STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

TECHNICAL REPORT COVERSHEET

650-050-38
ENVIRONMENTAL
MANAGEMENT
08/22

BRIDGE HYDRAULICS REPORT

Florida Department of Transportation

District 1

Fort Hamer Road PD&E Study

Limits of Project: Upper Manatee River Road to US 301

Manatee, Florida

Financial Management Number: XXXXX-X

ETDM Number: 14536

Date: 8/26/2024

Authorized Signature

Huseyin Demir
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Title

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CIP 6054767 FPID 452856-1
FORT HAMER ROAD PD&E STUDY
FROM UPPER MANATEE RIVER ROAD TO NORTH OF RIVE ISLE RUN
MANATEE, FL
BRIDGE HYDRAULICS REPORT

PREPARED FOR
KIMLEY HORN
200 SOUTH ORANGE AVE., SUITE 600,
ORLANDO, FL 32801

PREPARED BY
INTERA INCORPORATED
2114 NW 40TH TERRACE, SUITE A1
GAINESVILLE, FL 32605

AUGUST 2024

PROJECT INDEX AND ENGINEER'S CERTIFICATION

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Fort Hamer Bridge over Upper Manatee River, Manatee County, Florida

II. Governing Standards and Specifications
   a. AASHTO Guide Specifications for Bridges Vulnerable to Coastal Storms (2008)
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III. Computer Programs Used for Calculations and Analysis
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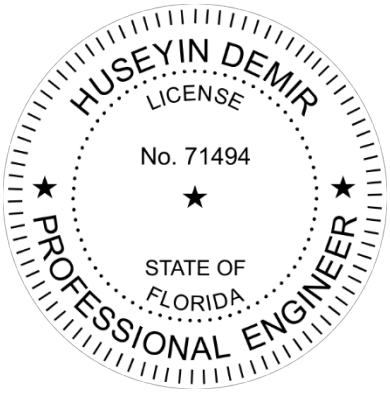
   c. Microsoft Excel for Microsoft Office 365

The official record of this report is the electronic file digitally signed and sealed under 61G15-23.004, F.A.C.



I, Huseyin Demir hereby state that this report, as listed in the following Table of Contents, is, to the best of my knowledge and belief, true and correct and represents the described work in accordance with current established engineering practices. I hereby certify that I am a Licensed Professional Engineer in the State of Florida practicing with INTERA Incorporated, and that I have supervised the preparation of and approve the evaluations, findings, opinions, and conclusions hereby reported.

This document has been digitally signed and sealed by Huseyin Demir with a Digital Signature.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

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1.0 Introduction

Kimley Horn under contract to Manatee County, Florida (County) is conducting a Project Development and Environment (PD&E) Study for widening the Fort Hamer Road from two lanes to four lanes from Upper Manatee River Road to US 301, approximately four miles. This section includes the two-lane Fort Hamer Bridge over Upper Manatee River (Bridge #134123). The widening would require a new bridge parallel to the existing one. The study includes a Bridge Hydraulic Report (BHR) as part of the scope of services. Kimley Horn subcontracted INTERA Incorporated (INTERA) to provide hydraulic and coastal engineering support in the development of the BHR for the proposed bridge in accordance with FDOT standards.

Complex flow patterns under extreme flood conditions at bridges located within coastal systems make such bridges susceptible to scour-related damage. To guard against scour-related damage, the Federal Highway Administration (FHWA) and the FDOT require a detailed analysis to determine design hydraulic parameters at the bridge and assess the vulnerability of bridges to flow-induced scour. Kimley Horn subcontracted INTERA for this reason.

This BHR combines the latest FHWA and FDOT technical guidelines with hydraulic modeling and coastal engineering methodologies. A two-dimensional hydrodynamic model by INTERA describing the system — including the most current survey information — provided predictions of hydraulic parameters needed to estimate various design conditions.

The following standards apply to the bridge's design.

- The design storm frequency equals 50 years (yrs) given that the AADT is larger than 1500 (FDOT, 2024a).
- The scour design flood frequency equals 100 yrs and the scour design check flood frequency equals 500 yrs (FDOT, 2024a).
- For concrete superstructures in aggressive environments (high chloride content), the FDOT (2024a) states that the minimum vertical clearance equals 12 feet (ft) between mean high water (MHW) and the low member of bridges.
- For drainage, the FDOT (2024a) states that the bridge design must incorporate a sea level rise analysis to assess the vulnerability of flooding over its design life.
- Finally, FDOT (2024a) stipulates that the bridge designer must limit the spread on the bridge deck resulting from a rainfall intensity of four inches per hour.

This report describes the study area and the results of the desktop study employing available data.

2.0 Site Description

2.1 General Site Characteristics

Fort Hamer Road crosses the Upper Manatee River (Figure 2.1) over a marshy island. The Manatee River is controlled by a dam six miles upstream of the bridge forming the Lake Manatee behind. Manatee River flows into Tampa Bay 16 miles downstream of the bridge location. The mouth is six miles from Gulf of Mexico (Figure 2.2). Given the location of the bridge in the Bay, design events will be associated with landfalling hurricanes creating storm surge within the bay.

