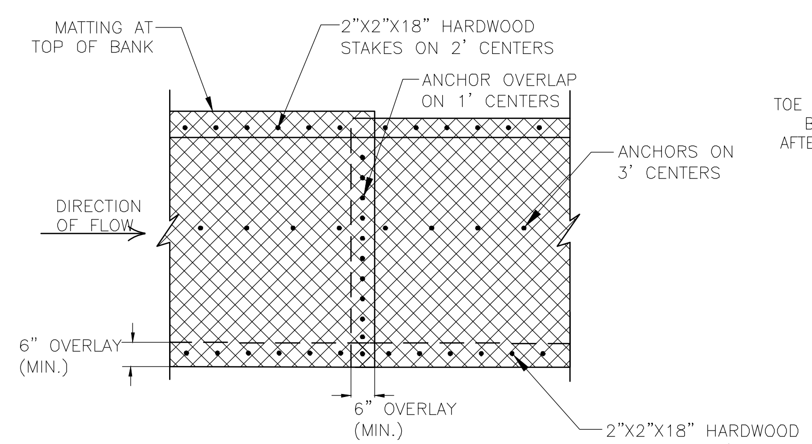
1. INSPECT ROCK SILT CHECKS AND CHANNELS ONCE A WEEK AND AFTER EVERY SIGNIFICANT RAINFALL EVENT.
2. CLEAN OUT SEDIMENT AND MAKE REPAIRS AS NECESSARY.
3. ROCK SILT CHECKS ARE TO BE REMOVED AND THE AREA TO BE RESTORED TO ITS NATURAL CONDITION WHEN PERMANENT EROSION AND SEDIMENT CONTROL PROCEDURES ARE EFFECTIVE.

ROCK SILT CHECK

SEEDING NOTES:

TEMPORARY SEED

1. ALL DISTURBED AREAS WILL BE STABILIZED USING MULCH AND TEMPORARY SEED TO PROVIDE ADEQUATE GROUND COVER AND CONDITION THE SOIL.
2. MULCH MUST BE ADDED TO ACHIEVE 99% COVERAGE (ROUGHLY 4 TONS/ACRE FOR WHEAT STRAW) SO THAT NO PATCH OF BARE SOIL LARGER THAN 1 SF IS OBSERVED.
3. A FERTILITY SOIL TEST SHALL BE USED TO DETERMINE FERTILIZER AMOUNTS OR, IF NO SOIL TEST IS AVAILABLE, A STANDARD MIXTURE SHALL BE APPLIED OF 2 TONS OF LIME PER ACRE AND 700-1000 LBS OF 10-10-10 FERTILIZER PER ACRE.



COIR FIBER MATTING DETAIL PLAN VIEW

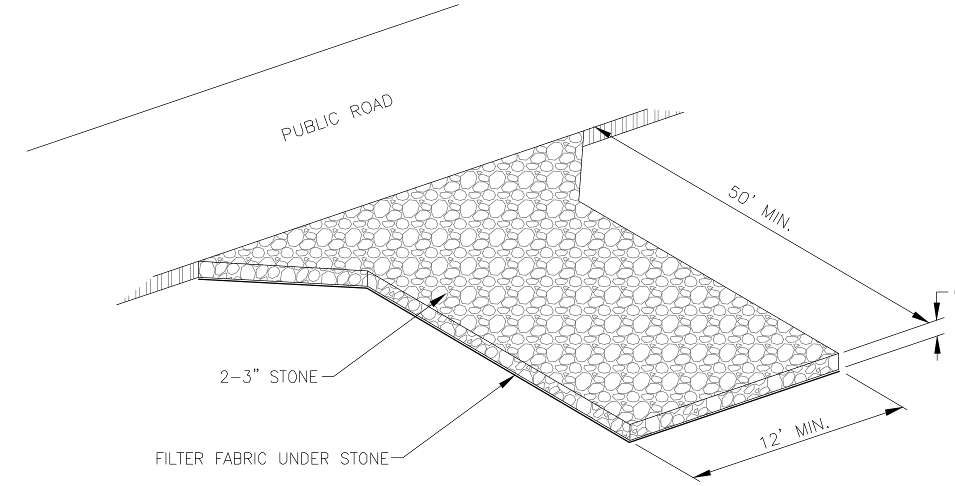
NOT TO SCALE

NOTES:

1. COIR MATTING TO BE UNDERLAIN BY STRAW AND SEED.
2. MATTING SHALL BE INSTALLED PRIOR TO THE INTRODUCTION OF WATER TO A STREAM SECTION.
3. COIR FIBER MATTING REPRESENTS THE MINIMUM LEVEL OF BANK PROTECTION ALLOWABLE. THE PREFERRED METHODS OF BANK PROTECTION ARE PRESENTED WITHIN THE DETAILS OF THE CONSTRUCTION PLANS

MAINTENANCE:

1. BANK PROTECTION SHALL BE INSPECTED AT LEAST ONCE A WEEK AND AFTER EACH SIGNIFICANT RAINFALL EVENT.
2. GOOD CONTACT BETWEEN COIR MATTING AND GROUND MUST BE MAINTAINED. REPAIR IF NECESSARY.
3. MONITOR AND REPAIR AS NECESSARY UNTIL GROUND COVER IS ESTABLISHED.



NOTES:

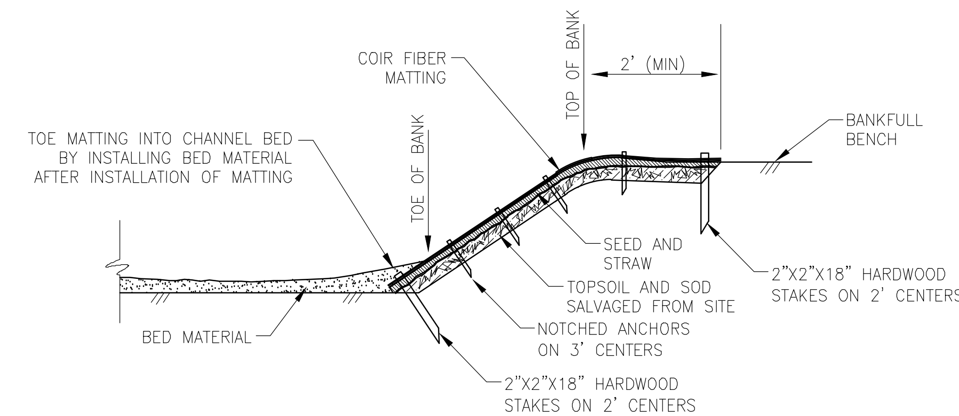
1. GRADE AND REMOVE ALL VEGETATION AND OBJECTIONABLE MATERIAL FROM PROPOSED ENTRANCE AREA.
2. PROVIDE DRAINAGE TO SUITABLE OUTLET.

MAINTENANCE:

1. CONSTRUCTION ENTRANCE SHALL BE INSPECTED AFTER EACH RAINFALL EVENT.
2. MAINTAIN CONSTRUCTION ENTRANCE IN CONDITION NECESSARY TO PREVENT MUD OR SEDIMENT FROM LEAVING THE SITE.
3. IMMEDIATELY REMOVE ANY OBJECTIONABLE MATERIAL SPILLED, WASHED, OR TRACKED ONTO PUBLIC ROADWAYS.

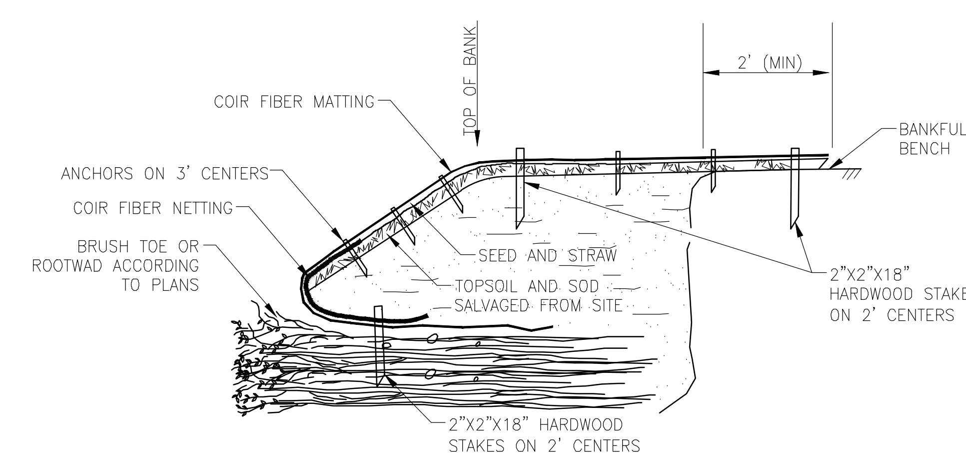
CONSTRUCTION ENTRANCE

NOT TO SCALE



STREAM BANK STABILIZATION METHOD 1

NOT TO SCALE



STREAM BANK STABILIZATION METHOD 2

NOT TO SCALE

Stantec

56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD MITIGATION SITE
HENDERSON COUNTY, NORTH CAROLINA

Title
DETAILS

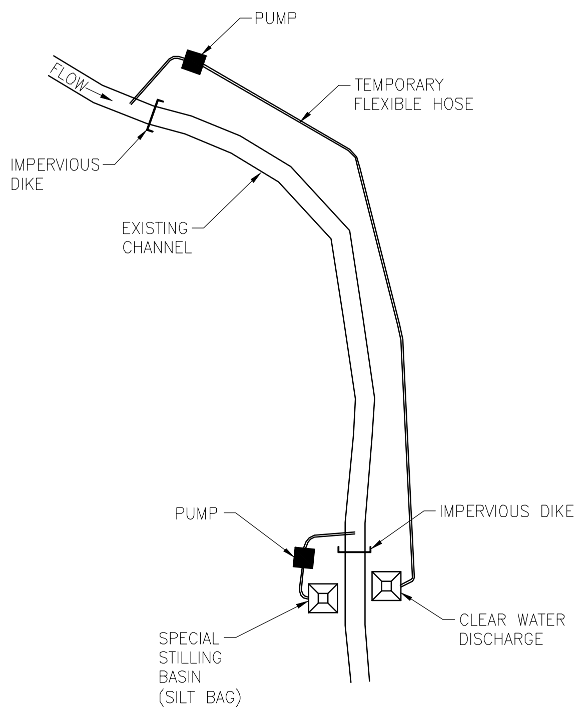
Permit-Seal

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038596 CHRISTOPHER M. ENGLE
5/27/20

Project Number: 172621103

RTS	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 3
Sheet EC-3



SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP-AROUND

1. INSTALL STILLING BASINS.
2. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
3. PLACE UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. PLACE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS. DEWATER ENTRAPPED AREA.
5. PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLANS.
6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF IMPERIOUS DIKES. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE. (DOWNSTREAM DIKE FIRST).
7. ALL GRADING AND STABILIZATION MUST BE COMPLETED WITHIN THE PUMP-AROUND AREA BETWEEN THE IMPERVIOUS DIKES. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF THE IMPERVIOUS DIKES.
8. REMOVE STILLING BASINS AND BACKFILL. STABILIZED DISTURBED AREA WITH SEED AND MULCH, OR ROLLED EROSION CONTROL PRODUCT IF THE WORK IS COMPLETED OUTSIDE OF OPTIMUM GERMINATION SEASONS WHEN UNFAVORABLE WEATHER PREVENTS THE ESTABLISHMENT OF VEGETATIVE GROUND COVER.

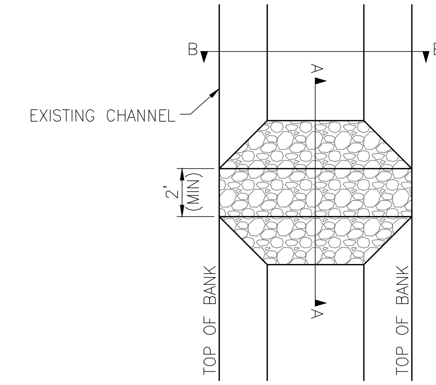
NOTES:

1. ALL EXCAVATION SHALL BE PERFORMED IN ONLY DRY OR ISOLATED SECTIONS OF THE CHANNEL.
2. IMPERVIOUS DIKES ARE TO BE USED TO ISOLATE WORK FROM STREAM FLOW WHEN NECESSARY.
3. ALL GRADED AREAS SHALL BE STABILIZED WITHIN 24 HOURS.
4. MAINTENANCE OF STREAM FLOW OPERATION SHALL BE INCIDENTAL TO THE WORK. THIS INCLUDES SHEETING, DIVERSIONS PIPES, PUMPS AND HOSES.
5. PUMPS AND HOSES SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA.

MAINTENANCE:

1. PUMP AROUND OPERATIONS SHALL BE INSPECTED TWICE DAILY WHEN IN USE, OR AS DIRECTED BY THE ENGINEER.
2. PUMP, SILT BAGS, HOSES, AND STILLING BASIN SHALL BE MAINTAINED IN A CONDITION NECESSARY TO FUNCTION PROPERLY.

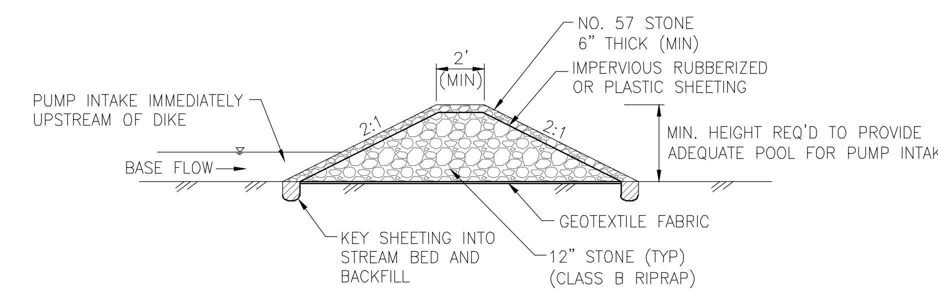
PUMP-AROUND OPERATION (TYP)
NOT TO SCALE



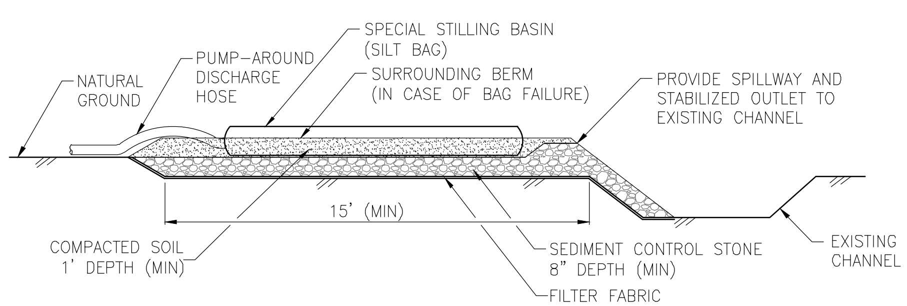
IMPERVIOUS DIKE PLAN VIEW
NOT TO SCALE

MAINTENANCE:

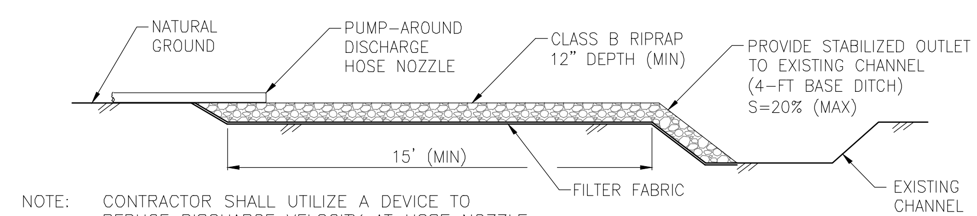
1. INSPECT IMPERVIOUS DIKES AND CHANNELS ONCE A WEEK AND AFTER EVERY SIGNIFICANT RAIN EVENT.
2. CLEAN OUT SEDIMENT AND MAKE REPAIRS WHEN NEEDED.
3. IMPERVIOUS DIKES ARE TO BE REMOVED AND THE AREA TO BE RESTORED TO ITS NATURAL CONDITION WHEN PERMANENT EROSION AND SEDIMENT CONTROL PROCEDURES ARE EFFECTIVE.



IMPERVIOUS DIKE SECTION A-A
NOT TO SCALE

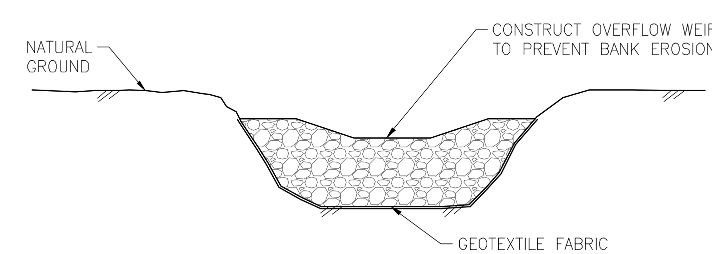


SPECIAL STILLING BASIN WITH ROCK PAD AND BERM
NOT TO SCALE

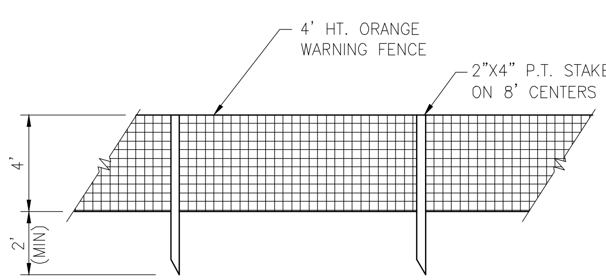


NOTE: CONTRACTOR SHALL UTILIZE A DEVICE TO REDUCE DISCHARGE VELOCITY AT HOSE NOZZLE SO THAT NO EROSION OCCURS ON RIPRAP PAD.

CLEAR WATER DISCHARGE ONTO ROCK PAD
NOT TO SCALE



IMPERVIOUS DIKE SECTION B-B
NOT TO SCALE



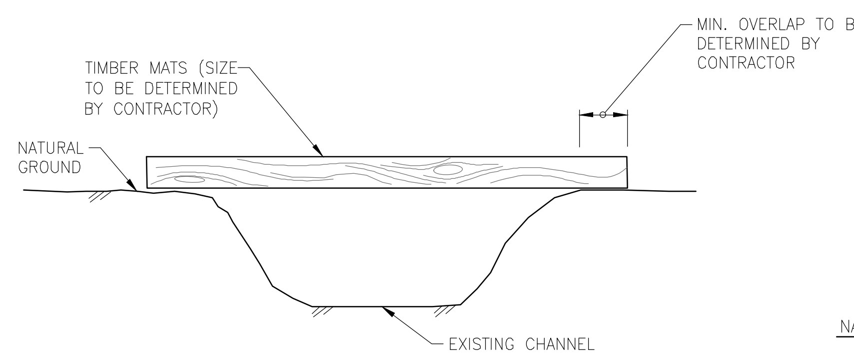
NOTES:

1. PROVIDE FENCE AS SHOWN ON PLAN.
2. PROVIDE AT LEAST ONE FOOT OF DISTANCE FROM TREE TO FENCE FOR EACH INCH OF TREE DBH. LOCATE FENCE OUTSIDE OF CRITICAL ROOT ZONE

MAINTENANCE:

1. REMOVE TREE PROTECTION FENCES WHEN ADJACENT CONSTRUCTION IS COMPLETED.
2. PRUNE ANY DAMAGED LIMBS OR ROOTS. USE TREE PAINT IF NECESSARY.
3. CONTINUE MAINTENANCE CARE IF NECESSARY. THIS MAY INCLUDE WATER, MULCH, AND FERTILIZER.

SENSITIVE AREA PROTECTION FENCE
NOT TO SCALE



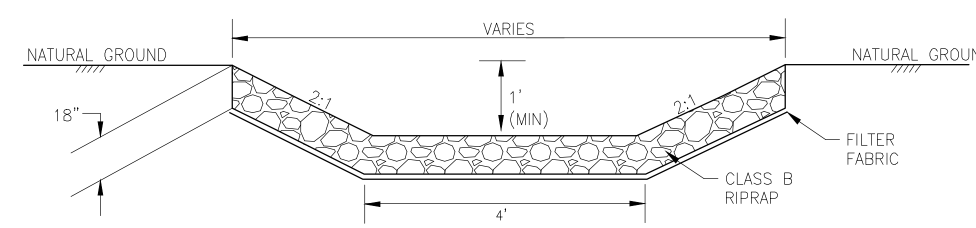
NOTES:

1. CONTRACTOR SHALL USE TIMBER MATS FOR ALL TEMPORARY STREAM CROSSINGS EXCEPT WHERE PERMANENT PIPE OR FORD CROSSINGS ARE USED, OR AS OTHERWISE APPROVED BY THE ENGINEER.
2. TIMBER MATS ARE TO BE SUFFICIENTLY LONG TO EXTEND BEYOND THE BANK SO THAT BANK FAILURE IS PREVENTED.
3. ALL TEMPORARY STREAM CROSSINGS SHALL BE MAINTAINED IN GOOD WORKING CONDITION. REGULAR INSPECTION AND MAINTENANCE OF CROSSINGS IS THE RESPONSIBILITY OF THE CONTRACTOR.

MAINTENANCE:

1. TEMPORARY CROSSINGS SHALL BE INSPECTED ONCE A WEEK AND AFTER EACH RAINFALL EVENT AND REPAIRED OR ADJUSTED TO MAINTAIN PROPER FUNCTION.

TEMPORARY STREAM CROSSING TIMBER MAT
NOT TO SCALE



MAINTENANCE:

1. INSPECT TEMPORARY DIVERSION CHANNELS ONCE A WEEK AND AFTER EVERY SIGNIFICANT RAINFALL EVENT.
2. MAINTAIN ADJACENT VEGETATION TO PROTECT FROM EROSION.

TEMPORARY DIVERSION CHANNEL
NOT TO SCALE

Stantec
56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD MITIGATION SITE
HENDERSON COUNTY, NORTH CAROLINA

Title
DETAILS

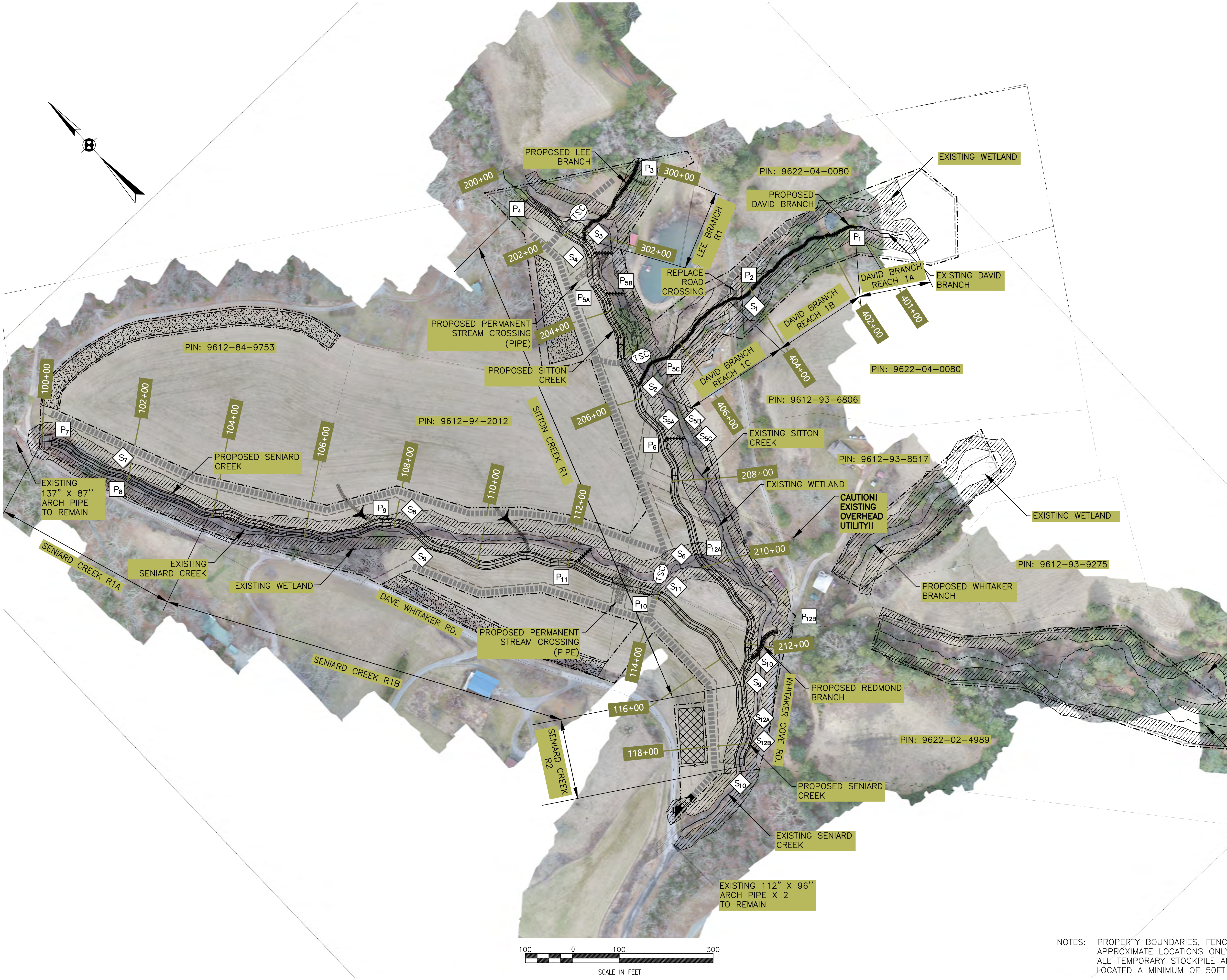
Permit-Seal

NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE
5/27/20

Project Number: 172621103

RTS	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 3
Sheet EC-3A



LOCATION KEY

LEGEND

- PROPOSED CONSTRUCTION ENTRANCE
- PROPOSED TEMPORARY STAGING AREA
- PROPOSED TEMPORARY STOCKPILE AREA
- PROPOSED SOIL WASTE LOCATION
- EXISTING 25-FT TROUT BUFFER
- PROPOSED HAUL ROUTE
- TSC TEMPORARY STREAM CROSSING
- PROPOSED SILT FENCE
- PROPOSED LIMITS OF DISTURBANCE
- CONSERVATION EASEMENT BOUNDARY
- PROPOSED TEMPORARY DIVERSION CHANNEL
- EXISTING PROPERTY BOUNDARY
- P PROPOSED PUMP INTAKE LOCATION
- S PROPOSED PUMP DISCHARGE AND SILT BAG LOCATION
- TEMPORARY ROCK SILT CHECK

NOTES: PROPERTY BOUNDARIES, FENCES AND UTILITIES NOT SURVEYED. APPROXIMATE LOCATIONS ONLY.
ALL TEMPORARY STOCKPILE AND STAGING AREAS SHALL BE LOCATED A MINIMUM OF 50FT FROM STREAM TOP OF BANK.

Stantec

56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NORTH CAROLINA

Title
EROSION CONTROL PLAN

Permit-Seal

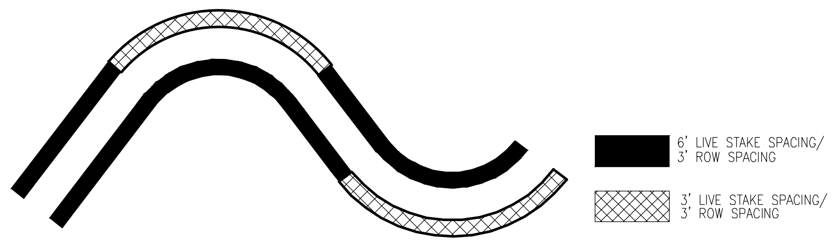
NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE 5/27/20

Project Number: 172621103

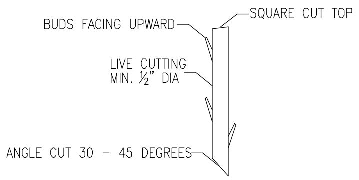
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision	Sheet
0	EC-4

V:\1726\active\172621103\DWG\1103-EC-04-Plan-1.dwg
2020/05/28 8:53 AM By: Just, Sam

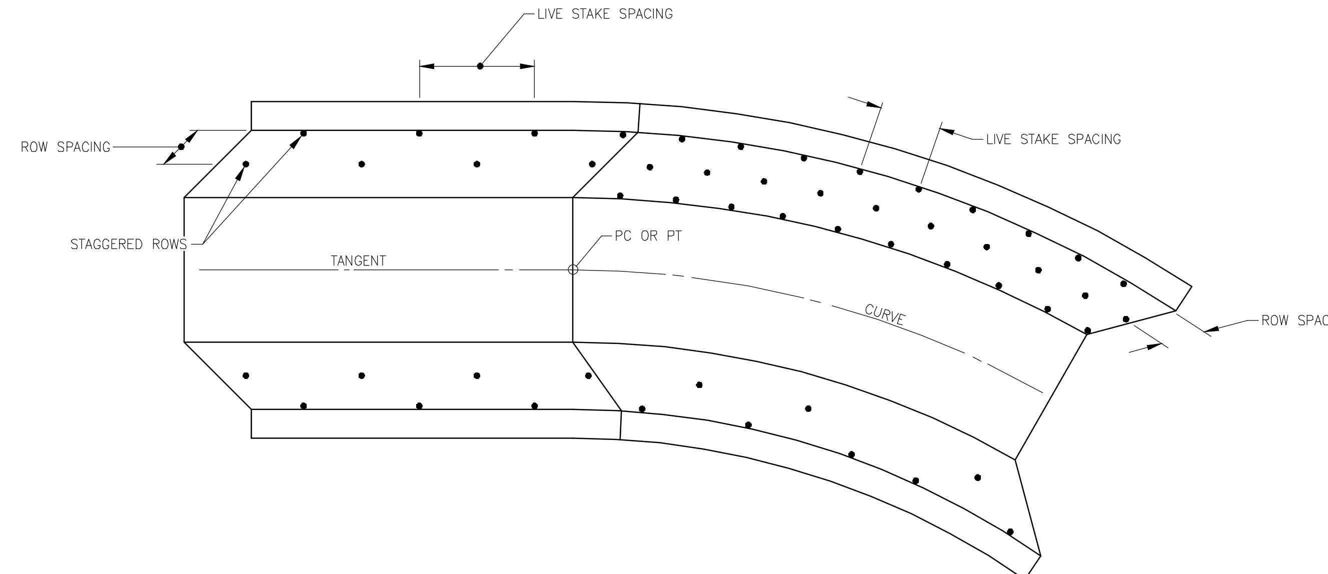


PLAN VIEW



LIVE STAKE DETAIL

NUMBER OF LIVE STAKE ROWS			
CHANNEL DEPTH (FT)	INSIDE OF BEND	TANGENT	OUTSIDE OF BEND
0 – 1.5	1	1	2
1.5 – 2.5	2	2	3
2.5 – 3.5	3	3	4



STAKING PATTERN

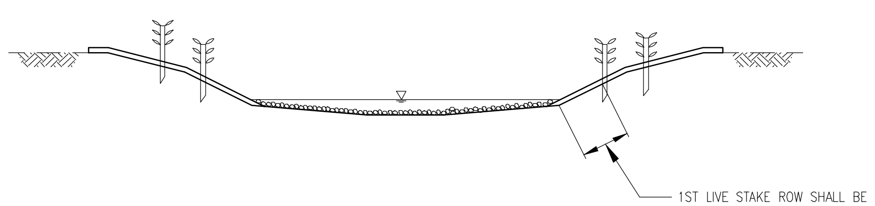
NOT TO SCALE

PLANTING NOTES:

TEMPORARY AND PERMANENT SEED
1. ALL DISTURBED AREAS WILL BE STABILIZED USING MULCH AND TEMPORARY SEED TO PROVIDE ADEQUATE GROUND COVER AND CONDITION THE SOIL.
2. MULCH MUST BE ADDED TO ACHIEVE 95% COVERAGE (ROUGHLY 4 TONS/ACRE FOR WHEAT STRAW)
3. A FERTILITY SOIL TEST SHALL BE USED TO DETERMINE FERTILIZER AMOUNTS OR, IF NO SOIL TEST IS AVAILABLE, A STANDARD MIXTURE SHALL BE APPLIED OF 2 TONS OF LIME PER ACRE AND 700–1000 LBS OF 10–10–10 FERTILIZER PER ACRE.

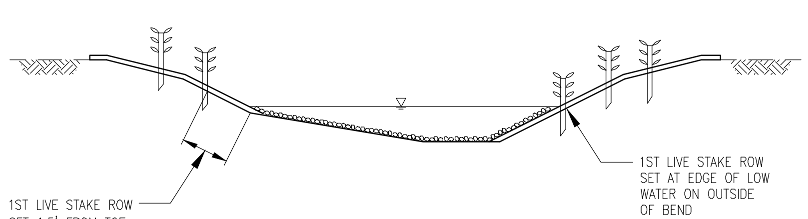
BARE ROOT PLANTINGS
1. PLANT BARE ROOT SHRUBS AND TREES IN AREAS AS INDICATED ON THE PLANS.
2. PROVIDE 8 FT OF SPACING BETWEEN INSTALLED PLANTS YIELDING A DENSITY OF 680 STEMS/AC, DIVIDED EQUALLY BETWEEN AVAILABLE SPECIES.
3. LOOSEN COMPACTED SOIL AND PLANT IN HOLES FORMED WITH A MATTOCK, DIBBLE BAR OR EQUAL.
4. PROVIDE PLANTING HOLE SUFFICIENT IN SIZE AND DEPTH TO PREVENT CROWDING OF ROOTS.
5. ROOTS SHALL BE KEPT MOIST DURING TRANSPORTATION, DISTRIBUTION, AND INSTALLATION.
6. PLANTS SHALL BE HEELED–IN INTO MOIST SOIL IF NOT PROMPTLY PLANTED AFTER DELIVERY TO THE PROJECT SITE.

LIVE STAKES:
1. STAKES SHOULD BE SPACED ACCORDING TO PLAN VIEW DETAIL AND DIVIDED EQUALLY BETWEEN THE AVAILABLE SPECIES.
2. STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY.
3. STAKES THAT ARE SPLIT SHALL NOT BE INSTALLED.
4. STAKES SHALL BE INSTALLED ORTHOGONAL TO THE BANK AND WITH BUDS POINTING UPWARDS.
5. STAKES SHALL BE ½ TO 2 INCHES IN DIAMETER AND 2 TO 3 FEET IN LENGTH.
6. AFTER INSTALLATION, THE TOP PORTION OF STAKES SHALL BE PRUNED WITH A SQUARE CUT LEAVING NO LESS THAN 3 INCHES AND NO MORE THAN 6 INCHES ABOVE THE GROUND.



RIFFLE SECTION

NOT TO SCALE



POOL SECTION

NOT TO SCALE

RIPARIAN & WETLAND PLANTINGS - BY STREAM

	Seniard Creek			Sitton Creek			Lee Branch		
	RIPARIAN AREA = 3.07 AC	WETLAND AREA = 0.04 AC	Setting RIP - RIPARIAN WET - WETLAND	RIPARIAN AREA = 0.79 AC	WETLAND AREA = 1.07AC	Setting RIP - RIPARIAN WET - WETLAND	RIPARIAN AREA = 0.45 AC	WETLAND AREA = 0.0 AC	Setting RIP - RIPARIAN WET - WETLAND
	COMMON NAME	SCIENTIFIC NAME		COMMON NAME	SCIENTIFIC NAME		COMMON NAME	SCIENTIFIC NAME	
TREES	River Birch	*Betula nigra*	RIP	River Birch	*Betula nigra*	RIP	Serviceberry	*Amelanchier arborea*	RIP
	Tulip poplar	*Liriodendron tulipifera*	RIP	Tulip poplar	*Liriodendron tulipifera*	RIP	Northern Red Oak	*Quercus rubra*	RIP
	Black Tupelo	*Nyssa sylvatica*	RIP	Black Tupelo	*Nyssa sylvatica*	RIP	American Beech	*Fagus grandifolia*	RIP
	Black Willow	*Salix nigra*	RIP / WET	American Holly	*Ilex opaca*	RIP	Black Tupelo	*Nyssa sylvatica*	RIP
	Green Ash	*Fraxinus pennsylvanica*	RIP / WET	Black Willow	*Salix nigra*	RIP / WET	American Holly	*Ilex opaca*	RIP
	American Sycamore	*Platanus occidentalis*	RIP / WET	American Sycamore	*Platanus occidentalis*	RIP / WET	American Hornbeam	*Carpinus caroliniana*	RIP
SHRUBS	Smooth Alder	*Alnus serrulata*	WET	Smooth Alder	*Alnus serrulata*	WET	American Witch-Hazel	*Hamamelis virginiana*	RIP
	Red Chokeberry	*Aronia arbutifolia*	WET	Red Chokeberry	*Aronia arbutifolia*	WET	Highbush Blueberry	*Vaccinium corymbosum*	RIP
	Winterberry	*Ilex verticillata*	WET	Winterberry	*Ilex verticillata*	WET	Sweet Pepperbush	*Clethra alnifolia*	RIP
	Black Elderberry	*Sambucus canadensis*	WET	Black Elderberry	*Sambucus canadensis*	WET	Smooth Alder	*Alnus serrulata*	WET
							Winterberry	*Ilex verticillata*	WET
							Black Elderberry	*Sambucus canadensis*	WET
							Red Chokeberry	*Aronia arbutifolia*	WET
LIVE STAKES	Silky dogwood	*Cornus amomum*		Silky dogwood	*Cornus amomum*		Silky dogwood	*Cornus amomum*	
	Elderberry	*Sambucus canadensis*		Elderberry	*Sambucus canadensis*		Elderberry	*Sambucus canadensis*	
	Black Willow	*Salix nigra*		Black Willow	*Salix nigra*				

RIPARIAN & WETLAND PLANTINGS - BY STREAM

	David Branch			Whitaker Branch			Redmond Branch		
	RIPARIAN AREA = 1.42 AC	WETLAND AREA = 0.28 AC	Setting RIP - RIPARIAN WET - WETLAND	RIPARIAN AREA = 0.76 AC	WETLAND AREA = 0.11 AC	Setting RIP - RIPARIAN WET - WETLAND	RIPARIAN AREA = 2.16 AC	WETLAND AREA = 0.35 AC	Setting RIP - RIPARIAN WET - WETLAND
	COMMON NAME	SCIENTIFIC NAME		COMMON NAME	SCIENTIFIC NAME		COMMON NAME	SCIENTIFIC NAME	
TREES	Serviceberry	*Amelanchier arborea*	RIP	Serviceberry	*Amelanchier arborea*	RIP	Serviceberry	*Amelanchier arborea*	RIP
	Northern Red Oak	*Quercus rubra*	RIP	Northern Red Oak	*Quercus rubra*	RIP	Northern Red Oak	*Quercus rubra*	RIP
	Sassafras	*Sassafras albidum*	RIP	Sassafras	*Sassafras albidum*	RIP	Sassafras	*Sassafras albidum*	RIP
	Sourwood	*Oxydendrum arboreum*	RIP	Sourwood	*Oxydendrum arboreum*	RIP	Sourwood	*Oxydendrum arboreum*	RIP
	American Holly	*Ilex opaca*	RIP	American Holly	*Ilex opaca*	RIP	American Holly	*Ilex opaca*	RIP
	American Hornbeam	*Carpinus caroliniana*	RIP	American Hornbeam	*Carpinus caroliniana*	RIP	American Hornbeam	*Carpinus caroliniana*	RIP
SHRUBS	American Witch-Hazel	*Hamamelis virginiana*	RIP	American Witch-Hazel	*Hamamelis virginiana*	RIP	American Witch-Hazel	*Hamamelis virginiana*	RIP
	Highbush Blueberry	*Vaccinium corymbosum*	RIP	Highbush Blueberry	*Vaccinium corymbosum*	RIP	Highbush Blueberry	*Vaccinium corymbosum*	RIP
	Sweet Pepperbush	*Clethra alnifolia*	RIP	Sweet Pepperbush	*Clethra alnifolia*	RIP	Sweet Pepperbush	*Clethra alnifolia*	RIP
	Smooth Alder	*Alnus serrulata*	WET	Smooth Alder	*Alnus serrulata*	WET	Smooth Alder	*Alnus serrulata*	WET
	Winterberry	*Ilex verticillata*	WET	Winterberry	*Ilex verticillata*	WET	Winterberry	*Ilex verticillata*	WET
	Black Elderberry	*Sambucus canadensis*	WET	Black Elderberry	*Sambucus canadensis*	WET	Black Elderberry	*Sambucus canadensis*	WET
	Red Chokeberry	*Aronia arbutifolia*	WET	Red Chokeberry	*Aronia arbutifolia*	WET	Red Chokeberry	*Aronia arbutifolia*	WET
				Smooth Witherod	*Viburnum nudum*	WET	Smooth Witherod	*Viburnum nudum*	WET
LIVE STAKES	Silky dogwood	*Cornus amomum*		Silky dogwood	*Cornus amomum*		Silky dogwood	*Cornus amomum*	
	Elderberry	*Sambucus canadensis*		Elderberry	*Sambucus canadensis*		Elderberry	*Sambucus canadensis*	

NOTE: PLANT SPECIES TO BE INSTALLED SHALL BE DEPENDENT ON SPECIES AVAILABILITY. CONTRACTOR MAY MODIFY COMPOSITION AS APPROVED BY ENGINEER.

PERMANENT RIPARIAN MIX

Riparian Buffer Mix (Mellow Marsh Farm)		
COMMON NAME	SCIENTIFIC NAME	% MIX
Autumn bentgrass	Agrostis perennans	15
Big bluestem	Andropogon gerardii	10
Lanceleaf coreopsis	Coreopsis lanceolata	10
Virginia wild rye	Elymus virginicus	20
Soft rush	Juncus effusus	5
Switchgrass	Panicum virgatum	15
Black-eyed susan	Rudbeckia hirta	10
Little bluestem	Schizachyrium scoparium	5
Indian grass	Sorghastrum nutans	5
Eastern gamagrass	Tripsacum dactyloides	5
Recommended application rate 20-25 lbs. per acre		

PERMANENT WETLAND MIX

Wetland Seed Mix (Mellow Marsh)		
COMMON NAME	SCIENTIFIC NAME	% MIX
Showy tickseed sunflower	Bidens aristosa	7
Fox sedge	Carex vulpinoidea	12
Deer tongue	Dichanthelium clandestinum	8
Riverbank wildrye	Elymus riparius	20
Soft rush	Juncus effusus, NC Ecotype	4
Smooth panicgrass	Panicum dichotomiflorum	14
Redtop panicgrass	Panicum rigidulum	8
Switchgrass	Panicum virgatum	23
Pennsylvania smartweed	Polygonum pensylvanicum	2
Eastern bur reed	Sparganium americanum	2
Recommended application rate 20-25 lbs. per acre		

NOTE: PERMANENT WETLAND MIX SHALL BE APPLIED TO ALL EXISTING AND PROPOSED WETLAND AREAS. PERMANENT RIPARIAN MIX SHALL BE APPLIED TO ALL OTHER AREAS INSIDE CONSERVATION EASEMENT.

COMMON NAME	SCIENTIFIC NAME	SEEDING DENSITY (lbs/acre)	SEEDING DATES
Temporary Seeding			
Partridge Pea	Chamaecrista fasciculata	8	MAR 15 - OCT 15
Daikon Radish	*Raphanus sativus var. longipinnatus*	8	MAR 15 - OCT 15
Browntop Millet	*Echinochloa esculenta*	8	MAR 15 - OCT 15
Buckwheat	Fagopyrum esculentum	10	MAR 15 - OCT 15
Cereal Rye	Secale cereal	26	OCT 15 - MAR 15

Stantec

56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
PLANTING DETAILS

Permit-Seal

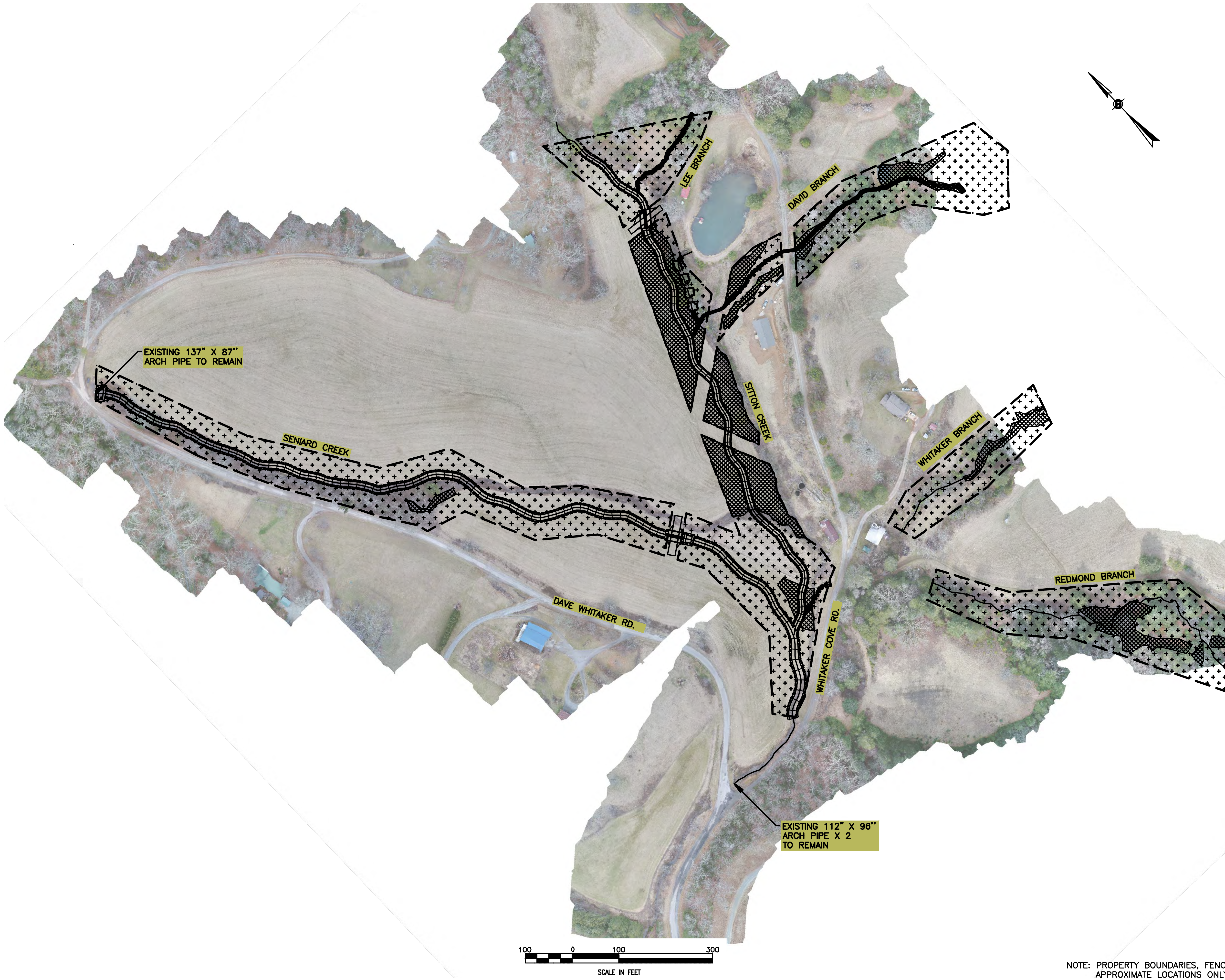
NORTH CAROLINA PROFESSIONAL SEAL 038595 ENGINEER CHRISTOPHER M. ENGLE
5/27/20

Project Number: 172621103

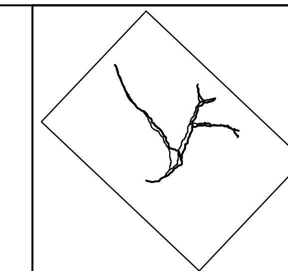
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0
Sheet P-1

V:\1726\active\172621103\DWG\1103-P-01-Details.dwg
2020/05/27 4:18 PM By: Jud, Sam



NOTE: PROPERTY BOUNDARIES, FENCES AND UTILITIES NOT SURVEYED. APPROXIMATE LOCATIONS ONLY.



LEGEND

- PROPOSED STREAM RESTORATION
- PROPOSED RIPARIAN PLANTING
- PROPOSED WETLAND PLANTING
- PROPOSED STREAMSIDE PLANTING (LIVE STAKES)
- PROPOSED CONSERVATION EASEMENT

Stantec

56 COLLEGE STREET, SUITE 201
ASHEVILLE, NC 28801
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NORTH CAROLINA

Title
SITE PLAN

Permit-Seal

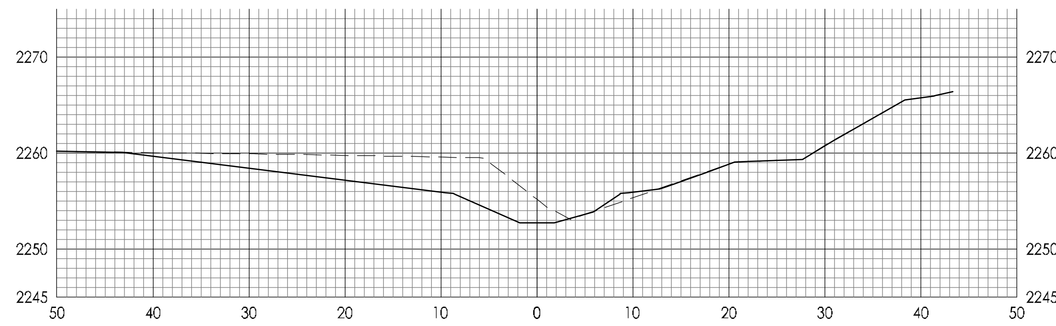
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038898 CHRISTOPHER M. ENGLE
5/27/20

Project Number: 172621103

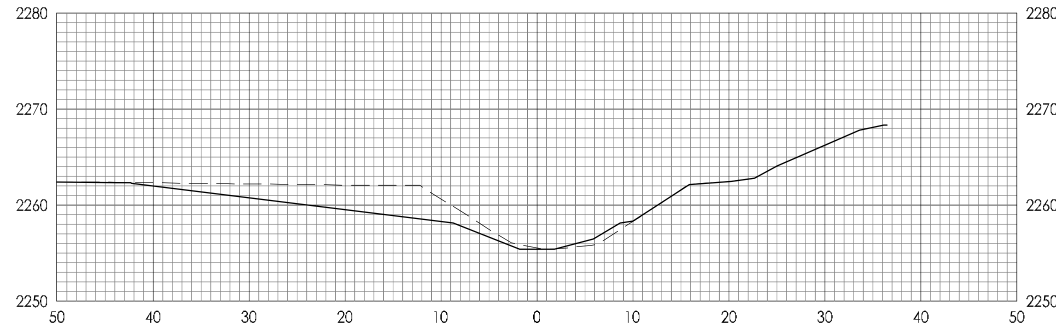
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision	Sheet
0	P-2

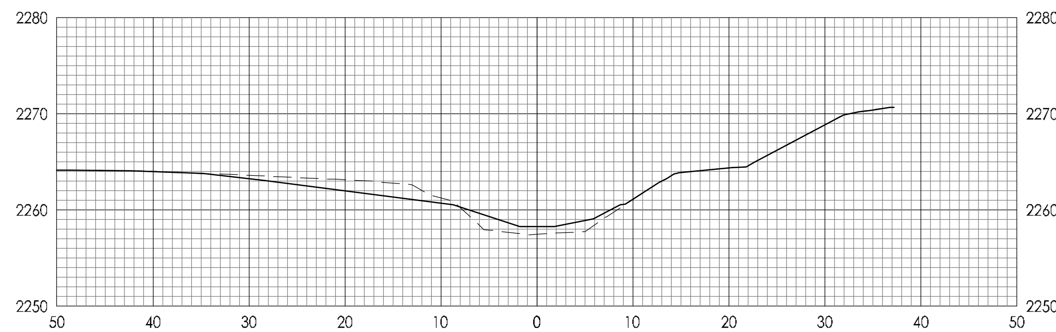
V:\1726\active\172621103\DWG\1103-P-02-Planting Plan.dwg
2020/05/28 12:03 PM By: Manner, Christina



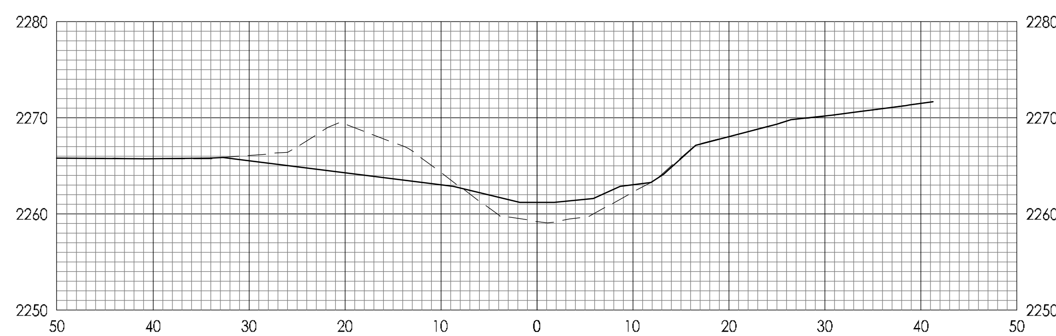
102+00



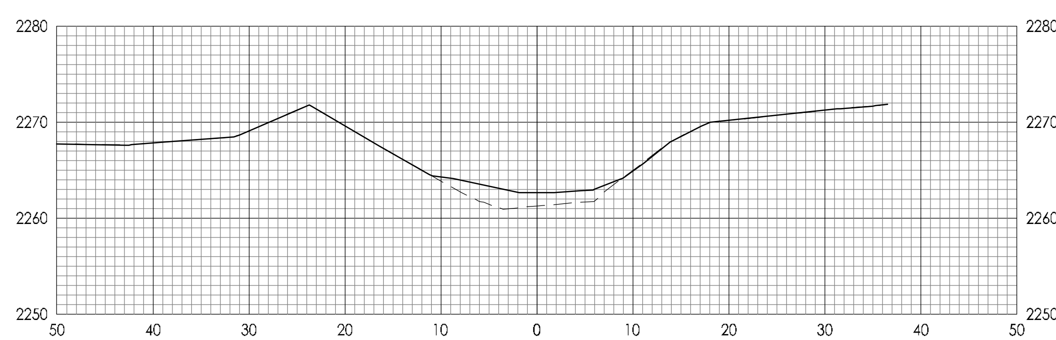
101+50



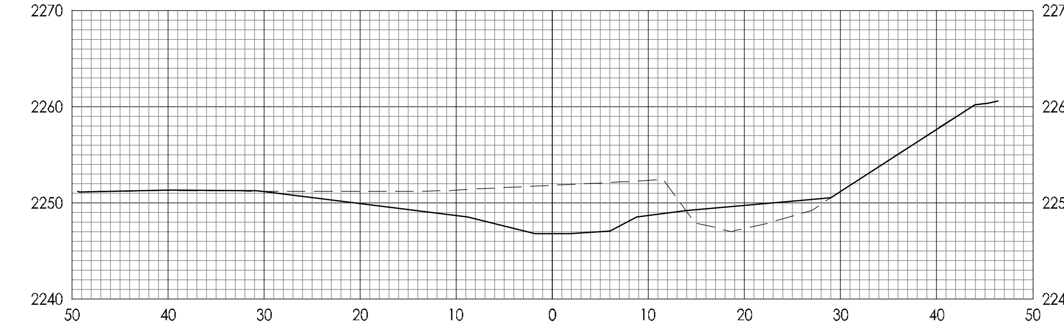
101+00



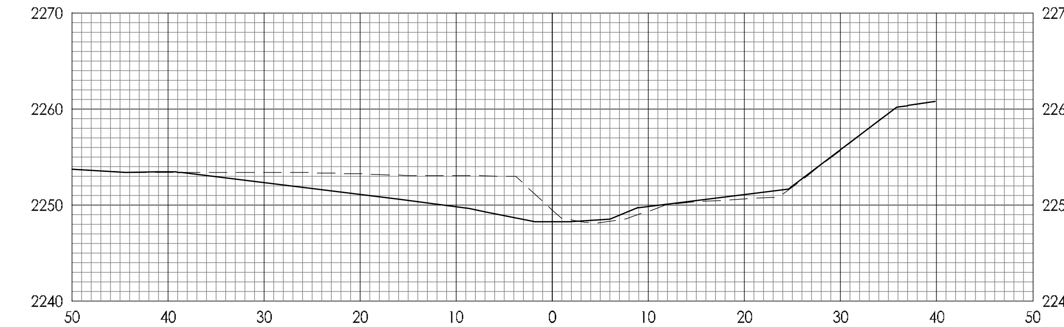
100+50



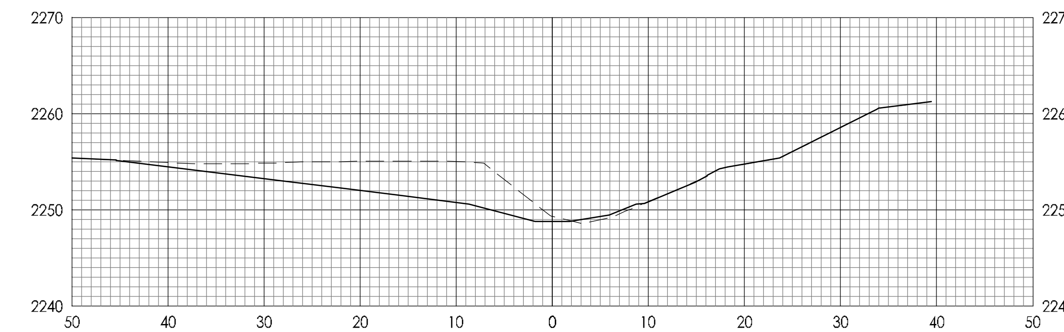
100+25



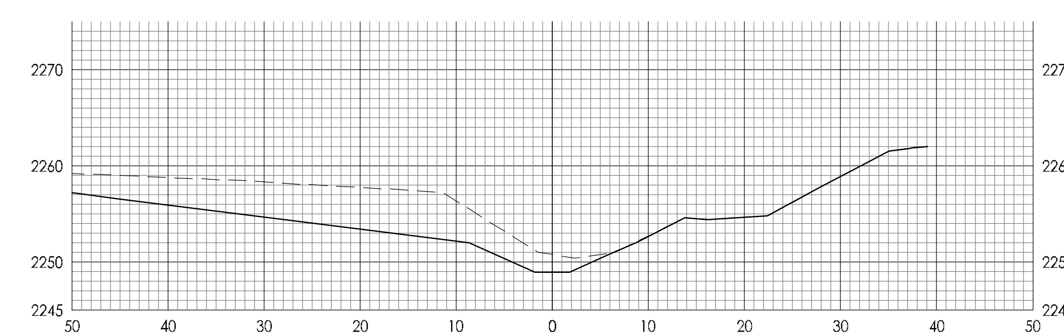
104+50



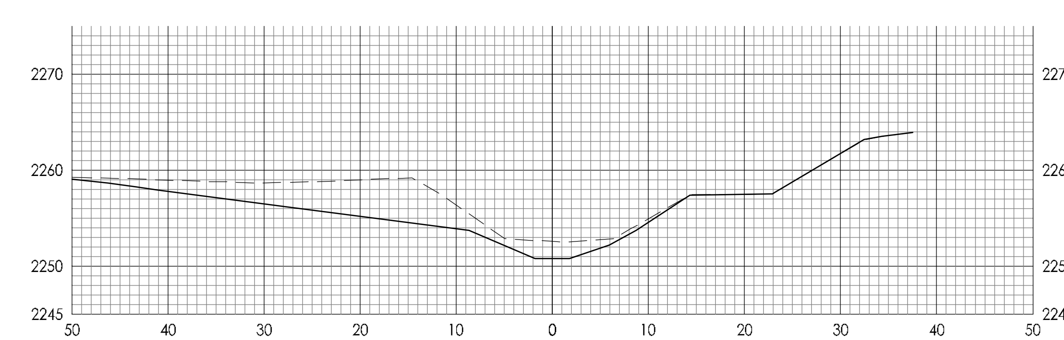
104+00



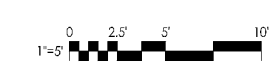
103+50



103+00



102+50



SaveDate: 2020/05/27 5:25 PM Login: Stokes, Ryan
c:\users\rystokes\onedrive - stantec office 365\desktop\seniard\seniard xs's - edited linework.dwg

Stantec

12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Permit-Seal

Client/Project
EW SOLUTIONS, LLC

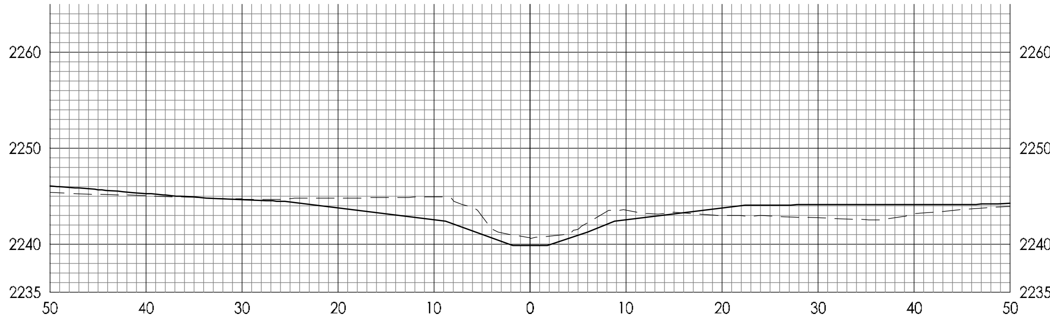
SENIARD CREEK MITIGATION SITE
-
HENDERSON COUNTY, NC

Title
SENIARD CROSS SECTIONS

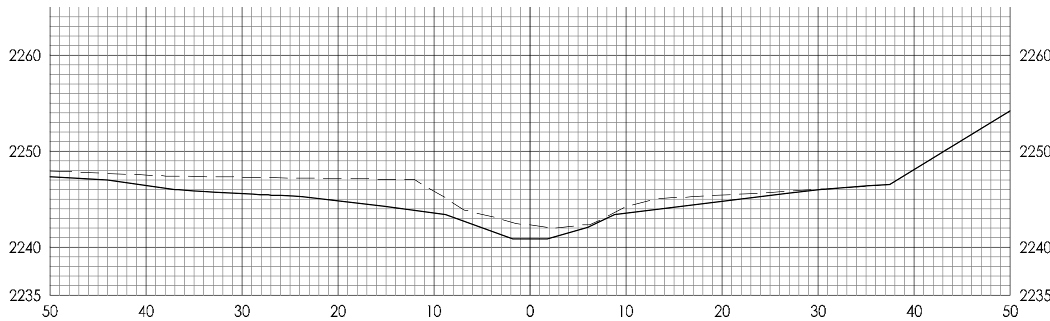
Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

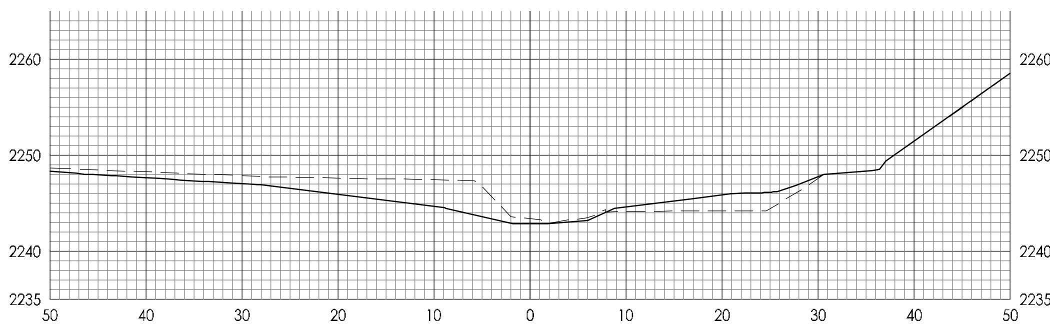
Revision 0
Sheet XS-1



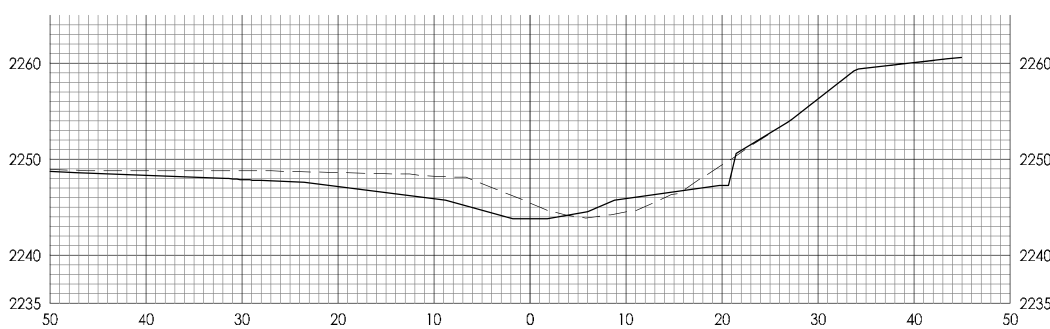
107+00



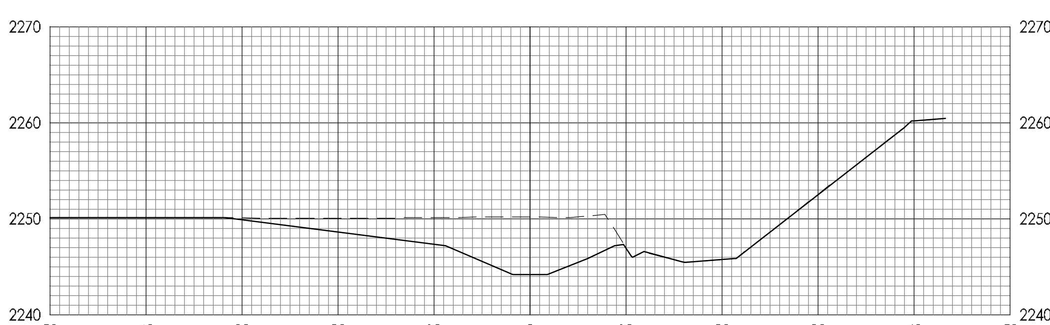
106+50



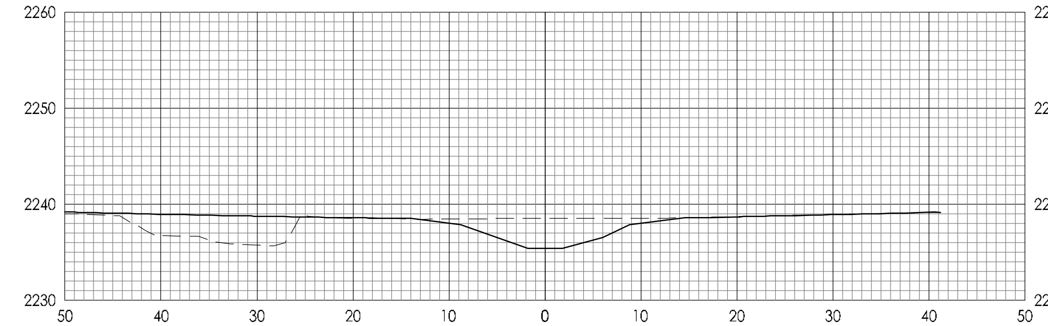
106+00



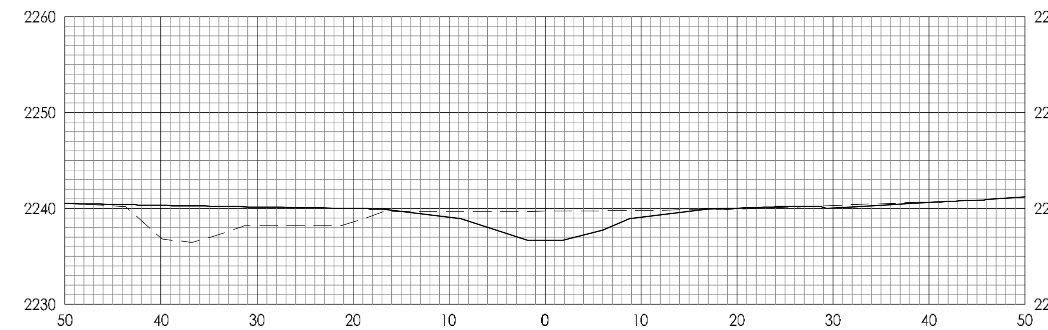
105+50



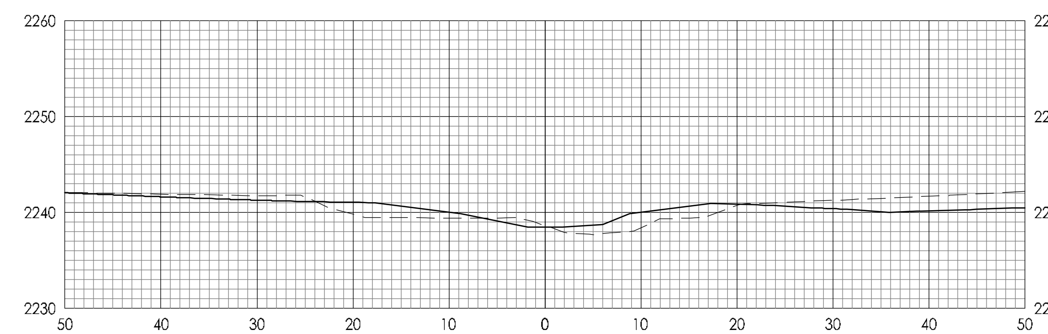
105+00



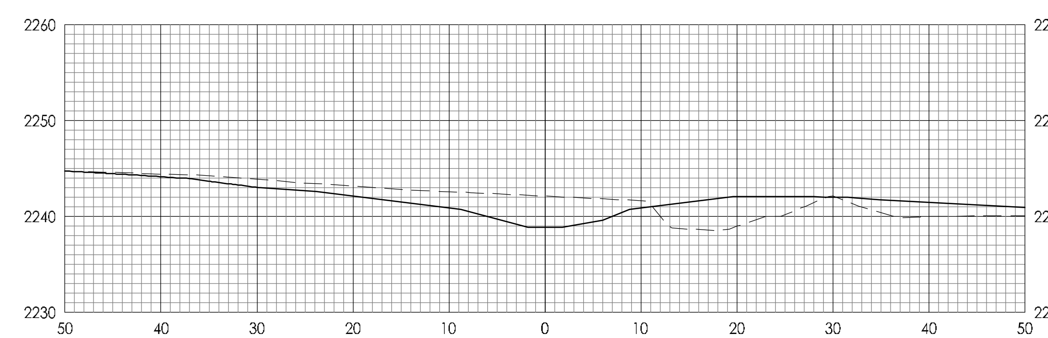
109+50



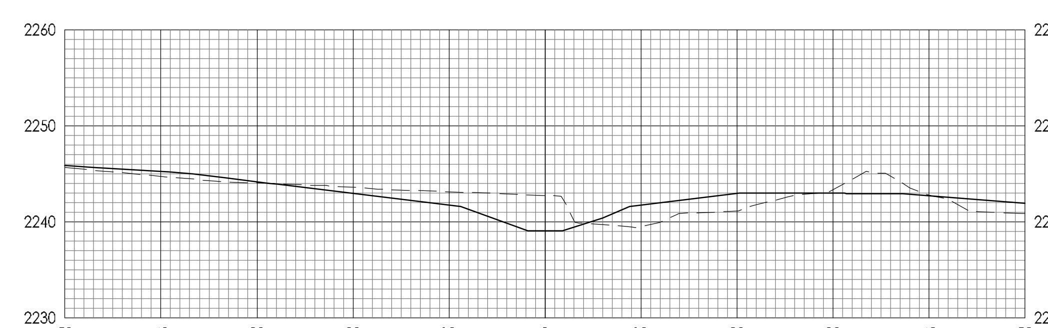
109+00



108+50



108+00



107+50

0 2.5' 5' 10'
1"=5'

