M E M O R A N D U M

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TO: **NCDMS**

FROM: **Matt Butler – RES**
Brad Breslow – RES

DATE: **March 25, 2021**

RE: **Response to DMS Comments on the Final Draft Mitigation Plan Cowford, Project ID #10095, DMS Contract #0007746**

Reviewers: Kim Browning, Travis Wilson, Maria Dunn, Todd Bowers, and Erin Davis,

USACE Comments, Kim Browning:

1. Figure 9, Buffer Width Zones: Without being able to review the actual data spreadsheet, it's difficult to determine whether terminal ends were accounted for. In the table provided on Figure 9 it appears you used the old version of the buffer tool. The new version (attached) allows terminal ends where the project exits the property to be exempt from counting against you. In this situation, the terminal end that ends at Kinston Highway would be exempt from the buffer rule. Additionally, the terminal end of KJ1-B that connects with the headwater valley would be exempt from being counted against you, but the terminal end, as drawn, should not extend into the headwater area. Lastly, the total stream length should not be entered into the spreadsheet that includes the headwater length, as this is a detriment to you. Please re-run the buffer tool to account for the crossing terminal end, clip the headwater from the actual buffer, and correct the length entered in the spreadsheet. I'm happy to meet with you if you need additional explanation.
    i. RES has used the new NSBW spreadsheet to update the crediting values. The headwater valley length was kept out of the creditable area as instructed.
2. Please adjust Table 14 and any asset tables.
    i. Table 14 and other associated tables have been updated with the new NSBW values. The NSBW Adjustment value has decreased from 258.443 to 201.670. This also changes the Total Adjusted SMU's from 3,595.443 to 3,538.67.

3. Figure 10: Please also include fixed image locations at the culvert at the terminal end of the project under Kinston Highway, and at the crossing. Channel formation is a concern on this site so please supplement gauge data with photo documentation.
    a. Figure 10 now includes reference to fixed image locations at the crossing and terminal end under Kinston Highway. Section 9.2 the Monitoring Plan also references these new fixed image locations.

3. Section 5 and Table 8 discuss the functional uplift potential and references the functional pyramid, including the physiochemical and biological uplift. These are benefits that are presumed and will not be measured by the monitoring. The footnote indicates that these will be measured indirectly. Regarding Table 8, the "measurement method" for biology is listed at an As-built survey, which is not a measure of biological uplift. Please modify these sections.
    a. Table 8 has been updated to remove any discussion of monitoring measurements for both Physicochemical and Biology.

4. Wetland reestablishment—In addition to adding wood to the channel it would be beneficial to add some coarse woody debris to the depressional areas and throughout the wetland for habitat, and to help store sediment, increase water storage/infiltration, and absorb water energy during overbank events.
    a. RES will need to haul in most of the woody debris used on this project from offsite sources. Should we have woody material left over after all proposed stream structures are installed, we will add it to the wetland.

5. It would have been beneficial to have additional buffers placed around the wetlands especially since immediately adjacent land uses may affect the function and sustainability of the site. Farming practices often result in equipment encroaching along the easement boundary. The effects of ditching immediately adjoining wetland projects is also a major concern if the farm fields become too inundated to farm.
    a. RES spoke with the landowner about expanding the size of the easement. Because of farming practices and loss of farmable area, the landowner declined this request. RES understands the concern with encroachment and will be installing signs at an increased frequency along the easement boundary to protect against any potential issues. RES does not anticipate the farm fields becoming too inundated but will work with the landowner to provide adaptive management that will not affect the wetland area.

6. The design sheets show field tile outlets in the project stream. We do not encourage any type of outlets through buffers, even if it's non-perforated, and into project streams. There will eventually need to be maintenance done of the tile which could disturb the buffer and channel. Please confirm that these tiles will be redirected and outlet outside the conservation easement.
    a. The outlets are now proposed totally outside of the easement. Swales will convey the flow into the easement to the stream.

7. The swales entering the conservation easement appear to be about 2' deep, there is concern that these may have a draining effect on the wetland.
    a. Yes, there is concern but hydrologic trespass constraints require the swales be at the proposed design depth. RES will monitor wetland hydrology in the creditable area.

8. Page 25: Please explain further how much of the wetland area is anticipated to be open water/marsh pockets. If it's a significant area you may want to consider planting herbaceous species and proposing a performance standard of a diversity of at least 4 species and over 75% cover.
    a. RES expects the trees in the wetland to grow and be overall trending towards a forested wetland. It is expected that depressions will form but not affect the wetland in the long run.

9. Table 13: Please add wetland indicator status to this table.
    a. Wetland indicator status has been added to Table 13 for each planted species.

10. Section 8.1.2: The 30 consecutive days of flow must be demonstrated annually. 30 days consecutive flow should be a minimum, not a goal.
    a. RES understands that 30 consecutive days of flow is not a goal. Wording has been added to this section to indicate this as a minimum.

11. Section 8.1.4: Longitudinal images SHOULD indicate the absence of developing bars within the channel…
    a. Sentence has been fixed to say images "should" indicate the absence.

12. Section 8.2.1: There is conflicting information for hydroperiods in this section. Please correct. Given that Muckalee soils are very wet, please use a hydroperiod of 16%. Please update Table 15 as well.
    a. The guidance indicates 12-16% and therefore the hydroperiod has been updated to 12-16% and the days required has been updated to align with this range.

13. Page 19: Regarding the reference site being located in a different watershed, especially since this project is located in the outer coastal plain, please confirm that the reference site and the Cowford site have similar topography, soils, drainage area, and ecoregion. Reference sites should have similar landscape position.
    a. RES chose the UT to Buffalo Creek reference site for this project to better fit the topography of Reach KJ1-C, which exhibits slopes more akin to the upper coastal plain. The reference reach drainage area is larger than project reaches, however, RES is confident that scaling channel dimensions to fit different drainage area sizes is a useful design technique when combined with the other techniques outlined in the mitigation plan.

14. Section 8.3: Any volunteer species on the approved planting list must be established for at least 2 years to count towards success and will be subject to the average height standard.
    a. Section 8.3 has been updated to clarify that volunteer species on the approved planting list. will be counted only after they have been present for two or more years of monitoring.

15. Section 4.3: Additional projects risks and constraints to discuss include beaver, replacement of the road culvert on Kinston Highway, adjacent ditching or drainage tile, etc.
    a. Additional risks and constraints have been added and discussed in Section 9.2.

16. Appendix D Credit Release Schedule: The IRT will review the Record Drawing/As-Built reports according to the 2008 Mitigation Rule's streamlined review process prior to approving the initial credit release. Please alter the statement regarding credits being released by DMS without prior written approval of the DE.
    a. RES understands that credits will not be released until Record Drawing/As-Built reports are reviewed. Appendix D has been edited to alter the sentence about releasing of credits without prior written approval of the DE.

17. Hay bales for toe protection seem a little risky if the system does not stay inundated. I understand that RES has successfully used this design in other states on low gradient systems with heavy live-staking; however, with this being an intermittent channel there is concern that it will not stay inundated. I am open to the use of new/different techniques and ultimately it is up to RES to demonstrate success and stability.
    a. Haybale toes are proposed in areas of low stream power and are intended more as a source of habitat and organic material and less as a bank protection. Therefore, there is limited risk to the system from these structures. RES understands that appropriate repairs will be required should an issue arise during monitoring.

WRC Comments, Travis Wilson & Maria Dunn:

1. The culvert crossing to be installed should be designed so the low flow barrel size closely matches the width of the baseflow channel in order for the structure to neither over widen nor constrict the channel flow. The secondary pipe elevation should be set at the established bankfull elevation. (This may already be the case, however it is not evident in the typical culvert crossing detail.)
    a. The culvert has been revised to a 66" x 51" corrugated metal arch pipe to better match the channel dimensions and promote bed material accumulation in the bottom of the culvert.

2. This is a relatively small watershed and hopefully can restore function as presented and desired; sometimes these features in agriculture fields are difficult to get to perform as desired and stay maintained.
    b. Quickly reaching the maximum potential functional uplift on a mitigation site is always a challenge. However, RES is confident that we have taken the appropriate steps to ensure we provide the maximum functional uplift possible for this site.

3. It was difficult to locate specific detail on how much of the former CRP easement vegetation will remain. Understanding there will be construction activity in the area, but trying to have a few of those old, more established trees would have a benefit.
    a. RES understands the concern for loss of more established trees through construction. During construction, RES will minimize mature trees that are cut down.

EPA Comments, Todd Bowers:

1. Section 5.1.3/Page 15: Recommend caution when using wood grade control or other instream structures in an intermittent stream/HWV such as KJ1-A.
    a. The proposed "grade control" structures in KJ1-A are meant to provide habitat more than grade control since the need for grade control is significantly reduced by the limited slope of this reach.

2. Section 7.2.1.2/Page 20: Denote that KJ1-B is undergoing P1 restoration and that the existing channel will be filled and/or graded to provide wetland habitat.
    a. Comment Incorporated

3. Section 7.4.1/Page 25: Recommend revising this date to NLT April 15 in order to allow for some buffer time to complete monitoring before November 1 and that the provider will seek IRT concurrence or approval to plant outside of the dormant season. Also, I recommend that the provider seek IRT approval to plant alternate species if any of the primary species of the Proposed Plant List per Table 13 are not available at the time of planting.
    a. Project will plan to be planted no later than April 15 to give more buffer time for completion of monitoring before November 1. RES will seek IRT approval if needed to plant outside of the dormant season. RES will also seek IRT approval if any of the primary species of the Proposed Plant List are not available at the time of planting.

4. Table 13/Page 26: Recommend adding Wetland Indicator Status for bare root planting tree species.
    a. Table 13 now includes Wetland Indicator Status for all trees.

5. Table 14/Page 29: Approach Priority Level for KJ1-A should be HWV and not P1 Restoration.
    a. Comment Incorporated

6. Section 9.5/Page 34: Recommend adding an additional gauge in an adjacent upland area to verify and document the wetland boundary.
    a. A sentence was added to say that RES would add an additional gauge in the adjacent upland area for verification of the wetland boundary. This new gauge will also be marked on Figure 10.

7. Table 15/Page 36: Recommend adding the number of consecutive days needed to meet the 9-12 percent of the growing season success criteria (approximately 29 days?). Two different criteria for wetland water table performance standards are listed here (9-12% and 12%).
    a. Table 15 has been corrected to have the same criteria for wetland water table performance standards of 12-16%. The number of consecutive days has also been added.

8. Recommend including a random mobile plot to the wetland areas each monitoring year in lieu of using all fixed plots.
    a. One fixed plot has been changed to become a random plot in the wetland. This has been updated in both the Monitoring Figure **(Figure 10**) and **Section 9.6 Vegetation Monitoring**.

9. Recommend that the Conservation Easement is extended around the wetlands to include a 50-foot upland buffer to ensure drainage effects from the adjacent fields is minimized.
    a. Due to landowner constraints RES was able to provide 10 to 40 feet of buffer around the wetland but was not able to ensure a 50-foot upland buffer around the entirety of the wetland.

DWR Comments, Erin Davis:

DWR Comments for the Cowford Draft Mitigation Plan – December 21, 2020

1. Page 8, Section 3.2.4 – Please expand on the future land use discussion to include potential adjacent area and watershed land use changes.
    a. A discussion of the Onslow County future land use plans is now discussed in Section 3.2.4. RES finds no large changes that would affect the success of this project.

2. Page 13, Section 4.3 – a. During the IRT site walk, the IRT recommended relocating the existing crossing to the upstream end of the project. Please provide a justification for keeping the easement break in the middle of the project. Also, why does the easement break need to be over 60 feet wide?
        i. Landowner needed crossing at current location for future land use. He has also requested a 60 foot break to allow for farm equipment and large truck transit for farming practices
    a. Please confirm that the proposed project easement does not overlap the utility and roadway easements, and that no known DOT work is planned for the downstream road/culvert.
        ii. The easement does not overlap the utility easement and no work is proposed for the downstream crossing in the State Transportation Improvement Plan.
    b. Not sure if it's a constraint or risks/uncertainties discussion, but have you evaluated the risk of hydrologic trespass that could result in ditching outside the proposed project easement?
        iii. RES has designed the project to minimize the risk of hydrologic trespass to the maximum extent practicable.

3. Page 20, Section 7.2.1.1 – a. Is any work proposed for the three ditches connect at the top of the project? Watershed size and slope in this area were major concerns noted during the IRT site walk.
    i. No work is proposed on these ditches as they are at least partially owned by offsite landowners.

    b. Please confirm if the wood structures will be installed in a pilot channel.
        i. Brush bed sills are proposed in the bottom of the HWV cross section.

4. Page 20, Section 7.2.1.2 – Should filling the existing channel and grading the existing ditch to a swale be included as restoration activities?
    a. Comment Incorporated

5. Page 20, Section 7.2.1.3 – During the IRT site walk, there was a discussion of a P1 approach below the wetland. Even with the additional buffer width, a P2 approach is being proposed? Considering this reach composes 47% of the project steam length, please discuss why a P1 is not feasible and the limitations of potential functional uplift associated with a P2 approach.
    a. A fully P1 approach is not feasible for Reach KJ1-C because the reach must tie to the elevation of the NCDOT culvert at the downstream end of the project. Please note that this is not a typical P2 approach since the channel bed is being raised significantly through this reach even though it requires that a new floodplain be graded in.

6. Page 21, Section 7.2.1.6 – Is there a concern with long term channel stability in using log structures for grade control on this intermittent stream?
    a. Several rock sills have been added to KJ1-C to promote long term stability. The slope of KJ1-A and B is flat enough that grade control concerns are limited.

7. Page 21. Section 7.2.1.7 – Has the amount of available onsite woody material for proposed stream stabilization and habitat structures been evaluated? If necessary, will offsite woody material be sourced to complete construction of all of the structures shown on the design sheets?
    a. There is not enough woody debris located on site to complete the project as designed and woody debris will therefore be hauled to the site.

8. Page 24, Section 7.2.3 – What is the possible drainage effect from Swale A on the proposed wetland restoration? Based on the design profile, Swale A appears to be approximately 2 feet deep.
    a. Swale A is required to be at the design depth to prevent hydrologic trespass and will have a draining effect on the proposed wetland. RES anticipates that raising the channel offsets this effect and a wetland will be established. Monitoring wells are proposed to ensure that wetland criteria are met.

9. Page 26, Table 13 –

    a. It would be helpful to have the wetland indicator status included. Also, DWR recommends adding a few alternate/substitution species.
        i. Table 13 now includes wetland indicator status for all trees. RES feels that the planting list has enough species that if a species is not available, we will alter percentages instead of adding a new species to the planting list.

b. The narrative notes planting zones at multiple points. DWR supports this level of detail and would like to see the table reflect the breakdown of species by planting zone. Given that multiple habitat types are expected onsite, were the inclusion of more shrub or midstory species considered, or additional live stake species for the headwater valley, treatment swale and pool plantings?
    i. Any mention of planting zones has been removed to make sure it is clear thatthere is only one plating zone and one target community. The planting plan was oriented in a way that would be tolerant of wetland areas. Buttonbush will be increased to 15% and added as a livestake to help increase the sub-canopy community.

10. Page 30, Section 8.1.2 (and Table 15) – Please clarify that surface flow is an annual performance standard.
    a. Section 8.1.2 now clarifies that surface flow is an annual performance standard. Table 15 also indicates this performance standard.

11. Page 30, Section 8.1.5 – Please rephrase the first sentence, the surface water flow performance standard applies to headwater valley approaches.
    a. The first sentence has been rephrased to say that while the performance standards still apply, RES wanted to use the headwater valley restoration success criteria to be more specific for the headwater morphology.

12. Page 31, Section 8.2.1 – This section notes multiple hydroperiods, which is a bit confusing. Table 15 lists 12%. DWR supports a minimum 16% wetland hydroperiod performance standard threshold.
    a. Table 15 was updated to a hydroperiod of 12-16% of the growing season. Section 8.2.1 has also been modified for this new hydroperiod.

13. Page 34, Section 9.3.1 – Due to flow concerns, DWR may request an additional gauge or supplemental documentation (e.g. video, photos) during monitoring to demonstrate that the performance standards are being met.
    a. RES understands that an additional gauge or documentation will be requested to demonstrate that performance standards are being met through monitoring.

14. Page 34, Section 9.6 – If open water and marsh cover could potentially constituent more than 20 percent of the wetland credit area, DWR recommends including an alternate herbaceous species diversity success criteria and monitoring plan.
    a. RES does not expect open water or marsh cover to exceed 20 percent of wetland credit area. There is an expectation of minimal topographical depressions to form but the wetland credit area is expected to be a forest. If open water or marsh cover does start to form excessively, RES will institute an adaptive management plan to fix the issue.

15. Page 35, Section 9.7 – In the baseline report, please make sure to include redline drawings and soil profiles at installed wetland well locations.
    a. RES will be sure to add any redline drawings and soil profiles from well locations on site. Section 9.7 now mentions these additions to the baseline report.

16. Page 36, Table 15 – Please confirm whether fencing is proposed.
    a. Table 15 has been updated to remove any discussion of fencing.

17. Page 38, Section 11 – DWR recommends higher sign posts or PVC extensions be considered along the easement boundaries that abut row crop if corn will continue to be in rotation.
    a. RES will use 10” white PVC poles to help delineate the boundary of the easement versus agriculture land.

18. Appendix F – Since a culverted crossing is proposed, it should be monitored for any issues during the monitoring/maintenance period.
    a. RES will monitor the culverted crossing during monitoring events to find any issues if they arise. Per the USACE comment #2, language has been added to Section 9.2 Visual Monitoring to specifically state the culvert crossings will be monitored and that digital images of the crossing will be taken annually.

19. Sheet E2 – Please call out the drain tile lines.
    a. Comment Incorporated

20. Sheet W1 – DWR appreciates the attempt to provide a buffer along the proposed wetland restoration area. What is the minimum buffer width shown? Figure 12 shows the 10YR inundation area along the northern CE boundary. Was additional buffer in this area discussed with the landowner?
    a. Addition buffer was discussed but not agreed upon.RES has designed the proposed crossing so that it overtops at approximately the same elevation as the CE Boundary in this area to reduce risk of sustained flooding outside the easement.

21. Sheet D3 – Tile Drain Outlet – DWR does not support outlet structures within the CE. DWR understands the site specific concerns of hydrologic trespass and is ok with the proposed outlet design and up to 7 proposed locations, if the structures can be shifted outside the CE so that the vegetated swales start at the CE boundary. This would eliminate the need for the landowner to request access from Stewardship if structure repairs/maintenance are needed. And it would avoid direct discharges within the CE. DWR requests that each swale be inspected during the project's monitoring/maintenance period for signs of instability and noted in the annual reports.
    a. Outlets have been shifted outside of the CE

22. Sheet D3 – Hay Bale Toe – Please provide more information about this technique (including photos over time) and situations/places it has been successfully implemented. Also, please provide adaptive management strategies for dealing with potential bank instability issues in these proposed treatment areas for this site. What are the benefits of this treatment compared to brush toe? Was onsite brush toe material availability a consideration for its use along the entire KJ1-B reach?
    a. Haybale toes are proposed in areas of low stream power and are intended more as a source of habitat and organic material and less as a bank protection. Therefore, there is limited risk to the system from these structures. RES understands that appropriate repairs will be required should an issue arise during monitoring. These repairs could include but are not limited to bank grading, brush mattress or brush toe installation.

Final Mitigation Plan
Cowford Project

DMS Project #: 100095 | Contract #: 7746 | USACE Action ID: SAW- 2019-00487
DWR Project #: 2019-0495 | RFP: 16-007577

March 2021

White Oak River Basin | HUC 03030001 | Onslow County, North Carolina

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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.

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1 PROJECT INTRODUCTION

1.1 Project Components

The Cowford Project (Project) is located within a rural watershed in Onslow County, North Carolina approximately three and half miles northwest of Richlands, NC. The Project lies within the White Oak River Basin, North Carolina United States Geological Survey (USGS) 8-digit Cataloguing Unit 03030001 and 14-digit hydrologic unit code (HUC) 03030001010010, a Targeted Local Watershed (TLW) and the Division of Water Resources (NCDWR) sub-basin 03-05-02 (**Figure 1**). The Project proposes to restore 3,337 linear feet (LF) of stream as well as re-establish 2.991 acres of wetland that will provide water quality benefit for 238 acres of drainage area **(Figure 2)**. The Project is in the Carolina Flatwoods Level IV ecoregion.

The Project area is comprised of a 17.20-acre easement involving one unnamed tributary within an entrenched channel between agricultural fields, totaling 2,988 existing LF, that drain to Cowford Branch, which eventually drains to the New River. The stream and wetland mitigation components are summarized in **Table 1**. The Project is accessible from state route NC-258. Coordinates for the Project areas are approximately 34.9233, -77.5917, at the crossing in the middle of the project.

1.2 Project Outcomes

The streams and wetlands proposed for restoration have been significantly impacted by ditching, drain tiling, and other agricultural practices for over 50 years. The stream is currently allowing sediment, nutrients, pesticides, and herbicides to flow freely into Cowford Branch and the New River. Both water bodies are classified as Class C and Nutrient Sensitive Waters. The proposed wetland restoration area will raise the local groundwater and restore a more natural hydrologic cycle to the riparian zone. Successful construction and restoration of this tributary and headwater wetland system will provide numerous benefits to water quality. Proposed improvements to the Project will help address impacts specifically discussed as priorities in in the 2010 White Oak River Basin Restoration Priorities (RBRP).

Through stream restoration, headwater valley (HWV) restoration, and wetland restoration, the Project presents 3,347 LF of proposed stream, generating 3,538.67 Warm Stream Mitigation Units (SMU) and 2.991 acres of proposed wetland, generating 2.991 Wetland Mitigation Units (WMU) (**Table 1**). This mitigation plan is consistent with the June 6, 2019 Post Contract IRT Meeting Minutes and IRT response emails (**Appendix B**).

Table 1. Cowford Project Components Summary

Stream Mitigation			
Mitigation Approach	**Linear Feet**	**Ratio**	**Warm SMU**
Restoration (HWV)	923	1:1	913.000*
Restoration	2,424	1:1	2,424.000
Total	**3,347**		**3,337.000**
	Non-standard Buffer Width Adjustment		**201.670****
	Total Adjusted SMUs		**3,538.67**

**Headwater valley credits are calculated from valley length, not included in NSBW calculations.*
*** Credit adjustment for Non-standard Buffer Width calculation using the Wilmington District Stream Buffer Credit Calculator issued by the USACE in January 2021. See Section 6.6 for further information*

Wetland Mitigation			
Mitigation Approach	**Area (acres)**	**Ratio**	**WMU**
Re-establishment	2.991	1:1	2.991
Total	**2.991**		**2.991**

2 WATERSHED APPROACH

The Project was selected based on its potential to support the objectives and goals of the DMS 2010 White Oak RBRP. The White Oak RBRP identified several restoration needs for the entire White Oak River Basin, as well as for HUC 03030001, specifically. The Project watershed was identified as a TLW (03030001010010, New River), a watershed that exhibits both the need and opportunity for stream, wetland, and riparian buffer restoration. Approximately 44% of this project's river basin is agricultural land. Basin wide goals for all Catalog Units (CUs) outlined in the 2010 White Oak RBRP and CU Specific Goals for the Upper New River Targeted Local Watershed include:

<u>*Basin wide goals for all CUs*</u>

1. *Protect and improve water quality throughout the Basin by reducing sediment and nutrient inputs into streams and river*
2. *Protect shellfish harvesting waters and reduce the number & frequency of Division of Environmental Health (DEH) closures of designated shellfish growing areas*
3. *Support efforts to restore local watersheds in the White Oak River Basin; and*
4. *Support implementation plans (NC Coastal Habitat Protection Plan (Street et al, 2005) and its associated implementation plans (NC Division of Marine Fisheries, 2007; NCDMF, 2009).*

<u>*Upper New River: 03030001010010 Specific Goals*</u>

1. *Planting riparian buffer zones with appropriate woody species.*
2. *Best management practices that offset the impacts of agriculture are also a high priority here.*
3. *Preservation should be considered where high-quality habitat exists and riparian corridors can be maintained.*

The Project directly supports many of these listed goals through the restoration and protection of aquatic resources and presents an opportunity to grow the already protected catchment in the Upper New River watershed from earlier DMS efforts in the White Oak River Basin. The lack of riparian buffer, historic stream manipulation, ditching in the watershed and agricultural practices are significant contributing factors to water quality impairment and habitat degradation in this watershed, and the Project will help address these identified stressors at a localized level, as described in Section 2.1.

2.1 Site Selection

Currently, the majority of the Project area is within agricultural fields, having row crops of a corn/soybean rotation. The lower portion of the stream has more incised banks with more of a riparian buffer in place. The Project will directly and indirectly address stressors identified in the RBRP by reconstructing natural channels within the agricultural field, stabilizing eroding stream banks and establishing floodplain connectivity, reducing sediment and nutrient loads, and restoring forested wetlands and buffers. Project-specific goals and objectives will be addressed further in **Section 5**. Watershed planning priority boundaries are shown on **Figure 1**, and the Project's drainage areas are shown on **Figure 2**.

The Project will address several goals outlined in the 2010 White Oak RBRP, one of the goals for all CUs and two goals from the Upper New River TLW. The Project includes restoration of streams, wetlands, and their associated buffers that will promote nutrient and sediment reduction in agricultural areas (RBRP Basinwide Goal 1). The project also will plant riparian buffer zones with appropriate woody species (RBRP TLW specific Goal 1) and the stream and wetland restoration and riparian buffer establishment to provide a natural buffer between the agricultural fields and the waterways is a best management practice that helps offset the impacts of agriculture (RBRP TLW specific Goal 2).

The land required for the construction, management, and stewardship of this Project includes portions of one parcel in Onslow County with the following ownership in **Table 2** & **Figure 3**. Once finalized, a copy of the land protection instrument will be included in **Appendix C**. The Division of Mitigation Services (DMS) Conservation Easement model template will be utilized to draft the site protection instruments.

Table 2. Project Parcel and Landowner Information

Owner of Record	PIN Or Tax Parcel ID#	Stream Reach
Kenneth W Jones	44220-129-3936 (Onslow County)	All

3 BASELINE AND EXISTING CONDITIONS

3.1 Watershed Summary Information

3.1.1 Drainage Area and Land Cover

The Project area is comprised of one unnamed tributary that flows east to west and drains into Cowford Branch just downstream of a road crossing. The total drainage area for the Project is 238 acres (0.37 mi^2) (**Figure 2**). The surrounding land use is agricultural and undeveloped land with scattered single-family homes. Drain tiles have been constructed to drain the surrounding slopes below the gently sloping to nearly level landscape along the edge of the interstream divide. Primary land use within the Project drainage area consists of approximately 75% Row Crop, 21% Woods, 3.3% Residential, and 0.06% Impervious Surface (**Figure 4**).

Table 3. Project Watershed Summary Information

Watershed Feature	Designation
Level IV Ecoregion	Carolina Flatwoods
River Basin	White Oak
USGS Hydrologic Unit 8-digit	03030001
USGS Hydrologic Unit 14-digit	03030001010010
DWR Sub-basin	03-05-02
Project Drainage Area (acres)	238
Percent Impervious Surface	0.06%
Surface Water Classification (drains to)	C and NSW

3.2 Landscape Characteristics

3.2.1 Physiography and Topography

The Project is located in the Carolina Flatwoods level IV ecoregion within the Middle Atlantic Coastal Plain level III ecoregion. This region is characterized by low-relief, wide upland surfaces on lightly dissected marine terraces. Large areas of poorly drained soils are common, contributing to swamps, Carolina bays, and low gradient streams with sandy and silty substrates. Artificial drainage for forestry and agriculture is common in this region, and the Project floodplain is no different. (Griffeth et al., 2002; **Appendix M**) An extensive ditch and drain-tile network rapidly removes surface water from the floodplain and lowers what would naturally be a high groundwater table. The Project exists in a transitional area between a broad interstream divide and the lower valley of Cowford Branch. The upper half of the project begins the transition from a nearly level mineral flat to a headwater stream in a gradual sloping manner. Just after the easement break, the valley becomes more defined and steepens to join with that of Cowford Branch (**Figure 2**). Elevations range from 43 ft to 71 ft above mean sea level (NAD83), based on topographic survey.

3.2.2 Geology and Soils

According to geology data from the North Carolina Geologic Survey, published in 1985, the Project is within geologic map unit Tec, occurring in the Coastal Plain Belt. This map unit is associated with sedimentary type rocks of the Comfort Member and New Hanover Member formation that formed during the Tertiary period within the Cenozoic era between 2 and 63 million years ago. This undivided formation may contain skeletal limestone commonly with locally-dolomitized solution cavities or phosphate-pebble conglomerates. The Project floodplain soil appears to have been formed in minor erosional deposition from the surrounding upland soils and is primarily characterized as sand, sandy clay, and loam. All soils on-site are formed in loamy and sandy marine deposits and the alluvium from those deposits. (**Appendix M**).

The Natural Resources Conservation Service (NRCS) depicts five mapping units across the Project (**Figure 5**). The Project area is dominated by Norfolk loamy fine sand (58%), with progressively smaller proportions of Stallings loamy fine sand (24%), Rains fine sandy loam (11%), Goldsboro fine sandy loam (4%), and Onslow loamy fine sand (3%). The soil characteristics of these map units are summarized in **Table 4**.

Rains fine sandy loam is the only soil unit on-site to be considered hydric by the NRCS. However, Norfolk loamy fine sand may contain hydric inclusions of Woodington or Mucklee; Stallings loamy fine sand may contain hydric inclusions of Woodington or Rains; and Onslow loamy fine sand may contain hydric inclusions of Rains. Stallings loamy fine sand is considered farmland of statewide importance, while Goldsboro fine sandy loam, Norfolk loamy fine sand, and Onslow loamy fine sand are all considered prime farmland, and Rains fine sandy loam is considered prime farmland if drained (NRCS, n.d.).

Table 4. Mapped Soil Series

Map Unit Symbol	Map Unit Name	Percent Hydric	Drainage Class	Hydrologic Soil Group	Landscape Setting
GoA	Goldsboro fine sandy loam, 0 to 2 percent slopes	No	Moderately Well Drained	A/D	Broad interstream divides on marine terraces
NoA	Norfolk loamy fine sand, 0 to 2 percent slopes	No	Well Drained	A	Ridges on marine terraces, broad interstream divides on marine terraces
NoB	Norfolk loamy fine sand, 2 to 6 percent slopes	No	Well Drained	A	Broad interstream divides on marine terraces
On	Onslow loamy fine sand	No	Moderately Well Drained	A	Broad interstream divides on marine terraces
Ra	Rains fine sandy loam, 0 to 2 percent slopes, Atlantic Coast Flatwoods	Yes	Poorly Drained	B/D	Carolina bays on marine terraces
St	Stallings loamy fine sand	No	Somewhat Poorly Drained	A/D	Flats on marine terraces

A detailed soil survey was performed on the Project parcel by a licensed soil scientist in January 2020 to evaluate the extent of hydric soils and the potential for wetland re-establishment for wetland mitigation (**Appendix M**). Soils on site typically have a dark surface despite years of drainage and cultivation. The typical soil surface consists of very dark gray to black sandy loam surface usually with brown or dark brown mottles. This dark surface is underlain by a gray to dark gray horizon with mottles. The mottles are concentrations of iron, manganese, and organic matter. Two borings appeared to have sandy deposition over a black, gleyed horizon possibly from sedimentation or effects from long-term cultivation. Black, high-organic soils also appear within the upper elevations of the landscape on the mineral flat. Additionally, the presence of a clayey textured horizon as well as areas with a possible spodic horizon provide potential for perching of a water table. In general, the soils on this site are highly variable and interpretation is difficult, which may be a result of many soils converging towards the upper reach of the tributary (**Appendix M**).

3.2.3 Existing Vegetation

Vegetation at the Project is made up of mainly brush species that grow along the banks of the ditches. These species include Muscadine (*Vitis rotundifolia*), *Carex sp.,* Brazilian vervain (*Verbena brasiliensis*), and

Pokeweed (*Phytolacca americana*). The fields next to the ditches have been used as agricultural fields. Along the downstream end of KJ1-C, a buffer was planted in 2004, funded by the United States Department of Agriculture (USDA), Farm Service Agency (FSA), Conservation Reserve Program (CRP). Ditch and stream buffer areas were planted but no bank stabilization took place. In this CRP zone, the vegetation changes from small brush to larger trees. The canopy becomes more closed and includes species like Persimmon (*Diaspyros virginiana*), Sawtooth Oak (*Quercus acutissima*), Loblolly Pine (*Pinus teada*), Southern Red Oak (*Quercus falcata*), Sugarberry (*Celtis laevigata*) and Southern Crabapple (*Malus angustolfia*). The herbaceous layer in this closed canopy area consists of Chinese privet (*Ligustrum sinense*), Shrubby Lespedeza (*Lespedeza bicolor*), Smooth Sumac (*Rhus glabra*), and Trumpet vine (*Campsis radicans*). Woody vines are also locally common and include Laurel Greenbrier (*Smilax laurifolia*).

3.2.4 Land Use – Historic, Current, and Future

The area surrounding the project has been used for agriculture since 1950 and has steadily grown in usage (**Figure 6**). The forested upstream area was cleared between 1950 and 1977, which led to an increase in the use of row crops, mainly corn and soybean. Between 1977 and 1982, KJ1-A was straightened for agricultural purposes. In 2004, a CRP was put in place on KJ1-C. However, this CRP easement expired by its own term in September of 2019, as can be seen in **Appendix C**. Between 1982-2010, the watershed just upstream of the project area was significantly altered by an increase in the number of ditches in the surrounding agricultural fields (**Figure 6**).

3.3 The future land use for the Project area will include 17.20 acres of conservation easement that will be protected in perpetuity. The Project easement will have 3,347 linear feet of a functioning stream, a minimum 50-foot riparian buffer, and 2.991 acres of riparian wetlands. Outside the Project, the area will likely remain in agricultural use. According to the "Onslow County Comprehensive Plan", adopted in 2009 and amended in 2014, the area surrounding the Cowford Mitigation Project does not expect to have major changes in landuse. The area is currently Residential Agriculture and vacant land. The Comprehensive Plan suggests that the soils around the town of Richlands are "Most Suitable Agriculture Soils" and does not expect that urbanization or a rise in residential agriculture will occur within the larger Richlands area. Reach Summary Information

The Project area is comprised of one unnamed tributary, KJ1, split into three reaches based on proposed mitigation treatment (A, B, and C), that flows east to west and drains just downstream of the project into Cowford Branch (**Figure 7**). Results of preliminary data collection are presented in **Table 5**. Morphological parameters are located in **Appendix B.**

Table 5. Summary of Existing Channel Characteristics

Reach	Drainage Area (ac)	A_{BKF} [1] (ft^2)	Width (ft)	Mean Depth (ft)	Width: Depth Ratio	Bank Height Ratio	Entrenchment Ratio	Sinuosity	Slope (ft/ft)
KJ1-A	115	3.8	4.1	0.9	4.3	2.5	1.8	1.00	0.004
KJ1-B	181	4.5	4.9	0.9	5.3	3.9	1.5	1.01	0.007
KJ1-C	238	6.5-8.2	6.6-6.7	1.0-1.2	5.4-6.8	1.8-4.2	1.9-2.1	1.02	0.007

[1] A_{BKF}= cross-sectional area (measured at approximate bankfull stage as estimated using existing conditions data and NC Regional Curve equations where field indicators were not present)

3.3.1 Channel Classification

The Project stream has been classified as intermittent using, the NCDWR Stream Identification Form version 4.11 (Stream ID Form) KJ1. The project stream was also rated using the North Carolina Stream Assessment Method (NCSAM) and received an overall score of Low (**Appendix H**). **Table 6** summarizes these stream parameters and the Stream ID Form as well as a stream identification map, which includes USGS and NRCS Onslow County Soil Survey mapped streams, can be found in **Appendix G**. Stream determinations have been verified by the USACE (**Appendix I**).

Table 6. Summary of Stream Parameters

Reach	Hydrology Status	Stream Determination Score	NCSAM Score	Reach Length (LF)	Rosgen Stream Classification
KJ1	Intermittent	27.5	Low	2,988	E5 – G5c

3.3.2 Existing Channel Morphology

3.3.2.1 Reach KJ1

KJ1-A

Reach KJ1-A originates at an ephemeral/intermittent break, located at the confluence of 3 ditches on the eastern boundary of the proposed conservation easement. The reach has a mild valley with limited longitudinal slope, has been historically ditched, and no longer provides significant ecological functions. KJ1-A flows west through row crop fields to KJ1-B. Much if not all the reach's morphology is currently driven by ditching instead of natural channel processes. The break between reach A and B was selected because the valley steepens and becomes more defined downstream of this point. Row crops are directly adjacent to both banks. Drain tiles from the adjacent fields currently outlet directly into the reach.

KJ1-A Banks

KJ1-A Banks

KJ1-B

Reach KJ1-B originates at downstream end of KJ1-A and flows west through hydric soils to a proposed culvert crossing and easement break. The reach has been ditched and has further degraded such that it lacks floodplain connection, appropriate patten, and bedform diversity. There is an existing 41 LF culvert crossing approximately in the middle of the reach. Row crops are directly adjacent to both banks. Drain tiles from the adjacent fields currently outlet directly into the reach.

KJ1-B Banks

Below the crossing on KJ1-B

KJ1-C

Reach KJ1-C originates downstream of the proposed easement break and continues west to the downstream limits of the conservation easement. The reach has a relatively steep (~1%), defined valley. Directly downstream of the easement, the channel flows under NC HWY 258 through a 48" CMP. The reach has been ditched and has further degraded and entrenched such that it lacks floodplain connection, appropriate pattern, and bedform diversity. Managed forest, from an expired CRP easement, forms an immature buffer along much of the right bank while row crops form much of the left bank.

KJ1-C Banks

KJ1-C Banks

3.4 Wetland Summary Information

3.4.1 Jurisdictional Wetland Information

A survey of existing wetlands was performed on October 3, 2019. Wetland boundaries were delineated using current methodology outlined in the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987).

A preliminary jurisdictional determination (PJD) request was sent to the USACE on October 4, 2019 and revised materials were submitted on November 12, 2019. The confirmed PJD package was completed by USACE; the PJD was received on February 12, 2020. These documents and correspondence can be found in **Appendix I**.

Within the boundaries of the proposed Project, no jurisdictional wetlands are present (**Figure 5**). The only jurisdictional feature is the stream KJ1 (**Appendix I**).

3.4.2 National Wetland Inventory

The USFWS National Wetland Inventory Map (NWI) also depicts no wetland areas within the Project (**Figure 5**). The only mapped NWI depicts palustrine forest wetlands in forested areas within a mile of the project boundaries.

3.4.3 Hydric Soil Indicators

A detailed hydric soil investigation for Cowford Mitigation Site was completed in January of 2020 by a soil scientist. A series of approximately 75 soil borings were performed to described and verify the presence and estimate the extent of hydric soil and soils that appear to exhibit relict or historic hydric indicators (**Appendix M**). Soils were characterized and classified using the Field Indicators of Hydric Soils in the United States, Version 7.0 (USDA-NRCS 2010). Hydric indicators were found within 12 inches of the soil surface and found in both riparian and non-riparian landscapes. The hydric soil indicators found include the F3-Depleted Matrix, S7- Dark Surface, A11-Depleted Below Dark Surface, A12-Thick Dark Surface, S5-Sandy Redox, and S9-Thin Dark Surface. Also present were *S5-Sandy Redox, S9-Thin Dark Surface,* and *F3-Depleted Matrix*. The range of the indicators points to the complexity of the soils at the location, and these can all be found on both riparian and non-riparian landscapes.

3.4.4 Existing Hydrology

Overbank flooding is limited by the deeply dredged and straightened channel and lowers surrounding groundwater elevation in the floodplain. Additionally, the drain tile system lowers the ground water elevations farther from the stream, extending to nearby portions of the contributing watershed. The smooth cultivated surfaces and ditches also quickly remove surface water to prevent accumulation and limit infiltration. These drainage modifications decrease both surface storage and subsurface storage. There are two potential surface drainage patterns that have a concave topography that contribute to the watershed. One enters along the stream channel from the northeast and one from the southeast where a ditch is located. Due to the landscape and potential convergence of multiple soil units, this site appears to have been historically part of a small riverine headwater system where hydric soil extends outward up into the higher elevations of the mineral flat. This Project is located along the transition from a riparian to non-riparian landscape where multiple soil morphologies were noted. This confluence of differing soils and the converging landscape provide variable soil textures and hydric soil indicators providing evidence this area supported a riparian wetland prior to drainage and conversions to agricultural use.

4 REGULATORY CONSIDERATIONS

4.1.1 Environmental Screening and Documentation

To ensure that a project meets the "Categorical Exclusion" criteria, the Federal Highways Administration (FHWA) and NCDMS have developed a categorical exclusion (CE) checklist that is included as part of each mitigation project's Environmental Screening process. The CE Approval Form for the Cowford Project is included in **Appendix K** and was approved by DMS and FHWA in August 2019.

4.1.2 Threatened and Endangered Species

Plants and animals with a federal classification of endangered or threatened are protected under provisions of Sections 7 and 9 of the Endangered Species Act of 1973, as amended. According to the United States Fish and Wildlife (USFWS) IPAC database review tool (USFWS 2018) and the self-certification process conducted by RES and submitted to the USFWS on August 2nd, 2019, there are sixteen endangered or threatened species listed that may occur in proximity to the Project. However, it was determined that only four species; Cooley's Meadowrue (*Thalictrum cooleyi*), Golden Sedge (*Carex lutea*), Pondberry (*Lindera melissifolia)*, and Roughed-leaved Loosestrife (*Lysimachia asperulaefolia*), had the potential to have suitable habitat on the property. After a habitat and species survey conducted on July 19th, 2019, it was determined there was "no suitable habitat" nor species present on site. Therefore a "no effect" determination was made for all of the listed species that were provided in the official species list. The USFWS was consulted through the self-certification process during the CE process and no response was provided by USFWS, which is typical as the certification letter (provided) is their official response unless they do not concur with the determination. Supporting documentation and correspondence can be found in **Appendix K**.

The Fish and Wildlife Coordination Act requires consultation with state fish and wildlife agencies when "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted…or otherwise controlled or modified. The North Carolina Wildlife Resources Commission (NCWRC) was consulted during the CE process and the NCWRC stated that there are no records of any state or federally listed species at the site nor any in the immediate vicinity of the site. Documentation is included in **Appendix K.**

4.1.3 Cultural Resources

A review of North Carolina State Historic Preservation Office (SHPO) GIS Web Service (accessed 11 February 2020) database revealed five listed or potentially eligible historic or archeological resources nearby the proposed project properties. Three of these listings are marked as gone; Billy Banks House (*ON0023*), India Anna Elizabeth Jarman House (*ON0318*), and Lloyd Humphrey House (*ON0306*). The other two documented buildings are the S. Ab Cox House (*ON0104*) and the William Kinsey House (*ON0342*). No construction shall be completed outside of proposed easement, so these listings should be untouched. RES consulted with the SHPO during the CE and the SHPO had "conducted a review of the project and are aware of no historic resources which would be affected by the project." Cultural Resources screening met the Categorical Exclusion Criteria for FHWA and DMS projects and documentation is included in **Appendix K**.

4.1.4 Federal Emergency Management Agency (FEMA)/ Hydrologic Trespass

According to the North Carolina Floodplain Mapping Information System, there is no part of the Project included within the mapped FEMA 100-year floodplain (Zone AE) and no regulated floodway is mapped (FEMA 2018) (**Figure 5**).

RES has completed a hydrologic and hydraulic analysis to minimize the risk of hydrologic trespass to the maximum extent practicable.

4.2 Clean Water Act - Section 401/404

Impacts to jurisdictional streams will be unavoidable, due to the restoration activities proposed. Although these impacts are unavoidable, the proposed stream treatment will result in an overall functional uplift of the stream system, as described in **Section 5**. All of KJ1 is proposed for restoration activities. These activities will have permanent impacts, due to stream restoration and stream realignment. No existing wetlands will be impacted during stream restoration activities. The project does intend to reestablish wetlands on-site. All stream impacts will be accounted for in the Pre-Construction Notification form.

Table 7. Regulatory Considerations

Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Pending Permit	Appendix I
Waters of the United States - Section 401	Yes	Pending Permit	Appendix I
Endangered Species Act	Yes	Yes	Appendix K
National Historic Preservation Act	Yes	Yes	Appendix K
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	Appendix L
Magnuson Stevens Act - Essential Fisheries Habitat	No	N/A	N/A
DOT Right-of-way Permit	Yes	No	N/A

4.3 Potential Constraints

Major project constraints include an existing culvert crossing on KJ1-B, road and utility right of ways, and multiple drainage ditches and drain tiles that outfall into the existing channel. Most of the drainage ditches and drain tiles tie to the bottom of the existing channel somewhat limiting the potential to connect the channel to the existing valley.

The proposed Project is located approximately 3 miles from Hell and Purgatory Airport. Hell and Purgatory Airport has a single grass runway and no permanent structures; it is not anticipated that the Project will interfere with the airport's function. There is a portion of Reach KJ1-C that was enrolled in a CRP contract which expired in 2019. The CRP program contract was for vegetated ditch buffers, which was herbaceous vegetation, and there was no requirement to stabilize eroding banks. The CRP contract had not provided funds for any of the tasks outlined in the RFP (RFP #16-007577). The contract ran for 15 years and it expired on September 20, 2019 (**Appendix C**).

5 FUNCTIONAL UPLIFT POTENTIAL

In order to thoroughly examine the potential functional uplift to stream systems proposed for restoration, the Stream Functions Pyramid Framework (Framework) (Harman et. al. 2012) serves as a useful concept to understand streams and their ecological functions. The Framework presents a logical, holistic view of streams that describes the interrelatedness of fundamental stream functions. The Framework defines five stream function categories, ordered into a hierarchy, that demonstrates the dependence of higher-level functions (biology, physicochemical, and geomorphology) on lower level functions (hydrology and hydraulics). Functions that affect the greatest number of other functions are illustrated at the base of the Pyramid, while functions that have the least effect on other functions are illustrated at the top. Further justifying this hierarchical concept, Fischenich (2006) found that the most critical restoration activities are those that address stream functions related to hydrodynamic processes, sediment transport processes, stream stability, and riparian buffers.

Therefore, principles of the Framework are utilized to discuss and communicate the potential functional uplift to streams at the Cowford project and to propose realistic, attainable goals and objectives. However, the determination of credits and performance standards for the Project follow guidance put forth by the USACE Wilmington District.

The Cowford Stream and Wetland Mitigation Project will provide numerous ecological and water quality benefits within the White Oak River Basin by applying an ecosystem restoration approach. The restoration approach at the reach scale of this project will have the greatest effect on the hydrology, hydraulic, and geomorphology functions of the system and is assumed to ultimately benefit the upper-level functions (physicochemical and biology) over time, and in combination with other projects within the watershed. Within the Project area, functional benefits and improvements related to the Function-Based Pyramid Framework are anticipated by realizing site-specific functional goals and objectives These goals and objectives, as they relate to the Framework, are outlined in **Table 8**.

5.1 Anticipated Functional Benefits and Improvements

5.1.1 Hydrology

The Project will locally address several historic hydrologic disturbances including deforestation and channelization; however, it is not anticipated that the Project will have a significant effect on hydrology at the watershed scale.

5.1.2 Hydraulic

The greatest potential uplift at the Project will be achieved by providing floodplain connectivity throughout the Project. Channels will be designed to promote stable channel hydraulics by increasing floodplain inundation, grade control, bank stabilization. Currently, hydraulic parameters for all reaches are not functioning due to lack of buffer, historic realignment, maintenance of agricultural drainage through the use of drain tiles and ditching and will be functioning post restoration.

5.1.3 Geomorphology

The proposed design will promote a dynamic transport of sediment through the project. Due to a lack of floodplain connection much of the current project has a high transport capacity that drastically limits the channels ability to store sediment. By promoting floodplain inundation and headwater valley characteristics the transport capacity will be reduced, allowing the stream to develop / utilize depositional areas (point bars and floodplain wetlands). In addition to reducing the transport capacity RES anticipates the project will also reduce sediment loading within the project corridor. This load reduction will be achieved through a reduction in bank erosion, planting a riparian buffer, and treating offsite drainage before it enters the reach.

Soil loss within the easement area is estimated to be reduced by approximately 80% through buffer planting (using the RUSLE2 software; NRCS). The Headwater Valley restoration (Reach KJ1-A) will act as a sediment sink for the downstream reaches. Channel stability and bedform diversity will be improved in restoration reaches by installing wood grade control, coir matting, bank vegetation, and habitat structures to promote a natural riffle-pool sequence. The existing channel will be filled to help raise the groundwater within the wetland. Channel substrate of KJ1-C will be supplemented by off-site material to ensure bed stability and habitat creation. Transport and storage of woody debris will be improved through increases in channel roughness from plantings and structure installation. Existing riparian vegetation for reach KJ1-C are functioning-at-risk due to lack of diversity of woody vegetation. Therefore, riparian buffers will be planted out to a minimum of 50 feet to improve the riparian vegetation to functioning levels, while also providing terrestrial habitat. All of these functional parameters are interconnected and depend on each other; therefore, improving this wide range of parameters will result in long-term functional geomorphic uplift.

5.1.4 Physicochemical

Although this Project would support the overarching goal in the White Oak RBRP to promote nutrient and sediment reduction in agricultural areas, it is difficult to measure nutrient and sediment reduction at this project level because they can be affected by many variables. However, several restoration actions that will be realized by the Project are known to reduce nutrients and sediment even though they may not be observable at the project level. These activities include removing drain tiles and/or outletting drain tiles into the floodplain, converting active agricultural fields into forested buffers, filtering runoff through buffer areas, and improving denitrification and nutrient uptake through buffer zones and riparian wetlands. Additional benefits may also come from functional uplift of the lower-level stream functions (hydraulics and geomorphology), which will reduce sediment and nutrients in the system through channel establishment, bank stabilization, and reforestation. Temperature regulation will also be improved through the restoration of canopy tree species to the stream buffer areas. Oxygen regulation will occur through two actions: first, the temperature of the water directly impacts the amount of gas held by the water. Therefore, by planting the buffer to shade the channel, water temperature is decreased, and dissolved oxygen is increased. Second, by constructing stable channels that include drop structures, mixing zones will form where oxygen dissolves much faster than the current exchange rate. The processing of organic matter will be improved once healthy riffles are shallow enough to catch twigs and branches that then retain leaves. Many of these physicochemical benefits occur slowly and are dependent on multiple variables within the stream ecosystem. Therefore, it is not practical or feasible to directly measure these parameters within the monitoring time frame of this project.

5.1.5 Biology

As mentioned for the physicochemical stream function, it will be difficult to see measurable results of the functional uplift of the biological functions at a project scale during the monitoring time frame of the project. However, since the life histories of many species likely to benefit from stream and wetland restoration are depending on the lower-level functions, the functional uplift from the hydraulic and geomorphic levels would likely have a positive effect on the biology over time and in combination with other projects within the watershed is anticipated. Again, there is no substitute for direct biological monitoring, but it is important to understand the hierarchy of the Stream Functions Pyramid Framework in order to help project long-term benefits of the Project, though only categories two and three (hydraulics and geomorphology) will be directly measured during the seven-year monitoring period. Ultimately, any functional uplift to biology at the Project can only be assumed.

5.1.6 Wetland Functional Uplift

The Project currently has no wetlands due to the incised channel and drain tile system rapidly removing surface and groundwater. The stream is currently allowing sediment, nutrients, pesticides, and herbicides to flow freely into Cowford Branch and the New River. Both water bodies are classified as Nutrient

Sensitive Waters. The proposed wetland restoration area will raise the local groundwater and restore a more natural hydrologic cycle to the riparian zone. Successful construction and restoration of this tributary and headwater wetland system will provide numerous benefits to water quality. Successful hydrologic restoration will provide numerous soils related functional uplifts in addition to the benefits of stream restoration. These include, re-establishment of natural oxidation reduction cycling, improved nutrient and chemical transformations, potential immobilization of phosphorus, increased organic carbon sequestration, improved soil structure (surface primarily), lower soil and surface water temperature after vegetative establishment, and increases in diversity of microbial and fungal populations that are important for soil health. Large scale benefits may include an increase of diverse wildlife habitat, and connectivity to the natural aquatic communities of Cowford Branch.

6 MITIGATION PROJECT GOALS AND OBJECTIVES

Through the comprehensive analysis of the Project's maximum functional uplift using the Stream Functions Pyramid Framework and conclusions based on a Site Hydric Soils Detailed Study (**Appendix M**), specific, attainable goals and objectives will be realized by the Project. These goals clearly address the degraded water quality and nutrient input from agricultural practices that were identified as major watershed stressors in the 2010 White Oak RBRP. The Project will address outlined RBRP Goal one and two of the TLW specific goals (listed in **Section 2**).

The Project goals are:

- Re-establish hydrology to a historical stream/wetland complex that has been impacted by historic channel realignment, channel entrenchment, field ditching, and field drain tiling;
- To transport water in a stable, non-erosive manner and maintain a stable water table in riparian floodplain wetlands that will also contribute to stream baseflow;
- Improve flood flow attenuation on site and downstream by allowing for overbank flows and connection to the floodplain;
- Create diverse bedforms and stable channels that achieve healthy dynamic equilibrium and provide suitable in-stream habitat for aquatic organisms;
- Limit sediment and nutrient inputs into stream system;
- Re-establish wetland;
- Restore native wetland and riparian vegetation;
- Indirectly support the goals of the 2010 White Oak RBRP to improve water quality and to reduce sediment and nutrient loads; and
- To support the life histories of aquatic and riparian plants and animals through stream restoration activities.

Anticipated functional uplift, benefits, and improvements within the Project area, as based on the Function Based Framework are outlined in **Table 8.**

Table 8. Functional Benefits and Improvements

Level	Function	Goal	Objective	Measurement Method
1	***Hydrology°*** *Transport of water from the watershed to the channel*	to transport water from the watershed to the channel in a non-erosive manner and maintain a stable water table in the riparian wetland	Convert the land-use of streams and their watersheds from cropland into riparian forest Maintain appropriate hydroperiod for Muckalee soil series	Percent Project drainage area converted to riparian forest (indirect measurement) Groundwater wells
2	***Hydraulic*** *Transport of water in the channel, on the floodplain, and through the sediments*	to transport water in a stable non-erosive manner	Improve flood bank connectivity by reducing bank height ratios and increasing entrenchment ratios Maintain regular, seasonal flow in restored, intermittent streams	Cross sections Stage Recorders Bank Height Ratio Entrenchment Ratio Flow gauge
3	**Geomorphology** *Transport of wood and sediment to create diverse bedforms and dynamic equilibrium*	to create a diverse bedform and a stable channel that achieves healthy dynamic equilibrium and provides suitable habitat for life	Limit erosion rates and increase channel stability to reference reach conditions Improve bedform diversity (pool spacing, percent riffles, etc.) Increase buffer width to at least 50 feet	As-built stream profile Cross sections Visual monitoring Vegetation plots
4	**Physicochemical °** *Temperature and oxygen regulation; processing of organic matter and nutrients*	Indirectly support the goals of the 2010 White Oak RBRP to achieve appropriate levels for water temperature, dissolved oxygen concentration, and other important nutrients including but not limited to Nitrogen and Phosphorus through buffer/wetland planting and wetland hydrologic restoration	Establish native hardwood riparian buffer to provide canopy shade and absorb nutrients Install in-stream structures to created aeration zones Promote sediment filtration, nutrient cycling, and organic accumulation through natural wetland biogeochemical processes	
5	**Biology °** *Biodiversity and life histories of aquatic life histories and riparian life*	to achieve functionality in levels 1-4 to support the life histories of aquatic and riparian plants and animals through instream	Improve aquatic habitat by installing habitat features, constructing pools of varying depths, and planting the riparian buffer and wetlands	

° These are benefits that are presumed and will not be measured by the monitoring

7 MITIGATION WORK PLAN

7.1 Reference Stream

The restoration portions of the Project are currently characterized by agricultural practices. Physical parameters of the Project were used, as well as other reference materials, to determine the target stream type. The "Classification of the Natural Communities of North Carolina" was also used to narrow the potential community types that would have existed at the Project (Schafale, 2012). An iterative process was used to develop the final information for the Project design.

Targeted reference conditions included the following:

- Located within the physiographic region and ecoregion,
- Similar land use on site and in the watershed,
- Similar soil types on site and in the watershed,
- Ideal, undisturbed habitat – several types of woody debris present,
- Similar topography,
- Similar slope,
- Pattern common among coastal plain streams, and
- Minimal presence of invasive species.

7.1.1 Reference Characterization

The selected reference stream is UT to Buffalo Creek which is part of the most downstream portion of the Buffalo Branch Stream Mitigation Project and is located in the Upper Neuse River Basin. The reach that was surveyed and analyzed is approximately 375 feet long with a drainage area of 1.11 square miles (709 acres). The land use in the watershed is not dominated by any one land use, but has major components of cropland, pasture, and forests, with minor components of developed area, wetlands, herbaceous, and open water. Site photographs of the reference stream are located in **Appendix B.**

The current State classification for Buffalo Creek downstream of the reference reach is C and NSW (NCDWR 2011). Class C waters are those protected for uses such as secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival, and maintenance of biological integrity, and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. Waters given the supplemental classification of Nutrient Sensitive Waters (NSW) are those needing additional nutrient management due to being subject to excessive growth of microscopic or macroscopic vegetation. Further, Buffalo Creek is listed on the 2018 303d list for impaired waters (North Carolina Department of Environmental Quality [NCDEQ] 2018). It received a Fair Bioclassification rating for benthic ecological/ biological integrity.

7.1.2 Reference Discharge

Several hydrologic models/methods were used to develop a bankfull discharge along with indicators of bankfull stage for the reference site. Existing drainage area, land use, slope, roughness, and cross-sectional area were all factors considered when performing the calculations. Using a combination of Coastal Regional Curves, in-house spreadsheet tools, and a project specific regional flood frequency analysis, the existing discharge for UT to Buffalo Creek was found to be approximately 18-21 cubic feet per second (ft^3/s). See **Section 7.2.2** for a more detailed description of the hydrologic analyses performed for this project.

7.2 Design Parameters

7.2.1 Stream Restoration Approach

The Project will include stream and headwater valley restoration. Stream restoration will incorporate the design of a single-thread, meandering channel, with parameters based on data taken from reference site, published empirical relationships, regional curves developed from existing project streams, and NC Regional Curves. Analytical design techniques will also be a crucial element of the project and will be used to determine the design discharge and to verify the design. Based on soil type, valley slope, and drainage area headwater valley restoration was incorporated in the design. Headwater valley restoration will include the design of a vegetated diffuse flow system that will allow for the passive development of a headwater stream. The USACE and DWR guidance "Information Regarding Stream Restoration with Emphasis on the Coastal Plain" was heavily utilized in the design of this reach. A conceptual plan is provided in **Figure 8** and the design plan sheets of the restoration approach is found in **Appendix A.**

The Project has been broken into the following design reaches:

7.2.1.1 Reach KJ1-A (HWV)

A headwater valley restoration approach is proposed for this reach to address historic ditching and buffer impacts. Restoration activities will include:

- Grading a headwater valley,
- Installing wood structures to provide grade control and habitat,
- Installing live stakes to stabilize the bed and banks,
- Riparian planting.

7.2.1.2 Reach KJ1-B

An offline restoration approach is proposed for this reach to address historic ditching and buffer impacts. Restoration activities will include:

- Grading a new, single-thread channel in the existing floodplain (Priority I Restoration),
- Installing log structures to provide grade control and habitat,
- Establishing a riffle-pool sequence throughout the new channel,
- Installing toe protection on meander bends,
- Installing live stakes to stabilize the banks and provide channel shading,
- Filling and grading the existing channel to create wetland habitat,
- Riparian planting.

7.2.1.3 Reach KJ1-C

An inline, P2 restoration approach is proposed for this reach to address historic ditching, channelization, and buffer impacts. Restoration activities will include:

- Grading a new, single-thread channel in an excavated floodplain,
- Installing rock and log structures to provide grade control and habitat,
- Establishing a riffle-pool sequence throughout the new channel,
- Installing toe protection on meander bends,
- Installing live stakes to stabilize the banks and provide channel shading,
- Filling the existing channel,
- Riparian planting, and
- Invasive vegetation treatment.

7.2.1.4 Typical Design Sections

Typical cross sections for riffles and pools are shown on the design plan sheets in **Appendix A**. All cross-section dimensions were developed from the analog reach but were altered based on existing site conditions, hydraulic modeling, and observations from other mitigation sites in the area.

7.2.1.5 Meander Pattern

The design plans showing the proposed channel alignment are provided in **Appendix A**. The meander pattern was derived directly from the analog reach and was altered in some locations to provide variability in pattern, to avoid on Project constraints, to improve constructability, and to promote wetland hydrology. The morphologic parameters summarized in the **Appendix B** were applied wherever these deviations occurred.

7.2.1.6 Longitudinal Profiles

The design profiles are presented in **Appendix A**. These profiles extend throughout the entire project for the proposed channel alignment. The profiles were designed using the analog reach bed features that were sized with the scaling factors. The bed slopes and bankfull energy gradients were determined for each design reach based on the valley slope and the sinuosity of the design reach. Log structures will be utilized in the design to control grade, divert flows, and provide additional habitat diversity and stability.

7.2.1.7 In-Stream Structures

Structures will be incorporated into the channel design to provide additional stability and improve aquatic habitat. Native materials and vegetation will be used for revetments and grade control structures where applicable. Typical structures that will protect the channel bed and/or banks will include riffle grade controls, log sills, rock sills, and brush bed sills.

Woody debris, including log sills, riffle material, and brush bed sills, will be placed throughout the channel. Bank stability measures include the installation of live stakes, brush toes, and hay bale toes. Typical details for proposed in-stream structures and revetments are in **Appendix A**.

7.2.2 Data Analysis

7.2.2.1 Stream Hydrologic Analysis

Hydrologic evaluations were performed for the design reaches using multiple methods to determine and validate the design bankfull discharge and channel geometry required to provide regular floodplain inundation. The use of various methods allows for comparison of results and eliminates reliance on a single model. Peak flows (**Table 9**) and corresponding channel cross sectional areas were determined for comparison to design parameters using the following methods:

- Regional Flood Frequency Analysis,
- AutoCAD's Hydraflow Hydrographs, and
- NC Regional Curves for the Rural Coastal Plain.

<u>Regional Flood Frequency Analysis</u>

A flood frequency analysis was completed for the study region using historic gauge data on all nearby USGS gauges with drainage areas less than 6,400 acres (10 mi^2) which passed the Dalrymple homogeneity test (Dalrymple, 1960). This is a subset of gauges used for USGS regression equations. Regional flood frequency equations were developed for the 1.1-, 1.5-, and 2-year peak discharges based on the gauge data. Discharges were then computed for the design reach. These discharges were compared to those predicted by the discharge regional curve and USGS regional regression 2-year discharge equations.

<u>AutoCAD's Hydraflow Express</u>

Hydraflow Express was used to simulate the rainfall-runoff process and establish peak flows for the watersheds. This model was chosen over the U.S. Army Corps of Engineers model HEC-HMS because it allows the user to adjust the peak shape factor. Rainfall data reflecting both a 284 and 100 peak shape factor were used along with a standard Type II distribution, and NRCS hydrology (time of concentrations and runoff curve numbers), to simulate the rainfall-runoff process.

Regional Curve Regression Equations

The North Carolina Rural Coastal regional curves by Doll et al. (2003) and Sweet and Geratz (2003) for discharge were used to predict the bankfull discharge for the Project. The regional curves predicted flows that are similar to those predicted by the 1.1-year flood frequency, while the Hyrdaflow values were much higher. The regional curve equations for NC discharges by Doll et al. (2003):

(1) $Q_{bkf}=16.56*(DA)^{0.72}$ (Doll et al., 2003)

(2) $Q_{bkf}=8.79*(DA)^{0.76}$ (Sweet and Geratz, 2003)

Where Q_{bkf}=bankfull discharge (ft^3/s) and DA=drainage area (mi^2).

Table 9. Peak Flow Comparison

Reach	Drainage Area (Ac)	FFQ $Q_{1.1}$	FFQ $Q_{1.5}$	NC Regional Curve Q (1)	NC Regional Curve Q (2)	Hydraflow Q_1	Hydraflow Q_2	Design Q
KJ1-A	115	5	16	5	2	9	14	-
KJ1-B	181	8	22	7	3	21	31	5
KJ1-C	238	9	26	8	4	30	44	8

7.2.2.2 Design Discharge

Based upon the hydrologic analyses described above, design discharges were selected that fall just below the FFQ 1.1 and the NC Regional Curve revised values. The selected flows for the restoration reaches are 5 ft^3/s for KJ1-B and 8 ft^3/s for KJ1-C. These discharges will provide frequent inundation of the adjacent floodplain.

7.2.2.3 Sediment Transport Analysis

An erosion and sedimentation analysis was performed to confirm that the restoration design creates a stable sand bed channel that neither aggrades nor degrades over time. Typically, sediment transport is assessed to determine a stream's ability to move a specific grain size at specified flows. Various sediment transport equations may be easily applied when estimating entrainment for gravel bed streams; however, these equations are not as effectively applied to sand bed channels where the entire bed becomes mobile during geomorphically significant flows. Therefore, more sophisticated modeling techniques were used to analyze the stream design for this project. The following methods and functions were utilized during the sediment transport analysis:

- HEC-RAS Stable Channel Design
- Permissible Shear Stress Approach, and
- Permissible Velocity Approach.

Stable Channel Design

Design cross-section dimensions were evaluated using the stable channel design functions within HEC-RAS. These functions are based upon the methods presented in the SAM Hydraulic Design Package for Channels developed by the USACE Waterways Experiment Station. The Copeland Method was developed specifically for sand bed channels (median grain size restriction of 0.0625 mm to 2 mm). The method sizes stable dimensions as a function of slope, discharge, roughness, side slope, bed material gradation, and the inflowing sediment discharge. Results are presented as a range of widths and slopes, and their unique solution for depth, making it easy to adjust channel dimensions to achieve stable channel configurations.

RES uses these results as a QAQC of the proposed channel dimension. The stable design output parameters are listed in **Table 10**.

Table 10. Stable Channel Design Output

Reach	Q (ft/s^3)	Bottom Width (ft)	Depth (ft)	Energy Slope (ft/ft)	Composite n value	Velocity (ft/s)	Shear Stress (lbs/ft^2)
KJ1-B	5	2	0.85	0.0025	0.04	1.3	0.13
KJ1-C	8	2	1.1	0.0015	0.03	1.4	0.10

The recommended channel characteristics showing in **Table 10** are relatively close to the proposed channel dimensions and were used to help validate the proposed design.

Shear Stress Approach

Shear stress is a commonly used tool for assessing channel stability. Allowable channel shear stresses are a function of bed slope, channel shape, flows, bed material (shape, size, and gradation), cohesiveness of bank materials, vegetative cover, and incoming sediment load. The shear stress approach compares calculated shear stresses to those found in the literature. Critical shear stress is the shear stress required to initiate motion of the channels median particle size (D_{50}).

RES uses the table below to further validate the design by confirming that the proposed bed shear stress at bank full is between the critical shear stress and maximum allowable shear stress.

Table 11. Comparison of Allowable and Proposed Shear Stresses

Reach	Proposed Bed Shear Stress at Bankfull Stage (lbs/ft^2)	Existing Critical Shear Stress (lbs/ft^2)	Allowable Shear Stress[1]		
			Sand/Sily/Clay (lbs/ft^2)	Coarse Gravel (lbs/ft^2)	Vegetation (lbs/ft^2)
KJ1-B	0.19	0.02	0.03 to 0.26	0.33 to 0.67	0.7 to 1.7
KJ1-C	0.21	0.02	0.03 to 0.26	0.33 to 0.67	0.7 to 1.7

[1](Fischenich, 2001)

Review of the above table shows that the proposed bed shear stresses for the Project design reaches are consistent with the allowable shear stresses for native substrate. Proposed riffles for KJ1-B will incorporate native materials and will be supplemented with woody debris. KJ1-B riffles will be supplemented with a mixture of gravel and woody debris to provided increased stability in the more confined valley until vegetation can be established. This supplemental gravel is larger than the material naturally supplied by the watershed. RES anticipates that this material will eventually mobilize and leave the site as sand fills in the voids and the channel bed transitions from framework supported to matrix supported (Wilcock, 2009).

Velocity Approach

Published data are readily available that provide entrainment velocities for different bed and bank materials. A comparison of calculated velocities to these permissible velocities is a simple method to aid in the verification of channel stability. **Table 12** compares the proposed velocities calculated using Manning's equation with the permissible velocities.

Table 12. Comparison of Permissible and Proposed Velocities

Reach	Manning's "n" Value	Design Velocity (ft/s)	Proposed Bed Material	Permissible Velocity[1] (ft/sec)
KJ1-B	0.045	1.3	Sand/Fine Gravel	1.75 – 2.5
KJ1-C	0.045	1.4	Coarse Gravel	2.5 - 6

[1](Fischenich, 2001)

Table 12 shows that the design velocity falls below the permissible velocity further validating the proposed design.

7.2.3 Wetland Restoration

The Cowford Project offers a total ecosystem restoration opportunity. As such, the wetland restoration is closely tied to the stream restoration and drain tile interruption. The Project will provide 2.991 WMUs through wetland re-establishment. Wetland re-establishment is only proposed in areas that have been determined appropriate for wetland restoration by a licensed soil scientist due to the presence of hydric soils and potential hydrology (**Appendix M**). Re-establishment activities will include; a successful restoration that raises the local groundwater elevation and allows frequent flooding, the plugging of ditches, removing all drain tiles within the easement, and creating shallow depression features in the wetland. A 2D model of the proposed stream restoration was run in HEC-RAS to evaluate the effectiveness of the design at increasing wetland flooding. Inundation maps from this model of the 1- and 10-year design storms are provided in **Figures 11** and **12**, respectively, and demonstrate that the proposed design will function in this capacity. These activities will help raise the local groundwater and have a more natural hydrologic cycle in the riparian zone. Surface roughening through shallow soil ripping will improve infiltration and slow runoff through the floodplain. Surface roughening will also create microtopography and shallow depressional areas, re-establishing more natural conditions and establishing habitat diversity. Historic land-use impacts will be addressed through the planting of a native hardwood wetland community.

7.3 Sediment Control Areas

A suite of sediment load attenuation structures in the form of treatment pools and engineered sediment packs (**Appendix A**, **Details**) will be installed within Swale A and B (**Figure 8**). Swale A will tie the flow from Ditch A to reach KJ1-B and Wetland WA, while picking up its bed elevation and treating agricultural runoff through the use of a treatment pool and planted vegetation. Swale B will tie the flow from Ditch B into reach KJ1-C while picking up its bed elevation and treating agricultural runoff through the use of a treatment pool, an engineered sediment pack, and planted vegetation. These structures will be installed within the conservation easement so that they are protected. Catastrophic failure or maintenance of the structures is not anticipated as they will be installed in a low-gradient area, and all treatment pools and swales will be well vegetated.

7.4 Vegetation and Planting Plan

7.4.1 Plant Community Restoration

The restoration of the plant communities is an important aspect of the restoration Project. The selection of plant species is based on what was observed in the forest surrounding the restoration Project and what is typically native to the area. Specifically, species identified in forested areas adjacent to the Project along with species described in the 2012 Guide to the Natural Communities of North Carolina, Fourth Approximation (Schafale, 2012) for coastal plain wetland-type communities were used to determine the most appropriate species for the restoration project.

A Coastal Plain Small Stream Swamp (Schafale, 2012) will be the target community along the Project reaches and wetlands. This community type represents a diverse group of species with differing flood tolerances, able to grow in close association with one another along stream and wetland features. Additionally, as tree species are able to survive less frequently flooded conditions than shown for their tolerance class, the planting plan selected takes into account the species that are best suitable for the most flooded zone of the project with the intention that they will likely survive both the wetland area and the more upland conditions (Stanturf, 2004). While reforestation is an important goal of this Project, it is expected that some open water and/or marsh pockets may persist in depressions within the swamp areas. These microtopographic features will further enhance community complexity and habitat diversity. The target community will be used for the planting areas within the Project, shown in **Appendix A**. The plant species list has been developed and can be found in **Table 13**. Hardwood species typical of the target community were observed in adjacent and nearby communities and were judged to be appropriate for this site. The whole project will be planted (16.35 acres). The trees within the previous CRP easement will be mostly removed during construction, so a new buffer will be planted (**Figure 10**).