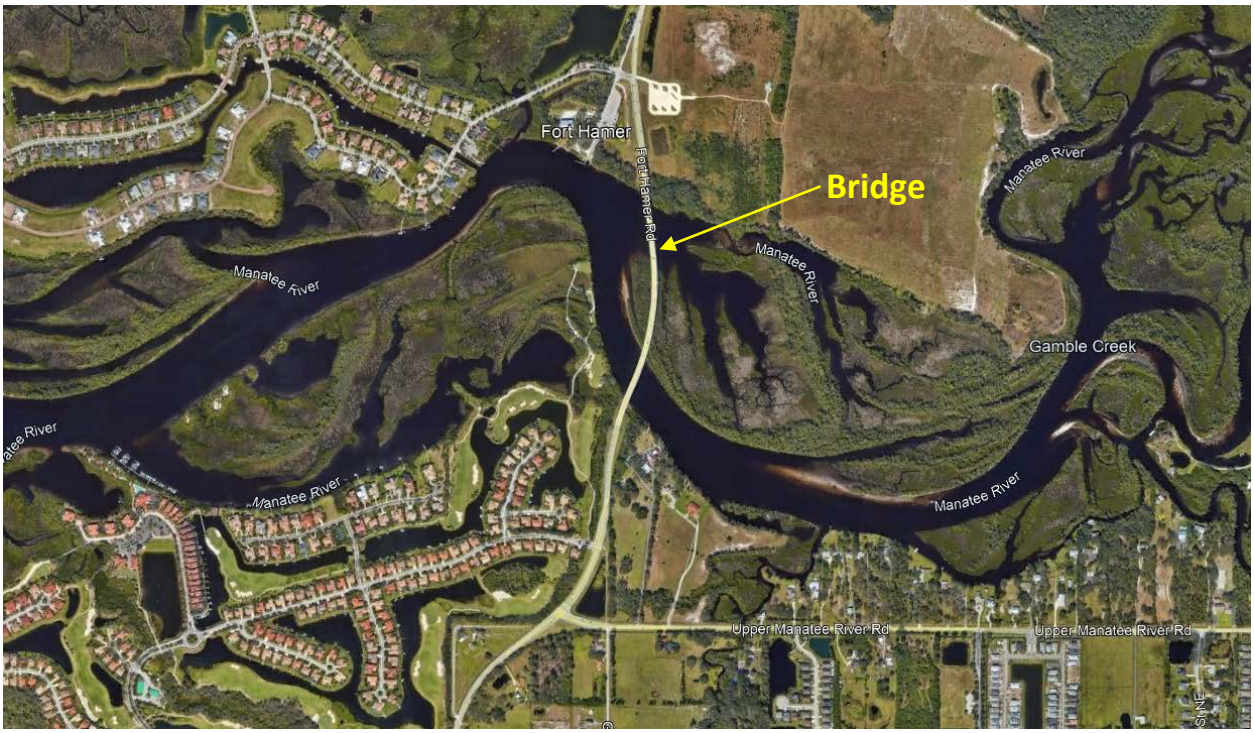

Figure 2.1 Bridge Map

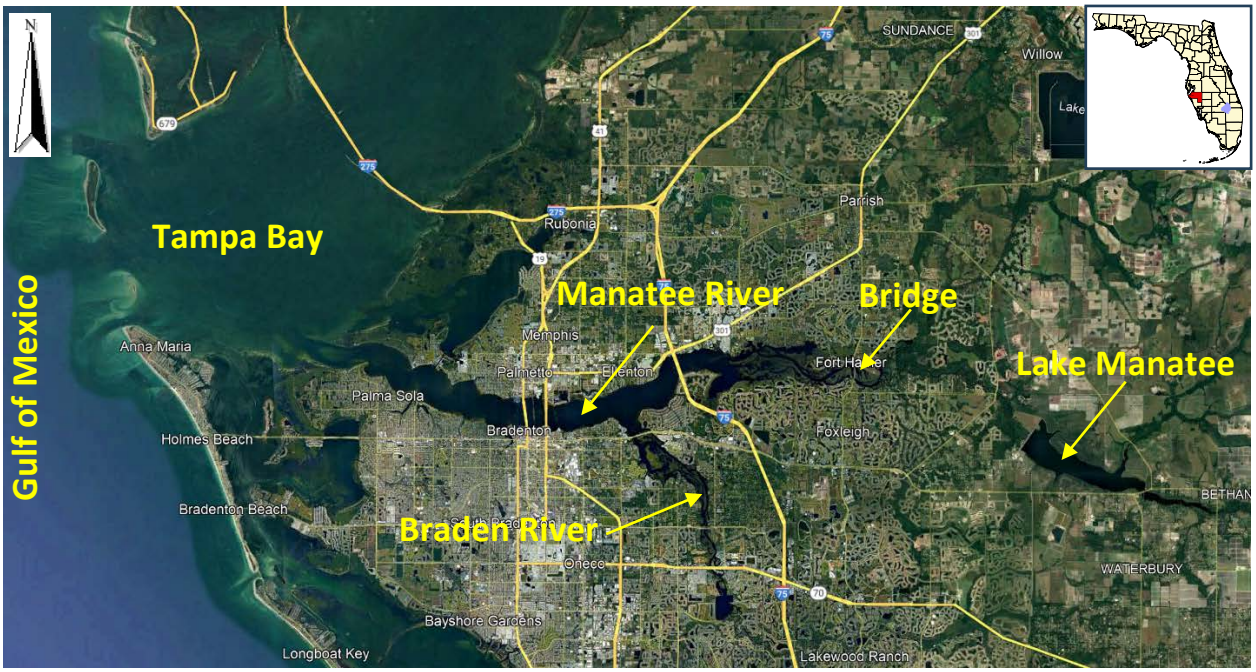

Figure 2.2 Location Map

2.2 Tidal Datums

The closest NOAA tidal gage to the bridge is Redfish Point, Manatee River FL 8726278 (Figure 2.3). The tidal datums are summarized in Table 2.1.

Table 2.1 Tidal Datums at Redfish Point, Manatee River FL 8726278.

Tidal Datum	Elevation (ft NAVD88)
Mean Higher High Water (MHHW)	+0.81
Mean High Water (MHW)	+0.57
Mean Sea Level (MSL)	-0.26
Mean Low Water (MLW)	-1.14
Mean Lower Low Water (MLLW)	-1.47
National Geodetic Datum of 1929 (NGVD 29)	-1.61

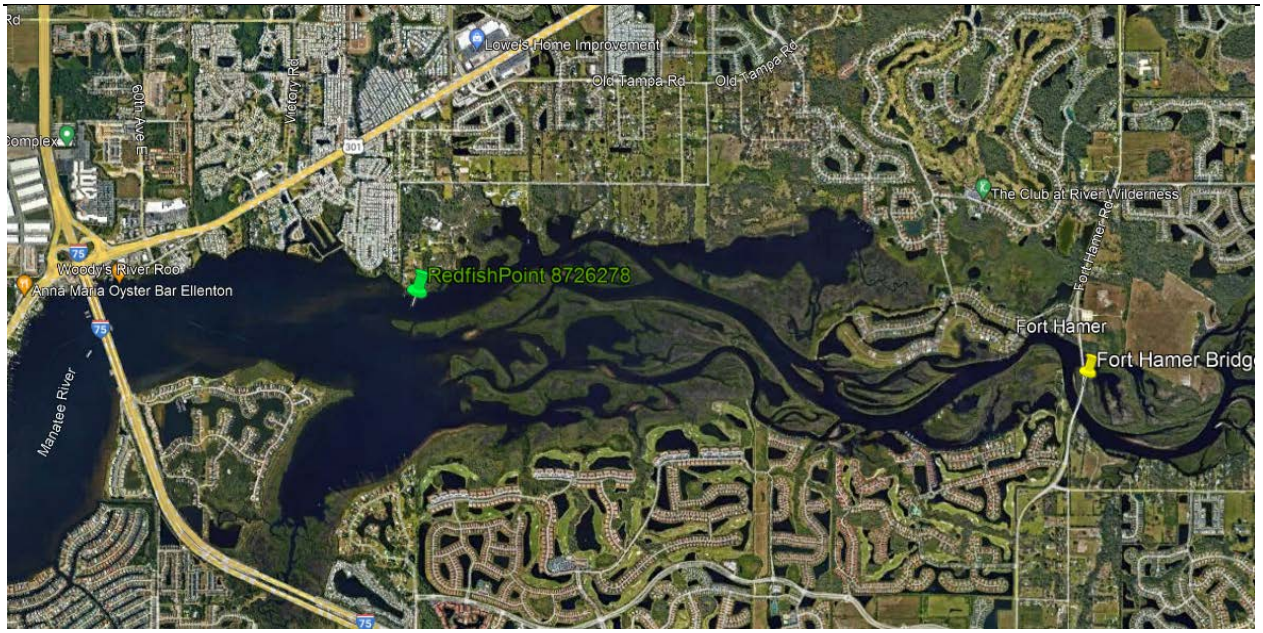

Figure 2.3 NOAA Tidal Gage Location for Redfish Point, Manatee River FL 8726278.

2.3 Hurricanes

Hurricanes have significantly affected the project location. Investigation of NOAA's HURDAT database reveals that from 1850 to 2021,36 tropical storms and 35 hurricanes have passed within 60 nautical miles (nmi) of the bridge. Figure 2.3 shows the paths of the hurricanes. As the figure shows, some of the hurricanes made landfall very near the site or moved parallel to the coast.

