

**Concurrence Point 3
Preferred Alternative Selection (LEDPA)**
and

**Concurrence Point 4A
Avoidance and Minimization**

TIP Project No. R-5808
WBS 46972.1.1

U.S. Route 158 Improvements
From Acorn Hill Road (S.R. 1002) to the Pasquotank County Line
Gates County



June 2021

Purpose of Today's Meeting:

The purpose of this meeting is to discuss Concurrence Points 3 and 4A, identifying the least environmentally damaging practicable alternative (LEDPA) to carry forward as the preferred alternative and documenting avoidance and minimization measures applied to the design of the project.

1. Introduction and Project Overview

1.1 Proposed Action

NCDOT proposes to improve approximately four miles of U.S. 158 in Gates County from Acorn Hill Road (S.R. 1002) to the Pasquotank County Line by widening the existing travel lanes and shoulders as well as stabilizing the side slopes. The proposed project is included in the North Carolina Department of Transportation's (NCDOT) *2020-2029 State Transportation Improvement Program (STIP)* as Project R-5808 with right of way acquisition scheduled to begin in fiscal year (FY) 2021 and construction in FY 2023.

1.2 Updates Since the Last Merger Meeting

A meeting with the Merger Team on April 21, 2021 was held for the purpose of reviewing the previous coordination and progress that had been made on the R-5808 project prior to the project being temporarily suspended in 2020, and to discuss the coordination that had taken place with NCDOT and USACE since 2020. No Concurrence Points were addressed during this meeting. NCDOT committed to continue coordination with the US Army Corps of Engineers (USACE) and Environmental Protection Agency (EPA) to discuss the justification document prepared by NCDOT and provide these two agencies additional information necessary to make a Least Environmentally Damaging Practicable Alternative (LEDPA) decision for the project.

A coordination meeting between NCDOT, FHWA, USACE, and EPA was held on May 4, 2021. During this meeting, it was concluded that USACE and EPA were comfortable making a LEDPA decision and that the C.P. 3 and 4A meeting could be scheduled. It was noted by USACE that project commitments will be suggested during the C.P. 3 and 4A meeting.

1.3 Meeting Purpose

The purpose of today's meeting is to reach concurrence on the Least Environmentally Damaging Practicable Alternative (LEDPA) (Concurrence Point 3) and to document existing and proposed avoidance and minimization measures (Concurrence Point 4A). At today's meeting, NCDOT will:

- Discuss the anticipated impacts of the three detailed study alternatives (Section 2.7).
- Recommend an alternative (Section 2.8).
- Present the avoidance and minimization measures which have been applied to the design of the project and will be evaluated further in final design (Section 3).

1.4 Study Area Description

The project study area is a 1,000-foot corridor (500 feet on either side of the U.S. 158 centerline). The attached **Figure 1** shows the project vicinity, and **Figure 2** shows the environmental features with anticipated impact areas. The eastern terminus of the project was selected based on the degradation of the slopes on the northern side of U.S. 158 which were mostly confined to the boundary of the Great Dismal Swamp National Wildlife Refuge (Refuge) that ends near the Pasquotank County line. The typical section also changes immediately east of the county line, with a recoverable area (i.e., shoulders) for drivers that is wider in Pasquotank County.

U.S. 158 is a major east-west route in northeastern North Carolina and is a designated NCDOT hurricane evacuation route. The existing facility is a two-lane road with a paved surface width of approximately 26 feet (approximately 11-foot wide lanes and 2-foot paved shoulders) with little to no graded shoulders. Slope degradation is currently occurring on the northern side slopes of U.S. 158 due to erosion from the adjacent standing water body and the burrowing of animals. The Refuge, located adjacent to the northern boundary of the proposed project, is a potential Section 4(f) resource.

1.5 Merger Process History

Prior to Entering Merger: A public meeting was held on Thursday, October 4, 2018 at the Sunbury Fire Department in Sunbury, NC. A total of 27 individuals attended the public meeting, and two written comments were received during the comment period ending October 19, 2018. A summary of written comments is provided in Appendix B.

Concurrence Point 1: Concurrence Point 1 for Project R-5808 was reached on February 21, 2019. The agreed upon study area and purpose and need for the project are as follows:

The proposed study area is a 1,000-foot wide corridor, 500 feet on either side of the U.S. 158 centerline, from Acorn Hill Road to the Pasquotank County Line as shown on the attached map.

Facility Deficiency (primary need): The existing traveled way and graded shoulders on U.S. 158 are below the minimum width for a roadway with a design speed of 60 mph and design volume above 2000 vehicles per day as listed in the NCDOT Roadway Design Manual and the AASHTO “A Policy on Geometric Design of Highways and Streets” (2011). Edges of the paved roadway have also been observed to be deteriorating due to unstable slopes and burrowing animals.

Hurricane evacuation (secondary need): U.S. 158 is a hurricane evacuation route, but the current facility deficiencies create potential concerns for large vehicles using the road.

Safety (secondary need): The crash rate for the study corridor, 205.73 crashes per 100 million vehicle miles traveled (MVMT), exceeds the critical crash rate (148.81 MVMT). The narrow road width and limited graded shoulder area may be contributing to some animal crashes and run-off the road crashes as the available recovery area for drivers is minimal.

Facility Deficiency (purpose): The purpose of this project is to bring the U.S. 158 corridor adjacent to the Refuge up to NCDOT and AASHTO standards and stabilize the slopes along the roadway from Acorn Hill Road to the Pasquotank County Line.

Hurricane evacuation (other desirable outcome): Another desirable outcome is to improve the hurricane evacuation route for vehicles along U.S. 158.

Safety (other desirable outcome): Another desirable outcome of this project is to improve safety along this section of the U.S. 158 corridor.

Concurrence Point 2: One detailed study alternative, Widen South, was proposed to be carried forward at the meeting held on February 21, 2019. The Merger Team asked NCDOT to also evaluate a Widen North alternative. Estimated impacts of the Widen North alternative were evaluated following the February 21 meeting and presented to the Merger Team at the April 18, 2019 meeting. Concurrence Point 2 for Project R-5808 was reached on April 18, 2019. The agreed upon alternatives to carry forward were:

- Alternative 1: Widen to the south, holding the northern right of way line and side slopes.
- Alternative 2: Widen to the north outside of the Refuge and widen to the south within the Refuge.
- Alternative 3: Widen to the north within NCDOT right-of-way with remaining widening to the south.
- No Build Alternative: Although the No Build Alternative does not meet purpose and need, it is recommended to be carried forward for comparison.

Concurrence Point 2A: Concurrence Point 2A for Project R-5808 was reached on April 18, 2019. The agreed upon major hydraulic structures were:

- Site 1 – Remove the existing double 12-foot by 6-foot reinforced concrete box culvert and replace with a triple 13-foot and 3-inch by 6-foot and 9-inch aluminum box culvert, buried one -foot.

Concurrence Point 3 and 4A Meeting (April 2020): During the joint C.P. 3/C.P. 4A Merger Meeting in April 2020, NCDOT outlined the estimated impacts of the three alternatives, and recommended Alternative 1: widening U.S. 158 to the south along the entire project limits. The three alternatives, the assumed buffer areas used to estimate impacts, and the estimated impacts to environmental resources (including the Great Dismal Swamp National Wildlife Refuge) are outlined in detail in **Table 1**.

During the April 2020 meeting, the Merger Team members except the US Army Corps of Engineers (USACE) and the Environmental Protection Agency (EPA) supported Alternative 1 as the LEDPA. USACE indicated that without definite proof that Alternative 2—which has the least amount of impacts to waters of the US—was not practicable, the USACE would be unable to support Alternative 1 as the LEDPA. EPA deferred their decision regarding the LEDPA until USACE was more comfortable with the LEDPA decision. NCDOT’s explanation for preferring Alternative 1 is summarized in the attached C.P. 3/C.P. 4A Meeting Minutes. At the conclusion of the meeting, USACE and EPA requested additional time to review the materials provided and coordinate with NCDOT. A summary of the April 2020 C.P. 3 and C.P. 4A meeting is included in **Appendix C**.

2. Merger Concurrence Point 3 – Preferred Alternative

2.1 No Build Alternative

The No Build Alternative is a baseline comparative alternative. The No Build Alternative would continue typical maintenance activities but would not make any substantial improvements to the U.S. 158 corridor. The No Build Alternative would not incur any right of way or construction costs. There would be no disruptions caused by construction. There would be no impacts to streams, wetlands, other natural and cultural resources, residences, or businesses, although continued shoulder and slope destabilization may have impacts on adjacent natural resources. The No Build Alternative would not meet the purpose of the project. Although the No Build Alternative would not meet the project purpose, it is recommended to be retained for additional screening to provide a basis for comparing the adverse effects and benefits of the detailed study build alternatives.

2.2 Build Alternative Typical Section

For all build alternatives, the proposed typical section for Project R-5808 includes two 12-foot lanes with 4-foot paved and 6-foot graded shoulders. Side slopes of 3:1 are proposed in the widening sections. Where the design proposes to hold the existing side slope (on the north side in Alternatives 1 and 2, and on the south side in Alternative 2 outside the Refuge) some small amount of fill will need to be added to the existing slope close to the edge of the roadway and within the existing right-of-way to tie to the existing slope.

To stabilize the existing side slopes on the north side of the roadway, rip rap is proposed to be installed on the slope in deteriorating areas within open water. A preliminary evaluation of the open water areas along the north side of the corridor estimated the water to be approximately 3 feet deep at the existing toe of slope. For permitting purposes, USACE and NCDWR will regard the placement of rip rap within a jurisdictional feature as fill.

2.3 Definition of Impact Areas

Buffers to estimate the impact area footprint were applied to each alternative since designs are conceptual and do not include drainage or utility impacts. In sections where the right-of-way and side slopes are proposed to be held, it was assumed no drainage or utility relocations would be needed, but a

2.5 Alternative 2

Alternative 2 proposes to widen the roadway to the north by holding the southern right-of-way line and side slopes west of the Refuge (see **Exhibit 2**). Rip rap will be used on the proposed fill slope to maintain slope stability; impacts of this rip rap placement are already included within the buffer calculation. Where U.S. 158 runs adjacent to the Refuge, Alternative 2 proposes to widen to the south and maintain the existing northern side slope, as proposed in Alternative 1 (see **Exhibit 1**). Rip rap is proposed in areas of open water on the northern side slope, partially outside the 10-foot buffer, and has therefore been added to the total impact quantity.

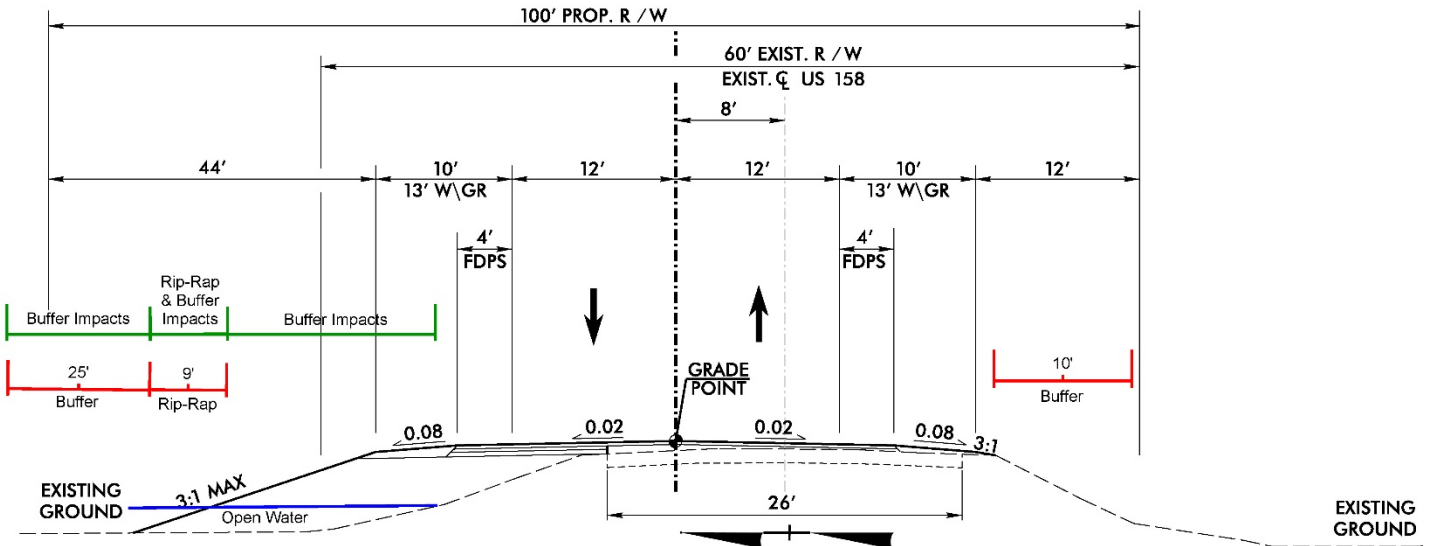


Exhibit 2. Alternative 2 Proposed Typical Section West of the Refuge

2.6 Alternative 3

Alternative 3 proposes to widen the roadway symmetrically west of the Refuge (see **Exhibit 3**). Where U.S. 158 runs adjacent to the Refuge, this alternative proposes to only widen to the north to the extent possible while maintaining the permanent fill impacts within NCDOT ROW (approximately 4 feet). The remainder of the widening (approximately 5 feet) is proposed to the south (see **Exhibit 4**). Rip rap (rock plating or a combination of rock embankment) will be used on the proposed fill slopes to maintain slope stability; impacts of this rip rap placement are already included within the buffer calculation.

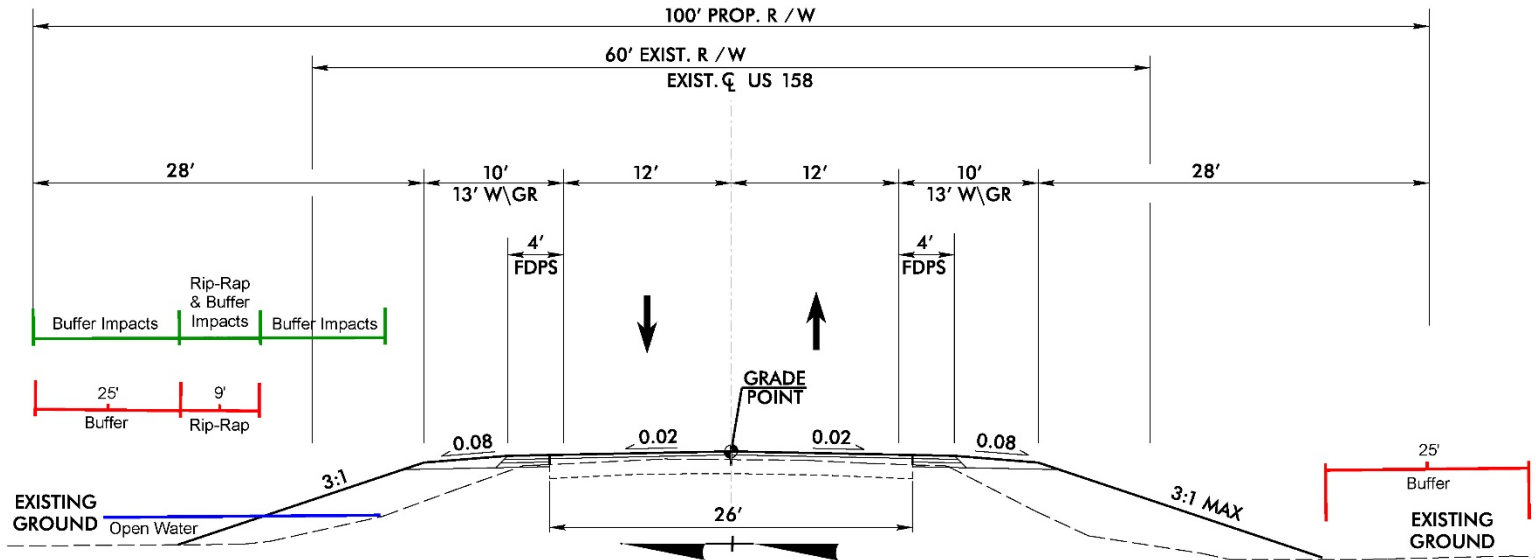


Exhibit 3. Alternative 3 Proposed Typical Section West of the Refuge

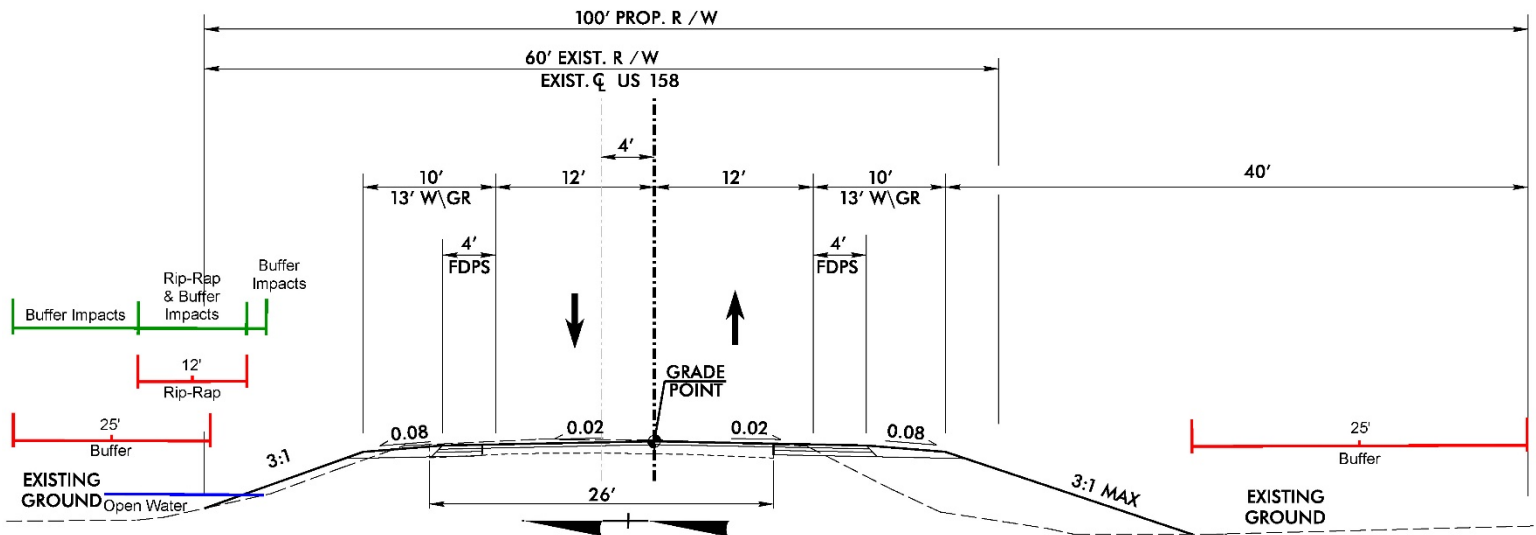


Exhibit 4. Alternative 3 Proposed Typical Section Adjacent to the Refuge

2.7 Anticipated Impacts

Impacts anticipated from the three build alternatives are summarized in **Table 1**. More detailed tables are provided in **Appendix A**. In addition to the impacts described in the April 2020 Merger Meeting, NCDOT has outlined additional considerations such as construction methods and work zone traffic control in more detail based on coordination with USACE and EPA. These considerations are summarized in **Table 1** and described in more detail following **Table 1**. Additional detail can also be found in **Appendix D**, the LEDPA

justification document prepared by NCDOT in March 2021. Since none of the agencies supported Alternative 3 as LEDPA during the April 2020 Merger meeting, the additional coordination and technical considerations focused on these two alternatives only and excluded Alternative 3 from evaluation of the additional considerations. The considerations that were not evaluated for Alternative 3 are indicated with “N/A” in **Table 1**.