The restoration of plant communities along the Project will provide stabilization and diversity. For rapid stabilization of the stream banks (primarily outside meanders), silky dogwood (*Cornus amomum*), Cottonwood (*Populus deltoides*), Buttonbush (*Cephalanthus occidentalis*) and black willow (*Salix nigra*) were chosen for live stakes along the restored channel because of their rapid growth patterns and high success rates. Willows grow at a faster rate than the species planted around them, providing faster bank stabilization and contribution of organic matter to the channel than the other planted woody species. As the community matures, the willows will slowly stop growing or die out as the other species outgrow them and create shade that the willows do not tolerate. The live stake species will be planted along the outside of the meander bends to three feet from the top of bank, creating a three-foot section along the top of bank. The live stakes will be spaced at least one per three linear feet with alternate spacing vertically.

The floodplain will also be planted with a seed mix that will promote a healthy ecosystem. RES plans on planting a seed mix with combination of temporary and permanent species, that prefer a coastal plain soil and are tolerant to wetland areas. This mix was created with a focus on the North Carolina Coastal Plain species but also considered the potential availability and cost of various species. This seed mix includes different wetland species which will promote growth and help the wetland re-establish. The non-wetland species will be planted in the proper areas within the project and will help the project reach the targeted community.

It is anticipated that vegetation planting will be conducted no later than March 15th, and there will be at least 180 days until the initiation of the first year of monitoring. Furthermore, any replanting that may occur throughout the monitoring phase of the Project will occur between November 15 and March 15, per the October 2016 USACE/NCIRT monitoring guidance. However, if the Project completes construction after March 15, the site will be planted no later than April 15.

Table 13. Proposed Plant List

Bare Root Planting Tree Species					
Species	**Common Name**	**Wetland Indicator Status**	**Spacing (ft)**	**Unit Type**	**% of Total Species Composition**
Betula nigra	River birch	FACW	9x6	Bare Root	15
Cephalanthus occidentalis	Buttonbush	OBL	9x6	Bare Root	15
Taxodium distichum	Bald cypress	OBL	9x6	Bare root	10
Quercus nigra	Water oak	FAC	9x6	Bare root	10
Quercus phellos	Willow oak	FACW	9x6	Bare root	10
Quercus lyrata	Overcup oak	OBL	9x6	Bare Root	10
Nyssa biflora	Swamp tupelo	OBL	9x6	Bare root	10
Platanus occidentalis	American Sycamore	FACW	9x6	Bare root	10
Quercus falcata	Southern Red Oak	FACU	9x6	Bare root	5
Fraxinus pennsylvanica	Green Ash	FACW	9x6	Bare root	5

Live Staking and Live Cuttings Bundle Tree Species			
Species	**Common Name**	**Wetland Indicator Status**	**% of Total Species Composition**
Salix nigra	Black willow	OBL	35
Cornus ammomum	Silky dogwood	FACW	25
Populus deltoides	Cottonwood	FAC	20
Cephalanthus occidentalis	Buttonbush	OBL	20

7.4.2 On-Site Invasive Species Management

Treatment for invasive species will be required within all grading limits associated with stream restoration. Invasive species will require different and multiple treatment methods, depending on plant phenology and the location of the species being treated (**Appendix J**). All treatment will be conducted as to maximize its effectiveness and reduce chances of detriment to surrounding native vegetation. Treatment methods will include mechanical (cutting with loppers, clippers, or chain saw) and chemical (foliar spray, cut stump, and hack and squirt techniques). Invasive or aggressive plants containing mature, viable seeds will be removed from the Project and properly disposed. All herbicide applicators will be supervised by a certified ground pesticide applicator with a North Carolina Department of Agriculture and Consumer Services (NCDA&CS) license and adhere to all legal and safety requirements according to herbicide labels, and NC and Federal laws. Management records will be kept on the plant species treated, type of treatment employed, type of herbicide used, application technique, and herbicide concentration and quantities used. These records will be included in all reporting documents.

7.4.3 Soil Restoration

After construction activities, the subsoil will be scarified and any compaction will be deep tilled before the topsoil is placed back over the Project. Any topsoil that is removed during construction will be stockpiled and placed over the Project during final soil preparation. This process should provide favorable soil conditions for plant growth. Rapid establishment of vegetation will provide natural stabilization for the Project.

7.5 Mitigation Summary

Natural channel design techniques have been used to develop the restoration designs described in this document. The combination of the analog and analytical design methods was determined to be appropriate for this Project because the watershed is rural, the causes of disturbance are known and have been abated, and there are minimal infrastructure constraints. The original design parameters were developed from the measured analog/reference reach data and applied to the subject stream. The parameters were then analyzed and adjusted through an iterative process using analytical tools and numerical simulations of fluvial processes.

The designs presented in this report provide for the restoration of natural coastal plain channel features and stream bed diversity to improve benthic habitat. The proposed design will allow flows that exceed the design bankfull stage to spread out over the floodplain and into adjacent wetlands. Native organic material will be installed throughout the restored reaches to reduce bank stress, provide grade control, and increase habitat diversity.

Forested riparian buffers of at least 50 feet on both sides of the channel will be established along the Project reaches. An appropriate riparian plant community (Coastal Plain Small Stream Swamp) will be established to include a diverse mix of species. The plant species list has been developed and can be found in **Table 13**. Within the planting area, certain targeted species will be planted in the appropriate target community location. Replanting of native species will occur where the existing buffer is impacted during construction.

Wetland re-establishment will be accomplished through stream restoration and drain tile interruption at the easement boundary. Stream restoration efforts will re-establish surface-groundwater connections that will provide retention and storage within this riparian wetland and drain tile interruption will further lift groundwater elevations. The restored wetland area will be planted with a native Coastal Plain Small Stream Swamp vegetation.

A combination of sediment load attenuation structures will be used on site; engineered sediment packs coupled with treatment pools and a treatment swale. These structures will be installed within the easement and will ultimately lead to the functional uplift of the site by reducing peak sediment loads and nutrient inputs while allowing for the continuation of agricultural production outside of the conservation easement.

Due to the nature of the project, complete avoidance of stream and buffer impacts is not possible. Proposed stream impacts, including stream relocation and crossing relocation, is a necessary restoration practice that will contribute to the functional uplift of the Project's aquatic resources. Stream restoration will also impact existing buffers, though all these areas will be replanted with a diverse tree community. All impacts will be accounted for in the Pre-Construction Notification (PCN) form.

7.6 Determination of Credits

Mitigation credits presented in **Table 14** are projections based upon site design (**Figure 8** and **Appendix A**). Upon completion of site construction, the project components and credit data will only be revised to be consistent with the as-built condition if there is a large discrepancy. Any deviation from the mitigation plan post approval, including adjustments to credits, will require a request for modification. This will be approved by the USACE. All credits will be released in accordance with credit release schedules outlined in the 2016 Wilmington District Stream and Wetland Compensatory Mitigation Update (**Appendix D**).

7.6.1 Credit Calculations for Non-Standard Buffer Widths

To calculate functional uplift credit adjustments, the Wilmington District Stream Buffer Credit Calculator from the USACE supplied to mitigation providers in January 2021 was utilized. To perform this calculation, GIS analysis was performed to determine the area (in square feet) of ideal buffer zones and actual buffer zones around all streams within the project, including the area within the arc around stream terminal ends. Minimum standard buffer widths are measured from the top of bank (50 feet in Piedmont and Coastal Plain counties or 30 feet in Mountain counties). The ideal buffers are the maximum potential size (in square feet) of each buffer zone measured around all creditable stream reaches, calculated using GIS, including areas outside of the easement. The actual buffer is the square feet in each buffer zone, as measured by GIS, excluding non-forested areas, all other credit type (e.g., wetland, nutrient offset, buffer), easement exceptions, open water, areas failing to meet the vegetation performance standard, etc. The stream terminal ends are where the streams exit or enter the project boundary, not including internal stream crossings. Additional credit is given to 150 feet in buffer width, so areas within the easement that are more than 150 feet from creditable streams were not included in this measurement. Non-creditable stream reaches within the easement are removed prior to calculating this area with GIS (for both ideal and actual). The stream lengths, mitigation type, number of terminal ends, ideal buffer, and actual buffer are all entered into the calculator. This data is processed, and the resulting credit amounts are totaled for the whole project (**Table 14** & **Figure 9**).

Table 14. Cowford Project (ID-100095) - Mitigation Components

Project Component (reach ID)	Wetland Position and Hydro Type	Existing Footage or Acreage	Stationing	Mitigation Plan Footage or Acreage	As-Built Footage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
KJ1-A		913	1+42 to 10+65	923	TBD	R	HWV	1:1	913.000	Headwater valley restoration, riparian planting
KJ1-B		647	10+65 to 19+17	852	TBD	R	P1	1:1	852.000	Channel restoration, riparian planting
KJ1-C		1,428	19+85 to 35+57	1,572	TBD	R	P2	1:1	1,572.000	Channel restoration, riparian planting
Total		2,988		**3,347**					**3,337.000**	
Non-Standard Buffer Width Adjustment									**201.670***	*NSBW credit does not include HWV length
Total Adjusted SMU's									**3,538.67**	
WA	RR	0.000		2.991	TBD	R		1:1	2.991	Stream restoration, drain tile interruption, native planting

Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)
		Riverine	Non-Riverine	
Restoration	3,347.000	2.991		
Enhancement				
Enhancement I				
Enhancement II				
Creation				
Preservation				
High Quality Pres				

Overall Assets Summary

Asset Category	Overall Credits
Stream	**3,538.670**
RP Wetland	**2.991**
NR Wetland	**NA**

8 PERFORMANCE STANDARDS

The success criteria for the Project will follow the 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation Update and subsequent agency guidance. Specific success criteria components are presented below.

8.1 Stream Success Criteria

8.1.1 Bankfull Events

Four bankfull flow events must be documented within the seven-year monitoring period. The bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until four bankfull events have been documented in separate years.

8.1.2 Surface Flow

Intermittent stream reaches being restored will be monitored annually to document intermittent or seasonal surface flow. This will be accomplished through direct observation and the use of automatic-logging pressure transducers with data loggers (flow gauge). Reaches must demonstrate a minimum of 30 consecutive days of flow.

8.1.3 Cross Sections

There should be little change in as-built cross sections. If changes do take place, they should be evaluated to determine if they represent a movement toward a less stable condition (for example down-cutting or erosion) or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross sections shall be classified using the Rosgen stream classification method, and all monitored cross sections should fall within the quantitative parameters defined for channels of the design stream type. Bank height ratio shall not exceed 1.2, and the entrenchment ratio shall be no less than 2.2 within restored riffle cross sections.

8.1.4 Digital Image Stations

Digital images will be used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures. Longitudinal images should indicate the absence of developing bars within the channel or an excessive increase in channel depth. Lateral images should not indicate excessive erosion or continuing degradation of the banks over time. A series of images over time should indicate successional maturation of riparian vegetation.

8.1.5 Headwater Valley Success Criteria (KJ1-A)

Though the above-mentioned performance standards do apply to channels constructed in accordance with the Information Regarding Stream Restoration With Emphasis on the Coastal Plain, Version 2, dated April 4, 2007, referred to here as the Headwater Stream Guidance. Since Reach KJ1-A is being proposed as headwater valley restoration the success criteria for this reach will be more specific to the reestablishment of appropriate hydrology and hydraulics, which leads to the passive development of headwaters stream geomorphology over time.

Channel formation must be documented using indicators consistent with RGL 05-05 in accordance with the following schedule:

a. During monitoring years 1 through 4, the preponderance of evidence must demonstrate a concentration of flow indicative of channel formation within the topographic low-point of the valley or crenulation as documented by the following indicators:
    - Scour (indicating sediment transport by flowing water)
    - Sediment deposition (accumulations of sediment and/or formation of ripples)
    - Sediment sorting (sediment sorting indicated by grain-size distribution within the primary path of flow)
    - Multiple observed flow events (must be documented by gauge data and/or photographs)
    - Destruction of terrestrial vegetation
    - Presence of litter and debris
    - Wracking (deposits of drift material indicating surface water flow)
    - Vegetation matted down, bent, or absent (herbaceous or otherwise)
    - Leaf litter disturbed or washed away

b. During monitoring years 5 through 7, the stream must successfully meet the requirements of standard 2(a) above and the preponderance of evidence must demonstrate the development of stream bed and banks (i.e., an ordinary high water mark) as documented by the following indicators:
    - Bed and banks (may include the formation of stream bed and banks, development of channel pattern such as meander bends and/or braiding at natural topographic breaks, woody debris, or plant root systems)
    - Natural line impressed on the bank (visible high water mark)
    - Shelving (shelving of sediment depositions indicating transport)
    - Water staining (staining of rooted vegetation)
    - Change in plant community (transition to species adapted for flow or inundation for a long duration, including hydrophytes)
    - Changes in character of soil (texture and/or chroma changes when compared to the soils abutting the primary path of flow)

8.2 Wetland Success Criteria

8.2.1 Wetland Hydrology Criteria

The Natural Resources Conservation Service (NRCS) has a current WETs table (1990-2019) for Onslow County upon which to base a normal rainfall amount and average growing season. The closest comparable data station was determined to be the WETS station for New River MCAF, NC. The growing season for Onslow County is 269 days long, extending from March 10 to December 4, and is based on a daily minimum temperature greater than 28 degrees Fahrenheit occurring in five of ten years.

Based upon field observation across the site the NRCS mapping units show a good correlation to actual site conditions in areas of the site. Mitigation guidance for soils in the Coastal Plain suggests a hydroperiod for the Muckalee soil of 12-16 percent of the growing season. The hydrology success criterion for the Site is to restore the water table so that it will remain continuously within 12 inches of the soil surface for 12-16 percent of the growing season (approximately 33 days) at each groundwater gauge location. Due to the extensive drainage efforts, it may take at least a year for the site to become completely saturated and reach the target hydroperiods.

8.3 Vegetation Success Criteria

Specific and measurable success criteria for plant density within the riparian buffers on the Project will follow IRT Guidance. The interim measures of vegetative success for the Project will be the survival of at least 320 planted three-year old trees per acre at the end of Year 3, 260 five-year old trees at seven feet in height at the end of Year 5, and the final vegetative success criteria will be 210 trees per acre with an average height of ten feet at the end of Year 7. Volunteer trees that are listed on the approved planting list will be counted, identified to species, and included in the yearly monitoring reports, and if established for two or more years, may be counted towards the success criteria of total planted stems,. Moreover, any single species can only account for up to 50 percent of the required number of stems within any vegetation plot. Any stems in excess of 50 percent will be shown in the monitoring table but will not be used to demonstrate success.

9 MONITORING PLAN

Annual monitoring data will be reported using the DMS Monitoring Report Template dated June 2017 and NC IRT monitoring template. The monitoring report shall provide a project data chronology that will facilitate an understanding of project status and trends, research purposes, and assist in decision making regarding project close-out. Monitoring reports will be prepared annually and submitted to DMS. Monitoring of the Project will adhere to metrics and performance standards established by the USACE's April 2003 Wilmington District Stream Mitigation Guidelines and the NC IRT's October 2016 Wilmington District Stream and Wetland Compensatory Mitigation Update. **Table 15** outlines the links between project objectives and treatments and their associated monitoring metrics and performance standards within the context of functional uplift based on the Stream Functions Pyramid Framework and a Site Hydric Soils Detailed Study. **Figure 10** depicts the proposed monitoring plan, including approximate numbers and locations of monitoring devices for the Project.

9.1 As-Built Survey

An as-built survey will be conducted following construction to document channel size, condition, and location. The survey will include a complete profile of thalweg, water surface, bankfull, and top of bank to compare with future geomorphic data. Longitudinal profiles will not be required in annual monitoring reports unless requested by USACE.

9.2 Visual Monitoring

Visual monitoring of all mitigation areas will be conducted a minimum of twice per monitoring year (MY) by qualified individuals. The visual assessments will include vegetation density, vigor, invasive species, and easement encroachments. Visual assessments of stream stability will include a complete streamwalk and structure inspection. The culvert crossing on KJ1-B will be monitored during the complete streamwalk to make sure any necessary repairs will be made. Digital images will be taken at fixed representative locations to record each monitoring event, as well as any noted problem areas or areas of concern. Fixed image locations will exist at each cross section, each vegetation plot, each stage recorder, and each groundwater well. Images will also be taken at the crossing in the middle of the project and the terminal end under Kinston Highway. Results of visual monitoring will be presented in a plan view exhibit with a brief description of problem areas and digital images. Photographs will be used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of channel structures. Longitudinal photos should indicate the absence of developing bars within the channel or an excessive increase in channel depth. Lateral photos should not indicate excessive erosion or continuing degradation of the banks over time. A series of photos over time should indicate successional maturation of riparian vegetation. Three ditches drain into the beginning of the headwater valley channel, one more into KJ1-B, and two into KJ1-C. These ditches will be monitored to minimize erosion potential. With the potential for beaver population onsite, the possibility for beaver management practices will need to be put in place.

9.3 Stream Hydrology Events

Continuous stage recorders, devices that utilize automatic-logging pressure transducers that are capable of documenting the height, frequency, and duration of bankfull events will be installed on Priority 2 Restoration reaches. A minimum of one stage recorder will be installed on each tributary that is greater than 1,000 feet in length, with one gauge required for every 5,000 feet of length on each tributary and a maximum of five gauges per tributary. Additionally, where restoration activities are proposed for intermittent streams, monitoring flow gauges should be installed to track the frequency and duration of stream flow events. There will be one flow gauge installed on KJ1-A and one stage recorder installed on KJ1-C.

9.3.1 Headwater Valley Specific Monitoring Plan (KJ1-A)

Headwater stream monitoring will be conducted for 7 years, with monitoring events occurring every year. Surface water flow will be documented using a flow gauge. The flow gauge will be located within the anticipated primary path of flow within the low point of the valley to ensure all flow events are captured and placed along the topographic low point of the valley as necessary to document the upstream end of channel forming flows. The number of gauge stations to be installed should be based on relevant factors, including pre and post-construction site conditions, valley slope and length, watershed size, adjacent wetlands, etc., and should be sufficient to document the upper end of stream formation when considered with the required field indicators listed in the performance standards as is required in the October 2016 Wilmington District Stream and Wetland Compensatory Mitigation Update. Channel formation within the valley or crenulation will be documented through the identification of field indicators consistent with those listed in Regulatory Guidance Letter No. 05-05. Identified field indicators (listed in the performance standards above) must be documented using data sheets and photographs, and their location must be shown on a plan view of the site to be included with the annual monitoring report. Additional monitoring and/or analysis may be necessary in the event of abnormal climactic conditions.

9.4 Cross Sections

Permanent cross sections will be installed at an approximate frequency of one per 20 bankfull widths with half in pools and half in riffles on all Restoration reaches. Morphological data will be measured and recorded for all cross-sections; however, only riffle cross sections will include bank height ratio and entrenchment ratio measurements. Cross sections will be monitored in Years 1, 2, 3, 5, and 7. The initial plan is to install three cross sections on KJ1-A, four on KJ1-B, and eight on KJ1-C.

9.5 Wetland Hydrology

Wetland hydrology will be monitored to document hydrologic conditions in the wetland re-establishment areas. This will be accomplished with automatic recording pressure transducer gauges installed in representative locations across the re-establishment area. The gauges will be downloaded quarterly and wetland hydroperiods will be calculated during the growing season. Gauge installation will follow current NCIRT guidance. Visual observations of primary and secondary wetland hydrology indicators will also be recorded during quarterly site visits. Three wetland gauges will be installed in the wetland to measure these conditions. An additional gauge will be added in the adjacent upland area to help determine the wetland boundary.

9.6 Vegetation Monitoring

Vegetation monitoring plots will be a minimum of 0.02 acres in size and cover a minimum of two percent of the planted area. There will be 14 plots within the planted area (16.35 acres). Plots will be a mixture of fixed and random plots, with nine fixed plots and five random plots (**Figure 10**). Planted area indicates all area in the easement that will be planted with trees. The following data will be recorded for all trees in the fixed plots: species, height, planting date (or volunteer), and grid location. For random plots, species and height will be recorded for all woody stems. The location (GPS coordinates and orientation) of the random plots will be identified in the annual monitoring reports. As discussed in **Section 7.2.3**, it is expected that some open water/marsh pockets may persist in localized areas within the Project area. Therefore, RES will attempt to avoid establishing vegetation plots in these potential areas. In the event that these areas become too large (greater than 0.1 acres) or more widespread throughout the Project, RES will document and map the areas to determine if any adaptive management is necessary. Vegetation will be planted and plots established at least 180 days prior to the initiation of the first year of monitoring. Monitoring will occur in Years 1, 2, 3, 5, and 7 between July 1st and leaf drop. Invasive and noxious species will be monitored so that none become dominant or alter the desired community structure of the Project. If necessary, RES will develop a species-specific treatment plan.

9.7 Scheduling/Reporting

A baseline monitoring report and as-built drawings documenting stream restoration activities will be developed within 60 days of the planting completion on the Project. The report will include all information required by DMS mitigation plan guidelines, including elevations, photographs and sampling plot locations, gauge locations, and a description of initial species composition by community type. The report will also include a list of the species planted and the associated densities, any redline drawings and soil profiles from well locations on site. Baseline vegetation monitoring will include species, height, date of planting, and grid location of each stem. The baseline report will follow DMS As-Built Baseline Monitoring Report Template June 2017, USACE guidelines, and the October 2017 Mitigation Credit Calculation Memo.

The monitoring program will be implemented to document system development and progress toward achieving the success criteria. The restored stream morphology will be assessed to determine the success of the mitigation. The monitoring program will be undertaken for seven years or until the final success criteria are achieved, whichever is longer.

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to DMS. The monitoring reports will include all information and be in the format required by USACE.

Table 15. Monitoring Requirements

Treatment	Objective	Monitoring Metric	Performance Standard
Convert land-use of Project reaches from row-crop to riparian forest and wetland	Improve the transport of water from the watershed to the channel in a non-erosive manner and maintain appropriate wetland hydrology for Muckalee soil series	Groundwater wells with pressure transducers: Downloaded quarterly	Water table within 12 inches of the ground surface for 12-16% of growing season (33 days of the growing season)
Reduce bank height ratios and increase entrenchment ratios by reconstructing channels to mimic reference reach conditions	Improve flood bank connectivity by reducing bank height ratios and increase entrenchment ratios	Stage recorders: Inspected semiannually	Four bankfull events occurring in separate years
		Flow gauges: Inspected quarterly	30+ days of continuous flow along the headwater valley
		Cross sections monitored annually Yearly photos taken and data sheets used to mark changes	Identify sediment sorting, scouring, sediment deposition and observe multiple flow events
			Identify bed and bank development, visible high-water marks, shelving, water staining, change in plant community and changes in soil character
		Cross sections: Surveyed in MY 1, 2, 3, 5 and 7	Entrenchment ratio shall be no less than 2.2 within restored reaches
			Bank height ratio shall not exceed 1.2
Establish a riparian buffer to limit erosion and sediment input to Project streams. Establish stable banks with livestakes, erosion control matting, and other in stream structures.	Limit erosion rates and maintain channel stability Improve bedform diversity (pool spacing, percent riffles, etc.) Increase buffer width to 50 feet	As-built stream profile	N/A
		Cross sections: Surveyed in MY 1, 2, 3, 5 and 7	Entrenchment ratio shall be no less than 2.2 within restored reaches
			Bank height ratio shall not exceed 1.2
		Visual monitoring: Performed at least semiannually	Identify and document significant stream problem areas; i.e. erosion, degradation, aggradation, etc.
		Vegetation plots: Surveyed in MY 1, 2, 3, 5 and 7	MY 1-3: ≥320 trees/acre MY 5: ≥260 trees/acre (7 ft. tall) MY 7: ≥210 trees/acre (10 ft. tall)
Restore wetland hydrology and plant and protect riparian buffer and riparian wetland	Promote sediment filtration, nutrient cycling, and organic accumulation through natural wetland biogeochemical processes	Groundwater wells with pressure transducers: Downloaded quarterly (*indirect measurement*)	Water table within 12 inches of the ground surface for 12-16% of growing season (33 days of the growing season)

	Establish native hardwood riparian buffer and high-functioning riparian wetland.	Vegetation plots: Surveyed in MY 1, 2, 3, 5 and 7 (*indirect measurement*)	MY 1-3: ≥320 trees/acre MY 5: ≥260 trees/acre (7 ft. tall) MY 7: ≥210 trees/acre (10 ft. tall)
	Protect aquatic resources in perpetuity	Visual assessment of established conservation signage: Performed at least semiannually (*indirect measurement*)	Identify and document any damaged or missing signs or easement markers.

10 ADAPTIVE MANAGEMENT PLAN

In the event the mitigation project or a specific component of the mitigation project fails to achieve the necessary performance standards as specified in the mitigation plan, the sponsor shall notify the members of the IRT and work with the IRT to develop contingency plans and remedial actions. Additionally, routine maintenance activities for the Project are outlined in **Appendix F**.

11 LONG-TERM MANAGEMENT PLAN

The Project will be transferred to the NCDEQ Stewardship Program (or 3rd party if approved). This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. Funding will be supplied by the responsible party on a yearly basis until such time an endowment is established. The NCDEQ Stewardship Program is developing an endowment system within the nonreverting, 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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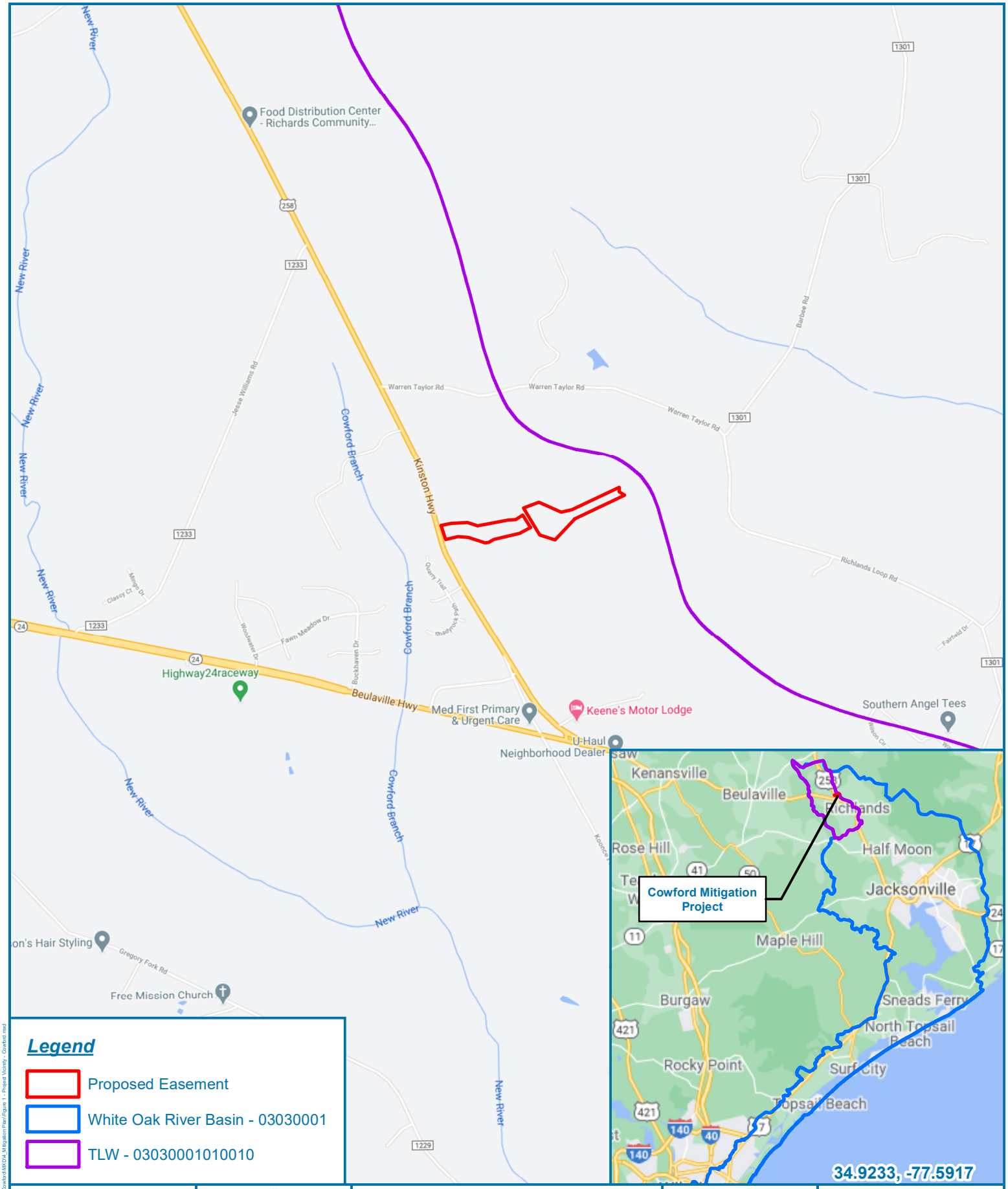
Figure 8: Conceptual Design Plan

Figure 9: Buffer Width Zones

Figure 10: Monitoring Plan

Figure 11: 1YR Inundation Map

Figure 12: 10YR Inundation Map



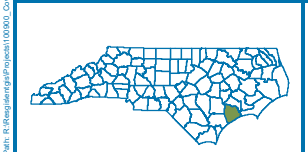


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Figure 1 - Project Vicinity

Cowford Mitigation Project

Onslow County, North Carolina

Date: 1/18/2021

Drawn by: GDS

Checked by: MDE

1 inch = 2,000 feet

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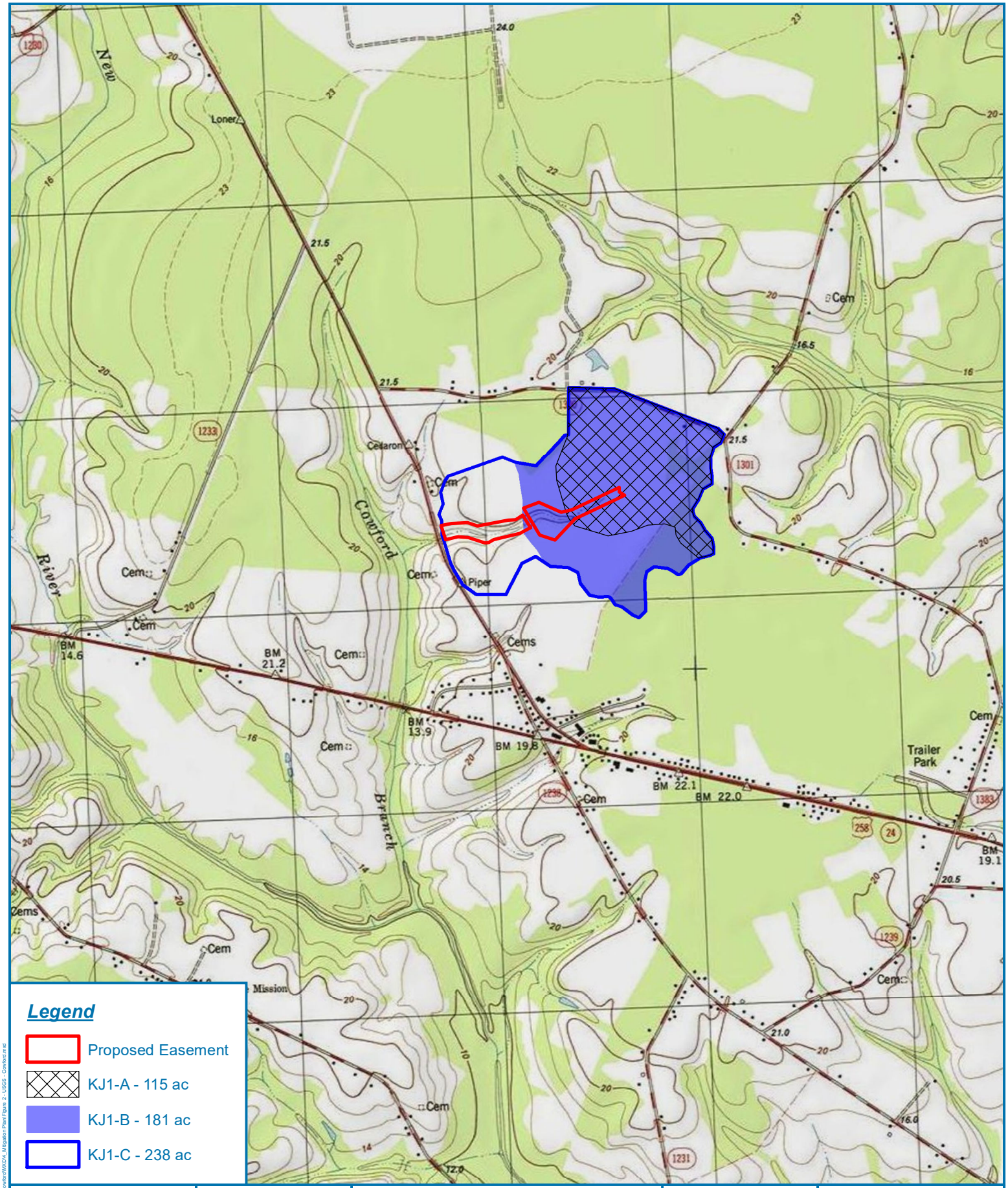

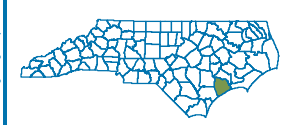

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Figure 2 - USGS
Richlands (1981)

Cowford Mitigation Project

Onslow County, North Carolina

Date:	1/14/2021
Drawn by:	GDS
Checked by:	MDE
1 inch = 2,000 feet	

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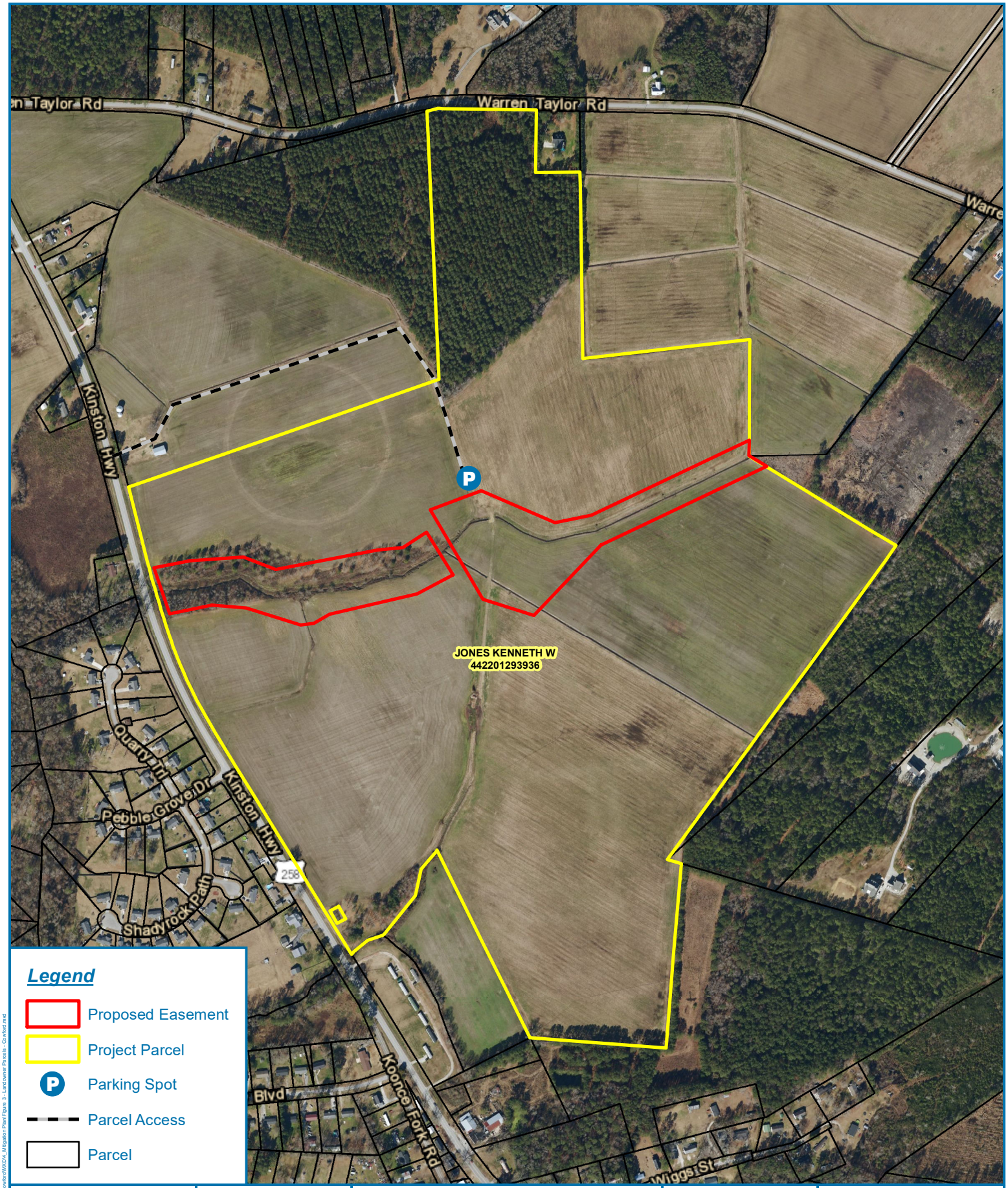

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Figure 3 - Landowner Parcel

Cowford Mitigation Project

Onslow County, North Carolina

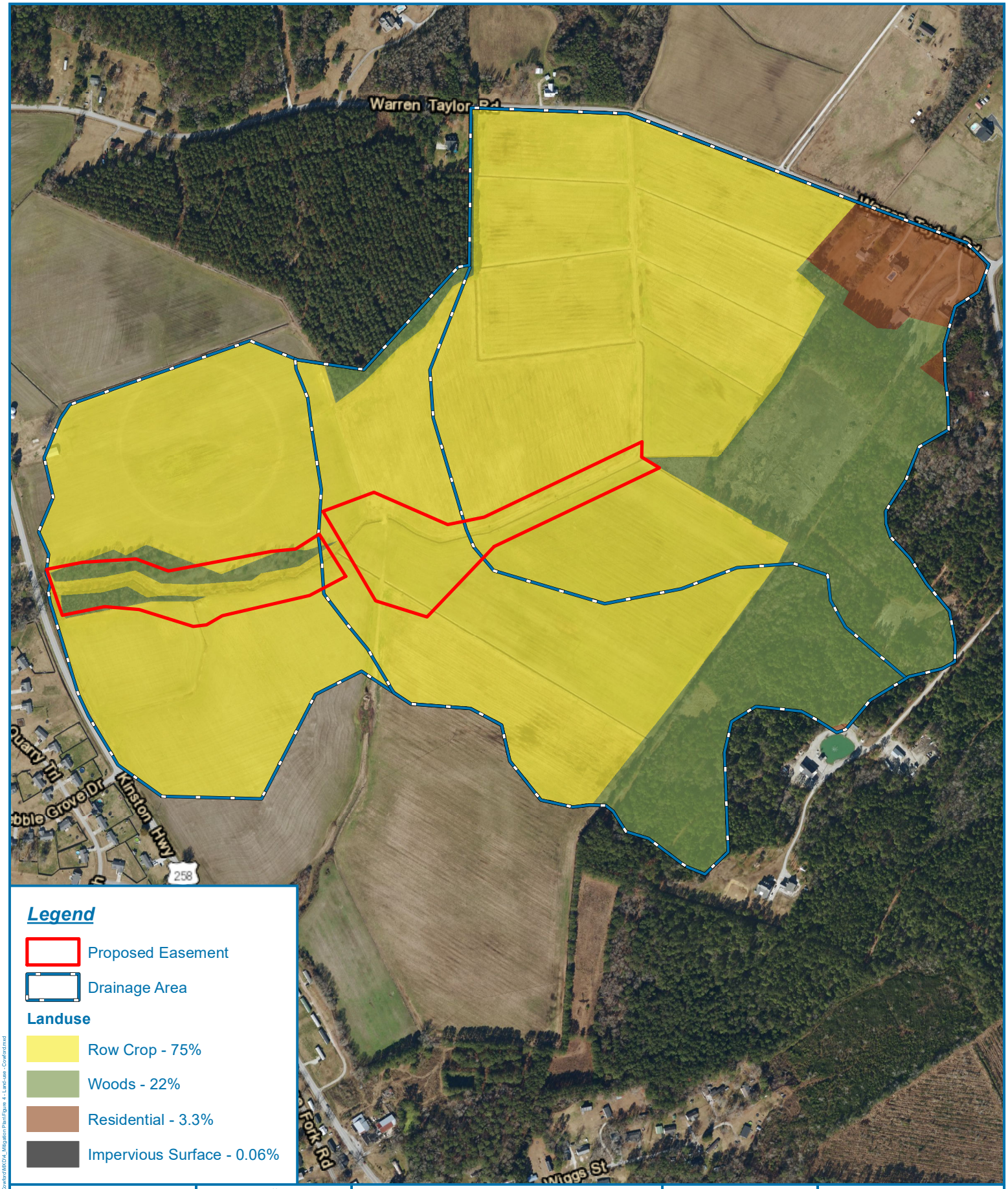
Date: 1/14/2021

Drawn by: GDS

Checked by: MDE

1 inch = 600 feet

Document Path: R:\Regulatory\Projects\100900_Cowford\MXD\4_Mitigation Plan\Figure 3 - Landowner Parcels - Cowford.mxd



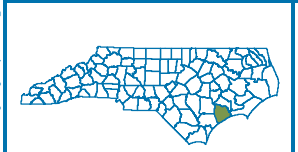


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Figure 4 - Land-use

Cowford Mitigation Project

Onslow County, North Carolina

Date: 1/14/2021

Drawn by: GDS

Checked by: MDE

1 inch = 600 feet

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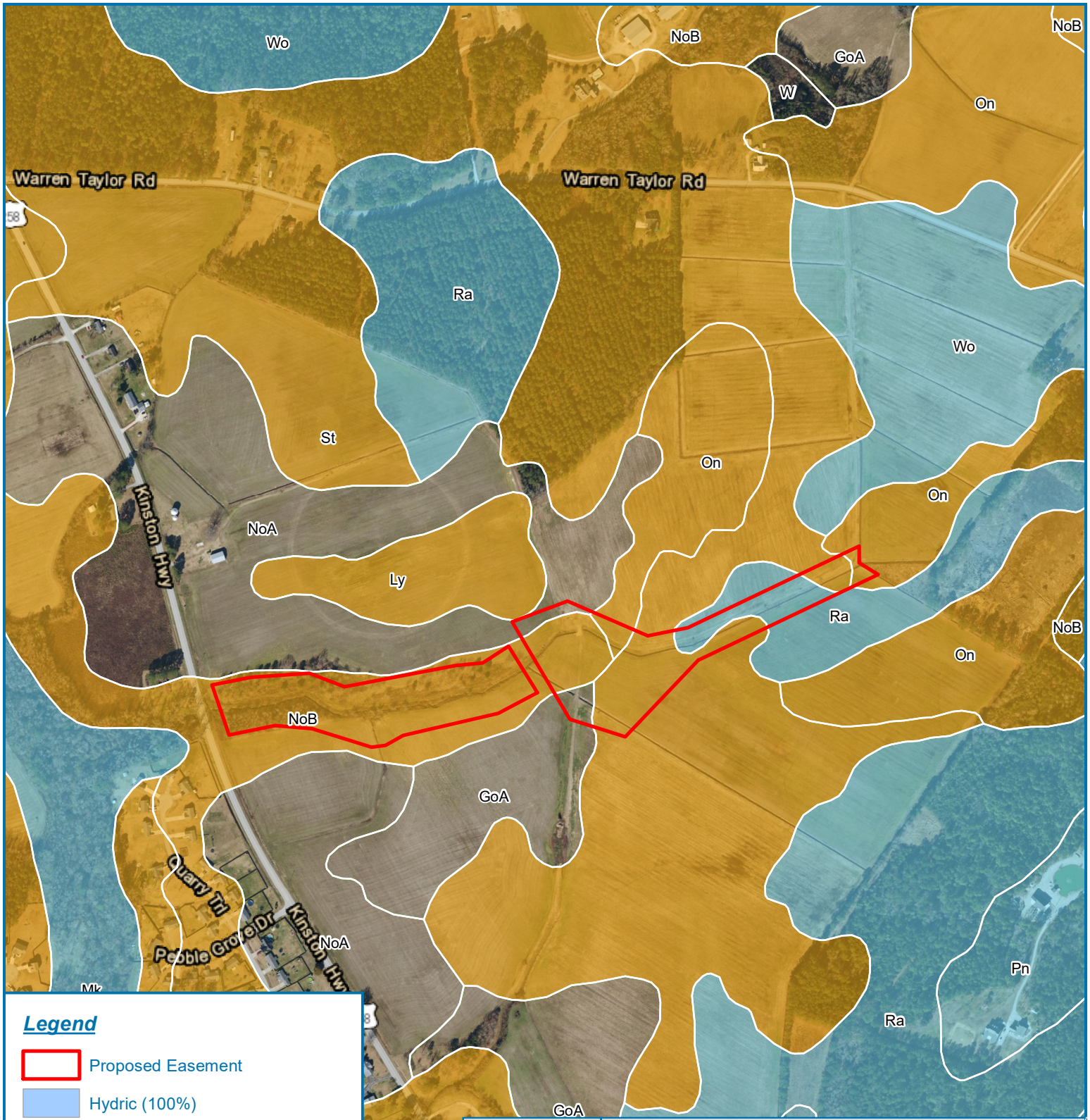
Document Path: R:\Regulatory\Projects\100900_Cowford\MXD\4_Mitigation Plan\Figure 4 - Land-use - Cowford.mxd



Legend

- Proposed Easement
- Hydric (100%)
- Predominantly Hydric (66-99%)
- Predominantly Hydric (33-65%)
- Predominantly Nonhydric (1-32%)
- Nonhydric (0%)

Map Unit Symbol	Map Unit Name
GoA	Goldsboro fine sandy loam, 0% to 2% slopes
NoA	Norfolk loamy fine sand, 0% to 2% slopes
NoB	Norfolk loamy fine sand, 2% to 6% slopes
On	Onslow loamy fine sand
Ra	Rains fine sandy loam, 0% to 2% slopes
St	Stallings loamy fine sand

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Figure 5 - Mapped Soils

Cowford Mitigation Project

Onslow County, North Carolina

Date: 1/14/2021

Drawn by: GDS

Checked by: MDE

1 inch = 600 feet

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Document Path: R:\Regulatory\Projects\100900_Cowford\MXD\4_Mitigation Plan\Figure 5- Mapped Soils - Cowford.mxd

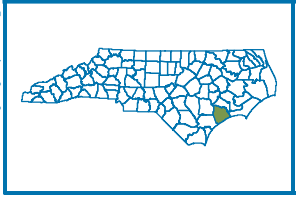

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Figure 6 - Historic Imagery

Cowford Mitigation Project

Onslow County, North Carolina

Date: 1/14/2021

Drawn by: GDS

Checked by: MDE

1 inch = 1,000 feet

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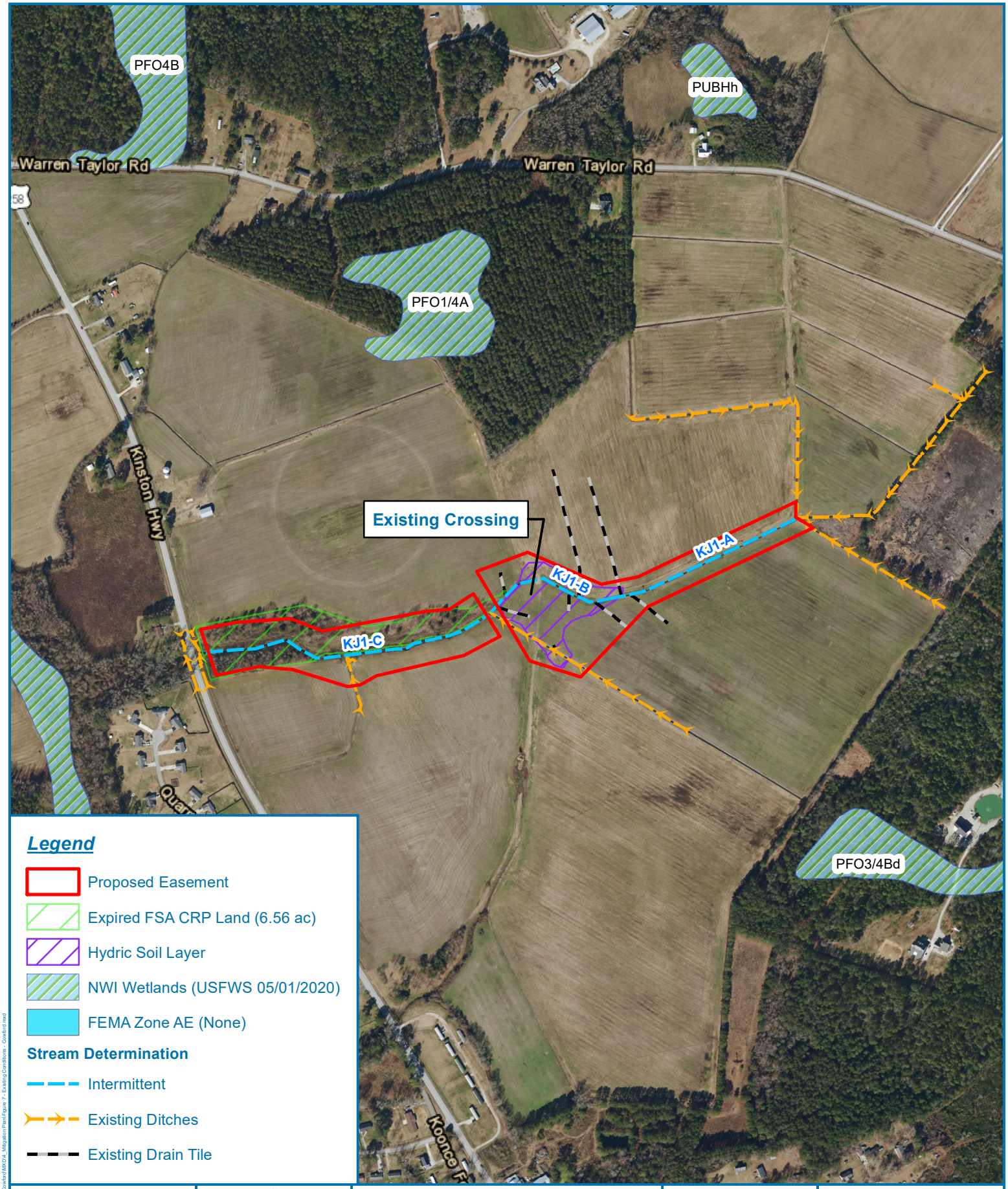

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Figure 7 - Existing Conditions

Cowford Mitigation Project

Onslow County, North Carolina

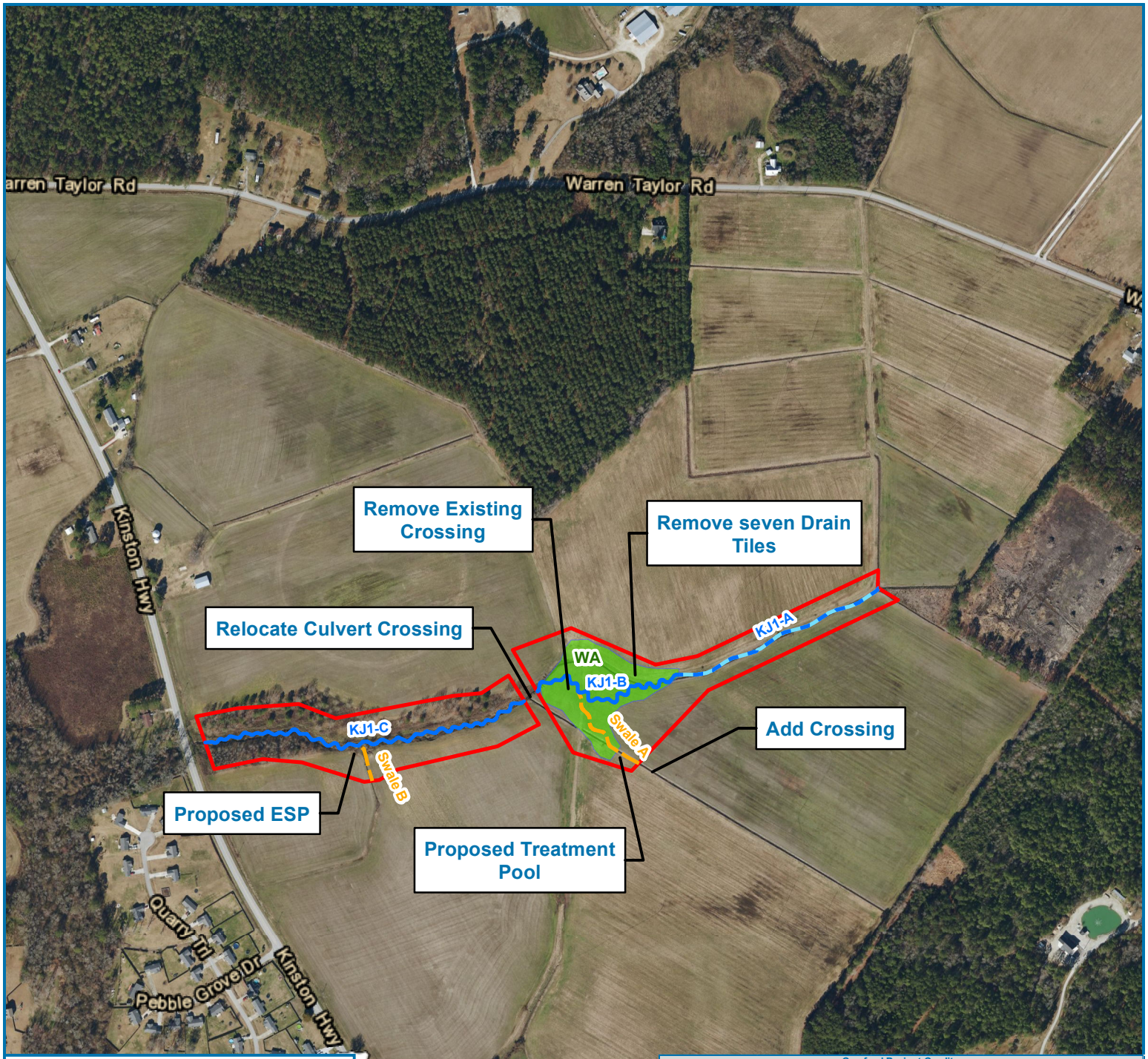
Date: 1/14/2021

Drawn by: GDS

Checked by: MDE

1 inch = 600 feet

Document Path: R:\Regulatory\Projects\100900_Cowford\MXD\4_Mitigation Plan\Figure 7 - Existing Conditions - Cowford.mxd



Legend

Proposal Easement (17.20 ac)

Mitigation Approach

Re-establishment

Restoration

Restoration (HWV)

Project Swale

Cowford Project Credits

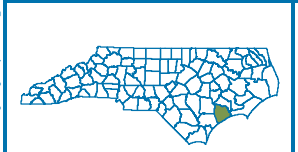
Reach	Mitigation Type	Proposed Length (LF)	Mitiation Ratio	SMUs
KJ1-A	Restoration (HWV)*	923	1:1	913.000
KJ1-B	Restoration	852	1:1	852.000
KJ1-C	Restoration	1,572	1:1	1,572.000
	Total	3,347		3,337.000
			**Credit Loss in Required Buffer	-76.450
			**Credit Gain for Additional Buffer	278.120
			Total Adjusted SMUs	3,538.670

*Headwater valley restoration length is calculated from valley length

**Stream Credit adjustments for additional buffer were not calculated on any HWV reach (USACE, 2018)

Cowford Wetland Credits

Proposed Wetland	Mitigation Type	Total Acres	Mitigation Ratio	WMUs
WA	Re-establishment	2.991	1:1	2.991
Total		2.991		2.991



N W E S

0 300 600

Feet

Figure 8 - Conceptual

Cowford Mitigation Project

Onslow County, North Carolina

Date: 3/25/2021

Drawn by: GDS

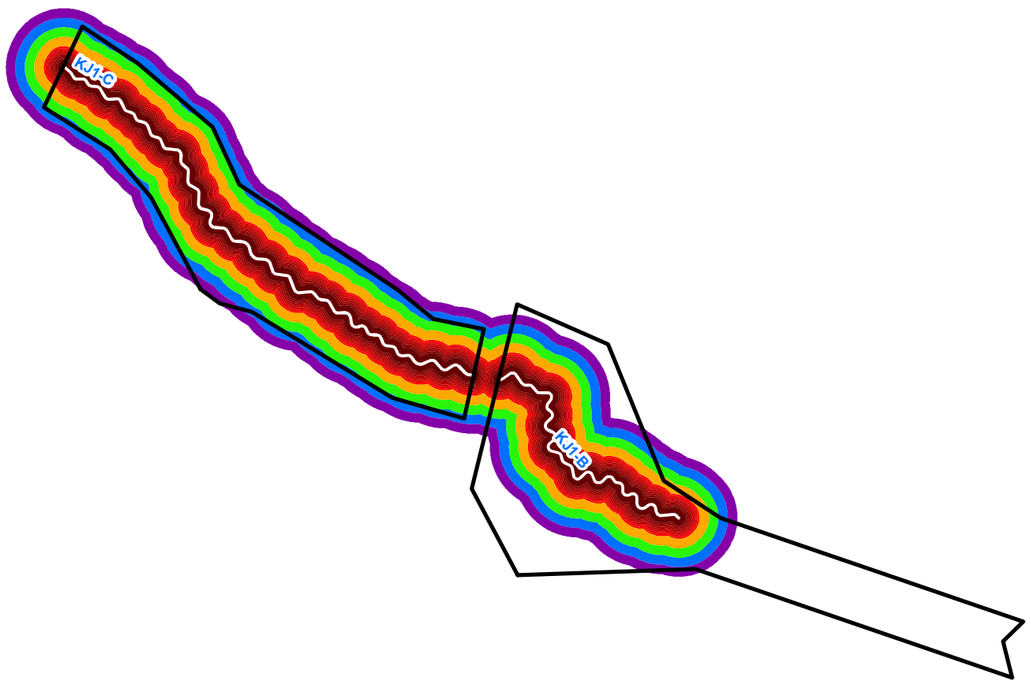
Checked by: MDE

1 inch = 600 feet

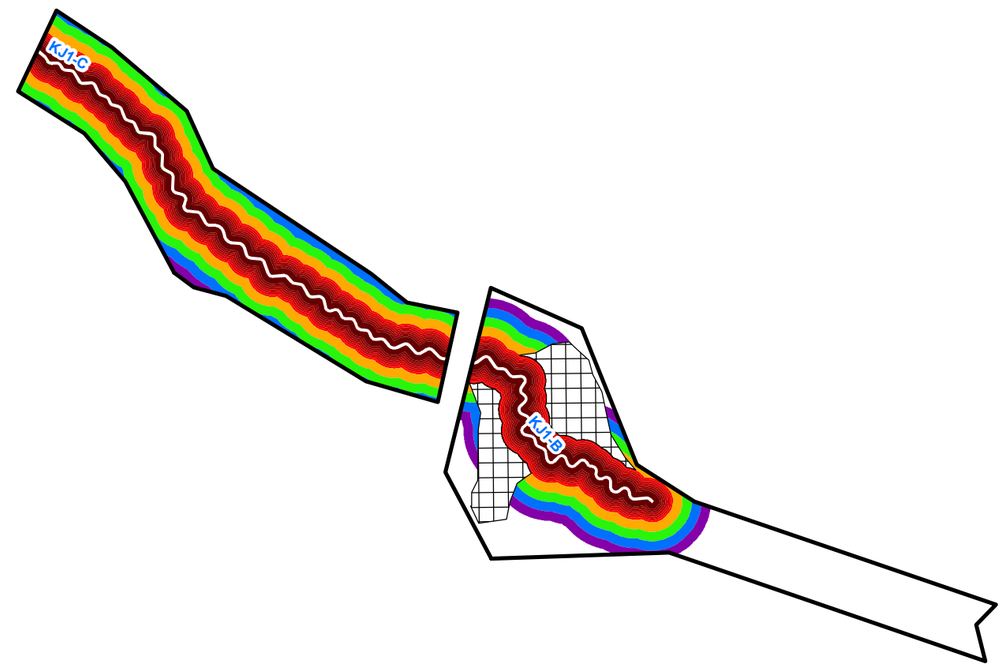
res

Document Path: R:\Regulatory\Projects\100900_Cowford\MXD\4_Mitigation Plan\Figure 8 - Conceptual - Cowford.mxd

Ideal Buffers



Actual Buffers



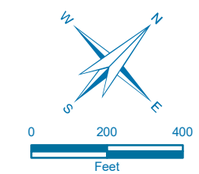


Figure 9 - Buffer Width Zones

Cowford Mitigation Project

Onslow County, North Carolina

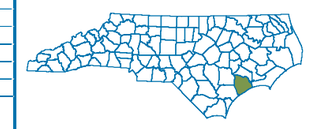
Date: 1/25/2021	Drawn by: GDS
Checked by: MDE	1 in = 400 feet

Legend

- Proposed Easement
- Ineligible Area

Buffer Width Zone

- 0-15 feet
- 16-20 feet
- 21-25 feet
- 26-30 feet
- 31-35 feet
- 36-40 feet
- 41-45 feet
- 46-50 feet
- 51-75 feet
- 76-100 feet
- 101-125 feet
- 126-150 feet
- Project Stream

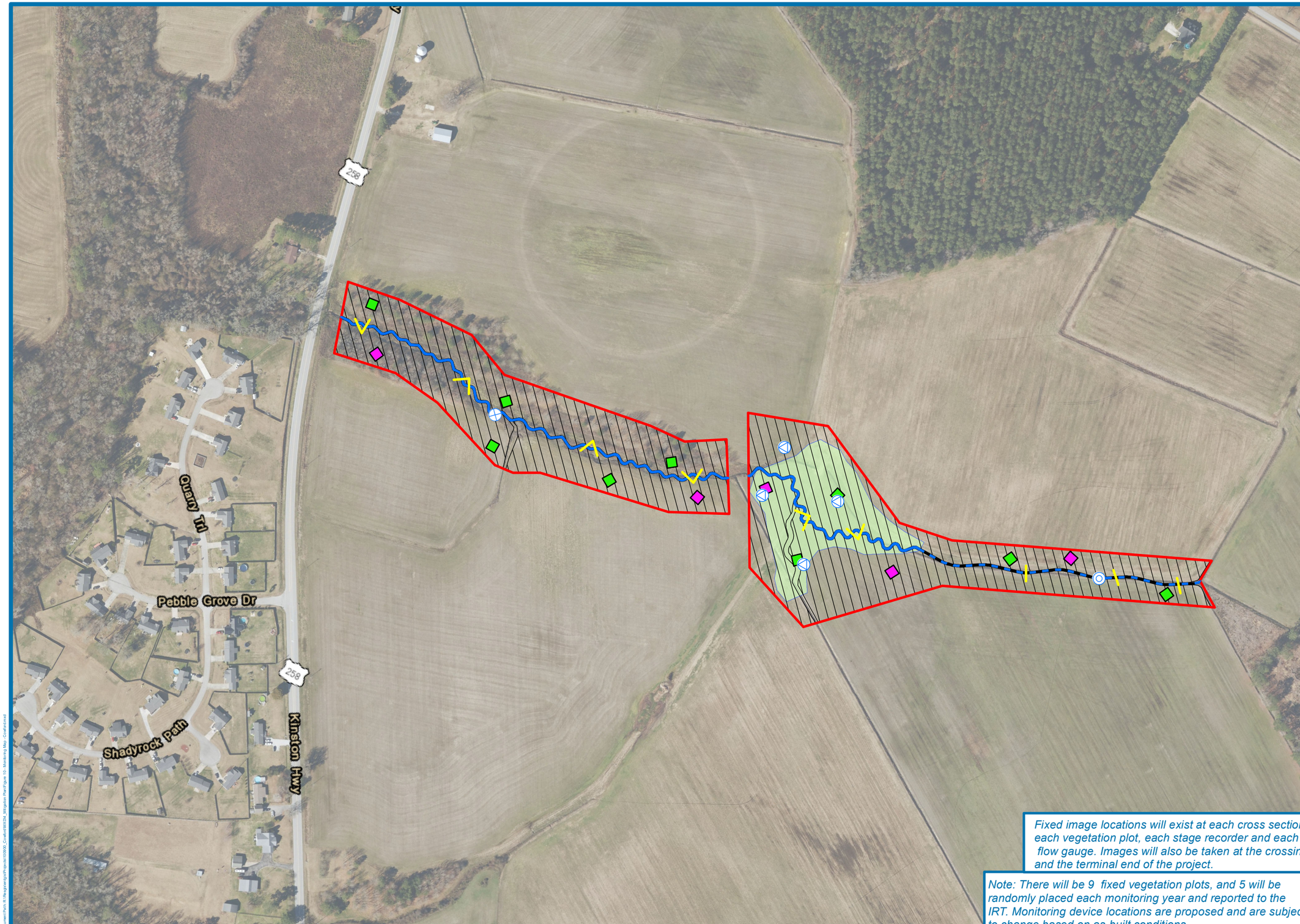


Buffer Width Zone (feet from Ordinary High Water Mark)

Buffer Zones	less than 15 feet	>15 to 20 feet	>20 to 25 feet	>25 to 30 feet	>30 to 35 feet	>35 to 40 feet	>40 to 45 feet	>45 to 50 feet	>50 to 75 feet	>75 to 100 feet	>100 to 125 feet	>125 to 150 feet
Max Possible Buffer (square feet)	73,073	24,515	24,593	24,672	24,750	24,829	24,907	24,986	126,106	128,069	130,031	131,994
Ideal Buffer (square feet)	73,975	24,360	24,219	24,210	24,217	23,943	23,857	23,838	120,047	122,584	125,658	128,943
Actual Buffer (square feet)	72,568	23,412	23,029	22,777	22,582	22,430	222,327	22,259	90,184	91,047	52,051	27,220
Zone Multiplier	50%	10%	10%	10%	5%	5%	5%	5%	7%	5%	4%	4%
Buffer Credit Equivalent	1,212	242	242	242	121	121	121	121	170	121	97	97
Percent of Ideal Buffer	98%	97%	96%	95%	100%	95%	95%	95%	75%	74%	41%	21%
Credit Adjustment	-20	-8	-10	-12	0	-6	-6	-6	127	90	40	20

Total Baseline Credit	Credit Loss in Required Buffer	Credit Gain for Additional Buffer	Net Change in Credit from Buffers	Total Credit
2,424.000	-76.450	278.120	201.670	2,625.670

Document Path: R:\Regional\gis\Projects\100930_Cowford\MXD\4_Mitigation Plan\Figure 9 - Buffer Width Zones - Cowford.mxd



N
W
E
S

0 150 300
Feet

Figure 10 - Monitoring Plan

Cowford Mitigation Project

Onslow County, North Carolina

Date: 1/25/2021	Drawn by: GDS
Checked by: RTM	1 in = 300 feet

Legend

- Proposed Easement - 17.20 ac
- Proposed Wetland
- Planted Area - (16.35

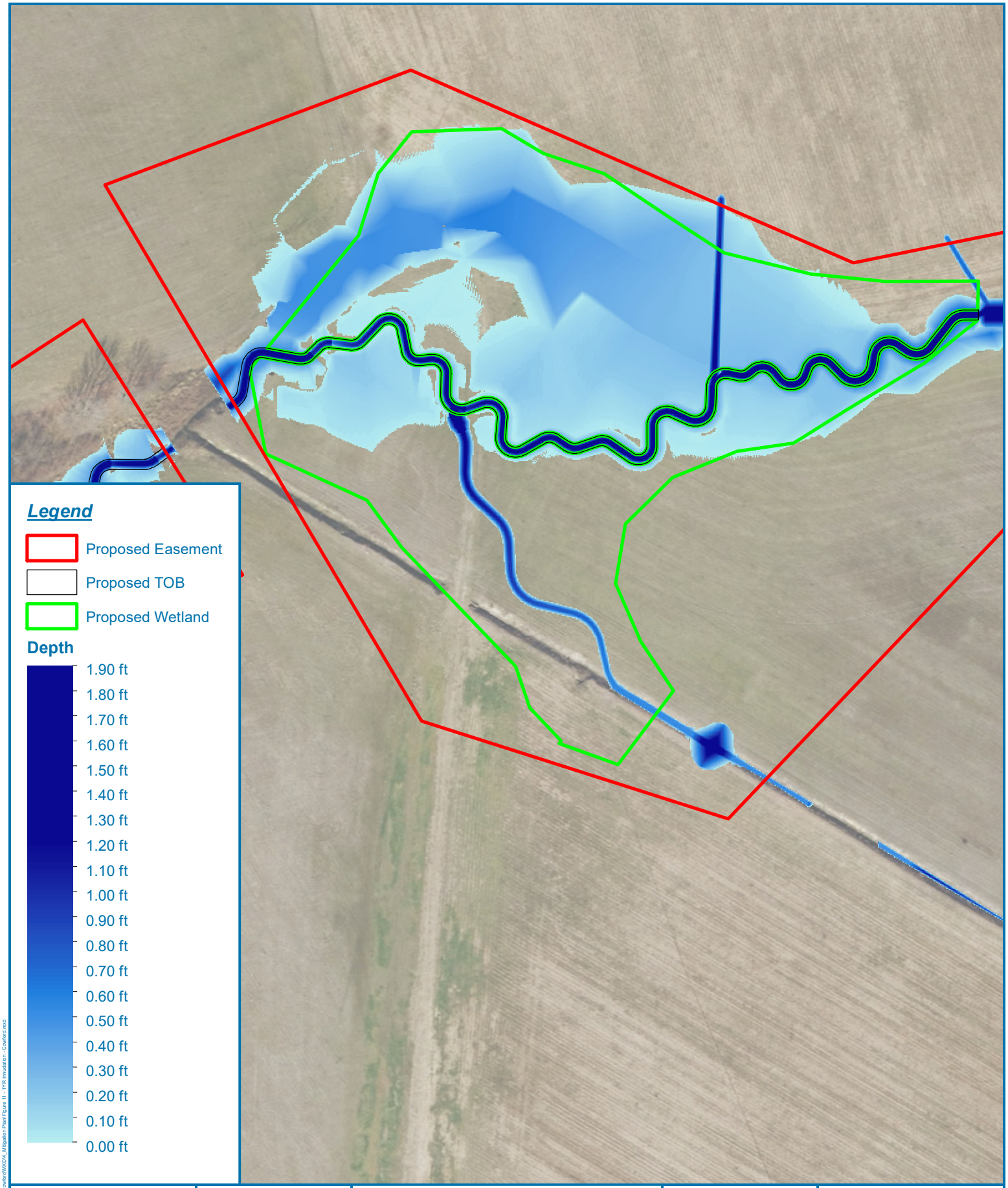
Monitoring Devices

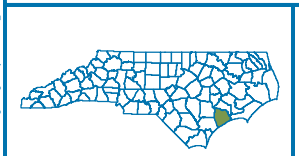
- Fixed Plot
- Random Plot
- Proposed Stream
- HWV Restoration Stream
- Flow Gauge
- Stage Recorder
- Wetland Well
- Cross Section

Fixed image locations will exist at each cross section, each vegetation plot, each stage recorder and each flow gauge. Images will also be taken at the crossing and the terminal end of the project.

Note: There will be 9 fixed vegetation plots, and 5 will be randomly placed each monitoring year and reported to the IRT. Monitoring device locations are proposed and are subject to change based on as-built conditions.

