MITIGATION PLAN
WITS END STREAM & WETLAND MITIGATION SITE
UNION COUNTY, NORTH CAROLINA

RFQ#: 16-032819-YD05 (Issued: 5/9/2019)
DMS PROJECT ID NO. 100164
DMS CONTRACT NO. 7968
USACE ACTION ID NO. SAW-2020-00455
NCDWR NO. 20200369

YADKIN RIVER BASIN
CATALOGING UNIT 03040105

Prepared for:
NORTH CAROLINA DIVISION OF MITIGATION SERVICES
RALEIGH, NORTH CAROLINA

October 22, 2021

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

REPLY TO
ATTENTION OF:

July 28, 2021

Regulatory Division

Re: NCIRT Review and USACE Approval of the NCDMS Wits End Mitigation Site / Union Co./ SAW-2020-00455/ NCDMS Project # 100164

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 Wits End Draft Mitigation Plan, which closed on May 27, 2021. These comments are attached for your review.

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

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

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

Sincerely,

Kimberly Danielle Browning

Digitally signed by Kimberly Danielle Browning
Date: 2021.07.28 13:34:50 -04'00'

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

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
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Response to IRT Comments Dated July 6th, 2021
DMS Project ID No. 100164
Full Delivery Contract No. 7968
USACE Action ID No. SAW-2020-00455
DWR Project No. 2020-0369
IFB 16-032819, RFQ 16-032819-YD05

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

WRC Comments, Olivia Munzer:

1. I have concerns for the number of crossings.
   Of the five total stream crossings, two are external, and the remaining three ATV crossings are internal and subject to the conservation easement. The ATV crossings are necessary to provide access to portions of the fee-simple parcel outside of the conservation easement; the easement cannot isolate land outside the easement. Consideration and efforts were made to combine the two crossings on UT2 (one farm crossing located outside the easement and one ATV located inside the easement). However, the two crossings are located on separate parcels. The removal of the internal ATC crossing would have required the upstream landowner to grant a permanent access easement, which the upstream landowner did not want to do. Additional signage will be installed upon completion of construction to thoroughly designate the ATV paths and crossings. Restoration Systems is currently the fee-simple owner of the property with the ATV paths. Our intent is to maintain ownership to diminish the occurrence/chance of any adverse impacts to the Site from the use of the ATV paths during the establishment of permanent vegetation.

2. Table 18. Seed Mix. Several of the species listed in the Permanent Seed Table are non-native or do not occur in the southern Piedmont region such as Agrostis gigantea, Agrostis stolonifera, Chrysanthemum leucanthemum, Chrysanthemum x superbum, most Gaillardia species, Cosmos bipinnatus, Consolida ajacis, Rudbekia amplexicaulis, Penstemon digitalis, and Verbena hastata. Consider native seed mixes for Piedmont.
   Table 18 has been updated for clarification. The sitewide seed mix primarily contains native species to the piedmont. Some regionally common naturalized species are included for functional and aesthetic purposes.

EPA Comments, Todd Bowers:

1. Table 5/Page 6: Excellent inclusion of wider than minimum riparian buffers to not only capture adjacent floodplain wetlands but a design that provides a suitable upland buffer to those wetlands.
   Understood.

2. Section 3.2/Page 10: Can the sponsor make the claim of sediment reduction of 200 tons a year similar to the reduction of nutrients claim in Section 3.3? Table 7 seems to allude to the possibility that this can be added to the narrative in either Section 3.2 or Section 3.4.
   Based on sediment and nutrient modeling, the project is expected to reduce both pollutants. A statement has been added below Table 7 indicating the reduction of 201 tons per year of sediment may be expected from project activities. Please note, this is based on published data for North Carolina and is for information purposes.

3. Section 3.3/Page 11: Can the reductions in nutrients claim be broken down into the phosphorus and nitrogen components?
   The statement has been updated to include 504 pounds of Nitrogen and 504 pounds of Phosphorus per year.

4. Section 3.5/Page 14: Narrative on soils and hydrology of the Waxhaw Branch floodplain is excellent. Due to the timing of this report, data from 2021 was not yet available however I would encourage the sponsor to provide the IRT with up to date groundwater data as soon as available. This will give the IRT time to evaluate the proper hydroperiod for Waxhaw Branch wetlands and establish a more accurate estimation for consecutive days of saturated conditions within 12 inches of surface performance standard.
   2021 groundwater data was collected and is has been submitted with the final detailed mitigation plan.

5. 5.Table 9/Page 15: Recommend adding data from 2021 as soon as available to verify or readjust the performance standard for consecutive days/% of growing season for the re-established and enhanced wetlands to meet. The high percentages of growing season based on the gauge summary may justify a higher than 8% of the growing season performance standard. The WETS data in Appendix C can support a lower percentage but was not included in the main document and does not include early March when conditions are likely to be wetter.
   Additional gauge data has been collected and is included in Appendix B and tables of the final mitigation plan. Based on pre-construction gauge data, we propose to keep the hydroperiod at 8% for a majority of the wetland asset areas, and adjust the hydroperiod to 10% for an isolated wetland reestablishment area located along the left bank of Waxhaw Branch (near pre-con gauge GW-1) between the crossing and existing forest edge where a drainage swale provides supplemental hydrology. Also, the 10% hydroperiod will apply to wetland enhancement and reestablishment areas along both sides of Waxhaw Branch from below the confluence of UT-3 to the confluence of UT-5 (Figure 9-B). Wetland preservation areas along Waxhaw Branch below the confluence of UT-3 will maintain their current level of hydrology. The narrative in Section 7.3 has been revised accordingly.

   Additionally, the proposed growing season end date has been modified to account for the modified growing season start date. Given that soil temperatures will seldom drop below 41°F at 12-inches below the soil surface, we propose to adjust the end of the growing season by using the most recent WETS 30-year historical temperature data. Using data from the Monroe 2 SE, NC AgACIS weather station from 1991-2020 with a 50% probability of mean air temperature being 28 °F the growing season ranges from March 18th – November 14th (241 days). The narrative in Section 8.1 has been revised accordingly.

   An interim response regarding this subject matter was provided to the USACE on September 8th, 2021. The email exchange is provided immediately following this response to comments letter.

6. Table 16/Page 21: Recommend adding the height requirement for planted trees at year 5 and 7 (7 and 10 feet respectively).
   The height requirement has been added to Table 16.

7. Table 16/Page 21: I am concerned that the 8% growing season threshold is too low for the expected hydrology in the re-established wetlands based on the data provided in Table 9 and the 2016 Guidance. Recommend supplementing this document with 2021 data as soon as it becomes available to make a more accurate estimation of the appropriate criteria. I think that a 10-12% threshold may be more suitable for this Site based on the 13-16% of 3 of 4 site gauges found in Table 9; understandably new data may tell another story with conflicting conclusions.
   Please see the response to EPA Comment #5.

8. Section 7.1/Page 22: Recommend adding a mention that the Site will be Priority 1 restoration with the exceptions of Priority 2 and tie in locations to be consistent with Figure 6 Restoration Plan Map.
   The Priority 2 exception has been added to the statement.

9. Section 7.1/Page 23: Recommend adding the number and location of the forded and piped channel crossings. I am curious about the equipment crossing located almost adjacent to the ATV trail that crosses UT 2 and the need for both crossings.

The description has been changed to read “One forded and two piped channel crossings….”. The forded crossing and adjacent ATV crossing on UT 2 are both required because the crossings are located on two properties with two separate property owners (please see the response WRC to Comment #1).

10. Table 17/Page 24: UT-4 Restoration mentions P2 stream restoration. See comment above about Priority 2 exceptions to the P1 approach.
The bullet item for UT 4 has been changed to read as follows. “Conduct P1 stream restoration (with P2 restoration at tie-in locations) along the ditched stream channel”.

11. Table 19, Figure 8 and Sheet P01: The planting plan densities (two versions) are slightly different especially with the addition of more Ilex opaca in Sheet P01. The acreage of the Dry-Mesic Oak- Hickory Forest is different between the two versions. Recommend updating and aligning the Planting Plan Table 19, Figure 8 and Sheet P01.
Planting table has been updated on sheet P01.

12. 12.Table 21 and 22/Page 29-30: The listed growing season of March 1-October 22 would likely support the 10-12% growing season performance criteria for hydrology based on data from Table 16.
Please see the response to EPA Comment #5.

13. Section 8.2.3/Page 32: recommend adding a threshold for supplemental planting where corrective action needs to be taken and when IRT approval would be required.
As these Sites are reviewed annually with the IRT, we presume that corrective action for vegetation will be taken at the request of the IRT.

14. Table 23/Page 32: Will deep ripping of floodplain soils risk interrupting the restrictive layer or properties found in the Cid or Secrest soil series?
Deep ripping was inadvertently left in the narrative and has been removed. To restore historic soil microtopography and provide appropriate conditions for tree planting and growth, soil surfaces will be roughened at the Site by plowing (<6-inches).

15. Table 23/Page 32: Recommend adding the marsh treatment BMPs (UT 2 and Waxhaw Branch) to the Objectives for Water Quality.
We can not add marsh treatment areas in live streams. Therefore, we are not able to add them to UT 2 or Waxhaw Branch.

16. Figure 6: Can the two forded crossings along UT2 be co-located?
These are located on two separate properties, owned by two landowners; we cannot combine them; please see the response to WRC Comment #1.

17. Figure 6: For UT 3 Upper there is a phrase “Construct a piped stream crossing at the tie with UT 3A”. A similar phrase is found for UT 3A as well. Please clarify or remove these statements as there does not appear to be a proposed crossing at this location.
The text was removed from Figure 6 that indicated a crossing near the intersection with UT 3 and UT 3A. The sponsor was able to have this crossing removed from the project.

18. Figure 8: Recommend adding Wetland Indicator Status for the tree species as shown in Table 19.
Figure 8 has been updated to match Table 19.

19. Sheet C28 (and others): Recommend adding the marsh treatment BMPs that are not currently included with the stream restoration plans illustrating steam structures, stream features, limits of construction and limits of disturbance.
Marsh treatment areas have been shown on the sheets where applicable.

DWR Comments, Erin Davis:

1. Page 1, Section 1.3 – Please include a discussion of current adjacent area land uses and any foreseeable changes in surrounding land uses within the project watershed.
   A paragraph was added to the document with the following text, "Based on the Lower Yadkin Pee-Dee River Basin Restoration Priorities (EEP 2009), between the years 2006 and 2030 the population of the Yadkin Pee-Dee River Basin located within North Carolina is expected to grow from 2.7 million to more than 3.9 million residents, an approximately 47 percent increase. Union County specifically was listed as exhibiting a potential 184 percent increase in population, largely attributed to the southeastward expansion of the City of Charlotte. The Site and its watershed are largely rural in nature and are separated from Charlotte by the Town of Monroe. Immediate growth of the area is not apparent or expected. Site watershed land use is characterized by agriculture, forest, and sparse residential development."

2. Page 6, Section 3.1 – DWR appreciates the thoroughness of the site soil investigation, including both field data collection and research reporting components.
   Understood.

3. Page 11, Section 3.4 - Please provide more detail on existing stream conditions. While Table 4 provides an overall summary, it doesn't identify why multiple approaches are proposed for each stream. DWR would welcome the inclusion of drone and ground photos of existing site conditions. These items are helpful in our review.
   Section 3.4 has been expanded to include a narrative with more detail of existing conditions including photographs, existing vegetation, invasive species.

4. Page 15, Section 3.5.1 – Please include any available data for 2021 in the final mitigation plan.
   2021 groundwater data is being collected and will be submitted with the final detailed restoration plan.

5. Page 19, Table 13 – One of the RBRP goals notes rapid urbanization of the area, was this a consideration in stream design resiliency?
   Yes, currently there is no expected development in the Site watershed. Much of the urbanization is tied to the City of Charlotte on the northwestern side of Monroe.

6. Page 22, Section 7.1 – Please note sections of proposed Priority II restoration.
   Text has been changed to read as follows. "Conduct P1 stream restoration (with P2 restoration at tie in locations) along the ditched stream channel".

7. Page 22, Dam Removal – DWR appreciates the discussion provided and proposed use of a filter bag during dewatering to limit turbidity and water quality impacts.
   Understood.

8. Page 23, Instream Structures – Was project location and flow regime a consideration in determining grade control material? Are there any long term stability concerns with using all wood grade control structures on intermittent streams (UT1, UT2, UT3, UT3A, UT4 and UT5) in the slate belt? DWR has observed decomposition of log structures on intermittent reaches in the slate belt during the monitoring period on other projects.
   Instream structures are intended to be a temporary stability measure that holds the stream profile until vegetation has established. We have no long-term concerns for stream stability using wooden structures.

9. Page 23, Crossings & Rd/Paths – Can you please summarize the number of crossings (including type and width), number of easement breaks (including width), and number of ATV paths (including length and width within CE).
   Section 7.1 text was updated as follows;
   Forded & Piped Channel Crossings
   External of the easement are one forded and two piped channel crossings which will be installed at locations depicted in Figure 6 (Appendix A) to allow access to portions of property isolated by the conservation

easement. The main piped crossing in the middle reach of Waxhaw Branch is within a 60-foot easement break. It is being done to replace an existing undersized pipe and to put the crossing under the existing powerline, minimizing the length of the easement break. The second piped crossing replaces an existing undersized piped located outside the easement at the top of UT 3 and does not require an easement break. The forded crossing in the middle reach of UT 2 is within a 45-foot easement break. The crossings may be constructed of hydraulically stable riprap or suitable rock. Crossings will be large enough to handle the weight of anticipated agricultural traffic. Approach grades to the crossing will be at an approximate 10:1 slope and constructed of hard, scour-resistant crushed rock or other permeable material free of fines.

Access road and ATV Paths

A significant portion of the property is being removed from development pressure by isolation from the easement. The access road to the residence is proposed to be moved into an existing powerline easement. This access road will be improved to reduce sedimentation and will be directed across a piped crossing.

Three 10-foot-wide earthen ATV paths (including three stream crossings) are proposed to cross the Site. ATV paths are approximately 1159 linear feet in length and will be earthen and/or mulched and surveyed/located on the conservation easement plat. The paths will be used to connect areas of a single parcel disconnected by the conservation easement. These areas are expected to be used for hunting or other types of outdoor enjoyment. Sections of the path within the easement are depicted in Figure 6 (Restoration Plan). The area beneath the ATV paths will not generate stream or wetland mitigation credit and are removed from the wider buffer calculator for additional stream mitigation credit.

10. Page 23, Table 17 – Please confirm streamside planting is proposed for Waxhaw Branch Downstream.
As depicted on Figure 8, the entire length of Waxhaw Branch has streamside planting proposed. Table 17 has been updated to depict this planting effort.

11. Page 24, Table 17 – Please confirm there a proposed piped crossing at the UT-3 and UT-3A tie in.
The piped crossing at the confluence with UT 3 and UT 3A has been removed from the project. Table 17 has been updated to remove verbiage concerning this crossing.

12. Page 25, Section 7.3 – Please verify that re-established wetlands will be jurisdictional (as currently defined).
The existing jurisdictional wetlands were delineated and verified post-implementation of the Navigable Waters Protection Rule. We recognize the definition of WOTUS is subject to change and may revert to a previous definition, that said we are confident the re-established wetland will be jurisdictional as they are in floodplains of jurisdictional streams.

13. Page 25, Section 7.3 & 7.4 – DWR encourages adding wood to wetland areas as habitat features.
Understood.

14. Page 26, Table 18 – Please confirm the asterisk note applies to all “species” headers.
The asterisk note has been removed, and the table was updated for clarification.

15. Page 27, Table 19 – Please verify proposed species percentages are consistent with both Figure 8 and Sheet P01.
The planting table has been updated on sheet P01.

16. Page 28, Section 7.7 – DWR is concerned about potential encroachment tied to use/maintenance of the ATV paths proposed within the project easement. We are glad that these trails will be marked. However, we suggest using “no mowing” signs (or similar) instead of the standard easement signs along the trails to avoid confusion of internal and external boundary lines.
Thank you for the feedback; we will absolutely mark the ATV paths with such signage.

17. Page 28, Section 7.8 – Please identify invasive plant species that have been observed onsite. DWR is particularly concerned with the presence of Bamboo onsite as it spreads via rhizome. If possible, DWR

requests this species be treated prior to construction to reduce the risk of spreading through grading and soil stockpiling activities.
Typical piedmont invasives are present, including Elaeagnus sp, Ligustrum sp, Lespedeza sp, microstegium, Johnson grass, etc. These will be treated during construction and throughout the monitoring period. The Site also hosts various escaped ornamentals such as nandina and sarcococca (sp), which will also be treated. A non-native clumping bamboo species has also been identified on upper UT3. Care will be taken to prevent the spread of rhizomes from this population during construction, and treatments will continue as needed throughout the monitoring period.

18. Page 28, Section 7 – Please include a brief soil restoration subsection addressing wetland and floodplain bench grading, compaction, planting medium/top soil, etc.
The following text was added to Section 7.6 Soil Restoration. "Soil grading will occur during stream restoration activities. Topsoil will be stockpiled during construction activities and spread on the soil surface once the subgrade has been established. The replaced topsoil will serve as a viable growing medium for community restoration to provide nutrients and aid in the survival of planted species."

19. Page 28, Section 9 – DWR recommends adding a sentence to this section stating that success criteria and monitoring will be completed in accordance with the 2016 NCIRT Guidance.
Text was added to read as follows. "If the mitigation Site or a specific component of the Site fails to achieve the necessary performance standards as specified in the mitigation plan and 2026 NCIRT guidance, the sponsor shall notify…….".

20. Page 29, Table 21 – Will a rain gauge be installed onsite? If an offsite source is proposed, please identify the location and distance to the project site.
A rain gauge will be installed onsite. If the rain gauge fails, the nearest reputable weather station (weather underground or NOAA Applied Climate Information System weather station) will be used to supplement the data. The weather station and its location will be reported in the monitoring document. At this time, the nearest weather station with reliable data is Monroe 2 Southeast (NOAA station FIPS 37179), located approximately 7 miles northwest of the Site.

21. Page 32, Section 8.2.3 – As currently designed, all wetland credit areas will be planted to become forest community types. No shrub or herbaceous dominated areas are anticipated in any of the pond bottom areas? If there is the chance of habitat variability, DWR suggests adding a brief discussion to Section 8.2.3 on how this may be addressed during the monitoring period.
We do not anticipate any wetlands becoming herbaceous-dominated. Wetland enhancement work will include the removal of berms which are currently preventing ponded areas from draining. Once these restrictive berms are removed, we anticipate the wetland enhancement areas will develop into forested, riparian riverine wetlands.

22. Page 32, Table 23 – Should project goals be the same as those listed in Table 16? Also, what are "academic goals"?
In discussions with IRT members, it was determined that NC WAM and NC SAM metrics for functional uplift, even though important, were not to be included in project goals. This results from the fact that specific monitoring of these metrics is not proposed. I inquired about removing NC WAM and NC SAM from future documents and was requested to include them as academically important aspects of functional uplift. Table 16 includes goals, objectives, functional uplift, performance criteria, and measurements that were agreed on by NC DMS representative and included as the Target Functions and Goals to be monitored for the project.

23. Figure 9 –
    a. DWR requests the groundwater gauge south of UT3 Upper be shifted from east to west of the two ponds (wetland enhancement areas).

The groundwater gauge has been moved to the requested location.

b. DWR requests a veg plot within the proposed planting area at the downstream end of Waxhaw Branch.
A vegetation plot has been moved to the downstream end of Waxhaw Branch.

24. Detail Sheets – Please add a typical detail for bare root and live stake planting.
The planting detail has been added to sheet P01.

25. Sheet 02B, Marsh Treatment Area – Please provide stone size and percent composition of riprap outlet, if an alternative non-hardened stabilized outlet is not feasible. Please include a note on whether the feature is designed to require long term maintenance. Also, please identify the max. depth of the proposed deep pools.
Marsh treatment detail has been updated with proposed rip rap class for pipe outlet and treatment area outlet, and a label added for maximum pool deep. No long-term maintenance is required, and the max depth of the proposed deep pools is 1 foot below the existing ground surface.

26. Sheet C05 – The permanent ATV channel ford appears to be wider than the 10 LF of no-credit noted in Table 1.B. Please confirm. (Same question for UT1 Sheet C26 & UT2 Sheet C29)
The perpendicular width of the proposed ATV ford crossings is 10'. The comment column of Table 1.B appropriately details the amount of credit removed for each ATV crossing.

27. Sheet C13 – Please provide context for the impervious dike callout (e.g. removal, installation, to remain).
The impervious dike shown on this sheet is part of the erosion control plan and has been removed from this sheet.

28. Sheet C16 – Please confirm that hatching and callouts for filling existing channels in not shown on sheets within the limits of construction line because of general proposed grading activities within these areas. All existing channels will be backfilled, correct?
Correct, all existing channels will be backfilled. Existing stream channels that are hatched and labeled as 'Fill Existing Channel' are locations that the construction of the proposed stream does not impact the existing channel (i.e., it's in a new channel vs. within the old channel).

29. Sheet C25 – Was DOT consulted to determine if any roadway/culvert improvement projects are planned for Snyders Store Road?
Yes, NCDOT has been consulted, and there are no roadway/culvert improvement projects planned for the 10' x 7' RCBC crossing underneath Snyders Store Road.

30. Sheet C27 – Are proposed contour lines anticipated to follow the same sinuous pattern of the limits of construction lines?
The proposed contours do follow the limits of construction. The 'long' offset often reflects a tie-in from the floodplain elevation to the natural ground grade. The design is such that the proposed floodplain will not become a 'shelf' with a jump up to the natural ground elevation; it will be a continuous slope.

31. Sheet C39 – What does the black line and two dashed lines crossing the easement near Sta. 15+50 indicate?
The solid black line was a design 'construction line' and has been removed from the plan. The two dashed lines indicate where the existing soil path is located and has been labeled as such.

32. General Design Questions –
a. There are multiple stream segments that go a distance between cross vane structures: Waxhaw Branch Sta. 3+30 to 6+60 (~330'), 30+40 to 41+40 (~1,100'), and 43+90 to 52+60 (~870'); UT4 0+00 to 3+40 (~340'). Are there any concerns with long term stream stability in these segments?
We have no concerns for long-term stability. Structures have been placed where required for stability (in abandoned channels to be backfilled), in areas where there is a hydrologic drop, and/or in areas with higher shear values (sharper bends). The stability of an appropriately sized stream should not be dependent upon structures. Ultimately, vegetation establishment provides long-term stability in restored streams.

b. There are no meander bend bank treatments proposed. Are there any concerns about long-term bank stability?
We have no concerns for long-term stability.

c. Is sufficient instream habitat enhancement uplift expected from proposed log vane/cross vane structures? DWR encourages adding woody instream habitat features.
We expect sufficient instream habitat to develop within one to two years through the development of streamside assemblage vegetation and channel substrate.

33. DWR appreciates efforts made to enhance the proposed project by capturing the major floodplain through wider buffers, providing wetland buffers, adding several BMPs and minimizing the number of external easement breaks.
Understood.

USACE Comments, Kim Browning:

1. Figure 10, Stream Buffer Credit Adjustment: Please provide the actual spreadsheet that was used to calculate the additional buffer credit. The inset table does not show how many exempted terminal ends and crossings were accounted for. Were the ATV trails included as crossings or just clipped out of the credited area? A map of the ideal buffers should also be included. Lastly, will the BMPs be planted as part of the buffer? If not, these areas should be removed from the buffer calculation.
The Excel spreadsheet used to calculate additional buffer credit was included in the digital submittal and is now included as a PDF in Appendix B. The ATV paths were clipped out as "ineligible areas" but, like the internal project crossings, were not included as terminal ends. BMPs will be planted as part of the buffer, so they were not removed from calculations. Lastly, a map of the ideal buffers has been included as Figure 10B in Appendix A.

   RS and Axiom provided the raw wider buffer tool data to Kim Browning via email on July 8th, 2021. She verified the tool was used correctly. The email correspondence is provided at the end of the response to the comments letter.

2. Figure 8 and Design Sheet P01: Please include the wetland indicator for each species.
Figure 8 and Sheet P01 have been updated with wetland indicator status for each species.

3. Figure 9: Please show the BMPs on this figure.
Figure 9 Has been updated to include Marsh Treatment areas.

4. Table 1.B, page 3: Please confirm that the crossing on UT2 R1 is proposed as a pipe. It appears to be listed as a ford on Design Sheet C29.
The crossing on UT2 R1 is a forded crossing. Text in Table 1B has been updated accordingly.

5. The location of the marsh treatment areas should be shown on the design sheets. It's preferable that rock outlets not be used unless necessary due to stability of steep slopes. Please confirm that the treatment areas will not be placed in existing or proposed wetlands.
Treatment areas are not located in wetland areas or creditable areas. We will attempt to minimize rock in outlets of marsh treatment areas and will be sensitive to the function of the feature.

6. Section 3.4: This section should be expanded to include a narrative with more detail of existing conditions, and broken out to describe each reach separately. Existing vegetation, including invasive species, should be listed. Photos of existing conditions would also be beneficial.
Section 3.4 has been expanded to include a narrative with more detail of existing conditions, including photographs, existing vegetation, invasive species.

7. Table 10: The Piedmont/Low Mountain Alluvial forest is listed as the reference forest ecosystem; however, only four species from this Table are proposed to be planted on Site. Suggest adding additional species from the target ecosystem to the planting list. Additionally, please provide a similar table for the Dry-Mesic Oak-Hickory forest.
   Table 10 lists species identified in our reference forest, not a complete list of species from the Piedmont/Low Mountain Alluvial Forest. Therefore, the planting list will not match Table 10 exactly. This largely results from some species in the reference forest are undesirable in the planting list (sweetgum, red maple, green ash) or are unavailable from local suppliers (eastern red cedar).

   As far as providing a list for Dry-Mesic Oak-Hickory forest, we did not have a reference community of this type, so inclusion into Table 10 is not feasible.

8. Page 23: There is concern regarding the maintenance of the ATV trails/crossings and the potential for encroachment. Is trail maintenance anticipated, and who will be responsible?
   ATV paths will be mulched before the completion of construction activities. Significant maintenance is not anticipated. If any maintenance occurs, the landowner must coordinate with DMS and stewardship before work begins. Restoration Systems is currently the fee-simple owner of the property with the ATV trails. Our intent is to maintain ownership to diminish the occurrence/chance of any adverse impacts to the Site from the use of the ATV paths during the establishment of permanent vegetation.

9. Is there a reason why UT3 and Waxhaw Branch run parallel before the confluence? Does topography prevent joining the two reaches further upstream?
   UT 3 underwent a significant design alteration after the IRT walkthrough, and considerable scrutiny concerning topography was conducted. Based on topographic surveys, the alignment for UT 3 is in the appropriate location.

10. Page 24: There is concern that the wetlands and vegetation proposed on UT4 will suffer as a result of priority 2 restoration activities. Please ensure that veg plots and gauge data capture these areas.
    Priority 2 restoration activities are expected to occur only at the upstream tie-in location and have been minimized to the maximum extent feasible. At present, there is no wetland credit being generated in the Priority 2 areas, so no groundwater gauges have been proposed. In addition, the Priority 2 bench is insufficiently wide to install a dedicated vegetation plot.

11. Page 26: The more recent Schafale (2012) Fourth Approximation is more appropriate to use.
    Schafale 2012 has been used in conjunction with Schafale and Weakley 1990 to develop vegetative planting lists.

12. Table 19: Several FACU species are proposed to be planted in areas proposed for wetlands; likewise, FACW Winged elm is proposed for upland areas. Please confirm species appropriateness.
    American Holly, Tulip Poplar, and White Oak are all frequently associated with Piedmont floodplain wetlands and are appropriate for planting at the Site. Similarly, Winged Elm is suitable for slopes adjacent to the wetland floodplains.

13. Table 22: The wetland soils performance standard should be revised to include soil profiles annually, at least in monitoring years 4-7.
    Text has been changed to read as follows. “Soil profile descriptions must meet one of the hydric soil indicators identified in the Field Indicators of Hydric Soils in the United States, Version 8.2 (USDA 2018) in monitoring years 4 and 7.”

14. Table 22: The groundwater gauge data provided as a supplement to the draft mitigation plan suggests that gauges 2, 3, 4, and 5 already meet 8% hydrology performance standard. Given that gauges 4 and 5 are located in preservation wetlands and currently show 14-17% hydrology, I agree with EPA’s comment #12. The hydrology performance standard should be 10% in order to show functional uplift.
    Please see the response to EPA Comment #5.

15. Section 8.2: I appreciate the thoughtfulness of this section. I would encourage this level of consideration on future projects. It would be beneficial to add a section on ATV path maintenance/encroachment.
Section 7.10 was added regarding the ATV paths.

Ray Holz

From: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Thursday, September 16, 2021 2:30 PM
To: Ray Holz
Cc: Reid, Matthew; Allen, Melonie (melonie.allen@ncdenr.gov); Alex Baldwin
Subject: RE: NCDMS Wits End / Union Co / SAW- 2020-00455

Follow Up Flag: Follow up
Flag Status: Flagged

Thanks Ray,
I appreciate you and Alex working with me to make these revisions. The changes look good, and including the Regional Supplement information for the growing season helped justify the extended monitoring period. Page 30 discusses 8% and 10% hydroperiods applying to preservation wetlands; I don't think it's accurate to include preservation in that discussion since they're already at 14% and 17%. I would suggest re-wording it so that preservation wetlands maintain their current level of hydrology (or something along those lines).

One request I have is to include the location (and label) of the existing gauges on a figure. I think it will help back up the fact that gauge 1 was most representative of the site and that's why 8% was appropriate.

I'm OK with moving forward, unless you need to discuss anything.
Thanks
Kim

Kim Browning
Mitigation Project Manager, Regulatory Division I U.S. Army Corps of Engineers

-----Original Message-----
From: Ray Holz <rholz@restorationsystems.com>
Sent: Wednesday, September 08, 2021 4:36 PM
To: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Cc: Reid, Matthew <matthew.reid@ncdenr.gov>; Allen, Melonie (melonie.allen@ncdenr.gov) <melonie.allen@ncdenr.gov>; Alex Baldwin <abaldwin@restorationsystems.com>
Subject: [Non-DoD Source] NCDMS Wits End / Union Co / SAW- 2020-00455

Kim - Regarding the wetland success hydroperiod and the end of the growing season determination at Wits End, RS has pulled together for your review ahead of resubmittal a track-changed version of the Mitigation Plan showing edits made to the following sections;

* Table 16 - Targeted Functions, Goals, Objectives, and Uplift
* 7.3 - Wetland Reestablishment
* Table 21 - Monitoring Summary, and
* Table 22 - Success Criteria.

We created two reestablishment success criteria hydroperiods (8 and 10%) which are depicted in a new Figure 9B. I have attached the track-changed word document, Figure 9B, and the Monroe 2 SE WETS data from 1991-2020, which we are using to set the end of the growing season.

Alex did a deep dive into determining the end of the growing season, but given soil temperature would likely never drop below 41 degrees in November and the general subjectiveness of other biological indicates (leaf drop, etc.), we felt the use of the WETS data was most appropriate. We are happy to set up a call to discuss this at your convenience.

Thanks for the time,

RH

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Raymond J. Holz | Restoration Systems, LLC

1101 Haynes St. Suite 211 | Raleigh, NC 27604

tel: 919.334.9122 | cell: 919.604.9314 | fax: 919.755.9492

email: rholz@restorationsystems.com

Ray Holz

From: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Thursday, July 08, 2021 4:52 PM
To: Kenan Jernigan
Cc: Ray Holz; Grant Lewis
Subject: RE: Wits End Wider Buffer Question

Hi Kenan
It looks like you did it correctly with 8 exemptions. The tool does not exempt internal crossings, I just couldn't tell how many exempt terminal ends you used without seeing the spreadsheet. I'd still like to see a map with the ideal buffers so I can compare it to the actual buffers you're getting credit for. I apologize if my comments on this one were all over the place; Erin, Casey and I were in a car accident on the way to a site visit a month ago and I missed a few weeks of work, so I picked this back up this week in the middle of my review.

Give me a call tomorrow if this still doesn't make sense.

Kim Browning
Mitigation Project Manager, Regulatory Division I U.S. Army Corps of Engineers

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From: Kenan Jernigan <kjernigan@axiomenvironmental.org>
Sent: Thursday, July 08, 2021 3:25 PM
To: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Cc: Ray Holz <rholz@restorationsystems.com>; Grant Lewis <glewis@axiomenvironmental.org>
Subject: [Non-DoD Source] Wits End Wider Buffer Question

Hey Kim,

We are working through the Wits End Mitigation Plan comments, and I had a question about your first comment regarding Figure 10, Stream Buffer Credit Adjustment. The comment says:

"Figure 10, Stream Buffer Credit Adjustment: Please provide the actual spreadsheet that was used to calculate the additional buffer credit. The inset table does not show how many exempted terminal ends and crossings were accounted for. Were the ATV trails included as crossings or just clipped out of the credited area? A map of the ideal buffers should also be included. Lastly, will the BMPs be planted as part of the buffer? If not, these areas should be removed from the buffer calculation."

I have attached the raw spreadsheet to this email for reference, and we plan on including a PDF of this table in the final Mit Plan. The ATV trails were clipped out as "ineligible areas" but like the internal project crossings, were not included as terminal ends. The Stream Buffer Credit Calculator instructions indicate that terminal ends include "all points where streams enter or exit the project boundaries, but not including internal crossings even if they are not protected by the easement." I'm not seeing anywhere in the tool to account for internal crossings. Should we be accounting for internal crossings with this tool?

Let me know if this would be easier to discuss over the phone.

Thanks,
Kenan

Kenan R. Jernigan

Project Scientist
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, NC 27603
kjernigan@axiomenvironmental.org
(919) 215-9465

MITIGATION PLAN
WITS END STREAM & WETLAND MITIGATION SITE
UNION COUNTY, NORTH CAROLINA

RFQ#: 16-032819-YD05 (Issued: 5/9/2019)
DMS PROJECT ID NO. 100164
DMS CONTRACT NO. 7968
USACE ACTION ID NO. SAW-2020-00455
NCDWR NO. 20200369

YADKIN RIVER BASIN
CATALOGING UNIT 03040105

Prepared for:
NORTH CAROLINA DIVISION OF MITIGATION SERVICES
RALEIGH, NORTH CAROLINA

Prepared by:

Restoration Systems, LLC
Authorized Representative: George Howard
Ph: 919-755-9490
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604

Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603

October 22, 2021

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

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

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

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

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

APPENDICES – CONTINUED

1. PROJECT INTRODUCTION

The Wits End Stream & Wetland Mitigation Site (hereafter referred to as the "Site") is a full-delivery project for the North Carolina Division of Mitigation Services. The Site encompasses 71.7 acres of impounded open water, agricultural fields, early succession forest, managed timber, and maintained fields along the warm waters of Waxhaw Branch and unnamed tributaries to Waxhaw Branch. The Site is located approximately five miles south of Wingate, NC, and seven miles north of the NC/SC state line (Figures 1 and 2, Appendix A).

1.1. Directions to Site

Directions to the Site from Wingate, NC:

- From W. Wilson St. and N. Main St., and south on N. Main St.
- In 0.8 miles, continue onto Witmore Rd.
- In 2.2 miles, turn left onto Nash Rd. and continue for 0.9 miles
- Turn left onto White Store Rd and continue for 0.5 miles
- Turn right at the 1st cross street onto Snyders Store Rd. and continue for 1.1 miles
- The site entrance (2414 Snyders Store Rd, Wingate, NC 28174) is on the right.

Site Latitude, Longitude 34.913353, -80.442090 (WGS84)

1.2. USGS Hydrologic Unit Code and NCDWR River Basin Designation

The Site is located within United States Geological Survey (USGS) 14-digit Cataloging Unit and **Targeted Local Watershed 03040105081020** (NC Division of Environmental Quality (DEQ) sub-basin 03-07-14) of the Yadkin River Basin (Figures 1 and 2, Appendix A). Site hydrology drains to warm water Waxhaw Branch and unnamed tributaries to Waxhaw Branch. Waxhaw Branch (Stream Index Number 13-17-40-6) has been assigned a Best Usage Classification of **WS-V** (NCDWR 2018). Waxhaw Branch is not listed on the final 2018 303(d) list (NCDEQ 2019). However, Waxhaw Branch drains to Lanes Creek, a WS-IV water supply for the town of Marshville. In addition, Lane Creek is currently listed on the final 2018 303(d) list of impaired and threatened waters. In 1998, Waxhaw Branch was listed as a State 303(d) stream due to impaired biological integrity. Agriculture was listed as the primary stressor, but the stream was removed from the list in 2010.

The Site encompasses the entire Waxhaw Branch valley, which contains the first 3,500 linear valley feet of FEMA's Waxhaw Branch Flood Zone AE; FEMA Panel 3710546200J.

1.3. Physiography and Land Use

The Site is in the Carolina Slate Belt, which is dissected by irregular plains that characterize regional physiography with moderate to steep slopes and low-moderate-gradient streams over a boulder and cobble-dominated substrate (Griffith et al. 2002). On-site floodplain elevations range from a high of 594 feet NGVD at the upper reach of Waxhaw Branch to a low of approximately 575 feet NGVD at the outfall of Waxhaw Branch (Figure 3, Appendix A).

The Site is defined by Waxhaw Branch, which is impounded within the upper half of the site by a 12-foot earthen dam, resulting in reduced stream habitat, lack of sediment transport, increased water temperature, altered flow regime, channel shape, and flood frequency. Below the 11.34-acre impoundment, Waxhaw Branch has been straightened and ditched and is subject to routine vegetation management. Five UTs to Waxhaw Branch are within the Site's footprint and are subject to significant agricultural stressors from row crop production (Figure 4A, Appendix A). 1951 imagery shows the entire Site watershed was subject to intensive agricultural impacts, including terracing of floodplains/slopes and the straightening of streams (Figure 4B, Appendix A).

At the Site outfall, Waxhaw Branch drains 1.09 square miles (700-acres). At the inlet to the site UT 1, 2, 3, 4, and 5 drain 32-acre, 59-acre, 161-acre, 66-acre, and 25-acre watersheds, respectively (Figure 3, Appendix A). The watersheds are dominated by agricultural land with some patches of forest land and sparse residential property. Impervious surfaces account for less than two percent of the upstream land surface.

Based on the Lower Yadkin Pee-Dee River Basin Restoration Priorities (EEP 2009), between the years 2006 and 2030 the population of the Yadkin Pee-Dee River Basin located within North Carolina is expected to grow from 2.7 million to more than 3.9 million residents, an approximately 47 percent increase. Union County specifically was listed as

exhibiting a potential 184 percent increase in population, largely attributed to the southeastward expansion of the City of Charlotte. The Site and its watershed are largely rural in nature and are separated from Charlotte by the Town of Monroe. Immediate growth of the area is not apparent or expected. Site watershed land use is characterized by agriculture, forest, and sparse residential development.

Site land use is characterized by open water and maintained fields. Riparian zones are primarily composed of maintained fields frequently sprayed with animal waste and used for wildlife management and hunting.

1.4. Project Components and Structure

The Site encompasses 71.7 acres along the warm water Waxhaw Branch and unnamed tributaries to Waxhaw Branch. In its current state (based on the approved PJD), the Site includes 8,208 linear feet of degraded stream channel, 6.38 acres of degraded wetland, 11.76 acres of open water, and 25.4 acres of drained hydric soil (Figure 4A, Appendix A).

Proposed Site restoration activities include the construction of meandering, E/C-type stream channel resulting in 10,612 linear feet of Priority I stream restoration, 232 linear feet of stream enhancement (Level I), 669 linear feet of stream enhancement (Level II [reduced ratio]), 22.886 acres of riparian wetland re-establishment, 1.442 acres of riparian wetland enhancement, 4.923 acres of riparian wetland preservation, and 0.351 acres of wetland creation (Table 1) (Figure 6, Appendix A).

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

Table 1.A Project Credits Summary

Restoration Level	Stream	Riparian Wetland
	Warm	Riverine
Restoration	10,612.000	--
Re-establishment	--	22.886
Rehabilitation	--	--
Enhancement	--	0.721
Enhancement I	154.667	--
Enhancement II	--	--
Enhancement II (reduced ratio)	133.400	--
Preservation	--	0.492
Creation	--	0.117
Benthics	218.001	--
Wider Buffer*	635.04	--
Totals	11,753.108	24.216

*See Figure 10 for Wider Buffer Tool output and results.

Table 1.B Project Components and Mitigation Credits (continued)

Project Segment	Existing Footage/ Acreage	Mitigation Plan Footage/ Acreage	Mitigation Category	Restoration Level	Mitigation Ratio	Mitigation Credits	Comment
Waxhaw Br Upstream R1	330	330	Warm	EII*	5.000	66.000	
Waxhaw Br Upstream R2	42	42	Warm	R	1.000	42.000	10 ft of ATV crossing between R2 and R3 receives no credit
Waxhaw Br Upstream R3	253	2547	Warm	R	1.000	2547.000	62 ft of piped crossing between R3 and R4 receives no credit
Waxhaw Br Upstream R4	923	1051	Warm	R	1.000	1051.000	
Waxhaw Br Downstream	1499	1362	Warm	R	1.000	1362.000	
UT 1 R1**	2	2	Warm	EII	0.000	0.000	12 ft of ATV crossing between R1 and R2 receives no credit
UT 1 R2	96	96	Warm	EII*	5.000	19.200	
UT 1 R3	35	78	Warm	R	1.000	78.000	
UT 2 R1	572	583	Warm	R	1.000	583.000	49 ft of forded crossing between R1 and R2 receives no credit
UT 2 R2	33	36	Warm	R	1.000	36.000	10 ft of ATV crossing between R2 and R3 receives no credit
UT 2 R3	91	562	Warm	R	1.000	562.000	
UT 3A	734	780	Warm	R	1.000	780.000	
UT 3 Upstream R1	168	168	Warm	EII*	5.000	33.600	
UT 3 Upstream R2	232	232	Warm	EI	1.500	154.667	
UT 3 Upstream R3	696	770	Warm	R	1.000	770.000	
UT 3 Downstream R1	1275	1459	Warm	R	1.000	1459.000	
UT 4	818	1223	Warm	R	1.000	1223.000	
UT 5 R1	73	73	Warm	EII*	5.000	14.600	
UT 5 R2	88	119	Warm	R	1.000	119.000	
Wetland Reestablishment	--	22.886	NA	Reestablishment	1.000	22.886	
Wetland Enhancement	1.066	1.442	NA	Enhancement	2.000	0.721	Some wetland enhancement included in ponds/open waters on PJD figures and application
Wetland Preservation	5.317	4.923	NA	Preservation	10.000	0.492	
Wetland Creation	--	0.351	NA	Creation	3.000	0.117	

* Enhancement at a reduced ratio

** Mitigation credit removed given length of reach

Table 2. Project Activity and Reporting History

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Technical Proposal	March 2020	March 2020
Institution Date (NCDMS Contract No. 7968)	--	June 28, 2019
Mitigation Plan	--	March 2021
Construction Plans	--	March 2021

Table 3. Project Contacts Table

Full Delivery Provider, Planting Contractor, General Contractor	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 Ray Holz 919-755-9490
Designer	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693
Engineer	Sungate Design Group, PA 905 Jones Franklin Rd. Raleigh, NC 27606 Josh Dalton, PA (919) 859-2243
Surveyor	Carolina Surveyors, Inc. 307 Dover St. Pineville, NC 28134 Thomas White 704-889-7601

Table 4. Project Attribute Table

Project Information	
Project Name	Wits End Site
Project County	Union County, North Carolina
Project Area (acres)	71.7
Project Coordinates (latitude & latitude)	34.913353, -80.442090
Project Watershed Summary Information	
Physiographic Province	Carolina Slate Belt
Project River Basin	Yadkin
USGS HUC for Project (8-digit)	03040105
NCDWR Sub-basin for Project	03-07-14
Project Drainage Area (acres)	700
Percentage of Project Drainage Area that is Impervious	<2%
CGIA Land Use Classification	Managed Herbaceous Cover

Table 4. Project Attribute Table (continued)

Reach Summary Information							
Parameters	**Waxhaw Br**	**UT 1**	**UT 2**	**UT 3**	**UT 3A**	**UT 4**	**UT 5**
Pre-project length (linear feet)	3047	133	696	2371	734	818	161
Post-project (linear feet)	5403	189	1240	2629	780	1223	192
Stream Thermal Regime	Warm	Warm	Warm	Warm	Warm	Warm	Warm
Valley Confinement	Moderately confined	Confined	Confined	Confined	Confined	Confined	Confined
Drainage Area (acres)	700	32	59	161	61	66	25
NCDWR Stream ID Score	36.5/41	28	20.5	26/33.5	23.5	22.5	27
Perennial, Intermittent, Ephemeral	Per	Int	Int	Per/Int	Int	Int	Int
NCDWR Water Quality Classification	WS-V						
Dominant Stream Classification (existing)	Eg 4/5	Eg 4	E 6	G 4/5	G 4	Cg & D 4/5	Eg 4
Dominant Stream Classification (proposed)	Ce 3/4	Ce 3/4	Ce 3/4	Ce 3/4	Ce 3/4	Ce 3/4	Ce 3/4
Dominant Evolutionary class (Simon and Hupp 1986)	III	III	III	III/IV	III/IV	V	III

Wetland Summary Information			
Parameters	Existing Wetlands	Existing Open Waters	Existing Drained Hydric Soils
Pre-Project (acres)	6.38	11.76	25.4
Post-Project (acres)	29.59 (Total)		
Wetland Type (non-riparian, riparian)	Riparian		
Mapped Soil Series	Cid channery silt loam and Goldston-Badin complex. Note – a variant of Cid, the Secrest-Cid complex has been identified during field surveys that is hydric in nature.		
Soil Hydric Status	Nonhydric and Nonhydric-Nonhydric		

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Waters of the US – Section 404	Yes	Yes	Section 404 Permit
Waters of the US – Section 401	Yes	Yes	Section 401 Certification
Endangered Species Act	Yes	Yes	CE Document (App F)
Historic Preservation Act	Yes	Yes	CE Document (App F)
Coastal Zone Management Act (CZMA or CAMA)	No	NA	NA
Essential Fisheries Habitat	No	NA	NA

2. WATERSHED APPROACH AND SITE SELECTION

Primary considerations for Site selection included the potential for water quality improvement within a region of North Carolina under livestock/agricultural pressure. More specifically, considerations included: desired aquatic resource functions, hydrologic conditions, soil characteristics, aquatic habitat diversity, habitat connectivity,

compatibility with adjacent land uses, reasonably foreseeable effects the mitigation project will have on ecologically important aquatic and terrestrial resources, and potential development trends and land use changes.

Currently, the proposed Site is characterized by disturbed forest, row crops, and hayfields. A summary of existing Site characteristics in favor of proposed stream and wetland activities include the following.

- Streams have been impounded, dredged, and straightened
- Streams and wetlands have been cleared of forest vegetation
- Site receives nonpoint source inputs, including agricultural chemicals and livestock waste
- Wetland soils have been compacted by agricultural equipment
- Wetland hydrology has been removed by stream channel entrenchment
- Wetlands have been flooded by impoundments

In addition to the opportunity for ecological improvements at the Site, the use of the particular mitigation activities and methods proposed in the Design Approach & Mitigation Work Plan (Section 7.0) is expected to produce naturalized stream and wetland resources that will be ecologically self-sustaining.

The *Lower Yadkin Pee-Dee River Basin Restoration Priorities 2009* (RBRP) report (NCEEP 2009) documents restoration goals developed for the Lower Yadkin Pee-Dee River Basin (USGS Hydrologic Units 03040103, 03040104, 03040105, 03040201, and 03040202). RBRP goals, specific to HU 03040105, which will be addressed by project mitigation activities, are as follows.

Table 5. RBRP Goals

RBRP Goal	Site Objectives Addressing RBRP Goals
Improved management of stormwater runoff. Mitigate impacts resulting from rapid urbanization of the area. Protect valuable threatened and endangered wildlife resources.	1. Restoring 10,612 linear feet of jurisdictional stream and enhancing an additional 899 linear feet of jurisdictional stream. 2. Provide valley restoration to the upper extent of the Waxhaw Branch FEMA mapping (3,500 l. valley ft. of FEMA floodplain restoration). 3. Re-establish riparian wetlands to 22.9 acres of drained, filled, or inundated hydric soils. 4. Enhance 1.4 acres of existing riparian bottomland hardwood wetlands. 5. Provide a 150-foot buffer on over 90% of the Site's streams and wetlands. 6. Remove sediment, nitrogen, and phosphorus inputs from row crop production and runoff treatment from a three-house poultry operation. 7. Install 6 marsh treatment facilities. 8. Plant a mix-hardwood riparian buffer on all protected features. 9. Removing existing land uses of agriculture production & silviculture. 10. Restore, enhance, and protect habitat for numerous wildlife resources within the project (riparian wetland, depressional wetlands, slope seeps, and upland hardwood/pine habitat).

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

3. BASELINE AND EXISTING CONDITIONS

3.1. Soils

Based on the Union County Soil Survey (USDA 1996) and Web Soil Survey mapping (USDA 2020), the Site contains the soil series outlined in Table 6. Existing wetlands and drained hydric soils were mapped by a licensed soil scientist (NCLSS # 1297) on February 15 and December 2, 2019; February 20, 2020; July 9-10, 14-15, 21-23; and September 1, 2020, as soils of the Cid and Secrest series (Figure 4A, Appendix A); soil boring logs are included as an appendix in the *Technical Supplement & 30% Design* document included in Appendix C.

Table 6. Site Soils

Map Unit Symbol	Map Unit Name (Classification)	Hydric Status	Description
BaB	Badin channery silt loam (*Typic Hapludults*)	Non-hydric	This series consists of well-drained soils on interfluves. Slopes range from 2-8 percent. Parent material is residuum weathered from metasedimentary rock and/or metavolcanics. Depth to the water table is more than 80 inches.
CmB	Cid channery silt loam (*Aquic Hapludults*)	Non-hydric	This series consists of moderately well-drained and somewhat poorly drained soils on nearly level and gently sloping soils on flats, on ridges in uplands, in depressions, and at the head of intermittent drainageways. Slopes range from 1-5 percent. Parent material is residuum weathered from metavolcanics and/or argillite. Depth to the water table is 12-30 inches.
GsB	Goldston-Badin complex (*Typic Dystrochrepts/ Typic Hapludults*)	Non-hydric	This complex consists of well-drained soils on interfluves and hillslopes on ridges. Slopes range from 2-8 percent. Parent material is residuum weathered from metavolcanics and/or argillite. Depth to the water table is more than 80 inches.
GsC	Goldston-Badin complex (*Typic Dystrochrepts/ Typic Hapludults*)	Non-hydric	This complex consists of well-drained soils on hillslopes on ridges. Slopes range from 8-15 percent. Parent material is residuum weathered from metavolcanics and/or argillite. Depth to the water table is more than 80 inches.
*ScA	Secrest-Cid complex (*Aquic Hapludults/ Aquic Hapludults*)	Hydric	This complex consists of moderately well-drained and somewhat poorly drained soils on nearly level and gently sloping soils on flats, on ridges in uplands, in depressions, and at the head of intermittent drainageways. Slopes range from 0-3 percent. Parent material is residuum weathered from metavolcanics and/or argillite. Depth to the water table is 12-30 inches.

*Soil series is not mapped according to soil survey but was observed during on-site soil investigations.

Over 230 soil borings were performed, with 177 of the soil borings exhibiting a hydric soil field indicator. The exercise included 52 soil profile descriptions (see Appendix C), representing soils observed in the various landscape positions and associated intermittent and perennial streams within the Project. Twenty-two soil profile descriptions were observed to have an altered F8 hydric soil indicator where land use practices have removed the indicator. However, these soils displayed evidence of a historic seasonal high-water table (SHWT) within 12-inches of the soil surface and included a consistent subsoil of soil profile descriptions displaying the F8 hydric indicator.

Soil borings were almost exclusively in the Cid soil map unit except for eight in the Goldston soil map unit. Soil borings within the Goldston soil map unit were in a small linear floodplain associated with an intermittent stream (UT4) where soil profile descriptions reflected soils more closely associated with the Cid soil map unit. The soil borings within the Cid soil map unit are variable, as shown in the soil profile descriptions and associated photos. The variability falls within the range of the official series description for both the Cid and Secrest soil map units and is largely dependent on landscape position. When these soils are associated with intermittent and perennial streams with active floodplains, the restrictive soil properties (including expansive mixed clay minerology and shallow to bedrock) allow retention of surface water. These features of the soil support wetland hydrology as water is retained through the winter months (wet season) and remains into the early spring due to slow permeability and moderately low saturated hydraulic conductivity. Within a couple of months from the start of the growing season, vegetation

begins to uptake available soil and surface water, which drives these wetlands' short hydroperiod. The soil profile descriptions and associated photos can be found along with official soil series descriptions for Cid and Secrest soil series in Appendix C.

F3 Depleted Matrix Soil Borings

The F3 depleted matrix hydric indicator was observed in 13 of the soil borings in the wetland preservation, enhancement, and rehabilitation areas. This indicator is found along the middle and outer floodplain of the downstream reach of Waxhaw Branch. This indicator was also observed in some isolated locations of proposed wetland reestablishment areas associated with first and second order streams. The restrictive soil layer consists of channery bedrock in the Cid soil series and expansive clay minerology associated with the deeper Secrest soil series.

F8 Redox Depressions Soil Borings

The F8 redox depressions hydric indicator was observed in 127 of the soil borings in the preservation, enhancement, and rehabilitation areas, especially along first order intermittent and perennial streams. The restrictive soil layer consists of channery bedrock and expansive clay minerology in the Cid soil series and the stickiness and plasticity clay consistence associated with the deeper Secrest soil series.

Altered F8 Redox Depressions Soil Borings

An altered version of the F8 redox depressions hydric indicator was observed in 22 of the soil borings in the rehabilitation areas, especially along first and second order intermittent and perennial streams currently in agriculture production. The restrictive soil layer consists of channery bedrock in the Cid soil series and expansive clay minerology associated with the deeper Secrest soil series. Redoximorphic concentrations were observed between 5 – 12-inches rather than the required 0 – 4-inches depth required. However, by having redoximorphic concentrations within the upper 12-inches this is evidence that a SHWT occurs at a depth that would support wetland hydrology. In addition, soils in preservation areas that display this hydric indicator were observed to have redoximorphic concentrations from 0 – 4-inches as well as extending deeper into the profile from the 5 – 12-inches depth range. This altered version of the F8 indicator is being included as land practices mainly plowing and colluvium from surrounding side slopes in agriculture production alter the observed depth at which the redoximorphic concentrations would occur historically prior to conversion to agriculture.

F19 Piedmont Floodplain Soil Borings

The F19 piedmont floodplain soils hydric indicator was observed in 37 of the soil borings in the wetland preservation, enhancement, and rehabilitation areas of second and third order perennial streams. The restrictive soil layer consists of channery bedrock and expansive clay minerology in the Cid soil series and the stickiness and plasticity clay consistence associated with the deeper Secrest soil series.

Additional Soil Borings

Spoil was observed in 21 soil boring locations where existing and historic pond dams were present. These areas include an abundance of large channers mixed in with excavated clay from when the ponds were excavated. Due to the abundance and size of the rock material auger refusal occurred at shallow depths (<6-inches).

Ten upland soil borings were completed and were observed at low elevations along the side slopes upgradient of toe slope landscape positions. It should be noted that several upland data points for the Preliminary Jurisdictional Determination ended up meeting an existing hydric indicator and were determined to be uplands from the result of ditching and altered hydrology.

Geology

The Site is within the Carolina Slate Belt where the Cid and Secrest soil series formed in residuum, weathered from argillite and other fine-grained metavolcanic rocks. Carolina Slate Belt soils are highly variable and, at times, mapped as complexes due to the scale at which they are mapped. For instance, the Cid soil map unit within the Site is a part of a single contiguous map unit that spans over 19,000-acres and is found at elevations ranging from 200 to 650 feet.

Parent Material

The USDA official series description describes unweathered bedrock below the soil surface at ~32 – 34 inches for Cid and ~62 – 80 inches for Secrest. Depth to bedrock is the main difference between the two soil series. The bedrock is comprised of hard, slightly fractured slate, argillite, or other fine-grained metamorphic rock. Argillite is a fine-grained sedimentary rock composed predominantly of indurated clay particles. Argillaceous rocks are basically lithified muds and oozes and contain variable amounts of silt-sized particles. The argillites grade into shale when the fissile layering typical of shale is developed. Mudstone is a fine-grained sedimentary rock formed from silt and clay and is similar to shale but has fewer laminations. Mudstone colors are variable and include brown/yellow color, indicating that even when reduced, the soil would not necessarily exhibit chroma 2 colors or less.

Landscape

The Site's landscape includes ridges and side slopes with soils (Badin and Goldston) that are shallow to bedrock, which leads to increased surface and subsurface runoff. As a result, the existing agricultural practices have utilized grassed drainageways to convey these hydrological inputs down gradient. These grassed drainageways convey water to the ditched streams and associated floodplains as well as the agricultural ponds. During the field assessment, areas of standing water and saturated soil were observed within the floodplain of Waxhaw Branch and the associated unnamed tributaries where seeps and drainageways enter the floodplains along the toe of slopes.

The Union County Soil Survey notes the geographic setting for both soil series as the following, “nearly level and gently sloping Secrest and Cid soils on flats, on ridges in the uplands, in depressions, and at the head of intermittent drainageways.” However, a review of Cid and Secrest mapped soil units in the surrounding area show these soils were also mapped to include floodplains of perennial streams. The geographic setting for the Cid and Secrest soils within the Site includes areas associated with the floodplain of perennial streams, including Waxhaw Branch, and extend upslope along perennial tributaries that contribute to Waxhaw Branch. The association of the Site’s Cid and Secrest soil series with perennial stream floodplains, in a lower landscape position than described by the Union County Soil Survey, supports that historic floodplain wetlands existed within the Site.

Additionally, 70+ years of agricultural land practice on the Site has caused variation to the floodplain soils. The highly erodible soils on the adjacent slopes have resulted in sediment accumulation across the floodplain soils. Floodplain hydrology across the Site has been significantly affected by these same land practices, including the straightening/ditching of streams and the construction of agricultural ponds. Considering these variables are primary components of the soil-forming process, it is clear that soil morphological properties have been affected. Especially considering existing wetlands have been partially restored at the Site only by ceasing agricultural production and returning the land to forested vegetation. Once the stream is restored and reconnected to the floodplain, the restored wetlands will exhibit one of these hydric soil field indicators.

Soil Series Characteristics/Morphology

Furthermore, the USDA official series description for the Cid and Secrest soil series describes a perched water table at a depth of 12 – 30 inches during the winter and spring. This water table depth is for Cid and Secrest soils located on interstream divides, lower side slopes, or broad flats around the heads of drainageways. The Cid and Secrest soil series found within the Site are associated with the floodplain of a third-order stream where historically, before agricultural land use, the water table would be within 12 inches of the surface. Especially, when considering the soil hydrology characteristics include somewhat poorly drained, slow runoff, and slow permeability, all of which would be representative of finding the Cid soil series on the floodplain of a perennial stream. Another contributing factor to support wetland hydrology for the Site’s Cid soils is the restrictive properties, including the shallow depth to bedrock (~29-34”) and moderate shrink-swell potential, both limiting the vertical movement of water in the soil. There is also documentation that slate fragments found in the soil surface can reduce evaporation losses, which are present in the Site landscape, and support historic retaining wetland hydrology (Daniels, Buol, Kleiss, Ditzler, 1999).

To further demonstrate the Site’s ability to support wetland hydrology, there are multiple agricultural ponds with eight distinct topographic crenulations providing hydrology inputs. The largest pond is identified in the 1970 Wingate, NC USGS Topo Quad. A review of historic aerials shows the pond consistently retains hydrology annually independent of the season and even through periods of documented drought conditions. Also, an additional five agricultural ponds (totaling ~5 acres) exists adjacent to the Site. Discussions with property owners revealed that the

smaller agricultural ponds are fed by springs, which further demonstrates the Site's historical ability of the landscape and soil to support wetland hydrology.

Hydric Field Indicators

Field Indicators of Hydric Soils in the United States, version 8.2 (USDA 2018) states, "*The indicators are used to identify the hydric soil component of wetlands; however, there are some hydric soils that lack any of the currently listed indicators. Therefore, the lack of any listed indicator does not prevent classification of the soil as hydric.*" The guidance also notes that hydric soils and their indicators are dynamic, with changes and additions expected as new research and field testing takes place.

Lastly, when not mapped as a complex, the Cid and Secrest soil series are not identified as hydric soils for Union County; however, when mapped as a complex, the soil map unit is listed as hydric with Wehadkee being the hydric component. While Cid and Secrest are not mapped as hydric, the range of soil properties for each soil series in the Union County Soil Survey and USDA official series description match hydric soil indicators. Specifically, the range of soil matrix chroma and redox concentrations for Cid meets the F8 and F19 indicators, and for Secrest meets the F3, F8, and F19 indicators. Considering the range of soil properties, combined with Site-specific soil morphological properties and associated Site floodplain landscape position, there is clear evidence that indicates the Site's Cid and Secrest soil series historically supported jurisdictional wetlands and are candidates for wetland restoration.

3.2. Sediment Model

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

Streambank characteristics involve measurements of bank height, angles, materials, presence of layers, rooting depth, rooting density, and percent of the bank protected by rocks, logs, roots, or vegetation. Site reaches have been measured for each BEHI and NBS characteristic and predicted lateral erosion rate, height, and length to calculate a cubic volume of sediment contributed by the reach each year. Data forms for the analysis and the data output is presented in Appendix B. Results of the model are shown in Table 7.

Table 7. BEHI and NBS Modeling Summary

Stream Reach	Proposed Mitigation Treatment	Predicted Sediment Contribution (tons/year)
Waxhaw Branch	Restoration	70.6
UT-1	Enhance II and Restoration	0.0
UT 2	Restoration	6.5
UT 3	Enhance I, Enhance II, and Restoration	100.2
UT 3A	Restoration	6.5
UT 4	Restoration	14.8
UT 5	Enhance II and Restoration	2.3
	Total Sediment Contribution (tons/year)	**201.0**

Based on sediment load modeling, stabilization of Site stream banks will directly reduce 201 tons per year of sediment from downstream receiving waters.

3.3. Nutrient Model

A preliminary land use nutrient model was developed to estimate nitrogen and phosphorus inputs from row crops at the Site. Model inputs include Site area, percent land use, rainfall, and row-crop type. Using published values of

nitrogen and phosphorus, the model predicts the nutrient input of fertilizer associated with land uses (USDA 2015, USDA 1992). A copy of the model input and output is presented in Appendix B.

Based on the land use nutrient model, cessation of agricultural land use activities at the Site will directly reduce 504 pounds of phosphorus and 504 pounds of nitrogen per year.

3.4. Project Site Stream

Streams targeted for restoration include Waxhaw Branch and unnamed tributaries to Waxhaw, which have been cleared, moved to the edge of the floodplain, dredged and straightened, plowed for agriculture, eroded vertically and laterally, and receive extensive sediment and nutrient inputs. Approximately 65 percent of the existing stream channel has been degraded, contributing to sediment export from the Site. In addition, streamside wetlands have been cleared and drained by channel downcutting, and land uses. Current Site conditions have resulted in degraded water quality, a loss of aquatic habitat, reduced nutrient and sediment retention, and unstable channel characteristics (loss of horizontal flow vectors that maintain pools and an increase in erosive forces to channel bed and banks). Site restoration activities will restore riffle-pool morphology, aid in energy dissipation, increase aquatic habitat, stabilize channel banks, and greatly reduce sediment loss from channel banks.

Reach Descriptions

Individual reach descriptions are as follows.

<u>UT 1</u>

UT 1 drains 32 acres of agriculture fields and originates onsite on a forested edge abutting the fields. The reach is wooded but the uppermost section has significant exposed bare ground and minimal herbaceous vegetation due to heavy overland flow from the fields above. The underlying soils are part of the Cid Series which are typical of upland flats. The canopy is composed of Eastern red cedar (*Juniperus virginiana*), pignut hickory (*Carya glabra*), winged elm (*Ulmus alata*), sweet gum (*Liquidambar styraciflua*), and willow oak (*Quercus phellos*). Herbaceous species include Japanese silt grass (*Microstegium vimineum*), blackberry (*Rubus sp.*), and greenbrier (*Smilax rotundifolia*). Invasive Chinese privet (*Ligustrum sinense*) is also present. Substrate composition is primarily gravel and cobble with clay banks. The bottom of the channel is 2-3' wide and the top of bank is 2-5' wide and 0.5-2' deep. Approximately 60% of the banks are actively eroding, most likely from high flow events and agriculture drainage.

<u>UT 2</u>

UT 2 is a highly degraded stream channel that drains 59 acres of agriculture production area containing corn crops and chicken houses. The stream channel is surrounded by fescue (*Festuca sp.*), knotweed (*Polygonum sp.*), and other early successional species adjacent to the planted row crops. It passes through a narrow strip of woods containing Eastern red cedar (*Juniperus virginiana*), willow oak (*Quercus phellos*), and loblolly pine (*Pinus taeda*) before entering the large onsite pond. The more mature trees are approximately 10-30 years old. Invasive Chinese privet (*Ligustrum sinense*) is present in the wooded corridor. The bottom of the channel is 2-5' wide and the top of bank is 3-6' wide and 1-3' deep. Heavy incision is occurring along the stream banks. The primary channel substrate is gravel, and the banks and bottom of channel are composed of exposed clay. The underlying soils are from the Cid Series.

<u>UT 3</u>

UT 3 drains 161 acres of agricultural fields with sparse wooded buffers along the upper stream corridor. Woody canopy species above the confluence with UT 3A include black walnut (*Juglans nigra*), hickory (*Carya spp.*), hackberry

(*Celtis laevigata*), cottonwood (*Populus deltoides*), sweet gum (*Liquidambar styraciflua*), and Eastern red cedar (*Juniperus virginiana*). Understory species include groundseltree (*Baccharis halimifolia*) and green ash (*Fraxinus pennsylvanica*) and vines including Japanese honeysuckle (*Lonicera japonica*), poison ivy (*Toxicodendron radicans*), and greenbrier (*Smilax rotundifolia*). Herb species include elderberry (*Sambucus canadensis*), blackberry (*Rubus spp.*), pokeweed (*Phytolacca americana*), silverweed (*Cinquefoil sp.*), and spleenwort (*Asplenium platyneuron*). Invasive species present are Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*), Chinaberry (*Melia azedarach*), and a small patch of bamboo (*Bambusoideae sp.*). The upper portion has a nearby adjacent ditch running along the edge of the agriculture field and experiences less erosion and incision than the reach below the upper pond. The bottom of the channel is approximately 3-5' wide and the top of bank is 3-8' wide. The uppermost reach is 2-4' deep and the section above the confluence with UT 3A is 3-6' deep with more heavily incised banks. Substrate composition is silt/clay, gravel, cobble, boulder, bedrock, and saprolite with the average size of substrate increasing as you travel downstream. Underlying soils are part of the Cid Series.

UT 3 below the confluence with UT 3A begins to flatten out and flow through agriculture fields with a narrow but densely vegetated buffer. Common plant species include black walnut (*Juglans nigra*), cottonwood (*Populus deltoides*), black willow (*Salix nigra*), pokeweed (*Phytolacca americana*), Japanese silt grass (Mic*rostegium vimineum*), blackberry (*Rubus sp.*), and greenbrier (*Smilax rotundifolia*). Chinese privet (*Ligustrum sinense*) dominates the understory. The bottom of the channel is 4-8' wide and the top of bank is 4-10' wide and 1-4' deep. The banks are heavily incised on outer bends and the substrate is primarily silt/clay, sand, and gravel with undercut clay banks. Some stretches have heavy debris piles of large and medium woody debris. Both ponds along the reach are densely vegetated with black willow (*Salix nigra*) and duckweed (*Lemna sp.*).

UT 3A

UT 3A drains 61 acres of agriculture fields and some densely vegetated, narrow corridors along the stream channel. Woody plant species include hackberry (*Celtis laevigata*), black walnut (*Juglans nigra*), willow oak (*Quercus phellos*), persimmon (*Diospyros virginiana*), and sweet gum (*Liquidambar styraciflua*) while vines and herb species include pokeweed (*Phytolacca americana*), poison ivy (*Toxicodendron radicans*), muscadine (*Vitus rotundifolia*), knotweed (*Polygonum sp.*), silverweed (*Cinquefoil sp.*), and goldenrod (*Solidago sp.*). Chinese privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora*) are the only invasives present and form a dense understory in the wooded portions of the tributary. The bottom of the channel is 2-4' wide and the top of bank is 3-8' wide and 0.5-4' deep. Substrate is composed of silt/clay, gravel, cobble, and some boulders. Approximately 40% of the stream is heavily incised, particularly on outer bends and where runoff from the agriculture fields accumulates during high flow events. Some tree roots exposed from incision span across the channel, indicating active erosion in recent history. The lower end of the reach has less active incision than the upper end. Soils are part of the Cid Series.

UT 4

UT 4 drains 66 acres of mixed-use area composed of agriculture fields and forested tracts with a large section of planted pines. Woody canopy species include winged elm (*Ulmus alata*) and green ash (*Fraxinus pennsylvanica*). Herbaceous species and vines include Japanese silt grass (Mic*rostegium vimineum*), goldenrod (*Solidago sp.*), greenbrier (*Smilax rotundifolia*), and blackberry (*Rubus sp.*). The stream channel is slightly incised with approximately 40% of its banks actively eroding. The bottom of the channel is 1-2' wide and the top of bank is 4-6' wide and 0-2' deep. The dominant substrate type is sand. Underlying soils are from the Cid Series and the Goldston-Badin complex.

UT 5

UT 5 drains 25 acres of agricultural fields and is underlain by the Goldston-Badin Complex soils. Woody canopy species include green ash (*Fraxinus pennsylvanica*), winged elm (*Ulmus alata*), and sweet gum (*Liquidambar styraciflua*). Herbaceous species and vines present are soft rush (*Juncus effuses*), pokeweed (*Phytolacca americana*), blackberry (*Rubus sp.*), greenbrier (*Smilax rotundifolia*), and Japanese silt grass (Mic*rostegium vimineum*). The dense understory is dominated by thick herbaceous species. The channel receives significant runoff from the upstream agriculture fields exposing some large root bases in-stream. The bottom of the channel is 1-1.5' wide and the top of the bank if 3-4' wide and 1-3' deep. Approximately 30% of the banks are actively eroding. Dominant substrate types are silt/clay and gravel. The underlying soils are from the Cid Series and the Goldston-Badin complex.

Waxhaw Branch

Waxhaw Branch drains approximately 700 acres of mixed agriculture fields and forest, calculated from its lowest point onsite. The upper reach above the large onsite pond is a slow-moving degraded channel that flows out of a smaller offsite pond. Woody species along the channel include hickory (*Carya spp.*), hackberry (*Celtis laevigata*), winged elm (*Ulmus alata*), Eastern red cedar (*Juniperus virginiana*), and sweet gum (*Liquidambar styraciflua*). Pokeweed (*Phytolacca americana*), blackberry (*Rubus sp.*), groundseltree (*Baccharis halimifolia*), and various grasses are the dominant herbaceous and vine species. Chinese privet (*Ligustrum sinense*) is densely populated in the understory. The channel is heavily degraded with 100% of its banks incised as clay cut banks. The dominant substrate types are silt/clay and gravel. The bottom of the channel is 10-14' wide and the top of bank is 10-15' wide and 1-5' deep. Underlying soils are from the Cid Series.

Waxhaw Branch above the confluence with UT 3 drains 422 acres. Below the large onsite pond, the stream is channelized and dominated by thick herbaceous species, with very few woody species. Blackberry (*Rubus sp.*), goldenrod (*Solidago sp.*), passionflower (*Passiflora sp.*), and soft rush (*Juncus effuses*) are the most common herbaceous plants. Woody species that are present include green ash (*Fraxinus pennsylvanica*), groundseltree (*Baccharis halimifolia*), and winged elm (*Ulmus alata*). Invasive Chinese privet (*Ligustrum sinense*) is present along the stream corridor. The bottom of the channel is 2' wide and the top of bank is 4-6' wide and 1-3' deep.

Below its confluence with UT 3, Waxhaw Branch enters a predominantly forested area with more mature (>15 years old) tree species before flowing offsite. Woody species include winged elm (*Ulmus alata*), sweet gum (*Liquidambar styraciflua*),

red maple (*Acer rubrum*), and green ash (*Fraxinus pennsylvanica*). Herbaceous species present are pokeweed (Phytolacca americana), goldenrod (*Solidago sp.*), and Japanese silt grass (*Microstegium vimineum*). Underlying soils continue as part of the Cid Series and the in-channel substrate is predominantly silt/clay, sand, and gravel. The bottom of the channel is 4-6' wide and the top of bank is 8-10' wide and 2-5' deep. Approximately 70% of the banks are eroding.

3.4.1. Existing Conditions Survey

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

Table 8 (next page) summarizes morphology parameters existing at the Site and preliminary estimates of stable stream attributes based upon regional curves for the Piedmont region of North Carolina (Harmen et al. 1999).

3.4.2. Channel Classification and Morphology

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

3.4.3. Channel Evolution

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

3.4.4. Valley Classification

Site streams are characterized by small stream, headwater, moderately confined to confined, alluvial valleys with approximately 50- to 100-foot floodplain valley widths. Valley slopes are typical for the Piedmont region and range from 0.0045-0.0278. Typical streams in this region include C- and E-type streams with slightly entrenched, meandering channels with a riffle-pool sequence.

3.4.5. Discharge

This hydrophysiographic region is characterized by moderate rainfall with precipitation averaging approximately 46.7 inches per year (USDA 1996). Drainage basin sizes range from 0.04- to 1.09-square miles across the Site.

The Site's discharge is dominated by a combination of upstream basin catchment, groundwater flow, and precipitation. Based on indicators of bankfull at two reference reaches and within the Site, the designed channel will equal approximately 93 percent of the channel size indicated by Piedmont regional curves (Harman et al. 1999); this is discussed in Section 5.2 (Bankfull Verification). Based on bankfull studies, the bankfull discharge ranges from 8.0-88.3 cubic feet per second for Site drainage areas.

Table 8. Essential Morphology Parameters

Parameter	Existing				Reference		Proposed			
	Waxhaw Br (Up)	Waxhaw Br (Down)	UT1	UT2	Uwharrie	Spencer Cr	Waxhaw Br (Up)	Waxhaw Br (Down)	UT1	UT2
Valley Width (ft)	100	150	50	40	50	50	100	150	50	40
Contributing Drainage Area (sq. mi.)	0.66	0.1.04	0.05	0.09	0.60	0.41	0.66	0.1.04	0.05	0.09
Channel/Reach Classification	Eg 4/5	Eg 4/5	Eg 4	E 6	E4	E3	Ce 3/4	Ce 3/4	Ce 3/4	Ce 3/4
Design Discharge Width (ft)	11.6	13.2	4.0-5.1	4.1-7.0	12.1	9.1	14.5	16.9	6.3	7.5
Design Discharge Depth (ft)	1.3	1.6	0.4-0.5	0.6-1.0	1.2	1.3	1.0	1.2	0.4	0.5
Design Discharge Area (ft^2)	15.0	20.4	2.8	4.0	14.2	10.4	15.0	20.4	2.8	4.0
Design Discharge Velocity (ft/s)	4.1	4.2	3.4	3.7	4.1	4.2	4.1	4.2	3.4	3.7
Design Discharge (cfs)	61.3	85.0	9.5	14.8	57.6	43.8	61.3	85.0	9.5	14.8
Water Surface Slope	0.0052	0.0042	0.0262	0.0089	0.0168	0.0128	0.0046	0.0039	0.0253	0.0076
Sinuosity	1.01	1.06	1.06	1.0	1.14	1.26	1.15	1.15	1.10	1.10
Width/Depth Ratio	8.9	8.3	5.7-10.2	4.1-2.0	10.1	7.8	14.0	14.0	14.0	14.0
Bank Height Ratio	1.5	1.8	1.1-1.5	1.0-1.5	1.0	1.0	1.0	1.0	1.0	1.0
Entrenchment Ratio	12.9	2.7	7.8-12.5	4.4-8.3	4.2	5.9	6.9	8.9	8.0	6.7
Substrate	Gravel/Sand	Gravel/sand	Gravel	Silt/Clay	Gravel	Cobble	Cobble/Gravel	Cobble/Gravel	Cobble/Gravel	Cobble/Gravel

Table 8. Essential Morphology Parameters (continued)

Parameter	Existing				Reference		Proposed			
	UT3	UT 3A	UT 4	UT5	Uwharrie	Spencer Cr	UT3	UT 3A	UT 4	UT5
Valley Width (ft)	75	50	50	50	50	50	75	50	50	50
Contributing Drainage Area (sq. mi.)	0.25	0.10	0.10	0.04	0.60	0.41	0.25	0.10	0.10	0.04
Channel/Reach Classification	G 4/5	G 4	Cg & D4/5	Eg4	E4	E3	Ce 3/4	Ce 3/4	Ce 3/4	Ce 3/4
Design Discharge Width (ft)	8.0	5.8	10.6	3.4	12.1	9.1	10.4	7.6	7.5	5.8
Design Discharge Depth (ft)	1.0	0.7	0.6	0.8	1.2	1.3	0.7	0.5	0.5	0.4
Design Discharge Area (ft^2)	7.8	4.1	4.3	2.4	14.2	10.4	7.8	4.1	4.0	2.4
Design Discharge Velocity (ft/s)	3.9	3.7	3.7	3.3	4.1	4.2	3.9	3.7	3.7	3.3
Design Discharge (cfs)	30.6	15.2	16.0	8.0	57.6	43.8	30.6	15.2	14.8	8.0
Water Surface Slope	0.0071	0.0090	0.0076	0.0113	0.0168	0.0128	0.0063	0.0084	0.0076	0.0107
Sinuosity	1.03	1.04	1.02	1.04	1.14	1.26	1.15	1.10	1.10	1.10
Width/Depth Ratio	8.0	8.3	29.8	4.6	10.1	7.8	14.0	14.0	14.0	14.0
Bank Height Ratio	2.3	1.6	1.4	1.3	1.0	1.0	1.0	1.0	1.0	1.0
Entrenchment Ratio	1.3	1.5	5.1	3.6	4.2	5.9	7.2	6.6	6.7	8.6
Substrate	Gravel/Sand	Gravel	Sand/Gravel	Gravel	Gravel	Cobble	Cobble/Gravel	Cobble/Gravel	Cobble/Gravel	Cobble/Gravel

3.5. Project Site Wetlands

The Site contains existing wetlands within forested areas located in the floodplain of Waxhaw Branch. Existing wetlands are also present on neighboring properties along unnamed tributaries and downstream along Waxhaw Branch. Also, within and adjacent to the Site are FIVE agricultural ponds inline or adjacent to existing streams, the largest being 11.34-acres. The existing wetlands and agriculture ponds are located in the soil map units of Badin channery silt loam (BaB), Cid channery silt loam (CmB) and Goldston-Badin complex (GsC). The majority of the wetlands are located in CmB, a non-hydric soil; however, all existing wetlands include a hydric soil field indicator. Hydric soil field indicators observed within the existing wetlands included: F3 – Depleted Matrix, F8 – Redox Depressions, and F19 – Piedmont Floodplain Soils. After discussing the Site soils with Mr. Daniel Spangler (member of the soil survey team for Union County Soil Survey, 1996) and evaluating the Site soils, it is evident the CmB soil map unit within areas of the Site has inclusions of Secrest. It may be more appropriately mapped as the Secrest-Cid complex (ScA), which is listed as a hydric soil for Union county.

The existing wetland complex within Waxhaw Branch's floodplain includes varying hydroperiods reflected by the multiple hydric soil field indicators. Hydrology inputs to the system include precipitation, surface runoff from adjacent slopes, groundwater from adjacent ridges and slopes, and overbank flooding from Waxhaw Branch. Surface depressions formed from remnant stream channels, windblown trees, and natural topography retain hydrological inputs associated with F3 and F19 indicators. Areas between these depressions have a soil surface that is slightly higher relative to the depressions and a water table within 12-inches of the soil surface, which exhibit F8 and F19 indicators. A series of groundwater gauges have been installed within the existing wetlands and areas with drained hydric soils to document the system's hydrology.

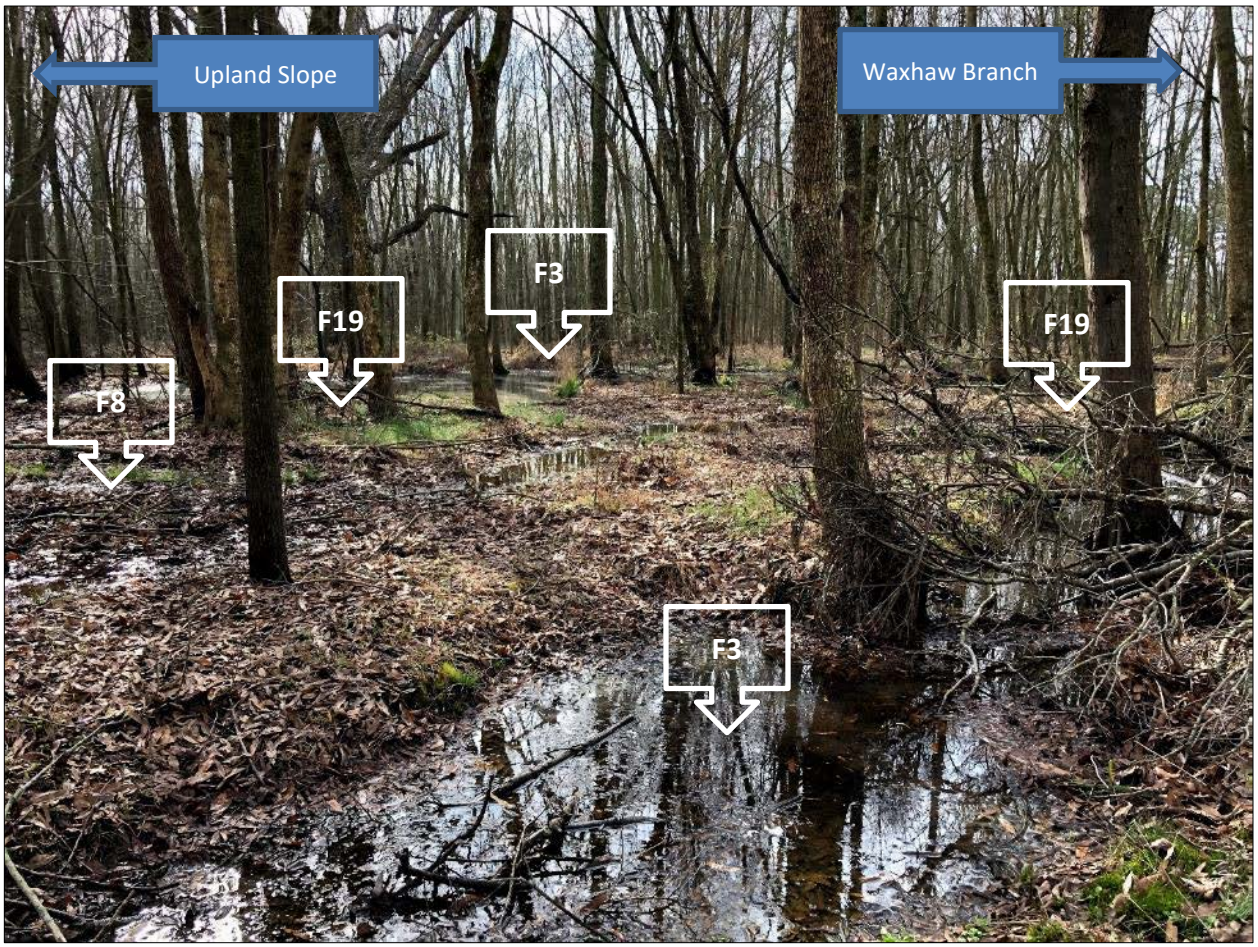

Photo 1 Hydric soil field indicators (F3, F8, and F19) and associated landscape position in existing wetlands along floodplain of Waxhaw Branch.

3.5.1. Groundwater Monitoring Gauges

Wetland gauge data gathered from 2020 and 2021 are presented in Table 9. The AgACIS 2 SE Monroe, NC station was used for precipitation and temperature data. Based on this data and bud bursts of two species documented on-Site, the modified growing season started on March 1st. Also, rainfall was above normal for February and below normal for March. The end of the modified growing season, November 15, was obtained using the most recent historic 30-year (1991-2020) temperature data from AgACIS 2 SE Monroe, NC station. See Section 8.1 for a detailed explanation and justification of the modified growing season.

Table 9. Summary of 2020 and 2021 Gauge Data

Gauge Summary (2020)			Gauge Summary (2021)		
Gauge #	**# of Days Wetland Hydrology Met**	**% of Growing Season***	**Gauge #**	**# of Days Wetland Hydrology Met**	**% of Growing Season***
GW-1	15	6	GW-1	17	7
GW-2	32	12	GW-2	21	8
GW-3	15	6	GW-3	21	8
GW-4	40	16	GW-4	44	17
GW-5	36	14	GW-5	36	14

*Modified growing season 3/1 – 11/14 (258 days)

Groundwater monitoring well hydrographs can be found in Appendix B.

During 2020, four gauges (gauges 2-5) placed in and around the forested wetland, of which three gauges (gauges 2, 4, and 5) met wetland hydrology. Gauge 3 is on a toe slope landscape position where groundwater and surface water enter the floodplain and represents the wetland boundary. Gauge 1 was placed at the base of a drainage swale in the agriculture field and is representative of the drained hydric soils being proposed for wetland restoration.

During the 2021 modified growing season similar results were noted, except that only one gauge met wetland hydrology. Groundwater gauge 2 met wetland hydrology criteria in 2020 and dropped from 12 to 8% of the modified growing season in early 2021.

3.5.2. Bathymetry Survey

A bathymetry survey was completed along with a standard topographic survey by Carolina Surveyors, Inc (Attachment D of the Technical Supplement located in Appendix C). The survey fieldwork was conducted in late June 2020, and a survey drawing was received on July 13, 2020. The survey shows a broad flat historic floodplain associated with Waxhaw Branch. The lowest elevation is the 584-foot contour, an isolated depression located adjacent to the dam that was most likely the primary source for the dam fill material. At the time of the survey, the water's edge elevation ranged from 590-feet on the downstream end to 593-feet on the upstream end. The survey identified a small sandbar near the existing dock associated with a boat ramp and marshy irregular terrain on the northern upstream area associated with Waxhaw Branch. The crenulations where streams and ephemeral features enter the pond appear relatively unchanged from historical conditions (Figure 4B - 1951 Aerial Photography). In general, the bathymetry survey did not identify any areas of significant manipulation from the construction of the impoundment or aggradation of sediments due to the impoundment.

The bathymetry survey was used to identify appropriate representative areas for transects to perform subaqueous soil sampling.

3.5.3. Subaqueous Soil Sampling

Subaqueous soil sampling was conducted on July 22 & 30, 2020, to identify the presence and depth of overburden on the historic soil surface and assess the soil morphology of the clay subsoil (restrictive layer) compared to soils proposed for wetland rehabilitation. This information allowed for a better understanding of the Site soil's ability to support wetland rehabilitation and prepare for design and construction approaches before dewatering the pond.

The subaqueous soil sampling analysis results indicate the composition and extent of the overburden observed do not present concerns for restoration. The restrictive layer was identified, and notable similarities of the subaqueous soils relative to the drained hydric soils in agriculture production were observed. A detailed analysis of the subaqueous soil sampling regimen and results can be found in Appendix C (Technical Supplement).

4. REFERENCE STUDIES

4.1. Reference Streams

Two reference reaches were identified for the Site. The first reference stream (Uwharrie) is located approximately 45 miles northeast of the Site along Horsepen Creek, a tributary to the Uwharrie River (Figure 5A, Appendix A). The second reference stream (Spencer Creek) is located approximately 45 miles northeast of the Site along Spencer Creek, a tributary to the Uwharrie River (Figure 5B, Appendix A). Both reference reaches exhibit similar slope, size, geology, and substrate expected to occur in Site streams. The streams were measured and classified by stream type (Rosgen 1996).

4.1.1. Channel Classification

The reference reaches are both characterized as E-type streams; Uwharrie Reference is a moderately sinuous (1.14) channel dominated by gravel substrate. Spencer Creek Reference had a slightly higher sinuosity channel (1.26), due to a lower valley slope, with a cobble-dominated substrate.

4.1.2. Discharge

Field indicators of bankfull approximate an average discharge of 57.6 and 43.8 cfs, respectively for the Uwharrie and Spencer Creek reference reaches, 93 percent of that predicted by the regional curves.

4.1.3. Channel Morphology

Dimension: Data collected at Uwharrie and Spencer Creek indicate bankfull cross-sectional areas of 14.2 and 10.4 square feet, respectively. Both streams were slightly smaller than predicted by the regional curve (93%). Uwharrie and Spencer Creek exhibit a bankfull width of 12.1 and 9.1, a bankfull depth of 1.2 and 1.3 feet, and width-to-depth ratios of 10.1 and 7.8, respectively (see Table B1, Morphological Stream Characteristics, Appendix B). Figures 5A and 5B (Appendix A) provide plan views and cross-sectional data for the reference reaches. The reference reaches exhibit a bank-height ratio of 1.0.

Pattern and Profile: In-field measurements of the reference reaches have yielded an average sinuosity of 1.14 at Uwharrie and 1.26 at Spencer Creek (thalweg distance/straight-line distance). Onsite valley slopes of Site restoration reaches range from 0.0278-0.0045. Valley slopes exhibited by reference channels range from 0.0161 at Spencer Creek to 0.0192 at Uwharrie, providing a median slope to compare existing and proposed Site conditions. Reference reaches had a suitable pattern with no shoot cutoffs, eroding outer bends, or excessively tight radius of curvatures, in addition to appropriate pool-to-pool spacing and meander wavelengths.

Substrate: Reference channels are characterized by substrate dominated by gravel and cobble sized particles, respectively.

4.2. Reference Forest Ecosystem

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

The RFE for this project is in the downstream, wooded reaches of Waxhaw Branch. The RFE supports plant community and landform characteristics that restoration efforts will attempt to emulate. Tree and shrub species identified within the reference forest and outlined in Table 10 will be used, in addition to other relevant species in the appropriate Schafale and Weakley (1990) and Schafale (2012) community descriptions.

Table 10. Reference Forest Ecosystem

Piedmont/Low Mountain Alluvial Forest		
red maple (*Acer rubrum*)	tulip poplar (*Liriodendron tulipifera*)	winged elm (*Ulmus alata*)
pignut hickory (*Carya glabra*)	sweetgum (*Liquidambar styraciflua*)	hackberry (*Celtis laevigata*)
green ash (*Fraxinus pennsylvanica*)	white oak (*Quercus alba*)	willow oak (*Quercus phellos*)
eastern red cedar (*Juniperus virginiana*)	laurel oak (*Quercus laurifolia*)	slippery elm (*Ulmus rubra*)

5. CHANNEL ASSESSMENTS

5.1. Channel Stability Assessment

Stream power and shear stress were estimated for 1) existing dredged and straightened reaches, 2) the reference reaches, and 3) proposed Site conditions. Existing, Site streams are characterized by a wide range of water surface slopes and varying degrees of degradation. The proposed channel should exhibit stream power and shear stress values to maintain sediment transport functions of a stable stream system, so the channel is neither aggrading nor degrading. The analysis indicates the proposed channel reaches are expected to maintain stream power as a function of width values of approximately 0.92-2.38 and shear stress values of approximately 0.22-0.62 (Table 11).

Table 11. Stream Power (Ω) and Shear Stress (τ) Values

	Bankfull Discharge (ft^3/sec)	Water surface Slope (ft/ft)	Total Stream Power (Ω) ($lb\text{-}ft/sec^3$)	Ω/W (lb/sec^3)	Hydraulic Radius (ft)	Shear Stress (τ) (lb/ft^2)	Velocity (v) (ft/sec)	τ v (lb/ ft-sec)	$\tau_{max'}$ (lb/ft^2)
Existing Conditions									
Waxhaw Branch upstream	61.3	0.0052	19.89	**1.71**	1.96	**0.64**	2.21	1.40	0.95
Waxhaw Branch downstream	85	0.0042	22.28	**1.69**	3.16	**0.83**	1.64	1.36	1.24
UT2	14.8	0.0089	8.22	**1.71**	0.89	**0.49**	2.60	1.28	0.74
UT4	16	0.0076	7.59	**0.72**	0.62	**0.29**	2.19	0.64	0.44
UT3	30.6	0.0071	13.56	**1.69**	2.58	**1.14**	1.19	1.36	1.71
UT3A	15.2	0.009	8.54	**1.47**	1.11	**0.62**	1.90	1.19	0.94
UT3 upstream	17.6	0.0089	9.77	**1.71**	2.29	**1.27**	1.02	1.30	1.91
UT1	9.5	0.0262	15.53	**3.38**	0.78	**1.27**	2.11	2.68	1.90
UT5	8	0.0113	5.64	**1.66**	0.92	**0.65**	1.74	1.13	0.97
Reference Conditions									
Reference-Uwharrie	57.6	0.0168	60.38	**4.99**	0.98	**1.03**	4.06	4.16	1.54
Reference-Spencer Creek	43.8	0.0128	34.98	**3.84**	0.89	**0.71**	4.21	2.99	1.06
Proposed Conditions									
Waxhaw Branch upstream	61.3	0.0046	17.60	**1.21**	0.91	**0.26**	4.09	1.07	0.39
Waxhaw Branch downstream	85	0.0039	20.69	**1.22**	1.06	**0.26**	4.17	1.07	0.39
UT2	14.8	0.0076	7.02	**0.94**	0.47	**0.22**	3.70	0.83	0.33
UT4	16	0.0076	7.59	**1.01**	0.47	**0.22**	4.00	0.89	0.33
UT3	30.6	0.0066	12.60	**1.21**	0.66	**0.27**	3.92	1.07	0.41
UT3A	15.2	0.0084	7.97	**1.05**	0.48	**0.25**	3.71	0.93	0.37
UT3 upstream	17.6	0.0084	9.23	**1.21**	0.48	**0.25**	4.29	1.07	0.37
UT1	9.5	0.0253	15.00	**2.38**	0.39	**0.62**	3.39	2.11	0.93
UT5	8	0.0107	5.34	**0.92**	0.36	**0.24**	3.33	0.81	0.36

The Uwharrie and Spencer Creek reference reach values for stream power are slightly higher than the Site due to steep valley/water surface slopes and narrow width-to-depth ratios. Shear stress values for the reference reach are also slightly elevated due to higher slopes; however, they appear similar to the measurement of the existing condition, as would be expected.

Existing, Site streams are characterized by a wide range of water surface slopes and varying degrees of degradation. In general, stream power values of existing streams are not significantly high due to several dams attenuating erosive stormwater pulses. Onsite channels have been straightened and are slightly incised, however, the channels do not receive excessive erosive forces that may lead to mass wasting. Overall, the proposed channel stream power and shear stress values are slightly high than the proposed values. Proposed stream power and shear stress values of the

design channels are adequate to mobilize and transport sediment through the Site without aggradation or erosion on proposed stream banks.

5.2. Bankfull Verification

Discharge estimates for the Site utilize an assumed definition of "bankfull" and the return interval associated with that bankfull discharge. For this study, the bankfull channel is defined as the channel dimensions designed to support the "channel forming" or "dominant" discharge (Gordon et al. 1992).

Based on available Piedmont regional curves, the predicted bankfull discharge for the reference reaches averages approximately 61.9 and 47.1 cubic feet per second (cfs) for Uwharrie and Spencer Creek, respectively (Harmen et al. 1999). The Piedmont region's USGS regional regression equation indicates that bankfull discharge for the reference reaches, at a 1.3-1.5 year return interval, average approximately 63-73 and 40-50 cfs, respectively (USGS 2006).

Field indicators of bankfull, primarily topographic breaks identified on the banks, and riffle cross-sections were utilized to obtain an average bankfull cross-sectional area for the reference reaches. The Piedmont regional curves were then utilized to plot the watershed area and discharge for the reference reach cross-sectional area. Field indicators of bankfull approximate an average discharge of 57.6 and 43.8 cfs for Uwharrie and Spencer Creek, respectively (93 percent of that predicted by the regional curves), verified by the range approximated by the USGS regional regression equation.

Based on the above analysis of methods to determine bankfull discharge, proposed conditions at the Site will be based on reference reaches and indicators of bankfull at the Site. The designed onsite channel restoration area will equal approximately 93 percent of the channel size indicated by Piedmont regional curves. Table 12 summarizes all methods analyzed for estimating bankfull discharge.

Table 12. Reference Reach Bankfull Discharge Analysis

Method	Watershed Area (square miles)	Return Interval (years)	Discharge (cfs)
Uwharrie Reference Reach			
Piedmont Regional Curves (Harman et al. 1999)	0.60	1.3-1.5	61.9
Piedmont Regional Regression Model (USGS 2006)	0.60	1.3-1.5	63-73
Field Indicators of Bankfull	0.60	1.3-1.5	57.6
Spencer Creek Reference Reach			
Piedmont Regional Curves (Harman et al. 1999)	0.41	1.3-1.5	47.1
Piedmont Regional Regression Model (USGS 2006)	0.41	1.3-1.5	40-50
Field Indicators of Bankfull	0.41	1.3-1.5	43.8

6. FUNCTIONAL UPLIFT AND PROJECT GOALS/OBJECTIVES

The *Lower Yadkin Pee-Dee River Basin Restoration Priorities 2009* (RBRP) report (NCEEP 2009) documents restoration goals developed for the Lower Yadkin Pee-Dee River Basin (USGS Hydrologic Units 03040103, 03040104, 03040105, 03040201, and 03040202). The Site is located within **Targeted Local Watershed (TLW) 03040105081020**; the Site is not located in a Regional or Local Watershed Planning Area; however, RBRP goals, specific to HU 03040105, will be addressed by project mitigation activities as follows.

Table 13. RBRP Goals

RBRP Goal	Site Objectives Addressing RBRP Goals
Improved management of stormwater runoff. Mitigate impacts resulting from rapid urbanization of the area. Protect valuable threatened and endangered wildlife resources.	1. Restoring 10,612 linear feet of jurisdictional stream and enhancing an additional 899 linear feet of jurisdictional stream. 2. Provide valley restoration to the upper extent of the Waxhaw Branch FEMA mapping (3,500 l. valley ft. of FEMA floodplain restoration). 3. Re-establish riparian wetlands to 23.3 acres of drained, filled, or inundated hydric soils. 4. Enhance 1.4 acres of existing riparian bottomland hardwood wetlands. 5. Provide a 150-foot buffer on over 90% of the Site's streams and wetlands. 6. Remove sediment, nitrogen, and phosphorus inputs from row crop production and treatment of runoff from a three-house poultry operation. 7. Install 6 marsh treatment facilities. 8. Plant a mix-hardwood riparian buffer on all protected features. 9. Removing existing land uses of agriculture production & silviculture. 10. Restore, enhance, and protect habitat for numerous wildlife resources within the project (riparian wetland, depressional wetlands, slope seeps, and upland hardwood/pine habitat).

Site-specific mitigation goals and objectives have been developed using the North Carolina Stream Assessment Method (NC SAM) and North Carolina Wetland Assessment Method (NC WAM) analyses of existing stream systems at the Site (NC SFAT 2015 and NC WFAT 2010). Site functional assessment data forms are available upon request; model output is included in Appendix B and is summarized in the following tables. NC SAM and NC WAM metrics are not to be used to prove mitigation success; however, these functions have been academically determined as uplift within the Site. Metrics academically targeted to meet the Site's goals and objectives are depicted in bold.

Table 14. NC SAM Summary

NC SAM Function Class Rating Summary	Waxhaw Branch	UT 3 upstream	UT 3 downstream	UT 3A
(1) HYDROLOGY	**LOW**	**LOW**	**LOW**	**LOW**
(2) Baseflow	HIGH	MEDIUM	MEDIUM	MEDIUM
(2) Flood Flow	**LOW**	**LOW**	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**	**LOW**	MEDIUM
(4) Floodplain Access	MEDIUM	MEDIUM	MEDIUM	MEDIUM
(4) Wooded Riparian Buffer	**LOW**	**LOW**	**LOW**	MEDIUM
(4) Microtopography	**LOW**	**LOW**	**LOW**	**LOW**
(3) Stream Stability	MEDIUM	MEDIUM	**LOW**	**LOW**
(4) Channel Stability	HIGH	HIGH	**LOW**	**LOW**
(4) Sediment Transport	MEDIUM	MEDIUM	HIGH	MEDIUM
(4) Stream Geomorphology	MEDIUM	MEDIUM	**LOW**	**LOW**

Table 14. NC SAM Summary (continued)

NC SAM Function Class Rating Summary	Waxhaw Branch	UT 3 upstream	UT 3 downstream	UT 3A
(1) WATER QUALITY	**LOW**	**LOW**	MEDIUM	HIGH
(2) Baseflow	HIGH	MEDIUM	MEDIUM	MEDIUM
(2) Stream-side Area Vegetation	**LOW**	**LOW**	**LOW**	MEDIUM
(3) Upland Pollutant Filtration	**LOW**	**LOW**	**LOW**	MEDIUM
(3) Thermoregulation	**LOW**	MEDIUM	MEDIUM	MEDIUM
(2) Indicators of Stressors	NO	NO	NO	NO
(2) Aquatic Life Tolerance	**LOW**	**LOW**	HIGH	HIGH
(1) HABITAT	**LOW**	**LOW**	MEDIUM	MEDIUM
(2) In-stream Habitat	MEDIUM	MEDIUM	HIGH	MEDIUM
(3) Baseflow	HIGH	MEDIUM	MEDIUM	MEDIUM
(3) Substrate	MEDIUM	MEDIUM	HIGH	MEDIUM
(3) Stream Stability	HIGH	HIGH	**LOW**	**LOW**
(3) In-Stream Habitat	MEDIUM	MEDIUM	HIGH	HIGH
(2) Stream-side Habitat	**LOW**	**LOW**	**LOW**	MEDIUM
(3) Stream-side Habitat	**LOW**	**LOW**	**LOW**	MEDIUM
(3) Thermoregulation	**LOW**	**LOW**	MEDIUM	MEDIUM
OVERALL	**LOW**	**LOW**	MEDIUM	MEDIUM

Based on NC SAM output, all three primary stream functional metrics (Hydrology, Water Quality, and Habitat), as well as 15 sub-metrics are under-performing as exhibited by a LOW metric rating (see Figure 4A, Appendix A for NC SAM data reaches). LOW performing metrics are to be academically targeted for functional uplift through mitigation activities, goals, objectives, and monitoring/success criteria.

Table 15. NC WAM Summary

NC WAM Sub-function Rating Summary	Waxhaw Br Wooded Downstream Wetlands	Waxhaw Branch Ag Field Upstream Wetlands
Wetland Type	Headwater Forest	Headwater Forest
(1) HYDROLOGY	MEDIUM	**LOW**
(2) Surface Storage & Retention	MEDIUM	**LOW**
(2) Sub-surface Storage and Retention	MEDIUM	MEDIUM
(1) WATER QUALITY	MEDIUM	**LOW**
(2) Pathogen change	MEDIUM	MEDIUM
(2) Particulate Change	MEDIUM	**LOW**
(2) Soluble change	MEDIUM	MEDIUM
(2) Physical Change	**LOW**	**LOW**
(1) HABITAT	**LOW**	**LOW**
(2) Physical Structure	**LOW**	**LOW**
(2) Landscape Patch Structure	HIGH	**LOW**
(2) Vegetative Composition	MEDIUM	**LOW**
OVERALL	MEDIUM	**LOW**

Based on NC WAM output, all three of the primary wetland functional metrics (Hydrology, Water Quality, and Habitat) and 6 sub-metrics are under-performing as exhibited by a LOW metric rating. LOW performing metrics are to be academically targeted for functional uplift through mitigation activities, goals, objectives, and monitoring success criteria.

Table 16 outlines the Site's targeted stream and wetland functions identified in NC DMS 2020 guidance targeted for functional uplift, restoration goals, and success criteria.

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

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain. Remove overburden to reconnect with adjacent wetlands	Dispersion of high flows on the floodplain, increase in biogeochemical cycling within the system, and recharging of riparian wetlands	Four bankfull events within the monitoring period	3 Crest gauges (pressure transducers)	To be determined
Improve stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function	Bank height ratios remain below 1.2 over the monitoring period, and visual assessments showing progression towards stability	28 Cross-section surveys	To be determined
Restore and enhance native floodplain and streambank vegetation	Plant native tree and understory species in riparian zones and plant appropriate species on streambanks.	Reduction in floodplain sediment inputs from runoff, increased bank stability, increased large woody debris and organic material in streams	The survival rate of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7. Trees must average 7 feet in height at MY 5 and 10 feet at MY 7.	37 fixed vegetation plots and 12 temporary vegetation plots	To be determined
Restore and enhance groundwater hydrology to drained or impacted hydric soil areas.	Reduce channel depth in incised stream reaches, remove drain tile, fill drainage ditches, and alleviate soil compaction from agriculture activities.	Particulate and pollution conversion, groundwater storage and reduced downstream flooding, habitat diversification, and vegetative composition conversion	Groundwater saturation within 12 inches of the soil surface for 8 % and 10 % of the modified growing season for reestablishment and improvement of hydrology in rehabilitation areas	27 groundwater gauges	To be determined

Note: Soil temperature will be collected with a continuously recording temperature probe to verify the start of the modified growing season corroborated by vegetative indicators including documentation of bud bursts.

7. DESIGN APPROACH AND MITIGATION WORK PLAN

7.1. Stream Restoration (Figure 6, Appendix A)

Stream restoration efforts are designed to restore a stable stream that approximates hydrodynamics, stream geometry, and local microtopography relative to reference conditions. Restoration at the Site will be Priority I (with the exceptions of Priority 2 at tie-in locations) restoration throughout. Within Priority I restoration areas, bankfull elevations will be raised to meet the adjacent valley floodplain elevation.

Stream Restoration to the Site's unnamed tributaries is expected to entail 1) channel excavation, 2) channel stabilization, 3) channel diversion, and 4) channel backfill.

Dam Removal

Stream restoration within several ponds will include 1) notching the dam to dewater sediments; 2) removal of the dam to the elevation of the adjacent floodplain; 3) excavating sediment that is unsuitable for channel bank construction; 4) backfilling areas of sediment removed with soil suitable for channel construction (if necessary); 5) excavation of the design channel, 6) stabilization of the channel with coir matting, seed, and mulch; and 7) installation of structures.

The dams will be notched in the summer of 2021, and the pond bed will be seeded with temporary grasses to stabilize sediments remaining in the pond. Care will be taken during notching of the dam to drain the maximum amount of water, thereby allowing sediments to dewater.

Once the pond has dewatered, and sediments have stabilized, the dam will be removed with finished grades matching the valley's elevations and floodplain above and below the dam location. Material removed from the dam, if suitable, may be used as channel backfill for reaches of the stream to be abandoned during Priority I stream restoration efforts. If additional backfill remains, the material will be stockpiled outside of the easement or spread evenly across the adjacent property and seeded for stabilization. Erosion control measures, such as silt fence, seeding, and mulching, will be implemented on all stockpiled or spread soil materials.

A determination on sediment quantity and quality within the abandoned pond will be made concerning the ability to work with/stabilize the sediment for stream construction. If sediment is deemed unsuitable for channel construction, the sediment will be removed from the vicinity of the design channel and spread along the pond's outer margins. Subsequently, suitable soil material will be placed in the design channel's location such that design channel banks will be stabilized without liquefaction. The removal of unsuitable material, installation of suitable material, and excavation of the design channel may occur simultaneously to reduce impacts of machinery on the pond bed.

Excavation of the design channel will occur in the pond bed similar to other stream restoration reaches, with stabilization using approved erosion control materials and techniques.

Agriculture Ponds

Two agriculture ponds along the upstream reach of UT 3 are proposed for wetland enhancement by recontouring the dam level with the surrounding floodplain. These ponds are expected to remain as small depressions with vernal pools left in the floodplain for wildlife habitat. The depressions are expected to be approximately 4 to 6 inches in depth that will pond water during wet periods of the year and dry out during the summer months. These depressions may not be characterized by woody vegetation and may constitute a freshwater marsh environment.

In addition, a small agriculture pond located in the upper reaches of UT 3 is located adjacent to the conservation easement boundary. This pond is proposed to have the outfall upgraded, including a new standpipe and outfall pipe that discharges to a level spreader. The pond dam, outfall pipe, and level spreader will be located outside of the conservation easement. This structure will discharge flow across the floodplain.

In-stream Structures

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

Forded & Piped Channel Crossings

External of the easement are one forded and two piped channel crossings which will be installed at locations depicted in Figure 6 (Appendix A) to allow access to portions of property isolated by the conservation easement. The main piped crossing in the middle reach of Waxhaw Branch is within a 60-foot easement break. It is being done to replace an existing undersized pipe and to put the crossing under the existing powerline, minimizing the length of the easement break. The second piped crossing replaces an existing undersized piped located outside the easement at the top of UT 3 and does not require an easement break. The forded crossing in the middle reach of UT 2 is within a 45-foot easement break. The crossings may be constructed of hydraulically stable riprap or suitable rock. Crossings will be large enough to handle the weight of anticipated agricultural traffic. Approach grades to the crossing will be at an approximate 10:1 slope and constructed of hard, scour-resistant crushed rock or other permeable material free of fines.

Access road and ATV Paths

A significant portion of the property is being removed from development pressure by isolation from the easement. The access road to the residence is proposed to be moved into an existing powerline easement. This access road will be improved to reduce sedimentation and will be directed across a piped crossing.

Three 10-foot-wide earthen ATV paths (including three stream crossings) are proposed to cross the Site. ATV paths are approximately 1159 linear feet in length and will be earthen and/or mulched and surveyed/located on the conservation easement plat. The paths will be used to connect areas of a single parcel disconnected by the conservation easement. These areas are expected to be used for hunting or other types of outdoor enjoyment. Sections of the path within the easement are depicted in Figure 6 (Restoration Plan). The area beneath the ATV paths will not generate stream or wetland mitigation credit and are removed from the wider buffer calculator for additional stream mitigation credit.

7.2. Individual Reach Descriptions

Mitigation activities for each individual stream reach and anticipated functional uplift are summarized in Table 17.

Table 17. Individual Reach Descriptions and Functional Uplift

Individual Reach	Mitigation Activities	Functional Uplift Provided for Identified Stressors
Waxhaw Branch Upstream Restoration and Enhance II (reduced ratio)	• Tie to the existing ground surface at the upstream extent • Remove pond dam • Conduct P1 stream restoration along the 1951 stream alignment • Install grade control/habitat structures • Install several marsh treatment areas to treat agriculture runoff • Below the dam, use P1 stream restoration on the historic floodplain • Construct a forded crossing for an ATV path • Move access road under the power line and install piped channel crossing • Plant a vegetative buffer within the entire floodplain and adjacent slopes/uplands	• Non-functioning riparian buffer/wetland vegetation • Sediment • Nutrients • Peak Flows • Artificial Barriers • Ditching/Draining • Limited Bedform Diversity • Absence of Large Woody Debris

Table 17. Individual Reach Descriptions and Functional Uplift (continued)

Waxhaw Branch Downstream Restoration	• Conduct P1 stream restoration in identified abandoned channel reaches • In areas where abandoned channels are not evident, use P1 stream restoration on the historic floodplain • Install grade control/habitat structures • Tie to the historic channel elevation with a drop structure • Plant a vegetative buffer in disturbed or cleared areas including the streamside areas along Waxhaw Branch	• Non-functioning riparian buffer/wetland vegetation • Sediment • Nutrients • Peak Flows • Artificial Barriers • Ditching/Draining • Limited Bedform Diversity • Absence of Large Woody Debris
UT-1 Restoration and Enhance II (reduced ratio)	• Tie to the existing ground surface and begin P1 stream restoration • Install grade control/habitat structures • Construct a forded crossing for ATV path • Tie to Waxhaw Branch • Plant a vegetative buffer within the entire floodplain and adjacent slopes/uplands	• Non-functioning riparian buffer/wetland vegetation • Limited Bedform Diversity • Absence of Large Woody Debris
UT-2 Restoration	• Tie to the existing ground surface and begin to step up for P1 stream restoration • Install grade control/habitat structures • Install several marsh treatment areas to treat agriculture runoff • Construct a forded stream crossing and a forded ATV crossing • Tie to Waxhaw Branch. • Plant a vegetative buffer within the entire floodplain and adjacent slopes/uplands	• Non-functioning riparian buffer/wetland vegetation • Sediment • Nutrients • Peak Flows • Ditching/Draining • Limited Bedform Diversity • Absence of Large Woody Debris
UT-3 Restoration, Enhance I, and Enhance II (reduced ratio)	• Tie to the existing ground surface at an installed piped crossing • Step the channel up using grade control/habitat structures and initiate Enhancement (Level I) channel construction until the channel is suitable for P1 stream restoration activities • Recontour two pond dams to allow for freshwater marshes in the floodplain • Conduct P1 stream restoration along right bank floodplain • Install grade control/habitat structures • Treat invasive species (privet and bamboo) • Plant a vegetative buffer within the entire floodplain and adjacent slopes/uplands	• Non-functioning riparian buffer/wetland vegetation • Sediment • Nutrients • Peak Flows • Ditching/Draining • Limited Bedform Diversity • Absence of Large Woody Debris
UT-3A Restoration	• Tie to the existing ground surface at the upstream extent • Remove a relict pond dam • Conduct P1 stream restoration along the ditched stream alignment • Install grade control/habitat structures • Treat invasive species • Plant a vegetative buffer within the entire floodplain and adjacent slopes/uplands	• Nutrients • Peak Flows • Ditching/Draining • Limited Bedform Diversity • Absence of Large Woody Debris

Table 17. Individual Reach Descriptions and Functional Uplift (continued)

UT-4 Restoration	• Tie to the existing ground surface at the upstream extent • Conduct P1 stream restoration (with P2 restoration at tie-in locations) along the ditched stream channel • In braided reached conduct P1 stream restoration on left bank floodplain • Install grade control/habitat structures • Tie to the downstream reach of Waxhaw Branch with a drop structure • Clear pine trees and plant with desirable hardwood forest • Treat invasive species • Plant a vegetative buffer within the entire floodplain and adjacent slopes/uplands	• Limited Bedform Diversity • Absence of Large Woody Debris
UT-5 Restoration and Enhance II (reduced ratio)	• Tie to existing ground surface and step channel up to begin P1 stream restoration • Treat invasive species • Install grade control/habitat structures • Tie to UT 4 • Plant a vegetative buffer within the entire floodplain and adjacent slopes/uplands	• Non-functioning riparian buffer/wetland vegetation • Sediment • Nutrients • Peak Flows • Limited Bedform Diversity • Absence of Large Woody Debris

An alternatives analysis was conducted concerning the design location and structure of UT 4 and 5. Specifically, the lower reach of UT 4 is currently braided due to the channel being moved to the side of the valley and subsequent sedimentation. A single thread channel was chosen for this reach to maintain sediment transport capacity within UT 4 and direct channel hydrology down the valley towards UT 5. Ultimately UT 4 will merge with UT 5 to increase channel maintaining flow across the broad, flat Waxhaw Branch floodplain.

7.3. Wetland Reestablishment

Wetland reestablishment of drained, filled, or impounded hydric soils is designed to restore a fully functioning wetland system, provide surface water storage, nutrient cycling, remove imported elements and compounds, and create a variety and abundance of wildlife habitat.

Portions of the Site underlain by hydric soils have been impacted by pond dam construction, stream degradation, ditching and dredging, vegetative clearing, agriculture plowing, and other land disturbances associated with historical land use management. Wetland reestablishment will focus on the restoration of vegetative communities, restoration of stream corridors and historic groundwater tables, and the reestablishment of soil structure and microtopographic variations. In addition, the construction of (or provisions for) surface water storage depressions (ephemeral pools) will also add an essential component to groundwater restoration activities. These activities will result in the reestablishment of 22.886 acres of jurisdictional riparian riverine wetlands.

Both Cid and Secrest soil series have the taxonomic nomenclature of Aquic Hapludults. Based on the 2016 guidance for recommended hydroperiods of common Piedmont soils, the hydroperiods for restored wetlands are 8% and 10% of the modified growing season. The 8% hydroperiod will apply to a majority of the wetland enhancement, reestablishment, preservation, and all of the creation areas. The 10% hydroperiod will apply to an isolated wetland reestablishment area located along the left bank of Waxhaw Branch between the crossing and existing forest edge where a drainage swale provides supplemental hydrology. Also, the 10% hydroperiod will apply to wetland enhancement and reestablishment areas along both sides of Waxhaw Branch from below the confluence of UT-3 to the confluence of UT-5 (Figure 9-B). Wetland preservation areas along Waxhaw Branch below he confluence of UT-3 will maintain their current level of hydrology. These hydroperiods represent historic wetlands for the Site as

observed in pre-construction gauge data and will produce wetland hydrology associated with hydric soil field indicators.

7.4. Wetland Enhancement

Wetland enhancement will focus on the cessation of land management activities, removal of historic wetland stressors, reconnection of upstream floodplains, and the restoration of vegetative communities resulting in the enhancement of 1.442 acres of jurisdictional riparian riverine wetlands.

7.5. Wetland Creation

Wetland creation includes the area beneath the Waxhaw dam with more than 1-foot of fill material and that had earthen dam material keyed into hydric soils. Removal of the earthen dam and restoration of hydric soils, hydrology, and vegetation will result in approximately 0.0351 acres of wetland creation.

7.6. Soil Restoration

Soil grading will occur during stream restoration activities. Topsoil will be stockpiled during construction activities and spread on the soil surface once the subgrade has been established. The replaced topsoil will serve as a viable growing medium for community restoration to provide nutrients and aid in the survival of planted species.

7.7. Riparian Buffer & Wetland Vegetation Restoration

Restoration of floodplain forests allows for the development and expansion of characteristic species across the landscape. Ecotonal changes between community types contribute to habitat diversity and provide secondary benefits, such as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife.

Revegetating floodplains will provide overall system stability, shade, and wildlife habitat. In addition, viable riparian communities will improve the system's biogeochemical function by filtering pollutants from overland and shallow subsurface flows and providing organic materials to adjacent stream channels.

Currently, the Site contains limited amounts of fescue (limited to grass swales). Physical removal of fescue is likely to occur during construction. If treatment is required ahead of planting, a broadcast application of Roundup Custom (Glyphosate) at a rate of 3% and a surfactant of AgriDex at a rate of 1% mixed with water will be applied. Application of herbicide would be completed by a NC licensed specialist.

A diverse and native herbaceous seed mix will be planted across the Site. This mix will provide soil stability, ecological diversity, and favorable growing conditions for the planted woody species. Seeding will consist of a seasonally appropriate temporary nurse crop (eg. millet or cereal rye), a mix of wildflowers known to benefit wildlife, including pollinators (eg. *Rudbeckia spp., Echinacea spp., Coreopsis spp., Eupatorium coelestinum, Chamaecrista fasciculata*), and a blend of low growing grasses, which will provide long term soil stability and wildlife benefit without unduly competing with the desired forbs or woody plantings (eg. *Agrostis spp.*). See Table 18 for potential species.

Table 18. Seed Mix

Temporary Seed (Erosion and Sediment Control)			
Species	**Application Rate**	**Application Date**	**Notes**
Secale cereale (Grain Rye)	130 lbs. per acre	Year-round	Disturbed or stockpile areas
Secale cereale (Brown Top Millet)	15 lbs. per acre	May - September	Near stream channels/banks

Table 18. Seed Mix (continued)

Permanent Seed- Sitewide @ 2 lbs /acre					
Species	**%**	**Species**	**%**	**Species**	**%**
Achillea millefolium	0.8	*Coreopsis tinctoria*	4	*Juncus tenuis*	0.5
Agrostis gigantea	15	*Cosmos bipinnatus*	1	*Lespedeza capitata*	0.5
Agrostis hyemalis	5	*Consolida ajacis*	2	*Liatris spicata*	0.5
Agrostis perennans	5	*Desmodium canadense*	1	*Monarda fistulosa*	0.5
Agrostis stolonifera	2	*Echinacea purpurea*	5	*Panicum anceps*	0.5
Baptisia australis	2	*Elymus virginicus*	5	*Panicum clandestinum*	5
Carex vulpinoidea	1	*Eupatorium coelestinum*	0.5	*Penstemon digitalis*	1
Chamaecrista fasciculata	1	*Eupatorium perfoliatum*	0.5	*Rudbeckia amplexicaulis*	1
Chamaecrista nictitans	1	*Gaillardia perennial*	0.5	*Rudbeckia hirta*	3
Chrysanthemum leucanthemum	4.5	*Helianthus angustifolius*	0.5	*Senna hebecarpa*	0.5
Chrysanthemum x superbum	3	*Heliopsis helianthoides*	0.5	*Tridens flavus*	18
Coreopsis lanceolata	4	*Hibiscus moscheutos*	5	*Verbena hastata*	1
Permanent Seed- Marsh Treatments, Pools, Seeps @ 5 lbs /acre					
Species	**%**	**Species**	**%**	**Species**	**%**
Panicum rigidulum	36	*Carex albolutescens*	8	*Carex lupulina*	5
Bidens aristosa	20	*Elymus virginicus*	6	*Carex vulpinoidea*	2
Helianthus angustifolius	18	*Juncus effusus*	5		

Variations in vegetative planting will occur based on the topography and hydrologic condition of soils. Vegetative species composition will be based on RFEs, site-specific features, and community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990). Community associations to be utilized include 1) Piedmont/Low Mountain Alluvial Forest, 2) Dry-Mesic Oak-Hickory Forest, and 3) Streamside Assemblage.

Bare-root seedlings within the Piedmont/Low Mountain Alluvial Forest and Dry-Mesic Oak-Hickory Forest will be planted at a density of approximately 680 stems per acre on 8-foot centers. In the stream-side assemblage, planting will occur at a density of roughly 2,720 stems per acre on 4-foot centers. Planting will be performed between November 15 and March 15 to allow plants to stabilize during the dormant period and set roots during the spring season. Potential species planted within the Site are detailed in Table 19 depicts the total number of stems and species distribution within each vegetation association (Figure 8, Appendix A).

Portions of the Site adjacent to UT 4 characterized by pine plantation are proposed to be cleared of pine trees and replaced with desirable hardwood forest. Clearing of pines will be conducted using best forestry management practices, including avoiding unnecessary impacts to existing streams and wetlands. Pine trees removed will be mulched and used within the Site along ATV paths or kept whole and distributed along the Waxhaw floodplain to introduce organic material back into the system. The area will be planted with trees, as depicted in Figure 8 (Appendix A).

Table 19. Planting Plan

Vegetation Association		Piedmont/Low Mountain Alluvial Forest*		Dry-Mesic Oak-Hickory Forest*		Stream-side Assemblage**		TOTAL	Potential substitute species or species for adaptive management planting
Area (acres)		28.0		22.2		7.8		58.0	
Species	**Indicator Status**	**# planted***	**% of total**	**# planted***	**% of total**	**# planted**	**% of total**	**# planted**	**Species**
River birch (*Betula nigra*)	FACW	2094	11	--	--	3182	15	5277	Box elder (*Acer negundo*) Hornbeam (*Carpinus caroliniana*) Sugarberry (*Celtis occidentalis*) Green ash (*Fraxinus pennsylvanica*) Red Mulberry (*Morus rubra*) Eastern cottonwood (*Populus deltoides*) Overcup oak (*Quercus lyrate*) Swamp chestnut oak (*Quercus michauxii*) Willow oak (*Quercus phellos*) Chestnut oak (*Quercus prinus*) Shumard oak (*Quercus shumardii*) American Elm (*Ulmus americana*) Slippery Elm (*Ulmus rubra*) Silky willow (*Salix caroliniana*)*** Silky dogwood (*Cornus amomumI*)*** Elderberry (*Sambucus nigra*)*** Button bush (*Cephalanthus occidentalis*)*** Arrowwood viburnum (*Viburnum dentatum*)***
Winged elm (*Ulmus alata*)	FACW	--	--	1510	10	--	--	1510	
Hackberry (*Celtis laevigata*)	FACW	2094	11	--	--	--	--	2094	
Red bud (*Cercis canadensis*)	FACU	--	--	1510	10	--	--	1510	
Silky dogwood (*Cornus amomum*)	FACW	2094	11	--	--	4243	20	6338	
Shagbark hickory (*Carya ovata*)	FACU	--	--	1510	10	--	--	1510	
Persimmon (*Diospyros virginiana*)	FAC	--	--	1510	10	--	--	1510	
Black gum (*Nyssa sylvatica*)	FAC	2094	11	1510	10	--	--	3604	
American holly (*Ilex Opaca*)	FACU	381	2	--	--	2122	10	2502	
Tulip poplar (*Liriodendron tulipifera*)	FACU	3046	16	--	--	--	--	3046	
Sycamore (*Platanus occidentalis*)	FACW	3046	16	--	--	4243	20	7290	
Mockernut hickory (*Carya alba/tomentosa*)	UPL	--	--	1510	10	--	--	1540	
Water oak (*Quercus nigra*)	FAC	2094	11	2264	15	4243	20	8602	
White oak (*Quercus alba*))	FACU	2094	11	2264	15	--	--	4359	
Red oak (*Quercus rubra*)	FACU	--	--	1510	10	--	--	1510	
Black willow (*Salix nigra*)***	OBL	--	--	--	--	3182	15	3182	
TOTAL		**19,040**	**100**	**15,096**	**100**	**21,216**	**100**	**55,352**	

* Planted at a density of 680 stems/acre.

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

***Live stakes

7.8. Fence / Easement Marking

The entire easement area will be appropriately marked to identify the easement boundaries per United States Army Corps of Engineers (USACE) and Interagency Review Team (IRT) requirements. No livestock operations exist on the adjacent properties; therefore, fencing will not be used on the Site. ATV path boundaries will be marked on either side as they cross through the easement at appropriate distances (+/- every 25-feet). Easement signage will also be attached to these posts.

7.9. Nuisance Species Management

Beaver, privet, and other potential nuisance species will be monitored throughout the seven years of monitoring. Locations of species and dams will be mapped and identified on the annual CCPV. Invasive will be controlled by either mechanical or chemical methods as part of the project. Beavers and dams will be removed promptly. Inspections for beaver and invasive species will occur at least twice a year.

7.10. ATV Trails

ATV paths are internal and subject to the conservation easement. Boundaries will be marked on either side as they cross through the easement at appropriate distances (+/- every 25-feet). Easement signage will also be attached to these posts. The ATV paths will be mulched prior to the completion of construction activities. Significant maintenance is not anticipated. If encroachment does occur, the sponsor may plant larger caliber trees on either side. If any maintenance is required, the landowner must coordinate with DMS and stewardship before work begins.

8. MONITORING AND SUCCESS CRITERIA

Monitoring will be conducted by Axiom Environmental, Inc based on the schedule in Table 20. A summary of monitoring is outlined in Table 21 (Figure 9, Appendix A). Annual monitoring reports will be submitted to the NCDMS by Restoration Systems no later than December 31 of each monitoring year data is collected.

Table 20. Monitoring Schedule

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

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Table 21. Monitoring Summary

Stream Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Stream Profile	Full longitudinal survey	As-built (unless otherwise required)	All restored stream channels	Graphic and tabular data.
Stream Dimension	Cross-sections	Years 1, 2, 3, 5, and 7	Total of 28 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern depicted on the plan view figure with a written assessment and photograph of the area included in the report
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Stream Hydrology	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through the monitoring period	5 surface water gauges on UT 2, 3A, 3, 4, and 5	Surface water data for each monitoring period
Bankfull Events	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through the monitoring period	3 crest gauges (pressure transducers on Waxhaw Br up-and downstream, and UT 3	Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through the monitoring period	Visual monitoring and photographic evidence as needed	Visual evidence, photo documentation, and/or rain data.
Benthic Macroinvertebrates	"Qual 4" method described in *Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates, Version 5.0* (NCDWR 2016)	Pre-construction, Years 3, 5, and 7 during the "index period" referenced in *Small Streams Biocriteria Development* (NCDWQ 2009)	2 stations (on Waxhaw Br upstream and UT 3 downstream); however, the exact locations will be determined at the time pre-construction benthics are collected	Results will be presented on a site-by-site basis. They will include a list of taxa collected, an enumeration of *Ephemeroptera, Plecoptera, Tricopetera* taxa, and Biotic Index values. *
Wetland Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Wetland Restoration	Groundwater gauges	Years 1, 2, 3, 4, 5, 6, and 7 throughout the year, with the modified growing season as defined below in Section 8.1	27 gauges spread throughout restored wetlands	Soil temperature and bud burst of two woody species at the beginning of each monitoring period to verify the start of the modified growing season, groundwater and rain data for each monitoring period
	Soil profile descriptions	As-built and Years 3, 5, and 7	27 soil profile descriptions, one at each groundwater gauge	Soil profile descriptions completed to assess the development of hydric soil morphologic features
Vegetation Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Vegetation establishment and vigor	Permanent vegetation plots 0.0247 acres (100 square meters) in size	As-built, Years 1, 2, 3, 5, and 7	37 plots spread across the Site	Species, height, planted vs. volunteer, stems/acre
	Annual random vegetation plots, 0.0247 acres (100 square meters) in size	As-built, Years 1, 2, 3, 5, and 7	12 plots randomly selected each year	Species and height

*Benthic Macroinvertebrate sampling data will not be tied to success criteria; however, the data may be used as a tool to observe positive gains to in-stream habitat

8.1. Success Criteria

Monitoring and success criteria for stream restoration should relate to project goals and objectives identified from on-site NC SAM and NC WAM data collection. Several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving success criteria. Table 22 summarizes Site success criteria.

Table 22. Success Criteria

Streams
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • Continuous surface flow in each intermittent tributary should occur each year for at least 30 consecutive days. • Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section over the monitoring period. • BHR at any measure riffle cross-section should not change by more than 10% from baseline condition during any single monitoring year. • The stream project shall remain stable, and all other performance standards shall be met through four separate bankfull events, occurring in separate years, during the monitoring years 1-7.
Wetland Hydrology & Soils
• During average climatic conditions, saturation or inundation within the upper 12 inches of the soil surface for 8 percent and 10 percent of the modified growing season as defined below (Figure 9B, Appendix A). • Soil profile descriptions must meet one of the hydric soil indicators identified in the Field Indicators of Hydric Soils in the United States, Version 8.2 (USDA 2018) in monitoring years 4 and 7.
Vegetation
• Within planted portions of the Site, a minimum of 320 stems per acre must be present at year 3, a minimum of 260 stems per acre must be present at year 5, and a minimum of 210 stems per acre must be present at year 7. • Trees must average 7 feet in height at year 5 and 10 feet at year 7. • Planted and volunteer stems are counted, provided they are included in the approved planting list for the Site; natural recruits not on the planting list may be considered by the IRT on a case-by-case basis. • Any single species can only account for up to 50% of the required number of stems within any vegetation plot.

Growing season is defined by each of the following three sources:

1. The 1987 Corps of Engineers Wetland Delineation Manual (1987 Manual) (Environmental Laboratory 1987) defines "growing season" in the Appendix A – Glossary as, “The portion of the year when soil temperatures at 19.7 in. below the soil surface are higher than biologic zero (5°C) (U.S. Department of Agriculture-Soil Conservation Service 1985). For ease of determination this period can be approximated by the number of frost-free days (U.S Department of the Interior 1970).”

2. The Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0) (EMP Supplement) defines “growing season” in the Appendix A – Glossary as, “In the Eastern Mountains and Piedmont Region, growing season dates are determined through onsite observations of the following indicators of biological activity in a given year: (1) above-ground growth and development of vascular plants and/or (2) soil temperature (see Chapter 4 for details). If onsite data gathering is not practical, growing season dates may be approximated by using WETS tables available from the NRCS National Water and Climate Center to determine the median dates of 28°F (−2.2°C) air temperatures in spring and fall based on long-term records gathered at the nearest appropriate National Weather Service meteorological station.”

3. The USACE 2016 mitigation guidance indicates the following for where to source data and how to identify the growing season, "The growing season information can be derived from County Soil Survey data and/or the USACE Regional Supplements (Atlantic and Gulf Coastal Plain Region, 2012, Eastern Mountains and Piedmont Region, 2012). In addition, the growing season will occur for the period identified on the WETS data tables for a probability of 50% and an air temperature of 28 °F."

Using the USACE 2016 mitigation guidance and based on a probability of 50% and an air temperature of 28°F the growing season is defined for Union County as the following:

1. Union County Soil Survey (USDA 1996), which uses recorded data from 1951-1981 at Monroe, North Carolina as:
    a. March 28 – November 3 (219 days)
2. USDA NRCS - National Water and Climate Center - Agricultural Applied Climate Information System (AgACIS) Monroe 2 SE, NC station (the closest station to the Site) as:
    a. March 23 – November 6 (228 days) using recorded data from 1971-2000
    b. March 23 – November 11 (233 days) using recorded data from 1981-2010
    c. March 18 – November 14 (241 days) using recorded data from 1991-2020

Based on the available historic data there are a range of growing season start and end dates with a trend of growing seasons becoming longer for each of the 30-year increments from 1951 – 2020. Records for the AgACIS station and county soil survey growing season data are in Appendix B,

A modification to the beginning of the growing season is proposed to capture the period of time when conditions (i.e. soil temperature is ≥ 41°F at 12-inches) are suitable for soil microbes to be active and take part in the process of forming hydric soil indicators. This is critical for this Site as the hydric soil indicators observed in the Site's existing jurisdictional wetlands are forming when wetland hydrology is present prior to the historic growing season start date.

For this Site the modified growing season will begin when the soil temperature at 12-inches below the soil surface is 41°F and two or more different non-evergreen vascular plant species growing in the wetland or surrounding area exhibit bud burst on two woody plants (i.e., some green foliage is visible between spreading bud scales). The modified growing season will not start earlier than March 1.

Since a modification to the beginning of the growing season is proposed a modification to the end of the growing season is deemed necessary by the NC IRT. The 1987 Manual and the EMP supplement both state the growing season continues as long as the soil temperature remains at ≥ 41°F. The USCAE 2016 mitigation guidance states, "…growing seasons that start earlier than March 1 or end later than November 20 may not be approved, depending upon project location."

Soil temperature was considered as an indicator to end the modified growing season; however, after viewing the DMS Crooked Creek soil temperature monitoring data in northwest Union County along with the research performed by Megonigal et al. 1996 it is likely soil temperature remains at 41 °F (5 °C) or higher at the 12 in. (30 cm) depth under normal conditions within this region well past November 20. Using the most recent (1991-2020) historic 30-year WETS data from AgACIS Monroe 2 SE, NC station the modified growing season end date will occur on November 14 as outlined in the 2012, Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region.

8.2. Contingency

If stream success criteria are not fulfilled, a mechanism for contingency will be implemented.

8.2.1. Stream Contingency

Stream contingency may include but may not be limited to 1) structure repair and/or installation; 2) repair of dimension, pattern, and/or profile variables; and 3) bank stabilization. The contingency method will be dependent

upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success, include 1) structure failure, 2) headcut migration through the Site, and/or 3) bank erosion.

Structure Failure

If structures are compromised, the affected structure will be repaired, maintained, or replaced. Once the structure is repaired or replaced, it must function to stabilize adjacent stream banks and/or maintain grade control within the channel. Structures that remain intact but exhibit flow around, beneath, or through the header/footer will be repaired by excavating a trench on the structure's upstream side. Filter fabric will be reinstalled in front of the pilings, and the channel backfilled to its appropriate pattern, dimension and profile. Structures that have been compromised, resulting in shifting or collapse of a header/footer, will be removed and replaced with a structure suitable for Site flows.

Headcut Migration Through the Site

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

Bank Erosion

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

Beaver and other Invasive Species

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

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

Road/Culvert Maintenance

Observation of road crossings/culverts will occur during regular monitoring visits conducted at the Site. Culverts will be monitored primarily for blockage; however, it will also be noted if erosion is occurring. Roadbeds, culverts, and crossings will be monitored for the seven-year monitoring period to ensure no additional sediment deposition occurs within the Site. Once the seven-year monitoring period has expired, maintenance of the crossing will be the landowner's responsibility.

Development/Logging

Topographic re-entrants discharging into the conservation easement typically are directed into marsh treatment areas that treat the initial stormwater pulse to capture sediment and nutrients from adjacent runoff. These areas will naturalize over time into small wetland depressions. If the property adjacent to the Site is developed or logged such that excessive sediment enters the Site, the marsh treatment area may be re-excavated to capture additional

drainage effluent. Maintenance of the marsh treatment area is not expected to occur over an extended period; however, short-term maintenance may occur until stabilization of the adjacent landscape features occurs.

8.2.2. Wetland Contingency

Hydrological contingency will require consultation with hydrologists and regulatory agencies if wetland hydrology enhancement is not achieved. Floodplain surface modifications, including the construction of ephemeral pools, represent a likely mechanism to increase the floodplain area in support of jurisdictional wetlands. Recommendations for a contingency to establish wetland hydrology will be implemented and monitored until Hydrology Success Criteria are achieved.

In Year 5, if the development of a hydric soil field indicator is not achieved, additional evaluations will be implemented to determine why a hydric soil indicator is not present. Initially, the vegetation, groundwater gauge, and rainfall data will be evaluated to identify if conditions are present for a hydric soil indicator to form. After reviewing the data, additional soil profile descriptions will be completed to determine the extent of the wetland reestablishment area lacking the development of a hydric soil indicator. A summary of the soil evaluation and recommendations will be included in the monitoring report.

8.2.3. Vegetation Contingency

If vegetation success criteria are not achieved, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting is expected to occur during the appropriate planting season (December through March). Supplemental planting will be performed as needed until the achievement of vegetation success criteria. Monitoring of supplemental planting will occur until IRT approval has been obtained.

8.3. Compatibility with Project Goals

Table 23 outlines the compatibility of Site performance criteria described above to Site goals and objectives that will be utilized to evaluate if Site goals and objectives are achieved.

Table 23. Compatibility of Performance Criteria to Academic Project Goals and Objectives

Goals	Objectives	Success Criteria
(1) HYDROLOGY		
Restore proper hydrodynamics to the Site and downstream receiving waters.	• Construct new channels at historic floodplain elevation to restore overbank flows • Remove impoundment and restore valley topography • Plant woody riparian buffer 150' from stream and wetland features • Deep rip floodplain soils to reduce compaction and increase soil surface roughness • Protect riparian buffers with a perpetual conservation easement	• BHR not to exceed 1.2 • < 10% change in BHR in any given year • Document four overbank events in separate monitoring years • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Cross-section measurements indicate a stable channel with the appropriate substrate • Visual documentation of stable channels and structures
(1) WATER QUALITY		
Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	• Plant a woody riparian buffer 150-feet off 90% of the Site's streams and wetlands and a 100-foot buffer on the Site's ephemeral streams. • Re-establish and enhance jurisdictional wetlands • Provide surface roughness and reduce compaction through plowing. • Restore overbank flooding by constructing channels at historic floodplain elevation. • Enhance existing wetlands by removing stressors and returning existing wetlands back to appropriate hydroperiods.	• Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria

(1) HABITAT		
Improve instream and stream-side habitat.	• Construct stable channels with the appropriate substrate and at historic floodplain elevations to restore overbank flows. • Remove impoundment & restore the Waxhaw Branch FEMA floodplain to historic conditions. • Plant woody riparian buffer to provide organic matter and shade • Re-establish and enhance existing jurisdictional wetlands • Provide large-woody debris in floodplain wetlands and project buffers to historic conditions. • Re-establish and enhance existing jurisdictional wetlands	• Cross-section measurement indicates a stable channel with the appropriate substrate • Visual documentation of stable channels and in-stream structures • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria

9. ADAPTIVE MANAGEMENT PLAN

If the mitigation Site or a specific component of the Site fails to achieve the necessary performance standards as specified in the mitigation plan and 2026 NCIRT guidance, the sponsor shall notify the Division on Mitigation Services (DMS), who in turn will inform members of the IRT. The Sponsor and DMS will work with the IRT to develop contingency plans remedial actions.

10. LONG-TERM MANAGEMENT PLAN

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

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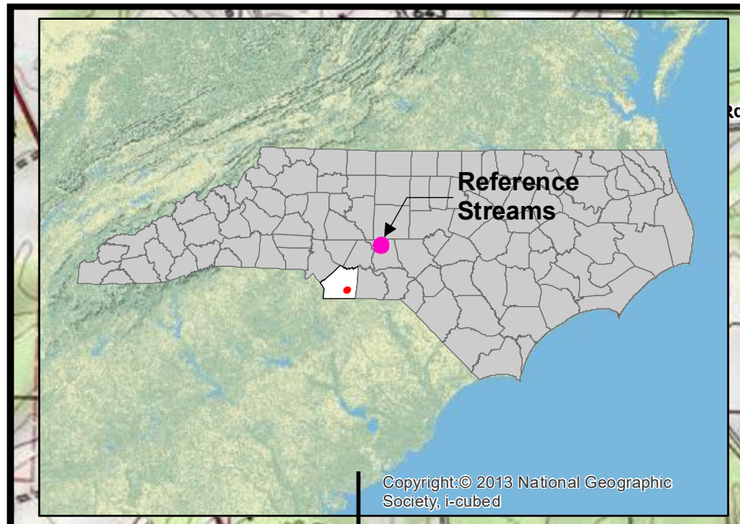
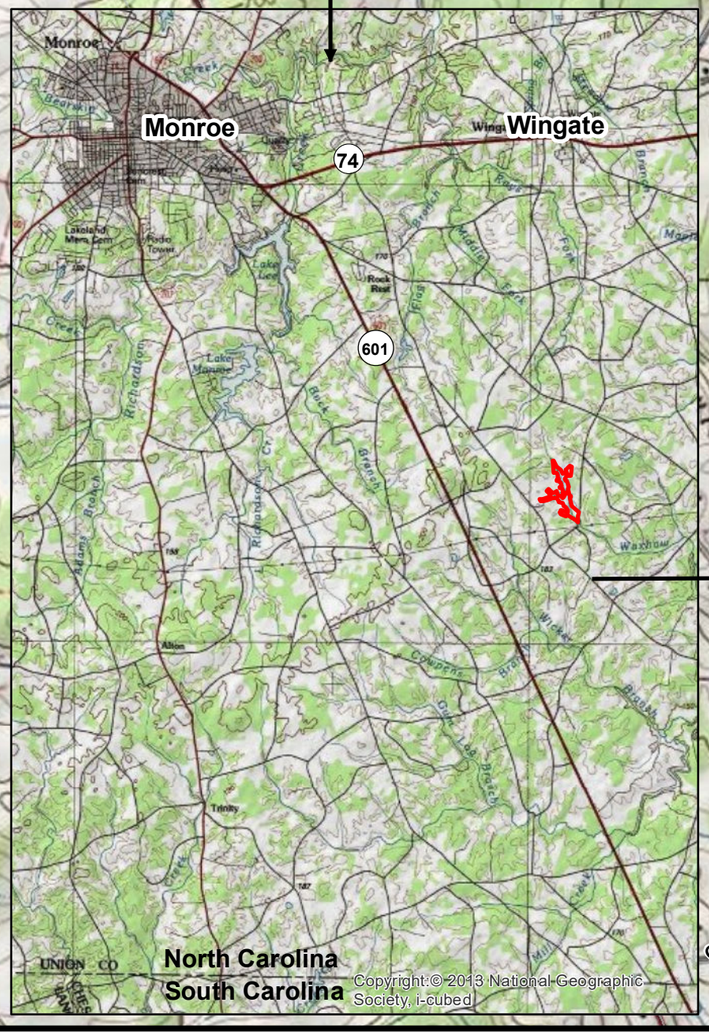
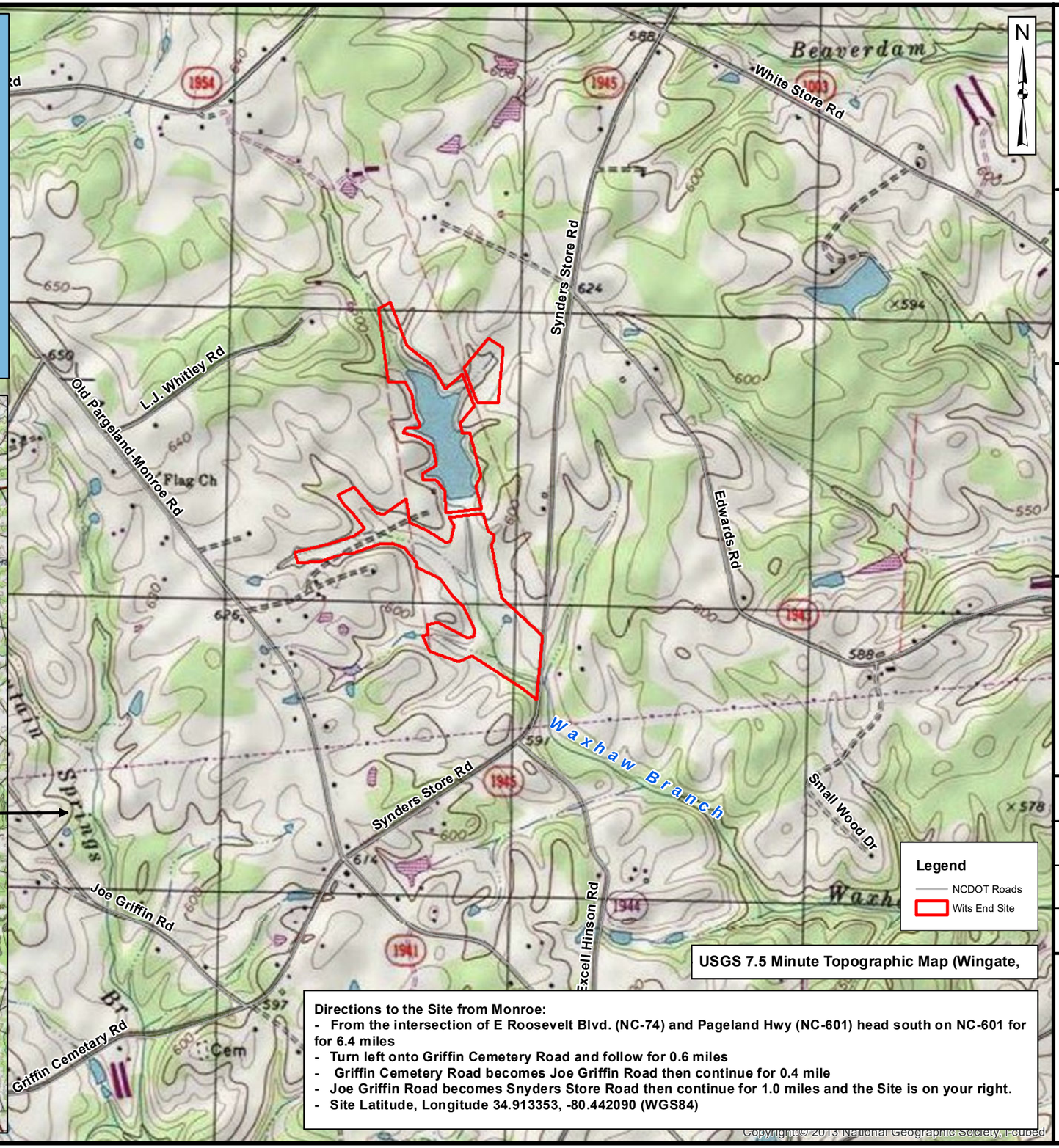
APPENDIX A. FIGURES







USGS 7.5 Minute Topographic Map (Wingate,

Directions to the Site from Monroe:
- From the intersection of E Roosevelt Blvd. (NC-74) and Pageland Hwy (NC-601) head south on NC-601 for for 6.4 miles
- Turn left onto Griffin Cemetery Road and follow for 0.6 miles
- Griffin Cemetery Road becomes Joe Griffin Road then continue for 0.4 mile
- Joe Griffin Road becomes Snyders Store Road then continue for 1.0 miles and the Site is on your right.
- Site Latitude, Longitude 34.913353, -80.442090 (WGS84)

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WITS END SITE

Union County, NC

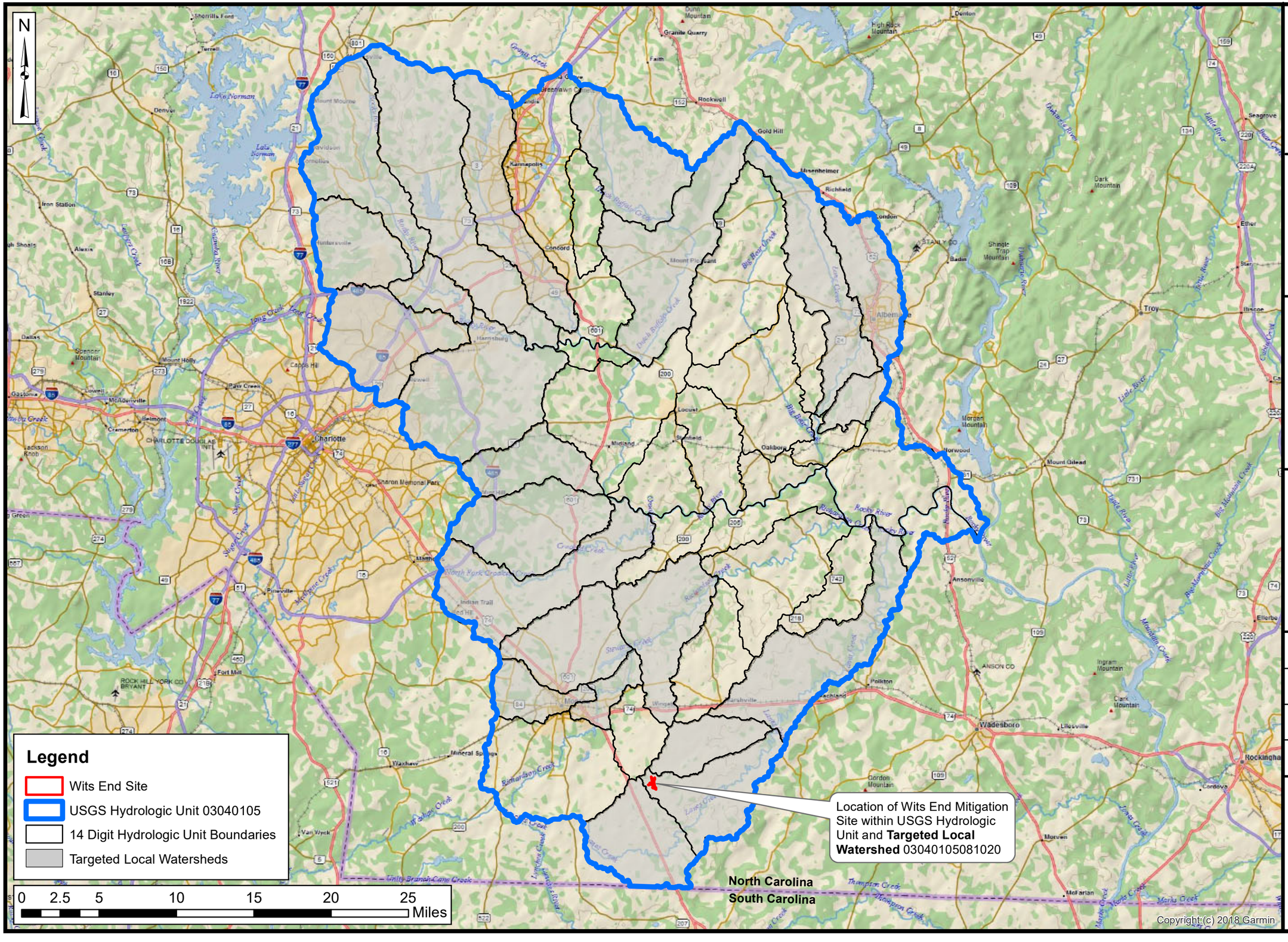
Title:

SITE LOCATION

Drawn by:	WGL
Date:	JUNE 2020
Scale:	1:15,000
Project No.:	20-011

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WITS END SITE

Union County, NC

Title:

HYDROLOGIC UNIT MAP

Drawn by: KRJ

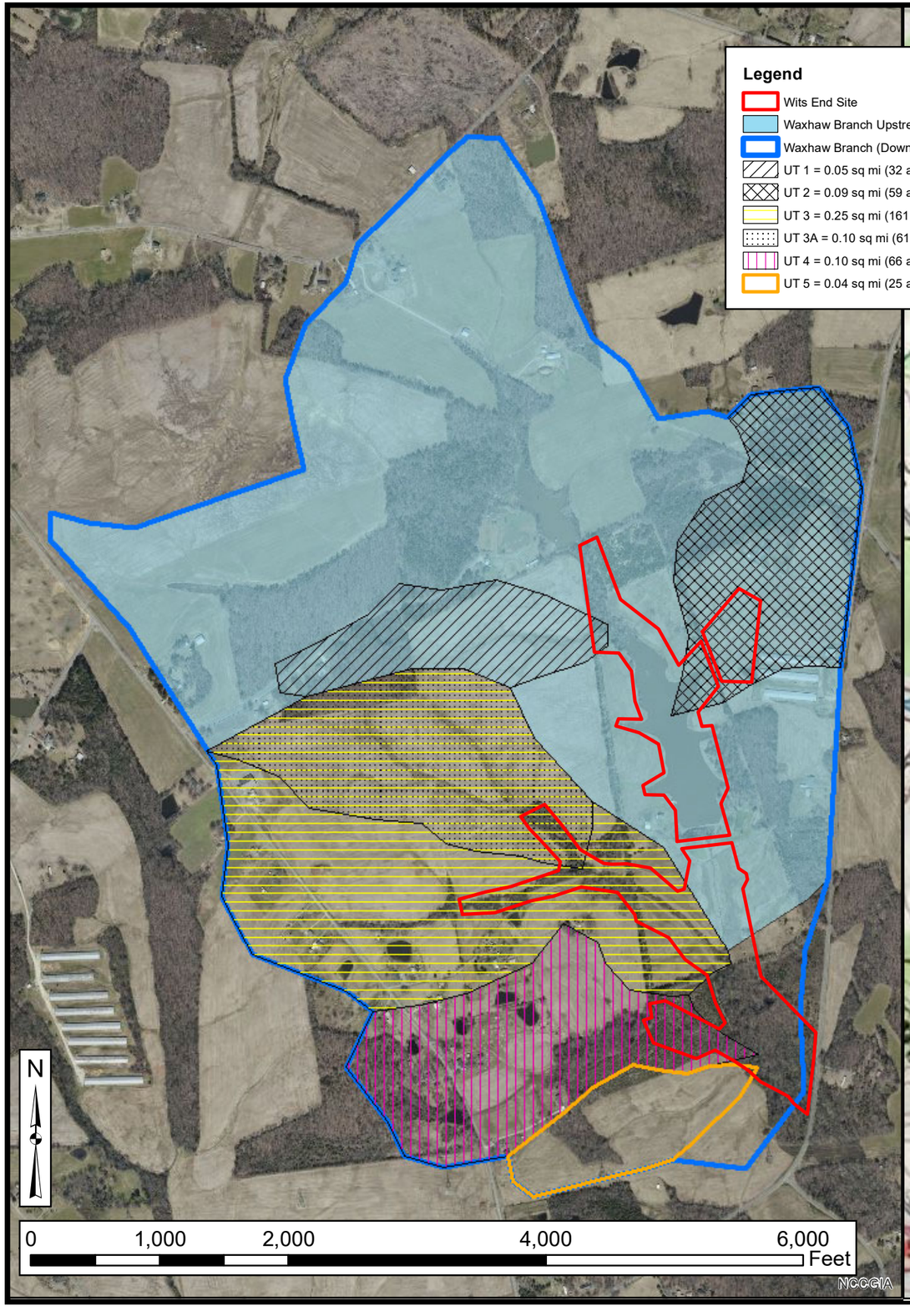
Date: JUNE 2020

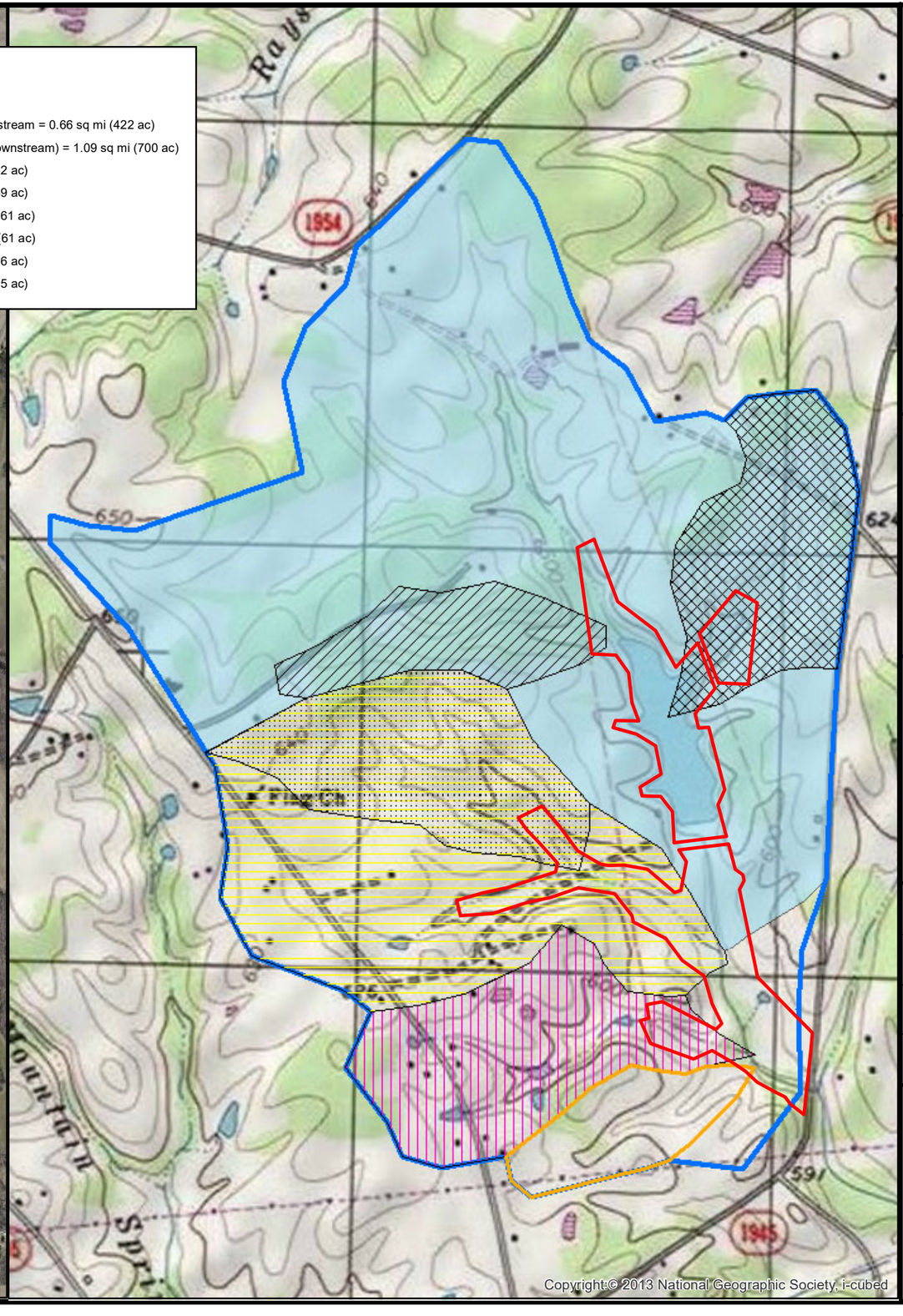
Scale: 1:370,000

Project No.: 20-011

FIGURE

2





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WITS END SITE

Union County, NC

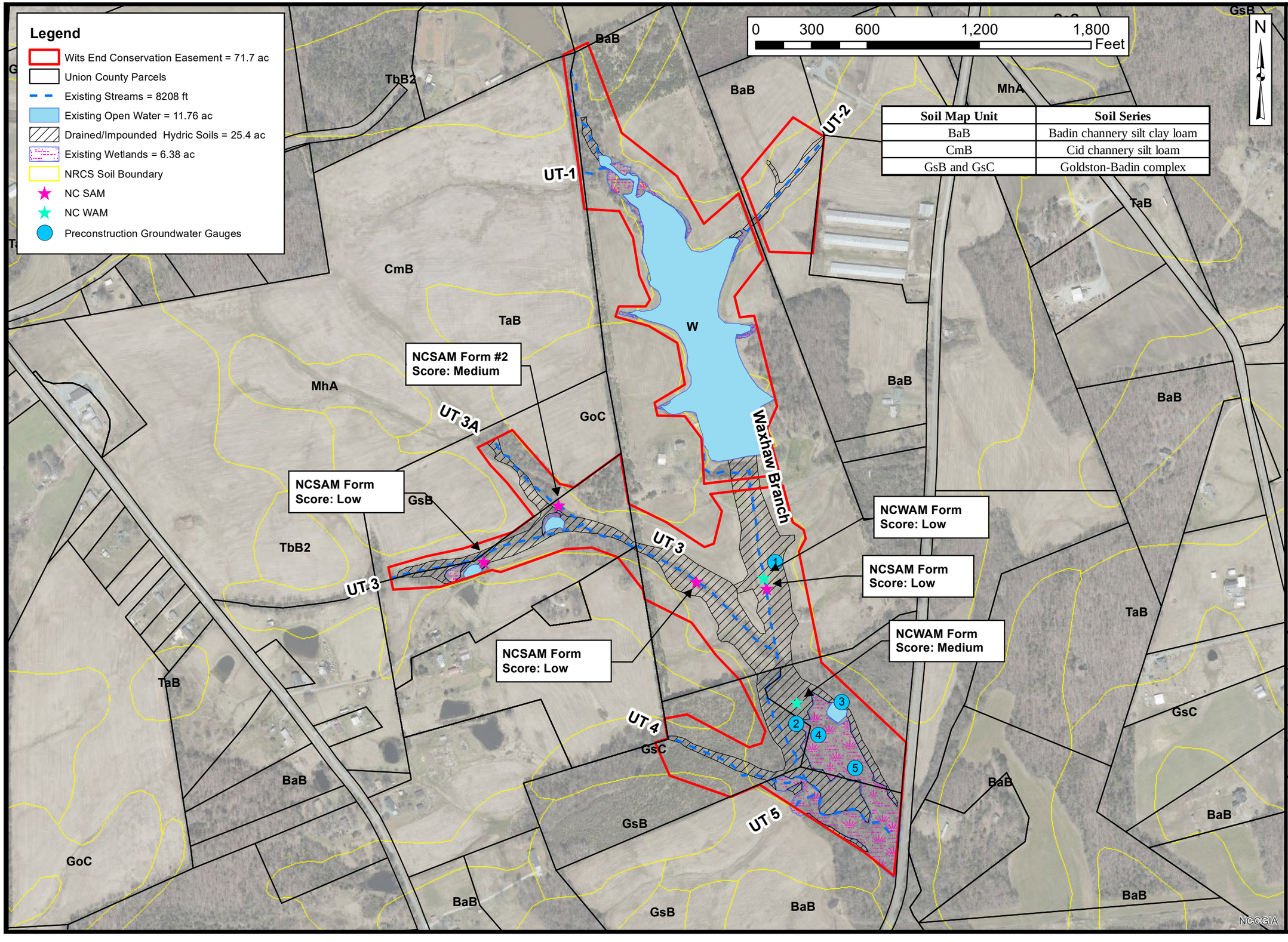
Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by:	KRJ
Date:	JUNE 2020
Scale:	1:12,000
Project No.:	20-011

FIGURE

3



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WITS END SITE

Union County, NC

Title:

EXISTING CONDITIONS AND SOILS

Drawn by: KRJ

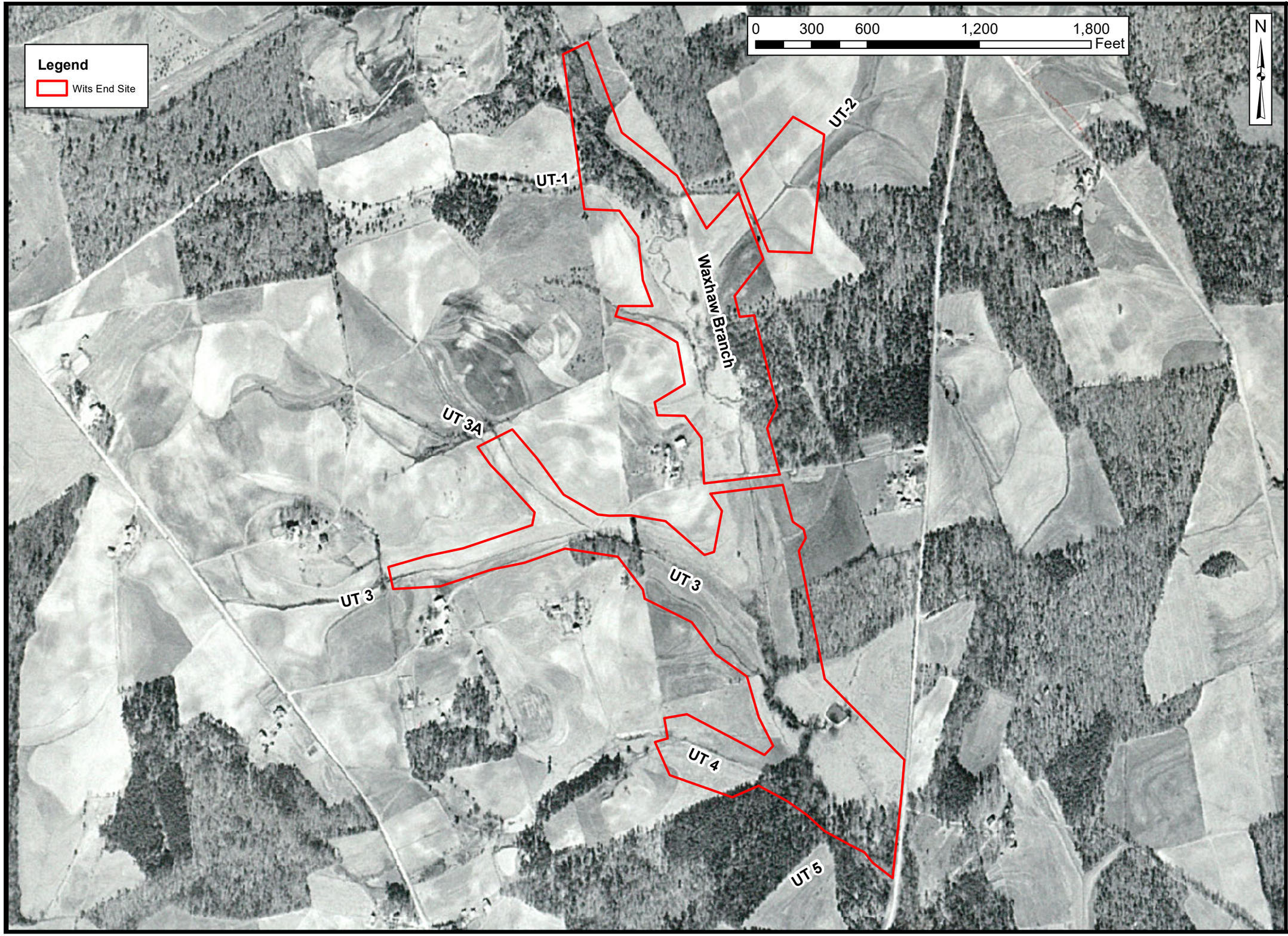
Date: JUNE 2020

Scale: 1:3700

Project No.: 20-011

FIGURE

4A



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WITS END SITE

Union County, NC

Title:

1951 Aerial Photography

Drawn by: KRJ

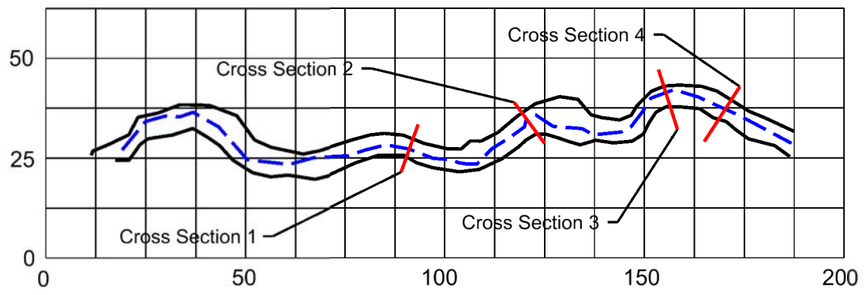
Date: JUNE 2020

Scale: 1:3700

Project No.: 20-011

FIGURE

4B

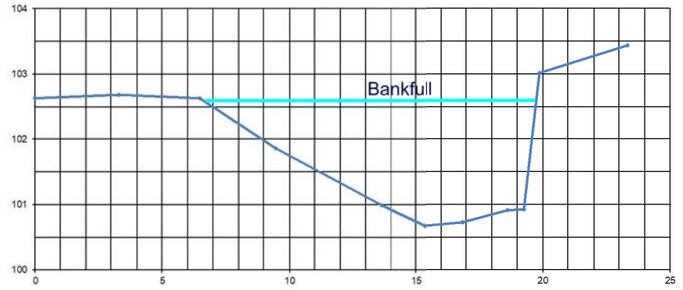


Reference Pattern

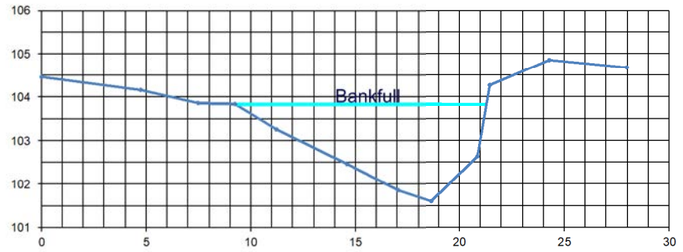
Lp-p = 52 (37 - 64) ft
Lm = 86 (60 - 97) ft
Wbelt = 28 (24 - 33) ft
Rc = 21 (12 - 28) ft
Lp-p/Wbkf = 4.2 (3.0 - 5.3)
Lm/Wbkf = 7.1 (5.0 - 8.0)
Wbelt/Wbkf = 2.3 (2.0 - 2.7)
Rc/Wbkf = 1.7 (1.0 - 2.3)
SIN = 1.14

Pattern Legend

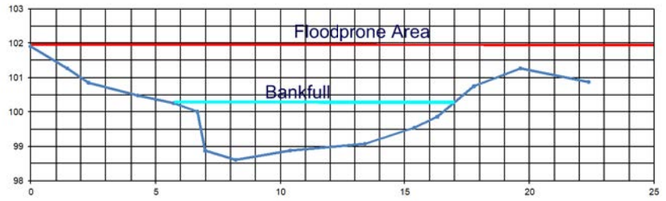
- Top of Bank
- Thalweg
- Cross Section



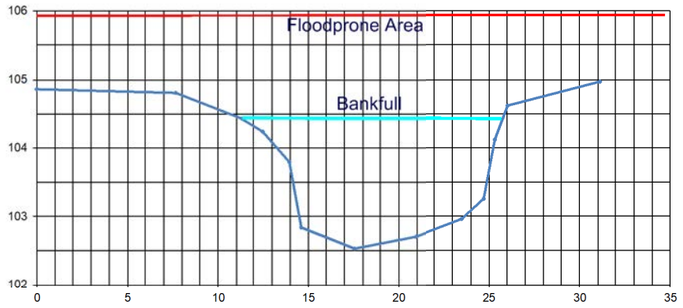
Cross Section 2 - Pool
Abkf = 16.9 ft
Wbkf = 13.3 ft
Dmax = 2.0 ft



Cross Section 3 - Pool
Abkf = 15.4 ft
Wbkf = 12.0 ft
Dmax = 2.2 ft

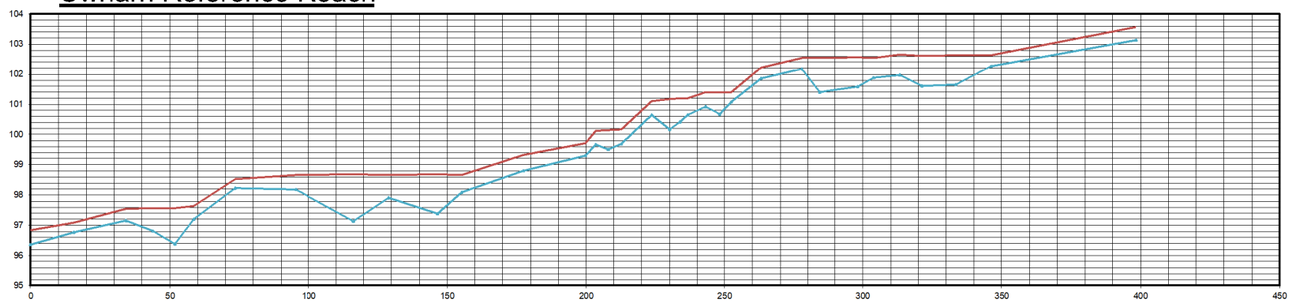


Cross Section 1 - Riffle
Abkf = 12.0 ft
Dave = 1.1 ft
Wbkf = 11.2 ft
Dmax = 1.6 ft
Bank Height = 1.6 ft
Bank Height Ratio = 1.0
W/D = 10.6
FPA = 50
ENT = 4.4
Stream Type = E



Cross Section 4 - Riffle
Abkf = 16.3 ft
Dave = 1.3 ft
Wbkf = 13.0 ft
Dmax = 1.7 ft
Bank Height = 1.7 ft
Bank Height Ratio = 1.0
W/D = 10.4
FPA = 50
ENT = 3.8
Stream Type = E

Uwharri Reference Reach



Profile (Reference Reach)

Save = 0.0168 rise/run
Svalley = 0.0192 rise/run
Sriffle = 0.0283 (0.0096 - 0.0846) rise/run
Spool = 0.0013 (0 - 0.0082) rise/run
Srun = 0 (0 - 0.0091) rise/run
Sglide = 0.0027 (0 - 0.0102) rise/run

- Water Surface
- Channel Bed

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Wits End

Union County
North Carolina

Title:
Uwharri
Reference Reach
Dimension, Pattern,
and Profile

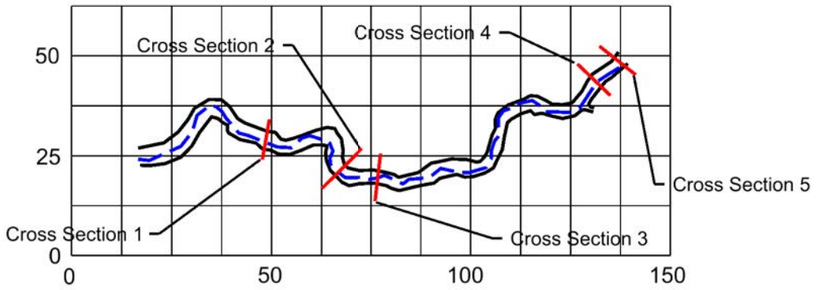
Scale: NA

Date: Sept 2020

Project No.: 20-011

FIGURE NO.