SaveDate: 2020/02/28 11:56 AM Login: Manner, Christina
v:\1726\active\172621103\dwg\seniard xs's.dwg

Stantec

12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

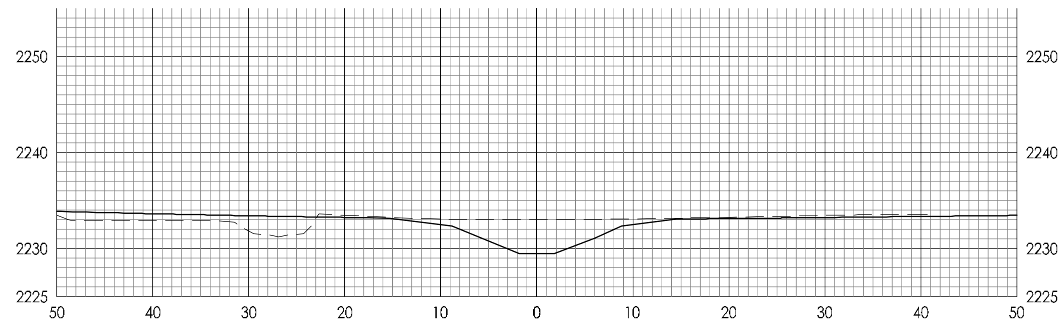
Title
SENIARD CROSS SECTIONS

Permit-Seal

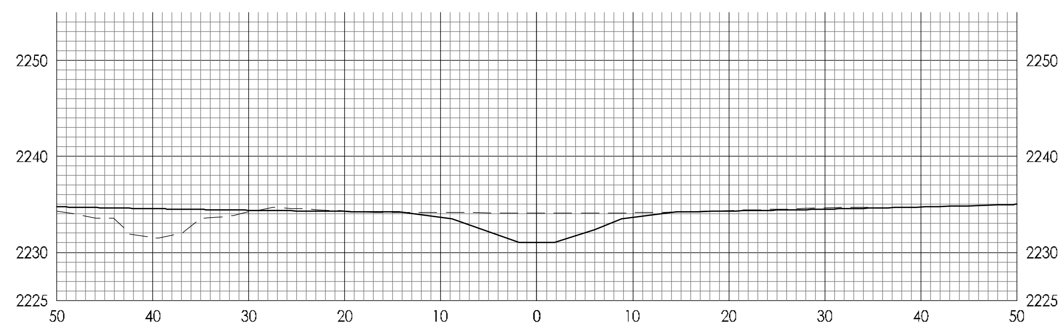
Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

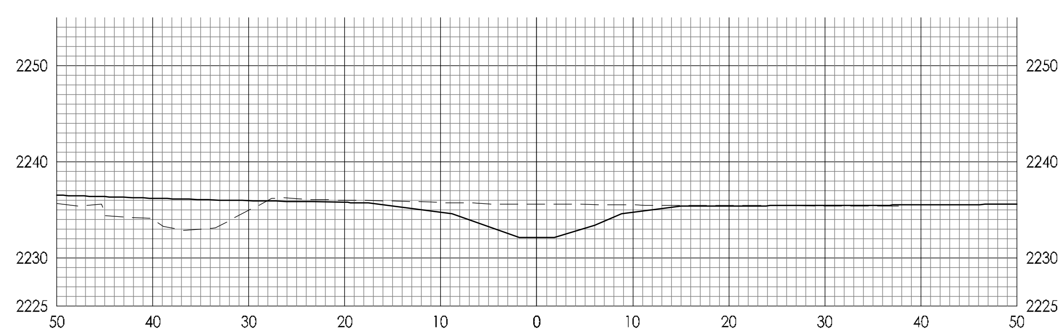
Revision 0
Sheet XS-2



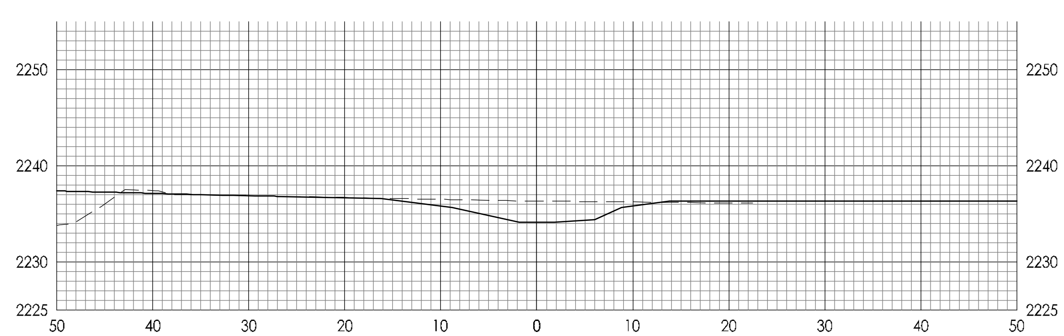
112+00



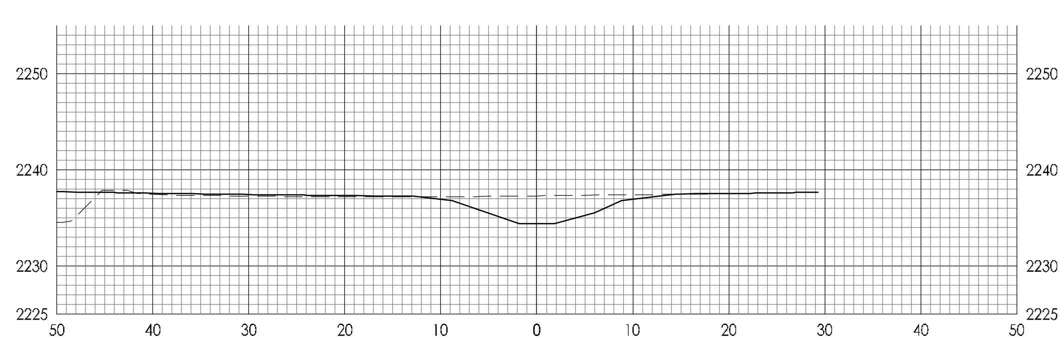
111+50



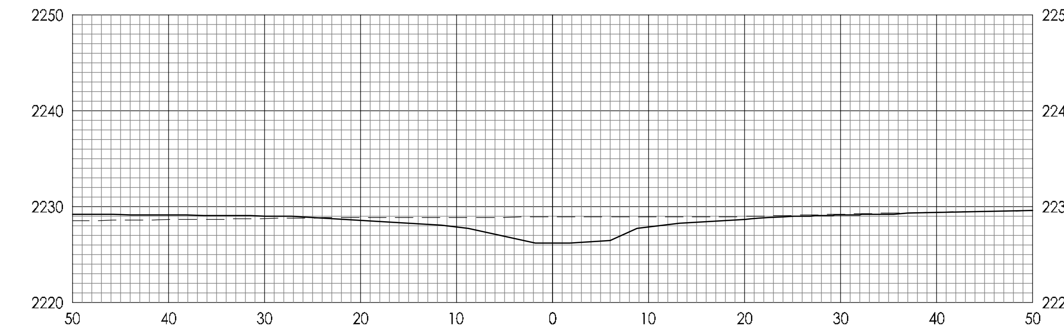
111+00



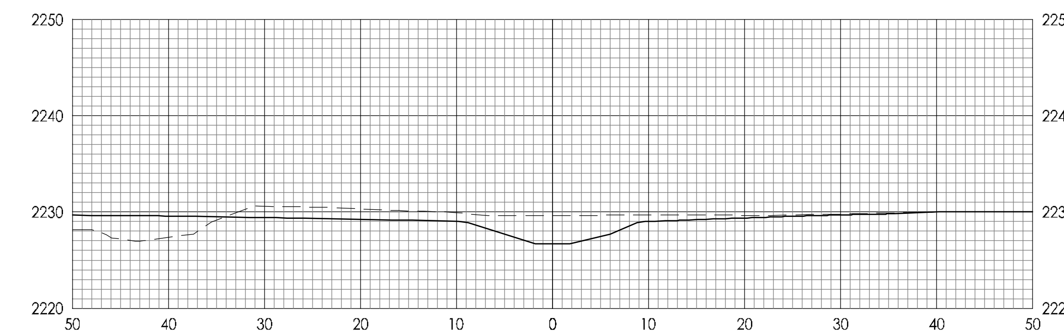
110+50



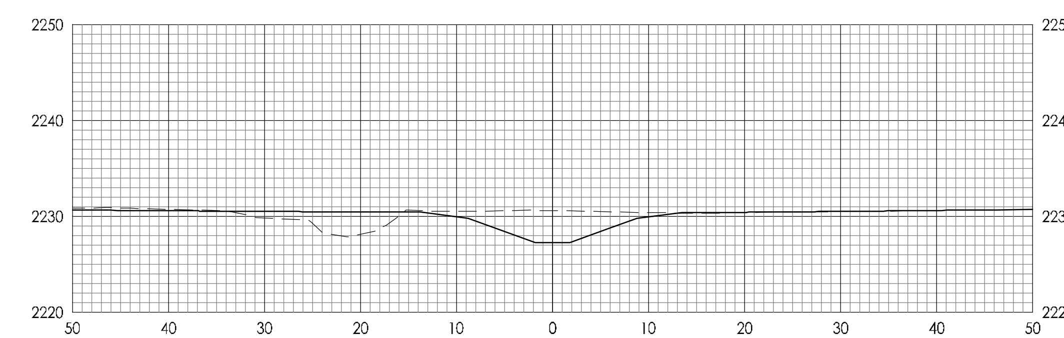
110+00



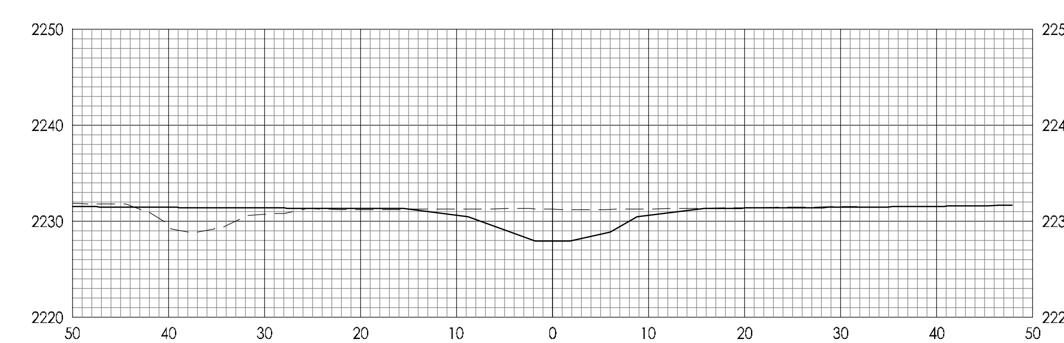
114+50



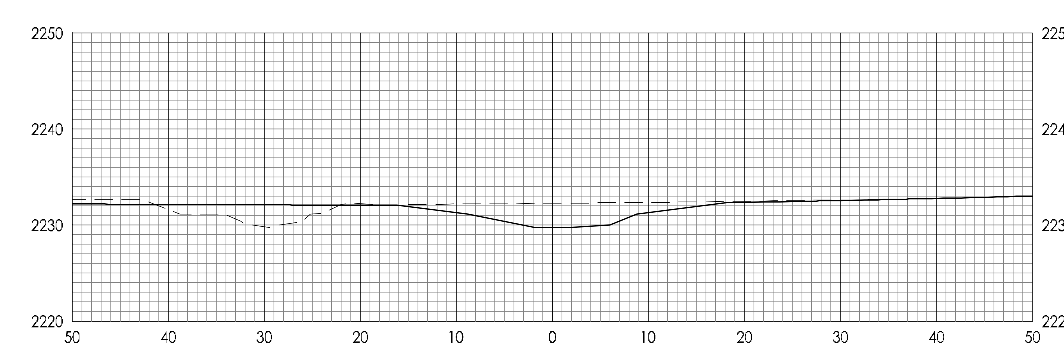
114+00



113+50



113+00



112+50

1"=5'

Stantec

12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

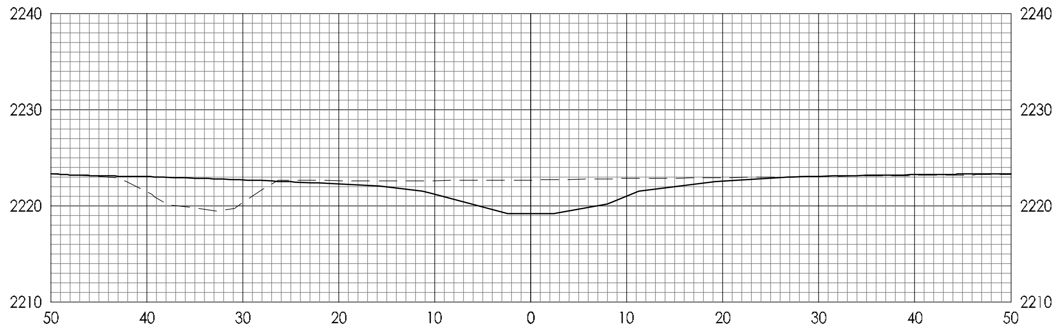
Title
SENIARD CROSS SECTIONS

Permit-Seal

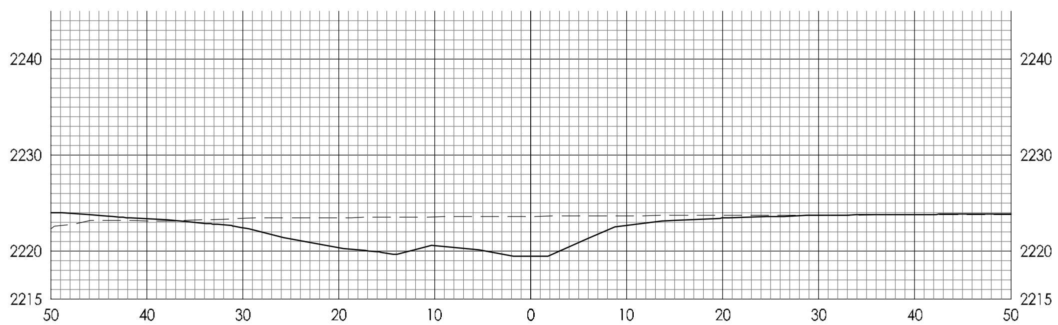
Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

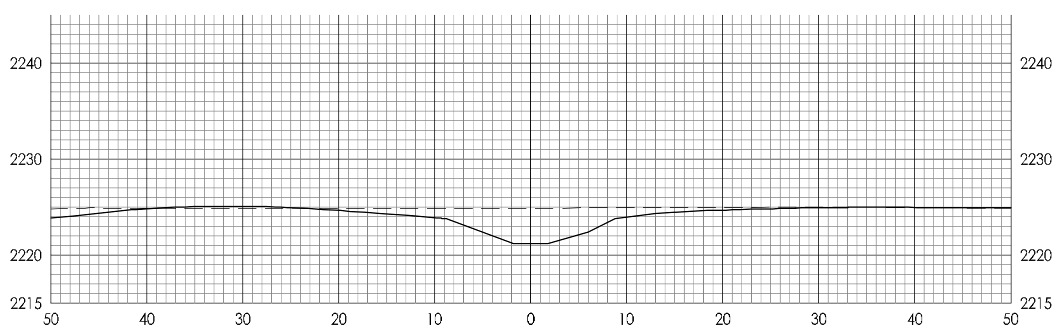
Revision 0
Sheet XS-3



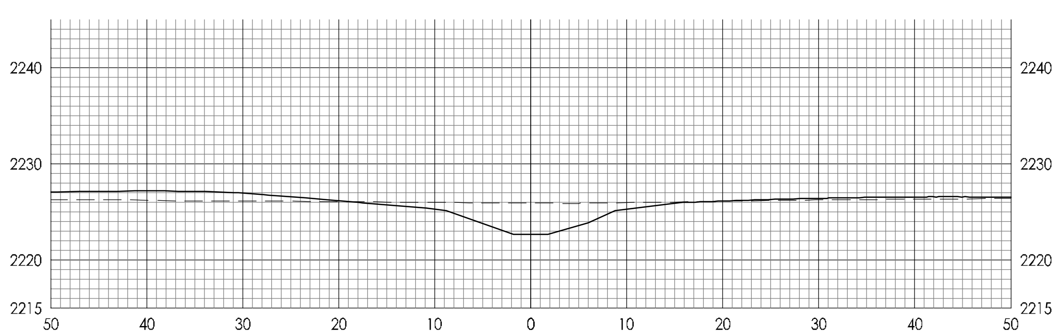
117+00



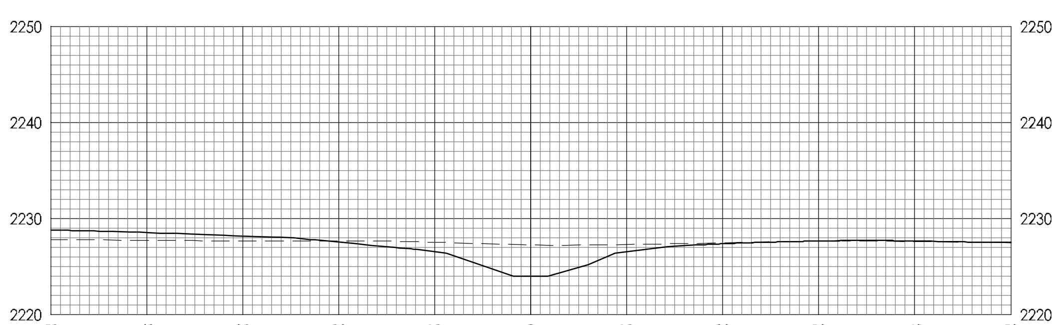
116+50



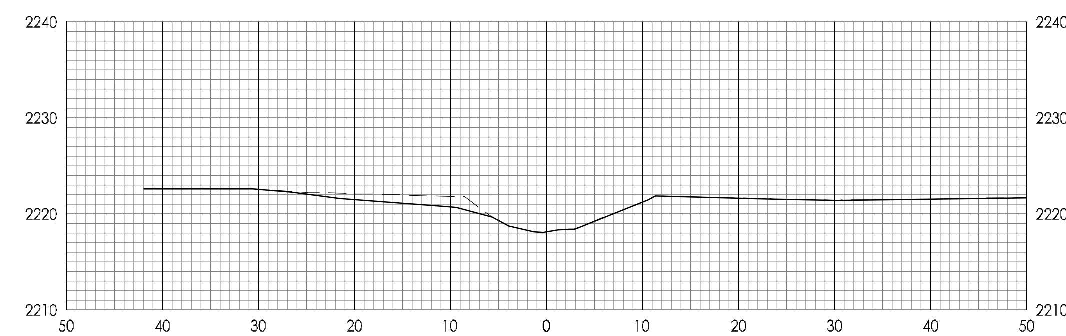
116+00



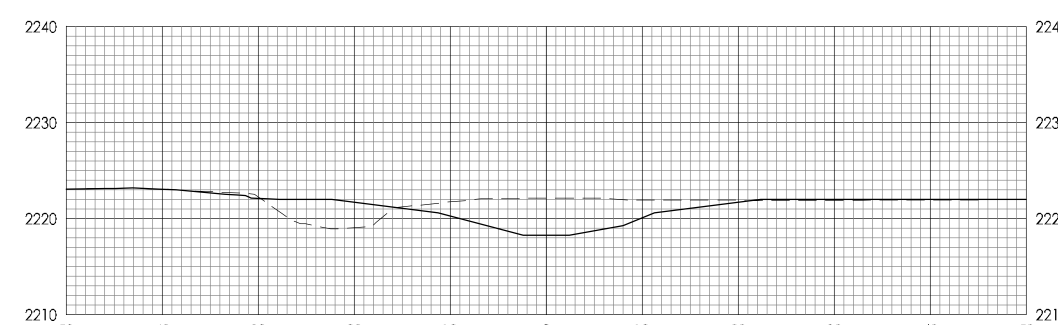
115+50



115+00



118+00



117+50

1"=5' 0 2.5' 5' 10'

Stantec
12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

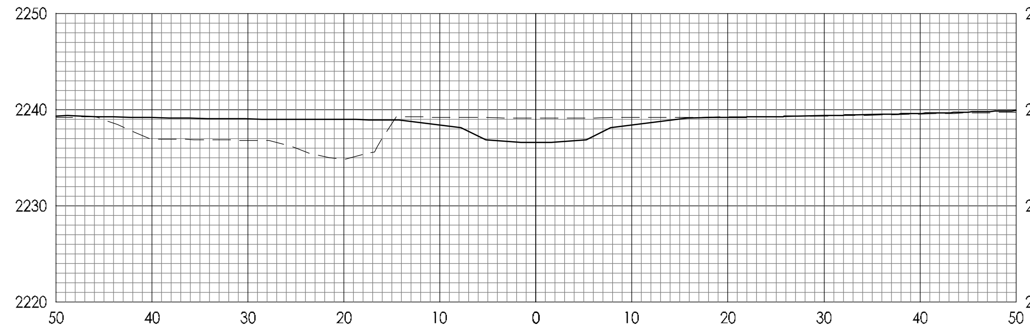
Title
SENIARD CROSS SECTIONS

Permit-Seal

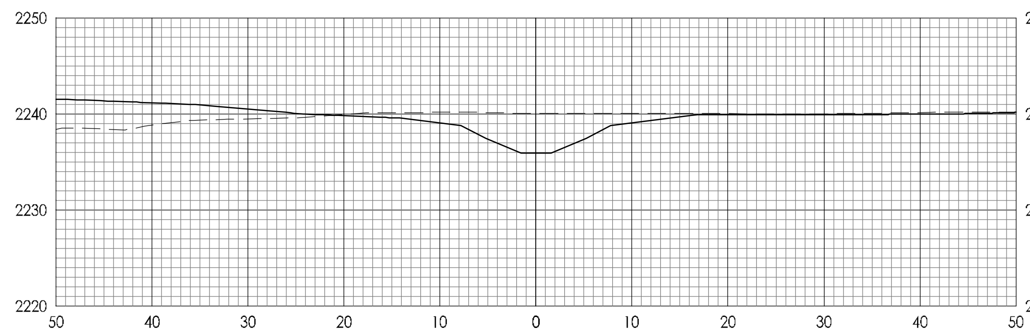
Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

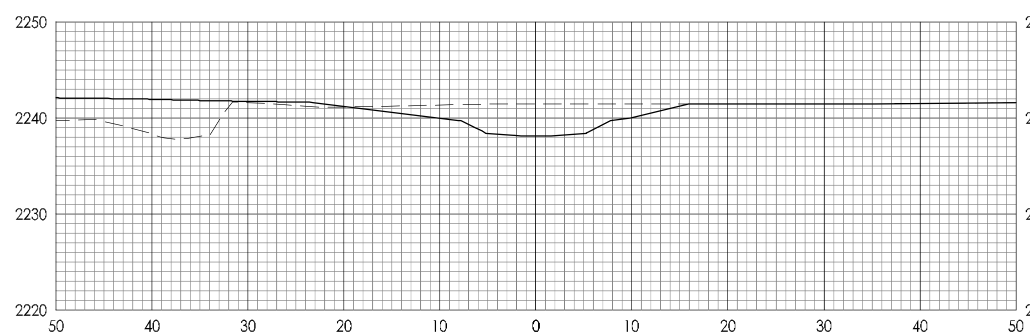
Revision 0
Sheet XS-4



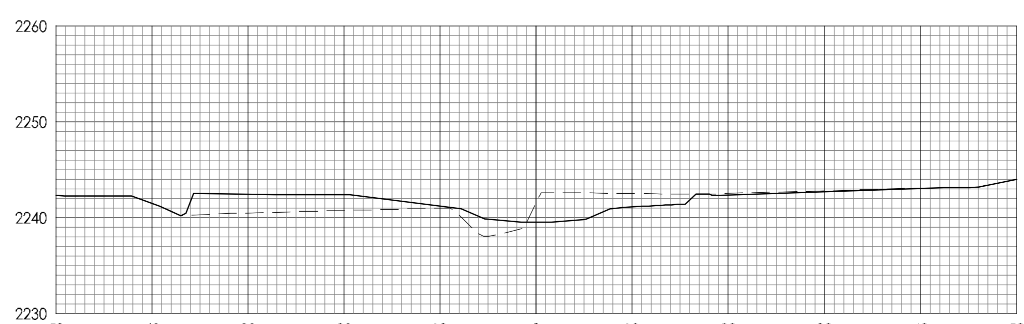
203+00



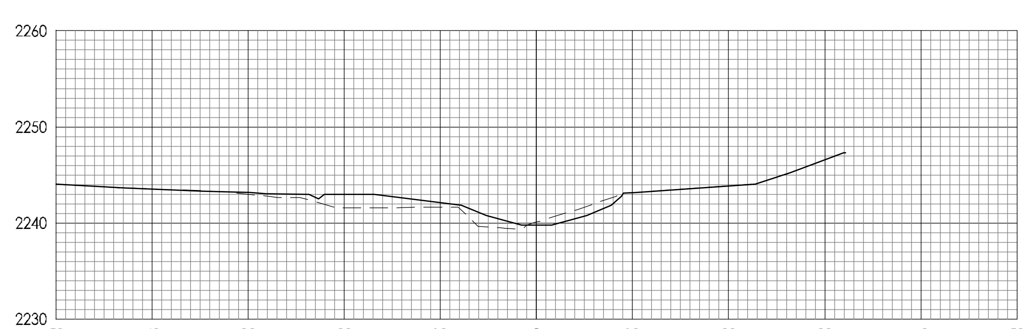
202+50



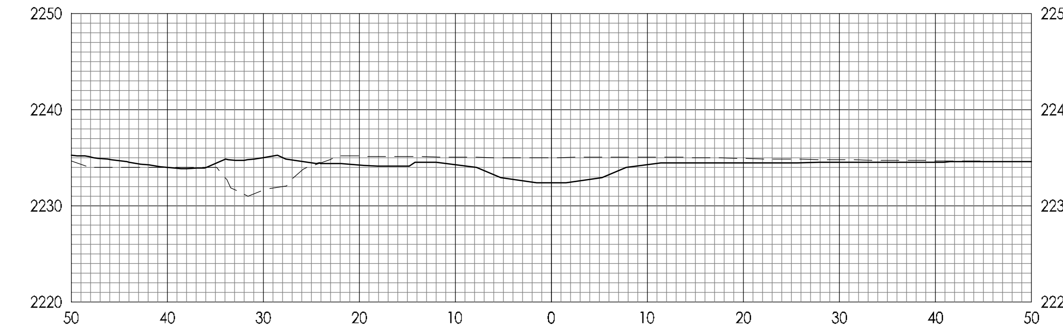
202+00



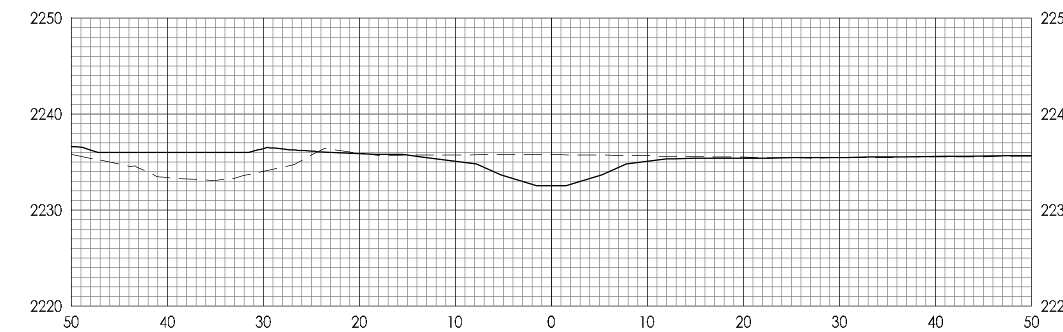
201+50



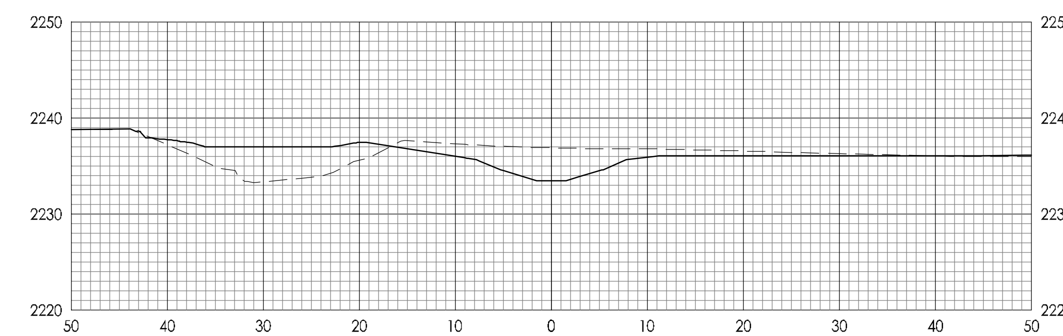
201+00



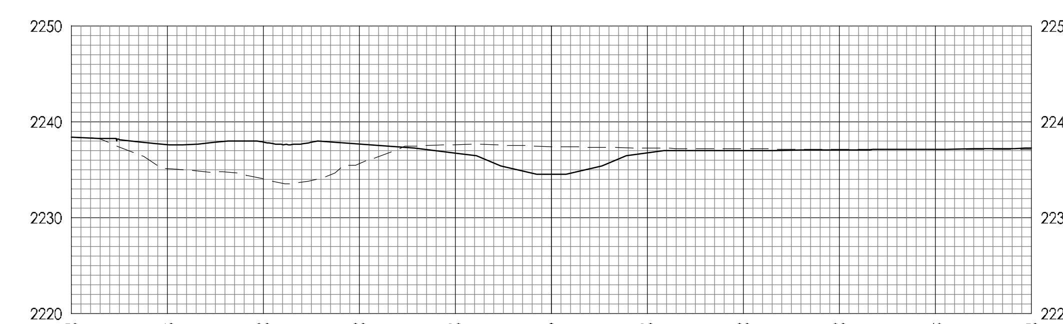
205+50



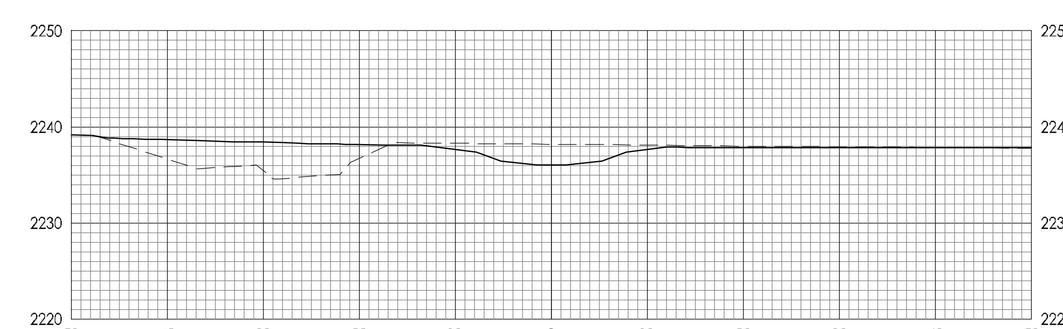
205+00



204+50



204+00



203+50

0 2.5' 5' 10'
1"=5'

LEGEND

EXISTING GROUND

PROPOSED GROUND

Stantec

12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
SITTON CROSS SECTIONS

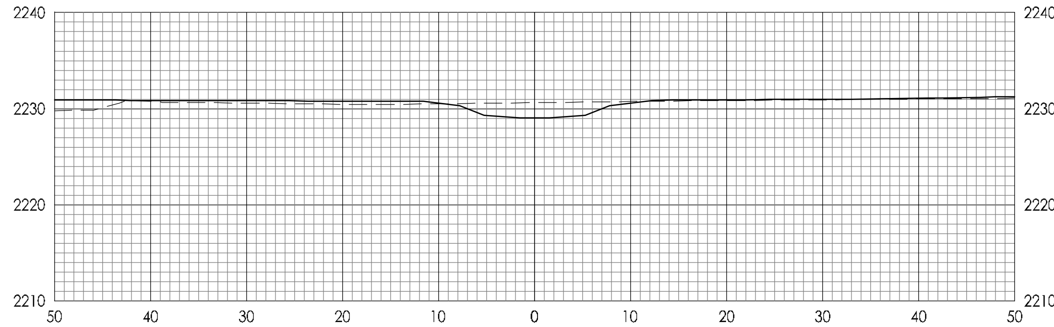
Permit-Seal

Project Number: 172621103

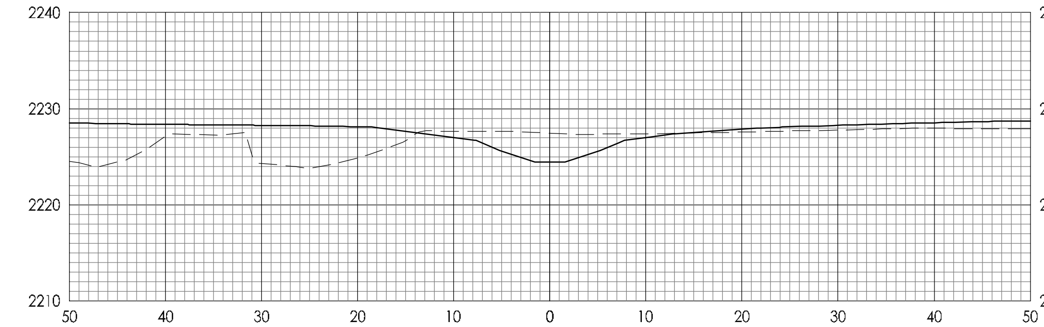
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0

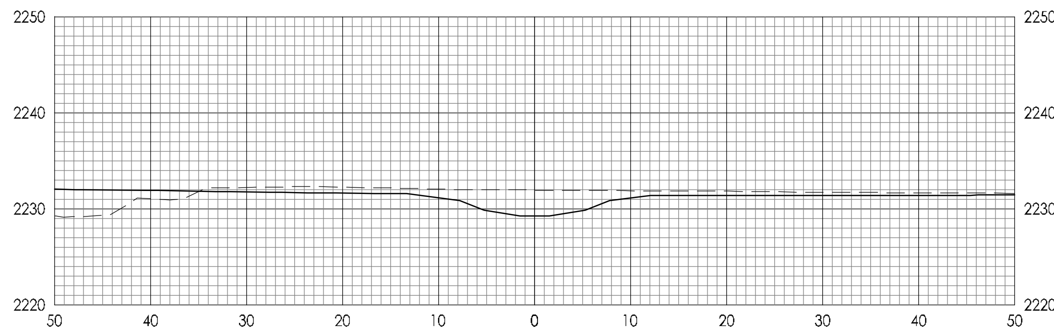
Sheet XS-5



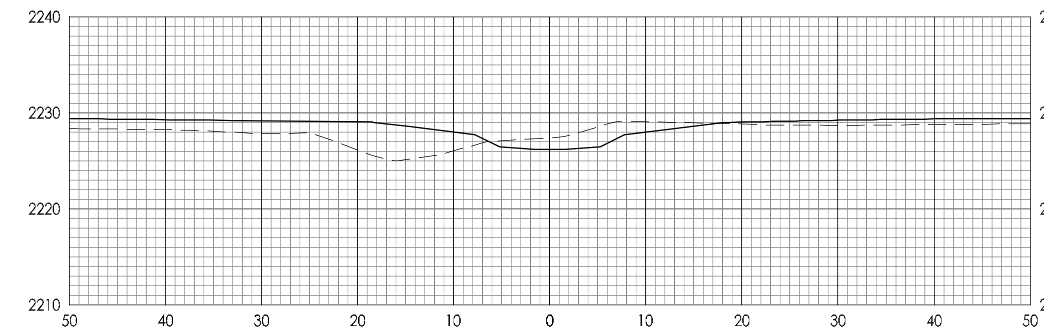
208+00



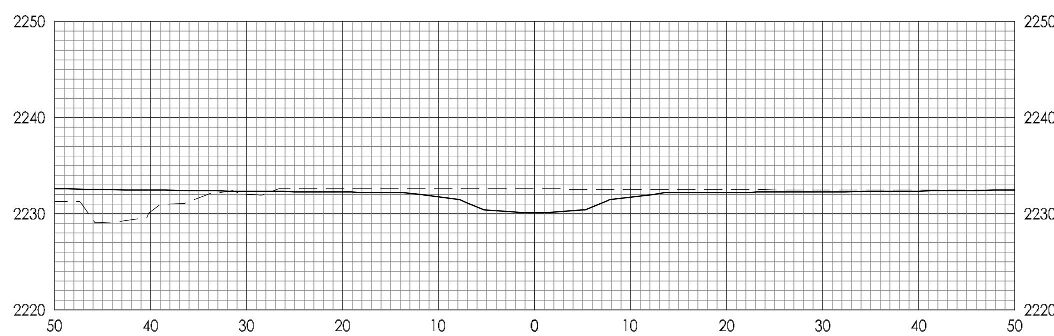
210+50



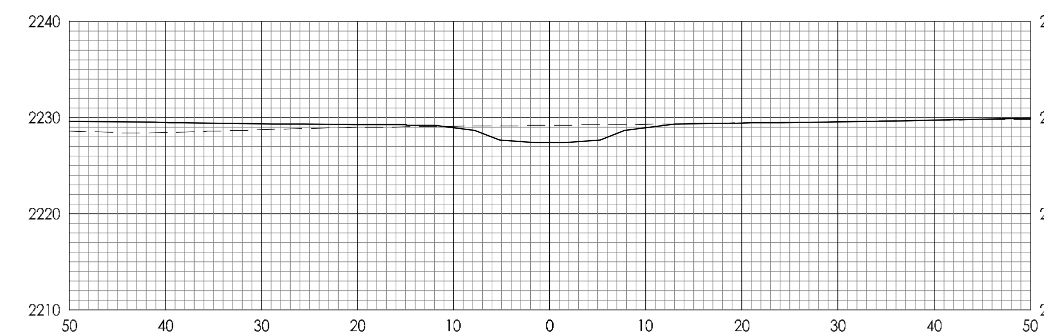
207+50



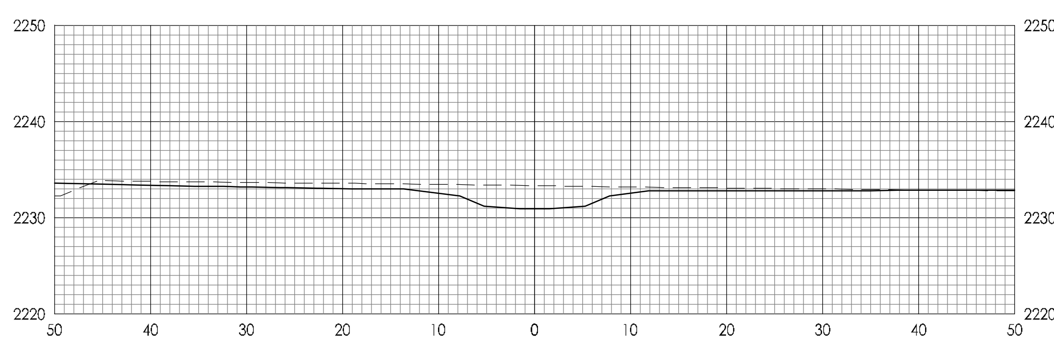
210+00



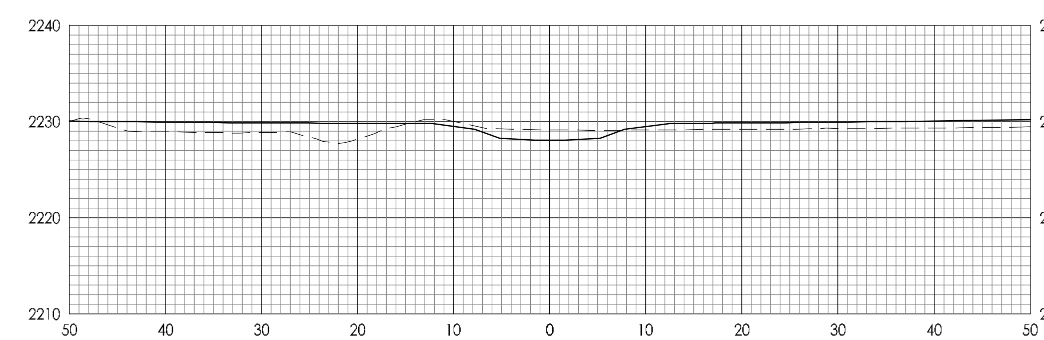
207+00



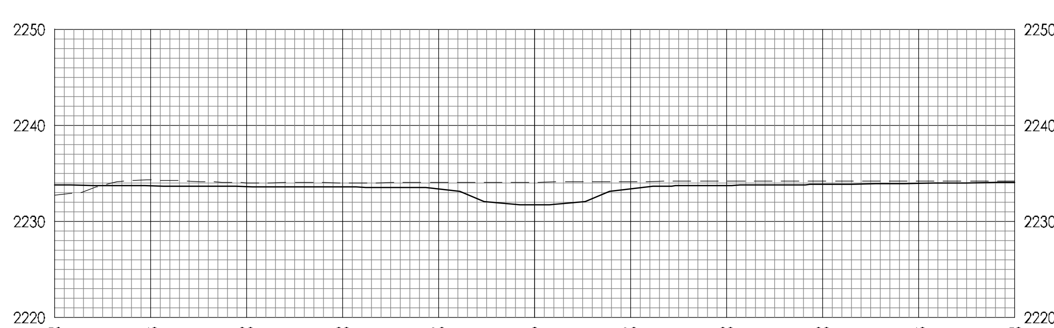
209+50



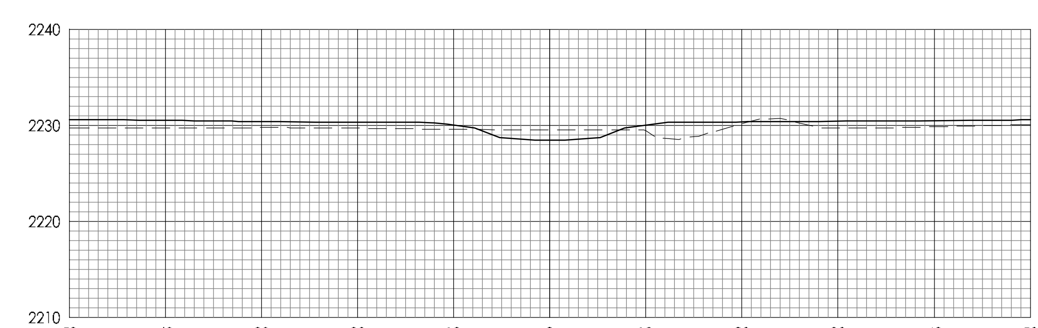
206+50



209+00



206+00



208+50

LEGEND

EXISTING GROUND

PROPOSED GROUND

1"=5' 0 2.5' 5' 10'

Stantec

12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
SITTON CROSS SECTIONS

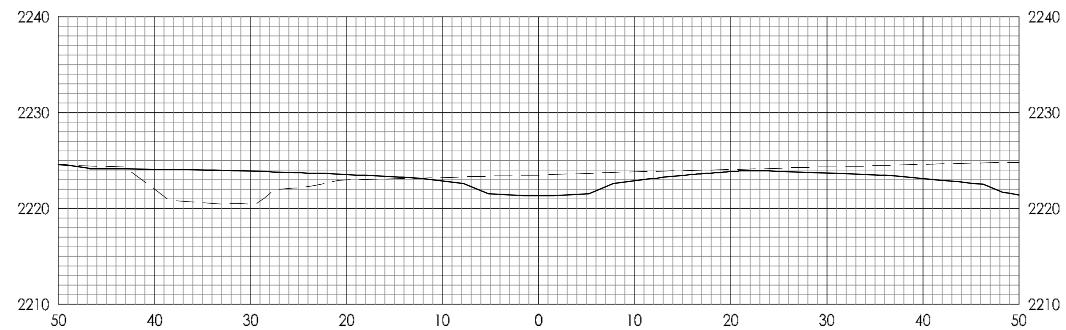
Permit-Seal

Project Number: 172621103

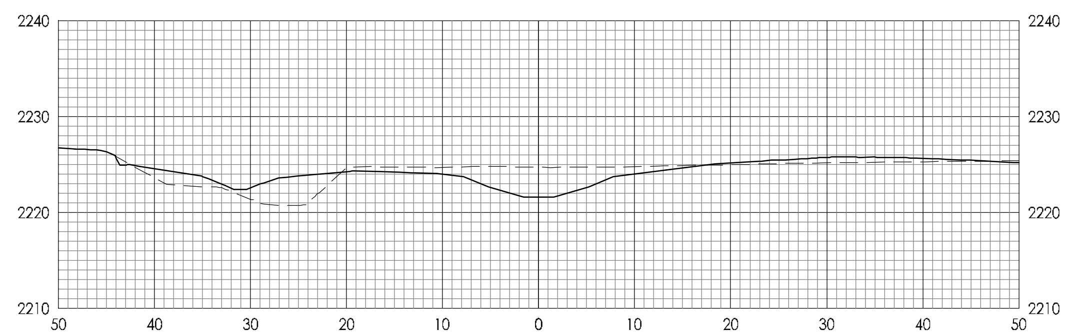
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0

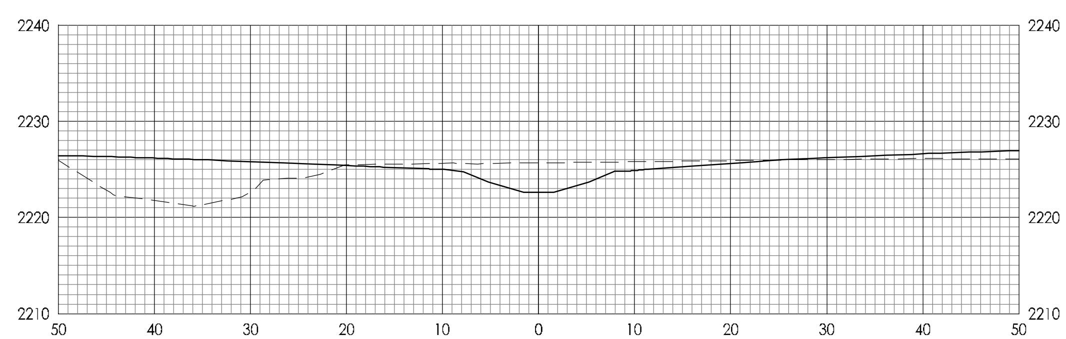
Sheet XS-6



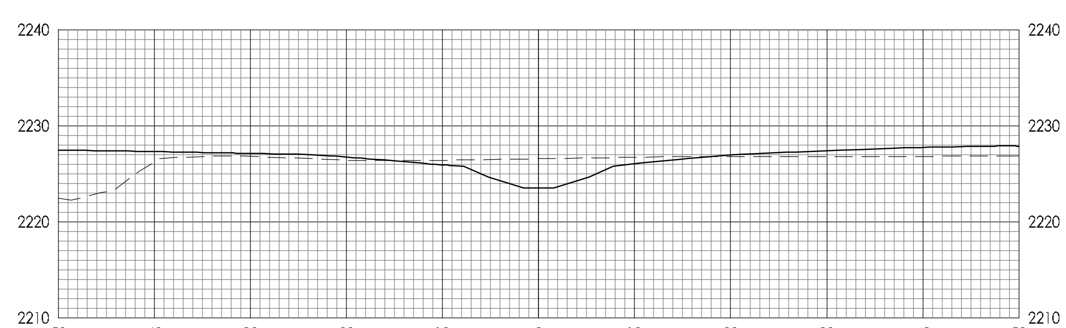
212+50



212+00



211+50



211+00

1"=5' 0 2.5' 5' 10'

LEGEND

EXISTING GROUND

PROPOSED GROUND

Stantec

12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
SITTON CROSS SECTIONS

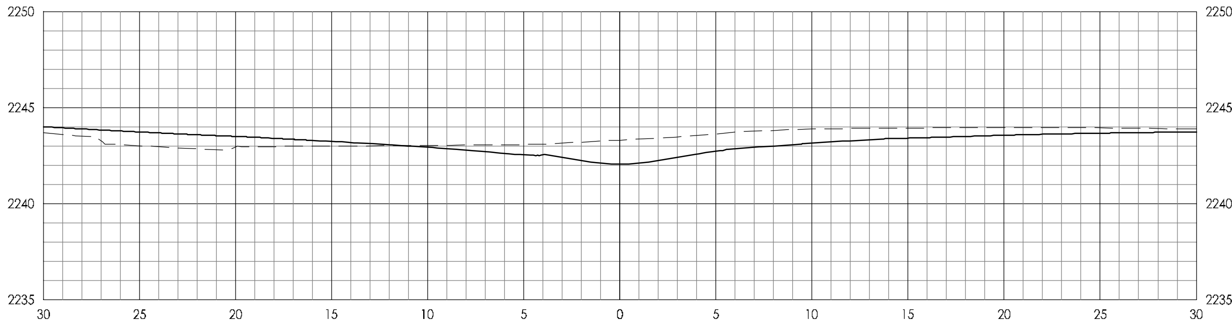
Permit-Seal

Project Number: 172621103

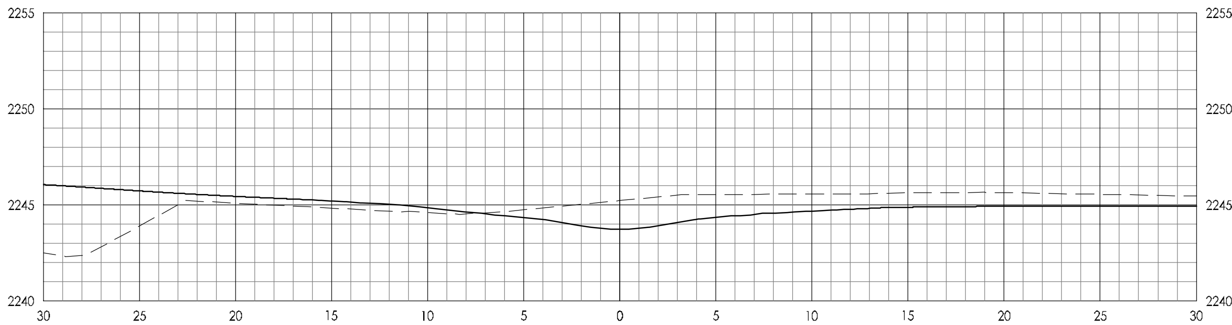
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0

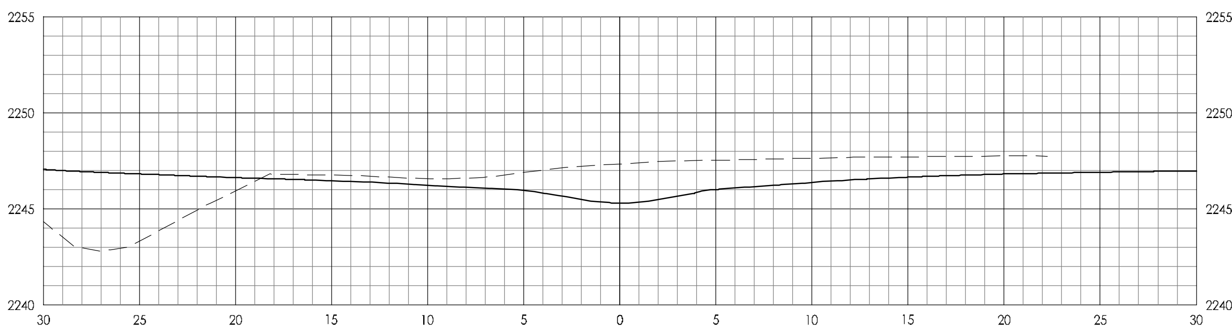
Sheet XS-7



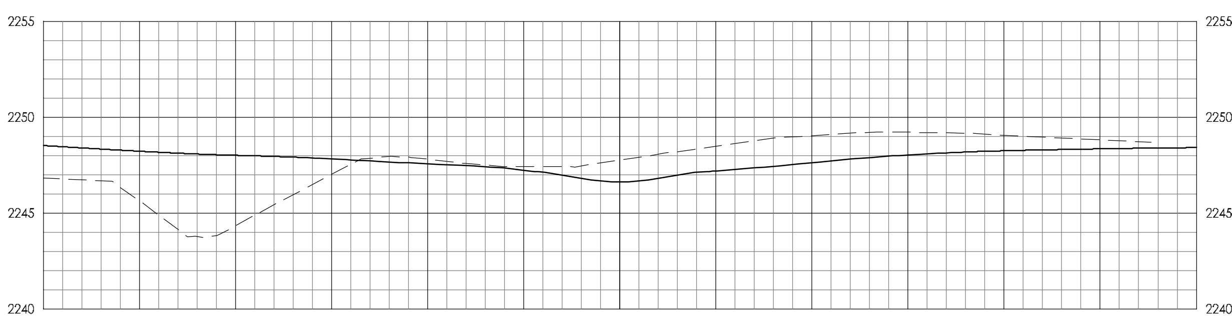
301+25



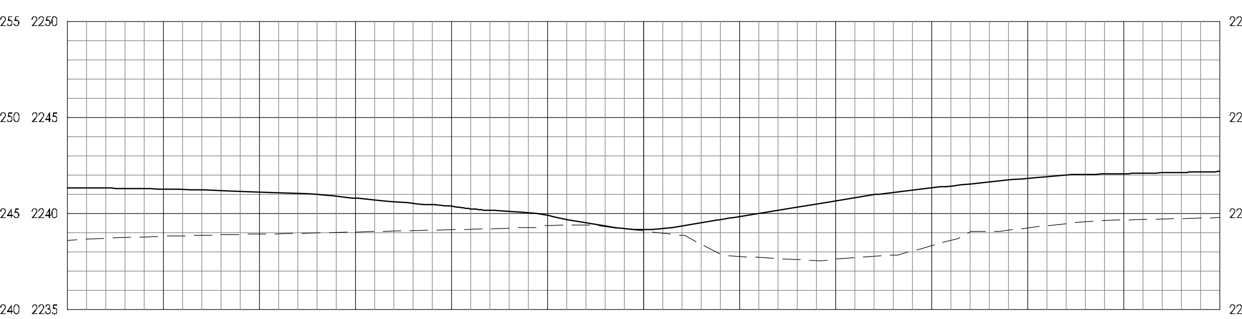
301+00



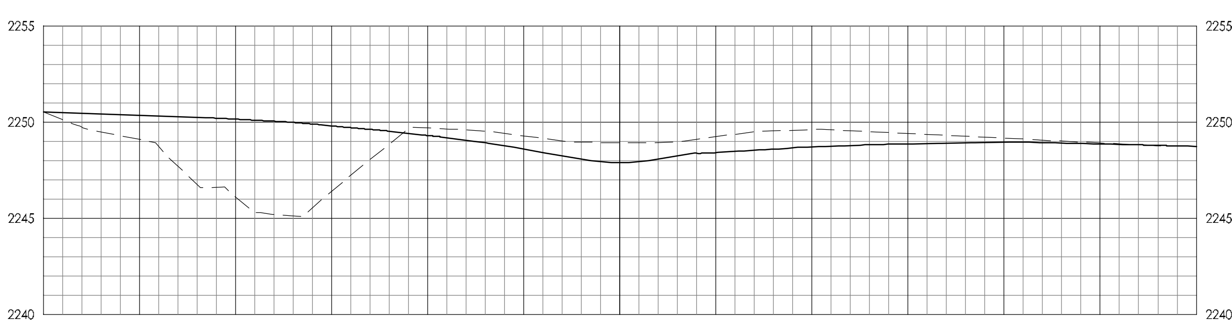
300+75



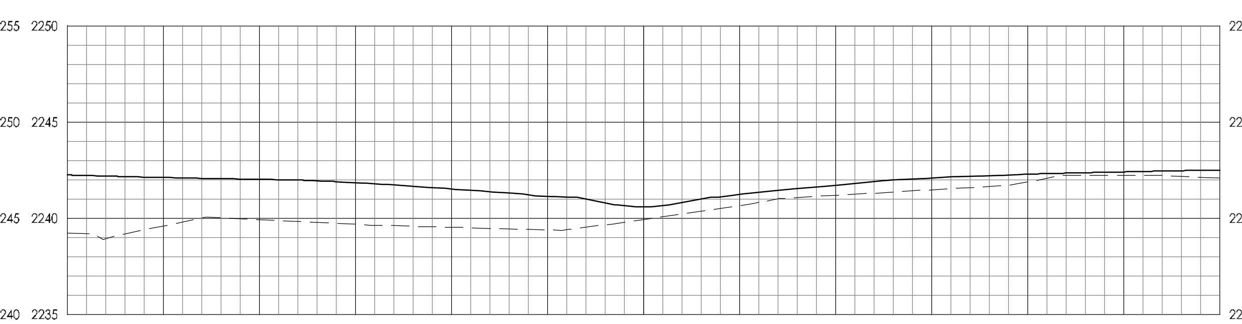
300+50



301+75



300+25



301+50

LEGEND

EXISTING GROUND

PROPOSED GROUND

0 2.5' 5' 10'
1"=5'

Stantec

12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Permit-Seal

Client/Project
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION SITE

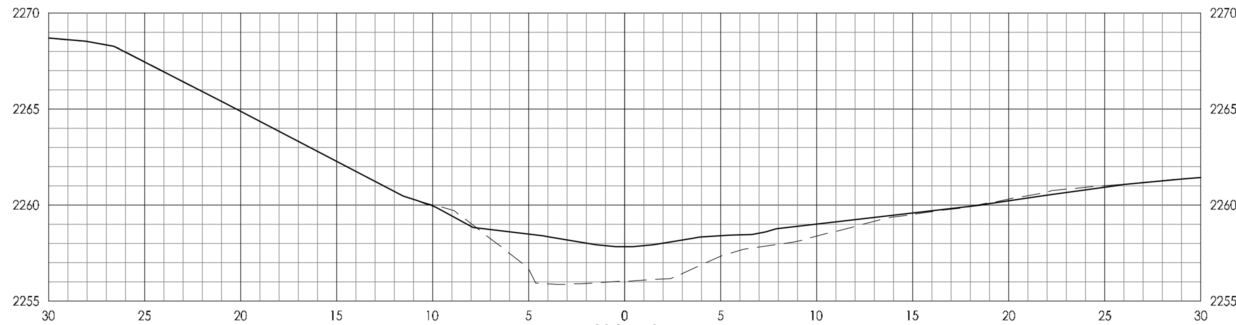
HENDERSON COUNTY, NC

Title
LEE CROSS SECTIONS

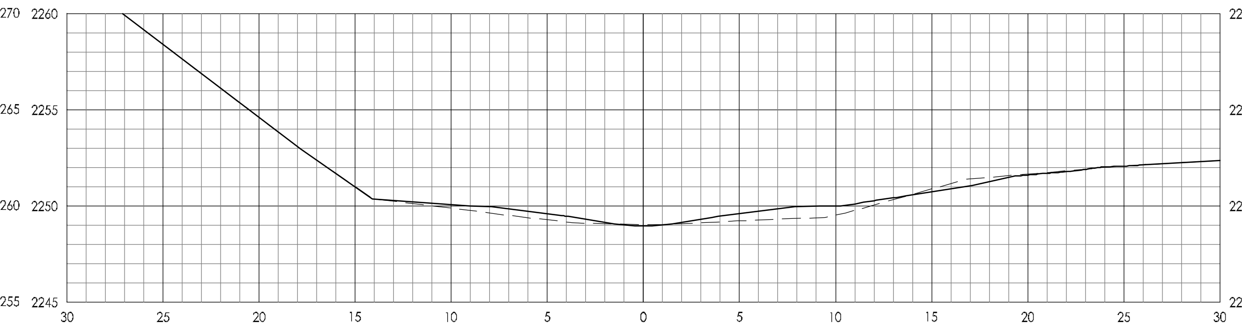
Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

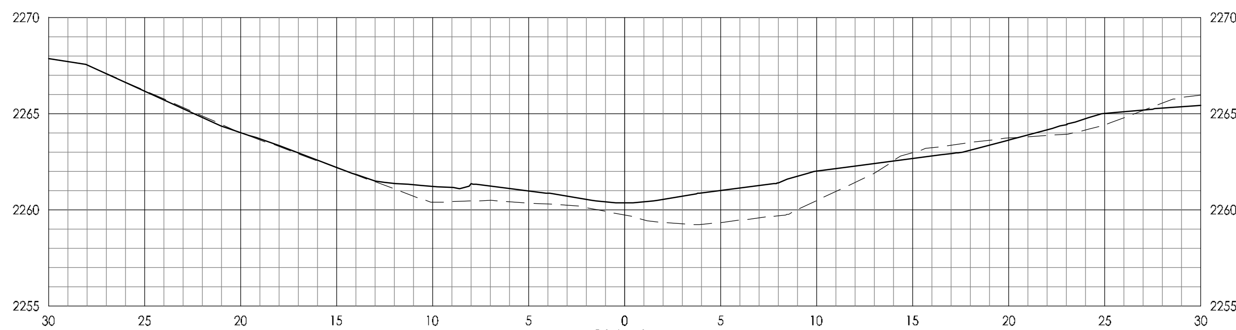
Revision	Sheet
0	XS-8



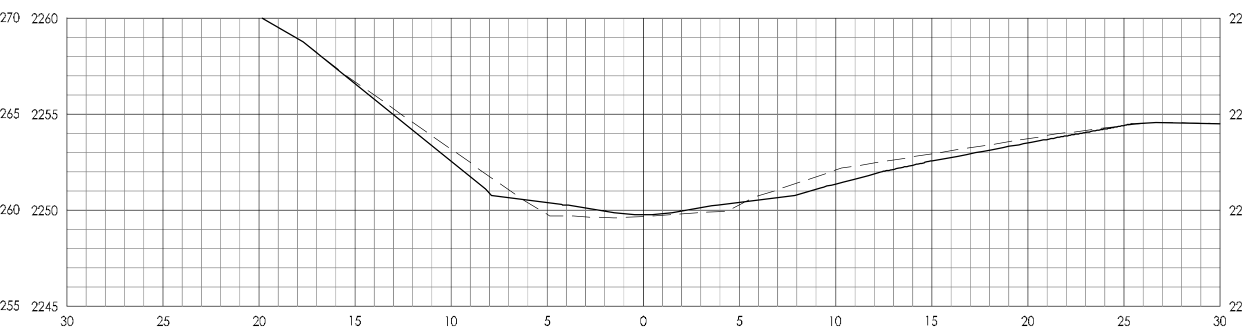
402+50



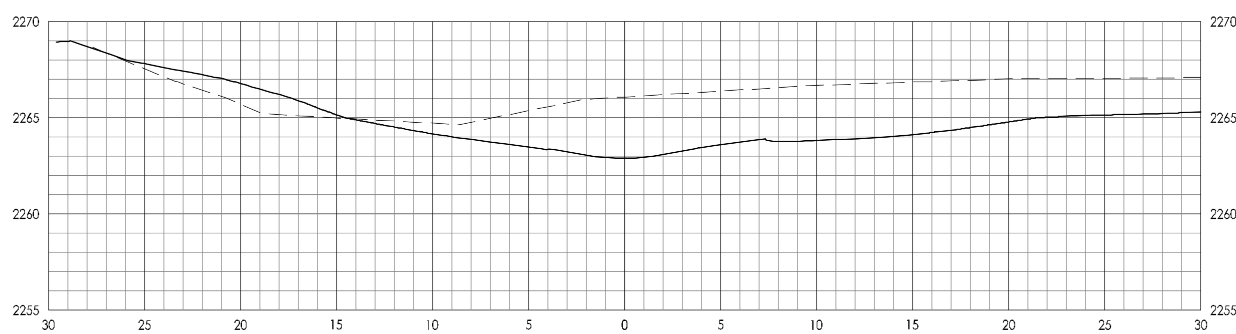
403+75



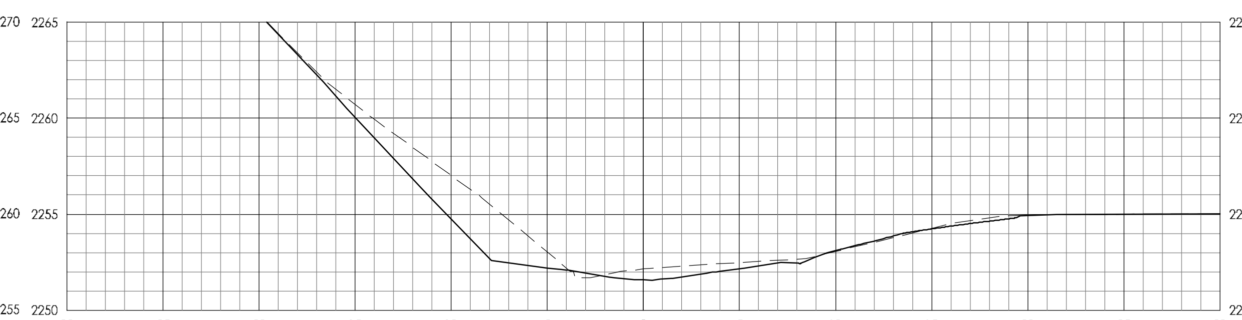
402+25



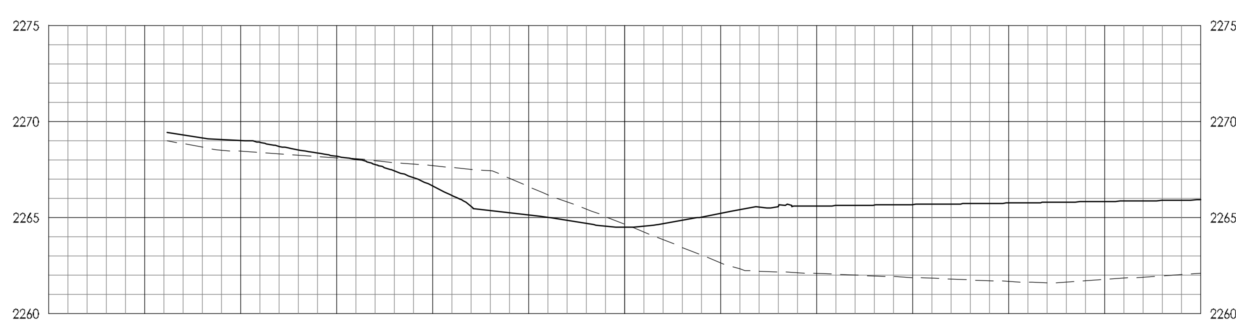
403+50



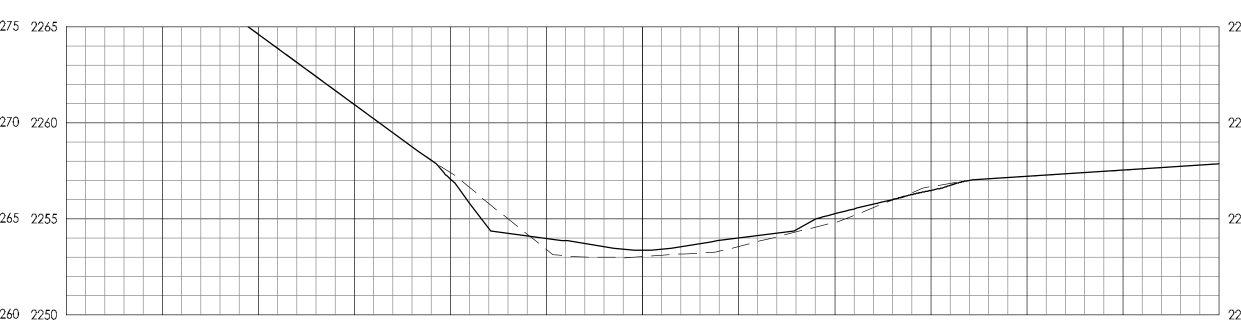
402+00



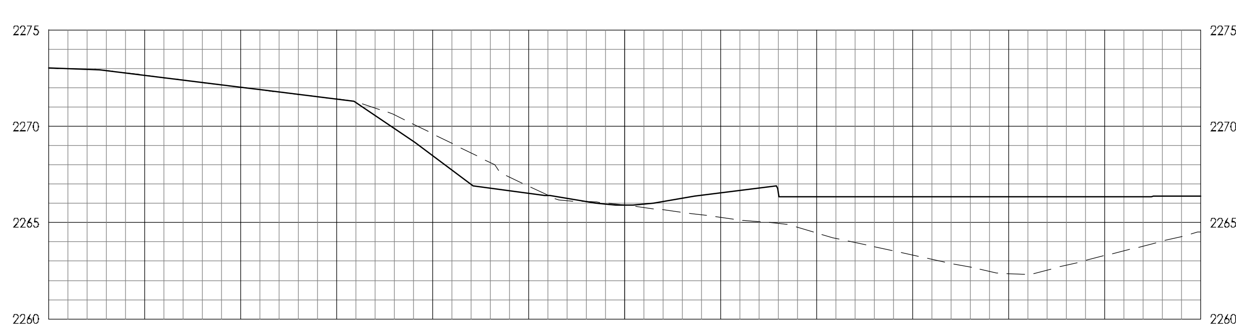
403+25



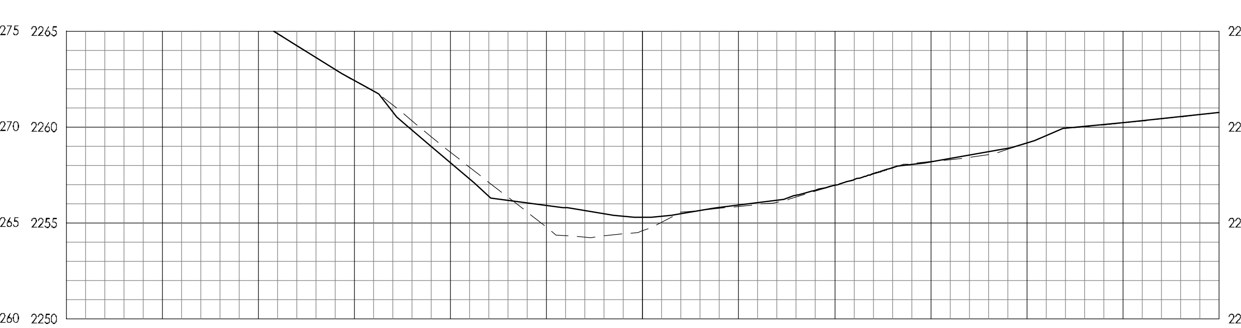
401+75



403+00



401+50



402+75

LEGEND

EXISTING GROUND

PROPOSED GROUND

0 2.5' 5' 10'

