FINAL MITIGATION PLAN

CRANE MITIGATION SITE

Lee County, North Carolina

DMS Project ID No. 100165
Full Delivery Contract No. 0302-01
USACE Action ID No. SAW-2020-01401
DWR Project No. 20201292
RFP No. 16-20190302

Cape Fear River Basin
Cataloging Unit 03030004

Prepared for:

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

February 2022

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

REPLY TO
ATTENTION OF:

February 14, 2022

Regulatory Division

Re: NCIRT Review and USACE Approval of the NCDMS Crane Mitigation Site / Lee Co.

SAW-2020-01401
NCDMS Project # 100165
NCDWR # 2020-1292

Lindsay Crocker
North Carolina Division of Mitigation Services
217 West Jones St.
Raleigh, NC 27603

Dear Mrs. Crocker:

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 Crane Draft Mitigation Plan, which closed on December 12, 2021. These comments are attached for your review.

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

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

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

Sincerely,

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

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
Jeremiah Dow—NCDMS
Worth Creech—RS

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Response to IRT Comments Dated January 28, 2022
DMS Project ID No. 100165
Full Delivery Contract No. 0302-01
USACE AID#: SAW-2020-01401
NCDWR#: 20201292
RFP 16-20190302

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

DWR Comments, Erin Davis:

1. Page 19, Section 4.3 – What measures were taken to look for a freshwater marsh reference site?
   Response: A study was conducted to located an accessible freshwater marsh in reference condition in the general vicinity of the Site. Soils, geology, topography, land use, and site accessibility were taken into account. A reference freshwater marsh was not found.

2. Page 24, Table 14 – In the performance criteria column, please consider noting the following: bankfull events must occur in separate years, min. 30-day annual consecutive flow intermittentreach threshold, stem height requirements, and wetland hydrology as an annual standard.
   Response: The detailed success criteria were added to Table 14.

3. Page 27, Instream Structures – Were project site characteristics and flow regimes considerations in determining grade control material? Are there any long term stability concerns with using all wood grade control structures on intermittent project streams (UT2, UT3, UT4 andUT5)? Also, has the amount of available onsite woody material been evaluated? Will you need to source material from offsite?
   Response: Site characteristics and flow regimes were considered in determining grade control material. Hardwood logs will be required for structures. It is anticipated that woody material will degrade over time, and natural woody material will develop a suitable root structure to compensate for erosive forces. Footer logs are included as an integral part of these structures.

4. Page 28, Table 16 – Were UT3 and UT4 evaluated for the need/opportunity of a BMP upstream of the proposed restoration reach?
   Response: BMPs were originally considered at the top of these reaches, however, both tributaries originate in reestablished wetlands which will naturally treat surface water entering the site. The Conservation Easement has been acquired and the SMUs gegenerated on channels extend to the easement boundary. If a BMP is added, we would need to include it in stream assets.

5. Page 29, Section 8.3 – Many of the wetland credit areas extend to the proposed conservation easement boundary. What is the risk of hydrologic trespass that may result in future ditching along the easement?
   Response: Hydrologic trespass was evaluated for all aspects of the project. Based on hydraulic models, soil mapping, and topography, hydrologic trespass will not occur.

6. Page 29, Wetland Rehabilitation – Existing ditches are mentioned. Please callout all existing ditches on Figure 5. Will all ditches be backfilled to surrounding grade? If not, please note the max. depth to remain open (which should be less than 1 foot in wetland credit areas).
   Response: Existing ditches have been added to Figure 5. All existing ditches within the easement will be backfilled to surrounding grade.

7. Page 29, Section 8.4 – How will potential soil compaction be addressed?
   Response: The topsoil stockpiling described in this section will help to address soil compaction. Additional measures include deep-ripping/plowing prior to planting. A sentence was added to indicate this.

8. Page 30, Section 8.5.1 – An alternative vegetation performance standard and monitoring protocol is needed for potential shrub/herb dominated wetland credit areas (e.g. improved species diversity based on percent cover in square-meter plots).
   Response: A row has been added in Table 20 to include herbaceous vegetation plots (square meter plots) that track the number of herbaceous species in the plot and percent cover. 3 plots are to be randomly installed in herbaceous dominated vegetation areas and the number of species in each plot tallied and percent cover will be noted. Table 21 Success Criteria has a line indicating that the plots must have a minimum number of 4 different herbaceous species present.

9. Page 31, Table 17 – DWR appreciates the proposed species diversity. It may be beneficial to include a few wetland shrub species that could be used in initial or supplemental planting efforts to target areas trending herb dominated.
   We will add some common and unique wetland shrub species over the life of the project.

10. Page 32, Table 18 – Have you considered not seeding Juncus effusus since it's already present onsite? On a few sites, we've observed Juncus effusus affecting planted stem density/vigor.
    Restoration System's does all the permanent seeding "in-house" and we will cut back on the juncus seeding as necessary.

11. Page 33, Section 8.5.2 – Will fescue and Bermuda grasses be treated prior to construction? Are there other nuisance species present onsite?
    Existing grass will be treated in high desity areas. Also, we do not think these grasses will thrive post construction due to the change in hydrology throughout the site.

12. Page 33, 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.
    Response: The following sentence was added to Section 9: "Monitoring will be conducted in accordance with 2016 NCIRT Guidelines (NCIRT, 2016)."

13. Page 34, Table 20 – DWR requests that three of the wetland reestablishment perm. veg plots and three of the large wetland enhancement area perm. veg plots be switched to random plots.
    Response: The vegetation monitoring requirements were revised to include 17 permanent vegetation plots and 6 random plots.

14. Page 35, Table 21 – Please clarify that the intermittent flow and wetland hydrology are annual performance criteria. Also, please confirm "average" is equivalent to "normal" climatic conditions.
    Response: The success criteria were clarified to indicate that the intermittent flow and wetland hydrology must occur annually. Additionally, the word "average" in the wetland hydrology performance criteria was replaced with "normal".

15. Page 35, Section 9.2 – DWR appreciates the inclusion of this section. Please note that some of the listed actions will require IRT review as adaptive management and may need USACE/DWR permit authorizations.

Response: This is understood, and a general statement indicating such was added to the beginning of section 9.2.

16. Page 36, Beaver – Why wait until the following fall/winter to trap beaver?
    Currently, there is no beavers on site. We will trap immediately if we see any activity.

17. Figure 5 – Please callout all existing crossings and ditches.
    Response: Existing crossings and ditch locations were added to Figure 5.

18. Figure 10 – Shouldn't the piped crossing be shown as the proposed ford crossing? Also, it's helpful when the legend includes proposed ratios.
    Response: The crossing on UT2 will be a piped crossing. The report text was updated accordingly. The mitigation ratios were also added to the legend on Figure 10.

19. Figure 13 –
    a. DWR requests one veg plot be shifted to within the UT1 Reach 1 wetland enhancement credit area. Also, see DWR comment #13 regarding random veg plots.

    Response: A permanent plot was moved into the UT1 Reach 1 wetland enhancement area. Regarding comment #13, six permanent plots (3 in wetland enhancement areas and 3 in reestablishment areas) were removed from Figure 13. These will be random plots and their locations will change each monitoring year.

    b. DWR requires that the two new (not shown on Fig. 5) groundwater gauges proposed along UT1 Reach 2 upstream of the easement break be shifted to the northwest extent of the reestablishment area – one can be paired with the reestablish. veg plot and one near the easement corner between the two enhancement areas (I can provide a markup if needed).

    Response: These gauge locations have been revised accordingly.

    c. Since the southern wetland enhancement area along UT1 Reach 3 and UT2 Reach 2 is not proposed for planting, is the proposed functional uplift hydrologic? If so, please add a groundwater gauge to this area. If not and this credit area is not proposed to be monitored to demonstrate functional uplift, DWR recommends a ratio change to 2.5:1.

    Response: There is no planting or hydrologic uplift proposed for this area. During the IRT site walkthrough, it was agreed that this area warranted a 2:1 ratio for wetland enhancement based on cattle removal. Cattle tend to herd in this area for shade, and their hoof shear and nutrient inputs have heavily impacted the existing wetland. Removal of cattle in this area will provide vast uplift to the wetland system.

20. Sheet C1.06 – There are two areas that appear to have a cut depth of greater than a foot. Are these existing spoil areas or stream bench cut areas? What is the total area of greater than one foot cut?
    Response: Areas of cut greater than 1.0' are created due to channel grading. The two areas on sheet C1.06 showing cut greater than 1.0' in the right floodplain total 396 square feet. The existing agricultural crossing upstream of UT2 station 0+00 casues the channel to be incised at the upstream extents. In addition to the channel being incised, a steep hill slope exists on the right side of the channel. The proposed grading shows grading the existing slope to a 4(H):1(V) slope from the proposed bankfull elevation. See sheet C5.06 for the proposed grading.

21. Sheet C5.01 – What is rationale behind shifting this stream section so far east? It appears to add double sinuosity and impacts existing wetlands rather than avoid them.
    Response: The design stream alignment follows the lowest portion of the floodplain, which is coincidentally where wetlands exist.

22. Sheet C5.02 – Please confirm that the log cross vane is proposed to span both channels at the UT1 and UT5 confluence.
    Response: Due to the geometry to the confluence of UT5 with UT1 the left vane arm of the log cross vane will span the UT5 channel. The left vane arm will have little slope to remain buried beneath the UT5 channel. If necessary, the left van arm will be notched in the UT5 channel to match the proposed grade.

23. Sheet C5.04 – Please confirm that the final bridge design will be included in the final mitigation plan and that the bridge will be installed during the project construction phase.
    Response: The proposed UT1 bridge crossing will be installed during construction of the stream restoration project. The UT1 bridge crossing detail on sheet C8.06 has been updated to inlcude details of the crossing not shown in the previously submitted plan set. Additionally, please refer to the revised mitigation plan for greater detail on the proposed UT1 bridge crossing.

24. Sheet C5.09 – Is the channel to be partially filled jurisdictional or a proposed BMP?
    Response: Restoration of UT3 begins at the point of jurisdiction as denoted and shown in the PJD package. Upstream of UT3 station 0+00 the channel is non-jurisdictional. The channel will be filled and graded to match the elevation of the proposed log sill at station 0+00 to mitigate up-valley migration of the existing head-cut.

25. Sheet C8.01 (Educational inquiry) – Is two feet a standard and sufficient embedded length for proposed log vanes and cross vanes?
    Response: Depth/length of embedment is deptermined based on the size of the channel being restored or stabilized and expected forces which the structure will encounter. Length of embedment for the proposed log vanes and log cross vanes has been edited to be minimum 3 feet.

26. Sheet C8.02 – Please callout approximate locations where the rock outlet may be installed.
    Response: Rock floodplain outlets will be installed based on field conditions at the time of construction. The detail is provided for informational purposes. The contractor and persons providing construction oversight will field locate rock floodplain outlets. The location of rock floodplain outlets will be included in the as-built survey.

27. Sheet L5.01 – Please add a bare root and live stake planting detail.
    Response: Bare root and live stake planting detail is provided on sheet L5.02.

28. General Design Question - Is sufficient instream habitat enhancement uplift expected from proposed log vane/cross vane structures? DWR encourages adding woody instream and bank toe habitat features. While currently there are no instream habitat performance standards, DWR does looks for evidence of instream habitat diversity and uplift during monitoring visits.
    Response: Its our experience that the wooden structure provide habitat and add stability to the streams. Additional woody debris and leaf matter are expected to accumulate naturally over the first few years post-construction. We will add woody debris to the floodplain as well based on past DWR comments on other projects.

29. DWR appreciates efforts made to enhance this project including minimizing easement breaks, using a spanning structure crossing, capturing stream origins where feasible, and incorporating wider buffers. We're glad to see a good diversity species proposed and inclusion of a local reference community. Additionally, the soils and LiDAR figures were very helpful for this review.
Response: Thank you for the feedback.

USACE Comments, Casey Haywood:

1. Section 4.2 & References: Please only use the most updated version of Schafale, GUIDE TO THE NATURAL COMMUNITIES OF NORTH CAROLINA FOURTH APPROXIMATION March 2012.
Response: References to the third approximation were removed from the document.

2. Table 9. Appreciate the consideration given to the reference streams and the forest ecosystem. Please note that while both red maple and sweetgum are identified within the reference forest community, these are common volunteer species and should not be included in the plant list.
Response: Red maple and sweetgum were removed from Table 9.

3. Table 14.
   a. Please note that bankfull events must occur in separate years.
   Response: This was noted.

   b. Vegetation performance standard should also include the height of trees in each plot must average 7 feet in year five and 10 feet in year 7 for the piedmont.
   Response: This was noted.

   c. Please include the 30-day consecutive flow performance standard for intermittent reaches.
   Response: This was included.

   d. Overall, please ensure the performance criteria in the table(s) match what is discussed in the narrative.
   Response: The criteria in Table 14 now matches the narrative.

4. Section 8.1.1 – Is the bridge crossing internal? Please include a photo point that captures both upstream and downstream of the crossing during monitoring.
Response: The bridge crossing is not internal. Photo points upstream and downstream of the bridge will be included during monitoring.

5. Section 8.5.1- Areas that are dominated by an open, herbaceous community as described in the narrative need to have a performance standard (i.e., percent cover). Adding photo points to these areas would be helpful.
Response: A row has been added in Table 20 to include herbaceous vegetation plots (1 square meter in size) that track the number of herbaceous species in the plot and percent cover. 3 plots are to be randomly installed in herbaceous dominated vegetation areas and the number of species in each plot tallied and percent cover will be noted. Table 21 Success Criteria has a line indicating that the plots must have a minimum number of 4 different herbaceous species present. These herbaceous-dominated areas will be photo documented as their establishment is observed.

6. Section 9. Please reference the 2016 NCIRT Guidance and include it in the references section of the document.
   Response: A sentence was added referencing the 2016 NCIRT Guidance. The guidance was also cited in the reference section.

7. Please include discussion in the text how you plan to treat/manage the existing fescue.
   Response: Existing grass will be chemically treated in high density areas. Also, we do not think these grasses will thrive post construction due to the change in hydrology throughout the site.

8. Figure 5. Existing Conditions: Please include the locations of the ditches on this map.
   Response: Ditch locations have been included on Figure 5.

USACE Comments, Kim Browning:

1. Section 3.4: I appreciate the detail and photo in this section for existing conditions. I would welcome this detail in future submittals.
   Response: Thank you.

2. Section 4: It would be helpful to discuss the in-stream habitat of the reference reaches.
   Response: A discussion of the habitat along each reference reach was added to Section 4.

3. Page 19, Section 4.3: Please list the marsh species that are found onsite or regionally occur.
   Response: The following species list was included in section 4.3: *Persicaria* spp., *Carex* spp., *Juncus trigonocarpus, Juncus tenuis, Juncus effusus, Verbena hastata, Bidens aristosa, Scirpus cyperinus, Leersia hexandra, Leersia oryzoides, Orontium aquaticum, Eriocaulon decangulare, Schoenoplectus subterminalis, Schoenoplectus etuberculatus, Sagittaria engelmanniana, Habenaria repens, Eupatorium perfoliatum, Peltandra virginica,* and *Glyceria obtusa.*

4. Page 23, Table 12: Why weren't SAM forms completed on UT3, UT4 and UT5? If you felt that the conditions were similar to those on UT2 and that the forms would be representative of several reaches, please state that in the text. This would be assuming the channels all had the same buffer widths, levels of incision, etc.
   Response: UTs 2, 3, 4, and 5 were all accounted for on the UT2 NCSAM form. The heading in Table 12 was updated to indicate this.

5. Table 13: The NC WAM functional rating for WAM 2 is listed as High; however, Figure 5 lists it as Low. Which is correct? Please adjust.
   Response: WAM form #2 scored high. Figure 5 has been adjusted accordingly.

6. Table 14: I agree with DWR's comment #2 and Casey's comment #3 regarding performance criteria. I would add that the wording of the performance criteria for groundwater hydrology should be amended so that reestablishment and rehabilitation areas will have saturation within 12 inches of the growing season for 12% of the growing season.
   Response: The wording of the performance criteria for groundwater hydrology was amended so that both reestablishment and rehabilitation areas will have saturation within 12 inches of the surface for 12% of the growing season.

a. It's not sufficient to state that there will be an improvement of hydrology in rehabilitation areas. It's unclear how you propose to show an improvement in hydrology when all the pre-construction gauge data in the areas proposed for rehabilitation already exceed 12%. Since the Antecedent Precipitation tool showed wetter than normal conditions in December and January, and normal conditions in March and April when monitoring would begin, this doesn't seem like an explanation for the performance standard proposed.

Response: The graphs were revised to incorporate the latest WETS data growing season (March 29 to November 8). Gauge 8 is the only Rehabilitation gauge with a hydroperiod greater than 12% (29 days, 12.8%) The Anticedent Precipitation Tool ouput included in Appendix B shows April 1, 2021 (3 days after the start pf the growing season) as "wetter than normal" with a drought index (PDSI) of "moderate wetness". Therefore, it can be assumed that under normal rainfall conditions, all gauges in wetland rehabilitation areas would likely show a hydroperiod of less than 12%.

7. Tables 14 & 20: If you intend on using the regional supplement to document vegetative indicators and soil temperature at the beginning of the growing season, you must also take these measurements at the end of the growing season to determine the end-date. Ideally, this would be collected prior to submitting the final mitigation plan so you have accurate dates. If you intend on using the WETS table for establishing November 8 as the end of the growing season, you must also use what is listed in the WETS table to establish the beginning of the growing season. Only one method for determining the growing season dates should be used. Additionally, a lot of inconsistencies can occur when documenting bud burst and leaf senescence/drop, such as which species are selected, the location of the vegetation, shading, etc., so that's why it's best to only measure the vegetative indicators once and determine a single growing season for the monitoring phase of the project.

   Response: The growing season was revised to the latest WETS growing season (3/29-11/8). No soil temperature data will be reported.

8. Section 7: Was the potential for hydrologic trespass evaluated? Many of the proposed wetland reestablishment and enhancement areas go to the easement boundary, so it's reasonable to expect wetter conditions on adjacent parcels. Impacts to adjoining parcels that are not under control of the sponsor/applicant raise concern of future ditching outside the easement.

   Response: Hydrologic trespass was evaluated for all aspects of the project. Based on hydraulic models, soil mapping, and topography, hydrologic trespass will not occur.

9. Sections 7.1, 7.2 and 7.3: Please refer to specific correspondence from USFWS, SHPO and NCNHE.

   Response: Teses sections have been updated.

10. Categorical Exclusion Documentation: Please send the Corps an electronic copy of letters from NCWRC, Natural Heritage, and SHPO. I have records of concurrence from USFWS.

    Response: Copies will be sent.

11. Table 16: For all reaches, are cattle being completely removed from the property? Or just from the easement? It might help clarify if you reword the statement to "Remove and fence livestock from the conservation easement."

    Response: The word "property" was replaced with "conservation easement" for all reaches.

12. Table 16: UT2 describes installing a forded crossing outside the easement, but Figure 10 shows a piped crossing. Please clarify.
    Response: The crossing upstream of the easement on UT2 will be a piped crossing. Table 16 was updated accordingly.

13. Section 8.4, Page 29: The grading depths overview design sheets were helpful in depicting areas of cut/fill. Are the areas of cut that are greater than 12", field crowns and/or spoil piles from past dredging activities?
    Response: See response to DWR comment #20 above.

14. Section 8.1.1: It would benefit you to discuss the piped crossing being installed outside the easement so that it's considered part of the review area for the permitting process.
    Response: A section describing the piped crossing was added to Section 8.1.1.

15. Section 8.5.1: An alternative performance standard for vegetation should be proposed for the herbaceous/shrub layer. Percent cover may be proposed to assess plant vigor rather than stem count, and a diversity of at least 4 species should be documented. Permanent and random vegetation plots should be located in these areas.
    Response: A row has been added in Table 20 to include herbaceous vegetation plots (1 square meter in size) that track the number of herbaceous species in the plot and percent cover. 3 plots are to be randomly installed in herbaceous dominated vegetation areas and the number of species in each plot tallied and percent cover will be noted. Table 21 Success Criteria has a line indicating that the plots must have a minimum number of 4 different herbaceous species present.

    a. If, during monitoring, large portions of the site are trending towards being more herbaceous, adaptive management may be required, to include planting additional OBL species.

    Response: Understood.

16. Table 20: How often does hydrology gauge monitoring occur annually?
    Response: Gauge downloads will occur at least quarterly but typically occur more frequently.

17. Figure 5: Please show the location of any existing ditches and crossings.
    Response: Existing ditches and crossing locations were added to Figure 5.

18. Figure 13 and Table 20: Please add at least six random vegetation plots or change six of the permanent plots to random plots in order to capture overall vegetative success on the site.
    Response: Six of the permanent vegetation plots have been changed to random plots. As these plots occur in random locations each year, they are not depicted on Figure 13, however, they are included in Table 20 and will be monitored annually.

19. Section 9.2: Thank you for including this section.
    Response: You are welcome.

20. Figure 13: Please label the groundwater gauges. It would also be helpful to label the wetlands, to correspond with the PJD labels for easy reference, rather than referring to them, for example, as the enhancement wetland by reach UT3.

Response: The groundwater gauges were labelled (1-15) and the wetlands were labelled corresponding to the PJD.

21. Section 8.1.1 and Sheet C5.04: Spanning bridge structures are preferable to culverts, but I would offer the following comments on bridge design:
    a. The channel under the crossing needs to be designed with structure/rock to retain the appropriate channel dimensions otherwise the banks will erode to the bridge supports due to the lack of vegetation.

    Response: The bridge detail on Sheet C8.06 describes aromoring the side slopes and channel bed with min. class B riprap or stone of equivalent size.

    b. We will require upstream and downstream photos of the crossing during monitoring to assure that bank stability at the bridge ends is not an issue.

    Response: The upstream and downstream of the bridge will be photodocumented during monitoring.

    c. I know it's likely too late on this project, if we didn't make the change prior to the draft mitigation plan, but these really need to be internal easements moving forward. As much as spanning structures are preferred, they will likely require more maintenance overtime. If they're not solid steel, wooden decking will need to be replaced, the flat edge of the bridge "girder" can be more susceptible to trapping debris or causing hydraulic issues during high flows, and landowner repair could easily default to replacing with a culvert.

    Response: Understood.

    d. I would recommend sending the bridge crossing details to the IRT prior to submitting the final construction/permit drawings to avoid delays in permit review, should we require additional information or request changes.

    Response: Understood

22. I agree with DWR's comment #28. Stream restoration involves significant uplift to most stream functions, and includes reestablishment of appropriate geomorphology, reconnection to the floodplain, recreation of in-stream habitat, and restoration of a native riparian buffer. While woody debris will eventually make it into the system as the buffer matures, this design is lacking in-stream habitat diversity and uplift. You might consider root wads or bank toe habitat features to provide cover and shade, and encourage the formation of deep pools at the outside of meander bends. Perhaps there's an opportunity to add woody riffles to UT2, UT3 and UT4 since they have small watersheds and will likely transport less sediment. I'd be interested to see the instream habitat of the reference reaches.

    Response: It is our experience that the use of course woody debris and bank toe habitat features can lead to instability in channels of this gradient. Woody debris and leaf matter are expected to accumulate naturally over the first few years post-construction. See sections 4.1.1.5 and 4.1.2.5 for descriptions of instream habitat along the reference reaches.

23. If the stream reach upstream of UT4 is non-jurisdictional, would it be possible to include a marsh treatment area to help filter agricultural runoff?

    Response: BMPs were originally considered at the top of these reaches, however, both tributaries originate in reestablished wetlands which will naturally treat surface water entering the site. The Conservation Easement has been acquired and the SMUs gegenerated on channels extend to the easement boundary. If a BMP is added, we would need to include it in stream assets.

24. Figures 8 and 13: Please explain why the location of UT3 was shifted out of what appears to be the natural valley and relocated through an existing wetland.
    Response: The design stream alignment follows the lowest portion of the floodplain, which is coincidentally where wetlands exist.

25. Figure 12: Do you anticipate that you will have to replant a portion of Wetland GA where stream restoration is proposed?
    Response: The Bottomland Hardwood Forest planting area extends ~100 feet into wetland GA where UT2 enters. Additionally, streamside assemblage planting is proposed for the entire length of UT1 and UT2 through wetland GA. It is not anticipated that construction will impact beyond that area.

26. It's unclear what the functional uplift is in Wetland GA since it's not being planted, and the hydrology is not being monitored. If enhancement is solely based on livestock exclusion, a ratio of 2.5:1 is more appropriate.
    Response: There is no planting or hydrologic uplift proposed for this area. During the IRT site walkthrough, it was agreed that this area warranted a 2:1 ratio for wetland enhancement based on cattle removal. Cattle tend to herd in this area for shade, and their hoof shear and nutrient inputs have heavily impacted the existing wetland. Removal of cattle in this area will provide vast uplift to the wetland system.

27. Sheet C5.06: If you plan on installing a piped crossing upstream of UT2, please include that on the design sheet, even if it's outside the conservation easement, so it can be included in the area of review for the 404 permit. I wasn't sure if it was an ag-exempt crossing or a driveway for landowner access. In all cases where exempt crossings are proposed, the crossings must comply with the requirements listed in 33 CFR 323.4, and the Mitigation Plan must explicitly document why the crossing is exempt.
    Response: An existing agricultural (culvert) crossing is located immediately upstream of UT2 station 0+00. This crossing is not included in the conservation easement and is not proposed to be modified as part of the project. Survey data was not collected on this existing agricultural crossing per the note on sheet C5.06.

28. Sheet C8.02: Where will the rock floodplain outlet be installed?
    Response: Rock floodplain outlets will we installed based on field conditions at the time of construction. The detail is provided for informational purposes. The contractor and persons providing construction oversight will field locate rock floodplain outlets. The location of rock floodplain outlets will be included in the as-built survey.

29. Appendix B: Figure 5 shows the location of NCDWR Forms but I couldn't locate them.
    Response: DWR forms have been included in Appendix B.

30. During the IRT site visit, UT1 at 2.5:1, the IRT agreed to that ratio provided that containerized trees were planted (species like cypress, gum, titi, bay, etc.). Please confirm that containerized trees are being planted.
    Response: 1-3 gallon size Cypress, Tupelo gum, Sweetbay, and Red bay will be supplemental planted into the existing forest along the Upper UT 1 Stream Enhancement area.

DWR Pre-Filing Meeting Request Form

Contact Name * worth creech

Contact Email Address * worth@restorationsystems.com

Project Owner * restoration systems

Project Name * crane mitigaiton site

Project County * Lee

Owner Address: *

Street Address
1101 Haynes Street
Address Line 2
suite 211
City
raleigh
State / Province / Region
nc
Postal / Zip Code
27604
Country
US

Is this a transportation project? * ◉ Yes ○ No

Type(s) of approval sought from the DWR:

- ☑ 401 Water Quality Certification - Regular
- ☐ 401 Water Quality Certification - Express
- ☐ Individual Permit
- ☐ Modification
- ☐ Shoreline Stabilization

Does this project have an existing project ID#? *

○ Yes ◉ No

Do you know the name of the staff member you would like to request a meeting with?

Erin Davis

Please give a brief project description below. *

This is a 3,217 SMU and 8.9 WMU DMS mitigation project in the Cape Fear 03030004 Cataloging unit. The Technical Proposal has been added to the IRT Portal. There is a planned IRT field meeting scheduled for September 29 at 9:00AM.

Please give a couple of dates you are available for a meeting.

9/29/2020

Please attach the documentation you would like to have the meeting about.

pdf only

By digitally signing below, I certify that I have read and understood that per the Federal Clean Water

Act Section 401 Certification Rule the following statements:

- This form completes the requirement of the Pre-Filing Meeting Request in the Clean Water Act Section 401 Certification Rule.
- I understand by signing this form that I cannot submit my application until 30 calendar days after this pre-filing meeting request.
- I also understand that DWR is not required to respond or grant the meeting request.

Your project's thirty-day clock started upon receipt of this application. You will receive notification regarding meeting location and time if a meeting is necessary. You will receive notification when the thirty-day clock has expired, and you can submit an application.

Signature *

Submittal Date 9/23/2020

FINAL MITIGATION PLAN

CRANE MITIGATION SITE

Lee County, North Carolina

DMS Project ID No. 100165
Full Delivery Contract No. 0302-01
USACE Action ID No. SAW-2020-01401
DWR Project No. 20201292
RFP No. 16-20190302

Cape Fear River Basin
Cataloging Unit 03030004

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
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Raleigh, North Carolina 27603
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919-215-1693 (phone)

February 2022

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

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

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

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

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1 PROJECT INTRODUCTION

The Crane Mitigation Site (hereafter referred to as the "Site") encompasses 27.7 acres of disturbed forest and livestock pasture along headwater tributaries to Little Crane Creek. The Site is located approximately two miles southwest of Lemon Springs, eight miles southwest of Sanford, and west of Rocky Fork Church Road (SR 1179) (Figures 1 and 2, Appendix A).

1.1 Directions to Site

Directions to the Site from Raleigh, North Carolina.

- Follow US-1 South for 47 miles,
- Turn left onto Rocky Fork Church Road,
- After 3.5 miles, the Site is on the right.
    - Site Latitude, Longitude
      35.365072° N, -79.219292° W (WGS84)

1.2 USGS Hydrologic Unit Code and NCDWR River Basin Designation

The Site is located within **Targeted Local Watershed (TLW) 03030004070010** (North Carolina Division of Water Resources [NCDWR] subbasin number 03-06-14. The Site is also located within a **Local Watershed Planning (LWP) area, Hydrology Targeted Resource Area (TRA), and Water Quality TRA** due to modifications/stressors in the watershed (Figure 3, Appendix A). Site hydrology drains to unnamed tributaries to Little Crane Creek (Stream Index Number 18-23-16-4), assigned a Best Usage Classification of **WS-III** (NCDWR 2021). Little Crane Creek is not listed on the NCDENR draft 2018 or final 2016 303(d) lists (NCDEQ 2018a, NCDEQ 2018b).

1.3 Physiography and Land Use

The Site is in the Sand Hills portion of the Southeastern Plains ecoregion of North Carolina. Regional physiography is characterized by dissected irregular plains, moderate to steep side slopes, and low to moderate gradient sandy-bottomed streams. Seepage and groundwater support steady stream flows and some small, saturated wetlands (Griffith et al. 2002). Onsite elevations range from a high of 460 feet National Geodetic Vertical Datum (NGVD) at the upper reaches to a low of approximately 395 feet NGVD at the Site outfall (USGS Murchisontown, North Carolina 7.5-minute topographic quadrangle) (Figure 1, Appendix A).

Site watershed sizes range from approximately 0.02 square miles (12.2 acres) on UT3 to 0.15 square miles (97.5 acres) on UT 1 at the outfall (Figure 4, Appendix A). The watershed is dominated by agricultural land, forest, and sparse residential development. Impervious surfaces account for less than two percent of the upstream watershed land surface.

Land use at the Site is characterized by active livestock pasture and disturbed forest (Figure 5, Appendix A). Pastures are underlain by hydric soils and during wet years are often characterized by livestock mires, springheads, and coalescing seepages. Headwaters of the Site were recently timbered and have developed into shrub scrub vegetation. Much of the timbered land is underlain by hydric soils; however, non-hydric, sandy ridges dissect some of the wetland slopes. An extensive network of ditched jurisdictional streams crosses the Site, with ditching extending up each topographic crenulation. Ditched streams are relatively deep in places reaching approximately four feet in depth. Streams were ditched to expedite flow from natural tributaries through the Site and remove groundwater from adjacent wetlands. The ditched stream network converges at the downstream portion of the Site, where the channels braid across the floodplain through a sediment deposition area.

Historic photography dating from 1961 to 1989 indicates the Site was forested with the northern and eastern margins cleared for grazing. The photos are not clear enough to discern channel presence or location. Between 1989 and 1993, the Site appears to have cleared for agriculture. By 1993, forest vegetation was removed from the Site except for the headwater areas and the lower half of UT 1. The property has been maintained as agriculture use to present day, with grasses planted for livestock and regular maintenance.

1.4 Project Components and Structure

The Site encompasses 27.66 acres of disturbed forest and livestock pasture along unnamed tributaries to Little Crane Creek. In its current state, the Site includes 3,696 linear feet of degraded stream channel (based on the approved PJD – Appendix D), 11.6 acres of degraded wetlands, 9.2 acres of drained or otherwise impacted hydric soils (Figure 5, Appendix A).

Proposed Site restoration activities include the construction of meandering, E/C-type stream channel resulting in 3,167 linear feet of stream restoration, 915 linear feet of stream enhancement (Level II), 8.815 acres of riparian wetland re-establishment, 0.683 acres of riparian wetland rehabilitation, and 10.646 acres of riparian wetland enhancement (Table 1).

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

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Table 1. Project Components and Mitigation Credits

Project Segment	Original Mitigation Plan Ft/Ac	Original Mitigation Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Credits		Comments
Stream							
UT 1, Reach 1	694	Warm	EII	2.50000	237.600		Straight-line valley length (594 lft) used for credit calculation at request of IRT
UT 1, Reach 2 (above crossing)	1335	Warm	R	1.00000	1335.000		60 foot easement break for crossing
UT 1, Reach 2 (below crossing)	267	Warm	R	1.00000	267.000		
UT 1, Reach 3	232	Warm	EII	2.50000	93.200		
UT 2, Reach 1	437	Warm	R	1.00000	437.000		
UT 2, Reach 2	88	Warm	EII	2.50000	35.200		
UT 3	463	Warm	R	1.00000	463.000		
UT 4	422	Warm	R	1.00000	422.000		
UT 5	243	Warm	R	1.00000	243.000		
				Total:	**3533**		
Wetland							
Wetland Reestablishment	8.815	R	REE	1.00000	8.815		
Wetland Rehabilitation	0.683	R	RH	1.50000	0.455		
Wetland Enhancement	10.646	R	E	2.00000	5.323		
				Total:	**14.593**		

Project Credits

	Stream			Riparian	Non-Rip	Coastal
Restoration Level	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	3167.000	0.000	0.000	0.000	0.000	0.000
Re-establishment				8.815	0.000	0.000
Rehabilitation				0.455	0.000	0.000
Enhancement				5.323	0.000	0.000
Enhancement I	0.000	0.000	0.000			
Enhancement II	366.000	0.000	0.000			
Creation				0.000	0.000	0.000
Preservation	0.000	0.000	0.000	0.000	0.000	
Totals	**3533.000**	**0.000**	**0.000**	**14.593**	**0.000**	**0.000**
Total Stream Credit	**3533**					
Total Wetland Credit	**14.593**					

Wetland Mitigation Category	
CM	Coastal Marsh
R	Riparian
NR	Non-Riparian

Restoration Level	
P	Preservation
E	Wetland Enhancement
EII	Stream Enhancement II
EI	Stream Enhancement I
C	Wetland Creation
RH	Wetland Rehabilitation
REE	Wetland Re-establishment
R	Restoration

Table 2. Project Activity and Reporting History
Crane Mitigation Site

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Technical Proposal (RFP#: 16-20190302)	March 2020	March 2020
Institution Date	--	July 30, 2020
Mitigation Plan	August 2021	September 2021
Construction Plans (100%)	--	January 2022

Table 3. Project Contacts Table
Crane Mitigation Site

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

Table 4. Project Attribute Table
Crane Mitigation Site

Project Information	
Project Name	Crane Mitigation Site
Project County	Lee County, North Carolina
Project Area (acres)	27.66
Project Coordinates (latitude & latitude)	35.367351, -79.222369
Planted Area (acres)	26.2
Project Watershed Summary Information	
Physiographic Province	Sand Hills
Project River Basin	Cape Fear
USGS HUC for Project (14-digit)	03030004070010
NCDWR Sub-basin for Project	03-06-14
Project Drainage Area (acres)	120.1
Percentage of Project Drainage Area that is Impervious	<2%
CGIA Land Use Classification	Managed Herbaceous Cover & Hardwood Swamps

Table 4. Project Attribute Table (Continued)
Crane Mitigation Site

Reach Summary Information					
Parameters	**UT 1**	**UT 2**	**UT 3**	**UT 4**	**UT 5**
Pre-project length of reach (linear feet)	2170	489	345	373	319
Post-project length of reach (linear feet)	2429	525	463	421	243
Valley Classification & Confinement	Rosgen Type VIII and III	Rosgen Type VIII and III	Rosgen Type VIII	Rosgen Type VIII	Rosgen Type VIII
Drainage Area (acres)	97.5	22.6	12.2	13.2	47.4
NCDWR Stream ID Score	31	26	27	26.5	29.5
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Intermittent	Intermittent	Intermittent/ Perennial
NCDWR Water Quality Classification	WS III				
Existing Morphological Description (Rosgen 1996)	Eg 5	G 5	Eg 5	Eg 5	Ge 5
Proposed Stream Classification (Rosgen 1996)	Ce 5	Ce 5	Ce 5	Ce 5	Ce 5
Existing Evolutionary Stage (Simon and Hupp 1986)	III/IV	IV	IV	II/III	IV
Underlying Mapped Soils	Wehadkee Soils				
Drainage Class	Poorly drained				
Hydric Soil Status	Hydric				
Valley Slope	0.0184	0.0158	0.0290	0.0146	0.0150
FEMA Classification	NA	NA	NA	NA	NA
Native Vegetation Community	Coastal Plain Bottomland Hardwoods (Brownwater Subtype) and Coastal Plain Small Stream Swamp (Brownwater Subtype)				
Watershed Land Use/Land Cover (Site)	70% agriculture land, 10% disturbed swamp forest, 19% forest, <1% low density residential/impervious surface				
Watershed Land Use/Land Cover (Hall and Crane Reference Channel)	Crane - 70% agriculture land, 10% disturbed swamp forest, 19% forest, <1% low density residential/impervious surface Hall - 50% agriculture, 48% forest, 2% low density residential/impervious surface				
Percent Composition of Exotic Invasive Vegetation	<5%				

Table 4. Project Attribute Table (continued)
Crane Mitigation Site

Wetland Summary Information			
Parameters	**Wetlands**		
Pre-project (acres)	11.330		
Post-project (acres)	20.146		
Wetland Type	Riparian riverine		
Mapped Soil Series	Wehadkee		
Drainage Class	Poorly drained		
Hydric Soil Status	Hydric		
Source of Hydrology	Groundwater, stream overbank		
Hydrologic Impairment	Incised streams, compacted soils, livestock, ditches		
Native Vegetation Community	Coastal Plain Bottomland Hardwoods (Brownwater Subtype) and Coastal Plain Small Stream Swamp (Brownwater Subtype)		
% Composition of Exotic Invasive Vegetation	<5%		
Restoration Method	Hydrologic, vegetative, livestock		
Enhancement Method	Vegetative, livestock		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States-Section 401	Yes	No	Section 401 Certification
Waters of the United States-Section 404	Yes	No	Section 404 Permit
Endangered Species Act	Yes	Yes	CE Document (App E)
Historic Preservation Act	Yes	Yes	CE Document (App E)
Coastal Zone Management Act	No	--	NA
FEMA Floodplain Compliance	Yes	Yes	FEMA Mapping (App F)
Essential Fisheries Habitat	No	--	NA

2 WATERSHED APPROACH AND SITE SELECTION

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

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

- Streams and wetlands are accessible by livestock,
- Streams and wetlands subject to ditching/dredging and incision,
- 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 livestock and agricultural equipment, and
- Wetland hydrology has been removed by stream channel entrenchment.

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

The *Cape Fear River Basin Restoration Priorities 2009* (RBRP) report (NCEEP 2009) documents restoration goals developed for the Cape Fear River Basin. The RBRP report documents restoration goals for the 03030004 catalog unit include reducing and controlling sediment and nutrient runoff and protect/augment designated natural heritage areas. Site-specific mitigation goals and objectives have been developed through the use of the North Carolina Stream Assessment Method (NC SAM), the North Carolina Wetland Assessment Method (NC WAM), and Site observations/measurements which are discussed further in Section 6.0 (Functional Uplift and Project Goals/Objectives).

3 BASELINE AND EXISTING CONDITIONS

3.1 Soils and Land Form

Table 5 describes soils that occur within the Site (Web Soil Survey, USDA 2020).

Table 5. Web Soil Survey Soils Mapped within the Site

Map Unit Symbol	Map Unit Name (Classification)	Hydric Status	Description
BaB	Blaney loamy sand (*Arenic Hapludults*)	Non-hydric	This series consists of well-drained soils found on convex low hills with 2-8 percent slopes. The parent material is sandy and loamy marine deposits. The depth to the water table and the restrictive features is more than 80 inches.
GhB	Gilead loamy sand (*Aquic Hapludults*)	Non-hydric (may include hydric inclusions)	This series consists of moderately well-drained soils found on convex low hills with 2-8 percent slopes. The parent material is loamy and clayey marine deposits. Depth to the water table is 18-30 inches, and depth to the restrictive features is more than 80 inches.
Wn	Wehadkee fine sandy loam (*Fluvaquentic Endoaquepts*)	Hydric	This series consists of frequently flooded; poorly drained soils found on 0-2 percent slopes in depressions on floodplains. The parent material is loamy alluvium. Depth to the water table is 0-12, and depth to the restrictive features is more than 80 inches.

The Web Soil Survey (USDA 2020) indicates the Site is mapped as Wehadkee soils with Gilead soils in headwater areas and Blaney soils on the Side slopes. Wehadkee soils form along streams and are formed from loamy, alluvial sediments. Detailed soil profiles collected by a licensed soil scientist confirm Site soils are hydric in nature and is characterized by the F3 (Depleted Matrix) hydric soil indicators (Figure 7, Appendix A). The F3 indicator includes soils with 60 percent or more chroma 2 or less within the upper 6 inches or starting within the upper 10 inches of the soil profile.

Headwater areas and interfluves are mapped by the NRCS as Gilead loamy sand, which is a non-hydric soil with inclusions of Bibb or Johnston soils. Based on the soils investigation, which identified the presence of organic material, the Site contains inclusions of Johnston soils, as denoted by the A12 (Thick Dark Surface) hydric indicator. Conversely, Bibb soils are characterized by a lack of muck and a thinner in the

soil surface horizon which does not fit the soils found onsite. Johnston soils occur along streams and floodplains, draws, and depressions in uplands. Johnston soils are characterized by a higher concentration of Mucky material in the surface horizon relative to Wehadkee soils. Detailed soil profiles observed in the headwater areas confirm that the soil is hydric and characterized by additional hydric indicators including S5 (Sandy Redox) and S6 (Stripped Matrix). The A12 indicator includes soils with a layer at least 6 inches thick with a depleted or gleyed matrix that has 60 percent or more chroma of 2 or less starting below 12 inches of the surface. The layer(s) above the depleted or gleyed matrix and starting at a depth <6 inches from the soil surface must have value of 2.5 or less and chroma of 1 or less to a depth of at least 12 inches and value of 3 or less and chroma of 1 or less in any remaining layers above the depleted or gleyed matrix. Sandy redox includes soils with a layer starting 6 inches from the soil surface with 60 percent or more chroma 2 or less and 2 percent or more distinct or prominent redox concentrations. Stripped matrix includes a layer starting within 6 inches of the soil surface in which iron oxides and/or organic matter have been stripped from the matrix, and the primary base color of the soil matrix has been exposed.

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) of each Site reach. The resulting BEHI and NBS values are 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 are available upon request, and the data output is presented in Appendix B. Results of the model are shown in Table 6.

Table 6. BEHI and NBS Modeling Summary

Stream Reach	Proposed Mitigation Treatment	Predicted Sediment Contribution (tons/year)
UT 1	Restoration and Enhancement (Level II)	83.4
UT 2	Restoration	11.6
UT 3	Restoration	4.31
UT 4	Restoration	6.15
UT 5	Restoration	14.23
Total Sediment Contribution (tons/year)		**119.7**

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

3.3 Nutrient Model

Nutrient modeling was conducted using a method developed by the North Carolina Division of Mitigation Services (NCDMS) (NCDMS 2016). The model determines nutrient and fecal coliform reductions from the exclusion of livestock from the buffer.

The equation for nutrient reduction for this model includes the following:

TN reduction (lbs/yr) = 51.04 (lbs/ac/yr) x Area (ac)
TP reduction (lbs/yr) = 4.23 (lbs/ac/yr) x Area (ac)

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

Equations for fecal coliform reduction for this model include the following.
Fecal coliform reduction (col) = 2.2 x 10^{11} (col/AU/day) x AU x 0.085

Where:
Col = quantities of Fecal Coliform bacteria
AU = animal unit (1000 lbs of livestock)

Results of the NCDMS analysis indicate the entirety of the 27.66-acre easement is grazed by livestock, which contributes 1413.8 lbs/yr of nitrogen, 117.2 lbs/yr of phosphorus, and 4.7 x 10^{11} col of fecal coliform/day that will be reduced due to the exclusion of livestock from the easement area. Fecal coliform values have been based on 25 head of cattle.

3.4 Project Site Streams

Streams targeted for restoration include unnamed tributaries to Little Crane Creek, which have been cleared, dredged, straightened, trampled by livestock, eroded vertically and laterally, and receive extensive sediment and nutrient inputs from agriculture activities. Approximately 58 percent of the existing stream channels are degraded from mechanical processes, including the ditching of streams and vegetation clearing, contributing to sediment export from the Site. In addition, streamside wetlands have been cleared and drained by channel downcutting and degraded by land use (cattle). 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, including re-establishing buffers, excluding livestock, and restoring stream channels, will restore riffle-pool morphology, aid in energy dissipation, increase aquatic habitat, stabilize channel banks, and significantly reduce sediment loss from channel banks.

Reach Descriptions – Individual reach descriptions are as follows.

UT 1 – The main receiving stream within the Site begins just offsite as a braided, headwater system that meanders through a recent cutover. At one time, the stream was ditched and moved to the edge of the floodplain. Disturbance (likely from timber activities) has resulted in the ditch filling and hydrology braiding through the cutover headwater reach. This area is underlain by soils of the Johnston series, which are typically found in floodplains and swamps of the Coastal Plain. Johnston soils are characterized by a high concentration of organic matter from extensive wetness and a lack of organic matter oxidation. Before timber harvest, this portion of the Site was likely characterized as a Sandhills streamhead swamp

or Coastal Plain small stream swamp. However, the area has been timbered and all that remains are a few saplings of red maple (*Acer rubrum*), water oak (*Quercus nigra*), pond pine (*Pinus palustris*), American holly (*Ilex opaca*), titi (*Cyrilla racemiflora*) with herbaceous vegetation including sedges (*Carex* sp.), rushes (*Juncus effusus*), and broom sedge (*Andropogon gerardii*).

UT 1 leaves the upper headwater timbered area and is immediately captured within a man-made ditch approximately 3 or 4 feet in depth. The ditch crosses active pasture, which was planted with grasses for livestock grazing and hay production. The ditched channel varies in depth across the remainder of the Site ranging from 1.0 to 2.1 feet in depth. Overall, the stream is classified as an Eg-type channel with bank-height-ratios ranging from 1.0 to 2.8. A general trend of this portion of UT 1 is that the channel gets more incised as it descends the valley until its lower reach, where a delta-like deposition area occurs (and a damaged culvert capturing sediment at its upstream end). The delta-like setting results from numerous issues, including lower slopes, high bedload from stream channel erosion/agriculture field runoff, high livestock trampling impacts as it is shaded and serves as a summer refuge. This portion of UT 1 is underlain by Wehadkee soils that are regularly saturated or inundated.

UT 1 substrate is predominantly sand. The lower reaches are devoid of woody vegetation on both banks throughout the Site. Vegetation is predominantly pasture grass, including fescue (*Festuca* sp.) and coastal Bermuda (*Cynodon* sp.). Fields are not regularly maintained, and a significant amount of opportunistic species have colonized, including broom sedge, dog fennel (*Eupatorium capillifolium*), rough cocklebur (*Xanthium strumarium*), pigweed (*Amaranthus hybridus*), and other species common to overgrazed areas. Several seepage areas and mires exist and are primarily composed of rushes, sedges, and smartweed (*Poygonum* spp).

UT 2 – Upstream from the Site, the tributary extends to and along Rocky Fork Church Rd. The channel originates near the road and coalesces into a swampy area partially impounded by an agriculture crossing at the Site boundary. As the stream enters the Site, a headcut has incised the channel to approximately 4.4 feet. Headcut migration has been hindered by the agriculture crossing. Once into the Site, it is difficult to discern if the channel was excavated or incised to a point that sinuosity was lost. As UT 2 continues downstream, it shallows until it enters the delta-like setting, similar to UT 1.

UT 2 is mapped by the NRCS as Wehadkee, which occurs on floodplains and steams. Similar to UT 1, the channel is characterized by pasture. As the channel reaches the delta-like formation, more trees begin to occur, primarily red maple. These trees are frequently inundated and are buttressing from exposure to standing water. Livestock has access to the entirety of the reach, and farm debris commonly occurs in and around the channel. Channel substrate is predominantly sand.

UT 3 – Originates within the Site at a springhead seep. The entire reach of UT 3 has been ditched and straightened and ranges in depth from 4.3 feet in the upper reaches to 1.4 feet in the lower reaches before converging with UT 1. UT 3 has been directed around its historic floodplain to direct drainage quickly through the Site. Currently, the low floodplain occurs adjacent to the existing channel and is characterized by thick Juncus mats and ponded conditions.

UT 3 is underlain by soils of the Wehadkee series, which occur beneath streams and floodplains. This portion of the Site likely supported Coastal Plain bottomland hardwood forest before clearing for pasture. Seepage slopes ring the margins of the UT 3 floodplain, and UT 3 originates at an active seepage zone. These seepages may have also had areas of Coastal Plain small stream swamp and/or Coastal Plain semipermanent impoundment. Similar to UT 1 and UT 2, livestock has access to the entirety of the reach. The riparian area along the reach is devoid of woody vegetation, and like other Site reaches, the channel substrate is predominantly sand.

UT 4 – Originates offsite as a ditch draining seepages and ponded pockets of rushes. The ditch traverses pasture, enters the Site, and becomes a jurisdictional stream (based on an approved PJD) above an existing agricultural crossing. Livestock access the stream and have wallowed out the stream channel upstream of the crossing to form a shallow pool that is teaming with fish and tadpoles. UT 4 crosses through a failing pipe and continues as a ditched stream for a short distance (373 ft) before converging with UT 1. Although the channel is not extensively incised, the bank-height-ratios range from 1.1 to 1.6.

As with other Site tributaries, UT 4 is underlain by Wehadkee soils that have been cleared and are impacted by livestock. The channel substrate is sand.

UT 5 – Despite UT 5 having a large drainage area (47 acres), the channel doesn't develop a jurisdictional channel until low in the alluvial valley, approximately 320 feet from its convergence with UT 1. The channel is 3 to 4 feet in depth and erodes laterally from incision due to a lack of deep-rooted vegetation and livestock trampling. The topographic crenulation for UT 5 extends upstream to a pond. The pond discharges into the timbered headwaters and flows overground into the pasture. Ultimately a knickpoint in the pasture serves as the origination point for UT 5. At this point, UT 5 is characterized by pasture grasses with pockets of rushes and sedges.

UT 5 is mapped by the NRCS as Wehadkee soils all the way to the pond. Aerial photography collected by a licensed drone pilot indicates that surface hydrology extends up the valley for a significant distance. This reach was likely a braided tributary before disturbance from timber harvest and livestock trampling.

The vegetative community above the origin point of UT 5 is similar to the upper reach of UT 1 and was probably a Sandhills streamhead swamp or Coastal Plain small stream swamp. Lower down the valley, a transition to Coastal Plain bottomland hardwoods likely occurred.

As UT 5 was only classified as a jurisdictional stream in its lower reaches, project construction will be initiated in the downstream jurisdictional reach; however, observations of channel formation will occur in the upper reaches for information gathering purposes.

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 5 (Appendix A). Stream geometry measurements under existing conditions are summarized in Table 7 (Essential Morphology Parameters) and presented in detail in Table B1 (Appendix B).

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 Eg-, Ge-, and G-type streams with variable sinuosity. Existing Site reaches are characterized by sand substrate.

3.4.3 Channel Evolution

Site streams targeted for restoration have been cleared of forest vegetation and channelized, resulting primarily in channels classified as channelized (Class III), degraded (Class IV), and aggraded and widened (Class V) channels throughout the Site (Simon and Hupp 1986).

3.4.4 Valley Classification

Site streams are characterized by moderately sized, first order, narrow, and sloped alluvial valleys with approximately 50- to 100-foot floodplain valley widths. The Site is characterized by two distinct valley types based on the Rosgen classification system (Rosgen 1996) and includes Valley Type VIII and Valley Type III.

Valley Type VIII is most readily identified by the presence of multiple river terraces positioned laterally along broad valleys with gentle, down-valley elevation relief. Alluvial terraces and floodplains are the predominant depositional landforms that produce a relatively high sediment supply. Valley Type VIII describes most of the Site's valleys except for the lower, downstream reaches of UT 1 and UT 2, which are characterized by Valley Type III and depositional in nature with characteristic alluvial fan landforms.

Valley slopes are typical for a headwater system in the Sand Hills region and range from 0.0146 to 0.0290.

3.4.5 Discharge

This hydro-physiographic region is characterized by moderate rainfall with precipitation averaging approximately 48.2 inches per year (USDA 1989). Drainage basin sizes range from a 0.02-square mile on UT 3 and UT 4 and 0.15 square mile on UT 1 at the Site outfall.

The Site's discharge is dominated by a combination of upstream basin catchment, groundwater flow, and precipitation. Based on indicators of bankfull at reference reaches and on-Site, the designed channel will equal 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 4.2-19.0 cubic feet per second for UT 3 and UT 1 at the Site outfall, respectively.

Table 7. Essential Morphology Parameters

Parameter	Existing					Reference		Proposed				
	UT 1	UT 2	UT3	UT4	UT5	Hall	Crane	UT 1	UT 2	UT3	UT4	UT5
Valley Width (ft)	9-100	5-12	4-50	8-50	6-11	115	50	100	50	50	75	100
Contributing Drainage Area (acres)	97.5	22.6	12.2	13.2	47.4	76.8	132.1	97.5	22.6	12.2	13.2	47.4
Channel/Reach Classification	Eg 5	G 5	Eg 5	Eg 5	Ge5	E5	E5	Ce 5	Ce 5	Ce 5	Ce 5	Ce 5
Design Discharge Width (ft)	4.3-12.5	2.2-4.8	2.1-4.2	1.8-4.8	3.7-4.7	5.9-7.2	6.7-7.2	7.7-8.9	4.8-5.5	3.8-4.4	3.9-4.6	6.1-7.0
Design Discharge Depth (ft)	0.4-1.2	0.4-0.8	0.3-0.6	0.3-0.7	0.6-0.8	0.7-0.8	0.8	0.6	0.3-0.4	0.3	0.3	0.4-0.5
Design Discharge Area (ft^2)	20.0	12.5	19.0	4.0	17.0	4.8	5.3	5.0	1.9	1.2	1.3	3.1
Design Discharge Velocity (ft/s)	0.9	0.5	0.2	1.1	0.7	3.8	3.9	3.8	3.5	3.5	3.5	3.6
Design Discharge (cfs)	19.0	6.6	4.2	4.5	11.3	18.0	20.5	19.0	6.6	4.2	4.5	11.3
Water Surface Slope	0.0179	0.0145	0.0287	0.0145	0.0149	0.0133	0.0062	0.0167	0.0144	0.0264	0.0133	0.0136
Sinuosity	1.03	1.09	1.01	1.01	1.01	1.2	1.17	1.10	1.10	1.10	1.10	1.10
Width/Depth Ratio	3.6-31.3	2.8-12.0	3.5-14.0	2.6-16.0	4.6-7.8	7.4-10.9	8.4-9.0	12-16	12-16	12-16	12-16	12-16
Bank Height Ratio	1.0-2.8	2.2-3.1	2.0-7.2	1.3-2.8	1.8-4.8	1.1	1.0	1.0	1.0	1.0	1.0	1.0
Entrenchment Ratio	1.6-23.3	1.8-2.5	1.3-23.8	1.7-15.6	1.3-2.6	13.6-20.8	6.9-7.5	6.5-16.8	5.2-13.6	6.6-17.1	12.7-21.9	8.2-21.3
Substrate	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand

3.5 Project Site Wetlands

Jurisdictional wetlands/hydric soils within the Site were delineated in the field following guidelines set forth in the *Corps of Engineers Wetlands Delineation Manual* and subsequent regional supplements and located using GPS technology with reported submeter accuracy (Environmental Laboratory 1987). A jurisdictional wetland delineation was completed and approved by United States Army Corps of Engineers (USACE) representative James Lastinger during a field meeting on February 25, 2021. Documentation of the delineation has been included in Appendix D. Existing jurisdictional wetlands are depicted in light blue, and drained hydric soils are depicted in a black cross-hatch (Figure 5, Appendix A).

3.5.1 Hydrological Characterization

Construction activities are expected to reestablish approximately 8.815 acres of drained/impacted riparian hydric soils, rehabilitate 0.683 acres of riparian wetlands, and enhance 10.646 acres of cleared riparian wetlands. Areas of the Site targeted for riparian wetlands will receive hydrological inputs from periodic overbank flooding of restored tributaries, groundwater migration into wetlands, upland/stormwater runoff, and, to a lesser extent, direct precipitation. Hydrological impairment in drained soils has resulted from lateral draw-down of the water table adjacent to existing, incised stream channels and ditches.

Wetlands impacted by drainage features (incised channels or ditches) were monitored by groundwater gauges before mitigation alterations. Three groundwater gauges were installed to catalog the existing hydrology of these wetland areas. Seven additional gauges were installed in areas of drained hydric soils that are proposed for wetland reestablishment. The preconstruction gauge locations are depicted in Figure 5 (Appendix A), and the data is provided in Appendix B.

Overall, the gauges within jurisdictional wetlands (as determined in the PJD) appeared to have water within 12 inches of the ground surface for between 44 days and 57 days of the growing season. For this analysis, the growing season is defined as occurring between March 1 and October 24. Although no ground temperature data was collected, the March 1 growing season start is being used for consistency with expected annual monitoring growing season length, verified by soil temperatures and bud burst.

It should be noted that the months leading up to the 2021 growing season were unusually wet. This is depicted in the USACE Antecedent Precipitation Tool output, which states March 1 and April 1, 2021, had drought indices of “Severe Wetness” and “Moderate Wetness” respectively (Appendix B).

Six of the seven groundwater gauges installed in drained hydric soils exhibited little to no hydrology during the monitoring period. Gauge 5 appeared to have groundwater within 12 inches of the ground surface for 42 days. The area surrounding gauge 5 was determined to be non-jurisdictional in the PJD, and its hydrology was likely boosted by the severely wet conditions early in the growing season.

3.5.2 Soil Characterization

Detailed soil mapping conducted by North Carolina Licensed Soil Scientists (NCLSS) in late 2020 indicated the Site is currently underlain by hydric soils of the Wehadkee series and Johnston series (Figure 7, Appendix A). Soils have been disturbed by livestock grazing, vegetation clearing, and conversion to pastureland. Hydric soils have been drained by ditching and channel incision. A portion of these soils have been effectively drained; however, seeps and springs (and areas of compacted soils) pockmark the area and are expected to have hydrology enhanced by proposed activities.

Onsite hydric soils are grey to gley in color and are predominantly associated with the A12 (Thick Dark Surface), F3 (Depleted Matrix), S5 (Sandy Redox), and S6 (Stripped Matrix) hydric soil field indicators. Six detailed soil profiles conducted by NCLSS were collected at the Site. Profile locations are depicted in Figure 7, Appendix A, with profile descriptions included in Appendix B. A few representative profiles are included below in Table 8.

Table 8. Representative Soil Profile Descriptions

Location	Mitigation Approach	Depth (inches)	Color	Texture
Soil Profile E (located in a downstream floodplain near Site outfall)	Enhancement	0 - 4	10 YR 2/1 10YR 3/4 mottles	Sandy Loam
		4 - 7	10 YR 4/1 10 YR 5/8 mottles 10 YR 3/6 mottles	Sandy Clay Loam
		7 – 12+	10 YR 6/1 10 YR 6/8 mottles 10YR 3/6 mottles	Sandy Clay Loam
Soil Profile B (located in the upper reaches of agriculture fields)	Reestablishment	0 – 8	10 YR 2/1 5 YR 3/4 mottles	Sandy Loam
		8 – 15+	10 YR 3/1 2.5 Y 3/2 concentrations	Clay Loam
Soil Profile G (located in disturbed forest headwaters)	Enhancement	0 - 7	10 YR 2/1	Sandy Loam
		7 – 15+	10 YR 4/1 10 YR 6/1 depletions 10 YR 4/4 mottles	Loamy Sand

4 REFERENCE STUDIES

4.1 Reference Streams

Distinct bankfull indicators were present within the reference stream channels. In addition, dimension, pattern, and profile variables had not been significantly altered or degraded, allowing for the calculation of restoration reach parameters. For this project, two reference reaches were measured, including the Hall reference site and Crane reference site. The Hall reference site was measured in 2004 for a NCDMS mitigation project, Hall Branch Mitigation Site, that has successfully closed out. The Crane reference site is located immediately downstream from the Site and was measured specifically for this project. Reference Site locations are provided in Figure 2, Appendix A.

4.1.1 Hall Reference Reach

4.1.1.1 Watershed Characterization

The Hall Reference Site is located in northeastern Richmond County within the same physiographic province, geologic unit, and landscape position as the Site. The reference reach is approximately 36 miles southwest of the Site in a topographic crenulation flowing to a similar-sized stream as the Site (0.12 square mile drainage area). Alterations, development, and impervious surfaces within the watershed are minimal.

4.1.1.2 Channel Classification

Stream geometry and substrate data have been evaluated to classify the reference reach based on a classification utilizing fluvial geomorphic principles (Rosgen 1996). This classification stratifies streams into comparable groups based on pattern, dimension, profile, and substrate characteristics. The reference reach is

characterized as an E-type, moderately sinuous (1.20) channel with a sand-dominated substrate. Reference reaches that are characterized by E-type channels typically have a dense herbaceous understory that resists erosive forces associated with deep, sinuous channels.

4.1.1.3 Discharge

The reference stream has an approximately 0.12-square mile watershed and a bankfull discharge of 18.0 cubic feet per second based on bankfull indicators.

4.1.1.4 Channel Morphology

Stream cross-sections and profiles were measured along the reference stream. The stream reach is transporting its sediment supply while maintaining stable dimension, pattern, and profile. Stream geometry measurements for the reference stream are summarized in the Morphological Stream Characteristics Table (Table B1, Appendix B).

Dimension: Data collected at the reference reach indicates a bankfull cross-sectional area of 4.8 square feet, a bankfull width of 6.6 feet, a bankfull depth of 0.8 feet, and a width-to-depth ratio of 9.2. Regional curves predict that the stream should exhibit a bankfull cross-sectional area of approximately 5.1 square feet for the approximate 0.12-square mile watershed (Harman et al. 1999). For a more detailed discussion on bankfull verification, see Section 5.2 (Bankfull Verification).

The reference reach exhibits a bank-height ratio averaging 1.1. In addition, the width of the flood-prone area is approximately 115 feet giving the channel an entrenchment ratio of 13.6 to 20.8, typical of a stable E-type channel.

Pattern: In-field measurements of the reference reach have yielded an average sinuosity of 1.20 (thalweg distance/straight-line distance). Other channel pattern attributes include an average pool-to-pool spacing ratio (L_{p-p}/W_{bkf}) of 3.0, a meander wavelength ratio (L_m/W_{bkf}) of 2.2 and a radius of curvature ratio (R_c/W_{bkf}) of 1.5. These variables were measured within a stable, forested reach, which did not exhibit any indications of pattern instability such as shoot cutoffs, abandoned channels, or oxbows.

Profile: Based on a elevational profile surveys, the reference reach is characterized by a valley slope of 0.0160 (rise/run). Ratios of the reference reach riffle, run, pool and glide slopes to average water surface slope are 1.0, 1.1, 0.8, and 0.5, respectively.

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

4.1.1.5 Channel Habitat

Instream habitat along the Hall Reference Site is characterized by a pronounced complex of shallow riffles and pools of various depths. There are scattered sticks, leaf packs, macrophytes, and various undercut banks throughout. The substrate is mostly sand. Mature tree roots extending into the streambed provide grade control and cover along the banks, and the mature canopy provides shade.

4.1.2 Crane Reference Reach

4.1.2.1 Watershed Characterization

The Crane reference reach is located immediately downstream of the Site in southern Lee County. Similar to the Hall reference reach, the Crane reference reach is located in the same physiographic province, geologic unit,

and landscape setting. The reference reach provides a perfect opportunity to determine design parameters within the same drainage basin and setting.

4.1.2.2 Channel Classification

The reference reach is characterized as an E-type, moderately sinuous (1.17) channel with a sand-dominated substrate.

4.1.2.3 Discharge

The reference stream has an approximately 0.21-square mile watershed and a bankfull discharge of 20.5 cubic feet per second based on bankfull indicators.

4.1.2.4 Channel Morphology

Stream cross-sections and profiles were measured along the reference stream. The stream reach is transporting its sediment supply while maintaining stable dimension, pattern, and profile. Stream geometry measurements for the reference stream are depicted in Figure 7 (Appendix A) and summarized in the Morphological Stream Characteristics Table (Table B1, Appendix B).

Dimension: Data collected at the reference reach indicates a bankfull cross-sectional area of 5.3 square feet, a bankfull width of 7.0 feet, a bankfull depth of 0.8 feet, and a width-to-depth ratio of 8.7. Regional curves predict that the stream should exhibit a bankfull cross-sectional area of approximately 7.3 square feet for the approximate 0.21-square mile watershed (Harman et al. 1999), below the 5.3-square feet displayed by channel bankfull indicators identified in the field. Low bankfull cross-sectional area may result from high bedload and low slope conditions for the Site; however, these conditions appear to be in equilibrium as the channel width-to-depth ratio is typical for the area. For a more detailed discussion on bankfull verification, see Section 5.2 (Bankfull Verification).

The reference reach exhibits a bank-height ratio of 1.0, which is representative of a stable E-type channel. In addition, the width of the flood-prone area is approximately 50 feet giving the channel an entrenchment ratio of 6.9-7.5, typical of a stable E-type channel.

Pattern: In-field measurements of the reference reach have yielded an average sinuosity of 1.17 (thalweg distance/straight-line distance). Other channel pattern attributes include an average pool-to-pool spacing ratio ($L_{p\text{-}p}/W_{bkf}$) of 4.0, a meander wavelength ratio (L_m/W_{bkf}) of 6.7 and a radius of curvature ratio (R_c/W_{bkf}) of 1.9. These variables were measured within a stable, forested reach, which did not exhibit any indications of pattern instability such as shoot cutoffs, abandoned channels, or oxbows.

Profile: Based on elevational profile surveys, the reference reach is characterized by a valley slope of 0.0073 (rise/run). Ratios of the reference reach riffle, run, pool and glide slopes to average water surface slope are 0.32, 0.12, 0.45, and 0.25, respectively. These numbers are below what would be expected for the reach. The numbers are low due to a series of grade control features (primarily roots and debris) that provided steps and pools, thereby flattening average facet features. However, the run slope maximum was 11 times the average water surface slope, as measured in various steps.

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

4.1.2.5 Channel Habitat

Instream habitat along the Crane Reference Site has been impacted by sediment (sand) deposition from upstream land use. However, leaf packs from surrounding mature vegetation are abundant, undercut banks are common, and there are sparse occurrences of sticks and macrophytes. The roots of mature trees and shrubs line the banks providing instream cover, and several roots extend into the streambed providing grade control. The entire reach is shaded by a dense, mature canopy.

4.2 Reference Forest Ecosystem

A Reference Forest Ecosystem (RFE) is a forested area used 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 located on the downstream Crane reference reach. The RFE supports plant community and landform characteristics that restoration efforts will attempt to emulate. Tree and shrub species identified within the reference forest (outlined in Table 9) will be used along with other relevant species in the appropriate Schafale and Weakley (2012) community descriptions.

Table 9. Reference Forest Ecosystem

Coastal Plain Bottomland Hardwood Forest (Brownwater Subtype)		
Scientific Name	**Common Name**	**Indicator Status**
Quercus alba	White oak	FACU
Quercus nigra	Water oak	FAC
Quercus laurifolia	Laurel oak	FACW
Ilex Opaca	American holly	FAC
Magnolia virginiana	Sweetbay	FACW
Vaccinium corymbosum	Highbush blueberry	FACW
Nyssa sylvatica	Black gum	FAC

Several species identified in the reference forest (*Magnolia virginiana, Vaccinium corymbosum*, and *Nyssa sylvatica*) are more characteristic of a Coastal Plain Small Stream Swamp (Brownwater Subtype) community, which is likely intermixed within the bottomland hardwood forest. The upper headwater reaches will likely be the wettest portion of the Site and include species such as *Taxodium distichum* (Cypress), *Nyssa aquatica* (Water tupelo), various bays such as *Persea palustris* (Red bay), as well as species listed above.

The Coastal Plain Bottomland Hardwood Forest vegetative community is distinguished from Small Stream Swamps community by their occurrence on river floodplains with well-developed alluvial landforms. The boundary is relatively arbitrary and difficult to delineate. Significant overlap in these two communities should not pose a problem, as species in both communities may be planted in each planting zone.

4.3 Freshwater Marsh

Some portions of the Site are expected to be dominated by an open, herbaceous vegetative community characteristic of a Coastal Plain Semi-Permanent Impoundment as described in Schafale and Weakley (2012).

Overbank flooding appears to occur and may result in extended periods of open water and emergent vegetation. A local freshwater marsh reference was not available, so planting will reflect native species currently found onsite and/or known to occur regionally. These species include but are not limited to *Persicaria* spp., *Carex* spp., *Juncus trigonocarpus*, *Juncus tenuis, Juncus effusus*, *Verbena hastata*, *Bidens aristosa*, *Scirpus cyperinus*, *Leersia hexandra*, *Leersia oryzoides*, *Orontium aquaticum*, *Eriocaulon decangulare*, *Schoenoplectus subterminalis*, *Schoenoplectus etuberculatus*, *Sagittaria engelmanniana*, *Habenaria repens*, *Eupatorium perfoliatum*, *Peltandra virginica*, and *Glyceria obtusa*.

5 CHANNEL ASSESSMENTS

5.1 Channel Stability Assessment

Channel degradation or aggradation occurs when hydraulic forces exceed or do not approach the resisting forces in the channel. The amount of degradation or aggradation is a function of the relative magnitude of these forces over time. The interaction of flow within the boundary of open channels is only imperfectly understood. Adequate analytical expressions describing this interaction have yet to be developed for conditions in natural channels. Thus, means of characterizing these processes rely heavily upon empirical formulas.

Traditional approaches for characterizing stability can be placed in two categories: 1) maximum permissible velocity and 2) tractive force, or stream power and shear stress. The former is advantageous in that velocity can be measured directly. Shear stress and stream power cannot be measured directly and must be computed from various flow parameters. However, stream power and shear stress are generally better measures of fluid force on the channel boundary than velocity.

Stream power and shear stress were estimated for 1) existing dredged and straightened reaches, 2) the reference reaches, and 3) proposed Site conditions. Average stream velocity and bankfull discharge values were calculated for the existing Site stream reaches, the reference reach, and proposed conditions. Important input values and output results (including stream power, shear stress, and per unit shear power and shear stress) are presented in Table 10.

To maintain sediment transport functions of a stable stream system, the proposed channel should exhibit stream power and shear stress values, so the channel is neither aggrading nor degrading. Results of the analysis indicate the proposed channel reaches are expected to maintain stream power as a function of width values of approximately 0.22-2.36 and shear stress values of approximately 0.10-0.52 (Table 10).

Table 10. Stream Power (Ω) and Shear Stress (τ) Values

	Bankfull Discharge (ft^3/s)	Water surface Slope (ft/ft)	Total Stream Power (Ω)	Ω/W	Hydraulic Radius	Shear Stress (τ)	Velocity (v)	τ v	τ_{max}
Existing Conditions									
UT1	19	0.0179	21.22	**3.17**	1.94	**2.17**	0.95	2.06	3.25
UT2	6.6	0.0145	5.97	**1.81**	2.36	**2.13**	0.53	1.13	3.20
UT3	4.2	0.0287	7.52	**2.21**	4.52	**8.10**	0.22	1.79	12.15
UT4	4.5	0.0077	2.16	**0.66**	0.93	**0.45**	1.13	0.50	0.67
UT5	11.3	0.0077	5.43	**1.32**	3.09	**1.49**	0.66	0.99	2.23
Reference Conditions									
Hall	18	0.0133	14.94	**2.26**	0.59	**0.49**	3.75	1.82	0.73
Crane	20.5	0.0062	7.93	**1.13**	0.62	**0.24**	3.87	0.92	0.36
Proposed Conditions									
UT1	19	0.0167	19.80	**2.36**	0.50	**0.52**	3.80	1.98	0.78
UT2	6.6	0.0144	5.93	**1.14**	0.31	**0.28**	3.47	0.96	0.41
UT3	4.2	0.0264	6.92	**1.69**	0.26	**0.42**	3.50	1.47	0.63
UT4	4.5	0.0039	1.10	**0.25**	0.27	**0.06**	3.46	0.22	0.10
UT5	11.3	0.0039	2.75	**0.42**	0.41	**0.10**	3.65	0.36	0.15

Hall reference reach values for stream power and shear stress are similar to proposed values for reaches with steeper valley and water surface slopes resulting in higher stream power and shear stress values. Crane reference reach values for stream power and shear stress are more similar to reaches with flatter valley and water surface slopes resulting in slightly lower stream power and shear stress values. However, this reference reach has a much larger drainage area compared to Site reaches with flatter slopes.

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 elevated compared to proposed values. Shear stress values of existing streams are significantly elevated as compared to proposed and reference reach values. Proposed stream power and shear stress values appear 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). Current research also estimates a bankfull discharge would be expected to occur approximately every 1.3 to 1.5 years (Rosgen 1996, Leopold 1994).

Although the Sand Hills are in the Coastal Plain, it was determined that the Site more readily matches the Piedmont regional curves. This was determined by measuring two reference stream reaches and plotting the bankfull cross-sectional area/discharge on each of the curves. Reference stream cross-sectional areas plotted significantly higher on the Coastal Plain regional curves (2.4 times higher for the Hall reference reach and 1.8 times higher for the Crane reference reach). However, the reference streams plotted very closely to the Piedmont regional curves, averaging approximately 83 percent of the cross-sectional area predicted by the

curves. Using the Piedmont regional curve, the predicted bankfull discharge for the Hall and Crane Reference Reaches is 18.0 and 20.5 cubic feet per second (cfs).

The USGS regional regression equation for the Piedmont region indicates that bankfull discharge at a 1.3-1.5 year return interval averages approximately 19.8-22.8 and 28.9-33.4 cfs, respectively (USGS 2011); similar to predicted bankfull indicators.

Based on the above analysis of methods to determine bankfull discharge, proposed conditions at the Site will be based on 83% of the bankfull cross-sectional area predicted by the Piedmont regional curves. Table 11 summarizes all methods analyzed for estimating bankfull discharge.

Table 11. Reference Reach Bankfull Discharge Analysis

Method	Watershed Area (square miles)	Return Interval (years)	Discharge (cfs)	% Predicted by Curves
Hall Reference Reach				
Piedmont Regional Curves (Harman et. al. 1999)	0.12	1.3-1.5	19.3	100%
Piedmont Regional Regression Model (USGS 2011)	0.12	1.3-1.5	19.8-22.8	103-118%
Field Indicators of Bankfull	0.12	1.3-1.5	18.0	94%
Crane Reference Reach				
Piedmont Regional Curves (Harman et. al. 1999)	0.21	1.3-1.5	28.5	100%
Piedmont Regional Regression Model (USGS 2011)	0.21	1.3-1.5	28.9-33.4	101-117%
Field Indicators of Bankfull	0.21	1.3-1.5	20.5	72%

6 FUNCTIONAL UPLIFT AND PROJECT GOALS/OBJECTIVES

Project goals are based on the *Cape Fear River Basin Restoration Priorities* (RBRP) report (NCEEP 2009) and on-site data collection of channel morphology and function observed during field investigations. The Site is located within **Targeted Local Watershed (TLW) 03030004070010** (Figure 2, Appendix A). The RBRP report documents restoration goals for the 03030004 cataloging unit include promoting low-impact development, stormwater management, restoration, and buffer protection in urbanizing areas and preservation elsewhere. The **LWP** for Crane's Creek lists key watershed stressors as excess sedimentation, stormwater runoff, inadequate riparian buffer, streambank erosion, and nutrient enrichment.

Site-specific mitigation goals and objectives have been academically developed through the use of North Carolina Stream Assessment Method (NC SAM), North Carolina Wetland Assessment Method (NC WAM) analyses of existing and reference stream systems at the Site, and NC DMS October 2020 guidance (NC SFAT 2015 and NC WFAT 2010). NC SAM and NC WAM rate functional metrics for streams and wetlands as high, medium, or low based on field data collected on forms and transferred into a rating calculator. Using Boolean logic, the rating calculator assigns a high, medium, or low value for each metric and overall function. Site functional assessment data forms are included in Appendix B.

Tables 12 through 14 summarize NC SAM and NC WAM metrics academically targeted for functional uplift and the corresponding mitigation activities proposed to provide functional uplift. 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 12. NC SAM Summary

NC SAM Function Class Rating Summary	SAM 1* UT 1 (Upstream)	SAM 2 UT 1 (Downstream)	SAM 3 UTs 2, 3, 4 and 5
(1) HYDROLOGY	HIGH	**LOW**	**LOW**
(2) Baseflow	HIGH	HIGH	HIGH
(2) Flood Flow	HIGH	**LOW**	**LOW**
(3) Streamside Area Attenuation	HIGH	**LOW**	**LOW**
(4) Floodplain Access	HIGH	**LOW**	**LOW**
(4) Wooded Riparian Buffer	**LOW**	**LOW**	**LOW**
(4) Microtopography	HIGH	**LOW**	**LOW**
(3) Stream Stability	HIGH	**LOW**	**LOW**
(4) Channel Stability	HIGH	**LOW**	**LOW**
(4) Sediment Transport	**LOW**	**LOW**	**LOW**
(4) Stream Geomorphology	HIGH	**LOW**	MEDIUM
(1) WATER QUALITY	MEDIUM	**LOW**	**LOW**
(2) Baseflow	HIGH	HIGH	HIGH
(2) Stream-side Area Vegetation	HIGH	**LOW**	**LOW**
(3) Upland Pollutant Filtration	HIGH	**LOW**	**LOW**
(3) Thermoregulation	MEDIUM	**LOW**	**LOW**
(2) Indicators of Stressors	YES	YES	YES
(2) Aquatic Life Tolerance	MEDIUM	MEDIUM	MEDIUM
(1) HABITAT	**LOW**	**LOW**	**LOW**
(2) In-stream Habitat	**LOW**	**LOW**	**LOW**
(3) Baseflow	HIGH	HIGH	HIGH
(3) Substrate	**LOW**	**LOW**	**LOW**
(3) Stream Stability	HIGH	**LOW**	**LOW**
(3) In-Stream Habitat	**LOW**	**LOW**	**LOW**
(2) Stream-side Habitat	MEDIUM	**LOW**	**LOW**
(3) Stream-side Habitat	MEDIUM	**LOW**	**LOW**
(3) Thermoregulation	MEDIUM	**LOW**	**LOW**
OVERALL	MEDIUM	**LOW**	**LOW**

*Stream is proposed for Enhancement Level II.

Based on NC SAM output, all three primary stream functional metrics (Hydrology, Water Quality, and Habitat), as well as 20 sub-metrics are under-performing as exhibited by a LOW metric rating (see Figure 5, Appendix A for NC SAM data reaches). LOW performing metrics are to be academically targeted for functional uplift through mitigation activities.

Table 13. NC WAM Summary

NC WAM Sub-function Rating Summary	WAM 1	WAM 2	WAM 3
Wetland Type	**Headwater Forest**	**Headwater Forest**	**Headwater Forest**
(1) HYDROLOGY	**LOW**	HIGH	**MEDIUM**
(2) Surface Storage & Retention	**LOW**	HIGH	**LOW**
(2) Sub-surface Storage and Retention	**LOW**	HIGH	HIGH
(1) WATER QUALITY	**LOW**	HIGH	**LOW**
(2) Pathogen change	MEDIUM	HIGH	**LOW**
(2) Particulate Change	**LOW**	MEDIUM	HIGH
(2) Soluble change	**LOW**	MEDIUM	MEDIUM
(2) Physical Change	MEDIUM	HIGH	**LOW**
(1) HABITAT	**LOW**	**LOW**	**LOW**
(2) Physical Structure	**LOW**	**LOW**	**LOW**
(2) Landscape Patch Structure	**LOW**	**LOW**	**LOW**
(2) Vegetative Composition	**LOW**	**LOW**	**LOW**
OVERALL	**LOW**	**HIGH**	**LOW**

NC WAM forms were filled out at three locations in the Site: one on a side-slope, one in the lower reaches, and one in the headwaters of the Site. Typically, NC WAM forms are not filled out in wetland restoration areas. However, the primary functional uplift to wetlands will occur in these areas. Therefore, NC WAM forms were filled out using best professional judgment concerning several sub-functions.

Table 14 outlines stream and wetland functions identified in NC DMS 2020 guidance targeted for functional uplift, restoration goals, and success criteria.

Table 14. 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, an increase in biogeochemical cycling within the system, and recharging of riparian wetlands.	Four bankfull events which must occur in separate years within the monitoring period. Intermittent reaches will demonstrate at least 30-days of consecutive flow.	2 Crest gauges (pressure transducers) on UT 1 and UT 2	To be determined
Improve stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.	Bank height ratios remain below 1.2 over the monitoring period. Visual assessments showing progression towards stability.	16 Cross-section surveys	To be determined
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zones and plant appropriate species on streambanks.	Reduction in floodplain sediment inputs from runoff, increased bank stability, increased LWD and organic material in streams, increased	A survival rate of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7. Trees in each plot must average 7 ft in height at MY5 and 10 ft in at MY7.	17 permanent and 6 random veg plots	To be determined
Restore and enhance groundwater hydrology to drained or impacted hydric soil areas.	Reduce channel depth in incised stream reaches, fill drainage ditches, and alleviate soil compaction from agriculture activities.	Particulate and pollution conversion, groundwater storage and reduced downstream flooding, habitat diversification, and vegetative composition conversion.	Groundwater saturation within 12 inches of the soil surface for 12 % of the growing season (annually) for reestablishment and rehabilitation areas.	15 groundwater gauges	To be determined

Note: Onsite rain data will be collected throughout each monitoring period.

7 SITE DESIGN AND IMPLEMENTATION CONSTRAINTS

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

No known Site constraints that may hinder proposed mitigation activities were identified during field surveys. Potential constraints reviewed include the following.

7.1 Threatened & Endangered Species

Four federally protected species are listed as occurring in Lee County as of January 11, 2021 (USFWS 2021); Table 15 summarizes potential habitat and a preliminary biological conclusion. A letter dated 10/19/20 from the USFWS states "has no objection to the activity as described in the permit application"

Table 15. Endangered Species Act Determinations

Species	Habitat	Potential Habitat at Site	Biological Conclusion
Bald eagle (*Haliaeetus leucocephalus*)	Bald eagles typically nest in tall, living trees in a conspicuous location near open water. Eagles forage over large bodies of water and utilize adjacent trees for perching.	Yes	No eagle act permit required
Red-cockaded woodpecker (*Picoides borealis*) Endangered	The red-cockaded woodpecker (RCW) typically occupies open, mature stands of southern pines, particularly longleaf pine (Pinus palustris), for foraging and nesting/roosting habitat. The RCW excavates cavities for nesting and roosting in living pine trees, aged 60 years or older, which are contiguous with pine stands at least 30 years of age to provide foraging habitat. The foraging range of the RCW is normally no more than 0.5 miles.	No	No effect
Cape Fear shiner (*Notropis mekistocholas*)	The Cape Fear shiner is known only from the Cape Fear River watershed. In general, habitat occurs in streams with clean gravel, cobble, or boulder substrates. It is most often observed inhabiting slow pools, riffles, and slow runs associated with water willow (*Justicia americana*) beds, which it uses for cover. Juveniles can be found inhabiting slackwater, among large rock outcrops and in flooded side channels and pools. Spawning occurs May through June when water temperatures reach 66 degrees Fahrenheit.	No	No Effect
Harperella (*Ptilimnium nodosum)*	Harperella in North Carolina typically occurs on rocky or gravel shoals and sandbars and along the margins of clear, swift-flowing stream sections	No	No Effect

7.2 Cultural Resources

The North Carolina State Historic Preservation Office (SHPO) had the following comment: "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."

7.3 North Carolina Natural Heritage Elements

A query of the North Carolina Natural Heritage Program (NCNHP) database indicates there are no records for rare species, important natural communities, natural areas, or conservation/managed areas within the proposed project boundary. Within a one-mile radius of the project boundary, NCNHP lists red-cockaded woodpecker (*Picoides borealis*) (Element Occurrence 3992 located approximately 0.3 miles west of the Site), the Seaboard Longleaf Pine Stand natural area (located east of Rocky Fork Church Road opposite the Site), an NCDOT Mitigation Site (located adjacent to US Highway 1 approximately 0.5-miles west-northwest of the Site), and several additional element occurrences including state-listed species and natural communities (Appendix E). We received no comments.

7.4 FEMA

Inspection of the FEMA Flood Insurance Rate Map 3710953800J, Panel 9538, effective September 6, 2006, indicates that Site streams are not located in a Special Flood Hazard Area. Therefore, the project should not alter FEMA flood zones, and a "Conditional Letter of Map Revision" (CLOMR) is unnecessary for this Site.

7.5 Utilities

No utilities are located within the project boundaries that would affect the project.

7.6 Air Transport Facilities

No air transport facilities are located within 5 miles of the Site.

7.7 Easement Breaks

Easement breaks were evaluated as a potential project constraint as they fragment the Site and reduce the potential functional uplift. This project includes one (1) easement break (60') for a crossing that is 20' feet in width. Therefore, easement breaks do not significantly reduce functional uplift of the Site and are not considered a project constraint.

8 DESIGN APPROACH AND MITIGATION WORK PLAN

8.1 Stream Design

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

Primary activities designed to restore Site streams include 1) stream restoration, 2) stream enhancement (Level II), 3) wetland reestablishment, 4) wetland rehabilitation, 5) wetland enhancement, and 6) vegetation planting (Figures 10 and 12, Appendix A).

8.1.1 Stream Restoration

Stream restoration efforts are designed to restore a stable stream that approximates hydrodynamics, stream geometry, and local microtopography relative to reference conditions. Restoration at the Site will be a combination of Priority I and II restoration. Bankfull elevations will be raised to meet the adjacent valley floodplain elevation as soon as tie-in elevations are achieved.

Stream restoration is expected to entail 1) channel excavation, 2) channel stabilization, 3) channel diversion, and 4) channel backfill.

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.

Bridge Crossing

Landowner constraints will necessitate the installation of a bridge crossing to allow access to portions of the property isolated by stream restoration activities Figure 10 (Appendix A). The crossing will be constructed with suitable dimensions to allow for stormwater flows, with adjacent floodplain pipes to allow overflow discharge onto the floodplain. Materials will include hydraulically stable rip-rap or suitable rock. The crossing will be large enough to handle anticipated farm and livestock use. 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. Fencing will be installed to restrict livestock access to Site waters.

Piped Channel Crossing

Landowner constraints will necessitate the installation of one piped channel crossing upstream, and outside of the easement boundary on UT 2, to allow access to portions of the property isolated by stream restoration activities Figure 10 (Appendix A). The existing crossing is currently perched and serves as a barrier to wildlife migration. The crossing will be constructed with a suitable sized pipe to allow for stormwater flows, with adjacent floodplain pipes to allow for overflow discharge onto the floodplain. Materials will include hydraulically stable rip-rap or suitable rock. The crossing will be large enough to handle anticipated vehicular traffic. Approach grades to the crossing will be at an approximate 10:1 slope and constructed of hard, scour-resistant crushed rock or other permeable material, which is free of fines.

8.1.2 Stream Enhancement (Level II)

Stream enhancement (level II) will entail the installation of easement markers and fencing to restrict livestock and planting riparian buffers with native forest vegetation to facilitate stream recovery and prevent further degradation of the stream.

8.2 Individual Reach Discussions

Mitigation strategies proposed for each reach are presented in Table 16.

Table 16. Individual Reach Descriptions and Functional Uplift

Individual Reach	Mitigation Activities	Functional Uplift Provided for Identified Stressors

UT 1	• Initiate Enhancement II at the upstream property boundary by treating invasive species, planting appropriate species, and fencing livestock. • Tie to the lower Enhancement reach and initiate P1 stream restoration at the historic floodplain elevation. • Install grade control/habitat structures. • Hydrate adjacent wetlands by backfilling incised, ditched stream channels. • Install a stream bridge crossing in the lower reaches of UT 1. • Remove and fence livestock from the conservation easement. • Plant a vegetative buffer within the entire floodplain. • Tie into the downstream reach of the channel before discharging the stream from the Site.	• Non-functioning riparian buffer/wetland vegetation • Nutrients • Fecal Coliform • Peak Flows • Artificial Barriers • Ditching/Draining • Habitat Fragmentation • Limited Bedform Diversity • Absence of Large Woody Debris
UT 2	• Tie into the upper, offsite reaches of UT 2 and initiate a combination of P1 and P2 stream restoration. • Install a piped crossing at the upper reaches to replace a failed piped crossing and fix the grade, this is outside the easement. • Install grade control/habitat structures. • Remove and fence livestock from the conservation easement. • Plant a vegetative buffer within the entire floodplain. • Tie into the downstream reach of the channel before discharging the stream from the Site.	• Non-functioning riparian buffer/wetland vegetation • Nutrients • Fecal Coliform • Peak Flows • Artificial Barriers • Ditching/Draining • Habitat Fragmentation • Limited Bedform Diversity • Absence of Large Woody Debris
UT 3	• Tie to seepage area and initiate P1 stream restoration in the lowest elevation portion of the valley. • Install grade control/habitat structures. • Hydrate adjacent wetlands by backfilling incised, ditched stream channels. • Tie into UT 1 across and inner bend at the appropriate elevation. • Remove and fence livestock from the conservation easement. • Plant a vegetative buffer within the entire floodplain.	• Non-functioning riparian buffer/wetland vegetation • Nutrients • Fecal Coliform • Peak Flows • Ditching/Draining • Habitat Fragmentation • Limited Bedform Diversity • Absence of Large Woody Debris
UT 4	• Initiate P1 stream restoration at the historic floodplain elevation. • Install grade control/habitat structures. • Hydrate adjacent wetlands by backfilling incised, ditched stream channels. • Tie the lower reaches of the channel into UT 1 across an inner bend. • Remove and fence livestock from the conservation easement. • Plant a vegetative buffer within the entire floodplain.	• Non-functioning riparian buffer/wetland vegetation • Nutrients • Fecal Coliform • Peak Flows • Ditching/Draining • Habitat Fragmentation • Limited Bedform Diversity • Absence of Large Woody Debris

Table 16. Individual Reach Descriptions and Functional Uplift (Continued)

UT 5	• Tie to seepage area and initiate P1 stream restoration in the lowest elevation portion of the valley.	• Non-functioning riparian buffer/wetland vegetation

	• Install grade control/habitat structures. • Hydrate adjacent wetlands by backfilling incised, ditched stream channels. • Tie into UT 1 across and inner bend at the appropriate elevation. • Remove and fence livestock from the conservation easement. • Plant a vegetative buffer within the entire floodplain.	• Nutrients • Fecal Coliform • Peak Flows • Ditching/Draining • Habitat Fragmentation • Limited Bedform Diversity • Absence of Large Woody Debris

8.3 Wetland Enhancement, Reestablishment, and Rehabilitation

Wetland enhancement, reestablishment, and rehabilitation are designed to restore a fully functioning wetland system to provide surface water storage, nutrient cycling, removal of imported elements and compounds, and create a variety and abundance of wildlife habitat.

Wetland Enhancement

Wetland enhancement includes areas of existing wetlands (based on the approved PJD) that have been subject to timber harvest, cleared of forest vegetation, or are pasture for livestock grazing. These areas will be planted with native forest vegetation and will have livestock removed/fenced from the area. Planting and livestock removal will enhance 10.646 acres of existing wetland within the Site boundaries.

Wetland Reestablishment

Portions of the Site underlain by hydric soils have been impacted by stream dredging, vegetative clearing, agriculture grazing, and other land disturbances associated with land use management. Wetland reestablishment will focus on restoring vegetative communities, restoring stream corridors and historic groundwater tables, and reestablishing soil structure and microtopographic variations. These activities will result in the reestablishment of approximately 8.815 acres of jurisdictional riparian riverine wetlands.