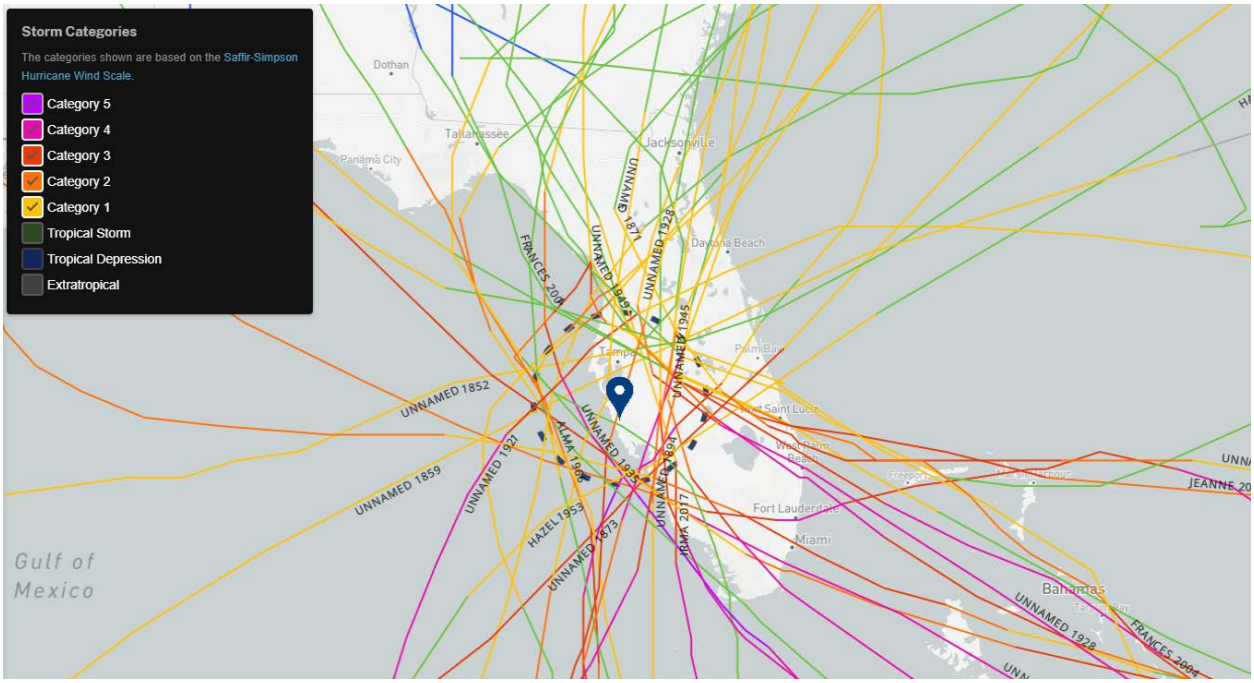

Figure 2.4 Hurricanes Passing within 60 nmi of the Bridge (1850-2022) (coast.noaa.gov/hurricanes)

2.4 FEMA Flood Map and Studies

FEMA performs return period analyses for flood susceptibility nationwide. The results of these analyses culminate in the production of FEMA Flood Insurance Rate Maps (FIRMs) detailing the flood elevations for a specified return interval for a specific region. FEMA's effective FIRM 12081C0195F shows a 100-yr base flood elevation (BFE) of +10 ft NAVD88 within an AE zone (Figure 2.4).

FEMA provides still water levels (i.e., water surface elevations) at the start of select coastal transects (Figure 2.5). Table 2.2 shows FEMA's published effective still water elevations for 50-, 100-, and 500-yr return period events at the closest transect: Transects 56. Note that this transect is close to I-75 and approximately five miles downstream of the bridge.

Table 2.2 FEMA Stillwater Levels near the Bridge at Coastal Transect No. 56

Return Period (yr)	Stillwater Elevation (ft NAVD88)
50	+6.7
100	+7.6
500	+9.9

All bridge crossings must comply with the National Flood Insurance Program. As shown on the effective FIRM, the bridge lies in a FEMA floodway. Therefore, a FEMA no-rise study is required.

Figure 2.5 FEMA Firmette for Bridge Area (www.msc.fema.gov)

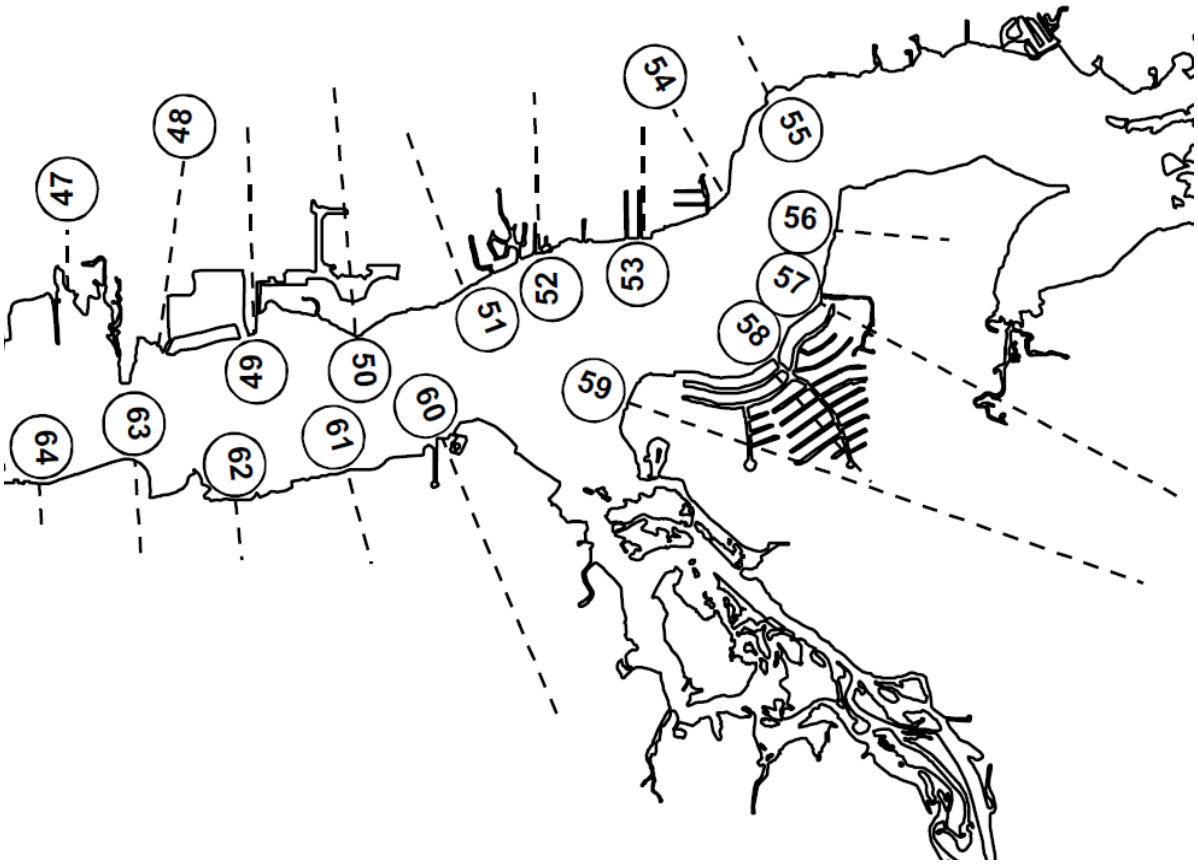

Figure 2.6 Coastal Transect Locations (www.msc.fema.gov)