The project was separated into three sections to compare alternatives: Section 1 (West) – Acorn Hill Road to the western boundary of the Refuge (approximately 1.9 miles), Section 2 (Refuge) – U.S. 158 segment adjacent to the Refuge (approximately 1.9 miles), and Section 3 (East) – eastern boundary of the Refuge to the eastern project terminus in Pasquotank County (approximately 0.2 miles).

Table 1. Summary of Anticipated Impacts to Jurisdictional Features

Resource		Alternative 1	Alternative 2	Alternative 3
Wetlands	West	8.5 acres	6.1 acres	11.4 acres
	Refuge	5.4 acres	5.5 acres	5.4 acres
	East	1.3 acres	1.3 acres	1.1 acres
	Total	15.2 acres	12.8 acres	17.9 acres
Streams	West	180 linear feet	155 linear feet	165 linear feet
	Refuge	0	0	0
	East	0	0	0
	Total	180 linear feet	155 linear feet	165 linear feet
Open Water	West	0 acres	0.6 acre	0.3 acres
	Refuge	2.4 acres*	2.4 acres*	5.2 acres
	East	0.3 acres*	0.3 acres*	0.7 acres
	Total	2.8 acres*	3.3 acres*	6.2 acres
Great Dismal Swamp National Wildlife Refuge (Section 4(f), Federal Land, and subject to USFWS Compatibility)		<ul style="list-style-type: none"> Potential temporary direct impacts for construction within the Refuge (10-foot buffer) 	<ul style="list-style-type: none"> Potential temporary direct impacts for construction within the Refuge (10-foot buffer) 	<ul style="list-style-type: none"> Potential temporary direct impacts for construction within the Refuge (25-foot buffer) Potential permanent direct impacts due to placement of fill and relocation of existing ditch/drainage system within the Refuge
Construction Cost		\$28.0 Million	\$33.6 Million	N/A
Construction Duration		36-48 months	12+ Additional months	N/A
Construction Methods		<ul style="list-style-type: none"> Undercut and backfill with suitable material Standard construction equipment. See Exhibit 5 	<ul style="list-style-type: none"> Undercut and backfill with suitable material In areas of open water, cofferdams will be used in 200' segments to allow for dewatering and undercutting Larger construction equipment See Exhibit 6 	N/A
Backfill Material		Select Material (sand gradation soil)	Class VII Material (blasted rock material with >50% diameter of 1.5' – 3', 30% diameter 2" – 1.5', and <20% diameter 2")	N/A
Hauling Distance for Backfill		Locally sourced	Regionally sourced (Sims, Wilson County ~ 125 miles)	N/A
Work Zone Traffic Control		<ul style="list-style-type: none"> Daily lane closures during construction Manual flagger and barrels Both lanes open during night-time hours. 	<ul style="list-style-type: none"> 24/7 lane closures during construction Automated flagger and concrete barriers 	N/A
Safety (Expected Crashes over 6 year time period)		52 (17% increase over No Build) Due to work zone present and lane closures	67 (46% increase over No Build) Due to work zone present, lane closures, and barrier present	82 (91% increase over No Build) Due to work zone present, lane closures, and barrier present
Mitigation Costs		\$1.86 Million	\$1.57 Million	\$2.19 Million

NOTE 1: Stream Impacts are rounded to the nearest 5-foot increment, wetland and open water impacts are rounded to the nearest 0.1 acre.

NOTE 2: Table 1 in the previous Merger packet included a potential for indirect impacts due to permanent placement of fill in jurisdictional features north of U.S. 158 which are well connected to the resources within the Refuge and the larger system. However, this has since been removed based on coordination with USACE and EPA and should no longer be considered in the determination of the LEDPA.

Highlighted text has been updated or added to Table 1 since the April 2020 Merger Meeting.

*Alternative 1 and Alternative 2 impacts include impacts due to the addition of rip rap (fill) on the existing side slope and outside of the 10-foot buffer and are in addition to the impacts estimated within the 10-foot buffer.

Great Dismal Swamp National Wildlife Refuge Impact Considerations

- As a recreational and wildlife refuge resource, the Refuge would be considered a Section 4(f) resource.
- As a federally owned property that is managed by the USFWS, property acquisition within the Refuge would require that the federal land transfer process (23 CFR § 710.601) be followed.
- As a property on the National Refuge System, USFWS would determine if this project is an appropriate use through the Compatibility Process (603 FW 2).
- Additional evaluation is needed to determine the effects of widening to the north on the water flow and water management (collaborating with the Newland Water Management District), the water control structure, and open water habitat. Additional design would be needed to calculate detailed impacts and determine if there are construction-related issues of widening within open water.
- Note that the previous Merger packet included a discussion about the potential for indirect impacts due to permanent placement of fill in jurisdictional features north of U.S. 158 which are well connected to the resources within the Refuge and the larger system. However, this has since been removed based on coordination with USACE and EPA and should no longer be considered in the determination of the LEDPA.

Dewatering

Alternative 2 is anticipated to require dewatering of small segments along the north side of U.S. 158 using cofferdams. Dewatering of the entire area by using existing risers on USFWS property, or east of the property, is not anticipated to be feasible due to multiple factors including the inability of the water control measures to drain the water to a sufficiently low level for construction; the lack of jurisdictional control over the water control measures outside of and to the east of the Refuge which is operated by the Newland Water Management District; and the potential for an increase of impacts to the Refuge by lowering the water level.

Preliminary calculations support the assertion that even if the risers were temporarily removed or a pipe was installed to temporarily drain the swamp, lowering water levels would not be practicable. With an estimated drainage area of the Dismal Swamp of 5.26 sq. miles, and an assumed average depth of 3 feet, and assuming 100% capacity at the drainage pipe, it would take 80 days to drain the water with a 36" pipe and 25 days using a 60" pipe. Note – these calculations only serve to indicate the magnitude of water involved. The precise drainage topography and connectivity of the canal and the swamp are not known. Given the amounts of water and time durations indicated for any useful drawdown, the efforts to construct a more accurate HEC-RAS hydraulic model is not warranted.

Construction Methods, Cost, and Duration

Based on the preliminary design and the limits of the delineated open water, eight individual cofferdams are anticipated to be required for construction of Alternative 2. No dewatering or cofferdams are anticipated to be required in Alternative 1. To comply with the work zone traffic control safety guidelines, the cofferdams would be no longer than 200 feet in length. The area needing to be dewatered is approximately 1,600 linear feet in length and covers an approximately 0.6-acre area.

Both Alternative 1 and 2 are anticipated to require the undercut and replacement of existing material with suitable material. The difference between the two alternatives is in the type of suitable material which will be needed. In Alternative 1, the undercut operation would result in a confined space that could be filled with select material, anticipated to be a sand gradation soil in this area (see **Exhibit 5**). Since Alternative 2 would conduct some of the undercut and backfill operations in open water areas which would not be confined, a Class VII Material would be required (see **Exhibit 6**). This material is specified to consist at least 50% of blasted rock material with a diameter of 1.5 to 3 feet, 30% with a diameter of 2 inches to 1.5 feet, and less than 20% of the material with a diameter less than 2 inches. This material

would have an approximate cost of \$145 per cubic yard. This material would not be able to be sourced locally like the select material and is anticipated to require trucking from the nearest quarry in Sims, Wilson County, approximately 125 miles away.

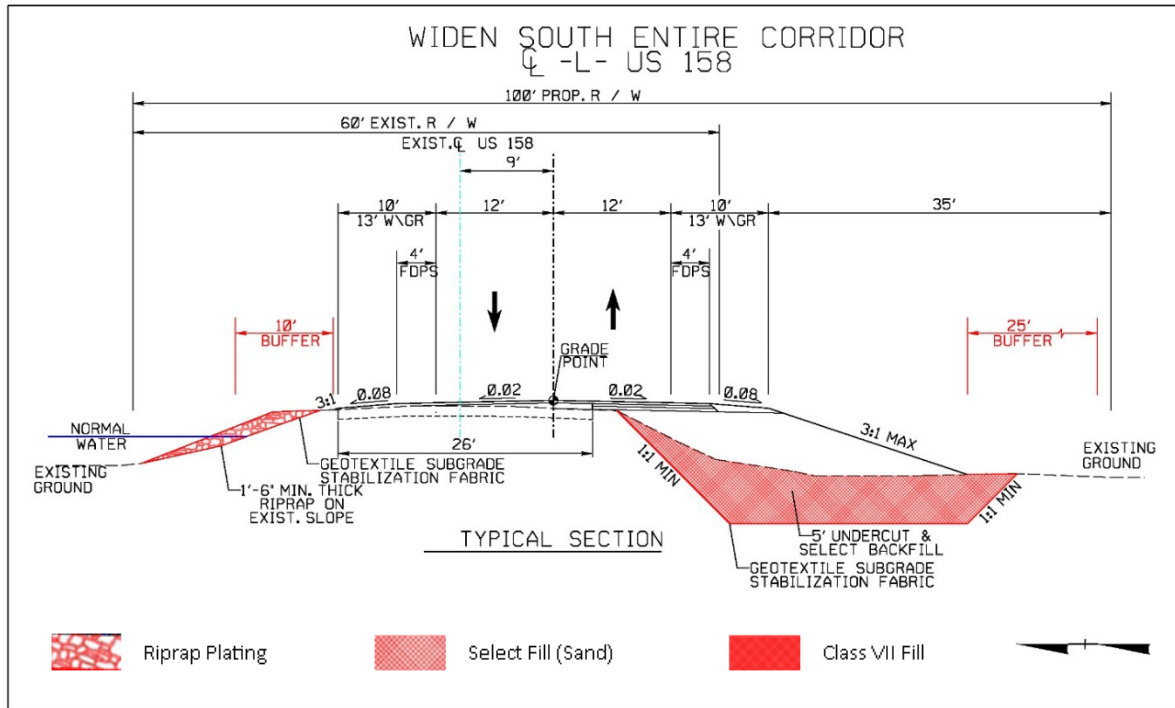


Exhibit 5. Alternative 1 Construction Methods and Undercut/Backfill Areas

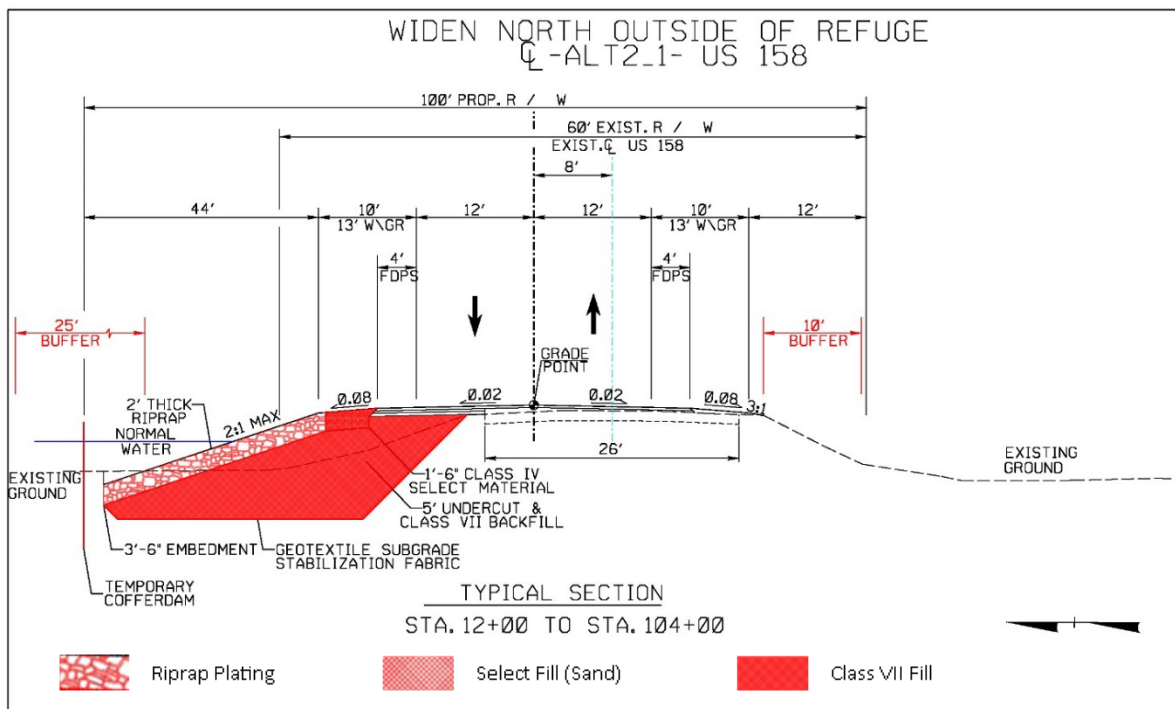


Exhibit 6. Alternative 2 Construction Methods and Undercut/Backfill Areas

Considering the addition of dewatering procedures and backfill with Class VII material to the construction methods of Alternative 2, as compared to Alternative 1, it is anticipated to increase the duration of construction by at least twelve months and the cost by 20%. Construction duration is of particular concern because US 158 is a designated hurricane evacuation route. Increased construction duration of twelve months would span up to two additional hurricane seasons over which construction could reduce evacuation efficiency.

Work Zone Traffic Control

Due to the use of dewatering procedures and cofferdams in Alternative 2, concrete barriers would be required to separate the work zone from traffic. The use of concrete barriers would then require 24/7 lane closures and use of an automated flagger system to control traffic on the one lane road throughout construction. Alternatively, in Alternative 1 lane closures could be limited to daytime operations during construction with the use of barrels to separate traffic from the work zone. A manual flagger could then be used in Alternative 1.

Safety

Table 2 provides a summary of expected crashes over a 72-month (i.e., 6-year) duration using Crash Modification Factors (CMFs) out of the Highway Safety Manual. The 72-month period accounts for the potential impacts to safe traffic operations during construction (i.e., influence of different work zone conditions/constraints) as well as the expected safety benefits associated with the proposed project improvements.

Table 2. Predictive Crash Analysis

Scenario	Crashes expected over 72 months			% Increase from Alternative 1		
	Injury	PDO*	Total	Injury	PDO*	Total
No Work-zone	14	29	43	-13%	-19%	-17%
Alternative 1	16	36	52	-	-	-
Alternative 2	20	47	67	25%	31%	29%
Alternative 3	23	59	82	44%	64%	58%

*PDO – Property Damage Only

NCDOT will strive to make any construction method and traffic configuration as safe as possible. There are however some inherent risks with different construction methods and traffic configurations. As with construction cost increases, the focus of this table is the percentage increase over the background number of crashes (No Work Zone). The CMFs applied to each alternative that increase the expected number of crashes include: “Work Zone Present”; “Lane Closures with Flagger Present” (which was applied to daytime hours of Alternative 1 and 24/7 operations to Alternatives 2 and 3); and “Barrier Present on Shoulder” in Alternatives 2 and 3. Once construction is completed on the alternatives there are CMFs applied for the “Widened Shoulders” that serve to reduce the expected crashes for the remainder of the 72-month duration. Note, this table was produced assuming the extended construction time associated with Alternative 2 as compared to Alternative 1.

Mitigation Costs

NCDOT recognizes that avoidance and minimization of jurisdictional wetland and stream impacts is of primary importance when developing and selecting a preferred project alternative. However, when final preferred alternative/LEDPA determinations are being made it is also prudent to calculate, consider, and compare the anticipated mitigation costs between alternatives. **Table 3** lists the anticipated wetland mitigation costs for each detail study alternative.

Table 3. Anticipated Mitigation Costs with and without Buffer

Alternative	Wetland Impacts w/ Buffer (10' or 25', depending on location) (from CP 3/4A Packet)	Wetland Impacts w/o Buffer
1	15.2 ac \$1,860,000	6.6 ac \$810,000
2	12.8 ac \$1,570,000	4.9 ac \$600,000
3	17.9 ac \$2,190,000	5.6 ac \$690,000

Note - all costs factor in a 2:1 mitigation ratio

2.8 NCDOT Recommended Alternative

NCDOT recommends Alternative 1. Although Alternative 1 has greater impacts to streams (difference of 25 feet) and wetlands (difference of 2.4 acres) than Alternative 2, NCDOT has considered the following benefits of Alternative 1:

- Lower potential for permanent direct impacts to the Great Dismal Swamp National Wildlife Refuge
- Fewer open water impacts
- Lower risk of future slope degradation and settlement due to construction in more suitable soils resulting in:
 - Less frequent impacts to surrounding environment during maintenance activities
 - Less cost to maintain
- Greater use of standard construction equipment and practices resulting in:
 - Shorter construction duration
 - Less disruption to traffic during construction
 - Safer work zone environment
 - Smaller footprint and impact to environmental resources
 - Lower cost to construct

3. Merger Concurrence Point 4A – Avoidance and Minimization Measures

NCDOT has attempted to avoid and minimize impacts to water resources during development of the preliminary functional designs by applying the following strategies:

Alternative 1

- An offset widening rather than symmetrical widening was used, resulting in fewer environmentally sensitive areas being affected by construction.
- Avoided permanent impacts within the Refuge by shifting the alignment.
- Fill embankments with 3:1 slopes were applied along the entire corridor rather than the original 6:1 slopes envisioned to reduce impacts to natural/environmental resources.

Alternative 2

- An offset widening rather than symmetrical widening was used, resulting in fewer environmentally sensitive areas being affected by construction.
- Avoided permanent impacts within the Refuge by shifting the alignment.
- Shifted the roadway alignment to minimize wetland impacts.
- Fill embankments with 3:1 slopes were applied along the entire corridor rather than the original 6:1 slopes envisioned to reduce impacts to natural/environmental resources.

Alternative 3

- Alternative 3 was developed to reduce wetland impacts across from the Refuge and investigated a third option (symmetrical widening) west of the Refuge.
- Shifted the roadway alignment to minimize wetland impacts.
- Fill embankments with 3:1 slopes were applied along the entire corridor rather than the original 6:1 slopes envisioned to reduce impacts to natural/environmental resources.

In addition, NCDOT will continue to refine the alignment of the LEDPA to further minimize impacts to streams and wetlands during final design.

