Preliminary Stormwater Management Design Study

US 21 (Sea Island Parkway) Harbor River Bridge Replacement

Project # P026862

Beaufort County, South Carolina

February 21, 2017

Contents

Tables

Figures

This page is intentionally left blank.

1 Introduction/Existing Conditions

The South Carolina Department of Transportation proposes to replace the existing US Highway 21 Bridge over the Harbor River in Beaufort County, South Carolina. The existing bridge to be replaced is 0.54 miles long and spans a navigable waterway, the Harbor River, to connect Saint Helena Island and Harbor Island. The proposed project involves replacement of the existing swing-span bridge with a proposed fixed, high level bridge on new alignment and tying back in to the existing road. The project site is located in a rural area and the roadway corridor consists of marshes, wetlands, and water bodies on either side.

The existing 2,851-foot long bridge over the Harbor River is a center swing-span bridge that is 24-feet wide with two 10-foot driving lanes. The existing road on either end of the bridge consists of two 12-foot driving lanes with 4-foot paved shoulders and is built on fill, creating a causeway across the marshy floodplains. Runoff from the existing bridge deck is collected by scuppers that discharge directly into the Harbor River and bordering wetlands. There are no closed drainage systems or major drainage crossings within the project limits.

The project site is located in a rural area and lies within the 100-year floodplain. Estuarine systems are found within the study project corridor and include deepwater tidal habitats and adjacent tidal wetlands. The predominant soils consist of muddy, fine sands.

2 Drainage Design Criteria

The hydrologic analysis is to be performed in accordance with SCDOT's Requirements for Hydraulic Design Studies dated May 26, 2009. Storm drainage systems will be designed with Geopak Drainage using a 10-year design storm. The Rational Method will be used to determine peak runoff values for storm drainage calculations since all drainage areas will be less than 100 acres. The published SCDOT rainfall intensity values for Hilton Head most represent the rainfall pattern for the project site. Table 2-1 details the drainage design criteria for the project.

Table 2-1. Drainage Design Criteria

DRAINAGE DESIGN				
DESIGN ELEMENT			**DESIGN CRITERIA**	**SOURCE**
Design Discharge	Cross-Line Pipes		50-year	SCDOT Requirements for Hydraulic Design Studies, May 26, 2009 **Section 2.2.2** and **2.2.3**
	Systems and Ditches	0 – 40 AC	10-year	
		40 – 500 AC	25-year	
		> 500 AC	50-year	
Spread Criteria	Roadway	Design Storm	10-year	SCDOT Requirements for Hydraulic Design Studies, May 26, 2009 **Section 2.2.4**
		Spread Width	½ travel lane	
	Bridge	Design Storm	10-year	HEC-21, Section 3.1
		Spread Width	Shoulder Width	
Minimum Ditch and Pipe Grades			Ditch = 0.1%, Pipe = 0.3%	SCDOT Requirements for Hydraulic Design Studies, May 26, 2009 **Section 2.2.5**
Minimum Velocity of Pipe			3 ft/sec	
Minimum Pipe Size	Storm Drainage Systems & Cross-Line Pipes		18"	SCDOT Requirements for Hydraulic Design Studies, May 26, 2009 **Section 2.2.6**
	Yard Drains & Driveway Pipes		15"	
Minimum Cover	Yard Drains		1.0'	SCDOT Requirements for Hydraulic Design Studies, May 26, 2009 **Section 2.2.7**
	Pipes except Yard Drains		2.0' for CB-16 3.0' for CB-17 & 18	

Grassed swales are to be designed in accordance with SCDOT's Stormwater Quality Design Manual. A grassed swale is allowed a maximum drainage area of 5 acres to properly treat the runoff. It must be capable of conveying the 10-year, 24-hour storm event without overtopping or reaching erosive peak runoff velocities and shear stresses.

