Memorandum

To: Rhode Island Department of Transportation
Two Capitol Hill
Providence, RI 02903

From: Peter Pavao

Date: March 15, 2019

Project #: 72900.00

Re: Reconstruction of the Pell Bridge Approaches
Environmental Assessment - Climate Change Impacts

1. Introduction

The Claiborne Pell Newport Bridge (Pell Bridge) carries State Route 138 between Jamestown and Newport and is the only road connection between Jamestown and Aquidneck Island. The Proposed Action Alternative of the Pell Bridge Interchange Project (Project) would provide direct connection from the northern part of the City to the downtown area, reduce queued vehicle traffic onto the Pell Bridge, reduce traffic in downtown Newport, and provide a portion of the bicycle and pedestrian facilities envisioned in the Aquidneck Island Transportation Study. The Proposed Action (Project) would occur in the City of Newport and Town of Middletown, Rhode Island. In accordance with the National Environmental Policy Act (NEPA), an Environmental Assessment (EA) is being developed to evaluate the impacts of construction and operation of the re-designed interchange on environmental resources.

The design life of a standard roadway is 30 years; the standard bridge design life is 50 years. During that time, sea levels in Newport are expected to gradually rise an estimated 1 to 3 feet[1]. This technical memorandum describes climate change impacts within the Study Area of the Project. Specifically addressed are identification of the Study Area and methodology; applicable regulations and criteria; impact assessment; cumulative impacts; mitigation; regulatory coordination; and summary of impacts.

2. Study Area and Methodology

The Study Area for inventorying the road structures subject to sea level rise includes the area around the Pell Bridge ramp and approaches in the City of Newport, associated roadways including Admiral Kalbfus Road, JT Connell Highway, and Halsey Street, as well as the Newport Secondary Track Rail Line.

In order to fully understand the anticipated climate conditions in Newport, VHB reviewed numerous climate change studies and analyses pertinent to the region. The following sources were consulted:

Federal Highway Administration Order 5520

This directive establishes FHWA policy on transportation system preparedness and resilience to climate change and extreme weather events.

[1] Rhode Island Department of Administration, "Vulnerability of Municipal Transportation Assets to Sea Level Rise and Storm Surge". Technical Paper 167. September 28, 2016.
http://www.planning.ri.gov/documents/sea_level/2016/TP167.pdf

Highways in the Coastal Environment: Assessing Extreme Events

This Hydraulic Engineering Circular put out by the U.S. Department of Transportation/Federal Highway Administration provides guidance on quantifying exposure to sea level rise, storm surge, and waves as a result of climate change. The guide also explains some of the damages that can be expected from climate-related events, as well as adaptation strategies.

NOAA National Centers for Environmental Information, Rhode Island State Summary

Climate summaries were created for all 50 states in response to a growing demand for more customized climate change data. These summaries provide information on observed and projected climate changes.

Vulnerability of Transportation Assets to Sea Level Rise (Technical Paper 164, Rhode Island Division of Statewide Planning)

This Technical Paper analyzes the State of Rhode Island transportation assets that would be at risk under one, three, five, and seven feet of sea level rise.

Vulnerability of Municipal Transportation Assets to Sea Level Rise and Storm Surge (Technical Paper 167, Rhode Island Division of Statewide Planning)

This Technical Paper analyzes Rhode Island municipal transportation assets that would be at risk under one, three, five, and seven feet of sea level rise, and how the various scenarios would change under a 100-year storm surge event. Appendices for this paper include a fact sheet for each Rhode Island coastal community.

Advanced STORMTOOLS
This online mapping program developed by the University of Rhode Island Shoreline Change Special Area Management Plan (SAMP) Team is based on simplified methods to estimate coastal inundation in Rhode Island under various scenarios. Available overlays include various levels of sea level rise and storm surge.