4. Schedule

- Categorical Exclusion – Summer 2021
- C.P. 4B and 4C Meeting – Fall 2021
- Submit Permit Application – Fall 2021
- Begin Right of Way Acquisition – Fall 2021
- Construction – FY 2023

Figures

Figure 1: Vicinity Map

Figure 2: Anticipated Impacts Cover Map

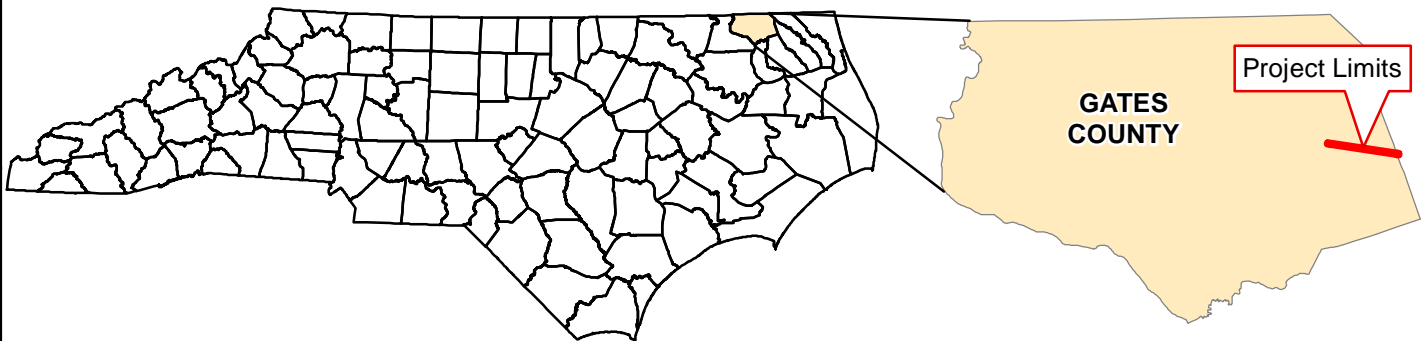
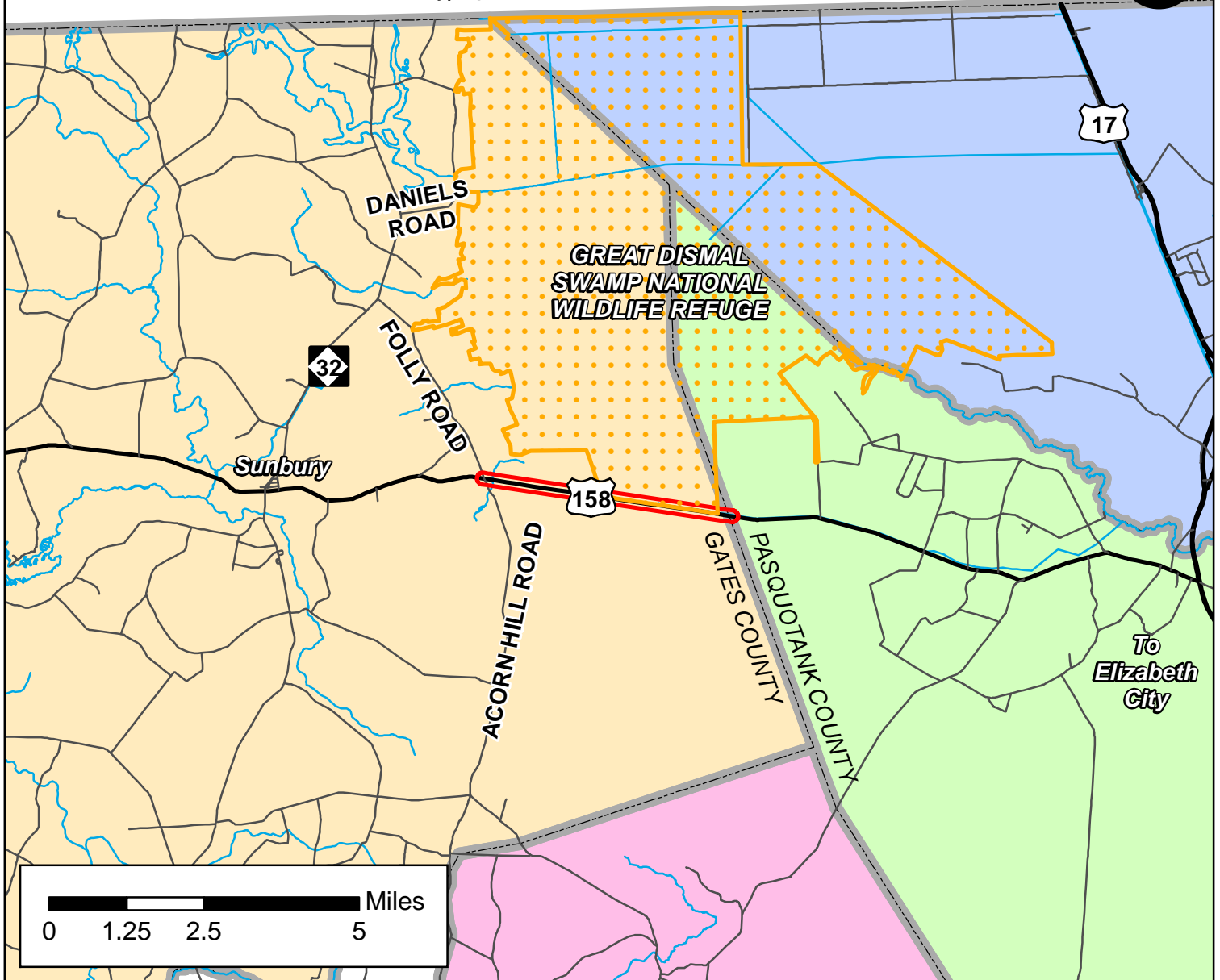
Figure 2.0.A-G: Impact Areas Map

Figure 2.1.A-G: Alternative 1 Impacts Map

Figure 2.2.A-G: Alternative 2 Impacts Map

Figure 2.3.A-G: Alternative 3 Impacts Map

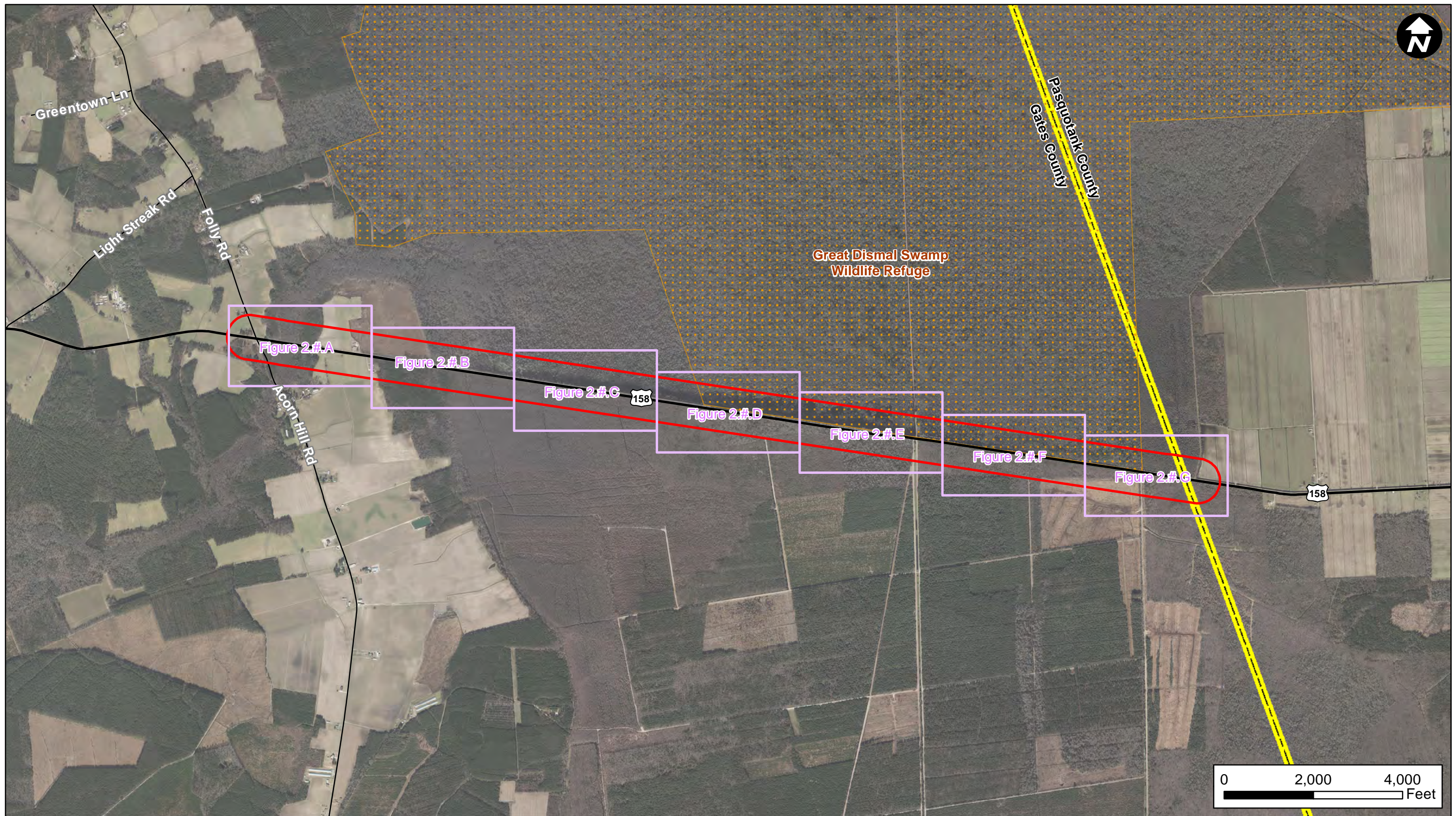
VIRGINIA STATE LINE







- Great Dismal Swamp National Wildlife Refuge
- Study Area
- Streams (NCDEQ)
- County Boundary

- Camden County
- Gates County
- Pasquotank County
- Perquimans County

Figure 1: Vicinity Map
NCDOT Project No. R-5808
Improvements to U.S. 158
Gates County



-  Figure 2.A-2.G Extents
-  Project Study Area
-  Great Dismal Swamp National Wildlife Refuge

 County Line

0 2,000 4,000
Feet

Figure 2 Anticipated Impacts Map
NCDOT Project No. R-5808
Improvements to U.S. 158
Gates County

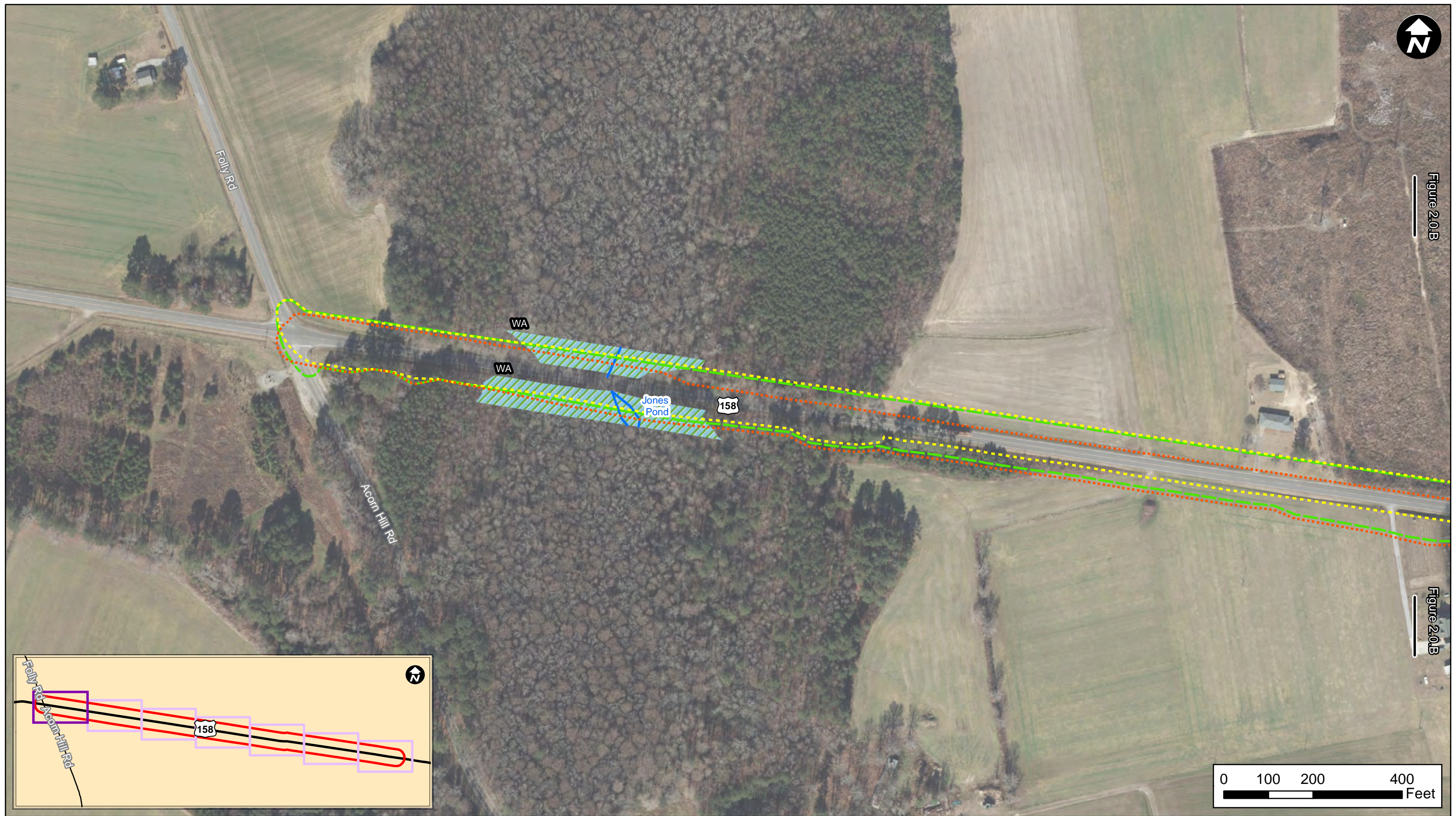


Figure 2.0.B

Figure 2.0.B



- Alternative 1 Impact Area
- Alternative 2 Impact Area
- Alternative 3 Impact Area
- Delineated Wetlands
- Delineated Streams

Figure 2.0.A Anticipated Impacts Map
 Impact Areas
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County

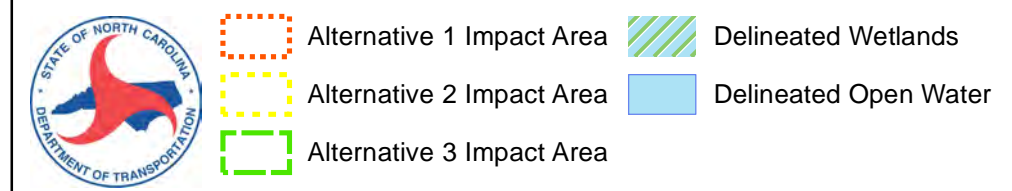
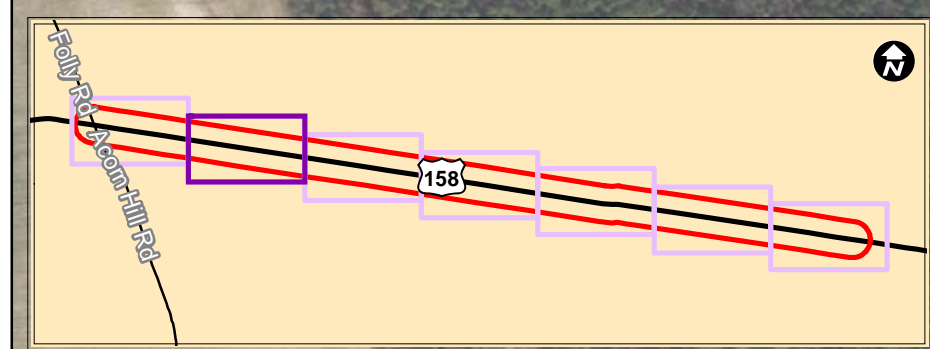
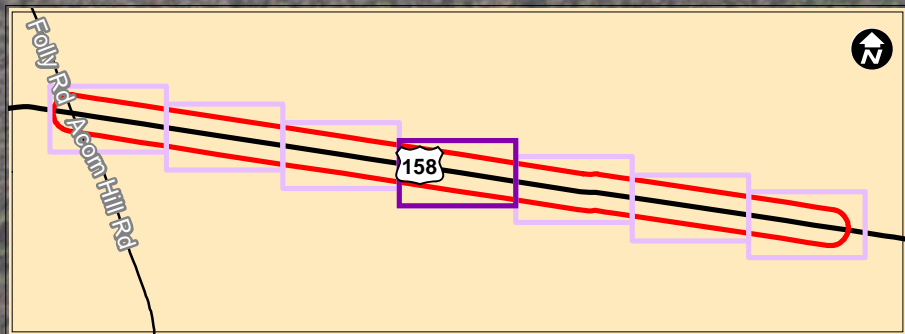


Figure 2.0.B Anticipated Impacts Map
 Impact Areas
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County



- Alternative 1 Impact Area
- Alternative 2 Impact Area
- Alternative 3 Impact Area
- Delineated Wetlands

Figure 2.0.C Anticipated Impacts Map
 Impact Areas
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County









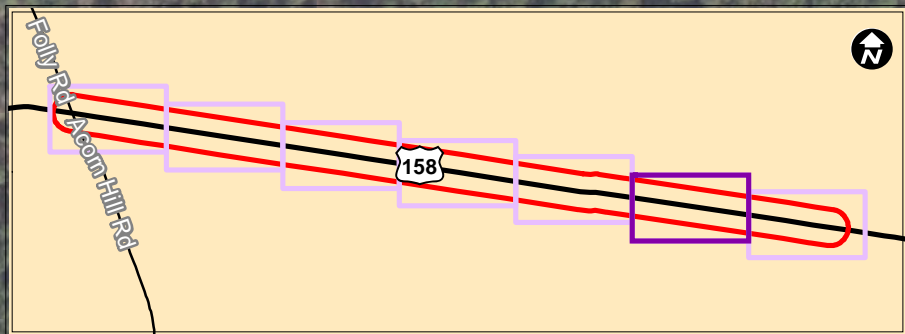
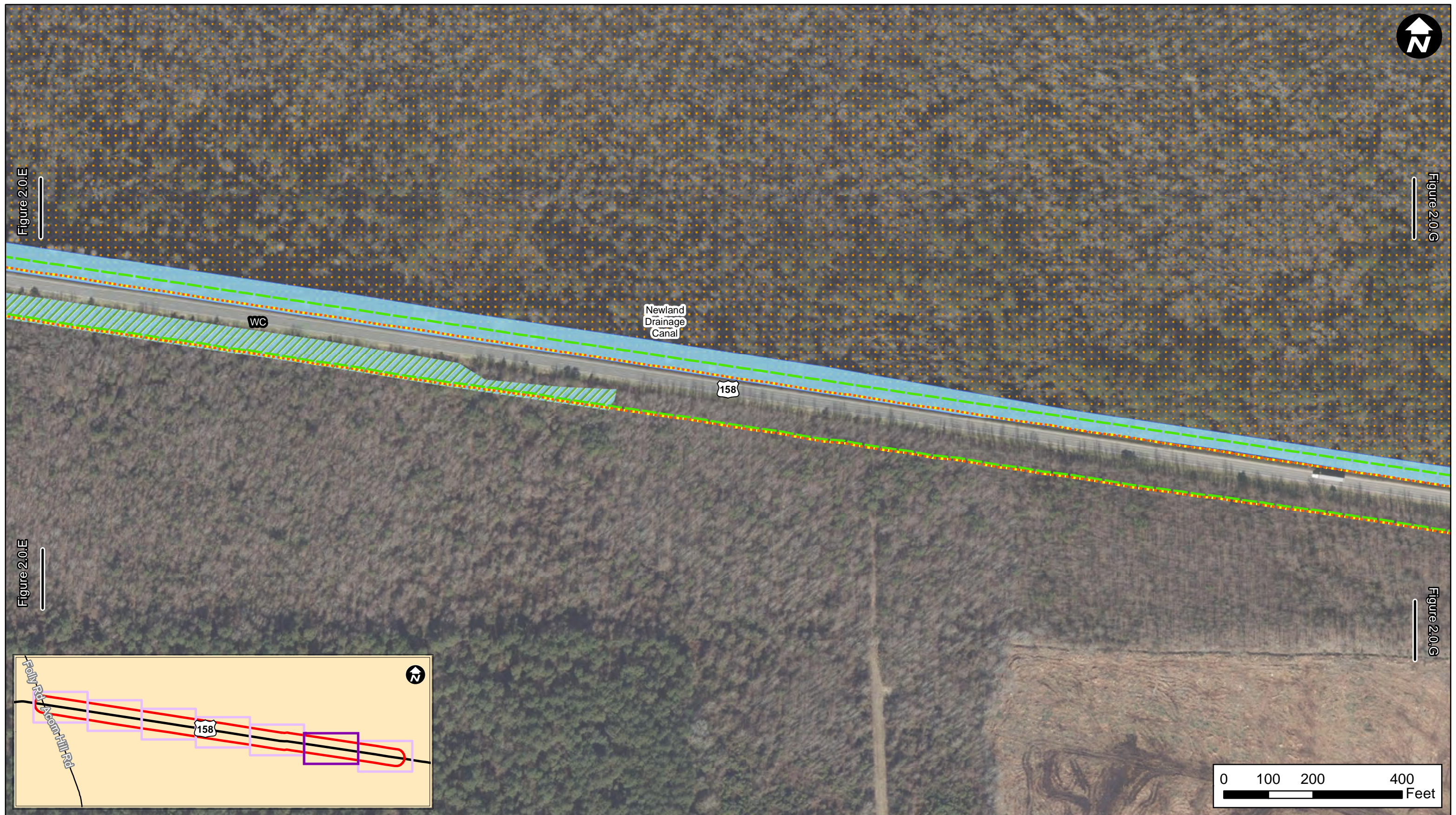
- | | | |
|---|---|---|
|  Alternative 1 Impact Area |  Great Dismal Swamp National Wildlife Refuge |  Delineated Open Water |
|  Alternative 2 Impact Area |  Delineated Wetlands | |
|  Alternative 3 Impact Area | | |