2.5 Sea Level Rise

Future sea level rise (SLR) in the project area could adversely affect foundation scour, vertical clearances, and wave attack on upland infrastructure. Most recording stations around the world have indicated that MSL has steadily risen over the past century. The predicted values of SLR vary depending on the predicted value of anticipated temperature rise. FDOT (2024a) indicates designers should apply straight-line extrapolation of the relative sea level rise trend at the nearest NOAA station with long term SLR to determine the sea level rise magnitude over the design life of the facility, in this case, the bridge. Figure 2.6 depicts the closest gage: Port Manatee, FL (8726384) with a SLR rate of 5.5 +/- 0.68 mm/yr. Given the assumption the replacement bridge will begin service in 2030 and have a design service life of 75 yrs, the rate of rise results in 0.62 m or 2.1 ft of sea level rise. Note that this value also includes adjustment for SLR from 1992 (the midpoint of the current tidal epoch) to 2030.

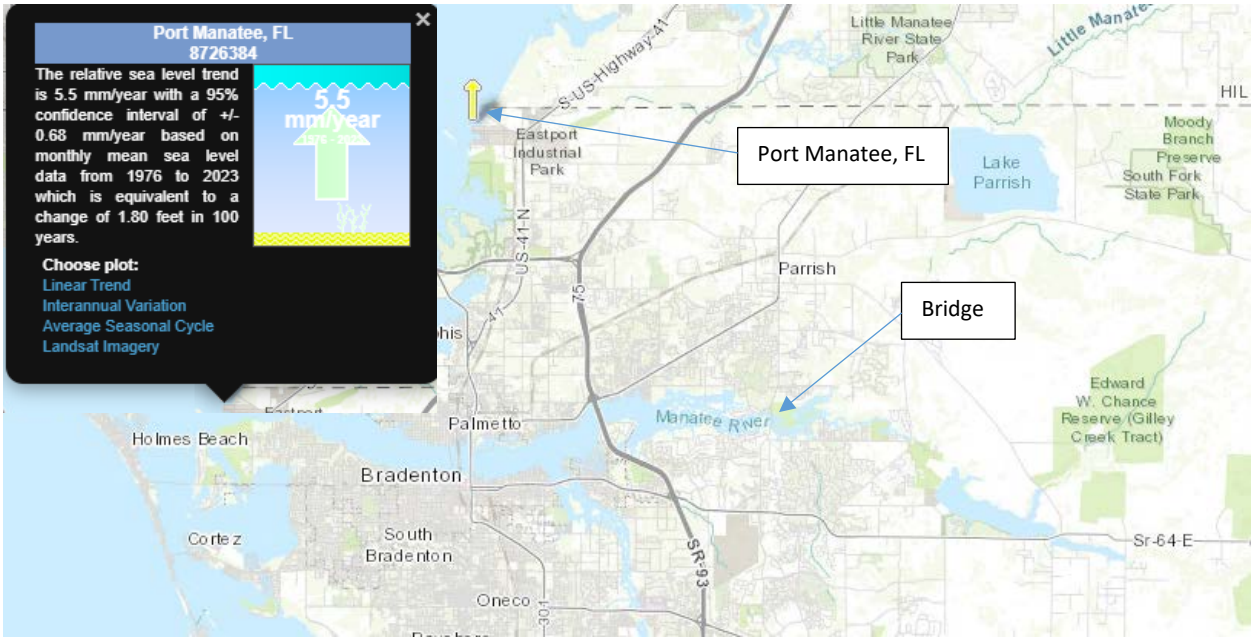

Figure 2.7 NOAA station with long term SLR trends (Sea Level Trends - NOAA Tides & Currents)

2.6 *Bridge Geometry and Alternative Analysis*

The existing bridge is 2318 feet long with 18 spans ranging from 100 to 144 feet, has a low member elevation of +22.3 ft NAVD. The proposed bridge, located 20 feet west of the current structure, was chosen over an east alignment due to lower right-of-way impacts and construction costs.

The new bridge will be 2315.6 feet long with 18 spans, aligned with the existing bridge. Both bridges' high elevations eliminate the risk of overtopping. Although a separate structure, the new bridge functions as a widening of the existing bridge due to their aligned substructures. This configuration, combined with the high elevations, ensures minimal impact on hydraulic efficiency and no expected backwater effects.

Located in a FEMA no-flood zone, a no-rise study will be conducted employing numerical modeling to confirm minimal hydraulic impacts. Detailed bridge plans and elevations are provided in Appendix A.

2.7 *SLIP Study*

Section 161.551, Florida Statutes (FS), requires state agencies, among others, which "commission or manage a construction project within the coastal building zone using funds appropriated from the state", conduct a sea level impact projection (SLIP) study. Florida DEP provides an online map service showing areas that require a SLIP study. The proposed bridge is shown as "Area at Risk Due to SLR" and requires a SLIP study (Figure 2.8).

