



**US Army Corps
of Engineers®**

APPENDIX A3: CIVIL ENGINEERING

WACCAMAW RIVER,

HORRY COUNTY, SOUTH CAROLINA

**FLOOD RISK MANAGEMENT STUDY INTEGRATED
FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT**

MAY 2026

MAIN REPORT SUMMARY

The Integrated Feasibility Report and Environmental Assessment (FR/EA), that this appendix addresses, details a collaborative study by the U.S. Army Corps of Engineers (USACE) and Horry County, South Carolina. It is aimed at reducing existing and future flood risks to communities and transportation infrastructure within the Waccamaw River Basin, with a focus on Horry County. The study identifies four key flood impact areas: Longs & Red Bluff, Conway, Bucksport, and Socastee.

The flood impacts in each of these areas were independent of each other, so solutions could be evaluated self-reliantly, making any proposed alternative plans separable. The study considered a range of structural, non-structural, and nature-based solutions while incorporating public feedback gathered during meetings. An environmental analysis was completed, and a Finding of No Significant Impact is included within the main report. The document completed a public review and comment period while also undergoing internal agency reviews and adapted to those concerns and suggestions. In addition to historical flooding, the report acknowledges the flooding event caused by Hurricane Debby in August 2024 during this study, and its impact was assessed to further inform the study's conclusions.

The Recommended Plan, based on an evaluation of alternatives, includes two separable elements that are incrementally justified: Relief Bridges (cross drains) in the Conway flood impact area and Barrier Removal in the Socastee flood impact area. The Recommended Plan is classified as the National Economic Development Plan and is also the plan that maximizes net comprehensive benefits. No alternatives were justified for Federal investment for the Longs & Red Bluff and Bucksport flood impact areas. This Appendix provides detailed Civil Engineering information to support these recommendations.

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A. INTRODUCTION

The study area covers the Waccamaw River and its tributaries from the South Carolina state line to its confluence with the Pee Dee River. Structural and non-structural measures were developed to reduce risk from flooding. Detailed descriptions of the measures can be found in the main report, as well as the rationale for the selection of the recommended plan.

A.1 Purpose

The purpose of this Appendix is to provide civil site design considerations for the proposed structural and nonstructural measures that were considered in each focus area. Design phase considerations and general construction recommendations are discussed.

B STRUCTURAL MEASURES

B.1 Road Elevation

The elevation of the Pee Dee Highway in Bucksport was proposed as a structural measure. The elevation would begin at the intersection of Highway 701 and end at the intersection of Pauley Swamp Rd. The width of the road was assumed to be 40 ft wide with a 2:1 slope to existing ground on both sides to a max width of 100ft. According to H&H modeling, the road needs to be raised to an elevation of 18.5ft. Portions of the road are already at this elevation or higher. The sections of roadway that will not need to be elevated are from Station 65+00 to 73+00, Station 85+00 to 172+00, and Station 178+00 to 235+00. The total approximate linear feet of road elevation is 20,000 LF. The required amount of structural fill is approximately 111,250 cu yd. Base course and surface will also be required to replace the roadway in the elevated sections. No analysis was performed to determine if the existing roadway drainage would need to be modified. Site specific topographic data was not obtained, so actual fill quantity could vary from this estimate. A utility survey was not performed for this measure, but it is assumed that utilities along the existing roadway may need to be relocated.

