4 Affected Environment, Environmental Consequences, and Mitigation

4.9 Wetlands and Floodplains

4.9.1 Introduction

This section assesses the potential construction and operational impacts of the No Build Alternative and Build Alternative on wetlands and floodplains. This section also identifies measures that would be implemented to avoid, minimize, and compensate construction and operational effects of the Build Alternative on wetlands and floodplains.

4.9.1.1 Regulatory Context

Wetland and floodplain resources are subject to jurisdiction under the following acts, regulations, and orders:

Federal

- Federal Water Pollution Control Act of 1972 (33 United States Code [USC] 1251-1376), as amended by Clean Water Act (1977) and Water Quality Act (1987), Section 401 and Section 404
- Clean Water Act, Section 402, National Pollutant Discharge Elimination System for Stormwater Discharges and Construction General Permit
- Rivers and Harbors Act of 1899 (33 USC 403), Section 10
- Coastal Zone Management Act Federal Consistency Review pursuant to 16 USC 1452, § 303 (1) and (2)
- Permit under Section 408 for the Alteration of a Civil Works project (33 USC 408)
- U.S. Coast Guard Bridge Permit pursuant to 33 USC §§ 401, 491, 525-533
- Location and Hydraulic Design of Encroachments on Flood Plains, 23 Code of Federal Regulations 650 Subpart A
- Executive Order 13112, Invasive Species, amended by Executive Order 13751

State

- Wetlands Protection Act (MA WPA; Massachusetts General Laws [MGL] Chapter 131 Section 40) and its implementing regulations (310 Code of Massachusetts Regulations [CMR] 10.00)
- Massachusetts Clean Waters Act (MGL c. 21, §§ 26–53) and regulations (314 CMR 9.00), Water Quality Certification

4.9.1.2 Methodology and Study Areas

The Wetlands and Floodplains Study Areas include the Sagamore Bridge and Bourne Bridge interchange approaches and Cape Cod Canal. The Study Areas for the wetlands and floodplains analysis include the Project Limits where physical work would occur within a construction zone as well as a 500-foot buffer from the construction zone.

Wetlands or Waters of the United States (WOTUS), floodplains, vernal pools, and Areas of Critical Environmental Concern (ACEC) within the Study Areas were identified using a range of data sources, including the following:

- GIS mapping
- Field wetland delineations (2020, 2021, 2024, 2025, and 2026)
- Vernal pool surveys (2020, 2025)
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps
- Coastal Zone Management Mapping
- U.S. Army Corps of Engineers (USACE) Major Rehabilitation Evaluation Environmental Assessment

Since the Draft Environmental Impact Statement (DEIS), there have been refinements to the Program Limits and additional field studies, which resulted in the identification of additional wetland resource areas in the Sagamore North, Bourne North, and Bourne South interchange approaches. No additional wetland resource areas were identified in the Sagamore South interchange approach or Cape Cod Canal. Refer to **Appendix 4.9, Wetlands and Floodplains Technical Report, Section 4.2**, for definitions of protected resources and **Appendix 4.9, Attachment 1, Abbreviated Notice of Resource Area Delineation**, for a summary and details of the wetland identification process.

4.9.2 Affected Environment

4.9.2.1 State Inland Resource Areas

In the Wetlands and Floodplains Study Areas, the following state-regulated inland resource areas were identified in the Sagamore North quadrant, Bourne North quadrant, and Bourne South quadrant interchange approaches:

- Bank
- Bordering Land Subject to Flooding (BLSF)
- Bordering Vegetated Wetland (BVW)
- Land Under Water Bodies and Waterways (LUW)

In addition, there are 100-foot buffer zones from the edges of both Bank and BVW resources. No wetland resource areas were identified in the Sagamore South quadrant. Since the DEIS, field surveys identified 20 additional inland wetland resources, 15 of which were identified as state non-jurisdictional Isolated Vegetated Wetlands (IVW) (listed in **Table 4.9-2**). State resources identified as IVWs are non-jurisdictional under MA WPA; whereas state resources identified as BVWs are

jurisdictional under MA WPA. Jurisdictional resources identified in the Program Limits are defined in **Table 4.9-1**, depicted in **Figure 4.9-1 through Figure 4.9-3**, and described in **Table 4.9-3**.

Table 4.9-1. Definitions of State Inland Wetland Resources

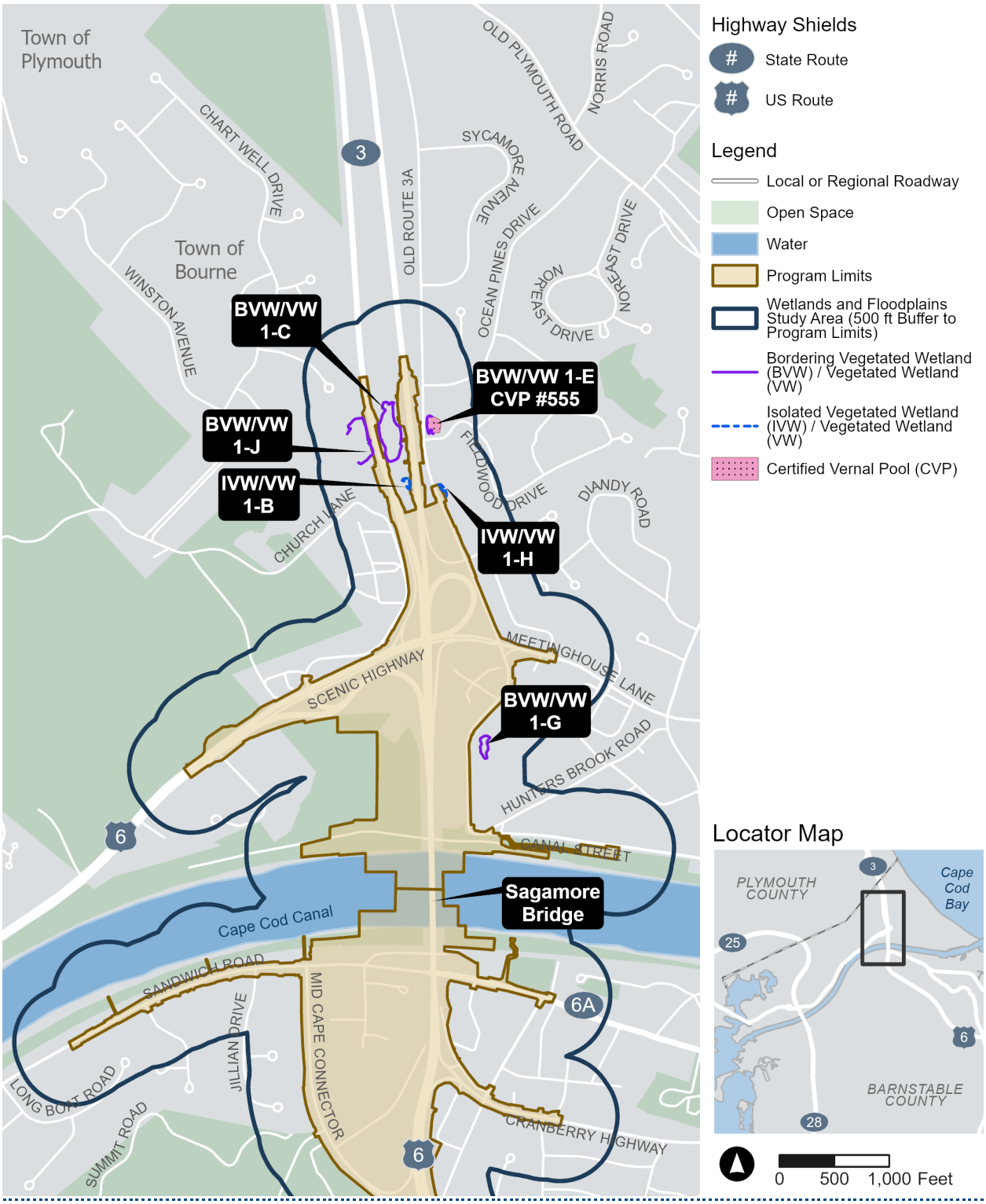
Resource	Definition
Bank	The portion of the land surface that normally abuts and confines a water body (stream lake or pond).
Bordering Land Subject to Flooding (BLSF)	An area with low, flat topography adjacent to and inundated by flood waters rising from creeks, rivers, streams, ponds, or lakes. It extends from the banks of these waterways and water bodies; where a Bordering Vegetated Wetland occurs, it extends from said wetland.
Bordering Vegetated Wetland (BVW)	Freshwater wetlands that border on creeks, rivers, streams, ponds, and lakes, including wet meadows, marshes, swamps, and bogs. These wetlands are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants.
Land Under Water Bodies and Waterways (LUW)	The bottom of, or land underneath, any creek, river, stream, pond, or lake.