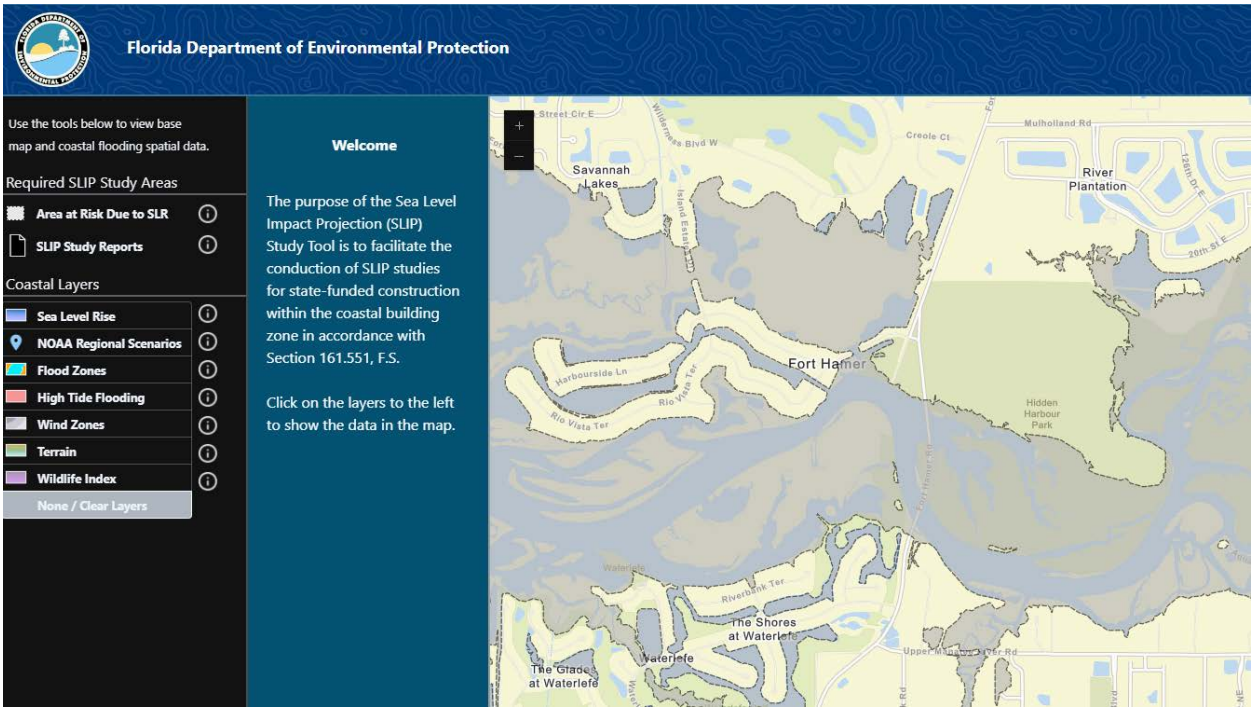

Figure 2.8 Florida EPA Slip Map Tool Showing the Proposed Bridge Location (https://floridadep-slip.org/Map.aspx)

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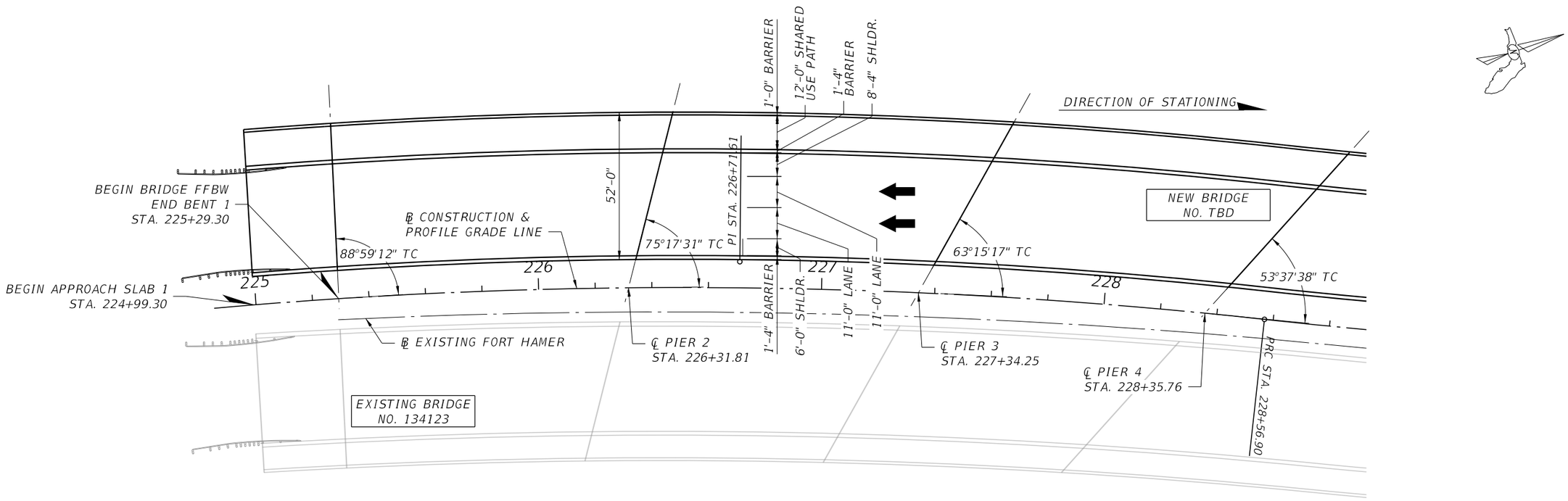
Appendix A: Bridge Plans



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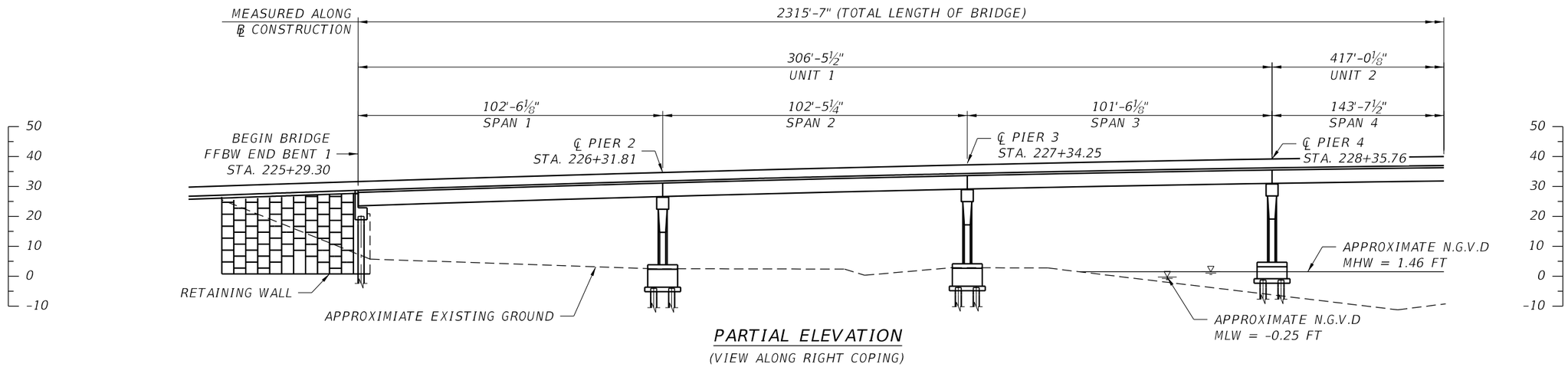

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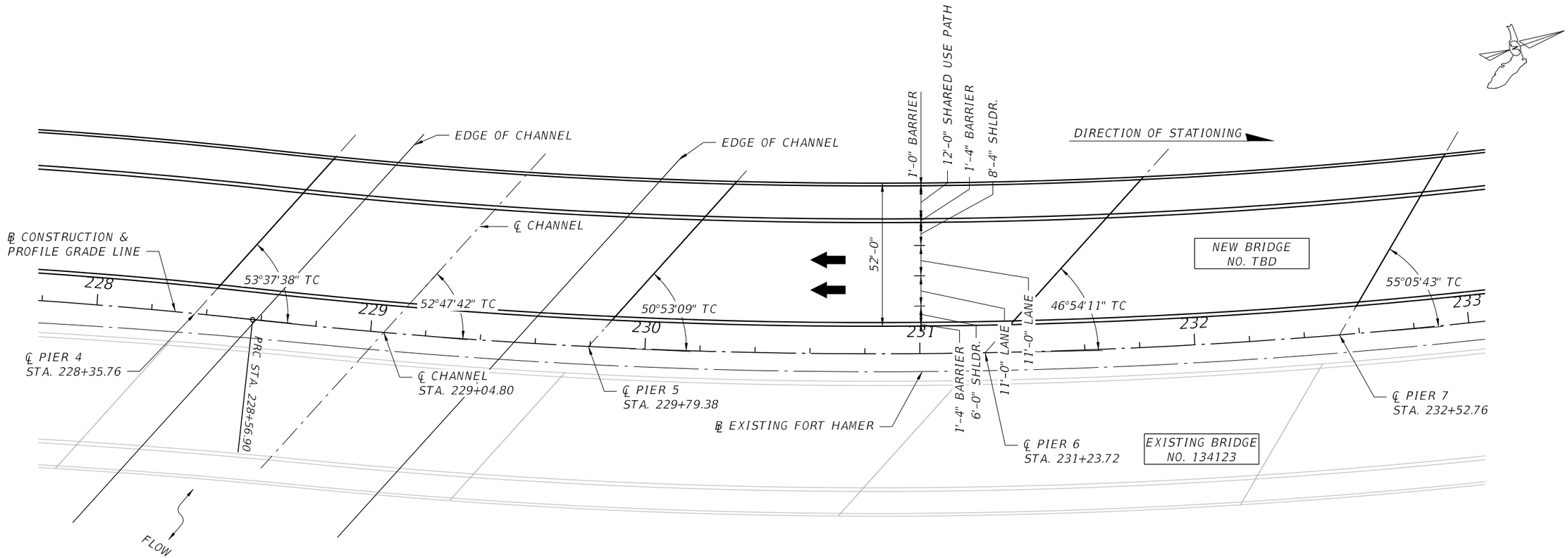