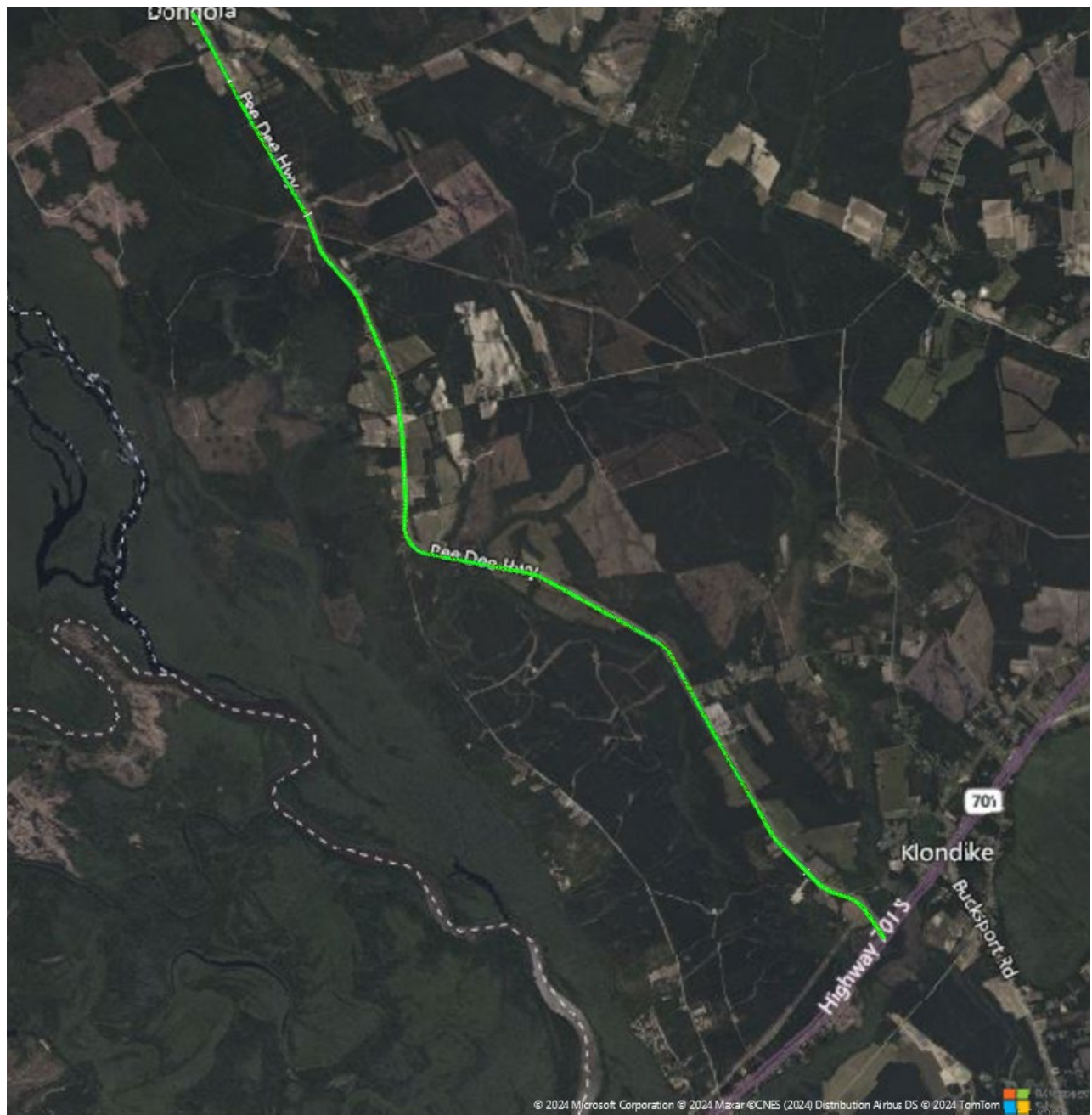


Figure B-1: Pee Dee Highway Road Elevation Alignment

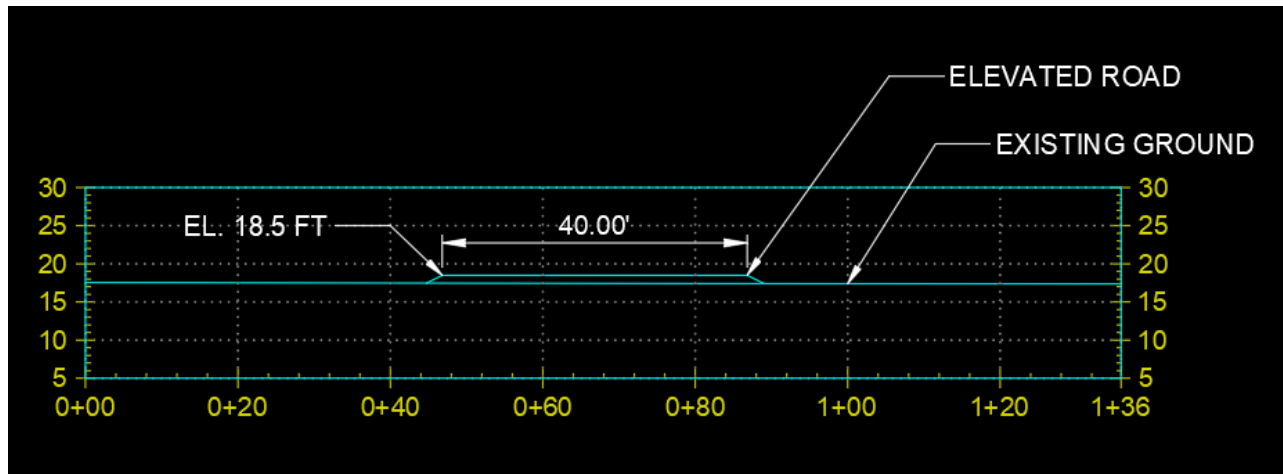
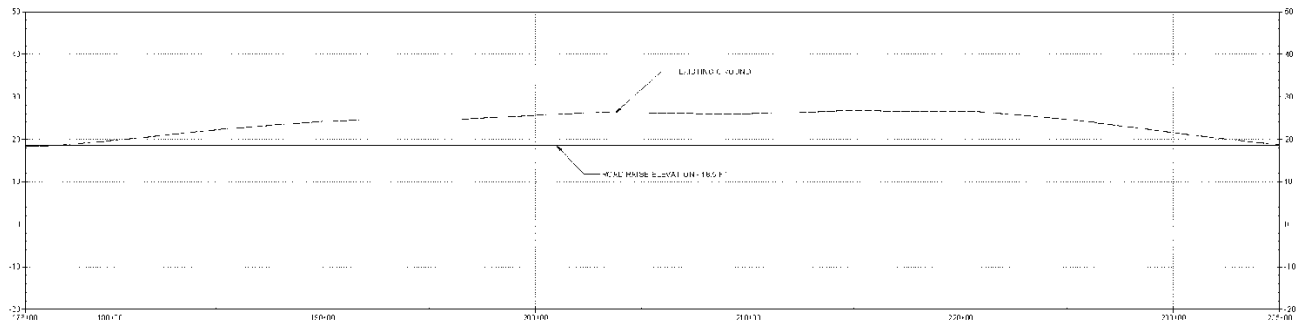
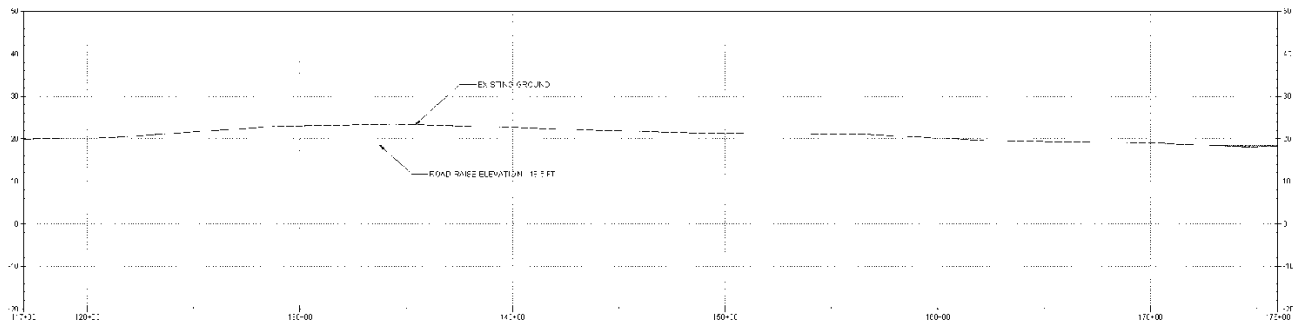
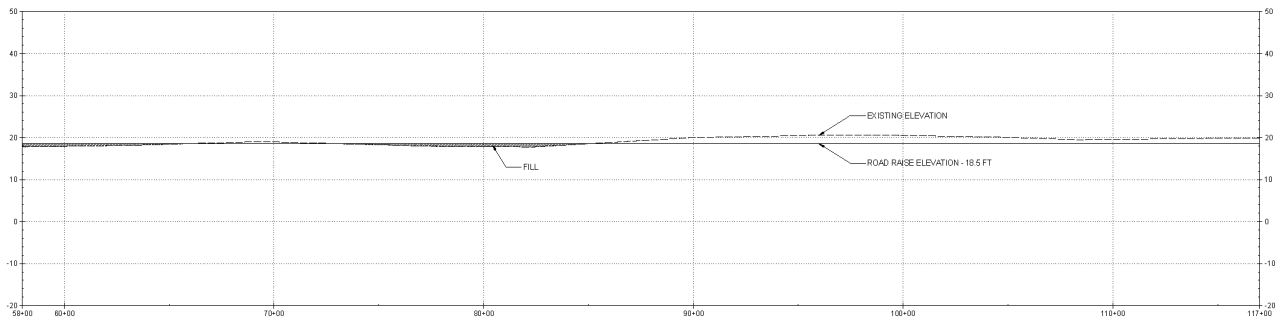
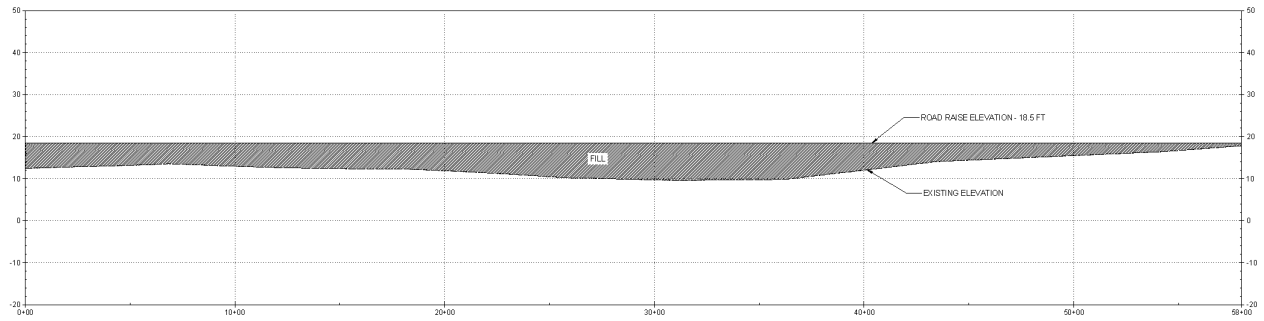