Figure 2.0.D Anticipated Impacts Map
 Impact Areas
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County



- | | | | | | |
|--|---------------------------|--|---|--|-----------------------|
| | Alternative 1 Impact Area | | Great Dismal Swamp National Wildlife Refuge | | Delineated Open Water |
| | Alternative 2 Impact Area | | Delineated Wetlands | | |
| | Alternative 3 Impact Area | | | | |

Figure 2.0.E Anticipated Impacts Map
 Impact Areas
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County









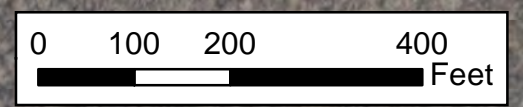
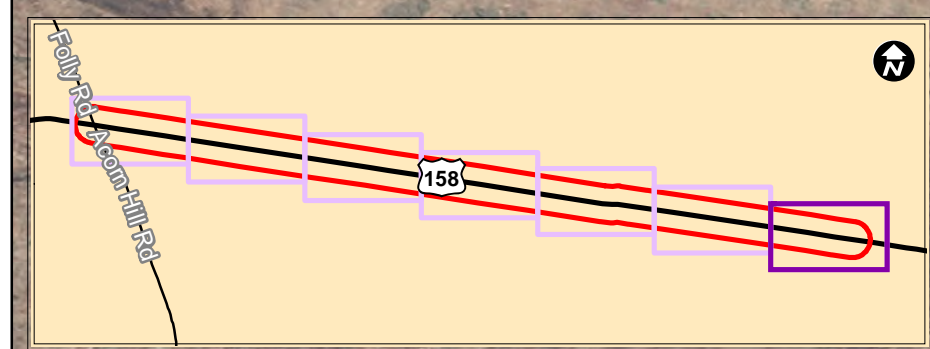
- | | | |
|---|---|---|
|  Alternative 1 Impact Area |  Great Dismal Swamp National Wildlife Refuge |  Delineated Open Water |
|  Alternative 2 Impact Area |  Delineated Wetlands | |
|  Alternative 3 Impact Area | | |

Figure 2.0.F Anticipated Impacts Map
 Impact Areas
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County










- | | | |
|---|---|---|
|  Alternative 1 Impact Area |  Great Dismal Swamp National Wildlife Refuge |  Delineated Open Water |
|  Alternative 2 Impact Area |  Delineated Wetlands |  County Line |
|  Alternative 3 Impact Area | | |

Figure 2.0.G Anticipated Impacts Map
 Impact Areas
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County

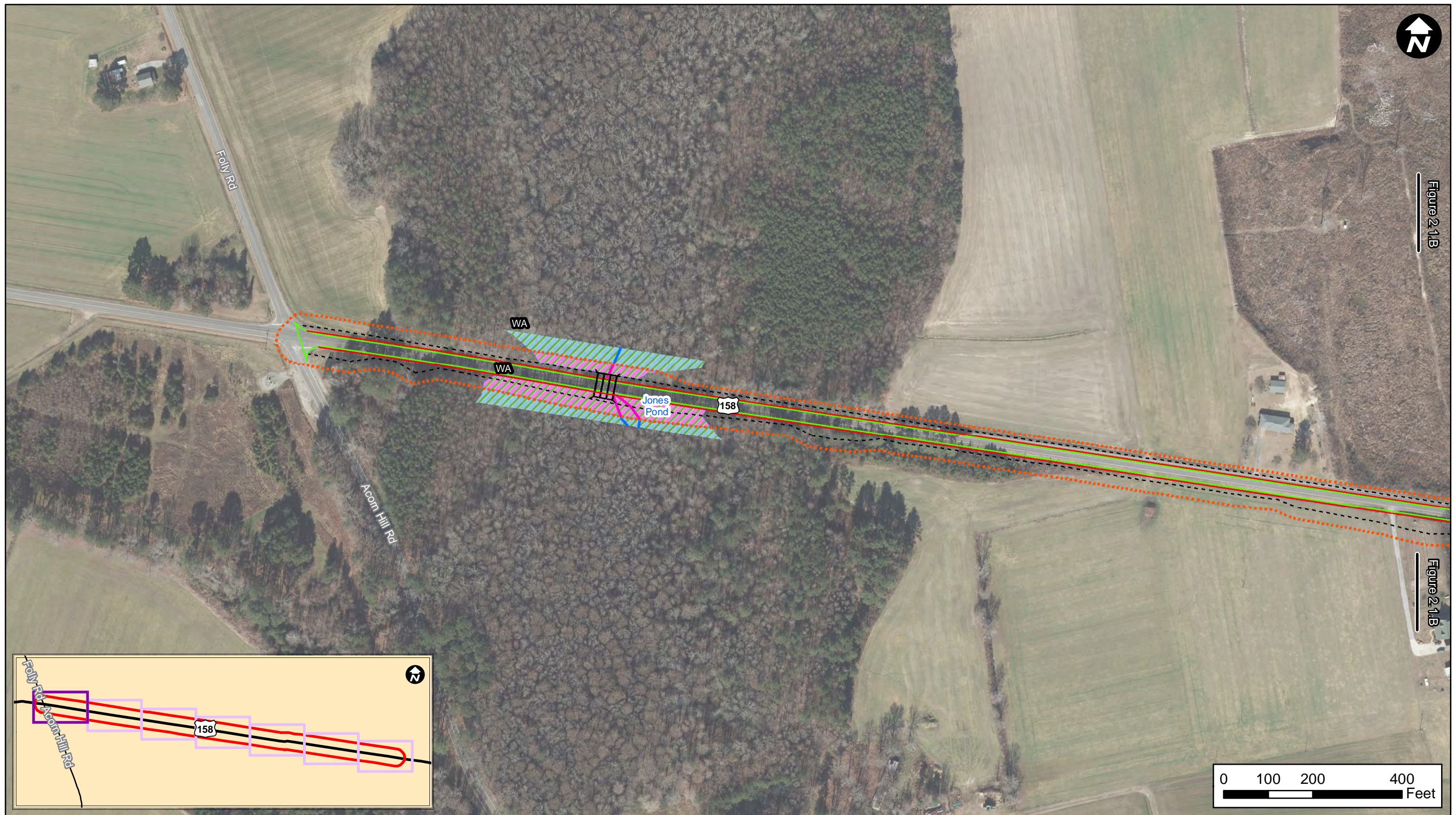
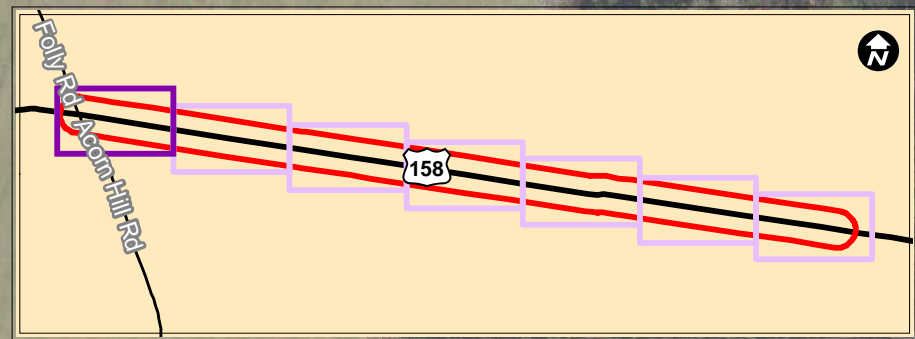


Figure 2.1.B

Figure 2.1.B

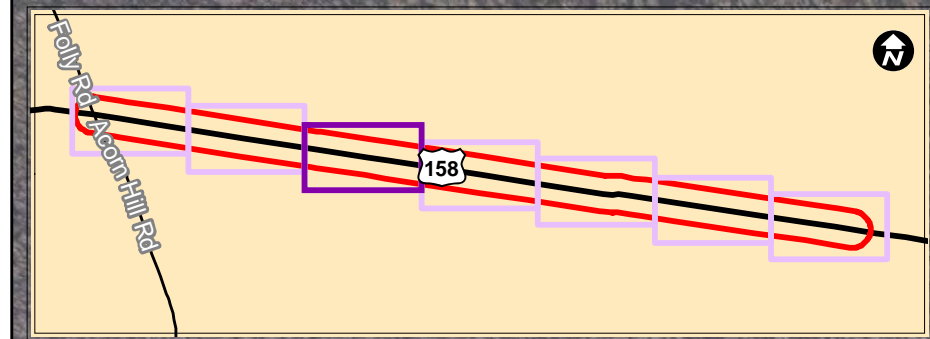


- | | | |
|---|---|---|
| — Proposed Edge of Travel | - - - - Proposed Slope Stakes | Alternative 1 Wetland Impacts |
| — Proposed Paved Shoulder | — Alternative 1 Stream Impacts | Delineated Wetlands |
| — Proposed Roadway Culvert | — Delineated Streams | Alternative 1 Impact Area |

Figure 2.1.A Anticipated Impacts Map
 Alternative 1
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County

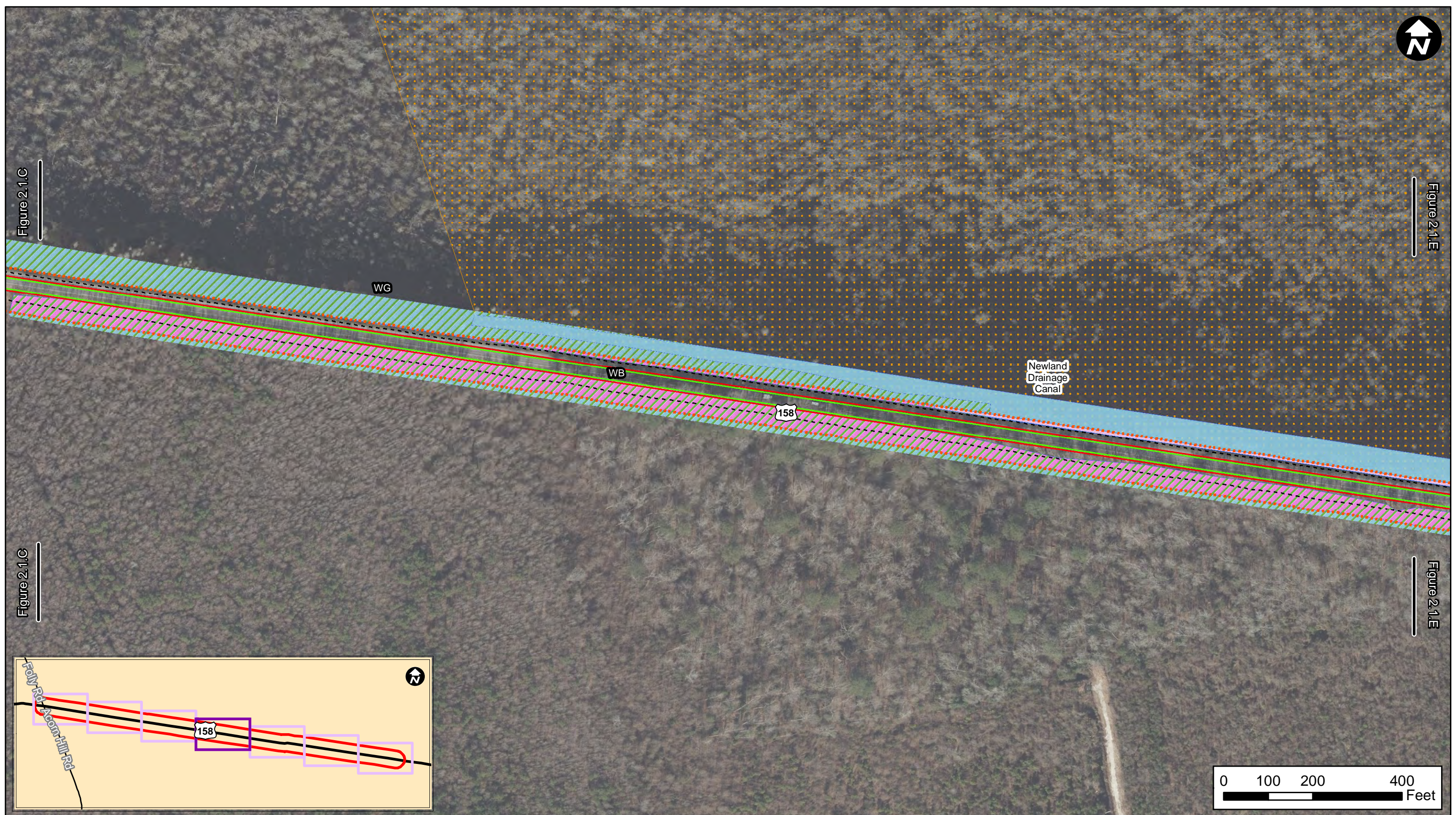


Figure 2.1.B Anticipated Impacts Map
 Alternative 1
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County



	Proposed Edge of Travel		Alternative 1 Wetland Impacts
	Proposed Paved Shoulder		Delineated Wetlands
	Proposed Slope Stakes		Alternative 1 Impact Area

Figure 2.1.C Anticipated Impacts Map
 Alternative 1
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County



<ul style="list-style-type: none"> — Proposed Edge of Travel — Proposed Paved Shoulder - - - - Proposed Slope Stakes 	<ul style="list-style-type: none"> Alternative 1 Open Water Impacts Delineated Open Water 	<ul style="list-style-type: none"> Alternative 1 Wetland Impacts Delineated Wetlands 	<ul style="list-style-type: none"> Great Dismal Swamp National Wildlife Refuge Alternative 1 Impact Area
--	--	--	--

Figure 2.1.D Anticipated Impacts Map
Alternative 1
NCDOT Project No. R-5808
Improvements to U.S. 158
Gates County

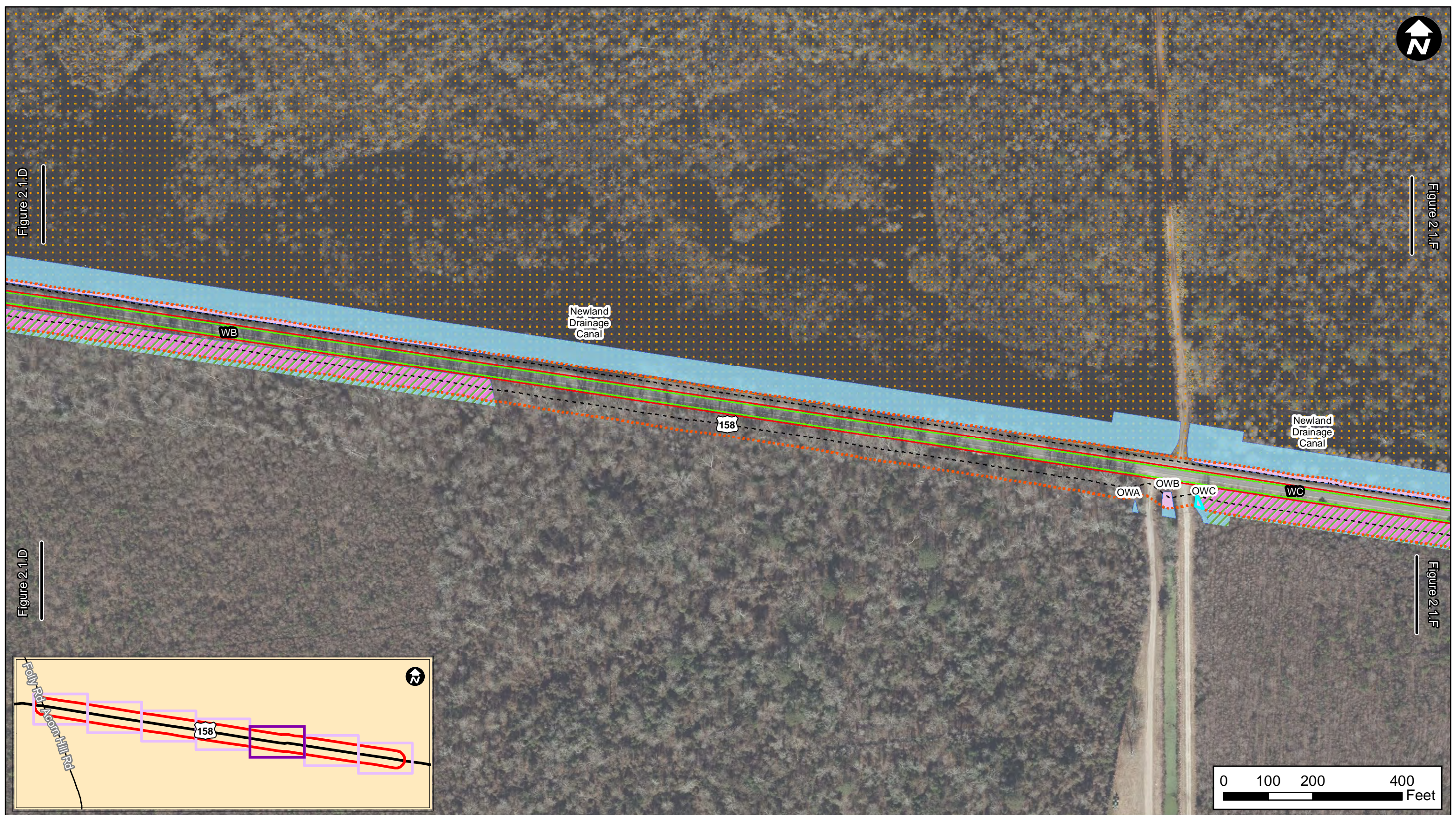
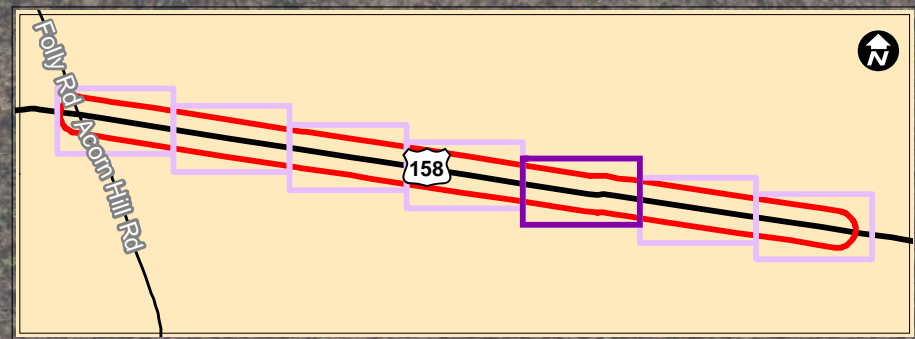