3 Proposed Conditions

The proposed design typical section for the road between the project limit tie-ins and the bridge consists of two 12-foot travel lanes and two 10-foot shoulders, in which 4-feet of the shoulders will be paved. The bridge consists of two 12-foot travel lanes and two 10-foot paved shoulders.

The proposed drainage design consists of deck drains along the outside edge of the bridge deck at the face of the barrier wall,where runoff will be collected in closed drainage systems suspended underneath the bridge. The bridge deck drain systems are proposed to tie to manholes or catch basins located at the ends of the bridge. Closed drainage will convey the bridge runoff into grassed swales. The grassed swales should provide water quality treatment before outfalling into the surrounding marshes and outside 1,000-feet away from shellfish beds, per OCRM requirements.

The deck drains should be placed so that spread will be less than 10-feet. Deck drains should be spaced so that the spread will remain within the shoulder and that 0 cfs will run off of the bridge at its ends and minimized to no more than 0.2 cfs bypass flow at any superevlevation rollover. Through analysis, it was determined that deck drains with 6-inch diameter openings would collect runoff and that a12-inch diameter PVC pipe would convey the runoff from the deck drains to the drainage system off of the bridge.

Catch basins should be placed at the ends of the approach slabs to collect runoff from the approach slabs and to tie in the bridge deck drain systems. Manholes should be used on superelevated sides of the roadway in lieu of catch basins to tie the bridge deck drain systems to the roadway drainage systems.

Smooth wall pipe will be used to convey the runoff in the closed drainage systems. The minimum pipe grade in the systems should be 0.3 percent. The minimum pipe size to be used in the roadway drainage systems is 18-inch diameter.

4 Temporary Sediment and Erosion Control

Throughout the duration of the project, a single row of silt fence should be installed and maintained at the construction limits along the length of the project. A double row of silt fence should be placed where the construction impacts are adjacent to marshes, wetlands, or streams.

Inlet protection should be provided at all existing and proposed inlets that are impacted by the proposed improvements. Type B Inlet Structure Filters should be used at manhole and drop inlet locations and Type E or F Inlet Structure Filters should be used at catch basins located in the curb and gutter sections.

Appropriately sized energy dissipaters will be installed at all storm drainage outlets to reduce discharge velocities.

All erosion control measures should be in accordance with SCDOT Standard Drawings from Sections 804 and 815.

5 Permanent Water Quality Considerations

The drainage systems are proposed to outfall at each end of the bridge into ditches that should convey the runoff to a distance greater than 1,000-feet from shellfish beds before outfalling into the marshes. The last 100-feet of the ditches should be grassed swales constructed and maintained per SCDOT's Stormwater Quality Design Manual to provide water quality BMPs. The proposed grassed swales should have a minimum flow length of 100-feet with a 2-foot wide base and 0.5-foot high earthen flow control structures spaced throughout to achieve water quality benefits and reduce runoff velocities and shear stresses. The minimum longitudinal grade recommended is 0.5 percent. Front and back side slopes should be no steeper than 2H:1V.

The ditches and grassed swales are proposed to be created between the proposed roadway fill slopes and the existing roadway. The ditches and grassed swales should run adjacent to the fill slopes to beyond the 1,000-foot shellfish bed minimum distance and then can discharge directly to the marsh. By utilizing the existing causeway section that will be abandoned, construction disturbance impacts to the surrounding wetlands should be minimized. Temporary drainage should be considered during further project development as the ditches in the existing roadway will not be able to be constructed until traffic is switched on to the realigned roadway.

6 Project Maps

See Figures 1 through 7 for the project’s vicinity, location, quad mapping, soils, FEMA flood information, and drainage areas.