Figure B-2: Typical Section of Road Elevation



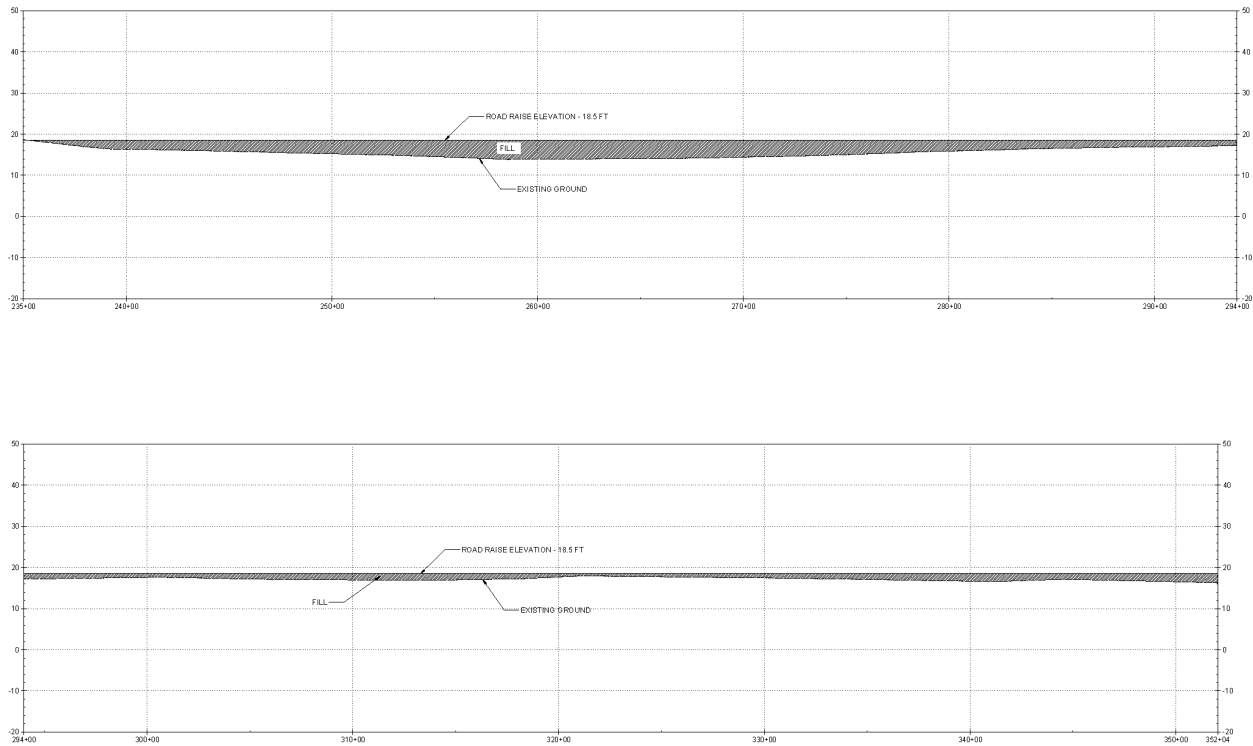


Figure B-3: Road Raise Profiles

Raising Pee Dee Highway was considered as part of the alternatives analysis. However, based on economic evaluation, the measure resulted in a low Benefit-Cost Ratio (BCR) and was therefore not advanced. Consequently, this measure is not included in the Recommended Plan.

B.2 Socastee Diversion Canal and Pond

In the Socastee focus area, an excavated diversion canal from Socastee Creek with a detention/retention pond was proposed. The location of the proposed pond is near the intersection of Burcale Rd. and Fantasy Harbour Blvd. The channel would connect the pond to Socastee Creek, following a small natural stream. The channel would require a culvert to be installed under Burcale Rd. Based on H&H modeling, a pond depth of 15ft was assumed with a 3:1 side slope. The channel bottom was estimated to have a width of 20ft, with a 1:1 side slope, and 10ft depth. The estimated quantity of excavation required for the retention/detention pod is 991,870 cu yd and 14,100 cu yd for the channel. No site-specific topographic surveys were performed so the quantity of excavation could vary. No site-specific utility surveys were performed, so utility relocations could be required during the construction of this measure.

Considerations during design need to be made about the ability of the in situ soil to retain water in the pond. A Geotech report provided by the non-federal sponsor for an adjacent Fire Station on Burcale Rd. indicated soft to firm fat clays (CH) ranging from 7 to 7.5ft below the surface. Very dense sands were encountered at depths 8-10ft below the surface, and interbedded silts, clays, and sands for the remainder of the estimated pond depth. Bentonite clay may be needed to mix with excavated soil to allow the pond to retain water. Excavated material will need to be hauled away from the site.

Water was not encountered in the hand auger borings at the time of drilling to a depth of 4 feet below the surface. Water levels within the cone soundings were interpreted from pore pressure readings to range from approximately 3 to 4 feet below the existing ground surface. The site is favorable for the development of shallow perched groundwater conditions due to the clayey upper soils. Dewatering will be required during excavation of the channel and pond.