5A

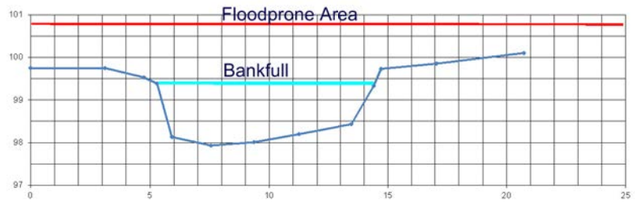


Reference Pattern

Lp-p = 30 (16 - 44) ft
Lm = 41 (29 - 65) ft
Wbelt = 21 (15 - 26) ft
Rc = 10 (5 - 18) ft
Lp-p/Wbkf = 3.4 (1.9 - 5.1)
Lm/Wbkf = 4.8 (3.3 - 7.5)
Wbelt/Wbkf = 2.5 (1.7 - 3.0)
Rc/Wbkf = 1.1 (0.5 - 2.0)
SIN = 1.26

Pattern Legend

- Top of Bank
- Thalweg
- Cross Section



Cross Section 1 - Riffle

Abkf = 10.4 ft
Dave = 1.1 ft
Wbkf = 9.1 ft
Dmax = 1.4 ft
Bank Height = 1.4 ft
Bank Height Ratio = 1.0
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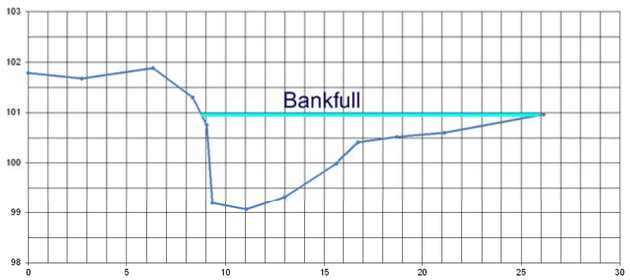
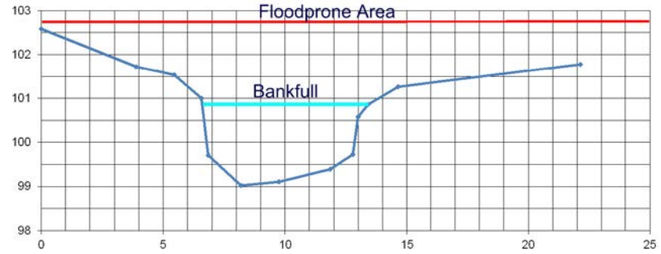
FPA = 50
ENT = 5.5
Stream Type = E



Cross Section 2 - Pool

Abkf = 14.2 ft
Wbkf = 17.4 ft
Dmax = 1.9 ft



Cross Section 3 - Riffle

Abkf = 9.8 ft
Dave = 1.4 ft
Wbkf = 6.8 ft
Dmax = 1.8 ft
Bank Height = 1.8 ft
Bank Height Ratio = 1.0
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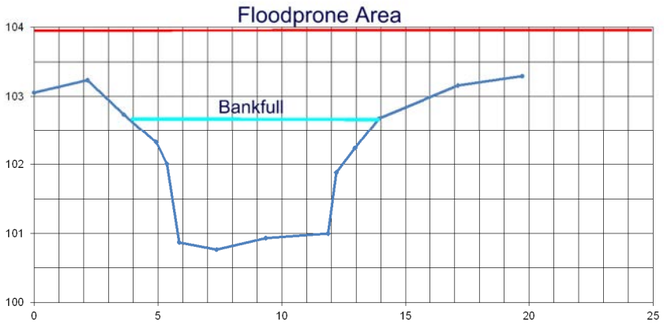
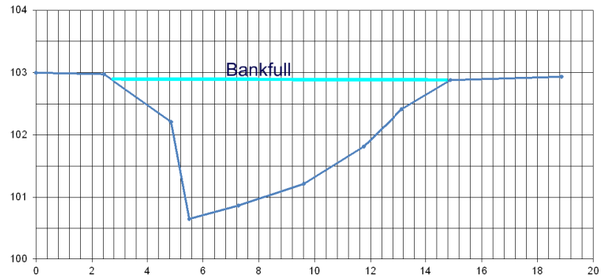
FPA = 50
ENT = 7.3
Stream Type = E



Cross Section 4 - Riffle

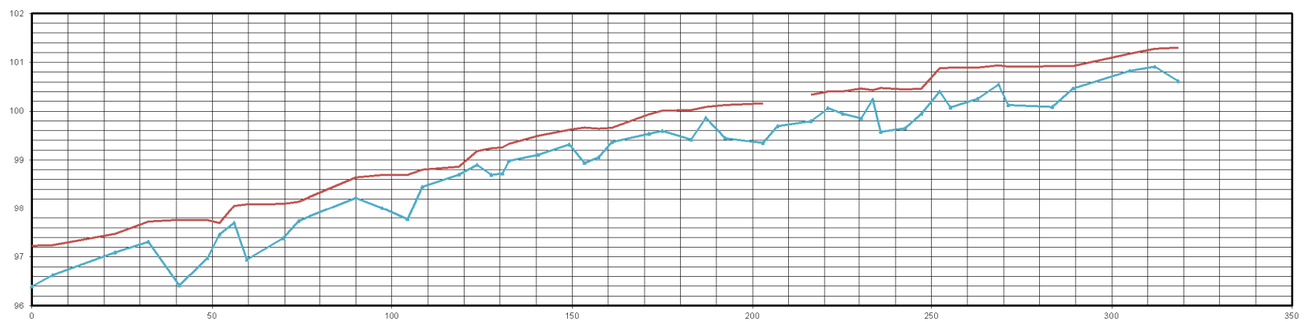
Abkf = 12.9 ft
Dave = 1.3 ft
Wbkf = 10.1 ft
Dmax = 1.9 ft
Bank Height = 1.9 ft
Bank Height Ratio = 1.0
W/D = 7.9
FPA = 50
ENT = 4.9
Stream Type = E



Cross Section 5 - Pool

Abkf = 14.1 ft
Wbkf = 12.1 ft
Dmax = 2.2 ft

Spencer Creek Reference Reach



Profile (Reference Reach)

Save = 0.0128 rise/run
Svalley = 0.0161 rise/run
Sriffle = 0.0260 (0.0157 - 0.0887) rise/run
Spool = 0.0006 (0 - 0.0117) rise/run
Srun = 0.0054 (0 - 0.0413) rise/run
Sglide = 0.007 (0 - 0.0210) rise/run

- Water Surface
- Channel Bed

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Wits End

Union County
North Carolina

Title:
Spencer Creek
Reference Reach
Dimension, Pattern,
and Profile

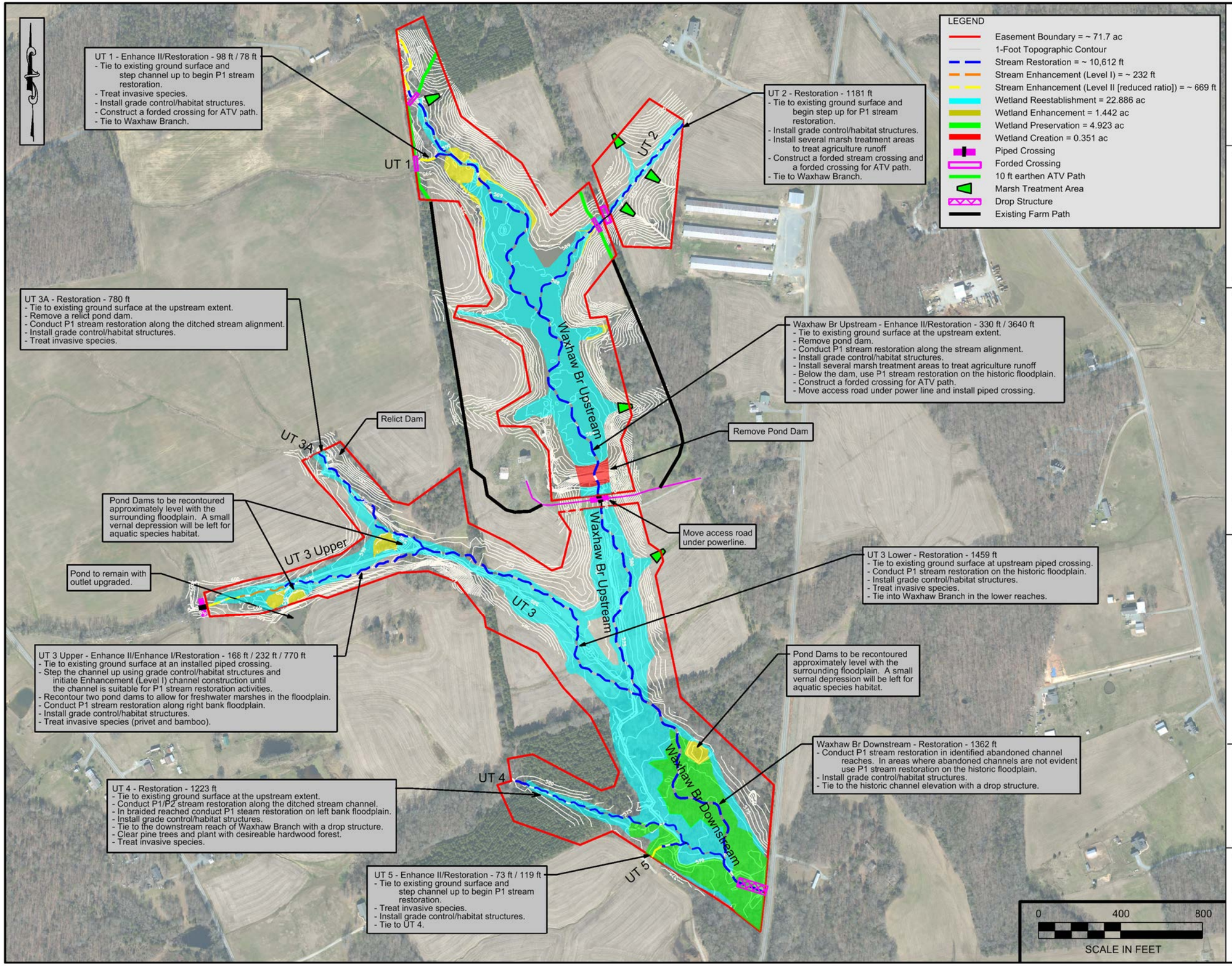
Scale: NA

Date: Sept 2020

Project No.: 20-011

FIGURE NO.

5B



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

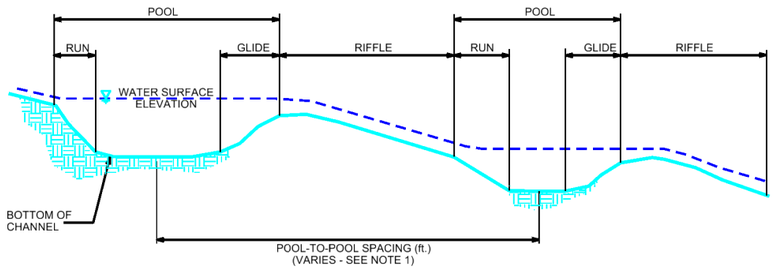
Wits End

Union County
North Carolina

Title:

Restoration Plan

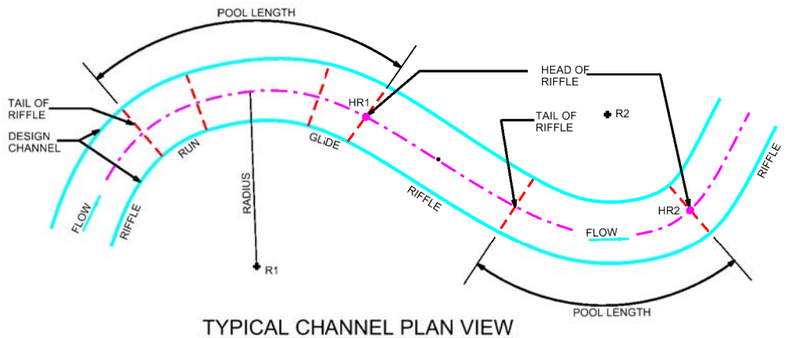
Scale:	FIGURE NO.
As Shown	6
Date: Sept 2020	
Project No.: 20-011	



TYPICAL CHANNEL PROFILE

NOTES:

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

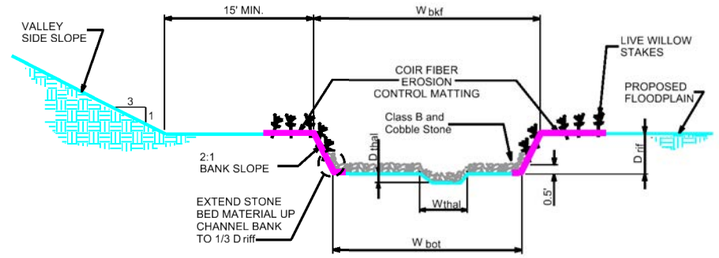


TYPICAL CHANNEL PLAN VIEW

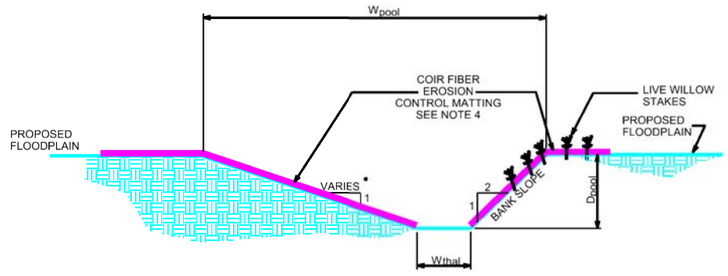
CHANNEL PLAN VIEW NOTES:

1. THE CONTRACTOR SHALL LAYOUT THE CHANNEL ALIGNMENT BY LOCATING THE RADII AND SCRIBING THE CENTER LINE FOR EACH POOL BEND. THE CONNECTING TANGENT SECTIONS SHALL COMPLETE THE LAYOUT OF THE CHANNEL.

2. FIELD ADJUSTMENTS OF THE ALIGNMENT MAY BE REQUIRED TO SAVE TREES OR AVOID OBSTACLES. THE STAKE-OUT SHALL BE APPROVED BY THE CONSTRUCTION MANAGER BEFORE CONSTRUCTION OF THE CHANNEL.



TYPICAL RIFFLE CROSS-SECTION



TYPICAL POOL CROSS-SECTION

CHANNEL CONSTRUCTION NOTES:

1. MATERIAL EXCAVATED FROM CHANNEL AND FLOODPLAIN SHALL BE USED TO BACKFILL EXISTING CHANNEL.

2. BANK PROTECTION SHALL CONSIST OF NATURAL COIR FIBER MATTING.

3. THE CONTRACTOR SHALL SUPPLY BED MATERIAL FOR THE ENTIRE BED LENGTH OF EACH RIFFLE SECTION. THE BED MATERIAL SHALL CONSIST OF A MIX OF CLASS A AND SMALLER STONE.

CROSS-SECTION DIMENSIONS

REACH	Wbkf (ft.)	Wbot (ft.)	Driff (ft.)	Dthal (ft.)	Dpool (ft.)	Wpool (ft.)	Wthal (ft.)
Waxhaw Br Upstream	14.5	9.3	1.2	0.1	1.8	17.4	6.6
Waxhaw Br Downstream	16.9	10.5	1.5	0.1	2.1	20.3	7.7
UT 2 and 4	7.5	4.7	0.6	0.1	0.9	9.0	3.6
UT 3	10.4	6.4	0.9	0.1	1.3	12.5	4.7
UT 3A and 3B	7.6	4.8	0.6	0.1	0.9	9.1	3.7

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Wits End

Union County
North Carolina

Title:

PROPOSED DIMENSION, PATTERN, AND PROFILE

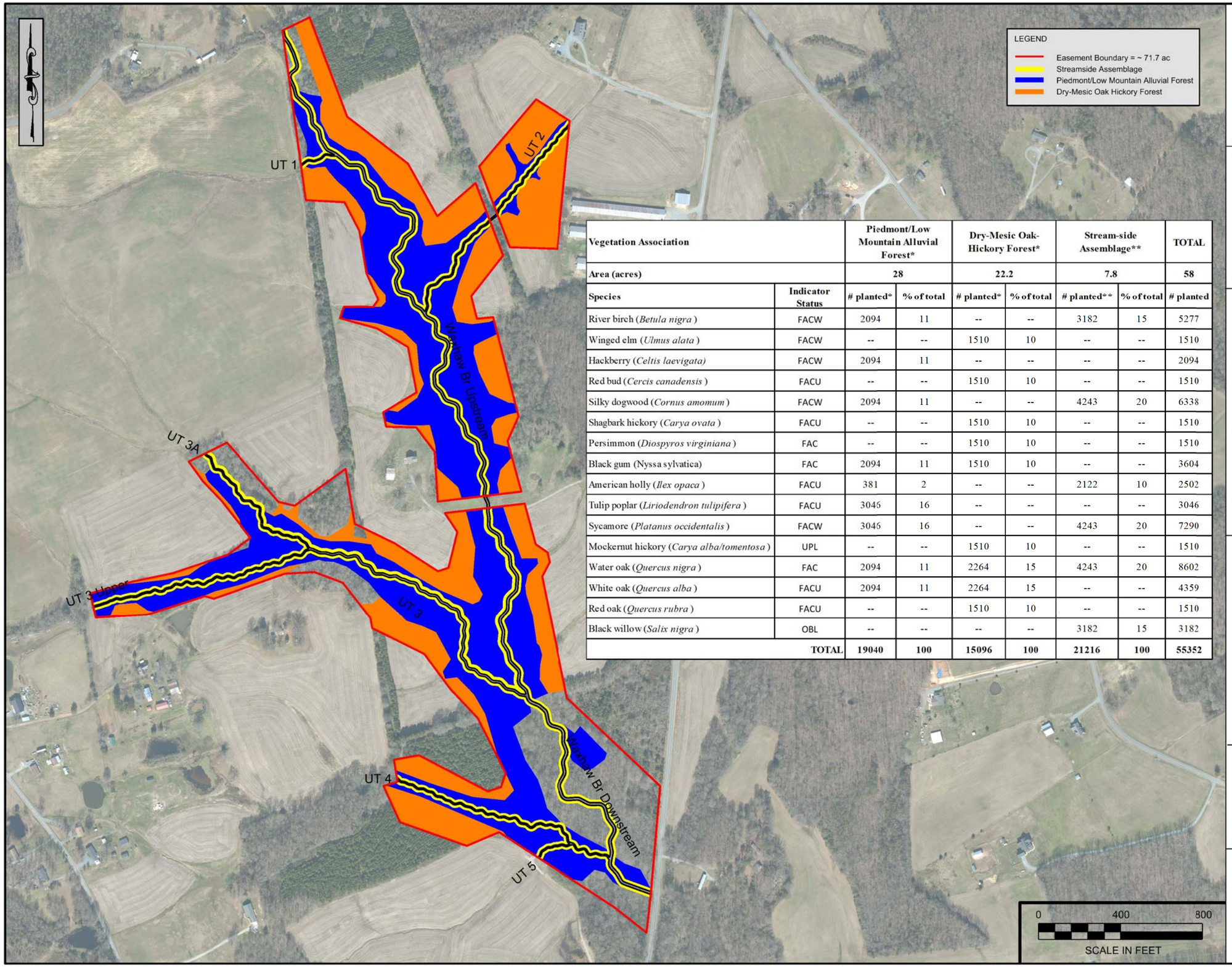
Scale: NA

Date: Sept 2020

Project No.: 20-011

FIGURE NO.

7



Vegetation Association		Piedmont/Low Mountain Alluvial Forest*		Dry-Mesic Oak-Hickory Forest*		Stream-side Assemblage**		TOTAL
Area (acres)		28		22.2		7.8		58
Species	Indicator Status	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
River birch (*Betula nigra*)	FACW	2094	11	--	--	3182	15	5277
Winged elm (*Ulmus alata*)	FACW	--	--	1510	10	--	--	1510
Hackberry (*Celtis laevigata*)	FACW	2094	11	--	--	--	--	2094
Red bud (*Cercis canadensis*)	FACU	--	--	1510	10	--	--	1510
Silky dogwood (*Cornus amomum*)	FACW	2094	11	--	--	4243	20	6338
Shagbark hickory (*Carya ovata*)	FACU	--	--	1510	10	--	--	1510
Persimmon (*Diospyros virginiana*)	FAC	--	--	1510	10	--	--	1510
Black gum (Nyssa sylvatica)	FAC	2094	11	1510	10	--	--	3604
American holly (*Ilex opaca*)	FACU	381	2	--	--	2122	10	2502
Tulip poplar (*Liriodendron tulipifera*)	FACU	3046	16	--	--	--	--	3046
Sycamore (*Platanus occidentalis*)	FACW	3046	16	--	--	4243	20	7290
Mockernut hickory (*Carya alba/tomentosa*)	UPL	--	--	1510	10	--	--	1510
Water oak (*Quercus nigra*)	FAC	2094	11	2264	15	4243	20	8602
White oak (*Quercus alba*)	FACU	2094	11	2264	15	--	--	4359
Red oak (*Quercus rubra*)	FACU	--	--	1510	10	--	--	1510
Black willow (*Salix nigra*)	OBL	--	--	--	--	3182	15	3182
	TOTAL	19040	100	15096	100	21216	100	55352

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Wits End

Union County
North Carolina

Title:

Planting Plan

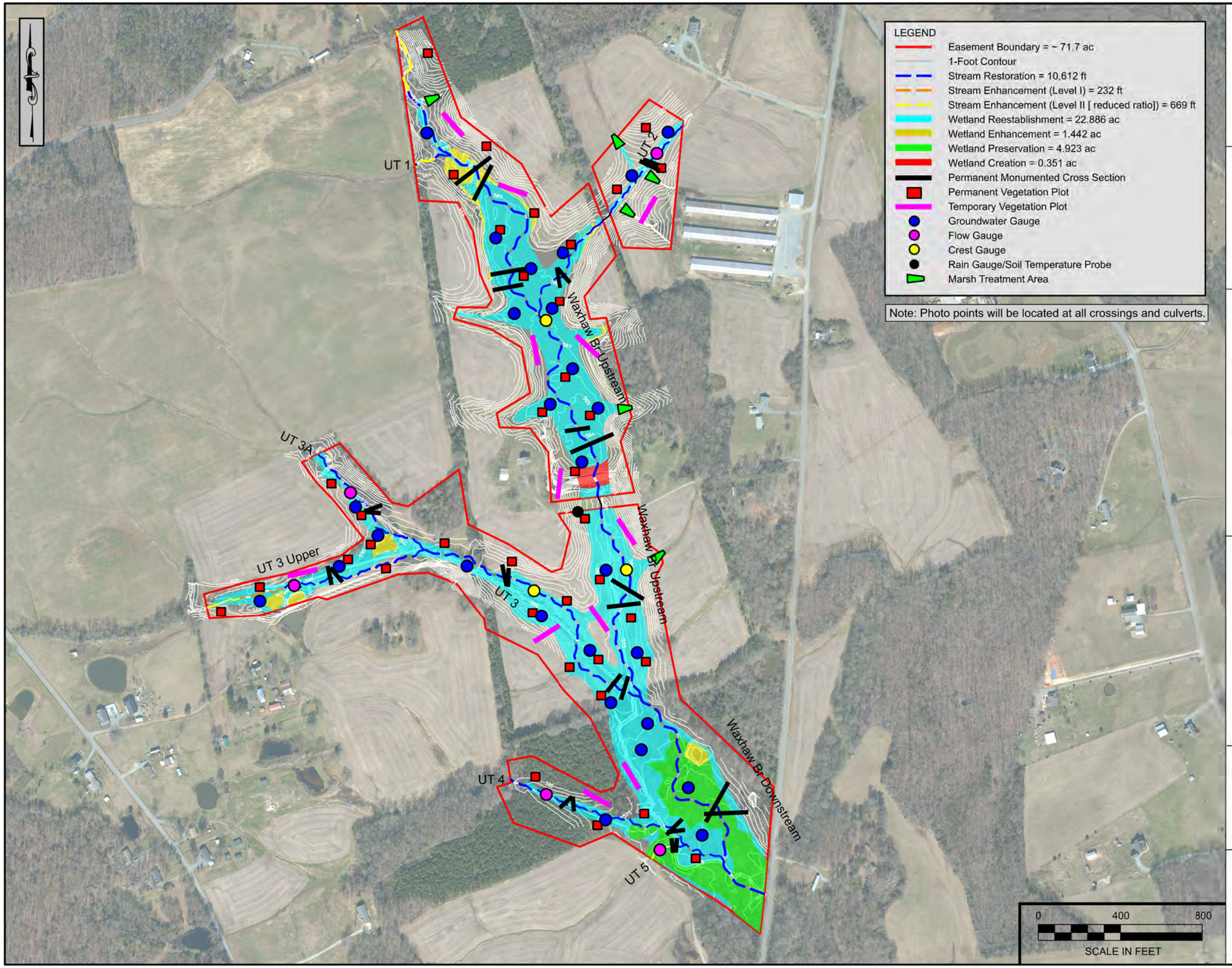
Scale: As Shown

Date: Sept 2020

Project No.: 20-011

FIGURE NO.

8



LEGEND

- Easement Boundary = ~ 71.7 ac
- 1-Foot Contour
- Stream Restoration = 10,612 ft
- Stream Enhancement (Level I) = 232 ft
- Stream Enhancement (Level II [reduced ratio]) = 669 ft
- Wetland Reestablishment = 22.886 ac
- Wetland Enhancement = 1.442 ac
- Wetland Preservation = 4.923 ac
- Wetland Creation = 0.351 ac
- Permanent Monumented Cross Section
- Permanent Vegetation Plot
- Temporary Vegetation Plot
- Groundwater Gauge
- Flow Gauge
- Crest Gauge
- Rain Gauge/Soil Temperature Probe
- Marsh Treatment Area

Note: Photo points will be located at all crossings and culverts.

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Wits End

Union County
North Carolina

Title:

Monitoring Plan

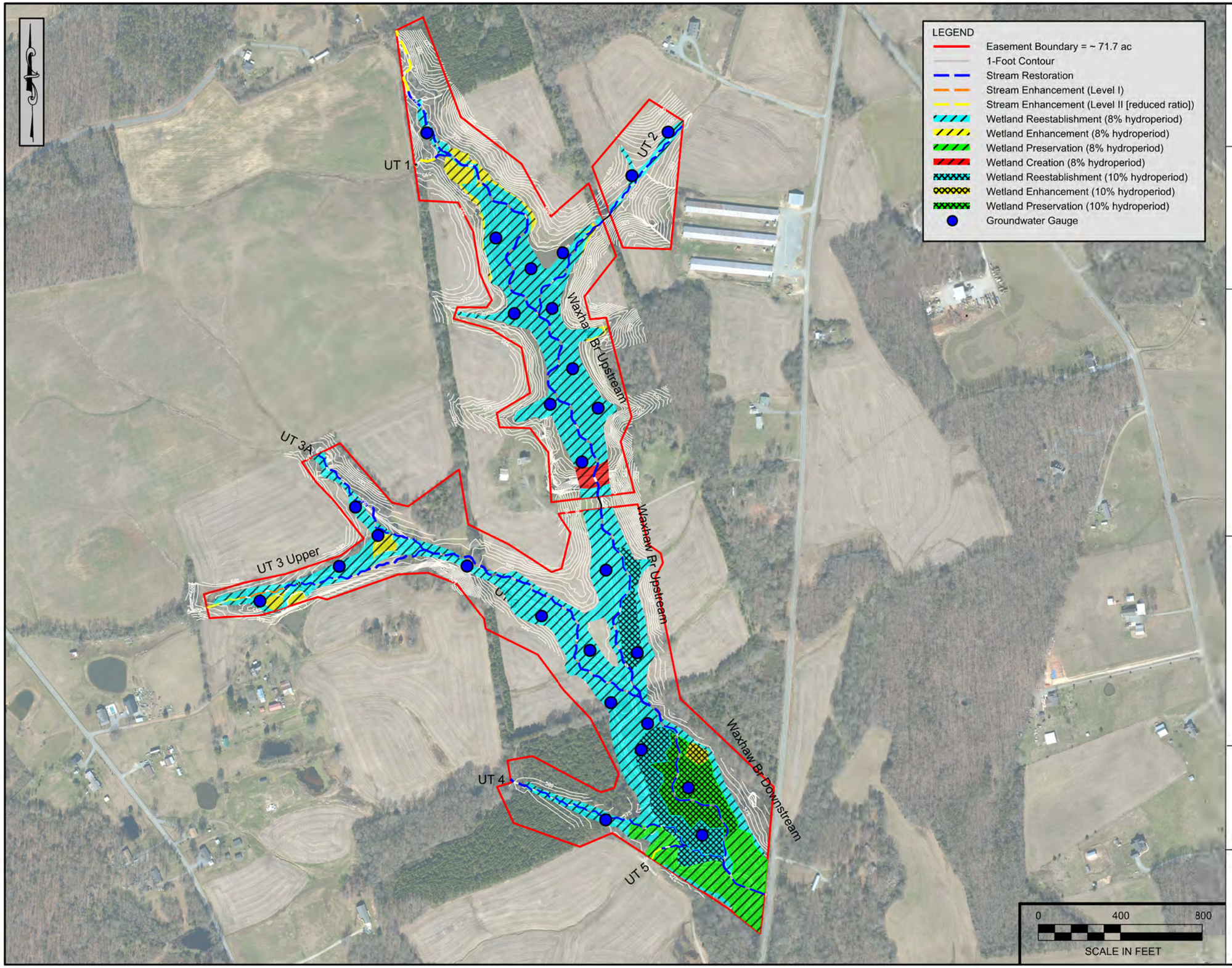
Scale: As Shown

Date: Sept 2020

Project No.: 20-011

FIGURE NO.

9A



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

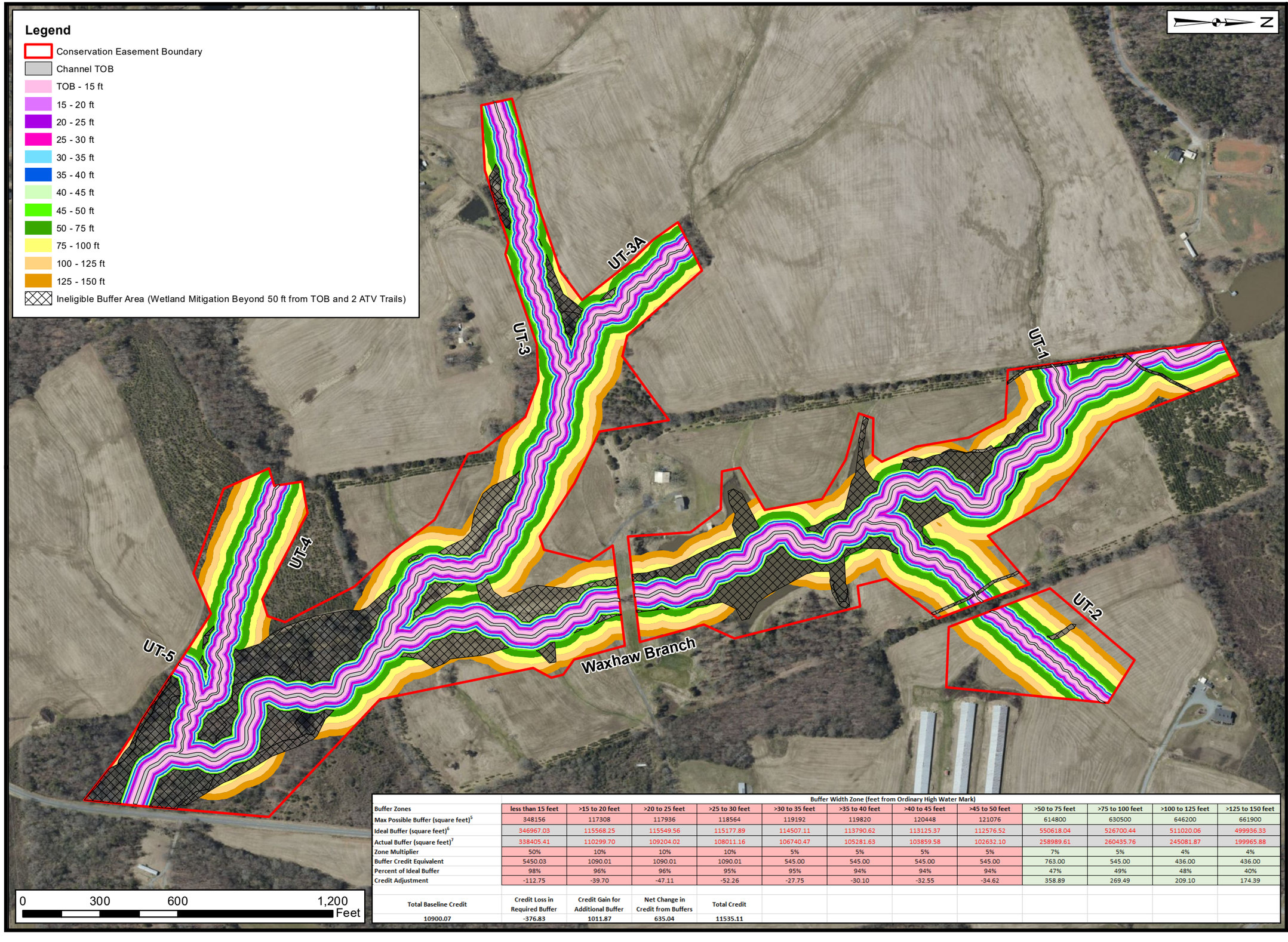
Wits End

Union County
North Carolina

Title:

Monitoring Plan

Scale:	FIGURE NO.
As Shown	9B
Date: Sept 2020	
Project No.: 20-011	



	Buffer Width Zone (feet from Ordinary High Water Mark)											
Buffer Zones	less than 15 feet	>15 to 20 feet	>20 to 25 feet	>25 to 30 feet	>30 to 35 feet	>35 to 40 feet	>40 to 45 feet	>45 to 50 feet	>50 to 75 feet	>75 to 100 feet	>100 to 125 feet	>125 to 150 feet
Max Possible Buffer (square feet)[5]	348156	117308	117936	118564	119192	119820	120448	121076	614800	630500	646200	661900
Ideal Buffer (square feet)[6]	346967.03	115568.25	115549.56	115177.89	114507.11	113790.62	113125.37	112576.52	550618.04	526700.44	511020.06	499936.33
Actual Buffer (square feet)[7]	338405.41	110299.70	109204.02	108011.16	106740.47	105281.63	103859.58	102632.10	258989.61	260435.76	245081.87	199965.88
Zone Multiplier	50%	10%	10%	10%	5%	5%	5%	5%	7%	5%	4%	4%
Buffer Credit Equivalent	5450.03	1090.01	1090.01	1090.01	545.00	545.00	545.00	545.00	763.00	545.00	436.00	436.00
Percent of Ideal Buffer	98%	96%	96%	95%	95%	94%	94%	94%	47%	49%	48%	40%
Credit Adjustment	-112.75	-39.70	-47.11	-52.26	-27.75	-30.10	-32.55	-34.62	358.89	269.49	209.10	174.39

Total Baseline Credit	Credit Loss in Required Buffer	Credit Gain for Additional Buffer	Net Change in Credit from Buffers	Total Credit
10900.07	-376.83	1011.87	635.04	11535.11

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WITS END SITE

Union County, NC

Title:

STREAM BUFFER CREDIT ADJUSTMENT OUTPUT

Drawn by: KRJ

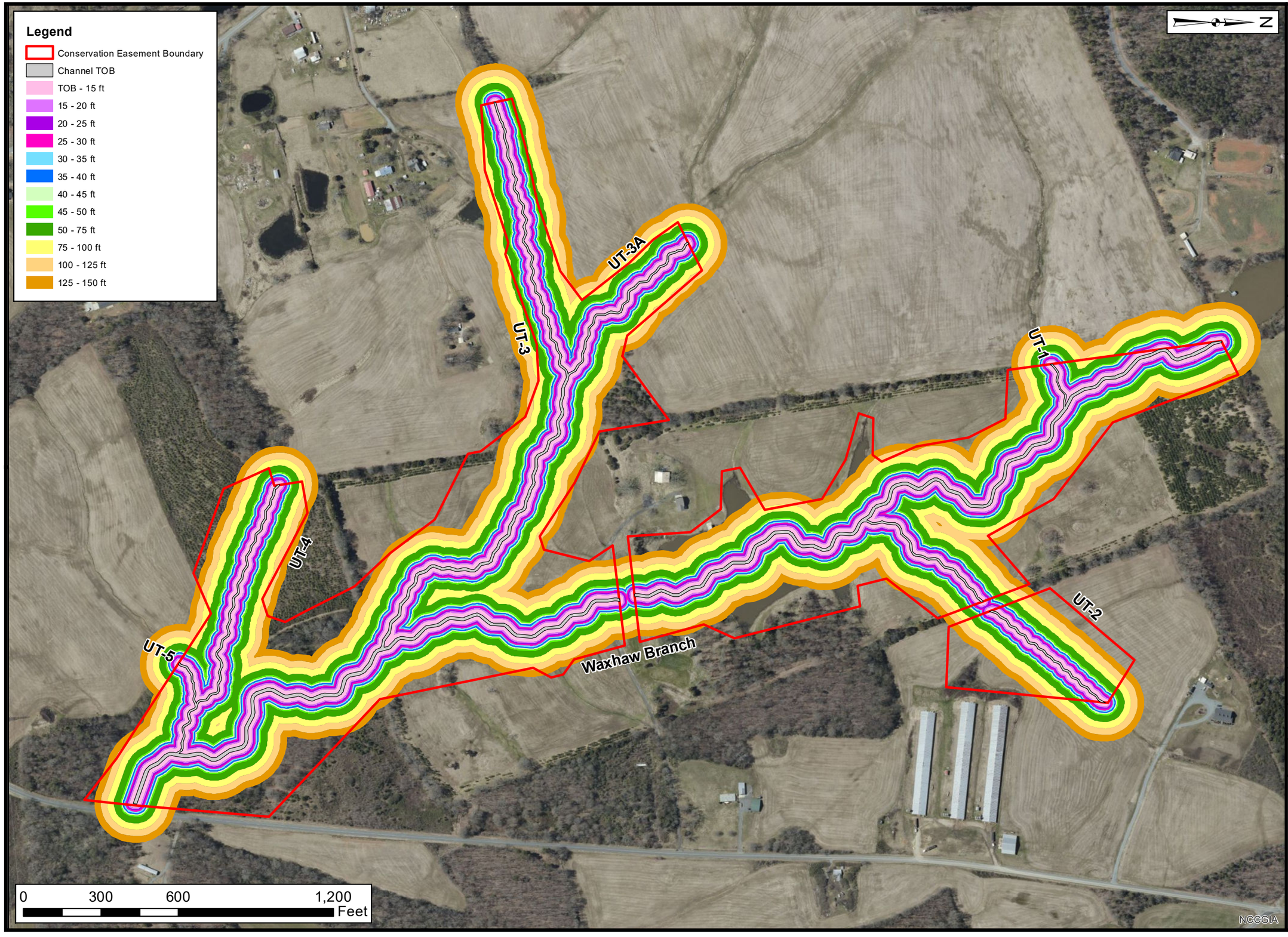
Date: MAR 2021

Scale: 1:4200

Project No.: 20-011

FIGURE

10A



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WITS END SITE

Union County, NC

Title:

STREAM BUFFER CREDIT ADJUSTMENT IDEAL BUFFER

Drawn by: KRJ

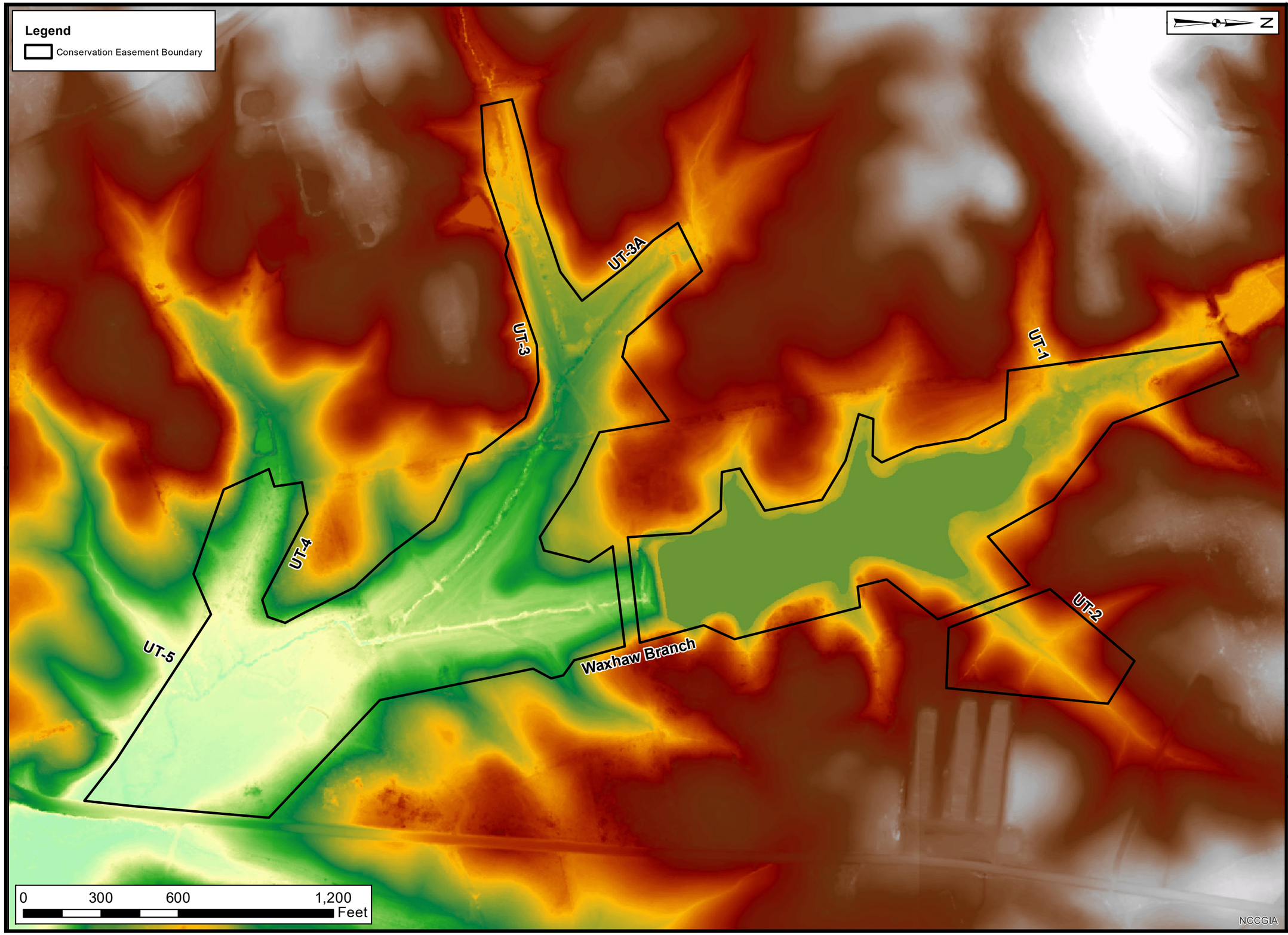
Date: JUL 2021

Scale: 1:4200

Project No.: 20-011

FIGURE

10B



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WITS END SITE

Union County, NC

Title:

LIDAR

Drawn by:	KRJ
Date:	JAN 2021
Scale:	1:4200
Project No.:	20-011

FIGURE

11

APPENDIX B. DATA

Table B1. Wits End Morphological Stream Characteristics
Figure B1 – Cross Section Locations
Existing Stream Cross-section Data
NC SAM Forms
NC WAM Forms
NCDWQ Stream Forms
BEHI/NBS Data
Nutrient Model
Soil Boring Log
Wilmington District Stream Buffer Calculator
Groundwater Gauge Graphs

Table B1. Wits End Morphological Stream Characteristics

Variables	REFERENCE - UWHARRIE	REFERENCE - Spencer Creek	Existing (Waxhaw Branch Upstream)	Proposed (Waxhaw Branch Upstream)	Existing (Waxhaw Branch Downstream)	Proposed (Waxhaw Branch Downstream)
Stream Type	E 4	E 3	Eg 4/5	Ce 3/4	Eg 4/5	Ce 3/4
Drainage Area (mi^2)	0.60	0.41	0.66	0.66	1.09	1.09
Bankfull Discharge (cfs)	57.6	43.8	61.3	61.3	88.3	88.3
Dimension Variables						
Bankfull Cross-Sectional Area (A_{bkf})	14.2	10.4	15.0	15.0	21.2	21.2
Existing Cross-Sectional Area ($A_{existing}$)	14.2	10.4	21.6 - 34.0	15.0	39.2 - 64.3	21.2
Bankfull Width (W_{bkf})	Mean: 12.1 Range: 11.2 - 13.0	Mean: 9.1 Range: 6.8 - 10.1	Mean: 11.6 Range: 10.4 to 13.3	Mean: 14.5 Range: 13.4 to 15.5	Mean: 13.2 Range: 12.0 to 13.4	Mean: 17.2 Range: 15.9 to 18.4
Bankfull Mean Depth (D_{bkf})	Mean: 1.2 Range: 1.1 - 1.3	Mean: 1.3 Range: 1.1 - 1.4	Mean: 1.3 Range: 1.1 to 1.4	Mean: 1.0 Range: 1.0 to 1.1	Mean: 1.6 Range: 1.5 to 1.7	Mean: 1.2 Range: 1.2 to 1.3
Bankfull Maximum Depth (D_{max})	Mean: 1.7 Range: 1.6 - 1.7	Mean: 1.8 Range: 1.4 - 1.9	Mean: 2.1 Range: 2.0 to 2.3	Mean: 1.3 Range: 1.2 to 1.7	Mean: 2.4 Range: 2.1 to 2.7	Mean: 1.6 Range: 1.5 to 2.0
Pool Width (W_{pool})	Mean: 12.7 Range: 12.0 - 13.3	Mean: 14.8 Range: 12.1 - 17.4	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 17.4 Range: 14.5 to 20.3	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 20.7 Range: 17.2 to 24.1
Maximum Pool Depth (D_{pool})	Mean: 2.1 Range: 2.0 - 2.2	Mean: 2.1 Range: 1.9 - 2.2		Mean: 1.8 Range: 1.6 to 2.1		Mean: 2.1 Range: 1.8 to 2.5
Width of Floodprone Area (W_{fpa})	Mean: 50 Range:	Mean: 50 Range:	Mean: 150 Range: 150 to 150	Mean: 100 Range: 50 to 150	Mean: 32 Range: 20 to 150	Mean: 150 Range: 100 to 200
Dimension Ratios						
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 4.2 Range: 3.8 - 4.5	Mean: 5.9 Range: 5.0 - 7.4	Mean: 12.9 Range: 11.2 to 14.4	Mean: 6.9 Range: 3.7 to 9.7	Mean: 2.7 Range: 1.5 to 11.3	Mean: 8.7 Range: 6.3 to 10.9
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 10.1 Range: 10.0 - 10.2	Mean: 7.8 Range: 4.9 - 8.3	Mean: 8.9 Range: 7.4 to 12.2	Mean: 14.0 Range: 12.0 to 16.0	Mean: 8.3 Range: 7.1 to 8.9	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.4 Range: 1.3 - 1.5	Mean: 1.3 Range: 1.3 - 1.5	Mean: 1.6 Range: 1.5 to 1.9	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.4 Range: 1.4 to 1.8	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.0 Range:	Mean: 1.0 Range:	Mean: 1.5 Range: 1.3 to 1.6	Mean: 1.0 Range: 1.0 to 1.3	Mean: 1.8 Range: 1.5 to 2.2	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 1.8 Range: 1.7 - 1.8	Mean: 1.6 Range: 1.5 - 1.7	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0
Pool Width / Bankfull Width (W_{pool}/W_{bkf})	Mean: 1.0 Range: 1.0 - 1.1	Mean: 1.6 Range: 1.3 - 1.9		Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area	Mean: 1.1 Range: 1.1 - 1.2	Mean: 1.4 Range:		Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4

Variables	REFERENCE - UWHARRIE	REFERENCE - UWHARRIE	Existing (Waxhaw Branch Upstream)	Proposed (Waxhaw Branch Upstream)	Existing (Waxhaw Branch Downstream)	Proposed (Waxhaw Branch Downstream)
Pattern Variables						
Pool to Pool Spacing (L_{p-p})	Med: 51.2 Range: 36.7 - 64.3	Med: 29.8 Range: 16.2 - 44.2	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 58.0 Range: 43.5 to 72.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 68.9 Range: 51.7 to 86.1
Meander Length (L_m)	Med: 85.9 Range: 60.2 - 97.1	Med: 41.4 Range: 28.8 - 64.6		Med: 101.4 Range: 72.5 to 130.4		Med: 120.6 Range: 86.1 to 155.1
Belt Width (W_{belt})	Med: 27.8 Range: 24.0 - 32.6	Med: 21.3 Range: 14.5 - 26.3		Med: 29.0 Range: 21.7 to 43.5		Med: 34.5 Range: 25.8 to 51.7
Radius of Curvature (R_c)	Med: 20.5 Range: 11.9 - 27.7	Med: 9.7 Range: 4.5 - 17.6		Med: 43.5 Range: 29.0 to 58.0		Med: 51.7 Range: 34.5 to 68.9
Sinuosity (Sin)	1.14	1.26	1.01	1.15	1.06	1.15
Pattern Ratios						
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 4.2 Range: 3.0 - 5.3	Med: 3.4 Range: 1.9 - 5.1	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 7.1 Range: 5.0 - 8.0	Med: 4.8 Range: 3.3 - 7.5		Med: 7.0 Range: 5.0 to 9.0		Med: 7.0 Range: 5.0 to 9.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 2.3 Range: 2.0 - 2.7	Med: 2.5 Range: 1.7 - 3.0		Med: 2.0 Range: 1.5 to 3.0		Med: 2.0 Range: 1.5 to 3.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 1.7 Range: 1.0 - 2.3	Med: 1.1 Range: 0.5 - 2.0		Med: 3.0 Range: 2.0 to 4.0		Med: 3.0 Range: 2.0 to 4.0
Profile Variables						
Average Water Surface Slope (S_{ave})	0.0168	0.0128	0.0052	0.0046	0.0042	0.0039
Valley Slope (S_{valley})	0.0192	0.0161	0.0053	0.0053	0.0045	0.0045
Riffle Slope (S_{riffle})	Mean: 0.0283 Range: 0.0096 - 0.0846	Mean: 0.0260 Range: 0.0157 - 0.0887	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 0.0078 Range: 0.0055 to 0.0092	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 0.0067 Range: 0.0047 to 0.0078
Pool Slope (S_{pool})	Mean: 0.0013 Range: 0 - 0.0082	Mean: 0.0006 Range: 0 - 0.0117		Mean: 0.0005 Range: 0.0000 to 0.0032		Mean: 0.0004 Range: 0.0000 to 0.0027
Run Slope (S_{run})	Mean: 0.0000 Range: 0 - 0.0091	Mean: 0.0054 Range: 0 - 0.0413		Mean: 0.0018 Range: 0.0000 to 0.0037		Mean: 0.0016 Range: 0.0000 to 0.0031
Glide Slope (S_{glide})	Mean: 0.0027 Range: 0 - 0.0102	Mean: 0.0070 Range: 0 - 0.0210		Mean: 0.0005 Range: 0.0000 to 0.0037		Mean: 0.0004 Range: 0.0000 to 0.0031
Profile Ratios						
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 1.7 Range: 0.6 - 5.0	Mean: 2.0 Range: 1.2 - 6.9	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 1.7 Range: 1.2 to 2.0	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 1.7 Range: 1.2 to 2.0
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 0.1 Range: 0 - 0.49	Mean: 0.1 Range: 0 - 0.9		Mean: 0.1 Range: 0.0 to 0.7		Mean: 0.1 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean: 0.00 Range: 0 - .55	Mean: 0.4 Range: 0 - 3.2		Mean: 0.4 Range: 0.0 to 0.8		Mean: 0.4 Range: 0.0 to 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean: 0.16 Range: 0 - 0.61	Mean: 0.5 Range: 0 - 1.6		Mean: 0.1 Range: 0.0 to 0.8		Mean: 0.1 Range: 0.0 to 0.8

Table B1 continued. Wits End Morphological Stream Characteristics

Variables	Existing (UT 2)	Existing (UT 4)	Proposed (UT 2 and 4)	Existing (UT 3)	Proposed (UT 3)
Stream Type	E 6	Cg and D 4/5	Ce 3/4	G 4/5	Ce 3/4
Drainage Area (mi^2)	0.09	0.10	0.09	0.25	0.25
Bankfull Discharge (cfs)	14.8	16.0	14.8	30.6	30.6
Dimension Variables					
Bankfull Cross-Sectional Area (A_{bkf})	4.0	4.3	4.0	7.8	7.8
Existing Cross-Sectional Area ($A_{existing}$)	4.0 - 7.4	4.6 - 10	4.0	16.4 - 35.2	7.8
Bankfull Width (W_{bkf})	Mean: 4.8 Range: 4.1 to 7.0	Mean: 10.6 Range: 4.4 to 17.9	Mean: 7.5 Range: 6.9 to 8.0	Mean: 8.0 Range: 7.1 to 10.3	Mean: 10.4 Range: 9.7 to 11.2
Bankfull Mean Depth (D_{bkf})	Mean: 0.8 Range: 0.6 to 1.0	Mean: 0.6 Range: 0.2 to 1.0	Mean: 0.5 Range: 0.5 to 0.6	Mean: 1.0 Range: 0.8 to 1.1	Mean: 0.7 Range: 0.7 to 0.8
Bankfull Maximum Depth (D_{max})	Mean: 1.4 Range: 1.2 to 1.4	Mean: 0.9 Range: 0.4 to 1.4	Mean: 0.7 Range: 0.6 to 0.9	Mean: 1.3 Range: 1.1 to 1.5	Mean: 1.0 Range: 0.9 to 1.2
Pool Width (W_{pool})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 9.0 Range: 7.5 to 10.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 12.5 Range: 10.4 to 14.6
Maximum Pool Depth (D_{pool})			Mean: 0.9 Range: 0.8 to 1.1		Mean: 1.3 Range: 1.1 to 1.5
Width of Floodprone Area (W_{fpa})	Mean: 33 Range: 22 to 40	Mean: 50 Range: 30 to 60	Mean: 50 Range: 25 to 75	Mean: 10 Range: 8 to 23	Mean: 75 Range: 50 to 100
Dimension Ratios					
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 5.4 Range: 4.7 to 8.3	Mean: 5.1 Range: 3.1 to 9.6	Mean: 6.7 Range: 3.6 to 9.4	Mean: 1.3 Range: 1.1 to 2.2	Mean: 7.2 Range: 5.2 to 9.0
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 6.0 Range: 4.1 to 2.0	Mean: 29.8 Range: 4.4 to 89.5	Mean: 14.0 Range: 12.0 to 16.0	Mean: 8.0 Range: 6.5 12.9 19.8	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.8 Range: 1.4 to 2.0	Mean: 1.4 Range: 1.3 to 3.0	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.4 Range: 1.3 to 1.4	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.1 Range: 1.0 to 1.5	Mean: 1.4 Range: 1.0 to 1.8	Mean: 1.0 Range: 1.0 to 1.3	Mean: 2.3 Range: 1.7 to 3.0	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0
Pool Width / Bankfull Width (W_{pool}/W_{bkf})			Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area			Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4
Pattern Variables					
Pool to Pool Spacing (L_{p-p})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 29.9 Range: 22.4 to 37.4	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 41.8 Range: 31.3 to 52.2
Meander Length (L_m)			Med: 52.4 Range: 37.4 to 67.3		Med: 73.1 Range: 52.2 to 94.0
Belt Width (W_{belt})			Med: 15.0 Range: 11.2 to 22.4		Med: 20.9 Range: 15.7 to 31.3
Radius of Curvature (R_c)			Med: 22.4 Range: 15.0 to 29.9		Med: 31.3 Range: 20.9 to 41.8
Sinuosity (Sin)	1.00	1.02	1.10	1.03	1.10
Pattern Ratios					
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0
Meander Length/ Bankfull Width (L_m/W_{bkf})			Med: 7.0 Range: 5.0 to 9.0		Med: 7.0 Range: 5.0 to 9.0
Meander Width Ratio (W_{belf}/W_{bkf})			Med: 2.0 Range: 1.5 to 3.0		Med: 2.0 Range: 1.5 to 3.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})			Med: 3.0 Range: 2.0 to 4.0		Med: 3.0 Range: 2.0 to 4.0
Profile Variables					
Average Water Surface Slope (S_{ave})	0.0089	0.0076	0.0076	0.0071	0.0066
Valley Slope (S_{valley})	0.0089	0.0078	0.0084	0.0073	0.0073
Riffle Slope (S_{riffle})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0130 Range: 0.0092 to 0.0153	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0113 Range: 0.0080 to 0.0133
Pool Slope (S_{pool})			Mean: 0.0008 Range: 0.0000 to 0.0053		Mean: 0.0007 Range: 0.0000 to 0.0046
Run Slope (S_{run})			Mean: 0.0031 Range: 0.0000 to 0.0061		Mean: 0.0027 Range: 0.0000 to 0.0053
Glide Slope (S_{glide})			Mean: 0.0008 Range: 0.0000 to 0.0061		Mean: 0.0007 Range: 0.0000 to 0.0053
Profile Ratios					
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 to 2.0
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})			Mean: 0.1 Range: 0.0 to 0.7		Mean: 0.1 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})			Mean: 0.4 Range: 0.0 to 0.8		Mean: 0.4 Range: 0.0 to 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})			Mean: 0.1 Range: 0.0 to 0.8		Mean: 0.1 Range: 0.0 to 0.8

Table B1 continued. Wits End Morphological Stream Characteristics

Variables	Existing (UT 3A)	Existing (UT 3 upstream)	Proposed (UT 3A and 3 upstream)
Stream Type	G 4	G 4/5	Ce 3/4
Drainage Area (mi^2)	0.10	0.12	0.10
Bankfull Discharge (cfs)	15.2	17.6	15.2
Dimension Variables			
Bankfull Cross-Sectional Area (A_{bkf})	4.1	4.7	4.1
Existing Cross-Sectional Area ($A_{existing}$)	7.0 - 8.9	14.2 - 20.2	4.1
Bankfull Width (W_{bkf})	Mean: 5.8 Range: 5.8 to 5.8	Mean: 5.7 Range: 5.3 to 6.1	Mean: 7.6 Range: 7.0 to 8.1
Bankfull Mean Depth (D_{bkf})	Mean: 0.7 Range: 0.7 to 0.7	Mean: 0.9 Range: 0.8 to 0.9	Mean: 0.5 Range: 0.5 to 0.6
Bankfull Maximum Depth (D_{max})	Mean: 1.0 Range: 0.9 to 1.0	Mean: 1.0 Range: 0.9 to 1.1	Mean: 0.7 Range: 0.6 to 0.9
Pool Width (W_{pool})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 9.1 Range: 7.6 to 10.6
Maximum Pool Depth (D_{pool})			Mean: 0.9 Range: 0.8 to 1.1
Width of Floodprone Area (W_{fpa})	Mean: 9 Range: 8 to 8	Mean: 8 Range: 7 to 8	Mean: 50 Range: 25 to 75
Dimension Ratios			
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 1.5 Range: 1.4 to 1.6	Mean: 1.3 Range: 1.1 to 1.5	Mean: 6.6 Range: 3.6 to 9.3
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 8.3 Range: 8.3 to 8.3	Mean: 6.8 Range: 5.9 to 7.6	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.4 Range: 1.3 to 1.4	Mean: 1.2 Range: 1.1 to 1.2	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.6 Range: 1.4 to 1.8	Mean: 2.9 Range: 2.3 to 3.4	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{poo}/D_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0
Pool Width / Bankfull Width (W_{pool}/W_{bkf})			Mean: 1.2 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area			Mean: 1.2 Range: 1.0 to 1.4

Variables	Existing (UT 3A)	Existing (UT 3 upstream)	Proposed (UT 3A and 3 upstream)
Pattern Variables			
Pool to Pool Spacing (L_{p-p})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 30.3 Range: 22.7 to 37.9
Meander Length (L_m)			Med: 53.0 Range: 37.9 to 68.2
Belt Width (W_{belt})			Med: 15.2 Range: 11.4 to 22.7
Radius of Curvature (R_c)			Med: 22.7 Range: 15.2 to 30.3
Sinuosity (Sin)	1.02	1.03	1.10
Pattern Ratios			
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0
Meander Length/ Bankfull Width (L_m/W_{bkf})			Med: 7.0 Range: 5.0 to 9.0
Meander Width Ratio (W_{belt}/W_{bkf})			Med: 2.0 Range: 1.5 to 3.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})			Med: 3.0 Range: 2.0 to 4.0
Profile Variables			
Average Water Surface Slope (S_{ave})	0.0090	0.0089	0.0084
Valley Slope (S_{valley})	0.0092	0.0092	0.0092
Riffle Slope (S_{riffle})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0142 Range: 0.0100 to 0.0167
Pool Slope (S_{pool})			Mean: 0.0008 Range: 0.0000 to 0.0059
Run Slope (S_{run})			Mean: 0.0033 Range: 0.0000 to 0.0067
Glide Slope (S_{glide})			Mean: 0.0009 Range: 0.0000 to 0.0067
Profile Ratios			
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 to 2.0
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})			Mean: 0.1 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})			Mean: 0.4 Range: 0.0 to 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})			Mean: 0.1 Range: 0.0 to 0.8

Table B1 continued. Wits End Morphological Stream Characteristics

Variables	Existing (UT 1)	Proposed (UT 1)	Existing (UT 5)	Proposed (UT 5)
Stream Type	Eg 4	Ce 3/4	Eg 4	Ce 3/4
Drainage Area (mi^2)	0.05	0.05	0.04	0.04
Bankfull Discharge (cfs)	9.5	9.5	8.0	8.0

Dimension Variables	Existing (UT 1)	Proposed (UT 1)	Existing (UT 5)	Proposed (UT 5)
Bankfull Cross-Sectional Area (A_{bkf})	2.8	2.8	2.4	2.4
Existing Cross-Sectional Area ($A_{existing}$)	3.0 - 6.0	2.8	2.4 - 6.1	2.4
Bankfull Width (W_{bkf})	Mean: 4.6 Range: 4.0 to 5.1	Mean: 6.3 Range: 5.8 to 6.7	Mean: 3.4 Range: 3.1 to 3.7	Mean: 5.8 Range: 5.4 to 6.2
Bankfull Mean Depth (D_{bkf})	Mean: 0.6 Range: 0.5 to 0.7	Mean: 0.4 Range: 0.4 to 0.5	Mean: 0.8 Range: 0.7 to 0.8	Mean: 0.4 Range: 0.4 to 0.4
Bankfull Maximum Depth (D_{max})	Mean: 1.0 Range: 0. 9 to 1. 0	Mean: 0.6 Range: 0.5 to 0.7	Mean: 1.3 Range: 1.0 to 1.6	Mean: 0.5 Range: 0.5 to 0.7
Pool Width (W_{pool})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 7.5 Range: 6.3 to 8.8	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 7.0 Range: 5.8 to 8.1
Maximum Pool Depth (D_{pool})		Mean: 0.8 Range: 0.7 to 0.9		Mean: 0.7 Range: 0.6 to 0.8
Width of Floodprone Area (W_{fpa})	Mean: 45 Range: 40 to 50	Mean: 50 Range: 25 to 75	Mean: 13 Range: 10 to 15	Mean: 30 Range: 15 to 50

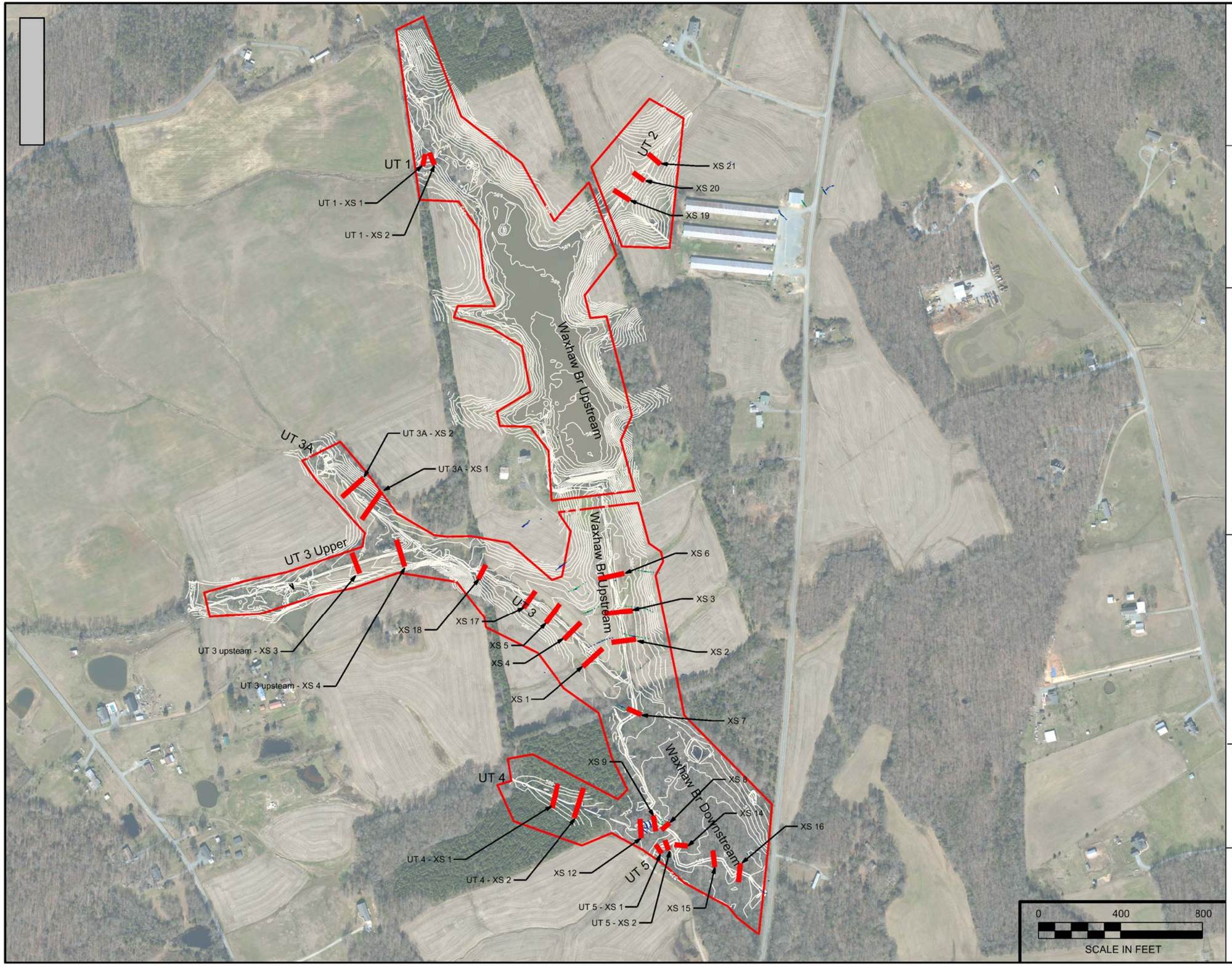
Dimension Ratios	Existing (UT 1)	Proposed (UT 1)	Existing (UT 5)	Proposed (UT 5)
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 10.2 Range: 7.8 to 12.5	Mean: 8.0 Range: 4.3 to 11.2	Mean: 3.6 Range: 3.2 to 4.1	Mean: 5.2 Range: 2.8 to 8.1
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 8.0 Range: 5.7 to 10.2	Mean: 14.0 Range: 12.0 to 16.0	Mean: 4.6 Range: 3.9 to 5.3	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.6 Range: 1.3 to 2.0	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.7 Range: 1.4 to 2.0	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.3 Range: 1.1 to 1.5	Mean: 1.0 Range: 1.0 to 1.3	Mean: 1.3 Range: 1.0 to 1.6	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{poo}/D_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0
Pool Width / Bankfull Width (W_{pool}/W_{bkf})		Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area		Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4

Variables	Existing (UT 1)	Proposed (UT 1)	Existing (UT 5)	Proposed (UT 5)
Pattern Variables				
Pool to Pool Spacing (L_{p-p})	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 25.0 Range: 18.8 to 31.3	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 23.2 Range: 17.4 to 29.0
Meander Length (L_m)		Med: 43.8 Range: 31.3 to 56.3		Med: 40.6 Range: 29.0 to 52.2
Belt Width (W_{belt})		Med: 12.5 Range: 9.4 to 18.8		Med: 11.6 Range: 8.7 to 17.4
Radius of Curvature (R_c)		Med: 18.8 Range: 12.5 to 25.0		Med: 17.4 Range: 11.6 to 23.2
Sinuosity (Sin)	1.06	1.10	1.04	1.10

Pattern Ratios	Existing (UT 1)	Proposed (UT 1)	Existing (UT 5)	Proposed (UT 5)
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0
Meander Length/ Bankfull Width (L_m/W_{bkf})		Med: 7.0 Range: 5.0 to 9.0		Med: 7.0 Range: 5.0 to 9.0
Meander Width Ratio (W_{belt}/W_{bkf})		Med: 2.0 Range: 1.5 to 3.0		Med: 2.0 Range: 1.5 to 3.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})		Med: 3.0 Range: 2.0 to 4.0		Med: 3.0 Range: 2.0 to 4.0

Profile Variables	Existing (UT 1)	Proposed (UT 1)	Existing (UT 5)	Proposed (UT 5)
Average Water Surface Slope (S_{ave})	0.0262	0.0253	0.0113	0.0107
Valley Slope (S_{valley})	0.0278	0.0278	0.0118	0.0118
Riffle Slope (S_{riffle})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0430 Range: 0.0303 to 0.0505	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0182 Range: 0.0129 to 0.0215
Pool Slope (S_{pool})		Mean: 0.0025 Range: 0.0000 to 0.0177		Mean: 0.0011 Range: 0.0000 to 0.0075
Run Slope (S_{run})		Mean: 0.0101 Range: 0.0000 to 0.0202		Mean: 0.0043 Range: 0.0000 to 0.0086
Glide Slope (S_{glide})		Mean: 0.0028 Range: 0.0000 to 0.0202		Mean: 0.0012 Range: 0.0000 to 0.0086

Profile Ratios	Existing (UT 1)	Proposed (UT 1)	Existing (UT 5)	Proposed (UT 5)
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 to 2.0
Pool Slope/Water Surface Slope (S_{poo}/S_{ave})		Mean: 0.1 Range: 0.0 to 0.7		Mean: 0.1 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})		Mean: 0.4 Range: 0.0 to 0.8		Mean: 0.4 Range: 0.0 to 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})		Mean: 0.1 Range: 0.0 to 0.8		Mean: 0.1 Range: 0.0 to 0.8



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Wits End

Union County
North Carolina

Title:

Cross Section Locations

Scale: As Shown	FIGURE NO. B1
Date: Sept 2020	
Project No.: 20-011	

Cross Section

section: Wits End Site (Waxhaw Br Downstream - XS 7)

Riffle

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description: Wits End Site (Waxhaw Br Downstream - XS 7)

height of instrument (ft): 700.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	122.8085	577.1915
	☐	7.859571	122.9035	577.0965
	☐	10.79817	122.967	577.033
	☐	12.8675	124.4525	575.5475
	☐	14.64603	124.7532	575.2468
	☐	16.02369	125.2966	574.7034
	☐	21.03678	128.1582	571.8418
	☐	24.38301	128.0109	571.9891
	☐	26.25042	127.8611	572.1389
	☐	28.98307	127.7517	572.2483
	☐	30.01228	127.2345	572.7655
	☐	30.88185	126.0749	573.9251
	☐	31.98673	123.5711	576.4289
	☐	34.87902	123.0302	576.9698
	☐	39.77996	122.807	577.193
	☐	42.50067	122.7481	577.2519
	☐	50.26372	122.5397	577.4603
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

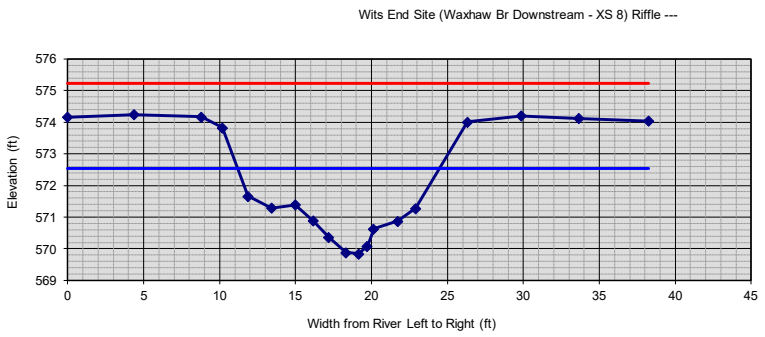
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
126.1	123.57	20.0		
573.9	576.43			

dimensions			
20.4	x-section area	1.5	d mean
13.4	width	14.7	wet P
2.1	d max	1.4	hyd radi
4.6	bank ht	8.9	w/d ratio
20.0	W flood prone area	1.5	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: Wits End Site (Waxhaw Br Downstream - XS 8)

Riffle

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description: Wits End Site (Waxhaw Br Downstream - XS 8)

height of instrument (ft): 700.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	125.8367	574.1633
	☐	4.371749	125.743	574.257
	☐	8.795502	125.829	574.171
	☐	10.17283	126.1742	573.8258
	☐	11.877	128.3348	571.6652
	☐	13.43758	128.7142	571.2858
	☐	14.9988	128.6108	571.3892
	☐	16.15593	129.1201	570.8799
	☐	17.20005	129.6379	570.3621
	☐	18.3258	130.1195	569.8805
	☐	19.16142	130.1536	569.8464
	☐	19.72105	129.9161	570.0839
	☐	20.14376	129.3667	570.6333
	☐	21.74126	129.1285	570.8715
	☐	22.9195	128.7226	571.2774
	☐	26.3327	125.9947	574.0053
	☐	29.85562	125.7999	574.2001
	☐	33.67662	125.8741	574.1259
	☐	38.23868	125.9584	574.0416
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

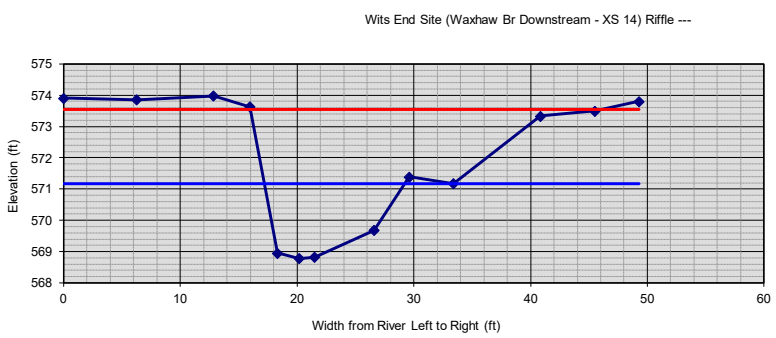
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
127.46	126.17	150.0		
572.54	573.83			

dimensions			
20.4	x-section area	1.5	d mean
13.3	width	15.0	wet P
2.7	d max	1.4	hyd radi
4.0	bank ht	8.7	w/d ratio
150.0	W flood prone area	11.3	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (Waxhaw Br Downstream - XS 14)**

Riffle

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description: **Wits End Site (Waxhaw Br Downstream - XS 14)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	■	0	126.0937	573.9063
	■	6.292476	126.1468	573.8532
	■	12.87449	126.0186	573.9814
	■	15.96135	126.3666	573.6334
	■	18.30636	131.0407	568.9593
	■	20.1974	131.2084	568.7916
	■	21.50797	131.1739	568.8261
	■	26.6068	130.3195	569.6805
	■	29.61685	128.6056	571.3944
	■	33.41656	128.8214	571.1786
	■	40.84687	126.6648	573.3352
	■	45.53388	126.501	573.499
	■	49.32431	126.1959	573.8041
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			

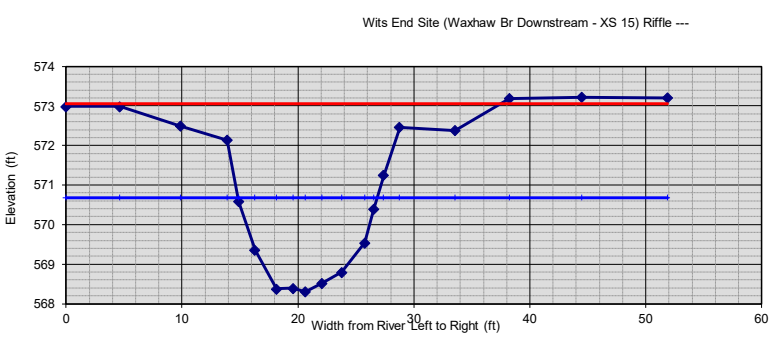
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
128.83	126.66	24.0		
571.17	573.34			

dimensions			
20.4	x-section area	1.7	d mean
12.0	width	13.9	wet P
2.4	d max	1.5	hyd radi
4.5	bank ht	7.1	w/d ratio
24.0	W flood prone area	2.0	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (Waxhaw Br Downstream - XS 15)**

Riffle

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description: **Wits End Site (Waxhaw Br Downstream - XS 15)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	■	0	127.0096	572.9904
	■	4.625211	127.0131	572.9869
	■	9.862401	127.5034	572.4966
	■	13.90046	127.8613	572.1387
	■	14.88673	129.4163	570.5837
	■	16.3071	130.6437	569.3563
	■	18.1428	131.6262	568.3738
	■	19.60095	131.6129	568.3871
	■	20.62904	131.7012	568.2988
	■	22.09312	131.4772	568.5228
	■	23.77201	131.2015	568.7985
	■	25.75522	130.4605	569.5395
	■	26.55339	129.6138	570.3862
	■	27.39845	128.754	571.246
	■	28.77523	127.5385	572.4615
	■	33.55808	127.6163	572.3837
	■	38.24487	126.8089	573.1911
	■	44.47721	126.7702	573.2298
	■	51.87175	126.7929	573.2071
	■			
	■			
	■			
	■			
	■			
	■			

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
129.32	127.86	32.0		
570.68	572.14			

dimensions			
20.4	x-section area	1.7	d mean
12.0	width	13.4	wet P
2.4	d max	1.5	hyd radi
3.8	bank ht	7.1	w/d ratio
32.0	W flood prone area	2.7	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section

section: **Wits End Site (Waxhaw Br Downstream - XS 16)**

Riffle

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description: **Wits End Site (Waxhaw Br Downstream - XS 16)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	128.9558	571.0442
	☑	3.067822	128.7881	571.2119
	☑	11.78278	127.6125	572.3875
	☐	13.26106	127.2421	572.7579
	☐	19.11512	128.3607	571.6393
	☐	22.46516	128.8027	571.1973
	☐	24.36603	130.2655	569.7345
	☐	26.45328	131.2109	568.7891
	☐	27.5409	131.7146	568.2854
	☐	29.02736	132.0551	567.9449
	☐	29.74824	131.8574	568.1426
	☐	31.09636	131.6923	568.3077
	☐	32.66973	131.7446	568.2554
	☐	35.48758	131.0258	568.9742
	☐	37.11866	129.4519	570.5481
	☐	39.21798	127.9105	572.0896
	☐	43.51962	127.5531	572.4469
	☐	47.32692	127.5908	572.4092
	☐	50.22572	127.4403	572.5597
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

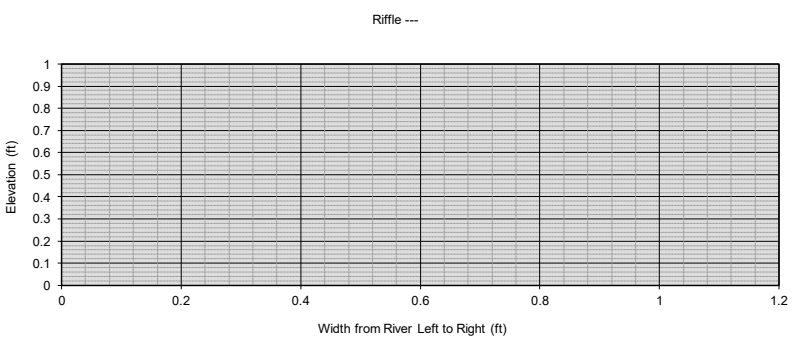
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
129.73	127.91	55.0		
570.27	572.09			

dimensions			
20.4	x-section area	1.6	d mean
13.2	width	14.3	wet P
2.3	d max	1.4	hyd radi
4.1	bank ht	8.5	w/d ratio
55.0	W flood prone area	4.2	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:

Riffle

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description:

height of instrument (ft):

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐			
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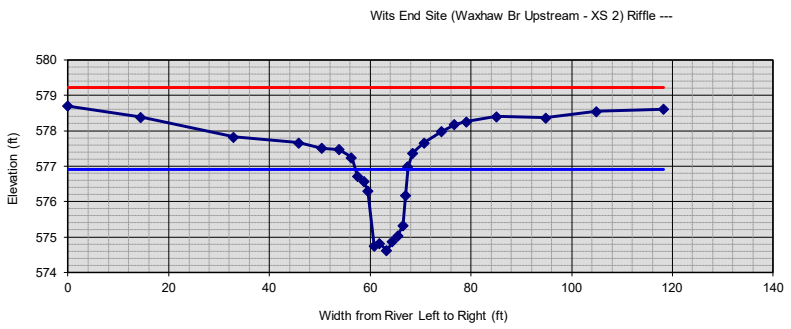
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
0	---			

dimensions			
0.0	x-section area	0.0	d mean
0.0	width	0.0	wet P
0.0	d max	0.0	hyd radi
0.0	bank ht	0.0	w/d ratio
0.0	W flood prone area	0.0	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Wits End Site (Waxhaw Br Upstream - XS 2)
	Riffle

	---
description:	Wits End Site (Waxhaw Br Upstream - XS 2)
height of instrument (ft):	700.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	121.3025	578.6976
	☐	14.41741	121.6114	578.3886
	☐	32.93871	122.1736	577.8264
	☐	45.78398	122.3348	577.6652
	☐	50.41913	122.4923	577.5077
	☐	53.81469	122.5299	577.4701
	☐	56.2733	122.7579	577.2421
	☐	57.50951	123.2867	576.7133
	☐	58.75617	123.4186	576.5814
	☐	59.55365	123.7044	576.2956
	☐	60.84641	125.2598	574.7402
	☐	61.86617	125.1831	574.8169
	☐	63.27488	125.3843	574.6157
	☐	64.41814	125.1232	574.8768
	☐	65.47784	124.961	575.039
	☐	66.49446	124.6672	575.3328
	☐	67.01634	123.8233	576.1767
	☐	67.45857	123.017	576.983
	☐	68.41196	122.6246	577.3754
	☐	70.75414	122.3349	577.6651
	☐	74.12777	122.0183	577.9817
	☐	76.75772	121.8204	578.1796
	☐	79.08626	121.7439	578.2561
	☐	85.05116	121.5963	578.4037
	☐	94.89487	121.6333	578.3667

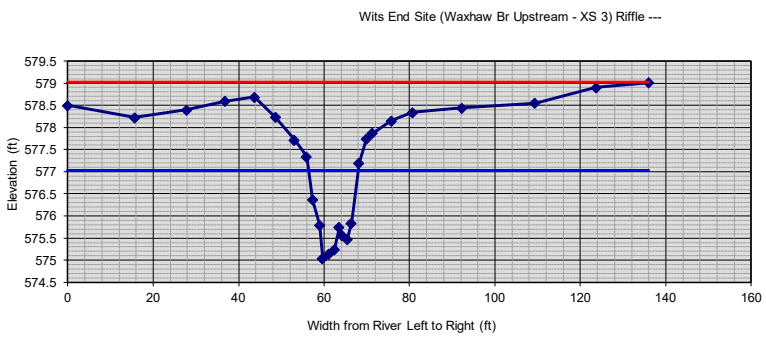
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
123.08	122.53	150.0		
576.92	577.47			

dimensions			
15.0	x-section area	1.4	d mean
10.4	width	12.2	wet P
2.3	d max	1.2	hyd radi
2.9	bank ht	7.2	w/d ratio
150.0	W flood prone area	14.4	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Wits End Site (Waxhaw Br Upstream - XS 3)
	Riffle

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description:	Wits End Site (Waxhaw Br Upstream - XS 3)
height of instrument (ft):	700.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	121.5056	578.4944
	☐	15.66326	121.7743	578.2257
	☐	27.80936	121.6053	578.3947
	☐	36.83055	121.4109	578.5891
	☐	43.71761	121.3114	578.6886
	☐	48.61252	121.7663	578.2337
	☐	53.08971	122.2837	577.7163
	☐	55.91122	122.6576	577.3424
	☐	57.29087	123.6354	576.3646
	☐	58.95162	124.2016	575.7984
	☐	59.66632	124.9628	575.0372
	☐	61.11099	124.8561	575.1439
	☐	62.43753	124.7624	575.2376
	☐	63.56406	124.2522	575.7478
	☐	64.31838	124.4385	575.5615
	☐	65.45781	124.533	575.467
	☐	66.38094	124.1631	575.8369
	☐	68.19802	122.8025	577.1975
	☐	69.94909	122.2622	577.7378
	☐	71.35174	122.1312	577.8688
	☐	75.73517	121.8469	578.1531
	☐	80.74436	121.6635	578.3365
	☐	92.29389	121.561	578.439
	☐	109.4238	121.4534	578.5466
	☐	123.6826	121.0937	578.9063

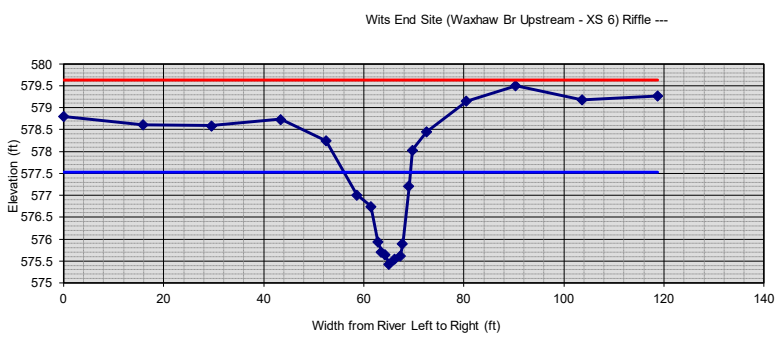
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
122.97	121.84	150.0		
577.03	578.16			

dimensions			
15.0	x-section area	1.3	d mean
11.6	width	12.9	wet P
2.0	d max	1.2	hyd radi
3.1	bank ht	9.0	w/d ratio
150.0	W flood prone area	12.9	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (Waxhaw Br Upstream - XS 6)**

Riffle

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description: **Wits End Site (Waxhaw Br Upstream - XS 6)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	121.2004	578.7996
	☐	15.85198	121.3877	578.6123
	☐	29.60339	121.4089	578.5911
	☐	43.37361	121.266	578.734
	☐	52.43762	121.7521	578.2479
	☐	58.57779	122.9865	577.0135
	☐	61.42751	123.2474	576.7526
	☐	62.81346	124.059	575.941
	☐	63.54732	124.2864	575.7136
	☐	64.20827	124.3491	575.6509
	☐	65.0869	124.5633	575.4367
	☐	66.20711	124.4455	575.5545
	☐	67.31435	124.3837	575.6163
	☐	67.76013	124.1032	575.8968
	☐	69.05983	122.7933	577.2067
	☐	69.74176	121.968	578.032
	☐	72.52202	121.5458	578.4542
	☐	80.54795	120.8459	579.1541
	☐	90.39262	120.4929	579.5071
	☐	103.6401	120.8157	579.1843
	☐	118.7102	120.7326	579.2674
	☐			
	☐			
	☐			
	☐			

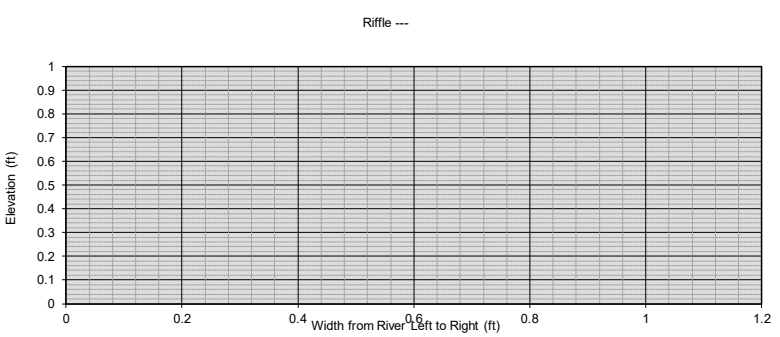
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
122.46	121.41	150.0		
577.54	578.59			

dimensions			
15.0	x-section area	1.1	d mean
13.4	width	14.5	wet P
2.1	d max	1.0	hyd radi
3.2	bank ht	11.9	w/d ratio
150.0	W flood prone area	11.2	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:

Riffle

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description:

height of instrument (ft):

notes	omit pt.	distance (ft)	FS (ft)	elevation
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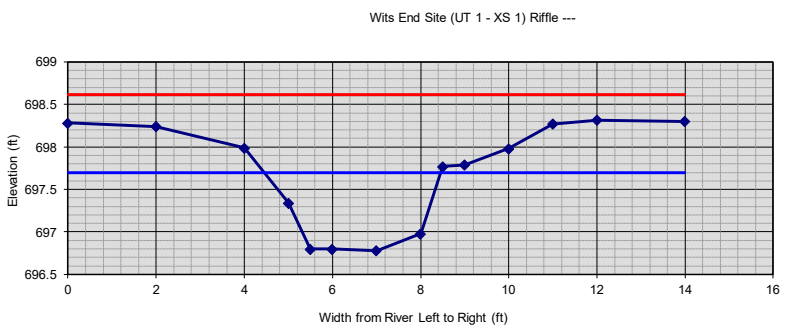
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
0	---			

dimensions			
0.0	x-section area	0.0	d mean
0.0	width	0.0	wet P
0.0	d max	0.0	hyd radi
0.0	bank ht	0.0	w/d ratio
0.0	W flood prone area	0.0	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Wits End Site (UT 1 - XS 1)
	Riffle --- ---
description:	Wits End Site (UT 1 - XS 1)
height of instrument (ft):	700.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	1.72	698.28
	☐	2	1.76	698.24
	☐	4	2.01	697.99
	☐	5	2.66	697.34
	☐	5.5	3.2	696.8
	☐	6	3.2	696.8
	☐	7	3.22	696.78
	☐	8	3.02	696.98
	☐	8.5	2.23	697.77
	☐	9	2.21	697.79
	☐	10	2.02	697.98
	☐	11	1.73	698.27
	☐	12	1.68	698.32
	☐	14	1.7	698.3
	☐			
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	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

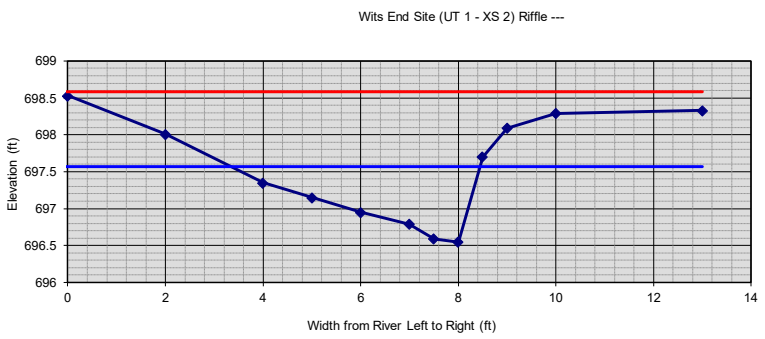
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
2.3	2.23	50.0		
697.7	697.77			

dimensions			
2.8	x-section area	0.7	d mean
4.0	width	4.8	wet P
0.9	d max	0.6	hyd radi
1.0	bank ht	5.8	w/d ratio
50.0	W flood prone area	12.5	ent ratio

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

check from channel material		
0	measured D84 (mm)	
0.0	relative roughness	fric. factor
0.000	Manning's n from channel material	

Cross Section



section:	Wits End Site (UT 1 - XS 2)
	Riffle --- ---
description:	Wits End Site (UT 1 - XS 2)
height of instrument (ft):	700.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	-1.5	1.43	698.57
	☐	0	1.47	698.53
	☐	2	1.99	698.01
	☐	4	2.65	697.35
	☐	5	2.85	697.15
	☐	6	3.05	696.95
	☐	7	3.21	696.79
	☐	7.5	3.41	696.59
	☐	8	3.45	696.55
	☐	8.5	2.3	697.7
	☐	9	1.91	698.09
	☐	10	1.71	698.29
	☐	13	1.67	698.33
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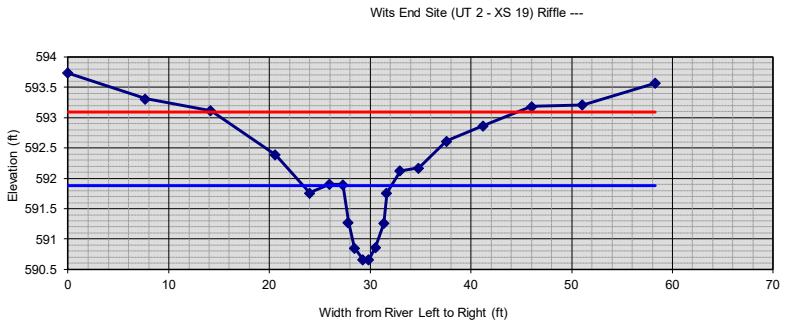
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
2.43	1.91	40.0		
697.57	698.09			

dimensions			
2.8	x-section area	0.5	d mean
5.1	width	5.9	wet P
1.0	d max	0.5	hyd radi
1.5	bank ht	9.4	w/d ratio
40.0	W flood prone area	7.8	ent ratio

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

check from channel material		
0	measured D84 (mm)	
0.0	relative roughness	fric. factor
0.000	Manning's n from channel material	

Cross Section



section: **Wits End Site (UT 2 - XS 19)**

Riffle

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description: **Wits End Site (UT 2 - XS 19)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**106.2563**	593.7437
	☐	**7.703989**	**106.6875**	593.3126
	☐	**14.17409**	**106.8856**	593.1144
	☐	**20.58538**	**107.6094**	592.3906
	☐	**23.99203**	**108.2375**	591.7625
	☐	**25.95308**	**108.0967**	591.9033
	☐	**27.29291**	**108.1039**	591.8961
	☐	**27.84135**	**108.7212**	591.2788
	☐	**28.44014**	**109.1434**	590.8566
	☐	**29.2933**	**109.3395**	590.6605
	☐	**29.86761**	**109.3358**	590.6642
	☐	**30.52441**	**109.1369**	590.8631
	☐	**31.36569**	**108.7394**	591.2606
	☐	**31.64681**	**108.2388**	591.7612
	☐	**32.984**	**107.873**	592.127
	☐	**34.8133**	**107.829**	592.171
	☐	**37.56977**	**107.3836**	592.6164
	☐	**41.24556**	**107.1324**	592.8676
	☐	**46.03126**	**106.8141**	593.1859
	☐	**51.09789**	**106.7882**	593.2118
	☐	**58.32752**	**106.4329**	593.5671
	☐			
	☐			
	☐			
	☐			

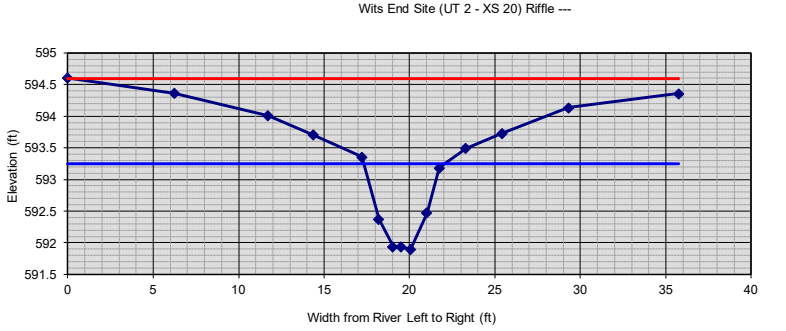
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
108.12	**108.12**	**33.0**		
591.88	591.88			

dimensions			
4.0	x-section area	0.6	d mean
7.0	width	7.9	wet P
1.2	d max	0.5	hyd radi
1.2	bank ht	12.5	w/d ratio
33.0	W flood prone area	4.7	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (UT 2 - XS 20)**

Riffle

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description: **Wits End Site (UT 2 - XS 20)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**105.3884**	594.6116
	☐	**6.253683**	**105.6349**	594.3651
	☐	**11.7295**	**105.9874**	594.0126
	☐	**14.37586**	**106.2935**	593.7065
	☐	**17.22303**	**106.6434**	593.3566
	☐	**18.21467**	**107.6267**	592.3733
	☐	**19.03538**	**108.0592**	591.9408
	☐	**19.51154**	**108.0661**	591.9339
	☐	**20.06701**	**108.1036**	591.8964
	☐	**21.02743**	**107.5265**	592.4735
	☐	**21.75763**	**106.8159**	593.1841
	☐	**23.30513**	**106.5068**	593.4932
	☐	**25.44749**	**106.2693**	593.7307
	☐	**29.32753**	**105.8642**	594.1358
	☐	**35.75707**	**105.64**	594.36
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	☐			

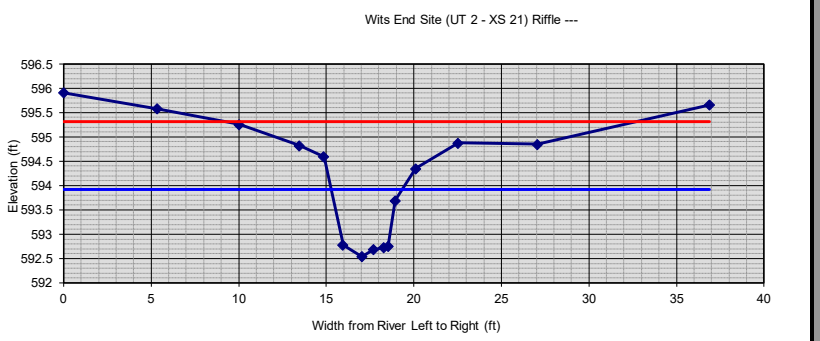
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
106.75	**106.64**	**40.0**		
593.25	593.36			

dimensions			
4.0	x-section area	0.8	d mean
4.8	width	5.7	wet P
1.4	d max	0.7	hyd radi
1.5	bank ht	5.7	w/d ratio
40.0	W flood prone area	8.4	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (UT 2 - XS 21)**

Riffle

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description: **Wits End Site (UT 2 - XS 21)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**104.0858**	595.9142
	☐	**5.345023**	**104.4215**	595.5785
	☐	**10.03149**	**104.7453**	595.2547
	☐	**13.46034**	**105.1763**	594.8237
	☐	**14.8619**	**105.4081**	594.5919
	☐	**15.96513**	**107.2199**	592.7801
	☐	**17.03749**	**107.4611**	592.5389
	☐	**17.69778**	**107.3116**	592.6884
	☐	**18.27792**	**107.2766**	592.7234
	☐	**18.53108**	**107.2403**	592.7597
	☐	**18.93804**	**106.3061**	593.6939
	☐	**20.11762**	**105.649**	594.351
	☐	**22.53563**	**105.1236**	594.8764
	☐	**27.07208**	**105.1482**	594.8518
	☐	**36.90459**	**104.344**	595.656
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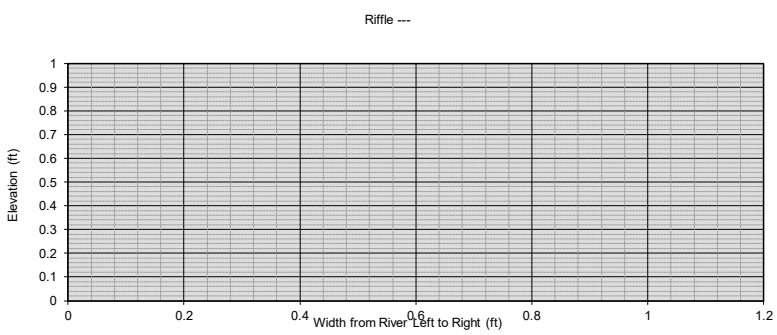
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
106.07	**105.4**	**22.0**		
593.93	594.6			

dimensions			
4.0	x-section area	1.0	d mean
4.1	width	5.5	wet P
1.4	d max	0.7	hyd radi
2.1	bank ht	4.2	w/d ratio
22.0	W flood prone area	5.4	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:

Riffle

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description:

height of instrument (ft):

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐			
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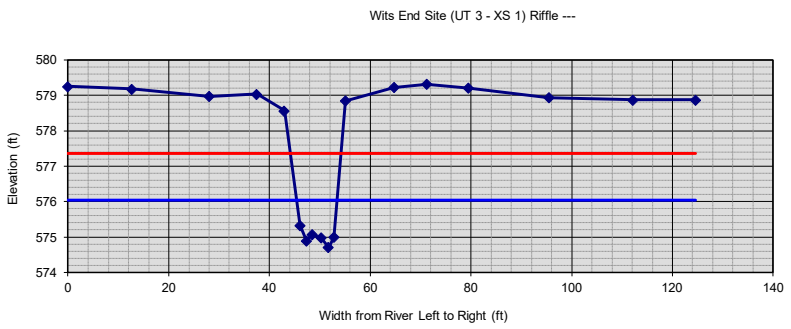
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
0	---			

dimensions			
0.0	x-section area	0.0	d mean
0.0	width	0.0	wet P
0.0	d max	0.0	hyd radi
0.0	bank ht	0.0	w/d ratio
0.0	W flood prone area	0.0	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (UT 3 - XS 1)**

Riffle

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description: **Wits End Site (UT 3 - XS 1)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**120.7434**	579.2566
	☐	**12.63983**	**120.8207**	579.1793
	☐	**28.07906**	**121.0274**	578.9726
	☐	**37.5133**	**120.9639**	579.0361
	☐	**42.98174**	**121.4354**	578.5646
	☐	**46.06249**	**124.6656**	575.3344
	☐	**47.35299**	**125.1061**	574.8939
	☐	**48.51128**	**124.9352**	575.0648
	☐	**50.25729**	**125.0239**	574.9761
	☐	**51.7197**	**125.296**	574.704
	☐	**52.77515**	**125.0074**	574.9926
	☐	**55.08331**	**121.1516**	578.8484
	☐	**64.78125**	**120.7791**	579.2209
	☐	**71.24162**	**120.6726**	579.3274
	☐	**79.54588**	**120.794**	579.206
	☐	**95.49237**	**121.0676**	578.9324
	☐	**112.1165**	**121.1299**	578.8701
	☐	**124.5873**	**121.1262**	578.8738
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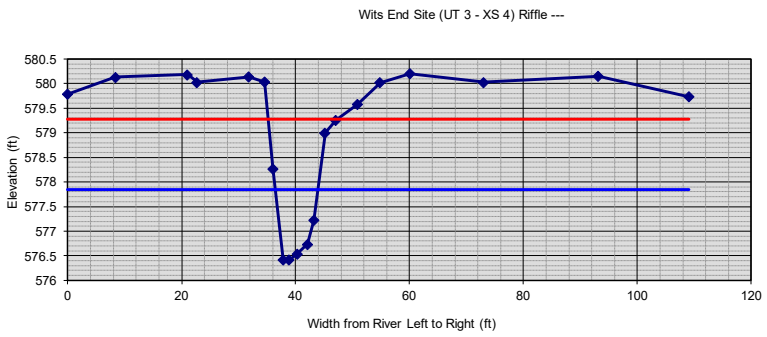
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
123.96	**121.44**	**10.0**		
576.04	578.56			

dimensions			
7.8	x-section area	1.0	d mean
8.0	width	9.1	wet P
1.3	d max	0.9	hyd radi
3.9	bank ht	8.3	w/d ratio
10.0	W flood prone area	1.2	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (UT 3 - XS 4)**

Riffle

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description: **Wits End Site (UT 3 - XS 4)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**120.2114**	579.7886
	☐	**8.368834**	**119.8672**	580.1328
	☐	**21.01086**	**119.8188**	580.1812
	☐	**22.72251**	**119.9706**	580.0294
	☐	**31.83254**	**119.861**	580.139
	☐	**34.55558**	**119.9681**	580.0319
	☐	**36.00894**	**121.7315**	578.2685
	☐	**37.86302**	**123.5758**	576.4242
	☐	**38.90192**	**123.5829**	576.4171
	☐	**40.31901**	**123.4564**	576.5436
	☐	**42.1117**	**123.2621**	576.7379
	☐	**43.21382**	**122.7739**	577.2261
	☐	**45.19732**	**121.0018**	578.9982
	☐	**47.12013**	**120.7368**	579.2632
	☐	**50.88633**	**120.4212**	579.5788
	☐	**54.84429**	**119.9771**	580.0229
	☐	**60.06807**	**119.7928**	580.2072
	☐	**73.0446**	**119.9742**	580.0258
	☐	**93.1665**	**119.851**	580.149
	☐	**109.0612**	**120.2637**	579.7363
	☐			
	☐			
	☐			
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	☐			

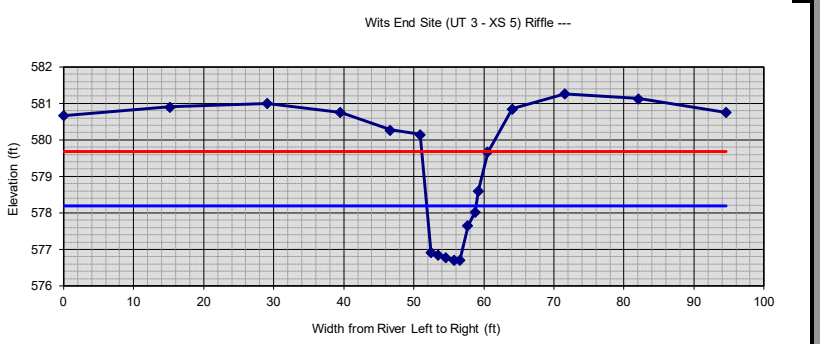
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
122.15	**119.98**	**8.0**		
577.85	580.02			

dimensions			
7.8	x-section area	1.0	d mean
7.5	width	8.4	wet P
1.4	d max	0.9	hyd radi
3.6	bank ht	7.2	w/d ratio
8.0	W flood prone area	1.1	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (UT 3 - XS 5)**

Riffle

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description: **Wits End Site (UT 3 - XS 5)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**119.3293**	580.6707
	☐	**15.17698**	**119.0979**	580.9021
	☐	**29.0636**	**118.9996**	581.0004
	☐	**39.55389**	**119.2455**	580.7545
	☐	**46.67837**	**119.7302**	580.2698
	☐	**50.89775**	**119.8518**	580.1482
	☐	**52.45442**	**123.0851**	576.9149
	☐	**53.53331**	**123.1512**	576.8489
	☐	**54.62791**	**123.2272**	576.7728
	☐	**55.75533**	**123.2894**	576.7106
	☐	**56.56091**	**123.2906**	576.7094
	☐	**57.72654**	**122.3484**	577.6516
	☐	**58.78594**	**121.9667**	578.0333
	☐	**59.21078**	**121.3908**	578.6092
	☐	**60.55935**	**120.3353**	579.6647
	☐	**64.06043**	**119.144**	580.856
	☐	**71.56608**	**118.7363**	581.2637
	☐	**82.04201**	**118.8712**	581.1288
	☐	**94.57593**	**119.2401**	580.7599
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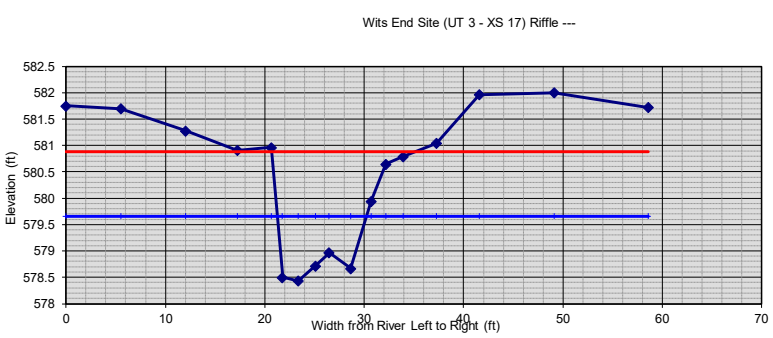
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
121.8	**119.85**	**9.0**		
578.2	580.15			

dimensions			
7.8	x-section area	1.1	d mean
7.1	width	8.4	wet P
1.5	d max	0.9	hyd radi
3.4	bank ht	6.4	w/d ratio
9.0	W flood prone area	1.3	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (UT 3 - XS 17)**

Riffle

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description: **Wits End Site (UT 3 - XS 17)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**118.2451**	581.7549
	☐	**5.541969**	**118.3022**	581.6978
	☐	**12.04823**	**118.7217**	581.2783
	☐	**17.24145**	**119.0906**	580.9094
	☐	**20.63978**	**119.0364**	580.9636
	☐	**21.78934**	**121.5037**	578.4963
	☐	**23.34775**	**121.5687**	578.4313
	☐	**25.12163**	**121.2835**	578.7165
	☐	**26.49573**	**121.0331**	578.9669
	☐	**28.63991**	**121.3276**	578.6724
	☐	**30.68757**	**120.0552**	579.9448
	☐	**32.17126**	**119.3519**	580.6481
	☐	**33.95387**	**119.2092**	580.7908
	☐	**37.2869**	**118.956**	581.044
	☐	**41.5889**	**118.0354**	581.9646
	☐	**49.13064**	**117.9936**	582.0064
	☐	**58.58211**	**118.2748**	581.7252
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	☐			

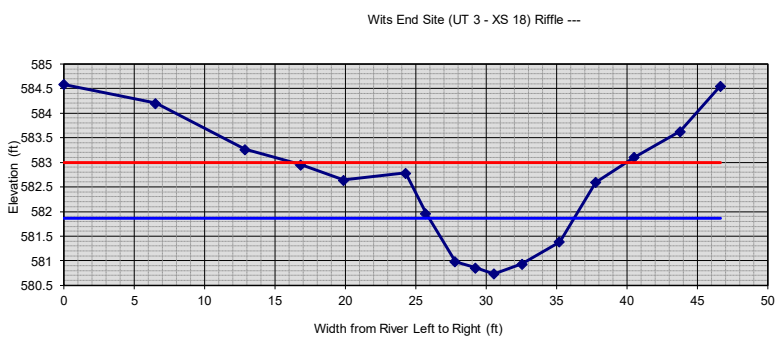
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
120.34	**119.35**	**14.0**		
579.66	580.65			

dimensions			
7.8	x-section area	0.9	d mean
9.0	width	10.1	wet P
1.2	d max	0.8	hyd radi
2.2	bank ht	10.3	w/d ratio
14.0	W flood prone area	1.6	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (UT 3 - XS 18)**

Riffle

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description: **Wits End Site (UT 3 - XS 18)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**115.4046**	584.5954
	☐	**6.532804**	**115.7979**	584.2021
	☐	**12.86676**	**116.7356**	583.2644
	☐	**16.82831**	**117.044**	582.956
	☐	**19.85303**	**117.3601**	582.6399
	☐	**24.27872**	**117.2181**	582.7819
	☐	**25.70961**	**118.0356**	581.9644
	☐	**27.79315**	**119.0191**	580.9809
	☐	**29.21759**	**119.1407**	580.8593
	☐	**30.55886**	**119.2587**	580.7413
	☐	**32.54276**	**119.0638**	580.9362
	☐	**35.20446**	**118.6144**	581.3856
	☐	**37.7763**	**117.4045**	582.5955
	☐	**40.49001**	**116.8985**	583.1015
	☐	**43.77803**	**116.3681**	583.6319
	☐	**46.6304**	**115.4482**	584.5518
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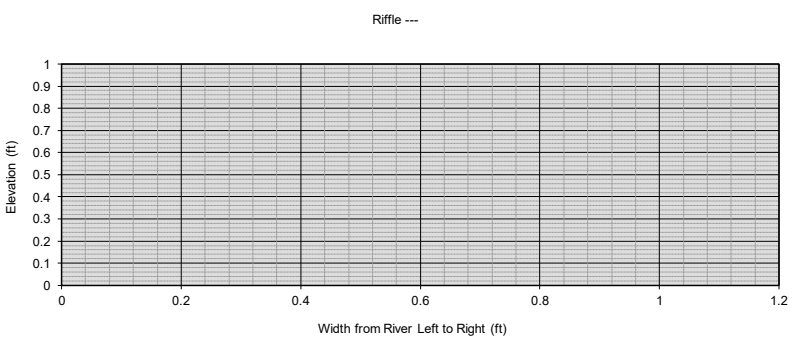
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
118.13	**117.4**	**23.0**		
581.87	582.6			

dimensions			
7.8	x-section area	0.8	d mean
10.3	width	10.7	wet P
1.1	d max	0.7	hyd radi
1.9	bank ht	13.7	w/d ratio
23.0	W flood prone area	2.2	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:

Riffle

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description:

height of instrument (ft):

notes	omit pt.	distance (ft)	FS (ft)	elevation
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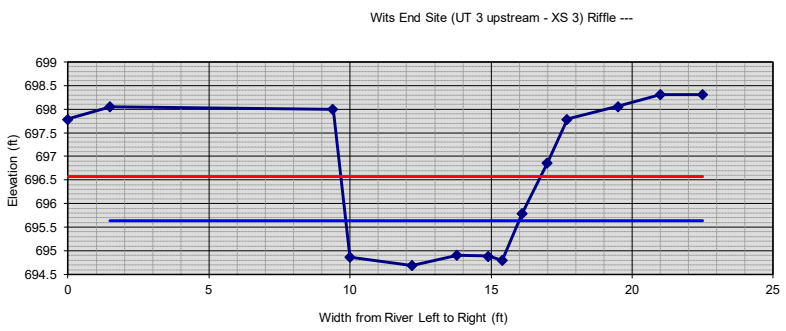
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
0	---			

dimensions			
0.0	x-section area	0.0	d mean
0.0	width	0.0	wet P
0.0	d max	0.0	hyd radi
0.0	bank ht	0.0	w/d ratio
0.0	W flood prone area	0.0	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Wits End Site (UT 3 upstream - XS 3)
	Riffle --- ---
description:	Wits End Site (UT 3 upstream - XS 3)
height of instrument (ft):	700.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	2.21	697.79
	☐	1.5	1.95	698.05
	☐	9.4	2	698
	☐	10	5.13	694.87
	☐	12.2	5.3	694.7
	☐	13.8	5.09	694.91
	☐	14.9	5.11	694.89
	☐	15.4	5.2	694.8
	☐	16.1	4.21	695.79
	☐	17	3.13	696.87
	☐	17.7	2.21	697.79
	☐	19.5	1.94	698.06
	☐	21	1.68	698.32
	☐	22.5	1.69	698.31
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

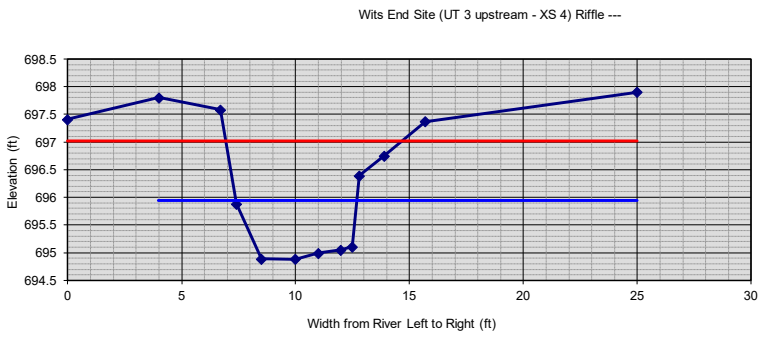
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
4.36	2.21	7.0		
695.64	697.79			

dimensions			
4.7	x-section area	0.8	d mean
6.1	width	7.2	wet P
0.9	d max	0.7	hyd radi
3.1	bank ht	8.0	w/d ratio
7.0	W flood prone area	1.1	ent ratio

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

check from channel material		
0	measured D84 (mm)	
0.0	relative roughness	0.0 fric. factor
0.000	Manning's n from channel material	

Cross Section



section:	Wits End Site (UT 3 upstream - XS 4)
	Riffle --- ---
description:	Wits End Site (UT 3 upstream - XS 4)
height of instrument (ft):	700.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	2.59	697.41
	☐	4	2.2	697.8
	☐	6.7	2.42	697.58
	☐	7.4	4.12	695.88
	☐	8.5	5.11	694.89
	☐	10	5.12	694.88
	☐	11	5.01	694.99
	☐	12	4.95	695.05
	☐	12.5	4.89	695.11
	☐	12.8	3.61	696.39
	☐	13.9	3.25	696.75
	☐	15.7	2.63	697.37
	☐	25	2.1	697.9
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

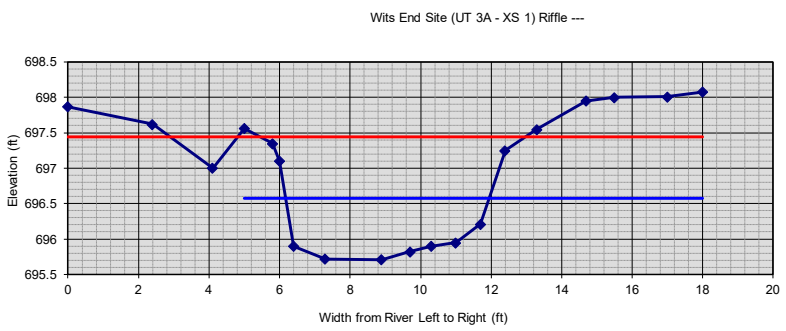
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
4.05	2.63	8.0		
695.95	697.37			

dimensions			
4.7	x-section area	0.9	d mean
5.3	width	6.4	wet P
1.1	d max	0.7	hyd radi
2.5	bank ht	6.1	w/d ratio
8.0	W flood prone area	1.5	ent ratio

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

check from channel material		
0	measured D84 (mm)	
0.0	relative roughness	0.0 fric. factor
0.000	Manning's n from channel material	

Cross Section



section: **Wits End Site (UT 3A - XS 1)**

Riffle

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description: **Wits End Site (UT 3A - XS 1)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	2.13	697.87
	☑	2.4	2.38	697.62
	☑	4.1	3	697
	☐	5	2.44	697.56
	☐	5.8	2.65	697.35
	☐	6	2.9	697.1
	☐	6.4	4.1	695.9
	☐	7.3	4.28	695.72
	☐	8.9	4.29	695.71
	☐	9.7	4.18	695.82
	☐	10.3	4.1	695.9
	☐	11	4.05	695.95
	☐	11.7	3.79	696.21
	☐	12.4	2.75	697.25
	☐	13.3	2.45	697.55
	☐	14.7	2.05	697.95
	☐	15.5	2	698
	☐	17	1.99	698.01
	☐	18	1.92	698.08
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

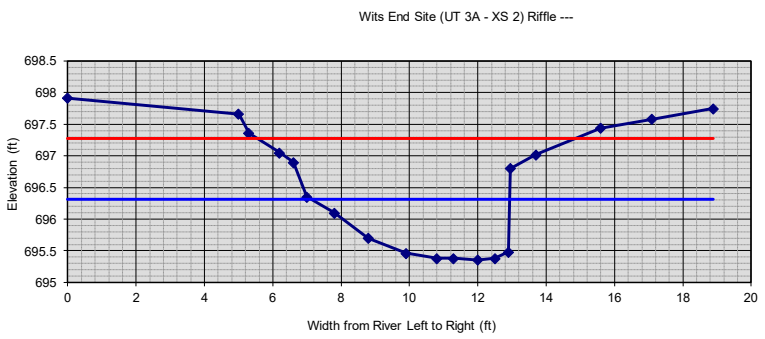
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
3.42	2.65	8.0		
696.58	697.35			

dimensions			
4.1	x-section area	0.7	d mean
5.8	width	6.5	wet P
0.9	d max	0.6	hyd radi
1.6	bank ht	8.2	w/d ratio
8.0	W flood prone area	1.4	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (UT 3A - XS 2)**

Riffle

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description: **Wits End Site (UT 3A - XS 2)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	2.08	697.92
	☐	5	2.34	697.66
	☐	5.3	2.64	697.36
	☐	6.2	2.95	697.05
	☐	6.6	3.1	696.9
	☐	7	3.65	696.35
	☐	7.8	3.9	696.1
	☐	8.8	4.3	695.7
	☐	9.9	4.54	695.46
	☐	10.8	4.62	695.38
	☐	11.3	4.62	695.38
	☐	12	4.64	695.36
	☐	12.5	4.62	695.38
	☐	12.9	4.52	695.48
	☐	12.95	3.2	696.8
	☐	13.7	2.98	697.02
	☐	15.6	2.56	697.44
	☐	17.1	2.42	697.58
	☐	18.9	2.25	697.75
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

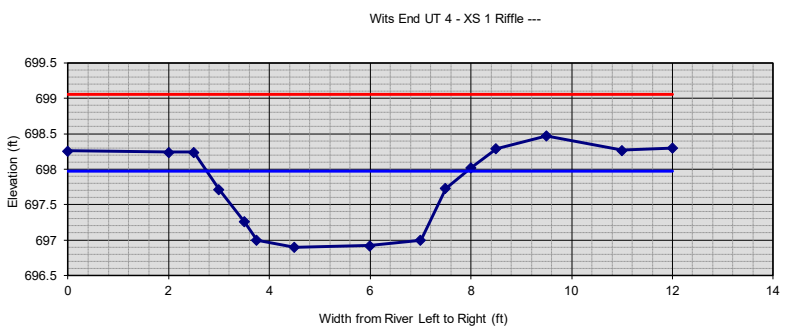
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
3.68	3.2	9.0		
696.32	696.8			

dimensions			
4.1	x-section area	0.7	d mean
5.8	width	6.8	wet P
1.0	d max	0.6	hyd radi
1.4	bank ht	8.3	w/d ratio
9.0	W flood prone area	1.5	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End UT 4 - XS 1**

Riffle

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description: **Wits End UT 4 - XS 1**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	1.74	698.26
	☐	2	1.76	698.24
	☐	2.5	1.76	698.24
	☐	3	2.29	697.71
	☐	3.5	2.74	697.26
	☐	3.75	3	697
	☐	4.5	3.1	696.9
	☐	6	3.08	696.92
	☐	7	3	697
	☐	7.5	2.27	697.73
	☐	8	1.98	698.02
	☐	8.5	1.71	698.29
	☐	9.5	1.53	698.47
	☐	11	1.73	698.27
	☐	12	1.7	698.3
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

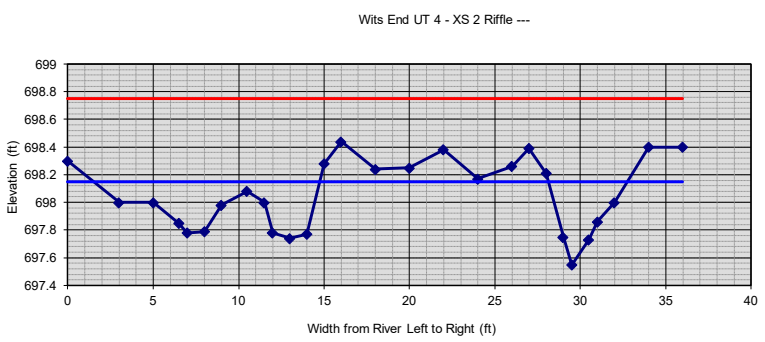
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
2.02	1.76	50.0		
697.98	698.24			

dimensions			
4.3	x-section area	0.8	d mean
5.2	width	6.0	wet P
1.1	d max	0.7	hyd radi
1.3	bank ht	6.3	w/d ratio
50.0	W flood prone area	9.6	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End UT 4 - XS 2**

Riffle

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description: **Wits End UT 4 - XS 2**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	1.7	698.3
	☐	3	2	698
	☐	5	2	698
	☐	6.5	2.15	697.85
	☐	7	2.22	697.78
	☐	8	2.21	697.79
	☐	9	2.02	697.98
	☐	10.5	1.92	698.08
	☐	11.5	2	698
	☐	12	2.22	697.78
	☐	13	2.26	697.74
	☐	14	2.23	697.77
	☐	15	1.72	698.28
	☐	16	1.56	698.44
	☐	18	1.76	698.24
	☐	20	1.75	698.25
	☐	22	1.62	698.38
	☐	24	1.83	698.17
	☐	26	1.74	698.26
	☐	27	1.61	698.39
	☐	28	1.79	698.21
	☐	29	2.25	697.75
	☐	29.5	2.45	697.55
	☐	30.5	2.27	697.73
	☐	31	2.14	697.86

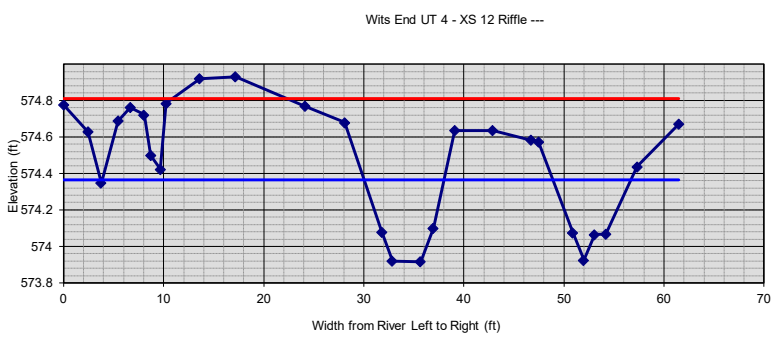
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
1.85	1.83	60.0		
698.15	698.17			

dimensions			
4.3	x-section area	0.2	d mean
17.9	width	18.2	wet P
0.6	d max	0.2	hyd radi
0.6	bank ht	74.5	w/d ratio
60.0	W flood prone area	3.4	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End UT 4 - XS 12**

Riffle

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description: **Wits End UT 4 - XS 12**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	■	0	125.2242	574.7758
	■	2.439166	125.372	574.628
	■	3.748465	125.6523	574.3477
	■	5.462365	125.3122	574.6878
	■	6.649243	125.2389	574.7611
	■	8.039055	125.2782	574.7218
	■	8.718118	125.5009	574.4991
	■	9.658038	125.5763	574.4237
	■	10.26622	125.2162	574.7838
	■	13.5954	125.08	574.92
	■	17.18233	125.0701	574.9299
	■	24.14367	125.2304	574.7696
	■	28.11371	125.321	574.679
	■	31.81356	125.9211	574.0789
	■	32.84708	126.0804	573.9196
	■	35.67393	126.0817	573.9183
	■	36.9473	125.8997	574.1003
	■	39.10131	125.3644	574.6356
	■	42.8985	125.3642	574.6358
	■	46.70169	125.4178	574.5822
	■	47.46153	125.4285	574.5715
	■	50.90506	125.926	574.074
	■	51.9738	126.0756	573.9244
	■	53.06471	125.9346	574.0654
	■	54.1877	125.9321	574.0679

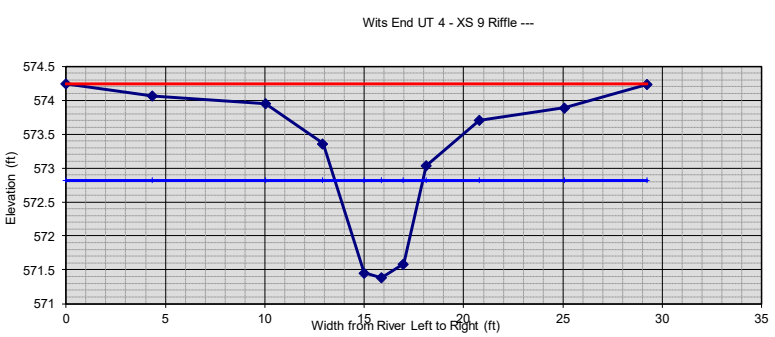
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
125.635	125.43	50.0		
574.365	574.57			

dimensions			
4.3	x-section area	0.3	d mean
15.9	width	16.1	wet P
0.4	d max	0.3	hyd radi
0.7	bank ht	59.3	w/d ratio
50.0	W flood prone area	3.1	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End UT 4 - XS 9**

Riffle

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description: **Wits End UT 4 - XS 9**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	■	0	125.7529	574.2471
	■	4.355013	125.9352	574.0648
	■	10.04516	126.0475	573.9525
	■	12.92272	126.6367	573.3633
	■	14.99926	128.5475	571.4525
	■	15.86524	128.6099	571.3901
	■	16.98381	128.4127	571.5873
	■	18.122	126.9642	573.0358
	■	20.79278	126.2939	573.7061
	■	25.0958	126.1105	573.8895
	■	29.22879	125.7658	574.2342
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			
	■			

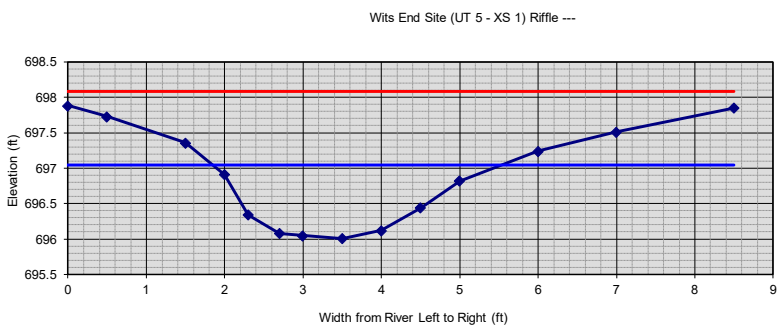
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
127.18	126.29	30.0		
572.82	573.71			

dimensions			
4.3	x-section area	1.0	d mean
4.4	width	5.6	wet P
1.4	d max	0.8	hyd radi
2.3	bank ht	4.6	w/d ratio
30.0	W flood prone area	6.8	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (UT 5 - XS 1)**

Riffle

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description: **Wits End Site (UT 5 - XS 1)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	-1.8	2.1	697.9
	☐	0	2.12	697.88
	☐	0.5	2.27	697.73
	☐	1.5	2.64	697.36
	☐	2	3.09	696.91
	☐	2.3	3.66	696.34
	☐	2.7	3.92	696.08
	☐	3	3.95	696.05
	☐	3.5	3.99	696.01
	☐	4	3.88	696.12
	☐	4.5	3.56	696.44
	☐	5	3.18	696.82
	☐	6	2.76	697.24
	☐	7	2.49	697.51
	☐	8.5	2.15	697.85
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

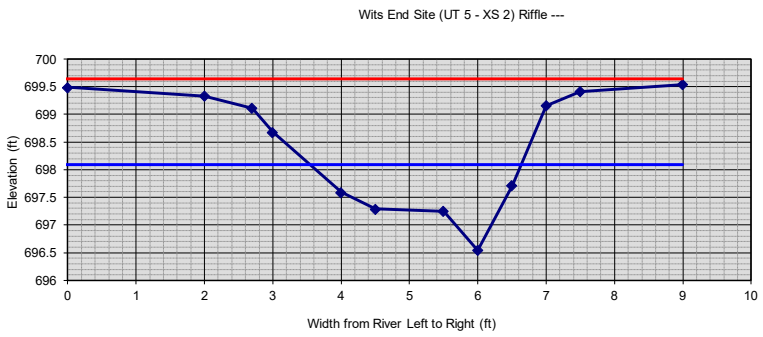
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
2.95	2.95	15.0		
697.05	697.05			

dimensions			
2.4	x-section area	0.7	d mean
3.7	width	4.5	wet P
1.0	d max	0.5	hyd radi
1.0	bank ht	5.6	w/d ratio
15.0	W flood prone area	4.1	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Wits End Site (UT 5 - XS 2)**

Riffle

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description: **Wits End Site (UT 5 - XS 2)**

height of instrument (ft): **700.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	-1.5	0.44	699.56
	☐	0	0.51	699.49
	☐	2	0.67	699.33
	☐	2.7	0.89	699.11
	☐	3	1.32	698.68
	☐	4	2.41	697.59
	☐	4.5	2.71	697.29
	☐	5.5	2.75	697.25
	☐	6	3.45	696.55
	☐	6.5	2.29	697.71
	☐	7	0.84	699.16
	☐	7.5	0.59	699.41
	☐	9	0.46	699.54
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
1.9	0.89	10.0		
698.1	699.11			

dimensions			
2.4	x-section area	0.8	d mean
3.1	width	4.8	wet P
1.6	d max	0.5	hyd radi
2.6	bank ht	4.0	w/d ratio
10.0	W flood prone area	3.2	ent ratio

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

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Wits End Site - Stream UT3 DS
2. Date of evaluation: 2/13/2019
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: A. Baldwin/RS
5. County: Union
6. Nearest named water body on USGS 7.5-minute quad: Waxhaw Branch
7. River basin: Yadkin-PeeDee
8. Site coordinates (decimal degrees, at lower end of assessment reach): 34.911157, -80.443906

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT3
10. Length of assessment reach evaluated (feet): 200
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 6
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

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

ADDITIONAL INFORMATION:

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

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

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

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

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

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

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

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

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☒J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

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

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

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

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

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

Check for Tidal Marsh Streams Only

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

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

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

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

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

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

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

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

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

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

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

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

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

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

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

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

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

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

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

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

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

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

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

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

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☒Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Wits End Site - Stream UT3 DS	Date of Assessment	2/13/2019
Stream Category	Pa2	Assessor Name/Organization	A. Baldwin/RS

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

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

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Wits End Site - Stream WB
2. Date of evaluation: 2/13/2019
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: A. Baldwin/RS
5. County: Union
6. Nearest named water body on USGS 7.5-minute quad: Waxhaw Branch
7. River basin: Yadkin-PeeDee
8. Site coordinates (decimal degrees, at lower end of assessment reach): 34.911744, -80.443165

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): Waxhaw Branch
10. Length of assessment reach evaluated (feet): 200
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 7
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

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

ADDITIONAL INFORMATION:

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

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

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

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

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

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

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

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

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☒J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

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

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

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

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

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

Check for Tidal Marsh Streams Only

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

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

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

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

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

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

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

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

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

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

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

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

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

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

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

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

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

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

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

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

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

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

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

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

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☒Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Wits End Site - Waxhaw Branch	Date of Assessment	2/13/2019
Stream Category	Pa3	Assessor Name/Organization	A. Baldwin/RS

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

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

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Wits End Site - Stream UT3 US
2. Date of evaluation: 12/2/2019
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: A. Baldwin/RS
5. County: Union
6. Nearest named water body on USGS 7.5-minute quad: Waxhaw Branch
7. River basin: Yadkin-PeeDee
8. Site coordinates (decimal degrees, at lower end of assessment reach): 34.911801, -80.448006

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT3 US
10. Length of assessment reach evaluated (feet): 200
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 9
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

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

ADDITIONAL INFORMATION:

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

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

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

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

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

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

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

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

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☒J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

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

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

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

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

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

Check for Tidal Marsh Streams Only

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

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

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

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

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

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

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

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

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

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

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

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

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

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

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

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

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

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

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

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

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

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

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

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

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☒Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Wits End Site - Stream UT3 US	Date of Assessment	12/2/2019
Stream Category	Pa1	Assessor Name/Organization	A. Baldwin/RS

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

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

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Wits End Site - Stream UT3A
2. Date of evaluation: 12/2/2019
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: A. Baldwin/RS
5. County: Union
6. Nearest named water body on USGS 7.5-minute quad: Waxhaw Branch
7. River basin: Yadkin-PeeDee
8. Site coordinates (decimal degrees, at lower end of assessment reach): 34.912608, -80.446902

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT3
10. Length of assessment reach evaluated (feet): 200
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 6
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

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

ADDITIONAL INFORMATION:

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

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

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

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

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

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

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

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

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☒J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

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

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

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

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

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

Check for Tidal Marsh Streams Only

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

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

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

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

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

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

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

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

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

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

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

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

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

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☒Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Wits End Site - Stream UT3A	Date of Assessment	12/2/2019
Stream Category	Pa1	Assessor Name/Organization	A. Baldwin/RS

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

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

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Wits End Site	Date of Evaluation	2/13/2019
Applicant/Owner Name	Restoration Systems	Wetland Site Name	Wetland WA
Wetland Type	Headwater Forest	Assessor Name/Organization	A. Baldwin/RS
Level III Ecoregion	Piedmont	Nearest Named Water Body	Waxhaw Branch
River Basin	Yadkin-PeeDee	USGS 8-Digit Catalogue Unit	03040105
County	Union	NCDWR Region	Mooresville
☒ Yes ☐ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	34.909632/-80.442470

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

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

Is the assessment area intensively managed? ☐ Yes ☒ No

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

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

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

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

Is the assessment area on a coastal island? ☐ Yes ☒ No

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

Does the assessment area experience overbank flooding during normal rainfall conditions? ☐ Yes ☒ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

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

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

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

4b.
- ☐A Soil ribbon < 1 inch
- ☒B Soil ribbon ≥ 1 inch

4c.
- ☒A No peat or muck presence
- ☐B A peat or muck presence

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric (skip for non-riparian wetlands)

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M).

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

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

7a. Is assessment area within 50 feet of a tributary or other open water?
☐Yes ☒No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

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

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

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

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

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

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

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

Answer for assessment area dominant landform.

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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

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

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

☒A 0
☐B 1 to 4
☐C 5 to 8

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

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

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

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

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

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

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

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

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

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

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

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

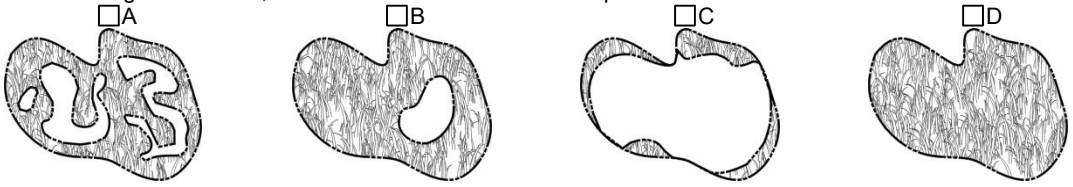
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

Include both natural debris and man-placed natural debris.
☒A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☐B Not A

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

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

☐A ☐B ☐C ☐D



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

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.
☐A Overbank and overland flow are not severely altered in the assessment area.
☒B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☐D Both overbank and overland flow are severely altered in the assessment area.

Notes

NC WAM FIELD ASSESSMENT FORM
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USACE AID #		NCDWR#	
Project Name	Wits End Site	Date of Evaluation	2/13/2019
Applicant/Owner Name	Restoration Systems	Wetland Site Name	Wetland WA
Wetland Type	Headwater Forest	Assessor Name/Organization	A. Baldwin/RS
Level III Ecoregion	Piedmont	Nearest Named Water Body	Waxhaw Branch
River Basin	Yadkin-PeeDee	USGS 8-Digit Catalogue Unit	03040105
County	Union	NCDWR Region	Mooresville
☒ Yes ☐ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	34.909632/-80.442470

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

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

Is the assessment area intensively managed? ☐ Yes ☒ No

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

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

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

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

Is the assessment area on a coastal island? ☐ Yes ☒ No

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

Does the assessment area experience overbank flooding during normal rainfall conditions? ☐ Yes ☒ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

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

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

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

4b.
- ☐A Soil ribbon < 1 inch
- ☒B Soil ribbon ≥ 1 inch

4c.
- ☒A No peat or muck presence
- ☐B A peat or muck presence

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric (skip for non-riparian wetlands)

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M).

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

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

7a. Is assessment area within 50 feet of a tributary or other open water?
☐Yes ☒No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

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

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

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

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

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

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

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

Answer for assessment area dominant landform.

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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

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

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

☒A 0
☐B 1 to 4
☐C 5 to 8

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

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

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

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

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

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

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

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

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

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

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

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

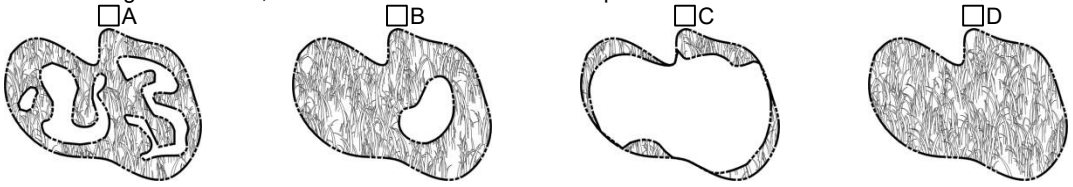
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

Include both natural debris and man-placed natural debris.
☒A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☐B Not A

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

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

☐A ☐B ☐C ☐D



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

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.
☐A Overbank and overland flow are not severely altered in the assessment area.
☒B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☐D Both overbank and overland flow are severely altered in the assessment area.

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetland WA	Date of Assessment	2/13/2019
Wetland Type	Headwater Forest	Assessor Name/Organization	A. Baldwin/RS

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **MEDIUM**

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Wits End Site	Date of Evaluation	2/13/2019
Applicant/Owner Name	Restoration Systems	Wetland Site Name	Waxhaw Br. LB Drained Wetland
Wetland Type	Headwater Forest	Assessor Name/Organization	A. Baldwin/RS
Level III Ecoregion	Piedmont	Nearest Named Water Body	Waxhaw Branch
River Basin	Yadkin-PeeDee	USGS 8-Digit Catalogue Unit	03040105
County	Union	NCDWR Region	Mooresville
☒ Yes ☐ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	34.911487/-80.443002

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

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

Is the assessment area intensively managed? ☒ Yes ☐ No

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

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

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

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

Is the assessment area on a coastal island? ☐ Yes ☒ No

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

Does the assessment area experience overbank flooding during normal rainfall conditions? ☐ Yes ☒ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

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

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

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

4b.
- ☐A Soil ribbon < 1 inch
- ☒B Soil ribbon ≥ 1 inch

4c.
- ☒A No peat or muck presence
- ☐B A peat or muck presence

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric (skip for non-riparian wetlands)

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M).

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

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

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

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

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

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

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

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

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

Answer for assessment area dominant landform.

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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

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

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

☐A 0
☐B 1 to 4
☒C 5 to 8

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

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

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

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

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

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

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

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

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

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

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

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

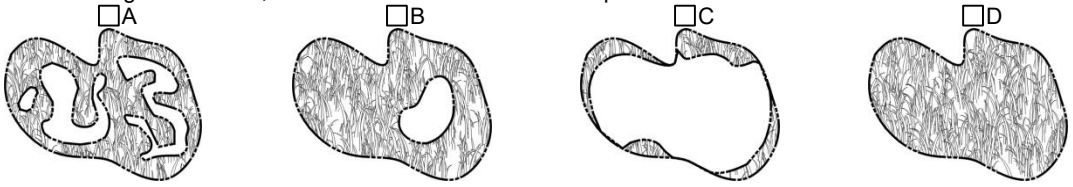
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

Include both natural debris and man-placed natural debris.
☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

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

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

☐A ☐B ☐C ☐D



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

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.
☐A Overbank and overland flow are not severely altered in the assessment area.
☒B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☐D Both overbank and overland flow are severely altered in the assessment area.

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Waxhaw Br. LB Drained Wetland	Date of Assessment	2/13/2019
Wetland Type	Headwater Forest	Assessor Name/Organization	A. Baldwin/RS

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **LOW**

NC DWQ Stream Identification Form Version 4.11

Date: 7/15/2020	**Project/Site:** Wits End/UT-1	**Latitude:** 34.917415
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.446420
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 28.00	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 16.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made 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 = 5.00)				
18. Fibrous roots in streambed	3 ○	2 ◉	1 ○	0 ○
19. Rooted upland plants in streambed	3 ◉	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ◉	0.5 ○	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/15/2020	**Project/Site:** Wits End/UT2	**Latitude:** 34.917837
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.442275
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 20.50	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.0)				
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 = 4.00)				
18. Fibrous roots in streambed	3 ○	2 ◉	1 ○	0 ○
19. Rooted upland plants in streambed	3 ○	2 ◉	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ◉	0.5 ○	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/14/2020	**Project/Site:** Wits End/UT3A	**Latitude:** 34.913456
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.447992
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 23.50	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 12.0)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made 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 = 5.00)				
18. Fibrous roots in streambed	3 ○	2 ◉	1 ○	0 ○
19. Rooted upland plants in streambed	3 ◉	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ◉	0.5 ○	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/14/2020	**Project/Site:** Wits End/UT3	**Latitude:** 34.911435
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.449754
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 26.00	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 13.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.0)				
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 = 5.50)				
18. Fibrous roots in streambed	3 ○	2 ◉	1 ○	0 ○
19. Rooted upland plants in streambed	3 ◉	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ○	0.5 ◉	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/14/2020	**Project/Site:** Wits End/UT3	**Latitude:** 34.912106
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.446075
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 33.50	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 21.0)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.0)				
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 = 5.50)				
18. Fibrous roots in streambed	3 ○	2 ●	1 ○	0 ○
19. Rooted upland plants in streambed	3 ●	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ●	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ●	1 ○	2 ○	3 ○
22. Fish	0 ●	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ●	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ○	0.5 ●	1 ○	1.5 ○
25. Algae	0 ●	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ●	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/15/2020	**Project/Site:** Wits End/UT4	**Latitude:** 34.909150
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.444794
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 22.50	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 11.0)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made 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 = 5.00)				
18. Fibrous roots in streambed	3 ○	2 ◉	1 ○	0 ○
19. Rooted upland plants in streambed	3 ◉	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ◉	0.5 ○	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/15/2020	**Project/Site:** Wits End/UT5	**Latitude:** 34.908106
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.442542
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 27.00	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 13.0)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0 ○	1 ○	2 ◉	3 ○
13. Iron oxidizing bacteria	0 ◉	1 ○	2 ○	3 ○
14. Leaf litter	1.5 ◉	1 ○	0.5 ○	0 ○
15. Sediment on plants or debris	0 ◉	0.5 ○	1 ○	1.5 ○
16. Organic debris lines or piles	0 ○	0.5 ○	1 ◉	1.5 ○
17. Soil-based evidence of high water table?	No = 0 ○		Yes = 3 ◉	

C. Biology (Subtotal = 6.50)				
18. Fibrous roots in streambed	3 ◉	2 ○	1 ○	0 ○
19. Rooted upland plants in streambed	3 ◉	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ○	0.5 ◉	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

Worksheet 20. BEHI variable worksheet

Stream: Wits End UT 1	Cross Section: 1	Date: 3/25/26	Observers: WYJ

Bank Height/Max Depth Bankfull (C)

Study Bank Height (ft)	Bankfull Height (ft)	A/B =
1.0 A	1.0 B	1.0 C

Root Depth/Bank Height (E)

Root Depth (ft)	Study Bank Height (ft)	D/A =
1.0 D	1.0 A	1.0 E

Weighted Root Density (G)

Root Density (%)	F*E =
20 F	20 G

Bank Angle (H)

Bank Angle (Degrees)
75 H

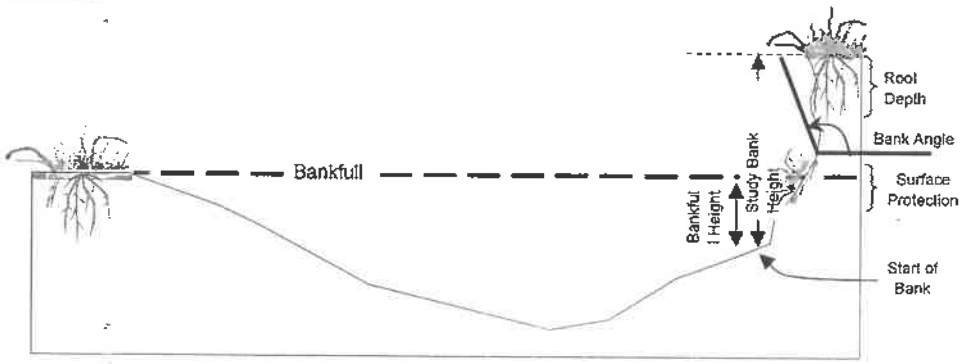
Surface Protection (I)

Surface Protection %
20 I

Bank Sketch

Vertical Distance (ft)

Horizontal Distance (ft)



Worksheet 21. Summary of bank erosion hazard index (BEHI)

Bank Erosion Hazard Rating Guide

Stream Wits End UT1 Reach Cross Section 1 Date 3/25/21 Crew WM

Bank Erosion Potential		Bank Height (ft): / Bankfull Height (ft):	Bank Height/ Bankfull Ht	Root Depth/ Bank Height	Root Density %	Bank Angle (Degrees)	Surface Protection%
VERY LOW	Value		1.0-1.1	1.0-0.9	100-80	0-20	100-80
	Index		1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9
	Choice		V: 1.0 I: 1.0	V: 1.0 I: 1.0	V: I:	V: I:	V: I:
LOW	Value		1.11-1.19	0.89-0.5	79-55	21-60	79-55
	Index		2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9
	Choice		V: I:	V: I:	V: I:	V: I:	V: I:
MODERATE	Value		1.2-1.5	0.49-0.3	54-30	61-80	54-30
	Index		4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9
	Choice		V: I:	V: I:	V: I:	V: 70 I: 5.0	V: I:
HIGH	Value		1.6-2.0	0.29-0.15	29-15	81-90	29-15
	Index		6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9
	Choice		V: I:	V: I:	V: 20 I: 7.0	V: I:	V: 20 I: 5.0
VERY HIGH	Value		2.1-2.8	0.14-0.05	14-5.0	91-119	14-10
	Index		8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0
	Choice		V: I:	V: I:	V: I:	V: I:	V: I:
EXTREME	Value		>2.8	<0.05	<5	>119	<10
	Index		10	10	10	10	10
	Choice		V: I:	V: I:	V: I:	V: I:	V: I:

V = value, I = index — **SUB-TOTAL** (Sum one index from each column): 19

Bank Material Description:

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT: 0

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT: 19

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.5	10-19.5	20-29.5	30-39.5	40-45	46-50

Bank location description (circle one)
Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: 19

Worksheet 20. BEHI variable worksheet

Stream: Wits End UT2	Cross Section: 20	Date: 3/25/21	Observers: WJJ

Bank Height/Max Depth Bankfull (C)

Study Bank Height (ft)	Bankfull Height (ft)	A/B =
1.5 A	1.4 B	1.1 C

Root Depth/Bank Height (E)

Root Depth (ft)	Study Bank Height (ft)	D/A =
0.5 D	1.5 A	0.33 E

Weighted Root Density (G)

Root Density (%)	F*E =
50 F	0.17 G

Bank Angle (H)

Bank Angle (Degrees)
80 H

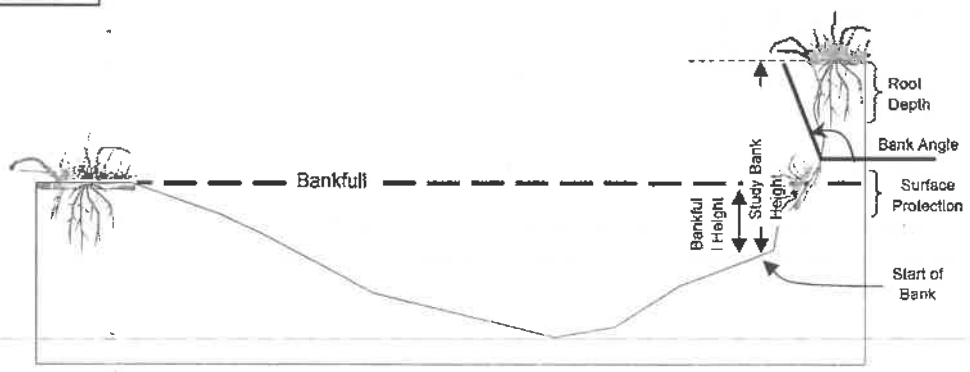
Surface Protection (I)

Surface Protection %
20 I

Bank Sketch

Vertical Distance (ft)

Horizontal Distance (ft)



Worksheet 21. Summary of bank erosion hazard index (BEHI)

Bank Erosion Hazard Rating Guide

Stream Wits End HT Reach XS 20 Date 3/25/21 Crew WJ

Bank Erosion Potential		Bank Height/ Bankfull Ht	Root Depth/ Bank Height	Root Density %	Bank Angle (Degrees)	Surface Protection%
Bank Height (ft): / Bankfull Height (ft):						
VERY LOW	Value	1.0-1.1	1.0-0.9	100-80	0-20	100-80
	Index	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9
	Choice	V: 1.1 I: 1.9	V: I:	V: I:	V: I:	V: I:
LOW	Value	1.11-1.19	0.89-0.5	79-55	21-60	79-55
	Index	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
MODERATE	Value	1.2-1.5	0.49-0.3	54-30	61-80	54-30
	Index	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9
	Choice	V: I:	V: .33 I: 5.5	V: 40 I: 5.0	V: 80 I: 5.9	V: I:
HIGH	Value	1.6-2.0	0.29-0.15	29-15	81-90	29-15
	Index	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9
	Choice	V: I:	V: I:	V: I:	V: I:	V: 20 I: 7.0
VERY HIGH	Value	2.1-2.8	0.14-0.05	14-5.0	91-119	14-10
	Index	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
V = value, I = index				SUB-TOTAL (Sum one index from each column)		25.3

Bank Material Description:

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. if sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT —

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT —

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.5	10-19.5	20-29.5	30-39.5	40-45	46-50

Bank location description (circle one)
Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING 25.3

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Wits End | Location: UT 2 | Date: 3/25/21 | Crew: WJ

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**
(2) Channel pattern (Rc/W): **Level II - General Prediction.**
(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**
(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**
(7) Velocity profiles/Isovels /Velocity gradient: **Level IV - Validation.**

Level I

(1) Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
1.45	0.8	1.9	High

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Dominant Near-Bank Stress: High

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating: High

Worksheet 20. BEHI variable worksheet

Stream: Wits End UT3 up	Cross Section: 3	Date: 3/25/21	Observers: WHT

Bank Height/Max Depth Bankfull (C)

Study Bank Height (ft)	Bankfull Height (ft)	A/B =
3.1 A	0.9 B	3.4 C

Root Depth/Bank Height (E)

Root Depth (ft)	Study Bank Height (ft)	D/A =
2 D	3.1 A	0.6 E

Weighted Root Density (G)

Root Density (%)	F*E =
40 F	0.4 G

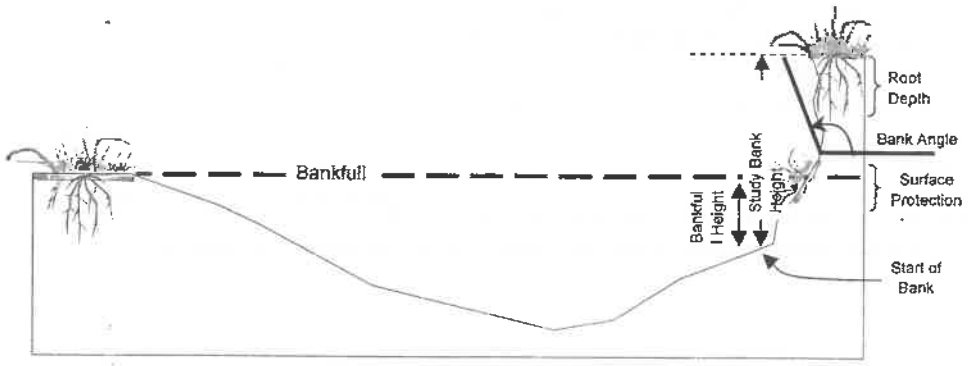
Bank Angle (H)

Bank Angle (Degrees)
85 H

Surface Protection (I)

Surface Protection %
20 I

Bank Sketch



Worksheet 21. Summary of bank erosion hazard index (BEHI)

Bank Erosion Hazard Rating Guide

Stream Wits End UT3 UP Reach xs 3 Date 3/25/21 Crew WH

Bank Erosion Potential		Bank Height (ft): / Bankfull Height (ft):	Bank Height/ Bankfull Ht	Root Depth/ Bank Height	Root Density %	Bank Angle (Degrees)	Surface Protection%
	VERY LOW	Value	1.0-1.1	1.0-0.9	100-80	0-20	100-80
		Index	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9
		Choice	V: I:	V: I:	V: I:	V: I:	V: I:
	LOW	Value	1.11-1.19	0.89-0.5	79-55	21-60	79-55
		Index	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9
		Choice	V: I:	V: .6 I: 3.0	V:60 I: 3.0	V: I:	V: I:
	MODERATE	Value	1.2-1.5	0.49-0.3	54-30	61-80	54-30
		Index	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9
		Choice	V: I:	V: I:	V: I:	V: I:	V: I:
	HIGH	Value	1.6-2.0	0.29-0.15	29-15	81-90	29-15
		Index	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9
		Choice	V: I:	V: I:	V: I:	V: 85 I: 7.0	V: 20 I: 7.0
	VERY HIGH	Value	2.1-2.8	0.14-0.05	14-5.0	91-119	14-10
		Index	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0
		Choice	V: I:	V: I:	V: I:	V: I:	V: I:
	EXTREME	Value	>2.8	<0.05	<5	>119	<10
		Index	10	10	10	10	10
		Choice	V: 3.4 I: 10	V: I:	V: I:	V: I:	V: I:
V = value, I = index					SUB-TOTAL (Sum one index from each column)		30

Bank Material Description:

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT —

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT —

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.5	10-19.5	20-29.5	30-39.5	40-45	46-50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING High

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: WFS End Location: UT3 up Date: 5/25/21 Crew: WB

Methods for Estimating Near-Bank Stress

(1) Trans vers e bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**
(2) Channel pattern (Rc/W): **Level II - General Prediction.**
(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**
(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**
(6) Ratio of near-bank shear stres s to bankfull shear stres s (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**
(7) Velocity profiles/Is ovels /Velocity gradient: **Level IV - Validation.**

Level I

(1) Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: EXT

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
3.1	0.8	3.8	EXT

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating

Worksheet 20. BEHI variable worksheet

Stream: Wits End UT 5	Cross Section: 2	Date: 3/25/21	Observers: WYL

Bank Height/Max Depth Bankfull (C)

Study Bank Height (ft) 2.6 A	Bankfull Height (ft) 1.6 B	A/B = 1.6 C

Root Depth/Bank Height (E)

Root Depth (ft) 1.0 D	Study Bank Height (ft) 2.6 A	D/A = 0.4 E

Weighted Root Density (G)

Root Density (%) 60 F	F*E = 0.3 G

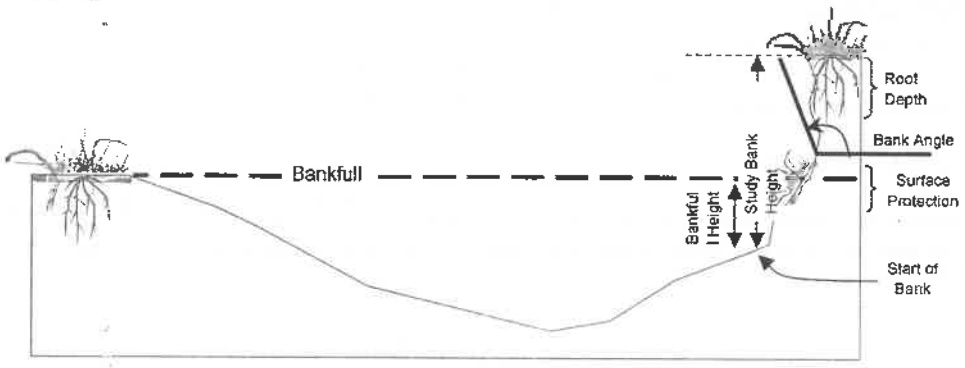
Bank Angle (H)

Bank Angle (Degrees) 45 H

Surface Protection (I)

Surface Protection % 40 I

Bank Sketch



Worksheet 21. Summary of bank erosion hazard index (BEHI)

Bank Erosion Hazard Rating Guide

Stream Wits End UT 5 Reach XS 2 Date 2/25/21 Crew W/M

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht	Root Depth/ Bank Height	Root Density %	Bank Angle (Degrees)	Surface Protection%
VERY LOW	Value	1.0-1.1	1.0-0.9	100-80	0-20	100-80
	Index	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
LOW	Value	1.11-1.19	0.89-0.5	79-55	21-60	79-55
	Index	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9
	Choice	V: I:	V: I:	V: 60 I: 3.0	V: 45 I: 3.0	V: I:
MODERATE	Value	1.2-1.5	0.49-0.3	54-30	61-80	54-30
	Index	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9
	Choice	V: I:	V: 0.4 I: 5.0	V: I:	V: I:	V: 40 I: 5.0
HIGH	Value	1.6-2.0	0.29-0.15	29-15	81-90	29-15
	Index	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9
	Choice	V: 1.6 I: 6.0	V: I:	V: I:	V: I:	V: I:
VERY HIGH	Value	2.1-2.8	0.14-0.05	14-5.0	91-119	14-10
	Index	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:

V = value, I = index — SUB-TOTAL (Sum one index from each column): 72

Bank Material Description:

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT —

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT —

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.5	10-19.5	20-29.5	30-39.5	40-45	46-50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING: MOD

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Wits End | Location: XT 5 | Date: 3/25/21 | Crew: WJ

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**
(2) Channel pattern (Rc/W): **Level II - General Prediction.**
(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**
(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**
(7) Velocity profiles/Isovels /Velocity gradient: **Level IV - Validation.**

Level I

(1) Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2)

Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3)

Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: Low

Level III

(5)

Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
1.7	1.6	1.1	Low

(6)

Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

Level IV

(7)

Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.60	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating: Low

Worksheet 20. BEHI variable worksheet

Stream: Wits End Waxhaw Br	Cross Section: 6	Date: 3/25/21	Observers: WHJ

Bank Height/Max Depth Bankfull (C)

Study Bank Height (ft)	Bankfull Height (ft)	A/B =
3.2 A	2.1 B	1.5 C

Root Depth/Bank Height (E)

Root Depth (ft)	Study Bank Height (ft)	D/A =
0.5 D	3.2 A	0.2 E

Weighted Root Density (G)

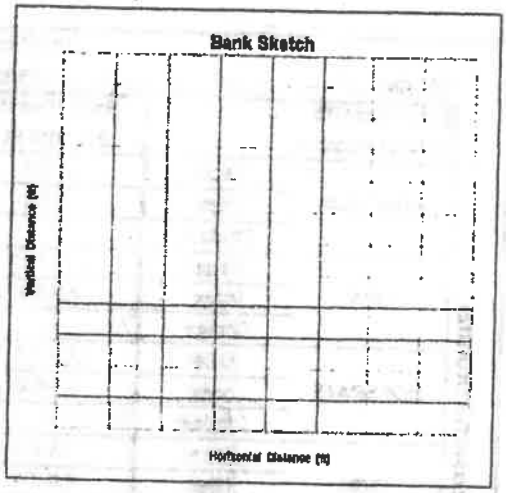
Root Density (%)	F*E =
60 F	0.12 G

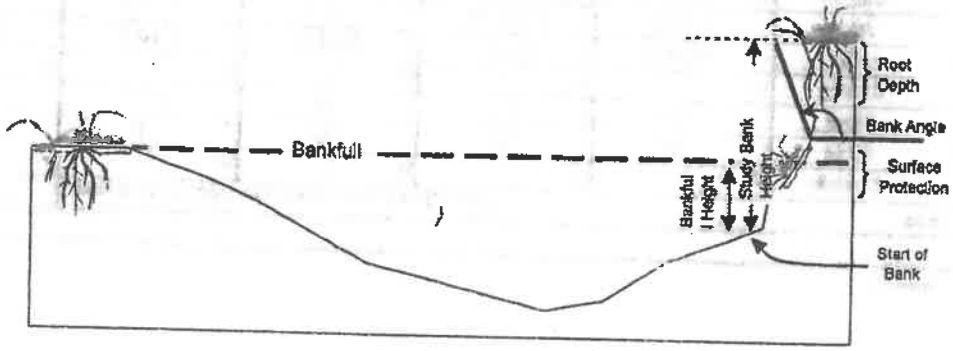
Bank Angle (H)

Bank Angle (Degrees)
60 H

Surface Protection (I)

Surface Protection %
30 I





Worksheet 21. Summary of bank erosion hazard index (BEHI)

Bank Erosion Hazard Rating Guide

Stream Wits End Wayhew Reach XS 6 Date 3/25/21 Crew WJ

Bank Erosion Potential		Bank Height (ft): / Bankfull Height (ft):	Bank Height/ Bankfull Ht	Root Depth/ Bank Height	Root Density %	Bank Angle (Degrees)	Surface Protection%
VERY LOW	Value		1.0-1.1	1.0-0.9	100-80	0-20	100-80
	Index		1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9
	Choice		V: I:	V: I:	V: I:	V: I:	V: I:
LOW	Value		1.11-1.19	0.89-0.5	79-55	21-60	79-55
	Index		2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9
	Choice		V: I:	V: I:	V: 60 I: 3.0	V: 60 I: 3.9	V: I:
MODERATE	Value		1.2-1.5	0.49-0.3	54-30	61-80	54-30
	Index		4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9
	Choice		V: 1.5 I: 5.9	V: I:	V: I:	V: I:	V: 30 I: 7.0
HIGH	Value		1.6-2.0	0.29-0.15	29-15	81-90	29-15
	Index		6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9
	Choice		V: I:	V: 0.2 I: 7.0	V: I:	V: I:	V: I:
VERY HIGH	Value		2.1-2.8	0.14-0.05	14-5.0	91-119	14-10
	Index		8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0
	Choice		V: I:	V: I:	V: I:	V: I:	V: I:
EXTREME	Value		>2.8	<0.05	<5	>119	<10
	Index		10	10	10	10	10
	Choice		V: I:	V: I:	V: I:	V: I:	V: I:

V = value, I = index — SUB-TOTAL (Sum one index from each column): 25.7

Bank Material Description:

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

BANK MATERIAL ADJUSTMENT

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.5	10-19.5	20-29.5	30-39.5	40-45	46-50

Bank location description (circle one)

Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING 25.7

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Wits End Location: Waxhaw Date: 6/25/21 Crew: WB

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**
(2) Channel pattern (Rc/W): **Level II - General Prediction.**
(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**
(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**
(7) Velocity profiles/Isovels/Velocity gradient: **Level IV - Validation.**

use →

Level I	(1)	Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High Extensive deposition (continuous, cross channel). NBS = Extreme Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2) Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3) Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4) Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: HIGH

use →

Level III

(5) Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
3.2	1.5	2.1	HIGH

(6) Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

use →

Level IV

(7) Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.80	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.81 - 0.80	1.61 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.80	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.8	> 2.3

Overall Near-Bank Stress Rating: HIGH

Worksheet 20. BEHI variable worksheet

Stream: Wits End Wakhaw Rd	Cross Section: 8	Date: 3/25/21	Observers: WTB

Bank Height/Max Depth Bankfull (C)

Study Bank Height (ft) 4.0 A	Bankfull Height (ft) 2.7 B	A/B = 1.4 C

Root Depth/Bank Height (E)

Root Depth (ft) 2.0 D	Study Bank Height (ft) 4.0 A	D/A = 0.5 E

Weighted Root Density (G)

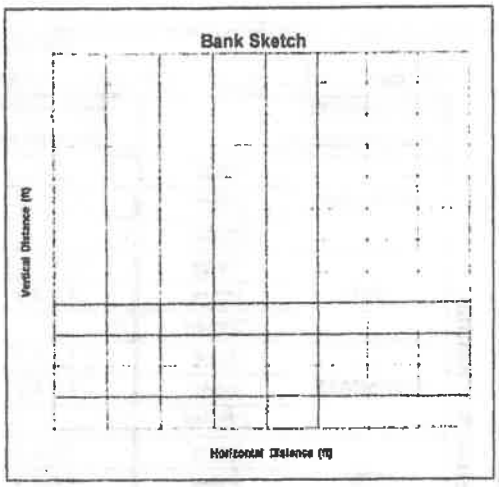
Root Density (%) 40 F	F*E = G

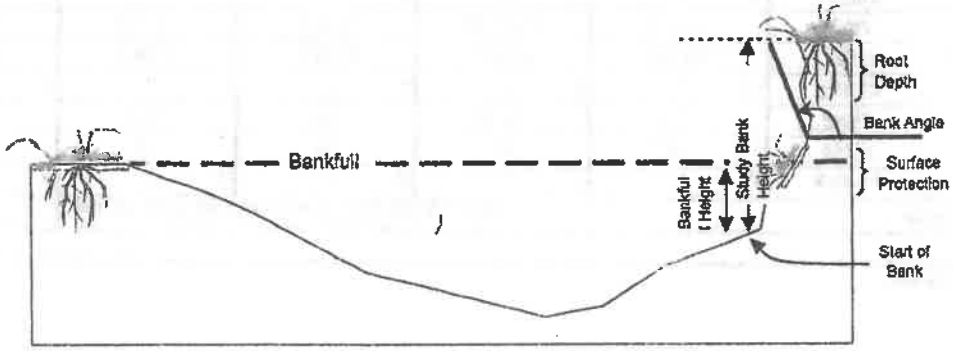
Bank Angle (H)

Bank Angle (Degrees) 45 H

Surface Protection (I)

Surface Protection % 30 I





Worksheet 21. Summary of bank erosion hazard index (BEHI)

Bank Erosion Hazard Rating Guide

Stream Wits End Waxhaw Reach XS 8 Date 3/25/21 Crew WJ

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht	Root Depth/ Bank Height	Root Density %	Bank Angle (Degrees)	Surface Protection%
VERY LOW	Value	1.0-1.1	1.0-0.9	100-80	0-20	100-80
	Index	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
LOW	Value	1.11-1.19	0.89-0.5	79-55	21-60	79-55
	Index	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9
	Choice	V: I:	V: .5 I: 3.9	V: I:	V: 45 I: 3.0	V: I:
MODERATE	Value	1.2-1.5	0.49-0.3	54-30	61-80	54-30
	Index	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9
	Choice	V: 1.4 I: 5.0	V: I:	V: 40 I: 5.0	V: I:	V: 30 I: 5.9
HIGH	Value	1.6-2.0	0.29-0.15	29-15	81-90	29-15
	Index	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
VERY HIGH	Value	2.1-2.8	0.14-0.05	14-5.0	91-119	14-10
	Index	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
EXTREME	Value	>2.8	<0.05	<5	>119	<10
	Index	10	10	10	10	10
	Choice	V: I:	V: I:	V: I:	V: I:	V: I:
V = value, I = index				SUB-TOTAL (Sum one index from each column)		22.8

Bank Material Description:

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)
Boulders (Banks composed of boulders have low bank erosion potential)
Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)
Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt Clay (+ 0; no adjustment)

BANK MATERIAL ADJUSTMENT /

Stratification Comments:

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT /

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.5	10-19.5	20-29.5	30-39.5	40-45	46-50

Bank location description (circle one)
Straight Reach Outside of Bend

GRAND TOTAL BEHI RATING 22.8

Worksheet 22A. Various field methods of estimating Near-Bank Stress risk ratings for the calculation of erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: Wits End Location: Waxhaw Cr Date: 3/25/21 Crew: WF

Methods for Estimating Near-Bank Stress

(1) Transverse bar or split channel/central bar creating NBS/high velocity gradient: **Level I - Reconnaissance.**
(2) Channel pattern (Rc/W): **Level II - General Prediction.**
(3) Ratio of pool slope to average water surface slope (S_p/S): **Level II - General Prediction.**
(4) Ratio of pool slope to riffle slope (S_p/S_{rif}): **Level II - General Prediction.**
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb}/d_{bkf}): **Level III - Detailed Prediction.**
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf}): **Level III - Detailed Prediction.**
(7) Velocity profiles/Isovels /Velocity gradient: **Level IV - Validation.**

use →

Level I

(1) Transverse and/or central bars - short and/or discontinuous. NBS = High/Very High
Extensive deposition (continuous, cross channel). NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow (Figure X). NBS = Extreme

Level II

(2) Radius of Curvature Rc (feet)	Bankfull Width W_{bkf} (feet)	Ratio Rc/W	Near-Bank Stress

(3) Pool Slope S_p	Average Slope S	Ratio S_p/S	Near-Bank Stress

(4) Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p/S_{rif}	Near-Bank Stress

Dominant Near-Bank Stress: Low

use →

Level III

(5) Near-Bank Max Depth d_{nb} (feet)	Mean Depth d (feet)	Ratio d_{nb}/d	Near-Bank Stress
3.0	2.5	1.2	Low

(6) Near-Bank Max Depth d_{nb} (feet)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d (feet)	Average Slope S	Shear Stress τ (lb/ft^2)	Ratio τ_{nb}/τ	Near-Bank Stress

use →

Level IV

(7) Velocity Gradient (ft/s/ft)	Near-Bank Stress

Converting Values to a Near-Bank Stress Rating

Near-Bank Stress Rating	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N/A	>3.0	< 0.20	< 0.4	<1.0	<0.8	<1.0
Low		2.21 - 3.0	0.20 - 0.40	0.41 - 0.80	1.0 - 1.5	0.8 - 1.05	1.0 - 1.2
Moderate		2.01 - 2.2	0.41 - 0.60	0.61 - 0.80	1.51 - 1.8	1.06 - 1.14	1.21 - 1.6
High	See (1) Above	1.81 - 2.0	0.61 - 0.80	0.81 - 1.0	1.81 - 2.5	1.15 - 1.19	1.61 - 2.0
Very High		1.5 - 1.8	0.81 - 1.0	1.01 - 1.2	2.51 - 3.0	1.20 - 1.60	2.01 - 2.3
Extreme		< 1.5	> 1.0	> 1.2	> 3.0	> 1.6	> 2.3

Overall Near-Bank Stress Rating: Low

Site		Wits End Steam Mitigation Site						
Stream		Waxhaw Branch			Bank Length		5029	
Observers		WGL			Date		25-Mar-21	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	154	Right	Mod	Mod	0.05	154	3	23.1
2	1024	Right	Mod	High	0.1	870	3	260.9
3	1233	Right	Mod	High	0.1	209	4	83.8
4	1606	Right	Mod	Low	0.02	372	4	29.8
5	1644	Right	Mod	EXT	0.6	39	4	92.4
6	1924	Right	Mod	Low	0.02	280	4	22.4
7	2078	Right	High	High	0.2	153	4	122.7
8	2179	Right	High	High	0.2	101	4	80.9
9	2512	Right	Mod	Low	0.02	333	4	26.7
10								
11								
12	155	Left	Mod	Low	0.02	155	3	9.3
13	1063	Left	Mod	High	0.1	908	3	272.5
14	1272	Left	Mod	High	0.1	208	4	83.4
15	1381	Left	High	High	0.2	110	4	87.7
16	1726	Left	Mod	Low	0.02	345	4	27.6
17	1780	Left	High	High	0.2	53	4	42.7
18	1973	Left	Mod	Low	0.02	193	4	15.5
19	2041	Left	High	High	0.2	68	4	54.5
20	2287	Left	Mod	Low	0.02	245	4	19.6
21	2354	Left	High	High	0.2	67	4	53.6
22	2457	Left	Mod	Low	0.02	103	4	8.3
23	2517	Left	High	High	0.2	60	4	47.9
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		1465.4
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		54.3
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		70.6
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.014

Site		Wits End Steam Mitigation Site						
Stream		UT 1			Bank Length		246	
Observers		WGL			Date		25-Mar-21	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	125	Right	Low	Low	0	125	1	0.0
2								
3	121	Left	Low	Low	0	121	1	0.0
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		0.0
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		0.0
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		0.0
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.000

Site		Wits End Steam Mitigation Site						
Stream		UT 2			Bank Length		1299	
Observers		WGL			Date		25-Mar-21	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	46	Right	Low	Low	0	46	0.5	0.0
2	179	Right	Low	Low	0	134	1.2	0.0
3	218	Right	High	Mod	0.15	39	1.5	8.8
4	336	Right	Low	Mod	0.01	117	1.2	1.4
5	440	Right	High	Mod	0.15	104	1.5	23.4
6	463	Right	High	High	0.2	23	1.5	6.9
7	518	Right	Low	Mod	0.01	55	2	1.1
8	556	Right	Low	Low	0	38	2	0.0
9	651	Right	High	Mod	0.15	95	2	28.6
10								
11								
12	59	Left	Low	Low	0	59	0.5	0.0
13	196	Left	Low	Low	0	138	1	0.0
14	336	Left	Mod	Mod	0.05	140	1	7.0
15	479	Left	High	Mod	0.15	143	1.5	32.2
16	557	Left	Mod	Mod	0.05	78	2	7.8
17	601	Left	Mod	Mod	0.05	44	2	4.4
18	648	Left	High	Mod	0.15	47	2	14.2
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		135.7
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		5.0
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		6.5
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.005

Site		Wits End Steam Mitigation Site						
Stream		UT 3			Bank Length		4674	
Observers		WGL			Date		25-Mar-21	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	476	Right	Low	Low	0	476	1	0.0
2	731	Right	High	Mod	0.15	255	3	114.5
3	1121	Right	High	Ext	0.4	391	3	468.9
4	1423	Right	High	Mod	0.15	302	3	135.7
5	2332	Right	High	Mod	0.15	909	4	545.2
6								
7								
8								
9	477	Left	Low	Low	0	477	1	0.0
10	690	Left	Mod	Mod	0.05	214	2	21.4
11	1143	Left	High	Mod	0.15	453	3	203.7
12	1427	Left	Mod	Mod	0.05	284	3	42.5
13	2342	Left	High	Mod	0.15	915	4	549.1
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		2081.1
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		77.1
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		100.2
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.021

Site		Wits End Steam Mitigation Site						
Stream		UT 3A			Bank Length		1445	
Observers		WGL			Date		25-Mar-21	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	165	Right	Low	Low	0	165	1	0.0
2	565	Right	Mod	Low	0.02	400	1.5	12.0
3	714	Right	Mod	Mod	0.05	150	3	22.4
4								
5								
6	229	Left	Low	Low	0	229	1	0.0
7	400	Left	High	Mod	0.15	170	3	76.6
8	731	Left	Mod	Mod	0.05	331	1.5	24.8
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		135.9
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		5.0
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		6.5
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.005

Site		Wits End Steam Mitigation Site						
Stream		UT 4			Bank Length		1505	
Observers		WGL			Date		25-Mar-21	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	262	Right	Low	Low	0	262	1	0.0
2	532	Right	Low	Low	0	270	0.6	0.0
3	609	Right	High	High	0.2	77	4	62.0
4	765	Right	High	High	0.2	156	3	93.4
5								
6								
7	248	Left	Low	Low	0	248	1	0.0
8	516	Left	Low	Low	0	268	0.5	0.0
9	601	Left	High	High	0.2	85	4	68.4
10	740	Left	High	High	0.2	139	3	83.4
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		307.1
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		11.4
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		14.8
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.010

Site		Wits End Steam Mitigation Site						
Stream		UT 5			Bank Length		304	
Observers		WGL			Date		25-Mar-21	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	61	Right	Mod	Low	0.02	61	2.5	3.0
2	109	Right	Low	Low	0	49	1	0.0
3	151	Right	High	Mod	0.15	42	3	18.8
4								
5								
6								
7	56	Left	Low	Low	0	56	1	0.0
8	99	Left	Mod	Low	0.02	43	2.5	2.2
9	153	Left	High	Mod	0.15	54	3	24.4
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		48.4
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		1.8
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		2.3
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.008

BEHI/NBS Summary

Stream Reach	Erosion Rate (tons/year)
Waxhaw Br	70.6
UT1	0.0
UT2	6.5
UT3	100.2
UT 3A	6.5
UT4	14.8
UT5	2.3
Total	**201.0**

Wits End
Land Use Nutrient Model

Stream Length	
Site Buffer Width	
Site Area (ft sq)	688248

Land Use	%
Pasture	
Woods	46.8
Row Crop	53.2
Urban	
must total 100	100

	Rainfall
Annual	

Land Use Characteristics		Number of Animals	N inputs lbs/au/yr	P inputs lbs/au/yr	Total N (lbs)	Total P (lbs)	
Pasture	Beef		113	40	0	0	
	Dairy		164	26	0	0	
	Pig		153	58	0	0	
	Horse		102	40	0	0	
	fert/ac		60	45	0	0	
					0	0	Total Pasture N and P

		% Row Crop Area	N inputs lbs/ac/yr	P inputs lbs/ac/yr	Total N	Total P	
Row Crop	Corn	100	60	60	504	504	
8.4	Cotton		20	20	0	0	
	Soybeans		0	15	0	0	
	Hay Fescue		50	45	0	0	
	Hay Bermuda		70	45	0	0	
	must total 100	100			504	504	Total Row Crop N and P

Woods Minimal Nutrients

		% Area	Runnoff	Concentration N (mg/l)	Concentration P (mg/l)	Total N (lbs)	Total P (lbs)	
Urban	Residential		0	2.2	0.4	0	0	
	Commercial/Industrial		0	2.3	0.3	0	0	
	Roadway		0	3.0	0.5	0	0	
						0.0	0.0	Total Urban N and P

Notes: Residential Assumes 25 % Impervious Surfac
Commercial/Industrial Assumes 75% Impervous Surface
Roadway Assumes 100% Impervious Surface
Annual Load (lbs) = 0.226*Annual Runoff (inches)*Concentration (mg/l)*Acres

Total Nutrients Removed within Easement

Total N Removed (lbs/yr)	**504**
Total P Removed (lbs/yr)	**504**

Soil Profile # 1

RESTORATION SYSTEMS, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
919-755-9490

SOIL BORING LOG

Project/Site: Wit's End Stream and Wetland Mitigation Site

County, State: Union, NC

Sampling Point/ Coordinates: Hydric Soil/ 34.908665, -80.441294

Investigator: A. Baldwin

Notes: Location of soil profile is depicted on Figure 4 of the Technical Proposal.

Water table observed at 9-inches.

Hydric Field Indicator - F19

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-2	2.5Y 3/3	80	10YR 4/6	20	clay loam
2-9	2.5Y 4/3	75	10YR 5/8	20	clay
			5YR 3/4	5	
9-13+	2.5Y 5/3	90	10YR 5/8	15	clay
			5YR 3/4	5	

North Carolina Licensed Soil Scientist

Number: 1297

Signature: 

Name/Print: Alex Baldwin

Soil Profile # 2

RESTORATION SYSTEMS, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
919-755-9490

SOIL BORING LOG

Project/Site: Wit's End Stream and Wetland Mitigation Site

County, State: Union, NC

Sampling Point/ Coordinates: Hydric Soil/ 34.909608, -80.442448

Investigator: A. Baldwin

Notes: Location of soil profile is depicted on Figure 4 of the Technical Proposal.