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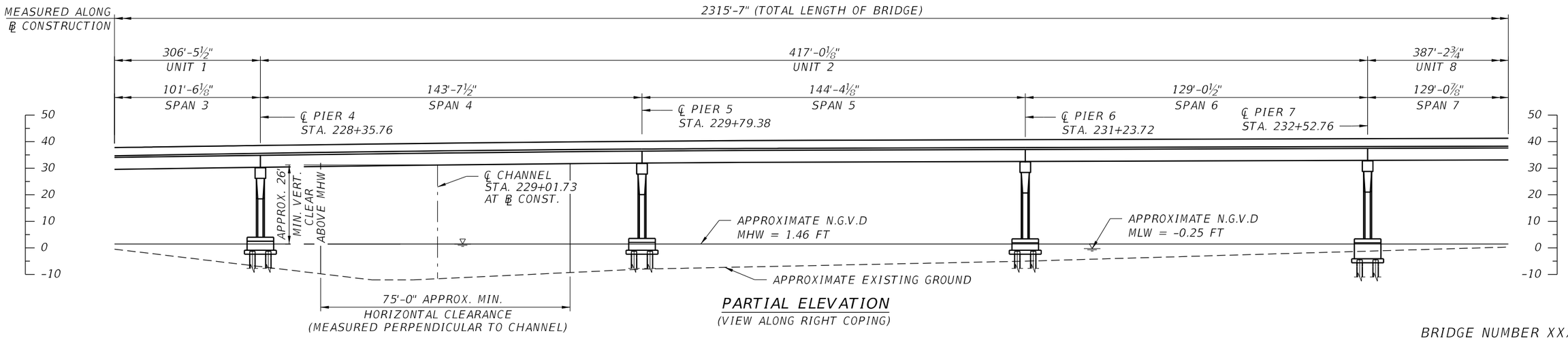

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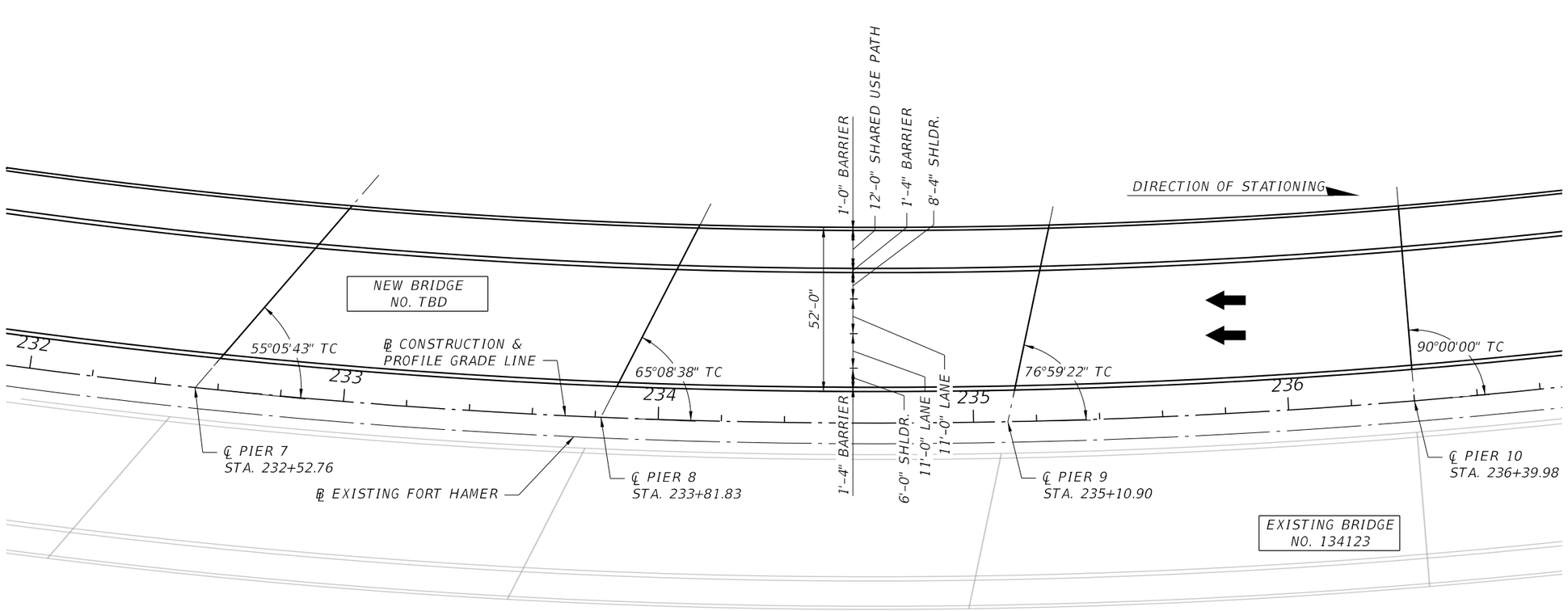

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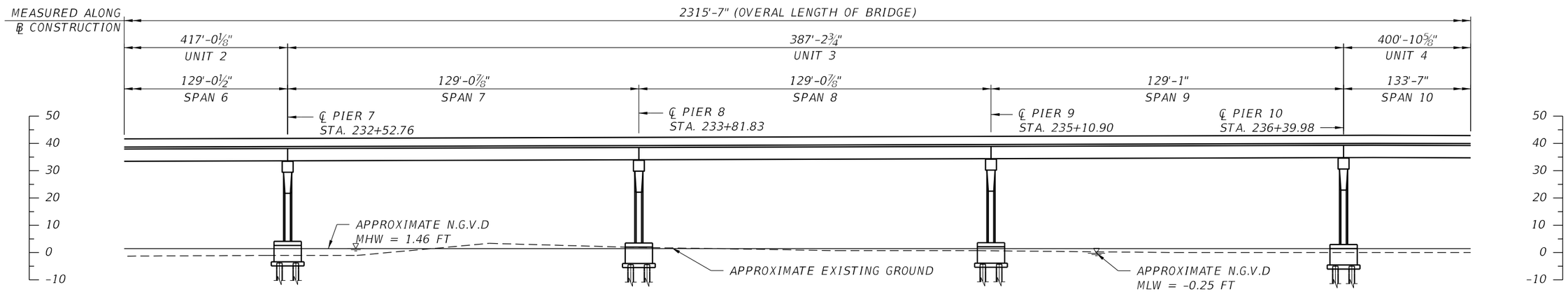