Figure B-4: Location of Detention/Retention Pond and Diversion Channel

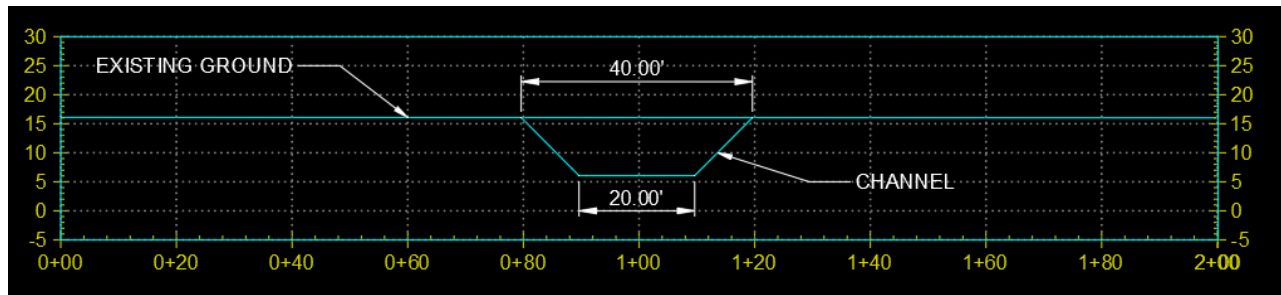


Figure B-5: Typical Section of the Diversion Channel

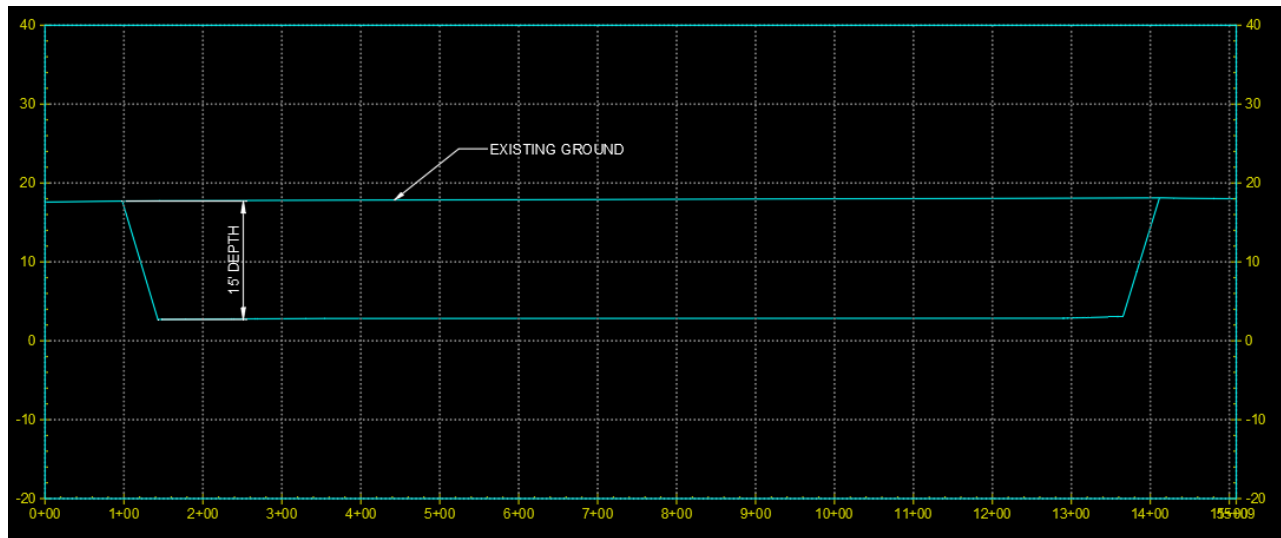


Figure B-6: Detention/Retention Pond Section

Although the Socastee Diversion Canal and Pond was considered as a potential flood risk reduction measure, the economic evaluation determined that the measure did not meet feasibility criteria due to a low Benefit-Cost Ratio (BCR). As a result, the measure was screened out and is not part of the Recommended Plan.

B.3 Simpson Creek Benching

Benching of Simpson Creek in the Red Bluff focus area was proposed. The existing channel would be benched on the right bank with a 140ft width and 1:1 slope to existing ground, and maximum width of 200ft. The estimated quantity of excavation is 714,380 cu yd. Site-specific topographic surveys were not performed for this measure, including bathymetry data of the existing tributary. Excavation quantities are likely over-estimated due to the existing channel area not being subtracted from the terrain.

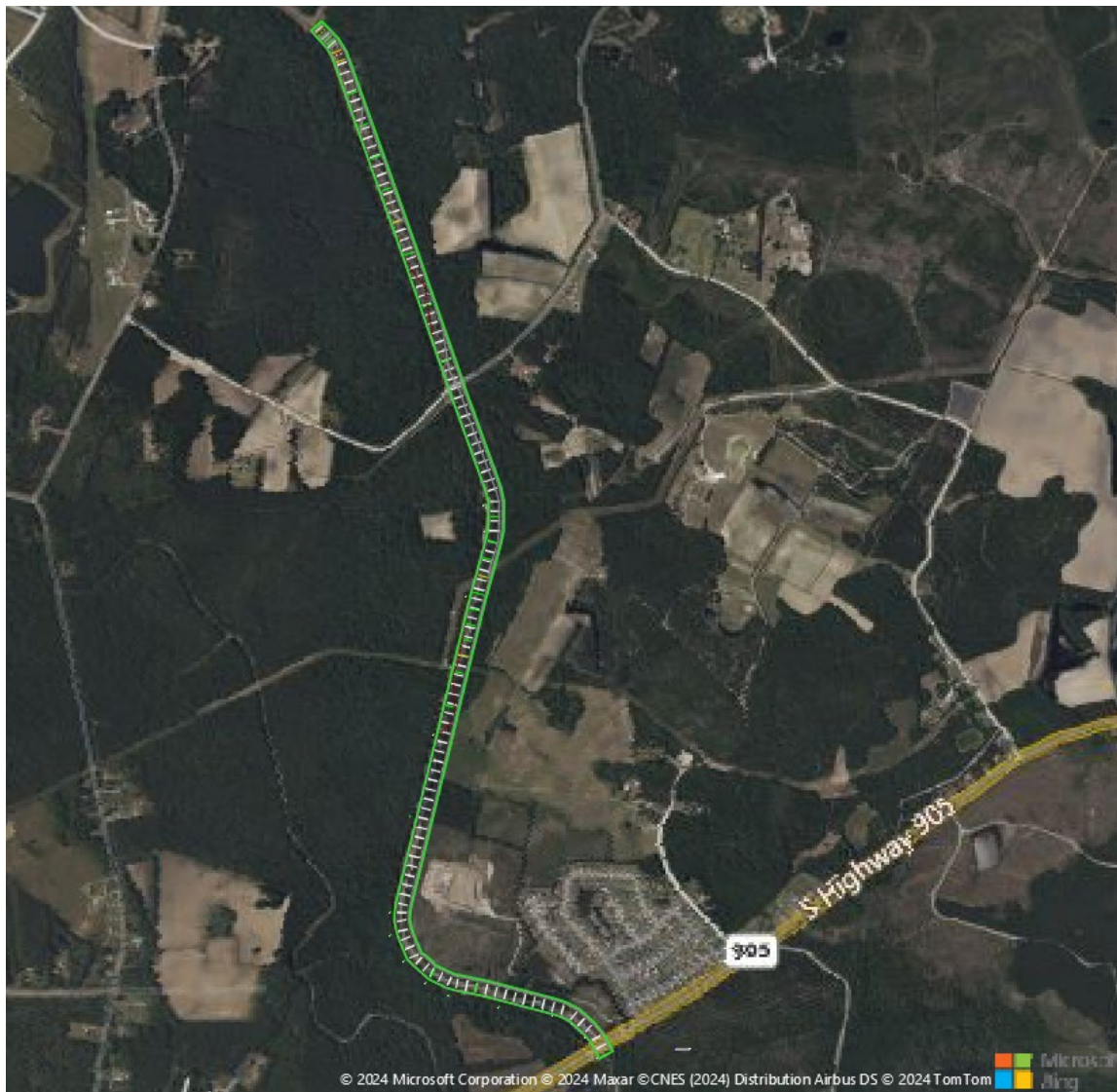


Figure B-7: Simpson Creek Benching Alignment

Although Simpson Creek benching was considered during plan formulation to improve local conveyance and reduce flood risk, the economic evaluation determined that the measure did not satisfy feasibility criteria due to a low Benefit-Cost Ratio (BCR). As a result, the measure was screened out and is not part of the Recommended Plan.

B.4 Flood Walls

The exact alignments of the flood walls proposed for the Longs and Socastee areas have not been determined. Site specific topographic surveys would need to be performed for these measures to ensure they are tying into high ground to achieve the estimated benefits from the H&H modeling. Power line easements cross Socastee Creek, so the flood walls proposed in this focus area may interfere with the construction of the walls. Utility surveys would also need to be performed to determine the extent of utility relocations required for these measures.

Floodwalls for the Longs and Socastee areas were evaluated during alternatives analysis. Based on the economic screening, these measures resulted in a low Benefit-Cost Ratio (BCR) and were therefore not carried forward. Accordingly, these measures are not included in the Recommended Plan.

B.5 Conway Relief Bridges (Cross Drains)

Relief Bridges (Cross Drains) have been proposed in the Conway focus area to connect the floodplain through the roadway embankment on Highway 501, Highway 501 Business, and Highway 905. The approximate locations of the centerline of the culverts (yellow line) that will collect flow are shown in the figures below. The culverts will be placed a minimum of 500ft away from the bridge abutments to minimize structural impacts. Proposed Cross section views are also shown at each location.