Table 4.9-2. State Inland Resource Areas

Figure ID	Quadrant	Flag Series/ Vernal Pool ID	State Resource Type
Figure 4.9-1	Sagamore North	1-G	Bordering Vegetated Wetland (BVW)
Figure 4.9-1	Sagamore North	1-B	Non-jurisdictional Isolated Vegetated Wetland (IVW)
Figure 4.9-1	Sagamore North	1-H	Non-jurisdictional IVW
Figure 4.9-2	Bourne North	3-TTA/Potential Vernal Pool (PVP) 10MA	Non-jurisdictional IVW
Figure 4.9-2	Bourne North	3-F/PVP 11MA	Non-jurisdictional IVW
Figure 4.9-2	Bourne North	3-O	Non-jurisdictional IVW
Figure 4.9-3	Bourne South	4-N expansion	BVW
Figure 4.9-3	Bourne South	4-Q	IVW
Figure 4.9-3	Bourne South	4-O/P	BVW
Figure 4.9-3	Bourne South	4-TTB	BVW
Figure 4.9-3	Bourne South	4-TTD	Non-jurisdictional IVW
Figure 4.9-3	Bourne South	BKA and BKAB	Intermittent stream
Figure 4.9-3	Bourne South	4-TT2F/PVP 13MA	Non-jurisdictional IVW

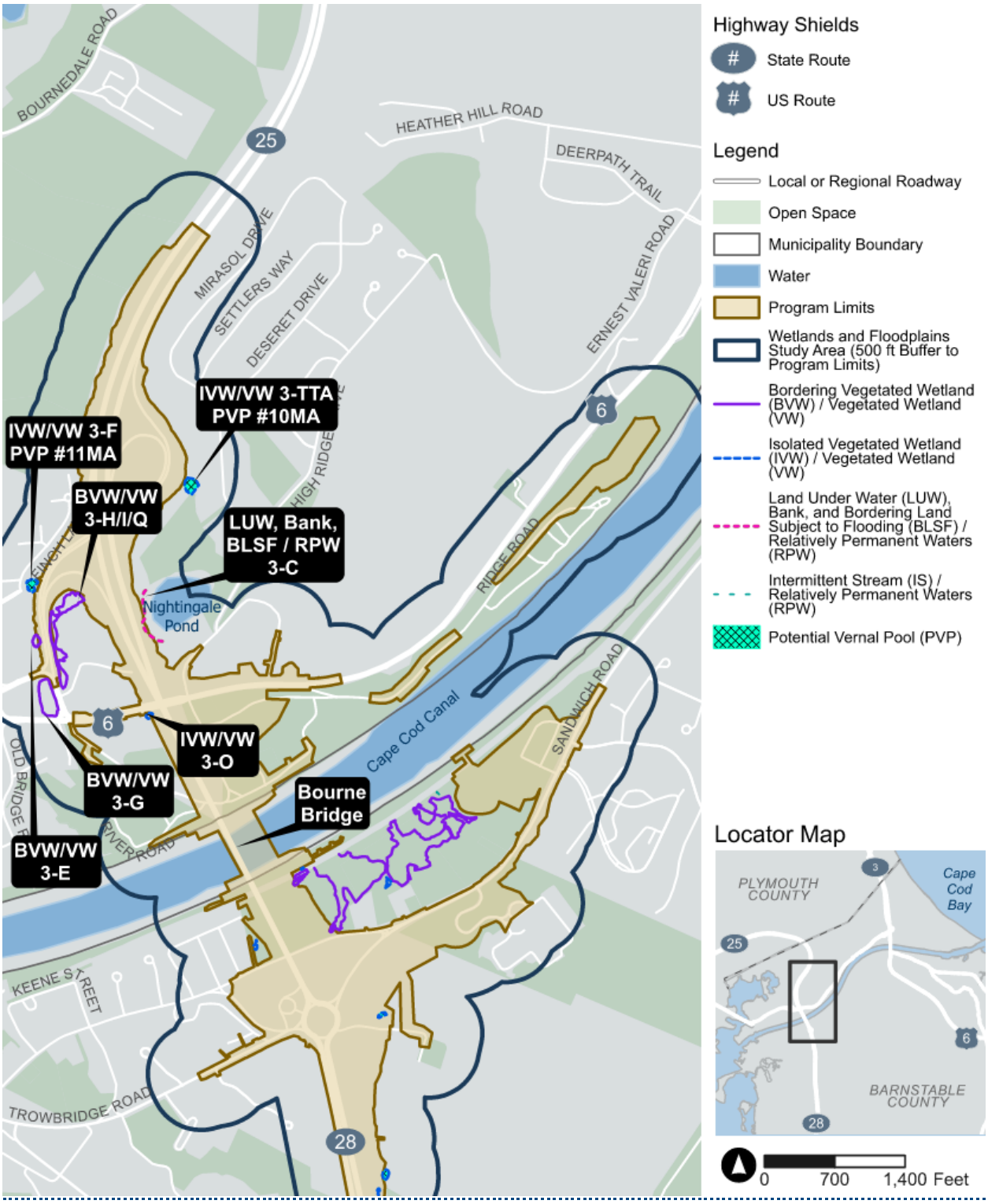
Figure ID	Quadrant	Flag Series/ Vernal Pool ID	State Resource Type
Figure 4.9-3	Bourne South	4-F	Non-jurisdictional IVW
Figure 4.9-3	Bourne South	4-Z/PVP 12MA	Non-jurisdictional IVW
Figure 4.9-3	Bourne South	4-W	Non-jurisdictional IVW
Figure 4.9-3	Bourne South	4-U/PVP 06MA	Non-jurisdictional IVW
Figure 4.9-3	Bourne South	4-S	Non-jurisdictional IVW
Figure 4.9-3	Bourne South	4-R	Non-jurisdictional IVW
Figure 4.9-3	Bourne South	4-TTF/Certified Vernal Pool #8258	Non-jurisdictional IVW

Figure 4.9-1. State and Federal Inland Wetlands (Sagamore North Quadrant Interchange Approach)



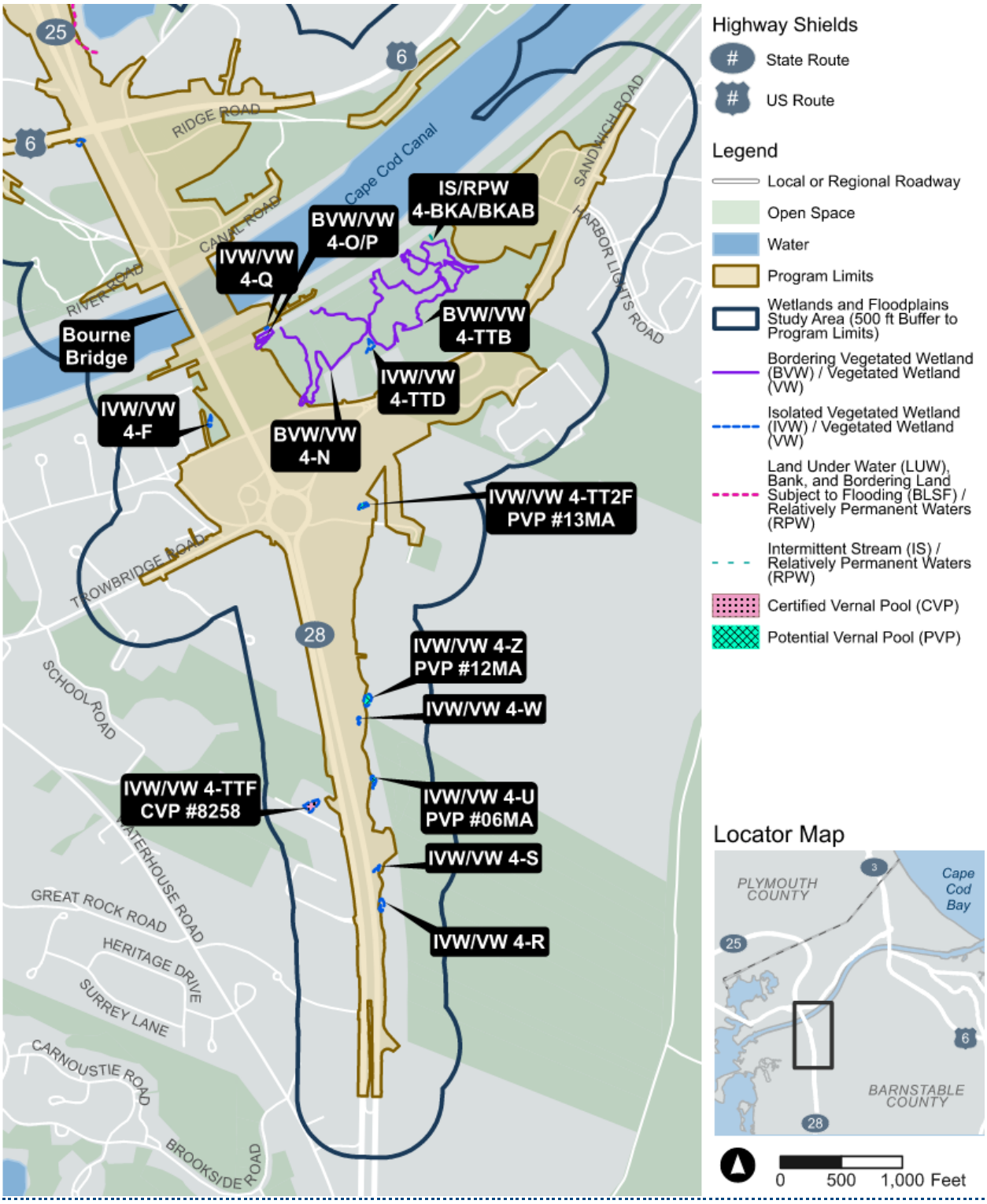
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-2. State and Federal Inland Wetlands (Bourne North Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2025