Wetland Rehabilitation

Wetland Rehabilitation will occur in areas of the Site that are currently jurisdictional; however, groundwater drawdown is presently affected by ditches and channel incision. These areas had preconstruction groundwater gauges installed in Early February 2021 (Appendix B). The location of groundwater gauges is depicted in Figure 5 (Appendix A). Wetland rehabilitation areas should show an improvement in hydrology, including increased hydroperiod during normal climatic conditions and/or increased stream connectivity from stream overbank flooding. Wetland rehabilitation activities will result in approximately 0.683 acres of improved jurisdiction riparian wetlands. Groundwater gauge data will be included in annual monitoring reports for comparison to preconstruction gauge data.

8.4 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 critical 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, as well as volunteer desirable native species which exist in the seed bank. Additionally, soil compaction will be addressed by deep-ripping/plowing the planting area prior to Site planting.

8.5 Natural Plant Community Restoration

Restoration of floodplain forest and stream-side habitat allows for the development and expansion of characteristic species across the landscape. Ecotonal changes between community types contribute to the diversity and provide secondary benefits, such as enhanced feeding and nesting opportunities for

mammals, birds, amphibians, and other wildlife. Reference Forest Ecosystem (RFE) data, onsite observations, and community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley, 2012) were used to develop the primary plant community associations that will be promoted during community restoration activities.

8.5.1 Planting Plan

Stream-side trees and shrubs include species with high value for sediment stabilization, rapid growth rate, and the ability to withstand hydraulic forces associated with bankfull flow and overbank flood events. Stream-side trees and shrubs will be planted within 15 feet of the channel top of bank throughout the meander belt-width. In addition, shrub elements will be planted along the reconstructed stream banks, concentrated along outer bends. Coastal Plain Bottomland Hardwood Forest (Brownwater Subtype) is the target community for the lower floodplain portions of the Site with Coastal Plain Small Stream Swamp (Brownwater Subtype), and possibly Sandhills Streamhead Swamp targeted for headwater portions of the Site. Significant overlap in species for each planting community allows for a broad fringe between the ecological zones.

Table 17 depicts the total number of stems and species distribution within each vegetation association (Figure 12, Appendix A). Planting will be performed between December 1 and March 15 to allow plants to stabilize during the dormant period and set root during the spring season.

Due to floodplain soils being of the Wehadkee and Johnston series, scattered openings dominated by herbs and shrubs are likely to develop over time. These areas are each expected to be less than an acre in size and encompass less than 20% of the Site. As the wetland matures, poorly drained soils will make conditions favorable for species like those described in a Coastal Plain Semipermanent Impoundment to thrive. Several species included in the seed mix are expected to do well in this community type, but much of the impoundment vegetation is expected to establish from the existing seedbank as the planted woody species fade out.

Table 17. Planting Plan

Vegetation Association		Coastal Plain Bottomland Hardwood Forest*		Coastal Plain Small Stream Swamp*		Stream-side Assemblage**		TOTAL
Area (acres)		**8**		**15.4**		**2.8**		**26.2**
Species	**Indicator Status**	**# planted***	**% of total**	**# planted***	**% of total**	**# planted****	**% of total**	**# planted**
Swamp black gum (*Nyssa biflora)*	OBL	0	0.0%	1000	9.5%	0	0.0%	1000
Bald cypress (*Taxodium distichum*)	OBL	500	9.2%	1000	9.5%	0	0.0%	1500
Tupelo gum (*Nyssa aquatica*)	OBL	0	0.0%	1000	9.5%	0	0.0%	1000
Black gum (*Nyssa sylvatica*)	FAC	500	9.2%	1000	9.5%	700	9.2%	2200
Silky dogwood (*Cornus amomum*)	FACW	0	0.0%	0	0.0%	1500	19.7%	1500
Sweetbay (*Magnolia virginiana*)	FACW	0	0.0%	1000	9.5%	0	0.0%	1000
Red bay (*Persea borbonia*)	FAC	250	4.6%	500	4.8%	0	0.0%	750
River birch (*Betula nigra*)	FACW	500	9.2%	500	4.8%	1500	19.7%	2500
Hackberry (*Celtis occidentalis*)	FACW	300	5.5%	500	4.8%	400	5.3%	1200
American elm (*Ulmus americana*)	FACW	300	5.5%	500	4.8%	800	10.5%	1600
Tulip poplar (*Liriodendron tulipifera*)	FAC	300	5.5%	500	4.8%	800	10.5%	1600
Sycamore (*Platanus occidentalis*)	FACW	300	5.5%	500	4.8%	800	10.5%	1600
Swamp chestnut oak (*Quercus michauxii*)	FACW	300	5.5%	500	4.8%	0	0.0%	800
Water oak (*Quercus nigra*)	FAC	500	9.2%	300	2.9%	400	5.3%	1200
Laurel oak (*Quercus larifolia*)	FACW	300	5.5%	500	4.8%	0	0.0%	800
Cherrybark oak (*Quercus pagoda*)	FAC	200	3.7%	0	0.0%	400	5.3%	600
Willow oak (*Quercus phellos*)	FACW	300	5.5%	500	4.8%	0	0.0%	800
Shumard oak (*Quercus shumardii*)	FACW	300	5.5%	500	4.8%	0	0.0%	800
Shagbark hickory (*Carya ovata*)	FACU	300	5.5%	0	0.0%	0	0.0%	300
Bitternut hickory (*Carya cordiformis*)	FAC	300	5.5%	200	1.9%	300	3.9%	800
	TOTAL	**5450**		**10500**		**7600**		**23550**

* Planted at a density of 680 stems/acre.

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

*** 1-3 gallon size Cypress, Tupelo gum, Sweetbay, and Red bay will be supplemental planted into the existing forest along the Upper UT 1 Stream Enhancement area.

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
Urochloa ramosa (Brown Top Millet)	15 lbs. per acre	May - September	Near stream channels/banks

Permanent Seed- Sitewide @ 2 lbs /acre		
Species	**Species**	**Species**
Agrostis hyemalis	*Desmodium canadense*	*Lespedeza capitata*
Agrostis perennans	*Echinacea purpurea*	*Liatris spicata*
Bidens aristosa	*Elymus virginicus*	*Monarda fistulosa*
Carex albolutescens	*Eupatorium coelestinum*	*Panicum anceps*
Carex lupulina	*Eupatorium perfoliatum*	*Panicum clandestinum*
Carex vulpinoidea	*Helianthus angustifolius*	*Rudbeckia hirta*
Chamaecrista fasciculata	*Heliopsis helianthoides*	*Senna hebecarpa*
Chamaecrista nictitans	*Hibiscus moscheutos*	*Tridens flavus*
Coreopsis lanceolata	*Juncus effusus*	*Verbena hastata*
Coreopsis tinctoria	*Juncus tenuis*	--

8.5.2 Nuisance Species Management

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

9 MONITORING AND SUCCESS CRITERIA

Monitoring will be conducted by Axiom Environmental, Inc based on the schedule in Table 19. Monitoring will be conducted in accordance with 2016 NCIRT Guidelines (NCIRT, 2016). A summary of monitoring is outlined in Table 20 (Figure 13, 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 19. Monitoring Schedule

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

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Table 20. Monitoring Summary

Stream Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Stream Profile	Full longitudinal survey	As-built (unless otherwise required)	All restored stream channels	Graphic and tabular data.
Stream Dimension	Cross-sections	Years 1, 2, 3, 5, and 7	Total of 16 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern will be depicted on a plan view figure with a written assessment and photograph of the area included in the report.
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Stream Hydrology	Continuous monitoring of surface water gauges and/or trail camera	Continuous recording throughout the monitoring period	6 surface water gauges; 1 on UT 1, 2 on UT 2, 1 on UT 3, 1 on UT 4, and 1 on UT 5	Surface water data for each monitoring period
Bankfull Events	Continuous monitoring of surface water gauges and/or trail camera	Continuous recording throughout the monitoring period		Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous recording throughout the monitoring period	All restored stream channels	Visual evidence, photo documentation, and/or rain data
Wetland Restoration	Groundwater gauges	Years 1-7, throughout the year with the growing season defined as March 29-November 8* downloaded quarterly	15 gauges spread throughout restored wetlands	Groundwater and rain data for each monitoring period
Vegetation establishment and vigor	Permanent vegetation plots 0.0247 acre (100 square meters) in size; *CVS-EEP Protocol for Recording Vegetation*, *Version 4.2* (Lee et al. 2008)	As-built, Years 1, 2, 3, 5, and 7	17 plots spread across the Site	Species, height, planted vs. volunteer, stems/acre
	Annual random vegetation plots, 0.0247 acre (100 square meters) in size	As-built, Years 1, 2, 3, 5, and 7	6 plots	Species and height
	Annual random herbaceous vegetation plots, 0.000247 acre (1 square meter) in size	Years 1, 2, 3, 5, and 7	3 plots located in herbaceous dominated vegetation areas	Number of species in plot and percent cover

* The growing season will be March 29 - November 8 as defined by the most recent (1991-2021) historic temperature data from WETS station Sanford 8 NE, NC resulting in a 225-day growing season.

9.1 Success Criteria

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

Table 21. Success Criteria

Streams
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section. • BHR at any measure riffle cross-section should not change by more than 10% from baseline condition during any given monitoring period. • The stream project shall remain stable, and all other performance standards shall be met through four separate bankfull events, occurring in individual years, during the monitoring years 1-7. • Intermittent streams will demonstrate at least 30-days of consecutive flow annually.
Wetland Hydrology
• Saturation or inundation within the upper 12 inches of the soil surface for, at a minimum, 12 percent of the growing season, annually during normal climatic conditions.
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 in height at year 7 in each plot. • 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. Natural recruits can only be counted toward success after they have been in the ground for 2 years. • Herbaceous vegetation plots must have a minimum of four species present.

9.2 Contingency

If stream success criteria are not fulfilled, a mechanism for contingency will be implemented. Some of the listed actions will require IRT review as adaptive management and may need USACE/DWR permit authorizations.

9.2.1 Stream Contingency

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

Structure Failure

In the event structures are compromised, the affected structure will be repaired, maintained, or replaced. Once the structure is repaired or replaced, it must function to stabilize adjacent stream banks and/or maintain grade control within the channel. Structures that remain intact, but exhibit flow around, beneath, or through the header/footer will be repaired by excavating a trench on the upstream side of

the structure and reinstalling filter fabric in front of the pilings. Structures that have been compromised, resulting in shifting or collapse of a header/footer, will be removed and replaced with a structure suitable for Site flows.

Headcut Migration Through the Site

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

Bank Erosion

If severe bank erosion occurs within the Site, resulting in the incision, lateral instability, and/or elevated width-to-depth ratios (locally or systemically), contingency measures to reduce bank erosion and the 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. In addition, 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(s) are identified in the Site, the location of the dam (if any) will be depicted on CCPV mapping, and the beaver will be trapped and removed immediately. Once beaver(s) have been trapped, the dam (if any) will be removed. Removal of the dam is expected to occur by hand to minimized disturbance to the adjacent mitigation areas.

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

Road/Bridge/Culvert Maintenance

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

Development/Logging

The Site is located in a region that is not expected to experience extensive development. In addition, the Site encompasses a significant portion of the headwater watershed, which should protect the Site from erosion resulting from development and/or logging.

9.2.2 Wetland Contingency

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

9.2.3 Vegetation Contingency

If vegetation success criteria are not achieved, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be completed as needed until the achievement of vegetation success criteria.

9.3 Compatibility with Project Goals

Table 22 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.

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

Goals	Objectives	Success Criteria
(1) HYDROLOGY		
• Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	• Construct new channel at historic floodplain elevation to restore overbank flows and restore jurisdictional wetlands • Remove a ditch network that contributes surface waters directly to the channel • Restore overbank flooding by constructing channels at historic floodplain elevation	• BHR not to exceed 1.2 • Document four overbank events in separate monitoring years • Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded
• Restore and enhance groundwater hydrology to drained or impacted hydric soil areas.	• Construct new channel at historic floodplain elevation to restore overbank flows and restore jurisdictional wetlands • Remove a ditch network that contributes surface waters directly to the channel • Restore/enhance jurisdictional wetlands adjacent to Site streams	• Cross-section measurements indicate a stable channel with appropriate substrate • Visual documentation of stable channels and structures • BHR not to exceed 1.2 • < 10% change in BHR in any given year • Livestock excluded from the easement • Attain Vegetation Success Criteria
(1) WATER QUALITY		
• Restore and enhance native floodplain and streambank vegetation.	• Remove livestock and reduce agricultural land/inputs • Plant woody riparian buffer • Restore/enhance jurisdictional wetlands adjacent to Site streams	• Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria
(1) HABITAT		
• Improve stability of stream channels.	• Construct channels with the proper pattern, dimension, and longitudinal profile • Remove livestock from the Site • Construct stable channels that do not contribute sediment to downstream receiving waters • Construct stable channels with woody debris available as instream habitat • Plant woody riparian buffer to provide organic matter and shade • Protect riparian buffers with a perpetual conservation easement • Stabilize stream banks • Install in-stream structures	• Cross-section measurement indicate a stable channel with appropriate substrate • Visual documentation of stable channels and in-stream structures. • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded

10 ADAPTIVE MANAGEMENT PLAN

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

11 LONG-TERM MANAGEMENT PLAN

The Site will be transferred to the NCDEQ Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspections 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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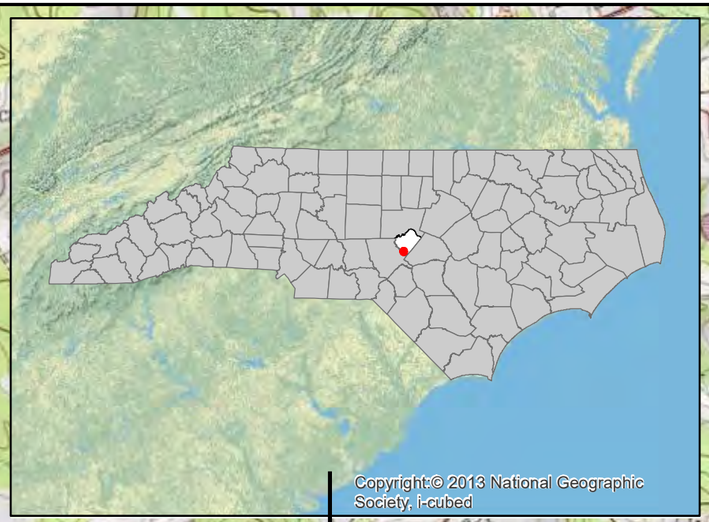
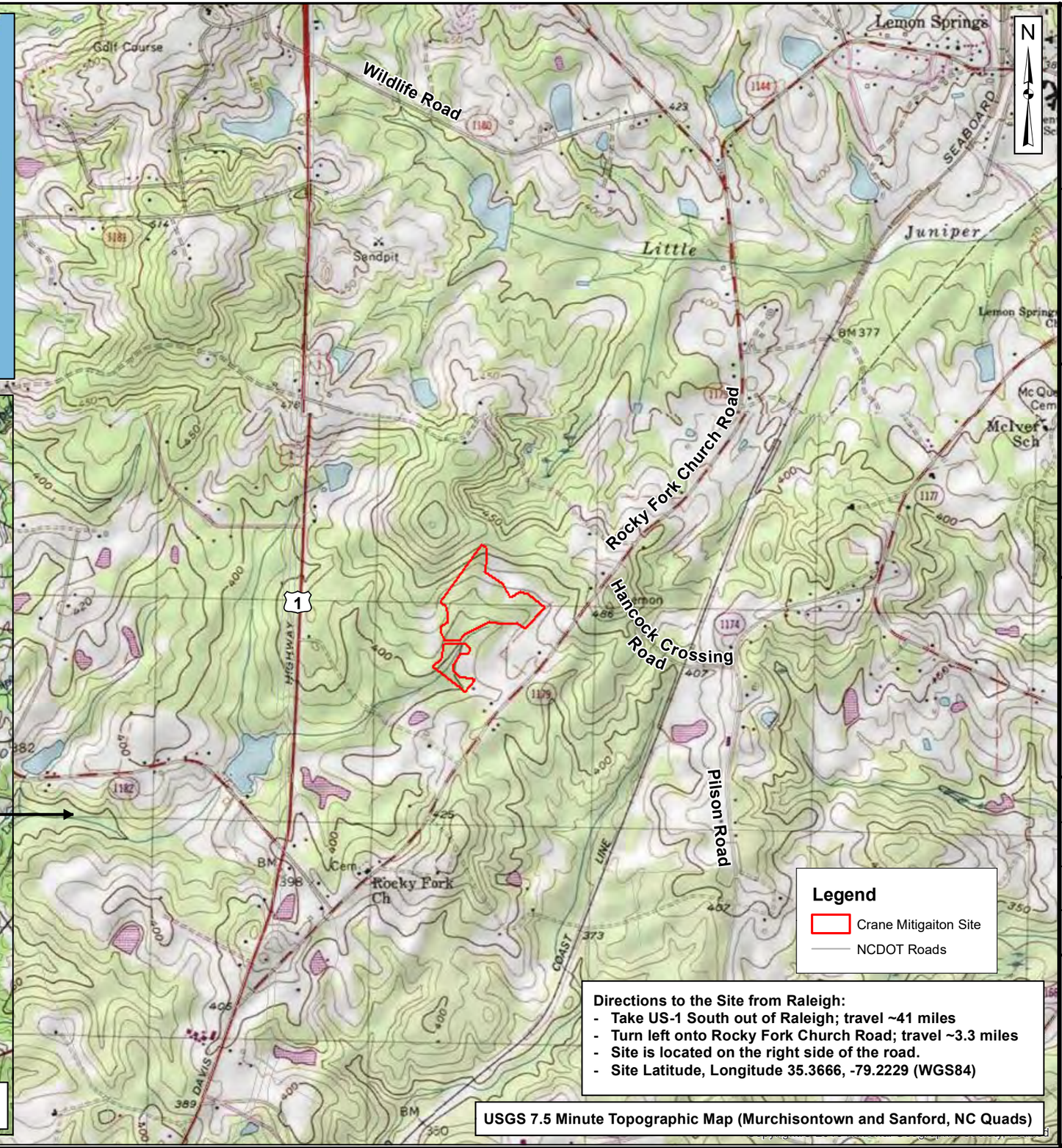
APPENDIX A. FIGURES



NOTE: No air transport facilities are located within 5 miles of the project area.



Legend

- Crane Mitigaiton Site
- NCDOT Roads

Directions to the Site from Raleigh:

- Take US-1 South out of Raleigh; travel ~41 miles
- Turn left onto Rocky Fork Church Road; travel ~3.3 miles
- Site is located on the right side of the road.
- Site Latitude, Longitude 35.3666, -79.2229 (WGS84)

USGS 7.5 Minute Topographic Map (Murchisontown and Sanford, NC Quads)

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE MITIGATION SITE

Lee County, NC

Title:

SITE LOCATION

Drawn by: KRJ

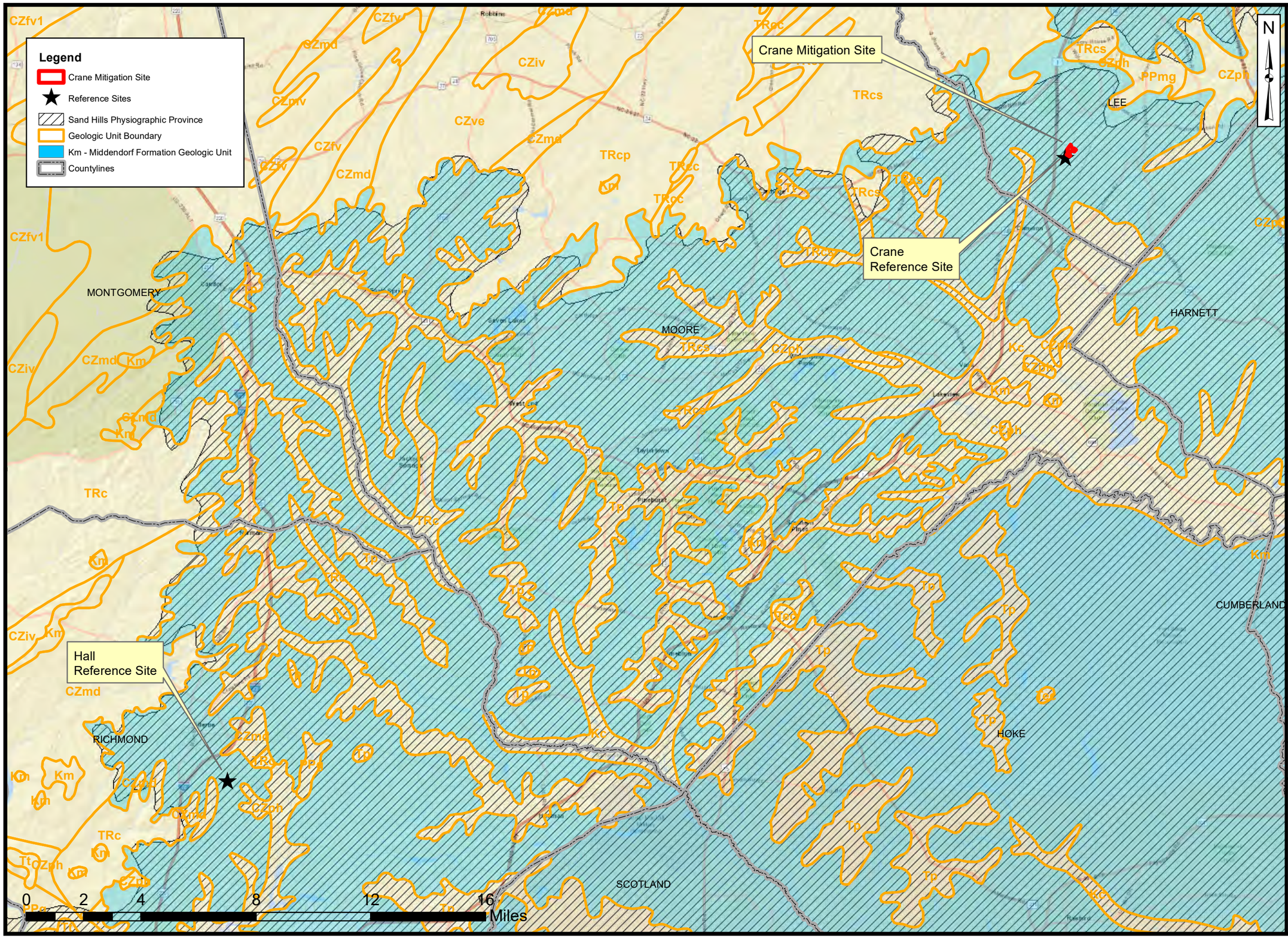
Date: JAN 2021

Scale: 1:20,000

Project No.: 18-002

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE MITIGATION SITE

Lee County, NC

Title:

REFERENCE SITE LOCATIONS

Drawn by:	WGL
Date:	JAN 2021
Scale:	1:120,000
Project No.:	20-032

FIGURE

2

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE MITIGATION SITE

Lee County, NC

Title:

HYDROLOGIC UNIT MAP

Drawn by: KRJ

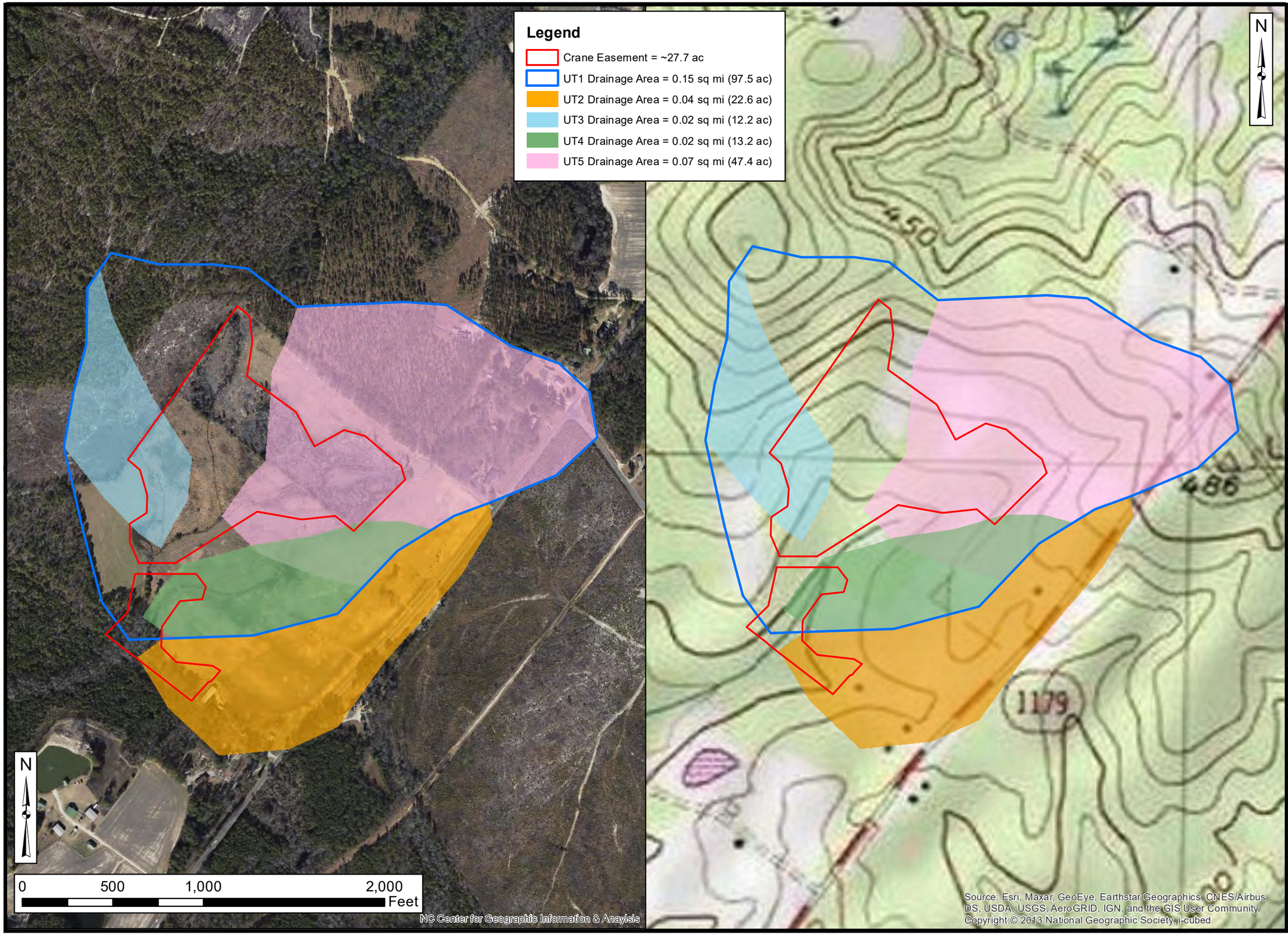
Date: JAN 2021

Scale: 1:375,000

Project No.: 20-032

FIGURE

3



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE MITIGATION SITE

Lee County, NC

Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by: KRJ

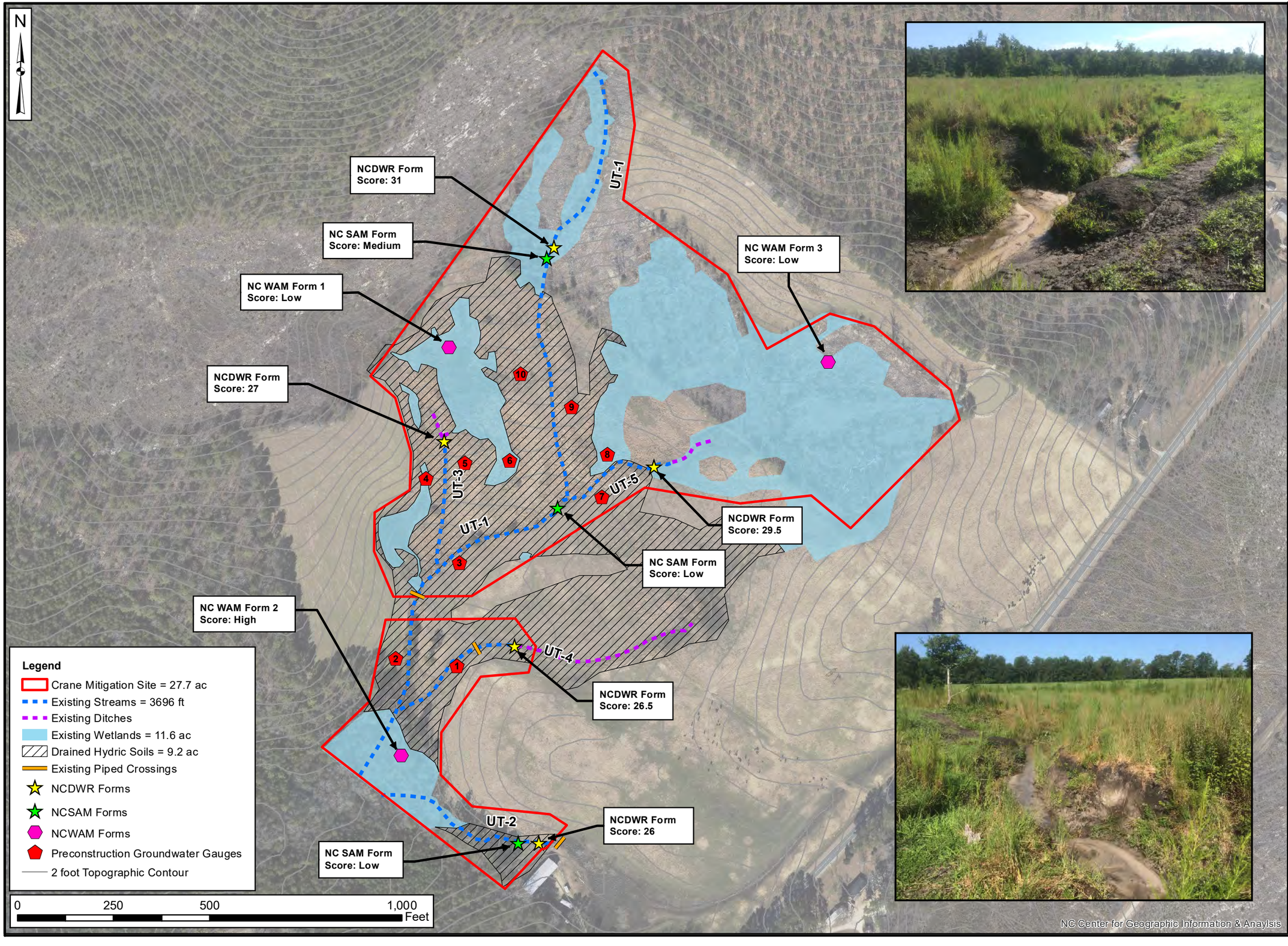
Date: MAY 2021

Scale: 1:6000

Project No.: 20-032

FIGURE

4



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE MITIGATION SITE

Lee County, NC

Title:

EXISTING CONDITIONS

Drawn by: KRJ

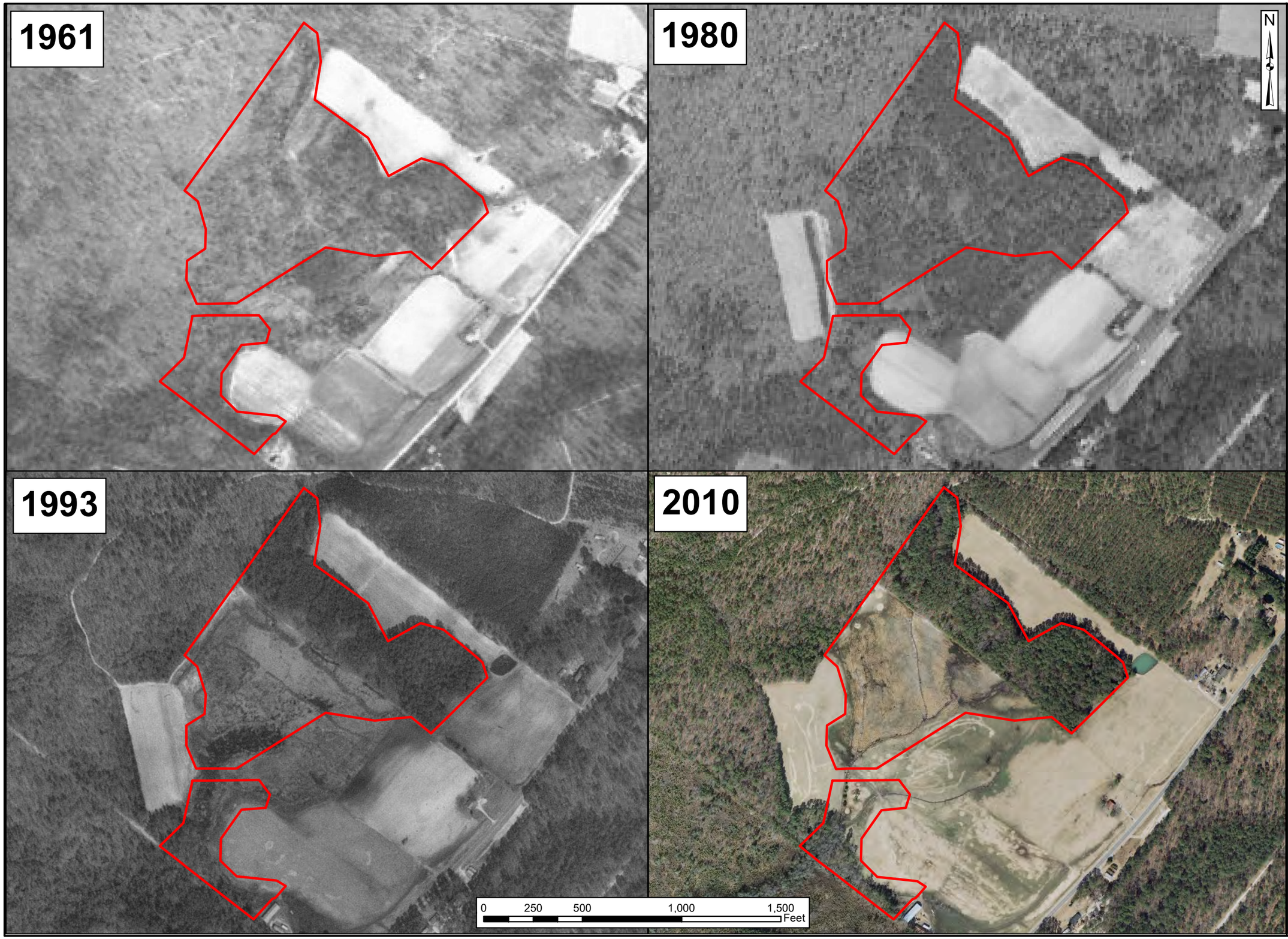
Date: FEB 2022

Scale: 1:3000

Project No.: 20-032

FIGURE

5



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Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE MITIGATION SITE

Lee County, NC

Title:

HISTORIC CONDITIONS

Drawn by: KRJ

Date: MAY 2021

Scale: 1:5500

Project No.: 20-032

FIGURE

6

Soil Map Unit	Soil Series
BaB	Blaney Loamy Sand
GhB	Gilead Loamy Sand
Wn	Wehadkee Fine Sandy Loam

N

BaD

BaD

CaB

BaB

GhB

Wn

Wn

BaB

F

C

D

B

A

E

Legend

- Crane Mitigation Site = 27.7 ac
- Existing Wetlands = 11.6 ac
- Drained Hydric Soils = 9.2 ac
- GPS Point
- Soil Profiles
- NRCS Soil Boundaries

0 250 500 1,000 Feet

Note: Each GPS Point had a minimum of 4 soil borings to identify the hydric/nonhydric soil boundary.

NC Center for Geographic Information & Anaylsis

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE MITIGATION SITE

Lee County, NC

Title:

SOILS

Drawn by: KRJ

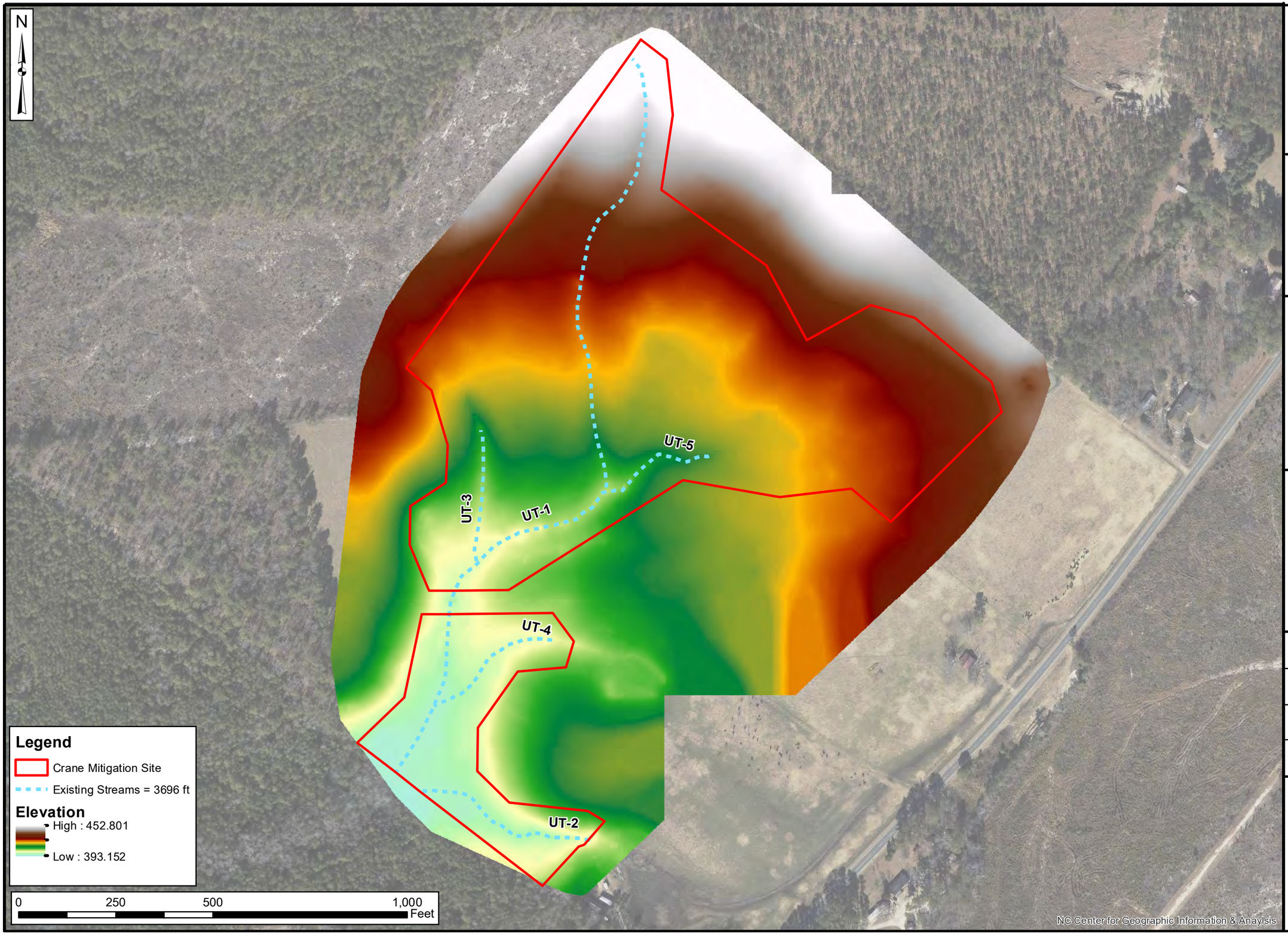
Date: MAY 2021

Scale: 1:3000

Project No.: 20-032

FIGURE

7



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE MITIGATION SITE

Lee County, NC

Title:

LIDAR

Drawn by: JMH

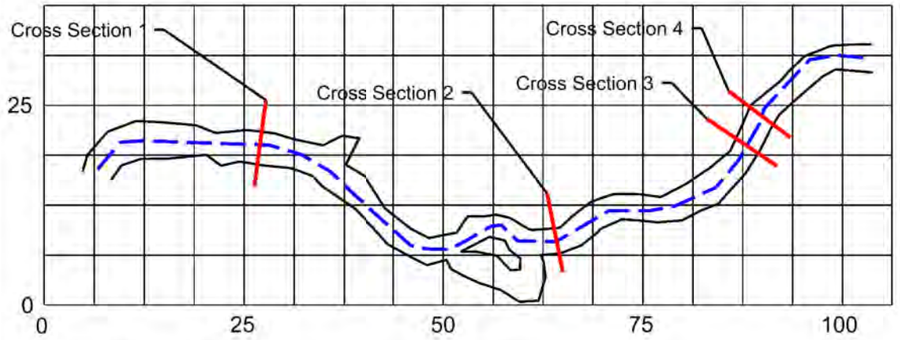
Date: FEB 2021

Scale: 1:3000

Project No.: 20-032

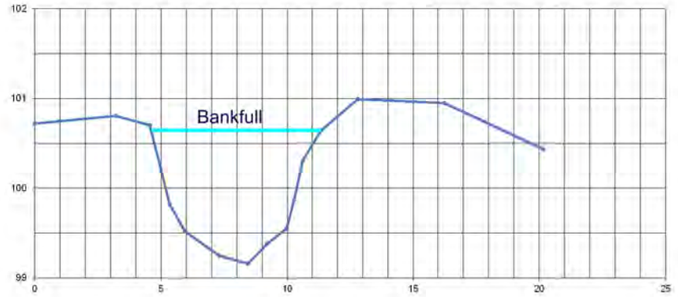
FIGURE

8

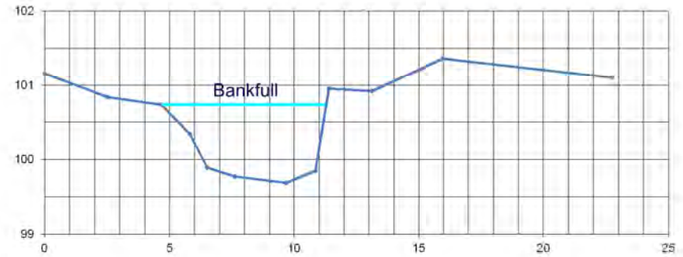


Reference Pattern
Lp-p = 28 (17 - 49 ft
Lm = 47 (30 - 64) ft
Wbelt = 18 (12 - 26) ft
Rc = 13 (7 - 22) ft
Lp-p/Wbkf = 4.0 (2.5 - 7.0)
Lm/Wbkf = 6.7 (4.3 - 9.2)
Wbelt/Wbkf = 2.7 (1.7 - 3.7)
Rc/Wbkf = 1.9 (1.1 - 3.1)
SIN = 1.17

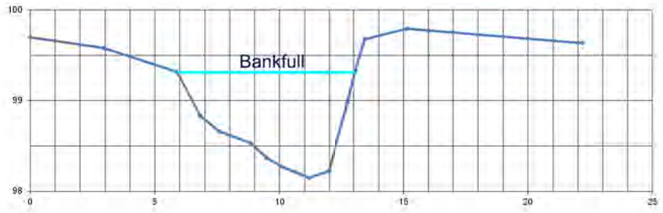
Pattern Legend
- Top of Bank
- Thalweg
- Cross Section



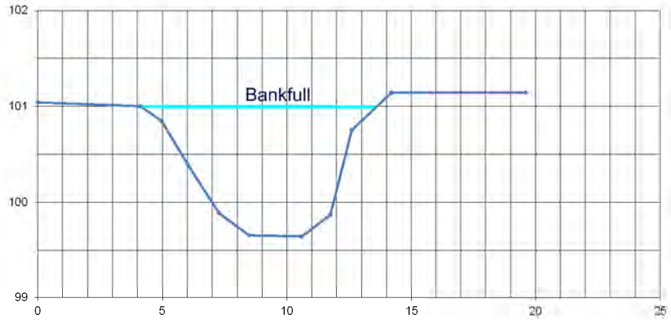
Cross Section 2 - Pool
Abkf = 6.8 ft
Wbkf = 6.7 ft
Dmax = 1.5 ft



Cross Section 3 - Riffle
Abkf = 5.1 ft
Dave = 0.8 ft
Wbkf = 6.7 ft
Dmax = 1.1 ft
Bank Height = 1.1 ft
Bank Height Ratio = 1.0
W/D = 8.9
FPA = 50
ENT = 7.4
Stream Type = E

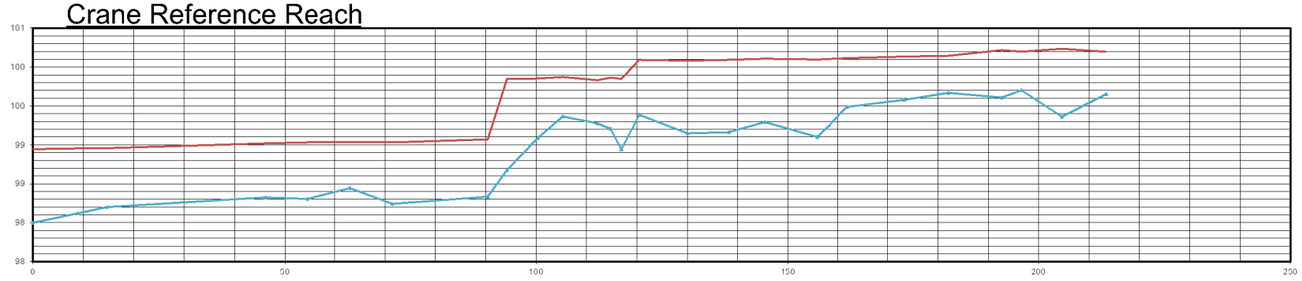


Cross Section 1 - Riffle
Abkf = 5.5 ft
Dave = 0.8 ft
Wbkf = 7.2 ft
Dmax = 1.2 ft
Bank Height = 1.2 ft
Bank Height Ratio = 1.0
W/D = 9.5
FPA = 50
ENT = 7.0
Stream Type = E



Cross Section 4 - Pool
Abkf = 8.0 ft
Wbkf = 9.5 ft
Dmax = 1.4 ft

Crane Reference Reach



Profile (Reference Reach)
Save = 0.0062 rise/run
Svalley = 0.0073 rise/run
Sriffle = 0.0020 (0 - 0.0034) rise/run
Spool = 0.0008 (0 - 0.0046) rise/run
Srun = 0.0028 (0 - 0.0685) rise/run
Sglide = 0.0016 (0 - 0.0125) rise/run

- Water Surface
- Channel Bed

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

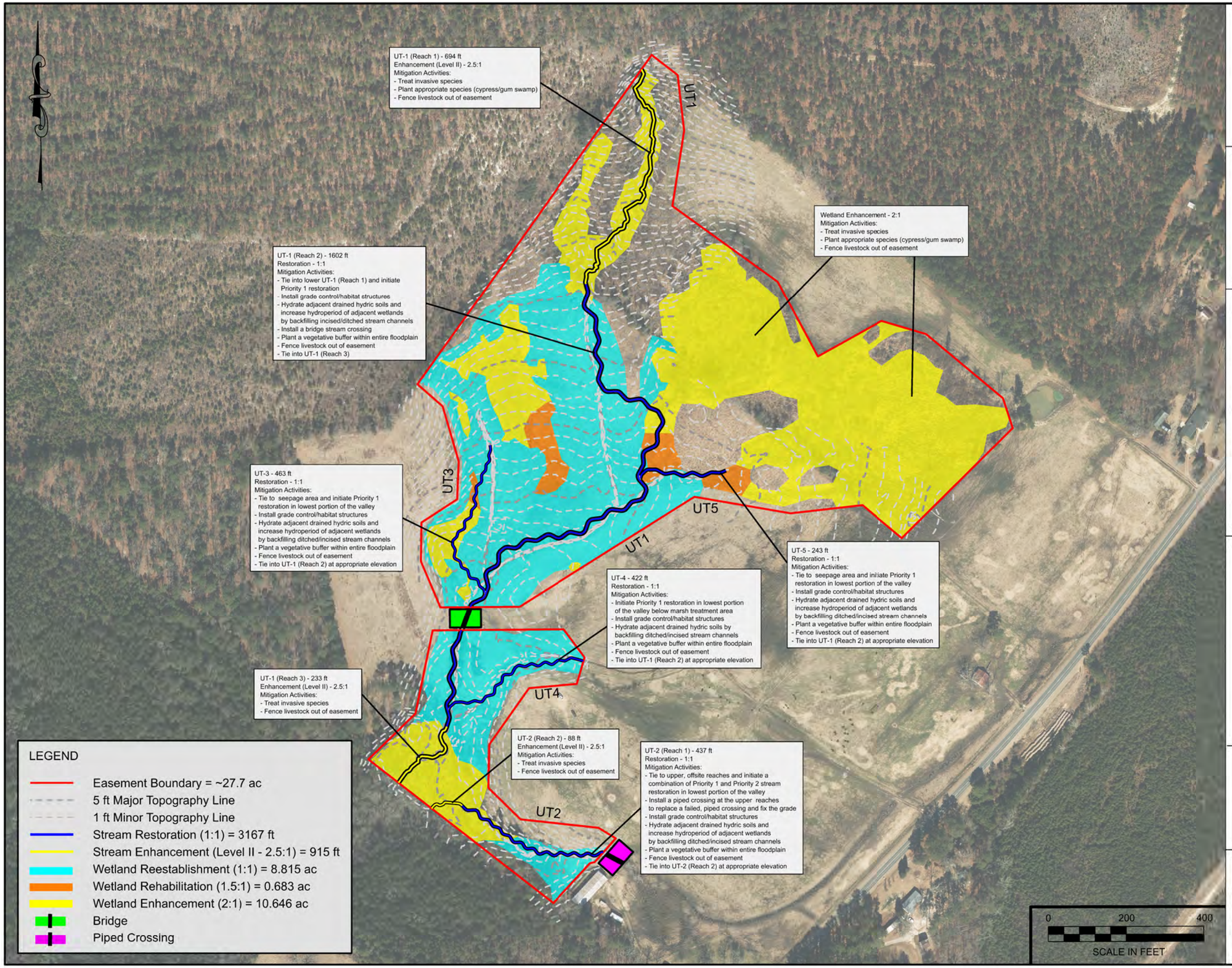
NOTES/REVISIONS

Project:
Crane
Mitigation Site

Lee County
North Carolina

Title:
Crane
Reference Reach
Dimension, Pattern,
and Profile

Scale: NA	FIGURE NO. 9
Date: JAN 2021	
Project No.: 20-032	



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RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Crane
Mitigation Site

Lee County
North Carolina

Title:

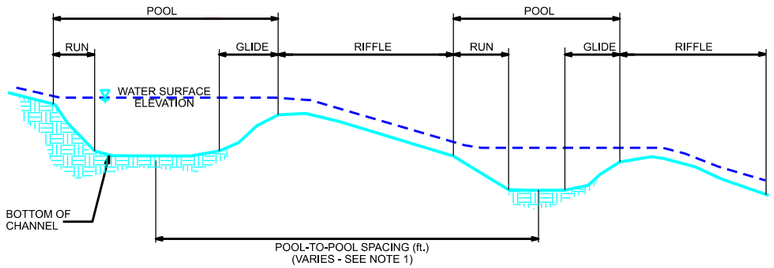
RESTORATION
PLAN

Scale:
AS SHOWN

Date:
MAY 2021

Project No.:
20-032

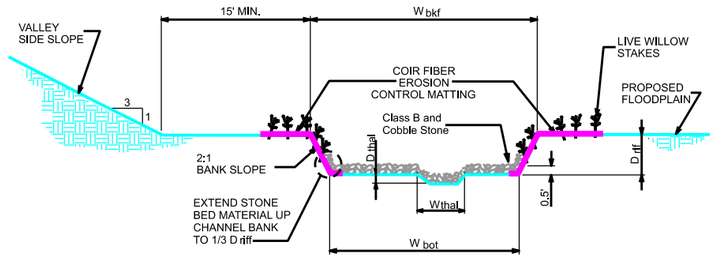
FIGURE NO.
10



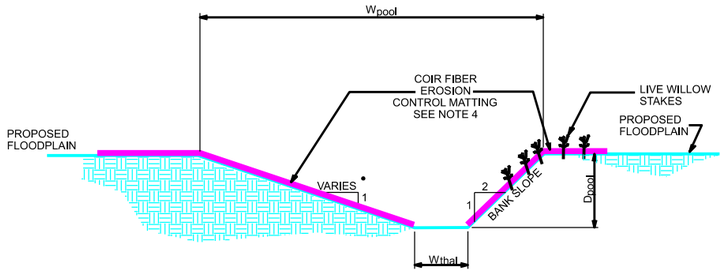
TYPICAL CHANNEL PROFILE

NOTES:

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



TYPICAL RIFFLE CROSS-SECTION



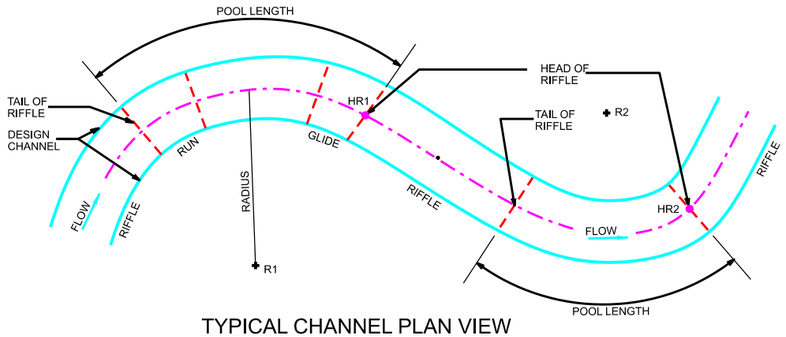
TYPICAL POOL CROSS-SECTION

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.



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.

CROSS-SECTION DIMENSIONS

REACH	Wbkf (ft.)	Wbot (ft.)	Driff (ft.)	Dthal (ft.)	Dpool (ft.)	Wpool (ft.)	Wthal (ft.)
UT 1	8.4	5.2	0.7	0.1	1.0	10.0	1.0
UT 2	5.2	3.2	0.4	0.1	0.6	6.2	1.0
UT 3	4.1	2.5	0.3	0.1	0.5	4.9	1.0
UT 4	4.1	2.7	0.3	0.1	0.5	5.1	1.0
UT 5	6.6	4.2	0.5	0.1	0.8	7.9	1.0

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Crane Mitigation Site

Lee County North Carolina

Title:

PROPOSED DIMENSION, PATTERN, AND PROFILE

Scale: NA

Date: MAY 2021

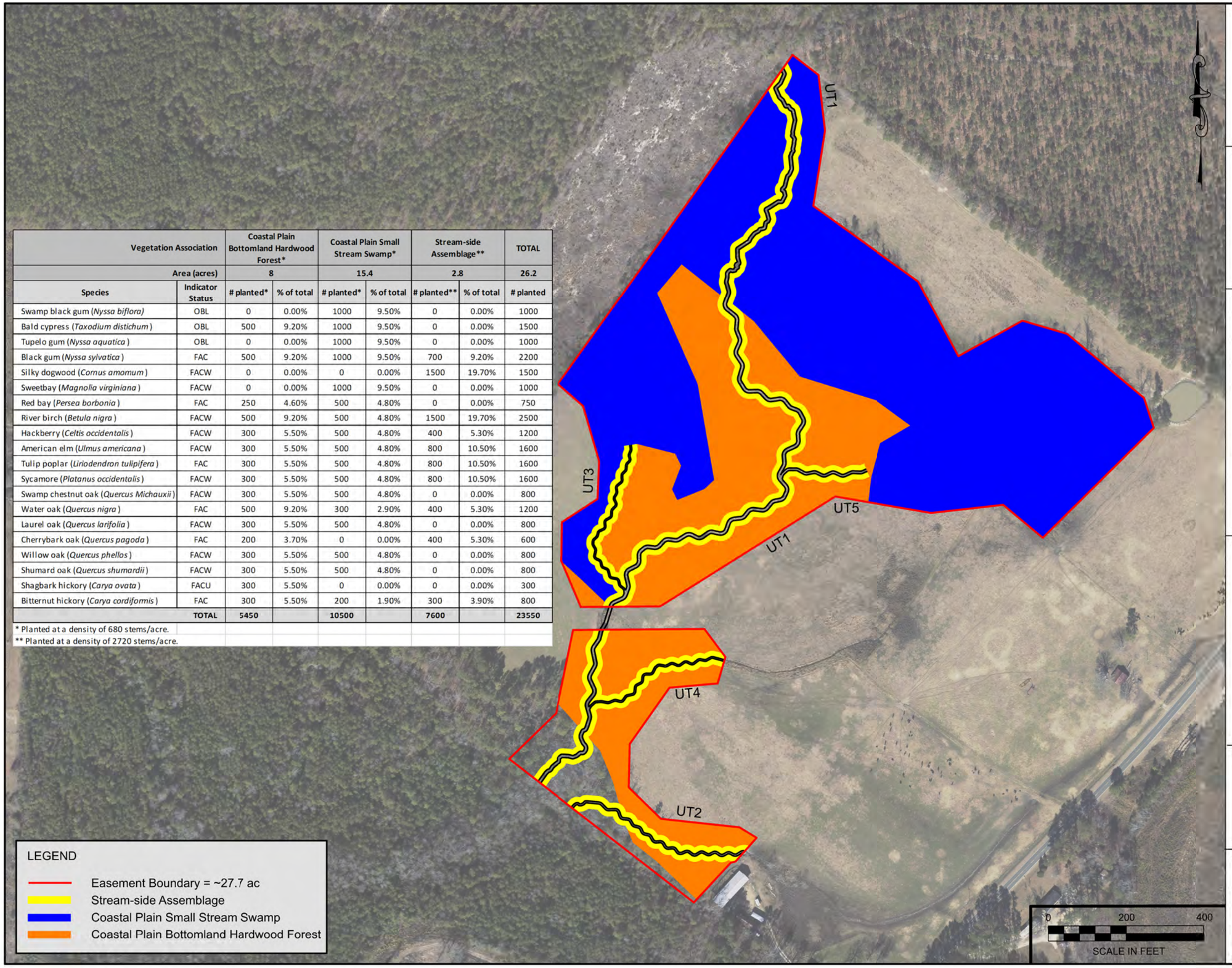
Project No.: 20-032

FIGURE NO.

11

Vegetation Association		Coastal Plain Bottomland Hardwood Forest*		Coastal Plain Small Stream Swamp*		Stream-side Assemblage**		TOTAL
Area (acres)		8		15.4		2.8		26.2
Species	Indicator Status	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
Swamp black gum (*Nyssa biflora*)	OBL	0	0.00%	1000	9.50%	0	0.00%	1000
Bald cypress (*Taxodium distichum*)	OBL	500	9.20%	1000	9.50%	0	0.00%	1500
Tupelo gum (*Nyssa aquatica*)	OBL	0	0.00%	1000	9.50%	0	0.00%	1000
Black gum (*Nyssa sylvatica*)	FAC	500	9.20%	1000	9.50%	700	9.20%	2200
Silky dogwood (*Cornus amomum*)	FACW	0	0.00%	0	0.00%	1500	19.70%	1500
Sweetbay (*Magnolia virginiana*)	FACW	0	0.00%	1000	9.50%	0	0.00%	1000
Red bay (*Persea borbonia*)	FAC	250	4.60%	500	4.80%	0	0.00%	750
River birch (*Betula nigra*)	FACW	500	9.20%	500	4.80%	1500	19.70%	2500
Hackberry (*Celtis occidentalis*)	FACW	300	5.50%	500	4.80%	400	5.30%	1200
American elm (*Ulmus americana*)	FACW	300	5.50%	500	4.80%	800	10.50%	1600
Tulip poplar (*Liriodendron tulipifera*)	FAC	300	5.50%	500	4.80%	800	10.50%	1600
Sycamore (*Platanus occidentalis*)	FACW	300	5.50%	500	4.80%	800	10.50%	1600
Swamp chestnut oak (*Quercus Michauxii*)	FACW	300	5.50%	500	4.80%	0	0.00%	800
Water oak (*Quercus nigra*)	FAC	500	9.20%	300	2.90%	400	5.30%	1200
Laurel oak (*Quercus larifolia*)	FACW	300	5.50%	500	4.80%	0	0.00%	800
Cherrybark oak (*Quercus pagoda*)	FAC	200	3.70%	0	0.00%	400	5.30%	600
Willow oak (*Quercus phellos*)	FACW	300	5.50%	500	4.80%	0	0.00%	800
Shumard oak (*Quercus shumardii*)	FACW	300	5.50%	500	4.80%	0	0.00%	800
Shagbark hickory (*Carya ovata*)	FACU	300	5.50%	0	0.00%	0	0.00%	300
Bitternut hickory (*Carya cordiformis*)	FAC	300	5.50%	200	1.90%	300	3.90%	800
	TOTAL	5450		10500		7600		23550

* Planted at a density of 680 stems/acre.
** Planted at a density of 2720 stems/acre.



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Crane
Mitigation Site

Lee County
North Carolina

Title:

PLANTING
PLAN

Scale: AS SHOWN

Date: MAY 2021

Project No.: 20-032

FIGURE NO.

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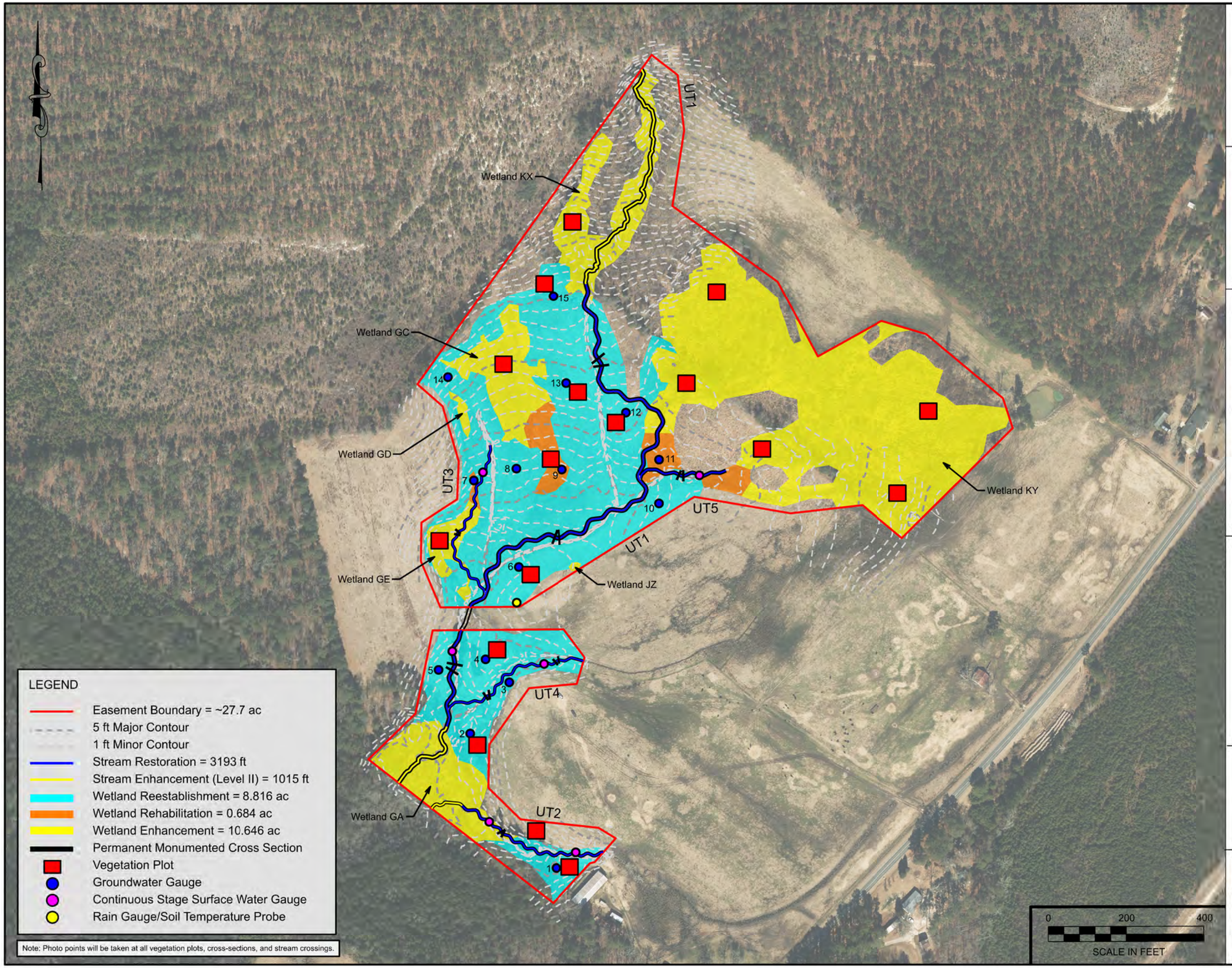

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Crane
Mitigation Site

Lee County
North Carolina

Title:

MONITORING
PLAN

Scale:	FIGURE NO.
AS SHOWN	13
Date: MAY 2021	
Project No.: 20-032	

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

JURISDICTIONAL AREA IMPACT LOCATIONS

Drawn by: AEK

Date: FEB 2022

Scale: 1:2800

Project No.: 20-032

FIGURE

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APPENDIX B. EXISTING STREAM & WETLAND DATA

Table B1. Crane Morphological Stream Characteristics
Figure B1. Cross Section Locations
Existing Stream Cross-section Data
NC DWR Forms
NC SAM Forms
NC WAM Forms
BEHI/NBS Data
Soil Boring Logs
Pre-Construction Groundwater Gauge Graphs
Antecedent Precipitation Data

Table B1. Crane Site Morphological Stream Characteristics

Variables	REFERENCE - HALL	REFERENCE- CRANE	Existing (UT 1)	Proposed (UT 1)	Existing (UT 2)	Proposed (UT 2)
Stream Type	E 5	E 5	Eg 5	Ce 5	G 5	Ce 5
Drainage Area (mi^2)	0.12	0.21	0.15	0.15	0.04	0.04
Bankfull Discharge (cfs)	18.0	20.5	19.0	19.0	6.6	6.6
Dimension Variables						
Bankfull Cross-Sectional Area (A_{bkf})	4.8	5.3	5.0	5.0	1.9	1.9
Existing Cross-Sectional Area ($A_{existing}$)	5.9 - 7.2	5.3-5.5	5.0 - 34	5.0	6.7 - 17.7	1.9
Bankfull Width (W_{bkf})	Mean: 6.6 Range: 5.9-7.2	Mean: 7.0 Range: 6.7-7.2	Mean: 6.7 Range: 4.3 to 12.5	Mean: 8.4 Range: 7.7 to 8.9	Mean: 3.3 Range: 2.2 to 4.8	Mean: 5.2 Range: 4.8 to 5.5
Bankfull Mean Depth (D_{bkf})	Mean: 0.8 Range: 0.7-0.8	Mean: 0.8 Range: 0.8-0.8	Mean: 0.9 Range: 0.4 to 1.2	Mean: 0.6 Range: 0.6 to 0.6	Mean: 0.6 Range: 0.4 to 0.8	Mean: 0.4 Range: 0.3 to 0.4
Bankfull Maximum Depth (D_{max})	Mean: 1.2 Range: 1.1-1.2	Mean: 1.2 Range: 1.1-1.2	Mean: 1.8 Range: 0.9 2.9 1.5	Mean: 0.8 Range: 0.7 to 1.0	Mean: 1.0 Range: 0.6 to 1.4	Mean: 0.5 Range: 0.4 to 0.6
Pool Width (W_{pool})	Mean: 10.2 Range:	Mean: 8.1 Range: 6.7-9.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 10.0 Range: 8.4 to 13.4	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 6.2 Range: 5.2 to 8.3
Maximum Pool Depth (D_{pool})	Mean: 1.6 Range:	Mean: 1.5 Range: 1.4-1.5		Mean: 1.0 Range: 0.9 to 1.2		Mean: 0.6 Range: 0.6 to 0.7
Width of Floodprone Area (W_{fpa})	Mean: 115 Range: 80-150	Mean: 50.0 Range:	Mean: 75 Range: 9 to 100	Mean: 100 Range: 50 to 150	Mean: 7 Range: 5 to 12	Mean: 50 Range: 25 to 75
Dimension Ratios						
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 17.4 Range: 13.6-20.8	Mean: 7.2 Range: 6.9-7.5	Mean: 13.0 Range: 1.6 to 23.3	Mean: 12.0 Range: 6.5 to 16.8	Mean: 2.1 Range: 1.8 to 2.5	Mean: 9.7 Range: 5.2 to 13.6
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 9.2 Range: 7.4-10.9	Mean: 8.7 Range: 8.4-9.0	Mean: 10.6 Range: 3.6 to 31.3	Mean: 14.0 Range: 12.0 to 16.0	Mean: 6.0 Range: 2.8 to 12.0	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.6 Range: 1.4-1.7	Mean: 1.4 Range: 1.4-1.5	Mean: 2.1 Range: 1.3 to 2.9	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.6 Range: 1.5 to 1.8	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.1 Range: 1.1-1.2	Mean: 1.0 Range:	Mean: 1.7 Range: 1.0 to 2.8	Mean: 1.0 Range: 1.0 to 1.3	Mean: 2.5 Range: 2.2 to 3.1	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 2.1 Range:	Mean: 1.8 Range: 1.8-1.9	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: 1.6 Range:	Mean: 1.2 Range: 1.0-1.4		Mean: 1.2 Range: 1.0 to 1.6		Mean: 1.2 Range: 1.0 to 1.6
Pool Area / Bankfull Cross Sectional Area	Mean: 1.6 Range:	Mean: 1.4 Range: 1.3-1.5		Mean: 1.3 Range: 1.1 to 1.5		Mean: 1.3 Range: 1.1 to 1.5

Variables	REFERENCE - HALL	REFERENCE- CRANE	Existing (UT 1)	Proposed (UT 1)	Existing (UT 2)	Proposed (UT 2)
Pattern Variables						
Pool to Pool Spacing (L_{p-p})	Med: 20.1 Range: 12 - 55	Med: 28.1 Range: 17-49	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 33.5 Range: 25.1 to 50.2	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 20.6 Range: 15.5 to 30.9
Meander Length (L_m)	Med: 32.2 Range: 16 - 73	Med: 46.8 Range: 30-64		Med: 50.2 Range: 41.8 to 66.9		Med: 30.9 Range: 25.8 to 41.3
Belt Width (W_{belt})	Med: 14.4 Range: 11.0 - 20.0	Med: 18.4 Range: 11.6 - 25.7		Med: 25.1 Range: 16.7 to 33.5		Med: 15.5 Range: 10.3 to 20.6
Radius of Curvature (R)	Med: 10.1 Range: 43949.0	Med: 12.9 Range: 7.3 - 21.5		Med: 25.1 Range: 16.7 to 41.8		Med: 15.5 Range: 10.3 to 25.8
Sinuosity (Sin)	1.20	1.17	1.03	1.10	1.09	1.10
Pattern Ratios						
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 3.0 Range: 1.8-8.3	Med: 4.0 Range: 2.5-7.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 6.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 6.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 4.9 Range: 2.4-11.1	Med: 6.7 Range: 4.3-9.2		Med: 6.0 Range: 5.0 to 8.0		Med: 6.0 Range: 5.0 to 8.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 2.2 Range: 1.7-3.0	Med: 2.7 Range: 1.7-3.7		Med: 3.0 Range: 2.0 to 4.0		Med: 3.0 Range: 2.0 to 4.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 1.5 Range: 0.6-4.2	Med: 1.9 Range: 1.1-3.1		Med: 3.0 Range: 2.0 to 5.0		Med: 3.0 Range: 2.0 to 5.0
Profile Variables						
Average Water Surface Slope (S_{ave})	0.0133	0.0062	0.0179	0.0167	0.0145	0.0144
Valley Slope (S_{valley})	0.0160	0.0073	0.0184	0.0184	0.0158	0.0158
Riffle Slope (S_{riffle})	Mean: 0.0138 Range: 0.0019 - 0.0305	Mean: 0.0020 Range: 0-0.0034	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 0.0167 Range: 0.0084 to 0.0251	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 0.0144 Range: 0.0072 to 0.0215
Pool Slope (S_{pool})	Mean: 0.0145 Range: 0 - 0.0472	Mean: 0.0008 Range: 0-0.0046		Mean: 0.0017 Range: 0.0000 to 0.0117		Mean: 0.0014 Range: 0.0000 to 0.0101
Run Slope (S_{run})	Mean: 0.0102 Range: 0 - 0.0402	Mean: 0.0028 Range: 0-0.0685		Mean: 0.0100 Range: 0.0000 to 0.0335		Mean: 0.0086 Range: 0.0000 to 0.0287
Glide Slope (S_{glide})	Mean: 0.0063 Range: 0 - 0.0246	Mean: 0.0016 Range: 0-0.0125		Mean: 0.0018 Range: 0.0000 to 0.0134		Mean: 0.0016 Range: 0.0000 to 0.0115
Profile Ratios						
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 1.0 Range: 0.1-2.3	Mean: 0.32 Range: 0-0.54	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 1.0 Range: 0.5 to 1.5	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 1.0 Range: 0.5 to 1.5
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 1.1 Range: 0 - 3.5	Mean: 0.12 Range: 0-0.73		Mean: 0.10 Range: 0.0 to 0.7		Mean: 0.10 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean: 0.8 Range: 0 - 3.0	Mean: 0.45 Range: 0-11.0		Mean: 0.6 Range: 0.0 to 2.0		Mean: 0.6 Range: 0.0 to 2.0
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean: 0.5 Range: 0 - 1.9	Mean: 0.25 Range: 0-2.0		Mean: 0.11 Range: 0.0 to 0.8		Mean: 0.11 Range: 0.0 to 0.8

Table B1 (Continued). Crane Site Morphological Stream Characteristics

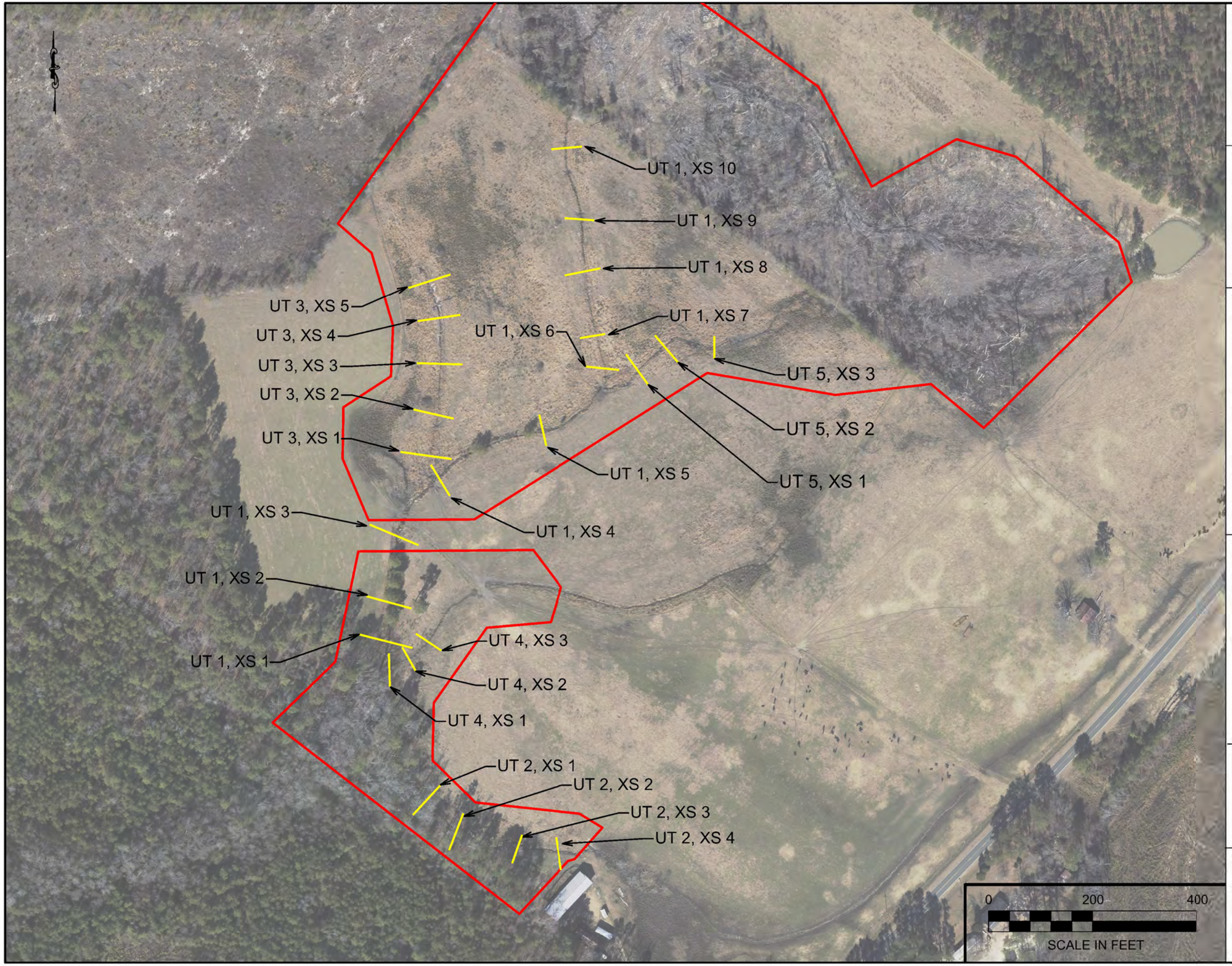
Variables	REFERENCE - HALL	REFERENCE- CRANE	Existing (UT 3)	Proposed (UT 3)	Existing (UT 4)	Proposed (UT 4)
Stream Type	E 5	E 5	Eg 5	Ce 5	Eg 5	Ce 5
Drainage Area (mi^2)	0.12	0.21	0.02	0.02	0.02	0.02
Bankfull Discharge (cfs)	18.0	20.5	4.2	4.2	4.5	4.5
Dimension Variables						
Bankfull Cross-Sectional Area (A_{bkf})	4.8	5.3	1.2	1.2	1.3	1.3
Existing Cross-Sectional Area ($A_{existing}$)	5.9 - 7.2	5.3-5.5	5.6 - 26.0	1.2	2.2 - 5.9	1.3
Bankfull Width (W_{bkf})	Mean: 6.6 Range: 5.9-7.2	Mean: 7.0 Range: 6.7-7.2	Mean: 3.4 Range: 2.1 to 4.2	Mean: 4.1 Range: 3.8 to 4.4	Mean: 3.3 Range: 1.8 to 4.8	Mean: 4.3 Range: 3.9 to 4.6
Bankfull Mean Depth (D_{bkf})	Mean: 0.8 Range: 0.7-0.8	Mean: 0.8 Range: 0.8-0.8	Mean: 0.4 Range: 0.3 to 0.6	Mean: 0.3 Range: 0.3 to 0.3	Mean: 0.5 Range: 0.3 to 0.7	Mean: 0.3 Range: 0.3 to 0.3
Bankfull Maximum Depth (D_{max})	Mean: 1.2 Range: 1.1-1.2	Mean: 1.2 Range: 1.1-1.2	Mean: 0.8 Range: 0.6 to 1.1	Mean: 0.4 Range: 0.4 to 0.5	Mean: 0.8 Range: 0.4 to 1.2	Mean: 0.4 Range: 0.4 to 0.5
Pool Width (W_{pool})	Mean: 10.2 Range:	Mean: 8.1 Range: 6.7-9.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 4.9 Range: 4.1 to 6.6	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 5.1 Range: 4.3 to 6.8
Maximum Pool Depth (D_{pool})	Mean: 1.6 Range:	Mean: 1.5 Range: 1.4-1.5		Mean: 0.5 Range: 0.4 to 0.6		Mean: 0.5 Range: 0.5 to 0.6
Width of Floodprone Area (W_{fpa})	Mean: 115 Range: 80-150	Mean: 50.0 Range:	Mean: 23 Range: 4 to 50	Mean: 50 Range: 25 to 75	Mean: 26 Range: 8.0 to 50	Mean: 75 Range: 50 to 100
Dimension Ratios						
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 17.4 Range: 13.6-20.8	Mean: 7.2 Range: 6.9-7.5	Mean: 8.1 Range: 1.3 to 23.8	Mean: 12.2 Range: 6.6 to 17.1	Mean: 9.8 Range: 1.7 to 15.6	Mean: 17.6 Range: 12.7 to 21.9
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 9.2 Range: 7.4-10.9	Mean: 8.7 Range: 8.4-9.0	Mean: 10.1 Range: 3.5 to 14.0	Mean: 14.0 Range: 12.0 to 16.0	Mean: 8.9 Range: 2.6 to 16.0	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.6 Range: 1.4-1.7	Mean: 1.4 Range: 1.4-1.5	Mean: 2.1 Range: 1.8 to 2.3	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.8 Range: 1.3 to 2.3	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.1 Range: 1.1-1.2	Mean: 1.0 Range:	Mean: 4.0 Range: 2.0 to 7.2	Mean: 1.0 Range: 1.0 to 1.3	Mean: 1.9 Range: 1.3 to 2.8	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 2.1 Range:	Mean: 1.8 Range: 1.8-1.9	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: 1.6 Range:	Mean: 1.2 Range: 1.0-1.4		Mean: 1.2 Range: 1.0 to 1.6		Mean: 1.2 Range: 1.0 to 1.6
Pool Area / Bankfull Cross Sectional Area	Mean: 1.6 Range:	Mean: 1.4 Range: 1.3-1.5		Mean: 1.3 Range: 1.1 to 1.5		Mean: 1.3 Range: 1.1 to 1.5

Variables	REFERENCE - HALL	REFERENCE- CRANE	Existing (UT 3)	Proposed (UT 3)	Existing (UT 4)	Proposed (UT 4)
Pattern Variables						
Pool to Pool Spacing (L_{p-p})	Med: 20.1 Range: 12 - 55	Med: 28.1 Range: 17-49	No distinct repetitive pattern of riffles and pools	Med: 16.4 Range: 12.3 to 24.6	No distinct repetitive pattern of riffles and pools	Med: 17.1 Range: 12.8 to 25.6
Meander Length (L_m)	Med: 32.2 Range: 16 - 73	Med: 46.8 Range: 30-64		Med: 24.6 Range: 20.5 to 32.8		Med: 25.6 Range: 21.3 to 34.1
Belt Width (W_{belt})	Med: 14.4 Range: 44155.0	Med: 18.4 Range: 11.6 - 25.7		Med: 12.3 Range: 8.2 to 16.4		Med: 12.8 Range: 8.5 to 17.1
Radius of Curvature (Rc)	Med: 10.1 Range: 43949.0	Med: 12.9 Range: 7.3 - 21.5		Med: 12.3 Range: 8.2 to 20.5		Med: 12.8 Range: 8.5 to 21.3
Sinuosity (Sin)	1.20	1.17	1.01	1.10	1.01	1.10
Pattern Ratios						
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 3.0 Range: 1.8-8.3	Med: 4.0 Range: 2.5-7.0	No distinct repetitive pattern of riffles and pools	Med: 4.0 Range: 3.0 to 6.0	No distinct repetitive pattern of riffles and pools	Med: 4.0 Range: 3.0 to 6.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 4.9 Range: 2.4-11.1	Med: 6.7 Range: 4.3-9.2		Med: 6.0 Range: 5.0 to 8.0		Med: 6.0 Range: 5.0 to 8.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 2.2 Range: 1.7-3.0	Med: 2.7 Range: 1.7-3.7		Med: 3.0 Range: 2.0 to 4.0		Med: 3.0 Range: 2.0 to 4.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 1.5 Range: 0.6-4.2	Med: 1.9 Range: 1.1-3.1		Med: 3.0 Range: 2.0 to 5.0		Med: 3.0 Range: 2.0 to 5.0
Profile Variables						
Average Water Surface Slope (S_{ave})	0.0133	0.0062	0.0287	0.0264	0.0145	0.0133
Valley Slope (S_{valley})	0.0160	0.0073	0.0290	0.0290	0.0146	0.0146
Riffle Slope (S_{riffle})	Mean: 0.0138 Range: 0.0019 - 0.0305	Mean: 0.0020 Range: 0-0.0034	No distinct repetitive pattern of riffles and pools	Mean: 0.0264 Range: 0.0132 to 0.0395	No distinct repetitive pattern of riffles and pools	Mean: 0.0133 Range: 0.0066 to 0.0199
Pool Slope (S_{pool})	Mean: 0.0145 Range: 0 - 0.0472	Mean: 0.0008 Range: 0-0.0046		Mean: 0.0026 Range: 0.0000 to 0.0185		Mean: 0.0013 Range: 0.0000 to 0.0093
Run Slope (S_{run})	Mean: 0.0102 Range: 0 - 0.0402	Mean: 0.0028 Range: 0-0.0685		Mean: 0.0158 Range: 0.0000 to 0.0527		Mean: 0.0080 Range: 0.0000 to 0.0265
Glide Slope (S_{glide})	Mean: 0.0063 Range: 0 - 0.0246	Mean: 0.0016 Range: 0-0.0125		Mean: 0.0029 Range: 0.0000 to 0.0211		Mean: 0.0015 Range: 0.0000 to 0.0106
Profile Ratios						
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 1.0 Range: 0.1-2.3	Mean: 0.32 Range: 0-0.54	No distinct repetitive pattern of riffles and pools	Mean: 1.0 Range: 0.5 to 1.5	No distinct repetitive pattern of riffles and pools	Mean: 1.0 Range: 0.5 to 1.5
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 1.1 Range: 0 - 3.5	Mean: 0.12 Range: 0-0.73		Mean: 0.10 Range: 0.0 to 0.7		Mean: 0.10 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean: 0.8 Range: 0 - 3.0	Mean: 0.45 Range: 0-11.0		Mean: 0.6 Range: 0.0 to 2.0		Mean: 0.6 Range: 0.0 to 2.0
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean: 0.5 Range: 0 - 1.9	Mean: 0.25 Range: 0-2.0		Mean: 0.11 Range: 0.0 to 0.8		Mean: 0.11 Range: 0.0 to 0.8

Table B1 (Continued). Crane Site Morphological Stream Characteristics

Variables	REFERENCE - HALL	REFERENCE- CRANE	Existing (UT 5)	Proposed (UT 5)
Stream Type	E 5	E 5	Ge 5	Ce 5
Drainage Area (mi^2)	0.12	0.21	0.07	0.07
Bankfull Discharge (cfs)	18.0	20.5	11.3	11.3
Dimension Variables				
Bankfull Cross-Sectional Area (A_{bkf})	4.8	5.3	3.1	3.1
Existing Cross-Sectional Area ($A_{existing}$)	5.9 - 7.2	5.3-5.5	7.5 - 25.9	3.1
Bankfull Width (W_{bkf})	Mean: 6.6 Range: 5.9-7.2	Mean: 7.0 Range: 6.7-7.2	Mean: 4.1 Range: 3.7 to 4.7	Mean: 6.6 Range: 6.1 to 7.0
Bankfull Mean Depth (D_{bkf})	Mean: 0.8 Range: 0.7-0.8	Mean: 0.8 Range: 0.8-0.8	Mean: 0.7 Range: 0.6 to 0.8	Mean: 0.5 Range: 0.4 to 0.5
Bankfull Maximum Depth (D_{max})	Mean: 1.2 Range: 1.1-1.2	Mean: 1.2 Range: 1.1-1.2	Mean: 1.0 Range: 0.8 to 1.2	Mean: 0.6 Range: 0.6 to 0.8
Pool Width (W_{pool})	Mean: 10.2 Range:	Mean: 8.1 Range: 6.7-9.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 7.9 Range: 6.6 to 10.5
Maximum Pool Depth (D_{pool})	Mean: 1.6 Range:	Mean: 1.5 Range: 1.4-1.5		Mean: 0.8 Range: 0.7 to 0.9
Width of Floodprone Area (W_{fpa})	Mean: 115 Range: 80-150	Mean: 50.0 Range:	Mean: 8 Range: 6 to 11	Mean: 100 Range: 50 to 150
Dimension Ratios				
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 17.4 Range: 13.6-20.8	Mean: 7.2 Range: 6.9-7.5	Mean: 1.9 Range: 1.3 to 2.6	Mean: 15.2 Range: 8.2 to 21.3
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 9.2 Range: 7.4-10.9	Mean: 8.7 Range: 8.4-9.0	Mean: 5.8 Range: 4.6 to 7.8	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.6 Range: 1.4-1.7	Mean: 1.4 Range: 1.4-1.5	Mean: 1.4 Range: 1.3 to 1.5	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.1 Range: 1.1-1.2	Mean: 1.0 Range:	Mean: 2.9 Range: 1.8 to 4.8	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 2.1 Range:	Mean: 1.8 Range: 1.8-1.9	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: 1.6 Range:	Mean: 1.2 Range: 1.0-1.4		Mean: 1.2 Range: 1.0 to 1.6
Pool Area / Bankfull Cross Sectional Area	Mean: 1.6 Range:	Mean: 1.4 Range: 1.3-1.5		Mean: 1.3 Range: 1.1 to 1.5

Variables	REFERENCE - HALL	REFERENCE- CRANE	Existing (UT 5)	Proposed (UT 5)
Pattern Variables				
Pool to Pool Spacing (L_{p-p})	Med: 20.1 Range: 12 - 55	Med: 28.1 Range: 17-49	No distinct repetitive pattern of riffles and pools	Med: 26.4 Range: 19.8 to 39.5
Meander Length (L_m)	Med: 32.2 Range: 16 - 73	Med: 46.8 Range: 30-64		Med: 39.5 Range: 32.9 to 52.7
Belt Width (W_{belt})	Med: 14.4 Range: 44155.0	Med: 18.4 Range: 11.6 - 25.7		Med: 19.8 Range: 13.2 to 26.4
Radius of Curvature (R)	Med: 10.1 Range: 43949.0	Med: 12.9 Range: 7.3 - 21.5		Med: 19.8 Range: 13.2 to 32.9
Sinuosity (Sin)	1.20	1.17	1.01	1.10
Pattern Ratios				
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 3.0 Range: 1.8-8.3	Med: 4.0 Range: 2.5-7.0	No distinct repetitive pattern of riffles and pools	Med: 4.0 Range: 3.0 to 6.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 4.9 Range: 2.4-11.1	Med: 6.7 Range: 4.3-9.2		Med: 6.0 Range: 5.0 to 8.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 2.2 Range: 1.7-3.0	Med: 2.7 Range: 1.7-3.7		Med: 3.0 Range: 2.0 to 4.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 1.5 Range: 0.6-4.2	Med: 1.9 Range: 1.1-3.1		Med: 3.0 Range: 2.0 to 5.0
Profile Variables				
Average Water Surface Slope (S_{ave})	0.0133	0.0062	0.0149	0.0136
Valley Slope (S_{alley})	0.0160	0.0073	0.0150	0.0150
Riffle Slope (S_{riffle})	Mean: 0.0138 Range: 0.0019 - 0.0305	Mean: 0.0020 Range: 0-0.0034	No distinct repetitive pattern of riffles and pools	Mean: 0.0136 Range: 0.0068 to 0.0205
Pool Slope (S_{pool})	Mean: 0.0145 Range: 0 - 0.0472	Mean: 0.0008 Range: 0-0.0046		Mean: 0.0014 Range: 0.0000 to 0.0095
Run Slope (S_{run})	Mean: 0.0102 Range: 0 - 0.0402	Mean: 0.0028 Range: 0-0.0685		Mean: 0.0082 Range: 0.0000 to 0.0273
Glide Slope (S_{glide})	Mean: 0.0063 Range: 0 - 0.0246	Mean: 0.0016 Range: 0-0.0125		Mean: 0.0015 Range: 0.0000 to 0.0109
Profile Ratios				
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 1.0 Range: 0.1-2.3	Mean: 0.32 Range: 0-0.54	No distinct repetitive pattern of riffles and pools	Mean: 1.0 Range: 0.5 to 1.5
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 1.1 Range: 0 - 3.5	Mean: 0.12 Range: 0-0.73		Mean: 0.10 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean: 0.8 Range: 0 - 3.0	Mean: 0.45 Range: 0-11.0		Mean: 0.6 Range: 0.0 to 2.0
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean: 0.5 Range: 0 - 1.9	Mean: 0.25 Range: 0-2.0		Mean: 0.11 Range: 0.0 to 0.8



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Crane
Mitigation Site

Lee County
North Carolina

Title:

Existing Conditions
Cross Section
Locations

Scale: As Shown

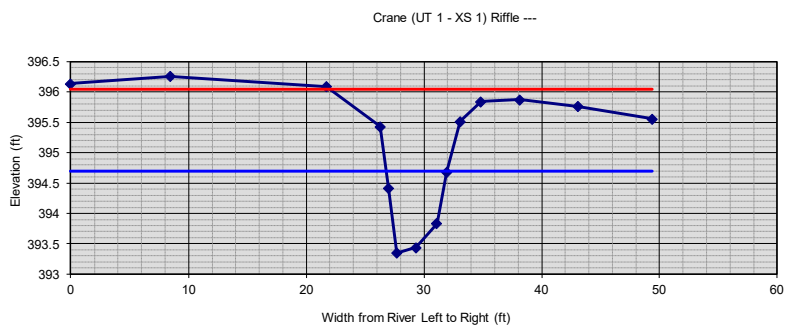
Date: JAN 2021

Project No.: 20-032

FIGURE NO.