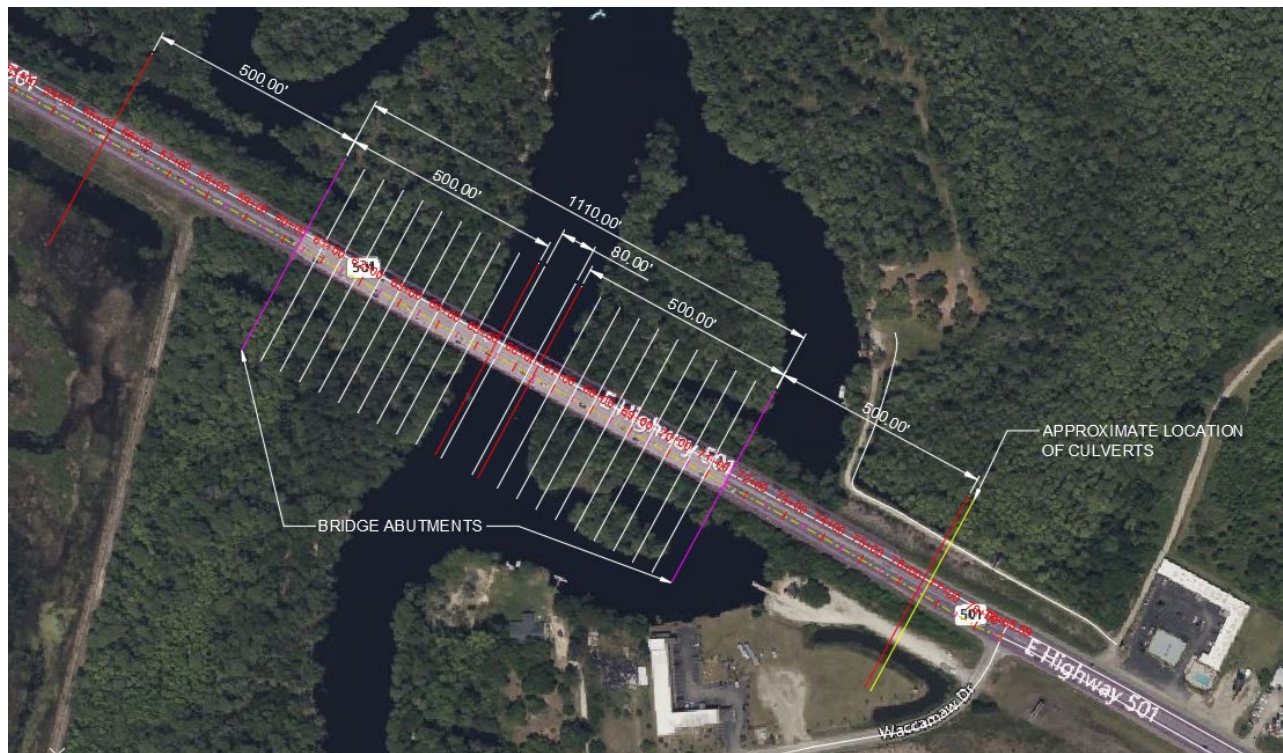


Figure B-8: Highway 501 Culvert Location

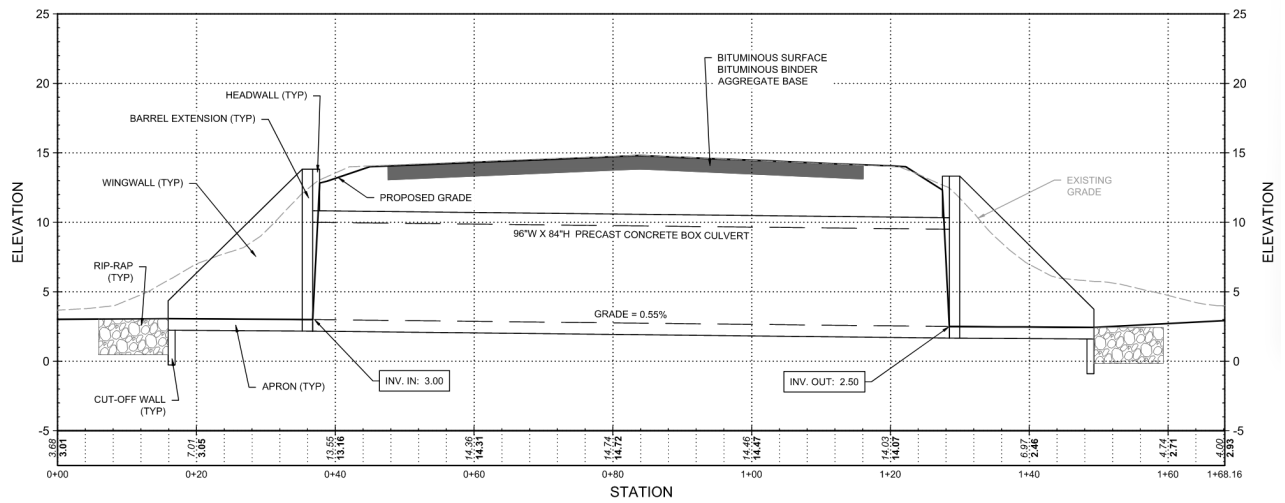


Figure B-9: Highway 501 Cross Section

The Highway 501 Relief Bridge will be two parallel 8'W x 7'H Precast Reinforced Concrete Box Culverts.