Figure 6-1. Vicinity Map

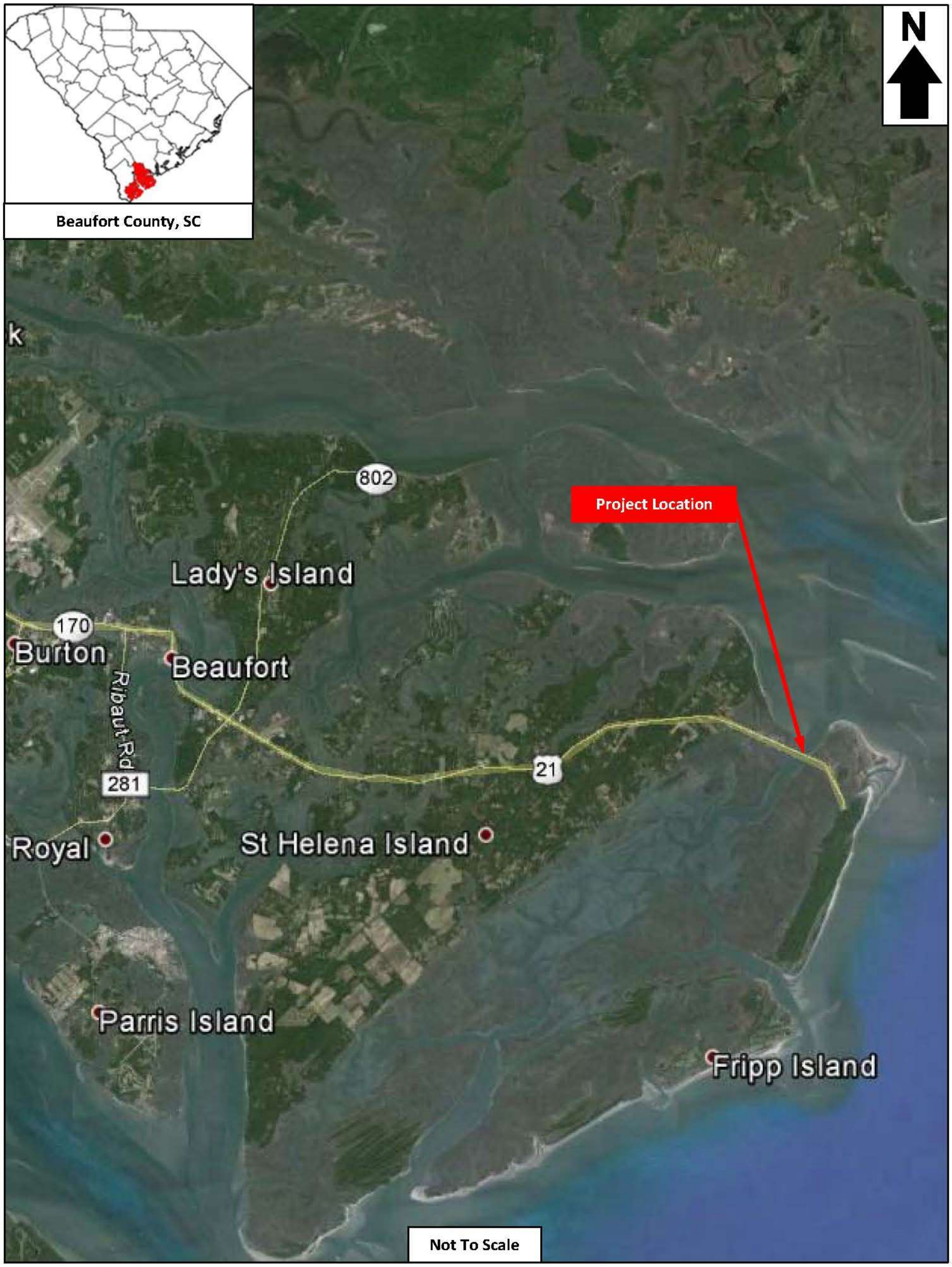

Figure 