Water table observed at 7-inches, debris lines in FP, water stains on trees, old berm/road along fence line.
Hydric Field Indicator - F19

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-1	2.5Y 4/3	85	10YR 4/6	5	clay loam
			10YR 3/6	10	
1-9	2.5Y 5/3	65	10YR 4/6	20	clay
			7.5YR 3/4	15	
9-15+	2.5Y 5/3	80	10YR 4/6	15	clay
			7.5YR 3/4	5	

North Carolina Licensed Soil Scientist

Number: 1297

Signature:

Name/Print: Alex Baldwin

Soil Profile # 3

RESTORATION SYSTEMS, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
919-755-9490

SOIL BORING LOG

Project/Site: Wit's End Stream and Wetland Mitigation Site

County, State: Union, NC

Sampling Point/ Coordinates: Hydric Soil/ 34.911654, -80.444949

Investigator: A. Baldwin

Notes: Location of soil profile is depicted on Figure 4 of the Technical Proposal.

Landscape position is along a toeslope with active seeps along the edge.
Hydric Field Indicator - F19

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-2	2.5Y 4/3	95	10YR 4/6	5	clay loam
2-12	2.5Y 5/3	80	7.5YR 5/8	15	clay
			7.5YR 4/6	5	
9-15+	2.5Y 5/3	65	7.5YR 5/8	15	clay
			7.5YR 4/6	5	
			2.5Y 6/2	15	

North Carolina Licensed Soil Scientist

Number: 1297

Signature:

Name/Print: Alex Baldwin

Soil Profile # 4

RESTORATION SYSTEMS, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
919-755-9490

SOIL BORING LOG

Project/Site: Wit's End Stream and Wetland Mitigation Site

County, State: Union, NC

Sampling Point/ Coordinates: Hydric Soil/ 34.912245, -80.443118

Investigator: A. Baldwin

Notes: Location of soil profile is depicted on Figure 4 of the Technical Proposal.

Landscape position is along an active floodplain active seeps along the outer edge of floodplain.
Hydric Field Indicator - F19

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-1	10YR 3/2	100			clay loam
1-10	2.5Y 5/3	85	2.5Y 6/4	10	clay
			10YR 6/6	5	
10-17+	2.5Y 5/3	75	10YR 4/6	15	clay
			2.5Y 6/4	10	

North Carolina Licensed Soil Scientist

Number: 1297

Signature: AHBM

Name/Print: Alex Baldwin

Soil Profile # 5

RESTORATION SYSTEMS, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
919-755-9490

SOIL BORING LOG

Project/Site: Wit's End Stream and Wetland Mitigation Site

County, State: Union, NC

Sampling Point/ Coordinates: Hydric Soil/ 34.912926, -80.447357

Investigator: A. Baldwin

Notes: Location of soil profile is depicted on Figure 4 of the Technical Proposal.

Landscape position is along a toeslope adjacent to UT3a.

Hydric Field Indicator - F19

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-2	10YR 4/3				loam
2-7	2.5Y 6/4	75	7.5YR 5/8	20	clay loam
			7.5YR 4/6	5	
7-14+	2.5Y 5/3	75	7.5YR 5/8	15	clay
			10YR 5/8	5	
			7.5YR 4/6	15	
			2.5Y 5/2	5	

North Carolina Licensed Soil Scientist

Number: 1297

Signature:

Name/Print: Alex Baldwin

Soil Profile # 6

RESTORATION SYSTEMS, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
919-755-9490

SOIL BORING LOG

Project/Site: Wit's End Stream and Wetland Mitigation Site

County, State: Union, NC

Sampling Point/ Coordinates: Hydric Soil/ 34.911801, -80.448006

Investigator: A. Baldwin

Notes: Location of soil profile is depicted on Figure 4 of the Technical Proposal.

Landscape position is along a toeslope with active seeps along the edge.

Hydric Field Indicator - F19

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-4	2.5Y 4/3	95	10YR 4/6	5	loam
4-9	2.5Y 5/4	80	7.5YR 4/6	10	clay loam
			7.5YR 5/6	10	
9-15+	2.5Y 5/3	70	7.5YR 4/6	15	clay loam
			7.5YR 5/6	15	

North Carolina Licensed Soil Scientist

Number: 1297

Signature: 

Name/Print: Alex Baldwin

Soil Profile # 7

RESTORATION SYSTEMS, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
919-755-9490

SOIL BORING LOG

Project/Site: Wit's End Stream and Wetland Mitigation Site

County, State: Union, NC

Sampling Point/ Coordinates: Hydric Soil/ 34.908623, -80.446356

Investigator: A. Baldwin

Notes: Location of soil profile is depicted on Figure 4 of the Technical Proposal.

Landscape position is along a toeslope with active seeps along the edge.

Hydric Field Indicator - F19

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-2	2.5Y 4/3	95	10YR 4/6	5	loam
2-9	2.5Y 5/3	65	10YR 4/6	10	silt loam
			10YR 5/8	10	
			2.5Y 6/2	15	
9+	N/A	N/A	N/A	N/A	channery

North Carolina Licensed Soil Scientist

Number: 1297

Signature:

Name/Print: Alex Baldwin

Soil Profile # 8

RESTORATION SYSTEMS, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
919-755-9490

SOIL BORING LOG

Project/Site: Wit's End Stream and Wetland Mitigation Site

County, State: Union, NC

Sampling Point/ Coordinates: Hydric Soil/ 34.909723, -80.441730

Investigator: A. Baldwin

Notes: Location of soil profile is depicted on Figure 4 of the Technical Proposal.
Landscape position is along an active floodplain active seeps along the outer edge of floodplain.
Water table at 7-inches
Hydric Soil Field Indicator – F19

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-2	10YR 3/2	100			silt loam
2-12	2.5Y 4/3	80	7.5YR 4/4	20	clay loam
12-15	2.5Y 6/3	80	10YR 4/6	20	clay
15-23+	2.5Y 6/3	60	10YR 5/8	30	clay
			10YR 6/1	10	

North Carolina Licensed Soil Scientist

Number: 1297

Signature:

Name/Print: Alex Baldwin

Soil Profile # 9

RESTORATION SYSTEMS, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
919-755-9490

SOIL BORING LOG

Project/Site: Wit's End Stream and Wetland Mitigation Site

County, State: Union, NC

Sampling Point/ Coordinates: Hydric Soil/ 34.909210, -80.442087

Investigator: A. Baldwin

Notes: Location of soil profile is depicted on Figure 4 of the Technical Proposal.
Landscape position is along an active floodplain active seeps along the outer edge of floodplain.
Water table at 5-inches
Hydric Soil Field Indicator – F19

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-3	10YR 3/2	100	7.5YR 4/6	5	silt loam
3-9	2.5Y 5/3	80	7.5YR 4/6	20	clay loam
9-16	2.5Y 5/3	65	7.5YR 4/6	20	clay
			2.5Y 6/2	10	
16-25+	2.5Y 6/2	45	2.5Y 5/6	45	clay
			10YR 3/6	10	

North Carolina Licensed Soil Scientist

Number: 1297

Signature:

Name/Print: Alex Baldwin

Soil Profile # 10

RESTORATION SYSTEMS, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
919-755-9490

SOIL BORING LOG

Project/Site: Wit's End Stream and Wetland Mitigation Site

County, State: Union, NC

Sampling Point/ Coordinates: Hydric Soil/ 34.909398, -80.442512

Investigator: A. Baldwin

Notes: Location of soil profile is depicted on Figure 4 of the Technical Proposal.
Landscape position is along an active floodplain active seeps along the outer edge of floodplain.
Water table at 3-inches
Hydric Soil Field Indicator – F19

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-2	10YR 3/2	100			silt loam
2-10	2.5Y 5/3	80	10YR 5/6	15	clay loam
			7.5YR 5/6	10	
10-18+	2.5Y 6/4	90	10YR 5/6	10	clay

North Carolina Licensed Soil Scientist

Number: 1297

Signature:

Name/Print: Alex Baldwin

Wilmington District Stream Buffer Credit Calculator

Site Name:	Wits End
USACE Action ID:	SAW-2020-00455
NCDWR Project Number:	20200369
Sponsor:	Restoration Systems
Number of Exempt Terminal Stream Ends[1]:	8
County:	Union
Minimum Required Buffer Width[2]:	50

Mitigation Type	Mitigation Ratio Multiplier[3]	Creditable Stream Length[4]	Include in Buffer Calculations	Baseline Stream Credit	Buffered Stream Length	Credit From Buffered Streams
Restoration (1:1)	1	10612	Yes	10612.00	10612.00	10612.00
Enhancement I (1.5:1)	1.5	232	Yes	154.67	232.00	154.67
Enhancement II (2.5:1)	2.5					
Preservation (5:1)	5	669	Yes	133.80	669.00	133.80
Other (7.5:1)	7.5					
Other (10:1)	10					
Custom Ratio 1						
Custom Ratio 2						
Custom Ratio 3						
Custom Ratio 4						
Custom Ratio 5						
Totals		**11513.00**		10900.47	11513.00	10900.47

	Buffer Width Zone (feet from Ordinary High Water Mark)											
Buffer Zones	**less than 15 feet**	**>15 to 20 feet**	**>20 to 25 feet**	**>25 to 30 feet**	**>30 to 35 feet**	**>35 to 40 feet**	**>40 to 45 feet**	**>45 to 50 feet**	**>50 to 75 feet**	**>75 to 100 feet**	**>100 to 125 feet**	**>125 to 150 feet**
Max Possible Buffer (square feet)[5]	348216	117328	117956	118584	119212	119840	120468	121096	614900	630600	646300	662000
Ideal Buffer (square feet)[6]	346967.03	115568.25	115549.56	115177.89	114507.11	113790.62	113125.37	112576.52	550618.04	526700.44	511020.06	499936.33
Actual Buffer (square feet)[7]	338405.41	110299.70	109204.02	108011.16	106740.47	105281.63	103859.58	102632.10	258989.61	260435.76	245081.87	199965.88
Zone Multiplier	50%	10%	10%	10%	5%	5%	5%	5%	7%	5%	4%	4%
Buffer Credit Equivalent	5450.23	1090.05	1090.05	1090.05	545.02	545.02	545.02	545.02	763.03	545.02	436.02	436.02
Percent of Ideal Buffer	98%	96%	96%	95%	95%	94%	94%	94%	47%	49%	48%	40%
Credit Adjustment	-112.75	-39.70	-47.11	-52.27	-27.75	-30.10	-32.55	-34.62	358.90	269.50	209.11	174.40

Total Baseline Credit	Credit Loss in Required Buffer	Credit Gain for Additional Buffer	Net Change in Credit from Buffers	Total Credit
10900.47	**-376.85**	**1011.91**	**635.06**	**11535.53**

[1] Number of terminal stream ends, including all points where streams enter or exit the project boundaries, but not including internal crossings even if they are not protected by the easement.

[2] Minimum standard buffer width measured from the top of bank (50 feet in piedmont and coastal plain counties or 30 feet in mountain counties)

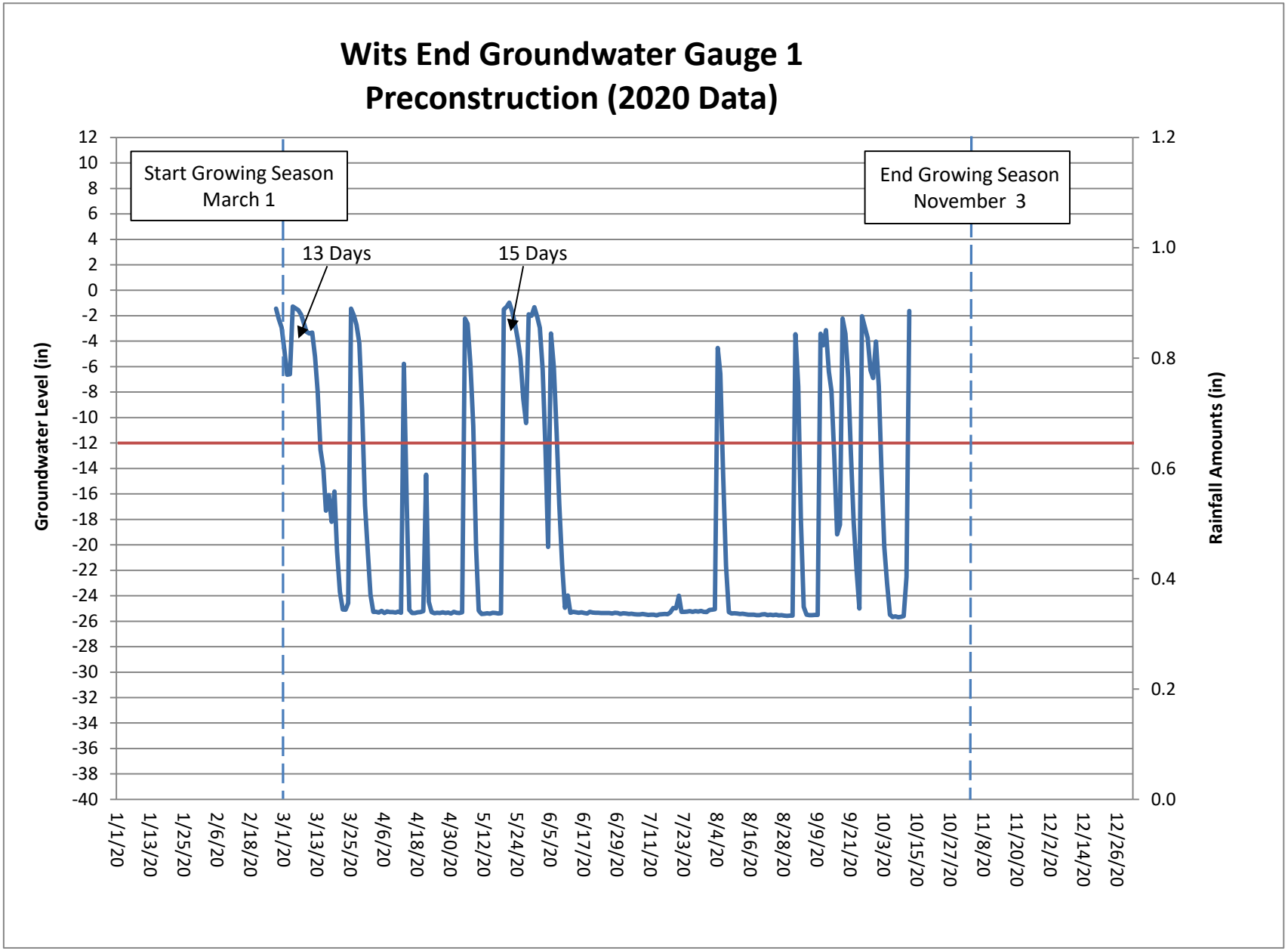
[3] Use the Custom Ratio fields to enter non-standard ratios, which are equal to the number of feet in the feet-to-credit mitigation ratio (e.g., for a perservation ratio of 8 feet to 1 credit, the multiplier would be 8).

[4] Equal to the number of feet of stream in each Mitigation Type. If stream reaches are not creditable, they should be excluded from this measurement, even if they fall within the easement.

[5] This amount is the maximum buffer area possible based on the linear footage of stream length if channel were perfectly straight with full buffer width and no internal crossings. This number is not used in calculations, but is provided as a reference.

[6] Maximum potential size (in square feet) of each buffer zone measured around all creditable stream reaches, calculated using GIS, including areas outside of the easement. The inner zone (0-15') should be measured from the top of the OHWM or the edge of the average stream width if OHWM is not known. Non-creditable stream reaches within the easement should be removed prior to calculating this area wtih GIS.

[7] Square feet in each buffer zone, as measured by GIS, excluding non-forested areas, all other credit type (e.g., wetland, nutrient offset, buffer), easement exceptions, open water, areas failing to meet the vegetation performance standard, etc. Additional credit is given to 150 feet in buffer width, so areas within the easement that are more than 150 feet from creditable streams should not be included in this measurement. Non-creditable stream reaches within the easement should be removed prior to calculating this area wtih GIS.


Wits End Groundwater Gauge 1
Preconstruction (2020 Data)
Start Growing Season
March 1
End Growing Season
November 3
13 Days
15 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/20
1/13/20
1/25/20
2/6/20
2/18/20
3/1/20
3/13/20
3/25/20
4/6/20
4/18/20
4/30/20
5/12/20
5/24/20
6/5/20
6/17/20
6/29/20
7/11/20
7/23/20
8/4/20
8/16/20
8/28/20
9/9/20
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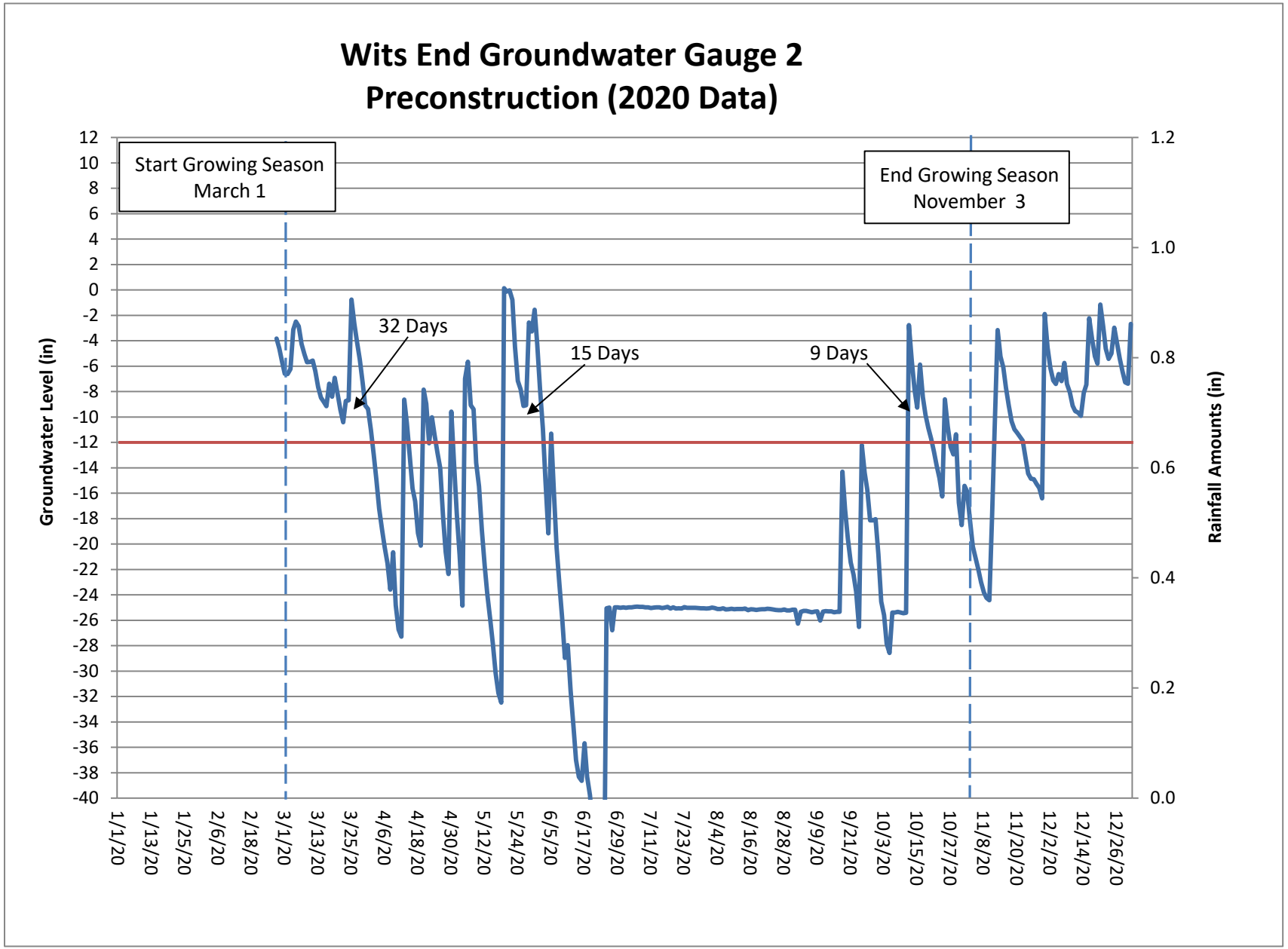
12/14/20
12/26/20


Wits End Groundwater Gauge 2
Preconstruction (2020 Data)
Start Growing Season
March 1
End Growing Season
November 3
32 Days
15 Days
9 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/20
1/13/20
1/25/20
2/6/20
2/18/20
3/1/20
3/13/20
3/25/20
4/6/20
4/18/20
4/30/20
5/12/20
5/24/20
6/5/20
6/17/20
6/29/20
7/11/20
7/23/20
8/4/20
8/16/20
8/28/20
9/9/20
9/21/20
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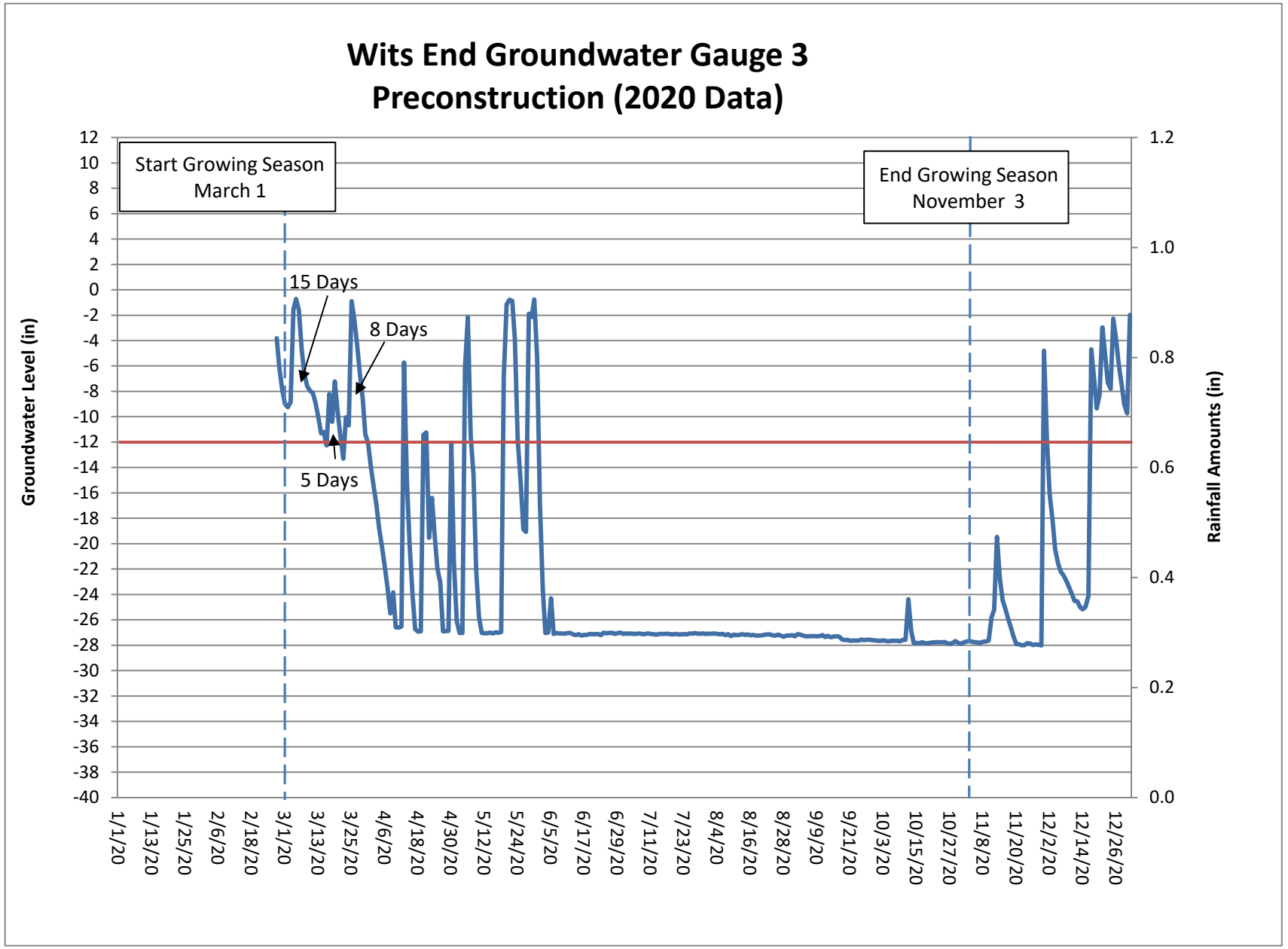
12/14/20
12/26/20


Wits End Groundwater Gauge 3
Preconstruction (2020 Data)
Start Growing Season
March 1
End Growing Season
November 3
15 Days
8 Days
5 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/20
1/13/20
1/25/20
2/6/20
2/18/20
3/1/20
3/13/20
3/25/20
4/6/20
4/18/20
4/30/20
5/12/20
5/24/20
6/5/20
6/17/20
6/29/20
7/11/20
7/23/20
8/4/20
8/16/20
8/28/20
9/9/20
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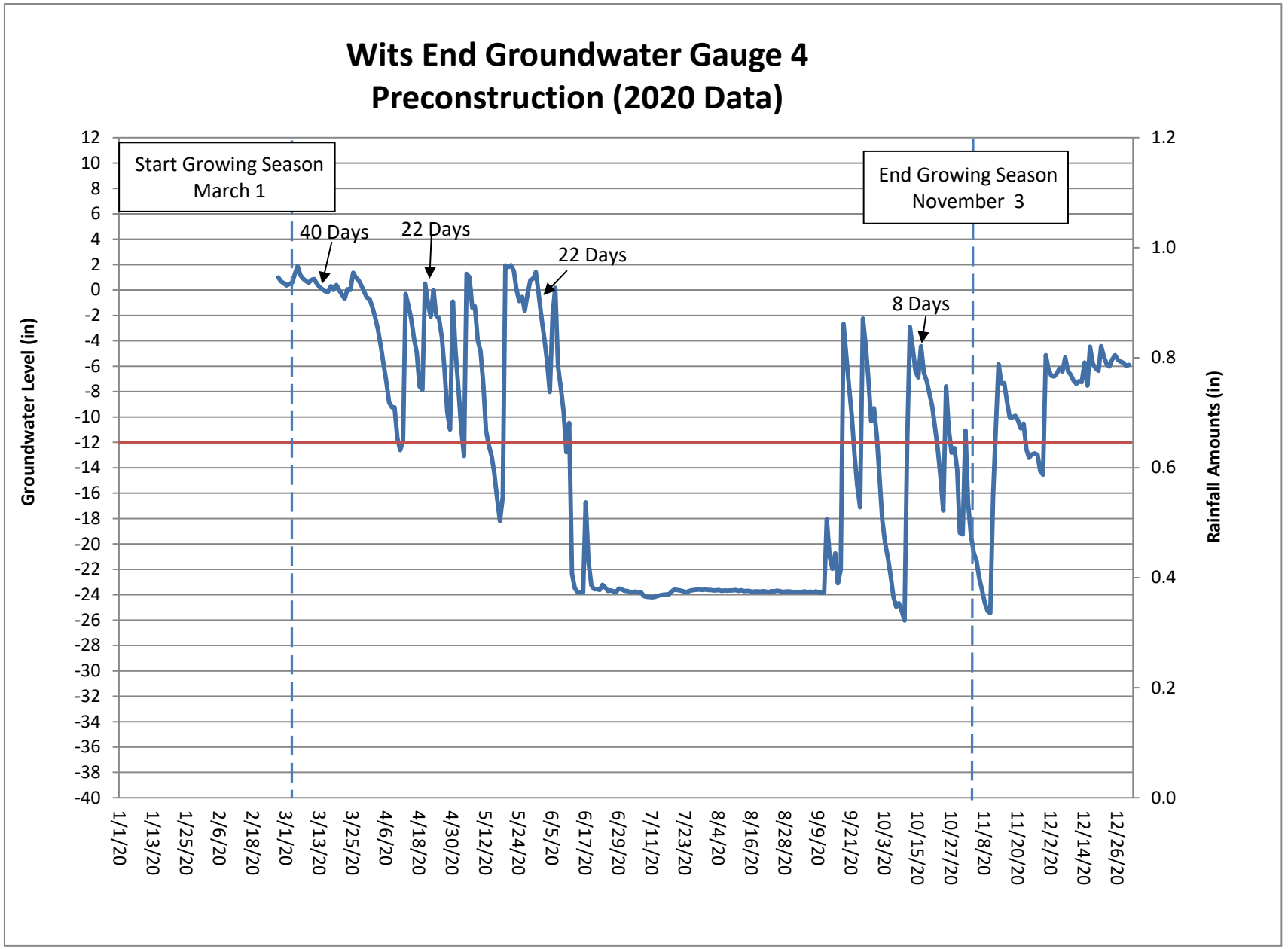
12/14/20
12/26/20


Wits End Groundwater Gauge 4
Preconstruction (2020 Data)
Start Growing Season
March 1
End Growing Season
November 3
40 Days
22 Days
22 Days
8 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/20
1/13/20
1/25/20
2/6/20
2/18/20
3/1/20
3/13/20
3/25/20
4/6/20
4/18/20
4/30/20
5/12/20
5/24/20
6/5/20
6/17/20
6/29/20
7/11/20
7/23/20
8/4/20
8/16/20
8/28/20
9/9/20
9/21/20
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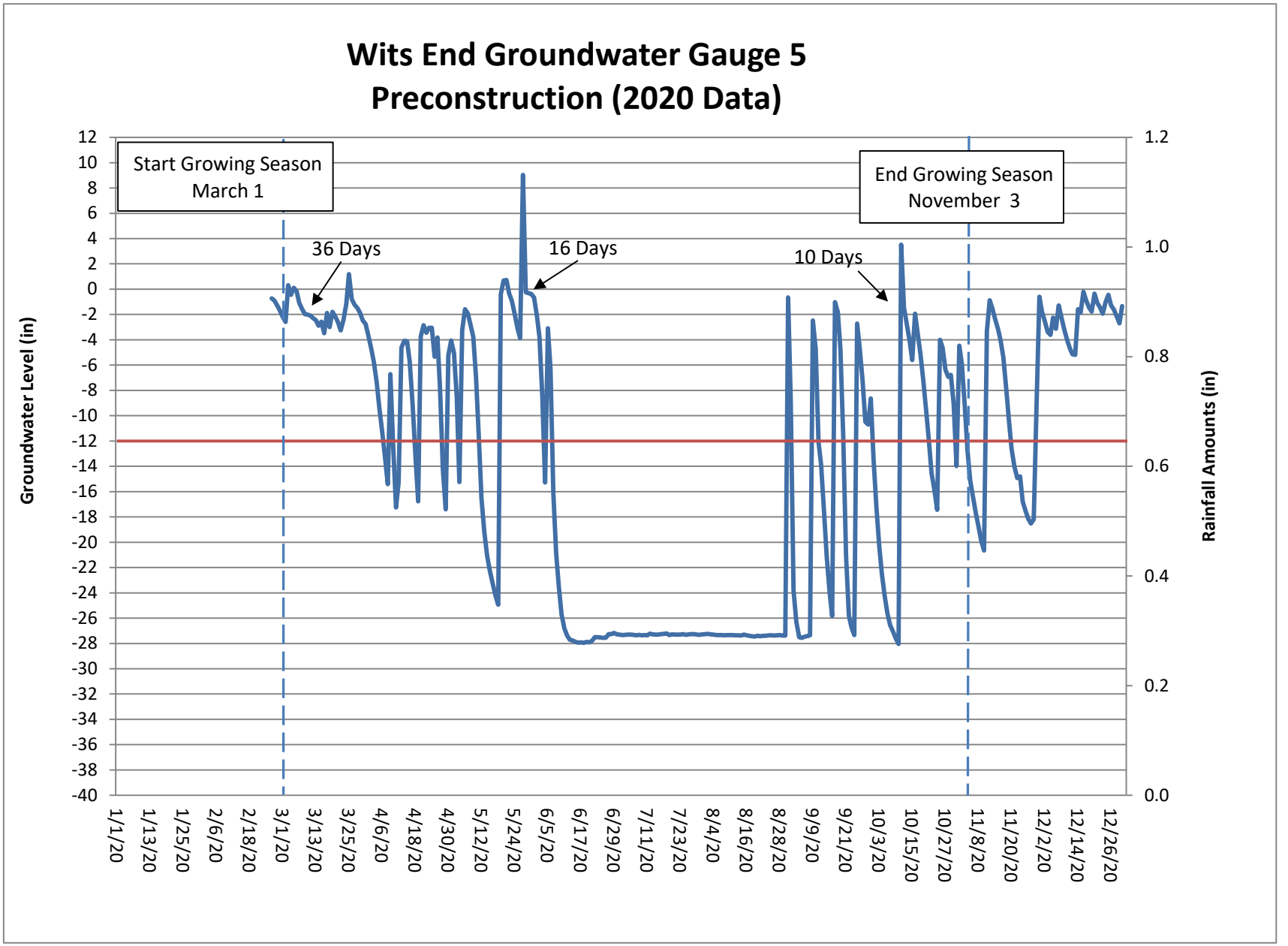
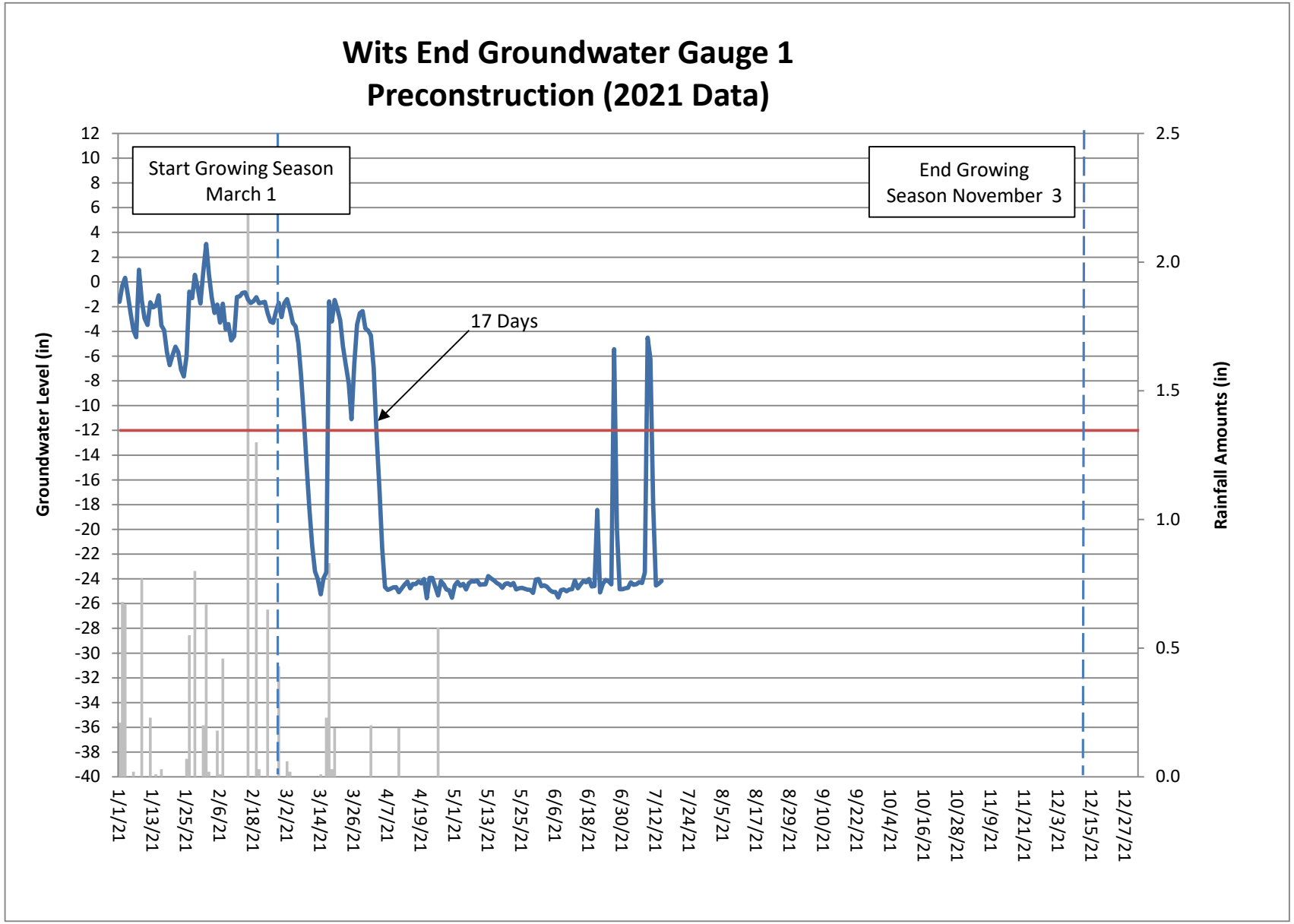
12/14/20
12/26/20


Wits End Groundwater Gauge 5
Preconstruction (2020 Data)
Start Growing Season
March 1
End Growing Season
November 3
36 Days
16 Days
10 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/20
1/13/20
1/25/20
2/6/20
2/18/20
3/1/20
3/13/20
3/25/20
4/6/20
4/18/20
4/30/20
5/12/20
5/24/20
6/5/20
6/17/20
6/29/20
7/11/20
7/23/20
8/4/20
8/16/20
8/28/20
9/9/20
9/21/20
10/3/20
10/15/20
10/27/20
11/8/20
11/20/20
12/2/20
12/14/20
12/26/20


Wits End Groundwater Gauge 1
Preconstruction (2021 Data)
Start Growing Season
March 1
End Growing
Season November 3
17 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
1/1/21
1/13/21
1/25/21
2/6/21
2/18/21
3/2/21
3/14/21
3/26/21
4/7/21
4/19/21
5/1/21
5/13/21
5/25/21
6/6/21
6/18/21
6/30/21
7/12/21
7/24/21
8/5/21
8/17/21
8/29/21
9/10/21
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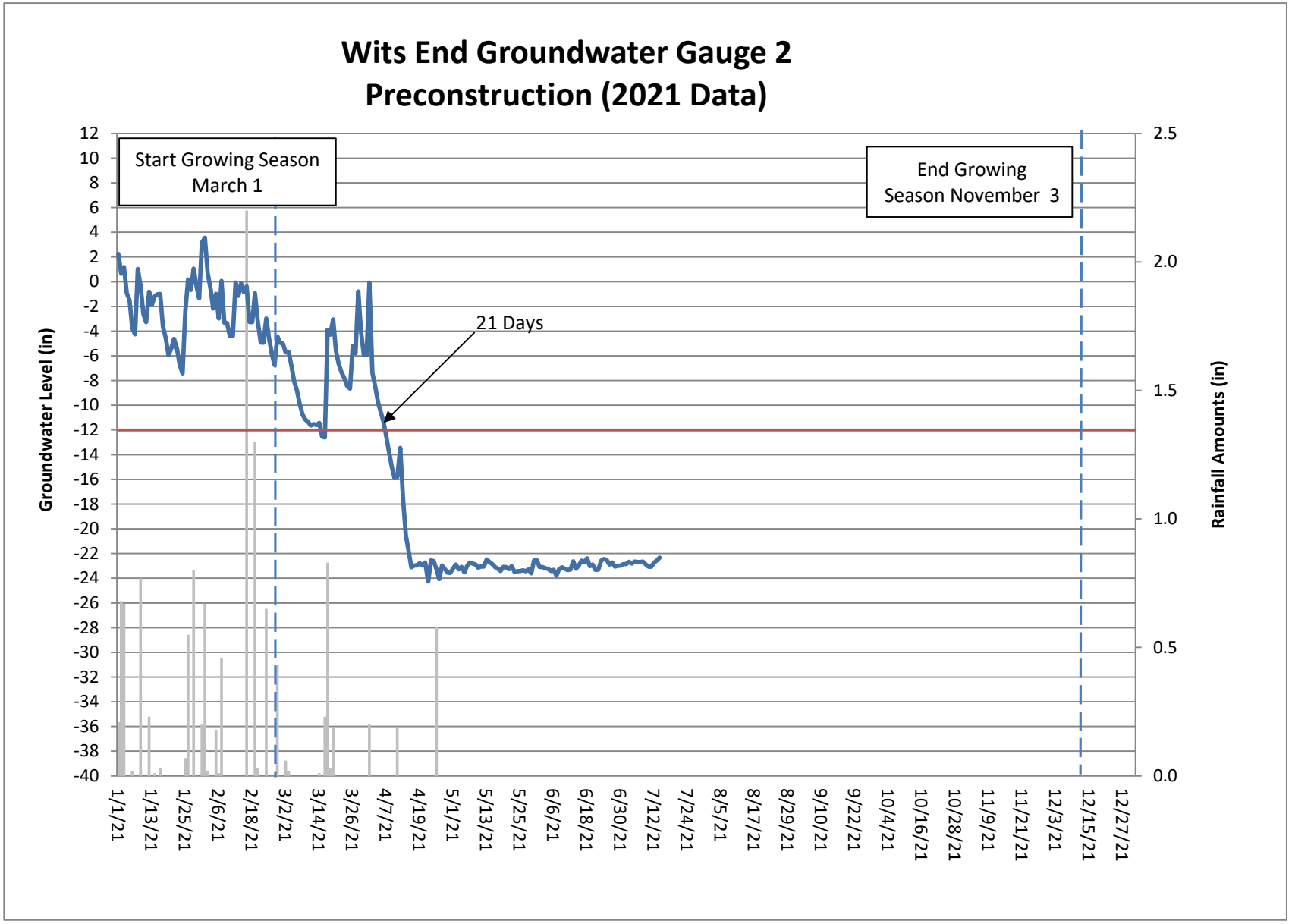
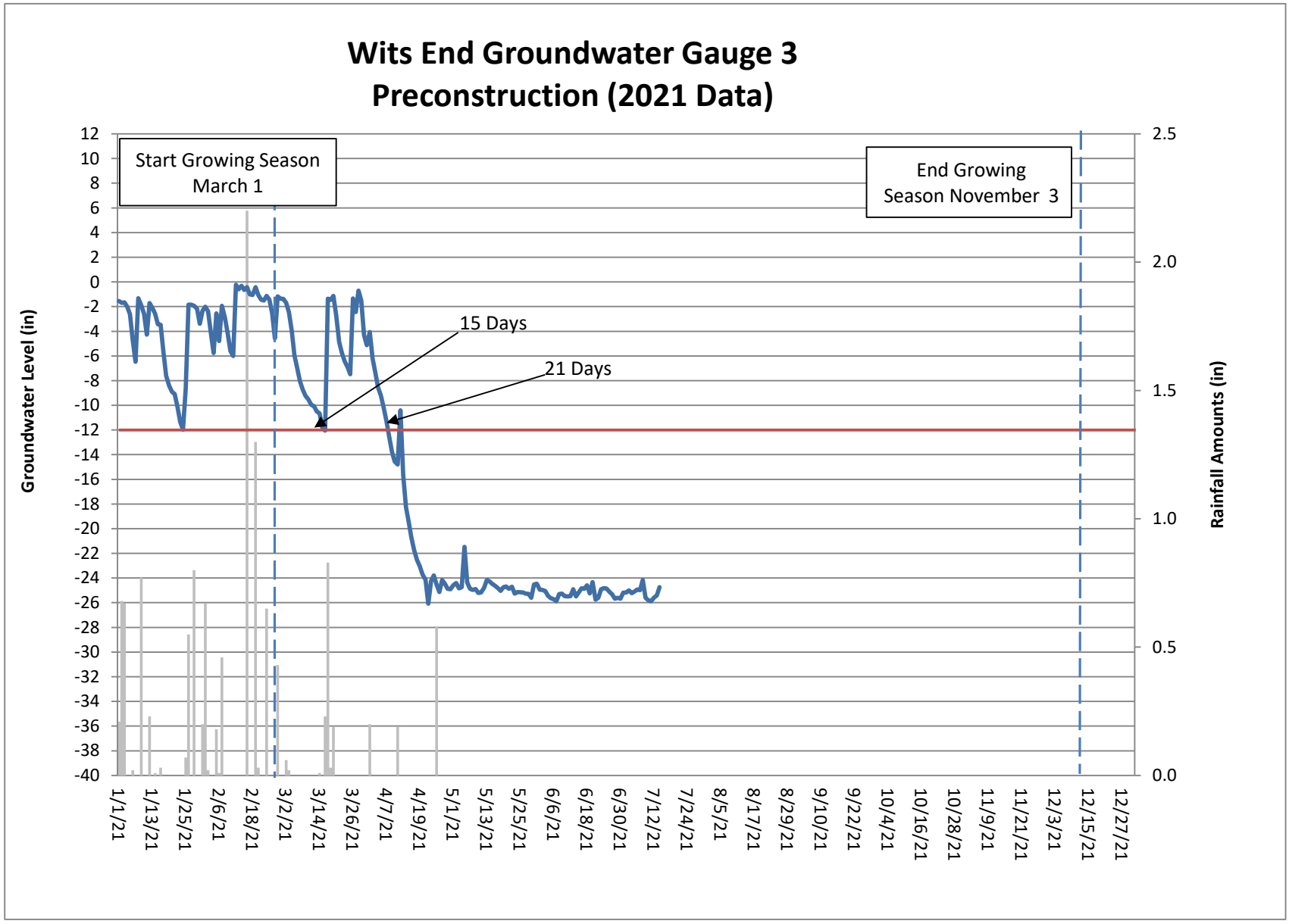
12/15/21
12/27/21


Wits End Groundwater Gauge 2
Preconstruction (2021 Data)
Start Growing Season
March 1
End Growing
Season November 3
21 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
1/1/21
1/13/21
1/25/21
2/6/21
2/18/21
3/2/21
3/14/21
3/26/21
4/7/21
4/19/21
5/1/21
5/13/21
5/25/21
6/6/21
6/18/21
6/30/21
7/12/21
7/24/21
8/5/21
8/17/21
8/29/21
9/10/21
9/22/21
10/4/21
10/16/21
10/28/21
11/9/21
11/21/21
12/3/21
12/15/21
12/27/21


Wits End Groundwater Gauge 3
Preconstruction (2021 Data)
Start Growing Season
March 1
End Growing
Season November 3
15 Days
21 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
1/1/21
1/13/21
1/25/21
2/6/21
2/18/21
3/2/21
3/14/21
3/26/21
4/7/21
4/19/21
5/1/21
5/13/21
5/25/21
6/6/21
6/18/21
6/30/21
7/12/21
7/24/21
8/5/21
8/17/21
8/29/21
9/10/21
9/22/21
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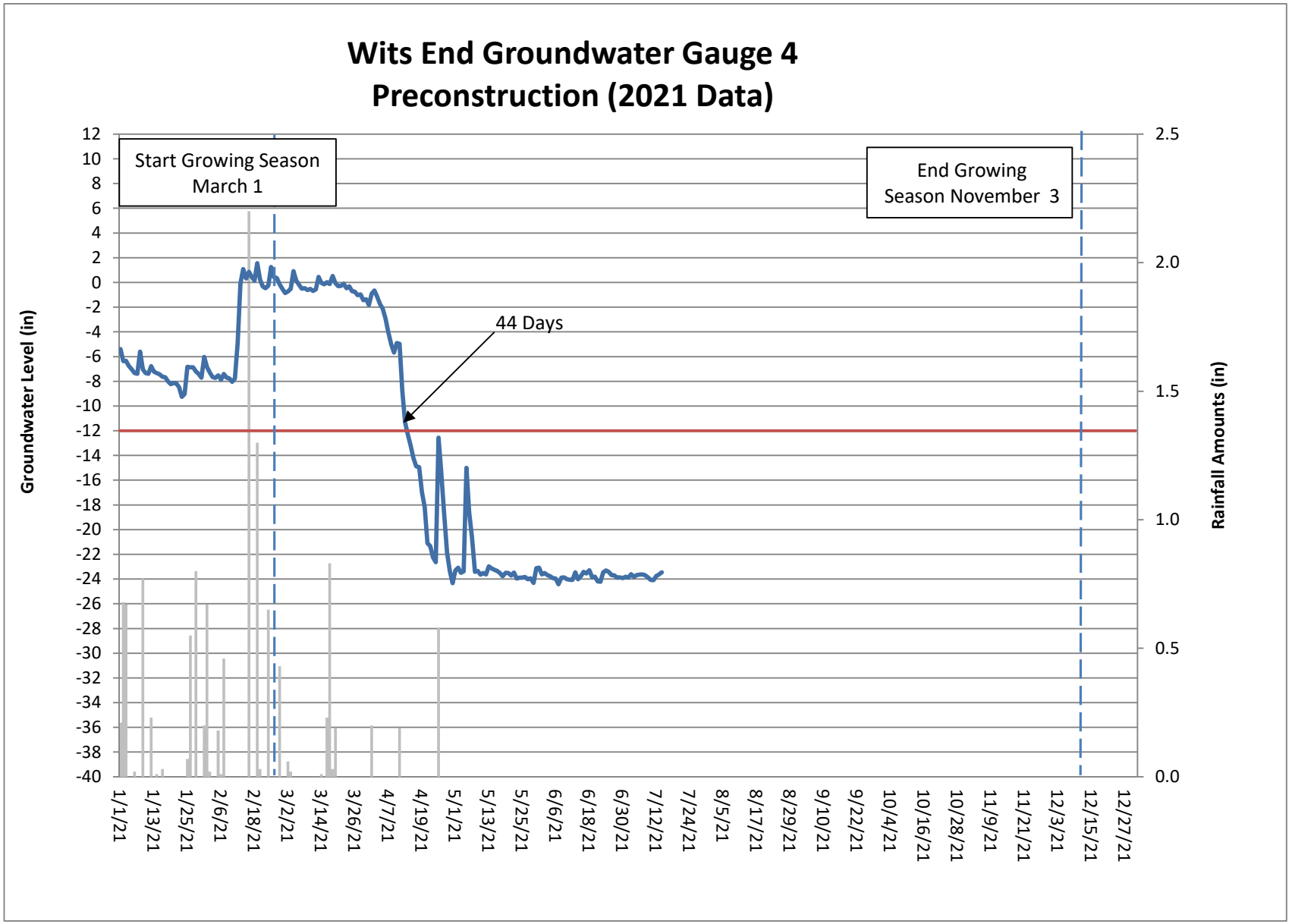
12/3/21
12/15/21
12/27/21


Wits End Groundwater Gauge 4
Preconstruction (2021 Data)
Start Growing Season
March 1
End Growing
Season November 3
44 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
1/1/21
1/13/21
1/25/21
2/6/21
2/18/21
3/2/21
3/14/21
3/26/21
4/7/21
4/19/21
5/1/21
5/13/21
5/25/21
6/6/21
6/18/21
6/30/21
7/12/21
7/24/21
8/5/21
8/17/21
8/29/21
9/10/21
9/22/21
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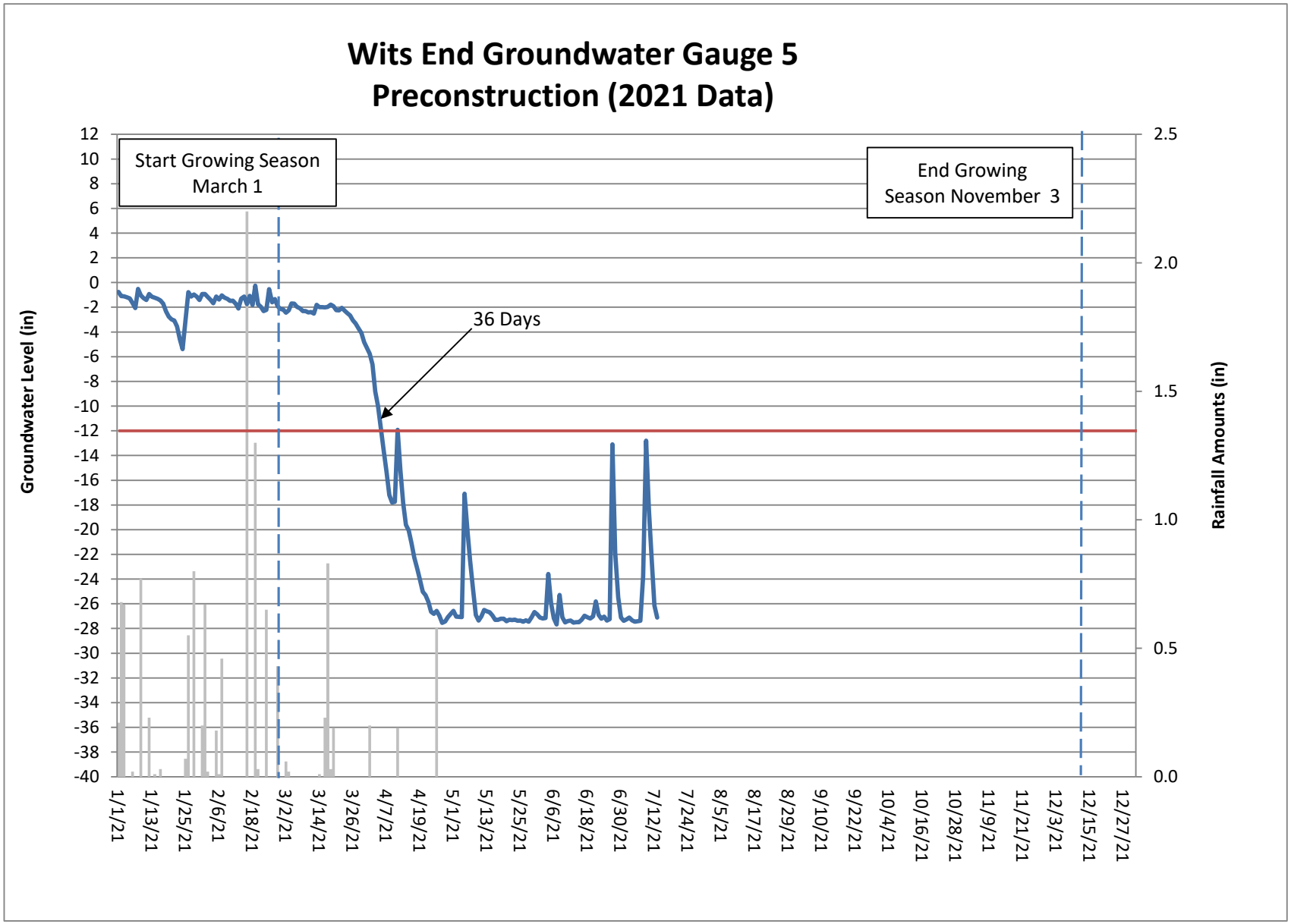
12/3/21
12/15/21
12/27/21


Wits End Groundwater Gauge 5
Preconstruction (2021 Data)
Start Growing Season
March 1
End Growing
Season November 3
36 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2.0
1.5
1.0
0.5
0.0
1/1/21
1/13/21
1/25/21
2/6/21
2/18/21
3/2/21
3/14/21
3/26/21
4/7/21
4/19/21
5/1/21
5/13/21
5/25/21
6/6/21
6/18/21
6/30/21
7/12/21
7/24/21
8/5/21
8/17/21
8/29/21
9/10/21
9/22/21
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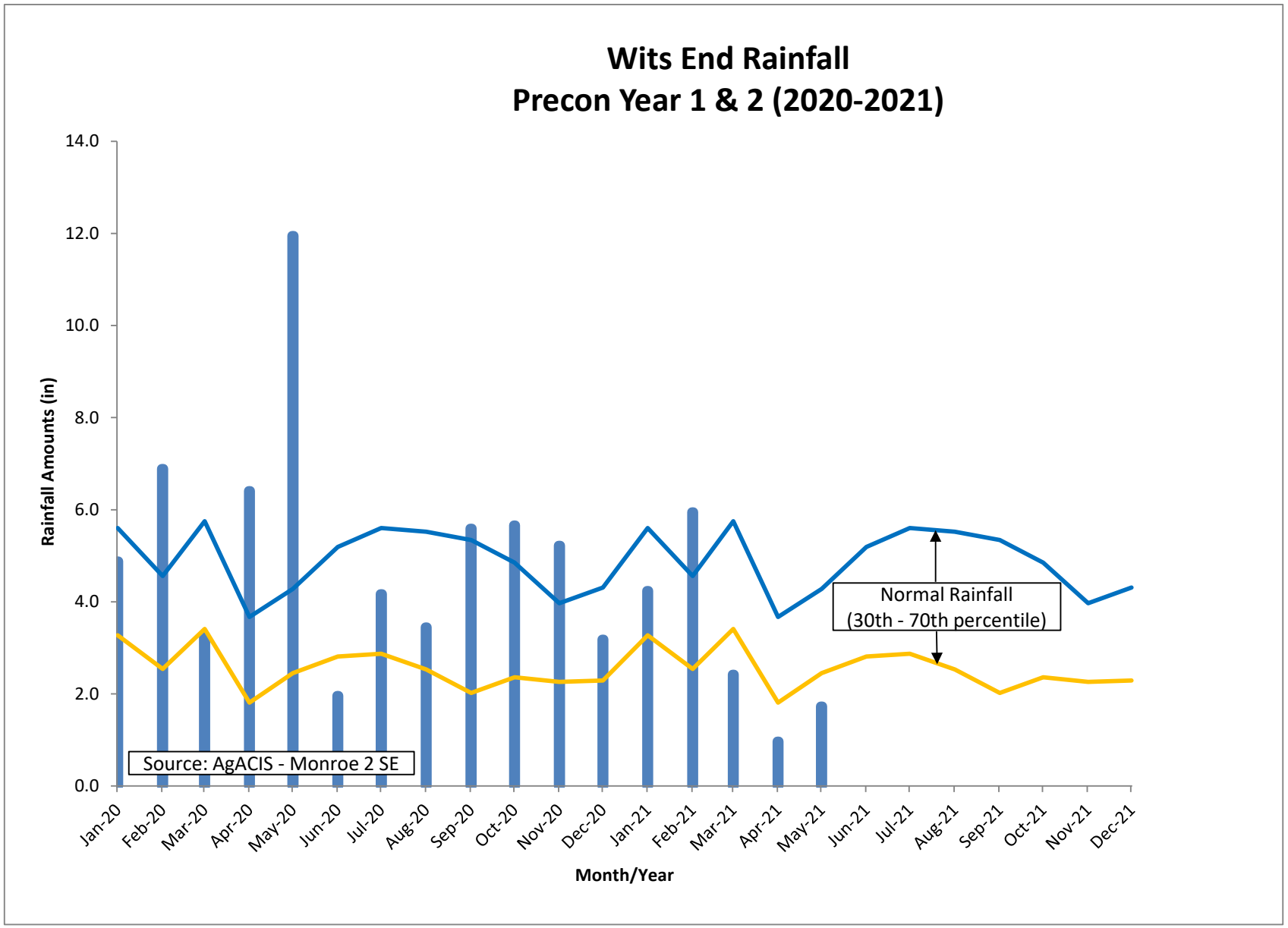
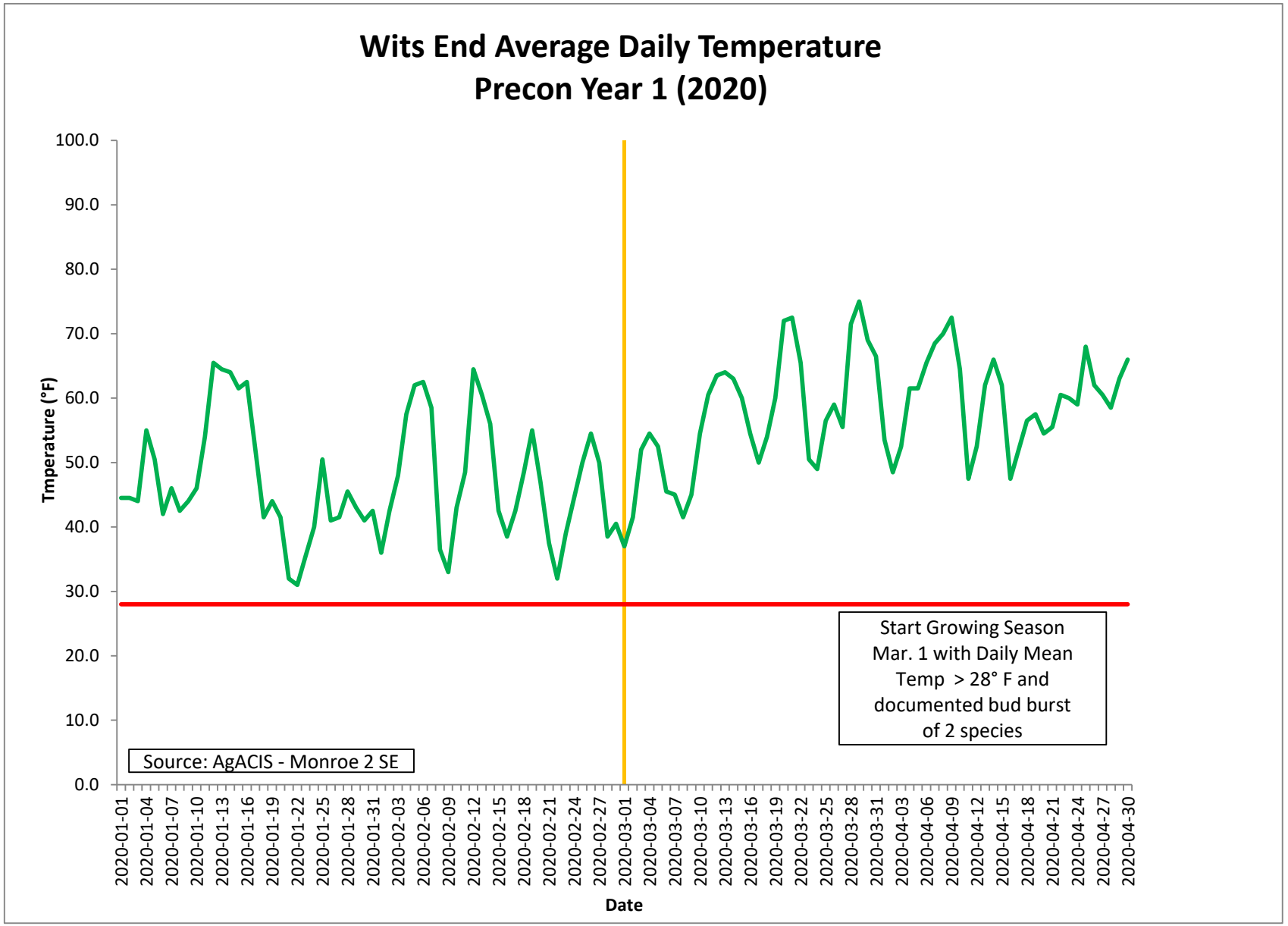
12/15/21
12/27/21


Wits End Rainfall
Precon Year 1 & 2 (2020-2021)
Rainfall Amounts (in)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Jan-20
Feb-20
Mar-20
Apr-20
May-20
Jun-20
Jul-20
Aug-20
Sep-20
Oct-20
Nov-20
Dec-20
Jan-21
Feb-21
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Month/Year
Normal Rainfall
(30th - 70th percentile)
Source: AgACIS - Monroe 2 SE


Wits End Average Daily Temperature
Precon Year 1 (2020)
Tmperature (°F)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
2020-01-01
2020-01-04
2020-01-07
2020-01-10
2020-01-13
2020-01-16
2020-01-19
2020-01-22
2020-01-25
2020-01-28
2020-01-31
2020-02-03
2020-02-06
2020-02-09
2020-02-12
2020-02-15
2020-02-18
2020-02-21
2020-02-24
2020-02-27
2020-03-01
2020-03-04
2020-03-07
2020-03-10
2020-03-13
2020-03-16
2020-03-19
2020-03-22
2020-03-25
2020-03-28
2020-03-31
2020-04-03
2020-04-06
2020-04-09
2020-04-12
2020-04-15
2020-04-18
2020-04-21
2020-04-24
2020-04-27
2020-04-30
Date
Start Growing Season
Mar. 1 with Daily Mean
Temp > 28° F and
documented bud burst
of 2 species
Source: AgACIS - Monroe 2 SE

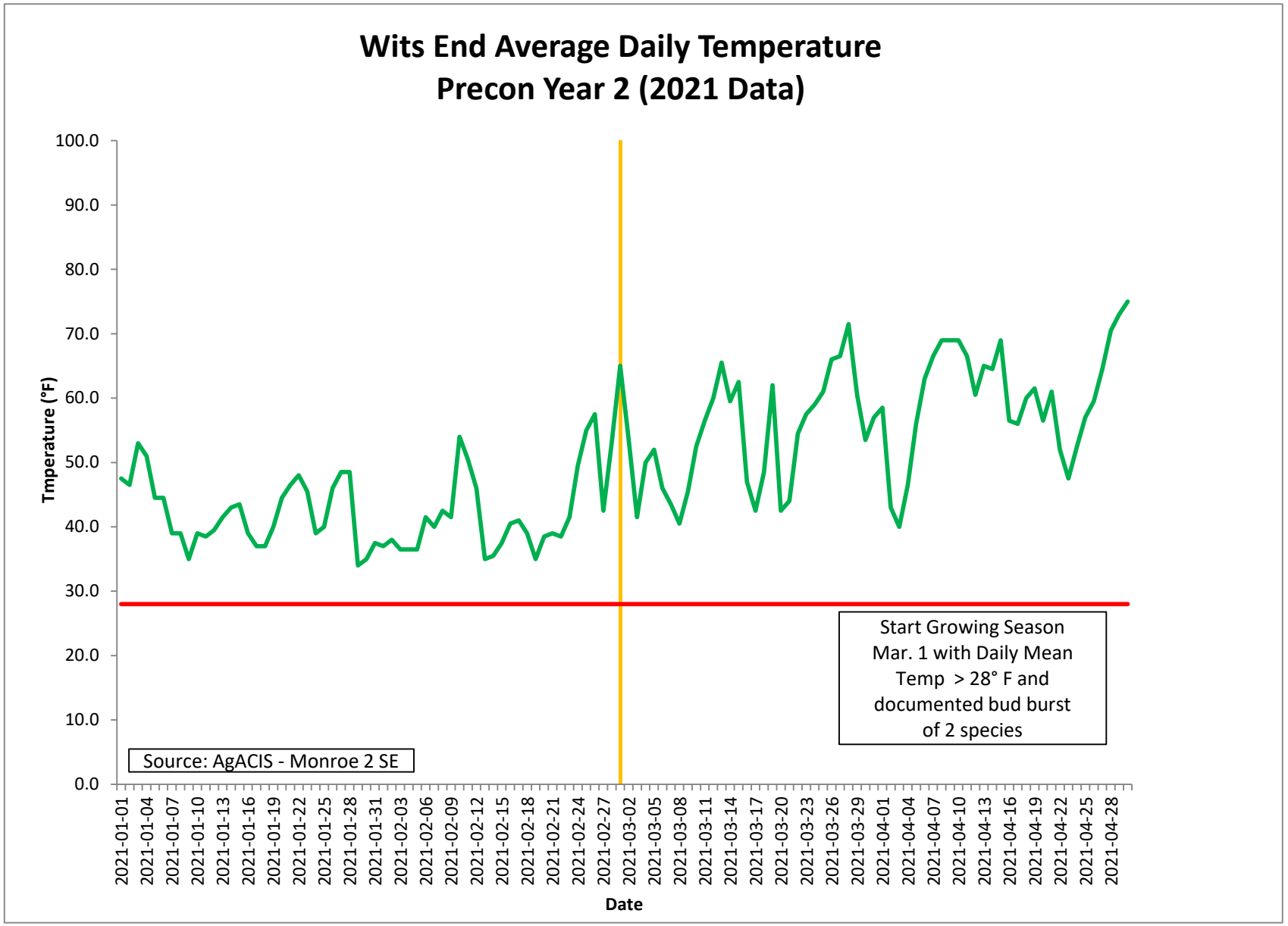

Wits End Average Daily Temperature
Precon Year 2 (2021 Data)
Tmperature (°F)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Source: AgACIS - Monroe 2 SE
Start Growing Season
Mar. 1 with Daily Mean
Temp > 28° F and
documented bud burst
of 2 species
2021-01-01
2021-01-04
2021-01-07
2021-01-10
2021-01-13
2021-01-16
2021-01-19
2021-01-22
2021-01-25
2021-01-28
2021-01-31
2021-02-03
2021-02-06
2021-02-09
2021-02-12
2021-02-15
2021-02-18
2021-02-21
2021-02-24
2021-02-27
2021-03-02
2021-03-05
2021-03-08
2021-03-11
2021-03-14
2021-03-17
2021-03-20
2021-03-23
2021-03-26
2021-03-29
2021-04-01
2021-04-04
2021-04-07
2021-04-10
2021-04-13
2021-04-16
2021-04-19
2021-04-22
2021-04-25
2021-04-28
Date

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Monroe, North Carolina)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Mar. 31	Apr. 9	Apr. 29
2 years in 10 later than--	Mar. 24	Apr. 5	Apr. 23
5 years in 10 later than--	Mar. 10	Mar. 28	Apr. 13
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 28	Oct. 22	Oct. 12
2 years in 10 earlier than--	Nov. 2	Oct. 26	Oct. 16
5 years in 10 earlier than--	Nov. 12	Nov. 3	Oct. 24

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Monroe, North Carolina)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	221	203	174
8 years in 10	230	209	181
5 years in 10	246	219	193
2 years in 10	263	229	206
1 year in 10	271	234	213

WETS Table

WETS Station: MONROE 2 SE, NC								
Requested years: 1971 - 2000								
Month	Avg Max Temp	Avg Min Temp	Avg Mean Temp	Avg Precip	30% chance precip less than	30% chance precip more than	Avg number days precip 0.10 or more	Avg Snowfall
Jan	52.0	31.4	41.7	4.71	3.27	5.60	8	1.5
Feb	56.8	33.4	45.1	3.81	2.54	4.56	6	1.2
Mar	64.9	40.5	52.7	4.85	3.41	5.75	8	0.7
Apr	73.6	47.5	60.5	3.02	1.81	3.67	6	0.0
May	80.1	56.2	68.2	3.59	2.45	4.28	7	0.0
Jun	86.6	64.2	75.4	4.32	2.81	5.19	7	0.0
Jul	89.6	68.4	79.0	4.63	2.87	5.60	7	0.0
Aug	87.9	66.9	77.4	4.53	2.53	5.52	6	0.0
Sep	82.6	60.9	71.8	4.38	2.02	5.34	5	0.0
Oct	73.4	48.5	60.9	4.04	2.36	4.85	5	0.0
Nov	63.6	40.1	51.8	3.33	2.26	3.97	6	0.0
Dec	54.8	33.6	44.2	3.58	2.29	4.31	7	0.5
Annual:					45.29	51.88		
Average	72.2	49.3	60.7	-	-	-	-	-
Total	-	-	-	48.79			77	3.9

GROWING SEASON DATES			
Years with missing data:	24 deg = 0	28 deg = 0	32 deg = 0
Years with no occurrence:	24 deg = 0	28 deg = 0	32 deg = 0
Data years used:	24 deg = 30	28 deg = 30	32 deg = 30
Probability	24 F or higher	28 F or higher	32 F or higher
50 percent *	3/5 to 11/22: 262 days	3/23 to 11/6: 228 days	4/11 to 10/25: 197 days
70 percent *	3/1 to 11/27: 271 days	3/18 to 11/11: 238 days	4/7 to 10/30: 206 days

WETS Table

WETS Station: MONROE 2 SE, NC								
Requested years: 1981 - 2010								
Month	Avg Max Temp	Avg Min Temp	Avg Mean Temp	Avg Precip	30% chance precip less than	30% chance precip more than	Avg number days precip 0.10 or more	Avg Snowfall
Jan	52.3	30.8	41.6	3.90	2.48	4.71	7	1.8
Feb	56.4	33.5	45.0	3.76	2.72	4.43	6	0.6
Mar	64.7	39.8	52.3	4.27	2.88	5.11	7	0.4
Apr	73.5	47.4	60.5	3.01	1.78	3.65	6	0.0
May	80.4	56.1	68.2	2.95	1.93	3.54	6	0.0
Jun	87.4	64.9	76.2	4.33	2.58	5.26	7	0.0
Jul	90.0	68.5	79.2	4.38	2.65	5.31	7	0.0
Aug	88.3	67.5	77.9	5.17	3.14	6.26	7	0.0
Sep	82.6	60.6	71.6	4.04	1.66	4.92	5	0.0
Oct	73.4	48.9	61.2	3.91	2.12	4.71	5	0.0
Nov	64.1	39.6	51.8	3.32	2.01	4.03	5	0.0
Dec	54.4	32.7	43.6	3.67	2.45	4.39	6	0.1
Annual:					42.48	50.59		
Average	72.3	49.2	60.7	-	-	-	-	-
Total	-	-	-	46.71			73	2.9

GROWING SEASON DATES			
Years with missing data:	24 deg = 0	28 deg = 0	32 deg = 0
Years with no occurrence:	24 deg = 0	28 deg = 0	32 deg = 0
Data years used:	24 deg = 30	28 deg = 30	32 deg = 30
Probability	24 F or higher	28 F or higher	32 F or higher
50 percent *	3/5 to 11/27: 267 days	3/23 to 11/11: 233 days	4/7 to 10/28: 204 days
70 percent *	2/27 to 12/4: 280 days	3/18 to 11/16: 243 days	4/1 to 11/3: 216 days

WETS Table

WETS Station: MONROE 2 SE, NC								
Requested years: 1991 - 2020								
Month	Avg Max Temp	Avg Min Temp	Avg Mean Temp	Avg Precip	30% chance precip less than	30% chance precip more than	Avg number days precip 0.10 or more	Avg Snowfall
Jan	53.1	30.3	41.7	3.93	2.76	4.65	6	1.1
Feb	56.8	32.7	44.8	3.30	2.45	3.77	6	0.3
Mar	64.1	38.6	51.4	4.10	2.99	4.79	7	0.4
Apr	73.5	47.4	60.5	3.66	2.08	4.20	6	0.1
May	80.6	56.9	68.8	3.58	2.05	4.15	5	0.0
Jun	87.6	65.3	76.5	4.63	3.02	5.51	7	0.0
Jul	91.1	68.8	80.0	4.01	2.68	5.01	7	0.0
Aug	88.9	67.9	78.4	4.89	3.02	5.79	7	0.0
Sep	83.5	61.4	72.5	4.60	2.32	5.54	5	0.0
Oct	74.2	49.2	61.7	3.69	2.01	4.36	4	0.0
Nov	63.7	37.6	50.7	3.42	1.81	4.21	5	0.0
Dec	55.5	32.9	44.2	3.98	2.77	4.71	6	0.2
Annual:					42.76	51.21		
Average	72.7	49.1	60.9	-	-	-	-	-
Total	-	-	-	47.79			71	2.1

GROWING SEASON DATES			
Years with missing data:	24 deg = 2	28 deg = 1	32 deg = 1
Years with no occurrence:	24 deg = 0	28 deg = 0	32 deg = 0
Data years used:	24 deg = 28	28 deg = 29	32 deg = 29
Probability	24 F or higher	28 F or higher	32 F or higher
50 percent *	2/28 to 11/29: 274 days	3/18 to 11/14: 241 days	4/2 to 11/3: 215 days
70 percent *	2/22 to 12/5: 286 days	3/13 to 11/19: 251 days	3/28 to 11/9: 226 days

APPENDIX C. WITS END TECHNICAL PROPOSAL SUPPLEMENT

TECHNICAL SUPPLEMENT & 30% DESIGN

WITS END STREAM & WETLAND MITIGATION SITE

UNION COUNTY, NORTH CAROLINA

FULL DELIVERY PROJECT
TO PROVIDE STREAM & WETLAND MITIGATION CREDITS WITHIN CATALOGING UNITS 03040105 OF THE YADKIN RIVER BASIN

Prepared for:
NORTH CAROLINA DIVISION OF MITIGATION SERVICES
RALEIGH, NORTH CAROLINA

Prepared by:

Restoration Systems, LLC
Ph: 919-755-9490
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604

Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603

October 5, 2020

TECHNICAL SUPPLEMENT & 30% DESIGN
WITS END STREAM & WETLAND MITIGATION SITE
UNION COUNTY, NORTH CAROLINA

FULL DELIVERY PROJECT TO PROVIDE STREAM & RIPARIAN WETLAND MITIGATION CREDITS WITHIN CATALOGING UNITS 03040105 OF THE YADKIN BASIN

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

Executive Summary

Upon the Interagency Review Team's initial review of the Wit's End Technical Proposal and associated field visit (06-01-2020), there was a discussion of the proposed wetland reestablishment areas. Specifically, there were concerns regarding the presence of drained hydric soils in the upper reaches of UT-3 and under the Waxhaw Branch pond, and the use of the F19 – Piedmont Floodplain Soil hydric soil indicator. As a result, the following requests were made to justify the areas proposed for wetland reestablishment: a detailed soils evaluation with representative soil profile descriptions, including subaqueous soil sampling – aka soggy bottom tests, a map of soil boring locations, and photos of representative soil profiles.

Following the IRT's recommendations and request for additional supporting data and documentation, Restoration Systems (RS) completed the following tasks in support of the proposed wetland mitigation assets:

- Five groundwater gauges were installed in February 2020 within upland areas, areas proposed for wetland preservation, and areas proposed for wetland reestablishment. Wetland hydrology was observed in wetland preservation areas, and not observed in the uplands or areas proposed for wetland reestablishment.
- A Preliminary Jurisdictional Determination was submitted, and field reviewed/approved by Bryan Roden Reynolds on September 29, 2020, confirming 8,209-l ft of jurisdictional streams, 6.383-ac of jurisdictional wetlands, and 11.588-ac of jurisdictional ponds.
- Completed a topographic and bathymetric survey of the Waxhaw Branch pond, which revealed the historic floodplain to be intact and not significantly altered from agricultural activities or the construction of the pond dam along Waxhaw Branch.
- Performed a subaqueous soils investigation (aka soggy bottom tests) within Waxhaw Branch, including five transects and 53 soil cores confirming the presence of a confining clay layer with hydric soil indicators and accumulation of sediment to be less than 1-ft.
- Completed a detailed soils investigation including over 230 soil borings with 177 soil borings exhibiting a F3 – Depleted Matrix, F8 – Redox Depressions, or F19 – Piedmont Floodplain Soils hydric soil field indicator representing 6.38-ac of existing wetlands and 25.46-ac of drained hydric soils. Note – these acreages match the PJD, which includes areas outside of the proposed easement boundary, and do not match the wetland assets in Table 6, which only contains assets within the proposed project boundary.
- Fifty-two representative soil profile descriptions with photos are included in this report
- A field survey of nearby existing forested wetlands associated with stream orders and landscape positions comparable to those observed within the Wit's End project.

Based on the additional data collected coupled with groundwater monitoring gauge data and the verbally approved Preliminary Jurisdictional Determination, there is substantial evidence to support the use of the identified hydric soil field indicators related to the proposed wetland assets.

1. Introduction

An Interagency Review Team (IRT) site visit took place on June 1, 2020, with the NC Division of Mitigation Services (DMS) and Restoration Systems (RS) to review the Technical Proposal for the Wit's End Stream and Wetland Mitigation Site (Project). At the conclusion of the site visit, there was discussion regarding the areas proposed for wetland rehabilitation, the presence of drained hydric soils, and the use of the F19 – Piedmont Floodplain Soil (F19) hydric soil indicator.

DWR requested additional soils work to be provided, including a detailed soils evaluation with representative soil profile descriptions, a map of soil boring locations, and photos of representative soils. Before approving any approach for the proposed wetland rehabilitation areas, the USACE, Todd Tugwell, mentioned he would solicit other opinions, including discussing the approach with the USACE Union County Project Manager conducting the Preliminary Jurisdictional Determination review.

To-date, RS has installed groundwater monitoring gauges in existing, and drained wetlands within the Project area, submitted and held a Preliminary Jurisdictional Determination (PJD) site visit, completed a project-wide topographic base map including a bathymetry survey of the Waxhaw Branch pond, collected subaqueous soil cores from the Waxhaw Branch pond, conducted a detailed soils evaluation within the Project area, and assessed local stream and wetland reference areas.

Detailed stream studies were conducted on proposed Project tributaries and two reference streams. Reference streams provided design morphological stream characteristics for existing and proposed Project tributaries. Based on data collected, Grant Lewis of Axiom Environmental developed a 30% stream design, with reach specific justification, which is in included in Appendix A along with morphological tables.

This Technical Supplement details the means, methods, and conclusions of RS' effort to document Project soils and existing wetlands. Data collected will act as the basis for wetland mitigation credit, which will be fully detailed in the Project's Restoration Plan.

2. Soil & Wetland Background

A narrative was included in the previously submitted Wit's End Technical Proposal dated March 9, 2020, which provides a discussion concerning the characterization of the Project wetlands and soils. This narrative is provided below as it provides a foundation in understanding the Project soils and their ability to support wetland hydrology.

2.1. Wetland Characterization

The Project contains existing wetlands within forested areas located in the floodplain of Waxhaw Branch. Existing wetlands are also present on neighboring properties along unnamed tributaries and downstream along Waxhaw Branch. Within and adjacent to the Project are six agricultural ponds (totaling ~14 acres) inline or adjacent to existing streams, the largest being 12.85-acres. The existing wetlands and agriculture ponds are located in the soil map units of Badin channery silt loam (BaB), Cid channery silt loam (CmB) and Goldston-Badin complex (GsC). The majority of the wetlands are located in CmB, a non-hydric soil; however, all existing wetlands include a hydric soil field indicator. Hydric soil field indicators observed within the existing wetlands included: F3 – Depleted Matrix, F8 – Redox Depressions, and F19 – Piedmont Floodplain Soils. After discussing the Project soils with Mr. Daniel Spangler (member of the soil survey team for Union County Soil Survey, 1996) and evaluating the Project soils, it is evident the CmB soil map unit within areas of the Project has inclusions of Secrest. It may be more appropriately mapped as the Secrest-Cid complex (ScA), which is listed as a hydric soil for Union county.

The existing wetland complex within the floodplain of Waxhaw Branch includes varying hydroperiods, which is reflected by the multiple hydric soil field indicators. Hydrology inputs to the system include precipitation, surface runoff from adjacent slopes, groundwater from adjacent ridges and slopes, and overbank flooding from Waxhaw Branch and Project tributaries. Surface depressions formed from remnant stream channels, windblown trees, and natural topography retain hydrological inputs and are associated with F3 and F19 indicators. Areas between these depressions have a soil surface that is slightly higher, relative to the depressions, with a water table within 12-inches of the soil surface which exhibit F8 and F19 indicators. A series of groundwater gauges have been installed within the existing wetlands and areas with drained hydric soils to document the hydrology of the system.

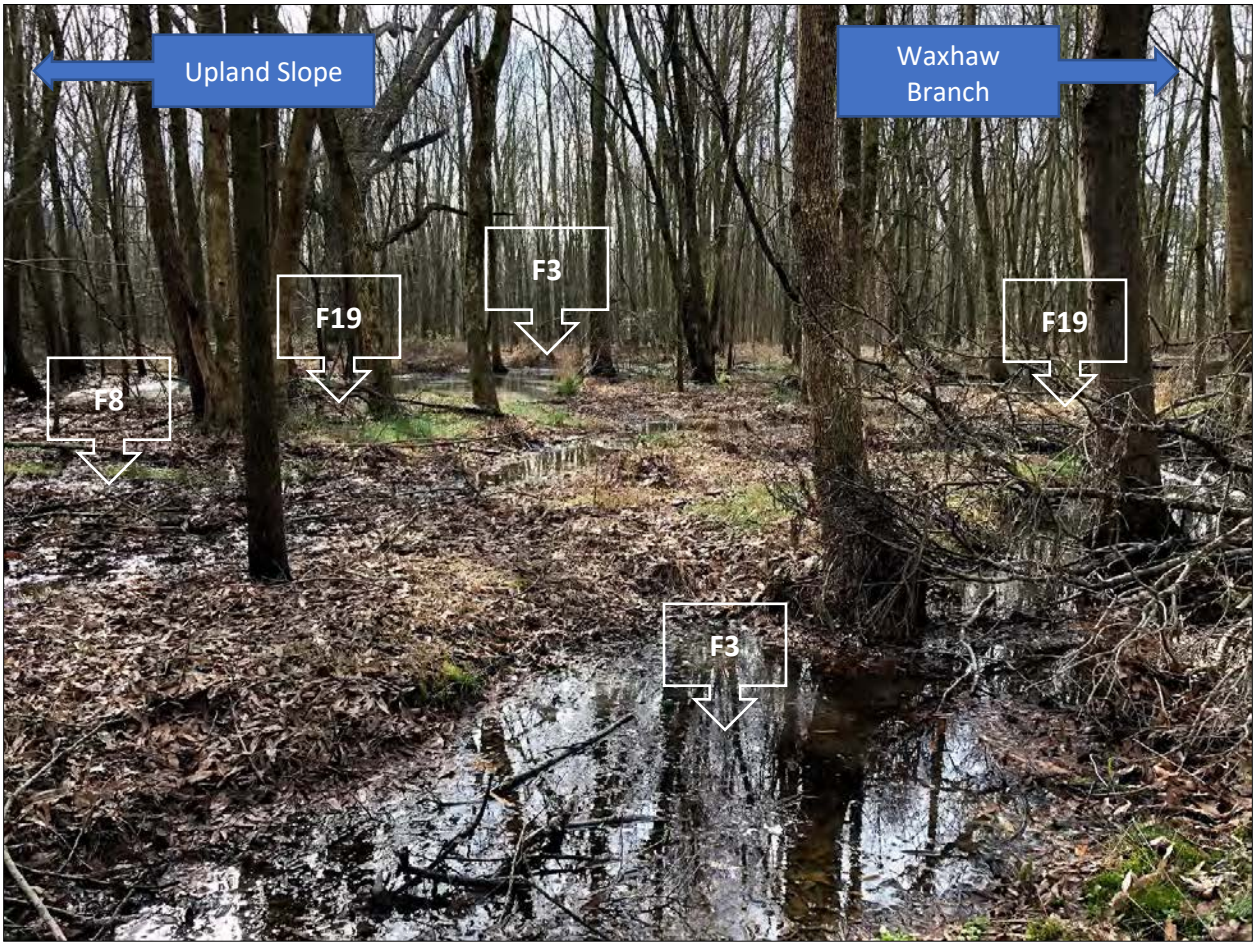


Photo 1 – Hydric soil field indicators (F3, F8, and F19) and associated landscape position in existing wetlands along the floodplain of Waxhaw Branch.

2.2. Soils

Based on the Union County Soil Survey (USDA 1996) and Web Soil Survey mapping (USDA 2017), the Project contains the soil series outlined in Table 1. Existing wetlands and drained hydric soils were mapped by a licensed soil scientist (NCLSS # 1297) on February 15 and December 2, 2019; February 20, 2020; July 9-10, 14-15, 21-23; and September 1, 2020, as soils of the Cid and Secrest series (Figure 1, Attachment A); soil boring logs are included in Appendix F.

Table 1 – Project Soils

Map Unit Symbol	Map Unit Name (Classification)	Hydric Status	Description
BaB	Badin channery silt loam (*Typic Hapludults*)	Non-hydric	This series consists of well-drained soils on interfluves. Slopes range from 2-8 percent. Parent material is residuum weathered from metasedimentary rock and/or metavolcanics. Depth to the water table is more than 80 inches.
CmB	Cid channery silt loam (*Aquic Hapludults*)	Non-hydric	This series consists of moderately well-drained and somewhat poorly drained soils on nearly level and gently sloping soils on flats, on ridges in uplands, in depressions, and at the head of intermittent drainageways. Slopes range from 1-5 percent. Parent material is residuum weathered from metavolcanics and/or argillite. Depth to the water table is 12-30 inches.
GsB	Goldston-Badin complex (*Typic Dystrochrepts/ Typic Hapludults*)	Non-hydric	This complex consists of well-drained soils on interfluves and hillslopes on ridges. Slopes range from 2-8 percent. Parent material is residuum weathered from metavolcanics and/or argillite. Depth to the water table is more than 80 inches.
GsC	Goldston-Badin complex (*Typic Dystrochrepts/ Typic Hapludults*)	Non-hydric	This complex consists of well-drained soils on hillslopes on ridges. Slopes range from 8-15 percent. Parent material is residuum weathered from metavolcanics and/or argillite. Depth to the water table is more than 80 inches.
*ScA	Secrest-Cid complex (*Aquic Hapludults/ Aquic Hapludults*)	Hydric	This complex consists of moderately well-drained and somewhat poorly drained soils on nearly level and gently sloping soils on flats, on ridges in uplands, in depressions, and at the head of intermittent drainageways. Slopes range from 0-3 percent. Parent material is residuum weathered from metavolcanics and/or argillite. Depth to the water table is more than 12-30 inches.

*Soil series is not mapped according to soil survey but was observed during on site soil investigations.

Geology

The Project is within the Carolina Slate Belt, where the Cid and Secrest soil series formed in residuum, weathered from argillite and other fine-grained metavolcanic rocks. The soils in the Carolina Slate Belt are highly variable and, at times, mapped as complexes due to the scale at which they are mapped. For instance, the Cid soil map unit within the Project is a single contiguous map unit that spans over 19,000-acres and is found at elevations ranging from 200 to 650 feet.

Parent Material

The USDA official series description (Attachment F) describes unweathered bedrock below the soil surface at ~32 – 34 inches for Cid and ~62 – 80 inches for Secrest. Depth to bedrock is the main difference between

the two soil series. The bedrock is comprised of hard, slightly fractured slate, argillite, or other fine-grained metamorphic rock. Argillite is a fine-grained sedimentary rock composed predominantly of indurated clay particles. Argillaceous rocks are basically lithified muds and oozes and contain variable amounts of silt-sized particles – the argillites grade into shale when the fissile layering typical of shale is developed. Mudstone is a fine-grained sedimentary rock formed from silt and clay and is similar to shale but has less laminations. Mudstone colors are variable and include brown/yellow color, indicating that even when reduced, the soil would not necessarily exhibit chroma 2 colors or less.

Landscape

The landscape surrounding the Project includes ridges and side slopes with soils (Badin and Goldston) that are shallow to bedrock, which leads to increased surface and subsurface runoff. As a result, the existing agricultural practices have utilized grassed drainageways to convey these hydrological inputs down gradient. These grassed drainageways convey water to the ditched streams and associated floodplains as well as the agricultural ponds. During the field assessment, areas of standing water and saturated soil were observed within the floodplain of Waxhaw Branch and the associated unnamed tributaries where seeps and drainageways enter the floodplains along the toe of slopes.

The Union County Soil Survey notes the geographic setting for both soil series as the following, "…nearly level and gently sloping Secrest and Cid soils on flats, on ridges in the uplands, in depressions, and at the head of intermittent drainageways." However, a review of Cid and Secrest mapped soil units in the surrounding area show these soils were also mapped to include floodplains of perennial streams (Appendix A – Figure 7). The geographic setting for the Cid and Secrest soils within the Project includes areas associated with the floodplain of perennial streams, including Waxhaw Branch and extend upslope along perennial tributaries that contribute to Waxhaw Branch. The association of the Project Cid and Secrest soil series with perennial stream floodplains in a lower landscape position than what is described provides support that historic floodplain wetlands existed within the Project.

Additionally, 70+ years of agricultural land practice on the Project has caused variation to the floodplain soils. The highly erodible soils on the adjacent slopes have resulted in the accumulation of sediment across the floodplain soils. Floodplain hydrology across the Project has been significantly affected by these same land practices, including the straightening/ditching of streams and the construction of agricultural ponds. Considering these variables are main components of the soil-forming process, it is clear that Project soil morphological properties have been affected. Especially considering existing wetlands have been partially restored at the Project only by ceasing agricultural production and returning the land to forested vegetation. Once the stream is restored and reconnected to the floodplain, the restored wetlands will exhibit one of these hydric soil field indicators.

Soil Series Characteristics/Morphology

Furthermore, the USDA official series description for the Cid and Secrest soil series describes a perched water table at a depth of 12 – 30 inches during the winter and spring. This water table depth is for Cid and Secrest soils located on interstream divides, lower side slopes, or broad flats around the heads of drainageways. The Cid and Secrest soil series found within the Project are associated with the floodplain of a third-order stream where historically, before agricultural land use, the water table would be within 12 inches of the surface. When considering the soil hydrology characteristics include somewhat poorly drained, slow runoff, and slow permeability, all of which would be representative of finding the Cid soil series on the floodplain of a perennial stream. Another contributing factor to support wetland hydrology for the Project's Cid soils is the restrictive properties, including the shallow depth to bedrock (~29-34") and moderate shrink-swell potential, both limiting the vertical movement of water in the soil. There is also documentation that slate fragments found in the soil surface can reduce evaporation losses, which

are present in the Project landscape and support historic retaining wetland hydrology (Daniels, Buol, Kleiss, Ditzler, 1999).

To further demonstrate the Project's ability to support wetland hydrology, there are multiple agricultural ponds (totaling ~14 acres), the most extensive being 12.85-acres with eight distinct topographic crenulations providing hydrology inputs. The largest pond is identified in the 1970 Wingate, NC USGS Topo Quad, and a review of historic aerials show the pond consistently retains hydrology annually independent of the season and even through periods of documented drought conditions. Also, an additional five agricultural ponds (totaling ~5 acres) exist adjacent to the Project. Discussions with property owners revealed that the smaller agricultural ponds are fed by springs, which further demonstrates the Project's historical ability of the landscape and soil to support wetland hydrology.

Hydric Field Indicators

Field Indicators of Hydric Soils in the United States, version 8.2 (USDA 2018) states, "*The indicators are used to identify the hydric soil component of wetlands; however, there are some hydric soils that lack any of the currently listed indicators. Therefore, the lack of any listed indicator does not prevent classification of the soil as hydric.*" The guidance also notes that hydric soils and their indicators are dynamic with changes and additions expected as new research and field testing takes place.

Lastly, when not mapped as a complex, the Cid and Secrest soil series are not identified as hydric soils for Union County; however, when mapped as a complex, the soil map unit is listed as hydric with Wehadkee being the hydric component. While Cid and Secrest are not mapped as hydric, the range of soil properties for each soil series in the Union County Soil Survey and USDA official series description match hydric soil indicators. Specifically, the range of soil matrix chroma and redoximorphic concentrations for Cid meets the F8 and F19 indicators, and for Secrest meets the F3, F8, and F19 indicators. Considering the range of soil properties, combined with Project-specific soil morphological properties and associated Project floodplain landscape position, there is clear evidence that indicates the Project's Cid and Secrest soil series historically supported jurisdictional wetlands and are candidates for wetland restoration.

3. Technical Supplemental Data

3.1. Groundwater Monitoring Gauges

Wetland gauge data gathered from the beginning of the 2020 growing season is presented in Table 2. RS used the AgACIS Monroe 2 SE weather station (34.9797, -80.5233) located in Union County, NC for precipitation and temperature data. The weather station documents daily average temperature above 28°F from March 1 moving forward. The 1987 US Army Corps Wetland Delineation Manual defines growing season as, "*the portion of the year when soil temperature (measured 20 inches below the surface) is above biological zero (5° C or 41° F). This period can be approximated by the number of frost-free days. The estimated starting date for the growing season is based on 28° F air temperature thresholds at a frequency of 5 years in 10 (HQUSACE, March 6 92).*" Based on this data and bud bursts of two species documented at Wit's End wetland hydrology was documented to begin on March 1. Also, rainfall was normal for January, above normal for February, and below normal for March.

Of the four gauges (gauges 2-5) were placed in and around the forested wetland, three gauges (gauges 2, 4, and 5) met wetland hydrology. Gauge 3 is on a toe slope landscape position where groundwater and surface water enter the floodplain and was positioned to represent the wetland boundary. Gauge 1 was placed at the base of a drainage swale in the agriculture field and is representative of the drained hydric soils being proposed for wetland restoration.

Table 2 – Summary of 2020 Growing Season Gauge Data

Gauge Summary (Downloaded 7/23/2020)*				
	Modified Growing Season (3/1 – 11/3, 248 days)**		WETS Growing Season (3/23 – 11/6, 228 days)***	
Gauge #	# of Days Wetland Hydrology Met	% of Growing Season	# of Days Wetland Hydrology Met	% of Growing Season
GW-1	15	6	5	2
GW-2	32	13	10	4
GW-3	15	6	9	4
GW-4	40	16	18	8
GW-5	40	16	14	6

* Groundwater monitoring well hydrographs along with rainfall and temperature data can be found in Attachment B.
** A proposed modified growing season is included based on mean daily temperature observed to be above 28°F at the nearby AgACIS Monroe 2 SE weather station
***The standard growing season associated with the WETS table from the nearby AgACIS Monroe 2 SE weather station is presented for comparison

3.2. Preliminary Jurisdictional Determination Request

RS performed a jurisdictional delineation on July 9-10 and 14-15, 2020. The PJD included eight streams totaling 8,209 linear feet, ten wetlands totaling 6.383 acres, and four bodies of open water totaling 11.756 acres. The PJD was submitted on August 7, 2020, and a field review was completed on September 30, 2020, with Mr. Bryan Roden Reynolds. The PJD was verbally approved as submitted except for the two small historic agriculture ponds located along UT-3. Mr. Roden Reynolds indicated that with the newly released Navigable Waters protection Rule, these pond features may not be considered jurisdictional. He was going to discuss with Todd Tugwell before making a final determination. The PJD identified the F3 (Depleted Matrix), F8 (Redox Depressions), and F19 (Piedmont Floodplain Soils) hydric soils indicators within the existing wetlands. The PJD request is included in Attachment C.

3.3. Bathymetry Survey

A bathymetry survey was completed along with a standard topographic survey by Carolina Surveyors, Inc (Attachment D). The fieldwork for the survey was conducted in late June 2020, and a survey drawing was received on July 13, 2020. The survey shows a broad flat historic floodplain associated with Waxhaw Branch. The lowest elevation is contour 584, an isolated depression located adjacent to the dam. Elevations for the edge of the water at the time of the survey ranged from 590-feet on the downstream end to 593-feet on the upstream end. The survey identified a small sandbar near the existing dock associated with a boat ramp, and marshy irregular terrain on the northern upstream area associated with Waxhaw Branch. The crenulations where streams and ephemeral features enter the pond appear relatively unchanged from historical conditions before constructing the pond dam. In general, the bathymetry survey did not identify any areas of significant manipulation from excavation during the construction of the impoundment or aggradation of sediments due to the impoundment.

The bathymetry survey was used to identify appropriate representative areas for transects to perform subaqueous soil sampling.

3.4. Subaqueous Soil Sampling

3.4.1. Introduction

Subaqueous soil sampling was conducted on July 22 & 30, 2020, to identify the presence and depth of overburden on the historic soil surface and to assess soil morphology of the clay subsoil (restrictive layer) for comparison to Project soils proposed for wetland rehabilitation. This information will allow for a better understanding of Project soils ability to support wetland rehabilitation and prepare for design and construction approaches before dewatering the pond.

This sampling effort provided physical samples and photographs from representative transects.

3.4.2. Methods

A transect sampling approach was chosen to capture the variability of the pond bed across the valley in multiple representative locations. Transects were identified based on a bathymetry survey of the pond included in the topographic survey. The transects were selected as representative sections of the upstream, middle, downstream, and crenulations entering the pond. On each transect a floating rope was fixed on either end to the shore, allowing a sampling platform to move along the transect with soil cores sampled at 5-meter increments.

A modified version of the following NRCS subaqueous soil sampling protocol was used: "*In order to sample from the exact location with depth, some soil mappers use a piece of PVC pipe with an inside diameter a little larger than the teeth on the bucket auger. The auger is placed into the pipe, and the sample is collected in the typical fashion. While the bucket is being removed, the PVC pipe is pushed deeper into the soil. The sample is retrieved and placed in a tray (typically a meter-long piece of vinyl gutter). The auger bucket is pushed down the pipe again, the spoil from pushing the PVC pipe down is removed, and then the next depth is sampled. This procedure is effective for sampling the upper 75 cm of the soil. Below this depth, however, collecting samples with a bucket auger becomes very difficult*." (Accessed July 7, 2020 https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcseprd1343022)

The identifications and labeling scheme for the transects and associated soil cores are provided below.

Table 3 – Summary of Soil Profile Descriptions of Subaqueous Soil Cores

Subaqueous Soil Sample Transect ID	Subaqueous Soil Sample Core ID
Dam	1 – 18
Duck Blind	1 – 14
Island	1 – 10
West Cove	1 – 4
Center	6 – 10

The modified version was conducted by vibrating and/or driving a 1.5-inch diameter clear PVC tube with a rubber mallet into the sediment until refusal or the water depth exceeded the tube. After driving the tube into the sediment, the tube was capped and removed by hand. This process allowed an intact sediment core to be collected and preserved for assessment. This method was repeated for all sampling locations and provided physical samples and photographs from representative transects (Appendix A).

Photos were taken in the field with a ruler to estimate the thickness of the soil horizons upon removing the soil core. Additionally, 13 intact soil cores (8 from the Dam transect and 5 from the Center transect) were brought back for additional analysis. Additional analysis included a soil profile descriptions and sending samples to the NCDA&CS Agronomic Services Division – Soil Testing Lab for the following analyses: soil texture, phosphorus, potassium, calcium, magnesium, sodium, weight per volume, pH, Mehlich buffer pH (acidity), CEC, base saturation, manganese, sulfur, zinc, copper and humic matter. To remove the soil core from the tube, excess water was siphoned from the top and then a solid plastic probe matching the inside diameter of the tube was used to push the sample onto a tray. The soil core was then split open to complete the soil profile description. Soil profile descriptions were completed for 9 of the soil cores on July 31, 2020. Five of the soil cores were allowed to air dry in the tubes for 30-days to assess the subsidence of the overburden sediment.

3.4.3. Results

Sampling Observations

When driving the tubes, four phases could generally be felt. First, freely sinking (clear water). Second, pushing through with gentle force (a mix of organic material and unconsolidated sediments). Third, a firm boundary was hit (Restrictive layer). In shallow areas, this was often a gravelly layer that became the point of refusal. In deeper areas, a tight restrictive clay layer could be felt, which took considerable force to penetrate. A fourth deeper soil layer (Underlying layer) allowed additional core depth with less effort than the third layer. In shallow areas, tubes were driven to the point of refusal, typically a rocky layer. In deeper areas, cores were driven through the restrictive layer into the underlying layer. Photographs of the subaqueous soil cores can be found in Attachment E.

Table 4 – Average Initial Depth of Organic Material/Unconsolidated Sediments

Transect ID	Depth of Organic Material/ Unconsolidated Sediments (inches)*
Dam	15
Duck Blind	12
Island	10
West Cove	3

* Note, sediment subsidence discussion follows Table 5.

Soil Profile Descriptions

The soil profile descriptions of the subaqueous soil cores generally included 3 to 4 distinct soil horizons that were described. The upper material was a mix of unconsolidated silt and varying degrees of decomposed organic material and ranged in thickness from 2 to 6-inches. The following horizon was the original surface horizon and ranged in texture from silt loam to silty clay loam. The thickness of the original surface ranged from 2 to 6-inches. Some of the soil cores included redoximorphic concentrations and depletions in this horizon. The third soil horizon was representative of the historic restrictive layer and ranged in texture from silty clay loam to clay with redoximorphic concentrations and in some instances redoximorphic depletions. A notable difference between the second and third horizons was the third horizon included a higher percentage of redoximorphic concentrations. This is likely due to the restrictive nature of the clay subsoil. Some of the soil cores included channer rock fragments, but only modified soil texture in soil cores that were close to shore.

Table 5 – Summary of Soil Profile Descriptions of Subaqueous Soil Cores

Subaqueous Soil Sample ID (Transect-Core Number)	Soil Profile Description Number*	Depth to Restrictive Soil Layer (inches)	Depth of Organic Material/Unconsolidated Sediments (inches)
Dam-11	34	8 – 13+	0 – 4
Dam-12	36	9 – 11+	0 – 3
Dam-13	48	6 – 8+	0 – 2
Dam-14	49	7 – 11+	0 – 5
Dam-15	50	9 – 12+	0 – 5
Center-6	51	8 – 11+	0 – 6
Center-7	37	14 – 16+	0 – 5
Center-9	52	11 – 16+	0 – 6
Center-10	35	11 – 17+	0 – 6

* Soil profile description of the subaqueous soil cores can be found in Attachment F.

Subsidence

In air drying the soil cores, it was anticipated the upper portion of the soil core that contained organic material and unconsolidated sediments would display linear shrinkage. However, the soil cores were unable to thoroughly dry while in the clear plastic tubes; this was partly because of the restrictive clay layer at the base acting as a clay plug. Also, the upper portion of the tube was at a length that made it difficult for water to evaporate. After attempting to air dry in the tube for 30-days, the soil cores were extracted from the tubes and allowed to air dry in the sampling tray. After drying exposed in an unconfined position, shrinkage was observed throughout the entire soil cores, including the upper organic material and unconsolidated sediments and the clay subsoil. While the amount of shrinkage could not be quantified, it was evident the subaqueous soil cores experienced notable shrinkage throughout – observed estimate of ~50% shrinkage in the overburden material and ~25% shrinkage in the restrictive clay layer.

3.4.4. Discussion:

The subaqueous soil sampling effort provided insight regarding the current conditions of the Project soils and information of the historic soil properties before being inundated. Specifically, the composition and extent of overburden observed did not present concerns for restoration. A restrictive layer was identified, and notable similarities of the subaqueous soils relative to the drained hydric soils in agriculture production were observed.

An apparent layer of overburden was observed within the soil cores and is a mixture of partially decomposed organic material and silt. This layer was observed predominantly in the deeper areas of the pond, including the middle of the historic valley of the Dam, Duck Blind, and Center transects. A difference in depth of the overburden was observed when comparing the initial sampling observations relative to the extracted soil profile descriptions. The overburden observed in the initial sampling observations appeared thicker because the fluid nature of the material streaked down the outer soil core. Additionally, the overburden contains organic material that acts as a sponge and expands when under saturated conditions. After drying, this material experienced notable shrinkage, and as a result, it is expected this material will decrease in-depth and area after the pond is dewatered. Additionally, the amount of material

observed in the samples is not excessive in depth or area and will not require excavation to the historic soil surface to support wetland hydrology. Moreover, there did not appear to be any differences in soil morphology that would affect the fertility of the soil and the ability to plant and grow trees in the historic pond bed.

A restrictive layer was observed both during the sampling effort by feel and post removal during the process of evaluating the soil cores and completing the soil profile descriptions. The restrictive layer observed along the margins of the pond included channers and is likely shallow to bedrock based on observations of the surrounding side slopes. Soils along the margins of the pond and extending upslope into the crenulations are likely associated with the Cid soil series. Soils in the historic floodplain included a restrictive clay layer with a texture ranging from silty clay loam to clay. The clay layer was observed to shrink and crack after drying, which is representative of 2:1 clay mineralogy, which restricts the vertical movement of water in the soil profile. These historic floodplain soils of the pond are likely a deeper version of the Cid soil series observed during the development of the Union County Soil Survey.

Potential for hydrology loss following dam removal is not expected for the restored stream and wetlands. The surrounding upland soils are shallow to bedrock, and the bedrock is observed in the downstream stream bed. Additionally, the 2:1 clay mineralogy will initially dry and crack following dam removal; however, remaining organics are anticipated to fill in the cracks to support the restoration of the soil structure. After restoration, the soil will regain historic structure upon returning to the natural wetting and drying annual cycle associated with the wet winter months, as observed in the existing downstream wetlands.

The soil profile descriptions of the subaqueous soil cores shared similar morphological properties to Project soils identified for wetland reestablishment currently in agriculture and silviculture production. The common properties included: redoximorphic concentrations found as pore linings and in the matrix along with soil peds, chroma 3 redoximorphic depletions, and chroma 3 soil matrices. These findings provide further support that even after 50+ years of being inundated, the mineralogy of these soils still displays properties that are not normally associated with being in a saturated and anaerobic condition for an extended period. Additionally, the data demonstrates the soils were not over excavated to construct the dam as a surface horizon was still observed.

3.5. Detailed Soils Evaluation

3.5.1. Introduction

A detailed soils evaluation within the Project area was conducted to provide additional data to justify and support the proposed wetland reestablishment areas for the Project. This work was performed on July 9-10, 14-15, 21-23, and September 1, 2020. Soils were evaluated by hand auger and use of a sharpshooter shovel to extract soil profiles which were described in the field. Representative soil profiles were described in the field and identified a hydric soil field indicator if present. Hydric soil indicators identified include F3 (Depleted Matrix), F8 (Redox Depressions), and F19 (Piedmont Floodplain Soils).

It should be noted the Project landscape has been in agriculture and silviculture production for an extended period, including terracing, plowing, relocating/ditching streams, and installation of farm ponds. These activities disturb hydric indicators of these as they manipulate the upper 8-inches where the indicators are located. Additionally, the short hydroperiod of these soils produces hydric indicators that are easily eliminated through the land practices mentioned above.

3.5.2. Methods

Over 230 soil borings were performed, with 177 of the soil borings exhibiting a hydric soil field indicator. The exercise included 52 soil profile descriptions representing soils observed in the various landscape positions and associated intermittent and perennial streams within the Project. Twenty-two soil profile descriptions were observed to have an altered F8 hydric soil indicator where land use practices have removed the indicator. However, these soils displayed evidence of a historic seasonal high-water table (SHWT) within 12-inches of the soil surface and included a consistent subsoil of soil profile descriptions displaying the F8 hydric indicator.

Soil borings were almost exclusively in the Cid soil map unit except for eight in the Goldston soil map unit. The soil borings within the Goldston soil map unit were in a small linear floodplain associated with an intermittent stream (UT4) where soil profile descriptions reflected soils more closely related to the Cid soil map unit. The soil borings within the Cid soil map unit are variable, as shown in the soil profile descriptions and associated photos. The variability falls within the range of the official series description for both the Cid and Secrest soil map units and is largely dependent on landscape position. When these soils are associated with intermittent and perennial streams with active floodplains, the restrictive soil properties (including expansive mixed clay mineralogy and shallow to bedrock) allow retention of surface water. These features of the soil support wetland hydrology as water is retained through the winter months (wet season) and remains into the early spring due to slow permeability and moderately low saturated hydraulic conductivity. Within a couple months of the start of the growing season, vegetation begins to uptake available soil and surface water, which drives the short hydroperiod of these wetlands.

3.5.3. Results and Discussion

The soil profile descriptions and associated photos can be found along with official soil series descriptions for Cid and Secrest soil series in Attachment F.

F3 Depleted Matrix Soil Borings

The F3 depleted matrix hydric indicator was observed in 13 soil borings in the wetland preservation, enhancement, and rehabilitation areas. This indicator is found along the middle and outer floodplain of the downstream reach of Waxhaw Branch. This indicator was also observed in some isolated locations of proposed wetland reestablishment areas associated with first and second-order streams. The restrictive soil layer consists of channery bedrock in the Cid soil series and expansive clay mineralogy associated with the deeper Secrest soil series.

F8 Redox Depressions Soil Borings

The F8 redox depressions hydric indicator was observed in 127 soil borings in the preservation, enhancement, and rehabilitation areas, especially along first-order intermittent and perennial streams. The restrictive soil layer consists of channery bedrock and expansive clay mineralogy in the Cid soil series and the stickiness and plasticity clay consistency associated with the deeper Secrest soil series. The F8 indicators were observed in closed depressions along the floodplains and were bounded by the toe of slopes and stream banks.

Altered F8 Redox Depressions Soil Borings

An altered version of the F8 redox depressions hydric indicator was observed in 22 of the soil borings in the rehabilitation areas, especially along first and second-order intermittent and perennial streams currently in agriculture production. The restrictive soil layer consists of channery bedrock in the Cid soil series and expansive clay mineralogy associated with the deeper Secrest soil series. Redoximorphic concentrations were observed between 5 – 12-inches rather than the required 0 – 4-inches depth

required. However, by having redoximorphic concentrations within the upper 12-inches this is evidence that a SHWT occurs at a depth that would support wetland hydrology. In addition, soils in preservation areas that display this hydric indicator were observed to have redoximorphic concentrations from 0 – 4-inches and extend deeper into the profile from the 5 – 12-inches depth range. This altered version of the F8 indicator is being included as land practices, mainly plowing and colluvium from surrounding side slopes in agriculture production, have filled in the historically closed depressions. Due to these depressions filling in with sediment from agricultural practices, the observed depth at which the redoximorphic concentrations would occur has been altered.

F19 Piedmont Floodplain Soil Borings

The F19 piedmont floodplain soils hydric indicator was observed in 37 of the soil borings in the wetland preservation, enhancement, and rehabilitation areas along floodplains of second and third-order perennial streams. The restrictive soil layer consists of channery bedrock and expansive clay mineralogy in the Cid soil series and the stickiness and plasticity clay consistency associated with the deeper Secrest soil series. It should be noted groundwater is often the source of hydrology for the F19 hydric indicator, and flooding may be rare.

Additional Soil Borings

Spoil was observed in 21 soil boring locations where existing and historic pond dams were present. These areas include an abundance of large channers mixed in with excavated clay from when the ponds were excavated. Due to the abundance and size of the rock material, auger refusal occurred at shallow depths (<6-inches).

Ten upland soil borings were completed and were observed at low elevations along the side slopes upgradient of toe slope landscape positions. It should be noted that several upland data points for the Preliminary Jurisdictional Determination ended up meeting an existing hydric indicator and were determined to be uplands from the result of ditching and altered hydrology.

3.6. Reference Wetlands

To better understand the variability of these soils in this setting, a desktop and field reconnaissance was performed to see if these soils are associated with wetlands under natural conditions. Four reference areas were identified that included Cid and Goldston soil map units. These reference locations were northeast of the Project associated at the head of an ephemeral stream in the Cid soil map unit, northwest of the Project associated with a floodplain of an intermittent stream in the Goldston soil map unit, within the Project along the downstream floodplain of Waxhaw Branch in the Cid soil map unit, and downstream of the Project along the floodplain of Waxhaw Branch in the Cid soil map unit.

All four areas included forested vegetation and met the three parameters for a jurisdictional wetland (Attachment G).

3.7. Conclusions

In summary, the detailed analysis provided herein provides firm support and justification for the proposed wetland mitigation assets, including documented wetland hydrology with groundwater monitoring gauges; a verbally approved PJD documenting existing wetlands with the presence of F3, F8, and F19 hydric soil indicators; a bathymetry survey detailing an intact historic floodplain; a detailed subaqueous soil sampling effort displaying less than a foot of overburden on the historic soil surface - confirming the bathymetry survey; a detailed soils investigation identifying hydric soil indicators associated with the proposed wetland reestablishment areas; and identifying nearby existing reference wetlands

incomparable landscapes and stream orders. Moreover, the hydrology of this system has been extensively modified for agriculture and silviculture land management activities for 80+ years. The extensive straightening and over-excavation of historic streams expedites the removal of precipitation and has removed wetland hydrology and the associate floodplain storage associated with the Project streams. The presence of existing wetlands in forested and modified forested areas along these straightened streams provides clear evidence the proposed reestablishment wetland areas will support wetland hydrology following restoration.

Presented below is a summary of the proposed wetland & stream mitigation assets and ratios.

Table 6 – Summary of Mitigation Assets and Credits

Wetland Features	Wetland Mitigation Type	Type	Acreage*	Mitigation Ratio	Riparian Riverine WMU
Drained, Filled, or Permanently Inundated	Reestablishment	Riparian Riverine	23.319	1:1	23.319
Existing	Enhancement	Riparian Riverine	1.416	2:1	0.708
Existing	Preservation	Riparian Riverine	4.918	10:1	0.492
	Totals		**29.6523 acres**		**24.519 WMUs**

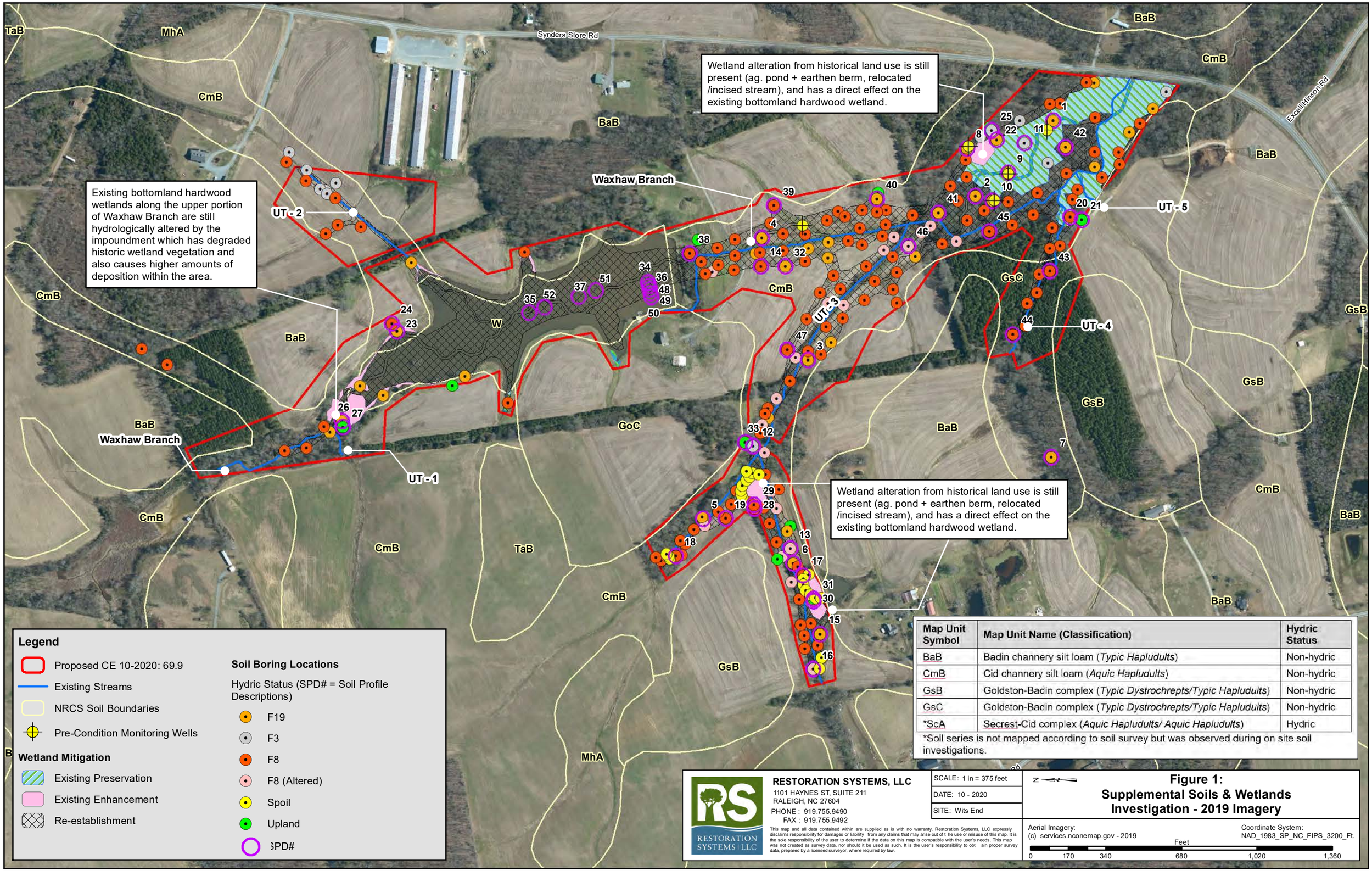
*Acreage accounts for easement breaks and the width associated with the proposed stream restoration channels.

Stream Mitigation Type	Liner Footage*	Mitigation Ratio	SMUs
Restoration	11,054	1:1	11,054
Enhancement (Level I)	232	1.5:1	170
Enhancement (Level III)	681	5:1	136
Totals	**11,967**		**11,360 SMUs**

*Based on 30% design – Figure 6 – Appendix A.

Appendix A. Figures

Figure 1 – Soils
Figure 2 – Subaqueous Sampling
Technical Proposal Figure 7 – Area Soils
Preliminary Mitigation Plan Figure 6 – 30% Restoration Plan
Table B1 – Morphological Stream Characteristics



Legend

- Proposed CE 10-2020: 69.9
- Existing Streams
- NRCS Soil Boundaries
- Pre-Condition Monitoring Wells

Wetland Mitigation

- Existing Preservation
- Existing Enhancement
- Re-establishment

Soil Boring Locations

Hydric Status (SPD# = Soil Profile Descriptions)

- F19
- F3
- F8
- F8 (Altered)
- Spoil
- Upland
- SPD#

Map Unit Symbol	Map Unit Name (Classification)	Hydric Status
BaB	Badin channery silt loam (*Typic Hapludults*)	Non-hydric
CmB	Cid channery silt loam (*Aquic Hapludults*)	Non-hydric
GsB	Goldston-Badin complex (*Typic Dystrochrepts/Typic Hapludults*)	Non-hydric
GsC	Goldston-Badin complex (*Typic Dystrochrepts/Typic Hapludults*)	Non-hydric
*ScA	Secrest-Cid complex (*Aquic Hapludults/ Aquic Hapludults*)	Hydric

*Soil series is not mapped according to soil survey but was observed during on site soil investigations.

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1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 375 feet
DATE: 10 - 2020
SITE: Wits End

Figure 1:
Supplemental Soils & Wetlands Investigation - 2019 Imagery

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 170 340 680 1,020 1,360

UT - 2

Waxhaw Branch

Dam
Cores 1 - 18
(Top to Bottom)

34
36
48
49
50

51
37
52
35

Center
Cores 10 - 6
(Left to Right)

Duck Blind
Cores 1 - 14
(Top to Bottom)

West Cove
Cores 4 - 1
(Left to Right)

Island
Cores 1 - 12
(Top to Bottom)

Legend

- Proposed CE 07-2020: 67.51

Carolina Surveyors Survey

- 5-ft Contours
- 1-ft Contours

Subaqueous Soil Sampling

- Sampling Transects
- Sampling Core Points
- Soil Profile Descriptions (#)

RESTORATION SYSTEMS, LLC
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FAX : 919.755.9492

SCALE: 1 in = 125 feet
DATE: 09 - 2020
SITE: Wits End

Figure 2:
Supplemental Subaqueous Soils Investigation - 2019 Imagery

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 55 110 220 330 440

Cid soils contain a wide range of properties and a single map unit extends from the interstream divides down into multiple stream order floodplains.

In this location Cid-Secrest soils are mapped along Barkers Branch, a stream with a similar drainage area to Waxhaw Branch at Wits End. The floodplain of Barkers Branch has sections that have been forested since 1993 and includes the period when the soils were mapped for the soil survey.

The floodplain of Barkers Branch is mapped as a Cid-Secrest complex and is mostly bordered by Cid.

In this location along a stream with a similar drainage area to Waxhaw Branch at the Site Chewacla soils are mapped. The floodplain of this stream has been mostly forested since 1993 and includes the period when the soils were mapped for the soil survey.

In this location along a stream with a similar drainage area to Waxhaw Branch at the Site Chewacla soils are mapped. The floodplain of this stream has been forested since 1993 and includes the period when the soils were mapped for the soil survey.

Cid soils contain a wide range of properties and a single map unit extends from the interstream divides down into multiple stream order floodplains.

Legend

- Wits End Project Footprint

Soil Map Units

- Cid
- Cid-Secrest complex [Hydric]
- Chewacla [Hydric]
- Not Displayed

NHD

- Named Hydrography
- UTs to Named Hydrography
- Unnamed Hydrography

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PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 2,000 feet

DATE: 03 - 2020

SITE: Wits End

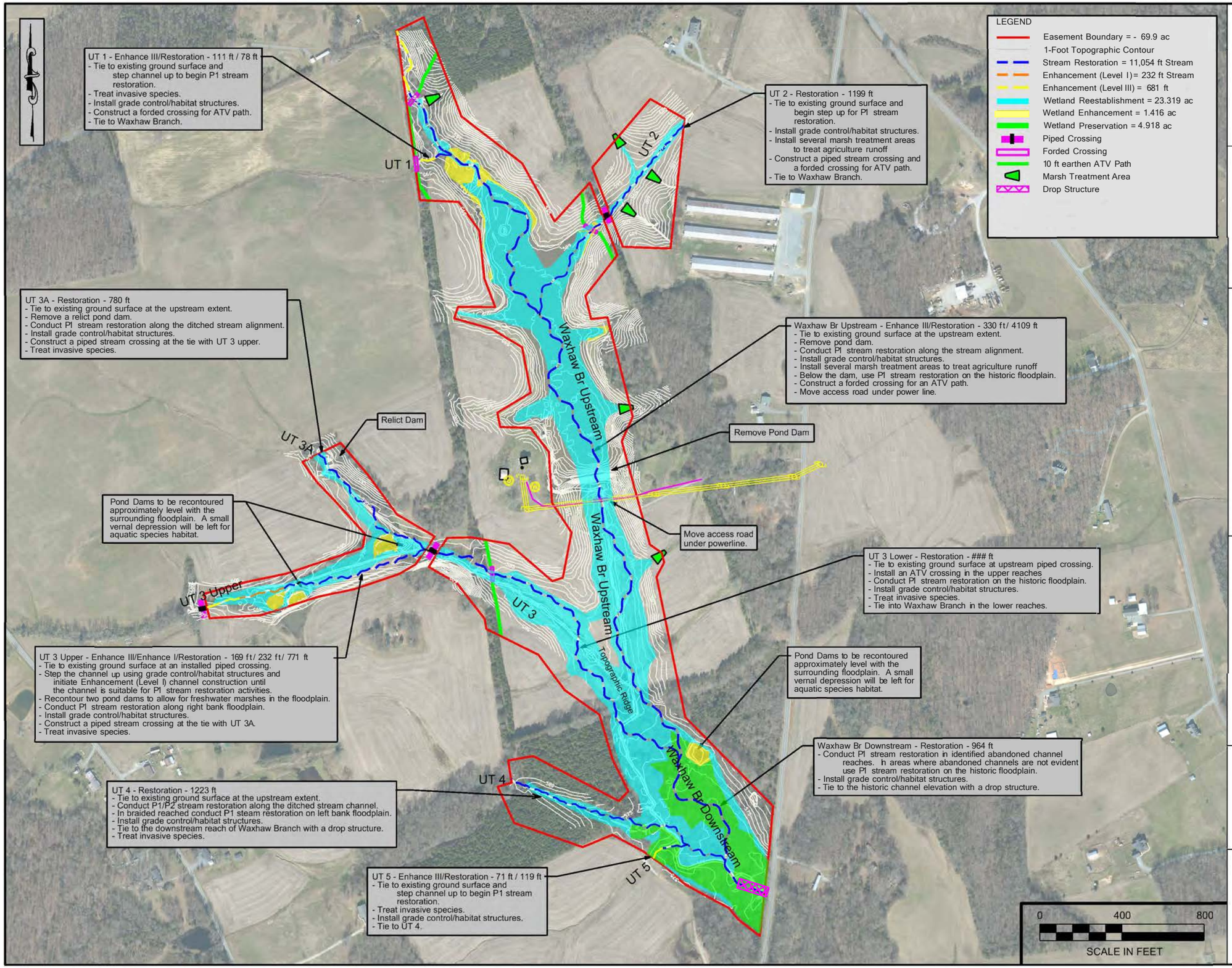
N

Figure 7:
Extent of Cid and Hydric Soils in the Surrounding Area

Background Image:
(c) NGS USA Topographic Maps - 2013

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 750 1,500 3,000 4,500 6,000



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Wits End

Union County
North Carolina

Title:

Restoration Plan

Scale:	FIGURE NO.
As Shown	**6**
Date: Sept2020	
Project No.: 20-011	

Table B1. Wits End Morphological Stream Characteristics

Variables	REFERENCE - UWHARRIE	REFERENCE - Spencer Creek	Existing (Waxhaw Branch Upstream)	Proposed (Waxhaw Branch Upstream)	Existing (Waxhaw Branch Downstream)	Proposed (Waxhaw Branch Downstream)
Stream Type	E 4	E 3	Eg 4/5	Ce 3/4	Eg 4/5	Ce 3/4
Drainage Area (mi^2)	0.60	0.41	0.66	0.66	1.04	1.04
Bankfull Discharge (cfs)	57.6	43.8	61.3	61.3	85.0	85.0
Dimension Variables						
Bankfull Cross-Sectional Area (A_{bkf})	14.2	10.4	15.0	15.0	20.4	20.4
Existing Cross-Sectional Area ($A_{existing}$)	14.2	10.4	21.6 - 34.0	15.0	39.2 - 64.3	20.4
Bankfull Width (W_{bkf})	Mean: 12.1 Range: 11.2 - 13.0	Mean: 9.1 Range: 6.8 - 10.1	Mean: 11.6 Range: 10.4 to 13.3	Mean: 14.5 Range: 13.4 to 15.5	Mean: 13.2 Range: 12.0 to 13.4	Mean: 16.9 Range: 15.6 to 18.1
Bankfull Mean Depth (D_{bkf})	Mean: 1.2 Range: 1.1 - 1.3	Mean: 1.3 Range: 1.1 - 1.4	Mean: 1.3 Range: 1.1 to 1.4	Mean: 1.0 Range: 1.0 to 1.1	Mean: 1.6 Range: 1.5 to 1.7	Mean: 1.2 Range: 1.1 to 1.3
Bankfull Maximum Depth (D_{max})	Mean: 1.7 Range: 1.6 - 1.7	Mean: 1.8 Range: 1.4 - 1.9	Mean: 2.1 Range: 2.0 to 2.3	Mean: 1.3 Range: 1.2 to 1.7	Mean: 2.4 Range: 2.1 to 2.7	Mean: 1.6 Range: 1.4 to 2.0
Pool Width (W_{pool})	Mean: 12.7 Range: 12.0 - 13.3	Mean: 14.8 Range: 12.1 - 17.4	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 17.4 Range: 14.5 to 20.3	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 20.3 Range: 16.9 to 23.7
Maximum Pool Depth (D_{pool})	Mean: 2.1 Range: 2.0 - 2.2	Mean: 2.1 Range: 1.9 - 2.2		Mean: 1.8 Range: 1.6 to 2.1		Mean: 2.1 Range: 1.8 to 2.4
Width of Floodprone Area (W_{fpa})	Mean: 50 Range:	Mean: 50 Range:	Mean: 150 Range: 150 to 150	Mean: 100 Range: 50 to 150	Mean: 32 Range: 20 to 150	Mean: 150 Range: 100 to 200
Dimension Ratios						
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 4.2 Range: 3.8 - 4.5	Mean: 5.9 Range: 5.0 - 7.4	Mean: 12.9 Range: 11.2 to 14.4	Mean: 6.9 Range: 3.7 to 9.7	Mean: 2.7 Range: 1.5 to 11.3	Mean: 8.9 Range: 6.4 to 11.1
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 10.1 Range: 10.0 - 10.2	Mean: 7.8 Range: 4.9 - 8.3	Mean: 8.9 Range: 7.4 to 12.2	Mean: 14.0 Range: 12.0 to 16.0	Mean: 8.3 Range: 7.1 to 8.9	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.4 Range: 1.3 - 1.5	Mean: 1.3 Range: 1.3 - 1.5	Mean: 1.6 Range: 1.5 to 1.9	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.4 Range: 1.4 to 1.8	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.0 Range:	Mean: 1.0 Range:	Mean: 1.5 Range: 1.3 to 1.6	Mean: 1.0 Range: 1.0 to 1.3	Mean: 1.8 Range: 1.5 to 2.2	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{poo}/D_{bkf})	Mean: 1.8 Range: 1.7 - 1.8	Mean: 1.6 Range: 1.5 - 1.7	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0
Pool Width / Bankfull Width (W_{poo}/W_{bkf})	Mean: 1.0 Range: 1.0 - 1.1	Mean: 1.6 Range: 1.3 - 1.9		Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area	Mean: 1.1 Range: 1.1 - 1.2	Mean: 1.4 Range:		Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4

Variables	REFERENCE - UWHARRIE	REFERENCE - UWHARRIE	Existing (Waxhaw Branch Upstream)	Proposed (Waxhaw Branch Upstream)	Existing (Waxhaw Branch Downstream)	Proposed (Waxhaw Branch Downstream)
Pattern Variables						
Pool to Pool Spacing (L_{p-p})	Med: 51.2 Range: 36.7 - 64.3	Med: 29.8 Range: 16.2 - 44.2	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 58.0 Range: 43.5 to 72.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 67.6 Range: 50.7 to 84.5
Meander Length (L_m)	Med: 85.9 Range: 60.2 - 97.1	Med: 41.4 Range: 28.8 - 64.6		Med: 101.4 Range: 72.5 to 130.4		Med: 118.3 Range: 84.5 to 152.1
Belt Width (W_{belt})	Med: 27.8 Range: 24.0 - 32.6	Med: 21.3 Range: 14.5 - 26.3		Med: 29.0 Range: 21.7 to 43.5		Med: 33.8 Range: 25.3 to 50.7
Radius of Curvature (R_c)	Med: 20.5 Range: 11.9 - 27.7	Med: 9.7 Range: 4.5 - 17.6		Med: 43.5 Range: 29.0 to 58.0		Med: 50.7 Range: 33.8 to 67.6
Sinuosity (Sin)	1.14	1.26	1.01	1.15	1.06	1.15
Pattern Ratios						
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 4.2 Range: 3.0 - 5.3	Med: 3.4 Range: 1.9 - 5.1	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 7.1 Range: 5.0 - 8.0	Med: 4.8 Range: 3.3 - 7.5		Med: 7.0 Range: 5.0 to 9.0		Med: 7.0 Range: 5.0 to 9.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 2.3 Range: 2.0 - 2.7	Med: 2.5 Range: 1.7 - 3.0		Med: 2.0 Range: 1.5 to 3.0		Med: 2.0 Range: 1.5 to 3.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 1.7 Range: 1.0 - 2.3	Med: 1.1 Range: 0.5 - 2.0		Med: 3.0 Range: 2.0 to 4.0		Med: 3.0 Range: 2.0 to 4.0
Profile Variables						
Average Water Surface Slope (S_{ave})	0.0168	0.0128	0.0052	0.0046	0.0042	0.0039
Valley Slope (S_{valley})	0.0192	0.0161	0.0053	0.0053	0.0045	0.0045
Riffle Slope (S_{riffle})	Mean: 0.0283 Range: 0.0096 - 0.0846	Mean: 0.0260 Range: 0.0157 - 0.0887	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 0.0078 Range: 0.0055 to 0.0092	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 0.0067 Range: 0.0047 to 0.0078
Pool Slope (S_{pool})	Mean: 0.0013 Range: 0 - 0.0082	Mean: 0.0006 Range: 0 - 0.0117		Mean: 0.0005 Range: 0.0000 to 0.0032		Mean: 0.0004 Range: 0.0000 to 0.0027
Run Slope (S_{run})	Mean: 0.0000 Range: 0 - 0.0091	Mean: 0.0054 Range: 0 - 0.0413		Mean: 0.0018 Range: 0.0000 to 0.0037		Mean: 0.0016 Range: 0.0000 to 0.0031
Glide Slope (S_{glide})	Mean: 0.0027 Range: 0 - 0.0102	Mean: 0.0070 Range: 0 - 0.0210		Mean: 0.0005 Range: 0.0000 to 0.0037		Mean: 0.0004 Range: 0.0000 to 0.0031
Profile Ratios						
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 1.7 Range: 0.6 - 5.0	Mean: 2.0 Range: 1.2 - 6.9	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 1.7 Range: 1.2 to 2.0	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 1.7 Range: 1.2 to 2.0
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 0.1 Range: 0 - 0.49	Mean: 0.1 Range: 0 - 0.9		Mean: 0.1 Range: 0.0 to 0.7		Mean: 0.1 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean: 0.00 Range: 0 - .55	Mean: 0.4 Range: 0 - 3.2		Mean: 0.4 Range: 0.0 to 0.8		Mean: 0.4 Range: 0.0 to 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean: 0.16 Range: 0 - 0.61	Mean: 0.5 Range: 0 - 1.6		Mean: 0.1 Range: 0.0 to 0.8		Mean: 0.1 Range: 0.0 to 0.8

Table B1 continuted. Wits End Morphological Stream Characteristics

Variables	Existing (UT 2)	Existing (UT 4)	Proposed (UT 2 and 4)	Existing (UT 3)	Proposed (UT 3)
Stream Type	E 6	Cg and D 4/5	Ce 3/4	G 4/5	Ce 3/4
Drainage Area (mi^2)	0.09	0.10	0.09	0.25	0.25
Bankfull Discharge (cfs)	14.8	16.0	14.8	30.6	30.6
Dimension Variables					
Bankfull Cross-Sectional Area (A_{bkf})	4.0	4.3	4.0	7.8	7.8
Existing Cross-Sectional Area ($A_{existing}$)	4.0 - 7.4	4.6 - 10	4.0	16.4 - 35.2	7.8
Bankfull Width (W_{bkf})	Mean: 4.8 Range: 4.1 to 7.0	Mean: 10.6 Range: 4.4 to 17.9	Mean: 7.5 Range: 6.9 to 8.0	Mean: 8.0 Range: 7.1 to 10.3	Mean: 10.4 Range: 9.7 to 11.2
Bankfull Mean Depth (D_{bkf})	Mean: 0.8 Range: 0.6 to 1.0	Mean: 0.6 Range: 0.2 to 1.0	Mean: 0.5 Range: 0.5 to 0.6	Mean: 1.0 Range: 0.8 to 1.1	Mean: 0.7 Range: 0.7 to 0.8
Bankfull Maximum Depth (D_{max})	Mean: 1.4 Range: 1.2 to 1.4	Mean: 0.9 Range: 0.4 to 1.4	Mean: 0.7 Range: 0.6 to 0.9	Mean: 1.3 Range: 1.1 to 1.5	Mean: 1.0 Range: 0.9 to 1.2
Pool Width (W_{pool})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 9.0 Range: 7.5 to 10.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 12.5 Range: 10.4 to 14.6
Maximum Pool Depth (D_{pool})			Mean: 0.9 Range: 0.8 to 1.1		Mean: 1.3 Range: 1.1 to 1.5
Width of Floodprone Area (W_{fpa})	Mean: 33 Range: 22 to 40	Mean: 50 Range: 30 to 60	Mean: 50 Range: 25 to 75	Mean: 10 Range: 8 to 23	Mean: 75 Range: 50 to 100
Dimension Ratios					
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 5.4 Range: 4.7 to 8.3	Mean: 5.1 Range: 3.1 to 9.6	Mean: 6.7 Range: 3.6 to 9.4	Mean: 1.3 Range: 1.1 to 2.2	Mean: 7.2 Range: 5.2 to 9.0
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 6.0 Range: 4.1 to 2.0	Mean: 29.8 Range: 4.4 to 89.5	Mean: 14.0 Range: 12.0 to 16.0	Mean: 8.0 Range: 6.5 12.9 19.8	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.8 Range: 1.4 to 2.0	Mean: 1.4 Range: 1.3 to 3.0	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.4 Range: 1.3 to 1.4	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.1 Range: 1.0 to 1.5	Mean: 1.4 Range: 1.0 to 1.8	Mean: 1.0 Range: 1.0 to 1.3	Mean: 2.3 Range: 1.7 to 3.0	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{poo}/D_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0
Pool Width / Bankfull Width (W_{pool}/W_{bkf})			Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area			Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4

Variables	Existing (UT 2)	Existing (UT 4)	Proposed (UT 2 and 4)	Existing (UT 3)	Proposed (UT 3)
Pattern Variables					
Pool to Pool Spacing (L_{p-p})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 29.9 Range: 22.4 to 37.4	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 41.8 Range: 31.3 to 52.2
Meander Length (L_m)			Med: 52.4 Range: 37.4 to 67.3		Med: 73.1 Range: 52.2 to 94.0
Belt Width (W_{belt})			Med: 15.0 Range: 11.2 to 22.4		Med: 20.9 Range: 15.7 to 31.3
Radius of Curvature (R_c)			Med: 22.4 Range: 15.0 to 29.9		Med: 31.3 Range: 20.9 to 41.8
Sinuosity (Sin)	1.00	1.02	1.10	1.03	1.10
Pattern Ratios					
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0
Meander Length/ Bankfull Width (L_m/W_{bkf})			Med: 7.0 Range: 5.0 to 9.0		Med: 7.0 Range: 5.0 to 9.0
Meander Width Ratio (W_{belt}/W_{bkf})			Med: 2.0 Range: 1.5 to 3.0		Med: 2.0 Range: 1.5 to 3.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})			Med: 3.0 Range: 2.0 to 4.0		Med: 3.0 Range: 2.0 to 4.0
Profile Variables					
Average Water Surface Slope (S_{ave})	0.0089	0.0076	0.0076	0.0071	0.0066
Valley Slope (S_{valley})	0.0089	0.0078	0.0084	0.0073	0.0073
Riffle Slope (S_{riffle})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0130 Range: 0.0092 to 0.0153	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0113 Range: 0.0080 to 0.0133
Pool Slope (S_{pool})			Mean: 0.0008 Range: 0.0000 to 0.0053		Mean: 0.0007 Range: 0.0000 to 0.0046
Run Slope (S_{run})			Mean: 0.0031 Range: 0.0000 to 0.0061		Mean: 0.0027 Range: 0.0000 to 0.0053
Glide Slope (S_{glide})			Mean: 0.0008 Range: 0.0000 to 0.0061		Mean: 0.0007 Range: 0.0000 to 0.0053
Profile Ratios					
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 to 2.0
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})			Mean: 0.1 Range: 0.0 to 0.7		Mean: 0.1 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})			Mean: 0.4 Range: 0.0 to 0.8		Mean: 0.4 Range: 0.0 to 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})			Mean: 0.1 Range: 0.0 to 0.8		Mean: 0.1 Range: 0.0 to 0.8

Table B1 continuted. Wits End Morphological Stream Characteristics

Variables	Existing (UT 3A)	Existing (UT 3 upstream)	Proposed (UT 3A and 3 upstream)
Stream Type	G 4	G 4/5	Ce 3/4
Drainage Area (mi^2)	0.10	0.12	0.10
Bankfull Discharge (cfs)	15.2	17.6	15.2
Dimension Variables			
Bankfull Cross-Sectional Area (A_{bkf})	4.1	4.7	4.1
Existing Cross-Sectional Area ($A_{existing}$)	7.0 - 8.9	14.2 - 20.2	4.1
Bankfull Width (W_{bkf})	Mean: 5.8 Range: 5.8 to 5.8	Mean: 5.7 Range: 5.3 to 6.1	Mean: 7.6 Range: 7.0 to 8.1
Bankfull Mean Depth (D_{bkf})	Mean: 0.7 Range: 0.7 to 0.7	Mean: 0.9 Range: 0.8 to 0.9	Mean: 0.5 Range: 0.5 to 0.6
Bankfull Maximum Depth (D_{max})	Mean: 1.0 Range: 0.9 to 1.0	Mean: 1.0 Range: 0.9 to 1.1	Mean: 0.7 Range: 0.6 to 0.9
Pool Width (W_{pool})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 9.1 Range: 7.6 to 10.6
Maximum Pool Depth (D_{pool})			Mean: 0.9 Range: 0.8 to 1.1
Width of Floodprone Area (W_{fpa})	Mean: 9 Range: 8 to 8	Mean: 8 Range: 7 to 8	Mean: 50 Range: 25 to 75
Dimension Ratios			
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 1.5 Range: 1.4 to 1.6	Mean: 1.3 Range: 1.1 to 1.5	Mean: 6.6 Range: 3.6 to 9.3
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 8.3 Range: 8.3 to 8.3	Mean: 6.8 Range: 5.9 to 7.6	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.4 Range: 1.3 to 1.4	Mean: 1.2 Range: 1.1 to 1.2	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.6 Range: 1.4 to 1.8	Mean: 2.9 Range: 2.3 to 3.4	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0
Pool Width / Bankfull Width (W_{pool}/W_{bkf})			Mean: 1.2 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area			Mean: 1.2 Range: 1.0 to 1.4

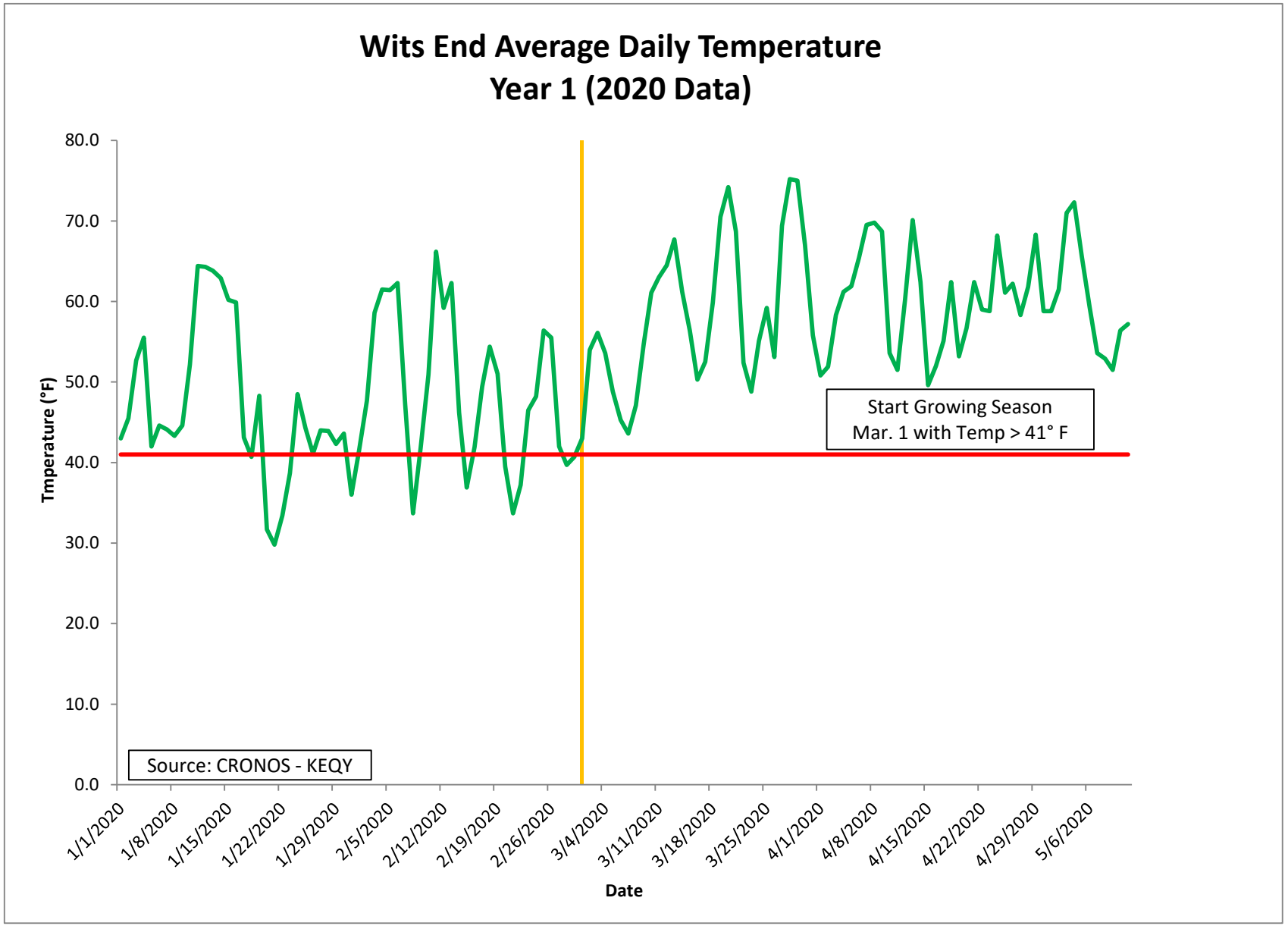
Variables	Existing (UT 3A)	Existing (UT 3 upstream)	Proposed (UT 3A and 3 upstream)
Pattern Variables			
Pool to Pool Spacing (L_{p-p})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 30.3 Range: 22.7 to 37.9
Meander Length (L_m)			Med: 53.0 Range: 37.9 to 68.2
Belt Width (W_{belt})			Med: 15.2 Range: 11.4 to 22.7
Radius of Curvature (R_c)			Med: 22.7 Range: 15.2 to 30.3
Sinuosity (Sin)	1.02	1.03	1.10
Pattern Ratios			
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0
Meander Length/ Bankfull Width (L_m/W_{bkf})			Med: 7.0 Range: 5.0 to 9.0
Meander Width Ratio (W_{belt}/W_{bkf})			Med: 2.0 Range: 1.5 to 3.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})			Med: 3.0 Range: 2.0 to 4.0
Profile Variables			
Average Water Surface Slope (S_{ave})	0.0090	0.0089	0.0084
Valley Slope (S_{valley})	0.0092	0.0092	0.0092
Riffle Slope (S_{riffle})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0142 Range: 0.0100 to 0.0167
Pool Slope (S_{pool})			Mean: 0.0008 Range: 0.0000 to 0.0059
Run Slope (S_{run})			Mean: 0.0033 Range: 0.0000 to 0.0067
Glide Slope (S_{glide})			Mean: 0.0009 Range: 0.0000 to 0.0067
Profile Ratios			
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	No distinct repetitive pattern of riffles and pools due to staightening activities	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 to 2.0
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})			Mean: 0.1 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})			Mean: 0.4 Range: 0.0 to 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})			Mean: 0.1 Range: 0.0 to 0.8

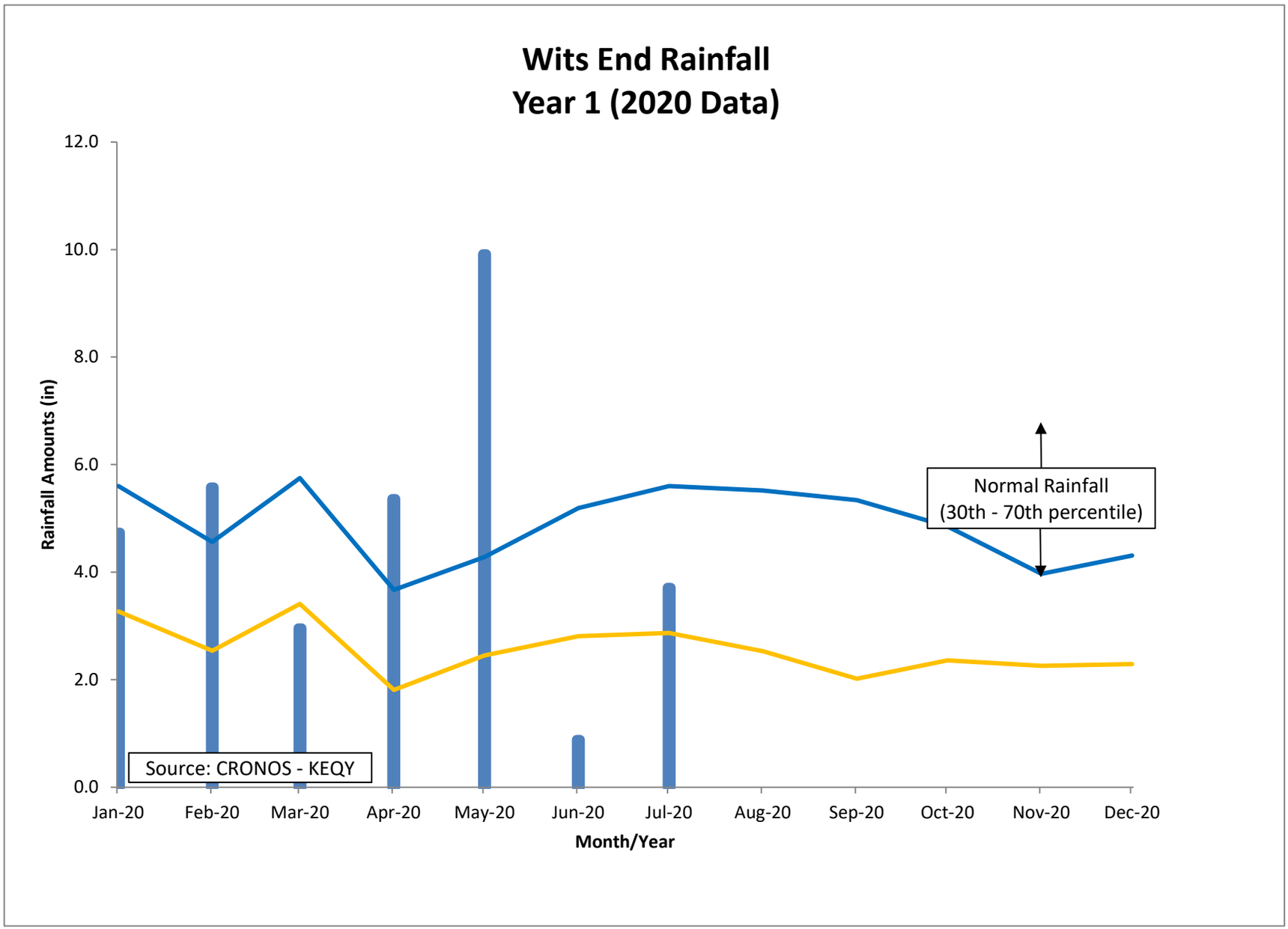
Table B1 continuted. Wits End Morphological Stream Characteristics

Variables	Existing (UT 1)	Proposed (UT 1)	Existing (UT 5)	Proposed (UT 5)
Stream Type	Eg 4	Ce 3/4	Eg 4	Ce 3/4
Drainage Area (mi^2)	0.05	0.05	0.04	0.04
Bankfull Discharge (cfs)	9.5	9.5	8.0	8.0
Dimension Variables				
Bankfull Cross-Sectional Area (A_{bkf})	2.8	2.8	2.4	2.4
Existing Cross-Sectional Area ($A_{existing}$)	3.0 - 6.0	2.8	2.4 - 6.1	2.4
Bankfull Width (W_{bkf})	Mean: 4.6 Range: 4.0 to 5.1	Mean: 6.3 Range: 5.8 to 6.7	Mean: 3.4 Range: 3.1 to 3.7	Mean: 5.8 Range: 5.4 to 6.2
Bankfull Mean Depth (D_{bkf})	Mean: 0.6 Range: 0.5 to 0.7	Mean: 0.4 Range: 0.4 to 0.5	Mean: 0.8 Range: 0.7 to 0.8	Mean: 0.4 Range: 0.4 to 0.4
Bankfull Maximum Depth (D_{max})	Mean: 1.0 Range: 0. 9 to 1. 0	Mean: 0.6 Range: 0.5 to 0.7	Mean: 1.3 Range: 1.0 to 1.6	Mean: 0.5 Range: 0.5 to 0.7
Pool Width (W_{pool})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 7.5 Range: 6.3 to 8.8	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 7.0 Range: 5.8 to 8.1
Maximum Pool Depth (D_{pool})		Mean: 0.8 Range: 0.7 to 0.9		Mean: 0.7 Range: 0.6 to 0.8
Width of Floodprone Area (W_{fpa})	Mean: 45 Range: 40 to 50	Mean: 50 Range: 25 to 75	Mean: 13 Range: 10 to 15	Mean: 30 Range: 15 to 50
Dimension Ratios				
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 10.2 Range: 7.8 to 12.5	Mean: 8.0 Range: 4.3 to 11.2	Mean: 3.6 Range: 3.2 to 4.1	Mean: 5.2 Range: 2.8 to 8.1
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 8.0 Range: 5.7 to 10.2	Mean: 14.0 Range: 12.0 to 16.0	Mean: 4.6 Range: 3.9 to 5.3	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf}/ D_{bkf} Ratio	Mean: 1.6 Range: 1.3 to 2.0	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.7 Range: 1.4 to 2.0	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.3 Range: 1.1 to 1.5	Mean: 1.0 Range: 1.0 to 1.3	Mean: 1.3 Range: 1.0 to 1.6	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0
Pool Width / Bankfull Width (W_{pool}/W_{bkf})		Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area		Mean: 1.2 Range: 1.0 to 1.4		Mean: 1.2 Range: 1.0 to 1.4

Variables	Existing (UT 1)	Proposed (UT 1)	Existing (UT 5)	Proposed (UT 5)
Pattern Variables				
Pool to Pool Spacing (L_{p-p})	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 25.0 Range: 18.8 to 31.3	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 23.2 Range: 17.4 to 29.0
Meander Length (L_m)		Med: 43.8 Range: 31.3 to 56.3		Med: 40.6 Range: 29.0 to 52.2
Belt Width (W_{belt})		Med: 12.5 Range: 9.4 to 18.8		Med: 11.6 Range: 8.7 to 17.4
Radius of Curvature (R_c)		Med: 18.8 Range: 12.5 to 25.0		Med: 17.4 Range: 11.6 to 23.2
Sinuosity (Sin)	1.06	1.10	1.04	1.10
Pattern Ratios				
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 5.0
Meander Length/ Bankfull Width (L_m/W_{bkf})		Med: 7.0 Range: 5.0 to 9.0		Med: 7.0 Range: 5.0 to 9.0
Meander Width Ratio (W_{belt}/W_{bkf})		Med: 2.0 Range: 1.5 to 3.0		Med: 2.0 Range: 1.5 to 3.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})		Med: 3.0 Range: 2.0 to 4.0		Med: 3.0 Range: 2.0 to 4.0
Profile Variables				
Average Water Surface Slope (S_{ave})	0.0262	0.0253	0.0113	0.0107
Valley Slope (S_{valley})	0.0278	0.0278	0.0118	0.0118
Riffle Slope (S_{riffle})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0430 Range: 0.0303 to 0.0505	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 0.0182 Range: 0.0129 to 0.0215
Pool Slope (S_{pool})		Mean: 0.0025 Range: 0.0000 to 0.0177		Mean: 0.0011 Range: 0.0000 to 0.0075
Run Slope (S_{run})		Mean: 0.0101 Range: 0.0000 to 0.0202		Mean: 0.0043 Range: 0.0000 to 0.0086
Glide Slope (S_{glide})		Mean: 0.0028 Range: 0.0000 to 0.0202		Mean: 0.0012 Range: 0.0000 to 0.0086
Profile Ratios				
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 to 2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.2 to 2.0
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})		Mean: 0.1 Range: 0.0 to 0.7		Mean: 0.1 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})		Mean: 0.4 Range: 0.0 to 0.8		Mean: 0.4 Range: 0.0 to 0.8
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})		Mean: 0.1 Range: 0.0 to 0.8		Mean: 0.1 Range: 0.0 to 0.8

Appendix B. Gauge Data


Wits End Average Daily Temperature
Year 1 (2020 Data)
Tmperature (°F)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1/1/2020
1/8/2020
1/15/2020
1/22/2020
1/29/2020
2/5/2020
2/12/2020
2/19/2020
2/26/2020
3/4/2020
3/11/2020
3/18/2020
3/25/2020
4/1/2020
4/8/2020
4/15/2020
4/22/2020
4/29/2020
5/6/2020
Date
Start Growing Season
Mar. 1 with Temp > 41° F
Source: CRONOS - KEQY


Wits End Rainfall
Year 1 (2020 Data)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Rainfall Amounts (in)
Normal Rainfall
(30th - 70th percentile)
Source: CRONOS - KEQY
Jan-20
Feb-20
Mar-20
Apr-20
May-20
Jun-20
Jul-20
Aug-20
Sep-20
Oct-20
Nov-20
Dec-20
Month/Year

Synders Store Rd

UT - 2

Pond - 1970 USGS
+/- 12.85 acres

Waxhaw Branch

UT - 1

GW-1

XS #2

Waxhaw Branch

XS #1

UT - 3

GW-3

GW-5

GW-4

GW-2

UT - 4

Old Pargeland-Monroe Rd

Legend

- NCSAM Form Locations
- NCWAM Form Locations
- Cross Sections
- Pre-Condition Monitoring Wells - 02-26-2020
- Existing Powerline
- Existing Driveway
- Existing & Historic Farm Roads / Crossings
- Existing Steams
- Existing Ephemeral Draws

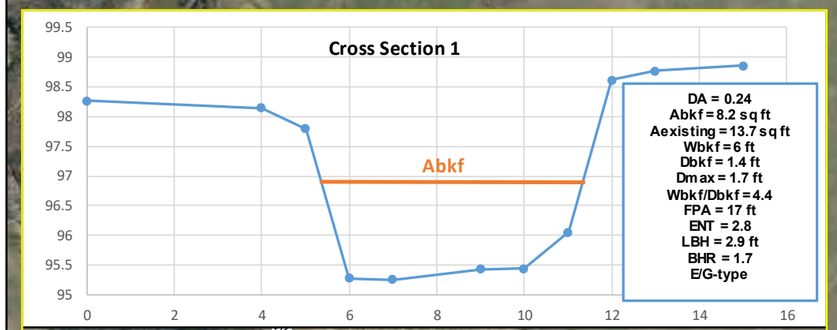
Open Water & Existing Wetlands

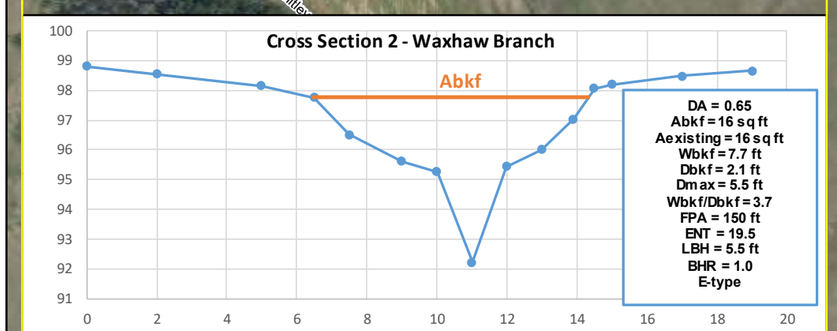
- Currently in Use; No - 1993 - Active
- Historically Used; No - Not Active
- Existing Wetlands = 7.41 acres
- Under Option/Landowner Authorization: 115 acres

Project Note: UT - 4
Between 1951 and 1993 UT-4 saw direct agricultural impacts which appear to have included row crop farming directly through the tributary and the establishment of an earthen impoundment / crossing over the tributary.

Between 1993 and 2020, land use shifted to silviculture, which it remains in today. The tract saw its first timber cut in 2008. Sediment deposition is clear throughout the reach from historical and current land uses.

RS has under control / landowner authorization to vet UT-4 for stream and wetland mitigation. The system is unique and has evolved past its historical land use but is still heavily manipulated. RS wishes to discuss this feature during the IRT Site review. RS HAS NOT added UT-4 to any mitigation totals detailed within this Technical Proposal.





Gauge Summary (Collected 4/28/2020)		
Gauge #	# of Days Wetland Hydrology Met	% of Growing Season*
GW-1	15	6
GW-2	32	13
GW-3	15	6
GW-4	40	16
GW-5	40	16

*Growing season 3/1-11/3 (248 days)

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

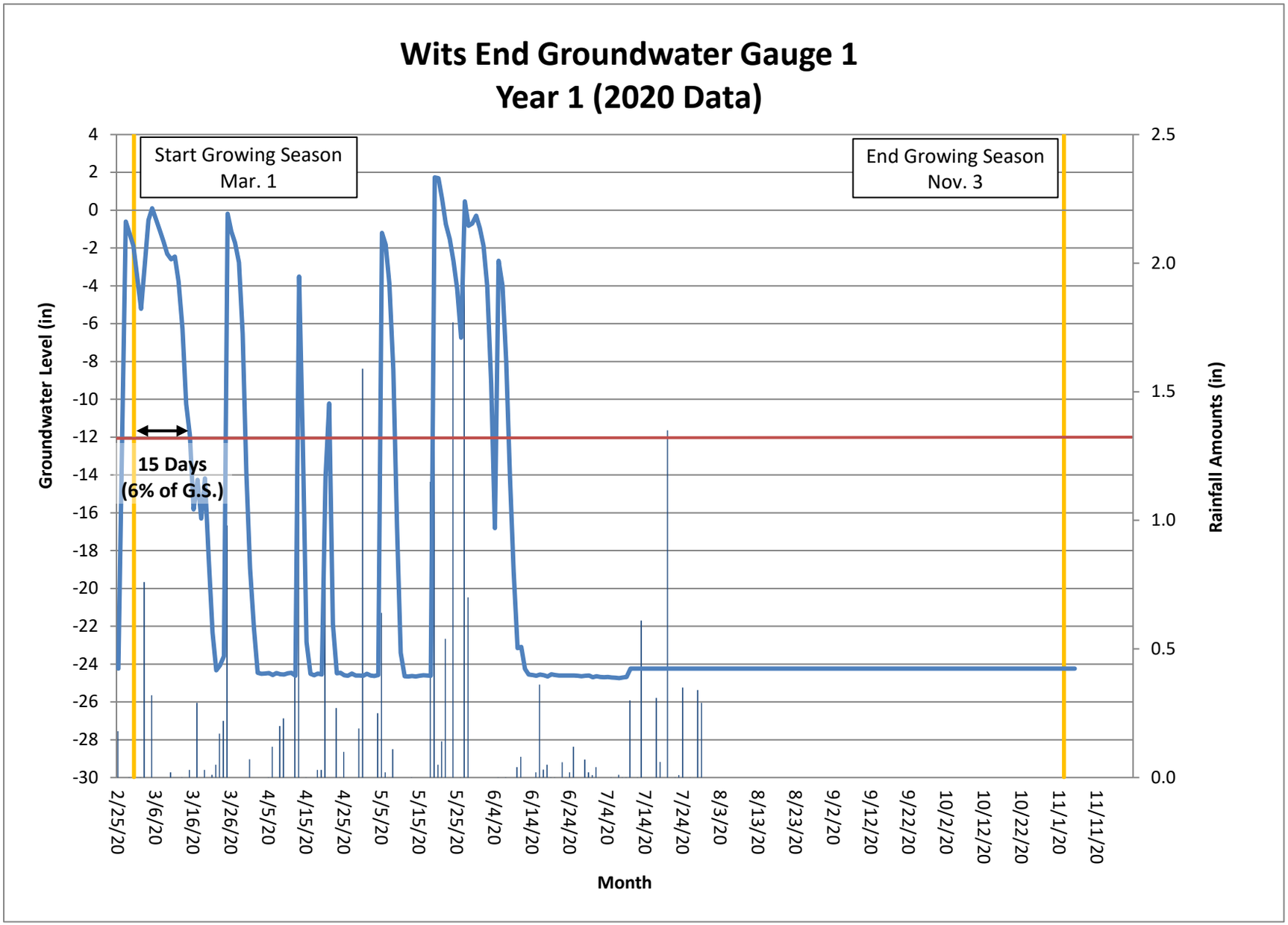
SCALE: 1 in = 375 feet
DATE: 03 - 2020
SITE: Wits End

Figure 5 A:
Existing Conditions
Site Features

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 170 340 680 1,020 1,360


Wits End Groundwater Gauge 1
Year 1 (2020 Data)
Start Growing Season
Mar. 1
End Growing Season
Nov. 3
15 Days
(6% of G.S.)
Groundwater Level (in)
Rainfall Amounts (in)
Month
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
2.5
2.0
1.5
1.0
0.5
0.0
2/25/20
3/6/20
3/16/20
3/26/20
4/5/20
4/15/20
4/25/20
5/5/20
5/15/20
5/25/20
6/4/20
6/14/20
6/24/20
7/4/20
7/14/20
7/24/20
8/3/20
8/13/20
8/23/20
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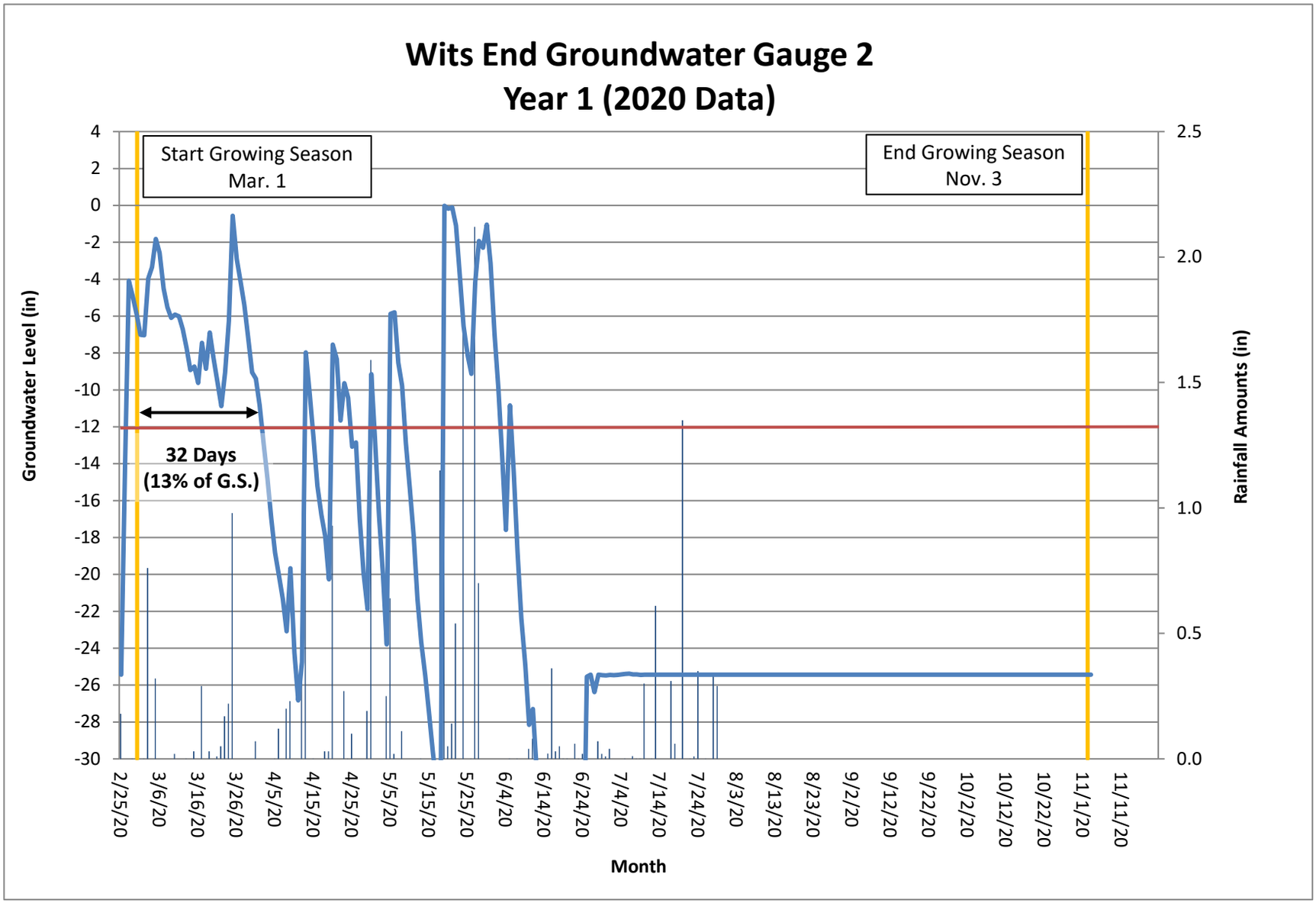
10/12/20
10/22/20
11/1/20
11/11/20


Wits End Groundwater Gauge 2
Year 1 (2020 Data)
Start Growing Season
Mar. 1
End Growing Season
Nov. 3
32 Days
(13% of G.S.)
Groundwater Level (in)
Rainfall Amounts (in)
Month
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
2.5
2.0
1.5
1.0
0.5
0.0
2/25/20
3/6/20
3/16/20
3/26/20
4/5/20
4/15/20
4/25/20
5/5/20
5/15/20
5/25/20
6/4/20
6/14/20
6/24/20
7/4/20
7/14/20
7/24/20
8/3/20
8/13/20
8/23/20
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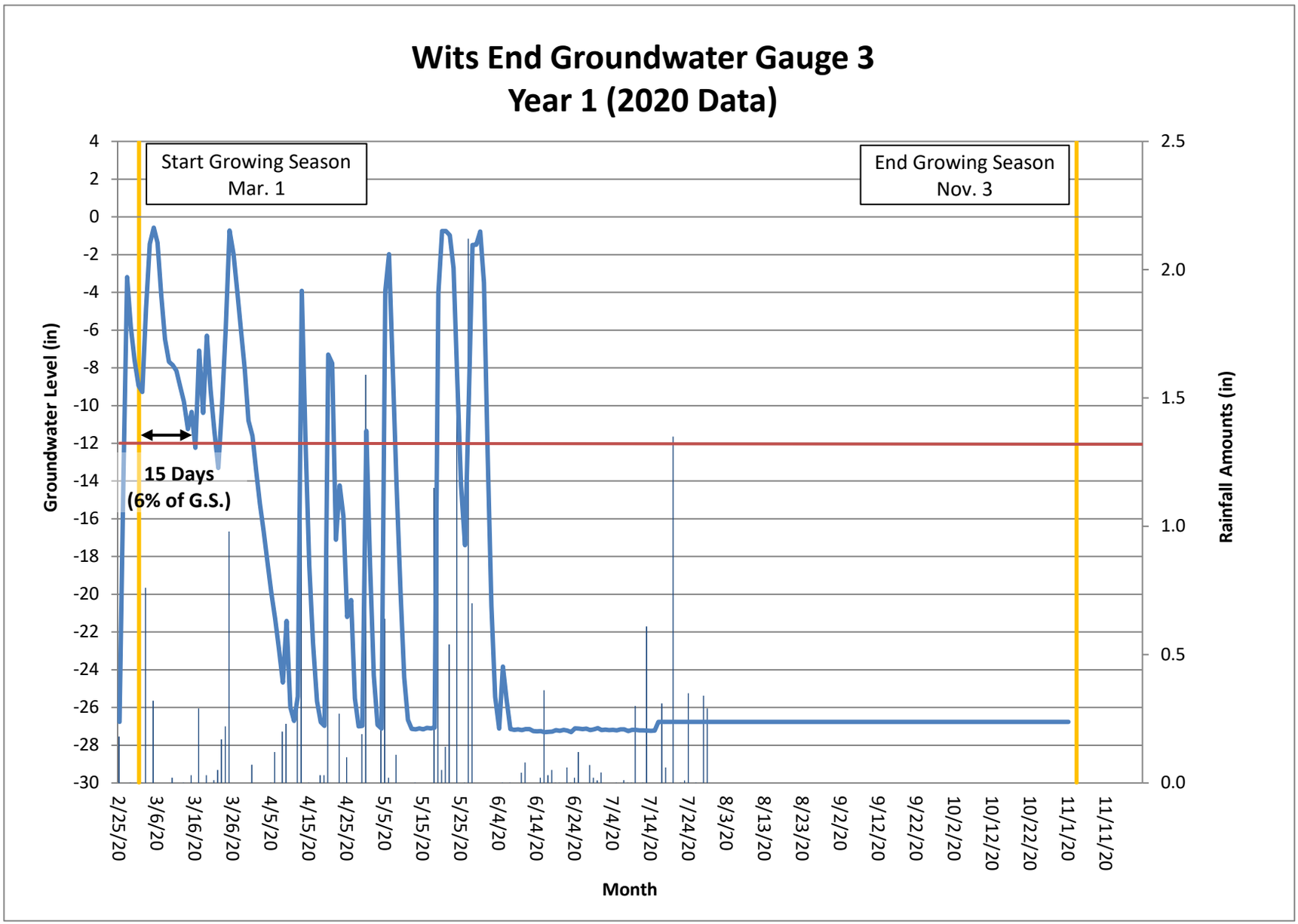
10/12/20
10/22/20
11/1/20
11/11/20


Wits End Groundwater Gauge 3
Year 1 (2020 Data)
Start Growing Season
Mar. 1
End Growing Season
Nov. 3
15 Days
(6% of G.S.)
Groundwater Level (in)
Rainfall Amounts (in)
Month
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
2.5
2.0
1.5
1.0
0.5
0.0
2/25/20
3/6/20
3/16/20
3/26/20
4/5/20
4/15/20
4/25/20
5/5/20
5/15/20
5/25/20
6/4/20
6/14/20
6/24/20
7/4/20
7/14/20
7/24/20
8/3/20
8/13/20
8/23/20
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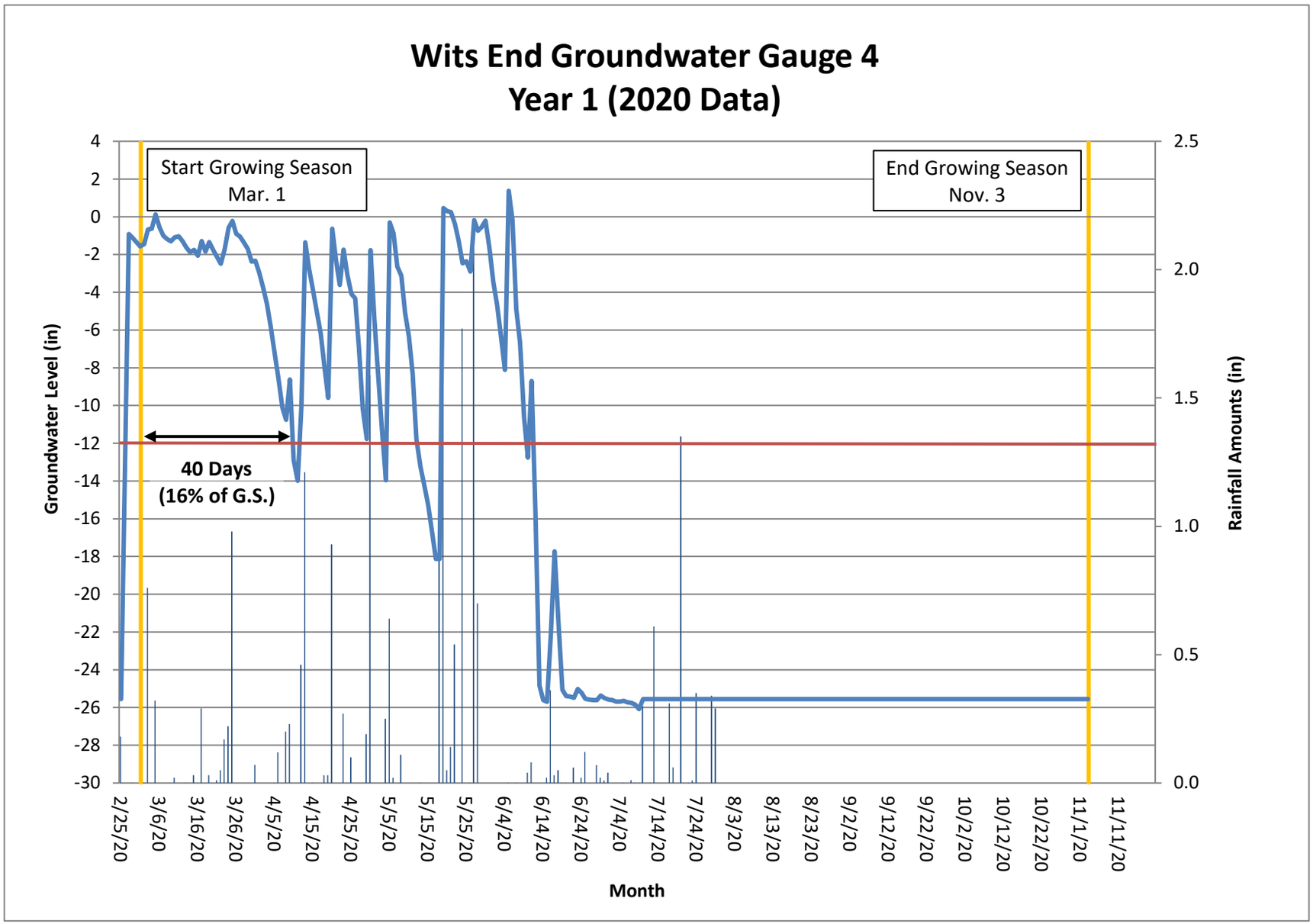
10/22/20
11/1/20
11/11/20


Wits End Groundwater Gauge 4
Year 1 (2020 Data)
Start Growing Season
Mar. 1
End Growing Season
Nov. 3
40 Days
(16% of G.S.)
Groundwater Level (in)
Rainfall Amounts (in)
Month
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
2.5
2.0
1.5
1.0
0.5
0.0
2/25/20
3/6/20
3/16/20
3/26/20
4/5/20
4/15/20
4/25/20
5/5/20
5/15/20
5/25/20
6/4/20
6/14/20
6/24/20
7/4/20
7/14/20
7/24/20
8/3/20
8/13/20
8/23/20
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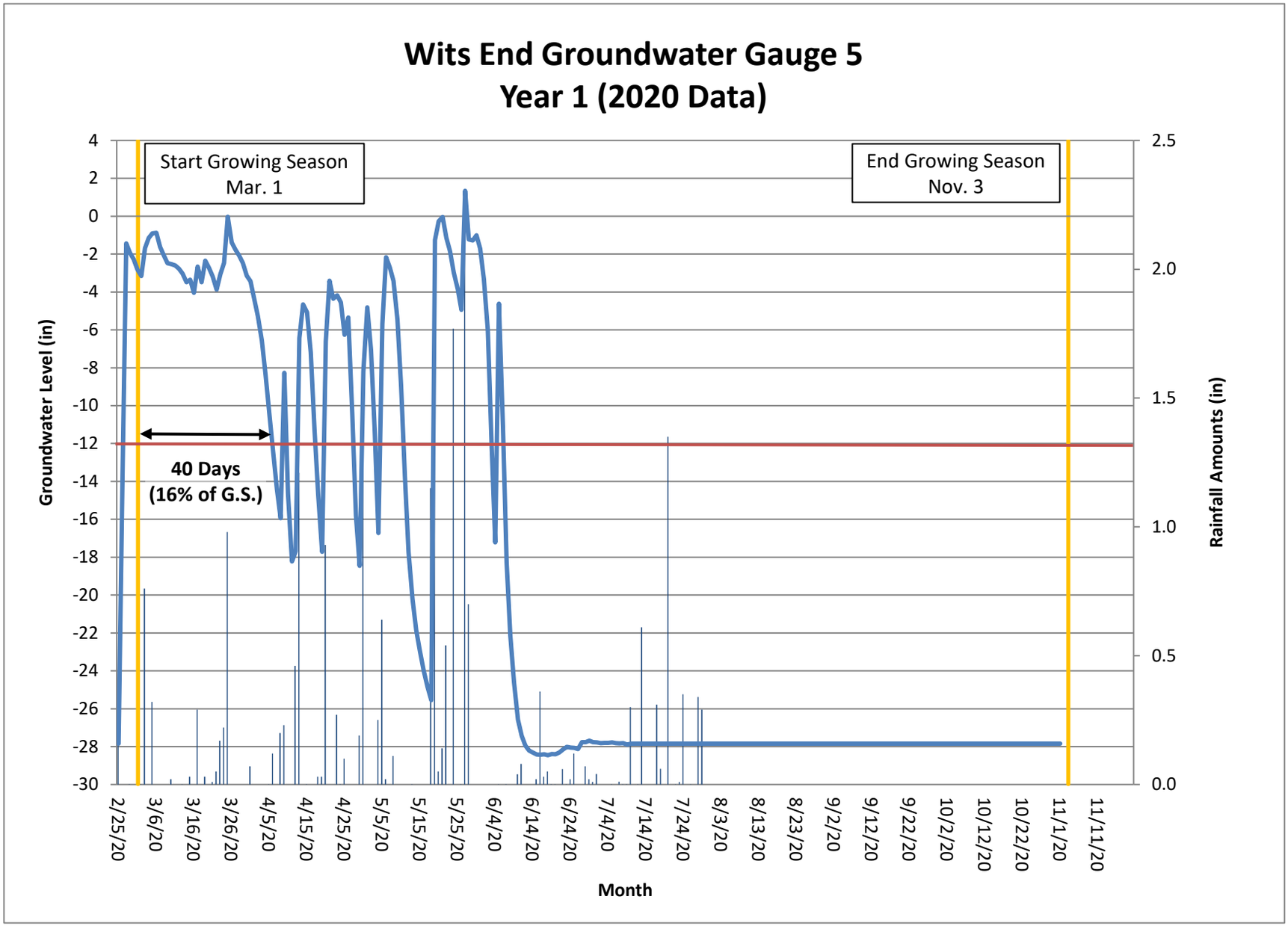
10/12/20
10/22/20
11/1/20
11/11/20


Wits End Groundwater Gauge 5
Year 1 (2020 Data)
Start Growing Season
Mar. 1
End Growing Season
Nov. 3
40 Days
(16% of G.S.)
Groundwater Level (in)
Rainfall Amounts (in)
Month
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
2.5
2.0
1.5
1.0
0.5
0.0
2/25/20
3/6/20
3/16/20
3/26/20
4/5/20
4/15/20
4/25/20
5/5/20
5/15/20
5/25/20
6/4/20
6/14/20
6/24/20
7/4/20
7/14/20
7/24/20
8/3/20
8/13/20
8/23/20
9/2/20
9/12/20
9/22/20
10/2/20
10/12/20
10/22/20
11/1/20
11/11/20

Appendix C. PJD Submittal

Jurisdictional Determination Request

US Army Corps of Engineers
Wilmington District

This form is intended for use by anyone requesting a jurisdictional determination (JD) from the U.S. Army Corps of Engineers, Wilmington District (Corps). Please include all supporting information, as described within each category, with your request. You may submit your request via mail, electronic mail, or facsimile. Requests should be sent to the appropriate project manager of the county in which the property is located. A current list of project managers by assigned counties can be found on-line at: http://www.saw.usace.army.mil/Missions/RegulatoryPermitProgram/Contact/CountyLocator.aspx, by calling 910-251-4633, or by contacting any of the field offices listed below. Once your request is received you will be contacted by a Corps project manager.