Document Path: R:\Raggsvlyn\Projects\100600_Cowford\MXD\4_Mitigation Plan\Figure 10 - Monitoring Map - Cowford.mxd





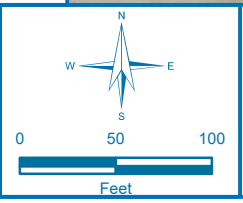


Figure 11 - 1YR Inundation Map

Cowford Mitigation Project

Onslow County, North Carolina

Date: 1/25/2021

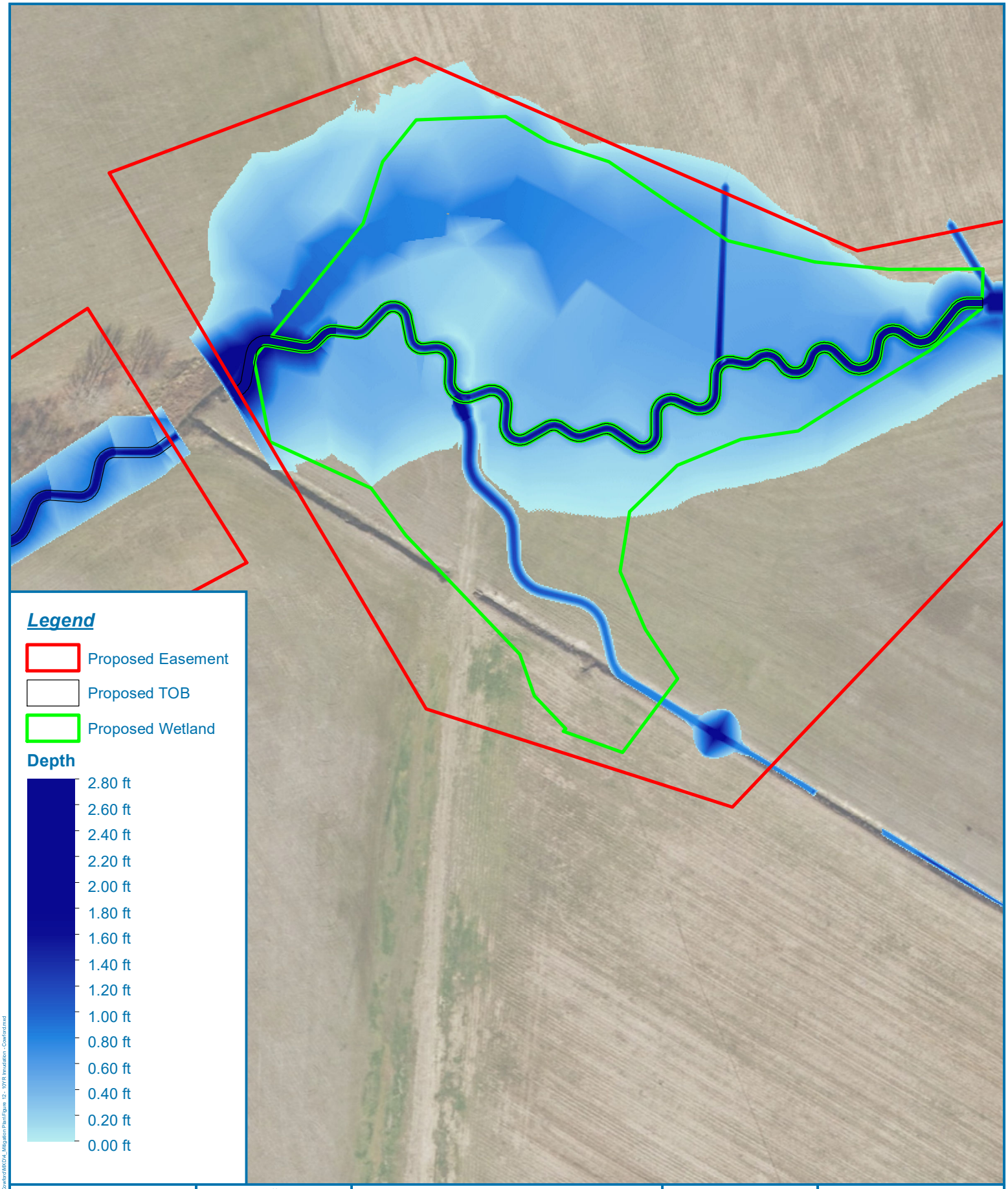
Drawn by: GDS

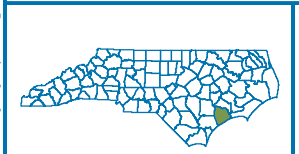
Checked by: MDE

1 inch = 100 feet

res

Document Path: R:\Regulatory\Projects\100900_Cowford\MXD\04_Mitigation Plan\Figure 11 - 1YR Inundation - Cowford.mxd





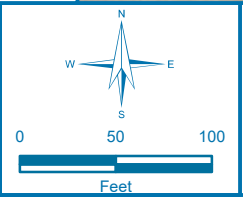


Figure 12 - 10YR Inundation Map

Cowford Mitigation Project

Onslow County, North Carolina

Date: 1/19/2021

Drawn by: GDS

Checked by: MDE

1 inch = 100 feet

Document Path: R:\Regulatory\Projects\100900_Cowford\MXD\04_Mitigation Plan\Figure 12 - 10YR Inundation - Cowford.mxd

Appendix B

- DMS IRT Site Visit Minutes
- Project Morphological Table
- Project Cross-section Plots and Photos
- Reference Reach Cross-section Plots and Photos
- WETS Table
- Background Attribute Table

IRT Meeting Notes

M E M O R A N D U M

302 Jefferson Street, Suite 110 Raleigh, North Carolina 27605 919.209.1052 tel.
919.829.9913 fax

TO: **Lindsay Crocker, DMS**

FROM: **Brad Breslow, RES**

DATE: **June 6, 2019**

RE: **Cowford Post-Contract IRT Site Visit Minutes**
CU: 03030001
DEQ Contract No: 7746
DMS Project ID: 100095
County: Onslow
DMS Project Manager: Lindsay Crocker

Meeting Details
Date/Time: April 17th, 2019, 10:00 AM
IRT Attendees: Todd Tugwell (USACE), Mac Haupt (DWR), Erin Davis (DWR)
DMS Attendees: Lindsay Crocker (DMS), Jeff Schaffer (DMS), Jeremiah Dow (DMS)
RES Attendees: David Godley (RES), Jeremy Schmid (RES), Frasier Mullen (RES), George Lankford (sub)

General Summary
IRT members agreed that the Cowford Site (the "Site") is acceptable for compensatory mitigation after some of their concerns are addressed. While the Site poses many challenges and associated risks, the Group agreed that the proposed project has the potential to provide functional uplift to the New River watershed.

General discussion with IRT members included voicing their concerns over the lack of drainage area and slope in the upper end of the stream reach. IRT suggested that a headwater valley approach could be used in this section, but RES would still need to provide documentation of flow.

Main concerns discussed include:

- The IRT recommended relocating the stream crossing proposed at the middle of the project to the upstream end if possible;
- RES should consider including a wider buffer around the proposed wetland to prevent outside ditching effects;
- RES will need to ensure drain tiles are removed from inside the easement;
- There was discussion of the stream design approach at the upper end where 3 ditches confluence to drain approximately 78 acres. The IRT expressed concern about the lack of fall across the reach and the resulting Priority II needed to achieve flow and prevent hydrologic trespass. Both Priority II and headwater valley approaches were discussed for the upper reach above the wetland, and Priority I below the wetland;
- RES will need to document flow within the upper reach through gauges if designed as a headwater valley. The use of cameras, video, and gauges to help substantiate flow was recommended;

- There was discussion that trees planted in the CRP easement could be used for in-stream structures. The group also discussed the possibility of leaving desirable species but also felt it would be ok to remove them pending WRC input at mitigation plan;
- The IRT would prefer to see a single thread channel proposed in drainage areas larger than 100 acres.

Morphological Parameters

Cowford Morphological Parameters

	Reference Reach		Existing						Design			
	Buffalo Branch		KJ1-A		KJ1-B		KJ1-C		KJ1-B		KJ1-C	
Feature	Riffle	Pool	Riffle		Riffle		Riffle	Riffle	Riffle	Pool	Riffle	Pool
Drainage Area (ac)	709		115		181		238		181		238	
Drainage Area (mi^2)	1.11		0.18		0.28		0.37		0.28		0.37	
NC Regional Curve Discharge (cfs)[2]	18		5		7		8		7		8	
VA Regional Curve Discharge (cfs)[3]	30		10		13		16		13		16	
Design/Calculated Discharge (cfs)[1]	**17**		-		-		-		**5**		**8**	
Dimension												
BKF Cross Sectional Area (ft^2)	12.8	11.8	3.8		4.5		6.5	8.2	5.0	8.8	5.0	8.8
BKF Width (ft)	12.3	8.5	4.1		4.9		6.7	6.6	8.0	10.0	8.0	10.0
BKF Mean Depth (ft)	1.1	1.4	0.9		0.9		1.0	1.2	0.6	0.9	0.6	0.9
BKF Max Depth (ft)	1.8	2.2	1.2		1.3		1.5	1.7	1.0	1.6	1.0	1.6
Wetted Perimeter (ft)	13.2	10.1	5.4		5.8		7.6	8.0	8.3	10.6	8.3	10.6
Hydraulic Radius (ft)	1.0	1.2	0.7		0.8		0.9	1.0	0.6	0.8	0.6	0.8
Width/Depth Ratio	12.3	6.2	4.3		5.3		6.8	5.4	12.8	11.4	12.8	11.4
Floodprone Width (ft)	33.8	35.6	7.2		7.3		12.5	14.3	>50	>50	>50	>50
Entrenchment Ratio	3.0	4.2	1.8		1.5		1.9	2.1	>2.2	>2.2	>2.2	>2.2
Bank Height Ratio	1.0	1.1	2.5		3.9		4.2	1.8	1.0	1.0	1.0	1.0
Substrate												
Description (D50)	Very Coarse Sand		Sand		Sand		Sand		Sand		Coarse Gravel	
D16 (mm)	0.4		-		-		-		-		-	
D50 (mm)	1.6		-		-		-		-		-	
D84 (mm)	5.7		-		-		-		-		-	
Pattern												
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Channel Beltwidth (ft)	5.9	27.8	-	-	-	-	-	-	4	27	7	23
Radius of Curvature (ft)	19.9	24.6	-	-	-	-	-	-	10	14	11	24
Radius of Curvature Ratio	1.6	2.0	-	-	-	-	-	-	1.3	1.8	1.4	3.0
Meander Wavelength (ft)	43.4	80.6	-	-	-	-	-	-	33	61	38	77
Meander Width Ratio	0.5	2.3	-	-	-	-	-	-	4.1	7.6	4.8	9.6
Profile												
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Riffle Length (ft)	6.8	22.4	-	-	-	-	-	-	5	27	8	32
Run Length (ft)	3.4	14.9	-	-	-	-	-	-	-	-	-	-
Pool Length (ft)	5.1	24.2	-	-	-	-	-	-	9	30	9	30
Pool -to-Pool Spacing (ft)	22.5	53.3	-	-	-	-	-	-	20	53	20	49
Additional Reach Parameters												
Valley Length (ft)	255		910		680		1395		602		1392	
Channel Length (ft)	312		913		688		1429		852		1572	
Sinuosity	1.22		1.00		1.01		1.02		1.42		1.13	
Valley Slope (ft/ft)	0.0		0.004		0.008		0.007		0.003		0.003	
Channel Slope (ft/ft)	0.0		0.004		0.007		0.007		0.002		0.003	
Rosgen Classification	E5		G5		G5		G5 to E5		E5 / C5		E4 / C4	

[1] Bankfull stage was estimated using NC Regional Curve equations and existing conditions data

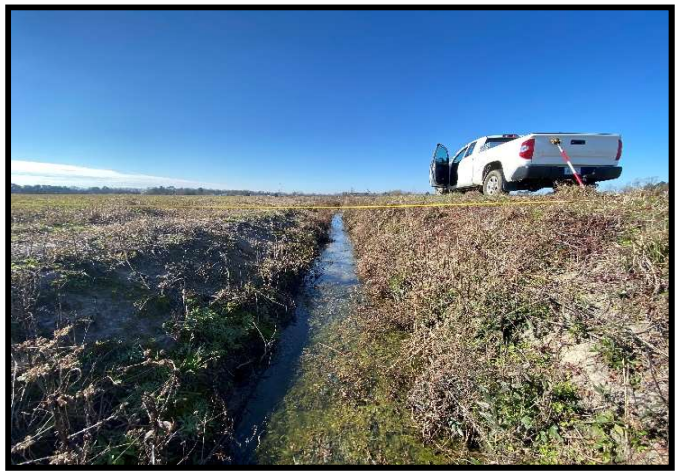
[2] NC Regional Curve equations source: Doll et al. (2003)

[3] VA Regional Curve equations source: Krstolic and Chaplin (2007)

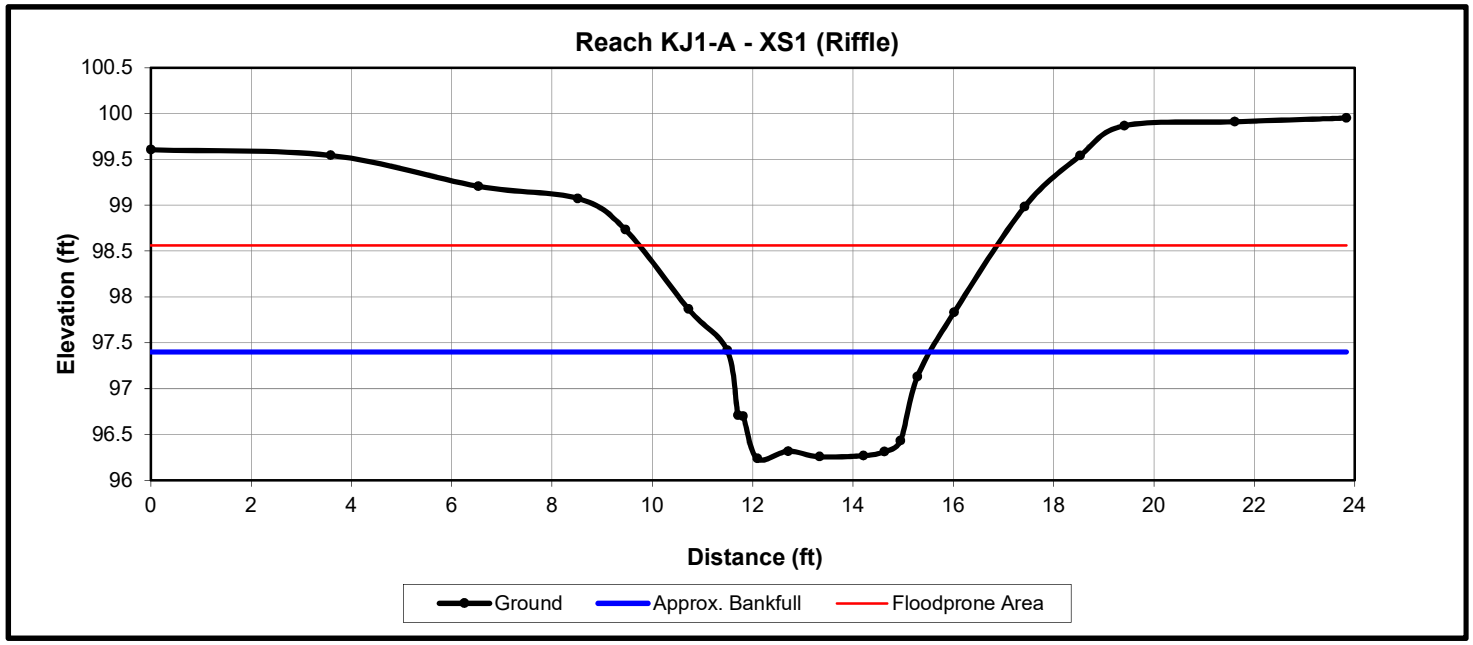
Cross Sections of Current Conditions

& Reference Reaches

Upstream

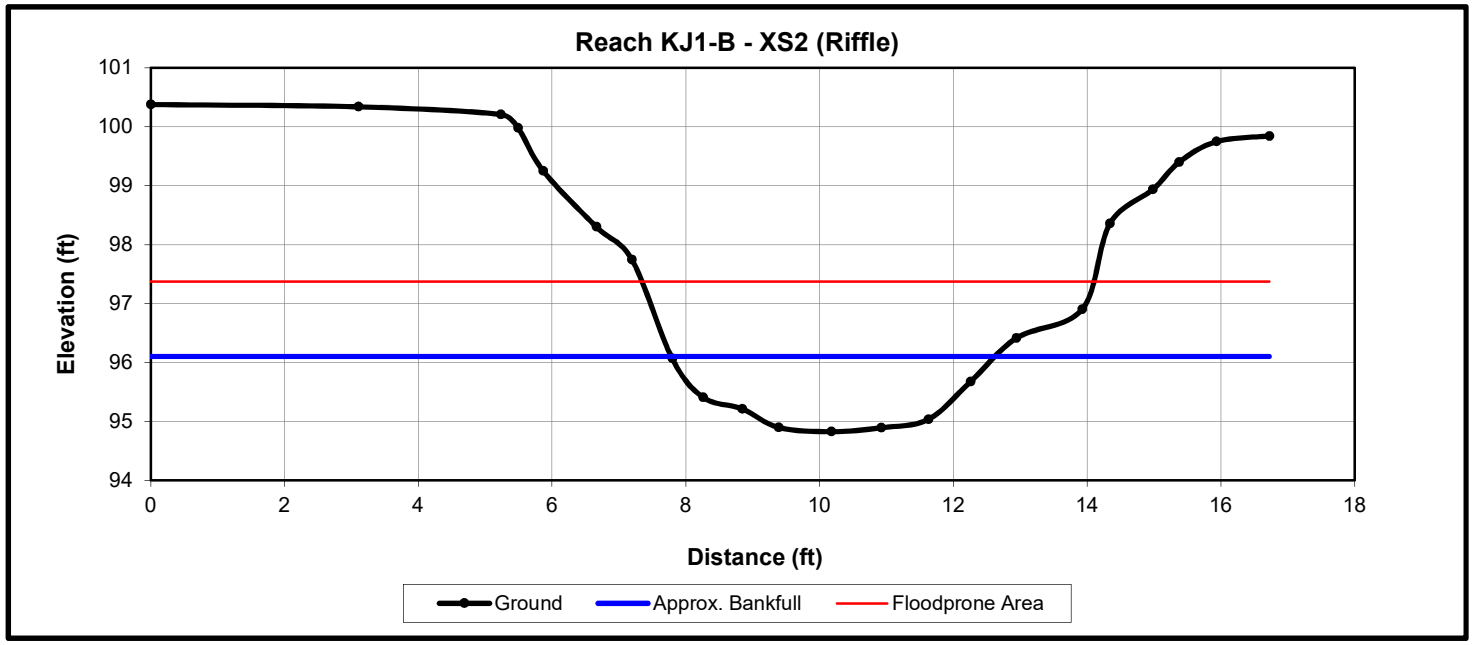


Downstream



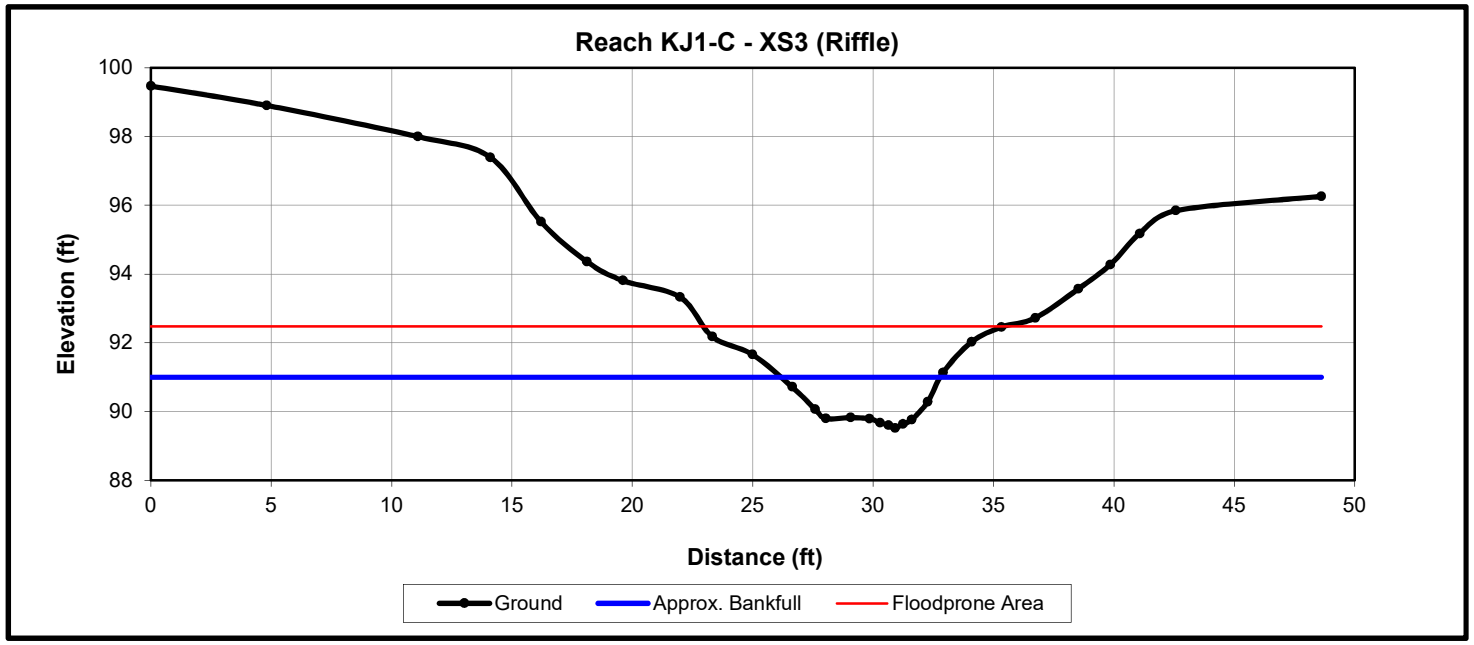
Upstream

Downstream



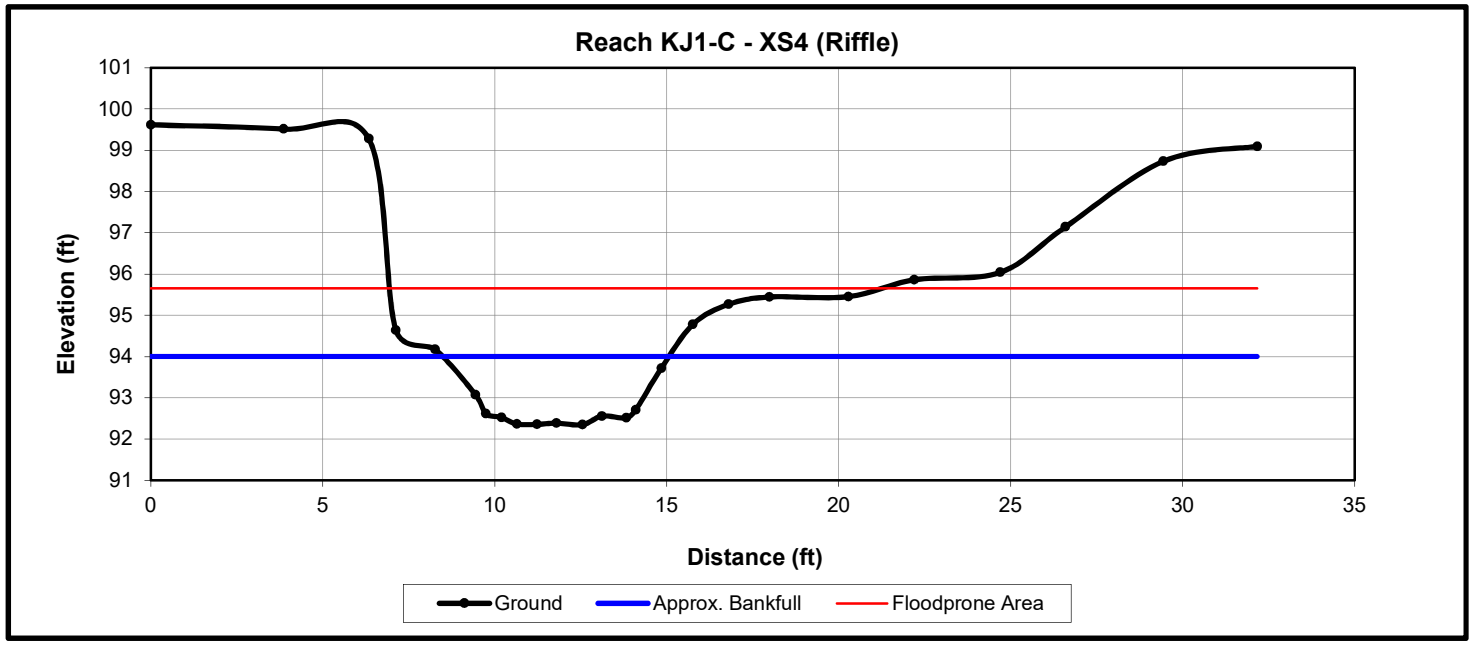
Upstream

Downstream



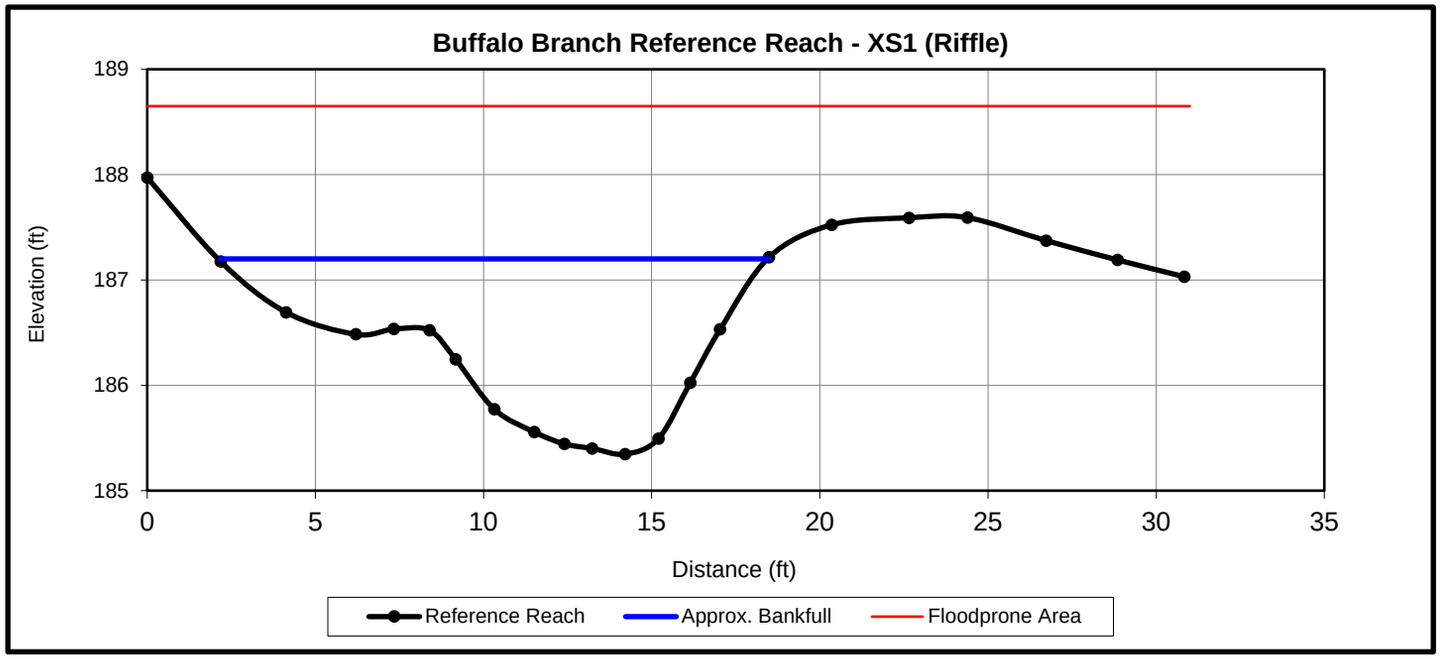
Upstream

Downstream



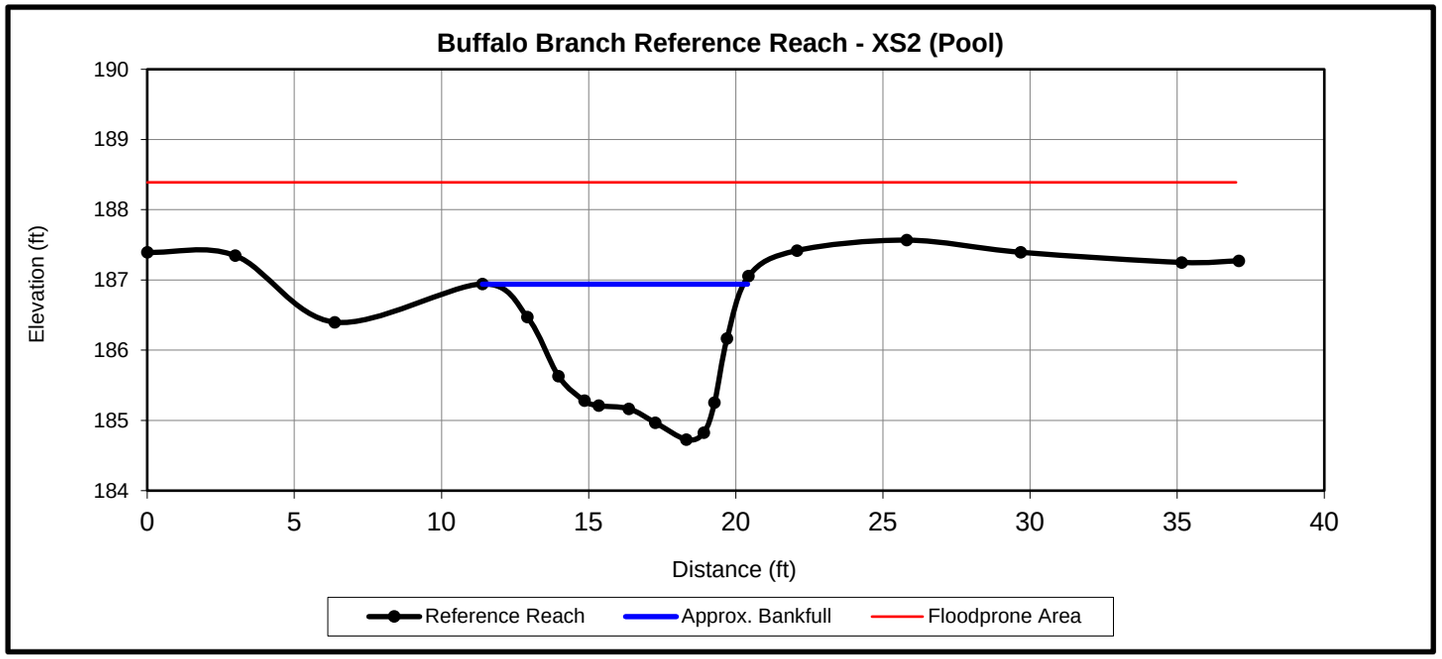
Upstream

Downstream



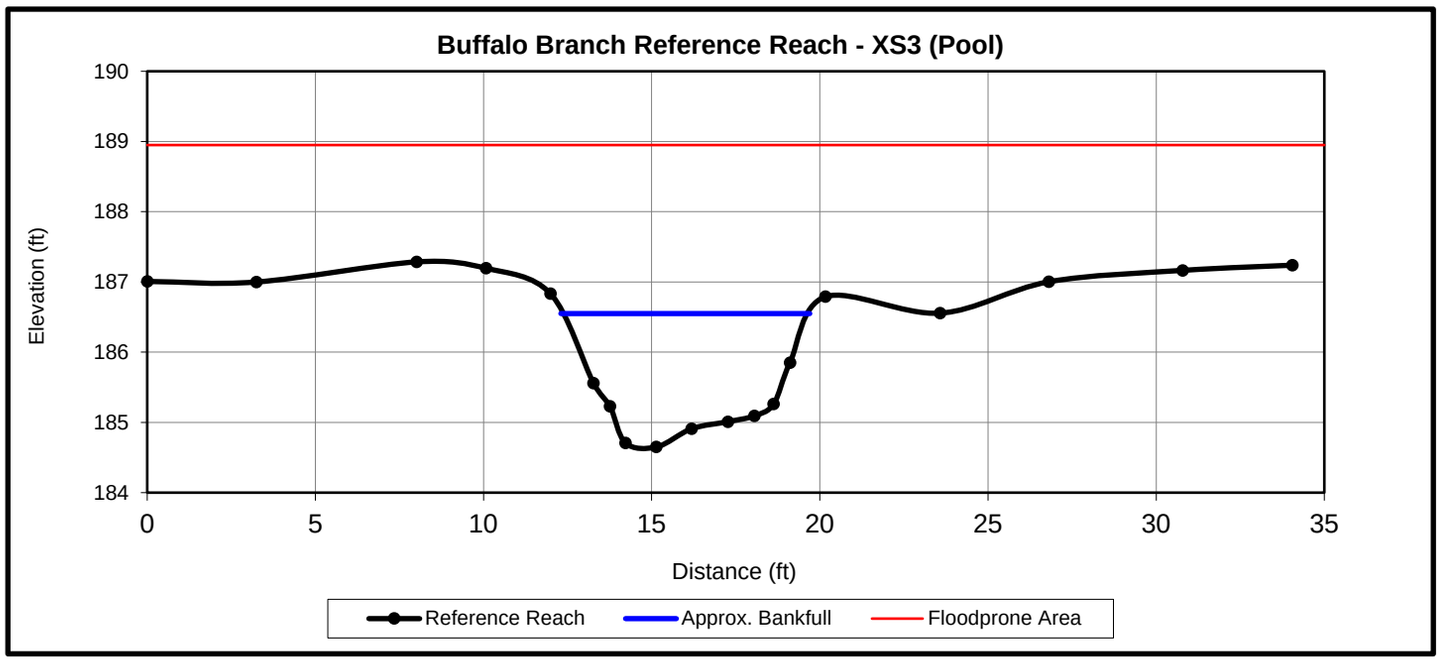
Upstream

Downstream



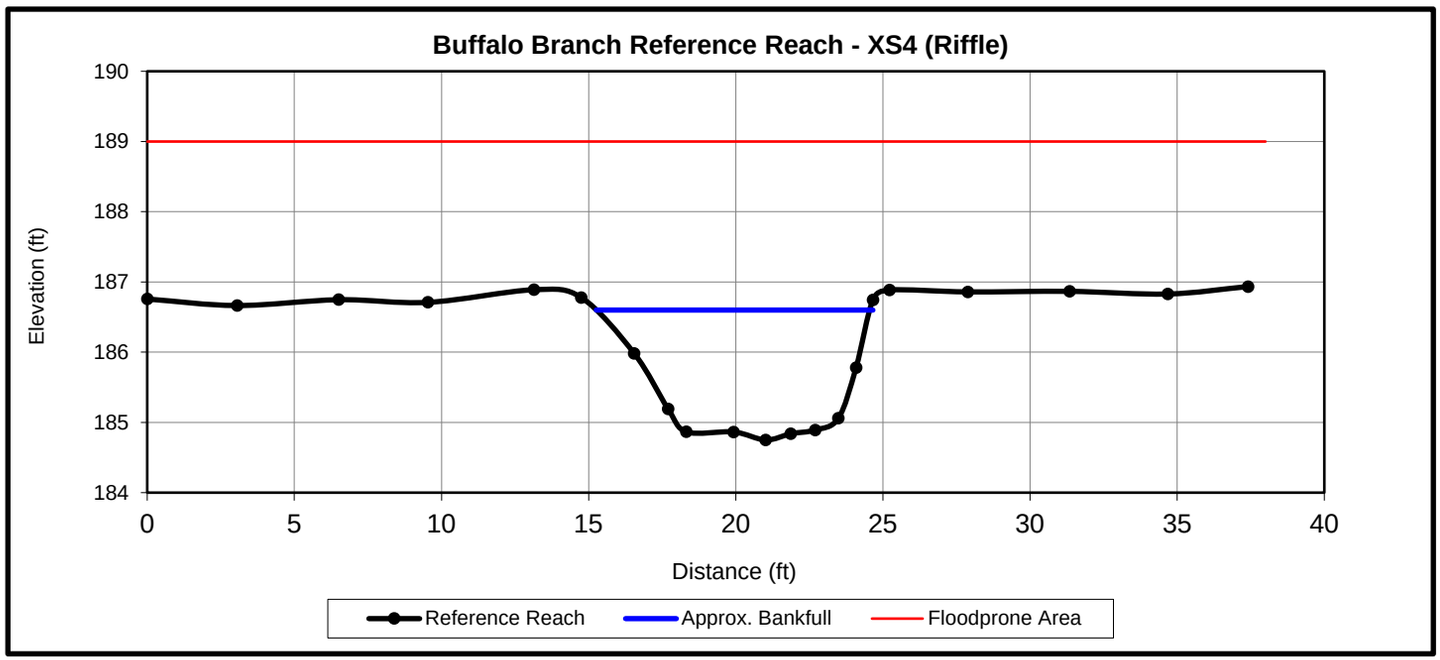
Upstream

Downstream



Upstream

Downstream



WETS Table

WETS Table

WETS Station: NEW RIVER MCAF, NC								
Requested years: 1989 - 2019								
Month	Avg Max Temp	Avg Min Temp	Avg Mean Temp	Avg Precip	30% chance precip less than	30% chance precip more than	Avg number days precip 0.10 or more	Avg Snowfall
Jan	56.2	35.0	45.6	3.85	2.79	4.53	7	-
Feb	59.6	37.3	48.4	3.27	2.16	3.92	6	-
Mar	66.1	42.9	54.5	3.94	2.80	4.67	7	-
Apr	74.2	51.4	62.8	3.35	1.90	4.09	5	-
May	80.7	60.2	70.4	4.00	2.60	4.81	6	-
Jun	87.0	68.4	77.7	5.00	3.36	5.99	8	-
Jul	89.6	72.1	80.8	6.22	4.48	7.33	9	-
Aug	88.0	70.9	79.5	7.04	3.48	8.60	9	-
Sep	83.6	66.2	74.9	6.87	3.90	8.37	7	-
Oct	75.4	54.4	64.9	4.05	2.23	4.94	5	-
Nov	66.3	43.6	54.9	3.53	2.01	4.29	5	-
Dec	59.1	38.1	48.6	3.66	2.58	4.35	6	-
Annual:					47.46	59.97		
Average	73.8	53.4	63.6	-	-	-	-	-
Total	-	-	-	54.79			80	-

GROWING SEASON DATES			
Years with missing data:	24 deg = 1	28 deg = 1	32 deg = 1
Years with no occurrence:	24 deg = 0	28 deg = 0	32 deg = 0
Data years used:	24 deg = 30	28 deg = 30	32 deg = 30
Probability	24 F or higher	28 F or higher	32 F or higher
50 percent *	2/20 to 12/22: 305 days	3/9 to 12/3: 269 days	3/23 to 11/16: 238 days
70 percent *	2/13 to 12/30: 320 days	3/2 to 12/10: 283 days	3/18 to 11/22: 249 days
* Percent chance of the growing season occurring between the Beginning and Ending dates.			

STATS TABLE - total precipitation (inches)													
Yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annl
1959							14.34						14.34
1960													
1961													
1962													
1963											M3.87	3.35	7.22
1964	6.94	7.01	1.73	6.15	4.06	5.21	9.81	7.33	6.21	5.27	2.16	4.01	65.89
1965	1.96	5.77	6.08	1.31	5.66	11.82	8.42	3.93	1.40	1.48	1.34	0.44	49.61
1966	7.53	5.70	2.66	1.64	5.41	5.34	6.96	5.26	4.54	1.16	1.48	3.98	51.66
1967	4.37	5.53	0.75	2.90	2.27	3.79	13.02	8.36	4.49	1.28	2.06	6.06	54.88
1968	4.30	2.37	1.70	3.17	2.21	2.39	M11.06	3.49	3.60	3.71	4.17	2.33	44.

													50
1969	2.55	1.91	5.44	2.63	3.75	8.89	6.64	7.50	1.70	3.83	5.73	3.99	54.56
1970	2.04	3.80	6.39	2.22	3.24	5.23	7.14	11.56	4.32	3.85	2.24	2.64	54.67
1971	3.86	2.92	3.38	2.77	2.68	6.31	7.32	5.17	4.90	5.14	1.03	1.16	46.64
1972	3.64	4.52	2.38	1.77	3.41	3.90	4.61	1.69	2.99	1.68	4.36	3.25	38.20
1973	2.49	4.02	3.01	5.27	2.69	9.19	7.37	6.51	2.10	1.21	0.58	5.17	49.61
1974	2.72	2.90	2.94	4.85	8.36	5.09	6.04	12.64	3.63	1.42	2.05	4.81	57.45
1975	5.40	5.60	2.63	4.36	1.71	4.62	8.98	5.65	9.20	4.41	1.60	6.10	60.26
1976	1.96	1.72	1.83	0.50	5.07	7.11	7.52	6.10	7.03	3.47	3.84	5.83	51.98
1977	2.94	2.05	5.46	1.51	7.61	4.20	4.95	5.20	4.23	6.49	3.92	4.02	52.58
1978	7.07	1.50	4.00	6.53	4.18	2.70		4.28	2.31	1.10	3.78	4.10	41.55
1979	6.82	4.50	3.16	3.90	5.73	5.08	7.28	3.59	12.19	1.35	3.73	2.66	59.99
1980	3.71	1.57	8.00	1.49	3.77	4.07	4.48	2.09	5.71	2.27	2.19	5.57	44.92
1981	1.41	2.46	2.01	0.53	7.14	7.06	5.53	12.45	1.74	0.70	1.05	5.29	47.37
1982	7.09	6.29	3.24	2.74	1.76	8.20	13.97	3.11	6.35	3.03	2.56	4.89	63.23
1983	4.07	9.06	7.49	3.50	0.63	2.63	5.06	3.83	1.79	2.64	4.67	5.86	51.23
1984	2.27	7.73	4.72	3.54	4.38	3.13	10.20	3.01	12.75	1.15	3.76	1.74	58.38
1985	3.13	4.75	2.81	0.57	1.86	2.17	7.42	7.20	5.34	8.88	6.69	1.96	52.78
1986	2.08	2.09	4.12	1.17	3.93	4.44	4.03	M10.62	0.85	3.30	4.24	4.18	45.05
1987	6.71	4.61	4.28	3.69	1.24	4.44	6.53	11.24	5.16	0.63	6.16	1.74	56.43
1988	5.27	2.30	2.98	3.59	8.24	5.37	7.61	6.80	2.19	2.71	3.90	0.49	51.45
1989	2.49	3.33	6.12	8.85	3.33	4.55	5.97	3.85	5.93	2.85	2.36	6.58	56.21
1990	2.09	1.31	5.85	2.37	4.38	3.63	4.79	4.56	2.16	4.69	3.06	1.43	40.32
1991	8.29	1.59	3.60	3.47	1.56	5.53	12.51	9.99	3.22	3.03	1.65	2.71	57.15
1992	7.04	1.58	3.92	2.50	5.40	4.18	4.64	16.39	2.35	2.47	5.96	4.72	61.15
1993	5.79	3.33	6.54	3.68	1.96	2.55	3.92	4.33	7.12	5.91	2.27	3.02	50.42
1994	6.68	2.61	7.16	0.51	3.80	3.60	5.37	4.16	7.74	5.61	2.21	4.45	53.90
1995	4.87	3.56	2.43	0.14	3.66	9.14	2.37	7.49	3.24	6.32	3.33	2.01	48.56
1996	4.53	1.47	4.77	3.06	2.94	7.42	15.66	5.35	17.24	7.18	1.86	3.48	74.96
1997	4.71	4.97	3.09	2.07	1.62	3.98	6.96	0.56	11.06	2.90	7.13	4.58	53.63
1998	6.50	10.68	2.43	3.28	8.84	4.35	8.60	12.79	4.70	0.71	1.69	5.53	70.10
1999													
2000	M1.94	M0.00	M0.00	M2.13	M0.00	M0.00	M0.30	M6.22	M10.31	M0.87	M5.78	M2.10	29.65
2001	1.55	3.31	4.84	1.63	3.84	8.38	4.45	4.36	7.13	0.94	1.50	1.53	43.46
2002	3.76	2.53	5.21	1.74	3.14	3.35	8.33	8.03	4.53	2.96	2.90	2.91	49.39

2003	2.71	5.25	7.22	6.64	11.47	7.03	MT	8.17	5.01	12.13	1.39	5.64	72.66
2004	1.86	5.07	1.65	2.67	5.50	4.51	6.21	13.03	6.79	0.52	2.41	1.51	51.73
2005	2.35	2.24	4.18	3.09	4.37	3.87	M5.92	2.19	6.37	M12.12	3.64	3.76	54.10
2006	3.21	1.36	1.19	3.59	2.57	9.30	6.38	7.92	5.01	3.56	12.97	5.41	62.47
2007	3.40	2.05	2.60	4.68	2.12	2.59	M1.57	M0.01	M0.37	3.65	0.57	2.58	26.19
2008	3.09	3.56	3.12	6.40	M4.69	M2.06	6.23	5.24	3.86	2.54	3.50	3.14	47.43
2009	1.82	2.25	3.31	2.25	4.81	2.34	M3.34	8.27	7.85	1.80	9.00	6.59	53.63
2010	3.36	4.31	2.16	0.91	1.37	5.75	M4.61	M3.86	15.95	1.28	1.37	M2.73	47.66
2011	2.54	4.41	3.32	1.66	2.25	M1.41	4.13	M8.77	4.21	1.97	2.42	0.51	37.60
2012	2.11	M1.84	7.86	2.46	6.52	2.44	6.53	7.74	2.13	5.50	1.99	4.77	51.89
2013	2.16	5.19	1.89	5.46	1.24	11.37	3.68	7.29	M3.52	2.87	3.67	2.54	50.88
2014	2.98	2.72	6.27	4.94	1.88	5.23	8.31	5.36	8.86	2.26	4.27	5.09	58.17
2015	6.58	4.86	2.98	2.39	5.04	11.23	3.39	11.73	2.92	8.95	8.04	5.07	73.18
2016	3.69	7.73	2.59	1.42	4.88	2.22	9.28	5.50	14.16	6.34	1.28	4.61	63.70
2017	3.86	2.18	4.05	6.16	M4.31	3.84	6.39	11.01	7.20	4.03	0.95	3.93	57.91
2018	5.08	1.83	2.15	6.85	11.01	7.26	9.16	8.37	20.37	2.68	5.41	M4.00	84.17
2019	M2.47	0.83	1.75	M2.42	M1.62	2.02	5.33	7.76	8.36	2.93	3.51	3.00	42.00
2020	1.40	6.29	4.08	3.18	7.17	M9.25	M2.85	M1.08					35.30

Notes: Data missing in any month have an "M" flag. A "T" indicates a trace of precipitation.

Data missing for all days in a month or year is blank.

Creation date: 2016-07-22

Background Attribute Table

Table 4. Project Background Information			
Project Name	Cowford Project		
County	Onslow		
Project Area (acres)	17.20		
Project Coordinates (latitude and longitude)	34.92293, -77.5917		
Planted Acreage (Acres of Woody Stems Planted)	16.35		
Project Watershed Summary Information			
Physiographic Province	63h - Carolina Flatwoods		
River Basin	White Oak		
USGS Hydrologic Unit 8-digit	3020302	USGS Hydrologic Unit 14-digit	30203020102
DWR Sub-basin	03-05-02		
Project Drainage Area (Acres and Square Miles)	238 acres (0.37 mi^2)		
Project Drainage Area Percentage of Impervious Area	<1%		
CGIA Land Use Classification	Cultivated, High Intensity		
Reach Summary Information			
Parameters	**Reach KJ1-A**	**Reach KJ1-B**	**Reach KJ1-C**
Length of reach (linear feet)	923	852	1572
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Unconfined	Moderately confined
Drainage area (Acres and Square Miles)	115	181	238
Perennial, Intermittent, Ephemeral	Intermittent	Intermittent	Intermittent
NCDWR Water Quality Classification	None	None	None
Stream Classification (existing)	G5	G5	G5 to E5
Stream Classification (proposed)	N/A	E5 / C5	E4 / C4
Evolutionary trend (Simon)	III	III	III-IV
FEMA classification	Zone X (Minimal Risk)	Zone X (Minimal Risk)	Zone X (Minimal Risk)
Wetland Summary Information			
Parameters	**Wetland WB**		
Size of Wetland (acres)	2.991		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian riverine		
Mapped Soil Series	Muckalee loam		
Drainage class	Poorly		
Soil Hydric Status	Yes (Per LSS)		
Source of Hydrology	Groundwater, surface flow, and stream flooding		
Restoration or enhancement method (hydrologic, vegetative etc.)	Hydrologic & vegetative restoration		
Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	No	Appendix K
Water of the United States - Section 401	Yes	No	Appendix K
Endangered Species Act	Yes	Yes	Appendix K
Historic Preservation Act	Yes	Yes	Appendix K

Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	No	Appendix L
Essential Fisheries Habitat	No	N/A	N/A

Appendix C

- CRP Easement Affidavit
- Site Protection Instrument

EXHIBIT C

Landowner Affidavit

AFFIDAVIT

STATE OF NORTH CAROLINA

COUNTY OF ONSLOW

BE IT KNOWN, that on this 22 day of August, 2018

BEFORE ME, the undersigned Notary Public, duly qualified in and for the State of North Carolina, personally came and appeared:

KENNETH W. JONES

known to me to be a credible person and of lawful age, who being by me first duly sworn, on his oath, did depose and state the following:

1. That all statements contained herein are true to the best of his knowledge, information, and belief;

2. Affiant is the fee title owner of two parcels of real property situated in Onslow County, North Carolina, being identified by the PIN number 4422-01-2939-36, and being that property conveyed by a deed recorded in Book 531, Page 388, and by the PIN number 4413-04-8154-25, and being that property conveyed by a deed recorded in Book 531, Page 388, both in the office of the Onslow County Register of Deeds (collectively, the "Property");

3. The Property is subject to a Conservation Reserve Program Contract dated November 20, 2017 (the "Contract");

4. The Contract expires by its own term on September 30, 2019 (the "Contract Expiration Date");

5. The Contract may be terminated by the terms of the Contract;

6. The Affiant executed that Agreement Regarding Proposed Mitigation Project dated August 22, 2018 with Environmental Banc & Exchange, LLC, a Maryland limited liability company (the "Agreement"); and

7. By the terms of the Agreement, the Affiant has agreed to: (i) allow the Contract to expire by its own term, or (ii) terminate the Contract before the Contract Expiration Date by the terms of the Contract.

[Affidavit continued on following page]

LENOIR COUNTY, NORTH CAROLINA, this 22 day of August, 2018

Kenneth W Jones
KENNETH W. JONES

Address of Affiant:
[INSERT]

Subscribed and sworn to before me, this 22 day of August, 2018.

Cynthia W. Thompson
NOTARY PUBLIC
Print Name: Cynthia W. Thompson
Bar/Notary No. _____
Commission Expires: 2/26/2023

CYNTHIA W. THOMPSON
Notary Public
Pitt County, NC
My Commission Expires
2/26/2023
NOTARY PUBLIC

Exhibit C

(Revised November 2017)

SITE PROTECTION INSTRUMENT

Site Protection Instrument(s) Summary Information

The land required for the construction, management, and stewardship of this mitigation project includes portions of the parcels listed below in Table C1. RES has obtained a conservation easement from the current landowners for the project area. The easement deed and survey plat will be submitted to DMS and State Property Office (SPO) for approval and will be held by the State of North Carolina. The easement deed will follow the NCDMS Full Delivery Conservation Easement Template dated May 5, 2017 and included in this appendix. Once recorded, the secured easement will allow RES to proceed with the project development and protect the mitigation assets in perpetuity. Once finalized, a copy of the land protection instrument(s) will be included in **Appendix C**.

Table C1. Project Parcel and Landowner Information

Owner of Record	Tax Parcel ID #	County	Site Protection Instrument	Deed Book and Page Numbers	Acreage Protected
Kenneth W Jones	44220-129-3936	Onslow County	Conservation Easement	--	17.20 ac

Appendix D

- Credit Release Schedule

CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported in the approved final mitigation plan, unless there are major discrepancies and then a mitigation plan addendum will be submitted. Under no circumstances shall any mitigation project be debited until the necessary Department of the Army (DA) authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the IRT, will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to be restarted or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows in **Table D1** and **Table D2**.

Table D1. Stream Credit Release Schedule

Credit Release Milestone	Release Activity	Interim Release	Total Release
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4*	Fourth year monitoring report demonstrates performance standards are being met	5%	65% (75%**)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%**)
6*	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%**)
7	Seventh year monitoring report demonstrates performance standards are being met and project has received closeout approval	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 IRT.*

***10% reserve of credits to be held back until the bankfull event performance standard has been met.*

Table D2. Wetland Credit Release Schedule

Credit Release Milestone	Release Activity	Interim Release	Total Release
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	15%	65%
4*	Fourth year monitoring report demonstrates performance standards are being met	5%	70%
5	Fifth year monitoring report demonstrates performance standards are being met	15%	85%
6*	Sixth year monitoring report demonstrates performance standards are being met	5%	90%
7	Seventh year monitoring report demonstrates performance standards are being met and project has received closeout approval	10%	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 IRT.*

Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan, can be released by DMS without prior written approval of the DE upon satisfactory completion of the following activities:

1) Approval of the final Mitigation Plan.
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
3) Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; per the DMS Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and a record drawing has been produced. Record drawings must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
4) Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 10% of a site's total stream credits shall be released after four bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than four bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, DMS will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

Appendix E

- Financial Assurance

FINANCIAL ASSURANCE

Pursuant to Section IV H and Appendix III of the NCDEQ DMS (formerly Ecosystem Enhancement Program) In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environmental Quality (NCDEQ) has provided the USACE-Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by NCDEQ DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

Appendix F

- Maintenance Plan

MAINTENANCE PLAN

The site will be monitored on a regular basis and a physical inspection will 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:

F1. Maintenance Plan

Component/Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting. Stream maintenance activities will be documented and reported in annual monitoring reports. Stream maintenance will continue through the monitoring period.
Wetland	Routine wetland maintenance and repair activities may include securing of loose coir matting, channel plug maintenance, and supplemental installations of live stakes and other target vegetation within the wetland.
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 treated by mechanical and/or chemical methods. Any vegetation requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations. Vegetation maintenance activities will be documented and reported in annual monitoring reports. Vegetation maintenance will continue through the monitoring period.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries will be marked with signs identifying the property as a mitigation site, and will include the name of the long-term steward and a contact number. 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. Easement monitoring and staking/signage maintenance will continue in perpetuity as a stewardship activity.
Road Crossing	N/A
Livestock Fencing	N/A
Beaver	Routine site visits and monitoring will be used to determine if beaver management is needed. If beaver activity poses a threat to project stability or vegetative success, RES will trap beavers and remove impoundments as needed. All beaver management activities will be documented and included in annual monitoring reports. Beaver monitoring and management will continue through the monitoring period.

Appendix G

- DWR Stream Forms

NC DWQ Stream Identification Form Version 4.11

Date: 8-8-18	**Project/Site:** Comford	**Latitude:**
Evaluator: DL, MD	**County:** Onslow	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27.5	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** *e.g. Quad Name:* KJ 1

A. Geomorphology (Subtotal = 18.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

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

B. Hydrology (Subtotal = 8)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 8)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

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

Notes:

Sketch:

Appendix H

- NC SAM Forms

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name Cowford - KJ1 | Date of Evaluation 10/3/2019

Stream Category Ia2 | Assessor Name/Organization Jeremy Schmid- RES

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

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

Appendix I

- Approved PJD (February 12, 2020)

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2019-00487** County: **Onslow** U.S.G.S. Quad: **NC- Richlands**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Requestor:	**Kenneth & Sue Jones** **322 Jamestown Road** **Pink Hill, NC 28572**	Agent:	**Resource Environmental Solutions** **Jeremy Schmid** **302 Jefferson Street** **Suite 110** **Raleigh, NC 27605**
Size (acres)	**16**	Nearest Town	**Richlands**
Nearest Waterway	**Cowford Branch**	River Basin	**Onslow Bay**
USGS HUC	**03020302**	Coordinates	Latitude: **34.9247** Longitude: **-77.5941**

Location description: **Project area is located east of Kinston Highway approximately 0.48 miles southeast of the intersection of Kinston Highway and Warren Taylor Road in Richlands, Onslow County, North Carolina.**

Indicate Which of the Following Apply:

A. Preliminary Determination

☒ There appear to be **waters** 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** 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 **10/3/2019**. Therefore this preliminary jurisdiction determination may be used in the permit evaluation process, including determining compensatory mitigation. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.

☐ There appear to be **waters** 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** 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** at the project area, which is not sufficiently accurate and reliable to support an enforceable permit decision. We recommend that you have the **waters** 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**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** 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** 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** 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 **Rachel Capito at (910)-251-4487 or Rachel.A.Capito@usace.army.mil**.

C. Basis For Determination: Basis For Determination: See the preliminary jurisdictional determination form dated 02/12/2020.

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: CAPITO.RACHEL.ANN.1536276790 Digitally signed by CAPITO.RACHEL.ANN.1536276790 Date: 2020.02.12 12:58:03 -05'00'

Date of JD: **02/12/2020** Expiration Date of JD: **Not applicable**

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **Kenneth & Sue Jones**	File Number: **SAW-2019-00487**	Date: **02/12/2020**

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: Rachel Capito** **Wilmington Regulatory Office** **U.S Army Corps of Engineers** **69 Darlington Avenue** **Wilmington, North Carolina 28403**	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: Rachel Capito, 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:** 02/12/2020

B. **NAME AND ADDRESS OF PERSON REQUESTING PJD:** Kenneth & Sue Jones, 322 Jamestown Road, Pink Hill, NC 28572

C. **DISTRICT OFFICE, FILE NAME, AND NUMBER:** Wilmington District, Cowford Site, SAW-2019-00487

D. **PROJECT LOCATION(S) AND BACKGROUND INFORMATION:** Project area is located east of Kinston Highway approximately 0.48 miles southeast of the intersection of Kinston Highway and Warren Taylor Road in Richlands, Onslow County, North Carolina.

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

State: NC County: Onslow City: Richlands

Center coordinates of site (lat/long in degree decimal format): Latitude: 34.9247 Longitude: -77.5941

Universal Transverse Mercator:

Name of nearest waterbody: Cowford Branch

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

☒Office (Desk) Determination. Date:

☐Field Determination. Date(s):

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

Site Number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic 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)
S1	34.9247	-77.5941	3,122	Non-wetland waters	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 should be included in subject file. Appropriately reference sources below where indicated for all checked items:

- [x] Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
  Map: Vicinity, USGS, NWI, Soil, Existing conditions, WOUS.
- [x] Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - [x] 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.
- [x] U.S. Geological Survey map(s). Cite scale & quad name: 24k Richlands.
- [ ] Natural Resources Conservation Service Soil Survey. Citation: _____.
- [x] 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): _____.
  or [ ] Other (Name & Date): _____.
- [ ] Previous determination(s). File no. and date of response letter: _____.
- [ ] Other information (please specify): _____.

<u>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.</u>

CAPITO.RACHEL.ANN.1536276790 Digitally signed by CAPITO.RACHEL.ANN.1536276790 Date: 2020.02.12 12:59:45 -05'00'

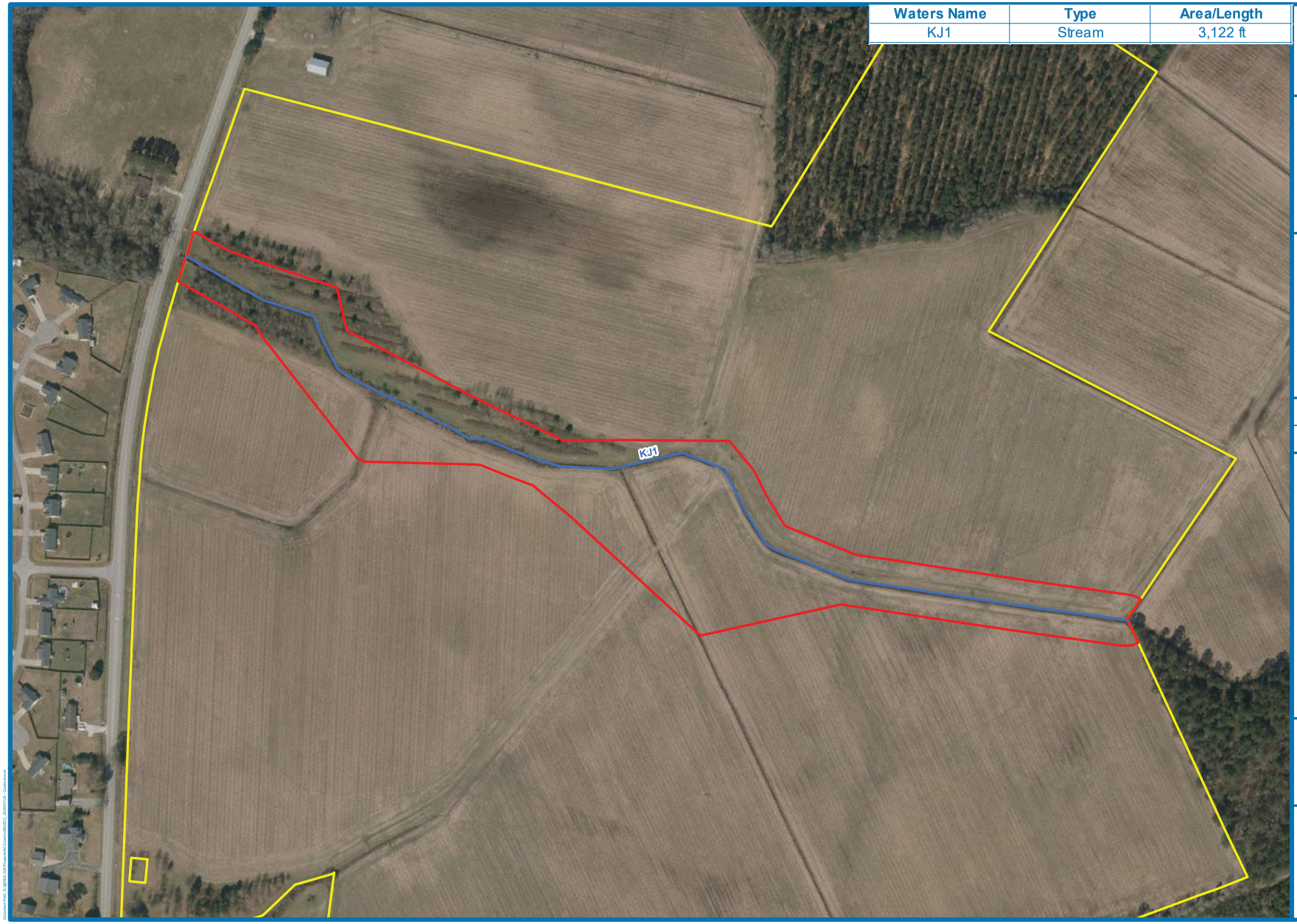
Signature and date of Regulatory staff member completing PJD

Jeremy Schmid Digitally signed by Jeremy Schmid DN: cn=Jeremy Schmid, o, ou, email=jschmid@res.us, c=US Date: 2018.04.24 10:02:26 -04'00'

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

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

Waters Name	Type	Area/Length
KJ1	Stream	3,122 ft



0 200 400
Feet
1 in = 267 feet

Potential Wetland or Non-Wetland Waters of the U.S. Map

Cowford Mitigation Project

Onslow County, North Carolina

Date: 10/3/2019	Drawn by: MDE
Revisions: NONE	Checked by: JLS

Legend

- Potential Non-Wetland Waters of the US
- Study Area
- Project Parcel

REFERENCE

1) Horizontal Datum is NAD83 UTM Zone 17N.

2) Map Projection is NAD_1983_StatePlane_North_Carolina_FIPS_3200_Feet

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Appendix J

- Invasive Species Plan

INVASIVE SPECIES PLAN

Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. These site inspections may identify the presence of invasive vegetation. RES will treat invasive species vegetation within the project area and provide remedial action on a case by- case basis. Common invasive species vegetation, such as Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*), tree-of-heaven (*Ailanthus altissima*), and Japanese honeysuckle (*Lonicera japonica*), will be treated to allow native plants to become established within the conservation easement. Treatment for invasive species will be required within all grading limits associated with stream restoration. Invasive species will require different and multiple treatment methods, depending on plant phenology and the location of the species being treated (**Appendix J**). All treatment will be conducted as to maximize its effectiveness and reduce chances of detriment to surrounding native vegetation. Treatment methods will include mechanical (cutting with loppers, clippers, or chain saw) and chemical (foliar spray, cut stump, and hack and squirt techniques). Invasive or aggressive plants containing mature, viable seeds will be removed from the Project and properly disposed. All herbicide applicators will be supervised by a certified ground pesticide applicator with a North Carolina Department of Agriculture and Consumer Services (NCDA&CS) license and adhere to all legal and safety requirements according to herbicide labels, and NC and Federal laws. Management records will be kept on the plant species treated, type of treatment employed, type of herbicide used, application technique, and herbicide concentration and quantities used. These records will be included in all reporting documents. Notably, although common rush is not an exotic invasive species, it can be a nuisance species and it is possible that allelopathic properties upon its decomposition can potentially inhibit tree growth.

Appendix K

- Approved Categorical Exclusion Form

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:	Cowford
County Name:	Onslow County
DMS Number:	100095
Project Sponsor:	Environmental Banc & Exchange, LLC, a RES company
Project Contact Name:	Matt Butler
Project Contact Address:	302 Jefferson Street, Suite 110, Raleigh, NC 27605
Project Contact E-mail:	mbutler@res.us
DMS Project Manager:	Lindsay Crocker

Project Description

The Cowford Project, in Onslow County, North Carolina will comprise a conservation easement totaling approximately 16 acres on one parcel and will involve the restoration of an unnamed tributary to Cowford Branch and an adjacent riparian wetland. Stream restoration practices may range from bank grading and planting to re-establishing stable planform and hydraulic geometry. Restoration activities will include natural design concepts and will be verified through rigorous engineering analyses and modeling. The historic riparian wetland adjacent to the unnamed tributary to Cowford Branch have been drained and converted to agricultural land for generations. The proposed riparian wetland restoration will address these historic land-use impacts through stream restoration, grading, surface roughening, and re-vegetation to restore a functional and diverse alluvial forest community. Restoration of these important ecosystems will improve local water quality, natural habitat, and biodiversity.

For Official Use Only

Reviewed By:

8/26/2019 — LHCrocker.

Date — **DMS Project Manager**

Conditional Approved By:

Date — **For Division Administrator FHWA**

☐ **Check this box if there are outstanding issues**

Final Approval By:

8-26-19 — Donald W. Brew

Date — **For Division Administrator FHWA**

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

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

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

Categorical Exclusion Summary

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, created a tax on the chemical and petroleum industries to clean up abandoned or uncontrolled hazardous waste sites.

As a part of the environmental screening and CERCLA compliance, an EDR Radius Map Report with Geocheck was ordered for the Cowford Mitigation Project through Environmental Data Resources, Inc (EDR) on June 12th, 2019. According to the EDR report, the project property was identified to be within an quarter of a mile to two incidents listed in the State and Tribal leaking Storage Tank List issued by the Department of Environment and Natural Resources and the State and tribal institutional control/engineering control registries and the Records of Emergency Release Reports. Both sites are located at lower elevations than the target property and are not adjacent to the project parcel. The first incident occurred at Jarman Fork Service Station in February of 1990 and was the result of a gas tank being excavated and nearly 30 gallons of gas spilled out in the excavation spot which contaminated a nearby water line. After purging and monitoring of the site, the incident was closed out in 2015. The second incident was in January of 1998 at the former Baysden's supermarket in which an aboveground tank spilled when it was overfilled during a fuel transfer from a tanker truck. Estimates between 100-200 gallons of gasoline were spilled during the incident. Cleanup followed soon after incident. The incident was closed out in 2003. The summary of the EDR report is enclosed.

In addition to the EDR search, a visual inspection of the Cowford site was conducted to assess the potential for the occurrence of recognized environmental conditions on the property that might not have been revealed in the EDR report. The inspection was conducted to locate and identify any obvious use, storage, or generation of hazardous materials. No hazardous storage containers or substances were observed during the visual inspection.

National Historical Preservation Act (Section 106)

The National Historical Preservation Act (NHPA) is legislation intended to preserve historical and archaeological sites in the United States of America. RES requested review and comment from the State Historic Preservation Office (SHPO) with respect to any archaeological and architectural resources related to the Cowford Mitigation Project on June 18th, 2019. SHPO responded July 9th, 2019 saying that they conducted a review and were not aware of any historic resources that would be affected by the project. The correspondence with SHPO can be found in the enclosed documents.

Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)

The Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act) provides important protections and assistance for those people affected by federally funded projects. The Uniform Act applies to the acquisition, rehabilitation, or demolition of real property for federally funded projects. The Cowford Mitigation Project is a full-delivery project that includes land acquisition. Notification of fair market value of the property and the lack of condemnation authority was completed by RES. The landowner was notified of fair market value and condemnation authority was listed in the option agreement. A copy of the letter sent to the landowner is enclosed

Endangered Species Act (ESA)

Section 7 of the ESA requires federal agencies, in consultation with and with the assistance of the Secretary of the Interior or of Commerce, as appropriate, to ensure that actions they authorize, fund or carry out are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for these species.

According to the United States Fish and Wildlife IPAC database review tool (USFWS 2018) and the self-certification process conducted by RES and submitted to the USFWS on June 18th, 2019 (and re-submitted on August 2nd, 2019) the list of threatened and endangered species includes 15 threatened, endangered, or candidate species on this list. A complete list can be seen on the Species conclusion table in the USFWS self-certification letter enclosed. After the original submission to USFWS, a habitat and species assessment and survey was conducted to make updated determinations on the species conclusion table. The survey that was conducted on July 19th evaluated the habitat and species presence for the Cooley's Meadowrue (*Thalictrum cooleyi*), the Roughed leaved loosestrife (*Lysimachia asperulaefolia*), and the suitable habitat for the Golden Sedge (*Carex lutea*) and the Pondberry (*Lindera melissifolia*). During this survey it was determined that there were no species present nor any suitable habitat for both the Cooley's Meadowrue and the Roughed leaved loosestrife. It was also determined that there is no suitable habitat for the Golden Sedge (*Carex lutea*) and the Pondberry (*Lindera melissifolia*) within the easement area. Therefore a "no effect" determination was made for all of the listed species that were provided in the official species list. A copy of the self-certification letter that was sent to the USFWS with the results of the survey is enclosed. No response was provided by USFWS which is typical as the certification letter (provided) is their official response unless they do not concur with the determination.

The Bald and Golden Eagle Protection Act (BGPA)

The Bald and Golden Eagle Protection Act (BGPA) is a federal status that protects two species of Eagle. The BGPA provides protection for the bald eagle and golden eagle by prohibiting the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16 U.S.C. 668(a) (BGPA, 1940). The Bald Eagle (*Haliaeetus leucocephalus*), has been identified in Onslow county; wetland and stream mitigation practices are unlikely to disturb nesting bald eagles.

Farmland Protection Policy Act (FPPA)

The Farmland Protection Policy Act (FPPA) is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. The Cowford Mitigation Project includes the conversion of prime farmland. As such, Form AD-1006 has been completed and submitted to the Natural Resource Conservation Service (NRCS). The completed form and correspondence documenting the submittal is enclosed.

Fish and Wildlife Coordination Act (FWCA)

The Fish and Wildlife Coordination Act (FWCA) of the United States was enacted to protect fish and wildlife when federal actions result in the control or modification of a natural stream or body of water. Since the Cowford Mitigation Project may include removal and/or replacement of existing culverts as well as stream bank stabilization, RES requested comment from the North Carolina Fish and Wildlife Resource Commission (NCWRC). The NCWRC responded on July 26, 2019 that there appears to be no listed species within the immediate project area. All correspondence is enclosed.