City of Newport's Natural Hazard Mitigation Plan, 2016 Update

This plan identifies local policies and actions that can be implemented over the long term to reduce risk and future losses from hazards. These mitigation policies and actions are identified based on an assessment of hazards, vulnerabilities, and risks and incorporate the participation of a wide range of stakeholders and the public in the planning process. "[M]odeled scenarios of hotter weather and increased precipitation, along with current climate trends such as increased sea level rise will affect Newport in the long term. Increased precipitation can lead to inland flooding and potentially cause issues."

- "Action #6: Categorize priority activities for city owned flood risk properties to develop sustainable and resilient facilities and infrastructure."

City of Newport's Comprehensive Land Use Plan, 2017

The Newport Comprehensive Plan is a roadmap to promote orderly growth and development as well as ensure the protection and management of land, water, and natural and cultural resources.

- "GOAL ED-1B) Continue to aggressively pursue opportunities to leverage climate change and resiliency as a key part of the City's economic development and diversification initiatives."

3. Applicable Regulations and Criteria

The Rhode Island Coastal Resource Management Council (CRMC)Red Book Section 1.1.6(I), discusses requirements for projects subject to coastal hazard analysis (including sea level rise). This information will not be used to approve or deny a project, but rather to educate the applicant. According to final rule 650-RICM-20-00-1.1.6(I), new roadway projects that occur within CRMC's jurisdiction will now require the submission of the CRMC coastal hazard application worksheet.[2] Applicants must provide the following information:

I. Coastal hazard analysis application requirements

1. The following new projects when subject to the jurisdiction of the CRMC must file a coastal hazard analysis with their CRMC application using the "CRMC Coastal Hazard Application Guidance" provided in Chapter 5 of the CRMC Shoreline Change Special Area Management Plan (Beach SAMP):

   a. construction of new residential buildings as defined in § 1.1.2 of this Part;

   b. construction of new commercial and industrial structures as defined in § 1.1.2 of this Part;

   c. construction of new beach pavilions as defined in § 1.1.2 of this Part;

   d. construction of any new private or public roadway, regardless of length;

   e. construction of any new infrastructure project subject to §§ 1.3.1(F), (H), and (M) of this Part; and

   f. construction of any new subdivisions with six (6) or more lots, any portion of which is within 200 feet of a shoreline feature.

2. The following modifications to existing projects subject to the jurisdiction of the CRMC must file a coastal hazard analysis with their CRMC application using the "CRMC Coastal Hazard Application Guidance" provided in Chapter 5 of the CRMC Shoreline Change Special Area Management Plan (Beach SAMP):

   a. any expansion of existing commercial structures over tidal waters;

   b. any expansion greater than 600 square feet to existing residential, commercial, industrial or beach pavilion structures;

   c. second story additions greater than 600 square feet to any existing residential, commercial, industrial or beach pavilion structures; and

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[2] Rhode Island Coastal Resources Management Council 650-RICR-20-00-1.1.6(I) "Coastal hazard analysis application requirements".

d. any modification to existing residential, commercial, industrial or beach pavilion structures when such structures are located within the CRMC minimum setback specified by § 1.1.9 of this Part.

3. All projects meeting the analysis thresholds established in §§ 1.1.6(I)(1) and (2) of this Part above shall complete the CRMC coastal hazard application worksheet and provide the following information as part of the application:

a. Identify the project design life (20, 30 50 years, etc.), which is the period of time during which a structure is expected by its designers to be functional within its specified parameters; in other words, the life expectancy of the structure before failure. This period of time is used to establish the appropriate sea level rise (SLR) scenario for analysis;

b. Using Table 1 in Chapter 5 of the Beach SAMP that is based upon the NOAA sea level rise high curve as adopted by the CRMC in § 1.1.10 of this Part determine the SLR projection at the end of the project design life; and

c. Assess the exposure and potential risk from coastal hazards at the project site based upon:

(1) sea level rise;

(2) shoreline erosion;

(3) base flood elevation (BFE) from FEMA flood insurance rate map; and

(4) STORMTOOLS design elevation.