ASHEVILLE & CHARLOTTE REGULATORY FIELD OFFICES
US Army Corps of Engineers
151 Patton Avenue, Room 208
Asheville, North Carolina 28801-5006
General Number: (828) 271-7980
Fax Number: (828) 281-8120

RALEIGH REGULATORY FIELD OFFICE
US Army Corps of Engineers
3331 Heritage Trade Drive, Suite 105
Wake Forest, North Carolina 27587
General Number: (919) 554-4884
Fax Number: (919) 562-0421

WASHINGTON REGULATORY FIELD OFFICE
US Army Corps of Engineers
2407 West Fifth Street
Washington, North Carolina 27889
General Number: (910) 251-4610
Fax Number: (252) 975-1399

WILMINGTON REGULATORY FIELD OFFICE
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, North Carolina 28403
General Number: 910-251-4633
Fax Number: (910) 251-4025

INSTRUCTIONS:

All requestors must complete Parts A, B, C, D, E, F and G.

NOTE TO CONSULTANTS AND AGENCIES: If you are requesting a JD on behalf of a paying client or your agency, please note the specific submittal requirements in **Part H**.

NOTE ON PART D – PROPERTY OWNER AUTHORIZATION: Please be aware that all JD requests must include the current property owner authorization for the Corps to proceed with the determination, which may include inspection of the property when necessary. This form must be signed by the current property owner(s) or the owner(s) authorized agent to be considered a complete request.

NOTE ON PART D - NCDOT REQUESTS: Property owner authorization/notification for JD requests associated with North Carolina Department of Transportation (NCDOT) projects will be conducted according to the current NCDOT/USACE protocols.

NOTE TO USDA PROGRAM PARTICIPANTS: A Corps approved or preliminary JD 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 also request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

A. PARCEL INFORMATION

Street Address: Snyders Store Rd

City, State: Buford, NC 28174

County: Union

Parcel Index Number(s) (PIN): Multiple see attached

B. REQUESTOR INFORMATION

Name: Restoration Systems LLC

Mailing Address: 1101 Haynes Street, Suite 211

Raleigh, NC 27604

Telephone Number: 919-274-2419

Electronic Mail Address: abaldwin@restorationsystems.com

Select one:

- ☐ I am the current property owner.
- ☑ I am an Authorized Agent or Environmental Consultant[1]
- ☐ Interested Buyer or Under Contract to Purchase
- ☐ Other, please explain. _____

C. PROPERTY OWNER INFORMATION[2]

Name: Multiple see attached

Mailing Address: _____

Telephone Number: _____

Electronic Mail Address: _____

[1] Must provide completed Agent Authorization Form/Letter.

[2] Documentation of ownership also needs to be provided with request (copy of Deed, County GIS/Parcel/Tax Record).

D. PROPERTY ACCESS CERTIFICATION[3,4]

By signing below, I authorize representatives of the Wilmington District, U.S. Army Corps of Engineers (Corps) to enter upon the property herein described for the purpose of conducting on-site investigations, if necessary, and issuing a jurisdictional determination pursuant to Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899. I, the undersigned, am either a duly authorized owner of record of the property identified herein, or acting as the duly authorized agent of the owner of record of the property.

Alex Baldwin
Print Name

Capacity: ☐ Owner ☑ Authorized Agent[5]

July 17, 2020
Date


Signature

E. REASON FOR JD REQUEST: (Check as many as applicable)

☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all aquatic resources.
☐ I intend to construct/develop a project or perform activities on this parcel which would be designed to avoid all jurisdictional aquatic resources under Corps authority.
☐ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps, and the JD would be used to avoid and minimize impacts to jurisdictional aquatic resources and as an initial step in a future permitting process.
☑ I intend to construct/develop a project or perform activities on this parcel which may require authorization from the Corps; this request is accompanied by my permit application and the JD is to be used in the permitting process.
☐ I intend to construct/develop a project or perform activities in a navigable water of the U.S. which is included on the district Section 10 list and/or is subject to the ebb and flow of the tide.
☐ A Corps JD is required in order obtain my local/state authorization.
☐ I intend to contest jurisdiction over a particular aquatic resource and request the Corps confirm that jurisdiction does/does not exist over the aquatic resource on the parcel.
☐ I believe that the site may be comprised entirely of dry land.
☐ Other: _____

[3] For NCDOT requests following the current NCDOT/USACE protocols, skip to Part E.
[4] If there are multiple parcels owned by different parties, please provide the following for each additional parcel on a continuation sheet.
[5] Must provide agent authorization form/letter signed by owner(s).

F. JURISDICTIONAL DETERMINATION (JD) TYPE (Select One)

☑ I am requesting that the Corps provide a preliminary JD for the property identified herein.

A Preliminary Jurisdictional Determination (PJD) provides an indication that there may be "waters of the United States" or "navigable waters of the United States"on a property. PJDs are sufficient as the basis for permit decisions. For the purposes of permitting, all waters and wetlands on the property will be treated as if they are jurisdictional "waters of the United States". PJDs cannot be appealed (33 C.F.R. 331.2); however, a PJD is "preliminary" in the sense that an approved JD can be requested at any time. PJDs do not expire.

☐ I am requesting that the Corps provide an approved JD for the property identified herein.

An Approved Jurisdictional Determination (AJD) is a determination that jurisdictional "waters of the United States" or "navigable waters of the United States" are either present or absent on a site. An approved JD identifies the limits of waters on a site determined to be jurisdictional under the Clean Water Act and/or Rivers and Harbors Act. Approved JDs are sufficient as the basis for permit decisions. AJDs are appealable (33 C.F.R. 331.2). The results of the AJD will be posted on the Corps website. A landowner, permit applicant, or other "affected party" (33 C.F.R. 331.2) who receives an AJD may rely upon the AJD for five years (subject to certain limited exceptions explained in Regulatory Guidance Letter 05-02).

☐ I am unclear as to which JD I would like to request and require additional information to inform my decision.

G. ALL REQUESTS

☑ Map of Property or Project Area. This Map must clearly depict the boundaries of the review area.

☑ Size of Property or Review Area 67.51 acres.

☑ The property boundary (or review area boundary) is clearly physically marked on the site.

H. REQUESTS FROM CONSULTANTS

☑ Project Coordinates (Decimal Degrees): Latitude: 34.912496
Longitude: -80.444339

☑ A legible delineation map depicting the aquatic resources and the property/review area. Delineation maps must be no larger than 11x17 and should contain the following: (Corps signature of submitted survey plats will occur after the submitted delineation map has been reviewed and approved).[6]

- North Arrow
- Graphical Scale
- Boundary of Review Area
- Date
- Location of data points for each Wetland Determination Data Form or tributary assessment reach.

For Approved Jurisdictional Determinations:

- Jurisdictional wetland features should be labeled as Wetland Waters of the US, 404 wetlands, etc. Please include the acreage of these features.
- Jurisdictional non-wetland features (i.e. tidal/navigable waters, tributaries, impoundments) should be labeled as Non-Wetland Waters of the US, stream, tributary, open water, relatively permanent water, pond, etc. Please include the acreage or linear length of each of these features as appropriate.
- Isolated waters, waters that lack a significant nexus to navigable waters, or non-jurisdictional upland features should be identified as Non-Jurisdictional. Please include a justification in the label regarding why the feature is non-jurisdictional (i.e. "Isolated", "No Significant Nexus", or "Upland Feature"). Please include the acreage or linear length of these features as appropriate.

For Preliminary Jurisdictional Determinations:

- Wetland and non-wetland features should not be identified as Jurisdictional, 404, Waters of the United States, or anything that implies jurisdiction. These features can be identified as Potential Waters of the United States, Potential Non-wetland Waters of the United States, wetland, stream, open water, etc. Please include the acreage and linear length of these features as appropriate.

☑ Completed Wetland Determination Data Forms for appropriate region
(at least one wetland and one upland form needs to be completed for each wetland type)

[6] Please refer to the guidance document titled "Survey Standards for Jurisdictional Determinations" to ensure that the supplied map meets the necessary mapping standards. http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Jurisdiction/

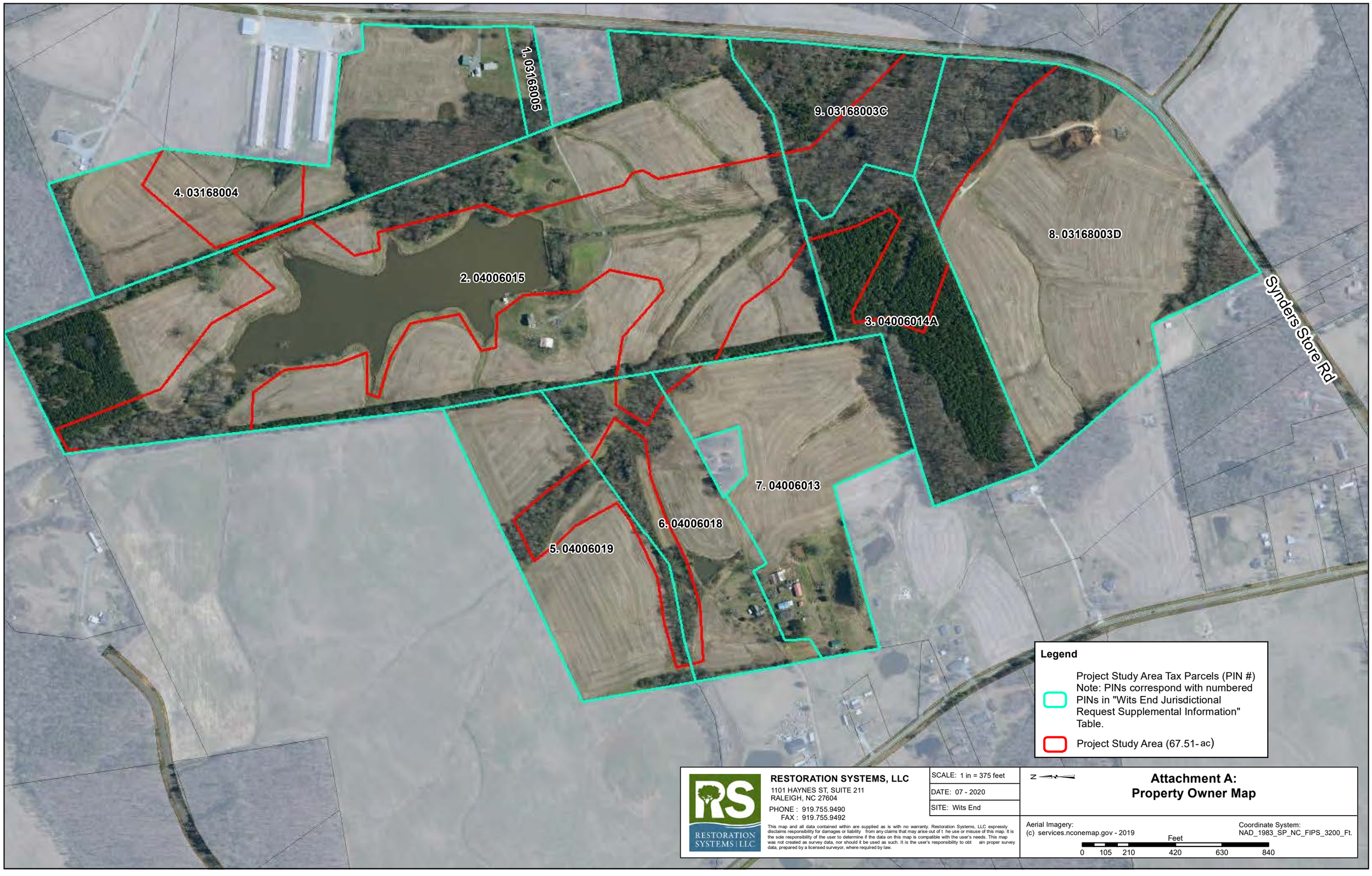
- [x] Completed appropriate Jurisdictional Determination form
  - **PJDs,** please complete a Preliminary Jurisdictional Determination Form[7] and include the Aquatic Resource Table
  - **AJDs**, please complete an Approved Jurisdictional Determination Form[8]
- [x] Vicinity Map
- [x] Aerial Photograph
- [x] USGS Topographic Map
- [x] Soil Survey Map
- [x] Other Maps, as appropriate (e.g. National Wetland Inventory Map, Proposed Site Plan, previous delineation maps, LIDAR maps, FEMA floodplain maps)
- [x] Landscape Photos (if taken)
- [ ] NCSAM and/or NCWAM Assessment Forms and Rating Sheets
- [x] NC Division of Water Resources Stream Identification Forms
- [ ] Other Assessment Forms

[7] www.saw.usace.army.mil/Portals/59/docs/regulatory/regdocs/JD/RGL_08-02_App_A_Prelim_JD_Form_fillable.pdf
[8] Please see http://www.saw.usace.army.mil/Missions/Regulatory-Permit-Program/Jurisdiction/

Principal Purpose: The information that you provide will be used in evaluating your request to determine whether there are any aquatic resources within the project area subject to federal jurisdiction under the regulatory authorities referenced above.
Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public, and may be made available as part of a public notice as required by federal law. Your name and property location where federal jurisdiction is to be determined will be included in the approved jurisdictional determination (AJD), which will be made available to the public on the District's website and on the Headquarters USAGE website.
Disclosure: Submission of requested information is voluntary; however, if information is not provided, the request for an AJD cannot be evaluated nor can an AJD be issued.

Wits End Jurisdictional Request Supplemental Information

A. Parcel Information – Parcel Address and Parcel Index Numbers	1. 0 Snyders Store Rd Buford, NC 28174 2. 0 Old Pageland Monroe Rd Buford, NC 28174 3. 0 Old Pageland Monroe Rd Buford, NC 28174 4. 0 Snyders Store Rd Buford, NC 28174 5. 0 Old Pageland Monroe Rd Buford, NC 28174 6. 2907 Old Pageland Monroe Rd Buford, NC 28174 7. 2911 Old Pageland Monroe Rd Buford, NC 28174 8. 0 Snyders Store Rd Buford, NC 28174 9. 0 Snyders Store Rd Buford, NC 28174	1. 03168005 2. 04006015 3. 04006014A 4. 03168004 5. 04006019 6. 04006018 7. 04006013 8. 03168003D 9. 03168003C Note: Attachment A is a map with corresponding parcels for each of the PINs listed.
C. Property Owner Information (Property Owner Information is listed in the same order as Parcel Information	1. Wits End LLC 2. Wits End LLC 3. Wits End LLC 4. Max Shelton and Sarah S. Brooks 5. Randy H. Guion 6. Jessie B. Guion 7. Jessie B. and Virginia L. Guion 8. Bibi Mariam Niazi-Sai 9. Gina Brooks Morris	1. 1226 Andover Rd, Charlotte, NC 28211 704-576-8810 dmarshall11@aol.com 2. 11232 Colonial Country Ln, Charlotte, NC 28277 704-576-8810 dmarshall11@aol.com 3. 11232 Colonial Country Ln, Charlotte, NC 28277 704-576-8810 dmarshall11@aol.com 4. 2407 Faulks Church Rd, Wingate, NC 28174 704-233-5427 5. 2921 Old Pageland Monroe Rd, Monroe, NC 28112 980-721-3561 6. 2909 Old Pageland Monroe Rd, Monroe, NC 28112 704-242-1903 7. 2909 Old Pageland Monroe Rd, Monroe, NC 28112 704-242-1903 8. PO Box 1219, Monroe, NC 28111 704-694-0731 9. 2250 Shaw Ferry Ln, Lenoir City, TN 37772 865-986-7905 ginamorris7221@gmail.com



Legend

- Project Study Area Tax Parcels (PIN #) Note: PINs correspond with numbered PINs in "Wits End Jurisdictional Request Supplemental Information" Table.
- Project Study Area (67.51- ac)

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 375 feet
DATE: 07 - 2020
SITE: Wits End

Attachment A: Property Owner Map

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 105 210 420 630 840

LANDOWNER AUTHORIZATION FORM

PROPERTY LEGAL DESCRITION:

Deed Book: 7180 **Page:** 262 **County:** Union

Deed Book: 4568 **Page:** 779 **County:** Union

Deed Book: 4568 **Page:** 786 **County:** Union

Parcel ID Number: 03168005, 04006015, & 04006014A

Street Address: Old Pageland Rd. Monrd (Approximately 2406 Snyders Store Road, Wingate, NC)

Property Owner (please print: (All 3) Wits End Farm - Dick Marshall, Manager

The undersigned, registered property owner(s) of the above property, do hereby authorize

Raymond Holz **of** Restoration Systems, LLC
(Contractor/Agent/Project Manager)[1] **(Name of Contractor/Agent Firm/Agency)[2]**

to take all actions necessary for the evaluation of the property as a potential stream, wetland and/or riparian buffer mitigation project, including conducting stream and/or wetland determinations and delineations, as well as issuance and acceptance of any required permit(s) or certification(s) subject, however to the express limitations, terms, conditions, and obligations set forth in that certain Agreement for Purchase and Sale of Real Property between Restoration Systems, LLC, as Buyer, and Wits End Farm LLC, as Seller, dated on or about the date hereof. I agree to allow regulatory agencies, including the US Army Corps of Engineers, to visit the property as part of these environmental reviews.

Property Owners(s) Address: (if different from above) 1226 Andover Rd. Charlotte, NC 28211

Property Owner Telephone Number: 704-576-8810

We hereby certify the above information to be true and accurate to the best of our knowledge.

Richard D Marshall 11-26-19
(Property Owner Authorized Signature) **(Date)**

(Property Owner Authorized Signature) **(Date)**

[1]Name of full delivery staff member (full-deliveries) or DMS project manager (design-bid-build).
[2]Name of company (full-deliveries) or DMS (design-bid-build).

LANDOWNER AUTHORIZATION FORM

PROPERTY LEGAL DESCRITION:

Deed Book: Page: County: Union

Parcel ID Number: 03168004

Street Address: Snyder Store Road
Wingate, NC 28174

704- 233- 5427

The undersigned, registered property owner(s) of the above property, do hereby authorize

Matthew Harrell of *Restoration Systems*

Grant Lewis of *Axiom Environmental*

to take all actions necessary for the evaluation of the property as a potential stream and wetland mitigation project, including conducting stream and/or wetland determinations and delineations, as well as issuance and acceptance of any required permit(s) or certification(s). I agree to allow regulatory agencies, including the US Army Corps of Engineers, to visit the property as part of these environmental reviews.

Property Owner: Brooks, Max Shelton & Wife Sarah S

Property Owners Address: 2407 Faulks Church Road
Wingate, NC 28174

Property Owner Telephone Number:

We hereby certify the above information to be true and accurate to the best of our knowledge.

Sarah S Brooks
Max Brooks

1- 29- 2020

(Property Owner Authorized Signature) (Date)

LANDOWNER AUTHORIZATION FORM

PROPERTY LEGAL DESCRITION:

Deed Book: Page: County: Union 980-721-3561

Parcel ID Number: 04006019

Street Address: Old Pageland Monroe Road
Monroe, NC 28112

The undersigned, registered property owner(s) of the above property, do hereby authorize

Matthew Harrell of *Restoration Systems*

Grant Lewis of *Axiom Environmental*

to take all actions necessary for the evaluation of the property as a potential stream and wetland mitigation project, including conducting stream and/or wetland determinations and delineations, as well as issuance and acceptance of any required permit(s) or certification(s). I agree to allow regulatory agencies, including the US Army Corps of Engineers, to visit the property as part of these environmental reviews.

Property Owner: Guion, Randy H & % Guion Mary

Property Owners Address: 2919 Old Pageland Monroe Road
Monroe, NC 28112

Property Owner Telephone Number:

We hereby certify the above information to be true and accurate to the best of our knowledge.

Randy Guion 1-29-20

(Property Owner Authorized Signature) (Date)

LANDOWNER AUTHORIZATION FORM

PROPERTY LEGAL DESCRITION:

Deed Book: 5896 Page: 171 County: Union

Parcel ID Number: 03168003C

Street Address: Snyder Store Road
Wingate, NC 28174

The undersigned, registered property owner(s) of the above property, do hereby authorize

Matthew Harrell of *Restoration Systems*

Grant Lewis of *Axiom Environmental*

to take all actions necessary for the evaluation of the property as a potential stream and wetland mitigation project, including conducting stream and/or wetland determinations and delineations, as well as issuance and acceptance of any required permit(s) or certification(s). I agree to allow regulatory agencies, including the US Army Corps of Engineers, to visit the property as part of these environmental reviews.

Property Owner: Gina Brooks Morris

Property Owners Address: 2250 Shaw Ferry Lane
Lenoir City, TN 37772

Property Owner Telephone Number: (865) 986-7905

We hereby certify the above information to be true and accurate to the best of our knowledge.

Gina B. Morris 7-10-19

(Property Owner Authorized Signature) (Date)

LANDOWNER AUTHORIZATION FORM

PROPERTY LEGAL DESCRITION:

Deed Book: 7073 Page: 202 County: Union

Parcel ID Number: 03168003D

Street Address: Snyder Store Road
Wingate, NC 28174

The undersigned, registered property owner(s) of the above property, do hereby authorize

Matthew Harrell of *Restoration Systems*

Grant Lewis of *Axiom Environmental*

to take all actions necessary for the evaluation of the property as a potential stream and wetland mitigation project, including conducting stream and/or wetland determinations and delineations, as well as issuance and acceptance of any required permit(s) or certification(s). I agree to allow regulatory agencies, including the US Army Corps of Engineers, to visit the property as part of these environmental reviews.

Property Owner: Bibi Mariam Niazi-Sai, Trustee

Property Owners Address: PO Box 1219
Monroe, NC 28111

Property Owner Telephone Number: (704) 694-0731

We hereby certify the above information to be true and accurate to the best of our knowledge.

B. Niazi-Sai Trustee 07/24/20

(Property Owner Authorized Signature) (Date)

LANDOWNER AUTHORIZATION FORM

PROPERTY LEGAL DESCRITION:

Deed Book: Page: County: Union

Parcel ID Number(s): 04006013, 04006018

Street Address: 2911 Old Pageland Monroe Road
Monroe, NC 28112

The undersigned, registered property owner(s) of the above property, do hereby authorize

Matthew Harrell of *Restoration Systems*

Grant Lewis of *Axiom Environmental*

to take all actions necessary for the evaluation of the property as a potential stream and wetland mitigation project, including conducting stream and/or wetland determinations and delineations, as well as issuance and acceptance of any required permit(s) or certification(s). I agree to allow regulatory agencies, including the US Army Corps of Engineers, to visit the property as part of these environmental reviews.

Property Owner: Guion, Jessie Brice & Wife Virginia L.

Property Owners Address: 2909 Old Pageland Monroe Road
Monroe, NC 28112

Property Owner Telephone Number: 704 - 242 - 1903

We hereby certify the above information to be true and accurate to the best of our knowledge.

Jesse B. Guion & Virginia Guion 7/21/2020

(Property Owner Authorized Signature) (Date)

Parcel Number

03168005

Owner

WITS END FARM LLC

Mailing Address

1226 ANDOVER RD
CHARLOTTE
NC , 28211

Account Information

Land Value	$17,600.00		
Building Value	$0.00	**Description**	7180-262
Total Value	$17,600.00	**Situs Address**	0 SNYDER STORE RD
Acreage	1.4700	**Property Class**	RESIDENTIAL

Sales Information

Sale Date	Sale Amount	Book & Page	Grantor
06/21/2018	$8,000.00	7180 262	BROOKS MAX SHELTON & SARAH S
03/24/2005	$10,000.00	3726 740	LAKEVIEW MEADOWS INC

Location Information

Municipal Administration	Union County	**12 Mile Service Area**	No
County Zoning Code	RA-40	**School**	School Assignment Information
Zoning Administration	Union County	**Census Tract Number**	207.02
ETJ		**FEMA Panel**	5462
Fire District	Allens Crossroads	**FEMA Zone**	
Soils	BaB		

Building Information

Total Living Area	0	**Improvement Type**	
Year Build	0		

District Voting Assignments (Jurisdictions)

Polling Place	Rock Rest Elementary School Gym	**School District**	2	**Congressional District**	8
Precinct District	#25	**State House**	55	**Senate District**	35

Parcel Number

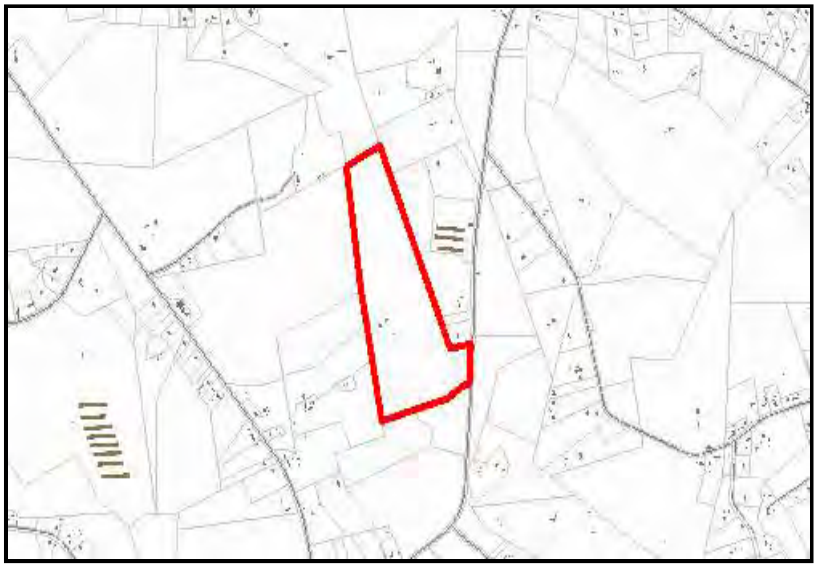
04006015

Owner

WITS END FARM LLC

Mailing Address

11232 COLONIAL COUNTRY LN
CHARLOTTE
NC , 28277



Account Information

Land Value	$289,200.00		
Building Value	$99,700.00	**Description**	ARGO PROPERTIES INC
Total Value	$388,900.00	**Situs Address**	0 OLDPAGELAND-MONRD
Acreage	83.3200	**Property Class**	FARM

Sales Information

Sale Date	Sale Amount	Book & Page	Grantor
05/30/2007	$433,500.00	4568 779	LAKEVIEW MEADOWS INC

Location Information

Municipal Administration	Union County	**12 Mile Service Area**	No
County Zoning Code	RA-40	**School**	School Assignment Information
Zoning Administration	Union County	**Census Tract Number**	207.02
ETJ		**FEMA Panel**	5462
Fire District	Allens Crossroads	**FEMA Zone**	AE
Soils	CmB,W,GsC,GoC,BaB		

Building Information

Total Living Area	896	**Improvement Type**	Single Family Dwelling
Year Build	2009		

District Voting Assignments (Jurisdictions)

Polling Place	Rock Rest Elementary School Gym	**School District**	2	**Congressional District**	8
Precinct District	#25	**State House**	55	**Senate District**	35

Parcel Number

04006014A

Owner

WITS END FARM LLC

Mailing Address

11232 COLONIAL COUNTRY LN
CHARLOTTE
NC , 28277

Account Information

Land Value	$79,100.00		
Building Value	$2,500.00	**Description**	OFF OLD PAGELAND-MONROE RD
Total Value	$81,600.00	**Situs Address**	0 OLDPAGELAND-MONROE RD
Acreage	16.8300	**Property Class**	FARM

Sales Information

Sale Date	Sale Amount	Book & Page	Grantor
05/30/2007	$58,000.00	4568 786	FOUSHEE CECIL B & JAMES PIERCE D MUL

Location Information

Municipal Administration	Union County	**12 Mile Service Area**	No
County Zoning Code	RA-40	**School**	School Assignment Information
Zoning Administration	Union County	**Census Tract Number**	207.02
ETJ		**FEMA Panel**	5462
Fire District	Allens Crossroads	**FEMA Zone**	AE
Soils	CmB,GsB,GsC,BaB		

Building Information

Total Living Area	0	**Improvement Type**	
Year Build	0		

District Voting Assignments (Jurisdictions)

Polling Place	Rock Rest Elementary School Gym	**School District**	2	**Congressional District**	8
Precinct District	#25	**State House**	55	**Senate District**	35

Parcel Number

03168004

Owner

BROOKS MAX SHELTON BROOKS SARAH S

Mailing Address

2407 FAULKS CHURCH RD
WINGATE
NC , 28174

Account Information

Land Value	$117,100.00		
Building Value	$9,800.00	**Description**	BROOKS
Total Value	$126,900.00	**Situs Address**	0 SNYDER STORE RD
Acreage	25.1520	**Property Class**	FARM

Sales Information

Sale Date	Sale Amount	Book & Page	Grantor

Location Information

Municipal Administration	Union County	**12 Mile Service Area**	No
County Zoning Code	RA-40	**School**	School Assignment Information
Zoning Administration	Union County	**Census Tract Number**	207.02
ETJ		**FEMA Panel**	5462
Fire District	Allens Crossroads	**FEMA Zone**	AE
Soils	CmB,BaB		

Building Information

Total Living Area	0	**Improvement Type**	
Year Build	0		

District Voting Assignments (Jurisdictions)

Polling Place	Rock Rest Elementary School Gym	**School District**	2	**Congressional District**	8
Precinct District	#25	**State House**	55	**Senate District**	35

Parcel Number

04006019

Owner

GUION
RANDY H

Mailing Address

%GUION MARY 2921 OLD PAGELAND
MONROE
MONROE
NC , 28112

Account Information

Land Value	$59,000.00		
Building Value	$0.00	**Description**	GUION OFF OLDPAGELAND-MON OFF OLDPAGELAND-MONRD
Total Value	$59,000.00	**Situs Address**	0 OLD PAGELAND MONROE RD
Acreage	17.8800	**Property Class**	UNBUILDABLE

Sales Information

Sale Date	Sale Amount	Book & Page	Grantor

Location Information

Municipal Administration	Union County	**12 Mile Service Area**	No
County Zoning Code	RA-40	**School**	School Assignment Information
Zoning Administration	Union County	**Census Tract Number**	207.02
ETJ		**FEMA Panel**	5462
Fire District	Allens Crossroads	**FEMA Zone**	
Soils	GsB,CmB,GoC		

Building Information

Total Living Area	0	**Improvement Type**	
Year Build	0		

District Voting Assignments (Jurisdictions)

Polling Place	Rock Rest Elementary School Gym	**School District**	2	**Congressional District**	8
Precinct District	#25	**State House**	55	**Senate District**	35

Parcel Number

04006018

Owner

GUION
JESSIE B

Mailing Address

2909 OLD PAGELAND MONROE
MONROE
NC , 281120000

Account Information

Land Value	$75,100.00		
Building Value	$36,500.00	**Description**	GUION 2907 OLD PAGELAND MONROE RD / OPCK966
Total Value	$111,600.00	**Situs Address**	2907 OLD PAGELAND MONROE RD
Acreage	14.6500	**Property Class**	FARM

Sales Information

Sale Date	Sale Amount	Book & Page	Grantor

Location Information

Municipal Administration	Union County	**12 Mile Service Area**	No
County Zoning Code	RA-40	**School**	School Assignment Information
Zoning Administration	Union County	**Census Tract Number**	207.02
ETJ		**FEMA Panel**	5462
Fire District	Allens Crossroads	**FEMA Zone**	
Soils	CmB,GsC,GoC,BaB		

Building Information

Total Living Area	1395	**Improvement Type**	
Year Build	1910		

District Voting Assignments (Jurisdictions)

Polling Place	Rock Rest Elementary School Gym	**School District**	2	**Congressional District**	8
Precinct District	#25	**State House**	55	**Senate District**	35

Parcel Number

04006013

Owner

GUION JESSIE BRICE GUION VIRGINIA L

Mailing Address

2909 OLD PAGELAND MONROE RD
MONROE
NC , 28112

Account Information

Land Value	$110,700.00		
Building Value	$68,800.00	**Description**	PRESSLEY / OPCK966
Total Value	$179,500.00	**Situs Address**	2911 OLD PAGELAND MONROE RD
Acreage	0.0000	**Property Class**	FARM

Sales Information

Sale Date	Sale Amount	Book & Page	Grantor

Location Information

Municipal Administration	Union County	**12 Mile Service Area**	No
County Zoning Code	RA-40	**School**	School Assignment Information
Zoning Administration	Union County	**Census Tract Number**	207.02
ETJ		**FEMA Panel**	5462
Fire District	Allens Crossroads	**FEMA Zone**	
Soils	CmB,GsC,BaB		

Building Information

Total Living Area	924	**Improvement Type**	
Year Build	1968		

District Voting Assignments (Jurisdictions)

Polling Place	Rock Rest Elementary School Gym	**School District**	2	**Congressional District**	8
Precinct District	#25	**State House**	55	**Senate District**	35

Parcel Number

03168003D

Owner

NIAZI-SAI
BIBI
MARIAM
TRUSTEE

Mailing Address

PO BOX 1219
MONROE
NC , 28111

Account Information

Land Value	$152,300.00		
Building Value	$0.00	**Description**	TRACT 4 BROOKS OPCJ045
Total Value	$152,300.00	**Situs Address**	0 SNYDERS STORE RD
Acreage	39.1100	**Property Class**	FARM

Sales Information

Sale Date	Sale Amount	Book & Page	Grantor
12/18/2017	$197,000.00	7073 202	S & P LAND PARTNERS LLC
06/08/2015	$0.00	6460 590	WINSTEAD PAULA
06/08/2015	$0.00	6460 590	WINSTEAD PAULA

Location Information

Municipal Administration	Union County	**12 Mile Service Area**	No
County Zoning Code	RA-40	**School**	School Assignment Information
Zoning Administration	Union County	**Census Tract Number**	207.02
ETJ		**FEMA Panel**	5462
Fire District	Allens Crossroads	**FEMA Zone**	AE
Soils	CmB,GsB,GsC,BaB		

Building Information

Total Living Area	0	**Improvement Type**	
Year Build	0		

District Voting Assignments (Jurisdictions)

Polling Place	Rock Rest Elementary School Gym	**School District**	2	**Congressional District**	8
Precinct District	#25	**State House**	55	**Senate District**	35

Parcel Number

03168003C

Owner

MORRIS
GINA
BROOKS

Mailing Address

2250 SHAW FERRY LN
LENOIR CITY
TN , 37772

Account Information

Land Value	$50,400.00		
Building Value	$0.00	**Description**	TRACT 3 BROOKS OPCJ045
Total Value	$50,400.00	**Situs Address**	0 SNYDERS STORE RD
Acreage	11.4000	**Property Class**	RESIDENTIAL

Sales Information

Sale Date	Sale Amount	Book & Page	Grantor
12/18/2012	$0.00	5896 171	BROOKS HILTON
12/12/2005	$0.00	4009 291	BROOKS HILTON
12/12/2005	$0.00	4009 291	BROOKS HILTON

Location Information

Municipal Administration	Union County	**12 Mile Service Area**	No
County Zoning Code	RA-40	**School**	School Assignment Information
Zoning Administration	Union County	**Census Tract Number**	207.02
ETJ		**FEMA Panel**	5462
Fire District	Allens Crossroads	**FEMA Zone**	AE
Soils	CmB,BaB		

Building Information

Total Living Area	0	**Improvement Type**	
Year Build	0		

District Voting Assignments (Jurisdictions)

Polling Place	Rock Rest Elementary School Gym	**School District**	2	**Congressional District**	8
Precinct District	#25	**State House**	55	**Senate District**	35

Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: 7/17/2020

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Alex Baldwin of Restoration Systems, LLC 1101 Haynes Street, Suite 211 Raleigh, NC 27604

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:

SAW-2020-00455 and DWR Project Number 2020-0369

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:

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

State: NC County/parish/borough: Union City: Buford

Center coordinates of site (lat/long in degree decimal format):

Lat.: 34.912496 Long.: -80.444339

Universal Transverse Mercator: 17

Name of nearest waterbody: Waxhaw Branch

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

☐ Office (Desk) Determination. Date:

☐ Field Determination. Date(s):

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

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

1) The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.

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

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

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

☐ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
Map: _____.

☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.
☐ Office concurs with data sheets/delineation report.
☐ Office does not concur with data sheets/delineation report. Rationale: _____.

☐ Data sheets prepared by the Corps: _____.

☐ Corps navigable waters' study: _____.

☐ U.S. Geological Survey Hydrologic Atlas: _____.
☐ USGS NHD data.
☐ USGS 8 and 12 digit HUC maps.

☒ U.S. Geological Survey map(s). Cite scale & quad name: 24,000 Wingate.

☒ Natural Resources Conservation Service Soil Survey. Citation: NRCS - 1996.

☒ National wetlands inventory map(s). Cite name: USFWS - 1983.

☐ State/local wetland inventory map(s): _____.

☒ FEMA/FIRM maps: FEMA - FIRM No. 3710546200J (10/16/2008).

☒ 100-year Floodplain Elevation is: 578.4-592.7.(National Geodetic Vertical Datum of 1929)

☒ Photographs: ☒ Aerial (Name & Date): NC CGIA - 2019.
or ☒ Other (Name & Date): Project Field Photos - Feb 13, 2019 & July 15-16, 2020.

☐ Previous determination(s). File no. and date of response letter: _____.

☐ Other information (please specify): _____.

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

7/17/2020

Signature and date of
Regulatory staff member
completing PJD

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

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

WITS END PJD – TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO JURISDICTION

Site number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
STREAMS					
Waxhaw Branch	34.911525	-80.443432	3401	Non-wetland waters (Per Stream)	404
UT-1	34.917436	-80.446253	140	Non-wetland waters (Int Stream)	404
UT-2	34.917305	-80.442819	641	Non-wetland waters (Int Stream)	404
UT-3	34.911810	-80.448080	1078	Non-wetland waters (Int Stream)	404
UT-3	34.911692	-80.444986	1269	Non-wetland waters (Per Stream)	404
UT-3A	34.912796	-80.447243	671	Non-wetland waters (Int Stream)	404
UT-4	34.908694	-80.443574	828	Non-wetland waters (Int Stream)	404
UT-5	34.908273	-80.442331	181	Non-wetland waters (Int Stream)	404
WETLANDS					
AA	34.908818	-80.441607	3.186	Wetland	404
AB	34.907919	-80.441608	2.131	Wetland	404
AC	34.917201	-80.445341	0.292	Wetland	404
AD	34.916484	-80.443645	0.057	Wetland	404
AE	34.915145	-80.443475	0.051	Wetland	404
AF	34.914039	-80.444960	0.034	Wetland	404
AG	34.915370	-80.445654	0.034	Wetland	404
AH	34.917102	-80.445714	0.389	Wetland	404
AI	34.911509	-80.448663	0.134	Wetland	404
AJ	34.912309	-80.446985	0.075	Wetland	404
Pond 1	34.909539	-80.441780	0.168	Open water	404
Pond 2	34.915139	-80.444320	11.344	Open water	404
Pond 3	34.911541	-80.448340	0.113	Open water	404
Pond 4	34.912258	-80.446883	0.131	Open water	404

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AA-UP
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Floodplain | Local Relief (concave, convex, none): none | Slope (%): 3
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.909394 | Long: -80.44148 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? NO Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☑ No ☐
Hydric Soil Present? Yes ☑ No ☐
Wetland Hydrology Present? Yes ☐ No ☑
Is the Sampled Area within a wetland? Yes ☐ No ☑

Remarks: Area appears to be a drained wetland where hydrology has been altered by relocating the stream to the opposite (right) side of the valley. Historically this area was likely the outer edge of the wetland boundary .

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? Yes ☐ No ☑

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AA-UP

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.	*Quercus phellos*	100	Y	FACW
2.				
3.				
4.				
5.				
6.				
7.				
		100	= Total Cover	
	50% of total cover: 50	20% of total cover: 20		
Sapling Stratum (Plot size: 30 ft radius)				
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Liquidambar styraciflua*	30	Y	FAC
2.	*Fraxinus pennsylvanica*	5		FACW
3.	*Quercus phellos*	5		FACW
4.	*Ligustrum sinenese*	5		FAC
5.	*Juniperus virginiana*	2		FACU
6.				
7.				
		47	= Total Cover	
	50% of total cover: 23.5	20% of total cover: 9.4		
Herb Stratum (Plot size: 30 ft radius)				
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Woody Vine Stratum (Plot size: 30 ft radius)				
1.				
2.				
3.				
4.				
5.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		

Dominance Test Worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

OBL species	0	x 1 =	0
FACW species	110	x 2 =	220
FAC species	35	x 3 =	105
FACU species	2	x 4 =	8
UPL species	0	x 5 =	0
Column Totals:	147 (A)		333 (B)

Prevalence Index = B/A = 2.3

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

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

SOIL

Sampling Point: AA-UP

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/2	100					SiL	
3-10+	10YR 6/2	50	5Y 8/1	30	D	M	SiCL	
			10YR 6/8	20	C	M		

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AA-WET
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Floodplain | Local Relief (concave, convex, none): none | Slope (%): 0
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.909359 | Long: -80.441595 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? NO Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☑ No ☐
Hydric Soil Present? Yes ☑ No ☐
Wetland Hydrology Present? Yes ☑ No ☐
Is the Sampled Area within a wetland? Yes ☑ No ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ☑ **No** ☐

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

Remarks: Monitoring wells were installed within Wetland AA in Feb 2020. Wetland hydrology was observed in the wells during the growing season and within normal rainfall for 32-40days in March-April representing 13-16% of the growing season.

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AA-WET

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.	*Quercus phellos*	80	Y	FACW
2.	*Liquidambar styraciflua*	10	Y	FAC
3.				
4.				
5.				
6.				
7.				
		90	= Total Cover	
	50% of total cover: 45	20% of total cover: 18		
Sapling Stratum (Plot size: 30 ft radius)				
1.	*Diospyros virginiana*	10	Y	FAC
2.	*Liquidambar styraciflua*	10	Y	FAC
3.				
4.				
5.				
6.				
7.				
		20	= Total Cover	
	50% of total cover: 10	20% of total cover: 4		
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Fraxinus pennsylvanica*	10	Y	FACW
2.	*Liquidambar styraciflua*	10	Y	FAC
3.	*Celtis occidentalis*	2		FACU
4.				
5.				
6.				
7.				
		22	= Total Cover	
	50% of total cover: 11	20% of total cover: 4.4		
Herb Stratum (Plot size: 30 ft radius)				
1.	*Microstegium vimineum*	60	Y	OBL
2.	*Juncus effusus*	25	Y	FACW
3.	*Carex lurida*	15	Y	OBL
4.	*Cinna arundinacea*	15	Y	FACW
5.	*Solidago gigantea*	3		FACW
6.	*Phytolacca americana*	2		FACU
7.				
8.				
9.				
10.				
11.				
		120	= Total Cover	
	50% of total cover: 60	20% of total cover: 24		
Woody Vine Stratum (Plot size: 30 ft radius)				
1.				
2.				
3.				
4.				
5.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	10	(A)
Total Number of Dominant Species Across All Strata:	10	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100%	(A/B)

Prevalence Index worksheet:

OBL species	75	x 1 =	75
FACW species	133	x 2 =	266
FAC species	40	x 3 =	120
FACU species	4	x 4 =	16
UPL species	0	x 5 =	0
Column Totals:	252 (A)		477 (B)

Prevalence Index = B/A = 1.9

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☑ **No** ☐

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

SOIL

Sampling Point: AA-WET

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	100					SiL	
3-12+	2.5Y 5/3	45	2.5Y 6/3	10	D	M	SiCL	
			10YR 5/8	30	C	PL		Prominent Redox Concentrations
			7.5YR 4/6	10	C	M		Prominent Redox Concentrations

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☑ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AB-UP
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Toeslope | Local Relief (concave, convex, none): none | Slope (%): 5
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.908259 | Long: -80.442863 | Datum: NAD83
Soil Map Unit Name: GsC - Goldston-Badin Complex | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☑ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☐ No ☑
Hydric Soil Present? Yes ☐ No ☑
Wetland Hydrology Present? Yes ☐ No ☑
Is the Sampled Area within a wetland? Yes ☐ No ☑

Remarks: Vegetation is disturbed as the area is along the edge of an existing ag field under row crop production.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ☐ **No** ☑

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AB-UP

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Sapling Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Shrub Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Herb Stratum	(Plot size: 30 ft radius)			
1.	*Cynodon dactylon*	40	Y	FACU
2.	*Glycine max*	30	Y	FACU
3.	*Triticum aestivum*	5		FACU
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
		75	= Total Cover	
	50% of total cover: 37.5	20% of total cover: 15		
Woody Vine Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	75	x 4 =	300
UPL species	0	x 5 =	0
Column Totals:	75 (A)		300 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

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

SOIL

Sampling Point: AB-UP

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	100					SL	
3-5	2.5Y 6/4	100					SL	
5-12+	2.5Y 5/6	100					SiCL	

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AB-WET
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Floodplain | Local Relief (concave, convex, none): concave | Slope (%): 0
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.908434 | Long: -80.442739 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? NO Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☑ No ☐
Hydric Soil Present? Yes ☑ No ☐
Wetland Hydrology Present? Yes ☑ No ☐
Is the Sampled Area within a wetland? Yes ☑ No ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? Yes ☑ No ☐

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AB-WET

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.	*Fraxinus pennsylvanica*	60	Y	FACW
2.	*Carya glabra*	30	Y	FACU
3.	*Quercus phellos*	25	Y	FACW
4.				
5.				
6.				
7.				
		115	= Total Cover	
	50% of total cover: 57.5	20% of total cover:	23	
Sapling Stratum (Plot size: 30 ft radius)				
1.	*Quercus phellos*	10	Y	FACW
2.	*Carya glabra*	10	Y	FACU
3.	*Fraxinus pennsylvanica*	10	Y	FACW
4.	*Celtis occidentalis*	10	Y	FACU
5.				
6.				
7.				
		40	= Total Cover	
	50% of total cover: 20	20% of total cover:	8	
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Carya glabra*	10	Y	FACU
2.	*Fraxinus pennsylvanica*	5	Y	FACW
3.	*Celtis occidentalis*	5	Y	FACU
4.				
5.				
6.				
7.				
		20	= Total Cover	
	50% of total cover: 10	20% of total cover:	4	
Herb Stratum (Plot size: 30 ft radius)				
1.	*Microstegium vimineum*	15	Y	OBL
2.	*Lolium arundinaceum*	15	Y	FAC
3.	*Persicaria hydropiperoides*	10		FACW
4.	*Cinna arundinacea*	10		FACW
5.	*Boehmeria cylindrica*	5		FACW
6.	*Campsis radicans*	2		FAC
7.				
8.				
9.				
10.				
11.				
		57	= Total Cover	
	50% of total cover: 28.5	20% of total cover:	11.4	
Woody Vine Stratum (Plot size: 30 ft radius)				
1.	*Smilax rotundifolia*	5	Y	FAC
2.	*Smilax bona-nox*	2		FAC
3.				
4.				
5.				
		7	= Total Cover	
	50% of total cover: 3.5	20% of total cover:	1.4	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 8 (A)

Total Number of Dominant Species Across All Strata: 13 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 62% (A/B)

Prevalence Index worksheet:

OBL species	15	x 1 =	15
FACW species	135	x 2 =	270
FAC species	24	x 3 =	72
FACU species	65	x 4 =	260
UPL species	0	x 5 =	0
Column Totals:	239 (A)		617 (B)

Prevalence Index = B/A = 2.6

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

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

SOIL

Sampling Point: AB-WET

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/2	95	7.5YR 4/6	5	C	PL	SL	Prominent Redox Concentrations
2-4	2.5Y 7/1	70	7.5YR 4/6	20	C	PL	SL	Prominent Redox Concentrations
			7.5YR 5/8	10	C	M		
4-13+	2.5Y 6/3	60	7.5YR 4/6	20	C	PL	SiCL	Prominent Redox Concentrations
			7.5YR 5/8	20	C	M		

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☑ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AC-UP
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Toeslope | Local Relief (concave, convex, none): none | Slope (%): 5
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.916775 | Long: -80.444524 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☑ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☐ No ☑
Hydric Soil Present? Yes ☐ No ☑
Wetland Hydrology Present? Yes ☐ No ☑
Is the Sampled Area within a wetland? Yes ☐ No ☑

Remarks: Vegetation is disturbed as the area is along the edge of an existing ag field under row crop production

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ☐ **No** ☑

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AC-UP

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Sapling Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Shrub Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Herb Stratum	(Plot size: 30 ft radius)			
1.	*Glycine max*	40	Y	FACU
2.	*Triticum aestivum*	30	Y	FACU
3.	*Solanum carolinense*	5		FACU
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
		75	= Total Cover	
	50% of total cover: 37.5	20% of total cover: 15		
Woody Vine Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	75	x 4 =	300
UPL species	0	x 5 =	0
Column Totals:	75 (A)		300 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

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

SOIL

Sampling Point: AC-UP

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	100					SiL	
3-8	2.5Y 5/4	90	2.5Y 6/8	10	C	M	SL	
8-15+	2.5Y 5/6	80	2.5Y 6/4	10	D	M	SiCL	
			2.5Y 6/8	10	C	M		

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AC-WET
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Floodplain | Local Relief (concave, convex, none): concave | Slope (%): 0
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.916746 | Long: -80.444604 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☑ , Soil ☐ , or Hydrology ☑ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☑ No ☐
Hydric Soil Present? Yes ☑ No ☐
Wetland Hydrology Present? Yes ☑ No ☐
Is the Sampled Area within a wetland? Yes ☑ No ☐

Remarks: All woody vegetation has been removed and hydrology is being controlled by the adjacent pond.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? (includes capillary fringe) Yes ☐ No ☑ Depth (inches): _____

Wetland Hydrology Present? **Yes** ☑ **No** ☐

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AC-WET

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Sapling Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Shrub Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Herb Stratum	(Plot size: 30 ft radius)			
1.	*Lolium arundinaceum*	40	Y	FAC
2.	*Carex vulpinoidea*	30	Y	OBL
3.	*Juncus effusus*	25	Y	FACW
4.	*Carex lurida*	20	Y	OBL
5.	*Persicaria hydropiperoides*	20	Y	FACW
6.				
7.				
8.				
9.				
10.				
11.				
		135	= Total Cover	
	50% of total cover: 67.5	20% of total cover: 27		
Woody Vine Stratum	(Plot size: 30 ft radius)			
1.				
2.				
3.				
4.				
5.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100%	(A/B)

Prevalence Index worksheet:

OBL species	50	x 1 =	50
FACW species	45	x 2 =	90
FAC species	40	x 3 =	120
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	135 (A)		260 (B)

Prevalence Index = B/A = 1.9

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☑ **No** ☐

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

SOIL

Sampling Point: AC-WET

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/2	85	10YR 4/6	15	C	PL	SiL	Prominent Redox Concentrations
5-12	2.5Y 5/3	65	10YR 4/6	15	C	PL	CL	Prominent Redox Concentrations
			10YR 5/8	20	C	M		
12-18+	2.5Y 5/4	75	10YR 4/6	25	C	M	CL	Prominent Redox Concentrations

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☑ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AH-UP
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Toeslope | Local Relief (concave, convex, none): convex | Slope (%): 5
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.91739 | Long: -80.446074 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? NO Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☑ No ☐
Hydric Soil Present? Yes ☐ No ☑
Wetland Hydrology Present? Yes ☐ No ☑
Is the Sampled Area within a wetland? Yes ☐ No ☑

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ☐ **No** ☑

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AH-UP

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.	*Fraxinus pennsylvanica*	25	Y	FACW
2.	*Liquidambar styraciflua*	25	Y	FAC
3.	*Quercus alba*	25	Y	FACU
4.	*Acer rubrum*	25	Y	FAC
5.				
6.				
7.				
		100	= Total Cover	
	50% of total cover: 50	20% of total cover: 20		
Sapling Stratum (Plot size: 30 ft radius)				
1.	*Fraxinus pennsylvanica*	5	Y	FACW
2.				
3.				
4.				
5.				
6.				
7.				
		5	= Total Cover	
	50% of total cover: 2.5	20% of total cover: 1		
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Fraxinus pennsylvanica*	30	Y	FACW
2.	*Ligustrum sinense*	30	Y	FAC
3.	*Quercus alba*	5		FACU
4.				
5.				
6.				
7.				
		65	= Total Cover	
	50% of total cover: 32.5	20% of total cover: 13		
Herb Stratum (Plot size: 30 ft radius)				
1.	*Lonicera japonica*	10	Y	FAC
2.	*Parthenocissus quinquefolia*	5		FAC
3.	*Solanum carolinense*	2		FACU
4.	*Cinna arundinacea*	2		FACW
5.				
6.				
7.				
8.				
9.				
10.				
11.				
		19	= Total Cover	
	50% of total cover: 9.5	20% of total cover: 3.8		
Woody Vine Stratum (Plot size: 30 ft radius)				
1.				
2.				
3.				
4.				
5.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 88% (A/B)

Prevalence Index worksheet:

OBL species	0	x 1 =	0
FACW species	62	x 2 =	124
FAC species	95	x 3 =	285
FACU species	32	x 4 =	128
UPL species	0	x 5 =	0
Column Totals:	189 (A)		537 (B)

Prevalence Index = B/A = 2.8

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☑ **No** ☐

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

SOIL

Sampling Point: AH-UP

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	70					SL	30% Channery (2-4" in size)

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AH-WET
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Floodplain | Local Relief (concave, convex, none): concave | Slope (%): 0
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.91741 | Long: -80.445967 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☑ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☑ No ☐
Hydric Soil Present? Yes ☑ No ☐
Wetland Hydrology Present? Yes ☑ No ☐
Is the Sampled Area within a wetland? Yes ☑ No ☐

Remarks: Hydrology is being controlled by the adjacent pond.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? (includes capillary fringe) Yes ☐ No ☑ Depth (inches): _____

Wetland Hydrology Present? **Yes** ☑ **No** ☐

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AH-WET

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.	*Fraxinus pennsylvanica*	20	Y	FACW
2.	*Diospyros virginiana*	20	Y	FAC
3.				
4.				
5.				
6.				
7.				
		40	= Total Cover	
	50% of total cover: 20	20% of total cover: 8		
Sapling Stratum (Plot size: 30 ft radius)				
1.	*Fraxinus pennsylvanica*	30	Y	FACW
2.	*Diospyros virginiana*	30	Y	FAC
3.				
4.				
5.				
6.				
7.				
		60	= Total Cover	
	50% of total cover: 30	20% of total cover: 12		
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Fraxinus pennsylvanica*	40	Y	FACW
2.	*Diospyros virginiana*	5		FAC
3.	*Ligustrum sinense*	2		FAC
4.				
5.				
6.				
7.				
		47	= Total Cover	
	50% of total cover: 23.5	20% of total cover: 9.4		
Herb Stratum (Plot size: 30 ft radius)				
1.	*Cinna arundinacea*	80	Y	FACW
2.	*Persicaria hydropiperoides*	10		FACW
3.	*Boehmeria cylindrica*	10		FACW
4.	*Rubus spp.*	5		FAC
5.	*Solidago gigantea*	2		FACW
6.	*Parthenocissus quinquefolia*	2		FAC
7.				
8.				
9.				
10.				
11.				
		109	= Total Cover	
	50% of total cover: 54.5	20% of total cover: 21.8		
Woody Vine Stratum (Plot size: 30 ft radius)				
1.				
2.				
3.				
4.				
5.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

OBL species	0	x 1 =	0
FACW species	192	x 2 =	384
FAC species	64	x 3 =	192
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	256 (A)		576 (B)

Prevalence Index = B/A = 2.3

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☑ **No** ☐

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

SOIL

Sampling Point: AH-WET

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	90	10YR 4/2	5	D	M	SiL	Prominent Redox Concentrations
			7.5YR 4/6	5	C	PL		
3-7	2.5Y 5/3	70	7.5YR 4/6	25	C	M	SiCL	Prominent Redox Concentrations
			7.5YR 3/4	5	C	PL		
7-15+	2.5Y 6/3	60	7.5YR 4/6	40	C	PL	SiCL	Prominent Redox Concentrations
			7.5YR 3/4	5	C	M		

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☑ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AI-UP
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Toeslope | Local Relief (concave, convex, none): none | Slope (%): 5
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.911532 | Long: -80.448521 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? NO Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☐ No ☑
Hydric Soil Present? Yes ☐ No ☑
Wetland Hydrology Present? Yes ☐ No ☑
Is the Sampled Area within a wetland? Yes ☐ No ☑

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? Yes ☐ No ☑

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AI-UP

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.	*Liquidambar styraciflua*	50	Y	FAC
2.	*Celtis occidentalis*	25	Y	FACU
3.	*Juniperus virginiana*	25	Y	FACU
4.				
5.				
6.				
7.				
		100	= Total Cover	
	50% of total cover: 50	20% of total cover: 20		
Sapling Stratum (Plot size: 30 ft radius)				
1.	*Bambusa vulgaris*	40	Y	FACU
2.	*Liquidambar styraciflua*	10		FAC
3.	*Celtis occidentalis*	10		FACU
4.	*Prunus serotina*	10		FACU
5.				
6.				
7.				
		70	= Total Cover	
	50% of total cover: 35	20% of total cover: 14		
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Ligustrum sinense*	50	Y	FAC
2.	*Bambusa vulgaris*	20	Y	FACU
3.				
4.				
5.				
6.				
7.				
		70	= Total Cover	
	50% of total cover: 35	20% of total cover: 14		
Herb Stratum (Plot size: 30 ft radius)				
1.	*Parthenocissus quinquefolia*	10	Y	FAC
2.	*Lonicera japoinica*	5		FACU
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
		15	= Total Cover	
	50% of total cover: 7.5	20% of total cover: 3		
Woody Vine Stratum (Plot size: 30 ft radius)				
1.				
2.				
3.				
4.				
5.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	43%	(A/B)

Prevalence Index worksheet:

OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	120	x 3 =	360
FACU species	135	x 4 =	540
UPL species	0	x 5 =	0
Column Totals:	255 (A)		900 (B)

Prevalence Index = B/A = 3.5

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☑

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

SOIL

Sampling Point: AI-UP

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/4	100					SL	
3-11	10YR 5/6	100					SiCL	
11-16+	10YR 5/6	95	7.5YR 5/8	5	C	PL	SiCL	

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AI-WET
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Floodplain | Local Relief (concave, convex, none): concave | Slope (%): 0
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.911539 | Long: -80.448571 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☑ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☑ No ☐
Hydric Soil Present? Yes ☑ No ☐
Wetland Hydrology Present? Yes ☑ No ☐
Is the Sampled Area within a wetland? Yes ☑ No ☐

Remarks: Hydrology is being controlled by the adjacent pond and ditching of the adjacent stream

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ☑ **No** ☐

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AI-WET

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		
Sapling Stratum (Plot size: 30 ft radius)				
1.	*Juglans nigra*	10	Y	FACU
2.	*Salix nigra*	10	Y	OBL
3.				
4.				
5.				
6.				
7.				
		20	= Total Cover	
	50% of total cover: 10	20% of total cover: 4		
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Ligustrum sinense*	10	Y	FAC
2.	*Fraxinus pennsylvanica*	5		FACW
3.				
4.				
5.				
6.				
7.				
		15	= Total Cover	
	50% of total cover: 7.5	20% of total cover: 3		
Herb Stratum (Plot size: 30 ft radius)				
1.	*Solidago gigantea*	25	Y	FACW
2.	*Rubus spp.*	10	Y	FAC
3.	*Parthenocissus quinquefolia*	5		FAC
4.	*Bambusa vulgaris*	5		FACU
5.	*Arundinaria gigantea*	5		FACW
6.				
7.				
8.				
9.				
10.				
11.				
		50	= Total Cover	
	50% of total cover: 25	20% of total cover: 10		
Woody Vine Stratum (Plot size: 30 ft radius)				
1.				
2.				
3.				
4.				
5.				
		0	= Total Cover	
	50% of total cover: 0	20% of total cover: 0		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	80%	(A/B)

Prevalence Index worksheet:

OBL species	10	x 1 =	10
FACW species	35	x 2 =	70
FAC species	25	x 3 =	75
FACU species	15	x 4 =	60
UPL species	0	x 5 =	0
Column Totals:	85 (A)		215 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☑ **No** ☐

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

SOIL

Sampling Point: AI-WET

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 4/3	100					SiL	
8-16	2.5Y 4/3	70	10YR 5/6	20	C	PL	CL	Prominent Redox Concentrations
			7.5YR 5/6	10	C	M		
16-22+	2.5Y 5/4	70	7.5YR 5/6	20	C	M	CL	Prominent Redox Concentrations
			10YR 5/6	10	C	PL		

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☑ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AJ-UP
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Toeslope | Local Relief (concave, convex, none): none | Slope (%): 0
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.912292 | Long: -80.447139 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? NO Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☐ No ☑
Hydric Soil Present? Yes ☐ No ☑
Wetland Hydrology Present? Yes ☐ No ☑
Is the Sampled Area within a wetland? Yes ☐ No ☑

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? Yes ☐ No ☑

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AJ-UP

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.	*Juglans nigra*	60	Y	FACU
2.	*Quercus phellos*	10		FACW
3.				
4.				
5.				
6.				
7.				
		70	= Total Cover	
	50% of total cover: 35	20% of total cover: 14		
Sapling Stratum (Plot size: 30 ft radius)				
1.	*Juglans nigra*	10	Y	FACU
2.				
3.				
4.				
5.				
6.				
7.				
		10	= Total Cover	
	50% of total cover: 5	20% of total cover: 2		
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Ligustrum sinense*	40	Y	FAC
2.	*Ligustrum japonica*	5		FAC
3.	*Quercus phellos*	5		FACW
4.				
5.				
6.				
7.				
		50	= Total Cover	
	50% of total cover: 25	20% of total cover: 10		
Herb Stratum (Plot size: 30 ft radius)				
1.	*Lonicera japoinica*	10	Y	FACU
2.	*Rubus spp.*	5	Y	FAC
3.	*Rosa multiflora*	5	Y	UPL
4.	*Phytolacca americana*	5	Y	FACU
5.				
6.				
7.				
8.				
9.				
10.				
11.				
		25	= Total Cover	
	50% of total cover: 12.5	20% of total cover: 5		
Woody Vine Stratum (Plot size: 30 ft radius)				
1.	*Lonicera japoinica*	5	Y	FACU
2.				
3.				
4.				
5.				
		5	= Total Cover	
	50% of total cover: 2.5	20% of total cover: 1		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	8	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	25%	(A/B)

Prevalence Index worksheet:

OBL species	0	x 1 =	0
FACW species	15	x 2 =	30
FAC species	50	x 3 =	150
FACU species	90	x 4 =	360
UPL species	5	x 5 =	25
Column Totals:	160 (A)		565 (B)

Prevalence Index = B/A = 3.5

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

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

SOIL

Sampling Point: AJ-UP

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 4/4	100					SL	
5-11	2.5Y 5/4	95	10YR 3/4	5	C	PL	SiCL	Sharp boundary on RC features
11-16+	2.5Y 5/4	75	2.5Y 7/1	15	D	M	SiCL	Sharp boundary on RC features
			2.5Y 6/6	5	C	M		
			2.5Y 7/8	5	C	M		

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Wits End | City/County: Buford/Union | Sampling Date: 7/15/2020
Applicant/Owner: Restoration Systems LLC | State: NC | Sampling Point: AJ-WET
Investigator(s): A. Baldwin | Section, Township, Range: Buford
Landform: (hillslope, terrace, etc.) Floodplain | Local Relief (concave, convex, none): concave | Slope (%): 0
Subregion (LRR or MLRA) LRR-P, MLRA-136 | Lat: 34.912295 | Long: -80.447061 | Datum: NAD83
Soil Map Unit Name: Cmb - Cid channery silt loam | NWI Classification: NA
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐ , Soil ☐ , or Hydrology ☑ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐
Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally problematic? NO (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☑ No ☐
Hydric Soil Present? Yes ☑ No ☐
Wetland Hydrology Present? Yes ☑ No ☐
Is the Sampled Area within a wetland? Yes ☑ No ☐

Remarks: Hydrology is being controlled by the adjacent pond and ditching of the adjacent stream

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): _____
Water Table Present? Yes ☐ No ☑ Depth (inches): _____
Saturation Present? Yes ☐ No ☑ Depth (inches): _____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ☑ **No** ☐

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

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: AJ-WET

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.	*Juglans nigra*	25	Y	FACU
2.	*Salix nigra*	25	Y	OBL
3.	*Quercus phellos*	5		FACW
4.				
5.				
6.				
7.				
		55	= Total Cover	
50% of total cover:	27.5	20% of total cover:	11	
Sapling Stratum (Plot size: 30 ft radius)				
1.	*Juglans nigra*	30	Y	FACU
2.	*Salix nigra*	5		OBL
3.	*Acer rubrum*	5		FAC
4.	*Fraxinus pennsylvanica*	5		FACW
5.				
6.				
7.				
		45	= Total Cover	
50% of total cover:	22.5	20% of total cover:	9	
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Ligustrum sinense*	5	Y	FAC
2.	*Fraxinus pennsylvanica*	5	Y	FACW
3.	*Quercus phellos*	5	Y	FACW
4.				
5.				
6.				
7.				
		15	= Total Cover	
50% of total cover:	7.5	20% of total cover:	3	
Herb Stratum (Plot size: 30 ft radius)				
1.	*Juncus effusus*	30	Y	FACW
2.	*Carex lurida*	20	Y	OBL
3.	*Persicaria hydropiperoides*	15		FACW
4.	*Solidago gigantea*	15		FACW
5.	*Lonicera japonica*	10		FAC
6.	*Rubus spp.*	5		FAC
7.	*Toxicodendron radicans*	5		FAC
8.				
9.				
10.				
11.				
		100	= Total Cover	
50% of total cover:	50	20% of total cover:	20	
Woody Vine Stratum (Plot size: 30 ft radius)				
1.	*Lonicera japonica*	5	Y	FAC
2.				
3.				
4.				
5.				
		5	= Total Cover	
50% of total cover:	2.5	20% of total cover:	1	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	7	(A)
Total Number of Dominant Species Across All Strata:	9	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	78%	(A/B)

Prevalence Index worksheet:

OBL species	50	x 1 =	50
FACW species	80	x 2 =	160
FAC species	35	x 3 =	105
FACU species	55	x 4 =	220
UPL species	0	x 5 =	0
Column Totals:	220 (A)		535 (B)

Prevalence Index = B/A = 2.4

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☑ **No** ☐

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

SOIL

Sampling Point: AJ-WET

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/3	95	10YR 6/6	5	C	M	SL	Distinct Redox Concentrations
2-12	10YR 5/3	85	10YR 3/6	15	C	M	SiL	Distinct Redox Concentrations
12-18+	10YR 5/4	80	10YR 5/8	20	C	M	SiL	Prominent Redox Concentrations

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

NC DWQ Stream Identification Form Version 4.11

Date: 7/15/2020	**Project/Site:** Wits End/UT-1	**Latitude:** 34.917415
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.446420
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 28.00	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 16.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made 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 = 5.00)				
18. Fibrous roots in streambed	3 ○	2 ◉	1 ○	0 ○
19. Rooted upland plants in streambed	3 ◉	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ◉	0.5 ○	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/15/2020	**Project/Site:** Wits End/UT2	**Latitude:** 34.917837
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.442275
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 20.50	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.0)				
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 = 4.00)				
18. Fibrous roots in streambed	3 ○	2 ◉	1 ○	0 ○
19. Rooted upland plants in streambed	3 ○	2 ◉	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ◉	0.5 ○	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/14/2020	**Project/Site:** Wits End/UT3A	**Latitude:** 34.913456
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.447992
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 23.50	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 12.0)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made 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 = 5.00)				
18. Fibrous roots in streambed	3 ○	2 ◉	1 ○	0 ○
19. Rooted upland plants in streambed	3 ◉	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ◉	0.5 ○	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/14/2020	**Project/Site:** Wits End/UT3	**Latitude:** 34.911435
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.449754
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 26.00	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 13.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.0)				
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 = 5.50)				
18. Fibrous roots in streambed	3 ○	2 ◉	1 ○	0 ○
19. Rooted upland plants in streambed	3 ◉	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ○	0.5 ◉	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/14/2020	**Project/Site:** Wits End/UT3	**Latitude:** 34.912106
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.446075
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 33.50	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 21.0)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.0)				
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 = 5.50)				
18. Fibrous roots in streambed	3 ○	2 ●	1 ○	0 ○
19. Rooted upland plants in streambed	3 ●	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ●	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ●	1 ○	2 ○	3 ○
22. Fish	0 ●	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ●	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ○	0.5 ●	1 ○	1.5 ○
25. Algae	0 ●	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ●	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/15/2020	**Project/Site:** Wits End/UT4	**Latitude:** 34.909150
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.444794
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 22.50	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 11.0)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made 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 = 5.00)				
18. Fibrous roots in streambed	3 ○	2 ◉	1 ○	0 ○
19. Rooted upland plants in streambed	3 ◉	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ◉	0.5 ○	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/15/2020	**Project/Site:** Wits End/UT5	**Latitude:** 34.908106
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.442542
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 27.00	**Stream Determination (circle one)** Ephemeral Intermittent ✓ Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 13.0)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0 ○	1 ○	2 ◉	3 ○
13. Iron oxidizing bacteria	0 ◉	1 ○	2 ○	3 ○
14. Leaf litter	1.5 ◉	1 ○	0.5 ○	0 ○
15. Sediment on plants or debris	0 ◉	0.5 ○	1 ○	1.5 ○
16. Organic debris lines or piles	0 ○	0.5 ○	1 ◉	1.5 ○
17. Soil-based evidence of high water table?	No = 0 ○		Yes = 3 ◉	

C. Biology (Subtotal = 6.50)				
18. Fibrous roots in streambed	3 ◉	2 ○	1 ○	0 ○
19. Rooted upland plants in streambed	3 ◉	2 ○	1 ○	0 ○
20. Macrobenthos (note diversity and abundance)	0 ◉	1 ○	2 ○	3 ○
21. Aquatic Mollusks	0 ◉	1 ○	2 ○	3 ○
22. Fish	0 ◉	0.5 ○	1 ○	1.5 ○
23. Crayfish	0 ◉	0.5 ○	1 ○	1.5 ○
24. Amphibians	0 ○	0.5 ◉	1 ○	1.5 ○
25. Algae	0 ◉	0.5 ○	1 ○	1.5 ○
26. Wetland plants in streambed	FACW = 0.75; ○	OBL = 1.5 ○	Other = 0 ◉	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/15/2020	**Project/Site:** Wits End/Waxhaw Br (DS)	**Latitude:** 34.908794
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.442535
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 41.00	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 23.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10.0)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 7.50)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75;	OBL = 1.5	Other = 0	

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

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 7/15/2020	**Project/Site:** Wits End/Waxhaw Br (US)	**Latitude:** 34.917755
Evaluator: A. Baldwin	**County:** Union	**Longitude:** -80.446212
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 36.50	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** e.g. Quad Name: Wingate

A. Geomorphology (Subtotal = 17.0)	Absent	Weak	Moderate	Strong
1[a]. Continuity of 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 controls	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] Man-made ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9.5)				
12. Presence of Baseflow	0	1	2	3 ●
13. Iron oxidizing bacteria	0 ●	1	2	3
14. Leaf litter	1.5 ●	1	0.5	0
15. Sediment on plants or debris	0	0.5	1 ●	1.5
16. Organic debris lines or piles	0	0.5	1 ●	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3 ●	

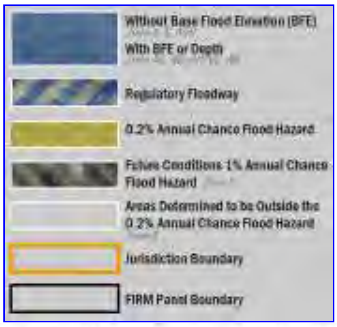
C. Biology (Subtotal = 10.00)				
18. Fibrous roots in streambed	3 ●	2	1	0
19. Rooted upland plants in streambed	3 ●	2	1	0
20. Macrobenthos (note diversity and abundance)	0 ●	1	2	3
21. Aquatic Mollusks	0 ●	1	2	3
22. Fish	0	0.5	1 ●	1.5
23. Crayfish	0 ●	0.5	1	1.5
24. Amphibians	0	0.5	1 ●	1.5
25. Algae	0	0.5 ●	1	1.5
26. Wetland plants in streambed	FACW = 0.75;		OBL = 1.5 ●	Other = 0

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

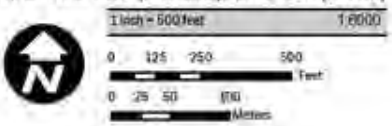
Notes:

Sketch:

Northing: = 428,368, Easting = 1,565,153 Northing: = 428,368, Easting = 1,568,622



North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)



Northing: = 424,899, Easting = 1,565,153 Northing: = 424,899, Easting = 1,568,622

This is an official copy of a portion of the above referenced flood map. This map incorporates changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov.

Save PDF

FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

NORTH CAROLINA
Panel(s):5462

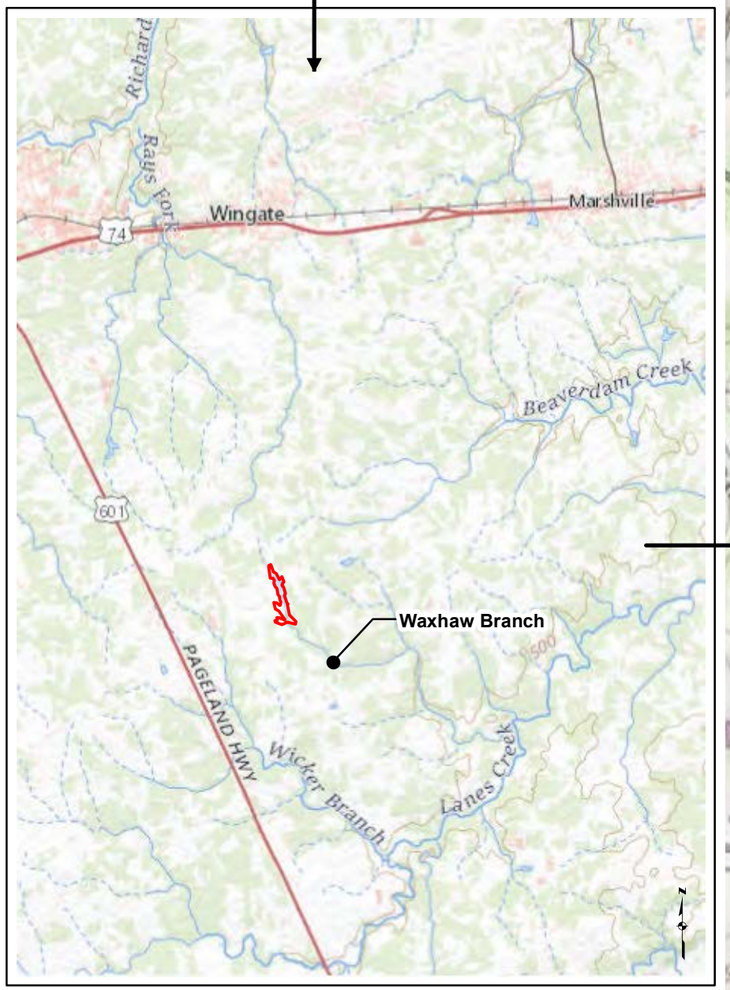
CONTAINS:

COMMUNITY	CID
UNION COUNTY	370234

Notice to User: The Map Number(s) shown below should be used when placing map orders; the Community Number(s) shown above should be used on insurance applications for the subject community.

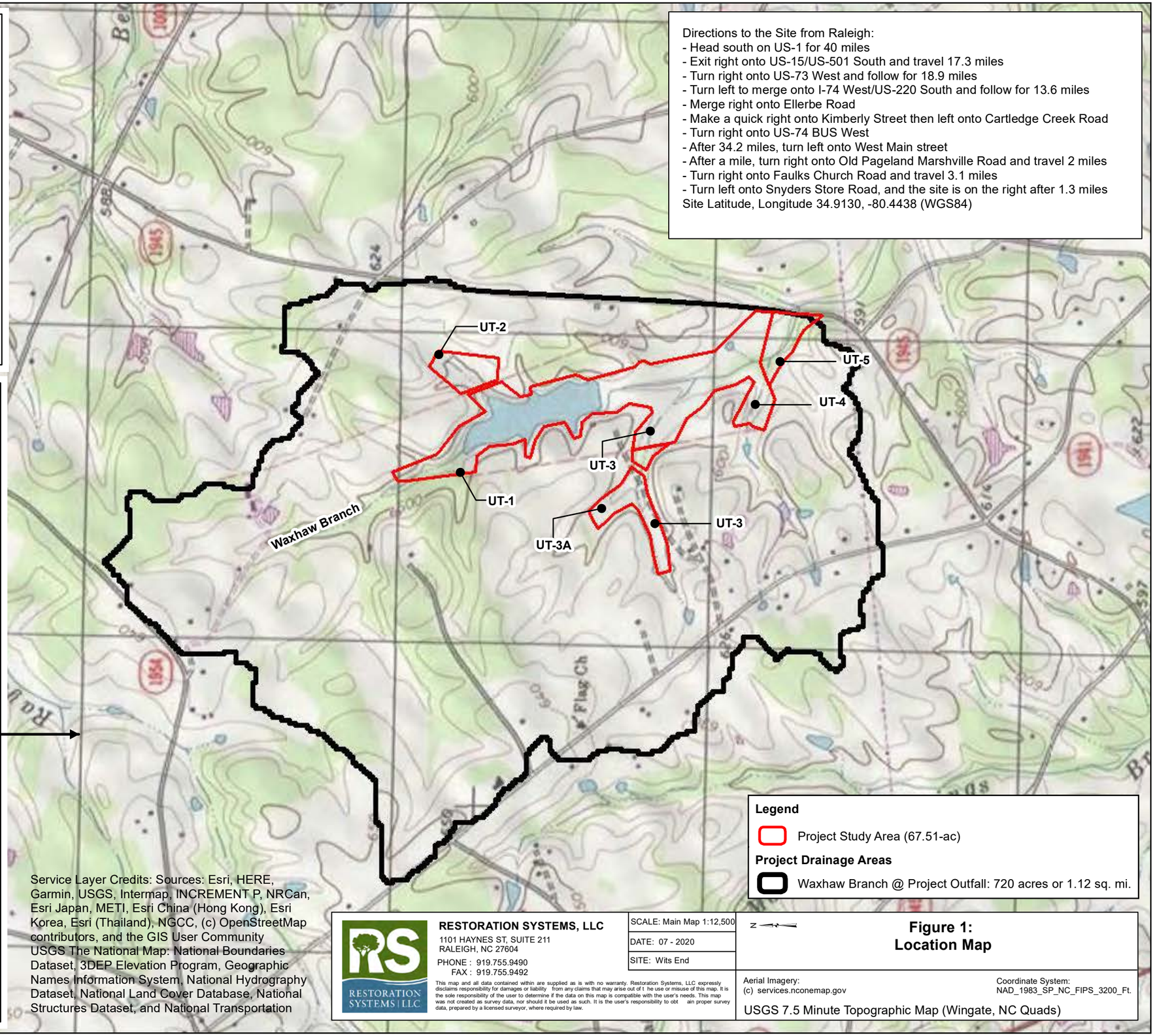
SELECTED PANELS:

MAP NUMBER	EFFECTIVE DATE
3710546200J	10/16/2008



Directions to the Site from Raleigh:
- Head south on US-1 for 40 miles
- Exit right onto US-15/US-501 South and travel 17.3 miles
- Turn right onto US-73 West and follow for 18.9 miles
- Turn left to merge onto I-74 West/US-220 South and follow for 13.6 miles
- Merge right onto Ellerbe Road
- Make a quick right onto Kimberly Street then left onto Cartledge Creek Road
- Turn right onto US-74 BUS West
- After 34.2 miles, turn left onto West Main street
- After a mile, turn right onto Old Pageland Marshville Road and travel 2 miles
- Turn right onto Faulks Church Road and travel 3.1 miles
- Turn left onto Snyders Store Road, and the site is on the right after 1.3 miles

Site Latitude, Longitude 34.9130, -80.4438 (WGS84)



Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation

Legend

Project Study Area (67.51-ac)

Project Drainage Areas

Waxhaw Branch @ Project Outfall: 720 acres or 1.12 sq. mi.

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

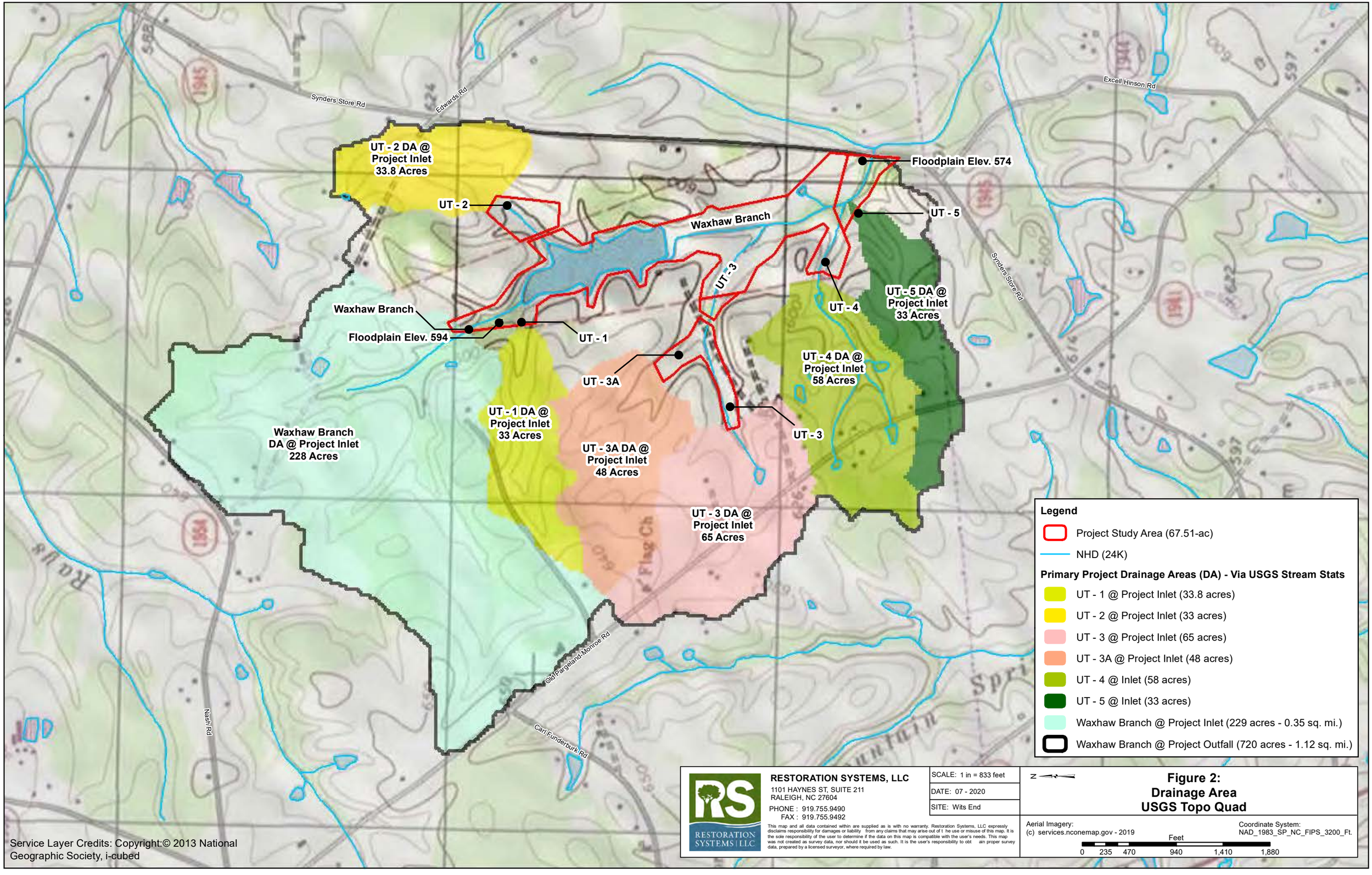
SCALE: Main Map 1:12,500
DATE: 07 - 2020
SITE: Wits End

Figure 1: Location Map

Aerial Imagery:
(c) services.nconemap.gov

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

USGS 7.5 Minute Topographic Map (Wingate, NC Quads)



RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

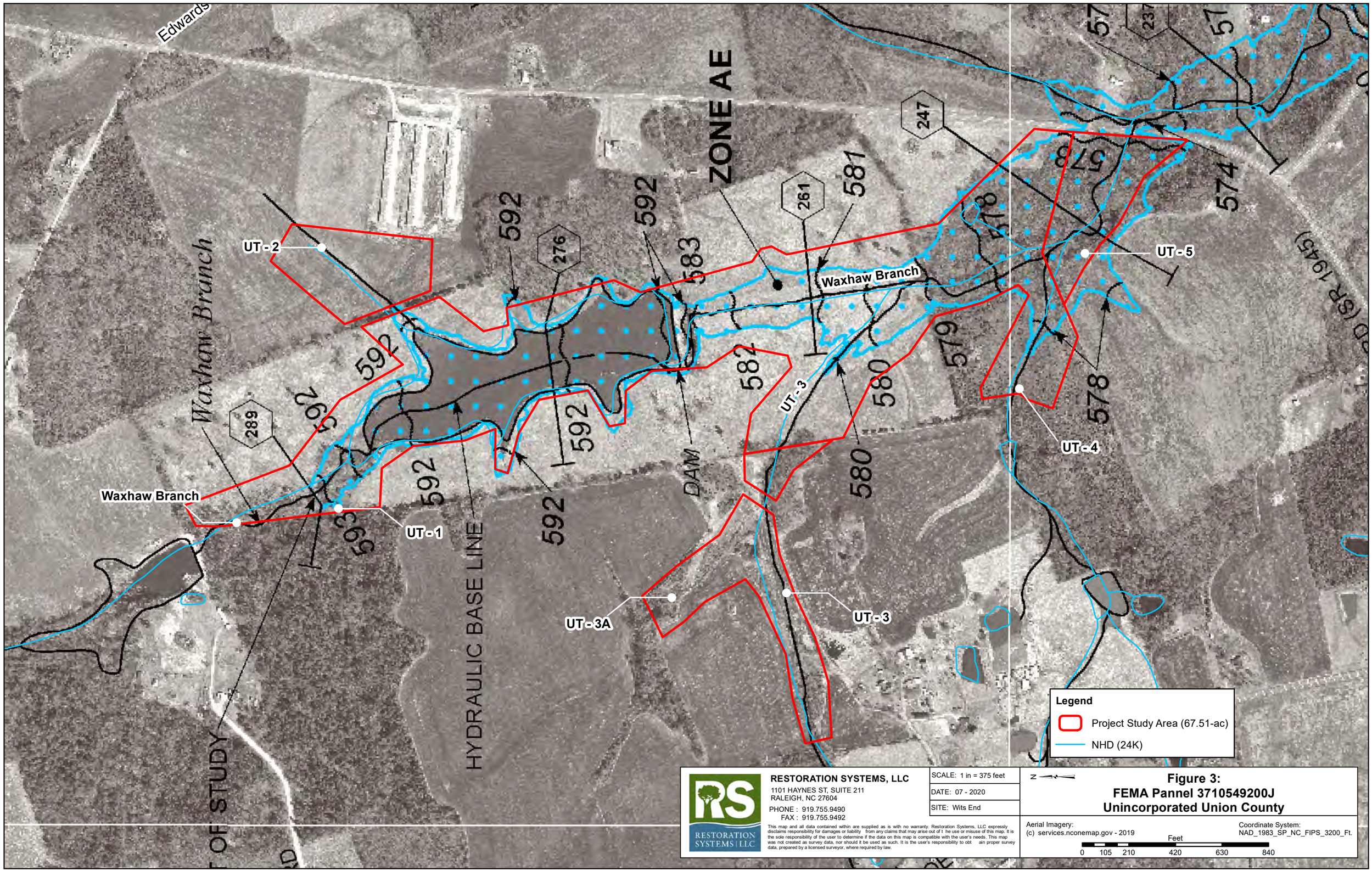
SCALE: 1 in = 833 feet
DATE: 07 - 2020
SITE: Wits End

Figure 2: Drainage Area USGS Topo Quad

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 235 470 940 1,410 1,880



RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

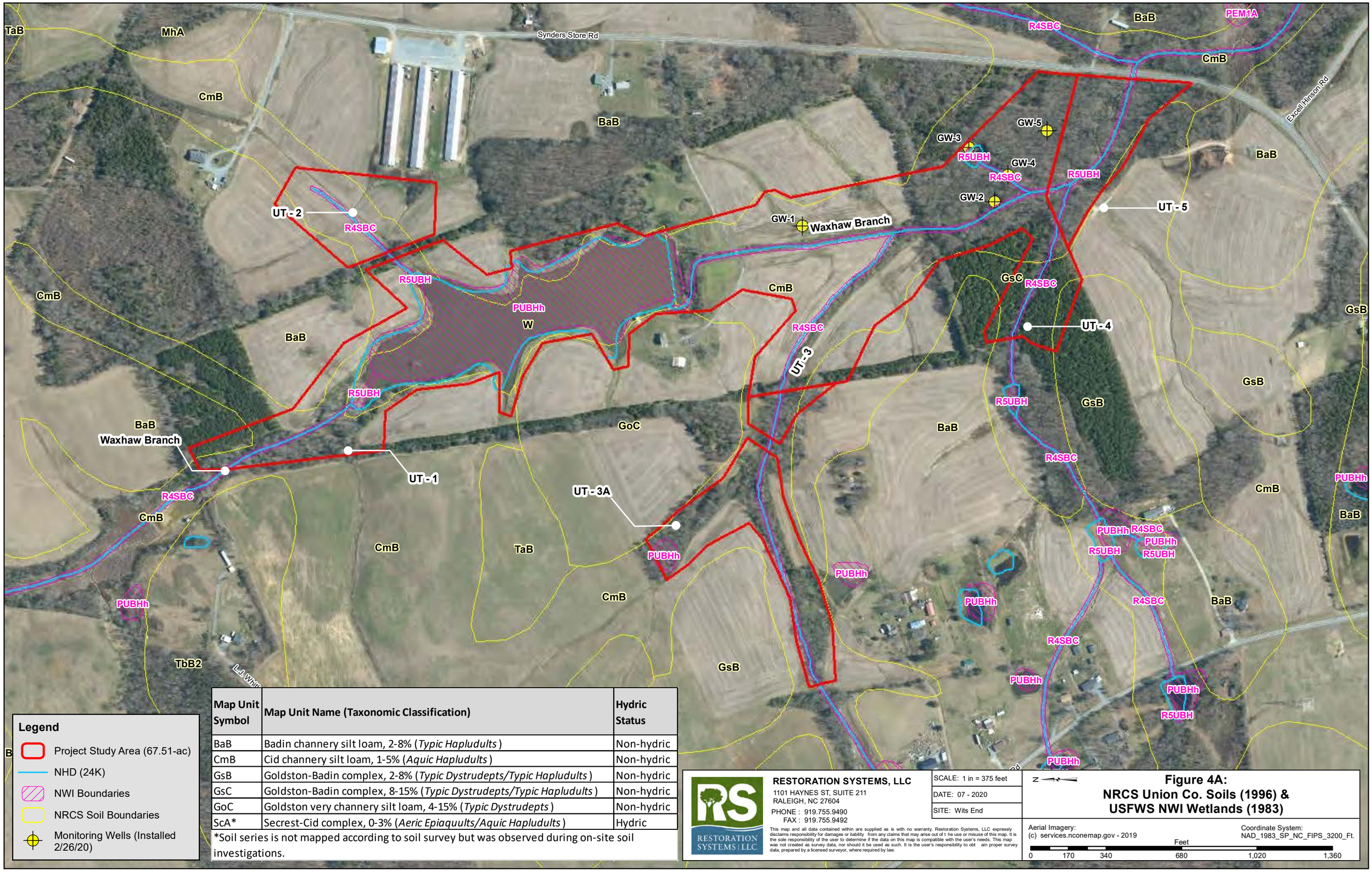
SCALE: 1 in = 375 feet
DATE: 07 - 2020
SITE: Wits End

Figure 3:
FEMA Pannel 3710549200J
Unincorporated Union County

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 105 210 420 630 840



Legend

- Project Study Area (67.51-ac)
- NHD (24K)
- NWI Boundaries
- NRCS Soil Boundaries
- Monitoring Wells (Installed 2/26/20)

Map Unit Symbol	Map Unit Name (Taxonomic Classification)	Hydric Status
BaB	Badin channery silt loam, 2-8% (*Typic Hapludults*)	Non-hydric
CmB	Cid channery silt loam, 1-5% (*Aquic Hapludults*)	Non-hydric
GsB	Goldston-Badin complex, 2-8% (*Typic Dystrudepts/Typic Hapludults*)	Non-hydric
GsC	Goldston-Badin complex, 8-15% (*Typic Dystrudepts/Typic Hapludults*)	Non-hydric
GoC	Goldston very channery silt loam, 4-15% (*Typic Dystrudepts*)	Non-hydric
ScA*	Secrest-Cid complex, 0-3% (*Aeric Epiaquults/Aquic Hapludults*)	Hydric

*Soil series is not mapped according to soil survey but was observed during on-site soil investigations.

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

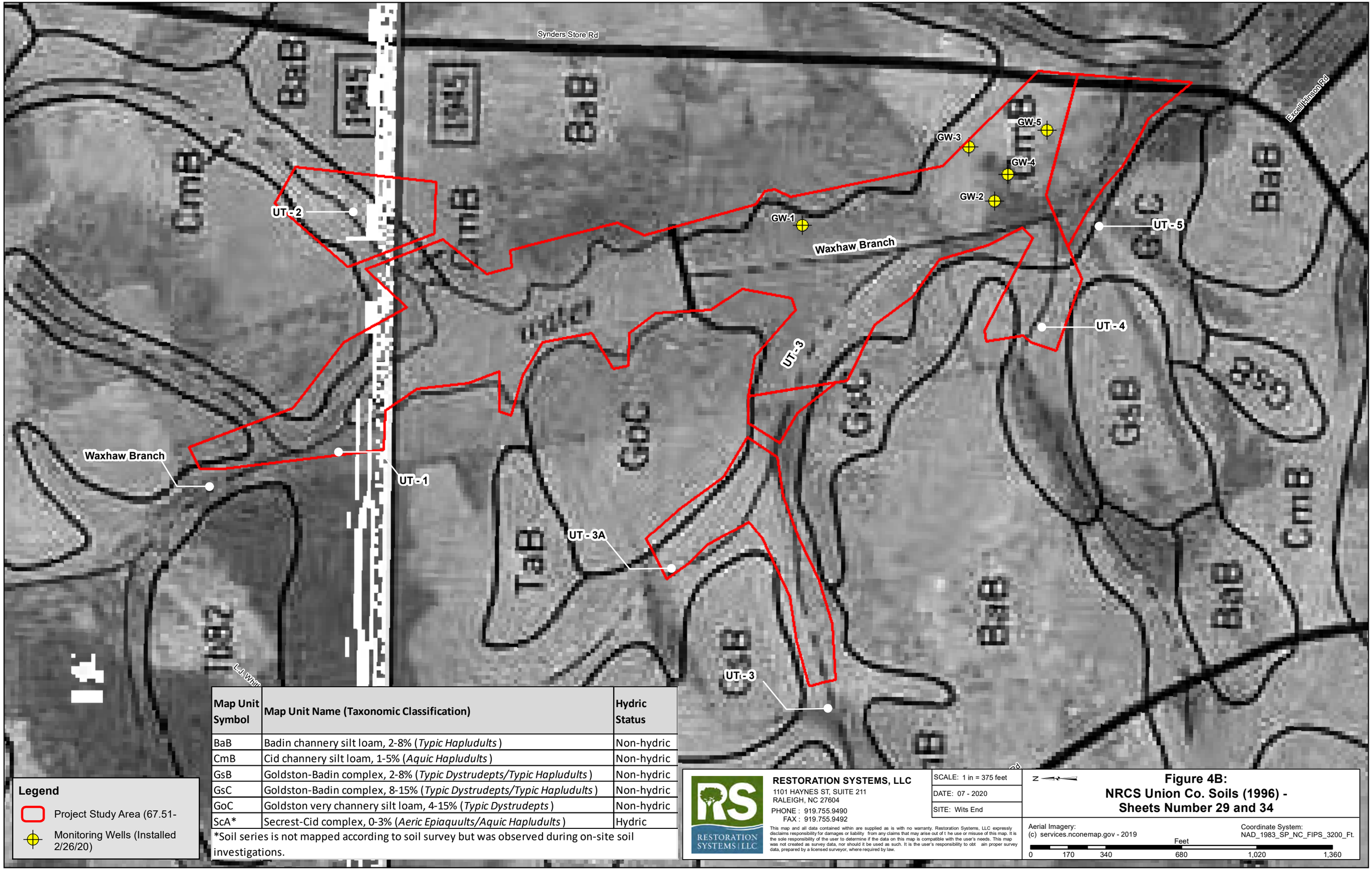
SCALE: 1 in = 375 feet
DATE: 07 - 2020
SITE: Wits End

Figure 4A:
NRCS Union Co. Soils (1996) & USFWS NWI Wetlands (1983)

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 170 340 680 1,020 1,360



Map Unit Symbol	Map Unit Name (Taxonomic Classification)	Hydric Status
BaB	Badin channery silt loam, 2-8% (*Typic Hapludults*)	Non-hydric
CmB	Cid channery silt loam, 1-5% (*Aquic Hapludults*)	Non-hydric
GsB	Goldston-Badin complex, 2-8% (*Typic Dystrudepts/Typic Hapludults*)	Non-hydric
GsC	Goldston-Badin complex, 8-15% (*Typic Dystrudepts/Typic Hapludults*)	Non-hydric
GoC	Goldston very channery silt loam, 4-15% (*Typic Dystrudepts*)	Non-hydric
ScA*	Secrest-Cid complex, 0-3% (*Aeric Epiaquults/Aquic Hapludults*)	Hydric

*Soil series is not mapped according to soil survey but was observed during on-site soil investigations.

Legend

- Project Study Area (67.51-
- Monitoring Wells (Installed 2/26/20)

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

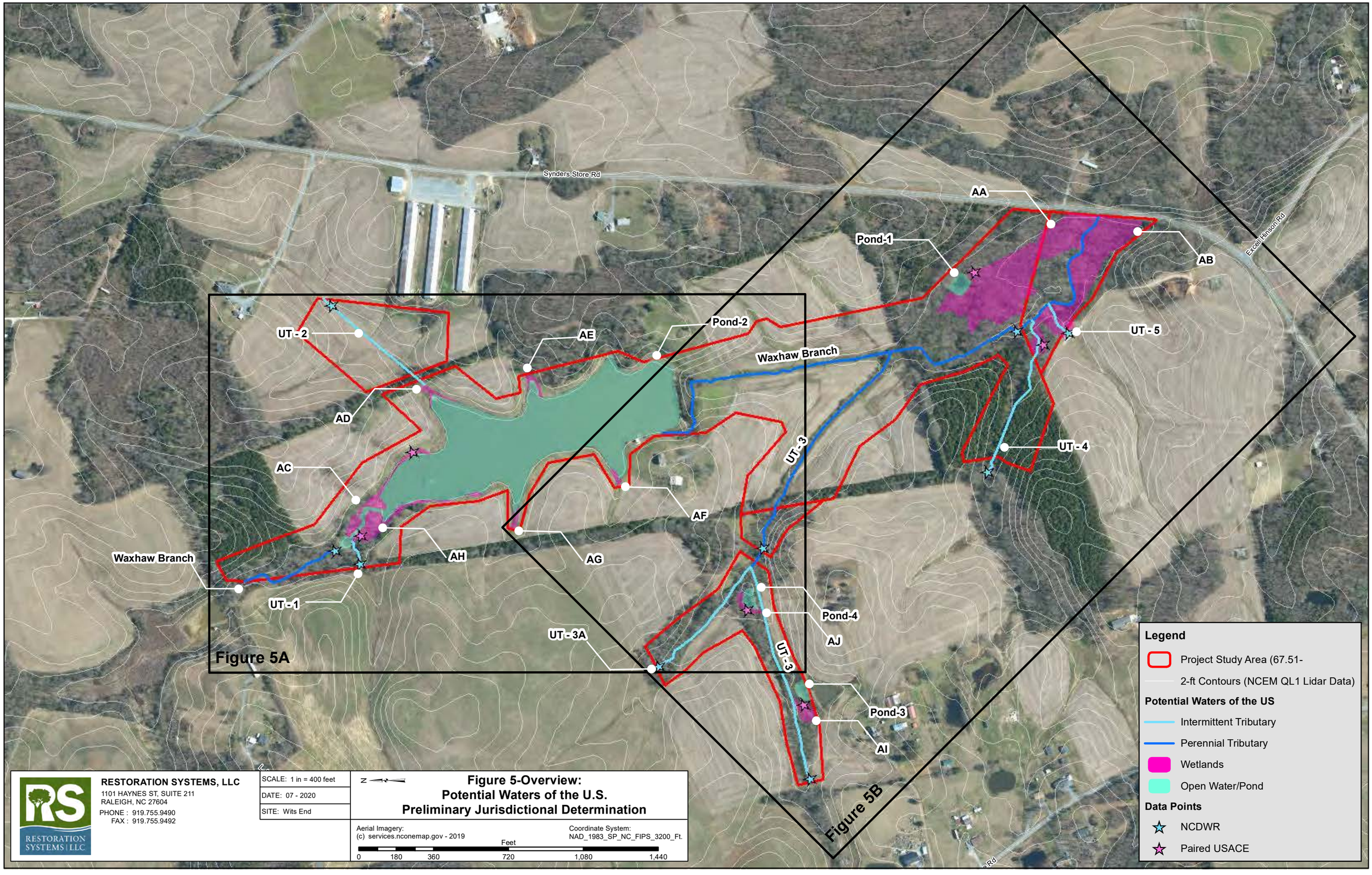
SCALE: 1 in = 375 feet
DATE: 07 - 2020
SITE: Wits End

Figure 4B:
NRCS Union Co. Soils (1996) - Sheets Number 29 and 34

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 170 340 680 1,020 1,360



RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

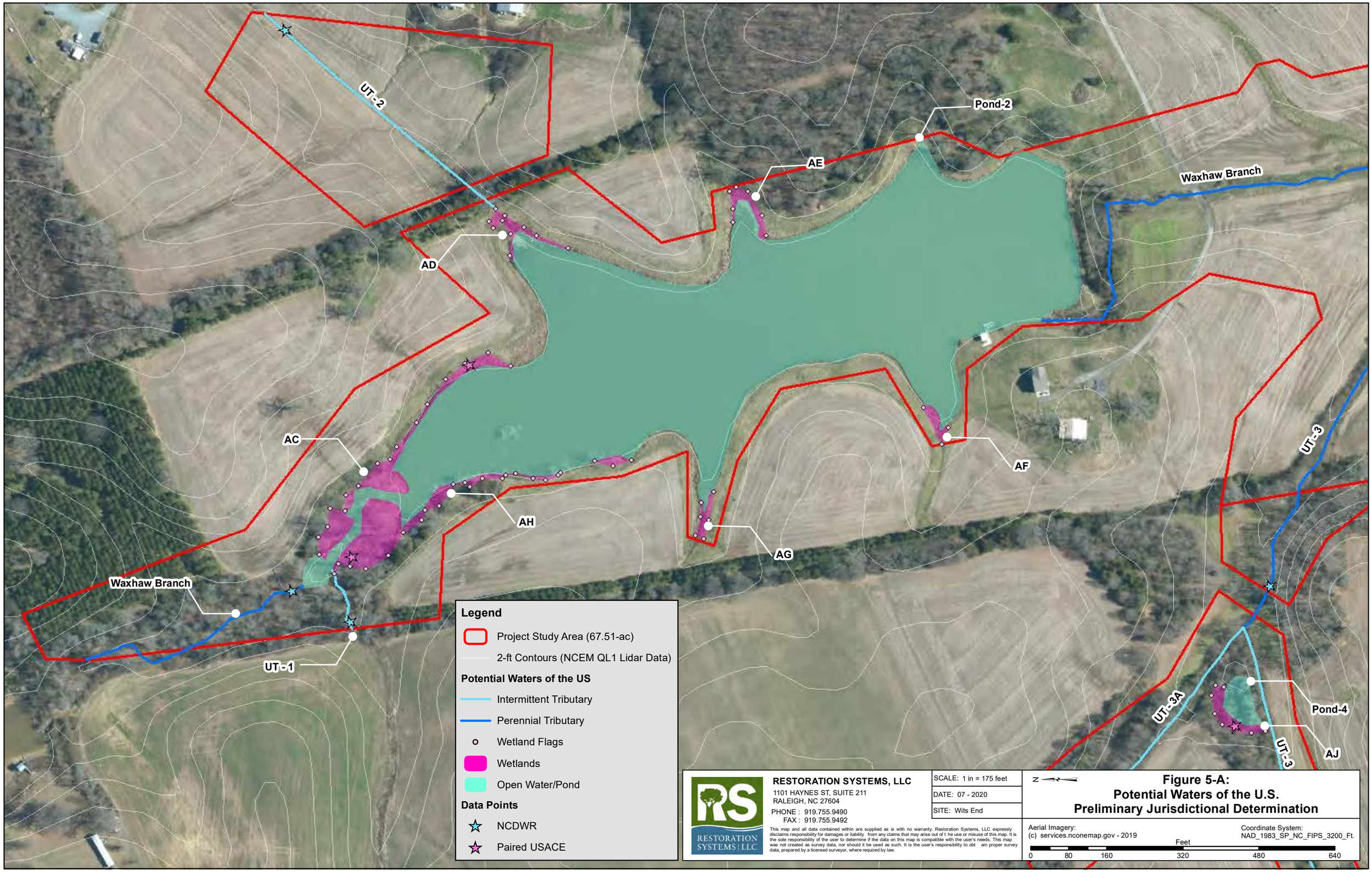
SCALE: 1 in = 400 feet	
DATE: 07 - 2020	
SITE: Wits End	

Figure 5-Overview:
Potential Waters of the U.S.
Preliminary Jurisdictional Determination

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 180 360 720 1,080 1,440



RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 175 feet
DATE: 07 - 2020
SITE: Wits End

Figure 5-A:
Potential Waters of the U.S.
Preliminary Jurisdictional Determination

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 80 160 320 480 640

Pond-2
AH
GW-1
Waxhaw Branch
Synders Store Rd
Pond-1
GW-3
AA
UT - 3
GW-4
GW-5
GW-2
UT-3A
AJ
Pond-4
UT-3
UT-5
AB
UT - 4
Pond-3
AI
Excell

Legend

- Project Study Area (67.51-ac)
- 2-ft Contours (NCEM QL1 Lidar Data)
- Monitoring Wells (Installed 2/26/20)

Potential Waters of the US

- Intermittent Tributary
- Perennial Tributary
- Wetland Flags
- Wetlands
- Open Water/Pond

Data Points

- NCDWR
- Paired USACE

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 217 feet
DATE: 07 - 2020
SITE: Wits End

Figure 5-B:
Potential Waters of the U.S.
Preliminary Jurisdictional Determination

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 100 200 400 600 800

WITS END PHOTO LOG

Photo 1: Wetland AA Upland Data Point – July 15, 2020

Photo 2: Wetland AA Wetland Data Point – July 15, 2020

Photo 3: Wetland AB Upland Data Point – July 15, 2020

Photo 4: Wetland AB Wetland Data Point – July 15, 2020

Photo 5: Wetland AC Upland Data Point – July 15, 2020

Photo 6: Wetland AC Wetland Data Point – July 15, 2020

Photo 7: Wetland AH Upland Data Point – July 15, 2020

Photo 8: Wetland AH Wetland Data Point – July 15, 2020

Photo 7: Wetland AI Upland Data Point – July 14, 2020

Photo 8: Wetland AI Wetland Data Point – July 14, 2020

Photo 9: Wetland AJ Upland Data Point – July 14, 2020

Photo 10: Wetland AJ Wetland Data Point – July 14, 2020

Photo 11: Waxhaw Branch Upstream Data Point entering pond facing downstream – Feb 13, 2019

Photo 12: Waxhaw Branch Downstream Data Point facing downstream – July 15, 2020

Photo 13: UT-1 Data Point facing downstream – July 15, 2020

Photo 14: UT-2 Data Point facing downstream – July 15, 2020

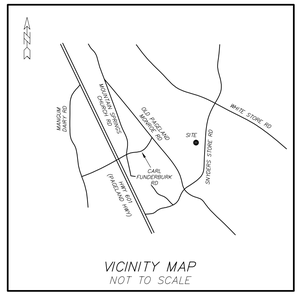
Photo 15: UT-3 Intermittent Data Point facing downstream – July 15, 2020

Photo 16: UT-3A Data Point facing downstream – July 15, 2020

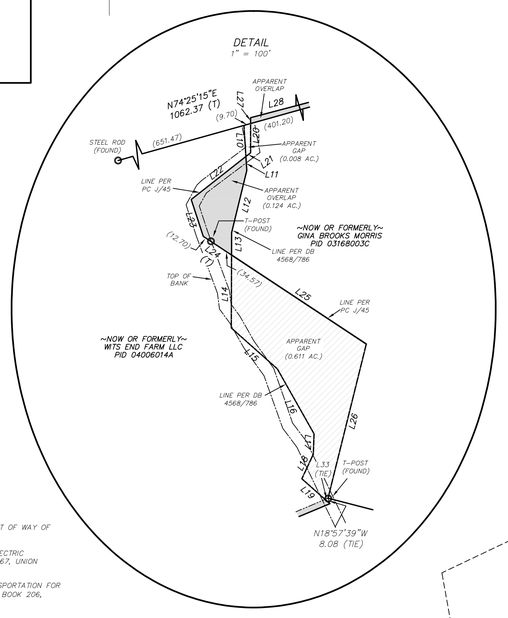
Photo 17: UT-4 Data Point facing downstream – July 15, 2020

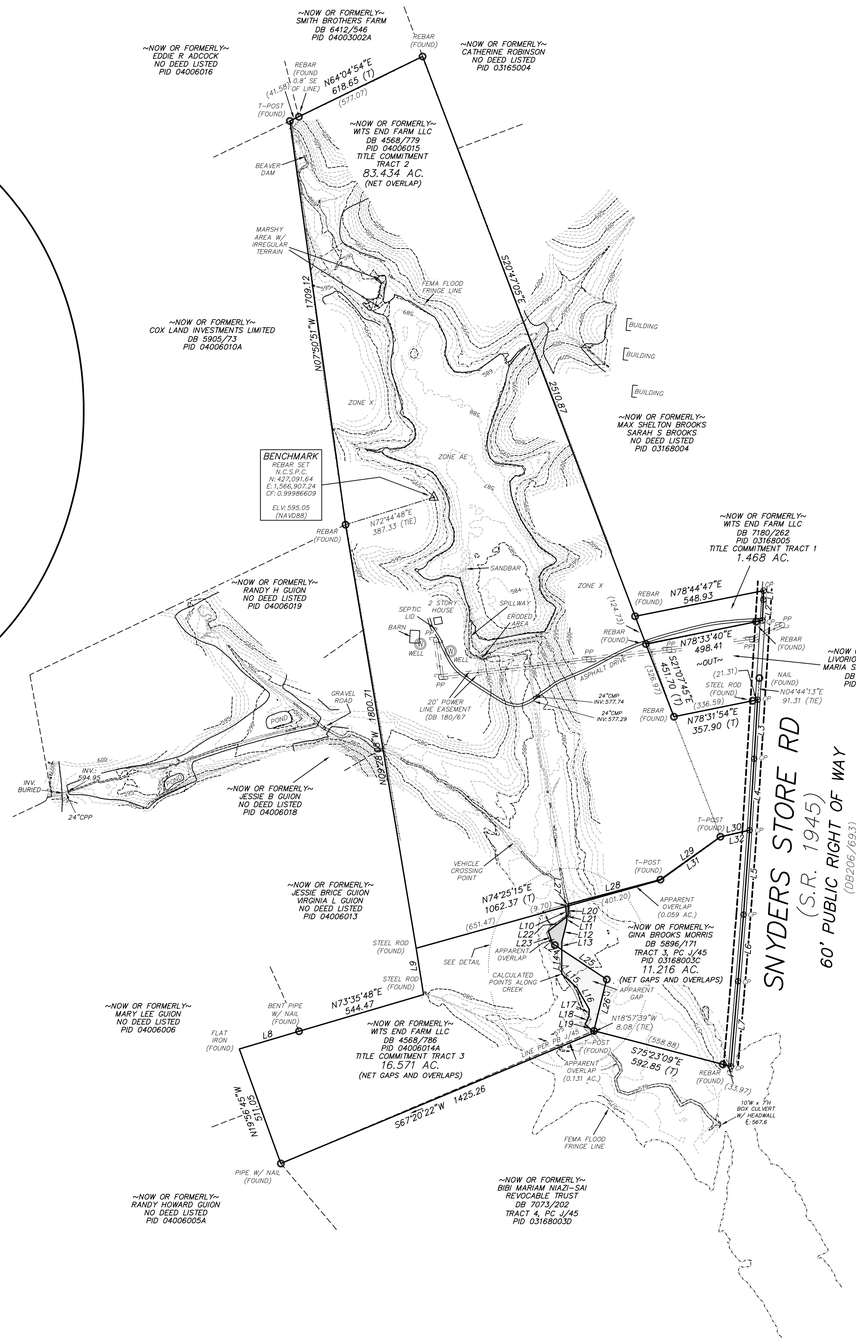
Photo 18: UT-5 Data Point facing downstream – July 15, 2020

Appendix D. Survey – Carolina Surveyors



VICINITY MAP
NOT TO SCALE





GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch = 300 ft.

REVISIONS:	DATE
TOPO ADDED	7/11/20
TOPO ADDED	8/20/20
TOPO ADDED	9/8/20

SCALE: 1" = 300'
2020\BAT\WTS END
2020\W\WTS END
PROJECT: 20-0252
DRAWN BY: NB
FIELD WORK: BG/SK/GW
JUNE 30, 2020

THIS IS TO CERTIFY TO FIRST AMERICAN TITLE INSURANCE COMPANY & RESTORATION SYSTEMS, LLC.THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1,2,3,4,6(a),7,8,11,13,&14 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED ON 6/26/20

THOMAS E. WHITE — DATE

LINE TABLE		
LINE	BEARING	LENGTH
L1	S01°11'44"W	37.48
L2	S02°42'39"W	87.25
L3	N03°21'56"E	248.05
L4	N03°36'05"E	300.00
L5	N04°07'57"E	354.82
L6	N04°39'05"E	280.71
L7	N04°56'07"E	358.31
L8	N73°28'44"E	261.39
L9	N09°05'24"W	196.80
L10	S03°40'20"E	43.45
L11	S03°40'20"E	19.51
L12	S13°45'12"W	89.44
L13	S00°10'58"W	31.38
L14	S00°10'58"W	102.04
L15	S48°20'58"E	86.02
L16	S29°30'40"E	104.40
L17	S02°03'59"W	28.52
L18	S25°06'00"W	37.74
L19	S48°23'03"E	52.45
L20	S00°06'24"E	40.74
L21	S51°45'31"W	8.44
L22	S51°45'31"W	97.34
L23	S18°11'31"E	54.12
L24	S56°33'02"E	47.27
L25	S56°33'02"E	225.84
L26	S13°56'52"W	222.00
L27	S00°06'24"E	8.15
L28	N75°11'52"E	400.00
L29	N54°26'52"E	309.00
L30	N77°25'21"E	126.05
L31	N54°15'24"E	310.96
L32	N77°04'35"E	125.46
L33	N67°00'56"E	4.39

SYMBOL LEGEND

- SET MONUMENT (TYPE INDICATED)
- EXISTING MONUMENT (TYPE INDICATED)
- CP — CALCULATED POINT
- GV — GAS VALVE
- WV — WATER VALVE
- MB — MAIL BOX
- WM — WATER METER
- W — WELL
- FH — FIRE HYDRANT
- SSMH — SANITARY SEWER MANHOLE
- SDMH — STORM DRAIN MANHOLE
- T — TELEPHONE/COMMUNICATIONS MANHOLE
- E — ELECTRIC MANHOLE
- DECIDUOUS TREE
- EVERGREEN TREE
- LP — LIGHT POLE
- PP — POWER/UTILITY POLE
- BFP — BACK FLOW PREVENTOR
- GW — GUY WIRE
- CB — CATCH BASIN
- DI — DROP INLET
- YI — YARD INLET

LINETYPE LEGEND

- BOUNDARY LINE
- TIE LINE
- RIGHT OF WAY
- APPROXIMATE RIGHT OF WAY (NOT SURVEYED)
- ADJOINING LINE (NOT SURVEYED)

LEGEND:

EIP = EXISTING IRON PIN
OIP = OLD IRON PIPE
SIP = SET IRON PIN
R/W = RIGHT OF WAY
AC = AIR CONDITIONING UNIT
PWR = POWER POLE
PM = POWER METER
PP = POWER POLE
LP = LIGHT POLE
GM = GAS METER
TELE = TELEPHONE PEDESTAL
CATV = CABLE TELEVISION
FOB = FIBER OPTIC BOX
WM = WATER METER
FES = FLARED END SECTION
RCP = REINFORCED CONCRETE PIPE
CMP = CORRUGATED METAL PIPE
CPP = CORRUGATED PLASTIC PIPE
PVC = POLYVINYL CHLORIDE PIPE
DU = DESTINATION UNKNOWN
SDE = STORM DRAINAGE EASEMENT
SDMH = STORM DRAIN MANHOLE
CB = CATCH BASIN
YI = YARD INLET
DI = DROP INLET
SSE = SANITARY SEWER EASEMENT
SSMH = SANITARY SEWER MANHOLE
CO = SEWER CLEAN OUT
BC = BACK OF CURB
(T) = TOTAL DISTANCE

FIRST AMERICAN TITLE INSURANCE COMPANY
COMMITMENT NO.: 20-NC-26655
COMMITMENT DATE: MAY 27, 2020 AT 08:00 AM

AS TO TRACT 1

5. TITLE OF ANY PORTION OF LAND LYING WITHIN THE RIGHT OF WAY OF SNYDERS STORE ROAD (SR 1945).

6. EASEMENT(S) AND/OR RIGHT(S) OF WAY TO PEE DEE ELECTRIC MEMBERSHIP CORPORATION RECORDED IN BOOK 180, PAGE 67, UNION COUNTY REGISTRY.

7. 60 FOOT WIDE RIGHT OF WAY TO DEPARTMENT OF TRANSPORTATION FOR SR 1945 (KNOWN AS SNYDERS STORE ROAD) RECORDED IN BOOK 206, PAGE 693, UNION COUNTY REGISTRY. **(AS SHOWN)**

AS TO TRACT 2

8. EASEMENT(S) AND/OR RIGHT(S) OF WAY TO PEE DEE ELECTRIC MEMBERSHIP CORPORATION RECORDED IN BOOK 180, PAGE 67, UNION COUNTY REGISTRY.

9. 60 FOOT WIDE RIGHT OF WAY TO DEPARTMENT OF TRANSPORTATION FOR SR 1945 (KNOWN AS SNYDERS STORE ROAD) RECORDED IN BOOK 206, PAGE 693, UNION COUNTY REGISTRY. **(AS SHOWN)**

10. RIGHTS OF OTHERS INCLUDING RIPARIAN, LITTORAL AND DRAINAGE IN AND TO THE WATERS OF ANY BRANCH, RIVER, STREAM, CREEK, LAKE, CANAL, DITCH OR OTHER WATERCOURSE WHICH JOINS OR TRAVERSES THE LAND.

AS TO TRACT 3

11. TRACT 3 LACKS INDEPENDENT MEANS OF ACCESS AND RELIES UPON ADJACENT TRACTS FOR ACCESS.

NOTES:

1. IRON PINS SET AT ALL CORNERS UNLESS OTHERWISE NOTED.
2. PROPERTY ZONED: R4-40 (SETBACKS & ZONING MATTERS ARE SUBJECT TO INTERPRETATION BY LOCAL MUNICIPALITIES)
3. TAX PARCEL NUMBERS AS SHOWN.
4. DEED REFERENCES AS SHOWN.
5. BOUNDARY SURVEY ONLY THROUGH POINTS AS SHOWN.
6. THIS PROPERTY IS LOCATED WITHIN AN AREA HAVING A ZONE DESIGNATION AE BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA), ON FLOOD INSURANCE RATE MAP (FIRM) NO. 3710546200J, WITH A DATE OF IDENTIFICATION OF 10/16/2008.
7. THIS PROPERTY MAY BE SUBJECT TO ADDITIONAL RECORDED OR UNRECORDED EASEMENTS, RIGHTS-OF-WAY, OR RESTRICTIVE COVENANTS, OTHER THAN SHOWN.
8. AREA COMPUTED BY COORDINATED METHOD.
9. NO NCGS MONUMENT FOUND WITHIN 2000'.
10. UTILITY LOCATIONS SHOWN ARE LOCATED BASED ON SITE CONDITIONS AT THE TIME OF SURVEY. CONTRACTORS ARE TO HAVE ALL UTILITIES ACCURATELY MARKED PRIOR TO CONSTRUCTION.
11. ANY CONSTRUCTION OR USE WITHIN ANY DELINEATED FLOOD AREA IS SUBJECT TO THE RESTRICTIONS IMPOSED BY ANY APPLICABLE ORDINANCES OR REGULATIONS.
12. OFFSITE ADJOINER LINES AND RIGHT-OF-WAY LINES SHOWN AS DASHED ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.
13. LINES SHOWN REPRESENTING FENCES AND WALLS ARE MEASURED FROM THE APPROXIMATE CENTERLINE AND DO NOT ACCOUNT FOR THE THICKNESS, PLUMBNESS OR MEANDER OF THE FENCE UNLESS OTHERWISE STATED.
14. DISTANCES SHOWN ARE U.S. SURVEY FEET UNLESS OTHERWISE NOTED.

THE FOLLOWING WAS USED TO ESTABLISH N.C.S.P.C. INFORMATION:
(1) CLASS OF SURVEY: A-URBAN LAND SURVEY
(2) POSITIONAL ACCURACY: 0.10'
(3) TYPE OF GPS FIELD PROCEDURE: STATIC, ONLINE POSITION USER SERVICE
(4) DATES OF SURVEY: 6/19/2020
(5) DATUM/EPOCH: NAD 83 (2011), EPOCH 2010
(6) PUBLISHED/FIXED-CONTROL USE: CORS SITES

DK7756 SCSR ED OWENS CORS ARP	N335522.010 W0802026.579	110465.3
DK7758 SCUN UNION CORS ARP	N344558.605 W0813855.699	111354.9
DM3995 NCRO ROCKINGHAM CORS ARP	N345751.987 W0794747.740	59469.3
DI1682 NCLU LUMBERTON CORS ARP	N343736.336 W0790439.694	129159.0
DO2638 SCWH WHITE ROSE CORS ARP	N345857.038 W0811157.440	69331.3

(7) GEOID MODEL: GEOID18; NAVD 88
(8) COMBINED GRID FACTOR(S): 0.99986609
(9) UNITS: U.S. SURVEY FEET

CAROLINA SURVEYORS, INC.
P.O. BOX 267 PINEVILLE, N.C. 28134 - 0267
THOMAS E. WHITE, NCPLS & SCPLS 704-889-7601
CERTIFICATE OF AUTHORIZATION NC:C-1242 SC:8884

#2410 SNYDERS STORE ROAD

AN ALTA/ NSPS LAND TITLE SURVEY SHOWING

SURVEYED FOR: RESTORATION SYSTEMS, LLC
TOTAL AREA: 113.622 ACRES

LANES CREEK TOWNSHIP, UNION COUNTY, NORTH CAROLINA

Appendix E. Subaqueous Soil Photo Log

Photo 1: Dam transect, soil cores 1-10 (Left to Right) – July 30, 2020

Photo 2: Dam transect, soil cores 11-18 (Left to Right) – July 30, 2020

Photo 3: Duck Blind transect, soil cores 1-10 (Left to Right) – July 30, 2020

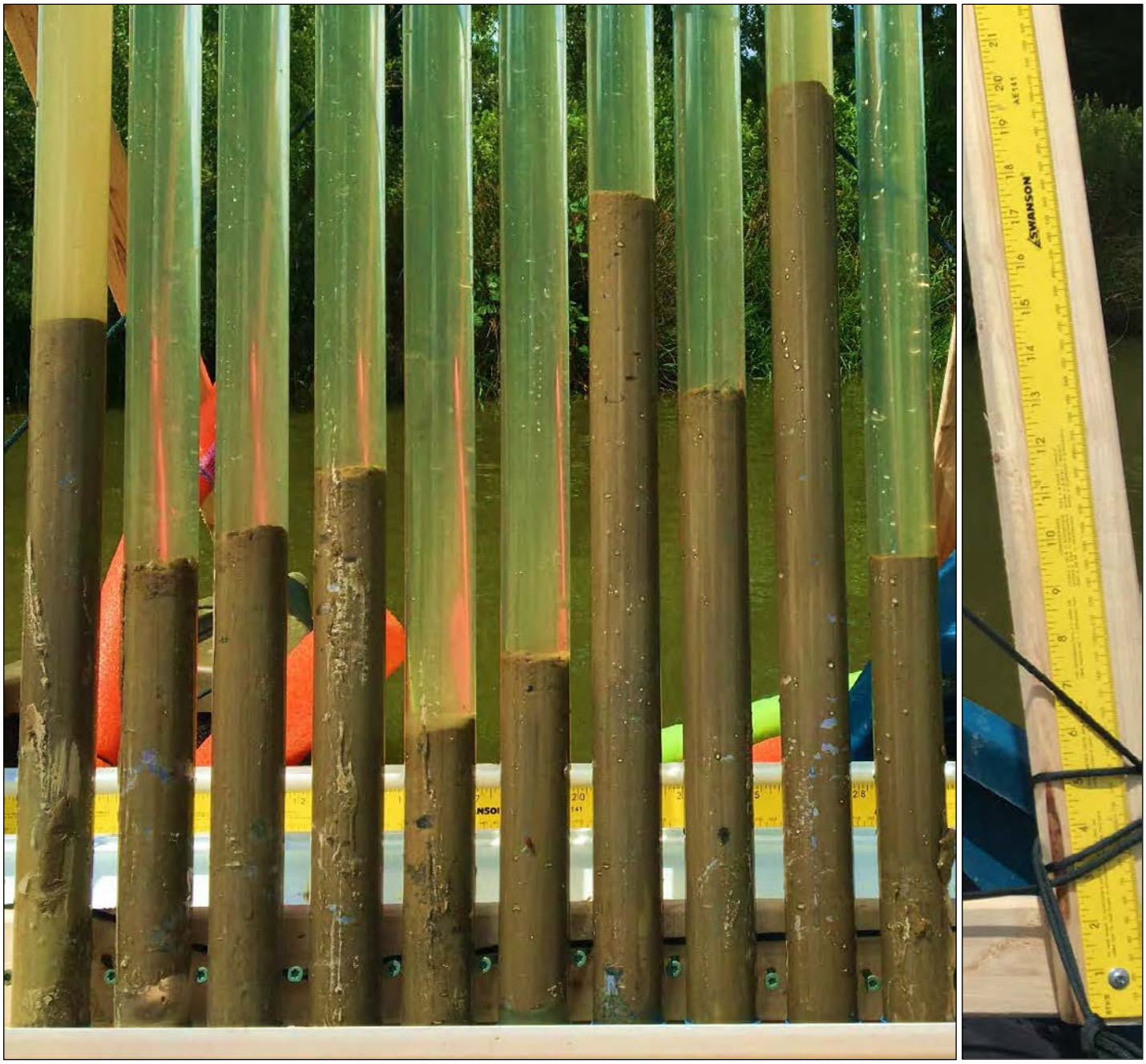


Photo 4: Island transect, soil cores 1-10 (Left to Right) – July 30, 2020

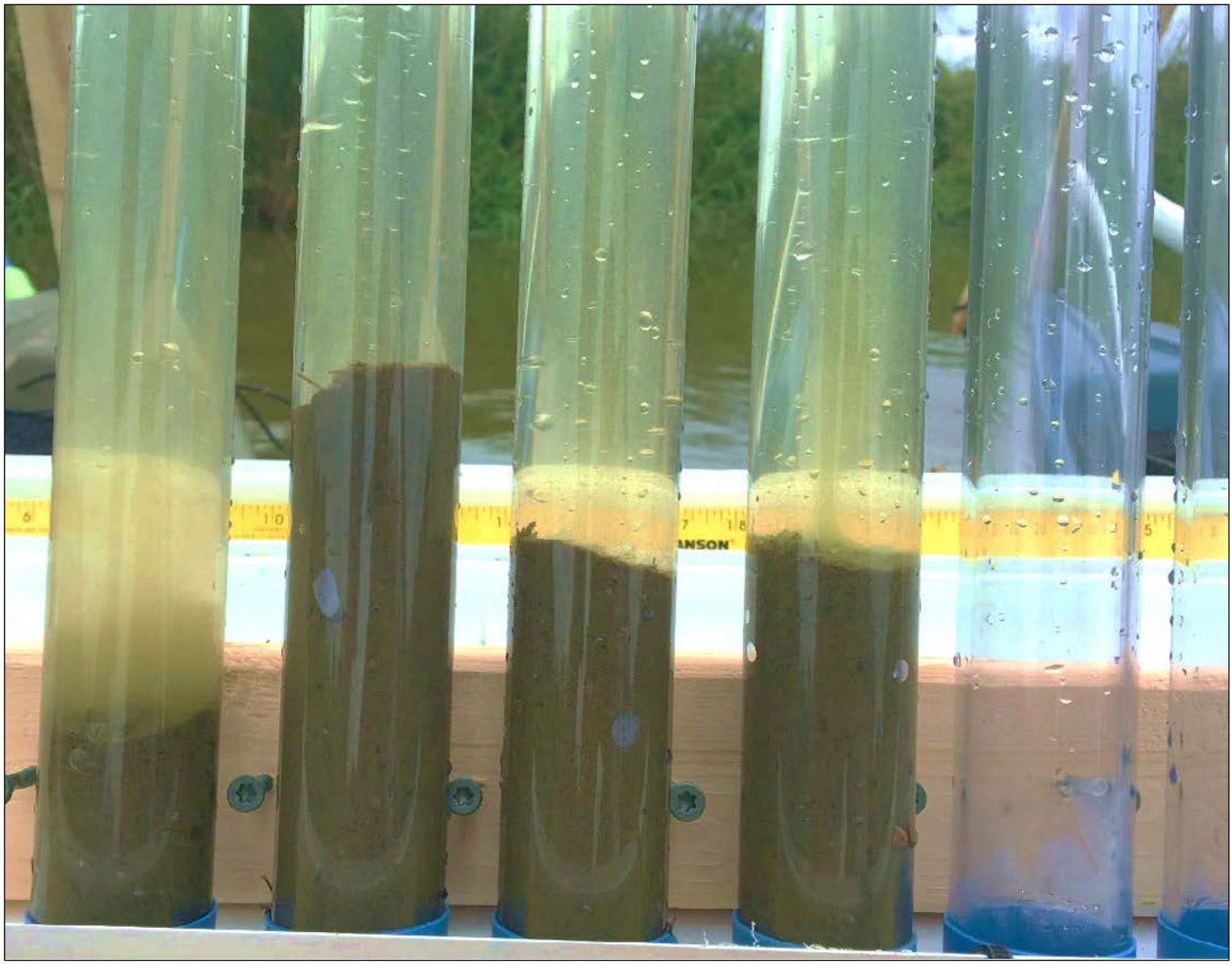


Photo 5: West Cove transect, soil cores 1-4 (Left to Right) – July 30, 2020

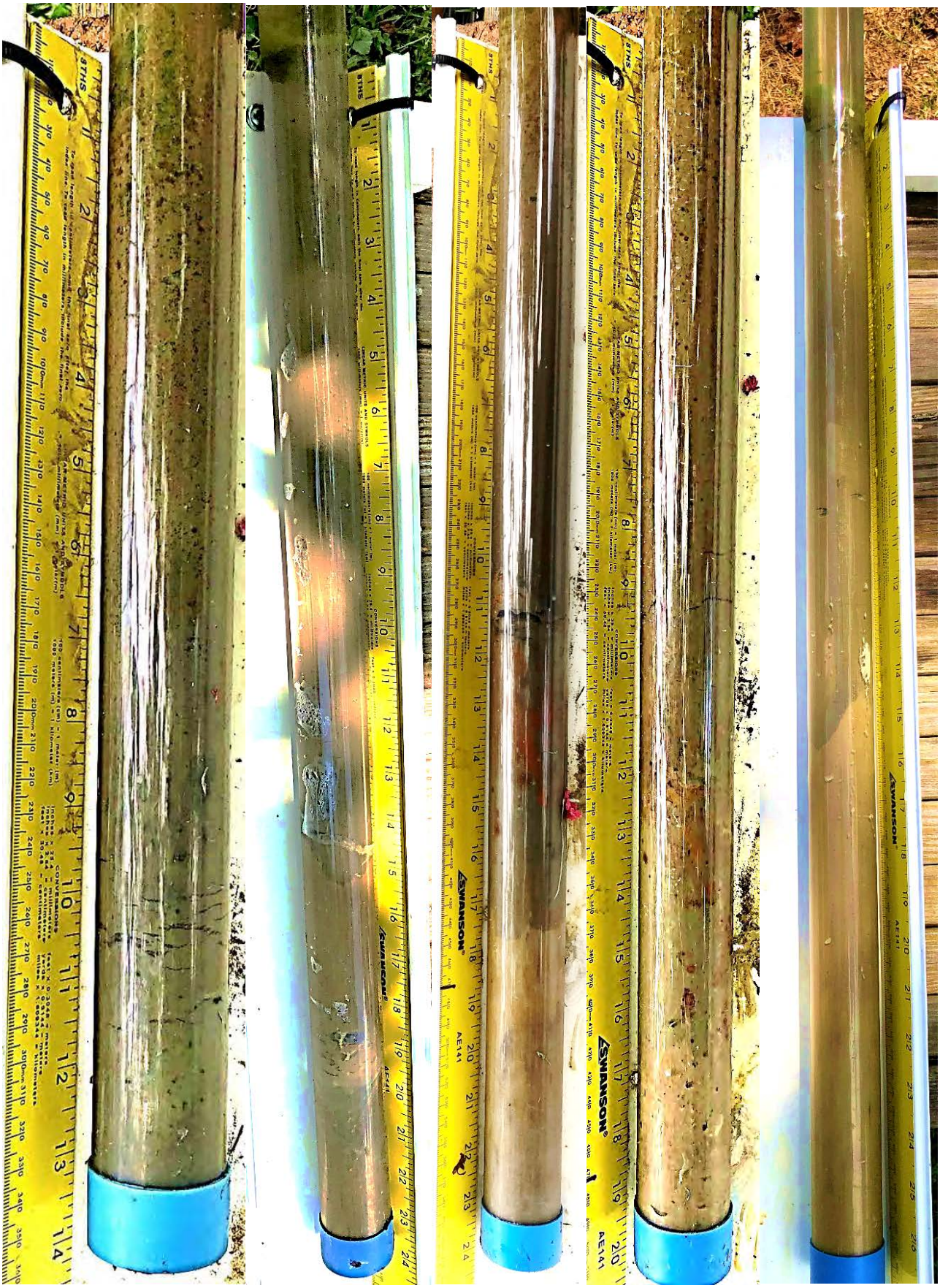


Photo 6: Center transect, soil cores 6-10 (Left to Right) – July 31, 2020

Appendix F. Soil Profile Descriptions

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #1

NAME: Alex Baldwin DATE: February 13, 2019

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.908665° N, 80.441294° W

WEATHER: Sunny, 50°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: 9-in DEPTH TO SHWT: 2-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	2.5Y 3/3	80	C/PL	10YR 4/6	20	Clay loam
2-9	2.5Y 4/3	75	C/PL	10YR 5/8	20	Clay
			C/M	5YR 3/4	5	
9-13+	2.5Y 5/3	90	C/PL	10YR 5/8	15	Clay
			C/M	5YR 3/4	5	

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

NOTES: Soil boring is in vicinity of monitoring gauge #5

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #2

NAME: Alex Baldwin DATE: February 13, 2019

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.909608° N, 80.442448 ° W

WEATHER: Sunny, 50°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: 7-in DEPTH TO SHWT: 1-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-1	2.5Y 4/3	85	C/PL	10YR 4/6	5	Clay loam
			C/M	10YR 3/6	10	
1-9	2.5Y 5/3	65	C/PL	10YR 4/6	20	Clay
			C/M	7.5YR 3/4	15	
9-15+	2.5Y 5/3	80	C/PL	10YR 5/8	15	Clay
			C/M	7.5YR 3/4	5	

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

NOTES: Debris lines in floodplain from surface water and water stains on trees, no channery observed

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #3

NAME: Alex Baldwin DATE: February 13, 2019

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.911654° N, 80.444949 ° W

WEATHER: Sunny, 50°

LANDSCAPE POSITION: Toeslope SLOPE (%): 3

VEGETATION/CROP: Fallow

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 9-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	2.5Y 4/3	95	C/PL	10YR 4/6	5	Clay loam
2-12	2.5Y 5/3	80	C/PL	7.5YR 4/6	15	Clay
			C/M	7.5YR 5/8	5	
12-15+	2.5Y 5/3	65	C/PL	7.5YR 4/6	5	Clay
			C/M	7.5YR 5/8	15	
			D/M	2.5Y 6/2	15	

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

NOTES: Active seeps observed in vicinity along toe of slope, some channery observed but not enough to modify texture

Photo 1

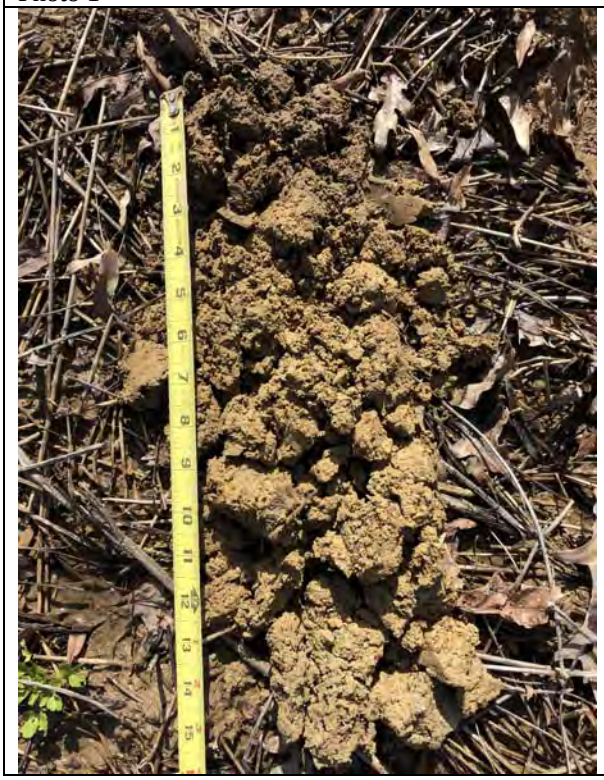


Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #4

NAME: Alex Baldwin DATE: February 13, 2019

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.911654° N, 80.443118 ° W

WEATHER: Sunny, 50°

LANDSCAPE POSITION: Toeslope SLOPE (%): 5

VEGETATION/CROP: Fallow

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 10-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-1	10YR 3/2	100				Clay loam
1-10	2.5Y 5/3	85	C/PL	2.5YR 6/4	10	Clay
			C/M	10YR 6/6	5	
10-17+	2.5Y 5/3	75	C/PL	2.5YR 6/4	10	Clay
			C/M	10YR 4/6	15	

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

NOTES: Active seeps observed in vicinity along toe of slope, some channery observed but not enough to modify texture

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #5

NAME: Alex Baldwin DATE: December 2, 2019

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.912926° N, 80.447357° W

WEATHER: Sunny, 50°

LANDSCAPE POSITION: Toeslope SLOPE (%): 5

VEGETATION/CROP: Successional forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 10-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	10YR 4/3	100				Loam
2-7	2.5Y 6/4	75	C/PL	7.5YR 4/6	5	Clay loam
			C/M	7.5YR 5/8	20	
7-14+	2.5Y 5/3	75	C/PL	7.5YR 4/6	15	Channery Clay
			C/M	7.5YR 5/8	15	
			C/M	10YR 5/8	5	
			D/M	2.5Y 5/2	5	

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

NOTES: _____

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #6

NAME: Alex Baldwin DATE: December 2, 2019

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.912926° N, 80.447357° W

WEATHER: Sunny, 50°

LANDSCAPE POSITION: Toeslope SLOPE (%): 3

VEGETATION/CROP: Fallow

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 9-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-4	2.5Y 4/3	95	C/PL	10YR4/6	5	Loam
4-9	2.5Y 5/4	80	C/PL	7.5YR 4/6	10	Clay loam
			C/M	7.5YR 5/6	10	
9-15+	2.5Y 5/3	70	C/PL	7.5YR 4/6	15	Clay loam
			C/M	7.5YR 5/6	15	

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

NOTES: Active seeps observed in vicinity along toeslope, channery observed but not enough to modify texture

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #7

NAME: Alex Baldwin DATE: December 2, 2019

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.912926° N, 80.447357° W

WEATHER: Partly Cloudy, 55°

LANDSCAPE POSITION: Floodplain SLOPE (%): 3

VEGETATION/CROP: Successional Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 2-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	2.5Y 4/3	95	C/PL	10YR4/6	5	Loam
2-9	2.5Y 5/3	65	C/PL	10YR4/6	10	Silt loam
			C/M	10YR 5/8	10	
			D/M	2.5Y 6/2	15	
9+	N/A	N/A	N/A	N/A	N/A	Ex. Channery

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

NOTES: Active seeps observed in vicinity along toeslope, bedrock observed in nearby streambed

Photo 1	Photo 2
	

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #8

NAME: Alex Baldwin DATE: February 26, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.909723° N, 80.441730° W

WEATHER: Partly Cloudy, 55°

LANDSCAPE POSITION: Toeslope SLOPE (%): 5

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: 7-in DEPTH TO SHWT: 2-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	10YR 3/2	100				Silt loam
2-12	2.5Y 4/3	80	C/PL	7.5YR 4/4	20	Clay loam
12-15	2.5Y 6/3	80	C/M	10YR 4/6	20	Clay
15-23+	2.5Y 6/3	60	C/M	10YR 5/8	30	Clay
			D/M	10YR 6/1	10	

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

NOTES: Debris lines observed in vicinity along toeslope from ephemeral flow of surrounding slopes, soil profile is near monitoring well 3

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #9

NAME: Alex Baldwin DATE: February 26, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.909210° N, 80.442087° W

WEATHER: Partly Cloudy, 50°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: 5-in DEPTH TO SHWT: 3-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	10YR 3/2	100	C/PL	7.5YR 4/6	5	Silt loam
3-9	2.5Y 5/3	80	C/M	7.5YR 4/6	20	Clay loam
9-16	2.5Y 5/3	65	C/M	7.5YR 4/6	20	Clay
			D/M	2.5Y 6/2	10	
16-25+	2.5Y 6/2	45	C/M	2.5Y 5/6	45	Clay
			C/M	10YR 3/6	10	

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

NOTES: Surrounding area includes depressions retaining surface water, debris lines observed from surface flow, soil profile is near monitoring well 4

Photo 1	Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #10

NAME: Alex Baldwin DATE: February 26, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.909398° N, 80.442512° W

WEATHER: Partly Cloudy, 50°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: 3-in DEPTH TO SHWT: 2-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	10YR 3/2	100				Silt loam
2-10	2.5Y 5/3	75	C/M	10YR 5/6	15	Clay loam
			C/M	7.5YR 5/6	10	
10-18+	2.5Y 6/4	90	C/M	10YR 5/6	10	Clay

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

NOTES: Surrounding area includes depressions retaining surface water, debris lines observed from surface flow, soil profile is near monitoring well 2

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #11

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.909013° N, 80.441633° W

WEATHER: Partly Cloudy, 85°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F3

DEPTH TO WATER: N/A DEPTH TO SHWT: 2-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	10YR 5/2	100	C/M	7.5YR 4/6	10	Clay loam
2-9	2.5Y 6/2	75	C/M	7.5YR 4/4	20	Silty clay loam
			C/M	7.5YR 5/8	10	
9-15+	2.5Y 6/3	90	C/M	7.5YR 4/6	5	Clay
			C/PL	7.5YR 4/6	20	
			C/M	10YR 5/8	15	

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

NOTES: Surrounding area includes depressions retaining surface water, debris lines observed from surface flow, soil profile is between monitoring wells 4 and 5.

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #12

NAME: Alex Baldwin DATE: July 22, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.912317° N, -80.446252° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Fallow

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F3

DEPTH TO WATER: N/A DEPTH TO SHWT: 7-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-4	10YR 3/2	100				Silt loam
4-7	2.5Y 6/3	45	C/M	10YR 4/6	10	Clay loam
	2.5Y 5/4	45				
7-12+	2.5Y 7/2	70	C/M	10YR 5/8	30	Clay

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

NOTES: Dry conditions made augering difficult in the subsoil, possibly indicating cemented silt particles

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #13

NAME: Alex Baldwin DATE: July 22, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.9118367° N, -80.447785° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Squash

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: Disturbed F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 10-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-8	2.5Y 4/3	100				Loam
8-10	2.5Y 6/3	100				Clay loam
10-20+	2.5Y 5/6	80	C/M	10YR 6/8	10	Clay
			D/M	2.5Y 6/3	10	

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

NOTES: Garden area appears to be tilled annually, surface has channers, surface horizon has an abrupt boundary from historic plowing of the area

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #14

NAME: Alex Baldwin DATE: July 22, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.912251° N, -80.443548° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Toe slope SLOPE (%): 2

VEGETATION/CROP: Soybeans

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 3-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	10YR 3/2	100				Silt loam
3-6	2.5Y 4/3	90	C/PL	10YR 3/6	10	Clay loam
6-12+	2.5Y 5/6	85	C/PL	10YR 3/6	5	Clay
			C/M	10YR 6/8	10	

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

NOTES: _____

Photo 1

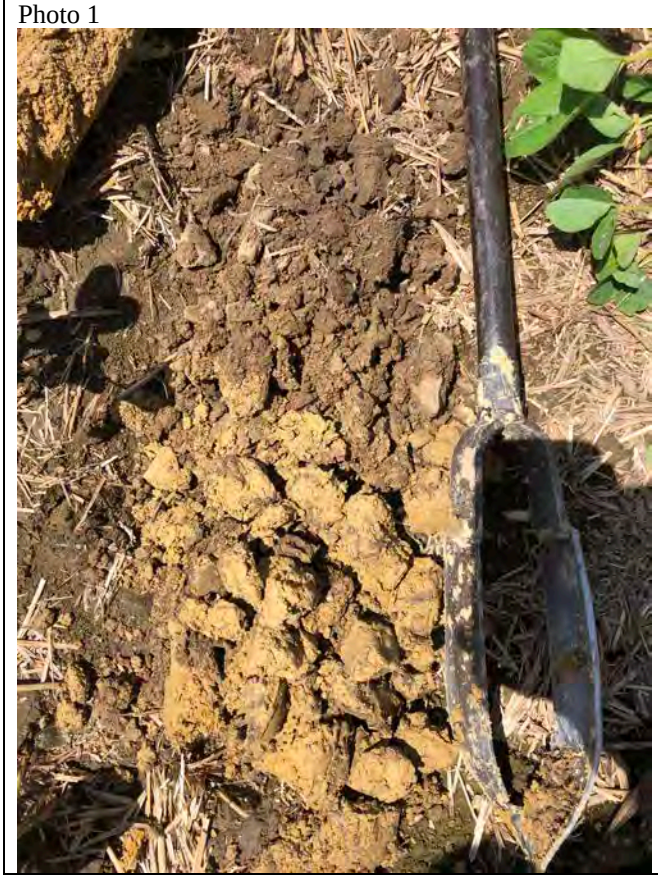


Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #15

NAME: Alex Baldwin DATE: July 23, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.911456° N, -80.449060° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Floodplain SLOPE (%): 2

VEGETATION/CROP: Successional forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 6-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-6	10YR 3/2	70	C/M	7.5YR 4/6	15	Silt loam
			C/PL	7.5YR 4/6	15	
6-9	10YR 3/2	45	C/M	7.5YR 4/6	10	Clay loam
	2.5Y 4/3	45				
9-16+	2.5Y 5/3	80	C/PL	7.5YR 5/8	15	Clay
			C/M	7.5YR 4/6	5	

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

NOTES: _____

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #16

NAME: Alex Baldwin DATE: July 23, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.911533° N, -80.449593° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Toe slope SLOPE (%): 2

VEGETATION/CROP: Edge of field

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: Disturbed F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 4-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-4	2.5Y 4/4	100				Silt loam
4-18+	2.5Y 5/4	45	C/PL	10YR 4/6	5	Clay loam
			C/M	10YR 3/6	5	
			D/M	2.5Y 7/2	15	

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

NOTES: _____

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #17

NAME: Alex Baldwin DATE: July 23, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.911676° N, -80.448180° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Toe slope/Historic Floodplain SLOPE (%): 5

VEGETATION/CROP: Successional forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 10-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	10YR 3/3	100				Silt loam
3-10	2.5Y 5/4	85	C/PL	7.5YR 4/6	5	Clay loam
			C/M	10YR 5/8	10	
10-15+	2.5Y 5/4	60	C/PL	7.5YR 4/6	10	Clay loam
			C/M	10YR 5/8	20	
			D/M	2.5Y 7/2	10	

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

NOTES: Area is below existing pond dam and appears to be disturbed from excavation of pond and building of dam, ephemeral channel on the right bank is conveying surface water from adjacent ag fields

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #18

NAME: Alex Baldwin DATE: July 23, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.913254° N, -80.447921° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Toe slope/Historic Floodplain SLOPE (%): 5

VEGETATION/CROP: Successional forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 3-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	2.5Y 4/3	100				Silt loam
3-8	2.5Y 6/4	75	C/PL	10YR 5/8	10	Silty clay loam
			D/M	2.5Y 7/2	15	
8-15+	2.5Y 6/4	45	C/PL	10YR 5/8	15	Clay loam
			C/M	7.5YR 4/6	5	
			D/M	2.5Y 7/2	35	

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

NOTES: Area is below existing pond dam and appears to be disturbed from excavation of pond and building of dam, ephemeral channel on the right bank is conveying surface water from adjacent ag fields

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #19

NAME: Alex Baldwin DATE: July 23, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.912642° N, -80.447347° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Toe slope/Historic Floodplain SLOPE (%): 3

VEGETATION/CROP: Soybeans

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 6-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-6	2.5Y 4/3	85	C/PL	10YR 3/6	15	Silt loam
6-9	2.5Y 5/3	65	C/PL	10YR 3/6	15	Clay loam
			C/M	10YR 4/6	20	
9-15+	2.5Y 6/6	70	C/M	10YR 5/8	20	Clay
			D/M	2.5Y 5/3	10	

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

NOTES: Photo 2 shows redox concentration pore linings observed

Photo 1

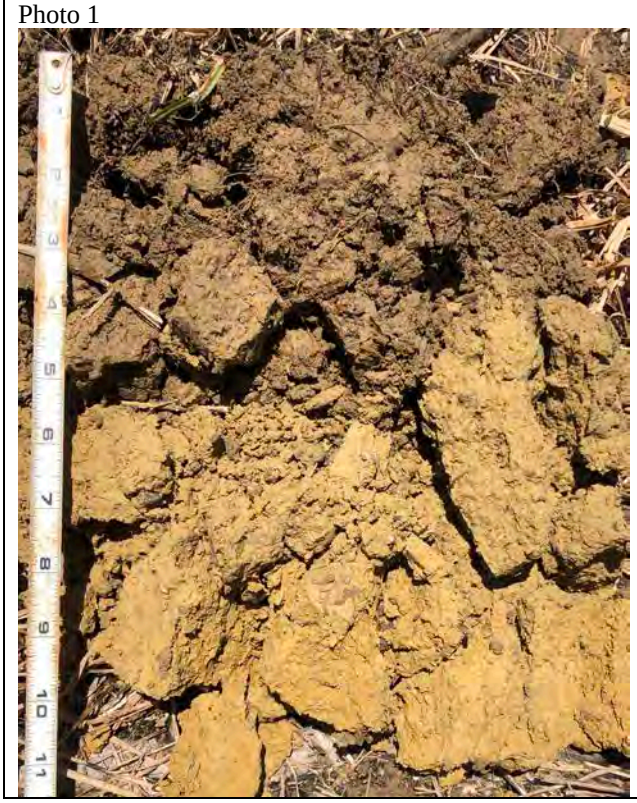


Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #20

NAME: Alex Baldwin DATE: July 15, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.908434° N, -80.442739° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 6-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	10YR 4/2	100	C/PL	7.5YR 4/6	5	Sandy loam
2-4	2.5Y 7/1	70	C/PL	7.5YR 4/6	20	Sandy loam
			C/M	7.5YR 5/8	10	
4-13+	2.5Y 6/3	60	C/PL	7.5YR 4/6	20	Silty clay loam
			C/M	7.5YR 5/8	20	

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

NOTES: Description is from wetland data point of existing wetland AB submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #21

NAME: Alex Baldwin DATE: July 15, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.908290° N, -80.442778° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Sideslope SLOPE (%): 5

VEGETATION/CROP: Edge of ag field,mix of forbes and wheat

SOIL MAP UNIT: GsC HYDRIC SOIL FIELD INDICATOR: N/A

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	10YR 3/2	100				Sandy loam
3-5	2.5Y 6/4	100				Sandy loam
5-12+	2.5Y 5/6	100				Silty clay loam

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

NOTES: Description is from upland data point adjacent to wetland AB submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #22

NAME: Alex Baldwin DATE: July 15, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.909359° N, -80.441595° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Floodplain SLOPE (%): 3

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 6-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	10YR 3/2	100				Silt loam
3-12+	2.5Y 5/3	45	C/PL	10YR 5/8	30	Silty clay loam
			C/M	7.5YR 4/6	10	
			D/M	2.5Y 6/3	10	

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

NOTES: Description is from existing wetland AA submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #23

NAME: Alex Baldwin DATE: July 15, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.916749° N, -80.444609° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Toe slope SLOPE (%): 0

VEGETATION/CROP: Herbaceous edge of ag field

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 6-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-5	10YR 3/2	85	C/PL	10YR 4/6	15	Silt loam
5-12	2.5Y 5/3	65	C/PL	10YR 4/6	15	Clay loam
			C/M	10YR 5/8	20	
12-18+	2.5Y 5/4	75	C/M	10YR 4/6	25	Clay loam

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

NOTES: Description is from wetland data point in existing wetland AC submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #24

NAME: Alex Baldwin DATE: July 15, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.916810° N, -80.444492° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Toe slope SLOPE (%): 5

VEGETATION/CROP: Soybeans

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: Drained F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 8-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	10YR 3/2	100				Silt loam
3-8	2.5Y 5/4	90	C/M	2.5Y 6/8	10	Sandy loam
8-15+	2.5Y 5/6	80	C/M	2.5Y 6/8	10	Silty clay loam
			D/M	2.5Y 6/4	10	

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

NOTES: Description is from upland data point adjacent to existing wetland AC submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #25

NAME: Alex Baldwin DATE: July 15, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.909419° N, -80.441453° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Toe slope SLOPE (%): 5

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: Drained F3

DEPTH TO WATER: N/A DEPTH TO SHWT: 8-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	10YR 3/2	100				Silt loam
2-10+	10YR 6/2	50	C/M	10YR 6/8	30	Silty clay loam
			D/M	5Y 8/1	20	

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

NOTES: Description is from upland data point adjacent to existing wetland AA submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #26

NAME: Alex Baldwin DATE: July 15, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.917410° N, -80.445967° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Toe slope SLOPE (%): 0

VEGETATION/CROP: Disturbed Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 0-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	10YR 3/2	90	C/PL	7.5YR 4/6	5	Silt loam
			D/M	10YR 4/2	5	
3-7	2.5Y 5/3	70	C/PL	7.5YR 4/6	25	Silty clay Loam
			C/M	7.5YR 3/4	5	
7-15+	2.5Y 6/3	60	C/PL	7.5YR 4/6	40	Silty clay loam
			C/M	7.5YR 3/4	5	

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

NOTES: Description is from wetland data point in existing wetland AH submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #27

NAME: Alex Baldwin DATE: July 15, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.917398° N, -80.446059° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Side slope SLOPE (%): 5

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: N/A

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-6	10YR 3/2	30			70	Extremely channery loam

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

NOTES: Description is from upland data point adjacent to existing wetland AH submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #28

NAME: Alex Baldwin DATE: July 14, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.912288° N, -80.447192° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Disturbed Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 2-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	10YR 3/2	95	C/M	10YR 6/6	5	Sandy loam
2-12	10YR 5/3	85	C/M	10YR 3/6	15	Silty loam
7-15+	10YR 5/4	80	C/M	10YR 5/8	20	Silty loam

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

NOTES: Description is from wetland data point in existing wetland AJ submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #29

NAME: Alex Baldwin DATE: July 14, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.912293° N, -80.447136° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Disturbed Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: Disturbed F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 11-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-5	10YR 4/4	100				Sandy loam
5-11	2.5Y 5/4	95	C/PL	10YR 3/4	5	Silty clay loam
11-16+	2.5Y 5/4	75	C/M	2.5Y 6/6	5	Silty clay loam
			C/M	2.5Y 7/8	5	
			D/M	2.5Y 7/1	15	

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

NOTES: Description is from upland data point adjacent to existing wetland AJ submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #30

NAME: Alex Baldwin DATE: July 14, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.911539° N, -80.448571° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Disturbed Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 8-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-8	10YR 4/3	100				Silt loam
8-16	2.5Y 4/3	70	C/PL	10YR 5/6	20	Clay loam
			C/M	7.5YR 5/6	10	
16-22+	2.5Y 5/4	70	C/PL	10YR 5/6	10	Clay loam
			C/M	7.5YR 5/6	20	

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

NOTES: Description is from wetland data point adjacent to existing wetland AI submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #31

NAME: Alex Baldwin DATE: July 14, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.911538° N, -80.448532° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Toe slope SLOPE (%): 5

VEGETATION/CROP: Disturbed Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: Disturbed F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 11-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	10YR 4/4	100				Sandy loam
3-11	10YR 5/6	100				Silty clay loam
11-16+	10YR 5/6	95	C/PL	7.5YR 5/8	5	Silty clay loam

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

NOTES: Description is from upland data point adjacent to existing wetland AI submitted in PJD

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #32

NAME: Alex Baldwin DATE: July 23, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.911951° N, -80.443547° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Soybeans

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 3-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	10YR 3/2	100				Silt loam
3-13	2.5Y 4/3	80	C/PL	10YR 3/6	10	Clay loam
			C/M	10YR 6/8	10	
13-16+	2.5Y 5/6	80	C/PL	10YR 3/6	5	Clay
			C/M	10YR 6/8	15	

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

NOTES: _____

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #33

NAME: Alex Baldwin DATE: July 22, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.912414° N, -80.446197° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Side slope SLOPE (%): 5

VEGETATION/CROP: Fallow field

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: N/A

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	10YR 4/3	100				Sandy loam
2-10	2.5Y 6/4	100				Silt loam
10-15+	2.5Y 5/4	95	C/PL	7.5YR 5/8	5	Clay loam

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

NOTES: Soil profile included channers in the clay subsoil but abundance was below the threshold to modify texture.

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #34

NAME: Alex Baldwin DATE: July 31, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.913645° N, -80.443817° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Pond Bed / Floodplain SLOPE (%): N/A

VEGETATION/CROP: Open water, this transect of soil cores was parallel to the dam and ~150-ft upstream from the dam.

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F3

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-4	5Y 2.5/2	100				Silty clay with organics
4-8	5Y 3/2	100				Silty clay
8-13+	5Y 5/2	75	C/PL&M	10YR 5/6	15	Channery silty clay
			D/M	5Y 5/3	10	

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

NOTES: Soil profile was collected using a combination of vibracore and push probe methods. Sample was collected on July 30th, described on July 31st, and photographed after drying on August 2nd.

Photos 1-3: Undisturbed, Split Profile (Wet), Split Profile (Dried)

Photos 4-5: Split Profile (Wet) 0-8" and 8-13"

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #35

NAME: Alex Baldwin DATE: July 31, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.915113° N, -80.444394° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Pond Bed / Floodplain SLOPE (%): N/A

VEGETATION/CROP: Open water, this transect of soil cores was perpendicular to the dam and ~700-ft upstream of the dam.

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F3

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-6	5Y 2.5/1	50				Hemic
	5Y 4/3	50				Organic SiL
6-11	5Y 4/2	100				Clay loam
11-17+	5Y 5/3	60	C/M	2.5Y 5/6	15	Clay
			C/PL	10YR 5/8	10	
			D/PL & M	2.5Y 6/1	15	

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

NOTES: Soil profile was collected using a combination of vibracore and push probe methods. Sample was collected on July 30th, described on July 31st, and photographed after drying on August 2nd.

Photos 1-3: Undisturbed, Split Profile (Wet), Split Profile (Dried)

Photos 4-6: Split Profile (Wet) 0-8", 5-13", and 13-17"

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #36

NAME: Alex Baldwin DATE: July 31, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.913635° N, -80.443871° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Pond Bed / Floodplain SLOPE (%): N/A

VEGETATION/CROP: Open water, this transect of soil cores was parallel to the dam and ~150-ft upstream from the dam.

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F3

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	5Y 2.5/2	75				Organic silty clay loam
	5Y 2.5/1	25				
3-9	5Y 5/2	85	C/M	10YR 5/8	15	Silty clay loam
9-11+	5Y 5/3	50	C/PL & M	10YR 5/8	15	Silty clay loam
	10Y 6/2	35				

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

NOTES: Soil profile was collected using a combination of vibracore and push probe methods. Sample was collected on July 30th, described on July 31st, and photographed after drying on August 2nd.

Photos 1-3: Undisturbed, Split Profile (Wet), Split Profile (Dried)

Photos 4-5: Split Profile (Dry) 2-5" and 8-11"

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #37

NAME: Alex Baldwin DATE: July 31, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.914504° N, -80.444040° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Pond Bed / Floodplain SLOPE (%): N/A

VEGETATION/CROP: Open water, this transect of soil cores was perpendicular to the dam and ~470-ft upstream of the dam.

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-5	5Y 5/2	85	D/M	6Y 6/2	15	Silty clay
5-14	5Y 5/3	65	C/M	2.5Y 5/6	20	Silty clay
			D/M	5Y 6/3	15	
14-16+	5Y 6/2	70	C/M	2.5Y 6/8	30	Silty clay

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

NOTES: Soil profile was collected using a combination of vibracore and push probe methods. Sample was collected on July 30th, described on July 31st, and photographed after drying on August 2nd.

Photos 1-2: Split Profile (Wet), Split Profile (Dried)

Photos 3-5: Split Profile (Wet) 0-8", 6-13", and 10-16"

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #38

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.913139° N, 80.443371° W

WEATHER: Partly Cloudy, 80°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Mostly herbaceous with scattered trees

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 4-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-4	10YR 3/2	85	C/PL	7.5YR 4/6	15	Clay loam
4-8	2.5Y 6/3	60	C/M	7.5YR 4/4	20	Clay loam
			C/PL	5YR 5/8	20	
8-18+	2.5Y 5/4	90	C/PL	7.5YR 4/6	10	Clay
			C/M	10YR 5/8	10	
			D/M	2.5Y 6/3	15	

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

NOTES: Location is immediately downstream of dam along Waxhaw Branch in an area that is not in ag production.

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #39

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.912102° N, 80.442632° W

WEATHER: Partly Cloudy, 80°

LANDSCAPE POSITION: Toe slope SLOPE (%): 3

VEGETATION/CROP: Fescue and mixed forbes

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 4-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-4	10YR 3/2	100				Clay loam
4-13	2.5Y 5/3	75	C/PL	7.5YR 4/6	15	Channery loam
			C/M	10YR 6/8	10	
13-17+	2.5Y 6/4	90	C/M	10YR 6/8	10	Channery clay
			D/M	2.5Y 5/3	10	

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

NOTES: Location is within a drainage swale of an existing ag field.

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #40

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.910826° N, 80.443371° W

WEATHER: Partly Cloudy, 80°

LANDSCAPE POSITION: Toe slope SLOPE (%): 1

VEGETATION/CROP: Soybeans

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 2-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	2.5Y 4/3	100				Loam
2-11	2.5Y 5/3	65	C/PL	7.5YR 4/6	15	Clay
			C/M	10YR 5/8	20	
11-16+	2.5Y 5/4	60	C/PL	7.5YR 4/6	20	Clay
			C/M	10YR 6/8	20	

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

NOTES: Location is within an existing ag field, near an isolated wooded motte in the middle of the field that is shallow to rock.

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #41

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.910066° N, 80.442703° W

WEATHER: Partly Cloudy, 80°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 3-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-3	10YR 4/3	100				Loam
3-16	2.5Y 6/3	65	C/M	7.5YR 4/6	15	Silty clay loam
			C/M	10YR 5/8	20	
16-25+	2.5Y 5/3	60				Clay

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

NOTES: Appears hydric indicators are relict from the result of relocating and excavating the nearby stream (Waxhaw Br).

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #42

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.908502° N, 80.441688° W

WEATHER: Partly Cloudy, 85°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 1-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-1	2.5Y 4/3	100				Loam
1-8	2.5Y 6/3	75	C/PL	7.5YR 4/6	25	Clay loam
8-18	2.5Y 5/3	45	C/PL	7.5YR 4/6	20	Clay
			C/M	10YR 4/6	15	
			D/M	2.5Y 6/2	20	
18+	2.5Y 6/4	45	C/PL	7.5YR 4/6	15	Clay
			C/M	10YR 5/8	25	
			D/M	2.5Y 7/3	15	

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

NOTES: Appears hydric indicators are relict from the result of relocating and excavating the nearby stream (Waxhaw Br).

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #43

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.908673° N, 80.443558° W

WEATHER: Partly Cloudy, 85°

LANDSCAPE POSITION: Floodplain SLOPE (%): 3

VEGETATION/CROP: Silviculture, 15-yr old pines

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8 & F19

DEPTH TO WATER: N/A DEPTH TO SHWT: 2-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	2.5Y 4/3	95	C/PL	7.5YR 4/6	5	Loam
2-8	2.5Y 5/3	75	C/M	7.5YR 3/4	10	Clay loam
			C/M	7.5YR 5/8	15	
8-14+	2.5Y 6/6	85	D/M	2.5Y 6/4	10	Clay

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

NOTES: Appears hydric indicators are relict from the result of relocating and excavating the nearby stream (UT to Waxhaw Br), debris piles and lack of herbaceous vegetation in areas indicate surface water flow and ponding.

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #44

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.909122° N, 80.444522° W

WEATHER: Partly Cloudy, 85°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Silviculture, 15-yr old pines

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 0-in

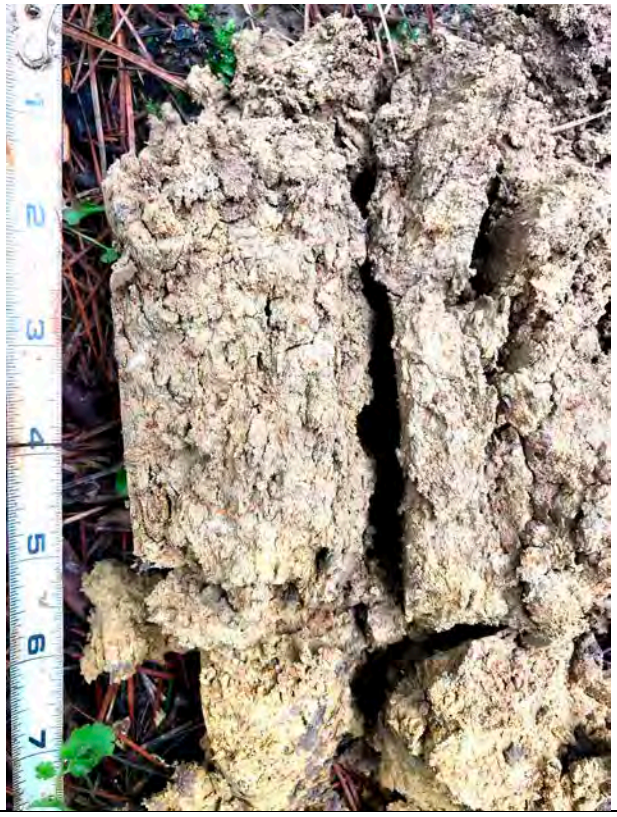
DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-5	2.5Y 4/3	85	C/PL	7.5YR 5/6	10	Clay loam
			C/M	7.5YR 3/4	5	
5-13+	2.5Y 6/6	90	D/M	2.5Y 6/4	10	Clay

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

NOTES: Appears hydric indicators are relict from the result of relocating and excavating the nearby stream (UT to Waxhaw Br), debris piles and lack of herbaceous vegetation in areas indicate surface water flow and ponding.

Photo 1

Photo 2



SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #45

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.909434° N, 80.442972° W

WEATHER: Partly Cloudy, 85°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Forest

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 1-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-1	2.5Y 4/3	100				Loam
1-11	2.5Y 5/4	70	C/PL	7.5YR 5/8	20	Clay loam
			C/M	7.5YR 4/6	10	
11-15+	2.5Y 5/4	70	C/M	5YR 4/6	20	Clay
			C/M	7.5YR 5/8	10	

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

NOTES: Appears hydric indicators are relict from the result of relocating and excavating the nearby stream (Waxhaw Br), debris piles and lack of herbaceous vegetation in areas indicate surface water flow and ponding.

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #46

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.910432° N, 80.443211° W

WEATHER: Partly Cloudy, 85°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Soybeans

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 4-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-4	2.5Y 4/3	100				Loam
4-13	2.5Y 5/4	80	C/M	10YR 5/8	10	Clay loam
			D/M	2.5Y 6/2	10	
13-21+	2.5Y 5/6	70	C/M	10YR 5/8	15	Clay
			D/M	2.5YR 6/4	15	

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

NOTES: Appears hydric indicators are relict from the result of relocating and excavating the nearby stream (UT to Waxhaw Br).

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #47

NAME: Alex Baldwin DATE: September 1, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.911911° N, 80.444798° W

WEATHER: Partly Cloudy, 85°

LANDSCAPE POSITION: Floodplain SLOPE (%): 0

VEGETATION/CROP: Soybeans

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F8

DEPTH TO WATER: N/A DEPTH TO SHWT: 2-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	2.5Y 4/3	100				Loam
2-15	2.5Y 5/3	60	C/PL	7.5YR 4/6	20	Clay loam
			C/M	7.5YR 4/6	5	
			C/M	10YR 6/6	15	
13-21+	2.5Y 5/4	45	D/M	2.5YR 6/2	10	Clay
	10YR 5/8	45				

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

NOTES: Appears hydric indicators are relict from the result of relocating and excavating the nearby stream (UT to Waxhaw Br).

Photo 1

Photo 2

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #48

NAME: Alex Baldwin DATE: July 31, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.913625° N, -80.443924° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Pond Bed / Floodplain SLOPE (%): N/A

VEGETATION/CROP: Open water, this transect of soil cores was parallel to the dam and ~150-ft upstream from the dam.

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F3

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-2	2.5Y 2/1	100				Organic SiL
2-6	2.5Y 4/3	100				Silty clay loam
6-8+	2.5Y 5/3	30	C/M	10YR 6/8	20	Clay loam
	2.5Y 5/4	30	D/M	Gley 1 5Y/5GY	20	

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

NOTES: Soil profile was collected using a combination of vibracore and push probe methods. Sample was collected on July 30th, described on July 31st, and photographed after drying on August 2nd.

Photos 1-3: Undisturbed, Soil Core (Wet), Split Profile (Wet)

Photo 4: Detailed soil ped of 6-8"

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #49

NAME: Alex Baldwin DATE: July 31, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.913615° N, -80.443977° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Pond Bed / Floodplain SLOPE (%): N/A

VEGETATION/CROP: Open water, this transect of soil cores was parallel to the dam and ~150-ft upstream from the dam.

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F19

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-5	2.5Y 2/1	100				Organic SiL
5-7	2.5Y 4/3	60				Silty clay loam
	2.5Y 2/1	40				
7-11+	2.5Y 5/3	35	C/M	10YR 6/8	20	Clay loam
	5Y 5/3	35	D/M	Gley 1 5Y/5GY	20	

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

NOTES: Soil profile was collected using a combination of vibracore and push probe methods. Sample was collected on July 30th, described on July 31st, and photographed after drying on August 2nd.

Photos 1-3: Undisturbed, Soil Core (Wet), Split Profile (Wet)

Photo 4: Detailed soil ped of 7-11"

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #50

NAME: Alex Baldwin DATE: July 31, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.913605° N, -80.444031° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Pond Bed / Floodplain SLOPE (%): N/A

VEGETATION/CROP: Open water, this transect of soil cores was parallel to the dam and ~150-ft upstream from the dam.