6-2. Location Map

Figure 6-3. USGS Quad Map

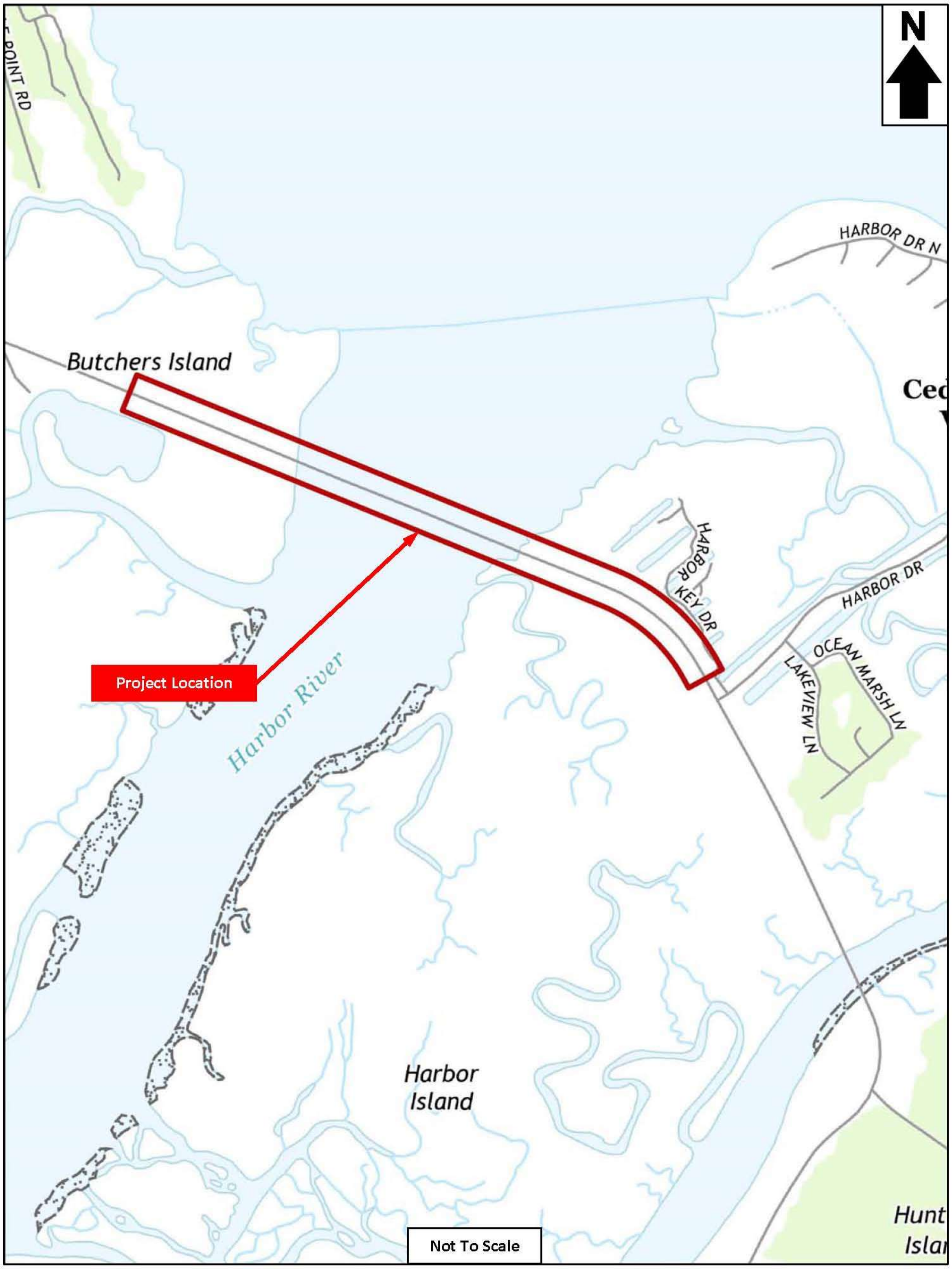