1"=5'

Stantec

12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
DAVID CROSS SECTIONS

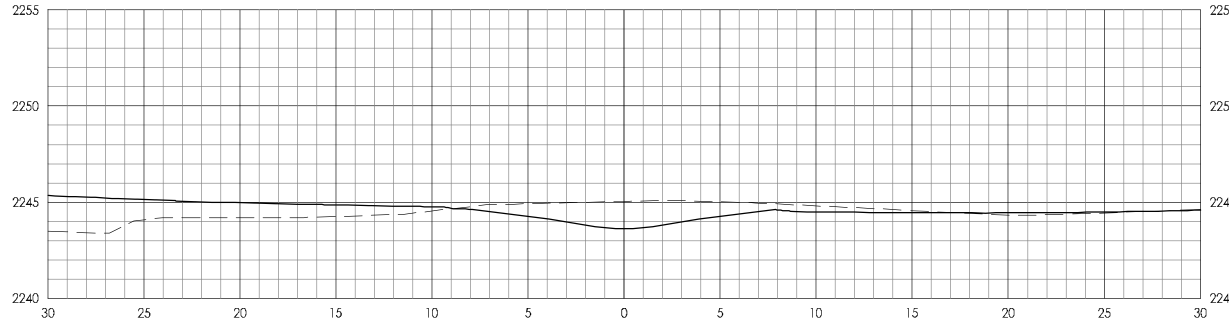
Permit-Seal

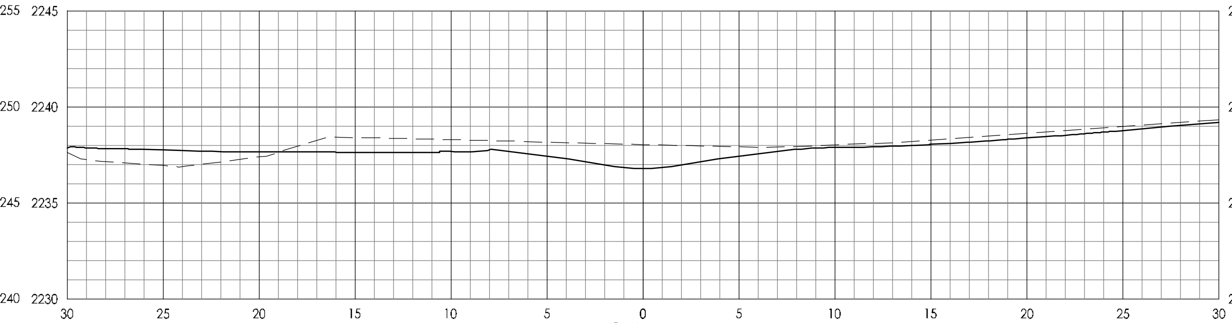
Project Number: 172621103

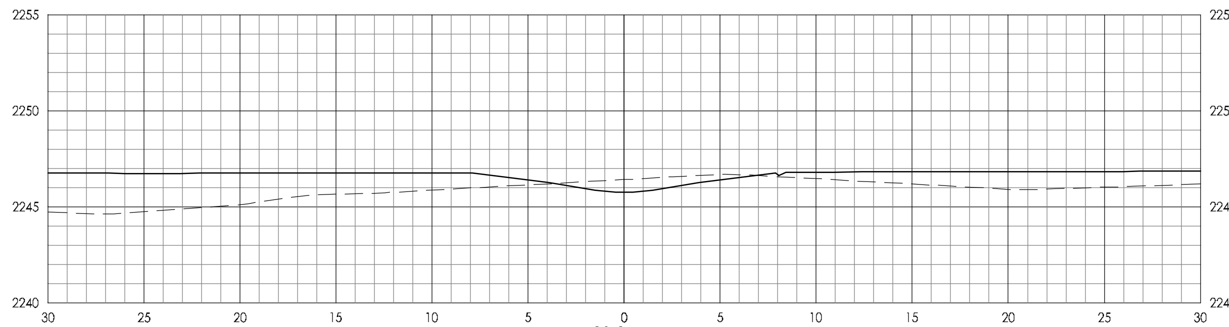
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

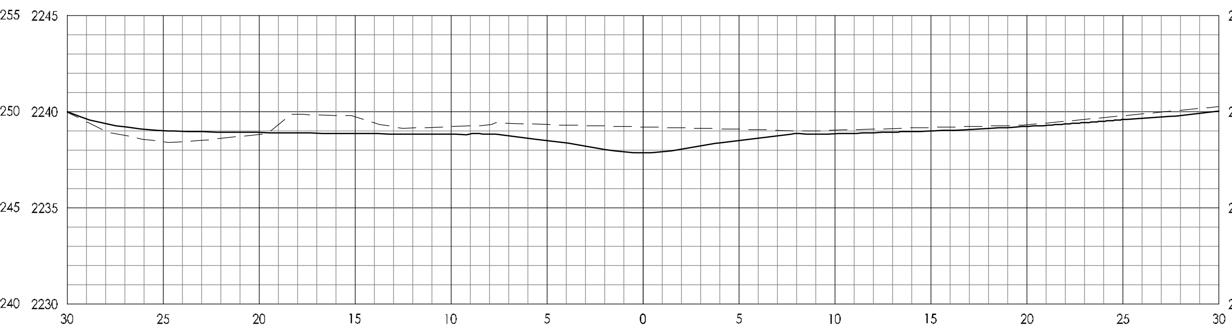
Revision 0

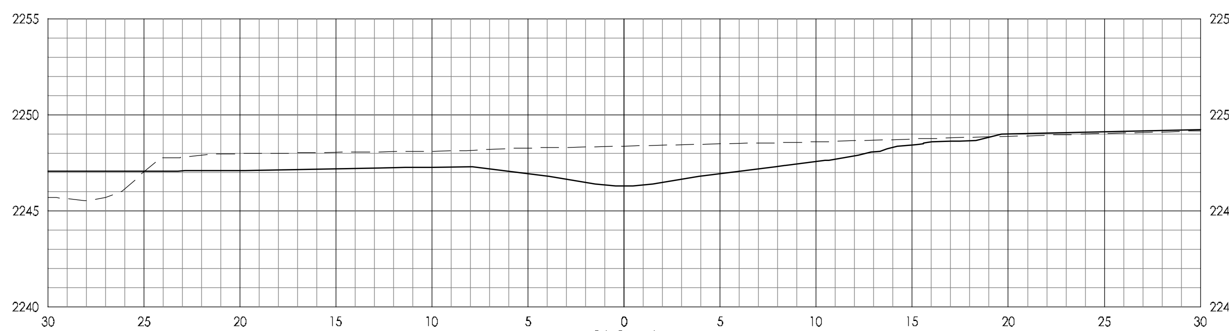
Sheet XS-9

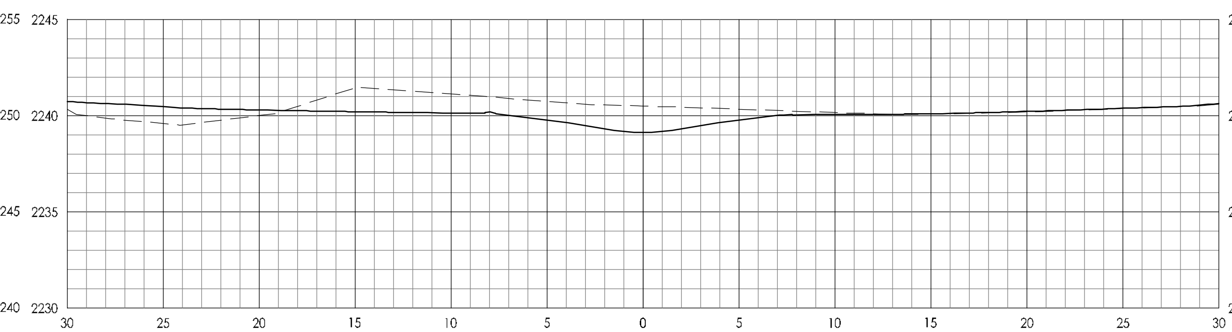

405+00

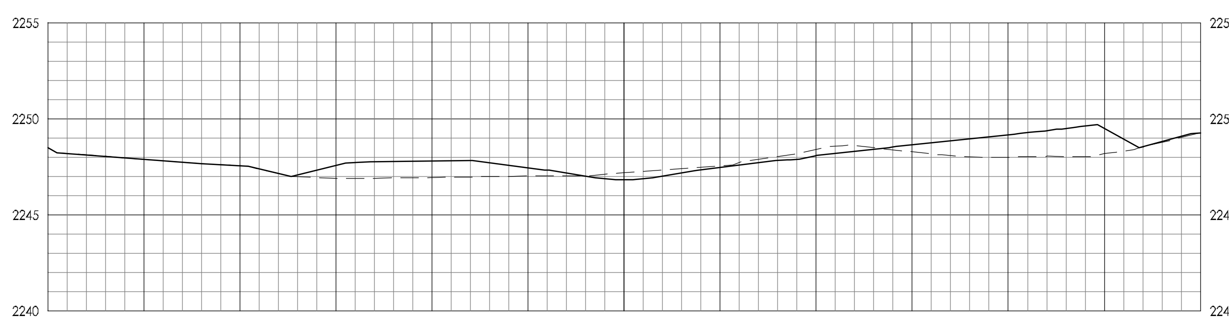

406+25

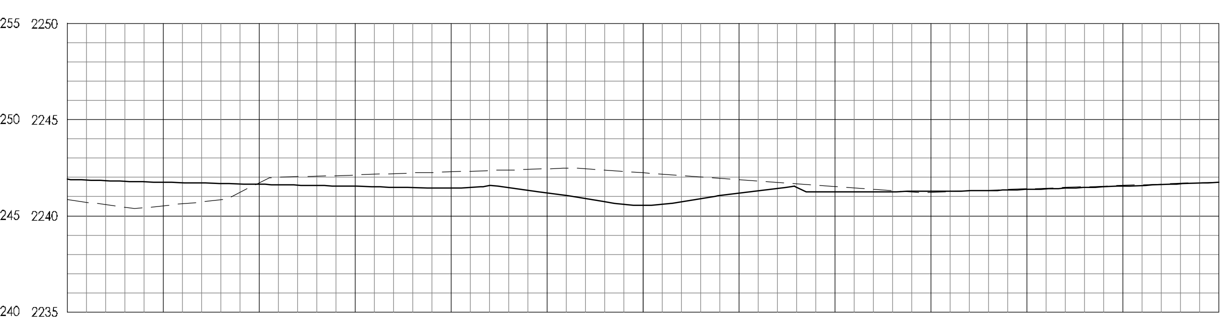

404+75

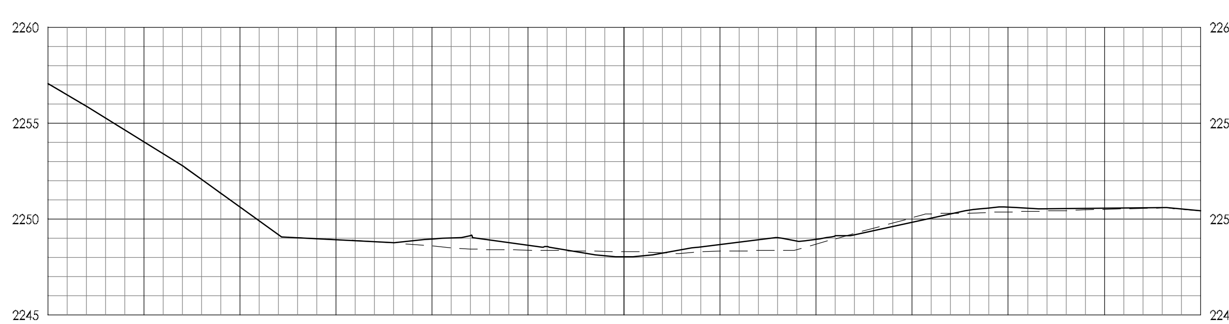

406+00

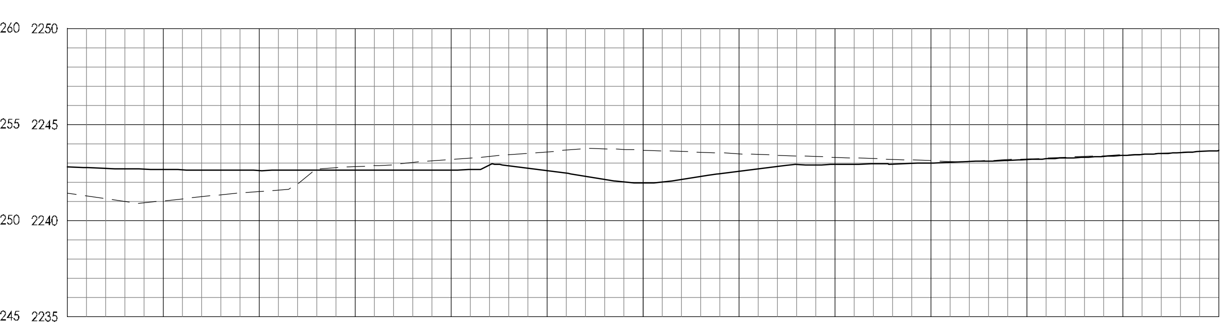

404+50


405+75


404+25


405+50


404+00


405+25

LEGEND

EXISTING GROUND

PROPOSED GROUND

0 2.5' 5' 10'

1"=5'

Stantec

12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Permit-Seal

Client/Project
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

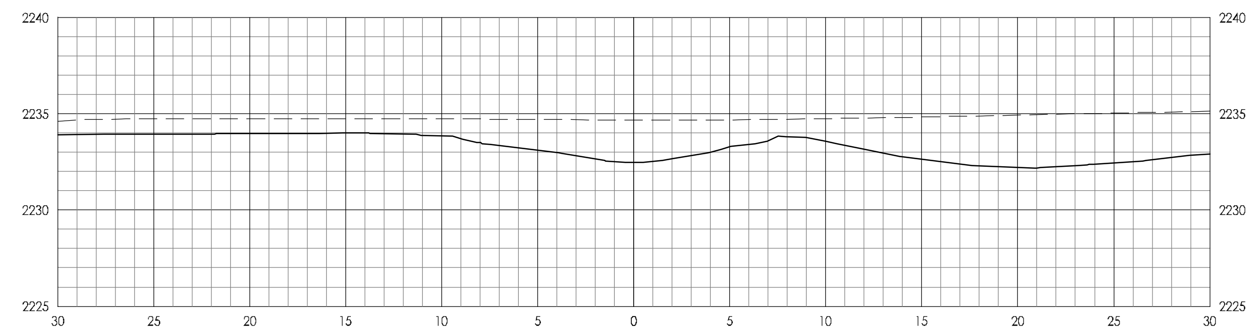
Title
DAVID CROSS SECTIONS

Project Number: 172621103

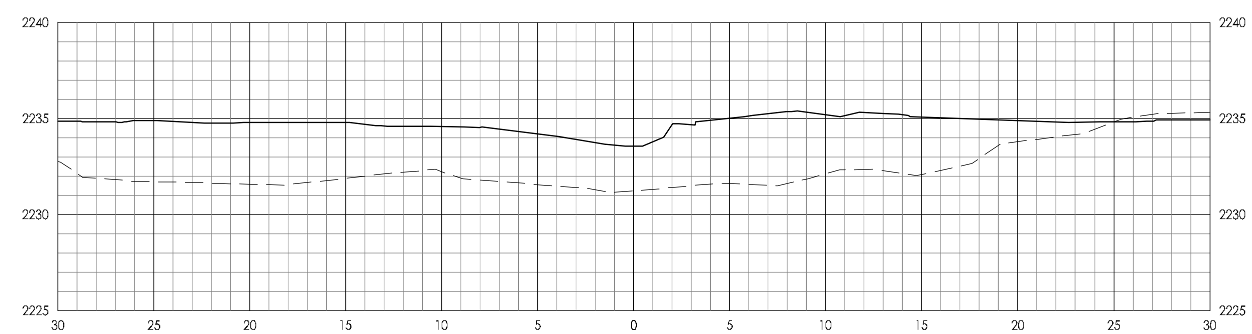
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0

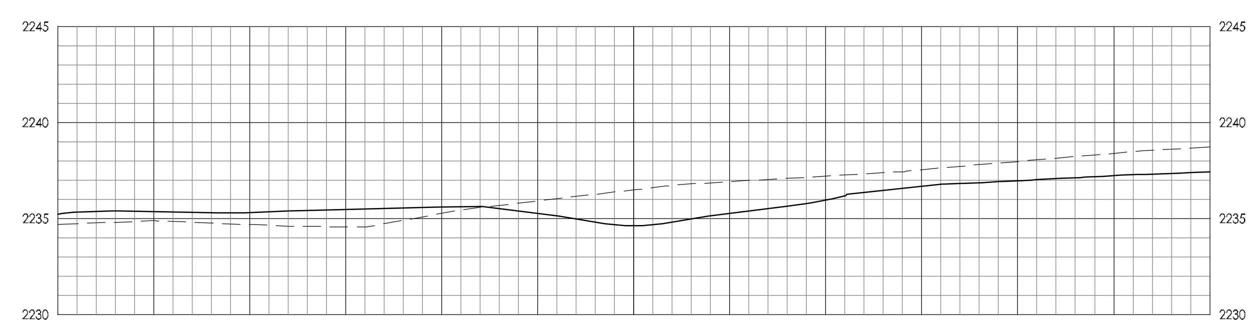
Sheet XS-10



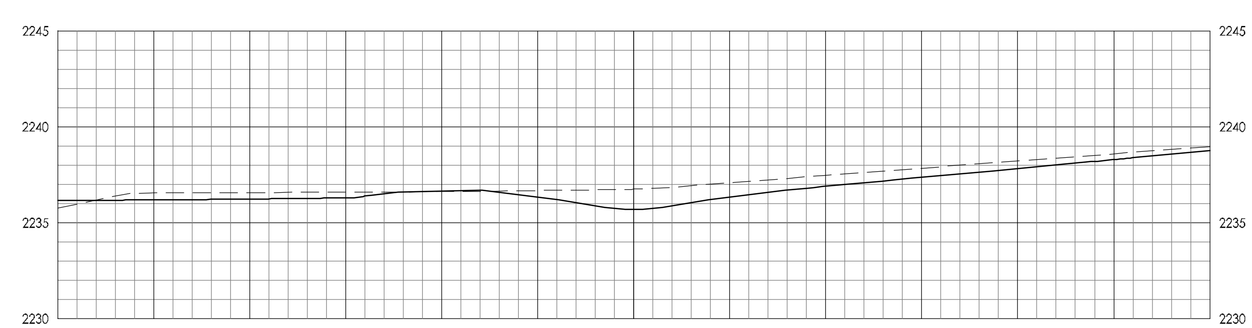
407+25



407+00



406+75



406+50

0 2.5' 5' 10'
1"=5'

LEGEND

EXISTING GROUND

PROPOSED GROUND

Stantec

12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Permit-Seal

Client/Project
EW SOLUTIONS, LLC

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

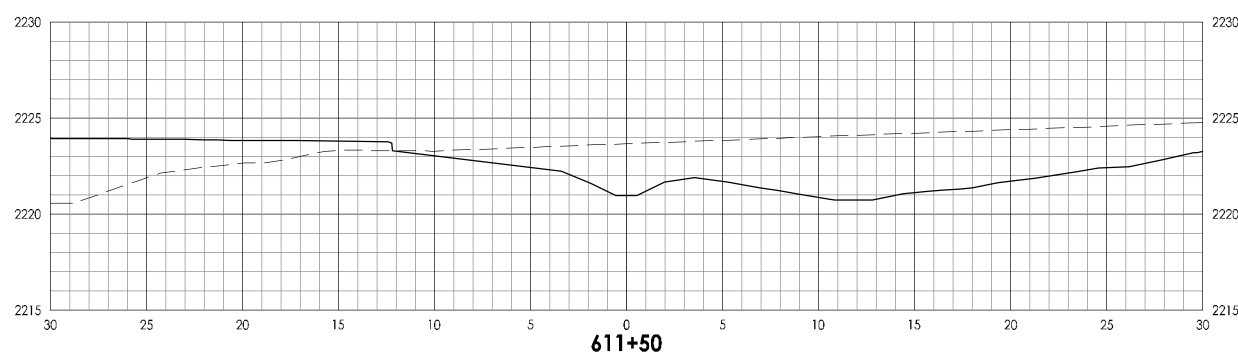
Title
DAVID CROSS SECTIONS

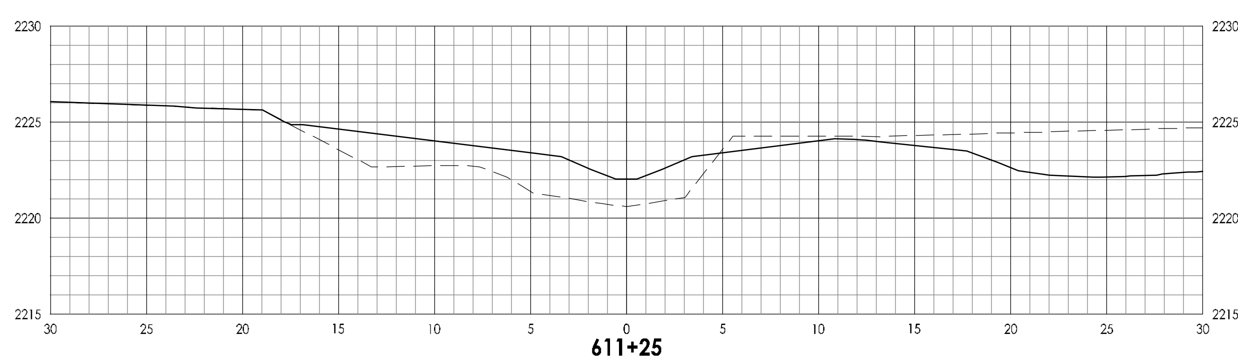
Project Number: 172621103

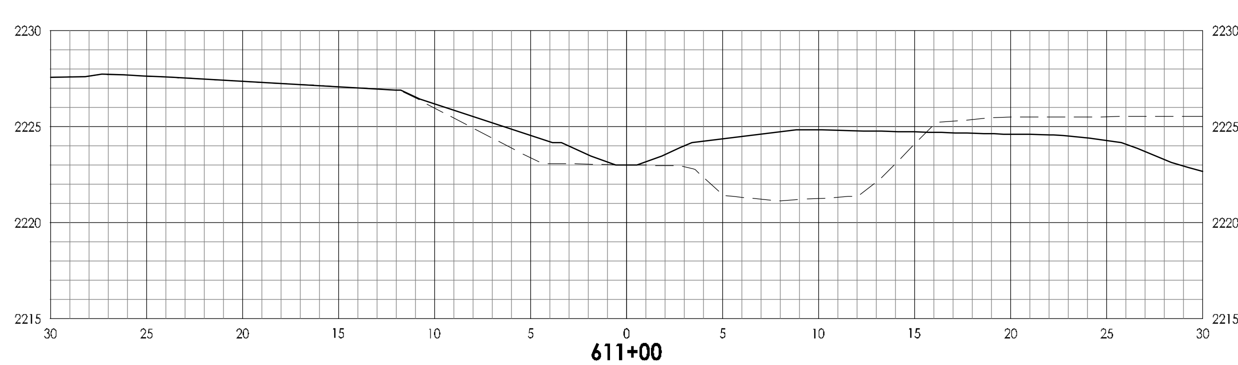
CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision 0

Sheet XS-11







1"=5' 0 2.5' 5' 10'

LEGEND

EXISTING GROUND

PROPOSED GROUND

SaveDate: 2020/05/27 7:36 PM Login: Stokes, Ryan
c:\users\rystokes\onedrive - stantec office 365\desktop\seniard\david xs's - edited linework.dwg

Stantec
12 1/2 Wall Street, Suite B
Asheville, North Carolina
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS, LLC
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
REDMOND CROSS SECTIONS

Permit-Seal

Project Number: 172621103

CEG	SGG	CME	20.05.22
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Revision	Sheet
0	XS-12

Page left intentionally blank for printing purposes.

Appendix C ASSESSMENT DATA

Includes:

Erosion rate sheets

Site assessment sheets

Site Hydric Soils Detailed Study

NCDNCR Response Letter Sitton

Creek Design Memo Post

Contract IRT Site Visit Memo

Page left intentionally blank for printing purposes.

Erosion Rate Calculations

Project:	Seniard	Date:	4/2/18
Project No.:	172621103-SNRD	Observer:	CEG
Stream:	Seniard Creek	Page:	1
Reach:	1A		

Observed Values

Reach Name	1A	1A	1A	1A	1A	1A	1A
Station/Location	100+00	100+50	100+50	101+00	101+00	102+00	102+00
Photo No.				R29	R29	R30	R30
Reach Length (ft)	50	50	50	100	100	25	150
Bank	Lt & Rt	Left	Right	Left	Right	Left	Right
Bank Height (ft)	6	5	3	5	2	5	2
Bankfull Height (ft)	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Root Density (%)	40%	40%	40%	40%	40%	40%	40%
Bank Angle (deg)	75	75	45	75	45	75	45
Surface Protection (%)	80%	50%	70%	75%	70%	60%	75%
Bank Material	Cobble	Cobble	Cobble	Cobble	Cobble	Cobble	Cobble
Stratification	None	None	None	None	None	None	None
Thalweg Position	Center	Center	Center	Off-center	Off-center	Off-center	Off-center
DTOE/DMEAN	> 1	> 1	> 1	< 1	< 1	< 1	< 1
Local Slope > Avg	No	No	No	No	No	No	No

BEHI Calculation

Bnk Ht / Bkf Ht	7.1	5.9	3.5	5.9	2.4	5.9	2.4
BEHI Score	10.0	10.0	10.0	10.0	8.6	10.0	8.6
Root Depth / Bnk Ht	0.1	0.1	0.1	0.1	0.2	0.1	0.2
BEHI Score	9.2	9.0	8.4	9.0	7.6	9.0	7.6
Weighted Root Density (%)	3%	3%	5%	3%	8%	3%	8%
BEHI Score	9.6	9.6	9.3	9.6	8.9	9.6	8.9
Bank Angle (deg)	75.0	75.0	45.0	75.0	45.0	75.0	45.0
BEHI Score	5.5	5.5	3.3	5.5	3.3	5.5	3.3
Surface Protection (%)	80%	50%	70%	75%	70%	60%	75%
BEHI Score	1.7	4.3	2.6	2.1	2.6	3.4	2.1
Bank Material Adjustment	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
Stratification Adjustment	0	0	0	0	0	0	0
Total BEHI Score	26.1	28.4	23.5	26.3	20.9	27.5	20.5
Rating	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

NBS Calculation

Thalweg Position Score	1	1	1	2	2	2	2
Toe Depth Ratio Score	1	1	1	0	0	0	0
Local Slope Score	0	0	0	0	0	0	0
Total NBS Rating	2	2	2	2	2	2	2
WARSS NBS Rating	3	3	3	2	2	2	2
Rating	Moderate	Moderate	Moderate	Low	Low	Low	Low

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Erosion Total (ft^3/yr)	36	15	9	16	6	4	10

Total Erosion (Sheet Total)	96

Erosion Rate Calculations

Project:	Seniard	Date:	4/2/18
Project No.:	172621103-SNRD	Observer:	CEG
Stream:	Seniard Creek	Page:	2
Reach:	1A and 1B		

Observed Values

Reach Name	1A	1A	1A	1A	1B	1B	1B
Station/Location	102+25	103+25	103+50	103+75	104+50	104+50	105+00
Photo No.	R31	R33	R33	R34	R36	R36	
Reach Length (ft)	100	125	25	75	50	50	50
Bank	Lt & Rt	Left	Right	Left	Right	Left	Right
Bank Height (ft)	5	5	1	2	5	2.5	5
Bankfull Height (ft)	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Root Density (%)	30%	30%	30%	30%	30%	30%	30%
Bank Angle (deg)	60	75	45	45	90	45	80
Surface Protection (%)	60%	60%	75%	75%	30%	75%	60%
Bank Material	Cobble	Cobble	Cobble	Cobble	Gravel	Gravel	Cobble
Stratification	None	None	None	None	None	Moderate	None
Thalweg Position	Off-center	Off-center	Center	Off-center	Center	Toe	Center
DTOE/DMEAN	> 1	< 1	< 1	> 1	< 1	> 1	< 1
Local Slope > Avg	No	Yes	Yes	No	No	No	No

BEHI Calculation

Bnk Ht / Bkf Ht	5.9	5.9	1.2	2.4	5.9	2.9	5.9
BEHI Score	10.0	10.0	3.1	8.6	10.0	9.5	10.0
Root Depth / Bnk Ht	0.1	0.1	0.4	0.2	0.1	0.2	0.1
BEHI Score	9.0	9.0	5.2	7.6	9.0	8.1	9.0
Weighted Root Density (%)	0.0	0.0	0.1	0.1	0.0	0.0	0.0
BEHI Score	9.7	9.7	8.4	9.2	9.7	9.4	9.7
Bank Angle (deg)	60.0	75.0	45.0	45.0	90.0	45.0	80.0
BEHI Score	4.0	5.5	3.3	3.3	8.0	3.3	6.0
Surface Protection (%)	0.6	0.6	0.8	0.8	0.3	0.8	0.6
BEHI Score	3.4	3.4	2.1	2.1	6.0	2.1	3.4
Bank Material Adjustment	-10.0	-10.0	-10.0	-10.0	5.0	5.0	-10.0
Stratification Adjustment	0	0	0	0	0	5.0	0
Total BEHI Score	26.1	27.6	12.1	20.8	47.7	42.3	28.1
Rating	Moderate	Moderate	Low	Moderate	Extreme	Very High	Moderate

NBS Calculation

Thalweg Position Score	2	2	1	2	1	2	1
Toe Depth Ratio Score	1	0	0	1	0	1	0
Local Slope Score	0	1	1	0	0	0	0
Total NBS Rating	3	3	2	3	1	3	1
WARSS NBS Rating	4	4	3	4	1	5	1
Rating	High	High	Moderate	High	Very Low	Very High	Very Low

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1	0.0	0.1	0.4	1.0	0.0
Erosion Total (ft^3/yr)	113	70	0	17	103	125	4

Total Erosion (Sheet Total)	432

Erosion Rate Calculations

Project:	Seniard	Date:	4/2/18
Project No.:	172621103-SNRD	Observer:	CEG
Stream:	Seniard Creek	Page:	3
Reach:	1B		

Observed Values

Reach Name	1B	1B	1B	1B	1B	1B	1B
Station/Location	105+00	105+50	105+50	106+60	106+00	106+80	107+25
Photo No.	R37	R38	R38	R41	R40	R41	R42
Reach Length (ft)	50	110	110	20	200	45	25
Bank	Lt & Rt	Left	Right	Left	Right	Left	Right
Bank Height (ft)	10	4	1	12	2.5	4	1.5
Bankfull Height (ft)	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Root Depth (ft)	2	1	0.99	2	2	2	1.49
Root Density (%)	30%	30%	30%	30%	30%	30%	30%
Bank Angle (deg)	60	60	45	45	60	90	45
Surface Protection (%)	50%	75%	75%	75%	75%	50%	90%
Bank Material	Gravel	Gravel	Gravel	Cobble	Gravel	Cobble	Cobble
Stratification	Moderate	None	None	None	None	None	None
Thalweg Position	Off-center	Center	Center	Toe	Center	Off-center	Center
DTOE/DMEAN	> 1	< 1	< 1	> 1	< 1	> 1	< 1
Local Slope > Avg	No	Yes	Yes	No	No	No	Yes

BEHI Calculation

Bnk Ht / Bkf Ht	10.5	4.2	1.1	12.6	2.6	4.2	1.6
BEHI Score	10.0	10.0	1.6	10.0	9.0	10.0	5.7
Root Depth / Bnk Ht	0.2	0.3	1.0	0.2	0.8	0.5	1.0
BEHI Score	7.6	7.0	-0.2	8.0	2.5	4.0	-0.1
Weighted Root Density (%)	0.1	0.1	0.3	0.1	0.2	0.2	0.3
BEHI Score	9.2	9.0	6.0	9.3	6.8	8.0	6.0
Bank Angle (deg)	60.0	60.0	45.0	45.0	60.0	90.0	45.0
BEHI Score	4.0	4.0	3.3	3.3	4.0	8.0	3.3
Surface Protection (%)	0.5	0.8	0.8	0.8	0.8	0.5	0.9
BEHI Score	4.3	2.1	2.1	2.1	2.1	4.3	0.9
Bank Material Adjustment	5.0	5.0	5.0	-10.0	5.0	-10.0	-10.0
Stratification Adjustment	5.0	0	0	0	0	0	0
Total BEHI Score	45.1	37.1	17.9	22.7	29.5	24.3	5.7
Rating	Extreme	High	Low	Moderate	Moderate	Moderate	Very Low

NBS Calculation

Thalweg Position Score	2	1	1	2	1	2	1
Toe Depth Ratio Score	1	0	0	1	0	1	0
Local Slope Score	0	1	1	0	0	0	1
Total NBS Rating	3	2	2	3	1	3	2
WARSS NBS Rating	4	3	3	5	1	4	3
Rating	High	Moderate	Moderate	Very High	Very Low	High	Moderate

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	2.4	0.1	0.0	0.2	0.0	0.1	0.0
Erosion Total (ft^3/yr)	2437	49	1	51	8	20	0

Total Erosion (Sheet Total)	2567

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Seniard Creek
Reach: 1B

Date: 4/2/18
Observer: CEG
Page: 4

Observed Values

Reach Name	1B	1B	1B	1B	1B	1B	1B
Station/Location	107+50	107+90	108+00	108+15	108+75	109+00	108+95
Photo No.	R42	R43	R43	R44	R45	R46	R46
Reach Length (ft)	40	25	75	85	20	50	65
Bank	Lt & Rt	Left	Right	Left	Right	Left	Right
Bank Height (ft)	3.5	3.5	1	2	2.5	4	1
Bankfull Height (ft)	1	1	1	1	1	1	1
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Root Density (%)	40%	40%	40%	40%	40%	40%	40%
Bank Angle (deg)	90	80	30	45	80	80	45
Surface Protection (%)	20%	75%	75%	75%	50%	75%	75%
Bank Material	Gravel	Gravel	Silt/Clay	Gravel	Gravel	Cobble	Cobble
Stratification	Moderate	Moderate	None	None	None	Moderate	Moderate
Thalweg Position	Center	Off-center	Center	Center	Off-center	Toe	Center
DTOE/DMEAN	> 1	< 1	< 1	< 1	> 1	> 1	< 1
Local Slope > Avg	No	Yes	No	No	No	No	Yes

BEHI Calculation

Bnk Ht / Bkf Ht	3.5	3.5	1.0	2.0	2.5	4.0	1.0
BEHI Score	10.0	10.0	1.0	8.0	8.8	10.0	1.0
Root Depth / Bnk Ht	0.1	0.1	0.4	0.2	0.2	0.1	0.4
BEHI Score	8.6	8.6	5.2	7.6	8.1	8.8	5.2
Weighted Root Density (%)	0.0	0.0	0.2	0.1	0.1	0.0	0.2
BEHI Score	9.4	9.4	7.9	8.9	9.1	9.5	7.9
Bank Angle (deg)	90.0	80.0	30.0	45.0	80.0	80.0	45.0
BEHI Score	8.0	6.0	2.5	3.3	6.0	6.0	3.3
Surface Protection (%)	0.2	0.8	0.8	0.8	0.5	0.8	0.8
BEHI Score	7.3	2.1	2.1	2.1	4.3	2.1	2.1
Bank Material Adjustment	5.0	5.0	0.0	5.0	5.0	-10.0	-10.0
Stratification Adjustment	5.0	5.0	0	0	0	5.0	5.0
Total BEHI Score	53.4	46.2	18.7	34.9	41.3	31.4	14.5
Rating	Extreme	Extreme	Low	High	Very High	High	Low

NBS Calculation

Thalweg Position Score	1	2	1	1	2	2	1
Toe Depth Ratio Score	1	0	0	0	1	1	0
Local Slope Score	0	1	0	0	0	0	1
Total NBS Rating	2	3	1	1	3	3	2
WARSS NBS Rating	3	4	1	1	4	5	3
Rating	Moderate	High	Very Low	Very Low	High	Very High	Moderate

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	1.3	2.4	0.0	0.1	0.8	0.1	0.0
Erosion Total (ft^3/yr)	377	213	0	16	42	26	1

Total Erosion (Sheet Total)	675

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Seniard Creek
Reach: 1B

Date: 4/2/18
Observer: CEG
Page: 5

Observed Values

Reach Name	1B	1B	1B	1B			
Station/Location	109+50	109+60	109+85	109+85			
Photo No.	R46	R46	R47	R47			
Reach Length (ft)	35	25	15	15			
Bank	Right	Left	Right	Left			
Bank Height (ft)	1	4	1.5	4			
Bankfull Height (ft)	1.2	1.2	1.2	1.2			
Root Depth (ft)	0.4	0.4	0.8	0.8			
Root Density (%)	30%	30%	40%	40%			
Bank Angle (deg)	45	90	60	75			
Surface Protection (%)	75%	10%	75%	50%			
Bank Material	Cobble	Cobble	Cobble	Cobble			
Stratification	Moderate	Moderate	Moderate	Moderate			
Thalweg Position	Center	Toe	Center	Center			
DTOE/DMEAN	< 1	> 1	< 1	< 1			
Local Slope > Avg	Yes	Yes	No	No			

BEHI Calculation

Bnk Ht / Bkf Ht	0.8	3.3	1.3	3.3			
BEHI Score	1.0	10.0	3.9	10.0			
Root Depth / Bnk Ht	0.4	0.1	0.5	0.2			
BEHI Score	5.2	8.8	3.8	7.6			
Weighted Root Density (%)	0.1	0.0	0.2	0.1			
BEHI Score	8.4	9.6	7.2	8.9			
Bank Angle (deg)	45.0	90.0	60.0	75.0			
BEHI Score	3.3	8.0	4.0	5.5			
Surface Protection (%)	0.8	0.1	0.8	0.5			
BEHI Score	2.1	10.0	2.1	4.3			
Bank Material Adjustment	-10.0	-10.0	-10.0	-10.0			
Stratification Adjustment	5.0	5.0	5.0	5.0			
Total BEHI Score	15.0	41.4	16.1	31.3			
Rating	Low	Very High	Low	High			

NBS Calculation

Thalweg Position Score	1	2	1	1			
Toe Depth Ratio Score	0	1	0	0			
Local Slope Score	1	1	0	0			
Total NBS Rating	2	4	1	1			
WARSS NBS Rating	3	6	1	1			
Rating	Moderate	Extreme	Very Low	Very Low			

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.0	0.7	0.0	0.1			
Erosion Total (ft^3/yr)	0	71	0	6			

Total Erosion (Sheet Total): 77

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Seniard Creek
Reach: 1B

Date: 4/2/18
Observer: CEG
Page: 6

Observed Values

Reach Name	1B	1B	1B	1B	1B	1B	1B
Station/Location	110+00	110+00	110+20	110+35	110+65	111+05	111+40
Photo No.	R47	R47	R48	R48	R49	R49	R50
Reach Length (ft)	65	20	15	105	40	85	50
Bank	Right	Left	Right	Left	Right	Left	Right
Bank Height (ft)	1	3.5	3.5	3.5	2	2.5	1.5
Bankfull Height (ft)	1	1	1	1	1	1	1
Root Depth (ft)	0.8	0.8	0.8	0.8	0.8	0.4	0.8
Root Density (%)	40%	40%	30%	40%	40%	30%	40%
Bank Angle (deg)	60	60	90	45	90	60	90
Surface Protection (%)	80%	80%	40%	80%	80%	80%	80%
Bank Material	Gravel	Gravel	Gravel	Gravel	Silt/Clay	Silt/Clay	Silt/Clay
Stratification	Moderate	Moderate	Moderate	Moderate	None	None	None
Thalweg Position	Off-center	Off-center	Off-center	Off-center	Center	Off-center	Off-center
DTOE/DMEAN	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Local Slope > Avg	No	No	No	No	No	No	No

BEHI Calculation

Bnk Ht / Bkf Ht	1.0	3.5	3.5	3.5	2.0	2.5	1.5
BEHI Score	1.0	10.0	10.0	10.0	8.0	8.8	5.3
Root Depth / Bnk Ht	0.8	0.2	0.2	0.2	0.4	0.2	0.5
BEHI Score	2.5	7.3	7.3	7.3	5.2	8.1	3.8
Weighted Root Density (%)	0.3	0.1	0.1	0.1	0.2	0.0	0.2
BEHI Score	5.8	8.8	9.1	8.8	7.9	9.4	7.2
Bank Angle (deg)	60.0	60.0	90.0	45.0	90.0	60.0	90.0
BEHI Score	4.0	4.0	8.0	3.3	8.0	4.0	8.0
Surface Protection (%)	0.8	0.8	0.4	0.8	0.8	0.8	0.8
BEHI Score	1.7	1.7	5.1	1.7	1.7	1.7	1.7
Bank Material Adjustment	5.0	5.0	5.0	5.0	0.0	0.0	0.0
Stratification Adjustment	5.0	5.0	5.0	5.0	0	0	0
Total BEHI Score	25.0	41.8	49.5	41.0	30.8	32.0	26.0
Rating	Moderate	Very High	Extreme	Very High	High	High	Moderate

NBS Calculation

Thalweg Position Score	2	2	2	2	1	2	2
Toe Depth Ratio Score	0	0	0	0	0	0	0
Local Slope Score	0	0	0	0	0	0	0
Total NBS Rating	2	2	2	2	1	2	2
WARSS NBS Rating	2	2	2	2	1	2	2
Rating	Low	Low	Low	Low	Very Low	Low	Low

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.0	0.6	0.7	0.6	0.1	0.1	0.0
Erosion Total (ft^3/yr)	2	42	39	220	8	22	2

Total Erosion (Sheet Total): 335

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Seniard Creek
Reach: 1B

Date: 4/2/18
Observer: CEG
Page: 7

Observed Values

Reach Name	1B	1B	1B	1B	1B	1B	1B
Station/Location	111+90	111+90	112+40	112+28	112+80	112+90	113+25
Photo No.	R50	R50	R51	R51	R52	R52	R53
Reach Length (ft)	50	38	50	52	50	35	25
Bank	Lt & Rt	Left	Right	Left	Right	Left	Right
Bank Height (ft)	1	2	1	1.5	3	1.5	3.5
Bankfull Height (ft)	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Root Depth (ft)	0.6	0.4	0.4	0.6	0.6	0.6	0.4
Root Density (%)	40%	30%	30%	30%	30%	40%	30%
Bank Angle (deg)	45	90	30	30	80	40	90
Surface Protection (%)	80%	40%	40%	70%	60%	75%	30%
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Gravel	Gravel	Silt/Clay	Silt/Clay
Stratification	None	None	Moderate	None	None	Moderate	Moderate
Thalweg Position	Off-center	Off-center	Toe	Off-center	Off-center	Toe	Center
DTOE/DMEAN	> 1	> 1	> 1	< 1	< 1	> 1	> 1
Local Slope > Avg	No	No	Yes	No	No	Yes	No

BEHI Calculation

Bnk Ht / Bkf Ht	1.2	2.4	1.2	1.8	3.5	1.8	4.1
BEHI Score	3.1	8.6	3.1	6.7	10.0	6.7	10.0
Root Depth / Bnk Ht	0.6	0.2	0.4	0.4	0.2	0.4	0.1
BEHI Score	3.5	7.6	5.2	5.2	7.6	5.2	8.6
Weighted Root Density (%)	0.2	0.1	0.1	0.1	0.1	0.2	0.0
BEHI Score	6.8	9.2	8.4	8.4	9.2	7.9	9.5
Bank Angle (deg)	45.0	90.0	30.0	30.0	80.0	40.0	90.0
BEHI Score	3.3	8.0	2.5	2.5	6.0	3.0	8.0
Surface Protection (%)	0.8	0.4	0.4	0.7	0.6	0.8	0.3
BEHI Score	1.7	5.1	5.1	2.6	3.4	2.1	6.0
Bank Material Adjustment	0.0	0.0	0.0	5.0	5.0	0.0	0.0
Stratification Adjustment	0	0	5.0	0	0	5.0	5.0
Total BEHI Score	18.4	38.5	29.4	30.3	41.2	29.9	47.2
Rating	Low	High	Moderate	High	Very High	High	Extreme

NBS Calculation

Thalweg Position Score	2	2	2	2	2	2	1
Toe Depth Ratio Score	1	1	1	0	0	1	1
Local Slope Score	0	0	1	0	0	1	0
Total NBS Rating	3	3	4	2	2	4	2
WARSS NBS Rating	4	4	6	2	2	6	3
Rating	High	High	Extreme	Low	Low	Extreme	Moderate

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.0	0.1	0.4	0.1	0.6	0.1	1.3
Erosion Total (ft^3/yr)	4	9	20	8	90	7	118

Total Erosion (Sheet Total)	256

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Seniard Creek
Reach: 1B

Date: 4/2/18
Observer: CEG
Page: 8

Observed Values							
Reach Name	1B	1B	1B	1B	1B	1B	
Station/Location	113+30	113+50	113+85	114+40	114+30	114+70	
Photo No.	R54	R54	R55	R55	R55	R56	
Reach Length (ft)	55	90	45	60	40	30	
Bank	Lt & Rt	Left	Right	Left	Right	Left	
Bank Height (ft)	1.5	1.5	3.5	1.5	3.5	1.5	
Bankfull Height (ft)	1.05	1.05	1.05	1.05	1.05	1.05	
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4	0.4	
Root Density (%)	30%	30%	30%	40%	30%	30%	
Bank Angle (deg)	45	40	90	40	70	45	
Surface Protection (%)	60%	60%	40%	60%	50%	50%	
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	
Stratification	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	
Thalweg Position	Center	Center	Toe	Center	Off-center	Toe	
DTOE/DMEAN	< 1	< 1	> 1	< 1	> 1	> 1	
Local Slope > Avg	Yes	Yes	Yes	Yes	Yes	No	
BEHI Calculation							
Bnk Ht / Bkf Ht	1.4	1.4	3.3	1.4	3.3	1.4	
BEHI Score	4.9	4.9	10.0	4.9	10.0	4.9	
Root Depth / Bnk Ht	0.3	0.3	0.1	0.3	0.1	0.3	
BEHI Score	6.8	6.8	8.6	6.8	8.6	6.8	
Weighted Root Density (%)	0.1	0.1	0.0	0.1	0.0	0.1	
BEHI Score	8.9	8.9	9.5	8.6	9.5	8.9	
Bank Angle (deg)	45.0	40.0	90.0	40.0	70.0	45.0	
BEHI Score	3.3	3.0	8.0	3.0	5.0	3.3	
Surface Protection (%)	0.6	0.6	0.4	0.6	0.5	0.5	
BEHI Score	3.4	3.4	5.1	3.4	4.3	4.3	
Bank Material Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	
Stratification Adjustment	5.0	5.0	5.0	5.0	5.0	5.0	
Total BEHI Score	32.3	32.0	46.3	31.7	42.5	33.1	
Rating	High	High	Extreme	High	Very High	High	
NBS Calculation							
Thalweg Position Score	1	1	2	1	2	2	
Toe Depth Ratio Score	0	0	1	0	1	1	
Local Slope Score	1	1	1	1	1	0	
Total NBS Rating	2	2	4	2	4	3	
WARSS NBS Rating	3	3	6	3	6	5	
Rating	Moderate	Moderate	Extreme	Moderate	Extreme	Very High	
Erosion Rate Prediction							
State	NC						
Erosion Rate (ft/yr)	0.1	0.1	1.3	0.1	0.5	0.1	
Erosion Total (ft^3/yr)	18	15	212	8	71	4	

Total Erosion (Sheet Total) 329

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Seniard Creek
Reach: 1B

Date: 4/2/18
Observer: CEG
Page: 9

Observed Values

Reach Name	1B	1B	1B	1B	1B	1B	1B
Station/Location	115+00	115+25	115+00	115+15	115+50	115+95	115+80
Photo No.	R57	R57	R57	R57	R58	R58	R58
Reach Length (ft)	25	55	15	35	45	10	50
Bank	Lt & Rt	Left	Right	Left	Right	Left	Right
Bank Height (ft)	0.5	2	2.5	1	0.5	2	1
Bankfull Height (ft)	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Root Depth (ft)	0.4	0.4	0.8	0.4	0.6	0.4	0.6
Root Density (%)	25%	35%	40%	40%	40%	30%	30%
Bank Angle (deg)	70	50	80	45	25	70	30
Surface Protection (%)	60%	60%	70%	60%	50%	40%	50%
Bank Material	Silt/Clay	Silt/Clay	Cobble	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay
Stratification	Moderate	Moderate	Moderate	Moderate	None	Moderate	None
Thalweg Position	Center	Center	Off-center	Center	Center	Off-center	Center
DTOE/DMEAN	< 1	< 1	> 1	< 1	> 1	> 1	> 1
Local Slope > Avg	No	No	No	No	No	No	No

BEHI Calculation

Bnk Ht / Bkf Ht	0.5	1.9	2.4	1.0	0.5	1.9	1.0
BEHI Score	1.0	7.4	8.6	1.0	1.0	7.4	1.0
Root Depth / Bnk Ht	0.8	0.2	0.3	0.4	1.2	0.2	0.6
BEHI Score	2.5	7.6	6.2	5.2	0.0	7.6	3.5
Weighted Root Density (%)	0.2	0.1	0.1	0.2	0.5	0.1	0.2
BEHI Score	7.3	9.1	8.3	7.9	4.5	9.2	7.6
Bank Angle (deg)	70.0	50.0	80.0	45.0	25.0	70.0	30.0
BEHI Score	5.0	3.5	6.0	3.3	2.3	5.0	2.5
Surface Protection (%)	0.6	0.6	0.7	0.6	0.5	0.4	0.5
BEHI Score	3.4	3.4	2.6	3.4	4.3	5.1	4.3
Bank Material Adjustment	0.0	0.0	-10.0	0.0	0.0	0.0	0.0
Stratification Adjustment	5.0	5.0	5.0	5.0	0	5.0	0
Total BEHI Score	24.3	36.0	26.6	25.7	12.0	39.3	18.9
Rating	Moderate	High	Moderate	Moderate	Low	High	Low

NBS Calculation

Thalweg Position Score	1	1	2	1	1	2	1
Toe Depth Ratio Score	0	0	1	0	1	1	1
Local Slope Score	0	0	0	0	0	0	0
Total NBS Rating	1	1	3	1	2	3	2
WARSS NBS Rating	1	1	4	1	3	4	3
Rating	Very Low	Very Low	High	Very Low	Moderate	High	Moderate

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.0	0.1	0.1	0.0	0.0	0.1	0.0
Erosion Total (ft^3/yr)	0	10	4	1	0	2	1

Total Erosion (Sheet Total): 19

Erosion Rate Calculations

Project:	Seniard	Date:	4/2/18
Project No.:	172621103-SNRD	Observer:	CEG
Stream:	Seniard Creek	Page:	10
Reach:	1B		

Observed Values

Reach Name	1B	1B	1B	1B	1B	1B	1B
Station/Location	116+30	116+05	116+45	116+55	116+70	117+15	117+30
Photo No.	R29	R29	R29	R29	R29	R29	R29
Reach Length (ft)	15	50	25	75	45	15	15
Bank	Lt & Rt	Left	Right	Left	Right	Left	Right
Bank Height (ft)	3.5	0.5	1.5	3.5	1.5	1	0.5
Bankfull Height (ft)	1	1	1	1	1	1	1
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Root Density (%)	25%	30%	30%	30%	30%	30%	30%
Bank Angle (deg)	90	20	60	75	80	20	20
Surface Protection (%)	20%	60%	60%	50%	40%	50%	50%
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay
Stratification	None	None	None	None	None	None	None
Thalweg Position	Center	Center	Off-center	Center	Off-center	Off-center	Center
DTOE/DMEAN	< 1	< 1	< 1	< 1	> 1	< 1	< 1
Local Slope > Avg	Yes	Yes	Yes	No	No	No	Yes

BEHI Calculation

Bnk Ht / Bkf Ht	3.5	0.5	1.5	3.5	1.5	1.0	0.5
BEHI Score	10.0	1.0	5.3	10.0	5.3	1.0	1.0
Root Depth / Bnk Ht	0.1	0.8	0.3	0.1	0.3	0.4	0.8
BEHI Score	8.6	2.5	6.8	8.6	6.8	5.2	2.5
Weighted Root Density (%)	0.0	0.2	0.1	0.0	0.1	0.1	0.2
BEHI Score	9.6	6.8	8.9	9.5	8.9	8.4	6.8
Bank Angle (deg)	90.0	20.0	60.0	75.0	80.0	20.0	20.0
BEHI Score	8.0	2.0	4.0	5.5	6.0	2.0	2.0
Surface Protection (%)	0.2	0.6	0.6	0.5	0.4	0.5	0.5
BEHI Score	7.3	3.4	3.4	4.3	5.1	4.3	4.3
Bank Material Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stratification Adjustment	0	0	0	0	0	0	0
Total BEHI Score	43.6	15.7	28.4	38.0	32.1	20.9	16.6
Rating	Very High	Low	Moderate	High	High	Moderate	Low

NBS Calculation

Thalweg Position Score	1	1	2	1	2	2	1
Toe Depth Ratio Score	0	0	0	0	1	0	0
Local Slope Score	1	1	1	0	0	0	1
Total NBS Rating	2	2	3	1	3	2	2
WARSS NBS Rating	3	3	4	1	4	2	3
Rating	Moderate	Moderate	High	Very Low	High	Low	Moderate

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.7	0.0	0.1	0.1	0.1	0.0	0.0
Erosion Total (ft^3/yr)	75	0	4	25	8	0	0

Total Erosion (Sheet Total)	113

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Seniard Creek
Reach: 2

Date: 4/2/18
Observer: CEG
Page: 11

Observed Values

Reach Name	2	2	2	2	2	2	2
Station/Location	117+30	117+45	117+80	118+50	118+90	119+15	119+15
Photo No.	R19	R19	R19	R20	R21	R21	R21
Reach Length (ft)	50	105	110	65	25	85	85
Bank	Lt & Rt	Left	Right	Left	Right	Left	Right
Bank Height (ft)	2.5	3.5	1.5	1.5	3.5	2	3
Bankfull Height (ft)	1	1	1	1	1	1	1
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Root Density (%)	30%	30%	30%	30%	30%	30%	30%
Bank Angle (deg)	50	80	30	40	75	30	45
Surface Protection (%)	40%	50%	60%	60%	40%	60%	60%
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay
Stratification	None	None	None	Moderate	None	None	None
Thalweg Position	Off-center	Center	Off-center	Center	Off-center	Off-center	Off-center
DTOE/DMEAN	> 1	< 1	> 1	< 1	< 1	> 1	< 1
Local Slope > Avg	No	No	Yes	Yes	Yes	Yes	Yes

BEHI Calculation

Bnk Ht / Bkf Ht	2.5	3.5	1.5	1.5	3.5	2.0	3.0
BEHI Score	8.8	10.0	5.3	5.3	10.0	8.0	9.6
Root Depth / Bnk Ht	0.2	0.1	0.3	0.3	0.1	0.2	0.1
BEHI Score	8.1	8.6	6.8	6.8	8.6	7.6	8.4
Weighted Root Density (%)	0.0	0.0	0.1	0.1	0.0	0.1	0.0
BEHI Score	9.4	9.5	8.9	8.9	9.5	9.2	9.5
Bank Angle (deg)	50.0	80.0	30.0	40.0	75.0	30.0	45.0
BEHI Score	3.5	6.0	2.5	3.0	5.5	2.5	3.3
Surface Protection (%)	0.4	0.5	0.6	0.6	0.4	0.6	0.6
BEHI Score	5.1	4.3	3.4	3.4	5.1	3.4	3.4
Bank Material Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stratification Adjustment	0	0	0	5.0	0	0	0
Total BEHI Score	34.9	38.5	26.9	32.4	38.8	30.7	34.1
Rating	High	High	Moderate	High	High	High	High

NBS Calculation

Thalweg Position Score	2	1	2	1	2	2	2
Toe Depth Ratio Score	1	0	1	0	0	1	0
Local Slope Score	0	0	1	1	1	1	1
Total NBS Rating	3	1	4	2	3	4	3
WARSS NBS Rating	4	1	6	3	4	6	4
Rating	High	Very Low	Extreme	Moderate	High	Extreme	High

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1	0.4	0.1	0.1	0.1	0.1
Erosion Total (ft^3/yr)	30	35	66	11	10	24	31

Total Erosion (Sheet Total)	206

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Seniard Creek
Reach: 2

Date: 4/2/18
Observer: TS, CME, CE
Page: 12

Observed Values

Reach Name	2	2	2	2	2	2	
Station/Location	120+00	120+20	121+10	121+90	122+15	122+45	
Photo No.	R23	R23	R24	R25	R26	R26	
Reach Length (ft)	20	90	80	25	30	52.63	
Bank	Lt & Rt	Left	Right	Left	Right	Left	
Bank Height (ft)	4	3	6	6	7	8	
Bankfull Height (ft)	1	1	1	1	1	1	
Root Depth (ft)	0.3	0.4	0.4	0.4	0.4	0.4	
Root Density (%)	20%	30%	30%	30%	30%	30%	
Bank Angle (deg)	80	75	90	80	85	90	
Surface Protection (%)	20%	60%	80%	70%	80%	80%	
Bank Material	Silt/Clay	Silt/Clay	Cobble	Cobble	Cobble	Cobble	
Stratification	None	None	None	None	None	None	
Thalweg Position	Center	Center	Center	Off-center	Center	Center	
DTOE/DMEAN	< 1	< 1	< 1	< 1	< 1	< 1	
Local Slope > Avg	Yes	Yes	Yes	No	No	No	

BEHI Calculation

Bnk Ht / Bkf Ht	4.0	3.0	6.0	6.0	7.0	8.0	
BEHI Score	10.0	9.6	10.0	10.0	10.0	10.0	
Root Depth / Bnk Ht	0.1	0.1	0.1	0.1	0.1	0.1	
BEHI Score	9.1	8.4	9.2	9.2	9.3	9.4	
Weighted Root Density (%)	0.0	0.0	0.0	0.0	0.0	0.0	
BEHI Score	9.8	9.5	9.7	9.7	9.8	9.8	
Bank Angle (deg)	80.0	75.0	90.0	80.0	85.0	90.0	
BEHI Score	6.0	5.5	8.0	6.0	7.0	8.0	
Surface Protection (%)	0.2	0.6	0.8	0.7	0.8	0.8	
BEHI Score	7.3	3.4	1.7	2.6	1.7	1.7	
Bank Material Adjustment	0.0	0.0	-10.0	-10.0	-10.0	-10.0	
Stratification Adjustment	0	0	0	0	0	0	
Total BEHI Score	42.2	36.4	28.6	27.5	27.8	28.9	
Rating	Very High	High	Moderate	Moderate	Moderate	Moderate	

NBS Calculation

Thalweg Position Score	1	1	1	2	1	1	
Toe Depth Ratio Score	0	0	0	0	0	0	
Local Slope Score	1	1	1	0	0	0	
Total NBS Rating	2	2	2	2	1	1	
WARSS NBS Rating	3	3	3	2	1	1	
Rating	Moderate	Moderate	Moderate	Low	Very Low	Very Low	

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.7	0.1	0.1	0.0	0.0	0.0	
Erosion Total (ft^3/yr)	114	30	29	5	4	7	

Total Erosion (Sheet Total)	188

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Seniard Creek
Reach: 2

Date: 4/2/18
Observer: CEG
Page: 13

Observed Values

Reach Name	2	2	2	2	2		
Station/Location	120+00	120+55	121+50	122+20	122+48		
Photo No.	R23	R23	R25	R26	R26		
Reach Length (ft)	55	95	70	28	39.63		
Bank	Lt & Rt	Left	Right	Left	Right		
Bank Height (ft)	3	3	4	7	2		
Bankfull Height (ft)	1	1	1	1	1		
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4		
Root Density (%)	30%	30%	30%	30%	30%		
Bank Angle (deg)	75	80	50	65	70		
Surface Protection (%)	60%	70%	60%	50%	60%		
Bank Material	Silt/Clay	Silt/Clay	Cobble	Cobble	Cobble		
Stratification	None	None	None	None	None		
Thalweg Position	Center	Off-center	Off-center	Center	Center		
DTOE/DMEAN	> 1	< 1	< 1	< 1	< 1		
Local Slope > Avg	No	Yes	No	No	No		

BEHI Calculation

Bnk Ht / Bkf Ht	3.0	3.0	4.0	7.0	2.0		
BEHI Score	9.6	9.6	10.0	10.0	8.0		
Root Depth / Bnk Ht	0.1	0.1	0.1	0.1	0.2		
BEHI Score	8.4	8.4	8.8	9.3	7.6		
Weighted Root Density (%)	0.0	0.0	0.0	0.0	0.1		
BEHI Score	9.5	9.5	9.6	9.8	9.2		
Bank Angle (deg)	75.0	80.0	50.0	65.0	70.0		
BEHI Score	5.5	6.0	3.5	4.5	5.0		
Surface Protection (%)	0.6	0.7	0.6	0.5	0.6		
BEHI Score	3.4	2.6	3.4	4.3	3.4		
Bank Material Adjustment	0.0	0.0	-10.0	-10.0	-10.0		
Stratification Adjustment	0	0	0	0	0		
Total BEHI Score	36.4	36.0	25.3	27.9	23.2		
Rating	High	High	Moderate	Moderate	Moderate		

NBS Calculation

Thalweg Position Score	1	2	2	1	1		
Toe Depth Ratio Score	1	0	0	0	0		
Local Slope Score	0	1	0	0	0		
Total NBS Rating	2	3	2	1	1		
WARSS NBS Rating	3	4	2	1	1		
Rating	Moderate	High	Low	Very Low	Very Low		

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1	0.0	0.0	0.0		
Erosion Total (ft^3/yr)	37	34	9	3	1		

Total Erosion (Sheet Total)	84

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Sitton Creek
Reach: 1

Date: 4/10/18
Observer: CEG
Page: 14

Observed Values

Reach Name	1	1	1	1	1	1	
Station/Location	200+00	200+00	201+20	201+20	202+20	201+95	
Photo No.	R1	R1	R4	R4	R5	R4	
Reach Length (ft)	120	120	100	75	55	45	
Bank	Right	Left	Right	Left	Right	Left	
Bank Height (ft)	3	1.5	3	2	2	3	
Bankfull Height (ft)	1	1	1	1	1	1	
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4	0.4	
Root Density (%)	20%	40%	30%	40%	40%	40%	
Bank Angle (deg)	80	30	60	60	40	50	
Surface Protection (%)	5%	60%	60%	60%	60%	60%	
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Gravel	Gravel	
Stratification	Moderate	None	None	None	None	None	
Thalweg Position	Toe	Center	Center	Toe	Off-center	Off-center	
DTOE/DMEAN	> 1	< 1	< 1	> 1	< 1	< 1	
Local Slope > Avg	No	No	No	No	No	No	

BEHI Calculation

Bnk Ht / Bkf Ht	3.0	1.5	3.0	2.0	2.0	3.0	
BEHI Score	9.6	5.3	9.6	8.0	8.0	9.6	
Root Depth / Bnk Ht	0.1	0.3	0.1	0.2	0.2	0.1	
BEHI Score	8.4	6.8	8.4	7.6	7.6	8.4	
Weighted Root Density (%)	0.0	0.1	0.0	0.1	0.1	0.1	
BEHI Score	9.6	8.6	9.5	8.9	8.9	9.3	
Bank Angle (deg)	80.0	30.0	60.0	60.0	40.0	50.0	
BEHI Score	6.0	2.5	4.0	4.0	3.0	3.5	
Surface Protection (%)	0.1	0.6	0.6	0.6	0.6	0.6	
BEHI Score	10.0	3.4	3.4	3.4	3.4	3.4	
Bank Material Adjustment	0.0	0.0	0.0	0.0	5.0	5.0	
Stratification Adjustment	5.0	0	0	0	0	0	
Total BEHI Score	48.6	26.6	34.9	32.0	36.0	39.2	
Rating	Extreme	Moderate	High	High	High	High	

NBS Calculation

Thalweg Position Score	2	1	1	2	2	2	
Toe Depth Ratio Score	1	0	0	1	0	0	
Local Slope Score	0	0	0	0	0	0	
Total NBS Rating	3	1	1	3	2	2	
WARSS NBS Rating	5	1	1	5	2	2	
Rating	Very High	Very Low	Very Low	Very High	Low	Low	

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	4.4	0.0	0.1	0.1	0.1	0.1	
Erosion Total (ft^3/yr)	1589	3	28	19	11	14	

Total Erosion (Sheet Total): 1665

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Sitton Creek
Reach: 1

Date: 4/10/18
Observer: CEG
Page: 15

Observed Values

Reach Name	1	1	1	1	1		
Station/Location	202+75	203+15	204+00	202+40	202+65		
Photo No.	R6	R6	R8	R5	R5		
Reach Length (ft)	40	85	100	25	70		
Bank	Lt & Rt	Left	Right	Left	Right		
Bank Height (ft)	4	1.5	1.5	4	1.5		
Bankfull Height (ft)	1	1	1	1	1		
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4		
Root Density (%)	30%	35%	20%	40%	35%		
Bank Angle (deg)	80	30	20	70	35		
Surface Protection (%)	20%	60%	40%	60%	60%		
Bank Material	Gravel	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay		
Stratification	Moderate	None	None	None	None		
Thalweg Position	Center	Off-center	Center	Off-center	Off-center		
DTOE/DMEAN	< 1	< 1	< 1	< 1	< 1		
Local Slope > Avg	Yes	Yes	No	No	No		