Figure 4.9-3. State and Federal Inland Wetlands (Bourne South Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2025

Of those state jurisdictional wetland areas identified, three would be impacted and are within the Bourne North quadrant interchange approach. **Table 4.9-3** lists these three wetland areas.

Table 4.9-3. State Inland Wetlands (Bourne North Quadrant Interchange Approach)

Figure Number	Wetland ID[1]	State Resource Area Type	Location	Description
Figure 4.9-2	Series 3-E	Bordering Vegetated Wetland (BVW)	Northeast of CVS parking lot on west side of State Route 25 eastbound off-ramp to U.S. Route 6/State Route 28; connected to 3-H/I/Q via culvert under State Route 25 ramps; eventually flows to Cape Cod Canal	Sparsely vegetated forested wetland dominated by alder buckthorn (*Frangula alnus*), red maple (*Acer rubrum*), and sensitive fern (*Onoclea sensibilis*)
Figure 4.9-2	Series 3-H/I/Q	BVW	East side of U.S. Route 6/State Route 28 southbound ramp to State Route 25; connected to wetland resource 3-G via culvert under U.S. Route 6/State Route 28 ramp; eventually flows to the Cape Cod Canal via culvert	Dominant vegetation includes arrowwood (*Viburnum dentatum*), red maple, gray birch (*Betula populifolia*), steeplebush (*Spiraea tomentosa*), and small cranberry (*Vaccinium oxycoccos*)
Figure 4.9-2	Series 3-C	• BVW • Land Under Waterbodies and Waterways (LUW) • Bank • Bordering Land Subject to Flooding (BLSF)	Nightingale Pond; east of State Route 25 northbound	Dominant vegetation on edge of pond includes black gum (*Nyssa sylvatica*), sweet pepperbush (*Clethra alnifolia*), and highbush blueberry (*Vaccinium corymbosum*)

[1] As identified in the Abbreviated Notice of Resource Area Delineation (ANRAD) (HNTB 2021, 2022) and additional field investigations.

Vernal Pools

Vernal pools in the Wetlands and Floodplains Study Area were identified during field surveys performed in 2020 and 2025. Vernal pools within or adjacent to the Wetlands and Floodplains Study Areas are described in **Table 4.9-4** and mapped in **Figure 4.9-1** through **Figure 4.9-3**.

Table 4.9-4. Vernal Pools in Project Limits

Figure No.	Survey Area/Wetland ID[1]	Vernal Pool ID[2]	Vernal Pool ID[3]	Comments
Figure 4.9-1	Sagamore North Quadrant/BVW 1-E	05DN	Certified #555	Within 100 feet of proposed work
Figure 4.9-2	Bourne North Quadrant/BVW 3-F	11MA	None	Does not meet biological criteria for certification
Figure 4.9-2	Bourne North Quadrant/ Isolated Vegetated Wetland (IVW) 3-TTA	10MA	Potential	Within 10 feet of proposed work
Figure 4.9-3	Bourne South Quadrant/ 4-B (Isolated Land Subject to Flooding [ILSF])	03MA	Potential #3001	Does not meet biological criteria for certification
Figure 4.9-3	Bourne South Quadrant/IVW 4W	05MA	None	Does not meet biological criteria for certification
Figure 4.9-3	Bourne South Quadrant/IVW 4-TTF	07MA	Certified #8258	Within 70 feet of proposed work
Figure 4.9-3	Bourne South Quadrant/IVW 4-TT2F	13MA	Potential	Within proposed limit of work
Figure 4.9-3	Bourne South Quadrant/IVW 4-Z	12MA	Potential	Within 30 feet of proposed work
Figure 4.9-3	Bourne South Quadrant/IVW 4-U	06MA	Potential	Within 1 foot of proposed work

[1] As identified in the ANRAD[1] and additional field investigations.

[2] As identified in Stantec (2020,[2] 2026[3])

[3] As identified by the Massachusetts Department of Fish and Wildlife Natural Heritage and Endangered Species Program.[4]

4.9.2.2 State Coastal Resource Areas

State coastal resource areas identified within the Sagamore and Bourne Bridge Study Areas are defined in **Table 4.9-5**, mapped in **Figure 4.9-4 through Figure 4.9-7**, and described in **Table 4.9-7**. Regarding

[1] HNTB Corporation. December 2021 and April 2022. Abbreviated Notice of Resource Area Delineation (ANRAD), MassDOT Cape Cod Canal Area Transportation Improvements Program, Project No. 608020, Bourne, Massachusetts.

[2] Stantec Consulting Services Inc. 2020. Bourne and Sagamore Bridge Improvement Projects – Rare, Threatened, and Endangered Species Habitat Assessment, MassDOT Project # 14-33419, Barnstable County, Massachusetts. Stantec Consulting Services Inc., Boston, Massachusetts. December.

[3] Stantec. 2026. Draft Cape Cod Bridges Program 2025 Vernal Pool Survey Report, Bourne, Massachusetts. Stantec Consulting Services Inc. January 8.

[4] Massachusetts Division of Fisheries and Wildlife. 2009. Guidelines for the Certification of Vernal Pool Habitat (updated 2020). Massachusetts Division of Fisheries and Wildlife. Westborough, Massachusetts. March.

existing coastal resources, the refined Study Areas within all four quadrants were expanded to include the proposed Section 4(f) mitigation, which encompassed additional coastal resource areas.

The areal extent of Land Containing Shellfish described in the DEIS was determined by the Shellfish Suitability polygon defined by the Massachusetts Division of Marine Fisheries in MassMapper and calculated by the sum of impacts to Land Under the Ocean (LUO) and Rocky Intertidal Shores. Impacts to Land Containing Shellfish presented in the Final Environmental Impact Statement are based on Massachusetts Division of Marine Fisheries data and supplemented by field observations.

Water elevations within the Cape Cod Canal were obtained from USACE.[5] Elevations in the USACE report were based on mean sea level datum and converted to North American Vertical Datum of 1988 (NAVD88) to establish the state jurisdictional limits. **Table 4.9-6** presents water elevations pertinent to state and federal jurisdictional limits. Variations in the values presented in **Table 4.9-6** result from differences in the timing and amplitude of the tides in Buzzards Bay and Cape Cod Bay: Buzzards Bay tide range is approximately 6 feet compared to Cape Cod Bay's range of approximately 10 feet, and the high and low tides precede that of Cape Cod Bay by about 3 hours.