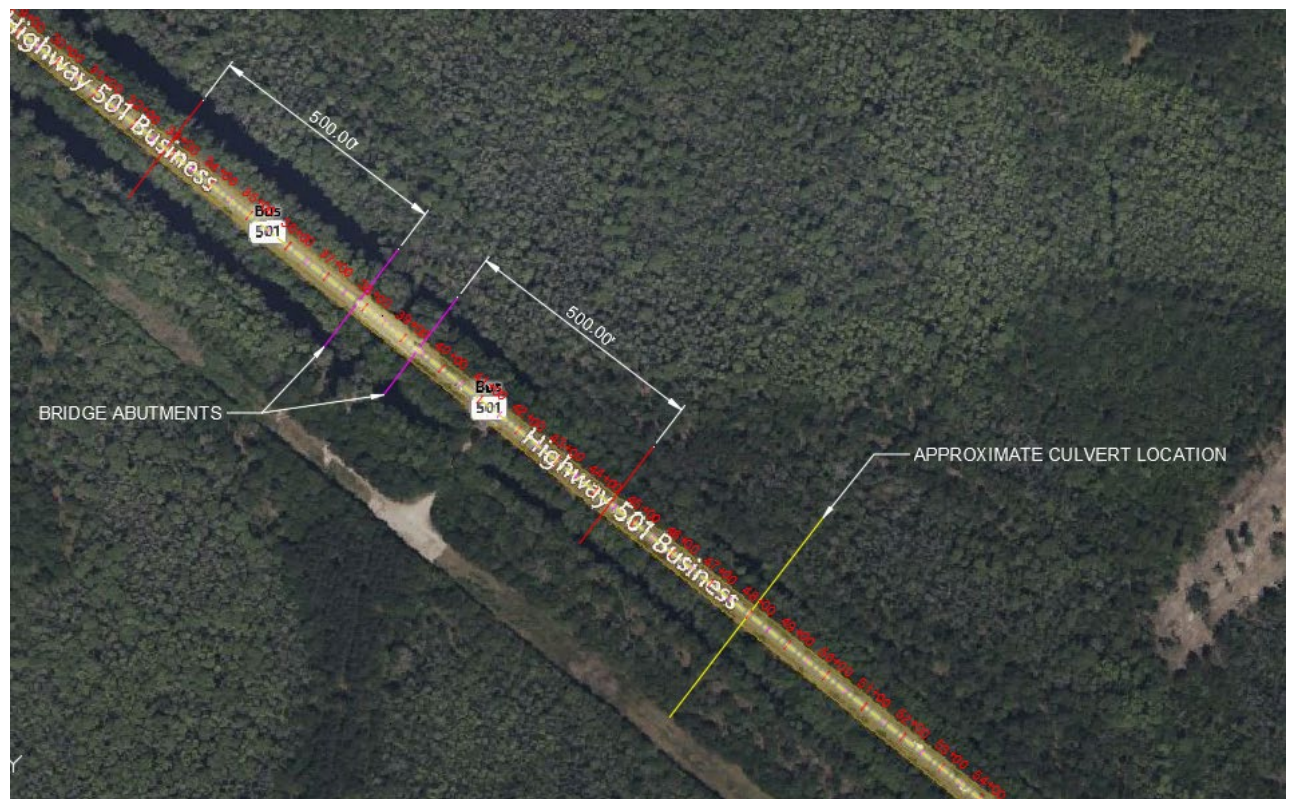


Figure B-10: Highway 501 Business Culvert Location

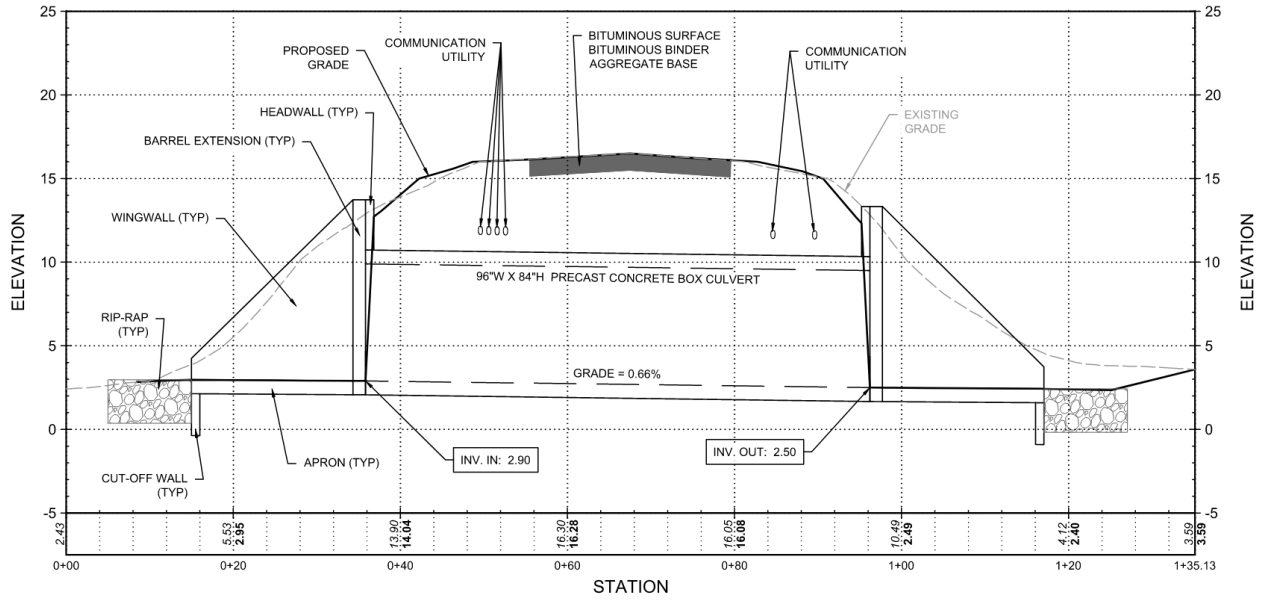


Figure B-11: Highway 501 Business Cross Section

The Highway 501 Business Relief Bridge will be two parallel 8'W x 7'H Precast Reinforced Concrete Box Culverts.