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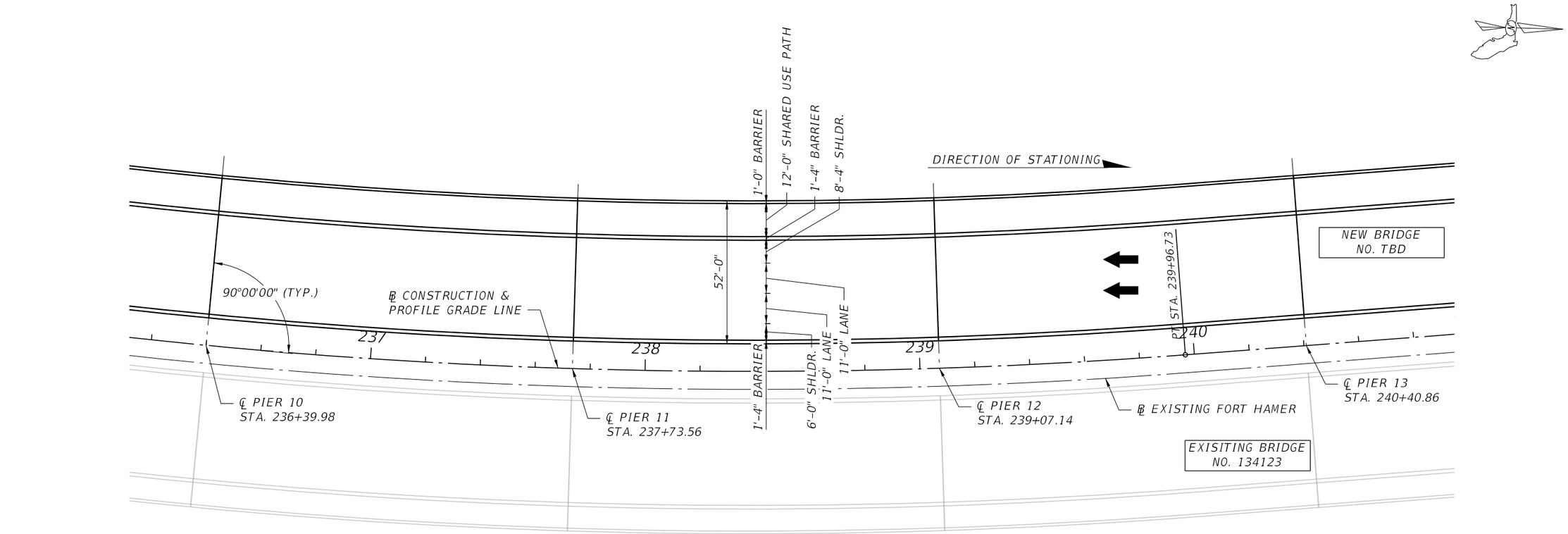

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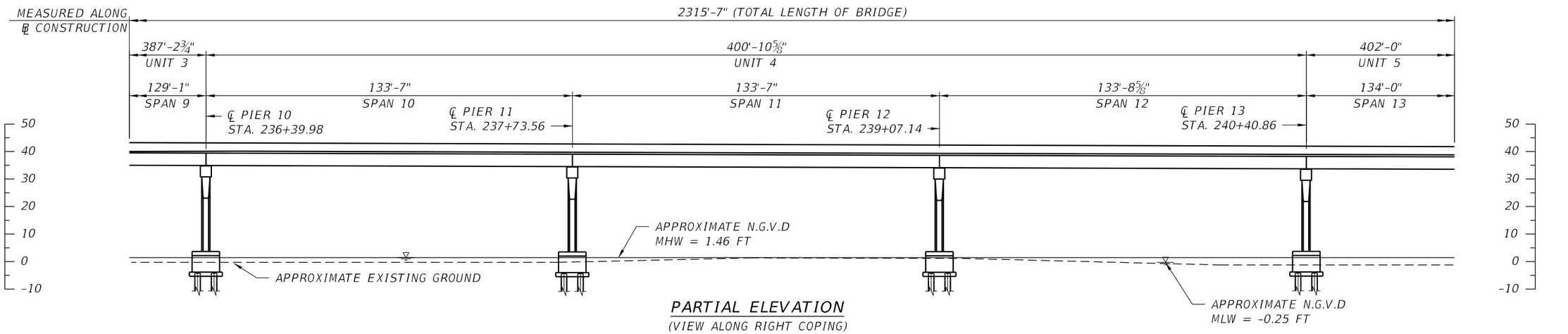

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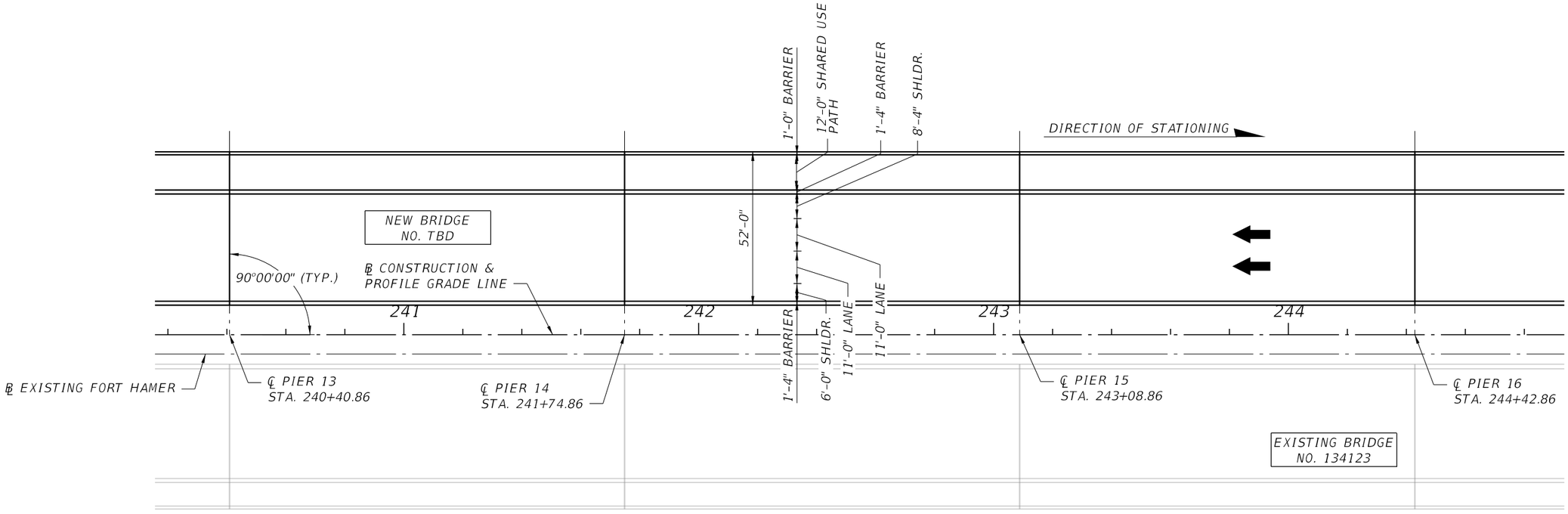