Table 4.9-5. Definitions of State Coastal Resource Areas

Resource	Definition
Land Under the Ocean (LUO)	Land extending from the mean low water line seaward to the boundary of the municipality's jurisdiction and includes land under estuaries.
Coastal Bank (CB)	The seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland.
Rocky Intertidal Shores (RIS)	Naturally occurring rocky areas, such as bedrock or boulder-strewn areas between the mean high water line and the mean low water line.
Land Containing Shellfish	Land under the ocean, tidal flats, rocky intertidal shores, salt marshes, and land under salt ponds when any such land contains shellfish.
Land Subject to Tidal Action (LSTA)	Land subject to the periodic rise and fall of a coastal water body, including spring tides.
LUO Underlying an Anadromous/Catadromous Fish Run	Area within estuaries, ponds, streams, creeks, rivers, lakes, or coastal waters, which is a spawning or feeding ground or passageway for anadromous or catadromous fish and which is identified by the Division of Marine Fisheries or has been mapped on the Coastal Atlas of the Coastal Zone Management Program.
Land Subject to Coastal Storm Flowage (LSCSF)	Land subject to inundation caused by coastal storms up to and including that caused by the 100-year storm surge of record or storm of record.

[5] U.S. Army Corps of Engineers (USACE). 2022. Environmental Assessment and Finding of No Significant Impact for Major Rehabilitation Evaluation, Cape Cod Canal Highway Bridges, Massachusetts. New England District, Concord, Massachusetts. March.

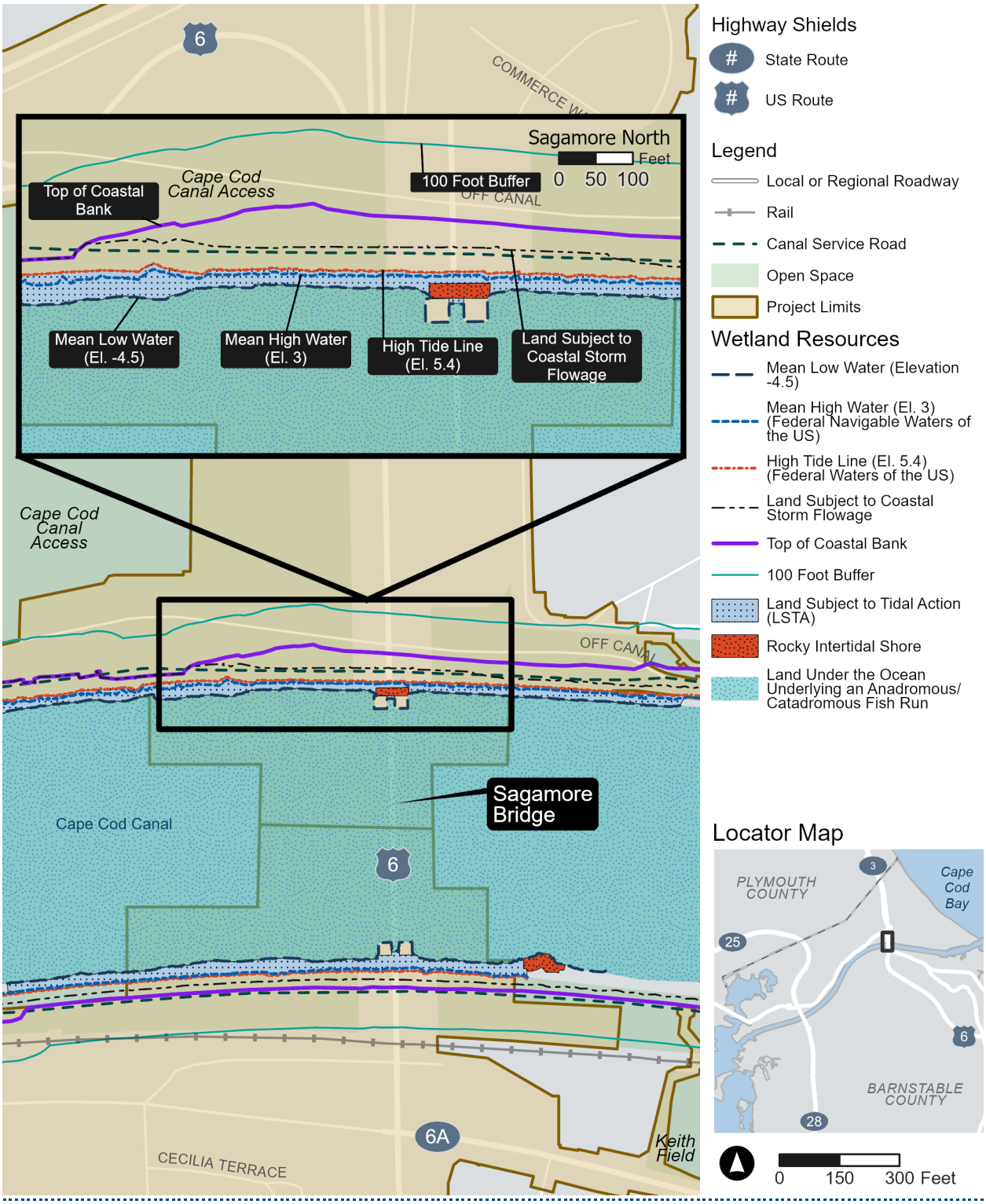
Table 4.9-6. Cape Cod Canal Water Elevations in Feet (Based on NAVD88)

Location	High Tide Line	Mean High Water	Mean Low Water
Sagamore Bridge	5.4	3.0	-4.5
Bourne Bridge	2.9	1.5	-3.0

The Study Areas were reviewed for the presence/absence of other state coastal resources (i.e., coastal beach, coastal dune, barrier beach, salt marsh, and land under salt ponds). These coastal resources were not observed.

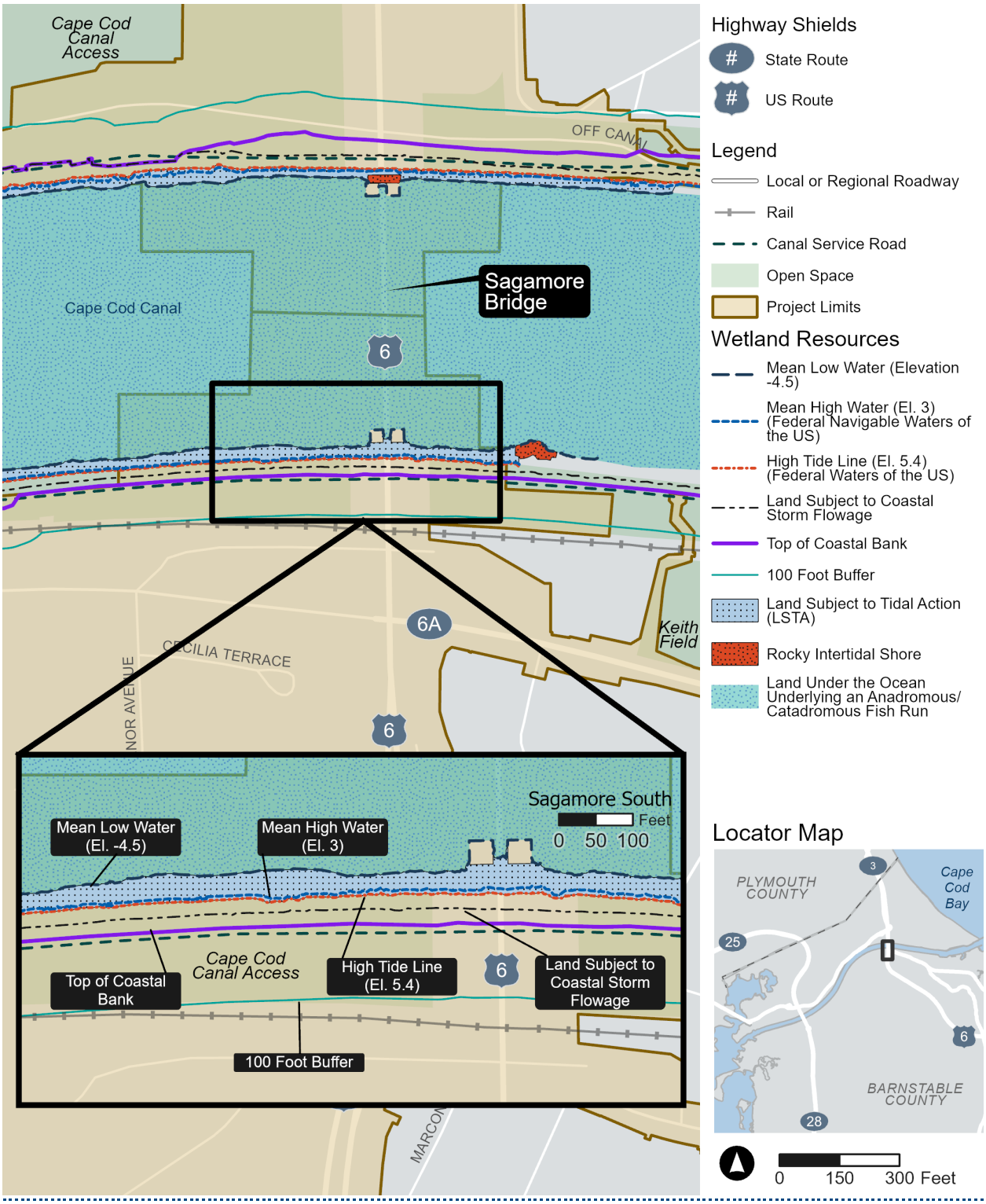
Exhibit 4.9-1 through Exhibit 4.9-8 depict the canal resource areas. As depicted in these exhibits, riprap comprises much of the shoreline along the canal.