B1

Cross Section



section: **Crane (UT 1 - XS 1)**

Riffle

---

description: **Crane (UT 1 - XS 1)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**103.861**	396.139
	☐	**8.445427**	**103.7434**	396.2566
	☐	**21.70029**	**103.9116**	396.0884
	☐	**26.28868**	**104.5681**	395.4319
	☐	**26.99367**	**105.5784**	394.4216
	☐	**27.68487**	**106.653**	393.347
	☐	**29.34191**	**106.5587**	393.4413
	☐	**31.09854**	**106.166**	393.834
	☐	**31.93373**	**105.3153**	394.6847
	☐	**33.07307**	**104.4825**	395.5175
	☐	**34.85578**	**104.1578**	395.8422
	☐	**38.14431**	**104.1248**	395.8752
	☐	**43.07302**	**104.2348**	395.7652
	☐	**49.37888**	**104.4449**	395.5551
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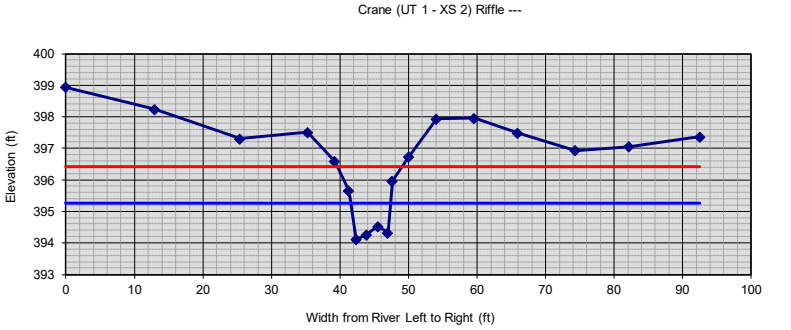
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
105.3	**104.16**	**100.0**		
394.7	395.84			

dimensions			
5.0	x-section area	1.0	d mean
5.2	width	6.3	wet P
1.4	d max	0.8	hyd radi
2.5	bank ht	5.3	w/d ratio
100.0	W flood prone area	19.4	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: **Crane (UT 1 - XS 2)**

Riffle

---

description: **Crane (UT 1 - XS 2)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**101.0646**	398.9354
	☐	**12.9168**	**101.7565**	398.2435
	☐	**25.39335**	**102.6937**	397.3063
	☐	**35.22834**	**102.4934**	397.5066
	☐	**39.21891**	**103.4206**	396.5794
	☐	**41.25911**	**104.347**	395.653
	☐	**42.32492**	**105.883**	394.117
	☐	**43.8662**	**105.7383**	394.2617
	☐	**45.52674**	**105.482**	394.518
	☐	**46.97737**	**105.6757**	394.3243
	☐	**47.63307**	**104.0348**	395.9652
	☐	**49.99766**	**103.2714**	396.7286
	☐	**54.07483**	**102.0651**	397.9349
	☐	**59.59342**	**102.0489**	397.9511
	☐	**65.88082**	**102.512**	397.488
	☐	**74.3598**	**103.0728**	396.9272
	☐	**82.15203**	**102.9503**	397.0497
	☐	**92.51886**	**102.6355**	397.3645
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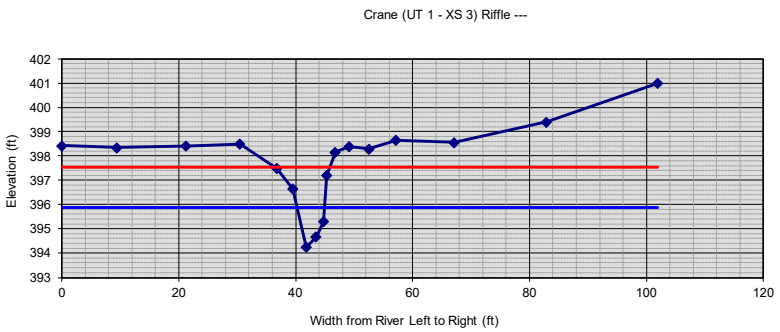
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
104.73	**102.49**	**9.0**		
395.27	397.51			

dimensions			
5.0	x-section area	0.9	d mean
5.8	width	7.1	wet P
1.2	d max	0.7	hyd radi
3.4	bank ht	6.8	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: **Crane (UT 1 - XS 3)**

Riffle

---

description: **Crane (UT 1 - XS 3)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**101.5703**	398.4297
	☐	**9.426116**	**101.6573**	398.3427
	☐	**21.24391**	**101.5872**	398.4128
	☐	**30.48485**	**101.5081**	398.4919
	☐	**36.772**	**102.5132**	397.4868
	☐	**39.54741**	**103.3471**	396.6529
	☐	**41.79669**	**105.7506**	394.2494
	☐	**43.5287**	**105.3349**	394.6651
	☐	**44.80326**	**104.6998**	395.3002
	☐	**45.33752**	**102.8041**	397.1959
	☐	**46.78404**	**101.8355**	398.1645
	☐	**49.19189**	**101.6143**	398.3857
	☐	**52.55501**	**101.7103**	398.2897
	☐	**57.21873**	**101.3475**	398.6525
	☐	**67.17505**	**101.4441**	398.5559
	☐	**82.92173**	**100.6042**	399.3958
	☐	**101.8904**	**98.99448**	401.0055
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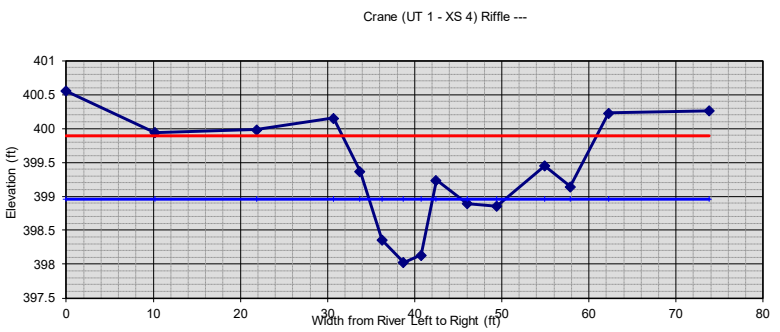
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
104.1	**101.84**	**10.0**		
395.9	398.16			

dimensions			
5.0	x-section area	1.1	d mean
4.7	width	6.1	wet P
1.7	d max	0.8	hyd radi
3.9	bank ht	4.5	w/d ratio
10.0	W flood prone area	2.1	ent ratio

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

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

Cross Section



section: **Crane (UT 1 - XS 4)**

Riffle

---

description: **Crane (UT 1 - XS 4)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**99.44592**	400.5541
	☐	**10.18895**	**100.0599**	399.9401
	☐	**21.88041**	**100.0176**	399.9824
	☐	**30.70169**	**99.84632**	400.1537
	☐	**33.73116**	**100.6336**	399.3664
	☐	**36.27958**	**101.6428**	398.3572
	☐	**38.72286**	**101.9735**	398.0265
	☐	**40.74658**	**101.8643**	398.1357
	☐	**42.48801**	**100.7596**	399.2404
	☐	**46.02243**	**101.1074**	398.8926
	☐	**49.39875**	**101.146**	398.8541
	☐	**54.93531**	**100.5479**	399.4521
	☐	**57.88425**	**100.8559**	399.1441
	☐	**62.28361**	**99.7722**	400.2278
	☐	**73.79652**	**99.73588**	400.2641
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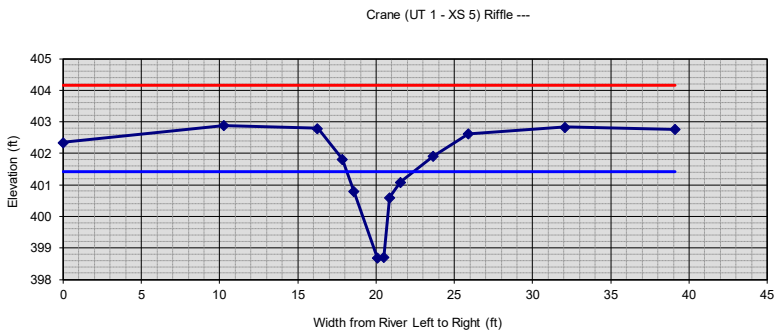
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
101.04	**99.85**	**29.0**		
398.96	400.15			

dimensions			
5.0	x-section area	0.4	d mean
12.3	width	12.7	wet P
0.9	d max	0.4	hyd radi
2.1	bank ht	30.3	w/d ratio
29.0	W flood prone area	2.4	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:	Crane (UT 1 - XS 5)
	Riffle

	---
description:	Crane (UT 1 - XS 5)
height of instrument (ft):	500.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	97.65515	402.3449
	☐	10.28276	97.10376	402.8962
	☐	16.26108	97.20381	402.7962
	☐	17.83245	98.18546	401.8145
	☐	18.58738	99.19456	400.8054
	☐	20.08981	101.3093	398.6907
	☐	20.4976	101.2982	398.7018
	☐	20.8646	99.39748	400.6025
	☐	21.57122	98.90911	401.0909
	☐	23.63557	98.09191	401.9081
	☐	25.90424	97.3817	402.6183
	☐	32.09522	97.16987	402.8301
	☐	39.09303	97.2341	402.7659
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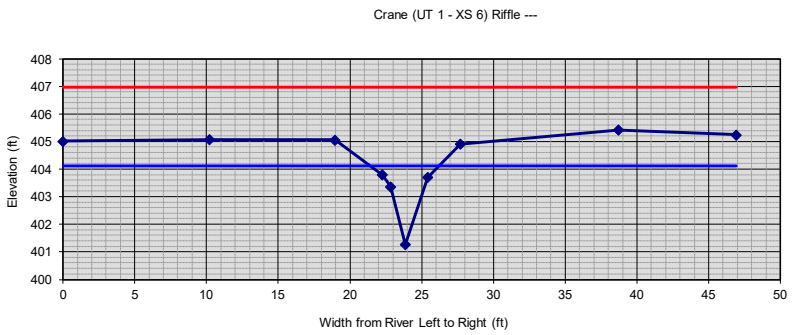
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
98.57	97.2	100.0		
401.43	402.8			

dimensions			
5.0	x-section area	1.2	d mean
4.3	width	7.5	wet P
2.7	d max	0.7	hyd radi
4.1	bank ht	3.7	w/d ratio
100.0	W flood prone area	23.2	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:	Crane (UT 1 - XS 6)
	Riffle

	---
description:	Crane (UT 1 - XS 6)
height of instrument (ft):	500.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	94.99009	405.0099
	☐	10.23904	94.92349	405.0765
	☐	18.95847	94.93855	405.0614
	☐	22.24106	96.20647	403.7935
	☐	22.83667	96.62957	403.3704
	☐	23.87442	98.74036	401.2596
	☐	25.41283	96.29453	403.7055
	☐	27.69389	95.08956	404.9104
	☐	38.71027	94.57034	405.4297
	☐	46.9417	94.75103	405.249
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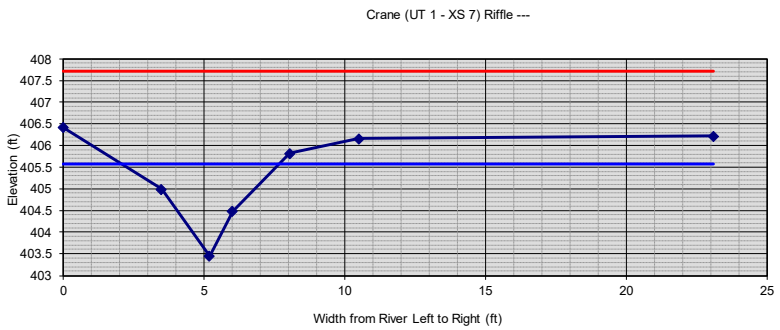
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
95.88	95.09	100.0		
404.12	404.91			

dimensions			
5.0	x-section area	1.0	d mean
4.8	width	7.8	wet P
2.9	d max	0.6	hyd radi
3.7	bank ht	4.6	w/d ratio
100.0	W flood prone area	20.8	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:	Crane (UT 1 - XS 7)
	Riffle

	---
description:	Crane (UT 1 - XS 7)
height of instrument (ft):	500.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	93.57248	406.4275
	☐	3.495357	95.00483	404.9952
	☐	5.196225	96.55544	403.4446
	☐	6.01398	95.51458	404.4854
	☐	8.046994	94.17932	405.8207
	☐	10.50493	93.8439	406.1561
	☐	23.08165	93.78234	406.2177
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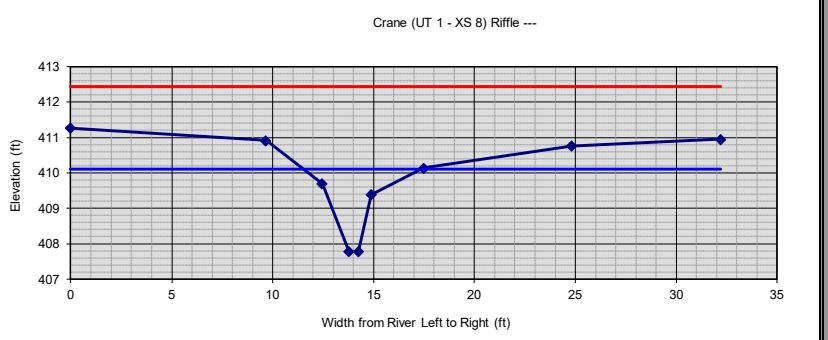
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
94.42	93.84	100.0		
405.58	406.16			

dimensions			
5.0	x-section area	0.9	d mean
5.6	width	7.2	wet P
2.1	d max	0.7	hyd radi
2.7	bank ht	6.3	w/d ratio
100.0	W flood prone area	17.8	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:	Crane (UT 1 - XS 8)
	Riffle

	---
description:	Crane (UT 1 - XS 8)
height of instrument (ft):	500.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	88.72565	411.2743
	☐	9.664537	89.08449	410.9155
	☐	12.46154	90.30883	409.6912
	☐	13.78279	92.20884	407.7912
	☐	14.25358	92.21389	407.7861
	☐	14.89531	90.60826	409.3917
	☐	17.49608	89.8601	410.1399
	☐	24.81297	89.23531	410.7647
	☐	32.21811	89.0496	410.9504

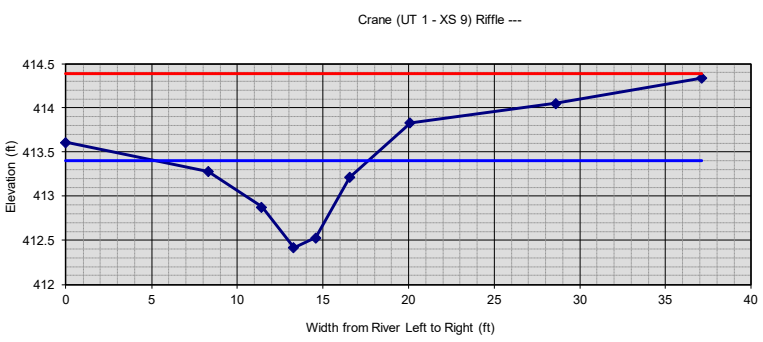
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
89.88	89.86	100.0		
410.12	410.14			

dimensions			
5.0	x-section area	0.8	d mean
5.9	width	8.2	wet P
2.3	d max	0.6	hyd radi
2.4	bank ht	7.0	w/d ratio
100.0	W flood prone area	16.8	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:	Crane (UT 1 - XS 9)
	Riffle

	---
description:	Crane (UT 1 - XS 9)
height of instrument (ft):	500.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	86.39107	413.6089
	☐	8.312204	86.72051	413.2795
	☐	11.42444	87.12332	412.8767
	☐	13.30405	87.58433	412.4157
	☐	14.59142	87.47247	412.5275
	☐	16.55869	86.78364	413.2164
	☐	20.10275	86.16751	413.8325
	☐	28.62156	85.94644	414.0536
	☐	37.12101	85.65739	414.3426

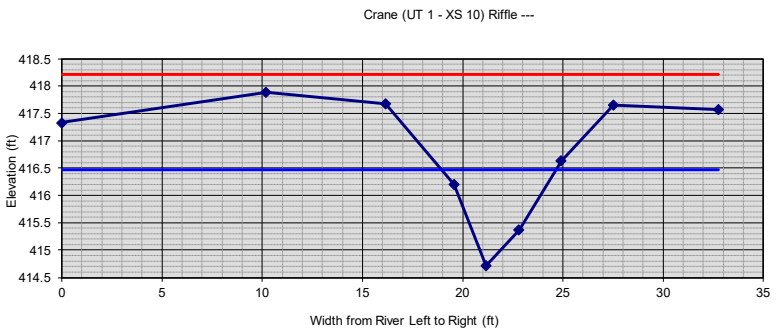
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
86.595	86.595	100.0		
413.405	413.405			

dimensions			
5.0	x-section area	0.4	d mean
12.5	width	12.7	wet P
1.0	d max	0.4	hyd radi
1.0	bank ht	31.3	w/d ratio
100.0	W flood prone area	8.0	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:	Crane (UT 1 - XS 10)
	Riffle

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description:	Crane (UT 1 - XS 10)
height of instrument (ft):	500.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	82.66584	417.3342
	☐	10.20062	82.10189	417.8981
	☐	16.15191	82.31878	417.6812
	☐	19.57316	83.79584	416.2042
	☐	21.17788	85.28003	414.72
	☐	22.81548	84.63076	415.3692
	☐	24.9245	83.36562	416.6344
	☐	27.51511	82.34664	417.6534
	☐	32.7803	82.42657	417.5734
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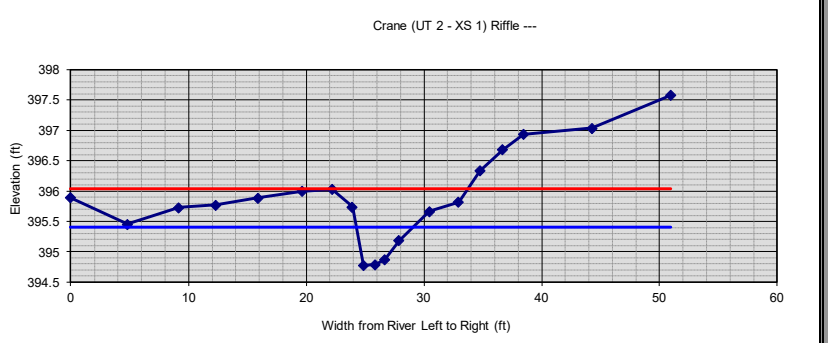
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
83.53	82.35	100.0		
416.47	417.65			

dimensions			
5.0	x-section area	0.9	d mean
5.7	width	6.8	wet P
1.8	d max	0.7	hyd radi
2.9	bank ht	6.4	w/d ratio
100.0	W flood prone area	17.6	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:	Crane (UT 2 - XS 1)
	Riffle

	---
description:	Crane (UT 2 - XS 1)
height of instrument (ft):	500.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	104.1052	395.8948
	☐	4.795888	104.5431	395.4569
	☐	9.180474	104.2677	395.7323
	☐	12.34215	104.2292	395.7708
	☐	15.88295	104.1146	395.8854
	☐	19.64498	104.0002	395.9998
	☐	22.19677	103.9698	396.0302
	☐	23.92564	104.2624	395.7376
	☐	24.8805	105.2248	394.7752
	☐	25.86924	105.2093	394.7907
	☐	26.67184	105.1274	394.8726
	☐	27.88095	104.8152	395.1848
	☐	30.47373	104.3318	395.6682
	☐	32.94166	104.1807	395.8193
	☐	34.76451	103.6664	396.3336
	☐	36.69016	103.3157	396.6843
	☐	38.4519	103.0622	396.9378
	☐	44.29016	102.9646	397.0354
	☐	50.99112	102.4166	397.5834
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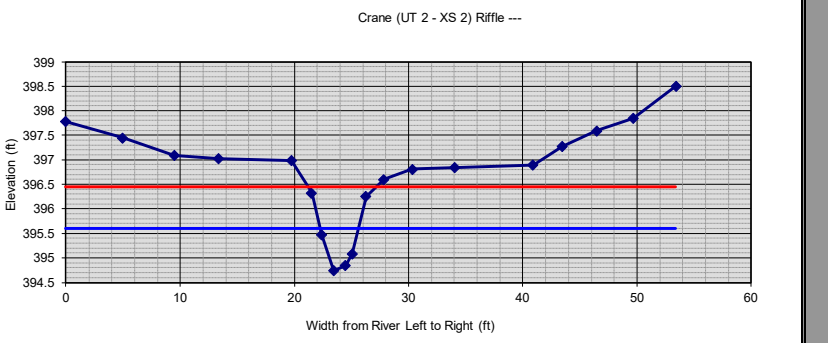
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
104.59	103.97	12.0		
395.41	396.03			

dimensions			
1.9	x-section area	0.4	d mean
4.8	width	5.2	wet P
0.6	d max	0.4	hyd radi
1.3	bank ht	12.4	w/d ratio
12.0	W flood prone area	2.5	ent ratio

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

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

Cross Section



section:	Crane (UT 2 - XS 2)
	Riffle

	---
description:	Crane (UT 2 - XS 2)
height of instrument (ft):	500.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	102.2135	397.7865
	☐	4.947785	102.5489	397.4511
	☐	9.480613	102.9084	397.0916
	☐	13.39833	102.973	397.027
	☐	19.74248	103.0141	396.9859
	☐	21.52144	103.6752	396.3248
	☐	22.39268	104.522	395.478
	☐	23.44286	105.2569	394.7431
	☐	24.49696	105.1523	394.8477
	☐	25.08003	104.9109	395.0892
	☐	26.28492	103.7423	396.2577
	☐	27.84789	103.3957	396.6043
	☐	30.35327	103.1879	396.8121
	☐	34.05753	103.1536	396.8464
	☐	40.91153	103.1063	396.8937
	☐	43.44828	102.7264	397.2736
	☐	46.48047	102.4042	397.5958
	☐	49.69564	102.1487	397.8513
	☐	53.4213	101.4937	398.5063
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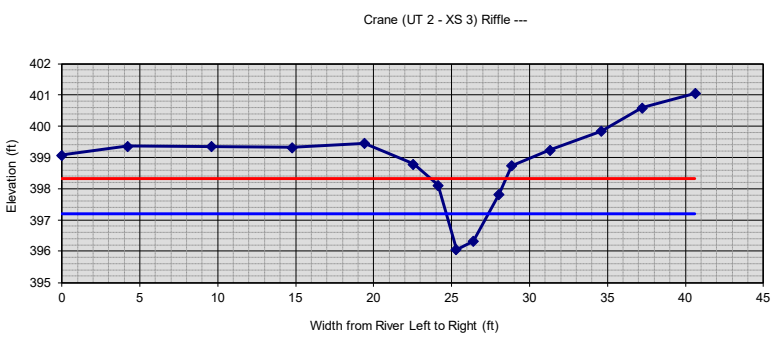
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
104.4	103.19	6.0		
395.6	396.81			

dimensions			
1.9	x-section area	0.6	d mean
3.3	width	3.9	wet P
0.9	d max	0.5	hyd radi
2.1	bank ht	6.0	w/d ratio
6.0	W flood prone area	1.8	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: **Crane (UT 2 - XS 3)**

Riffle

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description: **Crane (UT 2 - XS 3)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**100.9215**	399.0785
	☐	**4.218285**	**100.6408**	399.3592
	☐	**9.624848**	**100.6512**	399.3488
	☐	**14.80246**	**100.6815**	399.3185
	☐	**19.42963**	**100.5423**	399.4577
	☐	**22.56483**	**101.2064**	398.7936
	☐	**24.14682**	**101.8909**	398.1091
	☐	**25.30986**	**103.9435**	396.0565
	☐	**26.41007**	**103.675**	396.325
	☐	**28.03176**	**102.1878**	397.8122
	☐	**28.85914**	**101.2591**	398.7409
	☐	**31.3185**	**100.7607**	399.2393
	☐	**34.61222**	**100.1566**	399.8434
	☐	**37.23617**	**99.40777**	400.5922
	☐	**40.62951**	**98.93704**	401.063
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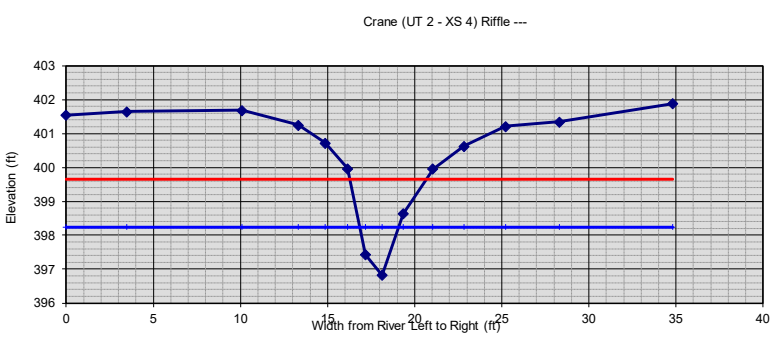
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
102.8	**101.26**	**5.0**		
397.2	398.74			

dimensions			
1.9	x-section area	0.7	d mean
2.7	width	3.7	wet P
1.1	d max	0.5	hyd radi
2.7	bank ht	3.8	w/d ratio
5.0	W flood prone area	1.9	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: **Crane (UT 2 - XS 4)**

Riffle

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description: **Crane (UT 2 - XS 4)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**98.45055**	401.5495
	☐	**3.493237**	**98.34657**	401.6534
	☐	**10.10076**	**98.30971**	401.6903
	☐	**13.33035**	**98.74992**	401.2501
	☐	**14.87432**	**99.27862**	400.7214
	☐	**16.1614**	**100.0302**	399.9698
	☐	**17.18057**	**102.5728**	397.4272
	☐	**18.1433**	**103.1688**	396.8312
	☐	**19.33639**	**101.3594**	398.6406
	☐	**21.05954**	**100.0438**	399.9562
	☐	**22.8455**	**99.3716**	400.6284
	☐	**25.22319**	**98.78942**	401.2106
	☐	**28.32427**	**98.65539**	401.3446
	☐	**34.81251**	**98.11032**	401.8897
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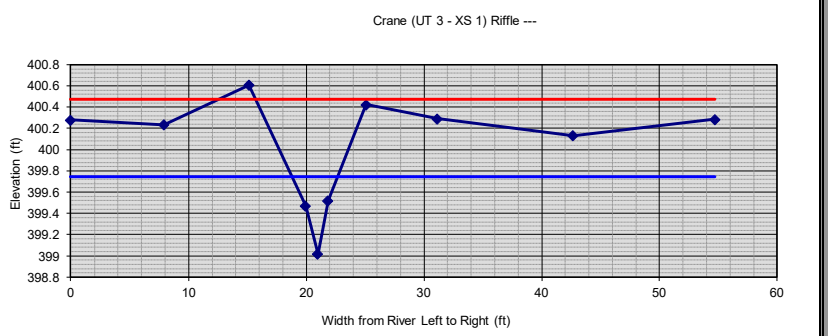
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
101.75	**98.79**	**4.5**		
398.25	401.21			

dimensions			
1.9	x-section area	0.8	d mean
2.2	width	3.7	wet P
1.4	d max	0.5	hyd radi
4.4	bank ht	2.6	w/d ratio
4.5	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: **Crane (UT 3 - XS 1)**
Riffle

---
description: **Crane (UT 3 - XS 1)**
height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**99.72149**	400.2785
	☐	**7.913575**	**99.76476**	400.2352
	☐	**15.13365**	**99.38987**	400.6101
	☐	**19.95306**	**100.5293**	399.4707
	☐	**20.98512**	**100.979**	399.021
	☐	**21.84337**	**100.4805**	399.5195
	☐	**25.07918**	**99.57705**	400.4229
	☐	**31.11236**	**99.70937**	400.2906
	☐	**42.68684**	**99.86719**	400.1328
	☐	**54.74199**	**99.71518**	400.2848

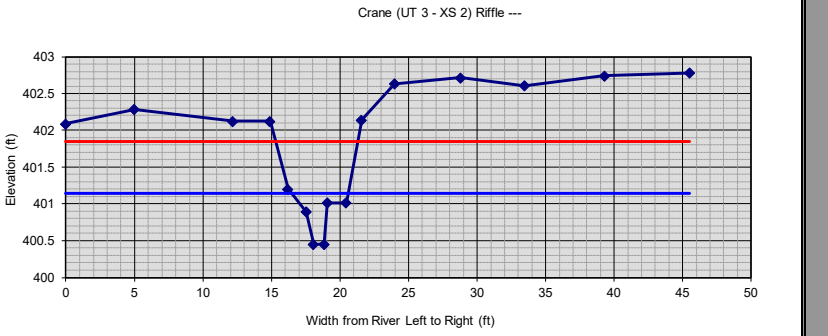
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
100.25	**99.58**	**50.0**		
399.75	400.42			

dimensions			
1.2	x-section area	0.3	d mean
3.9	width	4.2	wet P
0.7	d max	0.3	hyd radi
1.4	bank ht	12.7	w/d ratio
50.0	W flood prone area	12.8	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: **Crane (UT 3 - XS 2)**
Riffle

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description: **Crane (UT 3 - XS 2)**
height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**97.91267**	402.0873
	☐	**4.989111**	**97.71727**	402.2827
	☐	**12.18987**	**97.87809**	402.1219
	☐	**14.88493**	**97.87773**	402.1223
	☐	**16.19341**	**98.79876**	401.2012
	☐	**17.52063**	**99.10846**	400.8915
	☐	**18.06809**	**99.54754**	400.4525
	☐	**18.83959**	**99.54706**	400.4529
	☐	**19.06612**	**98.986**	401.014
	☐	**20.45783**	**98.98439**	401.0156
	☐	**21.56968**	**97.85735**	402.1427
	☐	**23.98502**	**97.3677**	402.6323
	☐	**28.7811**	**97.28448**	402.7155
	☐	**33.47475**	**97.39464**	402.6054
	☐	**39.30455**	**97.25783**	402.7422
	☐	**45.49975**	**97.21961**	402.7804

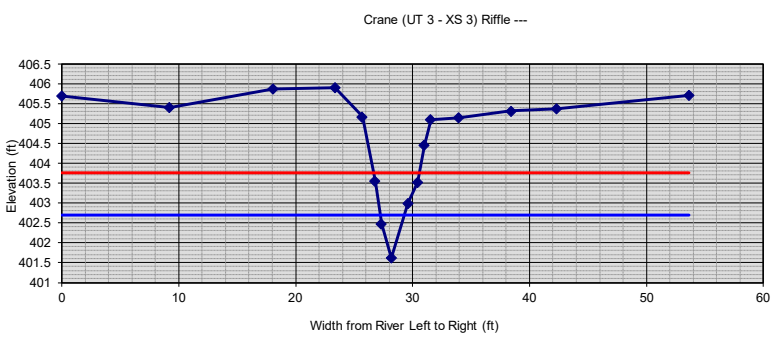
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
98.85	**97.88**	**6.0**		
401.15	402.12			

dimensions			
1.2	x-section area	0.3	d mean
4.2	width	4.8	wet P
0.7	d max	0.3	hyd radi
1.7	bank ht	14.1	w/d ratio
6.0	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: **Crane (UT 3 - XS 3)**

Riffle

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description: **Crane (UT 3 - XS 3)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**94.30514**	405.6949
	☐	**9.230464**	**94.59321**	405.4068
	☐	**18.07563**	**94.12616**	405.8738
	☐	**23.35658**	**94.08798**	405.912
	☐	**25.69912**	**94.83315**	405.1669
	☐	**26.80382**	**96.44588**	403.5541
	☐	**27.33997**	**97.52864**	402.4714
	☐	**28.2012**	**98.37027**	401.6297
	☐	**29.63146**	**97.00871**	402.9913
	☐	**30.44832**	**96.48453**	403.5155
	☐	**31.01021**	**95.54279**	404.4572
	☐	**31.56233**	**94.90239**	405.0976
	☐	**33.96877**	**94.85705**	405.143
	☐	**38.41688**	**94.68403**	405.316
	☐	**42.29492**	**94.62952**	405.3705
	☐	**53.63305**	**94.28857**	405.7114
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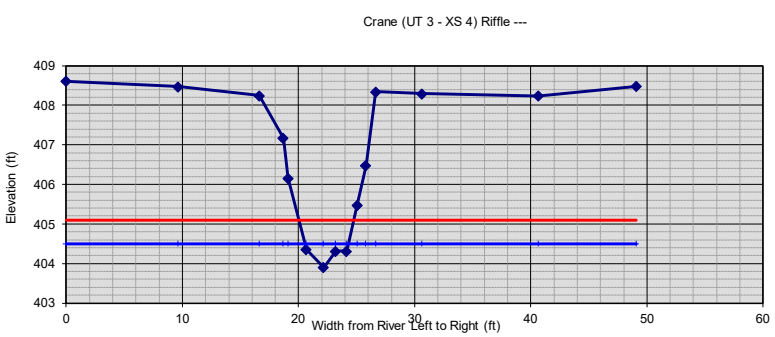
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
97.3	**94.9**	**50.0**		
402.7	405.1			

dimensions			
1.2	x-section area	0.6	d mean
2.1	width	3.0	wet P
1.1	d max	0.4	hyd radi
3.5	bank ht	3.8	w/d ratio
50.0	W flood prone area	23.8	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: **Crane (UT 3 - XS 4)**

Riffle

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description: **Crane (UT 3 - XS 4)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**91.38128**	408.6187
	☐	**9.606271**	**91.52455**	408.4755
	☐	**16.61271**	**91.75646**	408.2435
	☐	**18.68656**	**92.82966**	407.1703
	☐	**19.11151**	**93.84209**	406.1579
	☐	**20.66897**	**95.64984**	404.3502
	☐	**22.15741**	**96.09937**	403.9006
	☐	**23.21206**	**95.68345**	404.3165
	☐	**24.14022**	**95.68552**	404.3145
	☐	**25.04559**	**94.51836**	405.4816
	☐	**25.79288**	**93.52283**	406.4772
	☐	**26.63693**	**91.66023**	408.3398
	☐	**30.60645**	**91.70243**	408.2976
	☐	**40.64929**	**91.76314**	408.2369
	☐	**49.08506**	**91.52124**	408.4788
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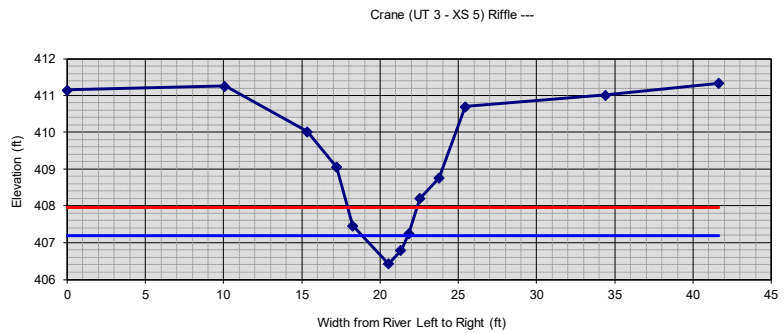
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
95.5	**91.76**	**5.0**		
404.5	408.24			

dimensions			
1.2	x-section area	0.3	d mean
3.7	width	4.0	wet P
0.6	d max	0.3	hyd radi
4.3	bank ht	12.0	w/d ratio
5.0	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:	**Crane (UT 3 - XS 5)**
	Riffle

	---
description:	**Crane (UT 3 - XS 5)**
height of instrument (ft):	**500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**88.84798**	411.152
	☐	**10.09512**	**88.74694**	411.2531
	☐	**15.34141**	**89.98257**	410.0174
	☐	**17.22113**	**90.94858**	409.0514
	☐	**18.23467**	**92.53561**	407.4644
	☐	**20.52481**	**93.56316**	406.4368
	☐	**21.33268**	**93.20954**	406.7905
	☐	**21.85312**	**92.74964**	407.2504
	☐	**22.52769**	**91.80016**	408.1998
	☐	**23.76921**	**91.23877**	408.7612
	☐	**25.4438**	**89.30154**	410.6985
	☐	**34.41553**	**88.98683**	411.0132
	☐	**41.64307**	**88.66643**	411.3336
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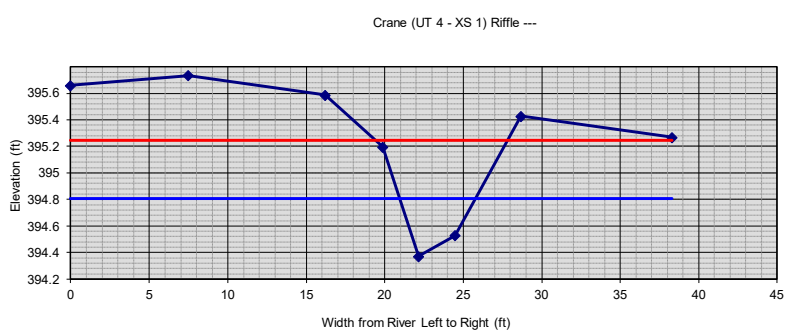
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
92.8	**89.3**	**4.0**		
407.2	410.7			

dimensions			
1.2	x-section area	0.4	d mean
3.0	width	3.4	wet P
0.8	d max	0.4	hyd radi
4.3	bank ht	7.3	w/d ratio
4.0	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:	Crane (UT 4 - XS 1)
	Riffle

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description:	Crane (UT 4 - XS 1)
height of instrument (ft):	500.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	104.3412	395.6588
	☐	7.504961	104.268	395.732
	☐	16.20545	104.4131	395.5869
	☐	19.8807	104.8046	395.1954
	☐	22.1696	105.6271	394.3729
	☐	24.4887	105.4708	394.5292
	☐	28.67701	104.5736	395.4264
	☐	38.33459	104.7316	395.2684
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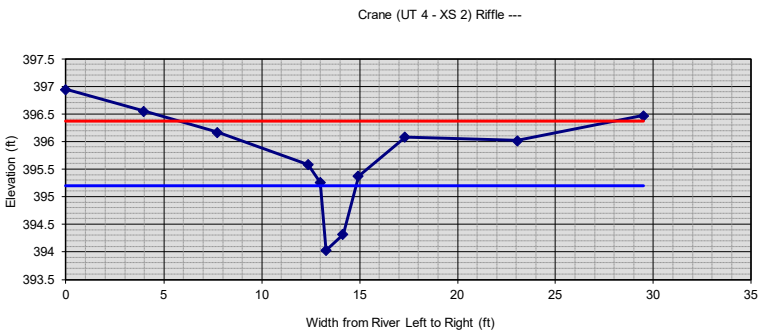
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
105.19	104.57	8.0		
394.81	395.43			

dimensions			
1.3	x-section area	0.3	d mean
4.8	width	5.0	wet P
0.4	d max	0.3	hyd radi
1.1	bank ht	18.3	w/d ratio
8.0	W flood prone area	1.7	ent ratio

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

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

Cross Section



section:	Crane (UT 4 - XS 2)
	Riffle

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description:	Crane (UT 4 - XS 2)
height of instrument (ft):	500.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	103.0505	396.9495
	☐	3.967775	103.4481	396.5519
	☐	7.722581	103.8329	396.1671
	☐	12.36119	104.4162	395.5838
	☐	12.99268	104.7412	395.2588
	☐	13.29021	105.9743	394.0257
	☐	14.15176	105.6848	394.3152
	☐	14.93612	104.627	395.373
	☐	17.32659	103.9204	396.0796
	☐	23.05505	103.9844	396.0156
	☐	29.50347	103.5285	396.4715
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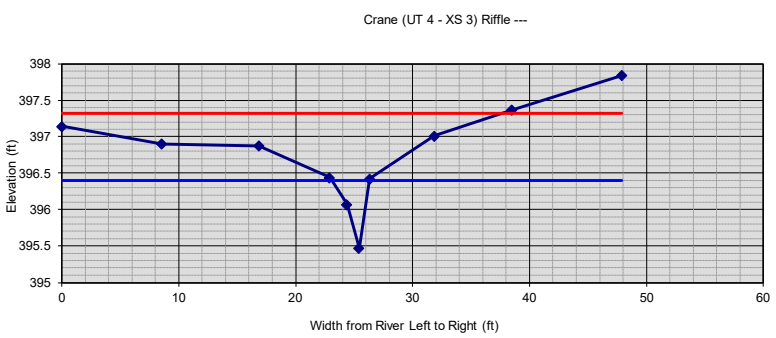
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
104.8	104.42	22.0		
395.2	395.58			

dimensions			
1.3	x-section area	0.7	d mean
1.8	width	3.2	wet P
1.2	d max	0.4	hyd radi
1.6	bank ht	2.4	w/d ratio
22.0	W flood prone area	12.2	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: **Crane (UT 4 - XS 3)**

Riffle

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description: **Crane (UT 4 - XS 3)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**102.8576**	397.1424
	☐	**8.57176**	**103.0981**	396.9019
	☐	**16.86133**	**103.1264**	396.8736
	☐	**22.91162**	**103.5604**	396.4396
	☐	**24.38901**	**103.9297**	396.0703
	☐	**25.42477**	**104.5267**	395.4733
	☐	**26.33612**	**103.5782**	396.4218
	☐	**31.85677**	**102.9903**	397.0097
	☐	**38.49428**	**102.6356**	397.3645
	☐	**47.91811**	**102.1534**	397.8466
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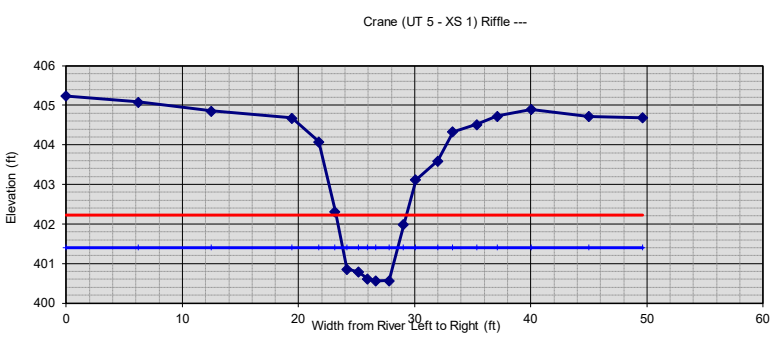
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
103.6	**103.13**	**50.0**		
396.4	396.87			

dimensions			
1.3	x-section area	0.4	d mean
3.2	width	3.8	wet P
0.9	d max	0.3	hyd radi
1.4	bank ht	8.2	w/d ratio
50.0	W flood prone area	15.4	ent ratio

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

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

Cross Section



section: **Crane (UT 5 - XS 1)**

Riffle

---

description: **Crane (UT 5 - XS 1)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**94.758**	405.242
	☐	**6.196695**	**94.912**	405.088
	☐	**12.4816**	**95.14**	404.86
	☐	**19.43801**	**95.318**	404.682
	☐	**21.74078**	**95.919**	404.081
	☐	**23.14853**	**97.684**	402.316
	☐	**24.18188**	**99.141**	400.859
	☐	**25.18333**	**99.214**	400.786
	☐	**25.93876**	**99.384**	400.616
	☐	**26.66211**	**99.432**	400.568
	☐	**27.81279**	**99.431**	400.569
	☐	**29.05207**	**98.014**	401.986
	☐	**30.09069**	**96.879**	403.121
	☐	**32.00963**	**96.401**	403.599
	☐	**33.28665**	**95.664**	404.336
	☐	**35.36618**	**95.482**	404.518
	☐	**37.13399**	**95.27**	404.73
	☐	**40.03803**	**95.101**	404.899
	☐	**45.01885**	**95.277**	404.723
	☐	**49.61673**	**95.309**	404.691
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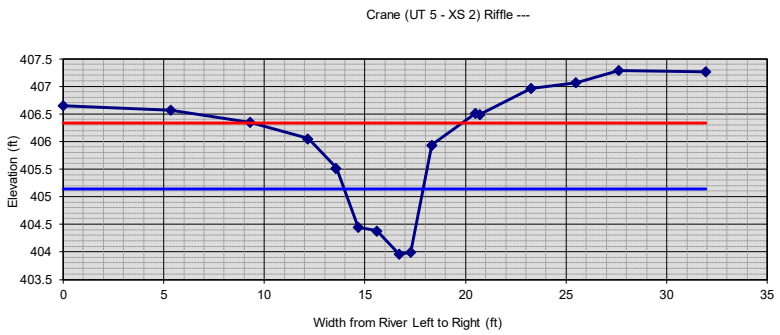
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
98.6	**95.66**	**6.0**		
401.4	404.34			

dimensions			
3.1	x-section area	0.6	d mean
4.7	width	5.4	wet P
0.8	d max	0.6	hyd radi
3.8	bank ht	7.4	w/d ratio
6.0	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: **Crane (UT 5 - XS 2)**

Riffle

---

description: **Crane (UT 5 - XS 2)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**93.35**	406.65
	☐	**5.345462**	**93.433**	406.567
	☐	**9.288156**	**93.653**	406.347
	☐	**12.17205**	**93.947**	406.053
	☐	**13.57011**	**94.482**	405.518
	☐	**14.66778**	**95.553**	404.447
	☐	**15.58609**	**95.619**	404.381
	☐	**16.71663**	**96.038**	403.962
	☐	**17.28469**	**96.008**	403.992
	☐	**18.33865**	**94.064**	405.936
	☐	**20.48821**	**93.486**	406.514
	☐	**20.72807**	**93.504**	406.496
	☐	**23.25018**	**93.036**	406.964
	☐	**25.49878**	**92.929**	407.071
	☐	**27.62426**	**92.704**	407.296
	☐	**31.94957**	**92.735**	407.265
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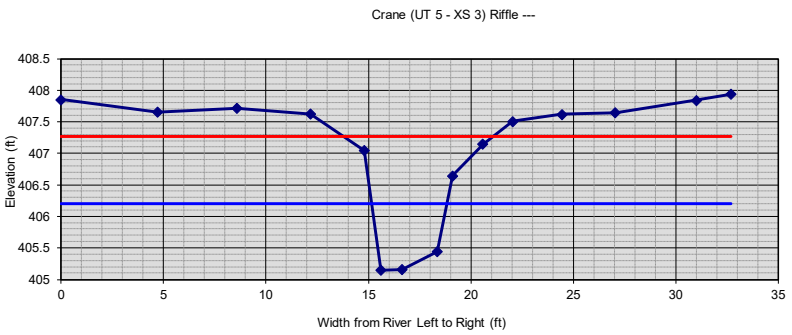
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
94.85	**93.95**	**10.5**		
405.15	406.05			

dimensions			
3.1	x-section area	0.8	d mean
4.0	width	5.0	wet P
1.2	d max	0.6	hyd radi
2.1	bank ht	5.1	w/d ratio
10.5	W flood prone area	2.6	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: **Crane (UT 5 - XS 3)**

Riffle

---

description: **Crane (UT 5 - XS 3)**

height of instrument (ft): **500.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**92.147**	407.853
	☐	**4.704401**	**92.347**	407.653
	☐	**8.584446**	**92.284**	407.716
	☐	**12.18514**	**92.377**	407.623
	☐	**14.7992**	**92.954**	407.046
	☐	**15.62192**	**94.853**	405.147
	☐	**16.64793**	**94.843**	405.157
	☐	**18.36571**	**94.56**	405.44
	☐	**19.10428**	**93.357**	406.643
	☐	**20.58734**	**92.853**	407.147
	☐	**22.04809**	**92.493**	407.507
	☐	**24.45279**	**92.382**	407.618
	☐	**27.05472**	**92.355**	407.645
	☐	**31.008**	**92.157**	407.843
	☐	**32.68399**	**92.058**	407.942
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FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
93.79	**92.49**	**7.0**		
406.21	407.51			

dimensions			
3.1	x-section area	0.8	d mean
3.7	width	4.8	wet P
1.1	d max	0.6	hyd radi
2.4	bank ht	4.4	w/d ratio
7.0	W flood prone area	1.9	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		

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): Crane Site - UT1
2. Date of evaluation: August 8, 2018
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: G. Lewis/Axiom Env.
5. County: Lee
6. Nearest named water body on USGS 7.5-minute quad: Crane Creek
7. River basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.366392, -79.222888

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT-1
10. Length of assessment reach evaluated (feet): 400
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 5
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

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): Crane Site - UT1 upstream
2. Date of evaluation: August 8, 2018
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: G. Lewis/Axiom Env.
5. County: Lee
6. Nearest named water body on USGS 7.5-minute quad: Crane Creek
7. River basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.368175, -79.222984

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT-1
10. Length of assessment reach evaluated (feet): 500
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 0.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 3.5
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	Crane Site - UT1	Date of Assessment	August 8, 2018
Stream Category	Ia1	Assessor Name/Organization	G. Lewis/Axiom Env.

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

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**HIGH**	
(3) Streamside Area Attenuation	**HIGH**	
(4) Floodplain Access	**HIGH**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**HIGH**	
(3) Stream Stability	**HIGH**	
(4) Channel Stability	**HIGH**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**HIGH**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**HIGH**	
(3) Upland Pollutant Filtration	**HIGH**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**HIGH**	
(3) In-stream Habitat	**LOW**	
(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 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): Crane Site - UT2
2. Date of evaluation: August 8, 2018
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: G. Lewis/Axiom Env.
5. County: Lee
6. Nearest named water body on USGS 7.5-minute quad: Crane Creek
7. River basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.364002, -79.223224

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT-2
10. Length of assessment reach evaluated (feet): 400
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): 4
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] <u>or</u> too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) <u>or</u> floodplain/intertidal zone unnaturally absent <u>or</u> assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B <u>Excessive</u> sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach <u>and</u> causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "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 <u>and</u> no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions <u>and</u> rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

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

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

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

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐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	Crane Site - UT2	Date of Assessment	August 8, 2018
Stream Category	Ia1	Assessor Name/Organization	G. Lewis/Axiom Env.

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	**LOW**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

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 $\leq$ 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	Crane Site - UT1	Date of Assessment	August 8, 2018
Stream Category	Ia1	Assessor Name/Organization	G. Lewis/Axiom Env.

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	**LOW**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC WAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Crane Mitigation Site	Date of Evaluation	December 17, 2020
Applicant/Owner Name	Restoration Systems	Wetland Site Name	Crane #1
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom
Level III Ecoregion	Southeastern Plains	Nearest Named Water Body	Crane Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030004
County	Lee	NCDWR Region	Raleigh
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.367468, -79.223893

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.

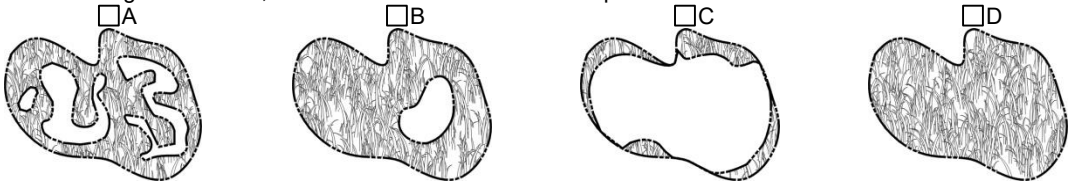
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

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	Crane #1	Date of Assessment	December 17, 2020
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **LOW**

NC WAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Crane Mitigation Site	Date of Evaluation	December 17, 2020
Applicant/Owner Name	Restoration Systems	Wetland Site Name	Crane #2
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom
Level III Ecoregion	Southeastern Plains	Nearest Named Water Body	Crane Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030004
County	Lee	NCDWR Region	Raleigh
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.364544, -79.224269

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.

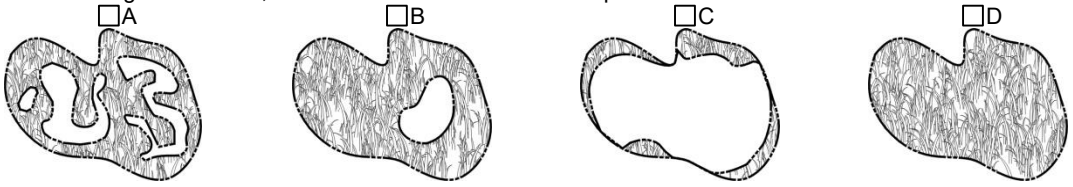
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

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	Crane #2	Date of Assessment	December 17, 2020
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **HIGH**

NC WAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Crane Mitigation Site	Date of Evaluation	December 17, 2020
Applicant/Owner Name	Restoration Systems	Wetland Site Name	Crane #3
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom
Level III Ecoregion	Southeastern Plains	Nearest Named Water Body	Crane Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030004
County	Lee	NCDWR Region	Raleigh
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.367422, -79.220482

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.

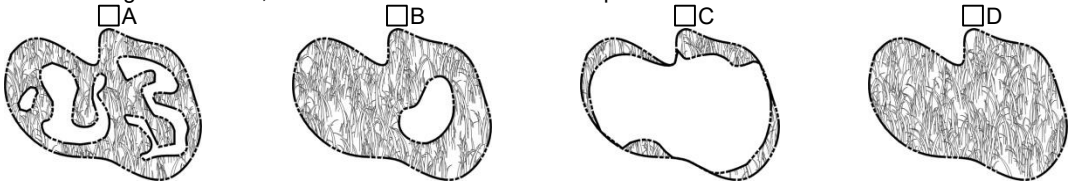
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

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	Crane #3	Date of Assessment	December 17, 2020
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom

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

Function Rating Summary

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

Overall Wetland Rating **LOW**

UT 1 @ woodline

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

NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2020	**Project/Site:** Crone	**Latitude:** 35.368252
Evaluator: AXE WGL	**County:** Lee	**Longitude:** -79.222723
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 31	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** Murchison town *e.g. Quad Name:*

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	(1)	2	3
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	(1)	2	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	(No = 0)		Yes = 3	

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

B. Hydrology (Subtotal = 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 = 11)				
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:

UT 2

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

NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2020	**Project/Site:** Crane	**Latitude:** 35.364001
Evaluator: AXE/WGL	**County:** Lee	**Longitude:** -79.223045
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 26	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** Murchison town *e.g. Quad Name:*

A. Geomorphology (Subtotal = 12.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	(0)	1	2	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	0	1	2	(3)
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	(No = 0)		Yes = 3	

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

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. 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: 12/12/20	**Project/Site:** Cove UT-3	**Latitude:** 35.366865
Evaluator: Jennings / Axiom	**County:** Lee County	**Longitude:** -79.223877
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** Murchison Town *e.g. Quad Name:*

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	0	(1)	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	(0.5)	1	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

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

B. Hydrology (Subtotal = 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 = 7)				
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:

UT 4

NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2020	**Project/Site:** Crane	**Latitude:** 35.365408
Evaluator: AYE / WGL	**County:** Lee	**Longitude:** -79.223259
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 26.5	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** Murchison town *e.g. Quad Name:*

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

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

B. Hydrology (Subtotal = 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 = 10)				
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:

UT 5

NC DWQ Stream Identification Form Version 4.11

Date: 12/25/2021	Project/Site: Crane	Latitude: 35.366687
Evaluator: AXE / WJJ	County: Lee	Longitude: -79.222057
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 29.5	Stream Determination (circle one) Ephemeral (Intermittent) Perennial	Other Murchison Town *e.g. Quad Name:*

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

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

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. 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:

Site		Crane Stream Mitigation Site						
Stream		UT 1 (right bank)			Bank Length		2410	
Observers		KJ			Date		8-Aug-18	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	625	right	Low	Low	0	625	1	0.0
2	1175	right	High	High	0.2	550	3	330.0
3	1220	right	Low	Low	0	45	1	0.0
4	1235	right	Mod	Mod	0.05	15	2	1.5
5	1320	right	High	High	0.2	85	3	51.0
6	1355	right	High	High	0.2	35	4	28.0
7	1400	right	High	High	0.2	45	3	27.0
8	1700	right	High	High	0.2	300	4	240.0
9	1790	right	High	High	0.2	90	2.5	45.0
10	1845	right	Mod	Mod	0.05	55	2.5	6.9
11	1925	right	Low	Low	0	80	1.5	0.0
12	2150	right	High	High	0.2	225	3	135.0
13	2190	right	Mod	Low	0.02	40	2	1.6
14	2410	right	Low	Low	0	220	1	0.0
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		866.0
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		32.1
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		41.7
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.017

Site		Crane Stream Mitigation Site						
Stream		UT 1 (left bank)			Bank Length		2410	
Observers		KJ			Date		8-Aug-18	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	625	left	Low	Low	0	625	1	0.0
2	1175	left	High	High	0.2	550	3	330.0
3	1220	left	Low	Low	0	45	1	0.0
4	1235	left	Mod	Mod	0.05	15	2	1.5
5	1320	left	High	High	0.2	85	3	51.0
6	1355	left	High	High	0.2	35	4	28.0
7	1400	left	High	High	0.2	45	3	27.0
8	1700	left	High	High	0.2	300	4	240.0
9	1790	left	High	High	0.2	90	2.5	45.0
10	1845	left	Mod	Mod	0.05	55	2.5	6.9
11	1925	left	Low	Low	0	80	1.5	0.0
12	2150	left	High	High	0.2	225	3	135.0
13	2190	left	Mod	Low	0.02	40	2	1.6
14	2410	left	Low	Low	0	220	1	0.0
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		866.0
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		32.1
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		41.7
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.017

Site		Crane Stream Mitigation Site						
Stream		UT 2			Bank Length		1070	
Observers		WGL			Date		8-Aug-18	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	75	left	Low	Low	0	75	0.4	0.0
2	185	left	Mod	Mod	0.05	110	1	5.5
3	235	left	High	High	0.2	50	2	20.0
4	425	left	High	High	0.2	190	2.5	95.0
5	535	left	Low	Low	0	110	1	0.0
6								
7								
8								
9	75	right	Low	Low	0	75	0.4	0.0
10	185	right	Mod	Mod	0.05	110	1	5.5
11	235	right	High	High	0.2	50	2	20.0
12	425	right	High	High	0.2	190	2.5	95.0
13	535	right	Low	Low	0	110	1	0.0
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		241.0
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		8.9
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		11.6
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.011

Site		Crane Stream Mitigation Site						
Stream		UT 3			Bank Length		650	
Observers		KJ			Date		8-Aug-18	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	85	left	High	Low	0.1	85	4	34.0
2	265	left	Mod	Low	0.02	180	3	10.8
3	325	left	Low	Low	0	60	2	0.0
4								
5	85	right	High	Low	0.1	85	4	34.0
6	265	right	Mod	Low	0.02	180	3	10.8
7	325	right	Low	Low	0	60	2	0.0
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		89.6
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		3.3
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		4.3
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.007

Site		Crane Stream Mitigation Site						
Stream		UT 4			Bank Length		1610	
Observers		KJ			Date		8-Aug-18	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	185	left	High	Low	0.1	185	3	55.5
2	275	left	Mod	Low	0.02	90	2	3.6
3	315	left	High	Low	0.02	40	2	1.6
4	805	left	Low	Low	0	490	1	0.0
5								
6	185	right	High	Low	0.1	185	3	55.5
7	275	right	Mod	Low	0.02	90	2	3.6
8	315	right	High	Low	0.1	40	2	8.0
9	805	right	Low	Low	0	490	1	0.0
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		127.8
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		4.7
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		6.2
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.004

Site		Crane Stream Mitigation Site						
Stream		UT 5			Bank Length		616	
Observers		KJ			Date		8-Aug-18	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	74	left	Mod	Mod	0.05	74	2	7.4
2	308	left	High	High	0.2	234	3	140.4
3								
4								
5								
6	74	right	Mod	Mod	0.05	74	2	7.4
7	308	right	High	High	0.2	234	3	140.4
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)		295.6
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		10.9
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		14.2
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.023

BEHI/NBS Summary

Stream Reach	Erosion Rate (tons/year)
UT 1	83.39
UT 2	11.60
UT 3	4.31
UT 4	6.15
UT 5	14.23
Total	**119.7**

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

SOIL BORING LOG

Date: 1/28/2020

Project/Site: Crane Mitigation Site

County, State: Lee County, NC

Sampling Point/ Coordinates: **Soil Profile A (35.36606, -79.22333)**

Investigator: W. Grant Lewis

Soil Series: Wehadkee Variant

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-4	10 YR 2/1	100					sandy loam
4-15+	10 YR 2/1	99	10 YR 4/6	1	C	PL	clay loam

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

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Date: 1/28/2020

Project/Site: Crane Mitigation Site

County, State: Lee County, NC

Sampling Point/ Coordinates: **Soil Profile B (35.36657, -79.22229)**

Investigator: W. Grant Lewis

Soil Series: Wehadkee Variant

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-8	10 YR 2/1	98	5 YR 3/4	5	C	M	sandy loam
8-15+	10 YR 3/1	95	2.5 Y 3/2	5	D	M	clay loam

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

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Date: 1/28/2020

Project/Site: Crane Mitigation Site

County, State: Lee County, NC

Sampling Point/ Coordinates: **Soil Profile C (35.36684, -79.22311)**

Investigator: W. Grant Lewis

Soil Series: Wehadkee Variant

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-6	10 YR 2/1	98	7.5 YR 4/6	2	C	PL	sandy loam
6-15+	2.5 Y 6/2	85	10 YR 4/6	5	C	M	sand
			10 YR 5/1	10	D	M	

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

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Date: 1/28/2020

Project/Site: Crane Mitigation Site

County, State: Lee County, NC

Sampling Point/ Coordinates: **Soil Profile D (35.36674, -79.22365)**

Investigator: W. Grant Lewis

Soil Series: Wehadkee Variant

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-3	10 YR 2/1	90	7.5 YR 4/6	5	C	PL	sandy loam
			10 YR 5/1	5	D	M	
3-9	10 YR 3/1	85	7.5 YR 4/6	15	C	PL	clay loam
9-15+	10 YR 3/1	80	7.5 YR 4/6	5	C	PL	sandy clay loam
			10 YR 5/2	15	D	M	

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

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Date: 8/8/2018

Project/Site: Crane Creek Mitigation Site

County, State: Lee County, NC

Sampling Point/
Coordinates: Soil Profile # E (35.364325, -79.224043)

Investigator: W. Grant Lewis

Soil Series: Wehadkee

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-4	10 YR 2/1	90	10 YR 3/4	10	sandy loam
4-7	10 YR 4/1	85	10 YR 5/8	10	sandy clay loam
			10 YR 3/6	5	
7-12+	10 YR 6/1	80	10 YR 6/8	10	sandy clay loam
			10 YR 4/6	5	

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

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

SOIL BORING LOG

Date: 8/8/2018

Project/Site: Crane Creek Mitigation Site

County, State: Lee County, NC

Sampling Point/
Coordinates: Soil Profile # F (35.367764, -79.222953)

Investigator: W. Grant Lewis

Soil Series: Gilead Loam

Notes: Location is shown on Figure 4.

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

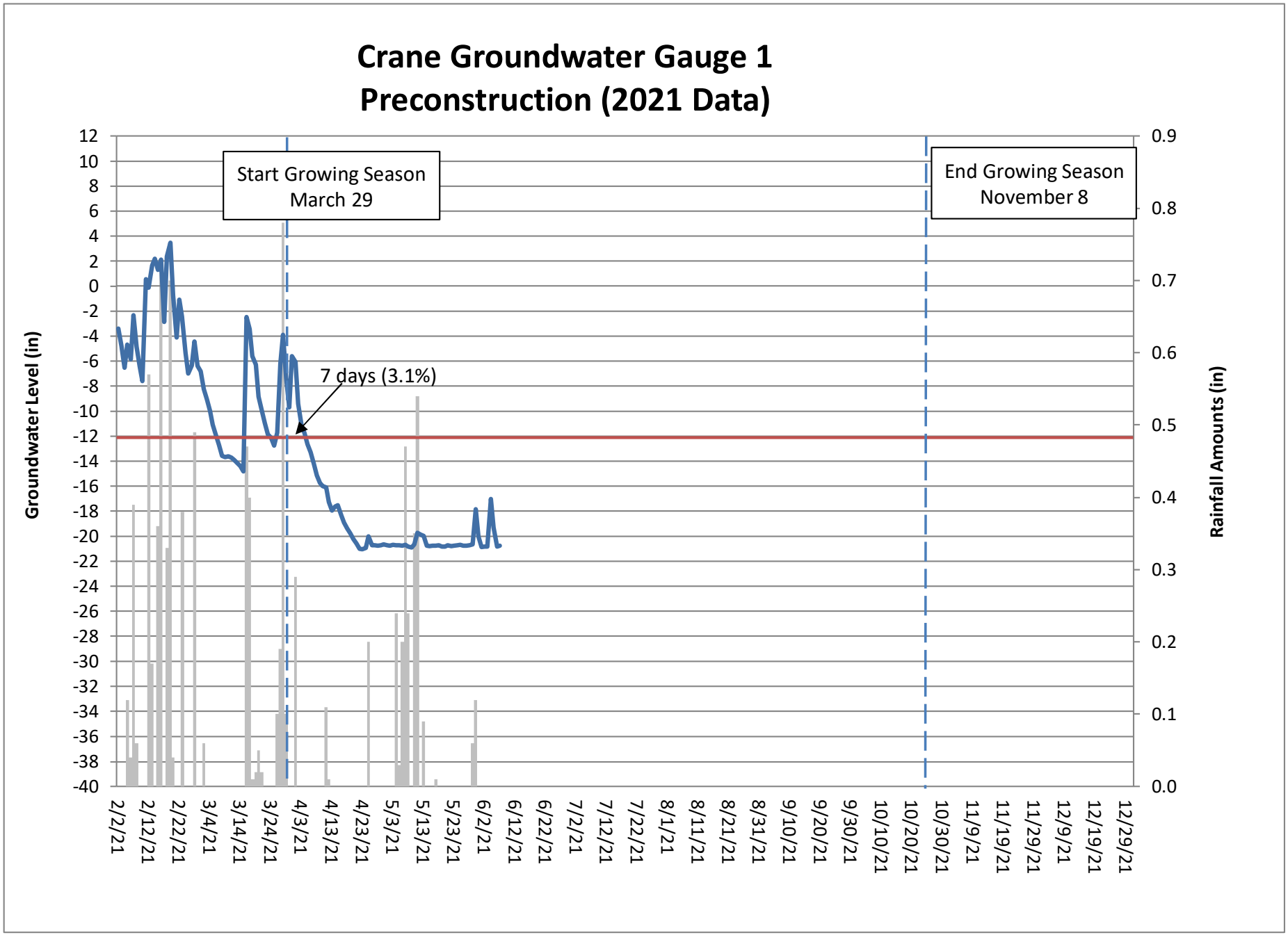
North Carolina Licensed Soil Scientist

Number: 1233

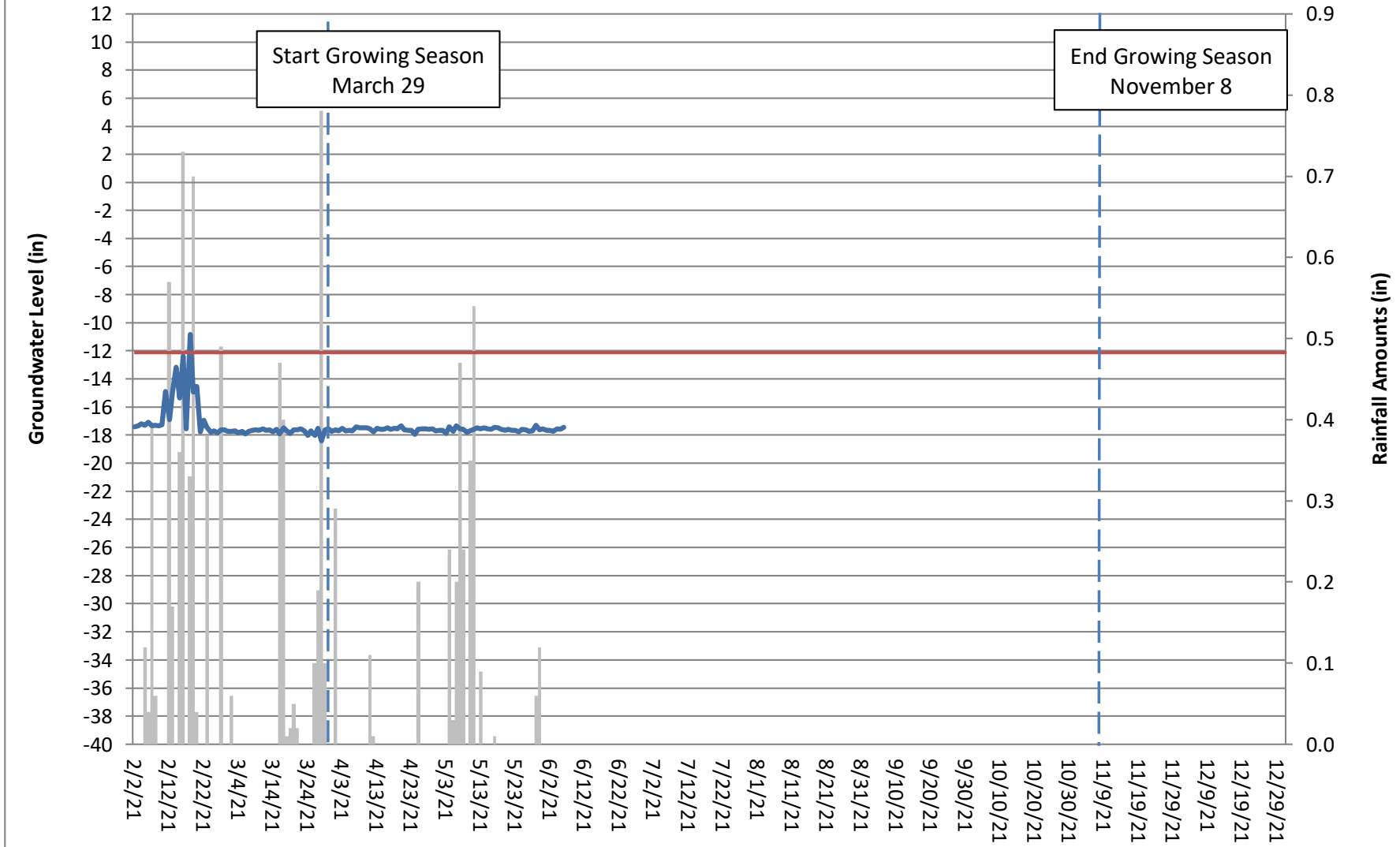
Signature: W Grant Lewis

Name/Print: W. Grant Lewis

Crane Groundwater Gauge 1
Preconstruction (2021 Data)



Crane Groundwater Gauge 2
Preconstruction (2021 Data)



Crane Groundwater Gauge 3
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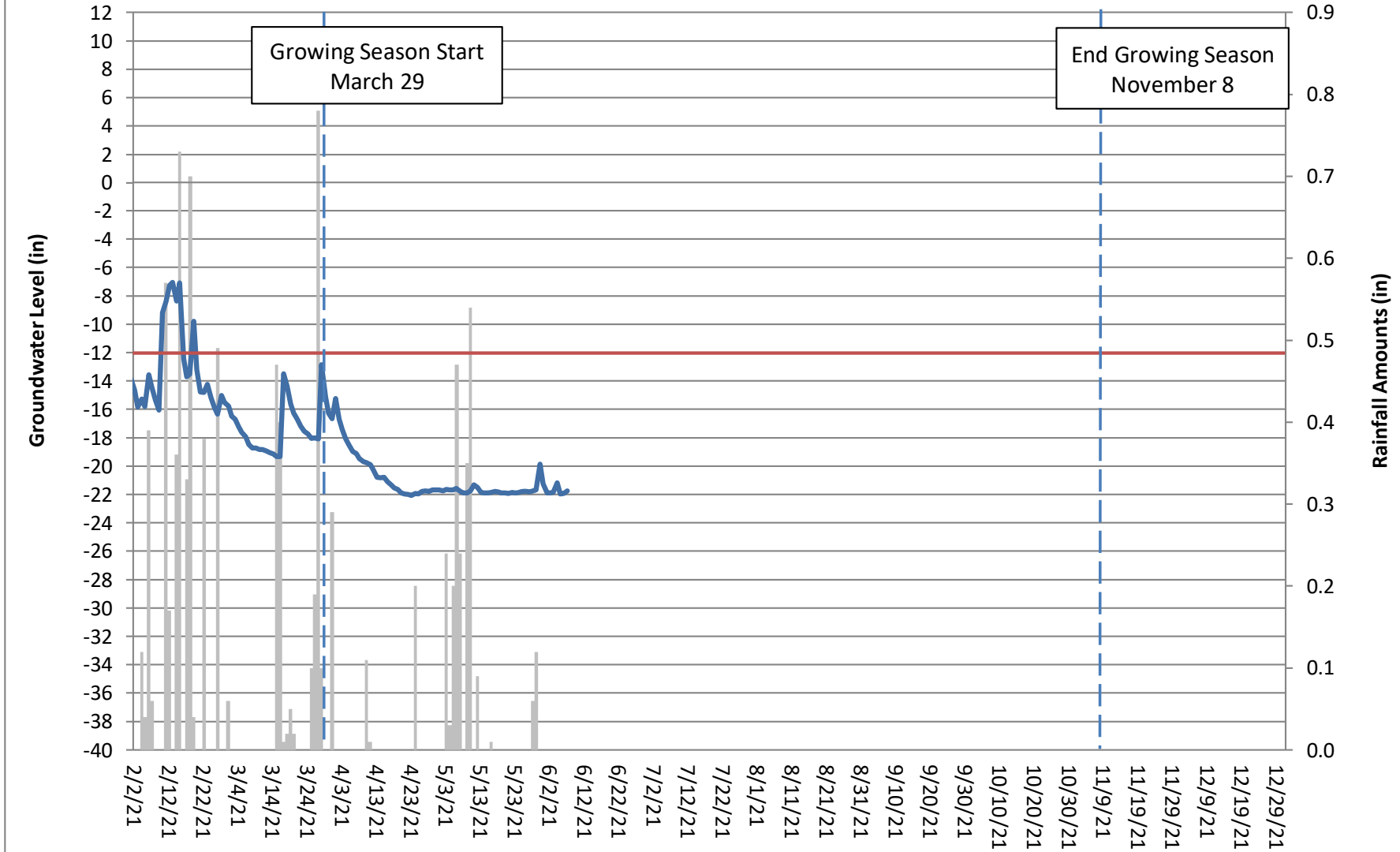
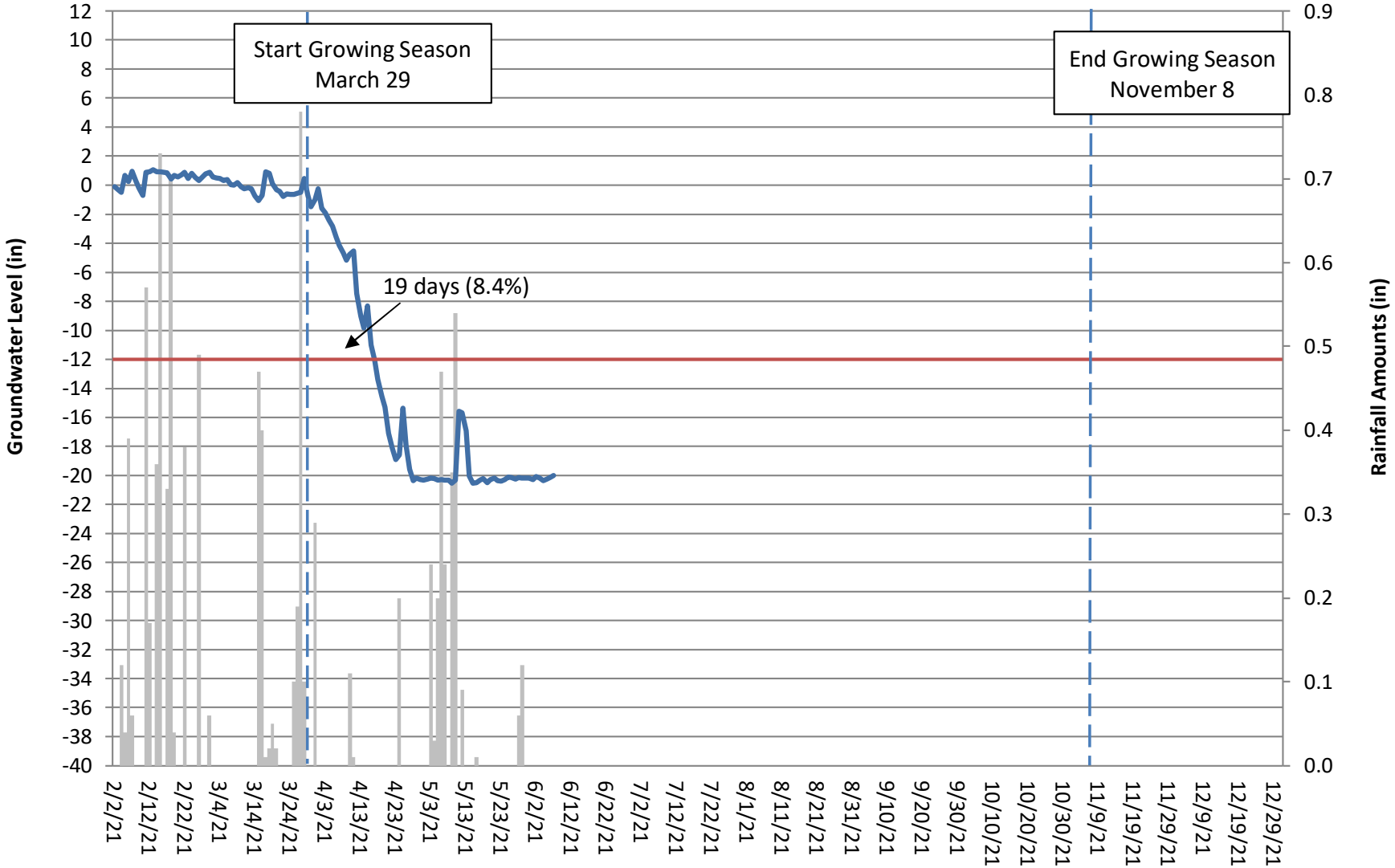
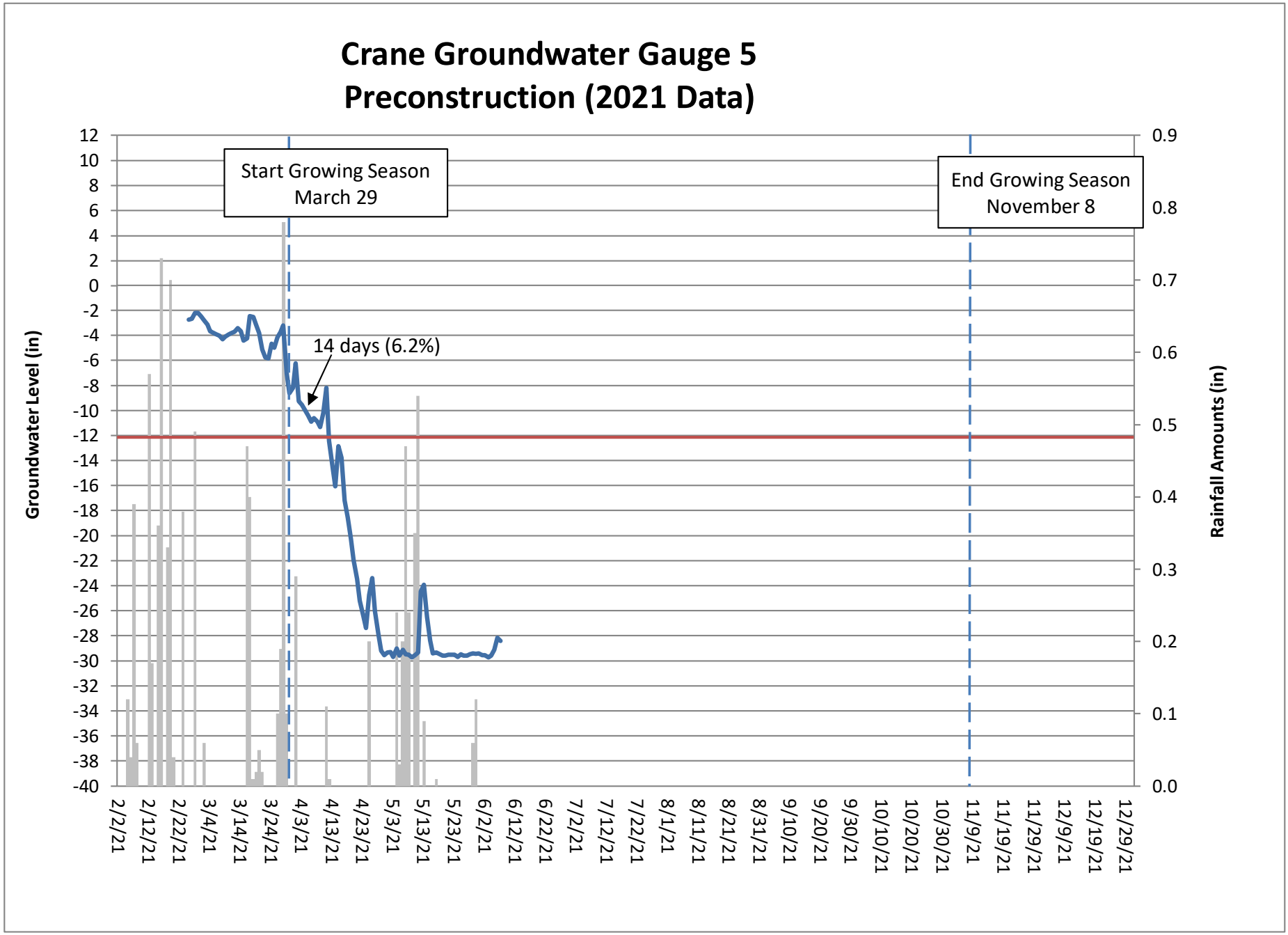


Crane Groundwater Gauge 4
Preconstruction (2021 Data)




Crane Groundwater Gauge 5
Preconstruction (2021 Data)
Start Growing Season
March 29
End Growing Season
November 8
14 days (6.2%)
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
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2/2/21
2/12/21
2/22/21
3/4/21
3/14/21
3/24/21
4/3/21
4/13/21
4/23/21
5/3/21
5/13/21
5/23/21
6/2/21
6/12/21
6/22/21
7/2/21
7/12/21
7/22/21
8/1/21
8/11/21
8/21/21
8/31/21
9/10/21
9/20/21
9/30/21
10/10/21
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11/29/21
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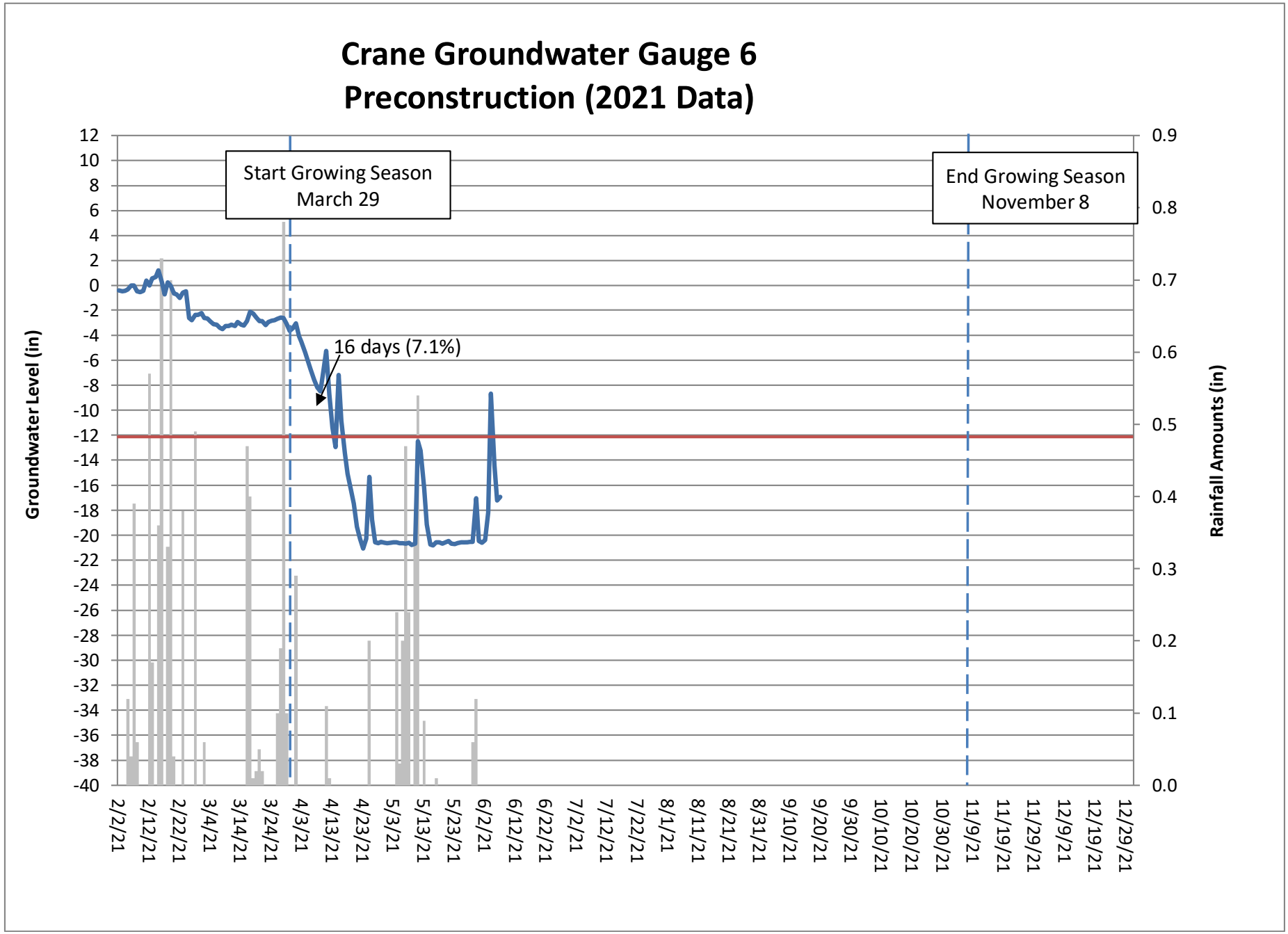
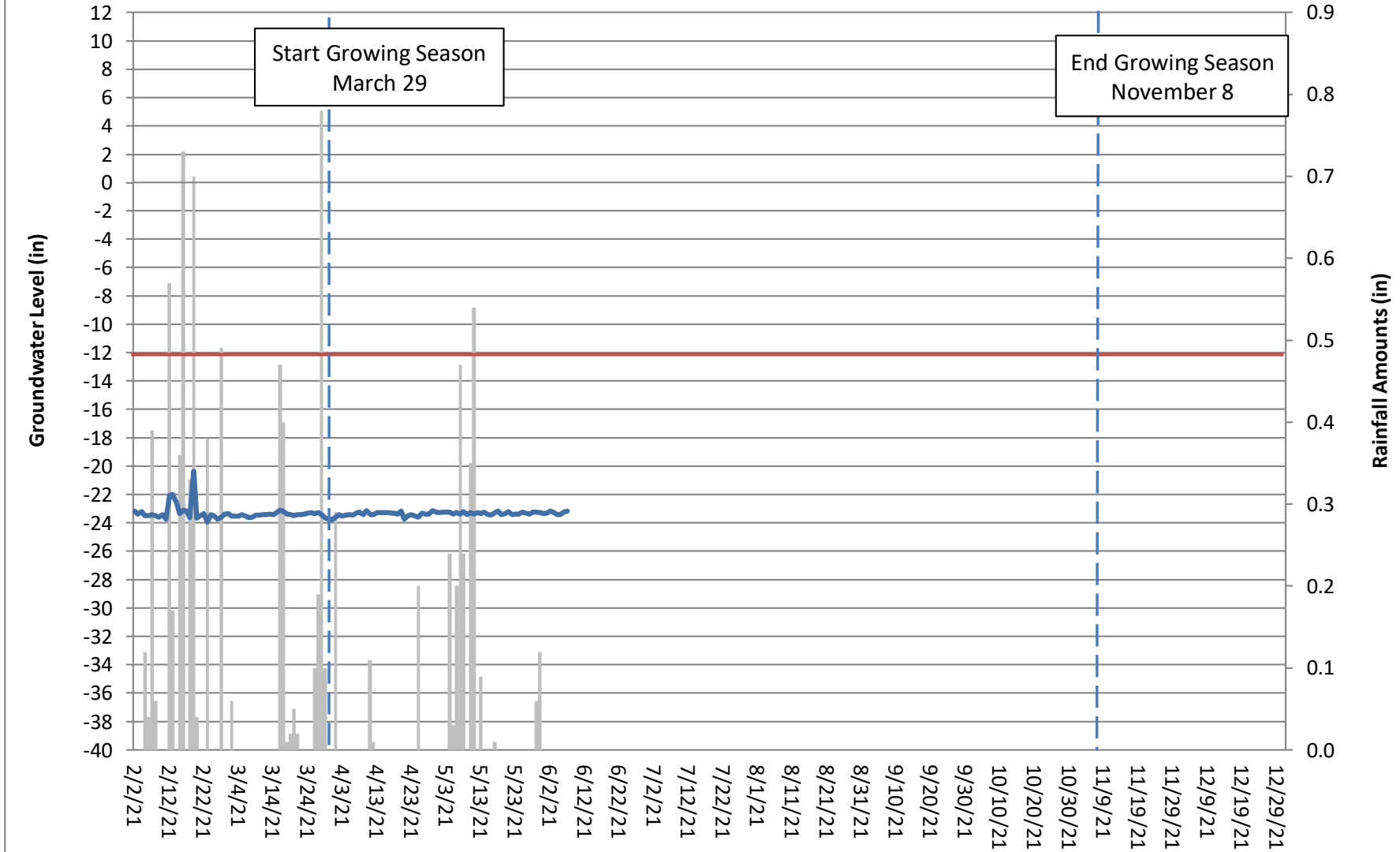
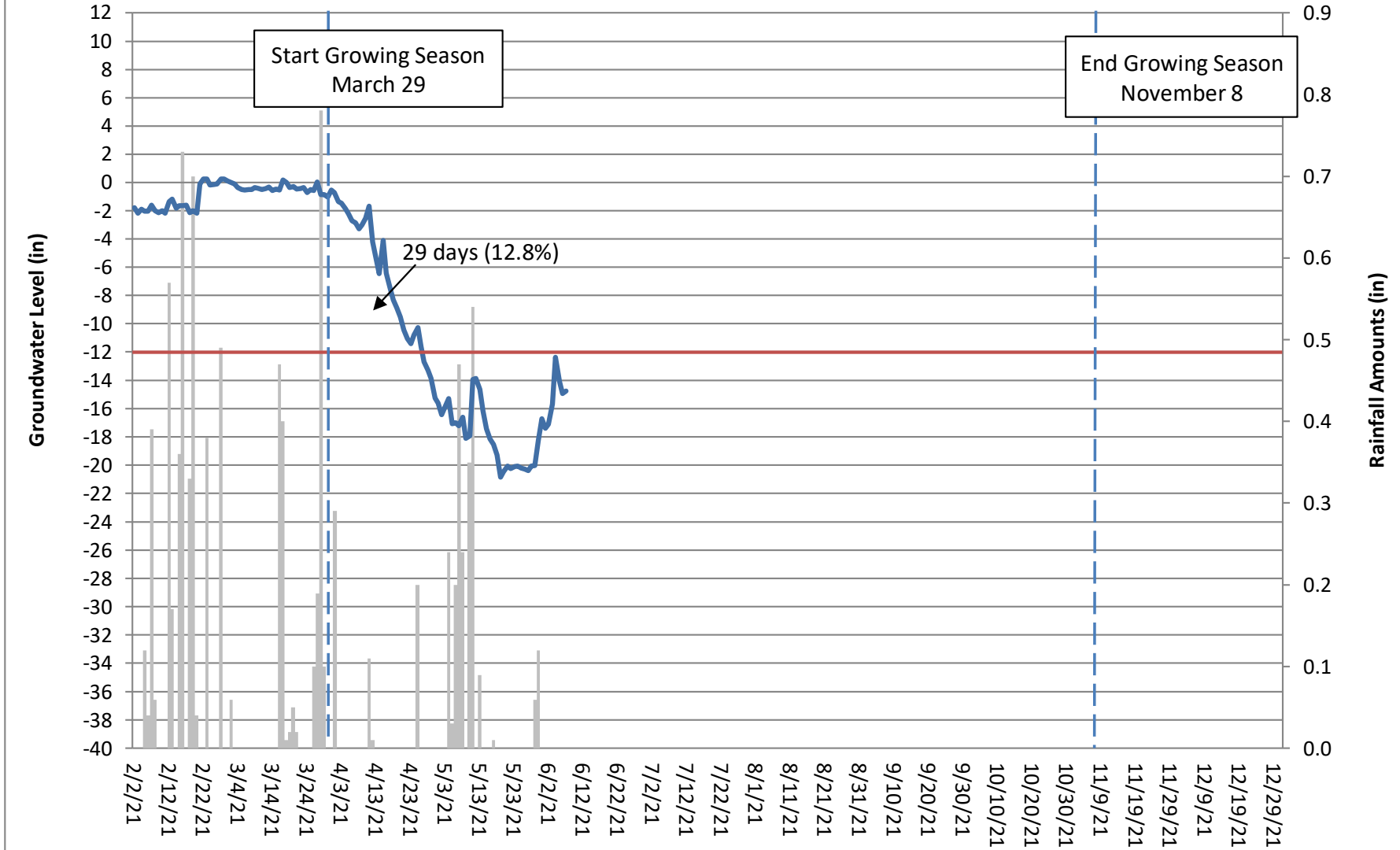
12/19/21
12/29/21