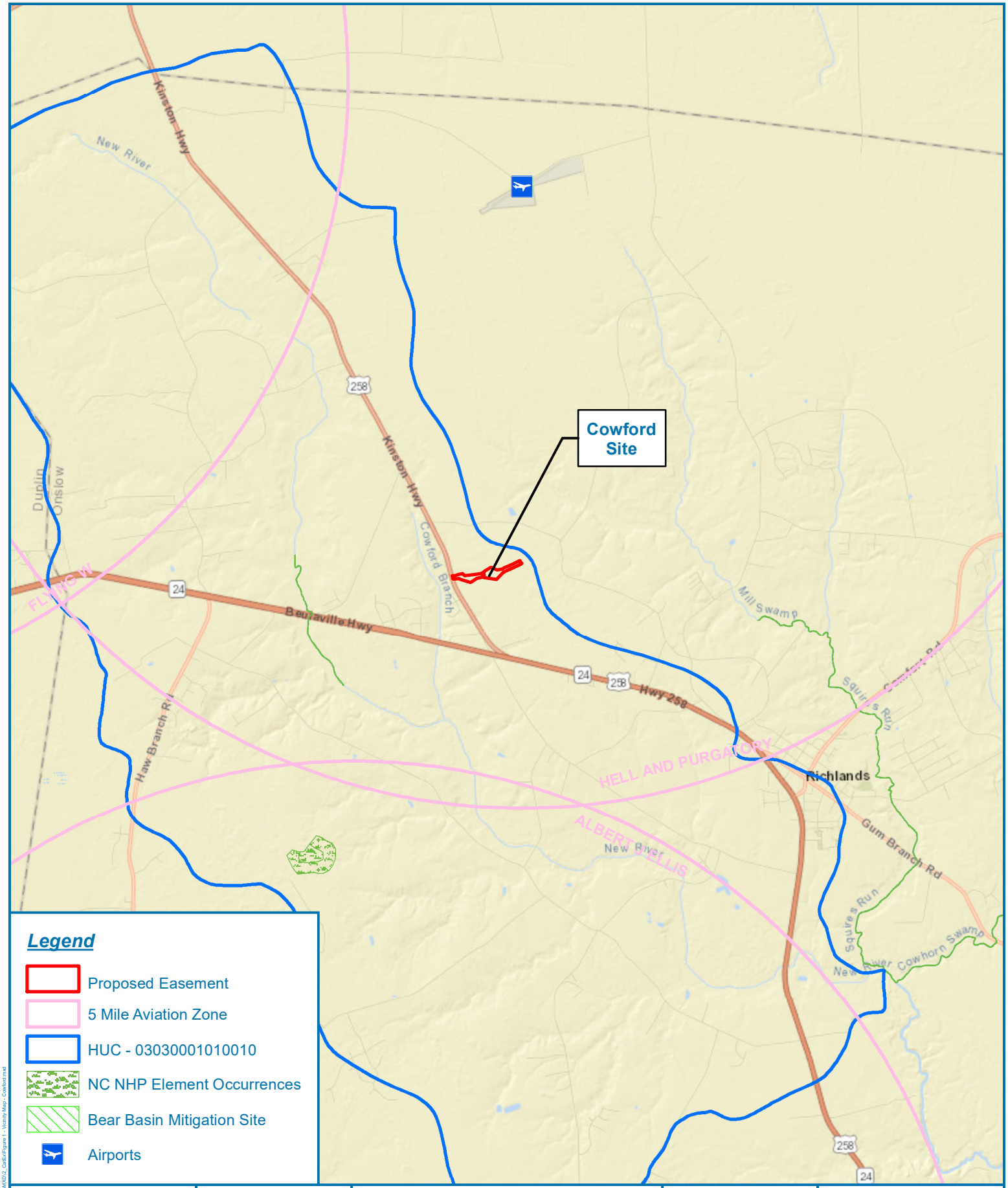
Migratory Bird Treaty Act (MBTA)

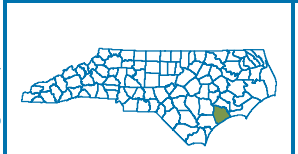
The MBTA makes it unlawful for anyone to kill, capture, collect, possess, buy, sell, trade, ship import, or extort and migratory bird. The indirect killing of birds by destroying their nests and eggs is covered by the MBTA, so construction in nesting areas during nesting seasons can constitute at taking.

RES consulted the USFWS's Information for Planning and Consultation (IPAC) tool and conducted a self-certification process and submitted it to the USFWS on June 18th, 2019 (and re-submitted on August 2nd, 2019) to generate a list of migratory birds that are expected to occur at the Cowford Mitigation Project. The

results concluded that no migratory birds of conservation concern occur at the Site, other than the Bald Eagle which was analyzed in the USFWS process.

EXHIBITS





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Miles

Figure 1 - Vicinity Map

Cowford Mitigation Site

Onslow County, North Carolina

Date: 8/5/2019

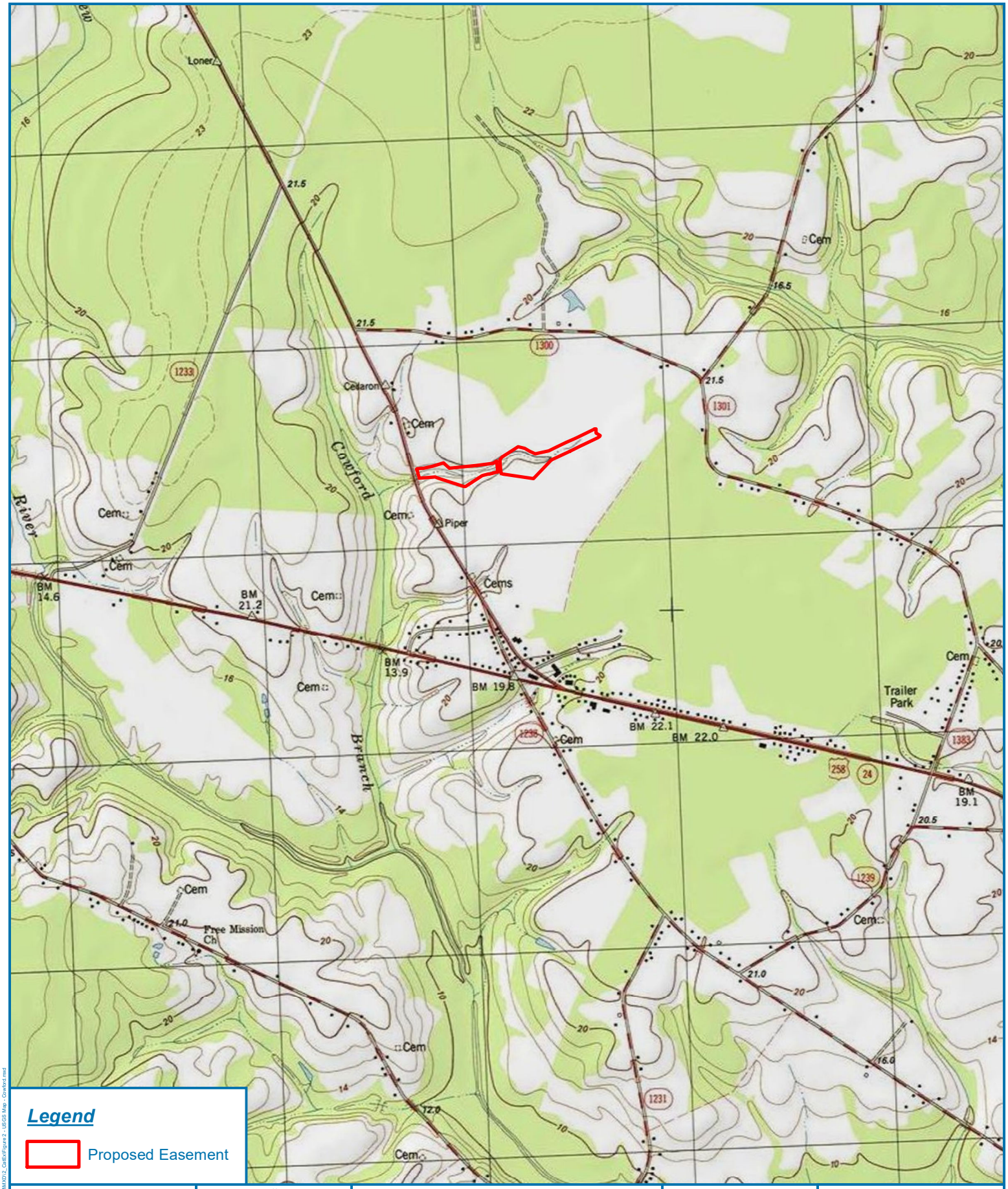
Drawn by: GDS

Checked by: JRM

1 inch = 1 mile

res

Document Path: S:\@RES GIS\Projects\NC\Cowford\MXD\2_Cat\Ev\Figure 1 - Vicinity Map - Cowford.mxd



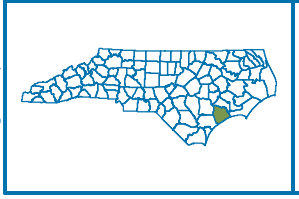


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Figure 2 - USGS Map
Richlands Quadrangle (1981)

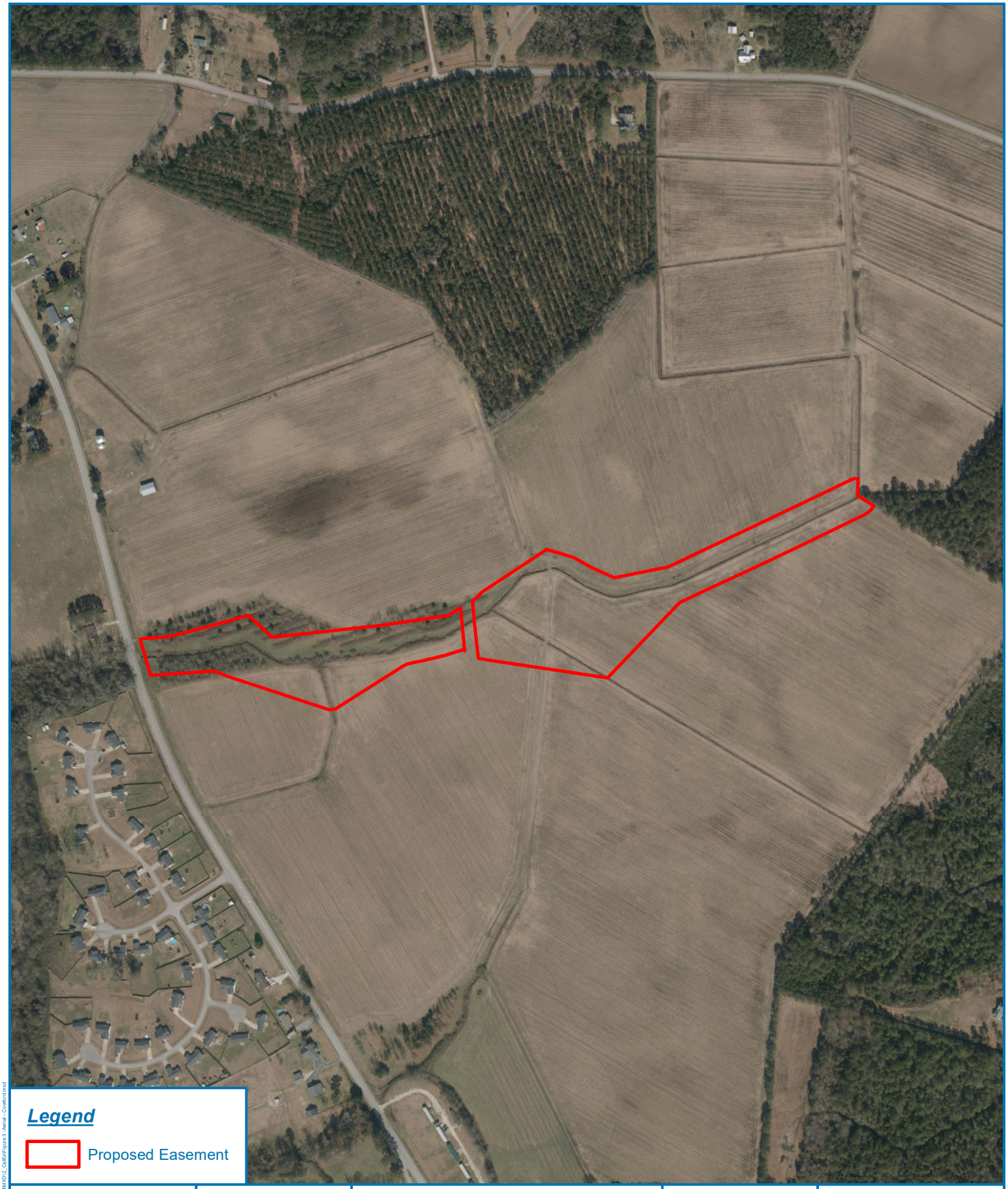
Cowford Mitigation Site

Onslow County, North Carolina

Date:	8/7/2019
Drawn by:	GDS
Checked by:	JRM
1 inch = 2,000 feet	

res

Document Path: S:\@RES GIS\Projects\NC\Cowford\MXD\2_CatEx\Figure 2 - USGS Map - Cowford.mxd



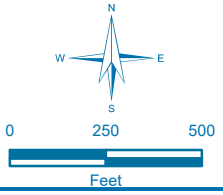


Figure 3 -Aerial Map

Cowford Mitigation Site

Onslow County, North Carolina

Date: 8/7/2019

Drawn by: GDS

Checked by: JRM

1 inch = 500 feet

res

Document Path: S:\@RES GIS\Projects\NC\Cowford\MX012_CatEx\Figure 3 -Aerial - Cowford.mxd

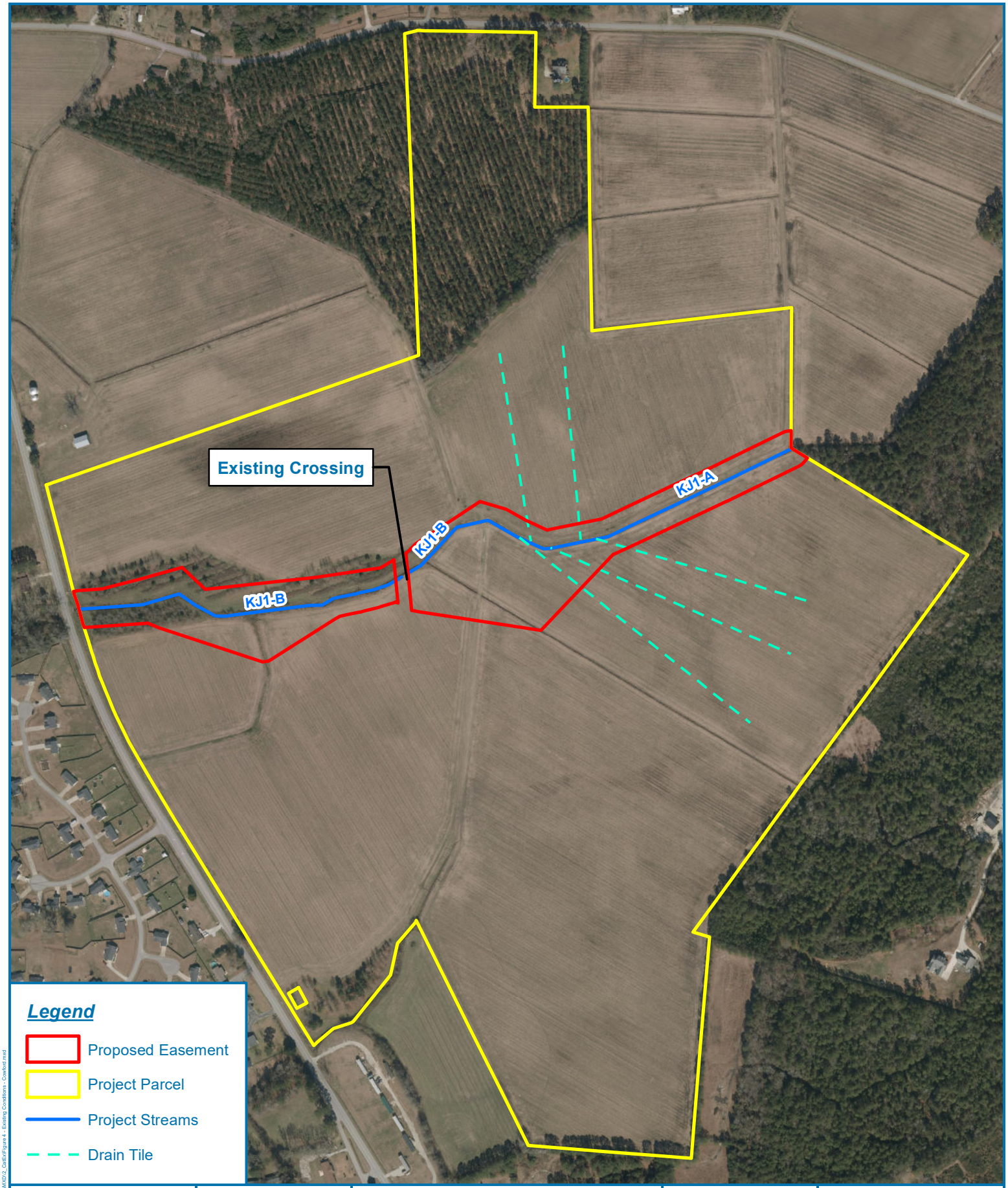


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Figure 4 - Existing Conditions

Cowford Mitigation Project

Onslow County, North Carolina

Date: 8/7/2019

Drawn by: GDS

Checked by: JRM

1 inch = 500 feet

res

Document Path: S:\@RES GIS\Projects\NC\Cowford\MXD\2_CatEx\Figure 4 - Existing Conditions - Cowford.mxd

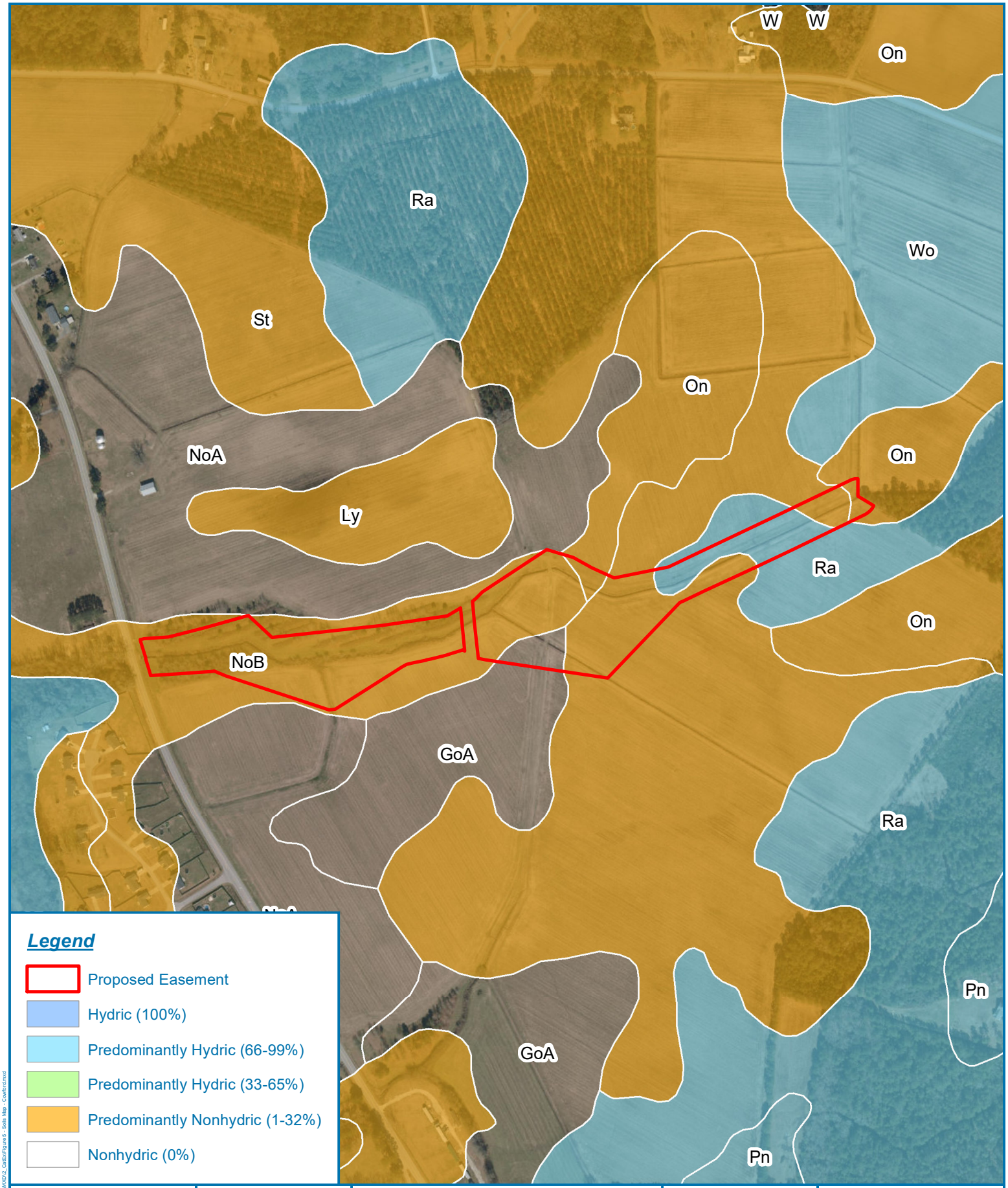

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Figure 5 - Soils Map

Cowford Mitigation Project

Onslow County, North Carolina

Date: 8/7/2019

Drawn by: GDS

Checked by: JRM

1 inch = 500 feet

res

Document Path: S:\@RES GIS\Projects\NC\Cowford\MX\012_CatEx\Figure 5 - Soils Map - Cowford.mxd

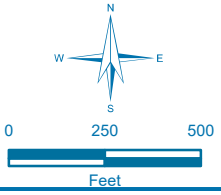

Figure 6 - Project Constraints

Cowford Mitigation Project

Onslow County, North Carolina

Date: 8/7/2019

Drawn by: GDS

Checked by: JRM

1 inch = 500 feet

res

Document Path: S:\@RES GIS\Projects\NC\Cowford\MX012_CatEx\Figure 6 - Project Constraints - Cowford.mxd

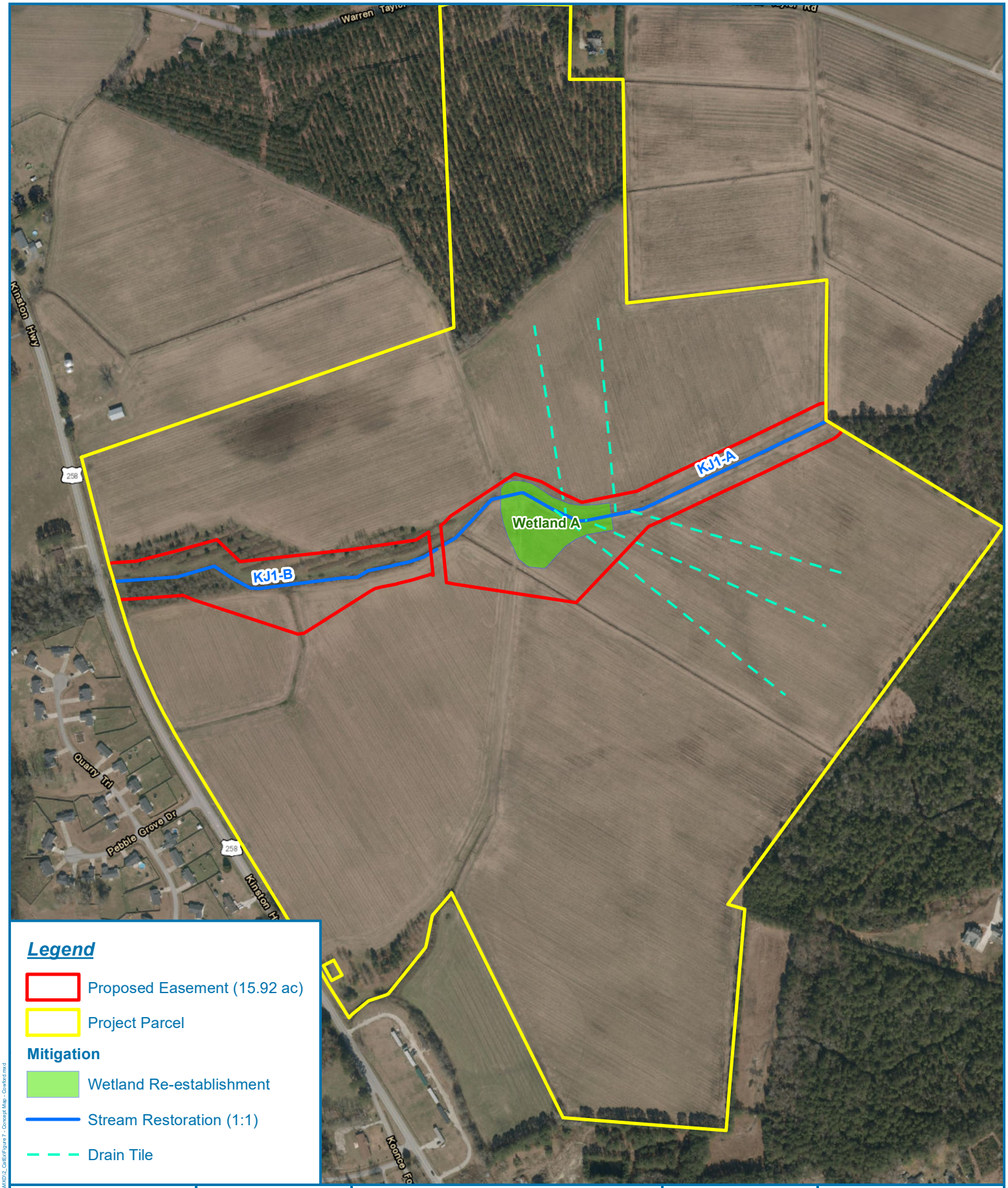

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Figure 7 - Concept Map

Cowford Mitigation Site

Onslow County, North Carolina

Date: 8/7/2019

Drawn by: GDS

Checked by: JRM

1 inch = 500 feet

res

Document Path: S:\@RES GIS\Projects\NC\Cowford\MX012_CatEx\Figure 7 - Concept Map - Cowford.mxd

USDA FORM AD-1006

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 6/10/2019
Name of Project Cowford	Federal Agency Involved Federal Highway Admin (FHWA)
Proposed Land Use Conservation Easement	County and State Onslow County, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS 6/10/2019 / Person Completing Form: Milton Cortes NC 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 166 acres
Major Crop(s) CORN	Farmable Land In Govt. Jurisdiction Acres: 74 % 384,215 acres	Amount of Farmland As Defined in FPPA Acres: 66 % 345,021 acres	
Name of Land Evaluation System Used Onslow Co., NC LESA	Name of State or Local Site Assessment System N/A	Date Land Evaluation Returned by NRCS July 03, 2019 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	15.9			
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	15.9			
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	12			
B. Total Acres Statewide Important or Local Important Farmland	3.9			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted	0.0046			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value	9.6			
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)	87			

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)	15			
2. Perimeter In Non-urban Use	(10)	10			
3. Percent Of Site Being Farmed	(20)	19			
4. Protection Provided By State and Local Government	(20)	0			
5. Distance From Urban Built-up Area	(15)	15			
6. Distance To Urban Support Services	(15)	0			
7. Size Of Present Farm Unit Compared To Average	(10)	10			
8. Creation Of Non-farmable Farmland	(10)	10			
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)	0			
TOTAL SITE ASSESSMENT POINTS	160	89	0	0	0
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	87	0	0	0
Total Site Assessment *(From Part VI above or local site assessment)*	160	89	0	0	0
TOTAL POINTS ***(Total of above 2 lines)***	260	176	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐

Reason For Selection:

Name of Federal agency representative completing this form:	Date:

(See Instructions on reverse side) **Form AD-1006 (03-02)**

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 - Federal agencies (or Federally funded projects) involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form. For Corridor type projects, the Federal agency shall use form NRCS-CPA-106 in place of form AD-1006. The Land Evaluation and Site Assessment (LESA) process may also be accessed by visiting the FPPA website, http://fppa.nrcs.usda.gov/lesa/.

Step 2 - Originator (Federal Agency) will send one original copy of the form together with appropriate scaled maps indicating location(s)of project site(s), to the Natural Resources Conservation Service (NRCS) local Field Office or USDA Service Center and retain a copy for their files. (NRCS has offices in most counties in the U.S. The USDA Office Information Locator may be found at http://offices.usda.gov/scripts/ndISAPI.dll/oip_public/USA_map, or the offices can usually be found in the Phone Book under U.S. Government, Department of Agriculture. A list of field offices is available from the NRCS State Conservationist and State Office in each State.)

Step 3 - NRCS will, within 10 working days after receipt of the completed form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland. (When a site visit or land evaluation system design is needed, NRCS will respond within 30 working days.

Step 4 - For sites where farmland covered by the FPPA will be converted by the proposed project, NRCS will complete Parts II, IV and V of the form.

Step 5 - NRCS will return the original copy of the form to the Federal agency involved in the project, and retain a file copy for NRCS records.

Step 6 - The Federal agency involved in the proposed project will complete Parts VI and VII of the form and return the form with the final selected site to the servicing NRCS office.

Step 7 - The Federal agency providing financial or technical assistance to the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

(For Federal Agency)

Part I: When completing the "County and State" questions, list all the local governments that are responsible for local land use controls where site(s) are to be evaluated.

Part III: When completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them or other major change in the ability to use the land for agriculture.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities planned build out capacity) that will cause a direct conversion.

Part VI: Do not complete Part VI using the standard format if a State or Local site assessment is used. With local and NRCS assistance, use the local Land Evaluation and Site Assessment (LESA).

1. Assign the maximum points for each site assessment criterion as shown in § 658.5(b) of CFR. In cases of corridor-type project such as transportation, power line and flood control, criteria #5 and #6 will not apply and will, be weighted zero, however, criterion #8 will be weighed a maximum of 25 points and criterion #11 a maximum of 25 points.

2. Federal agencies may assign relative weights among the 12 site assessment criteria other than those shown on the FPPA rule after submitting individual agency FPPA policy for review and comment to NRCS. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total points at 160. For project sites where the total points equal or exceed 160, consider alternative actions, as appropriate, that could reduce adverse impacts (e.g. Alternative Sites, Modifications or Mitigation).

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, convert the site assessment points to a base of 160.
Example: if the Site Assessment maximum is 200 points, and the alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \text{ X } 160 = 144 \text{ points for Site A}$$

For assistance in completing this form or FPPA process, contact the local NRCS Field Office or USDA Service Center.

NRCS employees, consult the FPPA Manual and/or policy for additional instructions to complete the AD-1006 form.

Farmland Classification—Onslow County, North Carolina
(Easement_PR_Cowford)

Map Scale: 1:4,950 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of statewide importance, if drained
- Farmland of statewide importance, if protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if irrigated
- Farmland of statewide importance, if drained and either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if irrigated and drained
- Farmland of statewide importance, if irrigated and either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if subsoiled, completely removing the root inhibiting soil layer
- Farmland of statewide importance, if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Farmland of statewide importance, if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance, if drained or either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if warm enough, and either drained or either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if warm enough
- Farmland of statewide importance, if thawed
- Farmland of local importance
- Farmland of local importance, if irrigated
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season

- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of statewide importance, if drained
- Farmland of statewide importance, if protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if irrigated
- Farmland of statewide importance, if drained and either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if irrigated and drained
- Farmland of statewide importance, if irrigated and either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if subsoiled, completely removing the root inhibiting soil layer
- Farmland of statewide importance, if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Farmland of statewide importance, if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance, if drained or either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if warm enough, and either drained or either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if warm enough
- Farmland of statewide importance, if thawed
- Farmland of local importance
- Farmland of local importance, if irrigated
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of statewide importance, if drained
- Farmland of statewide importance, if protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if irrigated

- Farmland of statewide importance, if drained and either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if irrigated and drained
- Farmland of statewide importance, if irrigated and either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if subsoiled, completely removing the root inhibiting soil layer
- Farmland of statewide importance, if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Farmland of statewide importance, if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance, if drained or either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if warm enough, and either drained or either protected from flooding or not frequently flooded during the growing season
- Farmland of statewide importance, if warm enough
- Farmland of statewide importance, if thawed
- Farmland of local importance
- Farmland of local importance, if irrigated
- Farmland of unique importance
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

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: Onslow County, North Carolina
Survey Area Data: Version 20, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 7, 2015—Oct 26, 2017

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.

Farmland Classification

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
GoA	Goldsboro fine sandy loam, 0 to 2 percent slopes	All areas are prime farmland	0.7	4.5%
NoB	Norfolk loamy fine sand, 2 to 6 percent slopes	All areas are prime farmland	9.1	57.1%
On	Onslow loamy fine sand	All areas are prime farmland	0.5	3.2%
Ra	Rains fine sandy loam, 0 to 2 percent slopes, Atlantic Coast Flatwoods	Prime farmland if drained	1.7	10.8%
St	Stallings loamy fine sand	Farmland of statewide importance	3.9	24.4%
Totals for Area of Interest			**15.9**	**100.0%**

Description

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The majority of soil attributes are associated with a component of a map unit, and such an attribute has to be aggregated to the map unit level before a thematic map can be rendered. Map units, however, also have their own attributes. An attribute of a map unit does not have to be aggregated in order to render a corresponding thematic map. Therefore, the "aggregation method" for any attribute of a map unit is referred to as "No Aggregation Necessary".

Tie-break Rule: Lower

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Soil Map—Onslow County, North Carolina
(Easement_PR_Cowford)

Map Scale: 1:4,950 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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: Onslow County, North Carolina
Survey Area Data: Version 20, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 7, 2015—Oct 26, 2017

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
GoA	Goldsboro fine sandy loam, 0 to 2 percent slopes	0.7	4.5%
NoB	Norfolk loamy fine sand, 2 to 6 percent slopes	9.1	57.1%
On	Onslow loamy fine sand	0.5	3.2%
Ra	Rains fine sandy loam, 0 to 2 percent slopes, Atlantic Coast Flatwoods	1.7	10.8%
St	Stallings loamy fine sand	3.9	24.4%
Totals for Area of Interest		**15.9**	**100.0%**

EDR REPORT

Cowford
1336 Kinston Highway
Richlands, NC 28574

Inquiry Number: 5681529.37s
June 12, 2019

The EDR Radius Map™ Report with GeoCheck®

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

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GEOCHECK ADDENDUM

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Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

1336 KINSTON HIGHWAY
RICHLANDS, NC 28574

COORDINATES

Latitude (North):	34.9286120 - 34˚ 55' 43.00''
Longitude (West):	77.5979950 - 77˚ 35' 52.78''
Universal Tranverse Mercator:	Zone 18
UTM X (Meters):	262689.2
UTM Y (Meters):	3868010.8
Elevation:	70 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5945711 RICHLANDS, NC
Version Date:	2013
West Map:	5945709 POTTERS HILL, NC
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140520, 20140524
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
1336 KINSTON HIGHWAY
RICHLANDS, NC 28574

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
1	JARMAN FORK SERVICE	HWY 258	LUST, INST CONTROL, IMD	Lower	991, 0.188, SSE
2	BAYSDEN'S SUPERMARKE	931 KINSTON HIGHWAY	LUST, LAST, INST CONTROL, IMD	Lower	1040, 0.197, SSE

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL ..... National Priority List
Proposed NPL ..... Proposed National Priority List Sites
NPL LIENS ..... Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ..... National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY ..... Federal Facility Site Information listing
SEMS ..... Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE ..... Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS ..... Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ..... RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG ..... RCRA - Large Quantity Generators
RCRA-SQG ..... RCRA - Small Quantity Generators
RCRA-CESQG ..... RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS ..... Land Use Control Information System
US ENG CONTROLS ..... Engineering Controls Sites List

US INST CONTROL..... Sites with Institutional Controls

Federal ERNS list

ERNS..... Emergency Response Notification System

State- and tribal - equivalent NPL

NC HSDS..... Hazardous Substance Disposal Site

State- and tribal - equivalent CERCLIS

SHWS..... Inactive Hazardous Sites Inventory

State and tribal landfill and/or solid waste disposal site lists

SWF/LF..... List of Solid Waste Facilities
OLI..... Old Landfill Inventory
DEBRIS..... Solid Waste Active Disaster Debris Sites Listing
LCID..... Land-Clearing and Inert Debris (LCID) Landfill Notifications

State and tribal leaking storage tank lists

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 voluntary cleanup sites

INDIAN VCP..... Voluntary Cleanup Priority Listing
VCP..... Responsible Party Voluntary Action Sites

State and tribal Brownfields sites

BROWNFIELDS..... Brownfields Projects Inventory

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS..... A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

SWRCY..... Recycling Center Listing
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

EXECUTIVE SUMMARY

ODI	Open Dump Inventory
IHS OPEN DUMPS	Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL	Delisted National Clandestine Laboratory Register
US CDL	National Clandestine Laboratory Register

Local Land Records

LIENS 2	CERCLA Lien Information

Records of Emergency Release Reports

HMIRS	Hazardous Materials Information Reporting System
SPILLS	Spills Incident Listing
SPILLS 90	SPILLS 90 data from FirstSearch
SPILLS 80	SPILLS 80 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR	RCRA - Non Generators / No Longer Regulated
FUDS	Formerly Used Defense Sites
DOD	Department of Defense Sites
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
2020 COR ACTION	2020 Corrective Action Program List
TSCA	Toxic Substances Control Act
TRIS	Toxic Chemical Release Inventory System
SSTS	Section 7 Tracking Systems
ROD	Records Of Decision
RMP	Risk Management Plans
RAATS	RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
PADS	PCB Activity Database System
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
ABANDONED MINES	Abandoned Mines
FINDS	Facility Index System/Facility Registry System

EXECUTIVE SUMMARY

ECHO ..... Enforcement & Compliance History Information
UXO ..... Unexploded Ordnance Sites
DOCKET HWC ..... Hazardous Waste Compliance Docket Listing
FUELS PROGRAM ..... EPA Fuels Program Registered Listing
AIRS ..... Air Quality Permit Listing
ASBESTOS ..... ASBESTOS
COAL ASH ..... Coal Ash Disposal Sites
DRYCLEANERS ..... Drycleaning Sites
Financial Assurance ..... Financial Assurance Information Listing
NPDES ..... NPDES Facility Location Listing
UIC ..... Underground Injection Wells Listing
AOP ..... Animal Operation Permits Listing
PCSRP ..... Petroleum-Contaminated Soil Remediation Permits
SEPT HAULERS ..... Permitted Septage Haulers Listing
CCB ..... Coal Ash Structural Fills (CCB) Listing

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP ..... EDR Proprietary Manufactured Gas Plants
EDR Hist Auto ..... EDR Exclusive Historical Auto Stations
EDR Hist Cleaner ..... EDR Exclusive Historical Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS ..... Recovered Government Archive State Hazardous Waste Facilities List
RGA LF ..... Recovered Government Archive Solid Waste Facilities List
RGA LUST ..... Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

State and tribal leaking storage tank lists

LUST: The Leaking Underground Storage Tank Incidents Management Database contains an inventory

of reported leaking underground storage tank incidents. The data come from the Department of Environment, & Natural Resources' Incidents by Address.

A review of the LUST list, as provided by EDR, and dated 02/01/2019 has revealed that there are 2 LUST sites within approximately 0.5 miles of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
JARMAN FORK SERVICE	***HWY 258***	***SSE 1/8 - 1/4 (0.188 mi.)***	***1***	***8***
Incident Phase: Closed Out Incident Number: 5646 Current Status: File Located in Archives				
BAYSDEN'S SUPERMARKE	***931 KINSTON HIGHWAY***	***SSE 1/8 - 1/4 (0.197 mi.)***	***2***	***11***
Incident Phase: Closed Out Incident Number: 32896 Current Status: File Located in House				

LAST: A listing of leaking aboveground storage tank site locations.

A review of the LAST list, as provided by EDR, and dated 02/01/2019 has revealed that there is 1 LAST site within approximately 0.5 miles of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
BAYSDEN'S SUPERMARKE	***931 KINSTON HIGHWAY***	***SSE 1/8 - 1/4 (0.197 mi.)***	***2***	***11***
Close Out: 11/02/2017 Close Out: 03/26/1998 Incident Number: 85456 Incident Number: 85458 Current Status: C Current Status: A				

State and tribal institutional control / engineering control registries

INST CONTROL: No Further Action Sites With Land Use Restrictions Monitoring.

A review of the INST CONTROL list, as provided by EDR, and dated 12/19/2018 has revealed that there are 2 INST CONTROL sites within approximately 0.5 miles of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
JARMAN FORK SERVICE	***HWY 258***	***SSE 1/8 - 1/4 (0.188 mi.)***	***1***	***8***
BAYSDEN'S SUPERMARKE	***931 KINSTON HIGHWAY***	***SSE 1/8 - 1/4 (0.197 mi.)***	***2***	***11***

ADDITIONAL ENVIRONMENTAL RECORDS

Records of Emergency Release Reports

IMD: Incident Management Database.

A review of the IMD list, as provided by EDR, and dated 07/21/2006 has revealed that there are 2 IMD

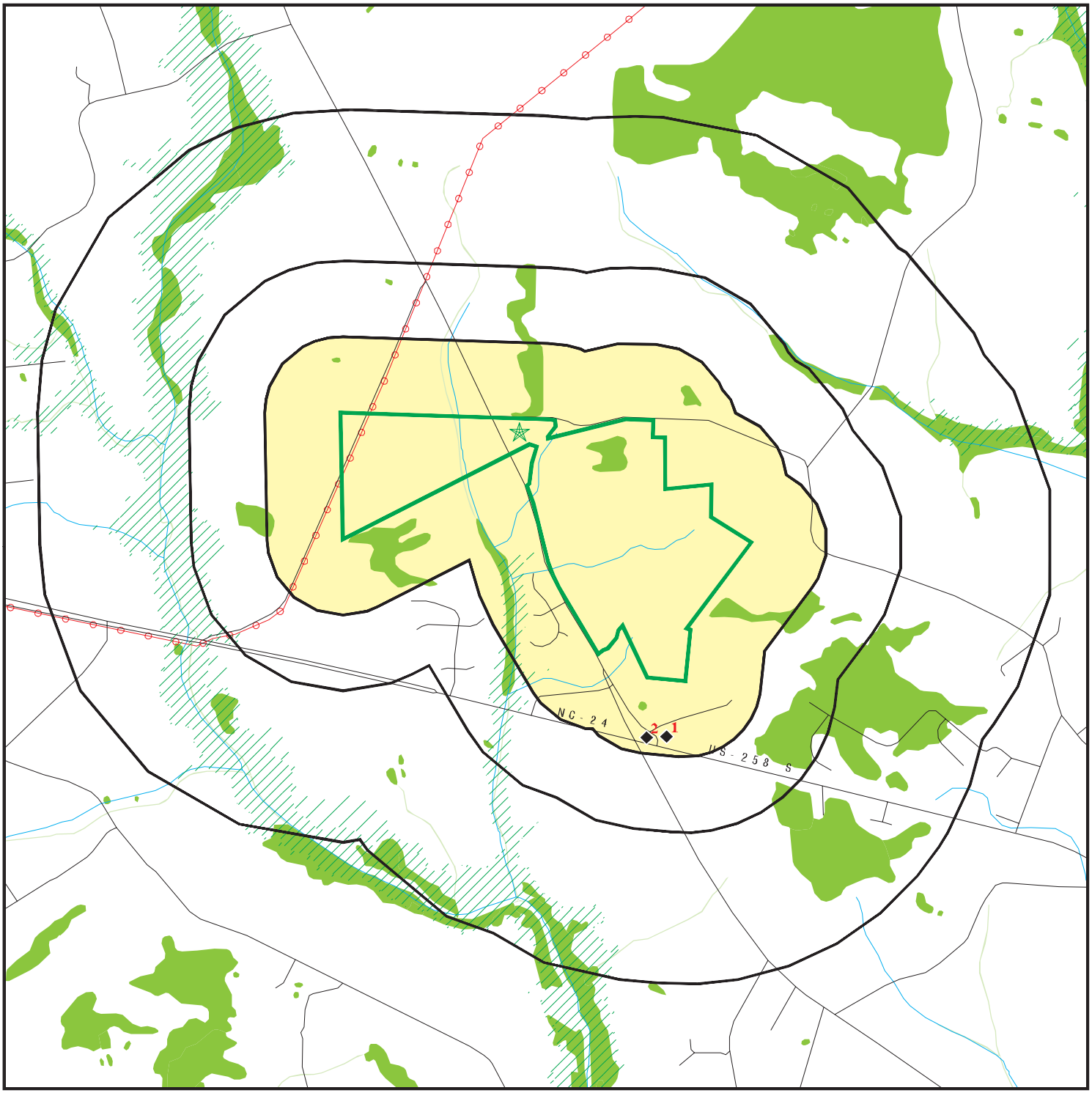
sites within approximately 0.5 miles of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
JARMAN FORK SERVICE	***HWY 258***	***SSE 1/8 - 1/4 (0.188 mi.)***	***1***	***8***
Facility Id: 5646				
BAYSDEN'S SUPERMARKE	***931 KINSTON HIGHWAY***	***SSE 1/8 - 1/4 (0.197 mi.)***	***2***	***11***
Facility Id: 18185				
Facility Id: 85456				
Facility Id: 85458				

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 5681529.37S



Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

National Priority List Sites

Dept. Defense Sites

0 1/4 1/2 1 Miles

Indian Reservations BIA

Power transmission lines

100-year flood zone

500-year flood zone

National Wetland Inventory

State Wetlands

Hazardous Substance Disposal Sites

N

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Cowford ADDRESS: 1336 Kinston Highway Richlands NC 28574 LAT/LONG: 34.928612 / 77.597995	CLIENT: Resource Environmental Solutions, LLC CONTACT: Grayson Sanner INQUIRY #: 5681529.37s DATE: June 12, 2019 1:13 pm

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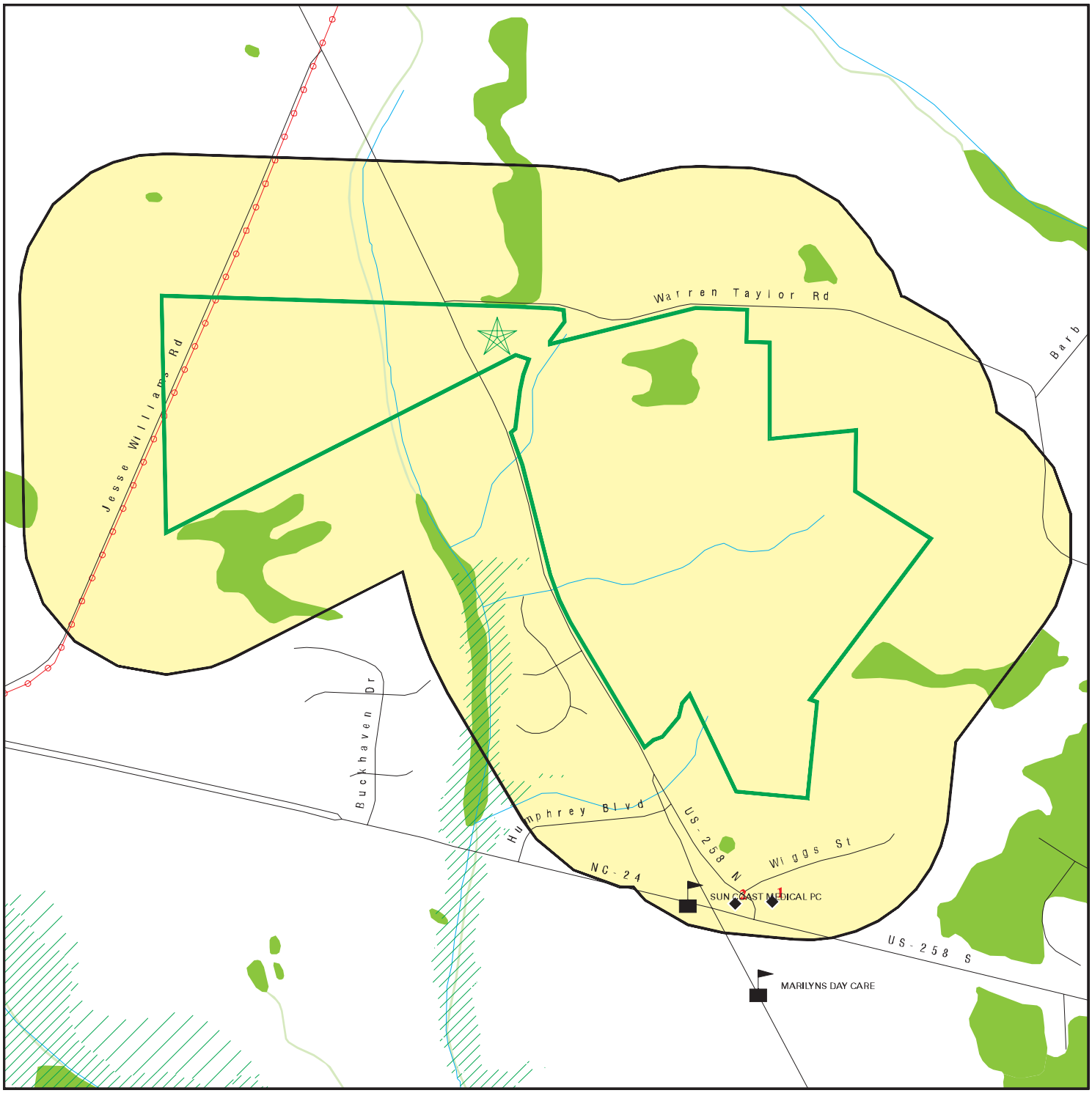
DETAIL MAP - 5681529.37S



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

0 1/8 1/4 1/2 Miles

Indian Reservations BIA

Power transmission lines

100-year flood zone

500-year flood zone

National Wetland Inventory

State Wetlands

Hazardous Substance Disposal Sites

N

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Cowford	CLIENT: Resource Environmental Solutions, LLC
ADDRESS: 1336 Kinston Highway Richlands NC 28574	CONTACT: Grayson Sanner
LAT/LONG: 34.928612 / 77.597995	INQUIRY #: 5681529.37s
	DATE: June 12, 2019 1:15 pm

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MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	0.001		0	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	0.001		0	NR	NR	NR	NR	0
State- and tribal - equivalent NPL								
NC HSDS	1.000		0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
OLI	0.500		0	0	0	NR	NR	0
DEBRIS	0.500		0	0	0	NR	NR	0
LCID	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
State and tribal leaking storage tank lists								
LUST	0.500		0	2	0	NR	NR	2
LAST	0.500		0	1	0	NR	NR	1
INDIAN LUST	0.500		0	0	0	NR	NR	0
LUST TRUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL	0.500		0	2	0	NR	NR	2
State and tribal voluntary cleanup sites								
INDIAN VCP	0.500		0	0	0	NR	NR	0
VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
SWRCY	0.500		0	0	0	NR	NR	0
HIST LF	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	0.001		0	NR	NR	NR	NR	0
US CDL	0.001		0	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	0.001		0	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	0.001		0	NR	NR	NR	NR	0
SPILLS	0.001		0	NR	NR	NR	NR	0
IMD	0.500		0	2	0	NR	NR	2

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
SPILLS 90	0.001		0	NR	NR	NR	NR	0
SPILLS 80	0.001		0	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	0.001		0	NR	NR	NR	NR	0
EPA WATCH LIST	0.001		0	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	0.001		0	NR	NR	NR	NR	0
TRIS	0.001		0	NR	NR	NR	NR	0
SSTS	0.001		0	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	0.001		0	NR	NR	NR	NR	0
RAATS	0.001		0	NR	NR	NR	NR	0
PRP	0.001		0	NR	NR	NR	NR	0
PADS	0.001		0	NR	NR	NR	NR	0
ICIS	0.001		0	NR	NR	NR	NR	0
FTTS	0.001		0	NR	NR	NR	NR	0
MLTS	0.001		0	NR	NR	NR	NR	0
COAL ASH DOE	0.001		0	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	0.001		0	NR	NR	NR	NR	0
RADINFO	0.001		0	NR	NR	NR	NR	0
HIST FTTS	0.001		0	NR	NR	NR	NR	0
DOT OPS	0.001		0	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	0.001		0	NR	NR	NR	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	0.001		0	NR	NR	NR	NR	0
US AIRS	0.001		0	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.001		0	NR	NR	NR	NR	0
FINDS	0.001		0	NR	NR	NR	NR	0
ECHO	0.001		0	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
DOCKET HWC	0.001		0	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
AIRS	0.001		0	NR	NR	NR	NR	0
ASBESTOS	0.001		0	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	0.001		0	NR	NR	NR	NR	0
NPDES	0.001		0	NR	NR	NR	NR	0
UIC	0.001		0	NR	NR	NR	NR	0
AOP	0.001		0	NR	NR	NR	NR	0
PCSRP	0.500		0	0	0	NR	NR	0
SEPT HAULERS	0.001		0	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
CCB	0.500		0	0	0	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	0.001		0	NR	NR	NR	NR	0
RGA LF	0.001		0	NR	NR	NR	NR	0
RGA LUST	0.001		0	NR	NR	NR	NR	0
- Totals --		0	0	7	0	0	0	7

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

1 SSE 1/8-1/4 0.188 mi. 991 ft. | **JARMAN FORK SERVICE STATION**
HWY 258
RICHLANDS, NC 28574 | **LUST**
INST CONTROL
IMD | **S101167751**
N/A

Relative: Lower

Actual: 60 ft.

LUST:

Facility ID:	Not reported
UST Number:	WI-824
Incident Number:	5646
Contamination Type:	GW
Source Type:	Leak-underground
Product Type:	P
Date Reported:	02/08/1990
Date Occur:	02/08/1990
Cleanup:	02/08/1990
Closure Request:	Not reported
Close Out:	12/16/2015
Level Of Soil Cleanup Achieved:	Industrial/Commercial
Tank Regulated Status:	R
# Of Supply Wells:	0
Commercial/NonCommercial UST Site:	COMMERCIAL
Risk Classification:	H
Risk Class Based On Review:	L
Corrective Action Plan Type:	Not reported
NOV Issue Date:	Not reported
NORR Issue Date:	08/31/1990
Site Priority:	Not reported
Phase Of LSA Req:	Not reported
Site Risk Reason:	Not reported
Land Use:	Not reported
MTBE:	No
MTBE1:	No
Flag:	No
Flag1:	No
LUR Filed:	11/20/2015
Release Detection:	0
Current Status:	File Located in Archives
RBCA GW:	Cleanups to alternate standards
PETOPT:	3
RPL:	False
CD Num:	602
Reel Num:	0
RPOW:	True
RPOP:	False
Error Flag:	0
Error Code:	Not reported
Valid:	True
Lat/Long Decimal:	34.9128 -77.5870
Testlat:	Not reported
Regional Officer Project Mgr:	DTM
Region:	WIL
Company:	GREAT GAS & OIL CO.
Contact Person:	MR. BOBBY WILLIAMS
Telephone:	Not reported
RP Address:	P.O. BOX 129
RP City,St,Zip:	JACKSONVILLE, NC 28540
RP County:	Not reported
Comments:	Tanks were pulled and some gas spilled out into the excavation upon

JARMAN FORK SERVICE STATION (Continued) **S101167751**

removal.02-07-90. 5 gallons of product spilled when removing the tank. No closure report ever submitted. A monitoring well was installed and sampled. Results indicated 80 ppb benzene. 1996 - Monitoring well resampled at request of region. Well was sampled without proper purging contaminants found. 2004 sampling revealed only 4.29 ppb benzene at estimated concentration. WiRO conducted well survey low risk. Site not found in TIMS. No soil samples taken. NRP'd for Soil and Groundwater /// pulled for archive 2.29.2016 ///

5 Min Quad: Not reported

PIRF:

Facility Id:	5646
Date Occurred:	1990-02-07 00:00:00
Date Reported:	1990-06-01 00:00:00
Description Of Incident:	DURING EXCAVATION OF USTS APPROX. 30 GALS. WAS SPILLED INTO PIT AREA, NEAR A MAIN WATER LINE. TESTS RESULTS CONFIRMED CONTAMINATION.
Owner/Operator:	MR. BOBBY WILLIAMS
Ownership:	4
Operation Type:	6
Type:	3
Location:	1
Site Priority:	95B
Priority Update:	1998-05-30 00:00:00
Wells Affected Y/N:	N
Samples Include:	0
7#5 Minute Quad:	3
5 Minute Quad:	1
Pirf/Min Soil:	Not reported
Release Code:	Not reported
Source Code:	Pirf
Err Type:	Not reported
Cause:	Not reported
Source:	Not reported
Ust Number:	Not reported
Last Modified:	2015-12-16 00:00:00
Incident Phase:	**Closed Out**
NOV Issued:	Not reported
NORR Issued:	1990-08-31 00:00:00
45 Day Report:	Not reported
Public Meeting Held:	Not reported
Corrective Action Planned:	Not reported
SOC Signed:	Not reported
Reclassification Report:	Not reported
RS Designation:	Not reported
Closure Request Date:	Not reported
Close-out Report:	Not reported

INST CONTROL:

Project Number:	WI-824
Object ID:	1263
DWM Contact:	Wilmington Regional Office (910) 796-7215
DWM Program:	Underground Storage Tank Section
Project Status:	No Further Action
COC:	Multi COC
Contamination Source:	UST System
Received Date:	11/19/2015

JARMAN FORK SERVICE STATION (Continued) **S101167751**

Restricted Media:	Multi-Media
Allowed Use:	Media Restrictions Only
Certification:	None
Plant Reception Date:	Not reported
Instrument Status:	Effective
Deed BK:	Not reported
Deed PG:	Not reported
Plat BK:	Not reported
Plat PG:	Not reported
Instrument:	Notice and Restriction
Deed:	Not reported
Deed Date:	Recorded 11-19-2015
Plat:	Not reported
Plat Date:	Not reported
X Coord:	2423580.7297
Y Coord:	426231.21105

IMD:

Region:	WIL
Facility ID:	5646
Date Occurred:	2/8/1990
Submit Date:	6/1/1990
GW Contam:	Yes, Groundwater Contamination has been detected
Soil Contam:	No
Incident Desc:	DURING EXCAVATION OF USTS APPROX. 30 GALS. WAS SPILLED INTO PIT AREA, NEAR A MAIN WATER LINE. TESTS RESULTS CONFIRMED CONTAMINATION.
Operator:	MR. BOBBY WILLIAMS
Contact Phone:	Not reported
Owner Company:	GREAT GAS & OIL CO.
Operator Address:	P.O. BOX 129
Operator City:	JACKSONVILLE
Oper City,St,Zip:	JACKSONVILLE, NC 28540-
Ownership:	Private
Operation:	Commercial
Material:	GASOLINE
Qty Lost 1:	Not reported
Qty Recovered 1:	UNK
Source:	Leak-underground
Type:	Gasoline/diesel
Location:	Facility
Setting:	Residential
Risk Site:	H
Site Priority:	95B
Priority Code:	H
Priority Update:	5/30/1998
Dem Contact:	DTM
Wells Affected:	No
Num Affected:	0
Wells Contam:	Not reported
Sampled By:	Responsible Parties
Samples Include:	Groundwater Samples
7.5 Min Quad:	Not reported
5 Min Quad:	Not reported
Latitude:	34.913941528
Longitude:	-77.59037559
Latitude Number:	Not reported
Longitude Number:	Not reported

JARMAN FORK SERVICE STATION (Continued) **S101167751**

Latitude Decimal:	Not reported
Longitude Decimal:	Not reported
GPS:	3
Agency:	DWM
Facility ID:	5646
Last Modified:	Not reported
Incident Phase:	RE
NOV Issued:	Not reported
NORR Issued:	Not reported
45 Day Report:	Not reported
Public Meeting Held:	Not reported
Corrective Action Planned:	Not reported
SOC Sighned:	Not reported
Reclassification Report:	Not reported
RS Designation:	Not reported
Closure Request Date:	Not reported
Close-out Report:	Not reported

2
SSE
1/8-1/4
0.197 mi.
1040 ft.

BAYSDEN'S SUPERMARKET (FORMER)
931 KINSTON HIGHWAY
RICHLANDS, NC 28574

LUST **S103131845**
LAST **N/A**
INST CONTROL
IMD

Relative:
Lower

Actual:
61 ft.

LUST:

Facility ID:	Not reported
UST Number:	WI-7827
Incident Number:	32896
Contamination Type:	GW
Source Type:	Leak-underground
Product Type:	P
Date Reported:	03/31/2004
Date Occur:	01/08/2004
Cleanup:	01/08/2004
Closure Request:	Not reported
Close Out:	11/02/2017
Level Of Soil Cleanup Achieved:	Industrial/Commercial
Tank Regulated Status:	R
# Of Supply Wells:	0
Commercial/NonCommercial UST Site:	COMMERCIAL
Risk Classification:	H
Risk Class Based On Review:	L
Corrective Action Plan Type:	Not reported
NOV Issue Date:	Not reported
NORR Issue Date:	Not reported
Site Priority:	Not reported
Phase Of LSA Req:	Not reported
Site Risk Reason:	Not reported
Land Use:	Residential
MTBE:	No
MTBE1:	Yes
Flag:	No
Flag1:	No
LUR Filed:	10/06/2017
Release Detection:	0
Current Status:	File Located in House
RBCA GW:	Cleanups to alternate standards

BAYSDEN'S SUPERMARKET (FORMER) (Continued) **S103131845**

PETOPT:	3
RPL:	True
CD Num:	0
Reel Num:	0
RPOW:	True
RPOP:	False
Error Flag:	0
Error Code:	N
Valid:	True
Lat/Long Decimal:	34.2077 -77.8636
Testlat:	Not reported
Regional Officer Project Mgr:	SAK
Region:	WIL
Company:	BAYSDEN'S SUPERMARKET
Contact Person:	MS. EDNA E. BAYSDEN
Telephone:	Not reported
RP Address:	416 CAVANAUGHTOWN ROAD
RP City,St,Zip:	RICHLANDS, NC 28574
RP County:	Not reported
Comments:	ust's were discovered when the area was being excavated during remediation of an overspill from aboveground storage tanks in 2004. See RAST incident 85456 for information on this spill. A NORR has been issued. //// August 2017 - talked with representative with Northeast Onslow Water and gave all addresses within 1000 feet and they confirmed that all properties were connected to public water.
5 Min Quad:	Not reported

PIRF:

Facility Id:	32896
Date Occurred:	2004-01-08 00:00:00
Date Reported:	2004-01-08 00:00:00
Description Of Incident:	Not reported
Owner/Operator:	Not reported
Ownership:	4
Operation Type:	6
Type:	3
Location:	1
Site Priority:	Not reported
Priority Update:	Not reported
Wells Affected Y/N:	N
Samples Include:	Not reported
7#5 Minute Quad:	N
5 Minute Quad:	Not reported
Pirf/Min Soil:	Not reported
Release Code:	Not reported
Source Code:	Not reported
Err Type:	2
Cause:	3
Source:	A
Ust Number:	P
Last Modified:	2017-11-02 00:00:00
Incident Phase:	**Closed Out**
NOV Issued:	Not reported
NORR Issued:	Not reported
45 Day Report:	Not reported
Public Meeting Held:	Not reported
Corrective Action Planned:	Not reported

BAYSDEN'S SUPERMARKET (FORMER) (Continued) **S103131845**

SOC Signed:	Not reported
Reclassification Report:	Not reported
RS Designation:	Not reported
Closure Request Date:	Not reported
Close-out Report:	Not reported

LAST:

Facility ID:	Not reported
UST Number:	WI-85456
Incident Number:	85456
Contamination Type:	GW
Source Type:	14
Product Type:	P
Date Reported:	01/12/1998
Date Occur:	01/10/1998
Cleanup:	Not reported
Closure Request:	Not reported
Close Out:	11/02/2017
Level Of Soil Cleanup Achieved:	Not reported
Tank Regulated Status:	Not reported
# Of Supply Wells:	0
Commercial/NonCommercial UST Site:	Not reported
Risk Classification:	H
Risk Class Based On Review:	H
Corrective Action Plan Type:	Not reported
NOV Issue Date:	Not reported
NORR Issue Date:	Not reported
Site Priority:	55
Phase Of LSA Req:	Not reported
Site Risk Reason:	Not reported
Land Use:	Not reported
MTBE:	No
MTBE1:	Yes
Flag:	No
Flag1:	No
LUR Filed:	Not reported
Release Detection:	0
Current Status:	C
RBCA GW:	Not reported
PETOPT:	3
RPL:	False
CD Num:	0
Reel Num:	0
RPOW:	False
RPOP:	False
Error Flag:	0
Error Code:	Not reported
Valid:	False
Lat/Long:	34 54 49.92 77 35 24.96
Lat/Long Decimal:	34.91388 -77.59027
Testlat:	Not reported
Regional Officer Project Mgr:	SAK
Region:	WIL
Company:	BAYSDENS SUPERMARKET
Contact Person:	EARL BAYSDEN
Telephone:	Not reported
RP Address:	931 KINSTON HIGNWAY

BAYSDEN'S SUPERMARKET (FORMER) (Continued) **S103131845**

RP City,St,Zip: RICHLANDS, NC
RP County: Not reported
Comments: RESPONSIBLE PARTY HAS BEEN ENFORCED FOR LACK OF CSA OR CAP.6/14/2002 MEETING WITH DAUTER TO DISCUSS HOW TO CLEAN WITH NO FUNDS. See UST incident No. 32896 for additional information concerning this site
5 Min Quad: Not reported

PIRF:
Facility Id: 85456
Date Occurred: Not reported
Date Reported: Not reported
Description Of Incident: Not reported
Owner/Operator: Not reported
Ownership: 5
Operation Type: 8
Type: Not reported
Location: Not reported
Site Priority: 55D
Priority Update: Not reported
Wells Affected Y/N: N
Wells Affected Number: 0
Samples Taken By: Not reported
Samples Include: Not reported
7#5 Min Quad: Not reported
5 Min Quad: Not reported
Pirf/Min Soil: Not reported
Release Code: Not reported
Cause: Not reported
Source: Not reported
Source Type: 1

Last Modified: 11/2/2017
Incident Phase: CO
NOV Issued: Not reported
NORR Issued: Not reported
45 Day Report: Not reported
Public Meeting Held: Not reported
Corrective Action Planned: Not reported
SOC Signed: Not reported
Reclassification Report: Not reported
RS Designation: Not reported
Closure Request Date: Not reported
Close-out Report: Not reported

Facility ID: Not reported
UST Number: WI-85458
Incident Number: 85458
Contamination Type: NO
Source Type: 19
Product Type: P
Date Reported: 01/10/1998
Date Occur: 01/10/1998
Cleanup: Not reported
Closure Request: Not reported
Close Out: 03/26/1998
Level Of Soil Cleanup Achieved: Not reported
Tank Regulated Status: Not reported
Of Supply Wells: 0

BAYSDEN'S SUPERMARKET (FORMER) (Continued) **S103131845**

Commercial/NonCommercial UST Site: Not reported
Risk Classification: Not reported
Risk Class Based On Review: L
Corrective Action Plan Type: Not reported
NOV Issue Date: Not reported
NORR Issue Date: Not reported
Site Priority: 55
Phase Of LSA Req: Not reported
Site Risk Reason: Not reported
Land Use: Not reported
MTBE: No
MTBE1: Unknown
Flag: No
Flag1: No
LUR Filed: Not reported
Release Detection: 0
Current Status: A
RBCA GW: Not reported
PETOPT: Not reported
RPL: False
CD Num: 471
Reel Num: 0
RPOW: False
RPOP: False
Error Flag: 0
Error Code: Not reported
Valid: False
Lat/Long: 34 54 49.92 77 35 24.96
Lat/Long Decimal: 34.91388 -77.59027
Testlat: Not reported
Regional Officer Project Mgr: Not reported
Region: WIL
Company: WORSLEY COMPANIES, INC.
Contact Person: DON QUINN
Telephone: Not reported
RP Address: P.O.BOX 3227
RP City,St,Zip: WILMINGTON, NC
RP County: Not reported
Comments: OVERFILL DURING FUEL TRANSFER FROM TANKER TRUCK CAUSED A LOSS OF 100-200 GALLONS OF GASOLINE. CLEANUP FOLLOWED SOON AFTER. INCIDENT IS NOT RELATED TO BAYSDENS SUPERMARKET INCIDENT AT THIS SAME LOCATION.
5 Min Quad: Not reported

PIRF:
Facility Id: 85458
Date Occurred: Not reported
Date Reported: Not reported
Description Of Incident: Not reported
Owner/Operator: Not reported
Ownership: 5
Operation Type: 8
Type: Not reported
Location: Not reported
Site Priority: 55E
Priority Update: Not reported
Wells Affected Y/N: N
Wells Affected Number: 0
Samples Taken By: Not reported

BAYSDEN'S SUPERMARKET (FORMER) (Continued) **S103131845**

Samples Include:	Not reported
7#5 Min Quad:	Not reported
5 Min Quad:	Not reported
Pirf/Min Soil:	Not reported
Release Code:	Not reported
Cause:	Not reported
Source:	Not reported
Source Type:	0
Last Modified:	3/26/1998
Incident Phase:	**CO**
NOV Issued:	Not reported
NORR Issued:	Not reported
45 Day Report:	Not reported
Public Meeting Held:	Not reported
Corrective Action Planned:	Not reported
SOC Signed:	Not reported
Reclassification Report:	Not reported
RS Designation:	Not reported
Closure Request Date:	Not reported
Close-out Report:	3/26/1998

INST CONTROL:

Project Number:	WI-7827
Object ID:	5079
DWM Contact:	Wilmington Regional Office (910) 796-7215
DWM Program:	Underground Storage Tank Section
Project Status:	No Further Action
COC:	Multi COC
Contamination Source:	UST System
Received Date:	10/5/2017
Restricted Media:	Multi-Media
Allowed Use:	Media Restrictions Only
Certification:	None
Plant Reception Date:	Not reported
Instrument Status:	Effective
Deed BK:	Not reported
Deed PG:	Not reported
Plat BK:	Not reported
Plat PG:	Not reported
Instrument:	Notice and Restriction
Deed:	Not reported
Deed Date:	Recorded 10-5-2017
Plat:	Not reported
Plat Date:	Not reported
X Coord:	2343590.9409
Y Coord:	168561.68177

IMD:

Region:	WIL
Facility ID:	18185
Date Occurred:	1/10/1998
Submit Date:	1/22/1998
GW Contam:	Not reported
Soil Contam:	Yes
Incident Desc:	IN JAN. 1998 AN AGST WAS OVERFILLED RESULTING IN DISCHARGE OF

BAYSDEN'S SUPERMARKET (FORMER) (Continued) **S103131845**

GASOLINE. OLD USTS ON SITE. AGSTS HAVE LEAKED OVER SEVERAL YEARS.