BEHI Calculation

Bnk Ht / Bkf Ht	4.0	1.5	1.5	4.0	1.5		
BEHI Score	10.0	5.3	5.3	10.0	5.3		
Root Depth / Bnk Ht	0.1	0.3	0.3	0.1	0.3		
BEHI Score	8.8	6.8	6.8	8.8	6.8		
Weighted Root Density (%)	0.0	0.1	0.1	0.0	0.1		
BEHI Score	9.6	8.8	9.3	9.5	8.8		
Bank Angle (deg)	80.0	30.0	20.0	70.0	35.0		
BEHI Score	6.0	2.5	2.0	5.0	2.8		
Surface Protection (%)	0.2	0.6	0.4	0.6	0.6		
BEHI Score	7.3	3.4	5.1	3.4	3.4		
Bank Material Adjustment	5.0	0.0	0.0	0.0	0.0		
Stratification Adjustment	5.0	0	0	0	0		
Total BEHI Score	51.7	26.7	28.5	36.7	27.0		
Rating	Extreme	Moderate	Moderate	High	Moderate		

NBS Calculation

Thalweg Position Score	1	2	1	2	2		
Toe Depth Ratio Score	0	0	0	0	0		
Local Slope Score	1	1	0	0	0		
Total NBS Rating	2	3	1	2	2		
WARSS NBS Rating	3	4	1	2	2		
Rating	Moderate	High	Very Low	Low	Low		

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	1.3	0.1	0.0	0.1	0.0		
Erosion Total (ft^3/yr)	431	14	3	10	3		

Total Erosion (Sheet Total)	461

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Sitton Creek
Reach: 1

Date: 4/10/18
Observer: CEG
Page: 16

Observed Values

Reach Name	1	1	1	1	1	1	
Station/Location	203+35	204+50	205+00	205+60	206+15	206+95	
Photo No.	R7	R8	R9	R9	R10	R11	
Reach Length (ft)	115	50	60	55	80	45	
Bank	Lt & Rt	Left	Right	Left	Right	Left	
Bank Height (ft)	1.5	4	2	2.5	2.5	2.5	
Bankfull Height (ft)	1	1	1	1	1	1	
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4	0.4	
Root Density (%)	30%	50%	30%	30%	30%	45%	
Bank Angle (deg)	20	45	45	70	70	50	
Surface Protection (%)	50%	60%	60%	50%	50%	60%	
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	
Stratification	None	None	None	None	None	None	
Thalweg Position	Center	Center	Center	Center	Off-center	Off-center	
DTOE/DMEAN	> 1	< 1	< 1	< 1	> 1	> 1	
Local Slope > Avg	No	No	No	No	No	No	

BEHI Calculation

Bnk Ht / Bkf Ht	1.5	4.0	2.0	2.5	2.5	2.5	
BEHI Score	5.3	10.0	8.0	8.8	8.8	8.8	
Root Depth / Bnk Ht	0.3	0.1	0.2	0.2	0.2	0.2	
BEHI Score	6.8	8.8	7.6	8.1	8.1	8.1	
Weighted Root Density (%)	0.1	0.1	0.1	0.0	0.0	0.1	
BEHI Score	8.9	9.3	9.2	9.4	9.4	9.0	
Bank Angle (deg)	20.0	45.0	45.0	70.0	70.0	50.0	
BEHI Score	2.0	3.3	3.3	5.0	5.0	3.5	
Surface Protection (%)	0.5	0.6	0.6	0.5	0.5	0.6	
BEHI Score	4.3	3.4	3.4	4.3	4.3	3.4	
Bank Material Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	
Stratification Adjustment	0	0	0	0	0	0	
Total BEHI Score	27.3	34.8	31.5	35.5	35.5	32.8	
Rating	Moderate	High	High	High	High	High	

NBS Calculation

Thalweg Position Score	1	1	1	1	2	2	
Toe Depth Ratio Score	1	0	0	0	1	1	
Local Slope Score	0	0	0	0	0	0	
Total NBS Rating	2	1	1	1	3	3	
WARSS NBS Rating	3	1	1	1	4	4	
Rating	Moderate	Very Low	Very Low	Very Low	High	High	

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1	0.1	0.1	0.1	0.1	
Erosion Total (ft^3/yr)	21	19	11	13	24	13	

Total Erosion (Sheet Total) 101

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Sitton Creek
Reach: 1

Date: 4/10/18
Observer: CEG
Page: 17

Observed Values

Reach Name	1	1	1	1	1	1	1
Station/Location	207+40	208+20	209+45	205+00	206+15	206+40	207+70
Photo No.	R12	R13	R15	R9	R10	R11	R12
Reach Length (ft)	80	125	55	115	25	130	40
Bank	Lt & Rt	Left	Right	Left	Right	Left	Right
Bank Height (ft)	2	1.5	3	1.5	5	1.5	2.5
Bankfull Height (ft)	1	1	1	1	1	1	1
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Root Density (%)	30%	40%	30%	40%	20%	30%	30%
Bank Angle (deg)	50	35	80	40	90	50	80
Surface Protection (%)	60%	60%	40%	60%	20%	60%	50%
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay
Stratification	None	None	None	None	None	None	None
Thalweg Position	Off-center	Center	Off-center	Center	Center	Center	Center
DTOE/DMEAN	> 1	> 1	> 1	< 1	> 1	< 1	> 1
Local Slope > Avg	No	No	No	No	No	No	No

BEHI Calculation

Bnk Ht / Bkf Ht	2.0	1.5	3.0	1.5	5.0	1.5	2.5
BEHI Score	8.0	5.3	9.6	5.3	10.0	5.3	8.8
Root Depth / Bnk Ht	0.2	0.3	0.1	0.3	0.1	0.3	0.2
BEHI Score	7.6	6.8	8.4	6.8	9.0	6.8	8.1
Weighted Root Density (%)	0.1	0.1	0.0	0.1	0.0	0.1	0.0
BEHI Score	9.2	8.6	9.5	8.6	9.8	8.9	9.4
Bank Angle (deg)	50.0	35.0	80.0	40.0	90.0	50.0	80.0
BEHI Score	3.5	2.8	6.0	3.0	8.0	3.5	6.0
Surface Protection (%)	0.6	0.6	0.4	0.6	0.2	0.6	0.5
BEHI Score	3.4	3.4	5.1	3.4	7.3	3.4	4.3
Bank Material Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stratification Adjustment	0	0	0	0	0	0	0
Total BEHI Score	31.7	26.8	38.6	27.1	44.2	27.9	36.5
Rating	High	Moderate	High	Moderate	Very High	Moderate	High

NBS Calculation

Thalweg Position Score	2	1	2	1	1	1	1
Toe Depth Ratio Score	1	1	1	0	1	0	1
Local Slope Score	0	0	0	0	0	0	0
Total NBS Rating	3	2	3	1	2	1	2
WARSS NBS Rating	4	3	4	1	3	1	3
Rating	High	Moderate	High	Very Low	Moderate	Very Low	Moderate

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1	0.1	0.0	0.7	0.0	0.1
Erosion Total (ft^3/yr)	38	11	20	3	89	3	11

Total Erosion (Sheet Total)	176

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Sitton Creek
Reach: 1

Date: 4/10/18
Observer: CEG
Page: 18

Observed Values

Reach Name	1	1	1	1	1	1	1
Station/Location	208+10	208+30	210+00	210+00	210+20	210+40	210+20
Photo No.	R13	R13	R16	R16	R16	R16	R16
Reach Length (ft)	20	170	20	20	20	38.67	58.67
Bank	Lt & Rt	Left	Right	Left	Right	Left	Right
Bank Height (ft)	1	1.25	3.5	1.5	3.5	5	2
Bankfull Height (ft)	1	1	1	1	1	1	1
Root Depth (ft)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Root Density (%)	25%	35%	40%	30%	30%	30%	40%
Bank Angle (deg)	90	60	50	25	75	45	50
Surface Protection (%)	10%	60%	60%	50%	50%	70%	70%
Bank Material	Silt/Clay	Silt/Clay	Gravel	Gravel	Silt/Clay	Silt/Clay	Silt/Clay
Stratification	None	None	Moderate	Moderate	Moderate	Moderate	Moderate
Thalweg Position	Toe	Off-center	Center	Center	Center	Off-center	Center
DTOE/DMEAN	> 1	> 1	< 1	< 1	< 1	> 1	< 1
Local Slope > Avg	No	No	Yes	No	No	No	No

BEHI Calculation

Bnk Ht / Bkf Ht	1.0	1.3	3.5	1.5	3.5	5.0	2.0
BEHI Score	1.0	3.9	10.0	5.3	10.0	10.0	8.0
Root Depth / Bnk Ht	0.4	0.3	0.1	0.3	0.1	0.1	0.2
BEHI Score	5.2	6.2	8.6	6.8	8.6	9.0	7.6
Weighted Root Density (%)	0.1	0.1	0.0	0.1	0.0	0.0	0.1
BEHI Score	8.7	8.5	9.4	8.9	9.5	9.7	8.9
Bank Angle (deg)	90.0	60.0	50.0	25.0	75.0	45.0	50.0
BEHI Score	8.0	4.0	3.5	2.3	5.5	3.3	3.5
Surface Protection (%)	0.1	0.6	0.6	0.5	0.5	0.7	0.7
BEHI Score	10.0	3.4	3.4	4.3	4.3	2.6	2.6
Bank Material Adjustment	0.0	0.0	5.0	5.0	0.0	0.0	0.0
Stratification Adjustment	0	0	5.0	5.0	5.0	5.0	5.0
Total BEHI Score	32.9	26.0	44.9	37.5	43.0	39.5	35.6
Rating	High	Moderate	Very High	High	Very High	Very High	High

NBS Calculation

Thalweg Position Score	2	2	1	1	1	2	1
Toe Depth Ratio Score	1	1	0	0	0	1	0
Local Slope Score	0	0	1	0	0	0	0
Total NBS Rating	3	3	2	1	1	3	1
WARSS NBS Rating	5	4	3	1	1	4	1
Rating	Very High	High	Moderate	Very Low	Very Low	High	Very Low

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1	0.7	0.1	0.5	0.8	0.1
Erosion Total (ft^3/yr)	5	24	50	3	35	163	11

Total Erosion (Sheet Total)	291

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: David Branch
Reach: 1

Date: 4/10/18
Observer: CEG
Page: 19

Observed Values

Reach Name	1	1	1	1	1	1	1
Station/Location	400+00	400+00	400+25	400+25	400+45	401+00	401+45
Photo No.	R 64	R64	R 65	R 65	R65	R66	R66
Reach Length (ft)	20	20	20	120	55	45	105
Bank	Right	Left	Right	Left	Right	Left	Right
Bank Height (ft)	1	2	2	1.5	1.5	2	1
Bankfull Height (ft)	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Root Depth (ft)	0.4	0.4	0.6	0.6	0.6	0.6	0.6
Root Density (%)	30%	30%	50%	40%	40%	60%	30%
Bank Angle (deg)	20	40	30	20	30	50	15
Surface Protection (%)	50%	50%	80%	80%	60%	80%	70%
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay
Stratification	None	None	None	None	None	None	None
Thalweg Position	Center	Center	Center	Center	Center	Center	Center
DTOE/DMEAN	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Local Slope > Avg	No	No	No	No	No	No	No

BEHI Calculation

Bnk Ht / Bkf Ht	1.7	3.3	3.3	2.5	2.5	3.3	1.7
BEHI Score	6.1	10.0	10.0	8.8	8.8	10.0	6.1
Root Depth / Bnk Ht	0.4	0.2	0.3	0.4	0.4	0.3	0.6
BEHI Score	5.2	7.6	6.4	5.2	5.2	6.4	3.5
Weighted Root Density (%)	0.1	0.1	0.2	0.2	0.2	0.2	0.2
BEHI Score	8.4	9.2	8.0	7.9	7.9	7.6	7.6
Bank Angle (deg)	20.0	40.0	30.0	20.0	30.0	50.0	15.0
BEHI Score	2.0	3.0	2.5	2.0	2.5	3.5	1.8
Surface Protection (%)	0.5	0.5	0.8	0.8	0.6	0.8	0.7
BEHI Score	4.3	4.3	1.7	1.7	3.4	1.7	2.6
Bank Material Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stratification Adjustment	0	0	0	0	0	0	0
Total BEHI Score	26.0	34.1	28.6	25.6	27.8	29.2	21.6
Rating	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate

NBS Calculation

Thalweg Position Score	1	1	1	1	1	1	1
Toe Depth Ratio Score	0	0	0	0	0	0	0
Local Slope Score	0	0	0	0	0	0	0
Total NBS Rating	1	1	1	1	1	1	1
WARSS NBS Rating	1	1	1	1	1	1	1
Rating	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Erosion Total (ft^3/yr)	0	4	1	3	1	2	2

Total Erosion (Sheet Total)	13

Erosion Rate Calculations

Project:	Seniard	Date:	4/10/18
Project No.:	172621103-SNRD	Observer:	CEG
Stream:	David Branch	Page:	20
Reach:	1		

Observed Values

Reach Name	1	1					
Station/Location	420+50	420+50					
Photo No.	R70	R70					
Reach Length (ft)	244.67	244.67					
Bank	Lt & Rt	Left					
Bank Height (ft)	1.5	2.5					
Bankfull Height (ft)	0.45	0.45					
Root Depth (ft)	0.4	0.4					
Root Density (%)	30%	30%					
Bank Angle (deg)	20	50					
Surface Protection (%)	70%	70%					
Bank Material	Silt/Clay	Silt/Clay					
Stratification	None	None					
Thalweg Position	Center	Center					
DTOE/DMEAN	< 1	< 1					
Local Slope > Avg	No	No					

BEHI Calculation

Bnk Ht / Bkf Ht	3.3	5.6					
BEHI Score	10.0	10.0					
Root Depth / Bnk Ht	0.3	0.2					
BEHI Score	6.8	8.1					
Weighted Root Density (%)	0.1	0.0					
BEHI Score	8.9	9.4					
Bank Angle (deg)	20.0	50.0					
BEHI Score	2.0	3.5					
Surface Protection (%)	0.7	0.7					
BEHI Score	2.6	2.6					
Bank Material Adjustment	0.0	0.0					
Stratification Adjustment	0	0					
Total BEHI Score	30.3	33.5					
Rating	High	High					

NBS Calculation

Thalweg Position Score	1	1					
Toe Depth Ratio Score	0	0					
Local Slope Score	0	0					
Total NBS Rating	1	1					
WARSS NBS Rating	1	1					
Rating	Very Low	Very Low					

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1					
Erosion Total (ft^3/yr)	69	58					

Total Erosion (Sheet Total)	127

Erosion Rate Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Lee Branch
Reach: 1

Date: 4/10/18
Observer: CEG
Page: 21

Observed Values

Reach Name	1	1	1	1			
Station/Location	600+00	600+00	600+15	600+15			
Photo No.	R73	R73	R74	R74			
Reach Length (ft)	10	10	30	30			
Bank	Left	Right	Left	Right			
Bank Height (ft)	1.5	1.5	4.5	4.5			
Bankfull Height (ft)	0.4	0.4	0.4	0.4			
Root Depth (ft)	0.3	0.3	0.3	0.3			
Root Density (%)	30%	30%	20%	20%			
Bank Angle (deg)	90	80	45	45			
Surface Protection (%)	20%	20%	30%	30%			
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay			
Stratification	None	None	None	None			
Thalweg Position	Center	Center	Center	Center			
DTOE/DMEAN	> 1	> 1	> 1	> 1			
Local Slope > Avg	No	No	No	No			

BEHI Calculation

Bnk Ht / Bkf Ht	3.8	3.8	11.3	11.3			
BEHI Score	10.0	10.0	10.0	10.0			
Root Depth / Bnk Ht	0.2	0.2	0.1	0.1			
BEHI Score	7.6	7.6	9.2	9.2			
Weighted Root Density (%)	0.1	0.1	0.0	0.0			
BEHI Score	9.2	9.2	9.8	9.8			
Bank Angle (deg)	90.0	80.0	45.0	45.0			
BEHI Score	8.0	6.0	3.3	3.3			
Surface Protection (%)	0.2	0.2	0.3	0.3			
BEHI Score	7.3	7.3	6.0	6.0			
Bank Material Adjustment	0.0	0.0	0.0	0.0			
Stratification Adjustment	0	0	0	0			
Total BEHI Score	42.1	40.1	38.3	38.3			
Rating	Very High	Very High	High	High			

NBS Calculation

Thalweg Position Score	1	1	1	1			
Toe Depth Ratio Score	1	1	1	1			
Local Slope Score	0	0	0	0			
Total NBS Rating	2	2	2	2			
WARSS NBS Rating	3	3	3	3			
Rating	Moderate	Moderate	Moderate	Moderate			

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.7	0.7	0.1	0.1			
Erosion Total (ft^3/yr)	11	11	15	15			

Total Erosion (Sheet Total)	51

Erosion Rate Calculations

Project:	Seniard	Date:	4/10/18
Project No.:	172621103-SNRD	Observer:	CEG
Stream:	Lee Branch	Page:	22
Reach:	1		

Observed Values

Reach Name	1	1	1	1	1		
Station/Location	600+45	600+45	601+10	601+10	601+20		
Photo No.	R74	R74	R75	R75	R75		
Reach Length (ft)	50	50	10	10	24.2		
Bank	Lt & Rt	Left	Right	Left	Right		
Bank Height (ft)	3.5	3	3	3	0.5		
Bankfull Height (ft)	0.4	0.4	0.4	0.4	0.4		
Root Depth (ft)	0.3	0.3	0.6	0.3	0.3		
Root Density (%)	45%	45%	30%	30%	20%		
Bank Angle (deg)	45	40	80	45	5		
Surface Protection (%)	30%	30%	50%	30%	30%		
Bank Material	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay	Silt/Clay		
Stratification	None	None	None	None	None		
Thalweg Position	Center	Center	Center	Center	Center		
DTOE/DMEAN	> 1	> 1	> 1	> 1	> 1		
Local Slope > Avg	No	No	Yes	No	No		

BEHI Calculation

Bnk Ht / Bkf Ht	8.8	7.5	7.5	7.5	1.3		
BEHI Score	10.0	10.0	10.0	10.0	3.9		
Root Depth / Bnk Ht	0.1	0.1	0.2	0.1	0.6		
BEHI Score	9.0	8.8	7.6	8.8	3.5		
Weighted Root Density (%)	0.0	0.0	0.1	0.0	0.1		
BEHI Score	9.5	9.4	9.2	9.6	8.4		
Bank Angle (deg)	45.0	40.0	80.0	45.0	5.0		
BEHI Score	3.3	3.0	6.0	3.3	1.3		
Surface Protection (%)	0.3	0.3	0.5	0.3	0.3		
BEHI Score	6.0	6.0	4.3	6.0	6.0		
Bank Material Adjustment	0.0	0.0	0.0	0.0	0.0		
Stratification Adjustment	0	0	0	0	0		
Total BEHI Score	37.7	37.2	37.1	37.6	23.1		
Rating	High	High	High	High	Moderate		

NBS Calculation

Thalweg Position Score	1	1	1	1	1		
Toe Depth Ratio Score	1	1	1	1	1		
Local Slope Score	0	0	1	0	0		
Total NBS Rating	2	2	3	2	2		
WARSS NBS Rating	3	3	5	3	3		
Rating	Moderate	Moderate	Very High	Moderate	Moderate		

Erosion Rate Prediction

State	NC						
Erosion Rate (ft/yr)	0.1	0.1	0.1	0.1	0.1		
Erosion Total (ft^3/yr)	39	17	4	3	1		

Total Erosion (Sheet Total)	63

Site Assessment Calculations

Project:	Seniard
Project No.:	172621103-SNRD
Stream:	Seniard Creek
Reach:	1A and 1B

Date:	4/2/18
Observers:	TS, CME, CE
Page:	1

Observed Values

Section Number	QS-1	QS-2	QS-3	QS-4	QS-5	QS-6	
Reach Name	1A	1A	1B	1B	1B	1B	
Location	U/S R32	D/S R32	U/S R 42	U/S R 46	U/S R 53	U/S R 55	
Latitude	35.412105	35.411970	35.411050	35.410730	35.410040	35.409810	
Longitude	-82.630014	-82.629960	-82.629100	-82.628600	-82.627900	-82.627800	
D_A (mi^2)	1.28	1.28	1.32	1.32	1.33	1.34	
W_{BKF} (ft)	13.0	10.7	11.4	8.1	8.5	8.0	
W_{BED} (ft)	11.5	8.4	10.2	4.4	5.3	5.4	
D_{BKF} (ft)	0.9	0.6	1.0	1.2	0.9	1.1	
$D_{TOE\ LT}$ (ft)	-0.1	0.1	0.0	0.0	-0.4	-0.5	
$D_{TOE\ RT}$ (ft)	0.0	-0.2	0.0	-0.6	-0.1	0.1	
Field D_{THAL} (ft)	-0.6	-0.5	-0.5	-0.7	-0.6	-0.7	
W_{THAL} (ft)	4.0	3.0	3.5	2.8	2.2	2.0	
Low Bank Height (ft)	6.5	7.0	3.5	3.3	2.5	2.5	
Bank/Terrace Height (ft)	6.5	7.0	3.5	3.3	2.5	2.5	
Flood Prone Width (ft)	14	14	12	19	15	14	

Section Calculations

D_{MAX} (ft)	1.45	1.05	1.45	1.92	1.45	1.75	
Average D_{TOE} (ft)	0.90	0.60	0.95	1.52	1.05	1.25	
D_{THAL} (ft)	0.55	0.45	0.50	0.40	0.40	0.50	
A_{BKF} (ft)	15.3	8.3	13.7	10.9	8.7	10.2	
D_{MEAN} (ft)	1.18	0.78	1.20	1.35	1.03	1.28	
W/D ratio	11.1	13.8	9.5	6.0	8.3	6.3	
Bank Height Ratio	4.9	7.1	2.8	2.1	2.1	1.8	
Entrenchment Ratio	1.1	1.3	1.0	2.3	1.7	1.8	

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.0	0.47

Reference Max Depth Equation

Coef	Exp
1.4	0.24

Reference Bed Width (ft)	9.0	9.0	9.1	9.1	9.1	9.2	
Bed Width Index (BWI)	1.3	0.9	1.1	0.5	0.6	0.6	
Reference D_{MAX} (ft)	1.5	1.5	1.5	1.5	1.5	1.5	
Max Depth Index (MDI)	1.0	0.7	1.0	1.3	1.0	1.2	

Stream Classification

Stream Type	G	F	G	G	G	G	

Site Assessment Calculations

Project:	Seniard	Date:	4/2/18
Project No.:	172621103-SNRD	Observers:	TS, CME, CE
Stream:	Seniard Creek	Page:	2
Reach:	1B and 2		

Observed Values

Section Number	QS-7	QS-8	QS-9				
Reach Name	1B	2	2				
Location	u/s R 29	d/s R 20	d/s R 23				
Latitude	35.409560	35.409010	35.408590				
Longitude	-82.627400	-82.627500	-82.628090				
D_A (mi^2)	1.34	2.44	2.45				
W_{BKF} (ft)	10.2	10.2	10.0				
W_{BED} (ft)	5.0	5.0	7.2				
D_{BKF} (ft)	1.0	1.0	1.0				
$D_{TOE\ LT}$ (ft)	-0.2	-0.2	-0.4				
$D_{TOE\ RT}$ (ft)	-0.4	-0.4	-0.5				
Field D_{THAL} (ft)	-0.6	-0.6	-0.6				
W_{THAL} (ft)	1.0	1.0	2.7				
Low Bank Height (ft)	3.5	3.5	3.0				
Bank/Terrace Height (ft)	3.5	3.5	3.0				
Flood Prone Width (ft)	14	14	16				

Section Calculations

D_{MAX} (ft)	1.55	1.55	1.60				
Average D_{TOE} (ft)	1.30	1.30	1.43				
D_{THAL} (ft)	0.25	0.25	0.18				
A_{BKF} (ft)	10.6	10.6	13.1				
D_{MEAN} (ft)	1.04	1.04	1.31				
W/D ratio	9.8	9.8	7.6				
Bank Height Ratio	2.6	2.6	2.3				
Entrenchment Ratio	1.4	1.4	1.6				

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.0	0.47

Reference Max Depth Equation

Coef	Exp
1.4	0.24

Reference Bed Width (ft)	9.2	12.2	12.2				
Bed Width Index (BWI)	0.5	0.4	0.6				
Reference D_{MAX} (ft)	1.5	1.7	1.7				
Max Depth Index (MDI)	1.0	0.9	0.9				

Stream Classification

Stream Type	G	G	G				

Site Assessment Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Sitton Creek
Reach: 1

Date: 4/11/18
Observers: TS, CME, CE
Page: 3

Observed Values

Section Number	QS-10	QS-11					
Reach Name	1	1					
Location	u/s R6	u/s R12					
Latitude	35.411250	35.410170					
Longitude	-82.626540	-82.626940					
D_A (mi^2)	0.96	0.98					
W_{BKF} (ft)	11.4	6.4					
W_{BED} (ft)	5.8	6.2					
D_{BKF} (ft)	1.1	0.9					
$D_{TOE\ LT}$ (ft)	-0.4	-0.1					
$D_{TOE\ RT}$ (ft)	-0.3	-0.2					
Field D_{THAL} (ft)	0.5	-0.4					
W_{THAL} (ft)	2.5	3.6					
Low Bank Height (ft)	4.3	4.0					
Bank/Terrace Height (ft)	4.3	4.0					
Flood Prone Width (ft)	21	11					

Section Calculations

D_{MAX} (ft)	0.65	1.20					
Average D_{TOE} (ft)	1.40	0.95					
D_{THAL} (ft)	-0.75	0.25					
A_{BKF} (ft)	8.9	7.2					
D_{MEAN} (ft)	0.78	1.13					
W/D ratio	14.6	5.7					
Bank Height Ratio	5.9	3.6					
Entrenchment Ratio	1.8	1.7					

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.0	0.47

Reference Max Depth Equation

Coef	Exp
1.4	0.24

Reference Bed Width (ft)	7.8	7.9					
Bed Width Index (BWI)	0.7	0.8					
Reference D_{MAX} (ft)	1.4	1.4					
Max Depth Index (MDI)	0.5	0.9					

Stream Classification

Stream Type	G	G					

Site Assessment Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: David Branch
Reach: 1

Date: 4/11/18
Observers: TS, CME, CE
Page: 4

Observed Values

Section Number	QS-12	QS-13	QS-14				
Reach Name	1b	1b	1c				
Location	R66	d/s R66	R71				
Latitude	35.410900	35.410800	35.410800				
Longitude	-82.623700	-82.625300	-82.625900				
D_A (mi^2)	0.01	0.01	0.01				
W_{BKF} (ft)	8.4	6.0	7.8				
W_{BED} (ft)	5.6	4.5	6.0				
D_{BKF} (ft)	0.7	0.6	0.3				
$D_{TOE\ LT}$ (ft)	0.2	0.3	0.1				
$D_{TOE\ RT}$ (ft)	0.1	0.2	0.0				
Field D_{THAL} (ft)	-0.2	-0.1	-0.2				
W_{THAL} (ft)	0.8	1.0	1.1				
Low Bank Height (ft)	2.0	1.8	1.5				
Bank/Terrace Height (ft)	2.0	1.8	1.5				
Flood Prone Width (ft)	15	12	10				

Section Calculations

D_{MAX} (ft)	0.80	0.72	0.50				
Average D_{TOE} (ft)	0.55	0.35	0.25				
D_{THAL} (ft)	0.25	0.37	0.25				
A_{BKF} (ft)	4.7	2.9	2.6				
D_{MEAN} (ft)	0.55	0.48	0.33				
W/D ratio	15.2	12.6	23.3				
Bank Height Ratio	2.7	2.7	3.4				
Entrenchment Ratio	1.8	2.0	1.3				

Index Calculations

Reference Bed Width Equation

Coef	Exp
8.0	0.47

Reference Max Depth Equation

Coef	Exp
1.4	0.24

Reference Bed Width (ft)	0.9	0.9	0.9				
Bed Width Index (BWI)	6.1	4.9	6.5				
Reference D_{MAX} (ft)	0.5	0.5	0.5				
Max Depth Index (MDI)	1.7	1.6	1.1				

Stream Classification

Stream Type	B	B	F				

Site Assessment Calculations

Project: Seniard
Project No.: 172621103-SNRD
Stream: Lee Branch
Reach: 1

Date: 4/11/18
Observers: TS, CME, CE
Page: 5

Observed Values

Section Number	QS-15						
Reach Name	1						
Location	R74						
Latitude	35.411600						
Longitude	-82.625500						
D_A (mi^2)	0.02						
W_{BKF} (ft)	1.8						
W_{BED} (ft)	1.4						
D_{BKF} (ft)	0.7						
$D_{TOE\ LT}$ (ft)	-0.1						
$D_{TOE\ RT}$ (ft)	0.0						
Field D_{THAL} (ft)	-0.2						
W_{THAL} (ft)	0.8						
Low Bank Height (ft)	4.5						
Bank/Terrace Height (ft)	4.5						
Flood Prone Width (ft)	3						

Section Calculations

D_{MAX} (ft)	0.85						
Average D_{TOE} (ft)	0.75						
D_{THAL} (ft)	0.10						
A_{BKF} (ft)	1.3						
D_{MEAN} (ft)	0.73						
W/D ratio	2.5						
Bank Height Ratio	5.5						
Entrenchment Ratio	1.8						

Index Calculations

Reference
Bed Width Equation

Coef	Exp
8.0	0.47

Reference
Max Depth Equation

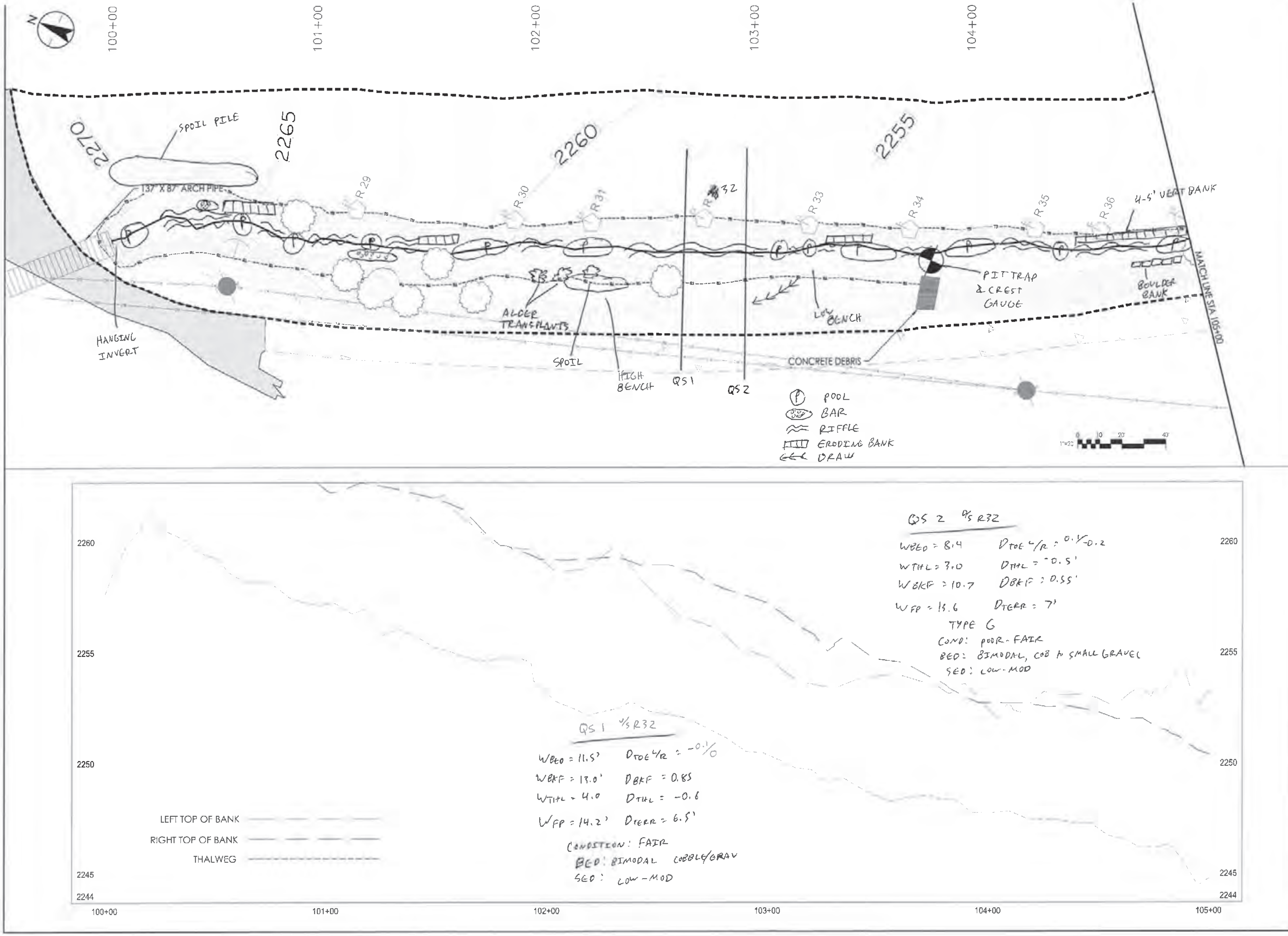
Coef	Exp
1.4	0.24

Reference Bed Width (ft)	1.3						
Bed Width Index (BWI)	1.1						
Reference D_{MAX} (ft)	0.5						
Max Depth Index (MDI)	1.6						

Stream Classification

Stream Type	G						

Page left intentionally blank for printing purposes.



Stantec

3325 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Client/Project
EW SOLUTIONS

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

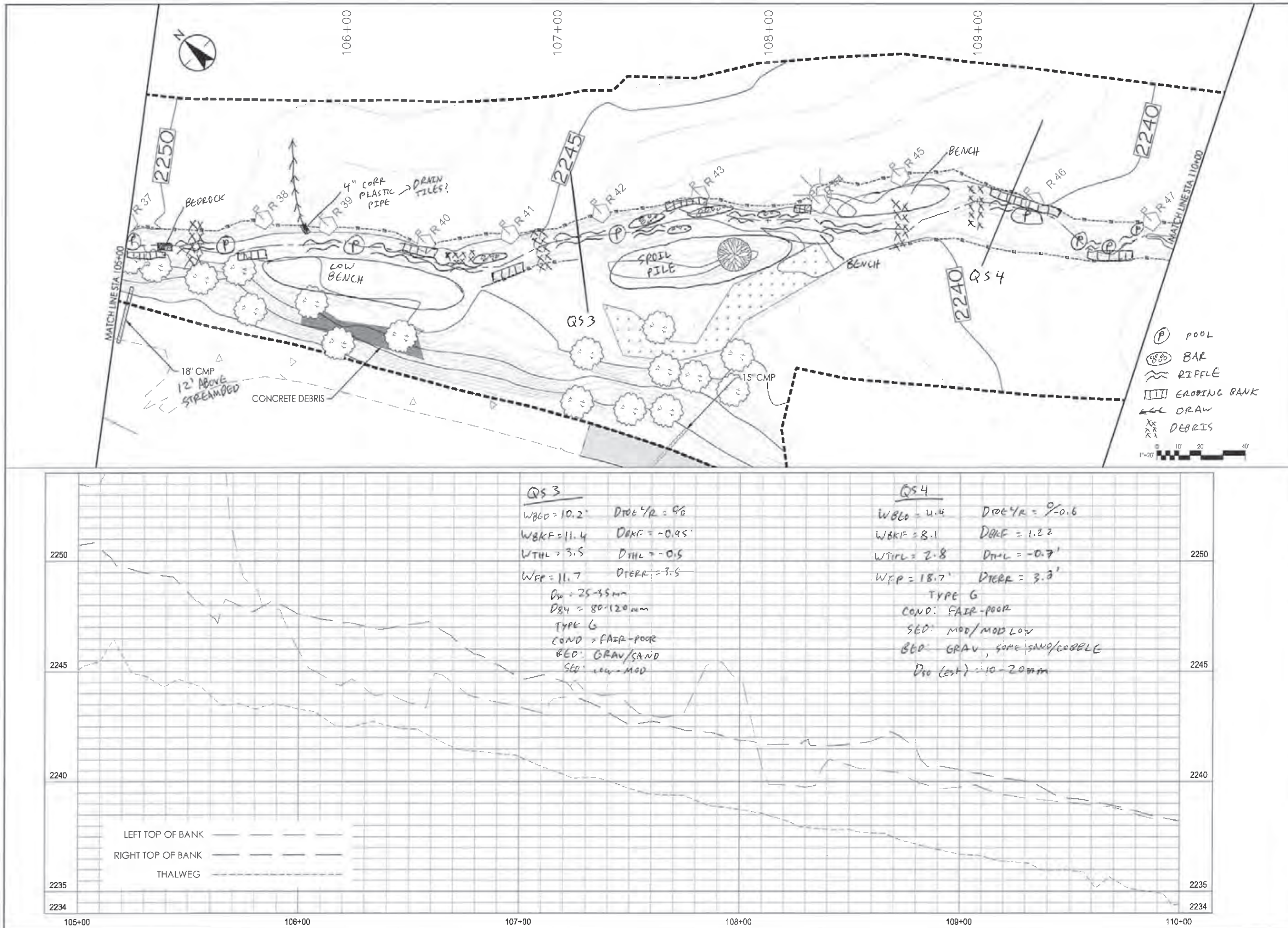
Title
SENIARD CREEK

Permit-Seal

Project Number: 172621103

RTS | SSS | CME | 18.27.05
Dwn. | Chkd. | Dsgn. | YY.MM.DD

Drawing No. PP-4
Revision 0
Sheet ---- of ##



Stantec

3325 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision

Issued

Client/Project
EW SOLUTIONS
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
SENIARD CREEK
PLAN AND PROFILE

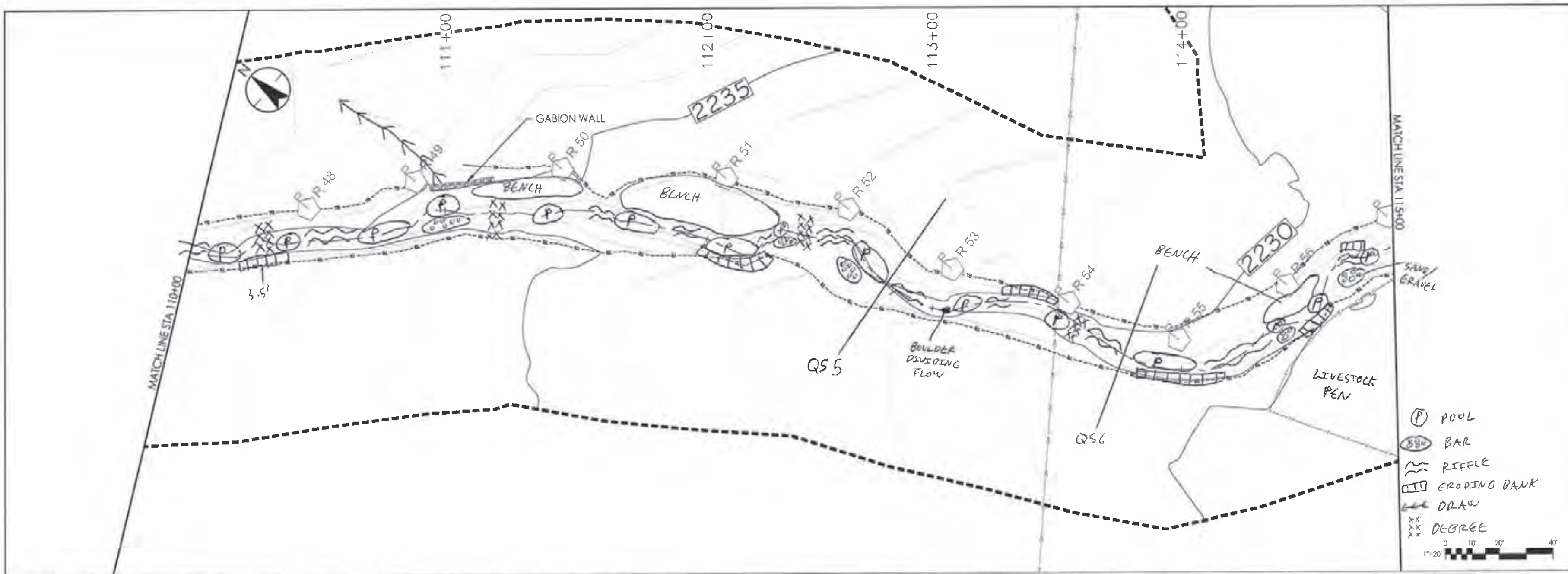
Permit-Seal

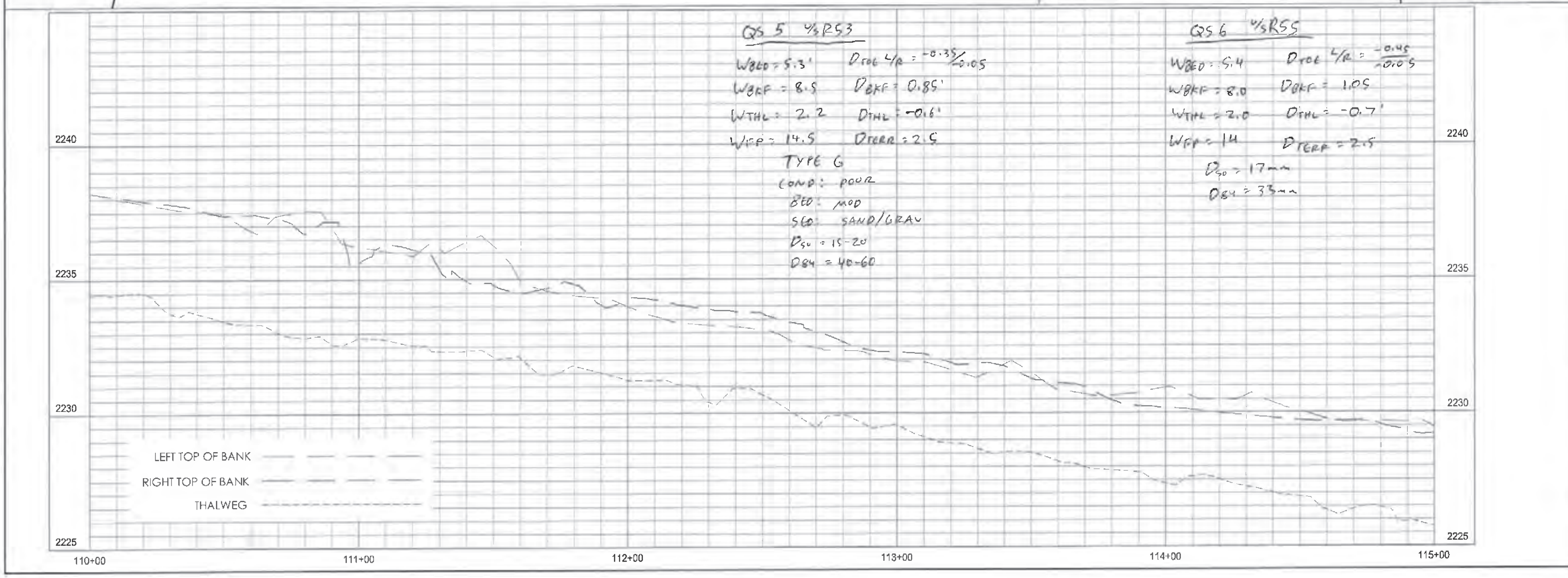
Project Number: 172621103

Drawing No. PP-5

Revision 0

Sheet — of ##





Stantec

3325 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision	By	Appd	YY.MM.DD

Issued	By	Appd	YY.MM.DD

Permit-Seal

Client/Project
EW SOLUTIONS

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

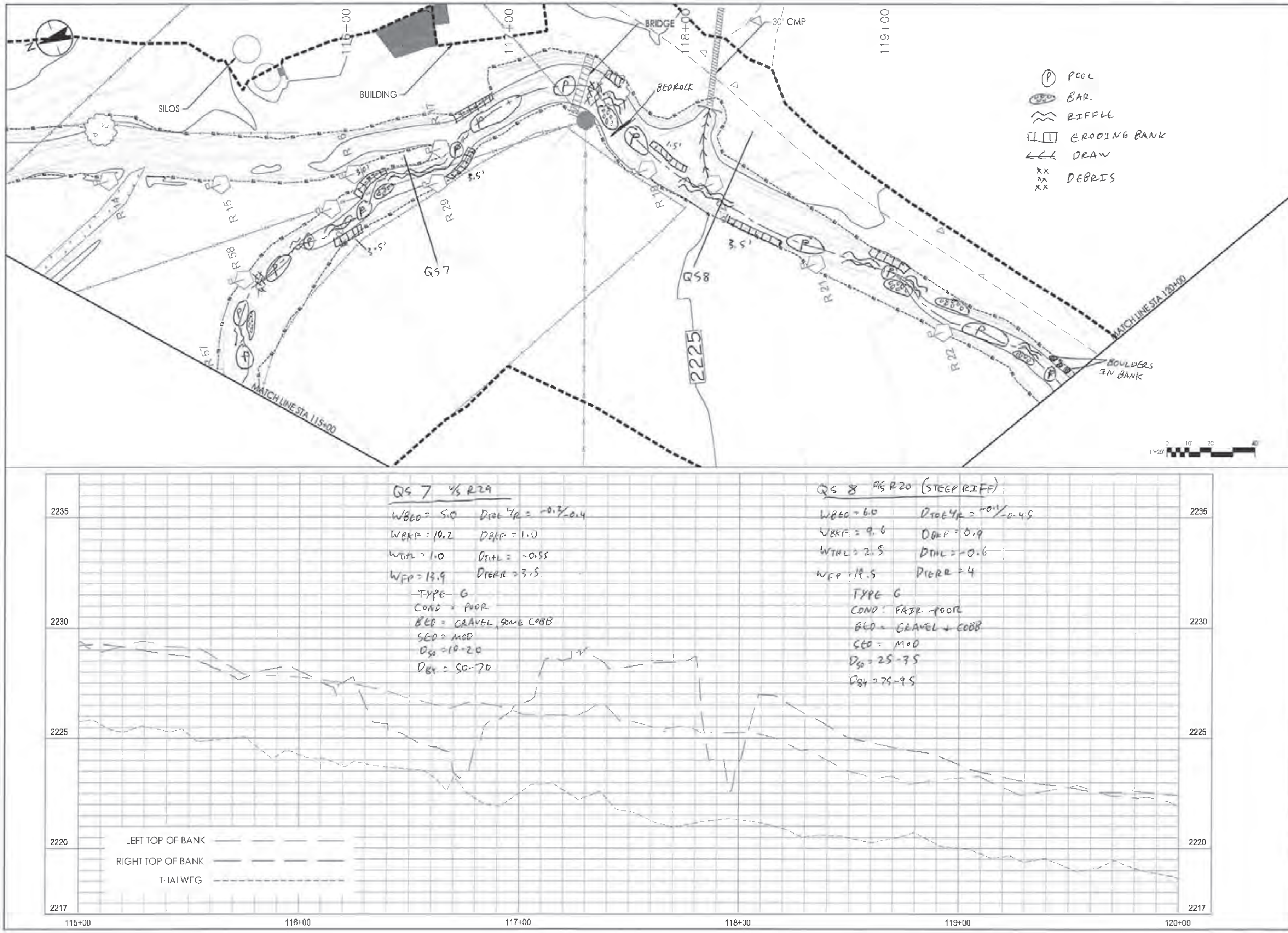
Title
SENIARD CREEK
PLAN AND PROFILE

Project Number: 172621103

RJS	SGG	CMC	18.27.03
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. PP-6

Revision 0
Sheet — of ##



Stantec

3325 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Client/Project
EW SOLUTIONS

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
SENIARD CREEK
PLAN AND PROFILE

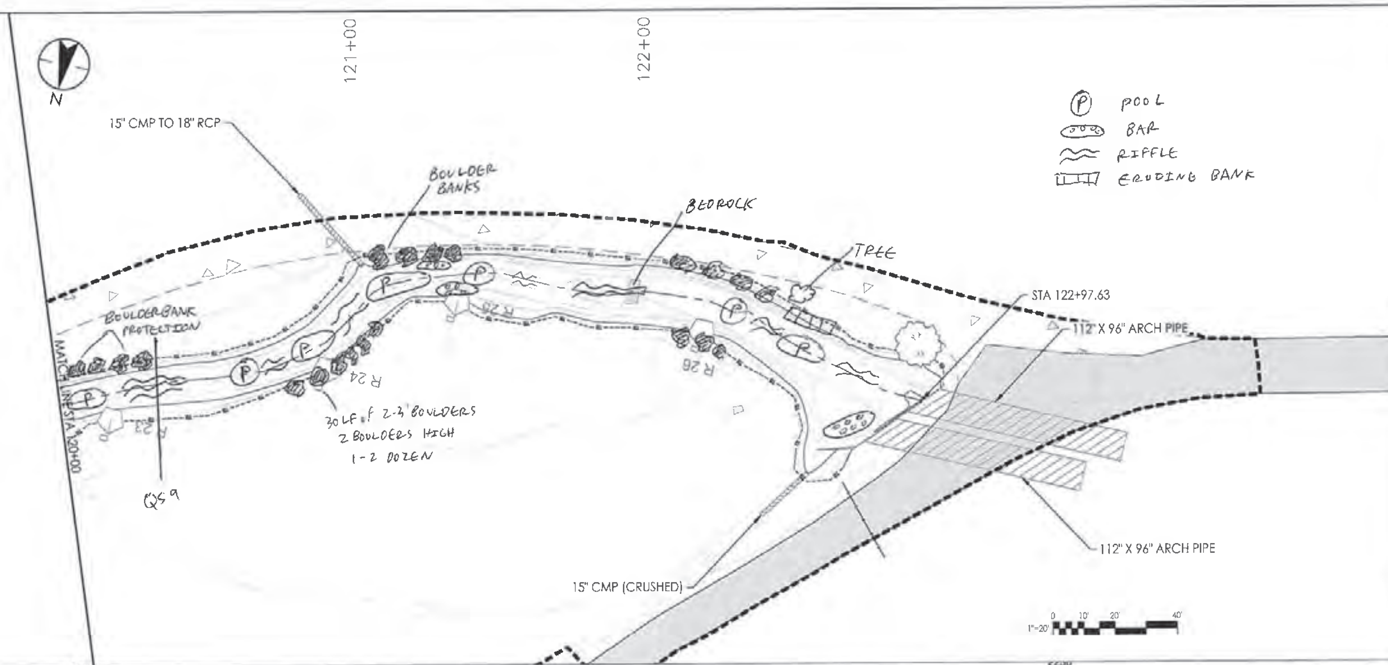
Permit-Seal

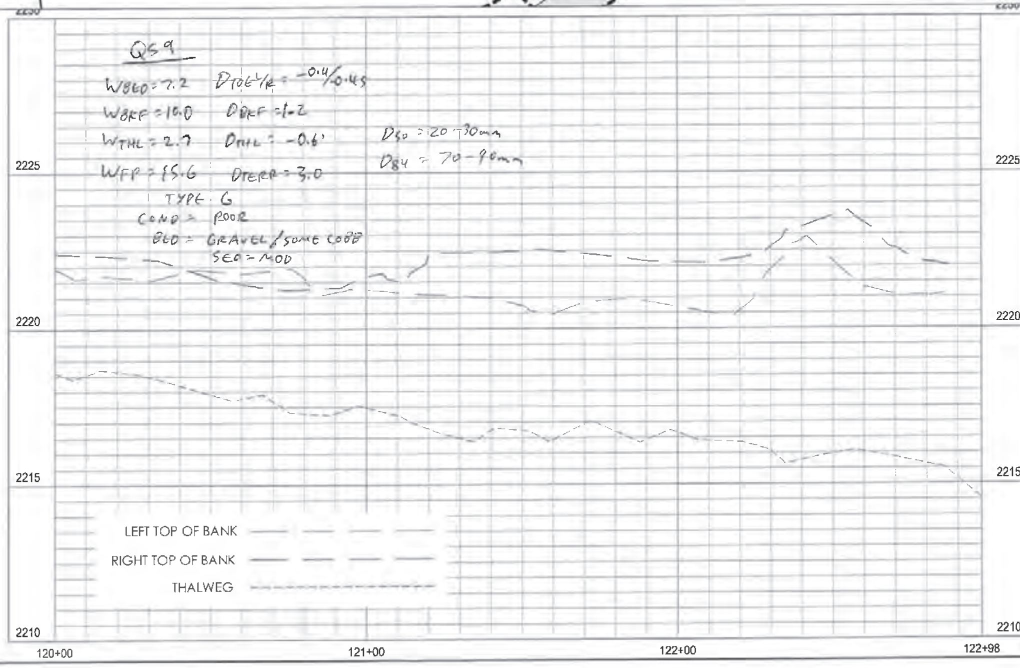
Project Number: 172621103

RTS	SGG	CME	18.07.03
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. PP-7

Revision 0
Sheet — of ##





Stantec
3325 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision | By | Appd. | YY.MM.DD
Issued | By | Appd. | YY.MM.DD

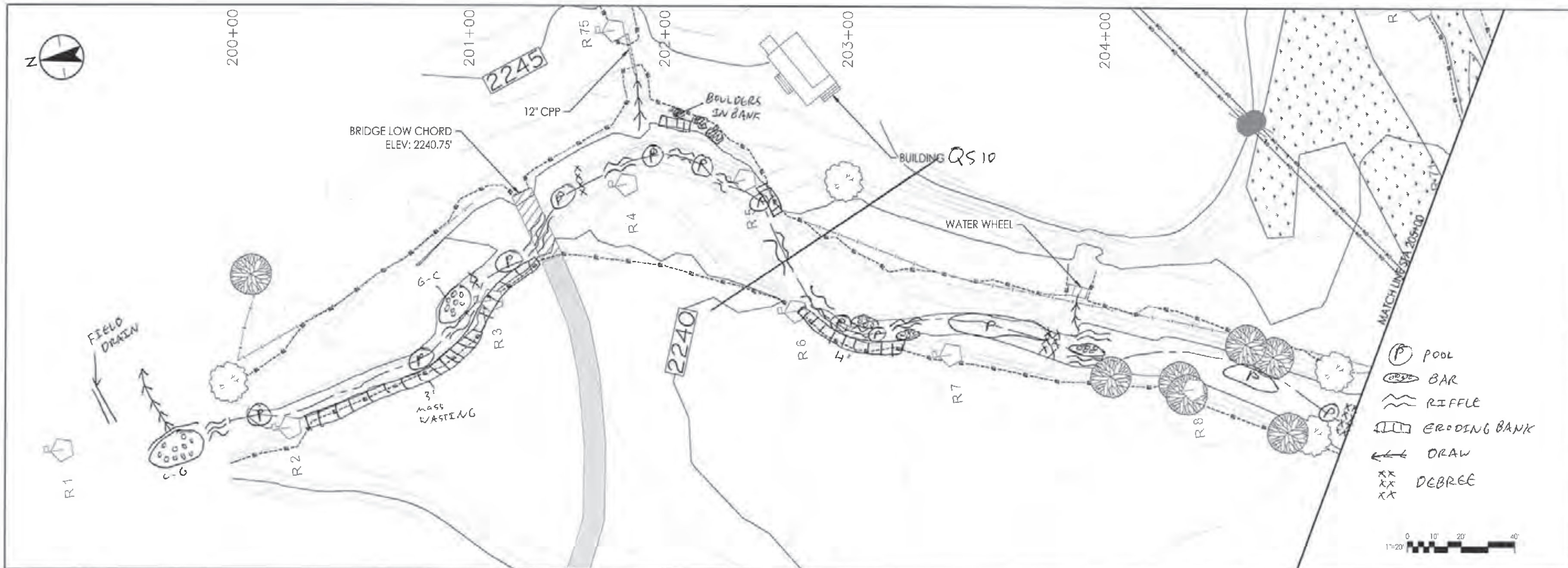
Permit-Seal

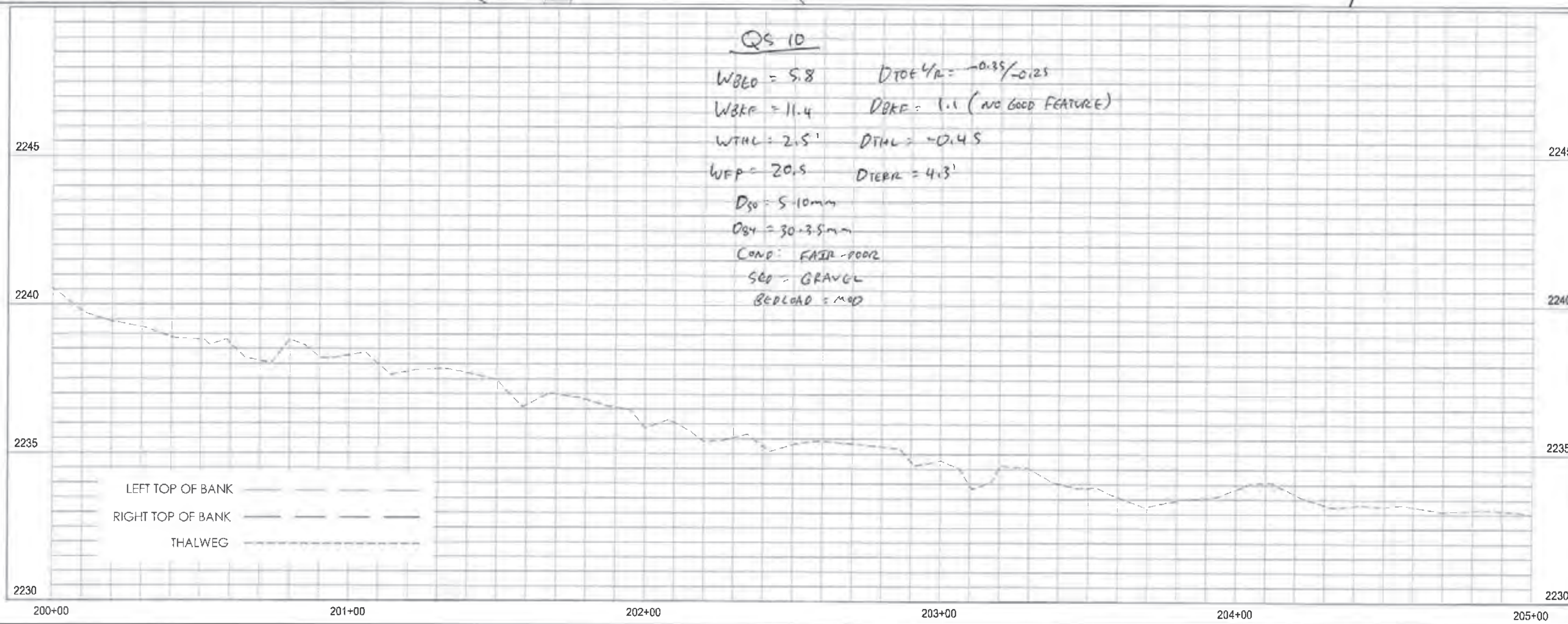
Client/Project
EW SOLUTIONS
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
SENIARD CREEK
PLAN AND PROFILE

Project Number: 172621103

Drawing No. PP-8
Revision 0
Sheet — of ##





Stantec

3325 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Client/Project
EW SOLUTIONS

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
SITTON CREEK
PLAN AND PROFILE

Permit-Seal

Project Number: 172621103

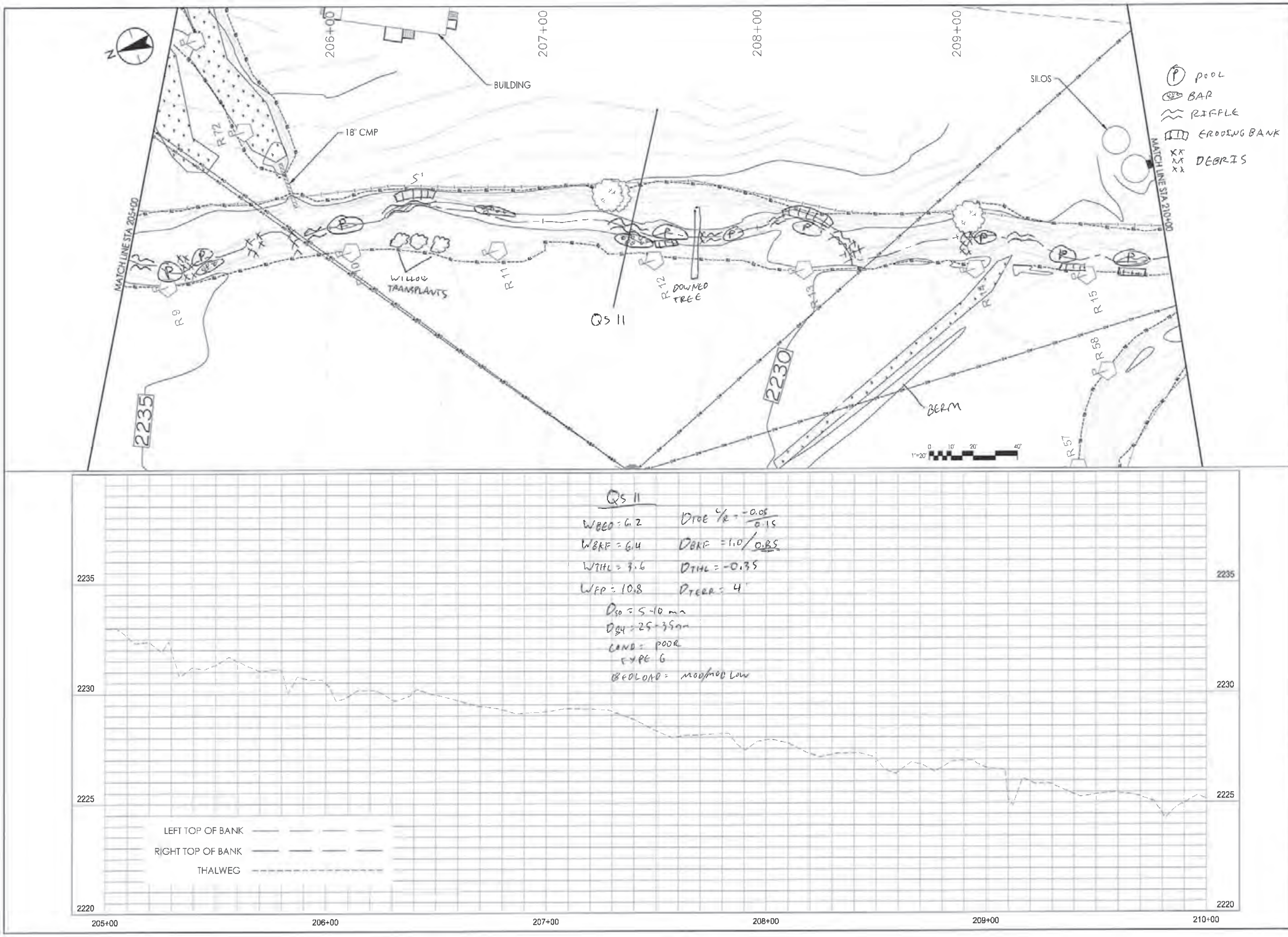
File Name: 1103-05-Sitton-PlanPro-Assessment.dwg

RTS	SGG	CME	18.27.03
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. PP-9

Revision 0

Sheet — of ##



Stantec

2950 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Permit-Seal

Client/Project
EW SOLUTIONS

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
SITTON CREEK
PLAN AND PROFILE

Project Number: 172621103

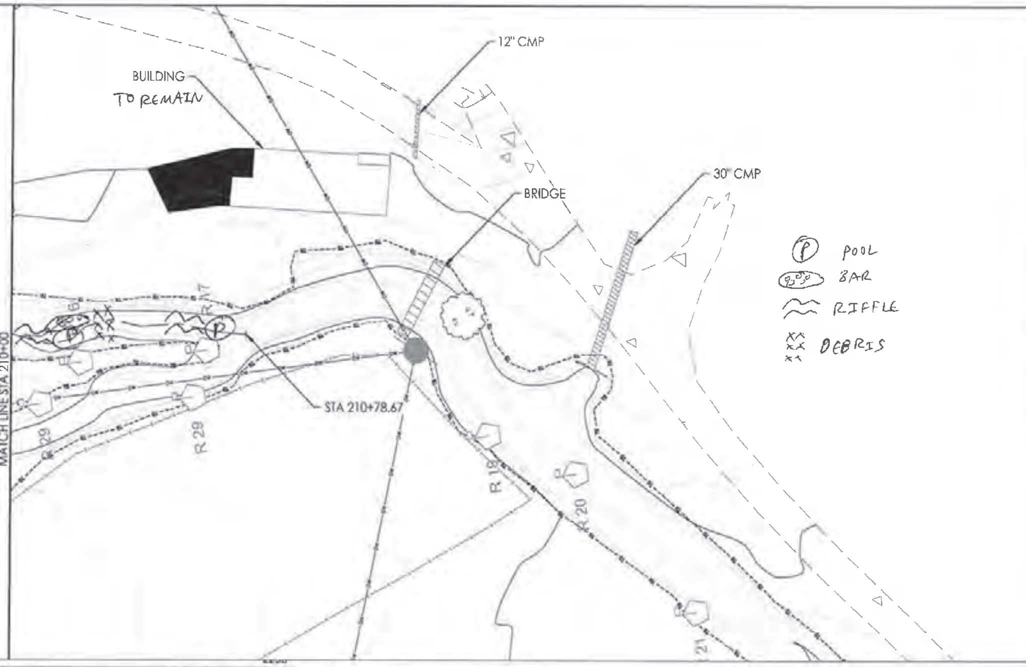
File Name: 1100-05-Sitton-PlanPro-Assessment.dwg

RTS	SGG	CME	[illegible]
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. PP-10

Revision 0

Sheet — of ##



LEFT TOP OF BANK
RIGHT TOP OF BANK
THALWEG

Stantec

3325 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Permit-Seal

Client/Project
EW SOLUTIONS

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

Title
SITTON CREEK
PLAN AND PROFILE

Project Number: 172621103

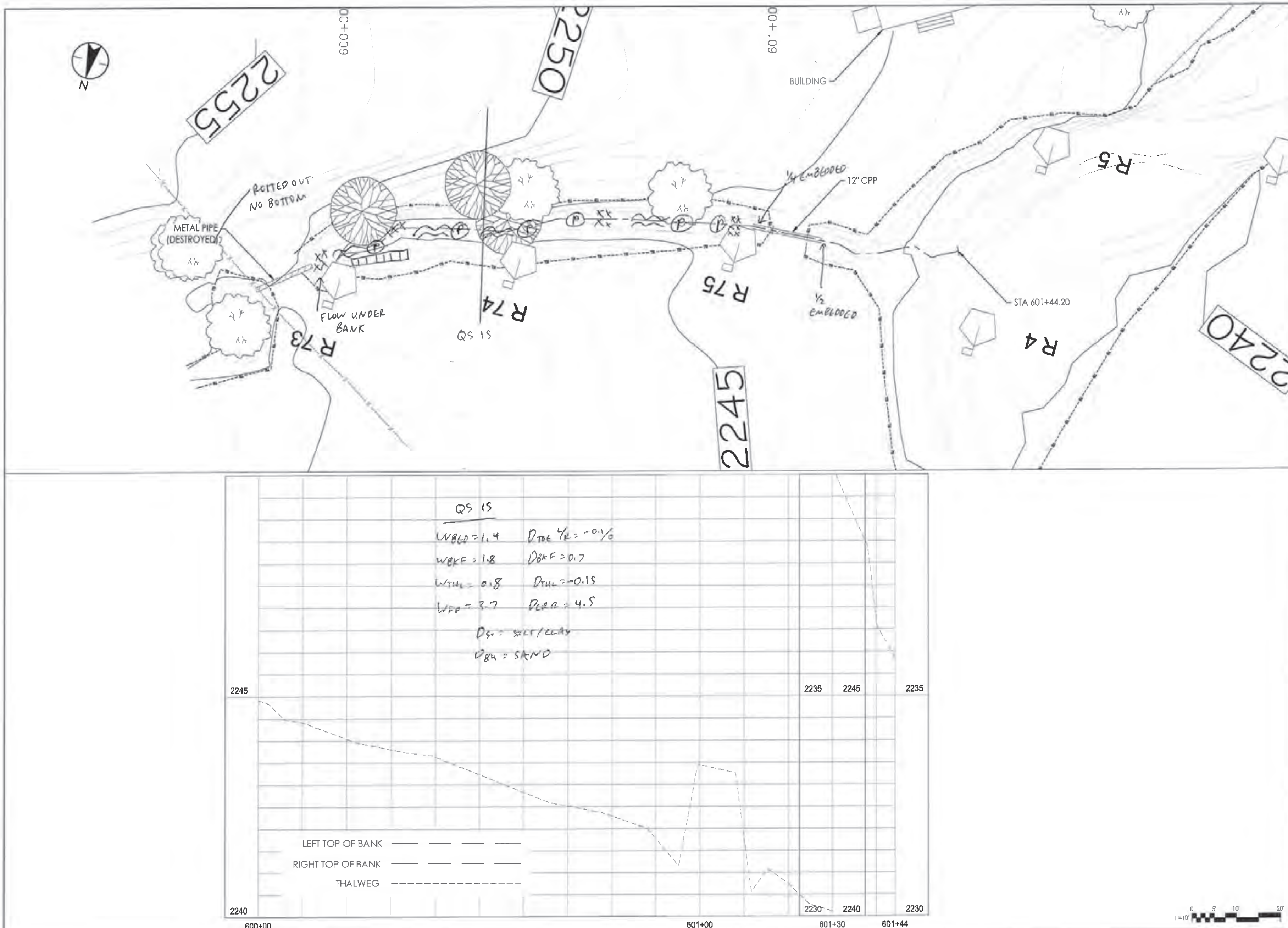
File Name: 1103-05-Sitton-Plan Pro-Assessment.dwg