Figure 4.9-4. State and Federal Coastal Resource Areas (Sagamore North Quadrant)



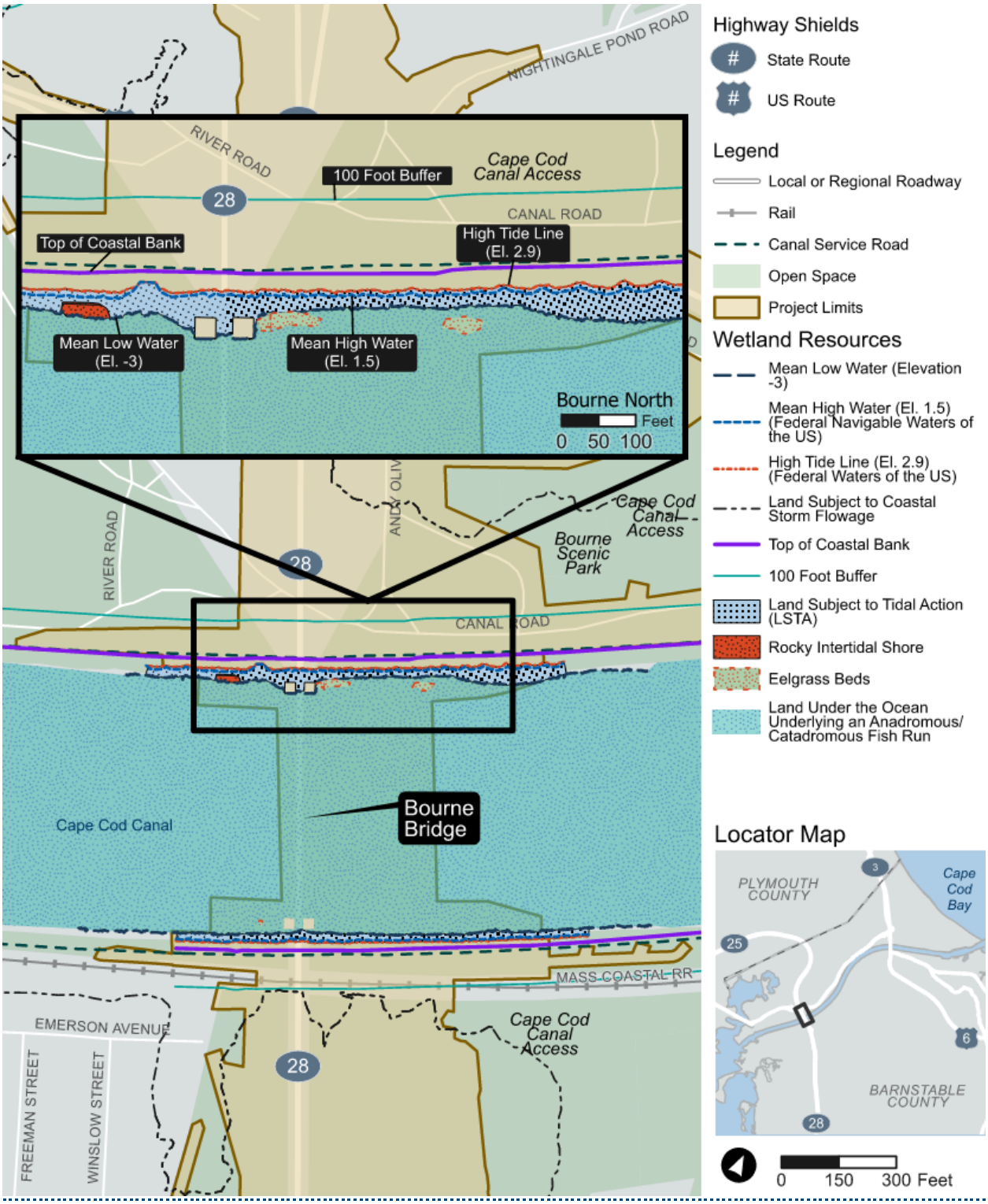
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-5. State and Federal Coastal Resource Areas (Sagamore South Quadrant)



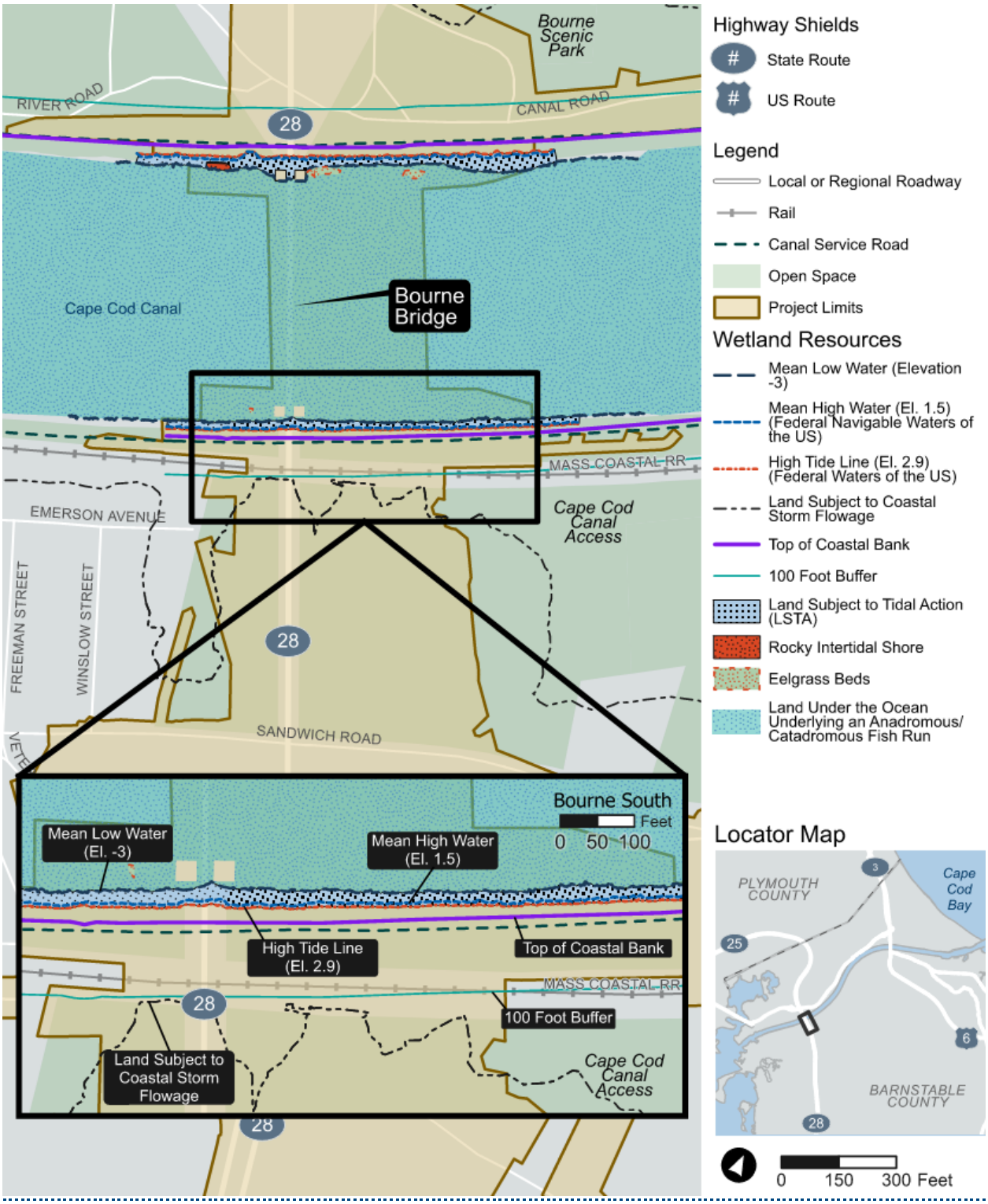
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-6. State and Federal Coastal Resource Areas (Bourne North Quadrant)