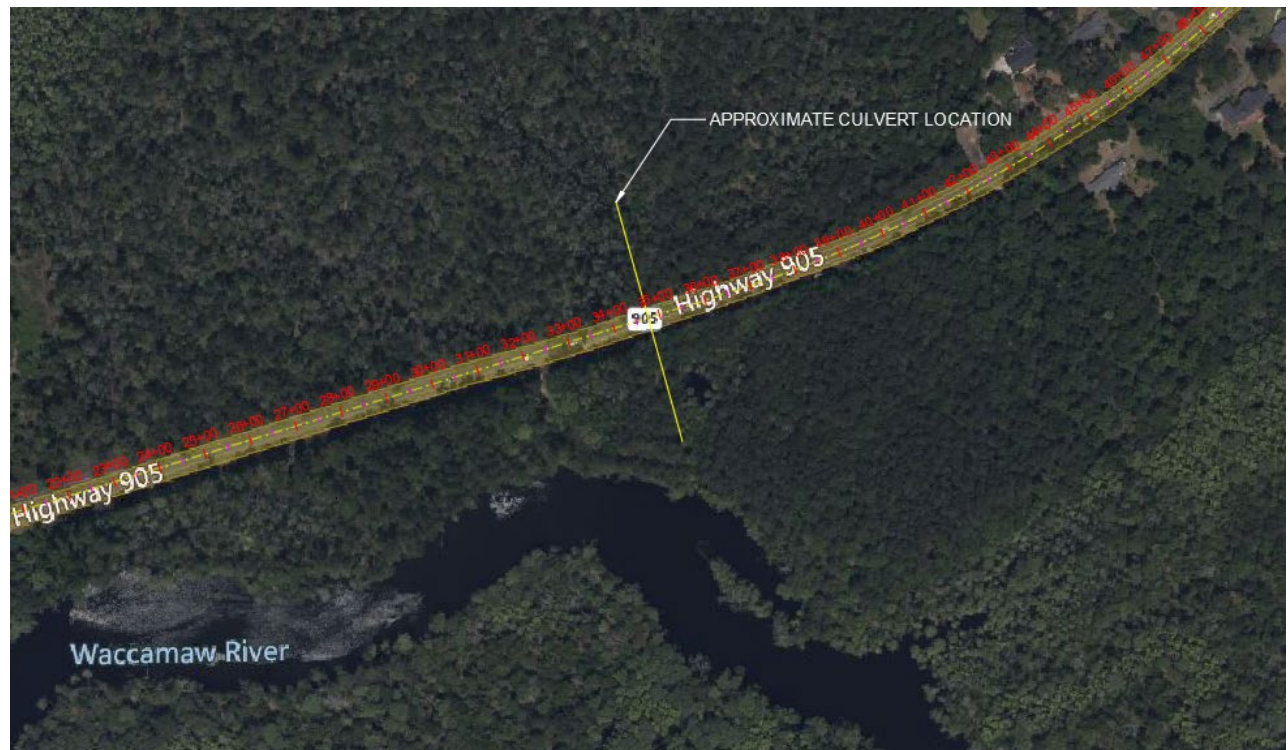


Figure B-12: Highway 905 Culvert Location

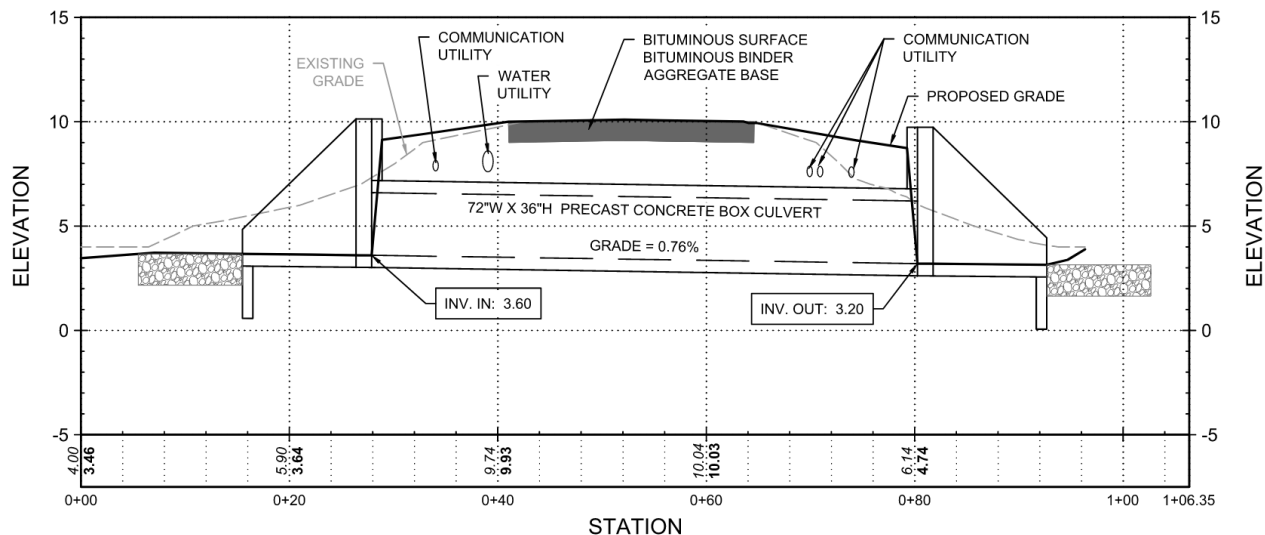


Figure B-13: Highway 905 Cross Section

The Highway 905 Relief will be three parallel 6'W x 3'H Precast Reinforced Concrete Box Culverts.

Two Concrete Wingwalls, Two Concrete Barell Extensions, Concrete Headwall, Concrete Apron w/ below ground cutoff wall, and surrounding Rip-Rap will be placed on the upstream and downstream of all three relief bridges. To be designed to meet SC DOT standards.

An example of what the culverts may look like is shown in the figure below.



Figure B-14: Examples of Reinforced Concrete Box Culverts

There are known Water and Communications utilities located along the HWY 905 and HWY 501 Business roadways. There are potentially other unknown utilities that GIS did not show. All utilities in the Right-of-Way will need to be protected and potentially modified to be raised above the new box culverts. Some may need temporary modification only during construction activities to not cause workability issues.

There are guardrails along HWY 501 and HWY 501 Business that will need to be removed during construction and then replaced after grading is completed. SC DOT requires MASH style semi rigid guardrails.

The asphalt road surface will have to be replaced after installation of the box culverts and regrading over the box culverts. Heavy duty asphalt needs to meet SC DOT specifications.

Open cut installation will likely be the best course of action for all three locations. HWY 501 will require a phased construction plan, to keep traffic moving.

B.6 Socastee Barrier Removal

Socastee Swamp currently has two weirs constructed as a part of a previous Federal project. Removal of these weirs was proposed to reduce flood risk in the surrounding area. USACE Jacksonville District completed a separate Scope of Work, located in Appendix I, to address the Weir Removal in much more detail.