RTS	SGG	CME	18.27.03
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. PP-11

Revision 0

Sheet — of ##



Stantec

3325 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Permit-Seal

Client/Project
EW SOLUTIONS

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

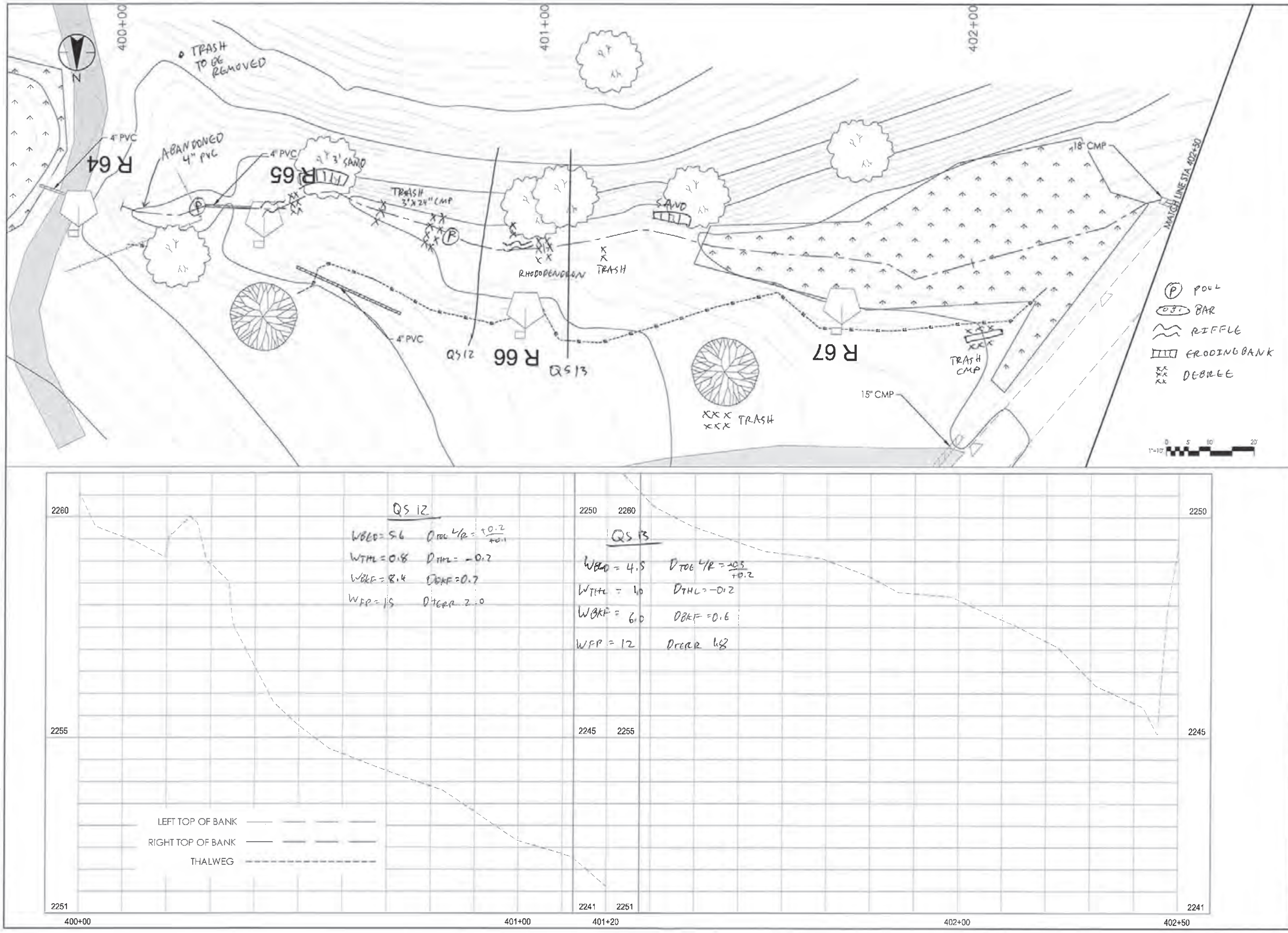
Title
LEE BRANCH
PLAN AND PROFILE

Project Number: 172621103

Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. PP-21

Revision 0
Sheet — of ##



Stantec

3325 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision | By | Appd | YY.MM.DD

Issued | By | Appd | YY.MM.DD

Client/Project
EW SOLUTIONS

SENIARD CREEK MITIGATION SITE

HENDERSON COUNTY, NC

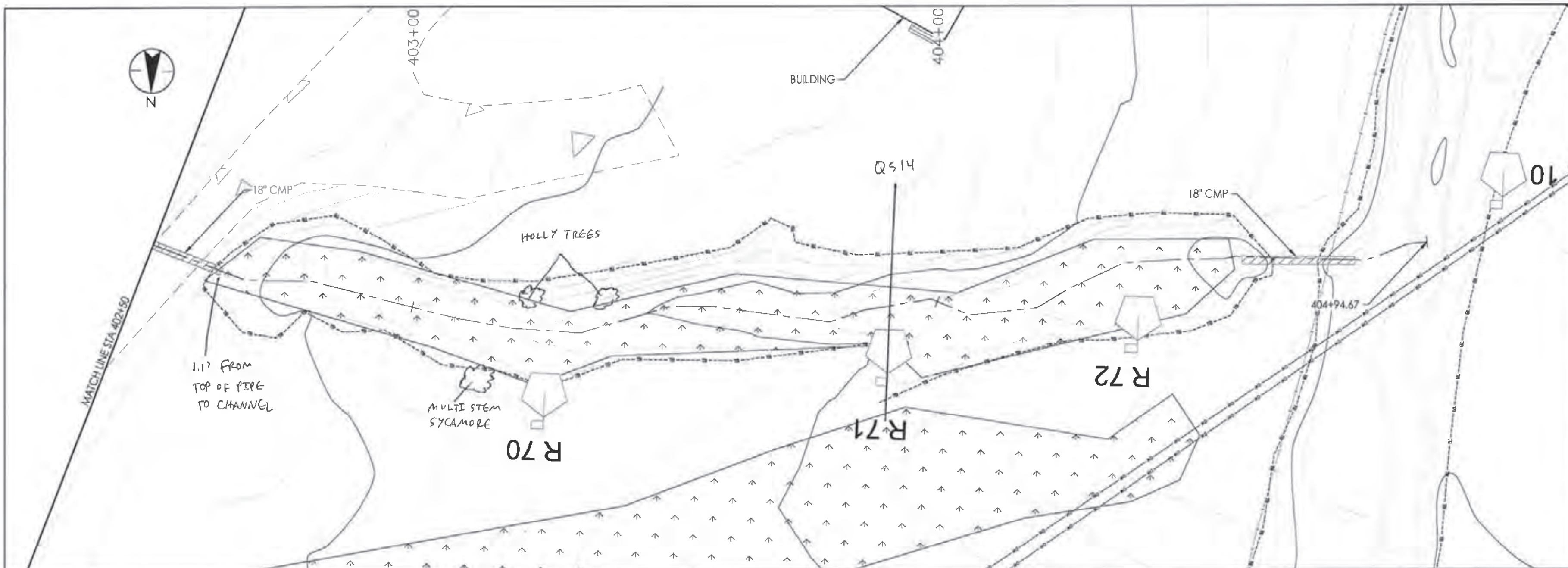
Title
DAVID BRANCH
PLAN AND PROFILE

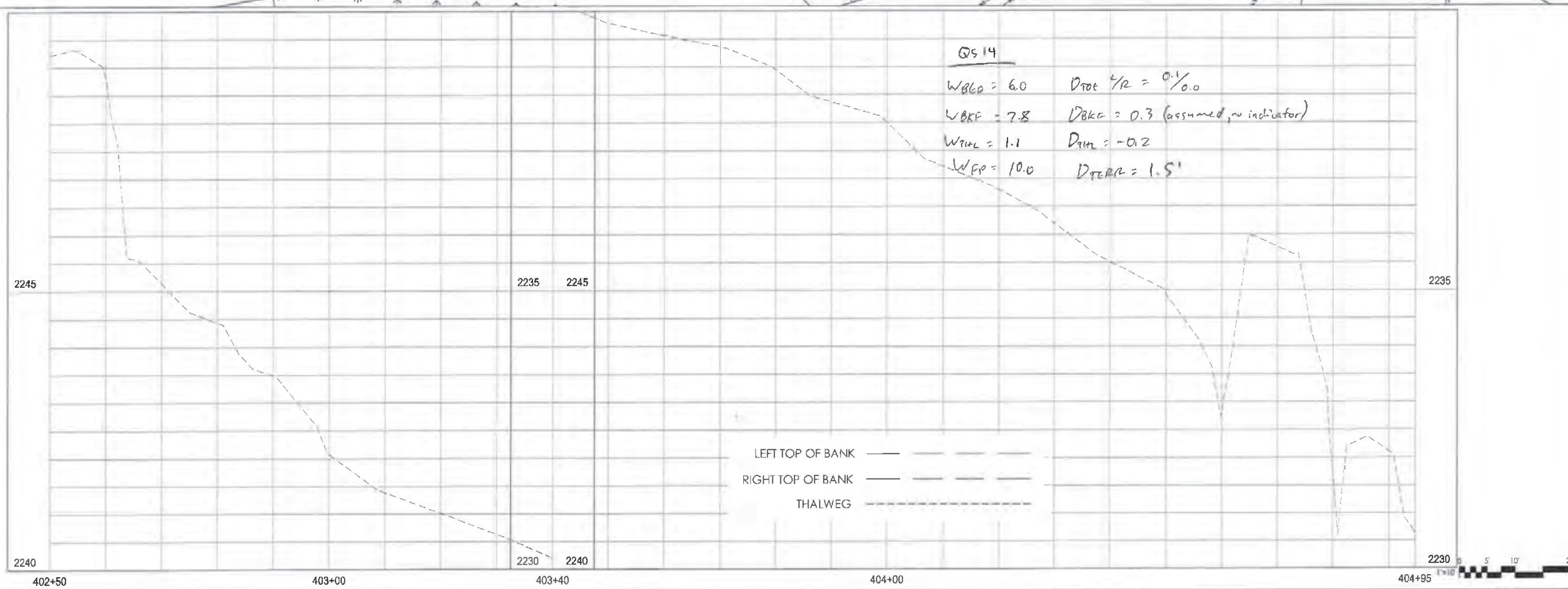
Permit-Seal

Project Number: 172621103

Dwn. | Chkd. | Dsgn. CME | YY.MM.DD 18.27.03

Drawing No. PP-17
Revision 0
Sheet — of ##





Stantec

3325 South Timberline Road, Suite 150
Fort Collins, Colorado 80525-2903
www.stantec.com

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

Permit-Seal

Client/Project
EW SOLUTIONS
SENIARD CREEK MITIGATION SITE
HENDERSON COUNTY, NC

Title
DAVID BRANCH
PLAN AND PROFILE

Project Number: 172621103

RTS	SGG	CMF	18.27.03
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. PP-18

Revision 0 Sheet — of ##

Page left intentionally blank for printing purposes.

Hydric Soils Detailed Study - FINAL
Seniard Mitigation Site
Henderson County, NC

Prepared for:

Mr. Owen Carson
Equinox Environmental
37 Haywood Street, Suite 100
Asheville, NC 28801

Prepared by:

George K Lankford Soil Scientist, LSS #1223
George K Lankford, LLC
238 Shady Grove Rd
Pittsboro, NC 27312

January 2019

Soil Scientist Seal

This report describes the results of the soil evaluation performed at the Seniard Mitigation Site in Henderson County, NC. Any subsequent transfer of the report by the user shall be made by transferring the complete report, including figures, maps, appendices, all attachments and disclaimers.

Study Objectives and Scope

The purpose of the study was to describe and delineate the extent of hydric soils that are potentially suitable for hydrologic restoration, rehabilitation, and reestablishment for mitigation. Potential of soils for hydrologic restoration in this study is evaluated considering the existing land use and conditions with the sites potential for creating a hydroperiod suitable for the landscape and soils. Restoration potential assumes the successful restoration of the stream to access the floodplain. Practical modifications that utilize the sites natural hydrology may include, but are not limited to surface drainage modifications, plugging drainage ditches, removal of fill materials, and microtopographic alteration such as surface roughening or enhancing existing depressions. Removal of fill material is typically limited due to cost and environmental impacts if an extensive area is involved. Because of historic land use, ripping of soils to remove compaction are often recommended. Restoration potential of areas delineated assumes a successful design and ability to construct site modifications necessary to restore adequate hydrology to hydric soil areas.

This report presents an evaluation of the subject property based upon a detailed field evaluation the purpose of confirming the presence and extent of hydric soil and assess the suitability for wetland restoration/mitigation at the site. This soil delineation and all boundaries shown are based on the detailed field evaluation.

The observations and opinions stated in this report reflect conditions apparent on the subject property at the time of the site evaluation. My findings, opinions, conclusions, and recommendations are based on the locations and boundaries of the property as evident in the field and professional experience.

Project Information and Background

The site location is approximately 11 miles northwest of Hendersonville, NC. It is located west of Dave Whitaker Road (SR 1346) along the floodplains of Seniard and Sitton Creeks, small tributaries to the North Mills River (Figure 1). The project area is approximately 2 acres within a hay field on the floodplain of Sitton and Seniard Creeks (Figure 2). The project lies within a natural topographic floodplain typical of the local landscape.

Current land use is maintained pasture grasses, but livestock appear to be absent. A small overhead utility line crosses the project. The surrounding land use is farm land, undeveloped forest land, and single-family homes. The streams are moderately incised with steep banks that range from well vegetated to eroding. A shallow ditch to drain a small slope seep has been constructed across the floodplain to Sitton Creek.

NRCS Soil Mapping

The project is in the Blue Ridge physiographic region where the landscape varies from relatively broad floodplains to narrow valleys and from rolling hills to very steep mountains. Located in Henderson County, the landscape has many deep, narrow valleys between the mountains where practically all of the nearly level land is along streams and larger drainage features. Land use around the site is rural farmland and undeveloped forest. Soil texture and slope have the largest effect on natural drainage of these landscapes.

The project is on floodplains that are in nearly level to gently sloping concave valleys and range from very poorly drained to well drained with subsoil ranging from loamy to clayey. Topography within the project site varies from slightly depressional to slightly elevated, where flooding and a seasonally high water table are the common limitations. The soils mapped by the USDA, Soil Conservation Service (SCS) Soil Survey of Henderson County (USDA 1980) indicate two soil map units occur on the floodplains of Seniard and Sitton Creeks with each map unit representing an area dominated by one or more major kinds of soil or miscellaneous areas. Map units are identified by the taxonomic classification of the dominant soils and inclusions of similar and dissimilar soils are provided. Parent materials of soil within the project area are sandy and loamy alluvium derived from granites, gneisses, and schists.

Within the floodplain where the project is located, the two map units are Codorus loam (Arkaqua) and Rosman fine sandy loam. Note some series have been reclassified by the NRCS to a similar series having the same taxonomy and management recommendations. The original map unit name is kept with the updated series in parenthesis for consistency. Codorus soils occur on nearly level to slightly concave areas on floodplains. They typically have a brown loam surface underlain by a dark brown loam or mottled grayish brown fine sandy loam. The Rosman soil are usually on slightly elevated positions of the floodplain and commonly adjacent to streams. They typically have a dark brown loam surface underlain by a yellowish brown loam or sandy loam.

The Cordorus (Arkaqua) and Rosman soils are not classified as hydric by the NRCS but have potential inclusions that are listed as hydric. The inclusions are very poorly drained Toxaway silt loam and very poorly drained Hemphill clay loam. Toxaway occurs in more defined depressional areas that accumulates higher organic matter in the surface horizon. The surface is very dark gray to black silt loam underlain by a very dark gray loam. The Hemphill series occur in depressions on low stream terraces. They have a very dark gray loam surface with a dark grayish brown clay or clay loam with mottles. The main limitation for these soils are a high water table and flooding. Grazing these soils while wet causes compaction.

Table 1. Seniard NRCS Mapped Soil Mapping Units

Mapping Unit/Series	**Hemphill clay loam**	**Toxaway silt loam**	**Codorus loam (arkaqua)**	**Rosman loam**
	Wetter ←			→ Drier
Parent Material	loamy and clayey alluvium	loamy alluvium	loamy alluvium	loamy alluvium
Topographic Slope Setting (down/across)	concave-concave	concave-linear	linear-linear	linear-linear
Natural Drainage Class	very poorly	very poorly	somewhat poorly	well
Seasonal High Water	surface	0 to 12	18 to 24	42 to 60
Flooding/Ponding Frequency	occasional/none	frequent/none	occasional/none	frequent/none
Permeability	slow	moderate	moderate	moderately rapid
Runoff Class	high	very high	low	very low
Ksat (in/hr of most limiting layer)	mod low to mod high	mod high to high	mod high to high	high
	0.06 to 0.20	0.57 to 1.98	0.57 to 1.98	1.98 to 5.95

Methodology

A detailed hydric soil delineation was completed in April, 2018. A series of soil borings were performed across the site to delineate the boundary between hydric soil and upland soil to described current soil characteristics, and evaluate the extent of hydric soil suitable for restoration. Soils were evaluated using morphologic characteristics to determine hydric indicators and evaluate current hydrology using criteria based on "*Field Indicators of Hydric Soils in the United States*" (USDA, NRCS, 2017, Version 8.1). The boring observations do not contain adequate detail to classify these soils to a series. Indicators used are valid for the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* (Version 2.0), Land Resource Region N (130B Southern Blue Ridge) (U.S. Army Corps of Engineers. 2010).

Soil boundaries were delineated based on soil borings information, landscape position, and local topographic relief. The hydric soil boundary points from field observations were collected with a sub-meter GPS system by Equinox staff and are used to locate the soil boundaries shown on the figures and calculate acreage. Soil boring locations were approximately located using the Trimble Outdoor Navigator smart phone application and exported to Google Earth.

At the Seniard site, more than 56 shallow borings from 12 to 24 inches were evaluated to delineate and characterize the soils (Figure 3). To described and document the range of soil characteristics at this site, five representative profiles were documented (Appendix A). Characteristics evaluated include texture, color, mottling, and saturation or water table where present. Other important features and characteristics were noted as observed.

Results and Discussion

Landscape setting

The project landscape is located along the floodplain at the confluence of Seniard Creek and a Sitton Creek. Most of the hydric soil is in the concave-linear floodplain on Sitton Creek above Seniard Creek. Sitton Creek is located to the left side of the floodplain. The lowest elevation of the floodplain appears to be more centrally located in the floodplain. The Creeks are incised and have a shallow levee or possibly spoil creating a slightly higher elevation beside the streams. Above the confluence of the streams a ditch drains a slope seep across the floodplain to Sitton Creek. Because of similar landscape positon and subtle soil changes, there is evidence that additional smaller seepages may occur along the base of this slope. These smaller seepages likely do not persist for long and may be present only during times of higher rainfall.

Soils description

Within the project area, three areas of hydric soil was identified that appears suitable for hydrologic restoration. Soil borings within the project boundary typically exhibited hydric soil indicators within 12 inches of the soil surface throughout floodplain (Appendix A). Soils examined within the project area typically have black to very dark brown sandy loam surface underlain by dark gray subsoil with redoximorphic concentrations. These mottles are likely relict. Much of the soils appear to have a shallow layer of fill or deposition over a buried dark horizon.

Many of the boring exhibit the dark horizon from 4 to 8 inches depth. The surface layer is likely disturbed by agricultural tillage and livestock grazing. Some areas may be the result of shallow fill or deposition. The dark horizons are an inclusion indicating historically conditions. The inclusion has reddish mottles that are atypical of the Toxaway and Hemphill series. This mottling may be the caused by long-term drainage allowing the oxidation of reduced iron that was either present or entered from the upland slopes. Slope seepages often contain higher amounts of reduced iron.

Historic surface disturbance may also have destroyed other hydric indicators through tillage or surface churning by livestock. Reduced periods of saturation combined with higher soil temperatures where forest cover is removed greatly increases the loss of surface organic matter. This loss of organic matter is visible when dark or black soils become brown or yellowish brown.

Hydric Soil Indicators

Hydric Soil Indicators are still present within the floodplain. The indicators present are the *F3-Depleted Matrix*, *F6-Redox Dark Surface*, and relict *A11-Depleted Below a Dark Surface*. The *F6* indicator is the most common indicator found across the site. The *F3* indicator is present where the reduction phase allows removal of iron minerals that give color to the soil resulting in gray color of parent material. Often traces of the iron as reddish mottles are visible in soil conditions. The *F6* indicator is present where long term saturation at the surface has inhibited decomposition of organics that results in the accumulation of dark organics. Iron minerals periodically introduced form characteristic dark red mottles but are often nearly obscured by the high organic content. The *F8* indicator occurs in depressional landscapes and exhibits iron concentrations along pore linings and can occur as large masses.

Potential Hydroperiod of Restored Soils

Based upon field observation across the Seniard site, the NRCS mapped units appear to have a moderate correlation to actual site conditions soils exhibiting characteristics most similar to expected inclusion types. Site soils have a subsoil of sandy loam, silt loam or sandy clay loam and likely have a slightly lower rate of internal drainage than the mapped soil units. The mapped soil series of Codorus is classified as a somewhat poorly drained *Fluvaquentic Dystrudepts* but field observations indicate a more developed dark surface more like the very poorly drained Toxaway (*Cumulic Humaquepts*) or Hemphill (*Fluventic Humudepts*) series.

Mitigation guidance for Common Mountain Soil Series suggests a hydroperiod for the Toxaway series of 12-16 percent during which the water table is within 12 inches of the surface (US Army Corps of Engineers 2016). No guidance on the Hemphill series is provided, but the wettest condition for mountain soils of 12-16 percent was assumed. These soils will require successful stream restoration to meet the suggested hydrologic criteria. This can be accomplished by relocating the stream channel into the lower elevation of the floodplain and raising the stream bed to raise the water table elevation. Surface roughening will increase storage and remove the smoother surface found in pastures.

Table 2. Wetland Hydroperiod Table for Soil at the Seniard Site

Mapping Unit/Series	Taxonomic Classification	Hydroperiod Range*	Available Water Capacity (water storage in profile)
Hemphill clay loam	*Fine, mixed, active, mesic* ***Umbric Endoaqualfs***	12-16%**	high (~10.4 in)
Toxaway silt loam	*Fine-loamy, mixed, superactive, nonacid, mesic* ***Cumulic Humaquepts***	12-16%	mod (~8.1 in)
Codorus loam (arkaqua)	*Fine-loamy, mixed, active, mesic* ***Fluvaquentic Dystrudepts***	7-9%	mod (~7.4 in)
Rosman loam	*Coarse-loamy, mixed, superactive, mesic* ***Fluventic Humudepts***	NA	mod (~8.5 in)

**Hydroperiod follows US Army Corps of Engineers. 2016. Wilmington District Stream and Wetland Compensatory Mitigation Update. North Carolina Interagency Review Team - October 24, 2016.*
*** No guidance on Hemphill clay loam-assumed wetter condition*

Summary Conclusions and Recommendations

The site is currently in agricultural use that is different from the historic landscape and hydrologic regime. Past landscape/land use changes at this site includes enhanced surface drainage, an incised channel moved to the edge of the floodplain, and a loss of surface organic matter from the change of the normal hydroperiod. The observed soils over the site are similar to inclusions expected within the mapped soil units. Much of the site has a loamy subsoil that will provide an adequate available water capacity after hydrologic restoration.

The soils observed across the site appear to be Toxaway (*Cumulic Humaquepts*) or Hemphill (*Fluventic Humudepts*) soils suitable for restoration with an expected hydroperiod of 10 to 16 percent. Within the upper reaches of the soil unit, a 9 to 12 percent hydroperiod may be expected. Natural variability across the site should be expected with wetter areas ranging to 16 percent in the lower elevations and depressions and 9 percent near the upland boundary lacking slope seepage.

Because of the sites observed soil characteristics and landscape position hydrologic restoration of the soil may be accomplished by realigning Sitton Creek into the floodplain and raising its bed elevation to restore the groundwater elevation to historic condition. Plugging the ditch draining the slope seepage will allow a natural hydroperiod to return in this area. To mimic natural systems, surface coarsening and creating shallow depressions across the floodplain will provide an appropriate landscape for diverse microhabitats. Due to compaction and long term agricultural use, a shallow ripping of the surface along the contour to no more than a depth of 8 to 10 inches is recommended. This decompaction will create adequate porosity for infiltration, enhance storage, and improve vegetative survival and growth. All ripping should be conducted in the dry to maximize its effectiveness.

The hydric soil located at the highest elevation along Sitton Creek may be more difficult to restore hydrology and hydrology may depend mostly upon the location and alignment of the restored channel. The hydroperiod in this area may slightly less than the suggested guidelines due to a slightly higher valley slope and limited seepage from the adjacent slope.

The Seniard project is located within a landscape suitable for wetland restoration and has soil exhibiting hydric indicators. An available water source for hydrology will be available when the channel is reconnected to the floodplain. Plugging of the drainage ditch will provide additional hydrology. Retention and storage within the floodplain will be returned to a natural state having an increased hydroperiod. Given the observed soil characteristics indicating historic wetland hydrology, because of favorable landscape positon, and the potential source for restoring hydrologic inputs, this site appears suitable for successful hydrologic wetland restoration.

This report describes the results of the soil evaluation performed at the Seniard Mitigation Site in Henderson County, NC. Any subsequent transfer of the report by the user shall be made by transferring the complete report, including figures, maps, appendices, all attachments and disclaimers.

References

Mid-Atlantic Hydric Soils Committee. 2011. A guide to hydric soils in the Mid-Atlantic Region, ver. 2.0. L.M. Vasilas and B.L. Vasilas (eds.). USDA, NRCS, Morgantown, WV. Available on CD and at <http://soils.usda.gov/technical/>.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at the following link: https://websoilsurvey.sc.egov.usda.gov/. Accessed [June/02/2018].

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

US Army Corps of Engineers. 2016. Wilmington District Stream and Wetland Compensatory Mitigation Update. North Carolina Interagency Review Team - October 24, 2016. SAW-2013-00668-PN http://www.saw.usace.army.mil/Missions/RegulatoryPermitProgram/

U.S. Army Corps of Engineers. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region Version 2.0, ed. J. F. Berkowitz, J. S. Wakeley, R. W. Lichvar, C. V. Noble. ERDC/EL TR-12-9. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

United States Department of Agriculture and Forest Service 1974. North Carolina Agricultural Experiment Station. Soil Survey of Henderson County North Carolina. January 1974.

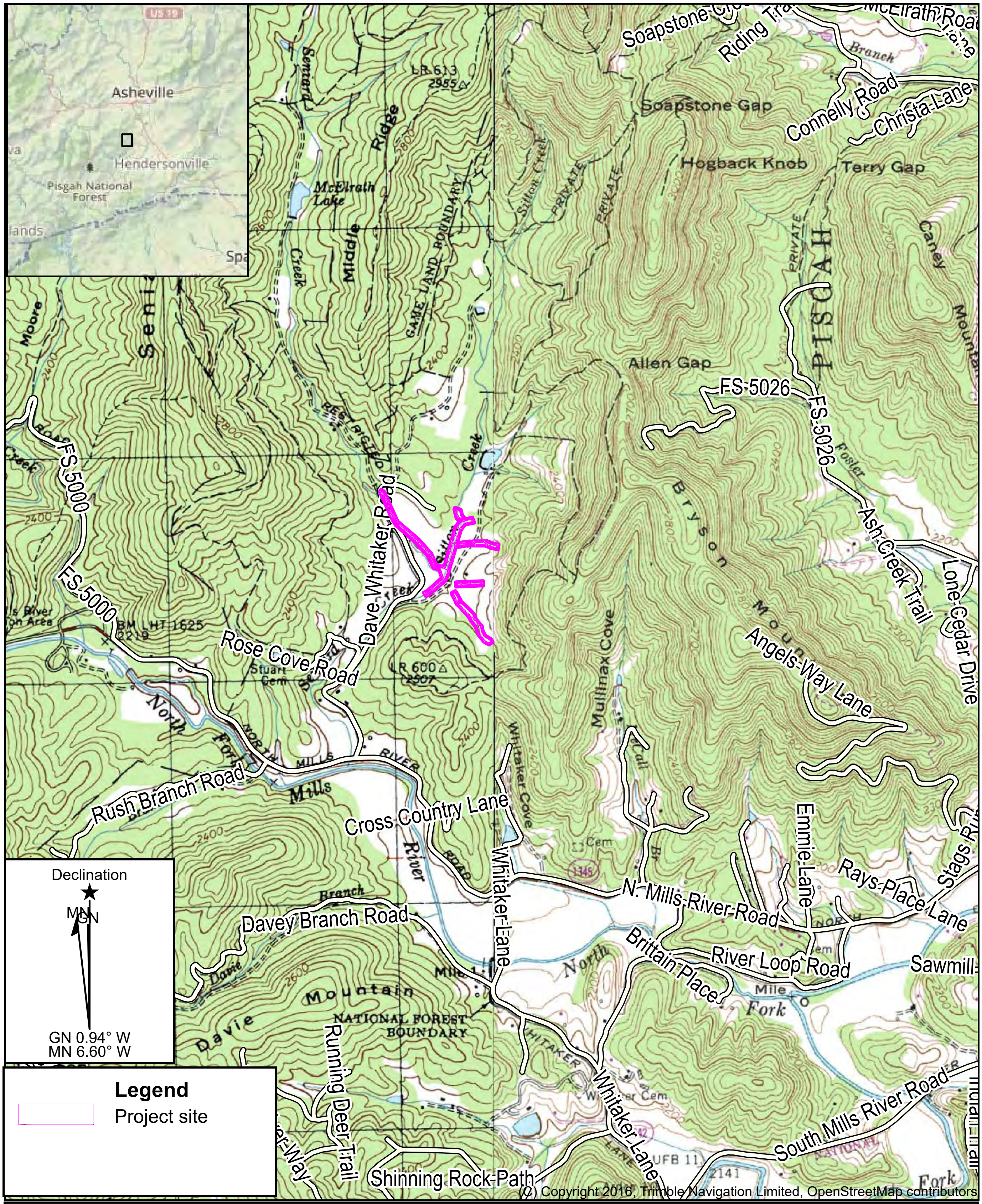
United States Department of Agriculture, Natural Resources Conservation Service. 2017. Field Indicators of Hydric Soils in the United States, Version 8.1. L.M. Vasilas, G.W. Hurt, and J.F. Berkowitz (eds.). USDA, NRCS, in cooperation with the National Technical Committee for Hydric Soils.

APPENDICE

Figures

Appendix A Soil Boring Log

Appendix B Photo Log



Horizontal Datum: WGS84

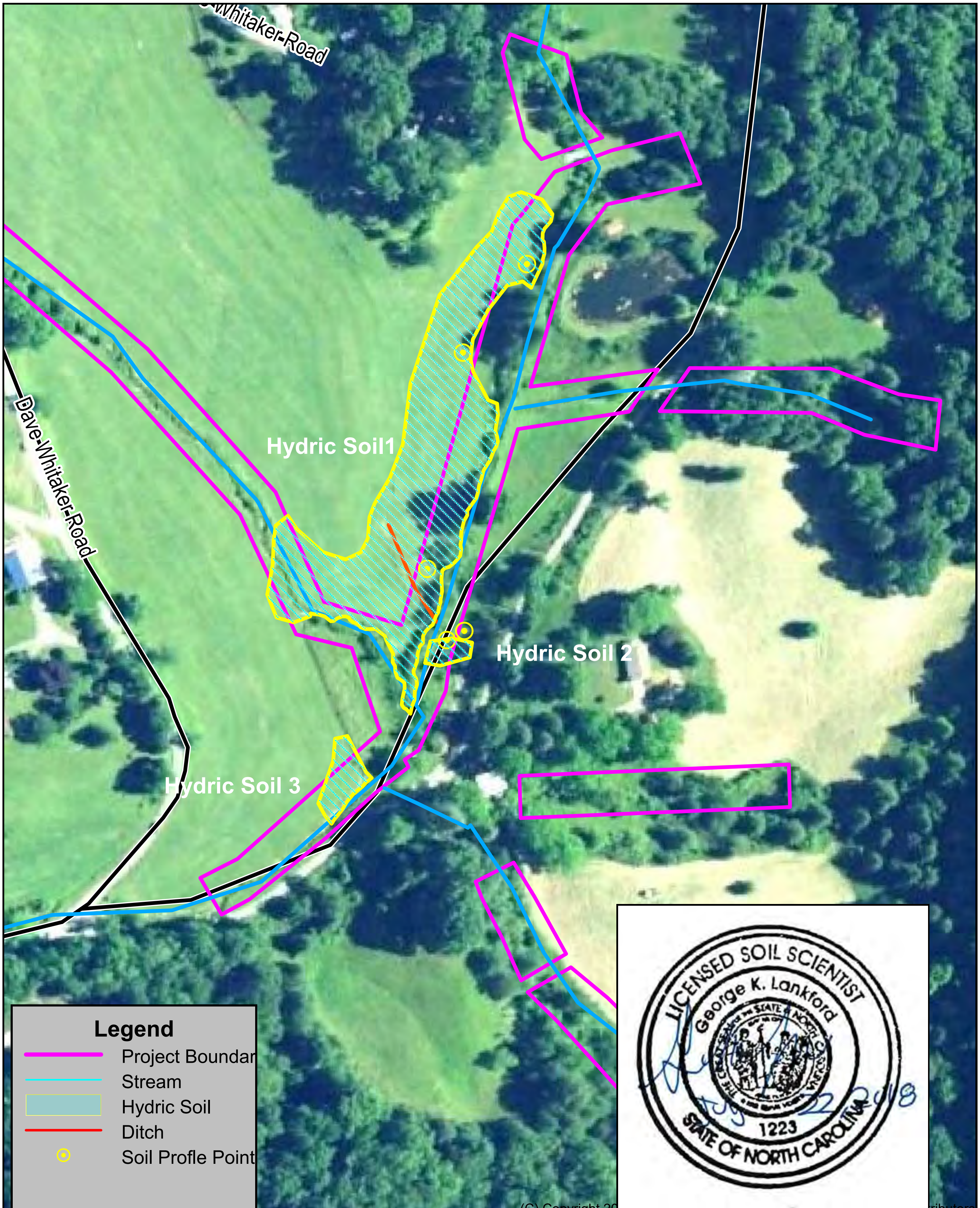
Scale: 1 inch = 2,000 ft.

Seniard Mitigation Site
Figure 1. Vicinity Map-USGS

SCALE 1:24000

0 1000 2000 3000 4000 5000
Feet

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
Miles



Scale: 1 inch = 200 ft.

Horizontal Datum: WGS84

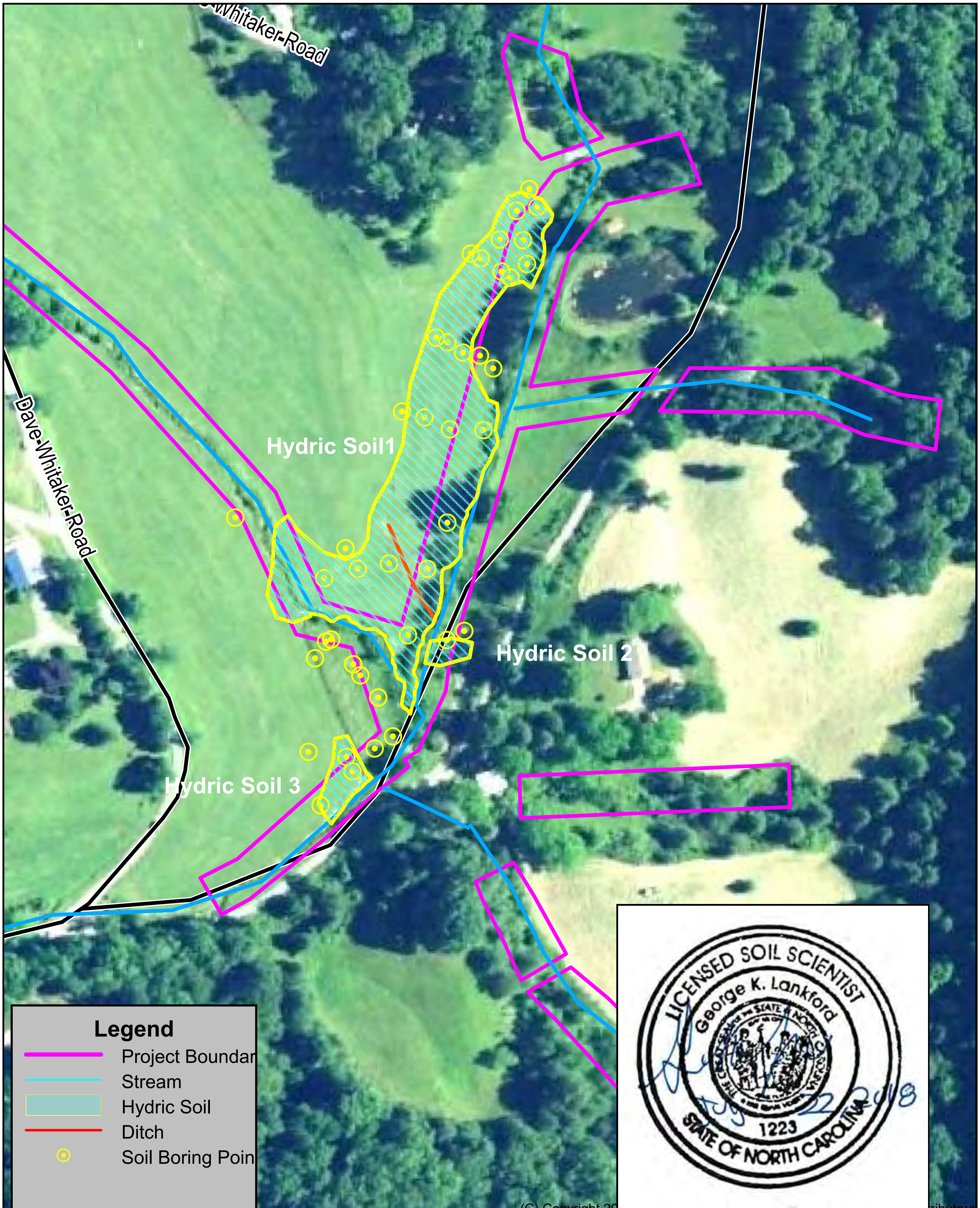
N
W E
S

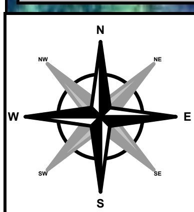
Seniard Mitigation Site
Figure 2. Aerial View

SCALE 1:2400

0 100 200 300 400
Feet

0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09
Miles





Scale: 1 inch = 200 ft. Horizontal Datum: WGS84

Seniard Mitigation Site
Figure 3. Soil Boring Points

SCALE 1:2400

0 100 200 300 400
Feet

0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09
Miles

Appendix B
Seniard Site-Henderson County NC
Soil Boring Descriptions

Table. Representative Soil Profiles at Seniard Mitigation Site

Depth (inches)	Color		Mottle Percentage (Location*)	Texture**	Notes
	Matrix	Mottle			
SB 40 (April 17 2017)			Hydric Indicators F6-Redox Dark Surface		
0-2	10 YR 2/2			SL	
2-12	10 YR 3/1	10 YR 3/6	7% (PL)	SL	~5 percent rounded gravel
SB 41 (April 17 2017) Upland profile			Hydric Indicators none		
0-11	10 YR 4/6			SL	
11-18	7.5 YR 4/6	5 YR 4/4	10% (PL)	SCL	
SB 42 (April 17 2017)			Hydric Indicators F3-Depleted Matrix		
0-4	10 YR 2/1			SL	
4-8	10 YR 3/2	10 YR 4/2	10% (PL)	S	
8-18	10 YR 4/1	10 YR 3/6	5% (PL)	SiL	
SB 43 (April 17 2017)			Hydric Indicators F3-Depleted Matrix-relict F6-Redox Dark Surface		
0-8	10 YR 2/1	10 YR 3/4	5% (PL)	S	
8-17	10 YR 4/3	10 YR 3/2	5% (PL)	SL	
17-22	10 YR 2/1	10 YR 3/3	5% (PL)p	SL	
SB 44 (April 17 2017)			Hydric Indicators A11-Depleted Below a Dark Surface- relict Or F6-Redox Dark Surface- relict		
0-3	10 YR 3/2			SL	
3-9	10 YR 3/3			SL	0-9 spoil from channel spoil?
9-19	10 YR 2/1			SL	

WT = observed apparent water table
*PL =pore lining, M = matrix
**Texture (follows USDA textural classification)
S = sand, L = loam, Si = silt, C = clay
f = fine, c = coarse (textural modifiers for sand)

Soil Scientist Seal

Appendix B
Seniard Site
Photo Log

April 2018

1. F3 Depleted Matrix and F6 Redox Dark Surface. (Profile # 43).

2. Concave landscape facing downstream. Sitton Creek is located to the left. (Profile # 43).

Appendix B
Seniard Site
Photo Log

April 2018

3. Relict indicators for A11 Thick Dark Surface and F6 Redox Dark Surface beneath spoil. (Profile # 44).

4. Along levee or berm of Sitton Creek to the left (Profile # 44).

North Carolina Department of Natural and Cultural Resources
State Historic Preservation Office
Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

January 8, 2018

Steve Melton
Equinox Environmental Consultation & Design, Inc.
37 Haywood Street
Asheville, NC 28801

Re: Seniard Creek Mitigation, Mills River Watershed, Henderson County, ER 17-1172

Dear Mr. Melton:

Thank you for your letter of November 28, 2017, transmitting the archaeological survey report by Michael Nelson and Tasha Benyshek. The report meets our guidelines and those of the Secretary of the Interior.

During the course of the survey, four sites were located within the project area. For purposes of compliance with Section 106 of the National Historic Preservation Act, we concur that archaeological sites 31HN308-311 are not eligible for listing in the National Register of Historic Places. These sites do not retain sufficient subsurface integrity or artifact density to yield information important to history or prehistory.

The report authors have recommended that no further archaeological investigation be conducted in connection with this project. We concur with this recommendation since the project will not involve significant archaeological resources.

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

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

Sincerely,

Renee Gledhill-Earley

for Ramona M. Bartos

cc: Michael Nelson/Tasha Benyshek, TRC

Location: 109 East Jones Street, Raleigh NC 27601 **Mailing Address**: 4617 Mail Service Center, Raleigh NC 27699-4617 **Telephone/Fax**: (919) 807-6570/807-6599

September 21, 2017

Attention: Steve Melton
EW Solutions
37 Haywood Street
Suite 100
Asheville, N.C. 28801

Reference: **Seniard Creek Mitigation Site**
French Broad River Basin – CU# 06010105
Henderson County, North Carolina
Project No. 100017
RFP: 16-006991

Mr. Melton,

The IRT field review of the Seniard Creek Mitigation Site on August 29, 2017, called into question the restoration approach proposed on a portion of Sitton Creek. The reach of concern starts at the location of the white pine grove adjacent to the existing pond and extends downstream to the confluence with Seniard Creek. It was the opinion of members of the IRT that this reach was sufficiently stable and provided adequate functions not to warrant restoration. The IRT suggested that enhancement efforts such as grading back the upper terrace and stabilizing the areas of eroding banks would be more appropriate. The design team voiced concerns associated with a stabilization and enhancement approach on an entrenched system and stated that it would be difficult to guaranty the stream would be stable at the time of monitoring close-out. The conversation concluded with DMS requesting that the design team re-evaluate the approach and provide either an alternative approach or further justification for restoration.

The design team revisited the site on September 13th and 14th to collect additional morphological data and evaluate the possibility of alternate approaches. This assessment included investigating channel conditions on Sitton Creek and Seniard Creek upstream of the project limits to identify potential reference morphology. An intact reference reach was located upstream on Seniard Creek. Additionally, upstream of the site, on Sitton Creek, stream conditions are stable and in near reference condition. There is evidence of a history of channel alterations, but the stream has been undisturbed for a sufficiently long period to form near reference morphology. A cross section was surveyed on this reach in order to provide a comparison with existing site conditions (See attached figure).

The following is a list of the cross section morphological parameters for this section:

$W_{BANKFULL}$ = 12.9 ft
$W_{CHANNEL\ BED}$ = 8.5 – 9.0 ft
$Area_{BANKFULL}$ = 8.9 sq.ft.
$Depth_{BANKFULL}$ = 0.8 – 1.0 ft
Width/Depth Ratio = 19

Five cross sections were also surveyed within the reach of Sitton Creek in question. These sections were not located in the most confining or degraded areas, but instead were located in the portions of the stream that were identified by the IRT as the most stable and functional. The selection was intentional in order to evaluate the long-term viability of these sub-reaches and to help determine the extent of modifications that may be required to promote long-term stability. The first on-site section, taken within the white pine grove, has a channel bed-width of 7.5 ft., bankfull width of 9.0 ft., and cross sectional area of 7.5 sq. ft. The width values are in the range of 70% to 90% of the reference values. Generally, departure values around 70% are considered marginal and values above 80% have a reasonable potential to remain stable. Further the bankfull depth and upper valley form are comparable to the reference section and suggest that future natural adjustments in this sub-reach will be minimal and relatively sustainable. However, this channel geometry represents only approximately 80 ft. of the entire 550 ft. reach in question (15%). This cross section is depicted in the attached figures with the reference section overlaid as a blue dashed line.

The remaining four cross sections represent a considerably different configuration than the white pine grove area. Throughout the remainder of the reach in question (85% of the total length) the cross section morphological parameters are as follows:

Parameter	**Range**	**Average**	**Departure (% of reference)**
$W_{BANKFULL}$	6.0 – 7.6	6.7	52%
$W_{CHANNEL\ BED}$	4.6 – 6.3	5.4	62%
$Area_{BANKFULL}$	8.1 – 10.8	9.1	102%
$Depth_{BANKFULL}$	1.4 – 2.3	1.9	211%
W/D Ratio	4 – 7	5	26%

The width values are 52% to 62% of the reference values. Bed-width values with this much deviation from reference condition can be expected to elevate stress in the lower third of the bank and scour the toe-of-bank as the channel attempts to re-establish proper geometry. This process is already underway as is evident by the undercut toes. Although this is not immediately obvious from visual observations, physical probing below the waterline revealed that approximately 60% to 80% of the banks are undercut below the waterline by 5 in. to 12 in.

Consideration was given to adopting a minimally invasive approach that would allow natural processes to shape and reform the channel geometry. Such an approach would require that the anticipated results of the erosion and deposition process would be acceptable. In order to estimate the magnitude of this process, the reference section was overlaid on the existing channel sections to calculate an approximate area of material that will be eroded by the channel to form the proper dimensions. Based on this area comparison it is estimated that approximately **2,500 ft^3**

of soil (156 tons) will be eroded and discharged downstream. The timing and rate of this process is uncertain, but will likely be on the order of decades not years.

Additionally, a minimally invasive approach would present several challenges and limitations since many locations within this reach are obviously unstable and will need to be stabilized. Stabilizing entrenched streams is inherently difficult and often counterproductive. Since the channel deficiencies and elevated shear stress issues are not addressed, the channel will likely respond by undermining the repairs or shifting the point of erosion downstream. This has been readily demonstrated by numerous NRCS projects in the mountains that have taken a similar approach and resulted failed structures and continued bank erosion.

Consideration was also given to implementing a more aggressive enhancement approach in order to establish a reliably stable stream within its present position. This too will present challenges and limitations that will negatively affect the end result. First, since bankfull depth is nearly twice the natural depth, the profile will need to be raised by approximately 1 ft. Second, since the channel width is approximately half the reference width, at least one bank will need to be excavated back 4 ft. to 5 ft. Third, a bankfull bench will need to be excavated on at least one side and in many locations on both sides. Fourth, although there will be many usable pattern features, topographic surveys and further assessment likely reveal pattern deficiencies that will require adjustments. The result of these activities would likely be that 50% to 80% of the existing landscape would be impacted by alterations, channel bed material would need to be composed partially of quarried stone, 'B' horizon soils would be exposed by the floodplain bench excavation, and the constructed floodplain would be artificially confined and set below the abandoned terrace. Additionally, two transition reaches will need to be designed which have the potential to negatively affect sediment transport continuity. In particular, at the downstream end, a lower gradient reach will be required to transition back to the priority I restoration reach of Seniard Creek. This has the potential reduce sediment transport capacity and result in aggradation of bed material.

Off-line restoration provides the most comprehensive approach which can address all of the deficiencies associated with this reach. By relocating the channel to the historic floodplain, not only can appropriate channel morphology be constructed, but the proper relationship between the bankfull channel and the floodplain can be restored. This has the potential of restoring appropriate groundwater conditions that will support native riparian vegetation and facilitate recovery of small wetland seeps adjacent to the stream that are common throughout the mountains. Although wetland credits are not being sought as part of this project, ground water gauges can be installed and monitored to demonstrate the recovery of groundwater hydrology that supports these components of the ecosystem.

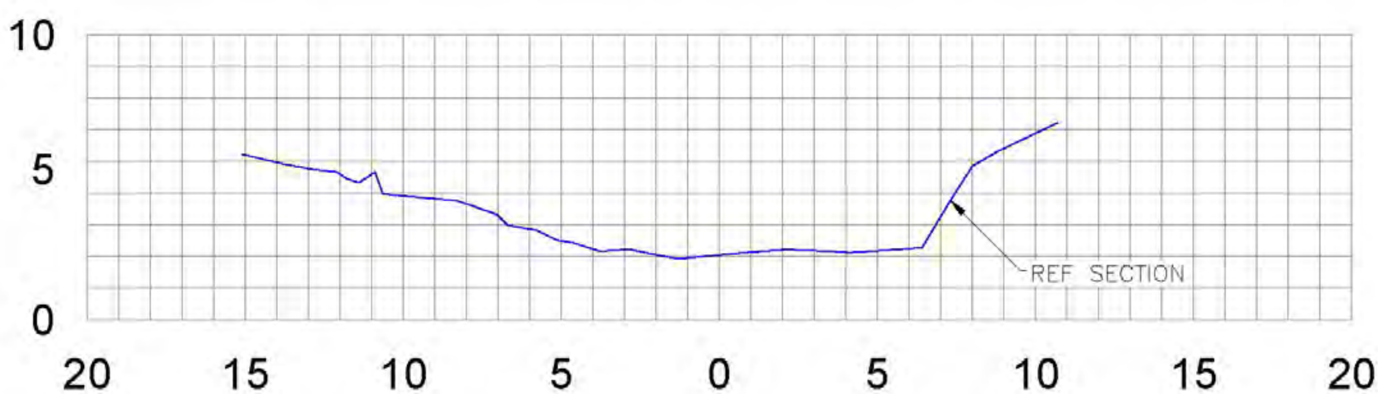
Additionally, offline restoration will allow for harvesting of bed material which will result in a stream bed composed entirely of native gravel and cobble. Existing willows and alders can be transplanted along the banks to provide a rapid recovery of shading vegetation and existing larger diameter trees can be easily avoided and saved. Further, a portion of the existing channel can be converted into an oxbow feature. This could be designed to provide a wetland feature that will buffer and filter runoff from the adjacent, maintained pond-area. Since the main channel will be constructed in an unconstrained valley, it will provide the opportunity to install significant woody material into the channel bed and bank structure.

The survey of these cross-sections and this more detailed examination of the existing channel conditions provide confirmation that present channel is not sustainable and that efforts to stabilize it in place will be counterproductive. An off-line restoration approach provides a comprehensive plan for restoration of the entire ecosystem and addresses all the present deficiencies of the system.

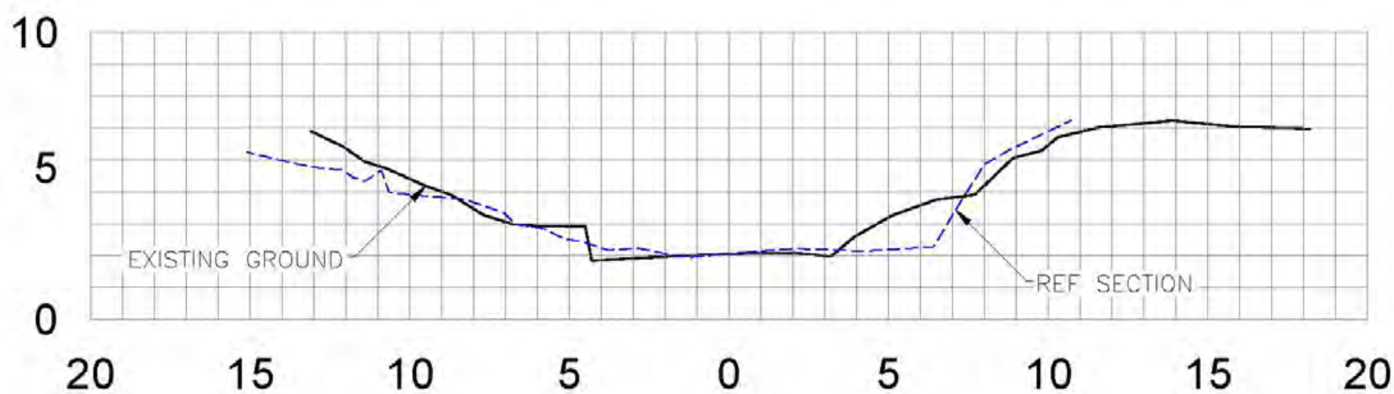
Sincerely,

S. Grant Ginn, PE
Principal, Senior River Restoration Engineer
Phone: (828) 229-8445
Grant.Ginn@Stantec.com

Upstream Reference Cross Section

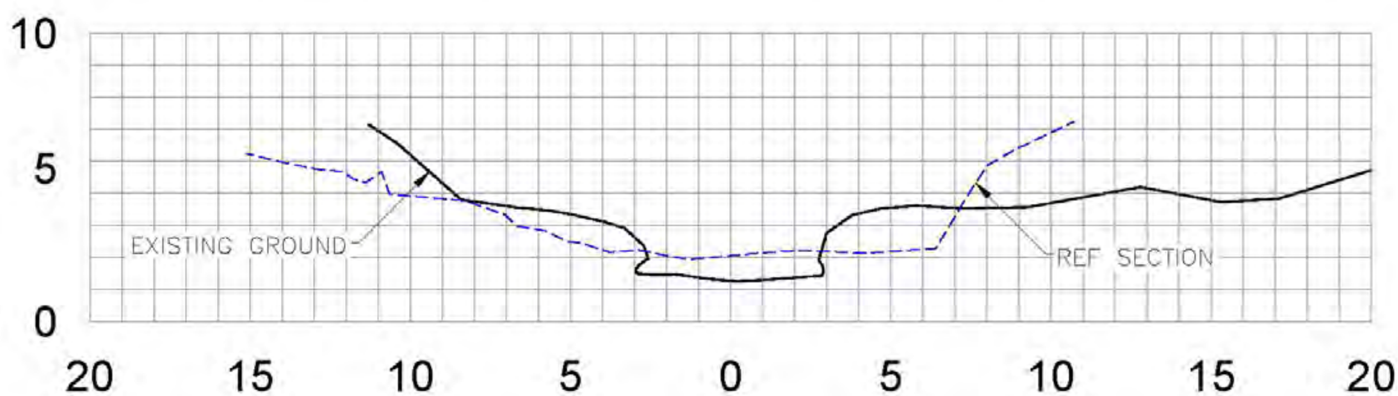


Pine Grove Cross Section

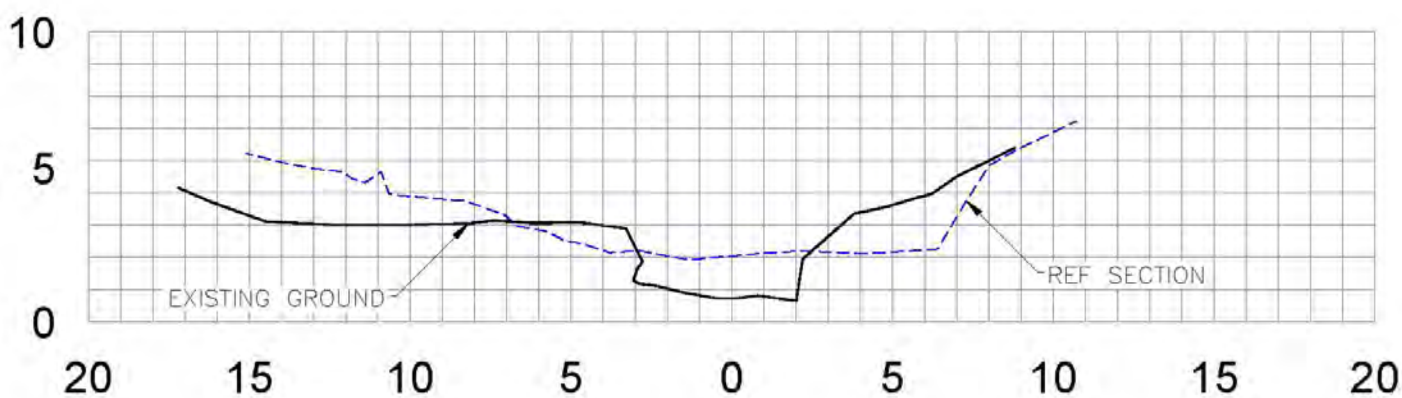


Cross Section 1

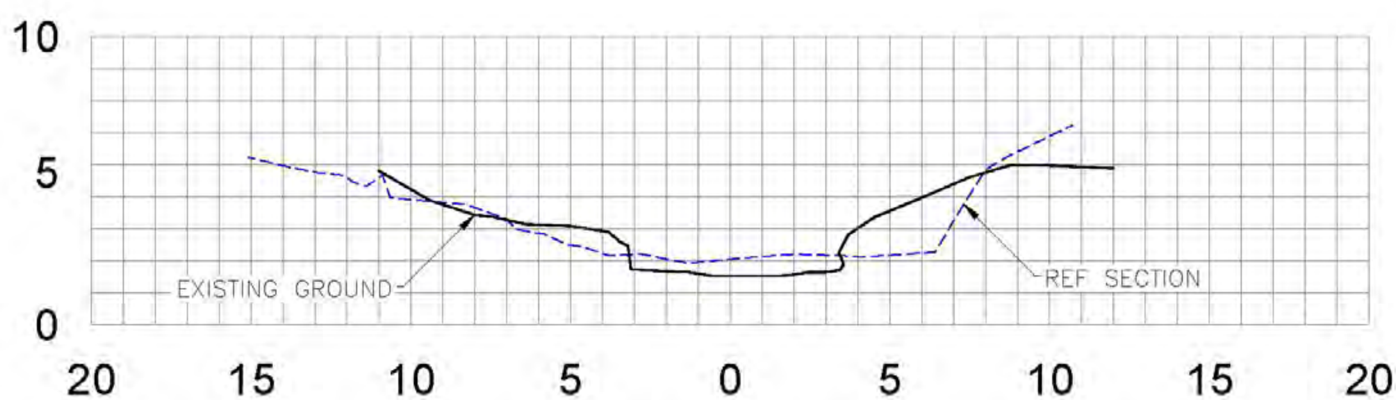
Cross Section 2



Cross Section 3



Cross Section 4



Mee⁺iŰḱ Nꞡ⁺e

MEET NG: Ωꞡ ⁺˘ ꞡŰ⁺rac⁺ ي T Si⁺e Vi i⁺
SeŰiard˘ reek S⁺rea Mi⁺iḱa⁺iꞡŰ Si⁺e
FreŰch Brꞡad 060 0 0! "# eŰder ꞡŰ˘ ꞡ$Ű⁺%&Ň
' E(˘ ꞡŰ⁺rac⁺ Nꞡ) * +,
' MS Ωrꞡ-ec⁺ Nꞡ) 000 *

' . TE: T$e da%& $ḱ$ ⁺ / , &/ 0 *& :00 0)) ⁺ꞡ 1:10 0))

23˘ . T 3 N: 0, * ' a4e 5 hi⁺aker ي d)&# ꞡr e Shꞡe&Ň

Attendees

Tꞡdd T$ḱ6 e7/8 9 S. ˘ E
. Űdrea 2e 7e 8 Ň 5 ي˘
: Brꞡ6 ŰiŰḱ 8 9 S. ˘ E
S⁺e4eŰ : iche; ki 8 9 S. ˘ E
' a4id Brꞡ6 Ű 8 9 S. ˘ E
Mac # a$0⁺ 8 Ň ' E(8 ' 5 ي
ZaŰ Ωrice 8 Ň ' E(8 ' 5 ي
Ωa$75 ie Űer 8 Ň ' E(8 ' MS
arr%T ꞡ ide 8 Ň ' E(8 ' MS 8 Ωrꞡ-ec⁺ MaŰaḱer
' aŰ4e%5 a7 h 8 E=$iŰꞡ>
Mare7/a B$Űcick 8 9 SF5 S
S⁺e4e Me7ꞡŰ 8 E5 Sꞡ7$⁺iꞡŰ 8 Ωrꞡ-ec⁺ MaŰaḱer
GraŰ⁺ GiŰŰ 8 S⁺aŰ⁺ec 8 ' e iḱŰer

Materials

- E5 Sꞡ7$⁺iꞡŰ &22́ TechŰica7Ωrꞡ0ꞡ a7da⁺ed / ? ! ? * iŰ re 0ꞡŰ e ⁺ꞡ ي FΩ @ 6A006, ,

Meeting Notes

) Ű⁺rꞡd$c⁺iꞡŰ ⁺ꞡ ⁺he i⁺e 6 a ḱi4eŰ a⁺ a ee⁺iŰḱ 07ace ꞡ;; ꞡ; ' a4e 5 hi⁺aker ي ꞡad a⁺ ⁺he 7ꞡ6 er eŰd ꞡ; SeŰiard˘ reek) The cꞡŰŰec⁺i4i⁺%⁺ꞡ ꞡ⁺her 0rꞡ⁺ec⁺ed 7aŰd 6 a di c$ ed) The a-ꞡri⁺%ꞡ; ⁺he head6 a⁺er are ei⁺her iŰ a 0ri4a⁺e cꞡŰ er4a⁺iꞡŰ ea e eŰ⁺ ꞡr he7d B%⁺he 9 SFS)

/) The i⁺e 4i i⁺ 6 a ⁺ar⁺ed iŰ ⁺he 7ꞡ6 er reache ꞡ; ⁺he SeŰiard˘ reek 6 hich 6 i7/Be ;$7/re ⁺ꞡra⁺iꞡŰ Ca⁺ a : i⁺iḱa⁺iꞡŰ ra⁺iꞡD Me Ber ꞡ; ⁺he ي T Űꞡ⁺ed ⁺ha⁺ 0ꞡi7Ber aŰd ⁺he ⁺raiḱh⁺eŰed chaŰŰe76 ere e4ideŰce ꞡ; 0a ⁺ di⁺chiŰḱ aŰd ⁺ha⁺ ⁺here 6 a a 7ack ꞡ; Bed;ꞡr di4er i⁺%)

1) Ωar⁺ici0aǗ⁺ 6 ere direc⁺ed ⁺ƨ ⁺he 0i0e ƨ$⁺;a7/Ǘear ⁺he idd7e ƨ; ⁺he SeǗiard˘ reek reach 6 here a 6 e⁺7aǗd BMΩ 6 a iǗdica⁺ed iǗ ⁺he ⁺echǗica70rƨ0ƨ a7) The ﮮ T cƨǗc$rred ⁺ha⁺ i⁺ 6 ƨ$7d Be a00rƨ0ria⁺e aǗd BeǗe;icia7⁺ƨ 0rƨ4ide ⁺hi ⁺rea eǗ⁺ ƨ; r$Ǘƨ;; ;rƨ ad-aceǗ⁺ 7aǗd $ e)

E) The ﮮ T aǩreed ⁺ha⁺ i⁺ 6 ƨ$7d Be a00rƨ0ria⁺e ⁺ƨ cƨǗd$c⁺ EǗhaǗce eǗ⁺ 2e4e7 re ⁺ƨra⁺iƨǗ C i⁺iǩa⁺iƨǗ ra⁺iƨ ƨ;)! : DƨǗ ⁺he $00er reach ƨ; SeǗiard˘ reek 6 here 7ƨ0e aǗd 4a7e%⁺%0e chaǗǩe ;rƨ ⁺he 7ƨ6 er ec⁺iƨǗ ƨ; SeǗiard˘ reek)

!) The ﮮ T ⁺ƨƨk i $e 6 i⁺h 0rƨ0ƨ ed re ⁺ƨra⁺iƨǗ ;ƨr 0ƨr⁺iƨǗ ƨ; Si⁺⁺ƨǗ˘ reek) Frƨ ⁺he $0 ⁺rea eǗd ⁺ƨ ⁺he area ƨ; ⁺he 6 hi⁺e 0iǗe ǩrƨ4e ⁺here 6 a ǩeǗera7aǩree eǗ⁺ ⁺ha⁺ re ⁺ƨra⁺iƨǗ 6 a 6 arraǗ⁺ed) BeǩiǗǗiǗǩ a⁺ ⁺he 0iǗe ǩrƨ4e aǗd ⁺heǗ iǗ e4era7 7ƨca⁺iƨǗ dƨ6 Ǘ ⁺rea &⁺he ﮮ T cƨ eǗ⁺ed ⁺ha⁺ ⁺he ⁺rea a00eared ⁺ƨ Be ;$Ǘc⁺iƨǗa7aǗd ⁺ha⁺ ⁺rea eǗhaǗce eǗ⁺ 6 ƨ$7d Be ƨre a00rƨ0ria⁺e) . di c$ iƨǗ ;ƨ7ƨ6 ed reǩardiǗǩ ⁺he BeǗe;i⁺ aǗd ri k a ƨcia⁺ed 6 i⁺h eǗhaǗce eǗ⁺ aǗd re ⁺ƨra⁺iƨǗ ƨ; aǗ eǗ⁺reǗched ⁺rea) The di c$ iƨǗ 6 a cƨǗc7$ded 6 i⁺h ' MS re=$e ⁺iǗǩ ⁺ha⁺ ⁺he de iǩǗ ⁺ea e4a7$a⁺e ⁺he a00rƨach aǗd 0rƨ4ide ⁺he ﮮ T 6 i⁺h addi⁺iƨǗa7 iǗ;ƨr a⁺iƨǗ ⁺ƨ $00ƨr⁺ a re ⁺ƨra⁺iƨǗ a00rƨach ƨǗ Si⁺⁺ƨǗ˘ reek)

6) 5 ﮮ˘ aǗd 9 SFS e Ber cƨ eǗ⁺ed ƨǗ ⁺he 0re eǗce ƨ; 6 hi⁺e 0iǗe ad-aceǗ⁺ ⁺ƨ ⁺he ⁺rea aǗd ⁺a⁺ed ⁺ha⁺ i⁺ 6 a Ǘƨ⁺ a de iraB7e 0ecie iǗ ⁺he ri0ariaǗ area) The%re=$e ⁺ed ⁺ha⁺ ⁺he e ⁺ree Be re ƨ4ed ;rƨ ⁺he ri0ariaǗ FƨǗe iǗc7$diǗǩ ⁺he ⁺aB7e ⁺rea reach a7ƨǗǩ Si⁺⁺ƨǗ˘ reek)

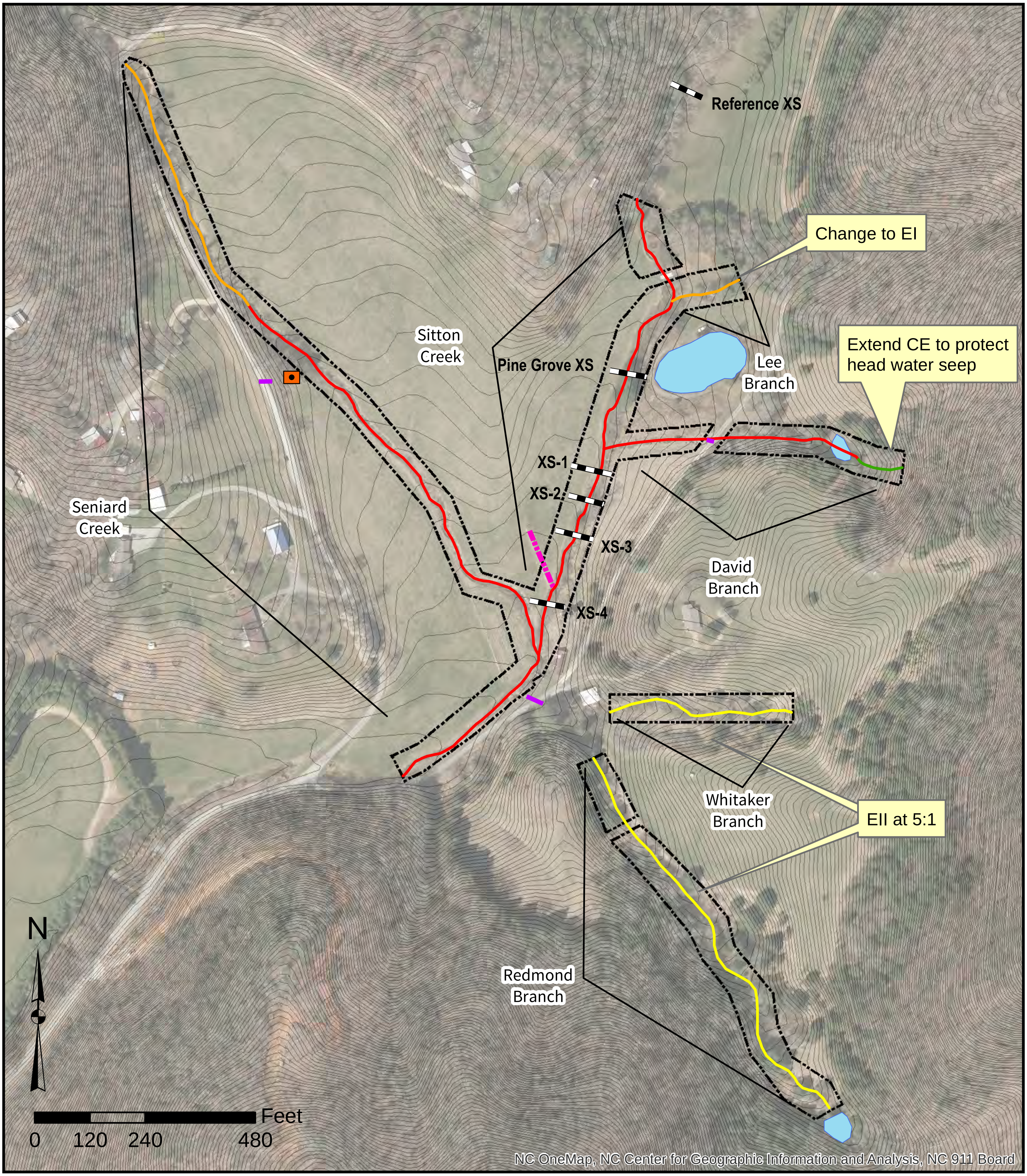
*) ⁺ 6 a di c$ ed aǗd aǩreed ƨǗ ⁺ha⁺ EǗhaǗce eǗ⁺ C i⁺iǩa⁺iƨǗ ra⁺iƨ ƨ;)! : D6 ƨ$7d Be cƨǗd$c⁺ed ƨǗ ⁺he eǗ⁺ire 7eǗǩ⁺h ƨ; 2ee BraǗch) E5 Sƨ7$⁺iƨǗ 0rƨ0ƨ ed ⁺hi reach a EǗhaǗce eǗ⁺ aǗd ⁺he ﮮ T ⁺hƨ$ǩh⁺ ⁺hi reach cƨ$7d Be ;$r⁺her eǗhaǗced B%addiǗǩ 7ƨǩ i7 ⁺ƨ 0ar⁺ia77%rai e ⁺he ⁺rea Bed&ǩradiǗǩ Back ⁺he riǩh⁺ BaǗk&aǗd re ƨ4iǗǩ ⁺he 6 hi⁺e 0iǗe)

+) There 6 a di c$ iƨǗ aBƨ$⁺ ⁺he ⁺6 ƨ 0riǗǩ aBƨ4e ' a4id BraǗch 0ƨǗd) Ωre er4a⁺iƨǗ credi⁺ Gra⁺iƨ 0: D6 ƨ$7d Be a00rƨ0ria⁺e ;ƨr ⁺he aiǗ ⁺e ƨ; ' a4id BraǗch&aBƨ4e ⁺he 0ƨǗd $0 ⁺ƨ ⁺he ee0? 0riǗǩ area&B$⁺ 6 ƨ$7d Ǘƨ⁺ Be a00rƨ0ria⁺e ;ƨr ⁺he 7Ǘear 6 e⁺7aǗd ⁺ƨ ⁺he Ǘƨr⁺h) E5 Sƨ7$⁺iƨǗ aǩreed ⁺ƨ iǗc7$de ⁺hi area iǗ ⁺he cƨǗ er4a⁺iƨǗ ea e eǗ⁺ ⁺ƨ 0rƨ⁺ec⁺ Bƨ⁺h 0riǗǩ ;eediǗǩ ' a4id BraǗch)

,) The ﮮ T 6 a iǗ aǩree eǗ⁺ 6 i⁺h re ƨ4a7ƨ; ⁺he 0ƨǗd da ƨǗ ' a4id BraǗch aǗd re ⁺ƨriǗǩ ⁺he ⁺rea ⁺hrƨ$ǩh ⁺he 0ƨǗd aǗd i edia⁺e7%Be7ƨ6 ⁺he ƨ$⁺;a77) F$r⁺her dƨ6 Ǘ ⁺rea &$0 ⁺rea ƨ; ⁺he 0i0e crƨ iǗǩ&aǗd dƨ6 Ǘ ⁺rea ƨ; ⁺he 0i0e crƨ iǗǩ&⁺he ﮮ T 6 a cƨǗcerǗed aBƨ$⁺ ⁺he ⁺rea re ⁺ƨra⁺iƨǗ a00rƨach) The ﮮ T 6 a iǗ aǩree eǗ⁺ 6 i⁺h ⁺he Ǘeed ⁺ƨ re07ace aǗd i 0rƨ4e ⁺he 0i0e crƨ iǗǩ B$⁺ ⁺a⁺ed ⁺ha⁺ ⁺he%6 ere cƨǗcerǗed ⁺ha⁺ ⁺he reach 6 ƨ$7d re4er⁺ ⁺ƨ a 7Ǘear 6 e⁺7aǗd) The ﮮ T ⁺a⁺ed ⁺ha⁺ 7Ǘear 6 e⁺7aǗd dƨ Ǘƨ⁺ 0rƨ4ide ⁺rea ;$Ǘc⁺iƨǗ aǗd ⁺here;ƨre caǗǗƨ⁺ Be ǩraǗ⁺ed ⁺rea credi⁺) The ﮮ T cƨǗc7$ded ⁺ha⁺ 6 i⁺h ⁺he direc⁺iƨǗ ⁺ha⁺ a7⁺hƨ$ǩh ⁺he% Be7e4ed ⁺ha⁺ ⁺he eǗd re $7⁺ 6 ƨ$7d Be a 7Ǘear 6 e⁺7aǗd ⁺he%6 ere 6 i77iǗǩ ⁺ƨ a77ƨ6 a re ⁺ƨra⁺iƨǗ a00rƨach ⁺ƨ 0rƨceed 6 i⁺h ⁺he $Ǘder ⁺aǗdiǗǩ ⁺ha⁺ i⁺ 6 a a⁺ ⁺he 0rƨ4ider ri k aǗd ⁺ha⁺ i; a ;$Ǘc⁺iƨǗiǗǩ ⁺rea ha Ǘƨ⁺ de4e7ƨ0ed B%⁺he ⁺i e ƨ; 0rƨ-ec⁺ c7ƨ e ⁺heǗ Ǘƨ ⁺rea credi⁺ 6 i77Be ǩraǗ⁺ed)

0) The ﮮ T di c$ ed ⁺ha⁺ ⁺he eǗ⁺ire 7eǗǩ⁺h ƨ; ﮮ ed ƨǗd BraǗch aǗd 5 hi⁺aker BraǗch did Ǘƨ⁺ ee⁺ ⁺he ;$77cri⁺eria ;ƨr ⁺rea EǗhaǗce eǗ⁺) ⁺ 6 a aǩreed ⁺ha⁺ ⁺he 0rac⁺ice cƨǗd$c⁺ed ƨǗ ﮮ ed ƨǗd BraǗch aǗd 5 hi⁺aker BraǗch 6 ƨ$7d Be credi⁺ed a EǗhaǗce eǗ⁺ a⁺ a ! : i⁺iǩa⁺iƨǗ ra⁺iƨ)

) . 77 ⁺rea ca77 aŰd 6 e⁺7aŰd de⁺er iŰa⁺iƺŰ 6 i77Be de⁺er iŰed B%⁺he a00rƺ0ria⁺e aǩeŰcie)
S⁺e4e : iche; ki aŰd ' a4id Brƺ6 Ű 6 ere 0re eŰ⁺ re0re eŰ⁺iŰǩ ⁺he 9 S. ˘ E) E5 S 6 i77cƺƺrdiŰa⁺e
6 i⁺h ⁺he ⁺ƺ ched$7e ⁺he de⁺er iŰa⁺iƺŰ) The ي T iŰdica⁺ed ⁺ha⁺i 0ac⁺ ⁺ƺ e>i ⁺iŰǩ 6 e⁺7aŰd
Űeed ⁺ƺ Be cƺŰ idered) The%re=$e ⁺ed a c7ear ⁺ra⁺eǩ%⁺ƺ ƺ;; e⁺ ⁺he 0ƺ iB7e 7ƺ ƺ; ⁺he e>i ⁺iŰǩ
6 e⁺7aŰd ƺŰ ⁺he 0rƺ-ec⁺ i⁺e)



EQUINOX

Figure A-8. Conceptual PlanV2
Seniard Creek
Stream Restoration Site
Henderson Co., NC
September 2017

Proposed Easement
Ponds
BMP
Ditch
Culvert
Contours 2 ft

Stream Restoration Type
Enhancement I
Enhancement II
Preservation
Restoration

This map is not a survey and is not to be construed as such.