Crane Groundwater Gauge 6
Preconstruction (2021 Data)
Start Growing Season
March 29
End Growing Season
November 8
16 days (7.1%)
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
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2/2/21
2/12/21
2/22/21
3/4/21
3/14/21
3/24/21
4/3/21
4/13/21
4/23/21
5/3/21
5/13/21
5/23/21
6/2/21
6/12/21
6/22/21
7/2/21
7/12/21
7/22/21
8/1/21
8/11/21
8/21/21
8/31/21
9/10/21
9/20/21
9/30/21
10/10/21
10/20/21
10/30/21
11/9/21
11/19/21
11/29/21
12/9/21
12/19/21
12/29/21

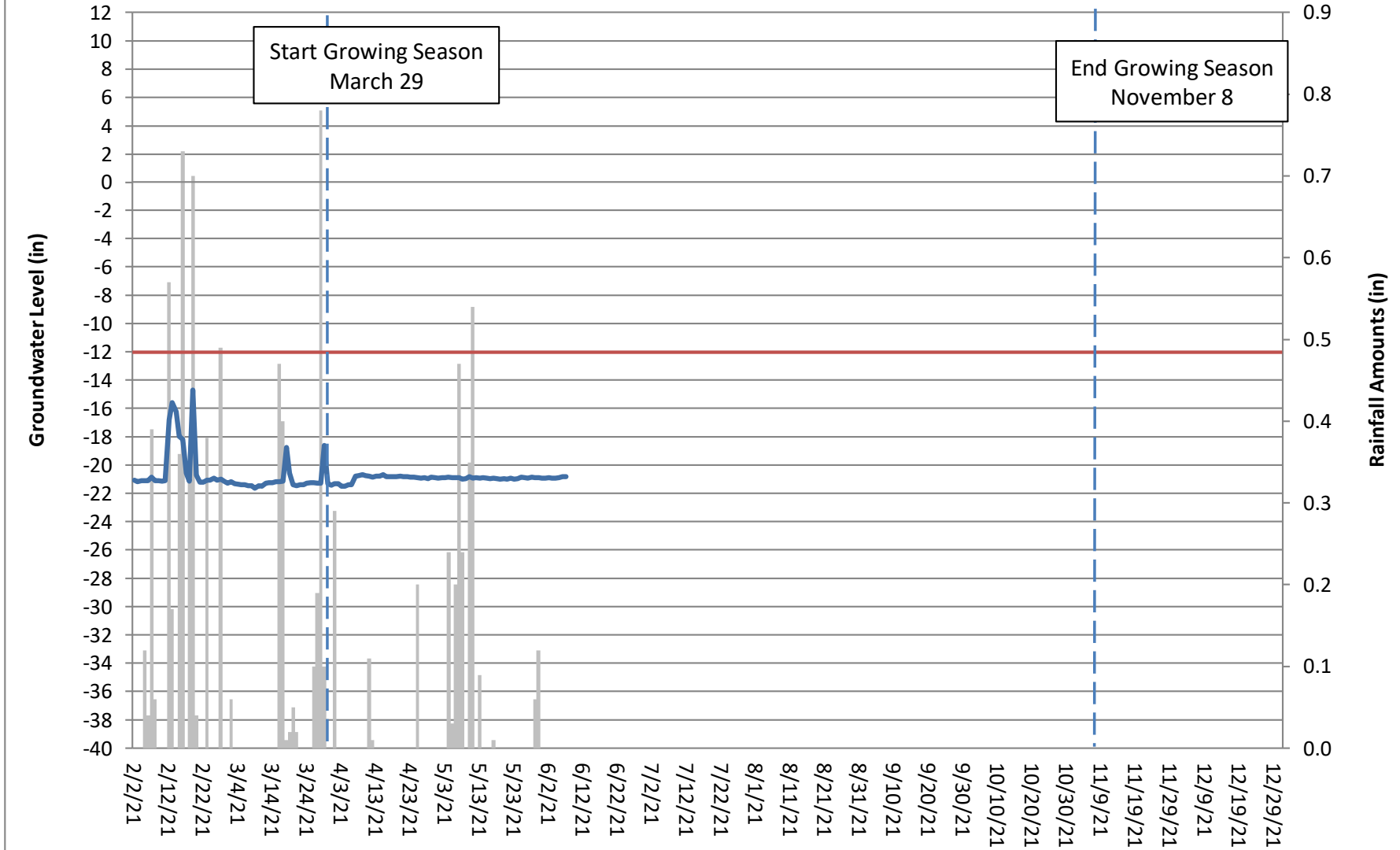
Crane Groundwater Gauge 7
Preconstruction (2021 Data)

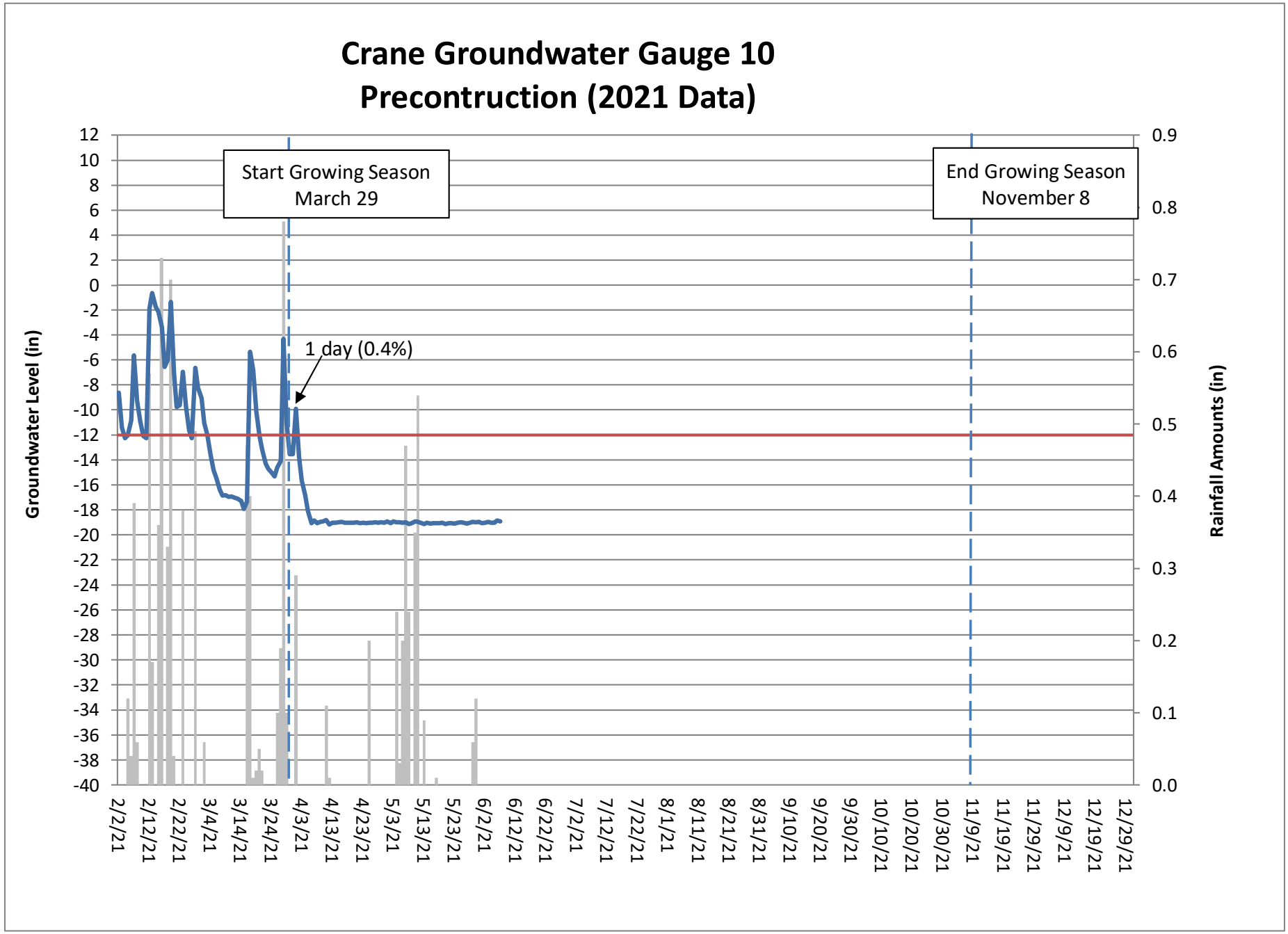


Crane Groundwater Gauge 8
Preconstruction (2021 Data)

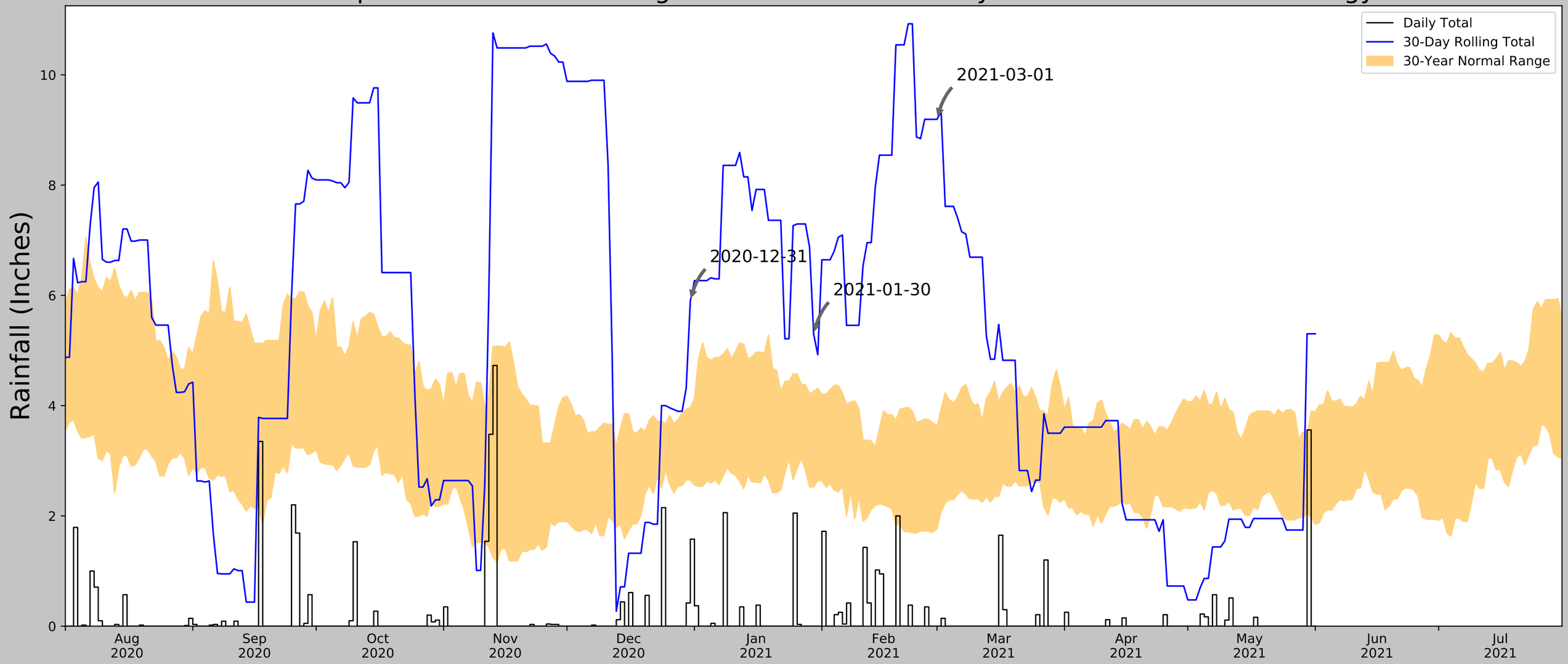


Crane Groundwater Gauge 9
Preconstruction (2021 Data)




Crane Groundwater Gauge 10
Precontruction (2021 Data)
Start Growing Season
March 29
End Growing Season
November 8
1 day (0.4%)
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
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2/2/21
2/12/21
2/22/21
3/4/21
3/14/21
3/24/21
4/3/21
4/13/21
4/23/21
5/3/21
5/13/21
5/23/21
6/2/21
6/12/21
6/22/21
7/2/21
7/12/21
7/22/21
8/1/21
8/11/21
8/21/21
8/31/21
9/10/21
9/20/21
9/30/21
10/10/21
10/20/21
10/30/21
11/9/21
11/19/21
11/29/21
12/9/21
12/19/21
12/29/21

Antecedent Precipitation vs Normal Range based on NOAA's Daily Global Historical Climatology Network



Coordinates	35.3666, -79.2229
Observation Date	2021-03-01
Elevation (ft)	407.1
Drought Index (PDSI)	Severe wetness
WebWIMP H_2O Balance	Wet Season

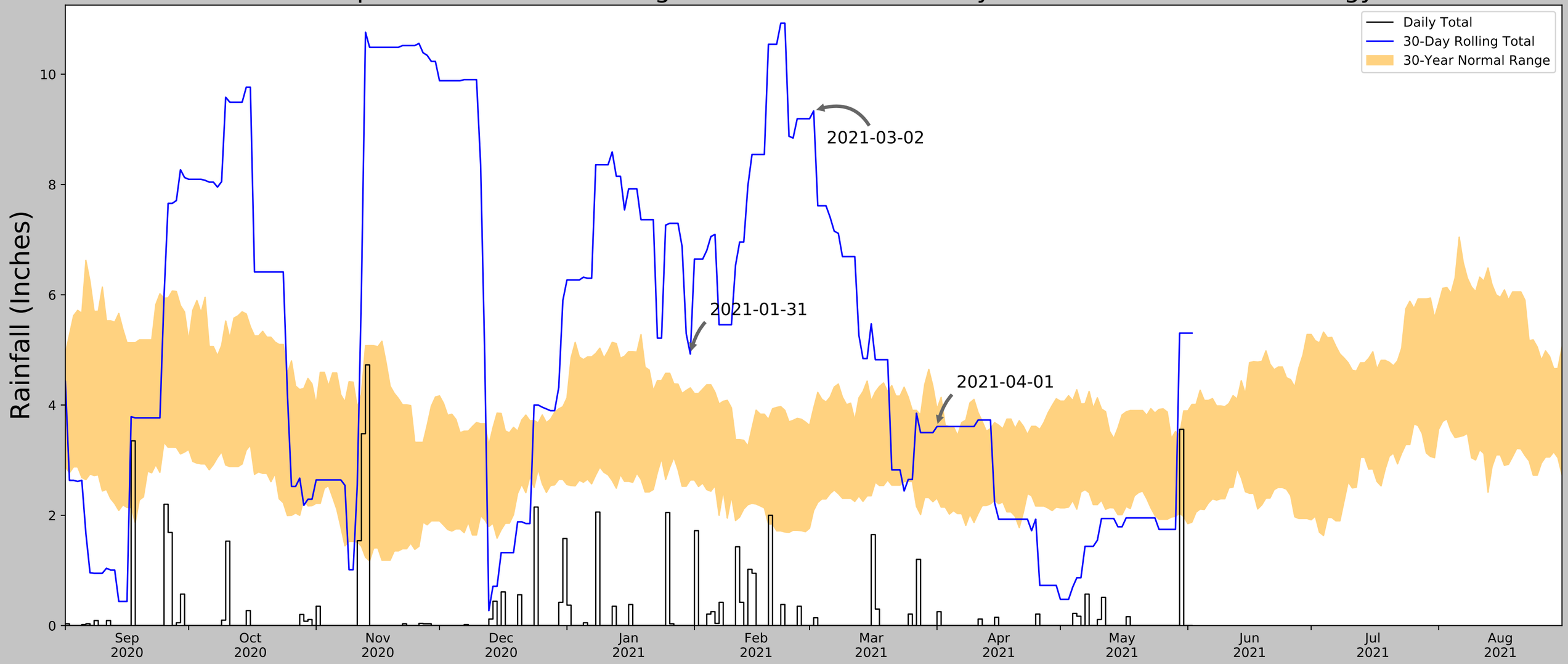
30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2021-03-01	1.765748	3.630709	9.192914	Wet	3	3	9
2021-01-30	2.526378	4.264567	5.295276	Wet	3	2	6
2020-12-31	2.651181	3.969685	5.897638	Wet	3	1	3
Result							Wetter than Normal - 18

Figure and tables made by the
Antecedent Precipitation Tool
Version 1.0

Written by Jason Deters
U.S. Army Corps of Engineers

Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days (Normal)	Days (Antecedent)
CARTHAGE WTP	35.3319, -79.4067	439.961	10.632	32.861	5.134	9818	71
SANFORD 6.6 S	35.3831, -79.1632	396.982	3.551	10.118	1.634	1141	18
SANFORD 2.9 SW	35.445, -79.2134	491.142	5.443	84.042	2.907	1	0
CAMERON 7.6 E	35.3287, -79.1163	277.887	6.554	129.213	3.796	47	1
SWANN	35.3953, -79.09	350.066	7.745	57.034	3.927	106	0
WHISPERING PINES 2.1 NE	35.2795, -79.3567	395.997	9.649	11.103	4.449	3	0
SANFORD 2.2 NW	35.4989, -79.2105	319.882	9.168	87.218	4.925	1	0
WHISPERING PINES 1.3 SW	35.2421, -79.3966	435.039	13.036	27.939	6.23	36	0
SANFORD 8 NE	35.5356, -79.0475	262.139	15.291	144.961	9.097	200	0

Antecedent Precipitation vs Normal Range based on NOAA's Daily Global Historical Climatology Network



Coordinates	35.3666, -79.2229
Observation Date	2021-04-01
Elevation (ft)	407.1
Drought Index (PDSI)	Moderate wetness
WebWIMP H_2O Balance	Wet Season

30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2021-04-01	2.312598	3.926772	3.610236	Normal	2	3	6
2021-03-02	2.086614	3.946457	9.334646	Wet	3	2	6
2021-01-31	2.640551	4.311417	4.925197	Wet	3	1	3
Result							Wetter than Normal - 15

Figure and tables made by the
Antecedent Precipitation Tool
Version 1.0

Written by Jason Deters
U.S. Army Corps of Engineers

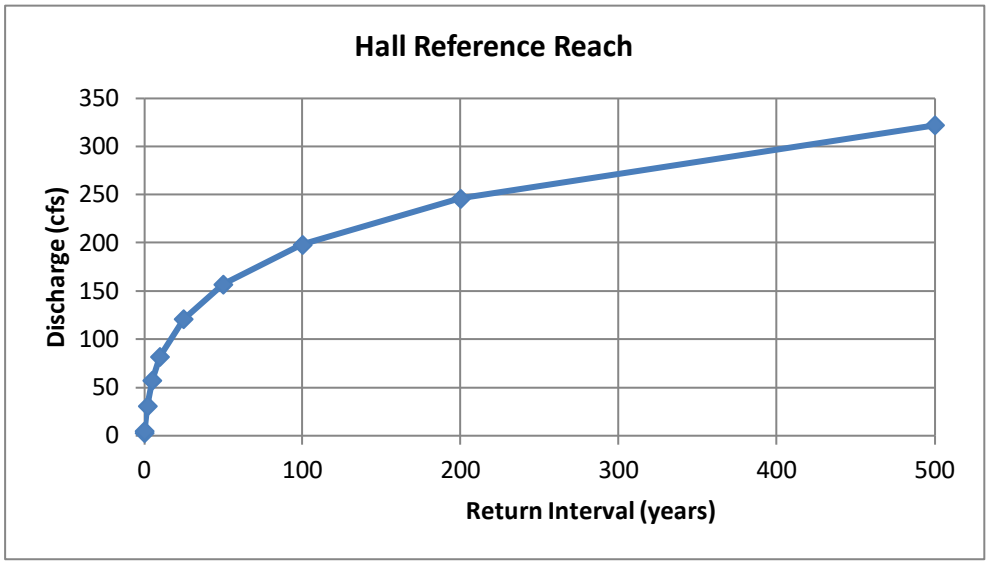
Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days (Normal)	Days (Antecedent)
CARTHAGE WTP	35.3319, -79.4067	439.961	10.632	32.861	5.134	9818	71
SANFORD 6.6 S	35.3831, -79.1632	396.982	3.551	10.118	1.634	1141	19
SANFORD 2.9 SW	35.445, -79.2134	491.142	5.443	84.042	2.907	1	0
CAMERON 7.6 E	35.3287, -79.1163	277.887	6.554	129.213	3.796	47	0
SWANN	35.3953, -79.09	350.066	7.745	57.034	3.927	106	0
WHISPERING PINES 2.1 NE	35.2795, -79.3567	395.997	9.649	11.103	4.449	3	0
SANFORD 2.2 NW	35.4989, -79.2105	319.882	9.168	87.218	4.925	1	0
WHISPERING PINES 1.3 SW	35.2421, -79.3966	435.039	13.036	27.939	6.23	36	0
SANFORD 8 NE	35.5356, -79.0475	262.139	15.291	144.961	9.097	200	0

APPENDIX C. FLOOD FREQUENCY ANALYSIS DATA

Reference Reaches
Flood Frequency Analaysis-Regional Regression Equation (USGS 2011)

Hall Reference Reach

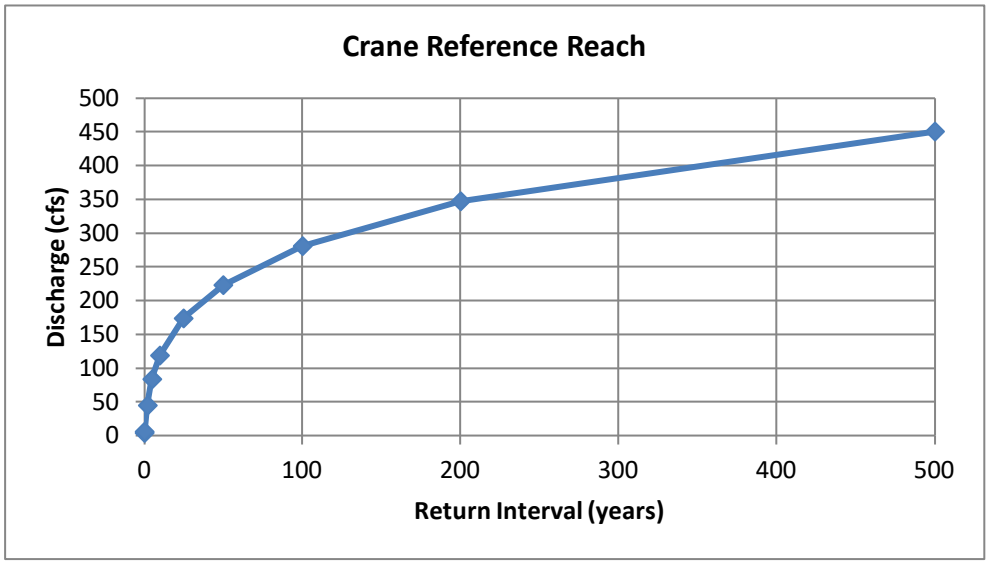
Return Interval (years)	Discharge (cfs)
0.1	**3**
0.3	**5**
2	30.5
5	57.6
10	82.1
25	121
50	157
100	198
200	246
500	322



Note: Bold values are interpolated.

Crane Reference Reach

Return Interval (years)	Discharge (cfs)
0.1	**4**
0.3	**6**
2	45.1
5	84.1
10	119
25	174
50	223
100	281
200	347
500	451



APPENDIX D. JURISDICTIONAL DETERMINATION INFO

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2020-01401** County: **Lee** U.S.G.S. Quad: **NC- Murchisontown**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Requestor:	**Axiom Environmental**
	Grant Lewis
Address:	**218 Snow Ave**
	Raleigh, NC 27603
Telephone Number:	**919-215-1693**
E-mail:	**glewis@axiomenvironmental.org**

Size (acres)	**28**	Nearest Town	**Sanford**
Nearest Waterway	**Little Crane Creek**	River Basin	**Cape Fear**
USGS HUC	**03030004**	Coordinates	Latitude: **35.3666**
			Longitude: **-79.2229**

Location description: **The project site is approximately 28 acres located adjacent to Rocky Fork Church Road, near the town of Sanford, Lee County, North Carolina.**

Indicate Which of the Following Apply:

A. Preliminary Determination

☒ There appear to be **waters, including wetlands** on the above described project area/property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). The **waters, including wetlands** have been delineated, and the delineation has been verified by the Corps to be sufficiently accurate and reliable. The approximate boundaries of these waters are shown on the enclosed delineation map dated **2/25/2021**. Therefore this preliminary jurisdiction determination may be used in the permit evaluation process, including determining compensatory mitigation. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.

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

B. Approved Determination

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

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

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

☐The **waters, including wetlands** on your project area/property have been delineated and the delineation has been verified by the Corps. The approximate boundaries of these waters are shown on the enclosed delineation map dated **DATE**. We strongly suggest you have this delineation surveyed. Upon completion, this survey should be reviewed and verified by the Corps. Once

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

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

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

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

Placement of dredged or fill material within waters of the US, including wetlands, without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). Placement of dredged or fill material, construction or placement of structures, or work within navigable waters of the United States without a Department of the Army permit may constitute a violation of Sections 9 and/or 10 of the Rivers and Harbors Act (33 USC § 401 and/or 403). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **James Lastinger at 919-554-4884 ext 32 or James.C.Lastinger@usace.army.mil**.

C. Basis For Determination: Basis For Determination: See the preliminary jurisdictional determination form dated 03/02/2021.

D. Remarks: None.

E. Attention USDA Program Participants

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

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

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

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

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

Corps Regulatory Official: James Lastinger

Date of JD: **03/02/2021** Expiration Date of JD: **Not applicable**

SAW-2020-01401

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete the Customer Satisfaction Survey located at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0

Copy furnished:

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **Axiom Environmental**, **Grant Lewis**	File Number: **SAW-2020-01401**	Date: **03/02/2021**

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

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at or http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or the Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the district engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact: **District Engineer, Wilmington Regulatory Division** **Attn: James Lastinger** **Raleigh Regulatory Office** **U.S Army Corps of Engineers** **3331 Heritage Trade Drive, Suite 105** **Wake Forest, North Carolina 27587**	If you only have questions regarding the appeal process you may also contact: Mr. Phillip Shannin, Administrative Appeal Review Officer CESAD-PDO U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 10M15 Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

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

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

For appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, **Attn: James Lastinger , 69 Darlington Avenue, Wilmington, North Carolina 28403**

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

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

PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: 03/02/2021

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Axiom Environmental, Grant Lewis, 218 Snow Ave, Raleigh, NC 27603

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Wilmington District, Crane Stream and Wetland Mitigation site, SAW-2020-01401

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION: The project site is approximately 28 acres located adjacent to Rocky Fork Church Road, near the town of Sanford, Lee County, North Carolina.

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

State: NC County: Lee City: Sanford
Center coordinates of site (lat/long in degree decimal format): Latitude: 35.3666 Longitude: -79.2229

Universal Transverse Mercator:

Name of nearest waterbody: Little Crane Creek

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

☐Office (Desk) Determination. Date:

☒Field Determination. Date(s): February 25, 2021

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

Site Number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resources in review area (acreage and linear feet, if applicable	Type of aquatic resources (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
UT-1	35.36723200	-79.22294300	2170 LF	Non wetland	Section 404
UT-2	35.36409200	-79.22369700	489 LF	Non wetland	Section 404
UT-3	35.36641400	-79.22387800	345 LF	Non wetland	Section 404
UT-4	35.36527100	-79.22382100	373 LF	Non wetland	Section 404
UT-5	35.36670300	-79.22237800	319 LF	Non wetland	Section 404
Wetland GA	35.36453800	-79.22432900	0.356 acre	Wetland	Section 404
Wetland GE	35.36624000	-79.22421200	0.031 acre	Wetland	Section 404
Wetland GD	35.36712000	-79.22414600	0.018 acre	Wetland	Section 404
Wetland GC	35.36725900	-79.22367000	0.13 acre	Wetland	Section 404
Wetland KX	35.36861500	-79.22288700	0.087 acre	Wetland	Section 404
Wetland KY	35.36712500	-79.22108100	0.757 acre	Wetland	Section 404
Wetland JZ	35.36604100	-79.22317000	14.512 acres	Wetland	Section 404

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

SUPPORTING DATA. Data reviewed for PJD (check all that apply) Checked items are included in the administrative record and are appropriately cited:

☒Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
Map: **attached dated February 2021**

☒Data sheets prepared/submitted by or on behalf of the PJD requestor. Datasheets:

☒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: **Murchisontown**

☒Natural Resources Conservation Service Soil Survey. Citation: **USFWS**

☒National wetlands inventory map(s). Cite name: **Lee County, 1989**

☐State/local wetland inventory map(s):_____

☐FEMA/FIRM maps:

☐100-year Floodplain Elevation is:_____ (National Geodetic Vertical Datum of 1929)

☒Photographs: ☒ Aerial (Name & Date): **2017**

or ☐ Other (Name & Date):

☐Previous determination(s). File no. and date of response letter:_____

☐Other information (please specify):

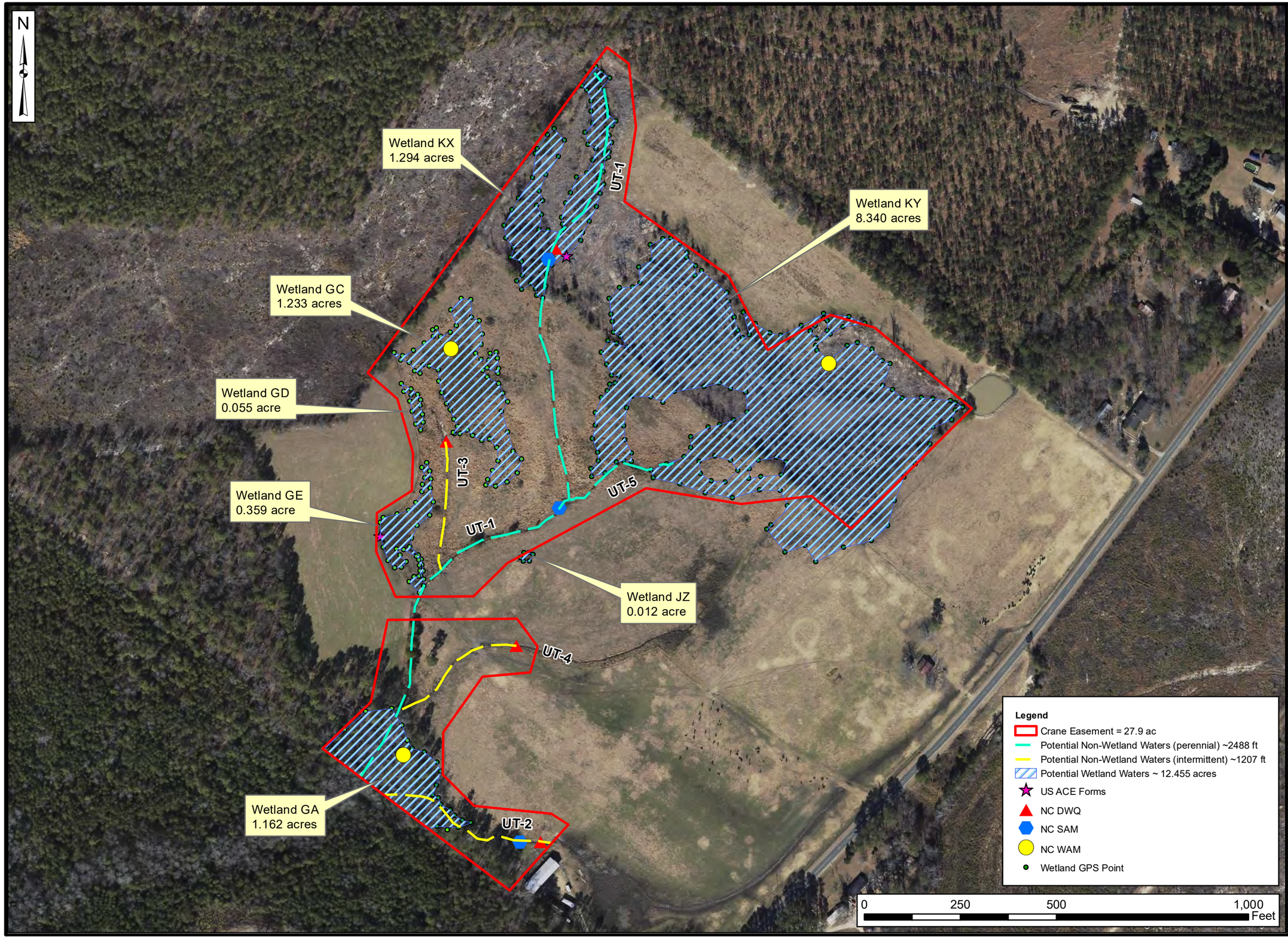
IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

James Lastinger

Signature and date of Regulatory staff member completing PJD
03/02/2021

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

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



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

POTENTIAL WATERS OF THE U.S.

Drawn by: KRJ

Date: FEB 2021

Scale: 1:2800

Project No.: 20-032

FIGURE

3

Preliminary ORM Data Entry Fields for New Actions

ACTION ID #: SAW-

Begin Date (Date Received):

Prepare file folder ☐

Assign Action ID Number in ORM ☐

1. Project Name [PCN Form A2a]: Crane

2. Work Type: ☑ Private ☐ Institutional ☐ Government ☐ Commercial

3. Project Description / Purpose [PCN Form B3d and B3e]:

The Crane Mitigation Site is approximately ~27.9 acres in size. The project is intended to restore/enhance/preserve approximately ~3805 linear feet of stream and ~16.2 acres of wetlands.

4. Property Owner / Applicant [PCN Form A3 or A4]: William E. Cole

5. Agent / Consultant [PNC Form A5 – or ORM Consultant ID Number]:
Worth Creech (Restoration Systems, LLC) / Grant Lewis (Axiom Environmental, Inc)

6. Related Action ID Number(s) [PCN Form B5b]: NA

7. Project Location – Coordinates, Street Address, and/or Location Description [PCN Form B1b]:
The Site is located off Rocky Fork Church Road near Lemon Springs, NC. (35.3666ºN, -79.2229ºW)

8. Project Location – Tax Parcel ID [PCN Form B1a]: 9538-37-3891-00, 9538-38-9217-00

9. Project Location – County [PCN Form A2b]: Lee County

10. Project Location – Nearest Municipality or Town [PCN Form A2c]: Lemon Springs, NC

11. Project Information – Nearest Waterbody [PCN Form B2a]: Little Crane Creek

12. Watershed / 8-Digit Hydrologic Unit Code [PCN Form B2c]: 03030004

Authorization: Section 10 ☐ Section 404 ☑ Section 10 and 404 ☐

Regulatory Action Type:

- ☐ Standard Permit
- ☐ Nationwide Permit #
- ☐ Regional General Permit #
- ☑ Jurisdictional Determination Request
- ☐ Pre-Application Request
- ☐ Unauthorized Activity
- ☐ Compliance
- ☐ No Permit Required

Revised 20150602

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: 5200 Rocky Fork Church Road

City, State: Sanford, NC

County: Lee

Parcel Index Number(s) (PIN): 953837389100, 953837389100, 9

B. REQUESTOR INFORMATION

Name: Grant Lewis - Axiom Environmental, In

Mailing Address: 218 Snow Avenue

Raleigh, NC 27603

Telephone Number: (919) 215-1693

Electronic Mail Address: glewis@axiomenvironmental.org

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: Restoration Systems, LLC

Mailing Address: 1101 Haynes Street, Suite 211

Raleigh, North Carolina 27604

Telephone Number: 919-389-3888

Electronic Mail Address: wcreech@restorationsystems.com

[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.

W. Grant Lewis
Print Name

Capacity: ☐ Owner ☑ Authorized Agent[5]

12/21/2020
Date

W Grant Lewis
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 ~27.9 acres.

☐ The property boundary (or review area boundary) is clearly physically marked on the site.

H. REQUESTS FROM CONSULTANTS

☑ Project Coordinates (Decimal Degrees): Latitude: 35.3666
Longitude: -79.2229

☑ 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)
- [ ] Landscape Photos (if taken)
- [x] 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 USACE 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.

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: 5200 Rocky Fork Church Road

City, State: Sanford, NC

County: Lee County

Parcel Index Number(s) (PIN): 953837389100, 953837389100, 9

B. REQUESTOR INFORMATION

Name: Grant Lewis - Axiom Environmental, Inc

Mailing Address: 218 Snow Avenue

Raleigh, NC 27603

Telephone Number: (919) 215-1693

Electronic Mail Address: glewis@axiomenvironmental.org

Select one:

- [x] I am the current property owner.
- [x] 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: Restoration Systems, LLC

Mailing Address: 1101 Haynes Street, Suite 211

Raleigh, North Carolina 27604

Telephone Number: 919-389-3888

Electronic Mail Address: wcreech@restorationsystems.com

[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.

W. Grant Lewis

Print Name

Capacity: ☐ Owner ☑ Authorized Agent[5]

12/1/2020

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 ~27.9 acres.

☐ The property boundary (or review area boundary) is clearly physically marked on the site.

H. REQUESTS FROM CONSULTANTS

☑ Project Coordinates (Decimal Degrees): Latitude: 35.3666
Longitude: -79.2229

☑ 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)
- [ ] Landscape Photos (if taken)
- [x] 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 USACE 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.

0ATTACHMENT

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD):

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

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
Crane Mitigation Site.

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

State: North Carolina County/parish/borough: Lee County City: Sanford

Center coordinates of site (lat/long in degree decimal format):
Lat 35.3666°N, Long. 79.2229°W

Name of nearest waterbody: Little Crane Creek

Identify (estimate) amount of waters in the review area:
Non-wetland waters: 3377 linear feet: 3-6 width (ft)
Cowardin Class: R3UB2 and R4UB2
Stream Flow: Perennial and Intermittent
Wetlands: 12.455 acres
Cowardin Class: PEM/PSS/PFO
Surface waters: N/A

Name of any water bodies on the site that have been identified as Section 10 waters:
Tidal: 0
Non-Tidal: 0

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

☐ Office (Desk) Determination. Date:
☐ Field Determination. Date(s):

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

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable. This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .

☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

- ☐ Office concurs with data sheets/delineation report.
- ☐ Office does not concur with data sheets/delineation report.

☐ Data sheets prepared by the Corps: .

☐ Corps navigable waters' study: .

☐ U.S. Geological Survey Hydrologic Atlas: .

- ☐ USGS NHD data.
- ☐ USGS 8 and 12 digit HUC maps.

☒ U.S. Geological Survey map(s). Cite scale & quad name: Murchisontown, NC 7.5-minute topographic quadrangle.

☒ USDA Natural Resources Conservation Service Soil Survey. Citation: Web Soil Survey (online at http://websoilsurvey.nrcs.usda.gov), and Soil Survey of Lee County (1989)

☐ National wetlands inventory map(s). Cite name: .

☐ State/Local wetland inventory map(s): .

☐ FEMA/FIRM maps: .

☐ 100-year Floodplain Elevation is: (National Geodetic Vertical Datum of 1929)

☒ Photographs: ☒ Aerial (Name & Date): NC OneMap 2017 Orthoimagery. or ☐ Other (Name & Date): .

☐ Previous determination(s). File no. and date of response letter: .

☐ Other information (please specify): .

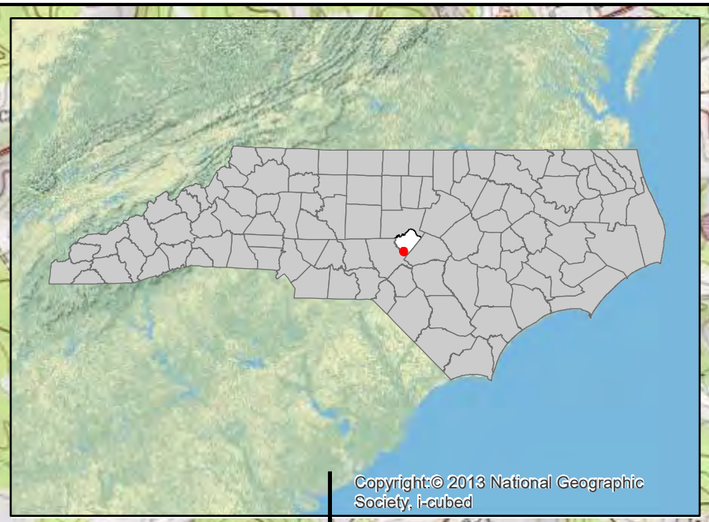
IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

W Grant Jr 12/21/2020

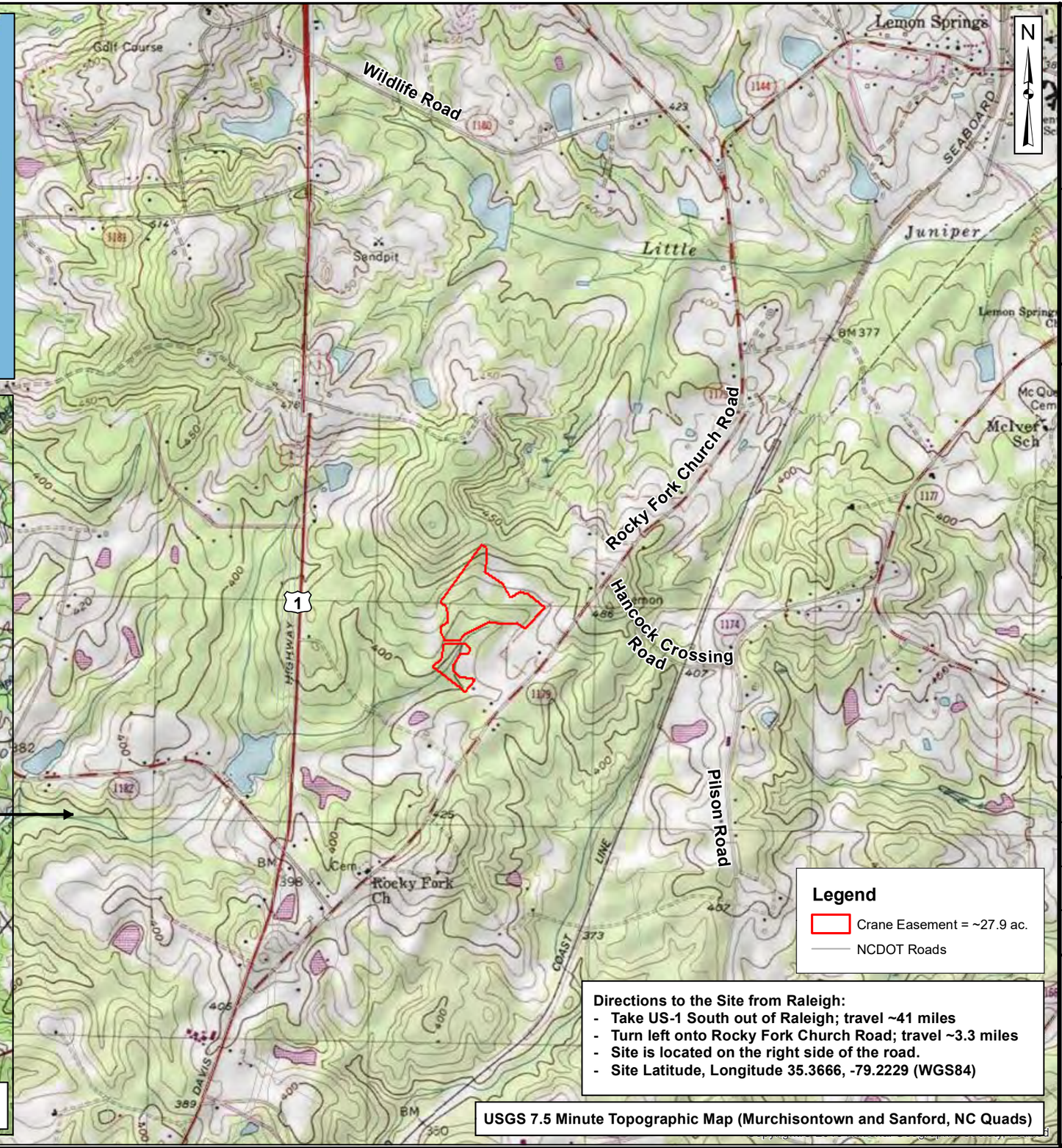
Signature and date of Regulatory Project Manager (REQUIRED)

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

Site number	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resource
1. UT-1	35.367232	-79.222943	R3UB2	2170 feet length, 3-10 feet avg width	non-section 10 – non-wetland
2. UT-2	35.364092	-79.223697	R4UB2	489 feet length, 2-4 feet avg width	non-section 10 – non-wetland
3. UT-3	35.366414	-79.223878	R4UB2	345 feet length, 2-4 feet avg width	non-section 10 – non-wetland
4. UT-4	35.365271	-79.223821	R4UB2	373 feet length, 2-4 feet avg width	non-section 10 – non-wetland
5. Wetland GA	35.364538	-79.224329	PEM/PFO	1.162 acre	non-section 10 wetland
6. Wetland GE	35.36624	-79.224212	PEM	0.359 acre	non-section 10 wetland
7. Wetland GD	35.36712	-79.224146	PEM	0.055 acre	non-section 10 wetland
8. Wetland GC	35.367259	-79.22367	PEM	1.233 acre	non-section 10 wetland
9. Wetland KX	35.368615	-79.222887	PEM	1.294 acre	non-section 10 wetland
10. Wetland KY	35.367125	-79.221081	PSS/PFO	8.340 acre	non-section 10 wetland
11. Wetland JZ	35.366041	-79.22317	PSS/PEM	0.012 acre	non-section 10 wetland



NOTE: No air transport facilities are located within 5 miles of the project area.



Legend

- Crane Easement = ~27.9 ac.
- NCDOT Roads

Directions to the Site from Raleigh:

- Take US-1 South out of Raleigh; travel ~41 miles
- Turn left onto Rocky Fork Church Road; travel ~3.3 miles
- Site is located on the right side of the road.
- Site Latitude, Longitude 35.3666, -79.2229 (WGS84)

USGS 7.5 Minute Topographic Map (Murchisontown and Sanford, NC Quads)

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

SITE LOCATION

Drawn by: KRJ

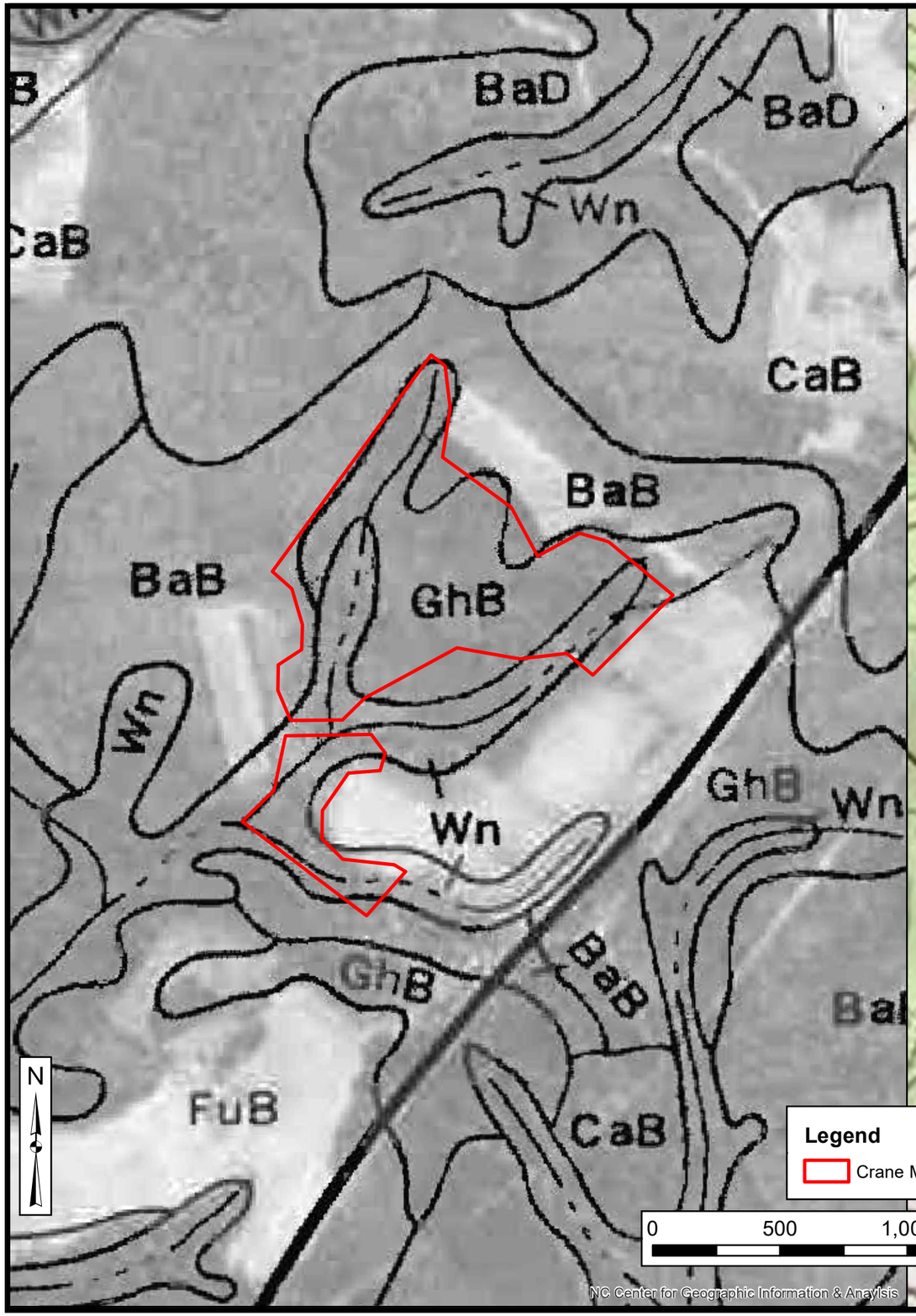
Date: FEB 2020

Scale: 1:20,000

Project No.: 18-002

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

PROJECT MAPPING

Drawn by: KRJ

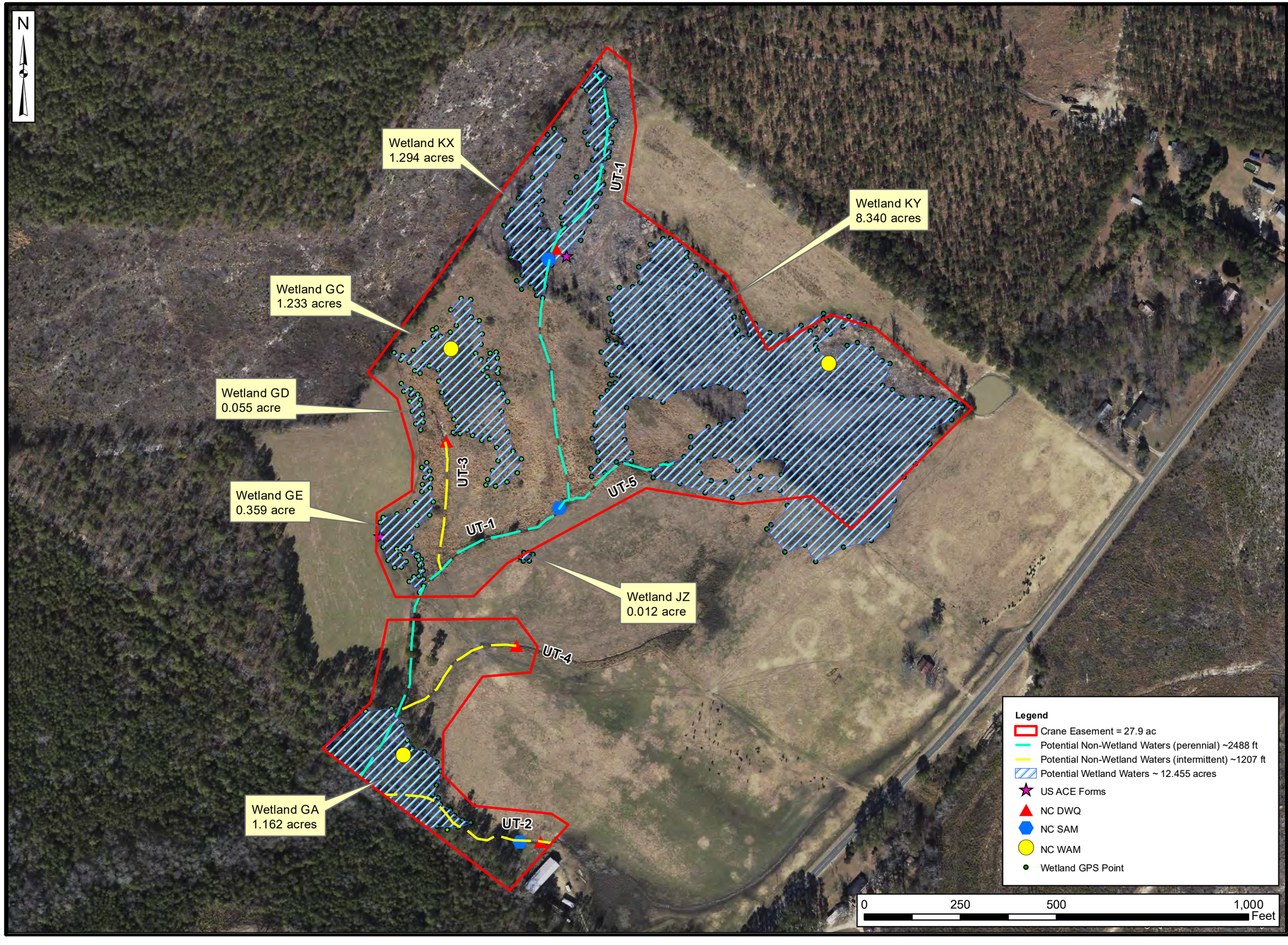
Date: FEB 2020

Scale: 1:6000

Project No.: 20-032

FIGURE

2



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

POTENTIAL WATERS OF THE U.S.

Drawn by: KRJ

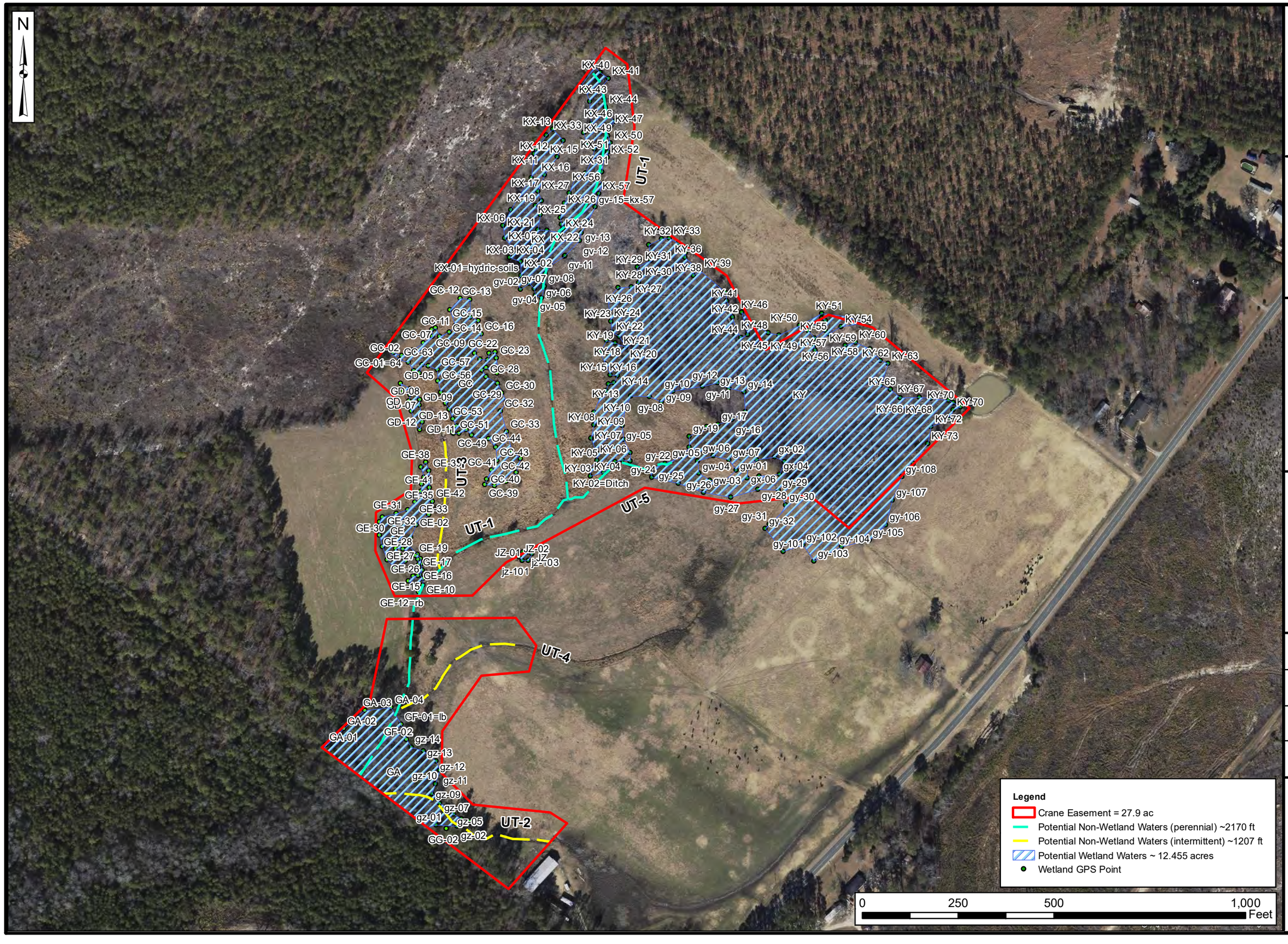
Date: FEB 2021

Scale: 1:2800

Project No.: 20-032

FIGURE

3



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

GPS POINT NUMBERS

Drawn by: KRJ

Date: FEB 2021

Scale: 1:2800

Project No.: 20-032

FIGURE

4

GV11 UP

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Crane City/County: Lee Sampling Date: 12/17/2020

Applicant/Owner: Restoration Systems State: NC Sampling Point: GV11 UP

Investigator(s): AXE Section, Township, Range: Greenwood

Landform (hillslope, terrace, etc.): hill slope Local relief (concave, convex, none): convex Slope (%): 4

Subregion (LRR or MLRA): LRR P Lat: 35.368199 Long: -79.222831 Datum: WGS 84

Soil Map Unit Name: Blaney loamy sand 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? (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 ____	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

Cut over area adjacent to a braided headwater stream.

Antecedent precipitation tool indicates the site is wetter than normal.

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)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along 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)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

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 (Four Strata) – Use scientific names of plants.

Sampling Point: GW1 WP

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling/Shrub Stratum (Plot size: 30 ft)			
1. Pinus Palustris	2	Y	FACW+
2. Ilex Opaca	1	N	FAC-
3.			
4.			
5.			
6.			
7.			
8.			
	3 = Total Cover		

50% of total cover: 1.5 20% of total cover: 0.6

Herb Stratum (Plot size: 30 ft)			
1. Rubus sp	10	N	—
2. Andropogon gerardii	20	Y	FAC-
3. Eupatorium capillifolium	5	N	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	35 = Total Cover		

50% of total cover: 17.5 20% of total cover: 7

Woody Vine Stratum (Plot size: 30 ft)			
1. Lonicera japonica	15	Y	FAC-
2. Smilax rotundifolia	1	N	FAC
3.			
4.			
5.			
	16 = Total Cover		

50% of total cover: 8 20% of total cover: 3.2

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.67 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: GV11 UP

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10 Yr 3/1	100					SL	
3-7	10 Yr 4/1	4/6	10 Yr 3/1	10	C	M	LS	disturbed from Timbering
	10 Yr 5/2	50						
7+	10 Yr 6/6	70	10 Yr 5/2	25	D	M	LS	
			10 Yr 3/1	5	C	M		

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

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ 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:

GVII Wet

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Crane City/County: Lee Sampling Date: 12/17/2020

Applicant/Owner: Restoration Systems State: NC Sampling Point: GVII Wet

Investigator(s): AXE Section, Township, Range: Greenwood

Landform (hillslope, terrace, etc.): Alluvial Valley Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LRR or MLRA): LRR P Lat: 35.368199 Long: -79.222831 Datum: WGS 84

Soil Map Unit Name: Gilead Loamy Sand NWI classification: Headwater Forest

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? (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 ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

Antecedent precipitation tool indicates the site is wetter than normal

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)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along 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)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 2
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 (Four Strata) – Use scientific names of plants.

Sampling Point: avif We

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	1	Y	FAC
2. Quercus nigra	1	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	2 = Total Cover		

50% of total cover: 1 20% of total cover: 0.4

Sapling/Shrub Stratum (Plot size: 30 ft)			
1. Cyrilla racemiflora	2	N	FACW
2. Magnolia virginiana	2	N	FACW+
3. Liquidambar styraciflua	1	N	FAC+
4. Ilex opaca	1	N	FAC-
5. Pinus palustris	1	N	FACU-
6.			
7.			
8.			
	7 = Total Cover		

50% of total cover: 3.5 20% of total cover: 1.4

Herb Stratum (Plot size: 30 ft)			
1. Andropogon gerardii	5	N	FAC-
2. juncus effusus	4	N	FACW+
3. Arrundinaria gigantea	1	N	FACW
4. Sphagnum	2	N	—
5. Rubus sp.	3	N	—
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15 = Total Cover		

50% of total cover: 7.5 20% of total cover: 3

Woody Vine Stratum (Plot size: 30 ft)			
1. Smilax laurifolia	3	N	FACW+
2. Lonicera japonica	4	Y	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: 3 (A)

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: GV11 Wet

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10 YR 2/1	100					SL	
7+	10YR 4/1	80	10 YR 6/1	19	D	M	LS	
			10 YR 4/4	1	C	PL		

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

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ✓ Sandy Redox (S5)
- ✓ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ 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:

GE28UP

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Crane City/County: Lee Sampling Date: 12/17/20

Applicant/Owner: Restoration Systems State: NC Sampling Point: GE28UP

Investigator(s): AXF / WGL Section, Township, Range: Greenwood

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%): 10

Subregion (LRR or MLRA): LRR P Lat: 35.366192 Long: -79.224447 Datum: WGS 84

Soil Map Unit Name: Blaney loamy Sand 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? (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 ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ____	
Wetland Hydrology Present?	Yes ____	No ____	

Remarks:

Antecedent climactic conditions indicate the site is wetter than normal

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)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along 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)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

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:

Area is in a cow pasture on a slope above a seep.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: GE WP

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	_____ = Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	_____ = Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 30 ft)			
1. Fescue	90	Y	—
2. Eupatorium capillifolium	2	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	92 = Total Cover		

50% of total cover: 46 20% of total cover: 18

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	_____	x 1 =	_____
FACW species	_____	x 2 =	_____
FAC species	_____	x 3 =	_____
FACU species	_____	x 4 =	_____
UPL species	_____	x 5 =	_____
Column Totals:	_____ (A)		_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (If observed, list morphological adaptations below).

Area is a grassy cow pasture

SOIL

Sampling Point: GE UP

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/2	100						Sandy Loam
3-9	10YR 5/3	100						Loamy Sand
9+	10YR 3/3	98	10YR 5/4	2	D	M		Sand

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

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ 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:

GE28 Wet

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Crane City/County: Lee Sampling Date: 12/17/20

Applicant/Owner: RS State: NC Sampling Point: GE28-Wet

Investigator(s): Jernigan Section, Township, Range: Green wood

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope (%): 1

Subregion (LRR or MLRA): LRR P Lat: 35.366192 Long: -79.224447 Datum: WGS84

Soil Map Unit Name: Wehadkee Fine Sandy loam NWI classification: Headwater Forest

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

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

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

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

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

Remarks:

Clear cut in cow pasture below a seepage slope.

Antecedent precipitation tool indicates the site is wetter than Normal.

HYDROLOGY

Wetland Hydrology Indicators:

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

- X Surface Water (A1)
- X High Water Table (A2)
- X 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 X	No ____	Depth (inches): 1
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes X No ____

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

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: GEL8 Wet

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		

Herb Stratum (Plot size: 30 ft)			
1. Juncus effusus	70	Y	FACW+
2. Eupatorium capillifolium	3	N	FACU
3. Polygonum sp.	5	N	—
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	78 = Total Cover		
50% of total cover: 39	20% of total cover: 16		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
50% of total cover: _____	20% of total cover: _____		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	_____	x 1 =	_____
FACW species	_____	x 2 =	_____
FAC species	_____	x 3 =	_____
FACU species	_____	x 4 =	_____
UPL species	_____	x 5 =	_____
Column Totals:	_____ (A)		_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No _____

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

SOIL Sampling Point: GE28 Wet

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/1	100					Sandy loam	
3-5	10YR 4/2	70	10YR 7/1	30	D	M	loamy sand	
5-10	10YR 2/1	95	" " 6/3	5	C	M	loamy sand	
10-	2.5Y 2.5/1	85	2.5Y 5/1	15	D	M	loamy sand	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(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)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 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) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ____

Remarks:

UT 1 @ woodline

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

NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2020	**Project/Site:** Crone	**Latitude:** 35.368252
Evaluator: AXE WGL	**County:** Lee	**Longitude:** -79.222723
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 31	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** Murchison town *e.g. Quad Name:*

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	(1)	2	3
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	(1)	2	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	(No = 0)		Yes = 3	

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

B. Hydrology (Subtotal = 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 = 11)				
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:

UT 2

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

NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2020	**Project/Site:** Crane	**Latitude:** 35.364001
Evaluator: AXE/WGL	**County:** Lee	**Longitude:** -79.223045
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 26	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** Murchison town *e.g. Quad Name:*

A. Geomorphology (Subtotal = 12.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	(0)	1	2	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	0	1	2	(3)
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	(No = 0)		Yes = 3	

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

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. 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: 12/12/20	**Project/Site:** Cove UT-3	**Latitude:** 35.366865
Evaluator: Jennings / Axiom	**County:** Lee County	**Longitude:** -79.223877
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** Murchison Town *e.g. Quad Name:*

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	0	(1)	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	(0.5)	1	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

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

B. Hydrology (Subtotal = 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 = 7)				
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:

UT 4

NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2020	**Project/Site:** Crane	**Latitude:** 35.365408
Evaluator: AYE / WGL	**County:** Lee	**Longitude:** -79.223259
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 26.5	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** Murchison town *e.g. Quad Name:*

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

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

B. Hydrology (Subtotal = 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 = 10)				
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 WAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Crane Mitigation Site	Date of Evaluation	December 17, 2020
Applicant/Owner Name	Restoration Systems	Wetland Site Name	Crane #1
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom
Level III Ecoregion	Southeastern Plains	Nearest Named Water Body	Crane Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030004
County	Lee	NCDWR Region	Raleigh
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.367468, -79.223893

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.

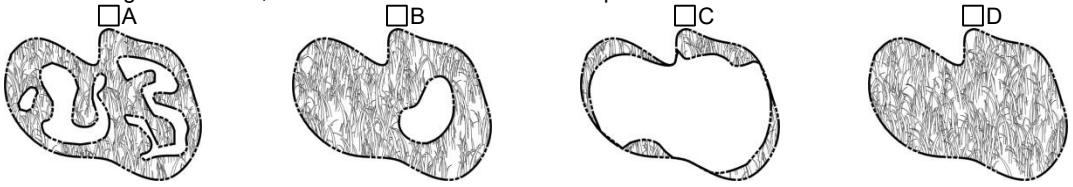
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

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	Crane #1	Date of Assessment	December 17, 2020
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **LOW**

NC WAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Crane Mitigation Site	Date of Evaluation	December 17, 2020
Applicant/Owner Name	Restoration Systems	Wetland Site Name	Crane #2
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom
Level III Ecoregion	Southeastern Plains	Nearest Named Water Body	Crane Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030004
County	Lee	NCDWR Region	Raleigh
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.364544, -79.224269

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.

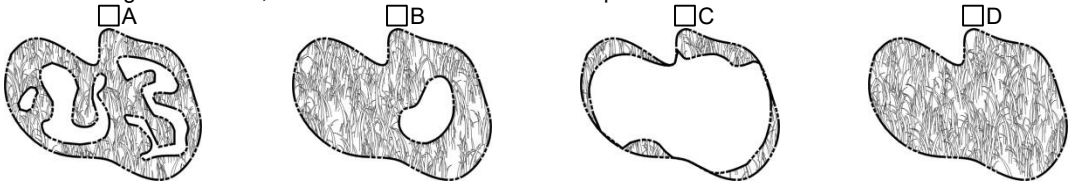
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

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	Crane #2	Date of Assessment	December 17, 2020
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **HIGH**

NC WAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Crane Mitigation Site	Date of Evaluation	December 17, 2020
Applicant/Owner Name	Restoration Systems	Wetland Site Name	Crane #3
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom
Level III Ecoregion	Southeastern Plains	Nearest Named Water Body	Crane Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030004
County	Lee	NCDWR Region	Raleigh
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.367422, -79.220482

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.

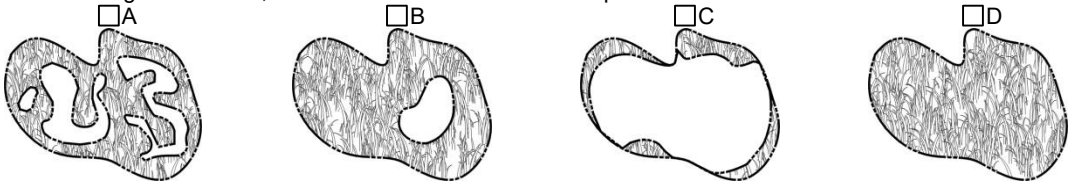
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

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	Crane #3	Date of Assessment	December 17, 2020
Wetland Type	Headwater Forest	Assessor Name/Organization	Jernigan/Axiom

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

Function Rating Summary

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

Overall Wetland Rating **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): Crane Site - UT1
2. Date of evaluation: August 8, 2018
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: G. Lewis/Axiom Env.
5. County: Lee
6. Nearest named water body on USGS 7.5-minute quad: Crane Creek
7. River basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.366392, -79.222888

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT-1
10. Length of assessment reach evaluated (feet): 400
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 5
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	Crane Site - UT1	Date of Assessment	August 8, 2018
Stream Category	Ia1	Assessor Name/Organization	G. Lewis/Axiom Env.

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	**LOW**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	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): Crane Site - UT1 upstream
2. Date of evaluation: August 8, 2018
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: G. Lewis/Axiom Env.
5. County: Lee
6. Nearest named water body on USGS 7.5-minute quad: Crane Creek
7. River basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.368175, -79.222984

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT-1
10. Length of assessment reach evaluated (feet): 500
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 0.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 3.5
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	Crane Site - UT1	Date of Assessment	August 8, 2018
Stream Category	Ia1	Assessor Name/Organization	G. Lewis/Axiom Env.

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

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**HIGH**	
(3) Streamside Area Attenuation	**HIGH**	
(4) Floodplain Access	**HIGH**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**HIGH**	
(3) Stream Stability	**HIGH**	
(4) Channel Stability	**HIGH**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**HIGH**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**HIGH**	
(3) Upland Pollutant Filtration	**HIGH**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**HIGH**	
(3) In-stream Habitat	**LOW**	
(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 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): Crane Site - UT2
2. Date of evaluation: August 8, 2018
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: G. Lewis/Axiom Env.
5. County: Lee
6. Nearest named water body on USGS 7.5-minute quad: Crane Creek
7. River basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.364002, -79.223224

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT-2
10. Length of assessment reach evaluated (feet): 400
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): 4
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] <u>or</u> too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) <u>or</u> floodplain/intertidal zone unnaturally absent <u>or</u> assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B <u>Excessive</u> sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach <u>and</u> causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "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 <u>and</u> no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions <u>and</u> rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

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

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

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

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐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	Crane Site - UT2	Date of Assessment	August 8, 2018
Stream Category	Ia1	Assessor Name/Organization	G. Lewis/Axiom Env.

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	**LOW**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

APPENDIX E. NC NHP LETTER AND CATEGORICAL EXCLUSION DOCUMENT

NC DEPARTMENT OF
NATURAL AND CULTURAL RESOURCES

Roy Cooper, **Governor**
Susi Hamilton, **Secretary**
Walter Clark, **Director, Land and Water Stewardship**

NCNHDE-10440

October 10, 2019

Allison Keith
Axiom Environmental
218 Snow Ave
Raleigh, NC 27603
RE: Crane Site; 18-002

Dear Allison Keith:

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
Crane Site
Project No. 18-002
October 10, 2019
NCNHDE-10440

Element Occurrences Documented Within a One-mile Radius of the Project Area

Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Rank	Accuracy	Federal Status	State Status	Global Rank	State Rank
Bird	3992	Picoides borealis	Red-cockaded Woodpecker	1975-07	X	3-Medium	Endangered	Endangered	G3	S2
Dragonfly or Damselfly	33757	Somatochlora georgiana	Coppery Emerald	2004-Pre	H?	5-Very Low	---	Significantly Rare	G3G4	S2?
Natural Community	12727	Pine/Scrub Oak Sandhill (Blackjack Subtype)	---	2010	C	2-High	---	---	G3	S3
Natural Community	54	Streamhead Pocosin	---	1993-04-22	C?	2-High	---	---	G4	S4
Vascular Plant	2202	Amorpha georgiana	Georgia Indigo-bush	1993-08-10	D	3-Medium	---	Endangered	G3T2	S2
Vascular Plant	9732	Lilium pyrophilum	Sandhills Lily	1993-08-10	F	3-Medium	---	Endangered	G2	S2
Vascular Plant	8696	Parnassia caroliniana	Carolina Grass-of-Parnassus	1967-10-17	X	4-Low	---	Threatened	G3	S2

Natural Areas Documented Within a One-mile Radius of the Project Area

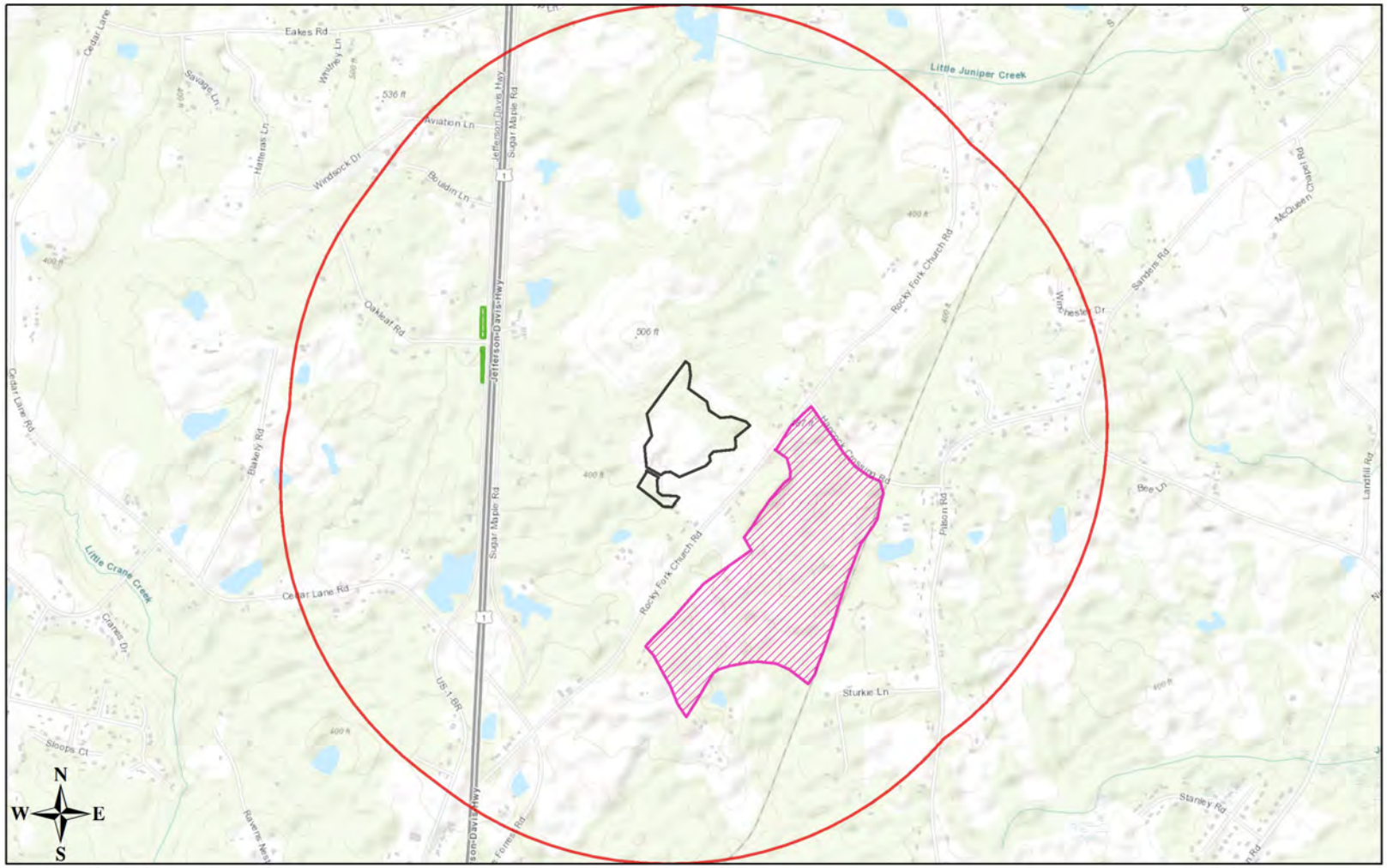
Site Name	Representational Rating	Collective Rating
Seaboard Longleaf Pine Stand	R4 (Moderate)	C4 (Moderate)

Managed Areas Documented Within a One-mile Radius of the Project Area

Managed Area Name	Owner	Owner Type
NC Department of Transportation Mitigation Site	NC Department of Transportation	State

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/content/help. Data query generated on October 10, 2019; source: NCNHP, Q3 Jul 2019. 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-10440: Crane Site



October 10, 2019

- Project Boundary
- Buffered Project Boundary
- NHP Natural Area (NHNA)
- Managed Area (MAREA)

1:24,392

0 0.2 0.4 0.8 mi

0 0.325 0.65 1.3 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

CRANE STREAM AND WETLAND MITIGATION SITE

Lee County, North Carolina

DMS Project No. 100165

Categorical Exclusion/ERTR

Prepared for:

North Carolina Department of Environmental Quality

Division of Mitigation Services

1652 Mail Service Center

Raleigh, NC 27699-1652

December 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:	Crane Mitigation Site
County Name:	Lee
DMS Number:	100165
Project Sponsor:	Restoration Systems, LLC
Project Contact Name:	Worth Creech
Project Contact Address:	1101 Haynes Street, Ste. 211, Raleigh, NC 27604
Project Contact E-mail:	worth@restorationsystems.com
DMS Project Manager:	Jeremiah Dow

Project Description

The Site occurs within 14-digit Cataloging Unit and Targeted Local Watershed 03030004070010 along warm water, unnamed tributaries to Little Crane Creek. The Site is included within the Cranes Creek Local Watershed Planning (LWP) area and a Hydrology Targeted Resource Area (TRA) and Water Quality (TRA) due to modifications/stressors in the watershed. The Site is located approximately 2 miles southwest of Lemon Springs, 8 miles southwest of Sanford, and west of Rocky Fork Church Road (SR 1179).

For Official Use Only

Reviewed By:

01/04/2021 — **Date**

 — **DMS Project Manager**

Conditional Approved By:

Date

For Division Administrator FHWA

☐ **Check this box if there are outstanding issues**

Final Approval By:

1-4-21 — **Date**

Donald W. Brew — **For Division Administrator FHWA**

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

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

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 December 3rd, 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 December 1th, 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)

Project activities are not likely to affect critical habitat for Endangered or Threatened Species. The proposed project will occur in existing agricultural fields which are intensively managed for cattle production. A biological survey included in the 9-step online compliance process found "no effect" based on no suitable habitat present as the land is currently in agriculture production and does not propose the removal of trees. A Self-certification letter was submitted on December 1st, 2020 and no recommendations following the 30-day review period. Receipt of the self-certification letter 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)

Please find the attached Form AD-1006 and email from Milton Cortes of the NRCS.

Fish and Wildlife Coordination Act (FWCA)

Project will impound, divert, channel deepen, or otherwise control/modify a water body and the USFWS and the NCWRC have been consulted. Correspondence attached.

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

Not applicable

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

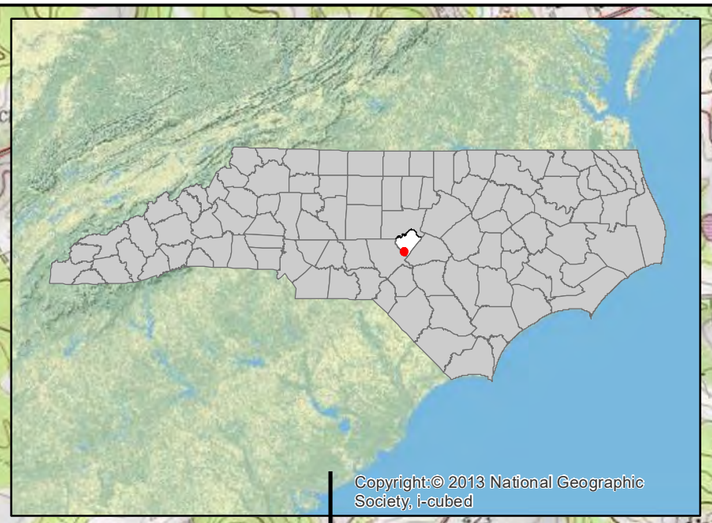
Not applicable – project is not located within an estuarine system

Migratory Bird Treaty Act (MBTA)

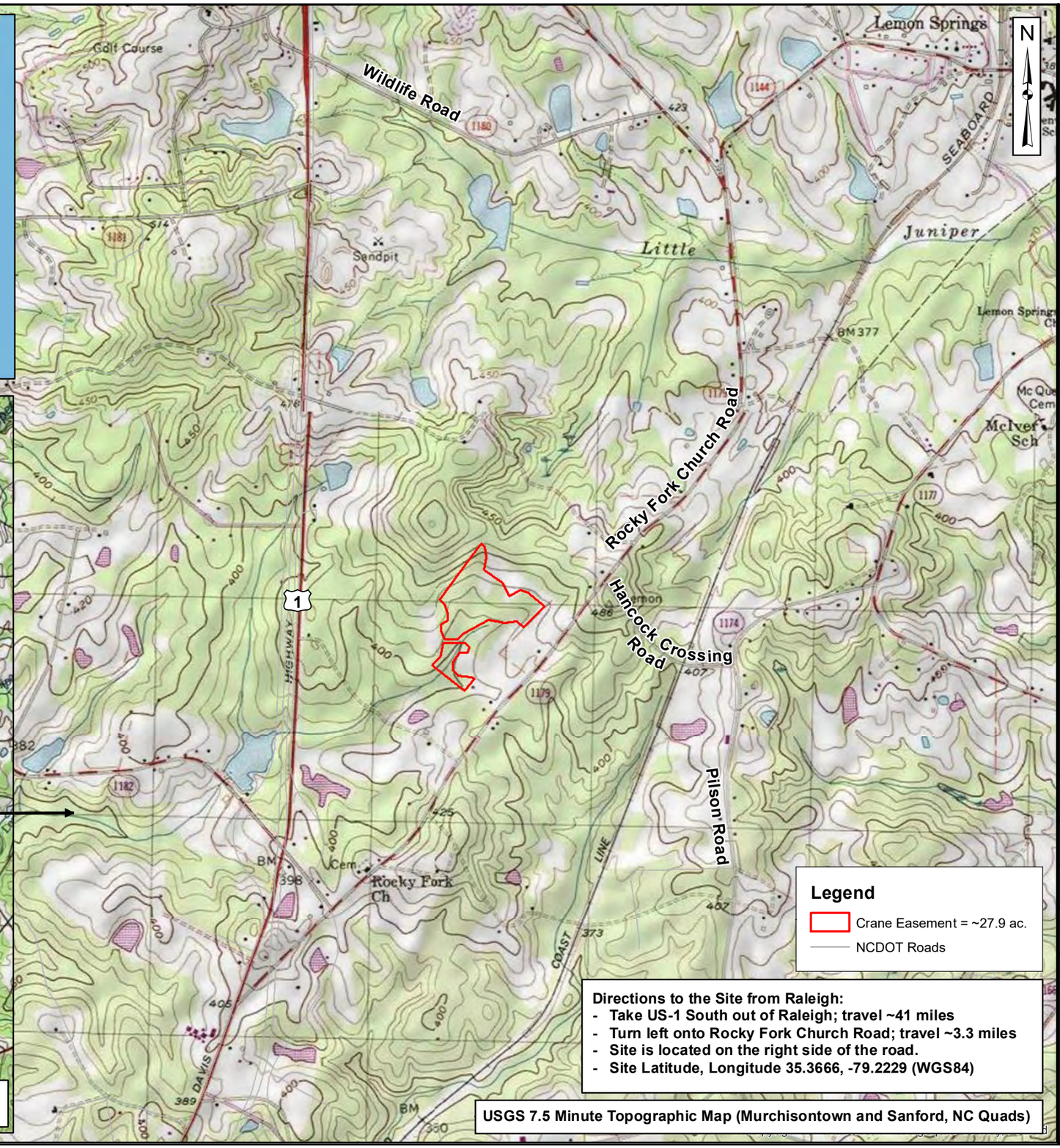
USFWS provided no recommendations for the project relative to the MBTA, please see attached letter sent to John Ellis (USFWS – Raleigh Regional Field Office) on Feb. 13, 2020.

Wilderness Act

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



NOTE: No air transport facilities are located within 5 miles of the project area.