Operator:	EARL BAYSDEN
Contact Phone:	Not reported
Owner Company:	Not reported
Operator Address:	931 KINSTON HWY.
Operator City:	RICHLANDS
Oper City,St,Zip:	RICHLANDS, NC 28574
Ownership:	Private
Operation:	Commercial
Material:	GASOLINE
Qty Lost 1:	Not reported
Qty Recovered 1:	Not reported
Material:	DIESEL
Qty Lost:	Not reported
Qty Recovered:	Not reported
Source:	Dredge Spoil
Type:	Gasoline/diesel
Location:	Facility
Setting:	Residential
Risk Site:	No
Site Priority:	55E
Priority Code:	E
Priority Update:	Not reported
Dem Contact:	Not reported
Wells Affected:	Not reported
Num Affected:	0
Wells Contam:	Not reported
Sampled By:	Dept. of Env. Management
Samples Include:	Groundwater Samples
7.5 Min Quad:	Not reported
5 Min Quad:	V27A
Latitude:	Not reported
Longitude:	Not reported
Latitude Number:	Not reported
Longitude Number:	Not reported
Latitude Decimal:	Not reported
Longitude Decimal:	Not reported
GPS:	NOD
Agency:	Not reported
Facility ID:	18185
Last Modified:	Not reported
Incident Phase:	Not reported
NOV Issued:	Not reported
NORR Issued:	Not reported
45 Day Report:	Not reported
Public Meeting Held:	Not reported
Corrective Action Planned:	Not reported
SOC Sighned:	Not reported
Reclassification Report:	Not reported
RS Designation:	Not reported
Closure Request Date:	Not reported
Close-out Report:	Not reported

Region:	WIL
Facility ID:	85456
Date Occurred:	1/12/1998

BAYSDEN'S SUPERMARKET (FORMER) (Continued) **S103131845**

Submit Date: 2/7/2001
GW Contam: Yes, Groundwater Contamination has been detected
Soil Contam: Not reported
Incident Desc: RESPONSIBLE PARTY HAS BEEN ENFORCED FOR LACK OF CSA OR CAP. 6/14/2002 MEETING WITH DAUTER TO DISCUSS HOW TO CLEAN WITH NO FUNDS
Operator: BAYSDEN, EARL
Contact Phone: 910-324-3564
Owner Company: BAYSDENS SUPERMARKET
Operator Address: 931 KINSTON HIGNWAY
Operator City: RICHLANDS
Oper City,St,Zip: RICHLANDS 910-324-3564
Ownership: Federal
Operation: 8
Material: Not reported
Qty Lost 1: Not reported
Qty Recovered 1: Not reported
Source: Dredge Spoil
Type: Gasoline/diesel
Location: Not reported
Setting: Not reported
Risk Site: Not reported
Site Priority: Not reported
Priority Code: D
Priority Update: Not reported
Dem Contact: SDC
Wells Affected: No
Num Affected: 0
Wells Contam: Not reported
Sampled By: Not reported
Samples Include: Not reported
7.5 Min Quad: Not reported
5 Min Quad: Not reported
Latitude: Not reported
Longitude: Not reported
Latitude Number: Not reported
Longitude Number: Not reported
Latitude Decimal: Not reported
Longitude Decimal: Not reported
GPS: GPS
Agency: DWQ
Facility ID: 85456
Last Modified: 6/26/2003
Incident Phase: RE
NOV Issued: 3/12/2001
NORR Issued: Not reported
45 Day Report: Not reported
Public Meeting Held: Not reported
Corrective Action Planned: Not reported
SOC Sighned: Not reported
Reclassification Report: Not reported
RS Designation: Not reported
Closure Request Date: Not reported
Close-out Report: Not reported

Region: WIL
Facility ID: 85458

BAYSDEN'S SUPERMARKET (FORMER) (Continued) **S103131845**

Date Occurred:	1/10/1998
Submit Date:	2/7/2001
GW Contam:	No Groundwater Contamination detected
Soil Contam:	Not reported
Incident Desc:	OVERFILL DURING FUEL TRANSFER FROM TANKER TRUCK CAUSED A LOSS OF 100-200 GALLONS OF GASOLINE. CLEANUP FOLLOWED SOON AFTER. INCIDENT IS NOT RELATED TO BAYSDENS S
Operator:	QUINN, DON
Contact Phone:	Not reported
Owner Company:	WORSLEY COMPANIES, INC.
Operator Address:	P.O.BOX 3227
Operator City:	WILMINGTON
Oper City,St,Zip:	WILMINGTON
Ownership:	Federal
Operation:	8
Material:	Not reported
Qty Lost 1:	Not reported
Qty Recovered 1:	Not reported
Source:	Spill-surface
Type:	Gasoline/diesel
Location:	Not reported
Setting:	Not reported
Risk Site:	Not reported
Site Priority:	Not reported
Priority Code:	E
Priority Update:	Not reported
Dem Contact:	SDC
Wells Affected:	No
Num Affected:	0
Wells Contam:	Not reported
Sampled By:	Not reported
Samples Include:	Not reported
7.5 Min Quad:	Not reported
5 Min Quad:	Not reported
Latitude:	Not reported
Longitude:	Not reported
Latitude Number:	Not reported
Longitude Number:	Not reported
Latitude Decimal:	Not reported
Longitude Decimal:	Not reported
GPS:	GPS
Agency:	DWQ
Facility ID:	85458
Last Modified:	6/26/2003
Incident Phase:	Closed Out
NOV Issued:	1/26/1998
NORR Issued:	Not reported
45 Day Report:	Not reported
Public Meeting Held:	Not reported
Corrective Action Planned:	Not reported
SOC Sighned:	Not reported
Reclassification Report:	Not reported
RS Designation:	Not reported
Closure Request Date:	Not reported
Close-out Report:	3/26/1998

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

CORRESPONDENCE

June 17, 2019

Kenneth and Sue Jones
322 Jonestown Road
Pink Hill, NC 28572

Re: Cowford Mitigation Project

Dear Kenneth and Sue,

As part of the environmental documentation process in preparation for the stream mitigation project on your property, this letter is to inform you of provisions in the Federal Highway Administration Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, referred to as the Uniform Act.

The Uniform Act requires that we inform you in writing that this conservation easement transaction is voluntary and that the project is being developed by Environmental Banc & Exchange, LLC for the North Carolina Division of Mitigation Services (NCDMS). Neither EBX nor NCDMS have the authority to acquire the property by eminent domain. In addition, EBX believes that the agreed purchase price for the conservation easement area represents the fair market value.

This letter is for your information, and you do not need to respond. As always, please feel free to call me at 919-817-7378 with any questions.

Sincerely,

Daniel Ramsay
General Manager

302 Jefferson Street, Suite 110
Raleigh, NC 27605

Corporate Headquarters
6575 West Loop South, Suite 300
Bellaire, TX 77401
Main: 713.520.540

June 21st, 2019

Maria Dunn
Coastal Coordinator
DENR Rgl
943 Washington Square Mall
Washington, NC 27889

Subject: Project Scoping for Cowford Mitigation Project in Onslow County

Dear Ms. Dunn,

The purpose of this letter is to request review and comment on any possible issues that might emerge with respect to fish and wildlife associated with a potential stream and wetland restoration project on the attached site (USGS site map with approximate property lines and areas of potential ground disturbance are enclosed). Resource Environmental Solutions, LLC (RES) is contracted by the North Carolina Division of Mitigation Services to conduct stream and riparian wetland activities for the Cowford Project to provide compensatory mitigation for unavoidable stream and wetland impacts. The proposed project presents an opportunity to restore 2.27 acres of riparian wetlands, and restore 3,770 linear feet of stream and associated riparian buffer. Historic riparian wetlands adjacent to Cowford Branch and unnamed tributaries to Cowford Branch have been drained and converted to agricultural land for generations. Other land use around the project is pasture, residential land, and some bottomland hardwood forest.

We thank you in advance for your timely response and cooperation. You may return the comment to my attention at the address below. Please feel free to contact me at mdeangelo@res.us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Matt DeAngelo | Ecologist

Resource Environmental Solutions, LLC (RES), through its wholly owned subsidiary Environmental Banc & Exchange, LLC (EBX) has been contracted by NC DMS in response to the RFP #16-007577 to provide stream and wetland mitigation credits in the White Oak River Basin (Cataloging Unit 03030001, Targeted Local Watershed 03030001010010).

RES has entered into contracts to purchase fee simple property and a conservation easements totaling approximately 16 acres on one parcel comprising the Cowford Project (Project), in Onslow County, North Carolina. The Project will involve the restoration of an unnamed tributary to Cowford Branch and some adjacent riparian wetlands.

As described in the following technical proposal, the Project will result in significant water quality improvements including:

- Reduced nutrient and sediment loads,
- Improved flood flow attenuation, and
- Increased dissolved oxygen concentrations.

The Project will provide uplift for ecological functions, including:

- Improved aquatic and terrestrial habitat diversity,
- Reduced water temperature,
- Restored native riparian plant communities, and
- Invasive species treatment.

The Project will restore, enhance, and protect an important aquatic resource and wildlife corridor while also accommodating existing agricultural land uses.

Watershed

The Project is in the Upper New River watershed (14-digit HUC 03030001010010), a Targeted Local Watershed (TLW) that is being stressed by agricultural non-point source pollution. The Project supports many of the White Oak River Basin Restoration Priorities (RBRP) goals and presents an opportunity to restore 2.27 acres of riparian wetlands and restore 3,681 linear feet of stream and associated riparian buffer. The Project will provide ecological and water quality benefits to the Upper New River Watershed within the White Oak River Basin. These benefits are not limited to the project area and have far-reaching effects throughout the White Oak River Basin. The Project will provide improvements to water quality, hydrologic function, and terrestrial and aquatic habitat connectivity. As stated in the 2010 White Oak RBRP report, the following restoration and protection goals are listed for the watershed:

1. *Protect and improve water quality throughout the Basin by reducing sediment and nutrient inputs into streams and rivers;*
2. *Protect shellfish harvesting waters and reduce the number & frequency of Division of Environmental Health (DEH) closures of designated shellfish growing areas;*
3. *Support efforts to restore local watersheds in the White Oak River Basin; and*
4. *Support implementation of the NC Coastal Habitat Protection Plan (Street et al, 2005) and its associated implementation plans (NC Division of Marine Fisheries, 2007; NCDMF, 2009).*

The Project directly supports many of these listed goals through the restoration and protection of aquatic resources, and presents an opportunity to grow the already protected catchment in the Upper New River watershed from earlier DMS efforts in the White Oak River Basin.

Stream and Wetland Restoration Approach

A key design consideration for the Project is ensuring the enhanced channels and restored wetlands achieve maximum functional uplift while allowing the existing agricultural land uses to continue. All restoration and enhancement practices will be designed and implemented to accommodate current and future flow conditions in this developing watershed.

Historic riparian wetlands adjacent the unnamed tributaries to Cowford Branch have been drained and converted to agricultural land for generations. In addition to stream channelization, wetland modifications include drainage ditches/tiles, de-forestation, and soil disturbance/fill. The proposed riparian wetland restoration will address these historic land-use impacts through stream restoration, grading, surface roughening, and re-vegetation to restore a functional and diverse alluvial forest community. Restoration of these important ecosystems will improve local water quality, natural habitat, and biodiversity.

Stream restoration practices may range from bank grading and planting to re-establishing stable planform and hydraulic geometry. For reaches requiring full restoration, natural design concepts will be applied and verified through rigorous engineering analyses and modeling. The objective of this approach is to design a geomorphically stable channel that provides habitat improvements and ties into the existing landscape. Structures utilized on the Project's channels will include log sills, log vanes, and brush toes.

The Project's riparian planting design will achieve the following goals: filter existing or potential runoff, provide channel and soil stability, and improve terrestrial wildlife habitat. The first step to developing the vegetation plan will be a comprehensive vegetation and tree survey as a component of the overall data collection. This will identify and map invasive species treatment areas, specimen trees for protection, likely seed sources and successional communities, and potential trees to use for construction materials. RES will perform all invasive exotic vegetation treatment. Treatments may include herbicide applications and/or mechanical control.

From: Dunn, Maria T.
To: Jamey Mceachran
Subject: [EXTERNAL] RE: [External] Project Scoping: Federal-Aid project (FHWA lead federal agency) administered by NC DMS in Onslow County
Date: Friday, July 26, 2019 3:50:48 PM

Mr. Mceachran,

I have looked at the site located off NC Hwy 258 near its intersection with NC Hwy 24 in Onslow County for a NCDMS project of 3,770' potential stream and 2.27 acres of wetland restoration credits. The area is associated with Cowford stream and is currently in agricultural use with minimal to no buffer.

There appears to be no listed species within the immediate project area. However, since there was minimal detail provided regarding site plans, it is difficult to say whether or not the project will provide successful mitigation. Site design is important to insure water quality and wildlife benefits can be obtained through the project by means of floodplain connectivity, appropriate vegetation, and travel corridors. An important detail to consider is the downstream culverts under NC Hwy 258. Generally the NCWRC provides comments during onsite meetings and during project proposals with the IRT. More conversation may be had at that time when further details are provided.

Thank you for the opportunity to review and provide comment. If I can be of additional service, please do not hesitate to call or email.

Maria

Maria T. Dunn
Coastal Coordinator

NC Wildlife Resources Commission
943 Washington Sq. Mall
Washington, NC 27889
office: 252-948-3916
fax: 252-975-3716

www.ncwildlife.org

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From: Jamey Mceachran <jmceachran@res.us>
Sent: Tuesday, June 18, 2019 1:29 PM
To: Dunn, Maria T. <maria.dunn@ncwildlife.org>
Cc: Matthew Deangelo <mdeangelo@res.us>
Subject: [External] Project Scoping: Federal-Aid project (FHWA lead federal agency) administered by

NC DMS in Onslow County

CAUTION: External email. Do not click links or open attachments unless you verify. Send all suspicious email as an attachment to report.spam@nc.gov

Hello Ms. Dunn,
Please see attached the request for review and comment on any possible issues that might emerge with respect to fish and wildlife associated with the Cowford stream and riparian wetland restoration project identified by RES and contracted by NC DMS.

Please let me know if you have any questions.

Thank you for your time and consideration.

Jamey

Jamey Redding McEachran
Ecology Team Lead
RES | res.us
Mobile: 919.623.9889

302 Jefferson Street, Suite 110
Raleigh, NC 27605

Corporate Headquarters
6575 West Loop South, Suite 300
Bellaire, TX 77401
Main: 713.520.5400

June 17, 2019

Milton Cortes
Natural Resources Conservation Service
4407 Bland Rd., Suite 117
Raleigh, NC 27609

Subject: AD-1006 Request for the Cowford Mitigation Project in Onslow County

Dear Mr. Cortes,

Resource Enviornmental Solutions (RES) requests review and comment from the Natural Resources Conservation Service on any possible concerns that may emerge with respect to farmland resources including prime, unique, statewide or local important farmland associated with the Cowford stream mitigation project. This project is being developed for the North Carolina Division of Mitigation Services. Please note that this request is in support of the development of the Categorical Exclusion (CE) and an Environmental Screening document for the referenced project.

The Cowford Project has been identified for the purposes of providing mitigation for unavoidable stream impacts in the White Oak River Basin. RES has been awarded the contract to design and implement the Cowford project. A requirement of the project is to prepare an Environmental Screening Document that describes resources present on the project site.

The Project is in the White Oak River Basin (03030001) in the Upper New River Targeted Local Watershed (03030001010010). The Project supports many of the White Oak River Basin Restoration Priorities (RBRP) goals and presents an opportunity to restore 3,770 linear feet of stream, restore 2.27 acres of wetland, and the associated riparian buffer. The proposed Project will provide ecological and water quality benefits within the White Oak River Basin. These benefits are not limited to the project area and have more far-reaching effects throughout the White Oak River Basin by providing improvements to water quality, hydrologic function, and habitat. The Project is in close proximity with the existing DMS Bear Basin Mitigation site, offering even more functional uplift to the local subwatershed. Coordinates for the site are as follows: 34.923 N, -77.591W.

An inventory of soils data was completed by RES utilizing Web Soil Survey to determine prime farmland classifications for the 15.9 acre project area. Three soil map units in the project area are classified as all areas are prime farmland, making up 64.8% of the site (Goldsboro fine sandy loam, Norfolk loamy fine sand, and Onslow loamy fine sand). One soil map unit is classified as prime farmland if drained and accounts for 10.8% of the site (Rains fine sandy loam, 0 to 2 percent slopes, Atlantic Coast Flatwoods). One soil map unit in the project area is classified as farmland of statewide importance making up 24.4% of the site (Stallings loamy fine sand).

Enclosed is Form AD-1006 with Parts I and III Completed and maps of the Cowford Site. We ask that you review the site information and complete Parts II, IV, and V as required by NRCS. Please email (mengel@res.us), or mail your reply to the our office on 302 Jeffferson Street, Suite 100, Raleigh, NC 27605.

We thank you in advance for your timely response and cooperation. Please feel free to contact me with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Megan D Engel | Ecologist II

Attachements: Vicinity Map (Figure 1), USGS Topographc Map (Figure 2), Aerial Map (Figure 3) Conceptual Plan Map (Figure 4), Web Soil Survey Report, & AD-1006

Megan Engel

From: Cortes, Milton - NRCS, Raleigh, NC <milton.cortes@usda.gov>
Sent: Wednesday, July 3, 2019 8:16 PM
To: Megan Engel
Subject: [EXTERNAL] RE: AD-1006 Request for the Cowford Mitigation Project in Onslow County
Attachments: AD1006_Cowford Mitigation Project.pdf

Importance: High

Follow Up Flag: Flag for follow up
Flag Status: Flagged

Megan:

Please, find attached the FARMLAND CONVERSION IMPACT RATING form AD1006 for the Cowford Mitigation Project in Onslow County, NC

If I can be of further assistance please let me know

Best Regards;

Milton Cortes
State Soil Scientist
USDA NRCS
4407 Bland Rd., Suite 117
Raleigh, NC 27609
Desk: 919-873-2171
Cell: 984-365-2201

From: Megan Engel <mengel@res.us>
Sent: Monday, June 17, 2019 3:32 PM
To: Cortes, Milton - NRCS, Raleigh, NC <milton.cortes@usda.gov>; Volinski, Petra - NRCS, New Bern, NC <petra.volinski@usda.gov>
Cc: Jamey Mceachran <jmceachran@res.us>; Bradley Breslow <bbreslow@res.us>
Subject: AD-1006 Request for the Cowford Mitigation Project in Onslow County

Mr. Cortes,

Resource Environmental Solutions (RES) requests review and comment from the Natural Resources Conservation Service on any possible concerns that may emerge with respect to farmland resources including prime, unique, statewide or local important farmland associated with the Cowford Mitigation Project. This project is being developed for the North Carolina Division of Mitigation Services. Please note that this request is in support of the development of the Categorical Exclusion (CE) and an Environmental Resource Technical Report for the referenced project.

Attached is a request letter along with Form AD-1006 with Parts I and III Completed and maps of the Project. We ask that you review the site information and complete Parts II, IV, and V as required by NRCS. We thank you in advance for your timely response and cooperation. Please feel free to contact me with any questions that you may have concerning the extent of site disturbance associated with this project.

Best,
Megan D Engel

Ecologist II
RES | res.us
Mobile: 909.844.7122

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302 Jefferson Street, Suite 110
Raleigh, NC 27605

Corporate Headquarters
6575 West Loop South, Suite 300
Bellaire, TX 77401
Main: 713.520.5400

June 21st, 2019

Renee Gledhill-Earley
North Carolina State Historic Preservation Office
4617 Mail Service Center
Raleigh NC 27699-4617

Subject: Project Scoping for Cowford Mitigation Project in Onslow County

Dear Ms. Gledhill-Earley,

Resource Environmental Solutions, LLC (RES) is contracted by the North Carolina Division of Mitigation Services to conduct stream and riparian wetland activities for the Cowford Project to provide compensatory mitigation for unavoidable stream and wetland impacts. The proposed project presents an opportunity to restore 2.27 acres of riparian wetlands, and restore 3,770 linear feet of stream and associated riparian buffer.

RES requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with a potential stream and wetland mitigation project on the Cowford Site (a USGS site map with approximate limits of conservation easement is attached).

A review of the N.C. State Historic Preservation Office (SHPO) HPOWEB GIS Service database (http://gis.ncdcr.gov/hpoweb/; accessed January 9, 2018) was performed as part of the site due diligence evaluation. The database did not reveal any listed or potentially eligible historic or archeological resources on the proposed properties. Other land use around the project is pasture, residential land, and some bottomland hardwood forest.

We ask that you review this site based on the attached information to determine the presence of any historic properties. We thank you in advance for your timely response and cooperation. You may return the comment to my attention at the address below, or via email. Please feel free to contact me at mdeangelo@res.us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Matt DeAngelo | Ecologist

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

July 9, 2019

Kimberly Browning
Wilmington District Corps of Engineers
Mitigation Field Office
3331 Heritage Trade Drive
Wake Forest, NC 27587

Re: Cowford Mitigation Site, Richlands, SAW 2019-00487, Onslow County, ER 19-1952

Dear Ms. Browning:

We have received a public notice concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or environmental.review@ncdcr.gov. 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

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Raleigh Field Office
P.O. Box 33726
Raleigh, NC 27636-3726

Date: 8/2/2019

Self-Certification Letter

Project Name Cowford Mitigation Project

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: Cowford

Date July 31, 2019

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
West Indian Manatee *(Trichechus manatus)*	No suitable habitat	No effect	
Piping Plover *(Charadrius melodus)*	No suitable habitat	No effect	
Red Knot *(Calidaris canutus rufa)*	No suitable habitat	No effect	
Red-cockaded Woodpecker *(Picoides borealis)*	No suitable habitat	No effect	No suitable pine trees on the property. Property has agricultural fields and CRP easement consisting of 10 year old planted sawtooth oak and loblolly pines
American Alligator *(Alligator mississippiensis)*	No suitable habitat	No effect	
Green Sea Turtle *(Chelonia mydas)*	No suitable habitat	No effect	
Hawksbill Sea Turtle *(Eretmochelys imbricate)*	No suitable habitat	No effect	
Kemp's Ridley Sea Turtle *(Lepidochelys kempii)*	No suitable habitat	No effect	
Leatherback Sea Turtle *(Dermochelys coriacea)*	No suitable habitat	No effect	
Loggerhead Sea Turtle *(Caretta caretta)*	No suitable habitat	No effect	
Cooley's Meadowrue *(Thalictrum cooleyi)*	No suitable habitat	No effect	Habitat and species survey conducted on July 19, 2019. Determined no suitable habitat nor species presence. Conclusion and determination revised to reflect this. See conclusion letter, pg 16-17.

Golden Sedge *(Carex lutea)*	No suitable habitat	No effect	Habitat survey conducted on July 19, 2019. Determined no suitable habitat present. Conclusion and determination revised to reflect this. See conclusion letter, pg. 16-17.
Pondberry *(Lindera melissifolia)*	No suitable habitat	No effect	Habitat survey conducted on July 19, 2019. Determined no suitable habitat present. Conclusion and determination revised to reflect this. See conclusion letter, pg 16-17.
Roughed leaved Loosestrife *(Lysimachia asperulaefolia)*	No suitable habitat	No effect	Habitat and species survey conducted on July 19, 2019. Determined no suitable habitat nor species presence. Conclusion and determination revised to reflect this. See conclusion letter, pg. 16-17.
Seabeach Amaranth *(Amaranthus pumilus)*	No suitable habitat	No effect	
Critical Habitat	No critical habitat present	No effect	
Bald eagle	Unlikely to disturb nesting bald eagles	No Eagle Act Permit Required	

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.

, Ecologist

8/2/2019

Signature /Title

Date

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: June 18, 2019
Consultation Code: 04EN2000-2019-SLI-1078
Event Code: 04EN2000-2019-E-02456
Project Name: Cowford

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The 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: 04EN2000-2019-SLI-1078

Event Code: 04EN2000-2019-E-02456

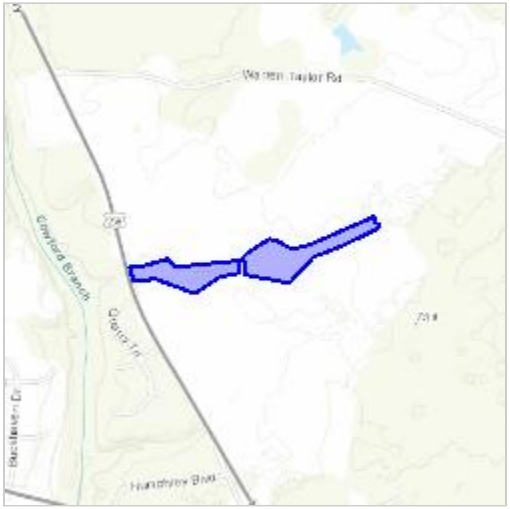
Project Name: Cowford

Project Type: LAND - RESTORATION / ENHANCEMENT

Project Description: Stream Restoration and Wetland Restoration

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/34.922883632421346N77.59454847090188W



Counties: Onslow, NC

Endangered Species Act Species

There is a total of 15 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.

Mammals

NAME	STATUS
West Indian Manatee *Trichechus manatus* There is **final** critical habitat for this species. Your location is outside the critical habitat. ***This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.*** Species profile: https://ecos.fws.gov/ecp/species/4469	Threatened

Birds

NAME	STATUS
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Red-cockaded Woodpecker *Picoides borealis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7614	Endangered

Reptiles

NAME	STATUS
American Alligator *Alligator mississippiensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/776	Similarity of Appearance (Threatened)
Green Sea Turtle *Chelonia mydas* Population: North Atlantic DPS There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6199	Threatened
Hawksbill Sea Turtle *Eretmochelys imbricata* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3656	Endangered
Kemp's Ridley Sea Turtle *Lepidochelys kempii* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5523	Endangered
Leatherback Sea Turtle *Dermochelys coriacea* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1493	Endangered
Loggerhead Sea Turtle *Caretta caretta* Population: Northwest Atlantic Ocean DPS There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1110	Threatened

Flowering Plants

NAME	STATUS
Cooley's Meadowrue *Thalictrum cooleyi* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3281	Endangered
Golden Sedge *Carex lutea* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6025	Endangered
Pondberry *Lindera melissifolia* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1279	Endangered
Rough-leaved Loosestrife *Lysimachia asperulaefolia* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2747	Endangered
Seabeach Amaranth *Amaranthus pumilus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8549	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

NC DEPARTMENT OF
NATURAL AND CULTURAL RESOURCES

Roy Cooper, **Governor**
Susi Hamilton, **Secretary**
Walter Clark, **Director, Land and Water Stewardship**

NCNHDE-9302

June 18, 2019

Matthew DeAngelo
Resource Environmental Solutions, LLC
302 Jefferson Street
Raleigh, NC 27607
RE: Cowford (updated 6182019

Dear Matthew DeAngelo:

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

No Element Occurrences are Documented Within a One-mile Radius of the Project Area

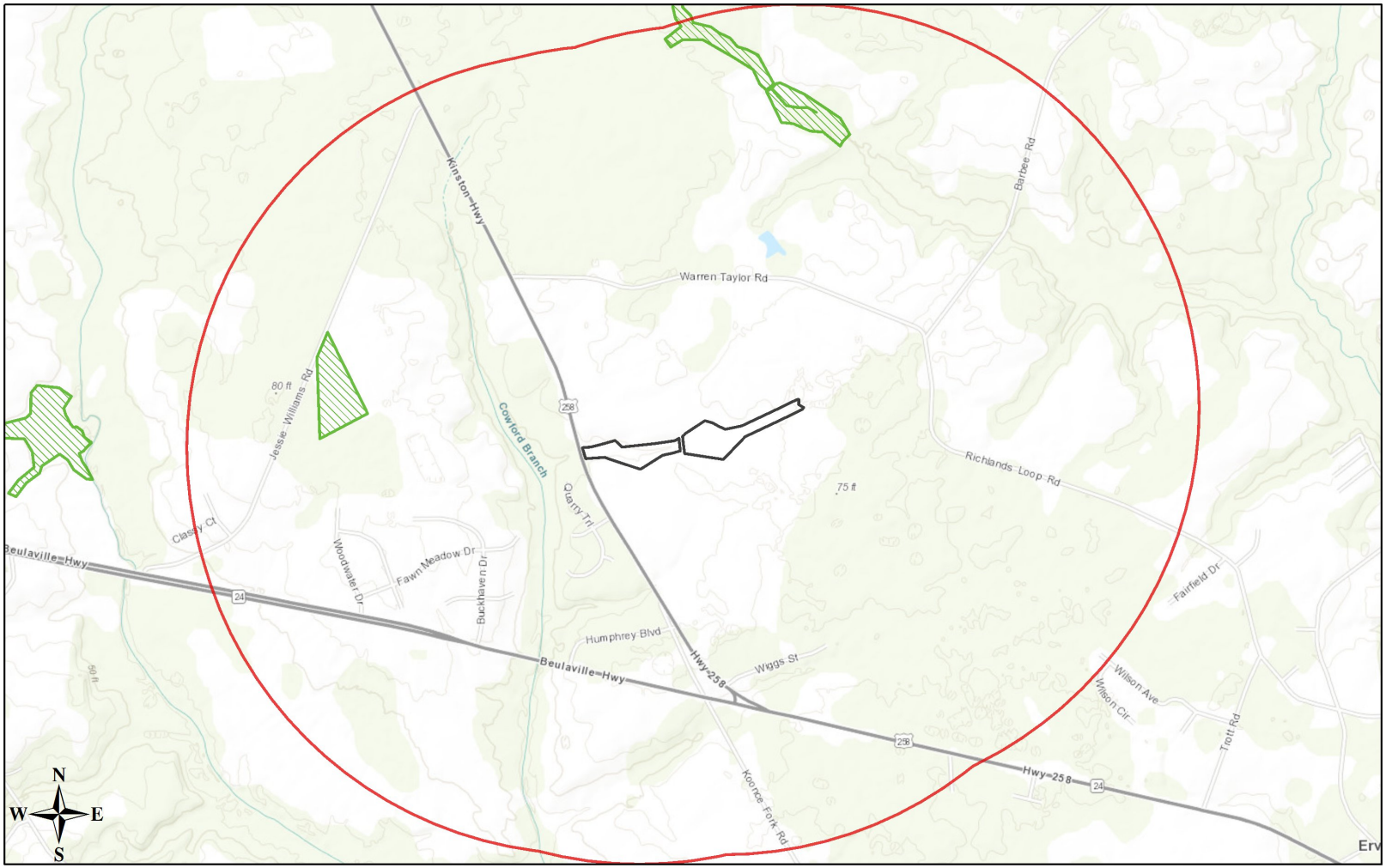
No Natural Areas are Documented Within a One-mile Radius of the Project Area

Managed Areas Documented Within a One-mile Radius of the Project Area

Managed Area Name	Owner	Owner Type
NC Division of Mitigation Services Easement	NC DEQ, Division of Mitigation Services	State

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/content/help. Data query generated on June 18, 2019; source: NCNHP, Q2 Apr 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-9302: Cowford (updated 6182019



June 18, 2019

- Project Boundary
- Buffered Project Boundary
- Managed Area (MAREA)

1:22,052

0 0.175 0.35 0.7 mi

0 0.3 0.6 1.2 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

RE: *Thalictrum cooleyi* Survey at Cowford site, Onslow County, NC

A plant survey for the federally listed Cooley's meadowrue, *Thalictrum cooleyi* (Fed E, S2 G2), was conducted on July 19th, 2019 at our Cowford Stream and Wetland Mitigation site (a Federal-Aid project (FHWA lead federal agency) administered by the North Carolina Division of Mitigation Services), located near Richlands, NC in Onslow County; no populations were located in this area. *T. cooleyi*'s range in North Carolina includes Brunswick, Columbus, Onslow and Pender counties; however, its suitable habitat includes fire dependent grassy bogs and pine savanna ecotones with regular disturbance, neither of which make up this site. The Cowford site consists of an eroded, overgrown ditch cut by an existing stream that bisects an exposed soybean field; less than half of the site is densely forested on the western-most easement boundary. The stream and floodplain are largely comprised of *Eupatorium capillifolium, Acer rubrum, Liquidambar styraciflua, Clethra alnifolia, Rubus pensilvanicus, Smilax sp., Typha latifolia, Rhexia sp., Toxicodendron radicans, Magnolia virginiana, Carex sp., Setaria sp., Chamaecrista, fasciculata, Verbena brasiliensis, Solanum carolinense,* and *Ambrosia artemisiifolia.* There is little to no disturbance (fire, mowing, powerline cut, etc.) that would create vegetation clearing which would support suitable habitat for *T. cooleyi.* The forested portion within the easement boundary predominantly consists of *Rubus pensilvanicus, Solidago sp., Lespedeza bicolor, Quercus acutissima, Diospyros virginiana, Baccharis halimifolia, Pinus teada, Ligustrum sinense, Malus angustifolia, Quercus falcata, Rhus glabra, Celtis laevigata, and Phytolacca americana.* A very dense understory persists throughout, allowing little to no light to support low-lying species like *T. cooleyi,* which requires an open understory (typically as a result of recent burns). *T. cooleyi* often grows in tandem with *Liriodendron tulipifera, Taxodium distichum,* and *Chamaecyparis thyoides,* none of which were found at this site.

Our method for surveying included splitting up (among two people) along both sides of the existing stream, recording the species present and any occurrences of potential suitable habitat; we continued surveying this way the entirety of the stream's length. When we reached the forested area within the site, we began making transects throughout, surveying the understory for *T. cooleyi* and its habitat. The habitat within the easement of this site was not representative of grassy bogs or pine savanna ecotones.

Though a reference population was not visited for this survey, one of the team members, Emily Ulman, has been to and seen a population of *T. cooleyi* in Columbus County, south of Lake Waccamaw, east of US Route 701, near Nakina, NC. Both survey members, Emily Ulman and Megan Engel, had dichotomous keys for the genus *Thalictrum,* amplified from Radford et al. (1968) and Weakley (2008) and had researched the information and pictures provided by the U.S. Fish and Wildlife Service for *T. cooleyi.* Megan and Emily have performed rare plant surveys in the past for threatened and endangered plant species in both North Carolina and California.

In conclusion, after conducting a more thorough evaluation of the habitat present at the Cowford Mitigation Site and surveying for *T. cooleyi* specifically we have determined that there

is **no suitable habitat** present within the Cowford Mitigation Site easement; therefore, we are changing the conclusion on the species conclusion table on the self-certification letter from **may affect** to **no effect** on any *T. cooleyi* populations.

Although this survey was primarily conducted for *T. cooleyi,* three other federally listed species were considered during this time (due to their range including Onslow county); golden sedge (*Carex lutea),* pondberry (*Lindera melissifolia),* and roughed leaved loosestrife, (*Lysimachia asperulaefolia).*

L. asperulaefolia's peak survey time occurs from mid-May through September, which was considered while surveying for *T. cooleyi.* Emily has visited two separate populations of *L. asperulaefolia* in the past (mid-June, 2018 and July, 2019), both of them being within the Green Swamp Preserve (owned by The Nature Conservancy) off of highway 211 in Brunswick County, NC, southeast of Lake Waccamaw. This species is most likely to occur within ecotones along longleaf pine savannas and pond pine pocosins, typically disturbed by fire (to maintain a sparse understory). *L. asperulaefolia* also occurs within Carolina bay communities, which do not exist at this site. Like *T. cooleyi*, *L. asperulaefolia* is heavily dependent on fire or disturbance (roadsides, powerline cuts, etc.) for its growth and reproduction. Additionally, *L. asperulaefolia* would have likely stood out, had it been present on this mitigation site, due to its bright yellow inflorescence displayed in a terminal raceme and its distinct leaf arrangement (whorled with three prominent veins). Due to these requirements, the Cowford mitigation site **did not represent a suitable habitat** and therefore has **no effect** on *L. asperulaefolia.*

The survey times for *C. lutea* (mid-April through mid-June) and *L. melissifolia* (February through March) have passed for this survey season; however, considering their suitable habitat and occurrence records in Onslow County, it is very unlikely that they would appear on the Cowford site. *C. lutea* typically shares a habitat with *T. cooleyi*, along pine savanna ecotones or in swampy areas, frequently cleared by fire; these habitat features do not occur on this mitigation site. Typical neighboring species of *C. lutea* are *Liriodendron tulipifera* and *Taxodium ascendens* which do not appear on this site. Because of a dense understory throughout and the need for the same/similar habitat as *T. cooleyi* (which is not present), it was determined that there is **not suitable** habitat for *C. lutea. L. melissifolia* has only one recorded occurrence in Onslow County (none recorded since) and otherwise prefers bottomland ponds and wet depressions (not characteristic of this site). Because there is no suitable habitat present for either of these species, it is highly unlikely that there would be any effect on them within this site. This survey did not determine whether the species was present as the survey was not conducted during optimal survey time for both species, but did determine that there was **no suitable habitat present** for *C. lutea* and *L. melissifolia*.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh ES Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

July 11, 2019

RECEIVED
JUL 15 2019
RALEIGH REGULATORY FIELD OFFICE

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- Cowford Mitigation Site / SAW-2019-00487/ Onslow 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 Kathy Matthews at (919) 856-4520, extension 27.

Sincerely,

for Kathryn H. Matthews
Pete Benjamin,
Field Supervisor

cc: NMFS, Beaufort, NC
EPA, Atlanta, GA
WRC, Raleigh

Appendix L

- DMS Floodplain Requirement Checklist

EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance Program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all EEP projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. State NFIP Engineer), NC Floodplain Mapping Unit (attn. State NFIP Coordinator) and NC Ecosystem Enhancement Program.

Project Location

Name of project:	Cowford Project
Name if stream or feature:	Unnamed Tributary to Cowford Branch
County:	Onslow County
Name of river basin:	White Oak River Basin
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Onslow County
DFIRM panel number for entire site:	4422 and 4423 (map number 3720442200K, effective date June 19, 2020 and map number 3720442300K, effective date June 19, 2020, respectively)
Consultant name:	Resource Environmental Solutions, LLC
Phone number:	(919) 209-1052
Address:	3600 Glenwood Avenue, Suite 100 Raleigh, NC 27612

Design Information

The Cowford Project is located within a rural watershed in Onslow County, North Carolina within the White Oak River Basin and USGS 14-digit HUC 030203020102. The Project proposes to restore 914 linear feet (LF) of headwater valley, 2,424 LF of stream, and re-establish 2.991 acres of wetland that will provide water quality benefit for 238 acres of drainage area. The purpose of the Project is to meet water quality improvements addressed in the River Basin Restoration Priorities and improve overall stream and wetland health.

Reach	Length (LF)	Mitigation Type
KJ1-A	914	Restoration (HWV)
KJ1-B	852	Restoration
KJ1-C	1,572	Restoration

Wetland	Acreage	Mitigation Type
WB	2.991	Re-establishment

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?

○ Yes ◉ No

If project is located in a SFHA, check how it was determined:

☐ Redelineation

☐ Detailed Study

☐ Limited Detail Study

☐ Approximate Study

☐ Don't know

List flood zone designation: Zone X (outside 0.2% floodplain)

Check if applies:

☐ AE Zone

- ○ Floodway
- ○ Non-Encroachment
- ◉ None

☐ A Zone

- ○ Local Setbacks Required
- ○ No Local Setbacks Required

If local setbacks are required, list how many feet:

Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?

○ Yes ◉ No

Land Acquisition (Check)

☐ State owned (fee simple)

☐ Conservation easment (Design Bid Build)

☑ Conservation Easement (Full Delivery Project)

Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)

Is community/county participating in the NFIP program?

Is community/county participating in the NFIP program? ◉ Yes ○ No Note: if community is not participating, then all requirements should be addressed to NFIP (attn: State NFIP Engineer, (919) 715-8000)
Name of Local Floodplain Administrator: Austin Brinkley, (910) 989-3089

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

- ☑ No Action
- ☐ No Rise
- ☐ Letter of Map Revision
- ☐ Conditional Letter of Map Revision
- ☐ Other Requirements

List other requirements:

Comments:

Name: Samuel Fasking Signature: _____

Title: Engineer I Date: 07.31.2020

Appendix M

- Detailed Soil Report

FINAL
Detailed Hydric Soils Study
Cowford Mitigation Site
Onslow County NC

Prepared for:

Matt Butler
Resource Environmental Solutions
302 Jefferson Street, Suite 110
Raleigh, NC 27605

Prepared by:

George K Lankford Soil Scientist, LSS #1223
George K Lankford, LLC
238 Shady Grove Rd
Pittsboro, NC 27312

February 2020

Soil Scientist Seal

This report describes the results of the soil evaluation performed at the Cowford Branch Mitigation Site in Onslow County, NC. Any subsequent transfer of the report by the user shall be made by transferring the complete report, including figures, maps, appendices, all attachments and disclaimers.

Study Objectives and Scope

The purpose of the study was to evaluate the site soils and delineate the extent of riparian hydric soils potentially suitable for hydrologic restoration and mitigation. All boundaries shown are based on the detailed field evaluation. The potential for hydrologic restoration is evaluated considering both the historic and existing land use, current conditions, and the sites potential for creating a hydroperiod suitable for its landscape setting and soils. In addition to the anticipated restoration of the stream to reestablish natural overbank flooding frequency, the practical modifications suggested generally utilize the available natural hydrology and may include, but are not limited to surface drainage modifications such as plugging drainage ditches, removal of fill materials, removal/plugging of drain tile, and microtopographic alteration such as surface roughening or enhancing existing depressions. Recommendation for the re-establishment of wetlands follows the Principles of Wetland Restoration (USEPA 2000) that promote successful establishment of a functioning wetland community by restoring ecological integrity through establishment of natural structure and function. This site evaluation focuses on evaluating the soils and the use of practical technical solutions to support restoration. Recommendations of removing extensive fill material is typically limited by cost and environmental. Restoration potential assumes a successful design and ability to construct site modifications necessary to restore adequate hydrology.

This report presents an evaluation of the subject property based upon a site evaluation and detailed field investigation for the purpose of confirming the presence of and delineating the extent of hydric soil. The site is assessed for the suitability of soils for wetland mitigation. The observations and opinions stated in this report reflect conditions apparent on the subject property at the time of the site evaluation. My findings, opinions, conclusions, and recommendations are based on professional experience, soils, drainage patterns, site conditions, and boundaries of the property as evident in the field.

Project Information and Background

The site is located approximately 3 miles northwest of Richlands NC, to the north of Highway 24 and east of Highway 258 (Kinston Highway). The project is on a tributary to the east of Cowford Branch, a tributary to the New River (Figure 1). The land use of the contributing watershed community is agricultural row crop or undeveloped forest land with scattered homes and farm buildings (Figure 2). The watershed is from a mineral flat having a slightly higher elevation with a nearly level landscape that would naturally exhibit a high ground water table. An extensive ditch network present rapidly removes surface water to allow cultivation. The tributary within this project is the primary drainage feature along the western edge of a mineral flat.

The project area is approximately 14 acres with approximately 4 acres evaluated for potential riparian hydric soil. The site is currently in row crops production of a soybeans/corn rotation on a small headwater tributary. The stream is dredged deeply into the floodplain to lower the local groundwater with drain tiles that lower the water table farther from the stream.

Topography of the project area is a broad, nearly level, interstream divide with low gradient side slopes to the small drainage features above the larger streams. Landscape surrounding the project is typical outer coastal plain where shallow valleys branch from the larger streams and have headwaters reaching up to the interstream divides. The interstream divide above the project is constricted somewhat with the divide becoming much broader to the east. This broader area to the east likely influences the local groundwater of this project. The small headwater tributary flowing through the project begins along the edge of this interstream divide, becoming steeper closer to Cowford Branch to the west of the project. Within the project the floodplain widens at where the gentle slope transitions to a steeper slope gradient. Along this transition is where the hydric soils were evaluated.

NRCS Soil Mapping

The NRCS mapping units are an area of soil having similar defined soil properties and physical characteristics with similar management criteria base upon these properties. Map units across a site are useful for general planning, but cover larger scales and which typically include smaller areas of dissimilar soils not discernable without a detailed site evaluation. Properties of the map units provide the background for interpreting the range of soil properties that may be encountered at the site.

The NRCS soil survey shows five soil map units within the project area (Table 1). These soils are typical of broad interstream divides with only the *Norfolk* soil sometimes associated with streams in Onslow County. The natural water table primarily depends on subtle elevation changes within a relatively flat landscape. Along the edge of flats and typically associated with drainages are the better drained *Norfolk* soils. All non-alluvial soils formed within loamy marine deposits and generally have a loamy surface underlain by a sandy clay loam (on line NRCS Web Soil Survey 2019).

Table 1. NRCS Mapped Soil Units at the Cowford Site

(map units in order of increasing depth to water table)

Series*	Taxonomic Class	Drainage Class	Hydric	Seasonal High Water Table (in)	Farmland classification
Rains fine sandy loam					
Rains (86%)	*Typic Paleaquults*	poorly	Yes	0 to 12	Prime farmland (if drained)
Pantego (6%)	*Umbric Paleaquults*	very poorly	Yes	0 to 12	
Stallings loamy fine sand					
Stallings (90%)	*Aeric Paleaquults*	somewhat poorly	No	12 to 30	Statewide importance
Woodington (5%)	*Typic Paleaquults*	poorly	Yes±	0 to 12	
Rains (2%)	*Typic Paleaquults*	poorly	Yes	0 to 12	
Onslow loamy fine sand					
Onslow (5%)	*Spodic Paleudults*	moderately well	No	18 to 36	Prime farmland
Rains (5%)	*Typic Paleaquults*	poorly	Yes	0 to 12	
Goldsboro fine sandy loam					
Goldsboro (87%)	*Aquic Paleudults*	moderately well	No	18 to 30	Prime farmland
Norfolk loamy fine sand					
Norfolk (85%)	*Typic Kandiudults*	well	No	40 to 72	Prime farmland
Woodington (3%)	*Typic Paleaquults*	poorly	Yes	0 to 12	
Muckalee (1%)	*Typic Fluvaquents*	poorly	Yes	0 to 12	

*Map units with potential hydric inclusion shown.

The *Rains* soil is poorly drained, *Stallings* is somewhat poorly drained, *Onslow* and *Goldsboro* are moderately well drained, and the *Norfolk* is well drained. Only the *Rains* map unit is rated as hydric by the NRCS, but a number of potential hydric inclusions are found in the map units. These inclusions are found in concave, depressional areas within the mapping units where drainage is slow. The project contains hydric soil where the soils on the flat begin to transition into a drainage feature.

The stream drainage feature is mapped as a *Norfolk loamy sand, 2 to 6 percent slope* (NoB)flanked by the *Goldsboro, 0 to 2 percent slopes* (GoA), and *Norfolk loamy sand, 0 to 2 percent slope* (NoA). The headwater of the stream appears to extend into multiple soil units of *Onslow loamy fine sand* (On), *Stallings loamy fine sand* (St), *Rains fine loamy sandy, 0 to 2 percent slope* (Ra), and *Goldsboro fine loamy sandy, 0 to 2 percent slope*. The Norfolk map unit may contain hydric inclusions of *Woodington* and *Mucklee*, both classified by NRCS as hydric. The *Onslow* map unit may contain inclusions of hydric *Rains*. The *Stallings* map unit may have inclusions of hydric *Woodington* and *Rains*. The *Goldsboro* and *Norfolk*, 0 to 2 percent map units are not expected to contain significant inclusions of hydric soil.

Project Approach

The mitigation project approach is to restore functional natural hydrology on the floodplain that will sustain wetland hydrology to appropriate portions of this landscape. An initial soil evaluation found that much of this site exhibits hydric soil characteristics typically found in drained and disturbed wetland soils. In the upper reaches, the stream is surrounded by what appears to be non-riparian hydric soils of the mineral flat that grade to riparian at the slope transition. The past land management and drainage modifications has removed wetland hydrology from these areas. To aid in farming use, the streams were deeply channelized and straightened to maximize row crop farming and drain tiles were installed to further lower local groundwater where sufficient slope is absent. Shallow ditches are also present to aid in removal of surface water. Because the site contains hydric soils and exhibits a suitable landform, the potential for wetland reestablishment may be present.

Landscape Setting

This project site is within the Outer Coastal Plain in the Carolina Flatwoods ecoregion on the headwater floodplain of an unnamed tributary to the Cowford Branch. Geology of the project and surrounding area is the Comfort Member and New Hanover Member formation. This undivided formation may contain skeletal limestone with locally dolomitized, solution cavities common or phosphate-pebble conglomerates. Cowford Branch is a tributary to the New River.

The local landscape is characterized by broad, nearly level gently rolling interstream divides with moderate slopes adjacent to the drainageways. The project lies within a concave headwater floodplain abutting a shallow depressional area along the edge of the interstream divide. The stream channel originates upslope of the floodplain at the edge of the interstream divide. The floodplain soil appears to have formed in minor erosional deposition originating from the surrounding upland soils.

Methodology

A detailed hydric soil investigation for Cowford Mitigation Site was completed in January of 2020. A series of approximately 75 soil borings were performed to described and verify the presence and estimate the extent of hydric soil and soils that appear to exhibit relict or historic hydric indicators (Figure 2). Soils were evaluated using morphologic characteristics to determine hydric indicators and evaluate current hydrology. Using criteria based on "*Field Indicators of Hydric Soils in the United States*" (USDA, NRCS, 2018, Version 8.2). The boring observations do not contain adequate detail to classify these soils to a series. Hydric soil indicators used are valid for the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region Version 2.0* within Major Land Resource Area (MLRA) 153A (Outer Coastal Plain) - Southern Piedmont and Land Resource Region (LRR) T- Atlantic and Gulf Coast Lowland Forest and Crop Region. A hydroperiod success criteria is

proposed based upon Corps mitigation guidelines (US Army Corps of Engineers 2016). Soil boring locations were approximately located using the Terrain Navigator Pro smart phone application by Trimble and figures were produced from the same software.

Hand auger soil borings, some to 36 inches, were used to described current soil characteristics, investigate indicators of biological soil reduction processes, and evaluate the extent of soil suitable for restoration. Representative profiles were described to document the range of characteristics found at this site (Appendix A). The field evaluation delineated potential hydric soil that indicate a high potential for wetland rehabilitation at this site. General conditions and patterns representative of this floodplain were noted. Borings extended beyond the riparian area into the surrounding elevations. Additional non-riparian soils were identified extending down to the riparian area, but a hydric soil map unit for non-riparian hydric soil was not delineated (Figure 2).

This report describes for the Cowford Mitigation Site these findings, conclusions, and recommendation for wetland restoration, including but not limited to the current hydrology, past and current management practices, and observed existing modifications. The relevant soil characteristics found that may affect potential hydrology are discussed.

Results and Discussion

Site Conditions

Currently the site is an agricultural field having row crops of a corn/soybean rotation. The surrounding land use is agricultural and undeveloped land with scattered single-family homes. Evidence of past land use indicates the floodplain area was used for staging equipment and contains a culvert crossing of the stream. This may be due to the landscape position near the head of the stream. Drain tile has been constructed to drain the surrounding slopes below the gently sloping to nearly level landscape along the edge of the interstream divide.

The stream on this site has been straightened and excavated below the natural groundwater elevation. It is very deeply incised from dredging and erosion. There is a slope change at the upper boundary of this wetland as the floodplain widens and flattens. At the downstream end of the wetland, the slope transitions to a steeper gradient not suitable for significant wetland formation. The stream depth is currently below the outlet elevations of the drain tile. Fields are cultivated to near the top of bank, with minimal, well maintained buffer. Below the culvert, the stream is actively eroding the banks. Within this headwater landscape, hydric soil appears to be riparian in nature. Upslope are hydric soils of non-riparian landscapes that extent down to the riparian zone identified.

The NRCS soil survey indicates this riparian landscape lies at the head of a *Norfolk* soil map unit (NoB) and intersection of multiple soil map units. This landscape position may explain the complexity and variability of the soils found across this landscape. This *Norfolk* soil unit may contain hydric inclusions of *Woodington* or *Mucklee*. The Woodington soil is more typical of an interstream divide and *Mucklee* soil is found along floodplains where streams are shallow and meandering.

Site Soils

Soils in this Coastal Plain landscape formed from loamy and sandy marine deposits with alluvial soil having formed in sediments from these upland soils. When poorly or very poorly drained, both alluvial and non-alluvial soils may accumulate high organic content in the surface horizons. At this site no distinct textural differences were observed to distinguish an alluvial soil from a non-alluvial soil. The most reliable indicator of a riparian soil is inferred from landscape position. This is especially true where the gentle slopes are transitioning into a headwater drainage feature where the slope provides on low energy flows despite overbank event resulting in minimal alluvial deposition.

Soils at this site typically have a dark surface despite years of drainage and cultivation. The surface is sandy or loamy and underlain by variable textures ranging from sandy clay to sand. Two borings appeared to have sandy deposition over a black, gleyed horizon, possibly from sedimentation or effects from long-term cultivation. A black, high organic soils also appear within the upper elevations of the landscape on the mineral flat. There does appear to be a clayey horizon crossing the valley near the downstream edge of the delineated hydric soil unit as well as areas with a possible spodic horizon. Presence of a clayey textured horizon would provide the potential for perching of a water table. The spodic is formed from water table fluctuations that move organic material down into the profile where it accumulates. These horizons are typically impermeable and can perch a water table also. In general, soils across this site are highly variable and interpretation is difficult. This may be the result of many soils converging on this landscape in the upper reach of a small tributary.

Hydric Soil Indicators

The soil evaluation confirmed the presence of hydric soil indicators within 12 inches of the soil surface throughout this map unit. The most common hydric soil indicators based on recorded profiles are *F3-Depleted Matrix, S7-Dark Surface, A11-Depleted Below Dark Surface,* and *A12-Thick Dark Surface.* Also present were *S5-Sandy Redox, S9-Thin Dark Surface,* and *F3-Depleted Matrix*. Soils having a dark surface having a loamy texture and underlain by a depleted horizon meet either the *A11* or *A12* indicator. A dark surface with a sandy texture meets the *S7* indicator. Soils having a spodic horizon meet the *S9* indicator. Soils underlain by a loamy or clayey texture that is depleted meet the *F3* indicator and sandy soils with a depleted matrix having redoximorphic mottles meets the *S5* indicator. These indicators can be found on both floodplains and non-riparian landscapes. The range of indicators reflect the complexity of the soils at this location.

Current Hydrologic Alterations

Overbank flooding is limited by the deeply dredged and straightened channel and lowers surrounding groundwater elevation in the floodplain. Additionally, the drain tile system lowers the ground water elevations farther from the stream, extending to nearby portions of the contributing watershed. The smooth cultivated surfaces and ditches also quickly remove surface water to prevent accumulation and limit infiltration. These drainage modifications decrease both surface storage and subsurface storage. A water table was only observed in a single boring at -25 inches (SB #03) during the initial site evaluation This area was noted as very moist during the detailed evaluation. This indicates an area likely available to provide a small discharge source of hydrology.

The shape of the hydric soil map unit from this investigation indicates two potential surface drainage patterns having a concave topography enter from the contributing watershed. One enters along the stream channel from the northeast and one from the southeast where a ditch is located. To the south, this soil unit appears to have a spodic horizon that limits vertical infiltration and may perch the water table similar to clayey textured horizons. This brittle horizon usually forms where the water table fluctuates with organic material moving down in the soil to the top of the drawn down water table.

Due to the landscape and potential convergence of multiple soil units, this site appears to have been historically part of a small riverine headwater system where hydric soil extends outward up into the higher elevations of the mineral flat. This site is located along the transition from a riparian to non-riparian landscape where multiple soil morphologies were noted. This confluence of differing soils and the converging landscape provide variable soil textures and hydric soil indicators providing evidence this area supported a riparian wetland prior to drainage and conversions to agricultural use.

Potential Hydroperiod for Restored Soils

Based upon this detailed study of soils at this site, the incised stream, presence of drain tile and ditches, and long-term management for agricultural uses, the natural hydrology has significantly been altered

resulting in a lower groundwater table. The site is within a suitable landscape position of a small headwater stream and soils exhibit numerous hydric indicators. Based on mitigation guidance for Coastal Plain soils (US Army Corps of Engineers 2016), a *Muckalee* series (*Typic Fluvaquents*) is suggested to have a hydroperiod of between 12 and 16 percent where the water table is within 12 inches of the surface during the growing season (Table 2). The *Muckalee* series does not have direct guidance on hydroperiod. Based on the taxonomic classification, a similar soil was used to determine a proposed hydroperiod. Because of natural variation found in natural systems, this site may be expected to exhibit a hydroperiod between 10 and 16 percent. Because the small extent of the restoration area and the drainage occurring within higher elevations above the project, a hydroperiod of 9 to 12 percent should be the reasonable target hydroperiod.

For the first year after construction, it may be practical to expect a hydroperiod of 8 to 10 percent as the site becomes wet and the higher groundwater table establishes. All suggested hydroperiods depend on the factors related to stream design and construction, frequency of flooding, effective removal of the drain tile system, and extent of surface drainage after construction. A successful hydrologic restoration should allow over time the reformation of some hydric indicators within the surface horizon where cultivation may have destroyed these indicators.

Table 2. Guidance for Hydroperiod Success Criteria at Cowford Mitigation Site

Mapping Unit/Series	Taxonomic Classification	Topographic Slope Setting (down/across)	Flooding/Ponding Frequency	Hydroperiod Range*
Muckalee loam	*Typic Fluvaquents*	concave-linear-	frequent/none	Yes (12-16%)±
Rains fine sandy loam	*Typic Paleaquults*	linear-linear-	none/none	Yes (10-12%)
Stallings loamy fine sand	*Aeric Paleaquults*	concave-linear-	none/none	No (7-9%)±
Onslow loamy fine sand	*Spodic Paleudults*	linear-linear-	none/none	No (NA)
Goldsboro fine sandy loam	*Aquic Paleudults*	linear-linear-	none/none	No (NA)
Norfolk loamy fine sand	*Typic Kandiudults*	convex- convex	none/none	No (NA)

**Hydroperiod follows US Army Corps of Engineers. 2016. Wilmington District Stream and Wetland Compensatory Mitigation Update. North Carolina Interagency Review Team - October 24, 2016.*
±Where series guidance not provided, simlar taxonomic subgroup substituted (Stallings and Muckalee)
NA - No guidance on Onslow, Goldsboro, and Norfolk soils –soils typically expected to lack significant hydroperiod.

Functional Uplift from Hydric Soil Restoration

The site currently has no wetlands due to the incised channel and drain tile system rapidly removing surface and groundwater. The stream is currently allowing sediment, nutrients, pesticides, and herbicides to flow freely into Cowford Branch and the New River. Both water bodies are classified as Nutrient Sensitive Waters. The proposed wetland restoration area will raise the local groundwater and restore a more natural hydrologic cycle to the riparian zone. Successful construction and restoration of this tributary and headwater wetland system will provide numerous benefits to water quality.

At this site successful hydrologic restoration will provide numerous soils related functional uplifts in addition to the benefits of stream restoration. These include, reestablishment of natural oxidation-reduction cycling, improved nutrient and chemical transformations, potential immobilization of

phosphorus, increased organic carbon sequestration, improved soil structure (surface primarily), lower soil and surface water temperature after vegetative establishment, and increases in diversity of microbial and fungal populations that are important for soil health. Large scale benefits may include an increase of diverse wildlife habitat, and connectivity to the natural aquatic communities of Cowford Branch.

Summary Conclusions and Recommendations

The Cowford Mitigation project consists of a floodplain currently within an agricultural landscape where a small deeply incised stream is allowing untreated runoff to enter Nutrient Sensitive Waters. The NRCS soil survey map units indicate the site is within the floodplain of a small headwater along the edge of an interstream divide. These map units are known to potentially contain inclusions of hydric soil in concave landscapes similar to conditions found at this site. Previous farming efforts have dredged and deepened the tributary, constructed drain tiles to lower groundwater, built shallow ditches, and recontoured the surface to remove surface water. The site historically supported riparian wetlands. These drainage modifications have eliminated natural flooding events and limited length of saturation normally found in wetlands. Multiple hydric soil indicators are present including: *A11-Depleted Below Dark Surface*, and *A12-Thick Dark Surface, S5-Sandy Redox, S7-Dark Surface, S9-Thin Dark Surface*, and *F3-Depleted Matrix*.

Recommendations

Restoration techniques that can be used to restore hydrology require a successful stream restoration that raises the local groundwater elevation and allows frequent flooding. Other methods include plugging of ditches, removal of drain tile, and surface roughening. Due to the agricultural nature of the site, ripping of the floodplain and wetland to a depth of 18 inches is recommended to decompact the area. Benefits of decompaction include, reduced runoff velocity, higher infiltration rate, improved soil structural properties and site storage. Other benefits include enhanced surface and subsurface biogeochemical cycling and storage. Additionally, this will improve planting conditions to increase survival and enhance long-term growth. Surface roughening with creation of shallow depressions to mimic local wetlands throughout the restoration area will reestablish more natural conditions while providing an appropriate landscape supporting a diverse habitat. All construction and decompaction activities should be limited or not undertaken when soils are saturated. Equipment and tillage in wet soils permanently damages soils by creating clods, ruts, and increasing compaction.

The hydric soils at this site can be expected to have a hydro period of 9 to 12 percent while small more pronounced depressional areas potentially exhibiting 12 to 16 percent. Due to the extensive drainage efforts, it may take at least a year for the site to become completely saturated and reach the target hydroperiods. For the first year after construction, it may be reasonable to expect a hydroperiod of 8 to 10 percent.

Conclusions

The topographic setting and hydric soil with potential hydrology are appropriate for a successful hydrologic restoration at the Cowford Branch mitigation site. Within the headwater floodplain of this small tributary the landscape position is suitable with the soils exhibiting hydric indicators reflecting historic wetland hydrology. Restoration of the stream should raise the groundwater to within 12 inches of the surface within of this floodplain and provide opportunities for overbank flooding

Restoration will reestablish natural functions to these degraded aquatic resources by providing a stable and unique wetland habitat to compliment the restored streams. Upon successful construction, the restored wetland will be able to provide functional benefits of sediment removal, soil chemical and biological transformations of nutrient and chemical pollutants while providing a range of wetland habitats. Other benefits include increased organic carbon accumulation/capture, improved soil structure

(surface primarily), and increases in diversity and beneficial microbial and fungal populations important for soil health.

Given the observed soil characteristics and presence of hydric soil indicators within a favorable landscape position, this site appears suitable for hydrologic wetland restoration. Successful hydrologic restoration at this site can provide numerous soils related functional uplifts. Because of the historically wet nature of this site, correct landscape position, the appropriate textured soils, and potential for restoration of adequate hydrology, this site is suitable for wetland restoration.

This report describes the results of the soil evaluation performed at the Cowford Mitigation Site in Onslow County, NC. Any subsequent transfer of the report by the user shall be made by transferring the complete report, including figures, maps, appendices, all attachments and disclaimers.

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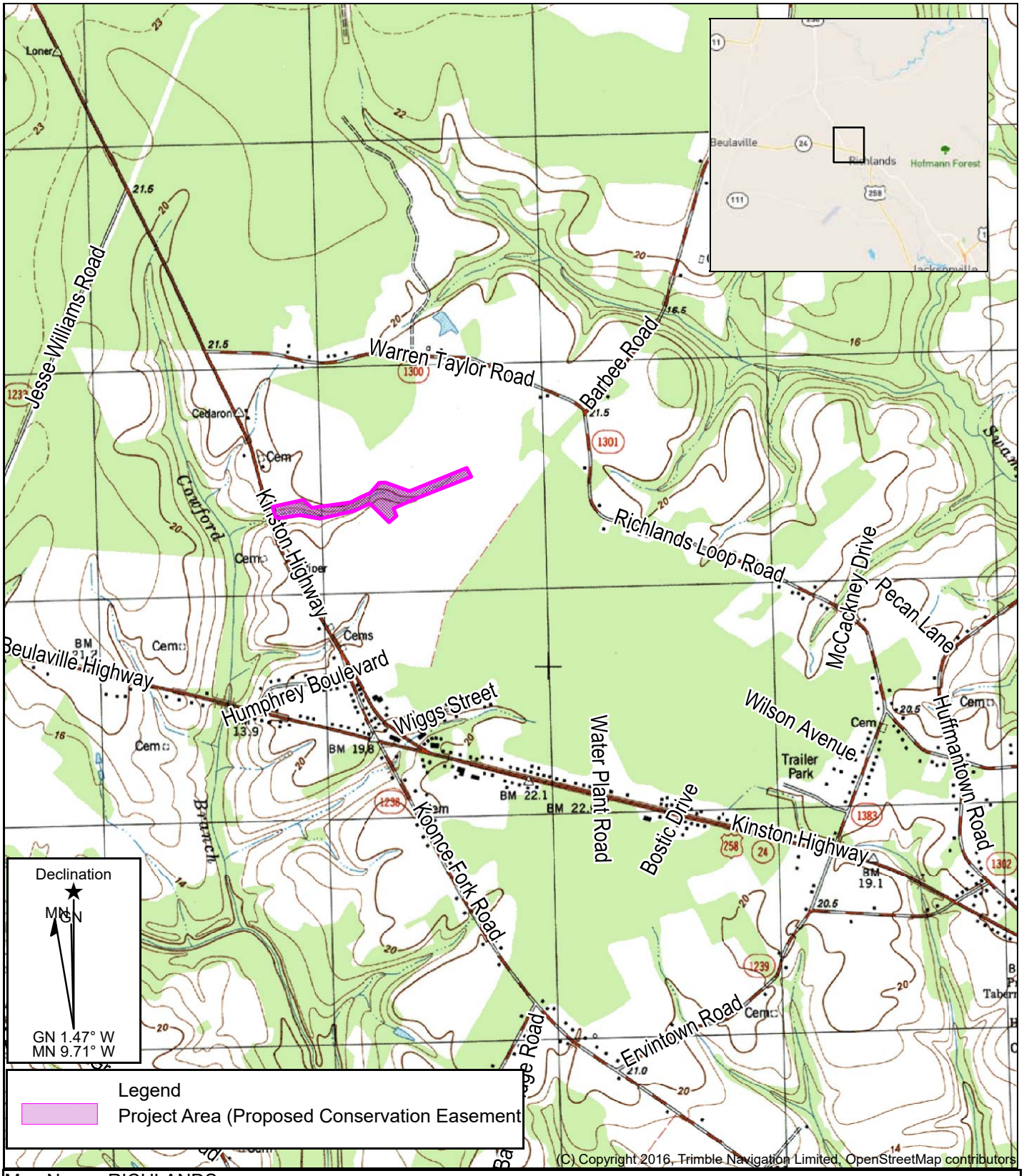
Figures

APPENDICES

Appendix A Soil Boring Log

Appendix B Photos

Appendix C NRCS Web Soil Survey Report



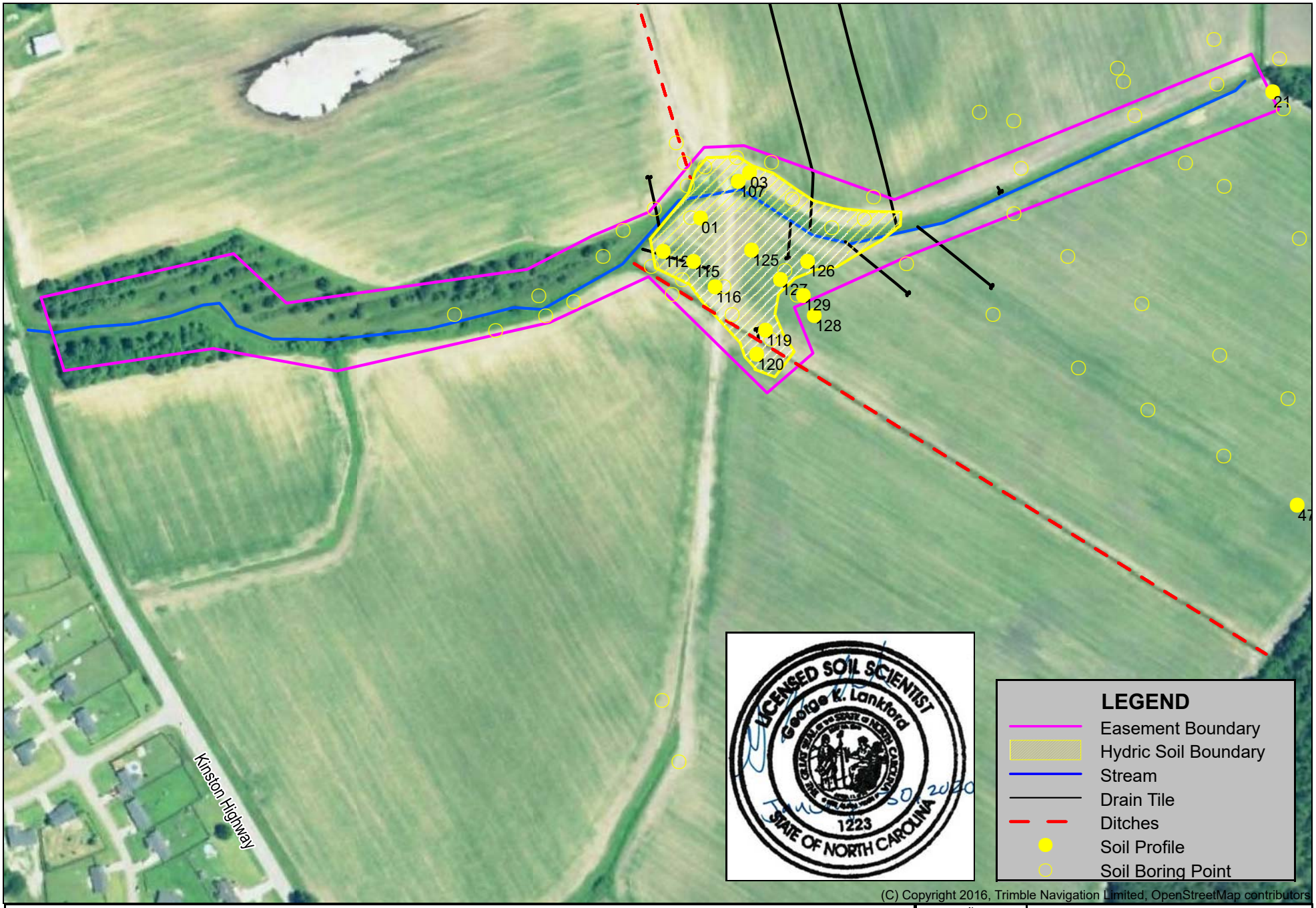
Map Name: RICHLANDS
Scale: 1 inch = 2,000 ft.

Figure 1. USGS Vicinity Map
Cowford Branch Mitigation Site
Onslow County, NC

SCALE 1:24000

0 1000 2000 3000 4000
Feet

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
Miles



(C) Copyright 2016, Trimble Navigation Limited, OpenStreetMap contributors

Scale: 1 inch = 300 ft.