Figure 2.1.D

Figure 2.1.F

Figure 2.1.D

Figure 2.1.F



- Proposed Edge of Travel
- Proposed Paved Shoulder
- - - Proposed Slope Stakes
- Alternative 1 Open Water Impacts
- Delineated Open Water
- Alternative 1 Wetland Impacts
- Delineated Wetlands
- Great Dismal Swamp National Wildlife Refuge
- Alternative 1 Impact Area

Figure 2.1.E Anticipated Impacts Map
 Alternative 1
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County

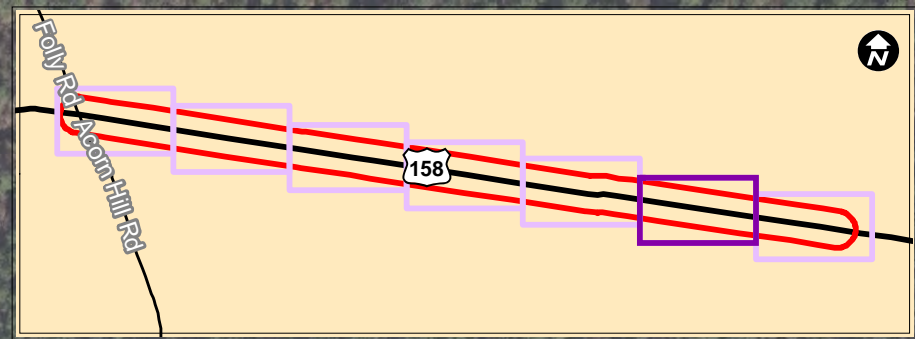


Figure 2.1.E

Figure 2.1.G

Figure 2.1.E

Figure 2.1.G



- | | | | |
|--|---|--|--|
| — Proposed Edge of Travel | Alternative 1 Open Water Impacts | Alternative 1 Wetland Impacts | Great Dismal Swamp National Wildlife Refuge |
| — Proposed Paved Shoulder | Delineated Open Water | Delineated Wetlands | Alternative 1 Impact Area |
| - - - - Proposed Slope Stakes | | | |

Figure 2.1.F Anticipated Impacts Map
 Alternative 1
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County



Proposed Edge of Travel

Proposed Paved Shoulder

Proposed Slope Stakes

County Line

Alternative 1 Open Water Impacts

Delineated Open Water

Alternative 1 Wetland Impacts

Delineated Wetlands

Great Dismal Swamp National Wildlife Refuge

Alternative 1 Impact Area

Figure 2.1.G Anticipated Impacts Map

Alternative 1

NCDOT Project No. R-5808

Improvements to U.S. 158

Gates County

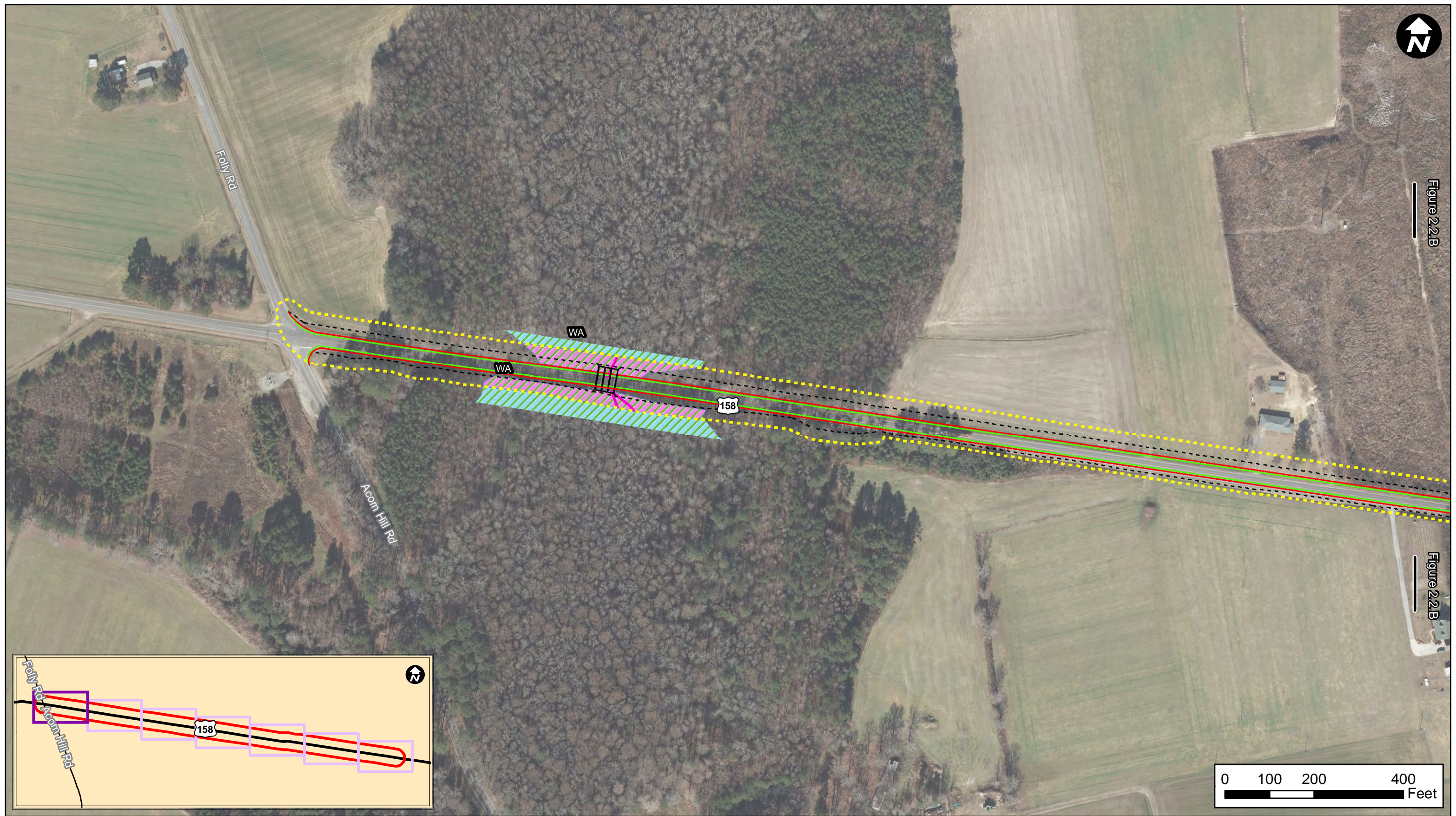
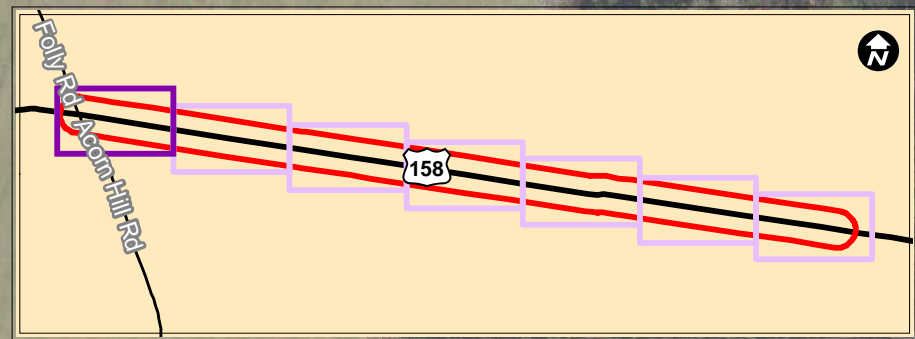


Figure 2.2.B

Figure 2.2.B



- Proposed Slope Stakes
- Proposed Edge of Travel
- Proposed Paved Shoulder
- Proposed Roadway Culvert
- Alternative 2 Stream Impacts
- Delineated Streams
- Alternative 2 Wetland Impacts
- Delineated Wetlands
- Alternative 2 Impact Area

Figure 2.2.A Anticipated Impacts Map
 Alternative 2
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County

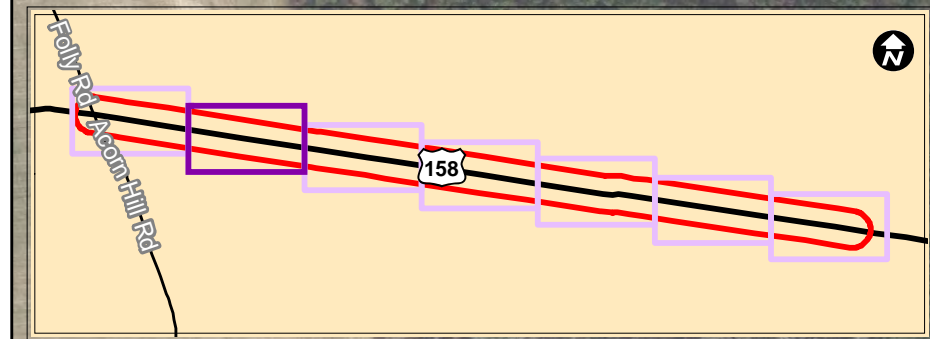


Figure 2.2.A

Figure 2.2.A

Figure 2.2.C

Figure 2.2.C



----- Proposed Slope Stakes

----- Proposed Edge of Travel

----- Proposed Paved Shoulder

----- Delineated Streams

----- Alternative 2 Open Water Impacts

----- Delineated Open Water

----- Alternative 2 Wetland Impacts

----- Delineated Wetlands

----- Alternative 2 Impact Area

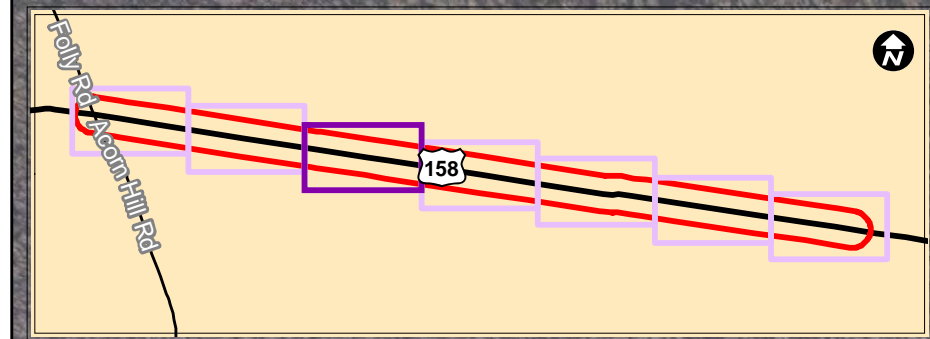
Figure 2.2.B Anticipated Impacts Map

Alternative 2

NCDOT Project No. R-5808

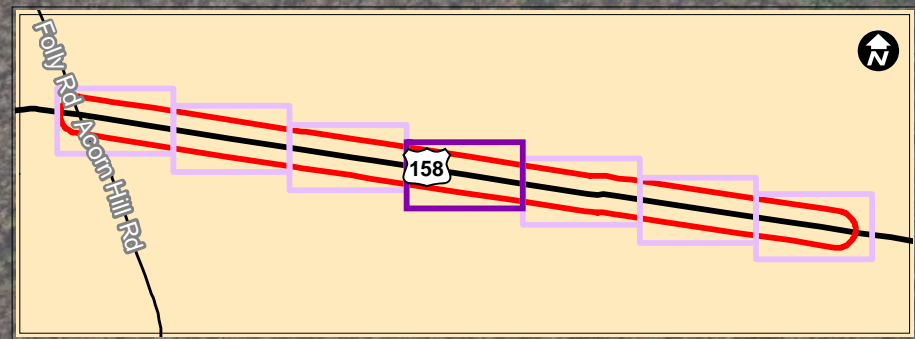
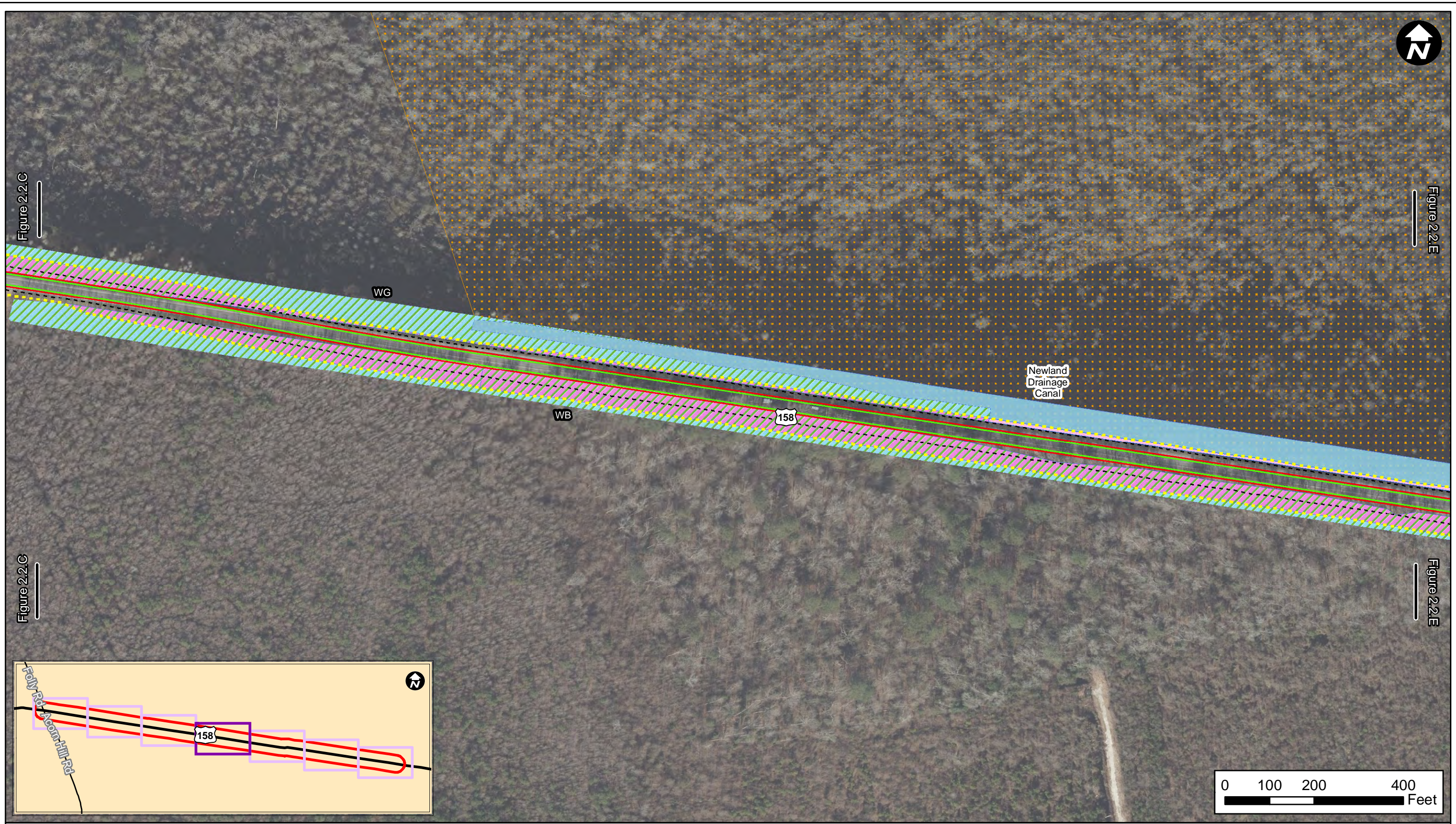
Improvements to U.S. 158

Gates County



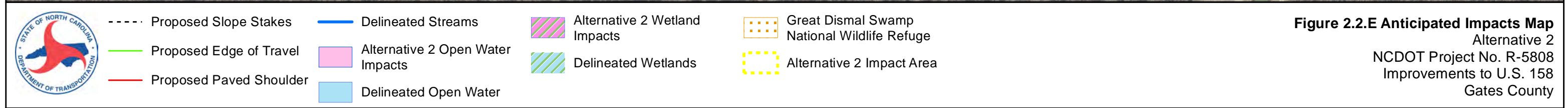
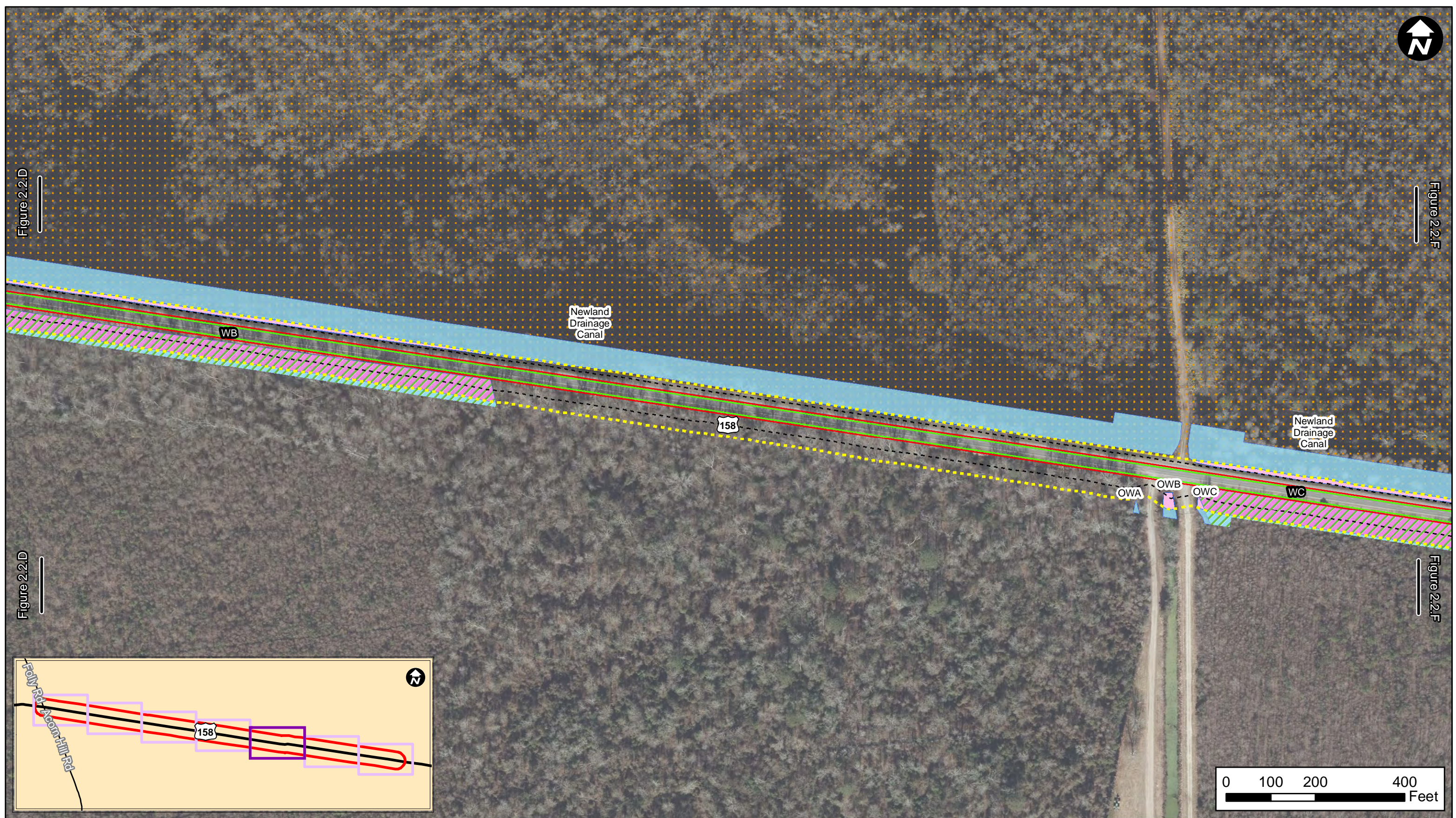
----- Proposed Slope Stakes	— Delineated Streams	Alternative 2 Impact Area
— Proposed Edge of Travel	Alternative 2 Wetland Impacts	
— Proposed Paved Shoulder	Delineated Wetlands	