Legend

- Crane Easement = ~27.9 ac.
- NCDOT Roads

Directions to the Site from Raleigh:

- Take US-1 South out of Raleigh; travel ~41 miles
- Turn left onto Rocky Fork Church Road; travel ~3.3 miles
- Site is located on the right side of the road.
- Site Latitude, Longitude 35.3666, -79.2229 (WGS84)

USGS 7.5 Minute Topographic Map (Murchisontown and Sanford, NC Quads)

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

SITE LOCATION

Drawn by:	KRJ
Date:	DEC 2020
Scale:	1:20,000
Project No.:	18-002

FIGURE

1

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

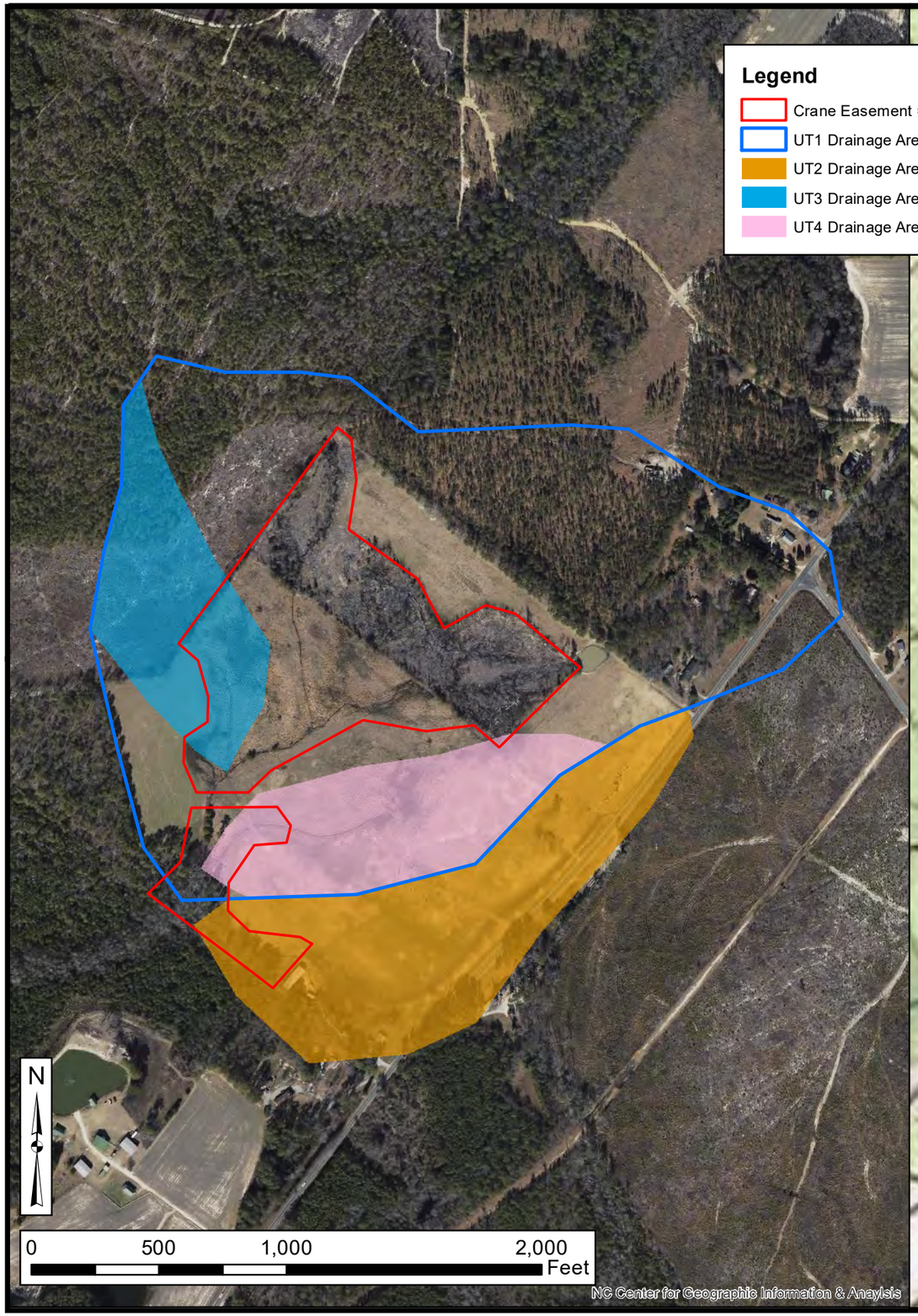
Title:

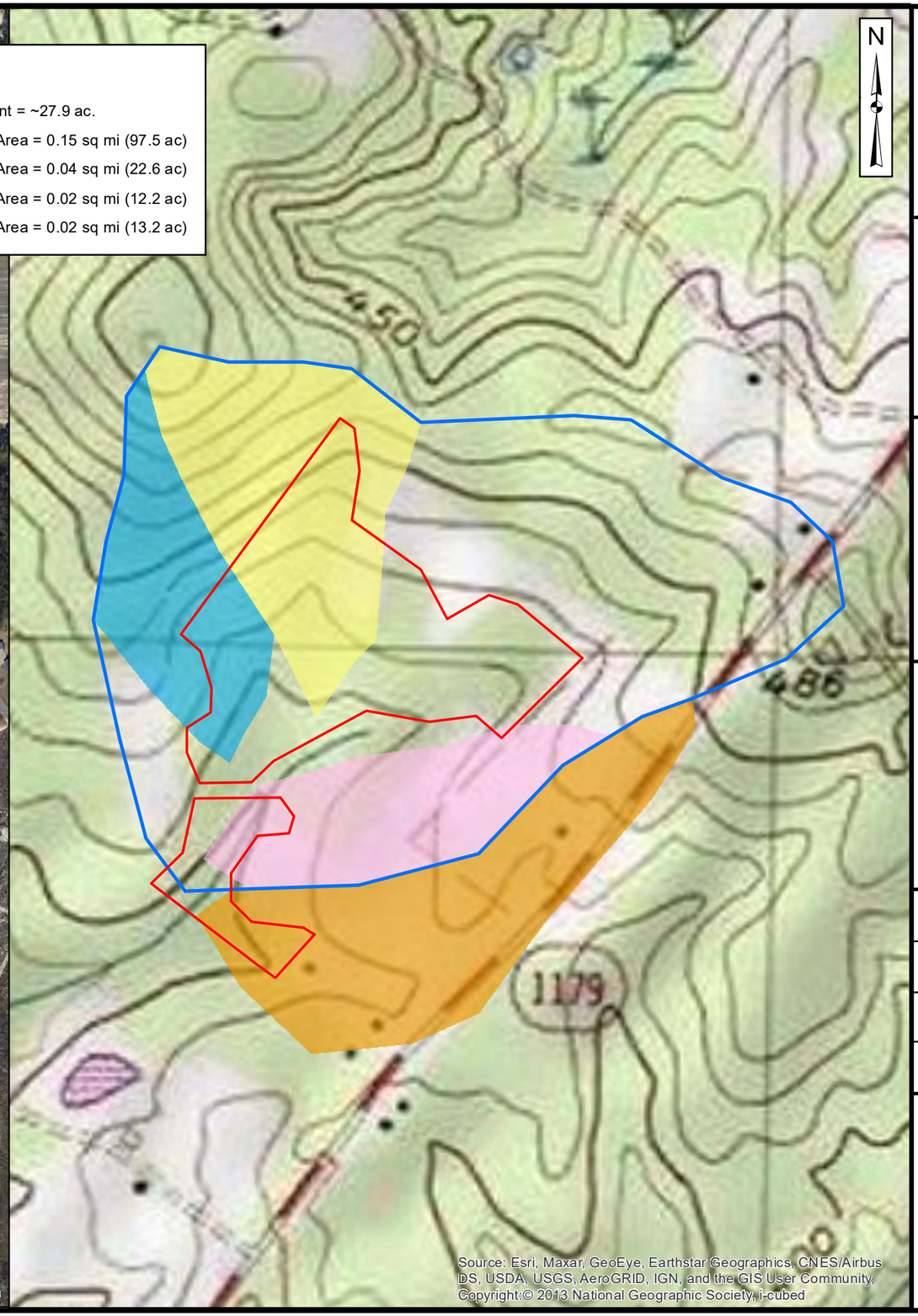
HYDROLOGIC UNIT MAP

Drawn by:	KRJ
Date:	DEC 2020
Scale:	1:375,000
Project No.:	18-002

FIGURE

2





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by: KRJ

Date: DEC 2020

Scale: 1:6000

Project No.: 18-002

FIGURE

3

Soil Map Unit	Soil Series
BaB	Blaney Loamy Sand
GhB	Gilead Loamy Sand
Wn	Wehadkee Fine Sandy Loam

N

BaD

BaD

CaB

BaB

GhB

Wn

Wn

NCDWR Form 3
Score: 33

NC SAM Form 3
Score: Medium

NC SAM Form 2
Score: Low

NCDWR Form 2
Score: 30.5

NCDWR Form 1
Score: 27

NC SAM Form 1
Score: Low

XS-1

XS-2

UT-1

UT-2

UT-3

UT-4

A

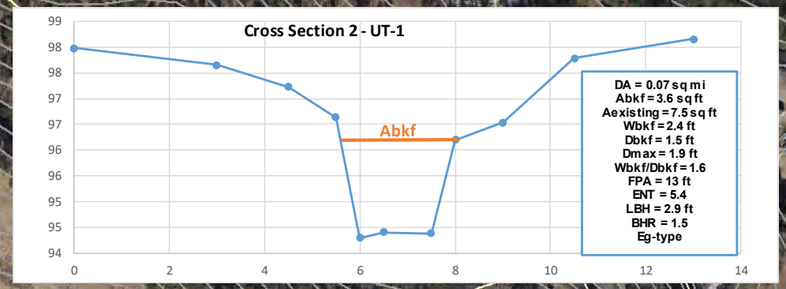
B

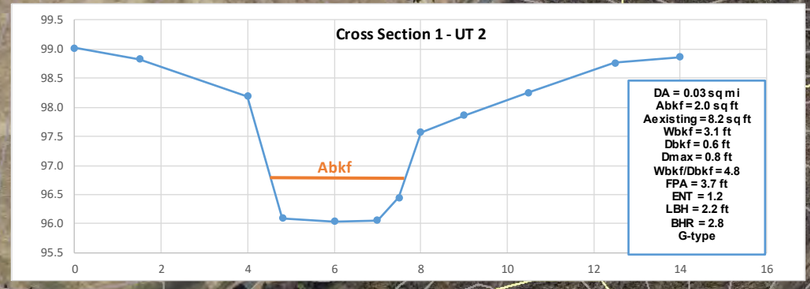
C

D

E

F





Legend

- Crane Easement = 27.9 ac
- Existing Streams 3376 ft
- Existing Wetlands = 7.7 ac
- Drained Hydric Soils = 8.6 ac
- Additional Existing Wetland (approximate) = 6.6 ac
- Cross Sections
- Soil Profiles
- NCSAM Form Locations
- NCDWR Form Locations
- NRCS Soil Boundaries
- 2 foot Topographic Contour

0 250 500 1,000 Feet

NC Center for Geographic Information & Analysis

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

EXISTING CONDITIONS AND SOILS

Drawn by: KRJ

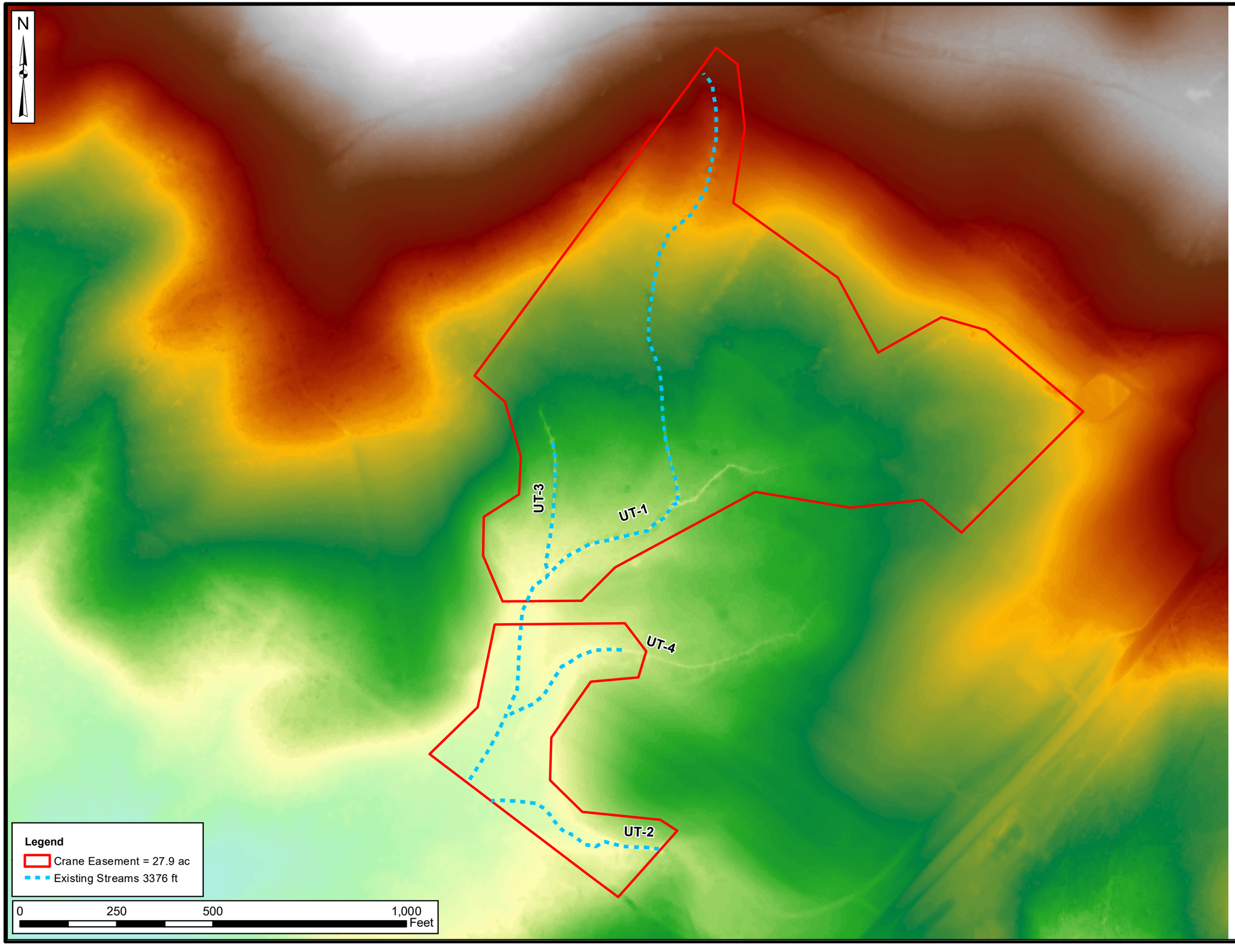
Date: DEC 2020

Scale: 1:3000

Project No.: 18-002

FIGURE

4



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

LIDAR

Drawn by: KRJ

Date: DEC 2020

Scale: 1:3000

Project No.: 18-002

FIGURE

5

N

Crane Mitigation Credits					
	GIS Feet / Ac.	Sinuosity	Stream Length	Ratio	SMU / WMU
Stream - Restoration	2568	1.1	2824.8	1.0	2824.8
Stream - Enhancement (level II)	891	1.1	980.1	2.5	392.04
		Total Length	3805	**Total SMUs**	**3217**
Wetland - Reestablishment	8.5			1	8.5
Wetland - Rehabilitation	0.6			1.5	0.40
Wetland - Enhancement	13.7			2	6.85
Total Acres	22.8			**Total WMU**	**15.75**

Fence livestock and treat invasives.

Tie into upstream channel.

Backfill ditches to elevate groundwater table.

1) Initiate Priority 1 stream restoration in the lowest elevation portio of the valley.
2) Install grade control and habitiat structures.
3) Backfill ditches to elevate groundwater table.

1) Initiate Priority 1 stream restoration in the lowest elevation portio of the valley.
2) Install grade control and habitiat structures.
3) Backfill ditches to elevate groundwater table.

UT-3

UT-1

Upgrade piped crossing to eliminate perched culvert.

UT-4

Install marsh treatment area to treat agriculture runoff.

Fence livestock and treat invasives.

Fence livestock and treat invasives.

Tie to upstream channel elevation.

UT-2

Initiate a mix of Priority 1 and 2 stream restoration.

Legend

- Crane Easement = 27.9 ac
- Stream Restoration = 2825 ft
- Stream Enhancement (Level II) = 980 ft
- Wetland Reestablishment = 8.5 ac
- Wetland Rehabilitation = 0.6 ac
- Wetland Enhancement = 7.1 ac
- Wetland Enhancement (approximate) = 6.6 ac
- MarshTreatment
- Piped_Crossing

0 250 500 1,000 Feet

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

CRANE STREAM MITIGATION SITE

Lee County, NC

Title:

PROPOSED CONDITIONS

Drawn by: KRJ

Date: DEC 2020

Scale: 1:2700

Project No.: 20-001.01

FIGURE

6

Crane Mitigation Site
3646 ROCKY FORK CHURCH RD
Sanford, NC 27332

Inquiry Number: 6288552.2s
December 03, 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

3646 ROCKY FORK CHURCH RD
SANFORD, NC 27332

COORDINATES

Latitude (North):	35.3663110 - 35° 21' 58.71''
Longitude (West):	79.2234540 - 79° 13' 24.43''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	661399.4
UTM Y (Meters):	3914916.8
Elevation:	447 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5945557 MURCHISONTOWN, NC
Version Date:	2013
North Map:	5945581 SANFORD, NC
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140619
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
3646 ROCKY FORK CHURCH RD
SANFORD, NC 27332

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
DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations
ODI	Open Dump Inventory
IHS OPEN DUMPS	Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL	Delisted National Clandestine Laboratory Register
US CDL	National Clandestine Laboratory Register

Local Land Records

LIENS 2	CERCLA Lien Information

Records of Emergency Release Reports

HMIRS	Hazardous Materials Information Reporting System
SPILLS	Spills Incident Listing
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
UXO Unexploded Ordnance Sites
DOCKET HWC Hazardous Waste Compliance Docket Listing
ECHO Enforcement & Compliance History Information
FUELS PROGRAM EPA Fuels Program Registered Listing
AIRS Air Quality Permit Listing
ASBESTOS ASBESTOS
COAL ASH Coal Ash Disposal Sites
DRYCLEANERS Drycleaning Sites
Financial Assurance Financial Assurance Information Listing
NPDES NPDES Facility Location Listing
UIC Underground Injection Wells Listing
AOP Animal Operation Permits Listing
PCSRP Petroleum-Contaminated Soil Remediation Permits
SEPT HAULERS Permitted Septage Haulers Listing
MINES MRDS Mineral Resources Data System
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.

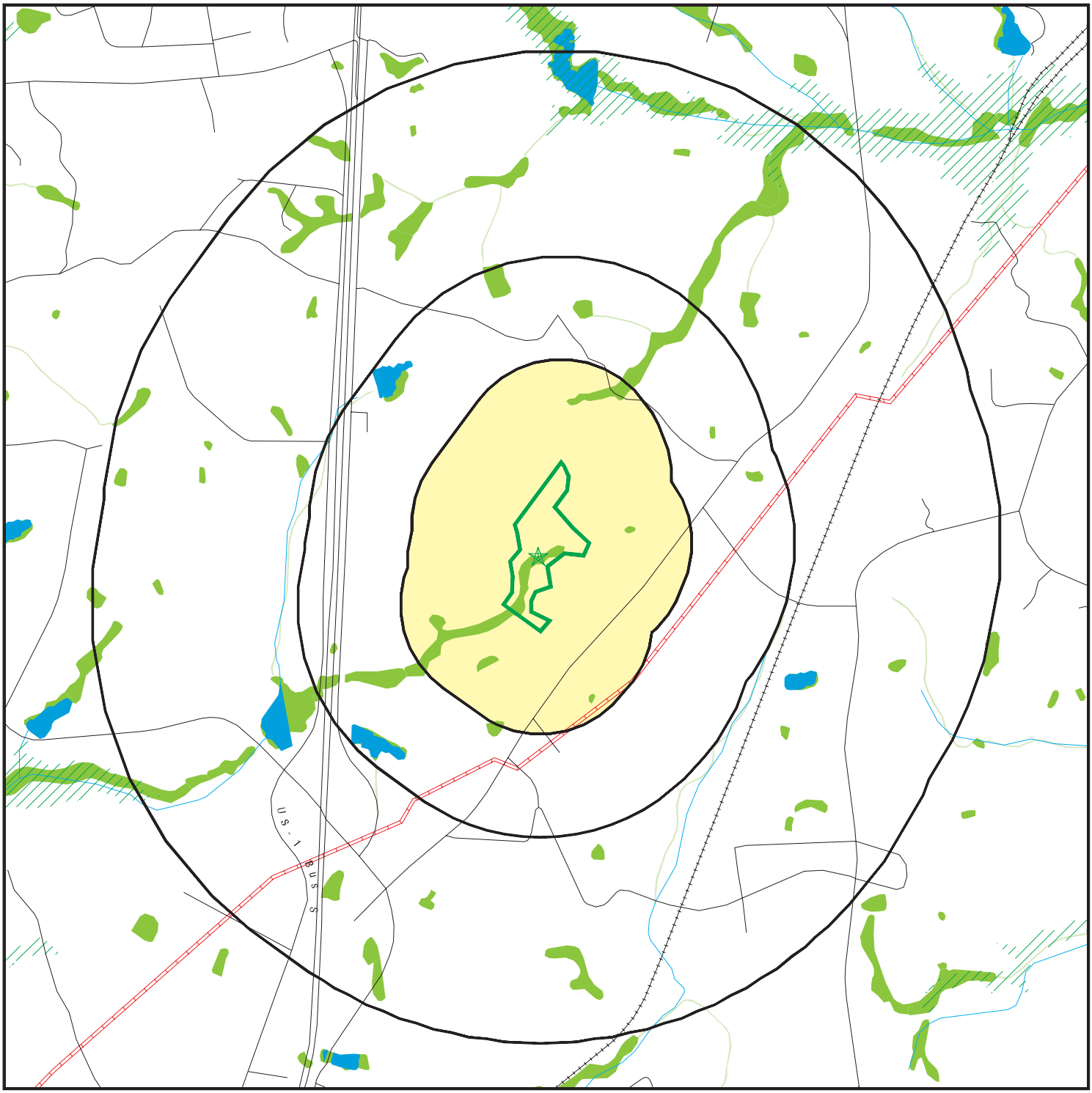
Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 1 records.

Site Name	Database(s)
LEE COUNTY LF	OLI

OVERVIEW MAP - 6288552.2S



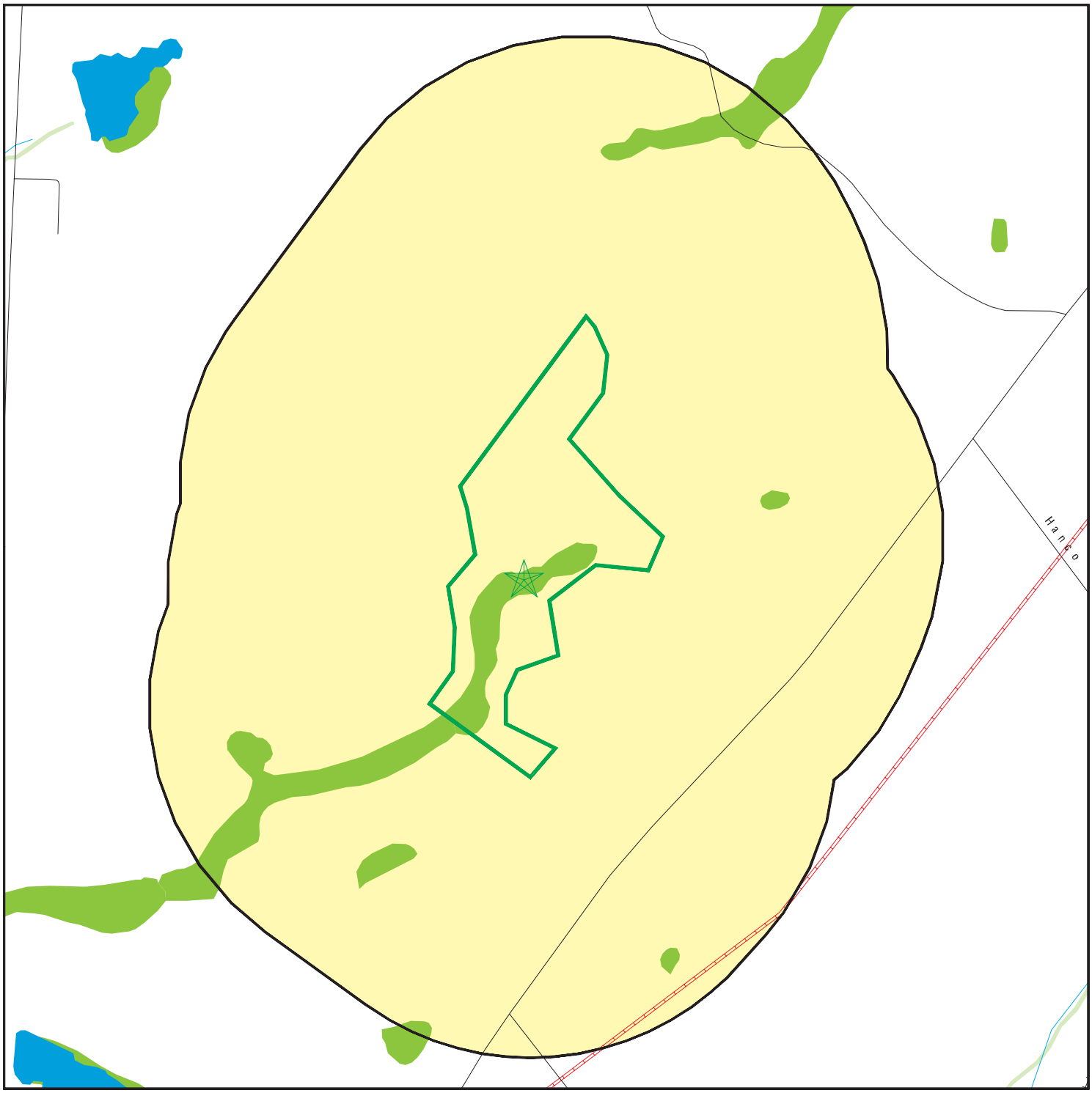
0 1/4 1/2 1 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Pipelines
- 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:	Crane Mitigation Site	CLIENT:	Restoration Systems, LLC
ADDRESS:	3646 ROCKY FORK CHURCH RD Sanford NC 27332	CONTACT:	JD Hamby
LAT/LONG:	35.366311 / 79.223454	INQUIRY #:	6288552.2s
		DATE:	December 03, 2020 2:15 pm

DETAIL MAP - 6288552.2S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Pipelines
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

0 1/16 1/8 1/4 Miles

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:	Crane Mitigation Site	CLIENT:	Restoration Systems, LLC
ADDRESS:	3646 ROCKY FORK CHURCH RD Sanford NC 27332	CONTACT:	JD Hamby
LAT/LONG:	35.366311 / 79.223454	INQUIRY #:	6288552.2s
		DATE:	December 03, 2020 2:16 pm

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION
Cameron Ingram, Executive Director

December 9, 2020

Mr. JD Hamby
Restoration Systems, Inc.
1101 Haynes Street, Suite 211
Raleigh, NC 27604

Subject: Request for Environmental Information for Cane Stream and Wetland Mitigation Project, Lee County, North Carolina.

Dear Mr. Hamby,

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) have reviewed the proposed project description. Comments are provided in accordance with certain provisions of the Clean Water Act of 1977 (as amended), 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.).

Restoration Systems, Inc. has developed the Cane Stream and Wetland Mitigation Site. The project will restore stream channels and riparian wetlands in existing cattle pastures and forested areas. The project footprint is 16.2 acres. The project area is located along Rocky Fork Church Road, northeast of its intersection with US Highway 1, southwest of Sanford.

The project area drains to Little Cane Creek in the Cape Fear River basin. Stream restoration projects often improve water quality and aquatic habitat. Establishing native, forested buffers in riparian areas will improve both aquatic and terrestrial habitats and provide a travel corridor for wildlife species.

In addition to stringent best management practices for erosion and sediment control during construction, the NCWRC recommends the use of biodegradable and wildlife-friendly sediment and erosion control devices. 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 and similar products that have been reinforced with plastic or metal mesh should be avoided as they impede 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. Any invasive plant species found onsite should be removed.

Thank you for the opportunity to review and comment on this project. If I can be of further assistance, please contact me at (910) 409-7350 or gabriela.garrison@ncwildlife.org.

Sincerely,

Gabriela Garrison
Eastern Piedmont Habitat Conservation Coordinator
Habitat Conservation Program

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 29, 2020

John Hamby jhamby@restorationsystems.com
Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, NC 27604

Re: Crane stream and wetland mitigation project, 6200 Rocky Fork Church Road, Sanford, Lee County, ER 20-1889

Dear Mr. Hamby:

Thank you for your letter of August 26, 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 Bartos, Deputy
State Historic Preservation Officer

December 1st, 2020

William Cole
3646 Rocky Fork Church Rd.
Sanford, NC 27332

Dear Mr. Cole:

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Lee 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 919-274-2419.

Sincerely,

JD Hamby
Project Manager

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
Phone: (919) 856-4520 Fax: (919) 856-4556

In Reply Refer To:
Consultation Code: 04EN2000-2020-SLI-1737
Event Code: 04EN2000-2021-E-00724
Project Name: Crane

December 08, 2020

Subject: Updated 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 species list generated pursuant to the information you provided identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the species' life histories and habitats and information on completing a biological assessment or

evaluation and can be found on our web page at http://www.fws.gov/raleigh. Please check the web site often for updated information or changes

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

Not all Threatened and Endangered Species that occur in North Carolina are subject to section 7 consultation with the U.S Fish and Wildlife Service. Atlantic and shortnose sturgeon, sea turtles,when in the water, and certain marine mammals are under purview of the National Marine Fisheries Service. If your project occurs in marine, estuarine, or coastal river systems you should also contact the National Marine Fisheries Service, http://www.nmfs.noaa.gov/

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office. If you have any questions or comments, please contact John Ellis of this office at john_ellis@fws.gov.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
(919) 856-4520

Project Summary

Consultation Code: 04EN2000-2020-SLI-1737

Event Code: 04EN2000-2021-E-00724

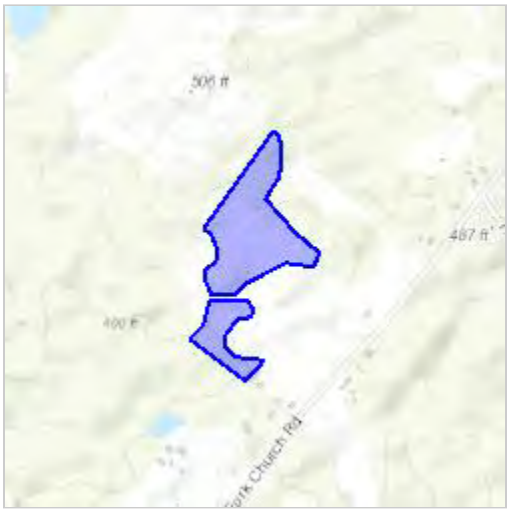
Project Name: Crane

Project Type: LAND - RESTORATION / ENHANCEMENT

Project Description: Stream and wetland restoration project in the Cape Fear 04

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/35.36772340480005N79.22330072907249W



Counties: Lee, NC

Endangered Species Act Species

There is a total of 1 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.

Flowering Plants

NAME	STATUS
Harperella *Ptilimnium nodosum* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3739	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Raleigh Field Office
P.O. Box 33726
Raleigh, NC 27636-3726

Date: 12/1/2020

Self-Certification Letter

Project Name Crane

Dear Applicant:

Thank you for using the U.S. Fish and Wildlife Service (Service) Raleigh Ecological Services online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the project named above in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA), and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended (Eagle Act). This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

The species conclusions table in the enclosed project review package summarizes your ESA and Eagle Act conclusions. Based on your analysis, mark all the determinations that apply:

- [x] "no effect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- [ ] "may affect, not likely to adversely affect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- [ ] "may affect, likely to adversely affect" determination for the Northern long-eared bat (Myotis septentrionalis) and relying on the findings of the January 5, 2016, Programmatic Biological Opinion for the Final 4(d) Rule on the Northern long-eared bat;
- [x] "no Eagle Act permit required" determinations for eagles.

We certify that use of the online project review process in strict accordance with the instructions provided as documented in the enclosed project review package results in reaching the appropriate determinations. Therefore, we concur with the "no effect" or "not likely to adversely affect" determinations for proposed and listed species and proposed and designated critical habitat; the "may affect" determination for Northern long-eared bat; and/or the "no Eagle Act permit required" determinations for eagles. Additional coordination with this office is not needed. Candidate species are not legally protected pursuant to the ESA. However, the Service encourages consideration of these species by avoiding adverse impacts to them. Please contact this office for additional coordination if your project action area contains candidate species. Should project plans change or if additional information on the distribution of proposed or listed species, proposed or designated critical habitat, or bald eagles becomes available, this determination may be reconsidered. This certification letter is valid for 1 year. Information about the online project review process including instructions, species information, and other information regarding project reviews within North Carolina is available at our website http://www.fws.gov/raleigh/pp.html. If you have any questions, you can write to us at Raleigh@fws.gov or please contact Leigh Mann of this office at 919-856-4520, ext. 10.

Sincerely,

/s/Pete Benjamin

Pete Benjamin
Field Supervisor
Raleigh Ecological Services

Enclosures - project review package

Species Conclusions Table

Project Name: Crane Mitigation Site

Date: 12/1/2020

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
Harperella	No suitable habitat	no effect	field survey concluded that there was no potential habitat on site
Bald Eagle	Unlikely to disturb nesting bald eagles	No Eagle Act Permit Required	No nest within site boundaries

Acknowledgement: I agree that the above information about my proposed project is true. I used all of the provided resources to make an informed decision about impacts in the immediate and surrounding areas.

JD Hamby / Project Manager

Signature /Title

12/1/2020

Date

From: Wells, Emily N
To: John Hamby
Cc: Mann, Leigh
Subject: Re: DUE DATE: JANUARY 7, 2021 Fw: [EXTERNAL] Crane Mitigation Site
Date: Monday, December 14, 2020 12:41:25 PM

Hi John,

We do not have any further comments and would concur with your self-certification.

Thank you,
Emily

Please note that our Office Phone System is currently not functional, and will not be until replaced. Email is the best way to reach me.

Thank you!

Emily Wells
USFWS Fish and Wildlife Biologist
Raleigh Ecological Services Field Office
551-F Pylon Drive
Raleigh, North Carolina 27606
Office # 919-856-4520 x25
Fax # 919-856-4556

Mailing Address:
P.O. Box 33726
Raleigh, North Carolina 27636-3726

From: Mann, Leigh <leigh_mann@fws.gov> on behalf of Raleigh, FW4 <raleigh@fws.gov>
Sent: Monday, December 14, 2020 10:43 AM
To: Wells, Emily N <emily_wells@fws.gov>
Subject: DUE DATE: JANUARY 7, 2021 Fw: [EXTERNAL] Crane Mitigation Site

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From: John Hamby <jhamby@restorationsystems.com>
Sent: Wednesday, December 9, 2020 3:26 PM
To: Raleigh, FW4 <raleigh@fws.gov>
Subject: [EXTERNAL] Crane Mitigation Site

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Raleigh ES Field Office
551-F Pylon Drive
Raleigh, North Carolina 27606

October 19, 2020

Kim Browning
U.S. Army Corps of Engineers, Wilmington District
Mitigation Field Office
3331 Heritage Trade Drive, Suite 105
Wake Forest, NC 27587

Re: NCDMS Crane Mitigation Site / SAW-2020-01401/ Lee County

Dear Mrs. Browning:

The U.S. Fish and Wildlife Service (Service) has reviewed the project advertised in the above referenced Public Notice. The project, as advertised in the Public Notice, is expected to have minimal adverse impacts to fish and wildlife resources. Therefore, we have no objection to the activity as described in the permit application.

In accordance with the Endangered Species Act of 1973, as amended, (ESA) and based on the information provided, and other available information, it appears the action is not likely to adversely affect federally listed species or their critical habitat as defined by the ESA. We believe that the requirements of section 7 (a)(2) of the ESA have been satisfied for this project. Please remember that obligations under the ESA must be reconsidered if: (1) new information identifies impacts of this action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

For your convenience a list of all federally protected endangered and threatened species in North Carolina is now available on our website at <http://www.fws.gov/raleigh>. Our web page contains a complete and updated list of federally protected species, and a list of federal species of concern known to occur in each county in North Carolina.

The Service appreciates the opportunity to review and provide comments on the proposed action. Should you have any questions regarding the project, please contact Emily Wells at (919) 856-4520, extension 25.

Sincerely,

For Pete Benjamin,
Field Supervisor

cc: NMFS, Beaufort, NC
EPA, Atlanta, GA
WRC, Raleigh

From:	Cortes, Milton - NRCS, Raleigh, NC
To:	John Hamby
Subject:	RE: AD-1006 Form
Date:	Tuesday, November 24, 2020 2:37:24 PM
Attachments:	image005.png image002.png AD-1006_Crane Mitigation Site.pdf
Importance:	High

Ok John:

Thank you for the map.

Please, find attached the Farmland conversion Impact Rating evaluation for the Crane Mitigation Site, Lee county, NC.

If I cane be of further assistance please let me 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/
Web Soil Survey: https://websoilsurvey.nrcs.usda.gov/app/

NRCS Mission – We deliver conservation solutions so agricultural producers can protect natural resources and feed a growing world.
NRCS Vision – A world of clean and abundant water, healthy soils, resilient landscapes, and thriving communities through voluntary conservation.

From: John Hamby <jhamby@restorationsystems.com>
Sent: Tuesday, November 24, 2020 2:16 PM
To: Cortes, Milton - NRCS, Raleigh, NC <milton.cortes@usda.gov>
Subject: RE: AD-1006 Form

Milton,

Thank you for bring that to my attention. I used the Web Soil Survey Tool to create the map and acres inventory that is attached as a PDF.

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 9/18/20
Name Of Project Crane Mitigation Site	Federal Agency Involved Federal Highway Administration
Proposed Land Use Stream and Wetland Restoration	County And State Lee County, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

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 159 acres
Major Crop(s) CORN	Farmable Land In Govt. Jurisdiction Acres: 129,310 acres % 78	Amount Of Farmland As Defined in FPPA Acres: 110,418 acres % 71	
Name Of Land Evaluation System Used Lee County, NC LESA	Name Of Local Site Assessment System N/A	Date Land Evaluation Returned By NRCS November 24, 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	19.8			
B. Total Acres To Be Converted Indirectly	0.3			
C. Total Acres In Site	20.1	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	11.8			
B. Total Acres Statewide And Local Important Farmland	0.8			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.0114			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	73.6			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	48	0	0	0

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	15			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	19			
4. Protection Provided By State And Local Government	20	0			
5. Distance From Urban Builtup Area	15	15			
6. Distance To Urban Support Services	15	9			
7. Size Of Present Farm Unit Compared To Average	10	5			
8. Creation Of Nonfarmable Farmland	10	0			
9. Availability Of Farm Support Services	5	5			
10. On-Farm Investments	20	5			
11. Effects Of Conversion On Farm Support Services	10	0			
12. Compatibility With Existing Agricultural Use	10	1			
TOTAL SITE ASSESSMENT POINTS	160	84	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	48	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	84	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	132	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

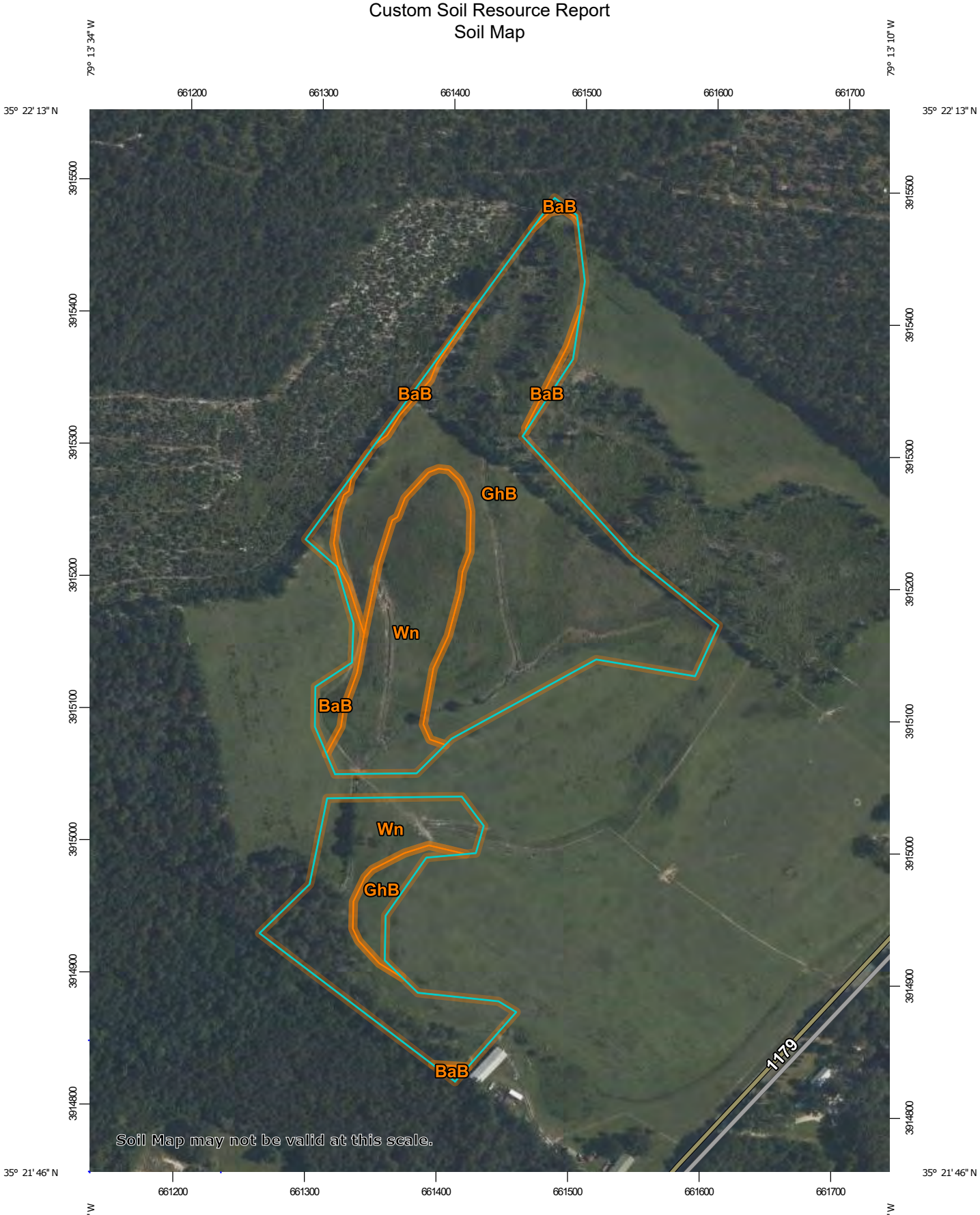
(See Instructions on reverse side)

This form was electronically produced by National Production Services Staff

Clear Form

Form AD-1006 (10-83)

Custom Soil Resource Report
Soil Map



Map Scale: 1:3,920 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lee County, North Carolina
Survey Area Data: Version 18, Jun 4, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 28, 2019—Jul 30, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BaB	Blaney loamy sand, 2 to 8 percent slopes	0.8	4.2%
GhB	Gilead loamy sand, 2 to 8 percent slopes	11.8	59.2%
Wn	Wehadkee fine sandy loam, 0 to 2 percent slopes, frequently flooded	7.3	36.6%
Totals for Area of Interest		**19.9**	**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 was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Lee County, North Carolina

BaB—Blaney loamy sand, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3t5n
Elevation: 160 to 660 feet
Mean annual precipitation: 38 to 52 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 210 to 245 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Blaney and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blaney

Setting

Landform: Low hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and loamy marine deposits

Typical profile

A - 0 to 4 inches: loamy sand
E - 4 to 25 inches: loamy sand
Bt - 25 to 62 inches: sandy clay loam
C - 62 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Ecological site: F137XY002GA - Loamy Summit Woodland - PROVISIONAL
Hydric soil rating: No

GhB—Gilead loamy sand, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3t62
Elevation: 160 to 660 feet
Mean annual precipitation: 38 to 52 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 210 to 245 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Gilead and similar soils: 90 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gilead

Setting

Landform: Low hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy and clayey marine deposits

Typical profile

Ap - 0 to 5 inches: loamy sand
Bt1 - 5 to 8 inches: sandy loam
Bt2 - 8 to 42 inches: sandy clay
Bt3 - 42 to 52 inches: sandy clay loam
C1 - 52 to 76 inches: clay
C2 - 76 to 80 inches: gravelly sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Bibb, undrained

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Johnston, undrained

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Wn—Wehadkee fine sandy loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2mz42
Elevation: 160 to 660 feet
Mean annual precipitation: 38 to 52 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 210 to 245 days
Farmland classification: Not prime farmland

Map Unit Composition

Wehadkee, undrained, and similar soils: 80 percent
Wehadkee, drained, and similar soils: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wehadkee, Undrained

Setting

Landform: Depressions on flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 7 inches: fine sandy loam
Bg - 7 to 58 inches: loam
Cg - 58 to 84 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained

Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Description of Wehadkee, Drained

Setting

Landform: Depressions on flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 7 inches: fine sandy loam
Bg - 7 to 58 inches: loam
Cg - 58 to 84 inches: sandy loam

Properties and qualities

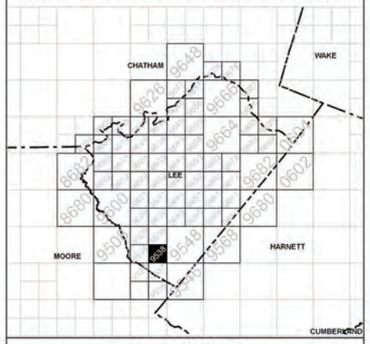
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

APPENDIX F. FEMA COORDINATION

STATE OF NORTH CAROLINA FIRM PANEL LOCATOR DIAGRAM



DATUM INFORMATION

The **projection** used in the preparation of this map was the North Carolina State Plane (FIPSZONE 3200). The **horizontal datum** was the North American Datum of 1983, GRS80 ellipsoid. Differences in datum, ellipsoid, projection, or Universal Transverse Mercator zones used in the production of FIRMS for adjacent jurisdictions may result in slight positional differences in map features across jurisdictional boundaries. These differences do not affect the accuracy of this FIRM. All coordinates on this map are in U.S. Survey Feet, where
1 U.S. Survey Foot = 1200/3937 Meters.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD 88). These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. An average offset between NAVD 88 and the National Geodetic Vertical Datum of 1929 (NGVD 29) has been computed for each North Carolina county. This offset was then applied to the NGVD 29 flood elevations that were not revised during the creation of this statewide format FIRM. The offsets for each county shown on this FIRM panel are shown in the vertical datum offset table below. Where a county boundary and a flooding source with unrevised NGVD 29 flood elevations are coincident, an individual offset has been calculated and applied during the creation of this statewide format FIRM. See Section 6.1 of the accompanying Flood Insurance Study report to obtain further information on the conversion of elevations between NAVD 88 and NGVD 29. To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the North Carolina Geodetic Survey at the address shown below. You may also contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

North Carolina Geodetic Survey
121 West Jones Street
Raleigh, NC 27601
(919) 733-3836
http://www.ngs.state.nc.us

County Average Vertical Datum Offset Table

County	Vertical Datum Offset (ft)
LEE	-0.76

* Example: NAVD 88 = NGVD 29 + (-0.76)

All streams listed in the **Flood Hazard Data Table** below were studied by detailed methods using field survey. Other flood hazard data shown on this map may have been derived using either a coastal analysis or limited detailed Riverine analysis. More information on the flooding sources studied by these analyses is contained in the Flood Insurance Study report.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevation determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** Areas to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- V19 — Cross section line
- 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000 m — 1000-meter Universal Transverse Mercator grid ticks, zone 17
- 1 477 500 FEET — 2500-foot grid values: North Carolina State Plane coordinate system (FIPSZONE 3200, State Plane NAD 83 feet)
- BM5510 — North Carolina Geodetic Survey bench mark (see explanation in the Datum Information section of this FIRM panel)
- BM5510 — National Geodetic Survey bench mark (see explanation in the Datum Information section of this FIRM panel)
- M1.5 — River Mile

GRID NORTH
MAP SCALE 1" = 500' (1 : 6,000)
250 0 250 500 750 1,000 FEET
150 0 150 300 METERS

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data, Limited Detailed Flood Hazard Data, and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of **regulatory floodways** shown on the FIRM for flooding sources studied by detailed methods were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data for flooding sources studied by detailed methods as well as **non-encroachment widths** for flooding sources studied by limited detailed methods are provided in the Flood Insurance Study (FIS) report for this jurisdiction. The FIS report also provides instructions for determining a floodway using non-encroachment widths for flooding sources studied by limited detailed methods.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 4.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

Base map information and geospatial data used to develop this FIRM were obtained from various organizations, including the participating local community(ies), state and federal agencies, and/or other sources. The primary base for this FIRM is aerial imagery acquired by Lee County. The time period of collection for the imagery is 1999. Information and geospatial data supplied by the local community(ies) that met FEMA base map specifications were considered the preferred source for development of the base map. See geospatial metadata for the associated digital FIRM for additional information about base map preparation.

Base map features shown on this map, such as **corporate limits**, are based on the most up-to-date data available at the time of publication. **Changes in the corporate limits may have occurred since this map was published**. Map users should consult the appropriate community official or website to verify current conditions of jurisdictional boundaries and base map features. This map may contain roads that were not considered in the hydraulic analysis of streams where no new hydraulic model was created during the production of this statewide format FIRM.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

If you have **questions about this map**, or questions concerning the National Flood Insurance Program in general, please call **1 – 877 – FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.

An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the **North Carolina Floodplain Mapping Program** website at http://www.ncfloodmaps.com, or contact the **FEMA Map Service Center** at 1-800-358-9616 for information on all related products associated with this FIRM. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index or visit http://www.ncfloodmaps.com

EFFECTIVE DATE OF FLOOD INSURANCE RATE MAP PANEL
SEPTEMBER 6, 2006

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to statewide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent, the North Carolina Division of Emergency Management or the National Flood Insurance Program at the following phone numbers or websites:

NC Division of Emergency Management (919) 715-8000 http://www.nccrimecontrol.org/nfip
National Flood Insurance Program 1-800-638-6620 http://www.fema.gov/nfip

NORTH CAROLINA Cooperating Technical State
FEMA IS COOPERATING TECHNICAL PARTNER

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach of floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map floodplain areas at the local level. As a part of this effort, the state of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

www.ncfloodmaps.com

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 9538J

FIRM
FLOOD INSURANCE RATE MAP
NORTH CAROLINA

PANEL 9538
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	CID No.	PANEL	SUFFIX
LEE COUNTY	370331	9538	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

EFFECTIVE DATE SEPTEMBER 6, 2006
MAP NUMBER 3710953800J

State of North Carolina
Federal Emergency Management Agency

APPENDIX G. FINANCIAL ASSURANCES

Pursuant to Section IV H and Appendix III of the NCDEQ DMS (formerly Ecosystem Enhancement Program) In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environmental Quality (NCDEQ) has provided the USACE-Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by NCDEQ DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

APPENDIX H. SITE PROTECTION INSTRUMENT

FILED ELECTRONICALLY
LEE COUNTY NC
PAMELA G. BRITT
REGISTER OF DEEDS
==========
FILED Jun 22, 2021
AT 12:16:50 PM
BOOK 01634
START PAGE 0665
END PAGE 0676
INSTRUMENT # 05082
EXCISE TAX $1,107.00

Excise Tax $1,107.00
STATE OF NORTH CAROLINA

DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS PROVIDED PURSUANT TO FULL DELIVERY MITIGATION CONTRACT

LEE COUNTY

SPO File Number: 53-AA
DMS Project Number: 100165

Prepared by: Office of the Attorney General
Property Control Section
Return to: NC Department of Administration
State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS, made this 22 day of June, 2021, by William E. Cole, and wife, Joyce T. Cole (collectively "**Grantor**"), whose mailing address is 3646 Rocky Fork Church Road, Sanford, NC 27330, 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 0302-01.

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 Greenwood Township, Lee County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 79.33 acres and being conveyed to the Grantor by deeds as recorded in **Deed Book 3751 at Page 751, Deed Book 286 at Page 532, and Deed Book 707 at Page 831** of the Lee 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 Little Crane Creek.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement 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 23.34 acres and Conservation Easement Area 2 containing approximately 4.32 acres for a total of **27.66 acres,** as shown on plat of survey titled "Conservation Easement for the State of North Carolina Division of Mitigation Services, over a Portion of the Lands of William E. Cole and Wife, Joyce T. Cole, Current Owners per D.B. 3751, Pg. 741, D.B. 286, Pg. 532, and D.B. 707, Pg. 831 (PIN Numbers 9538-37-3891, 9538-38-9217 & 9538-48-0960), DMS Project ID #100165, SPO Number 53-AA, Crane, Greenwood Township, Lee County, North Carolina" dated May 28, 2021, by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded in **Plat Book 2021, Page 104,** Lee 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.

William E. Cole (SEAL)
William E. Cole

Joyce T. Cole (SEAL)
Joyce T. Cole

NORTH CAROLINA
COUNTY OF WAKE

I, Meghan Burns, a Notary Public in and for the County and State aforesaid, do hereby certify that William E. Cole and Joyce T. Cole, 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 16th day of June, 2021

Notary Public

MEGHAN BURNS NOTARY PUBLIC WAKE COUNTY, N.C. My Comm. Exp. 03-04-2023

My commission expires:

3/4/2023

Exhibit A

Conservation Easement Area 1

BEING ALL OF Conservation Easement Area 1 of the Crane Site over a portion of the land of the William E. Cole and wife, Joyce T. Cole (PIN No. 9538-37-3891, 9538-38-9217 & 9538-48-0960), lying and being situated in Greenwood Township, Lee County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 4 and being a Southeastern corner of the Conservation Easement Area 1 and being located North 11°51'19" West 250.03 feet from an iron stake with a blue cap (Point No. 101) with N.C. Grid Coordinates N=588,051.4748', E=1,934,363.0374' (NAD '83, 2011).

Thence from the Point of Beginning (Point No.4), North 50°09'39" West 132.15' to an iron stake; thence South 83°31'37" West 186.03' to an iron stake; thence North 80°16'22" West 250.49' to an iron stake; thence South 57°53'00" West 530.46' to an iron stake; thence South 89°32'28" West 203.78' to an iron stake; thence North 22°55'55" West 128.47' to an iron stake; thence North 00°48'05" East 99.32' to an iron stake; thence North 56°54'55" East 109.41' to an iron stake; thence North 02°22'31" East 97.39' to an iron stake; thence North 16°17'39" West 146.96' to an iron stake; thence North 48°48'14" West 86.16' to an iron stake; thence North 35°37'46" East 450.53' to an iron stake; thence North 35°23'10" East 587.12' to an iron pipe; thence South 52°22'32" East 84.25' to an iron stake; thence South 06°38'58" East 143.63' to an iron stake; thence South 08°52'30" West 195.08' to an iron stake; thence South 54°17'31" East 332.63' to an iron stake; thence South 28°13'13" East 218.52' to an iron stake; thence North 60°56'43" East 187.68' to an iron stake; thence South 73°32'24" East 119.48' to an iron stake; thence South 50°08'11" East 211.83' to an iron stake; thence South 50°08'11" East 44.76' to an iron stake; thence South 18°08'02" East 80.75' to an iron stake; thence South 45°14'16" West 400.81' to an iron stake; which is the point of beginning (Point No.4), having an area of 23.34 acres, more or less.

Conservation Easement Area 2

BEING ALL OF Conservation Easement Area 2 of the Crane Site over a portion of the land of the William E. Cole and wife, Joyce T. Cole (PIN No. 9538-37-3891), lying and being situated in Greenwood Township, Lee County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 36 and being the most Southern corner of the Conservation Easement Area 2 and being located South 53°52'33" West 1172.92 feet from an iron stake with a blue cap (Point No. 101) with N.C. Grid Coordinates N=588,051.4748', E=1,934,363.0374' (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 36), North 52°14'10" West 600.82' to an iron stake; thence North 45°50'34" East 168.09' to an iron stake; thence North 11°44'45" East 217.90' to an iron stake; thence North 89°32'28" East 337.03' to an iron stake; thence South 36°52'12" East 89.89' to an iron stake; thence South 16°20'24" West 70.71' to an iron stake; thence South 84°59'13" West 124.17' to an iron stake; thence South 35°15'05" West 176.72' to an iron stake; thence South 01°15'44" West 110.99' to an iron stake; thence South 45°36'34" East 115.40' to an iron stake; thence South 83°50'59" East 202.55' to an iron stake; thence South 58°42'25" East 51.81' to an iron stake; thence South 41°36'54" West 81.11' to an iron stake; thence South 74°51'28" West 13.03' to an iron stake; thence South 42°53'25" West 138.95' to an iron stake; which is the point of beginning, (Point No. 36) having an area of 4.32 acres, more or less.

BOTH 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, over a Portion of the Lands of William E. Cole and Wife, Joyce T. Cole, Current Owners per D.B. 3751, Pg. 741, D.B. 286, Pg. 532, and D.B. 707, Pg. 831 (PIN Numbers 9538-37-3891, 9538-38-9217 & 9538-48-0960), DMS Project ID #100165, SPO Number 53-AA, Crane, Greenwood Township, Lee County, North Carolina" dated May 28, 2021, by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded in **Plat Book 2021, Page 104,** Lee County Register of Deeds.

AND SUCH CONSERVATION EASEMENT AREAS TOGETHER WITH (1) a new ten (10') feet-wide access easement that runs from NCSR 1179 (Rocky Fork Church Road) to the foregoing Conservation Easement Area 1, the outer boundaries for which run along (and are the same as) the tie downs depicted for the new thirty feet (30') wide non-exclusive access easement labeled as "ACCESS EASEMENT 1" as shown on the foregoing plat of survey recorded in **Plat Book 2021, Page 104,** Lee County Register of Deeds, with such ten feet (10') wide access easement running entirely within the thirty feet (30') wide non-exclusive access easement labeled as "ACCESS EASEMENT 1" as shown on the foregoing plat of survey, but rather than running for a width of thirty feet (30'), the easement runs for a width of ten feet (10') (notwithstanding that a thirty feet [30'] wide access easement is shown on the plat), and (2) that certain new sixty feet (60') wide non-exclusive access easement labeled as "ACCESS EASEMENT 2" for ingress, egress, and regress and as shown on the foregoing plat of survey recorded in **Plat Book 2021, Page 104,** Lee County Register of Deeds.

APPENDIX I. CREDIT RELEASE SCHEDULE

The schedules below list the updated credit release schedules for stream and wetland mitigation projects developed by the ILF/NCDMS in North Carolina:

Credit Release Schedule and Milestones for Wetlands			
Credit Release Milestone	**Release Activity**	**ILF/NCDMS**	
		Interim Release	**Total Released**
1	Site Establishment (includes all required criteria stated above)	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	30%	30%
3	Year 1 monitoring report demonstrates that interim performance standards have been met	10%	40%
4	Year 2 monitoring report demonstrates that interim performance standards have been met	10%	50%
5	Year 3 monitoring report demonstrates that interim performance standards have been met	15%	65%
6*	Year 4 monitoring report demonstrates that interim performance standards have been met	5%	70%
7	Year 5 monitoring report demonstrates that interim performance standards have been met	15%	85%
8*	Year 6 monitoring report demonstrates that interim performance standards have been met	5%	90%
9	Year 7 monitoring report demonstrates that performance standards have been met	10%	100%

*Please note that vegetation plot data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

Credit Release Schedule and Milestones for Streams			
Credit Release Milestone	**Release Activity**	**ILF/NCDMS**	
		Interim Release	**Total Released**
1	Site Establishment (includes all required criteria stated above)	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	30%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%
6*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)
7	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)
8*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)
9	Year 7 monitoring report demonstrates that channels are stable, performance standards have been met	10%	90% (100%**)

*Please note that vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

**10% reserve of credits to be held back until the bankfull event performance standard has been met.

APPENDIX J. MAINTENANCE PLAN

Maintenance Plan

The Site shall be monitored on a regular basis and a physical inspection of the site shall be conducted a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

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 K. IRT SITE VISIT NOTES

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

As specified within RFP #16-20190302, an on-site meeting with regulatory agencies and DMS staff was conducted on September 29, 2020. Below is a list of attendees and general site visit notes.

Attendees:

USACE:
- Todd Tugwell

NC WRC:
Travis Wilson

NC DMS:
- Jeremiah Dow
- Lindsay Crocker
- Tim Baumgartner

NC DWR:
- Erin Davis

Restoration Systems:
- Worth Creech

Axiom Environmental
- Grant Lewis

Site Visit Notes:
- Overall, the project was well received by the IRT

Wetlands:

- Preconstruction groundwater gauges are encouraged in several areas within the Site to document existing groundwater table elevations and durations. Areas for preconstruction groundwater gauges include the following.
    - Between Reestablishment and Enhancement zones
    - Between Reestablishment and upland zones
    - In Rehabilitation zones
    - In Reestablishment zones

Streams:

General:

- Tributaries 2, 3, and 4 will require stream flow gauges.
- A single, corrugated pipe will be used in the channel at all crossings. Crossings can have floodplain pipes.

UT1:

- The upper reaches of UT 1 are proposed to be credited as Enhancement Level II with a 2.5:1 mitigation ratio. The IRT agreed to this ratio due to wider buffers and containerized supplemental planting adjacent to the stream channel. This area appears to be a cypress/gum swamp and appropriate species will be planted including Titi (*Cyrilla racemiflora*), bays (*Magnolia virginiana* and *Persea palustris*), as well as other species identified in a reference forest. This area will be included in the vegetation monitoring.
- The upper reaches of UT 1 are to be calculated on down valley length.

UT2:

- An existing piped crossing is located at the upstream extent of UT 2. This piped crossing is to be upgraded as part of the mitigation project to ensure proper stability and aquatic life passage.
- Drainage around the barn/shed will be directed to a marsh treatment area, if feasible.

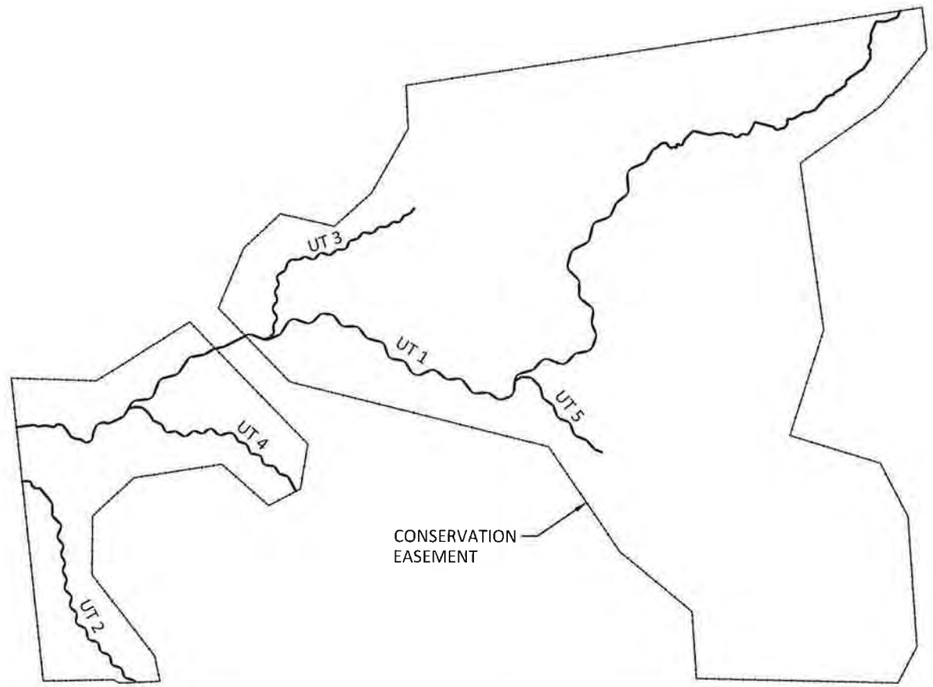
APPENDIX L. CONSTRUCTION PLANS

NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES

CONSTRUCTION DRAWINGS
CRANE MITIGATION SITE
LEE COUNTY, NORTH CAROLINA
DATE: FEBRUARY 23, 2022

SITE DATA TABLE	
RIVER BASIN	CAPE FEAR
8-DIGIT HUC	03030004
TOTAL DISTURBED AREA	30.9 AC
DMS PROJECT ID NO.	100165
FULL DELIVERY CONTRACT NO.	0302-01
USACE ACTION ID NO.	SAW-2020-01401
DWR PROJECT NO.	20201292
RFP NO.	16-20190302
COORDINATE SYSTEM	NAD83 NORTH CAROLINA STATE PLANES, US FOOT

GRAPHIC SCALE
0 150 300 600
1 inch = 300 ft.

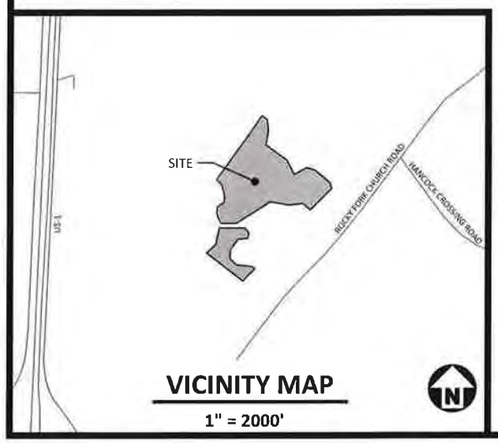


SHEET INDEX

MITIGATION SUMMARY

TRIBUTARY	PROPOSED LENGTH
UT1	2428
UT2	525
UT3	463
UT4	422
UT5	243

TOTAL DISTURBED AREA = 30.9 AC.



VICINITY MAP
1" = 2000'

RESTORATION LEVEL	STREAM (LF)	RIPARIAN WETLAND (AC)	NON-RIPARIAN WETLAND (AC)
RESTORATION	3165	-	-
ENHANCEMENT II	915	-	-
REESTABLISHMENT	-	8.815	-
REHABILITATION	-	0.683	-
ENHANCEMENT	-	10.646	-
TOTALS	4180	20.144	-
MITIGATION UNITS	3533	14.593	-

*TOTAL STREAM MITIGATION UNITS INCLUDE UNITS FROM THE WIDER BUFFER TOOL
*STRAIGHT-LINE VALLEY LENGTH IS USED FOR UT1-R1 CREDIT CALCULATION
*WETLAND REHABILITATION, ENHANCEMENT, PRESERVATION, AND SOME RE-ESTABLISMENT ARE NOT CREDIT GENERATING.

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218 SNOW AVENUE
RALEIGH, NC 27603
CONTACT: GRANT LEWIS
PHONE: 919.215.1693
Axiom Environmental, Inc.

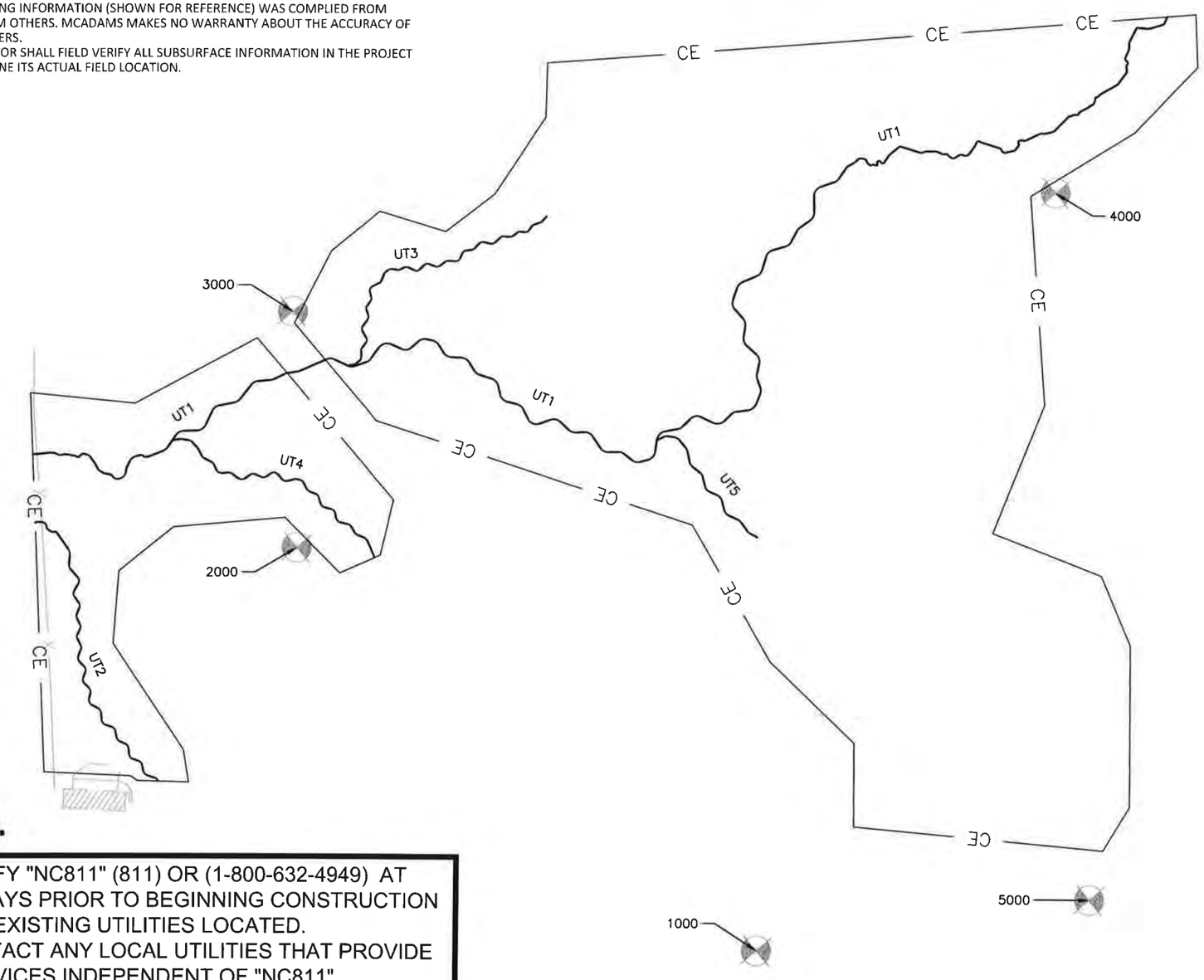
CLIENT
RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
CONTACT: WORTH CREECH
PHONE: 919.389.3888

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.24.22

GENERAL NOTES:

1. COORDINATE SYSTEM: NAD83 NORTH CAROLINA STATE PLANES, US FOOT
2. TOPOGRAPHY AND SPOT ELEVATIONS SHOWN ARE FROM AN ACTUAL FIELD SURVEY COMPLETED BY K2 DESIGN GROUP.
3. PLANIMETRICS, UTILITIES, INVERTS AND BUILDING INFORMATION (SHOWN FOR REFERENCE) WAS COMPLIED FROM AUTOCAD FILES PROVIDED TO MCADAMS FROM OTHERS. MCADAMS MAKES NO WARRANTY ABOUT THE ACCURACY OF THE INFORMATION SHOWN PROVIDED BY OTHERS.
4. PRIOR TO CONSTRUCTION, THE SITE CONTRACTOR SHALL FIELD VERIFY ALL SUBSURFACE INFORMATION IN THE PROJECT AREA TO ENSURE ITS ACCURACY AND DETERMINE ITS ACTUAL FIELD LOCATION.

CONTROL POINT LOCATIONS			
CONTROL POINT	NORTHING	EASTING	ELEVATION
1000	588051.47.48	1934363.0374	427.77
2000	587894.5162	1933401.5353	403.58
3000	588128.5384	1933110.0405	401.83
4000	589182.9861	1933744.0866	432.14
5000	588511.6462	1934642.2517	428.97



Know what's below. Call before you dig.

CONTRACTOR SHALL NOTIFY "NC811" (811) OR (1-800-632-4949) AT LEAST 3 FULL BUSINESS DAYS PRIOR TO BEGINNING CONSTRUCTION OR EXCAVATION TO HAVE EXISTING UTILITIES LOCATED. CONTRACTOR SHALL CONTACT ANY LOCAL UTILITIES THAT PROVIDE THEIR OWN LOCATOR SERVICES INDEPENDENT OF "NC811". REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY.

GRAPHIC SCALE
0 100 200 400
1 inch = 200 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1-20-22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS
LEE COUNTY, NORTH CAROLINA

RS RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

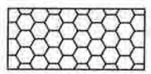
PROJECT NO.	2021110220
FILENAME	C1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=200'
DATE	01.18.2022

CONSERVATION EASEMENT AND CONTROL POINTS

C1.00

LEGEND AND SYMBOLS

- LD — LIMITS OF DISTURBANCE
- CE — PROPOSED CONSERVATION EASEMENT
- PROPERTY LINE
- 250 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING STREAM CENTERLINE
- EXISTING TOP OF BANK
- 250 — PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED STREAM CENTERLINE
- PROPOSED TOP OF BANK
- EXISTING FENCING



PROPOSED RIFFLE

PROPOSED LOG CROSS VANE

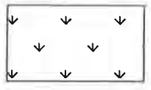
PROPOSED LOG VANE

PROPOSED SILL STEP

PROPOSED LOG SILL

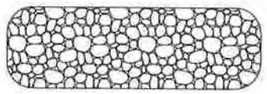
WETLAND ENHANCEMENT

WETLAND REHABILITATION



WETLAND RE-ESTABLISHMENT

EROSION CONTROL LEGEND



CONSTRUCTION ENTRANCE

HAUL ROAD

STAGING/STOCKPILE AREA

SF — SILT FENCE

SILT FENCE OUTLET

PUMP AROUND PUMP

CHANNEL PLUG

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS
LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

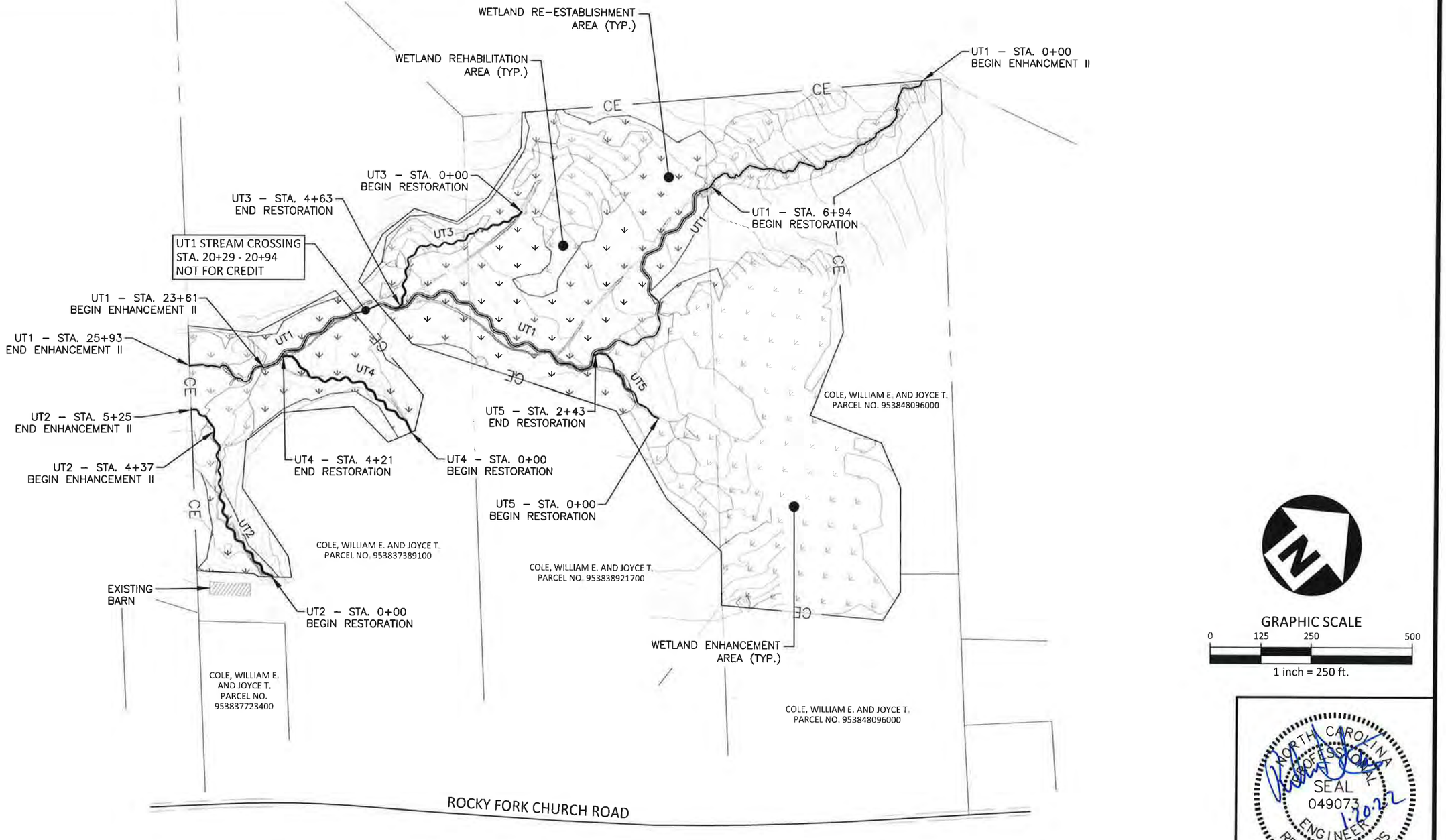
Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	C1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	
DATE	01.18.2022

LEGEND AND SYMBOLS

C1.01



N

GRAPHIC SCALE

0 125 250 500

1 inch = 250 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	C1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=250'
DATE	01.18.2022

PROJECT OVERVIEW

C1.02

GENERAL NOTES:

1. CONTRACTOR SHALL OBTAIN ALL NECESSARY LICENSES AND PERMITS REQUIRED TO COMPLETE THE WORK INCLUDED IN THE CONTRACT DOCUMENTS AT THE CONTRACTOR'S EXPENSE.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THAT THEY AND THEIR SUBCONTRACTOR'S HAVE THE CORRECT/MOST UP-TO-DATE PLANS AVAILABLE.
3. CONTRACTOR SHALL GIVE MINIMUM 72 HOURS NOTICE TO NC DEMLR AND PROJECT ENGINEER PRIOR TO CONSTRUCTION.
4. ALL WORK WITHIN JURISDICTIONAL BOUNDARIES (WETLAND AND STREAMS) SHALL BE PERFORMED IN STRICT ACCORDANCE WITH APPROVED NATIONWIDE PERMIT NO. SAW-2020-01401.
5. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED.
6. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING BUFFER VEGETATION AND CONSTRUCTION CORRIDOR TO THE MAXIMUM EXTENT PRACTICAL.
7. THERE MAY BE WETLANDS WITHIN THIS SITE. IT IS THE OWNER'S RESPONSIBILITY TO COMPLETE A JURISDICTIONAL REVIEW FOR ON-SITE WETLANDS AND PERMIT ANY DISTURBANCES PRIOR TO ANY GRADING ACTIVITY.
8. IF THE CONTRACTOR, IN THE COURSE OF WORK, FINDS ANY DISCREPANCIES IN THE PLANS OR NOTES GIVEN BY THE PROJECT ENGINEER, IT SHALL BE HIS/HER DUTY IMMEDIATELY INFORM THE PROJECT ENGINEER, IN WRITING, AND THE PROJECT ENGINEER WILL PROMPTLY VERIFY THE SAME. ANY WORK DONE AFTER SUCH DISCOVERY, UNTIL AUTHORIZED, WILL BE AT THE CONTRACTOR'S RISK.
9. ANY DAMAGE TO PRIVATE PROPERTY AND/OR EXISTING UTILITIES INCURRED DURING CONSTRUCTION ACTIVITIES SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
10. ALL MECHANIZED EQUIPMENT OPERATED NEAR SURFACE WATERS SHALL BE INSPECTED AND MAINTAINED REGULARLY TO PREVENT CONTAMINATION OF SURFACE WATERS FROM FUELS, LUBRICANTS, HYDRAULIC FLUIDS, OR OTHER TOXIC MATERIALS. CONSTRUCTION SHALL BE STAGED IN ORDER TO MINIMIZE THE EXPOSURE OF EQUIPMENT TO SURFACE WATERS TO THE MAXIMUM EXTENT PRACTICABLE. FUELING, LUBRICATION, AND GENERAL EQUIPMENT MAINTENANCE SHALL BE PERFORMED IN A MANNER TO PREVENT, TO THE MAXIMUM EXTENT PRACTICABLE, CONTAMINATION OF SURFACE WATERS BY FUELS AND OILS.
11. HEAVY EQUIPMENT WORKING IN WETLANDS SHALL BE PLACED ON MATS OR OTHER MEASURES SHALL BE TAKEN TO MINIMIZE SOIL DISTURBANCE.

CONSTRUCTION SEQUENCE:

1. OBTAIN PLAN APPROVAL AND OTHER APPLICABLE PERMITS.
2. OBTAIN AN APPROVED (STAMPED) EROSION & SEDIMENT CONTROL PLAN AND KEEP IT ON-SITE EITHER IN THE INSPECTION BOX, CONSTRUCTION OFFICE, OR WITH THE CONTRACTOR.
3. SCHEDULE AND HOLD AN ON-SITE PRE-CONSTRUCTION CONFERENCE AT LEAST ONE WEEK PRIOR TO BEGINNING ANY LAND-DISTURBING ACTIVITIES. THE CONFERENCE SHOULD BE ATTENDED BY A DEMLR EROSION CONTROL INSPECTOR, THE GENERAL CONTRACTOR, ANY SUBCONTRACTORS, THE ENGINEER, AND A REPRESENTATIVE OF THE OWNER.
4. CONTRACTOR SHALL NOTIFY "NC811" (811) OR (1-800-632-4949) AT LEAST 3 FULL BUSINESS DAYS PRIOR TO BEGINNING CONSTRUCTION OR EXCAVATION TO HAVE EXISTING UTILITIES LOCATED. CONTRACTOR SHALL CONTACT ANY LOCAL UTILITIES THAT PROVIDE THEIR OWN LOCATOR SERVICES INDEPENDENT OF "NC811". REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY.
5. ALL DIMENSIONS AND GRADES SHOWN ON THE PLANS SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. CONTRACTOR SHALL NOTIFY THE ENGINEER IF ANY DISCREPANCIES EXIST PRIOR TO PROCEEDING WITH CONSTRUCTION, FOR NECESSARY PLAN OR GRADE CHANGES. NO EXTRA COMPENSATION SHALL BE PAID TO THE CONTRACTOR FOR ANY WORK DONE DUE TO DIMENSIONS OR GRADES SHOWN INCORRECTLY ON THESE PLANS IF SUCH NOTIFICATION HAS NOT BEEN GIVEN.
6. ESTABLISH CONSTRUCTION ENTRANCE (SEE DETAIL ON SHEET C6.08) AND STAGING AREAS ACCORDING TO THE EROSION CONTROL PLANS. IF NECESSARY, TEMPORARY DRIVEWAY PERMIT FOR CONSTRUCTION ENTRANCES IN NCDOT RIGHT OF WAY MUST BE PRESENTED AT PRE-CONSTRUCTION MEETING. THE CONTRACTOR SHOULD DOCUMENT, VISUALLY AND IN WRITING, THE EXISITNG CONDITIONS OF ANY PERMANENT SITE ACCESS LOCATIONS AND ACCESS ROUTES TO BE USED DURING CONSTRUCTION.
7. ALL EROSION CONTROL MEASURES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE NC DEQ EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANNUAL.
8. INSTALL EROSION CONTROL MEASURES (SILT FENCE, TREE PROTECTION, ETC.) AS SHOWN ON PLANS, CLEARING ONLY AS NECESSARY TO INSTALL THESE DEVICES.
9. STAGING/STOCKPILE AREAS SHOWN ON THE PLANS ARE APPROXIMTE. CONTRACTOR TO FIELD LOCATE STAGING/STOCKPILE AREAS MIN. 50' FROM SURFACE WATERS AS APPROVED BY THE ENGINEER.
10. PARK ALL CONSTRUCTION EQUIPMENT, INCLUDING TRUCKS AND HEAVY EQUIPMENT WITHIN THE LIMITS OF DISTURBANCE.
11. WHEN ACCESS TO A CONSTRUCTION AREA REQUIRES CROSSING A DELINEATED JURISDICTIONAL FEATURE, IMPACTS SHALL BE MINIMIZED BY PLACING A TEMPORARY STREAM/WETLAND CROSSING (LOG MAT) ACROSS THE FEATURE PRIOR TO ACCESSING THE AREA WITH HEAVY EQUIPMENT PER APPROVED PLANS AND SPECIFICATIONS. SEE SHEET C6.09 FOR LOG MAT DETAIL.
12. INSTALL REMAINING EROSION CONTROL MEASURES AS SHOWN ON SHEETS C6.03 - C6.07. CLEAR AND GRUB ONLY AS NECESSARY TO INSTALL THESE DEVICES.
13. BEGIN GRADING ACTIVITIES. IN GENERAL, THE CONTRACTOR SHALL WORK FROM UPSTREAM TO DOWNSTREAM AND CONSTRUCTION IN A LIVE CHANNEL UTILIZE A PUMP-AROUND OR FLOW DIVERSION MEASURE AS SHOWN ON THE PLANS. MAINTAIN AND ADJUST E&SC MEASURES AS GRADING PROGRESSES.
14. CONTRACTOR SHALL EXCAVATE THE PROPOSED CHANNEL AND MODIFY SECTIONS OF THE EXISTING CHANNEL BASED ON THE PROPOSED PROFILE (SHEET C5.00-C5.15) IN SECTIONS NO GREATER THAN 300 LINEAR FEET AT A TIME (EXCEPT WHERE LONGER SECTIONS ARE NECESSARY TO MAINTAIN CONSTRUCTABILITY).
15. 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.
16. WORK SECTIONS THAT INVOLVE THE CONSTRUCTION OF A CONFLUENCE OF TWO OR MORE REACHES MAY REQUIRE THE USE OF TWO OR MORE PUMP-AROUND OPERATIONS.
17. GRADING OF SOME PORTIONS OF THE PROPOSED FLOODPLAIN MAY NEED TO BE DELAYED UNTIL AFTER WORK IN SUBSEQUENT SECTIONS HAS BEEN COMPLETED, ESPECIALLY NEAR THE CONFLUENCES. HAUL ROADS AND TEMPORARY SILT FENCE MAY ALSO NEED TO BE REMOVED BEFORE THE PROPOSED FLOODPLAIN CAN BE COMPLETED AND/OR UNUSED EXISTING CHANNEL BE FILLED.
18. AFTER EXCAVATING THE CHANNEL TO DESIGN GRADES, INSTALLING IN-STREAM STRUCTURES, SEED AND MULCH, MATTING, AND TRANSPLANTS, THE NEW CHANNEL CAN RECEIVE FLOW AFTER APPROVAL BY THE ENGINEER.
19. NO WATER SHALL BE TURNED INTO ANY SECTION OF CHANNEL PRIOR TO THE CHANNEL BEING COMPLETELY STABILIZED WITH ALL STRUCTURES INSTALLED.
20. ANY GRADING ACTIVITIES ADJACENT TO THE STREAM CHANNEL SHALL BE COMPLETED PRIOR TO TURNING WATER INTO THE NEW STREAM CHANNEL SEGMENTS. THE CONTRACTOR SHALL NOT GRADE OR ROUGHEN ANY AREAS WHERE EXCAVATION ACTIVITIES HAVE NOT BEEN COMPLETED UNLESS SHOWN ON THE PLANS OR DIRECTED BY THE ENGINEER. NO DISTURBANCE SHALL OCCUR OUTSIDE OF THE LIMITS OF DISTURBANCE.
21. CONTRACTOR SHALL IMPROVE AND CONSTRUCT THE FARM ROADS AND PERMANENT CROSSINGS BY INSTALLING BRIDGES/CULVERTS, STABILIZING SIDE SLOPES, AND MODIFYING THE FARM ROAD BED ACCORDING TO THE PLANS AND SPECIFICATIONS. PERMANENT STREAM CROSSINGS WILL BE INSTALLED WHILE THE WORKING SECTION CONTAINING THE CROSSING HAS BEEN DEWATERED. ADJUST HAUL ROADS AND ASSOCIATED SILT FENCE AS NECESSARY WHEN PERMANENT STREAM CROSSINGS ARE INSTALLED. THE CONTRACTOR MAY PLACE A TEMPORARY STREAM CROSSING (I.E. LOG MAT) IN THE LOCATION OF THE PERMANENT CROSSING PRIOR TO INSTALLATION OF THE PERMANENT STRUCTURE.
22. THE CONTRACTOR SHALL DILIGENTLY AND CONTINUOUSLY MAINTAIN ALL EROSION CONTROL DEVICES AND STRUCTURES.
23. STABILIZE THE SITE AS AREAS ARE BROUGHT TO FINISHED GRADE. AT THE CONCLUSION OF GRADING AND CONSTRUCTION OR IF LAND-DISTURBING ACTIVITY STOPPED FOR MORE THAN 14 CONSECUTIVE CALENDAR DAYS, PERMANENT SEED MIXTURE SHALL BE APPLIED TO DISTRUBED AREAS PER SHEET L5.01.
24. CONTRACTOR SHALL PLANT WOODY VEGETATION AND LIVE STAKES, ACCORDING TO PLANTING DETAILS AND SPECIFICATIONS. THE CONTRACTOR SHALL COMPLETE THE LIVE STAKING AND REFORESTATION (BARE-ROOT PLANTING) PHASE OF THE PROJECT AND APPLY PERMANENT SEEDING AT THE APPROPRIATE TIME OF YEAR.
25. COORDINATE WITH THE EROSION CONTROL INSPECTOR PRIOR TO REMOVAL OF ANY EROSION CONTROL MEASURES.
26. STABILIZE ALL DISTURBED AREAS. REMOVE STAGING AREA AND CONSTRUCTION ENTRANCE.
27. REMOVE ALL EROSION CONTROL MEASURES AND CONTACT NC DEMLR FOR FINAL INSPECTION ONCE PERMANENT VEGETATION HAS BEEN ESTABLISHED.
28. PERMANENT SITE ACCESS LOCATIONS AND ACCESS ROUTES USED DURING CONSTRUCTON SHALL BE RETURNED TO EQUAL OR BETTER CONDITION THAN THEY EXISTED PRIOR TO THE BEGINING OF CONSTRUCTION ACTIVITIES BEFORE DEMOBILIZING FROM THE SITE.
29. DEMOBILIZE ALL EQUIPMENT AND MATERIALS FROM SITE.

CHANNEL CONSTRUCTION (PUMP AROUND):

1. INSTALL PUMP AROUND ALONG 200' TO 300' OF STREAM CHANNEL, OR NO MORE THAN CAN BE CONSTRUCTED IN ONE (1) WORKING DAY (DEWATERING AND PUMP AROUND DETAILS ON SHEET C6.11).
2. RIPRAP APRONS WILL BE CONSTRUCTED TO IMPEDE ANY EROSION OF THE CHANNEL AND STREAM BANKS BY THE WATER DIVERTED FROM THE PUMP-AROUND PROCEDURE.
3. WORK SECTIONS THAT INVOLVE THE CONSTRUCTION OF A CONFLUENCE OR TWO REACHES MAY REQUIRE THE USE OF TWO PUMP-AROUND OPERATIONS.
4. HARVEST MATERIAL FROM THE BOTTOM OF THE EXISTING CHANNEL TO BE PLACED IN THE BOTTOM OF THE PROPOSED CHANNEL. THIS SHALL INCLUDE THE SURFACE MATERIAL AND UP TO ONE (1) FOOT BELOW TO INCLUDE THE HYPORHEIC ZONE. ADDITIONAL RIVER STONE SHALL BE MIXED WITH EXISTING CHANNEL MATERIAL AS NECESSARY.
5. IN-STREAM STRUCTURES WILL BE INSTALLED ACCORDING TO THE DETAILS PRESENTED ON SHEET C8.00-C8.06.
6. FILL EXISTING CHANNEL ON THE SAME WORKING DAY AS COMPLETING THE PROPOSED CHANNEL. IN NO EVENT SHALL THE EXISTING CHANNEL BE FILLED PRIOR TO THE COMPLETE CONSTRUCTION OF THE CORRESPONDING PROPOSED CHANNEL.
7. ANY DEWATERING OPERATIONS DURING CONSTRUCTION SHALL USE A FLOATING INTAKE AND SILT BAG TO MINIMIZE SEDIMENT DISCHARGE. FLOATING INTAKE AND SILT BAG SHALL BE CONTINUOUSLY MONITORED WHILE IN USE FOR SIGNS OF CLOGGING OR MALFUNCTION.
8. ANY EXCAVATED MATERIAL CONTAINING MANMADE MATERIAL IS NOT SUITABLE MATERIAL FOR CHANNEL FILL AND MUST BE DISPOSED OF OFFSITE UNLESS OTHERWISE DIRECTED BY OWNER.
9. IN ANY SECTION WHERE THE NEW CHANNEL ALIGNMENT CROSSES THE EXISTING CHANNEL A CLAY PLUG WILL BE INSTALLED IN THE EXISTING CHANNEL AS PER DETAIL ON SHEET C6.07.
10. THE PROPOSED CHANNEL BANKS SHALL BE STABILIZED WITH EROSION CONTROL MATTING AND TEMPORARY SEEDING UPON COMPLETION OF EACH SECTION AS PER DETAIL ON SHEETS C6.08 AND L5.01.
11. COMPLETE ALL EARTHWORK, STRUCTURE INSTALLATION, AND STABILIZATION IN THE PUMP AROUND AREA.
12. CONTRACTOR SHALL NOTIFY ENGINEER UPON DISCOVERY OF ANY CONSTRAINTS DISCOVERED IN THE CONSTRUCTION OF THE PROPOSED CHANNEL OR STRUCTURE PLACEMENT AND ADJUSTMENTS CAN BE MADE ON SITE.
13. GRADING OF THE PROPOSED FLOODPLAIN MAY NEED TO BE DELAYED UNTIL AFTER WORK IN SUBSEQUENT SECTIONS HAS BEEN COMPLETED, ESPECIALLY NEAR CONFLUENCES. HAUL ROADS AND TEMPORARY SILT FENCE MAY ALSO NEED TO BE REMOVED BEFORE THE PROPOSED FLOODPLAIN CAN BE COMPLETED AND/OR UNUSED EXISTING CHANNEL CAN BE FILLED.

EXISTING CONDITION & DEMOLITION NOTES:

1. THERE SHALL BE NO DEMOLITION ACTIVITIES UNTIL AFTER A PRE-CONSTRUCTION MEETING HAS TAKEN PLACE.
2. ALL MATERIAL TO BE DEMOLISHED SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT A PERMITTED SITE IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL LAWS.
3. EXISTING UTILITIES AND STRUCTURES SHOWN, BOTH UNDERGROUND AND ABOVE GROUND, ARE BASED ON A FIELD SURVEY AND THE BEST AVAILABLE RECORD DRAWINGS. THE CONTRACTOR SHALL VERIFY FIELD CONDITIONS PRIOR TO BEGINNING RELATED CONSTRUCTION. ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER IMMEDIATELY.

SITE PREPARATION: CLEARING & TOPSOIL/SUBSOIL EXCAVATION

1. ALL SHRUBS AND SMALL TREES DESIGNATED BY THE ENGINEER WILL BE SAVED FOR TRANSPLANTING. PLANTS THAT ARE TO BE TRANSPLANTED WILL BE MARKED WITH HIGHLY VISIBLE TAPE.
2. ANY UNUSABLE TREES & BRUSH REMOVED DURING CLEARING & GRUBBING OF SITE SHALL BE CHIPPED ON SITE AND HAULED OFF SITE FOR DISPOSAL.
3. CONTRACTOR SHALL MANAGE EXCAVATED TOPSOIL SEPARATELY FROM EXCAVATED SUBSOIL. EXCAVATED TOPSOIL SHALL BE PLACED WITHIN THE DESIGNATED TEMPORARY STOCKPILE AREAS AWAY FROM THE CHANNEL TO BE FILLED (SEE PLANS). TOPSOIL SHALL BE FREE OF STONES OVER 1" IN DIAMETER, ROOTS, STICKS, RUBBISH, STIFF CLAY, AND EXTRANEOUS MATTER.
4. EXCAVATED SUBSOIL SHALL BE PLACED NEAR THE CHANNEL TO BE FILLED. ONCE THE NEW STREAM IS CONSTRUCTED, SUBSOIL SHALL BE USED TO FILL THE EXISTING CHANNEL FIRST, THEN STOCKPILED TOPSOIL SHALL BE USED FOR THE FINAL 6 INCHES OF FILL TO ACHIEVE DESIGN GRADES AND CREATE A SOIL BASE FOR VEGETATION.
5. CONTRACTOR SHALL HARVEST AND STOCKPILE NATIVE CHANNEL SUBSTRATE (COBBLE, STONE, ETC.) FOR USE IN PROPOSED IN-STREAM STRUCTURES.