Horizontal Datum: WGS84

SCALE 1:3600

0 100 200 300 400 500

Feet

Cowford Branch Mitigation Site
Figure 2. Aerial View - Hydric Soils

Appendix A
Cowford Branch Mitigation Site, Onslow County NC
Soil Boring Descriptions

Table Representative Soil Profiles at the Cowford Site

Depth (inches)	Color		Mottle Percentage (Location*)	Texture**	Notes
	Matrix	Mottle			
SB 01 **August 7, 2018**			Hydric Indicators A12-Thick Dark Surface		
0-12	2.5 Y 3/1			SL	area with drain tile
12-18	2.5 Y 5/1	10 YR 5/6	20% (PL)	SCL	
SB 03 **August 7, 2018**			Hydric Indicators WT at -25 A12-Thick Dark Surface		
0-11	2.5 Y 3/1			SL	
11-16	N 2.5/-			CL	
16-26	2.5 Y 3/1			fSL	
26-30	2.5 Y 5/1			fSL	
SB 21 **August 7, 2018**			Hydric Indicators No WT observed A11-Depleted Below Dark Surface F3-Depleted Matrix		
0-8	2.5 Y 2.5/1			fSL	
8-23	2.5 Y 5/1	7.5 YR 4/6	5% (PL)	fSL	
SB 47 **August 7, 2018**			Hydric Indicators No WT observed A11-Depleted Below Dark Surface F3-Depleted Matrix		
0-9	N 2.5/-			SL	
9-15	N 2.5/-	2.5 Y 4/1	15% (PL)	SL	
15-19	2.5 Y 5/2	2.5 Y 4/6	10% (PL)	fSL	
19-26	2.5 Y 4/1	2.5 Y 4/6	15% (PL)	SCL	
SB 107 **November 7, 2019**			Hydric Indicators No WT observed S5-Sandy Redox		
0-6	7.5 YR 4/4	7.5 YR 6/4	5%	LS	
6-10	7.5 YR 4/1	7.5 YR 3/4	10% (PL)	LS	
10-23	7.5 YR 4/1	7.5 YR 5/2 7.5 YR 3/4	5% (PL) 2% (PL)	LS	
23-33	7.5 YR 3/1	7.5 YR 5/1 7.5 YR 3/4	10% (PL) 5% (PL)	SCL	
SB 112 **November 7, 2019**			Hydric Indicators No WT observed S7-Dark Surface		
0-9	7.5 YR 3/1			LS	~80% coated sand grains
9-19	7.5 YR 4/2	5 YR 4/6	2% (M)	LS	
19-25	7.5 YR 4/6	5 YR 5/8		SC	no structure and restrictive

Appendix A
Cowford Branch Mitigation Site, Onslow County NC
Soil Boring Descriptions

SB 115 **November 7, 2019**			Hydric Indicators S7-Dark Surface	No WT observed	
0-16	7.5 YR 3/1			LS	~75% coated sand grains
16-29	N 2.5/-			SL	
29-36	7.5 YR 5/2	7.5 YR 2.5/1	20% (PL)	LS	
SB 116 **November 7, 2019**			Hydric Indicators S7-Dark Surface S9-Thin Dark Surface	No WT observed	
0-8	7.5 YR 3/1			LS	~75% coated sand grains
8-11	7.5 YR 2.5/1	7.5 YR 3/1 7.5 YR 7/2	5% (PL) 5% (PL)	LS	
11-16	7.5 YR 2.5/3	7.5 YR 5/6	30% (PL)	LS	brittle-possibly spodic
16-28	7.5 YR 6/2			S	
SB 119 **November 7, 2019**			Hydric Indicators F3-Depleted Matrix	No WT observed	
0-8	7.5 YR 3/2			SL	~60% coated sand grains
8-20	7.5 YR 4/2	7.5 YR 4/6	20% (M)	SC	weak structure-limited pore space
SB 120 **November 7, 2019**			Hydric Indicators F3-Depleted Matrix	No WT observed	
0-10	7.5 YR 2.5/1			SL	
10-21	7.5 YR 5/2	7.5 YR 4/6	5% (M)	SC	
SB 125 **January 16, 2020**			Hydric Indicators S7-Dark Surface	No WT observed	
0-8	7.5 YR 2.5/1			LS	~90% coated sand grains
8-13	7.5 YR 6/3	7.5 YR 5/6	15% (PL)	LS	
13-20	7.5 YR 5/3	7.5 YR 5/6 7.5 YR 4/6	15% (PL) 2% (PL)	SL	4/6 mottles have distinct boundaries
20-27	7.5 YR 5/2	7.5 YR 5/6	20% (PL)	SCL	weak structure-restrictive
27-40	7.5 YR 5/1	7.5 YR 5/6 7.5 YR 4/6	20% (PL) 10% (PL)	SCL	weak structure-restrictive
SB 126 **January 16, 2020**			Hydric Indicators A12-Thick Dark Surface	No WT observed	
0-6	10 YR 2/1			SL	~60% coated sand grains
6-16	10 YR 2/1			SL	~90% coated sand grains
16-22	10 YR 4/1	10 YR 4/4	2% (PL)	SL	relict hydric
22-26	10 YR 5/3	7.5 YR 5/8	5% (PL)	SCL	
26-30	7.5 YR 5/8	10 YR 4/3	25% (PL)	SC	
30-41	7.5 YR 5/1	7.5 YR 5/8	20% (PL)	SC	

Appendix A
Cowford Branch Mitigation Site, Onslow County NC
Soil Boring Descriptions

SB 127 **January 16, 2020**			Hydric Indicators No WT observed S7-Dark Surface S9-Thin Dark Surface		
0-10	10 YR 2/1			fSL	~90% coated sand grains
10-13	7.5 YR 2.5/1			fSL	
13-18	7.5 YR 2.5/2	5 YR 5/8	15% (PL)	SL	brittle-possibly spodic
18-23	7.5 YR 2.5/3	7.5 YR 5/6	10% (PL)	SL	saturated
23-35	7.5 YR 5/2	7.5 YR 4/6	10% (PL)	SC	restrictive

Hydric indicators valid for NRCS Land Resource Region 153A (Outer Coastal Plain) and Land Resource Region T
WT = observed apparent water table
*PL =pore lining, M = matrix
**Texture (follows USDA textural classification)
S = sand, L = loam, Si = silt, C = clay
f = fine, c = coarse (textural modifiers for sandy soils)

Soil Scientist Seal

Appendix B
Cowford Branch Mitigation Site – Onslow County, NC
Photo Log

January 2020

1. Hydric profile. Meets the S7-Dark Surface indicator. SB#125.

2. Landscape looking across floodplain upstream. SB#125.

Appendix B
Cowford Branch Mitigation Site – Onslow County, NC
Photo Log

January 2020

3. Hydric profile. Meets the S7-Dark Surface and S9-Thin Dark Surface indicators. SB#127..

4. Hydric profile. Meets the A12 Thick-Dark Surface indicator. SB#125.

Soil Map—Onslow County, North Carolina
(Cowford Branch)

Map Scale: 1:13,200 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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: Onslow County, North Carolina
Survey Area Data: Version 21, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 7, 2015—Oct 26, 2017

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

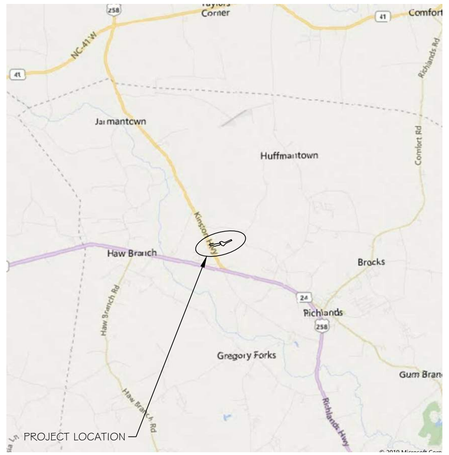
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CrB	Craven fine sandy loam, 1 to 4 percent slopes	1.1	0.1%
CrC	Craven fine sandy loam, 4 to 8 percent slopes	42.5	4.7%
GoA	Goldsboro fine sandy loam, 0 to 2 percent slopes	32.2	3.6%
GpB	Goldsboro-Urban land complex, 0 to 5 percent slopes	37.8	4.2%
Ly	Lynchburg fine sandy loam, 0 to 2 percent slopes, Atlantic Coast Flatwoods	40.5	4.5%
MaC	Marvyn loamy fine sand, 6 to 15 percent slopes	15.5	1.7%
Mk	Muckalee loam	55.7	6.2%
NoA	Norfolk loamy fine sand, 0 to 2 percent slopes	98.2	10.9%
NoB	Norfolk loamy fine sand, 2 to 6 percent slopes	146.2	16.2%
On	Onslow loamy fine sand	63.3	7.0%
Pn	Pantego mucky loam	41.9	4.6%
Ra	Rains fine sandy loam, 0 to 2 percent slopes, Atlantic Coast Flatwoods	213.3	23.7%
St	Stallings loamy fine sand	92.5	10.3%
Wo	Woodington loamy fine sand	20.2	2.2%
Totals for Area of Interest		**901.0**	**100.0%**

COWFORD MITIGATION SITE

ONSLOW COUNTY

WHITE OAK RIVER BASIN: HUC 03030001
MAY 2021

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
3600 GLENWOOD AVE, SUITE 100
RALEIGH, NC 27612



VICINITY MAP
NTS

PROJECT COORDINATES: 34.9233, -77.5917

Know what's **below.**
Call before you dig

NOTICE TO CONTRACTOR

PRIOR TO CONSTRUCTION, DIGGING, OR EXCAVATION THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UNDERGROUND UTILITIES (PUBLIC OR PRIVATE) THAT MAY EXIST AND CROSS THROUGH THE AREA(S) OF CONSTRUCTION, WHETHER INDICATED ON THE PLANS OR NOT. CALL "811" A MINIMUM OF 72 HOURS PRIOR TO DIGGING OR EXCAVATING. REPAIRS TO ANY UTILITY DAMAGED RESULTING FROM CONSTRUCTION ACTIVITIES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

PROJECT DIRECTORY

DESIGNED FOR:
LINDSAY CROCKER
NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
217 WEST JONES ST., SUITE 3000A
RALEIGH, NC 27603

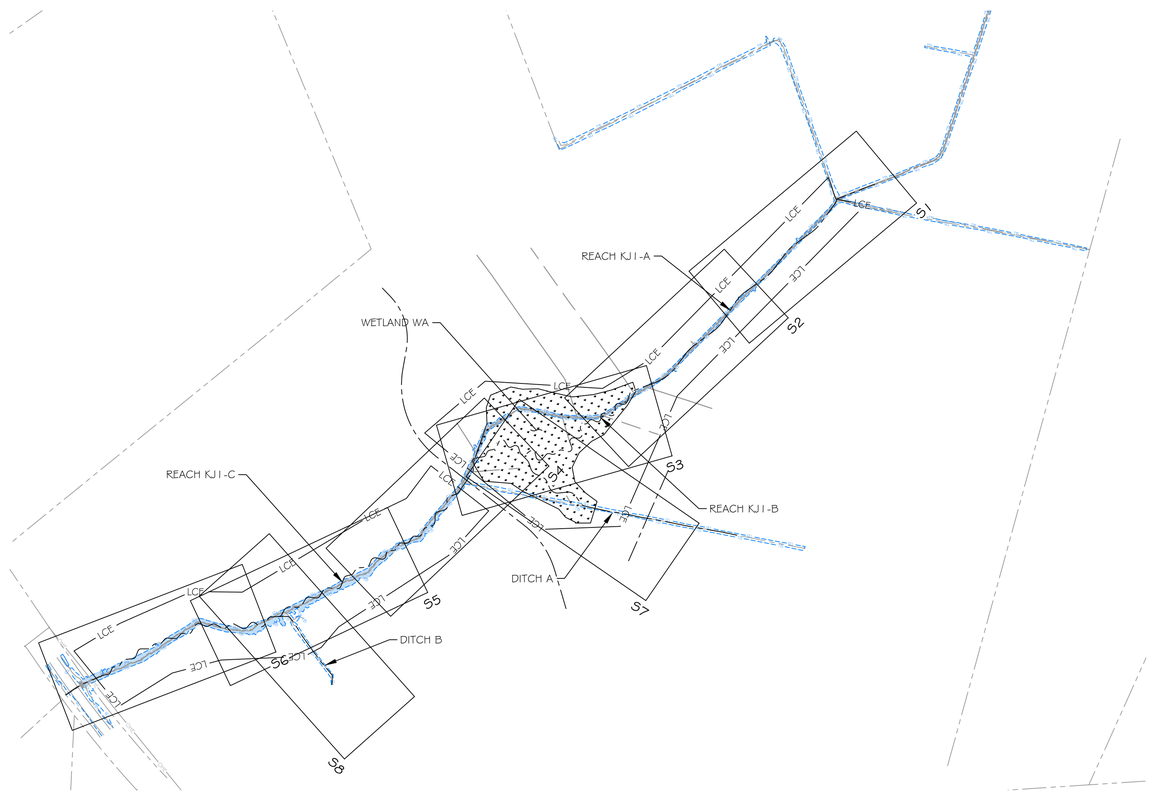
DESIGNED BY:
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
3600 GLENWOOD AVE., SUITE 100
RALEIGH, NC 27612

SURVEYED BY:
WSP USA, INC.
128 TALBERT ROAD
SUITE A
MOORESVILLE, NC 28117

CONSTRUCTION PROJECT MANAGER:
PAUL DUNN
(910) 574-2629
pdunn@res.us

DMS PROJECT #: 100095
CONTRACT #: 7746
USACE ACTION ID #: SAW-2019-00487
RFP #: 16-007577
DWR #: 2019-0495

PROJECT TOPOGRAPHY AND EXISTING CONDITIONS PLANIMETRICS SURVEY WAS PROVIDED BY WSP USA, INC. (NC FIRM LICENSE NUMBER F-0891, J. BRANDON HICKS, NC PLS L-5219), DATED SEPTEMBER 19, 2019



SITE MAP
NTS

Sheet List Table	
Sheet Number	Sheet Title
-	COVER
A1	OVERALL AERIAL
E1	NOTES
E2	EXISTING CONDITIONS
S1	REACH KJ1
S2	REACH KJ1
S3	REACH KJ1
S4	REACH KJ1
S5	REACH KJ1
S6	REACH KJ1
S7	SWALE A
S8	SWALE B
W1	WETLAND PLAN
P1	PLANTING PLAN
X1	CULVERT CROSSINGS
EC1	EROSION CONTROL
EC2	EROSION CONTROL
EC3	EROSION CONTROL
EC4	EROSION CONTROL
EC5	EROSION CONTROL
D1	DETAILS
D2	DETAILS
D3	DETAILS
D4	DETAILS
D5	DETAILS
D6	DETAILS

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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042590 ENGINEER BENJAMIN R. CARROLL
5/4/21

PLOT DATE: 5/4/2021

REVISIONS:

RELEASED FOR: FINAL DESIGN - RELEASED FOR CONSTRUCTION

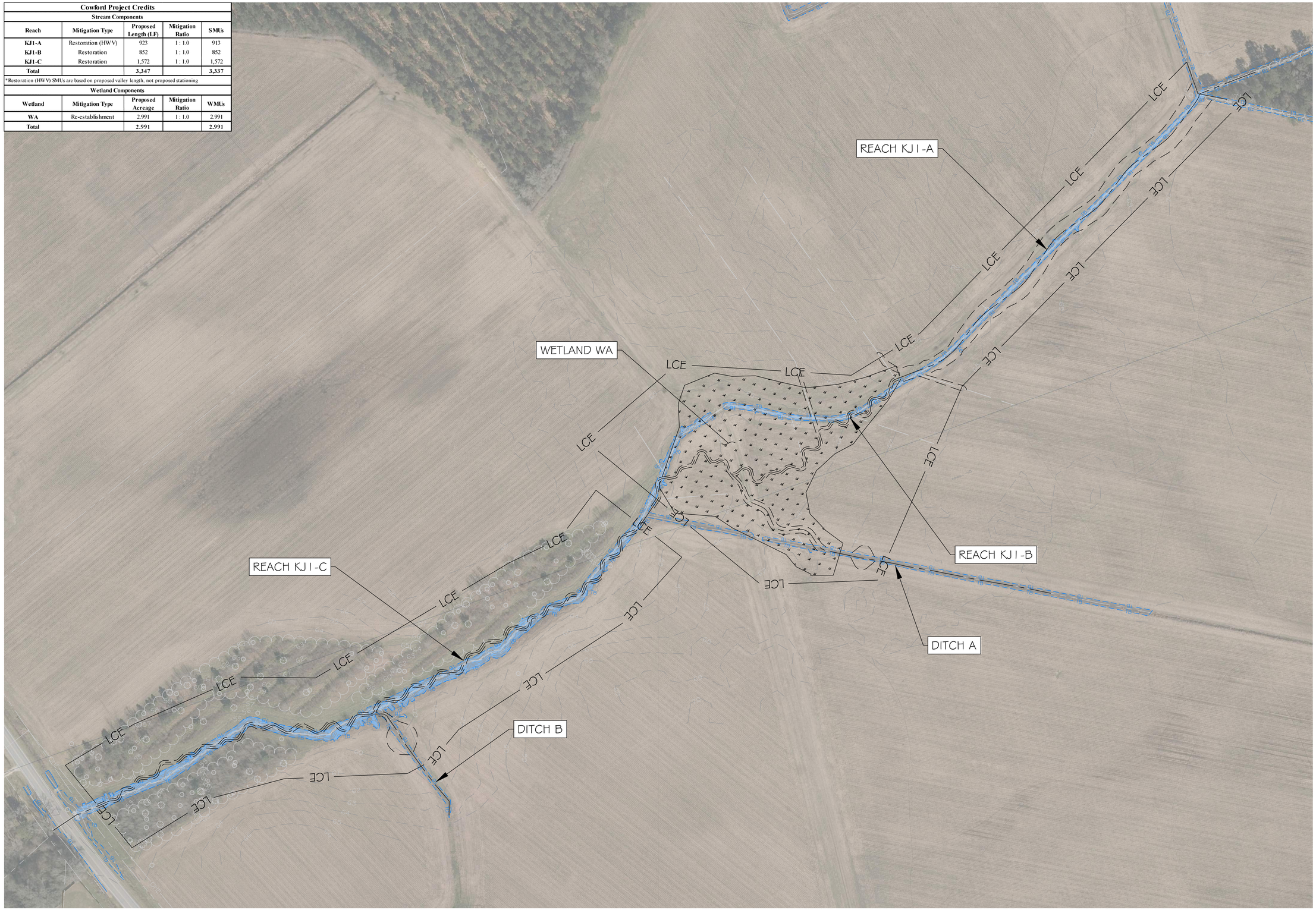
PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

-

FILE NAME:R:\Rescad\Projects\100900-Cowford\DWG\0675_SHT_COVER.dwg SAVED BY: Staking

Cowford Project Credits				
Stream Components				
Reach	**Mitigation Type**	**Proposed Length (LF)**	**Mitigation Ratio**	**SMUs**
KJ1-A	Restoration (HWV)	923	1 : 1.0	913
KJ1-B	Restoration	852	1 : 1.0	852
KJ1-C	Restoration	1,572	1 : 1.0	1,572
Total		**3,347**		**3,337**
*Restoration (HWV) SMUs are based on proposed valley length, not proposed stationing				
Wetland Components				
Wetland	**Mitigation Type**	**Proposed Acreage**	**Mitigation Ratio**	**WMUs**
WA	Re-establishment	2.991	1 : 1.0	2.991
Total		**2.991**		**2.991**



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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BENJAMIN R. CARROLL
5/4/21

FULL SCALE: 1"=100

0 100 200

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
OVERALL AERIAL

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

A1

STREAM CONSTRUCTION NOTES:

1. ALL PROPOSED CHANNELS AND TEMPORARY AND PERMANENT CROSSINGS SHALL BE CONSTRUCTED IN A DRY CONDITION VIA OFFLINE CONSTRUCTION WHERE POSSIBLE. PUMP AROUND OPERATIONS SHOULD BE LIMITED TO AREAS WHERE THE EXISTING AND PROPOSED CHANNEL ALIGNMENTS OVERLAP.

2. ALL IMPERVIOUS DIKES AND PUMPING APPARATUS SHALL BE REMOVED FROM THE STREAM AT THE END OF EACH DAY TO RESTORE NORMAL FLOW BACK TO THE CHANNEL UNLESS OTHERWISE APPROVED BY THE ENGINEER. WITH APPROVAL, A PUMP AROUND MAY BE ALLOWED TO RUN CONTINUOUSLY IF THERE IS NO FORECAST FOR RAIN OVERNIGHT, AND/OR THE PUMP APPARATUS IS MAINTAINED AND MONITORED CONTINUOUSLY.

3. CONSTRUCT UPSTREAM PORTION OF THE CHANNEL FIRST, WORKING IN AN UPSTREAM TO DOWNSTREAM DIRECTION, UNLESS OTHERWISE APPROVED BY THE ENGINEER.

4. REMOVE AND STOCKPILE TOPSOIL WITHIN AREAS THAT ARE TO BE CUT 9" OR MORE BELOW EXISTING GRADE. STOCKPILED TOPSOIL IS TO BE PLACED ALONG THE FLOODPLAIN BENCHES.

5. STRUCTURES ARE TO BE INSTALLED IN LOCATIONS SHOWN ON PLAN SHEETS (AS INDICATED ON THE STRUCTURE TABLES) USING METHODS DESCRIBED IN THE DETAIL SHEETS. PRIOR TO FINE GRADING, OBTAIN APPROVAL OF THE ENGINEER ON INSTALLATION OF STRUCTURES.

6. UPON COMPLETION OF FINE GRADING, INSTALL STREAM BANK STABILIZATION INCLUDING, EROSION CONTROL MATTING OR SOD MATS ALONG CHANNEL BANKS.

7. FILL AND STABILIZE ABANDONED SEGMENTS OF THE EXISTING CHANNEL PER SHEET D3 OR DIRECTION OF THE ENGINEER.

LEGEND

EXISTING CONTOUR MAJOR — 50
EXISTING CONTOUR MINOR — 46
PROPOSED CONTOUR MAJOR — 50
PROPOSED CONTOUR MINOR — 42
EXISTING STREAM — TB, BB, BH
EXISTING TOP OF BANK — TB
EXISTING BOTTOM OF BANK — BB
EXISTING OVERHEAD ELECTRIC UTILITY LINE — OHE
PROPERTY LINE
EXISTING DRAIN TILE
EXISTING TREELINE
EXISTING TREE
PROPOSED TOP OF BANK
PROPOSED CENTERLINE OF CHANNEL
LIMITS OF PROPOSED CONSERVATION EASEMENT — LCE
PROPOSED WETLAND
PROPOSED CHANNEL PLUG (SEE DETAIL D3)
BRUSH TOE PROTECTION (SEE DETAIL D3)
HAY BALE TOE PROTECTION (SEE DETAIL D3)
ENGINEERED SEDIMENT PACK (SEE DETAIL D2)
LOG SILL (SEE DETAIL D4)
ROCK SILL (SEE DETAIL D6)
RIFFLE GRADE CONTROL (SEE DETAIL D5)
BRUSH BED SILL (SEE DETAIL D4)
LOG STRUCTURE (PROFILE)
ROCK STRUCTURE (PROFILE)

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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BENJAMIN CARROLL
5/4/21

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
NOTES

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:
E1

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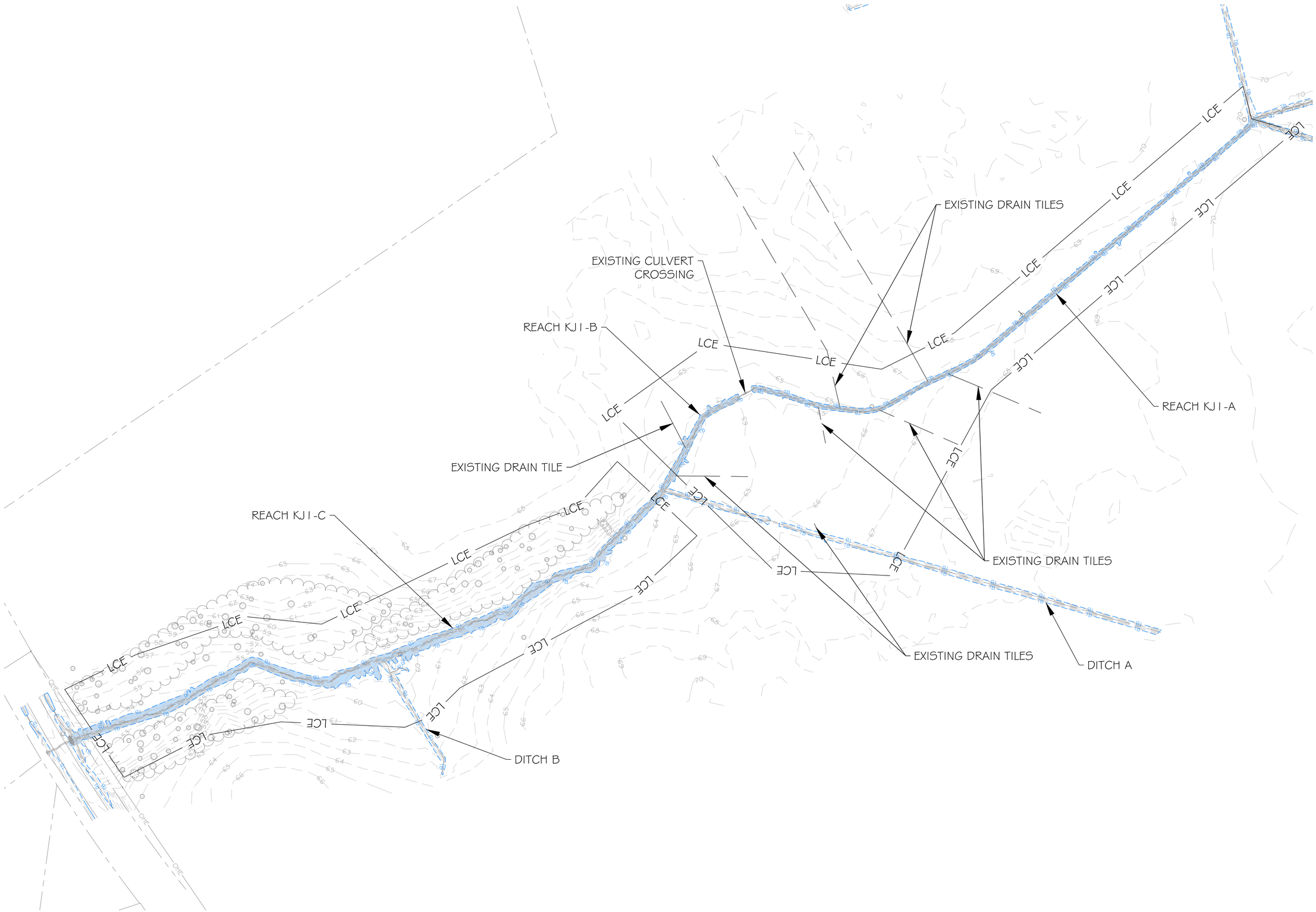

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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BENTON R. CARROLL
5/4/21

FULL SCALE: 1"=100

0 100 200

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE:
5/4/2021

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COWFORD MITIGATION SITE
ONSLOW COUNTY

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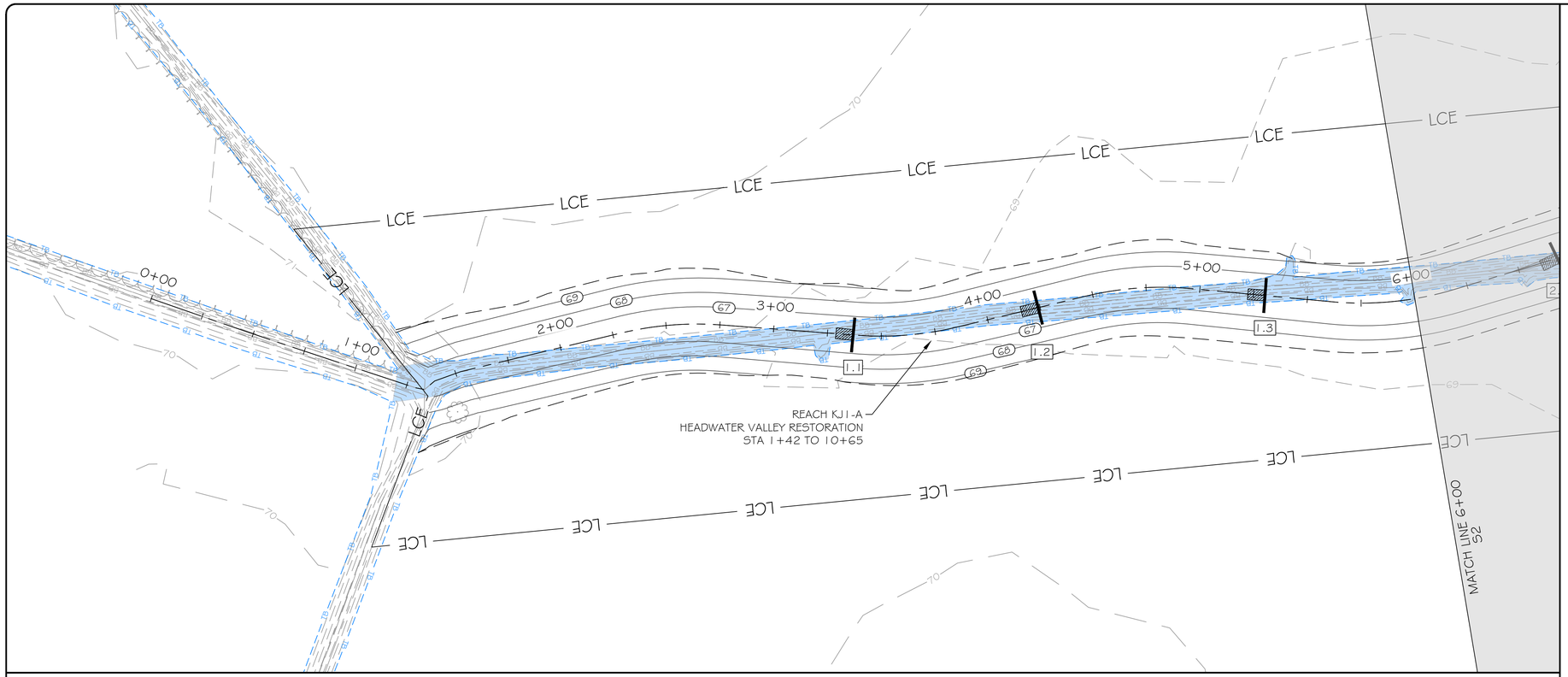
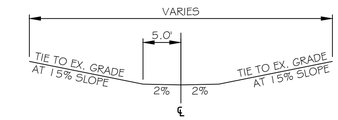
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

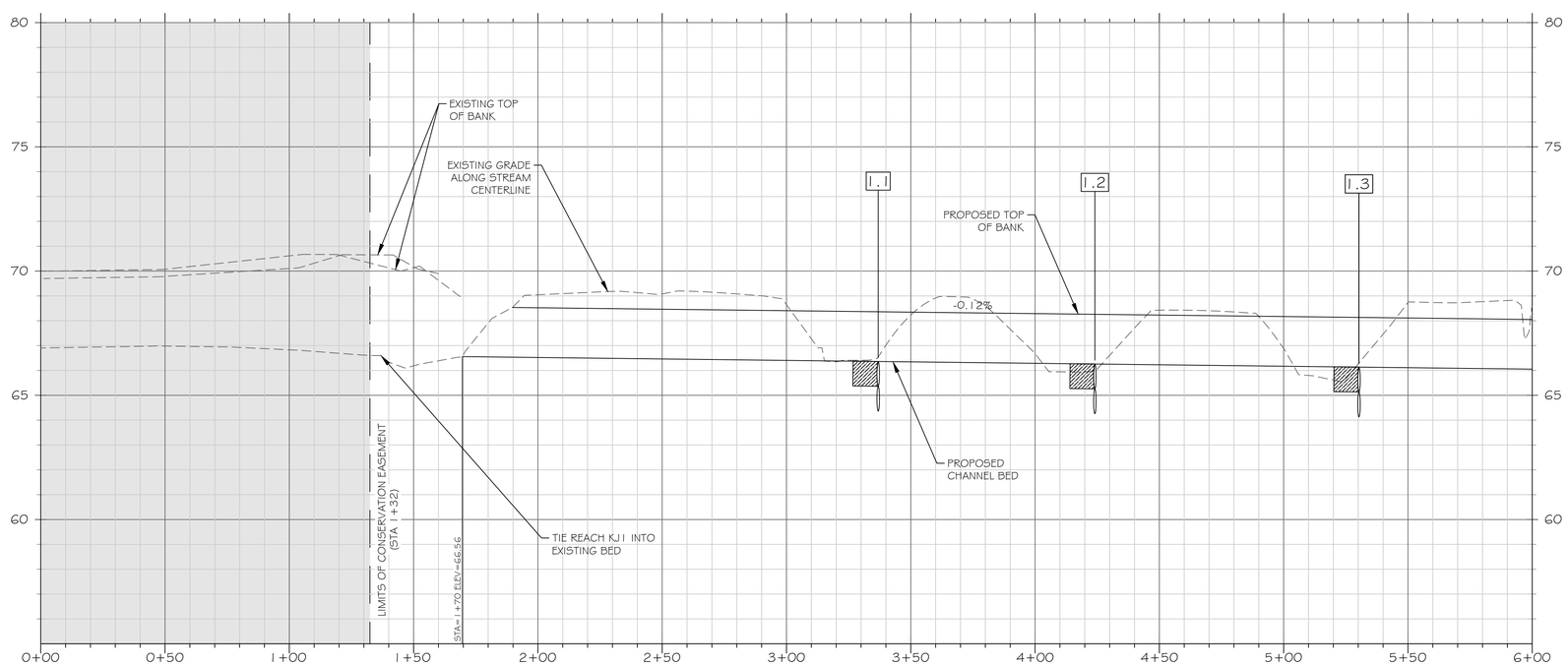
E2



REACH KJ1-A STA 1+57 TO STA 10+65



TYPICAL CROSS SECTION



SCALE: HOR 1"=30'; VERT 1"=3'

STRUCTURE TABLE			
NO.	TYPE	STA.	ELEV.
1.1	BRUSH BED SILL	3+37'	66.36'
1.2	BRUSH BED SILL	4+24'	66.26'
1.3	BRUSH BED SILL	5+30'	66.13'

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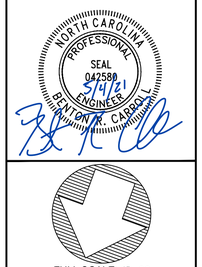
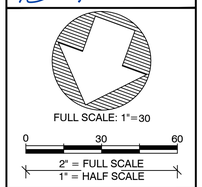
SEAL





PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
REACH KJ1

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

S1

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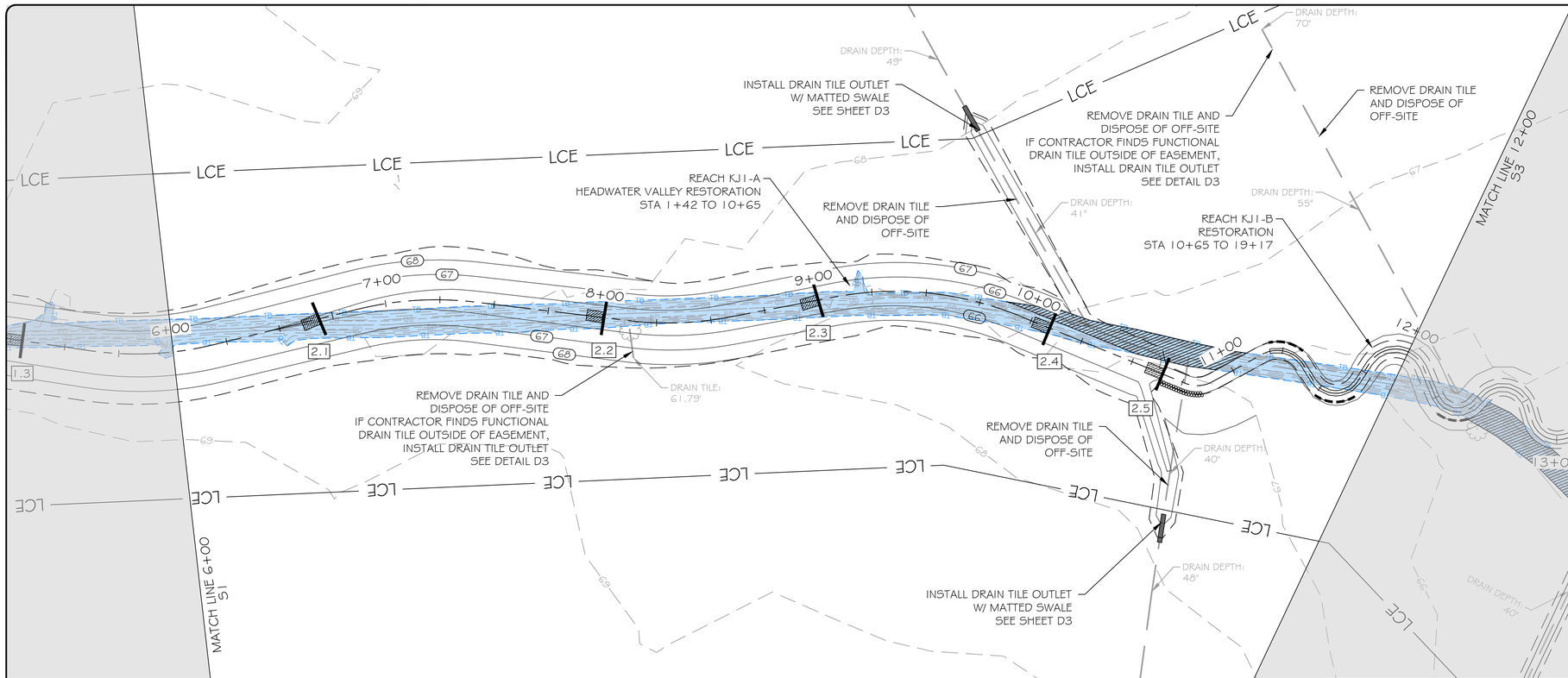
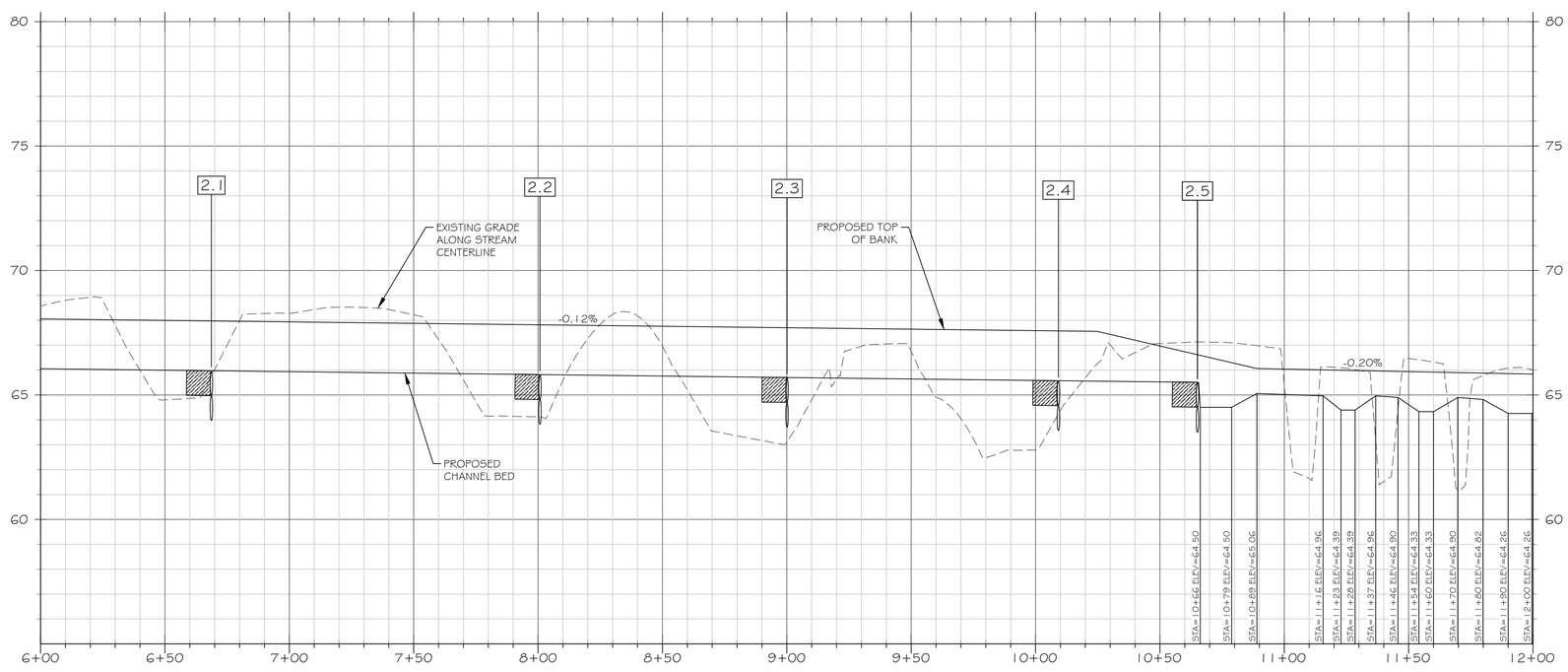
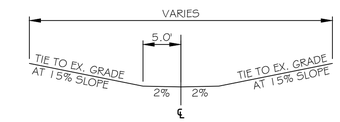




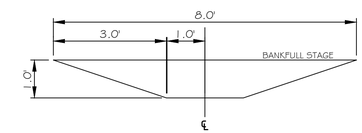
SCALE: HOR 1"=30'; VERT 1"=3'

REACH KJ1-A STA 1+57 TO STA 10+65

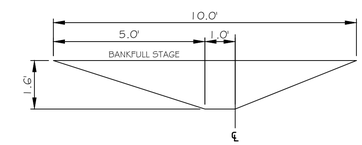


TYPICAL CROSS SECTION

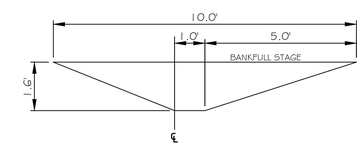
REACH KJ1-B STA 10+65 TO STA 19+40



TYPICAL RIFFLE CROSS SECTION



TYPICAL RIGHT MEANDER CROSS SECTION



TYPICAL LEFT MEANDER CROSS SECTION

STRUCTURE TABLE			
NO.	TYPE	STA.	ELEV.
2.1	BRUSH BED SILL	6+69'	65.97'
2.2	BRUSH BED SILL	8+01'	65.82'
2.3	BRUSH BED SILL	9+00'	65.70'
2.4	BRUSH BED SILL	10+15'	65.57'
2.5	BRUSH BED SILL	10+65'	65.50'

TOE PROTECTION TABLE			
BANK	TYPE	FROM STA.	TO STA.
RT	BRUSH TOE	10+65'	10+84'
LT	HAY BALE TOE	11+19'	11+32'
RT	HAY BALE TOE	11+50'	11+65'

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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BRIAN R. CARROLL 5/4/21

FULL SCALE: 1"=30

0 30 60

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 5/4/2021

REVISIONS:

RELEASED FOR: FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME: COWFORD MITIGATION SITE ONSLOW COUNTY

DRAWING TITLE: REACH KJ1

PROJECT NUMBER: 0675
PROJECT MANAGER: MB
DESIGNED: BRC
DRAWN: SCF
CHECKED: AFM

SHEET NUMBER:

S2

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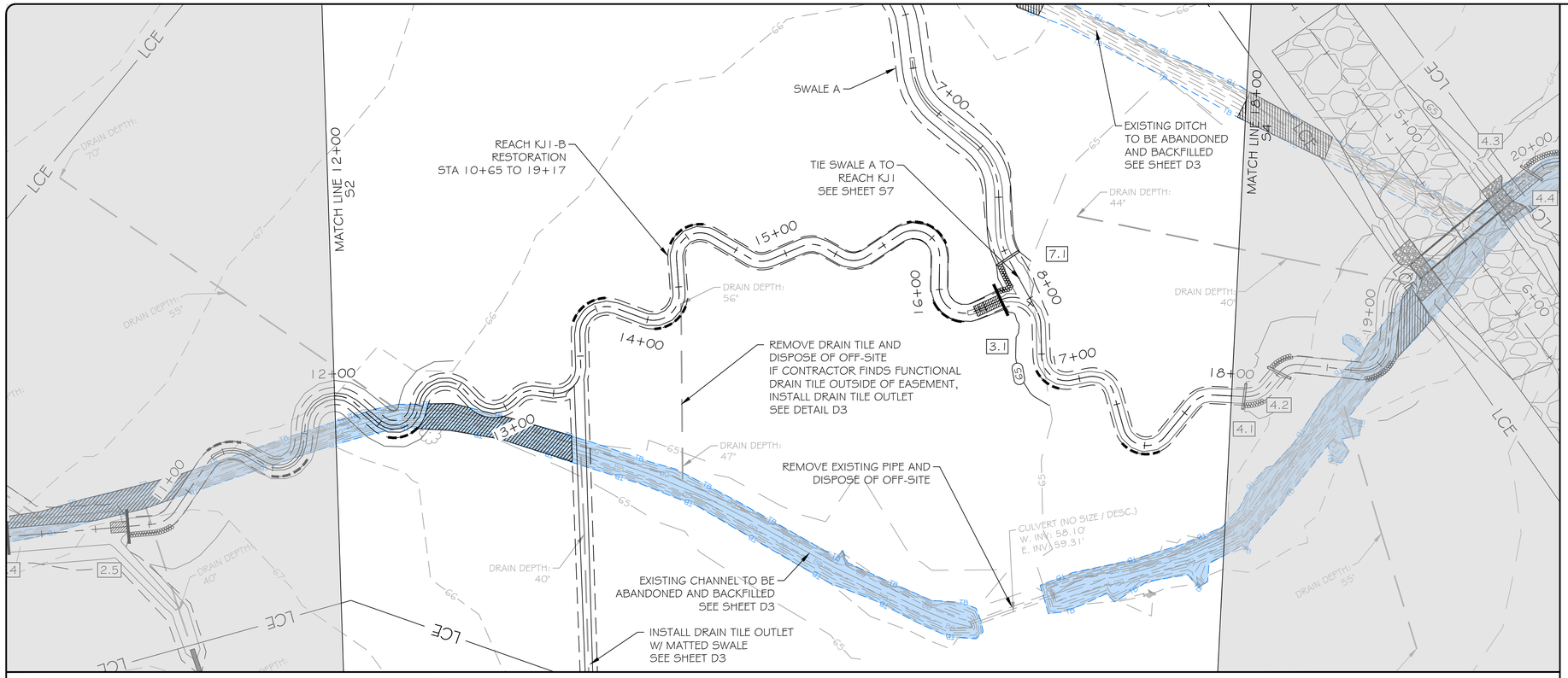
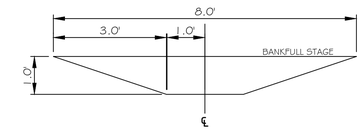
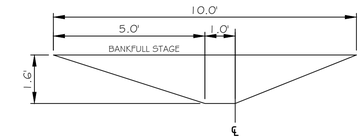


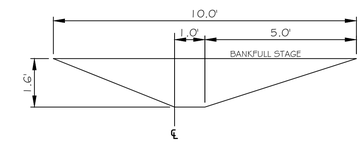
REACH KJ1-B STA 10+65 TO STA 19+40



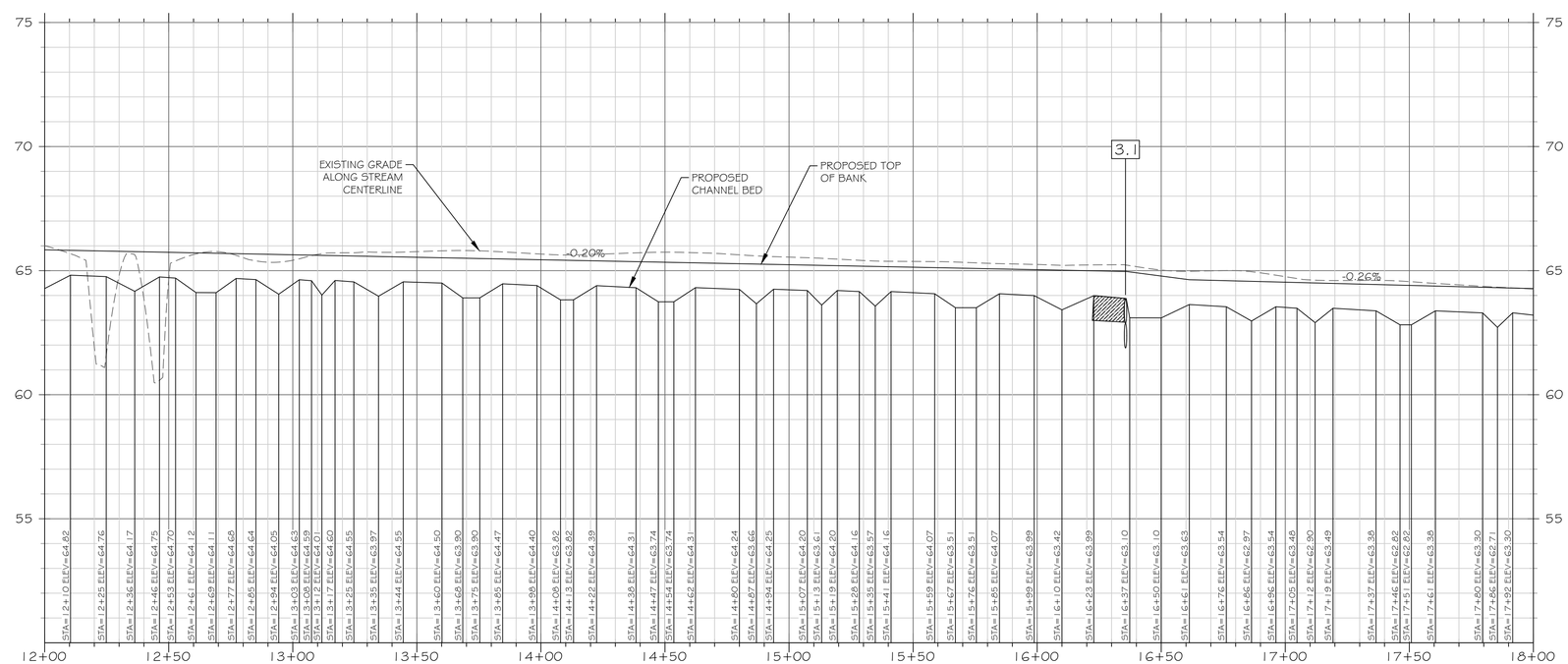
TYPICAL RIFFLE CROSS SECTION



TYPICAL RIGHT MEANDER CROSS SECTION



TYPICAL LEFT MEANDER CROSS SECTION



SCALE: HOR 1"=30'; VERT 1"=3'

STRUCTURE TABLE			
NO.	TYPE	STA.	ELEV.
3.1	BRUSH BED SILL	16+36'	63.88'

TOE PROTECTION TABLE			
BANK	TYPE	FROM STA.	TO STA.
RT	HAY BALE TOE	12+31'	12+41'
RT	HAY BALE TOE	13+29'	13+40'
LT	HAY BALE TOE	13+65'	13+80'
RT	HAY BALE TOE	14+03'	14+17'
LT	HAY BALE TOE	14+43'	14+58'
LT	HAY BALE TOE	15+63'	15+80'
RT	HAY BALE TOE	16+04'	16+17'
LT	BRUSH TOE	16+36'	16+40'
RT	HAY BALE TOE	16+81'	16+91'
RT	HAY BALE TOE	17+42'	17+55'

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License: F-1428

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BRYTON R. CARROLL 5/4/21

FULL SCALE: 1"=30

0 30 60

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 5/4/2021

REVISIONS:

RELEASED FOR: FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME: COWFORD MITIGATION SITE ONSLOW COUNTY

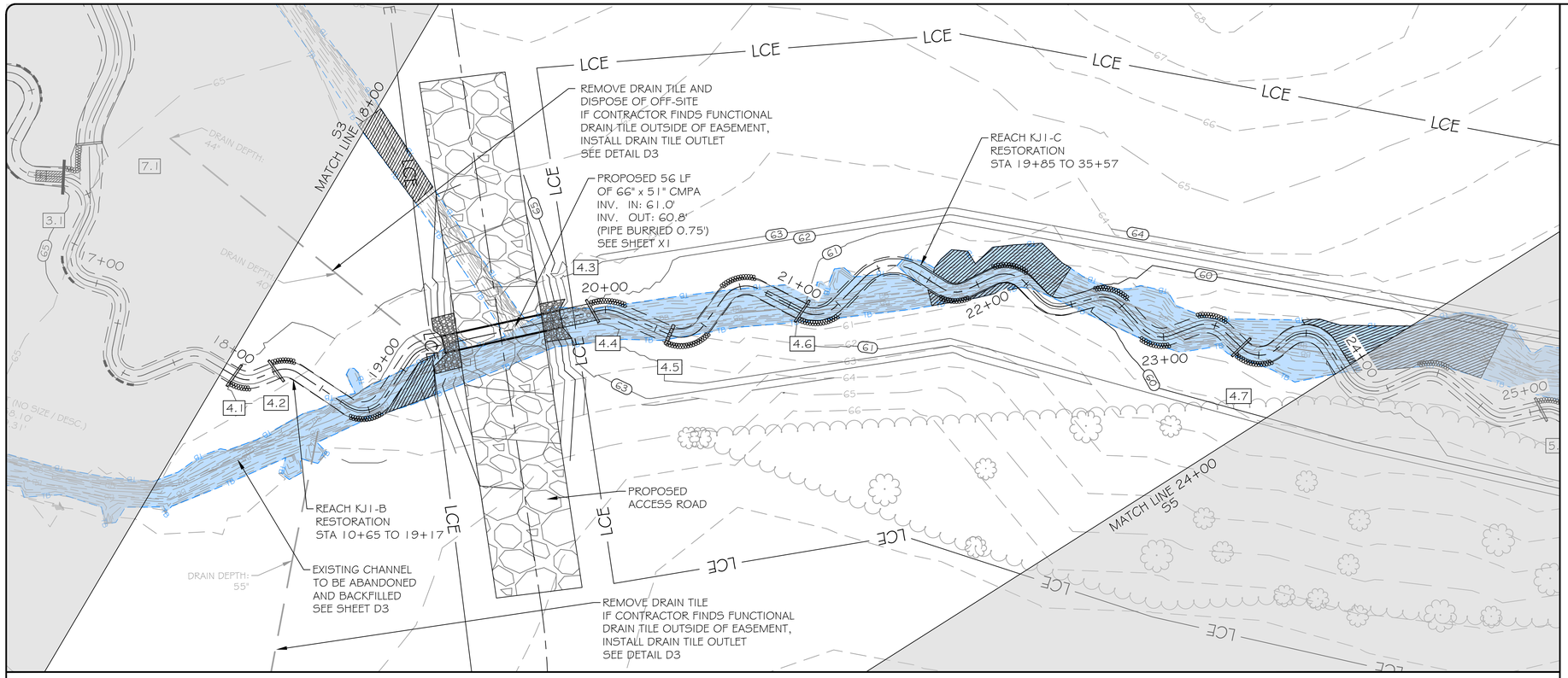
DRAWING TITLE: REACH KJ1

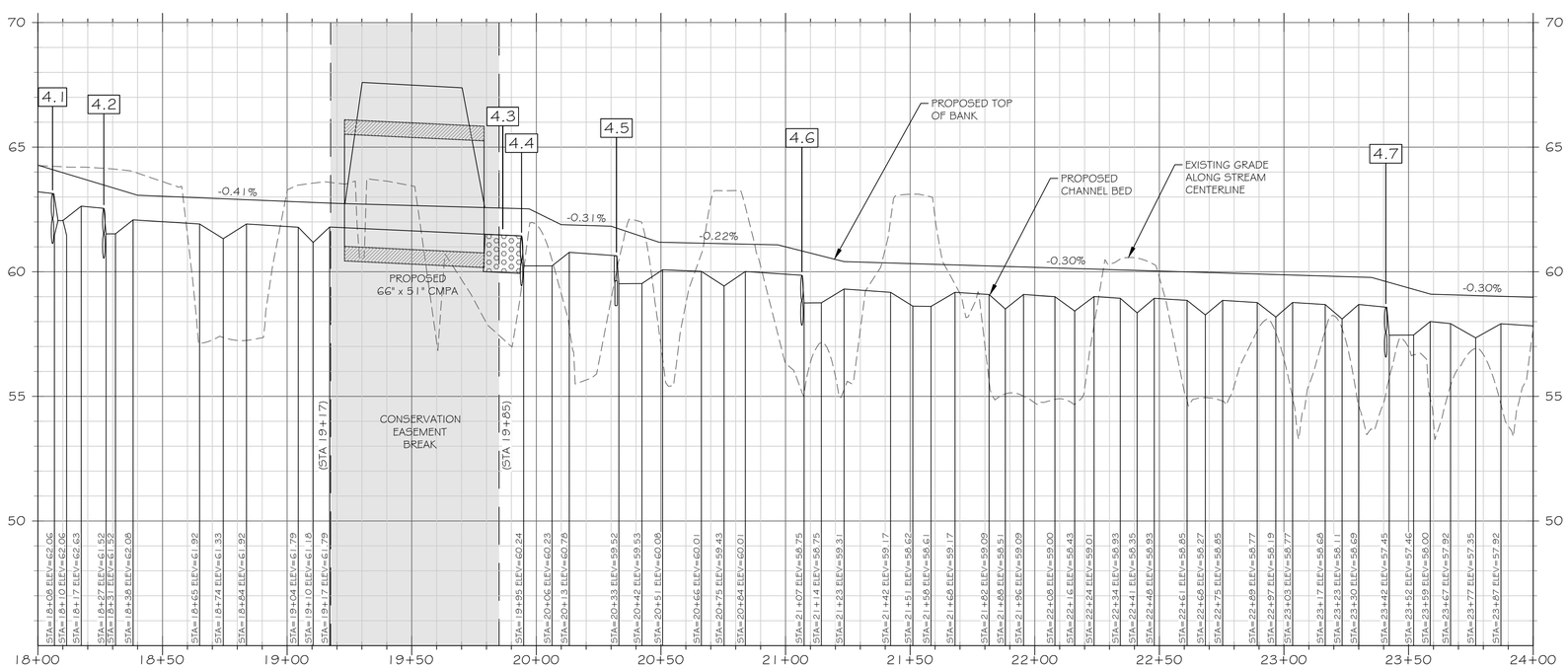
PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

S3

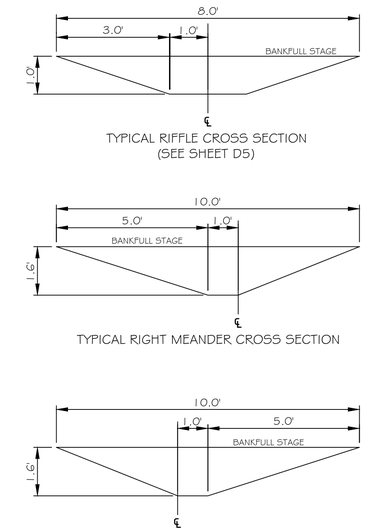
FILE NAME:R:\Rescad\Projects\100900-Cowford\DWG\0675_SHT_KJ1.dwg SAVED BY: Bcarroll





SCALE: HOR 1"=30'; VERT 1"=3'

REACH KJ1-B STA 10+65 TO STA 19+40
REACH KJ1-C STA 19+70 TO STA 35+57



STRUCTURE TABLE			
NO.	TYPE	STA.	ELEV.
4.1	LOG SILL	18+06'	63.13'
4.2	LOG SILL	18+26'	62.54'
4.3	RIFFLE GRADE CONTROL	19+87'	61.47'
4.4	LOG SILL	19+94'	61.43'
4.5	ROCK SILL	20+32'	60.64'
4.6	LOG SILL	21+07'	59.85'
4.7	LOG SILL	23+41'	58.57'

TOE PROTECTION TABLE			
BANK	TYPE	FROM STA.	TO STA.
RT	BRUSH TOE	18+06'	18+13'
LT	BRUSH TOE	18+26'	18+34'
RT	BRUSH TOE	18+73'	18+79'
LT	BRUSH TOE	19+93'	20+09'
RT	BRUSH TOE	20+32'	20+44'
LT	BRUSH TOE	20+71'	20+79'
RT	BRUSH TOE	21+07'	21+19'
RT	BRUSH TOE	21+85'	21+92'
LT	BRUSH TOE	22+12'	22+20'
LT	BRUSH TOE	22+64'	22+72'
RT	BRUSH TOE	22+93'	23+00'
LT	BRUSH TOE	23+20'	23+27'
RT	BRUSH TOE	23+41'	23+55'

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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BRANDON R. CARROLL
5/19/21

FULL SCALE: 1"=30
0 30 60
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1" = HALF SCALE

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S4

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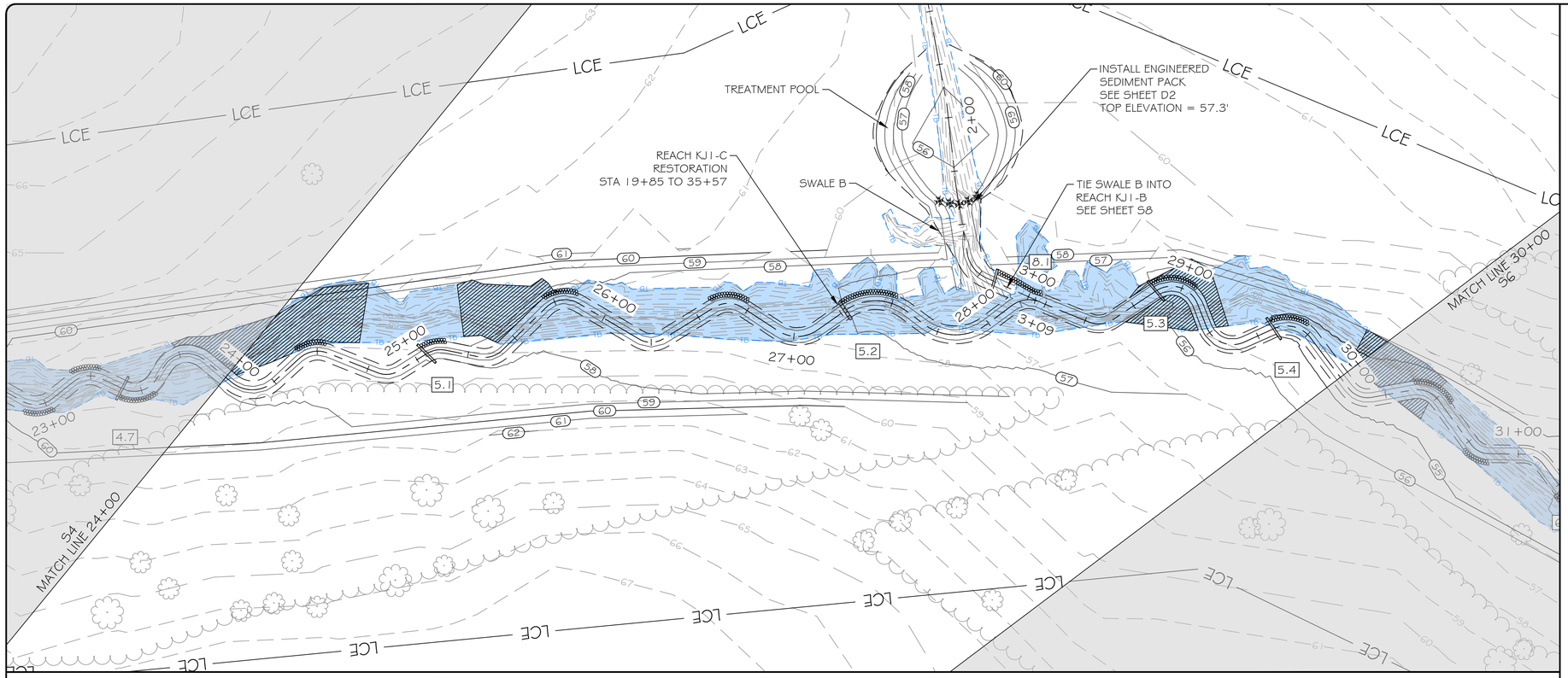
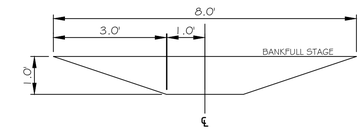
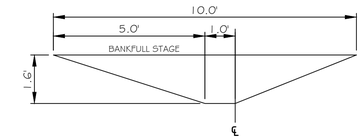


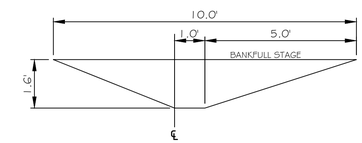
REACH KJ1-C STA 19+70 TO STA 35+57



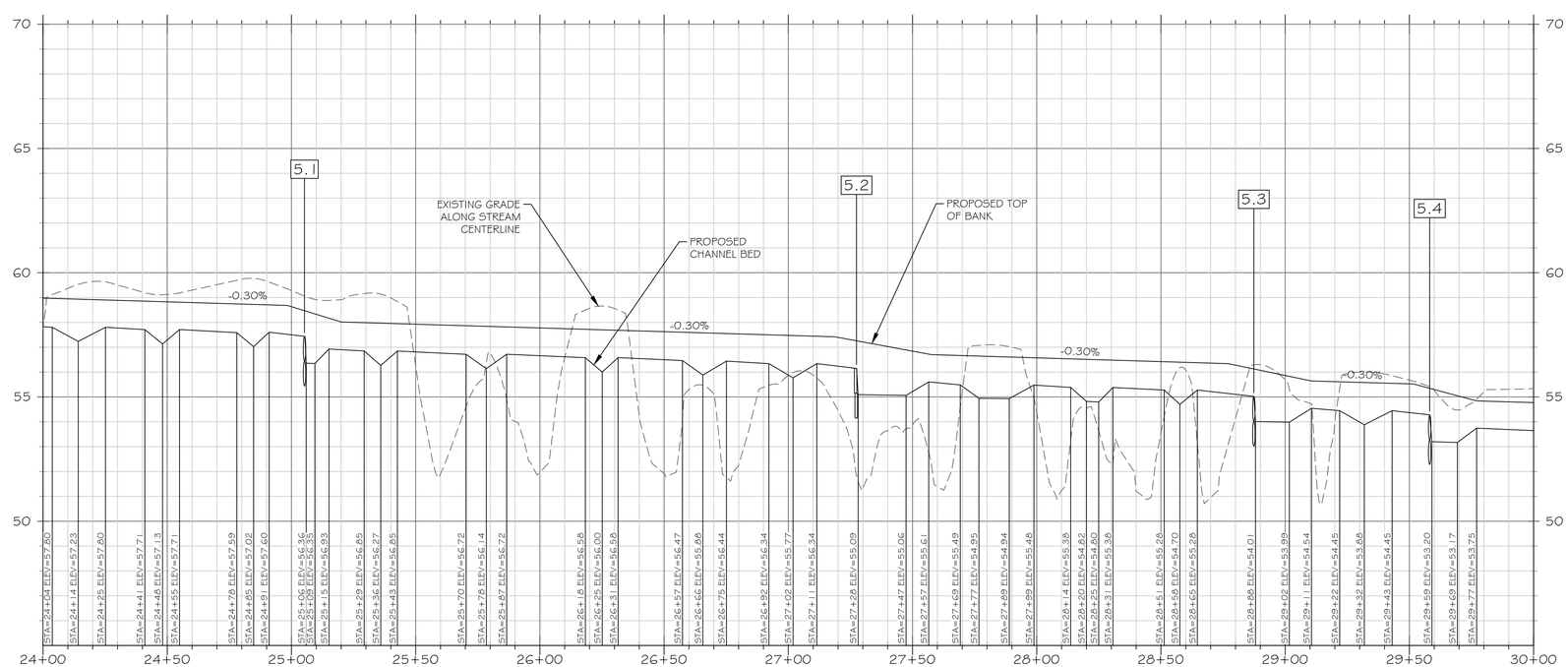
TYPICAL RIFFLE CROSS SECTION
(SEE SHEET D5)



TYPICAL RIGHT MEANDER CROSS SECTION



TYPICAL LEFT MEANDER CROSS SECTION



SCALE: HOR 1"=30'; VERT 1"=3'

STRUCTURE TABLE			
NO.	TYPE	STA.	ELEV.
5.1	LOG SILL	25+05'	57.44'
5.2	ROCK SILL	27+27'	56.15'
5.3	LOG SILL	28+87'	55.02'
5.4	LOG SILL	29+58'	54.28'

TOE PROTECTION TABLE			
BANK	TYPE	FROM STA.	TO STA.
LT	BRUSH TOE	24+44'	24+51'
LT	BRUSH TOE	25+05'	25+12'
LT	BRUSH TOE	25+74'	25+82'
LT	BRUSH TOE	26+62'	26+69'
LT	BRUSH TOE	27+28'	27+51'
LT	BRUSH TOE	28+16'	28+27'
LT	BRUSH TOE	28+87'	29+05'
LT	BRUSH TOE	29+58'	29+73'

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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BENJAMIN R. CARROLL

5/4/21

FULL SCALE: 1"=30

0 30 60

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
REACH KJ1

PROJECT NUMBER: 0675
PROJECT MANAGER: MB
DESIGNED: BRC
DRAWN: SCF
CHECKED: AFM

SHEET NUMBER:
S5

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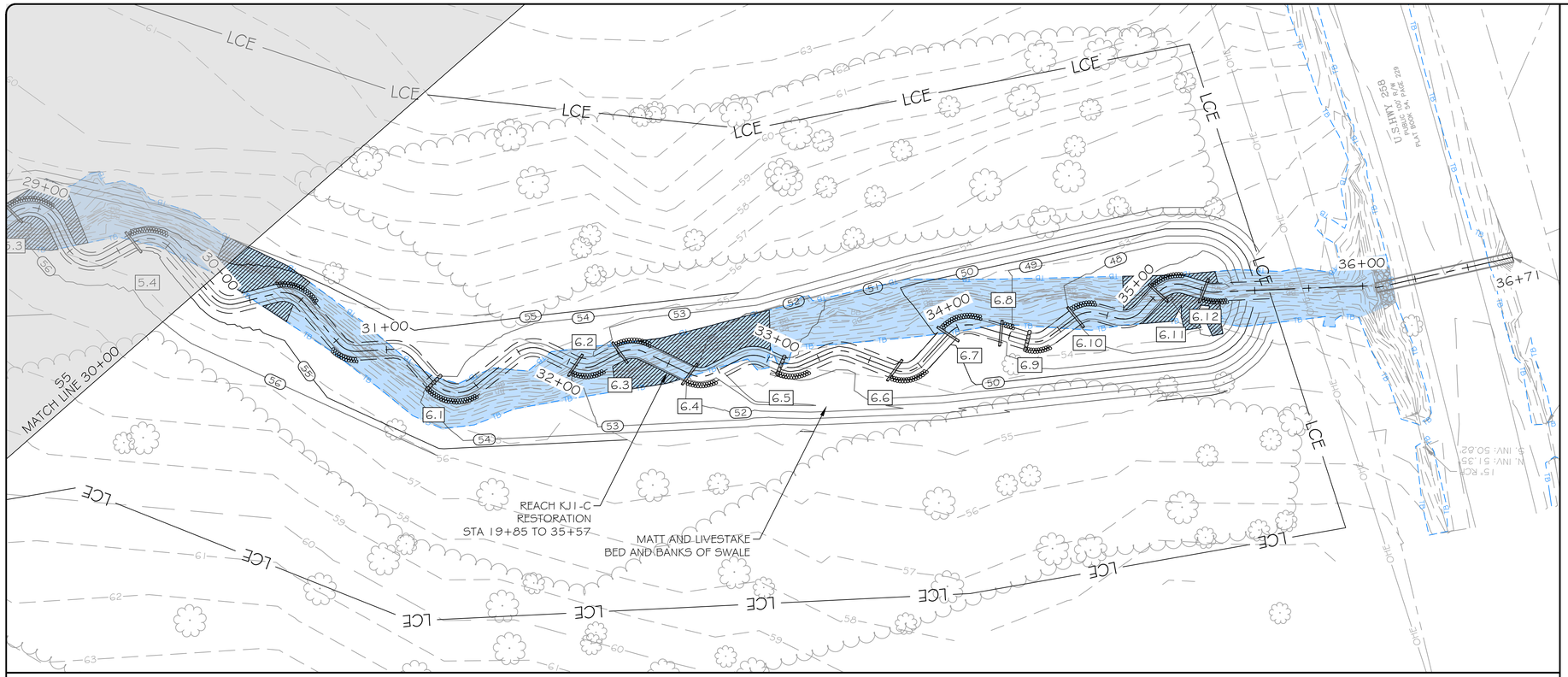
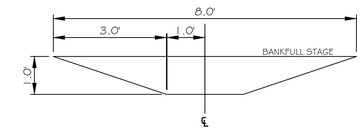
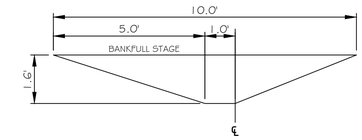


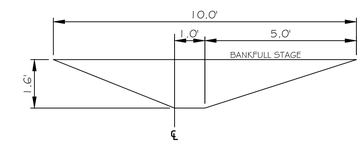
REACH KJ1-C STA 19+70 TO STA 35+57



TYPICAL RIFFLE CROSS SECTION
(SEE SHEET D5)



TYPICAL RIGHT MEANDER CROSS SECTION



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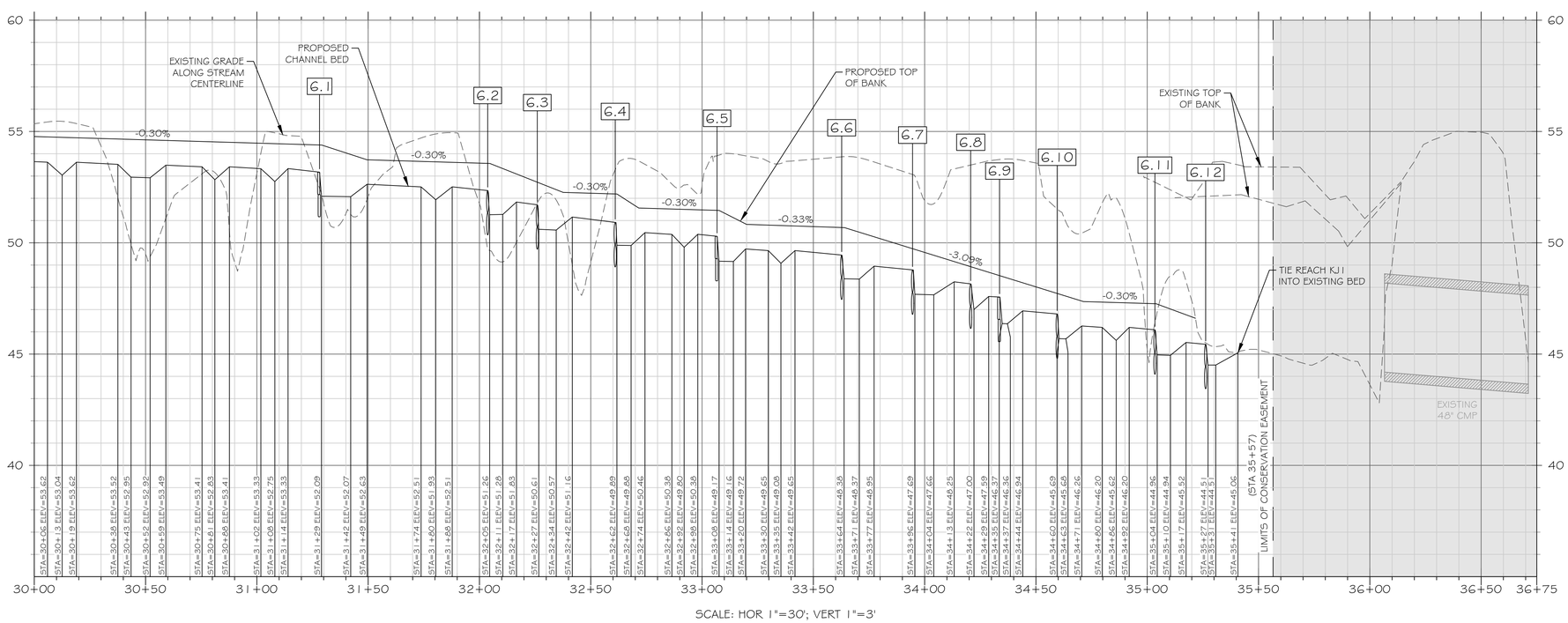