Figure 2.2.C Anticipated Impacts Map
 Alternative 2
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County



- | | | | |
|-----------------------------|----------------------------------|-------------------------------|---|
| ----- Proposed Slope Stakes | — Delineated Streams | Alternative 2 Wetland Impacts | Great Dismal Swamp National Wildlife Refuge |
| — Proposed Edge of Travel | Alternative 2 Open Water Impacts | Delineated Wetlands | Alternative 2 Impact Area |
| — Proposed Paved Shoulder | Delineated Open Water | | |

Figure 2.2.D Anticipated Impacts Map
 Alternative 2
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County





----- Proposed Slope Stakes

----- Proposed Edge of Travel

----- Proposed Paved Shoulder

----- Delineated Streams

----- Alternative 2 Open Water Impacts

----- Delineated Open Water

----- Alternative 2 Wetland Impacts

----- Delineated Wetlands

----- Great Dismal Swamp National Wildlife Refuge

----- Alternative 2 Impact Area

Figure 2.2.F Anticipated Impacts Map

Alternative 2

NCDOT Project No. R-5808

Improvements to U.S. 158

Gates County



- | | | | |
|-----------------------------|----------------------------------|-------------------------------|---|
| ----- Proposed Slope Stakes | --- County Line | Delimited Open Water | Great Dismal Swamp National Wildlife Refuge |
| --- Proposed Edge of Travel | --- Delimited Streams | Alternative 2 Wetland Impacts | Alternative 2 Impact Area |
| --- Proposed Paved Shoulder | Alternative 2 Open Water Impacts | Delimited Wetlands | |

Figure 2.2.G Anticipated Impacts Map
 Alternative 2
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County

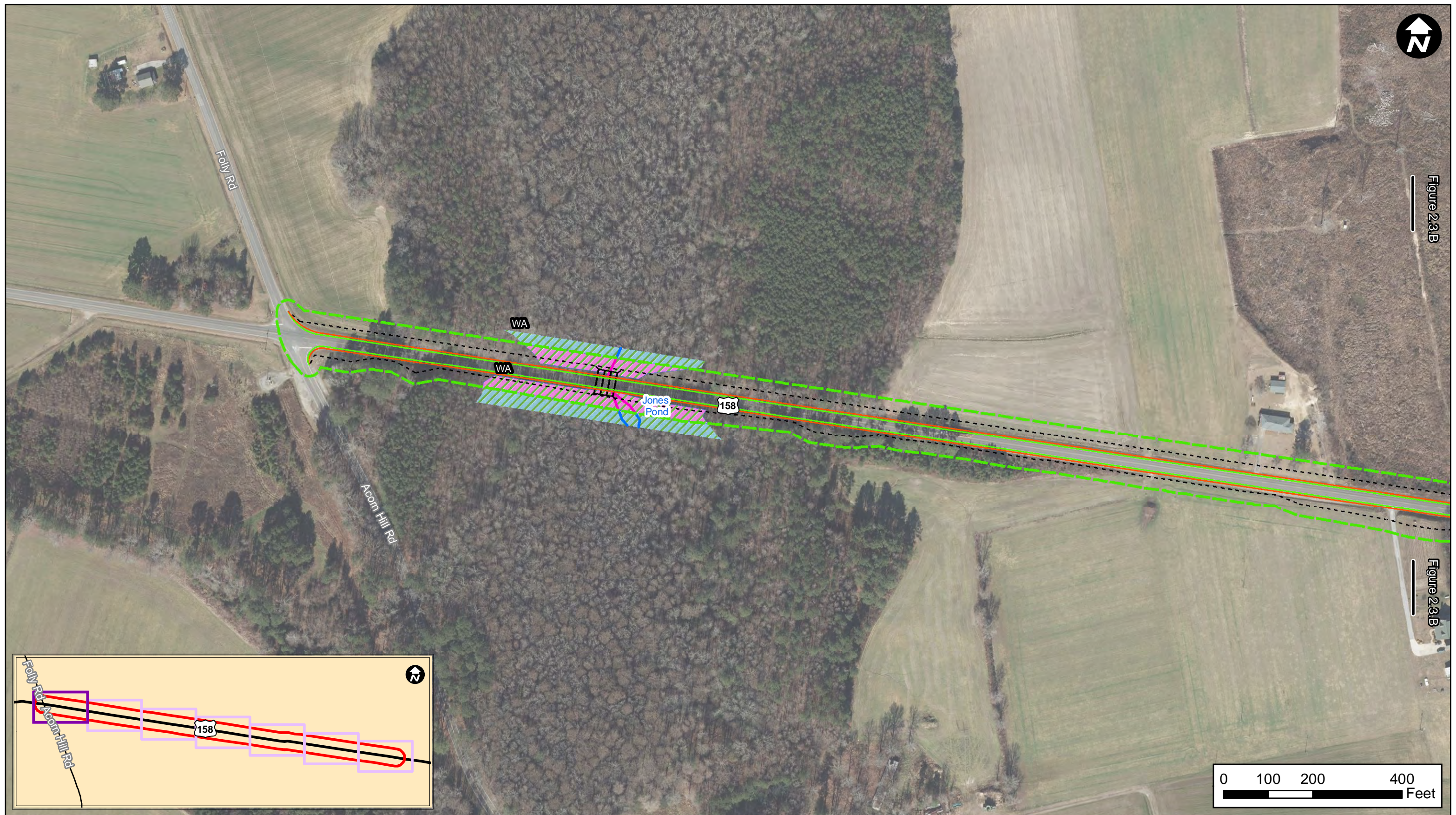
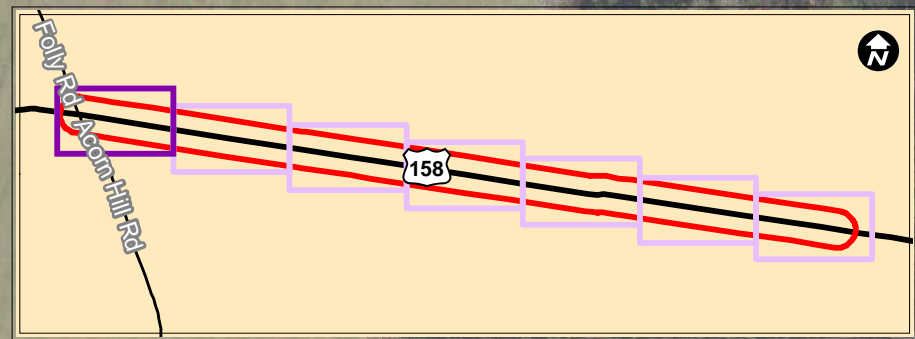


Figure 2.3.B

Figure 2.3.B



- | | | |
|---|---|---|
| — Proposed Edge of Travel | - - - - Slope Stakes | WA Alternative 3 Wetland Impacts |
| — Proposed Paved Shoulder | — Alternative 3 Stream Impacts | WA Delineated Wetlands |
| — Proposed Roadway Culvert | — Delineated Streams | WA Alternative 3 Impact Area |

Figure 2.3.A Anticipated Impacts Map
 Alternative 3
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County



Proposed Edge of Travel

Proposed Paved Shoulder

Slope Stakes

Alternative 3 Wetland Impacts

Delineated Wetlands

Alternative 3 Open Water Impacts

Delineated Open Water

Alternative 3 Impact Area

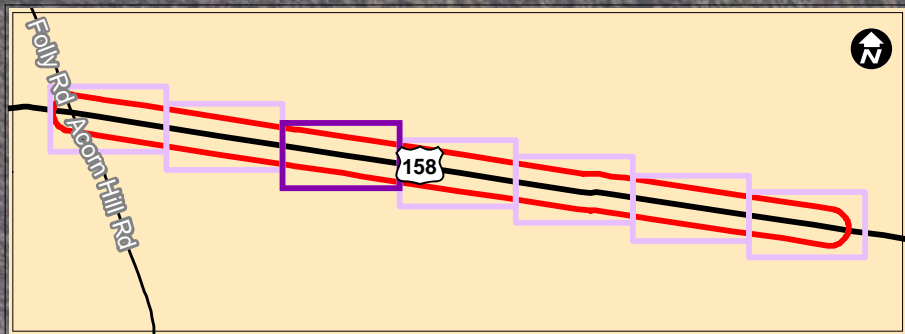
Figure 2.3.B Anticipated Impacts Map

Alternative 3

NCDOT Project No. R-5808

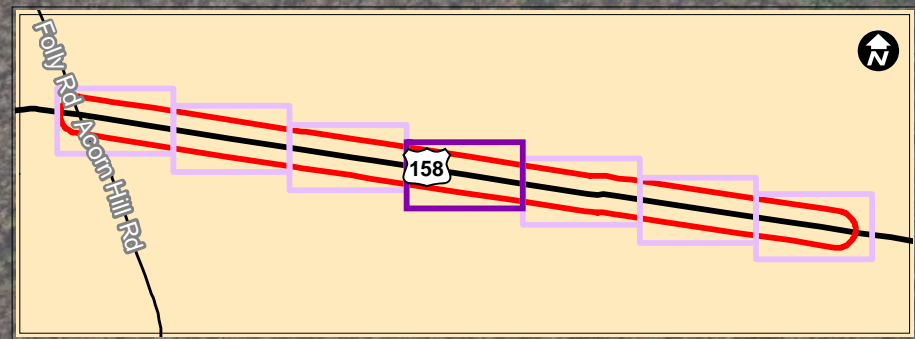
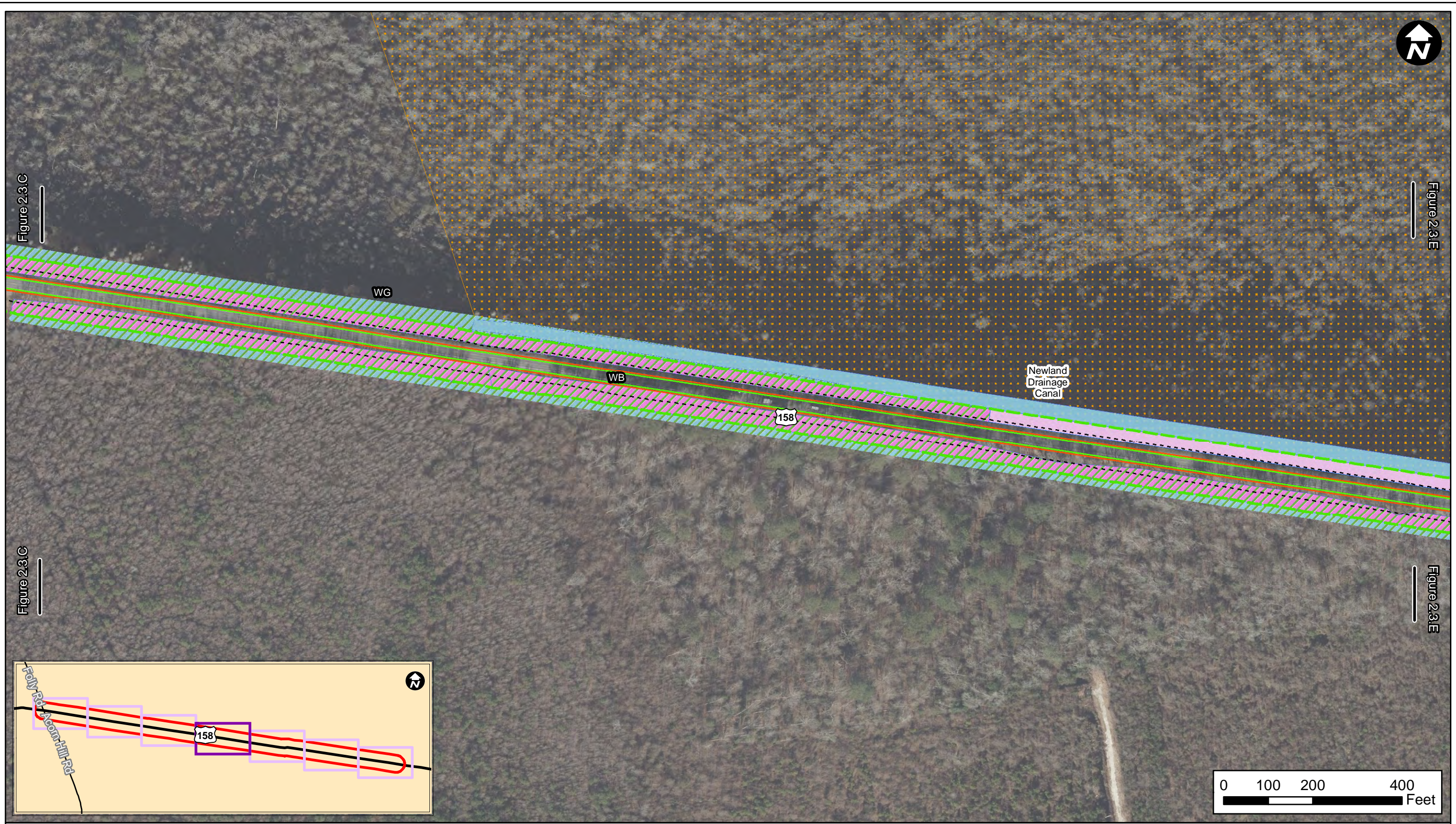
Improvements to U.S. 158

Gates County



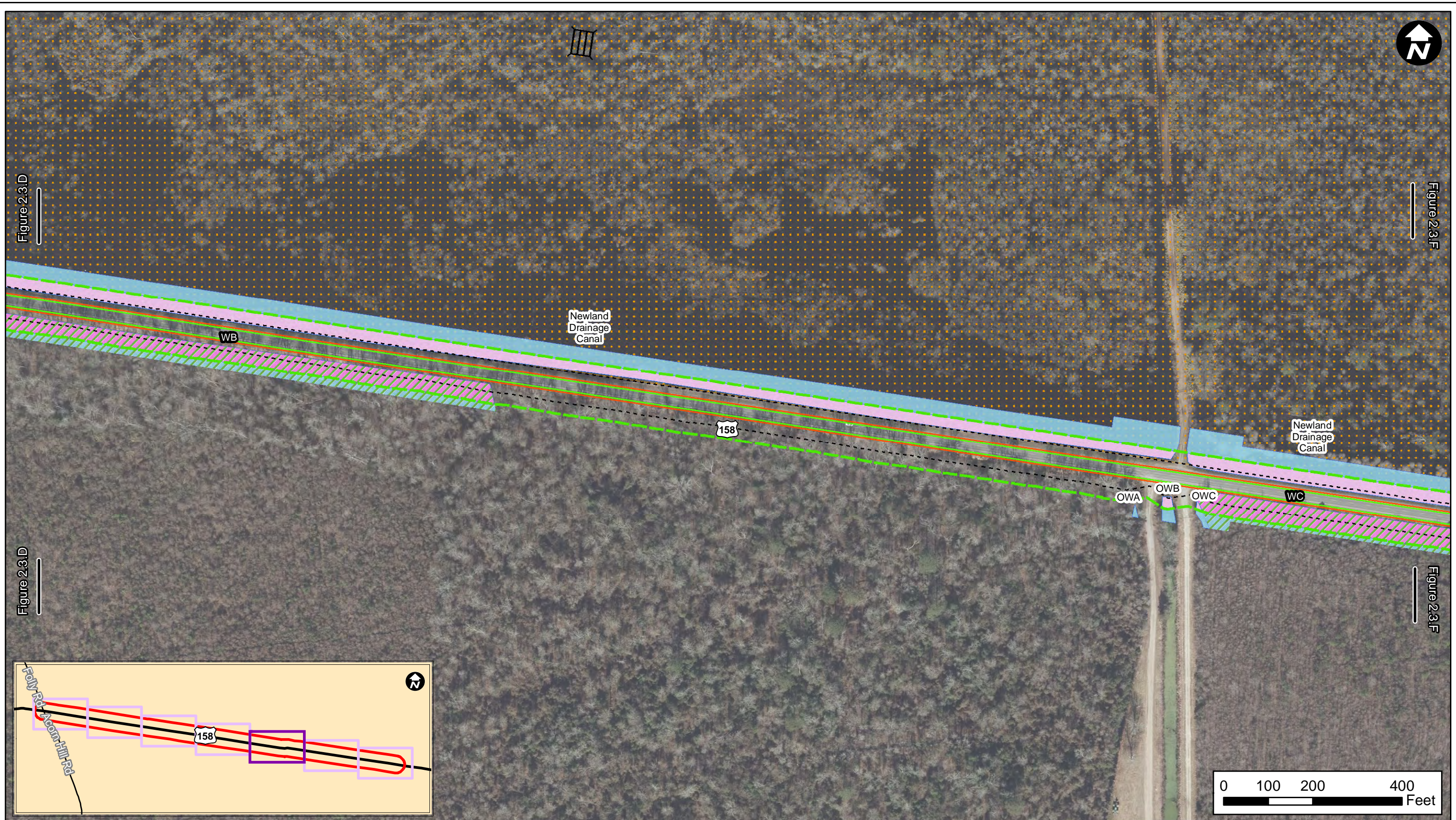
- Proposed Edge of Travel
- Proposed Paved Shoulder
- Slope Stakes
- Alternative 3 Wetland Impacts
- Delineated Wetlands
- Alternative 3 Impact Area

Figure 2.3.C Anticipated Impacts Map
 Alternative 3
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County



- | | | | |
|---------------------------|-------------------------------|----------------------------------|---|
| — Proposed Edge of Travel | Alternative 3 Wetland Impacts | Alternative 3 Open Water Impacts | Great Dismal Swamp National Wildlife Refuge |
| — Proposed Paved Shoulder | Delineated Wetlands | Delineated Open Water | Alternative 3 Impact Area |
| - - - Slope Stakes | | | |

Figure 2.3.D Anticipated Impacts Map
 Alternative 3
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County