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F3

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-5	2.5Y 2/1	100				Organic SiL
5-9	2.5Y 4/3	50				Silty clay loam
	2.5Y 2/1	50				
9-12+	2.5Y 5/2	60	C/M	2.5Y 5/6	10	Clay loam
			D/M	2.5Y 5/3	30	

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

NOTES: Soil profile was collected using a combination of vibracore and push probe methods. Sample was collected on July 30th, described on July 31st, and photographed after drying on August 2nd.

Photos 1-2: Undisturbed, Split Profile (Wet)

Photo 3: Detailed soil ped of 9-12"

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #51

NAME: Alex Baldwin DATE: July 31, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.914295° N, -80.443946° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Pond Bed / Floodplain SLOPE (%): N/A

VEGETATION/CROP: Open water, this transect of soil cores was perpendicular to the dam and ~390-ft upstream of the dam.

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F3

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-6	2.5Y 2/1	100				Organic SiL
6-8	2.5Y 2/1	70	D/M	2.5Y 4/3	30	Silty clay loam
8-11+	2.5Y 4/2	100				Silty clay loam

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

NOTES: Soil profile was collected using a combination of vibracore and push probe methods. Sample was collected on July 30th, described on July 31st, and photographed after drying on August 2nd.

Photo 1: Undisturbed Soil Core

Photo 2: Extracted Soil Core (Wet)

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #52

NAME: Alex Baldwin DATE: July 31, 2020

PROJECT NUMBER/NAME: Wit's End Stream and Wetland Mitigation Project

LOCATION: Union County, NC: 34.914926° N, -80.444210° W

WEATHER: Sunny, 90°

LANDSCAPE POSITION: Pond Bed / Floodplain SLOPE (%): N/A

VEGETATION/CROP: Open water, this transect of soil cores was perpendicular to the dam and ~630-ft upstream of the dam.

SOIL MAP UNIT: CmB HYDRIC SOIL FIELD INDICATOR: F3

DEPTH TO WATER: N/A DEPTH TO SHWT: N/A

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%	
0-6	2.5Y 4/2	50				Organic SiL
	2.5Y 4/3	50				
6-11	2.5Y 4/2	50				Silty loam
	2.5Y 5/3	50				
11-16+	2.5Y 5/2	45	C/M	2.5Y 5/6	10	Clay loam
	2.5Y 5/3	45				

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

NOTES: Soil profile was collected using a combination of vibracore and push probe methods. Sample was collected on July 30th, described on July 31st, and photographed after drying on August 2nd.

Photos 1-2: Undisturbed and Extracted Soil Core

Photo 3: Split Profile (Wet)

Appendix G. Reference Wetland Photo Log

WITS END REFERENCE WETLANDS PHOTO LOG

Photo 1: Basin wetland NE of Project upstream of an ephemeral stream – March 12, 2020

Photo 2: Floodplain wetland NW of Project upstream of UT4 – Mar 12, 2020

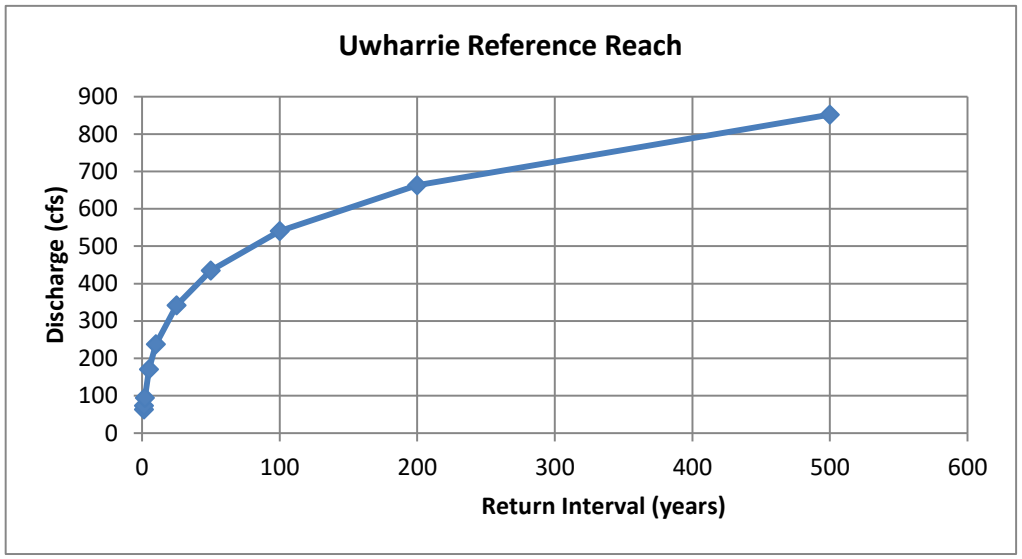
Photo 3: Waxhaw Branch Project Area Floodplain Wetland Left bank – Feb. 26, 2020

Photo 4: Waxhaw Branch Downstream of Project Floodplain Wetland Right bank – March 12, 2020

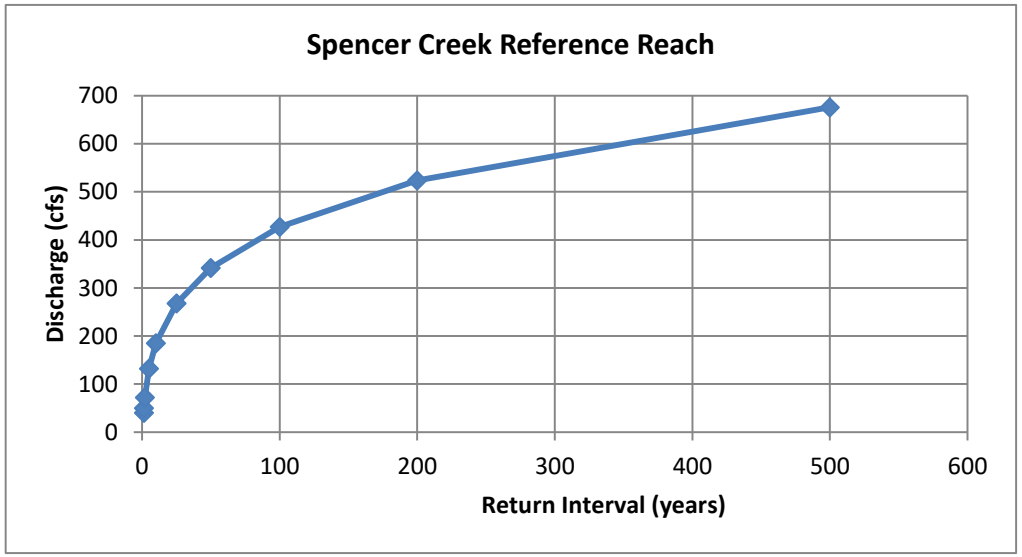
APPENDIX D. FLOOD FREQUENCY ANALYSIS

Reference Reaches
Flood Frequency Analaysis-Regional Regression Equation (USGS 2004)

Return Interval (years)	Discharge (cfs)
1.3	**63**
1.5	**73**
2	94.3
5	171
10	238
25	342
50	435
100	541
200	663
500	852



Return Interval (years)	Discharge (cfs)
1.3	**40**
1.5	**50**
2	72.2
5	132
10	185
25	268
50	342
100	427
200	524
500	676



APPENDIX E. JURISDICTIONAL DETERMINATION INFORMATION

Grant Lewis

From: Grant Lewis
Sent: Friday, October 9, 2020 1:24 PM
To: Brian.Hawkins@unioncountync.gov
Subject: Wits End FEMA documentation
Attachments: FEMA_Documentation.pdf

Hello Brian;

As I explained in my prior email, I am trying to coordinate with Union County concerning FEMA floodplain requirements for the Wits End stream restoration Site. I am attaching documentation in support of our requirement to coordinate with the Union County local floodplain administrator. If you are the Union County floodplain administrator, please review the information and fill out the last page of the FEMA floodplain checklist.

If you are not the Union County floodplain administrator, please notify me so I may forward to the proper authority.

Thank you
Grant

Grant Lewis
Senior Project Manager
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603
glewis@axiomenvironmental.org
(919) 215-1693 (cell)

Axiom Environmental, Inc.

Axiom Environmental, Inc.

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

October 9, 2020

Brian Hawkins, PE, CFM
Union County Stormwater Engineer
500 N. Main Street, Suite 70
Monroe, NC 28112

Re: Wits End Stream and Wetland mitigation project
Union County **20-011**
FEMA Floodplain Requirements Checklist

Dear Mr. Hawkins:

The purpose of this letter is to request concurrence from the Union County concerning a stream and wetland restoration site located in Union County. The Site encompasses approximately 69.9 acres of land with an agriculture pond, disturbed forest, pasture, and row crops along Waxhaw Branch and its unnamed tributaries. Proposed activities at the Site include the restoration of stream channels, enhancement of stream channel, and restoration/enhancement of riparian wetlands.

Stream reaches are depicted on the attached figures and lengths/priority are as follows:

Reach	**Length**	**Priority**
Waxhaw Branch	5403	Restoration and Enhancement (Level III)
UT 1	189	Restoration and Enhancement (Level III)
UT 2	1199	Restoration
UT 3	2983	Restoration and Enhancement (Level I and III)
UT 3A	780	Restoration
UT 4	1223	Restoration
UT 5	190	Restoration and Enhancement (Level III)

FEMA mapping was reviewed to determine if the project is located in a FEMA study area (DFIRM panel number 5462). Based on existing floodplain mapping, the Site is in Special Flood Hazard Area. Therefore, we request guidance from your organization as to how to mover forward with the project.

We thank you in advance for your timely response and cooperation. Please feel free to contact the below referenced NC DMS Project Manager with any questions that you may have concerning the extent of site disturbance associated with this project.

Yours truly,

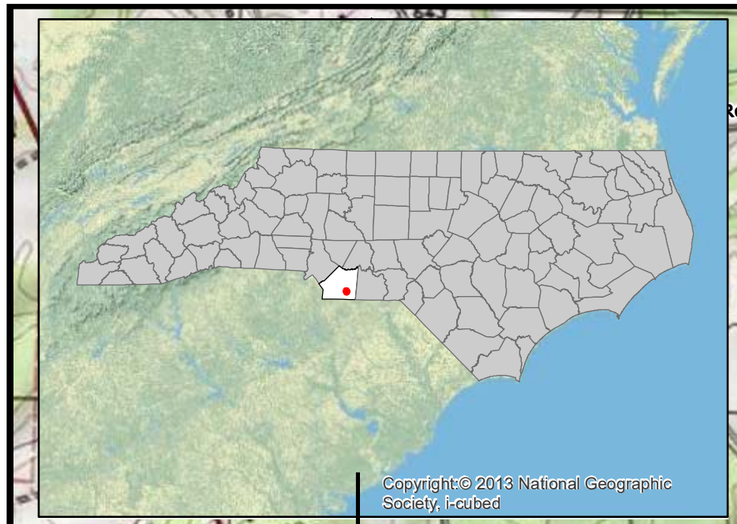
AXIOM ENVIRONMENTAL

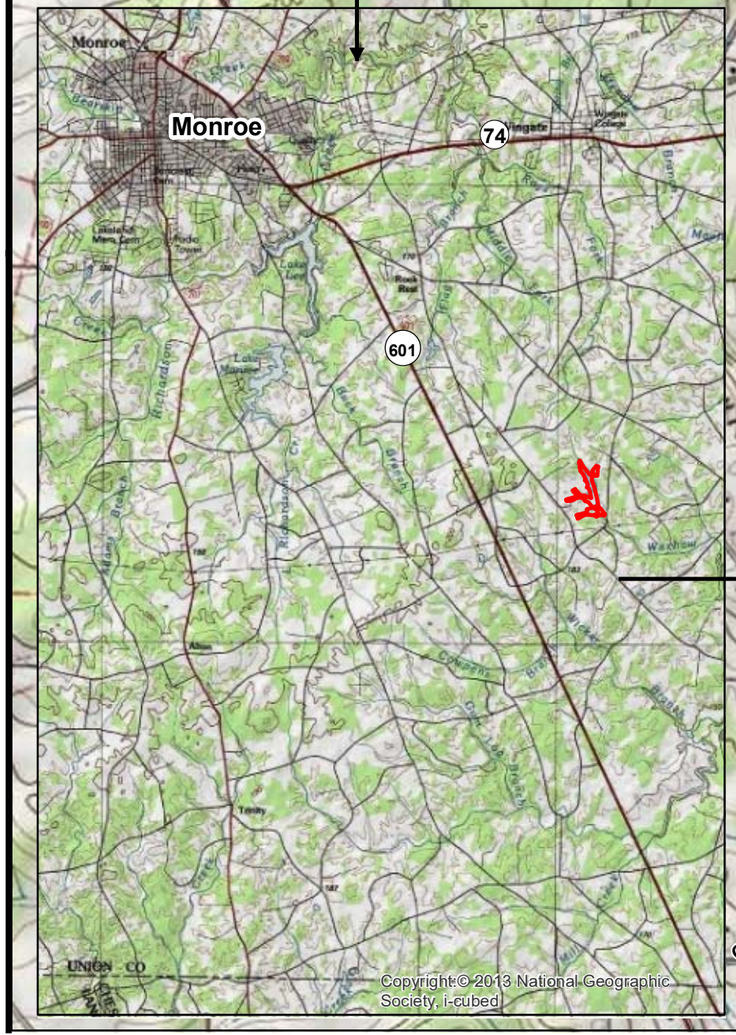
W. Grant Lewis
Senior Project Manager

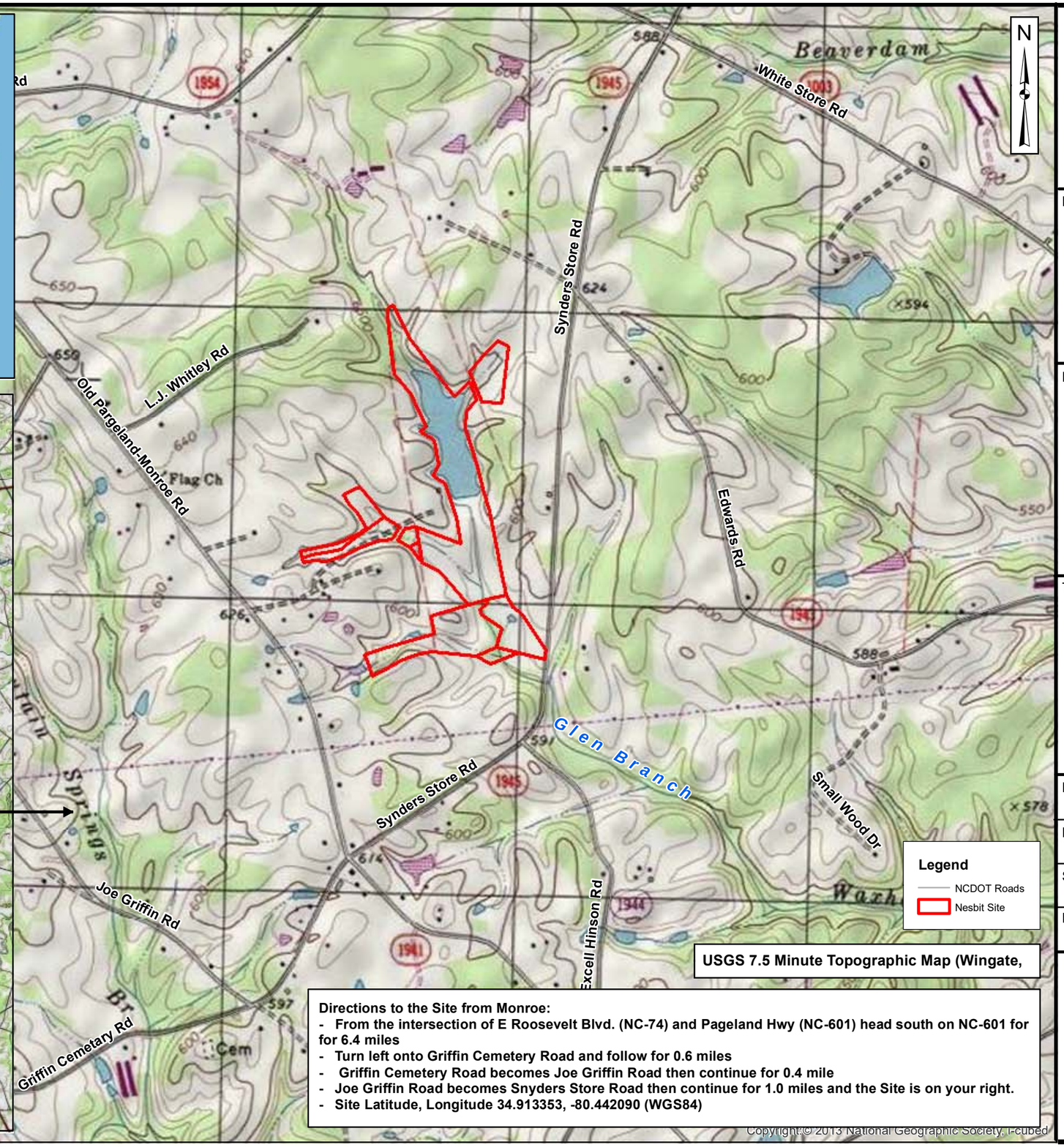
Attachments

- Figure 1 Site Location
- Figure 2 Hydrologic Unit Map
- Figure 3 Topography and Drainage Area
- Figure 4 Existing Conditions
- Figure 5 Proposed Conditions
- EEP Floodplain Requirements Checklist

Cc JD Hamby
Matthew Reed







Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS LLC

Project:

WHITS END SITE

Union County, NC

Title:

SITE LOCATION

Drawn by: WGL

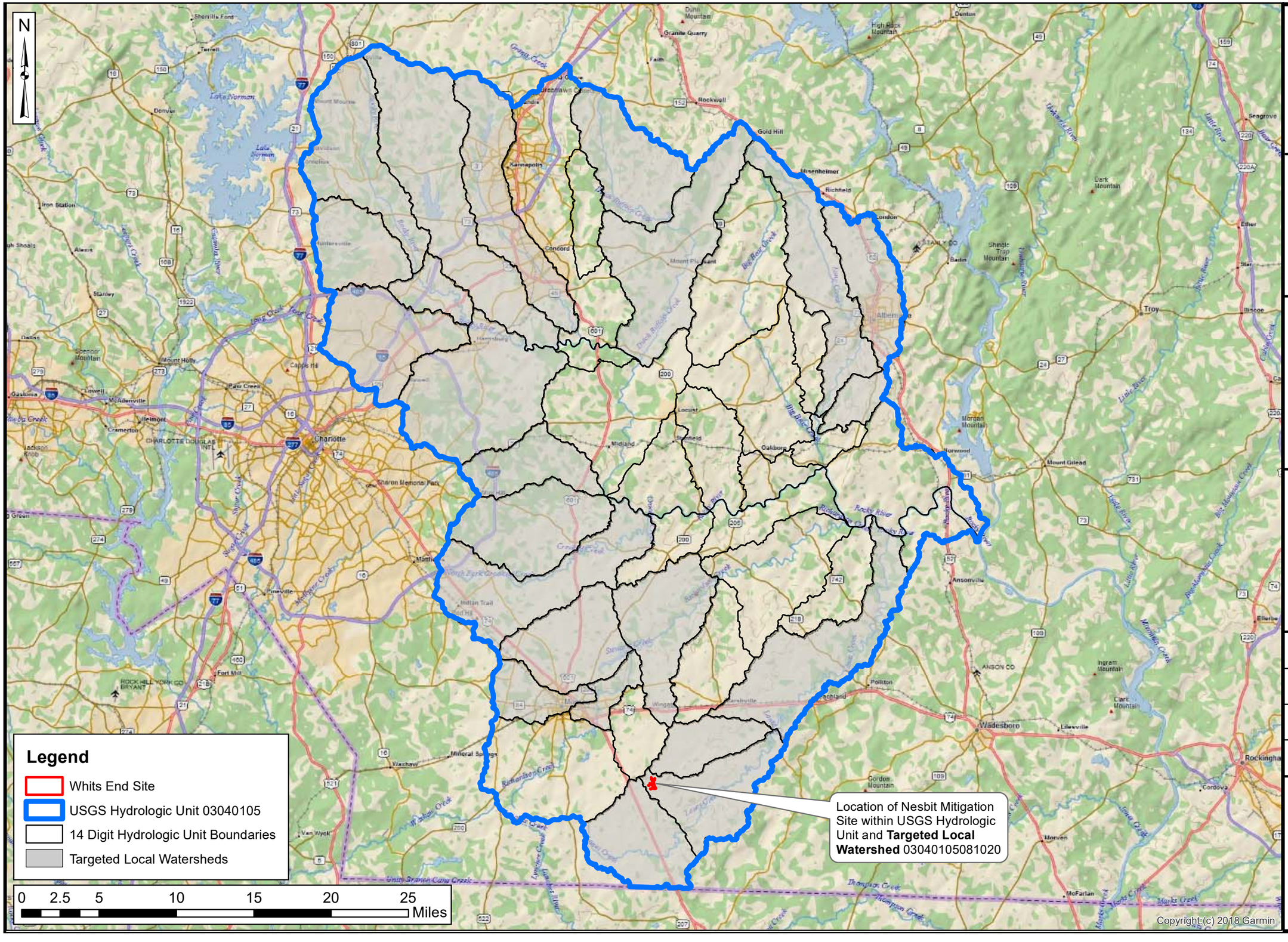
Date: JUNE 2020

Scale: 1:15,000

Project No.: 20-011

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS LLC

Project:

WHITS END SITE

Union County, NC

Title:

HYDROLOGIC UNIT MAP

Drawn by: KRJ

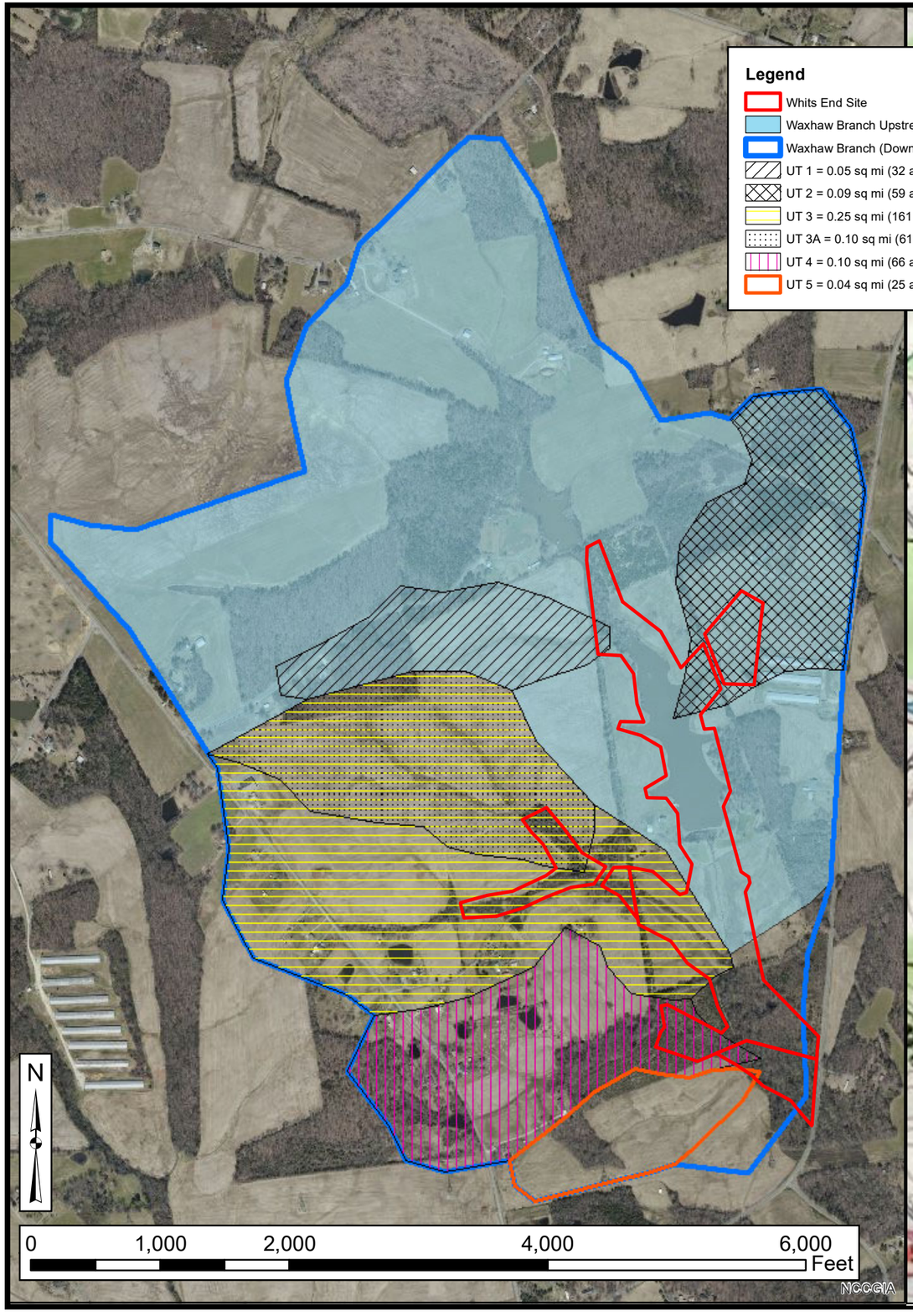
Date: JUNE 2020

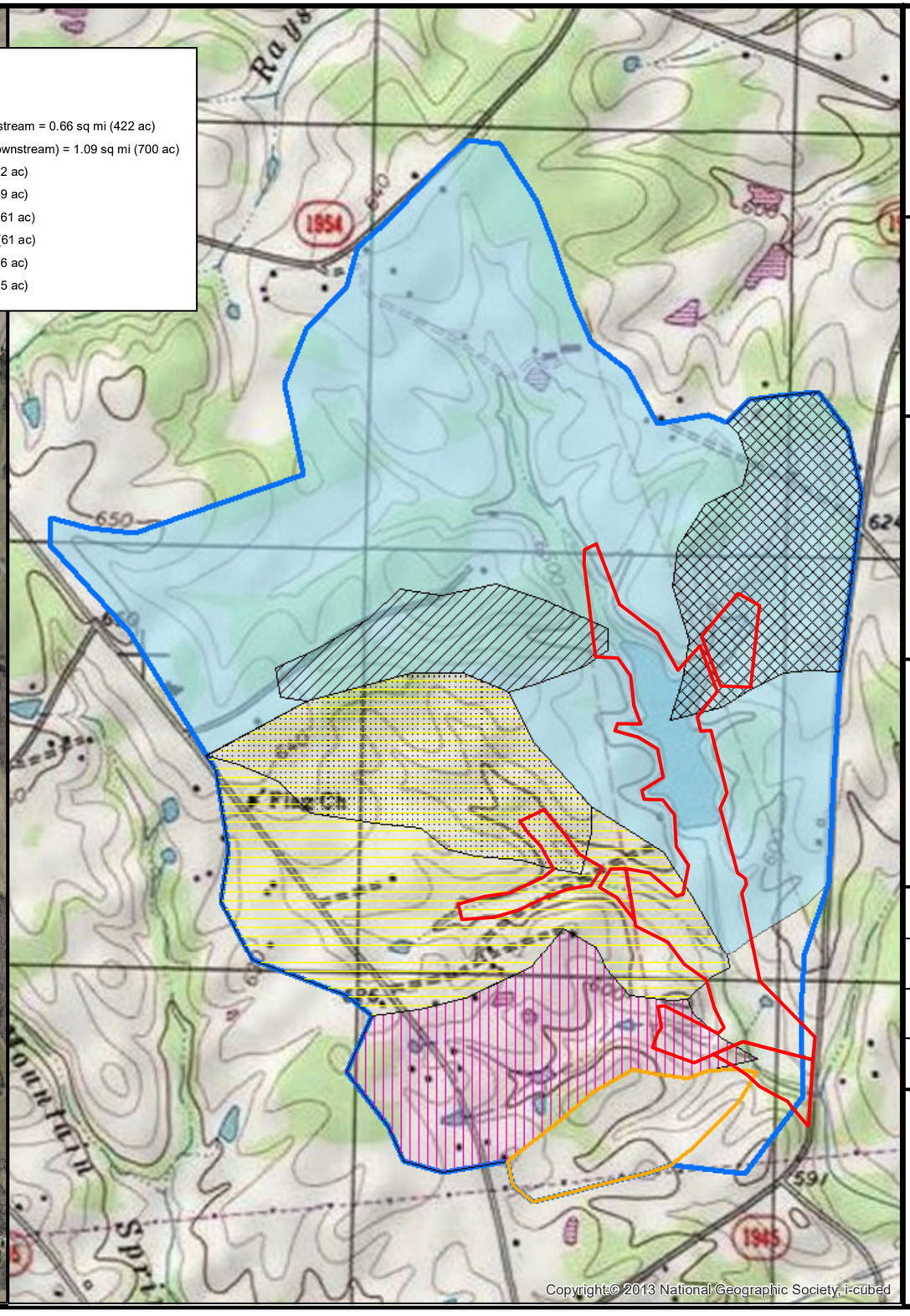
Scale: 1:370,000

Project No.: 20-011

FIGURE

2





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WHITS END SITE

Union County, NC

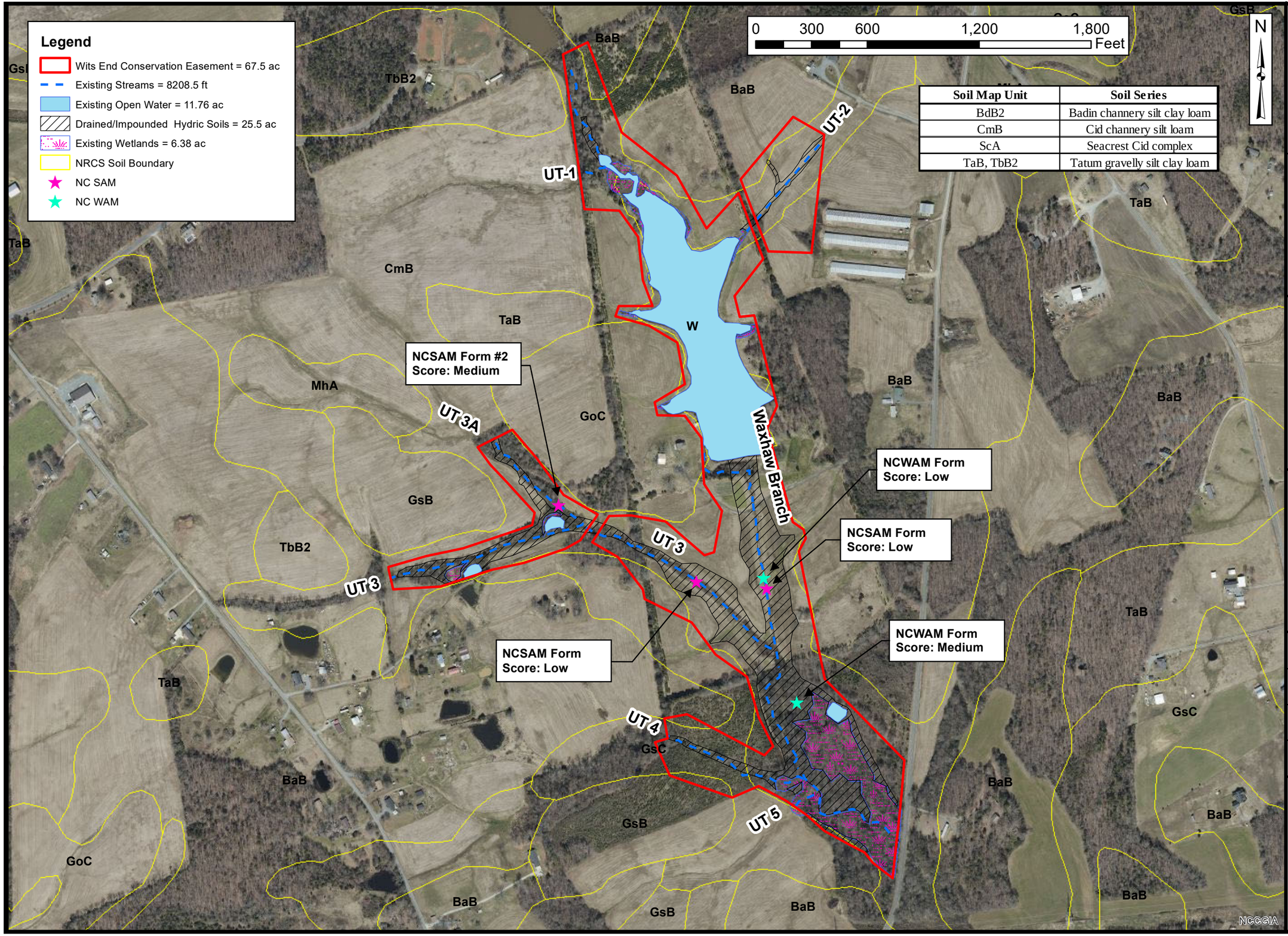
Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by:	KRJ
Date:	JUNE 2020
Scale:	1:12,000
Project No.:	20-011

FIGURE

3



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WHITS END SITE

Union County, NC

Title:

EXISTING CONDITIONS AND SOILS

Drawn by: KRJ

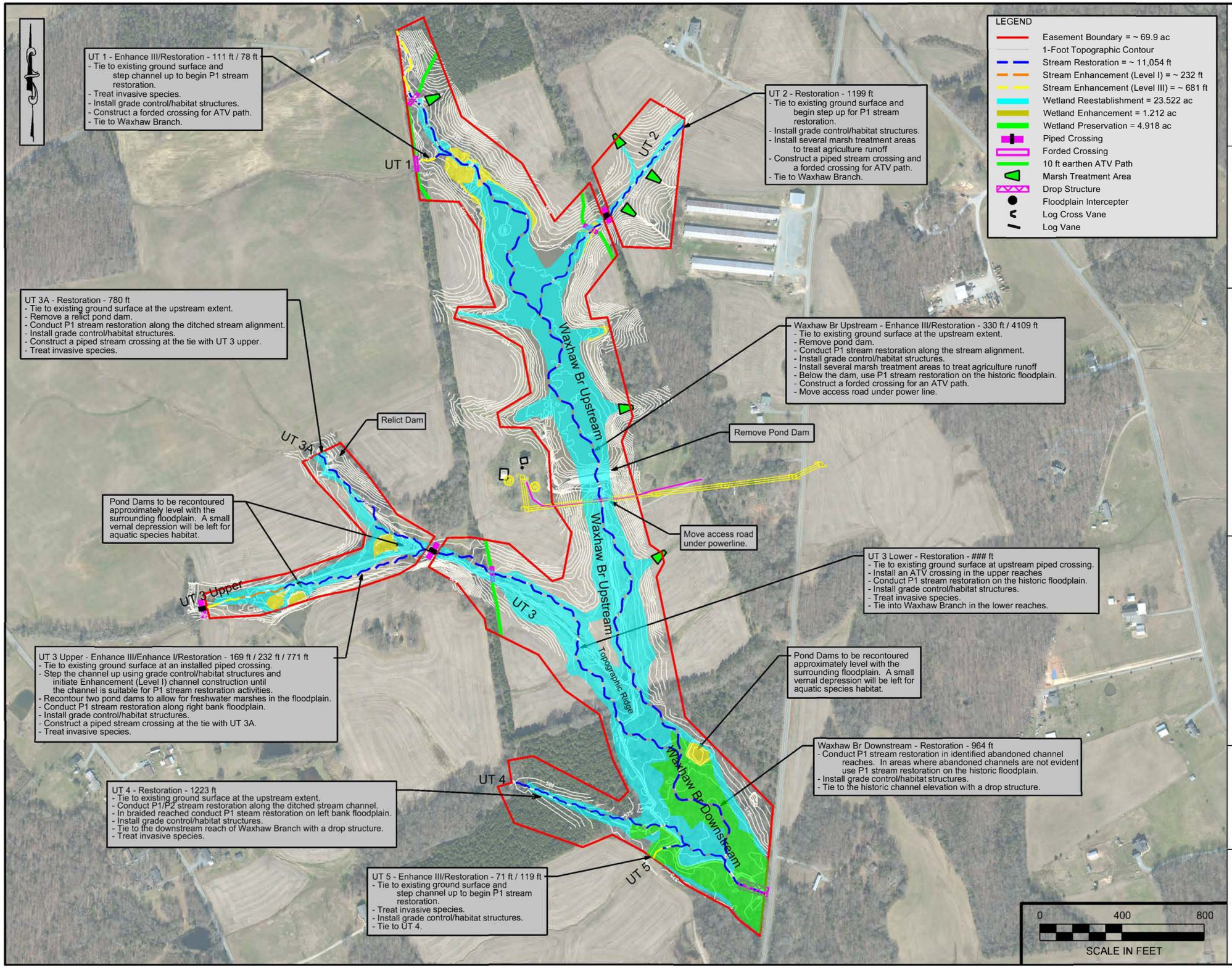
Date: JUNE 2020

Scale: 1:3700

Project No.: 20-011

FIGURE

4



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Wits End

Union County
North Carolina

Title:

Restoration Plan

Scale:	FIGURE NO.
As Shown	5
Date: Sept 2020	
Project No.: 20-011	

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:	Wits End Site
Name if stream or feature:	Waxhaw Branch
County:	Union
Name of river basin:	Yadkini
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Monroe/Union
DFIRM panel number for entire site:	5462
Consultant name:	Axiom Environmental, Inc.
Phone number:	919-215-1693
Address:	218 Snow Avenue Raleigh, NC 27603

Design Information

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

Summarize stream reaches or wetland areas according to their restoration priority.
(See Attached)

Example

Reach	Length	Priority
Example: Reach A	*1000*	*One (Restoration)*
Example: Reach B	*2000*	*Three (Enhancement)*

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: Brian Hawkins
Phone Number: 704-283-3642

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

☐ No Action

☐ No Rise

☐ Letter of Map Revision

☐ Conditional Letter of Map Revision (CLOMR)

☐ Other Requirements

List other requirements:

Comments:

Name: W. Grant Lewis Signature: _____

Title: President Date: _____

APPENDIX F. CATEGORICAL EXCLUSION DOCUMENT

WITS END STREAM AND WETLAND MITIGATION SITE

Union County, North Carolina

DMS Project No. 100164

Categorical Exclusion/ERTR

Prepared for:

North Carolina Department of Environmental Quality

Division of Mitigation Services

1652 Mail Service Center

Raleigh, NC 27699-1652

October 2020

Appendix A

Categorical Exclusion Form for Division of Mitigation Services Projects
Version 2

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

Part 1: General Project Information	
Project Name:	Wits End Stream and Wetland Mitigation Site
County Name:	Union
DMS Number:	100164
Project Sponsor:	Restoration Systems, LLC
Project Contact Name:	Alex Baldwin
Project Contact Address:	1101 Haynes Street, Suite 211, Raleigh, NC 27604
Project Contact E-mail:	abaldwin@restorationsystems.com
DMS Project Manager:	Matthew Reid

Project Description

The Site is positioned 5 miles south of Wingate, NC and 7 miles north of the NC/SC state line. The Site includes Waxhaw Branch and is within the NCDWR Targeted Local Watershed 03040105081020. Proposed restoration activities include 11,054 lf of stream restoration, 232 lf of stream enhancement (level I), 681 lf of stream enhancement (level II), 23.3 ac of riparian riverine wetland reestablishment, 1.4 ac of riparian riverine wetland enhancement, and 4.9 acres of riparian riverine wetland preservation. Site alterations include cessation of agriculture, restoration of streams & wetlands, and planting native woody vegetation. Mitigation will result in net gains in hydrology, water quality, and habitat functions, and will provide 11,905 stream mitigation units and 24.5 riparian riverine wetland mitigation units. The proposed conservation easement will be +/- 68 acres.

For Official Use Only

Reviewed By:

November 5, 2020 — Matthew Reid

Date — **DMS Project Manager**

Conditional Approved By:

Date — **For Division Administrator FHWA**

☐ **Check this box if there are outstanding issues**

Final Approval By:

11-12-20 — Donald W. Brew

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 specie 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

Wit's End Stream & Wetland

Mitigation Site

Categorical Exclusion

Summary

TASK 1 b.) Categorical Exclusion Summary:

Part 1: General Project Information (Attached)

Part 2: All Projects Regulation/Questions

Coastal Zone Management Act

No issue – project is not located within a CAMA county.

CERCLA

No issue within project boundaries – please see the attached Executive Summary from a Limited Phase 1 Site Assessment performed by Environmental Data Resources, Inc. on June 17th, 2020.

National Historic Preservation Act (Section 106)

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

Uniform Act

Please see the attached letters, sent to the landowners September 2nd, 2020.

Part 3: Ground-Disturbing Activates Regulation/Questions

American Indian Religious Freedom Act (AIRFA)

Not applicable – project is not located in a county claimed as "territory" by the Eastern Band of Cherokee Indians.

Antiquities Act (AA)

Not applicable – project is not located on Federal land.

Archaeological Resources Protection Act (ARPA)

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

Endangered Species Act (ESA)

The Union County listed endangered species include the Carolina heelsplitter (*Lasmigona decorate*), Michaux's sumac (*Rhus michaauxii*), and Schweinitz's sunflower (*Helianthus schweinitzii*). RS requested a review and comment from the Asheville USFWS office on September 2, 2020 concerning potential impacts to threatened or endangered species related to the project. A response was received on Oct. 1, 2020 (Letter dated Sept. 17, 2020) from USFWS (Janet Mizzi, Field Supervisor via email from Karla Quast) and recommended target surveys for Michaux's sumac and Schweinitz's sunflower as service records show known occurrences of suitable habitat for both of these species in the project vicinity. A pedestrian survey was conducted by walking transects across suitable habitat areas within the project and no individual species were observed. A follow-up email was submitted to the Asheville USFWS with the results of the survey. A response was received on Oct. 30, 2020 (Letter dated Oct. 9, 2020) from USFWS (Janet Mizzi, Field Supervisor via email from Karla Quast) and determined the project would result in "no effect" for Carolina heelsplitter and "may affect, not likely to adversely affect" for Michaux's sumac and Schweinitz's sunflower. All correspondence with USFWS is attached.

Executive Order 13007 (Indian Sacred Sites)

Not applicable – project is not located in a county claimed as "territory" by the Eastern Band of Cherokee Indians.

Farmland Protection Policy Act (FPPA)

The Form AD-1006 was submitted via email to Milton Cortes of the NRCS on August 7, 2020. The completed AD-1006 form and email reply from Milton Cortes on Oct. 7, 2020 is attached.

Fish and Wildlife Coordination Act (FWCA)

USFWS and NCWRC have been consulted. See Appendix B: USFWS (Bryan Tompkins, Asheville Field Office) was contacted via email on Sept. 2, 2020 with a scoping letter, and an email response was received on Oct. 1, 2020 from USFWS (Janet Mizzi, Field Supervisor via email from Karla Quast) with recommendations and requesting documentation of surveys for two listed endangered plant species (Schweinitz's sunflower and Michaux's sumac). A follow-up email was sent on Oct. 5, 2020 documenting that surveys were performed during the target survey window for both species and no individuals for either species were observed. A response was received on Oct. 30, 2020 (Letter dated Oct. 9, 2020) from USFWS (Janet Mizzi, Field Supervisor via email from Karla Quast) and determined the project would result in "no effect" for Carolina heelsplitter and "may affect, not likely to adversely affect" for Michaux's sumac and Schweinitz's sunflower. USFWS provided general on behalf of natural resources which will be implemented in the design and construction of the project.

NCWRC (Shannon Deaton, Habitat Conservation Program Manager) was contacted via email on August 7, 2020, and an email response was received on August 17, 2020 from NCWRC (Olivia Munzer) with recommendations. These recommendations in the attached emails from USFWS and NCWRC will be implemented in the design and construction of the project.

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

Not applicable

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

Not applicable – project is not located within an estuarine system

Migratory Bird Treaty Act (MBTA)

USFWS provided no recommendations for the project relative to the MBTA, please see attached response from Janet Mizzi (USFWS – Asheville Regional Field Office) received on Oct. 1, 2020 (Letter dated Sept. 17, 2020). A follow-up correspondence received on Oct. 30, 2020 (Letter dated Oct. 9, 2020) from USFWS (Janet Mizzi, Field Supervisor via email from Karla Quast) did not include any recommendations related to the MBTA.

Wilderness Act

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

Wit's End Stream & Wetland

Mitigation Site

Categorical Exclusion

Attachments

August 7th, 2020

Renee Gledhill-Earley,
Environmental Review Coordinator
North Carolina State Historic Preservation Office
109 East Jones Street
Raleigh, NC 27699-4617
Sent electronically to Environmental.Review@ncdcr.gov

Re: Wits End Stream and Wetland Mitigation Project, Union County, NC

Dear Ms. Gledhill-Earley,

The purpose of this letter is to request written concurrence from the State Historic Preservation Office (SHPO) for the Wits End Stream and Wetland Mitigation Project in Union County, a Full-Delivery project for the N.C. Davison of Mitigation Services. Please review and comment on any possible issues that might emerge with respect to SHPO from the proposed stream and wetland restoration project depicted on the attached mapping.

Project Name:	Wits End Stream and Wetland Mitigation Project
Project Location:	Site Latitude, Longitude 34.9130, -80.4438 (WGS84)
Project Contact:	Alex Baldwin, Restoration Systems LLC, 1101 Haynes St. Suite 211, Raleigh, NC 27604

Project Description: The project has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. Permits from the NC DWR and USACE will be obtained to restore waters of the US. Soil and erosion control permits will also be obtained. The project encompasses 67.51 acres currently used for row crops, silviculture, and recreational (hunting/fishing) use. The proposed mitigation activities will include the reestablishment of 8,103 linear feet of jurisdictional streams, reestablishment of 23.080 acres of jurisdictional wetlands, enhancement of 1.373 acres of jurisdictional wetlands, and preservation of 5.000 acres of jurisdictional wetlands.

The term “cultural resources” refers to prehistoric or historic archaeological sites, structures, or artifact deposits over 50 years old. “Significant” cultural resources are those that are eligible or potentially eligible for inclusion in the National Register of Historic Places. Evaluations of site significance are made with reference to the eligibility criteria of the National Register (36 CFR 60) and in consultation with the North Carolina State Historic Preservation Office (SHPO).

Field visits were conducted in July 2020 to conduct evaluations for presence of structures or features that may be eligible for the National Register of Historic Places. No structures were identified within the Site boundaries that may be eligible for the National Register. In addition to field reviews for historically relevant structures, a records search was conducted at the SHPO office to determine if documented occurrences of historic structures or artifacts occur within, or adjacent to the Site. The SHPO records

identify no existing features within the Site boundaries and one feature within a 1.0-mile radius of the Site. The result was identified ~0.9-miles to the southwest as SO: UN0140: Griffin Family House.

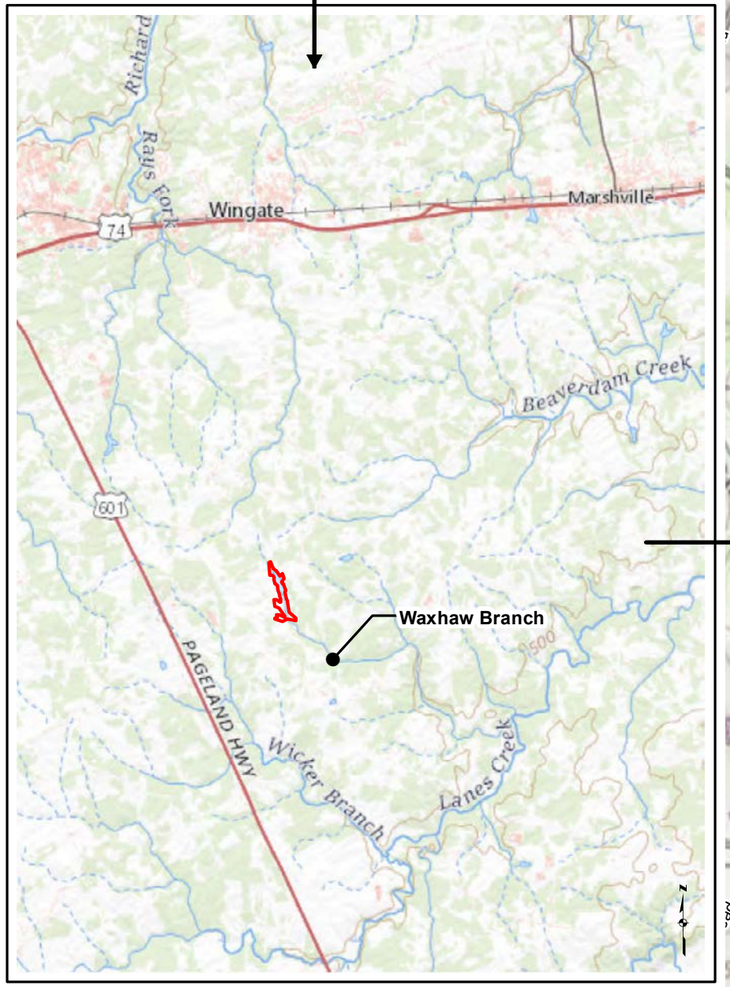
Typical SHPO coordination will occur prior to construction activities to determine if any significant cultural resources are present; however, no constraints are expected at this time. We thank you in advance for your timely response and cooperation. Please feel free to contact me with any questions that you may have concerning the extent of site disturbance associated with this project.

Respectfully,

RESTORATION SYSTEMS, LLC

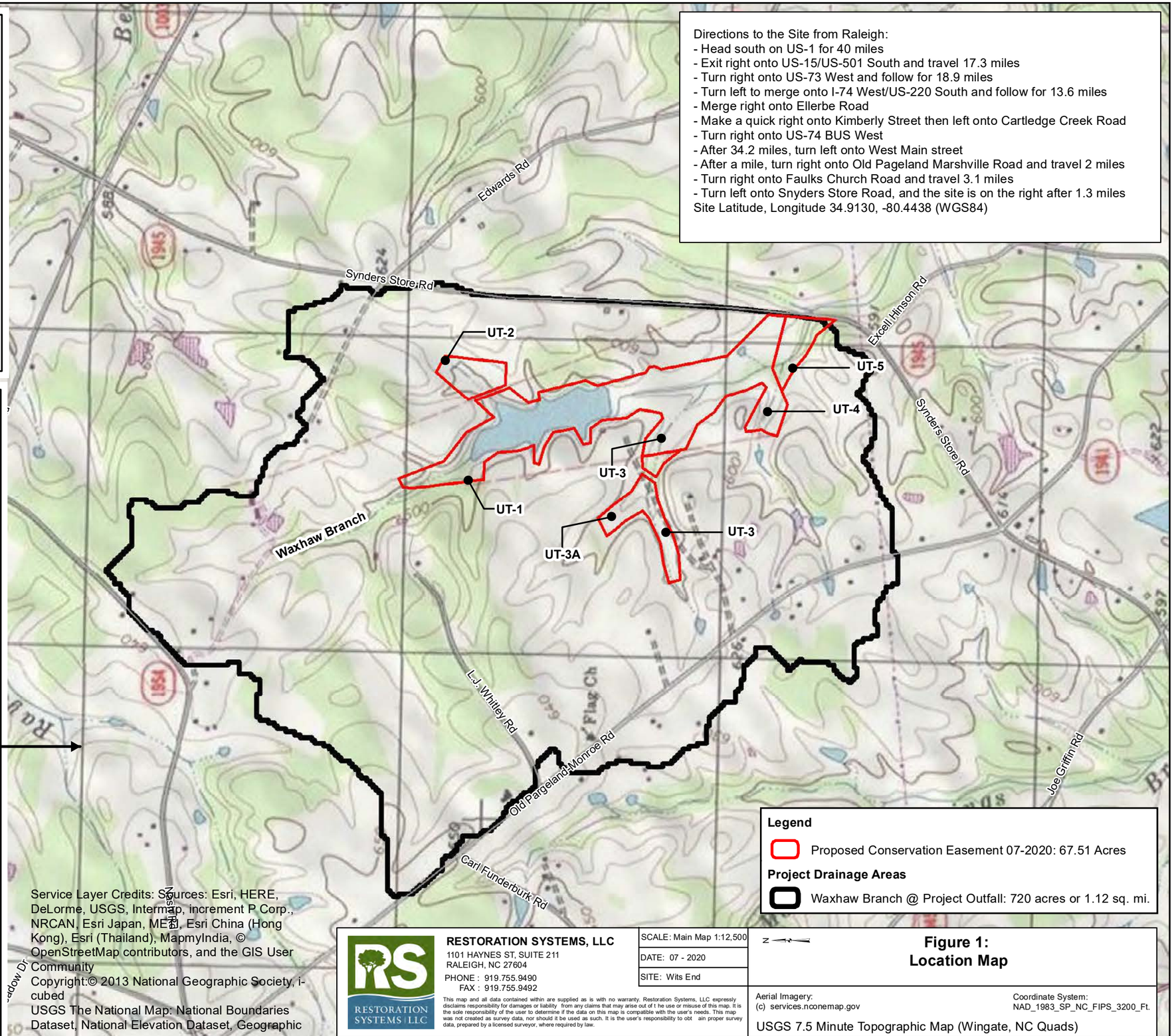
Alex Baldwin, LSS, PWS
Sr. Environmental Scientist
abaldwin@restorationsytems.com
919-755-9490

Attachments – Location and Condition Maps



Directions to the Site from Raleigh:
- Head south on US-1 for 40 miles
- Exit right onto US-15/US-501 South and travel 17.3 miles
- Turn right onto US-73 West and follow for 18.9 miles
- Turn left to merge onto I-74 West/US-220 South and follow for 13.6 miles
- Merge right onto Ellerbe Road
- Make a quick right onto Kimberly Street then left onto Cartledge Creek Road
- Turn right onto US-74 BUS West
- After 34.2 miles, turn left onto West Main street
- After a mile, turn right onto Old Pageland Marshville Road and travel 2 miles
- Turn right onto Faulks Church Road and travel 3.1 miles
- Turn left onto Snyders Store Road, and the site is on the right after 1.3 miles

Site Latitude, Longitude 34.9130, -80.4438 (WGS84)



Legend

Proposed Conservation Easement 07-2020: 67.51 Acres

Project Drainage Areas

Waxhaw Branch @ Project Outfall: 720 acres or 1.12 sq. mi.

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Copyright:© 2013 National Geographic Society, i-cubed
USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: Main Map 1:12,500
DATE: 07 - 2020
SITE: Wits End

Figure 1: Location Map

Aerial Imagery:
(c) services.nconemap.gov

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

USGS 7.5 Minute Topographic Map (Wingate, NC Quads)

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Location of Wits End Stream & Wetland Mitigation Site within USGS Hydrologic Unit and Targeted Local Watershed 03040105081020

DEQ - Subbasin 03-07-14

Legend

NC DMS TLWs & LWPs

- TLW
- TLW & LWP
- USGS 8-Digit HUC 03040105 - 'Yadkin 05'

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 6 miles

DATE: 07 - 2020

SITE: Wits End

N

Figure 2: Hydrologic Unit Map

Aerial Imagery: (c)

Coordinate System: NAD_1983_SP_NC_FIPS_3200_Ft.

Miles

0 1.75 3.5 7 10.5 14

Synders Store Rd

Excell Hinson Rd

UT - 2

UT - 5

Waxhaw Branch

XS #2

Pond - 1970 USGS
+/- 11.34 acres

XS #1

UT - 4

UT - 3

Waxhaw Branch

UT - 1

UT - 3A

UT - 3

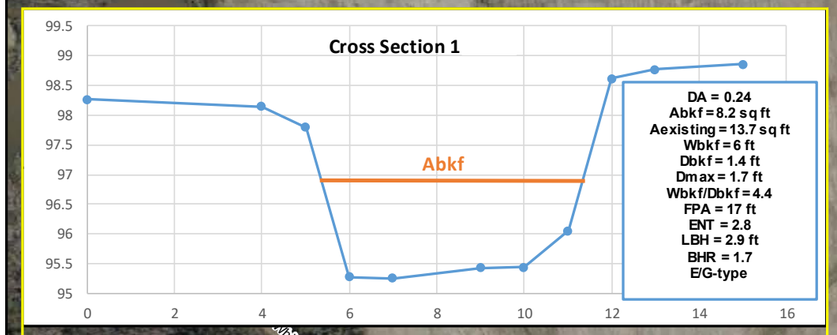
Old Pargeland-Monroe Rd

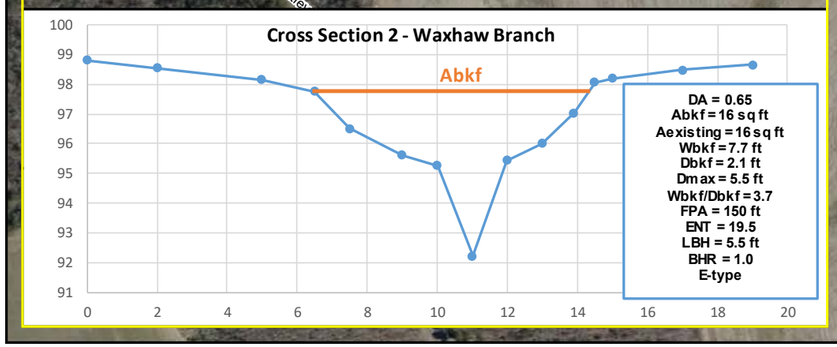
Project Note: UT - 4
Between 1951 and 1993 UT-4 saw direct agricultural impacts which appear to have included row crop farming directly through the tributary and the establishment of an earthen impoundment / crossing over the tributary.

Between 1993 and 2020, land use shifted to silviculture, which it remains in today. The tract saw its first timber cut in 2008. Sediment deposition is clear throughout the reach from historical and current land uses.

Legend

- Proposed CE 07-2020: 67.51 Acres
- Existing Streams
- NCSAM Form Locations
- NCWAM Form Locations
- Cross Sections
- Pre-Condition Monitoring Wells - 02-26-2020
- Existing Powerline
- Existing Driveway
- Existing & Historic Farm Roads / Crossings
- Existing Open Water
- Existing Wetlands





RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 375 feet
DATE: 07 - 2020
SITE: Wits End

Figure 3:
Existing Conditions
Site Features

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 170 340 680 1,020 1,360

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

September 24, 2020

Alex Baldwin, LSS, PWS abaldwin@restorationsystems.com
Restoration Systems, LLC.
1101 Haynes Street, Suite 211
Raleigh, NC 27604

Re: Wits End Stream and Wetland Mitigation Project, Site Latitude, Longitude 34.9130, -80.4438 (WGS84), Union County, ER 20-1783

Dear Alex Baldwin:

Thank you for your letter of August 7, 2020, regarding the above-referenced undertaking. We have reviewed the submittal and offer the following comments.

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

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

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, Environmental Review Coordinator, at 919-814-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley
for

Ramona M. Bartos
Deputy State Historic Preservation Officer

September 2nd, 2020

Mr. & Mrs. Max Brooks
2407 Faulks Church Rd
Wingate, NC 28174

Dear Mr. & Mrs. Brooks:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Union County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490.

Sincerely,

Alex Baldwin
Project Manager

September 2nd, 2020

Mr. and Mrs. Jessie Guion
2909 Old Pageland Monroe Rd
Monroe, NC 28112

Dear Mr. & Mrs. Guion:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Union County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490.

Sincerely,

Alex Baldwin
Project Manager

September 2nd, 2020

Mr. Dick Marshall
1226 Andover Rd
Charlotte, NC 28211

Dear Mr. Marshall:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Union County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490.

Sincerely,

Alex Baldwin
Project Manager

September 2nd, 2020

Ms. Gina Morris
2250 Shaw Ferry Ln
Lenoir City, TN 37772

Dear Ms. Morris:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Union County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490.

Sincerely,

Alex Baldwin
Project Manager

September 2nd, 2020

Dr. Niazi-Sai
PO Box 1219
Monroe, NC 28111

Dear Dr. Niazi-Sai:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Union County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490.

Sincerely,

Alex Baldwin
Project Manager

September 2nd, 2020

Mr. Randy Guion
2921 Old Pageland Monroe Rd
Monroe, NC 28112

Dear Mr. Guion:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Union County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-755-9490.

Sincerely,

Alex Baldwin
Project Manager

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Asheville Ecological Services Field Office
160 Zillicoa Street
Asheville, NC 28801-1082
Phone: (828) 258-3939 Fax: (828) 258-5330
http://www.fws.gov/nc-es/es/countyfr.html

In Reply Refer To: August 07, 2020
Consultation Code: 04EN1000-2020-SLI-0816
Event Code: 04EN1000-2020-E-01921
Project Name: Wits End Stream and Wetland Mitigation Site

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The attached species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. Although not required by section 7, many agencies request species lists to start the informal consultation process and begin their fulfillment of the requirements under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

This list, along with other helpful resources, is also available on the U.S. Fish and Wildlife Service (Service) Asheville Field Office's (AFO) website: https://www.fws.gov/raleigh/species/cntylist/nc_counties.html. The AFO website list includes “species of concern” species that could potentially be placed on the federal list of threatened and endangered species in the future. Also available are:

Design and Construction Recommendations
https://www.fws.gov/asheville/htmls/project_review/Recommendations.html

Optimal Survey Times for Federally Listed Plants
https://www.fws.gov/nc-es/plant/plant_survey.html

Northern long-eared bat Guidance
https://www.fws.gov/asheville/htmls/project_review/NLEB_in_WNC.html

Predictive Habitat Model for Aquatic Species
https://www.fws.gov/asheville/htmls/Maxent/Maxent.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could require modifications of these lists. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of the species lists should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website or the AFO website (the AFO website dates each county list with the day of the most recent update/change) at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list or by going to the AFO website.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a Biological Evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12 and on our office's website at https://www.fws.gov/asheville/htmls/project_review/assessment_guidance.html.

If a Federal agency (or their non-federal representative) determines, based on the Biological Assessment or Biological Evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species, and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at: http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF.

Though the bald eagle is no longer protected under the Endangered Species Act, please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require additional consultation (see https://www.fws.gov/southeast/our-services/permits/eagles/). Wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds (including bald and golden eagles) and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm;

http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Asheville Ecological Services Field Office
160 Zillicoa Street
Asheville, NC 28801-1082
(828) 258-3939

Project Summary

Consultation Code: 04EN1000-2020-SLI-0816

Event Code: 04EN1000-2020-E-01921

Project Name: Wits End Stream and Wetland Mitigation Site

Project Type: LAND - RESTORATION / ENHANCEMENT

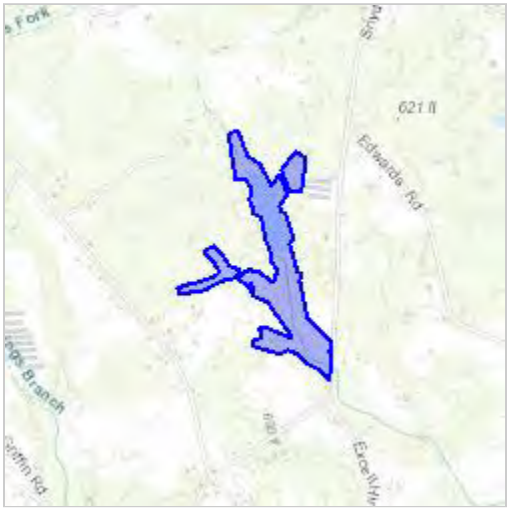
Project Description: The Site is located in the southwestern portion of Union County, NC south of Monroe, NC within USGS 14-digit HUC 03040105081020, which is a Targeted Local Watershed (TLW), and NCDWR Subbasin 03-07-14.

The proposed mitigation activities will occur in a 67.5 ac conservation easement and will include reestablishment of 8,103 lft of jurisdictional streams, reestablishment of 23.080 ac of jurisdictional wetlands, enhancement of 1.373 ac of jurisdictional wetlands, and preservation of 5.000 ac of jurisdictional wetlands.

The project is scheduled to be constructed during the winter of 2020-21, and then will be monitored for 7-years.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/34.917291846031816N80.44292038005474W



Counties: Union, NC

Endangered Species Act Species

There is a total of 3 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Clams

NAME	STATUS
Carolina Heelsplitter *Lasmigona decorata* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3534	Endangered

Flowering Plants

NAME	STATUS
Michaux's Sumac *Rhus michauxii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5217	Endangered
Schweinitz's Sunflower *Helianthus schweinitzii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3849	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

NC DEPARTMENT OF
NATURAL AND CULTURAL RESOURCES

Roy Cooper, **Governor**
Susi Hamilton, **Secretary**
Walter Clark, **Director, Land and Water Stewardship**

NCNHDE-12498

July 20, 2020

Alexander Baldwin
Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, NC 27604
RE: Wits End - July 2020

Dear Alexander Baldwin:

The North Carolina Natural Heritage Program (NCNHP) appreciates the opportunity to provide information about natural heritage resources for the project referenced above.

Based on the project area mapped with your request, a query of the NCNHP database indicates that there are no records for rare species, important natural communities, natural areas, and/or conservation/managed areas within the proposed project boundary. Please note that although there may be no documentation of natural heritage elements within the project boundary, it does not imply or confirm their absence; the area may not have been surveyed. The results of this query should not be substituted for field surveys where suitable habitat exists. In the event that rare species are found within the project area, please contact the NCNHP so that we may update our records.

The attached 'Potential Occurrences' table summarizes rare species and natural communities that have been documented within a one-mile radius of the property boundary. The proximity of these records suggests that these natural heritage elements may potentially be present in the project area if suitable habitat exists. Tables of natural areas and conservation/managed areas within a one-mile radius of the project area, if any, are also included in this report.

If a Federally-listed species is found within the project area or is indicated within a one-mile radius of the project area, the NCNHP recommends contacting the US Fish and Wildlife Service (USFWS) for guidance. Contact information for USFWS offices in North Carolina is found here: https://www.fws.gov/offices/Directory/ListOffices.cfm?statecode=37.

Please note that natural heritage element data are maintained for the purposes of conservation planning, project review, and scientific research, and are not intended for use as the primary criteria for regulatory decisions. Information provided by the NCNHP database may not be published without prior written notification to the NCNHP, and the NCNHP must be credited as an information source in these publications. Maps of NCNHP data may not be redistributed without permission.

The NC Natural Heritage Program may follow this letter with additional correspondence if a Dedicated Nature Preserve, Registered Heritage Area, Clean Water Management Trust Fund easement, or Federally-listed species are documented near the project area.

If you have questions regarding the information provided in this letter or need additional assistance, please contact Rodney A. Butler at rodney.butler@ncdcr.gov or 919-707-8603.

Sincerely,
NC Natural Heritage Program

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Within a One-mile Radius of the Project Area
Wits End - July 2020
July 20, 2020
NCNHDE-12498

No Element Occurrences are Documented Within a One-mile Radius of the Project Area

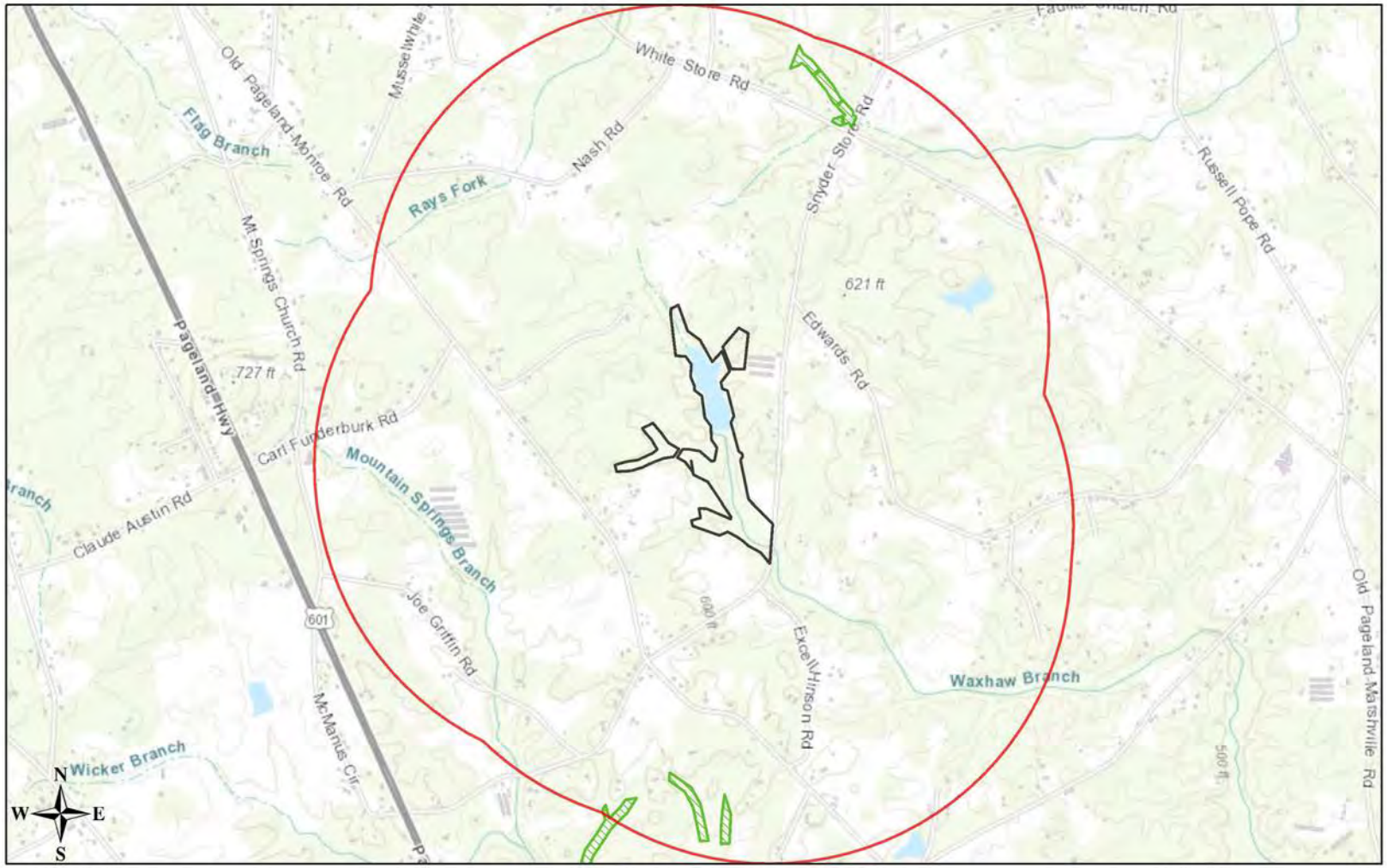
No Natural Areas are Documented Within a One-mile Radius of the Project Area

Managed Areas Documented Within a One-mile Radius of the Project Area

Managed Area Name	Owner	Owner Type
NC Division of Mitigation Services Easement	NC DEQ, Division of Mitigation Services	State
NC Division of Mitigation Services Easement	NC DEQ, Division of Mitigation Services	State

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/help. Data query generated on July 20, 2020; source: NCNHP, Q3 July 2020. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

NCNHDE-12498: Wits End - July 2020



July 20, 2020

- Project Boundary
- Buffered Project Boundary
- Managed Area (MAREA)

1:28,985

0 0.25 0.5 1 mi

0 0.375 0.75 1.5 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Endangered Species, Threatened Species, and Candidate Species, Union County, North Carolina

Updated: 07-17-2020

Critical Habitat Designations:

Carolina heelsplitter - *Lasmigona decorata* - The main stem of Goose Creek (Pee Dee River system), from the N.C. Highway 218 Bridge, downstream to its confluence with the Rocky River, and the main stem of Duck Creek, from the Mecklenburg/Union County line, downstream to its confluence with Goose Creek; the main stem of Waxhaw Creek (Catawba River system), from the N.C.Highway 200 Bridge, downstream to the North Carolina/South Carolina State line; and the main stem of Flat Creek (Pee Dee River system), Lancaster County, South Carolina, from the S.C. Route 204 Bridge, downstream to its confluence with the Lynches River, and the main stem of the Lynches River, Lancaster and Chesterfield Counties, South Carolina, from the confluence of Belk Branch, Lancaster County, northeast (upstream) of the U.S.Highway 601 Bridge, downstream to the S.C. Highway 903 Bridge in Kershaw County, South Carolina. Within these areas, the primary constituent elements include: (i)Permanent, flowing, cool, clean water; (ii)Geomorphically stable stream and river channels and banks; (iii)Pool, riffle, and run sequences within the channel; (iv)Stable substrates with no more than low amounts of fine sediment; (v)Moderate stream gradient; (vi)Periodic natural flooding; and (vii)Fish hosts, with adequate living, foraging, and spawning areas for them.
Federal Register Reference: July 2, 2002, Federal Register, 67:44501-44522.

Common Name	Scientific name	Federal Status	Record Status
Vertebrate:			
Invertebrate:			
Atlantic pigtoe Range by Basin	*Fusconaia masoni*	ARS	Current
Carolina heelsplitter	*Lasmigona decorata*	E	Current
Vascular Plant:			
Georgia aster	*Symphyotrichum georgianum*	C	Current
Michaux's sumac	*Rhus michauxii*	E	Historical
Schweinitz's sunflower	*Helianthus schweinitzii*	E	Current
Nonvascular Plant:			
Lichen:			

Definitions of Federal Status Codes:
E = endangered. A taxon "in danger of extinction throughout all or a significant portion of its range."
T = threatened. A taxon "likely to become endangered within the foreseeable future throughout all or a significant portion of its range."
C = candidate. A taxon under consideration for official listing for which there is sufficient information to support listing. (Formerly "C1" candidate species.)
BGPA =Bald and Golden Eagle Protection Act. See below.
ARS = At Risk Species. Species that are Petitioned, Candidates or Proposed for Listing under the Endangered Species Act. Consultation under Section 7(a)(2) of the ESA is not required for Candidate or Proposed species; although a Conference, as described under Section 7(a)(4) of the ESA is recommended for actions affecting species proposed for listing.
T(S/A) = threatened due to similarity of appearance. A taxon that is threatened due to similarity of appearance with another listed species and is listed for its protection. Taxa listed as T(S/A) are not biologically endangered or threatened and are not subject to Section 7 consultation. See below.
EXP = experimental population. A taxon listed as experimental (either essential or nonessential). Experimental, nonessential populations of endangered species (e.g., red wolf) are treated as threatened species on public land, for consultation purposes, and as species proposed for listing on private land.
P = proposed. Taxa proposed for official listing as endangered or threatened will be noted as "PE" or "PT", respectively.

Bald and Golden Eagle Protection Act (BGPA):

In the July 9, 2007 Federal Register(72:37346-37372), the bald eagle was declared recovered, and removed (de-listed) from the Federal List of Threatened and Endangered wildlife. This delisting took effect August 8,2007. After delisting, the Bald and Golden Eagle Protection Act (Eagle Act) (16 U.S.C. 668-668d) becomes the primary law protecting bald eagles. The Eagle Act prohibits take of bald and golden eagles and provides a statutory definition of "take" that includes "disturb". The USFWS has developed National Bald Eagle Management Guidelines to provide guidance to land managers, landowners, and others as to how to avoid disturbing bald eagles. For mor information, visit http://www.fws.gov/migratorybirds/baldeagle.htm

Threatened due to similarity of appearance(T(S/A)):

In the November 4, 1997 Federal Register (55822-55825), the northern population of the bog turtle (from New York south to Maryland) was listed as T (threatened), and the southern population (from Virginia south to Georgia) was listed as T(S/A) (threatened due to similarity of appearance). The T(S/A) designation bans the collection and interstate and international commercial trade of bog turtles from the southern population. The T(S/A) designation has no effect on land management activities by private landowners in North Carolina, part of the southern population of the species. In addition to its official status as T(S/A), the U.S. Fish and Wildlife Service considers the southern population of the bog turtle as a Federal species of concern due to habitat loss.

Definitions of Record Status:
Current - Based on NC Natural Heritage Program information, this taxon is considered to be extant in the county.
Historical - Based on NC Natural Heritage Program information, this taxon is considered to be historical in the county, meaning that all recorded occurrences are either extirpated, have not been found in recent surveys, or have not been surveyed recently enough to be confident they are still present.
Obscure - the date and/or location of observation is uncertain.
Incidental/migrant - the species was observed outside of its normal range or habitat.
Probable/potential - the species is considered likely to occur in this county based on the proximity of known records (in adjacent counties), the presence of potentially suitable habitat, or both.

September 2nd, 2020

Bryan Tompkins, Fish & Wildlife Biologist
USFWS Asheville Field Office
160 Zillicoa Street
Asheville, NC 28801-1082

Re: Wits End Stream and Wetland Mitigation Site, Union County, NC

Mr. Tompkins,

Restoration Systems, LLC (RS), of Raleigh, NC has been awarded a contract by NC Division of Mitigation Services to provide 10,000 Stream Mitigation Units and 20 Wetland Mitigation Units at the Wits End Stream and Wetland Mitigation Site in Union County, North Carolina.

One of the earliest tasks to be performed by RS is completion of an environmental screening and preparation/submittal of a Categorical Exclusion (CE) document. This document is specifically required by the Federal Highway Administration (FHWA) to ensure compliance with various federal environmental laws and regulations. DMS must demonstrate that its projects comply with federal mandates as a precondition to FHWA reimbursement of compensatory mitigation costs borne by the North Carolina Department of Transportation to offset its projects' unavoidable impacts to streams and wetlands.

In order for the project to proceed, RS is obligated to coordinate with your office for recommendations with the project relative to the Migratory Bird Treaty Act (MBTA). This letter provides you with certain details of the Wit's End Stream and Wetland Mitigation Site, including the project's location, a general description of its physiography, hydrography and existing land uses, as well as the intended modifications to the site proposed by RS. We request your review of the details provided and make recommendations to protect migratory birds.

Project Location & Description
The Site is characterized by agricultural fields utilized for row crop production. All Site hydrology drains through a ditch network to Waxhaw Branch. The Site is predominately encompassed within agricultural fields that have been ditched/drained, cleared of vegetation, and are maintained for row crop production with the remaining areas consisting of agricultural ponds and remnant forests. The proposed conservation easement area is approximately 67.51 acres in size.

The Site is in the Carolina Slate Belt, which is dissected by irregular plains that characterize regional physiography with moderate to steep slopes and low-moderate-gradient streams over a boulder and cobble-dominated substrate (Griffith et al. 2002). On-site floodplain elevations range from a high of 594 feet NGVD at the upper reach of Waxhaw Branch to a low of approximately 574 feet NGVD at the outfall of Waxhaw Branch (Figures 1-3).

Adjacent land management activities include silviculture, row crop production, and poultry houses. These areas include grass swales, ephemeral ditching, and agricultural ponds to control and alter

hydrology for existing land uses. These land use practices contribute nutrient, sediment, and fecal coliform into downstream receiving waters.

Restoration Means & Methods

The Site is located within USGS 14-digit HUC 03040105081020, which is a Targeted Local Watershed (TLW), and NCDWR Subbasin 03-07-14. The Lower Yadkin Pee-Dee River Basin Restoration Priorities (RBRP) 2009 report (NCEEP 2009) documents the following restoration goals for the Lower Yadkin Pee-Dee River Basin including USGS Hydrologic Unit 0304050105: improved management of stormwater runoff, mitigate impacts resulting from rapid urbanization of the area, and protect valuable threatened and endangered wildlife resources. The proposed mitigation activities will address RBRP goals through the reestablishment of 8,103 lft of jurisdictional streams, reestablishment of 23.080 ac of jurisdictional wetlands, enhancement of 1.373 ac of jurisdictional wetlands, and preservation of 5.000 ac of jurisdictional wetlands.

Restoration of vegetation allows for development and expansion of characteristic species across the landscape. Ecotonal changes between community types contribute to diversity and provide secondary benefits, such as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife. In addition, viable vegetative communities will improve system biogeochemical function by filtering pollutants from overland and shallow subsurface flows and providing organic materials.

Vegetative species composition will be based on Reference Forest Ecosystems (RFEs), site-specific features, and community descriptions from Classification of the Natural Communities of North Carolina (Schafale and Weakley 1990); the community associations to be utilized are Piedmont/Low Mountain Alluvial Forest and Dry-Mesic Oak-History Forest.

Bare-root seedlings within the Piedmont/Low Mountain Alluvial Forest and Dry-Mesic Oak-Hickory Forest will be planted at a density of approximately 680 stems per acre on 8-foot centers, and in the stream-side assemblage at a density of approximately 2,720 stems per acre on 4-foot centers. Planting will be performed between November 15 and March 15 to allow plants to stabilize during the dormant period and set root during the spring season.

Should you have any questions or if any additional information is needed to complete the Form, please feel free to contact me at the office 919.274.2419. Your valuable time and cooperation are much appreciated.

Sincerely,

RESTORATION SYSTEMS, LLC

Alex Baldwin
Project Manager
abaldwin@restorationsytems.com
919-274-2419

Attachments- Location and Condition Maps and IPaC Resources Migratory Bird List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Asheville Field Office
160 Zillicoa Street
Asheville, North Carolina 28801

September 17, 2020

Alex Baldwin
Restoration Systems
1101 Haynes St. Suite 211
Raleigh, NC 27604
abaldwin@restorationsystems.com

Dear Alex Baldwin:

Subject: Wits End Stream and Wetland Mitigation Site; Union County, North Carolina
Log No. 4-2-20-496

The U.S. Fish and Wildlife Service (Service) has reviewed the information provided in your correspondence dated September 2, 2020 wherein you solicit our comments regarding project-mediated impacts to federally protected species and request our concurrence with your effect determinations. We submit the following comments in accordance with the provisions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e); the National Environmental Policy Act (42 U.S.C. §4321 et seq.); and section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) (Act).

Project Description

According to the information provided, the proposed project aims to restore 8,103 linear feet of Waxhaw Branch and approximately 23 acres of jurisdictional wetlands in Allens Crossroads, North Carolina. The site is approximately 67 acres in extent and consists of riparian mixed forest, maintained transmission line easements, and unpaved roadways. Surrounding land use is dominated by forested and agricultural developments. This, along with IPCA data, were the only details provided of proposed project actions.

Federally Listed Endangered and Threatened Species

Service records show known occurrences of suitable habitat for the federally endangered Schweinitz's sunflower (*Helianthus schweinitzii*) and Michaux's sumac (*Rhus michauxii*) in the project vicinity. Targeted surveys for these species should be conducted during the optimal survey window(s) where proposed project-mediated impacts overlap suitable habitats for these species. Survey efforts between late August and October would span the optimal survey window for all of the species referenced above. Please submit your survey results to this office when they become available to complete our review and to inform a prudent effect determination from the appropriate action agency. In lieu of surveys during the optimal survey window, the Applicant may choose to assume presence of this species and identify measures to sufficiently avoid impacts to areas onsite that contain suitable habitat.

In accordance with the Act, it is the responsibility of the appropriate federal agency or its designated representative to review its activities or programs and to identify any such activities or programs that may affect endangered or threatened species or their habitats. If it is determined that the proposed activity may adversely affect any species federally listed as endangered or threatened, formal consultation with this office must be initiated.

We offer the following general recommendations on behalf of this and other natural resources:

Our habitat suitability models predict the presence of the Carolina darter (*Etheostoma collis*) and Eastern Creekshell (*Villosa delumbis*) in project receiving waters. These are species of concern and not afforded legal protection under the Act at this time. However, incorporating proactive conservation measures on their behalf may preclude the need to list it in the future. Like many aquatic animals, this species is susceptible to habitat and water quality degradation mediated by siltation, chemical runoff, and habitat loss. Project design and implementation should consider potential impacts to this species and identify measures to avoid them.

Erosion and Sediment Control

Measures to control sediment and erosion should be installed before any ground-disturbing activities occur. Grading and backfilling should be minimized, and existing native vegetation should be retained (if possible) to maintain riparian cover for fish and wildlife. Disturbed areas should be revegetated with native grass and tree species as soon as the project is completed. Ground disturbance should be limited to what will be stabilized quickly, preferably by the end of the workday. **Natural fiber matting (coir) should be used for erosion control as synthetic netting can trap animals and persist in the environment beyond its intended purpose.**

Stream Channel and Bank Restoration

A natural, stable stream system is one that is able to transport a wide range of flows and associated sediment bed load while maintaining channel features and neither degrading nor aggrading. Alterations to the dimension, pattern, or profile of the stream channel as well as changes to streambank vegetation, floodplains, hydrology, or sediment input can significantly alter this equilibrium.

We offer the following recommendations for the Applicant's consideration:

1. Streambanks with deep-rooted woody vegetation are the most stable, and stream restoration efforts should incorporate the use of native vegetation adapted to the site conditions. Live dormant stakes may be used to reestablish root structure in riparian areas. In areas where banks are severely undercut, high, and steep, whole-tree revetment or rock may be used as a stabilization treatment (small rock, gravel, sand, and dirt are not recommended due to their erosive nature), and it should not extend above the bank-full elevation (the elevation of the channel where the natural floodplain begins). Deep-rooting woody vegetation should be established along banks where any channel work is accomplished. Tree and shrub plantings should be spaced at intervals no greater than 10 feet along banks. Vegetated riparian zone widths should be as wide as practical but should extend at least 30 feet from the stream channel.

2. Only the absolute minimum amount of work should be done within stream channels to accomplish necessary reconstruction. Restoration plans should account for the constraints of the site and the opportunities to improve stream pattern, dimension, and profile with minimal disturbance.

3. Reconstruction work should follow natural channel design methodologies that are based on the bank-full, or channel-forming, stage of the stream. Bank-full stage maintains the natural channel dimensions and transports the bulk of sediment over time. Natural channel conditions should be identified using a reference reach (nearby stream reaches that exemplify restoration goals). Restoration design should match the pattern, dimension, and profile of the reference reach to ensure the project's success.

4. All work in or adjacent to stream waters should be conducted in a dry work area to the extent possible. Sandbags, cofferdams, bladder dams, or other diversion structures should be used to prevent excavation in flowing water. These diversion structures should be removed as soon as the work area is stable.

5. Equipment should not be operated in the stream unless absolutely necessary. Machinery should be operated from the banks in a fashion that minimizes disturbance to woody vegetation. Equipment should be: (a) washed to remove any contaminant residue prior to project construction, (b) in good working order, and (c) checked to ensure there are no leaks of potential contaminants (such as oil or other lubricants) prior to and during construction.

6. Adequate measures to control sediment and erosion must be implemented prior to any ground-disturbing activities in order to minimize effects on downstream aquatic resources. In North Carolina, non-cohesive and erosion-prone soils are most common in the felsic-crystalline terrains of the mountain and upper piedmont regions. Therefore, reconstruction work should be staged such that disturbed areas would be stabilized with seeding, mulch, and/or biodegradable (coir) erosion-control matting prior to the end of each workday. Matting should be secured in place with staples; stakes; or, wherever possible, live stakes of native trees. If rain is expected prior to temporary seed establishment, additional measures should be implemented to protect water quality along slopes and overburden stockpiles (for example, stockpiles may be covered with plastic or other geotextile material and surrounded with silt fencing).

The Service appreciates the opportunity to provide these comments. Please contact Mr. Byron Hamstead of our staff at byron_hamstead@fws.gov, if you have any questions. In any future correspondence concerning this project, please reference our Log Number 4-2-20-496.

Sincerely,
- - original signed - -
Janet Mizzi
Field Supervisor

From: Alex Baldwin
To: "Quast, Karla L"; Hamstead, Byron A
Subject: RE: Wits End Stream and Wetland Mitigation Site; Union County, North Carolina Log No. 4-2-20-496
Date: Monday, October 5, 2020 4:50:00 PM
Attachments: image001.png

Hi Karla and Byron,

I wanted to follow-up regarding our Project with the associated Log Number 4-2-20-496 to provide our survey results for Schweinitz's sunflower (*Helianthus schweinitzii*) and Michaux's sumac (*Rhus michauxii*). Target surveys were conducted during the optimal survey windows by myself, my qualifications include being a NC Licensed Soil Scientist (#1297) and Professional Wetland Scientist (#2221), and 15-years of experience.

Michaux's sumac:
Suitable habitat occurs within the project area along open areas of the site, residential yards, open woods, and the edge of agricultural fields. Surveys included walking these areas where suitable habitat was identified and was performed on July 9, 2020. The survey resulted in no individuals being identified.

Schweinitz's sunflower:
Suitable habitat occurs within the project area including edges of the oak-hickory woods, the existing powerline easement, and the edge of agricultural fields. Surveys included walking these areas where suitable habitat was identified and was performed on September 1, 2020. The survey resulted in no individuals being identified.

Please let me know if there is any additional information I can provide to assist your review.

Thank you,
Alex

Alex Baldwin | Restoration Systems, LLC
1101 Haynes St. Suite 211 | Raleigh, NC 27604
tel: 919.334.9112 | cell: 919.274.2419 | fax: 919.755.9492
email: abaldwin@restorationsystems.com

From: Quast, Karla L <karla_quast@fws.gov>
Sent: Thursday, October 1, 2020 3:49 PM
To: Alex Baldwin <abaldwin@restorationsystems.com>
Cc: Hamstead, Byron A <byron_hamstead@fws.gov>

Subject: Wits End Stream and Wetland Mitigation Site; Union County, North Carolina Log No. 4-2-20-496

Good Afternoon Alex,

Attached is the Services response to the proposed Wits End Stream and Wetland Mitigation project. Please feel free to reach out with any questions.

Thank you,

Karla Quast
Administrative Assistant
Asheville Field Office
U.S. Fish & Wildlife Service, South Atlantic/Gulf Region
160 Zillicoa St.
Asheville, NC 28801
karla_quast@fws.gov
office 828/258-3939, ext. 42232
cell 828/230-7836

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Asheville Field Office
160 Zillicoa Street
Asheville, North Carolina 28801

October 9, 2020

Alex Baldwin
Restoration Systems
1101 Haynes St. Suite 211
Raleigh, NC 27604
abaldwin@restorationsystems.com

Dear Alex Baldwin:

Subject: Wits End Stream and Wetland Mitigation Site; Union County, North Carolina
Log No. 4-2-20-496

The U.S. Fish and Wildlife Service (Service) has reviewed the information provided in your correspondence dated October 5, 2020 wherein you solicit our comments regarding project-mediated impacts to federally protected species and request our concurrence with your effect determinations. We submit the following comments in accordance with the provisions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e); the National Environmental Policy Act (42 U.S.C. §4321 et seq.); and section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) (Act).

Project Description

According to the information provided, the proposed project aims to restore 8,103 linear feet of Waxhaw Branch and approximately 23 acres of jurisdictional wetlands in Allens Crossroads, North Carolina. The site is approximately 67 acres in extent and consists of riparian mixed forest, maintained transmission line easements, and unpaved roadways. Surrounding land use is dominated by forested and agricultural developments. This, along with IPCA data, were the only details provided of proposed project actions.

Federally Listed Endangered and Threatened Species

Service records show known occurrences for the federally endangered Schweinitz's sunflower (*Helianthus schweinitzii*) in the project vicinity and suitable habitat occurs onsite. Your correspondence also indicates that suitable habitat is present onsite for the federally endangered Michaux's sumac (*Rhus michauxii*). Targeted surveys for these species were conducted, July 9, 2020 and September 1, 2020, during their respective optimal survey windows. No evidence for these plants was detected at that time. Due to the presence of suitable habitat, but lack of onsite evidence for these species, we believe the probability for project-mediated loss is insignificant and discountable. Therefore, we would concur with a "may affect, not likely to adversely affect" determination from the federal action agency.

Based on the information provided, we have no concerns for any other federally protected species and we require no further action at this time. Please be aware that obligations under section 7 of the Endangered Species Act must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered, (2) this action is subsequently modified in a manner that was not considered in this review, or (3) a new species is listed or critical habitat is determined that may be affected by the identified action.

We offer the following general recommendations on behalf of natural resources:

Erosion and Sediment Control

Measures to control sediment and erosion should be installed before any ground-disturbing activities occur. Grading and backfilling should be minimized, and existing native vegetation should be retained (if possible) to maintain riparian cover for fish and wildlife. Disturbed areas should be revegetated with native grass and tree species as soon as the project is completed. Ground disturbance should be limited to what will be stabilized quickly, preferably by the end of the workday. **Natural fiber matting (coir) should be used for erosion control as synthetic netting can trap animals and persist in the environment beyond its intended purpose.**

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A natural, stable stream system is one that is able to transport a wide range of flows and associated sediment bed load while maintaining channel features and neither degrading nor aggrading. Alterations to the dimension, pattern, or profile of the stream channel as well as changes to streambank vegetation, floodplains, hydrology, or sediment input can significantly alter this equilibrium.

We offer the following recommendations for the Applicant's consideration:

1. Streambanks with deep-rooted woody vegetation are the most stable, and stream restoration efforts should incorporate the use of native vegetation adapted to the site conditions. Live dormant stakes may be used to reestablish root structure in riparian areas. In areas where banks are severely undercut, high, and steep, whole-tree revetment or rock may be used as a stabilization treatment (small rock, gravel, sand, and dirt are not recommended due to their erosive nature), and it should not extend above the bank-full elevation (the elevation of the channel where the natural floodplain begins). Deep-rooting woody vegetation should be established along banks where any channel work is accomplished. Tree and shrub plantings should be spaced at intervals no greater than 10 feet along banks. Vegetated riparian zone widths should be as wide as practical but should extend at least 30 feet from the stream channel.

2. Only the absolute minimum amount of work should be done within stream channels to accomplish necessary reconstruction. Restoration plans should account for the constraints of the site and the opportunities to improve stream pattern, dimension, and profile with minimal disturbance.

3. Reconstruction work should follow natural channel design methodologies that are based on the bank-full, or channel-forming, stage of the stream. Bank-full stage maintains the natural channel dimensions and transports the bulk of sediment over time. Natural channel conditions should be identified using a reference reach (nearby stream reaches that exemplify restoration goals). Restoration design should match the pattern, dimension, and profile of the reference reach to ensure the project's success.

4. All work in or adjacent to stream waters should be conducted in a dry work area to the extent possible. Sandbags, cofferdams, bladder dams, or other diversion structures should be used to prevent excavation in flowing water. These diversion structures should be removed as soon as the work area is stable.

5. Equipment should not be operated in the stream unless absolutely necessary. Machinery should be operated from the banks in a fashion that minimizes disturbance to woody vegetation. Equipment should be: (a) washed to remove any contaminant residue prior to project construction, (b) in good working order, and (c) checked to ensure there are no leaks of potential contaminants (such as oil or other lubricants) prior to and during construction.

6. Adequate measures to control sediment and erosion must be implemented prior to any ground-disturbing activities in order to minimize effects on downstream aquatic resources. In North Carolina, non-cohesive and erosion-prone soils are most common in the felsic-crystalline terrains of the mountain and upper piedmont regions. Therefore, reconstruction work should be staged such that disturbed areas would be stabilized with seeding, mulch, and/or biodegradable (coir) erosion-control matting prior to the end of each workday. Matting should be secured in place with staples; stakes; or, wherever possible, live stakes of native trees. If rain is expected prior to temporary seed establishment, additional measures should be implemented to protect water quality along slopes and overburden stockpiles (for example, stockpiles may be covered with plastic or other geotextile material and surrounded with silt fencing).

The Service appreciates the opportunity to provide these comments. Please contact Mr. Byron Hamstead of our staff at byron_hamstead@fws.gov, if you have any questions. In any future correspondence concerning this project, please reference our Log Number 4-2-20-496.

Sincerely,
- - original signed - -
Janet Mizzi
Field Supervisor

August 7th, 2020

Shannon Deaton,
Habitat Conservation Program Manager
North Carolina Wildlife Resources Commission
1701 Mail Service Center
Raleigh, NC 27699-1701

Re: Wits End Stream and Wetland Mitigation Project, Union County, NC

Dear Ms. Deaton:

The purpose of this letter is to request concurrence from the North Carolina Wildlife Recourse Commission concerning a stream and wetland restoration project located in Union County for the N.C. Division of Mitigation Services. The project will restore streams and riparian wetlands in existing row crop fields, silviculture tracts, and remnant forest. Please review and comment on any possible issues that might emerge with respect to the Fish and Wildlife Coordination Act from the potential stream and wetland restoration project. Attached is a USGS base map with the Project's 67.5 acre footprint identified. The Project is located in the Yadkin-Pee Dee River Basin within USGS 14-digit HUC 03040105081020, which is a Targeted Local Watershed (TLW), and NCDWR Subbasin 03-07-14.

The proposed mitigation activities will include reestablishment of 8,103 lft of jurisdictional streams, reestablishment of 23.080 ac of jurisdictional wetlands, enhancement of 1.373 ac of jurisdictional wetlands, and preservation of 5.000 ac of jurisdictional wetlands.

Should you have any questions or if any additional information is needed to complete the review, please feel free to contact me at 919.274.2419. Your time and review are much appreciated.

Respectfully,

RESTORATION SYSTEMS, LLC

Alex Baldwin, LSS, PWS
Senior Environmental Scientist
abaldwin@restorationsytems.com
919-274-2419

Attachments- Location and Condition Maps

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

17 August 2020

Mr. Alex Baldwin
Restoration Systems
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604

SUBJECT: Environmental Review of the Wits End Stream and Wetland Mitigation Site in Union County, North Carolina.

Mr. Baldwin,

Biologists with the North Carolina Wildlife Resource Commission (NCWRC) received your request to review and comment on any possible concerns regarding the Wits End Stream and Wetland Mitigation Site. Comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) and North Carolina General Statutes (G.S. 113-131 et seq.).

The Wits End Stream and Wetland Mitigation Site is located southwest of the intersection of Synders Store Road and Excell Hinson Road near Monroe, Union County, North Carolina. The site consists of row crop fields, silviculture tracts, and remnant forest. The proposed 67.51-acre conservation easement occurs along Waxhaw Branch and its unnamed tributaries in the Yadkin-Pee Dee River basin. The mitigation project will reestablish 8,103 linear feet of streams and 23.080 acres (ac) of wetlands, enhance 1.373 ac of wetlands, and preserve 5.0 ac of wetlands.

NCWRC has records of the state endangered Carolina Creekshell (*Villosa vaughaniana*) and Savannah Lilliput (*Toxolasma pullus*), state special concern Carolina Darter (*Etheostoma collis*), and significantly rare Eastern Creekshell (*V. delumbis*) downstream of the project.

Stream restoration projects often improve water quality and aquatic habitat. Establishing native, forested buffers in riparian areas will help protect water quality, improve aquatic and terrestrial habitats, and provide a travel corridor for wildlife species. Based upon the information provided to NCWRC, it is unlikely that stream and wetland mitigation will adversely affect any federal or state-listed species. However, we offer the following preliminary recommendations to minimize impacts to aquatic and terrestrial wildlife resources:

1. We recommend riparian buffers are as wide as possible, given site constraints and landowner needs. NCWRC generally recommends a woody buffer of 100 feet on perennial streams to

Mailing Address: Habitat Conservation • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

maximize the benefits of buffers, including bank stability, stream shading, treatment of overland runoff, and wildlife habitat.

2. We recommend the planting list is diverse and consists of species typically found in that natural vegetation community, as described by M.P. Schafale in The Guide to The Natural Communities of North Carolina, Fourth Approximation (https://www.ncnhp.org/references/nhp-publications/fourth-approximation-descriptions).
3. We request stringent sediment and erosion control measures because of the potential for state-protected species to occur downstream of the site.
4. Due to the decline in populations of most bat species, we recommend leaving snags and mature trees, or if necessary, remove tees outside the maternity roosting season for bats (May 15 – August 15).
5. The use of biodegradable and wildlife-friendly sediment and erosion control devices is strongly recommended. Silt fencing, fiber rolls and/or other products should have loose-weave netting that is made of natural fiber materials with movable joints between the vertical and horizontal twines. Silt fencing that has been reinforced with plastic or metal mesh should be avoided as it impedes the movement of terrestrial wildlife species. Excessive silt and sediment loads can have detrimental effects on aquatic resources including destruction of spawning habitat, suffocation of eggs, and clogging of gills.

Thank you for the opportunity to provide comments. If I can be of additional assistance, please call (919) 707-0364 or email olivia.munzer@ncwildlife.org.

Sincerely,

Olivia Munzer
Western Piedmont Habitat Conservation Coordinator
Habitat Conservation Program

August 7th, 2020

Milton Cortes
USDA Natural Resources Conservation Service
4407 Bland Road
Suite 117
Raleigh, NC 27609

Re: Wits End Stream and Wetland Mitigation Site, Union County, NC

Restoration Systems, LLC (RS), of Raleigh, NC has been awarded a contract by DMS to provide 10,000 Stream Mitigation Units and 20 Wetland Mitigation Units at the Wits End Stream and Wetland Mitigation Site (Site) in Union County, North Carolina.

One of the earliest tasks to be performed by RS is completion of an environmental screening and preparation/submittal of a Categorical Exclusion (CE) document. This document is specifically required by the Federal Highway Administration (FHWA) to ensure compliance with various federal environmental laws and regulations. DMS must demonstrate that its projects comply with federal mandates as a precondition to FHWA reimbursement of compensatory mitigation costs borne by the North Carolina Department of Transportation to offset its projects' unavoidable impacts to streams and wetlands.

In order for the project to proceed, RS is obligated to coordinate with the NRCS to complete Form AD-1006 in compliance with the Farmland Protection Policy Act on behalf of the FHWA. The purpose of this letter is to request your assistance in completion of the Form.

Project Location & Description
The Site is characterized by agricultural fields utilized for row crop production. All Site hydrology drains through a ditch network to Waxhaw Branch. The Site is predominately encompassed within agricultural fields that have been ditched/drained, cleared of vegetation, and are maintained for row crop production with the remaining areas consisting of agricultural ponds and remnant forests. The proposed conservation easement area is approximately 67.51 acres in size.

The Site is in the Carolina Slate Belt, which is dissected by irregular plains that characterize regional physiography with moderate to steep slopes and low-moderate-gradient streams over a boulder and cobble-dominated substrate (Griffith et al. 2002). On-site floodplain elevations range from a high of 594 feet NGVD at the upper reach of Waxhaw Branch to a low of approximately 574 feet NGVD at the outfall of Waxhaw Branch (Figure 1 & 2).

Restoration Means & Methods
The Site is located within USGS 14-digit HUC 03040105081020, which is a Targeted Local Watershed (TLW), and NCDWR Subbasin 03-07-14. The Lower Yadkin Pee-Dee River Basin Restoration Priorities (RBRP) 2009 report (NCEEP 2009) documents the following restoration goals for the Lower Yadkin Pee-Dee River Basin including USGS Hydrologic Unit 0304050105: improved management of stormwater runoff, mitigate impacts resulting from rapid urbanization of the area, and protect valuable threatened and endangered wildlife resources. The proposed mitigation activities will address RBRP goals through

the reestablishment of 8,103 lft of jurisdictional streams, reestablishment of 23.080 ac of jurisdictional wetlands, enhancement of 1.373 ac of jurisdictional wetlands, and preservation of 5.000 ac of jurisdictional wetlands.

Restoration of vegetation allows for development and expansion of characteristic species across the landscape. Ecotonal changes between community types contribute to diversity and provide secondary benefits, such as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife. In addition, viable vegetative communities will improve system biogeochemical function by filtering pollutants from overland and shallow subsurface flows and providing organic materials.

Vegetative species composition will be based on Reference Forest Ecosystems (RFEs), site-specific features, and community descriptions from Classification of the Natural Communities of North Carolina (Schafale and Weakley 1990); the community associations to be utilized are Piedmont/Low Mountain Alluvial Forest and Dry-Mesic Oak-History Forest.

Bare-root seedlings within the Piedmont/Low Mountain Alluvial Forest and Dry-Mesic Oak-Hickory Forest will be planted at a density of approximately 680 stems per acre on 8-foot centers, and in the stream-side assemblage at a density of approximately 2,720 stems per acre on 4-foot centers. Planting will be performed between November 15 and March 15 to allow plants to stabilize during the dormant period and set root during the spring season.

Should you have any questions or if any additional information is needed to complete the Form, please feel free to contact me at 919.274.2419. Your time and review are much appreciated.

Respectfully,

RESTORATION SYSTEMS, LLC

Alex Baldwin, LSS, PWS
Senior Environmental Scientist
abaldwin@restorationsytems.com
919-274-2419

Attachments- Location and Condition Maps
AD-1006 Form
NRCS Web Soil Survey

From:	Cortes, Milton - NRCS, Raleigh, NC
To:	Alex Baldwin
Subject:	RE: Wits End Stream & Wetland Mitigation Site Review
Date:	Wednesday, October 7, 2020 3:14:01 PM
Attachments:	image004.png image003.png Wits_End_AD-1006.pdf
Importance:	High

Good afternoon Mr. Baldwin;

Please find attached the FARMLAND CONVERSION IMPACT RATING evaluation for the Wits End Mitigation Site, Stream & Wetland Restoration, Union Co. NC

If we can be of further assistance please let us know'

Best regards;

Milton Cortés
State Soil Scientist
Raleigh, North Carolina State Office
Natural Resources Conservation Service
United States Department of Agriculture
Office: 919-873-2171
Cell: 984-365-2201
Milton.Cortes@usda.gov

NRCS NC: https://www.nrcs.usda.gov/wps/portal/nrcs/site/nc/home/

From: Alex Baldwin <abaldwin@restorationsystems.com>
Sent: Monday, October 5, 2020 10:52 AM
To: Cortes, Milton - NRCS, Raleigh, NC <milton.cortes@usda.gov>
Subject: RE: Wits End Stream & Wetland Mitigation Site Review

Mr. Cortes,

I called your office phone on Oct. 2, 2020 and left a voicemail inquiring on the status of the Farmland Conversion AD – 1006 form submitted via email on Aug. 7, 2020. I wanted to follow-up and see if this is something you will be able to complete as it is the last piece we need to submit our Categorical Exclusion.

Please give me a call (919-274-2419) if there is anything that needs to be discussed.

Thanks,
Alex

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 08/07/2020
Name of Project Wits End Mitigation Site	Federal Agency Involved FHWA
Proposed Land Use Stream & Wetland Restoration	County and State Union County, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS / Person Completing Form: Milton Cortes NRCS NC

Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☑ NO ☐	Acres Irrigated: none	Average Farm Size: 190 acres
Major Crop(s): CORN	Farmable Land In Govt. Jurisdiction — Acres: 94 % 384,651 acres	Amount of Farmland As Defined in FPPA — Acres: 77.4 % 291,581 acres	
Name of Land Evaluation System Used: Union Co. NC LESA	Name of State or Local Site Assessment System: N/A	Date Land Evaluation Returned by NRCS: October 7, 2020 by eMail	

PART III *(To be completed by Federal Agency)*	Alternative Site Rating: Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	49.4			
B. Total Acres To Be Converted Indirectly	18.1			
C. Total Acres In Site	67.5			
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	0			
B. Total Acres Statewide Important or Local Important Farmland	62.20			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted	0.0213			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value	41.3			
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)	87			

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)	15			
2. Perimeter In Non-urban Use	(10)	10			
3. Percent Of Site Being Farmed	(20)	7			
4. Protection Provided By State and Local Government	(20)	0			
5. Distance From Urban Built-up Area	(15)	15			
6. Distance To Urban Support Services	(15)	10			
7. Size Of Present Farm Unit Compared To Average	(10)	3			
8. Creation Of Non-farmable Farmland	(10)	0			
9. Availability Of Farm Support Services	(5)	4			
10. On-Farm Investments	(20)	15			
11. Effects Of Conversion On Farm Support Services	(10)	0			
12. Compatibility With Existing Agricultural Use	(10)	1			
TOTAL SITE ASSESSMENT POINTS	160	80	0	0	0
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	87	0	0	0
Total Site Assessment *(From Part VI above or local site assessment)*	160	80	0	0	0
TOTAL POINTS ***(Total of above 2 lines)***	260	167	0	0	0

Site Selected: Yes	Date Of Selection July 1, 2019	Was A Local Site Assessment Used? YES ☑ NO ☐

Reason For Selection:

The Site was selected to provide stream and wetland mitigation to offset anticipated impacts of these features in the surrounding area as identified by NCDMS. The Site includes breaks in the easement to allow access to land outside the easement to facilitate adjacent land use.

Name of Federal agency representative completing this form: Restoration Systems, LLC	Date: 8/7/2020

(See Instructions on reverse side) **Form AD-1006 (03-02)**

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Union County, North Carolina

Wits End Stream and Wetland Mitigation Site

August 7, 2020

Contents

Custom Soil Resource Report
Soil Map

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BaB	Badin channery silt loam, 2 to 8 percent slopes	7.4	10.6%
CmB	Cid channery silt loam, 1 to 5 percent slopes	45.8	65.5%
GoC	Goldston very channery silt loam, 4 to 15 percent slopes	0.8	1.2%
GsB	Goldston-Badin complex, 2 to 8 percent slopes	0.4	0.6%
GsC	Goldston-Badin complex, 8 to 15 percent slopes	5.0	7.2%
W	Water	10.3	14.8%
Totals for Area of Interest		**69.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

Wits End Mitigation Site
SNYDER STORE RD
Wingate, NC 28174

Inquiry Number: 6095455.2s
June 17, 2020

The EDR Radius Map™ Report with GeoCheck®

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

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

SNYDER STORE RD
WINGATE, NC 28174

COORDINATES

Latitude (North):	34.9135010 - 34° 54' 48.60''
Longitude (West):	80.4410430 - 80° 26' 27.75''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	551060.8
UTM Y (Meters):	3863396.0
Elevation:	626 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5946505 WINGATE, NC
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140517
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
SNYDER STORE RD
WINGATE, NC 28174

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION

NO MAPPED SITES FOUND

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL ---------- National Priority List
Proposed NPL ---------- Proposed National Priority List Sites
NPL LIENS ---------- Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ---------- National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY ---------- Federal Facility Site Information listing
SEMS ---------- Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE ---------- Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS ---------- Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ---------- RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG ---------- RCRA - Large Quantity Generators
RCRA-SQG ---------- RCRA - Small Quantity Generators
RCRA-VSQG ---------- RCRA - Very Small Quantity Generators (Formerly Conditionally Exempt Small Quantity Generators)

Federal institutional controls / engineering controls registries

LUCIS ---------- Land Use Control Information System

US ENG CONTROLS Engineering Controls Sites List
US INST CONTROLS Institutional Controls Sites List

Federal ERNS list

ERNS Emergency Response Notification System

State- and tribal - equivalent NPL

NC HSDS Hazardous Substance Disposal Site

State- and tribal - equivalent CERCLIS

SHWS Inactive Hazardous Sites Inventory

State and tribal landfill and/or solid waste disposal site lists

SWF/LF List of Solid Waste Facilities
DEBRIS Solid Waste Active Disaster Debris Sites Listing
OLI Old Landfill Inventory
LCID Land-Clearing and Inert Debris (LCID) Landfill Notifications

State and tribal leaking storage tank lists

LUST Regional UST Database
LAST Leaking Aboveground Storage Tanks
INDIAN LUST Leaking Underground Storage Tanks on Indian Land
LUST TRUST State Trust Fund Database

State and tribal registered storage tank lists

FEMA UST Underground Storage Tank Listing
UST Petroleum Underground Storage Tank Database
AST AST Database
INDIAN UST Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

INST CONTROL No Further Action Sites With Land Use Restrictions Monitoring

State and tribal voluntary cleanup sites

INDIAN VCP Voluntary Cleanup Priority Listing
VCP Responsible Party Voluntary Action Sites

State and tribal Brownfields sites

BROWNFIELDS Brownfields Projects Inventory

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS A Listing of Brownfields Sites

EXECUTIVE SUMMARY

Local Lists of Landfill / Solid Waste Disposal Sites

SWRCY ---------- Recycling Center Listing
HIST LF ---------- Solid Waste Facility Listing
INDIAN ODI ---------- Report on the Status of Open Dumps on Indian Lands
ODI ---------- Open Dump Inventory
DEBRIS REGION 9 ---------- Torres Martinez Reservation Illegal Dump Site Locations
IHS OPEN DUMPS ---------- Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL ---------- Delisted National Clandestine Laboratory Register
US CDL ---------- National Clandestine Laboratory Register

Local Land Records

LIENS 2 ---------- CERCLA Lien Information

Records of Emergency Release Reports

HMIRS ---------- Hazardous Materials Information Reporting System
SPILLS ---------- Spills Incident Listing
IMD ---------- Incident Management Database
SPILLS 90 ---------- SPILLS 90 data from FirstSearch
SPILLS 80 ---------- SPILLS 80 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR ---------- RCRA - Non Generators / No Longer Regulated
FUDS ---------- Formerly Used Defense Sites
DOD ---------- Department of Defense Sites
SCRD DRYCLEANERS ---------- State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR ---------- Financial Assurance Information
EPA WATCH LIST ---------- EPA WATCH LIST
2020 COR ACTION ---------- 2020 Corrective Action Program List
TSCA ---------- Toxic Substances Control Act
TRIS ---------- Toxic Chemical Release Inventory System
SSTS ---------- Section 7 Tracking Systems
ROD ---------- Records Of Decision
RMP ---------- Risk Management Plans
RAATS ---------- RCRA Administrative Action Tracking System
PRP ---------- Potentially Responsible Parties
PADS ---------- PCB Activity Database System
ICIS ---------- Integrated Compliance Information System
FTTS ---------- FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS ---------- Material Licensing Tracking System
COAL ASH DOE ---------- Steam-Electric Plant Operation Data
COAL ASH EPA ---------- Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER ---------- PCB Transformer Registration Database
RADINFO ---------- Radiation Information Database
HIST FTTS ---------- FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS ---------- Incident and Accident Data
CONSENT ---------- Superfund (CERCLA) Consent Decrees

INDIAN RESERV - Indian Reservations
FUSRAP - Formerly Utilized Sites Remedial Action Program
UMTRA - Uranium Mill Tailings Sites
LEAD SMELTERS - Lead Smelter Sites
US AIRS - Aerometric Information Retrieval System Facility Subsystem
US MINES - Mines Master Index File
ABANDONED MINES - Abandoned Mines
FINDS - Facility Index System/Facility Registry System
ECHO - Enforcement & Compliance History Information
DOCKET HWC - Hazardous Waste Compliance Docket Listing
UXO - Unexploded Ordnance Sites
FUELS PROGRAM - EPA Fuels Program Registered Listing
AIRS - Air Quality Permit Listing
ASBESTOS - ASBESTOS
COAL ASH - Coal Ash Disposal Sites
DRYCLEANERS - Drycleaning Sites
Financial Assurance - Financial Assurance Information Listing
NPDES - NPDES Facility Location Listing
UIC - Underground Injection Wells Listing
AOP - Animal Operation Permits Listing
SEPT HAULERS - Permitted Septage Haulers Listing
MINES MRDS - Mineral Resources Data System
PCSRP - Petroleum-Contaminated Soil Remediation Permits
CCB - Coal Ash Structural Fills (CCB) Listing

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP - EDR Proprietary Manufactured Gas Plants
EDR Hist Auto - EDR Exclusive Historical Auto Stations
EDR Hist Cleaner - EDR Exclusive Historical Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS - Recovered Government Archive State Hazardous Waste Facilities List
RGA LF - Recovered Government Archive Solid Waste Facilities List
RGA LUST - Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

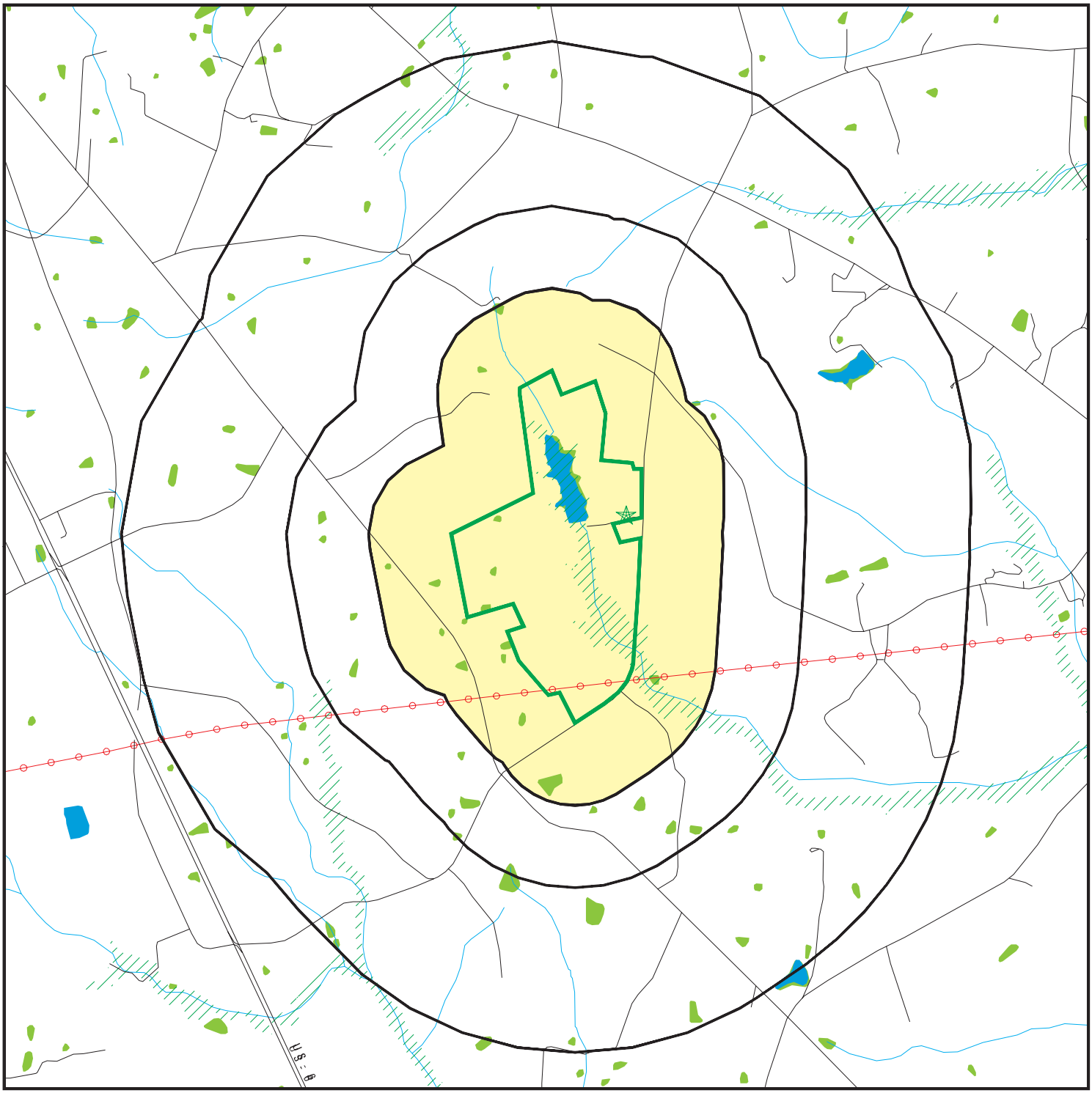
Surrounding sites were not identified.

Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 6095455.2S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites

0 1/4 1/2 1 Miles

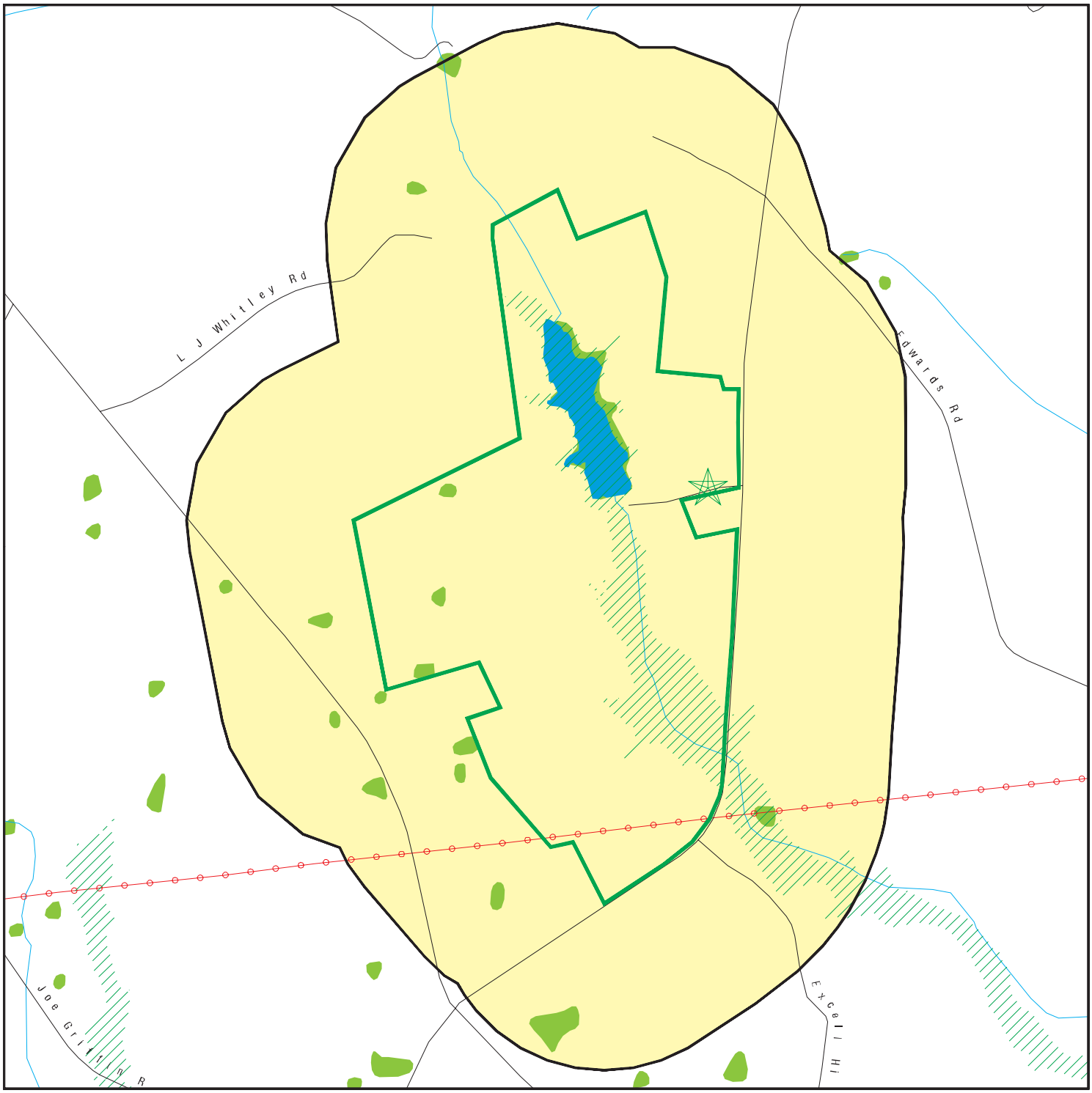
- Indian Reservations BIA
- Power transmission lines
- Special Flood Hazard Area (1%)
- 0.2% Annual Chance Flood Hazard
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

N

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Wits End Mitigation Site ADDRESS: SNYDER STORE RD Wingate NC 28174 LAT/LONG: 34.913501 / 80.441043	CLIENT: Restoration Systems, LLC CONTACT: Alex Baldwin INQUIRY #: 6095455.2s DATE: June 17, 2020 2:00 pm

DETAIL MAP - 6095455.2S



0 1/8 1/4 1/2 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Power transmission lines
- Special Flood Hazard Area (1%)
- 0.2% Annual Chance Flood Hazard
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Wits End Mitigation Site	CLIENT: Restoration Systems, LLC
ADDRESS: SNYDER STORE RD Wingate NC 28174	CONTACT: Alex Baldwin
LAT/LONG: 34.913501 / 80.441043	INQUIRY #: 6095455.2s DATE: June 17, 2020 2:01 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	1.000		0	0	0	0	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-VSQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROLS	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	0.001		0	NR	NR	NR	NR	0
State- and tribal - equivalent NPL								
NC HSDS	1.000		0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
DEBRIS	0.500		0	0	0	NR	NR	0
OLI	0.500		0	0	0	NR	NR	0
LCID	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0
LAST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
LUST TRUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
INDIAN VCP	0.500		0	0	0	NR	NR	0
VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
SWRCY	0.500		0	0	0	NR	NR	0
HIST LF	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	0.001		0	NR	NR	NR	NR	0
US CDL	0.001		0	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	0.001		0	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	0.001		0	NR	NR	NR	NR	0
SPILLS	0.001		0	NR	NR	NR	NR	0
IMD	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
SPILLS 90	0.001		0	NR	NR	NR	NR	0
SPILLS 80	0.001		0	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	0.001		0	NR	NR	NR	NR	0
EPA WATCH LIST	0.001		0	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	0.001		0	NR	NR	NR	NR	0
TRIS	0.001		0	NR	NR	NR	NR	0
SSTS	0.001		0	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	0.001		0	NR	NR	NR	NR	0
RAATS	0.001		0	NR	NR	NR	NR	0
PRP	0.001		0	NR	NR	NR	NR	0
PADS	0.001		0	NR	NR	NR	NR	0
ICIS	0.001		0	NR	NR	NR	NR	0
FTTS	0.001		0	NR	NR	NR	NR	0
MLTS	0.001		0	NR	NR	NR	NR	0
COAL ASH DOE	0.001		0	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	0.001		0	NR	NR	NR	NR	0
RADINFO	0.001		0	NR	NR	NR	NR	0
HIST FTTS	0.001		0	NR	NR	NR	NR	0
DOT OPS	0.001		0	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	0.001		0	NR	NR	NR	NR	0
US AIRS	0.001		0	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	0.001		0	NR	NR	NR	NR	0
ECHO	0.001		0	NR	NR	NR	NR	0
DOCKET HWC	0.001		0	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
AIRS	0.001		0	NR	NR	NR	NR	0
ASBESTOS	0.001		0	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	0.001		0	NR	NR	NR	NR	0
NPDES	0.001		0	NR	NR	NR	NR	0
UIC	0.001		0	NR	NR	NR	NR	0
AOP	0.001		0	NR	NR	NR	NR	0
SEPT HAULERS	0.001		0	NR	NR	NR	NR	0
MINES MRDS	0.001		0	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
PCSRP	0.500		0	0	0	NR	NR	0
CCB	0.500		0	0	0	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	0.001		0	NR	NR	NR	NR	0
RGA LF	0.001		0	NR	NR	NR	NR	0
RGA LUST	0.001		0	NR	NR	NR	NR	0
- Totals --		0	0	0	0	0	0	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

NO SITES FOUND

Count: 0 records. ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 04/27/2020
Date Data Arrived at EDR: 05/06/2020
Date Made Active in Reports: 05/28/2020
Number of Days to Update: 22

Source: EPA
Telephone: N/A
Last EDR Contact: 06/03/2020
Next Scheduled EDR Contact: 07/13/2020
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 04/27/2020
Date Data Arrived at EDR: 05/06/2020
Date Made Active in Reports: 05/28/2020
Number of Days to Update: 22

Source: EPA
Telephone: N/A
Last EDR Contact: 06/03/2020
Next Scheduled EDR Contact: 07/13/2020
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/27/2020
Date Data Arrived at EDR: 05/06/2020
Date Made Active in Reports: 05/28/2020
Number of Days to Update: 22

Source: EPA
Telephone: N/A
Last EDR Contact: 06/03/2020
Next Scheduled EDR Contact: 07/13/2020
Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 04/03/2019
Date Data Arrived at EDR: 04/05/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 04/03/2020
Next Scheduled EDR Contact: 07/13/2020
Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA's Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 04/27/2020
Date Data Arrived at EDR: 05/06/2020
Date Made Active in Reports: 05/28/2020
Number of Days to Update: 22

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 06/03/2020
Next Scheduled EDR Contact: 07/27/2020
Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that. based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 04/27/2020
Date Data Arrived at EDR: 05/06/2020
Date Made Active in Reports: 05/28/2020
Number of Days to Update: 22

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 06/03/2020
Next Scheduled EDR Contact: 07/27/2020
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/23/2020
Date Data Arrived at EDR: 03/25/2020
Date Made Active in Reports: 05/21/2020
Number of Days to Update: 57

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 03/25/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 03/23/2020
Date Data Arrived at EDR: 03/25/2020
Date Made Active in Reports: 05/21/2020
Number of Days to Update: 57

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 03/25/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/23/2020
Date Data Arrived at EDR: 03/25/2020
Date Made Active in Reports: 05/21/2020
Number of Days to Update: 57

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 03/25/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 03/23/2020
Date Data Arrived at EDR: 03/25/2020
Date Made Active in Reports: 05/21/2020
Number of Days to Update: 57

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 03/25/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Quarterly

RCRA-VSQG: RCRA - Very Small Quantity Generators (Formerly Conditionally Exempt Small Quantity Generators)

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Very small quantity generators (VSQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/23/2020
Date Data Arrived at EDR: 03/25/2020
Date Made Active in Reports: 05/21/2020
Number of Days to Update: 57

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 03/25/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Quarterly

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 11/04/2019
Date Data Arrived at EDR: 11/13/2019
Date Made Active in Reports: 01/28/2020
Number of Days to Update: 76

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 05/14/2020
Next Scheduled EDR Contact: 08/24/2020
Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 02/13/2020
Date Data Arrived at EDR: 02/20/2020
Date Made Active in Reports: 05/15/2020
Number of Days to Update: 85

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 05/15/2020
Next Scheduled EDR Contact: 09/07/2020
Data Release Frequency: Varies

US INST CONTROLS: Institutional Controls Sites List

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 02/13/2020
Date Data Arrived at EDR: 02/20/2020
Date Made Active in Reports: 05/15/2020
Number of Days to Update: 85

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 05/15/2020
Next Scheduled EDR Contact: 09/07/2020
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/16/2019
Date Data Arrived at EDR: 12/19/2019
Date Made Active in Reports: 03/06/2020
Number of Days to Update: 78

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 03/24/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Quarterly

State- and tribal - equivalent NPL

HSDS: Hazardous Substance Disposal Site

Locations of uncontrolled and unregulated hazardous waste sites. The file includes sites on the National Priority List as well as those on the state priority list.

Date of Government Version: 08/09/2011
Date Data Arrived at EDR: 11/08/2011
Date Made Active in Reports: 12/05/2011
Number of Days to Update: 27

Source: North Carolina Center for Geographic Information and Analysis
Telephone: 919-754-6580
Last EDR Contact: 04/10/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Biennially

State- and tribal - equivalent CERCLIS

SHWS: Inactive Hazardous Sites Inventory

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 03/03/2020
Date Data Arrived at EDR: 03/11/2020
Date Made Active in Reports: 05/27/2020
Number of Days to Update: 77

Source: Department of Environment, Health and Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 06/10/2020
Next Scheduled EDR Contact: 09/21/2020
Data Release Frequency: Quarterly

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: List of Solid Waste Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 03/06/2020
Date Data Arrived at EDR: 03/24/2020
Date Made Active in Reports: 06/10/2020
Number of Days to Update: 78

Source: Department of Environment and Natural Resources
Telephone: 919-733-0692
Last EDR Contact: 03/24/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Varies

OLI: Old Landfill Inventory

Old landfill inventory location information. (Does not include no further action sites and other agency lead sites).

Date of Government Version: 08/22/2019
Date Data Arrived at EDR: 10/11/2019
Date Made Active in Reports: 12/19/2019
Number of Days to Update: 69

Source: Department of Environment & Natural Resources
Telephone: 919-733-4996
Last EDR Contact: 04/10/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Varies

DEBRIS: Solid Waste Active Disaster Debris Sites Listing
NCDEQ Division of Waste Management Solid Waste Section Temporary Disaster Debris Staging Site (TDDSS) Locations which are available to be activated in a disaster or emergency.. Disaster Debris Sites can only be used for temporary disaster debris storage if the site's responsible party activates the site for use by notifying the NCDEQ DWM Solid Waste Section staff during an emergency

Date of Government Version: 10/31/2019
Date Data Arrived at EDR: 12/20/2019
Date Made Active in Reports: 02/24/2020
Number of Days to Update: 66
Source: Department of Environmental Quality
Telephone: 919-707-8247
Last EDR Contact: 03/20/2020
Next Scheduled EDR Contact: 06/29/2020
Data Release Frequency: Varies

LCID: Land-Clearing and Inert Debris (LCID) Landfill Notifications
A list all of the Land-Clearing and Inert Debris (LCID) Landfill Notification facilities (under 2 acres in size) in North Carolina.

Date of Government Version: 09/06/2018
Date Data Arrived at EDR: 01/09/2019
Date Made Active in Reports: 03/25/2019
Number of Days to Update: 75
Source: Department of Environmental Quality
Telephone: 919-707-8248
Last EDR Contact: 04/10/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Varies

State and tribal leaking storage tank lists

LAST: Leaking Aboveground Storage Tanks
A listing of leaking aboveground storage tank site locations.

Date of Government Version: 01/17/2020
Date Data Arrived at EDR: 02/04/2020
Date Made Active in Reports: 04/17/2020
Number of Days to Update: 73
Source: Department of Environment & Natural Resources
Telephone: 877-623-6748
Last EDR Contact: 05/05/2020
Next Scheduled EDR Contact: 08/17/2020
Data Release Frequency: Quarterly

LUST: Regional UST Database
This database contains information obtained from the Regional Offices. It provides a more detailed explanation of current and historic activity for individual sites, as well as what was previously found in the Incident Management Database. Sites in this database with Incident Numbers are considered LUSTs.

Date of Government Version: 01/17/2020
Date Data Arrived at EDR: 02/04/2020
Date Made Active in Reports: 04/07/2020
Number of Days to Update: 63
Source: Department of Environment and Natural Resources
Telephone: 919-707-8200
Last EDR Contact: 05/05/2020
Next Scheduled EDR Contact: 08/17/2020
Data Release Frequency: Quarterly

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 10/10/2019
Date Data Arrived at EDR: 12/05/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 67
Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 10/11/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 68
Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 10/03/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/14/2020
Number of Days to Update: 72
Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 10/01/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 68
Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 10/04/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/27/2020
Number of Days to Update: 85
Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 10/02/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 68
Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 10/01/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 68
Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 10/15/2019
Date Data Arrived at EDR: 12/17/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 55
Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

LUST TRUST: State Trust Fund Database
This database contains information about claims against the State Trust Funds for reimbursements for expenses incurred while remediating Leaking USTs.

Date of Government Version: 01/03/2020
Date Data Arrived at EDR: 01/08/2020
Date Made Active in Reports: 03/12/2020
Number of Days to Update: 64
Source: Department of Environment and Natural Resources
Telephone: 919-733-1315
Last EDR Contact: 04/08/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Quarterly

State and tribal registered storage tank lists

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 02/01/2020
Date Data Arrived at EDR: 03/19/2020
Date Made Active in Reports: 06/09/2020
Number of Days to Update: 82

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 03/19/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Varies

UST: Petroleum Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 01/17/2020
Date Data Arrived at EDR: 02/04/2020
Date Made Active in Reports: 04/06/2020
Number of Days to Update: 62

Source: Department of Environment and Natural Resources
Telephone: 919-733-1308
Last EDR Contact: 05/05/2020
Next Scheduled EDR Contact: 08/17/2020
Data Release Frequency: Quarterly

AST: AST Database
Facilities with aboveground storage tanks that have a capacity greater than 21,000 gallons.

Date of Government Version: 03/17/2020
Date Data Arrived at EDR: 03/18/2020
Date Made Active in Reports: 05/27/2020
Number of Days to Update: 70

Source: Department of Environment and Natural Resources
Telephone: 919-715-6183
Last EDR Contact: 06/10/2020
Next Scheduled EDR Contact: 09/28/2020
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 10/11/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 68

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 10/04/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/27/2020
Number of Days to Update: 85

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 10/11/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 68

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 10/03/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/14/2020
Number of Days to Update: 72

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 10/01/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 68

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 10/02/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 68

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 10/01/2019
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 68

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 10/10/2019
Date Data Arrived at EDR: 12/05/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 67

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 05/20/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

INST CONTROL: No Further Action Sites With Land Use Restrictions Monitoring

A land use restricted site is a property where there are limits or requirements on future use of the property due to varying levels of cleanup possible, practical, or necessary at the site.

Date of Government Version: 03/03/2020
Date Data Arrived at EDR: 03/11/2020
Date Made Active in Reports: 05/27/2020
Number of Days to Update: 77

Source: Department of Environmental Quality
Telephone: 919-508-8400
Last EDR Contact: 06/10/2020
Next Scheduled EDR Contact: 09/21/2020
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

VCP: Responsible Party Voluntary Action Sites
Responsible Party Voluntary Action site locations.

Date of Government Version: 03/03/2020
Date Data Arrived at EDR: 03/11/2020
Date Made Active in Reports: 05/27/2020
Number of Days to Update: 77
Source: Department of Environment and Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 06/10/2020
Next Scheduled EDR Contact: 09/21/2020
Data Release Frequency: Quarterly

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27
Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 142
Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 03/18/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Projects Inventory
A brownfield site is an abandoned, idled, or underused property where the threat of environmental contamination has hindered its redevelopment. All of the sites in the inventory are working toward a brownfield agreement for cleanup and liabitliy control.

Date of Government Version: 12/02/2019
Date Data Arrived at EDR: 01/02/2020
Date Made Active in Reports: 03/11/2020
Number of Days to Update: 69
Source: Department of Environment and Natural Resources
Telephone: 919-733-4996
Last EDR Contact: 03/31/2020
Next Scheduled EDR Contact: 07/13/2020
Data Release Frequency: Quarterly

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites
Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 06/01/2020
Date Data Arrived at EDR: 06/02/2020
Date Made Active in Reports: 06/09/2020
Number of Days to Update: 7
Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 06/02/2020
Next Scheduled EDR Contact: 09/28/2020
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

HIST LF: Solid Waste Facility Listing
A listing of solid waste facilities.

Date of Government Version: 11/06/2006
Date Data Arrived at EDR: 02/13/2007
Date Made Active in Reports: 03/02/2007
Number of Days to Update: 17

Source: Department of Environment & Natural Resources
Telephone: 919-733-0692
Last EDR Contact: 01/19/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SWRCY: Recycling Center Listing
A listing of recycling center locations.

Date of Government Version: 12/11/2019
Date Data Arrived at EDR: 12/12/2019
Date Made Active in Reports: 02/24/2020
Number of Days to Update: 74

Source: Department of Environment & Natural Resources
Telephone: 919-707-8137
Last EDR Contact: 04/09/2020
Next Scheduled EDR Contact: 08/10/2020
Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 04/16/2020
Next Scheduled EDR Contact: 08/10/2020
Data Release Frequency: Varies

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 04/09/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: No Update Planned

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land
A listing of all open dumps located on Indian Land in the United States.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 08/06/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 176

Source: Department of Health & Human Serivces, Indian Health Service
Telephone: 301-443-1452
Last EDR Contact: 05/01/2020
Next Scheduled EDR Contact: 08/10/2020
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 03/18/2020
Date Data Arrived at EDR: 03/19/2020
Date Made Active in Reports: 06/09/2020
Number of Days to Update: 82

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 05/18/2020
Next Scheduled EDR Contact: 09/07/2020
Data Release Frequency: No Update Planned

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 03/18/2020
Date Data Arrived at EDR: 03/19/2020
Date Made Active in Reports: 06/09/2020
Number of Days to Update: 82

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 05/18/2020
Next Scheduled EDR Contact: 09/07/2020
Data Release Frequency: Quarterly

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 04/27/2020
Date Data Arrived at EDR: 05/06/2020
Date Made Active in Reports: 05/28/2020
Number of Days to Update: 22

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 06/03/2020
Next Scheduled EDR Contact: 07/13/2020
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/05/2019
Date Data Arrived at EDR: 12/06/2019
Date Made Active in Reports: 02/14/2020
Number of Days to Update: 70

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 03/24/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Quarterly

SPILLS: Spills Incident Listing

A listing spills, hazardous material releases, sanitary sewer overflows, wastewater treatment plant bypasses and upsets, citizen complaints, and any other environmental emergency calls reported to the agency.

Date of Government Version: 01/06/2020
Date Data Arrived at EDR: 01/09/2020
Date Made Active in Reports: 03/16/2020
Number of Days to Update: 67

Source: Department of Environment & Natural Resources
Telephone: 919-807-6308
Last EDR Contact: 06/04/2020
Next Scheduled EDR Contact: 09/21/2020
Data Release Frequency: Quarterly

IMD: Incident Management Database

Groundwater and/or soil contamination incidents

Date of Government Version: 01/17/2020
Date Data Arrived at EDR: 02/04/2020
Date Made Active in Reports: 04/14/2020
Number of Days to Update: 70

Source: Department of Environment and Natural Resources
Telephone: 877-623-6748
Last EDR Contact: 05/05/2020
Next Scheduled EDR Contact: 08/17/2020
Data Release Frequency: No Update Planned

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 09/27/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 03/06/2013
Number of Days to Update: 62

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SPILLS 80: SPILLS80 data from FirstSearch

Spills 80 includes those spill and release records available from FirstSearch databases prior to 1990. Typically, they may include chemical, oil and/or hazardous substance spills recorded before 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 80.

Date of Government Version: 06/14/2001
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 03/06/2013
Number of Days to Update: 62

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 03/23/2020
Date Data Arrived at EDR: 03/25/2020
Date Made Active in Reports: 05/21/2020
Number of Days to Update: 57

Source: Environmental Protection Agency
Telephone: (404) 562-8651
Last EDR Contact: 03/25/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 01/28/2020
Date Data Arrived at EDR: 02/19/2020
Date Made Active in Reports: 05/14/2020
Number of Days to Update: 85

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 05/18/2020
Next Scheduled EDR Contact: 08/31/2020
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 04/10/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Semi-Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 04/02/2018
Date Data Arrived at EDR: 04/11/2018
Date Made Active in Reports: 11/06/2019
Number of Days to Update: 574

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 04/06/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 01/01/2017
Date Data Arrived at EDR: 02/03/2017
Date Made Active in Reports: 04/07/2017
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 05/15/2020
Next Scheduled EDR Contact: 08/24/2020
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 12/16/2019
Date Data Arrived at EDR: 12/19/2019
Date Made Active in Reports: 02/27/2020
Number of Days to Update: 70

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 03/24/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 05/04/2020
Next Scheduled EDR Contact: 08/17/2020
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 09/30/2017
Date Data Arrived at EDR: 05/08/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 73

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 05/08/2020
Next Scheduled EDR Contact: 08/17/2020
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 06/21/2017
Date Made Active in Reports: 01/05/2018
Number of Days to Update: 198

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 03/20/2020
Next Scheduled EDR Contact: 06/29/2020
Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2018
Date Data Arrived at EDR: 02/05/2020
Date Made Active in Reports: 04/24/2020
Number of Days to Update: 79

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 05/21/2020
Next Scheduled EDR Contact: 08/31/2020
Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 05/01/2019
Date Data Arrived at EDR: 10/23/2019
Date Made Active in Reports: 01/15/2020
Number of Days to Update: 84

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 04/21/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 04/27/2020
Date Data Arrived at EDR: 05/06/2020
Date Made Active in Reports: 05/28/2020
Number of Days to Update: 22

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 06/03/2020
Next Scheduled EDR Contact: 09/14/2020
Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 11/05/2019
Date Data Arrived at EDR: 11/20/2019
Date Made Active in Reports: 04/17/2020
Number of Days to Update: 149
Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 04/15/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35
Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 04/27/2020
Date Data Arrived at EDR: 05/06/2020
Date Made Active in Reports: 06/09/2020
Number of Days to Update: 34
Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 06/03/2020
Next Scheduled EDR Contact: 08/17/2020
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 10/09/2019
Date Data Arrived at EDR: 10/11/2019
Date Made Active in Reports: 12/20/2019
Number of Days to Update: 70
Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 04/10/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 11/18/2016
Date Data Arrived at EDR: 11/23/2016
Date Made Active in Reports: 02/10/2017
Number of Days to Update: 79
Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 03/26/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25
Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: No Update Planned

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25
Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: No Update Planned

MLTS: Material Licensing Tracking System
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 10/25/2019
Date Data Arrived at EDR: 10/25/2019
Date Made Active in Reports: 01/15/2020
Number of Days to Update: 82
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 04/10/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2018
Date Data Arrived at EDR: 12/04/2019
Date Made Active in Reports: 01/15/2020
Number of Days to Update: 42
Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 06/05/2020
Next Scheduled EDR Contact: 09/14/2020
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 01/12/2017
Date Data Arrived at EDR: 03/05/2019
Date Made Active in Reports: 11/11/2019
Number of Days to Update: 251
Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 06/01/2020
Next Scheduled EDR Contact: 09/14/2020
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 09/13/2019
Date Data Arrived at EDR: 11/06/2019
Date Made Active in Reports: 02/10/2020
Number of Days to Update: 96
Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 05/08/2020
Next Scheduled EDR Contact: 08/17/2020
Data Release Frequency: Varies

RADINFO: Radiation Information Database
The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/01/2019
Date Data Arrived at EDR: 07/01/2019
Date Made Active in Reports: 09/23/2019
Number of Days to Update: 84

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 07/13/2020
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 01/02/2020
Date Data Arrived at EDR: 01/28/2020
Date Made Active in Reports: 04/17/2020
Number of Days to Update: 80

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 04/28/2020
Next Scheduled EDR Contact: 08/10/2020
Data Release Frequency: Quarterly

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2019
Date Data Arrived at EDR: 01/17/2020
Date Made Active in Reports: 03/06/2020
Number of Days to Update: 49

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 03/26/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2015
Date Data Arrived at EDR: 02/22/2017
Date Made Active in Reports: 09/28/2017
Number of Days to Update: 218

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 03/25/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 07/14/2015
Date Made Active in Reports: 01/10/2017
Number of Days to Update: 546

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 04/10/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 08/08/2017
Date Data Arrived at EDR: 09/11/2018
Date Made Active in Reports: 09/14/2018
Number of Days to Update: 3

Source: Department of Energy
Telephone: 202-586-3559
Last EDR Contact: 04/29/2020
Next Scheduled EDR Contact: 08/17/2020
Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 08/30/2019
Date Data Arrived at EDR: 11/15/2019
Date Made Active in Reports: 01/28/2020
Number of Days to Update: 74

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 05/18/2020
Next Scheduled EDR Contact: 08/31/2020
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 04/27/2020
Date Data Arrived at EDR: 05/06/2020
Date Made Active in Reports: 05/28/2020
Number of Days to Update: 22

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 06/03/2020
Next Scheduled EDR Contact: 07/13/2020
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data
A listing of minor source facilities.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

MINES VIOLATIONS: MSHA Violation Assessment Data
Mines violation and assessment information. Department of Labor, Mine Safety & Health Administration.

Date of Government Version: 03/31/2020
Date Data Arrived at EDR: 04/01/2020
Date Made Active in Reports: 05/21/2020
Number of Days to Update: 50

Source: DOL, Mine Safety & Health Admi
Telephone: 202-693-9424
Last EDR Contact: 05/27/2020
Next Scheduled EDR Contact: 09/14/2020
Data Release Frequency: Quarterly

US MINES: Mines Master Index File
Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 02/11/2020
Date Data Arrived at EDR: 02/25/2020
Date Made Active in Reports: 05/21/2020
Number of Days to Update: 86

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 05/21/2020
Next Scheduled EDR Contact: 09/07/2020
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing
This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 01/16/2018
Date Data Arrived at EDR: 02/28/2020
Date Made Active in Reports: 05/22/2020
Number of Days to Update: 84

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 05/27/2020
Next Scheduled EDR Contact: 09/07/2020
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing
Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 05/21/2020
Next Scheduled EDR Contact: 09/07/2020
Data Release Frequency: Varies

ABANDONED MINES: Abandoned Mines
An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 03/05/2020
Date Data Arrived at EDR: 03/06/2020
Date Made Active in Reports: 05/29/2020
Number of Days to Update: 84

Source: Department of Interior
Telephone: 202-208-2609
Last EDR Contact: 06/03/2020
Next Scheduled EDR Contact: 09/21/2020
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 02/03/2020
Date Data Arrived at EDR: 03/03/2020
Date Made Active in Reports: 05/28/2020
Number of Days to Update: 86

Source: EPA
Telephone: (404) 562-9900
Last EDR Contact: 06/02/2020
Next Scheduled EDR Contact: 09/14/2020
Data Release Frequency: Quarterly

ECHO: Enforcement & Compliance History Information

ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 01/05/2020
Date Data Arrived at EDR: 01/07/2020
Date Made Active in Reports: 03/06/2020
Number of Days to Update: 59

Source: Environmental Protection Agency
Telephone: 202-564-2280
Last EDR Contact: 04/07/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Quarterly

DOCKET HWC: Hazardous Waste Compliance Docket Listing

A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 05/31/2018
Date Data Arrived at EDR: 07/26/2018
Date Made Active in Reports: 10/05/2018
Number of Days to Update: 71

Source: Environmental Protection Agency
Telephone: 202-564-0527
Last EDR Contact: 05/18/2020
Next Scheduled EDR Contact: 09/07/2020
Data Release Frequency: Varies

UXO: Unexploded Ordnance Sites

A listing of unexploded ordnance site locations

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 01/17/2019
Date Made Active in Reports: 04/01/2019
Number of Days to Update: 74

Source: Department of Defense
Telephone: 703-704-1564
Last EDR Contact: 04/03/2020
Next Scheduled EDR Contact: 07/27/2020
Data Release Frequency: Varies

FUELS PROGRAM: EPA Fuels Program Registered Listing

This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 02/18/2020
Date Data Arrived at EDR: 02/19/2020
Date Made Active in Reports: 05/14/2020
Number of Days to Update: 85

Source: EPA
Telephone: 800-385-6164
Last EDR Contact: 05/19/2020
Next Scheduled EDR Contact: 08/31/2020
Data Release Frequency: Quarterly

AIRS: Air Quality Permit Listing

A listing of facilities with air quality permits.

Date of Government Version: 03/09/2020
Date Data Arrived at EDR: 03/11/2020
Date Made Active in Reports: 05/27/2020
Number of Days to Update: 77

Source: Department of Environmental Quality
Telephone: 919-707-8726
Last EDR Contact: 06/09/2020
Next Scheduled EDR Contact: 09/21/2020
Data Release Frequency: Varies

ASBESTOS: ASBESTOS
Asbestos notification sites

Date of Government Version: 02/07/2020
Date Data Arrived at EDR: 02/13/2020
Date Made Active in Reports: 04/24/2020
Number of Days to Update: 71

Source: Department of Health & Human Services
Telephone: 919-707-5973
Last EDR Contact: 05/04/2020
Next Scheduled EDR Contact: 08/03/2020
Data Release Frequency: Varies

COAL ASH: Coal Ash Disposal Sites
A listing of coal combustion products distribution permits issued by the Division for the treatment, storage, transportation, use and disposal of coal combustion products.

Date of Government Version: 03/06/2020
Date Data Arrived at EDR: 03/24/2020
Date Made Active in Reports: 06/05/2020
Number of Days to Update: 73

Source: Department of Environment & Natural Resources
Telephone: 919-807-6359
Last EDR Contact: 03/24/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Varies

DRYCLEANERS: Drycleaning Sites
Potential and known drycleaning sites, active and abandoned, that the Drycleaning Solvent Cleanup Program has knowledge of and entered into this database.

Date of Government Version: 12/11/2019
Date Data Arrived at EDR: 12/16/2019
Date Made Active in Reports: 02/25/2020
Number of Days to Update: 71

Source: Department of Environment & Natural Resources
Telephone: 919-508-8400
Last EDR Contact: 03/20/2020
Next Scheduled EDR Contact: 06/29/2020
Data Release Frequency: Varies

Financial Assurance 1: Financial Assurance Information Listing
A listing of financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 01/17/2020
Date Data Arrived at EDR: 02/04/2020
Date Made Active in Reports: 04/07/2020
Number of Days to Update: 63

Source: Department of Environment & Natural Resources
Telephone: 919-733-1322
Last EDR Contact: 05/05/2020
Next Scheduled EDR Contact: 08/17/2020
Data Release Frequency: Quarterly

Financial Assurance 2: Financial Assurance Information Listing
Information for solid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 10/02/2012
Date Data Arrived at EDR: 10/03/2012
Date Made Active in Reports: 10/26/2012
Number of Days to Update: 23

Source: Department of Environmental & Natural Resources
Telephone: 919-508-8496
Last EDR Contact: 03/19/2020
Next Scheduled EDR Contact: 07/06/2020
Data Release Frequency: Varies

Financial Assurance 3: Financial Assurance Information
Hazardous waste financial assurance information.

Date of Government Version: 01/08/2020
Date Data Arrived at EDR: 01/09/2020
Date Made Active in Reports: 03/12/2020
Number of Days to Update: 63

Source: Department of Environment & Natural Resources
Telephone: 919-707-8222
Last EDR Contact: 06/04/2020
Next Scheduled EDR Contact: 09/21/2020
Data Release Frequency: Varies

NPDES: NPDES Facility Location Listing

General information regarding NPDES(National Pollutant Discharge Elimination System) permits.

Date of Government Version: 12/03/2019
Date Data Arrived at EDR: 01/28/2020
Date Made Active in Reports: 04/06/2020
Number of Days to Update: 69

Source: Department of Environment & Natural Resources
Telephone: 919-733-7015
Last EDR Contact: 04/28/2020
Next Scheduled EDR Contact: 08/10/2020
Data Release Frequency: Varies

UIC: Underground Injection Wells Listing

A listing of uncerground injection wells locations.

Date of Government Version: 03/02/2020
Date Data Arrived at EDR: 03/04/2020
Date Made Active in Reports: 05/12/2020
Number of Days to Update: 69

Source: Department of Environment & Natural Resources
Telephone: 919-807-6412
Last EDR Contact: 05/28/2020
Next Scheduled EDR Contact: 09/14/2020
Data Release Frequency: Quarterly

AOP: Animal Operation Permits Listing

This listing includes animal operations that are required to be permitted by the state.

Date of Government Version: 04/01/2020
Date Data Arrived at EDR: 05/26/2020
Date Made Active in Reports: 05/27/2020
Number of Days to Update: 1

Source: Department of Environmental Quality
Telephone: 919-707-9129
Last EDR Contact: 05/26/2020
Next Scheduled EDR Contact: 09/21/2020
Data Release Frequency: Varies

MINES MRDS: Mineral Resources Data System

Mineral Resources Data System

Date of Government Version: 04/06/2018
Date Data Arrived at EDR: 10/21/2019
Date Made Active in Reports: 10/24/2019
Number of Days to Update: 3

Source: USGS
Telephone: 703-648-6533
Last EDR Contact: 05/21/2020
Next Scheduled EDR Contact: 09/07/2020
Data Release Frequency: Varies

PCS ENF: Enforcement data

No description is available for this data

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 02/05/2015
Date Made Active in Reports: 03/06/2015
Number of Days to Update: 29

Source: EPA
Telephone: 202-564-2497
Last EDR Contact: 03/26/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Varies

PCS: Permit Compliance System

PCS is a computerized management information system that contains data on National Pollutant Discharge Elimination System (NPDES) permit holding facilities. PCS tracks the permit, compliance, and enforcement status of NPDES facilities.

Date of Government Version: 07/14/2011
Date Data Arrived at EDR: 08/05/2011
Date Made Active in Reports: 09/29/2011
Number of Days to Update: 55

Source: EPA, Office of Water
Telephone: 202-564-2496
Last EDR Contact: 06/08/2020
Next Scheduled EDR Contact: 09/21/2020
Data Release Frequency: Semi-Annually

SEPT HAULERS: Permitted Septage Haulers Listing

This list of all active and permitted Septage Land Application Site (SLAS) and Septage Detention and Treatment Facility (SDTF) sites in North Carolina. The purpose of this map is to provide the public and government entities a visual overview of the businesses that manage septage and septage facilities throughout the state.

Date of Government Version: 01/07/2020
Date Data Arrived at EDR: 01/10/2020
Date Made Active in Reports: 03/16/2020
Number of Days to Update: 66

Source: Department of Environmental Quality
Telephone: 919-707-8248
Last EDR Contact: 04/10/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Varies

PCS INACTIVE: Listing of Inactive PCS Permits

An inactive permit is a facility that has shut down or is no longer discharging.

Date of Government Version: 11/05/2014
Date Data Arrived at EDR: 01/06/2015
Date Made Active in Reports: 05/06/2015
Number of Days to Update: 120

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 03/26/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Semi-Annually

CCB: Coal Ash Structural Fills (CCB) Listing

These are not permitted Coal Ash landfills A list all of the now closed Coal Ash Structural Fills (CCB) in North Carolina, in point data form. The purpose is to provide the public and other government entities a visual overview of coal ash structural fills throughout the state and increase public awareness of their current locations.

Date of Government Version: 09/06/2018
Date Data Arrived at EDR: 01/09/2019
Date Made Active in Reports: 03/25/2019
Number of Days to Update: 75

Source: Department of Environmental Quality
Telephone: 919-707-8248
Last EDR Contact: 04/08/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Varies

PCSRP: Petroleum-Contaminated Soil Remediation Permits

To treat petroleum-contaminated soil in order to protect North Carolinaa??s environment and the health of the citizens of North Carolina.

Date of Government Version: 01/07/2020
Date Data Arrived at EDR: 01/08/2020
Date Made Active in Reports: 03/17/2020
Number of Days to Update: 69

Source: Department of Environmental Quality
Telephone: 919-707-8248
Last EDR Contact: 04/08/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Varies

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historical Auto Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historical Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environment, Health and Natural Resources in North Carolina.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/24/2013
Number of Days to Update: 176

Source: Department of Environment, Health and Natural Resources
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environment, Health and Natural Resources in North Carolina.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/13/2014
Number of Days to Update: 196

Source: Department of Environment, Health and Natural Resources
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environment, Health and Natural Resources in North Carolina.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/20/2013
Number of Days to Update: 172

Source: Department of Environment, Health and Natural Resources
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 01/30/2020
Date Data Arrived at EDR: 01/30/2020
Date Made Active in Reports: 03/09/2020
Number of Days to Update: 39

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 05/12/2020
Next Scheduled EDR Contact: 08/24/2020
Data Release Frequency: No Update Planned

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2018
Date Data Arrived at EDR: 04/10/2019
Date Made Active in Reports: 05/16/2019
Number of Days to Update: 36

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 04/10/2020
Next Scheduled EDR Contact: 07/20/2020
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 01/01/2019
Date Data Arrived at EDR: 05/01/2019
Date Made Active in Reports: 06/21/2019
Number of Days to Update: 51

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 04/29/2020
Next Scheduled EDR Contact: 08/10/2020
Data Release Frequency: Quarterly

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 06/30/2018
Date Data Arrived at EDR: 07/19/2019
Date Made Active in Reports: 09/10/2019
Number of Days to Update: 53

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 04/02/2020
Next Scheduled EDR Contact: 07/27/2020
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2018
Date Data Arrived at EDR: 10/02/2019
Date Made Active in Reports: 12/10/2019
Number of Days to Update: 69

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 05/14/2020
Next Scheduled EDR Contact: 08/31/2020
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 05/31/2018
Date Data Arrived at EDR: 06/19/2019
Date Made Active in Reports: 09/03/2019
Number of Days to Update: 76

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 06/04/2020
Next Scheduled EDR Contact: 09/21/2020
Data Release Frequency: Annually

Oil/Gas Pipelines
Source: Endeavor Business Media
Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by Endeavor Business Media. This information is provided on a best effort basis and Endeavor Business Media does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of Endeavor Business Media.

Electric Power Transmission Line Data
Source: Endeavor Business Media
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Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Child Care Facility List
Source: Department of Health & Human Services
Telephone: 919-662-4499

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetland Inventory
Source: US Fish & Wildlife Service
Telephone: 703-358-2171

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

WITS END MITIGATION SITE
SNYDER STORE RD
WINGATE, NC 28174

TARGET PROPERTY COORDINATES

Latitude (North):	34.913501 - 34° 54' 48.60''
Longitude (West):	80.441043 - 80° 26' 27.75''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	551060.8
UTM Y (Meters):	3863396.0
Elevation:	626 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5946505 WINGATE, NC
Version Date:	2013

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

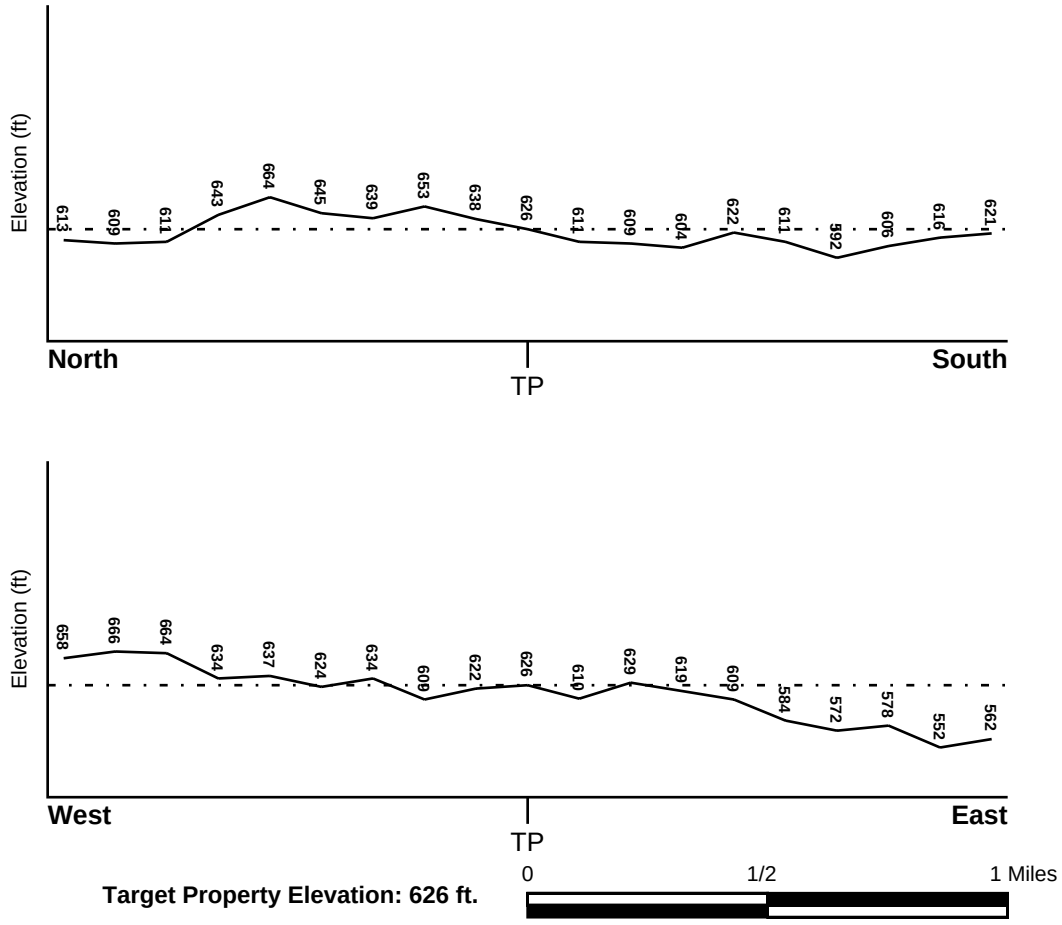
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General South

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
3710546200J	FEMA FIRM Flood data

Additional Panels in search area:	FEMA Source Type
Not Reported	

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
WINGATE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

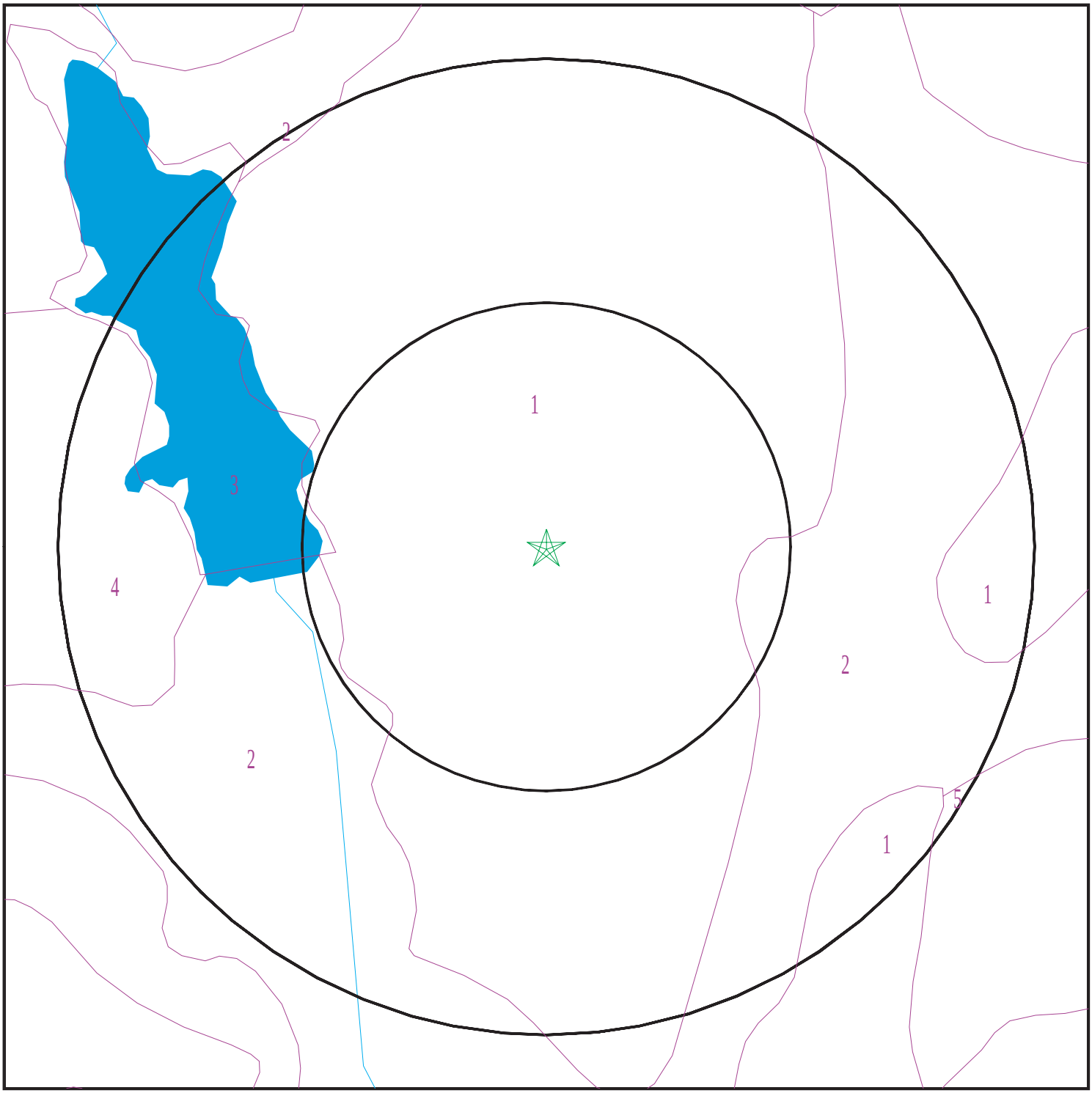
Era:	Paleozoic
System:	Cambrian
Series:	Cambrian
Code:	Ce *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Eugeosynclinal Deposits

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 6095455.2s



Target Property
SSURGO Soil
Water

0 1/16 1/8 1/4 Miles

N

SITE NAME:	Wits End Mitigation Site	CLIENT:	Restoration Systems, LLC
ADDRESS:	SNYDER STORE RD Wingate NC 28174	CONTACT:	Alex Baldwin
LAT/LONG:	34.913501 / 80.441043	INQUIRY #:	6095455.2s
		DATE:	June 17, 2020 2:01 pm

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Badin

Soil Surface Texture: channery silt loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	5 inches	channery silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	Not reported	Max: 14 Min: 0	Max: Min:
2	5 inches	35 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	Not reported	Max: 14 Min: 0	Max: Min:
3	35 inches	42 inches	weathered bedrock	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	Not reported	Max: 14 Min: 0	Max: Min:

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
4	42 inches	46 inches	unweathered bedrock	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	Not reported	Max: 14 Min: 0	Max: Min:

Soil Map ID: 2

Soil Component Name: Cid

Soil Surface Texture: channery silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 77 inches

Depth to Watertable Min: > 61 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	channery silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:
2	9 inches	22 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
3	22 inches	27 inches	channery silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:
4	27 inches	31 inches	weathered bedrock	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:
5	31 inches	35 inches	unweathered bedrock	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:

Soil Map ID: 3

Soil Component Name: Water

Soil Surface Texture: channery silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class:
Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

No Layer Information available.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Map ID: 4

Soil Component Name: Goldston

Soil Surface Texture: very channery silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	5 inches	very channery silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:
2	5 inches	16 inches	very channery silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:
3	16 inches	27 inches	weathered bedrock	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:
4	27 inches	31 inches	unweathered bedrock	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:

Soil Map ID: 5

Soil Component Name: Tatum

Soil Surface Texture: gravelly silt loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	gravelly silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:
2	7 inches	42 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:
3	42 inches	53 inches	weathered bedrock	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	Not reported	Max: 14 Min: 0	Max: Min:

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

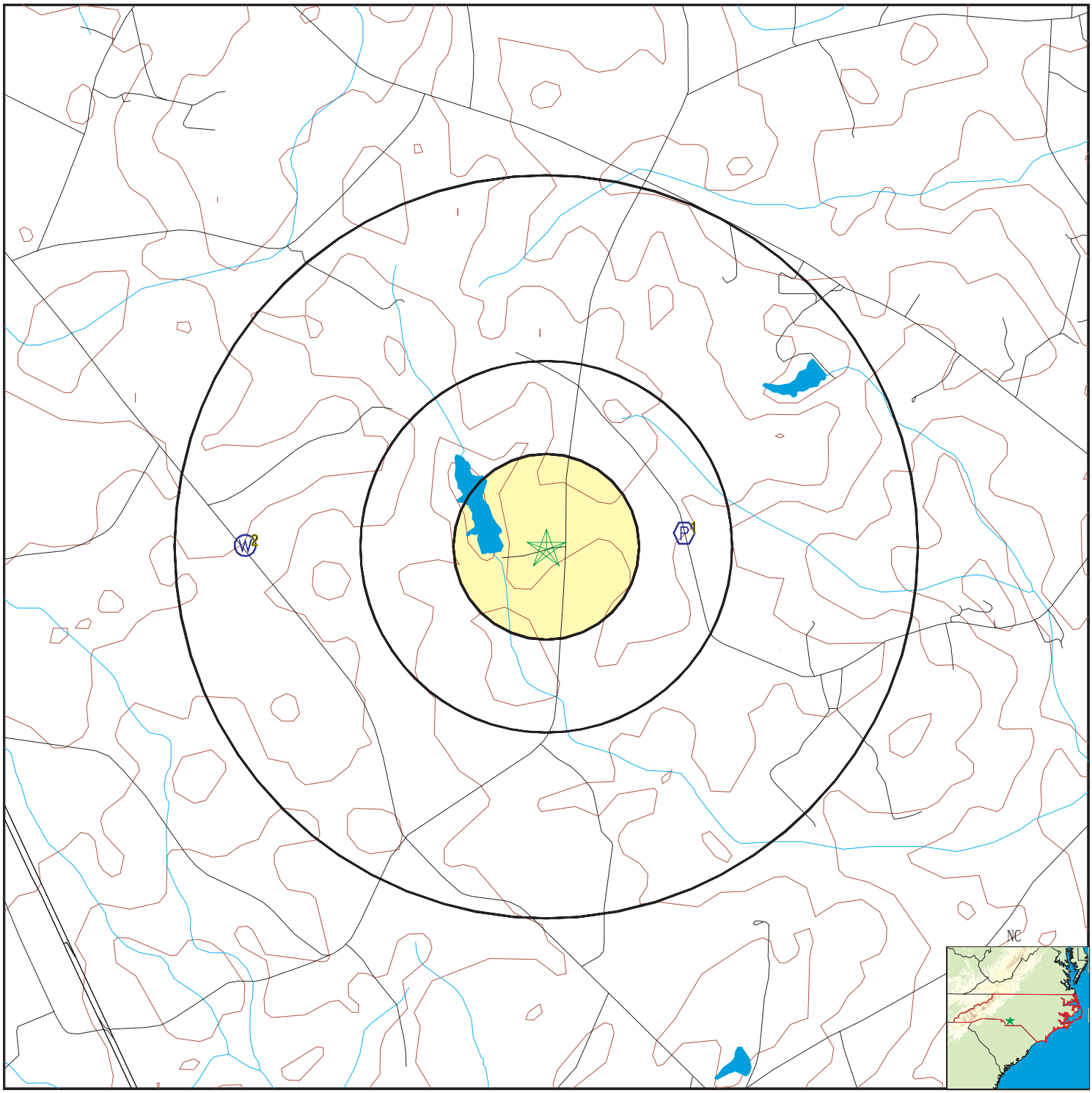
MAP ID	WELL ID	LOCATION FROM TP
1	NC0190509	1/4 - 1/2 Mile East

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
2	NC3000000003222	1/2 - 1 Mile West

PHYSICAL SETTING SOURCE MAP - 6095455.2s



- County Boundary
- Major Roads
- Contour Lines
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons
- Groundwater Flow Direction
- GI Indeterminate Groundwater Flow at Location
- GV Groundwater Flow Varies at Location
- Wildlife Areas
- Natural Areas
- Rare & Endangered Species

SITE NAME:	Wits End Mitigation Site	CLIENT:	Restoration Systems, LLC
ADDRESS:	SNYDER STORE RD Wingate NC 28174	CONTACT:	Alex Baldwin
LAT/LONG:	34.913501 / 80.441043	INQUIRY #:	6095455.2s
		DATE:	June 17, 2020 2:01 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

1
East
1/4 - 1/2 Mile
Lower | **FRDS PWS** | **NC0190509**

Epa region:	04	State:	NC
Pwsid:	NC0190509	Pwsname:	FLAG BRANCH BAPTIST CHURCH
Cityserved:	Not Reported	Stateserved:	NC
Zipserved:	Not Reported	Fipscounty:	37179
Status:	Active	Retpopsrvd:	60
Pwssvcconn:	2	Psource longname:	Groundwater
Pwstype:	TNCWS	Owner:	Private
Contact:	JORDAN, EXCELL	Contactorgname:	JORDAN, EXCELL
Contactphone:	704-283-1571	Contactaddress1:	PO BOX 3215
Contactaddress2:	Not Reported	Contactcity:	MONROE
Contactstate:	NC	Contactzip:	28112
Pwsactivitycode:	A		

PWS ID:	NC0190509	PWS type:	System Owner/Responsible Party
PWS name:	E H MARTIN	PWS address:	Not Reported
PWS city:	MONROE	PWS state:	NC
PWS zip:	28110	PWS ID:	NC0190509
PWS type:	System Owner/Responsible Party		
PWS name:	FLAG BRANCH BAPT CH	PWS address:	Not Reported
PWS city:	WADESBORO	PWS state:	NC
PWS zip:	Not Reported	PWS name:	FLAG BRANCH BAPTIST CHURCH
PWS type code:	NC	Retail population served:	60
Contact:	JORDAN, EXCELL	Contact address:	PO BOX 3215
Contact address:	MONROE	Contact city:	NC
Contact state:	28	Contact zip:	704-254-89
Contact telephone:	Not Reported		

PWS ID:	NC0190509	Activity status:	Active
Date system activated:	7706	Date system deactivated:	Not Reported
Retail population:	00000050	System name:	E H MARTIN
System address:	Not Reported	System city:	MONROE
System state:	NC	System zip:	28110

County FIPS:	090	City served:	MONROE

Population served:	Under 101 Persons	Treatment:	Untreated

Latitude:	345907	Longitude:	0803258

Latitude:	345450	Longitude:	0802605

Violation id:	1001	Orig code:	S
State:	NC	Violation Year:	2001
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	01/01/2001
Cmp edt:	03/31/2001		

Violation id:	1102	Orig code:	S
State:	NC	Violation Year:	2002
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	22	Violation name:	MCL, Monthly (TCR)
Rule code:	110	Rule name:	TCR

Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	05/01/2002
Cmp edt:	05/31/2002		

Violation id:	1204	Orig code:	S
State:	NC	Violation Year:	2004
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	04/01/2004
Cmp edt:	04/30/2004		

Violation id:	1305	Orig code:	S
State:	NC	Violation Year:	2004
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2004
Cmp edt:	09/30/2004		

Violation id:	1405	Orig code:	S
State:	NC	Violation Year:	2004
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/01/2004
Cmp edt:	12/31/2004		

Violation id:	1505	Orig code:	S
State:	NC	Violation Year:	2005
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	01/01/2005
Cmp edt:	03/31/2005		

Violation id:	1605	Orig code:	S
State:	NC	Violation Year:	2005
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	04/01/2005
Cmp edt:	06/30/2005		

Violation id:	1885305	Orig code:	S
State:	NC	Violation Year:	2005
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/01/2005
Cmp edt:	09/30/2005		

Violation id:	1885406	Orig code:	S
State:	NC	Violation Year:	2005
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)

Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/01/2005
Cmp edt:	12/31/2005		

Violation id:	2247706	Orig code:	S
State:	NC	Violation Year:	2005
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	76		
Violation name:	PN Violation without NPDWR Violation		
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	11/20/2005
Cmp edt:	Not Reported		

Violation id:	3906705	Orig code:	S
State:	NC	Violation Year:	2005
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	76		
Violation name:	PN Violation without NPDWR Violation		
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	08/21/2005
Cmp edt:	Not Reported		

Violation id:	4303802	Orig code:	S
State:	NC	Violation Year:	2002
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	76		
Violation name:	PN Violation without NPDWR Violation		
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/04/2002
Cmp edt:	Not Reported		

Violation id:	4303906	Orig code:	S
State:	NC	Violation Year:	2006
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	01/01/2006
Cmp edt:	03/31/2006		

Violation id:	4304006	Orig code:	S
State:	NC	Violation Year:	2005
Contamination code:	1040	Contamination Name:	Nitrate
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	331	Rule name:	Nitrates
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	01/01/2005
Cmp edt:	12/31/2005		

Violation id:	4304007	Orig code:	S
State:	NC	Violation Year:	2007
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	75	Violation name:	PN Violation for NPDWR Violation
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	06/24/2007
Cmp edt:	Not Reported		

Violation id:	4304008	Orig code:	S
State:	NC	Violation Year:	2007
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	75	Violation name:	PN Violation for NPDWR Violation
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	03/14/2007
Cmp edt:	Not Reported		

Violation id:	4304009	Orig code:	S
State:	NC	Violation Year:	2007
Contamination code:	7500	Contamination Name:	Public Notice
Violation code:	75	Violation name:	PN Violation for NPDWR Violation
Rule code:	410	Rule name:	PN rule
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	07/22/2007
Cmp edt:	Not Reported		

Violation id:	4304010	Orig code:	S
State:	NC	Violation Year:	2010
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	22	Violation name:	MCL, Monthly (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	02/01/2010
Cmp edt:	02/28/2010		

Violation id:	700	Orig code:	S
State:	NC	Violation Year:	2000
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	01/01/2000
Cmp edt:	03/31/2000		

Violation id:	801	Orig code:	S
State:	NC	Violation Year:	2000
Contamination code:	1040	Contamination Name:	Nitrate
Violation code:	03	Violation name:	Monitoring, Regular
Rule code:	331	Rule name:	Nitrates
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	03/01/2000
Cmp edt:	05/31/2000		

Violation id:	901	Orig code:	S
State:	NC	Violation Year:	2000
Contamination code:	3100	Contamination Name:	Coliform (TCR)
Violation code:	23	Violation name:	Monitoring, Routine Major (TCR)
Rule code:	110	Rule name:	TCR
Violation measur:	Not Reported	Unit of measure:	Not Reported
State mcl:	Not Reported	Cmp bdt:	10/01/2000
Cmp edt:	10/31/2000		

Violation ID:	1001	Orig Code:	S
Enforcemnt FY:	2001	Enforcement Action:	05/01/2001
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal

Violation ID:	1001	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal

Violation ID:	1001	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	1001	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Informal
Violation ID:	1001	Orig Code:	S
Enforcemnt FY:	2001	Enforcement Action:	05/01/2001
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	1102	Orig Code:	S
Enforcemnt FY:	2002	Enforcement Action:	07/12/2002
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	1102	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	1102	Orig Code:	S
Enforcemnt FY:	2002	Enforcement Action:	05/31/2002
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	1102	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	1102	Orig Code:	S
Enforcemnt FY:	2002	Enforcement Action:	05/31/2002
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	1102	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Informal
Violation ID:	1204	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	1204	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Informal
Violation ID:	1204	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	1204	Orig Code:	S
Enforcemnt FY:	2004	Enforcement Action:	05/27/2004
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	1204	Orig Code:	S
Enforcemnt FY:	2004	Enforcement Action:	05/27/2004
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	1305	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	11/09/2004
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	1305	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006

Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	1305	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	11/09/2004
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	1305	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	1305	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Informal
Violation ID:	1405	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Informal
Violation ID:	1405	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	02/04/2005
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	1405	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	1405	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	02/04/2005
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	1405	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	1505	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	1505	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	05/05/2005
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	1505	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	05/05/2005
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	1505	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Informal
Violation ID:	1505	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	05/15/2006
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	1505	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	1605	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal

Violation ID:	1605	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	08/09/2005
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	1605	Orig Code:	S
Enforcemnt FY:	2005	Enforcement Action:	08/09/2005
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	1605	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Informal
Violation ID:	1605	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	1605	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	05/15/2006
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	1885305	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	10/24/2005
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	1885305	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	05/15/2006
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	1885305	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Informal
Violation ID:	1885305	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	11/14/2005
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	1885305	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	06/11/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	1885305	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	11/14/2005
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	1885305	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	1885406	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	1885406	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	09/02/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	1885406	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	05/15/2006
Enforcement Detail:	St AO (w/penalty) issued	Enforcement Category:	Formal
Violation ID:	1885406	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	03/13/2006

Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	1885406	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	03/13/2006
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	2247706	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	04/17/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	2247706	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	04/17/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Resolving
Violation ID:	3906705	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	04/17/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	3906705	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	04/17/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Resolving
Violation ID:	4303802	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	04/17/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Resolving
Violation ID:	4303802	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	04/17/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	4303906	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	06/23/2006
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	4303906	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	08/31/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	4303906	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	4303906	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	06/23/2006
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	4304006	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	09/29/2006
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	4304006	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/21/2006
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	4304006	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/21/2006
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	4304007	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	02/14/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving

Violation ID:	4304008	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	02/14/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	4304009	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	09/15/2010
Enforcement Detail:	St Intentional no-action	Enforcement Category:	Resolving
Violation ID:	4304009	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	09/15/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	4304010	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	02/13/2010
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	4304010	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	02/22/2010
Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	4304010	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	02/13/2010
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	4304010	Orig Code:	S
Enforcemnt FY:	2010	Enforcement Action:	08/13/2010
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	600	Orig Code:	S
Enforcemnt FY:	2000	Enforcement Action:	02/04/2000
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	600	Orig Code:	S
Enforcemnt FY:	2000	Enforcement Action:	02/04/2000
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	700	Orig Code:	S
Enforcemnt FY:	2000	Enforcement Action:	05/03/2000
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	700	Orig Code:	S
Enforcemnt FY:	2000	Enforcement Action:	05/03/2000
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	801	Orig Code:	S
Enforcemnt FY:	2000	Enforcement Action:	09/14/2000
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	801	Orig Code:	S
Enforcemnt FY:	2000	Enforcement Action:	09/14/2000
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
Violation ID:	801	Orig Code:	S
Enforcemnt FY:	2004	Enforcement Action:	03/05/2004
Enforcement Detail:	St Compliance achieved	Enforcement Category:	Resolving
Violation ID:	901	Orig Code:	S
Enforcemnt FY:	2001	Enforcement Action:	12/19/2000
Enforcement Detail:	St Formal NOV issued	Enforcement Category:	Informal
Violation ID:	901	Orig Code:	S
Enforcemnt FY:	2006	Enforcement Action:	07/12/2006

Enforcement Detail:	St Public Notif received	Enforcement Category:	Informal
Violation ID:	901	Orig Code:	S
Enforcemnt FY:	2001	Enforcement Action:	12/19/2000
Enforcement Detail:	St Public Notif requested	Enforcement Category:	Informal
PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1001	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	1/1/2001 0:00:00	Compliance end date:	3/31/2001 0:00:00
Enforcement date:	5/1/2001 0:00:00	Enforcement action:	State Formal NOV Issued
Violation measurement:	Not Reported		
PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1001	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	1/1/2001 0:00:00	Compliance end date:	3/31/2001 0:00:00
Enforcement date:	5/1/2001 0:00:00	Enforcement action:	State Public Notif Requested
Violation measurement:	Not Reported		
PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1001	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	1/1/2001 0:00:00	Compliance end date:	3/31/2001 0:00:00
Enforcement date:	7/12/2006 0:00:00	Enforcement action:	State Public Notif Received
Violation measurement:	Not Reported		
PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1102	Contaminant:	COLIFORM (TCR)
Violation type:	Max Contaminant Level, Monthly (TCR)		
Compliance start date:	5/1/2002 0:00:00	Compliance end date:	5/31/2002 0:00:00
Enforcement date:	5/31/2002 0:00:00	Enforcement action:	State Formal NOV Issued
Violation measurement:	Not Reported		
PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1102	Contaminant:	COLIFORM (TCR)
Violation type:	Max Contaminant Level, Monthly (TCR)		
Compliance start date:	5/1/2002 0:00:00	Compliance end date:	5/31/2002 0:00:00
Enforcement date:	5/31/2002 0:00:00	Enforcement action:	State Public Notif Requested
Violation measurement:	Not Reported		
PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1102	Contaminant:	COLIFORM (TCR)
Violation type:	Max Contaminant Level, Monthly (TCR)		
Compliance start date:	5/1/2002 0:00:00	Compliance end date:	5/31/2002 0:00:00
Enforcement date:	7/12/2002 0:00:00	Enforcement action:	State Public Notif Received
Violation measurement:	Not Reported		
PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1102	Contaminant:	COLIFORM (TCR)
Violation type:	Max Contaminant Level, Monthly (TCR)		
Compliance start date:	5/1/2002 0:00:00	Compliance end date:	5/31/2002 0:00:00
Enforcement date:	7/12/2006 0:00:00	Enforcement action:	State Public Notif Received
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1204	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	4/1/2004 0:00:00	Compliance end date:	4/30/2004 0:00:00
Enforcement date:	5/27/2004 0:00:00	Enforcement action:	State Formal NOV Issued
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1204	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	4/1/2004 0:00:00	Compliance end date:	4/30/2004 0:00:00
Enforcement date:	5/27/2004 0:00:00	Enforcement action:	State Public Notif Requested
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1204	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	4/1/2004 0:00:00	Compliance end date:	4/30/2004 0:00:00
Enforcement date:	7/12/2006 0:00:00	Enforcement action:	State Public Notif Received
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1305	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	7/1/2004 0:00:00	Compliance end date:	9/30/2004 0:00:00
Enforcement date:	11/9/2004 0:00:00	Enforcement action:	State Formal NOV Issued
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1305	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	7/1/2004 0:00:00	Compliance end date:	9/30/2004 0:00:00
Enforcement date:	11/9/2004 0:00:00	Enforcement action:	State Public Notif Requested
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1305	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	7/1/2004 0:00:00	Compliance end date:	9/30/2004 0:00:00
Enforcement date:	7/12/2006 0:00:00	Enforcement action:	State Public Notif Received
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1405	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	10/1/2004 0:00:00	Compliance end date:	12/31/2004 0:00:00
Enforcement date:	2/4/2005 0:00:00	Enforcement action:	State Formal NOV Issued
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1405	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	10/1/2004 0:00:00	Compliance end date:	12/31/2004 0:00:00
Enforcement date:	2/4/2005 0:00:00	Enforcement action:	State Public Notif Requested

Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 | PWS type code: NC
Violation ID: 1405 | Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 10/1/2004 0:00:00 | Compliance end date: 12/31/2004 0:00:00
Enforcement date: 7/12/2006 0:00:00 | Enforcement action: State Public Notif Received
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 | PWS type code: NC
Violation ID: 1505 | Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 1/1/2005 0:00:00 | Compliance end date: 3/31/2005 0:00:00
Enforcement date: 5/15/2006 0:00:00 | Enforcement action: State AO (w/penalty) Issued
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 | PWS type code: NC
Violation ID: 1505 | Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 1/1/2005 0:00:00 | Compliance end date: 3/31/2005 0:00:00
Enforcement date: 5/5/2005 0:00:00 | Enforcement action: State Formal NOV Issued
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 | PWS type code: NC
Violation ID: 1505 | Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 1/1/2005 0:00:00 | Compliance end date: 3/31/2005 0:00:00
Enforcement date: 5/5/2005 0:00:00 | Enforcement action: State Public Notif Requested
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 | PWS type code: NC
Violation ID: 1505 | Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 1/1/2005 0:00:00 | Compliance end date: 3/31/2005 0:00:00
Enforcement date: 7/12/2006 0:00:00 | Enforcement action: State Public Notif Received
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 | PWS type code: NC
Violation ID: 1605 | Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 4/1/2005 0:00:00 | Compliance end date: 6/30/2005 0:00:00
Enforcement date: 5/15/2006 0:00:00 | Enforcement action: State AO (w/penalty) Issued
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 | PWS type code: NC
Violation ID: 1605 | Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 4/1/2005 0:00:00 | Compliance end date: 6/30/2005 0:00:00
Enforcement date: 7/12/2006 0:00:00 | Enforcement action: State Public Notif Received
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 | PWS type code: NC
Violation ID: 1605 | Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)

Compliance start date: 4/1/2005 0:00:00 Compliance end date: 6/30/2005 0:00:00
Enforcement date: 8/9/2005 0:00:00 Enforcement action: State Formal NOV Issued
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 PWS type code: NC
Violation ID: 1605 Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 4/1/2005 0:00:00 Compliance end date: 6/30/2005 0:00:00
Enforcement date: 8/9/2005 0:00:00 Enforcement action: State Public Notif Requested
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 PWS type code: NC
Violation ID: 1885305 Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 7/1/2005 0:00:00 Compliance end date: 9/30/2005 0:00:00
Enforcement date: 10/24/2005 0:00:00 Enforcement action: State Public Notif Requested
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 PWS type code: NC
Violation ID: 1885305 Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 7/1/2005 0:00:00 Compliance end date: 9/30/2005 0:00:00
Enforcement date: 11/14/2005 0:00:00 Enforcement action: State Formal NOV Issued
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 PWS type code: NC
Violation ID: 1885305 Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 7/1/2005 0:00:00 Compliance end date: 9/30/2005 0:00:00
Enforcement date: 5/15/2006 0:00:00 Enforcement action: State AO (w/penalty) Issued
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 PWS type code: NC
Violation ID: 1885305 Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 7/1/2005 0:00:00 Compliance end date: 9/30/2005 0:00:00
Enforcement date: 7/12/2006 0:00:00 Enforcement action: State Public Notif Received
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 PWS type code: NC
Violation ID: 1885406 Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 10/1/2005 0:00:00 Compliance end date: 12/31/2005 0:00:00
Enforcement date: 3/13/2006 0:00:00 Enforcement action: State Formal NOV Issued
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 PWS type code: NC
Violation ID: 1885406 Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 10/1/2005 0:00:00 Compliance end date: 12/31/2005 0:00:00
Enforcement date: 3/13/2006 0:00:00 Enforcement action: State Public Notif Requested
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60 PWS type code: NC

Violation ID:	1885406	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	10/1/2005 0:00:00	Compliance end date:	12/31/2005 0:00:00
Enforcement date:	5/15/2006 0:00:00	Enforcement action:	State AO (w/penalty) Issued
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	1885406	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	10/1/2005 0:00:00	Compliance end date:	12/31/2005 0:00:00
Enforcement date:	7/12/2006 0:00:00	Enforcement action:	State Public Notif Received
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	2247706	Contaminant:	7500
Violation type:	76	Compliance start date:	11/20/2005 0:00:00
Compliance end date:	12/31/2025 0:00:00	Enforcement date:	No Enf Action as of
Enforcement action:	7/8/2009 0:00:00	Violation measurement:	Not Reported

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	3906705	Contaminant:	7500
Violation type:	76	Compliance start date:	8/21/2005 0:00:00
Compliance end date:	12/31/2025 0:00:00	Enforcement date:	No Enf Action as of
Enforcement action:	7/8/2009 0:00:00	Violation measurement:	Not Reported

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	4303802	Contaminant:	7500
Violation type:	76	Compliance start date:	7/4/2002 0:00:00
Compliance end date:	12/31/2025 0:00:00	Enforcement date:	No Enf Action as of
Enforcement action:	7/8/2009 0:00:00	Violation measurement:	Not Reported

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	4303906	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	1/1/2006 0:00:00	Compliance end date:	3/31/2006 0:00:00
Enforcement date:	6/23/2006 0:00:00	Enforcement action:	State Formal NOV Issued
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	4303906	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	1/1/2006 0:00:00	Compliance end date:	3/31/2006 0:00:00
Enforcement date:	6/23/2006 0:00:00	Enforcement action:	State Public Notif Requested
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	4303906	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	1/1/2006 0:00:00	Compliance end date:	3/31/2006 0:00:00
Enforcement date:	7/12/2006 0:00:00	Enforcement action:	State Public Notif Received
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	4304006	Contaminant:	NITRATE

Violation type: 3
Compliance start date: 1/1/2005 0:00:00
Compliance end date: 12/31/2005 0:00:00
Enforcement date: 7/21/2006 0:00:00
Enforcement action: State Formal NOV Issued
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60
PWS type code: NC
Violation ID: 4304006
Contaminant: NITRATE
Violation type: 3
Compliance start date: 1/1/2005 0:00:00
Compliance end date: 12/31/2005 0:00:00
Enforcement date: 7/21/2006 0:00:00
Enforcement action: State Public Notif Requested
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60
PWS type code: NC
Violation ID: 4304006
Contaminant: NITRATE
Violation type: 3
Compliance start date: 1/1/2005 0:00:00
Compliance end date: 12/31/2005 0:00:00
Enforcement date: 9/29/2006 0:00:00
Enforcement action: State Compliance Achieved
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60
PWS type code: NC
Violation ID: 4304007
Contaminant: 7500
Violation type: 75
Compliance start date: 6/24/2007 0:00:00
Compliance end date: 12/31/2025 0:00:00
Enforcement date: No Enf Action as of
Enforcement action: 7/8/2009 0:00:00
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60
PWS type code: NC
Violation ID: 4304008
Contaminant: 7500
Violation type: 75
Compliance start date: 3/14/2007 0:00:00
Compliance end date: 12/31/2025 0:00:00
Enforcement date: No Enf Action as of
Enforcement action: 7/8/2009 0:00:00
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60
PWS type code: NC
Violation ID: 4304009
Contaminant: 7500
Violation type: 75
Compliance start date: 7/22/2007 0:00:00
Compliance end date: 12/31/2025 0:00:00
Enforcement date: No Enf Action as of
Enforcement action: 7/8/2009 0:00:00
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60
PWS type code: NC
Violation ID: 700
Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 1/1/2000 0:00:00
Compliance end date: 3/31/2000 0:00:00
Enforcement date: 5/3/2000 0:00:00
Enforcement action: State Formal NOV Issued
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60
PWS type code: NC
Violation ID: 700
Contaminant: COLIFORM (TCR)
Violation type: Monitoring, Routine Major (TCR)
Compliance start date: 1/1/2000 0:00:00
Compliance end date: 3/31/2000 0:00:00
Enforcement date: 5/3/2000 0:00:00
Enforcement action: State Public Notif Requested
Violation measurement: Not Reported

PWS name: FLAG BRANCH BAPTIST CHURCH
Population served: 60
PWS type code: NC
Violation ID: 801
Contaminant: NITRATE
Violation type: 3
Compliance start date: 3/1/2000 0:00:00
Compliance end date: 5/31/2000 0:00:00
Enforcement date: 3/5/2004 0:00:00
Enforcement action: State Compliance Achieved
Violation measurement: Not Reported

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	801	Contaminant:	NITRATE
Violation type:	3	Compliance start date:	3/1/2000 0:00:00
Compliance end date:	5/31/2000 0:00:00	Enforcement date:	9/14/2000 0:00:00
Enforcement action:	State Formal NOV Issued	Violation measurement:	Not Reported

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	801	Contaminant:	NITRATE
Violation type:	3	Compliance start date:	3/1/2000 0:00:00
Compliance end date:	5/31/2000 0:00:00	Enforcement date:	9/14/2000 0:00:00
Enforcement action:	State Public Notif Requested		
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	901	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	10/1/2000 0:00:00	Compliance end date:	10/31/2000 0:00:00
Enforcement date:	12/19/2000 0:00:00	Enforcement action:	State Formal NOV Issued
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	901	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	10/1/2000 0:00:00	Compliance end date:	10/31/2000 0:00:00
Enforcement date:	12/19/2000 0:00:00	Enforcement action:	State Public Notif Requested
Violation measurement:	Not Reported		

PWS name:	FLAG BRANCH BAPTIST CHURCH		
Population served:	60	PWS type code:	NC
Violation ID:	901	Contaminant:	COLIFORM (TCR)
Violation type:	Monitoring, Routine Major (TCR)		
Compliance start date:	10/1/2000 0:00:00	Compliance end date:	10/31/2000 0:00:00
Enforcement date:	7/12/2006 0:00:00	Enforcement action:	State Public Notif Received
Violation measurement:	Not Reported		

2
West
1/2 - 1 Mile
Higher

NC WELLS **NC3000000003222**

PWD ID:	NC0190509	System Name:	FLAG BRANCH BAPTIST CHURCH
PWS Type:	Non Community Transient	Primary Source:	Ground Water
Water Type:	Ground Water	Facility Name:	WELL #1
Facility Type:	Well	Well Depth:	265
Owner:	FLAG BRANCH BAPTIST CHURCH_190509		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

Federal EPA Radon Zone for UNION County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 28174

Number of sites tested: 2

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	1.000 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetland Inventory
Source: US Fish & Wildlife Service
Telephone: 703-358-2171

HYDROGEOLOGIC INFORMATION

AQUIFLOW^{R} Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

North Carolina Public Water Supply Wells
Source: Department of Environmental Health
Telephone: 919-715-3243

OTHER STATE DATABASE INFORMATION

North Carolina Wildlife Resources/Game Lands
Source: Center for Geographic Information and Analysis
Telephone: 919-733-2090
All publicly owned game lands managed by the North Carolina Wildlife Resources Commission and as listed in Hunting and Fishing Maps.