Source: Massachusetts Department of Transportation, 2025

Figure 4.9-7. State and Federal Coastal Resource Areas (Bourne South Quadrant)



Source: Massachusetts Department of Transportation, 2025

Table 4.9-7. State Coastal Resource Areas

Resource Area Type	Location	How Determined
Land Under the Ocean (LUO)	Within Cape Cod Canal	Below mean low water elevation based on U.S Army Corps of Engineers (2022)[1]
Coastal Bank	Along north and south shorelines of entire length of Cape Cod Canal; 100-foot buffer applies	Massachusetts Department of Environmental Protection Wetlands Program Policy 92-1 Coastal Banks
Rocky Intertidal Shores (RIS)	1,652 square feet at Sagamore North quadrant approach and 1,167 square feet at Bourne North quadrant approach	Based on field observations between mean high water and mean low water
Land Subject to Tidal Action (LSTA)	Within the Cape Cod Canal	Between mean low water and High Tide Line (including spring tides) based on U.S Army Corps of Engineers (2022)[1]
LUO Underlying an Anadromous/Catadromous Fish Run	Along north and south shorelines of entire length of Cape Cod Canal	As mapped by Massachusetts Department of Fish and Game Division of Marine Fisheries
Land Containing Shellfish	Within Cape Cod Canal	As mapped by Massachusetts Department of Fish and Game Division of Marine Fisheries and supplemented by visual survey
Land Subject to Coastal Storm Flowage (LSCSF) or 1% annual chance flood hazard	Elevation 14 feet NAVD88 at Sagamore Bridge, elevation 16 feet NAVD88 west of Bourne Bridge, and elevation 15 feet NAVD88 east of Bourne Bridge	Based on Federal Emergency Management Agency Flood Insurance Study and Rate Map and elevation verified by survey

[1] U.S. Army Corps of Engineers (USACE). 2022. Environmental Assessment and Finding of No Significant Impact for Major Rehabilitation Evaluation, Cape Cod Canal Highway Bridges, Massachusetts. New England District, Concord, Massachusetts. March.

Exhibit 4.9-1. Banks of Cape Cod Canal Adjacent to Sagamore North Quadrant Bridge Piers, Looking East

Source: Massachusetts Department of Transportation, 2024

Exhibit 4.9-2. Banks of Cape Cod Canal Adjacent to Sagamore North Quadrant Bridge Piers, Looking South

Source: Massachusetts Department of Transportation, 2024

Exhibit 4.9-3. Banks of Cape Cod Canal Adjacent to Sagamore South Quadrant Bridge Piers, Looking East

Source: Massachusetts Department of Transportation, 2024

Exhibit 4.9-4. Banks of Cape Cod Canal Adjacent to Sagamore South Quadrant Bridge Piers, Looking East-Northeast

Source: Massachusetts Department of Transportation, 2024

Exhibit 4.9-5. Banks of Cape Cod Canal Adjacent to Bourne North Quadrant Bridge Piers, Looking East

Source: Massachusetts Department of Transportation, 2024

Exhibit 4.9-6. Banks of Cape Cod Canal Adjacent to Bourne North Quadrant Bridge Piers, Looking South

Source: Massachusetts Department of Transportation, 2024

Exhibit 4.9-7. Banks of Cape Cod Canal Adjacent to Bourne South Quadrant Bridge Piers, Looking East

Source: Massachusetts Department of Transportation, 2024

Exhibit 4.9-8. Banks of Cape Cod Canal Adjacent to Bourne South Quadrant Bridge Piers, Looking East (closeup view)

Source: Massachusetts Department of Transportation, 2024

4.9.2.3 Waters of the United States

The Cape Cod Bridges Program (Program) is proceeding under the presumption that aquatic resources that meet the federal definition of wetlands and any Relatively Permanent Water with a High Tide Line, Mean High Water mark, or Ordinary High Water mark are subject to USACE jurisdiction pursuant to the Clean Water Act (CWA) and/or Section 10 of the Rivers and Harbors Act of 1899. The terms WOTUS and federal are used interchangeably to refer to these aquatic resources.

Inland Waters of the United States

Inland WOTUS were identified in the Sagamore North quadrant, Bourne North quadrant, and Bourne South quadrant interchange approaches. **Figure 4.9-1** through **Figure 4.9-3** depict these resources. No inland WOTUS were identified within the Sagamore South quadrant interchange approach.

Federal inland Vegetated Wetlands (VW) and WOTUS are listed in **Table 4.9-8**. MassDOT has filed a Jurisdictional Determination request with USACE to verify the federal regulatory status of inland VWs within the Program Limits. Once approved, the Jurisdictional Determination will identify which inland VWs are federally jurisdictional, and which ones are not. Therefore, impacts to federally regulated WOTUS may be less than those disclosed in this FEIS if not all wetlands are determined by USACE to be federally jurisdictional. Final calculations for impacts to WOTUS will be described in federal wetlands permit applications.

Table 4.9-8. Federal Inland Resource Areas

Figure ID	Quadrant	Flag Series/ Vernal Pool ID	Federal Resource Type
Figure 4.9-1	Sagamore North	1-G	Vegetated Wetland (VW)
Figure 4.9-1	Sagamore North	1-B	VW
Figure 4.9-1	Sagamore North	1-H	VW
Figure 4.9-2	Bourne North	3-TTA/Potential Vernal Pool (PVP) 10MA	VW
Figure 4.9-2	Bourne North	3-F/PVP 11MA	VW
Figure 4.9-2	Bourne North	3-O	VW
Figure 4.9-3	Bourne South	4-N expansion	VW
Figure 4.9-3	Bourne South	4-Q	VW
Figure 4.9-3	Bourne South	4-O/P	VW
Figure 4.9-3	Bourne South	4-TTB	VW
Figure 4.9-3	Bourne South	4-TTD	VW
Figure 4.9-3	Bourne South	BKA and BKAB	Waters of the US (WOTUS)
Figure 4.9-3	Bourne South	4-TT2F/PVP 13MA	VW
Figure 4.9-3	Bourne South	4-F	VW

Figure ID	Quadrant	Flag Series/ Vernal Pool ID	Federal Resource Type
Figure 4.9-3	Bourne South	4-Z/PVP 12MA	VW
Figure 4.9-3	Bourne South	4-W	VW
Figure 4.9-3	Bourne South	4-U/PVP 06MA	VW
Figure 4.9-3	Bourne South	4-S	VW
Figure 4.9-3	Bourne South	4-R	VW
Figure 4.9-3	Bourne South	4-TTF/Certified Vernal Pool #8258	VW

Of those wetland resources identified, eight would be impacted and are within the Bourne North quadrant and Bourne South interchange approaches. **Table 4.9-9** lists these eight WOTUS.

Table 4.9-9. Federal Inland Wetland Resource Areas (Bourne Interchange Approaches)

Figure No.	Wetland ID[1]	Resource Area Type	Location	Description
Figure 4.9-2	Series 3-E	Vegetated Wetland	Northeast of CVS parking lot on west side of State Route 25 eastbound off-ramp to U.S. Route 6/State Route 28; connected to 3-H/I/Q via culvert under State Route 25 ramps; eventually flows to Cape Cod Canal.	Sparsely vegetated forested wetland dominated by alder buckthorn, red maple, and sensitive fern
Figure 4.9-2	Series 3-H/I/Q	Vegetated Wetland	East side of U.S. Route 6/State Route 28 southbound ramp to State Route 25; connected to wetland resource 3-G via culvert under U.S. Route 6/State Route 28 ramp; eventually flows to the Cape Cod Canal via culvert	Dominant vegetation includes arrowwood, red maple, gray birch, steeplebush, and small cranberry
Figure 4.9-2	Series 3-C	Vegetated Wetland and Relatively Permanent Water	Nightingale Pond; east of State Route 25 northbound	Dominant vegetation on edge of pond includes black gum, sweet pepperbush, and highbush blueberry
Figure 4.9-2	Series 3-O	Vegetated Wetland	Southwest corner intersection of U.S. Route 6 and State Route 28	Dominant vegetation includes broadleaf cattail *(Typha latifolia)*