From:	Leslie, Andrea J
To:	Tugwell, Todd J CIV USARMY CESAW (US); Haupt, Mac; Steve Melton; Browning, Kimberly D CIV USARMY CESAW (US); Kichefski, Steven L CIV USARMY CESAW (US); Brown, David W CIV USARMY CESAW (US); Price, Zan (George); marella_buncick@fws.gov
Cc:	Wiesner, Paul; Tsomides, Harry; Ginn, Grant
Subject:	RE: [External] RE: Seniard Creek #100017 Post Contract IRT Site Visit Notes
Date:	Tuesday, October 3, 2017 3:23:49 PM

Hi Steve,

Thank you for the summary. Just a clarification - I didn't mean to recommend that the white pines be removed. I do question their long-term usefulness in the riparian zone (as they will likely come down at some point during a storm and because they limit growth of a more typical riparian herbaceous and subcanopy/canopy community), especially as they dominate the riparian canopy where they are. However, keeping the shade on that stream with those white pines is useful. I leave it up to the providers to determine whether they should stay or go.

Andrea

Andrea Leslie
Mountain Habitat Conservation Coordinator
NC Wildlife Resources Commission
20830 Great Smoky Mountain Expressway
Waynesville, NC 28786
828-400-4223
www.ncwildlife.org

-----Original Message-----
From: Tugwell, Todd J CIV USARMY CESAW (US) [mailto:Todd.Tugwell@usace.army.mil]
Sent: Monday, October 02, 2017 4:38 PM
To: Haupt, Mac <mac.haupt@ncdenr.gov>; Steve Melton <steve@equinoxenvironmental.com>; Leslie, Andrea J <andrea.leslie@ncwildlife.org>; Browning, Kimberly D CIV USARMY CESAW (US) <Kimberly.D.Browning@usace.army.mil>; Kichefski, Steven L CIV USARMY CESAW (US) <Steven.L.Kichefski@usace.army.mil>; Brown, David W CIV USARMY CESAW (US) <David.W.Brown@usace.army.mil>; Price, Zan (George) <Zan.Price@ncdenr.gov>; marella_buncick@fws.gov
Cc: Wiesner, Paul <paul.wiesner@ncdenr.gov>; Tsomides, Harry <harry.tsomides@ncdenr.gov>; Ginn, Grant <Grant.Ginn@stantec.com>
Subject: [External] RE: Seniard Creek #100017 Post Contract IRT Site Visit Notes

Steve,
I don't have any other comments besides what was already mentioned.
Thanks,
Todd

-----Original Message-----
From: Haupt, Mac [mailto:mac.haupt@ncdenr.gov]
Sent: Monday, October 02, 2017 3:10 PM
To: Steve Melton <steve@equinoxenvironmental.com>; Tugwell, Todd J CIV USARMY CESAW (US) <Todd.Tugwell@usace.army.mil>; Leslie, Andrea J <andrea.leslie@ncwildlife.org>; Browning, Kimberly D CIV USARMY CESAW (US) <Kimberly.D.Browning@usace.army.mil>; Kichefski, Steven L CIV USARMY CESAW (US) <Steven.L.Kichefski@usace.army.mil>; Brown, David W CIV USARMY CESAW (US) <David.W.Brown@usace.army.mil>; Price, Zan (George) <Zan.Price@ncdenr.gov>; marella_buncick@fws.gov
Cc: Wiesner, Paul <paul.wiesner@ncdenr.gov>; Tsomides, Harry <harry.tsomides@ncdenr.gov>; Ginn, Grant <Grant.Ginn@stantec.com>
Subject: [EXTERNAL] RE: Seniard Creek #100017 Post Contract IRT Site Visit Notes

Steve M.,

I reviewed you notes and feel they pretty much captured what we discussed on site. However, I do not feeling that all the ratios are set after a preliminary site visit.

Typically, the IRT wants to see more information (mit plan) and final approval will happen then. I realize you need to budget to make sure the project can move forward. As I recall, when we discussed the two enhancement reaches, Whitaker and Redmond, we felt like a ratio of 5:1 would be "at best" more appropriate, which means unless the work on those reaches gives more functional uplift in the mitigation plan the ratio may be higher.

Thanks,

Mac

From: Steve Melton [mailto:steve@equinoxenvironmental.com]
Sent: Wednesday, September 27, 2017 2:07 PM
To: Tugwell, Todd SAW <Todd.Tugwell@usace.army.mil>; Leslie, Andrea J <andrea.leslie@ncwildlife.org>; Browning, Kimberly D CIV USARMY CESAW (US) <Kimberly.D.Browning@usace.army.mil>; Kichefski, Steven L SAW <Steven.L.Kichefski@usace.army.mil>; Brown, David W CIV USARMY CESAW (US) <David.W.Brown@usace.army.mil>; Haupt, Mac <mac.haupt@ncdenr.gov>; Price, Zan (George) <Zan.Price@ncdenr.gov>; marella_buncick@fws.gov
Cc: Wiesner, Paul <paul.wiesner@ncdenr.gov>; Tsomides, Harry <harry.tsomides@ncdenr.gov>; Ginn, Grant <Grant.Ginn@stantec.com>
Subject: Seniard Creek #100017 Post Contract IRT Site Visit Notes

All,

Please see the attached Site Visit Meeting Notes. The notes include a detailed investigation into portions of Sitton Creek where there was some disagreement during the site visit on the proposed restoration. Everyone please review and give us feedback and make a final decision on Sitton Creek so we can move forward accordingly.

Thank you for your time and attention to this.

Sincerely,

Steve Melton

Vice President

---

37 Haywood Street, Suite 100

Asheville, NC 28801

Blockedwww.equinoxenvironmental.com <Blockedhttp://www.equinoxenvironmental.com/>

(828) 253-6856 extension 207

Check out our website and blog! Visit us at Blockedwww.equinoxenvironmental.com <Blockedhttp://www.equinoxenvironmental.com/>

Appendix D FUNCTIONAL ASSESSMENT

Page left intentionally blank for printing purposes.

Seniard Creek Reach 1 (A) Restoration				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows		Appropriate baseflow	Water enters reach through culvert with a significant drop
	• Channel Forming Flows		$Q_{CHANNEL}$ >> $Q_{BANKFULL}$	somewhat entrenched due to road embankment river-right and high terrace/pasture river left
	• Overbank Flooding		$Q_{OVERANK}$ > $Q_{10\ YEAR}$	Entrenchment limiting frequency of overbank flooding
	• Hyporheic Flow		$DEPTH_{SUBSTRATE}$ < 0.5 ft Limited head potentials	Cobbly; depth to substrate shallow. Low scour potential. Low sediment load.
	• Groundwater		Stream surface water >4 ft below terrace	Entrenchment resulting in drawdown of adjacent groundwater.
Sediment Transport and Storage	• Bed Form Diversity		Profile limited given existing gradient; short, shallow pools	Confinement of R bank causing some disruption to profile. Basically a step-pool system due to gradient
	• Energy Management		Elevated shear stresses, especially during increased discharge	Energy dissipation to bed at higher discharge. Entrenchment resulting in increased shear stress
	• Sediment Continuity		BEHI = MOD NBS = MOD low sediment load	Bank scour not prevalent. Steep banks due to entrenchment. Good riparian veg. No significant aggradation.
	• Substrate Quality		D_{50} = 30 mm, D_{84} = 100 mm No excessive fines	Valley position limiting input of fines. Minor inputs from steep banks and bank erosion.
Organic Material Transport and Storage	• Bed Form Diversity		Few LWD forced pools No wood complex riffles	Moderate sources of wood present, but large diameter wood is limited/absent.
	• Energy Management		Some LWD present in channel	Existing channel is chute-like, so transport through reach is likely high
	• Aquatic Habitat		low organic storage potential	some LWD and snags are available but transport is high
Natural Communities	• Temperature and Oxygen Regulation		Some shading	Narrow buffer, primarily on one side
	• Process Organic Matter and Nutrients		LWD structure = 1 per 12 BKF	Somewhat limited LWD supply; shear and gradient routing organic materials
	• Biodiversity		Mid-successional reach Narrow riparian buffer	Mixed hardwood (alder, wiollow, apple, sweetgum) and some invasives (privet)
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width Left ≈ 5 ft Buffer width Right ≈ 5 ft	narrow due to entrenched channel and road embankment
	• Longitudinal Connectivity of biotic and abiotic process		U/s forest = 0 ft D/s forest = 100 ft	narrow buffer, though long and linear, fairly continuous through reach; fragmented (road) to upstream forest and downstream to fields
	• Source and Sink for natural populations		Mid-successional vegetation	Buffer development occuring in entrenched portion of reach
Status Key: Optimal Suboptimal Marginal oor				

Seniard Creek Reach 1 (B) Restoration				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows		Diminished baseflow	Baseflow appears to reduce downstream due to increased fines in bed
	• Channel Forming Flows		$Q_{CHANNEL} > Q_{BANKFULL}$	Entrenchment resulting in excessive storm flow disturbances
	• Overbank Flooding		$Q_{OVERANK} > Q_{5\ YEAR}$	Entrenchment limiting frequency of overbank flooding
	• Hyporheic Flow		$DEPTH_{SUBSTRATE} < 0.4$ ft Limited head potentials	Increased load of fine sediments DS of transport reach causing aggradation and lowering occurrence of head potentials
	• Groundwater		Stream surface water 3 ft below terrace	Entrechment resulting in drawdown of adjacent ground water
Sediment Transport and Storage	• Bed Form Diversity		Limited riffle/pool form	Elevated shear stress and adjacent agriculture disrupting riffle/pool formation
	• Energy Management		Elevated shear stresses, especially during increased discharge	Entrechment resulting in elevated shear stress
	• Sediment Continuity		BEHI = HIGH NBS = MOD Sediment load = moderate	Excessive shear stress and agricultural incursions contributing to bank scour
	• Substrate Quality		D_{50} = 17 mm, D_{84} = 33 mm Fines >50%	On-site sediment sources increasing input of finer sediment
Organic Material Transport and Storage	• Bed Form Diversity		Few LWD forced pools; no wood riffle complexes	Limited LWD supply; elevated shear stress routing organic material
	• Energy Management		LWD structures = 1 per 30 Bkf	Limited LWD supply; agricultural incursions disrupting LWD establishment
	• Aquatic Habitat		Occasional leaf packs; marginal organic storage potential	Limited LWD or snags to trap and retain organic material
Natural Communities	• Temperature and Oxygen Regulation		Limited shading; elevated temperature	Limited mature riparian vegetation, especially downstream
	• Process Organic Matter and Nutrients		Low biomass	Limited to no mature riparian vegetation; agricultural incursions
	• Biodiversity		Low species diversity	Limited to no mature riparian vegetation; agricultural incursions
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width Left ≈ 2 ft Buffer width Right ≈ 3 ft	Narrow, discontinuous riparian buffer adjacent to agricultural land use
	• Longitudinal Connectivity of biotic and abiotic process		Fragmented connectivity to U/s and D/s forest	Fragmented connection to upstream forested land use
	• Source and Sink for natural populations		early successional/ agricultural vegetation; no opportunities for successional development	Poor riparian buffer; agricultural impacts
Status Key: Optimal Suboptimal Marginal or				

Seniard Creek Reach 2 Restoration				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows		Diminished baseflow	Presence of excessive fines in bed material
	• Channel Forming Flows		$Q_{CHANNEL} >> Q_{BANKFULL}$	Entrenchment resulting in elevated storm flow disturbances
	• Overbank Flooding		$Q_{OVERANK} > Q_{5\ YEAR}$	Entrenchment severaly limiting frequency of overbank flooding
	• Hyporheic Flow		$DEPTH_{SUBSTRATE} \approx 1$ ft Limited head potentials	Increased load of finer sediments resulting in pool filling and low occurrence of head potentials
	• Groundwater		Water surface approx 3 ft below terrace	Entrenchment resulting in drawdown of adjacent groundwater
Sediment Transport and Storage	• Bed Form Diversity		Limited riffle/pool form	Elevated shear; bank maintenance and animal incursions disrupting riffle/pool formation
	• Energy Management		Elevated shear stresses, especially during increased discharge	Entrechment resulting in elevated shear stress
	• Sediment Continuity		BEHI = HIGH NBS = MOD Sediment load = moderate	Excessive shear stress and agricultural incursions contributing to bank scour
	• Substrate Quality		D_{50} = 25 mm, D_{84} = 75 mm Fines > 50%	On-site sediment sources increasing input of finer sediment
Organic Material Transport and Storage	• Bed Form Diversity		No LWD forced pool development; no wood riffle complexes	No LWD supply; elevated shear stress mobilizing and routing organic material
	• Energy Management		No LWD structures	No LWD supply; elevated shear stress mobilizing and routing organic material
	• Aquatic Habitat		No leaf packs; little oraginic storage potential	No LWD or snags to trap organic debris
Natural Communities	• Temperature and Oxygen Regulation		No shading	Little/no mature riparian vegetation; mowed banks
	• Process Organic Matter and Nutrients		Low biomass	Little/No mature riparian vegetation; Agriculture and maintained landscape
	• Biodiversity		Low species diversity	Little/No mature riparian vegetation; Agriculture and maintained landscape
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width Left ≈ 0 ft Buffer width Right ≈ 0 ft	Little to no riparian buffer
	• Longitudinal Connectivity of biotic and abiotic process		U/s forest = 0 ft D/s forest = 0 ft	No connection to forested land use
	• Source and Sink for natural populations		No opportunities for population equilibrium	No riaprian buffer; athropogenic and livestock impacts

Status Key: Optimal Suboptimal Marginal oor

Sitton Creek Reach 1

Restoration

Stream Function	Supported Attributes	Status	Condition	Cause/Association
Water Transport and Storage	• Proper Seasonal Flows		Diminished baseflow	Baseflow appears to reduce downstream due to increased fines in bed
	• Channel Forming Flows		$Q_{CHANNEL} >> Q_{BANKFULL}$	Entrenchment resulting in excessive storm flow disturbances
	• Overbank Flooding		$Q_{OVERANK} > Q_{10\ YEAR}$	Entrenchment limiting frequency of overbank flooding
	• Hyporheic Flow		$DEPTH_{SUBSTRATE} < 1$ ft Limited head potentials	Increased load of fine sediments resulting in pool filling and less occurrence of head potentials
	• Groundwater		Stream surface water 3 ft below terrace	Entrechment resulting in drawdown of adjacent ground water
Sediment Transport and Storage	• Bed Form Diversity		Limited riffle/pool form	Elevated shear stress and adjacent agriculture disrupting riffle/pool formation
	• Energy Management		Elevated shear stresses, especially during increased discharge	Entrechment resulting in elevated shear stress
	• Sediment Continuity		BEHI = HIGH NBS = LOW Sediment load = Mod/High	Excessive shear stress and agricultural incursions contributing to bank scour
	• Substrate Quality		D_{50} = 10 mm, D_{84} = 35 mm Fines >50%	On-site sediment sources increasing input of finer sediment
Organic Material Transport and Storage	• Bed Form Diversity		Few LWD forced pools; Wood riffle complex = Low	Limited LWD supply; elevated shear stress routing organic material
	• Energy Management		LWD structures = 1 per 20 Bkf	Limited LWD supply; agricultural incursions disrupting LWD establishment
	• Aquatic Habitat		Occasional leaf packs; marginal organic storage potential	Limited LWD or snags to trap and retain organic material
Natural Communities	• Temperature and Oxygen Regulation		Limited shading; elevated temperature	Limited mature riparian vegetation
	• Process Organic Matter and Nutrients		Low biomass	Limited mature riparian vegetation; agricultural incursions
	• Biodiversity		Low species diversity	Limited mature riparian vegetation; agricultural incursions
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width Left ≈ 3 ft Buffer width Right ≈ 3 ft	Narrow, discontinuous riparian buffer adjacent to agricutural land use
	• Longitudinal Connectivity of biotic and abiotic process		U/s forest = 100 ft D/s forest = 0 ft	Upstream connection to forested land use
	• Source and Sink for natural populations		mixed successional and agricultural vegetation; few opportunities for successional development	Poor riparian buffer; agricultural impacts

Status Key: Optimal Suboptimal Marginal oor

Lee Branch Reach 1

Restoration

Stream Function	Supported Attributes	Status	Condition	Cause/Association
Water Transport and Storage	• Proper Seasonal Flows		Normal baseflow	spring- and precip fed headwaters
	• Channel Forming Flows		$Q_{CHANNEL} > Q_{BANKFULL}$	past ditching; entrenched and actively incising channel
	• Overbank Flooding		$Q_{OVERANK} > Q_{10\ YEAR}$	floodplain connectivity limited due to entrenchment
	• Hyporheic Flow		$DEPTH_{SUBSTRATE} < 0.5$ ft Head potentials exist	Natural channel substrate provide occassional occurrence of head potentials
	• Groundwater		Stream surface water 3-4 ft below terrace	degraded hydrologic connection due to entrenchment
Sediment Transport and Storage	• Bed Form Diversity		Limited riffle/pool form	Elevated shear stress disrupting pool formation
	• Energy Management		Elevated shear stresses, especially during increased discharge	Entrechment resulting in elevated shear stress
	• Sediment Continuity		BEHI = HIGH NBS = MOD Fines >50%	Excessive shear stress and agricultural incursions contributing to bank scour
	• Substrate Quality		D_{50} = <1 mm, D_{84} = <2 mm Excessive fines	On-site sediment from scour and headcuts
Organic Material Transport and Storage	• Bed Form Diversity		No LWD forced pools Wood riffle complex = few	Limited LWD supply
	• Energy Management		No LWD Structures	Some potential for LWD structure, but absent in existing conditions
	• Aquatic Habitat		Occasional leaf packs; organic storage potential	Entrenchment and bank angles preclude efficient carbon storage
Natural Communities	• Temperature and Oxygen Regulation		Full shading except for short portion of reach; adequate temperature	Mature vegetation present
	• Process Organic Matter and Nutrients		High biomass	Mature vegetation present
	• Biodiversity		Relatively low species diversity	Mature riparian vegetation in overstory; riparian vegetation limited due to loss of hydrology
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width Left ≈ 10 ft Buffer width Right ≈ 10 ft	Connected to some forested land use, though generally low latitudinal connectivity
	• Longitudinal Connectivity of biotic and abiotic process		U/s forest = abundant D/s forest = 50 ft	Connected to abundant forested landcover upstream; existing bridge D/S
	• Source and Sink for natural populations		Mixed successional community	Current two-track/bridge inhibits community development

Status Key: Optimal Suboptimal Marginal oor

David Branch Reach 1 (A) Preservation				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows	Optimal	Normal baseflow	Spring-fed headwaters
	• Channel Forming Flows	Optimal	$Q_{CHANNEL} \approx Q_{BANKFULL}$	small channel upstream of existing pond
	• Overbank Flooding	Suboptimal	$Q_{OVERANK} > Q_{2\ YEAR}$	slight entrenchment
	• Hyporheic Flow	Suboptimal	$DEPTH_{SUBSTRATE} < 0.5$ ft Head potentials exist	Natural channel substrate provide occassional occurrence of head potentials
	• Groundwater	Optimal	Stream surface water 1 ft below terrace	functional floodplain connectivity
Sediment Transport and Storage	• Bed Form Diversity	Suboptimal	small pocket pools, some associated with LWD	LWD present but not fully utilized
	• Energy Management	Optimal	Normal levels of shear stress	Good energy dissipation via bed, banks, and floodplain access
	• Sediment Continuity	Optimal	BEHI = Low NBS = Very Low Fines < 30%	Low sediment supply matched to headwater system
	• Substrate Quality	Optimal	No excessive fines	No elevated sediment sources from watershed
Organic Material Transport and Storage	• Bed Form Diversity	Optimal	Some LWD forced pools (1 per 10 Bkf) Wood riffle complex = few	LWD supply available and productive
	• Energy Management	Suboptimal	LWD Struct: 1 per 10 Bkf	LWD supply available and productive
	• Aquatic Habitat	Optimal	Frequent leaf packs; good organic storage potential	LWD supply available and productive
Natural Communities	• Temperature and Oxygen Regulation	Optimal	Full shading; adequate temperature	Mature riparian and overstory vegetation
	• Process Organic Matter and Nutrients	Optimal	High biomass	Mature riparian and overstory vegetation
	• Biodiversity	Optimal	High native species diversity	Mature riparian and overstory vegetation
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process	Suboptimal	Buffer width Left ≈ 150 ft Buffer width Right ≈ 75 ft	Connected to forested land use, though some adjacency to maintained pasture
	• Longitudinal Connectivity of biotic and abiotic process	Suboptimal	U/s forest = abundant D/s forest = 75 ft	Connected to abundant forested landcover upstream
	• Source and Sink for natural populations	Optimal	Mid-late successional community	Mature riparian and overstory vegetation
Status Key: Optimal Suboptimal Marginal oor				

David Branch Reach 1 (B) Restoration				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows		Altered hydrology	Pond U/s
	• Channel Forming Flows		$Q_{CHANNEL} \neq Q_{BANKFULL}$	Pond U/s attenuating discharge
	• Overbank Flooding		$Q_{OVERANK} > Q_{5\ YEAR}$	somewhat entrenched; pond outfall failing
	• Hyporheic Flow		$DEPTH_{SUBSTRATE} < 0.5$ ft Head potentials exist	Natural channel substrate provide occassional occurrence of head potentials
	• Groundwater		Stream surface water 2 ft below terrace	marginal floodplain connectivity
Sediment Transport and Storage	• Bed Form Diversity		poor pool development with very wide spacing	some LWD present but significantly under utilized
	• Energy Management		Elevated shear stresses, especially during increased discharge	Somewhat entrenched
	• Sediment Continuity		BEHI = MOD NBS = VLOW Fines < 20%	some aggradation downstream of pond, some bed and bank instability
	• Substrate Quality		some excessive fines	
Organic Material Transport and Storage	• Bed Form Diversity		Lack of complexity and increase in fines limiting diversity	some LWD supply available esp. on river left; somewhat entrenched
	• Energy Management		LWD Struct: 1 per 15 Bkf	some LWD supply available
	• Aquatic Habitat		incision and aggradation limiting factors	some LWD supply available
Natural Communities	• Temperature and Oxygen Regulation		Partial shading; some temperature regulation	Some mature riparian and overstory vegetation
	• Process Organic Matter and Nutrients		Moderate biomass	Some mature riparian and overstory vegetation
	• Biodiversity		Moderate native species diversity	Some mature riparian and overstory vegetation, mostly rhododendron
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width Left ≈ 10 ft Buffer width Right ≈ 5 ft	fragmented habitats on either side of watercourse
	• Longitudinal Connectivity of biotic and abiotic process		U/s forest = abundant D/s forest ends at road/culvert	impounded pond upstream and culvert downstream
	• Source and Sink for natural populations		Mid-late successional community	
Status Key: Optimal Suboptimal Marginal oor				

David Branch Reach 1 (C) Restoration				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows	Marginal	Altered hydrology	Pond U/s
	• Channel Forming Flows	Poor	$Q_{CHANNEL} \neq Q_{BANKFULL}$	Pond U/s attenuating discharge
	• Overbank Flooding	Marginal	$Q_{OVERANK} > Q_{5\ YEAR}$	entrenchment limiting hyrologic connectivity
	• Hyporheic Flow	Suboptimal	$DEPTH_{SUBSTRATE} < 0.5$ ft Head potentials exist	Natural channel substrate provide occassional occurrence of head potentials
	• Groundwater	Marginal	Stream surface water >2 ft below terrace	entrenchment impairing functional floodplain connectivity
Sediment Transport and Storage	• Bed Form Diversity	Marginal	Pools largely absent	Lack of LWD inhibiting bedform complexity
	• Energy Management	Marginal	Elevated shear stress	Lack of channel form
	• Sediment Continuity	Marginal	BEHI = HIGH NBS = MOD Fines > 50%	culvert under road inhibiting sediment transport processes
	• Substrate Quality	Poor	D_{50} = __ mm, D_{84} = __ mm excessive fines	excessive fines due to US conditions, entrenchment
Organic Material Transport and Storage	• Bed Form Diversity	Marginal	Lack of complexity and increase in fines	Entrenchment; low availablibility of LWD
	• Energy Management	Marginal	LWD Struct: 1 per 20 Bkf	upstream culvert limiting longitudinal connectivity
	• Aquatic Habitat	Marginal	incision and aggradation limiting factors	low availablibility of LWD
Natural Communities	• Temperature and Oxygen Regulation	Poor	Poor shading and diminished riparian corridor	Entrenchment and mowing resulting in degraded riparian zones
	• Process Organic Matter and Nutrients	Marginal	Low biomass	Entrenchment and mowing resulting in degraded riparian zones
	• Biodiversity	Marginal	Low native species diversity	Entrenchment and mowing resulting in degraded riparian zones
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process	Poor	Buffer width Left ≈ 2 ft Buffer width Right ≈ 0 ft	degraded buffer
	• Longitudinal Connectivity of biotic and abiotic process	Poor	U/s forest = 0 ft D/s forest = 0 ft	culvert limiting connectivity
	• Source and Sink for natural populations	Marginal	Early/Mid-successional community	impaired riparian conditions

Status Key: Optimal Suboptimal Marginal oor

Whitaker Branch Reach 1 Enhancement 2				
Stream Function	**Supported Attributes**	**Status**	**Condition**	**Cause/Association**
Water Transport and Storage	• Proper Seasonal Flows		Normal baseflow	Spring-fed headwaters
	• Channel Forming Flows		$Q_{CHANNEL} \approx Q_{BANKFULL}$	presence of bankfull features evident
	• Overbank Flooding		$Q_{OVERANK} \approx Q_{2\ YEAR}$	fully functional flooplain
	• Hyporheic Flow		$DEPTH_{SUBSTRATE} < 0.5$ ft Head potentials exist	some valley confinement resulting in presence of ample fines
	• Groundwater		Stream surface water 0-2 ft below terrace	good flooplian connectivity upstream; depth to terrace increases downstream
Sediment Transport and Storage	• Bed Form Diversity		> 10% pools; Pool spacing ≈ 8•BKF	good beform complexity with pool/riffle development
	• Energy Management		Appropriate shear stress	functional roughness froml bedform diversity and functional riprian zone
	• Sediment Continuity		BEHI = Low NBS = Low moderate sediment load	some fines likely due to valley position
	• Substrate Quality		some excessive fines in low transport portions of reach	On-site sediment sources increasing input of finer sediment
Organic Material Transport and Storage	• Bed Form Diversity		Presence of LWD forced pools and wood complex riffles	Adequate supply supply of LWD, esp upstream
	• Energy Management		some LWD and good bed form complexity for bed/bank dissipation	LWD present though not fully utilized.
	• Aquatic Habitat		good potential but limited by some aggradation of fines	good channel/flooplain structure limited by on site sediment sources
Natural Communities	• Temperature and Oxygen Regulation		excellent shading	robust riparian zone in most locations; some non-native species present
	• Process Organic Matter and Nutrients		functional processes occurring	robust riparian zone in most locations; some non-native species present
	• Biodiversity		mid successional development with signs of past disturbances	robust riparian zone in most locations; some non-native species present
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process		Buffer width Left < 20 ft; Buffer width Right > 50 ft	Buffer somewhat disturbed with discontinuous cover, esp in DS portion of reach
	• Longitudinal Connectivity of biotic and abiotic process		U/s forest > 500 ft; D/s forest = 0 ft	Culvert downstream; good connection to forested land use upstream
	• Source and Sink for natural populations		Mid successional vegetation	robust riparian zone in most locations; some non-native species present

Status Key: Optimal Suboptimal Marginal Poor

Redmond Branch Reach 1
Enhancement 2

Stream Function	Supported Attributes	Status	Condition	Cause/Association
Water Transport and Storage	• Proper Seasonal Flows	🟩	Normal baseflow	Spring-and pond-fed headwaters; good hydrologic connectivity
	• Channel Forming Flows	🟩	$Q_{CHANNEL} \approx Q_{BANKFULL}$	presence of bankfull features evident
	• Overbank Flooding	🟩	$Q_{OVERANK} \approx Q_{2\ YEAR}$	fully functional flooplain
	• Hyporheic Flow	🟩	$DEPTH_{SUBSTRATE} < 0.25$ ft Head potentials exist	Natural channel substrate provides sigtnificant opportunity for head potentials
	• Groundwater	🟩	Stream surface water 1 ft below terrace	functional floodplain connectivity
Sediment Transport and Storage	• Bed Form Diversity	🟩	> 15% pools; Pool spacing ≈ 8•BKF	good beform complexity with pool/riffle development
	• Energy Management	🟩	Appropriate shear stress	functional roughness froml bedform diversity and robust riprian zone
	• Sediment Continuity	🟨	BEHI = Low NBS = Low moderate sediment load	upstream pond somewhat limiting longitudinal transport processes
	• Substrate Quality	🟩	Few excessive fines or aggraded areas	functional sediment transport through most of reach
Organic Material Transport and Storage	• Bed Form Diversity	🟨	Presence of LWD forced pools and wood complex riffles	LWD present but not fully utilized
	• Energy Management	🟩	some LWD and good bedform complexity for bed/bank dissipation	ample floodplain access
	• Aquatic Habitat	🟨	good potential but limited by minor lack of functional wood	lack of leaf packs to to lack of in-channel LWD
Natural Communities	• Temperature and Oxygen Regulation	🟩	Full shading; adequate temperature	Mid successional canopy and functional riparian zone
	• Process Organic Matter and Nutrients	🟨	Moderate biomass	Could benefit from additional wood and carbon storage
	• Biodiversity	🟨	High native species diversity	some canopy patchiness and some non-native species present
Landscape Connectivity	• Latitudinal Connectivity of biotic and abiotic process	🟨	Buffer width Left > 150 ft Buffer width Right ≈ 50 ft	adjacent road and two-track
	• Longitudinal Connectivity of biotic and abiotic process	🟧	U/s forest = abundant D/s terminates at culvert	Logitudinal connectivity inhibited by presence of pond upstream
	• Source and Sink for natural populations	🟨	Mid-late successional community	Downstream culvert precludes full finctionality

Status Key: 🟩 Optimal 🟨 Suboptimal 🟧 arginal 🟥 or

Appendix E DESIGN CALCULATIONS

Page left intentionally blank for printing purposes.

1.0 Conceptual Design

Estimated Channel Values from Regional Curves

Design Status

Complete

Project: Seniard Creek Mitigation Project
Project No.: 172621103
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

Hydro-Physio Province: NC Mountains

Regional Curve Equations

	Coefficient	Exponent
W_{BKF} :	17.36	0.3693
A_{BKF} :	18.559	0.6616
d_{MEAN} :	1.1771	0.2697
Q_{BKF} :	55.425	0.7874
W_{BED} :	12	0.45
d_{MAX} :	1.5	0.27

Approximate Equations

	Coefficient	Exponent	
W_{BKF} :	14.53496	0.39	(Not Used in Calculations)
d_{MAX} :	1.64794	0.27	(Not Used in Calculations)

Reach	Estimated Dimensions from Regional Curves								
	Drain. Area (mi^2)	W_{BKF} (ft)	A_{BKF} (ft^2)	d_{MEAN} (ft)	W_{BED} (ft)	d_{MAX} (ft)	Pool Spacing (ft)	Rc (ft)	Tangent Length (ft)
Seniard Creek - R1A	1.29	19.1	22.0	1.3	13.5	1.6	95	38	38
Seniard Creek - R1B	1.34	19.3	22.5	1.3	13.7	1.6	97	39	39
Seniard Creek - R2	2.46	24.2	33.7	1.5	18.0	1.9	121	48	48
Sitton Creek - R1	0.99	17.3	18.4	1.2	11.9	1.5	86	35	35
Lee Branch	0.02	4.1	1.4	0.4	2.1	0.5	20	8	8
David Branch - R1A	0.01	3.2	0.9	0.3	1.5	0.4	16	6	6
David Branch - R1B	0.01	3.2	0.9	0.3	1.5	0.4	16	6	6
David Branch - R1C	0.04	5.3	2.2	0.5	2.8	0.6	26	11	11
Whitaker Branch	0.04	5.3	2.2	0.5	2.8	0.6	26	11	11
Redmond Branch 1A	0.07	6.5	3.2	0.6	3.6	0.7	33	13	13
Redmond Branch 1B	0.11	7.7	4.3	0.6	4.4	0.8	38	15	15

1.1 Reach Locations

Project: Seniard Creek Mitigation Project
Project No.: 172621103
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

Reach	Existing Thalweg Stationing		Proposed Design Stationing		Description
	Begin	End	Begin	End	
Seniard Creek - R1A	100+00	104+13	100+00	103+96	Enhancement of left bank, tie at right bench
Seniard Creek - R1B	104+13	116+76	103+96	116+70	Full restoration to Sitton confluence
Seniard Creek - R2	116+76	122+97	116+70	118+51	Downstream of confluence to project end
Sitton Creek - R1	200+00	210+79	200+55	212+91	Top of site to confluence with Seniard
Lee Branch	300+00	301+44	300+00	302+26	Headwater channel
David Branch - R1A	400+00	401+35	400+00	401+32	Headwater channel until pond
David Branch - R1B	400+00	400+95	401+32	404+28	Headwater channel to road
David Branch - R1C	500+00	504+26	404+28	407+39	HWC to Sitton
Whitaker Branch	500+00	504+26	500+00	504+26	
Redmond Branch 1A	600+00	610+66	600+00	610+66	Enhancement
Redmond Branch 1B	610+66	611+60	610+66	611+52	CMP outfall to Sitton

2.0 Discharge Calculations

Design Status: **Draft**

Project: Seniard Creek Mitigation Project
Project No.: 172621103
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

Estimated Discharges

Reach	Drainage Area (mi^2)	Bankfull (cfs)	2-yr (cfs)	5-yr (cfs)	10-yr (cfs)	50-yr (cfs)	100-yr (cfs)			
Seniard Creek - R1A	1.29	68	161	288	395	708	874			
Seniard Creek - R1B	1.34	70	166	295	405	725	895			
Seniard Creek - R2	2.46	113	254	445	606	1066	1308			
Sitton Creek - R1	0.99	55	134	240	332	598	740			
Lee Branch	0.02	3	9	17	25	50	65			
David Branch - R1A	0.01	1	5	11	16	32	42			
David Branch - R1B	0.01	1	5	11	16	32	42			
David Branch - R1C	0.04	4	14	27	40	78	100			
Whitaker Branch	0.04	4	14	27	40	78	100			
Redmond Branch 1A	0.07	7	21	40	57	111	141			
Redmond Branch 1B	0.11	10	29	54	77	148	188			

2.1 Discharge Calculation Input

Discharge Method Used: USGS Regional Regression

Hydro-Physio Province: NC Mountains

NCDOT Rural Equations

Hydrologic Contour:	7.00
Watershed Length:	N/A
Watershed Width:	N/A
Percent Forest:	N/A

Regional Regression Equations

Event	Coef	Exp
2-yr	135	0.702
5-yr	242	0.677
10-yr	334	0.662
25-yr	476	0.645
50-yr	602	0.635
100-yr	745	0.625
200-yr	908	0.616
500-yr	1160	0.605

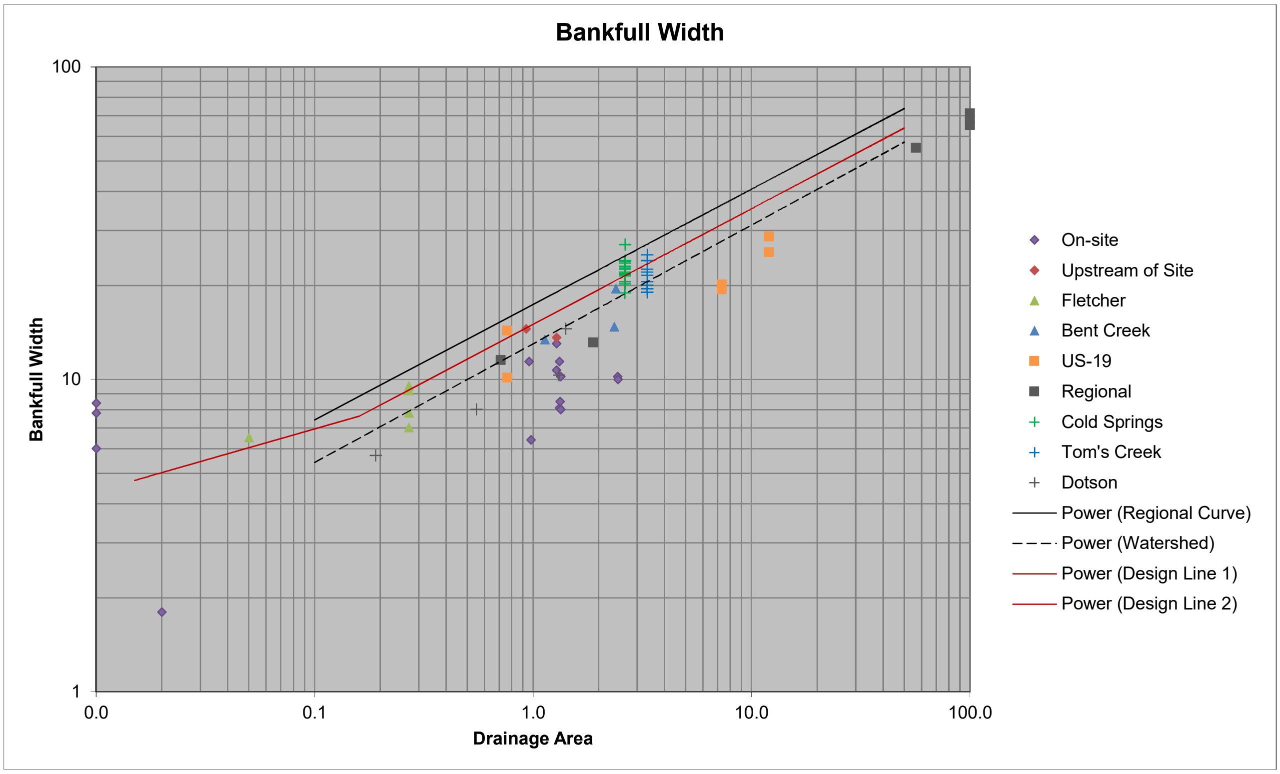
Bankfull Regional Equation

Event	Coef	Exp
Bankfull	55.425	0.7874

3.0 Hydraulic Geometry

Project: Seniard Creek Mitigation Project
Project No.: 172621103
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

Design Status
Draft

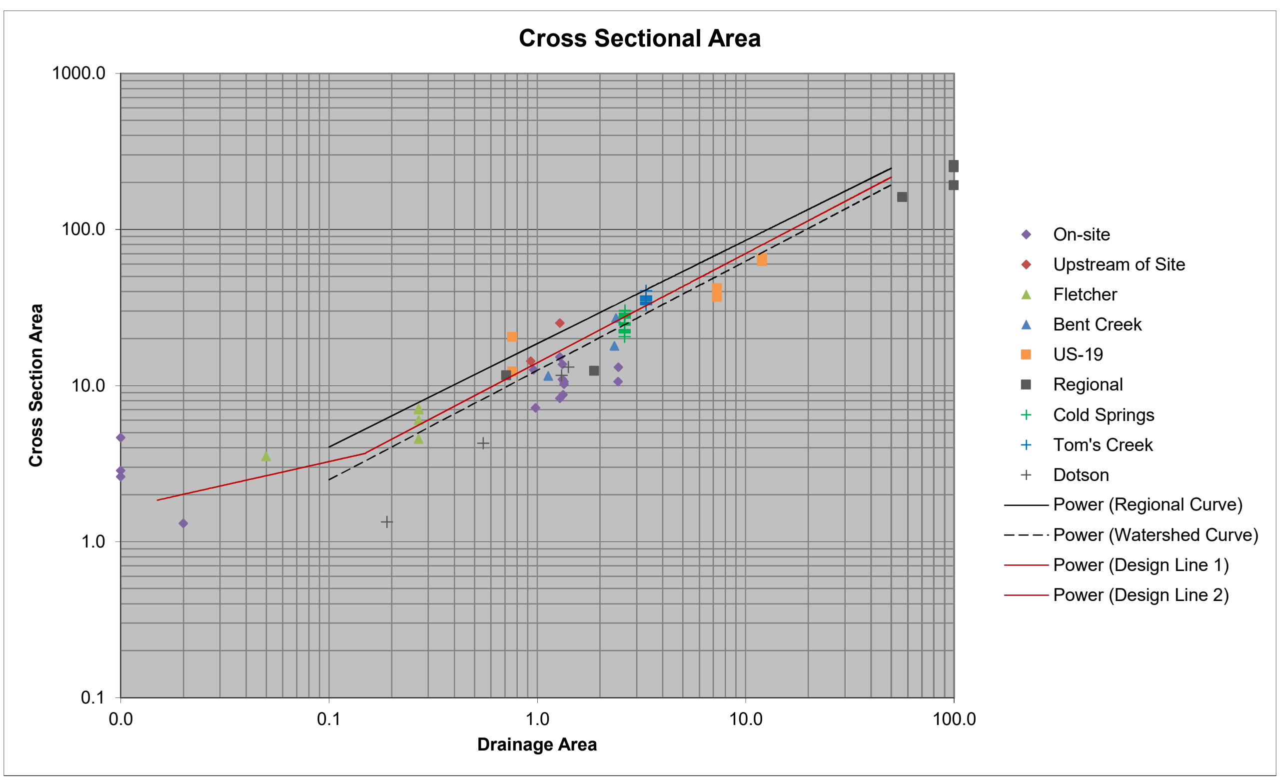


Design Equations

	Coef	Exp
Design Line 1 :	15.0	0.37
Design Line 2 :	11.0	0.20

Regional Regression Equations

	Coef	Exp	
Regional Curve :	17.4	0.37	(NC Mountains)
Watershed Curve :	13.0	0.38	



Design Equations

	Coef	Exp
Design Line 1 :	14.0	0.70
Design Line 2 :	6.5	0.30

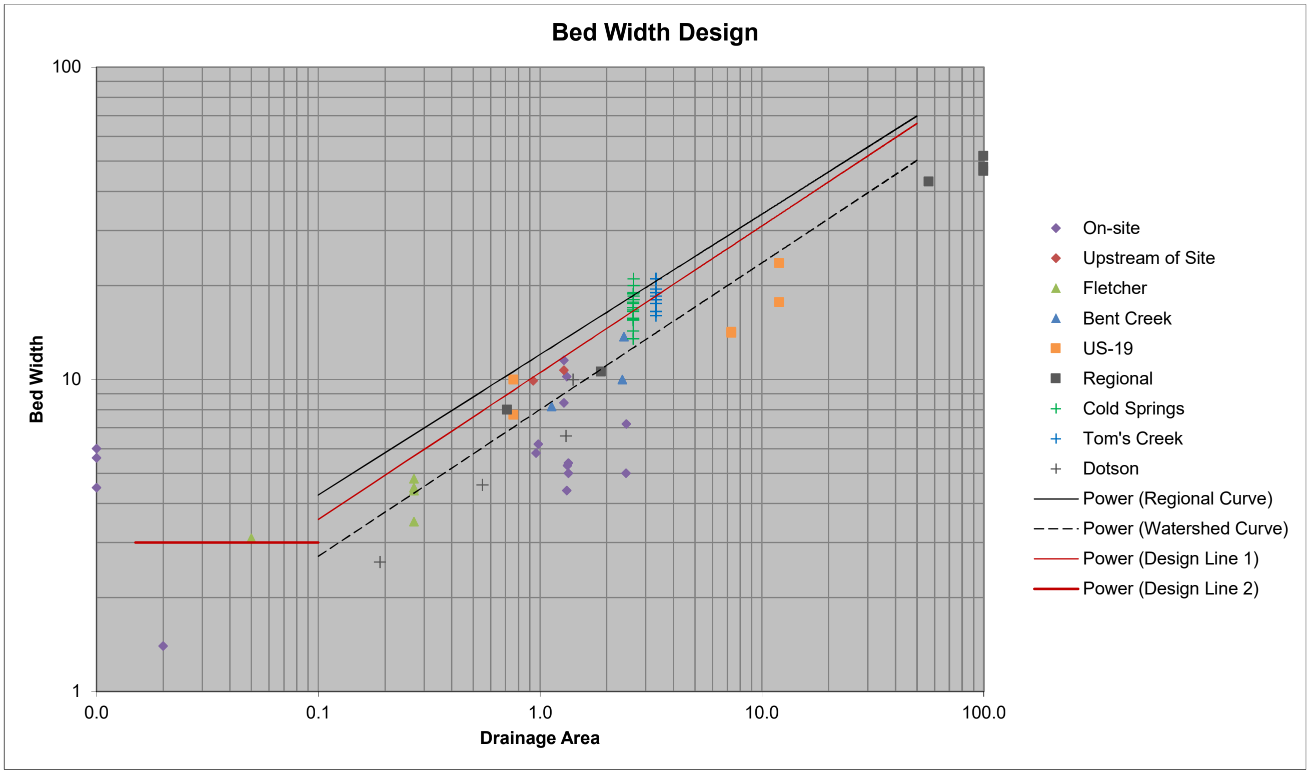
Regional Regression Equations

	Coef	Exp	
Regional Curve :	18.6	0.66	(NC Mountains)
Watershed Curve :	12.5	0.70	

3.1 Hydraulic Geometry

Design Status
Draft

Project: Seniard Creek Mitigation Project
Project No.: 1.73E+08
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

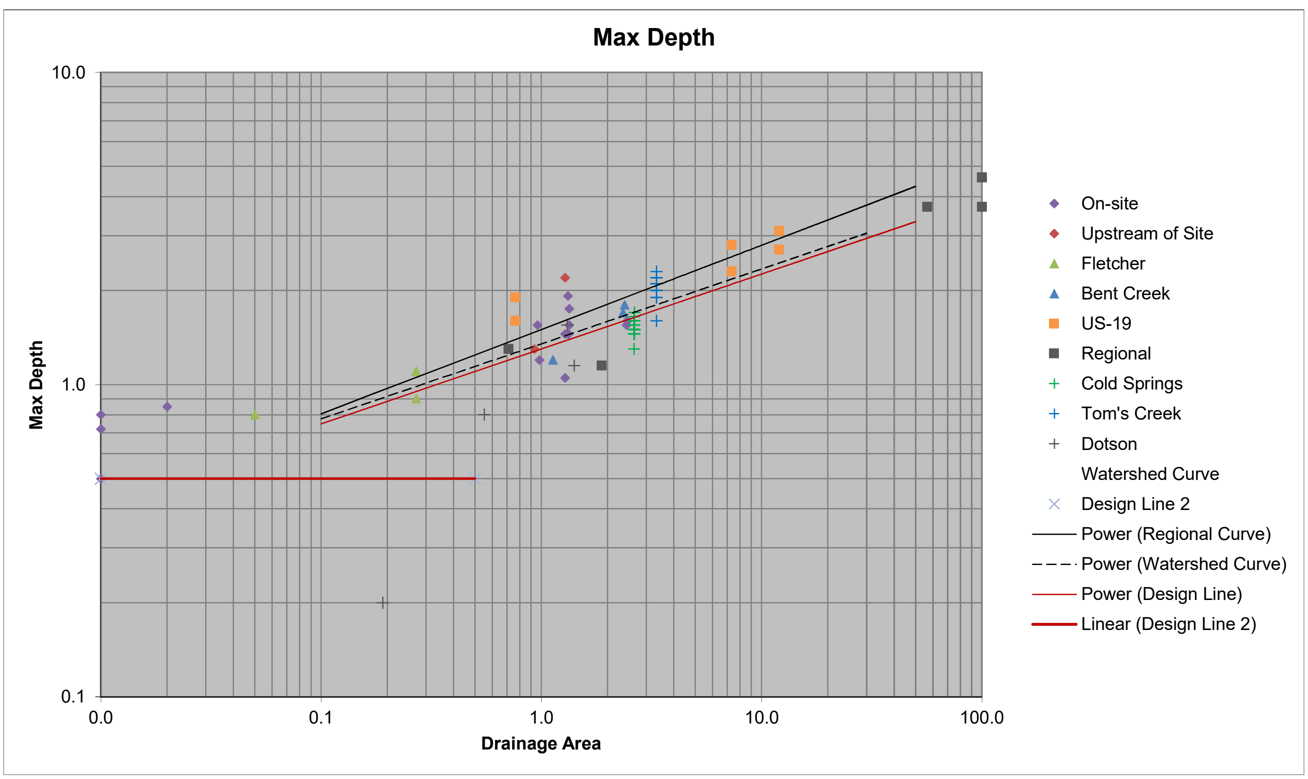


Design Equations

	Coef	Exp
Design Line 1 :	10.5	0.47
Design Line 2 :	3.0	0.00

Regional Regression Equations

	Coef	Exp	
Regional Curve :	12.0	0.45	(NC Mountains)
Watershed Curve :	8.0	0.47	



Design Equations

	Coef	Exp
Design Line :	1.3	0.24

Regional Regression Equations

	Coef	Exp	
Regional Curve :	1.5	0.27	(NC Mountains)
Watershed Curve :	1.4	0.24	

4.0 Sediment Regime

Project: Seniard Creek Mitigation Project
Project No.: 172621103
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

Design Status: **Draft**

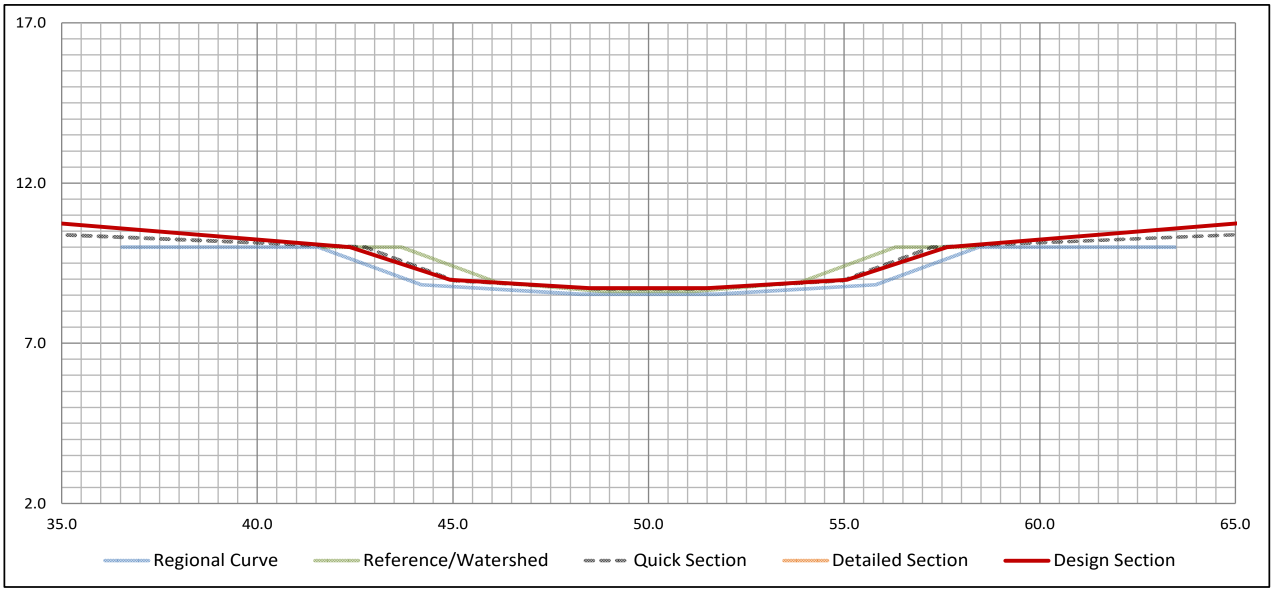
Reach	Seniard - prelim	Sitton Offsite - prelim	Sitton Onsite - prelim	Sitton Offsite - Photo Estimate	Seniard Subsurface Borrow	Sitton Subsurface Borrow 1	Sitton Subsurface Borrow 2
Bed Material Nature							
Depth of Bed Probe (ft)	0.05	0.05	0.05				
Matrix Bonding	Mod	Mod	Mod				
Parent Material Exposure	No	No	No				
Well Graded	Mod	Mod	Mod				
Depositional Patterns							
Point Bars	Mod	Mod	Mod				
Mid-channel Bars	Min	Min	Min				
Side-channel Bars	Mod	Mod	Mod				
Diagonal Bars	None	None	None				
Bar Length/W_{BED}	2	2	2				
Dune Presentation of Bars	None	None	None				
Channel Branching	None	None	None				
Tributary Deltas	N/A	N/A	N/A				
Dune Length/Height (ft)	N/A	N/A	N/A				
Ripple Length/Height (ft)	N/A	N/A	N/A				
Sediment Measurements							
Pebble Count (Riffle) % Sand					13%	31%	19%
D_{50}				30	48	14.4	30.3
D_{84}				85	110	41	71.6
D_{95}				120	120	67	90
Pebble Count (Reach) % Sand					13%	31%	19%
D_{50}					48	14.4	30.3
D_{84}					110	41	71.6
D_{95}					120	67	90
Bar Sample % Sand				%	13%	31%	19%
D_{50}				20	48	14.4	30.3
D_{84}				70	110	41	71.6
D_{95}				110	120	67	90
D_{MAX}				130	127	89	95
Bed Sample % Sand					13%	31%	19%
D_{50}	13	20	20	40	48	14.4	30.3
D_{84}	35	45	45	90	110	41	71.6
D_{95}	60	80	80	150	120	67	90
Sediment Regime							
Sediment Load	Mod	Mod	Mod				
Sediment Mobility	Mod Low	Mod Low	Mod Low				

5.0 Design Section 1

Project:	Seniard Creek Mitigation Project
Project No.:	172621103
Client:	EW Solutions, LLC
Contract No.:	-
County/State:	Henderson, NC

Design Status

Draft



Design Section

	Coef	Exp
W_{BED}	10.50	0.47
d_{MAX}	1.30	0.24
Bank Slope	2.5	(H:1)
Thalweg Ratio	0.3	
Toe Depth Ratio	0.8	
Bench Width Ratio	0.7	
Bench Slope	10	(H:1)
Drainage Area	0.93	(sq. mi.)

Point of Comparison
Sitton pit traps section

Section Comparisons

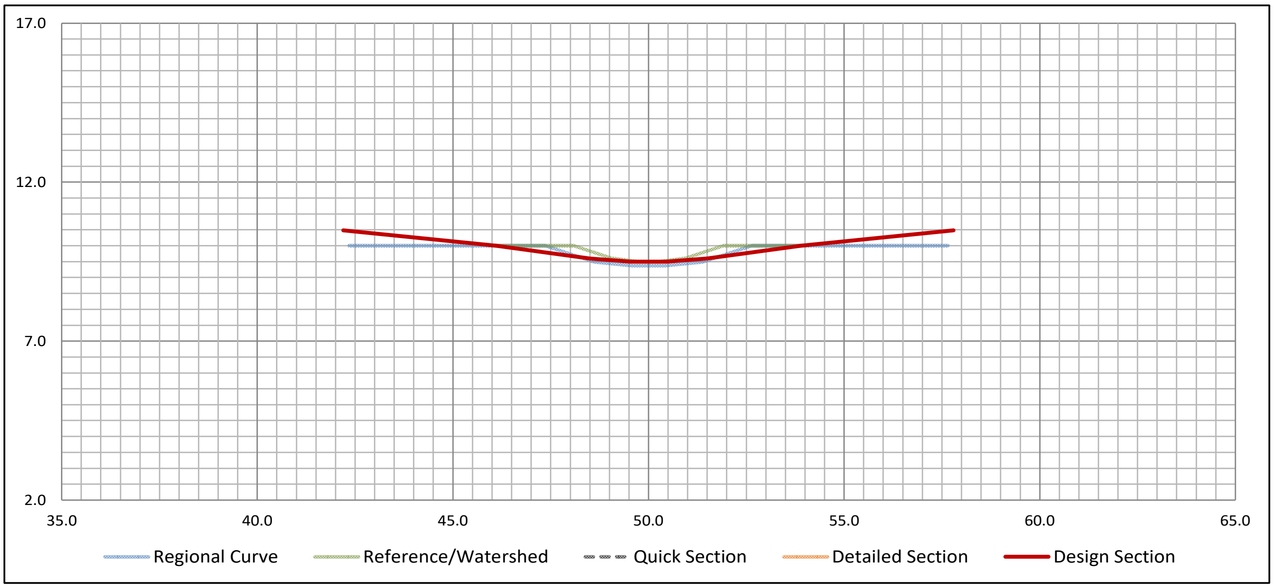
	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
W_{BKF}	16.9	12.6	14.5	0.0	15.3
	90%	121%	105%	#DIV/0!	
W_{BED}	11.6	7.7	9.9		10.1
	87%	131%	103%		
W_{THL}	3.5	2.3	2.5		3.0
	87%	131%	122%		
d_{MAX}	1.5	1.4	1.3	0.0	1.3
	87%	93%	98%	#DIV/0!	
d_{TOE}	1.2	1.1	1.1		1.0
	87%	93%	97%		
A_{BKF}	17.7	11.9	14.4		14.7
	83%	123%	102%	#VALUE!	
d_{MEAN}	1.05	0.94	0.99		0.96
	92%	102%	97%	#VALUE!	
P	17.4	13.1	15.0		15.7
	90%	119%	105%	#VALUE!	
Hydr. R	1.02	0.90	0.96		0.94
	92%	104%	98%	#VALUE!	
W/d Ratio	16.1	13.5	14.6		15.9
	98%	118%	108%	#VALUE!	

5.1 Design Section 2

Project: Seniard Creek Mitigation Project
Project No.: 1.73E+08
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

Design Status

Draft



Design Section

	Coef	Exp
W_{BED}	3.00	0.00
d_{MAX}	0.50	0.00
Bank Slope	6.0	(H:1)
Thalweg Ratio	0.3	
Toe Depth Ratio	0.8	
Bench Width Ratio	0.5	
Bench Slope	8	(H:1)
Drainage Area	0.04	(sq. mi.)

Point of Comparison
0%

Section Comparisons

	Regional Curve	Ref/ Wtrshed	Quick Section	Detailed Section	Design Section
W_{BKF}	5.3	3.8	0.0	0.0	7.8
	148%	204%	#DIV/0!	#DIV/0!	
W_{BED}	2.8	1.9	0.0		3.0
	106%	162%	#DIV/0!		
W_{THL}	0.8	0.6	0.0		0.9
	106%	162%	#DIV/0!		
d_{MAX}	0.6	0.5	0.0	0.0	0.5
	79%	99%	#DIV/0!	#DIV/0!	
d_{TOE}	0.5	0.4	0.0		0.4
	79%	99%	#DIV/0!		
A_{BKF}	2.2	1.3	0.0		2.4
	107%	183%	#DIV/0!	#VALUE!	
d_{MEAN}	0.42	0.34	#DIV/0!		0.30
	72%	90%	#DIV/0!	#VALUE!	
P	5.5	4.0	0.0		7.9
	143%	197%	#DIV/0!	#VALUE!	
Hydr. R	0.40	0.32	#DIV/0!		0.30
	75%	93%	#DIV/0!	#VALUE!	
W/d Ratio	12.7	11.4	#DIV/0!		25.8
	204%	227%	#DIV/0!	#VALUE!	