4. All projects meeting the analysis thresholds established in §§ 1.1.6(I)(1) and (2) of this Part above shall provide site plans of the proposed project with the following overlays:

a. Sea level rise analysis showing the corresponding proposed project design life SLR scenario (maximum of 9.61 feet for NOAA high curve by 2100). Applicants should consider evaluating the coastal hazards risk associated with frequent storm events (1, 3 or 5-year storms) combined with minimal sea level rise of 1-2 feet to account for extreme high tide events which can occur any year during the expected project design life;

b. 100-yr return storm event and the 100-yr storm event with the corresponding design life SLR scenario;

c. Projected erosion rate for structure design life at the project site using the appropriate CRMC shoreline change map; and

d. Sea Level Affecting Marshes Model (SLAMM) for 1, 3 and 5 feet SLR scenarios for large projects and subdivisions only.

5. All projects meeting the analysis thresholds established in §§ 1.1.6(I)(1) and (2) of this Part above shall describe the proposed coastal adaptation techniques incorporated into the project design to overcome or accommodate any coastal hazard exposure risks resulting from the analyses required by § 1.1.6(I) of this Part.

4. Impact Assessment

Sea Level Rise

Sea level rise is caused by thermal expansion of sea water and the addition of freshwater from melted land ice, both impacted by changing climate conditions. Rising sea level is a problem for coastal communities like Newport, as it increases the risk for flooding and the landward extent of storm surge during hurricanes and Nor'easters.

Although the Study Area has a general elevation of less than 20 feet (NAVD88), the Newport coastal topography along Narragansett Bay restricts the landward impact of three feet of sea level rise to the immediate coastal area (see Figure 1). An exception occurs where an unnamed stream enters the bay just west of the 3rd Street Extension. The STORMTOOLS online mapping tool estimates that three feet of seal level rise will inundate the area along the stream at the end of Rolling Green Road.

According to the analysis done by the Rhode Island Department of Administration, State Highway 138 East/West and the on-ramp to RI-138 West are not vulnerable to three feet of sea level rise.[3] The Newport Secondary Track in Newport would also not be directly impacted by up to three feet of sea level rise.[4]

There are no identified impacts of three feet of sea level rise on the proposed project. Similarly, the project would not alter the current extent or timing of expected sea level rise scenarios.

Storm Surge

The impacts of storm surge from a 1% annual chance storm (100-year event) would likely extend inland into the entire project area even without any sea level rise. However, it is worth noting that the project is located outside of the Limit of Moderate Wave Action (LiMWA) and damage from wage action is predicted to be negligible (see Figure 2). Embankments used to support approaches to coastal bridges are susceptible to erosion caused by storm surge. Depending on the intensity of the waves and the roadway design, partial or complete undermining of the roadbed can occur.[5] Other potential damage caused by storm surge includes destruction caused by water flowing across a road and then down an embankment; damage from bluff erosion and shoreline recession; surge-related wave damage to a bridge deck; and structural damage from wave runup. Please refer to the EA Floodplain Tech Memo for a detailed analysis of potential storm surge impacts within the Project area.

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[3] Rhode Island Department of Administration, "Vulnerability of Municipal Transportation Assets to Sea Level Rise and Storm Surge". Technical Paper 167, September 28, 2016. http://www.planning.ri.gov/documents/sea_level/2016/TP167.pdf

[4] Rhode Island Department of Administration, "Vulnerability of Transportation Assets to Sea Level Rise". Technical Paper 164, January 2015.

[5] U.S. Department of Transportation, Federal Highway Administration, *Highways in the Coastal Environment: Assessing Extreme Events*, October 2014. https://www.fhwa.dot.gov/engineering/hydraulics/pubs/nhi14006/nhi14006.pdf

The STORMTOOLS online mapper visually displays the extent and elevation of the 100-year storm surge with three feet of sea level rise. Using this mapping data, the flood depth during a major storm surge event at the Admiral Kalbfus/JT Connell Highway rotary is estimated to be 7.59 feet above current ground elevation. At that rotary, the current elevation is about 8 feet, with very little proposed change in elevation as a result of the project.