NC Natural Heritage Sites: Natural Heritage Element Occurrence Sites
Source: Natural Heritage Occurrence Sites Center for Geographic Information and Analysis
Telephone: 919-733-2090
A point coverage identifying locations of rare and endangered species, occurrences of exemplary or unique natural ecosystems (terrestrial or aquatic), and special animal habitats (e.g., colonial waterbird nesting sites).

NC Natural Areas: Significant Natural Heritage Areas
Source: Center for Geographic Information and Analysis
Telephone: 919-733-2090
A polygon converage identifying sites (terrestrial or aquatic) that have particular biodiversity significance. A site's significance may be due to the presenceof rare species, rare or high quality natural communities, or other important ecological features.

RADON

State Database: NC Radon
Source: Department of Environment & Natural Resources
Telephone: 919-733-4984
Radon Statistical and Non Statiscal Data

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

STREET AND ADDRESS INFORMATION

APPENDIX G. FEMA DOCUMENTATION

Grant Lewis

From: Grant Lewis
Sent: Friday, October 9, 2020 1:24 PM
To: Brian.Hawkins@unioncountync.gov
Subject: Wits End FEMA documentation
Attachments: FEMA_Documentation.pdf

Hello Brian;

As I explained in my prior email, I am trying to coordinate with Union County concerning FEMA floodplain requirements for the Wits End stream restoration Site. I am attaching documentation in support of our requirement to coordinate with the Union County local floodplain administrator. If you are the Union County floodplain administrator, please review the information and fill out the last page of the FEMA floodplain checklist.

If you are not the Union County floodplain administrator, please notify me so I may forward to the proper authority.

Thank you
Grant

Grant Lewis
Senior Project Manager
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603
glewis@axiomenvironmental.org
(919) 215-1693 (cell)

Axiom Environmental, Inc.

Axiom Environmental, Inc.

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

October 9, 2020

Brian Hawkins, PE, CFM
Union County Stormwater Engineer
500 N. Main Street, Suite 70
Monroe, NC 28112

Re: Wits End Stream and Wetland mitigation project
Union County **20-011**
FEMA Floodplain Requirements Checklist

Dear Mr. Hawkins:

The purpose of this letter is to request concurrence from the Union County concerning a stream and wetland restoration site located in Union County. The Site encompasses approximately 69.9 acres of land with an agriculture pond, disturbed forest, pasture, and row crops along Waxhaw Branch and its unnamed tributaries. Proposed activities at the Site include the restoration of stream channels, enhancement of stream channel, and restoration/enhancement of riparian wetlands.

Stream reaches are depicted on the attached figures and lengths/priority are as follows:

Reach	**Length**	**Priority**
Waxhaw Branch	5403	Restoration and Enhancement (Level III)
UT 1	189	Restoration and Enhancement (Level III)
UT 2	1199	Restoration
UT 3	2983	Restoration and Enhancement (Level I and III)
UT 3A	780	Restoration
UT 4	1223	Restoration
UT 5	190	Restoration and Enhancement (Level III)

FEMA mapping was reviewed to determine if the project is located in a FEMA study area (DFIRM panel number 5462). Based on existing floodplain mapping, the Site is in Special Flood Hazard Area. Therefore, we request guidance from your organization as to how to mover forward with the project.

We thank you in advance for your timely response and cooperation. Please feel free to contact the below referenced NC DMS Project Manager with any questions that you may have concerning the extent of site disturbance associated with this project.

Yours truly,

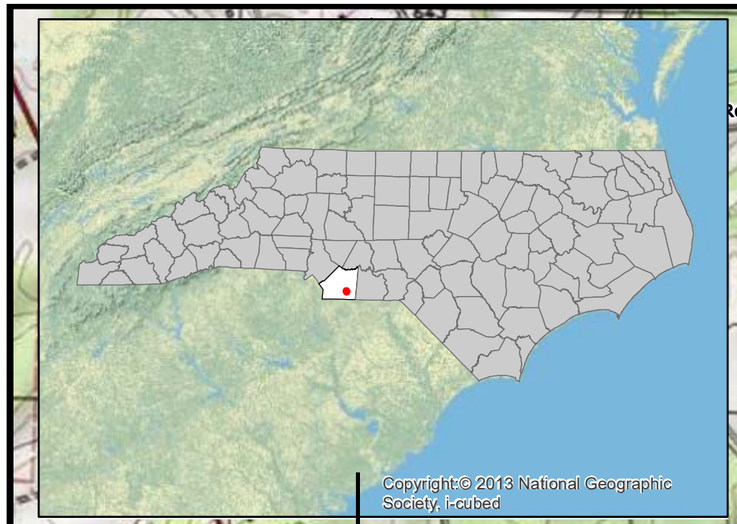
AXIOM ENVIRONMENTAL

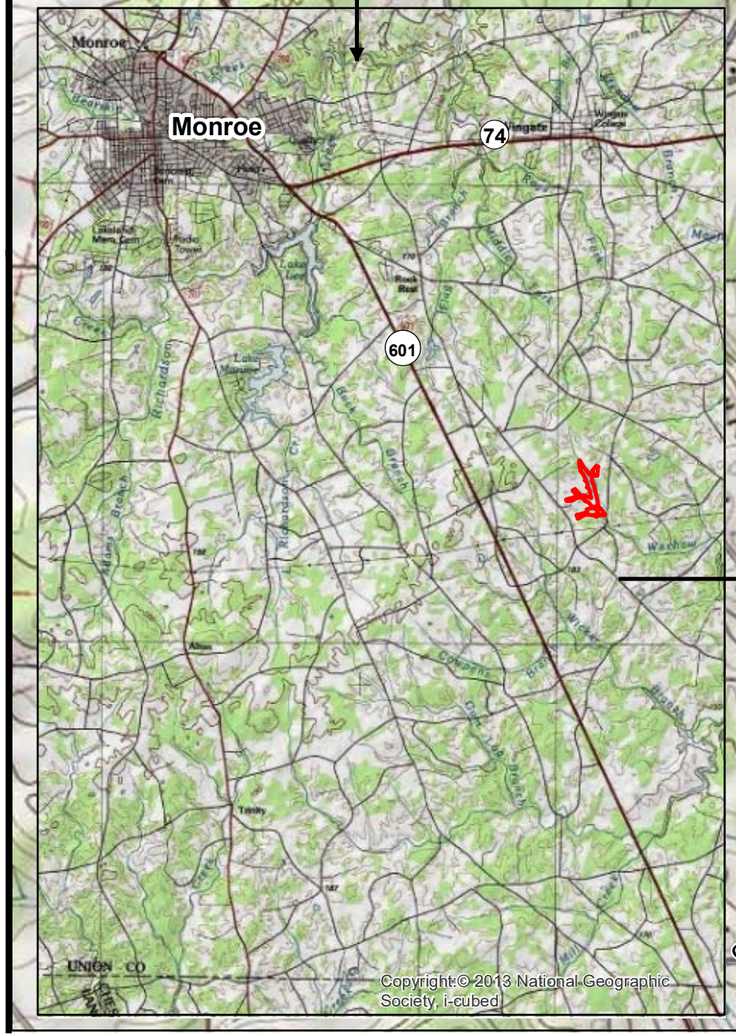
W. Grant Lewis
Senior Project Manager

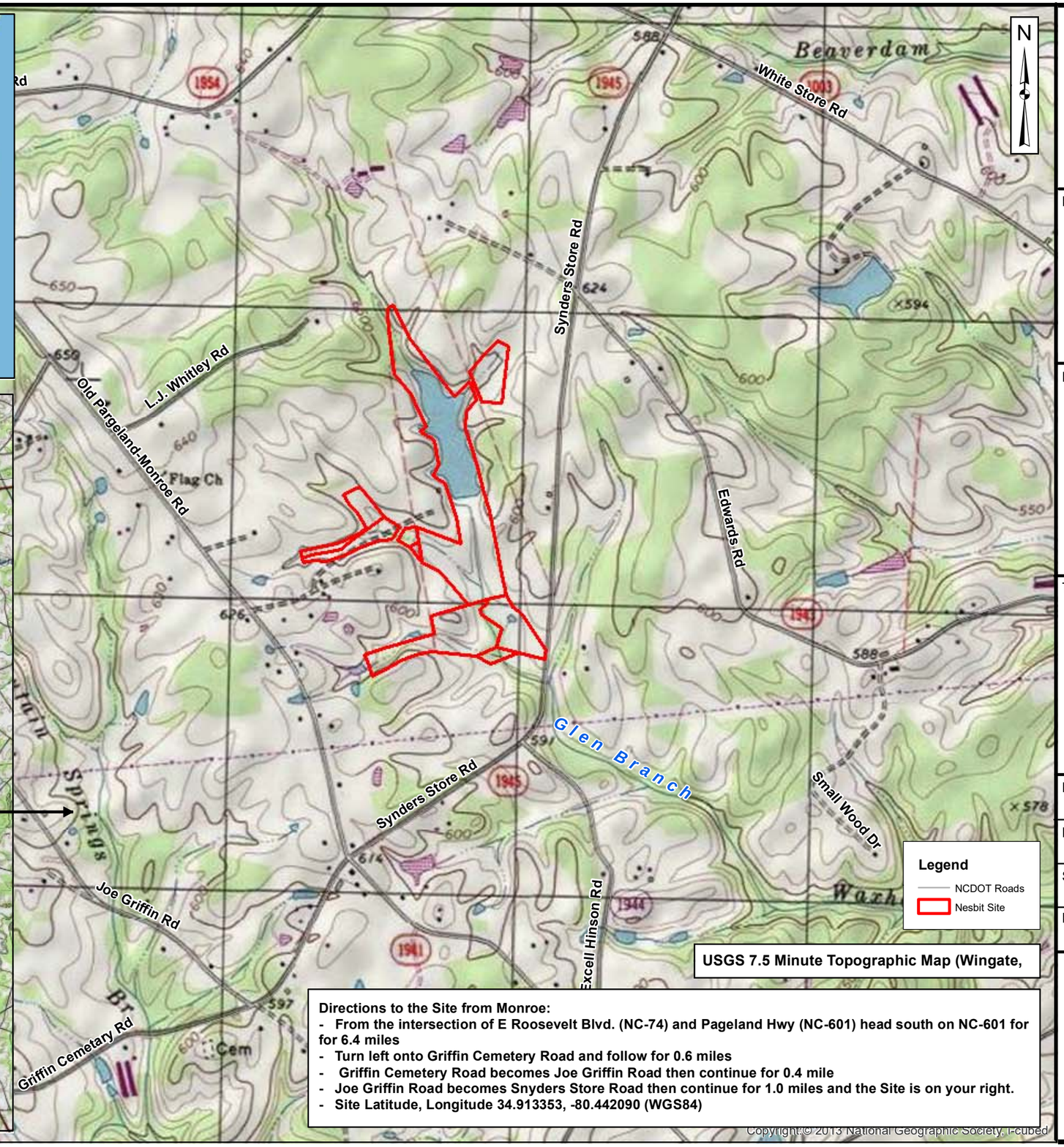
Attachments

- Figure 1 Site Location
- Figure 2 Hydrologic Unit Map
- Figure 3 Topography and Drainage Area
- Figure 4 Existing Conditions
- Figure 5 Proposed Conditions
- EEP Floodplain Requirements Checklist

Cc JD Hamby
Matthew Reed







Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS LLC

Project:

WHITS END SITE

Union County, NC

Title:

SITE LOCATION

Drawn by: WGL

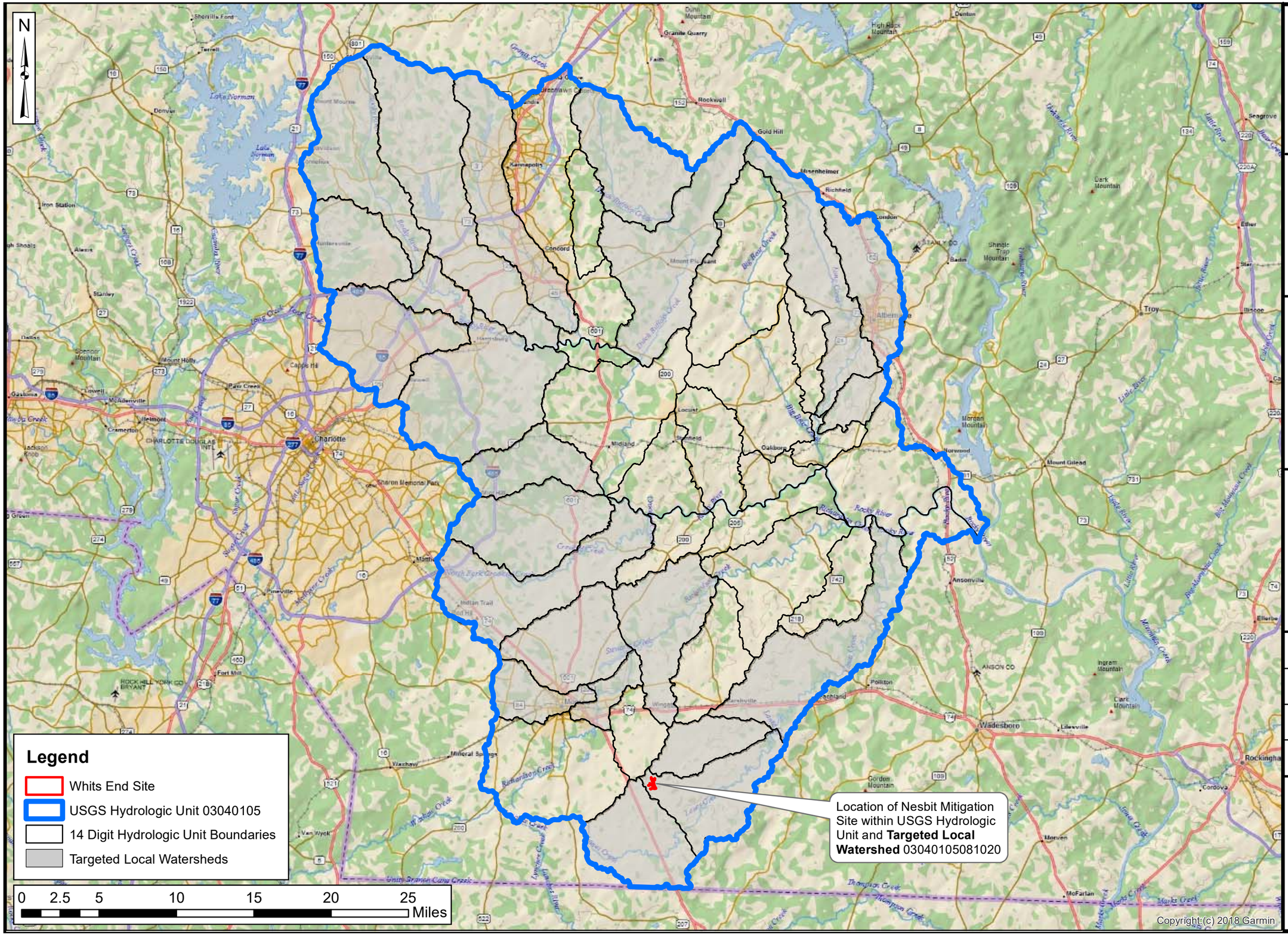
Date: JUNE 2020

Scale: 1:15,000

Project No.: 20-011

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS LLC

Project:

WHITS END SITE

Union County, NC

Title:

HYDROLOGIC UNIT MAP

Drawn by: KRJ

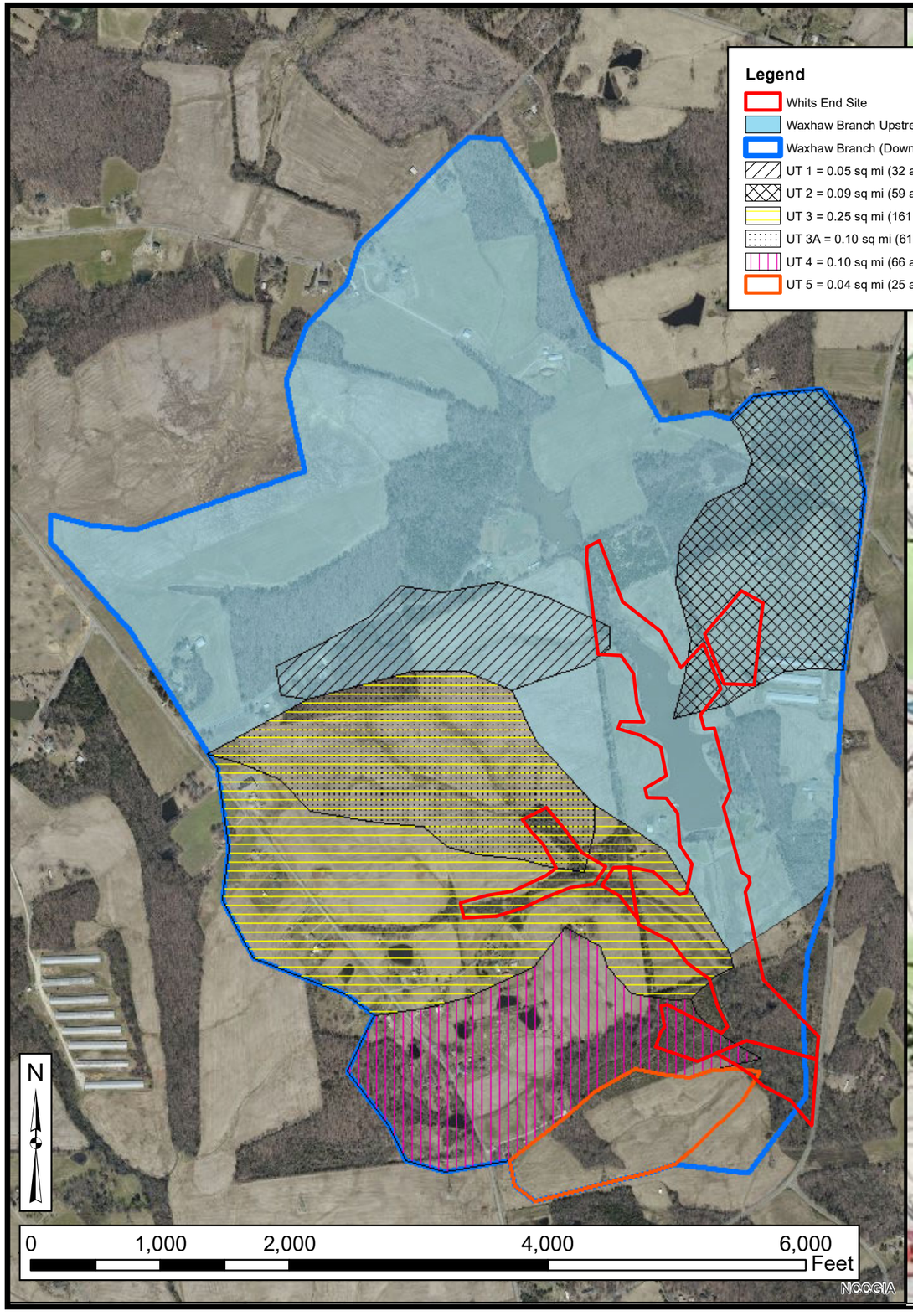
Date: JUNE 2020

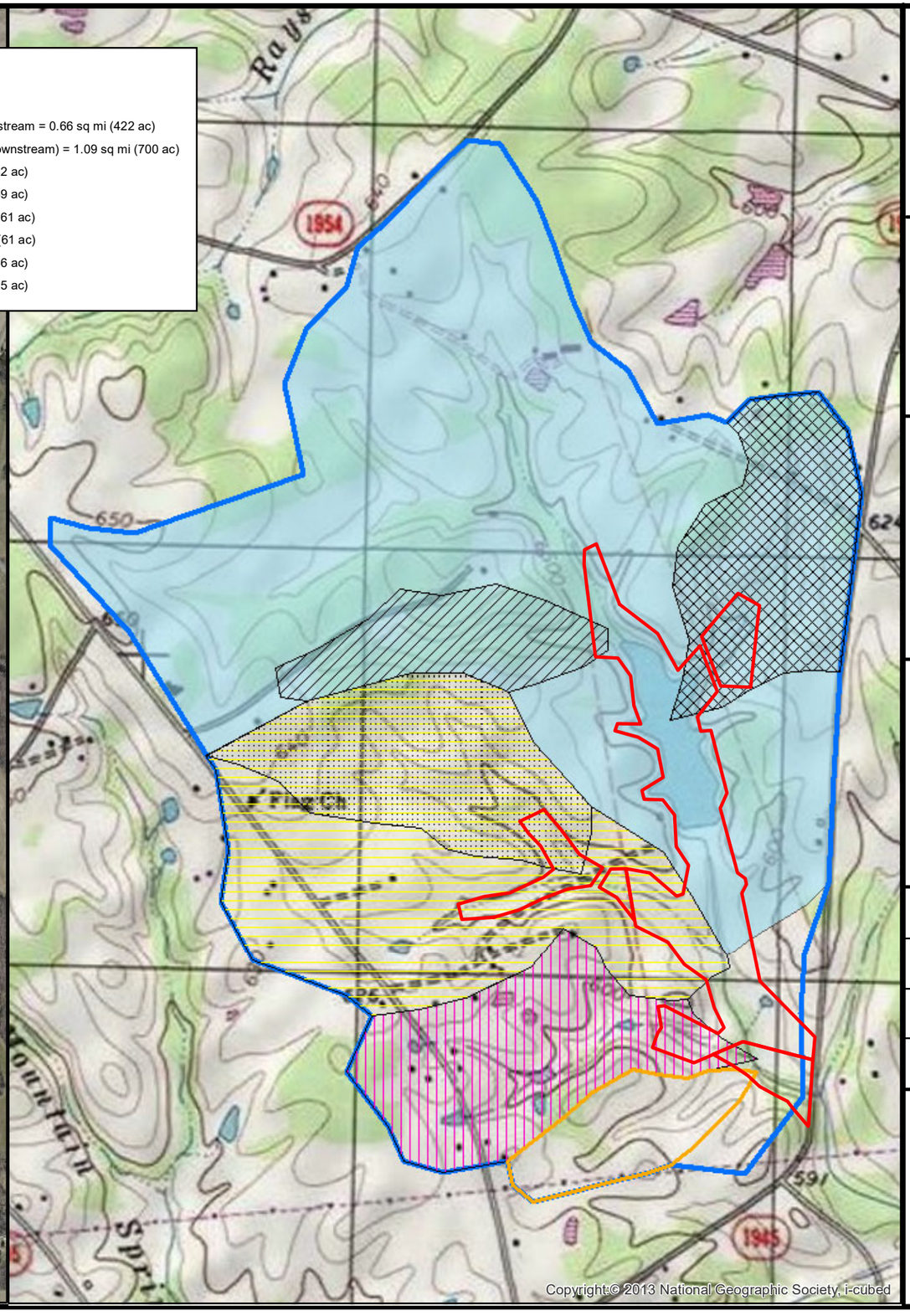
Scale: 1:370,000

Project No.: 20-011

FIGURE

2





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WHITS END SITE

Union County, NC

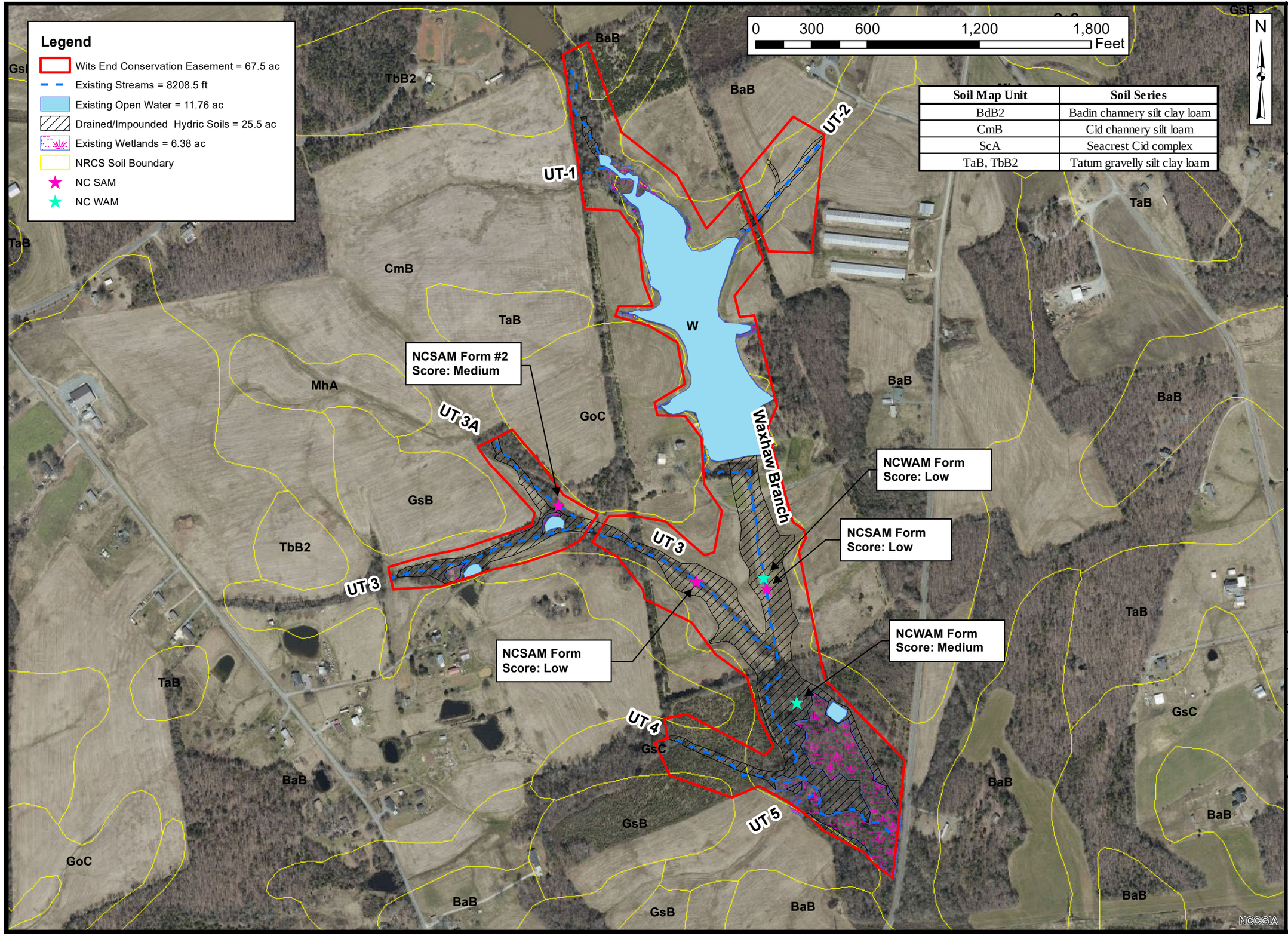
Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by:	KRJ
Date:	JUNE 2020
Scale:	1:12,000
Project No.:	20-011

FIGURE

3



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

WHITS END SITE

Union County, NC

Title:

EXISTING CONDITIONS AND SOILS

Drawn by: KRJ

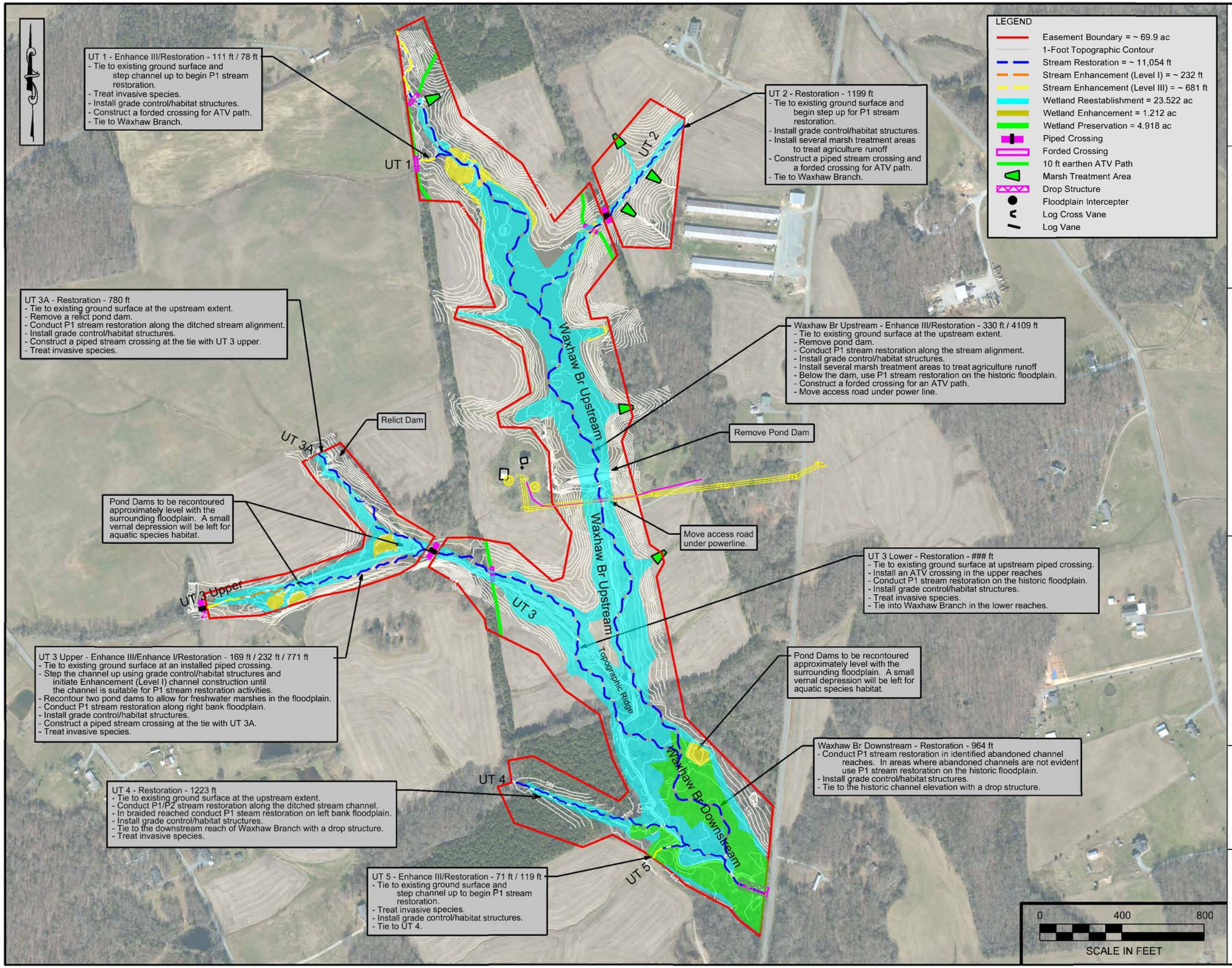
Date: JUNE 2020

Scale: 1:3700

Project No.: 20-011

FIGURE

4



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Wits End

Union County
North Carolina

Title:

Restoration Plan

Scale:	FIGURE NO.
As Shown	5
Date: Sept 2020	
Project No.: 20-011	

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:	Wits End Site
Name if stream or feature:	Waxhaw Branch
County:	Union
Name of river basin:	Yadkini
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Monroe/Union
DFIRM panel number for entire site:	5462
Consultant name:	Axiom Environmental, Inc.
Phone number:	919-215-1693
Address:	218 Snow Avenue Raleigh, NC 27603

Design Information

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

Summarize stream reaches or wetland areas according to their restoration priority.
(See Attached)

Example

Reach	Length	Priority
Example: Reach A	*1000*	*One (Restoration)*
Example: Reach B	*2000*	*Three (Enhancement)*

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: Brian Hawkins
Phone Number: 704-283-3642

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

☐ No Action

☐ No Rise

☐ Letter of Map Revision

☐ Conditional Letter of Map Revision (CLOMR)

☐ Other Requirements

List other requirements:

Comments:

Name: W. Grant Lewis Signature: _____

Title: President Date: _____

APPENDIX H. FINANCIAL ASSURANCE

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

APPENDIX I. SITE PROTECTION INSTRUMENT

FILED
UNION COUNTY, NC
CRYSTAL D. GILLIARD
REGISTER OF DEEDS

FILED	Jun 22, 2021
AT	12:06 pm
BOOK	08144
START PAGE	0757
END PAGE	0769
INSTRUMENT #	29496
EXCISE TAX	$2,110.00

DM

Excise Tax $2,110.00
STATE OF NORTH CAROLINA

Parcel 04-006-015

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

UNION COUNTY

SPO File Number: 90-BN and 90-BO
DMS Project Number: 100164

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 22nd day of June, 2021, by Restoration Systems, LLC a North Carolina limited liability company, ("**Grantor**"), whose mailing address is 1101 Hayes Street, Suite 211, Raleigh, NC 27604, to the State of North Carolina, ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environmental Quality (formerly 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 Restoration Systems, LLC, a North Carolina limited liability company, 1101 Hayes Street, Suite 211, Raleigh, NC 27604 and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number 7968.

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 (formerly Department of Environment and Natural Resources), which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Buford Township, Union County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 118.491 acres and being conveyed to the Grantor by deeds as recorded in **Deed Book 7927 at Page 67** and **Deed Book 7931 at Page 561** and **Deed Book 7957 at Page 895** of the Union 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 Waxhaw Branch.

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:

BEING ALL of Conservation Easement Area 1 containing a total of approximately 32.634 acres and Conservation Easement Area 2 containing a total of approximately 24.205 acres for a total of **56.839 acres**, as shown on the plat of survey titled "Conservation Easement for the State of North Carolina, Division of Mitigation Services, Owners: Restoration Systems LLC and Max Shelton Brooks & Sarah S. Brooks, DMS Project ID No. 100164, SPO Numbers 90-BN, 90-BO", in Buford Township, Union County, North Carolina, dated April 28, 2021, by Thomas E. White, PLS Number L-4689, Carolina Surveyors, Inc. recorded in **Plat Cabinet P, Pages 903-904**, Union 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 the location more particularly described on **Exhibit A** ("Access Easement") attached hereto and incorporated herein by this reference, to access the Conservation Easement Area for the purposes set forth herein. This grant of easement shall not vest any rights in the public and shall not be construed as a public dedication of the Access Easement. Grantor covenants, represents and warrants that it is the sole owner of and is seized of the Property in fee simple and has the right to grant and convey this Access Easement.

III. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

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

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

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

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

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

all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Conservation Easement Area is prohibited.

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

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

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

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

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

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

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

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

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

M. Subdivision and Conveyance. Grantor voluntarily agrees that no further subdivision, partitioning, or dividing of the Conservation Easement Area portion of the Property owned by the Grantor in fee simple ("fee") that is subject to this Conservation Easement is allowed. Any future transfer of the Property shall be subject to this Conservation Easement and Right of Access and to the

Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Conservation Easement Area for the purposes set forth herein.

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

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

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

IV. GRANTEE RESERVED USES

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

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

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

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

E. Crossing Area(s). The Grantee is not responsible for maintenance of crossing area(s), however, the Grantee, its employees and agents, successors or assigns, reserve the right to repair

crossing area(s), at its sole discretion and to recover the cost of such repairs from the Grantor if such repairs are needed as a result of activities of the Grantor, his successors or assigns.

V. ENFORCEMENT AND REMEDIES

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

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

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

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

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

VI. MISCELLANEOUS

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

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

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

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

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

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

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

and

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

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

VII. QUIET ENJOYMENT

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

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

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

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

Restoration Systems, LLC
a North Carolina limited liability company

_____ (SEAL)
Name: John Preyer
Title: COO - Restoration Systems, LLC

NORTH CAROLINA
COUNTY OF Wake

I, John Duncan Hamby, a Notary Public in and for the County and State aforesaid, do hereby certify that John Preyer, as COO of Restoration Systems, LLC, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS, WHEREOF, I have hereunto set my hand and Notary Seal this the 17th day of June, 2021.

_____
Notary Public

My commission expires:

11-15-21

JOHN DUNCAN HAMBY NOTARY PUBLIC WAKE COUNTY, NC My Commission Expires 11-15-2021

Exhibit A

Conservation Easement Area 1

BEING ALL of Conservation Easement 1 of the Wits End Site over a portion of the lands of Restoration Systems LLC and being more particularly described as follows:

BEGINNING at point 31, being a set rebar with cap; thence with a bearing of S 15°14'47" E and a distance of 205.11' to a set rebar with cap; thence with a bearing of S 55°06'47" E and a distance of 70.81' to a set rebar with cap; thence with a bearing of S 13°08'40" E and a distance of 47.95' to a set rebar with cap; thence with a bearing of S 27°52'29" W and a distance of 78.88' to a set rebar with cap; thence with a bearing of S 11°33'45" E and a distance of 605.79' to a set rebar with cap; thence with a bearing of S 46°41'36" E and a distance of 625.30' to a set rebar with cap on the westerly margin of the right of way of Snyders Store Rd; thence following the margin thereof four (4) calls: (1) with a bearing of S 04°56'07" W and a distance of 274.13' to a set rebar with cap; (2) with a bearing of S 04°58'10" W and a distance of 248.74' to a set rebar with cap; (3) with a bearing of S 06°01'44" W and a distance of 108.90' to a set rebar with cap; (4) with a bearing of S 06°55'20" W and a distance of 84.30' to a set rebar on the common line of the property of Bibi Mariam Niazi-Sai Revocable Trust (now or formerly) recorded in Deed Book 7073, Page 202; thence following the common line thereof three (3) calls: (1) with a bearing of N 51°45'49" W and a distance of 199.85' to a set rebar; (2) with a bearing of N 57°04'04" W and a distance of 671.33' to a set rebar; (3) with a bearing of S 67°00'56" W and a distance of 170.56' to a set rebar with cap; thence with a bearing of N 70°30'44" W and a distance of 345.08' to a set rebar with cap; thence with a bearing of N 24°31'03" W and a distance of 193.69' to a set rebar with cap on the common line of the property of Jessie Brice Guion & Virginia L Guion (now of formerly); thence following the common line thereof two (2) calls: (1) with a bearing of N 73°35'48" E and a distance of 70.91' to an existing steel rod; thence with a bearing of N 09°05'20" W and a distance of 108.83' to a set rebar with cap; thence with a bearing of N 79°49'16" E and a distance of 123.58' to a set rebar with cap; thence with a bearing of S 62°21'12" E and a distance of 378.23' to a set rebar with cap; thence with a bearing of N 72°37'39" E and a distance of 67.94' to a set rebar with cap; thence with a bearing of N 18°24'15" E and a distance of 71.11' to a set rebar with cap; thence with a bearing of N 26°54'00" W and a distance of 302.88' to a set rebar with cap; thence with a bearing of N 43°28'53" W and a distance of 191.32' to a set rebar with cap; thence with a bearing of N 36°37'38" W and a distance of 213.89' to a set rebar with cap; thence with a bearing of N 63°37'12" W and a distance of 283.44' to a set rebar with cap; thence with a bearing of N 09°28'08" W and a distance of 50.24' to a set rebar with cap; thence with a bearing of N 09°28'08" W and a distance of 235.10' to a set rebar with cap; thence with a bearing of N 09°28'08" W and a distance of 231.95' to a set rebar with cap; thence with a bearing of S 63°54'20" E and a distance of 219.08' to a set rebar with cap; thence with a bearing of S 57°06'52" E and a distance of 248.60' to a set rebar with cap; thence with a bearing of N 71°53'48" E and a distance of 54.09' to a set rebar with cap; thence with a bearing of N 13°56'00" E and a distance of 179.45' to a set rebar with cap; thence with a bearing of N 33°19'50" W and a distance of 110.63' to a set rebar with cap; thence with a bearing of N 83°12'17" E and a distance of 391.30' to a set rebar with cap; being the point of BEGINNING, having an area of 32.634 acres, more or less.

Conservation Easement Area 2

BEING ALL of Conservation Easement 2 of the Wits End Site over a portion of the lands of Restoration Systems LLC and being more particularly described as follows:

BEGINNING at point 1, being an existing t-post, being the northwesterly corner of the property of Restoration Systems, LLC (now or formerly) recorded in Deed Book 7927, Page 67, and being on the common line of the property of Eddie Adcock (now or formerly) recorded in Deed Book 213, Page 416; thence following the common line thereof with a bearing of N 64°04'54" E and a distance of 146.79' to a set rebar with cap; thence with a bearing of S 20°46'49" E and a distance of 517.72' to a set rebar with cap; thence with a bearing of S 52°20'20" E and a distance of 373.95' to a set rebar with cap; thence with a bearing of S 29°08'23" E and a distance of 293.08' to a set rebar with cap; thence with a bearing of N 49°11'43" E and a distance of 246.63' to a set rebar with cap on the western line of the property of Max Shelton Brook & Sarah S Brooks (now or formerly) recorded in Deed Book 412, Page 401; thence following said western line with a bearing of S 20°47'05" E and a distance of 377.22' to a set rebar with cap; thence with a bearing of S 38°00'23" W and a distance of 252.03' to a set rebar with cap; thence with a bearing of S 14°03'10" E and a distance of 115.63' to a set rebar with cap; thence with a bearing of N 84°06'53" E and a distance of 79.29' to a set rebar with cap; thence with a bearing of S 14°19'40" E and a distance of 499.10' to a set rebar with cap; thence with a bearing of S 24°00'21" W and a distance of 131.20' to a set rebar with cap; thence with a bearing of S 15°14'48" E and a distance of 255.51' to a set rebar with cap; thence with a bearing of S 83°12'17" W and a distance of 410.01' to a set rebar with cap; thence with a bearing of N 03°36'51" W and a distance of 243.67' to a set rebar with cap; thence with a bearing of N 37°08'10" W and a distance of 147.65' to a set rebar with cap; thence with a bearing of N 88°35'10" W and a distance of 147.36' to a set rebar with cap; thence with a bearing of N 11°30'04" W and a distance of 71.40' to a set rebar with cap; thence with a bearing of N 59°10'49" E and a distance of 189.42' to a set rebar with cap; thence with a bearing of N 10°41'06" W and a distance of 224.73' to a set rebar with cap; thence with a bearing of N 58°52'52" W and a distance of 176.02' to a set rebar with cap; thence with a bearing of N 74°31'17" W and a distance of 187.35' to a set rebar with cap; thence with a bearing of N 18°34'19" E and a distance of 59.02' to a set rebar with cap; thence with a bearing of S 89°39'19" E and a distance of 142.78' to a set rebar with cap; thence with a bearing of N 34°48'24" E and a distance of 43.42' to a set rebar with cap; thence with a bearing of N 23°43'37" W and a distance of 143.57' to a set rebar with cap; thence with a bearing of N 09°25'22" W and a distance of 206.78' to a set rebar with cap; thence with a bearing of N 27°13'41" W and a distance of 158.70' to a set rebar with cap; thence with a bearing of N 86°56'55" W and a distance of 189.19' to a set rebar with cap on the eastern line of the property of Cox Land Investments, Limited (now or formerly) recorded in Deed Book 5905, Page 73; thence following said eastern line with a bearing of N 07°50'51" W and a distance of 834.04' to a set rebar with cap; being the set rebar with cap of BEGINNING, having an area of 24.205 acres, more or less.

ALL OF THE FOREGOING CONSERVATION EASEMENT AREAS as shown on plat of survey titled "Conservation Easement for the State of North Carolina, Division of Mitigation Services, Owners: Restoration Systems LLC and Max Shelton Brooks & Sarah S. Brooks, DMS Project ID No. 100164, SPO Numbers 90-BN, 90-BO", in Buford Township, Union County, North

Carolina, dated April 28, 2021, by Thomas E. White, PLS Number L-4689, Carolina Surveyors, Inc. recorded in Plat Cabinet P, Pages 903-904, Union County Register of Deeds.

Access Easement 1

ALL SUCH CONSERVATION EASEMENT AREAS TOGETHER WITH that certain new non-exclusive access easements labeled as "Access Easement #1" for ingress, egress, and regress and as shown on the foregoing described plat of survey recorded in Plat Cabinet P, Pages 903-904, Union County Register of Deeds.

FILED
UNION COUNTY, NC
CRYSTAL D. GILLIARD
REGISTER OF DEEDS

FILED	Jun 22, 2021
AT	12:06 pm
BOOK	08144
START PAGE	0770
END PAGE	0780
INSTRUMENT #	29497
EXCISE TAX	$91.00

DM

Excise Tax $91.00
STATE OF NORTH CAROLINA

Parcel 03-168-004

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

UNION COUNTY

SPO File Number: 90-BN and 90-BO
DMS Project Number: 100164

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 21st day of June, 2021, by Max Shelton Brooks and wife Sarah S. Brooks, (collectively "**Grantor**"), whose mailing address is 2407 Faulks Church Road, Wingate, NC 28174, to the State of North Carolina, ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environmental Quality (formerly 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 Restoration Systems, LLC, a North Carolina limited liability company, 1101 Hayes Street, Suite 211, Raleigh, NC 27604 and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number 7968.

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 (formerly Department of Environment and Natural Resources), which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Buford Township, Union County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 57.25 acres and being conveyed to the Grantor by deed as recorded in **Deed Book 412 at Page 401** of the Union 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 Waxhaw Branch.

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:

BEING ALL of Conservation Easement Area 3 containing a total of approximately 5.011 acres, as shown on the plat of survey titled "Conservation Easement for the State of North Carolina, Division of Mitigation Services, Owners: Restoration Systems LLC and Max Shelton Brooks & Sarah S. Brooks, DMS Project ID No. 100164, SPO Numbers 90-BN, 90-BO", in Buford Township, Union County, North Carolina, dated April 28, 2021, by Thomas E. White, PLS Number L-4689, Carolina Surveyors, Inc. recorded in **Plat Cabinet P, Pages 903-904**, Union 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 the location more particularly described on Exhibit A ("Access Easement") attached hereto and incorporated herein by this reference, to access the Conservation Easement Area for the purposes set forth herein. This grant of easement shall not vest any rights in the public and shall not be construed as a public dedication of the Access Easement. Grantor covenants, represents and warrants that it is the sole owner of and is seized of the Property in fee simple and has the right to grant and convey this Access Easement.

III. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

IV. GRANTEE RESERVED USES

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

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

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

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

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

V. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with

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

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

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

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

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

VI. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision

to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

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

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

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

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

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

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

and

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

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

VII. QUIET ENJOYMENT

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

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

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

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

Max Shelton Brooks (SEAL)
Max Shelton Brooks

Sarah S Brooks (SEAL)
Sarah S. Brooks

NORTH CAROLINA
COUNTY OF Union

I, Robert D. Palmer, a Notary Public in and for the County and State aforesaid, do hereby certify that Max Shelton Brooks and Sarah S. Brooks, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS, WHEREOF, I have hereunto set my hand and Notary Seal this the 21st day of June, 2021.

Robert D. Palmer
Notary Public

My commission expires:

01-22-2026

ROBERT D. PALMER NOTARY PUBLIC UNION COUNTY, NC

Exhibit A

Conservation Easement Area 3

BEING ALL of Conservation Easement 3 of the Wits End Site over a portion of the lands of Max Shelton Brooks and wife Sarah S. Brooks and being more particularly described as follows:

BEGINNING at point 91; thence with a bearing of N 40°03'46" E and a distance of 182.12' to a set rebar with cap; thence with a bearing of N 40°29'44" E and a distance of 246.55' to a set rebar with cap; thence with a bearing of S 57°48'05" E and a distance of 195.66' to a set rebar with cap to a set rebar, being the northwestern corner of the property of Roger L James & Cynthia L James (now or formerly) recorded in Deed Book 4460, Page 790; thence following the western line thereof with a bearing of S 05°33'32" W and a distance of 626.85' to a set rebar with cap; thence with a bearing of N 88°00'16" W and a distance of 233.08' to a set rebar with cap; thence with a bearing of N 20°47'05" W and a distance of 420.53' to a set rebar with cap; being the point of BEGINNING, having an area of 5.011 acres, more or less.

THE FOREGOING CONSERVATION EASEMENT AREA as shown on plat of survey titled "Conservation Easement for the State of North Carolina, Division of Mitigation Services, Owners: Restoration Systems LLC and Max Shelton Brooks & Sarah S. Brooks, DMS Project ID No. 100164, SPO Numbers 90-BN, 90-BO", in Buford Township, Union County, North Carolina, dated April 28, 2021, by Thomas E. White, PLS Number L-4689, Carolina Surveyors, Inc. recorded in **Plat Cabinet P, Pages 903-904**, Union County Register of Deeds.

Access Easement 2

SUCH CONSERVATION EASEMENT AREA TOGETHER WITH that certain new non-exclusive access easements labeled as "Access Easement #2" for ingress, egress, and regress and as shown on the foregoing described plat of survey recorded in Plat Cabinet P, Pages 903-904, Union County Register of Deeds.

FILED
UNION COUNTY, NC
CRYSTAL D. GILLIARD
REGISTER OF DEEDS

FILED	Sep 30, 2021
AT	01:27 pm
BOOK	08263
START PAGE	0609
END PAGE	0619
INSTRUMENT #	46673
EXCISE TAX	$126.00

SH

Excise Tax: $126.00

STATE OF NORTH CAROLINA

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

UNION COUNTY

SPO File Number: 90-BQ
DMS Project Number: 100164

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 30th day of September, 2021, by Randy H. Guion and Karen Guion, husband and wife ("**Grantor**"), whose mailing address is 2921 Old Pageland Monroe Road, Monroe, NC 28112, to the State of North Carolina, ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the

Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environmental Quality (formerly 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 Restoration Systems, LLC, a North Carolina limited liability company, 1101 Haynes Street, Suite 211, Raleigh, NC 27604 and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number 7968.

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 (formerly Department of Environment and Natural Resources), which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Buford Township, Union County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 17.88 acres and being conveyed to the Grantor by deed as recorded in **Deed Book 420 at Page 363** of the Union 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 Waxhaw Branch.

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:

BEING ALL of Conservation Easement Area 6 containing a total of approximately 0.972 acres and Conservation Easement Area 7 containing a total of approximately 2.273 acres, for a **total of 3.245 acres**, as shown on the plat of survey titled "Conservation Easement for the State of North Carolina, Division of Mitigation Services, Owners: Estate of Jessie Brice Guion, Virginia L. Guion, widow, and Randy H. Guion and wife Karen Guion, DMS Project ID No. 100164, SPO Numbers 90-BN, 90-BO, 90-BP, 90-BQ" in Buford Township, Union County, North Carolina, dated September 7, 2021, by Thomas E. White, PLS Number L-4689, Carolina Surveyors, Inc. recorded in **Plat Cabinet Q, File 133**, Union 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.

VI. QUIET ENJOYMENT

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

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

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

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

Randy H. Guion (SEAL)
Randy H. Guion

Karen A. Guion (SEAL)
Karen Guion**

**** Karen Guion joins in to quitclaim any marital interest she has in the Conservation Easement Area and any other property rights conveyed or granted herein, but she does not join in the warranties of this instrument.**

NORTH CAROLINA
COUNTY OF UNION

I, EMILY S. THOMAS, a Notary Public in and for the County and State aforesaid, do hereby certify that Randy H. Guion and Karen Guion, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 29th day of September, 2021.

Emily S. Thomas
Notary Public

My commission expires:
1/26/2024

EMILY S. THOMAS NOTARY PUBLIC UNION COUNTY, NC

Exhibit A

Conservation Easement Area 6

BEING ALL of Conservation Easement 6 of the Wits End Site over a portion of the lands Randy H. Guion and being more particularly described as follows:

BEGINNING at Point 72; thence with a bearing of N 12°35'19" W and a distance of 66.59' to a set rebar with cap; thence with a bearing of N 74°17'45" E and a distance of 210.49' to a set rebar with cap; thence with a bearing of N 78°08'50" E and a distance of 203.71' to a set rebar with cap; thence with a bearing of N 71°25'33" E and a distance of 281.06' to a set rebar with cap; thence with a bearing of S 53°58'47" W and a distance of 85.47' to a set rebar with cap; thence with a bearing of S 52°54'27" W and a distance of 170.66' to a set rebar with cap; thence with a bearing of S 78°21'25" W and a distance of 348.03' to a set rebar with cap; thence with a bearing of S 74°29'34" W and a distance of 111.86' to a set rebar with cap; being the point of BEGINNING, having an area of 0.972 acres, more or less.

Conservation Easement Area 7

BEING ALL of Conservation Easement 7 of the Wits End Site over a portion of the lands Randy H. Guion and being more particularly described as follows:

BEGINNING at point 77, being a set rebar with cap, and being on the southern line of the property of Randy H Guion (now or formerly); thence with a bearing of N 38°06'26" W and a distance of 231.56' to a set rebar with cap; thence with a bearing of N 43°42'28" W and a distance of 130.65' to a set rebar with cap; thence with a bearing of N 35°47'05" W and a distance of 117.15' to a set rebar with cap; thence with a bearing of N 63°22'40" E and a distance of 146.64' to a set rebar with cap; thence with a bearing of N 63°22'35" E and a distance of 61.26' to a set rebar with cap; thence with a bearing of S 41°10'36" E and a distance of 383.78' to a set rebar with cap; thence with a bearing of S 76°39'57" E and a distance of 81.72' to a set rebar with cap; thence with a bearing of S 54°06'04" W and a distance of 70.36' to a set rebar with cap; thence with a bearing of S 53°58'47" W and a distance of 197.05' to a set rebar with cap; being the set rebar with cap of BEGINNING, having an area of 2.273 acres, more or less.

ALL OF THE FOREGOING CONSERVATION EASEMENT AREAS as shown on plat of survey titled "Conservation Easement for the State of North Carolina, Division of Mitigation Services, Owners: Estate of Jessie Brice Guion, Virginia L. Guion, widow, and Randy H. Guion and wife Karen Guion, DMS Project ID No. 100164, SPO Numbers 90-BN, 90-BO, 90-BP, 90-BQ" in Buford Township, Union County, North Carolina, dated September 7, 2021, by Thomas E. White, PLS Number L-4689, Carolina Surveyors, Inc. recorded in Plat Cabinet Q, File 133, Union County Register of Deeds.

FILED
UNION COUNTY, NC
CRYSTAL D. GILLIARD
REGISTER OF DEEDS

FILED	Sep 30, 2021
AT	01:27 pm
BOOK	08263
START PAGE	0597
END PAGE	0608
INSTRUMENT #	46672
EXCISE TAX	$294.00

SH

Excise Tax: $294.00

STATE OF NORTH CAROLINA

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

UNION COUNTY

SPO File Number: 90-BP
DMS Project Number: 100164

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 30th day of September, 2021, by Virginia L. Guion (a/k/a Mary Virginia Lowery Guion), a widow, and Virginia L. Guion, as Executor of the Estate of Jessie Brice Guion (collectively "**Grantor**"), whose mailing address is 2909 Old Pageland Monroe Road, Monroe, NC 28112, to the State of North Carolina, ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the

Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environmental Quality (formerly 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 Restoration Systems, LLC, a North Carolina limited liability company, 1101 Haynes Street, Suite 211, Raleigh, NC 27604 and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number 7968.

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 (formerly Department of Environment and Natural Resources), which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Buford Township, Union County, North Carolina (the "**Property**"), and being more particularly described as those certain parcels of land containing a total of approximately 35.405 acres and being conveyed to the Grantor by deeds as recorded in **Deed Book 329 at Page 136**, **Deed Book 329 at Page 140**, **Deed Book 416 at Page 716** and **Deed Book 839 at Page 282** of the Union County Registry, North Carolina, and in accordance with will probated in **Union County Estate File Number 21-E-0683**; 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 Waxhaw Branch.

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:

BEING ALL of Conservation Easement Area 4 containing a total of approximately 0.282 acres and Conservation Easement Area 5 containing a total of approximately 6.378 acres, for a **total of 6.660 acres**, as shown on the plat of survey titled "Conservation Easement for the State of North Carolina, Division of Mitigation Services, Owners: Estate of Jessie Brice Guion, Virginia L. Guion, widow, and Randy H. Guion and wife Karen Guion, DMS Project ID No. 100164, SPO Numbers 90-BN, 90-BO, 90-BP, 90-BQ" in Buford Township, Union County, North Carolina, dated September 7, 2021, by Thomas E. White, PLS Number L-4689, Carolina Surveyors, Inc. recorded in **Plat Cabinet Q, File 133**, Union 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 hereunto set his hand and seal, the day and year first above written.

Virginia L. Guion (SEAL)
Virginia L. Guion (a/k/a Mary Virginia Lowery Guion)

Estate of Jessie Brice Guion

By: Virginia L. Guion (SEAL)
Virginia L. Guion, Executor

NORTH CAROLINA
COUNTY OF Union

I, Carrie Hargett, a Notary Public in and for the County and State aforesaid, do hereby certify that Virginia L. Guion, personally and as Executor of the Estate of Jessie Brice Guion, appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 21th day of September, 2021.

Carrie Hargett
Notary Public

My commission expires:
3/16/2022

CARRIE HARGETT NOTARY PUBLIC UNION COUNTY, NC

Exhibit A
Legal Description

Conservation Easement Area 4

BEING ALL of Conservation Easement 4 of the Wits End Site over a portion of the lands of Virginia L. Guion, a widow and being more particularly described as follows:

BEGINNING at point 58, being the northeastern corner of the property of Jessie Brice Guion & Virginia L Guion (now or formerly) recorded in Deed Book 414, Page 716; thence with a bearing of S 09°28'08" E and a distance of 235.10' to a set rebar with cap; thence with a bearing of N 37°53'39" W and a distance of 219.71' to a set rebar with cap; thence with a bearing of N 58°42'22" E and a distance of 112.66' to a set rebar with cap; being the point of BEGINNING, having an area of 0.282 acres, more or less.

Conservation Easement Area 5

BEING ALL of Conservation Easement 5 of the Wits End Site over a portion of the lands the Virginia L. Guion, a widow, and being more particularly described as follows:

BEGINNING at point 58, being the northeastern corner of the property of Jessie Brice Guion & Virginia L Guion (now or formerly) recorded in Deed Book 414, Page 716; thence with a bearing of S 58°42'22" W and a distance of 112.66' to a set rebar with cap; thence with a bearing of N 69°23'37" W and a distance of 147.79' to a set rebar with cap; thence with a bearing of S 86°54'59" W and a distance of 144.24' to a set rebar with cap; thence with a bearing of S 70°37'27" W and a distance of 368.13' to a set rebar with cap; thence with a bearing of N 74°29'51" W and a distance of 46.26' to a set rebar with cap; thence with a bearing of S 72°02'40" W and a distance of 293.76' to a set rebar with cap; thence with a bearing of S 86°39'35" W and a distance of 251.33' to a set rebar with cap; thence with a bearing of N 13°24'17" W and a distance of 55.04' to a set rebar with cap; thence with a bearing of N 74°29'34" E and a distance of 111.86' to a set rebar with cap; thence with a bearing of N 78°21'25" E and a distance of 348.03' to a set rebar with cap; thence with a bearing of N 52°54'27" E and a distance of 170.66' to a set rebar with cap; thence with a bearing of N 53°58'47" E and a distance of 85.47' to a set rebar with cap; thence with a bearing of N 53°58'47" E and a distance of 139.47' to a set rebar with cap; thence with a bearing of N 53°58'47" E and a distance of 197.05' to a set rebar with cap; thence with a bearing of N 54°06'04" E and a distance of 70.36' to a set rebar with cap; thence with a bearing of N 54°06'04" E and a distance of 305.88' to a set rebar with cap; thence with a bearing of S 09°28'08" E and a distance of 271.05' to a set rebar with cap; thence with a bearing of S 09°28'08" E and a distance of 231.95' to a set rebar with cap; being the point of BEGINNING, having an area of 6.378 acres, more or less.

ALL OF THE FOREGOING CONSERVATION EASEMENT AREAS as shown on plat of survey titled "Conservation Easement for the State of North Carolina, Division of Mitigation Services, Owners: Estate of Jessie Brice Guion, Virginia L. Guion, widow, and Randy H. Guion and wife Karen Guion, DMS Project ID No. 100164, SPO Numbers 90-BN, 90-BO, 90-BP, 90-BQ" in Buford Township, Union County, North Carolina, dated September 7, 2021, by Thomas

E. White, PLS Number L-4689, Carolina Surveyors, Inc. recorded in Plat Cabinet Q, File 133, Union County Register of Deeds.

APPENDIX J. CREDIT RELEASE SCHEDULE

The schedules below list the updated credit release schedules for stream and wetland mitigation projects developed by bank and ILF sites in North Carolina:

Credit Release Schedule and Milestones for Wetlands					
Credit Release Milestone	**Release Activity**	**Banks**		**ILF/NCDMS**	
		Interim Release	**Total Released**	**Interim Release**	**Total Released**
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that interim performance standards have been met	10%	50%	10%	50%
5	Year 3 monitoring report demonstrates that interim performance standards have been met	15%	65%	15%	65%
6*	Year 4 monitoring report demonstrates that interim performance standards have been met	5%	70%	5%	70%
7	Year 5 monitoring report demonstrates that interim performance standards have been met	15%	85%	15%	85%
8*	Year 6 monitoring report demonstrates that interim performance standards have been met	5%	90%	5%	90%
9	Year 7 monitoring report demonstrates that performance standards have been met	10%	100%	10%	100%

*Please note that vegetation plot data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

Credit Release Schedule and Milestones for Streams					
Credit Release Milestone	Release Activity	Banks		ILF/NCDMS	
		Interim Release	Total Released	Interim Release	Total Released
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%	10%	50%
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%	10%	60%
6*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)	5%	65% (75%**)
7	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)	10%	75% (85%**)
8*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)	5%	80% (90%**)
9	Year 7 monitoring report demonstrates that channels are stable, performance standards have been met	10%	90% (100%**)	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 of credits to be held back until the bankfull event performance standard has been met.

APPENDIX K. MAINTENANCE PLAN

Maintenance Plan

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

Component/Feature	**Maintenance through project close-out**
Stream	Routine channel maintenance and repair activities may include securing of loose coir matting and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Beaver	Beaver and associated dams are to be removed as they colonize and until the project is closed.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree- blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.
Road Crossing	Road crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.

APPENDIX L. POST IRT MEETING NOTES

Restoration Systems, LLC
1101 Haynes St. Suite 211
Raleigh, North Carolina
Ph: (919) 755-9490
Fx: (919) 755-9492

June 19, 2020

RE: Wit's End Mitigation Site
Post-IRT Site Visit Notes
DMS Contract No. 7968

Attendees:
USACE: Todd Tugwell
NCDWR: Mac Haupt and Erin Davis
NCDMS: Matthew Reid and Melonie Allen
AXE: Grant Lewis
RS: Ray Holz and Alex Baldwin

On Monday June 1, 2020, representatives of the Interagency Review Team (IRT) met with representatives from North Carolina Division of Mitigation Services, Restoration Systems, and Axiom Environmental at the Wit's End Mitigation Site to review proposed site mitigation features and approaches. Below is a summary of what was discussed and how those comments will be addressed as the mitigation plan moves forward. This proposal will be further refined in the development of the Mitigation Plan.

Streams:

- All parties were in agreement on a restoration approach for streams except for UT-4.
- UT-4 can be included for restoration if the easement can be expanded to include the remaining section extending downstream to the confluence with Waxhaw Branch.
- The IRT noted that flow gauges would be required on all UT's.
- No stream credit would be provided for ephemeral features in the easement.
- BMPs would be expected on all ephemeral features.

Wetlands:

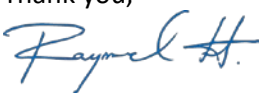
- All parties were in agreement on the presence of existing wetlands in the downstream forested floodplain of Waxhaw Branch and should be proposed as wetland preservation outside of the documented hydrologic influence Waxhaw Branch which has down cut approximately 4-5 feet.
- DWR was accepting of the potential for wetland restoration in the floodplain of Waxhaw Branch and the use of the F19 hydric indicator. They expressed caution about the use of the indicator as their experience has seen the F19 hydric indicator used on floodplains of larger streams. USACE was concerned about all proposed wetland restoration areas and the application of the F19 hydric indicator.
- DWR and USACE had concerns regarding the presence of drained hydric soils in the upper reaches of UT-3 and under the pond.
- DWR requested more soils work to be provided in the mitigation plan including a detailed soils evaluation using a grid mapping approach with representative profile descriptions, a map of soil boring locations, and photos of representative profiles.
- DWR requested transects of monitoring wells extending from the edge of the wetland across the floodplain to the stream as a part of overall project monitoring.
- DWR was receptive of the proposed 8% of the growing season wetland hydroperiod for proposed wetland restoration areas.

Ponds:

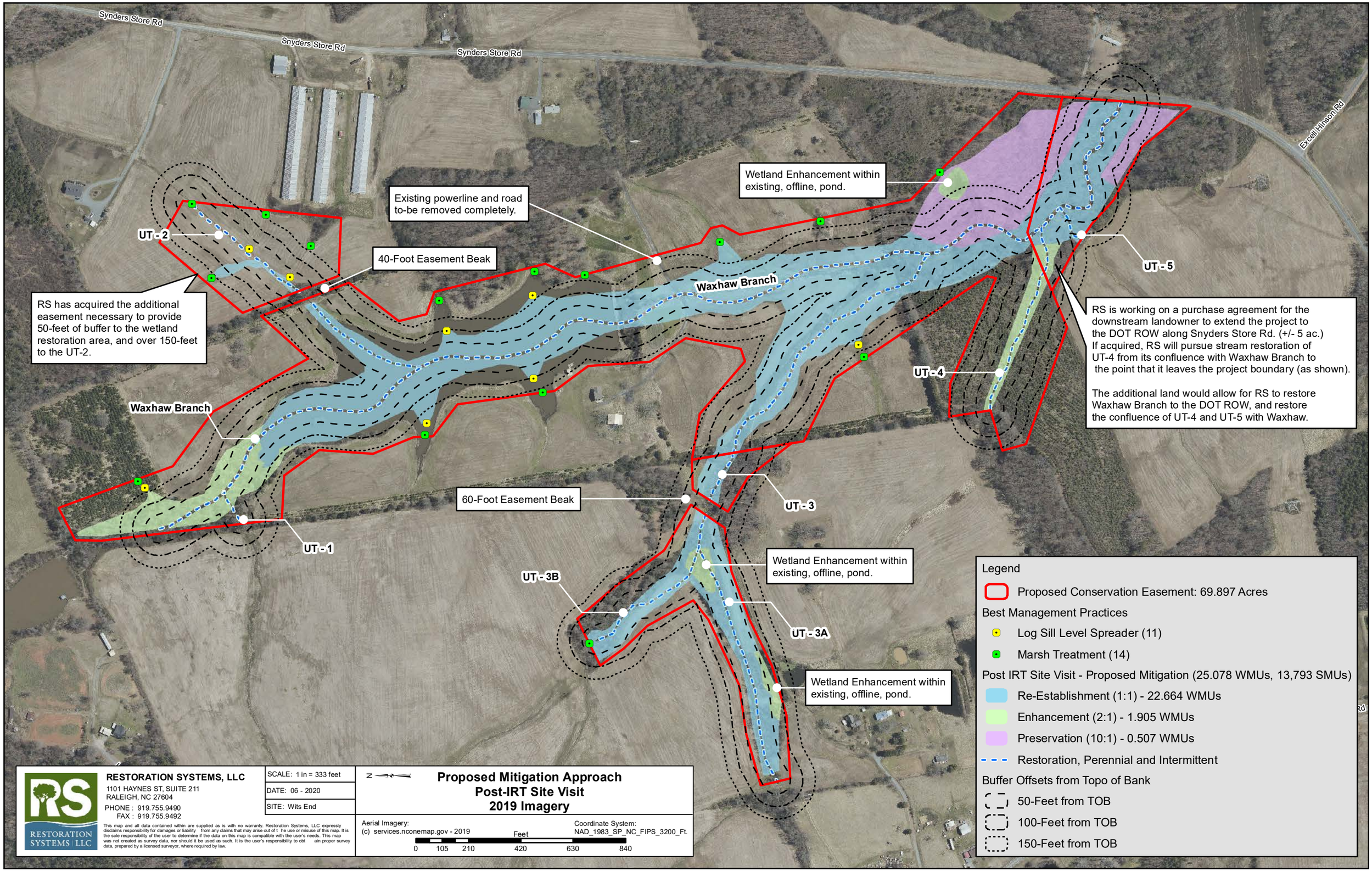
- The small historic pond adjacent to the downstream wetland preservation area could be credited at 2:1 for removal of berm, planting, and enhancing habitat.
- The small historic pond at the confluence of UT-3A and UT-3B and along UT-3 has potential for enhancement if the water level is lowered and habitat is enhanced with planting and/or structures.
- Regarding the large in line pond associated with Waxhaw Branch the proposed stream restoration was acceptable. There were concerns over the historic existence of wetlands under the pond. It was noted that if the pond was dug out or had filled with sediment this would be viewed as wetland creation. At this time the IRT lacked enough information to provide a credit ratio for wetland credits under the pond. A recommendation was made to perform a bathymetry survey to gain additional information regarding the presence or lack of sediment, and to investigate the soils after the pond is drained.

In summary, the IRT was accepting of the project but will require additional information before agreeing to credit ratios and wetland restoration components of the project. RS will remove credits generated from ephemeral features and attempt to gather supplemental data for the existing substrate of the large pond. RS will provide a detailed soils evaluation and justification for proposed credit ratios associated with restoration/enhancement of assets associated with historic remnant ag ponds.

Thank you,



Raymond Holz
Restoration Systems



RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 333 feet
DATE: 06 - 2020
SITE: Wits End

Proposed Mitigation Approach
Post-IRT Site Visit
2019 Imagery

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.

Feet
0 105 210 420 630 840

Restoration Systems, LLC
1101 Haynes St. Suite 211
Raleigh, North Carolina
Ph: (919) 755-9490
Fx: (919) 755-9492

November 5, 2020

RE: Wit's End Mitigation Site
Post-IRT Site Visit Notes
DMS Contract No. 7968, SAW-2020-00455, DWR-2020-0369 v1

Attendees:
USACE: Todd Tugwell
NCDWR: Erin Davis
NCDMS: Paul Wiesner and Matthew Reid
AXE: Grant Lewis
RS: Ray Holz and Alex Baldwin

On November 2, 2020, representatives of the Interagency Review Team (IRT) met with representatives from the North Carolina Division of Mitigation Services (NCDMS), Restoration Systems (RS), and Axiom Environmental (AXE) at the Wit's End Mitigation Site to review the technical supplement and 30% design submitted on October 7, 2020. Below is a summary of the discussed topics and IRT comments. RS will use this summary, and additional IRT notes received in the development of the Mitigation Plan.

Streams:

- The IRT had questions about Waxhaw Branch and UT 3 running parallel to each other before their confluence. RS and Axiom stated the design was based on the detailed topographic survey and point file from the surveyor. The design was governed by locating the valley's low point and applying the appropriate pattern based on reference reach data. Further, it was discussed that Waxhaw Branch and UT 3 have two separate valleys, with a distinct topographic rise between them. The IRT requested more information concerning the elevations and topography at this location of the Site. RS has provided a two high-resolution PDF figures, one with the topographic survey and the other with QL2 LiDAR at 1-foot contours, for IRT's use in evaluating the design. If additional data/discussion is required, a web-conference could be set up to review the Site's topography and stream design. RS and Axiom have begun evaluating alternatives for the UT-3 and Waxhaw Branch confluence.
- The IRT had questions about UT 4 tie in location to Waxhaw Branch. It was discussed in the field that UT 4 and UT 5 were designed to combine as UT 5 enters the larger Waxhaw Valley, providing appropriate stream power for sediment transport. This design approach would also provide hydrology uplift for wetland re-establishment areas of the Site. The IRT agreed to the proposed restoration of both UT 4 and 5, with further justification within the Mitigation Plan regarding channel location.
- IRT discussed the possibility of maintaining the lower reach of UT 4 as a braided stream/wetland complex. Based on the approved PJD, this area contains approximately 0.20 acres of existing wetlands and is roughly 125 linear valley feet long. Axiom and RS will investigate the pros and cons of this mitigation strategy. All parties agreed to the proposed restoration approach for the remainder of UT-4.
- A discussion of removing existing pines along UT 4 was had, and RS stated pines would be removed within the riparian area and adjacent uplands. The IRT agreed their removal and the subsequent establishment of native hardwood species would be beneficial. Additional maintenance protocols will be provided in the Mitigation Plan to ensure volunteer pines do not recolonize the area. Pine trees removed will be mulched and used within the Site along ATV paths or kept whole and distributed along the Waxhaw floodplain to introduce organic material back into the system.

- The IRT noted addressing bamboo removal along the upper margins of UT 3 pre-construction and providing follow-up treatments early in monitoring. RS concurred and agreed that even if bamboo was located outside of the proposed/final easement, RS would treat and remove all stems during the monitoring period.
- It was noted the proposed Waxhaw Branch drop structure would be constructed with natural material (i.e., log structures).

Wetlands:

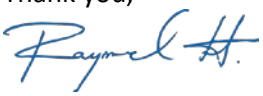
- The IRT requested that additional narrative and description of the vernal pool wetland complex associated with the pond and dam removals along UT 3 be included in the Mitigation Plan. Also, there is an expectation the restored vernal pool wetland complexes will have a fluctuating hydroperiod and not be inundated year-round.
- The IRT indicated they would further review the technical supplement information and reach out to others to evaluate the proposed wetland re-establishment within drained hydric soils for the project. The IRT also proposed including soil profile descriptions during monitoring to assess hydric indicator development. RS was open to including this monitoring component for soils in wetland re-establishment areas.
- The IRT noted the high chroma matrix color of some wetland re-establishment soils and inquired about the landscape position associated with the F8 hydric indicator. RS noted the F8 indicator does not include a chroma requirement for the matrix as the hydric indicator coupled with landscape position indicate wetland hydrology. RS discussed that agricultural manipulation of proposed wetland re-establishment areas has obscured natural depressional landform features.
- The IRT asked about the proposed hydroperiod for the wetlands. RS offered an 8% hydroperiod based on soil taxonomy of Aquic Hapludults in the Piedmont (6-8% hydroperiod), which was noted and proposed in the Technical Proposal.

Easement:

- The IRT inquired about the 4 ATV crossings shown in the easement and why they were included. RS noted the acquisition of the entire parcel and crossings provide access to isolated areas outside the easement. The crossings will be clearly marked and stabilized with natural materials (i.e., mulch/wood chips). ATV paths will be depicted on the conservation easement plat and recorded at the Union County Registry. The ATV paths/forded crossings will be thoroughly discussed in the Mitigation Plan, and areas within ATV paths/forded crossings will not generate mitigation credit.
- Most project streams will include a +200-ft buffer

In summary, the IRT accepted the project and appreciated the additional data collection and technical supplement provided to support the project. The IRT asked for some downstream reaches, near confluences, to be redesigned or for there to be proper justification in the Mitigation Plan supporting the stream design/alignment. The proposed vernal pools will need to be detailed in the Mitigation Plan to include planting assemblage and work to be performed. Wetland re-establishment areas will have little to no grading beyond the construction associated with stream restoration activities and removing earthen berms/impoundments. There was a general agreement on credit ratios provided there is detailed justification in the Mitigation Plan.

Thank you,



Raymond Holz
Restoration Systems

Legend
Proposed CE 10-2020: 68.52 Acres
Exisitng Contours from Topographic Survey
5-ft Contours
1-ft Contours
Stream Mitigation Assets
Proposed Stream Restoration, Enhancement, and Preservation
Wetland Mitigation Assets
Existing Preservation
Existing Enhancement
Reest
RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492
This map and all data contained within are supplied as is with no warranty. Restoration Systems, LLC expressly disclaims responsibility for damages or liability from any claims that may arise out of t he use or misuse of this map. It is the sole responsibility of the user to determine if the data on this map is compatible with the user's needs. This map was not created as survey data, nor should it be used as such. It is the user's responsibility to obt ain proper survey data, prepared by a licensed surveyor, where required by law.
SCALE: 1 in = 33 feet
DATE: 11 - 2020
SITE: Wits End
N
Figure 1:
Stream and Wetland Assets with
Existing Topography - 2019 Imagery
Aerial Imagery:
(c) services.nconemap.gov - 2019
Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft.
Feet
0 25 50 100 150 200
575-ft
585-ft
580-ft
575-ft
575-ft
580-ft
580-ft

Legend

Proposed CE 10-2020: 68.52 Acres

Exisitng Contours from QL2 LiDAR

1-ft Contours

Stream Mitigation Assets

Proposed Stream Restoration, Enhancement, and Preservation

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 33 feet
DATE: 11 - 2020
SITE: Wits End

Figure 1:
Stream and Wetland Assets with Existing QL2 LiDAR - 2019 Imagery

Aerial Imagery:
(c) services.nconemap.gov - 2019

Coordinate System:
NAD_1983_SP_NC_FIPS_3200_Ft

Feet
0 25 50 100 150 200

UT - 3 upper

APPENDIX M. CONSTRUCTION PLANS

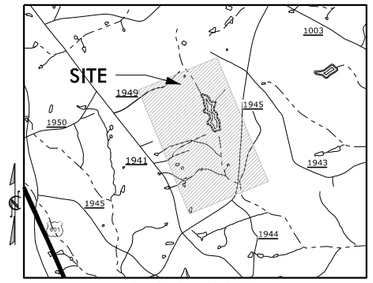
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
CONSTRUCTION PLANS
WITS END SITE

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	WITS END SITE	1	

LOCATION: UNION COUNTY, NORTH CAROLINA

TYPE OF WORK: STREAM RESTORATION AND ENHANCEMENT (CLEARING, GRUBBING, GRADING, EROSION CONTROL AND PLANTING)

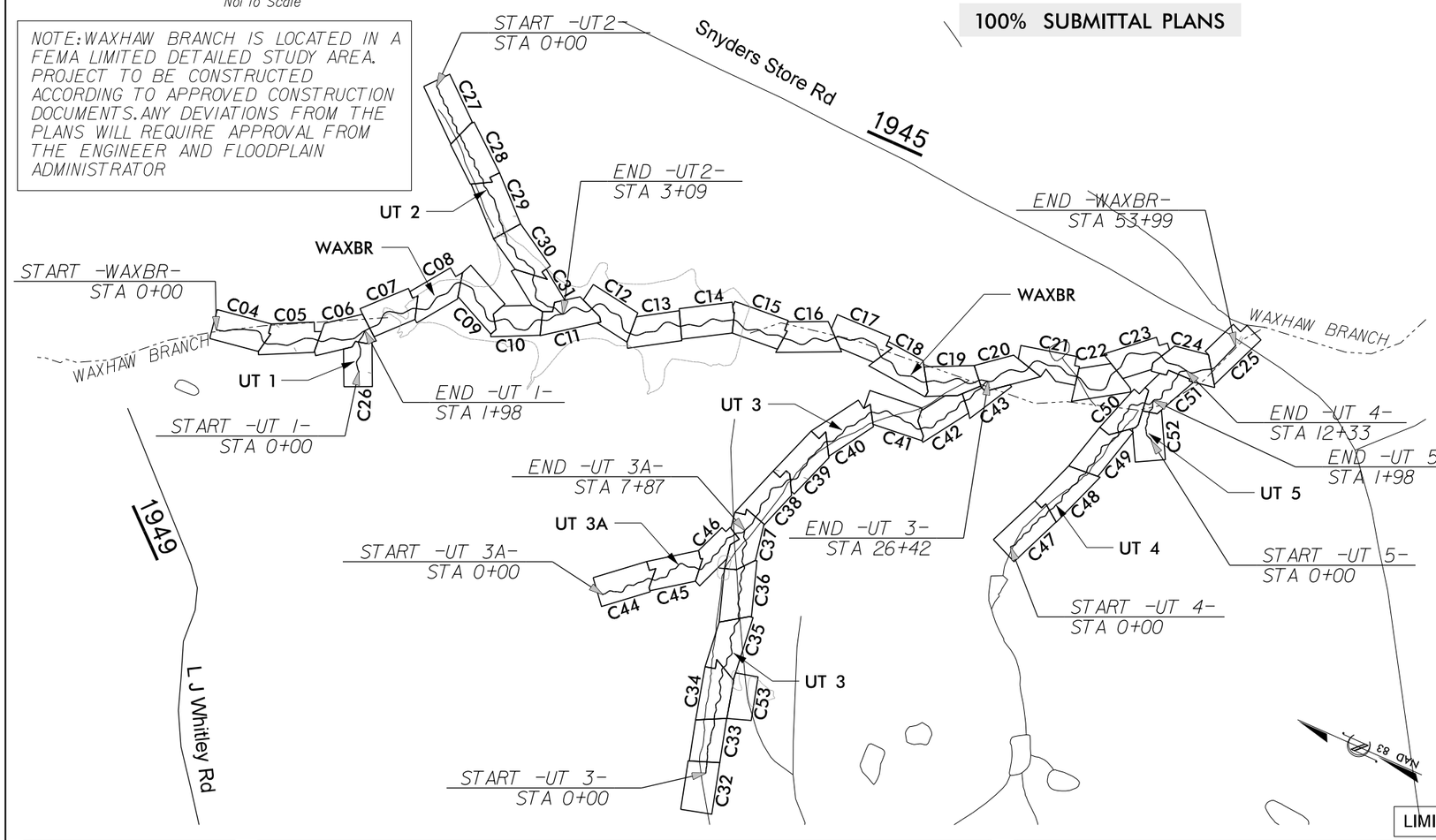
100% SUBMITTAL PLANS



VICINITY MAP
Not to Scale

NOTE: WAXHAW BRANCH IS LOCATED IN A FEMA LIMITED DETAILED STUDY AREA. PROJECT TO BE CONSTRUCTED ACCORDING TO APPROVED CONSTRUCTION DOCUMENTS. ANY DEVIATIONS FROM THE PLANS WILL REQUIRE APPROVAL FROM THE ENGINEER AND FLOODPLAIN ADMINISTRATOR

INDEX OF SHEETS



LIMITS OF DISTURBANCE: 89.85 AC

GRAPHIC SCALES

20 10 0 20 40
PLANS

20 10 0 20 40
PROFILE (HORIZONTAL)

4 2 0 4 8
PROFILE (VERTICAL)

PROPOSED LENGTH OF -WAXBR- = 5403		PROPOSED LENGTH OF -UT 3A- = 780	
PROPOSED LENGTH OF -UT 1- = 189		PROPOSED LENGTH OF -UT 4- = 1223	
PROPOSED LENGTH OF -UT 2- = 1240		PROPOSED LENGTH OF -UT 5- = 192	
PROPOSED LENGTH OF -UT 3- = 2629			
TOTAL STREAM LENGTHS (LF) = 11656			
RESTORATION LEVEL	STREAM (linear footage)	RIPARIAN WETLAND (acreage)	NONRIPARIAN WETLAND (acreage)
RESTORATION	10612	22.918 (Reestablishment)	0.000
ENHANCEMENT I	232	1.789 (Rehabilitation)	0.000
ENHANCEMENT II	669	0.000	0.000
PRESERVATION	0	4.914	
CREATION	0	0.351	
TOTALS	11513	29.972	0.000
MITIGATION UNITS	11753.536 SMUs	24.230 RIPARIAN WMUs	NONRIPARIAN WMUs

Axiom Environmental, Inc.
Axiom Environmental
218 Snow Ave
Raleigh, NC 27603
GRANT LEWIS
PROJECT DESIGNER

RESTORATION SYSTEMS | LLC
Restoration Systems
1101 Haynes St.
Suite 211
Raleigh, NC 27604
WORTH CREECH
SITE CONSTRUCTION MANAGER

Prepared in the Office of:
SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890
JOSHUA G. DALTON, P.E.
PROJECT ENGINEER

DocuSigned by:
Joshua G Dalton
1088AD8C1499AC3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021
DATE:

CONTRACT: WITS END SITE

9/30/2021
Wits End_psh_C01.dgn
jharvey

CONVENTIONAL PLAN SHEET SYMBOLS

Note: Not to Scale **S.U.E. = Subsurface Utility Engineering*

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin (EIP)
- Computed Property Corner
- Property Monument (ECM)
- Parcel/Sequence Number (123)
- Existing Fence Line
- Proposed Fence Gate
- Proposed Barbed Wire Fence
- Existing Wetland Boundary (WLB)
- Proposed Wetland Boundary (WLB)
- Existing Endangered Animal Boundary (EAB)
- Existing Endangered Plant Boundary (EPB)
- Existing Historic Property Boundary (HPB)

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign (S)
- Well (W)
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream (JS)
- Buffer Zone 1 (BZ 1)
- Buffer Zone 2 (BZ 2)
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch (FLOW)

RIGHT OF WAY & PROJECT CONTROL:

- Secondary Horiz and Vert Control Point
- Primary Horiz Control Point
- Primary Horiz and Vert Control Point

- Exist Permanent Easment Pin and Cap
- New Permanent Easement Pin and Cap
- Vertical Benchmark
- Existing Right of Way Marker
- Existing Right of Way Line
- New Right of Way Line (RW)
- New Right of Way Line with Pin and Cap (RW)
- New Right of Way Line with Concrete or Granite R/W Marker (RW)
- New Control of Access Line with Concrete C/A Marker (CA)
- Existing Control of Access (CA)
- New Control of Access (CA)
- Existing Easement Line (E)
- New Conservation Easement (E)
- New Temporary Drainage Easement (TDE)
- New Permanent Drainage Easement (PDE)
- New Permanent Drainage / Utility Easement (DUE)
- New Permanent Utility Easement (PUE)
- New Temporary Utility Easement (TUE)
- New Aerial Utility Easement (AUE)

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut (C)
- Proposed Slope Stakes Fill (F)
- Proposed Curb Ramp (CR)
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert (CONC)
- Bridge Wing Wall, Head Wall and End Wall (CONC WW)

MINOR:

- Head and End Wall (CONC HW)
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB (CB)
- Paved Ditch Gutter
- Storm Sewer Manhole (S)
- Storm Sewer (S)

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole (P)
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole
- H-Frame Pole
- U/G Power Line LOS B (S.U.E.*) (P)
- U/G Power Line LOS C (S.U.E.*) (P)
- U/G Power Line LOS D (S.U.E.*) (P)

TELEPHONE:

- Existing Telephone Pole

WATER:

- Water Manhole (W)
- Water Meter
- Water Valve
- Water Hydrant
- U/G Water Line LOS B (S.U.E*) (W)
- U/G Water Line LOS C (S.U.E*) (W)
- U/G Water Line LOS D (S.U.E*) (W)
- Above Ground Water Line (A/G Water)

GAS:

- Gas Valve
- Gas Meter
- U/G Gas Line LOS B (S.U.E.*) (G)
- U/G Gas Line LOS C (S.U.E.*) (G)
- U/G Gas Line LOS D (S.U.E.*) (G)
- Above Ground Gas Line (A/G Gas)

SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line (SS)
- Above Ground Sanitary Sewer (A/G Sanitary Sewer)
- SS Forced Main Line LOS B (S.U.E.*) (FSS)
- SS Forced Main Line LOS C (S.U.E.*) (FSS)
- SS Forced Main Line LOS D (S.U.E.*) (FSS)

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box (S)
- Utility Unknown U/G Line LOS B (S.U.E.*) (?UTL)
- U/G Tank; Water, Gas, Oil
- Underground Storage Tank, Approx. Loc. (UST)
- A/G Tank; Water, Gas, Oil
- Geoenvironmental Boring
- U/G Test Hole LOS A (S.U.E.*)
- Abandoned According to Utility Records (AATUR)
- End of Information (E.O.I.)
- Existing Contour Major
- Existing Contour Minor
- Contour Interval = 1 ft
- Riffle Rip Rap
- Log Vane
- Log Cross Vane
- Step Pool Structure (Begin / End)
- Stream Plug
- Floodplain Interceptor
- Proposed Fence
- Limits of Disturbance (LOD)

SUNGATE DESIGN GROUP, P.A.
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TEL: 919.851.1415
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

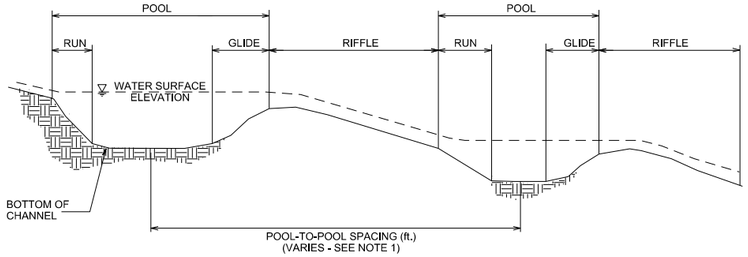
WITS END
UNION COUNTY, NC

SYMBOLOGY

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH COIA
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C01A**

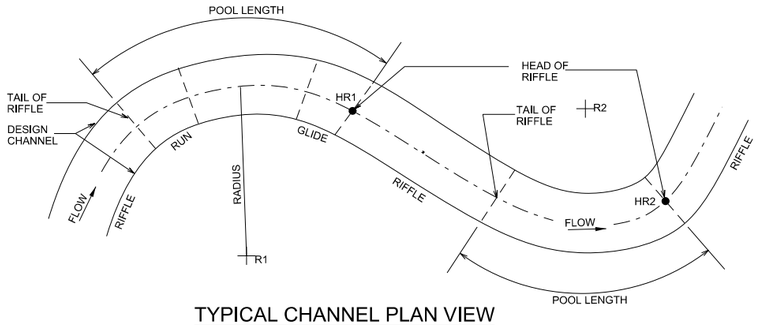
9/30/2021
Wits End_PSH_C01a.dgn
Harvey



TYPICAL CHANNEL PROFILE

NOTES:

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



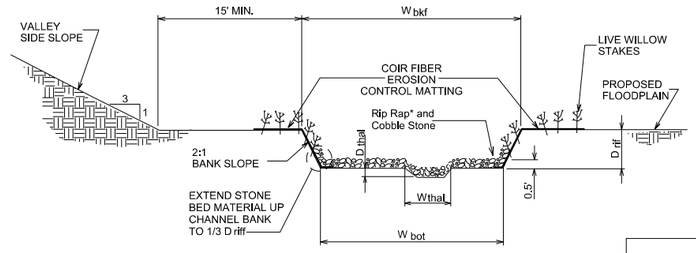
TYPICAL CHANNEL PLAN VIEW

CHANNEL PLAN VIEW NOTES:

1. THE CONTRACTOR SHALL LAYOUT THE CHANNEL ALIGNMENT BY LOCATING THE RADII AND SCRIBING THE CENTER LINE FOR EACH POOL BEND. THE CONNECTING TANGENT SECTIONS SHALL COMPLETE THE LAYOUT OF THE CHANNEL.

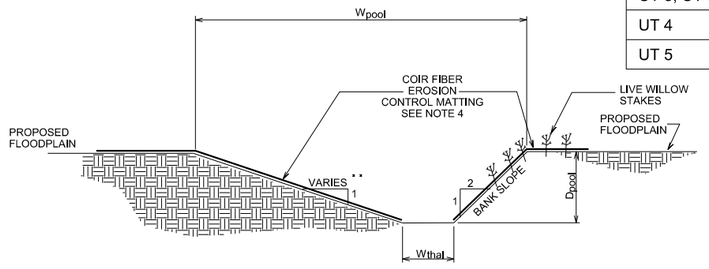
2. FIELD ADJUSTMENTS OF THE ALIGNMENT MAY BE REQUIRED TO SAVE TREES OR AVOID OBSTACLES. THE STAKE-OUT SHALL BE APPROVED BY THE CONSTRUCTION MANAGER BEFORE CONSTRUCTION OF THE CHANNEL.

3. GPS EQUIPMENT ACCEPTABLE FOR USE TO PERFORM CHANNEL ALIGNMENT LAYOUT.



TYPICAL RIFFLE CROSS-SECTION

* Riffle Rip Rap			
REACH	RIP RAP CL 'B' %	RIP RAP CL 'A' %	RIP RAP COBBLE %
Waxhaw (upstream and downstream)	30	30	40
UT 1	0	40	60
UT 2	0	40	60
UT 3, UT 3A	0	40	60
UT 4	0	40	60
UT 5	0	40	60



TYPICAL POOL CROSS-SECTION

CHANNEL CONSTRUCTION NOTES:

1. MATERIAL EXCAVATED FROM CHANNEL AND FLOODPLAIN SHALL BE USED TO BACKFILL EXISTING CHANNEL.

2. BANK PROTECTION SHALL CONSIST OF NATURAL COIR FIBER MATTING.

3. THE CONTRACTOR SHALL SUPPLY BED MATERIAL FOR THE ENTIRE BED LENGTH OF EACH RIFFLE SECTION. THE BED MATERIAL SHALL CONSIST OF A MIX OF RIP RAP* AND SMALLER STONE.

Cross Section Dimensions								
Stream Name	Stationing	W bkf (ft)	W bot (ft)	D riff (ft)	D thal (ft)	D pool (ft)	W pool (ft)	W thal (ft)
WAXBR UPS	3+30-44+38	14.5	9.3	1.2	0.1	1.8	17.4	1.0
WAXBR DNS	44+38-54+02	17.2	10.8	1.5	0.1	2.1	20.7	1.0
UT 1		6.3	3.9	0.5	0.1	0.8	7.5	1.0
UT 2, UT4		7.5	4.7	0.6	0.1	0.9	9.0	1.0
UT3 UPS, UT3A	1+68-11+71	7.6	4.8	0.6	0.1	0.9	9.1	1.0
UT 3 DNS	11+71-30+53	10.4	6.4	0.9	0.1	1.3	12.5	1.0
UT 5		5.8	3.8	0.4	0.1	0.7	7	1.0

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SUNGATE DESIGN GROUP, P.A.
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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

TYPICALS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C02
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

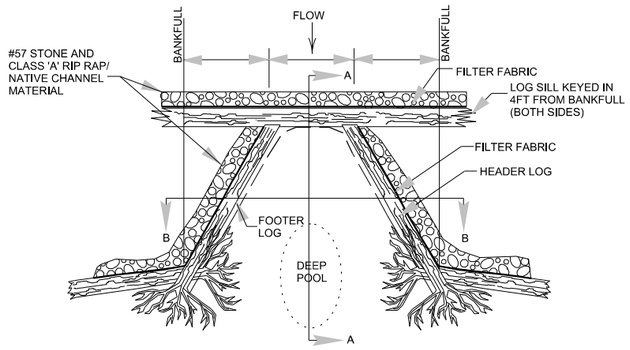
SHEET NO.
C02

9/30/2021
Wits End_psh_C02.dgn
jharvey

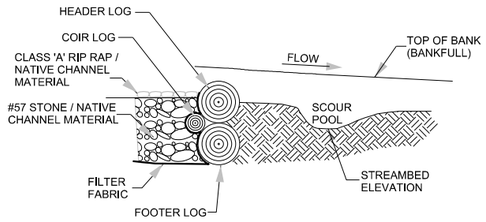
LOG CROSS VANE

SCALE:NTS

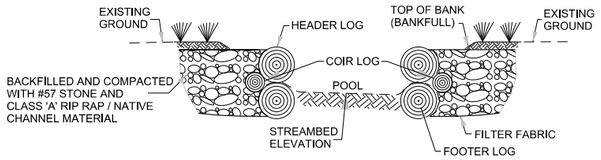
PLAN VIEW



NOTES:
1. HEADER AND FOOTER LOGS SHALL BE A MINIMUM OF 18" DIAMETER AND SHALL BE A HARDWOOD SPECIES. (FOOTER LOG MAY BE SUBSTITUTED WITH PINE)
2. A DOUBLE FOOTER LOG MAY BE REQUIRED IN SAND BED STREAMS.
3. ALL STONES ARE TO BE STRUCTURE STONES.
4. FILTER FABRIC SHALL BE PLACED ON THE UPSTREAM SIDE OF THE STRUCTURE TO PREVENT WASHOUT OF SEDIMENT THROUGH LOG GAPS. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.
5. PERPENDICULAR ROOTWAD LOGS ARE REQUIRED IF THE LOG VANE ARM DOES NOT HAVE A ROOTBALL TO TIE INTO THE BANK.



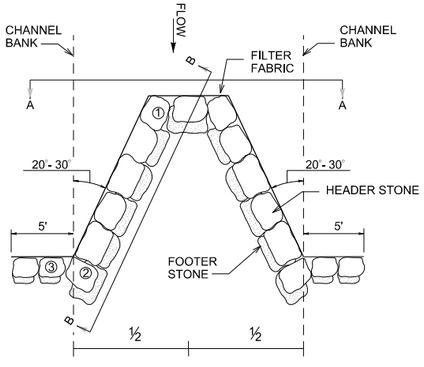
SECTION A-A



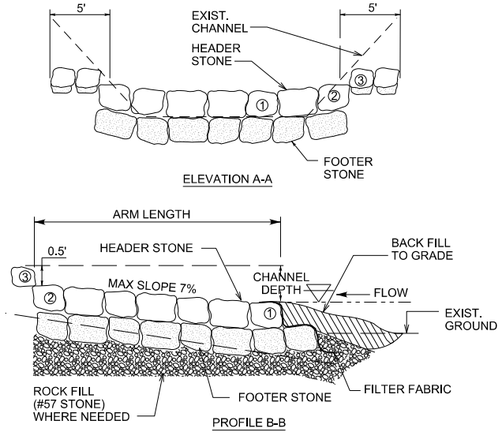
SECTION B-B

REACH	ARM LENGTH (FT.)	CHANNEL DEPTH (FT.)
Waxhaw Br Upstream (3+30-44+38)	13	1.2 - 1.7
Waxhaw Br Downstream (44+38-54+02)	16	1.4 - 2.0
UT 2, 3A, 4, and 5 UT 3 Upstream (1+68-11+71)	7	0.6 - 0.9
UT 3 Downstream (11+71-30+53)	10	0.9 - 1.2

NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 24" ALONG THE SHORTEST DIMENSION.

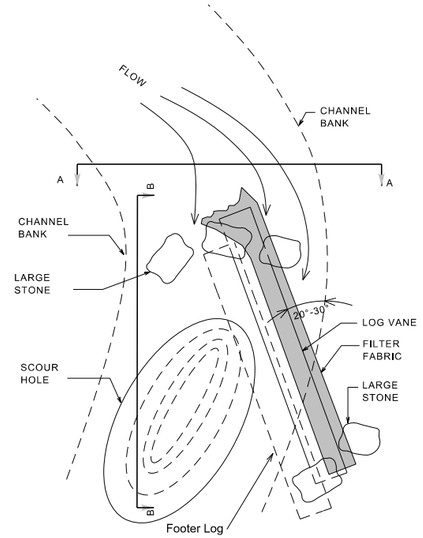


PLAN VIEW



PROFILE B-B

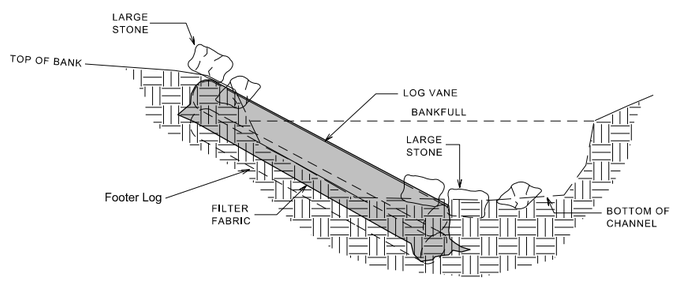
TYPICAL CROSS-VANE



NOTE:
FILTER FABRIC TOED IN AND DRAPED ON UPSTREAM SIDE OF LOG VANE PRIOR TO BACKFILL.

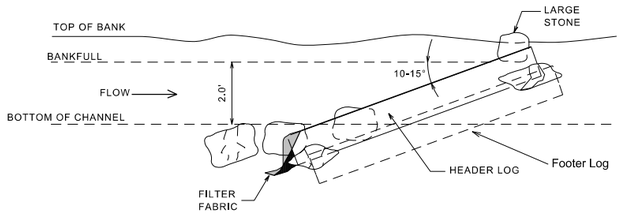
PLAN VIEW

SCALE: N.T.S.



CROSS-SECTION A-A

SCALE: N.T.S.



PROFILE B-B

SCALE: N.T.S.

NOTE:
FILTER FABRIC TOED IN AND DRAPED ON UPSTREAM SIDE OF LOG VANE PRIOR TO BACKFILL.

TYPICAL LOG VANE

DocuSigned by:
Joshua G. Dalton
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NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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RALEIGH, NORTH CAROLINA 27606
TEL: 919.851.9545
ENG FIRM LICENSE NO. C-2890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

DETAILS

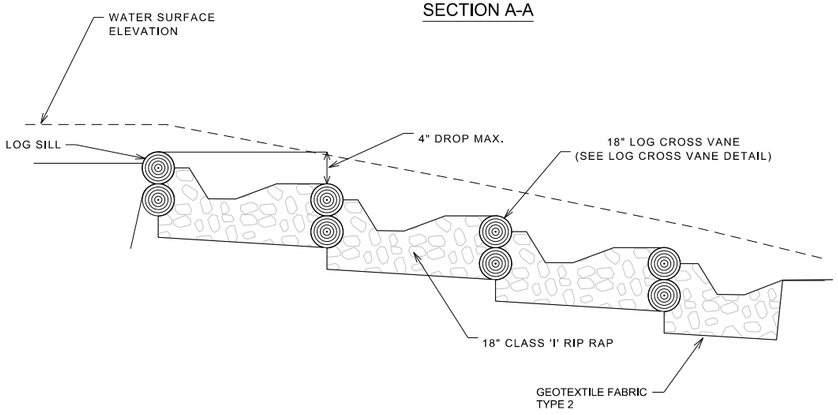
PROJECT # : 121-20024
DRAWING NAME: WITS END PSH C02A
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C02A

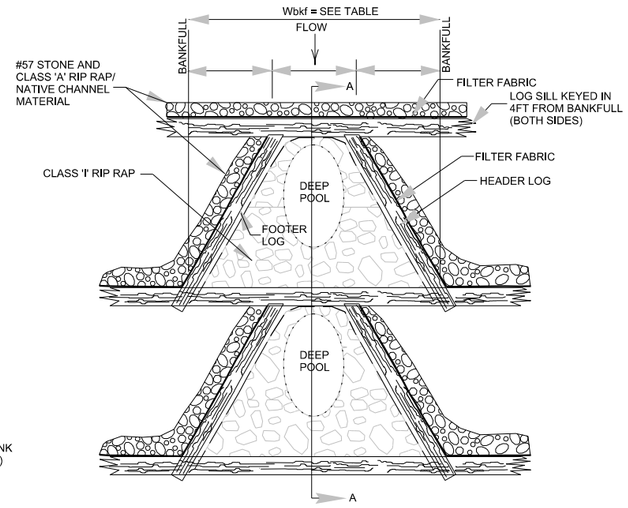
9/30/2021
Wits End_psh_C02a.dgn
Layout

DROP STRUCTURE

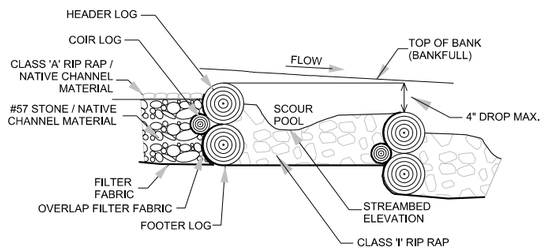
SECTION A-A



PLAN VIEW



DROP STRUCTURE ENLARGEMENT



STRUCTURE NOTES:
1. FILL CLASS '1' RIP RAP VOIDS WITH CLASS 'A' RIP RAP/ #57 STONE/ NATIVE CHANNEL MATERIAL MIXTURE.

CROSS-SECTION DIMENSIONS		
REACH	Wbkf (ft.)	Distance between Drops
WAXHAW	17.2	17'

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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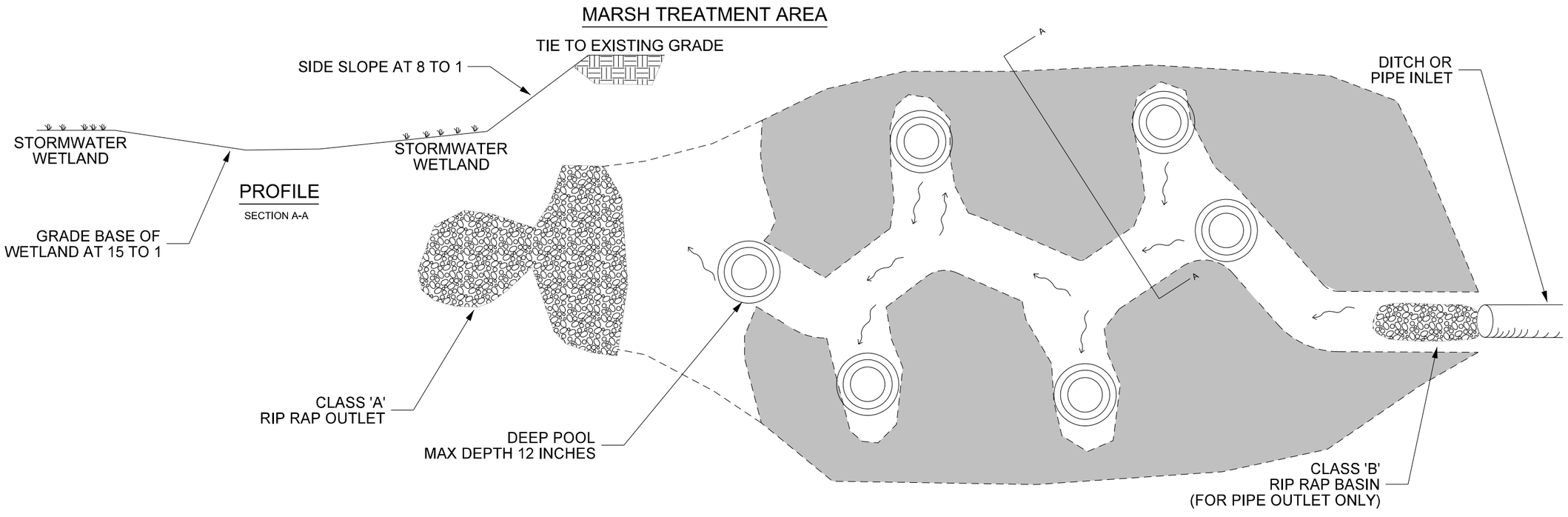
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: 919.859.1353
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

MARSH TREATMENT AREA



WITS END
UNION COUNTY, NC

DETAILS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C02B
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C02B

9/30/2021
Wits End_psh_C02b.dgn
Layout

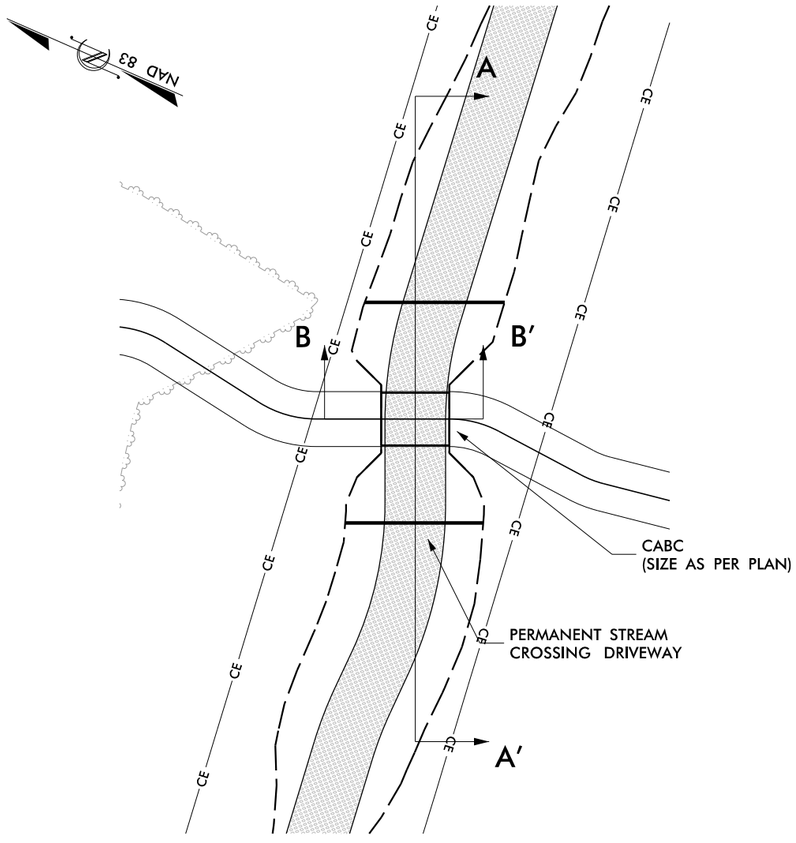
PERMANENT CROSSING

SCALE: N.T.S.

STA 29+57 –WAXBR–

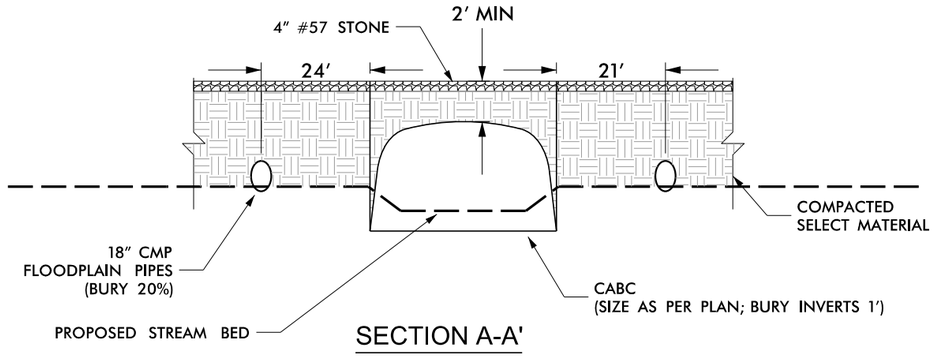
Permanent Pipe Crossings

Centerline Station	Pipe Size	Pipe Length (feet)	Pipe Invert In (feet)	Pipe Invert Out (feet)	Bury Depth (feet)
29+56.61 -WAXBR-	1 @ 13'-10" x 5'-5" CABC	18	578.7	578.5	1.0

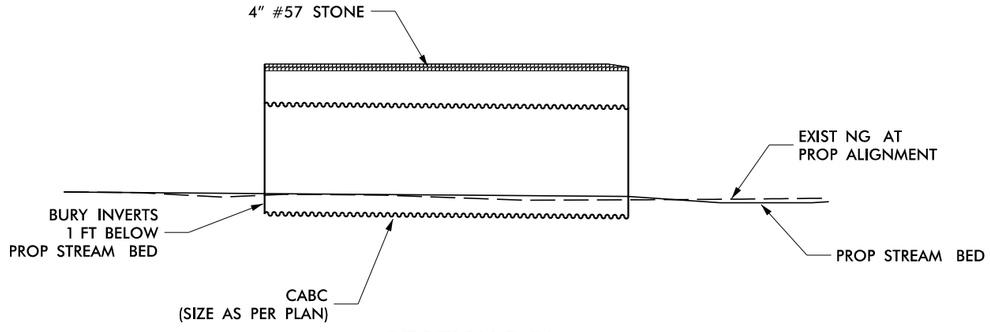


SEE SHEET C03E FOR DRIVEWAY HORIZONTAL AND VERTICAL LAYOUT

CONSTRUCTION SEQUENCE:
1) UTILIZE STILLING BASIN(S) AS NEEDED THROUGHOUT CULVERT CONSTRUCTION.
2) CONSTRUCT TEMPORARY CHANNEL CHANGE WITH LINER OR UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
3) INSTALL IMPERVIOUS DIKES UPSTREAM AND DOWNSTREAM OF PROPOSED CROSSING AND DIVERT FLOW INTO TEMPORARY CHANNEL OR BEGIN PUMPING OPERATIONS.
4) DEWATER CONSTRUCTION AREA, UTILIZING STILLING BASIN FOR PUMPED EFFLUENT.
5) CONSTRUCT 1@13'–10"x5'–5" CABC (BURIED 1'), INLET/OUTLET CHANNEL W/FLOODPLAIN BENCH, & 1@18" CMP FLOODPLAIN PIPE ON EITHER SIDE OF CABC (BURIED 20%).
6) EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF IMPERVIOUS DIKES.
7) REMOVE IMPERVIOUS DIKES AND TEMPORARY CHANNEL CHANGE W/LINER OR PUMP AND TEMPORARY FLEXIBLE HOSE.
8) DIRECT FLOW THROUGH 1@13'–10"x5'–5" CABC (BURIED 1').
9) COMPLETE DRIVEWAY.



SECTION A-A'



SECTION B-B'

SEE ADDITIONAL DETAILS
PSH C02D

DocuSigned by: Joshua G. Dalton
1089ADBC14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PHONE (919) 859-1865
ENG FIRM LICENSE NO. C-890

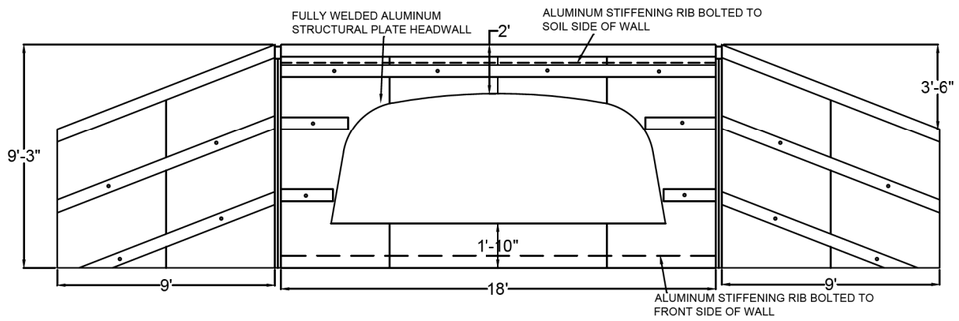
Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

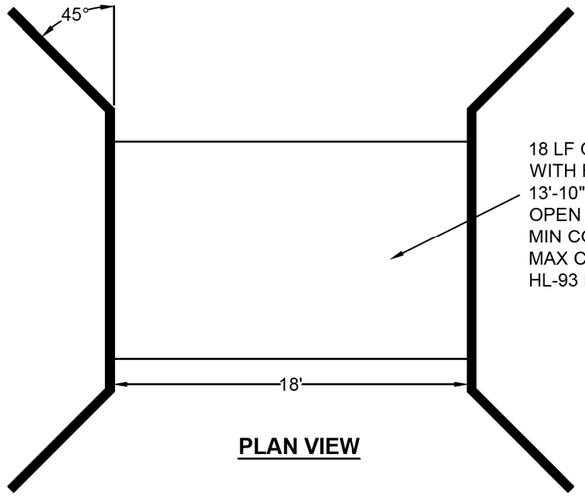
DETAILS

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C02C
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	02C

9/30/2021
Wits End_psh_C02c.dgn
jharvell



END VIEW- INLET & OUTLET HEADWALL



18 LF OF #24-L2 ALUMINUM BOX CULVERT
WITH FULL ALUMINUM INVERT
13'-10" SPAN X 5'-5" RISE
OPEN END AREA= 65.6 SF
MIN COVER= 1.4'
MAX COVER= 4.0'
HL-93 LOADING

PLAN VIEW

DESCRIPTION

SUNGATE DESIGN

POMONA PIPE PRODUCTS
4611 DUNDAS DR.
GREENSBORO, NC 27407
336-292-8060

DATE: JAN 8, 2021
SHEET
NOT TO SCALE

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: 919.859.2243
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

DETAILS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C02D
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C02D

9/30/2021
Wits End_psh_C02d.dgn
Harvey

PERMANENT CROSSING

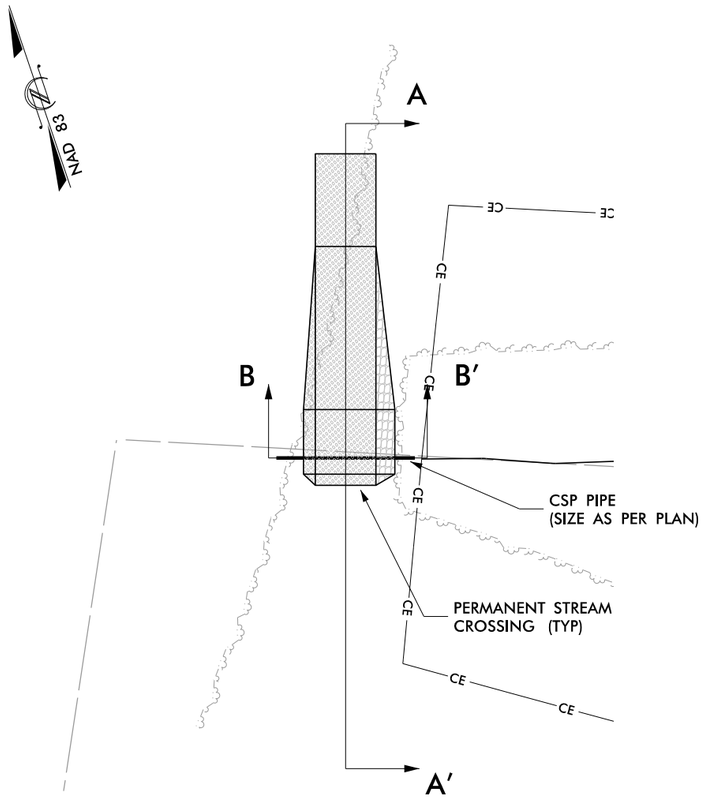
SCALE: N.T.S.

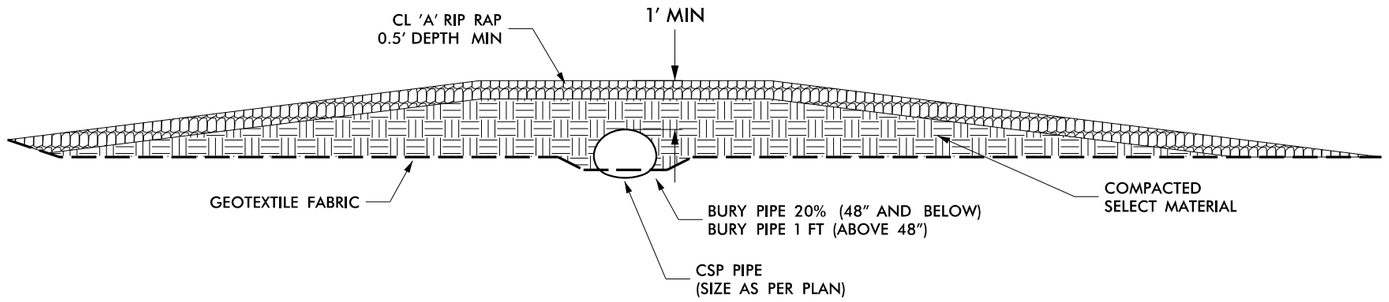
STA –0+10 –UT3–

NOTES:
1) INSTALL PERMANENT CROSSING WHILE CONSTRUCTION LOCATION WITHIN STREAM HAS BEEN DEWATERED.
2) IF UNABLE TO INSTALL WHILE LOCATION IS DRY, PLACE MATTING ON EXPOSED SOILS.
3) INSTALL 18" CMP FLOODPLAIN PIPES IN FLOODPLAIN AS INDICATED ON PLANS.

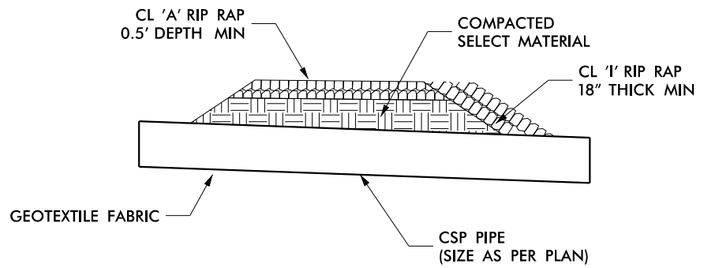
Permanent Pipe Crossings

Centerline Station	Pipe Size	Pipe Length (feet)	Pipe Invert In (feet)	Pipe Invert Out (feet)	Bury Depth (feet)
-0+10 -UT3	1 @ 54" CSP	37	594.2	593.9	1.0





SECTION A-A'



SECTION B-B'

DocuSigned by: Joshua G Dalton
1089ADBC14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: 919.859.1865
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

DETAILS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C02E
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

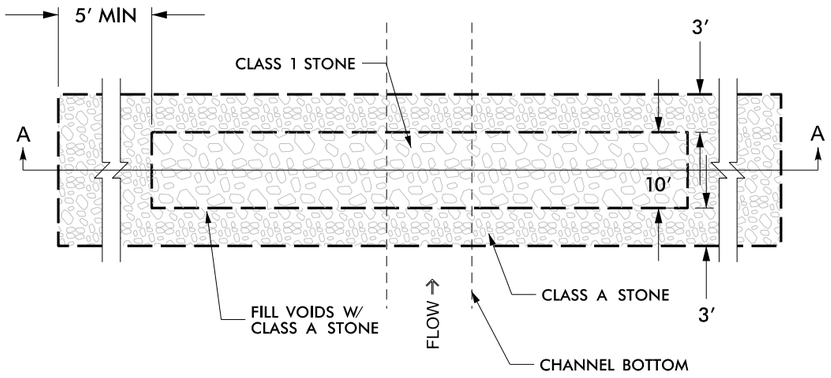
SHEET NO. ***C02E***

9/30/2021
Wits End_psh_C02e.dgn
Default

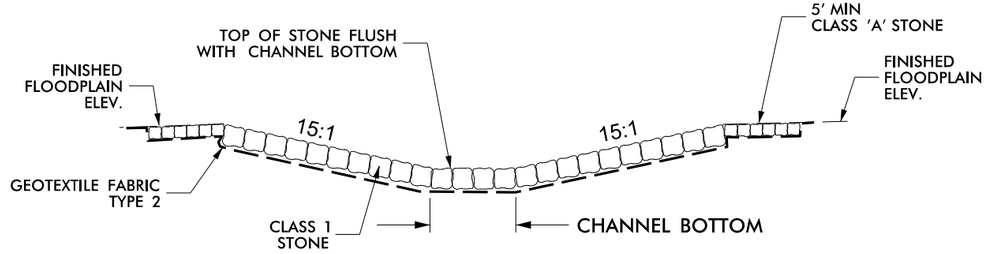
PERMANENT CHANNEL FORD DETAIL

SCALE: N.T.S.

STA 6+11 -UT 2-



PLAN VIEW



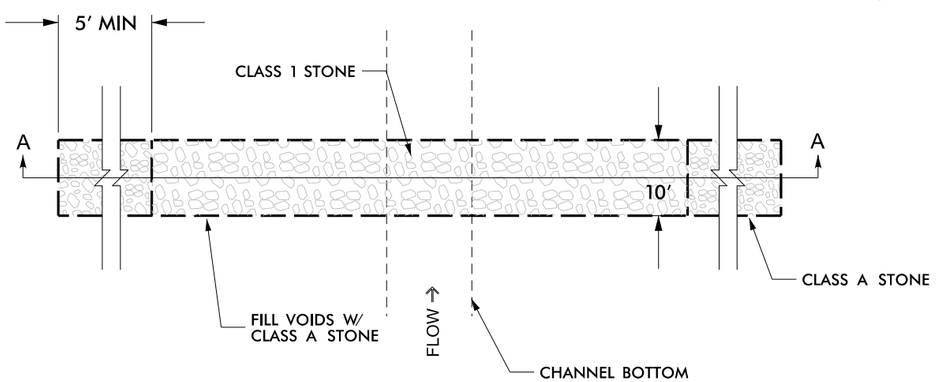
SECTION A-A

NOTES:
1) KEEP FORD CROSS FALL WITHIN 1–2% OF STREAM GRADIENT.
2) FILL VOIDS BETWEEN CLASS 1 STONE WITH CLASS A TO CREATE DRIVEABLE SURFACE.

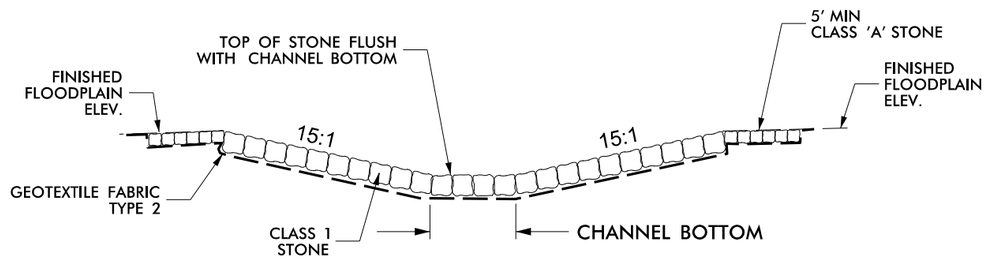
PERMANENT ATV CHANNEL FORD DETAIL

SCALE: N.T.S.

STA 3+78 -WAXBR-
STA 0+12 -UT 1-
STA 6+72 -UT 2-



PLAN VIEW



SECTION A-A

NOTES:
1) KEEP FORD CROSS FALL WITHIN 1–2% OF STREAM GRADIENT.
2) FILL VOIDS BETWEEN CLASS 1 STONE WITH CLASS A TO CREATE DRIVEABLE SURFACE.

DocuSigned by:
Joshua G Dalton
1089ABBC14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: 919.859.1865
ENG FIRM LICENSE NO. C-3890

Axiom Environmental, Inc.

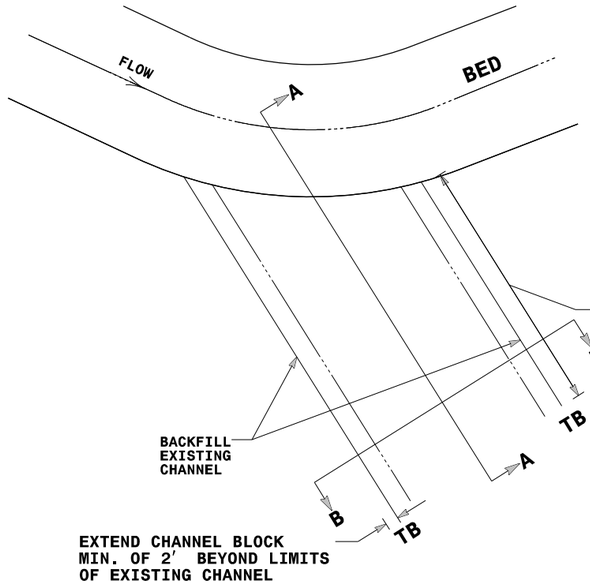
WITS END
UNION COUNTY, NC

DETAILS

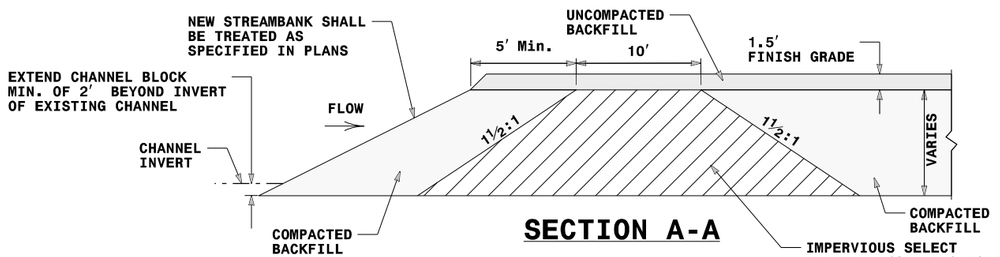
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C02F
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C02F

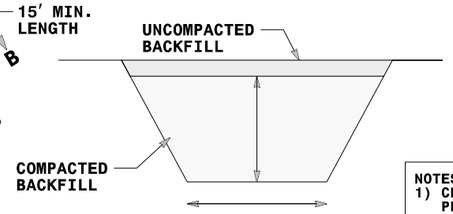
9/30/2021
Wits End_psh_C02f.dgn
Jarvis



PLAN VIEW



SECTION A-A

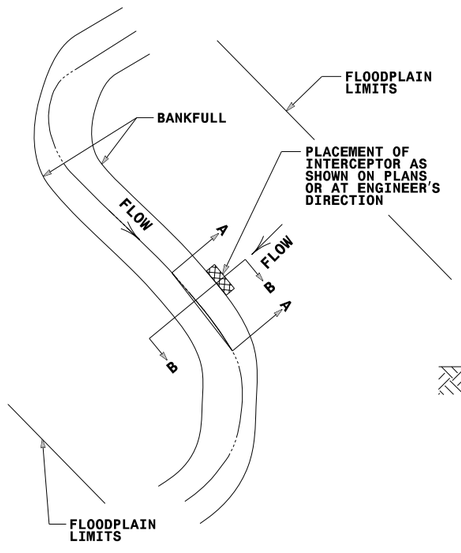


SECTION B-B

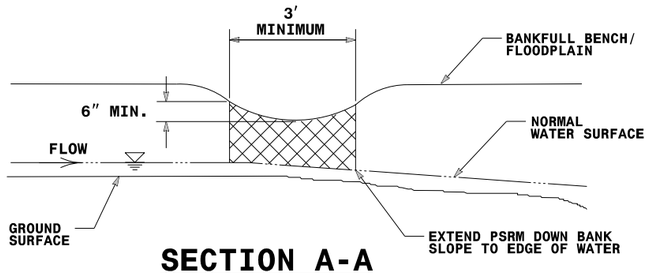
STREAM PLUG

NOT TO SCALE

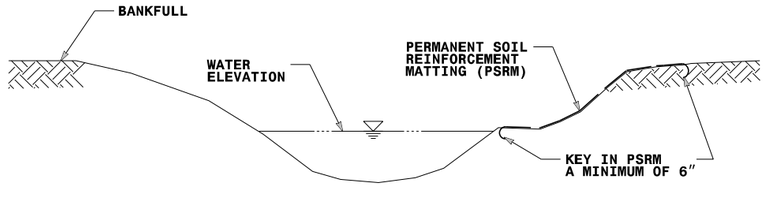
NOTES:
1) CHANNEL BLOCK SHALL BE INSTALLED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.
2) BLOCK SHOULD BE INSTALLED AT THE INTERFACE BETWEEN EXISTING CHANNEL AND PROPOSED CHANNEL.
3) BOTTOM OF BLOCK SHOULD BE A MINIMUM OF 2′ BELOW THE INVERT OF THE EXISTING CHANNEL.
4) BLOCK SHOULD EXTEND A MINIMUM OF 2′ BEYOND THE LIMITS OF THE EXISTING STREAM CHANNEL.
5) INSTALL EROSION CONTROL MATTING AND SEED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS IMMEDIATELY AFTER GRADING.
6) COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.



PLAN VIEW



SECTION A-A



SECTION B-B

FLOODPLAIN INTERCEPTOR DETAIL

NOT TO SCALE

DocuSigned by: Joshua G. Dalton 1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.852.1003
ENG FIRM LICENSE NO. C-890

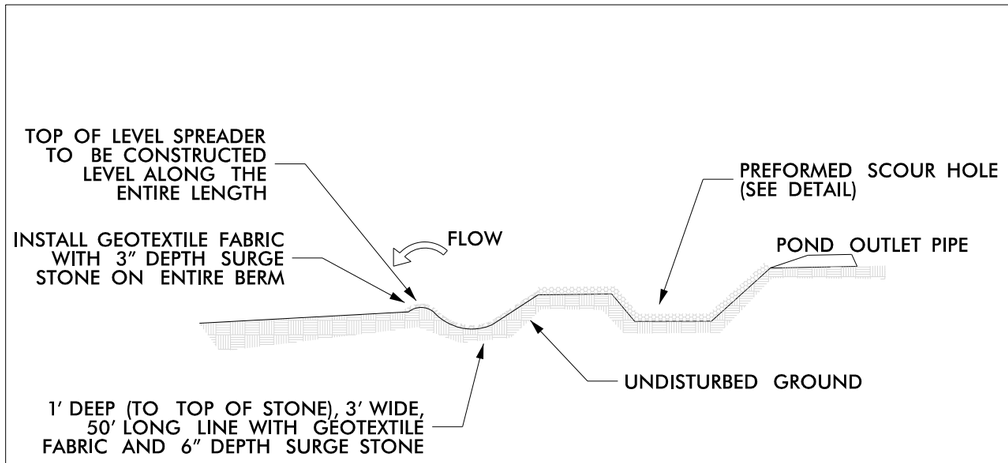
Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

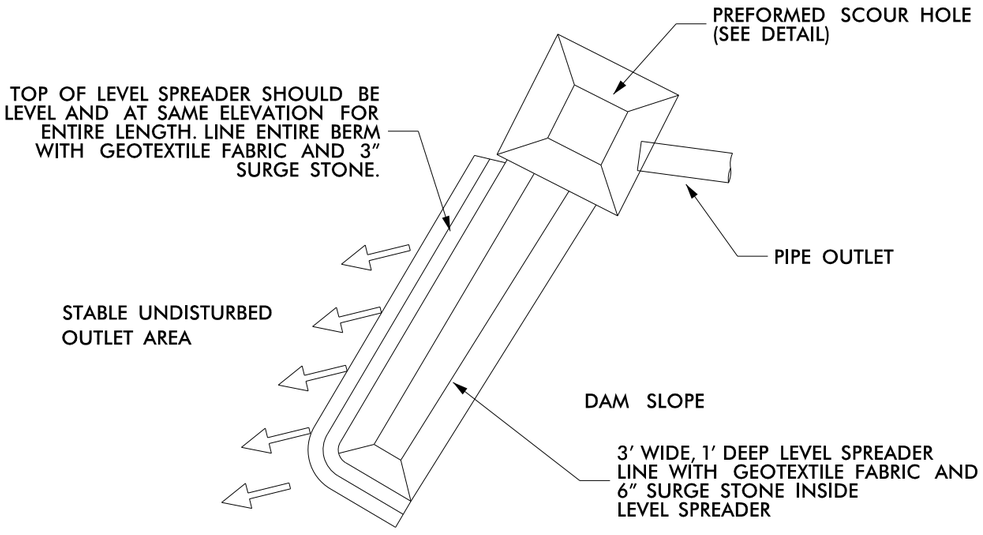
DETAILS

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C02G
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	*C02G*

9/30/2021
Wits End_psh_C02g.dgn
jharvell



LEVEL SPREADER (SECTION VIEW)



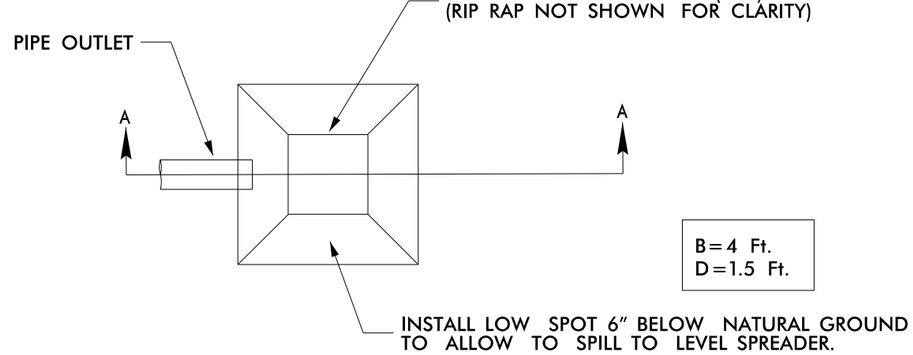
LEVEL SPREADER (PLAN VIEW)

NOTES:

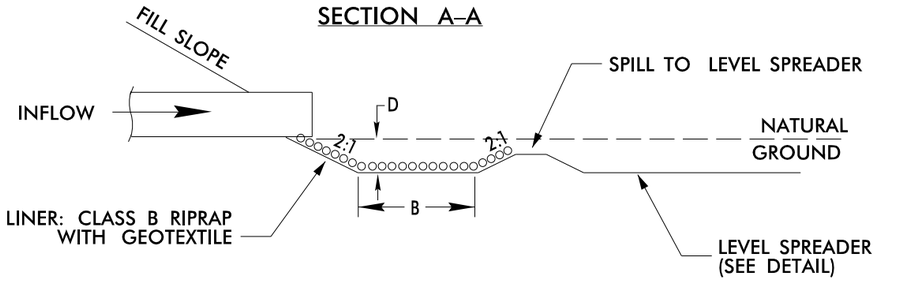
1. CONSTRUCT LEVEL SPREADER AT A UNIFORM HEIGHT WITH A FLAT GRADE OVER THE ENTIRE LENGTH OF THE DEVICE.
2. LINE WITH GEOTEXTILE FABRIC AND 6" SURGE STONE.
3. CONSTRUCT THE LEVEL SPREADER ON UNDISTURBED SOIL (NOT ON FILL).
4. IMMEDIATELY AFTER CONSTRUCTION, APPROPRIATELY SEED AND MULCH ANY DISTURBED AREAS.
5. INSPECT THE LEVEL SPREADER ANNUALLY. CLEAN OUT AND MAKE ANY NECESSARY REPAIRS.

PREFORMED SCOUR HOLE

PLAN VIEW



SECTION A–A



DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: 919.859.1353
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

DETAILS

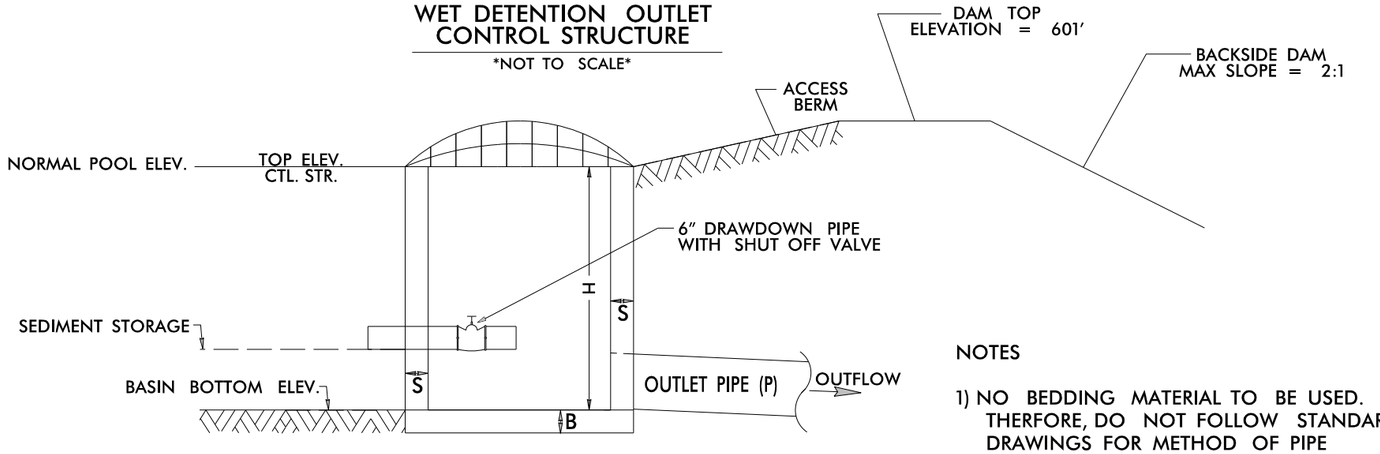
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C02H
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C02H

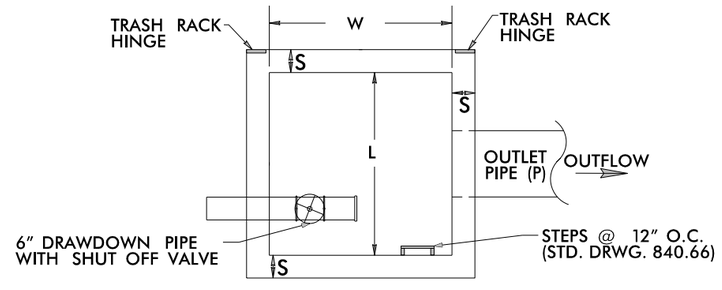
9/30/2021
Wits End_psh_C02h.dgn
Jarvis

WET DETENTION OUTLET CONTROL STRUCTURE

NOT TO SCALE



SIDE VIEW



PLAN VIEW

TRASH RACK NOT SHOWN FOR CLARITY

NOTES

1) NO BEDDING MATERIAL TO BE USED. THERFORE, DO NOT FOLLOW STANDARD DRAWINGS FOR METHOD OF PIPE INSTALLATION FOR OUTLET PIPE THROUGH EMBANKMENT.
2) ENSURE TRASH RACK OPENS FREELY AND WITHOUT INTERFERENCE.
3) SHUT OFF VALVE MAY BE A GATE VALVE, BALL VALVE, SHEAR GATE, ETC. SHUT OFF VALVE IS TO REMAIN CLOSED DURING NORMAL OPERATON.
4) ALL EXISTING TREES AND WOODY VEGETATION SHALL BE REMOVED FROM THE DAM.
5) ALL FILL MATERIAL SHALL BE COMPACTED AT 0 TO 3 PERCENT ABOVE THE STANDARD PROCTOR OPTIMUM MOISTURE CONTENT.
6) FILL MATERIAL SHALL BE PLACED AND COMPACTED IN LIFTS NO GREATER THAN 1 VERTICAL FOOT AT A TIME.

MINIMUM DIMENSIONS FOR WET DETENTION OUTLET CONTROL STRUCTURE

STATION	OFFSET	SIDE WALLS (INCHES)	BASE B (INCHES)	CTL. STR. DIMENSIONS			TOP ELEVATION CONTROL STRUCTURE	BOTTOM ELEVATION CONTROL STRUCTURE	OUTLET PIPE INVERT	OUTLET PIPE DIAMETER(P) INCHES	OUTLET PIPE MATERIAL
				W	L	H					
03+57 –UT3–	136' RT	6.0"	12.0"	4.0'	4.0'	4.0'	600.00'	596.00'	595.00'	18.0	DUCTILE IRON

DocuSigned by: Joshua G. Dalton 1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: (919) 859-0123
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

DETAILS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C02J
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. ***C02J***

9/30/2021
Wits End_psh_C02J.dgn
jharvell

DocuSigned by:
Joshua G Dalton
1089ABBC14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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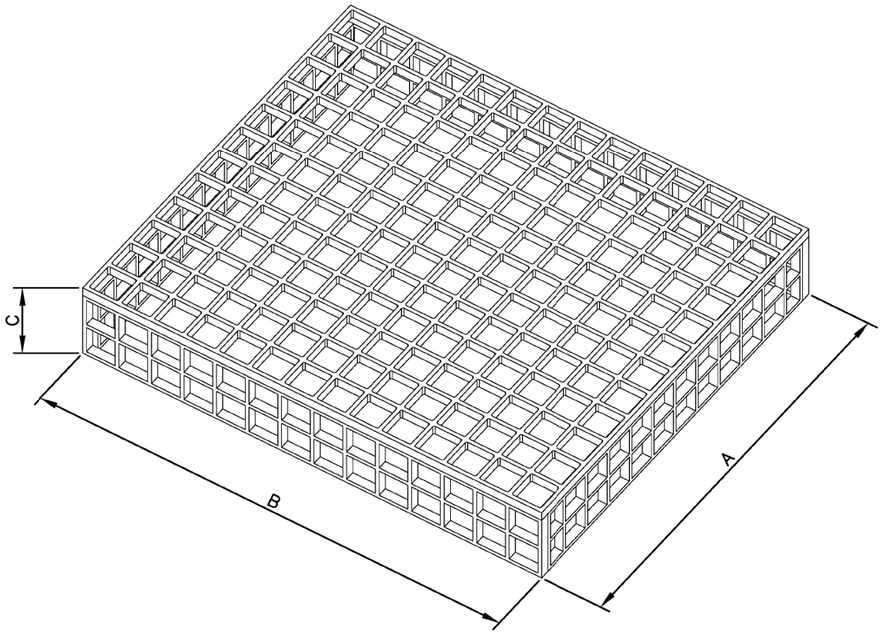
FLAT ROOF RECTANGULAR RACKS/WEIRS

(STANDARD SIZES)
DIMENSIONS IN INCHES TO THE NEAREST 1/4"



HOST STRUCTURE INSIDE DIMENSIONS
_____ LENGTH _____ WALL THICKNESS (REQUIRED)
_____ WIDTH

AS DISTRIBUTED BY CONTECH CONSTRUCTION PRODUCTS NATIONALLY

WIDTH (A)	11 3/8	16 3/4	22 1/8	27 1/2	32 7/8	38 1/4	43 5/8	49	54 3/8	59 3/4	65 1/8	70 1/2	75 7/8	81 7/8	87 1/4
CODE	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16

LENGTH (B)	11 3/8	16 3/4	22 1/8	27 1/2	32 7/8	38 1/4	43 5/8	49	54 3/8	59 3/4	65 1/8	70 1/2	75 7/8	81 7/8	87 1/4
CODE	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16

HEIGHT (C)	7 1/2	12 7/8
CODE	01	02
	1 GRID HIGH	2 GRID HIGH

FLAT ROOF (FR) 49" (09) WIDTH (A) 49" (09) LENGTH (B) 7 1/2" (01) HEIGHT (C)

CONTECH® CONSTRUCTION PRODUCTS INC.
9025 CENTRE POINTE DRIVE, SUITE 400
WEST CHESTER, OHIO 45069
PH: 1.800.338.1122 FAX: 513.645.7399

CUSTOMER:	**DATE:**
	DRAWN BY:
PROJECT:	**APP'D BY:**
	DETAIL:

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: 919.859.0115
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

DETAILS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C02K
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C02K

9/30/2021
Wits End_psh_C02k.dgn
Revised

SURVEY INFORMATION PROPERTY/ EASEMENT PROVIDED BY:
CAROLINA SURVEYORS, INC.
P.O. BOX 267
PINEVILLE, NC 28134

HORIZONTAL DATUM: NAD 83 (2011)
VERTICAL DATUM: NAVD 1988

200′ 100′ 0 200′ 400′
SCALE: 1″ = 400′

NAD 83

Snyders Store Rd
1945

L J Whitley Rd
1949

WAXHAW BRANCH

UT 1
UT 2
UT 3
UT 3A
UT 4
UT 5

NL OI CNTRL–TR–T
NL 66
NL 68
WAXBR
NL 63
NL RT–TR2
NL 60
NL 70
NL 72
NL 74
NL 31
NL HUB AN TAC
NL 26
OI NL CNTRL–GPS
NL 37
WAXBR
NL40–RT–TR1
NL 39
NL 57
NL 56
NL 54
NL 42
NL 41
OI NL CNTRL TR–T

BENCHMARK
REBAR SET
N.C.S.P.C.
N: 427,091.64
E: 1,566,907.24
CF: 0.99986609

ELV: 595.05
(NAVD88)

Wits End Control Points				
Pt ##	Northing	Easting	Elevation	Type
NL OI CNTRL-RT-T	428481.86	1566962.93	618.39	
NL 66	428310.45	1566630.59	604.58	
NL RT-TR2	427930.80	1566459.30	596.35	
NL 63	427963.50	1566810.88	593.93	
NL 68	428027.03	1567082.61	608.51	
NL 60	427572.42	1566501.17	601.93	
NL 70	427481.14	1567349.89	604.03	
NL 72	427247.03	1567486.57	601.97	
NL 57	427056.72	1566589.75	605.03	
NL OI CNTRL (BENCHMARK)	427091.64	1566907.24	595.05	
NL 74	426987.24	1567597.71	607.38	
NL 31	426683.30	1567708.92	604.90	
NL 56	426479.84	1566731.70	602.25	
NL 26	426407.32	1567589.08	600.82	
NL HUB AN TAC	426142.12	1567836.12	598.06	
NL 54	426077.01	1566786.96	584.05	
NL 42	425657.10	1566831.98	594.52	
NL 39	425679.88	1567275.35	579.53	
NL 37	425590.84	1567694.14	588.43	
OI NL CNTRL-GPS	425764.55	1568013.05	597.88	
NL 40-TR-TR1	425442.55	1567494.97	577.39	
OI NL CNTRL TR-T	425251.88	1566886.40	595.88	
NL 41	425375.02	1567052.63	593.65	

9/30/2021
Wits End_psh_C03.dgn
Jarvis

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.859.1363
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

CONTROL POINTS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C03
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C03

SURVEY INFORMATION PROPERTY/ EASEMENT PROVIDED BY:
CAROLINA SURVEYORS, INC.
P.O. BOX 267
PINEVILLE, NC 28134

200' 100' 0 200' 400'
SCALE: 1" = 400'

HORIZONTAL DATUM: NAD 83 (2011)
VERTICAL DATUM: NAVD 1988

NAD 83

Snyders Store Rd
1945

L J Whitley Rd
1949

WAXHAW BRANCH

UT 1

UT 2

UT 3

UT 3A

UT 4

UT 5

WAXBR

CE CONSERVATION EASEMENT

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.859.1353
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

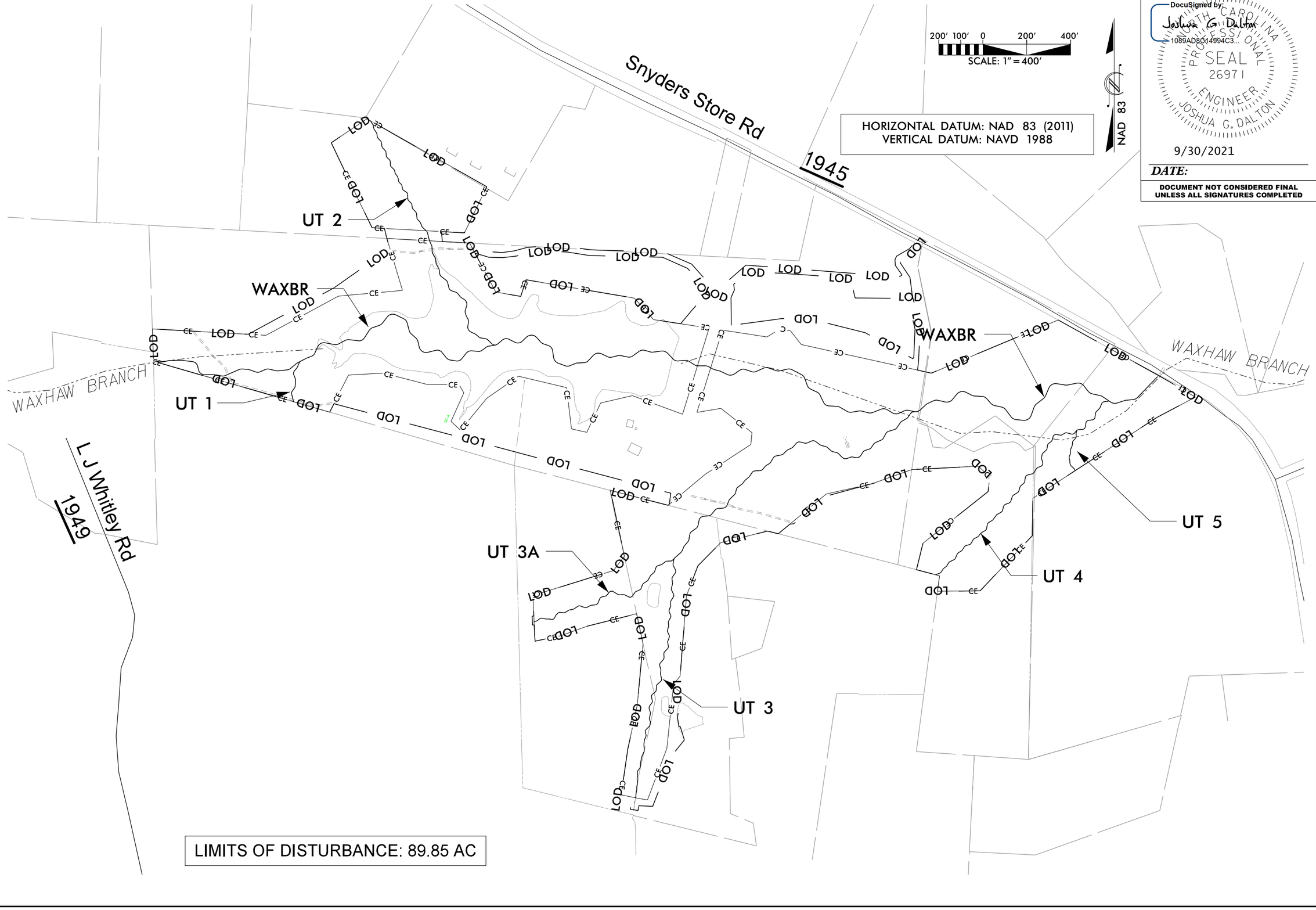
WITS END
UNION COUNTY, NC

EASEMENT

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C03A
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. C03A

9/30/2021
Wits End_psh_C03a.dgn
Jarvis



HORIZONTAL DATUM: NAD 83 (2011)
VERTICAL DATUM: NAVD 1988

LIMITS OF DISTURBANCE: 89.85 AC

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

SOUTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.859.1365
ENG FIRM LICENSE NO. C-3890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

LIMITS OF DISTURBANCE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C03B
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C03B

9/30/2021
Wits End_psh_C03b.dgn
Jarvis

Snyders Store Rd
1945

L J Whitley Rd
1949

WAXHAW BRANCH

UT 1

UT 2

UT 3

UT 3A

UT 4

UT 5

WAXBR

MARSH TREATMENT

CE

E

200' 100' 0 200' 400'
SCALE: 1" = 400'

HORIZONTAL DATUM: NAD 83 (2011)
VERTICAL DATUM: NAVD 1988

NAD 83

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021
DATE:

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DENOTES MARSH TREATMENT

DENOTES WETLAND REESTABLISHMENT

DENOTES WETLAND ENHANCEMENT

DENOTES WETLAND PRESERVATION

DENOTES WETLAND CREATION

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: (919) 851-9545
ENG FIRM LICENSE NO. C-3890

Axiom Environmental, Inc.

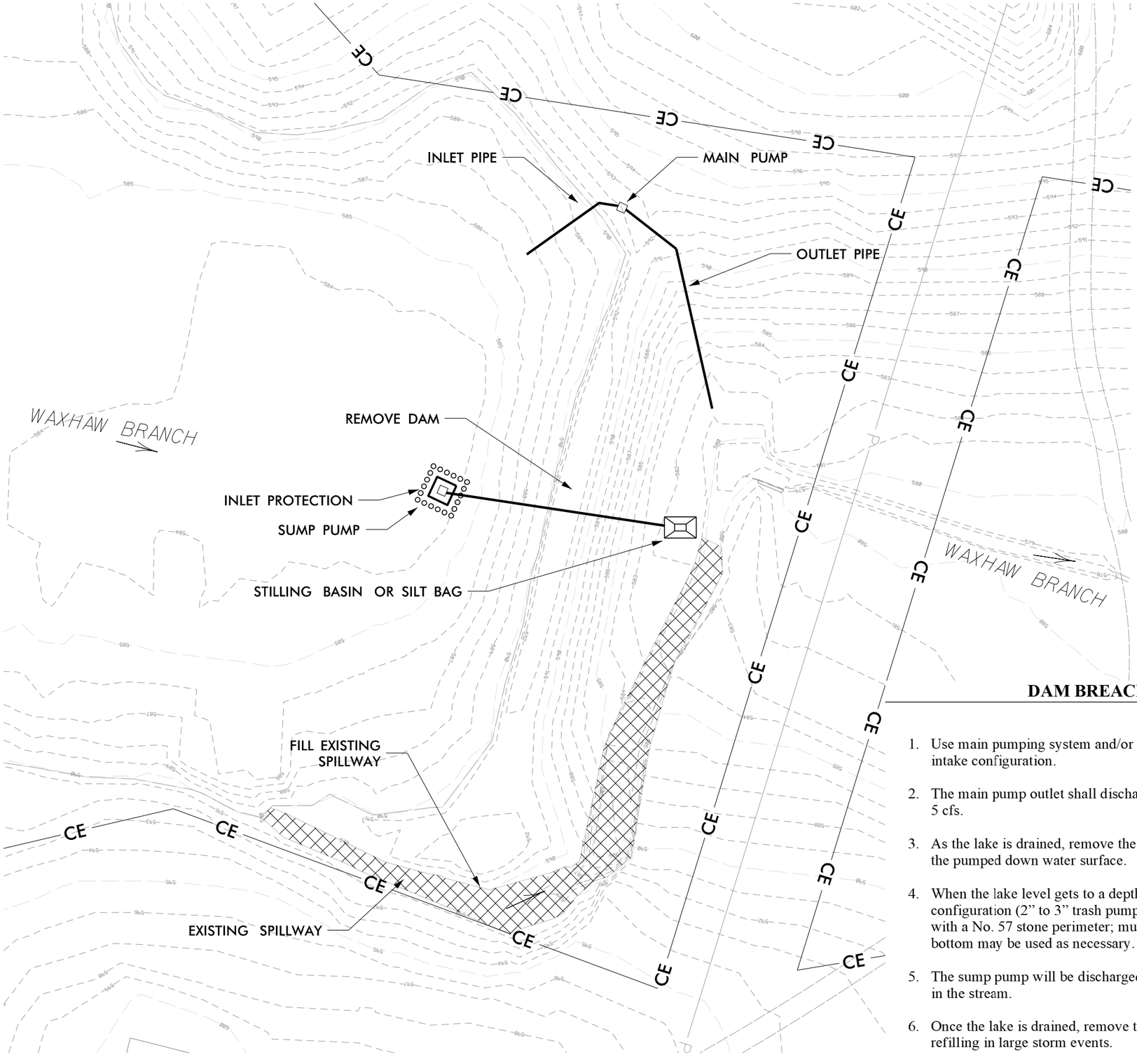
WITS END
UNION COUNTY, NC

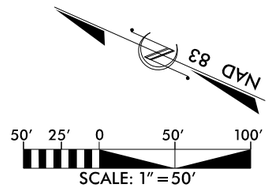
WETLAND REESTABLISHMENT

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C03C
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C03C

9/30/2021
Wits End_psh_C03c.dgn
Layout





DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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HORIZONTAL DATUM: NAD 83 (2011)
VERTICAL DATUM: NAVD 1988

DAM BREACH AND DEWATERING SEQUENCE

1. Use main pumping system and/or siphon to dewater lake from top of water column using a floating intake configuration.
2. The main pump outlet shall discharge directly to the outlet channel. The total pump rate shall not exceed 5 cfs.
3. As the lake is drained, remove the dam embankment from the top down. Remove down to 1 foot above the pumped down water surface.
4. When the lake level gets to a depth of 2 to 3 feet and mud/muck becomes prevalent, use a sump pump configuration (2" to 3" trash pump) to fully dewater the lake. The pump(s) will be placed on a pallet with a No. 57 stone perimeter; multiple sump configurations located at various low points in the lake bottom may be used as necessary.
5. The sump pump will be discharged through a filter bag or system of stilling basins prior to discharging in the stream.
6. Once the lake is drained, remove the remaining portion of the dam embankment to prevent the lake from refilling in large storm events.

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Axiom Environmental, Inc.