Proposed Edge of Travel

Proposed Paved Shoulder

Proposed Roadway Culvert

Slope Stakes

Alternative 3 Wetland Impacts

Delineated Wetlands

Alternative 3 Open Water Impacts

Delineated Open Water

Great Dismal Swamp National Wildlife Refuge

Alternative 3 Impact Area

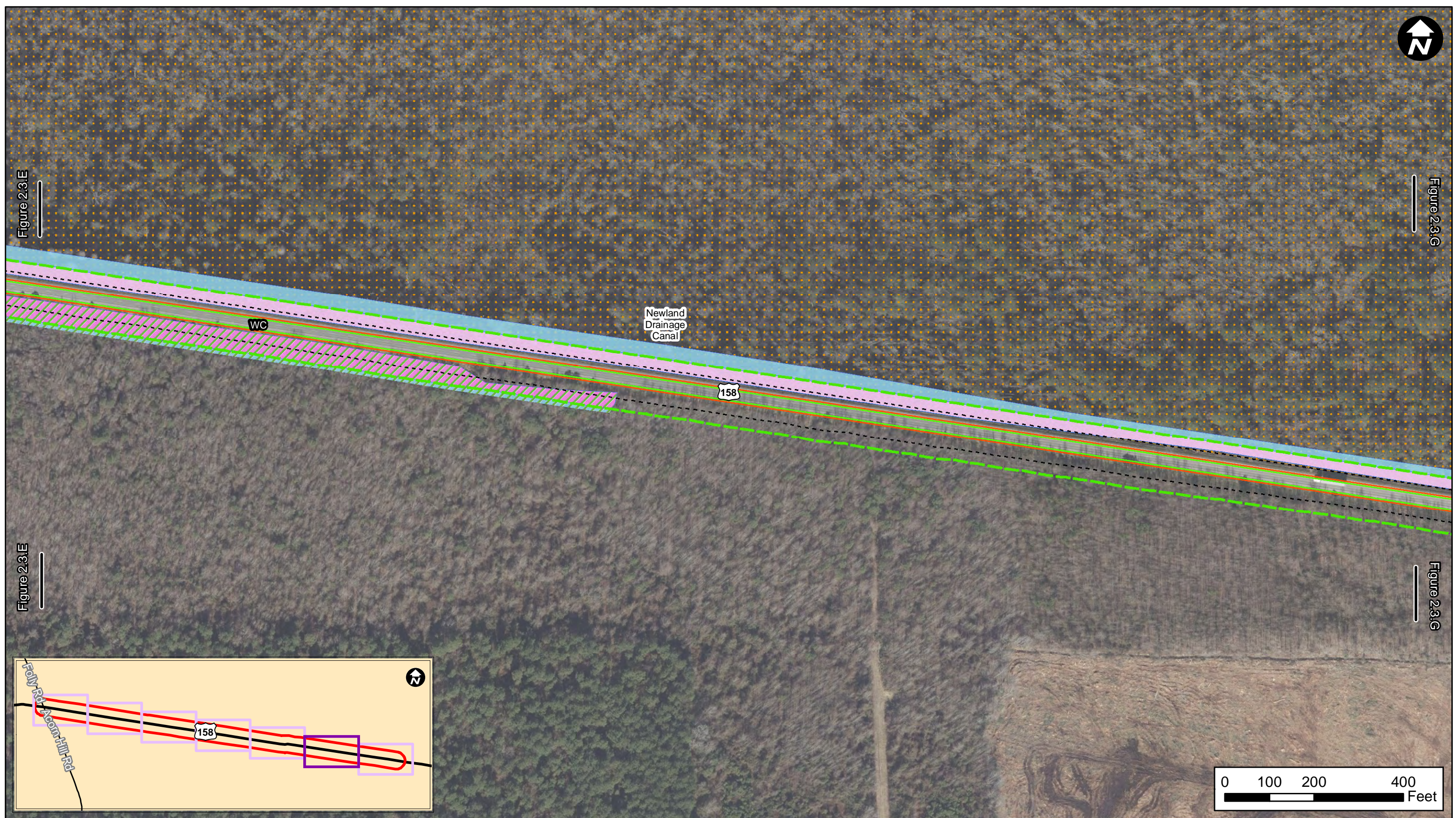
Figure 2.3.E Anticipated Impacts Map

Alternative 3

NCDOT Project No. R-5808

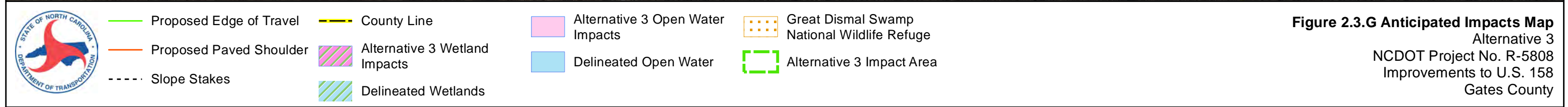
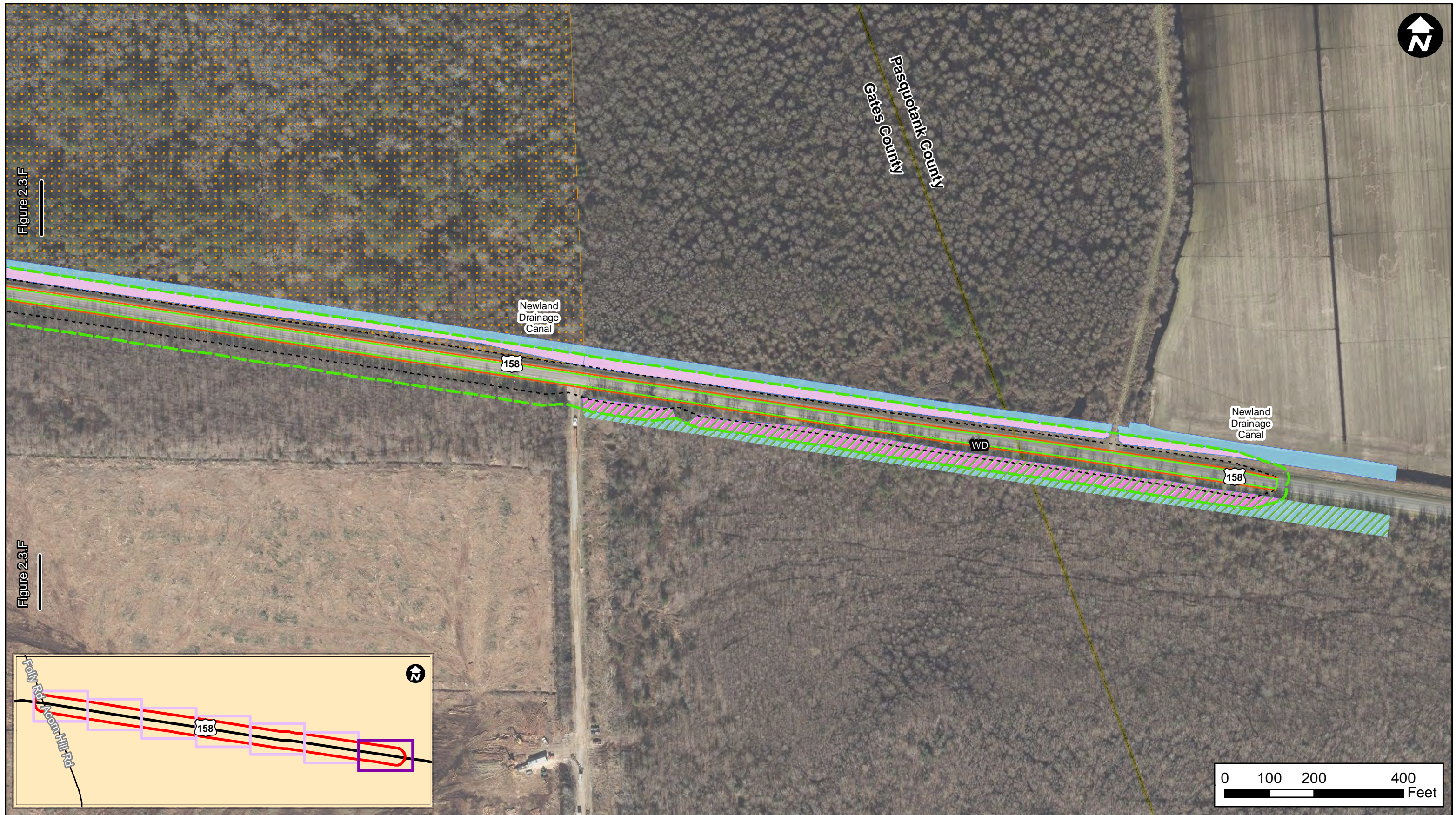
Improvements to U.S. 158

Gates County



- | | | | |
|---|--|---|--|
| — Proposed Edge of Travel | Alternative 3 Wetland Impacts | Alternative 3 Open Water Impacts | Great Dismal Swamp National Wildlife Refuge |
| — Proposed Paved Shoulder | Delineated Wetlands | Delineated Open Water | Alternative 3 Impact Area |
| - - - - Slope Stakes | | | |

Figure 2.3.F Anticipated Impacts Map
 Alternative 3
 NCDOT Project No. R-5808
 Improvements to U.S. 158
 Gates County



Appendix A: Detailed Impact Tables

Impacts were calculated using the following buffers:

- Alternative 1: Buffered 10 feet to the north and 25 feet to the south.
- Alternative 2: West of the Refuge, Alternative 2 was buffered 25 feet to the north and 10 feet to the south. Adjacent to the Refuge, Alternative 2 was buffered 10 feet to the north and 25 feet to the south.
- Alternative 3: Buffered 25 feet on both sides of the corridor.

Table A1. Anticipated Wetland Impacts (acres)

Feature	Alternative 1	Alternative 2	Alternative 3	Figure
WA	0.6	0.6	0.6	Figure 2.1-3.A
WB	11.1	3.9	9.2	Figures 2.1-3.B - 2.1-3.E
WC	2.1	2.1	1.9	Figures 2.1-3.E - 2.1-3.F
WD	1.3	1.3	1.1	Figure 2.1-3.G
WE	0	0.3	0.2	Figure 2.1-3.B
WF	0	<0.1	<0.1	Figure 2.1-3.B
WG	0.2	4.7	4.8	Figures 2.1-3.B - 2.1-3.D
Total	15.2	12.8	17.8	

NOTE: Wetland impacts are rounded to the nearest 0.1-acre increment.

Table A2. Anticipated Stream Impacts (ft)

Feature	Alternative 1	Alternative 2	Alternative 3	Figure
Jones Pond	180	155	165	Figure 2.A

NOTE: Stream Impacts are rounded to the nearest 5-foot increment.

Table A3. Anticipated Open Water Impacts (acres)

Feature	Alternative 1	Alternative 2	Alternative 3	Figure
Newland Drainage Canal	2.7*	3.3*	6.1	Figures 2.1-3.B and 2.1-3.D - 2.1-3.G
OWB	<0.1	<0.1	<0.1	Figure 2.1-3.E
OWC	<0.1	<0.1	<0.1	Figure 2.1-3.E
Total	2.8*	3.3*	6.2	

NOTE: Open Water impacts are rounded to the nearest 0.1-acre increment.

*Alternative 1 and Alternative 2 impacts include impacts due to the addition of rip rap (fill) on the existing side slope and outside of the 10-foot buffer and are in addition to the impacts estimated within the 10-foot buffer.

Appendix B: Public Comment Summary

A public meeting was held for the NCDOT R-5808 project on Thursday, October 4, 2018 from 5 – 7 p.m. at the Sunbury Fire Department in Sunbury, NC. A total of 27 individuals attended the public meeting, and a total of two written comments were received during the comment period ending October 19, 2018. Responses to comments received are included below in *italics*.

- Increased traffic and speed have increased roadkill. Request signs warning drivers of wildlife and reducing the speed to 35 mph.
 - *The current posted speed of 55 mph will be maintained on this section of roadway to be consistent with guidelines for a rural arterial with level terrain. This will also maintain the existing traffic flow and driver expectation. However, measures to mitigate wildlife impacts may be considered.*
- A resident near the corridor is interested in selling borrow material for the project. His property is on the north side of 158, close to the intersection of Acorn Hill and 158.

Appendix C: C.P. 3 / C.P. 4A Merger Meeting Summary **(April 2020)**

MEMORANDUM – MEETING SUMMARY

SUBJECT: STIP Project No. R-5808: Improvements to U.S. 158 from Acorn Hill Road to the Pasquotank County Line

MEETING PURPOSE: The purpose of this meeting was to discuss the least environmentally damaging practicable alternative and minimization measures applied to the design to reach concurrence on Concurrence Points 3 and 4A.

MEETING DATE, TIME, and LOCATION: April 15, 2020, 1:00 P.M., Video Conference Call

PARTICIPANTS:

	Agency/Organization	Attendee	Email
Merger Team	ARPO	Angela Welsh	awelsh@accog.org
	FHWA – NC Division	Felix Davila	felix.davila@dot.gov
	NCDCCR – HPO	Renee Gledhill-Earley	renee.gledhill-earley@ncdcr.gov
	NCDCM	Greg Daisey	greg.daisey@ncdenr.gov
	NCDEQ	Garcy Ward	garcy.ward@ncdenr.gov
	NCDOT – Division 1	Ryan Shook	rlshook@ncdot.gov
	NCWRC	Travis Wilson	travis.wilson@ncwildlife.org
	USACE	Kyle W. Barnes	kyle.w.barnes@usace.army.mil
	USEPA	Amanetta Somerville	somerville.amanetta@epa.gov
	USFWS	Gary Jordan	gary_jordan@fws.gov
	USFWS – Great Dismal Swamp	Chris Lowie	chris_lowie@fws.gov
	USFWS – Great Dismal Swamp	Jennifer Wright	jennifer_wright@fws.gov
	USFWS – Great Dismal Swamp	Melanie Willard	melanie_willard@fws.gov
NCDOT Staff	NCDOT – Division 1	Barry Hobbs	bhobbs@ncdot.gov
	NCDOT – Division 1	Gretchen Byrum	gabyrum@ncdot.gov
	NCDOT – Division 1	Paul Williams	pcwilliams2@ncdot.gov
	NCDOT – Environmental Policy Unit	Colin Mellor	cmellor@ncdot.gov
	NCDOT – Environmental Policy Unit	Mike Sanderson	jmsanderson@ncdot.gov
	NCDOT – Mitigation and Modeling	Wes Cartner	wcartner@ncdot.gov
Consultant	Kimley-Horn	Carroll Collins	carroll.collins@kimley-horn.com
	Kimley-Horn	Claire Collett	claire.collett@kimley-horn.com
	Kimley-Horn	Colin Frosch	colin.frosch@kimley-horn.com
	Kimley-Horn	Jason Hartshorn	jason.hartshorn@kimley-horn.com
	Kimley-Horn	Stephen Holland	stephen.holland@kimley-horn.com
	Kimley-Horn	Teresa Gresham	teresa.gresham@kimley-horn.com
	Kimley-Horn	William Sullivan	william.sullivan@kimley-horn.com

DISCUSSION

Teresa Gresham began the meeting with recommended best practices for conducting the meeting via GoToMeeting and Colin Frosch completed roll call of attendees. Teresa also outlined the purpose of the meeting, as shown above, the history of the project including the previously completed concurrence points, and updates for the Merger Team since the last Merger Meeting was held in April 2019; these are outlined in the packet provided to attendees. The public notice was distributed by the US Army Corps of Engineers (USACE), which can be seen here:

https://saw-nav.usace.army.mil/FILES/Public_Notice/SAW-2018-01073-PN.pdf. Rene Gledhill-Earley noted that the NC Department of Natural and Cultural Resource (NCDNR) had submitted a written comment to USACE in response to the public notice distributed in February. Kyle Barnes confirmed that USACE received the comment on March 20, 2020.

Concurrence Point 3

Typical Section and Anticipated Jurisdictional Impacts

Teresa presented the proposed typical sections of the three alternatives considered by the project team, and then Colin presented the impact calculation methodology and the estimated quantity of impacts to jurisdictional features, as detailed in the packet. Kyle asked for clarification of what the 25-foot buffer included and whether these impacts would be considered fill. Colin and Teresa explained that the 25-foot buffer was used following standard NCDOT Merger practice with designs at this preliminary level to estimate the potential for impacts outside of the proposed slope stakes. This is intended to include permanent drainage easements, permanent utility easements, and temporary construction easements. It has not yet been determined how much of this 25-foot buffer area would be fill and how much would be temporary impacts.

In order to make a fair comparison between alternatives and to conservatively estimate the total impacts of the project which may include modifications to the existing drainage features, the entire 25-foot buffer was calculated as a “fill” impact. The calculated impact area of the buffer extends from the edge of the delineated wetland or open water resource adjacent to the roadway, to the edge of the 25-foot buffer of the slope stakes. It was noted by the project team that it would be more appropriate to label the impacts shown in green that are within the slope stakes as “direct” impacts rather than “buffer” impacts.

Although all of the typical section graphics show impacts due to rip-rap placement, only Alternative 1, and Alternative 2 adjacent to the Great Dismal Swamp National Wildlife Refuge (Refuge), have anticipated rip-rap impacts which fall outside of the estimated buffer impact and direct impact areas. This is because these are the only locations where the alternatives propose to maintain the existing side slope on the north side of U.S. 158. Colin also clarified that these existing side slopes areas are not proposed to be improved to a 3:1 slope, and therefore there would be no fill other than the rip-rap north of U.S. 158 in Alternative 1 and Alternative 2 adjacent to the Refuge. Rip-rap is only proposed to be placed in locations where the side slope is directly adjacent to an open water feature. Wetland areas and areas where the open water is further away from the roadway's side slope are not anticipated to necessitate rip-rap.

Kyle said that the 4:1 existing slope assumption used by the project team was very conservative as the existing slopes were most likely much steeper. Stephen Holland agreed and said that the slope greatly varies so this was selected as a conservative estimate. If the slopes are steeper, the amount of rip-rap impact estimated would decrease.

Other Impacts and Factors for Consideration

Colin and Teresa presented the other impacts considered including those to the Refuge, a Section 4(f) resource. Factors considered for practicability of the alternatives included construction cost and duration, maintenance frequency and cost, and safety during construction, all of which are detailed in the packet.

Amanetta Somerville asked if the relative increase in cost for Alternatives 2 and 3 could be detailed to better describe what was included and what dollar amount this represented. These costs were not included in the packet because they are only estimates, and have not fully been reviewed by NCDOT. Colin said that Alternative 1, used as a baseline for cost comparison, is estimated to cost approximately \$28 million. The relative cost increases calculated for Alternatives 2 and 3 considered the additional rock plating, cofferdam, dewatering, automated flagger device, portable concrete barrier, and impact attenuators that would be required in those two alternatives and not in Alternative 1. Alternative 2 is anticipated to cost \$3 million more than Alternative 1 (\$31 million), and Alternative 3 is anticipated to cost \$15 million more than Alternative 1 (\$43 million). These additional costs do not include mitigation which is typically not considered during the LEDPA decision. Stephen noted that the construction duration would also be longer for these two Alternatives (approximately nine months longer for Alternative 2 and two to three years longer for Alternative 3).

Felix Davila asked why Alternative 1 would have less permanent direct and indirect impacts to the Refuge. Colin clarified that only temporary impacts are expected during construction with Alternative 1. He then went on to explain that since no direct or indirect permanent impacts, are currently anticipated with Alternative 1, that this would represent less overall impacts to the Refuge as compared to Alternatives 2 and 3 which are anticipated to potentially have permanent indirect and direct impacts on the Refuge.

Amanetta asked if an estimated cost of the additional maintenance activities and what those activities would be were available. Teresa and Stephen explained that this was currently a qualitative rather than quantitative factor as the detailed cost estimate for maintenance activities has not been completed. The anticipated frequency of maintenance activities are anticipated to include mostly mill and overlay of the pavement surface. Kyle asked if NCDOT had any data of current maintenance of this segment of U.S. 158. Colin Mellor noted that the potential for more frequent maintenance activities also doesn't meet the purpose of the project to address facility deficiencies by not reducing the necessary maintenance activities. If requested, the project team could provide the Merger Team members with a more detailed list of maintenance activities.

Kyle raised concern regarding the statement that there would be additional risk of settlement and slope degradation when widening to the north since the rip-rap was proposed to be placed there for protection. Colin and Stephen explained that the settlement concerns are associated with the total weight of the fill, rock plating/rock embankment, and roadway pavement being placed on the unsuitable soft sub-grade. The rip-rap would only protect the surface of the slope from additional degradation.

Selection of the LEDPA

Based on the impacts and practicability factors discussed above and in the packet, NCDOT recommended selecting Alternative 1 as the least environmentally damaging practicable alternative (LEDPA). Kyle said that USACE would be unable to support Alternative 1 as the preferred alternative at this time since it is not the least environmentally damaging alternative. Teresa noted that although Alternative 1 does not have the least environmental impacts, NCDOT believes the practicability concerns with Alternatives 2 and 3 outweigh the environmental benefits.

Gary Jordan said that the US Fish and Wildlife Service (USFWS) can support Alternative 1 as the LEDPA for the reasons stated by the project team. In summary, Alternative 1 presents the least potential for impacts to the Refuge including some of the non-quantifiable effects to the Refuge and the duration of construction.

Garcy Ward (NC Division of Environmental Quality), Felix Davila (Federal Highway Administration), Angela Welsh (Albemarle Rural Planning Organization), Travis Wilson (NC Wildlife Resources Commission), and Greg Daisey (NC Division of Coastal Management) all expressed support for selecting Alternative 1 as the LEDPA. Renee indicated that NCDOT would not object to Alternative 1 as the LEDPA but would request that an archaeological evaluation be conducted on the west side of the project south of U.S. 158 where there is a known archaeological site.