6.0 Typical Section Dimensions

Design Status: **Draft**

Project: Seniard Creek Mitigation Project
Project No.: 172621103
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

Reach	Drainage Area (mi^2)	Design Section	W_{BKF}	W_{BED}	W_{THAL}	W_{BENCH}	d_{MAX}	d_{TOE}	Bank Slope (H:1)
Seniard Creek - R1A	1.29	1	17.4	11.8	3.6	12	1.38	1.11	2.5
Seniard Creek - R1B	1.34	1	17.6	12.0	3.6	12	1.39	1.12	2.5
Seniard Creek - R2	2.46	1	22.5	16.0	4.8	16	1.61	1.29	2.5
Sitton Creek - R1	0.99	1	15.6	10.5	3.1	11	1.30	1.04	2.5
Lee Branch	0.02	2	7.8	3.0	0.9	4	0.50	0.40	6
David Branch - R1A	0.01	2	7.8	3.0	0.9	4	0.50	0.40	6
David Branch - R1B	0.01	2	7.8	3.0	0.9	4	0.50	0.40	6
David Branch - R1C	0.04	2	7.8	3.0	0.9	4	0.50	0.40	6
Whitaker Branch	0.04	2	7.8	3.0	0.9	4	0.50	0.40	6
Redmond Branch 1A	0.07	2	7.8	3.0	0.9	4	0.50	0.40	6
Redmond Branch 1B	0.11	1	6.8	3.7	1.1	5	0.77	0.61	2.5

Reach	Pool Dimensions				
	Width Ratio	W_{IN}	W_{OUT}	d_{POOL}/d_{MAX} Ratio	d_{POOL}
Seniard Creek - R1A	1.1	10.4	8.7	1.5	2.07
Seniard Creek - R1B	1.1	10.6	8.8	1.5	2.09
Seniard Creek - R2	1.1	13.5	11.2	1.5	2.42
Sitton Creek - R1	1.1	9.4	7.8	1.5	1.95
Lee Branch	1.1	4.7	3.9	1.5	0.75
David Branch - R1A	1.1	4.7	3.9	1.5	0.75
David Branch - R1B	1.1	4.7	3.9	1.5	0.75
David Branch - R1C	1.1	4.7	3.9	1.5	0.75
Whitaker Branch	1.1	4.7	3.9	1.5	0.75
Redmond Branch 1A	1.1	4.7	3.9	1.5	0.75
Redmond Branch 1B	1.1	4.1	3.4	1.5	1.15

6.1 Hydraulic Dimensions

Design Status

Draft

Project: Seniard Creek Mitigation Project
Project No.: 1.73E+08
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

Reach	Stream Type	A_{BKF}	P_{WET}	R_{HYD}	d_{MEAN}	W/D Ratio	Entrench Ratio
Seniard Creek - R1A	Bc	18.3	17.8	1.03	1.05	16.5	1.4
Seniard Creek - R1B	Bc	18.7	18.1	1.04	1.06	16.6	1.4
Seniard Creek - R2	Bc	28.2	23.0	1.23	1.26	17.9	1.1
Sitton Creek - R1	Bc	15.3	16.1	0.95	0.98	16.0	2.0
Lee Branch	B	2.4	7.9	0.30	0.30	25.8	1.5
David Branch - R1A	B	2.4	7.9	0.30	0.30	25.8	1.9
David Branch - R1B	B	2.4	7.9	0.30	0.30	25.8	1.9
David Branch - R1C	B	2.4	7.9	0.30	0.30	25.8	1.9
Whitaker Branch	B	2.4	7.9	0.30	0.30	25.8	1.5
Redmond Branch 1A	B	2.4	7.9	0.30	0.30	25.8	2.6
Redmond Branch 1B	B	3.6	7.0	0.51	0.53	12.8	2.9

6.2 Morphologic Dimensions

Reach	Pool Spacing/W_{AVG}			Pool Spacing				Belt Width	
	min	target	max	min	target	max	min	target	max
Seniard Creek - R1A	4.2	5.6	7.0	61.3	**81.8**	102.2	21.9	**29.2**	36.5
Seniard Creek - R1B	4.2	5.6	7.0	62.3	**83.1**	103.9	22.3	**29.7**	37.1
Seniard Creek - R2	4.2	5.6	7.0	80.9	**107.8**	134.8	28.9	**38.5**	48.1
Sitton Creek - R1	4.2	5.6	7.0	54.8	**73.0**	91.3	19.6	**26.1**	32.6
Lee Branch	4.2	5.6	7.0	22.7	**30.2**	37.8	8.1	**10.8**	13.5
David Branch - R1A	4.2	5.6	7.0	22.7	**30.2**	37.8	8.1	**10.8**	13.5
David Branch - R1B	4.2	5.6	7.0	22.7	**30.2**	37.8	8.1	**10.8**	13.5
David Branch - R1C	4.2	5.6	7.0	22.7	**30.2**	37.8	8.1	**10.8**	13.5
Whitaker Branch	4.2	5.6	7.0	22.7	**30.2**	37.8	8.1	**10.8**	13.5
Redmond Branch 1A	4.2	5.6	7.0	22.7	**30.2**	37.8	8.1	**10.8**	13.5
Redmond Branch 1B	4.2	5.6	7.0	22.1	**29.4**	36.8	7.9	**10.5**	13.1

7.0 Competence Calculations

Project: Seniard Creek Mitigation Project
Project No.: 172621103
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

Design Status: **Draft**

Reach	Hydraulic Radius (ft)	Largest Particle Calculations				Representative Particle Calculations			
		τ*	γ_S	D_{MAX} (mm)	S (ft/ft)	τ*	γ_S	D_{50} (mm)	S (ft/ft)
Seniard Creek - R1A	1.03	0.050	1.65	150	0.0396	0.056	1.65	45	0.0133
Seniard Creek - R1B	1.04	0.050	1.65	150	0.0392	0.056	1.65	45	0.0132
Seniard Creek - R2	1.23	0.050	1.65	150	0.0331	0.056	1.65	45	0.0111
Sitton Creek - R1	0.95	0.025	1.65	200	0.0284	0.056	1.65	30	0.0095
Lee Branch	0.30	0.025	1.65	200	0.0905	0.056	1.65	30	0.0304
David Branch - R1A	0.30	0.025	1.65	200	0.0905	0.056	1.65	30	0.0304
David Branch - R1B	0.30	0.025	1.65	200	0.0905	0.056	1.65	30	0.0304
David Branch - R1C	0.30	0.025	1.65	200	0.0905	0.056	1.65	30	0.0304
Whitaker Branch	0.30	0.025	1.65	200	0.0905	0.056	1.65	30	0.0304
Redmond Branch 1A	0.30	0.025	1.65	200	0.0905	0.056	1.65	30	0.0304
Redmond Branch 1B	0.51	0.025	1.65	200	0.0531	0.056	1.65	30	0.0178

Reach	Calculation Method	Sediment Load	Percent Calculated Slope		Design Slope Range (ft/ft)		
			Min	Max			
Seniard Creek - R1A	Representative Particle	Moderate	90%	110%	0.0120	to	0.0146
Seniard Creek - R1B	Representative Particle	Moderate	90%	110%	0.0118	to	0.0145
Seniard Creek - R2	Representative Particle	Moderate	90%	110%	0.0100	to	0.0122
Sitton Creek - R1	Representative Particle	Moderate	90%	110%	0.0086	to	0.0105
Lee Branch	Representative Particle	Low	80%	100%	0.0243	to	0.0304
David Branch - R1A	Representative Particle	Low	80%	100%	0.0243	to	0.0304
David Branch - R1B	Representative Particle	Low	80%	100%	0.0243	to	0.0304
David Branch - R1C	Representative Particle	Low	80%	100%	0.0243	to	0.0304
Whitaker Branch	Representative Particle	Low	80%	100%	0.0243	to	0.0304
Redmond Branch 1A	Representative Particle	Low	80%	100%	0.0243	to	0.0304
Redmond Branch 1B	Representative Particle	Moderate	90%	110%	0.0161	to	0.0196

8.0 HEC-RAS Output Existing Conditions

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	E.G. Elev	Froude # Chl	Vel Chnl	Shear Chan	Power Chan	Power Total
			(cfs)	(ft)	(ft)	(ft)		(ft/s)	(lb/sq ft)	(lb/ft s)	(lb/ft s)
US	9	Bankfull	68	2259.38	2261.6	2262.02	0.84	5.25	1.88	9.86	9.86
US	9	2-yr	161	2259.38	2262.31	2263.21	1.01	7.6	3.54	26.87	26.87
US	9	5-yr	288	2259.38	2263.29	2264.43	0.95	8.55	4.04	34.54	34.54
US	9	10-yr	395	2259.38	2263.84	2265.26	1	9.58	4.9	46.91	46.91
US	9	50-yr	708	2259.38	2265.29	2267.17	1	10.99	5.95	65.35	65.35
US	9	100-yr	874	2259.38	2265.92	2268	1	11.57	6.41	74.15	74.15
US	8	Bankfull	68	2257.02	2258.61	2259.03	0.92	5.19	1.98	10.28	10.28
US	8	2-yr	161	2257.02	2259.5	2260.11	0.84	6.3	2.46	15.49	15.49
US	8	5-yr	288	2257.02	2260.06	2261.17	1.01	8.45	4.13	34.91	34.91
US	8	10-yr	395	2257.02	2260.78	2261.92	0.94	8.6	4.03	34.67	34.67
US	8	50-yr	708	2257.02	2261.99	2263.61	1	10.22	5.31	54.3	54.3
US	8	100-yr	874	2257.02	2262.6	2264.3	1.01	10.44	5.45	56.92	55.74
US	7	Bankfull	68	2248.5	2250.1	2250.5	0.83	5.07	1.78	9	9
US	7	2-yr	161	2248.5	2250.8	2251.61	1.01	7.22	3.25	23.45	23.45
US	7	5-yr	288	2248.5	2251.91	2252.72	0.84	7.21	2.9	20.9	20.9
US	7	10-yr	395	2248.5	2252.15	2253.39	1.01	8.92	4.35	38.78	38.78
US	7	50-yr	708	2248.5	2253.46	2255.01	1	9.96	5.02	50.03	47.03
US	7	100-yr	874	2248.5	2254.62	2255.41	0.66	7.53	2.61	19.64	6.84
US	6	Bankfull	68	2240.65	2242.51	2242.86	0.72	4.73	1.49	7.03	7.03
US	6	2-yr	161	2240.65	2243.64	2244.02	0.65	5.16	1.57	8.09	3.47
US	6	5-yr	288	2240.65	2244	2244.72	0.87	7.31	3.03	22.18	9.87
US	6	10-yr	395	2240.65	2244.67	2245.18	0.71	6.57	2.3	15.13	3.96
US	6	50-yr	708	2240.65	2245.19	2245.77	0.74	7.44	2.79	20.73	5.97
US	6	100-yr	874	2240.65	2245.35	2246.01	0.77	7.97	3.15	25.09	7.8
US	5	Bankfull	68	2232.33	2234.49	2234.79	0.7	4.52	1.37	6.21	4.69
US	5	2-yr	161	2232.33	2234.99	2235.68	0.91	6.73	2.78	18.73	14.88
US	5	5-yr	288	2232.33	2235.7	2236	0.59	4.97	1.39	6.89	1.77
US	5	10-yr	395	2232.33	2235.85	2236.19	0.62	5.37	1.6	8.61	2.44
US	5	50-yr	708	2232.33	2236.2	2236.61	0.69	6.17	2.05	12.67	3.83
US	5	100-yr	874	2232.33	2236.34	2236.79	0.7	6.33	2.14	13.57	4.36
US	4.4	Bankfull	68	2229.26	2230.82	2231.25	1.01	5.26	0.86	4.5	4.5
US	4.4	2-yr	161	2229.26	2231.57	2231.88	0.72	4.96	0.63	3.12	0.84
US	4.4	5-yr	288	2229.26	2231.86	2232.28	0.82	6.22	0.93	5.8	1.78
US	4.4	10-yr	395	2229.26	2232.1	2232.59	0.86	6.92	1.1	7.64	1.58
US	4.4	50-yr	708	2229.26	2232.69	2233.09	0.78	7.1	1.07	7.61	1.34
US	4.4	100-yr	874	2229.26	2232.81	2233.26	0.82	7.7	1.24	9.55	1.8
US	4.3	Bankfull	68	2228.4	2230.27	2230.47	0.63	3.59	0.37	1.34	0.77
US	4.3	2-yr	161	2228.4	2230.72	2231.06	0.77	4.98	0.66	3.29	1.08
US	4.3	5-yr	288	2228.4	2231.11	2231.44	0.75	5.43	0.73	3.97	1
US	4.3	10-yr	395	2228.4	2231.22	2231.67	0.87	6.49	1.02	6.62	1.66
US	4.3	50-yr	708	2228.4	2231.76	2232.13	0.77	6.64	0.97	6.47	1.22
US	4.3	100-yr	874	2228.4	2231.88	2232.3	0.82	7.21	1.13	8.17	1.48
US	4	Bankfull	68	2228.07	2228.9	2229.18	0.94	4.37	1.54	6.71	4.79
US	4	2-yr	161	2228.07	2229.44	2229.68	0.69	4.36	1.26	5.48	1.36
US	4	5-yr	288	2228.07	2229.7	2229.98	0.73	5.06	1.59	8.05	2.19
US	4	10-yr	395	2228.07	2229.85	2230.16	0.77	5.58	1.87	10.43	2.97
US	4	50-yr	708	2228.07	2230.16	2230.57	0.86	6.78	2.61	17.66	5.03
US	4	100-yr	874	2228.07	2230.37	2230.73	0.81	6.71	2.46	16.53	3.93

8.1 HEC-RAS Output Proposed Conditions											
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	E.G. Elev	Froude # Chl	Vel Chnl	Shear Chan	Power Chan	Power Total
			(cfs)	(ft)	(ft)	(ft)		(ft/s)	(lb/sq ft)	(lb/ft s)	(lb/ft s)
US	#12	Bankfull	68	2262.2	2263.27	2263.69	1.01	5.21	1.67	8.68	8.68
US	#12	2-yr	161	2262.2	2263.95	2264.59	0.96	6.47	2.16	13.95	10.60
US	#12	5-yr	288	2262.2	2264.63	2265.42	0.89	7.33	2.42	17.74	10.07
US	#12	10-yr	395	2262.2	2265.07	2265.94	0.87	7.85	2.61	20.45	10.91
US	#12	50-yr	708	2262.2	2265.95	2267.1	0.89	9.35	3.35	31.33	16.56
US	#12	100-yr	874	2262.2	2266.31	2267.62	0.91	10.01	3.72	37.2	19.52
US	#13	Bankfull	68	2258.52	2259.6	2260.01	0.98	5.08	1.95	9.88	9.88
US	#13	2-yr	161	2258.52	2260.25	2260.92	0.97	6.55	2.74	17.95	15.01
US	#13	5-yr	288	2258.52	2260.94	2261.78	0.91	7.5	3.15	23.59	15.55
US	#13	10-yr	395	2258.52	2261.41	2262.34	0.88	8.03	3.37	27.09	16.04
US	#13	50-yr	708	2258.52	2262.34	2263.56	0.9	9.53	4.29	40.85	22.79
US	#13	100-yr	874	2258.52	2262.75	2264.09	0.9	10.12	4.67	47.23	25.72
US	#14	Bankfull	68	2248.81	2249.88	2250.3	1.01	5.2	1.66	8.65	8.65
US	#14	2-yr	161	2248.81	2250.54	2251.21	0.98	6.56	2.22	14.6	12.06
US	#14	5-yr	288	2248.81	2251.23	2252.08	0.92	7.57	2.59	19.57	12.61
US	#14	10-yr	395	2248.81	2251.71	2252.65	0.89	8.11	2.78	22.52	12.99
US	#14	50-yr	708	2248.81	2252.66	2253.93	0.91	9.69	3.57	34.57	18.58
US	#14	100-yr	874	2248.81	2253.07	2254.49	0.92	10.35	3.92	40.55	21.19
US	#15	Bankfull	68	2241	2242.43	2242.62	0.6	3.52	0.86	3.03	2.99
US	#15	2-yr	161	2241	2243.07	2243.43	0.68	4.93	1.48	7.27	3.84
US	#15	5-yr	288	2241	2243.47	2244.06	0.81	6.5	2.38	15.47	6.84
US	#15	10-yr	395	2241	2243.78	2244.45	0.83	7.13	2.74	19.54	8.52
US	#15	50-yr	708	2241	2244.39	2245.35	0.91	8.89	3.93	34.91	12.21
US	#15	100-yr	874	2241	2244.98	2245.63	0.73	7.76	2.82	21.87	6.17
US	#16	Bankfull	68	2232.85	2233.91	2234.33	1.01	5.2	1.67	8.68	8.68
US	#16	2-yr	161	2232.85	2234.62	2235.21	0.97	6.19	2.05	12.68	10.84
US	#16	5-yr	288	2232.85	2235.33	2235.95	0.84	6.5	1.98	12.87	5.21
US	#16	10-yr	395	2232.85	2235.84	2236.3	0.68	5.97	1.54	9.21	2.16
US	#16	50-yr	708	2232.85	2236.36	2236.78	0.67	6.43	1.67	10.76	2.23
US	#16	100-yr	874	2232.85	2236.5	2236.95	0.69	6.83	1.86	12.71	2.75
US	4.4	Bankfull	68	2229.4	2231.05	2231.18	0.45	2.92	0.23	0.66	0.53
US	4.4	2-yr	161	2229.4	2232.88	2232.89	0.14	1.44	0.04	0.06	0.01
US	4.4	5-yr	288	2229.4	2233.28	2233.3	0.17	1.83	0.06	0.12	0.02
US	4.4	10-yr	395	2229.4	2233.45	2233.48	0.2	2.22	0.09	0.21	0.04
US	4.4	50-yr	708	2229.4	2233.78	2233.85	0.28	3.18	0.19	0.59	0.12
US	4.4	100-yr	874	2229.4	2233.91	2234	0.31	3.64	0.24	0.87	0.19
US	4.35		Culvert								
US	4.3	Bankfull	68	2228.5	2229.63	2229.98	0.89	4.74	0.68	3.24	3.24
US	4.3	2-yr	161	2228.5	2230.23	2230.88	0.96	6.47	1.09	7.05	5.08
US	4.3	5-yr	288	2228.5	2231.17	2231.54	0.63	5.44	0.65	3.54	0.61
US	4.3	10-yr	395	2228.5	2231.49	2231.82	0.6	5.57	0.65	3.65	0.44
US	4.3	50-yr	708	2228.5	2231.79	2232.24	0.73	7.17	1.05	7.5	1
US	4.3	100-yr	874	2228.5	2232.01	2232.41	0.7	7.12	1.01	7.15	0.98
US	4	Bankfull	68	2226.9	2227.83	2228.21	0.98	5.01	1.9	9.52	8.14
US	4	2-yr	161	2226.9	2228.44	2229.06	0.96	6.52	2.67	17.44	13.34
US	4	5-yr	288	2226.9	2229.1	2229.91	0.93	7.59	3.19	24.23	13.56
US	4	10-yr	395	2226.9	2229.69	2230.02	0.6	5.62	1.61	9.02	1.72
US	4	50-yr	708	2226.9	2230.01	2230.46	0.71	6.96	2.38	16.54	3.79
US	4	100-yr	874	2226.9	2230.06	2230.68	0.82	8.12	3.22	26.11	5.69

8.2 HEC-RAS Output Comparison							
River	River Sta	Profile	WSEL Diff	Power ch Diff	Power ch % Diff	Power Tot Diff	Power Tot % Diff
US	9	Bankfull	1.67	-1.18	-12%	-1.18	-12%
US	9	2-yr	1.64	-12.92	-48%	-16.27	-61%
US	9	5-yr	1.34	-16.8	-49%	-24.47	-71%
US	9	10-yr	1.23	-26.46	-56%	-36	-77%
US	9	50-yr	0.66	-34.02	-52%	-48.79	-75%
US	9	100-yr	0.39	-36.95	-50%	-54.63	-74%
US	8	Bankfull	0.99	-0.4	-4%	-0.4	-4%
US	8	2-yr	0.75	2.46	16%	-0.48	-3%
US	8	5-yr	0.88	-11.32	-32%	-19.36	-55%
US	8	10-yr	0.63	-7.58	-22%	-18.63	-54%
US	8	50-yr	0.35	-13.45	-25%	-31.51	-58%
US	8	100-yr	0.15	-9.69	-17%	-30.02	-54%
US	7	Bankfull	-0.22	-0.35	-4%	-0.35	-4%
US	7	2-yr	-0.26	-8.85	-38%	-11.39	-49%
US	7	5-yr	-0.68	-1.33	-6%	-8.29	-40%
US	7	10-yr	-0.44	-16.26	-42%	-25.79	-67%
US	7	50-yr	-0.8	-15.46	-31%	-28.45	-60%
US	7	100-yr	-1.55	20.91	106%	14.35	210%
US	6	Bankfull	-0.08	-4	-57%	-4.04	-57%
US	6	2-yr	-0.57	-0.82	-10%	0.37	11%
US	6	5-yr	-0.53	-6.71	-30%	-3.03	-31%
US	6	10-yr	-0.89	4.41	29%	4.56	115%
US	6	50-yr	-0.8	14.18	68%	6.24	105%
US	6	100-yr	-0.37	-3.22	-13%	-1.63	-21%
US	5	Bankfull	-0.58	2.47	40%	3.99	85%
US	5	2-yr	-0.37	-6.05	-32%	-4.04	-27%
US	5	5-yr	-0.37	5.98	87%	3.44	194%
US	5	10-yr	-0.01	0.6	7%	-0.28	-11%
US	5	50-yr	0.16	-1.91	-15%	-1.6	-42%
US	5	100-yr	0.16	-0.86	-6%	-1.61	-37%
US	4.4	Bankfull	0.23	-3.84	-85%	-3.97	-88%
US	4.4	2-yr	1.31	-3.06	-98%	-0.83	-99%
US	4.4	5-yr	1.42	-5.68	-98%	-1.76	-99%
US	4.4	10-yr	1.35	-7.43	-97%	-1.54	-97%
US	4.4	50-yr	1.09	-7.02	-92%	-1.22	-91%
US	4.4	100-yr	1.1	-8.68	-91%	-1.61	-89%
US	4.3	Bankfull	-0.64	1.9	142%	2.47	321%
US	4.3	2-yr	-0.49	3.76	114%	4	370%
US	4.3	5-yr	0.06	-0.43	-11%	-0.39	-39%
US	4.3	10-yr	0.27	-2.97	-45%	-1.22	-73%
US	4.3	50-yr	0.03	1.03	16%	-0.22	-18%
US	4.3	100-yr	0.13	-1.02	-12%	-0.5	-34%
US	4	Bankfull	-1.07	2.81	42%	3.35	70%
US	4	2-yr	-1	11.96	218%	11.98	881%
US	4	5-yr	-0.6	16.18	201%	11.37	519%
US	4	10-yr	-0.16	-1.41	-14%	-1.25	-42%
US	4	50-yr	-0.15	-1.12	-6%	-1.24	-25%
US	4	100-yr	-0.31	9.58	58%	1.76	45%

10.0 Transition Reach Design

Project: Seniard Creek Mitigation Project
Project No.: 172621103
Client: EW Solutions, LLC
Contract No.: -
County/State: Henderson, NC

Design Status: **Draft**

Stone Specification:	NCDOT

Stone Class	Nominal Size (in)	D50 (mm)
Class A	6	118
Class B	12	219
Class I	18	247
Class II	24	350

Reach	Location	Design Discharge (cfs)	Transition Slope (ft/ft)	Design Size (mm)	Selected Stone D_{50} (mm)	Shear Factor of Safety	Nominal Stone Size (in)	Armor Stone Class
Seniard Creek - R1A	100+20	708	0.06	402	219	0.6	12	Class B

Page left intentionally blank for printing purposes.

Appendix F SITE PROTECTION INSTRUMENT

Page left intentionally blank for printing purposes.

SLIDE 11381

CERTIFICATE OF SURVEY AND ACCURACY:

I, KEVIN L. JONES, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION FROM DEED DESCRIPTION(S) RECORDED IN DB: 533 PG: 113, DB: 1409 PG: 284, DB: 1616, PG: 326, PG: 1616, DB: 332, AND THAT THE BOUNDARIES NOT SURVEYED ARE INDICATED AS DRAWN FROM INFORMATION AS REFERENCED; THAT THE RATIO OF PRECISION AS CALCULATED DOES NOT EXCEED 1:10,000; THAT THE GPS PORTION OF THIS PROJECT WAS TO PERFORM A GRID TIE TO THE NC STATE PLANE COORDINATE SYSTEM AND INFORMATION USED IS SHOWN & NOTED HEREON; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED.

I ALSO HEREBY CERTIFY THAT THIS PLAT IS OF ONE OF THE FOLLOWING: GS 47-30 F(11) D; 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.

GPS METADATA
CLASS OF SURVEY: HORIZONTAL: A
FIELD PROCEDURE: STATIC NETWORK
DATES: 02/07/18-02/08/18
DATUM: NAD83(2011)
EPOCH: 2010
GEOID: 12B
AVERAGE COMBINED FACTOR: 0.99977344
POSITIONAL ACCURACY: HORIZONTAL: 0.03
UNITS: USFT
CORS USED: HAYW, NCHE, NCMA, NCSW

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 21ST DAY OF AUGUST, 2018, A.D.

NORTH CAROLINA PROFESSIONAL SEAL L-5016 LAND SURVEYOR KEVIN L. JONES

THIS DOCUMENT IS NOT VALID UNLESS SIGNED AND SEALED.

KEVIN L. JONES, PLS L-5016

HENDERSON COUNTY, NORTH CAROLINA

THIS PLAT DOES NOT CREATE A SUBDIVISION OF PROPERTY IN HENDERSON COUNTY. THE PURPOSE OF THIS SURVEY IS TO IDENTIFY THE CONSERVATION EASEMENT AREAS ONLY. NO TRANSFER OF PROPERTY IS TAKING PLACE.

I HEREBY CERTIFY THAT THE DIVISION OF PROPERTY, OR OTHER, DESCRIBED HEREON IS EXEMPT FROM THE HENDERSON COUNTY SUBDIVISION REGULATIONS BY DEFINITION.

Allen S. McNeill 8-28-18
PLANNING DIRECTOR (OR AGENT) DATE

I, Allen S. McNeill REVIEW OFFICER FOR HENDERSON COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING FOR WHICH THE REVIEW OFFICER HAS RESPONSIBILITY AS PROVIDED BY LAW.

Allen S. McNeill 8-28-18
REVIEW OFFICER DATE

REGISTERED THIS THE 29th DAY OF AUGUST 20 18 AT 11:59 AM AND RECORDED IN PLAT BOOK SLIDE PAGE 11381 BY:

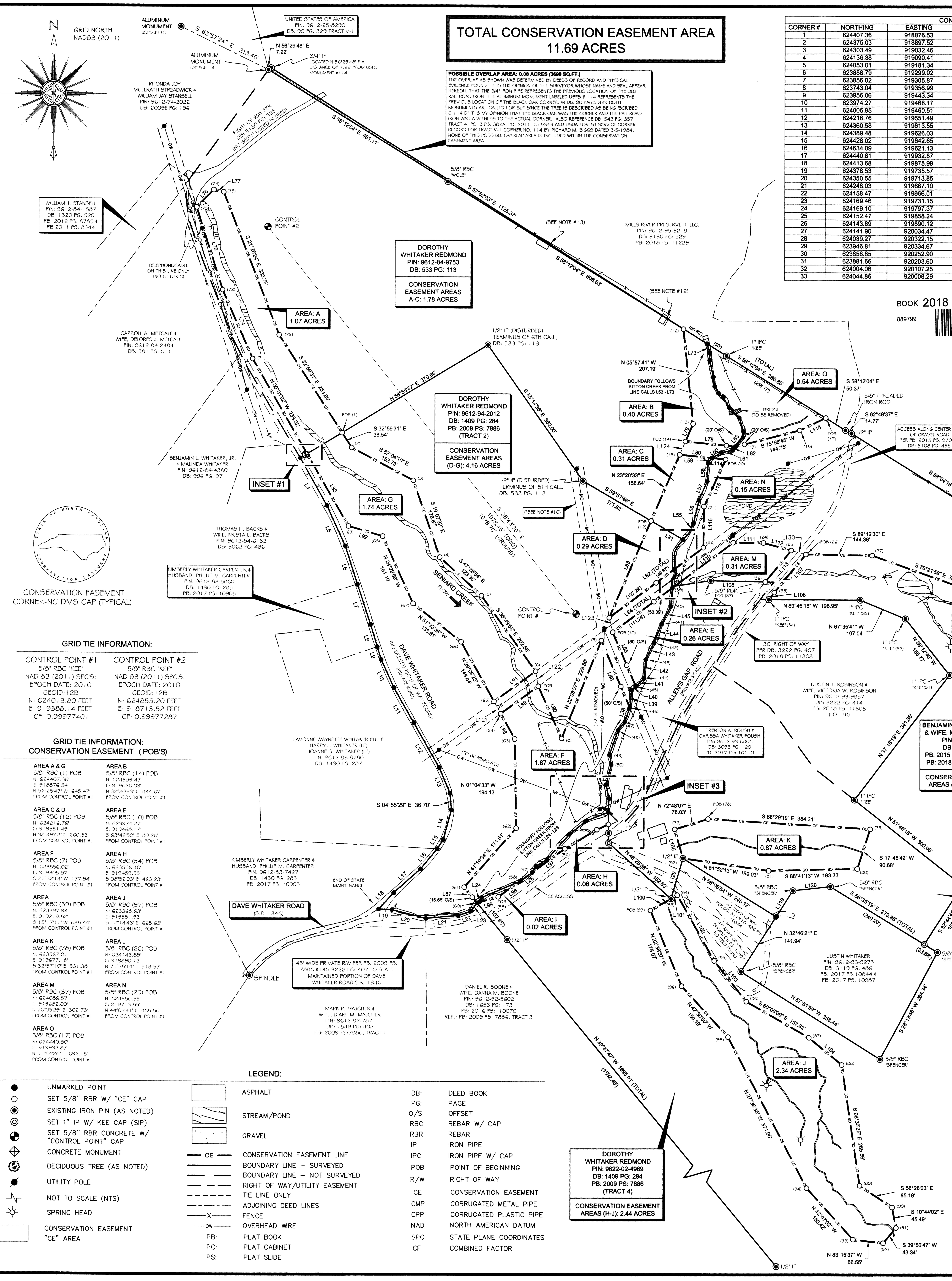
William Lee King
DEPUTY
William Lee King
REGISTER OF DEEDS

0 120' 240' 360'

ONE INCH = ONE HUNDRED & TWENTY FEET

SURVEYOR'S NOTES:

1. ALL DISTANCES AND COORDINATES ARE GROUND MEASUREMENTS IN US SURVEY FEET UNLESS OTHERWISE NOTED.
2. AREAS CALCULATED BY THE COORDINATE METHOD.
3. PROPERTY SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS AND RESTRICTIONS THAT ARE RECORDED, UNRECORDED, WRITTEN AND UNWRITTEN. THE PROFESSIONAL SURVEYOR HAS MADE NO INVESTIGATION OR INDEPENDENT SEARCH FOR EASEMENTS, RIGHT OF WAYS, ENCUMBRANCES, RESTRICTIVE COVENANTS, CORRECT OWNERSHIP OR ANY OTHER FACTS THAT AN ACCURATE AND CURRENT TITLE SEARCH MAY DISCLOSE. A NC LICENSED ATTORNEY SHOULD BE CONSULTED.
4. HENDERSON COUNTY GIS WEBSITE USED TO IDENTIFY ADJOINING PROPERTY OWNERS.
5. THE STATE OF NORTH CAROLINA, ITS EMPLOYEES AND AGENTS, SUCCESSORS AND ASSIGNS, RECEIVE A PERPETUAL RIGHT OF ACCESS TO THE EASEMENT AREA OVER THE PROPERTY AT REASONABLE TIMES TO UNDERTAKE ANY ACTIVITIES TO RESTORE, CONSTRUCT, MANAGE, MAINTAIN, ENHANCE, AND MONITOR THE STREAM, WETLAND AND ANY OTHER RIPARIAN RESOURCES IN THE EASEMENT AREA, IN ACCORDANCE WITH RESTORATION ACTIVITIES OR A LONG-TERM MANAGEMENT PLAN AS DESCRIBED IN SECTION III-A OF THE CONSERVATION EASEMENT AGREEMENT.
6. UTILITIES WERE LOCATED BASED ON VISIBLE ABOVE GROUND STRUCTURES AND MARKINGS PROVIDED BY NC 811. THEREFORE, THE LOCATION OF UNDERGROUND UTILITIES ARE APPROXIMATE OR MAY BE PRESENT AND NOT SHOWN HEREON. CALL 1-800-632-4949 BEFORE DIGGING.
7. ALL EXISTING FENCES WITHIN THE CONSERVATION EASEMENT AREAS ARE TO BE REMOVED.
8. BY GRAPHIC DETERMINATION, NO PORTION OF THE SUBJECT PROPERTY APPEARS TO LIE WITHIN A SPECIAL FLOOD HAZARD AREA (SFHA) AS DETERMINED BY THE F.E.M.A. MAP# 3700961200J & # 3700962200J DATED 10/02/08.
9. PROPERTY IS ZONED: (R-3). REFER TO HENDERSON COUNTY, NC LAND DEVELOPMENT CODE OF ORDINANCES.
10. THE RIGHT OF WAY WIDTH REQUIRED FOR OVERHEAD DISTRIBUTION POWER LINES OF ANY VOLTAGE IS NORMALLY A 30-FOOT CORRIDOR (15 FEET ON EACH SIDE) PER DUKE ENERGY.
11. PROPERTY LINE RUNS WITH THE CENTER OF CREEK. BOUNDARY LINE CALLS START AT THE INTERSECTION OF THE BRIDGE AND FOLLOW THE CREEK TO AN UNMARKED POINT IN THE COMMON BOUNDARY LINE OF MILLS RIVER PRESERVE II, LLC. LINE CALL NUMBERS ARE L19 THROUGH L73.
12. SHED IS 5.29' OVER THE LINE LABELED S 58°12'04" E 606.63'.
13. SHED IS 5.14' OVER THE LINE LABELED S 58°12'04" E 606.63'.
14. TIE LINES FROM CONTROL POINT #1 TO THE POINT OF BEGINNING OF EACH CONSERVATION EASEMENT AREA ARE LISTED IN THE TABLE ENTITLED "GRID TIE INFORMATION: CONSERVATION EASEMENT (POB'S)".



GRID TIE INFORMATION:

CONTROL POINT #1	CONTROL POINT #2
5/8" RBC "KEE"	5/8" RBC "KEE"
NAD 83 (2011) SPC'S:	NAD 83 (2011) SPC'S:
EPOCH DATE: 2010	EPOCH DATE: 2010
GEOID: 12B	GEOID: 12B
N: 624013.80 FEET	N: 624855.20 FEET
E: 919388.14 FEET	E: 918713.52 FEET
CF: 0.99977401	CF: 0.99977287

GRID TIE INFORMATION: CONSERVATION EASEMENT (POB'S)

AREA A & G
5/8" RBC (1) POB
N: 624407.36'
E: 918876.54'
N 52°25'47" W 645.47'
FROM CONTROL POINT #1

AREA B
5/8" RBC (14) POB
N: 624389.47'
E: 919626.03'
N 32°20'33" E 444.67'
FROM CONTROL POINT #1

AREA C & D
5/8" RBC (12) POB
N: 624216.76'
E: 919551.49'
N 38°49'42" E 260.53'
FROM CONTROL POINT #1

AREA E
5/8" RBC (10) POB
N: 623974.27'
E: 919468.17'
S 63°42'59" E 89.26'
FROM CONTROL POINT #1

AREA F
5/8" RBC (7) POB
N 623856.02'
E. 919305.87'
S 27°32'14" W 177.94'
FROM CONTROL POINT #1

AREA H
5/8" RBC (54) POB
N: 623556.10'
E: 919459.55'
S 08°52'03" E 463.23'
FROM CONTROL POINT #1

AREA I
5/8" RBC (59) POB
N: 623397.94'
E: 919219.82'
S 15°17'11" W 638.44'
FROM CONTROL POINT #1

AREA J
5/8" RBC (97) POB
N: 623368.63'
E: 919551.93'
S 14°14'43" E 665.63'
FROM CONTROL POINT #1

AREA K
5/8" RBC (78) POB
N. 623567.91'
E: 919677.18'
S 32°57'10" E 531.38'
FROM CONTROL POINT #1

AREA L
5/8" RBC (26) POB
N: 624143.89'
E: 919890.12'
N 75°28'14" E 518.57'
FROM CONTROL POINT #1

AREA M
5/8" RBC (37) POB
N: 624086.57'
E: 919682.00'
N 76°05'29" E 302.73'
FROM CONTROL POINT #1

AREA N
5/8" RBC (20) POB
N: 624350.55'
E: 919713.85'
N 44°02'41" E 468.50'
FROM CONTROL POINT #1

AREA O
5/8" RBC (17) POB
N: 624440.80'
E: 919932.87'
N 51°54'26" E 692.15'
FROM CONTROL POINT #1

LEGEND:

UNMARKED POINT	ASPHALT
SET 5/8" RBR W/ "CE" CAP	STREAM/POND
EXISTING IRON PIN (AS NOTED)	GRAVEL
SET 1" IP W/ KEE CAP (SIP)	CE — CONSERVATION EASEMENT LINE
SET 5/8" RBR CONCRETE W/ "CONTROL POINT" CAP	BOUNDARY LINE – SURVEYED
CONCRETE MONUMENT	BOUNDARY LINE – NOT SURVEYED
DECIDUOUS TREE (AS NOTED)	RIGHT OF WAY/UTILITY EASEMENT
UTILITY POLE	TIE LINE ONLY
NOT TO SCALE (NTS)	ADJOINING DEED LINES
SPRING HEAD	FENCE
CONSERVATION EASEMENT "CE" AREA	OW — OVERHEAD WIRE

DB:	DEED BOOK
PG:	PAGE
O/S	OFFSET
RBC	REBAR W/ CAP
RBR	REBAR
IP	IRON PIPE
IPC	IRON PIPE W/ CAP
POB	POINT OF BEGINNING
R/W	RIGHT OF WAY
CE	CONSERVATION EASEMENT
CMP	CORRUGATED METAL PIPE
CPP	CORRUGATED PLASTIC PIPE
NAD	NORTH AMERICAN DATUM
PB:	PLAT BOOK
SPC	STATE PLANE COORDINATES
PC:	PLAT CABINET
CF	COMBINED FACTOR
PS:	PLAT SLIDE

CONSERVATION EASEMENT CORNER COORDINATE TABLE (USFT)

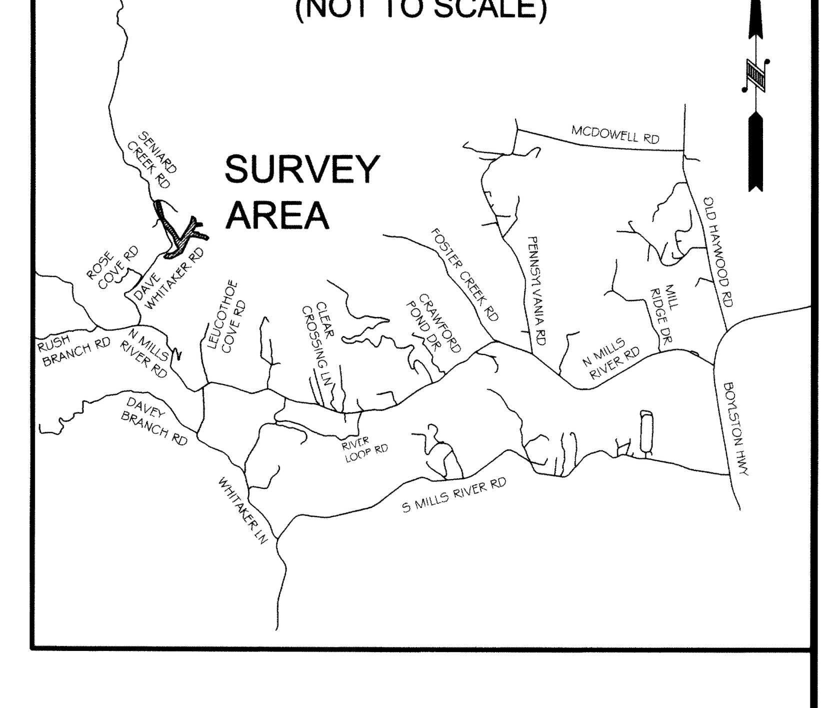
CORNER #	NORTHING	EASTING	CORNER #	NORTHING	EASTING	CORNER #	NORTHING	EASTING
1	624407.36	918876.53	34	624045.65	919809.34	67	624035.61	919032.46
2	624375.03	918897.52	35	624060.93	919821.12	68	624182.21	918965.66
3	624303.49	919032.46	36	624084.09	919801.37	69	624204.12	918890.92
4	624136.38	919090.41	37	624086.57	919682.00	70	624361.30	918800.11
5	624053.01	919181.34	38	624074.81	919603.63	71	624568.26	918680.54
6	623888.79	919299.92	39	624070.92	919598.39	72	624718.00	918614.56
7	623856.02	919305.87	40	624031.11	919595.10	73	624897.77	918557.08
8	623743.04	919356.99	41	623991.90	919575.19	74	624935.39	918594.86
9	623956.06	919443.34	42	623951.74	919558.56	75	624930.88	918616.34
10	623974.27	919468.17	43	623914.68	919540.42	76	624620.23	918738.33
11	624005.95	919460.51	44	623873.39	919536.75	77	623545.42	919604.55
12	624216.76	919551.49	45	623856.58	919518.60	78	623567.90	919677.18
13	624360.58	919613.55	46	623810.08	919505.88	79	623546.21	920030.82
14	624389.48	919626.03	47	623779.51	919495.05	80	623459.88	920003.08
15	624428.02	919642.65	48	623760.64	919480.30	81	623455.45	919809.80
16	624634.09	919621.13	49	623707.95	919461.71	82	623482.17	919622.68
17	624440.81	919932.87	50	623686.38	919465.37	83	623394.34	919596.95
18	624413.68	919875.99	51	623642.71	919454.50	84	623402.14	919610.61
19	624378.53	919735.57	52	623612.70	919460.46	85	623259.26	919691.53
20	624350.55	919713.85	53	623582.61	919459.14	86	623170.73	919761.76
21	624248.03	919667.10	54	623556.10	919459.55	87	623092.07	919898.58
22	624158.47	919666.01	55	623544.40	919434.25	88	623033.08	919969.91
23	624169.46	919731.15	56	623503.10	919364.42	89	622770.43	920009.20
24	624169.10	919797.37	57	623450.83	919293.38	90	622723.34	920080.18
25	624152.47	919858.24	58	623432.03	919267.22	91	622678.64	920088.66
26	624143.89	919890.12	59	623397.94	919219.82	92	622645.37	920060.89
27	624141.90	920034.47	60	623384.07	919173.64	93	622653.17	919994.80
28	624039.27	920322.15	61	623418.42	919145.20	94	622764.75	919893.92
29	623946.81	920334.67	62	623547.59	919258.18	95	623093.56	919721.95
30	623856.85	920252.90	63	623741.68	919254.54	96	623204.28	919620.49
31	623881.66	920203.60	64	623796.45	919224.02	97	623368.63	919551.93
32	624004.06	920107.25	65	623822.85	919209.32			
33	624044.86	920008.29	66	623952.55	919137.11			

BOOK 2018 PAGE 11381 (1)

889799

VICINITY MAP

(NOT TO SCALE)



CERTIFICATE OF OWNERSHIP AND DEDICATION:

I/WE, THE UNDERSIGNED, CERTIFY THAT WE ARE THE OWNER OF THE PROPERTY SHOWN AND DESCRIBED HEREON AND ACCEPT AND ADOPT THIS PLAT AND THE CONSERVATION EASEMENTS WITH OUR FREE CONSENT AND DEDICATE, GRANT AND CONVEY AN EASEMENT OVER OUR ADJACENT PROPERTY FOR ACCESS TO AND FROM THE CONSERVATION EASEMENTS SET FORTH HEREIN.

Dorothy Whitaker Redmond 8-22-18
DOROTHY WHITAKER REDMOND DATE

David Carroll Whitaker 8-22-18
DAVID CARROLL WHITAKER DATE

Tricia Whitaker 8-22-18
PATRICIA WHITAKER DATE

Benjamin Lee Whitaker Jr 8-22-18
BENJAMIN LEE WHITAKER, JR. DATE

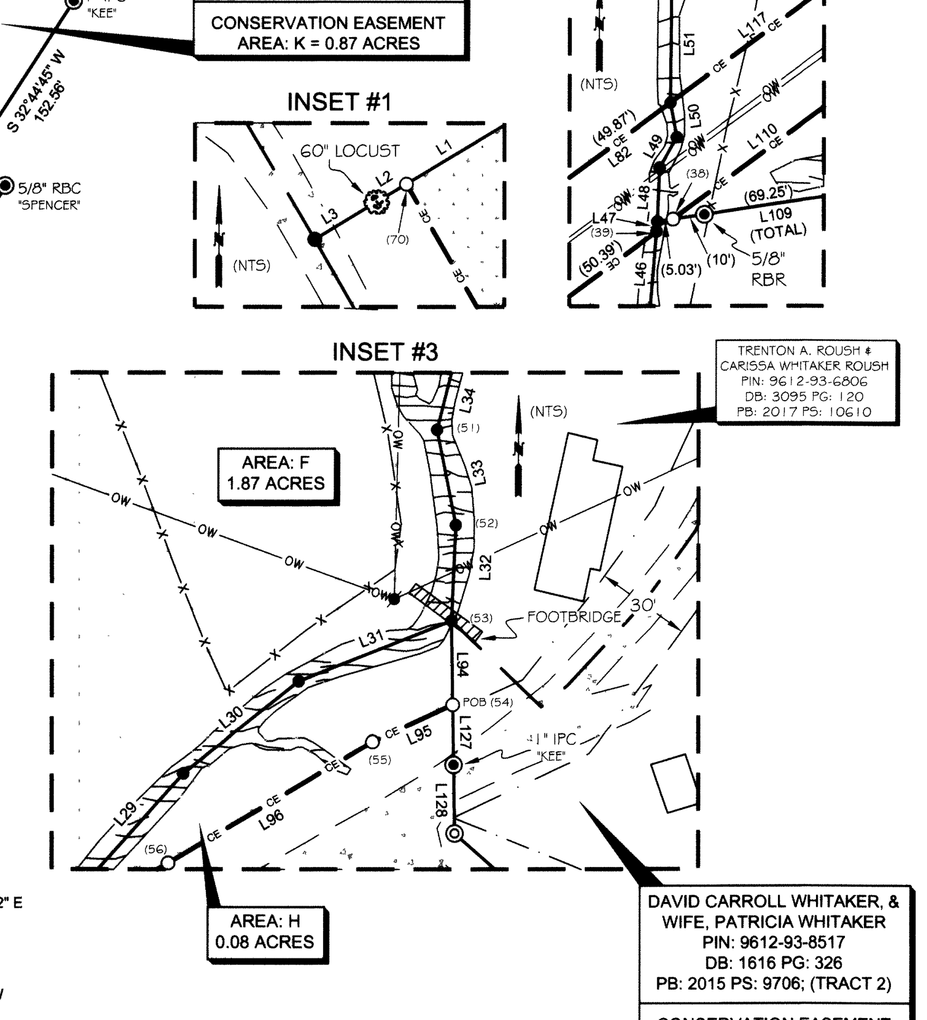
Malinda Whitaker 8-22-18
MALINDA WHITAKER DATE

LINE	BEARING	DISTANCE	LINE	BEARING	DISTANCE
L1	S 58°55'32" W	89.22'	L66	N 44°35'40" W	31.46'
L2	S 58°55'32" W	3.45'	L67	N 30°43'54" W	25.37'
L3	S 58°55'32" W	13.96'	L68	N 49°12'21" W	14.48'
L4	S 29°32'55" E	118.70'	L69	N 28°23'57" W	16.41'
L5	S 24°32'44" E	97.08'	L70	N 08°35'45" W	20.04'
L6	S 17°51'34" E	87.19'	L71	N 12°29'38" W	37.66'
L7	S 18°16'29" E	92.15'	L72	N 00°18'52" E	16.78'
L8	S 17°04'23" E	50.76'	L73	N 17°17'40" W	20.26'
L9	S 17°04'23" E	29.44'	L74	N 23°46'50" W	163.63'
L10	S 24°14'10" E	66.75'	L75	N 17°43'52" W	188.75'
L11	S 29°41'58" E	88.25'	L76	N 45°07'39" E	53.31'
L12	S 29°41'07" E	112.54'	L77	S 78°08'37" E	21.95'
L13	S 23°00'03" E	60.19'	L78	N 84°17'30" W	110.09'
L14	S 15°03'29" W	66.73'	L79	N 23°19'50" E	41.97'
L15	S 33°24'51" W	23.95'	L80	S 84°17'30" E	70.37'
L16	S 39°35'09" W	56.74'	L81	N 59°51'46" W	81.15'
L17	S 48°28'53" W	78.17'	L82	S 53°24'57" W	177.16'
L18	S 42°42'07" W	48.18'	L83	N 23°20'33" E	229.60'
L19	S 86°58'15" E	28.89'	L84	N 53°24'57" E	162.17'
L20	N 75°42'14" E	76.57'	L85	N 23°11'32" W	128.04'
L21	N 85°02'41" E	70.45'	L86	S 23°11'32" E	158.81'
L22	N 71°05'09" E	28.62'	L87	N 39°37'47" W	44.60'
L23	N 38°16'42" E	23.09'	L88	N 29°07'22" W	62.70'
L24	N 38°16'42" E	15.47'	L89	N 53°57'16" E	101.23'
L25	N 66°54'37" E	91.31'	L90	S 24°20'36" E	164.29'
L26	N 54°17'10" E	32.22'	L91	S 53°57'16" W	112.05'
L27	N 31°41'47" E	16.19'	L92	N 73°39'18" W	77.89'
L28	N 57°28'29" E	28.18'	L93	N 30°01'02" W	181.53'
L29	N 41°48'47" E	73.41'	L94	S 00°53'08" E	26.51'
L30	N 51°23'40" E	46.51'	L95	S 65°10'35" W	27.87'
L31	N 68°22'07" E	51.85'	L96	S 59°23'39" W	81.12'
L32	N 02°31'45" E	30.12'	L97	S 53°39'24" W	88.19'
L33	N 11°14'02" W	30.59'	L98	S 47°58'10" W	58.38'
L34	N 13°58'08" E	45.00'	L99	S 73°16'52" W	48.21'
L35	N 09°37'01" W	21.88'	L100	N 60°15'53" E	51.84'
L36	N 19°26'04" E	55.87'	L101	N 60°15'53" E	15.73'
L37	N 37°59'29" E	23.96'	L102	S 29°31'31" E	164.20'
L38	N 19°30'40" E	32.43'	L103	S 38°25'41" E	113.01'
L39	N 06°26'40" E	38.72'	L104	S 50°24'23" E	92.57'
L40	N 47°12'42" E	11.77'	L105	N 15°59'20" W	65.79'
L41	N 47°12'42" E	24.74'	L106	N 37°38'15" E	19.29'
L42	N 05°04'47" E	14.00'	L107	N 39°44'58" E	107.91'
L43	N 26°04'31" E	41.26'	L108	N 88°48'40" W	119.40'
L44	N 22°29'28" E	43.47'	L109	S 81°28'04" W	84.28'
L45	N 26°55'07" E	43.98'	L110	N 53°24'57" E	158.81'
L46	N 04°43'44" E	39.95'	L111	S 89°41'22" E	66.23'
L47	N 04°43'44" E	3.15'	L112	S 74°43'04" E	63.10'
L48	N 40°16'22" E	16.94'	L113	S 39°44'58" W	88.94'
L49	N 29°39'22" E	11.08'	L114	S 84°17'30" E	30.43'
L50	N 10°32'30" W	11.11'	L115	S 24°30'45" W	112.68'
L51	N 00°30'17" E	37.66'	L116	S 00°41'53" W	89.56'
L52	N 30°29'20" E	19.08'	L117	S 53°24'57" W	78.75'
L53	N 40°34'06" E	13.66'	L118	S 64°30'04" W	63.02'
L54	N 40°34'06" E	21.59'	L119	N 32°46'21" E	67.67'
L55	N 23°32'08" E	21.23'	L120	N 83°52'04" E	81.83'
L56	N 13°01'04" E	51.61'	L121	N 29°07'01" W	30.21'
L57	N 24°14'39" E	44.12'	L122	N 10°17'46" W	33.30'
L58	N 02°38'56" E	39.61'	L123	N 13°35'48" W	32.59'
L59	N 33°54'00" E	14.00'	L124	N 23°20'33" E	31.48'
L60	N 60°37'07" E	24.02'	L125	S 74°56'54" E	33.02'
L61	N 78°15'18" E	25.28'	L126	N 40°27'41" W	30.44'
L62	N 15°27'22" E	10.22'	L127	N 00°53'08" W	18.86'
L63	N 38°15'27" E	26.02'	L128	N 00°53'08" W	21.58'
L64	N 06°00'56" E	12.68'	L129	S 16°19'27" W	91.53'
L65	N 17°38'59" W	31.22'	L130	S 74°56'54" E	33.02'

This document presented and filed:
08/28/2018 11:59:05 AM

WLK

WILLIAM LEE KING, Henderson COUNTY, NC



A CONSERVATION EASEMENT SURVEY FOR

THE STATE OF NORTH CAROLINA, NCDEQ: DIVISION OF MITIGATION SERVICES
"SENIARD CREEK"
SPO FILE NO's. 45-DG, 45-DI, 45-DH DMS SITE ID NO. 100017

PARCEL IDENTIFICATION #'S: 9612-84-9753, 9612-94-2012, 9622-02-4989, 9612-93-8517 & 9622-04-1013

CURRENT OWNER(S) LISTED AS:
DOROTHY WHITAKER REDMOND, DAVID CARROLL WHITAKER, PATRICIA WHITAKER, BENJAMIN LEE WHITAKER, JR. & MALINDA WHITAKER

SITE ADDRESS: DAVE WHITAKER ROAD, MILLS RIVER, NC

DEED REFERENCE'S:
DB: 533 PG: 113, DB: 1409 PG: 284,
DB: 1616 PG: 326 & DB: 1616 PG: 332

MILLS RIVER TOWNSHIP, HENDERSON COUNTY, NORTH CAROLINA

SURVEY BY: KJ,NH,DD,MK DRAWN BY: PBK CHECKED BY: KJ
SURVEY DATE: 02/07/18-07/16/18 JOB #180116-CE

REVISION: DATE REVISED:

SHEET SIZE: 24"X36" | *SHEET #: 1 OF 1* | *SCALE: 1"=120'*

Kee MAPPING & SURVEYING
P.O. Box 2566
Asheville, NC 28802
(828) 575-9021
www.keemap.com
License # C-3039

BOOK 3241 PAGE 109 (12)

889802

This document presented and filed:
08/28/2018 12:17:07 PM

WLK

WILLIAM LEE KING, Henderson COUNTY, NC
Transfer Tax: $26.00

Excise tax: $ 26

STATE OF NORTH CAROLINA

HENDERSON COUNTY

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

SPO File Number: 45-DI
DMS Project Number: 100017

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 22 day of August, 2018, by David Carroll Whitaker and Tricia Whitaker ("Grantor"), husband and wife, whose mailing address is 606 Dave Whitaker Road, Horse Shoe, NC 28742, to the State of North Carolina, ("**Grantee**"), with a mailing address of State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

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

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between EW Solutions, LLC, 37 Haywood St., Suite 100, Asheville, NC 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 7189.

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

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

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

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

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

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

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Mills River Township, Henderson County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 4.74 acres as shown on Plat Slide 9706, Henderson County Registry, and being conveyed to the Grantor by Warranty Deed as recorded in Deed Book 1616, Page 326 of the Henderson 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 Whitaker Branch and North Fork Mills River.

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

The Conservation Easement Area consists of the following:

That tract designated as "Conservation Easement Area K," containing a total of 0.87 acres as shown on the plat of survey entitled "A Conservation Easement Survey for: The State of North Carolina, NCDEQ: Division of Mitigation Services, Seniard Creek, SPO File Nos. 45-DG, 45-DI, 45-DH, DMS Site ID No. 100017", by Kee Mapping and Surveying, PA (license # C-3039) between the dates of 02/07/18 – 07/16/18 and under the supervision of Kevin L. Jones, NC PLS (License # L-5016) and shown on a plat of survey as recorded in Plat Book 2018, Slide 11381 of the Henderson County Register of Deeds.

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

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

I. DURATION OF EASEMENT

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

II. ACCESS EASEMENT

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

III. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

IV. GRANTEE RESERVED USES

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

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

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

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

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

V. ENFORCEMENT AND REMEDIES

A. **Enforcement.** To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with

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

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

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

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

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

VI. MISCELLANEOUS

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

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

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

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

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

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

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

and

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

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

VII. QUIET ENJOYMENT

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

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

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

IN TESTIMONY WHEREOF, the Grantor has duly executed the foregoing document the day and year first above written.

GRANTOR:
DAVID CARROLL WHITAKER AND TRICIA WHITAKER, husband and wife

David Carroll Whitaker
David Carroll Whitaker

Tricia Whitaker
Tricia Whitaker

STATE OF NORTH CAROLINA
COUNTY OF Buncombe

I, Joyce Keathley Brown, a Notary Public in and for the County and State aforesaid, do hereby certify that both David Carroll Whitaker and Tricia Whitaker appeared before me this day and each acknowledged his or her due execution of the foregoing instrument for the purposes therein expressed.

WITNESS my hand and notarial seal, this 22 day of August, 2018.

Joyce Keathley Brown, Notary Public
Joyce Keathley Brown
Printed name of notary
My Commission Expires:
March 26, 2023

JOYCE KEATHLEY BROWN NOTARY PUBLIC BUNCOMBE COUNTY, NC

SEAL/STAMP

Exhibit A

A Conservation Easement for
The State of North Carolina,
NCDEQ: Division of Mitigation Services,
"Seniard Creek Mitigation Site"
Property of:
David Carroll Whitaker and wife Patricia Whitaker
SPO FILE NO. 45-DI DMS SITE ID NO. 100017

The following conservation easement areas are located off of Dave Whitaker Road, SR# 1346, within the Mills River Township, Henderson County, North Carolina and being on a portion of that property conveyed to David Carroll Whitaker and wife Patricia Whitaker in Deed Book 1616 Page 326 (Plat Book 2015 Slide 9706) of the Henderson County Register of Deeds, and being more particularly described as follows (all bearings are grid bearings and all distances are horizontal ground distances):
Being all of a conservation easement area containing **0.87 Acre**, being the same more or less, according to a plat of survey entitled "A Conservation Easement Survey for: The State of North Carolina, NCDEQ: Division of Mitigation Services, Seniard Creek Mitigation Site, SPO File Nos. 45-DG, 45-DI, 45-DH, DMS Site ID No. 100017", on the property of David Carroll Whitaker and wife Patricia Whitaker; Job# 180116-CE. This description of land was prepared from an actual survey performed between the dates of 02/07/18 – 07/16/18 and under the supervision of Kevin L. Jones, NC PLS (License # L-5016) and shown on a plat of survey as recorded in Plat Book 2018, Slide 11381 of the Henderson County Register of Deeds, to which reference should be made for a more complete description.

Conservation Easement Area K: ***0.87 Acre***
Being on a portion of land recorded in Deed Book 1616 Page 326, being Tract 2 of Plat Book 2015 Slide 9706 of the Henderson County Register of Deeds and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 78), said rebar being located S 32°57'10" E a distance of 531.38 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence with the conservation easement area the following (6) courses and distances;

(1) S 86°29'19" E a distance of 354.31 feet to a 5/8" rebar set with a CE cap (CORNER 79);
(2) S 17°48'49" W, crossing a small stream, a distance of 90.68 feet to a 5/8" rebar set with a CE cap (CORNER 80);
(3) S 88°41'13" W a distance of 193.33 feet to a 5/8" rebar set with a CE cap (CORNER 81);
(4) N 81°52'13" W a distance of 189.03 feet to an existing 1/2" iron pipe (CORNER 82), said iron pipe being at a common corner of Deed Book 1616 Page 326 and Deed Book 1409 Page 284, second tract;

(5) N 15°59'20" W, crossing a small stream, a distance of 65.79 feet to a 5/8" rebar set with a CE cap (CORNER 77);
(6) N 72°48'07" E a distance of 76.03 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area K containing a total of 0.87 Acres being the same more or less.

BOOK 3241 PAGE 121 (15)

889803

This document presented and filed:
08/28/2018 12:17:08 PM

WLK

WILLIAM LEE KING, Henderson COUNTY, NC
Transfer Tax: $73.00

Excise tax: $ 73

STATE OF NORTH CAROLINA

HENDERSON COUNTY

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

SPO File Number: 45-DH
DMS Project Number: 100017

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 22 day of August, 2018, by Benjamin Lee Whitaker, Jr. and Malinda Whitaker ("Grantor"), husband and wife, whose mailing address is 30 Deer Acres Drive, Horse Shoe, NC 28742, to the State of North Carolina, ("**Grantee**"), with a mailing address of State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

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

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between EW Solutions, LLC, 37 Haywood St., Suite 100, Asheville, NC 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 7189.

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

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

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

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

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

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

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Mills River Township, Henderson County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 13.78 acres as shown in Plat Book 2015, Slide 9706, Henderson County Registry, and being conveyed to the Grantor by Warranty Deed as recorded in Deed Book 1616, Page 332 of the Henderson County Registry, North Carolina, less and except approximately 3.63 acres; 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 Sitton Creek, Lee Branch, David Branch and North Fork Mills River.

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

The Conservation Easement Area consists of the following:

Those tracts designated "Conservation Easement Areas L, M, N, and O" containing a total of 2.44 acres as shown on a plat of survey entitled "A Conservation Easement Survey for: The State of North Carolina, NCDEQ: Division of Mitigation Services, Seniard Creek, SPO File Nos. 45-DG, 45-DI, 45-DH, DMS Site ID No. 100017", by Kee Mapping and Surveying, PA (license # C-3039) between the dates of 02/07/18 – 07/16/18 and under the supervision of Kevin L. Jones, NC PLS (License # L-5016) and shown on a plat of survey as recorded in Plat Book 2018, Slide 11381 of the Henderson County Register of Deeds.

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

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

I. DURATION OF EASEMENT

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

II. ACCESS EASEMENT

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

III. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

IV. GRANTEE RESERVED USES

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

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

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

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

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

V. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with

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

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

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

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

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

VI. MISCELLANEOUS

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

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

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

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

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

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

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

and

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

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

VII. QUIET ENJOYMENT

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

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

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

IN TESTIMONY WHEREOF, the Grantor has duly executed the foregoing document the day and year first above written.

GRANTOR:
BENJAMIN LEE WHITAKER, JR. AND MALINDA WHITAKER, husband and wife

Benj Lee Whitaker Jr
Benjamin Lee Whitaker, Jr.

Malinda Whitaker
Malinda Whitaker

STATE OF NORTH CAROLINA
COUNTY OF Buncombe

I, Joyce Keathley Brown, a Notary Public in and for the County and State aforesaid, do hereby certify that both Benjamin Lee Whitaker, Jr. and Malinda Whitaker appeared before me this day and each acknowledged his or her due execution of the foregoing instrument for the purposes therein expressed.

WITNESS my hand and notarial seal, this 22 day of August, 2018.

Joyce Keathley Brown, Notary Public
Joyce Keathley Brown
Printed name of notary
My Commission Expires:
March 26, 2023

JOYCE KEATHLEY BROWN
NOTARY PUBLIC
BUNCOMBE COUNTY, NC

SEAL/STAMP

Exhibit A
Legal Description
A Conservation Easement for
The State of North Carolina,
NCDEQ: Division of Mitigation Services,
"Seniard Creek Mitigation Site"
Property of:
Benjamin Lee Whitaker, Jr. and wife Malinda Whitaker
SPO FILE NO. 45-DH DMS SITE ID NO. 100017

The following conservation easement areas are located off of Dave Whitaker Road, SR# 1346, within the Mills River Township, Henderson County, North Carolina and being on portions of that property conveyed to Benjamin Lee Whitaker, Jr. and wife Malinda Whitaker in Deed Book 1616 Page 332 of the Henderson County Register of Deeds, and being more particularly described as follows (all bearings are grid bearings and all distances are horizontal ground distances):
Being all of four conservation easement areas containing a total of **2.44 Acres**, being the same more or less, according to a plat of survey entitled "A Conservation Easement Survey for: The State of North Carolina, NCDEQ: Division of Mitigation Services, Seniard Creek Mitigation Site, SPO File Nos. 45-DG, 45-DI, 45-DH, DMS Site ID No. 100017", on the property of Benjamin Lee Whitaker, Jr. and wife Malinda Whitaker; Job# 180116-CE. This description of land was prepared from an actual survey performed between the dates of 02/07/18 – 07/16/18 and under the supervision of Kevin L. Jones, NC PLS (License # L-5016) and shown on a plat of survey as recorded in Plat Book 2018, Slide 11381 of the Henderson County Register of Deeds, to which reference should be made for a more complete description.

<u>Conservation Easement Area L:</u> ***1.44 Acres***
Being on a portion of land recorded in Deed Book 1616 Page 332, being a portion of Tract 1 of Plat Book 2015 Slide 9706, and being Lot 1A of Plat Book 2018 Slide 11303 of the Henderson County Register of Deeds and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 26) on an extension of the southeast line of a 30 foot wide private road right of way as shown on Plat Book 2018 Slide 11303 of the Henderson County Registry, said rebar being located N 75°28'14" E a distance of 518.57 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence leaving the aforementioned right of way line and with the conservation easement area the following (5) courses and distances:

(1) S 89°12'30" E a distance of 144.36 feet to a 5/8" rebar set with a CE cap (CORNER 27);
(2) S 70°21'58" E a distance of 305.44 feet to a 5/8" rebar set with a CE cap (CORNER 28);
(3) S 07°42'41" E a distance of 93.30 feet to a 5/8" rebar set with a CE cap (CORNER 29);
(4) S 42°16'07" W a distance of 121.57 feet to a 5/8" rebar set with a CE cap (CORNER 30);

(5) N 63°16'54" W a distance of 55.19 feet to an existing 1" iron pipe with a Kee cap (CORNER 31), said iron pipe being a common corner of Deed Book 1616 Page 332 and Deed Book 3222 Page 414 as shown on Plat Book 2018 Slide 11303 of the Henderson County Registry;

Thence with the common line of Deed Book 1616 Page 332 and Deed Book 3222 Page 414 of the Henderson County Registry and continuing with the conservation easement area the following (3) courses and distances:

(1) N 38°12'40" W a distance of 155.77 feet to an existing 1" iron pipe with a Kee cap (CORNER 32)
(2) N 67°35'41" W a distance of 107.04 feet to an existing 1" iron pipe with a Kee cap (CORNER 33)
(3) N 89°46'18" W a distance of 198.95 feet to an existing 1" iron pipe with a Kee cap (CORNER 34), said iron pipe being on the southeastern line of the aforementioned 30 foot wide private road right of way;

Thence leaving the aforementioned common line and with the southeastern line of the aforementioned 30 foot wide private road right of way and the extension thereof and continuing with the conservation easement area the following (2) courses and distances:

(1) N 37°38'15" E a distance of 19.29 feet to a 5/8" rebar set with a CE cap (CORNER 35);
(2) N 39°44'58" E a distance of 107.91 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area L containing a total of 1.44 Acres, being the same more or less.

<u>Conservation Easement Area M:</u> ***0.31 Acre***
Being on a portion of land recorded in Deed Book 1616 Page 332, being a portion of Tract 1 of Plat Book 2015 Slide 9706, and being Lot 1A of Plat Book 2018 Slide 11303 of the Henderson County Register of Deeds and being more particularly described as follows:
BEGINNING AT AN EXISTING 5/8" REBAR (CORNER 37) in a common line of Deed Book 1616 Page 332 and Deed Book 3095 Page 120 of the Henderson County Registry, said rebar being located N 76°05'29" E a distance of 302.73 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence with the aforementioned common line and with the conservation easement area the following (2) courses and distances:

(1) S 81°28'04" W a distance of 69.25 feet to an existing 5/8" rebar;
(2) S 81°28'04" W a distance of 10.00 feet to a 5/8" rebar set with a CE cap (CORNER 38), said rebar being on the southeast line of a 30 foot wide right of way easement of Duke Energy Company;

Thence leaving the aforementioned common line, with the southeast line of the aforementioned 30 foot wide right of way easement and continuing with the conservation easement area N 53°24'57" E a distance of 158.81 feet to a 5/8" rebar set with a CE cap (CORNER 23);

Thence leaving the southeast line of the aforementioned 30 foot wide right of way easement and continuing with the conservation easement area the following (2) courses and distances:

(1) S 89°41'22" E a distance of 66.23 feet to a 5/8" rebar set with a CE cap (CORNER 24);
(2) S 74°43'04" E a distance of 63.10 feet to a 5/8" rebar set with a CE cap (CORNER 25), said rebar being on an extension of the northwestern line of a 30 foot wide private road right of way as shown on Plat Book 2018 Slide 11303 of the Henderson County Registry;

Thence with the northwestern line of the aforementioned 30 foot wide private road right of way and continuing with the conservation easement area S 39°44'58" W a distance of 88.94 feet to a 5/8" rebar set with a CE cap (CORNER 36), said rebar being in a common line of Deed Book 1616 Page 332 and Deed Book 3095 Page 120 of the Henderson County Registry;

Thence leaving the northwestern line of the aforementioned 30 foot wide private road right of way, with a common line of Deed Book 1616 Page 332 and Deed Book 3095 Page 120 of the Henderson County Registry, and continuing with the conservation easement area, N 88°48'40" W a distance of 119.40 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area M containing a total of 0.31 Acre, being the same more or less.