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 049073 REBECCA STUBBS 1.20.22

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2905 Meridian Parkway
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phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

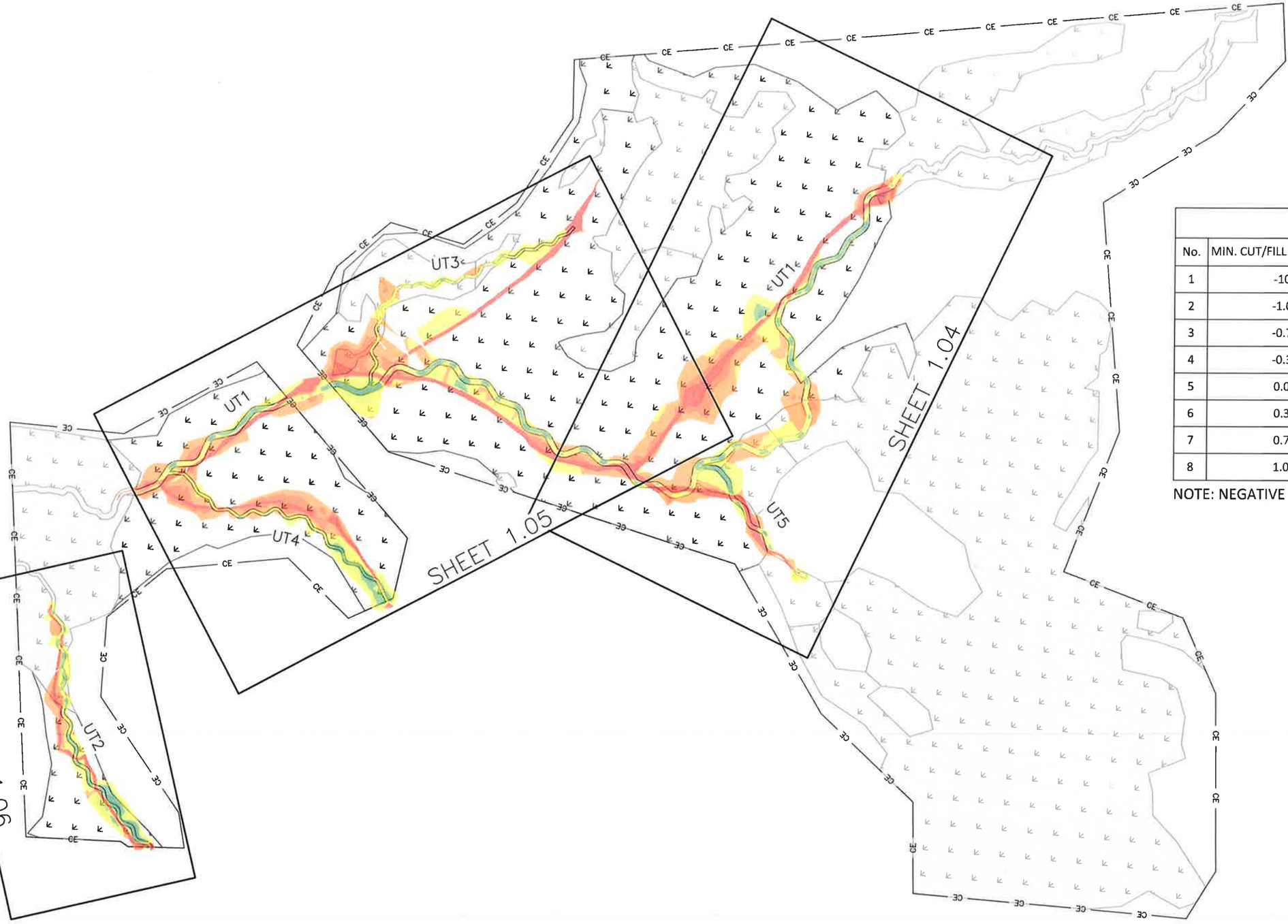
Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	C1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	
DATE	01.18.2022

CONSTRUCTION NOTES

C1.03



ELEVATIONS TABLE			
No.	MIN. CUT/FILL DEPTH (ft)	MAX. CUT/FILL DEPTH (ft)	COLOR
1	-10	-1.0	
2	-1.0	-0.7	
3	-0.7	-0.3	
4	-0.3	0.0	
5	0.0	0.3	
6	0.3	0.7	
7	0.7	1.0	
8	1.0	10	

NOTE: NEGATIVE VALUES INDICATE CUT

GRAPHIC SCALE

0 75 150 300

1 inch = 150 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

CRANE MITIGATION SITE

PRELIMINARY CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	C2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=150'
DATE	01.18.2022

GRADING DEPTHS

C1.04

MATCHLINE SHEET 1.05

ELEVATIONS TABLE			
No.	MIN. CUT/FILL DEPTH (ft)	MAX. CUT/FILL DEPTH (ft)	COLOR
1	-10	-1.0	
2	-1.0	-0.7	
3	-0.7	-0.3	
4	-0.3	0.0	
5	0.0	0.3	
6	0.3	0.7	
7	0.7	1.0	
8	1.0	10	

NOTE: NEGATIVE VALUES INDICATE CUT

UT1

UT5

GRAPHIC SCALE

0 25 50 100

1 inch = 50 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.2022

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CRANE MITIGATION SITE

PRELIMINARY CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

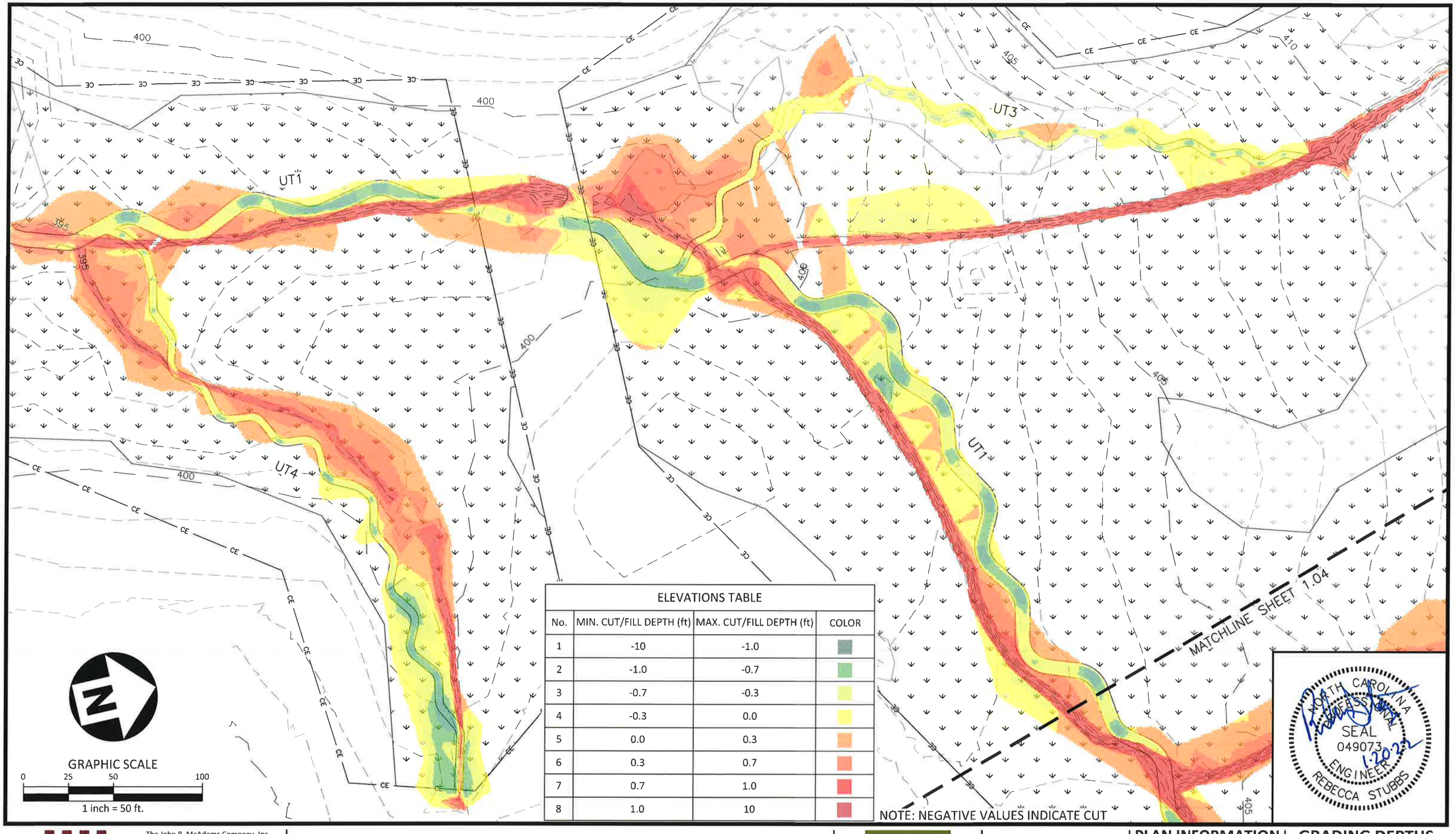
Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	C2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=50'
DATE	01.18.2022

GRADING DEPTHS

C1.05



GRAPHIC SCALE

0 25 50 100

1 inch = 50 ft.

ELEVATIONS TABLE			
No.	MIN. CUT/FILL DEPTH (ft)	MAX. CUT/FILL DEPTH (ft)	COLOR
1	-10	-1.0	
2	-1.0	-0.7	
3	-0.7	-0.3	
4	-0.3	0.0	
5	0.0	0.3	
6	0.3	0.7	
7	0.7	1.0	
8	1.0	10	

NOTE: NEGATIVE VALUES INDICATE CUT

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

PRELIMINARY CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

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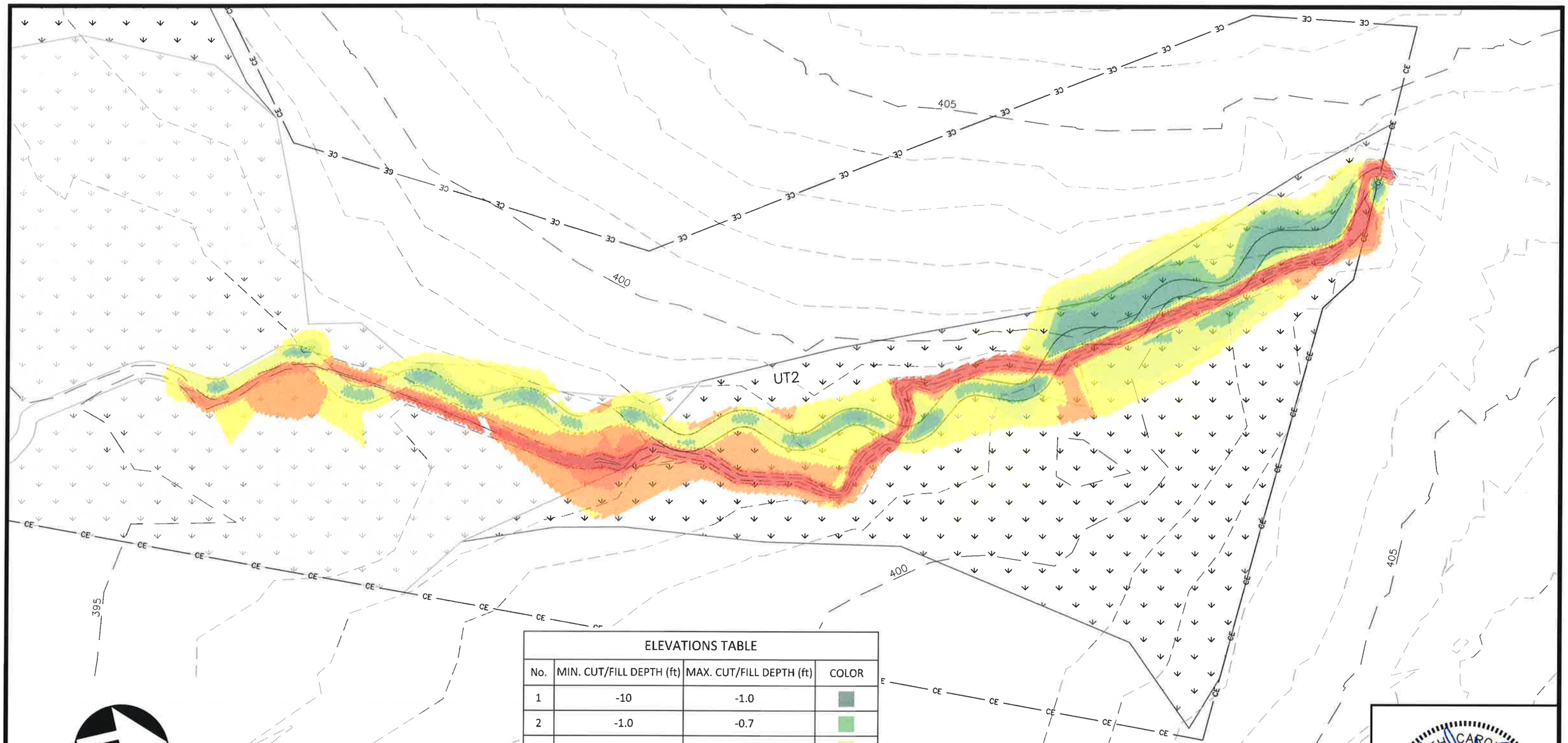
PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	C2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=50'
DATE	01.18.2022

GRADING DEPTHS

C1.06



ELEVATIONS TABLE			
No.	MIN. CUT/FILL DEPTH (ft)	MAX. CUT/FILL DEPTH (ft)	COLOR
1	-10	-1.0	
2	-1.0	-0.7	
3	-0.7	-0.3	
4	-0.3	0.0	
5	0.0	0.3	
6	0.3	0.7	
7	0.7	1.0	
8	1.0	10	

NOTE: NEGATIVE VALUES INDICATE CUT

GRAPHIC SCALE
0 15 30 60
1 inch = 30 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE
PRELIMINARY CONSTRUCTION DRAWINGS
LEE COUNTY, NORTH CAROLINA

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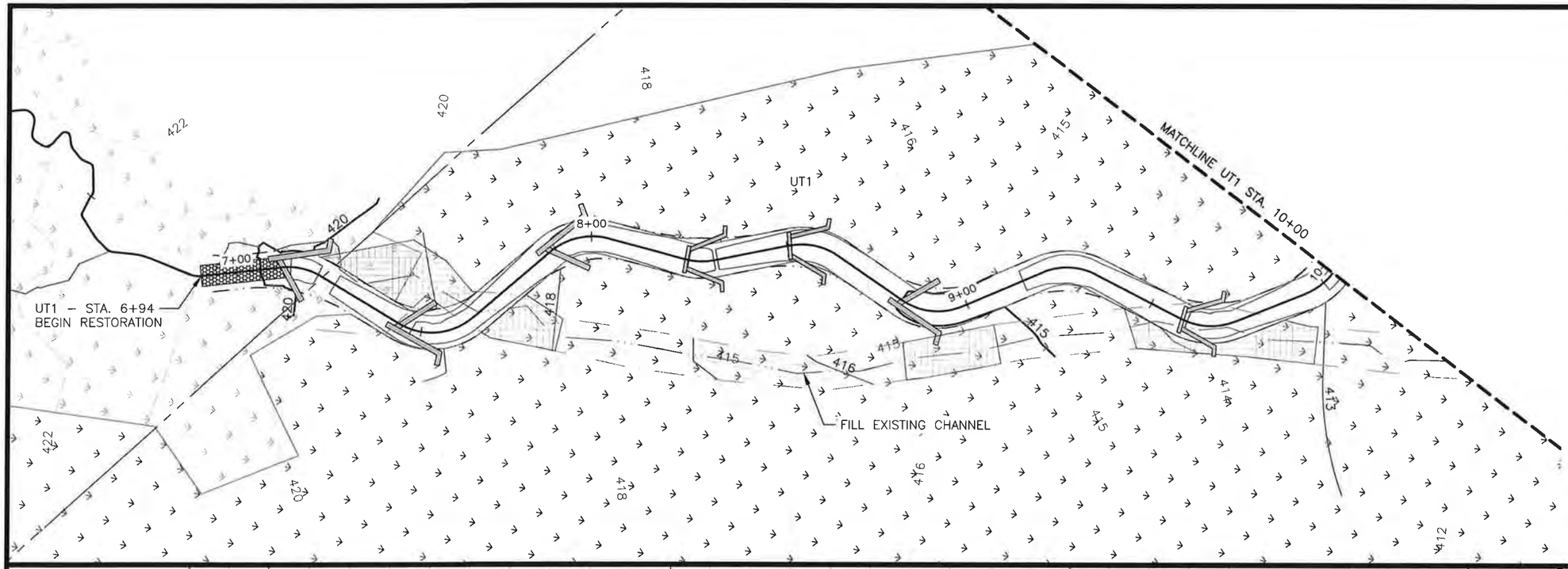
Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	C2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=30'
DATE	01.18.2022

GRADING DEPTHS

C1.07



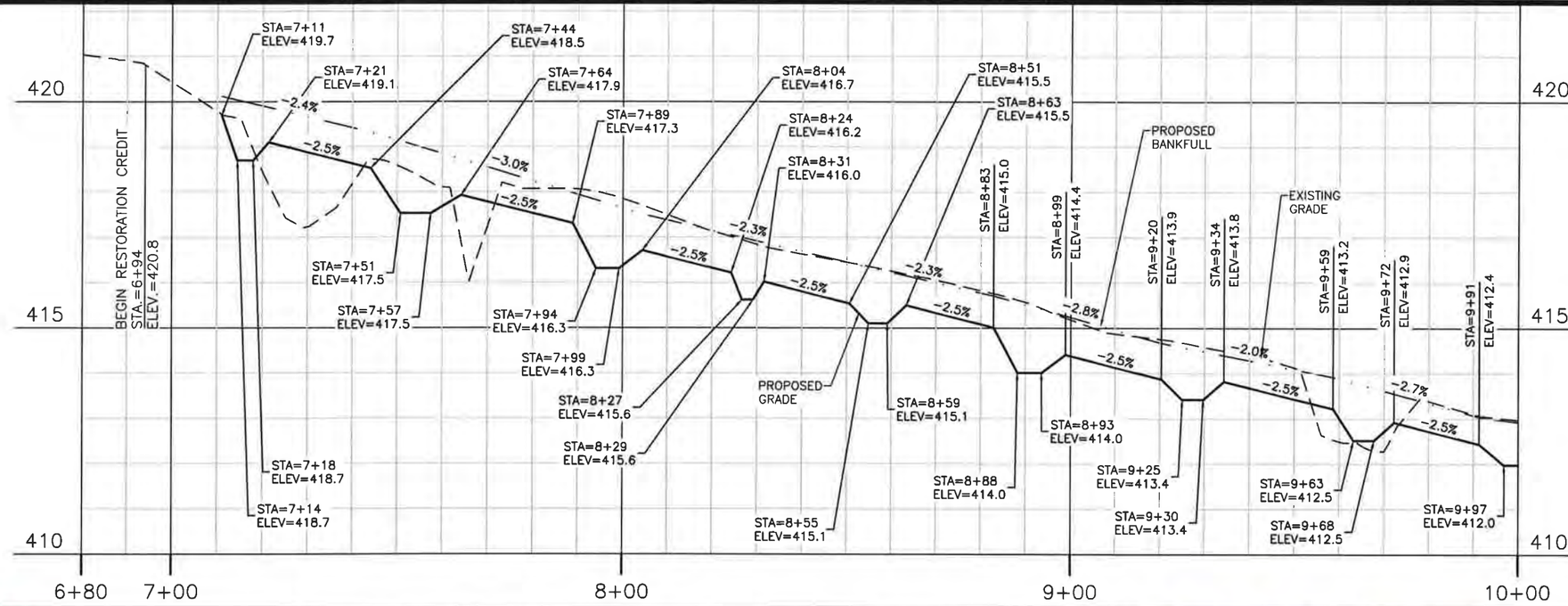
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
SILL STEP	7+11	419.7
SILL STEP	7+44	418.5
SILL STEP	7+89	417.3
LOG CROSS VANE	8+24	416.2
LOG CROSS VANE	8+51	415.5
SILL STEP	8+83	415.0
LOG CROSS VANE	9+59	413.2

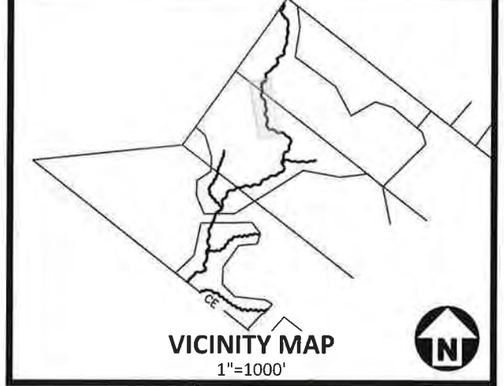
GRAPHIC SCALE

0 15 30 60

1 inch = 30 ft.

TOTAL DISTURBED AREA = 30.9 AC.





NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

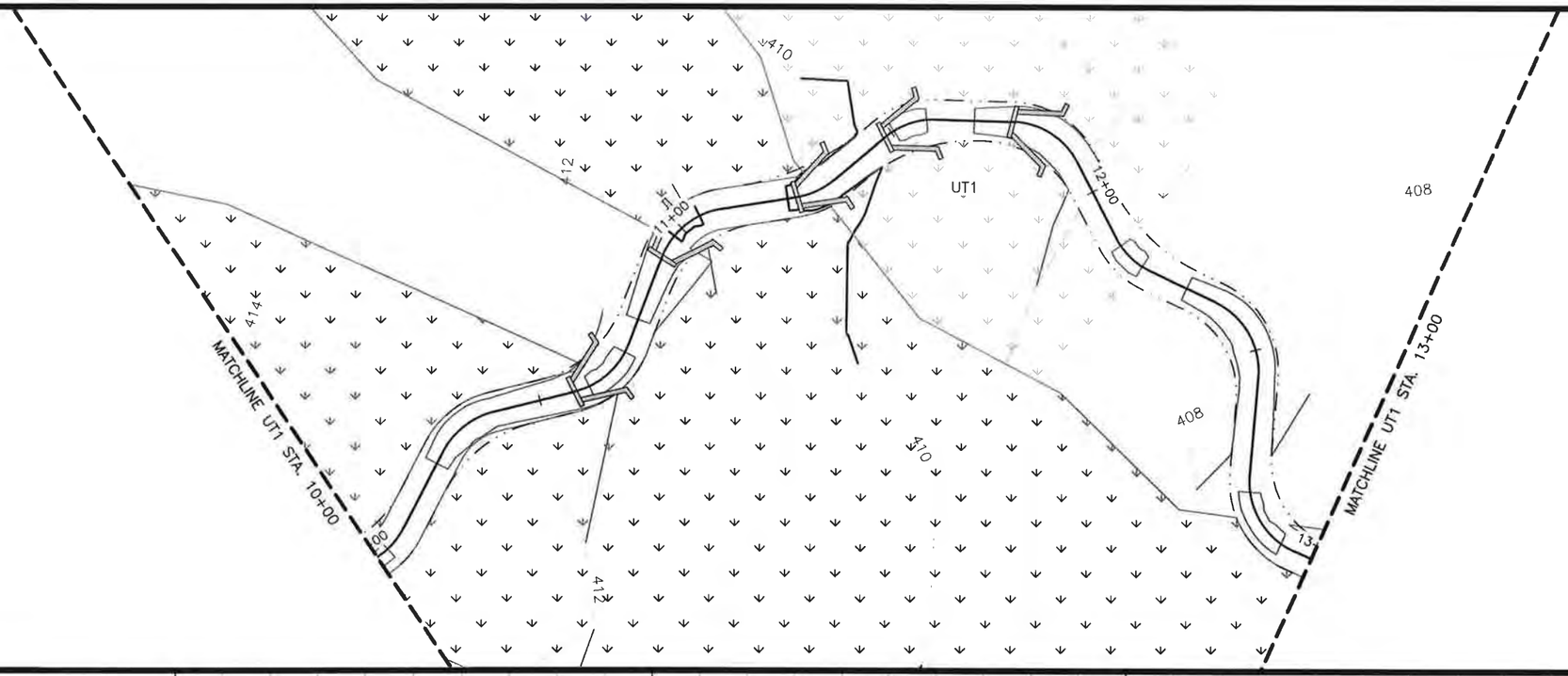
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=30'
DATE	01.18.2022

PLAN AND PROFILE

UT1 STA. 6+80 - 10+00

C5.00



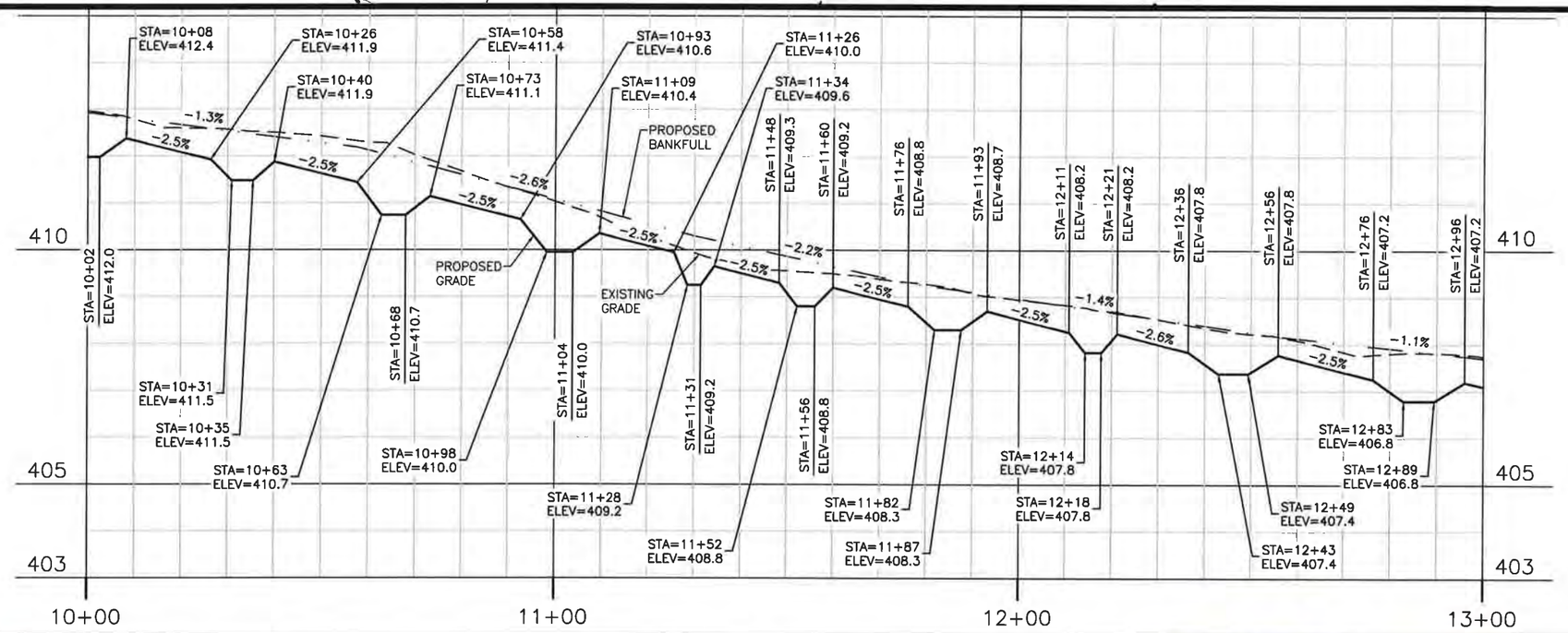
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE	10+58	411.4
LOG CROSS VANE	10+93	410.6
LOG CROSS VANE	11+26	410.0
LOG CROSS VANE	11+48	409.3
LOG CROSS VANE	11+76	408.8

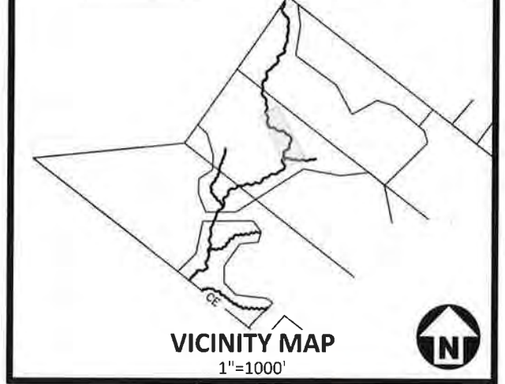
GRAPHIC SCALE

0 15 30 60

1 inch = 30 ft.

TOTAL DISTURBED AREA = 30.9 AC.





NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT SEAL 049073 ENGINEER REBECCA STUBBS

1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

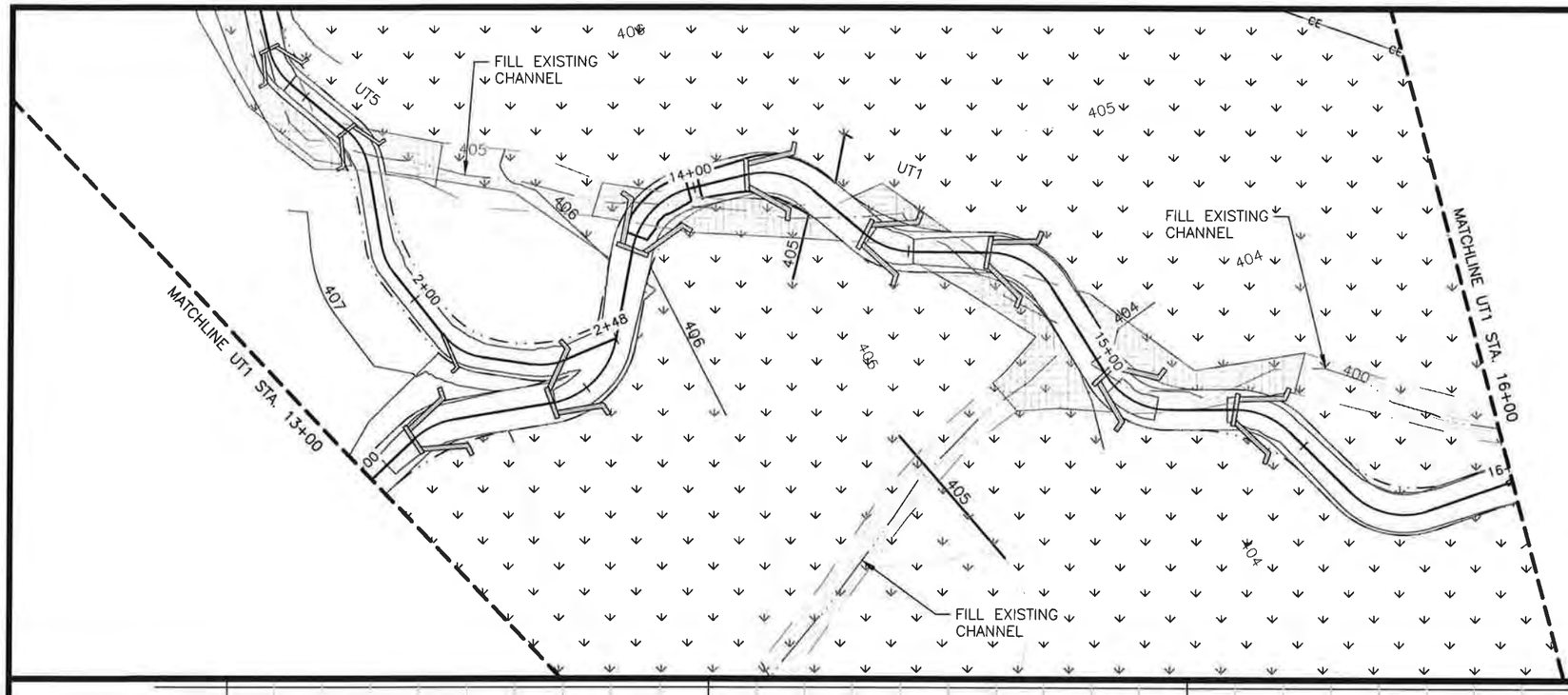
PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=30'
DATE	01.18.2022

PLAN AND PROFILE

UT1 STA. 10+00 - 13+00

C5.01



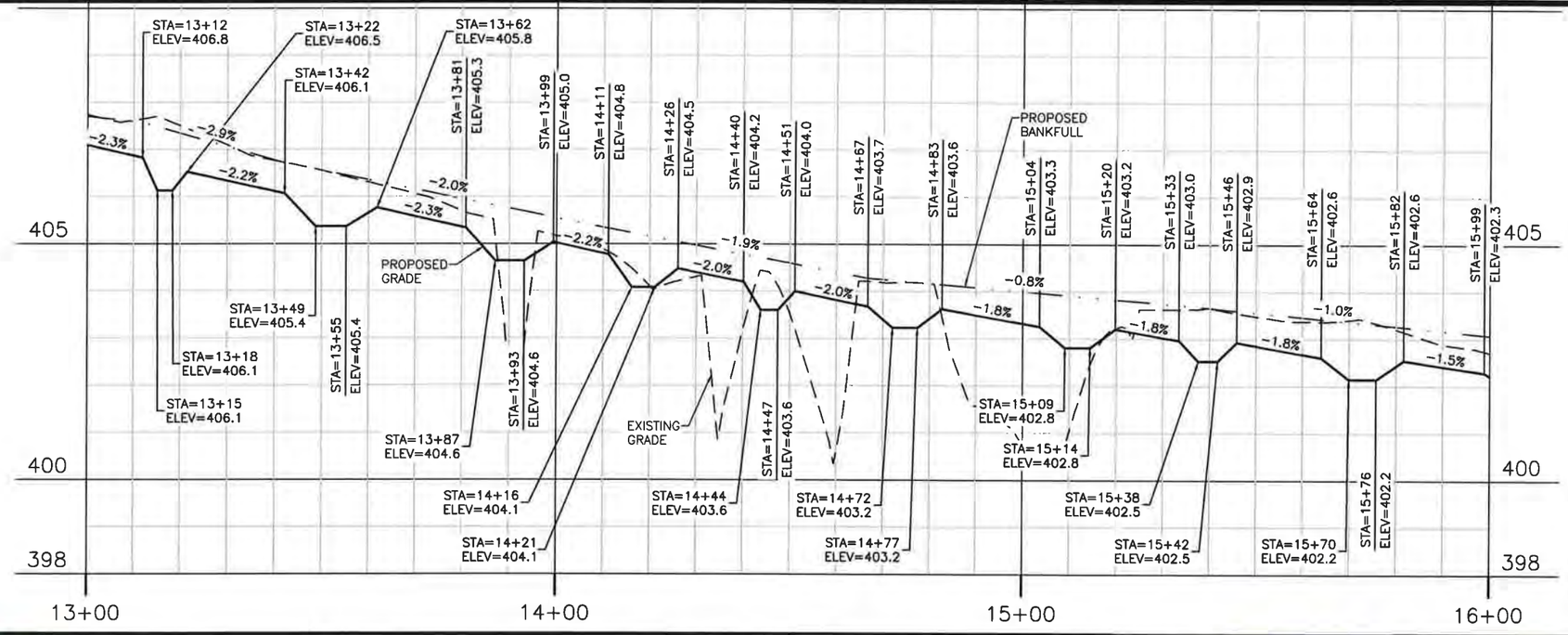
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE	13+12	406.8
LOG CROSS VANE	13+42	406.1
LOG CROSS VANE	13+81	405.3
LOG CORSS VANE	14+11	404.8
LOG CROSS VANE	14+40	404.2
LOG CROSS VANE	14+67	403.7
LOG CROSS VANE	15+04	403.3
LOG CROSS VANE	15+33	403.0
LOG VANE	15+99	402.3

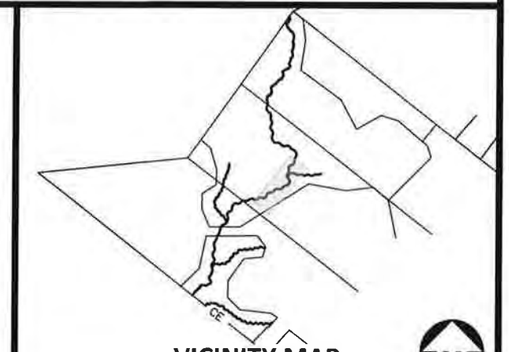
GRAPHIC SCALE

0 15 30 60

1 inch = 30 ft.

TOTAL DISTURBED AREA = 30.9 AC.





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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

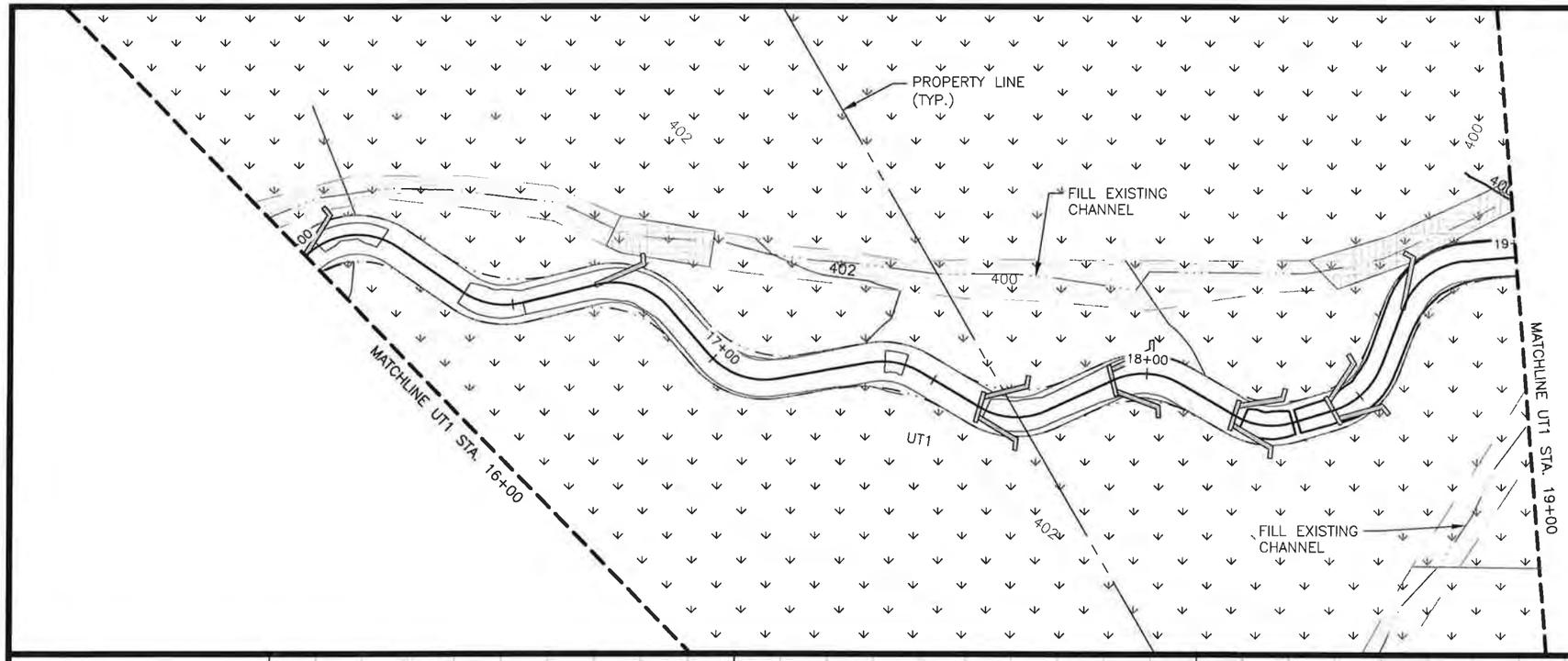
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=30'
DATE	01.18.2022

PLAN AND PROFILE

UT1 STA. 13+00 - 16+00

C5.02



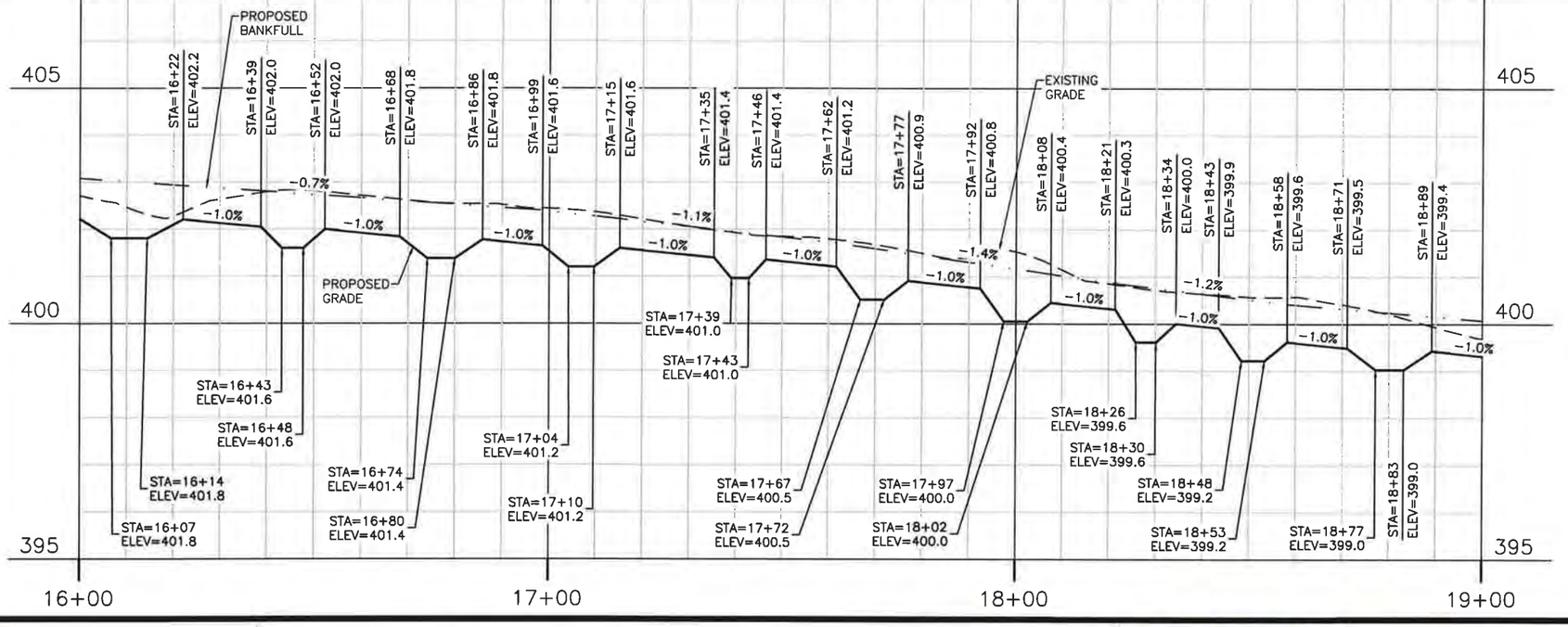
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG VANE	16+68	401.8
LOG CROSS VANE	17+62	401.2
LOG CROSS VANE	17+92	400.8
LOG CROSS VANE	18+21	400.3
LOG CROSS VANE	18+43	399.9
LOG VANE	18+71	399.5

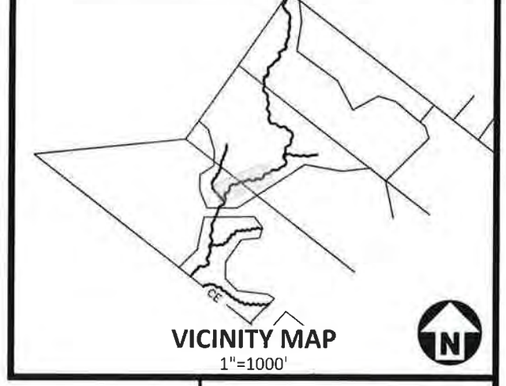
GRAPHIC SCALE

0 15 30 60

1 inch = 30 ft.

TOTAL DISTURBED AREA = 30.9 AC.





NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

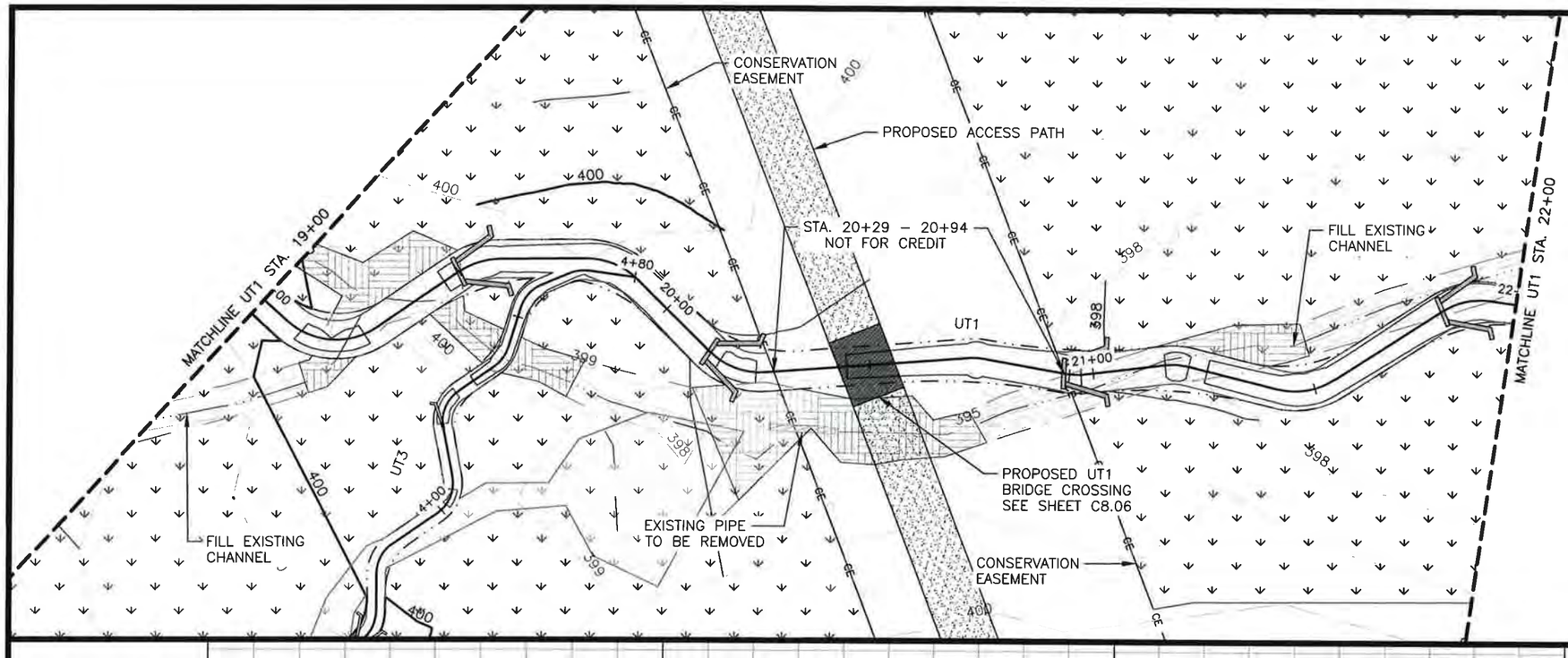
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=30'
DATE	01.18.2022

PLAN AND PROFILE

UT1 STA. 16+00 - 19+00

C5.03



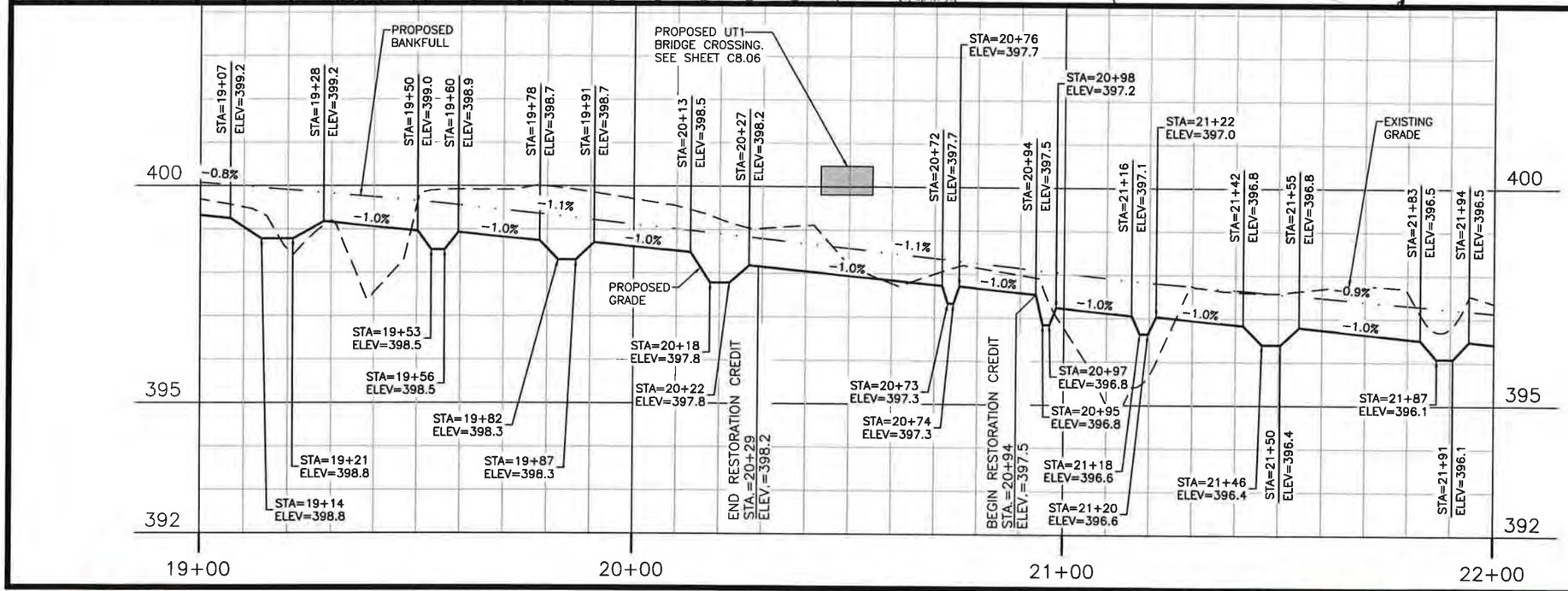
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE	19+50	399.0
LOG CROSS VANE	20+13	398.5
LOG CROSS VANE	20+94	397.4
LOG CROSS VANE	21+83	396.5

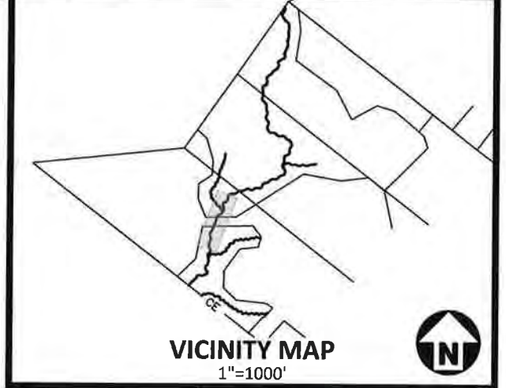
GRAPHIC SCALE

0 15 30 60

1 inch = 30 ft.

TOTAL DISTURBED AREA = 30.9 AC.





VICINITY MAP
1"=1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS
2.23.22

The John R. McAdams Company, Inc.
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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

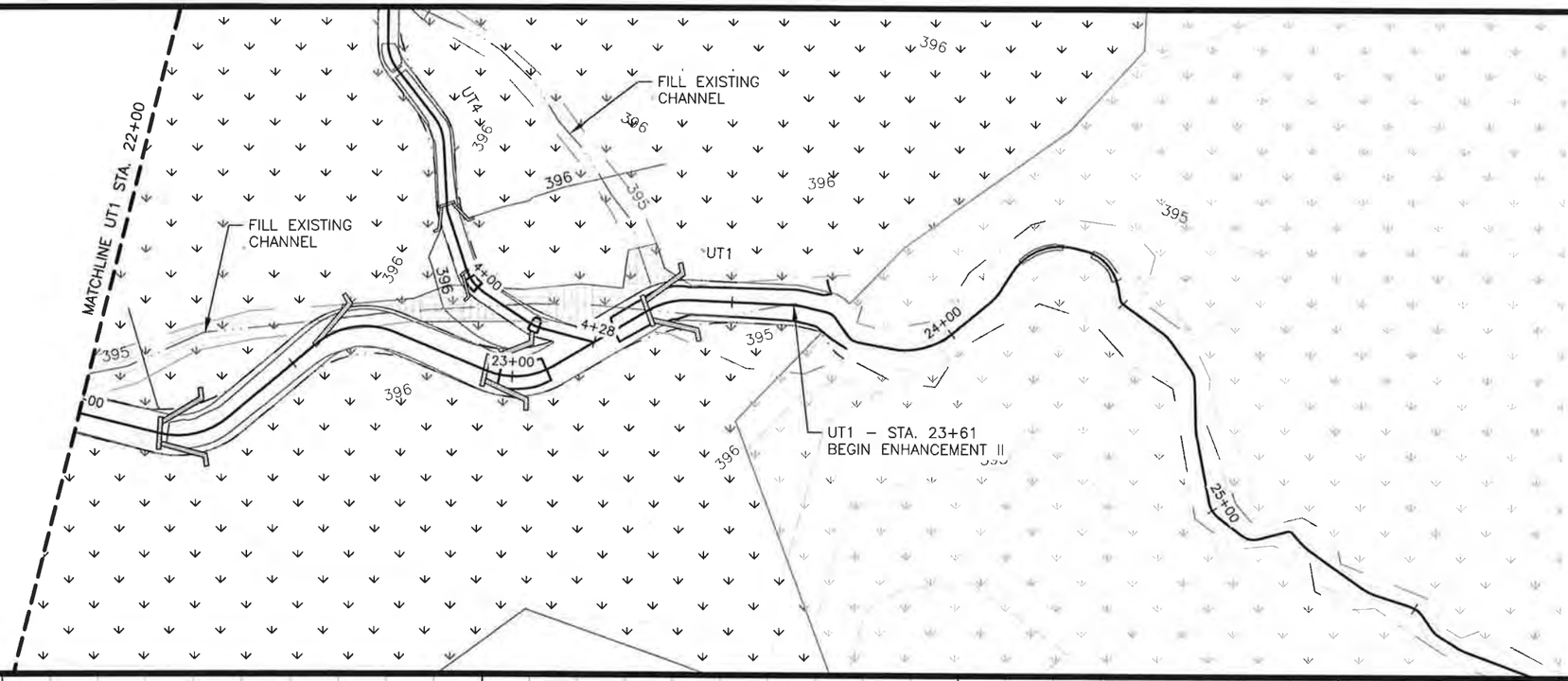
RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=30'
DATE	01.18.2022

PLAN AND PROFILE
UT1

C5.04



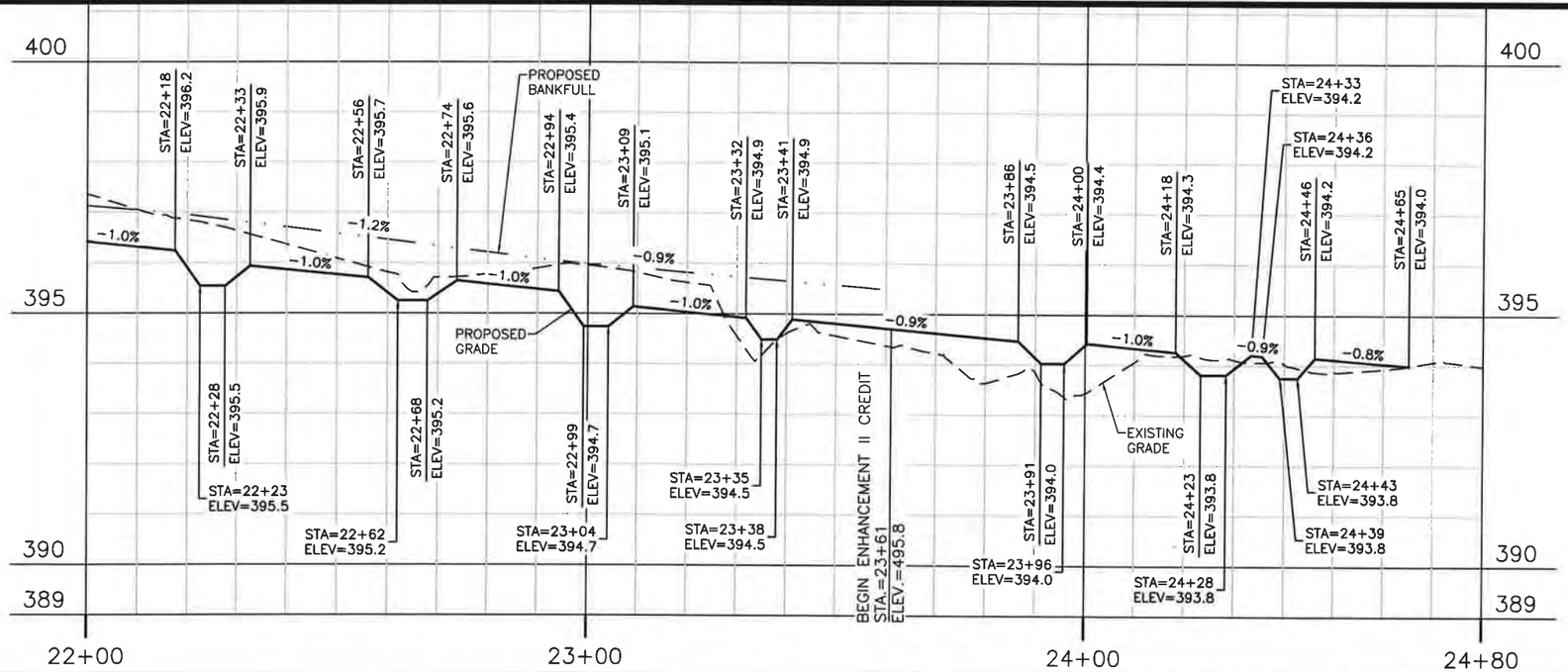
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE	22+18	396.2
LOG VANE	22+56	395.7
LOG CROSS VANE	22+94	395.4
LOG CROSS VANE	23+32	394.9

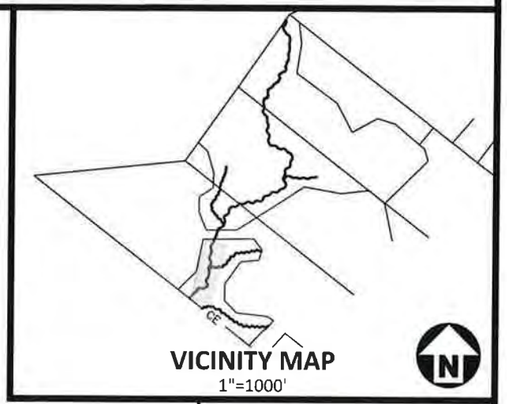
GRAPHIC SCALE

0 15 30 60

1 inch = 30 ft.

TOTAL DISTURBED AREA = 30.9 AC.





NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

MCADAMS

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

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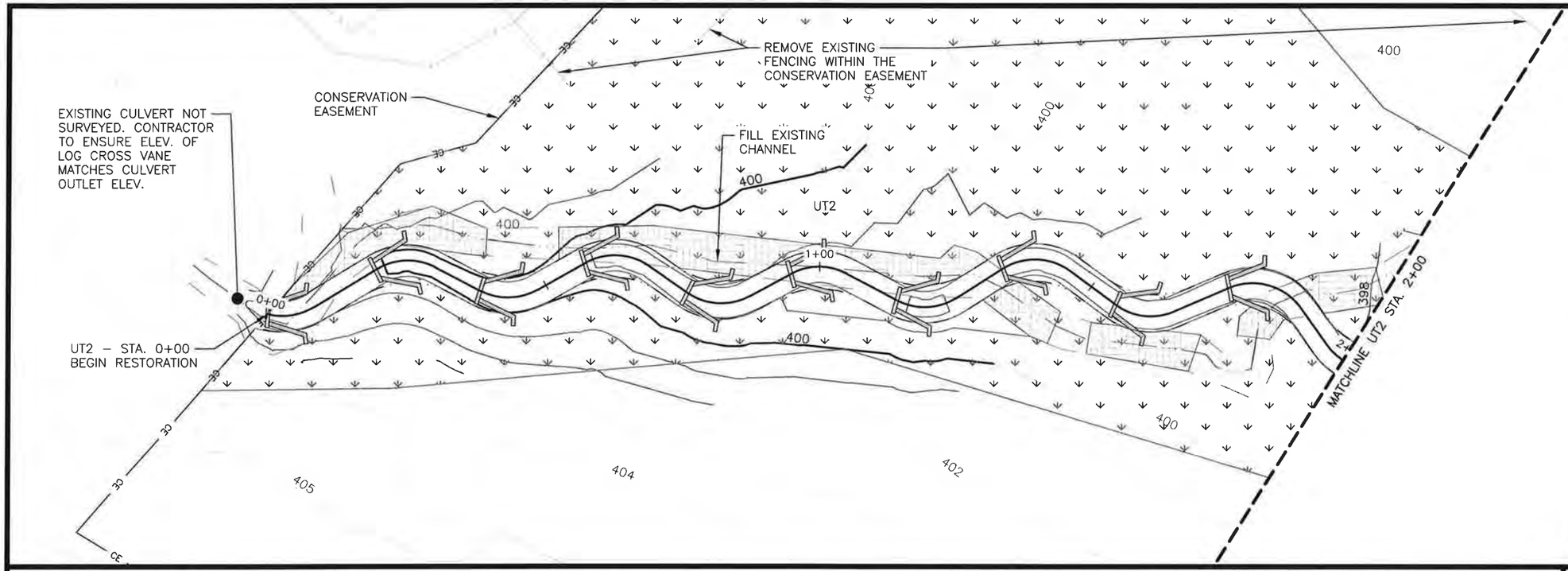
PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=30'
DATE	01.18.2022

PLAN AND PROFILE

UT1 STA. 22+00 - 24+80

C5.05



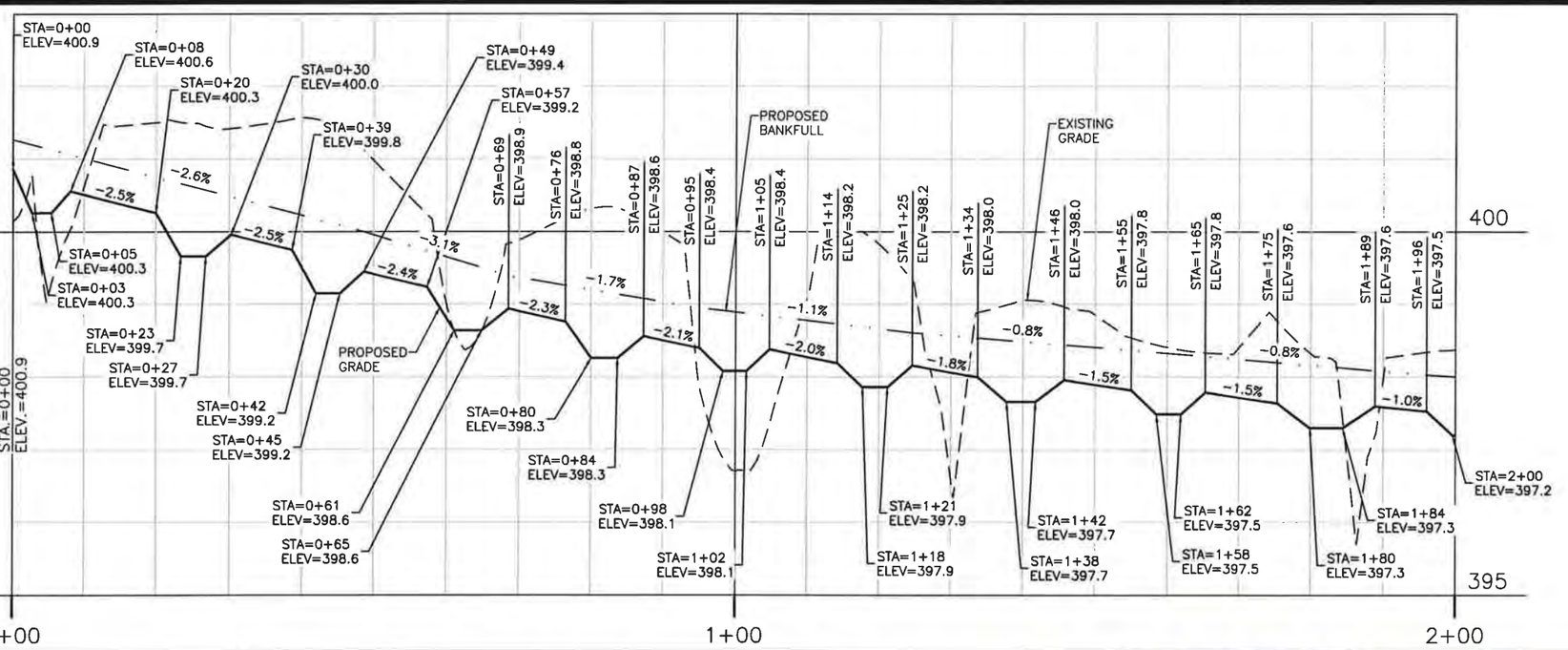
UT2 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE	0+00	400.9
LOG CROSS VANE	0+20	400.3
LOG CROSS VANE	0+39	399.8
LOG CROSS VANE	0+57	399.2
LOG CROSS VANE	0+76	398.8
LOG CROSS VANE	0+95	398.4
LOG CROSS VANE	1+14	398.2
LOG CROSS VANE	1+34	398.0
LOG CROSS VANE	1+55	397.8
LOG CROSS VANE	1+75	397.6

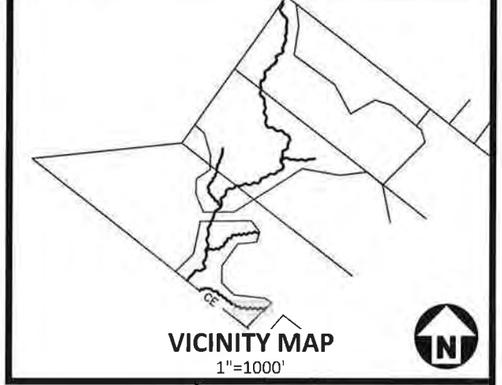
GRAPHIC SCALE

0 10 20 40

1 inch = 20 ft.

TOTAL DISTURBED AREA = 30.9 AC.





NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.28.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

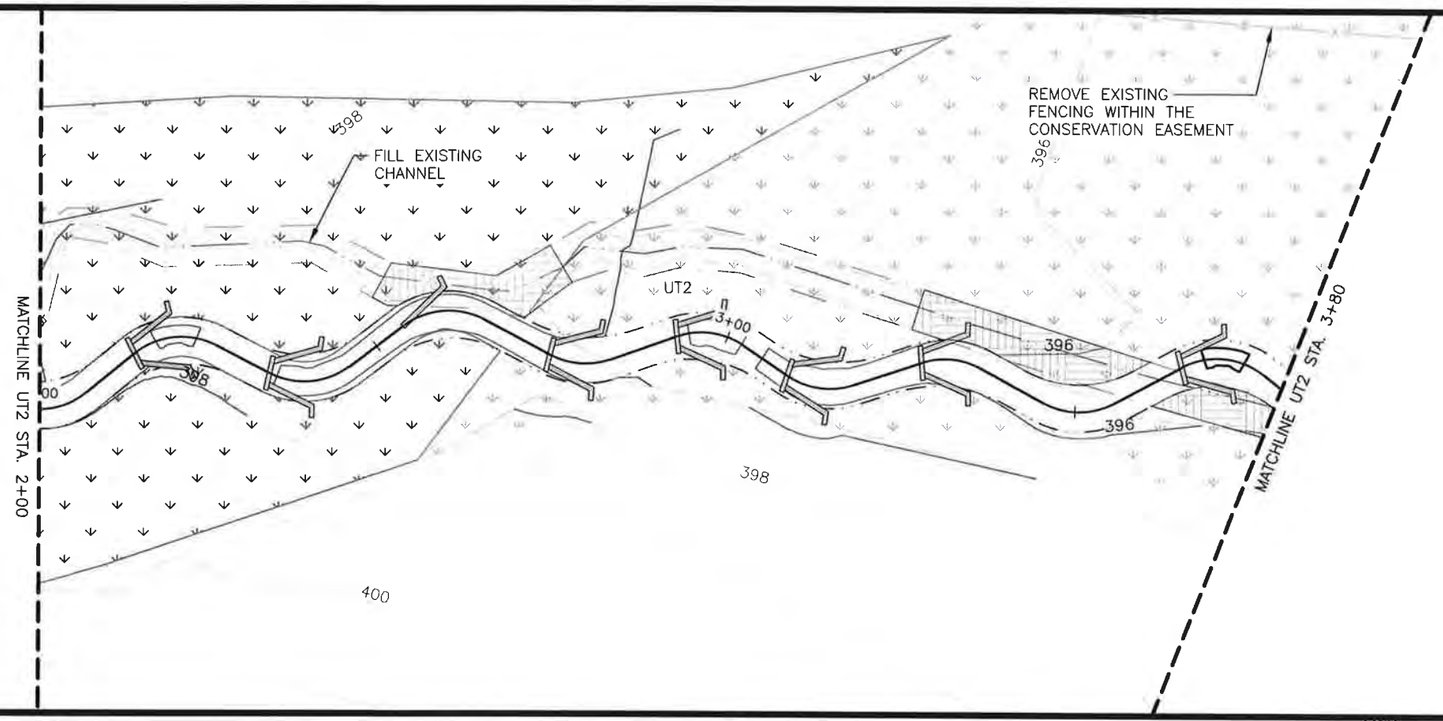
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=20'
DATE	01.18.2022

PLAN AND PROFILE

UT2 STA. 0+00 - 2+00

C5.06



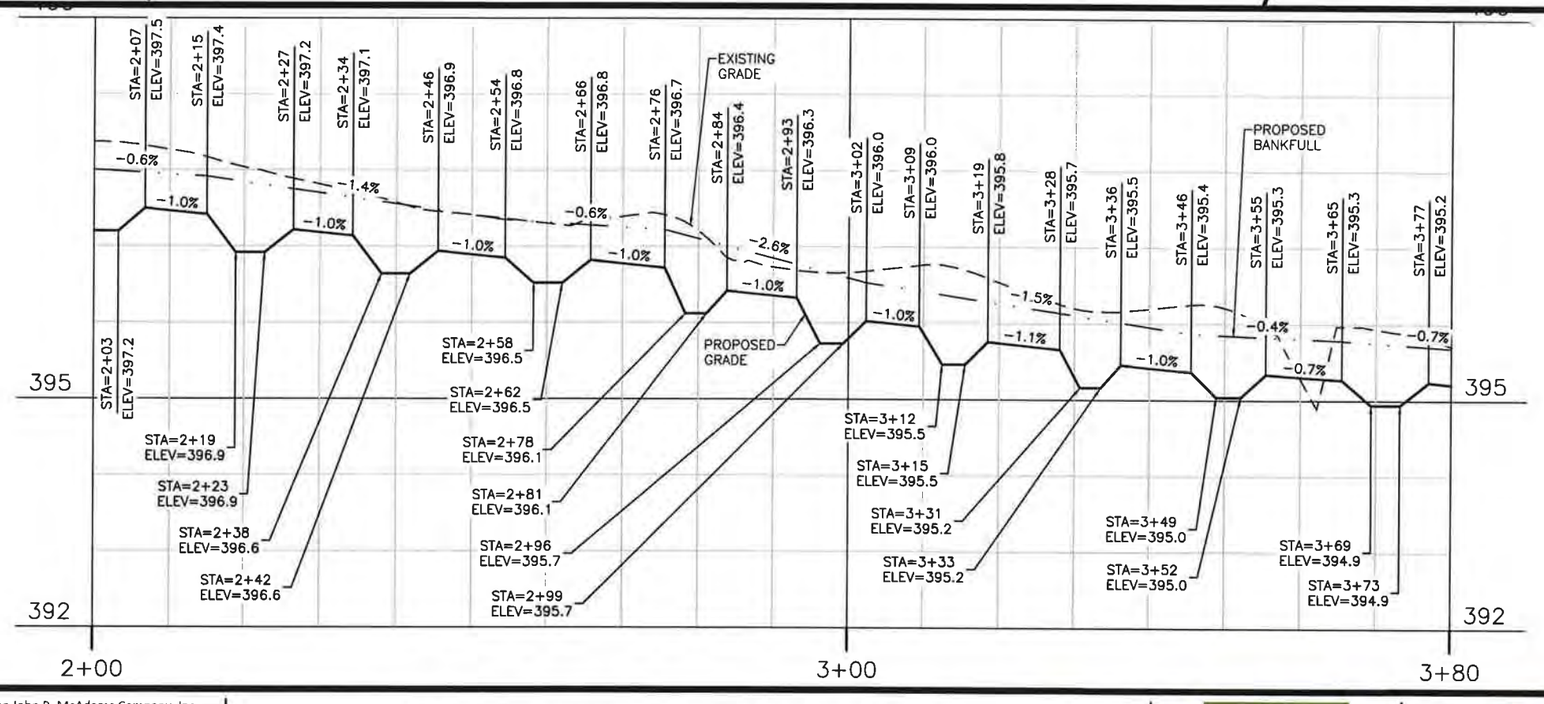
UT2 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE	2+15	397.4
LOG CROSS VANE	2+34	397.1
LOG VANE	2+54	396.8
LOG CROSS VANE	2+76	396.7
LOG CROSS VANE	2+93	396.3
LOG CROSS VANE	3+09	396.0
LOG CROSS VANE	3+28	395.7
LOG CROSS VANE	3+65	395.3

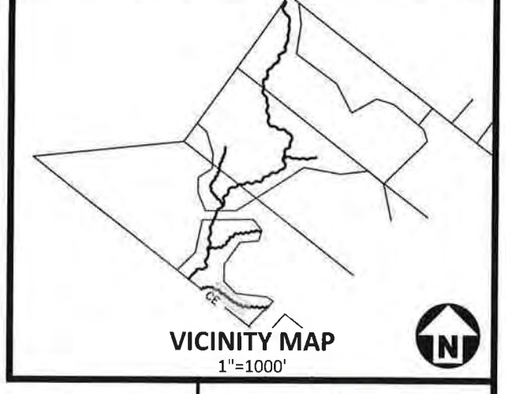
GRAPHIC SCALE

0 10 20 40

1 inch = 20 ft.

TOTAL DISTURBED AREA = 30.9 AC.





NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.2022

MCADAMS

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

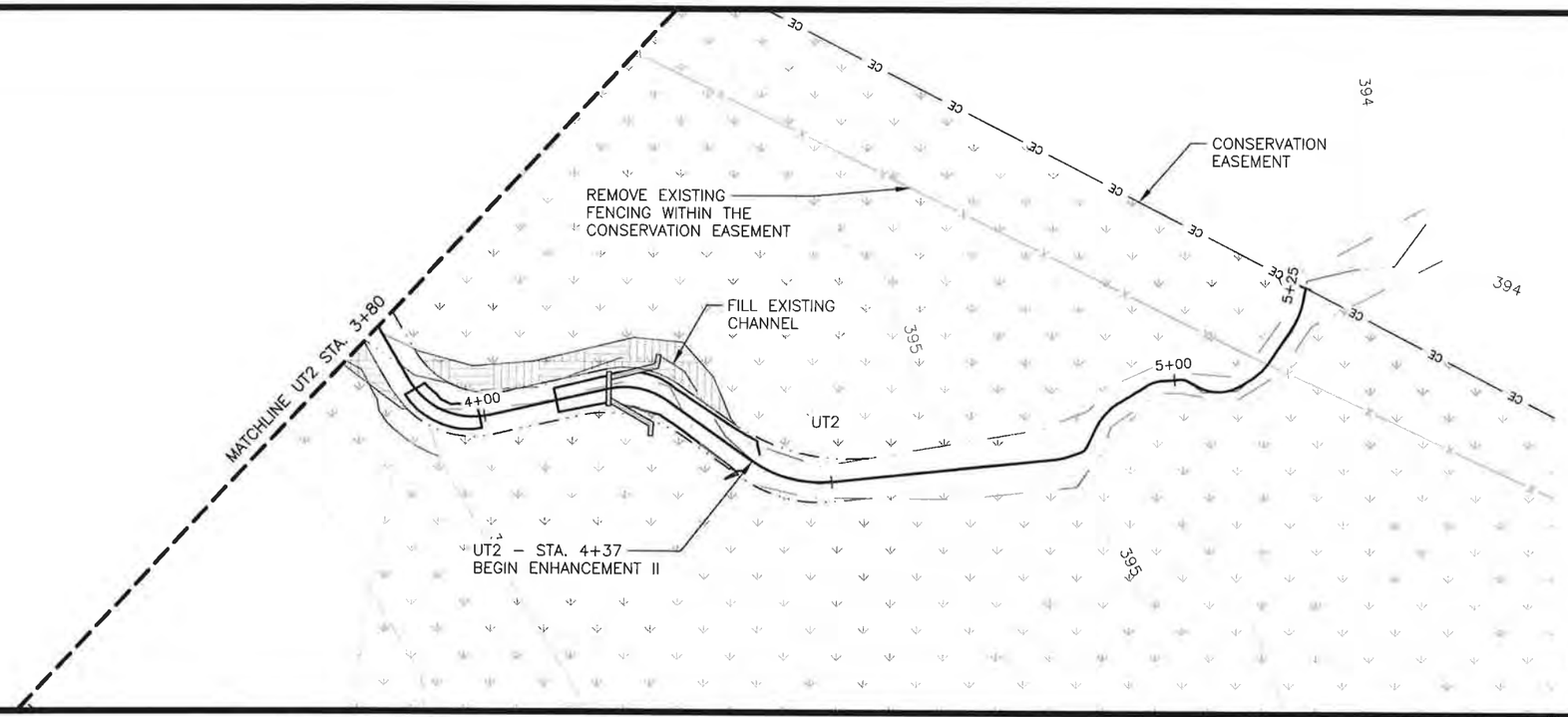
PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=20'
DATE	01.18.2022

PLAN AND PROFILE

UT2 STA. 2+00 - 3+80

C5.07



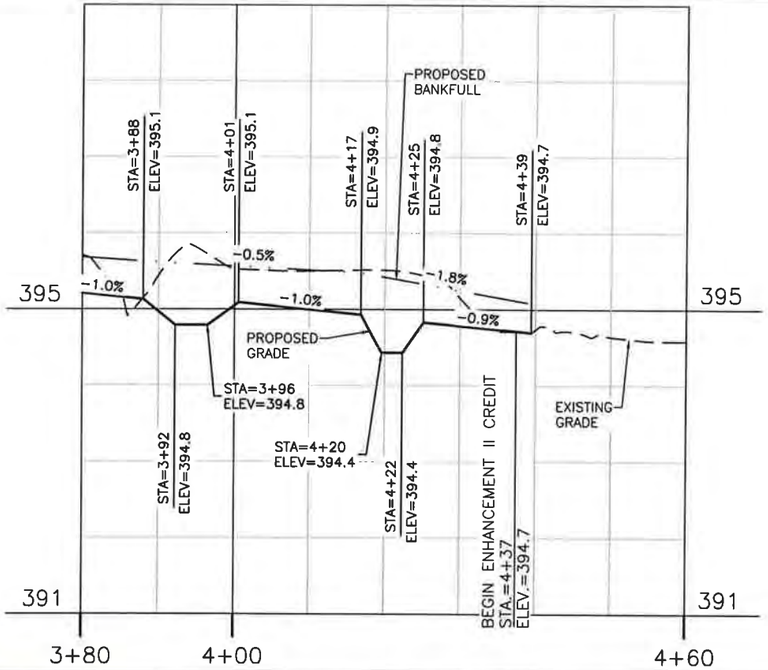
UT2 CREEK STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE	4+17	394.9

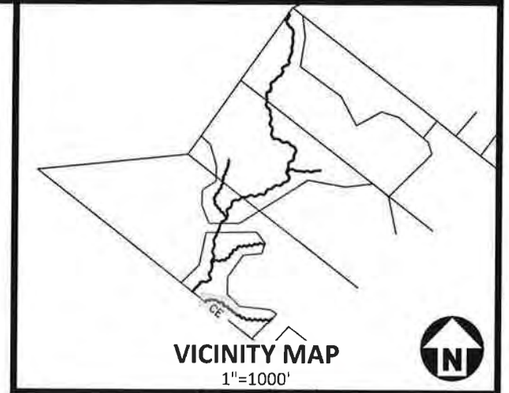
GRAPHIC SCALE

0 10 20 40

1 inch = 20 ft.

TOTAL DISTURBED AREA = 30.9 AC.





NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

MCADAMS

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

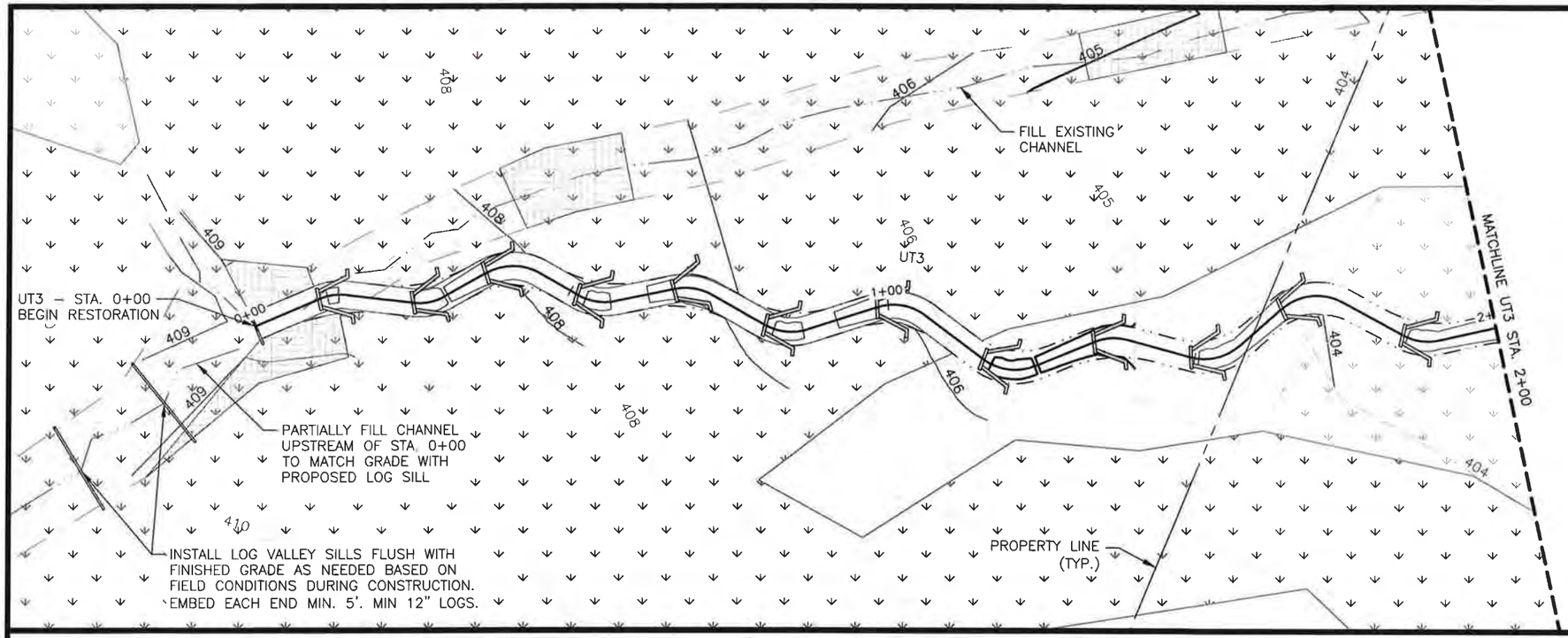
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=20'
DATE	01.18.2022

PLAN AND PROFILE

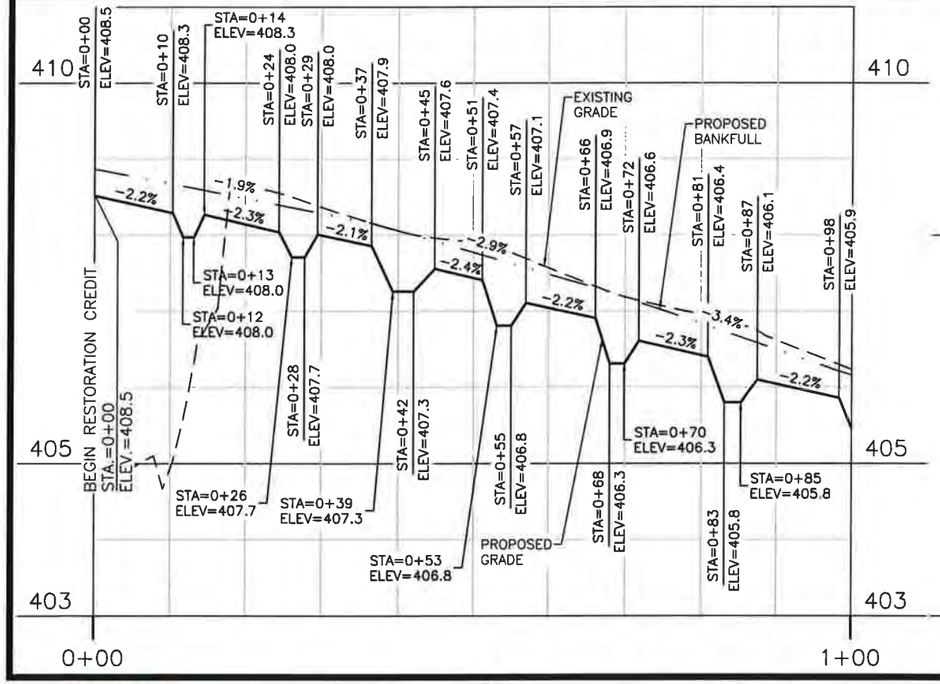
UT2 STA. 3+80 - 4+60

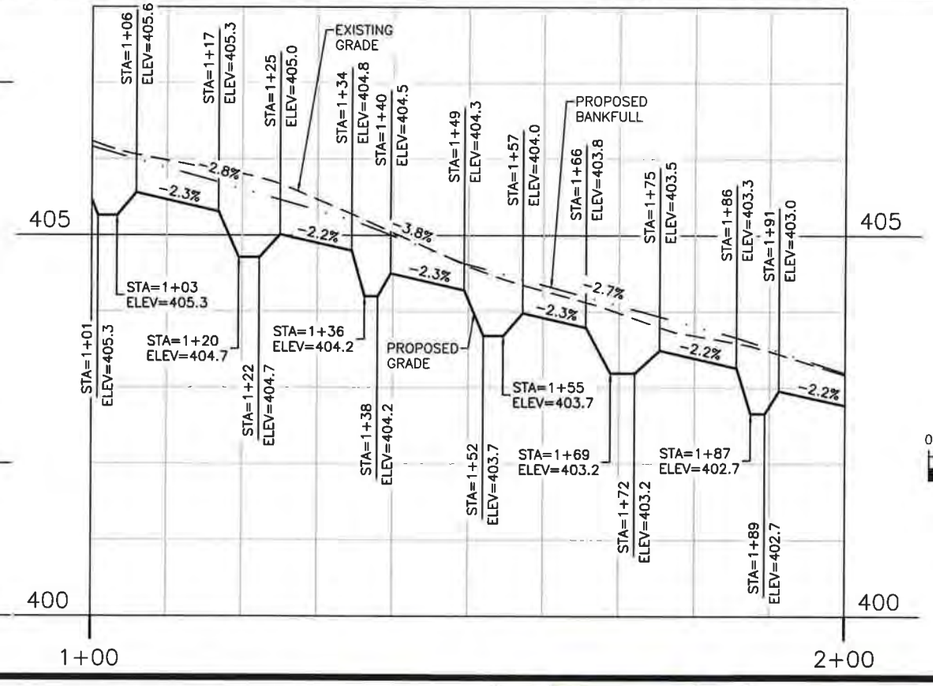
C5.08

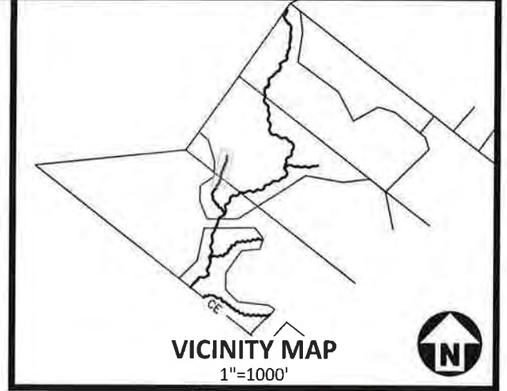


UT3 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG SILL	0+00	408.5
LOG CROSS VANE	0+10	408.3
LOG CROSS VANE	0+24	408.0
LOG CROSS VANE	0+37	407.9
LOG CROSS VANE	0+51	407.4
LOG CROSS VANE	0+66	406.9
LOG CROSS VANE	0+81	406.4
LOG CROSS VANE	0+98	405.9
LOG CROSS VANE	1+17	405.3
LOG CROSS VANE	1+34	404.8
LOG CROSS VANE	1+49	404.3
LOG CROSS VANE	1+66	403.8
LOG CROSS VANE	1+86	403.3

TOTAL DISTURBED AREA = 30.9 AC.







GRAPHIC SCALE
0 10 20 40
1 inch = 20 ft.