The flood depth at the end of the local business access road is estimated to be between 3 and 7 feet above current (and proposed) ground elevation. It is anticipated that under three feet of sea level rise, storm surge will flood at-grade access to the elevated road structures in the project area.

Extreme Temperatures

Between 1895 and 2011, air temperatures in New England have increased by almost two degrees Fahrenheit.[6] By 2050, Rhode Island cities such Newport will likely experience 40 days of extreme heat a year; which is four times the current average of 10 days.[7] Longer and hotter heat waves may lead to more pavement cracking or road buckling.

Warmer Sea Surface Temperatures

The average global sea temperature has generally risen from 1880 to 2015. During the past three decades, sea surface temperatures have been consistently higher than at any other time during the recorded period.[8] The average ocean surface temperature is projected to rise through the early 21st century based on a range of greenhouse gas emission scenarios.[9] These warming waters can cause seawater to expand, contributing to sea level rise. Warmer waters can also fuel the intensity of hurricanes, but not necessarily produce more hurricanes. Regardless of the greenhouse emissions model, "it is likely that future tropical hurricanes will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical sea surface temperatures".[10]

Increased Rainfall

As climate patterns change, Rhode Island is predicted to see an increase in annual precipitation and a greater number of extreme precipitation events. This can lead to more frequent washouts of paved surfaces and rutting of paved surfaces.

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[6] U.S. Global Change Research Program, National Climate Assessment. 2014. https://nca2014.globalchange.gov/report/regions/northeast

[7] Climate Central and ICF International, *States at Risk Report Card* http://reportcard.statesatrisk.org/

[8] EPA Climate Change Indicators: Sea Surface Temperature. https://www.epa.gov/climate-indicators/climate-change-indicators-sea-surface-temperature

[9] IPCC 2013, Fifth Assessment Report: Climate Change 2013: The Physical Science Basis, Chapter 11: Near-term Climate Change: Projections and Predictability https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter11_FINAL.pdf

[10] IPCC 2007, Fourth Assessment Report: Climate Change 2007: The Physical Science Basis, Summary for Policymakers https://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

5. Cumulative Impacts

Rising sea levels and storm surge could impact future development in the area but the proposed Project will not contribute to these impacts.

6. Mitigation

This project would not have a measurable impact on changing climate conditions.

Potential mitigation strategies, according to the Federal Highway Administration, include:

- maintaining infrastructure for optimal performance,
- increasing redundancy, such as providing alternate routes,
- protecting the shoreline infrastructure through hardened or soft engineered solutions,
- Increasing bridge deck elevations or lowering road profiles to allow for overwash, or
- Relocating the structure away from the vulnerable coastal area.

7. Regulatory Coordination and Required Permits

No special permits or coordination are required to protect the Project from the impacts of climate change.

8. Summary of Impacts

The Project area is not vulnerable to impacts from three feet of sea level rise. Current and future storm surge conditions, on top of the three feet of sea level rise, would occasionally inundate the area. The elevated portions of the transportation route would be better protected from flood waters than the at-grade portions, but access may be limited.