STRUCTURE TABLE			
NO.	TYPE	STA.	ELEV.
6.1	ROCK SILL	31+28'	53.17'
6.2	LOG SILL	32+04'	52.35'
6.3	LOG SILL	32+26'	51.71'
6.4	LOG SILL	32+61'	50.91'
6.5	ROCK SILL	33+07'	50.29'
6.6	LOG SILL	33+63'	49.45'
6.7	LOG SILL	33+95'	48.78'
6.8	LOG SILL	34+21'	48.15'
6.9	ROCK SILL	34+34'	47.56'
6.1	LOG SILL	34+60'	46.80'
6.11	LOG SILL	35+03'	46.09'
6.12	LOG SILL	35+26'	45.44'

TOE PROTECTION TABLE			
BANK	TYPE	FROM STA.	TO STA.
LT	BRUSH TOE	30+41'	30+48'
RT	BRUSH TOE	30+78'	30+84'
RT	BRUSH TOE	31+28'	31+46'
RT	BRUSH TOE	32+04'	32+11'
LT	BRUSH TOE	32+26'	32+34'
RT	BRUSH TOE	32+61'	32+69'
RT	BRUSH TOE	33+06'	33+12'
RT	BRUSH TOE	33+62'	33+72'
LT	BRUSH TOE	33+94'	34+05'
LT	BRUSH TOE	34+21'	34+26'
RT	BRUSH TOE	34+34'	34+40'
LT	BRUSH TOE	34+60'	34+67'
LT	BRUSH TOE	35+04'	35+14'
RT	BRUSH TOE	35+27'	35+34'

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FULL SCALE: 1"=30

0 30 60

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
REACH KJ1

PROJECT NUMBER: 0675
PROJECT MANAGER: MB
DESIGNED: BRC
DRAWN: SCF
CHECKED: AFM

SHEET NUMBER:
S6

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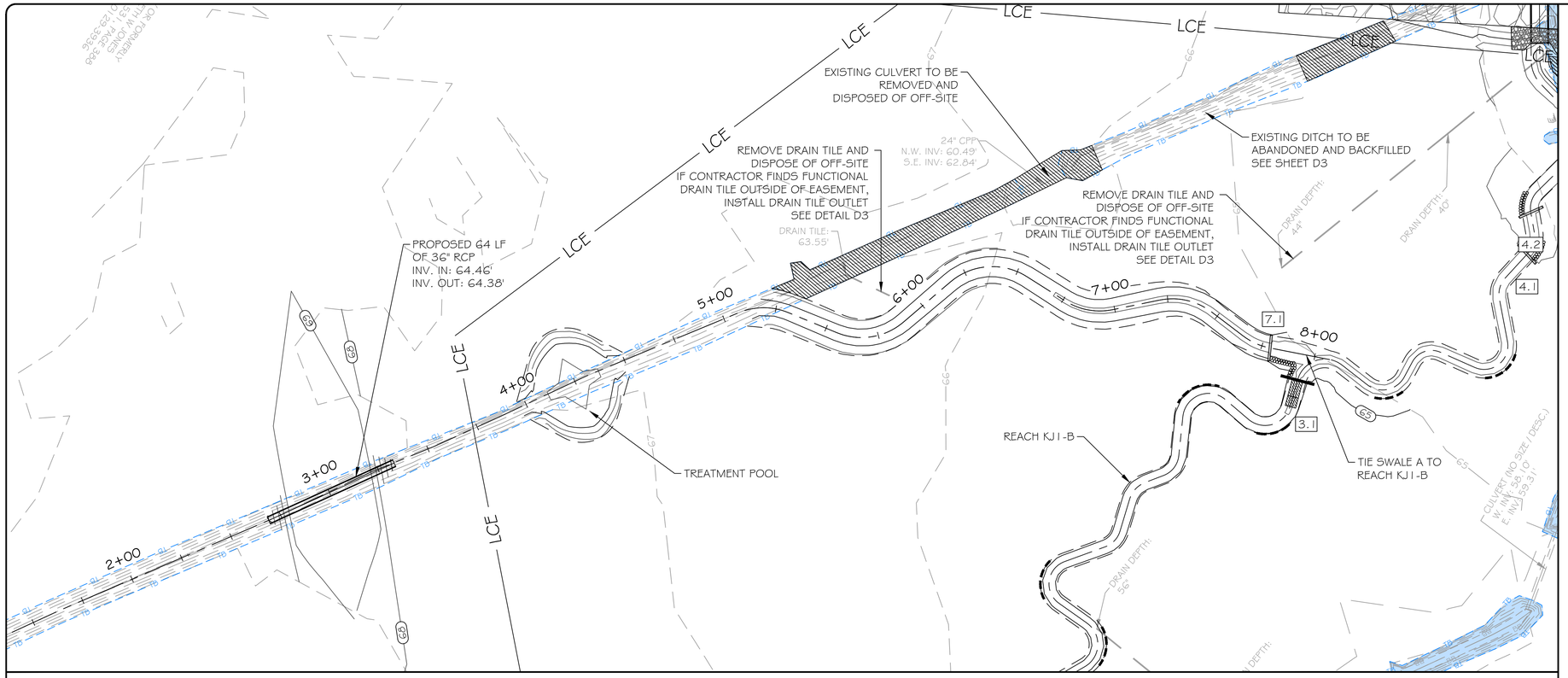
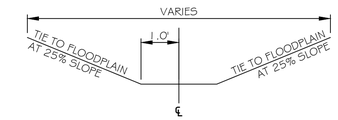


SWALE A STA 5+17 TO STA 7+96



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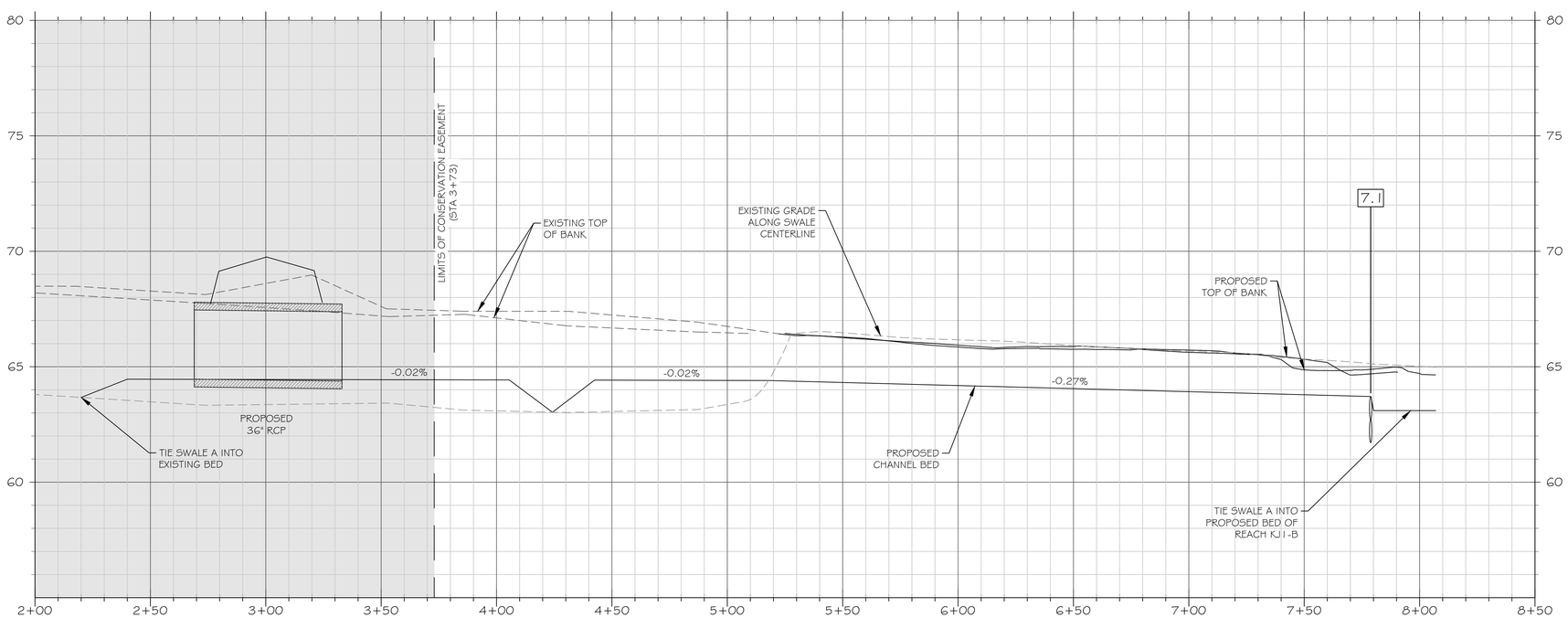

SCALE: HOR 1"=30'; VERT 1"=3'

STRUCTURE TABLE			
NO.	TYPE	STA.	ELEV.
7.1	LOG SILL	7+79'	63.71'

TOE PROTECTION TABLE			
BANK	TYPE	FROM STA.	TO STA.
RT	BRUSH TOE	7+80'	7+92'

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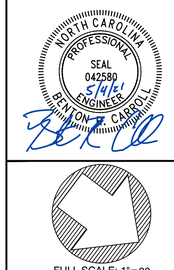

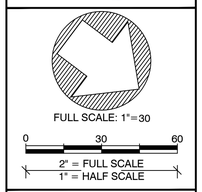

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
SWALE A

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:
S7

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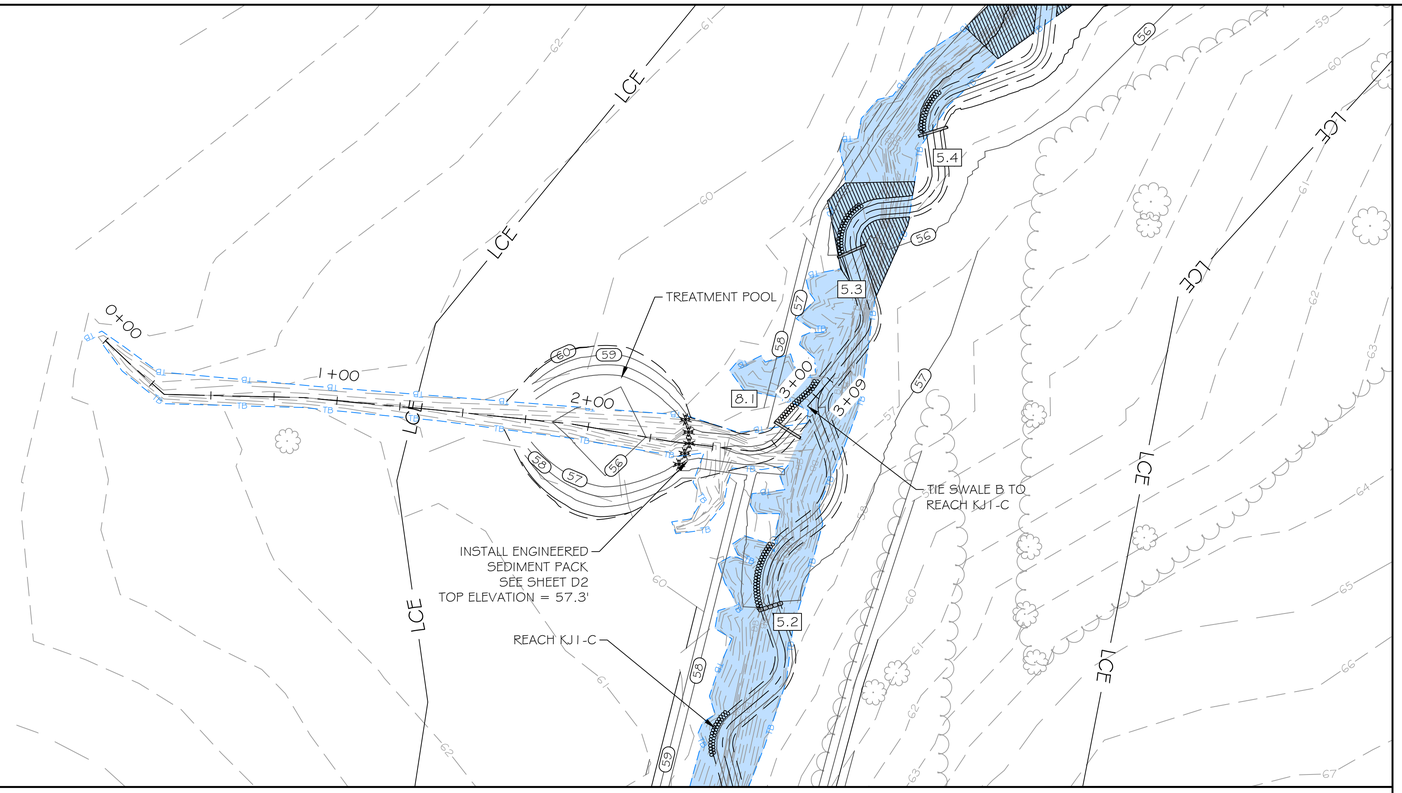
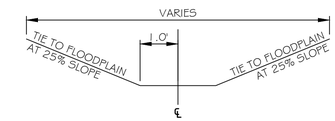


SWALE B STA 1+75 TO STA 2+95



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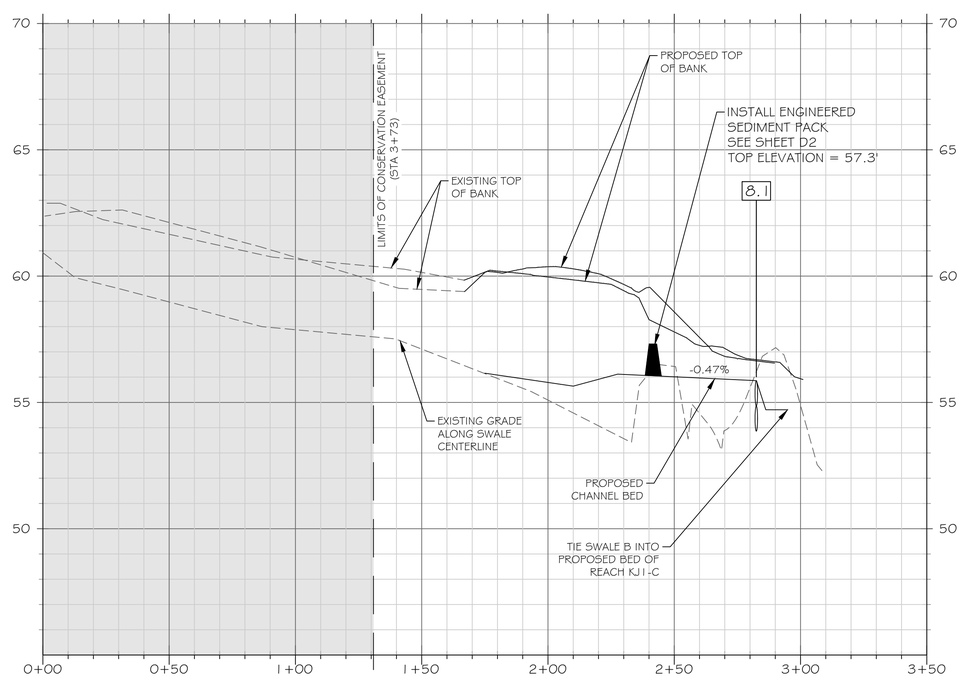

SCALE: HOR 1"=30'; VERT 1"=3'

STRUCTURE TABLE

NO.	TYPE	STA.	ELEV.
8.1	LOG SILL	2+83'	55.86'

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NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BENTON R. CARROLL
5/4/21

FULL SCALE: 1"=30

0 30 60

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
SWALE B

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

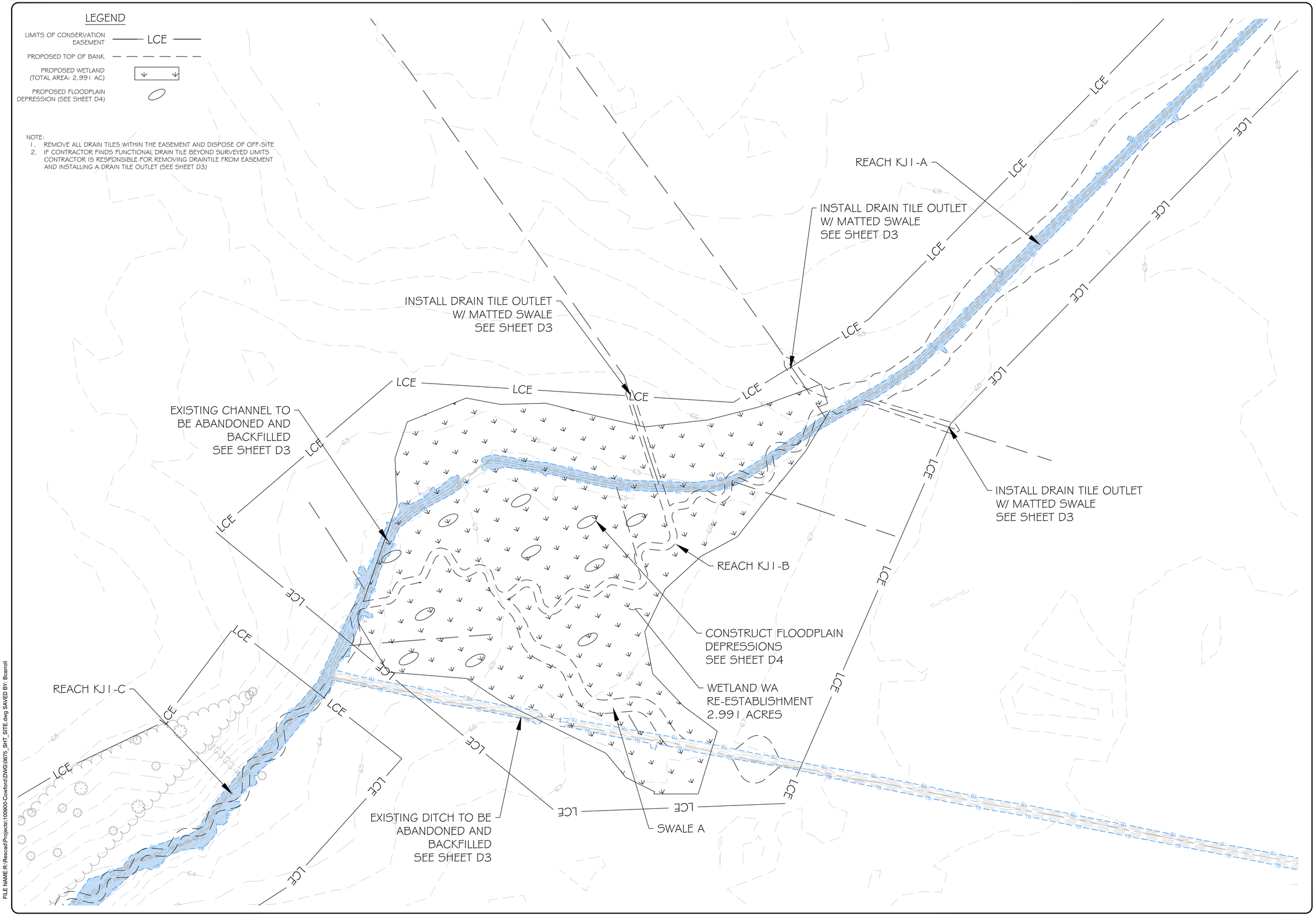
S8

FILE NAME:R:\Rescad\Projects\100900-Cowford\DWG\0675_SHT_DITCH_B.dwg SAVED BY: Bcarroll

LEGEND

LIMITS OF CONSERVATION EASEMENT	LCE
PROPOSED TOP OF BANK	
PROPOSED WETLAND (TOTAL AREA: 2.991 AC)	
PROPOSED FLOODPLAIN DEPRESSION (SEE SHEET D4)	

NOTE:
1. REMOVE ALL DRAIN TILES WITHIN THE EASEMENT AND DISPOSE OF OFF-SITE
2. IF CONTRACTOR FINDS FUNCTIONAL DRAIN TILE BEYOND SURVEYED LIMITS CONTRACTOR IS RESPONSIBLE FOR REMOVING DRAINTILE FROM EASEMENT AND INSTALLING A DRAIN TILE OUTLET (SEE SHEET D3)



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SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042590 ENGINEER BENTON R. CARROLL
5/4/21

FULL SCALE: 1"=50

0 50 100

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
WETLAND PLAN

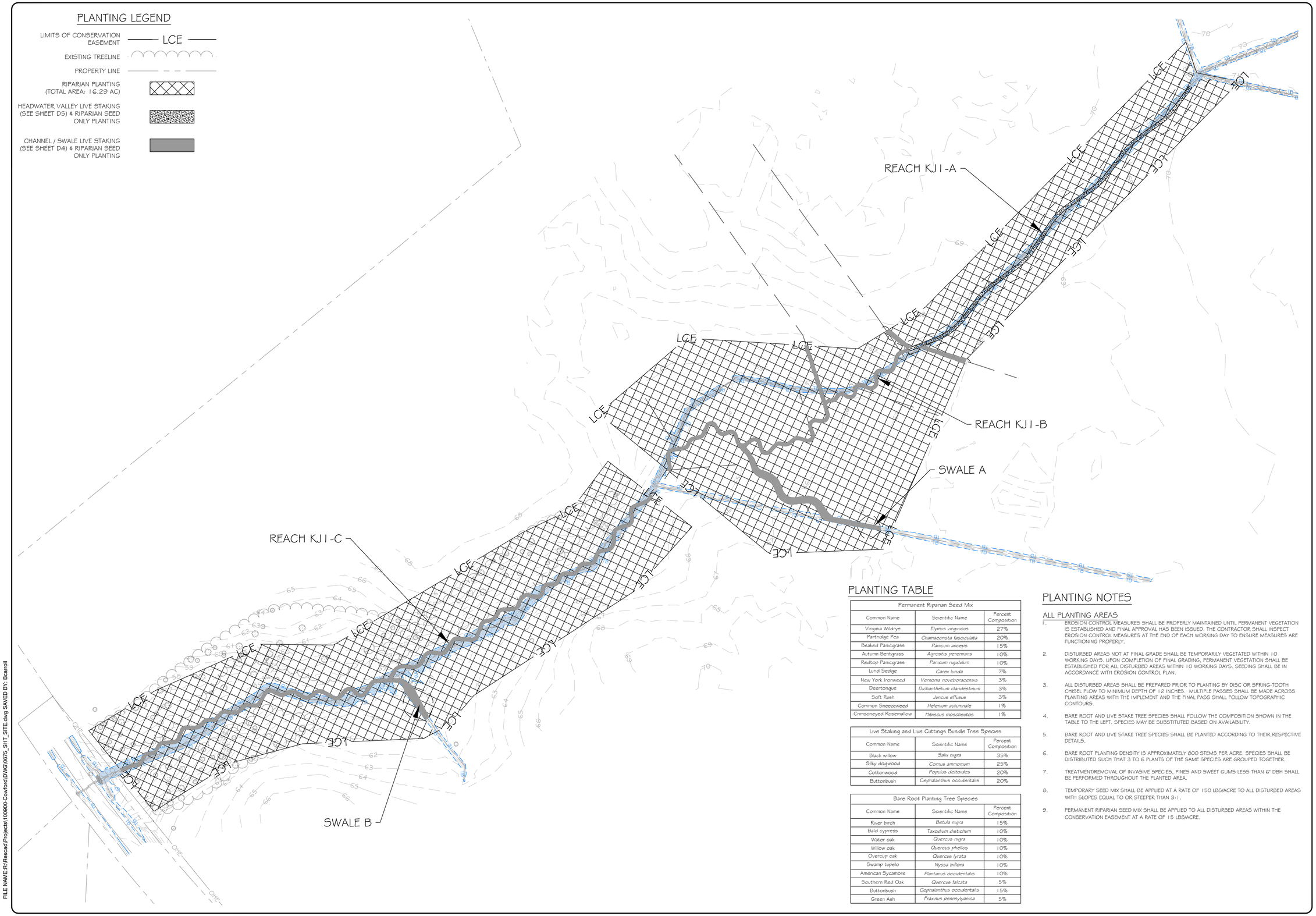
PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

W1

PLANTING LEGEND

- LIMITS OF CONSERVATION EASEMENT — LCE
- EXISTING TREELINE
- PROPERTY LINE
- RIPARIAN PLANTING (TOTAL AREA: 16.29 AC)
- HEADWATER VALLEY LIVE STAKING (SEE SHEET D5) & RIPARIAN SEED ONLY PLANTING
- CHANNEL / SWALE LIVE STAKING (SEE SHEET D4) & RIPARIAN SEED ONLY PLANTING



PLANTING TABLE

Permanent Riparian Seed Mix		
Common Name	Scientific Name	Percent Composition
Virginia Wildrye	*Elymus virginicus*	27%
Partridge Pea	*Chamaecrista fasciculata*	20%
Beaked Panicgrass	*Panicum anceps*	15%
Autumn Bentgrass	*Agrostis perennans*	10%
Redtop Panicgrass	*Panicum rigidulum*	10%
Lurid Sedge	*Carex lurida*	7%
New York Ironweed	*Vernonia noveboracensis*	3%
Deertongue	*Dichanthelium clandestinum*	3%
Soft Rush	*Juncus effusus*	3%
Common Sneezeweed	*Helenium autumnale*	1%
Crimsoneyed Rosemallow	*Hibiscus moscheutos*	1%

Live Staking and Live Cuttings Bundle Tree Species		
Common Name	Scientific Name	Percent Composition
Black willow	*Salix nigra*	35%
Silky dogwood	*Cornus ammomum*	25%
Cottonwood	*Populus deltoides*	20%
Buttonbush	*Cephalanthus occidentalis*	20%

Bare Root Planting Tree Species		
Common Name	Scientific Name	Percent Composition
River birch	*Betula nigra*	15%
Bald cypress	*Taxodium distichum*	10%
Water oak	*Quercus nigra*	10%
Willow oak	*Quercus phellos*	10%
Overcup oak	*Quercus lyrata*	10%
Swamp tupelo	*Nyssa biflora*	10%
American Sycamore	*Plantanus occidentalis*	10%
Southern Red Oak	*Quercus falcata*	5%
Buttonbush	*Cephalanthus occidentalis*	15%
Green Ash	*Fraxinus pennsylvanica*	5%

PLANTING NOTES

ALL PLANTING AREAS

1. EROSION CONTROL MEASURES SHALL BE PROPERLY MAINTAINED UNTIL PERMANENT VEGETATION IS ESTABLISHED AND FINAL APPROVAL HAS BEEN ISSUED. THE CONTRACTOR SHALL INSPECT EROSION CONTROL MEASURES AT THE END OF EACH WORKING DAY TO ENSURE MEASURES ARE FUNCTIONING PROPERLY.
2. DISTURBED AREAS NOT AT FINAL GRADE SHALL BE TEMPORARILY VEGETATED WITHIN 10 WORKING DAYS. UPON COMPLETION OF FINAL GRADING, PERMANENT VEGETATION SHALL BE ESTABLISHED FOR ALL DISTURBED AREAS WITHIN 10 WORKING DAYS. SEEDING SHALL BE IN ACCORDANCE WITH EROSION CONTROL PLAN.
3. ALL DISTURBED AREAS SHALL BE PREPARED PRIOR TO PLANTING BY DISC OR SPRING-TOOTH CHISEL PLOW TO MINIMUM DEPTH OF 12 INCHES. MULTIPLE PASSES SHALL BE MADE ACROSS PLANTING AREAS WITH THE IMPLEMENT AND THE FINAL PASS SHALL FOLLOW TOPOGRAPHIC CONTOURS.
4. BARE ROOT AND LIVE STAKE TREE SPECIES SHALL FOLLOW THE COMPOSITION SHOWN IN THE TABLE TO THE LEFT. SPECIES MAY BE SUBSTITUTED BASED ON AVAILABILITY.
5. BARE ROOT AND LIVE STAKE TREE SPECIES SHALL BE PLANTED ACCORDING TO THEIR RESPECTIVE DETAILS.
6. BARE ROOT PLANTING DENSITY IS APPROXIMATELY 800 STEMS PER ACRE. SPECIES SHALL BE DISTRIBUTED SUCH THAT 3 TO 6 PLANTS OF THE SAME SPECIES ARE GROUPED TOGETHER.
7. TREATMENT/REMOVAL OF INVASIVE SPECIES, PINES AND SWEET GUMS LESS THAN 6" DBH SHALL BE PERFORMED THROUGHOUT THE PLANTED AREA.
8. TEMPORARY SEED MIX SHALL BE APPLIED AT A RATE OF 150 LBS/ACRE TO ALL DISTURBED AREAS WITH SLOPES EQUAL TO OR STEEPER THAN 3:1.
9. PERMANENT RIPARIAN SEED MIX SHALL BE APPLIED TO ALL DISTURBED AREAS WITHIN THE CONSERVATION EASEMENT AT A RATE OF 15 LBS/ACRE.

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5/4/21

FULL SCALE: 1" = 100

0 100 200

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 5/4/2021

REVISIONS:

RELEASED FOR: FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME: COWFORD MITIGATION SITE ONSLOW COUNTY

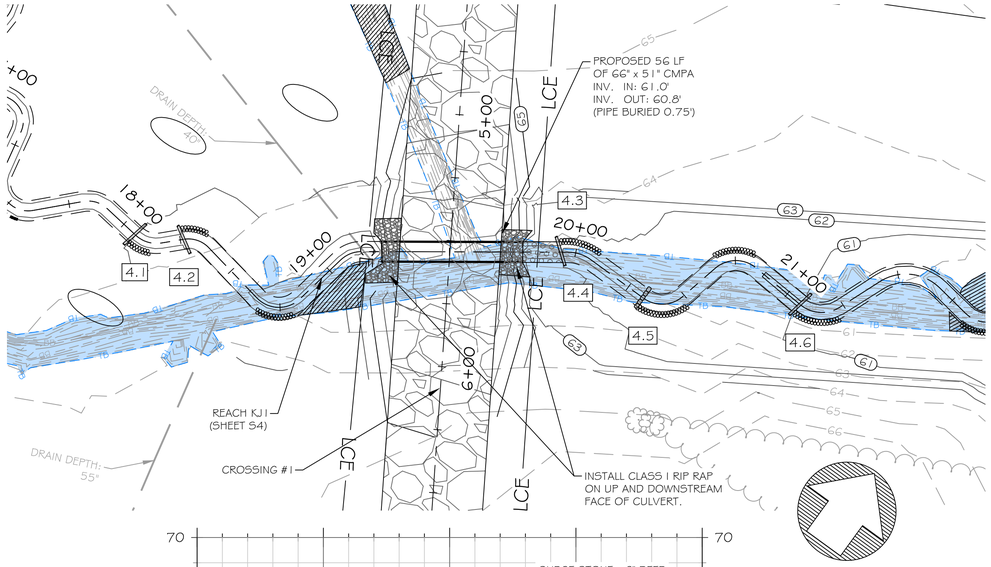
DRAWING TITLE: PLANTING PLAN

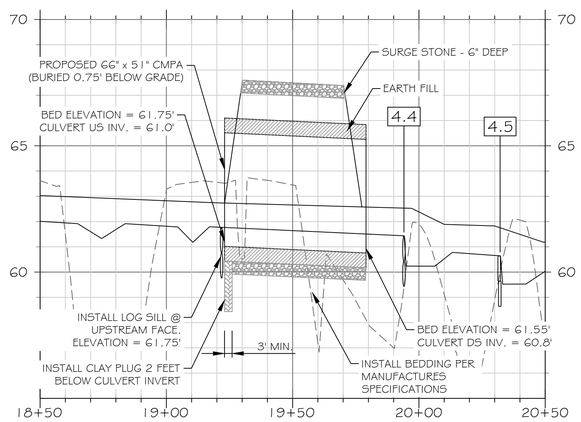
PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

P1

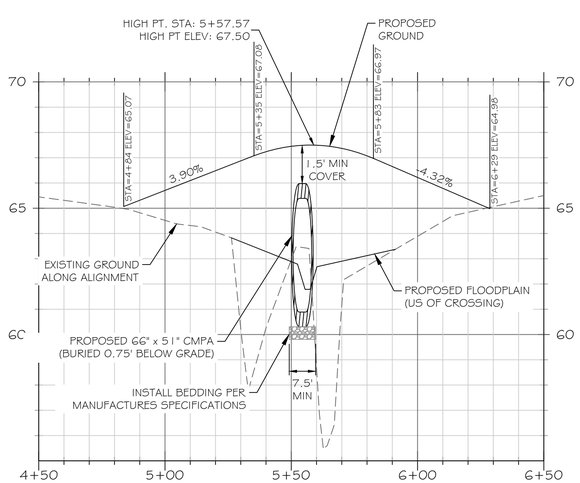
FILE NAME:R:\Rescad\Projects\100900-Cowford\DWG\0675_SHT_SITE.dwg SAVED BY: Bcarroll





SCALE: HOR 1"=30'; VERT 1"=3'

PIPE PROFILE



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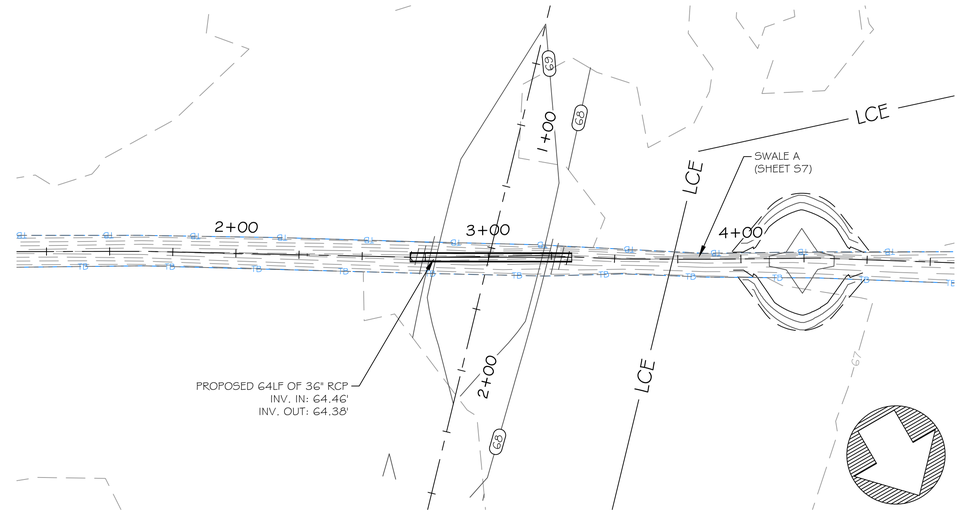
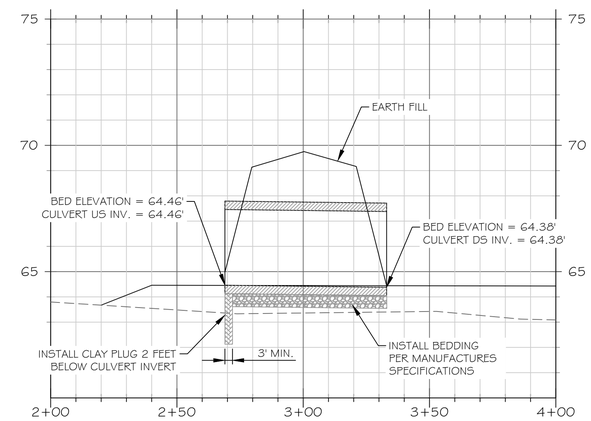
ROAD PROFILE





SCALE: HOR 1"=30'; VERT 1"=3'

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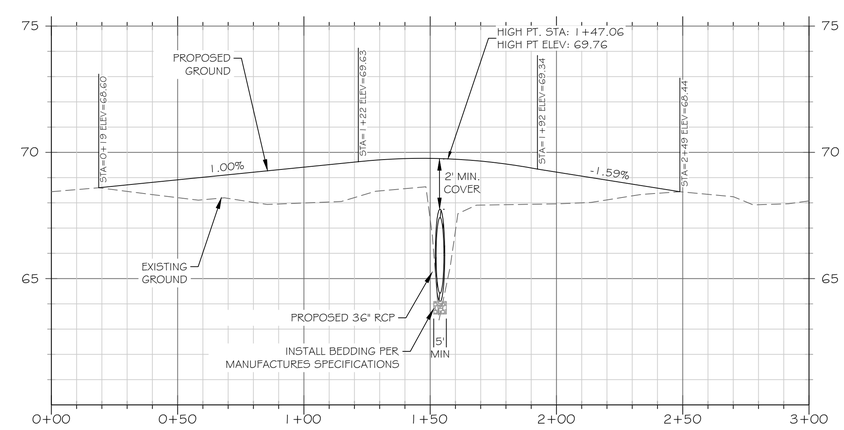

SCALE: HOR 1"=30'; VERT 1"=3'

ROAD PROFILE

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Engineering Services Provided By:
RES Environmental Operating Company, LLC
License: F-1428

SEAL

FULL SCALE: 1"=30

0 30 60

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE:
5/19/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
CULVERT CROSSINGS

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

X1

FILE NAME:R:\Rescad\Projects\100900-Cowford\DWG\0675_SHT_KJ1.dwg SAVED BY: Bcarroll

TEMPORARY SEEDING SCHEDULE - FALL / EARLY WINTER

SEEDING MIXTURE
SPECIES RATE (LB/ACRE)

- RYE (GRAIN) 120

SEEDING DATES
- MOUNTAINS—AUG. 15 - DEC. 15
- COASTAL PLAIN AND PIEDMONT—AUG. 15 - DEC. 30

SOIL AMENDMENTS
FOLLOW SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 1,000 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH NETTING OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.

MAINTENANCE
REPAIR AND REFERTILIZE DAMAGED AREAS IMMEDIATELY. TOPDRESS WITH 50 LB/ACRE OF NITROGEN IN MARCH. IF IT IS NECESSARY TO EXTEND TEMPORARY COVER BEYOND JUNE 15, OVERSEED WITH 50 LB/ACRE KOBE (PIEDMONT AND COASTAL PLAIN) OR KOREAN (MOUNTAINS) WINTER WHEAT IN LATE FEBRUARY OR EARLY MARCH.

TEMPORARY SEEDING - LATE WINTER / EARLY SPRING

SEEDING MIXTURE
SPECIES RATE (LB/ACRE)

- RYE (GRAIN) 120
- WINTER WHEAT* 50

*OMIT WINTER WHEAT WHEN DURATION OF TEMPORARY COVER IS NOT TO EXTEND BEYOND JUNE.

SEEDING DATES
- MOUNTAINS (ABOVE 2,500 FT): FEB. 15 - MAY 15
- MOUNTAINS (BELOW 2,500 FT): FEB. 1 - MAY 1
- PIEDMONT: JAN. 1 - MAY 1
- COASTAL PLAIN: DEC. 1 - APR. 15

SOIL AMENDMENTS
FOLLOW RECOMMENDATION OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH NETTING OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.

MAINTENANCE
RE-FERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, RE-FERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

TEMPORARY SEEDING - LATE SPRING / SUMMER

SEEDING MIXTURE
SPECIES RATE (LB/ACRE)

- GERMAN MILLET* 40

*IN THE PIEDMONT AND MOUNTAINS, A SMALL-STEMMED SUDANGRASS MAY BE SUBSTITUTED AT A RATE OF 50 LB/ACRE.

SEEDING DATES
- MOUNTAINS: MAY 15 - AUG. 15
- PIEDMONT: MAY 1 - AUG. 15
- COASTAL PLAIN: APR. 15 - AUG. 15

SOIL AMENDMENTS
FOLLOW RECOMMENDATION OF SOIL TESTS OR APPLY 2,000 LB/ACRE GROUND AGRICULTURAL LIMESTONE AND 750 LB/ACRE 10-10-10 FERTILIZER.

MULCH
APPLY 4,000 LB/ACRE STRAW. ANCHOR STRAW BY TACKING WITH NETTING OR A MULCH ANCHORING TOOL. A DISK WITH BLADES SET NEARLY STRAIGHT CAN BE USED AS A MULCH ANCHORING TOOL.

MAINTENANCE
REFERTILIZE IF GROWTH IS NOT FULLY ADEQUATE. RESEED, REFERTILIZE AND MULCH IMMEDIATELY FOLLOWING EROSION OR OTHER DAMAGE.

GROUND COVER SCHEDULE

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

Permanent Riparian Seed Mix

Common Name	Scientific Name	Percent Composition
Virginia Wildrye	*Elymus virginicus*	27%
Partridge Pea	*Chamaecrista fasciculata*	20%
Beaked Panicgrass	*Panicum anceps*	15%
Autumn Bentgrass	*Agrostis perennans*	10%
Redtop Panicgrass	*Panicum rigidulum*	10%
Lurid Sedge	*Carex lurida*	7%
New York Ironweed	*Vernonia noveboracensis*	3%
Deertongue	*Dichanthelium clandestinum*	3%
Soft Rush	*Juncus effusus*	3%
Common Sneezeweed	*Helenium autumnale*	1%
Crimsoneyed Rosemallow	*Hibiscus moscheutos*	1%

EROSION CONTROL:

GENERAL NOTES

1. REVIEW CONSTRUCTION SEQUENCE FOR ADDITIONAL EROSION CONTROL MEASURES. ALL PERMANENT AND TEMPORARY EROSION CONTROL STRUCTURES (I.E ROCK CHECK DAMS, SILT FENCE AND TEMPORARY CONSTRUCTION ENTRANCES) SHALL BE INSTALLED PRIOR TO THE START OF CONSTRUCTION OF THE LAND-DISTURBING ACTIVITY.
2. CONSTRUCTION ACCESS AREAS SHOWN ARE TO GUIDE CONTRACTOR DURING CONSTRUCTION. CONTRACTOR SHALL COORDINATE WITH ENGINEER IF ALTERNATIVE CONSTRUCTION ACCESS ROUTES WILL IMPROVE EFFICIENCY OF CONSTRUCTION.
3. ALL AREAS DISTURBED BY THE CONTRACTOR SHALL BE SEEDED PER THE SPECIFICATIONS IN THE SEEDING SCHEDULE SHOWN ON THIS SHEET.
4. CONTRACTOR TO PERFORM SOIL TESTING TO DETERMINE VEGETATIVE VIABILITY PRIOR TO LAND DISTURBANCE.
5. MULCH: APPLY 2 TONS/ACRE GRAIN STRAW AND ANCHOR STRAW ON ALL OTHER DISTURBED AREAS.
6. EROSION CONTROL:
   A. INSTALL PERMANENT VEGETATIVE COVER AND THE LONG-TERM EROSION PROTECTION MEASURES OR STRUCTURES AS DIRECTED BY ENGINEER UPON CONSTRUCTION COMPLETION. APPROPRIATE EROSION CONTROL MEASURES MUST BE PLACED BETWEEN THE DISTURBED AREA AND AFFECTED WATERWAY AND MAINTAINED UNTIL PERMANENTLY VEGETATED.
   B. PROVIDE FOR HANDLING THE INCREASED RUNOFF CAUSED BY CHANGED SOIL AND SURFACE CONDITIONS. USE EFFECTIVE MEANS TO CONSERVE EXISTING ON-SITE SOIL CONDITIONS.
   C. DURING CONSTRUCTION ACTIVITIES, ALL DISTURBED AREAS SHALL BE STABILIZED AT THE END OF EACH WORKING DAY. USE TEMPORARY PLANT COVER, MULCHING, AND/OR STRUCTURES TO CONTROL RUNOFF AND PROTECT AREAS SUBJECT TO EROSION DURING CONSTRUCTION.
   D. ALL SEDIMENT AND EROSION CONTROLS ARE TO BE INSPECTED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND AFTER ANY STORM EVENT OF GREATER THAN 1.0 INCHES OF PRECIPITATION DURING ANY 24-HOUR PERIOD. MAINTENANCE OF SEDIMENT TRAPPING STRUCTURES SHALL BE PERFORMED AS NECESSARY PER THESE INSPECTIONS. SILT FENCING SHALL BE INSTALLED AS SHOWN ON PLANS.
   E. STABILIZATION MEASURES SHALL BE INITIATED AT THE END OF EACH DAY IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED. GROUNDCOVER MUST BE ESTABLISHED PER THE "GROUND COVER SCHEDULE" SHOWN ON THIS SHEET IN AREAS WHERE CONSTRUCTION HAS TEMPORARILY CEASED. ALL AREAS WHERE FINAL GRADE HAS BEEN ESTABLISHED SHALL BE PERMANENTLY STABILIZED WITHIN 2 CALENDAR DAYS.
   F. CONTRACTOR MUST TAKE THE NECESSARY ACTION INCLUDING BUT NOT LIMITED TO TIRE WASHING STATIONS AT EACH ACCESS POINT TO MINIMIZE THE TRACKING OF MUD ONTO THE PAVED ROADWAY FROM CONSTRUCTION AREAS. DAILY REMOVAL OF MUD/SOIL MAY BE REQUIRED.
   G. ALL EROSION CONTROL DEVICES SHALL BE PROPERLY MAINTAINED DURING ALL PHASES OF CONSTRUCTION UNTIL THE COMPLETION OF ALL CONSTRUCTION ACTIVITIES AND ALL DISTURBED AREAS HAVE BEEN STABILIZED. ADDITIONAL CONTROL DEVICES MAY BE REQUIRED DURING CONSTRUCTION IN ORDER TO CONTROL EROSION AND/OR OFF SITE SEDIMENTATION. CONTRACTOR SHALL REMOVE ALL TEMPORARY CONTROL DEVICES ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED.
   H. EROSION CONTROL MATTING SHALL BE INSTALLED PER CHANNEL MATTING DETAIL (SEE DETAIL D1).
   I. SILT FENCING TO BE INSTALLED AROUND INDICATED STOCKPILE AREAS TO PREVENT LOSS OF SEDIMENT. STOCKPILE AREAS MAY BE RELOCATED UPON APPROVAL FROM ENGINEER.
   J. ASPHALT TACKIFIER SHALL NOT BE USED.
   K. WETLANDS/STREAMS CANNOT BE ENCROACHED UNDER ANY CIRCUMSTANCES IF NOT APPROVED AS DESIGNATED IMPACT AREAS.
   L. ACTIVITIES MUST AVOID DISTURBANCE OF WOODY RIPARIAN VEGETATION WITHIN THE PROJECT AREA TO THE GREATEST EXTENT PRACTICABLE. REMOVAL OF VEGETATION MUST BE LIMITED TO ONLY THAT NECESSARY FOR CONSTRUCTION OF THE CHANNEL.
   M. NO ONSITE BURIAL OF CONSTRUCTION DEBRIS WILL BE PERMITTED. VEGETATIVE DEBRIS SHALL BE STOCKPILED AND DISPOSED OF ONSITE PER DIRECTION OF ENGINEER.
   N. ANY GRADING BEYOND THE CONSTRUCTION LIMITS SHOWN ON THE PLAN IS A VIOLATION OF THE NORTH CAROLINA EROSION CONTROL ORDINANCE, AND IS SUBJECT TO A FINE.
   O. REFERENCE PLAN SHEET DETAILS AND NCDENR STANDARDS FOR CONSTRUCTION OF EROSION CONTROL MEASURES.
   P. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL EROSION CONTROL MEASURES RELATED TO THE CONSTRUCTION SITE.
   Q. THE LOCATIONS OF SOME EROSION CONTROL MEASURES MAY HAVE TO BE ALTERED FROM THOSE SHOWN ON THE PLANS IF DRAINAGE PATTERNS CHANGE DURING CONSTRUCTION.
   R. IF IT IS DETERMINED DURING THE COURSE OF CONSTRUCTION THAT SIGNIFICANT SEDIMENT IS LEAVING THE SITE (DESPITE THE PROPER IMPLEMENTATION AND MAINTENANCE OF EROSION CONTROL MEASURES), THE PERSON RESPONSIBLE FOR THE LAND DISTURBING ACTIVITY IS OBLIGATED TO TAKE ADDITIONAL PROTECTIVE ACTION.

CONSTRUCTION NOTES:

1. INSTALL EROSION CONTROL MEASURES AS DESCRIBED IN THE EROSION CONTROL PLAN AND NOTES. EROSION CONTROL MEASURES MAY BE PHASED-IN TO THOSE AREAS OF THE PROJECT CURRENTLY BEING WORKED ON. THE CONTRACTOR MAY MODIFY OR RELOCATE EROSION CONTROL MEASURES TO MAKE ADJUSTMENTS FOR UNFORESEEN FIELD CONDITIONS SO LONG AS PROPER CONSTRUCTION IS MAINTAINED TO ENSURE THE INTEGRITY AND USEFULNESS OF THE PROPOSED MEASURES. ALL DISTURBED AREAS ALONG CHANNEL BANKS SHALL BE STABILIZED WITH TEMPORARY SEED AND MULCH AT THE END OF EACH DAY.
2. EXISTING WETLANDS CANNOT BE ENCROACHED UPON UNDER ANY CIRCUMSTANCES IF NOT APPROVED AS DESIGNATED IMPACT AREAS. HIGH VISIBILITY FENCING MUST BE PLACED AROUND ALL EXISTING WETLANDS THAT ARE LOCATED ADJACENT TO CONSTRUCTION ACTIVITIES AND/OR ARE LOCATED WITHIN THE PROPOSED CONSERVATION EASEMENT.
3. STOCKPILE AREAS AND TEMPORARY STREAM CROSSINGS MAY BE RELOCATED OR ADDED UPON THE APPROVAL OF THE ENGINEER. SILT FENCING MUST BE INSTALLED AROUND ALL STOCKPILE AREAS.
4. THE WORK TO RESHAPE THE CHANNEL BANKS WILL BE PERFORMED USING EQUIPMENT WORKING FROM THE TOP OF THE EXISTING STREAM BANK, WHERE POSSIBLE.
5. CONSTRUCTION EQUIPMENT WILL NOT BE PLACED WITHIN THE ACTIVE CHANNEL TO PERFORM WORK IF POSSIBLE. PLATFORMS SHOULD BE USED TO CROSS CHANNEL WHERE ACCESS IS NOT POSSIBLE.
6. NO MORE CHANNEL SHALL BE DISTURBED THAN CAN BE STABILIZED BY THE END OF THE WORK DAY OR PRIOR TO RESTORING FLOW TO NEWLY CONSTRUCTED CHANNEL SEGMENTS.
7. CONTRACTOR SHALL REMOVE ALL TEMPORARY CONTROL DEVICES ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED. A MAXIMUM OF 200 LINEAR FEET OF STREAM MAY BE DISTURBED AT ANY ONE TIME. STABILIZE STREAM BANKS IMMEDIATELY AFTER GRADING.
8. ALL EXCAVATED MATERIAL MUST BE PLACED WITHIN DESIGNATED STOCKPILE AREAS.
9. AT LOCATIONS IN WHICH THE EXISTING CHANNEL IS BEING MAINTAINED, TEMPORARY PUMP AROUND DAMS AND BYPASS PUMPING WILL BE USED TO DE-WATER THE WORK AREA AS DESCRIBED IN THE DETAILS.
10. WHEN THE PROPOSED CHANNEL HAS BEEN SUFFICIENTLY STABILIZED TO PREVENT EROSION, ALL TEMPORARY PUMP AROUND DAMS WILL BE REMOVED FROM THE ACTIVE STREAM CHANNEL AND NORMAL FLOW RESTORED. ACCUMULATED SEDIMENT SHALL BE DISPOSED OF IN DESIGNATED SPOILS AREAS PRIOR TO REMOVAL OF TEMPORARY PUMP AROUND DAM.
11. AT LOCATIONS IN WHICH LOG STRUCTURES, ROCK STRUCTURES, BOULDER TOE STABILIZATION, AND LOG TOE STABILIZATION ARE CALLED FOR ON THE PLANS, TEMPORARY COFFER DAMS AND BYPASS PUMPING WILL BE USED TO DE-WATER THE WORK AREA, EXCEPT AT LOCATIONS IN WHICH THE NORMAL FLOW CAN BE DIVERTED AROUND THE WORK AREA WITH THE USE OF AN EXISTING CHANNEL. WHEN THE TOE HAS BEEN SUFFICIENTLY STABILIZED TO RESTRAIN EROSION ALL TEMPORARY COFFER DAMS WILL BE REMOVED FROM THE ACTIVE STREAM CHANNEL AND NORMAL FLOW RESTORED. ACCUMULATED SEDIMENT SHALL BE DISPOSED OF IN DESIGNATED SPOILS AREA PRIOR TO REMOVAL OF TEMPORARY COFFER DAM.
12. MATERIAL THAT IS REMOVED FROM THE STREAM WILL BE RE-DEPOSITED OUTSIDE OF THE ACTIVE CHANNEL AND ITS FLOODPLAIN.
13. TEMPORARY AND PERMANENT STABILIZATION OF ALL DISTURBED GRASSED AREAS AT THE TOP OF THE CHANNEL BANKS WILL BE IN ACCORDANCE WITH THE SEEDING AND MULCHING SPECIFICATION AS SHOWN ON PLANS.
14. RE-FERTILIZE AND RE-SEED DISTURBED AREAS IF NECESSARY.
15. CONTRACTOR SHALL COMPLETE SELF INSPECTIONS AND MONITORING AS OUTLINED IN THE SELF-INSPECTION AND SELF-MONITORING COMBINED FORM LOCATED AT: *https://deq.nc.gov/about/divisions/energy-mineral-land-resources/erosion-sediment-control/forms*. THIS FORM SHOULD BE UP TO DATE AND AVAILABLE AT THE JOB SITE AT ALL TIMES.

STREAM CONSTRUCTION SEQUENCE:

1. CONDUCT PRE-CONSTRUCTION MEETING INCLUDING OWNER, ENGINEER, ASSOCIATED CONTRACTORS, AND OTHER AFFECTED PARTIES.
2. EROSION AND SEDIMENT CONTROL (E&SC) PERMIT AND A CERTIFICATE OF COVERAGE (COC) MUST BE OBTAINED BEFORE ANY LAND DISTURBING ACTIVITIES OCCUR. THE COC CAN BE OBTAINED BY FILLING OUT THE ELECTRONIC NOTICE OF INTENT (e-NOI) FOR AT DEQ.NC.GOV/NCGO1. PLEASE NOTE, THE e-NOI FORM MAY ONLY BE FILLED OUT ONCE THE PLANS HAVE BEEN APPROVED. A COPY OF THE E&SC PERMIT, THE COC, AND A HARD COPY OF THE PLAN MUST BE KEPT ON SITE, PREFERABLY IN A PERMITS BOX, AND ACCESSIBLE DURING INSPECTION.
3. CONTRACTOR IS FULLY RESPONSIBLE FOR CONTACTING ALL APPROPRIATE PARTIES AND ASSURING THAT UTILITIES ARE LOCATED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. CALL NC 811 FOR UTILITY LOCATING SERVICES 48 HOURS PRIOR TO COMMENCEMENT OF ANY WORK. CONTRACTOR SHALL VERIFY LOCATION AND DEPTH OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION.
4. PRIOR TO CONSTRUCTION, STABILIZED GRAVEL ENTRANCE/EXIT AND ROUTES OF INGRESS AND EGRESS SHALL BE ESTABLISHED AS SHOWN ON THE PLANS AND DETAILS.
5. PRIOR TO ANY LAND DISTURBING ACTIVITIES, INSTALL SILT FENCING AND ANY ASSOCIATED EROSION ARRESTING DEVICES (CHECK DAMS, WATTLES, DIVERSION DIKES, ETC.) AS SHOWN ON THE PLANS AND DETAILS.
6. INSTALL TEMPORARY STREAM CROSSINGS AS SHOWN ON PLANS. TEMPORARY STREAM CROSSINGS SHOULD ONLY BE INSTALLED WHEN NECESSARY.
7. PREPARE STAGING AND STOCKPILING AREAS IN LOCATIONS AS SHOWN ON THE CONSTRUCTION PLANS OR AS APPROVED BY THE ENGINEER. ANY EXCESS SPOIL FROM STREAM CONSTRUCTION SHALL BE USED TO CONSTRUCT CHANNEL PLUGS AS SHOWN ON PLANS.
8. CONTRACTOR TO PERFORM SOIL TESTING TO DETERMINE VEGETATIVE VIABILITY PRIOR TO LAND DISTURBANCE.
9. ALL PROPOSED CHANNELS AND TEMPORARY AND PERMANENT CROSSINGS SHALL BE CONSTRUCTED IN A DRY CONDITION VIA OFFLINE CONSTRUCTION WHERE POSSIBLE. PUMP AROUND OPERATIONS SHOULD BE LIMITED TO AREAS WHERE THE EXISTING AND PROPOSED CHANNEL ALIGNMENTS OVERLAP.
10. INSTALL PUMP AROUND APPARATUS AND IMPERVIOUS DIKES AT UPSTREAM END OF PROJECT. AS CONSTRUCTION PROGRESSES, MOVE PUMP AROUND OPERATION DOWNSTREAM.
11. CONSTRUCT UPSTREAM PORTION OF THE CHANNEL FIRST, WORKING IN AN UPSTREAM TO DOWNSTREAM DIRECTION UNLESS OTHERWISE APPROVED BY THE ENGINEER.
12. ROUGH GRADING OF CHANNEL SHALL BE PERFORMED PRIOR TO INSTALLATION OF STRUCTURES.
13. INSTALL STRUCTURES AS SHOWN ON PLANS AND DETAILS. PRIOR TO FINE GRADING, OBTAIN APPROVAL OF THE ENGINEER ON INSTALLATION OF STRUCTURES.
14. UPON COMPLETION OF FINE GRADING, INSTALL STREAM BANK STABILIZATION INCLUDING, EROSION CONTROL MATTING OR SOD MATS ALONG CHANNEL BANKS.
15. FILL AND STABILIZE ABANDONED SEGMENTS OF THE EXISTING CHANNEL PER DIRECTION OF THE ENGINEER.
16. ALL IMPERVIOUS DIKES AND PUMPING APPARATUS SHALL BE REMOVED FROM THE STREAM AT THE END OF EACH DAY TO RESTORE NORMAL FLOW BACK TO THE CHANNEL UNLESS OTHERWISE APPROVED BY THE ENGINEER. WITH APPROVAL, A PUMP AROUND MAY BE ALLOWED TO RUN CONTINUOUSLY IF THERE IS NO FORECAST FOR RAIN OVERNIGHT, AND/OR THE PUMP APPARATUS IS MAINTAINED AND MONITORED CONTINUOUSLY.
17. DURING STREAM CONSTRUCTION ACTIVITIES, THE WORK AREA SHALL BE STABILIZED IMMEDIATELY AFTER GRADING AND AT THE END OF EACH WORKING DAY.
18. INSTALL LIVE STAKE, BARE ROOT, AND CONTAINERIZED PLANTINGS AS SPECIFIED ON PLANTING PLANS.
19. WHEN THE PROJECT IS COMPLETE, THE PERMITTEE SHALL CONTACT DEMLR TO CLOSE OUT THE E&SC PLAN. AFTER DEMLR INFORMS THE PERMITTEE OF THE PROJECT CLOSE OUT, VIA INSPECTION REPORT, THE PERMITTEE SHALL VISIT DEQ.NC.GOV/NCGO1 TO SUBMIT AN ELECTRONIC NOTICE OF TERMINATION (e-NOT). A $100 ANNUAL GENERAL PERMIT FEE WILL BE CHARGED UNTIL THE e-NOT HAS BEEN FILLED OUT.

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SEAL
NORTH CAROLINA PROFESSIONAL SEAL 042590 ENGINEER BRIAN R. CARROLL
5/4/21

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
EROSION CONTROL

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:
EC1

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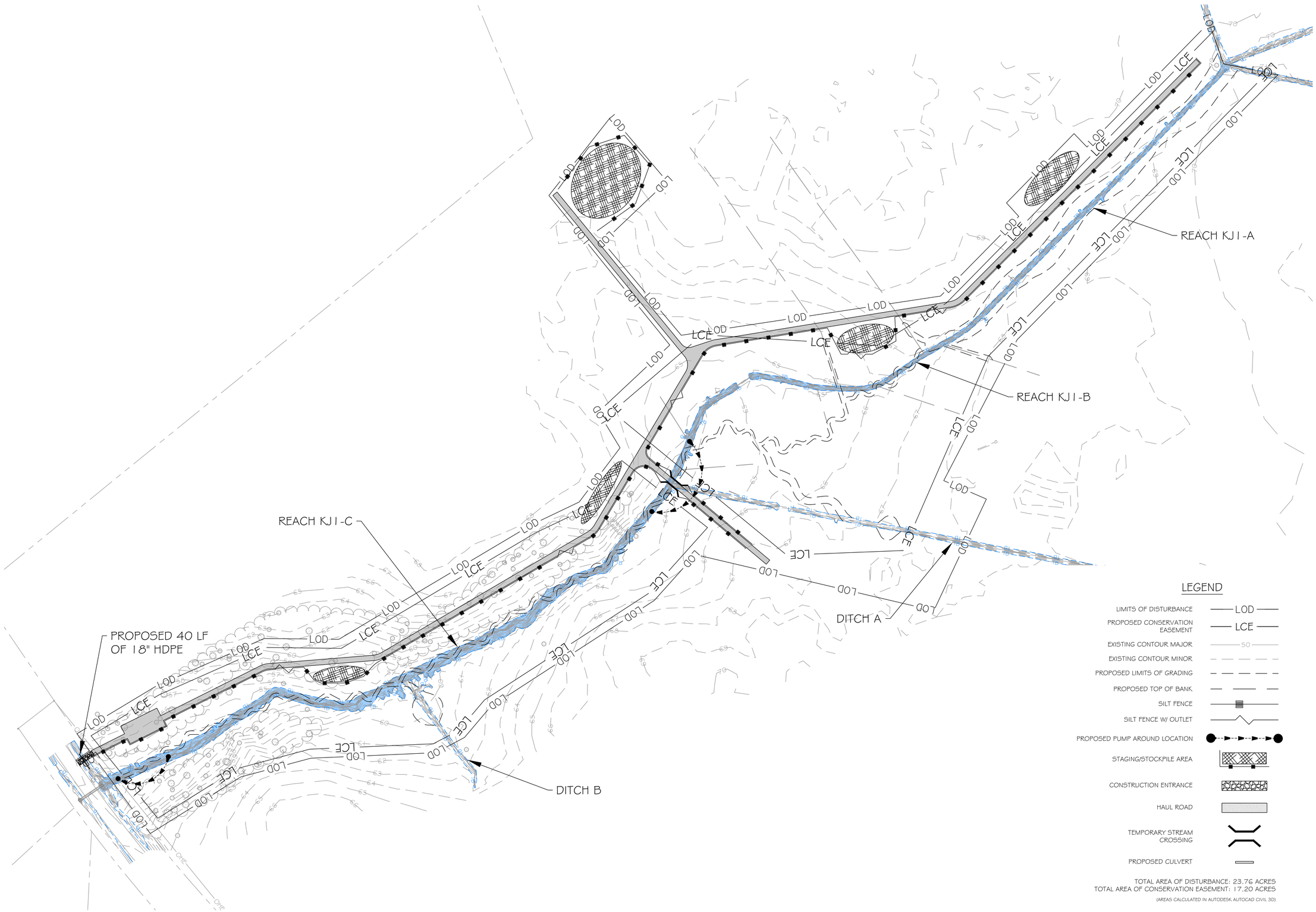

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Engineering Services Provided By:
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License: F-1428

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BENJAMIN R. CARROLL
5/4/21

FULL SCALE: 1"=100

0 100 200

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

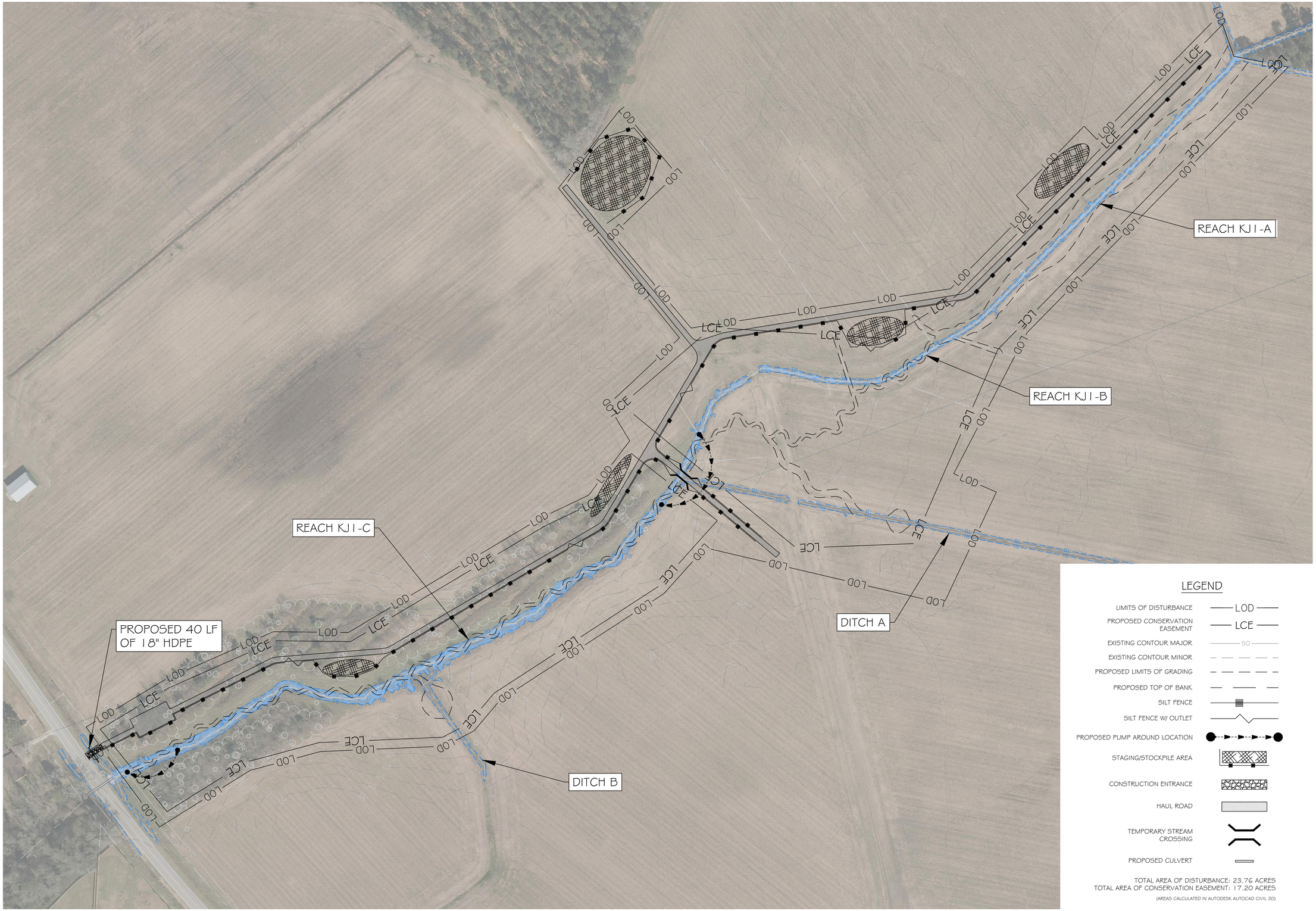
PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
EROSION CONTROL

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

EC2



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Engineering Services Provided By:
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License: F-1428

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BENTON R. CARROLL
5/4/21

FULL SCALE: 1" = 100

0 100 200

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
EROSION CONTROL

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

EC3

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

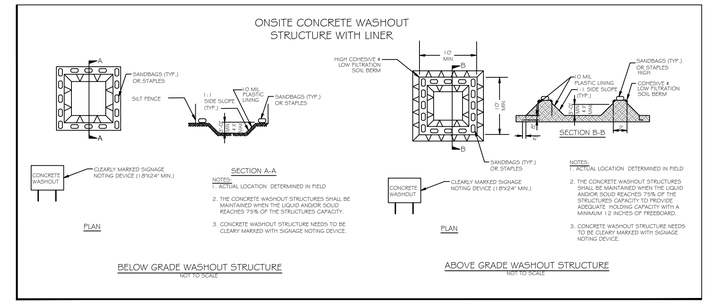
1. Do not dump paint and other liquid waste into storm drains, streams or wetlands.
2. Locate paint washouts at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
3. Contain liquid wastes in a controlled area.
4. Containment must be labeled, 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.



CONCRETE WASHOUTS

1. Do not discharge concrete or cement slurry from the site.
2. Dispose of, or recycle settled, hardened concrete residue in accordance with local and state solid waste regulations and at an approved facility.
3. Manage washout from mortar mixers in accordance with the above item and in addition place the mixer and associated materials on impervious barrier and within lot perimeter silt fence.
4. Install temporary concrete washouts per local requirements, where applicable. If an alternate method or product is to be used, contact your approval authority for review and approval. If local standard details are not available, use one of the two types of temporary concrete washouts provided on this detail.
5. Do not use concrete washouts for dewatering or storing defective curb or sidewalk sections. Stormwater accumulated within the washout may not be pumped into or discharged to the storm drain system or receiving surface waters. Liquid waste must be pumped out and removed from project.
6. Locate washouts at least 50 feet from storm drain inlets and surface waters unless it can be shown that no other alternatives are reasonably available. At a minimum, install protection of storm drain inlet(s) closest to the washout which could receive spills or overflow.
7. Locate washouts in an easily accessible area, on level ground and install a stone entrance pad in front of the washout. Additional controls may be required by the approving authority.
8. Install at least one sign directing concrete trucks to the washout within the project limits. Post signage on the washout itself to identify this location.
9. Remove leavings from the washout when at approximately 75% capacity to limit overflow events. Replace the tarp, sand bags or other temporary structural components when no longer functional. When utilizing alternative or proprietary products, follow manufacturer's instructions.
10. At the completion of the concrete work, remove remaining leavings and dispose of in an approved disposal facility. Fill pit, if applicable, and stabilize any disturbance caused by removal of washout.

HERBICIDES, PESTICIDES AND RODENTICIDES

1. Store and apply herbicides, pesticides and rodenticides in accordance with label restrictions.
2. Store herbicides, pesticides and rodenticides in their original containers with the label, which lists directions for use, ingredients and first aid steps in case of accidental poisoning.
3. Do not store herbicides, pesticides and rodenticides in areas where flooding is possible or where they may spill or leak into wells, stormwater drains, ground water or surface water. If a spill occurs, clean area immediately.
4. Do not stockpile these materials onsite.

HAZARDOUS AND TOXIC WASTE

1. Create designated hazardous waste collection areas on-site.
2. Place hazardous waste containers under cover or in secondary containment.
3. Do not store hazardous chemicals, drums or bagged materials directly on the ground.

NCG01 GROUND STABILIZATION AND MATERIALS HANDLING

EFFECTIVE: 04/01/19

res
3600 Glenwood Ave, Suite 100
Raleigh, NC 27612
Main: 919.829.9909
www.res.us

Engineering Services Provided By:
RES Environmental Operating Company, LLC
License: F-1428

SEAL

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
EROSION CONTROL

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:
EC4

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PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION A: SELF-INSPECTION

Self-inspections are required during normal business hours in accordance with the table below. When adverse weather or site conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. In addition, when a storm event of equal to or greater than 1.0 inch occurs outside of normal business hours, the self-inspection shall be performed upon the commencement of the next business day. Any time when inspections were delayed shall be noted in the Inspection Record.

Inspect	Frequency (during normal business hours)	Inspection records must include:
(1) Rain gauge maintained in good working order	Daily	Daily rainfall amounts. If no daily rain gauge observations are made during weekend or holiday periods, and no individual-day rainfall information is available, record the cumulative rain measurement for those un-attended days (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 (SDOs)	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 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 documented in the manner described:

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

In addition to the E&SC Plan documents above, the following items shall be kept on the site and available for agency 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 30 days. 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.

(c) All data used to complete the Notice of Intent and older 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).

(a) 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.

(b) Anticipated bypasses and unanticipated bypasses.

(c) 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 Division's Emergency Response personnel at (800) 662-7956, (800) 858-0368 or (919) 733-3300.

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.