Figure No.	Wetland ID[1]	Resource Area Type	Location	Description
Figure 4.9-3	Series 4-TT2F	Vegetated Wetland	East of Bourne Rotary	Dominant vegetation includes Canada rush *(Juncus canadensis)*, soft rush *(Juncus effusus)*, woolgrass *(Scirpus cyperinus)*, and shallow sedge *(Carex lurida)*
Figure 4.9-3	Series 4-W	Vegetated Wetland	East of State Route 28 northbound and south of Bourne Community Solar Farm access driveway	Dominant vegetation includes rattlesnake manna grass *(Glyceria canadensis)*, leather leaf *(Chamaedaphne calyculata)*, and alder buckthorn
Figure 4.9-3	Series 4-S	Vegetated Wetland	Adjacent to State Route 28 northbound	Dominant vegetation includes red maple, alder buckthorn, and American pennywort *(Hydrocotyle americana)*
Figure 4.9-3	Series 4-R	Vegetated Wetland	Adjacent to State Route 28 northbound	Dominant vegetation includes red maple, American elm *(Ulmus americana)*, and arrowwood

[1] As identified in the ANRAD[6] and additional field investigations.

Coastal (Tidal) Waters of the United States

Coastal WOTUS are those waters subject to the ebb and flow of the tide. Cape Cod Canal is a tidal Navigable WOTUS. Coastal WOTUS identified within the Cape Cod Canal Study Area at both bridge locations are depicted in **Figure 4.9-4 through Figure 4.9-7**. Water elevations pertinent to federal jurisdictional limits are as presented for state jurisdictional limits in **Table 4.9-6** and were obtained from USACE.[7] The Bourne North quadrant includes two eelgrass beds totaling 2,345 square feet east of

[6] HNTB Corporation. December 2021 and April 2022. Abbreviated Notice of Resource Area Delineation (ANRAD), MassDOT Cape Cod Canal Area Transportation Improvements Program, Project No. 608020, Bourne, Massachusetts.

[7] U.S. Army Corps of Engineers. 2022. Environmental Assessment and Finding of No Significant Impact for Major Rehabilitation Evaluation, Cape Cod Canal Highway Bridges, Massachusetts. New England District, Concord, Massachusetts. March.

the existing piers and the Bourne South quadrant includes one 100-square-foot eelgrass bed west of the existing piers along with isolated eelgrass sprigs further west (**Figure 4.9-7**). The Sagamore Bridge location does not include areas vegetated with eelgrass.[8]

In terms of the authorization of federal impacts to WOTUS, the excavation to install piers and pier protection riprap and the dredging for vessel access are not subject to Section 404 permitting because they have been determined to be integral to bridge construction and do not involve discharges of fill. It is anticipated that these activities will be permitted through the U.S. Coast Guard bridge permit application process.[9]

4.9.2.4 Floodplains

FEMA Flood Insurance Rate Map panels (25001C0316K, 25001C0318K, 25001C0313K, 25001C0314K, 25001C0501J, and 25001C0502J) identify the 1% annual chance flood hazard (i.e., 100-year floodplain) boundary within the Study Area. The limits of the FEMA-delineated floodplain within the Study Area are mapped in **Figure 4.9-8** and **Figure 4.9-9**.

The FEMA Flood Insurance Study and Map, with a revised effective date of July 6, 2021, shows Cape Cod Canal as Zone AE, 1% annual chance flood hazard ranging between elevation 16 feet NAVD88 to the west of Bourne Bridge to elevation 15 feet NAVD88 to the east of Bourne Bridge. At Sagamore Bridge, the 1% annual chance flood hazard is elevation 14 feet NAVD88.

At the Bourne North quadrant interchange approach, Zone AE extends beyond the banks of Cape Cod Canal into Belmont Circle. At the Bourne South quadrant interchange approach, the flood zone extends into the adjacent properties on either side of the bridge. At the Sagamore North quadrant interchange approach, Zone AE is along the landward edge of the existing pedestrian path, and at the Sagamore South quadrant interchange approach, Zone AE is confined to the banks of Cape Cod Canal.

Zone A flood zone (i.e., 1% annual chance flood hazard) with no Base Flood Elevation is associated with Nightingale Pond, which is in the Bourne North quadrant. Considering no Base Flood Elevation is provided, a hydrologic analysis was conducted to determine it. The analysis determined the Base Flood Elevation to be 14.5 feet NAVD88.

4.9.2.5 Areas of Critical Environmental Concern

The Herring River Watershed is a mapped ACEC that occurs within the Sagamore North quadrant interchange approach (**Figure 4.9-10**). The ACEC is mapped on the west side of State Route 3 and includes BVW series 1-J. At the southern end of the Bourne South quadrant interchange approach, the Project Limits overlap with the Bourne Back River ACEC (**Figure 4.9-11**).

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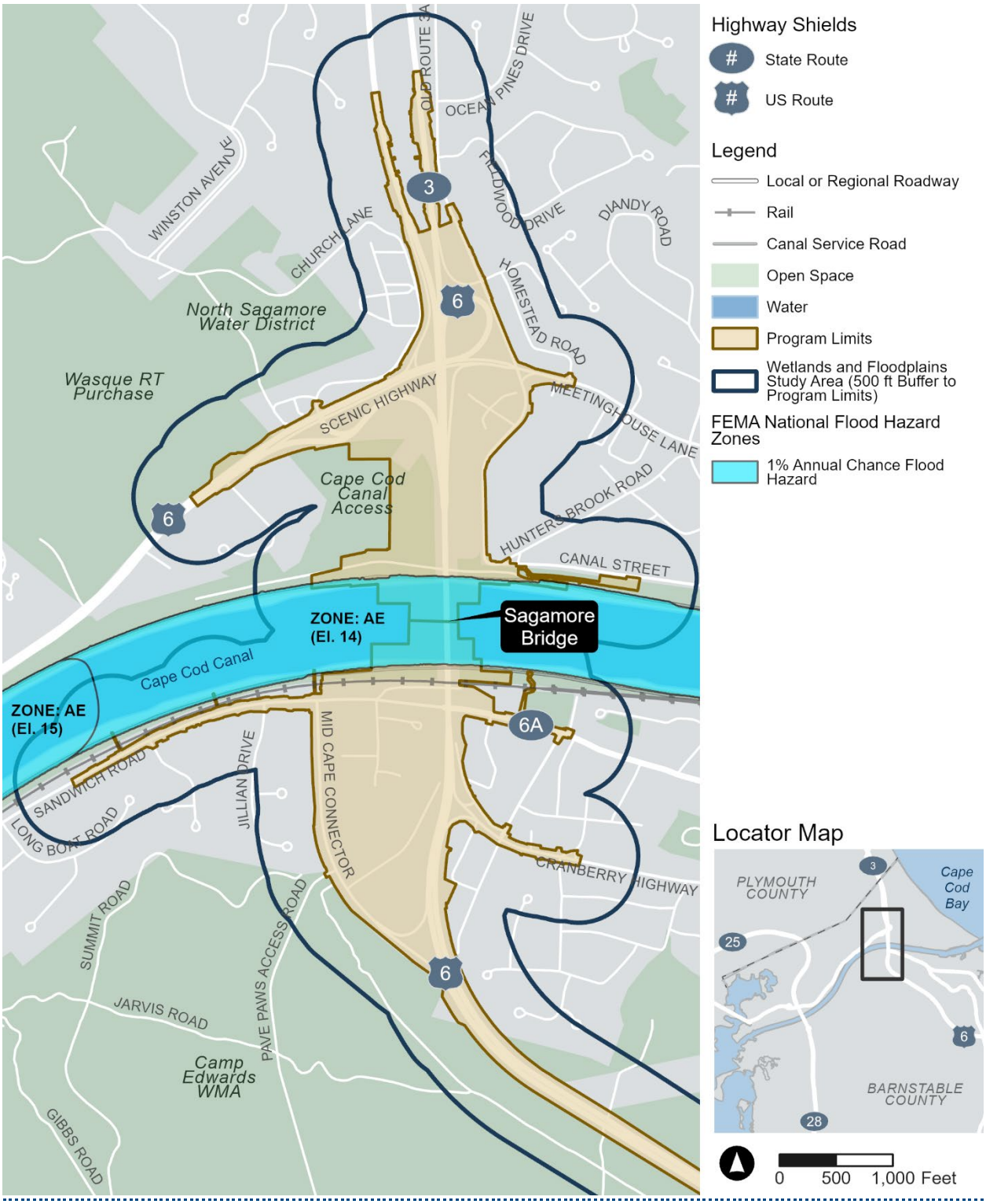
[8] The Eelgrass Survey Report is provided in **Appendix 4.11, Attachment 3**.