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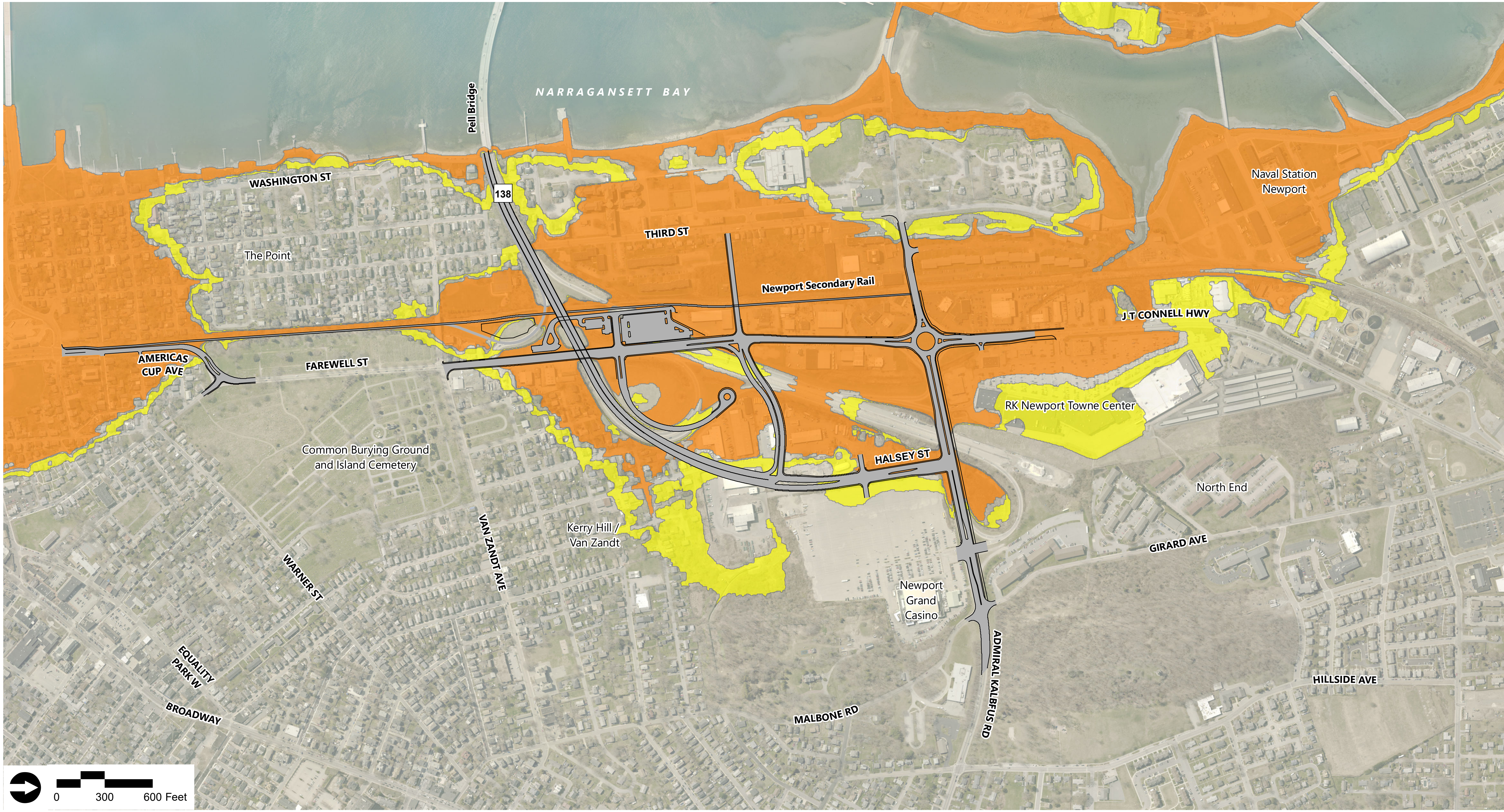
Aerial Source: RIGIS
Sea Level Rise Source: RIGIS

3 Feet of Sea Level Rise

Proposed Project Areas
Project Area

Figure 1
Project Area with 3 Feet of Sea Level Rise

Reconstruction of the Pell Bridge Approaches Newport/Middletown, Rhode Island



Aerial Source: RIGIS
Sea Level Rise and 100 Year Storm Surge Event Source: RIGIS

100 Year Storm Surge Event Plus 3-Foot Sea Level Rise
- 100-Year Storm Surge Event
- 100-Year Plus 3 Feet of Sea Level Rise

Proposed Project Areas
- Project Area

Figure 2

Project Area with 3 Feet of Sea Level Rise and 100yr Storm Surge

Reconstruction of the Pell Bridge Approaches Newport/Middletown, Rhode Island