Conservation Easement Area N: ***0.15 Acre***
Being on a portion of land recorded in Deed Book 1616 Page 332, being a portion of Tract 1 of Plat Book 2015 Slide 9706, and being Lot 1A of Plat Book 2018 Slide 11303 of the Henderson County Register of Deeds and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 20) near a fence southeast of Sitton Creek, said rebar being located N 44°02'41" E a distance of 468.50 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence with the conservation easement area and generally with a fence S 24°30'45" W a distance of 112.68 feet to a 5/8" rebar set with a CE cap (CORNER 21);

Thence leaving the fence and continuing with the conservation easement area S 00°41'53" W a distance of 89.56 feet to a 5/8" rebar set with a CE cap (CORNER 22), said rebar being on the northwestern line of a 30 foot wide right of way easement of Duke Energy Company;

Thence with the northwestern line of the aforementioned 30 foot wide right of way easement and continuing with the conservation easement area S 53°24'57" W a distance of 78.75 feet to an unmarked point in the center of Sitton Creek, said point being in the common line of Deed Book 1616 Page 332 and Deed Book 1409 Page 284, first tract of the Henderson County Registry;

Thence leaving the northwestern line of the aforementioned 30 foot wide right of way easement, with the aforementioned common line, up and with Sitton Creek and continuing with the conservation easement area the following (3) courses and distances:

(1) N 00°30'17" E a distance of 37.66 feet to an unmarked point;
(2) N 30°29'20" E a distance of 19.08 feet to an unmarked point;
(3) N 40°34'06" E a distance of 13.66 feet to an unmarked point, said point being at common corner of Deed Book 1409 Page 284, first tract and Deed Book 533 Page 113 in the line of Deed Book 1616 Page 332;

Thence leaving the aforementioned common line, with the line of Deed Book 1616 Page 332 and Deed Book 553 Page 113, up and with the center of Sitton Creek, and continuing with the conservation easement the following (6) courses and distances:

(1) N 40°34'06" E a distance of 21.59 feet to an unmarked point;
(2) N 23°32'08" E a distance of 21.23 feet to an unmarked point;
(3) N 13°01'04" E a distance of 51.61 feet to an unmarked point;
(4) N 24°14'39" E a distance of 44.12 feet to an unmarked point;
(5) N 02°38'56" E a distance of 39.61 feet to an unmarked point;
(6) N 33°54'00" E a distance of 14.00 feet to an unmarked point;

Thence leaving the aforementioned common line, leaving the center of Sitton Creek and continuing with the conservation easement area S 84°17'30" E a distance of 30.43 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area N containing a total of 0.15 Acre, being the same more or less.

<u>Conservation Easement Area O:</u> ***0.54 Acre***
Being on a portion of land recorded in Deed Book 1616 Page 332, being a portion of Tract 1 of Plat Book 2015 Slide 9706, and being Lot 1A of Plat Book 2018 Slide 11303 of the Henderson County Register of Deeds and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 17) in a common line of Deed Book 1616 Page 332 and Deed Book 3230 Page 529 as shown on Plat Book 2018 Slide 11229 of the Henderson County Registry, said rebar being located N 51°54'26" E a distance of 692.15 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence leaving the aforementioned common line and with the conservation easement area the following (3) courses and distances:

(1) S 64°30'04" W a distance of 63.02 feet to a 5/8" rebar set with a CE cap (CORNER 18);
(2) S 75°56'45" W a distance of 124.75 feet to a 5/8" rebar set with a CE cap (CORNER 19);

(3) S 75°56'45" W a distance of 20.00 feet to an unmarked point in the center of Sitton Creek, said point being in a common line of Deed Book 1616 Page 332 and Deed Book 553 Page 113 of the Henderson County Registry;

Thence with the aforementioned common line, up and with the center of Sitton Creek and continuing with the conservation easement area the following (11) courses and distances:

(1) N 38°15'27" E a distance of 26.02 feet to an unmarked point;
(2) N 06°00'56" E a distance of 12.68 feet to an unmarked point;
(3) N 17°38'59" W a distance of 31.22 feet to an unmarked point;
(4) N 44°35'40" W a distance of 31.46 feet to an unmarked point;
(5) N 30°43'54" W a distance of 25.37 feet to an unmarked point;
(6) N 49°12'21" W a distance of 14.48 feet to an unmarked point;
(7) N 28°23'57" W a distance of 16.41 feet to an unmarked point;
(8) N 08°35'45" W a distance of 20.04 feet to an unmarked point;
(9) N 12°29'38" W a distance of 37.66 feet to an unmarked point;
(10) N 00°18'52" E a distance of 16.78 feet to an unmarked point;
(11) N 17°17'40" W a distance of 20.26 feet to an unmarked point, said point being a common corner of Deed Book 1616 Page 332 and Deed Book 533 Page 113 in the line of Deed Book 3130 Page 529 of the Henderson County Registry;

Thence leaving the aforementioned common line, leaving the center of Sitton Creek, with a common line of Deed Book 1616 Page 332 and Deed Book 3130 Page 529 of the Henderson County Registry, and continuing with the conservation easement area the following (2) courses and distances:

(1) S 58°12'04" E a distance of 50.00 feet to an existing 1" iron pipe with a Kee cap;
(2) S 58°12'04" E a distance of 256.17 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area O containing a total of 0.54 Acre, being the same more or less.

BOOK 3241 PAGE 136 (21)

889804

This document presented and filed:
08/28/2018 12:17:09 PM

WLK

WILLIAM LEE KING, Henderson COUNTY, NC
Transfer Tax: $300.00

Excise tax: $ 300.00

STATE OF NORTH CAROLINA

HENDERSON COUNTY

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

SPO File Number: 45-DG
DMS Project Number: 100017

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 02 day of August, 2018, by Dorothy Whitaker Redmond ("Grantor"), unmarried, whose mailing address is 1097 Dave Whitaker Road, Horse Shoe, NC 28742, to the State of North Carolina, ("**Grantee**"), with a mailing address of State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

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

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between EW Solutions, LLC, 37 Haywood St., Suite 100, Asheville, NC 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 7189.

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

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

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

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

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

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

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Mills River Township, Henderson County, North Carolina (the "**Property**"), and being more particularly described as those certain parcels of land containing approximately 12.81 acres and 53.04 acres as shown in Plat Book 2009, Slide 7886, Henderson County Registry, being conveyed to the Grantor by Special Warranty Deed as recorded in Deed Book 1409, Page 284 of the Henderson County Registry; and 12.7 acres as conveyed to Grantor by deed recorded in Deed Book 533, Page 113, Henderson County Registry; 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 Seniard Creek, Sitton Creek, Redmond Branch and North Fork Mills River.

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

The Conservation Easement Area consists of the following:

Those tracts designated "Conservation Easement Area A, B, C, D, E, F, G, H, I, and J", containing a total of 8.38 acres as shown on the plat of survey entitled "A Conservation Easement Survey for: The State of North Carolina, NCDEQ: Division of Mitigation Services, Seniard Creek, SPO File Nos. 45-DG, 45-DI, 45-DH, DMS Site ID No. 100017", by Kee Mapping and Surveying, PA (license # C-3039) between the dates of 02/07/18 – 07/16/18 and under the supervision of Kevin L. Jones, NC PLS (License # L-5016) and shown on a plat of survey as recorded in Plat Book 2018, Slide 11381 of the Henderson County Register of Deeds.

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

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

I. DURATION OF EASEMENT

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

II. ACCESS EASEMENT

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

III. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

IV. GRANTEE RESERVED USES

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

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

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

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

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

V. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with

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

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

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

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

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

VI. MISCELLANEOUS

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

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

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

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

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

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

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

and

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

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

VII. QUIET ENJOYMENT

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

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

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

IN TESTIMONY WHEREOF, the Grantor has duly executed the foregoing document the day and year first above written.

GRANTOR:
DOROTHY WHITAKER REDMOND, UNMARRIED

Dorothy Whitaker Redmond
Dorothy Whitaker Redmond

STATE OF NORTH CAROLINA
COUNTY OF Buncombe

I, Joyce Keathley Brown, a Notary Public in and for the County and State aforesaid, do hereby certify that Dorothy Whitaker Redmond appeared before me this day and acknowledged her due execution of the foregoing instrument for the purposes therein expressed.

WITNESS my hand and notarial seal, this 22 day of August, 2018.

Joyce Keathley Brown, Notary Public
Joyce Keathley Brown
Printed name of notary
My Commission Expires:
March 26, 2023

JOYCE KEATHLEY BROWN
NOTARY PUBLIC
BUNCOMBE COUNTY, NC

SEAL/STAMP

Exhibit A:
A Conservation Easement for
The State of North Carolina,
NCDEQ: Division of Mitigation Services,
"Seniard Creek Mitigation Site"
Property of: Dorothy Whitaker Redmond
SPO FILE NO. 45-DG DMS SITE ID NO. 100017

The following conservation easement areas are located off of Dave Whitaker Road, SR# 1346, within the Mills River Township, Henderson County, North Carolina and being on portions of those properties conveyed to Dorothy Whitaker Redmond in Deed Book 533 Page 113 and Deed Book 1409 Page 284 (Plat Book 2009 Slide 7886) of the Henderson County Register of Deeds, and being more particularly described as follows (all bearings are grid bearings and all distances are horizontal ground distances):
Being all of ten conservation easement areas containing a total of **8.38 Acres**, being the same more or less, according to a plat of survey entitled "A Conservation Easement Survey for: The State of North Carolina, NCDEQ: Division of Mitigation Services, Seniard Creek Mitigation Site, SPO File Nos. 45-DG, 45-DI, 45-DH, DMS Site ID No. 100017", on the property of Dorothy Whitaker Redmond; Job# 180116-CE. This description of land was prepared from an actual survey performed between the dates of 02/07/18 – 07/16/18 and under the supervision of Kevin L. Jones, NC PLS (License # L-5016) and shown on a plat of survey as recorded in Plat Book 2018, Slide 11381 of the Henderson County Register of Deeds, to which reference should be made for a more complete description.

<u>Conservation Easement Area A:</u> ***1.07 Acres***
Being on a portion of land recorded in Deed Book 533 Page 113 of the Henderson County Register of Deeds and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 1) in a common line of Deed Book 533 Page 113 and Deed Book 1409 Page 284, first tract, said rebar being located N 52°25'47" W a distance of 645.47 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet, said CORNER 1 being also located S 58°55'32" W a distance of 370.66 feet from an existing 1/2" Iron Pipe (disturbed), said iron pipe being at the terminus of the sixth call of Deed Book 533 Page 113 and the northernmost corner of Deed Book 1409 Page 284, first tract of the Henderson County Registry;

Thence with the aforementioned common line, crossing Seniard Creek, and with the conservation easement area, S 58°55'32" W a distance of 89.22 feet to a 5/8" rebar set with a CE cap (CORNER 70), said rebar being located N 58°55'32" E, passing through a 60" locust on line at a distance of 13.96 feet, a total distance of 17.41 feet from an unmarked point in the center of a private road designated Dave Whitaker Road, said point being at a common corner of Deed Book 533 Page 113 and Deed Book 1409 Page 284, first tract in the line of Deed Book 3062 Page 486 of the Henderson County Registry;

Thence leaving the aforementioned common line, continuing with the conservation easement area, and running generally parallel with Dave Whitaker Road (private) the following (2) courses and distances:

(1) N 30°01'02" W a distance of 239.02 feet to a 5/8" rebar set with a CE cap (CORNER 71);
(2) N 23°46'50" W a distance of 163.63 feet to a 5/8" rebar set with a CE cap (CORNER 72), said rebar being on the eastern line of a 30 foot wide right of way easement of Duke Energy Company;
Thence with the eastern line of the aforementioned 30 foot wide right of way easement, continuing generally parallel with Dave Whitaker Road (private), and continuing with the conservation easement area
N 17°43'52" W a distance of 188.75 feet to a 5/8" rebar set with a CE cap (CORNER 73);

Thence leaving the eastern line of the aforementioned 30 foot wide right of way easement, leaving the proximity of Dave Whitaker Road (private), and continuing with the conservation easement area the following (4) courses and distances:

(1) N 45°07'39" E, recrossing Seniard Creek, a distance of 53.31 feet to a 5/8" rebar set with a CE cap (CORNER 74);
(2) S 78°08'37" E a distance of 21.95 feet to a 5/8" rebar set with a CE cap (CORNER 75);
(3) S 21°26'24" E a distance of 333.75 feet to a 5/8" rebar set with a CE cap (CORNER 76);
(4) S 32°59'31" E a distance of 253.80 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area A containing a total of 1.07 Acres, being the same more or less.

Conservation Easement Area B: ***0.40 Acre***
Being on a portion of land recorded in Deed Book 533 Page 113 of the Henderson County Register of Deeds and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 14), said rebar being located N 32°20'33" E a distance of 444.67 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence with the conservation easement area the following (2) courses and distances:

(1) N 23°19'50" E a distance of 41.97 feet to a 5/8" rebar set with a CE cap (CORNER 15);
(2) N 05°57'41" W a distance of 207.19 feet to a 5/8" rebar set with a CE cap (CORNER 16) in a common line of Deed Book 533 Page 113 and Deed Book 3130 Page 529 as shown on Plat Book 2018 Slide 11229 of the Henderson County Registry;

Thence with the aforementioned common line and continuing with the conservation easement area S 58°12'04" E a distance of 60.63 feet to an unmarked point in the center of Sitton Creek at a common corner of Deed Book 533 Page 113 and Deed Book 1616 Page 332 as shown on Plat Book 2015 Slide 9706 and Plat Book 2018 Page 11303 of the Henderson County Registry, said point being located N 58°12'04" W a distance of 50.00 feet from an existing 1" iron pipe with a Kee cap in said common line;

Thence leaving the aforementioned common line and with a common line of Deed Book 533 Page 133 and Deed Book 1616 Page 332 of the Henderson County Registry, down and with the center of Sitton Creek, and continuing with the conservation easement area, the following (11) courses and distances:

(1) S 17°17'40" E a distance of 20.26 feet to an unmarked point;
(2) S 00°18'52" W a distance of 16.78 feet to an unmarked point;
(3) S 12°29'38" E a distance of 37.66 feet to an unmarked point;
(4) S 08°35'45" E a distance of 20.04 feet to an unmarked point;
(5) S 28°23'57" E a distance of 16.41 feet to an unmarked point;
(6) S 49°12'21" E a distance of 14.48 feet to an unmarked point;
(7) S 30°43'54" E a distance of 25.37 feet to an unmarked point;
(8) S 44°35'40" E a distance of 31.46 feet to an unmarked point;
(9) S 17°38'59" E a distance of 31.22 feet to an unmarked point;
(10) S 06°00'56" W a distance of 12.68 feet to an unmarked point;
(11) S 38°15'27" W a distance of 26.02 feet to an unmarked point;

Thence leaving the aforementioned common line, leaving the center of Sitton Creek and continuing with the conservation easement area the following (2) courses and distances:

(1) N 84°17'30" W a distance of 20.00 feet to a 5/8" rebar set with a CE cap;
(2) N 84°17'30" W a distance of 90.09 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area B containing a total of 0.40 Acre, being the same more or less.

Conservation Easement Area C: ***0.31 Acre***
Being on a portion of land recorded in Deed Book 533 Page 113 of the Henderson County Register of Deeds and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 12) in a common line of Deed Book 533 Page 113 and Deed Book 1409 Page 284, first tract of the Henderson County Registry, said rebar being located N 38°49'42" E a distance of 260.53 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet, said CORNER 1 being also located S 59°51'46" E a distance of 171.82 feet from an existing 1/2" Iron Pipe (disturbed), said iron pipe being at the terminus of the fifth call of Deed Book 533 Page 113;

Thence leaving the aforementioned common line and with the conservation easement area the following (2) courses and distances:

(1) N 23°20'33" E a distance of 156.64 feet to a 5/8" rebar set with a CE cap (CORNER 13);

(2) S 84°17'30" E a distance of 70.37 feet to an unmarked point in the center of Sitton Creek and in a common line of Deed Book 533 Page 113 and Deed Book 1616 Page: 332;

Thence with the aforementioned common line, down and with the center of Sitton Creek, and continuing with the conservation easement area the following (6) courses and distances:

(1) S 33°54'00" W a distance of 14.00 feet to an unmarked point;
(2) S 02°38'56" W a distance of 39.61 feet to an unmarked point;
(3) S 24°14'39" W a distance of 44.12 feet to an unmarked point;
(4) S 13°01'04" W a distance of 51.61 feet to an unmarked point;
(5) S 23°32'08" W a distance of 21.23 feet to an unmarked point;
(6) S 40°34'06" W a distance of 21.59 feet to an unmarked point;

Thence leaving the aforementioned common line, leaving the center of Sitton Creek and continuing with the conservation easement area N 59°51'46" W, passing through an 18" holly at a distance of 9.65 feet, a total distance of 81.15 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area C containing a total of 0.31 Acre, being the same more or less.

Conservation Easement Area D: ***0.29 Acre***
Being on a portion of land recorded in Deed Book 1409 Page 284, first tract, being Tract 2 of Plat Book 2009 Slide 7886 of the Henderson County Register of Deeds, and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 12) in a common line of Deed Book 1409 Page 284, first tract and Deed Book 533 Page 113, said rebar being located N 38°49'42" E a distance of 260.53 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet, said CORNER 1 being also located S 59°51'46" E a distance of 171.82 feet from an existing 1/2" Iron Pipe (disturbed), said iron pipe being at the terminus of the fifth call of Deed Book 533 Page 113 of the Henderson County Registry;

Thence with the aforementioned common line and with the conservation easement area S 59°51'46" E, passing through an 18" holly on line at a distance of 71.50 feet, a total distance of 81.15 feet to an unmarked point in the center of Sitton Creek at a common corner of Deed Book 1409 Page 284, first tract and Deed Book 533 Page 113 in the line of Deed Book 1616 Page 332 of the Henderson County Registry;

Thence leaving the aforementioned common line, with a common line of Deed Book 1409 Page 284, first tract and Deed Book 1616 Page 332 of the Henderson County Registry, down and with the center of Sitton Creek, and continuing with the conservation easement area the following (3) courses and distances:

(1) S 40°34'06" W a distance of 13.66 feet to an unmarked point;
(2) S 30°29'20" W a distance of 19.08 feet to an unmarked point;

(3) S 00°30'17" W a distance of 37.66 feet to an unmarked point, said point being in the northwestern line of a 30 foot wide right of way easement of Duke Energy Company;

Thence leaving the aforementioned common line, with the northwestern line of the aforementioned 30 foot wide right of way easement, and continuing with the conservation easement area the following (2) courses and distances:

(1) S 53°24'57" W a distance of 49.87 feet to a 5/8" rebar set with a CE cap;
(2) S 53°24'57" W a distance of 127.29 feet to a 5/8" rebar set with a CE cap (CORNER 11) at the intersection of the northwestern line of the aforementioned 30 foot wide right of way easement with the eastern line of a second 30 foot wide right of way easement of Duke Energy Company;

Thence leaving the aforementioned right of way easement lines and continuing with the conservation easement area N 23°20'33" E a distance of 229.60 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area D containing a total of 0.29 Acre, being the same more or less.

<u>**Conservation Easement Area E:**</u> <u>***0.26 Acre***</u>
Being on a portion of land recorded in Deed Book 1409 Page 284, first tract, being Tract 2 of Plat Book 2009 Slide 7886 of the Henderson County Register of Deeds, and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 10) at the intersection of the southeastern line of a 30 foot wide right of way easement with the eastern line of a second 30 foot wide right of way easement, both of Duke Energy Company, said rebar being located S 63°42'59" E a distance of 89.26 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence with the southeastern line of the first aforementioned 30 foot wide right of way easement and with the conservation easement area the following (2) courses and distances:

(1) N 53°24'57" E a distance of 111.78 feet to a 5/8" rebar set with a CE cap;
(2) N 53°24'57" E a distance of 50.39 feet to an unmarked point (CORNER 39) in the center of Sitton Creek, said point being in a common line of Deed Book 1409 Page 284, first tract and Deed Book 3095 Page 120 as shown on Plat Book 2017 Slide 10610 of the Henderson County Registry;

Thence leaving the southeastern line of the aforementioned 30 foot wide right of way easement, with the aforementioned common line, down and with Sitton Creek, and continuing with the conservation easement area the following (6) courses and distances:

(1) S 04°43'44" W a distance of 39.95 feet to an unmarked point (CORNER 40);
(2) S 26°55'07" W a distance of 43.98 feet to an unmarked point (CORNER 41);

(3) S 22°29'28" W a distance of 43.47 feet to an unmarked point (CORNER 42);
(4) S 26°04'31" W a distance of 41.26 feet to an unmarked point (CORNER 43);
(5) S 05°04'47" W a distance of 41.45 feet to an unmarked point (CORNER 44);
(6) S 47°12'42" W a distance of 24.74 feet to an unmarked point (CORNER 45) in the eastern line of a 30 foot wide right of way easement of Duke Energy Company;

Thence leaving the aforementioned common line, with the eastern line of the aforementioned 30 foot wide right of way easement and continuing with the conservation easement the following (2) courses and distances:

(1) N 23°11'32" W a distance of 50.00 feet to a 5/8" rebar set with a CE cap;
(2) N 23°11'32" W a distance of 78.04 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area E containing a total of 0.26 Acre, being the same more or less.

Conservation Easement Area F: ***1.87 Acre***
Being on a portion of land recorded in Deed Book 1409 Page 284, first tract, being Tract 2 of Plat Book 2009 Slide 7886 of the Henderson County Register of Deeds, and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 7) in the southeastern line of a 30 foot wide right of way easement of Duke Energy Company, said rebar being located S 27°32'14" W a distance of 177.94 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence leaving the southeastern line of the aforementioned 30 foot wide right of way easement and with the conservation easement area the following (2) courses and distances:

(1) S 24°20'36" E, crossing Seniard Creek, a distance of 124.00 feet to a 5/8" rebar set with a CE cap (CORNER 8);
(2) N 22°03'57" E, recrossing Seniard Creek, a distance of 229.86 feet to a 5/8" rebar set with a CE cap (CORNER 9), said rebar being at the intersection of the southeastern line of the aforementioned 30 foot wide right of way easement with the western line of a second 30 foot wide right of way easement of Duke Energy Company;

Thence leaving the southeastern line of the first aforementioned 30 foot wide right of way easement, with the western line of the second aforementioned 30 foot wide right of way easement, and continuing with the conservation easement area the following (2) courses and distances:
(1) S 23°11'32" E a distance of 108.81 feet to a 5/8" rebar set with a CE cap;
(2) S 23°11'32" E a distance of 50.00 feet to an unmarked point (CORNER 46) in the center of Sitton Creek, said point being in a common line of Deed Book 1409 Page 284, first tract and Deed Book 3095 Page 120 of the Henderson County Registry;

Thence leaving the western line of the aforementioned 30 foot wide right of way easement, with the common line of Deed Book 1409 Page 284, first tract and Deed Book 3095 Page 120 of the Henderson County Registry, down and with the center of Sitton Creek and continuing with the conservation easement area the following (7) courses and distances:

(1) S 19°30'40" W a distance of 32.43 feet to an unmarked point (CORNER 47);
(2) S 37°59'29" W a distance of 23.96 feet to an unmarked point (CORNER 48);
(3) S 19°26'04" W a distance of 55.87 feet to an unmarked point (CORNER 49);
(4) S 09°37'01" E a distance of 21.88 feet to an unmarked point (CORNER 50);
(5) S 13°58'08" W a distance of 45.00 feet to an unmarked point (CORNER 51), said point being at the centerline intersection of Sitton Creek and Seniard Creek;
(6) S 11°14'02" E a distance of 30.59 feet to an unmarked point (CORNER 52);
(7) S 02°31'45" W a distance of 30.12 feet to an unmarked point (CORNER 53) under a wooden footbridge, said point being a common corner of Deed Book 3095 Page 120, Deed Book 1616 Page 326 as shown on Plat Book 2015 Slide 9706, and Deed Book 1409 Page 284, second tract, in a common line with Deed Book 1409 Page 284, first tract of the Henderson County Registry;

Thence leaving the aforementioned common line, with the common line of Deed Book 1409 Page 284, first tract and Deed Book 1409 Page 284, second tract of the Henderson County Registry, down and with the center of Sitton Creek, and continuing with the conservation easement area the following (8) courses and distances:

(1) S 68°22'07" W a distance of 51.85 feet to an unmarked point;
(2) S 51°23'40" W a distance of 46.51 feet to an unmarked point;
(3) S 41°48'47" W a distance of 73.41 feet to an unmarked point;
(4) S 57°28'29" W a distance of 28.18 feet to an unmarked point;
(5) S 31°41'47" W a distance of 16.19 feet to an unmarked point (CORNER 57);
(6) S 54°17'10" W a distance of 32.22 feet to an unmarked point (CORNER 58);
(7) S 66°54'37" W a distance of 91.31 feet to an unmarked point;
(8) S 38°16'42" W a distance of 15.47 feet to an unmarked point, said point being at the westernmost corner of Deed Book 1409 Page 284, second tract and the northernmost corner of Deed Book 1653 Page 173 as shown on Plat Book 2016 Page 10070 and Plat Book 2009 Page 7886, in a common line with Deed Book 1409 Page 284, first tract, of the Henderson County Registry;

Thence leaving the aforementioned common line, leaving the center of Sitton Creek, and continuing with the conservation easement area the following (5) courses and distances:

(1) N 39°37'47" W a distance of 16.65 feet to a 5/8" rebar set with a CE cap (CORNER 60);
(2) N 39°37'47" W a distance of 27.95 feet to a 5/8" rebar set with a CE cap (CORNER 61);
(3) N 41°10'34" E a distance of 171.61 feet to a 5/8" rebar set with a CE cap (CORNER 62);
(4) N 01°04'33" W a distance of 194.13 feet to a 5/8" rebar set with a CE cap (CORNER 63);
(5) N 29°07'22" W a distance of 62.70 feet to a 5/8" rebar set with a CE cap (CORNER 64) in the southeastern line of the first aforementioned 30 foot right of way easement;

Thence with the southeastern line of the aforementioned 30 foot right of way easement and continuing with the conservation easement area N 53°57'16" E a distance of 101.23 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area F containing a total of 1.87 Acres, being the same more or less.

<u>Conservation Easement Area G:</u> *1.74 Acres*
Being on a portion of land recorded in Deed Book 1409 Page 284, first tract, being Tract 2 of Plat Book 2009 Slide 7886 of the Henderson County Register of Deeds, and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 1) in a common line of Deed Book 1409 Page 284, first tract and Deed Book 533 Page 113, said rebar being located N 52°25'47" W a distance of 645.47 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet, said CORNER 1 being also located S 58°55'32" W a distance of 370.66 feet from an existing 1/2" Iron Pipe (disturbed), said iron pipe being at the northernmost corner of Deed Book 1409 Page 284, first tract and the terminus of the sixth call of Deed Book 533 Page 113 of the Henderson County Registry;

Thence leaving the aforementioned common line and with the conservation easement area the following (5) courses and distances:

(1) S 32°59'31" E a distance of 38.54 feet to a 5/8" rebar set with a CE cap (CORNER 2);
(2) S 62°04'10" E a distance of 152.73 feet to a 5/8" rebar set with a CE cap (CORNER 3);
(3) S 19°07'32" E a distance of 176.87 feet to a 5/8" rebar set with a CE cap (CORNER 4);
(4) S 47°28'54" E a distance of 123.36 feet to a 5/8" rebar set with a CE cap (CORNER 5);
(5) S 35°49'53" E a distance of 202.56 feet to a 5/8" rebar set with a CE cap (CORNER 6), said rebar being in the northwestern line of a 30 foot wide right of way easement of Duke Energy Company;

Thence with the northwestern line of the aforementioned 30 foot wide right of way easement, crossing Seniard Creek, and continuing with the conservation easement area, S 53°57'16" W a distance of 112.05 feet to a 5/8" rebar set with a CE cap (CORNER 65);

Thence leaving the northwestern line of the aforementioned 30 foot wide right of way easement and continuing with the conservation easement area the following (5) courses and distances:

(1) N 29°06'23" W a distance of 148.44 feet to a 5/8" rebar set with a CE cap (CORNER 66);
(2) N 51°33'36" W a distance of 133.61 feet to a 5/8" rebar set with a CE cap (CORNER 67);
(3) N 24°29'56" W a distance of 161.10 feet to a 5/8" rebar set with a CE cap (CORNER 68);
(4) N 73°39'18" W a distance of 77.89 feet to a 5/8" rebar set with a CE cap (CORNER 69) east of Dave Whitaker Road (private);
(5) N 30°01'02" W, generally parallel with Dave Whitaker Road (private) a distance of 181.53 feet to a 5/8" rebar set with a CE cap (CORNER 70) in the common line of Deed Book 1409 Page 284, first tract and Deed Book 533 Page 113, said rebar being located N

58°55'32" E, passing through a 60" locust on line at a distance of 13.96 feet, a total distance of 17.41 feet from an unmarked point in the center of Dave Whitaker Road (private), said point being at a common corner of Deed Book 1409 Page 284, first tract and Deed Book 533 Page 113 in the line of Deed Book 3062 Page 486 of the Henderson County Registry;

Thence with the common line of Deed Book 1409 Page 284, first tract and Deed Book 533 Page 113 of the Henderson County Registry, recrossing Seniard Creek, and continuing with the conservation easement area, N 58°55'32" E a distance of 89.22 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area G containing a total of 1.74 Acres, being the same more or less.

Conservation Easement Area H: ***0.08 Acre***
Being on a portion of land recorded in Deed Book 1409 Page 284, second tract, being Tract 4 of Plat Book 2009 Slide 7886 of the Henderson County Register of Deeds, and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 54) in a common line of Deed Book 1409 Page 284, second tract and Deed Book 1616 Page 326 of the Henderson County Registry, said rebar being located S 08°52'03" E a distance of 463.23 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence leaving the aforementioned common line and with the conservation easement area the following (3) courses and distances:

(1) S 65°10'35" W a distance of 27.87 feet to a 5/8" rebar set with a CE cap (CORNER 55);
(2) S 59°23'39" W a distance of 81.12 feet to a 5/8" rebar set with a CE cap (CORNER 56);
(3) S 53°39'24" W a distance of 88.19 feet to an unmarked point in the center of Sitton Creek, said point being in a common line of Deed Book 1409 Page 284, second tract and Deed Book 1409 Page 284, first tract;

Thence with the aforementioned common line, up and with the center of Sitton Creek, and continuing with the conservation easement area the following (5) courses and distances:

(1) N 31°41'47" E a distance of 16.19 feet to an unmarked point;
(2) N 57°28'29" E a distance of 28.18 feet to an unmarked point;
(3) N 41°48'47" E a distance of 73.41 feet to an unmarked point;
(4) N 51°23'40" E a distance of 46.51 feet to an unmarked point;
(8) N 68°22'07" E a distance of 51.85 feet to an unmarked point (CORNER 53) under a wooden footbridge, said point being a common corner of Deed Book 1409 Page 284, second tract, Deed Book 3095 Page 120, and Deed Book 1616 Page 332, in a common line with Deed Book 1409 Page 284, first tract of the Henderson County Registry;

Thence leaving the aforementioned common line, with a common line of Deed Book 1409 Page 284, second tract and Deed Book 1616 Page 332, and continuing with the conservation easement area
S 00°53'08" E a distance of 26.51 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area H containing a total of 0.08 Acre, being the same more or less.

<u>**Conservation Easement Area I:**</u> ***0.02 Acre***
Being on a portion of land recorded in Deed Book 1409 Page 284, second tract, being Tract 4 of Plat Book 2009 Slide 7886 of the Henderson County Register of Deeds, and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 59), said rebar being located S 15°17'11" W a distance of 638.44 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence with the conservation easement area S 73°16'52" W a distance of 48.21 feet to an unmarked point in the center of Sitton Creek, said point being at the westernmost corner of Deed Book 1409 Page 284, second tract and the northernmost corner of Deed Book 1653 Page 173 in a common line with Deed Book 1409 Page 284, first tract of the Henderson County Registry;

Thence with a common line of Deed Book 1409 Page 284, second tract and Deed Book 1409 Page 284, first tract, up and with the center of Sitton Creek, and continuing with the conservation easement area the following (2) courses and distances:

(1) N 38°16'42" E a distance of 15.47 feet to an unmarked point;
(2) N 66°54'37" E a distance of 91.31 feet to an unmarked point (CORNER 58);

Thence leaving the aforementioned common line, leaving the center of Sitton Creek and continuing with the conservation easement area S 54°17'10" W a distance of 58.38 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area I containing a total of 0.02 Acre, being the same more or less.

<u>Conservation Easement Area J:</u> ***2.34 Acres***
Being on a portion of land recorded in Deed Book 1409 Page 284, second tract, being Tract 4 of Plat Book 2009 Slide 7886 of the Henderson County Register of Deeds, and being more particularly described as follows:
BEGINNING AT A 5/8" REBAR SET WITH A CE CAP (CORNER 97), said rebar being located S 14°14'43" E a distance of 665.63 feet from Control Point #1, a 5/8" rebar with a Control Point cap set in concrete having North Carolina State Plane Coordinates (2011) of Northing: 624013.80 feet and Easting: 919388.14 feet;

Thence with the conservation easement area the following (15) courses and distances:

(1) N 60°15'53" E, crossing a small stream, a distance of 51.84 feet to an existing 1/2" iron pipe (CORNER 83), said iron pipe being at a common corner of Deed Book 1409 Page 284, second tract and Deed Book 1616 Page 326;
(2) N 60°15'53" E a distance of 15.73 feet to a 5/8" rebar set with a CE cap (CORNER 84) located southwest of a gravel road;
(3) S 29°31'31" E a distance of 164.20 feet to a 5/8" rebar set with a CE cap (CORNER 85), said rebar being located in said gravel road;
(4) S 38°25'41" E a distance of 113.01 feet to a 5/8" rebar set with a CE cap (CORNER 86), said rebar being located south of said gravel road;
(5) S 60°06'09" E a distance of 157.82 feet to a 5/8" rebar set with a CE cap (CORNER 87);
(6) S 50°24'23" E a distance of 92.57 feet to a 5/8" rebar set with a CE cap (CORNER 88);
(7) S 08°30'25" E a distance of 265.56 feet to a 5/8" rebar set with a CE cap (CORNER 89);
(8) S 56°26'03" E a distance of 85.19 feet to a 5/8" rebar set with a CE cap (CORNER 90);
(9) S 10°44'02" E a distance of 45.49 feet to a 5/8" rebar set with a CE cap (CORNER 91);
(10) S 39°50'47" W, crossing a small stream, a distance of 43.34 feet to a 5/8" rebar set with a CE cap (CORNER 92);
(11) N 83°15'37" W a distance of 66.55 feet to a 5/8" rebar set with a CE cap (CORNER 93);
(12) N 42°07'02" W a distance of 150.42 feet to a 5/8" rebar set with a CE cap (CORNER 94);
(13) N 27°36'35" W a distance of 371.06 feet to a 5/8" rebar set with a CE cap (CORNER 95);
(14) N 42°30'00" W a distance of 150.19 feet to a 5/8" rebar set with a CE cap (CORNER 96);
(15) N 22°38'37" W a distance of 178.07 feet to the TRUE POINT OF BEGINNING;

Being all of that area of land in Conservation Easement Area J containing a total of 2.34 Acres, being the same more or less.

BOOK 3241 PAGE 157 (2)

889805

This document presented and filed:
08/28/2018 12:17:10 PM

WLK

WILLIAM LEE KING, Henderson COUNTY, NC

Prepared by and after recording mail to: EW Solutions, 37 Haywood St., Suite 100, Asheville, NC 28801

NORTH CAROLINA
HENDERSON COUNTY

BOUNDARY LINE AGREEMENT

This Boundary Line Agreement is made as of the 22 day of August, 2018, by and between Benjamin Lee Whitaker and Malinda Whitaker, husband and wife, (hereinafter the "Whitakers"), with a primary address of 30 Deer Acres Drive, Horse Shoe, NC 28742, and Dorothy Whitaker Redmond, unmarried (hereinafter "Mrs. Redmond"), with a primary address of 1097 Dave Whitaker Road, Horse Shoe, NC 28759, (collectively, "the Parties").

Whereas, the Whitakers are the owners of a certain tract of land adjacent to lands held by Mrs. Redmond located in Henderson County, North Carolina and described in the Henderson County Registry by deeds recorded in Book 1616 at page 332 (the "Whitaker tracts"); and

Whereas, Mrs. Redmond is the owner of certain tracts of land described in deeds recorded in Deed Book 1409, Page 284 and Deed Book 533, Page 113, Henderson County Registry (the "Redmond tracts"); and

Whereas, the parties hereto wish to clarify the boundary line of their properties in accordance with a survey by Kee Mapping and Surveying dated 5/21/18, 2018, recorded in Book 2018 at Plat Slide 11381, Henderson County Registry (the "Survey") as set forth below.

Now, therefore, in consideration of the foregoing and for other good and valuable consideration, the parties hereto agree as follows:

The Whitakers and Mrs. Redmond do hereby consent and agree that the boundary line between those portions of the Whitaker tract and the Redmond tract currently lying between line calls L48 through L73 as indicated on the Survey shall continue to run with the lines L48 through L73, as set forth in the Survey, regardless of the future flow, location, and position of Sitton Creek.

The Parties hereto agree, to the fullest extent permitted by law, to defend, protect, indemnify and hold harmless the State of North Carolina from and against all claims, actions, liabilities damages, fines, penalties, costs and expenses incurred as a direct or indirect result of the relocation, redirection, or removal of the existing stream channel from its current location.

This Boundary Line Agreement inures to the benefit of and binds the parties hereto and their respective heirs, successors, agents and assigns. The rights and the burdens established herein, except as limited hereafter, are intended to be granted in perpetuity to run with the land. This document shall be considered to have been prepared equally on behalf of the parties hereto and shall not be construed more strictly against either of them.

Benj Lee Whitaker
Benjamin Lee Whitaker

Malinda Whitaker
Malinda Whitaker

Dorothy Whitaker Redmond
Dorothy Whitaker Redmond

NORTH CAROLINA
HENDERSON COUNTY

I, a notary public for Buncombe County, North Carolina, hereby certify that Benjamin Lee Whitaker and Malinda Whitaker, husband and wife, both of whom are known personally to me, appeared before me this day, and each being duly sworn, executed the foregoing instrument for the purposes set forth therein.

Joyce Keathley Brown, Notary Public
Printed Name of Notary: Joyce Keathley Brown

My commission expires: March 26, 2023

Stamp/Seal JOYCE KEATHLEY BROWN NOTARY PUBLIC BUNCOMBE COUNTY, NC

NORTH CAROLINA
HENDERSON COUNTY

I, a notary public for Buncombe County, North Carolina, hereby certify that Dorothy Whitaker Redmond, who is known personally to me, appeared before me this day, and being duly sworn, executed the foregoing instrument for the purposes set forth therein.

Joyce Keathley Brown, Notary Public
Printed Name of Notary: Joyce Keathley Brown

My commission expires: March 26, 2023

Stamp/Seal JOYCE KEATHLEY BROWN NOTARY PUBLIC BUNCOMBE COUNTY, NC

BOOK 3241 PAGE 159 (2)
889806

This document presented and filed:
08/28/2018 12:17:11 PM
WLK
WILLIAM LEE KING, Henderson COUNTY, NC

Prepared by and after recording mail to: EW Solutions, 37 Haywood St., Suite 100, Asheville, NC 28801

NORTH CAROLINA
HENDERSON COUNTY

BOUNDARY LINE AGREEMENT

This Boundary Line Agreement is made as of the 22 day of August, 2018, by and between Carissa Whitaker Roush and Trenton Andrew Roush, wife and husband, (hereinafter the "Roushes"), with a primary address of 608 Dave Whitaker Road, Horse Shoe, NC 28742, and Dorothy Whitaker Redmond, unmarried (hereinafter "Mrs. Redmond"), with a primary address of 1097 Dave Whitaker Road, Horse Shoe, NC 28759, (collectively, "the Parties").

Whereas, the Roushes are the owners of a certain tract of land adjacent to lands held by Mrs. Redmond located in Henderson County, North Carolina and described in the Henderson County Registry by deed recorded in Book 3095 at page 120 (the "Roush tract"); and

Whereas, Mrs. Redmond is the owner of a tract of land described in a deed recorded in Deed Book 1409, Page 284, Henderson County Registry (the "Redmond Tract"); and

Whereas, the parties hereto wish to clarify the boundary line of their properties in accordance with a survey by Kee Mapping and Surveying dated 8/21/18, 2018, recorded in Book 2018 at Plat Slide 1138, Henderson County Registry (the "Survey") as set forth below.

Now, therefore, in consideration of the foregoing and for other good and valuable consideration, the parties hereto agree as follows:

> The Roushes and Mrs. Redmond do hereby consent and agree that the boundary line between those portions of the Roush tract and the Redmond tract currently lying between line calls L32 through L47 as indicated on the Survey shall continue to run with the lines L32 through L47, as set forth in the Survey, regardless of the future flow, location, and position of Sitton Creek.

The Parties hereto agree, to the fullest extent permitted by law, to defend, protect, indemnify and hold harmless the State of North Carolina from and against all claims, actions, liabilities damages, fines, penalties, costs and expenses incurred as a direct or indirect result of the relocation, redirection, or removal of the existing stream channel from its current location.

This Boundary Line Agreement inures to the benefit of and binds the Parties hereto and their respective heirs, successors, agents and assigns. The rights and the burdens established herein, except as limited hereafter, are intended to be granted in perpetuity to run with the land. This document shall be considered to have been prepared equally on behalf of the parties hereto and shall not be construed more strictly against either of them.

Trenton Andrew Roush
Trenton Andrew Roush

Carissa Whitaker Roush
Carissa Whitaker Roush

Dorothy Whitaker Redmond
Dorothy Whitaker Redmond

NORTH CAROLINA
HENDERSON COUNTY

I, a notary public for Buncombe County, North Carolina, hereby certify that Trenton Andrew Roush and Carissa Whitaker Roush, husband and wife, both of whom are known personally to me, appeared before me this day, and each being duly sworn, executed the foregoing instrument for the purposes set forth therein.

Joyce Keathley Brown, Notary Public
Printed Name of Notary: Joyce Keathley Brown

My commission expires: March 26, 2023

Stamp/Seal JOYCE KEATHLEY BROWN NOTARY PUBLIC BUNCOMBE COUNTY, NC

NORTH CAROLINA
HENDERSON COUNTY

I, a notary public for Buncombe County, North Carolina, hereby certify that Dorothy Whitaker Redmond, who is known personally to me, appeared before me this day, and being duly sworn, executed the foregoing instrument for the purposes set forth therein.

Joyce Keathley Brown, Notary Public
Printed Name of Notary: Joyce Keathley Brown

My commission expires: March 26, 2023

Stamp/Seal JOYCE KEATHLEY BROWN NOTARY PUBLIC BUNCOMBE COUNTY, NC

Page left intentionally blank for printing purposes.

Appendix G CREDIT RELEASE SCHEDULE

Page left intentionally blank for printing purposes.

CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported in the approved final mitigation plan, unless there are discrepancies, whereby a mitigation plan addendum request will be submitted. Under no circumstances shall any mitigation project be debited until the necessary DA authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Stream Credits			
Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	30%	30%
1	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%
2	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%
3	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%
4*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)
5	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)
6*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)
7	Year 7 monitoring report demonstrates that channels are stable, performance standards have been met	10%	90% (100%**)

*Please note that vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

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

Initial Allocation of Released Credits

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

a. Approval of the final Mitigation Plan

b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property

c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; Per the NC DMS Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.

d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

Subsequent Credit Releases

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

Appendix H FINANCIAL ASSURANCE

Page left intentionally blank for printing purposes.

FINANCIAL ASSURANCE

Pursuant to Section IV H and Appendix III of the Division of Mitigation Service's (formally Ecosystem Enhancement Program) In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the U.S. Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

Page intentionally left blank for printing

Appendix I MAINTENANCE PLAN

Page left intentionally blank for printing purposes.

MAINTENANCE PLAN

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

Component/Feature	Maintenance through project closeout
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Wetland	Routine wetland maintenance and repair activities may include securing of loose coir matting and supplemental installations of live stakes and other target vegetation within the wetland. Areas where storm water and floodplain flows intercept the wetland may also require maintenance to prevent scour.
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. If replanting is necessary, changes to species assemblage may be required in response to factors that were not originally predicted. 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.
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 and marking will follow the RFP-contracted requirements. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.

Page intentionally left blank for printing

Appendix J DWR STREAM IDENTIFICATION FORMS

Page left intentionally blank for printing purposes.

NC DWQ Stream Identification Form Version 4.11

Date: 02-6-17	**Project/Site:** Seniard Creek	**Latitude:** 35.409612
Evaluator: DA / OC	**County:** Henderson	**Longitude:** -82.627317
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 40	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name:* Skyland / Dunsmore Mtn

A. Geomorphology (Subtotal = 19.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel *	No = 0		Yes = 3	

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

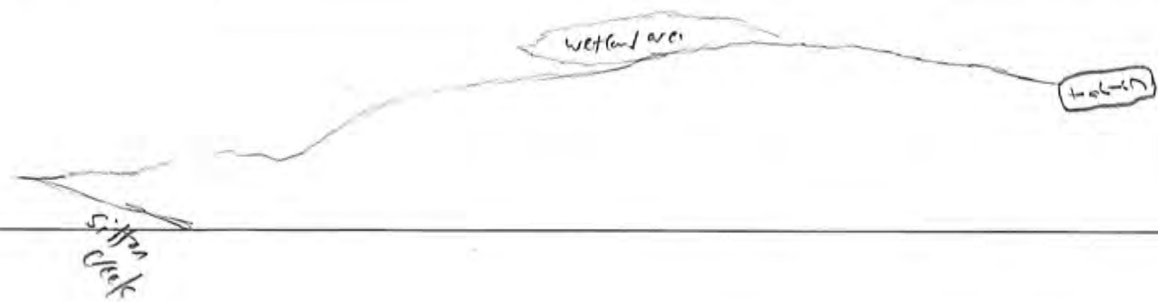
B. Hydrology (Subtotal = 9.5)	Absent	Weak	Moderate	Strong
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 11)	Absent	Weak	Moderate	Strong
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: caddisfly 3x; water penny; snail

Sketch:



NC DWQ Stream Identification Form Version 4.11

Date: 7-6-17	**Project/Site:** Sitton Creek	**Latitude:** 35.409612
Evaluator: OC/DA	**County:** Henderson	**Longitude:** -82.677317
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 43.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:* Skyland / Dunsmore Mtn

A. Geomorphology (Subtotal = 29)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

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

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

C. Biology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
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: caddisfly water penny stonefly mayfly

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 2/6/17	Project/Site: Lee Branch	Latitude: 35.40762
Evaluator: DA/OC	County: Henderso.	Longitude: -82.627317
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 28	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Skyland / Dunsmore Mtn *e.g. Quad Name:*

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
* 11. Second or greater order channel	No = 0		Yes = 3	

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

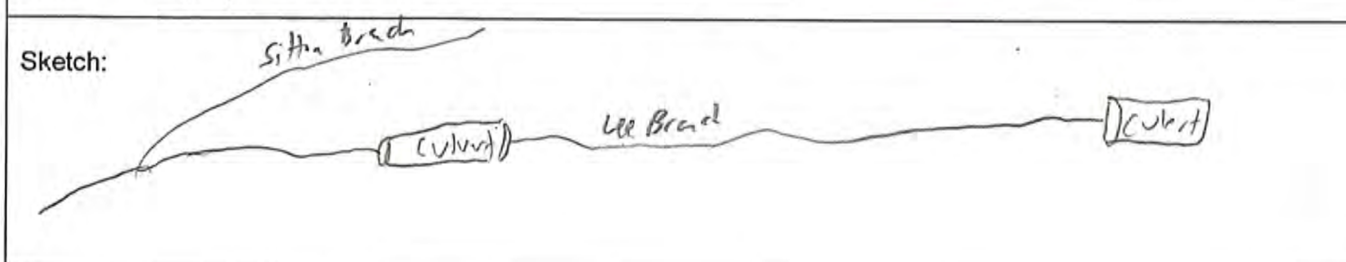
B. Hydrology (Subtotal = 8)	Absent	Weak	Moderate	Strong
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 8.5)	Absent	Weak	Moderate	Strong
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

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

Notes: mayfly

Sketch:



upstream of pond

NC DWQ Stream Identification Form Version 4.11

Date: 02/06/17	**Project/Site:** David Branch	**Latitude:** 35.409612
Evaluator: OC/PA	**County:** Henderson	**Longitude:** -82.627317
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:* Skyland/Dunsmore Mtn

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

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

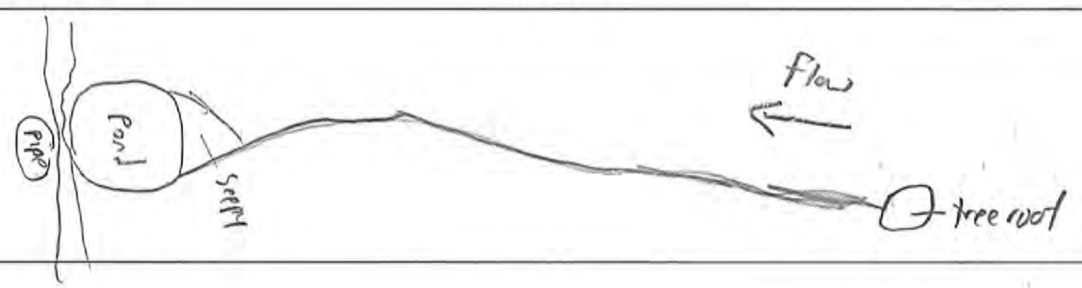
B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 8)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. 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: Dobsonfly (1) dosmog (1)

Sketch:



NC DWQ Stream Identification Form Version 4.11

Date: 2/7/17	Project/Site: Redmond Branch	Latitude: 35.409612
Evaluator: OC/DA	County: Henderson	Longitude: -82.627317
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 37.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other *e.g. Quad Name:* Skyland / Dunsmore mtn

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

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

B. Hydrology (Subtotal = 11)	Absent	Weak	Moderate	Strong
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 = 11.5)	Absent	Weak	Moderate	Strong
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: caddisflys (multiple) mayfly

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 02-6-17	Project/Site: Whitaker Branch	Latitude: 35.409612
Evaluator: EC/DA	County: Henderson	Longitude: -82.627317
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other Skyland / Dunsmore Mtn *e.g. Quad Name:*

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

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

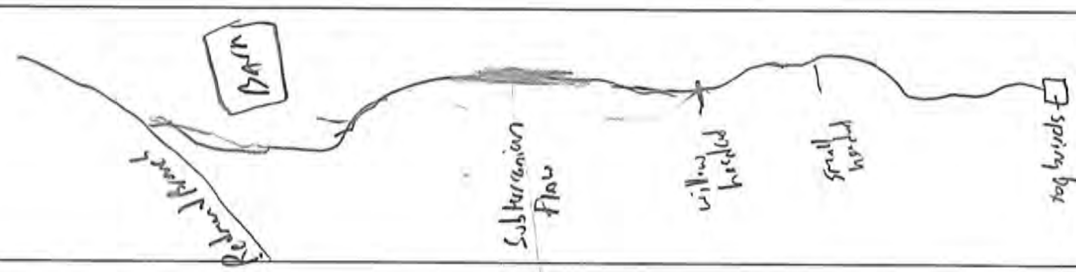
B. Hydrology (Subtotal = 8.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	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: 1 salamander

Sketch:



Appendix K WETLAND JD FORMS

Page left intentionally blank for printing purposes.

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action ID: **SAW-2017-01571** County: **Henderson** U.S.G.S. Quad: **Dunsmore Mountain and Skyland**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: **Equinox Environmental / Attn.: Owen Carson**
Address: **37 Haywood Street, Suite 100**
Asheville, NC 28801
Telephone Number: **828-253-6856**

Size (acres): **35** Nearest Town: **Horse Shoe**
Nearest Waterway: **UTs Seniard Creek, UTs Sitton Creek, Seniard Creek, and Sitton Creek** Coordinates: **35.40955 N, 82.62727 W**
River Basin/ HUC: **Upper French Broad (06010105)**

Location description: **The site is located on a tract of land (PINs 9622-04-0080, 9612-93-6806, 9612-93-8517, 9612-84-9753, 9612-94-2012, and 9622-02-4989) north of the intersection of Dave Whitaker Road and an unnamed road in Horse Shoe, Henderson County, North Carolina.**

Indicate Which of the Following Apply:

A. Preliminary Determination

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

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

B. Approved Determination

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

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

_ We recommend you have the waters of the U.S. on your property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

_ The waters of the U.S. including wetlands on your project area have been delineated and the delineation has been verified by the Corps. If you wish to have the delineation surveyed, the Corps can review and verify the survey upon completion. Once verified, this survey will provide an accurate depiction of all areas subject to CWA and/or RHA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

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

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

_ The property is located in one of the 20 Coastal Counties subject to regulation under the Coastal Area Management Act (CAMA). You should contact the Division of Coastal Management to determine their requirements.

Placement of dredged or fill material within waters of the US and/or wetlands without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). Placement of dredged or fill material, construction or placement of structures, or work within navigable waters of the United States without a Department of the Army permit may constitute a violation of Sections 9 and/or 10 of the Rivers and Harbors Act (33 USC § 401 and/or 403). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **David Brown** at **828-271-7980, ext. 4232** or **david.w.brown@usace.army.mil**.

C. Basis for Determination:

See attached preliminary jurisdictional determination form.

D. Remarks:

The potential waters of the U.S., at this site, were verified on-site by the Corps on January 4, 2018 and are as approximately depicted on the attached Seniard Creek Mitigation Site Resources Map (dated January 4, 2018) submitted by Equinox Environmental.

E. Attention USDA Program Participants

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

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

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

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

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by, N/A (Preliminary-JD).

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

Corps Regulatory Official: ______________________
David Brown

Issue Date of JD: **February 2, 2018** Expiration Date: N/A Preliminary JD

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete our Customer Satisfaction Survey, located online at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

Copy furnished: None

BLANK PAGE

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **Equinox Environmental / Attn.: Owen Carson**	File Number: **SAW-2017-01571**	Date: **February 2, 2018**

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

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the district engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT		
REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)		
ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.		
POINT OF CONTACT FOR QUESTIONS OR INFORMATION:		
If you have questions regarding this decision and/or the appeal process you may contact: **District Engineer, Wilmington Regulatory Division, Attn: David Brown 151 Patton Avenue, Room 208 Asheville, North Carolina 28801-5006 828-271-7980, ext. 4232**	If you only have questions regarding the appeal process you may also contact: Mr. Jason Steele, Administrative Appeal Review Officer CESAD-PDO U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 10M15 Atlanta, Georgia 30303-8801 Phone: (404) 562-5137	
RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.		
Signature of appellant or agent.	Date:	Telephone number:

For appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, Attn.: David Brown, 69 Darlington Avenue, Wilmington, North Carolina 28403

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

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

PRELIMINARY JURISDICTIONAL DETERMINATION (JD) FORM
U.S. Army Corps of Engineers

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JD: February 2, 2018

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:
Equinox Environmental / Attn.: Owen Carson
37 Haywood Street, Suite 100
Asheville, NC 28801

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: CESAW-RG-A, SAW-2017-01571, NCDMS ILF-Seniard Creek Mitigation Site

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
The site is located on a tract of land (PINs 9622-04-0080, 9612-93-6806, 9612-93-8517, 9612-84-9753, 9612-94-2012, and 9622-02-4989) north of the intersection of Dave Whitaker Road and an unnamed road in Horse Shoe, Henderson County, North Carolina.

State: **NC** County/parish/borough: **Henderson** City: **Horse Shoe**
Center coordinates of site (lat/long in degree decimal format): **35.40955 N, 82.62727 W**
Universal Transverse Mercator: **N/A**
Name of nearest waterbody: **UTs Seniard Creek, UTs Sitton Creek, Seniard Creek, and Sitton Creek**

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☒ Office (Desk) Determination. Date: **February 2, 2018**
☒ Field Determination. Date(s): **January 4, 2018**

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

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

Site Number	Centered Coordinates (decimal degrees) Latitude	Longitude	Estimated Amount of Aquatic Resource in Review Area (linear feet or acre)	Type of Aquatic Resources	Geographic Authority to Which Aquatic Resource "May Be" Subject
Seniard Creek	35.410376	-82.628185	2045 lf	☐ Wetland ☒ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
Sitton Creek	35.409924	-82.627037	1100 lf	☐ Wetland ☒ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
UT Sitton Creek (Lee Branch)	35.411481	-82.626086	61 lf	☐ Wetland ☒ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
UT Sitton Creek (David Branch Lower)	35.410646	-82.626044	34 lf	☐ Wetland ☒ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
UT Sitton Creek (David Branch Upper)	35.410438	-82.62491	280 lf	☐ Wetland ☒ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
UT Seniard Creek (Whitaker Branch)	35.408962	-82.626025	164 lf	☐ Wetland ☒ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
UT Seniard Creek (Redmond Branch)	35.407979	-82.626162	1137 lf	☐ Wetland ☒ Non-wetland Waters	☒ Section 404 ☐ Section 10/404

UT Seniard Creek (UT Redmond Branch)	35.407529	-82.625886	185 lf	☐ Wetland ☒ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
W01	35.407154	-82.625309	0.103 ac	☒ Wetland ☐ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
W02	35.407671	-82.625872	0.217 ac	☒ Wetland ☐ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
W03	35.408992	-82.625630	0.108 ac	☒ Wetland ☐ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
W04	35.410530	-82.624949	0.101 ac	☒ Wetland ☐ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
W05	35.410636	-82.625848	0.052 ac	☒ Wetland ☐ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
W06	35.410624	-82.626395	0.068 ac	☒ Wetland ☐ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
W07	35.410784	-82.626375	0.115 ac	☒ Wetland ☐ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
W08	35.409938	-82.627240	0.021 ac	☒ Wetland ☐ Non-wetland Waters	☒ Section 404 ☐ Section 10/404
W09	35.410932	-82.629043	0.038 ac	☒ Wetland ☐ Non-wetland Waters	☒ Section 404 ☐ Section 10/404

1. The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.

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

finds that there *"may be"* waters of the U.S. and/or that there *"may be"* navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA

Data reviewed for preliminary JD (check all that apply) - Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

☒ Maps, plans, plots or plat submitted by or on behalf of preliminary JD requester: **Equinox Environmental**
☒ Data sheets prepared/submitted by or on behalf of preliminary JD requester. **Equinox Environmental**
  ☒ Office concurs with data sheets/delineation report.
  ☐ Office does not concur with data sheets/delineation report. Rational:
☐ Data sheets prepared by the Corps:
☐ Corps navigable waters' study:
☐ U.S. Geological Survey (USGS) Hydrologic Atlas:
  ☐ USGS NHD data.
  ☐ USGS 8 and 12 digit HUC maps.
☒ USGS map(s). Cite scale & quad name: **Dunsmore Mountain and Skyland.**
☒ Natural Resources Conservation Service (NRCS) Soil Survey.
  Citation: **Henderson County, NC**
☐ National wetlands inventory (NWI) map(s). Cite name:
☐ State/Local wetland inventory map(s):
☒ Federal Emergency Management Agency (FEMA) / Flood Insurance Rate Map (FIRM) maps: **Map No. 3700961200J, Panel 9612, Effective Date Oct. 2, 2008, & Map No. 3700962200J, Panel 9622, Effective Date Oct. 2, 2008**
☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
☒ Photographs: ☒ Aerial (Name & Date): **Google Earth Pro, Oct. 2015; Nov. 2013; Oct. 2010; May 2009; Jun. 2008; Mar. 2007; Jun. 2006; Mar. 1998; Mar. 1995**
  or ☐ Other (Name & Date):
☐ Previous determination(s). File no. and date of response letter:
☐ Applicable/supporting scientific literature:
☒ Other information (please specify): **The site contains wetlands as determined by the *1987 Corps of Engineers Wetland Delineation Manual* and the *Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Eastern Mountain and Piedmont Region, Version 2.0.* These wetlands are contiguous and flow directly into associated streams which flow indirectly into TNWs. Wetland hydrology is enhanced with an abutting stream via normal down gradient flows and periods of high water. The wetlands abut to stream channels, Seniard Creek, UTs Seniard Creek, Sitton Creek, and UTs Sitton Creek, located on the site that exhibit indicators of ordinary high water marks (OWHM).**

The streams on the site are Seniard Creek, UTs Seniard Creek, Sitton Creek, and UTs Sitton Creek, all exhibit indicators OHWM including developed bed and bank, scour, presence of litter and debris, destruction of terrestrial vegetation, sediment sorting and deposition, and leaf litter washed away. Seniard Creek, Sitton Creek, and some of the UTs Sitton Creek are depicted as solid blue lines on the USGS 7.5 minute quadrangle maps Dunsmore Mountain and Skyland and the most current Natural Resource Conservation Service Soil Survey for Henderson County. Solid blue line features on these mapping conventions typically represent perennial streams.

The UTs Sitton Creek flow into Sitton Creek, which flows into Seniard Creek. UTs Seniard Creek flow into Seniard Creek, which flows into the North Fork Mills River, then into the Mills River. The Mills River flows into the French Broad River, a traditional navigable river, which merges with the Holston River to form the Tennessee River. The Tennessee River flows into the Ohio River then to the Mississippi River before entering the Gulf of Mexico.

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.

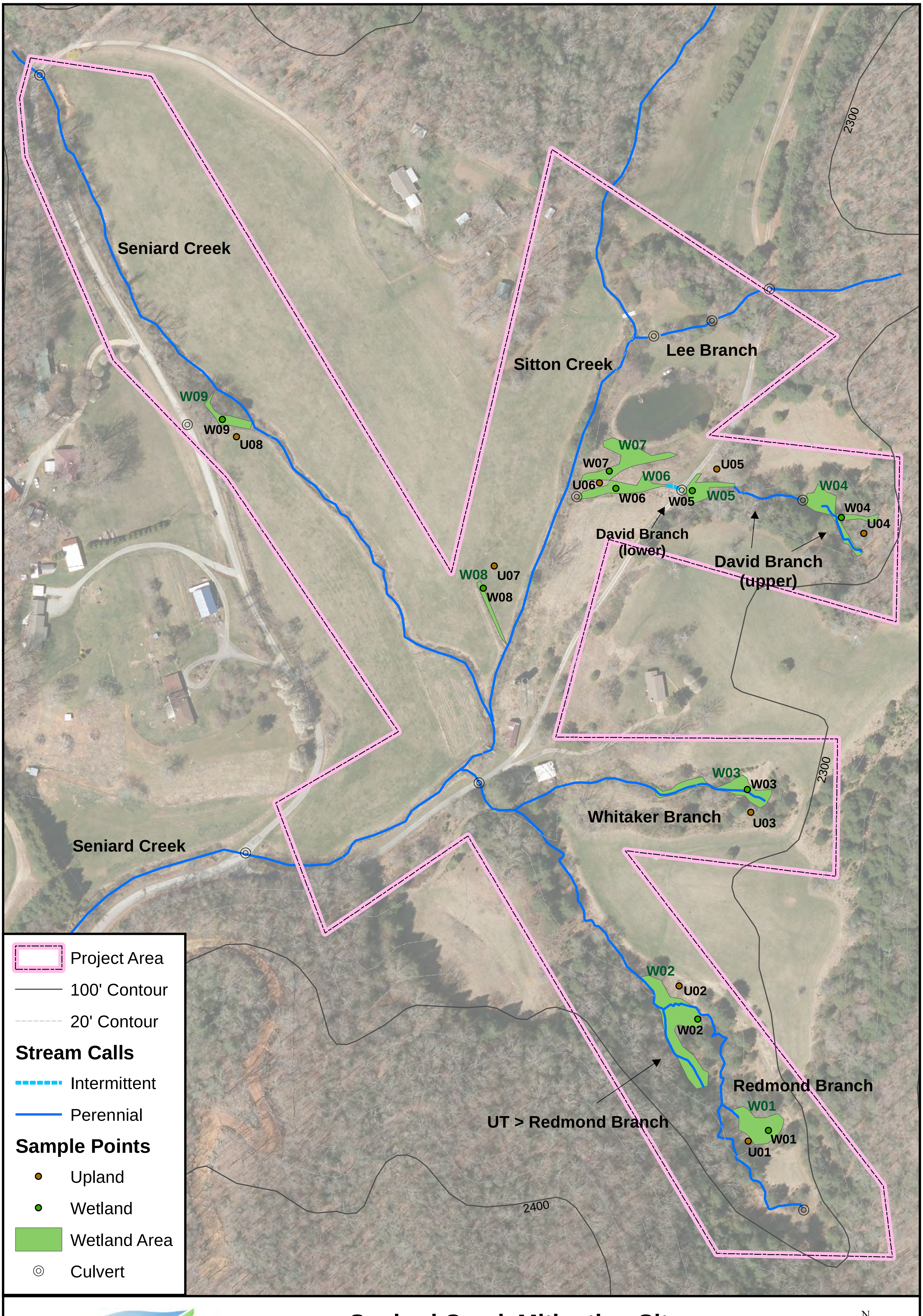
David Brown, February 2, 2018
Signature and date of Regulatory staff member completing preliminary JD

Equinox Environmental / Attn.: Owen Carson (per Agent Authorization)
Signature and date of person requesting preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

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

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

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



EQUINOX

Seniard Creek Mitigation Site Resources Map 1-04-2018

0 250 500 Feet

N W E S

Page left intentionally blank for printing purposes.

Appendix L INVASIVE SPECIES

Page left intentionally blank for printing purposes.

INVASIVE SPECIES

Invasive species within the riparian buffers and conservation easement will be treated as necessary at the time of construction. The extent of invasive species coverage will be monitored on a semi-annual basis, mapped and controlled as necessary throughout the required monitoring period. 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.

Page intentionally left blank for printing

Appendix M CATEGORICAL EXCLUSION

Page left intentionally blank for printing purposes.

Categorical Exclusion Form for Division of Mitigation Services

Part 1: General Project Information	
Project Name:	Seniard Creek
County Name:	Henderson
EEP Number:	100017
Project Sponsor:	EW Solutions, LLC
Project Contact Name:	Steve Melton
Project Contact Address:	37 Haywood Stree, Suite 100, Asheville, NC 28801
Project Contact E-mail:	Steve@equinoxenvironmental.com
EEP Project Manager:	Harry Tsomides

Project Description

A stream and wetland restoration site in the Mills River watershed whose objectives are to restore 5,221 linear feet of existing tributaries (for this project known as Seniard Creek, Sitton Creek, Redmond Branch, Whitaker Branch, David Branch, and Lee Branch). All stream reaches have been previously relocated or ditched resulting in degraded channels; riparian areas have been cleared and regraded resulting in loss the riparian buffer. Approximately 9 acres of riparian buffer will be revegetated and placed in a permanent conservation easement to protect the restored stream channels and riparian wetlands.

For Official Use Only

Reviewed By:

2/20/2018 — Harry Tsomides

Date — **EEP Project Manager**

Conditional Approved By:

Date — **For Division Administrator FHWA**

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

Final Approval By:

2-20-18

Date — **For Division Administrator FHWA**

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

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

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

Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☒ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☒ N/A

Page left intentionally blank for printing purposes.

Appendix N FLOODPLAIN CHECKLIST

Page left intentionally blank for printing purposes.

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:	Seniard Mitigation Site
Name of stream or feature:	Seniard Creek and Sitton Creek
County:	Henderson County
Name of river basin:	French Broad
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Henderson County
DFIRM panel number for entire site:	9612
Consultant name:	Stantec Consulting Services Inc.
Phone number:	(828) 229-8446
Address:	56 College Street, Suite 201 Asheville, NC 28801

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 plans for project limits.

The Seniard Mitigation Site is located approximately 5.5 miles northwest of Mills River, NC. The Site encompasses approximately 13 acres of agricultural land and consists of six unstable streams (Seniard Creek, Sitton Creek, Lee Branch, David Branch, Whitaker Branch, and Redmond Branch). The goal of the project is to restore ecological function to the existing streams, wetlands, and riparian corridor by returning the streams to a proper relationship with the floodplain, eliminating drainage ditches and spoil piles, removing invasive species, and re-vegetating the riparian area with native plant species appropriate for the valley and watershed conditions.

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

Reach	Length	Priority
Seniard Creek 1A	396	*One and Two (Rest and Enh)*
Seniard Creek 1B	1274	*One (Restoration)*
Seniard Creek 2	176	*One (Restoration)*
Sitton Creek 1	1236	*One (Restoration)*
Lee Branch	226	*One (Restoration)*
David Branch 1A	132	*Preservation*
David Branch 1B	335	*One and Two (Rest and Enh)*
David Branch 1C	273	*One (Restoration)*
Whitaker Branch	426	*Two (Enhancement)*
Redmond Branch 1A	1054	*Two (Enhancement)*
Redmond Branch 1B	94	*One (Restoration)*

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?
○ Yes ◉ No

If project is located in a SFHA, check how it was determined:
☐ Redelineation
☐ Detailed Study
☐ Limited Detail Study
☐ Approximate Study
☐ Don't know

List flood zone designation:

Check if applies:
☐ AE Zone
- ○ Floodway
- ○ Non-Encroachment
- ◉ None

☐ A Zone
- ○ Local Setbacks Required
- ○ No Local Setbacks Required

If local setbacks are required, list how many feet:

Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?

○ Yes ◉ No

Land Acquisition (Check)
☐ State owned (fee simple)
☐ Conservation easment (Design Bid Build)
☑ Conservation Easement (Full Delivery Project)

Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)
Is community/county participating in the NFIP program? ☒ Yes ☐ No Note: if community is not participating, then all requirements should be addressed to NFIP (attn: State NFIP Engineer, (919) 715-8000)
Name of Local Floodplain Administrator: Natalie J. Berry Phone Number: (828) 694-6521

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

- ☑ No Action
- ☐ No Rise
- ☐ Letter of Map Revision
- ☐ Conditional Letter of Map Revision
- ☐ Other Requirements

List other requirements:

Comments:

Name: Chris Engle Signature: ______________

Title: Senior Project Engineer Date: 5/22/2020