Figure 6-4. Soils Map

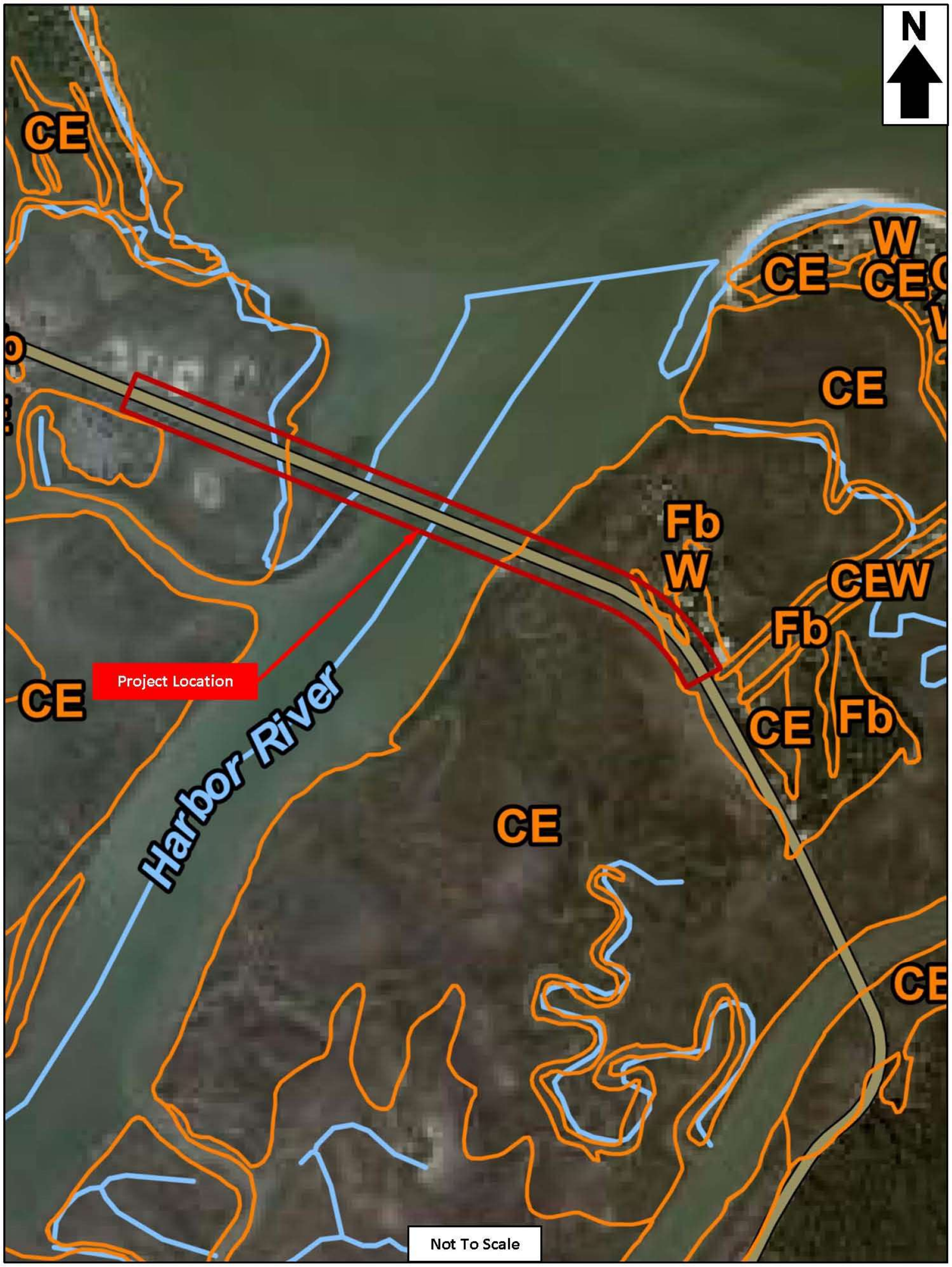

Figure 6-5. FEMA