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
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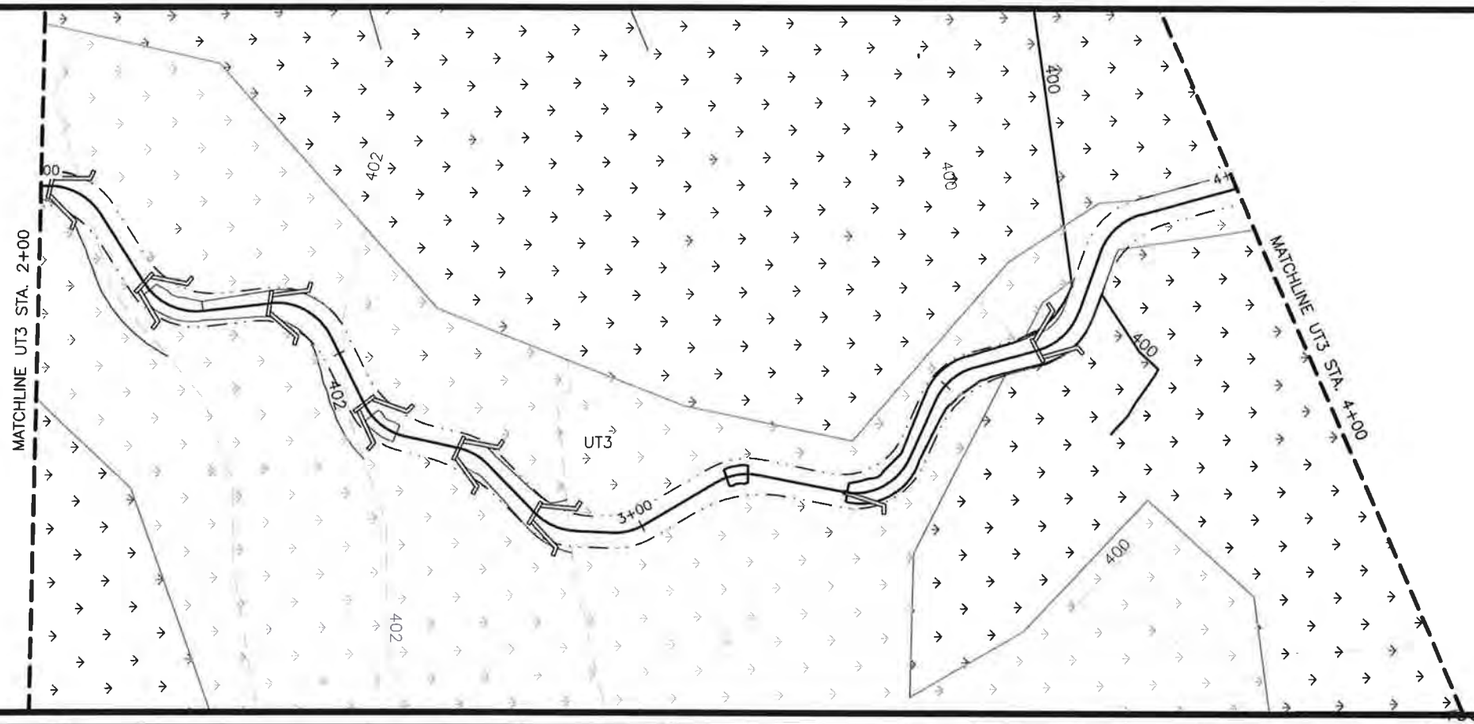
DRAWN BY	RHW
SCALE	1"=20'
DATE	01.18.2022

PLAN AND PROFILE

UT3 STA. 0+00 - 2+00

C5.09



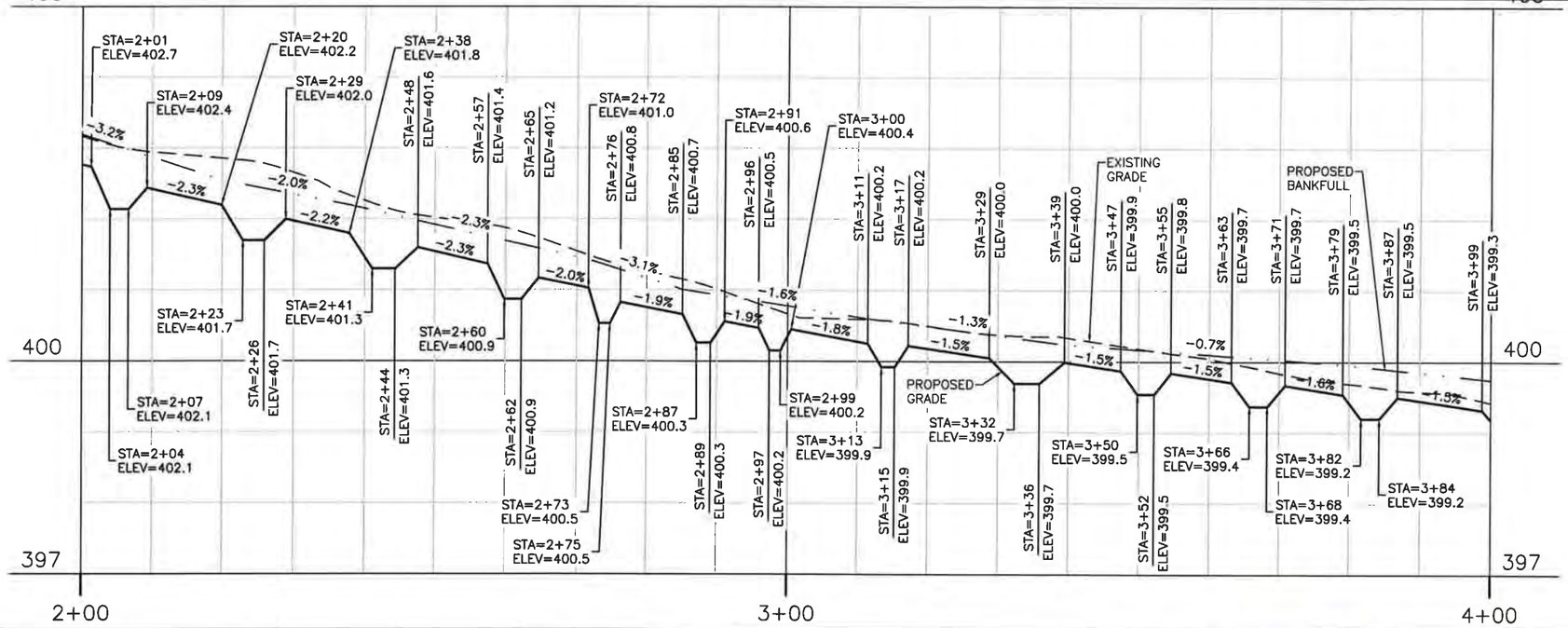
UT3 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE	2+01	402.7
LOG CROSS VANE	2+20	402.2
LOG CROSS VANE	2+38	401.8
LOG CROSS VANE	2+57	401.4
LOG CROSS VANE	2+72	401.0
LOG CROSS VANE	2+85	400.7
LOG VANE	3+29	400.0
LOG CROSS VANE	3+63	399.7

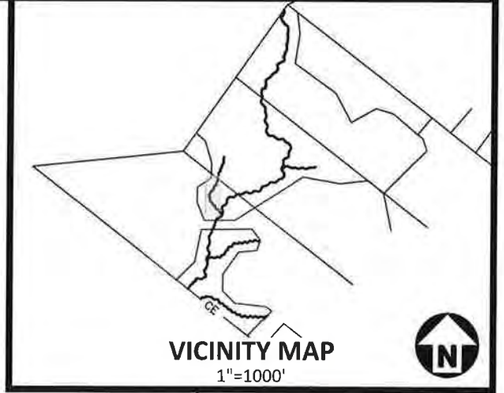
GRAPHIC SCALE

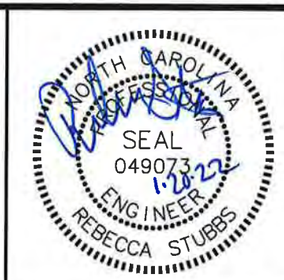
0 10 20 40

1 inch = 20 ft.

TOTAL DISTURBED AREA = 30.9 AC.







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CRANE MITIGATION SITE

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PLAN INFORMATION

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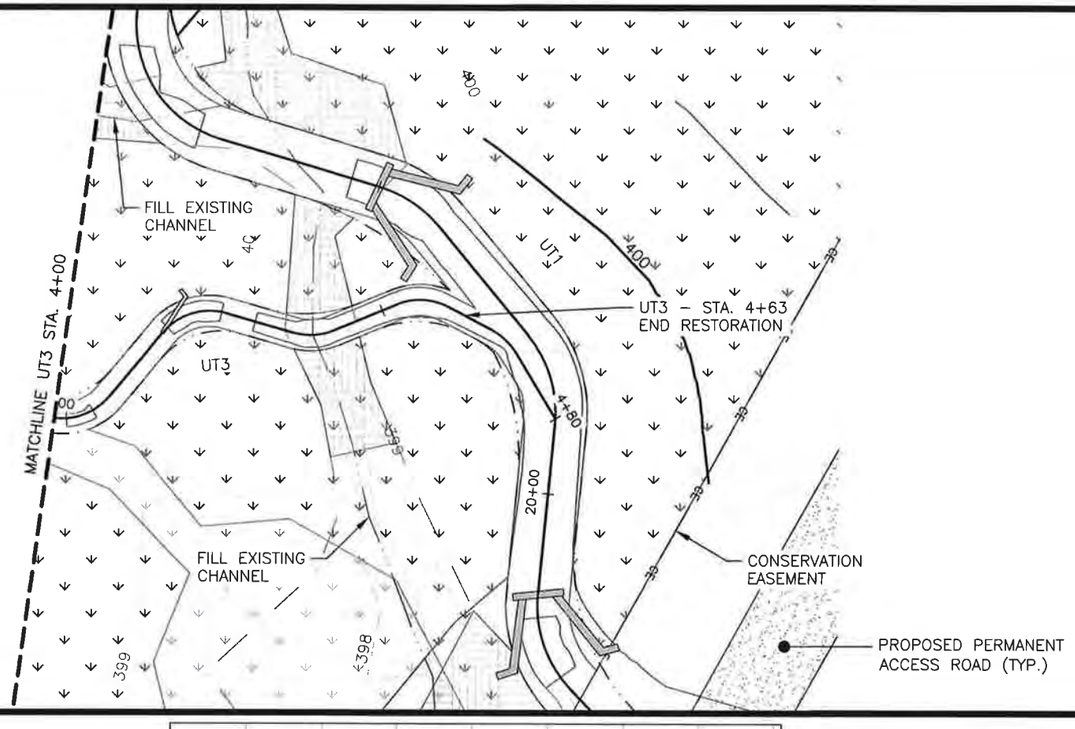
SCALE	1"=20'
DATE	01.18.2022

PLAN AND PROFILE

UT3 STA. 2+00 - 4+00

C5.10



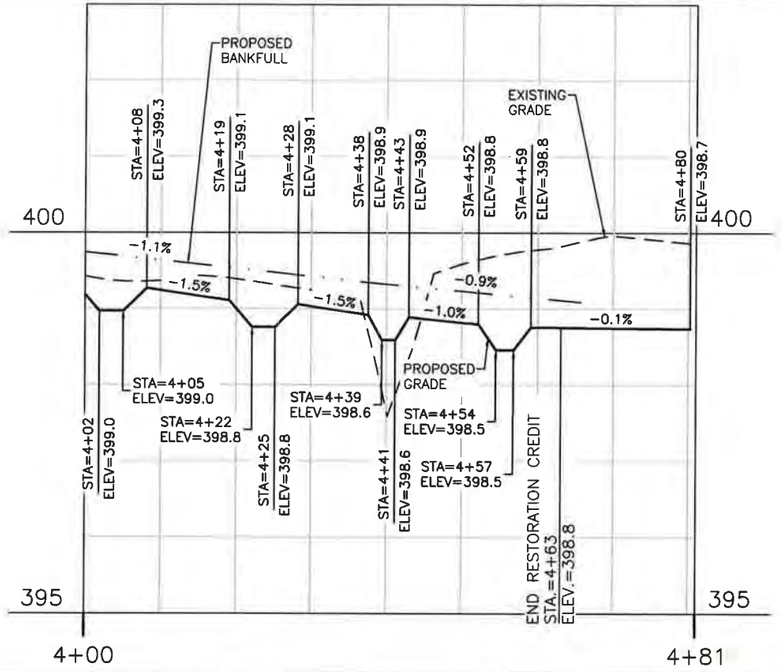
UT3 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG VANE	4+19	399.1

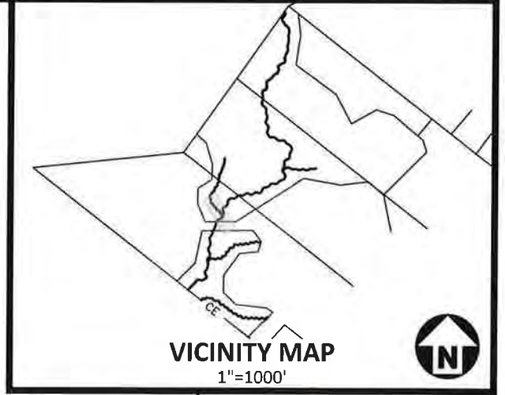
GRAPHIC SCALE

0 10 20 40

1 inch = 20 ft.

TOTAL DISTURBED AREA = 30.9 AC.





NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

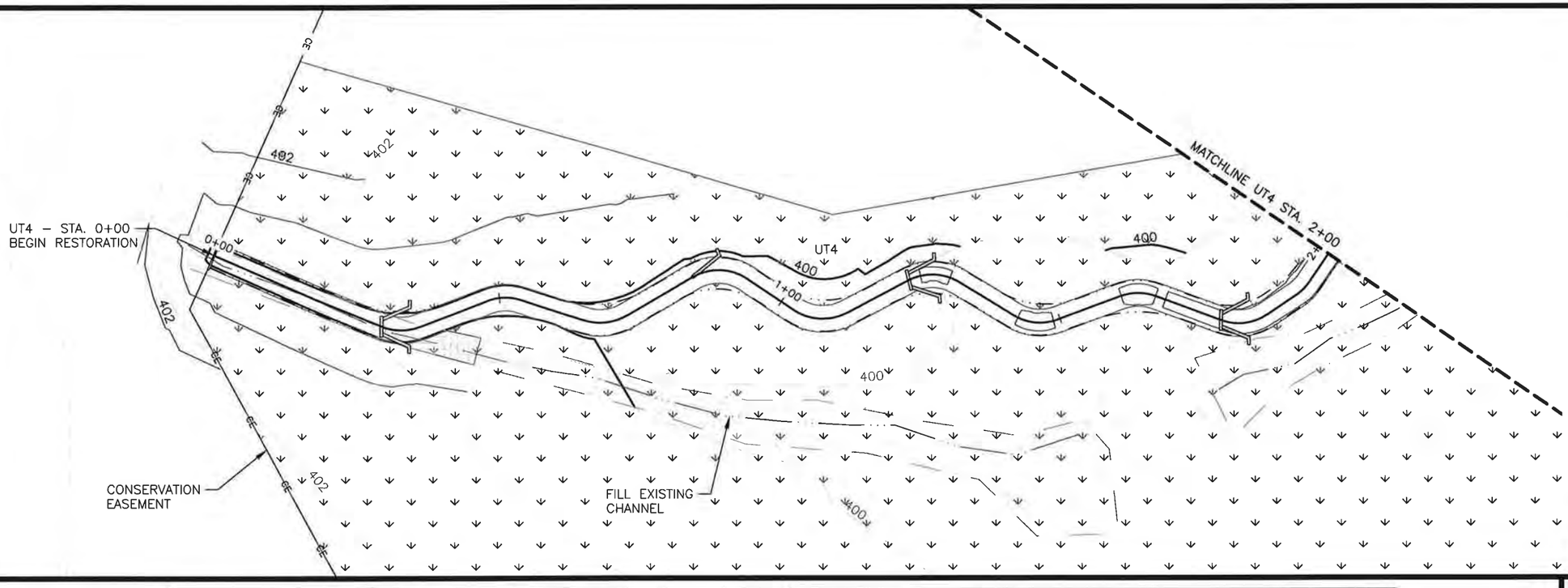
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=20'
DATE	01.18.2022

PLAN AND PROFILE

UT3 STA. 4+00 - 4+81

C5.11



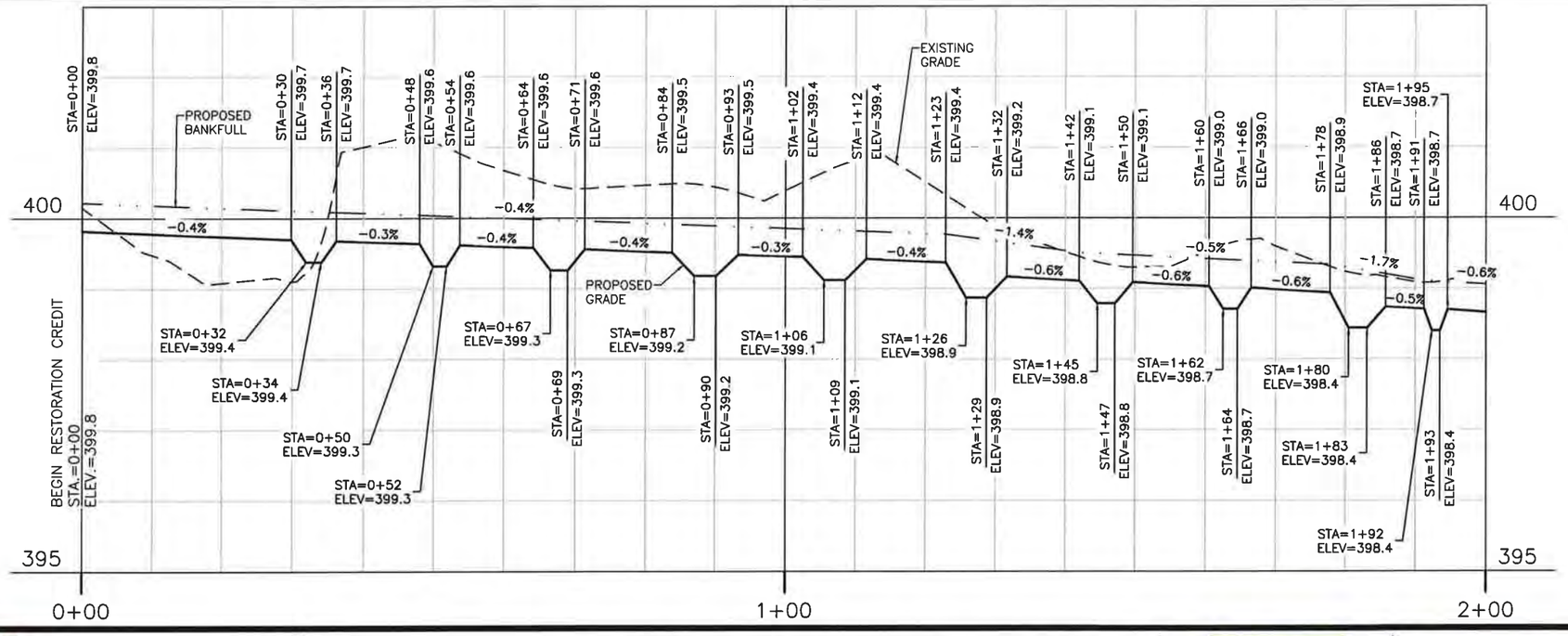
UT4 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG SILL	0+00	399.8
LOG CROSS VANE	0+30	399.7
LOG VANE	0+84	399.5
LOG CROSS VANE	1+23	399.4
LOG CROSS VANE	1+78	398.9

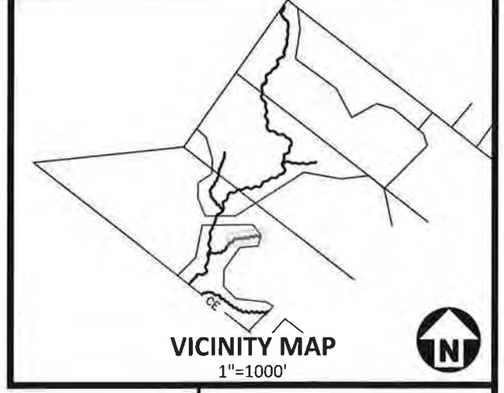
GRAPHIC SCALE

0 10 20 40

1 inch = 20 ft.

TOTAL DISTURBED AREA = 30.9 AC.





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CRANE MITIGATION SITE

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LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

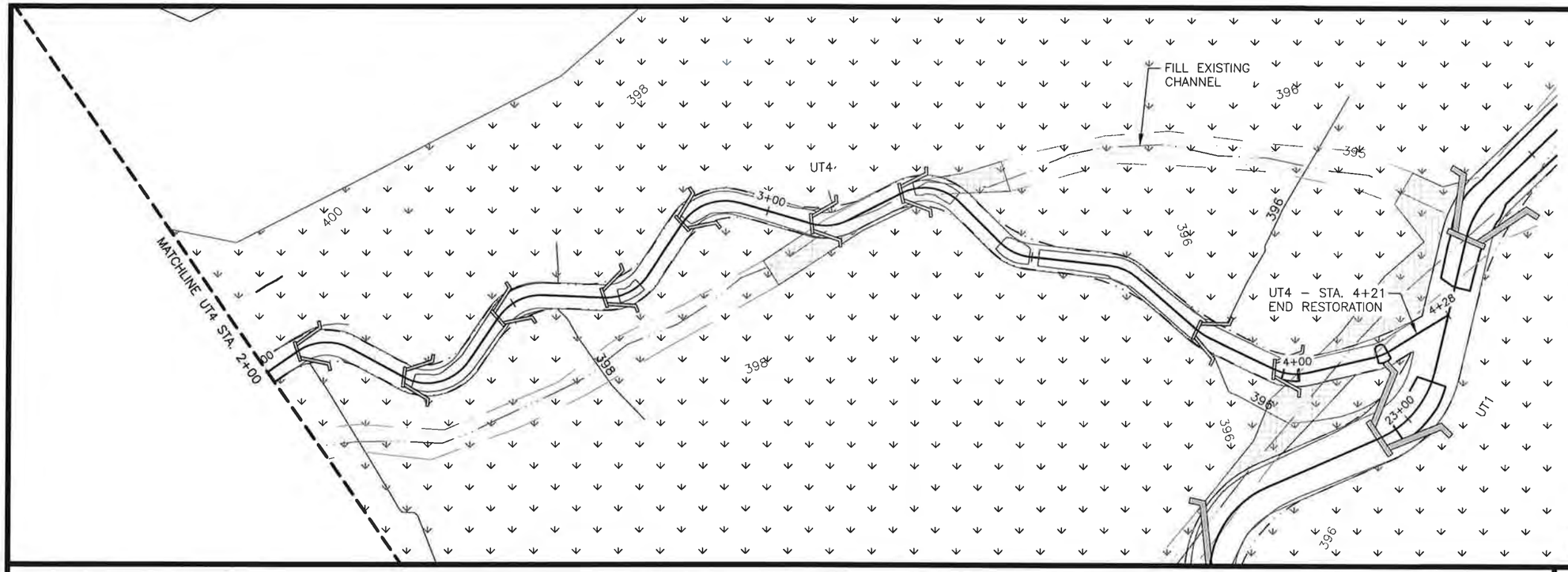
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=20'
DATE	01.18.2022

PLAN AND PROFILE

UT4 STA. 0+00 - 2+00

C5.12



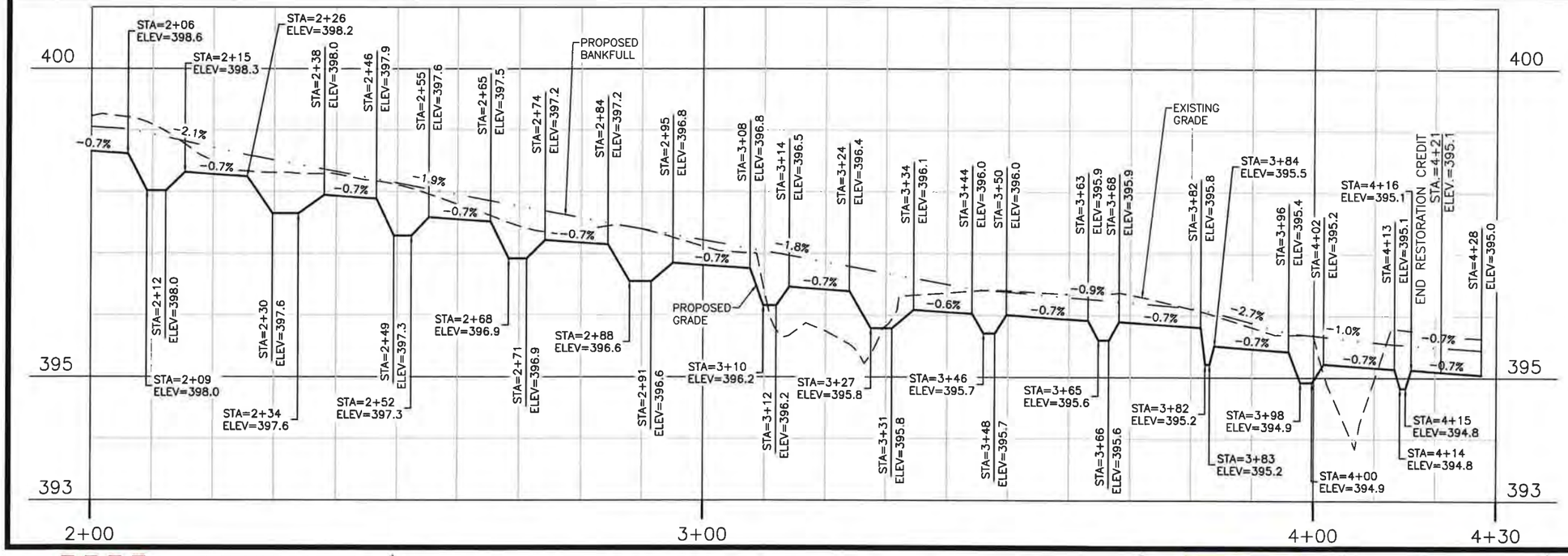
UT4 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE	2+06	398.6
LOG CROSS VANE	2+26	398.2
LOG CROSS VANE	2+46	397.9
LOG CROSS VANE	2+65	397.5
LOG CROSS VANE	2+84	397.2
LOG CROSS VANE	3+08	396.8
LOG CROSS VANE	3+24	396.4
LOG CROSS VANE	3+82	395.8
LOG CROSS VANE	3+96	395.4

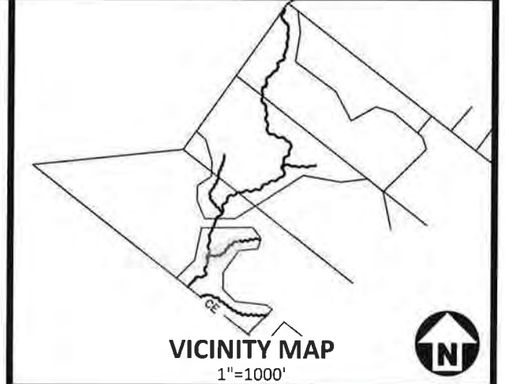
GRAPHIC SCALE

0 10 20 40

1 inch = 20 ft.

TOTAL DISTURBED AREA = 30.9 AC.





NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.28.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

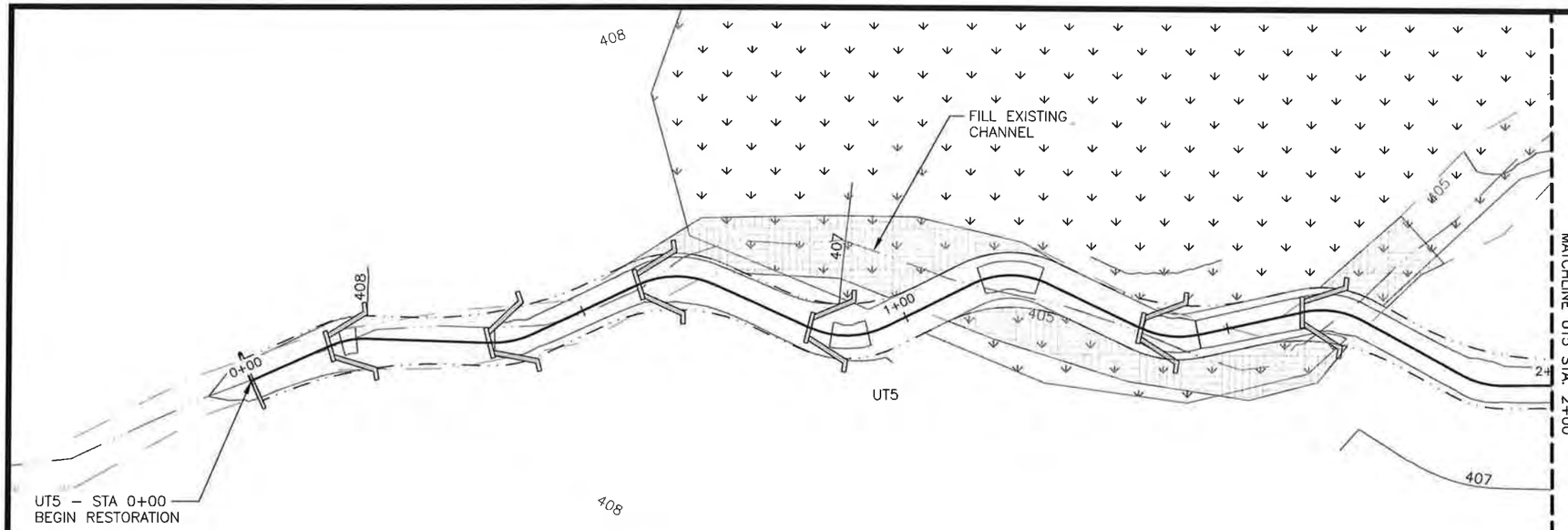
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=20'
DATE	01.18.2022

PLAN AND PROFILE

UT4 STA. 2+00 - 4+28

C5.13



UT5 STRUCTURE LOCATIONS

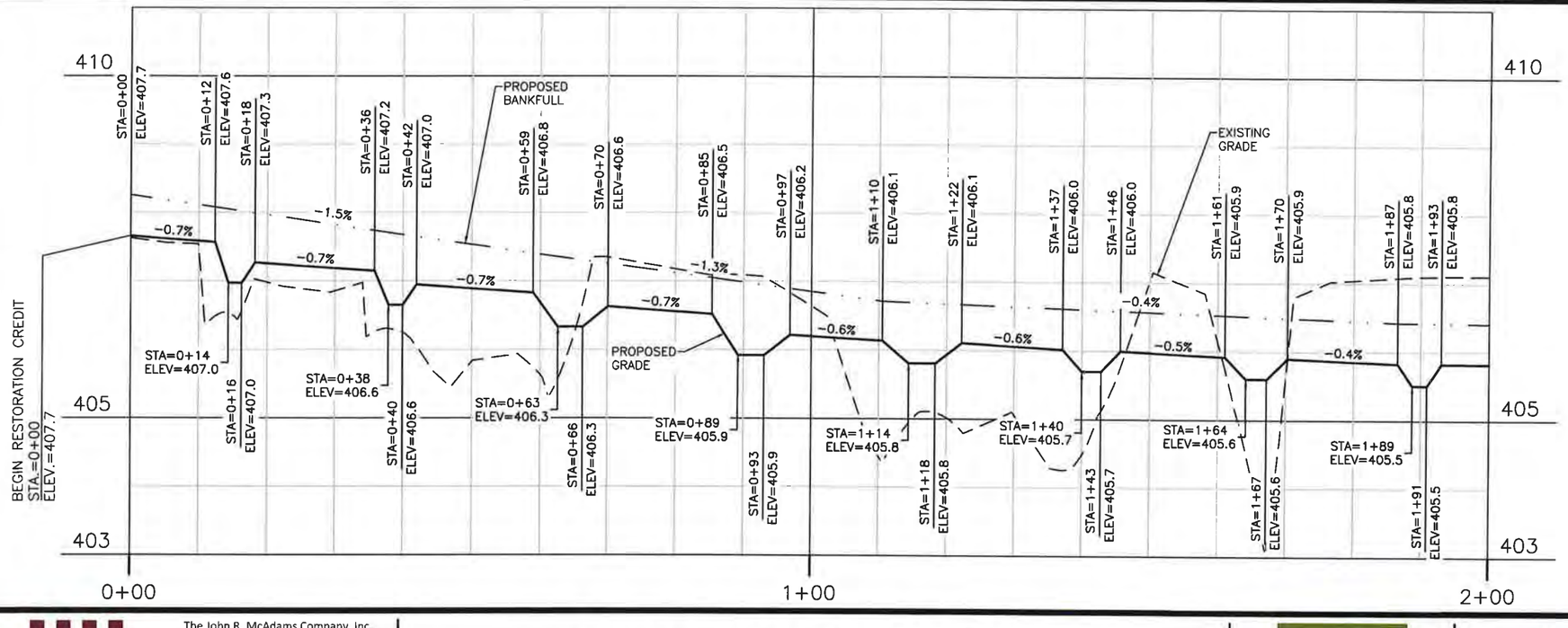
STRUCTURE TYPE	STATION	ELEVATION
LOG SILL	0+00	407.7
LOG CROSS VANE	0+12	407.6
LOG CROSS VANE	0+36	407.2
LOG CROSS VANE	0+59	406.8
LOG CROSS VANE	0+85	406.5
LOG CROSS VANE	1+37	406.0
LOG CROSS VANE	1+61	405.9

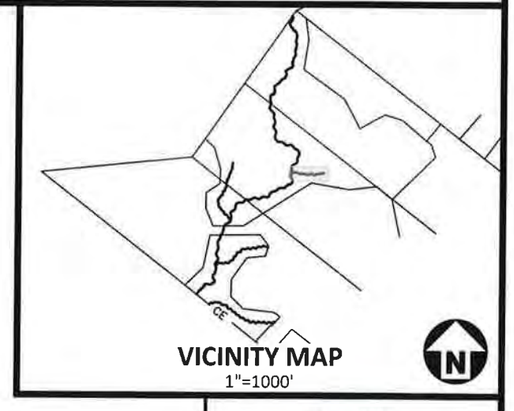
GRAPHIC SCALE

0 10 20 40

1 inch = 20 ft.

TOTAL DISTURBED AREA = 30.9 AC.





NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS
1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

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PLAN INFORMATION

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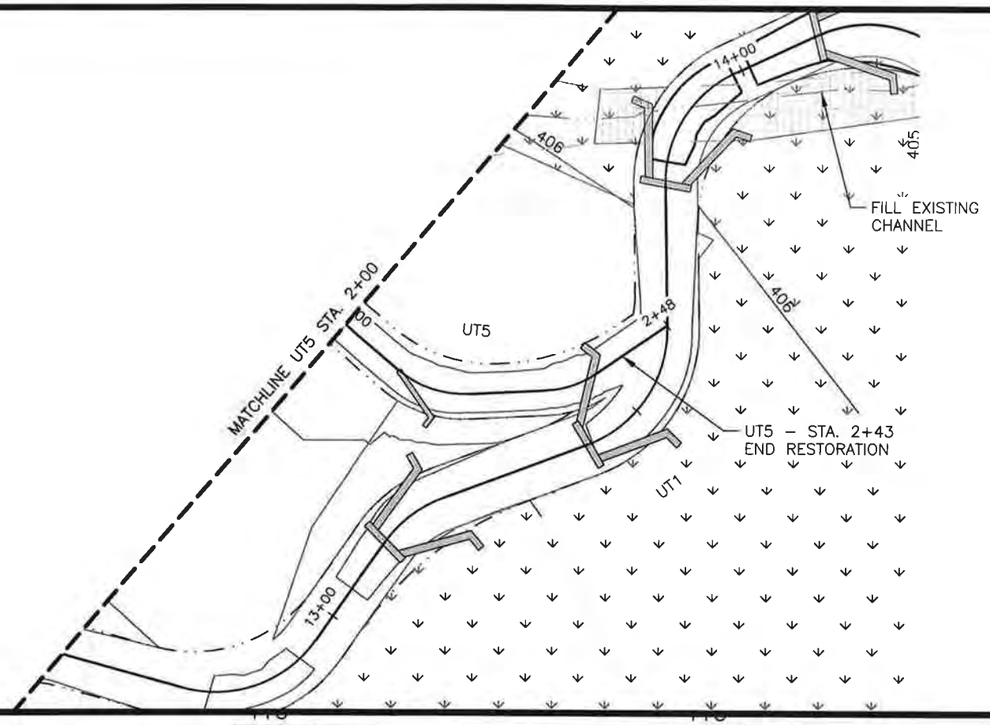
FILENAME	P1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=20'
DATE	01.18.2022

PLAN AND PROFILE

UT5 STA. 0+00 - 2+00

C5.14



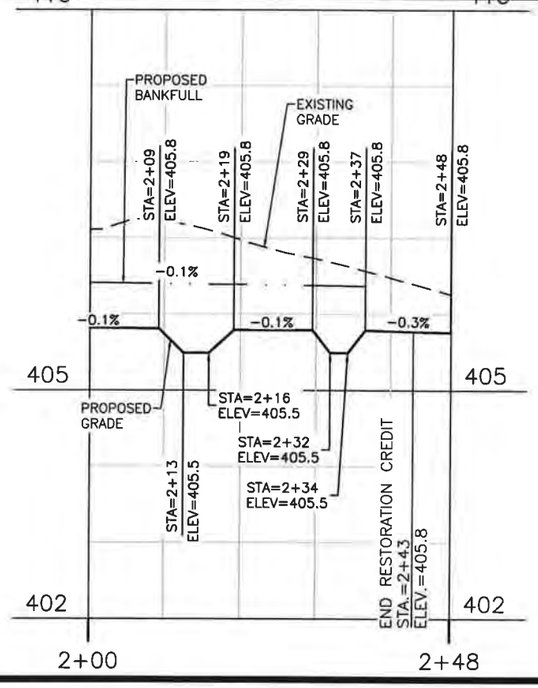
UT5 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG VANE	2+09	405.8

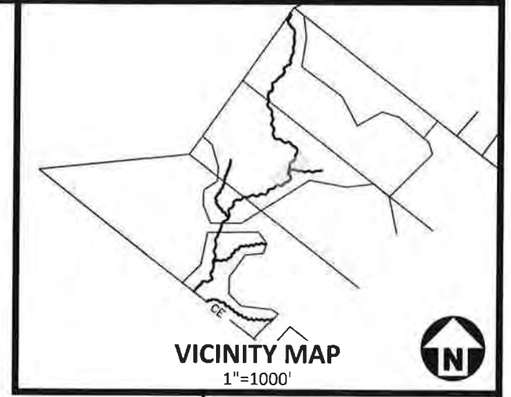
GRAPHIC SCALE

0 10 20 40

1 inch = 20 ft.

TOTAL DISTURBED AREA = 30.9 AC.





VICINITY MAP
1"=1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS
1.28.22

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CRANE MITIGATION SITE

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PLAN INFORMATION	
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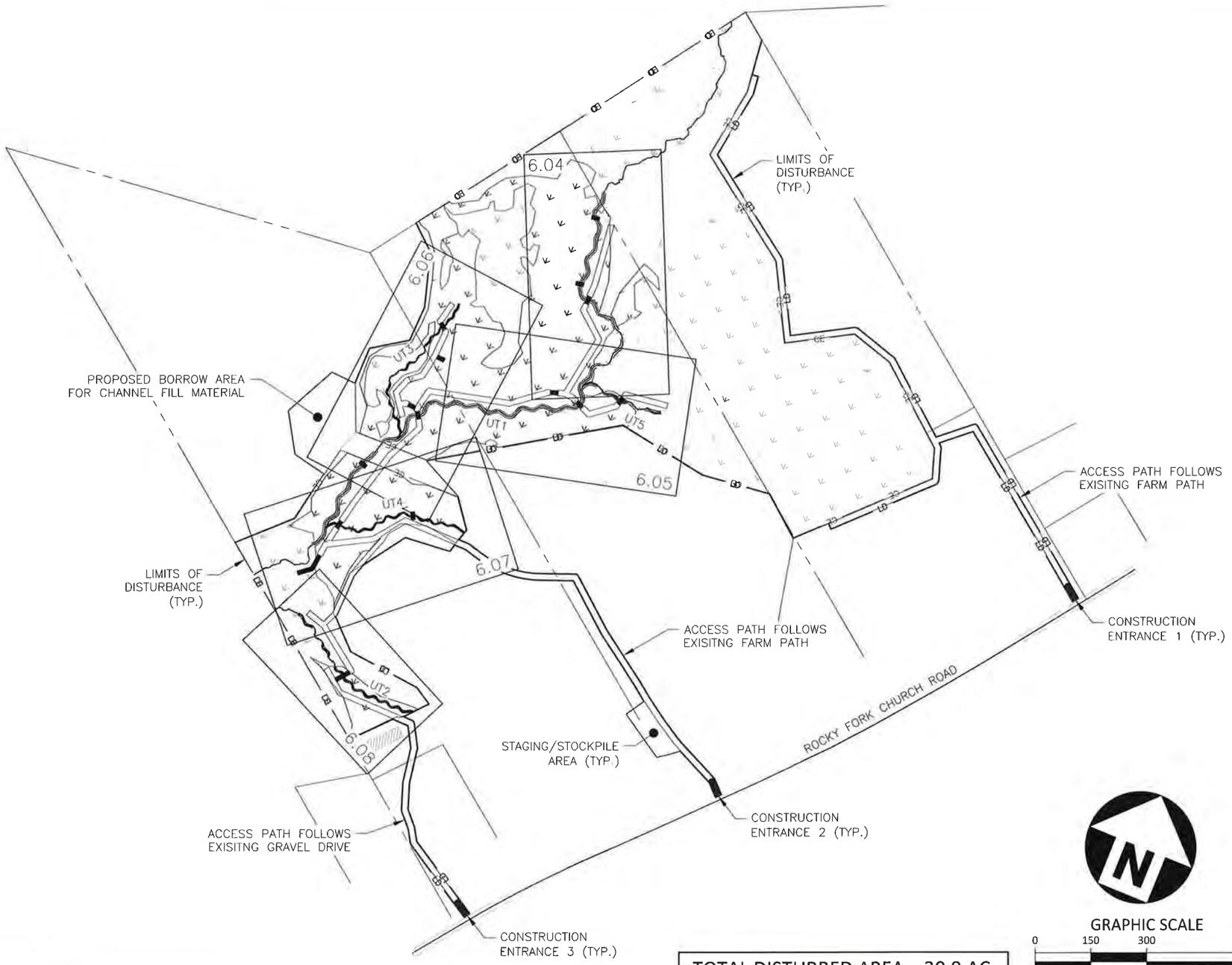
SCALE	1"=20'
DATE	01.18.2022

PLAN AND PROFILE

UT5 STA. 2+00 - 2+48

C5.15



TOTAL DISTURBED AREA = 30.9 AC.

GRAPHIC SCALE

0 150 300 600

1 inch = 300 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

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PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	EC1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=300'
DATE	01.18.2022

EROSION CONTROL PLAN OVERVIEW

C6.00

EROSION & SEDIMENT CONTROL NOTES:

1. GRADING AND EROSION CONTROL METHODS SHALL ADHERE TO THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY (NC DEQ) DIVISION OF ENERGY, MINERAL, AND LAND RESOURCES (NC DEMLR) STANDARDS AND SPECIFICATIONS. WHERE METHODS DIFFER FROM LEE COUNTY, THE MORE STRINGENT METHOD SHALL BE APPLIED.
2. EROSION AND SEDIMENT CONTROL (E&SC) PERMIT AND A CERTIFICATE OF COVERAGE (COC) MUST BE OBTAINED BEFORE ANY LAND DISTURBANCE ACTIVITIES.
3. WHEN PROJECT IS COMPLETE, THE PERMITEE SHALL VISIT DEQ.NC.GOV/NCG01 TO SUBMIT AN ELECTRONIC NOTICE OF TERMINATION (E-NOT). A $100 ANNUAL GENERAL FEE WILL BE CHARGED UNTIL THE E-NOT HAS BEEN FILLED OUT.
4. E&SC DEVICES MUST BE INSTALLED AND INSPECTED PRIOR TO ANY GRADING ON SITE. THE CONTRACTOR SHALL CALL FOR AN INSPECTION BY NC DEMLR ONCE INITIAL MEASURES ARE IN PLACE.
5. A COPY OF THE APPROVED EROSION CONTROL PLAN MUST BE ON FILE AT THE JOB SITE AT ALL TIMES. FAILURE TO FOLLOW THE APPROVED PLAN SEQUENCE AND DETAILS COULD SUBJECT THE CONTRACTOR TO FINES AND PENALTIES ISSUED BY LEE COUNTY AND NC DEMLR.
6. CONSTRUCTION, MAINTENANCE, AND REMOVAL OF ALL EROSION CONTROL DEVICES ARE THE RESPONSIBILITY OF THE CONTRACTOR UNLESS OTHERWISE NOTED.
7. ANY GRADING BEYOND THE DENUDED LIMITS SHOWN ON THE PLAN IS A VIOLATION OF THE APPROVED EROSION CONTROL PLAN AND IS SUBJECT TO A FINE BY LEE COUNTY AND NC DEMLR.
8. DISTURBANCE OUTSIDE OF THE SITE PROPERTY LIMITS OR PUBLIC R/W SHALL ONLY BE ALLOWED BY SIGNED GRADING AGREEMENTS AND/OR EASEMENTS BETWEEN THE DEVELOPER AND OFFSITE PROPERTY OWNER.
9. THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN SAFE OPEN ACCESS TO ALL ADJACENT PROPERTIES DURING CONSTRUCTION PERIOD FOR IMPROVEMENTS.
10. GRADING MORE THAN ONE ACRE WITHOUT AN APPROVED EROSION CONTROL PLAN IS A VIOLATION OF THE STATE EROSION CONTROL REGULATIONS AND IS SUBJECT TO A FINE.
11. STAGING AREAS, STOCKPILE AREAS, CONSTRUCTION ENTRANCES, AND ACCESS ROAD WILL BE IDENTIFIED AND LOCATED ACCORDING TO THE EROSION CONTROL PLANS AND LANDOWNER. VARIANCES WILL BE ALLOWED ASSUMING BOTH THE CONTRACTOR AND THE ENGINEER VERBALLY AGREE.
12. CONTRACTOR SHALL SEED AND STABILIZE ALL STEEP SLOPES (GREATER THAN 3H:1V) WITHIN 7 DAYS, 10 DAYS FOR MODERATE SLOPES (3H:1V OR LESS) AND WITHIN 14 CALENDAR DAYS EVERYWHERE ELSE ACCORDING TO THE TEMPORARY SEEDING SCHEDULE ON SHEET L5.01.
13. FOR ANY LAND DISTURBING ACTIVITY WHERE GRADING ACTIVITIES HAVE BEEN COMPLETED, TEMPORARY OR PERMANENT GROUND COVER (SHEET L5.01) SUFFICIENT TO RESTRAIN EROSION SHALL BE PROVIDED AS SOON AS PRACTICAL, BUT IN NO CASE LATER THAN SEVEN (7) DAYS AFTER COMPLETING THE WORK. STABILIZATION IS THE BEST FORM OF EROSION CONTROL. TEMPORARY SEEDING IS NECESSARY TO ACHIEVE EROSION CONTROL ON LARGE DENUDED AREAS AND ESPECIALLY WHEN SPECIFICALLY REQUIRED AS PART OF THE CONSTRUCTION SEQUENCE ON THE PLAN.
14. THE EROSION CONTROL INSPECTOR MAY REQUIRE ADDITIONAL FIELD MEASURES AS NECESSARY TO PROVIDE ADEQUATE PROTECTION FROM RECEIVING WATER COURSES.
15. PROTECTION OF EXISTING VEGETATION: AT THE START OF GRADING INVOLVING THE STRIPPING OF TOPSOIL OR LOWERING OF EXISTING GRADE AROUND A TREE, A CLEAN, SHARP, VERTICAL CUT SHALL BE MADE AT THE EDGE OF THE TREE SAVE AREA AT THE SAME TIME AS OTHER EROSION CONTROL MEASURES ARE INSTALLED. THE TREE PROTECTION FENCING SHALL BE INSTALLED ON THE SIDE OF THE CUT FARTHEST AWAY FROM THE TREE TRUNK AND SHALL REMAIN IN PLACE UNTIL ALL CONSTRUCTION IN THE VICINITY OF THE TREES IS COMPLETE. NO STORAGE OF MATERIALS, FILL, OR EQUIPMENT AND NO TRESPASSING SHALL BE ALLOWED WITHIN THE BOUNDARY OF THE PROTECTED AREA AND SHALL BE POSTED ON THE PROTECTION FENCE. A PROTECTION FENCE CONSTRUCTED OF MATERIAL RESISTANT TO DEGRADATION BY SUN, WIND, AND MOISTURE FOR THE DURATION OF THE CONSTRUCTION, SHALL BE INSTALLED AT THE SAME TIME AS THE EROSION CONTROL MEASURES AND SHALL BE IN PLACE UNTIL ALL CONSTRUCTION IN THE VICINITY OF THE TREES IS COMPLETE (SEE DETAIL ON SHEET C6.6.10).
16. INSTALLATION OF ALL PROPOSED E&SC DEVICES AND MAINTENANCE OF THOSE DEVICES IS REQUIRED. THE CONTRACTOR MAY BE ALLOWED, WITH PRIOR APPROVAL FROM THE OWNER, TO COORDINATE CHANGES TO THE PLAN WITH THE E&SC INSPECTOR AND THE ENGINEER.
17. CONTRACTOR SHALL INSPECT AND REPAIR ALL EROSION CONTROL DEVICES AT LEAST ONCE PER WEEK AND AFTER EVERY SIGNIFICANT RAINFALL EVENT. EACH DEVICE IS TO BE MAINTAINED OR REPLACED IF SEDIMENT ACCUMULATION HAS REACHED ONE HALF THE CAPACITY OF THE DEVICE.
9. STAGING/STOCKPILE AREAS SHOWN ON THE PLANS ARE APPROXIMTE. CONTRACTOR TO FIELD LOCATE STAGING/STOCKPILE AREAS MIN. 50' FROM SURFACE WATERS AS APPROVED BY THE ENGINEER.
10. INSTALL SILT FENCE FOR ALL STAGING AND STOCKPILE AREAS (SEE DETAIL ON SHEET C6.10). ANY STOCKPILE AREAS SHALL USE TWO (2) ROWS OF SILT FENCE.
11. CONTRACTOR WILL FIELD LOCATE SILT FENCE OUTLETS AT LOW POINTS IN SILT FENCE AND/OR A MINIMUM OF EVERY 100 LINEAR FEET OF SILT FENCE AS REQUIRED TO PROVIDE RELIEF FROM CONCENTRATED FLOWS. SILT FENCE OUTLETS SHOWN ON THESE PLANS ARE BASED ON THE BEST TOPOGRAPHIC INFORMATION AVAILABLE AT THE TIME OF DESIGN. CONTRACTOR TO FIELD VERIFY AND ADJUST LOCATIONS OF SILT FENCE OUTLETS AND/OR PLACE ADDITIONAL OUTLETS TO INSURE THAT ALL LOW SPOTS ALONG THE SILT FENCE HAVE AN OUTLET.
12. WASHED STONE AND WIRE BACKING SHALL BE USED WITH SILT FENCE WHENEVER SILT FENCE IS PLACE AT THE TOE OF A SLOPE >10' VERTICAL OR ALONG ANY CHANNEL OR WATER COURSE WHERE 50' OF BUFFER IS NOT PROVIDED.
13. ALL DIMENSIONS AND GRADES SHOWN ON THE PLANS SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. CONTRACTOR SHALL NOTIFY THE OWNER IF ANY DISCREPANCIES EXIST PRIOR TO PROCEEDING WITH CONSTRUCTION FOR NECESSARY PLAN OR GRADE CHANGES. NO EXTRA COMPENSATION SHALL BE PAID TO THE CONTRACTOR FOR ANY WORK DONE DUE TO DIMENSIONS OR GRADES SHOWN INCORRECTLY ON THESE PLANS IF SUCH NOTIFICATION HAS NOT BEEN GIVEN.
14. NO DEBRIS SHALL BE TRACKED ONTO PUBLIC RIGHT OF WAY. IF THE SITUATION OCCURS WHERE MUD, ROCKS AND DEBRIS IS TRACKED ONTO PAVEMENT, THE CONTRACTOR SHALL CLEAN THE PAVEMENT AND INSTALL ADDITIONAL MEASURES TO PREVENT FUTURE OCCURRENCES.
15. IF CONCRETE WASHOUTS ARE UTILIZED, THESE AREAS ARE TO BE WITHIN THE LIMITS OF DISTURBANCE AND SHOULD BE LOCATED AT LEAST 50 FT. AWAY FROM STORM DRAIN INLETS AND SURFACE WATER.

EROSION & SEDIMENT CONTROL MAINTENANCE PLAN:

1. QUALIFIED PERSONNEL, ON A DAILY BASIS WILL EVALUATE ALL TEMPORARY EROSION AND SEDIMENT CONTROL PRACTICES FOR STABILITY AND OPERATION.
2. INSPECT AND MAINTAIN ALL EROSION CONTROL MEASURES EVERY 7 DAYS AND AFTER EACH SIGNIFICANT RAINFALL (1.0" OR GREATER) AND DOCUMENT WITH INSPECTION REPORTS AND WRITTEN LOGS SHALL BE KEPT.
3. A RAIN GAUGE WILL ALSO BE KEPT ON-SITE AND DAILY RAINFALL AMOUNTS WILL BE RECORDED.
4. ANY REPAIRS NEEDED WILL BE PERFORMED IMMEDIATELY TO MAINTAIN ALL PRACTICES AS DESIGNED.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF TEMPORARY ON-SITE E&SC MEASURES.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING AND FOLLOWING THE APPROVED E&SC PLAN.
7. A COPY OF THE COMBINED SELF-INSPECTION MONITORING FORM CAN BE FOUND ON THE NC DEMLR WEBSITE AT: HTTPS://DEQ.NC.GOV/ABOUT/DIVISIONS/ENERGY-MINERAL-LAND-RESOURCES/EROSION-SEDIMENT-CONTROL/FORMS

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	EC1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	
DATE	01.18.2022

EROSION CONTROL PLAN NOTES

C6.01

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.

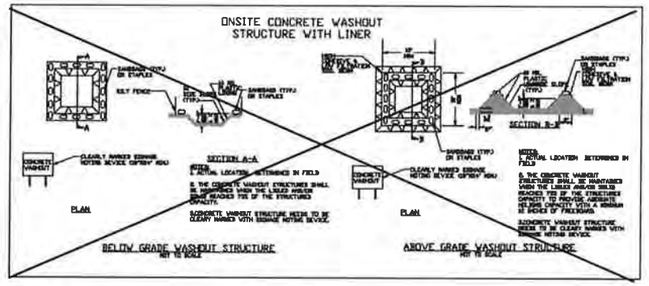
PORTABLE TOILETS

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.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.19.22

NCG01 GROUND STABILIZATION AND MATERIALS HANDLING

EFFECTIVE: 04/01/19

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

PLAN INFORMATION

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DRAWN BY	RHW
SCALE	
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EROSION CONTROL PLAN NOTES

C6.02

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 (and this will determine if a site inspection is needed). Days on which no rainfall occurred shall be recorded as "zero." The permittee may use another rain-monitoring device approved by the Division.
(2) E&SC Measures	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the measures inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Indication of whether the measures were operating properly, 5. Description of maintenance needs for the measure, 6. Description, evidence, and date of corrective actions taken.
(3) Stormwater 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

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS
LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

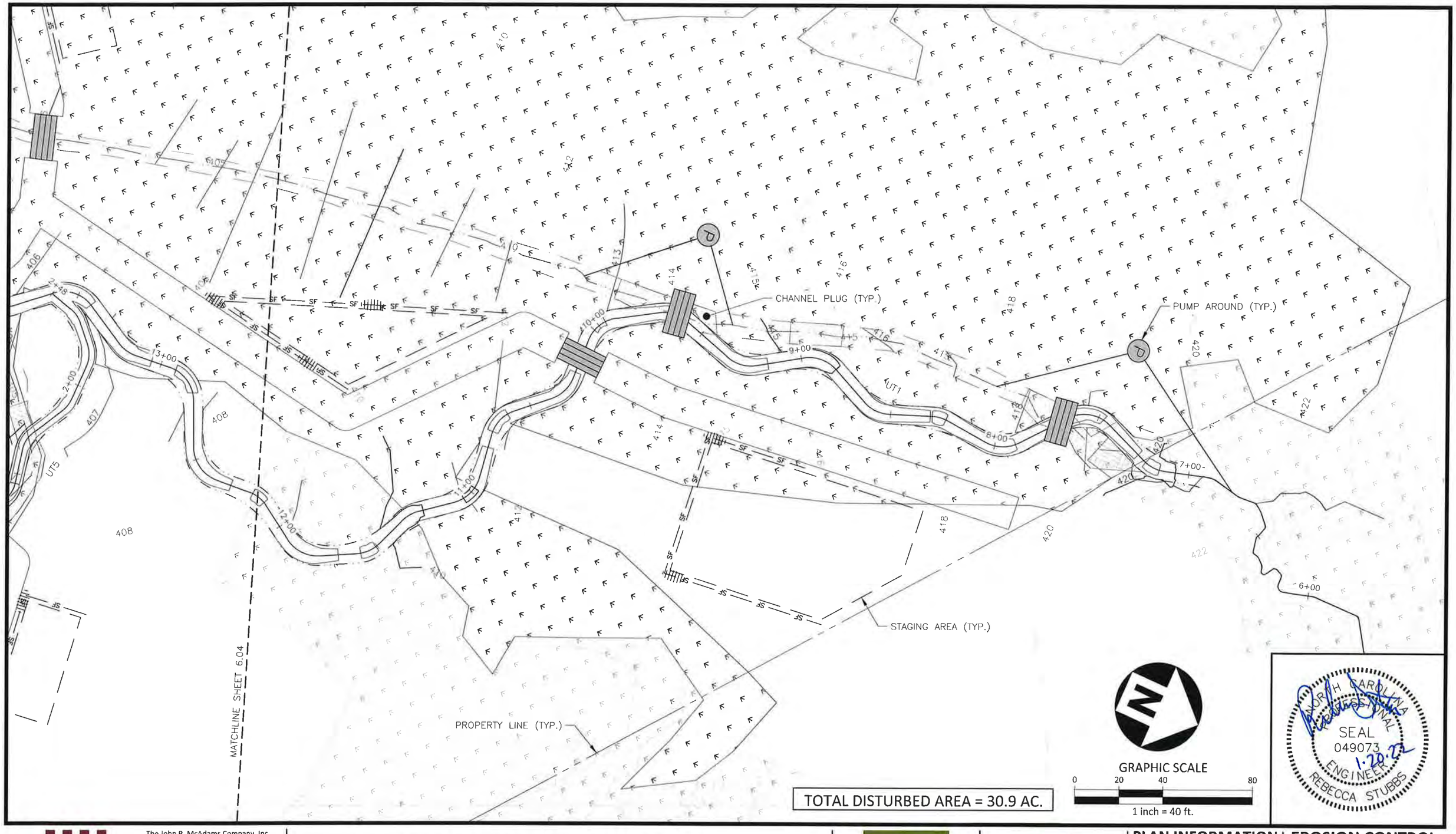
Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	EC1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	
DATE	01.18.2022

EROSION CONTROL PLAN NOTES

C6.03



GRAPHIC SCALE

0 20 40 80

1 inch = 40 ft.

TOTAL DISTURBED AREA = 30.9 AC.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RS RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	EC1
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SCALE	1"=40'
DATE	01.18.2022

EROSION CONTROL PLAN

C6.04

MATCHLINE SHEET 6.03

STAGING AREA (TYP.)

ÜT1

UT5

PUMP AROUND (TYP.)

CHANNEL PLUG (TYP.)

LIMITS OF DISTURBANCE (TYP.)

PROPERTY LINE (TYP.)

MATCHLINE SHEET 6.05

TOTAL DISTURBED AREA = 30.9 AC.

GRAPHIC SCALE

0 20 40 80

1 inch = 40 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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McADAMS

CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

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EROSION CONTROL PLAN

C6.05

PROPOSED BORROW AREA
FOR CHANNEL FILL MATERIAL

PROPERTY LINE (TYP.)

LIMITS OF DISTURBANCE (TYP.)

PERMANENT
ACCESS ROAD

PROPOSED UT1
BRIDGE CROSSING

UT3

UT1

PUMP AROUND (TYP.)

CHANNEL PLUG (TYP.)

STAGING AREA (TYP.)

MATCHLINE SHEET 6.06

MATCHLINE SHEET 6.04

TOTAL DISTURBED AREA = 30.9 AC.

GRAPHIC SCALE
0 20 40 80
1 inch = 40 ft.

NORTH CAROLINA
PROFESSIONAL
SEAL
049073
ENGINEER
REBECCA STUBBS
1.20.22

The John R. McAdams Company, Inc.
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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS
LEE COUNTY, NORTH CAROLINA

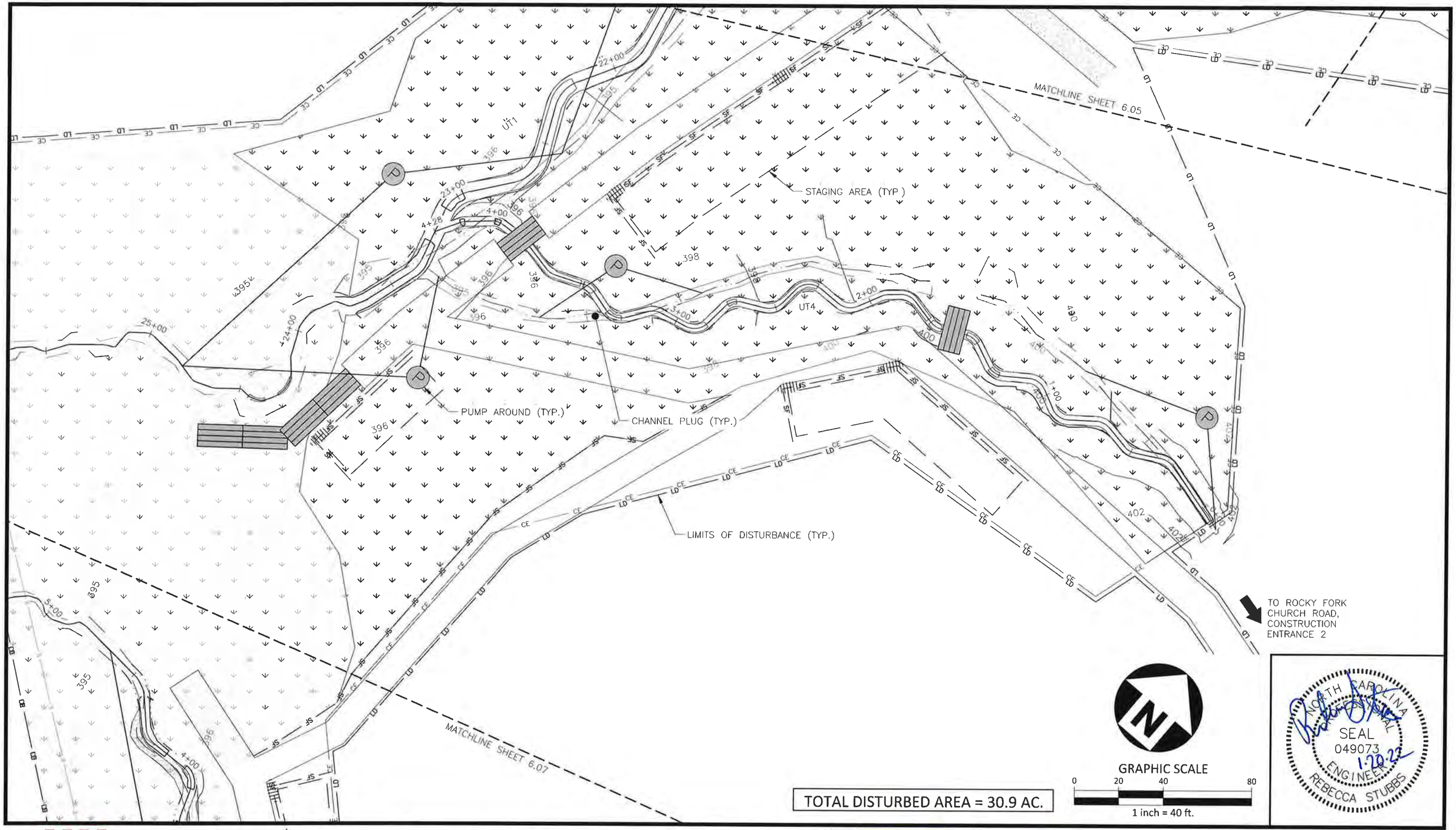
RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	EC1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=40'
DATE	01.18.2022

EROSION CONTROL PLAN

C6.06



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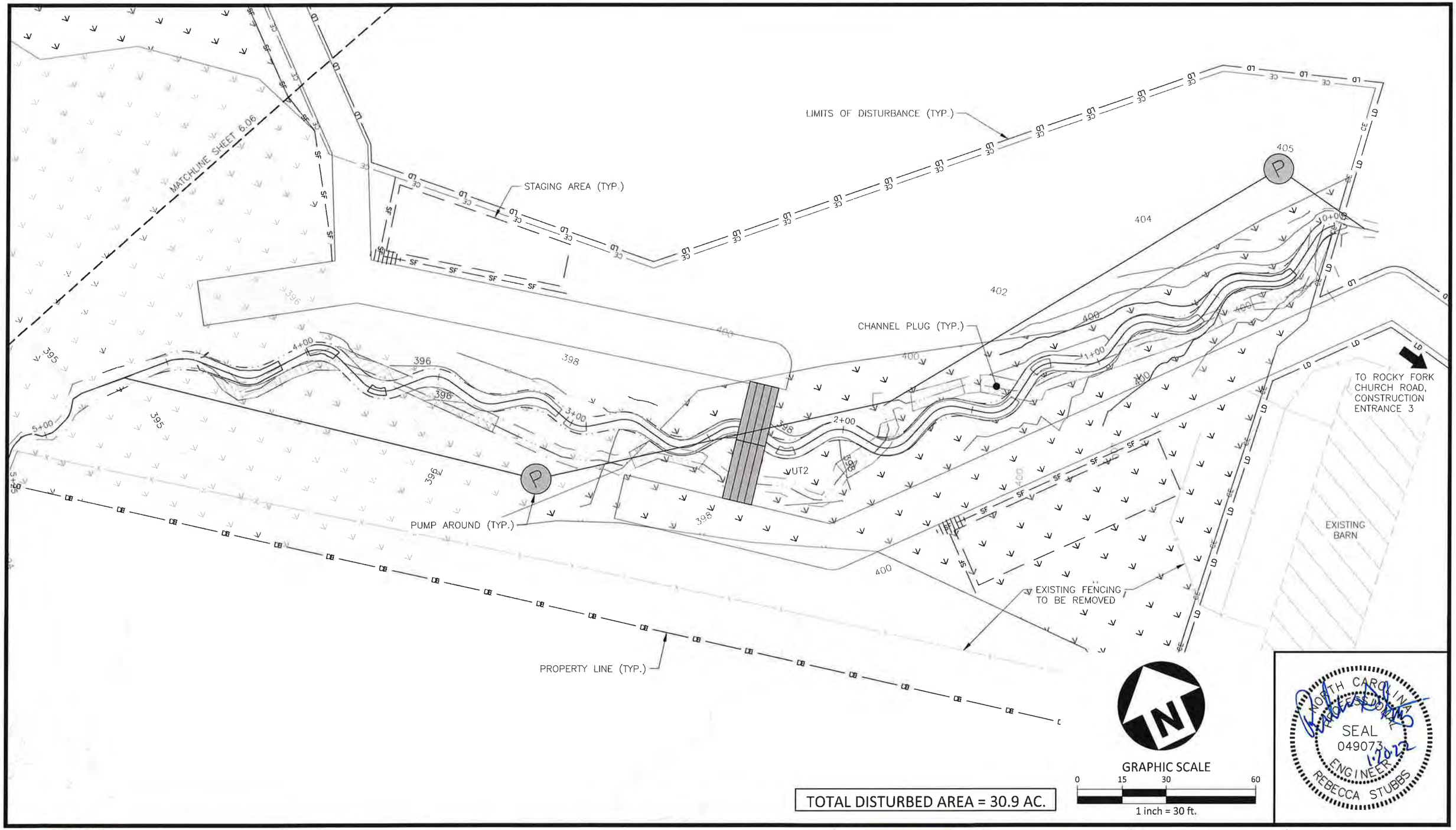
EROSION CONTROL PLAN

C6.07



TOTAL DISTURBED AREA = 30.9 AC.

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PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	EC1
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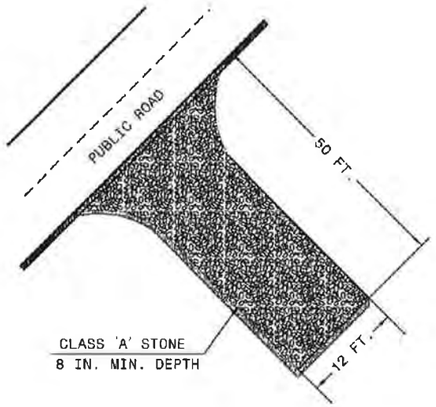
SCALE	1"=30'
DATE	01.18.2022

EROSION CONTROL PLAN

C6.08



NOTES

1. PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
2. LOCATE ENTRANCES TO PROVIDE FOR UTILIZATION BY ALL CONSTRUCTION VEHICLES.
3. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOPDRESSING WITH STONE WILL BE NECESSARY.
4. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED UP IMMEDIATELY.
5. LOCATE GRAVEL CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
6. NUMBER AND LOCATION OF CONSTRUCTION ENTRANCES TO BE DETERMINED BY THE ENGINEER.
7. USE CLASS 'A' STONE OR OTHER COARSE AGGREGATE APPROVED BY THE ENGINEER.
8. INSTALL CONSTRUCTION ENTRANCES IN A WAY TO PREVENT VEHICLES FROM BYPASSING CONSTRUCTION ENTRANCE LEAVING PROJECT SITE.

NOTE: PLACE GEOTEXTILE FOR DRAINAGE BENEATH STONE

STATE OF NORTH CAROLINA
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DIVISION OF HIGHWAYS
RALEIGH, N.C.

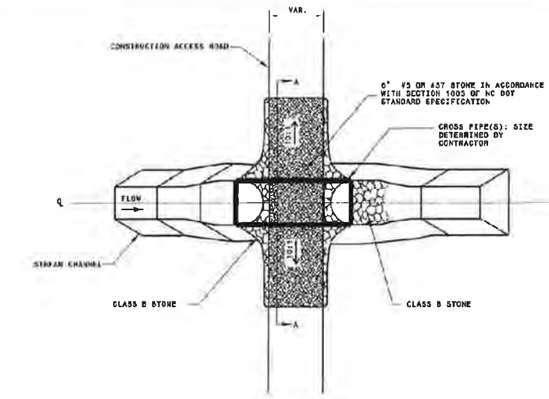
1-18

ROADWAY STANDARD DRAWING FOR
GRAVEL CONSTRUCTION ENTRANCE

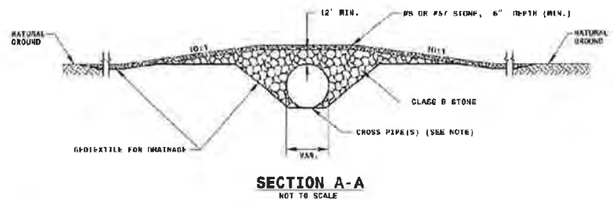
SHEET 1 OF 1
1607.01

CONSTRUCTION ENTRANCE
N.T.S.

NOTE:
INSTALL SILT FENCE OR STRAW WATTLES ALONG CONSTRUCTION ENTRANCES TO PREVENT SEDIMENT RUNOFF INTO ROADSIDE DITCH.



PLAN VIEW



SECTION A-A
NOT TO SCALE

NOTES

PIPE(S) FOR TEMPORARY STREAM CROSSING SHALL BE DESIGNED TO PASS THE PEAK OR BANKFULL FLOW, WHICHEVER IS LESS, FROM A 2-YEAR PEAK STORM, WITHOUT OVER TOPPING.

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-18

ROADWAY STANDARD DRAWING FOR
TEMPORARY STREAM CROSSING

SHEET 1 OF 1
1645.01

TEMPORARY STREAM CROSSING
N.T.S.

NOTE:
LOG MATS MAY BE USED IN PLACE OF TEMPORARY CULVERT STREAM CORSSINGS WHERE APPROPRIATE.

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CRANE MITIGATION SITE
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RESTORATION SYSTEMS LLC

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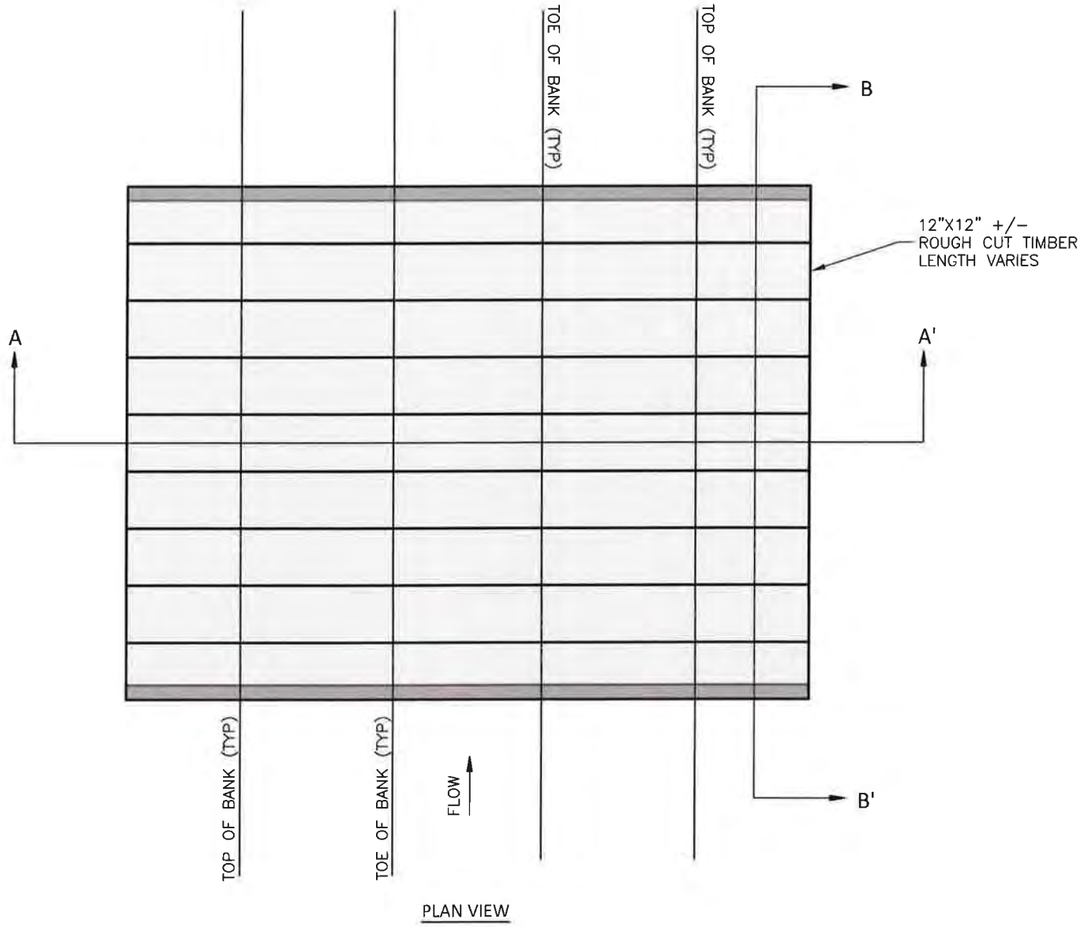
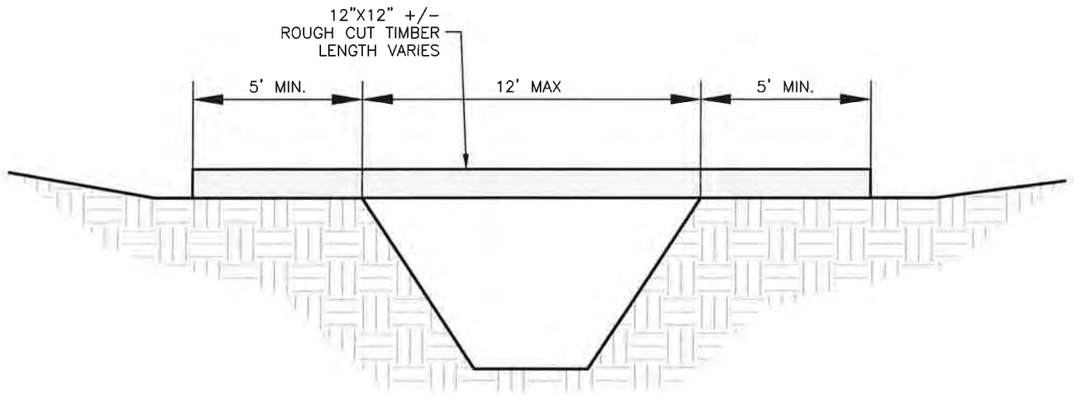
EROSION CONTROL DETAILS

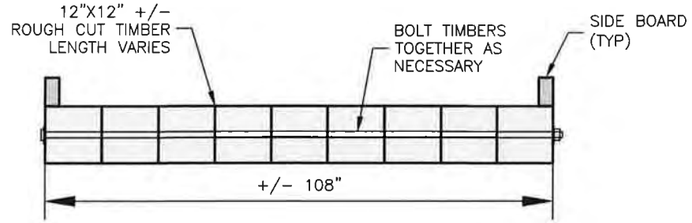
C6.09



PLAN VIEW



SECTION A - A'



SECTION B - B'

NOTES:

1. DETAIL PROVIDED FOR INFORMATIONAL PURPOSES. USE OF LOG MAT IS AT THE CONTRACTORS DISCRETION.
2. LOG MATS ARE TO HAVE SOLID DECK AND SIDE BOARDS.
3. USE MULTIPLE LOG MATS WHERE NECESSARY TO ACCOMIDATE EQUIPMENT WIDTH.

LOG MAT

N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.23

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CRANE MITIGATION SITE

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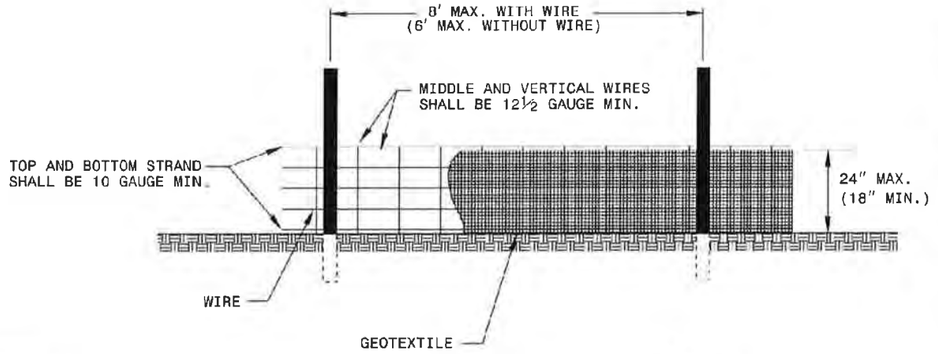
EROSION CONTROL DETAILS

C6.10



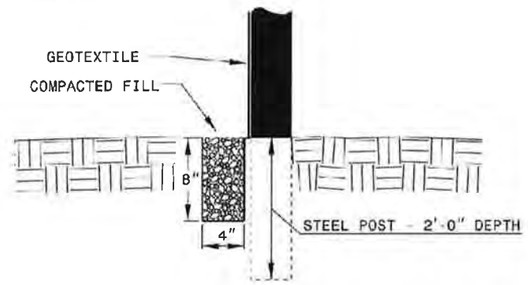
NOTES

USE GEOTEXTILE A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE POSTS AND WIRE AS DIRECTED.

USE WIRE A MINIMUM OF 32" IN WIDTH AND WITH A MINIMUM OF 5 LINE WIRES WITH 12" VERTICAL SPACING.

PROVIDE 5'-0" STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE.

FOR MECHANICAL SLICING METHOD INSTALLATION, GEOTEXTILE SHALL BE A MAXIMUM OF 18" ABOVE GROUND SURFACE.



EXTENSION OF GEOTEXTILE AND WIRE INTO TRENCH

1-18

STATE OF NORTH CAROLINA
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DIVISION OF HIGHWAYS
RALEIGH, N.C.

ROADWAY STANDARD DRAWING FOR
TEMPORARY SILT FENCE

SHEET 1 OF 1
1605.01

TEMPORARY SILT FENCE
N.T.S.

NOTES

USE NO. 5 OR NO. 57 STONE FOR SEDIMENT CONTROL STONE.

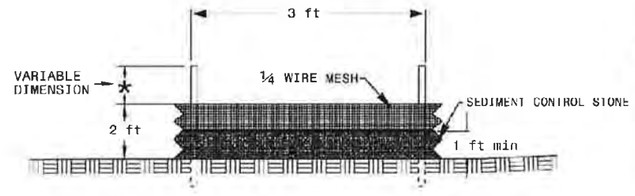
USE HARDWARE CLOTH 24 GAUGE WIRE MESH WITH ¼ INCH MESH OPENINGS.

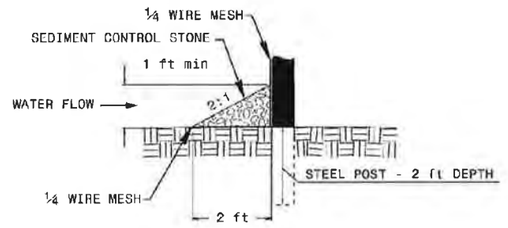
INSTALL 5 FT. SELF FASTENER ANGLE STEEL POST 2 FT. DEEP MINIMUM.

ATTACH HARDWARE CLOTH TO POSTS WITH WIRE STAPLE OR OTHER ACCEPTABLE METHODS.

SPACE POSTS A MAXIMUM OF 3 FT.

FOR INSTALLATION BETWEEN SECTIONS OF SILT FENCE, EXTEND SEDIMENT CONTROL STONE A MINIMUM OF 12" ON EACH SIDE OF SPECIAL SEDIMENT CONTROL FENCE SECTION.





1-18

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ROADWAY STANDARD DRAWING FOR
SPECIAL SEDIMENT CONTROL FENCE

SHEET 1 OF 1
1606.01

SILT FENCE OUTLET
N.T.S.

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CRANE MITIGATION SITE
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LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

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EROSION CONTROL DETAILS

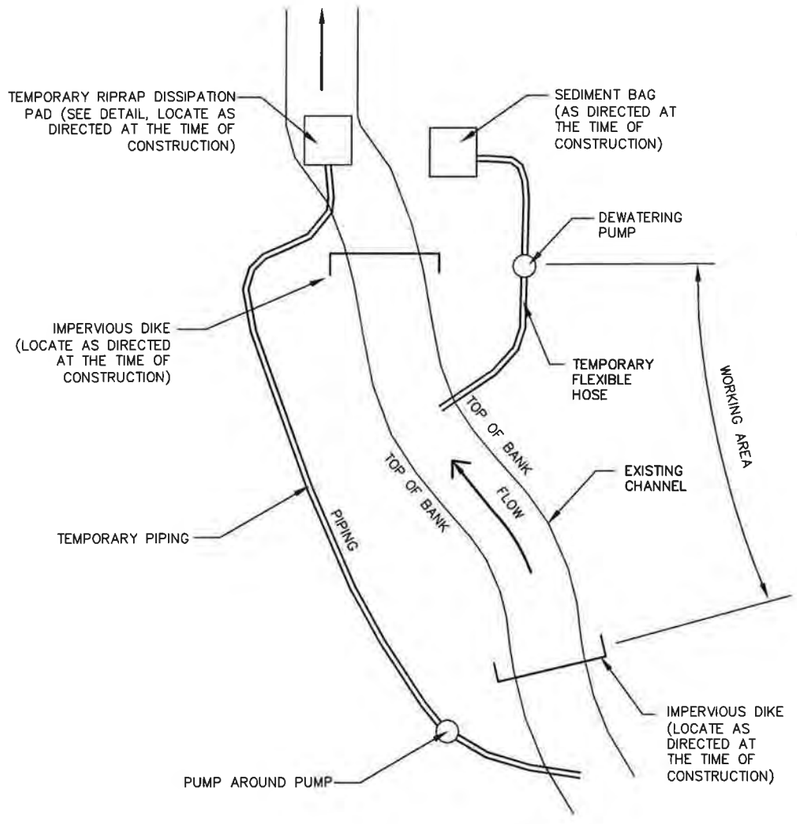
C6.11

NOTES:

1. EXCAVATION SHALL BE PERFORMED IN ONLY DRY SECTIONS OF CHANNEL UNLESS DRAINAGE AREA EXCEEDS 6 SQUARE MILES.
2. IMPERVIOUS DIKES SHOULD BE USED TO ISOLATE WORK AREAS FROM STREAM FLOW.
3. THE CONTRACTOR SHALL NOT DISTURB MORE AREA THAN CAN BE STABILIZED IN ONE WORKING DAY.
4. EACH PUMP AROUND PUMP SHOULD ADEQUATELY CONVEY BASE FLOW VOLUMES.
5. PUMP AROUND OPERATIONS SHOULD NOT BE UNDERTAKEN IF SIGNIFICANT RAINFALL IS FORECAST IN THE CONSTRUCTION PERIOD.

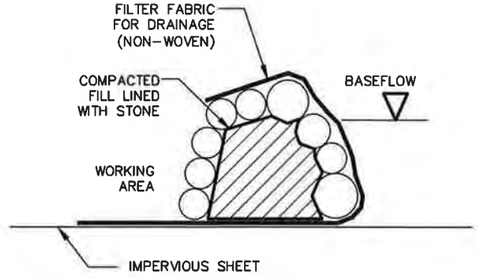
SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP AROUND

1. INSTALL SEDIMENT BAG AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR WILL INSTALL THE PUMP AROUND PUMP AND THE THE TEMPORARY PIPING THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK SITE TO THE SEDIMENT BAG.
3. INSTALL UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. INSTALL THE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS IF NEEDED TO DEWATER THE ENTRAPPED AREA. THE PUMP AND HOSE FOR THIS PURPOSE SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. THIS WATER WILL ALSO FLOW INTO A SEDIMENT BAG.
5. THE CONTRACTOR WILL PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLAN AND FOLLOWING THE GENERAL CONSTRUCTION SEQUENCE.
6. THE CONTRACTOR WILL EXCAVATE ANY ACCUMULATED SEDIMENT AND DEWATER BEFORE REMOVAL OF THE IMPERVIOUS DIKE. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE/PIPING STARTING WITH THE DOWNSTREAM DIKE FIRST.
7. ONCE THE WORKING AREA IS COMPLETED, REMOVE THE STILLING BASINS AND STABILIZE DISTURBED AREAS TO SPECIFICATIONS AS SHOWN ON PLANS.



TYPICAL PUMP AROUND SETUP

N.T.S.



IMPERVIOUS DIKE DETAIL (PROFILE VIEW)

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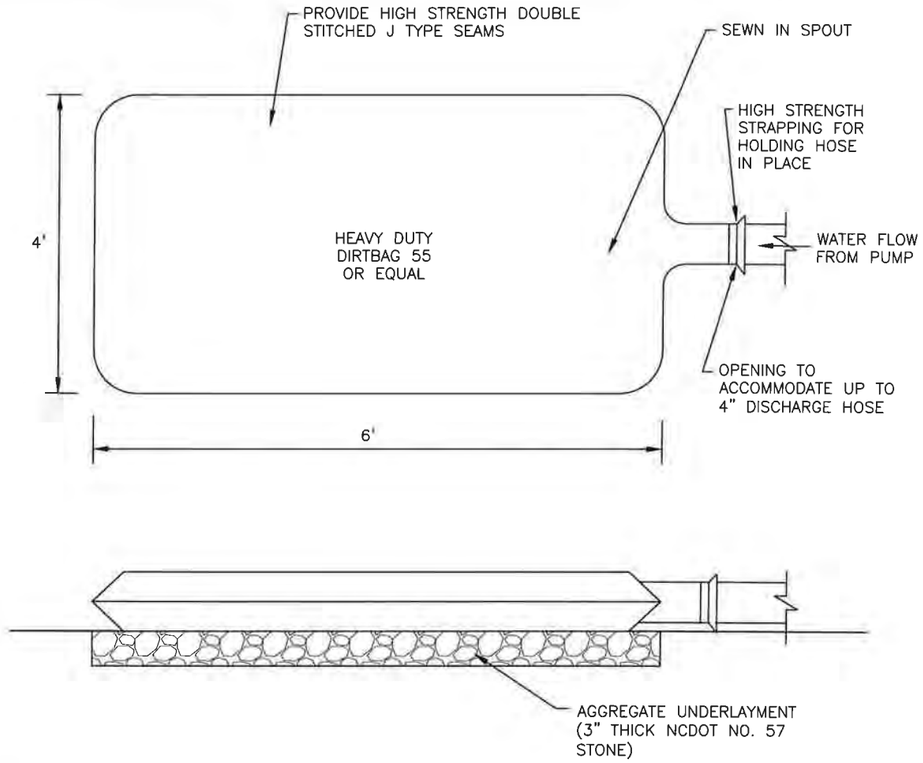
EROSION CONTROL DETAILS

C6.12



NOTES

1. THE DEWATERING BAG SHALL BE MADE OF NON-WOVEN GEOTEXTILE WITH A MIN. SURFACE AREA OF 225 SQUARE FEET PER SIDE.
2. ALL STRUCTURAL SEAMS SHALL BE SEWN WITH A DOUBLE STITCH USING A DOUBLE NEEDLE MACHINE WITH HIGH STRENGTH THREAD.
3. THE SEAM STRENGTH SHALL WITHSTAND 100 LB/IN USING ASTM D-4884 TEST METHOD.
4. THE GEOTEXTILE FABRIC SHALL BE 10 OZ NON-WOVEN FABRIC.
5. DISCHARGE FROM THE DEWATERING BAG SHALL BE DIRECTED SUCH THAT PRE-DISTURBANCE HYDROLOGY IS NOT CHANGED.
6. TRANSPORT AND PLACE DEWATERING BAGS WITH CARE TO PREVENT RIPPING OR TEARING THE FABRIC.
7. AVOID INSTALLING ON STEEP SLOPES AS THE BAG MAY ROLL, CAUSING FAILURE.
8. INSERT THE DISCHARGE HOSE A MINIMUM OF 1-FOOT INSIDE THE DEWATERING BAG. DO NOT INSERT MORE THAN ONE DISCHARGE HOSE INTO THE DEWATERING BAG.
9. AVOID USE OF EXCESSIVE FLOW RATES OR OVERFILLING THE DEWATERING BAG. THIS MAY CAUSE THE BAG TO RUPTURE OR CAUSE FAILURE TO THE HOSE TO BAG CONNECTION.

MAINTENANCE

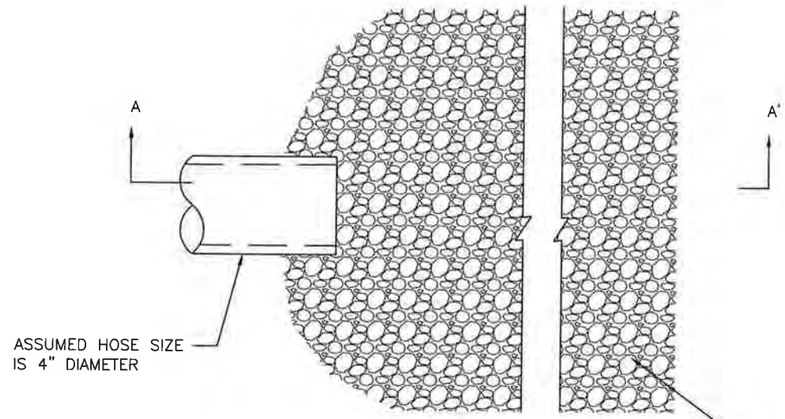
1. FOLLOW ALL MANUFACTURER RECOMMENDATIONS FOR INSPECTION AND MAINTENANCE GUIDELINES. REPLACE DEWATERING BAGS WHEN TRAPPED SEDIMENT HAS ACCUMULATED TO 50% OF THE BAG CAPACITY OR IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
2. DEWATERING BAGS ARE FULL WHEN THEY NO LONGER EFFICIENTLY FILTER SEDIMENT OR PASS WATER AT A REASONABLE RATE.

SEDIMENT FILTER BAG DETAIL

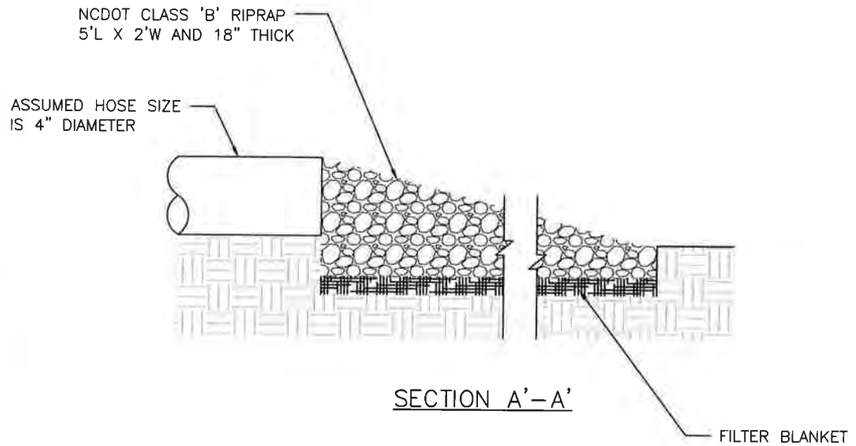
N.T.S.

NOTES

1. IN WELL-DEFINED CHANNEL, EXTEND THE RIPRAP APRON UP THE CHANNEL BANKS TO AN ELEVATION OF 6" ABOVE THE MAXIMUM TAILWATER DEPTH OR TO THE TOP OF BANK WHICHEVER IS LESS.
2. A FILTER BLANKET AND NON-WOVEN GEOTEXTILE FABRIC SHOULD BE INSTALLED BETWEEN THE RIPRAP AND SOIL FOUNDATION. FILTER BLANKET SHALL CONSIST OF MINIMUM 4" THICK LAYER OF STONE (NCDOT #57) UNDERLAIN WITH NON-WOVEN GEOTEXTILE FABRIC.



PLAN VIEW



SECTION A'-A'

TEMPORARY RIPRAP DISSIPATION PAD

N.T.S.