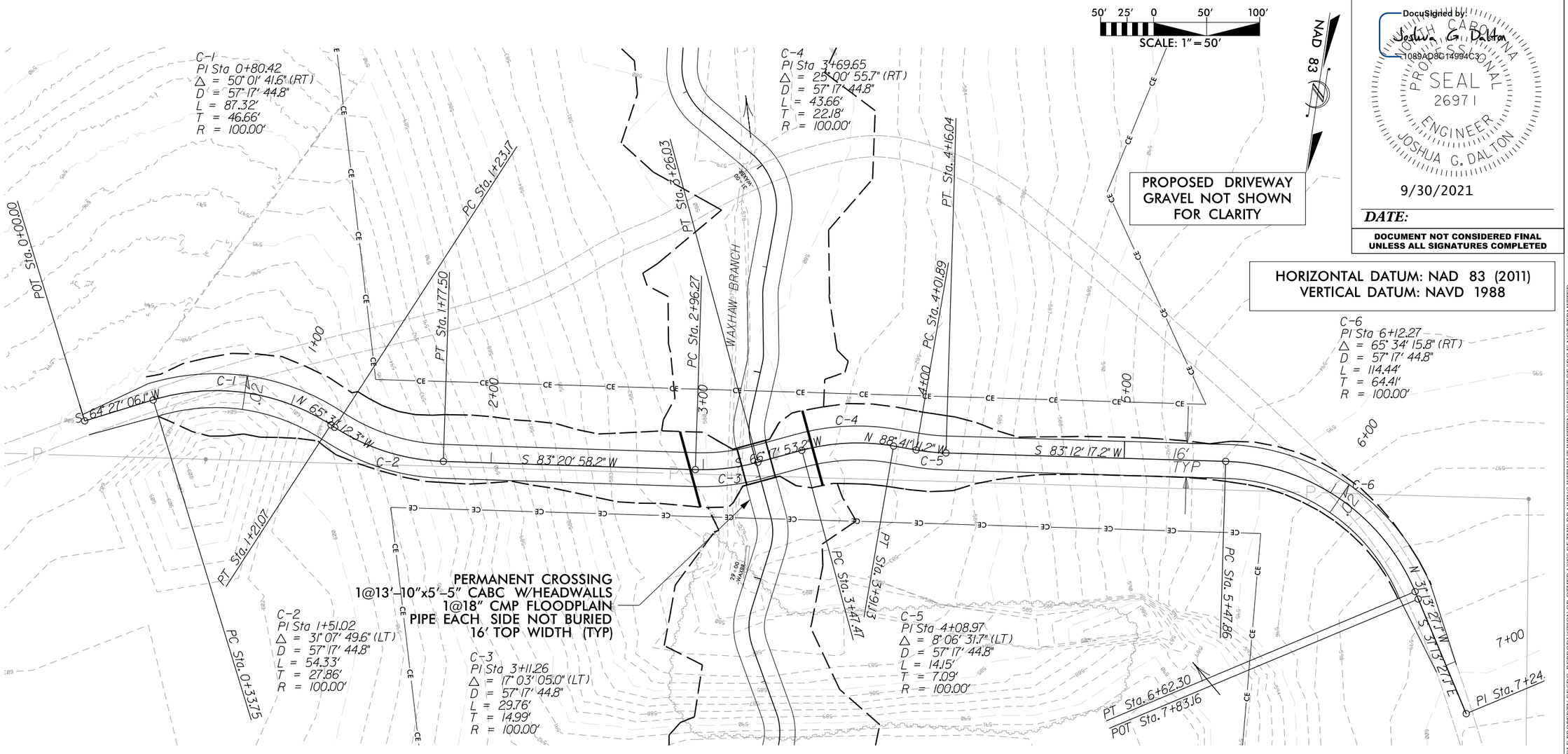
WITS END
UNION COUNTY, NC

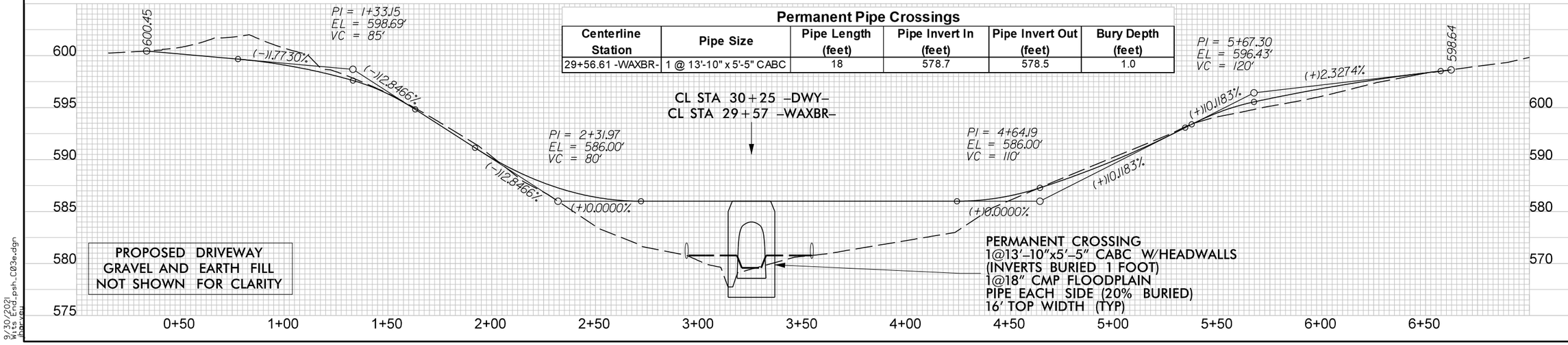
DAM BREACH

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C03D
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C03D

9/30/2021
Wits End_psh_C03d.dgn
jharvell





Permanent Pipe Crossings

Centerline Station	Pipe Size	Pipe Length (feet)	Pipe Invert In (feet)	Pipe Invert Out (feet)	Bury Depth (feet)
29+56.61 -WAXBR-	1 @ 13'-10" x 5'-5" CABC	18	578.7	578.5	1.0

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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HORIZONTAL DATUM: NAD 83 (2011)
VERTICAL DATUM: NAVD 1988

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PHONE (919) 859-1353
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

DRIVEWAY REALIGNMENT

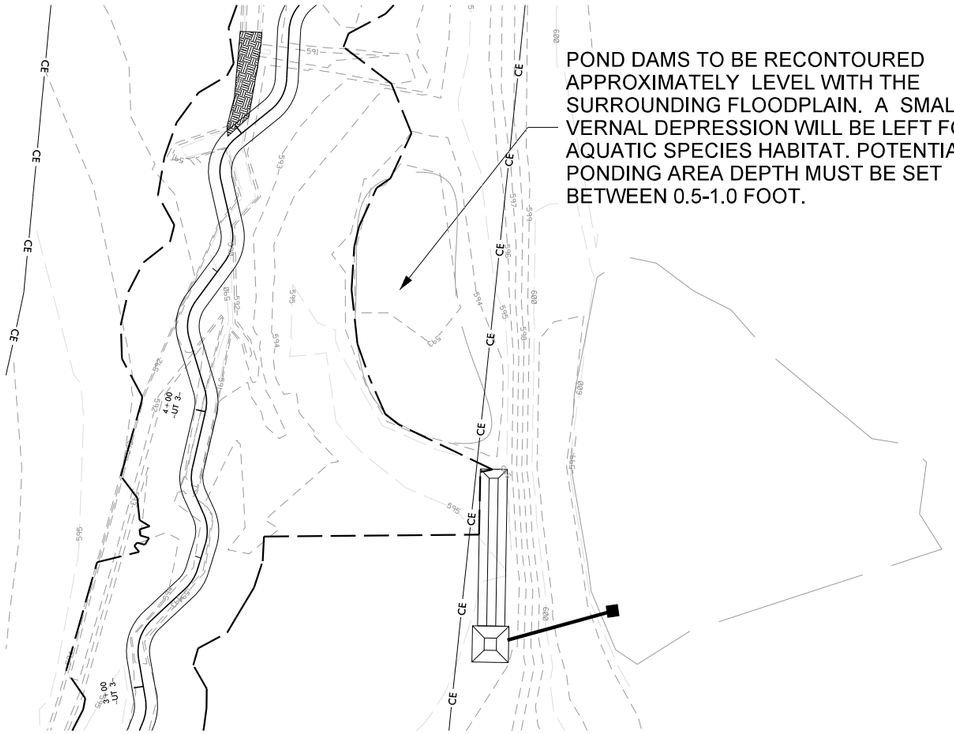
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C03E
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C03E**

9/30/2021
Wits End_psh_C03e.dgn
jharvey

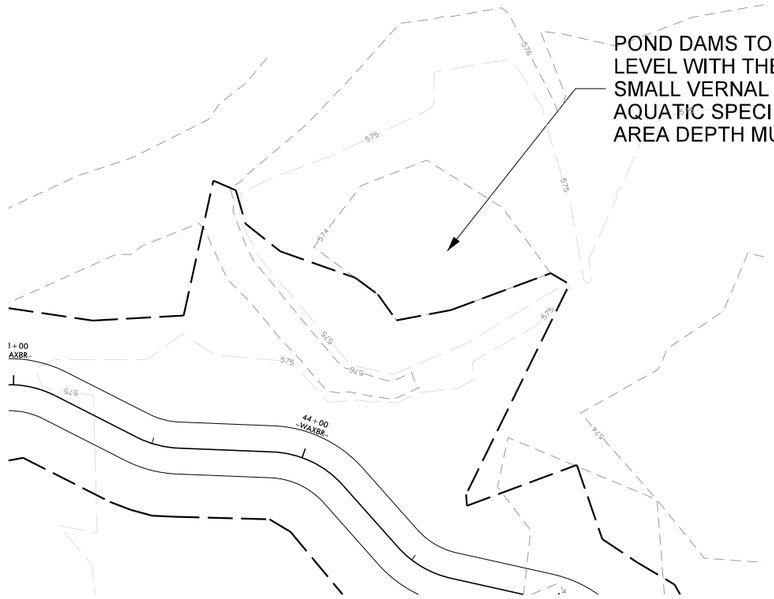
POND DAMS TO BE RECONTOURED APPROXIMATELY LEVEL WITH THE SURROUNDING FLOODPLAIN. A SMALL VERNAL DEPRESSION WILL BE LEFT FOR AQUATIC SPECIES HABITAT. POTENTIAL PONDING AREA DEPTH MUST BE SET BETWEEN 0.5-1.0 FOOT.

STA 10+00 –UT3– LT
STA 6+00 –UT3A– RT



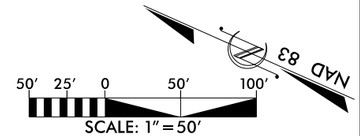
POND DAMS TO BE RECONTOURED APPROXIMATELY LEVEL WITH THE SURROUNDING FLOODPLAIN. A SMALL VERNAL DEPRESSION WILL BE LEFT FOR AQUATIC SPECIES HABITAT. POTENTIAL PONDING AREA DEPTH MUST BE SET BETWEEN 0.5-1.0 FOOT.

STA 4+50 –UT3– RT



POND DAMS TO BE RECONTOURED APPROXIMATELY LEVEL WITH THE SURROUNDING FLOODPLAIN. A SMALL VERNAL DEPRESSION WILL BE LEFT FOR AQUATIC SPECIES HABITAT. POTENTIAL PONDING AREA DEPTH MUST BE SET BETWEEN 0.5-1.0 FOOT.

STA 44+00 –WAXBR– LT



HORIZONTAL DATUM: NAD 83 (2011)
VERTICAL DATUM: NAVD 1988

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021
DATE:

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SUNGATE DESIGN GROUP, P.A.
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PH: 919.859.0513
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

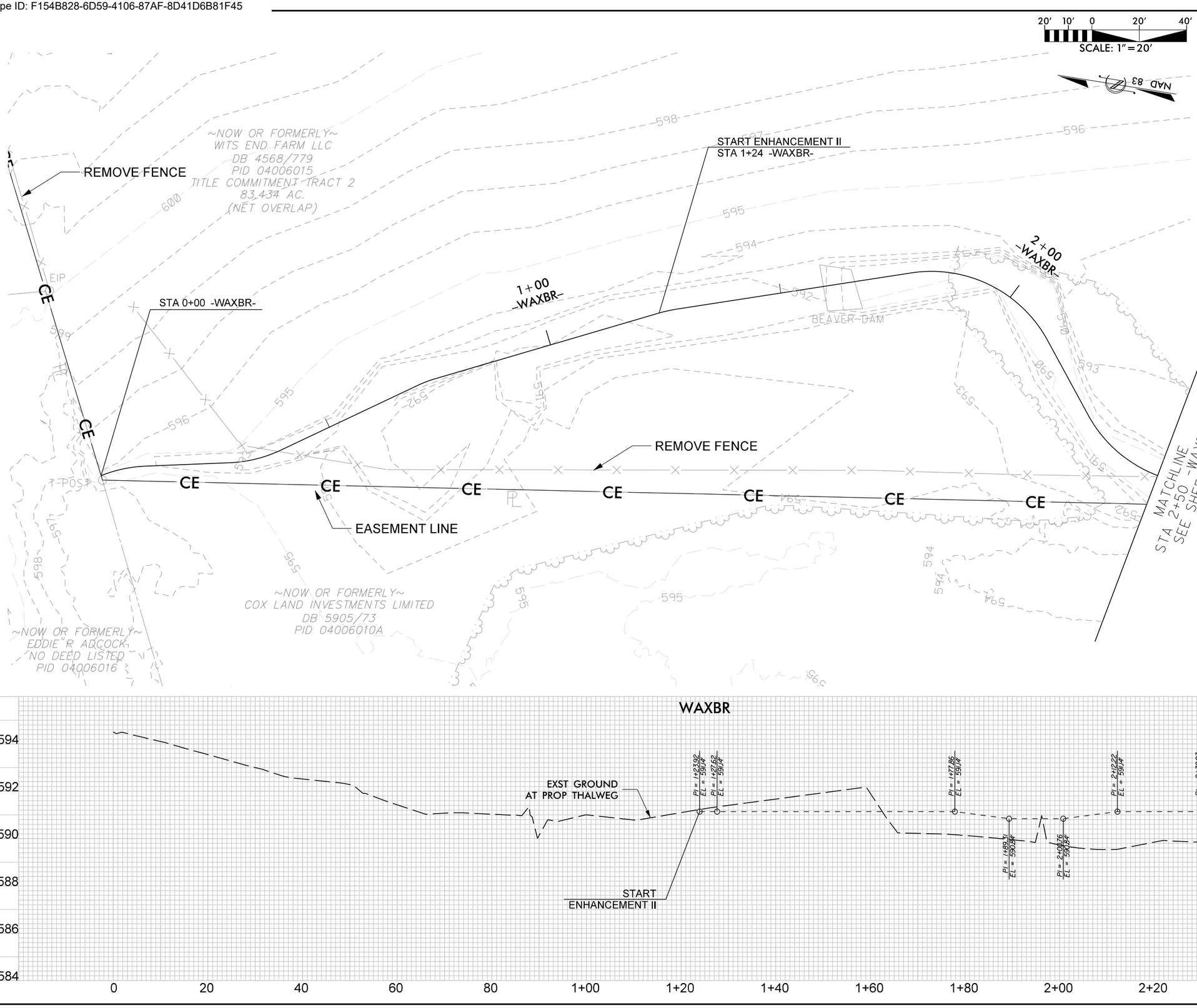
WITS END
UNION COUNTY, NC

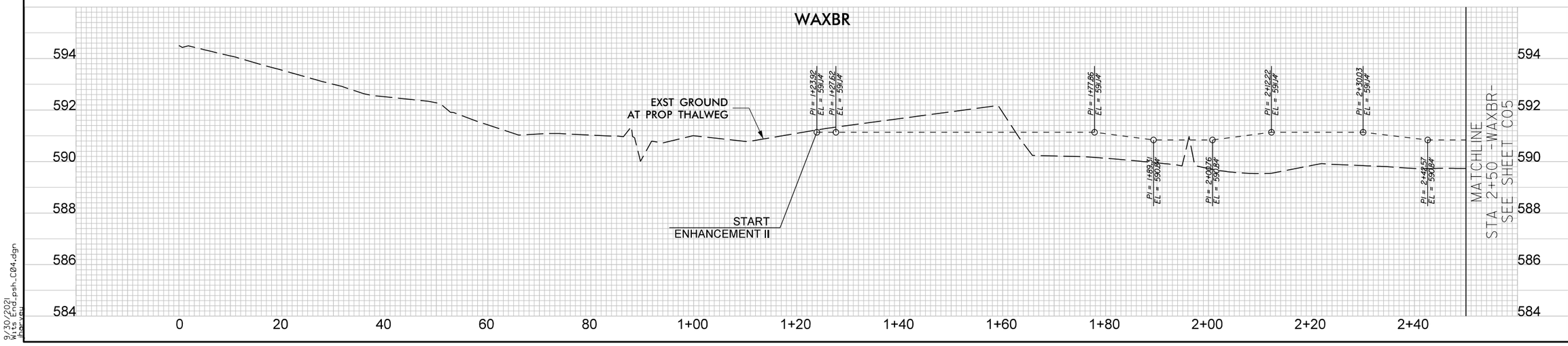
POND RECONTOURS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C03F
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C03F

9/30/2021
Wits End_psh_C03f.dgn
jharden





DocuSigned by: Joshua G Dalton 1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.859.1353
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C04
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C04

9/30/2021
Wits End_psh_C04.dgn
jharvey

20' 10' 0 20' 40'
SCALE: 1" = 20'

NAD 83

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

~NOW OR FORMERLY~
WITS END FARM LLC
DB 4568/778
PID 04006015
TITLE COMMITMENT TRACT 2
83.434 AC.
(NET OVERLAND)

MARSH TREATMENT

LIMITS OF GRADING

PROP BANKFULL

EX SOIL PATH

END ENHANCEMENT II
START RESTORATION
STA 3+30 -WAXBR-

3+00
-WAXBR-

4+00
-WAXBR-

MATCHLINE
STA 2+50 -WAXBR-
SEE SHEET C04

MATCHLINE
STA 5+00 -WAXBR-
SEE SHEET C06

CE

REMOVE FENCE

EASEMENT LINE

~NOW OR FORMERLY~
COX LAND INVESTMENTS LIMITED
DB 5905/173
PID 04006010A

PROP BANKFULL

LIMITS OF GRADING

PERMANENT ATV CHANNEL FORD

DENOTES MARSH TREATMENT

WAXBR

PROP THALWEG

EXST GROUND AT PROP THALWEG

END ENHANCEMENT II
START RESTORATION

PI = 2+47.66
EL = 591.14

PI = 2+55.11
EL = 590.84

PI = 3+06.40
EL = 591.14

PI = 3+08.06
EL = 590.84

PI = 3+11.28
EL = 591.14

PI = 3+10.72
EL = 590.84

PI = 3+29.61
EL = 590.05

PI = 3+47.25
EL = 590.36

PI = 3+52.65
EL = 590.65

PI = 3+63.45
EL = 590.55

PI = 3+46.05
EL = 590.65

PI = 4+31.44
EL = 590.67

PI = 4+35.83
EL = 590.29

PI = 4+44.60
EL = 590.59

PI = 4+40.21
EL = 590.29

PI = 4+71.08
EL = 590.46

PI = 4+78.73
EL = 590.05

PI = 4+79.03
EL = 590.45

PI = 4+76.38
EL = 590.05

594
592
590
588
586
584

2+60 2+80 3+00 3+20 3+40 3+60 3+80 4+00 4+20 4+40 4+60 4+80 5+00

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.851.1545
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

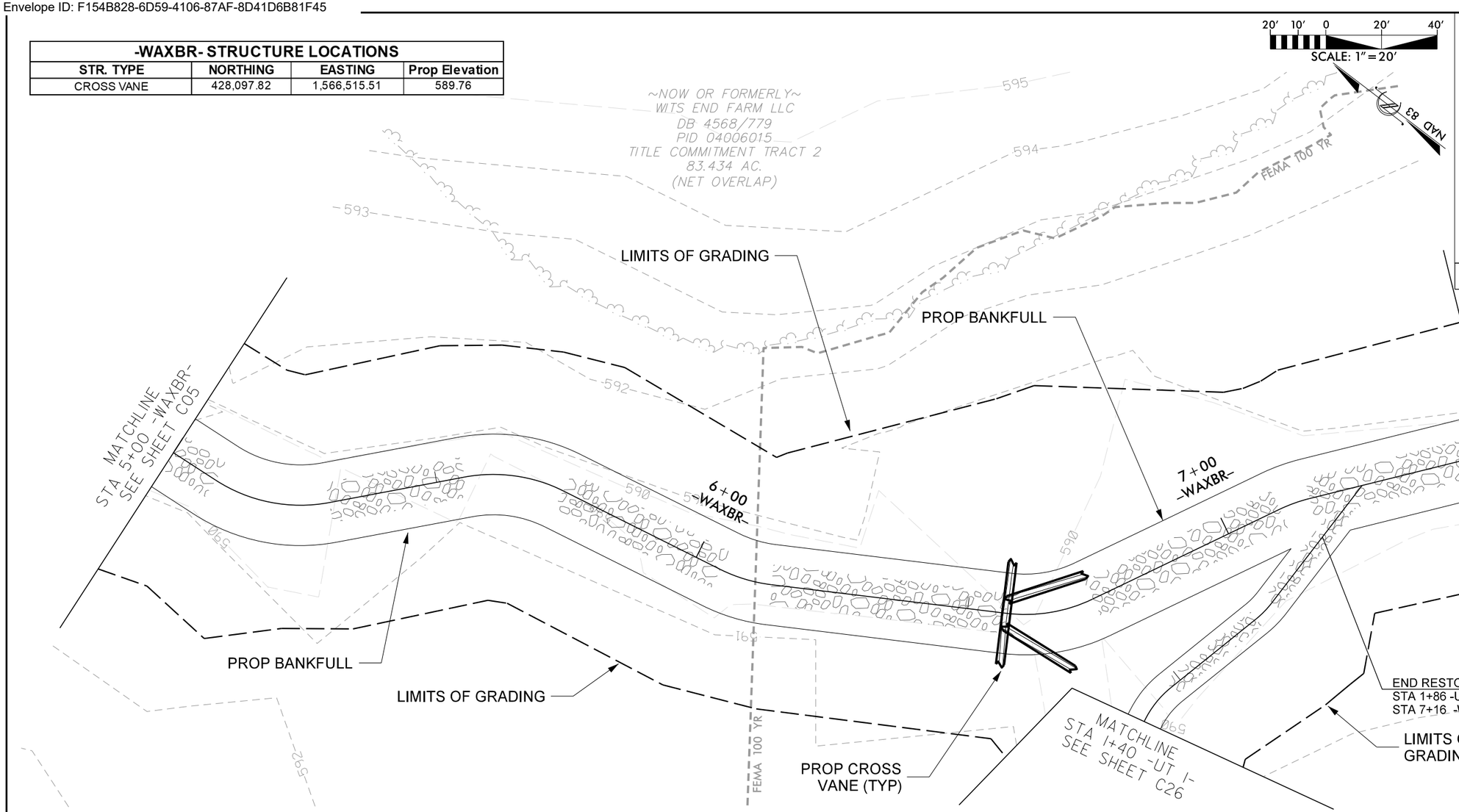
PLAN AND PROFILE

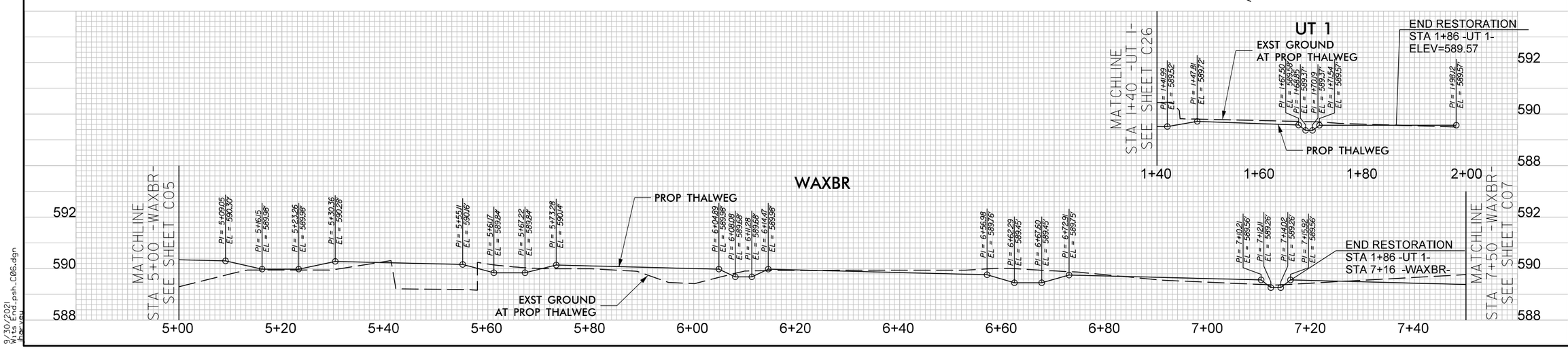
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C05
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C05**

9/30/2021
Wits End_psh_C05.dgn
Layout

-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	428,097.82	1,566,515.51	589.76





DocuSigned by:
Joshua G Dalton
1689AD8C14994C3...

NORTH CAROLINA
PROFESSIONAL
SEAL
26971
ENGINEER
JOSHUA G. DALTON

9/30/2021

DATE:

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905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.859.1353
ENG FIRM LICENSE NO. C-3590

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C06
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C06

9/30/2021
Wits End_psh_C06.dgn
Darren

-WAXBR- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	428,022.22	1,566,616.56	589.23
CROSS VANE	427,910.48	1,566,745.41	588.61

SCALE: 1" = 20'

~NOW OR FORMERLY~
WITS END FARM LLC
DB 4568/779
PID 04006015
TITLE COMMITMENT TRACT 2
83.434 AC.
(NET OVERLAP)

FEMA 100 YR

NAD 83

LIMITS OF GRADING
PROP BANKFULL
PROP CROSS VANE (TYP)

8+00 -WAXBR-
9+00 -WAXBR-

MATCHLINE STA 7+50 -WAXBR- SEE SHEET C06

MATCHLINE STA 10+00 -WAXBR- SEE SHEET C08

DocuSigned by: Joshua G Dalton 1080AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
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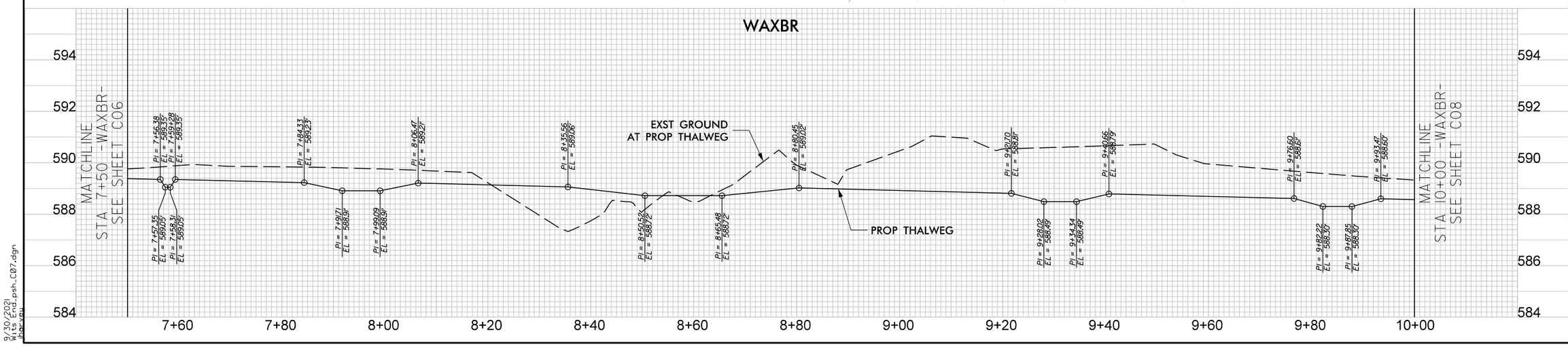
RALEIGH, NORTH CAROLINA 27606
PH: 919.851.1563
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

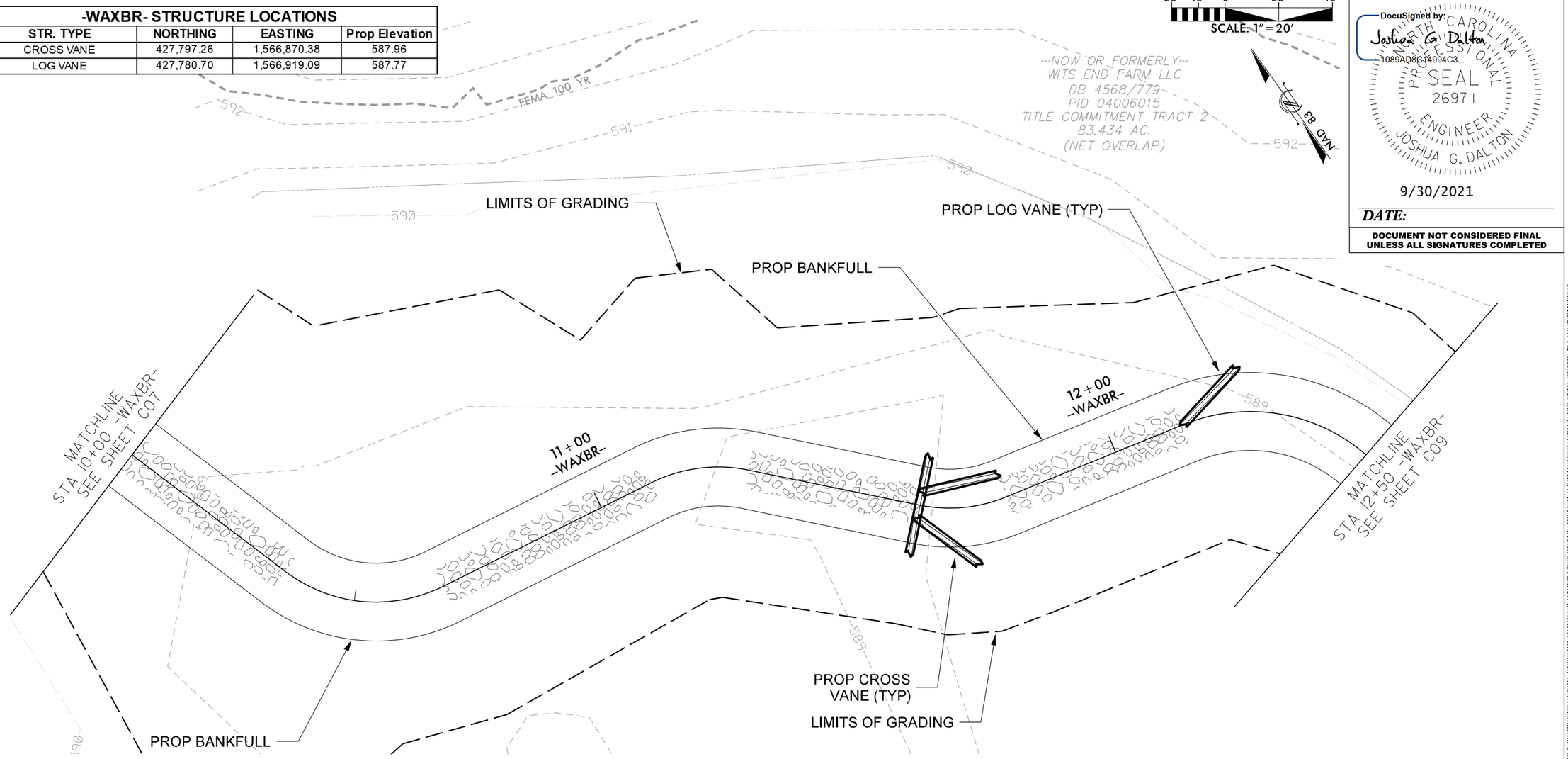
PLAN AND PROFILE

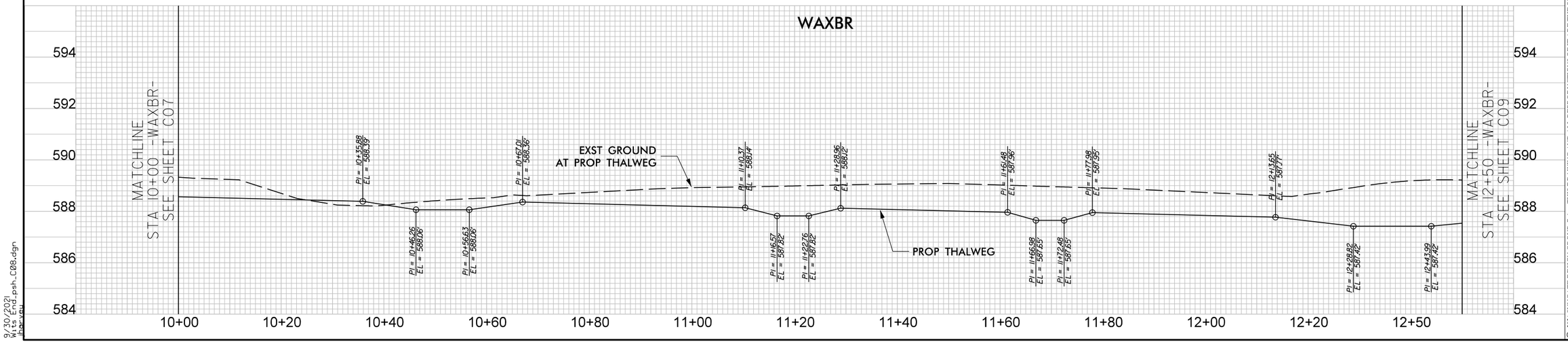


PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C07
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C07

9/30/2021
Wits End_psh_C07.dgn
jharvey

-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	427,797.26	1,566,870.38	587.96
LOG VANE	427,780.70	1,566,919.09	587.77





DocuSigned by: Joshua G. Dalton 1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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RALEIGH, NORTH CAROLINA 27606
PH: (919) 859-1353
ENG FIRM LICENSE NO. C-2890

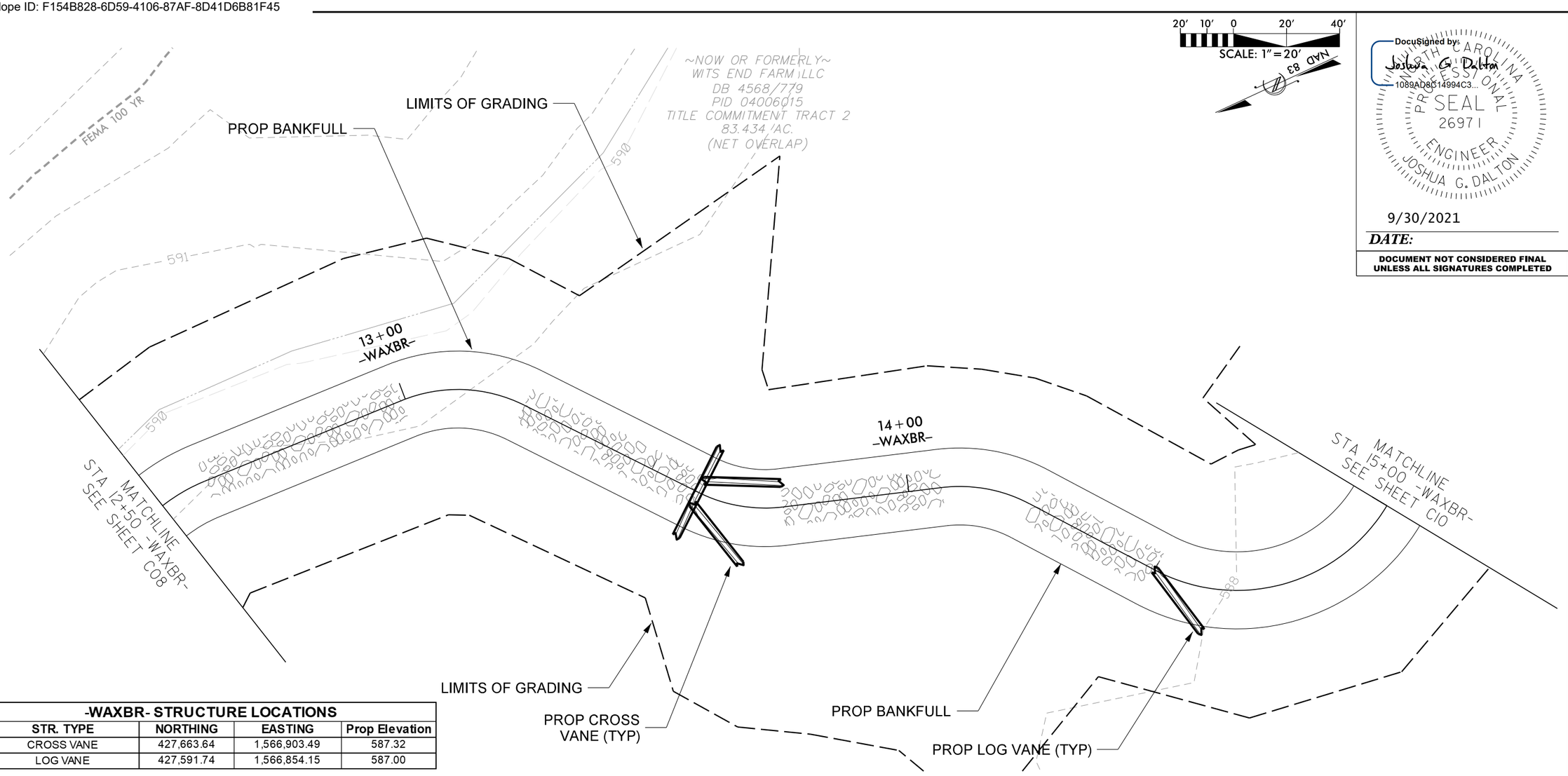
Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

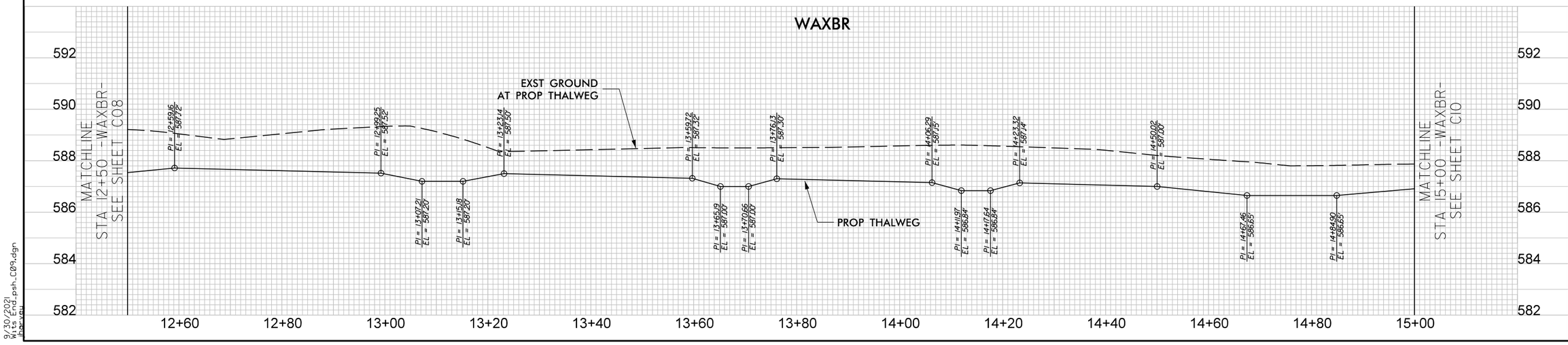
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C08
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C08

9/30/2021
Wits End_psh_C08.dgn
Harvey



-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	427,663.64	1,566,903.49	587.32
LOG VANE	427,591.74	1,566,854.15	587.00



DocuSigned by:
Joshua G Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
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RALEIGH, NORTH CAROLINA 27606
PH: 919.851.2545
ENG FIRM LICENSE NO. C-2890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

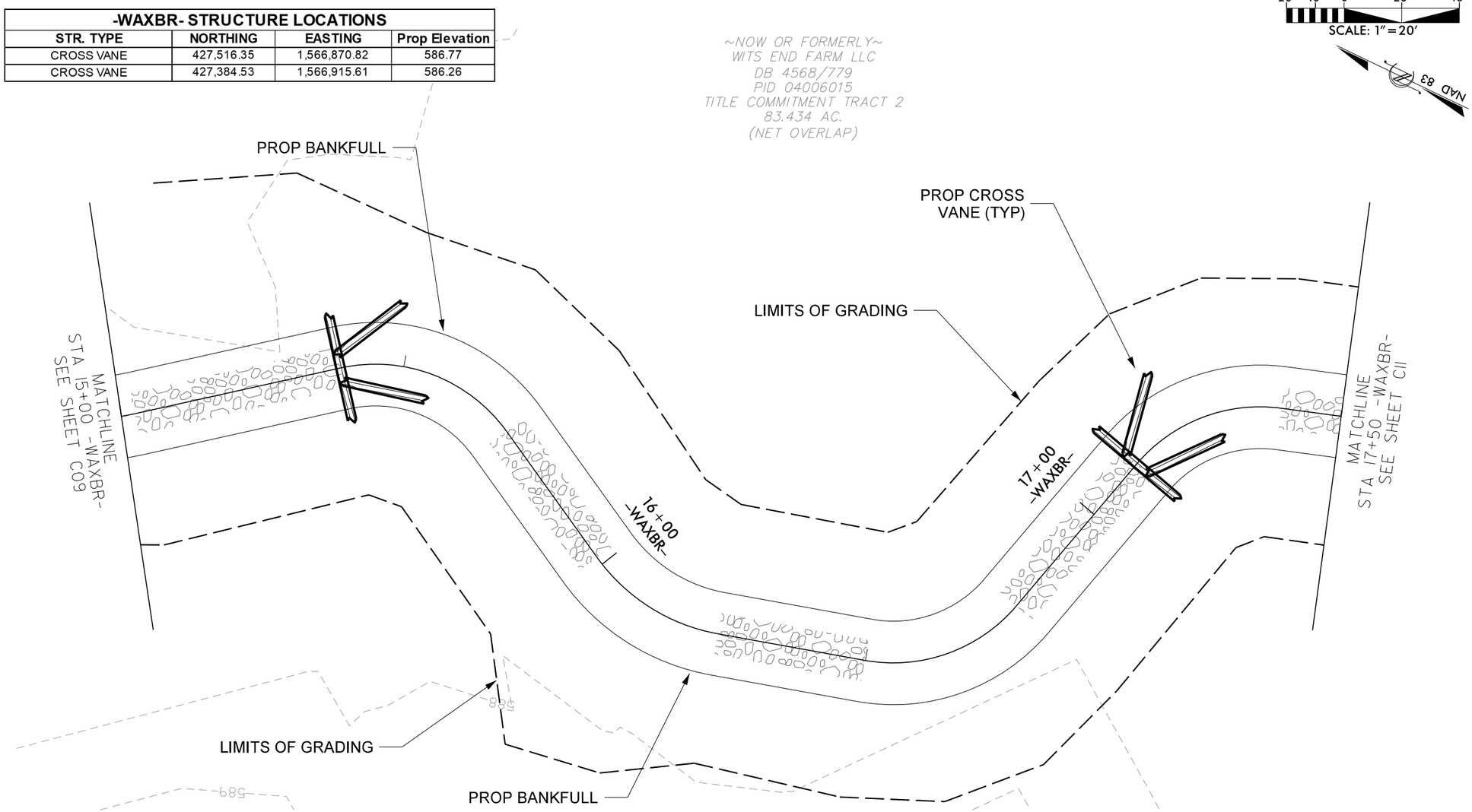
PLAN AND PROFILE

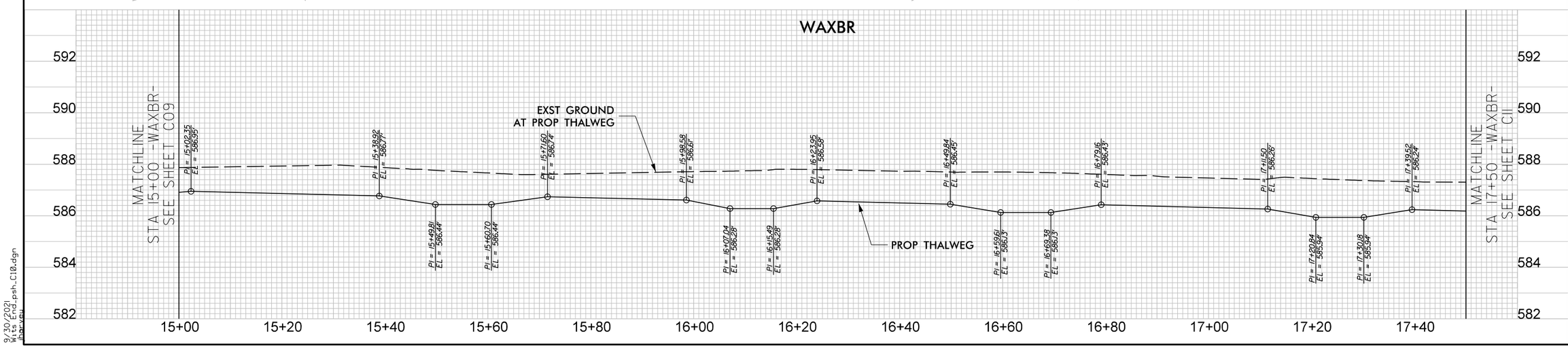
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C09
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
C09

9/30/2021
Wits End_psh_C09.dgn
Jarrell

-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	427,516.35	1,566,870.82	586.77
CROSS VANE	427,384.53	1,566,915.61	586.26





20' 10' 0 20' 40'
SCALE: 1" = 20'

NAD 83

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-0515
ENG FIRM LICENSE NO. C-3890

Axiom Environmental, Inc.

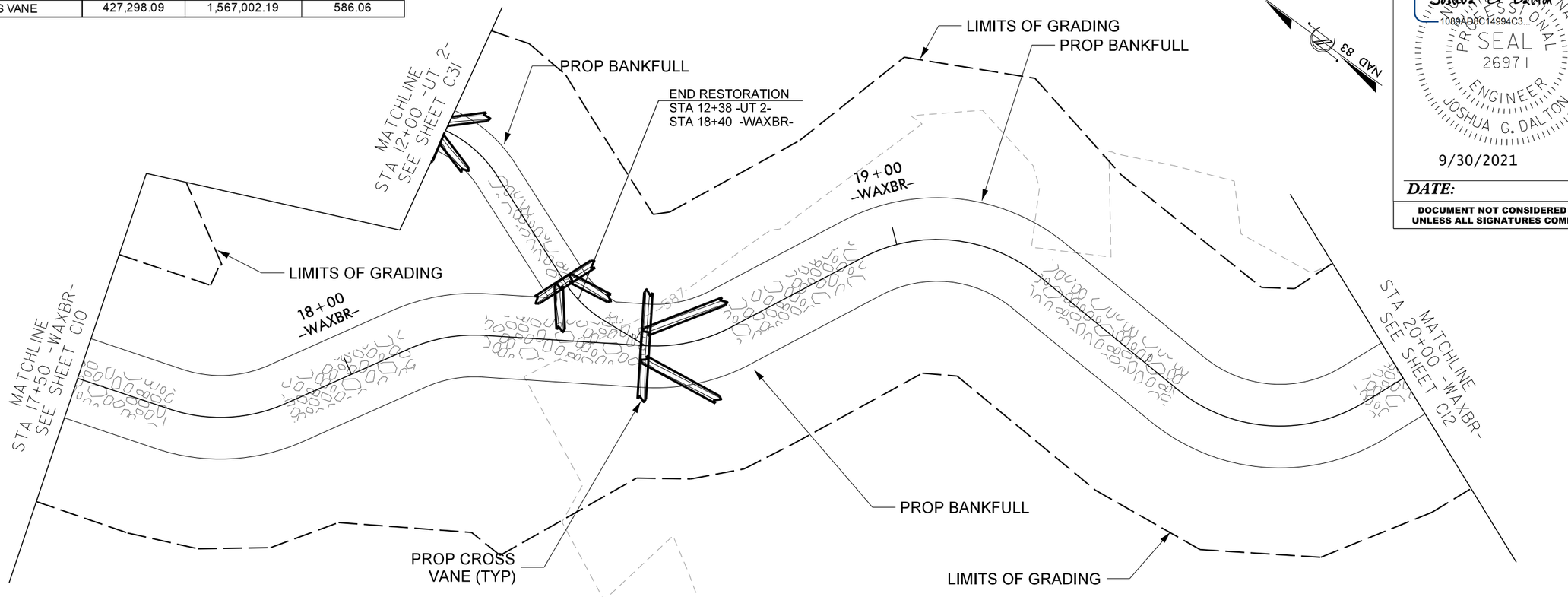
WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C10
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C10

9/30/2021
Wits End_psh_C10.dgn
Harvey

-UT 2- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	427,298.09	1,567,002.19	586.06



20′ 10′ 0 20′ 40′
SCALE: 1″ = 20′

NAD 83

DocuSigned by:
Joshua G Dalton
1089ABBC14994C3...

NORTH CAROLINA
PROFESSIONAL
SEAL
26971
ENGINEER
JOSHUA G. DALTON

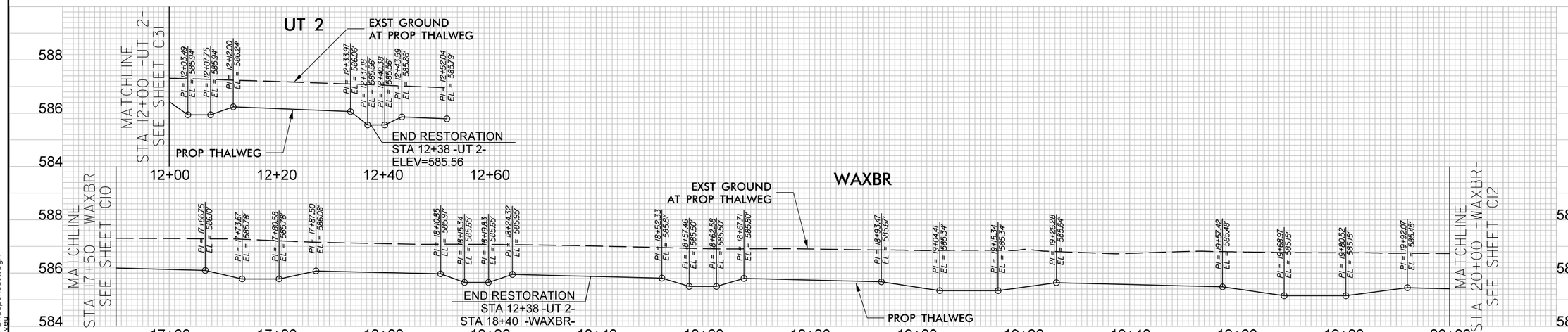
9/30/2021

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

~NOW OR FORMERLY~
WITS END FARM LLC
DB 4568/779
PID 04006015
TITLE COMMITMENT TRACT 2
83.434 AC.
(NET OVERLAP)

-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	427,280.31	1,567,001.62	585.81



SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: 919.851.1563
ENG FIRM LICENSE NO. C-890

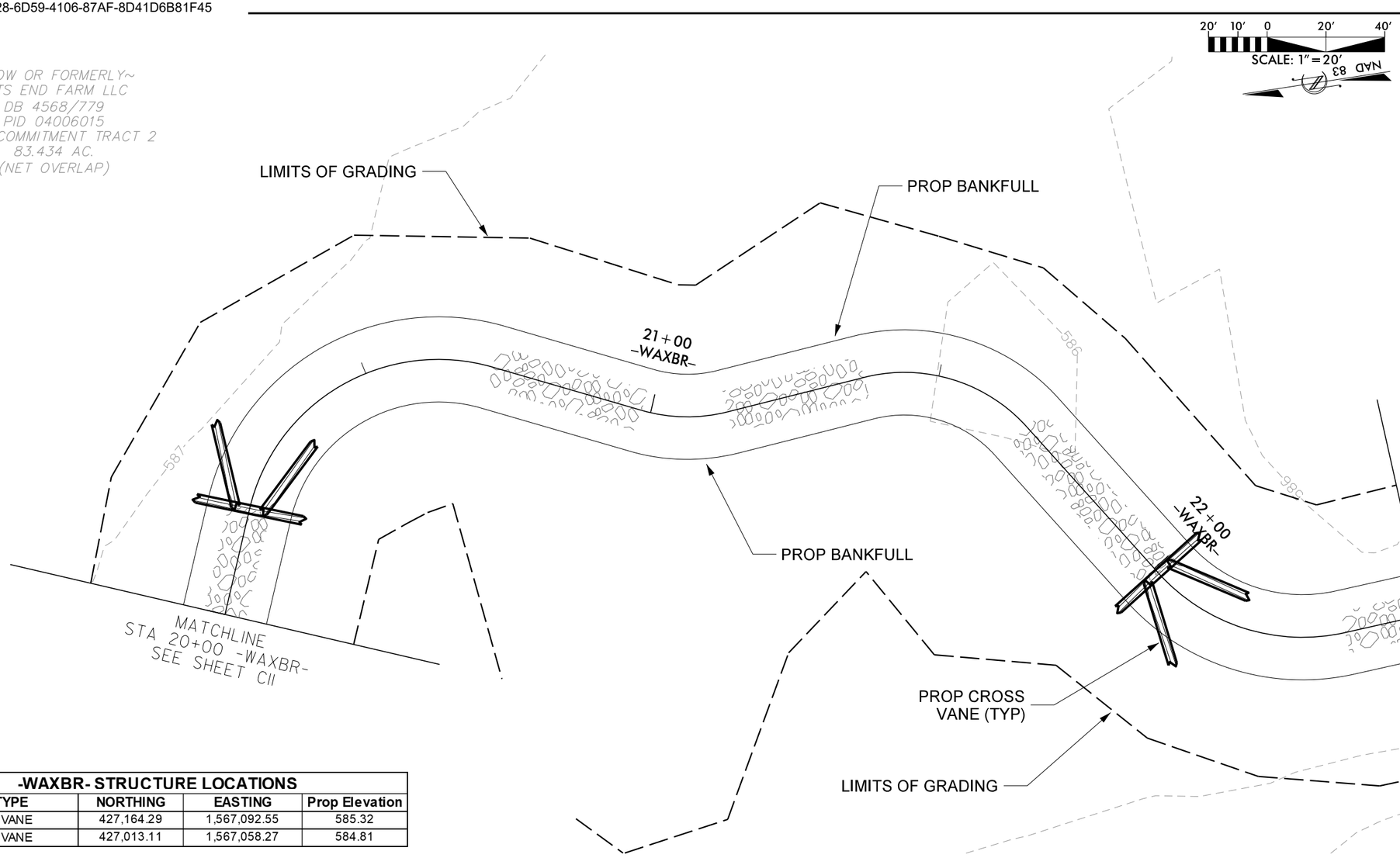
Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

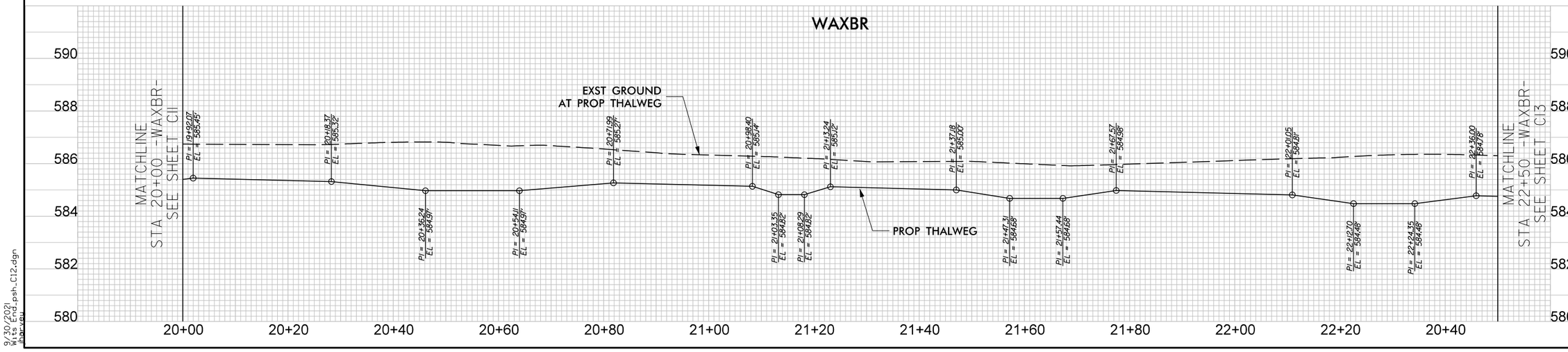
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C11
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	***C11***

9/30/2021
Wits End_psh_C11.dgn
Jarrell



-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	427,164.29	1,567,092.55	585.32
CROSS VANE	427,013.11	1,567,058.27	584.81



DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.859.1865
ENG FIRM LICENSE NO. C-3590

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :
1221-20024
DRAWING NAME:
WITS END PSH C12
DATE:
2021
DRAWN BY:
JRH
REVIEWED BY:
JGD
REVISIONS:

SHEET NO.
C12

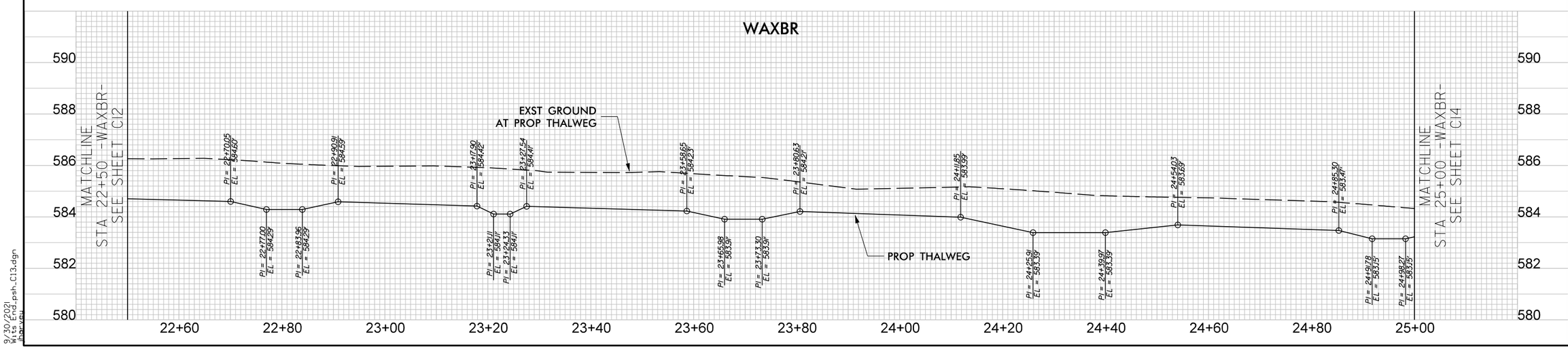
9/30/2021
Wits End_psh_C12.dgn
Harvey

-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,876.87	1,567,093.83	584.23
CROSS VANE	426,853.19	1,567,139.76	583.99

20' 10' 0 20' 40'
SCALE: 1" = 20'
NAD 83

~NOW OR FORMERLY~
WITS END FARM LLC
DB 4568/779
PID 04006015
TITLE COMMITMENT TRACT 2
83.434 AC.
(NET OVERLAP)

PROP BANKFULL
LIMITS OF GRADING
23+00 -WAXBR-
24+00 -WAXBR-
PROP CROSS VANE (TYP)
PROP BANKFULL
LIMITS OF GRADING
MATCHLINE STA 22+50 -WAXBR- SEE SHEET C12
MATCHLINE STA 25+00 -WAXBR- SEE SHEET C14



DocuSigned by:
Joshua G Dalton
1089ADBC14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C13
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C13

9/30/2021
Wits End_psh_C13.dgn
Harvey

-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,750.37	1,567,184.71	583.23
CROSS VANE	426,668.53	1,567,243.34	582.34
CROSS VANE	426,620.77	1,567,260.71	581.81
CROSS VANE	426,577.27	1,567,284.60	581.49

20' 10' 0 20' 40'
SCALE: 1" = 20'

NAD 83

~NOW OR FORMERLY~
WITS END FARM LLC
DB 4568/779
PID 04006015
TITLE COMMITMENT TRACT 2
83.434 AC.
(NET OVERLAP)

LIMITS OF GRADING
PROP BANKFULL
584
26+00 -WAXBR-
27+00 -WAXBR-
MATCHLINE STA 25+00 -WAXBR- SEE SHEET C13
MATCHLINE STA 27+50 -WAXBR- SEE SHEET C15
PROP CROSS VANE (TYP)
PROP BANKFULL
LIMITS OF GRADING

WAXBR

EXST GROUND AT PROP THALWEG
PROP THALWEG

PI = 25+04.75 EL = 583.35'
PI = 25+31.99 EL = 583.23'
PI = 25+36.19 EL = 582.63'
PI = 25+40.39 EL = 582.63'
PI = 25+44.59 EL = 582.93'
PI = 25+78.43 EL = 582.66'
PI = 25+86.01 EL = 582.34'
PI = 25+93.58 EL = 582.34'
PI = 26+01.16 EL = 582.64'
PI = 26+13.45 EL = 582.34'
PI = 26+47.74 EL = 581.74'
PI = 26+56.04 EL = 581.74'
PI = 26+64.33 EL = 582.04'
PI = 26+92.35 EL = 581.81'
PI = 26+96.12 EL = 581.50'
PI = 26+99.89 EL = 581.50'
PI = 27+03.66 EL = 581.80'
PI = 27+42.24 EL = 581.49'

588 586 584 582 580 578
25+00 25+20 25+40 25+60 25+80 26+00 26+20 26+40 26+60 26+80 27+00 27+20 27+40

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021
DATE:

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905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: (919) 859-0515
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

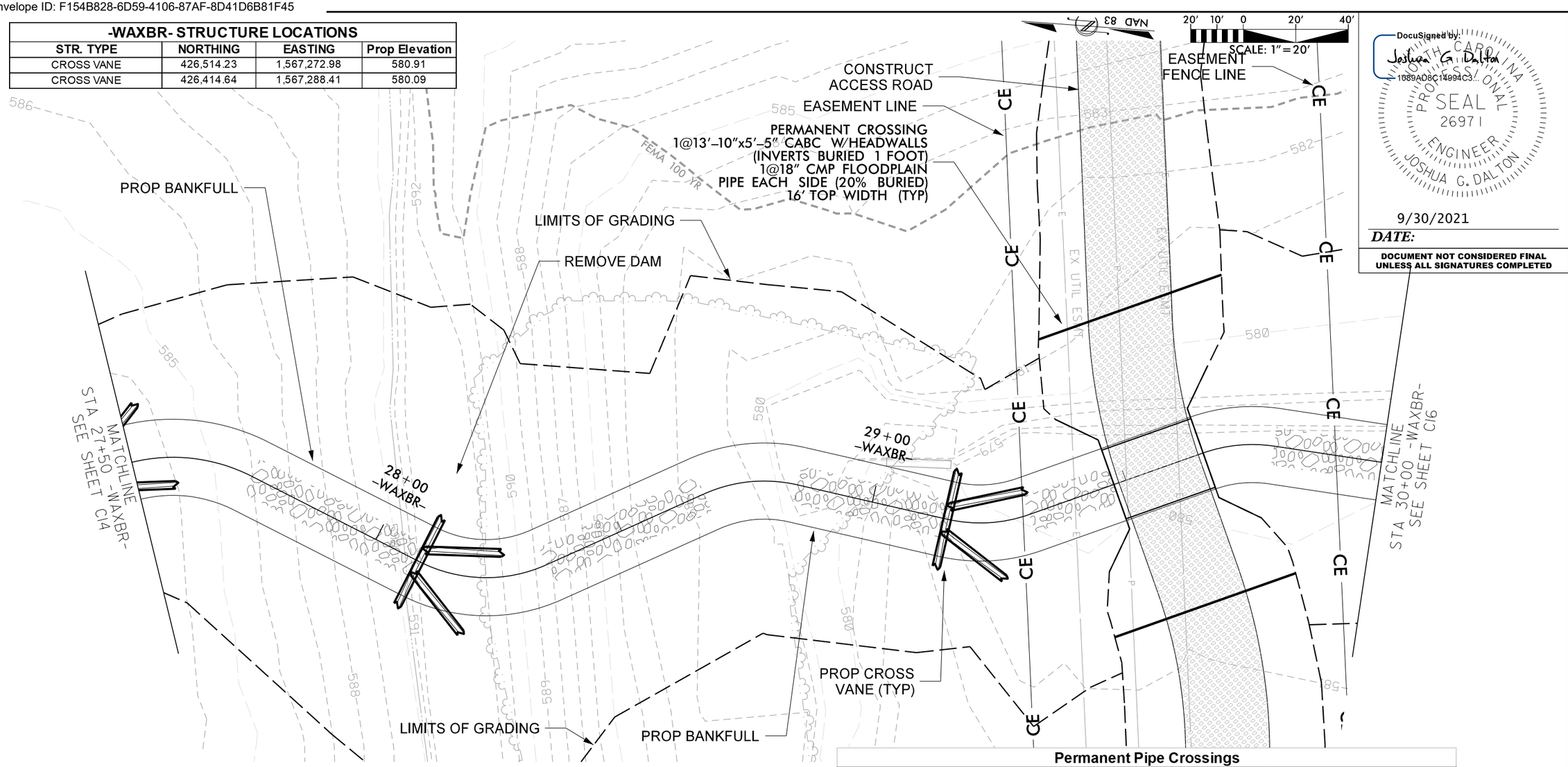
PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C14
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C14**

9/30/2021
Wits End_psh_C14.dgn
jharvey

-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,514.23	1,567,272.98	580.91
CROSS VANE	426,414.64	1,567,288.41	580.09



DocuSigned by:
Joshua G. Dalton
1689AD8C14994C3...

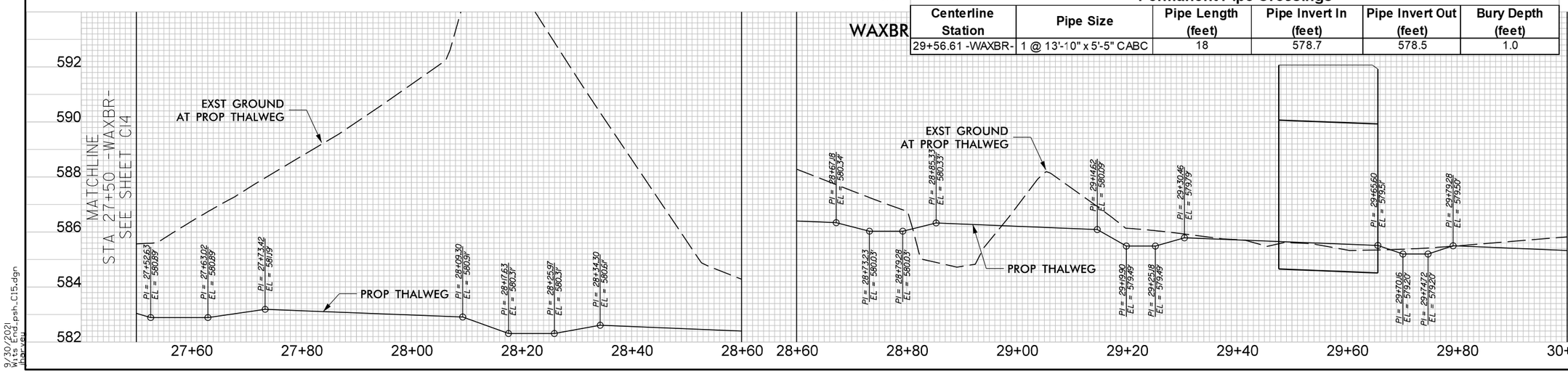
NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021
DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Permanent Pipe Crossings

Centerline Station	Pipe Size	Pipe Length (feet)	Pipe Invert In (feet)	Pipe Invert Out (feet)	Bury Depth (feet)
29+56.61 -WAXBR-	1 @ 13'-10" x 5'-5" CABC	18	578.7	578.5	1.0



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PH: (919) 852-1003
ENG FIRM LICENSE NO. C-0910

Axiom Environmental, Inc.

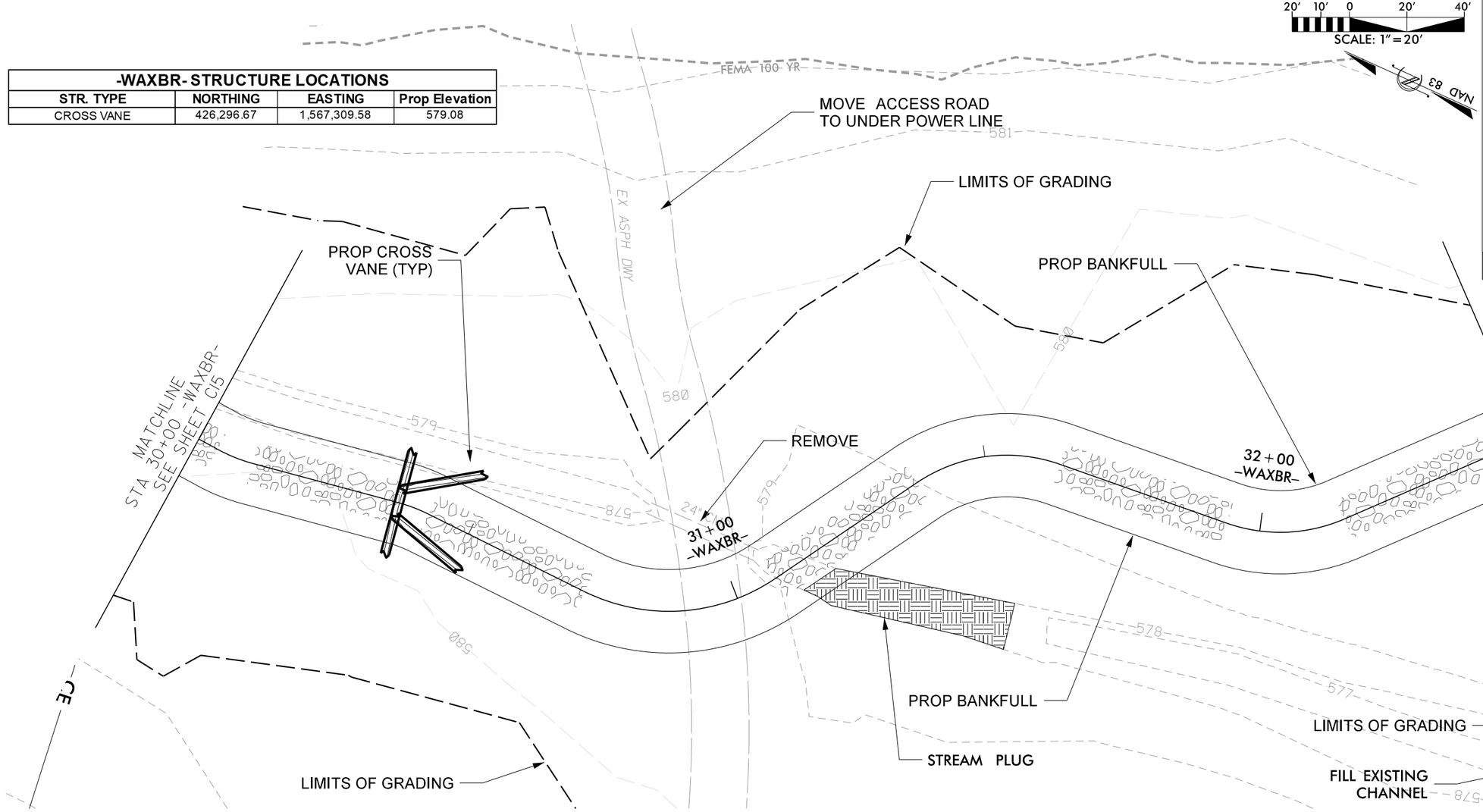
WITS END
UNION COUNTY, NC

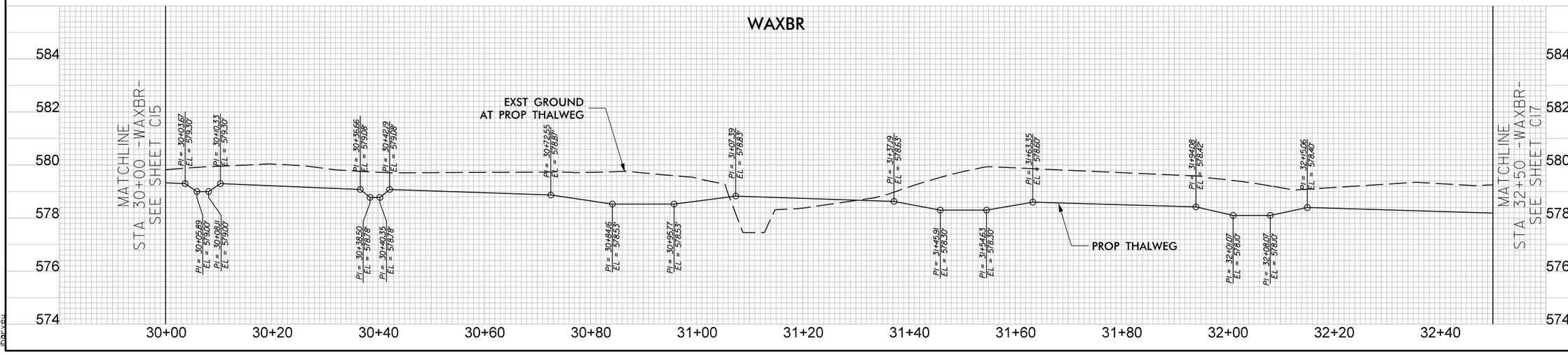
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C15
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C15

9/30/2021
Wits End psh_C15.dgn
jharvey

-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,296.67	1,567,309.58	579.08





DocuSigned by:
Joshua G Dalton
1080AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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PH: (919) 851-9985
ENG FIRM LICENSE NO. C-3590

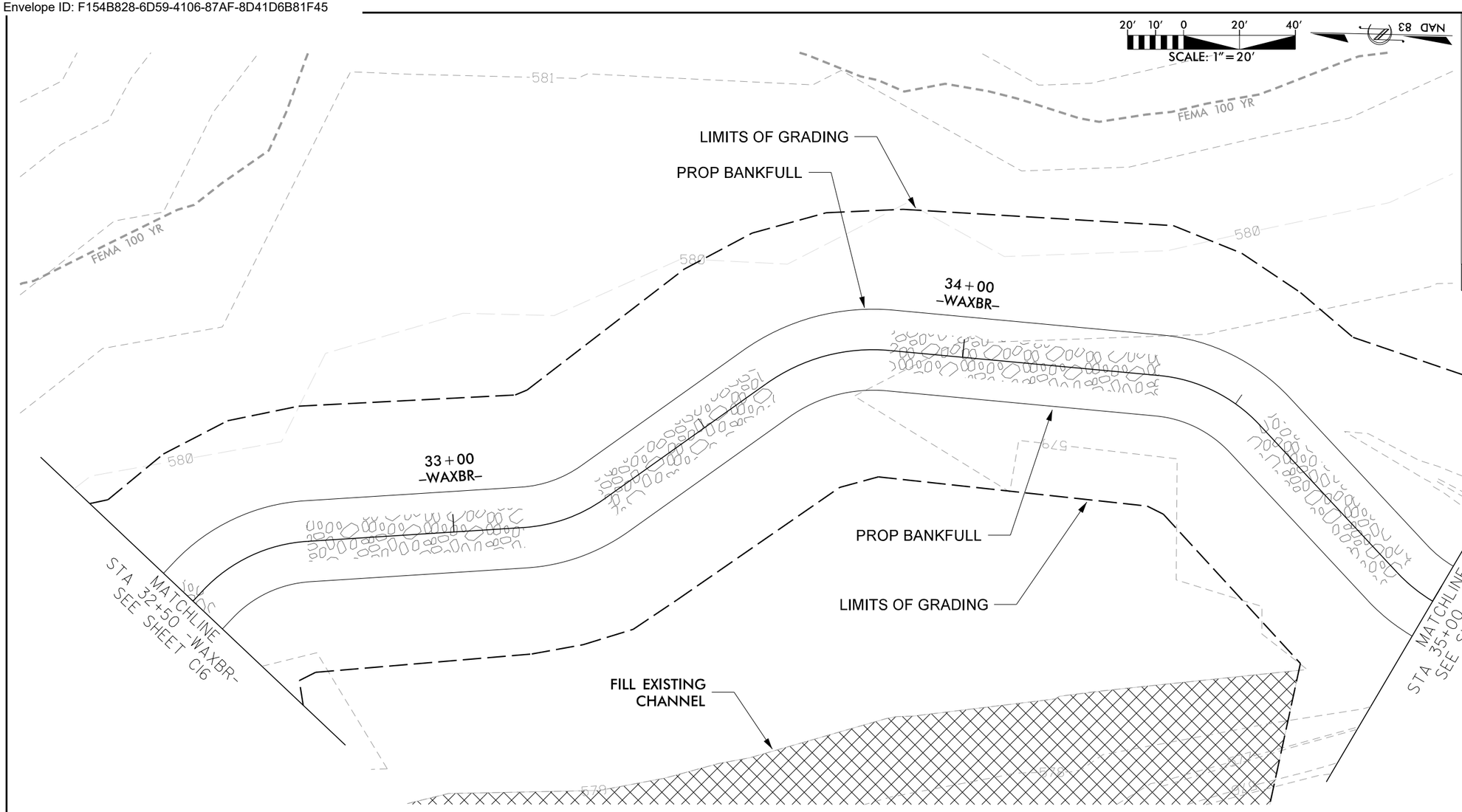
Axiom Environmental, Inc.

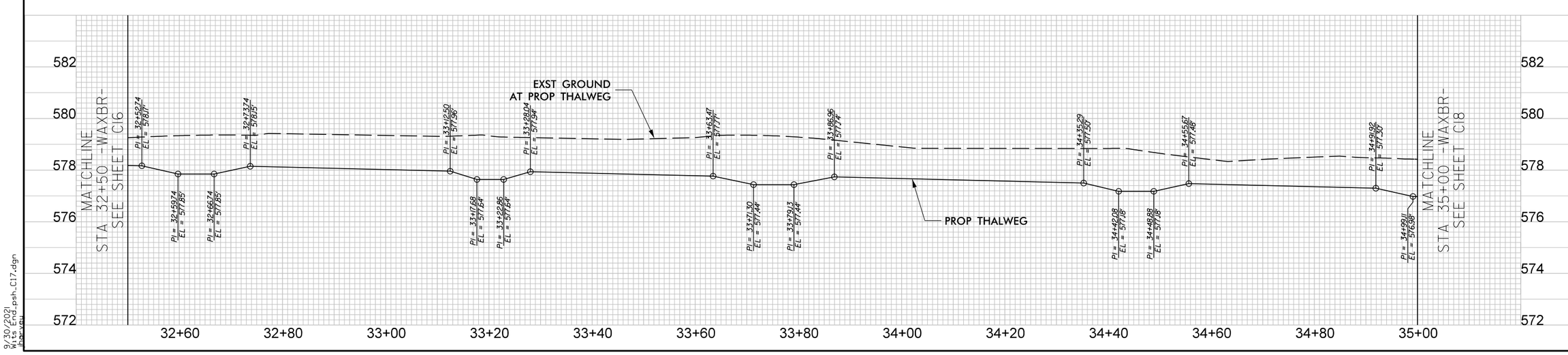
WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C16
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C16

9/30/2021
Wits End_psh_C16.dgn
Harvey





DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.859.1865
ENG FIRM LICENSE NO. C-3890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C17
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C17

9/30/2021
Wits End_psh_C17.dgn
jharvey

20' 10' 0 20' 40'
SCALE: 1" = 20'
NAD 83

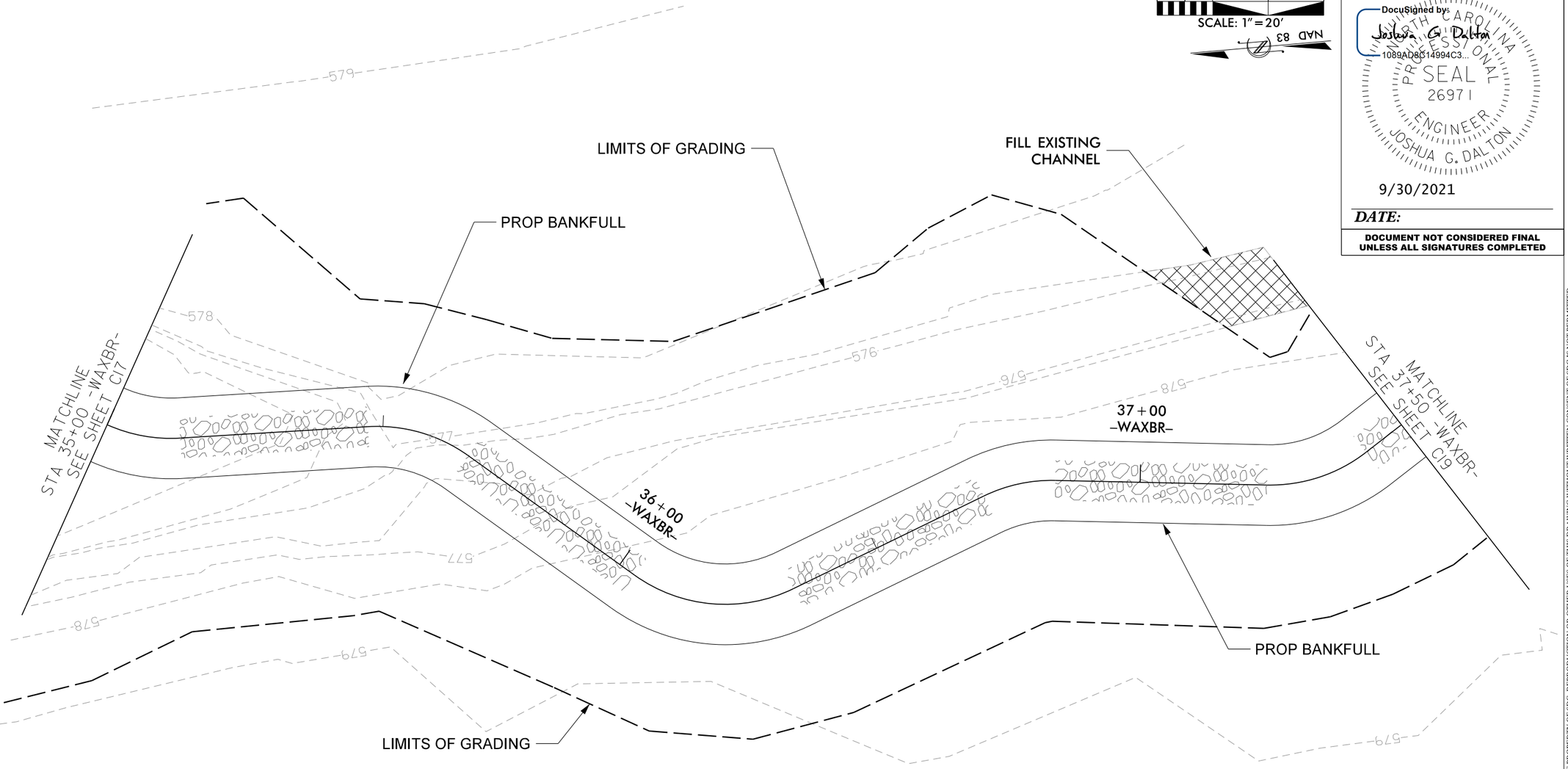
DocuSigned by:
Joshua G Dalton
1089AD8C14994C3...

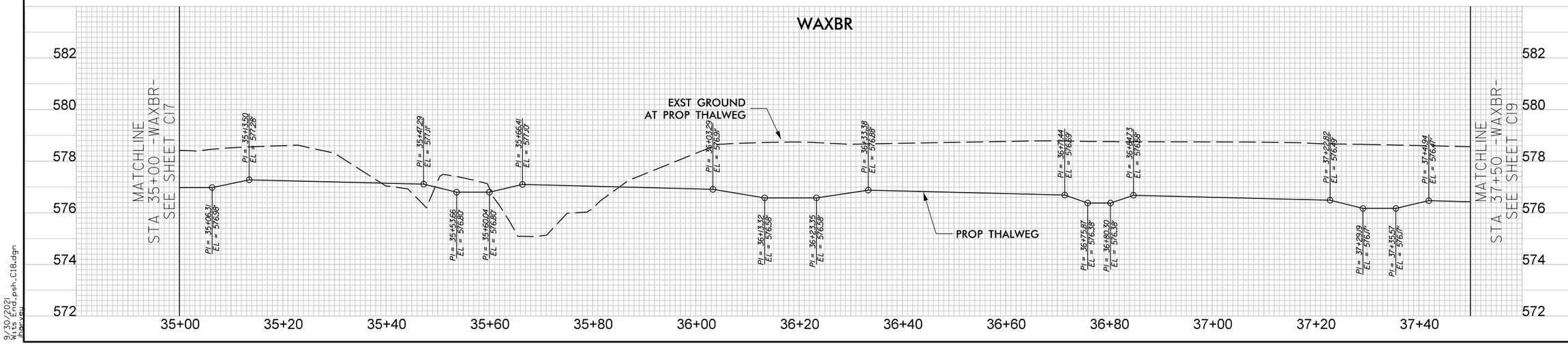
NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED





SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: 919.859.1353
ENG FIRM LICENSE NO. C-3590

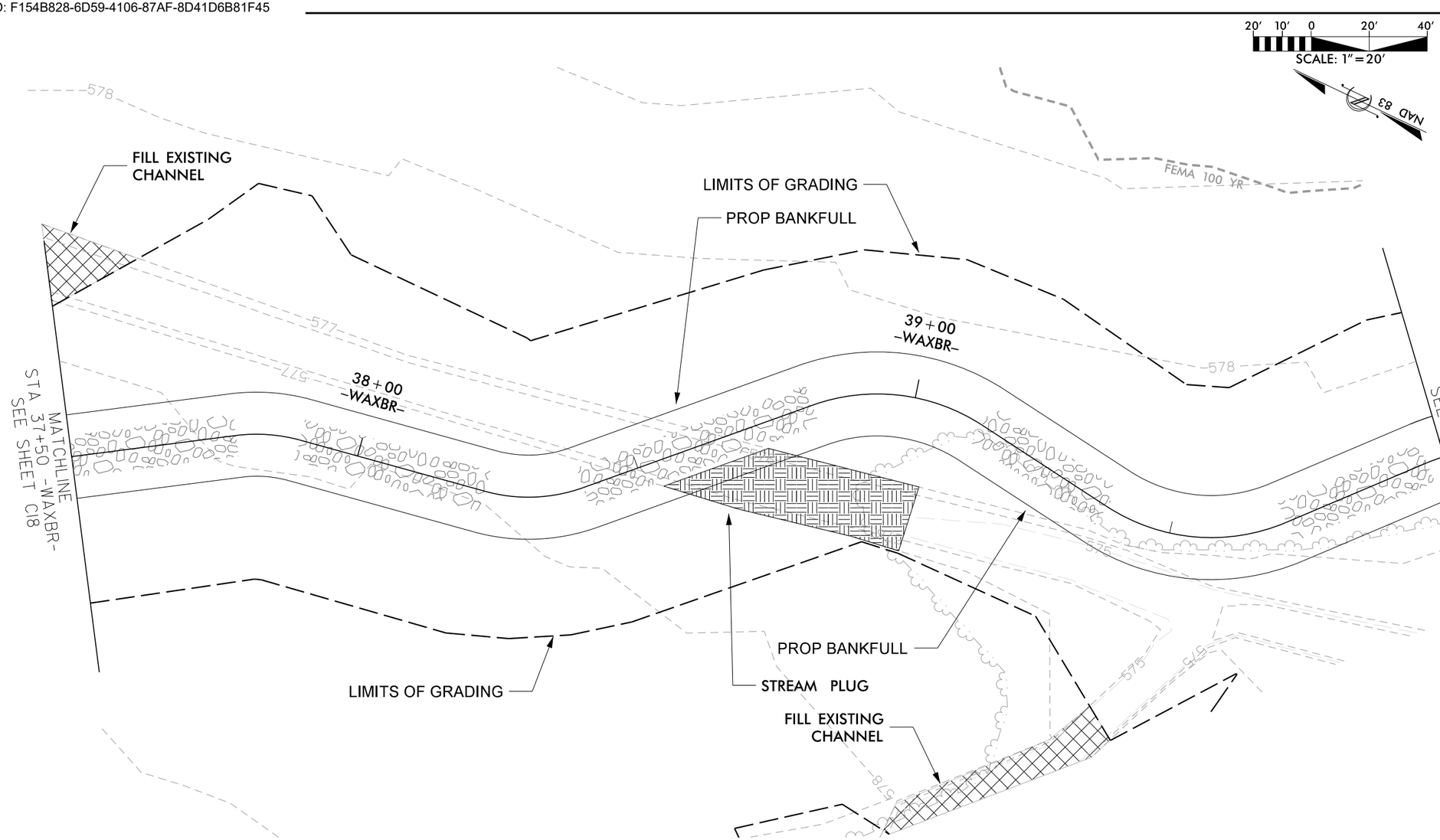
Axiom Environmental, Inc.

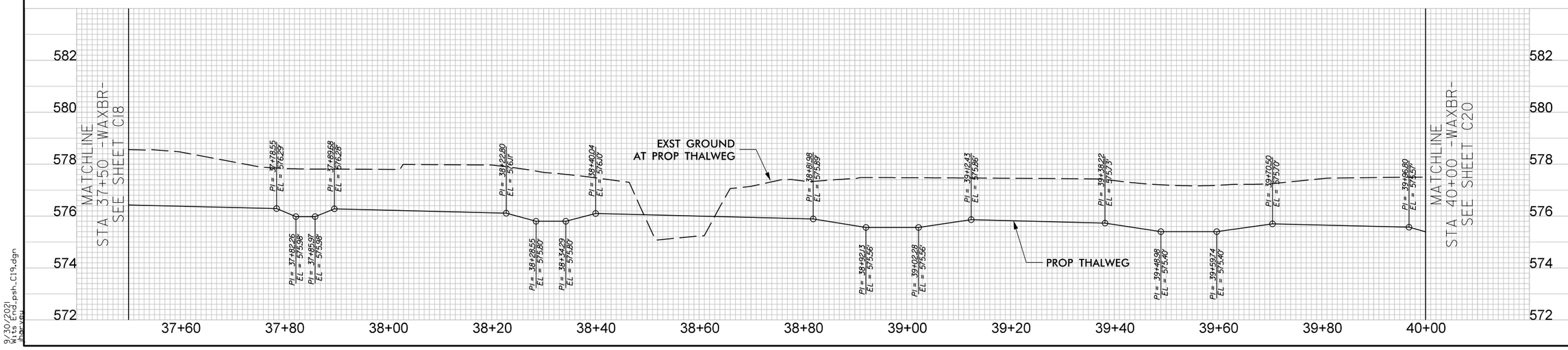
WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C18
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	***C18***

9/30/2021
Wits End_psh_C18.dgn
jgarrett





DocuSigned by:
Joshua G Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SUNGATE DESIGN GROUP, P.A.
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RALEIGH, NORTH CAROLINA 27606
TEL: 919.851.1865
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

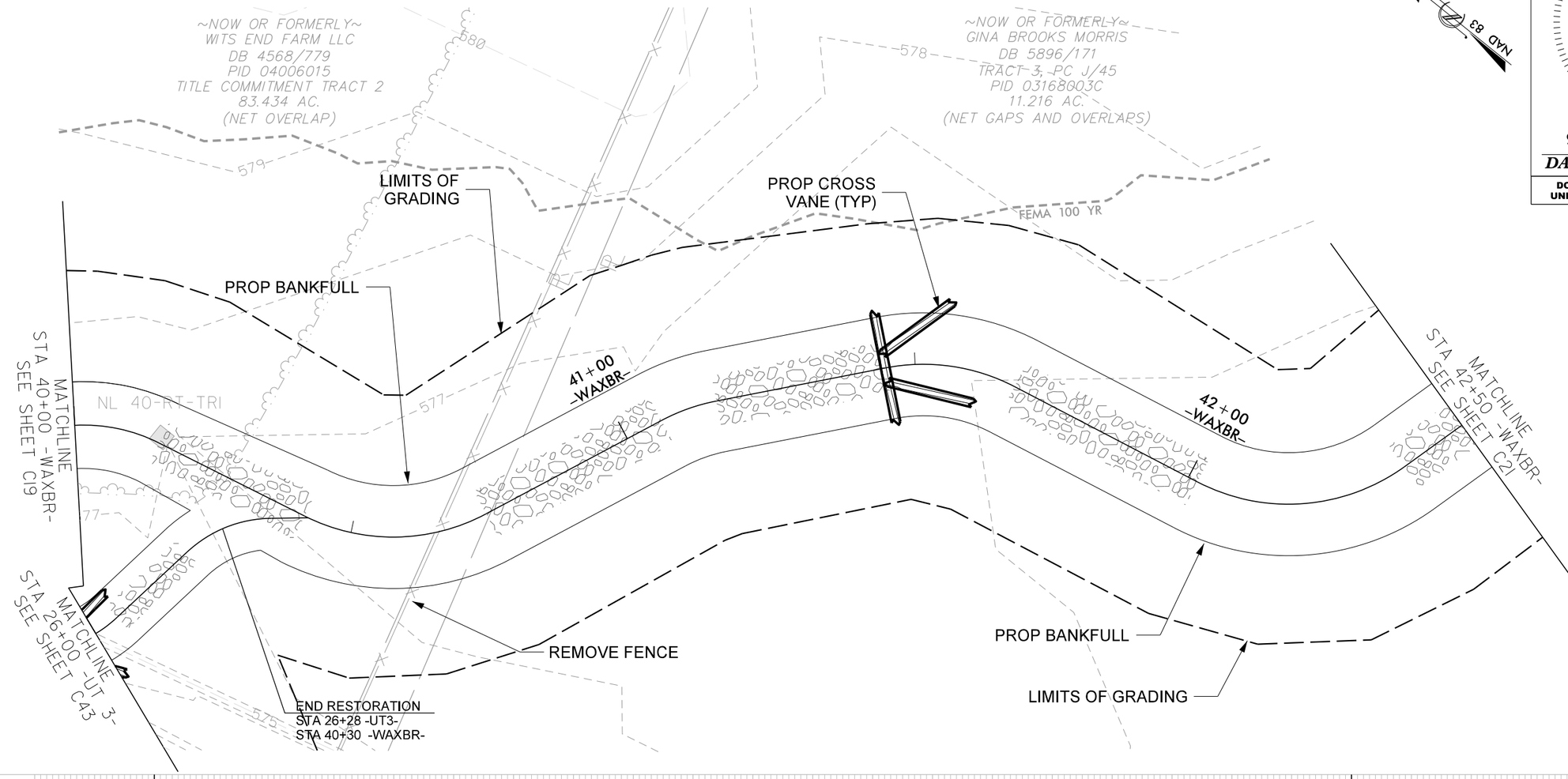
PLAN AND PROFILE

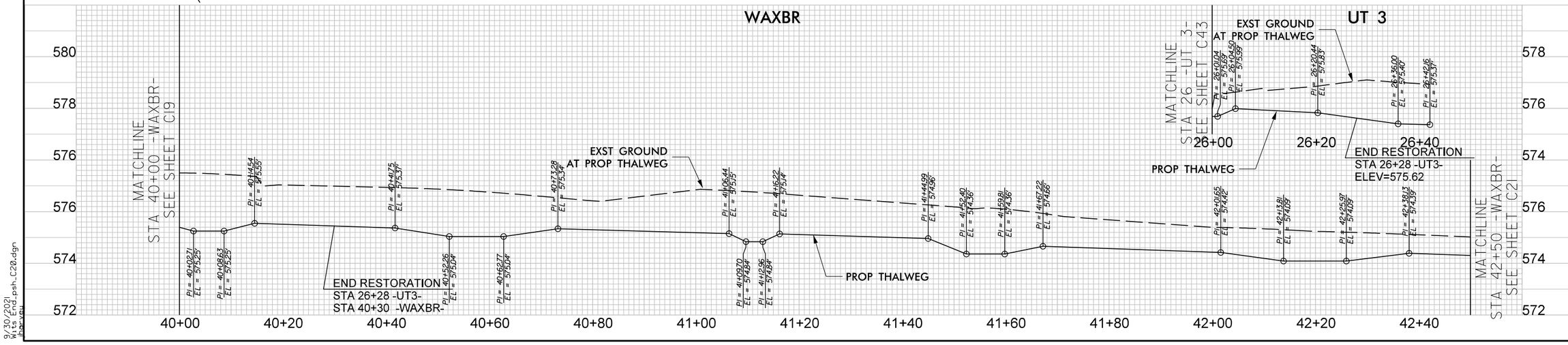
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C19
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. ***C19***

9/30/2021
Wits End_psh_C19.dgn
jharvell

-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	425,354.65	1,567,581.24	574.93





20' 10' 0 20' 40'
SCALE: 1" = 20'

NAD 83

DocuSigned by:
Joshua G. Dalton
10089A080414994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021
DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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RALEIGH, NORTH CAROLINA 27606
PH: 919.859.1353
ENG FIRM LICENSE NO. C-3890

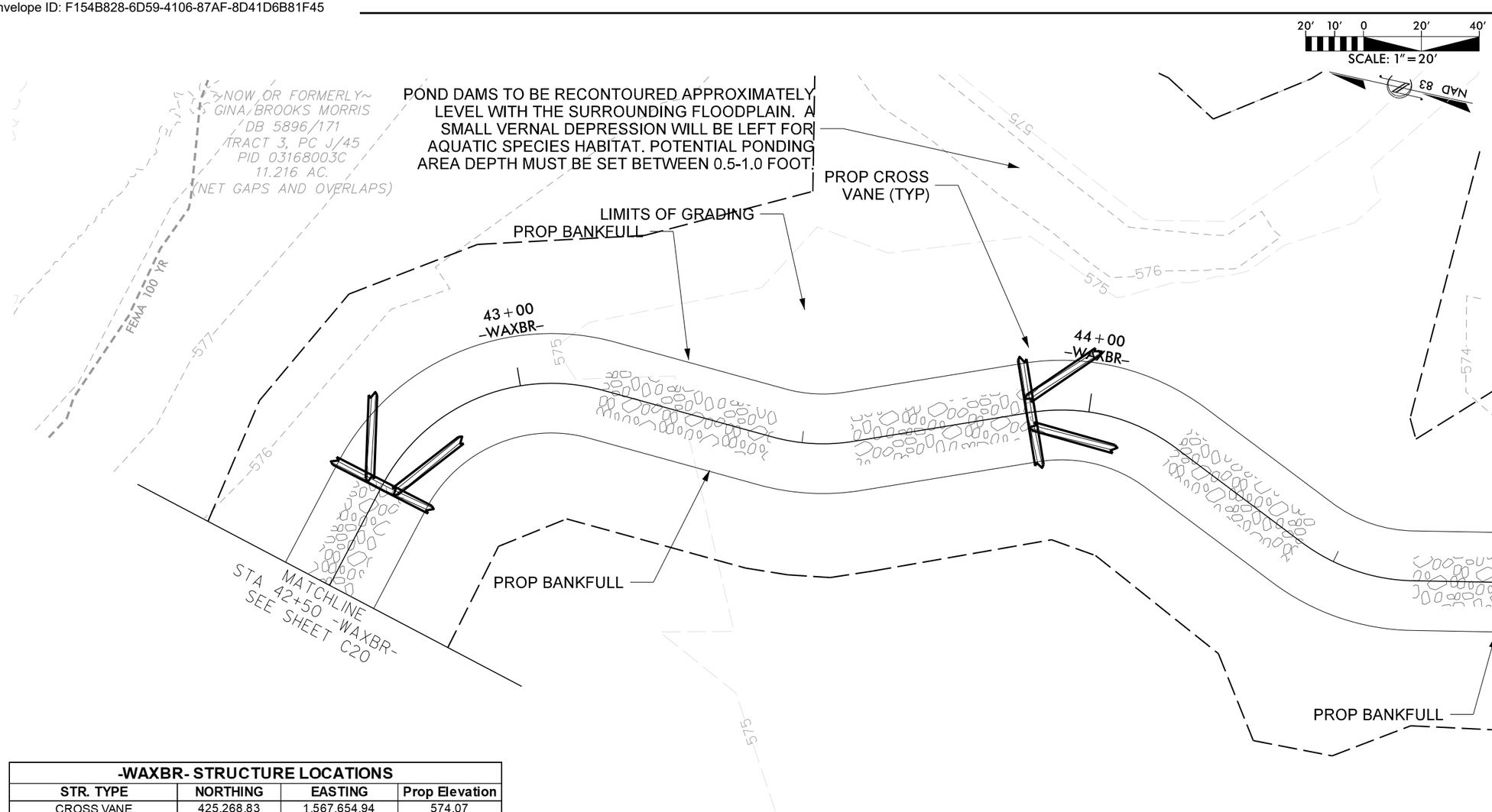
Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

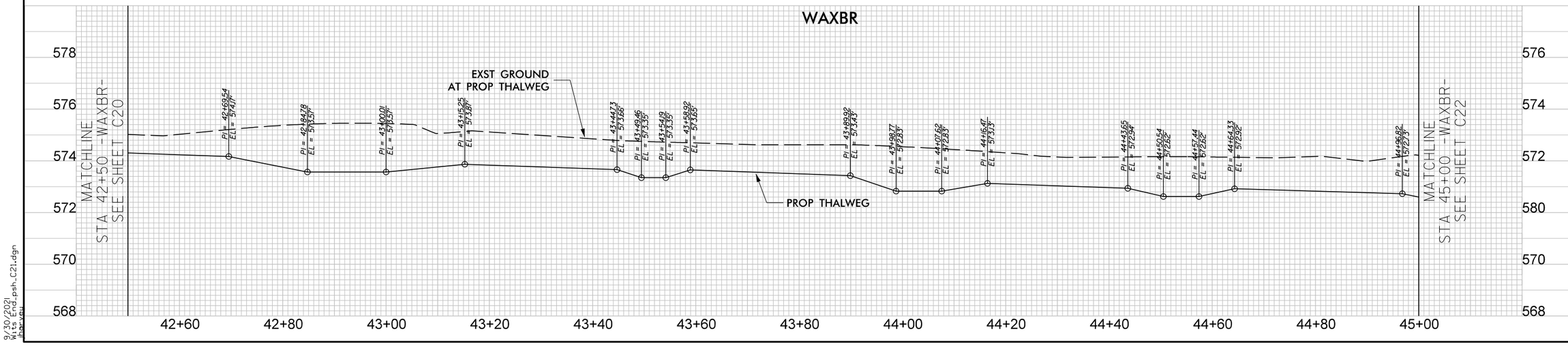
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C20
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C20

9/30/2021
Wits End_psh_C20.dgn
Harvey



-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	425,268.83	1,567,654.94	574.07
CROSS VANE	425,161.22	1,567,688.84	573.27



DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.851.1000
ENG FIRM LICENSE NO. C-950

Axiom Environmental, Inc.

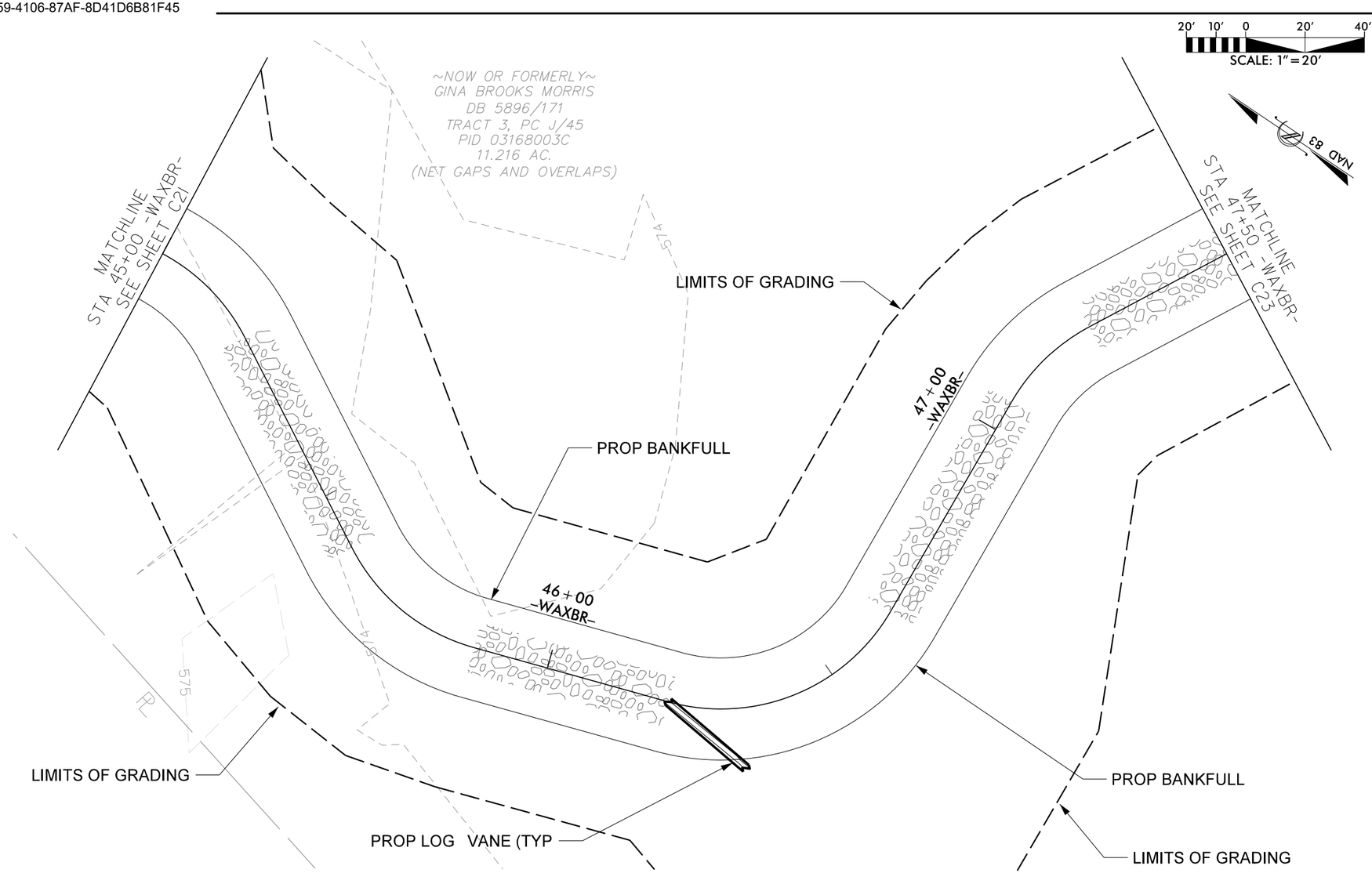
WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C21
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C21**

9/30/2021
Wits End_psh_C21.dgn
Harvey



DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

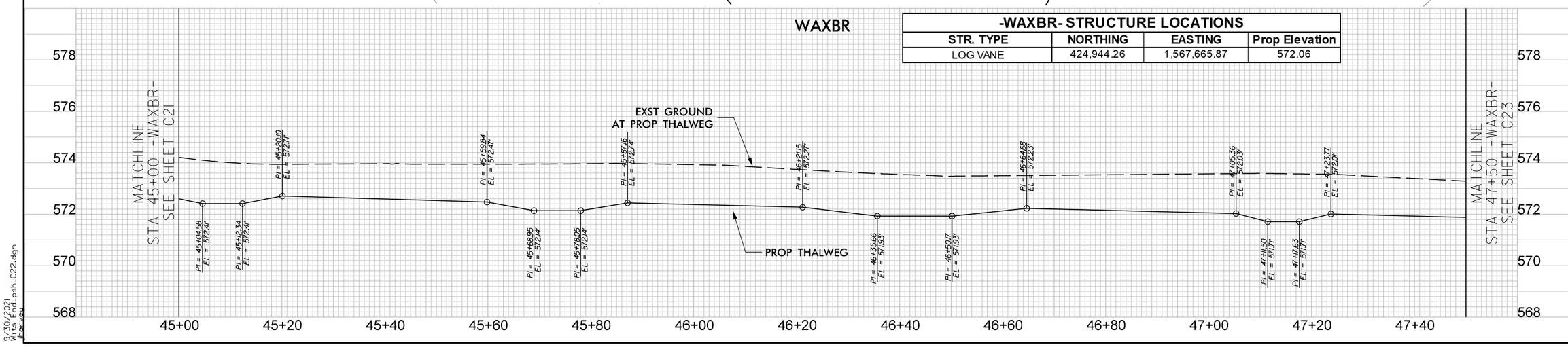
DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

WAXBR

-WAXBR- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Prop Elevation
LOG VANE	424,944.26	1,567,665.87	572.06



SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.851.1444
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C22
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. ***C22***

9/30/2021
Wits End_psh_C22.dgn
Jarvis

SCALE: 1" = 20'

NAD 83

DocuSigned by: Joshua G. Dalton 1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROP BANKFULL

LIMITS OF GRADING

48+00 -WAXBR-

49+00 -WAXBR-

PROP BANKFULL

LIMITS OF GRADING

MATCHLINE STA 47+50 -WAXBR- SEE SHEET C22

MATCHLINE STA 50+00 -WAXBR- SEE SHEET C24

~NOW OR FORMERLY~ BIBI MARIAM NIAZI-SAI REVOCABLE TRUST DB 7073/202 TRACT 4, PC J/45 PID 031680030

~NOW OR FORMERLY~ GINA BROOKS MORRIS DB 5896/171 TRACT 3, PC J/45 PID 03168003C 11.216 AC. (NET GAPS AND OVERLAPS)

EXST GROUND AT PROP THALWEG

PROP THALWEG

MATCHLINE STA 47+50 -WAXBR- SEE SHEET C22

MATCHLINE STA 50+00 -WAXBR- SEE SHEET C24

PI = 47+16.63 EL = 571.81

PI = 47+69.10 EL = 571.50

PI = 47+74.58 EL = 571.50

PI = 47+80.05 EL = 571.80

PI = 48+16.44 EL = 571.60

PI = 48+33.02 EL = 571.26

PI = 48+47.59 EL = 571.26

PI = 48+62.17 EL = 571.56

PI = 49+00.73 EL = 571.45

PI = 49+04.78 EL = 571.14

PI = 49+08.82 EL = 571.14

PI = 49+12.87 EL = 571.44

PI = 49+54.32 EL = 571.37

PI = 49+66.66 EL = 570.88

PI = 49+78.99 EL = 570.88

PI = 49+91.8 EL = 571.28

576 574 572 570 568 566

47+60 47+80 48+00 48+20 48+40 48+60 48+80 49+00 49+20 49+40 49+60 49+80 50+00

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-0515
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

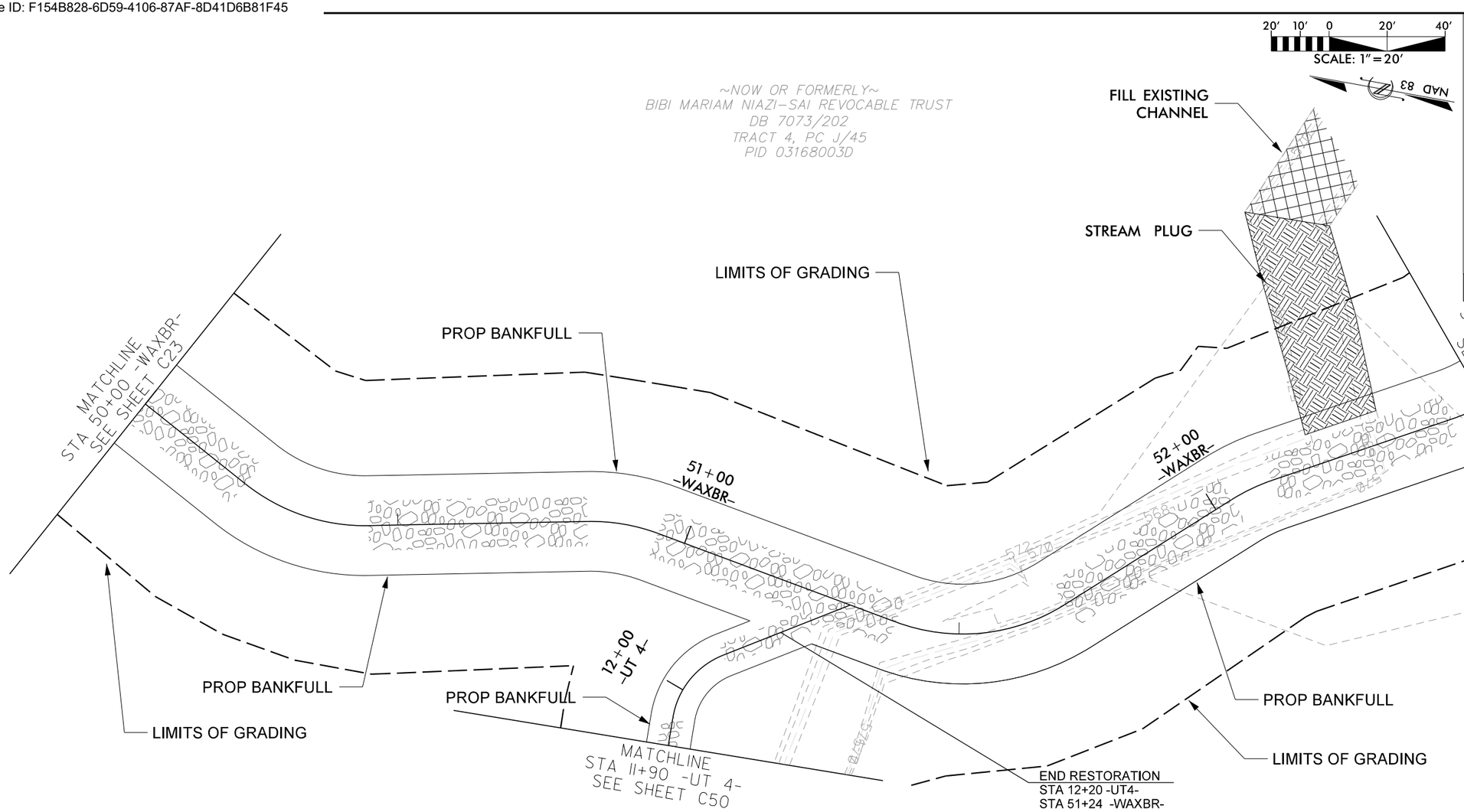
WITS END
UNION COUNTY, NC

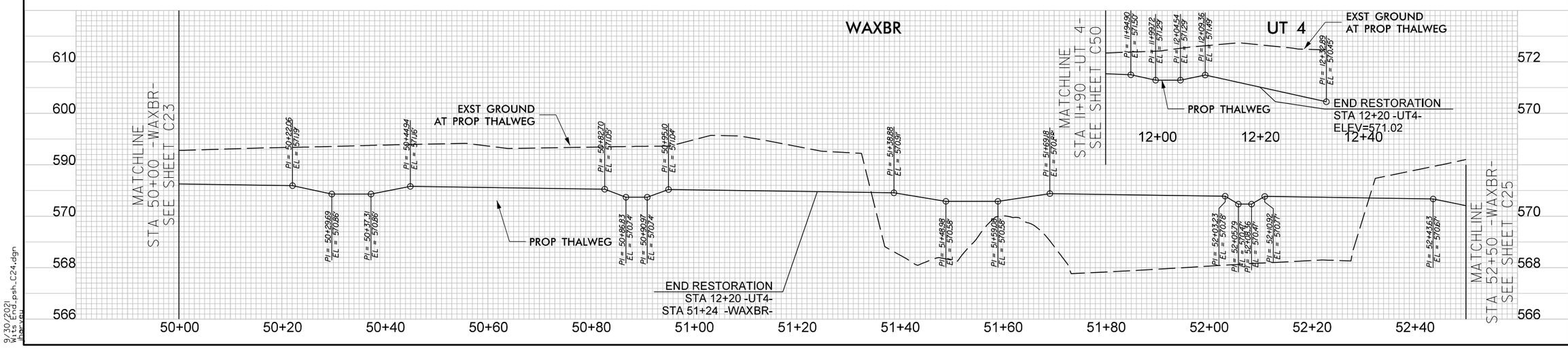
PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C23
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C23**

9/30/2021
Wits End_psh_C23.dgn
Harveg





DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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ENG FIRM LICENSE NO. C-3590

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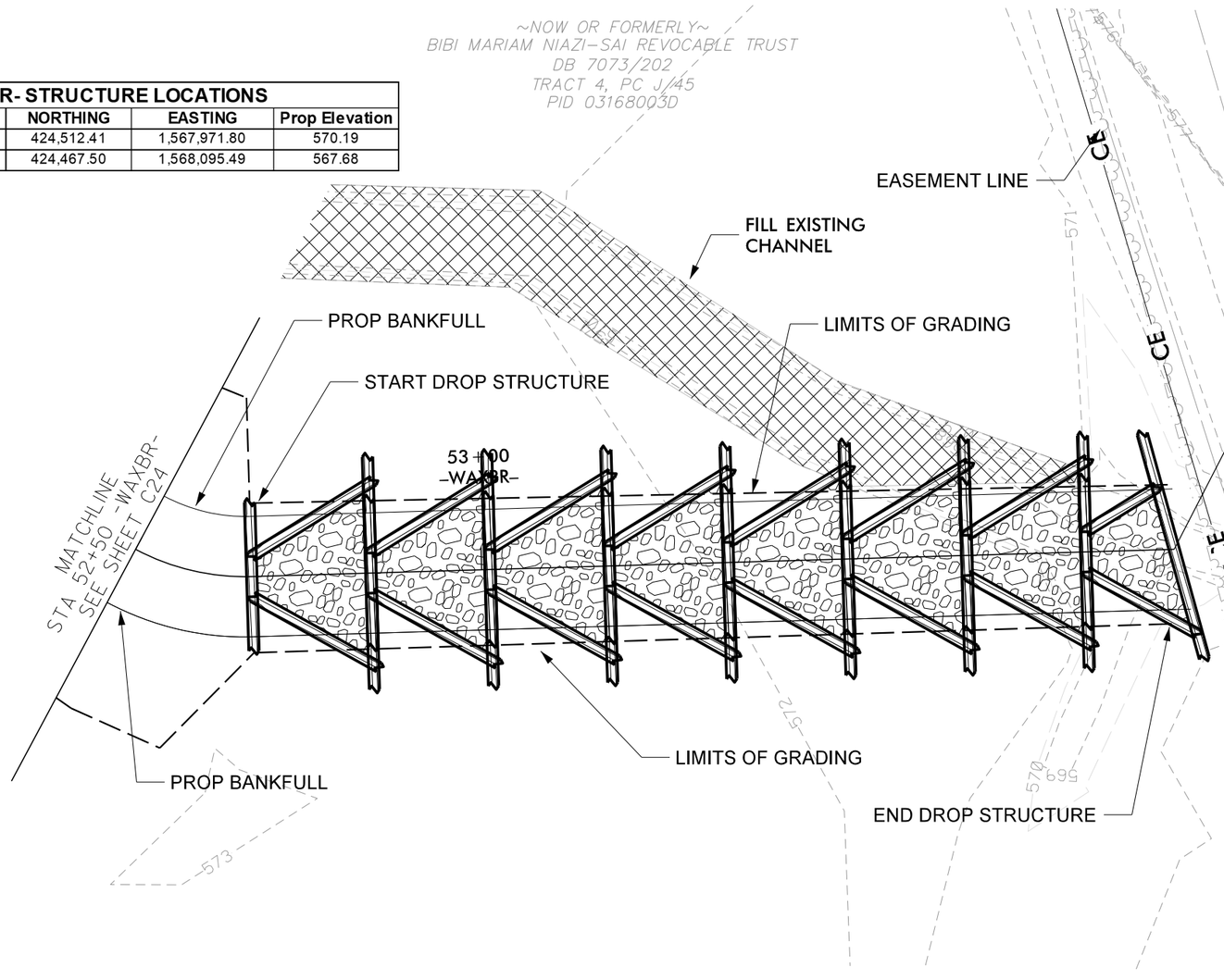
WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C24
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C24

9/30/2021
Wits End_psh_C24.dgn
Jrharvell

-WAXBR- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
DROP STRUCTURE	424,512.41	1,567,971.80	570.19
DROP STRUCTURE	424,467.50	1,568,095.49	567.68



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Joshua G. Dalton
T089ADBC14994C3...

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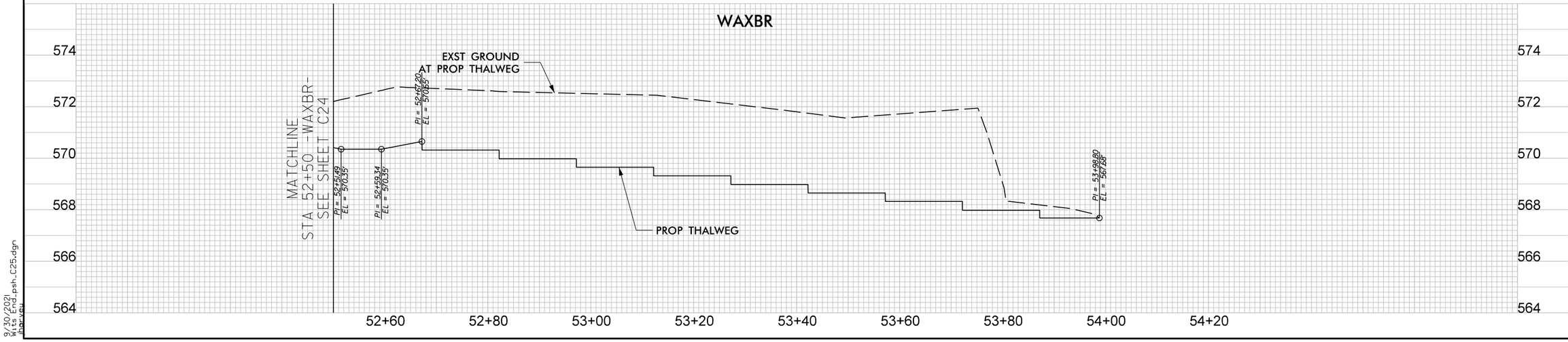

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WITS END
UNION COUNTY, NC

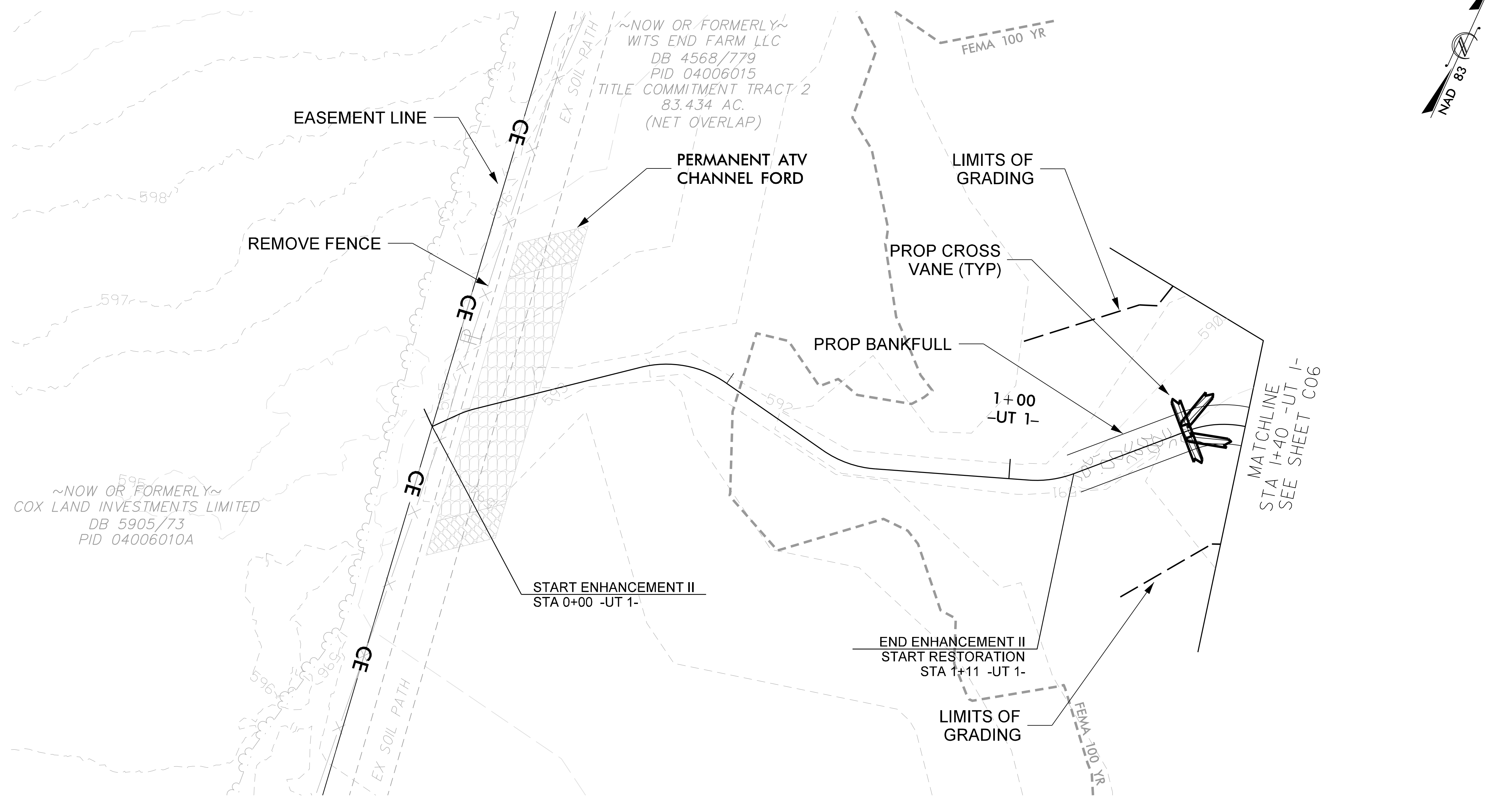
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C25
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C25

9/30/2021
Wits End_psh_C25.dgn
jharvell

-UT 1- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	428,061.74	1,566,506.76	589.73



DocuSigned by:
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1089AD8C14994C3...

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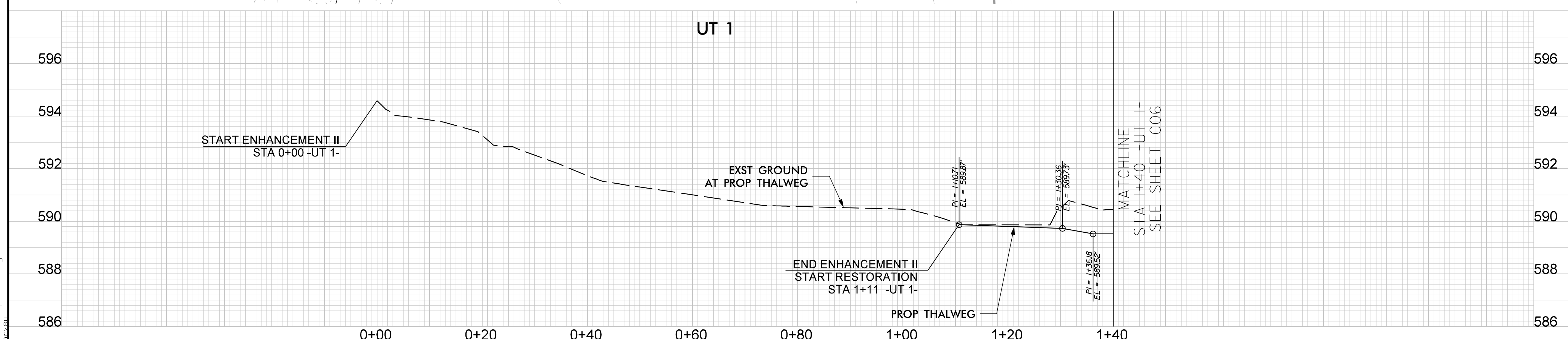

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Wits_End_psh_C26.dgn

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WITS END
UNION COUNTY, NC
PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C26
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C26**

SCALE: 1" = 20'

NAD 83

~NOW OR FORMERLY~
ROGER L JAMES
CYNTHIA L JAMES
BK 4460 PG 790
PID 03168004A

EASEMENT LINE

CE

PL (GIS)

LIMITS OF GRADING

PROP BANKFULL

1+00 -UT 2-

2+00 -UT 2-

MATCHLINE STA 2+50 -UT 2- SEE SHEET C28

START RESTORATION STA 0+00 -UT 2-

LIMITS OF GRADING

PROP BANKFULL

~NOW OR FORMERLY~
MAX SHELTON BROOKS
SARAH S BROOKS
NO DEED LISTED
PID 03168004

EASEMENT LINE

UT 2

EXST GROUND AT PROP THALWEG

PROP THALWEG

START RESTORATION STA 0+00 -UT 2-

MATCHLINE STA 2+50 -UT 2- SEE SHEET C28

PI = 0+00.00 EL = 595.26
PI = 0+19.43 EL = 594.85
PI = 0+21.77 EL = 595.15
PI = 0+21.10 EL = 594.85
PI = 0+22.76 EL = 595.15
PI = 0+38.34 EL = 595.06
PI = 0+40.16 EL = 594.75
PI = 0+41.99 EL = 594.75
PI = 0+43.81 EL = 595.05
PI = 0+59.24 EL = 594.96
PI = 0+61.09 EL = 594.65
PI = 0+63.34 EL = 594.65
PI = 0+65.39 EL = 594.95
PI = 0+80.50 EL = 594.86
PI = 0+83.27 EL = 594.55
PI = 0+86.05 EL = 594.55
PI = 0+88.82 EL = 594.85
PI = 1+04.89 EL = 594.76
PI = 1+08.02 EL = 594.45
PI = 1+11.14 EL = 594.45
PI = 1+14.27 EL = 594.75
PI = 1+29.72 EL = 594.66
PI = 1+32.82 EL = 594.35
PI = 1+35.93 EL = 594.35
PI = 1+39.03 EL = 594.65
PI = 1+54.78 EL = 594.55
PI = 1+58.06 EL = 594.24
PI = 1+61.35 EL = 594.24
PI = 1+64.63 EL = 594.54
PI = 1+79.09 EL = 594.46
PI = 1+82.75 EL = 594.15
PI = 1+86.42 EL = 594.15
PI = 1+90.08 EL = 594.45
PI = 2+01.94 EL = 594.35
PI = 2+05.67 EL = 594.04
PI = 2+09.41 EL = 594.04
PI = 2+13.14 EL = 594.34
PI = 2+28.13 EL = 594.19
PI = 2+31.64 EL = 593.88
PI = 2+35.15 EL = 593.88
PI = 2+38.66 EL = 594.08

600 598 596 594 592 590

0 20 40 60 80 1+00 1+20 1+40 1+60 1+80 2+00 2+20 2+40

20' 10' 0 20' 40'

DocuSigned by:
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1089AD8C14994C3...

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WITS END
UNION COUNTY, NC

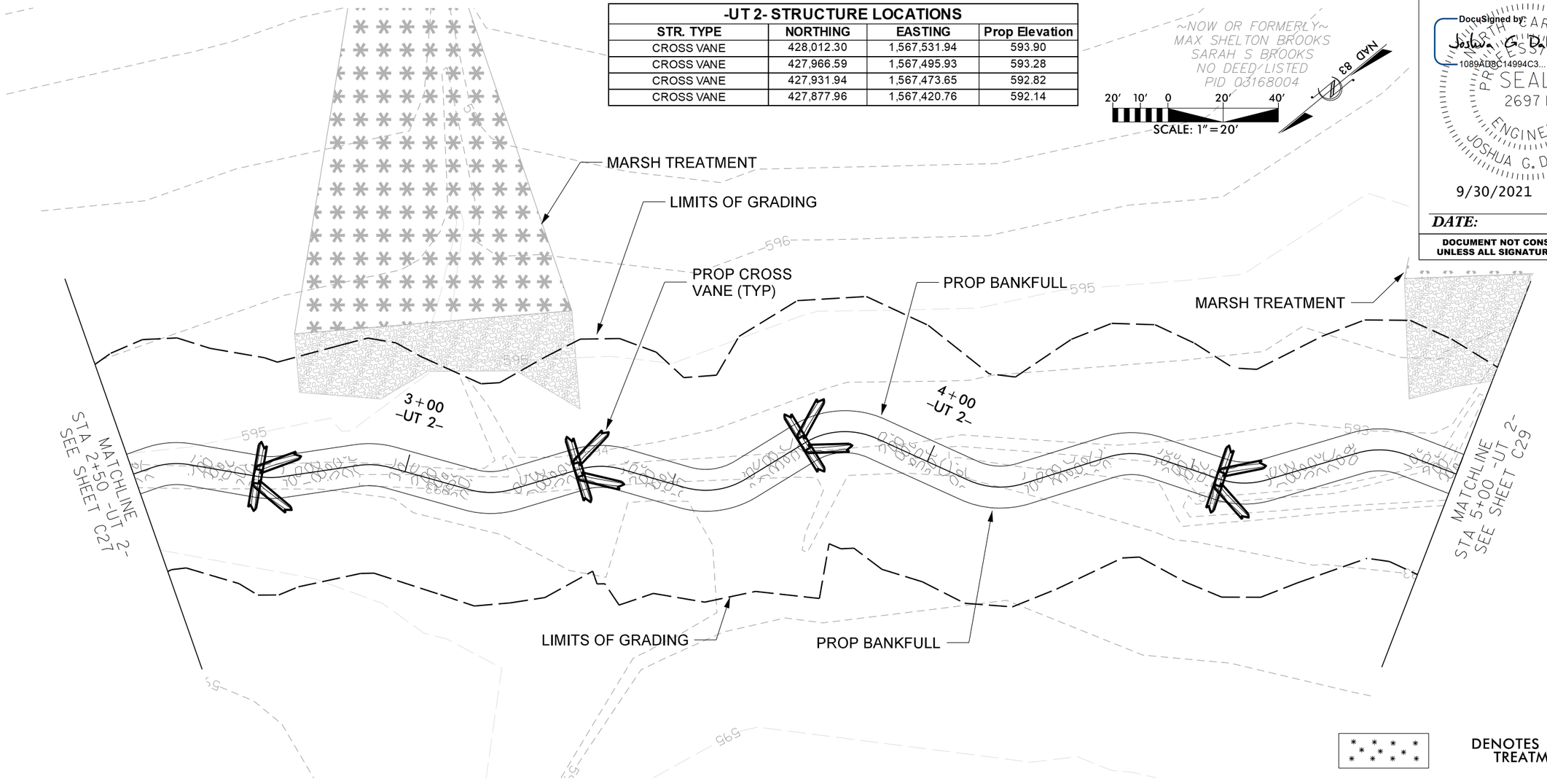
PLAN AND PROFILE

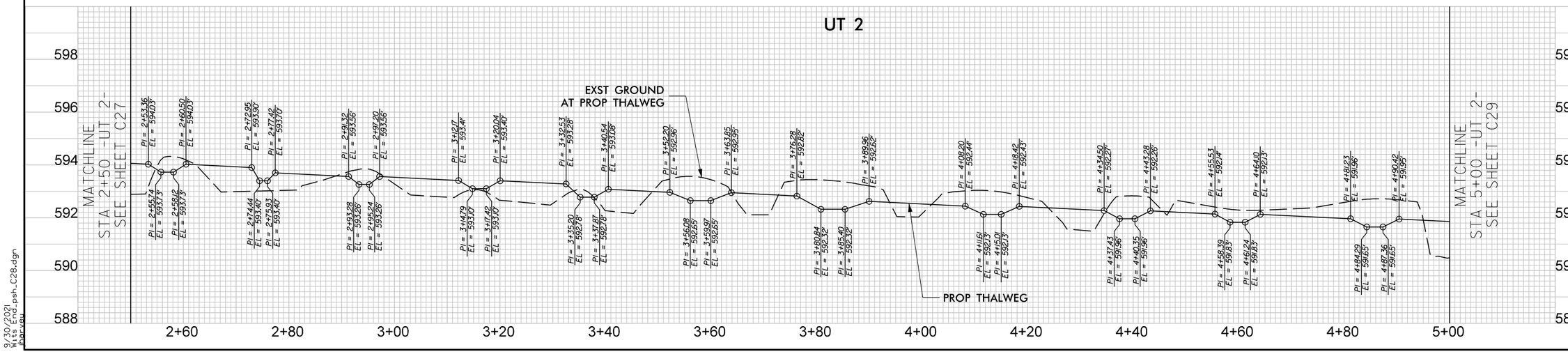
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C27
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C27**

9/30/2021
Wits End_psh_C27.dgn
jharvey

-UT 2- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	428,012.30	1,567,531.94	593.90
CROSS VANE	427,966.59	1,567,495.93	593.28
CROSS VANE	427,931.94	1,567,473.65	592.82
CROSS VANE	427,877.96	1,567,420.76	592.14





DocuSigned by: Joshua G. Dalton 1089AD8C14994C3...

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9/30/2021

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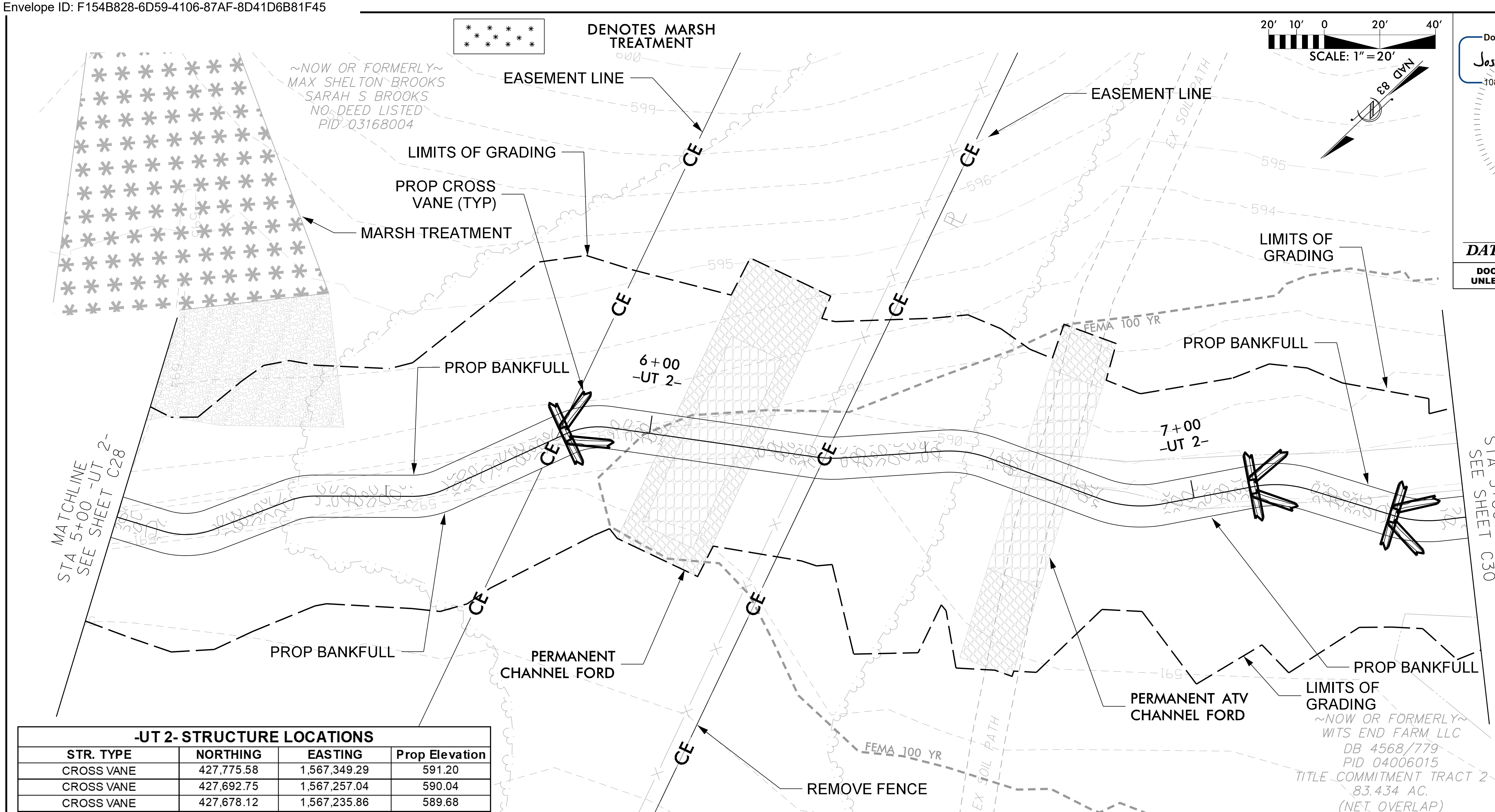
WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C28
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

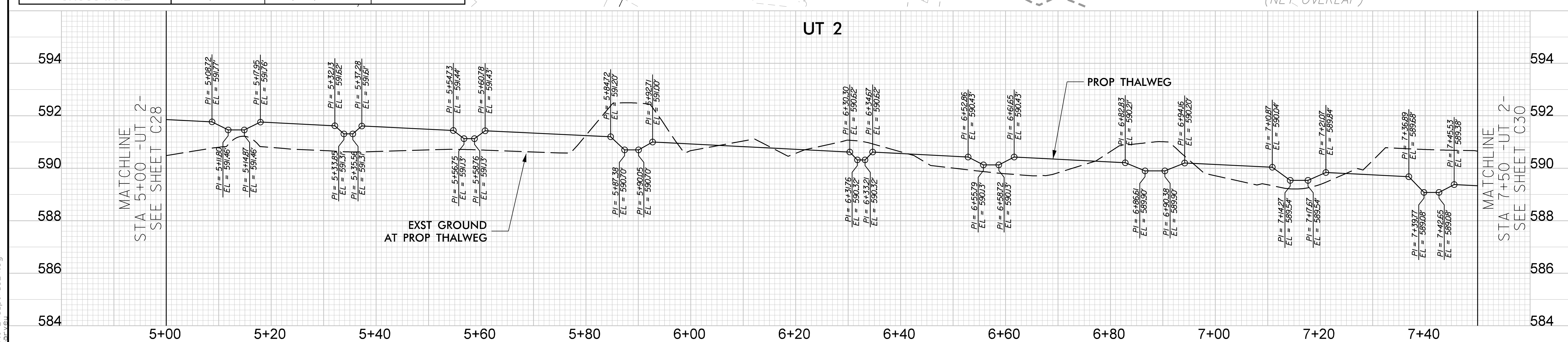
SHEET NO. **C28**

9/30/2021
Wits End_psh_C28.dgn
Parker



-UT 2- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	427,775.58	1,567,349.29	591.20
CROSS VANE	427,692.75	1,567,257.04	590.04
CROSS VANE	427,678.12	1,567,235.86	589.68



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9/30/2021

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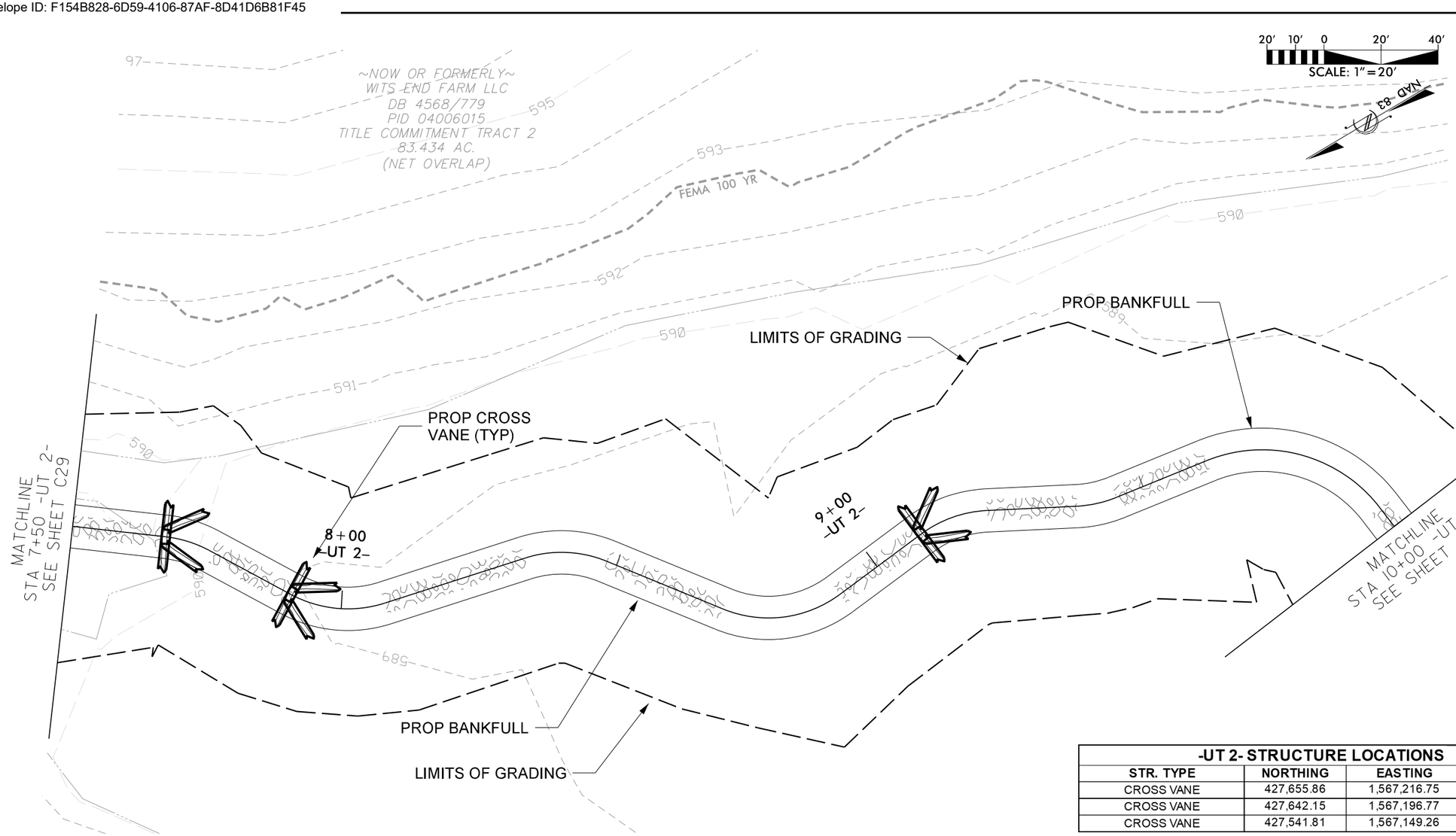
WITS END
UNION COUNTY, NC

PLAN AND PROFILE

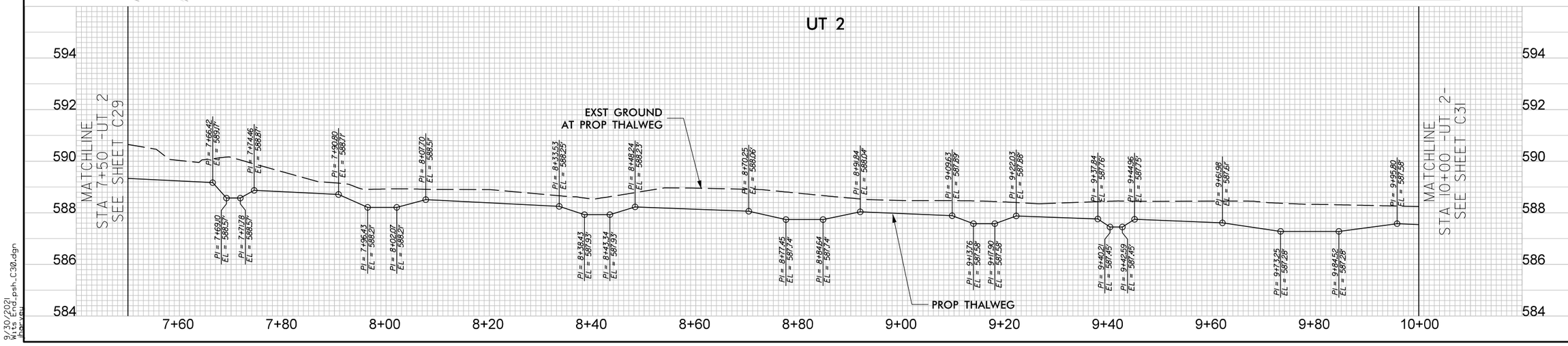
PROJECT #: 1221-20024
DRAWING NAME: WITS END PSH C29
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. C29

9/30/2021 Wits_End_psh_C29.dgn



-UT 2- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	427,655.86	1,567,216.75	589.17
CROSS VANE	427,642.15	1,567,196.77	588.71
CROSS VANE	427,541.81	1,567,149.26	587.89



DocuSigned by: Joshua G. Dalton
1089AD8C14994C3...

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9/30/2021

DATE:

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WITS END
UNION COUNTY, NC

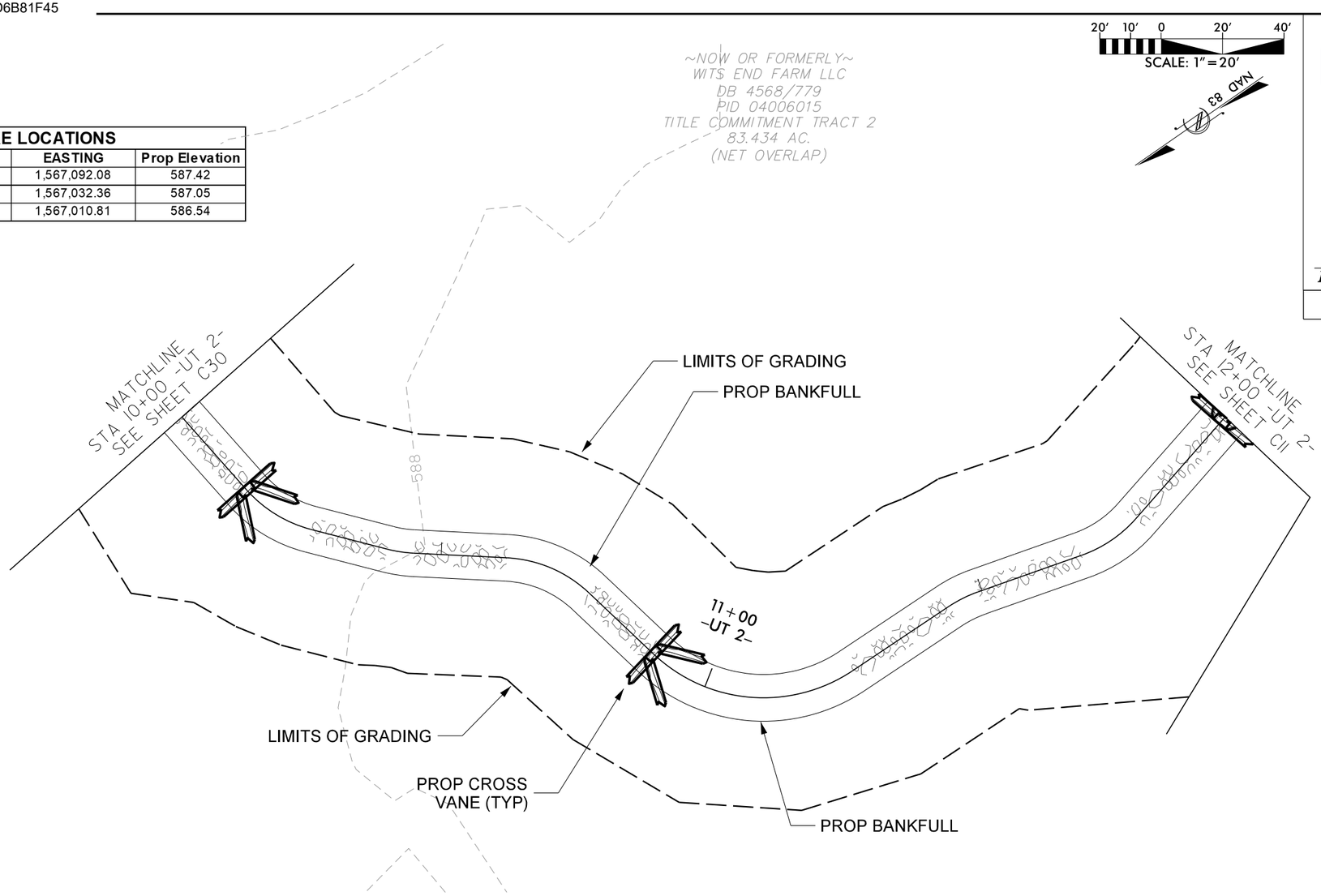
PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C30
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C30**

9/30/2021
Wits End_psh_C30.dgn
jharvell

-UT 2- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	427,468.01	1,567,092.08	587.42
CROSS VANE	427,428.83	1,567,032.36	587.05
CROSS VANE	427,331.14	1,567,010.81	586.54



DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

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9/30/2021

DATE:

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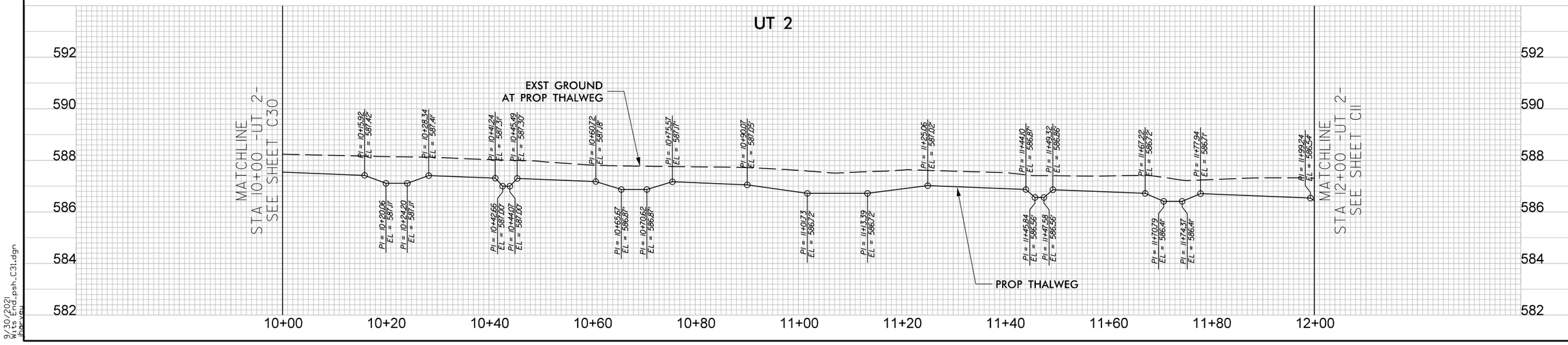

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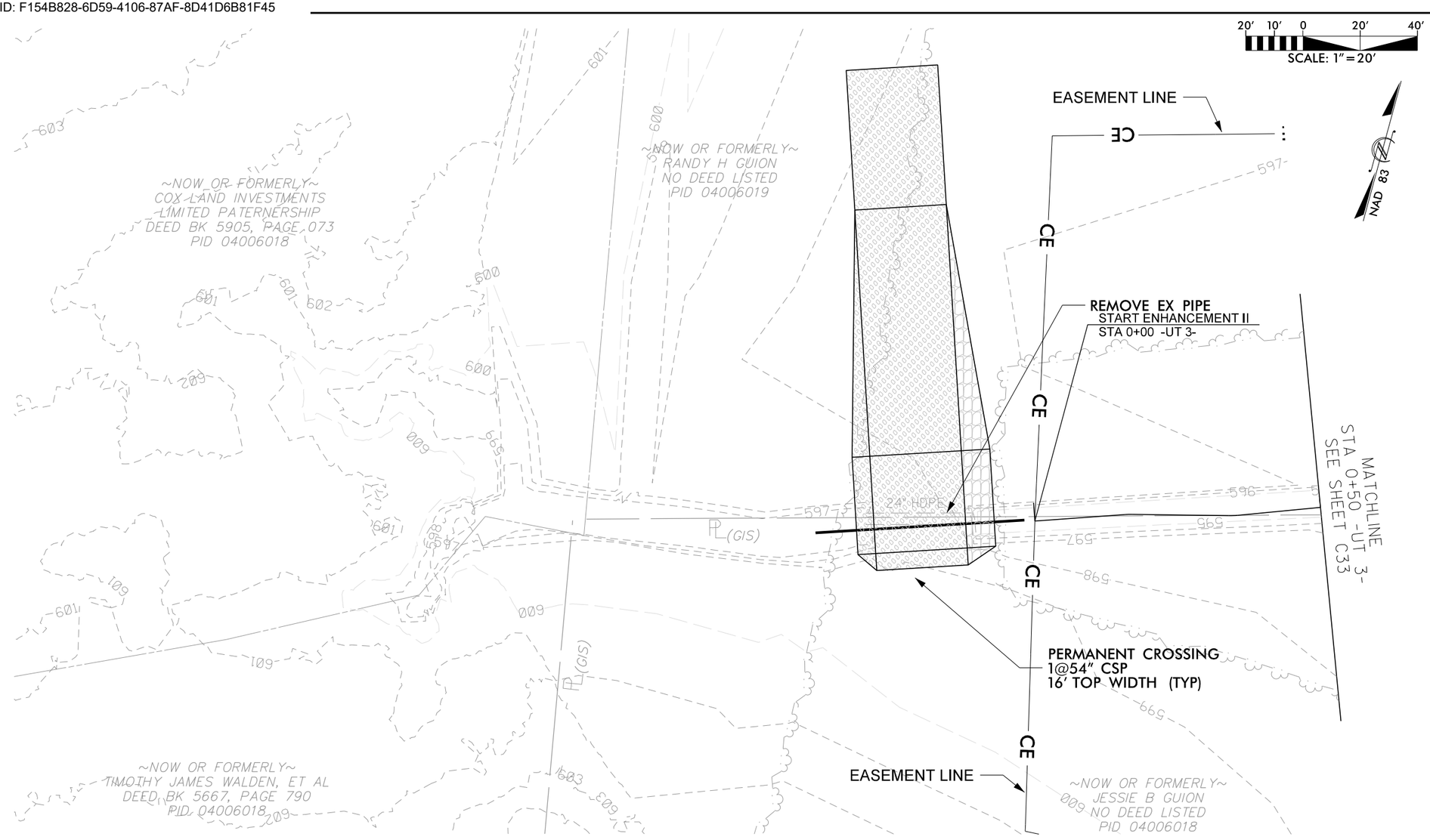
WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C31
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	***C31***

9/30/2021
Wits End_psh_C31.dgn
Harvey



DocuSigned by:
Joshua G. Dalton
1089AD8C14994C6...

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9/30/2021

DATE:

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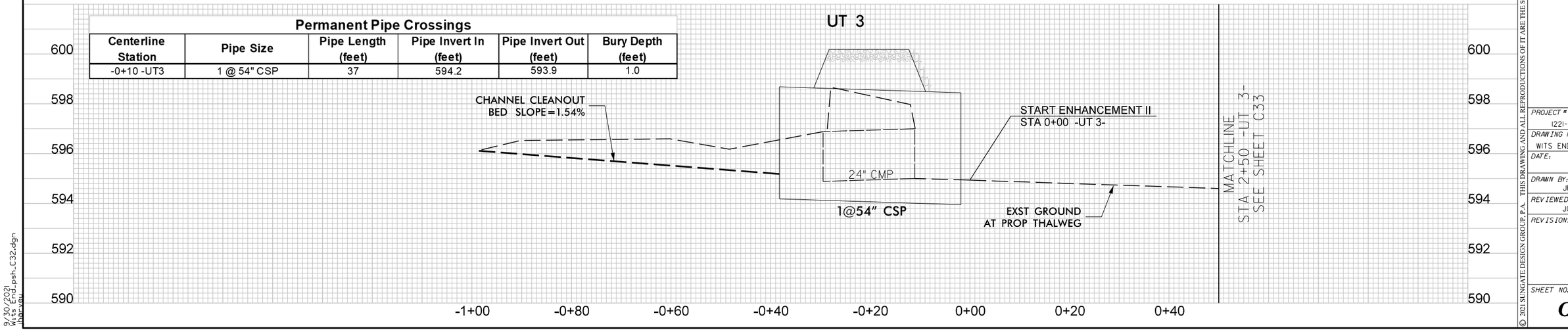
Permanent Pipe Crossings

Centerline Station	Pipe Size	Pipe Length (feet)	Pipe Invert In (feet)	Pipe Invert Out (feet)	Bury Depth (feet)
-0+10 -UT3	1 @ 54" CSP	37	594.2	593.9	1.0



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ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

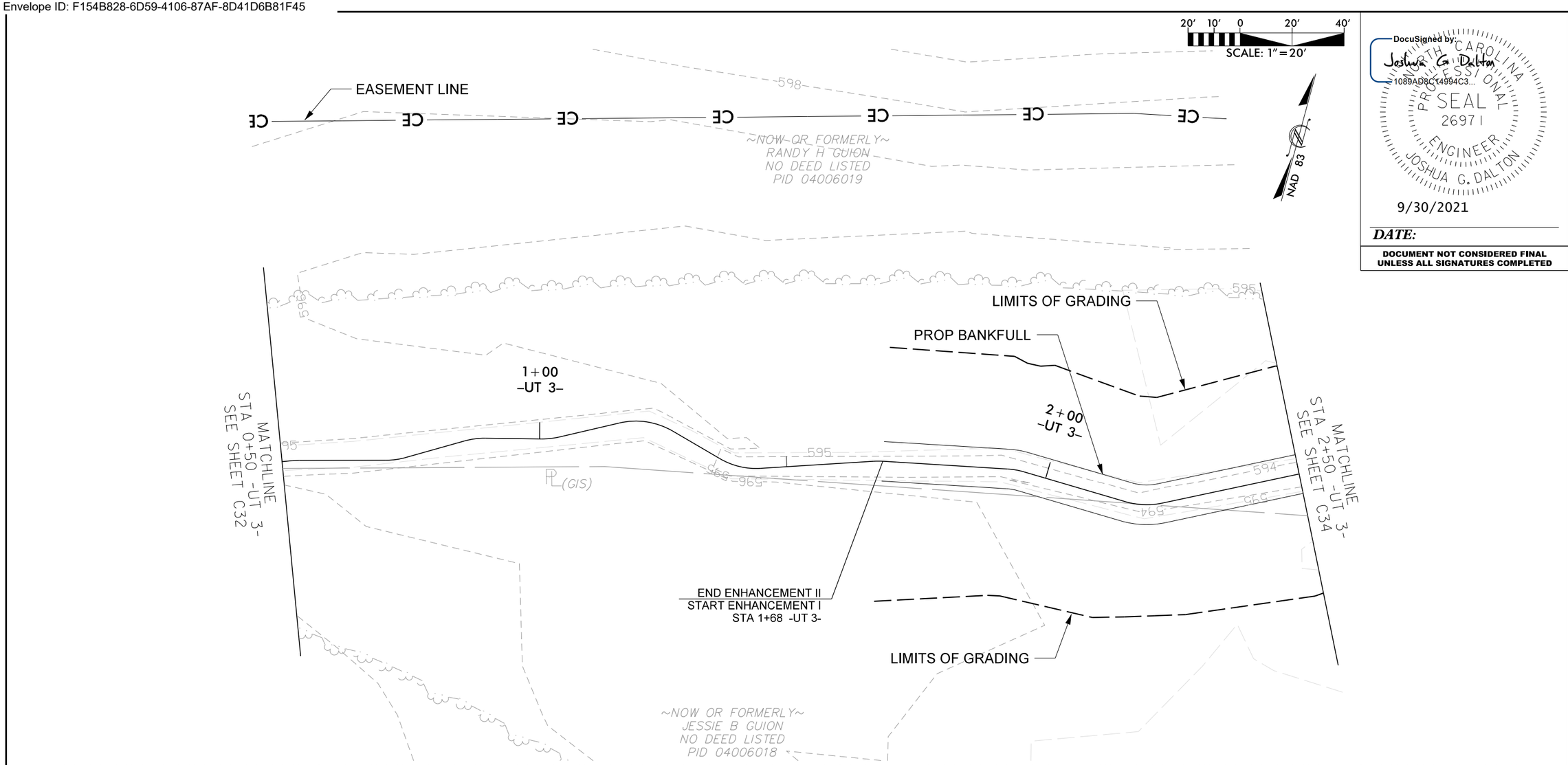
WITS END
UNION COUNTY, NC

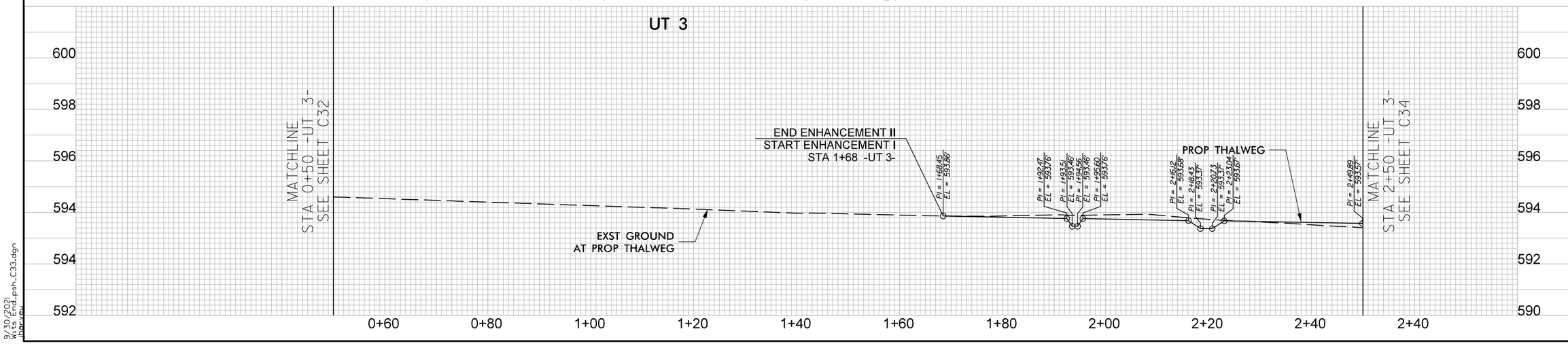
PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C32
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. ***C32***

9/30/2021
Wits End_psh_C32.dgn
Default





DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA
PROFESSIONAL
SEAL
26971
ENGINEER
JOSHUA G. DALTON

9/30/2021

DATE:

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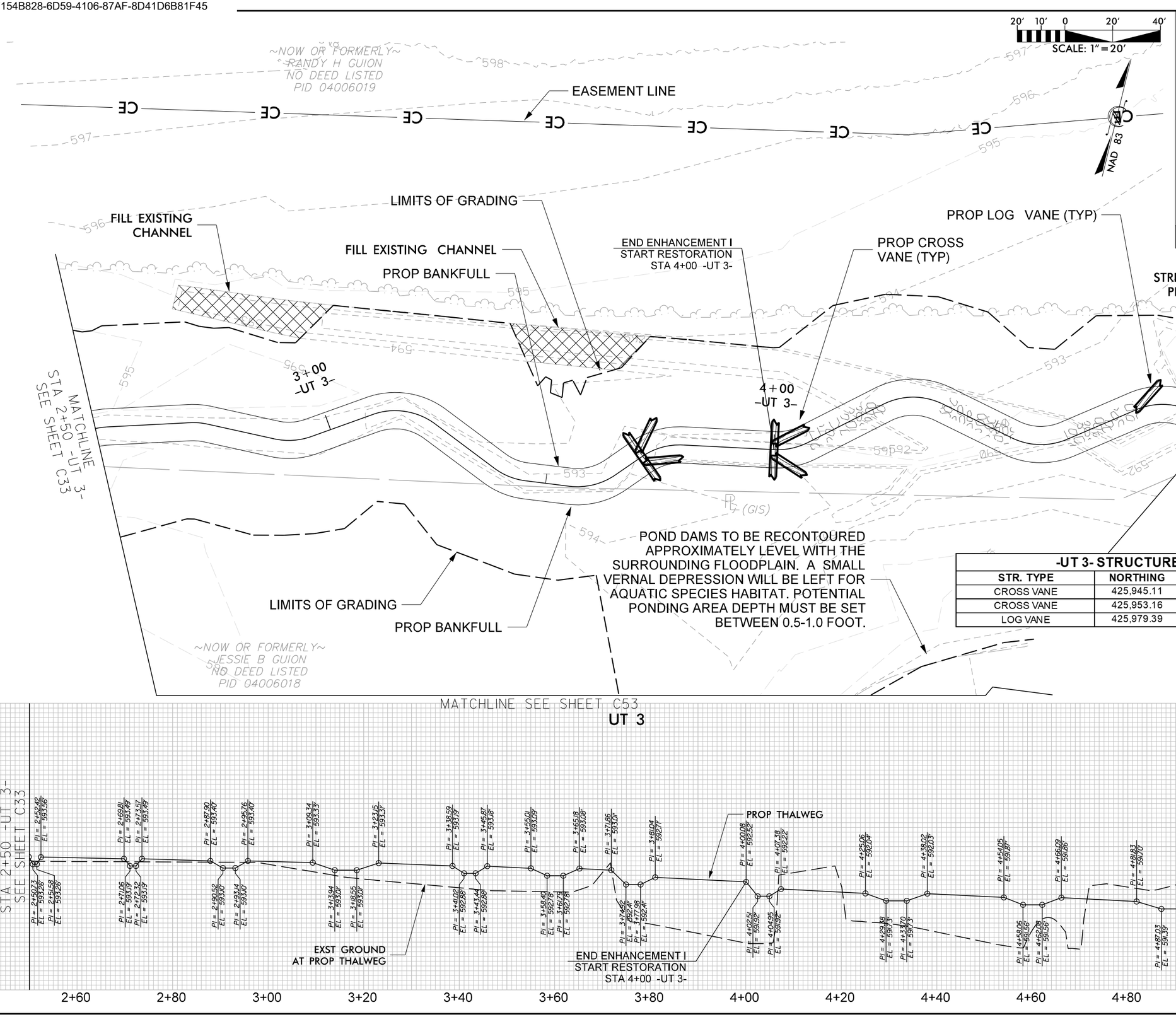
WITS END
UNION COUNTY, NC

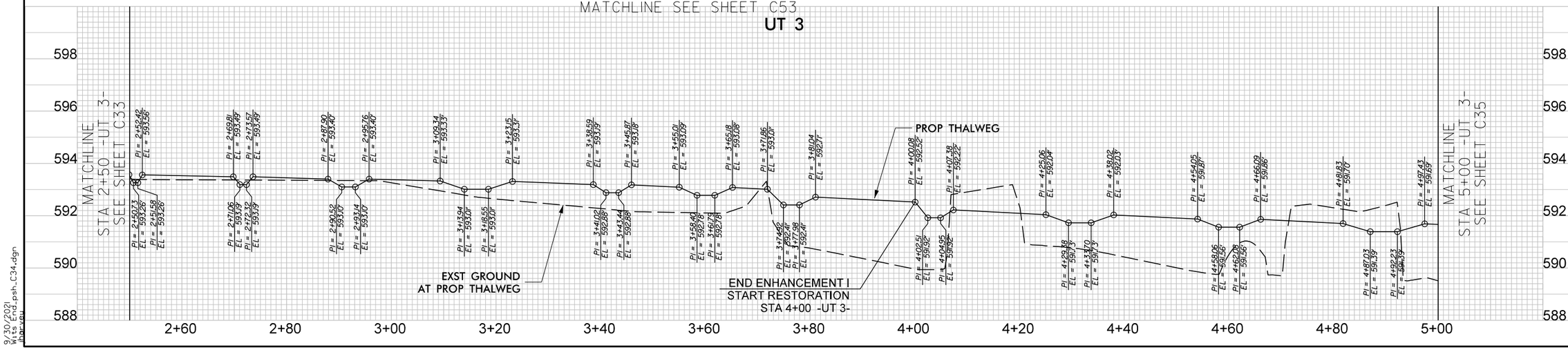
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C33
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C33

9/30/2021
Wits End_psh_C33.dgn
jharvell



-UT 3- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	425,945.11	1,565,730.02	593.01
CROSS VANE	425,953.16	1,565,756.56	592.52
LOG VANE	425,979.39	1,565,828.23	591.70



DocuSigned by: Joshua G. Dalton 1089AD8C14894C3...

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9/30/2021

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C34
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C34**

9/30/2021
Wits End_psh_C34.dgn
Layout

-UT 3- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	425,970.81	1,565,909.67	591.18
CROSS VANE	426,003.21	1,565,974.05	590.38

SCALE: 1" = 20'

DocuSigned by:
Joshua G. Dalton
10B9A080C1494C3...

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RALEIGH, NORTH CAROLINA 27606
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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C35
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C35

9/30/2021
Wits End_psh_C35.dgn
jharvey

~NOW OR FORMERLY~
RANDY H GUION
NO DEED LISTED
PID 04006019

EASEMENT LINE

FILL EXISTING CHANNEL
PROP CROSS VANE (TYP)
NAD 83
PL(GIS)
FILL EXISTING CHANNEL
PROP BANKFULL
STREAM PLUG
LIMITS OF GRADING
6+00 -UT 3-
7+00 -UT 3-
MATCHLINE STA 5+00 -UT 3- SEE SHEET C34
MATCHLINE STA 7+50 -UT 3- SEE SHEET C36
PROP BANKFULL
LIMITS OF GRADING
POND
~NOW OR FORMERLY~
JESSIE B GUION
NO DEED LISTED
PID 04006018

MATCHLINE SEE SHEET C53

UT 3

EXST GROUND AT PROP THALWEG
PROP THALWEG

MATCHLINE STA 5+00 -UT 3- SEE SHEET 34
MATCHLINE STA 7+50 -UT 3- SEE SHEET C36

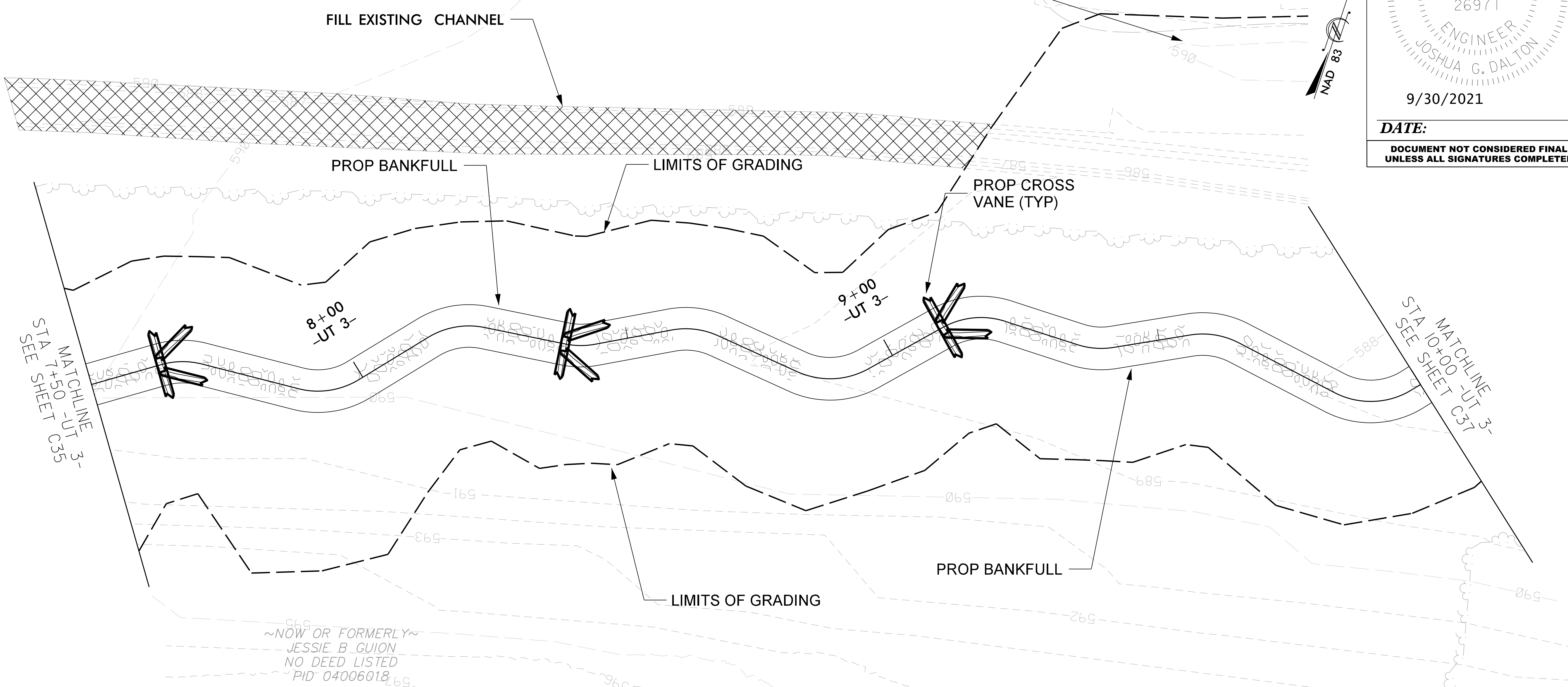
596
594
592
590
588
586

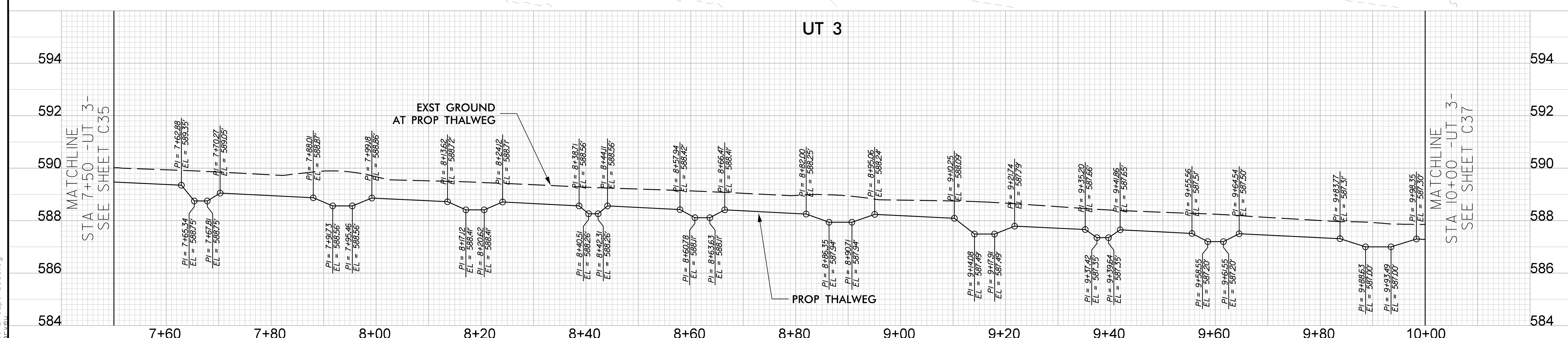
5+00 5+20 5+40 5+60 5+80 6+00 6+20 6+40 6+60 6+80 7+00 7+20 7+40

-UT 3- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,012.70	1,566,084.46	589.35
CROSS VANE	426,038.77	1,566,151.64	588.56
CROSS VANE	426,062.68	1,566,214.62	588.09

POND DAMS TO BE RECONTOURED APPROXIMATELY LEVEL WITH THE SURROUNDING FLOODPLAIN. A SMALL VERNAL DEPRESSION WILL BE LEFT FOR AQUATIC SPECIES HABITAT. POTENTIAL PONDING AREA DEPTH MUST BE SET BETWEEN 0.5-1.0 FOOT.

SCALE: 1" = 20'





DocuSigned by: Joshua G Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

DATE: 9/30/2021

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT #: 1221-20024
DRAWING NAME: WITS END PSH C36
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. C36

9/30/2021 Wits End_psh_C36.dgn

-UT 3- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,093.05	1,566,309.59	587.11
CROSS VANE	426,131.33	1,566,414.76	586.29

SCALE: 1" = 20'

POND DAMS TO BE RECONTOURED APPROXIMATELY LEVEL WITH THE SURROUNDING FLOODPLAIN. A SMALL VERNAL DEPRESSION WILL BE LEFT FOR AQUATIC SPECIES HABITAT. POTENTIAL PONDING AREA DEPTH MUST BE SET BETWEEN 0.5-1.0 FOOT.