Flood Map

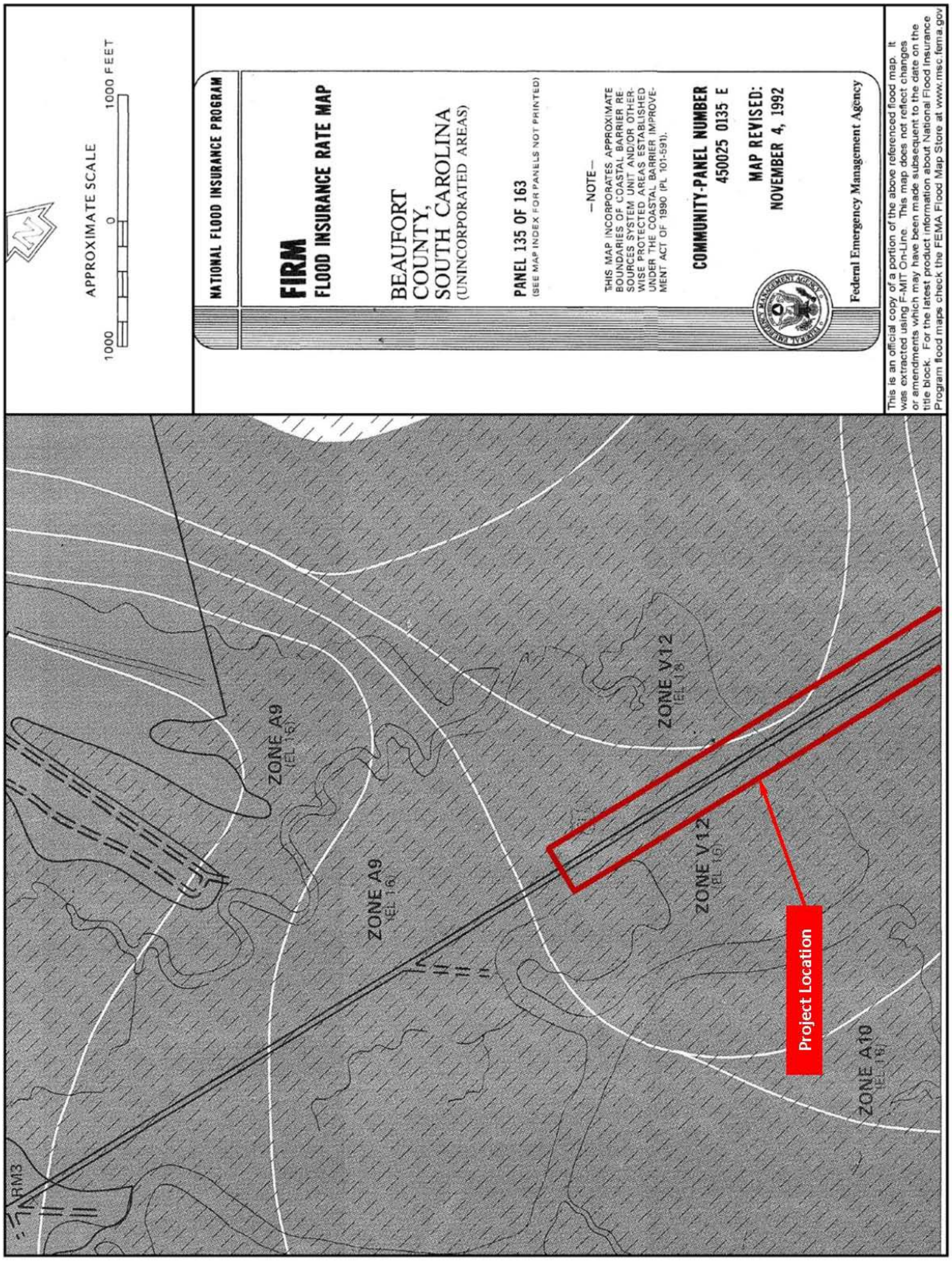

Figure 6-6. FEMA Flood Map