NCG01 SELF-INSPECTION, RECORDKEEPING AND REPORTING

EFFECTIVE: 04/01/19

res
3600 Glenwood Ave, Suite 100
Raleigh, NC 27612
Main: 919.829.9909
www.res.us

Engineering Services Provided By:
RES Environmental Operating Company, LLC
License: F-1428

SEAL

PLOT DATE: 5/4/2021

REVISIONS:

RELEASED FOR: FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME: COWFORD MITIGATION SITE ONSLOW COUNTY

DRAWING TITLE: EROSION CONTROL

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER: EC5

FILE NAME:R:\Rescad\Projects\100900-Cowford\DWG\0675_SHT_ESC.dwg SAVED BY: Stasking

WHEN AND WHERE TO USE IT
SILT FENCE IS APPLICABLE IN AREAS:

WHERE THE MAXIMUM SHEET OR OVERLAND FLOW PATH LENGTH TO THE FENCE IS 100-FEET.
WHERE THE MAXIMUM SLOPE STEEPNESS (NORMAL [PERPENDICULAR] TO FENCE LINE) IS 2H:1V.
THAT DO NOT RECEIVE CONCENTRATED FLOWS GREATER THAN 0.5 CFS.

DO NOT PLACE SILT FENCE ACROSS CHANNELS OR USE IT AS A VELOCITY CONTROL BMP.

CONSTRUCTION SPECIFICATIONS:

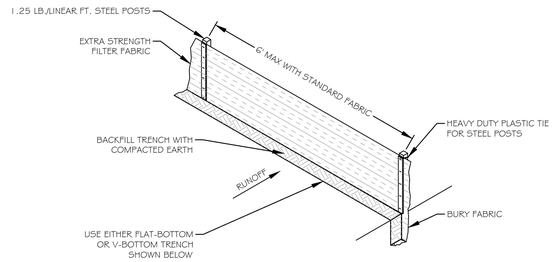
1. USE A SYNTHETIC FILTER FABRIC OF AT LEAST 95% BY WEIGHT OF POLYOLEFINS OR POLYESTER, WHICH IS CERTIFIED BY THE MANUFACTURER OR SUPPLIER AS CONFORMING TO THE REQUIREMENTS IN ASTM D 6461. SYNTHETIC FILTER FABRIC SHOULD CONTAIN ULTRAVIOLET RAY INHIBITORS AND STABILIZERS TO PROVIDE A MINIMUM OF 6 MONTHS OF EXPECTED USABLE CONSTRUCTION LIFE AT A TEMPERATURE RANGE OF 0° TO 120° F.
2. ENSURE THAT POSTS FOR SEDIMENT FENCES ARE 1.33 LB/LINEAR FT STEEL WITH A MINIMUM LENGTH OF 5 FEET. MAKE SURE THAT STEEL POSTS HAVE PROJECTIONS TO FACILITATE FASTENING THE FABRIC.

CONSTRUCTION:

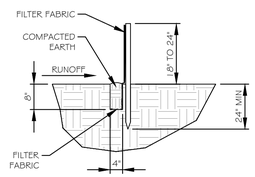
1. CONSTRUCT THE SEDIMENT BARRIER OF EXTRA STRENGTH SYNTHETIC FILTER FABRICS.
2. ENSURE THAT THE HEIGHT OF THE SEDIMENT FENCE DOES NOT EXCEED 24 INCHES ABOVE THE GROUND SURFACE. (HIGHER FENCES MAY IMPOUND VOLUMES OF WATER SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.)
3. CONSTRUCT THE FILTER FABRIC FROM A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID JOINTS. WHEN JOINTS ARE NECESSARY, SECURELY FASTEN THE FILTER CLOTH ONLY AT A SUPPORT POST WITH 4 FEET MINIMUM OVERLAP TO THE NEXT POST.
4. EXTRA STRENGTH FILTER FABRIC WITH 6 FEET POST SPACING DOES NOT REQUIRE WIRE MESH SUPPORT FENCE. SECURELY FASTEN THE FILTER FABRIC DIRECTLY TO POSTS. WIRE OR PLASTIC ZIP TIES SHOULD HAVE MINIMUM 50 POUND TENSILE STRENGTH.
5. EXCAVATE A TRENCH APPROXIMATELY 4 INCHES WIDE AND 8 INCHES DEEP ALONG THE PROPOSED LINE OF POSTS AND UPSLOPE FROM THE BARRIER.
6. PLACE 12 INCHES OF THE FABRIC ALONG THE BOTTOM AND SIDE OF THE TRENCH.
7. BACKFILL THE TRENCH WITH SOIL PLACED OVER THE FILTER FABRIC AND COMPACT. THOROUGH COMPACTION OF THE BACKFILL IS CRITICAL TO SILT FENCE PERFORMANCE.
8. DO NOT ATTACH FILTER FABRIC TO EXISTING TREES.

MAINTENANCE:

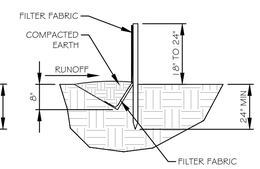
1. INSPECT SEDIMENT FENCES AT LEAST ONCE A WEEK AND AFTER EACH RAINFALL. MAKE ANY REQUIRED REPAIRS IMMEDIATELY.
2. SHOULD THE FABRIC OF A SEDIMENT FENCE COLLAPSE, TEAR, DECOMPOSE OR BECOME INEFFECTIVE, REPLACE IT PROMPTLY.
3. REMOVE SEDIMENT DEPOSITS AS NECESSARY TO PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAIN AND TO REDUCE PRESSURE ON THE FENCE. TAKE CARE TO AVOID UNDERMINING THE FENCE DURING CLEANOUT.
4. REMOVE ALL FENCING MATERIALS AND UNSTABLE SEDIMENT DEPOSITS AND BRING THE AREA TO GRADE AND STABILIZE IT AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.



SILT FENCE INSTALLATION



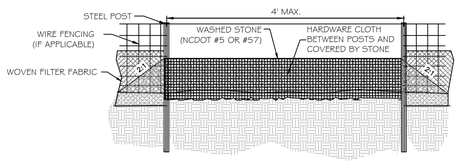
FLAT-BOTTOM TRENCH DETAIL



V-SHAPED TRENCH DETAIL

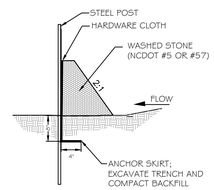
TEMPORARY SILT FENCE

NTS



GENERAL NOTES:

1. SEDIMENT FILTER OUTLET AND HARDWARE CLOTH SHALL BE 16 INCHES HIGH BUT NO TALLER THAN 18 INCHES.
2. HARDWARE CLOTH SHALL BE ANCHORED TO THE STEEL POSTS SECURELY USING APPROPRIATE ANCHORS. HARDWARE CLOTH SHALL BE KEYED IN A MINIMUM OF 12 INCHES IN LENGTH AND BACKFILLED PROPERLY AS SHOWN IN ABOVE DETAIL. HARDWARE CLOTH TO BE SAME AS STD. #30.09 (19 GAUGE, 1/4" SPACING).
3. POSTS SHALL BE NO MORE THAN 4 FEET APART.
4. SITE OUTLETS AT ANY POINT SMALL CONCENTRATED FLOWS ARE ANTICIPATED AND AT THE DIRECTION OF THE INSPECTOR.
5. ONE ACRE MAXIMUM DRAINAGE AREA PER OUTLET.



MAINTENANCE NOTES:

1. FILTER OUTLETS SHALL BE INSPECTED BY THE FINANCIALLY RESPONSIBLE PARTY OR HIS AGENT IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REPAIRS NEEDED SHALL BE MADE IMMEDIATELY.
2. THE STONE SHALL BE REPLACED PROMPTLY AFTER ANY EVENT THAT HAS CLOGGED OR REMOVED IT.
3. SEDIMENT DEPOSITS SHOULD BE REMOVED WHEN DEPOSITS REACH HALF THE HEIGHT OF THE BARRIER. ANY SEDIMENT DEPOSITS REMAINING IN PLACE AFTER THE SILT FENCE OUTLET IS REMOVED SHALL BE DRESSED TO CONFORM TO THE EXISTING GRADE, PREPARED AND SEEDED.

SILT FENCE OUTLET

NTS

INSTALLATION NOTES:

SITE PREPARATION

1. GRADE AND COMPACT AREA.
2. REMOVE ALL ROCKS, CLODS, VEGETATION, AND OBSTRUCTIONS SO THAT MATTING WILL HAVE DIRECT CONTACT WITH THE SOIL.
3. PREPARE SEEDBED BY LOOSENING 3 TO 4 INCHES OF TOPSOIL ABOVE FINAL GRADE.
4. TEST SOILS FOR ANY NUTRIENT DEFICIENCIES AND SUBMIT SOIL TEST RESULTS TO THE ENGINEER. APPLY ANY TREATMENT SUCH AS LIME OR FERTILIZERS TO THE SOIL IF NEEDED.

SEEDING

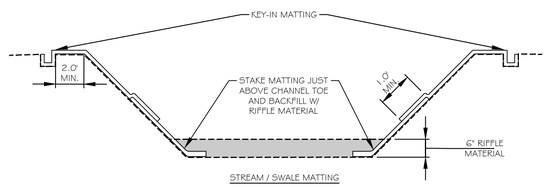
1. SEE PLANTING SHEETS FOR SEEDING REQUIREMENTS.
2. APPLY SEED TO SOIL BEFORE PLACING MATTING.

INSTALLATION - STREAM BANK

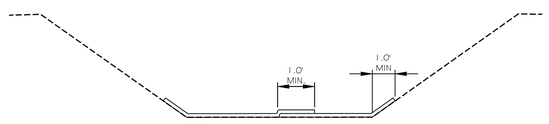
1. SEE GRADING NOTES ON PLAN AND PROFILE SHEETS AND DETAIL SHEETS FOR INFORMATION REGARDING WHAT AREAS ARE TO RECEIVE COIR MATTING.
2. OVERLAP ADJACENT MATS 6" (IN DIRECTION PARALLEL TO FLOW) AND ANCHOR EVERY 12" ACROSS THE OVERLAP. THE UPSTREAM MAT SHOULD BE PLACED OVER THE DOWNSTREAM MAT.
3. EDGES SHOULD BE SHINGLED AWAY FROM THE FLOW OF WATER.
4. LAY MAT LOOSE TO ALLOW CONTACT WITH SOIL. DO NOT STRETCH TIGHT.
5. ANCHOR MAT USING BIODEGRADABLE STAKES.
6. EXTEND MAT 2 TO 3 FEET PAST TOP OF BANK.
7. PLACE ADJACENT ROLLS IN THE ANCHOR TRENCH WITH A MINIMUM OF 4" OVERLAP. SECURE WITH BIODEGRADABLE STAKES, BACKFILL ANCHOR TRENCH, AND COMPACT SOIL.
8. STAKE AT 12" INTERVALS ALONG OVERLAP.
9. IF MORE THAN ROLL IS REQUIRED TO COVER THE CHANNEL FROM THE TOP OF BANK DOWN TO THE TOE, THEN OVERLAP MATTING BY A MINIMUM OF 1'.

INSTALLATION - HEADWATER VALLEY

1. SEE GRADING NOTES ON PLAN AND PROFILE SHEETS AND DETAIL SHEETS FOR INFORMATION REGARDING WHAT AREAS ARE TO RECEIVE COIR MATTING.
2. OVERLAP ADJACENT MATS 6" (IN DIRECTION PARALLEL TO FLOW) AND ANCHOR EVERY 12" ACROSS THE OVERLAP. THE UPSTREAM MAT SHOULD BE PLACED OVER THE DOWNSTREAM MAT.
3. EDGES SHOULD BE SHINGLED AWAY FROM THE FLOW OF WATER.
4. LAY MAT LOOSE TO ALLOW CONTACT WITH SOIL. DO NOT STRETCH TIGHT.
5. ANCHOR MAT USING BIODEGRADABLE STAKES.
6. EXTEND MAT A MINIMUM OF 1 FOOT PAST TOE OF SLOPE.
7. STAKE AT 12" INTERVALS ALONG OVERLAP.
8. IF MORE THAN ROLL IS REQUIRED TO COVER THE VALLEY BOTTOM, THEN OVERLAP MATTING BY A MINIMUM OF 1' IN THE CENTER OF THE CHANNEL.



STREAM / SWALE MATTING



HEADWATER VALLEY MATTING

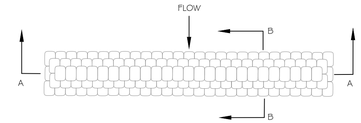
EROSION CONTROL MATTING MUST MEET OR EXCEED THE FOLLOWING REQUIREMENTS:

REACH KJ1-B & C
- 100 % COCONUT FIBER (COIR) TWINE WOVEN INTO A HIGH STRENGTH MATRIX.
- THICKNESS - 0.30 IN. MINIMUM.
- SHEAR STRESS – 4.63 LBS/SQFT
- FLOW VELOCITY- OBSERVED 16 FT/SEC
- WEIGHT - 26.55 OZ/SY
- OPEN AREA - 39%
- SLOPES – UP TO A MAXIMUM OF 1:1

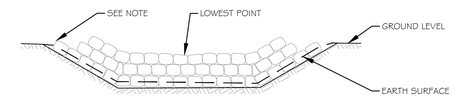
REACH KJ1-A / SWALE A & B
- 100 % WOOD FIBER
- THICKNESS - 0.313 IN. MINIMUM.
- SHEAR STRESS – 2.25 LBS/SQFT
- FLOW VELOCITY- OBSERVED 9 FT/SEC
- WEIGHT - 0.74 LBS/SY
- SLOPES – UP TO A MAXIMUM OF 1.5:1

COIR MATTING

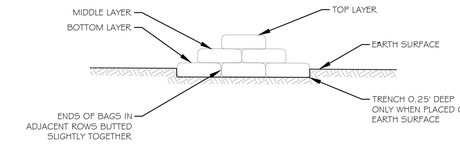
NTS



PLAN VIEW



SECTION A-A



SECTION B-B

MAINTENANCE:

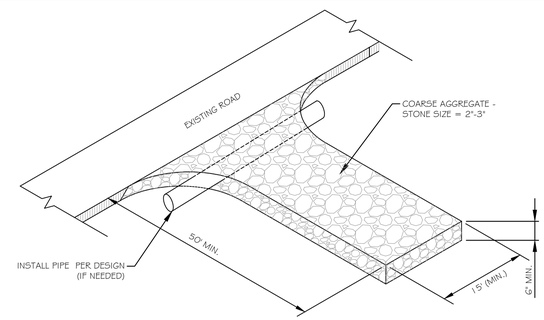
1. PERIODICALLY INSPECT SANDBAG DIKE FOR DAMAGE AND LEAKS AND REPAIR AS NEEDED
2. REMOVE IMPOUNDED TRASH AND SEDIMENT

NOTES:

1. END OF DIKE AT GROUND LEVEL TO BE HIGHER THAN THE LOWEST POINT OF FLOW CHECK
2. SUFFICIENT SANDBAGS ARE TO BE PLACED TO PREVENT SCOURING
3. SANDBAG BARRIERS SHALL BE CONSTRUCTED OF THREE LAYERS OF SANDBAGS. THE BOTTOM LAYER SHALL CONSIST OF 3 ROWS OF BAGS, THE MIDDLE LAYER SHALL CONSIST OF 2 ROWS OF BAGS AND THE TOP LAYER SHALL CONSIST OF 1 ROW OF BAGS
4. THE RECOMMENDED DIMENSION OF A FILLED SANDBAG SHALL BE APPROXIMATELY 0.5 FT X 0.5 FT X 1.5 FT

SANDBAG IMPERVIOUS DIKE

NTS



PURPOSE:

STABILIZED CONSTRUCTION ENTRANCES SHOULD BE USED AT ALL POINTS WHERE TRAFFIC WILL BE LEAVING A CONSTRUCTION SITE AND MOVING DIRECTLY ONTO A PUBLIC ROAD. INSTALL A CULVERT PIPE ACROSS THE ENTRANCE WHEN NEEDED TO PROVIDE POSITIVE DRAINAGE.

CONSTRUCTION SPECIFICATIONS:

1. CLEAR THE ENTRANCE AND EXIT AREA OF ALL VEGETATION, ROOTS, AND OTHER OBJECTIONABLE MATERIAL AND PROPERLY GRADE IT.
2. PLACE THE GRAVEL TO THE SPECIFIC GRADE AND DIMENSIONS SHOWN ON THE DETAIL, AND SMOOTH IT.
3. PROVIDE DRAINAGE TO CARRY WATER TO A SEDIMENT TRAP OR OTHER SUITABLE OUTLET.
4. USE GEOTEXTILE FABRICS BECAUSE THEY IMPROVE STABILITY OF THE FOUNDATION IN LOCATIONS SUBJECT TO SEEPAGE OR HIGH WATER TABLE.

MAINTENANCE:

1. MAINTAIN THE GRAVEL PAD IN A CONDITION TO PREVENT MUD OR SEDIMENT FROM LEAVING THE CONSTRUCTION SITE. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH 2-INCH STONE.
2. AFTER EACH RAINFALL, INSPECT ANY STRUCTURE USED TO TRAP SEDIMENT AND CLEAN IT OUT AS NECESSARY.
3. IMMEDIATELY REMOVE ALL OBJECTIONABLE MATERIALS SPILLED, WASHED, OR TRACKED ONTO PUBLIC ROADWAYS, OR AIRFIELD PAVEMENTS.

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE

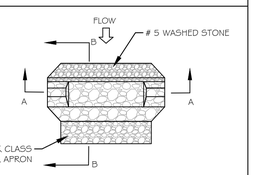
NTS

NOTES:

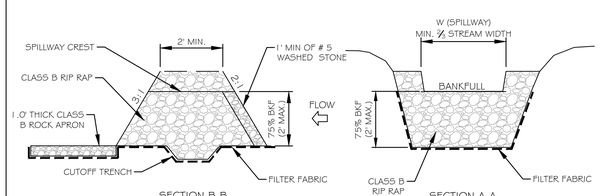
1. CONSTRUCT DAM ACCORDING TO NCDENR EROSION CONTROL MANUAL
2. RIPRAP SHALL BE CLASS I
3. PLACE ROCK DAM AS SHOWN ON PLANS. EXTEND CLASS B RIP RAP ROCK APRON 2 FEET DOWNSTREAM FROM TOE OF ROCK DAM

MAINTENANCE:

1. INSPECT CHECK DAM PERIODICALLY AND AFTER EACH SIGNIFICANT RAINFALL EVENT FOR DAMAGE AND SEDIMENT ACCUMULATION
2. AT A MINIMUM, REMOVE SEDIMENT WHEN ACCUMULATIONS REACH ONE-HALF THE HEIGHT OF THE SEDIMENT CONTROL STONE
3. REPLACE OR CLEAN SEDIMENT CONTROL STONE AS NEEDED TO ALLOW WATER TO DRAIN THROUGH THE DEVICE BETWEEN RAINFALL EVENTS



PLAN



SECTION B-B SECTION A-A

TEMPORARY ROCK CHECK DAM

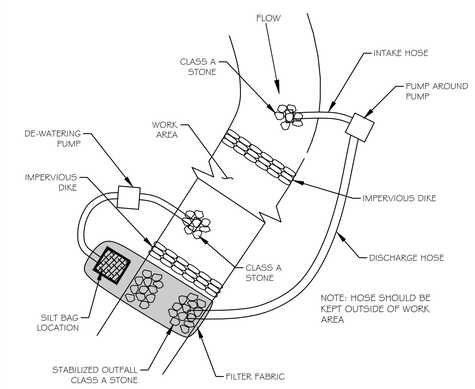
NTS

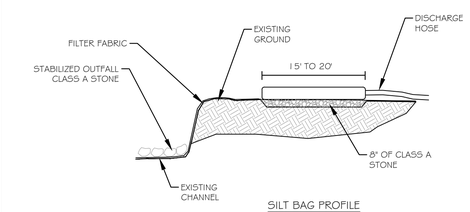
NOTES:

1. EXCAVATION SHALL BE PERFORMED ONLY IN DRY AND/OR ISOLATED SECTIONS OF CHANNEL.
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. A MAXIMUM OF 200 FEET MAY BE DISTURBED AT ANY ONE TIME.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING PUMP SIZE SUFFICIENT TO PUMP BASE FLOW.
5. DIKE MUST BE CONSTRUCTED OF NON-ERODIBLE MATERIALS SUCH AS SANDBAGS.

SEQUENCE OF CONSTRUCTION:

1. INSTALL STILLING BASIN AND STABILIZED OUTFALL USING CLASS A RIP RAP AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR SHALL INSTALL THE PUMP AROUND PUMP AND THE TEMPORARY PIPING THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK AREA TO THE STABILIZED OUTFALL.
3. INSTALL UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. INSTALL THE DOWNSTREAM IMPERVIOUS DIKE AND DEWATERING 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 BE PUMPED TO AN OUTFALL STABILIZED WITH CLASS A RIP RAP.
5. THE CONTRACTOR SHALL EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF THE IMPERVIOUS DIKE. WHEN DEWATERING AREA, ALL DIRTY WATER MUST BE PUMPED THROUGH A SILT BAG. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE/PIPING STARTING WITH THE DOWNSTREAM DIKE FIRST.
6. ONCE THE WORKING AREA IS COMPLETED, REMOVE ALL RIP RAP AND IMPERVIOUS DIKES AND STABILIZE DISTURBED AREAS WITH SEED AND MULCH.
7. ALL WORK IN CHANNEL MUST BE COMPLETED BEFORE REMOVING IMPERVIOUS DIKE.





SILT BAG PROFILE

PUMP AROUND & DEWATERING DETAIL

NTS

res
3600 Glenwood Ave, Suite 100
Raleigh, NC 27612
Main: 919.829.9909
www.res.us

Engineering Services Provided By:
RES Environmental Operating Company, LLC
License: F-1428

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 042580 5/4/21 ENGINEER BENTON R. CARROLL

PLOT DATE:

REVISIONS:

RELEASED FOR: FINAL DESIGN - RELEASED FOR CONSTRUCTION 5/4/2021

PROJECT NAME: COWFORD MITIGATION SITE ONSLOW COUNTY

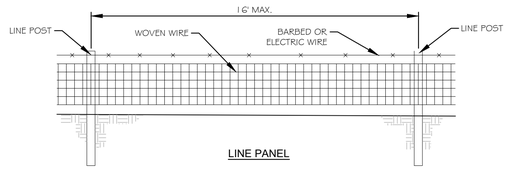
DRAWING TITLE: DETAILS

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

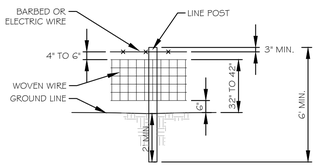
SHEET NUMBER:

D1

FILE NAME:R:\Rescad\Projects\100\00-Cowford\DWGs\0675_SHT_DETAILS.dwg SAVED BY: Bcarroll



LINE PANEL



WOVEN WIRE:
ASTM CLASS 3 GALVANIZED.
TOP AND BOTTOM WIRES MIN. 12 GAUGE.
INTERMEDIATE AND STAY WIRES MIN.
12 1/2 GAUGE.

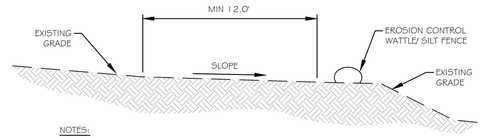
WOVEN WIRE WITH ONE BARB DETAIL

NOTES:

1. LINE POSTS (WOODEN): MIN. 4 IN. DIAM. OR 4 IN. SQUARE.
2. LINE POSTS (STEEL): STUDDED OR PUNCHED T, U, OR Y SHAPED, WITH ANCHOR PLATES.
3. MIN. WEIGHT 1.3 LBS./FT. (EXCLUDING ANCHOR PLATE). POSTS SHALL BE DRIVEN A MINIMUM OF 18" DEEP AND MUST BE AT LEAST 5.5 FT IN LENGTH
4. SPECIES AND TREATMENT FOR ALL WOOD: USE UNTREATED DURABLE POSTS OF SPECIES SUCH AS RED CEDAR, BLACK LOCUST OR OSAGE-ORANGE WITH BARK REMOVED, OR NON-DURABLE WOOD THAT IS PRESERVATIVE PRESSURE TREATED (0.40 LBS./CUBIC FOOT CCA, OR EQUIVALENT NON-CCA TREATMENT). DO NOT USE RED PINE.

WOVEN WIRE FENCE (NRCS DETAIL 382A)

NTS



NOTES:

1. MAINTAIN HAUL ROAD DURING CONSTRUCTION
2. RETURN TO ORIGINAL GRADE AT THE COMPLETION OF WORK
3. VEGETATE ALL DISTURBED AREAS
4. REMOVE COMPOST FILTER SOCK UPON ESTABLISHMENT OF VEGETATION

TYPICAL HAUL ROAD

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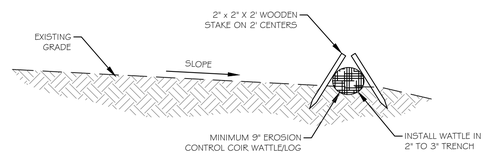

PROFILE VIEW

NOTES:

1. EROSION CONTROL WATTLES OR COIR LOGS/WATTLES MAY BE USED IN PLACE OF SILT FENCE
2. INSTLL A MINIMUM OF 2 UPSLOPE STAKES AND 4 DOWNSLOPE STAKES AT AN ANGLE TO WEDGE WATTLE IN PLACE

MAINTENANCE:

1. INSPECT WATTLE PERIODICALLY AND AFTER EACH SIGNIFICANT RAINFALL EVENT FOR DAMAGE AND SEDIMENT ACCUMULATION
2. REPLACE OR CLEAN WATTLE AS NEEDED TO ALLOW WATER TO DRAIN THROUGH THE NATURAL FIBERS BETWEEN RAINFALL EVENTS

EROSION CONTROL WATTLE

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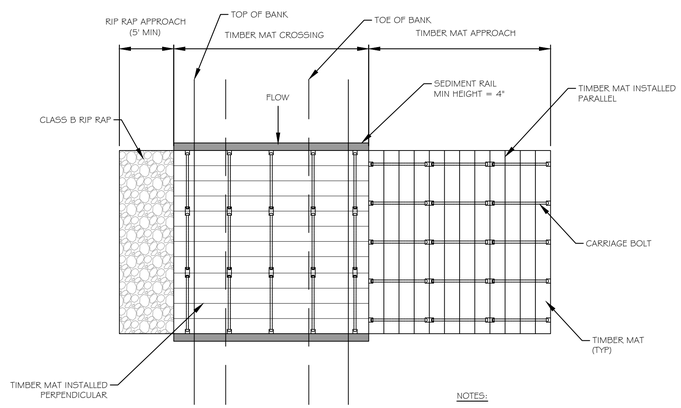
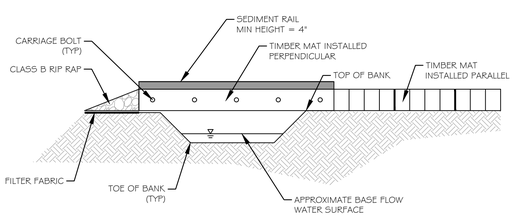


PLAN VIEW



SECTION VIEW

NOTES:

1. TIMBER MATS SHALL BE USED FOR TEMPORARY CONSTRUCTION ACCESS TO TRAVERSE WET AND/OR MUDDY AREAS ADJACENT TO THE STREAM AND TO CROSS THE STREAM AND OTHER CONCENTRATED FLOW AREAS.
2. THE STREAM CROSSING SHALL BE INSTALLED IN A DRY CONDITION WHEN FLOW IS LOW. THERE SHALL BE MINIMAL TO NO DISTURBANCE OF THE CHANNEL BED AND BANKS AS A RESULT OF INSTALLING THE APPROACHES OR CROSSING.
3. THE LENGTH OF TIMBER MAT REQUIRED TO CROSS THE STREAM OR CONCENTRATED FLOW AREAS SHALL BE SUCH THAT THE TIMBER MAT EXTENDS PAST THE TOP OF BANK ON EACH SIDE OF THE CROSSING A SUFFICIENT DISTANCE TO SUPPORT THE MAXIMUM EQUIPMENT SIZE USING THE CROSSING.
4. STREAM CROSSINGS SHALL BE INSTALLED WITH THE TIMBER MAT LENGTHS ORIENTED PERPENDICULAR TO THE TOPS OF THE STREAM BANKS. TIMBER MAT STREAM APPROACHES SHALL BE INSTALLED WITH THE TIMBER MAT LENGTHS ORIENTED PARALLEL TO THE TOPS OF THE STREAM BANKS.
5. TIMBER MATS SHALL HAVE A SOLID DECK WITH NO GAPS OR SPACES ALLOWED BETWEEN THE INDIVIDUAL BOARDS/TIMBERS.
6. A 4" MINIMUM HEIGHT SEDIMENT RAIL SHALL BE PROVIDED AT STREAM CROSSINGS TO PREVENT TRACKED SEDIMENT FROM FALLING INTO THE STREAM BED.
7. STREAM CROSSING APPROACHES FROM DRY AREAS SHALL BE CONSTRUCTED USING CLASS B RIP RAP PLACED OVER FILTER FABRIC.
8. ALL TIMBER MATS, FILTER FABRIC, AND RIP RAP SHALL BE COMPLETELY REMOVED FROM THE SITE WHEN THE CROSSING IS REMOVED.

TIMBER MAT TEMPORARY CROSSING

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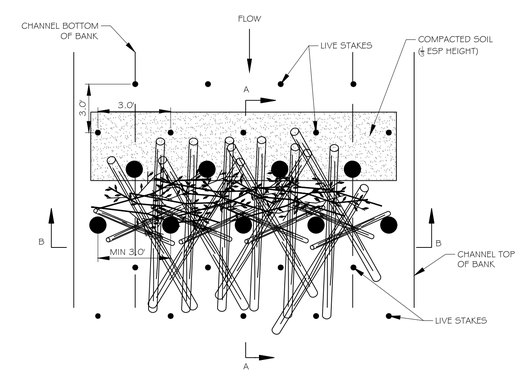
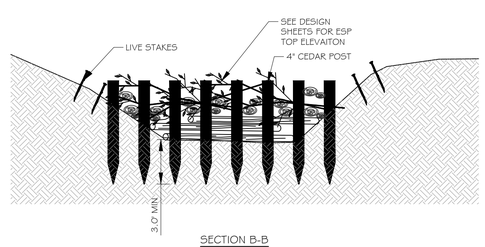
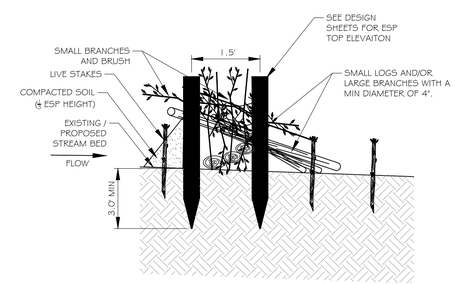




SECTION B-B



SECTION A-A

NOTES:

1. DRIVE 2 ROWS OF 4" CEDAR POSTS ON MINIMUN 3' CENTERS PAST MINIMUM DEPTH AS SHOWN.
2. FILL THE VOID BETWEEN POST ROWS W/ AN EVEN MIX OF HARDWOOD LOGS, LIMBS, AND BRUSH AS SHOWN.
3. TOP ELEVATION (SHOWN ON DESIGN SHEETS) SHOULD BE UNIFORM.
4. REDUCE POST SPACING AS NEEDED TO IMPROVE STRUCTURE STABILITY.
5. PLACE AND COMPACT FILL ON UPSTREAM FACE OF THE ESP.
6. FILL SHOULD BE PLACED AT A UNIFORM HEIGHT EQUAL TO $\frac{1}{3}$ OF THE TOTAL ESP HEIGHT (MEASURED FROM CHANNEL BED).
7. SEE PLANTING TABLE ON SHEET P1 FOR ACCEPTABLE LIVE STAKE SPECIES.

ENGINEERED SEDIMENT PACK (ESP)

NTS

res
3600 Glenwood Ave, Suite 100
Raleigh, NC 27612
Main: 919.829.9909
www.res.us

Engineering Services Provided By:
RES Environmental Operating Company, LLC
License: F-1428

SEAL

PLOT DATE:

REVISIONS:

RELEASED FOR: FINAL DESIGN - RELEASED FOR CONSTRUCTION 5/4/2021

PROJECT NAME: COWFORD MITIGATION SITE ONSLOW COUNTY

DRAWING TITLE: DETAILS

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

D2

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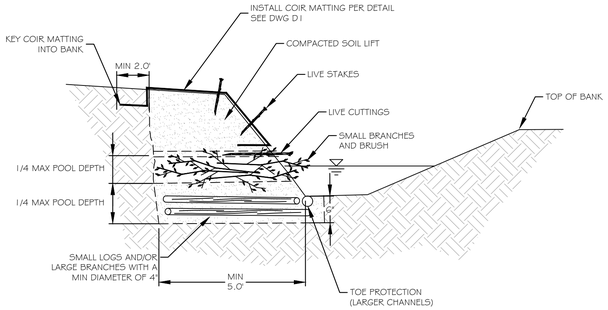
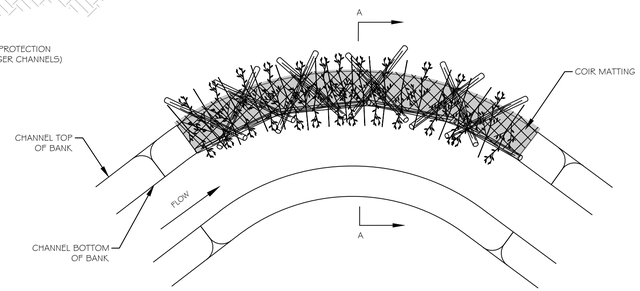


SECTION A-A

NOTES:

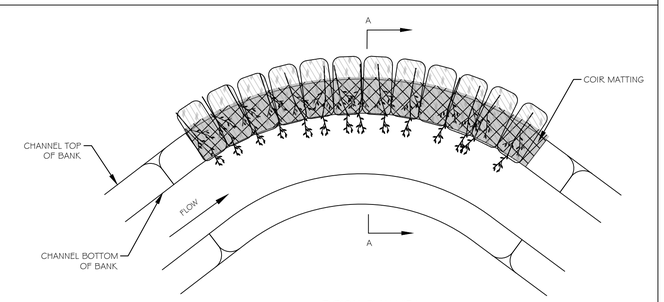
1. OVER EXCAVATE THE OUTSIDE BEND OF THE CHANNEL. PLACE LARGER BRANCHES AND LOGS IN A CRISS-CROSS PATTERN. LOCK IN PLACE WITH FILL COVERING 6 IN TO 12 IN OF THE LARGER BRANCHES/SMALL LOGS.
2. PLACE SMALLER BRANCHES AND BRUSH OVER THE LARGER BRANCHES/SMALL LOGS (HARDWOOD SPECIES ONLY) AND COMPACT LIGHTLY TOGETHER. BACKFILL AND COMPACT TO LOCK IN PLACE.
3. PLACE LIVE CUTTINGS OVER THE SMALL BRANCHES AND BRUSH. SEE TABLE ON PLANTING SHEET FOR ACCEPTABLE LIVE CUTTING AND LIVE STAKE SPECIES AND COMPOSITION. CUTTINGS SHOULD BE RINSED AT CUTTING POINT TO ALLOW BETTER ROOTING.
4. INSTALL EROSION CONTROL (COIR) MATTING OVER COMPACTED SOIL PER DIRECTION OF ENGINEER. COIR MATTING SHOULD BE KEYED INTO TOP OF BANK.
5. INSTALL 1 TO 3 ROWS OF LIVE STAKES ABOVE THE LIVE CUTTINGS LAYER PER DIRECTION OF ENGINEER.
6. LIVE CUTTINGS SHOULD NOT EXTEND PAST ⅓ OF CHANNEL BOTTOM WIDTH.



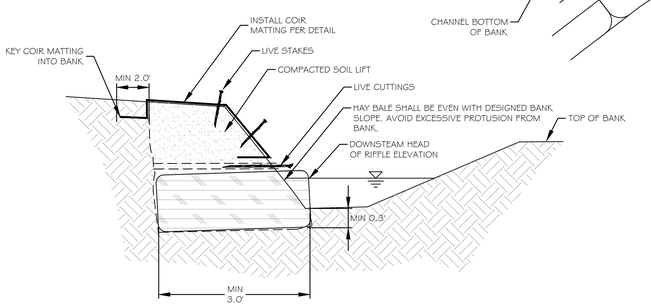
TYPICAL PLAN VIEW

BRUSH TOE

NTS



TYPICAL PLAN VIEW



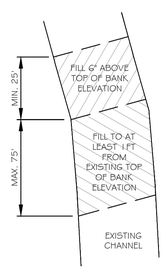
SECTION A-A

NOTES:

1. HAY BALES SHALL BE APPROXIMATLY 14" X 18" X 36" STANDARD 2 STRAND (BIODEGADABLE TWINE) BALES.
2. OVER EXCAVATE THE OUTSIDE BEND OF THE CHANNEL. INSTALL HAY BALE, BACKFILL AND COMPACT TO LOCK IN PLACE.
3. HAY BALES SHOULD BE INSTALLED SUCH THAT THE TOP OF THE BALE IS AT THE SAME ELEVATION AS THE HEAD OF THE DOWNSTREAM RIFFLE.
4. PLACE LIVE CUTTINGS OVER THE HAY BALE. SEE TABLE ON PLANTING SHEET FOR ACCEPTABLE LIVE CUTTING AND LIVE STAKE SPECIES AND COMPOSITION. CUTTINGS SHOULD BE RINSED AT CUTTING POINT TO ALLOW BETTER ROOTING.
6. LIVE CUTTINGS SHOULD NOT EXTEND PAST ⅓ OF CHANNEL BOTTOM WIDTH.
7. INSTALL COMPACTED SOIL LIFT. COIR MATTING SHOULD BE WRAPED UNDER SOIL LIFT AND KEYED INTO TOP OF BANK.
8. INSTALL 1 TO 3 ROWS OF LIVE STAKES ABOVE THE LIVE CUTTINGS LAYER PER DIRECTION OF ENGINEER.

HAY BALE TOE

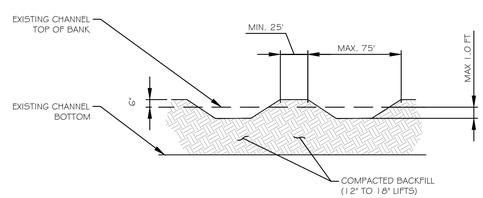
NTS



PLAN VIEW

NOTES:

1. IN AREAS WHERE EXISTING CHANNEL IS TO BE ABANDONED, FILL EXISTING CHANNEL TO TOP OF BANK ELEVATION WHEN POSSIBLE.
2. CHANNEL MUST BE FILLED IN 12" TO 18" LIFTS AND COMPACTED ACCORDINGLY.
3. WHEN SPOIL DOES NOT EXIST IN ORDER TO COMPLETELY FILL EXISTING CHANNEL TO TOP OF BANK ELEVATION, FILL CHANNEL TO AN ELEVATION 6" ABOVE TOP OF BANK ELEVATION FOR AT LEAST 25 LF OUT OF EVERY 100 LF SEGMENT. REMAINING CHANNEL SECTIONS ARE TO BE FILLED TO A DEPTH OF NO LESS THAN 1 FT FROM TOP OF BANK ELEVATION.
4. IN AREAS WHERE THE EXISTING CHANNEL IS LOCATED OUTSIDE OF THE CONSERVATION EASEMENT, THE CHANNEL MUST BE FILLED COMPLETELY IN 12" LIFTS.

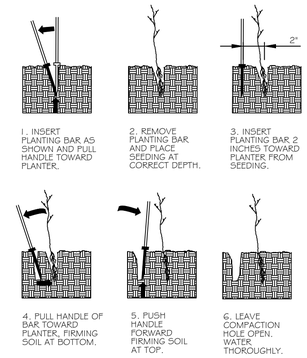


TYPICAL SECTION

CHANNEL ABANDONMENT AND BACKFILL

NTS

DIBBLE PLANTING METHOD
USING THE KBC PLANTING BAR



PLANTING NOTES:

PLANTING BAG
DURING PLANTING, SEEDLINGS SHALL BE KEPT IN A MOIST CANVAS BAG OR SIMILAR CONTAINER TO PREVENT THE ROOT SYSTEMS FROM DRYING.

KBC PLANTING BAR
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.

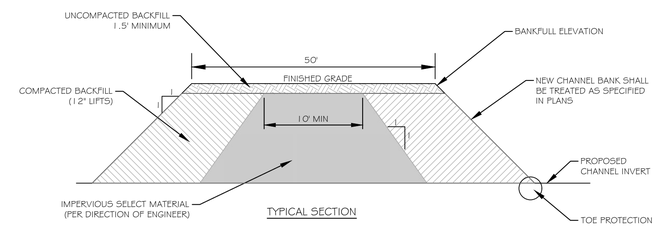
ROOT PRUNING
ALL SEEDLINGS SHALL BE ROOT PRUNED, IF NECESSARY, SO THAT NO ROOTS EXTEND MORE THAN 10 INCHES BELOW THE ROOT COLLAR.

NOTES:

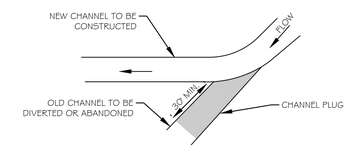
BARE ROOTS SHALL BE PLANTED 6 FT. TO 10 FT. ON CENTER, RANDOM SPACING, AVERAGING 8 FT. ON CENTER. APPROXIMATELY 680 PLANTS PER ACRE.

BARE ROOT PLANTING

NTS



TYPICAL SECTION



PLAN VIEW

CHANNEL PLUG

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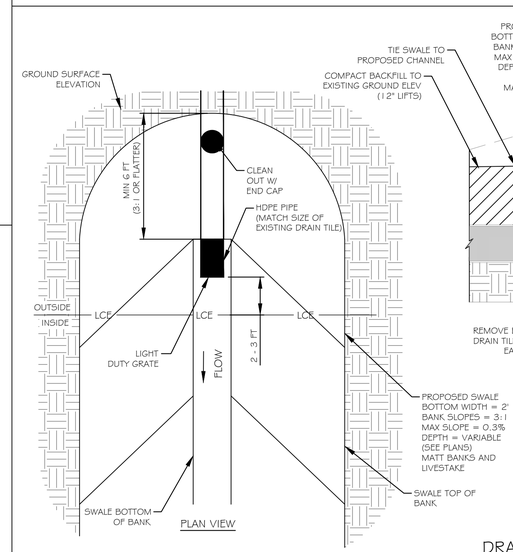
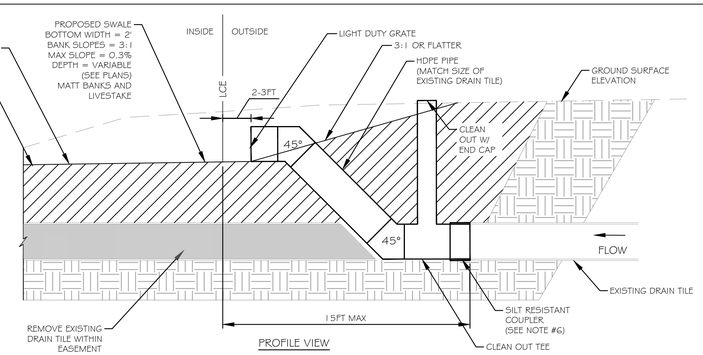


PLAN VIEW



PROFILE VIEW

NOTES:

1. DISTURBACE OUTSIDE OF THE CONSERVATION EASEMENT SHOULD BE MINIMIZED TO THE EXTENT PRACTICAL AND SHOULD NOT EXTEND BEYOND 15FT FROM THE EASEMENT.
2. EXCAVATE DOWN TO DRAIN TILE MAINTAINING SLOPES MEETING OSHA GUIDLINES. CONTRACTOR SHALL FOLLOW ALL OSHA TRENCHING AND EXCAVATION GUIDELINES.
3. CUT DRAIN TILE AND REMOVE ALL FRAGMENTS FROM EXCAVATED TRENCH. REMOVED TILE IS TO BE DISPOSED OF OFF-SITE.
4. BACKFILL DOWNSTREAM TRENCH IN 12" LIFTS.
5. INSTALL HDPE PIPE MATCHING THE SIZE OF THE EXITING DRAIN TILE. HDPE PIPE SHOULD BE INSTALLED TO MANUFACTURES SPECIFICATIONS.
6. CONNECT HDPE TO EXISTING DRAIN TILE WITH A SILT RESISTANT CONNECTION PER MANUFACTURES RECOMMENDATIONS.
7. OUTLET SHOULD BE INSTALLED WITH A LIGHT DUTY GRATE SUCH THAT THE OUTLET PIPE TERMINATES 2-3 FEET FROM THE PROPOSED CONSERVATION EASEMENT.
8. DIG OUTLET SWALE AT PROPOSED DIMENSIONS AND TIE TO PROPOSED CHANNEL.

DRAIN TILE OUTLET

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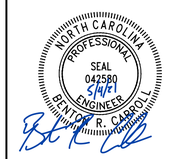


PLOT DATE:

REVISIONS:

RELEASED FOR: FINAL DESIGN - RELEASED FOR CONSTRUCTION 5/4/2021

PROJECT NAME: COWFORD MITIGATION SITE ONSLOW COUNTY

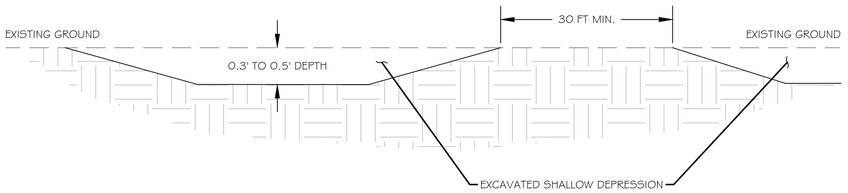
DRAWING TITLE: DETAILS

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

D3

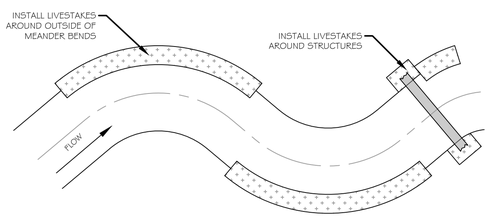
FILE NAME:R:\Rescad\Projects\100900-Cowford\DWG\0675_SHT_DETAILS.dwg SAVED BY: Bcarroll



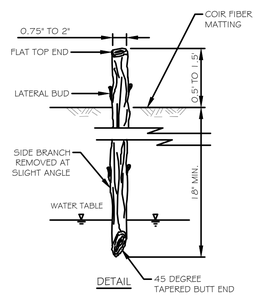
NOTES:
1. DEPRESSIONS SHALL MAKE UP NO MORE THAN 0.05 ACRES OF WETLAND AREA (APPROX. 1.7%)
2. INDIVIDUAL DEPRESSIONS SHALL BE NO LARGER THAN 200 FT^2

EXCAVATED SHALLOW DEPRESSIONS

NTS



PLAN VIEW



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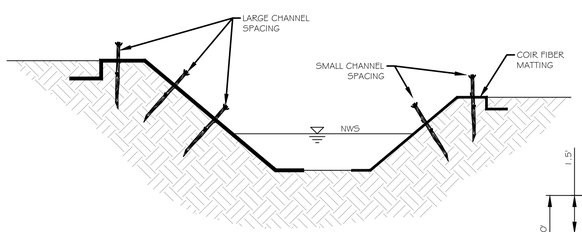

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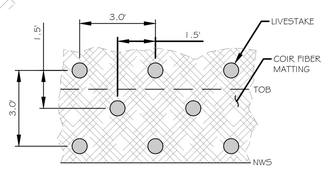
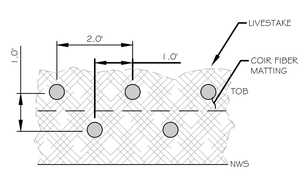


LIVESTAKE SPACING
LARGE CHANNEL

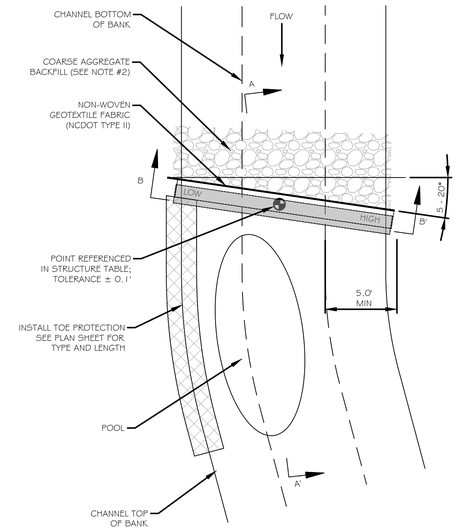


LIVESTAKE SPACING
SMALL CHANNEL

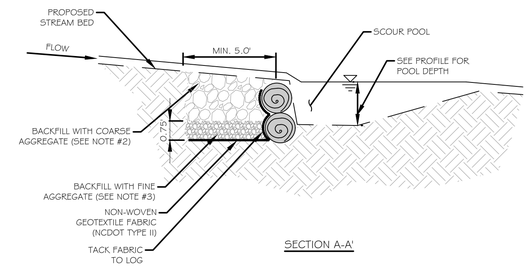
NOTES:
1. SEE TABLE ON PLANTING SHEET(S) FOR ACCEPTABLE SPECIES AND COMPOSITION.
2. LIVE STAKES SHOULD BE 2 TO 3 FEET LONG AND 0.75 TO 2 INCHES IN DIAMETER.
3. LIVE STAKES SHALL BE PLANTED ON 1.5' ALTERNATING SPACING ON LARGE CHANNELS (POOL DEPTH > 2FT) AND 1.0' ALTERNATING SPACING ON SMALL CHANNELS (POOL DEPTH < 2FT).
4. LIVE STAKES SHALL BE PLANTED ON ALL RESTORATION REACHES AND ALONG ALL ENHANCEMENT REACHES AS SHOWN ON PLANTING PLAN SHEET(S).

CHANNEL / SWALE LIVE STAKING

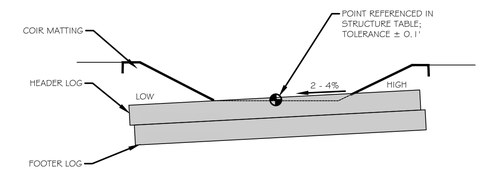
NTS



TYPICAL PLAN VIEW



SECTION A-A'

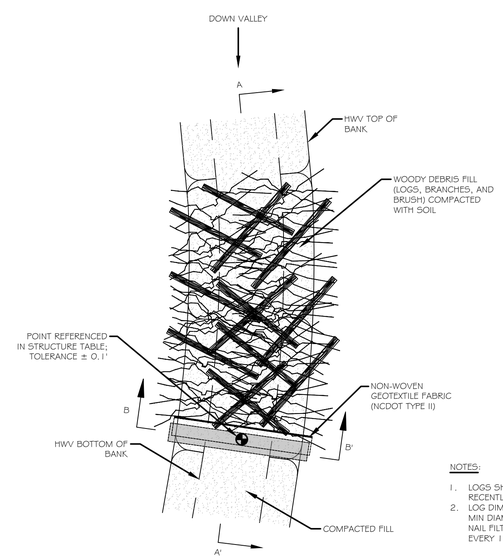


SECTION B-B'

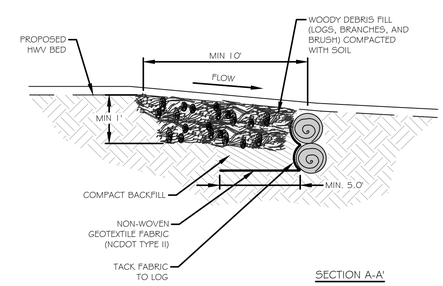
LOG SILL

NTS

NOTES:
1. LOGS SHOULD BE RELATIVELY STRAIGHT HARDWOOD AND RECENTLY HARVESTED
2. COARSE AGGREGATE BACKFILL SHALL CONSIST OF AN EQUAL MIX OF SURGE STONE, AND CLASS B RIPRAP
3. FINE AGGREGATE BACKFILL SHALL CONSIST OF AN EQUAL MIX OF ABC STONE AND NATIVE MATERIAL.
4. BACKFILL SHOULD BE COMPACTED IN 8" LIFTS.
5. TOE PROTECTION IS TO BE INSTALLED ON THE DOWNSTREAM LOW SIDE OF ALL LOG SILLS AND SHOULD ABUT THE DOWNSTREAM FACE OF THE LOGS.
6. NAIL FILTER FABRIC USING 3" 10D GALVANIZED COMMON NAIL EVERY 1.5' ALONG THE LOG
7. HIGH SIDE OF LOG SHALL BE APPROX. 0.2' HIGHER THAN LOW END
8. LOG DIMENSIONS:
   MIN DIAM. = 12"
   MIN LENGTH = 18'

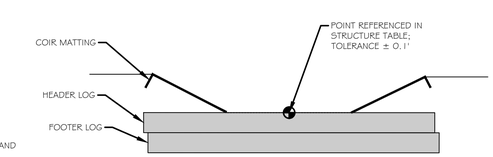


TYPICAL PLAN VIEW



SECTION A-A'

NOTES:
1. LOGS SHOULD BE RELATIVELY STRAIGHT HARDWOOD AND RECENTLY HARVESTED.
2. LOG DIMENSIONS:
   MIN DIAM. = 10", MIN LENGTH = 18'
   NAIL FILTER FABRIC USING 3" 10D GALVANIZED COMMON NAIL EVERY 1.5' ALONG THE LOG.



SECTION B-B'

BRUSH BED SILL

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NORTH CAROLINA PROFESSIONAL SEAL 042580 ENGINEER BENJAMIN R. CARROLL
5/4/21

PLOT DATE:

REVISIONS:

RELEASED FOR: FINAL DESIGN - RELEASED FOR CONSTRUCTION 5/4/2021

PROJECT NAME: COWFORD MITIGATION SITE ONSLOW COUNTY

DRAWING TITLE: DETAILS

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

D4

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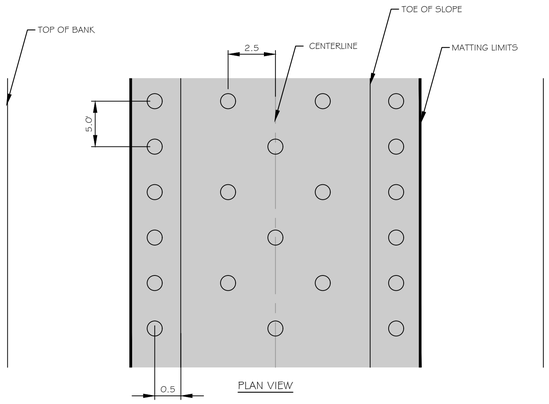
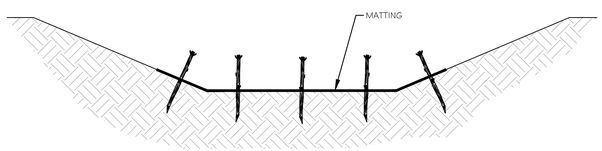
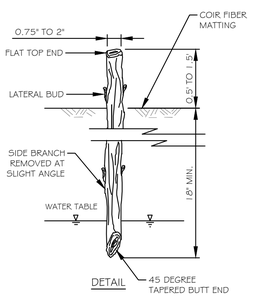


PLAN VIEW



TYPICAL SECTION



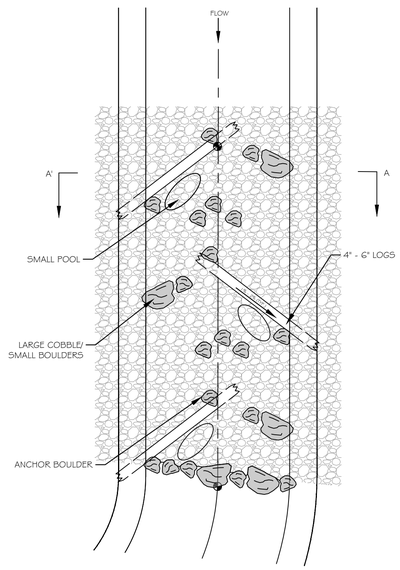
DETAIL

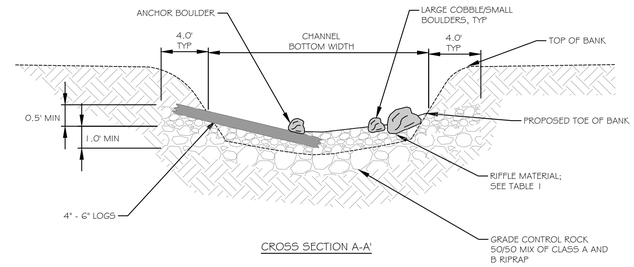
NOTES:

1. SEE TABLE ON PLANTING SHEET(S) FOR ACCEPTABLE SPECIES AND COMPOSITION.
2. LIVE STAKES SHOULD BE 2 TO 3 FEET LONG AND 0.75 TO 2 INCHES IN DIAMETER.
3. LIVE STAKES SHALL BE PLANTED ON 5 FOOT CENTERS ALONG THE HEADWATER VALLEY TOE OF SLOPE AS SHOWN IN THE PLAN VIEW ABOVE.

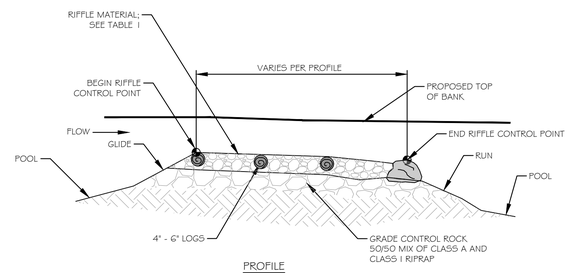
HEADWATER VALLEY LIVE STAKING

NTS





CROSS SECTION A-A'



PROFILE

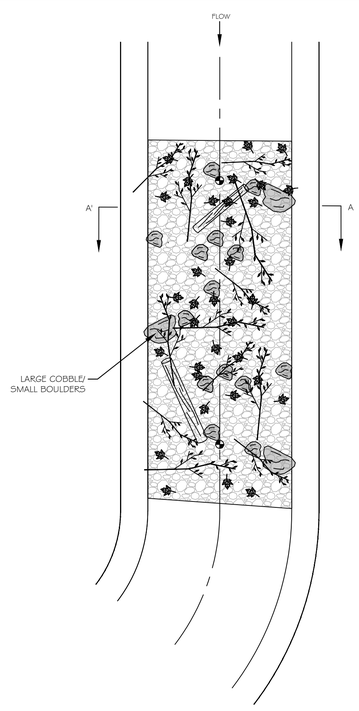
RIFFLE GRADE CONTROL

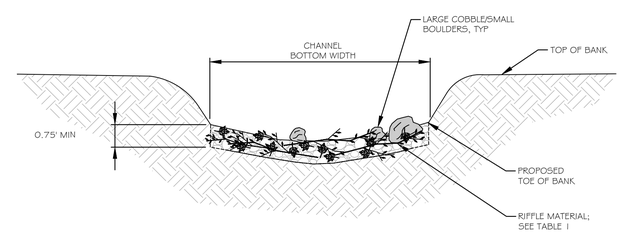
NTS

NOTES:

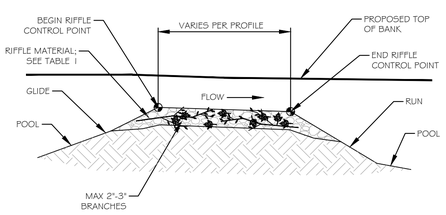
1. RIFFLE GRADE CONTROL STRUCTURES SHALL BE INSTALLED IN NEWLY GRADED CHANNEL SECTIONS, AS SPECIFIED ON THE PLAN SHEETS.
2. ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE BEGINNING AND END OF RIFFLE POINTS TO ESTABLISH PART OF THE PROFILE OF THE CHANNEL. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE RIFFLE INSTALLATION WITHIN A TOLERANCE OF ±0.2'.
3. GRADE CONTROL ROCK SHALL BE COMPRISED OF A 50/50 MIX OF CLASS A AND B RIPRAP. GRADE CONTROL ROCK SHALL BE PLACED SUCH THAT THE ADDITION OF THE SPECIFIED THICKNESS OF RIFFLE MATERIAL SHALL ACHIEVE THE DESIGNATED GRADES.
4. RIFFLE MATERIAL SHALL BE COMPRISED OF ROCKS AND LOGS. THE ROCK MATERIAL COMPOSITION SHALL MATCH TABLE 1. RIFFLE MATERIAL SHALL BE EXCAVATED, STOCKPILED, AND RE-USED FROM ABANDONED CHANNEL SECTIONS. ROCK RIFFLE MATERIAL OBTAINED OFFSITE SHALL BE SLIGHTLY ROUNDED, "RIVER-TYPE" ROCK, UNLESS OTHER ROCK CHARACTERISTICS ARE APPROPRIATE FOR THE CHANNEL.
5. SPACING AND NUMBER OF LOGS SHOULD BE BASED ON RIFFLE LENGTH AND MAY VARY BASED ON LOG AVAILABILITY. LOGS SHOULD BE SPACED EQUALLY AND ANCHORED TO THE CHANNEL BED WITH BOULDERS.
6. THE PLACEMENT OF GRADE CONTROL ROCK AND/OR RIFFLE MATERIAL SHALL BE DONE IN A MANNER TO CREATE A SMOOTH PROFILE, WITH NO ABRUPT "JUMP" (TRANSITION) BETWEEN THE UPSTREAM POOL-GLIDE AND THE RIFFLE, AND LIKEWISE NO ABRUPT "DROP" (TRANSITION) BETWEEN THE RIFFLE AND THE DOWNSTREAM RUN-POOL. THE FINISHED CROSS SECTION OF THE RIFFLE MATERIAL SHALL GENERALLY MATCH THE SHAPE AND DIMENSIONS SHOWN ON THE RIFFLE TYPICAL SECTION WITH SOME VARIABILITY OF THE THALWEG LOCATION AS A RESULT OF THE SMALL POOLS AND LOGS.
7. THE END OF RIFFLE CONTROL POINT MAY TIE IN TO ANOTHER IN-STREAM STRUCTURE (LOG SILL , J-HOOK, ETC.). NO LOGS SHOULD BE INCLUDED WITHIN THE FOOTPRINT OF THE PROPOSED STRUCTURE.
8. THE CONSTRUCTED RIFFLE SHALL BE KEYED IN TO THE STREAM BANKS AND/OR BED AS DESIGNATED BY THE DESIGNER. THE "KEY" SHALL EXTEND BEYOND THE TOP OF BANK FOR THE LENGTH OF THE RIFFLE. WHERE PRESERVATION OF EXISTING STREAM BANK VEGETATION IS A PRIORITY A "KEY" MAY NOT BE USED (OR THE DIMENSIONS MAY BE ADJUSTED) TO LIMIT DISTURBANCE.

TABLE 1 - RIFFLE COMPOSITION		
REACH	STONE SIZE	%
KJ1	CLASS B	75
	SURGE	25





CROSS SECTION A-A'



PROFILE

TYPICAL RIFFLE

NTS

NOTES:

1. TYPICAL RIFFLES SHALL BE INSTALLED IN ALL NEWLY GRADED CHANNEL SECTIONS THROUGHOUT THE PROJECT UNLESS OTHERWISE SPECIFIED ON PLAN SHEETS.
2. ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE BEGINNING AND END OF RIFFLE POINTS TO ESTABLISH PART OF THE PROFILE OF THE CHANNEL. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE RIFFLE INSTALLATION WITHIN A TOLERANCE OF ±0.2'.
3. RIFFLE MATERIAL SHALL BE COMPRISED OF 75% ROCKS AND 25% WOODY MATERIAL. WOODY MATERIAL SHALL CONSIST OF LOGS, BRANCHES, AND BRUSH NO GREATER THAN 3" IN DIAMETER. THE ROCK MATERIAL SHALL CONSIST OF NATIVE SUBSTRATE MATERIAL WHEN POSSIBLE. NATIVE MATERIAL SHALL BE EXCAVATED, STOCKPILED, AND RE-USED FROM ABANDONED CHANNEL SECTIONS. IF A SUITABLE QUANTITY OF NATIVE SUBSTRATE MATERIAL CANNOT BE HARVESTED, CONTRACTOR MAY SUBSTITUTE THE RIFFLE MATERIAL WITH ROCK MATCHING THE COMPOSITION IN TABLE 1.
4. THE PLACEMENT OF RIFFLE MATERIAL SHALL BE DONE IN A MANNER TO CREATE A SMOOTH PROFILE, WITH NO ABRUPT "JUMP" (TRANSITION) BETWEEN THE UPSTREAM POOL-GLIDE AND THE RIFFLE, AND LIKEWISE NO ABRUPT "DROP" (TRANSITION) BETWEEN THE RIFFLE AND THE DOWNSTREAM RUN-POOL. THE FINISHED CROSS SECTION OF THE RIFFLE MATERIAL SHALL GENERALLY MATCH THE SHAPE AND DIMENSIONS SHOWN ON THE RIFFLE TYPICAL SECTION WITH SOME VARIABILITY OF THE THALWEG LOCATION AS A RESULT OF THE SMALL POOLS AND LOGS.
5. THE END OF RIFFLE CONTROL POINT MAY TIE IN TO ANOTHER IN-STREAM STRUCTURE (LOG SILL , J-HOOK, ETC.). NO LOGS SHOULD BE INCLUDED WITHIN THE FOOTPRINT OF THE PROPOSED STRUCTURE.

TABLE 1 - STONE COMPOSITION		
REACH	STONE SIZE	%
KJ1-C	CLASS B	75
	SURGE	25

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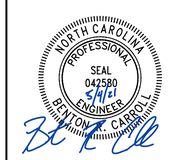
SEAL



PLOT DATE:

REVISIONS:

RELEASED FOR: FINAL DESIGN - RELEASED FOR CONSTRUCTION 5/4/2021

PROJECT NAME: COWFORD MITIGATION SITE ONSLOW COUNTY

DRAWING TITLE: DETAILS

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

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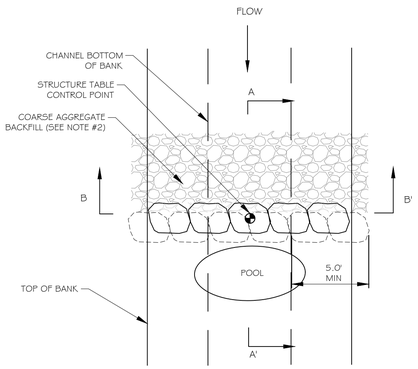
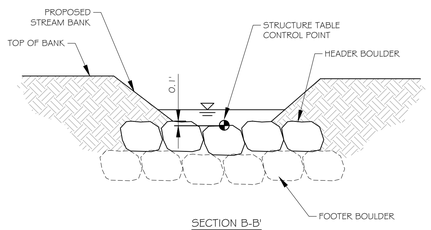
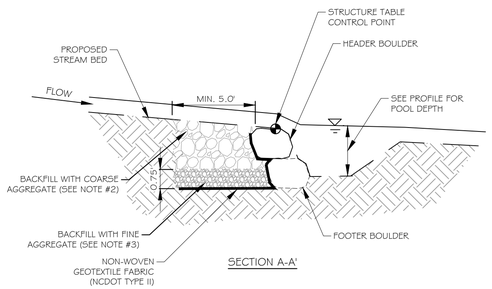


PLAN VIEW



SECTION B-B'



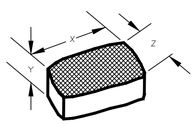
SECTION A-A'

NOTES:

1. SEE STRUCTURE BOULDER SIZE TABLE FOR MINIMUM DIMENSIONS OF BOULDERS. THE UPPER LIMIT FOR BOULDER SIZES SHOULD BE NO MORE THAN 20% GREATER THAN THE SPECIFIED MINIMUM SIZE AND SHALL BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION OF THE STRUCTURE.
2. COARSE AGGREGATE BACKFILL SHALL CONSIST OF AN EQUAL MIX OF SURGE STONE AND CLASS B RIPRAP.
3. FINE AGGREGATE BACKFILL SHALL CONSIST OF AN EQUAL MIX OF ABC STONE AND NATIVE MATERIAL.
4. BOULDERS AT TOE OF BANK SHALL BE INSTALLED SLIGHTLY HIGHER (APPROX. 0.1') IN ORDER TO PROMOTE LOW FLOW INTO CENTER OF CHANNEL.
5. THE BOULDER SILL IS GENERALLY CONSTRUCTED AS FOLLOWS:
   A. PLACE FOOTER BOULDERS. A LAYER OF BEDDING MATERIAL UNDER THE FOOTER BOULDERS MAY BE SPECIFIED BY THE DESIGNER. THERE SHALL BE NO GAPS BETWEEN BOULDERS.
   B. INSTALL FILTER FABRIC.
   C. PLACE COURSE BACKFILL BEHIND THE FOOTER BOULDERS.
   D. INSTALL HEADER BOULDERS ON TOP OF AND SET SLIGHTLY BACK FROM THE FOOTER BOULDERS (SUCH THAT PART OF THE HEADER BOULDER IS RESTING ON THE COARSE BACKFILL). HEADER BOULDERS SHALL SPAN THE SEAMS OF THE FOOTER BOULDERS. THERE SHALL NOT BE A SEAM IN THE CENTER OF THE STREAM BED (AT THE THALWEG). THERE SHALL BE NO GAPS BETWEEN BOULDERS.
   E. PLACE COARSE BACKFILL BEHIND HEADER BOULDERS ENSURING THAT ANY VOIDS BETWEEN THE BOULDERS ARE FILLED.
4. BACKFILL SHALL BE COMPACTED IN 8" LIFTS.

ROCK SILL

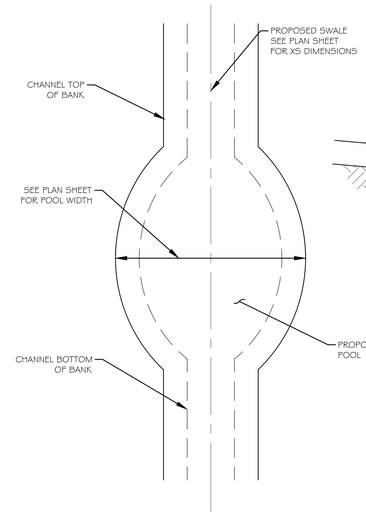
NTS



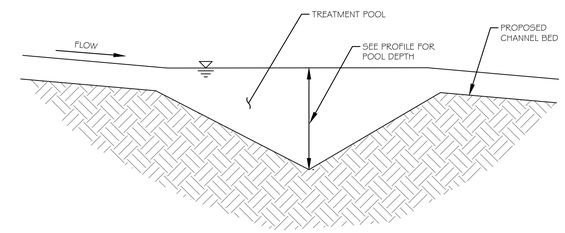
3 PRIMARY ROCK DIMENSIONS:

X. LONGEST DIMENSION
Y. SHORTEST DIMENSION
Z. INTERMEDIATE DIMENSION

STRUCTURE MINIMUM BOULDER SIZE		
REACH	DIMENSION	LENTGH (IN.)
X1	X	18
	Y	12
	Z	18
X2	X	24
	Y	18
	Z	18



PLAN VIEW



PROFILE

NOTES:

1. COIR MATTING SHALL BE INSTALLED ON ALL CHANNEL AND POOL BANKS PER THE COIR MATTING DETAIL
2. CHANNEL AND POOL BANKS SHALL BE LIVE STAKED PER THE CHANNEL / SWALE LIVE STAKING DETAIL. SEE TABLE ON PLANTING SHEET(S) FOR ACCEPTABLE SPECIES AND COMPOSITION.
3. CHANNEL AND POOL SHALL BE SEEDED PER THE RIPARIAN SEED MIX FOUND ON THE PLANTING PLAN SHEET(S)

TREATMENT POOL

NTS

res
3600 Glenwood Ave, Suite 100
Raleigh, NC 27612
Main: 919.829.9909
www.res.us

Engineering Services Provided By:
RES Environmental Operating Company, LLC
License: F-1428

SEAL

PLOT DATE:
5/4/2021

REVISIONS:

RELEASED FOR:
FINAL DESIGN - RELEASED FOR CONSTRUCTION

PROJECT NAME:
COWFORD MITIGATION SITE
ONSLOW COUNTY

DRAWING TITLE:
DETAILS

PROJECT NUMBER:	0675
PROJECT MANAGER:	MB
DESIGNED:	BRC
DRAWN:	SCF
CHECKED:	AFM

SHEET NUMBER:

D6

FILE NAME:R:\Rescad\Projects\100900-Cowford\DWG\0675_SHT_DETAILS.dwg SAVED BY: Bcarroll