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

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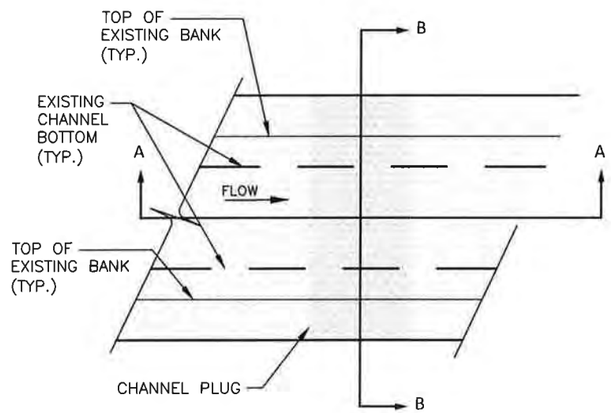
EROSION CONTROL DETAILS

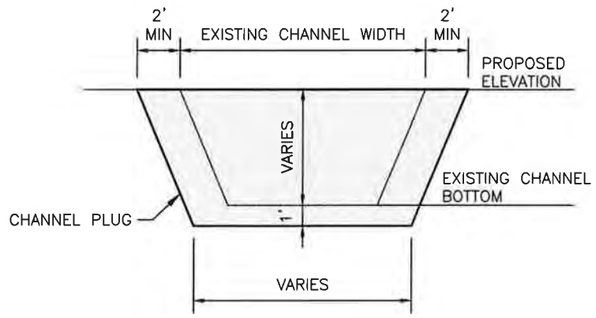
C6.13

CHANNEL PLUG NOTES:

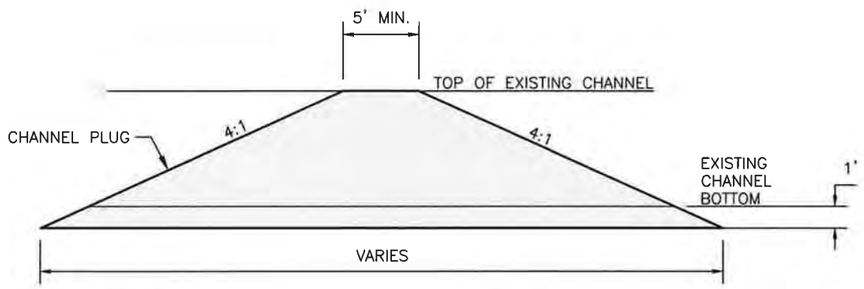
1. CHANNEL PLUGS TO BE LOCATED AS SHOWN ON PLAN SHEETS C5.00 THROUGH C5.15 AND AT OTHER LOCATIONS AS DIRECTED BY THE CONSTRUCTION MANAGER.
2. CHANNEL PLUG MATERIAL SHALL BE CLAY SOIL HARVESTED ON SITE OR BROUGHT INTO THE SITE AS WELL AS MATERIAL USED IN REMOVED ROCK CHECK DAMS IF SUITABLE.
3. CHANNEL MATERIAL SHALL BE FREE OF ALL VISIBLE ORGANIC DEBRIS SUCH AS ROOTS AND LIMBS. SOILS WITH ORGANIC MATTER CONTENT EXCEEDING 5% BY WEIGHT SHALL NOT BE USED.
4. ROCKS AND STONES WITH A DIAMETER GREATER THAN 3 INCHES (IN ANY DIRECTION) SHALL BE REMOVED FROM FILL PRIOR TO COMPACTION.
5. FILL MATERIAL PLACED AT DENSITIES LOWER THAN SPECIFIED MINIMUM DENSITIES OR AT MOISTURE CONTENTS OUTSIDE THE SPECIFIED RANGES OR OTHERWISE NOT CONFORMING TO THE SPECIFIED REQUIREMENTS SHALL BE REMOVED AND REWORKED AND REPLACED WITH ACCEPTABLE MATERIALS.
6. TOPSOIL SHALL BE PLACED ON TOP OF THE SOIL LIFTS IN THE SAME MANOR AS THE REST OF THE GRADED CONSTRUCTION SITE
7. CHANNEL PLUGS WILL BE PLANTED ACCORDING TO THE PLANTING PLAN ON SHEETS L5.00-L5.02.
8. MINIMUM CHANNEL PLUG LENGTH TO BE 20 LINEAR FEET.



PLAN VIEW



SECTION B-B'



SECTION A-A'

IMPERVIOUS CHANNEL PLUG DETAILS

N.T.S.

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EROSION CONTROL DETAILS

C6.14

NOTES:

1. AN EROSION CONTROL BLANKET SHALL BE USED TO STABILIZE THE NEWLY CONSTRUCTED CHANNEL FROM THE TOP OF BANK TO TOE OF SLOPE AND SHALL BE 100% BIODEGRADABLE.
2. THE CHANNEL SIDE SLOPES SHALL BE FINE GRADED, SEEDED, FERTILIZED, AND LIMED PRIOR TO INSTALLING THE EROSION CONTROL BLANKET. REMOVE ROOTS, TWIGS, AND OTHER DEBRIS WHICH WOULD CAUSE BULGES IN THE MATTING AS WELL AS PREVENT THE MATTING FROM BEING LAID FLUSH TO THE FINISHED SURFACE.
3. KEY-IN EDGES OF MATTING A MINIMUM OF 6 INCHES INTO FINISHED GRADE. LAY MATTING SHINGLED DOWNSTREAM TO UPSTREAM, OVERLAPPING AT EDGES A MINIMUM OF 1 FOOT.
4. INSTALL STAKES TO ENSURE GOOD GROUND CONTACT OF THE MATTING TO WITHSTAND MEDIUM TO HIGH FLOWS. STAKES SHALL BE 100% BIODEGRADABLE AND INSTALLED PER THE MANUFACTURER'S SPECIFICATIONS INCLUDING, BUT NOT LIMITED TO, THE MANUFACTURER'S RECOMMENDED DENSITY AND PATTERN.
5. KEY-IN EDGES OF MATTING A MINIMUM OF 6 INCHES, PARTICULARLY NEAR RESTORATION STRUCTURES, BOULDERS, LOGS, ETC. CHECK MATTING FOR LOOSE ENDS, FLAPS, OR OTHER WEAKNESSES OR DAMAGE WHICH MAY CAUSE IT TO BECOME LOOSE UNDER FLOW CONDITIONS.
6. MATTING SHALL BE PLACED ON ALL GRADED STREAM BANKS.
7. FIELD ADJUSTMENTS TO MATTING LOCATION MAY BE MADE AT THE DISCRETION OF THE DESIGNER.
8. THE EROSION CONTROL BLANKET SHALL CONSIST OF A MACHINE-PRODUCED BLANKET MADE OF COCONUT FIBER AND BE EQUIVALENT OR BETTER THAN THE FOLLOWING SPECIFICATION. SOIL STABILIZATION MATTING WHICH USES PLASTICS, METALS, OR OTHER MAN-MADE MATERIALS IN THE CONSTRUCTION OF THE MATERIAL WILL NOT BE PERMITTED.

WEIGHT = 13.6 OZ/SY

TENSILE STRENGTH DRY (ASTM D 4595) = 780 LBS/FT MACHINE DIRECTION
744 LBS/FT CROSS DIRECTION

TENSILE STRENGTH WET (ASTM D 4595) = 672 LBS/FT MACHINE DIRECTION
648 LBS/FT CROSS DIRECTION

ELONGATION FAILURE WET (ASTM D 4595) = 30% MACHINE DIRECTION
28% CROSS DIRECTION

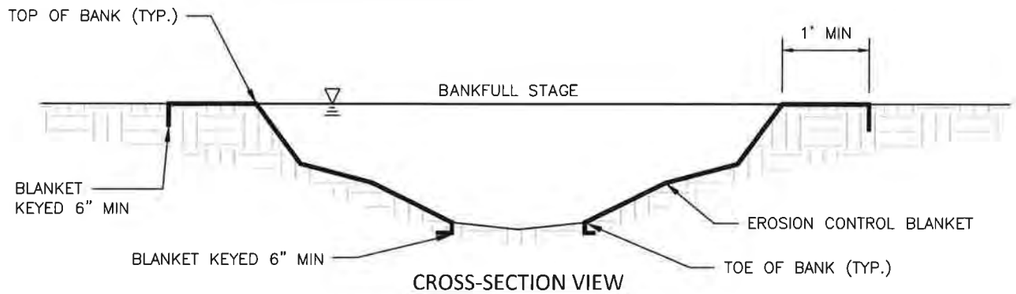
OPEN AREA = 65%

RECOMMENDED SHEAR STRESS = 3LBS/SQ.FT.

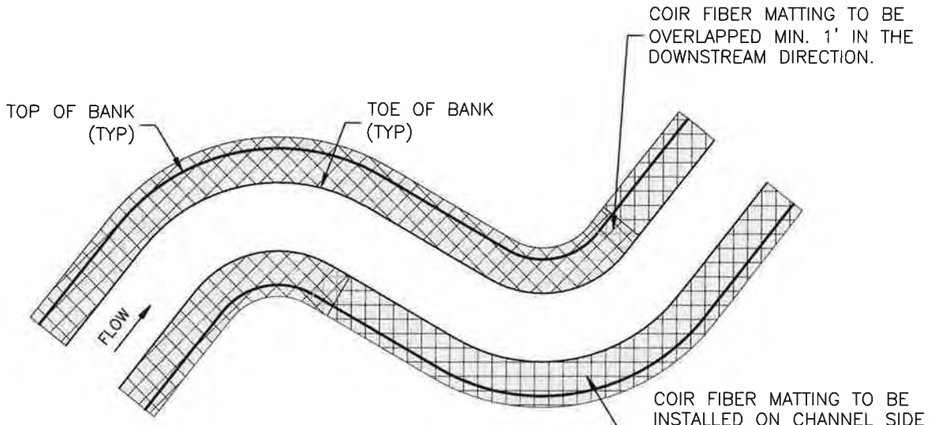
RECOMMENDED FLOW = 8FT/S

RECOMMENDED SLOPE </= 1:1

MINIMUM TWINE COUNT PER FOOT = 15X14



CROSS-SECTION VIEW



PLAN VIEW

EROSION CONTROL BLANKET DETAILS

N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

McADAMS

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www.mcadamsco.com

CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS
LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

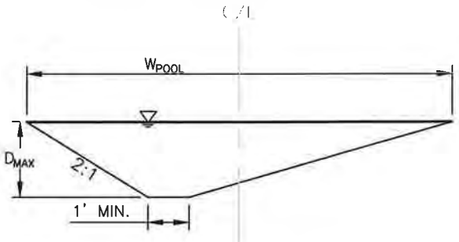
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	D1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	01.18.2022

EROSION CONTROL DETAILS

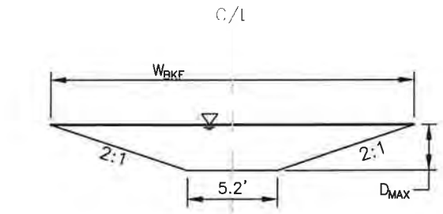
C6.15

TYPICAL POOL CROSS-SECTION ORIENTATION IS FOR A MEANDER BEND TOWARD STREAM RIGHT AND SHALL BE MIRRORED FOR MEANDER BENDS TOWARDS STREAM LEFT



W_{POOL} = 10.0 FT
D_{MAX} = 1.0 FT

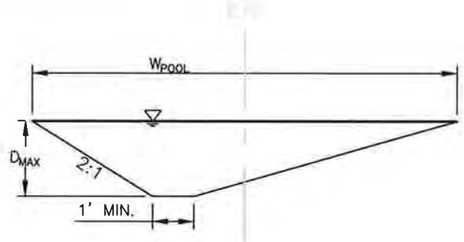
TYPICAL POOL



W_{bkf} = 8.4 FT
D_{MAX} = 0.8 FT
D_{MEAN} = 0.6 FT
A_{bkf} = 5.0 SF

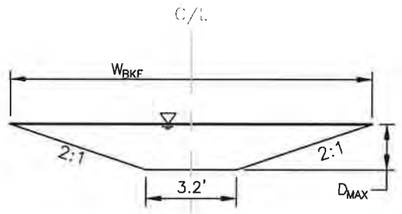
TYPICAL RIFFLE

UT1
N.T.S.



W_{POOL} = 6.2 FT
D_{MAX} = 0.6 FT

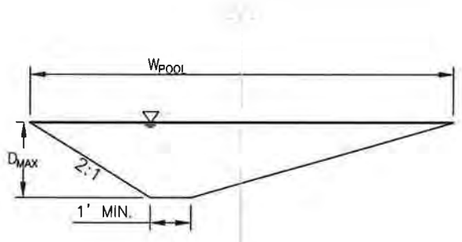
TYPICAL POOL



W_{bkf} = 5.2 FT
D_{MAX} = 0.5 FT
D_{MEAN} = 0.4 FT
A_{bkf} = 1.9 SF

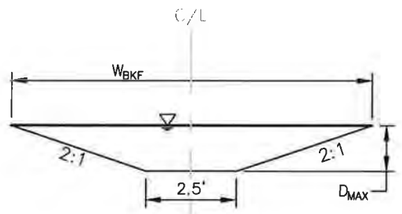
TYPICAL RIFFLE

UT2
N.T.S.



W_{POOL} = 4.9 FT
D_{MAX} = 0.5 FT

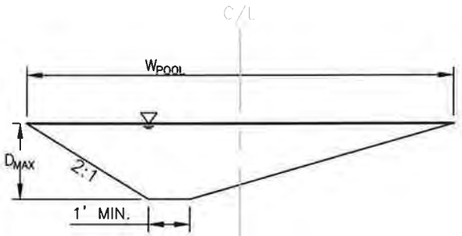
TYPICAL POOL



W_{bkf} = 4.1 FT
D_{MAX} = 0.4 FT
D_{MEAN} = 0.3 FT
A_{bkf} = 1.2 SF

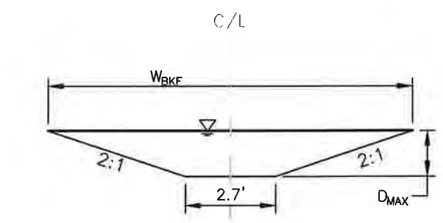
TYPICAL RIFFLE

UT3
N.T.S.



W_{POOL} = 5.1 FT
D_{MAX} = 0.5 FT

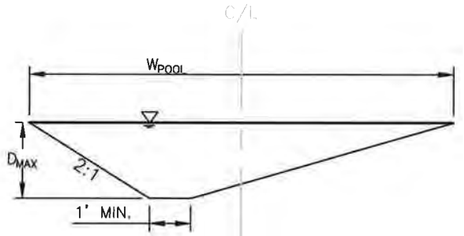
TYPICAL POOL



W_{bkf} = 4.3 FT
D_{MAX} = 0.4 FT
D_{MEAN} = 0.3 FT
A_{bkf} = 1.3 SF

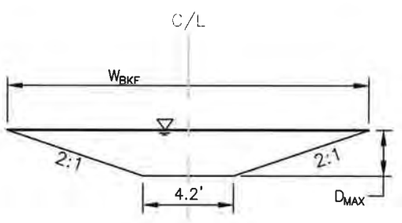
TYPICAL RIFFLE

UT4
N.T.S.



W_{POOL} = 7.9 FT
D_{MAX} = 0.8 FT

TYPICAL POOL



W_{bkf} = 6.6 FT
D_{MAX} = 0.6 FT
D_{MEAN} = 0.5 FT
A_{bkf} = 3.1 SF

TYPICAL RIFFLE

UT5
N.T.S.

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CRANE MITIGATION SITE

PRELIMINARY CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	20211102220
FILENAME	D2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	07.30.2021

SRTEAM DETAILS

C8.00

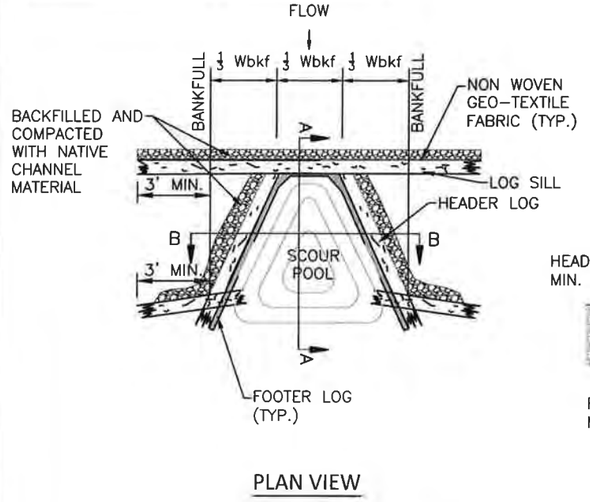
GENERAL NOTES:

1. A LOG CROSS VANE IS A GRADE CONTROL, IN-STREAM STRUCTURE THAT DIRECTS STREAM FLOW AWAY FROM THE STREAM BANKS AND IN TOWARD THE CENTER OF THE CHANNEL.
2. ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE UPSTREAM INVERT (CENTER) OF THE CROSS VANE TO ESTABLISH PART OF THE PROFILE. A NOTCH MAY BE CUT INTO THE LOG AT THE INVERT LOCATION. POOL ELEVATION CONTROL POINTS OR EXCAVATION TO A SPECIFIED MAXIMUM POOL DEPTH SHALL BE DESIGNATED TO ESTABLISH THE REMAINING PROFILE. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE INSTALLATION WITHIN THE TOLERANCE SPECIFIED BY THE DESIGNER.
3. THE VANE ARM SHALL BE SLOPED 3-5% AND INTERCEPT THE STREAM BANK AT A HEIGHT EQUAL TO BETWEEN ½ BANKFULL STAGE AND BANKFULL STAGE. ELEVATION CONTROL POINTS MAY BE ESTABLISHED AT THE LEFT AND RIGHT STREAM BANK/VANE ARM INTERCEPT POINTS. THE VANE ARM INTERCEPT LOCATION MAY BE OTHERWISE DESCRIBED BY ITS RELATIONSHIP TO BANKFULL STAGE OR BY THE LENGTH AND SLOPE OF THE VANE ARM. BANKFULL IS NOT NECESSARILY THE TOP OF THE STREAM BANK SLOPE.
4. IF THE PLANS DESIGNATE THE USE OF MULTIPLE LOG CROSS VANES A TABLE OF ALL STATION LOCATIONS AND CONTROL POINT ELEVATIONS SHALL BE PROVIDED IN THIS DETAIL OR PROVIDED ELSEWHERE IN THE PLANS AND REFERENCED HEREIN.
5. TYPICAL RIFFLE AND POOL CROSS SECTIONS SHALL BE PROVIDED ELSEWHERE IN THE PLANS TO ESTABLISH THE DIMENSIONS OF THE CHANNEL GRADING INTO WHICH THE LOG CROSS VANES ARE TO BE INSTALLED.
6. LOGS SHALL BE RELATIVELY STRAIGHT HARDWOOD, RECENTLY HARVESTED AND BE A MINIMUM OF 18" DIAMETER. THE LENGTH SHALL BE SUCH THAT THE LOG IS BURIED INTO THE SOIL OF THE STREAM BANK (ON ONE END) AND STREAM BED (ON THE OTHER END) A MINIMUM DISTANCE AS SPECIFIED BY THE DESIGNER. THE INVERT LOG SHALL BE KEYED INTO THE BANK A MINIMUM 3 FEET PAST TOP OF BANK WIDTH.
7. A SINGLE LOG MAY BE USED IN LIEU OF A HEADER/FOOTER LOG COMBINATION. A DOUBLE FOOTER LOG MAY BE REQUIRED IN SAND BED STREAMS.
8. NON-WOVEN GEOTEXTILE FABRIC OF A TYPE AND SIZE SPECIFIED BY THE DESIGNER SHALL BE USED TO SEAL THE GAPS BETWEEN THE LOG(S) AND THE STREAM BED, UNDER THE COARSE BACKFILL MATERIAL. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
9. COARSE BACKFILL OF THE LOG CROSS VANE SHALL BE OF A TYPE, SIZE, AND GRADATION AS SPECIFIED BY THE DESIGNER. COARSE BACKFILL SHALL BE PLACED TO A THICKNESS EQUAL TO THE DEPTH OF THE HEADER (AND ANY FOOTER) LOGS AND SHALL EXTEND OUT FROM THE VANE ARMS TO THE STREAM BANK AND UPSTREAM A DISTANCE SPECIFIED BY THE DESIGNER.
10. AS AN OPTION, FLAT-SIDED BOULDERS OF A SIZE (LENGTH, WIDTH, AND THICKNESS) AS SPECIFIED BY THE DESIGNER MAY BE PLACED AS BALLAST ON TOP OF THE STREAM BANK SIDE OF THE EMBEDDED VANE ARMS. DUCK BILL ANCHORS MAY BE USED IN LIEU OF BALLAST BOULDERS.
11. DUCKBILL ANCHORS WITH GALVANIZED CABLE ATTACHED (OF A GAGE ADEQUATE TO SECURE THE SPECIFIED DIAMETER LOG) MAY BE USED TO SECURE LOGS INTO THE STREAM BED AND/OR BANKS TO THE SPECIFIED DEPTH. FLAT SIDED BOULDERS (LENGTH, WIDTH, AND THICKNESS SPECIFIED BY DESIGNER) CAN BE USED IN LIEU OF THE LOG INVERT/DUCKBILL ANCHOR SYSTEM.

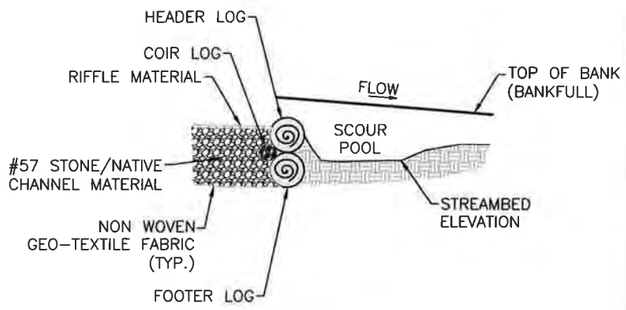
CONSTRUCTION GUIDELINES:

1. THE VANE ARMS OF THE LOG CROSS VANE SHALL BE CONSTRUCTED FIRST, FOLLOWED BY THE LOG INVERT.
2. OVER-EXCAVATE STREAM BED TO A DEPTH EQUAL TO THE TOTAL THICKNESS OF THE HEADER (AND FOOTER IF SPECIFIED) LOGS.
3. PLACE VANE ARM FOOTER LOGS, IF SPECIFIED. THE SLOPE OF THE VANE ARM IS MEASURED ALONG THE VANE ARM WHICH IS INSTALLED AT AN ANGLE TO THE STREAM BANK AND PROFILE.
4. INSTALL VANE ARM HEADER LOG ON TOP OF AND SET SLIGHTLY FORWARD OR BACK FROM THE FOOTER LOG.
5. INSTALL INVERT LOG AND DUCKBILL ANCHOR.
6. NAIL FILTER FABRIC TO THE HEADER LOG USING A GALVANIZED NAIL WITH A PLASTIC CAP. THE SIZE AND GAGE OF NAIL AND NAIL SPACING SHALL BE SPECIFIED BY THE DESIGNER.
7. PLACE COARSE BACKFILL BEHIND LOG(S) ENSURING THAT ANY VOIDS BETWEEN THE LOGS ARE FILLED.
8. IF ANY EROSION CONTROL MATTING IS SPECIFIED FOR USE IN THE VICINITY OF THE VANE ARM INTERCEPT POINTS, ALL MATTING EDGES SHALL BE NEATLY SECURED AROUND THE LOGS.

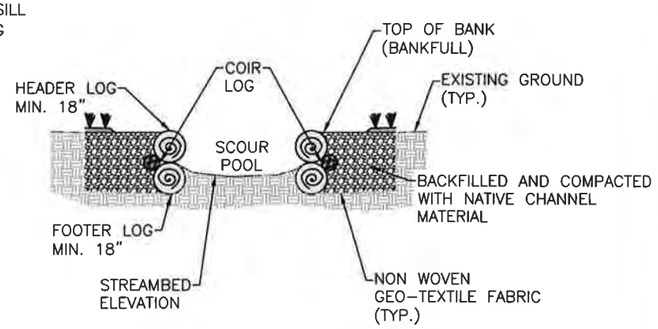
TRIBUTARY	W_{bkf} (FT)
UT1	8.4
UT2	5.2
UT3	4.1
UT4	4.3
UT5	6.6



PLAN VIEW



SECTION A - A



SECTION B - B

LOG CROSS VANE DETAIL

N.T.S.

NOTE: GEOTEXTILE FABRIC (NON–WOVEN) SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS.

MECHANICAL PROPERTIES	TEST METHOD	UNIT	MINIMUM AVERAGE ROLL VALUE	
			MD	CD
GRAB TENSILE STRENGTH	ASTM D 4632	N (lbs)	912 (205)	912 (205)
GRAB TENSILE ELONGATION	ASTM D 4632	%	50	50
TRAPEZOID TEAR STRENGTH	ASTM D 4533	N (lbs)	356 (80)	356 (80)
CBR PUNCTURE STRENGTH	ASTM D 6241	N (lbs)	2225 (500)	
APPARENT OPENING SIZE (AOS)[1]	ASTM D 4751	mm (U.S. SIEVE)	0.18 (80)	
PERMITTIVITY	ASTM D 4491	sec $^{-1}$	1.1	
FLOW RATE	ASTM D 4491	l/min/m² (gal/min/ft²)	3870 (95)	
UV RESISTANCE (AT 500 HOURS)	ASTM D 4355	% STRENGTH RETAINED	70	

[1]ASTM D 4751: AOS IS A MAXIMUM OPENING DIAMETER VALUE

PHYSICAL PROPERTIES	TEST METHOD	UNIT	TYPICAL VALUE	
WEIGHT	ASTM D 5261	g/m² (oz/yd²)	271 (8.0)	
THICKNESS	ASTM D 5199	mm (mils)	1.8 (72)	
ROLL DIMENSIONS (WIDTH X LENGTH)	–	ft	12.5 X 360	15 X 300
ROLL AREA	–	m² (yd²)	418 (500)	
ESTIMATED ROLL WEIGHT	–	kg (lb)	120 (265)	

NON-WOVEN GEOTEXTILE FABRIC MATERIAL SPECIFICATIONS

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.23.22

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CRANE MITIGATION SITE

PRELIMINARY CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	D2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	01.18.2022

STREAM DETAILS

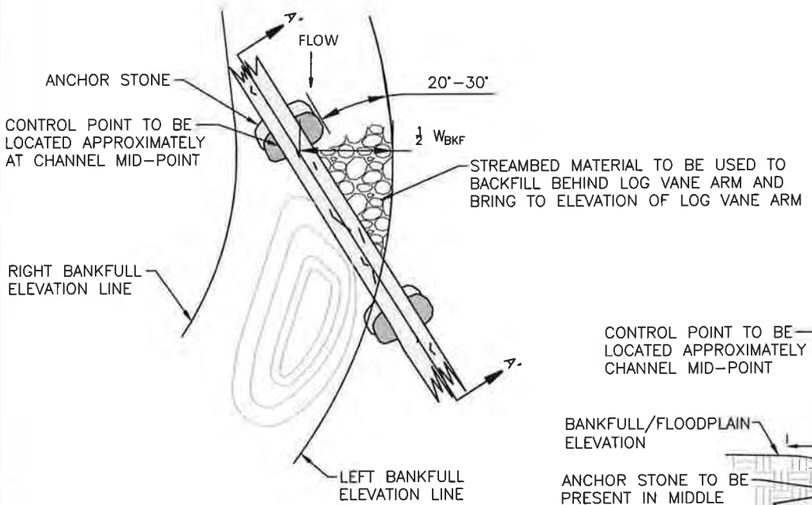
C8.01

GENERAL NOTES

1. LOG VANES WILL BE ANGLED @20-30° FROM STREAM BANK.
2. LOG VANES SHALL BE LARGE ENOUGH TO OCCUPY ⅔ OF THE POOL MAXIMUM DEPTH.
3. LOG VANE WILL BE SLOPED AT 3-5%.
4. SEED AND SOIL STABILIZATION MATTING WILL BE PLACED ALONG STREAM BANKS FOR STABILIZATION PURPOSES WHERE DISTURBANCES HAS OCCURRED AS A RESULT STRUCTURE INSTALLATION.
5. DESIGN ENGINEER SHALL CONSIDER IMPLEMENTATION OF OTHER STREAM BANK PROTECTION MEASURES IN CONJUNCTION WITH LOG VANE STRUCTURE.

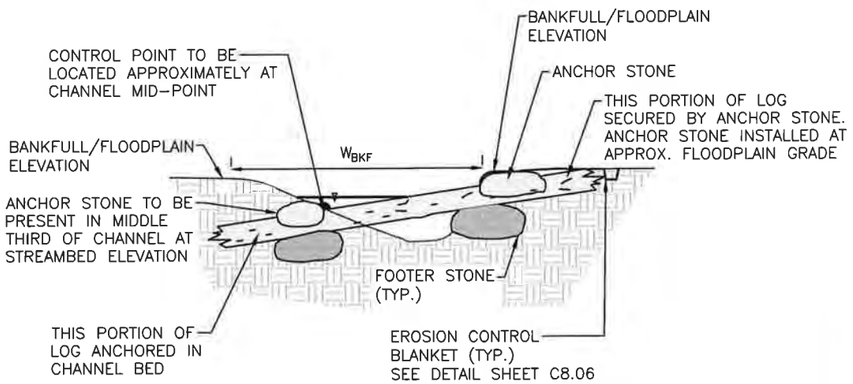
CONSTRUCTION GUIDELINES

1. ALL EROSION AND SEDIMENT CONTROL DEVICES SHOULD BE INSTALLED IN ACCORDANCE WITH AN APPROVED EROSION AND SEDIMENT CONTROL (E&SC) PLAN.
2. FLOW FROM THE STREAM SHOULD BE DIVERTED AWAY FROM THE WORK AREA IN ACCORDANCE WITH THE APPROVED E&SC PLAN AND THE SITE SHOULD BE DEWATERED.
3. LOG VANES SHOULD BE ANGLED 20 TO 30 DEGREES FROM THE UPSTREAM BANK. LOG VANE ARMS SHOULD BE INSTALLED WITH A VERTICAL ANGLE ALONG THE VANE ARM RANGING FROM 3 TO 5 PERCENT. LOG VANES SHOULD SPAN APPROXIMATELY ONE-HALF TO TWO-THIRDS OF THE BANKFULL CHANNEL WIDTH.
4. EXCAVATE THE TRENCH AND PREPARE THE AREA ALONG THE STREAMBANK AND IN THE STREAMBED FOR PLACEMENT OF FOOTER ROCKS. FOOTER ROCKS SHOULD BE INSTALLED AT BOTH THE STREAMBANK AND THALWEG LOCATIONS TO ENSURE PROPER FOOTING OF THE LOG VANE STRUCTURE AND TO ELIMINATE SCOUR AT KEY TIE-IN POINTS.
5. PLACE LOG ONTO THE FOOTER ROCKS SUCH THAT THE LOG VANE ARM THAT TIES INTO THE STREAMBANK WILL BE INSTALLED AT THE BANKFULL ELEVATION AND THE OTHER END OF THE LOG VANE ARM WILL BE EMBEDDED INTO THE STREAMBED AT THE THALWEG ELEVATION AND WILL BE LOCATED WITHIN THE MIDDLE THIRD OF THE BANKFULL CHANNEL WIDTH.
6. ANCHOR ROCKS SHOULD BE INSTALLED ON TOP OF BOTH ENDS OF THE LOG VANE. ANCHOR STONES IN THE STREAMBED WILL BE OFFSET TO THE UPSTREAM SIDE OF THE LOG VANE AND PLACED TO MINIMIZE ROLLING OF ANCHOR STONE AND WILL NOT PROTRUDE FROM THE STREAMBED ELEVATION MORE THAN ONE-THIRD THE THICKNESS OF THE ANCHOR ROCK. ANCHOR ROCKS WILL BE PLACED ALONG THE STREAMBANK POSITION OF THE LOG VANE ARM IN SIMILAR FASHION AND WILL NOT EXTEND MORE THAN ONE-THIRD THE THICKNESS OF THE ANCHOR ROCK.
7. THE LOG VANE ARM THAT TIES INTO THE STREAMBANK SHOULD EXTEND A MINIMUM OF 5 TO 6 FEET INTO THE STREAMBANK. ADDITIONALLY THE THALWEG END OF THE STRUCTURE SHOULD BE EMBEDDED A MINIMUM OF 2 TO 3 FEET. WHEN TWO LOGS ARE USED TO ACCOMPLISH THE DESIGN SPECIFICATION OF THE LOG VANE, THE LOGS SHOULD BE SECURED TOGETHER WITH CABLES OR REBAR MATERIAL BASED UPON MANUFACTURING SPECIFICATIONS. LOG VANES SHOULD BE ANCHORED INTO THE STREAMBED WITH SUPPORT PILINGS AND/OR DUCKBILL ANCHORS WITH LENGTHS EXCEEDING THE POTENTIAL OF LONG-TERM BED DEGRADATION AND/OR SCOUR DEPTHS.
8. PLACEMENT OF SALVAGED STREAMBED MATERIAL OBTAINED DURING TRENCH EXCAVATIONS WILL BE PLACED ALONG THE UPSTREAM SIDE OF THE LOG VANE ARM AND BETWEEN THE STREAMBANK TO CREATE A UNIFORM SLOPE BETWEEN THE LOG VANE ARM AND THE STREAMBANK. AT THE MINIMUM, STREAMBED GRAVEL WILL BE PLACED TO THE ELEVATION OF THE SLOPING LOG VANE ARM ON THE UPSTREAM SIDE OF THE LOG VANE.
9. SOIL STABILIZATION MATTING WILL BE INSTALLED ALONG THE STREAMBANKS IN THE AREA OF DISTURBANCES AND SHOULD BE SEEDED, MULCHED, AND PLANTED WITH APPROVED LANDSCAPING.
10. REMOVE THE APPROVED E&SC PLAN DEVICES UPON STABILIZATION OF THE CHANNEL IN ACCORDANCE WITH THE APPROVED PLAN.



PLAN VIEW

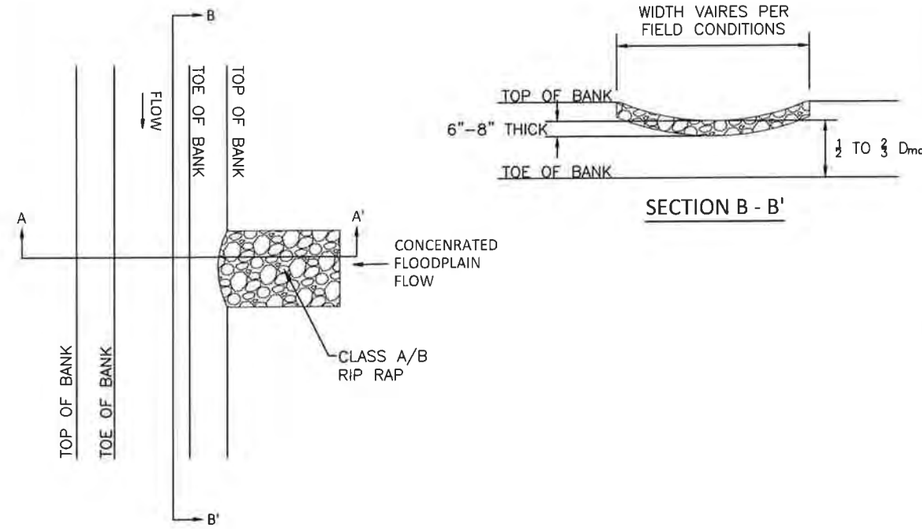
TRIBUTARY	W_{bkf} (FT)
UT1	8.4
UT2	5.2
UT3	4.1
UT4	4.3
UT5	6.6



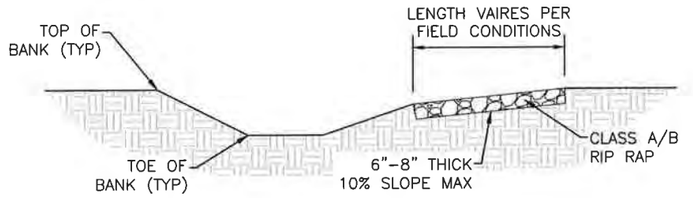
SECTION A' - A'

LOG VANE DETAIL

N.T.S.



SECTION B - B'



SECTION A - A'

ROCK FLOODPLAIN OUTELT

N.T.S.

NOTE:
1. CONSTRUCT ROCK FLOODPLAIN OUTLETS WHERE CONCENTRATED FLOWS IN THE FLOODPLAIN ENTER THE DESIGN CHANNEL.
2. MAKE ADJUSTMENT TO THE LOCATION OF ROCK FLOODPLAIN OULETS SHOWN IN THE PLANS BASED ON FIELD CONDITIONS AT THE TIME OF CONSTRUCTION.
3. THE ENGINEER ON SITE MAY MAKE CHANGES TO THE QUANTITY AND LOCATION OF ROCK FLOODPLAIN OUTLETS BASED ON FIELD CONDITIONS AT THE TIME OF CONSTRUCTION.

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CRANE MITIGATION SITE

PRELIMINARY CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	20211102220
FILENAME	D2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	07.30.2021

STREAM DETAILS

C8.02

GENERAL NOTES:

1. A BOULDER OR LOG SILL STEP MAY BE USED ALONE OR IN COMBINATION WITH A CONSTRUCTED RIFFLE. CONTRACTOR TO CONSULT DESIGN ENGINEER FOR FINAL MATERIAL SPECIFICATIONS.
2. AN ELEVATION CONTROL POINT SHALL BE DESIGNATED AT THE CENTER OF THE SILL TO ESTABLISH PART OF THE PROFILE. POOL ELEVATION CONTROL POINTS OR EXCAVATION TO A SPECIFIED MAXIMUM POOL DEPTH SHALL BE DESIGNATED TO ESTABLISH THE REMAINING PROFILE. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE INSTALLATION WITHIN THE TOLERANCE SPECIFIED BY THE DESIGNER.
3. NO PART OF THE SILL SHALL BE PLACED ABOVE THE ELEVATION OF THE STREAM BED.
4. REFER TO THE PLAN-PROFILE FOUND ON SHEETS C5.00 - C5.15 FOR THE STATION LOCATIONS AND CONTROL POINT ELEVATIONS OF EACH BOULDER OR LOG SILL STEP SPECIFIED FOR THE PROJECT.
5. ALL BOULDERS SHALL CONSIST OF ANGULAR, TABULAR, FLAT ROCK WITH MINIMUM OF TWO PARALLEL SIDES, AND HAVE A NATURAL APPEARANCE AND COLOR. ROUNDED EDGES ARE ACCEPTABLE SO LONG AS ROUNDED EDGES ARE NOT BEARING OR SUPPORTING. APPROXIMATE DIMENSIONS OF BOULDERS SHALL MEASURE IN LENGTH, WIDTH, AND HEIGHT SPECIFIED IN THE TABLE BELOW. ALL STONE SHALL BE FREE FROM LAMINATION AND WEAK CLEAVAGES. THE STONE SHOULD NOT DISINTEGRATE SIGNIFICANTLY FROM THE ACTION OF AIR, WATER, OR IN HANDLING AND PLACING. STONE WITH TOOL MARKS, DRILL HOLES, AND OTHER BLASTING EVIDENCE SHALL NOT BE UTILIZED IN EXPOSED LOCATIONS.
6. FILTER FABRIC OF A TYPE AND SIZE SPECIFIED BY THE DESIGNER SHALL BE USED TO SEAL THE GAPS BETWEEN THE BOULDERS AND THE STREAM BED, UNDER THE COARSE BACKFILL MATERIAL. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
7. BACKFILL ROCK ON THE UPSTREAM SIDE OF THE STRUCTURE SHALL BE NATIVE CHANNEL MATERIAL OR RIVER COBBLE OF EQUIVALENT SIZE AND HAVE AN AVERAGE DIAMETER OF 8". SMALLER AGGREGATE (I.E. NO. #57) OR COBBLE STONES SHALL BE USED TO FILL VOIDS SUCH THAT EACH BOULDER RESTS SOLIDLY ON THE PREVIOUS ROCK LAYER WITH MINIMAL OPPORTUNITY FOR MOVEMENT.

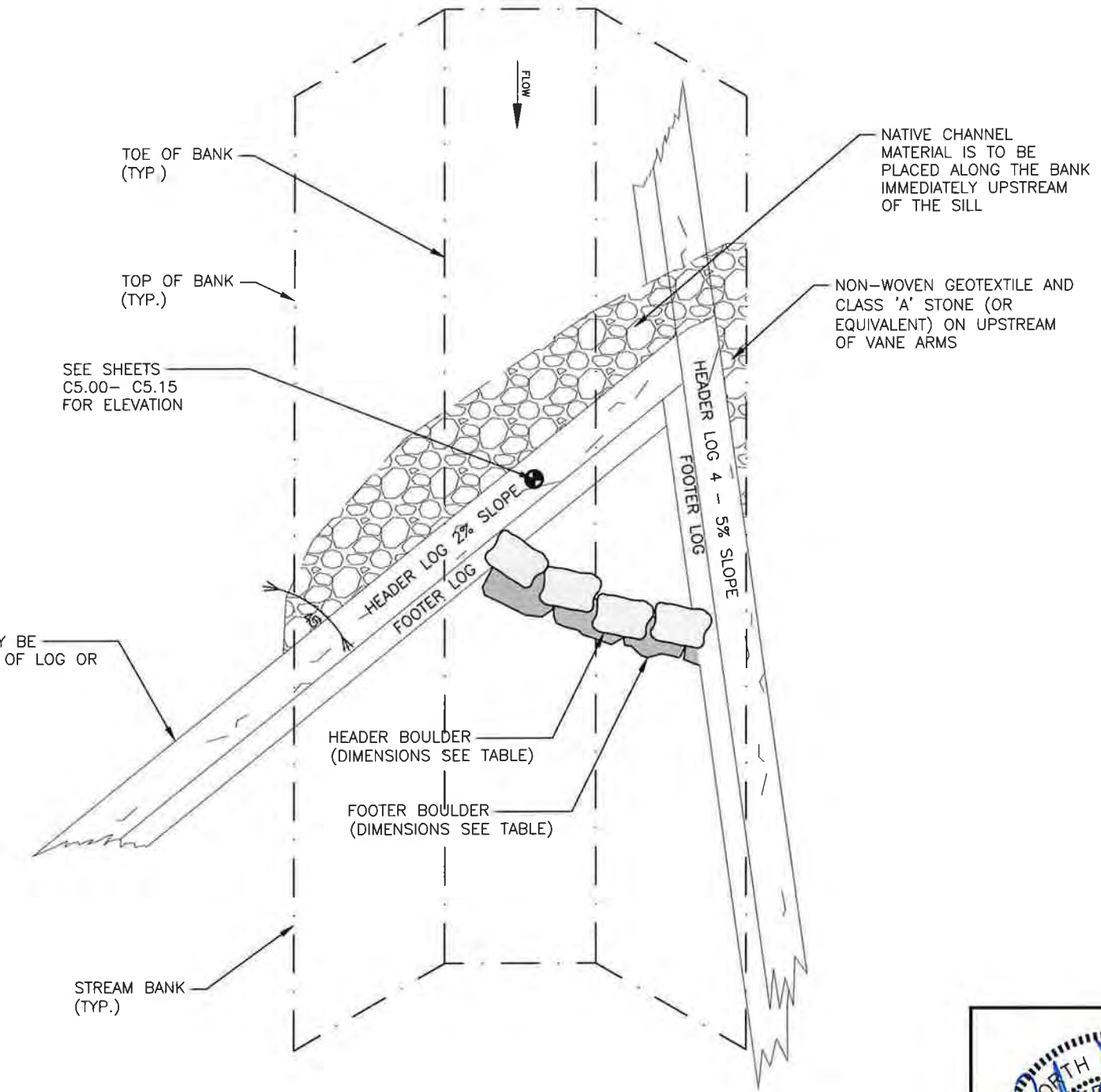
CONSTRUCTION GUIDELINES:

1. STREAM SHALL BE DIVERTED AWAY FROM THE WORK AREA AND THE SITE SHALL BE DEWATERED.
2. EXCAVATE TRENCH FOR FOOTER ROCKS TO THE ELEVATION AND GRADES NECESSARY FOR PLACEMENT OF BOTH FOOTER AND HEADER BOULDER SO THAT THE DESIRED ELEVATION OF THE HEADER BOULDER MEETS THE LINES AND GRADES OF THE STRUCTURE SCHEDULE IN ACCORDANCE WITH THE PLANS AND PROFILES.
3. PLACE FOOTER BOULDERS IN EXCAVATED TRENCH WITH ADJACENT BOULDERS ABUTTING EACH OTHER. FOOTER BOULDERS SHALL BE PLACED NEATLY SO THAT THE HEADER BOULDERS CAN REST SECURELY ON TWO FOOTER BOULDERS. SMALLER ROCK SHALL BE USED TO FILL VOID SPACES SO THAT EACH BOULDER RESTS SOLIDLY ON THE PREVIOUS BOULDER WITH MINIMAL OPPORTUNITY FOR MOVEMENT.
4. BOULDER SILL ROCKS WILL TIE INTO THE CHANNEL BOTTOM ELEVATION AT THE LOCATION OF EACH SILL AND EXTEND INTO THE STREAMBANK A MINIMUM OF 5' UNLESS OTHERWISE SPECIFIED BY THE DESIGNER.
5. PLACE FILTER FABRIC BEHIND BOULDER SILL AND ALONG THE BOTTOM OF THE STREAM BED.
6. PLACE COARSE BACKFILL BEHIND BOULDERS ENSURING THAT ANY VOIDS BETWEEN THE ROCKS ARE FILLED.
7. TRIM ANY EXPOSED FILTER FABRIC AROUND THE SILL INSTALLATION. CHECK PROPER FUNCTION/FLOW PATH BY OBSERVING FLOW OVER STRUCTURE. REPAIR AS NEEDED TO ENSURE PROPER FUNCTION.
8. ENSURE NO LEAKAGE/FLOW UNDER OR AROUND STRUCTURE BY PROPERLY GRADING, SEALING, AND COMPACTING UNDER AND AROUND THE STRUCTURE.
9. EROSION CONTROL BLANKET SHALL BE INSTALLED IN AREAS SHOWN ON THIS DETAIL AND IN COMPLIANCE WITH INSTALLATION INSTRUCTIONS ON THE EROSION CONTROL DETAIL ON SHEET C6.08.

TRIBUTARY	BOTTOM CHANNEL WIDTH (FT)	W_{bkf}(FT)	MIN. SILL LENGTH (FT)
UT1	5.2	8.4	14.0
UT2	3.2	5.2	10.0
UT3	2.5	4.1	10.0
UT4	2.7	4.3	10.0
UT5	4.2	6.6	12.0

TRIBUTARY	BOULDER LENGTH* (FT)	BOULDER WIDTH* (FT)	BOULDER HEIGHT* (IN)
UT1	2.0	1.3	12.0
UT2	2.0	1.3	12.0
UT3	2.0	1.3	12.0
UT4	2.0	1.3	12.0
UT5	2.0	1.3	12.0

*MINIMUM DIMENSIONS SHOWN



SILL STEP DETAIL
N.T.S.

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 049073 REBECCA STUBBS
1-28-22

The John R. McAdams Company, Inc.
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CRANE MITIGATION SITE

PRELIMINARY CONSTRUCTION DRAWINGS
LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS, LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	20211102220
FILENAME	D2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	07.30.2021

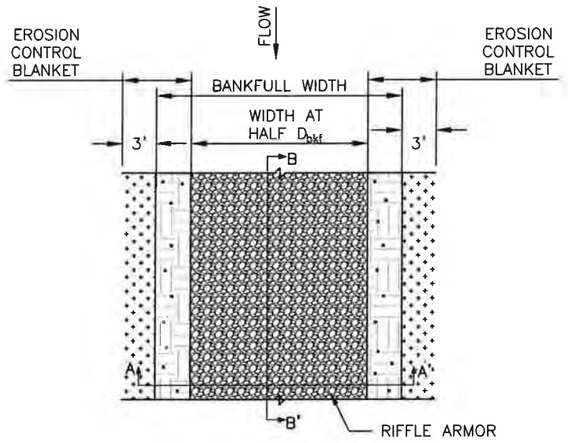
STREAM DETAILS

C8.03

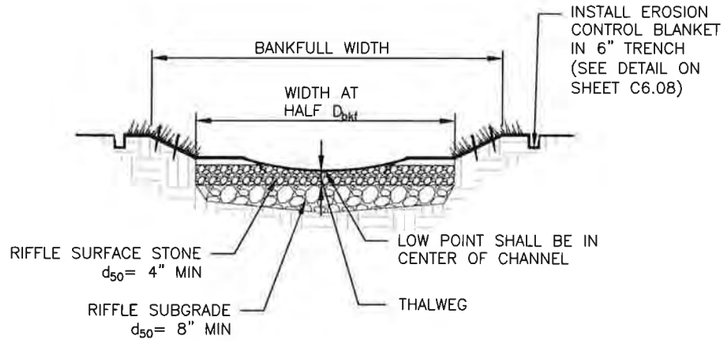
GENERAL NOTES

1. RIFFLE ARMOR DEPTH SHALL BE A MINIMUM OF 18 INCHES.
2. EXTEND RIFFLE ARMOR UP TO HALF BANKFULL DEPTH.
3. LOW POINT (THALWEG) SHALL BE IN THE CENTER OF CHANNEL.
4. RIFFLE SUBGRADE MATERIAL SHALL BE NCDOT CLASS 'B' RIPRAP OR RIVER COBBLE OF EQUIVALENT SIZE AND HAVE AN AVERAGE DIAMETER OF 8". NATIVE CHANNEL MATERIAL FROM THE EXISTING CHANNEL SHALL BE USED WHENEVER POSSIBLE.
5. GRAVEL SUBSTRATE FROM THE EXISTING CHANNEL SHALL BE STOCKPILED AND REUSED AS SURFACE STONE IN THE NEW CHANNEL. GRAVEL SHALL BE PLACED AT EACH RIFFLE LOCATION IN ACCORDANCE WITH THE GRADATION SHOWN ON THESE PLANS. SOME EXCAVATION OF CHANNEL BED MATERIAL MAY BE NECESSARY PRIOR TO PLACEMENT OF RIFFLE TO ENSURE PROPER CROSS-SECTIONAL DIMENSIONS ONCE RIFFLE IS CONSTRUCTED. RE-DRESSING OF CHANNEL AND BANKS MAY BE REQUIRED FOLLOWING CONSTRUCTION OF RIFFLES AND CHANNEL.

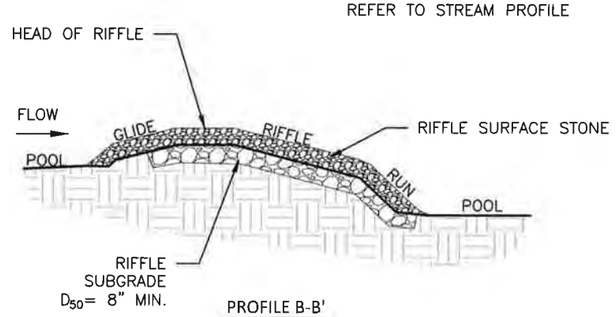
TRIBUTARY	BOTTOM CHANNEL WIDTH (FT)	W_{bkf} (FT)	WIDTH AT HALF D_{bkf} (FT)
UT1	5.2	8.4	6.8
UT2	3.2	5.2	4.2
UT3	2.5	4.1	3.3
UT4	2.7	4.3	3.5
UT5	4.2	6.6	5.4



PLAN VIEW



CROSS SECTION A-A'



PROFILE B-B'

CONSTRUCTED RIFFLE DETAIL

N.T.S.

NORTH CAROLINA REGISTERED PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.10.22

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CRANE MITIGATION SITE

PRELIMINARY CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	20211102220
FILENAME	D2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	07.30.2021

STREAM DETAILS

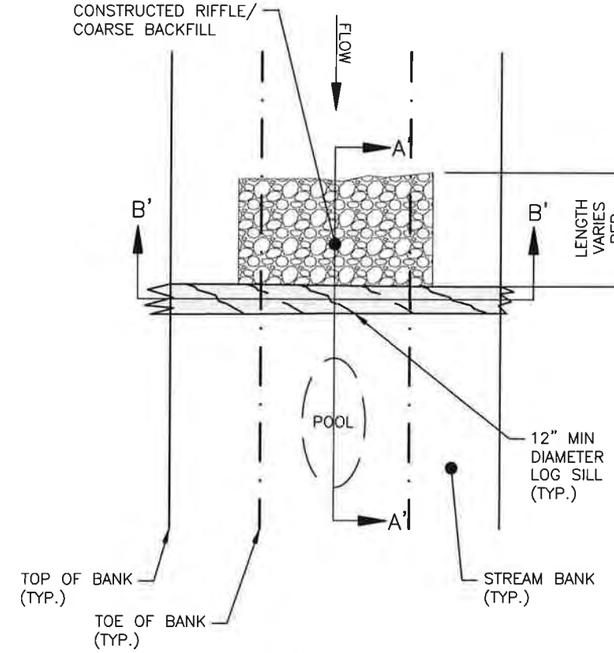
C8.04

GENERAL NOTES:

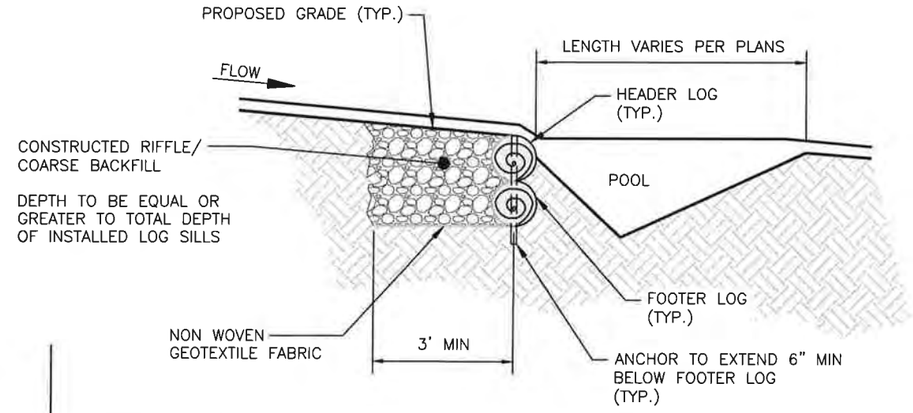
1. A LOG SILL MAY BE USED ALONE OR IN COMBINATION WITH A CONSTRUCTED RIFFLE.
2. AN ELEVATION CONTROL POINT SHALL BE DESIGNATED AT THE CENTER OF THE SILL TO ESTABLISH PART OF THE PROFILE. POOL ELEVATION CONTROL POINTS OR EXCAVATION TO A SPECIFIED MAXIMUM POOL DEPTH SHALL BE DESIGNATED TO ESTABLISH THE REMAINING PROFILE. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE INSTALLATION WITHIN THE TOLERANCE SPECIFIED BY THE DESIGNER.
3. NO PART OF THE SILL SHALL BE PLACED ABOVE THE ELEVATION OF THE STREAM BED.
4. REFER TO THE PLAN-PROFILE FOUND ON SHEETS C5.00 - C5.15 FOR THE STATION LOCATIONS AND CONTROL POINT ELEVATIONS OF EACH LOG SILL SPECIFIED FOR THE PROJECT.
5. LOGS SHALL BE OF A LENGTH AND DIAMETER SPECIFIED BY THE DESIGNER AND BE ROT-RESISTANT, RELATIVELY STRAIGHT HARDWOOD, RECENTLY HARVESTED. THE LENGTH OF THE SILL EMBEDDED INTO EACH BANK SHALL EQUAL OR EXCEED THE DIMENSIONS SHOWN IN SECTION B'-B' OF THIS DETAIL.
6. A SINGLE LOG MAY BE USED IN LIEU OF A HEADER/FOOTER LOG COMBINATION WITH APPROVAL OF THE ENGINEER.
7. FILTER FABRIC OF A TYPE AND SIZE SPECIFIED BY THE DESIGNER SHALL BE USED TO SEAL THE GAPS BETWEEN THE LOG(S) AND THE STREAM BED, UNDER THE COARSE BACKFILL MATERIAL. THE FABRIC SHALL BE NAILED TO THE ENTIRE LENGTH HEADER AND FOOTER LOG USING A GALVANIZED NAIL WITH A PLASTIC CAP. THE SIZE AND GAGE OF NAIL AND NAIL SPACING SHALL BE SPECIFIED BY THE DESIGNER. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
8. COARSE BACKFILL OF THE LOG SILL SHALL BE OF A TYPE, SIZE, AND GRADATION AS SPECIFIED BY THE DESIGNER. COARSE BACKFILL SHALL BE PLACED TO A THICKNESS EQUAL TO THE DEPTH OF THE HEADER (AND ANY FOOTER) LOGS AND SHALL EXTEND UPSTREAM FROM THE SILL A DISTANCE SPECIFIED BY THE DESIGNER.

CONSTRUCTION GUIDELINES:

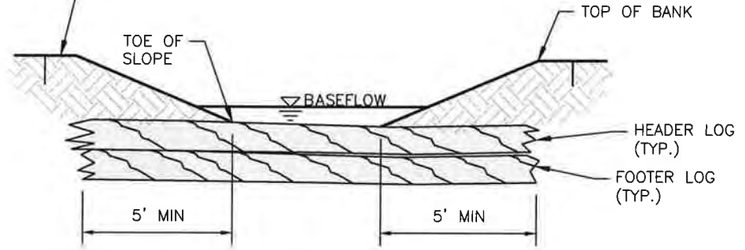
1. STREAM SHALL BE DIVERTED AWAY FROM THE WORK AREA AND THE SITE SHALL BE DEWATERED.
2. OVER-EXCAVATE STREAM BED TO A DEPTH EQUAL TO THE TOTAL THICKNESS AND LENGTH OF THE HEADER (AND FOOTER IF SPECIFIED) LOGS.
3. PLACE FOOTER LOGS, IF SPECIFIED, PERPENDICULAR TO THE PROPOSED CHANNEL WITHIN THE EXCAVATED TRENCH. A LAYER OF BEDDING MATERIAL UNDER THE FOOTER LOG MAY BE SPECIFIED BY THE DESIGNER.
4. INSTALL HEADER LOG ON TOP OF THE FOOTER LOG. HEADER LOG MAY BE SET FORWARD OR BACK FROM FOOTER LOG AS AN OPTION. THE TOP OF THE HEADER LOG SHALL CONFORM TO THE STREAM BED ELEVATION AT THE LOCATION WHICH IT IS PLACED.
5. SECURE LOG(S) WITH ANCHORS AT MAXIMUM SPACING OF 2 FEET ON CENTER. ANCHORS SHALL BE ½" DIAMETER MINIMUM REBAR OR DRIFT PIN. ANCHOR MUST HAVE SUFFICIENT LENGTH TO PASS THROUGH BOTH LOGS AND ENTER THE GROUND AT LEAST 6 INCHES.
6. PLACE FILTER FABRIC BEHIND LOG SILL AND ALONG THE BOTTOM OF THE STREAM BED. NAIL FILTER FABRIC TO THE HEADER LOG.
7. PLACE COARSE BACKFILL BEHIND LOG(S) ENSURING THAT ANY VOIDS BETWEEN THE LOGS ARE FILLED.
8. TRIM ANY EXPOSED FILTER FABRIC AROUND THE SILL INSTALLATION. CHECK PROPER FUNCTINO/FLOW PATH BY OBSERVING FLOW OVER STRUCTURE. REPAIR AS NEEDED TO ENSURE PROPER FUNCTION.
9. ENSURE NO LEAKAGE/FLOW UNDER OR AROUND STRUCTURE BY PROPERLY GRADING, SEALING, AND COMPACTING UNDER AND AROUND THE STRUCTURE.
10. EROSION CONTROL BLANKET SHALL BE INSTALLED IN AREAS SHOWN ON THIS DETAIL AND IN COMPLIANCE WITH INSTALLATION INSTRUCTIONS ON THE EROSION CONTROL DETAIL.



PLAN VIEW



SECTION A' - A'



SECTION B' - B'

LOG SILL

N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 7.30.22

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CRANE MITIGATION SITE

PRELIMINARY CONSTRUCTION DRAWINGS

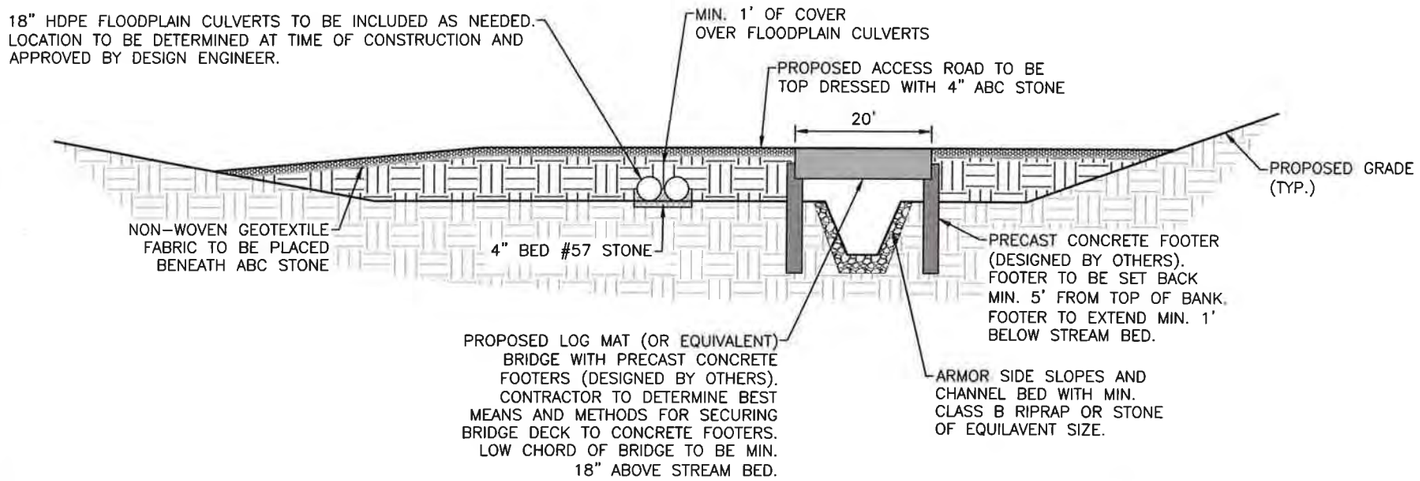
LEE COUNTY, NORTH CAROLINA

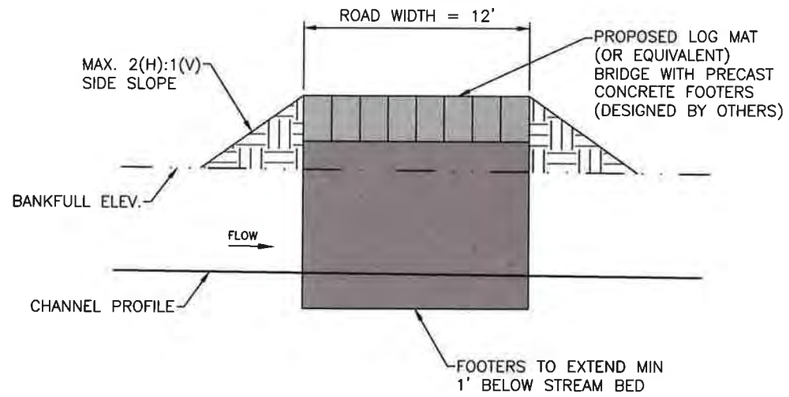
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	20211102220
FILENAME	D2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	07.30.2021

STREAM DETAILS

C8.05





UT1 BRIDGE CROSSING

N.T.S.

GENERAL NOTES

1. INSTALL PERMANENT CROSSING WHILE CONSTRUCTION LOCATION HAS BEEN DEWATERED.
2. IF UNABLE TO INSTALL WHILE LOCATION IS DRY, PLACE MATTING ON EXPOSED SOILS.
3. ALL MATERIAL TO BE PLACED AND COMPACTED WITHIN ROAD EMBANKMENT SHALL BE FREE FROM ROOTS, STUMPS, WOOD, STONES GREATER THAN 6", AND FROZEN OR OTHER OBJECTIONABLE MATERIAL.
4. ARMOR CHANNEL BED AND SIDE SLOPES BENEATH THE BRIDGE CROSSING WITH CLASS 'B' RIPRAP, MATCHING THE PROPOSED GRADE.
5. CONTRACTOR IS RESPONSIBLE FOR SECURING THE PROPOSED LOG MAT BRIDGE (OR EQUIVALENT) TO THE PRECAST CONCRETE FOOTERS (DESIGNED BY OTHERS). METHODS FOR SECURING THE BRIDGE DECK TO THE FOOTERS SHALL BE PRESENTED TO THE ON-SITE CONSTRUCTION ADMINSTRATOR FOR APPROVAL PRIOR TO CONSTRUCTION OF THE CROSSING.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.23.22

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CRANE MITIGATION SITE

PRELIMINARY CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	D2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	01.18.2022

UT1 CROSSING DETAIL

C8.06

PROPOSED FIVE-STRAND BARBED WIRE FENCE

PROPOSED 2" TUBE 12' STEEL GATE

L2.01

L2.02

L2.03

UT1

UT2

UT3

UT4

UT5

ROCKY FORK CHURCH ROAD

TOTAL DISTURBED AREA = 30.9 AC.

GRAPHIC SCALE

0 100 200 400

1 inch = 200 ft.

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 049073 REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	L2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=200'
DATE	01.18.2022

FENCING PLAN OVERVIEW

L2.00

PROPOSED FIVE-STRAND BARBED WIRE FENCE

PROPOSED 2" TUBE 12' STEEL GATE

PROPOSED FENCING OFFSET 2' OUTWARD FROM EASEMENT

PROPOSED FENCING TO TIE TO EXISTING FENCING

PROPOSED ACCESS ROAD SEE SHEET C8.06

PROPOSED 2" TUBE 12' STEEL GATE

20' WIDE FENCE BREAK CENTERED ON PROPOSED ACCESS ROAD

PROPOSED FENCING OFFSET 2' OUTWARD FROM EASEMENT

PROPOSED FENCING OFFSET 2' OUTWARD FROM EASEMENT

REMOVE EXISTING FENCING WITHIN THE CONSERVATION EASEMENT

PROPOSED FENCING TO TIE TO EXISTING FENCING

PROPERTY LINE (TYP.)

PROPOSED 2" TUBE 12' STEEL GATE

PROPERTY LINE (TYP.)

PROPERTY LINE (TYP.)

MATCHLINE SHEET L2.02

MATCHLINE SHEET L2.03

UT1

UT2

UT3

UT4

UT5

GRAPHIC SCALE

0 50 100 200

1 inch = 100 ft.

TOTAL DISTURBED AREA = 30.9 AC.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RS RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	L2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=100'
DATE	01.18.2022

FENCING PLAN

L2.01

PROPOSED FIVE-STRAND BARBED WIRE FENCE

PROPOSED 2" TUBE 12' STEEL GATE

PROPERTY LINE (TYP)

PROPOSED FECNING TO END AT PROPERTY LINE

PROPOSED 2" TUBE 12' STEEL GATE

PROPOSED FENCING OFFSET 2' OUTWARD FROM EASEMENT

UT3

UT1

UT5

MATCHLINE SHEET L2.01

MATCHLINE SHEET L2.03

PROPERTY LINE (TYP.)

PROPOSED FECNING TO END AT PROPERTY LINE

PROPOSED 2" TUBE 12' STEEL GATE

PROPERTY LINE (TYP.)

PROPOSED FENCING OFFSET 2' OUTWARD FROM EASEMENT

TOTAL DISTURBED AREA = 30.9 AC.

GRAPHIC SCALE

0 50 100 200

1 inch = 100 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
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DATE	01.18.2022

FENCING PLAN

L2.02

PROPOSED FIVE-STRAND BARBED WIRE FENCE

PROPOSED 2" TUBE 12' STEEL GATE

MATCHLINE SHEET L2.01

MATCHLINE SHEET L2.02

UTS

PROPOSED FENCING OFFSET 2' OUTWARD FROM EASEMENT

PROPOSED FENCING OFFSET 2' OUTWARD FROM EASEMENT

PROPERTY LINE (TYP.)

PROPERTY LINE (TYP.)

PROPOSED 2" TUBE 12' STEEL GATE

GRAPHIC SCALE

0 50 100 200

1 inch = 100 ft.

TOTAL DISTURBED AREA = 30.9 AC.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

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PLAN INFORMATION

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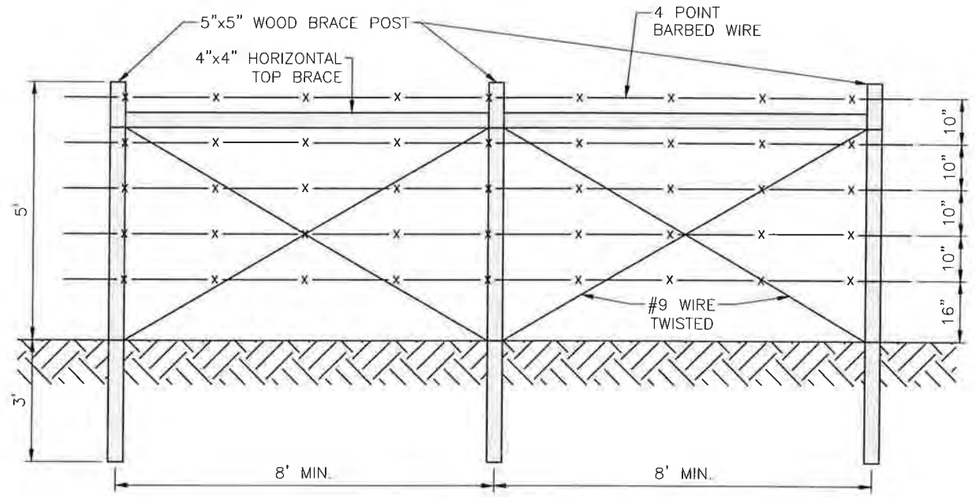
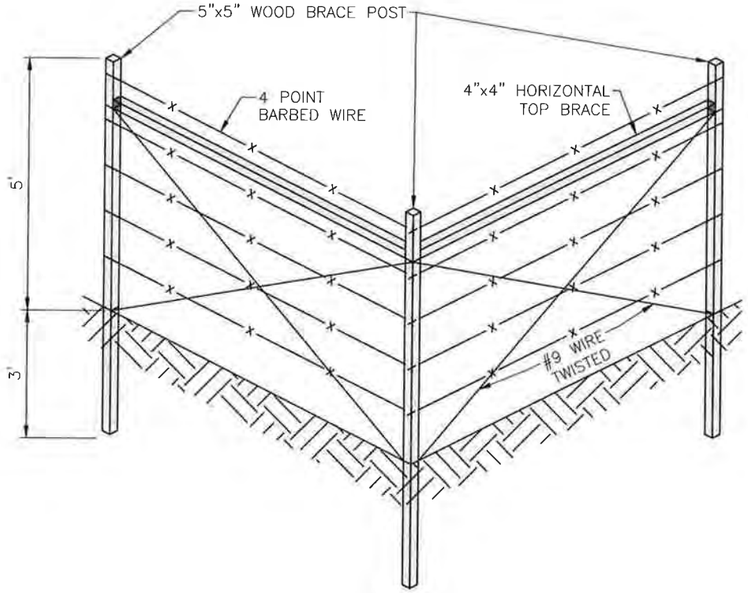
FILENAME	L2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=100'
DATE	01.18.2022

FENCING PLAN

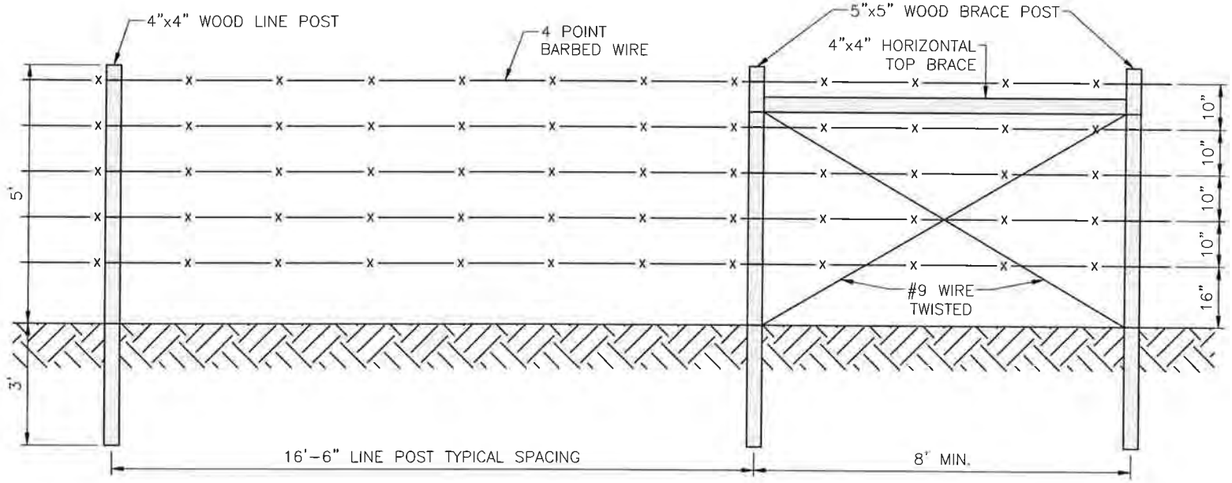
L2.03



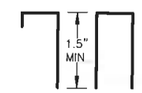
LINE BRACE
MAXIMUM SPACING 300'



CORNER BRACE
FOR CORNERS GREATER THAN 15°



END OR GATE BRACE



STAPLE TYPES
USE ONE #9 STAPLE OR
TWO #16 STAPLES AT EACH
POINT OF ATTACHMENT

FIVE-STRAND BARBED WIRE FENCING

N.T.S.

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS
LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	2021110220
FILENAME	L2
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	
DATE	01.18.2022

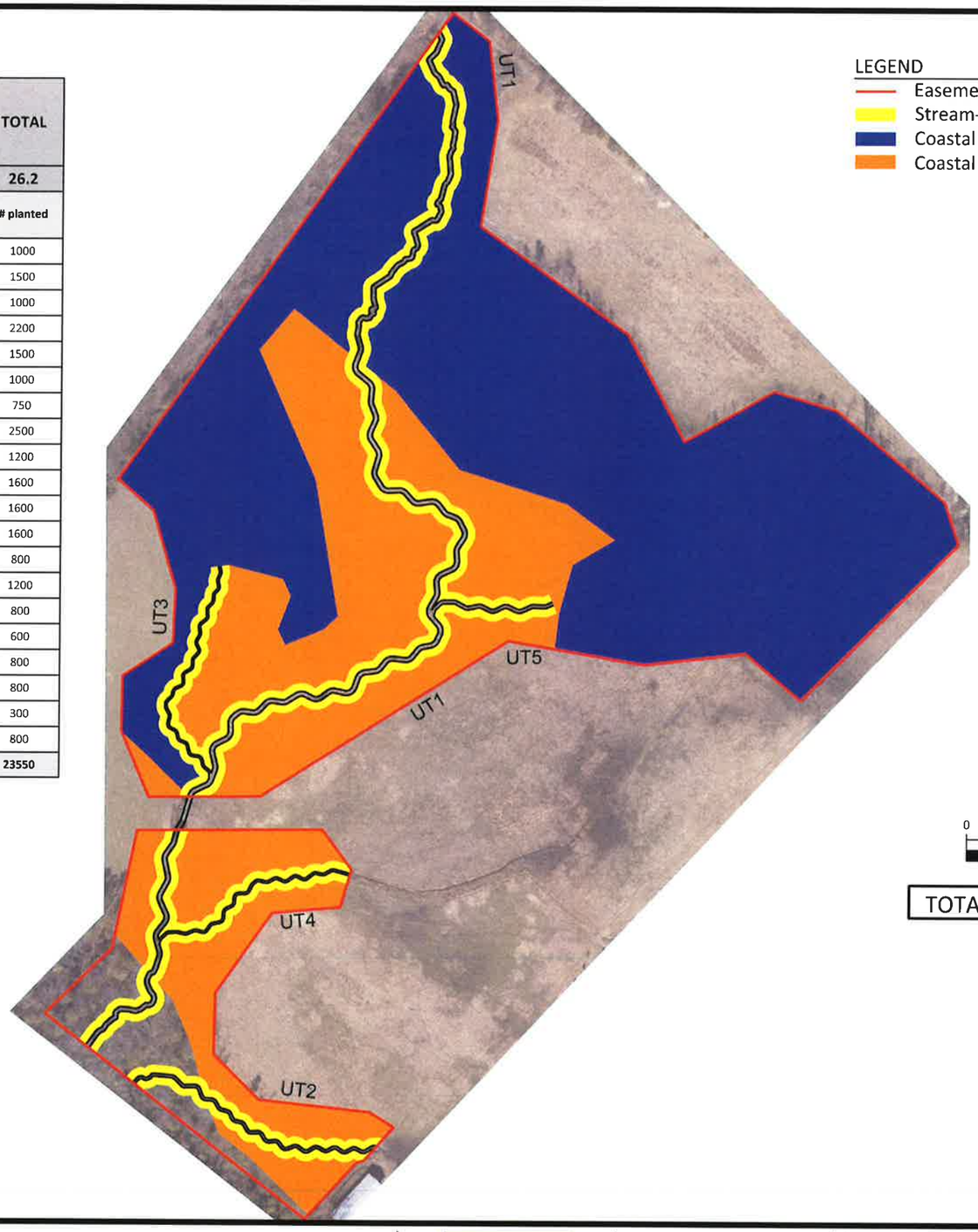
FENCING PLAN

L2.04

Vegetation Association		Coastal Plain Bottomland Hardwood Forest*		Coastal Plain Small Stream Swamp*		Stream-side Assemblage**		TOTAL
Area (acres)		8		15.4		2.8		26.2
Species	Indicator Status	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
Swamp black gum (*Nyssa biflora*)	OBL	0	0.00%	1000	9.50%	0	0.00%	1000
Bald cypress (*Taxodium distichum*)	OBL	500	9.20%	1000	9.50%	0	0.00%	1500
Tupelo gum (*Nyssa aquatica*)	OBL	0	0.00%	1000	9.50%	0	0.00%	1000
Black gum (*Nyssa sylvatica*)	FAC	500	9.20%	1000	9.50%	700	9.20%	2200
Silky dogwood (*Cornus amomum*)	FACW	0	0.00%	0	0.00%	1500	19.70%	1500
Sweetbay (*Magnolia virginiana*)	FACW	0	0.00%	1000	9.50%	0	0.00%	1000
Red bay (*Persea borbonia*)	FAC	250	4.60%	500	4.80%	0	0.00%	750
River birch (*Betula nigra*)	FACW	500	9.20%	500	4.80%	1500	19.70%	2500
Hackberry (*Celtis occidentalis*)	FACW	300	5.50%	500	4.80%	400	5.30%	1200
American elm (*Ulmus americana*)	FACW	300	5.50%	500	4.80%	800	10.50%	1600
Tulip poplar (*Liriodendron tulipifera*)	FAC	300	5.50%	500	4.80%	800	10.50%	1600
Sycamore (*Platanus occidentalis*)	FACW	300	5.50%	500	4.80%	800	10.50%	1600
Swamp chestnut oak (*Quercus Michauxii*)	FACW	300	5.50%	500	4.80%	0	0.00%	800
Water oak (*Quercus nigra*)	FAC	500	9.20%	300	2.90%	400	5.30%	1200
Laurel oak (*Quercus larifolia*)	FACW	300	5.50%	500	4.80%	0	0.00%	800
Cherrybark oak (*Quercus pagoda*)	FAC	200	3.70%	0	0.00%	400	5.30%	600
Willow oak (*Quercus phellos*)	FACW	300	5.50%	500	4.80%	0	0.00%	800
Shumard oak (*Quercus shumardii*)	FACW	300	5.50%	500	4.80%	0	0.00%	800
Shagbark hickory (*Carya ovata*)	FACU	300	5.50%	0	0.00%	0	0.00%	300
Bitternut hickory (*Carya cordiformis*)	FAC	300	5.50%	200	1.90%	300	3.90%	800
	TOTAL	5450		10500		7600		23550

* Planted at a density of 680 stems/acre.

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



LEGEND
- Easement Boundary = ~27.7 ac
- Stream-side Assemblage
- Coastal Plain Small Stream Swamp
- Coastal Plain Bottomland Hardwood Forest

N

GRAPHIC SCALE
0 100 200 400
1 inch = 200 ft.

TOTAL DISTURBED AREA = 30.9 AC.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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CRANE MITIGATION SITE

CONSTRUCTION DRAWINGS

LEE COUNTY, NORTH CAROLINA

RS RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	L1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	1"=200'
DATE	07.30.2021

PLANTING PLAN

L5.00

TEMPORARY SEEDING SCHEDULE:

TEMPORARY SEEDING SHALL BE APPLIED AS NEEDED DURING CONSTRUCTION TO STABILIZE BARE OR DISTURBED AREAS OF SOIL AND AT THE COMPLETION OR ALL GRADING AND EARTHWORK ACTIVITIES WITHIN A PARTICULAR AREA OF THE SITE. PERMANENT SEED MAY BE DISTRIBUTED WITH TEMPORARY SEED UPON THE FINAL APPLICATION OF TEMPORARY SEED.

SEEDING METHODS

1. EVENLY APPLY SEED USING A CYCLONE SEEDER, DRILL, CULTIPACKER SEEDER, OR HYDROSEEDER. THIS MUST BE DONE WITHIN 48 HOURS OF LAND DISTURBING ACTIVITIES.
2. MULCH WITH CLEAN WHEAT STRAW.
3. AFTER SEEDING, APPLY MULCH TO AREAS UNDER HARSH CONDITIONS SUCH AS AREAS THAT HAVE BEEN GRADED, OR THOSE WHICH WILL RECEIVE CONCENTRATED FLOWS. AREAS CONSIDERED TO BE UNDER HARSH CONDITIONS WILL BE CONSIDERED THE AREAS GRADED FOR THE WETLAND VALLEY.
4. RESEED AND MULCH AREAS WHERE SEEDLING EMERGENCE IS LESS THAN 80% COVERAGE, OR WHERE EROSION OCCURS, AS SOON AS POSSIBLE. DO NOT MOW. PROTECT FROM TRAFFIC AS MUCH AS POSSIBLE.

NOTES

1. TEMPORARY ANNUAL SEED SELECTION SHOULD BE BASED ON SEASON OF PROJECT INSTALLATION.
2. A SINGLE SPECIES FOR TEMPORARY COVER IS ACCEPTABLE
3. IN SOME CASES WHERE SEASONS OVERLAP, A MIXTURE OF TWO OR MORE SPECIES MAY BE NECESSARY. HOWEVER, APPLICATION RATES SHOULD NOT EXCEED THE TOTAL RECOMMENDED RATE PER ACRE.
4. TEMPORARY SEED SHOULD BE MIXED AND APPLIED SIMULTANEOUSLY WITH THE PERMANENT SEED MIX IF OPTIMAL PLANTING DATES ALLOW.

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
Urochloa ramosa (Brown Top Millet)	15 lbs. per acre	May - September	Near stream channels/banks

PERMANENT SEEDING SCHEDULE:

PLANT MATERIAL SELECTION

1. REFER TO THE TABLES ON THIS SHEET FOR APPROPRATE SELECTION OF NATIVE PERMANENET SEEDS.
2. PERMANENT SEED MIXTURE SHOULD BE APPLIED USING AN APPLICATION RATE AND METHOD RECOMMENDED BY THE NURSERY.

SEEDBED PREPRATION

1. DISTURBED SOILS WITHIN THE RIPARIAN AREAS MUST BE AMMENDED TO PROVIDE AN OPTIMUM ENVORONMENT FR SEE GERMINATION AND SEEDNG GROWTH.
2. THE pH OF THE SOIL MUST BE SUCH THAT IT IS NOT TOXIC AND NUTRIENTS ARE AVAILABLE.
3. SOIL ANALYSIS SHOULD BE PERFORMED TO DETERMINE NUTRIENT AND LIME NEEDS OF EACH SITE.
4. APROPRIATE pH LEVELS ARE BETWEEN 5.5 AND 7.0
5. RIPARIAN BUFFERS REGULATED FOR NUTRIENT MANAGEMENT MAY BE LIMITED TO A SINGLE APPLICATION OF FERTILIZER.
6. SUITABLE MECHANICAL MEANS SUCH AS DISKING, RAKING, AND HARROWING MUST BE EMPLOYED TO LOOSEN COMPACTED SOILS PRIOR TO SEEDING.

PLANTING

1. APPLY SEED UNIFORMLY WITH A CYCLONE SEEDER, DROP-TYPE SPREADER, DRILL, OR HYDROSEEDER ON A FIRM, FRIABLE SEEDBED.
2. IN FINE SOILS, SEEDS SHOULD BE DRILLED 0.25-0.5 INCHES. IN COURSE SAND SOILS, SEEDS SHOULD BE PLANTED NO MORE THAN 0.75 INCHES.

MULCH

1. MULCH ALL PLANTING AREAS IMMEDIATELY AFTER SEEDING.
2. IF PLANTING ON STREAMBANKS STEEPER THAN 10% OR OTHER AREAS SUBJEC TO FLOODING, A BIODEGRADEABLEL ROLLED EROSION CONTROL PRODUCT IS RECOMMENDED TO HOLD SEED AND SOIL IN PLACE.

MAINTENANCE

1. THE RECOMMENEDED PERMANENT GRASS SPECIES MAY REQIRE TWO YEARS FOR ESTABLISHMENT DEPENDIG ON SITE CONDITIONS.
2. INSPECT SEEDED AREAS FOR FAILURE AND MAKE NECESSARY REPAIRS, SOIL AMENDMENTS, AND RE-SEEEDINGS.
3. IF WEEDY EXOTIC SPECIES HAVE TAKEN OVER AREAS AFTER THE FIRST GROING SEASON, THE INVASIVE SPECIES MUST BE ERADICATED TO ALLOW STAIVE SPECIES TO GROW.
4. MONITORING THE SITE UNTIL LONG-TERM STABILITY HAS BEEN ESTABLISHED.

Permanent Seed- Sitewide @ 2 lbs /acre		
Species	**Species**	**Species**
Agrostis hyemalis	*Desmodium canadense*	*Lespedeza capitata*
Agrostis perennans	*Echinacea purpurea*	*Liatris spicata*
Bidens aristosa	*Elymus virginicus*	*Monarda fistulosa*
Carex albolutescens	*Eupatorium coelestinum*	*Panicum anceps*
Carex lupulina	*Eupatorium perfoliatum*	*Panicum clandestinum*
Carex vulpinoidea	*Helianthus angustifolius*	*Rudbeckia hirta*
Chamaecrista fasciculata	*Heliopsis helianthoides*	*Senna hebecarpa*
Chamaecrista nictitans	*Hibiscus moscheutos*	*Tridens flavus*
Coreopsis lanceolata	*Juncus effusus*	*Verbena hastata*
Coreopsis tinctoria	*Juncus tenuis*	--

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.28.22

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CRANE MITIGATION SITE
CONSTRUCTION DRAWINGS
LEE COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

PLAN INFORMATION

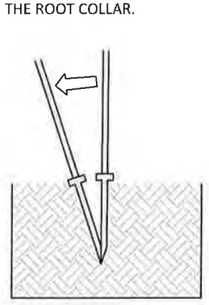
PROJECT NO.	2021110220
FILENAME	L1
CHECKED BY	RAS
DRAWN BY	RHW
SCALE	NTS
DATE	07.30.2021

PLANTING AND SEEDING TABLES

L5.01

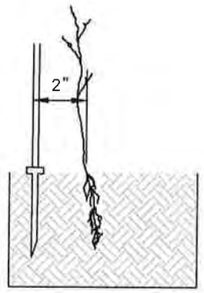
NOTES:

1. AREAS NOTED AS BARE ROOT PLANTINGS WITHIN THE PLANTING ZONE SHALL BE PLANTED WITH SPECIES LISTED ON SHEET L5.00.
2. DURING PLANTING, SEEDLINGS SHALL BE KEPT IN A MOIST CANVAS BAG OR SIMILAR CONTAINER TO PREVENT ROOT SYSTEMS FROM DRYING.
3. PLANTING BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS SECTION, AND SHALL BE 12 INCHES LONG, 4 INCHES WIDE AND 1 INCH THICK AT CENTER.
4. ALL SEEDLINGS SHALL BE ROOT PRUNED, IF NECESSARY, SO THAT NO ROOTS EXTEND MORE THAN 10 INCHES BELOW THE ROOT COLLAR.

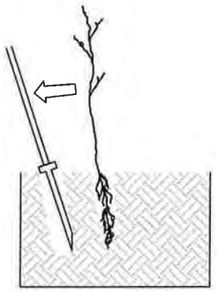


1. INSERT PLANTING BAR 12" INTO THE GROUND AS SHOWN AND PULL HANDLE TOWARD PLANTER.

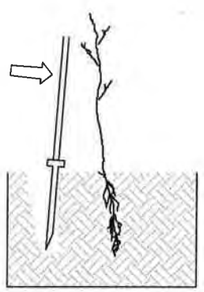
2. REMOVE PLANTING BAR AND PLACE SEEDING AT CORRECT DEPTH.



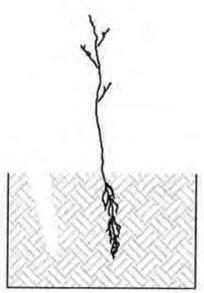
3. INSERT PLANTING BAR 2 INCHES TOWARD PLANTER FROM SEEDING.



4. PULL HANDLE OF BAR TOWARD PLANTER, FIRMING SOIL AT BOTTOM.



5. PUSH HANDLE FORWARD FIRMING SOIL AT TOP



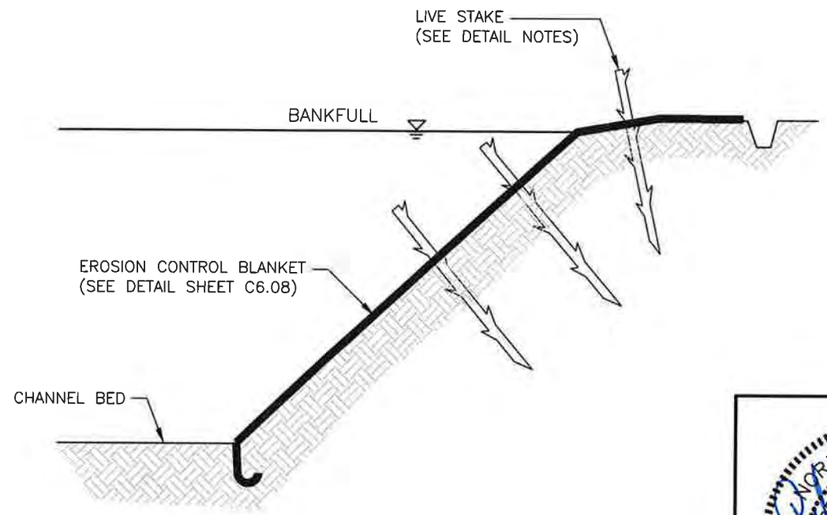
6. LEAVE COMPACTION HOLE OPEN WATER THOROUGHLY.

BARE ROOT PLANTING DETAIL

N.T.S.

NOTES:

1. AREAS NOTED AS LIVE STAKES WITHIN THE PLANTING ZONE SHALL BE PLANTED WITH SPECIES LISTED ON SHEET L5.00.
2. ONE LIVE STAKE SPECIES PER LIVE STAKE AREA. ALTERNATE SPECIES PER LIVE STAKE AREA.
3. ALL LIVE STAKES SHALL BE DORMANT AT TIME OF ACQUISITION AND PLANTING.
4. LIVE STAKES SHALL BE 1/2-2" IN DIAMETER. LIVE STAKES SHALL ALSO BE 2 - 4 FEET IN LENGTH.
5. DURING PREPARATION, THE BASAL ENDS OF THE LIVE STAKES SHALL BE CLEANLY CUT AT AN ANGLE TO FACILITATE EASY INSERTION INTO THE SOIL, WHILE THE TOPS SHALL BE CUT SQUARE OR BLUNT FOR TAMPING. ALL LIMBS SHALL BE REMOVED FROM THE SIDES OF THE LIVE CUTTING PRIOR TO INSTALLATION.
6. CUTTINGS FOR LIVE STAKES SHALL BE HARVESTED IN A MANNER SUCH THAT THEY ARE CUT, IMMEDIATELY PUT INTO WATER TO BE SOAKED FOR 10 DAYS, AND THEN PLANTED IMMEDIATELY AFTER THE 10 DAYS ARE COMPLETED. CUTTINGS SHALL REMAIN WET UNTIL THEY ARE PLANTED. OUTSIDE STORAGE LOCATIONS SHOULD BE CONTINUALLY SHADED AND PROTECTED FROM WIND AND DIRECT SUNLIGHT.
7. LIVE STAKES SHALL BE TAMPED AT AN ANGLE INTO THE GROUND SURFACE WITH A DEAD BLOW HAMMER, WITH BUDS ORIENTED IN AN UPWARD DIRECTION. STAKES SHOULD BE TAMPED UNTIL APPROXIMATELY 3/4 OF THE STAKE LENGTH IS WITHIN THE GROUND. ANY STAKES THAT ARE SPLIT OR DAMAGED DURING INSTALLATION SHALL BE REMOVED AND REPLACED.
8. THE AREA AROUND EACH LIVE STAKE SHALL BE COMPACTED BY FOOT AFTER THE LIVE STAKE HAS BEEN INSTALLED.
9. ONE TO TWO INCHES SHALL BE CUT CLEANLY OFF OF THE TOP OF EACH LIVE STAKE (WITH LOPPERS) AT AN ANGLE OF APPROXIMATELY 15 DEGREES FOLLOWING INSTALLATION.



LIVE STAKE DETAIL

N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 1.20.22

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PLAN INFORMATION

PROJECT NO.	2021110220
FILENAME	L1
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DRAWN BY	RHW
SCALE	NTS
DATE	07.30.2021

PLANTING DETAILS

L5.02