POND

LIMITS OF GRADING

PROP BANKFULL

PROP CROSS VANE (TYP)

STREAM PLUG

END RESTORATION
STA 7+78 -UT 3A-
STA 11+63 -UT 3-

FILL EXISTING CHANNEL

~NOW OR FORMERLY~
JESSIE B GUION
NO DEED LISTED
PID 04006018

MATCHLINE STA 7+40 -UT 3A- SEE SHEET C47

MATCHLINE STA 10+00 -UT 3- SEE SHEET C36

MATCHLINE STA 12+50 -UT 3- SEE SHEET C38

11+00 -UT 3-

12+00 -UT 3-

NAD 83

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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UT 3

UT 3A

EXST GROUND AT PROP THALWEG

PROP THALWEG

END RESTORATION
STA 7+78 -UT 3A-
ELEV=586.19

END RESTORATION
STA 7+78 -UT 3A-
STA 11+63 -UT 3-

592
590
588
586
584
582

7+40
7+60
7+80
10+00
10+20
10+40
10+60
10+80
11+00
11+20
11+40
11+60
11+80
12+00
12+20
12+40

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WITS END
UNION COUNTY, NC

PLAN AND PROFILE

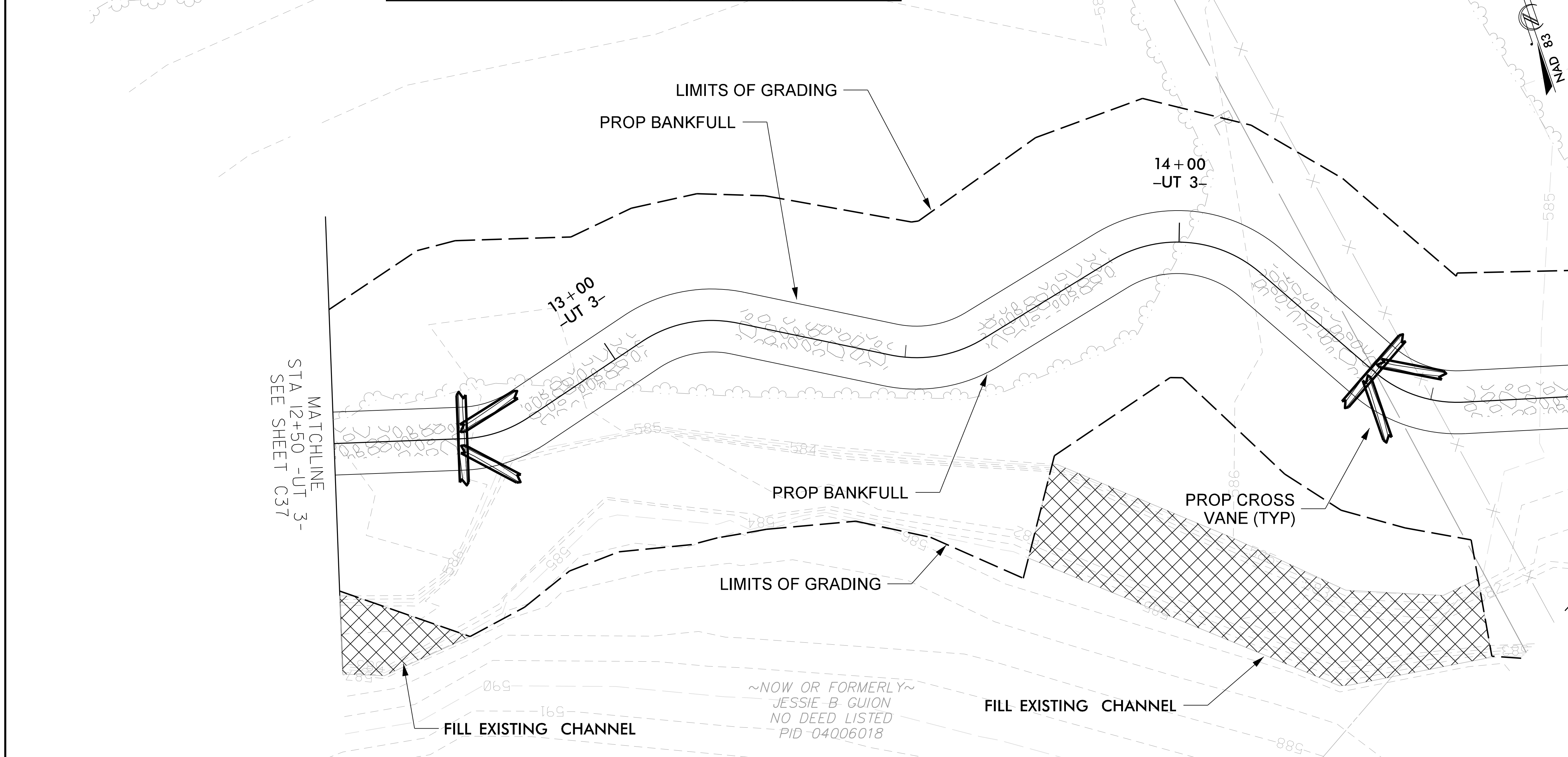
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C37
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. C37

9/30/2021
Wits End_psh_C37.dgn
jharkey

-UT 3- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,115.27	1,566,541.40	585.26
CROSS VANE	426,077.24	1,566,687.26	584.22
CROSS VANE	426,061.06	1,566,722.74	583.78



DocuSigned by:
Joshua G Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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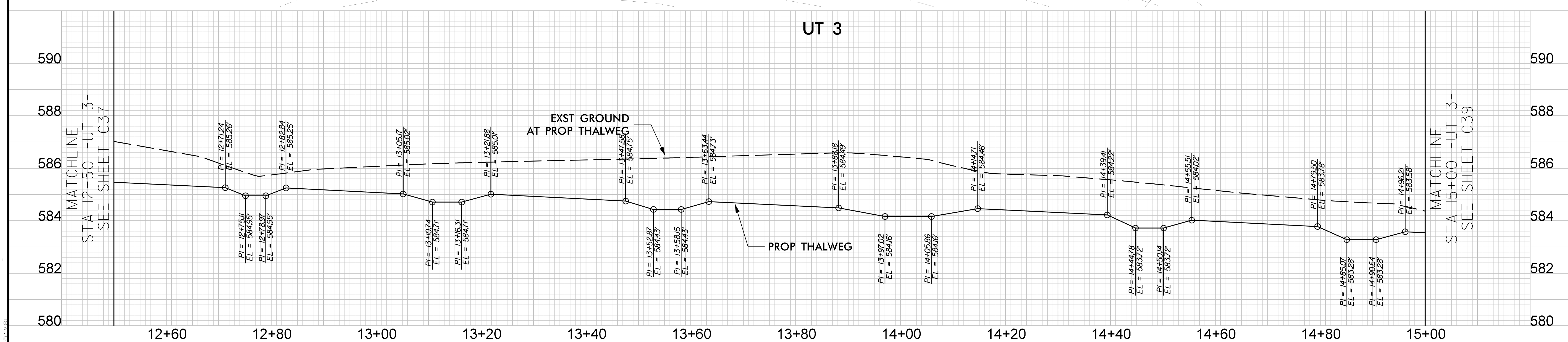

9/30/2021
Wits_End_psh_C38.dgn

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Axiom Environmental, Inc.

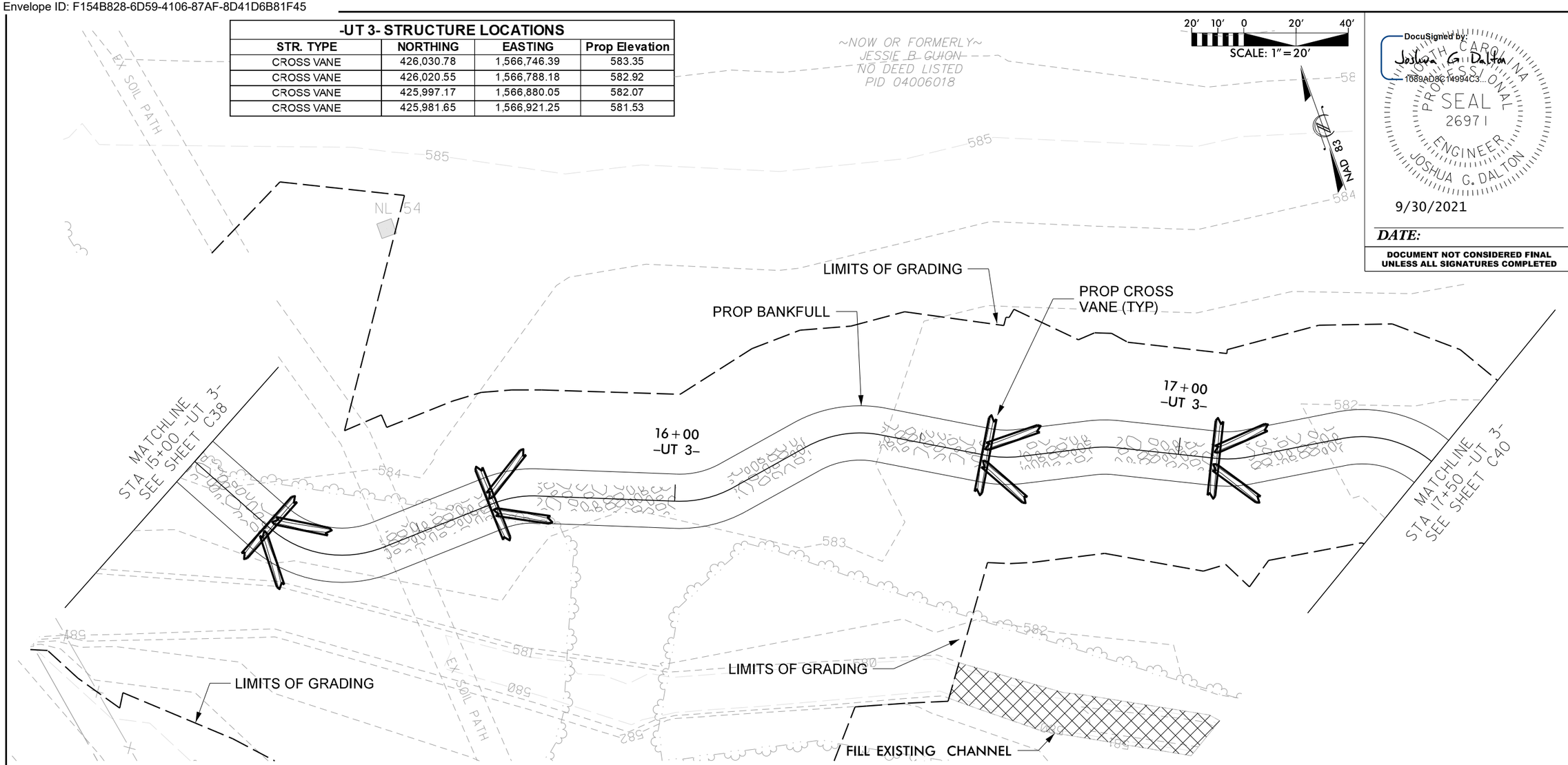
WITS END
UNION COUNTY, NC

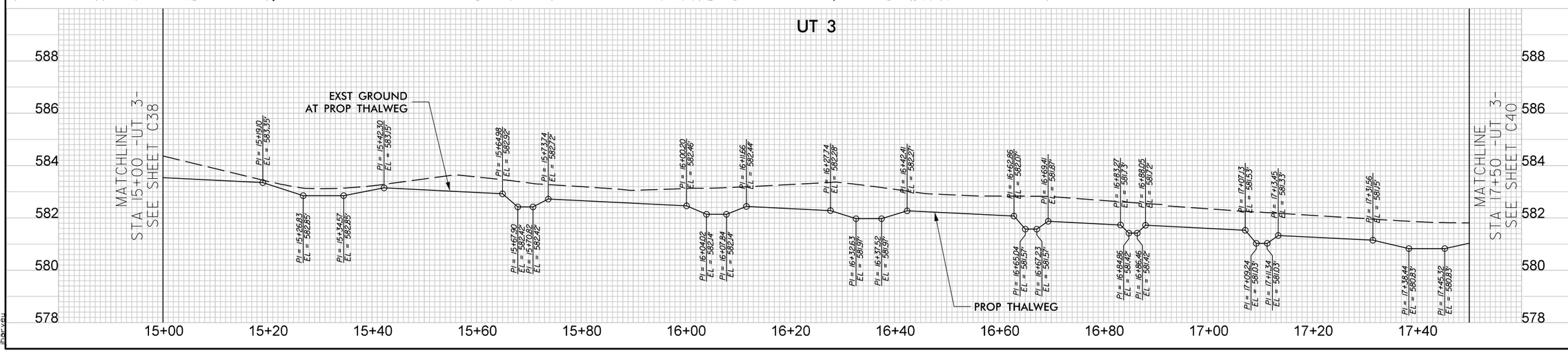
PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C38
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C38**

-UT 3- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,030.78	1,566,746.39	583.35
CROSS VANE	426,020.55	1,566,788.18	582.92
CROSS VANE	425,997.17	1,566,880.05	582.07
CROSS VANE	425,981.65	1,566,921.25	581.53





DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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Axiom Environmental, Inc.

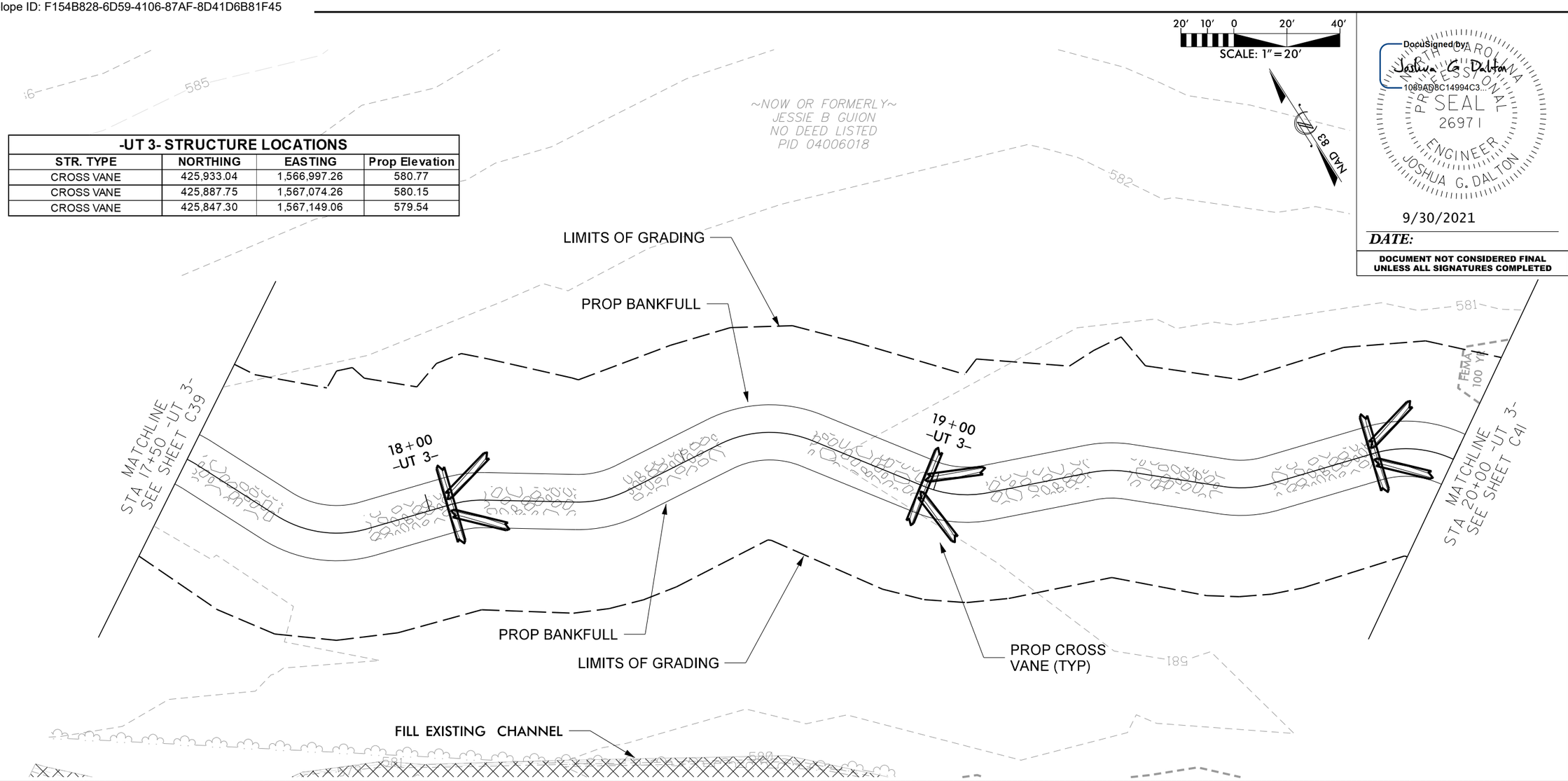
WITS END
UNION COUNTY, NC

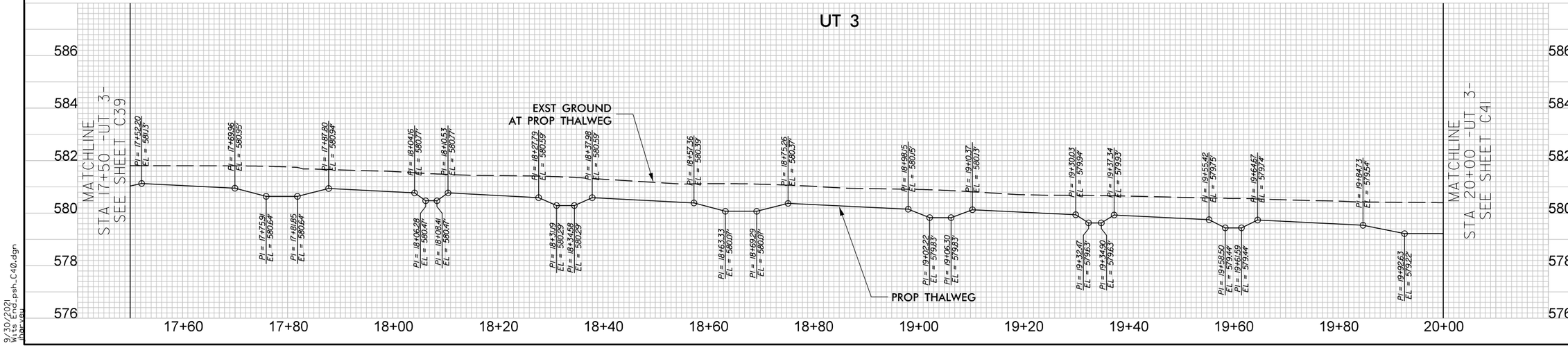
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C39
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C39

9/30/2021
Wits End_psh_C39.dgn
jharvey

-UT 3- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	425,933.04	1,566,997.26	580.77
CROSS VANE	425,887.75	1,567,074.26	580.15
CROSS VANE	425,847.30	1,567,149.06	579.54





DocuSigned by:
Joshua G Dalton
1089AD8C14994C3...

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9/30/2021

DATE:

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :
I22I-20024

DRAWING NAME:
WITS END PSH C40

DATE:
2021

DRAWN BY:
JRH

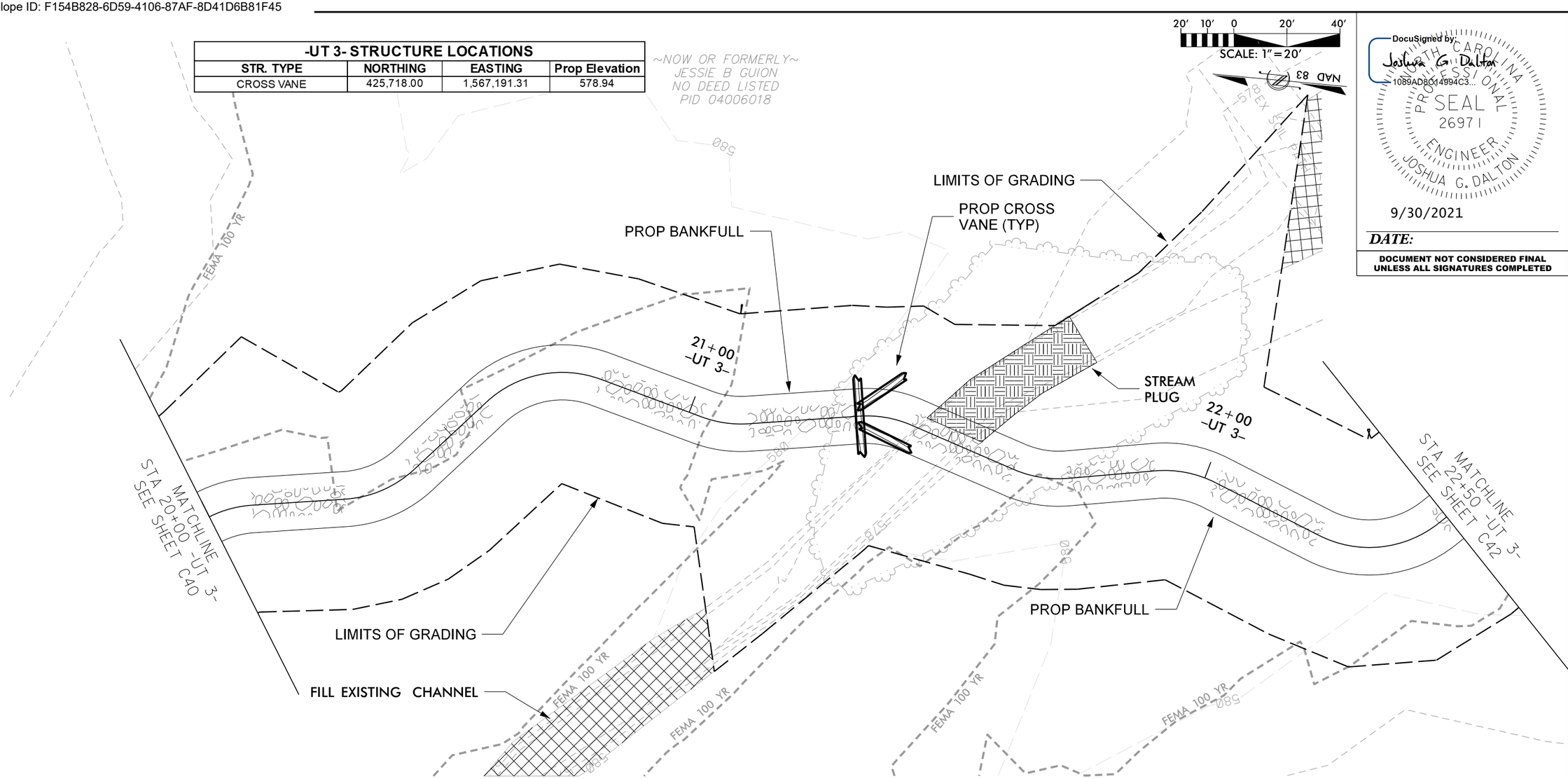
REVIEWED BY:
JGD

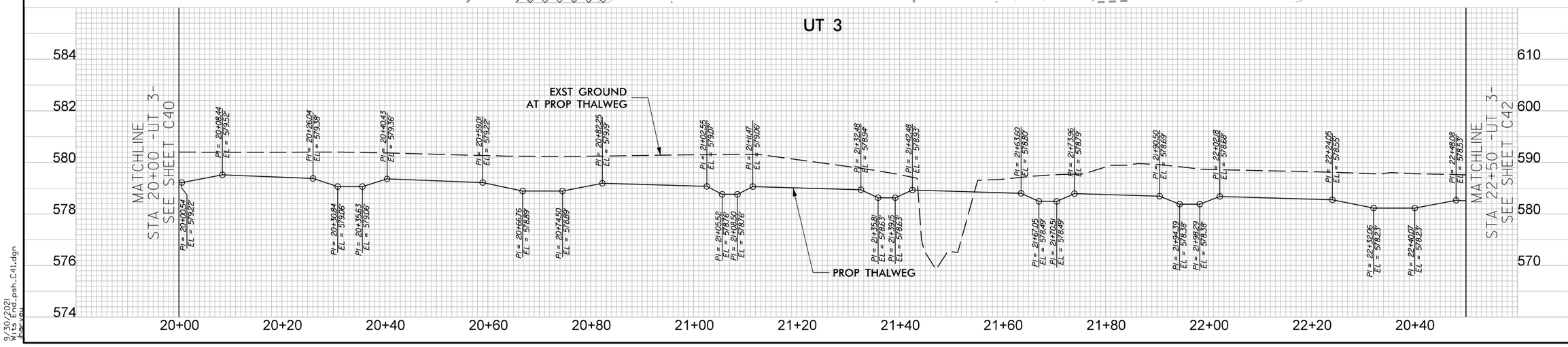
REVISIONS:

SHEET NO.
C40

9/30/2021
Wits End_psh_C40.dgn
jharvey

-UT 3- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	425,718.00	1,567,191.31	578.94





DocuSigned by: Joshua G. Dalton 1089AD8C14994C3...

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9/30/2021

DATE:

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PH: 919.851.1986
ENG FIRM LICENSE NO. C-890

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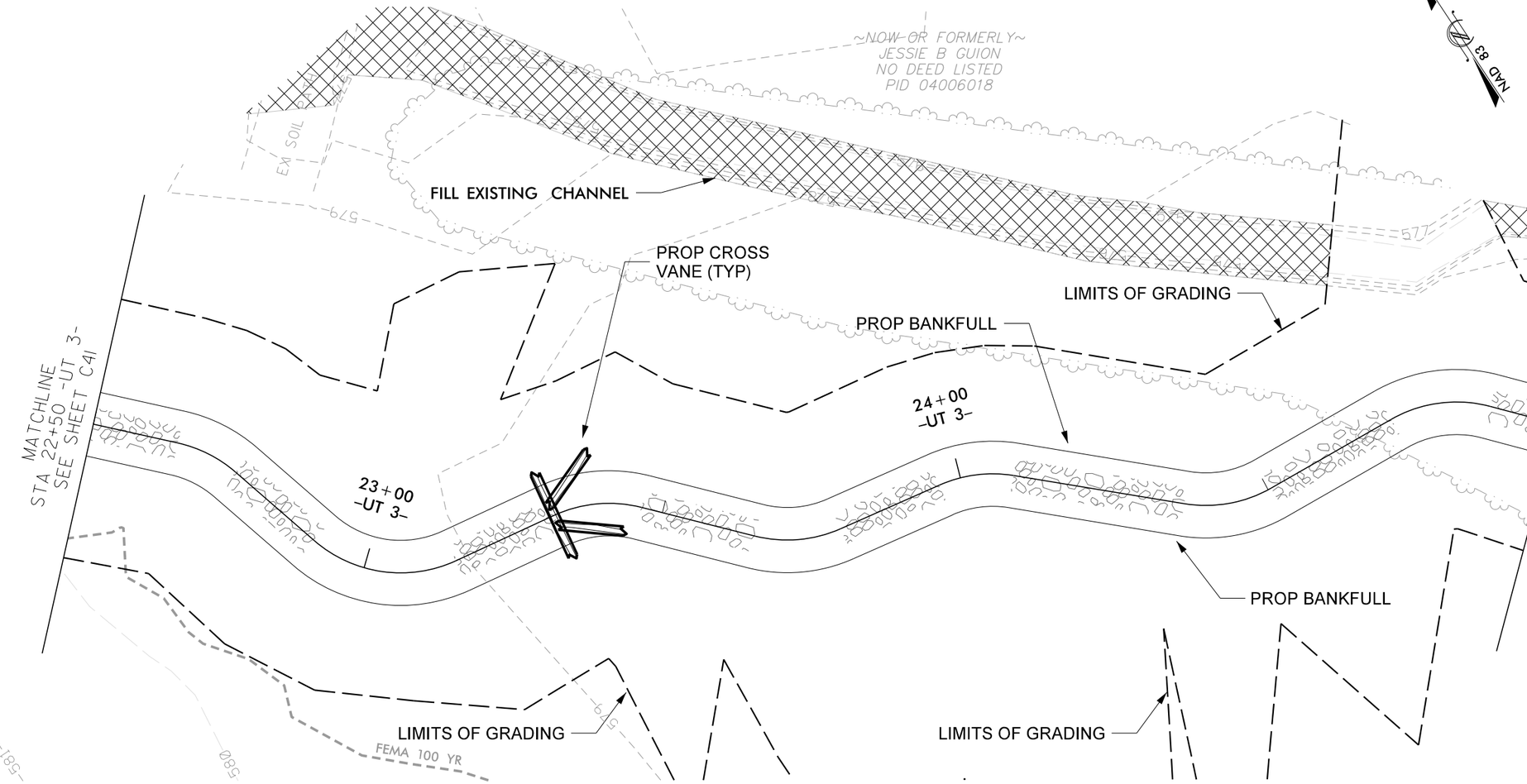
WITS END
UNION COUNTY, NC

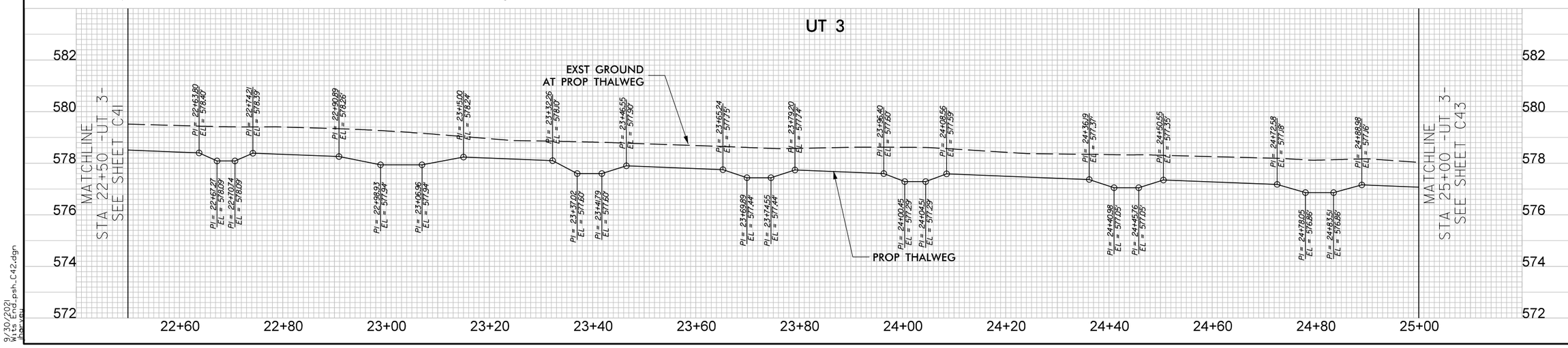
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C41
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C41

9/30/2021
Wits End_psh_C41.dgn
Darren

-UT 3- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	425,553.32	1,567,236.03	578.10





DocuSigned by: Joshua G Dalton 1089AD8C14994C3...

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9/30/2021

DATE:

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WITS END
UNION COUNTY, NC

PLAN AND PROFILE

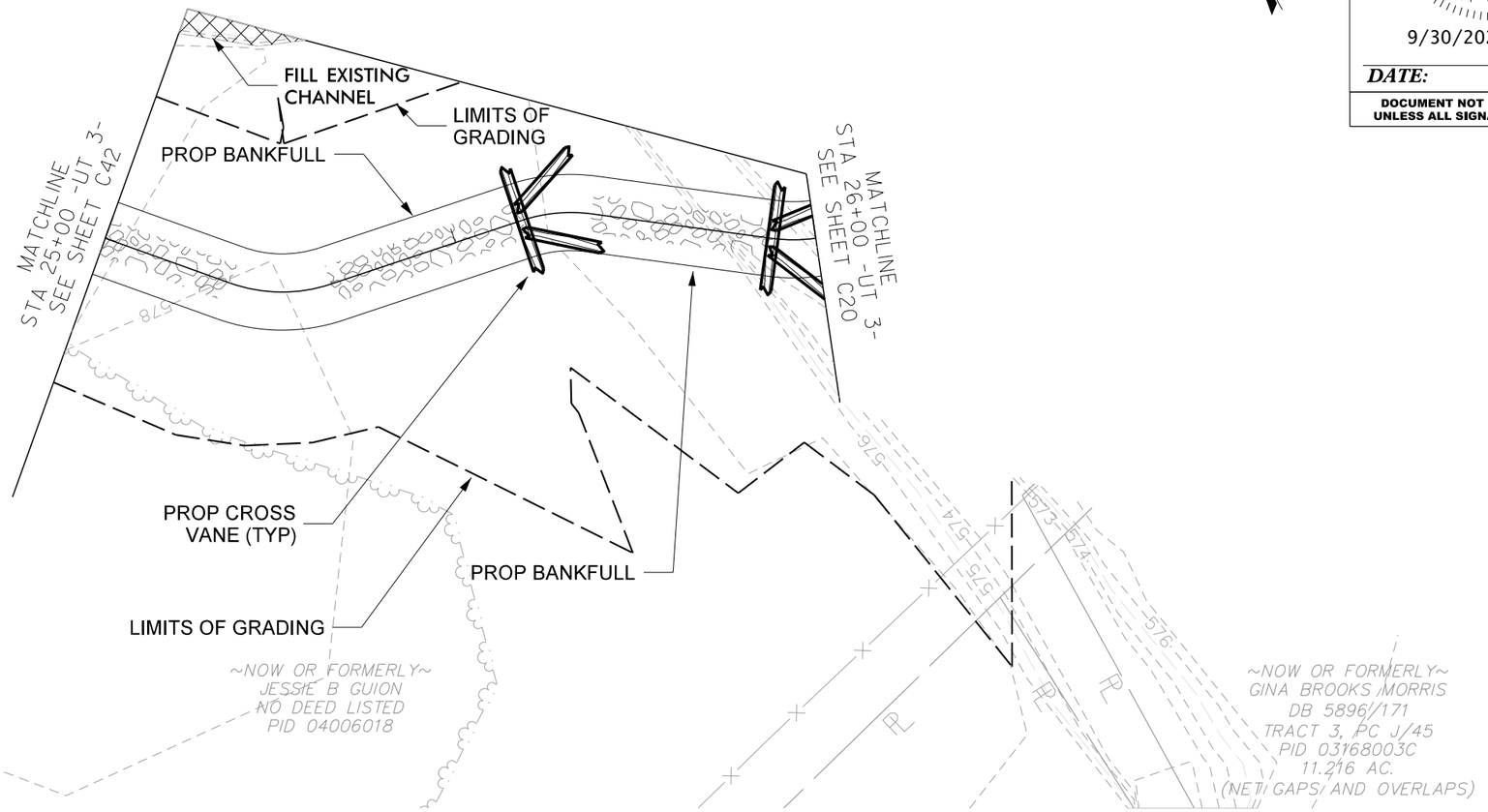
PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C42
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C42

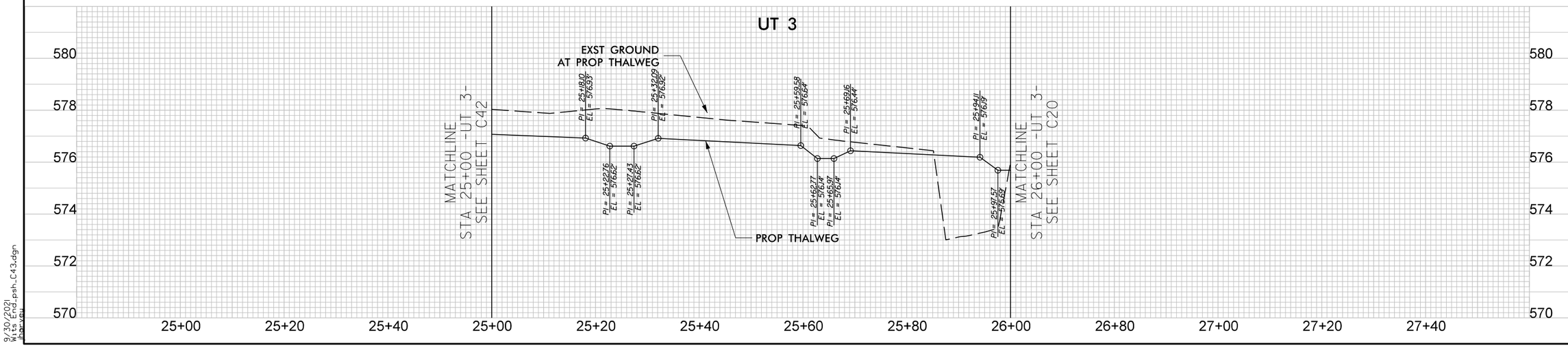
9/30/2021
Wits End_psh_C42.dgn
harvey

-UT 3- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	425,451.95	1,567,428.59	576.64
CROSS VANE	425,433.38	1,567,457.40	576.19

20' 10' 0 20' 40'
SCALE: 1" = 20'

NAD 83





DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

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9/30/2021

DATE:

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RALEIGH, NORTH CAROLINA 27606
TEL: 919.859.1353
ENG FIRM LICENSE NO. C-3590

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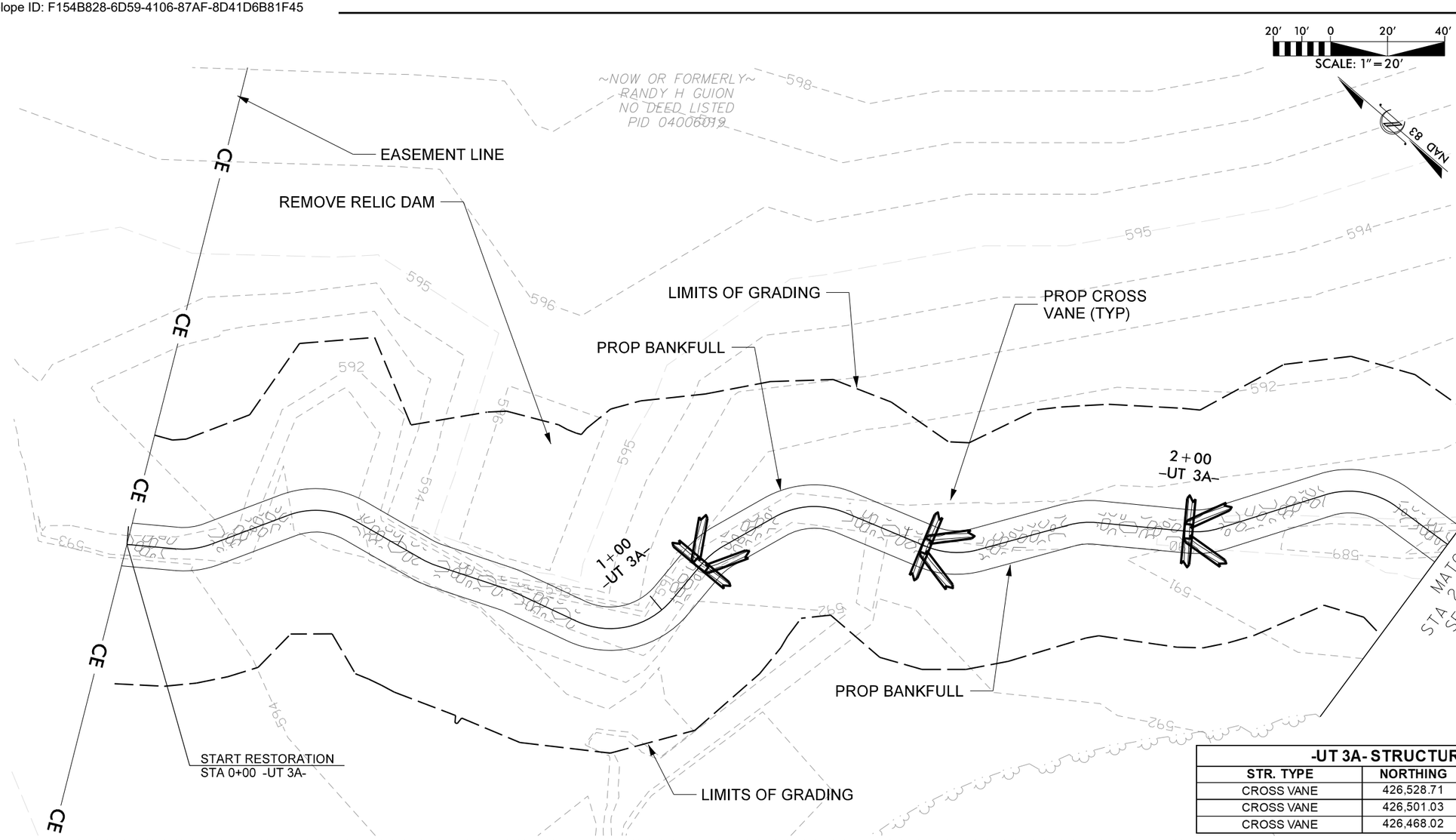
WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C43
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C43

9/30/2021
Wits End_psh_C43.dgn
Parker



20′ 10′ 0 20′ 40′
SCALE: 1″ = 20′

NAD 83

DocuSigned by:
Joshua G. Dalton
-1080AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

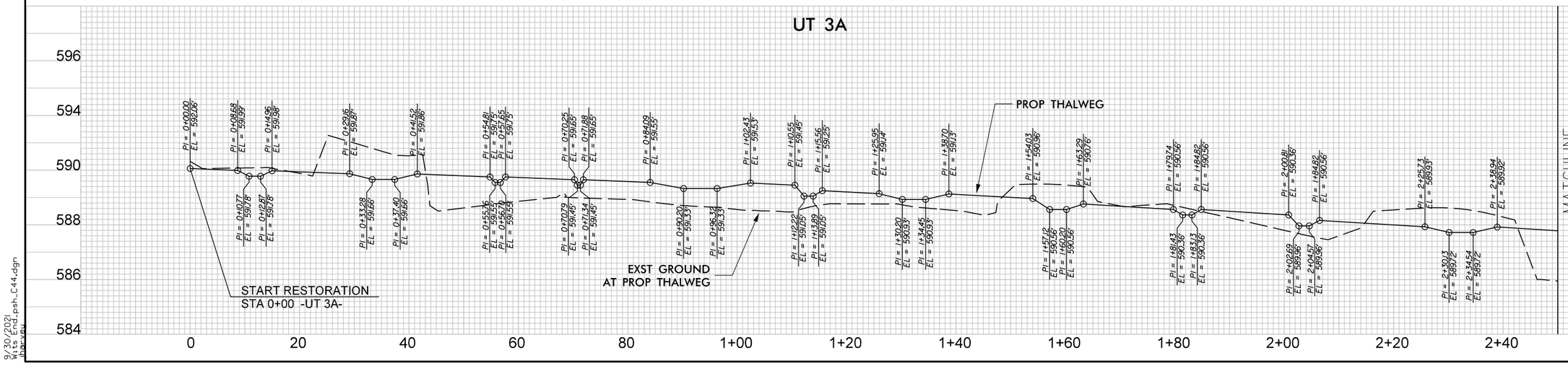
9/30/2021

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

-UT 3A- STRUCTURE LOCATIONS

STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,528.71	1,565,988.44	591.45
CROSS VANE	426,501.03	1,566,016.54	590.96
CROSS VANE	426,468.02	1,566,048.53	590.36



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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

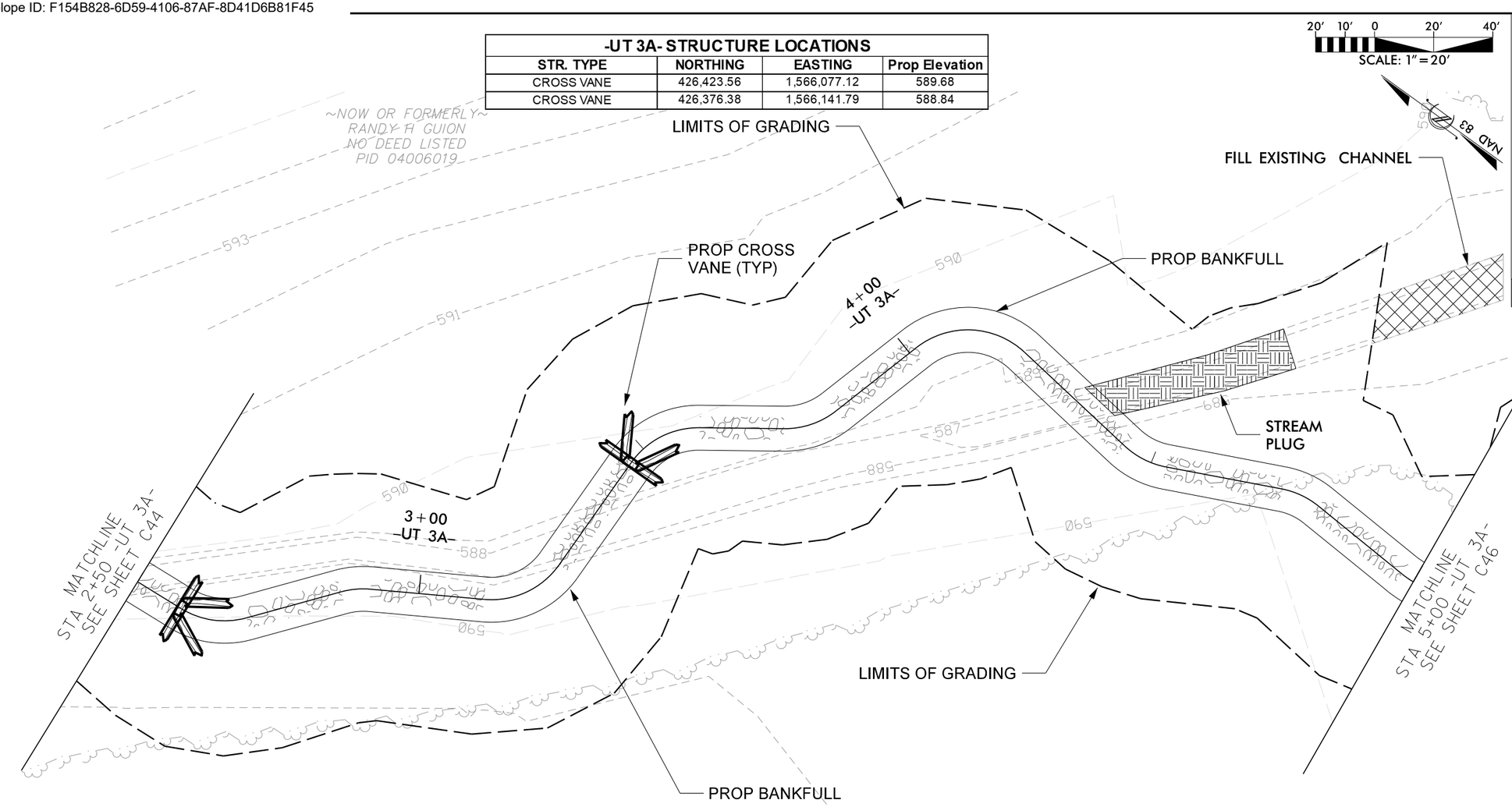
PLAN AND PROFILE

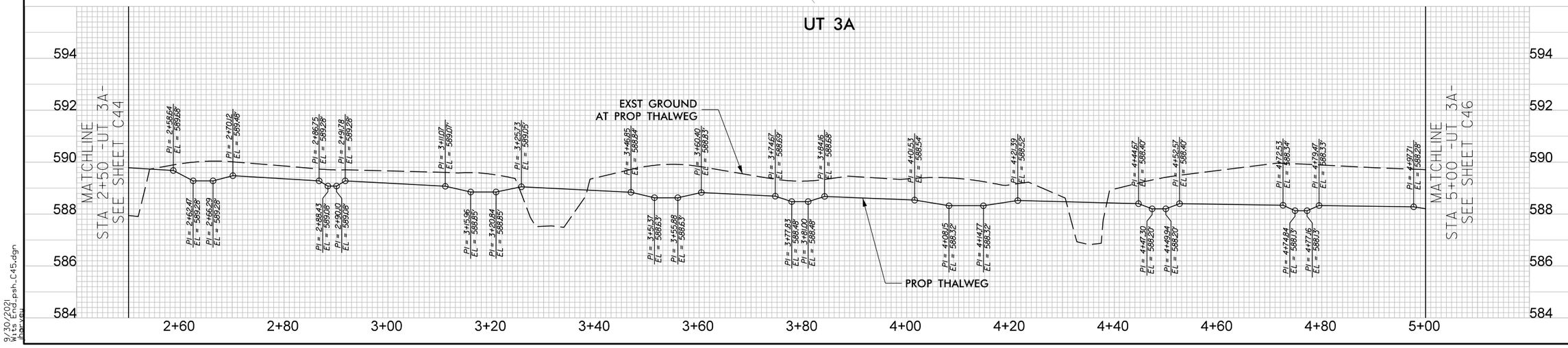
PROJECT # : 122I-20024
DRAWING NAME: WITS END PSH C44
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C44**

9/30/2021
Wits End_psh_C44.dgn
jharvell

-UT 3A- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,423.56	1,566,077.12	589.68
CROSS VANE	426,376.38	1,566,141.79	588.84





DocuSigned by: Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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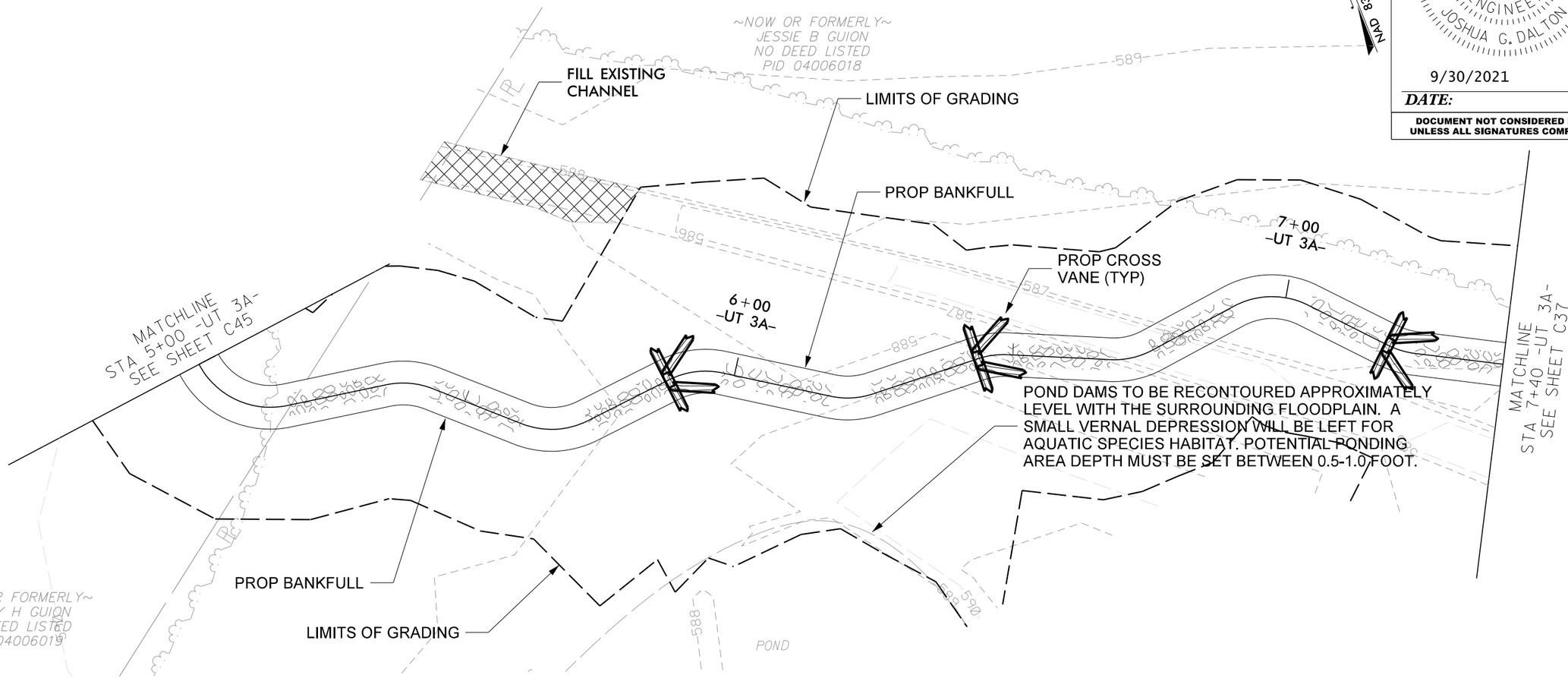
WITS END
UNION COUNTY, NC

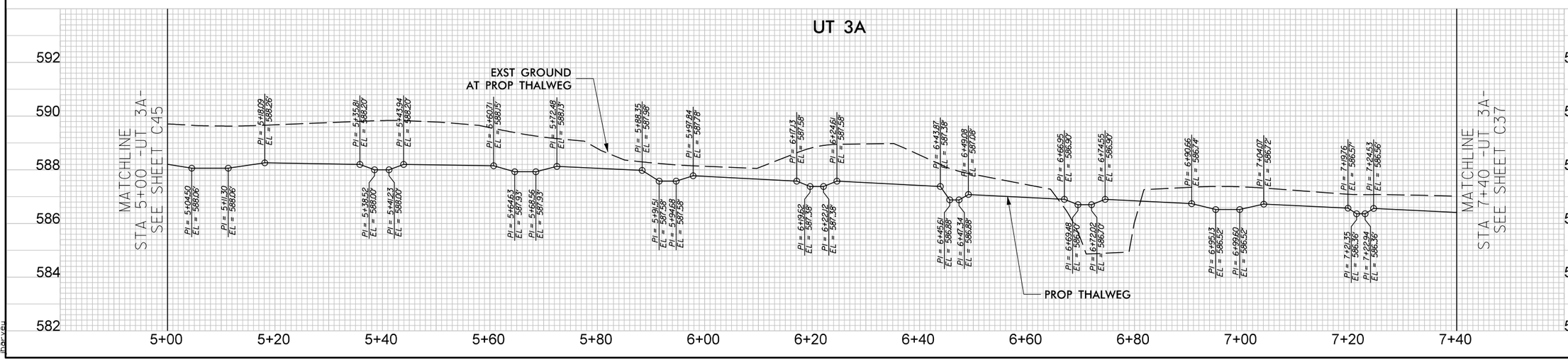
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C45
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C45

9/30/2021
Wits End_psh_C45.dgn
Parker

-UT 3A- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	426,224.68	1,566,278.15	587.98
CROSS VANE	426,208.24	1,566,329.44	587.38
CROSS VANE	426,184.00	1,566,396.66	586.57





DocuSigned by:
Joshua G Dalton
1089A58C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021
DATE:

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RALEIGH, NORTH CAROLINA 27606
PH: (919) 852-1003
ENG FIRM LICENSE NO. C-3890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C46
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C46**

9/30/2021
Wits End_psh_C46.dgn
Default

20' 10' 0 20' 40'
SCALE: 1" = 20'

NAD 83

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

SOUTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: 919.851.9985
ENG FIRM LICENSE NO. C-3890

Axiom Environmental, Inc.

EASEMENT LINE

START RESTORATION
STA 0+00 -UT 4-

LIMITS OF GRADING

PROP BANKFULL

1+00 -UT 4-

2+00 -UT 4-

MATCHLINE STA 2+50 -UT 4- SEE SHEET C48

~NOW OR FORMERLY~
JESSIE BRICE GUION
VIRGINIA L GUION
NO DEED LISTED
PID 04006013

~NOW OR FORMERLY~
WITS END FARM LLC
DB 4568/786
PID 04006014A
TITLE COMMITMENT TRACT 3
16.571 AC.
(NET GAPS AND OVERLAPS)

PROP BANKFULL

LIMITS OF GRADING

UT 4

START RESTORATION
STA 0+00 -UT 4-

EXST GROUND AT PROP THALWEG

PROP THALWEG

MATCHLINE STA 2+50 -UT 4- SEE SHEET C48

582 580 578 576 574 572

0 20 40 60 80 1+00 1+20 1+40 1+60 1+80 2+00 2+20 2+40

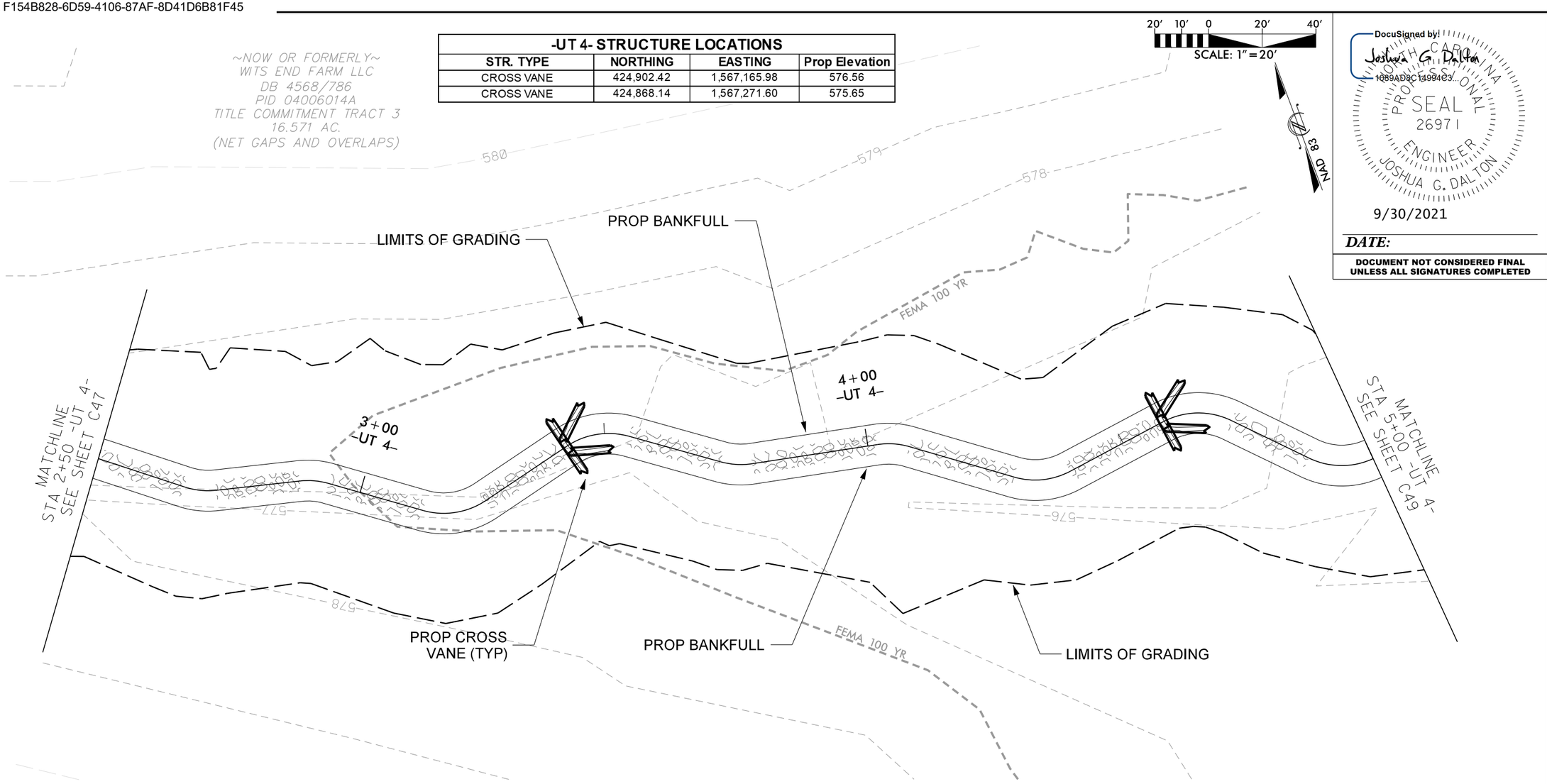
WITS END
UNION COUNTY, NC

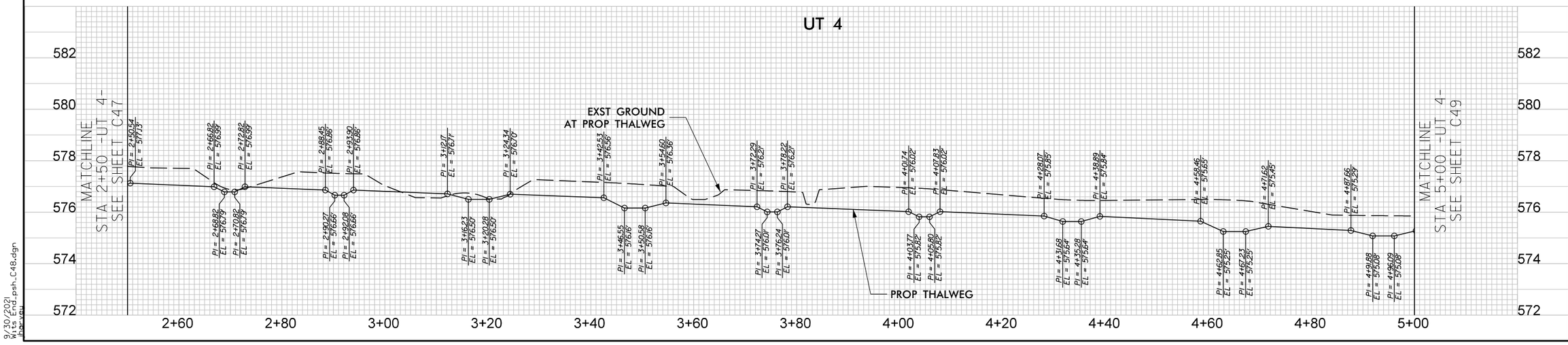
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C47
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C47

9/30/2021
Wits End_psh_C47.dgn
jharvey

-UT 4- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	424,902.42	1,567,165.98	576.56
CROSS VANE	424,868.14	1,567,271.60	575.65





20' 10' 0 20' 40'
SCALE: 1" = 20'

NAD 83

DocuSigned by:
Joshua G. Dalton
1089AD8C1494C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

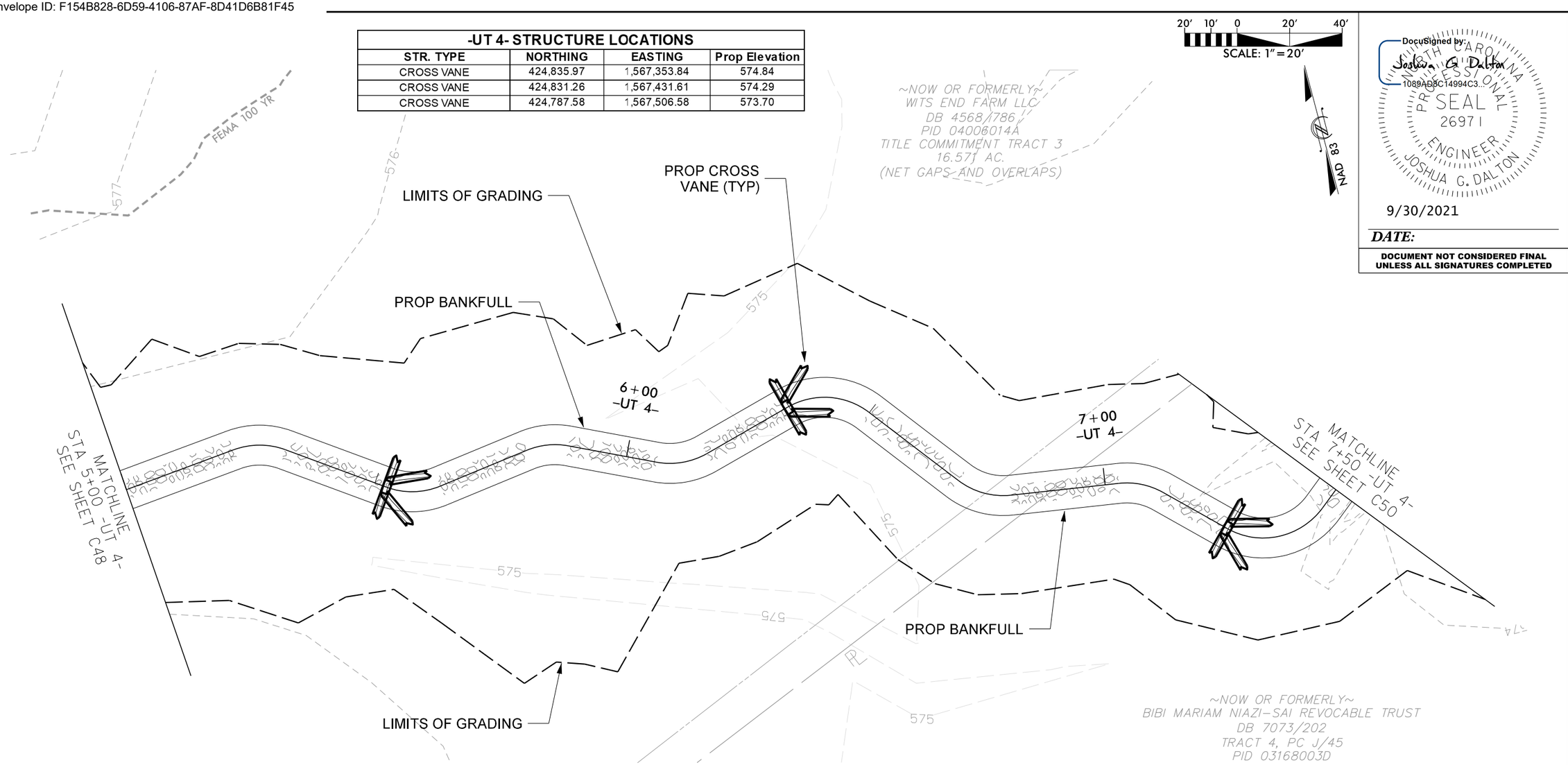
WITS END
UNION COUNTY, NC

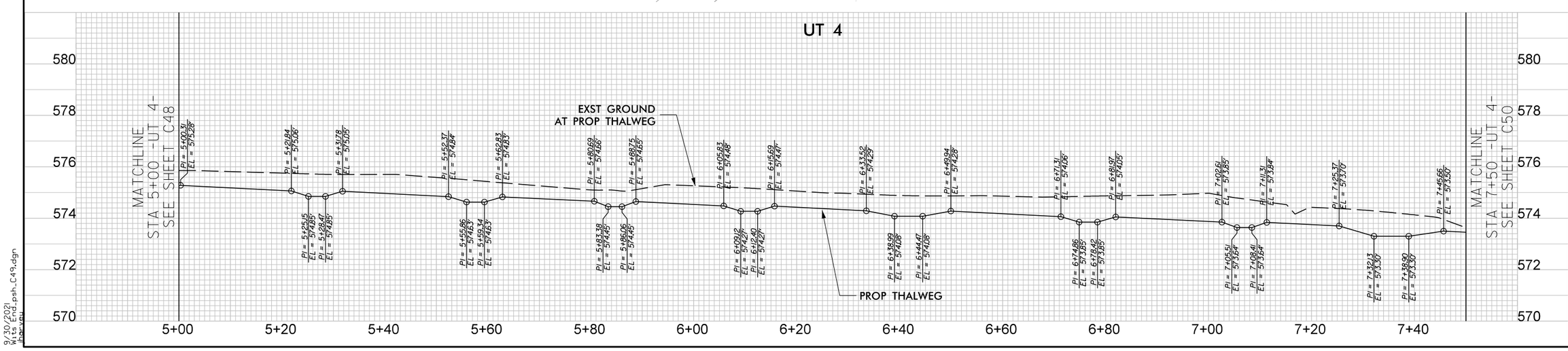
PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C48
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C48

9/30/2021
Wits End_psh_C48.dgn
jharvey

-UT 4- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	424,835.97	1,567,353.84	574.84
CROSS VANE	424,831.26	1,567,431.61	574.29
CROSS VANE	424,787.58	1,567,506.58	573.70





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9/30/2021

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PLAN AND PROFILE

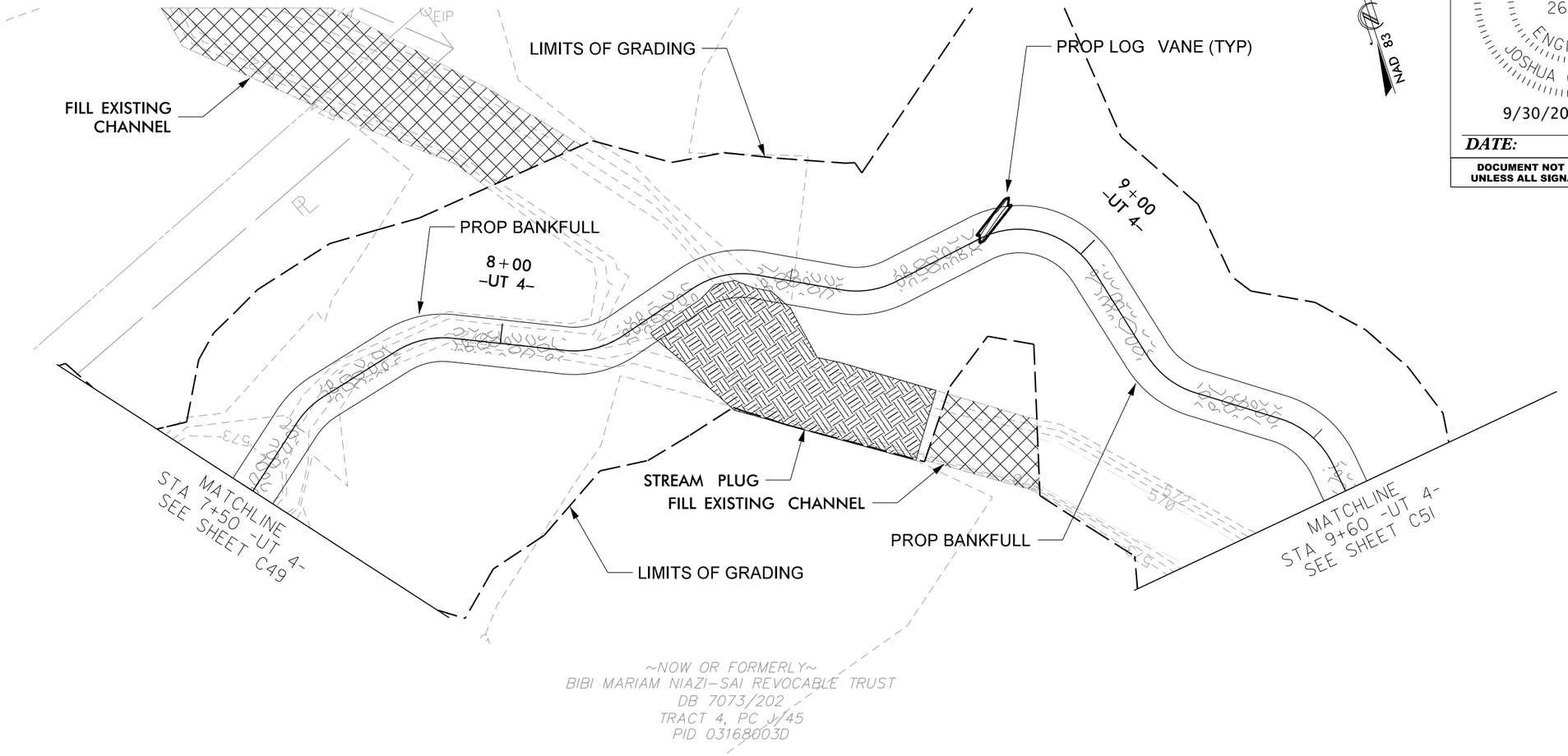
PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C49
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	C49

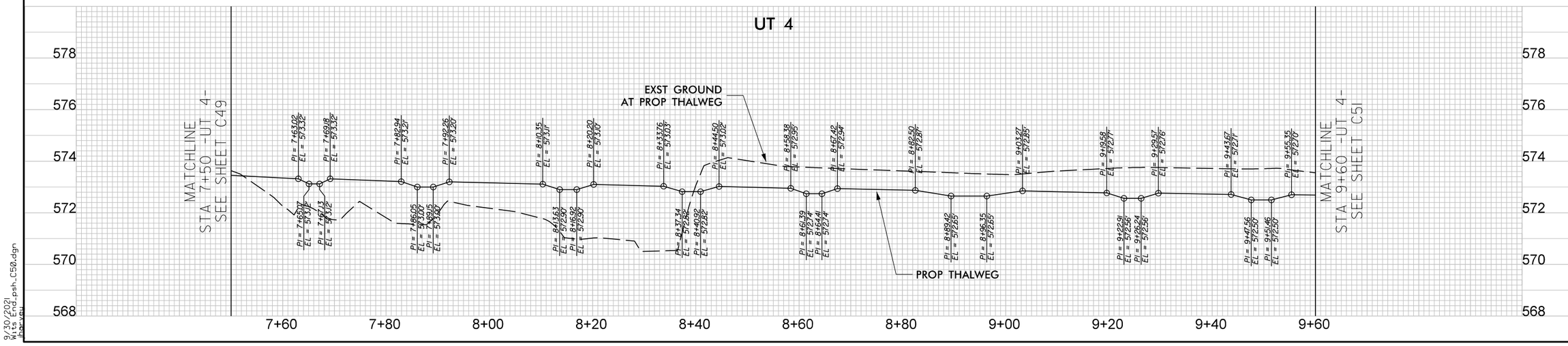
9/30/2021
Wits End_psh_C49.dgn
Layout

-UT 4- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
LOG VANE	424,791.43	1,567,652.04	572.87

20′ 10′ 0 20′ 40′
SCALE: 1" = 20′

NAD 83





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1089AD8C14994C3...

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UNION COUNTY, NC

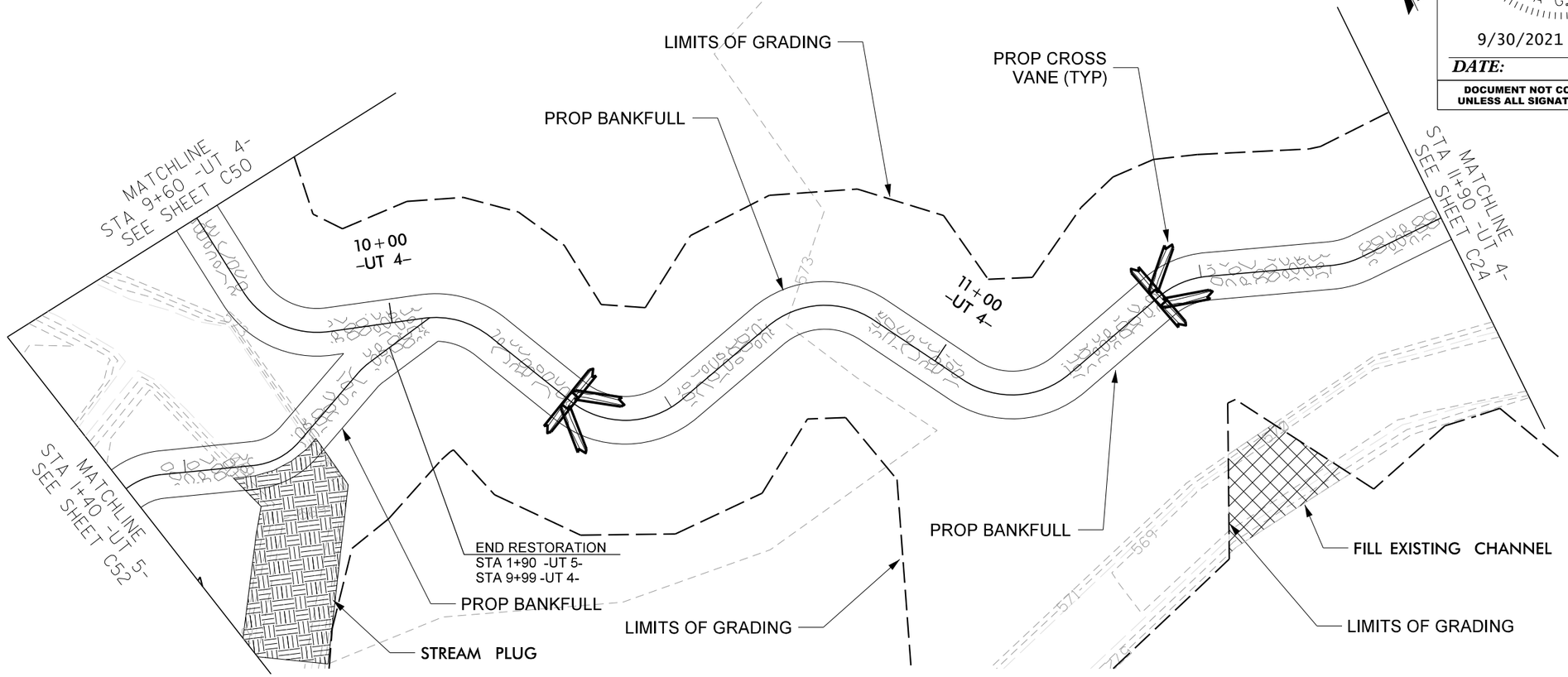
PLAN AND PROFILE

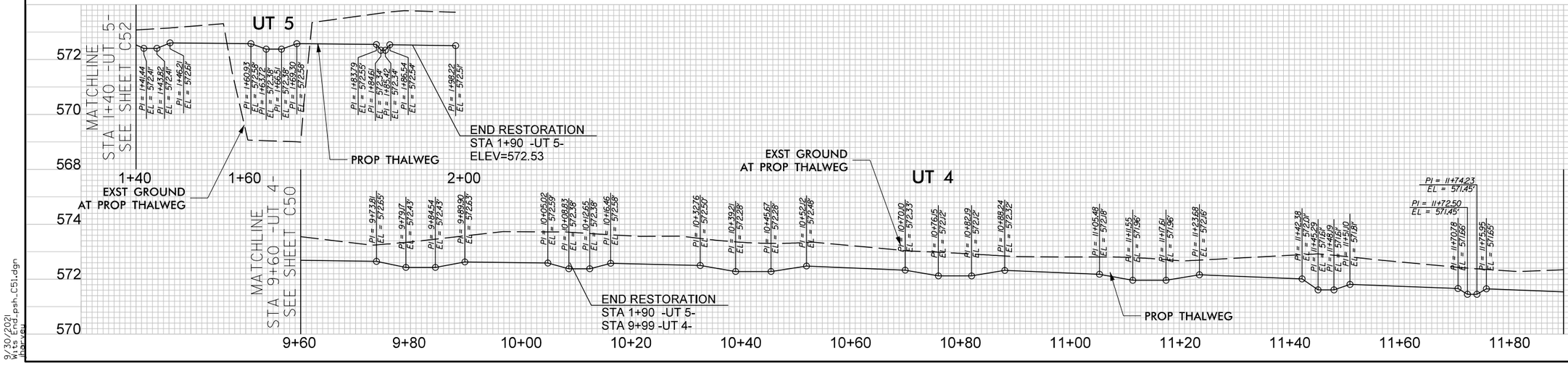
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C50
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C50**

9/30/2021
Wits End_psh_C50.dgn
jharden

-UT 4- STRUCTURE LOCATIONS			
STR. TYPE	NORTHING	EASTING	Prop Elevation
CROSS VANE	424,682.81	1,567,736.59	572.50
CROSS VANE	424,657.89	1,567,828.54	572.01





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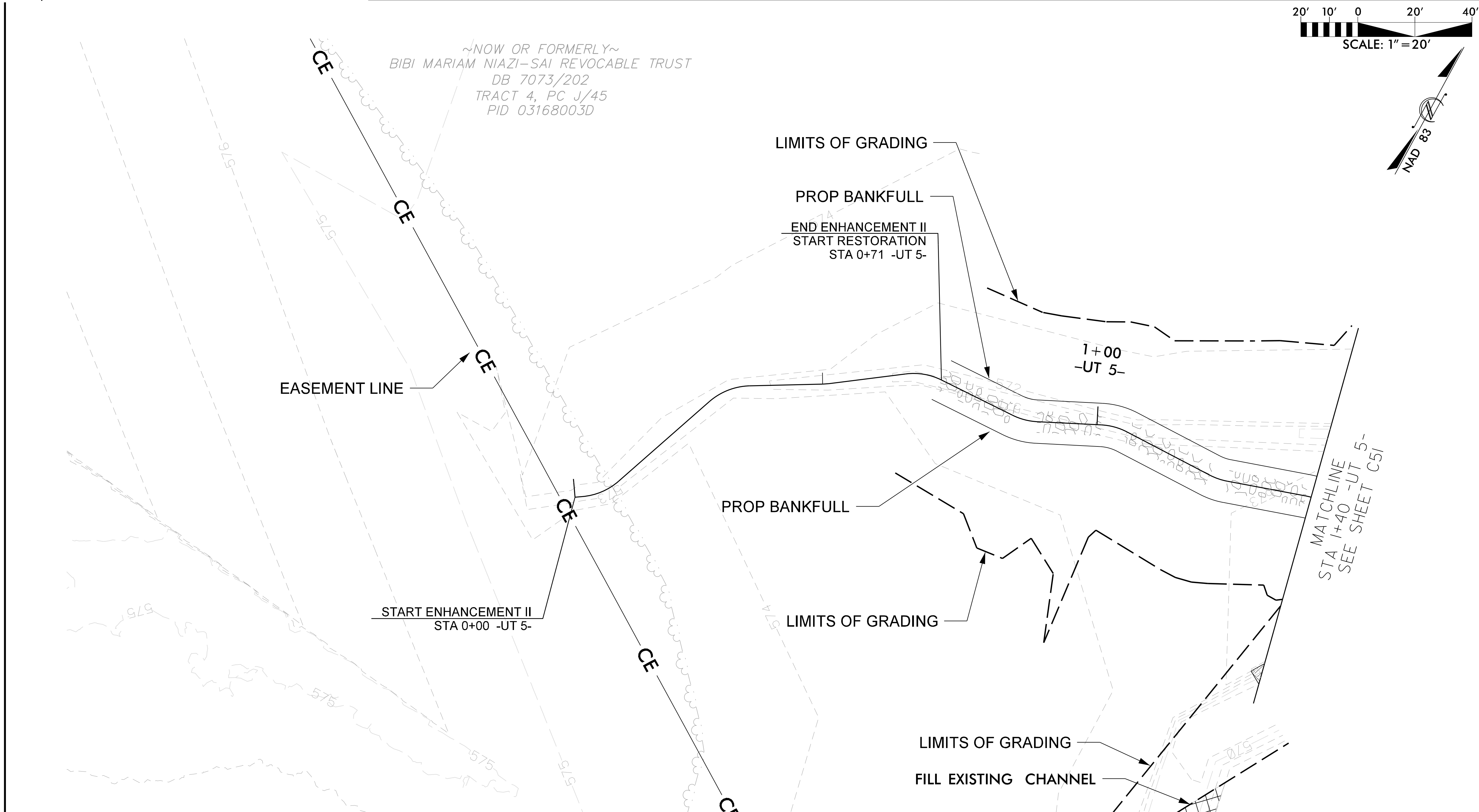
UNION COUNTY, NC

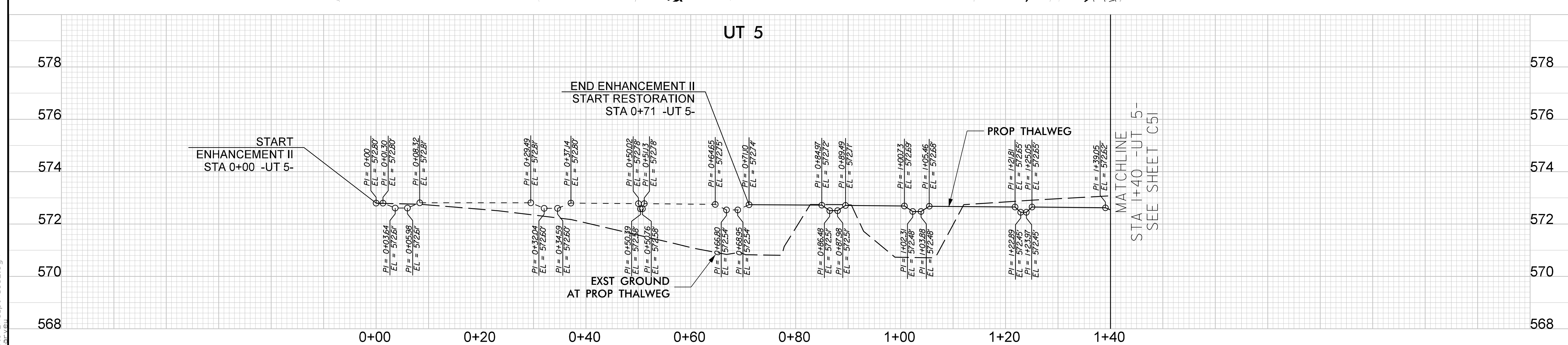
PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C51
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **C51**

9/30/2021
Wits End_psh_C51.dgn
Jharvell





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SEAL
26971
ENGINEER
JOSHUA G. DALTON

9/30/2021

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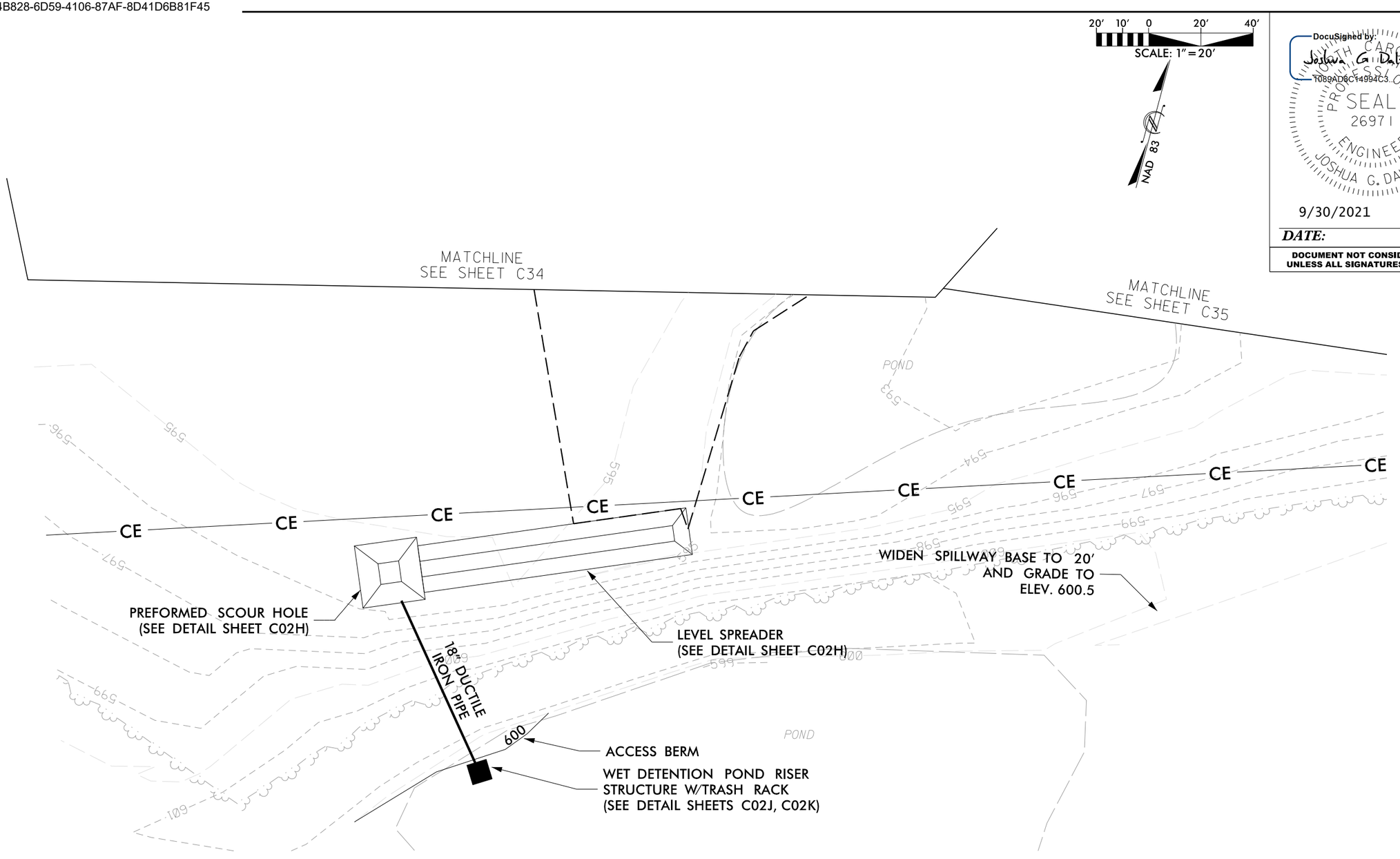
Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH C52
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:
SHEET NO. C52

9/30/2021
Wits_End_psh_C52.dgn
harvey



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Joshua G. Dalton
7089AD8C14994C3...

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9/30/2021

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WITS END
UNION COUNTY, NC

PLAN AND PROFILE

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH C53
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	*C53*

9/30/2021
Wits End_psh_C53.dgn
jharvell

CONSTRUCTION SEQUENCE

Construction Notes:

1. Staging areas, stockpile areas, construction entrances and access roads will be identified and located according to the Erosion Control Plans and landowner agreements. Variances will be allowed assuming both the Contractor and Designer verbally agree.

2. A construction entrance (as shown on sheet E03E) from Secondary Road 1945 (Snyders Store Rd) will be installed for access to WAXBR, UT1, UT2, UT3, UT3A, UT4 and UT5 as shown on the Erosion Control Plans.

3. The Contractor will install silt fencing, as noted on the Erosion Control Plans, at applicable staging and stockpile areas.

4. The proposed stream alignment and structure locations will be staked for each reach (WAXBR, UT1, UT2, UT3, UT3A, UT4 and UT5). Staking will be restricted to riffle elevations only in order to establish and maintain grade for the entire system. Pools will be excavated once structures are installed.

5. The Contractor will begin stockpiling materials in a designated staging area. General details associated with all sections include:

    a. Sediment bags will be used to filter the groundwater and placed within areas of newly excavated channel that are offline from the existing flow. These bags will be utilized as the contractor or designer deem necessary.
    b. Temporary and permanent seed mixes, including applicable mulching, will be applied to the streambanks and disturbed areas at the end of each working day as definable sections are completed. Erosion control matting will be installed on top of the seed and straw in accordance with the Erosion Control Construction Sequence.
    c. Excavated material that is stockpiled will follow erosion and sediment control guidelines as they relate to material storage and stockpiling.
    d. All remaining disturbed areas are to be seeded and covered according to the Erosion Control Construction Sequence.
    e. Riprap aprons will be constructed to impede any erosion of the channel and streambanks by the water diverted from the pump-around procedure.

6. Boulders and materials used for stream structures will be delivered through the primary construction entrance and stockpiled in the appropriate area.

7. This project will require pumping water around the channels during construction. Work will generally proceed from upstream to downstream.

8. Adjust haul roads and associated silt fence as necessary when permanent stream crossings are installed.

Construction Sequence

1. The Contractor will excavate the proposed channel and modify portions of the existing channel based on riffle elevations in sections no greater than 300' in length at a time (except where longer sections are necessary to maintain constructability) in an upstream to downstream fashion. Impervious dikes will be installed upstream and downstream of the current work section before work on the section is initiated unless noted otherwise (see Table 1.-Working Sections below for suggested work section stations and progression). Water will be diverted around the current work section through the use of a pump and temporary flexible hose. The current work section will be dewatered using an additional pump and a sediment bag. Work sections that involve the construction of a confluence of two reaches may require the use of two pump-around operations. Structures will be installed according to the details presented in the Construction Plans. Excavate only a portion of the channel that can be completed and stabilized within the same day. All excavated material will be placed in an appropriate stockpile area. Pools will be established once structures and channel alignments have been completed locally. Permanent stream crossings will be installed while the working section containing the crossing has been dewatered.

Grading of some portions of the proposed floodplain may need to be delayed until after work in subsequent sections has been completed, especially near confluences. Haul roads and temporary silt fence may also need to be removed before the proposed floodplain can be completed and/or unused existing channel can be filled.

Table 1. - Working Sections

Order of Progress	Pump Station #	Reach	Begin Station	End Station	Pump	Construction Notes
1	P-1	**WAXBR**	3+25	6+25	CD150 6" Pump	Construct ATV ford crossing
2	P-2	**WAXBR**	6+25	7+35	CD150 6" Pump	Operate pump stations P-2 and P-3 simultaneously to build confluence of WAXBR and UT1.
3	P-3	**UT1**	0+00	1+86	3" Trash Pump	
4	P-4	**WAXBR**	7+35	10+35	CD150 6" Pump	
5	P-5	**WAXBR**	10+35	13+35	CD150 6" Pump	
6	P-6	**WAXBR**	13+35	16+35	CD150 6" Pump	
7	P-7	**WAXBR**	16+35	18+25	CD150 6" Pump or CD225 8"	
8	P-8	**UT2**	0+00	3+00	3" Trash Pump	
9	P-9	**UT2**	3+00	5+75	3" Trash Pump	
10	P-10	**UT2**	5+75	8+75	3" Trash Pump	Construct ford and ATV ford crossings.
11	P-11	**UT2**	8+75	11+75	3" Trash Pump or CD100 4" Pump	
12	P-12	**WAXBR**	18+25	20+62	CD225 8" Pump	Operate pump stations P-12 and P-13 simultaneously to build confluence of WAXBR and UT1.
13	P-13	**UT2**	11+75	12+38	3" Trash Pump or CD100 4" Pump	

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WITS END
UNION COUNTY, NC

EROSION CONTROL NOTES

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E02
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **E02**

9/30/2021
Wits End_PSH_E02.dgn
Jarvis

Table 1. - Working Sections

Order of Progress	Pump Station #	Reach	Begin Station	End Station	Pump	Construction Notes
14	P-14	**WAXBR**	20+62	23+62	CD225 8" Pump	
15	P-15	**WAXBR**	23+62	26+62	CD225 8" Pump	
16	P-16	**WAXBR**	26+62	29+00	CD225 8" Pump	
17	P-17	**WAXBR**	29+00	32+00	CD225 8" Pump	Construct drive crossing.
18	P-18	**WAXBR**	32+00	35+00	CD225 8" Pump	
19	P-19	**WAXBR**	35+00	38+00	CD225 8" Pump	
20	P-20	**WAXBR**	38+00	40+00	CD225 8" Pump	
21	P-21	**UT3**	-0+50	0+36	3" Trash Pump or CD100 4" Pump	Construct permanent crossing.
22	P-22	**UT3**	1+50	3+50	3" Trash Pump or CD100 4" Pump	
23	P-23	**UT3**	3+50	6+50	3" Trash Pump or CD100 4" Pump	
24	P-24	**UT3**	6+50	9+50	3" Trash Pump or CD100 4" Pump	
25	P-25	**UT3**	9+50	10+65	3" Trash Pump or CD100 4" Pump	
26	P-26	**UT3A**	0+00	3+00	3" Trash Pump	
27	P-27	**UT3A**	3+00	6+00	3" Trash Pump	
28	P-28	**UT3**	10+65	11+85	CD100 4" Pump	Operate pump stations P-28 and P-29 simultaneously to build confluence of UT3 and UT3A.
29	P-29	**UT3A**	6+00	7+78	3" Trash Pump or CD100 4" Pump	
30	P-30	**UT3**	11+85	14+85	CD100 4" Pump	
31	P-31	**UT3**	14+85	17+85	CD100 4" Pump	
32	P-32	**UT3**	17+85	20+85	CD100 4" Pump	
33	P-33	**UT3**	20+85	23+85	CD100 4" Pump	
34	P-34	**UT3**	23+85	25+50	CD100 4" Pump	
35	P-35	**WAXBR**	40+00	42+22	CD225 8" Pump	Operate pump stations P-35 and P-36 simultaneously to build confluence of WAXBR and UT3.
36	P-36	**UT3**	25+50	26+28	CD100 4" Pump	
37	P-37	**WAXBR**	42+22	45+22	CD225 8" Pump	
38	P-38	**WAXBR**	45+22	48+22	CD225 8" Pump	
39	P-39	**WAXBR**	48+22	51+00	CD225 8" Pump	
40	P-40	**UT4**	0+00	3+00	3" Trash Pump or CD100 4" Pump	
41	P-41	**UT4**	3+00	6+00	3" Trash Pump or CD100 4" Pump	
42	P-42	**UT4**	6+00	9+00	3" Trash Pump or CD100 4" Pump	
43	P-43	**UT4**	9+00	10+76	3" Trash Pump or CD100 4"	Operate pump stations P-43 and P-44 simultaneously to build confluence of UT4 and UT5.
44	P-44	**UT5**	0+66	1+90	3" Trash Pump	
45	P-45	**WAXBR**	51+00	52+55	CD225 8" Pump	Operate pump stations P-45 and P-46 simultaneously to build confluence of WAXBR and UT4.
46	P-46	**UT4**	10+76	12+20	CD100 4" Pump	
47	P-47	**WAXBR**	52+55	53+99	DPC300 12" Pump	Construct drop structure.

DocuSigned by: Joshua G. Dalton 1089ADBC14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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CONSTRUCTION SEQUENCE (CONTINUED)

1. Ponds shall be dewatered according to pond Dam Breach and Dewatering Sequence (see sheet C03C).

2. At the end of each working day, the Contractor will be responsible for the application of seed and straw, as applicable, to newly established streambanks and disturbed areas. Erosion control matting will be installed on top of the seed and straw in accordance with the Erosion Control Construction Sequence.

Post-Construction
After all channel work has been completed:

1. All remaining disturbed areas are to be seeded and mulched in accordance with the Erosion Control Construction Sequence.

2. Live staking can begin on all completed sections of channel (WAXBR, UT1, UT2, UT3, UT3A, UT4 and UT5) in accordance with the Planting Plans.

3. Once channel construction and seeding has been complete, bare-rooted seedlings will be installed.

4. All haul road locations to be restored to pre-construction conditions.

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL NOTES

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E02A
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. ***E02A***

9/30/2021
Wits End_PSH_E02a.dgn
Harvey

Table 1. - Working Sections

Order of Progress	Pump Station #	Reach	Begin Station	End Station	Construction Notes
21	P-21	**UT3**	-1+00	0+36	Ditch silt removal, construct crossing
22	P-22	**UT3**	0+36	3+36	
23	P-23	**UT3**	3+36	6+36	
24	P-24	**UT3**	6+36	9+36	
25	P-25	**UT3**	9+36	10+63	
26	P-26	**UT3A**	0+00	3+00	
27	P-27	**UT3A**	3+00	6+00	
28	P-28	**UT3**	10+63	11+85	Operate pump stations P-28 and P-29 simultaneously to build confluence of UT3 and UT3A.
29	P-29	**UT3A**	6+00	7+78	
30	P-30	**UT3**	11+85	14+85	
31	P-31	**UT3**	14+85	17+85	
32	P-32	**UT3**	17+85	20+85	
33	P-33	**UT3**	20+85	23+85	
34	P-34	**UT3**	23+85	25+50	
35	P-35	**WAXBR**	40+00	42+22	Operate pump stations P-35 and P-36 simultaneously to build confluence of WAXBR and UT3.
36	P-36	**UT3**	25+50	26+28	
37	P-37	**WAXBR**	42+22	45+22	
38	P-38	**WAXBR**	45+22	48+22	
39	P-39	**WAXBR**	48+22	51+00	
40	P-40	**UT4**	0+00	3+00	
41	P-41	**UT4**	3+00	6+00	
42	P-42	**UT4**	6+00	9+00	
43	P-43	**UT4**	9+00	10+76	Operate pump stations P-43 and P-44 simultaneously to build confluence of UT4 and UT5.
44	P-44	**UT5**	0+66	1+90	
45	P-45	**WAXBR**	51+00	52+56	Operate pump stations P-45 and P-46 simultaneously to build confluence of WAXBR and UT4.
46	P-46	**UT4**	10+76	12+20	
47	P-47	**WAXBR**	52+56	53+99	Construct drop structure

CONSTRUCTION SEQUENCE (CONTINUED)

1. Ponds shall be dewatered according to pond Dam Breach and Dewatering Sequence (see sheet C03C).

2. At the end of each working day, the Contractor will be responsible for the application of seed and straw, as applicable, to newly established streambanks and disturbed areas. Erosion control matting will be installed on top of the seed and straw in accordance with the Erosion Control Construction Sequence.

Post-Construction
After all channel work has been completed:

1. All remaining disturbed areas are to be seeded and mulched in accordance with the Erosion Control Construction Sequence.

2. Live staking can begin on all completed sections of channel (WAXBR, UT1, UT2, UT3, UT3A, UT4 and UT5) in accordance with the Planting Plans.

3. Once channel construction and seeding has been complete, bare-rooted seedlings will be installed.

4. All haul road locations to be restored to pre-construction conditions.

Permanent Seeding (Main Mix)		
Common Name	**Latin**	**% (weight)**
Purpletop	Tridens flavus	18
Redtop	Agrostis alba	15
Deertongue	Dicanthelium clandestinum	5
Little Bluestem	Schizachyrium scoparium	5
Purple coneflower	Echinacea purpurea	5
Virginia wildrye	Elymus virginicus	5
Winter bentgrass	Agrostis hyemalis	5
Oxeye daisy	Chrysanthemum leucanthemum	4.5
Lanceleaf coreopsis	Coreopsis lanceoata	4
Plains coreopsis	Coreopsis tinctoria	4
Blackeyed Susan	Rudbeckia hirta	3
Shasta Daisy	Chrysanthemum maximum	3
Blanketflower (Gaillardia)	Gaillardia aristata	2
Blue false indigo	Baptisia australis	2
Creeping bentgrass	Agrostis stolonifera	2
Rocket larkspur	Delphinium ajacis	2
Blue vervain	Verbena hastata	1
Clasping Coneflower	Rudbeckia amplexus	1
Common Yarrow	Achillea millefolium	1
Cosmos	Cosmos bipnnatus	1
Fox sedge	Carex vulpinoidea	1
Narrowleaf sunflower	Helianthus angustifolius	1
Oxeye sunflower	Heliopsis helianthoides	1
Partridge pea	Chamaecrista fasciculata	1
Sensitive pea	Chamaecrista nictitans	1
Showy ticktrefoil	Desmodium canadense	1
Tall White beardtongue	Penstemon digitalis	1
Boneset	Eupatorium perfoliatum	0.5
Marsh blazing star	Liatris spicata	0.5
Mistflower	Eupatorium coelestinum	0.5
Path rush	Juncus tenuis	0.5
Redtop panicgrass	Panicum rigidulum	0.5
Rosemallow	Hibiscus moscheutos	0.5
Roundhead lespedeza	Lespedeza capitata	0.5
Wild bergamot	Monarda fistulosa	0.5
Wild senna	Senna hebecarpa	0.5
Note: Apply mix at rate of 2 lbs per acre.		
Recommended Planting Time: Any time		

Permanent Seeding (Wetland Mix)		
Common Name	**Latin**	**% (weight)**
Redtop Panicgrass	Panicum rigidulum	36
Bur-marigold	Bidens aristosa	20
Narrowleaved Sunflower	Helianthus angustifolius	18
Greenwhite Sedge	Carex albolutescens	8
Virginia Wildrye	Elymus virginicus	6
Soft Rush	Juncus effusus	5
Hop Sedge	Carex lupulina	5
Fox Sedge	Carex vulpinoidea	2
Note: Apply mix at rate of 4 lbs per acre.		
Recommended Planting Time: Any time		

DocuSigned by:
Joshua G. Dalton
-1889AD8C1499403...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL NOTES

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E02B
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
E02B

9/30/2021
Wits End_PSH_E02b.dgn
Jarvis

GROUND STABILIZATION AND MATERIALS HANDLING PRACTICES FOR COMPLIANCE WITH THE NCG01 CONSTRUCTION GENERAL PERMIT

Implementing the details and specifications on this plan sheet will result in the construction activity being considered compliant with the Ground Stabilization and Materials Handling sections of the NCG01 Construction General Permit (Sections E and F, respectively). The permittee shall comply with the Erosion and Sediment Control plan approved by the delegated authority having jurisdiction. All details and specifications shown on this sheet may not apply depending on site conditions and the delegated authority having jurisdiction.

SECTION E: GROUND STABILIZATION

Required Ground Stabilization Timeframes		
Site Area Description	**Stabilize within this many calendar days after ceasing land disturbance**	**Timeframe variations**
(a) Perimeter dikes, swales, ditches, and perimeter slopes	7	None
(b) High Quality Water (HQW) Zones	7	None
(c) Slopes steeper than 3:1	7	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed
(d) Slopes 3:1 to 4:1	14	-7 days for slopes greater than 50' in length and with slopes steeper than 4:1 -7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed
(e) Areas with slopes flatter than 4:1	14	-7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed unless there is zero slope

Note: After the permanent cessation of construction activities, any areas with temporary ground stabilization shall be converted to permanent ground stabilization as soon as practicable but in no case longer than 90 calendar days after the last land disturbing activity. Temporary ground stabilization shall be maintained in a manner to render the surface stable against accelerated erosion until permanent ground stabilization is achieved.

GROUND STABILIZATION SPECIFICATION

Stabilize the ground sufficiently so that rain will not dislodge the soil. Use one of the techniques in the table below:

Temporary Stabilization	Permanent Stabilization
• Temporary grass seed covered with straw or other mulches and tackifiers • Hydroseeding • Rolled erosion control products with or without temporary grass seed • Appropriately applied straw or other mulch • Plastic sheeting	• Permanent grass seed covered with straw or other mulches and tackifiers • Geotextile fabrics such as permanent soil reinforcement matting • Hydroseeding • Shrubs or other permanent plantings covered with mulch • Uniform and evenly distributed ground cover sufficient to restrain erosion • Structural methods such as concrete, asphalt or retaining walls • Rolled erosion control products with grass seed

POLYACRYLAMIDES (PAMS) AND FLOCCULANTS

1. Select flocculants that are appropriate for the soils being exposed during construction, selecting from the *NC DWR List of Approved PAMS/Flocculants*.
2. Apply flocculants at or before the inlets to Erosion and Sediment Control Measures.
3. Apply flocculants at the concentrations specified in the *NC DWR List of Approved PAMS/Flocculants* and in accordance with the manufacturer's instructions.
4. Provide ponding area for containment of treated Stormwater before discharging offsite.
5. Store flocculants in leak-proof containers that are kept under storm-resistant cover or surrounded by secondary containment structures.

EQUIPMENT AND VEHICLE MAINTENANCE

1. Maintain vehicles and equipment to prevent discharge of fluids.
2. Provide drip pans under any stored equipment.
3. Identify leaks and repair as soon as feasible, or remove leaking equipment from the project.
4. Collect all spent fluids, store in separate containers and properly dispose as hazardous waste (recycle when possible).
5. Remove leaking vehicles and construction equipment from service until the problem has been corrected.
6. Bring used fuels, lubricants, coolants, hydraulic fluids and other petroleum products to a recycling or disposal center that handles these materials.

LITTER, BUILDING MATERIAL AND LAND CLEARING WASTE

1. Never bury or burn waste. Place litter and debris in approved waste containers.
2. Provide a sufficient number and size of waste containers (e.g dumpster, trash receptacle) on site to contain construction and domestic wastes.
3. Locate waste containers at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
4. Locate waste containers on areas that do not receive substantial amounts of runoff from upland areas and does not drain directly to a storm drain, stream or wetland.
5. Cover waste containers at the end of each workday and before storm events or provide secondary containment. Repair or replace damaged waste containers.
6. Anchor all lightweight items in waste containers during times of high winds.
7. Empty waste containers as needed to prevent overflow. Clean up immediately if containers overflow.
8. Dispose waste off-site at an approved disposal facility.
9. On business days, clean up and dispose of waste in designated waste containers.

PAINT AND OTHER LIQUID WASTE

1. Do not dump paint and other liquid waste into storm drains, streams or wetlands.
2. Locate paint washouts at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
3. Contain liquid wastes in a controlled area.
4. Containment must be labeled, sized and placed appropriately for the needs of site.
5. Prevent the discharge of soaps, solvents, detergents and other liquid wastes from construction sites.

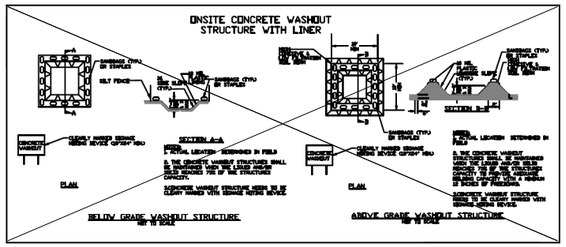
PORTABLE TOILETS

1. Install portable toilets on level ground, at least 50 feet away from storm drains, streams or wetlands unless there is no alternative reasonably available. If 50 foot offset is not attainable, provide relocation of portable toilet behind silt fence or place on a gravel pad and surround with sand bags.
2. Provide staking or anchoring of portable toilets during periods of high winds or in high foot traffic areas.
3. Monitor portable toilets for leaking and properly dispose of any leaked material. Utilize a licensed sanitary waste hauler to remove leaking portable toilets and replace with properly operating unit.

EARTHEN STOCKPILE MANAGEMENT

1. Show stockpile locations on plans. Locate earthen-material stockpile areas at least 50 feet away from storm drain inlets, sediment basins, perimeter sediment controls and surface waters unless it can be shown no other alternatives are reasonably available.
2. Protect stockpile with silt fence installed along toe of slope with a minimum offset of five feet from the toe of stockpile.
3. Provide stable stone access point when feasible.
4. Stabilize stockpile within the timeframes provided on this sheet and in accordance with the approved plan and any additional requirements. Soil stabilization is defined as vegetative, physical or chemical coverage techniques that will restrain accelerated erosion on disturbed soils for temporary or permanent control needs.

NORTH CAROLINA *Environmental Quality*



CONCRETE WASHOUTS

1. Do not discharge concrete or cement slurry from the site.
2. Dispose of, or recycle settled, hardened concrete residue in accordance with local and state solid waste regulations and at an approved facility.
3. Manage washout from mortar mixers in accordance with the above item and in addition place the mixer and associated materials on impervious barrier and within lot perimeter silt fence.
4. Install temporary concrete washouts per local requirements, where applicable. If an alternate method or product is to be used, contact your approval authority for review and approval. If local standard details are not available, use one of the two types of temporary concrete washouts provided on this detail.
5. Do not use concrete washouts for dewatering or storing defective curb or sidewalk sections. Stormwater accumulated within the washout may not be pumped into or discharged to the storm drain system or receiving surface waters. Liquid waste must be pumped out and removed from project.
6. Locate washouts at least 50 feet from storm drain inlets and surface waters unless it can be shown that no other alternatives are reasonably available. At a minimum, install protection of storm drain inlet(s) closest to the washout which could receive spills or overflow.
7. Locate washouts in an easily accessible area, on level ground and install a stone entrance pad in front of the washout. Additional controls may be required by the approving authority.
8. Install at least one sign directing concrete trucks to the washout within the project limits. Post signage on the washout itself to identify this location.
9. Remove leavings from the washout when at approximately 75% capacity to limit overflow events. Replace the tarp, sand bags or other temporary structural components when no longer functional. When utilizing alternative or proprietary products, follow manufacturer's instructions.
10. At the completion of the concrete work, remove remaining leavings and dispose of in an approved disposal facility. Fill pit, if applicable, and stabilize any disturbance caused by removal of washout.

HERBICIDES, PESTICIDES AND RODENTICIDES

1. Store and apply herbicides, pesticides and rodenticides in accordance with label restrictions.
2. Store herbicides, pesticides and rodenticides in their original containers with the label, which lists directions for use, ingredients and first aid steps in case of accidental poisoning.
3. Do not store herbicides, pesticides and rodenticides in areas where flooding is possible or where they may spill or leak into wells, stormwater drains, ground water or surface water. If a spill occurs, clean area immediately.
4. Do not stockpile these materials onsite.

HAZARDOUS AND TOXIC WASTE

1. Create designated hazardous waste collection areas on-site.
2. Place hazardous waste containers under cover or in secondary containment.
3. Do not store hazardous chemicals, drums or bagged materials directly on the ground.

NCG01 GROUND STABILIZATION AND MATERIALS HANDLING

EFFECTIVE: 04/01/19

DocuSigned by:
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NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

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WITS END
UNION COUNTY, NC

EROSION CONTROL NOTES

PROJECT # : 1221-20024
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SHEET NO. ***E02B***

9/30/2021
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PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION A: SELF-INSPECTION

Self-inspections are required during normal business hours in accordance with the table below. When adverse weather or site conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. In addition, when a storm event of equal to or greater than 1.0 inch occurs outside of normal business hours, the self-inspection shall be performed upon the commencement of the next business day. Any time when inspections were delayed shall be noted in the Inspection Record.

Inspect	Frequency (during normal business hours)	Inspection records must include:
(1) Rain gauge maintained in good working order	Daily	Daily rainfall amounts. If no daily rain gauge observations are made during weekend or holiday periods, and no individual day rainfall information is available, record the cumulative rain measurement for those un-attended days (anc this will determine if a site inspection is needed). Days on which no rainfall occurred shall be recorded as "zero." The permittee may use another rain-monitoring device approved by the Division.
(2) E&SC Measures	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the measures inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Indication of whether the measures were operating properly, 5. Description of maintenance needs for the measure, 6. Description, evidence, and date of corrective actions taken.
(3) Stormwater discharge outfalls (SDCs)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the discharge outfalls inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Evidence of indicators of stormwater pollution such as oil sheen, floating or suspended solids or discoloration, 5. Indication of visible sediment leaving the site, 6. Description, evidence, and date of corrective actions taken.
(4) Perimeter of site	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If visible sedimentation is found outside site limits, then a record of the following shall be made: 1. Actions taken to clean up or stabilize the sediment that has left the site limits, 2. Description, evidence, and date of corrective actions taken, and 3. An explanation as to the actions taken to control future releases.
(5) Streams or wetlands onsite or offsite (where accessible)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If the stream or wetland has increased visible sedimentation or a stream has visible increased turbidity from the construction activity, then a record of the following shall be made: 1. Description, evidence and date of corrective actions taken, and 2. Records of the required reports to the appropriate Division Regional Office per Part III, Section C, Item (2)(a) of this permit.
(6) Ground stabilization measures	After each phase of grading	1. The phase of grading (installation of perimeter E&SC measures, clearing and grubbing, installation of storm drainage facilities, completion of all land-disturbing activity, construction or redevelopment, permanent ground cover). 2. Documentation that the required ground stabilization measures have been provided within the required timeframe or an assurance that they will be provided as soon as possible.

NOTE: The rain inspection resets the required 7 calendar day inspection requirement.

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION B: RECORDKEEPING

1. E&SC Plan Documentation

The approved E&SC plan as well as any approved deviation shall be kept on the site. The approved E&SC plan must be kept up-to-date throughout the coverage under this permit. The following items pertaining to the E&SC plan shall be kept on site and available for inspection at all times during normal business hours.

Item to Document	Documentation Requirements
(a) Each E&SC measure has been installed and does not significantly deviate from the locations, dimensions and relative elevations shown on the approved E&SC plan.	Initial and date each E&SC measure on a copy of the approved E&SC plan or complete, date and sign an inspection report that lists each E&SC measure shown on the approved E&SC plan. This documentation is required upon the initial installation of the E&SC measures or if the E&SC measures are modified after initial installation.
(b) A phase of grading has been completed.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate completion of the construction phase.
(c) Ground cover is located and installed in accordance with the approved E&SC plan.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate compliance with approved ground cover specifications.
(d) The maintenance and repair requirements for all E&SC measures have been performed.	Complete, date and sign an inspection report.
(e) Corrective actions have been taken to E&SC measures.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate the completion of the corrective action.

2. Additional Documentation to be Kept on Site

In addition to the E&SC plan documents above, the following items shall be kept on the site and available for inspectors at all times during normal business hours, unless the Division provides a site-specific exemption based on unique site conditions that make this requirement not practical:

(a) This General Permit as well as the Certificate of Coverage, after it is received.

(b) Records of inspections made during the previous twelve months. The permittee shall record the required observations on the Inspection Record Form provided by the Division or a similar inspection form that includes all the required elements. Use of electronically-available records in lieu of the required paper copies will be allowed if shown to provide equal access and utility as the hard-copy records.

3. Documentation to be Retained for Three Years

All data used to complete the e-NOI and all inspection records shall be maintained for a period of three years after project completion and made available upon request. [40 CFR 122.41]

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION C: REPORTING

1. Occurrences that Must be Reported

Permittees shall report the following occurrences:

(a) Visible sediment deposition in a stream or wetland.

(b) Oil spills if:
- They are 25 gallons or more,
- They are less than 25 gallons but cannot be cleaned up within 24 hours,
- They cause sheen on surface waters (regardless of volume), or
- They are within 100 feet of surface waters (regardless of volume).

(c) Releases of hazardous substances in excess of reportable quantities under Section 311 of the Clean Water Act (Ref: 40 CFR 110.3 and 40 CFR 117.3) or Section 102 of CERCLA (Ref: 40 CFR 302.4) or G.S. 143-215.85.

(d) Anticipated bypasses and unanticipated bypasses.

(e) Noncompliance with the conditions of this permit that may endanger health or the environment.

2. Reporting Timeframes and Other Requirements

After a permittee becomes aware of an occurrence that must be reported, he shall contact the appropriate Division regional office within the timeframes and in accordance with the other requirements listed below. Occurrences outside normal business hours may also be reported to the Department's Environmental Emergency Center personnel at (800) 858-0368.

Occurrence	Reporting Timeframes (After Discovery) and Other Requirements
(a) Visible sediment deposition in a stream or wetland	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the sediment and actions taken to address the cause of the deposition. Division staff may waive the requirement for a written report on a case-by-case basis. • If the stream is named on the NC 303(d) list as impaired for sediment-related causes, the permittee may be required to perform additional monitoring, inspections or apply more stringent practices if staff determine that additional requirements are needed to assure compliance with the federal or state impaired-waters conditions.
(b) Oil spills and release of hazardous substances per Item 1(b)-(c) above	• ***Within 24 hours***, an oral or electronic notification. The notification shall include information about the date, time, nature, volume and location of the spill or release.
(c) Anticipated bypasses [40 CFR 122.41(m)(3)]	• ***A report at least ten days before the date of the bypass, if possible***. The report shall include an evaluation of the anticipated quality and effect of the bypass.
(d) Unanticipated bypasses [40 CFR 122.41(m)(3)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days,*** a report that includes an evaluation of the quality and effect of the bypass.
(e) Noncompliance with the conditions of this permit that may endanger health or the environment[40 CFR 122.41(l)(7)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the noncompliance, and its causes; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time noncompliance is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. [40 CFR 122.41(l)(6). • Division staff may waive the requirement for a written report on a case-by-case basis.

PART II, SECTION G, ITEM (4)
DRAW DOWN OF SEDIMENT BASINS FOR MAINTENANCE OR CLOSE OUT

Sediment basins and traps that receive runoff from drainage areas of one acre or more shall use outlet structures that withdraw water from the surface when these devices need to be drawn down for maintenance or close out unless this is infeasible. The circumstances in which it is not feasible to withdraw water from the surface shall be rare (for example, times with extended cold weather). Non-surface withdrawals from sediment basins shall be allowed only when all of the following criteria have been met:

(a) The E&SC plan authority has been provided with documentation of the non-surface withdrawal and the specific time periods or conditions in which it will occur. The non-surface withdrawal shall not commence until the E&SC plan authority has approved these items,
(b) The non-surface withdrawal has been reported as an anticipated bypass in accordance with Part III, Section C, Item (2)(c) and (d) of this permit,
(c) Dewatering discharges are treated with controls to minimize discharges of pollutants from stormwater that is removed from the sediment basin. Examples of appropriate controls include properly sited, designed and maintained dewatering tanks, weir tanks, and filtration systems,
(d) Vegetated, upland areas of the sites or a properly designed stone pad is used to the extent feasible at the outlet of the dewatering treatment devices described in Item (c) above,
(e) Velocity dissipation devices such as check dams, sediment traps, and riprap are provided at the discharge points of all dewatering devices, and
(f) Sediment removed from the dewatering treatment devices described in Item (c) above is disposed of in a manner that does not cause deposition of sediment into waters of the United States.

NORTH CAROLINA *Environmental Quality*

NCG01 SELF-INSPECTION, RECORDKEEPING AND REPORTING | EFFECTIVE: 04/01/19

DocuSigned by:
Joshua G. Dalton
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NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL NOTES

PROJECT # : 122I-20024
DRAWING NAME: WITS END PSH E02D
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. ***E02D***

9/30/2021
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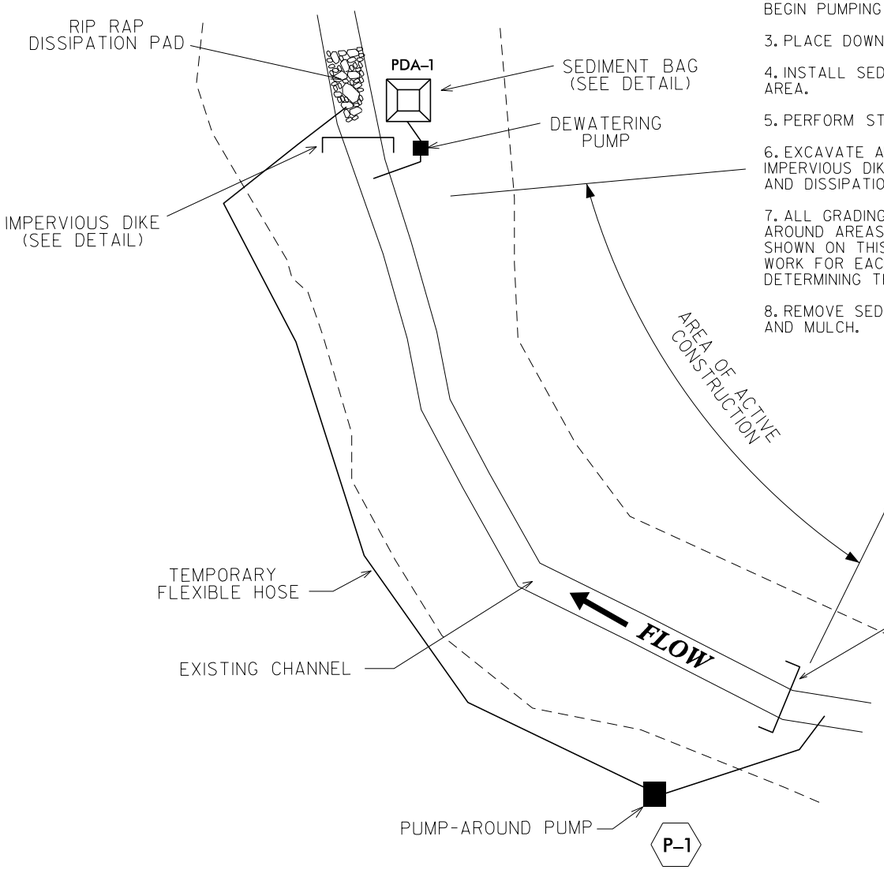


CONSTRUCTION SEQUENCE FOR TYPICAL PUMP-AROUND:

1. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.

2. PLACE UPSTREAM IMPERVIOUS DIKE, DOWNSTREAM RIP RAP DISSIPATION PAD, AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.

3. PLACE DOWNSTREAM IMPERVIOUS DIKE.

4. INSTALL SEDIMENT BAG AND ASSOCIATED PUMP. DEWATER THE ENTRAPPED AREA.

5. PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLANS.

6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF IMPERVIOUS DIKES. REMOVE IMPERVIOUS DIKES, PUMPS, TEMPORARY FLEXIBLE HOSE, AND DISSIPATION PAD (BEGIN WITH DOWNSTREAM IMPERVIOUS DIKE FIRST).

7. ALL GRADING AND STABILIZATION MUST BE COMPLETED WITHIN THE PUMP AROUND AREAS BETWEEN THE IMPERVIOUS DIKES. THE IMPERVIOUS LOCATIONS AS SHOWN ON THIS SHEET ONLY REPRESENT THE UPPER AND LOWER EXTENT OF WORK FOR EACH STREAM SEGMENT. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF THE IMPERVIOUS DIKES.

8. REMOVE SEDIMENT BAG(S) AND BACKFILL. STABILIZE DISTURBED AREA WITH SEED AND MULCH.

NOTES:

1. ALL EXCAVATION SHALL BE PERFORMED IN ONLY DRY OR ISOLATED SECTIONS OF CHANNEL

2. IMPERVIOUS DIKES ARE TO BE USED TO ISOLATE WORK FROM STREAM FLOW WHEN NECESSARY

3. ALL GRADED STREAM BANKS SHALL BE SEEDED, MULCHED, AND MATTED AT THE END OF EACH WORKING DAY. ALL OTHER GRADED AREAS SHALL BE SEEDED IN ACCORDANCE WITH THE CONSTRUCTION DOCUMENTS.

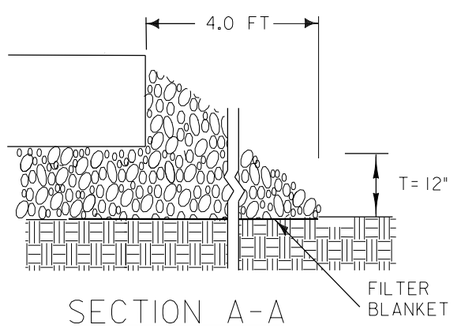
4. MAINTENANCE OF STREAM FLOW OPERATIONS SHALL BE INCIDENTAL TO THE WORK, THIS INCLUDES POLYETHYLENE SHEETING, DIVERSION PIPES, PUMPS, AND HOSES.

5. PUMPS AND HOSES SHALL BE OF A SUFFICIENT SIZE AND NUMBER TO DEWATER THE WORK AREA.

6. RIP RAP DISSIPATION PAD TO BE INSTALLED DOWNSTREAM OF LOWER IMPERVIOUS DIKE

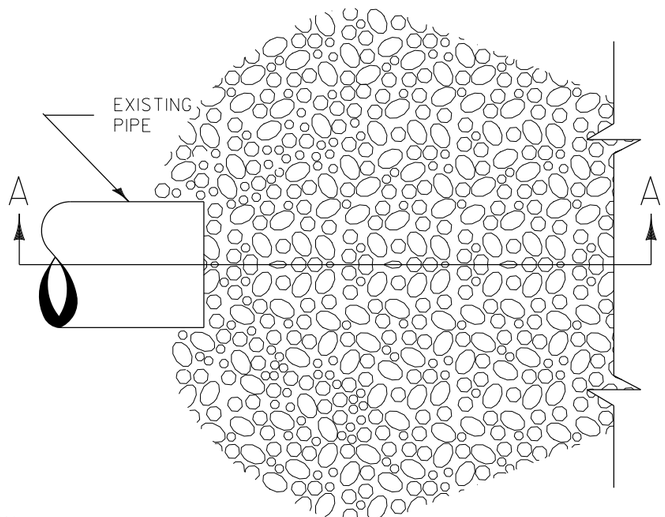
TYPICAL PUMP-AROUND OPERATION

RIPRAP DISSIPATION PAD



SECTION A-A

PLAN VIEW



NOTES:

1. La IS THE LENGTH OF THE RIPRAP APRON.
2. T = THICKNESS
3. IN A WELL-DEFINED CHANNEL EXTEND THE APRON UP THE CHANNEL BANKS TO THE TOP OF THE BANK.
4. A FILTER BLANKET OR FILTER FABRIC SHOULD BE INSTALLED BETWEEN THE RIPRAP AND SOIL FOUNDATION.

RIP RAP DISIPATION PAD SPECIFICATIONS

ASSUMED HOSE SIZE (IN)	PERMANENT (Y/N)	LENGTH La (FT)	WIDTH Wo (FT)	STONE SIZE d50 (IN)	STONE CLASS	THICKNESS (IN)
4"	N	4.0	1.0	3	A	12

DocuSigned by:
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NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL DETAILS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E03
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. ***E03***

9/30/2021
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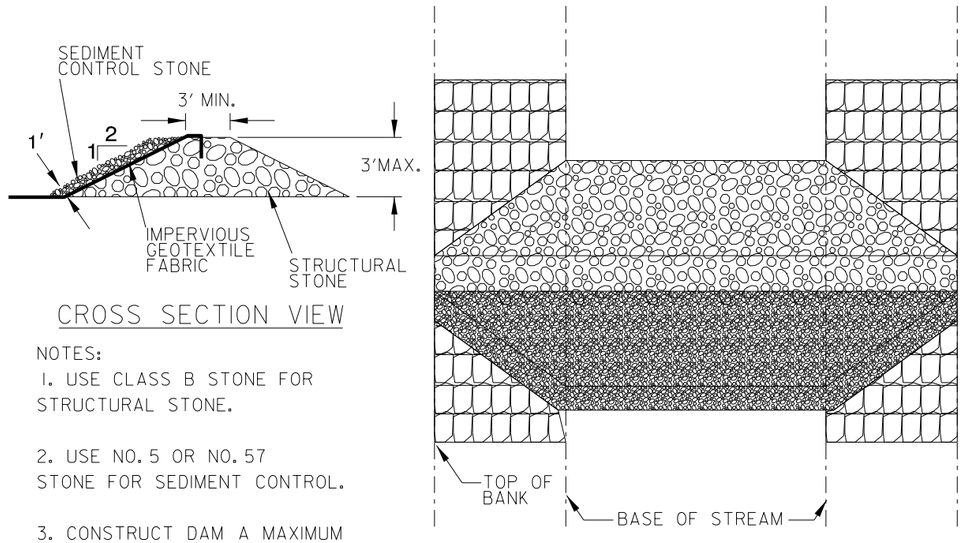
IMPERVIOUS DIKE



CROSS SECTION VIEW

NOTES:

1. USE CLASS B STONE FOR STRUCTURAL STONE.

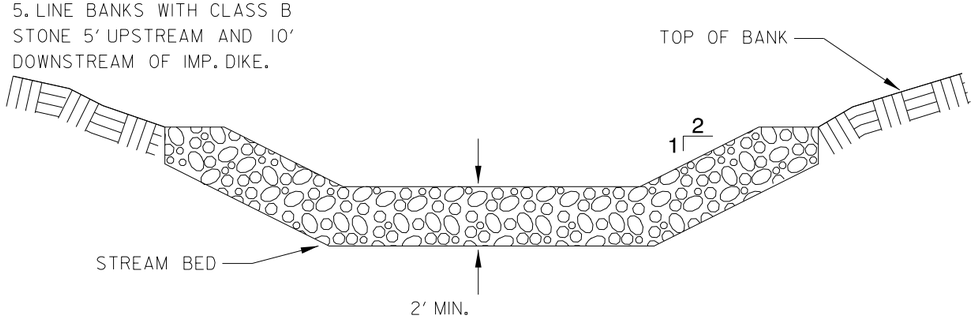
2. USE NO. 5 OR NO. 57 STONE FOR SEDIMENT CONTROL.

3. CONSTRUCT DAM A MAXIMUM OF 1 FT. ABOVE NORMAL FLOW DEPTH.

4. TOE IN IMPERVIOUS MATERIAL

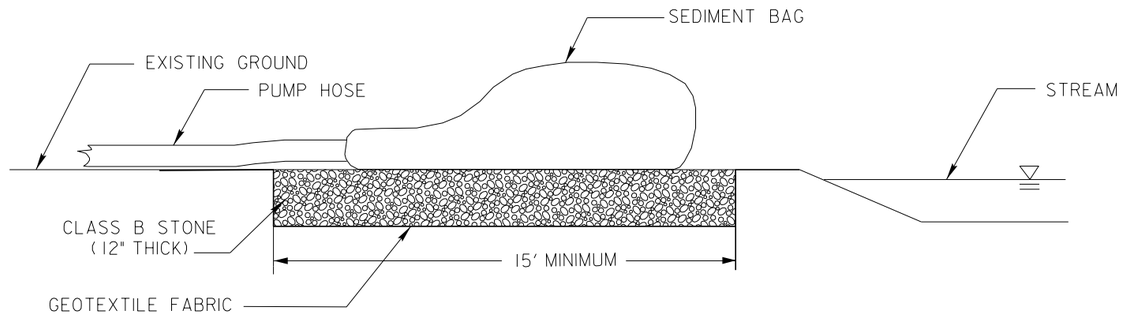
5. LINE BANKS WITH CLASS B STONE 5' UPSTREAM AND 10' DOWNSTREAM OF IMP. DIKE.

TOP VIEW



FRONT VIEW

SEDIMENT BAG



INSTALLATION:

1. INSTALL SEDIMENT BAG ON A SLOPE SO INCOMING WATER FLOWS DOWNHILL THROUGH BAG WITHOUT CREATING MORE EROSION. TO INCREASE THE EFFICIENCY OF FILTRATION, PLACE THE BAG ON A GRAVEL BED IN ORDER TO MAXIMIZE WATER FLOW THROUGH THE SURFACE AREA OF THE BAG.

2. BAG IS FULL WHEN IT NO LONGER CAN EFFICIENTLY FILTER SEDIMENT OR ALLOW WATER TO PASS AT A REASONABLE RATE. FLOW RATES WILL VARY DEPENDING ON THE SIZE OF SEDIMENT BAG, THE TYPE AND AMOUNT OF SEDIMENT DISCHARGED INTO THE BAG, THE TYPE OF GROUND, ROCK OR OTHER SUBSTANCE UNDER THE BAG AND THE DEGREE OF THE SLOPE ON WHICH THE BAG LIES. UNDER MOST CIRCUMSTANCES THE SEDIMENT BAG WILL ACCOMMODATE FLOW RATES OF 1100 GALLONS PER MINUTE. USE OF EXCESSIVE FLOW RATES OR OVERFILLING WITH SEDIMENT WILL CAUSE THE BAG TO RUPTURE OR FAILURE OF THE HOSE ATTACHMENT STRAPS.

3. DISPOSE OF SEDIMENT BAG AS DIRECTED BY THE SITE DESIGNER. IF ALLOWED, BAG MAY BE CUT OPEN AND THE CONTENTS SEEDED AFTER REMOVING VISIBLE FABRIC.

4. REFER TO DETAIL REGARDING GEOTEXTILE FABRIC ATTRIBUTES.

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
PH: 919.859.0515
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL DETAILS

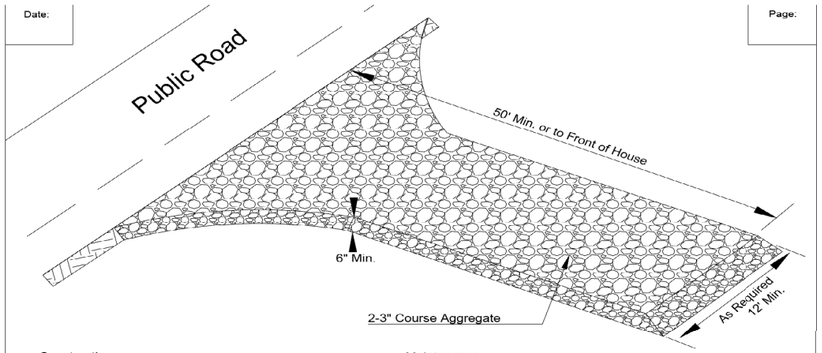
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E03A
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. ***E03A***

9/30/2021
Wits End_PSH_E03a.dgn
Default

Date:

Page:



Construction:
1. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade it.
2. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.
3. Provide drainage to carry water to a sediment trap or other suitable outlet.
4. Use geotextile fabrics in order to improve stability of the foundation in locations subject to seepage or high water table.

Maintenance:
1. Per NCG-01 inspect at least once a week and after each 1 inch or greater rainfall; make any required repairs immediately.
2. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. This may require periodic topdressing with 2 inch stone.
3. Immediately remove all objectionable materials spilled, washed or tracked onto public roadways.

NORTH CAROLINA Environmental Quality

EFFECTIVE DATE: 11/12/2020

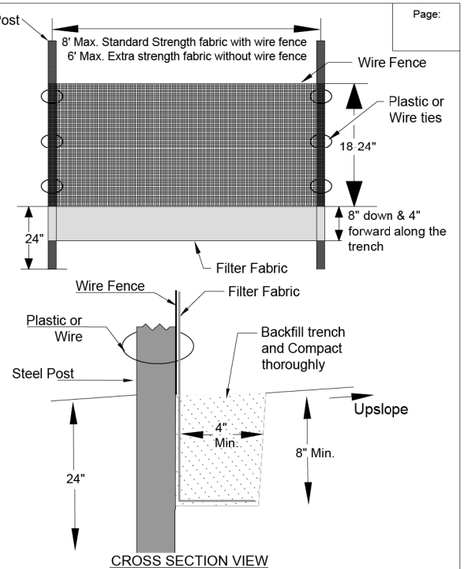
CONSTRUCTION ENTRANCE / EXIT

Date:

Page:

Construction:
1. Construct the sediment barrier of standard strength or extra strength synthetic filter fabrics.
2. Ensure that the height of the sediment fence does not exceed 24 inches above the ground. (Higher fences may impound volumes of water sufficient to cause failure of the structure.)
3. Construct the filter fabric from a continuous roll cut to the length of the barrier to avoid joints. When joints are necessary, securely fasten the filter cloth only at a support post with 4 feet minimum overlap to the next post.
4. Support standard strength filter fabric by wire mesh fastened securely to the upslope side of the posts. Extend the wire mesh support to the bottom of the trench. Fasten the wire reinforcement, then fabric on the upslope side of the fence post. Wire or plastic zip ties should have a minimum 50 pound tensile strength.
5. When a wire mesh support fence is used, space posts a maximum of 8 feet apart. Supports should be driven securely into the ground a minimum of 24 inches.
6. Extra strength filter fabric with 6 feet post spacing does not require wire mesh support fence. Securely fasten the filter fabric directly to posts. Wire or plastic zip ties should have a minimum of 50 pound tensile strength.
7. Excavate the trench approximately 4 inches wide and 8 inches deep along the proposed line of the posts and upslope from the barrier.
8. Place 12 inches of fabric along the bottom and side of the trench.
9. Backfill the trench with soil placed over the filter fabric and compact. Thorough compaction of the backfill is critical to silt fence performance.
10. Do not attach filter fabric to existing trees.

Maintenance:
1. Inspect sediment fences at least once a week and after each 1 inch rainfall. Make any required repairs immediately.
2. Should the fabric of a sediment fence collapse, tear, decompose, or become ineffective, replace it promptly.
3. Remove sediment deposits as necessary to provide adequate storage volume for the next rain and reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.
4. Remove all fencing materials and unstable sediment deposits and bring the area to grade and stabilize it after the contributing drainage area has been properly stabilized.



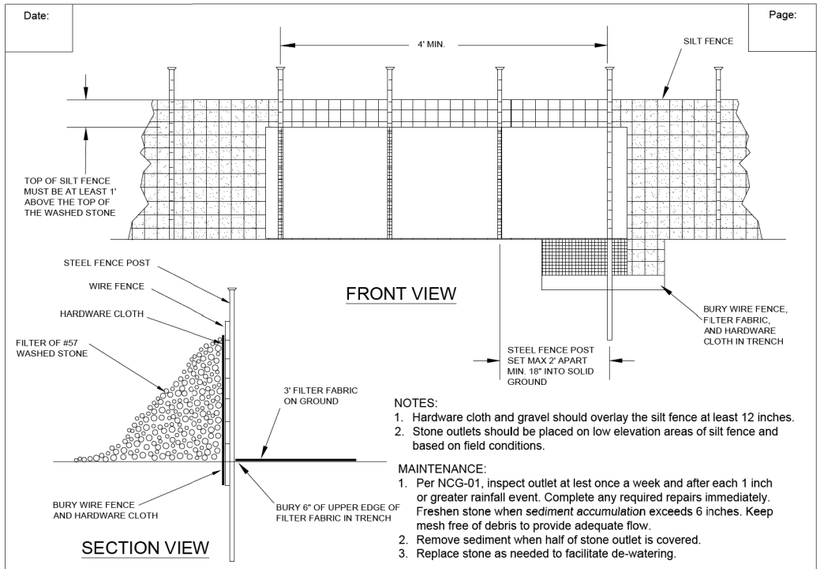
NORTH CAROLINA Environmental Quality

EFFECTIVE DATE: 11/12/2020

SILT FENCE

Date:

Page:



NOTES:
1. Hardware cloth and gravel should overlay the silt fence at least 12 inches.
2. Stone outlets should be placed on low elevation areas of silt fence and based on field conditions.

MAINTENANCE:
1. Per NCG-01, inspect outlet at lest once a week and after each 1 inch or greater rainfall event. Complete any required repairs immediately. Freshen stone when sediment accumulation exceeds 6 inches. Keep mesh free of debris to provide adequate flow.
2. Remove sediment when half of stone outlet is covered.
3. Replace stone as needed to facilitate de-watering.

NORTH CAROLINA Environmental Quality

EFFECTIVE DATE: 11/12/2020

SILT FENCE OUTLET

DocuSigned by:
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9/30/2021

DATE:

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ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL DETAILS

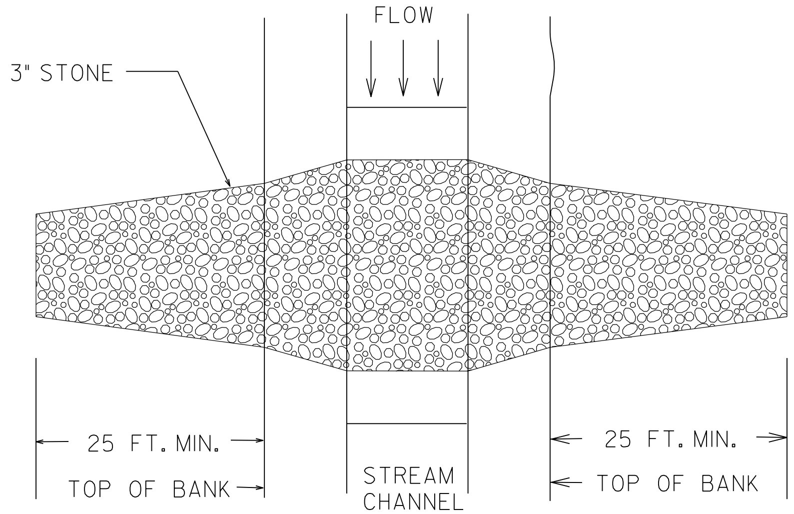
PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E03B
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
E03B

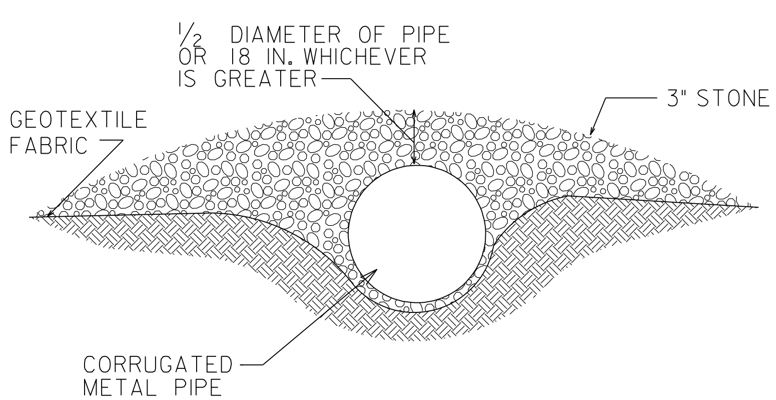
9/30/2021
Wits End_PSH_E03b.dgn
Jarvis

TEMPORARY CULVERTED STREAM CROSSING

NOTE: FOR USE IN EXISTING CHANNELS ONLY.
NOT FOR USE IN RESTORED STREAMS.

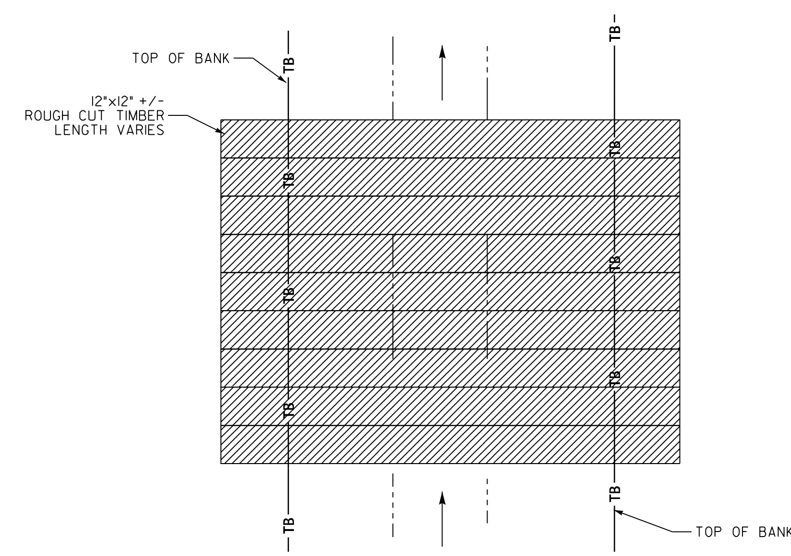


PLAN VIEW



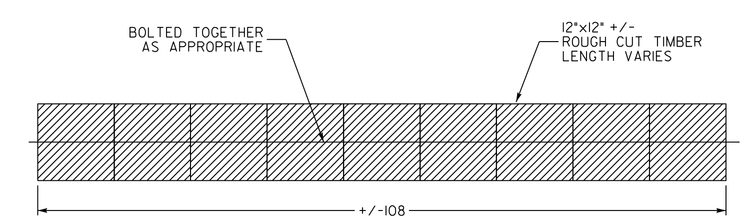
PROFILE VIEW

LOG MAT BRIDGE

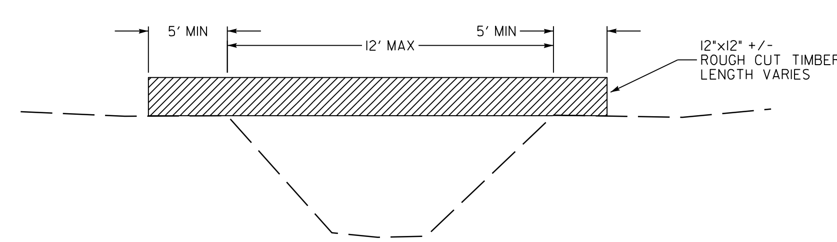


PLAN VIEW

NOTE:
DETAIL PROVIDED FOR INFORMATIONAL PURPOSES. USE OF LOG MAT BRIDGE IS AT CONTRACTORS DISCRETION.



SECTION THROUGH LOG MAT BRIDGE



CROSS SECTION VIEW

DocuSigned by:
Joshua G Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

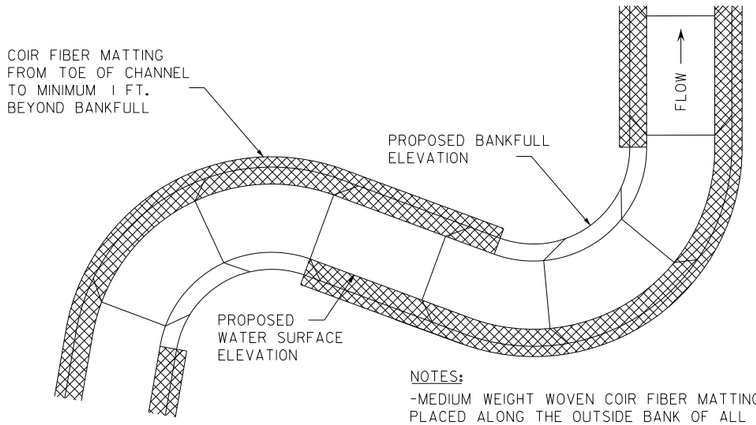
EROSION CONTROL DETAILS

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH E03C
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	

SHEET NO.
E03C

9/30/2021
Wits End_PSH_E03c.dgn
harvey

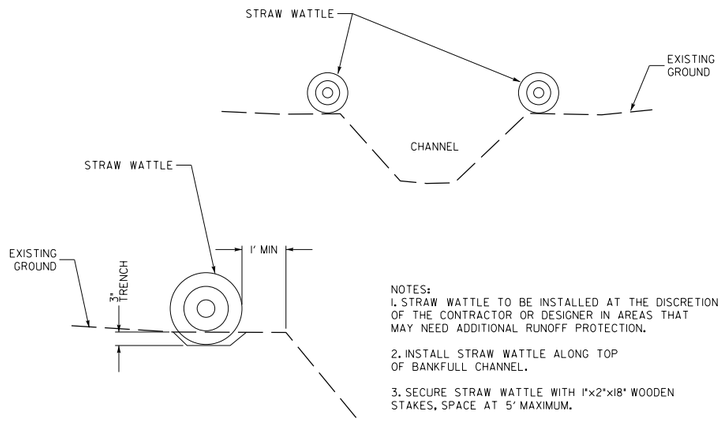
TYPICAL MATTING LOCATION



NOTES:

-MEDIUM WEIGHT WOVEN COIR FIBER MATTING SHALL BE PLACED ALONG THE OUTSIDE BANK OF ALL BENDS AND ALONG BOTH SIDES OFTHE CHANNEL IN TANGENT AREAS.
-FIELD ADJUSTMENTS TO MATTING LOCATION MAY BE MADE AT THE DESIGNERS OR CONTRACTORS DISCRETION AS NECESSARY.

STRAW WATTLE



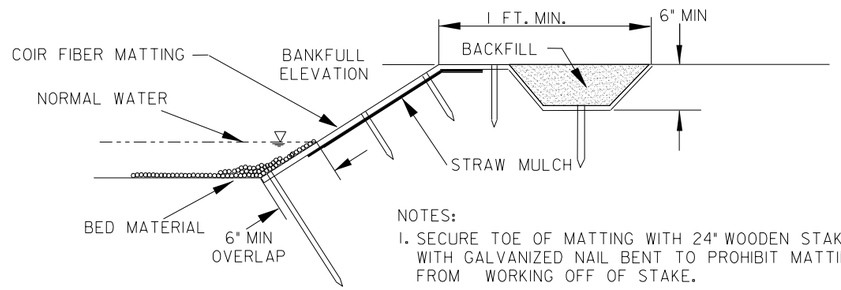
NOTES:
1. STRAW WATTLE TO BE INSTALLED AT THE DISCRETION OF THE CONTRACTOR OR DESIGNER IN AREAS THAT MAY NEED ADDITIONAL RUNOFF PROTECTION.

2. INSTALL STRAW WATTLE ALONG TOP OF BANKFULL CHANNEL.

3. SECURE STRAW WATTLE WITH 1"x2"x18" WOODEN STAKES. SPACE AT 5' MAXIMUM.

4. STRAW SHALL BE CERTIFIED WEED FREE.

COIR MATTING CROSS SECTION



NOTES:
1. SECURE TOE OF MATTING WITH 24" WOODEN STAKES WITH GALVANIZED NAIL BENT TO PROHIBIT MATTING FROM WORKING OFF OF STAKE.

2. USE 12" WOODEN STAKES ON 5' CENTERS OR AS DIRECTED BY MANUFACTURER'S RECOMMENDATIONS.

3. MINIMUM 1' WIDE, 6" DEEP TRENCH OVER TOP OF BANK WITH MATTING LAID FLAT AND STAKED. TRENCH TO BE BACKFILLED WITH EXCAVATED MATERIAL.

DocuSigned by:
Joshua G Dalton
1080AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL DETAILS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E03D
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
E03D

9/30/2021
Wits End_PSH_E03d.dgn
jharvey

SURVEY INFORMATION PROPERTY/ EASEMENT PROVIDED BY:
CAROLINA SURVEYORS, INC.
P.O. BOX 267
PINEVILLE, NC 28134

HORIZONTAL DATUM: NAD 83 (2011)
VERTICAL DATUM: NAVD 1988

200′ 100′ 0 200′ 400′
SCALE: 1″ = 400′

NAD 83

Snyders Store Rd 1945

L J Whitley Rd 1949

WAXHAW BRANCH

E04 E05 E06 E07 E08 E09 E10

GRAVEL CONSTRUCTION ENTRANCE – SEE INSET

BORROW AREA

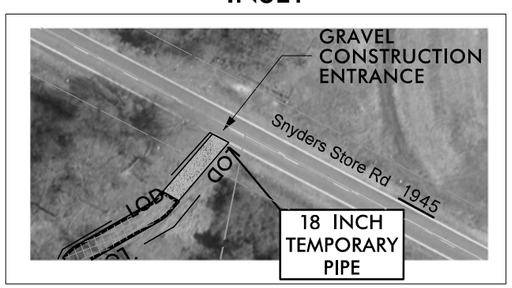
STAGING AREA

UT 1 UT 2 UT 3 UT 3A UT 4 UT 5

WAXBR

LOD CE

INSET



HAUL ROAD

9/30/2021
Wits End_psh_E03e.dgn
jharvell

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

HAUL ROADS

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E03E
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO.
E03E

NOTE:
INSTALL STRAW WATTLES BETWEEN WORK AREA AND STREAMS (EXISTING AND PROPOSED).

LOD — LIMITS OF DISTURBANCE

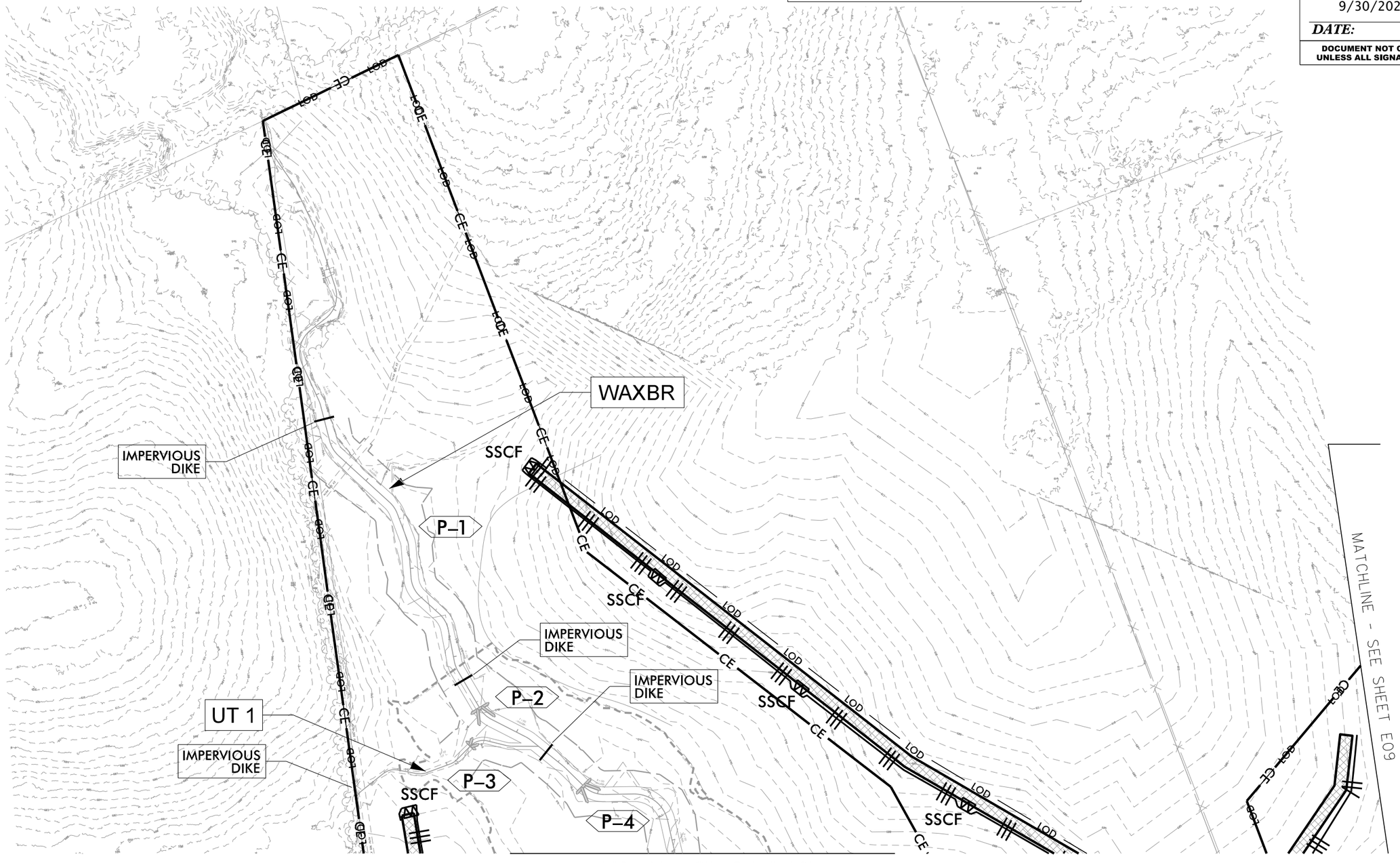
TEMPORARY SILT FENCE

HAUL ROAD

SPECIAL SEDIMENT CONTROL FENCE BREAK

100′ 50′ 0 100′ 200′
SCALE: 1″ = 100′

NAD 83



DocuSigned by:
Joshua G Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH E04
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	***E04***

9/30/2021
Wits End_psh_E04.dgn
jharvell

NOTE:
INSTALL STRAW WATTLES BETWEEN WORK AREA AND STREAMS (EXISTING AND PROPOSED).

LOD — LIMITS OF DISTURBANCE
TEMPORARY SILT FENCE
HAUL ROAD
SPECIAL SEDIMENT CONTROL FENCE BREAK
SILT CHECK – TYPE 'A'

100' 50' 0 100' 200'
SCALE: 1" = 100'

NAD 83

MATCHLINE - SEE SHEET E04

MATCHLINE - SEE SHEET E09

MATCHLINE - SEE SHEET E06

P-4 P-5 P-6 P-7 P-9 P-10 P-11 P-12 P-13

IMPERVIOUS DIKE

WAXBR

SSCF

SC-A

UT 2

LOD CE

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
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TEL: 919.851.1545
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E05
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. E05

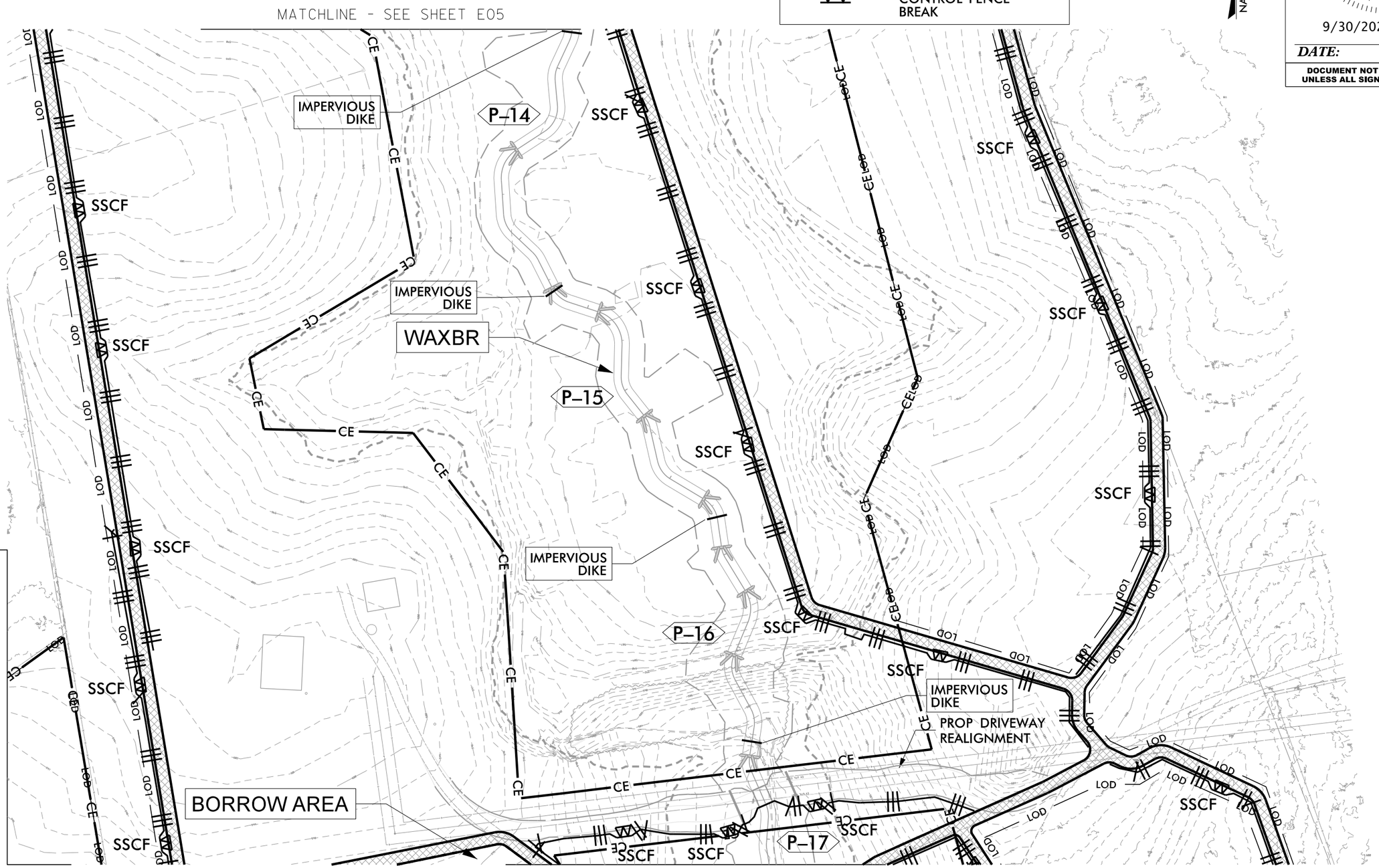
9/30/2021
Wits End_psh_E05.dgn
Jarvis

NOTE:
INSTALL STRAW WATTLES BETWEEN WORK AREA AND STREAMS (EXISTING AND PROPOSED).

— LOD —	LIMITS OF DISTURBANCE
	TEMPORARY SILT FENCE
	HAUL ROAD
	SPECIAL SEDIMENT CONTROL FENCE BREAK

100′ 50′ 0 100′ 200′
SCALE: 1″=100′

NAD 83



DocuSigned by:
Joshua G Dalton
1088AD8C1494043...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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SUNGATE DESIGN GROUP, P.A.
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PH: (919) 851-2545
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL

PROJECT # :	1221-20024
DRAWING NAME:	WITS END PSH E06
DATE:	2021
DRAWN BY:	JRH
REVIEWED BY:	JGD
REVISIONS:	
SHEET NO.	***E06***

9/30/2021
Wits End_psh_E06.dgn
Harvey

NOTE:
INSTALL STRAW WATTLES BETWEEN WORK AREA AND STREAMS (EXISTING AND PROPOSED).

LOD — LIMITS OF DISTURBANCE
TEMPORARY SILT FENCE
HAUL ROAD
SPECIAL SEDIMENT CONTROL FENCE BREAK

100′ 50′ 0 100′ 200′
SCALE: 1″ = 100′

NAD 83

BORROW AREA

MATCHLINE - SEE SHEET E06

SSCF
CE
LOD
P–17
P–18
P–19
P–20
P–31
P–32
P–33
P–34
IMPERVIOUS DIKE
UT 3
WAXBR
BORROW AREA
STAGING AREA
GRAVEL CONSTRUCTION ENTRANCE
1945 Snyders Store Rd

MATCHLINE - SEE SHEET E10

MATCHLINE - SEE SHEET E08

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021
DATE:

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TEL: 919.851.2003
ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E07
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. E07

9/30/2021
Wits End_psh_E07.dgn
Jarvai

NOTE:
INSTALL STRAW WATTLES BETWEEN WORK AREA AND STREAMS (EXISTING AND PROPOSED).

— LOD —	LIMITS OF DISTURBANCE
	TEMPORARY SILT FENCE
	HAUL ROAD
	SPECIAL SEDIMENT CONTROL FENCE BREAK

100′ 50′ 0 100′ 200′
SCALE: 1″ = 100′

NAD 83

MATCHLINE - SEE SHEET E07

MATCHLINE - SEE SHEET E09

1945 Snyders Store Rd

DocuSigned by:
Joshua G. Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021
DATE:

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TEL: 919.851.1415
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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E08
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. E08

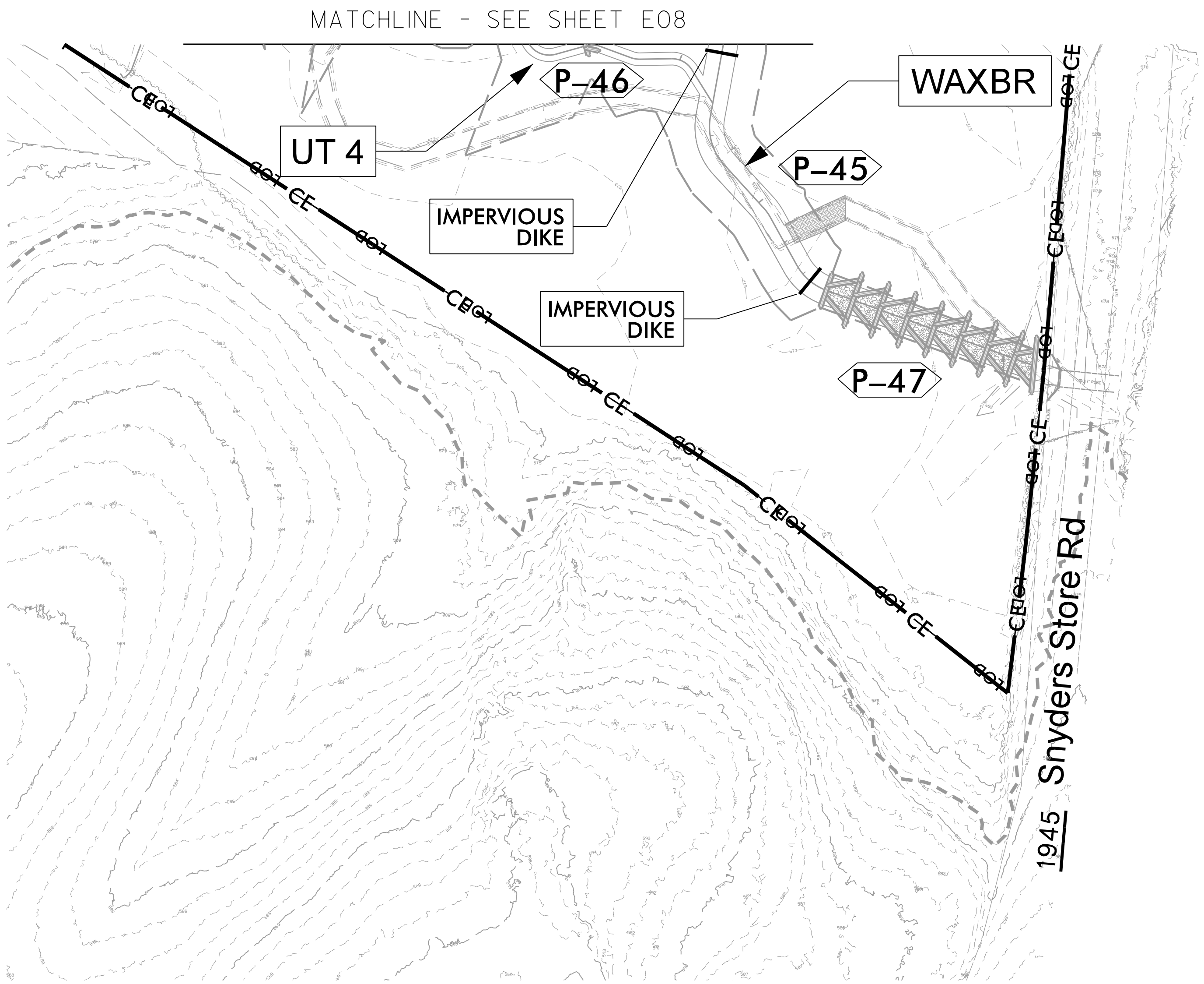
9/30/2021
Wits End_psh_E08.dgn
Harvell

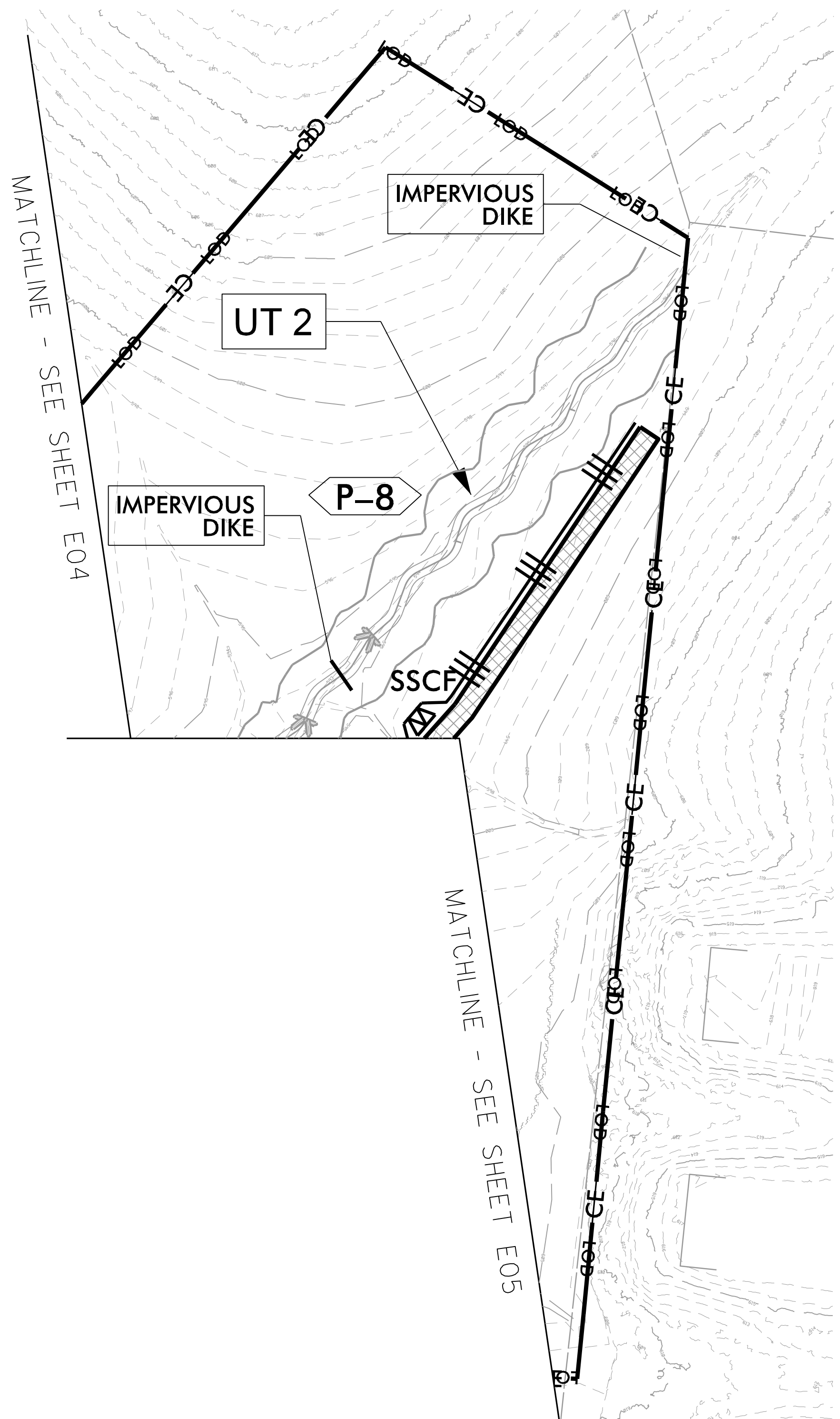
NOTE:
INSTALL STRAW WATTLES BETWEEN WORK AREA AND STREAMS (EXISTING AND PROPOSED).

— LOD —	LIMITS OF DISTURBANCE
(symbol)	TEMPORARY SILT FENCE
(symbol)	HAUL ROAD
(symbol)	SPECIAL SEDIMENT CONTROL FENCE BREAK

100' 50' 0 100' 200'
SCALE: 1" = 100'

NAD 83





DocuSigned by:
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1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

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ENG FIRM LICENSE NO. C-890

Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

EROSION CONTROL

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E09
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. **E09**

9/30/2021
Wits_End_psh_E09.dgn
jharvey

NOTE:
INSTALL STRAW WATTLES BETWEEN WORK AREA AND STREAMS (EXISTING AND PROPOSED).

LOD	LIMITS OF DISTURBANCE
	TEMPORARY SILT FENCE
	HAUL ROAD
	SPECIAL SEDIMENT CONTROL FENCE BREAK

SCALE: 1" = 100'

DocuSigned by:
Joshua G Dalton
1089AD8C14994C3...

SOUTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

9/30/2021

DATE:

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC

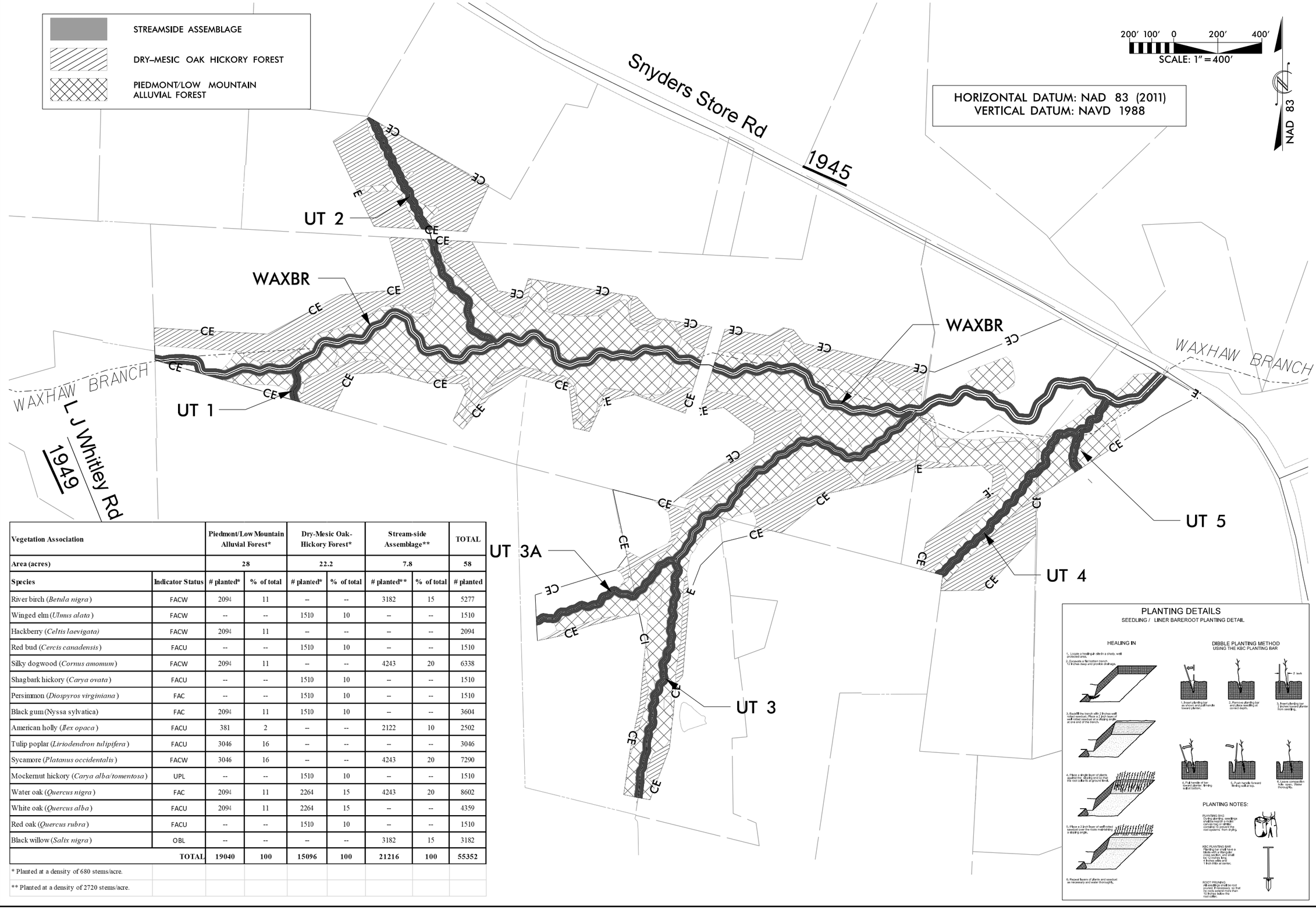
EROSION CONTROL

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH E10
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. E10

MATCHLINE - SEE SHEET E06
MATCHLINE - SEE SHEET E07
MATCHLINE

9/30/2021
Wits End_psh_E10.dgn
Marvel



Vegetation Association		Piedmont/Low Mountain Alluvial Forest*		Dry-Mesic Oak-Hickory Forest*		Stream-side Assemblage**		TOTAL
Area (acres)		28		22.2		7.8		58
Species	Indicator Status	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
River birch (*Betula nigra*)	FACW	2094	11	--	--	3182	15	5277
Winged elm (*Ulmus alata*)	FACW	--	--	1510	10	--	--	1510
Hackberry (*Celtis laevigata*)	FACW	2094	11	--	--	--	--	2094
Red bud (*Cercis canadensis*)	FACU	--	--	1510	10	--	--	1510
Silky dogwood (*Cornus amomum*)	FACW	2094	11	--	--	4243	20	6338
Shagbark hickory (*Carya ovata*)	FACU	--	--	1510	10	--	--	1510
Persimmon (*Diospyros virginiana*)	FAC	--	--	1510	10	--	--	1510
Black gum (Nyssa sylvatica)	FAC	2094	11	1510	10	--	--	3604
American holly (*Ilex opaca*)	FACU	381	2	--	--	2122	10	2502
Tulip poplar (*Liriodendron tulipifera*)	FACU	3046	16	--	--	--	--	3046
Sycamore (*Platanus occidentalis*)	FACW	3046	16	--	--	4243	20	7290
Mockernut hickory (*Carya alba/tomentosa*)	UPL	--	--	1510	10	--	--	1510
Water oak (*Quercus nigra*)	FAC	2094	11	2264	15	4243	20	8602
White oak (*Quercus alba*)	FACU	2094	11	2264	15	--	--	4359
Red oak (*Quercus rubra*)	FACU	--	--	1510	10	--	--	1510
Black willow (*Salix nigra*)	OBL	--	--	--	--	3182	15	3182
	TOTAL	19040	100	15096	100	21216	100	55352

* Planted at a density of 680 stems/acre.

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

9/30/2021
Wits End_psh_P01.dgn
jharvey

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Axiom Environmental, Inc.

WITS END
UNION COUNTY, NC
PLANTING

PROJECT # : 1221-20024
DRAWING NAME: WITS END PSH P01
DATE: 2021
DRAWN BY: JRH
REVIEWED BY: JGD
REVISIONS:

SHEET NO. ***P01***