Amanetta said she did not believe there was enough of a difference in construction duration between Alternatives 1 and 2 to make Alternative 2 impracticable. Amanetta said that the US Environmental Protection Agency (USEPA) will wait to provide concurrence on the LEDPA until USACE is more comfortable with the LEDPA decision.

Kyle said he believes there is some additional room for discussion regarding constructability, the difference in cost, and potential for reduction in impacts, as compared to the assumptions made, and may want to see more detail or information regarding that. Teresa said that although a higher level of detail for construction costs and methods is typically not available at this point in the Merger process, the project team has done a brief calculation of impacts based on slope stakes only (without a buffer). This calculation indicated that although Alternative 1 would still be anticipated to have more wetland impacts than Alternative 2, that difference would be about half of the difference when comparing the impacts calculated with a buffer.

The group discussed in more detail the dewatering that is anticipated to be necessary for Alternative 2 and 3 where construction of the roadway bed would be in existing open water. Stephen described that this process would use coffer dams to section off segments of the project and a pump would be used to

dewater the area within the coffer dam. Kyle inquired whether a manual method could be used instead to decrease the in-water work required for dewatering. Chris Lowie explained that in this segment of the Refuge, there is very little water control capability. The main control measure is located east of the Refuge along U.S. 158 and is operated by the Newland Water Management District which may present jurisdictional control issues. He believes this is an approximately 5-foot diameter pipe and that the necessary dewatering may be too much for this “dike” location to handle. There is also a smaller control measure on Refuge property north of U.S. 158 on Weyerhaeuser Ditch Road. Chris does not believe that would be sufficient to perform the dewatering. The main issue is that the area along U.S. 158 is where most of the water in the Refuge naturally flows. It is also anticipated that to dewater the areas of the Refuge where construction activities would occur would end up requiring the dewatering of a much larger area which could have adverse effects on areas of the Refuge not previously accounted for on an exponential scale.

Kyle requested additional time for USACE to review the materials and references. Amanetta asked that Kyle include her on any of this additional findings. The Merger Team did not request additional information from the project team at this time.

Concurrence Point 4A

Teresa presented the minimization measures applied to the project thus far as described in the packet so that the Merger Team members could review them now and potentially provide concurrence at a later date via email if C.P. 3 can be resolved without a follow-up meeting. Felix asked about the anticipated Section 4(f) documentation and level of impact. Teresa identified that the project team believes Alternative 1 would either be a *de minimis* impact or a No Effect to the Refuge. Chris and Gary deferred the type of Section 4(f) documentation to FHWA and indicated they would review and consider concurrence on the impact conclusion FHWA deems appropriate.

ACTION ITEMS

- Kimley-Horn will prepare and distribute meeting minutes.
- USACE and USEPA will look into additional resources to make a decision on C.P. 3 and follow-up with the Merger Team.

Appendix D: LEDPA Justification Document (March 2021)

R-5808 CP3 LEDPA Justification

STIP Project No. R-5808: Improvements to U.S. 158 from Acorn Hill Road to the Pasquotank County Line

Introduction

On April 15, 2020, a video conference call was convened to discuss the least environmentally damaging practicable alternative (LEDPA) and minimization measures applied to the design to reach concurrence on NCDOT Merger Concurrence Points (CP) 3 and 4A.

In addition to the No-Build alternative, three (3) Alternatives were studied in detail:

- Alternative 1: Widen to the south, holding the northern right of way line and side slopes;
- Alternative 2: Widen to the north outside of the Dismal Swamp National Wildlife Refuge (NWR) and widen to the south within/adjacent to the Refuge;
- Alternative 3: Widen to the north within NCDOT right-of-way along the length of approximately the entire project limits with remaining widening to the south.

Impacts anticipated with the three build alternatives are summarized in **Table 1**.

Table 1: Anticipated Impacts to Jurisdictional Features

Resource		Alternative 1	Alternative 2	Alternative 3
Wetlands	West Section	8.5 acres	6.1 acres	11.4 acres
	Refuge Section	5.4 acres	5.5 acres	5.4 acres
	East Section	1.3 acres	1.3 acres	1.1 acres
	Total	15.2 acres	12.8 acres	17.9 acres
Streams	West Section	180 linear feet	155 linear feet	165 linear feet
	Refuge Section	0	0	0
	East Section	0	0	0
	Total	180 linear feet	155 linear feet	165 linear feet
Open Water	West Section	0 acres	0.6 acres	0.3 acres
	Refuge Section	2.4 acres*	2.4 acres*	5.2 acres
	East Section	0.3 acres*	0.3 acres*	0.7 acres
	Total	2.8 acres*	3.3 acres*	6.2 acres

NOTE: Stream Impacts are rounded to the nearest 5-foot increment, wetland and open water impacts are rounded to the nearest 0.1 acre.

*Alternative 1 and Alternative 2 impacts include impacts due to the addition of rip rap (fill) on the existing side slope and outside of the 10-foot buffer and are in addition to the impacts estimated within the 10-foot buffer.

Based on the impacts listed above and practicability factors included in the Merger meeting packet/presentation, NCDOT recommended selecting Alternative 1 as the least environmentally damaging practicable alternative (LEDPA).

Gary Jordan said that the US Fish and Wildlife Service (USFWS) can support Alternative 1 as the LEDPA for the reasons stated by the project team. In summary, Alternative 1 presents the least potential for impacts to the Refuge including non-quantifiable/indirect effects to the Refuge and the duration of construction.

Garcy Ward (NC Division of Environmental Quality), Felix Davila (Federal Highway Administration), Angela Welsh (Albemarle Rural Planning Organization), Travis Wilson (NC Wildlife Resources Commission), and Greg Daisey (NC Division of Coastal Management) also all expressed support for Alternative 1 as the LEDPA.

Renee Gledhill-Earley indicated that NCDOT would not object to Alternative 1 as the LEDPA but would request that an archaeological evaluation be conducted at the west end of the project limits and south of U.S. 158 where there is a known archaeological site. Since the CP 3 and 4A meeting, the NCDOT Archaeology Group has completed a “Survey Required” form and is in the process of scheduling field work to complete the survey of the archaeological site.

Amanetta Sommerville (US EPA) said she did not believe there was enough of a difference in construction duration between Alternatives 1 and 2 to make Alternative 2 impracticable. Amanetta said that the USEPA will wait to provide concurrence on the LEDPA until USACE is more comfortable with the LEDPA decision.

Kyle Barnes (USACE) said that the Corps would be unable to support Alternative 1 as the preferred alternative at this time since it is not the least environmentally damaging practicable alternative (LEDPA). Teresa Gresham (KHA) noted that while Alternative 1 does not have the least environmental impacts, NCDOT believes the practicability concerns with Alternatives 2 and 3 outweigh their environmental benefits.

Kyle Barnes believed there was some additional room for discussion regarding constructability concerns, refined cost differences, and refined impact projections, as compared to the assumptions made and presented at the CP3 meeting. NCDOT needs to show that Alternative 2 is not practicable, as defined by the 404(b)(1) guidelines which state – “The term practicable means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.” The following discussion and information attempts to provide more information on these parameters without proceeding too far into the design process.

Additional Discussion

Dewatering

One of the questions raised by the USACE during the CP 3 merger meeting involved the potential of lowering open water levels in the canal by using one or both of two (2) existing hydraulic riser structures. Chris Lowie of the USFWS anticipated this was infeasible due to multiple factors including the inability of the water control measures to drain the water to a sufficiently low level for construction; the lack of jurisdictional control over the water control measures outside of and to the east of the Refuge which is operated by the Newland Water

Management District; and the potential for an increase of impacts to the Refuge by lowering the water level.

KHA personnel believe the existing riser control structures are likely not capable of substantially dewatering the canal as it is supported by a large portion of the Great Dismal Swamp. Based on field evaluations during summer months when one riser was fully opened, permanent water levels of approximately 1 to 2 feet remain in the vicinity of much of the canal. Further, the Newland Water Management District Water may require water to be held back by that riser to facilitate crop planting. Opening the riser is likely to flood a large portion of the fields downstream.

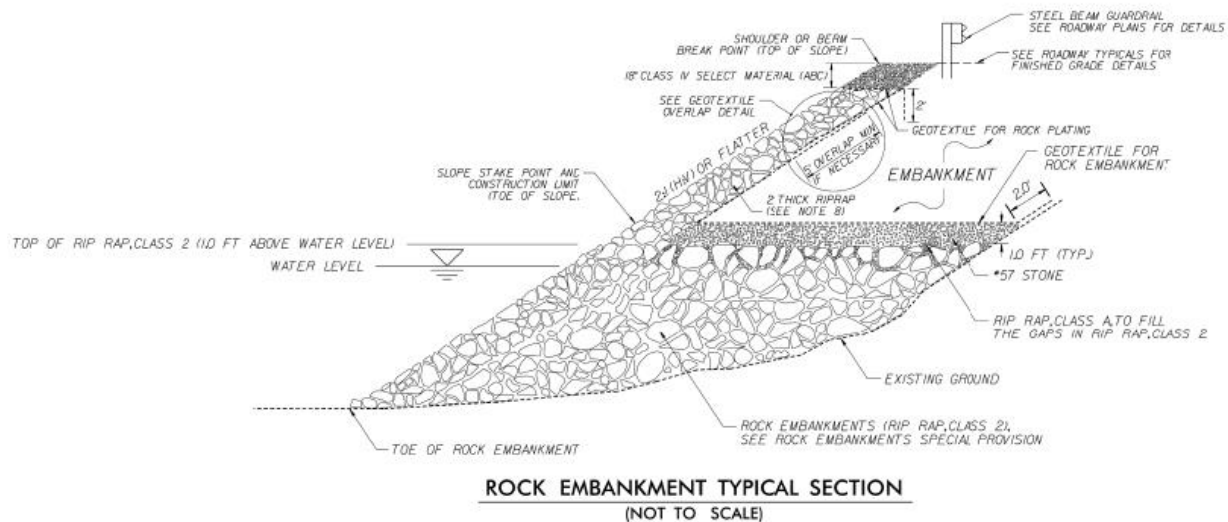
Preliminary calculations support the assertion that even if the risers were temporarily removed or a pipe was installed to temporarily drain the swamp, lowering water levels would not be practicable. With an estimated drainage area of the Dismal Swamp of 5.26 sq. miles, and an assumed average depth of 3 feet, and assuming 100% capacity at the drainage pipe, it would take 80 days to drain the water with a 36" pipe and 25 days using a 60" pipe. Note – these calculations only serve to indicate the magnitude of water involved. The precise drainage topography, connectivity of the canal and the swamp are not known. Given the amounts of water and time durations indicated for any useful drawdown, the efforts to construct a more accurate HEC-RAS hydraulic model is not warranted.

Construction Cost and Time

Discussion of additional construction costs between Alternatives 1, 2, and 3 offered at the CP 3 meeting was based on some assumptions by KHA staff, which considered cofferdam installation and associated monthly operational costs, as well as the additional traffic control these construction methods would require. Stephen Holland (KHA) outlined the proposed procedure for dewatering during construction of Alternative 2. Cofferdams are proposed to be used to remove water within the proposed construction limits. Approximately eight (8) individual cofferdams will be needed to comply with the work zone traffic control safety guidelines, which dictate the distance between automatic flagger traffic control devices shall be placed no more than 200 feet apart. The area needing to be dewatered is approximately 1,600 linear feet in length and covers an approximately 0.6-acre area. The dewatering process is the main reason why the construction of Alternative 2 is anticipated to take approximately nine (9) months longer than Alternative 1. This yielded an approximate 10% increase in construction costs of Alternative 2 over Alternative 1. Further comparison of potential construction methods detailed below indicate that the overall resultant estimated increase in cost for Alternative 2 over Alternative 1 is likely over 20% more, and additional construction time will be twelve (12) months. Construction duration is of particular concern because US 158 is a designated hurricane evacuation route. Increased construction durations of nine to twelve months could mean one or even two additional hurricane seasons over which construction could reduce evacuation efficiency.

Consultation with NCDOT's Geotechnical Unit and Division 1 construction personnel reveals that construction in open water areas of Alternative 2 will involve undercutting and the replacement of undercut material with Class VII select material to a level 1.0 foot above the normal standing water elevation (see Figure 1., a typical section from another project that used Class 2 riprap instead of Class VII). Regulatory agencies will also require NCDOT's Division 1 to place geotechnical fabric under the rock embankment.

Figure 1. Rock Embankment Construction - Typical Section



With an approximate cost of \$145/CY (cubic yard) for Class VII material, and approximately 2CY per foot of embankment as shown above (assume an average 15 feet embankment width and average 7 feet embankment thickness), this would add approximately \$0.5M to the cost of Alternative 2. Once the fabric is in place the construction is similar to placing a soil embankment, but it is about 1.5 times slower due to the increased trucking. The legal load volume for each truck carrying stone is less than if it was carrying soil. The increase in time and subsequent impact to project schedule would be more likely 12+ months versus the previously discussed 9 months. Additionally, Class VII material, needed to construct the embankment in the open water sections of Alternative 2, would likely be sourced from Sims, in Wilson County, NC, located approximately 115 road miles from the project site. The lack of rock in the coastal plain of NC, suitable for embankment construction, is a primary reason that this construction method is rarely used in Division 1.

Where possible, NCDOT Division 1 opts for the more conventional construction methods that would be associated with widening to the south side of the roadway, west of the Refuge, in Alternative 1. While unsuitable soils would still need to be undercut, short sections would be undercut and immediately backfilled with select embankment material and the inclusion of

fabric or geotextile as appropriate. Embankment material would likely be sourced nearby in Pasquotank or Camden counties.

In addition to the increase in project costs and impacts to schedule, preliminary geotechnical borings indicate the groundwater elevation in the project area is approximately at, or within 1.0 foot of, the base of roadway embankment soils. If construction involves dewatering there is the risk it may cause subsurface soil compaction and, consequently, sinking or settling of the roadway above.

Randy Midgett, Division 1 Construction Engineer, did not have a specific example of settlement due to dewatering on a causeway road section. However, a residence in Elizabeth City adjacent to a deep utility and culvert cut (approximately 20 feet away) had to be evacuated and the residence purchased and demolished. Dewatering as part of the utility construction caused the house to settle. The house sat upon a prior converted wetland. There was a significant organic muck type layer overlain by fill. When dewatered the organic layer collapsed and caused rapid settlement. The soil profile was similar to the roadway sections on U.S. 158.

Safety

Table 2 provides a summary of expected crashes over a 72-month (i.e., 6-year) duration using Crash Modification Factors (CMF's) out of the Highway Safety Manual. The 72-month period accounts for the potential impacts to safe traffic operations during construction (i.e., influence of different work zone conditions/constraints) as well as the expected safety benefits associated with the proposed project improvements.

Table 2: Predictive Crash Analysis

Scenario	Crashes expected over 72 months			% Increase from Alternative 1		
	Injury	PDO*	Total	Injury	PDO*	Total
No Work-zone	14	29	43	-13%	-19%	-17%
Alternative 1	16	36	52	-	-	-
Alternative 2	20	47	67	25%	31%	29%
Alternative 3	23	59	82	44%	64%	58%

*PDO – Property Damage Only

NCDOT will strive to make any construction method and traffic configuration as safe as possible. There are however some inherent risks with different construction methods and traffic configurations. As with construction cost increases, the focus of this table is the percentage increase over the background number of crashes (No Work-zone) which is low. The CMF's applied that to each alternative that increase the expected number of crashes include: "Work Zone Present"; "Lane Closures with Flagger Present" (which was applied to daytime hours of Alternative 1 and 24/7 operations to Alternatives 2 and 3); and "Barrier Present on Shoulder" in Alternatives 2 and 3. Once construction is completed on the alternatives there are CMF's applied for the "Widened Shoulders" that serve to reduce the expected crashes for the

remainder of the 72-month duration. NOTE – this table was produced assuming the +9-month construction timeframe for Alternatives

Anticipated Impact Reduction

During the CP 3 meeting, KHA personnel indicated that as the buffers were removed from the typical sections Teresa said that although a higher level of detail for construction costs and methods is typically not available at this point in the Merger process, the project team has done a brief calculation of impacts based on slope stakes only (without a buffer). This calculation indicated that although Alternative 1 would still be anticipated to have more wetland impacts than Alternative 2, that difference would be about half of the difference when comparing the impacts calculated with a buffer.

The “unbuffered” impacts that were mentioned during the most recent CP 3 meeting were calculated for wetlands and were based on slope stakes alone. These numbers do not include a buffer and so do not include potential temporary or permanent impacts due to changes in design, utilities, or drainage. (Rip rap was assumed in open water only, so does not affect the wetland impact calculations.)

Table 3: Anticipated Impact Reductions with and without Buffer

Alternative	Wetland Impacts w/ Buffer (10' or 25', depending on location) (from CP 3/4A Packet)	Wetland Impacts w/o Buffer
1	15.2 ac	6.6 ac
2	12.8 ac	4.9 ac
3	17.9 ac	5.6 ac

The buffer applied to a design typical section is added to account for potential impacts, permanent or temporary, that can occur as final project designs are completed. These can result from utility installation, final drainage design, and construction work. Projected impacts on projects like the R-5808 widening project are often exacerbated because the resources are positioned parallel to the proposed road improvements, and when the 10 or 25 ft buffer was added to the estimated slope stake limits of the road, potential impact numbers look high. To illustrate this, a table of potential impacts reduced to the estimated proposed slope stake limits was provided (Table 3). The table indicates that when final design avoids and minimizes impacts to the maximum extent practicable, and careful construction methods are implemented, impacts could be less than half of the buffered impact totals. While it is too early in the planning and design process to definitively calculate impacts, it is not anticipated that the entire buffer outside the slope stakes will have to be cleared for construction.

Anticipated Mitigation Costs

NCDOT recognizes that avoidance and minimization of jurisdictional wetland and stream impacts is of primary importance when developing and selecting preferred project alternatives. However, when final preferred alternative/LEDPA determinations are being made it is prudent to calculate, consider, and compare the anticipated mitigation costs between alternatives. Table 4. lists the anticipated wetland mitigation costs for each detail study alternative.

Table 4: Anticipated Mitigation Costs with and without Buffer

Alternative	Wetland Impacts w/ Buffer (10' or 25', depending on location) (from CP 3/4A Packet)	Wetland Impacts w/o Buffer
1	15.2 ac \$1,860,000	6.6 ac \$810,000
2	12.8 ac \$1,570,000	4.9 ac \$600,000
3	17.9 ac \$2,190,000	5.6 ac \$690,000

Note - all costs factor in a 2:1 mitigation ratio

Summary

NCDOT recommends Alternative 1 over Alternative 2. Although Alternative 1 has greater impacts to streams (25 feet) and wetlands (1.7 acres of unbuffered impacts) than Alternative 2, NCDOT believes the following practicability concerns should be considered in the context that this is a facility upgrade, shoulder widening, and safety project, with traffic maintained onsite during construction. Alternative 1 does not require the dewatering, undercut, and embankment construction methods that Alternative 2 requires, resulting in:

- A significantly shorter construction duration – Alternative 2 would likely take more than 12 months longer to construct
- Less disruption to traffic during construction
- Safer work zone environment
- Lower cost to construct
- No risk of further settlement of the existing roadway embankment by construction dewatering
- Lower potential for permanent direct and indirect impacts to the Great Dismal Swamp National Wildlife Refuge
- Fewer open water impacts

Alternative 1 also offers lower risk of future slope degradation and settlement due to embankment construction that will not be exposed to standing water post-construction, resulting in:

- Less frequent impacts to surrounding environment during maintenance activities
- Less cost to maintain