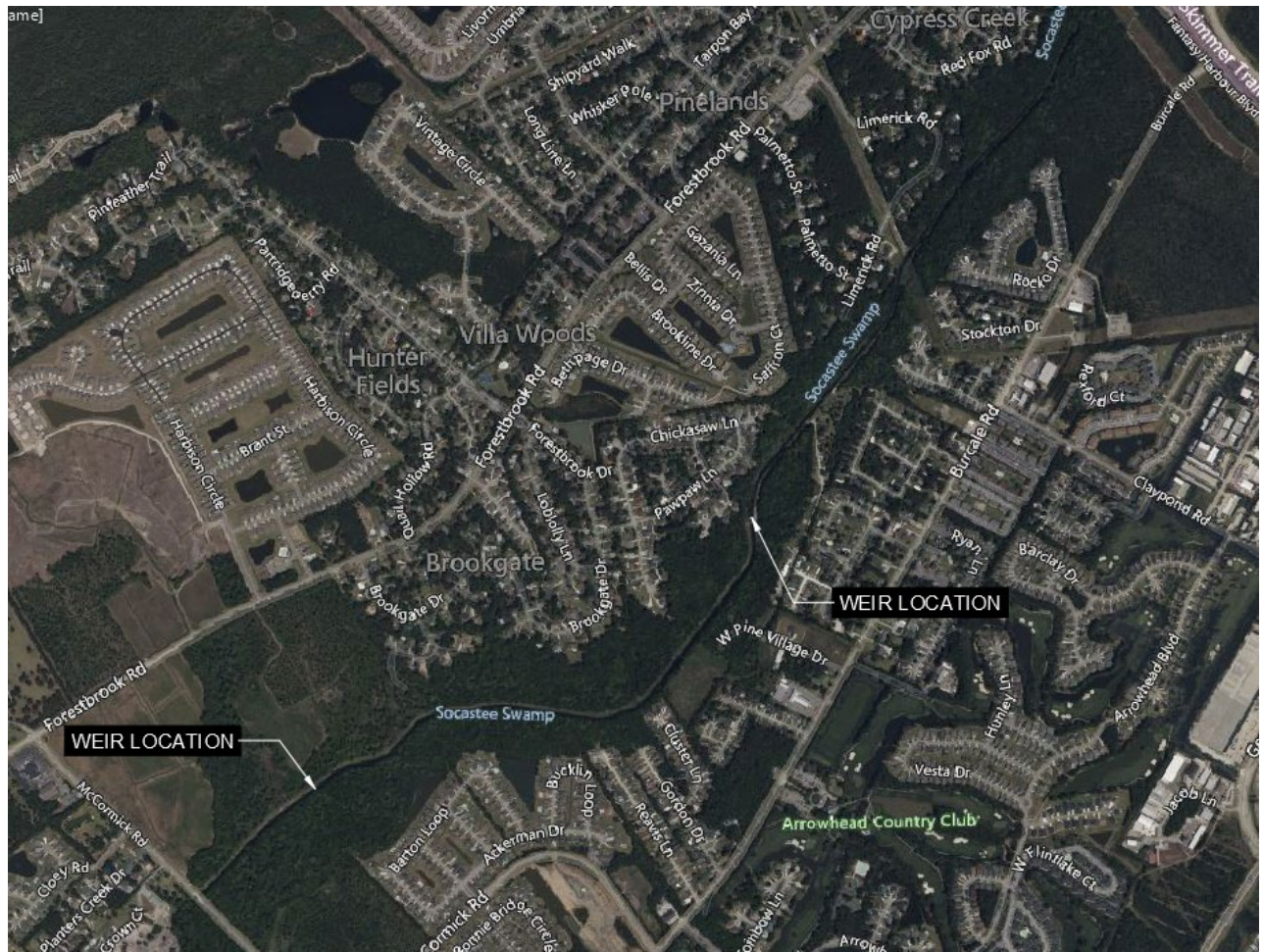


Figure B-15: Location of Weirs on Socastee Swamp

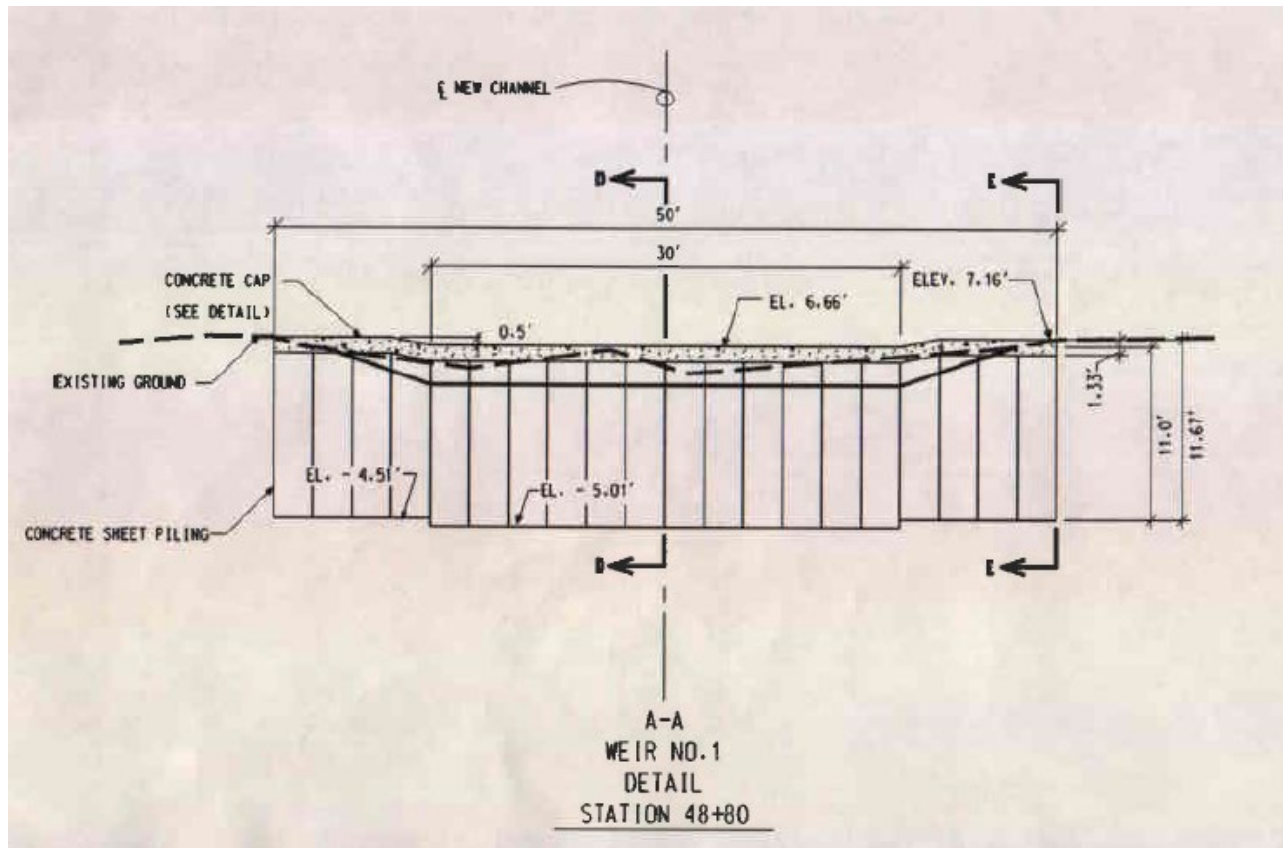


Figure B-16: Downstream Weir on Socastee Swamp

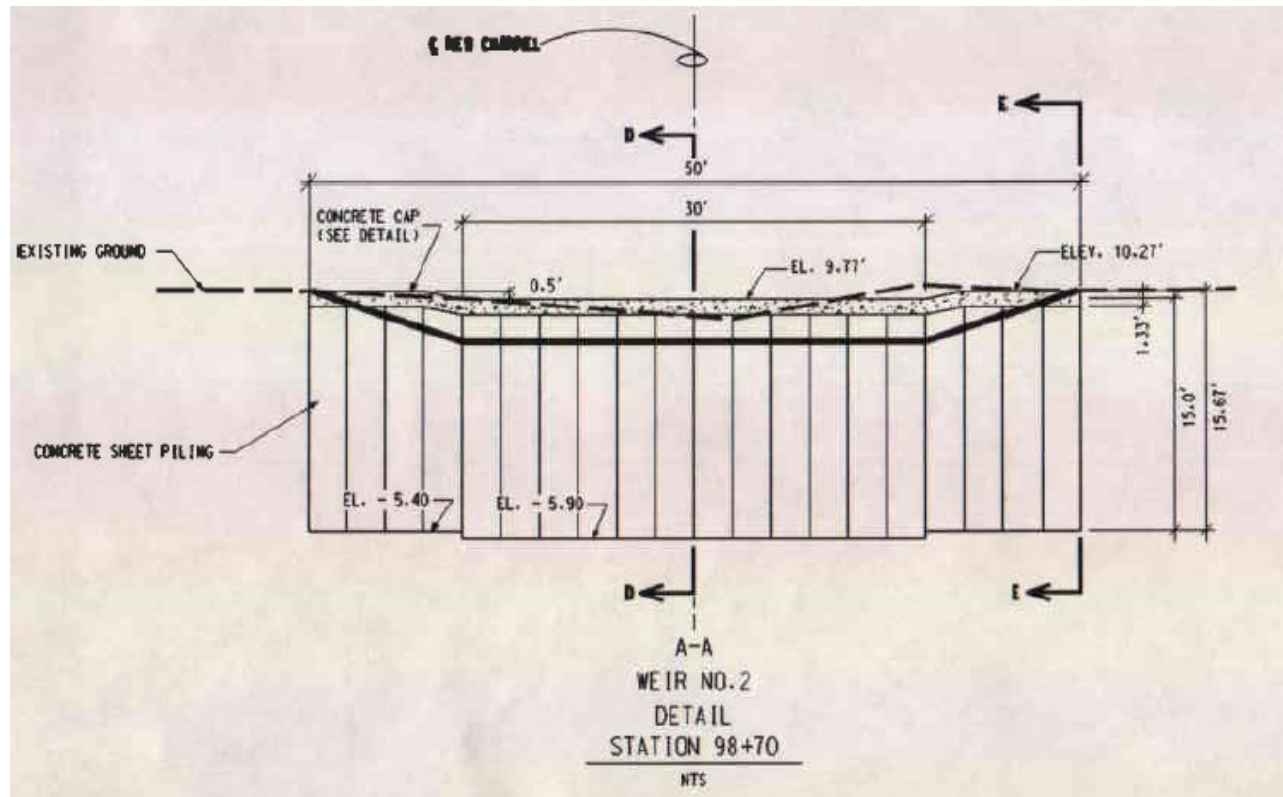


Figure B-17: Upstream Weir on Socastee Swamp

B.7 Other Structural Measures

For all other structural measures not addressed above, topographic surveys would need to be performed during design. Existing utilities near the proposed excavation areas should be located prior to construction activities. The number of structures and utilities impacted will be further refined in future planning and design phases.

C NONSTRUCTURAL MEASURES

C.1 Elevation

In each of the focus areas, elevation of residential homes was evaluated. Existing utilities near the proposed excavation areas should be located prior to construction activities. Excavation trenches near the existing structures should be graded such that rainwater does not saturate the soils beneath the existing foundation.