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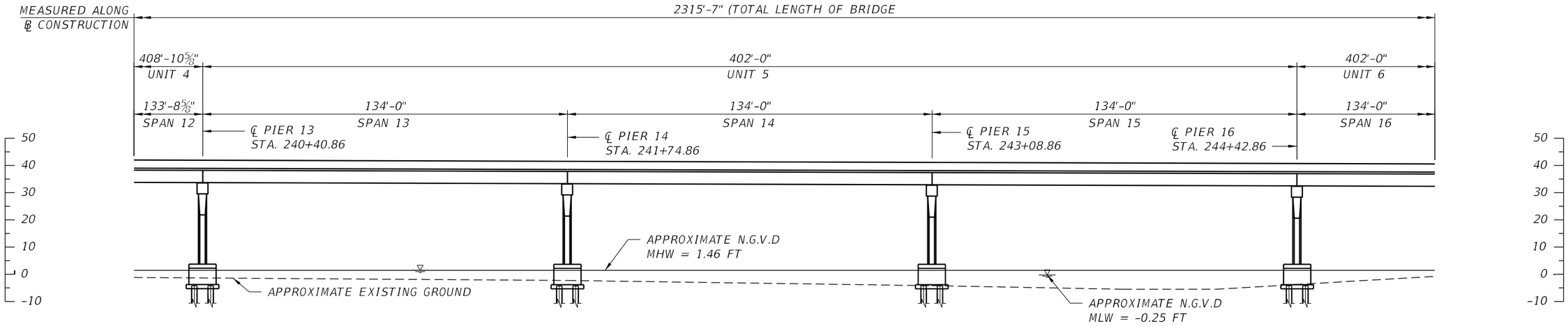

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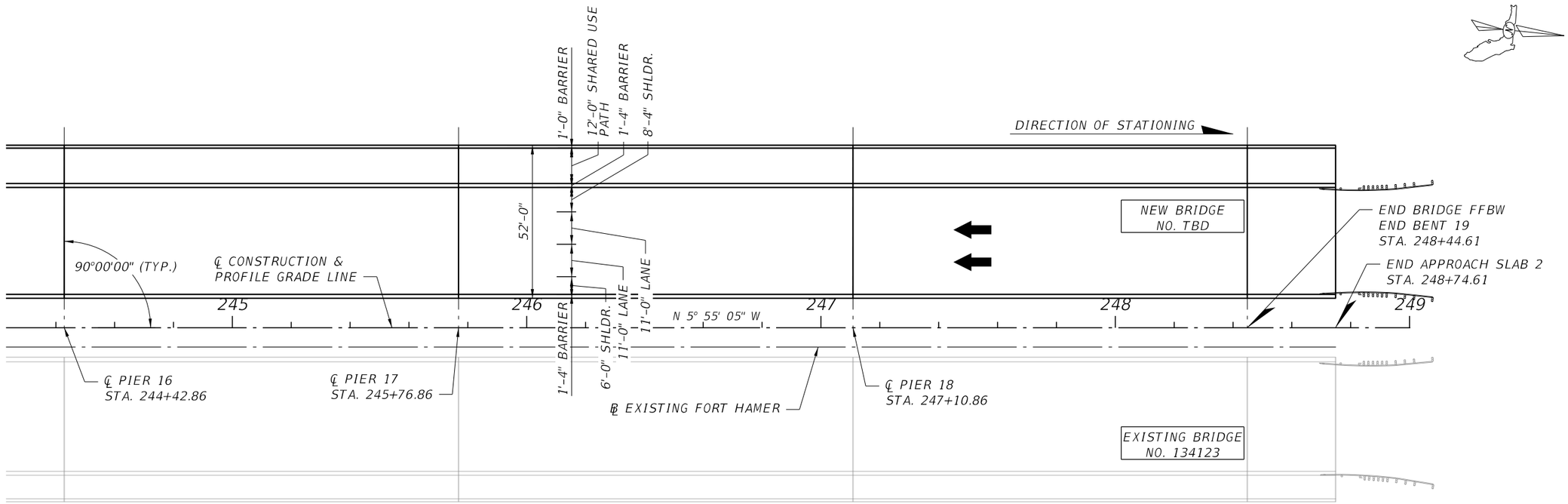
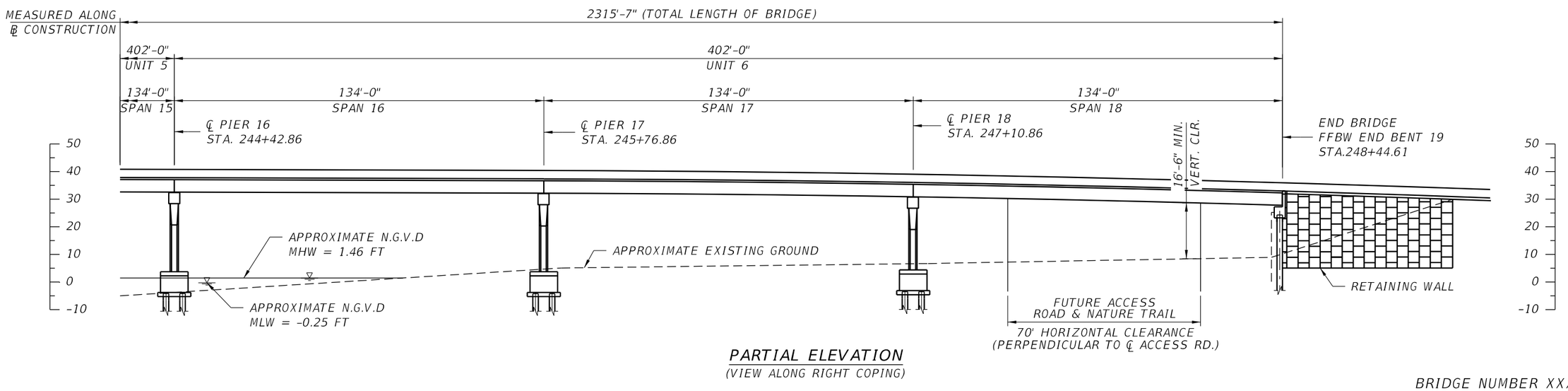


PARTIAL PLAN



PARTIAL ELEVATION

(VIEW ALONG RIGHT COPING)

BRIDGE NUMBER XXXXXX

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

No.	REVISIONS	DATE	BY

Kimley»Horn

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201 NORTH FRANKLIN STREET, SUITE 1400, TAMPA, FL 33602
PHONE: (813) 620-1460
WWW.KIMLEY-HORN.COM

PROJECT NO.	6054767
DATE	04/10/2024
SCALE	AS SHOWN
DESIGNED BY	
DRAWN BY	
CHECKED BY	

Manatee County FLORIDA

FT. HAMER ROAD

MANATEE COUNTY FL

LICENSED PROFESSIONAL

JOSEPH A. ROBERTS JR., P.E.

FL LICENSE NUMBER 78547

DATE:

PLAN AND ELEVATION (6 OF 6)

SHEET NUMBER