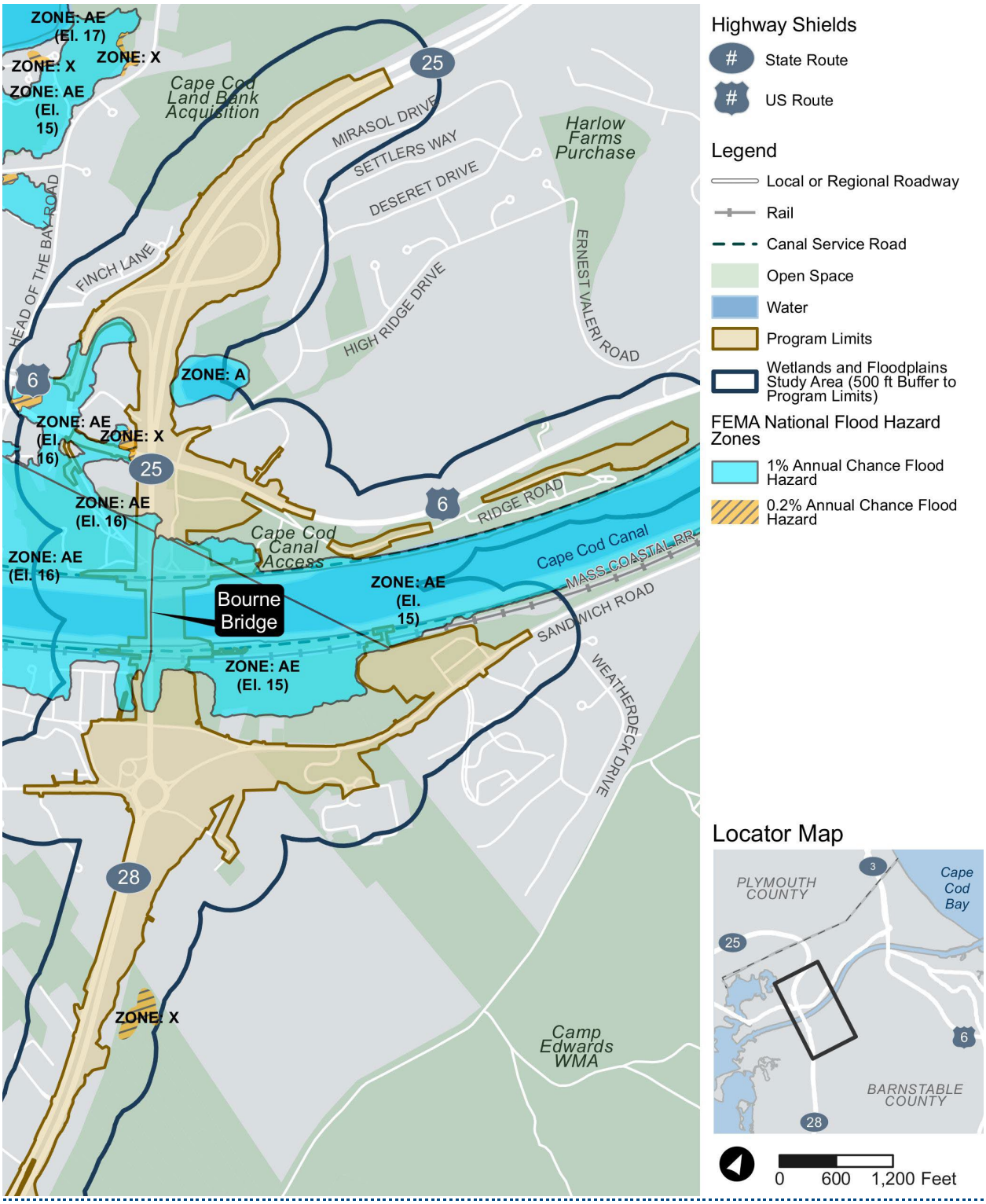
[9] Memorandum of Understanding between the United States Coast Guard and the United States Army Corps of Engineers. Bridges and Causeways Over, In, or Affecting Navigable Waters of the United States. 2023. https://www.dco.uscg.mil/Portals/9/USCG-USACE_Bridge_MOU_19Jan2023.pdf

Figure 4.9-8. Floodplains (Sagamore Bridge)



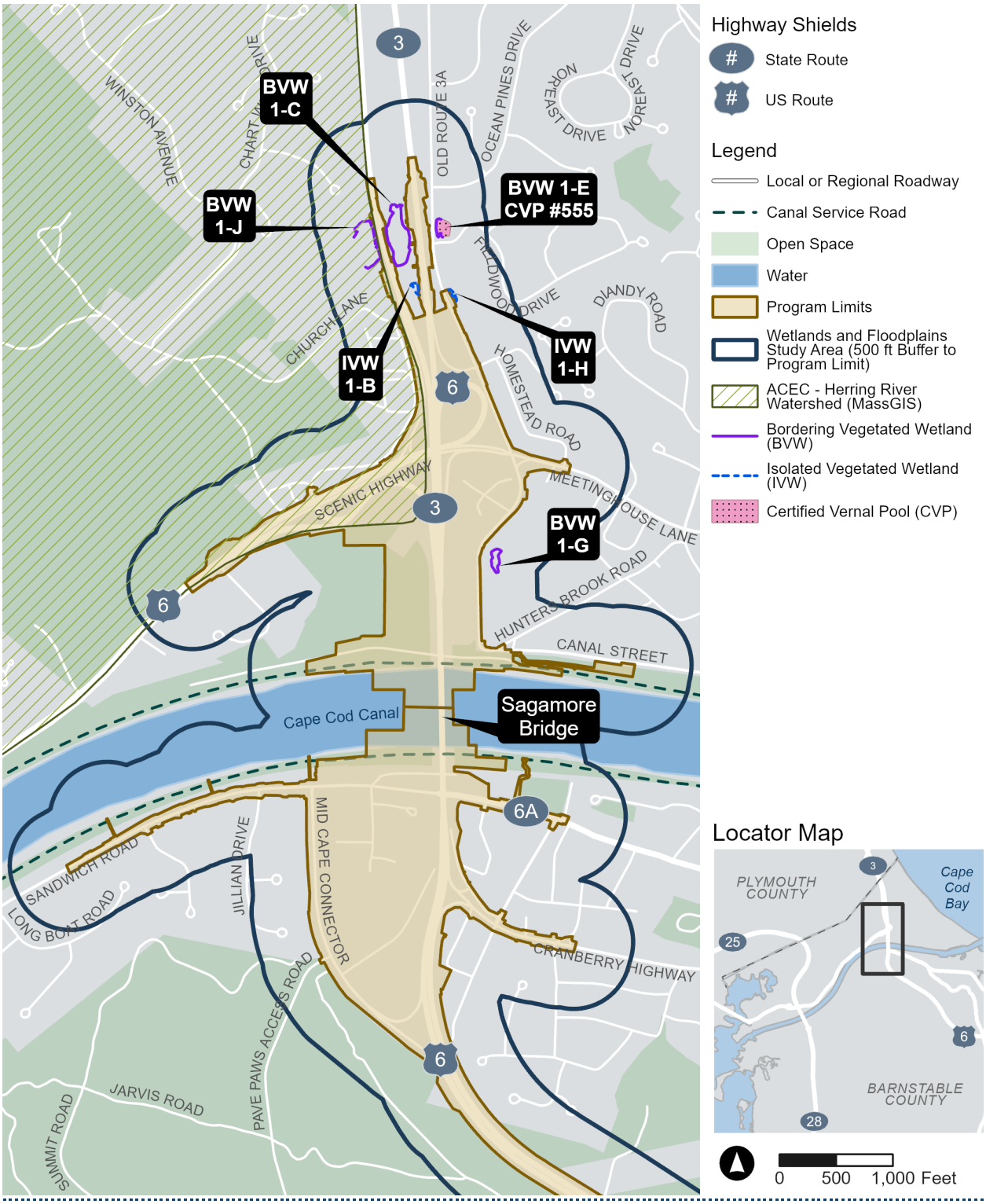
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-9. Floodplains (Bourne Bridge)



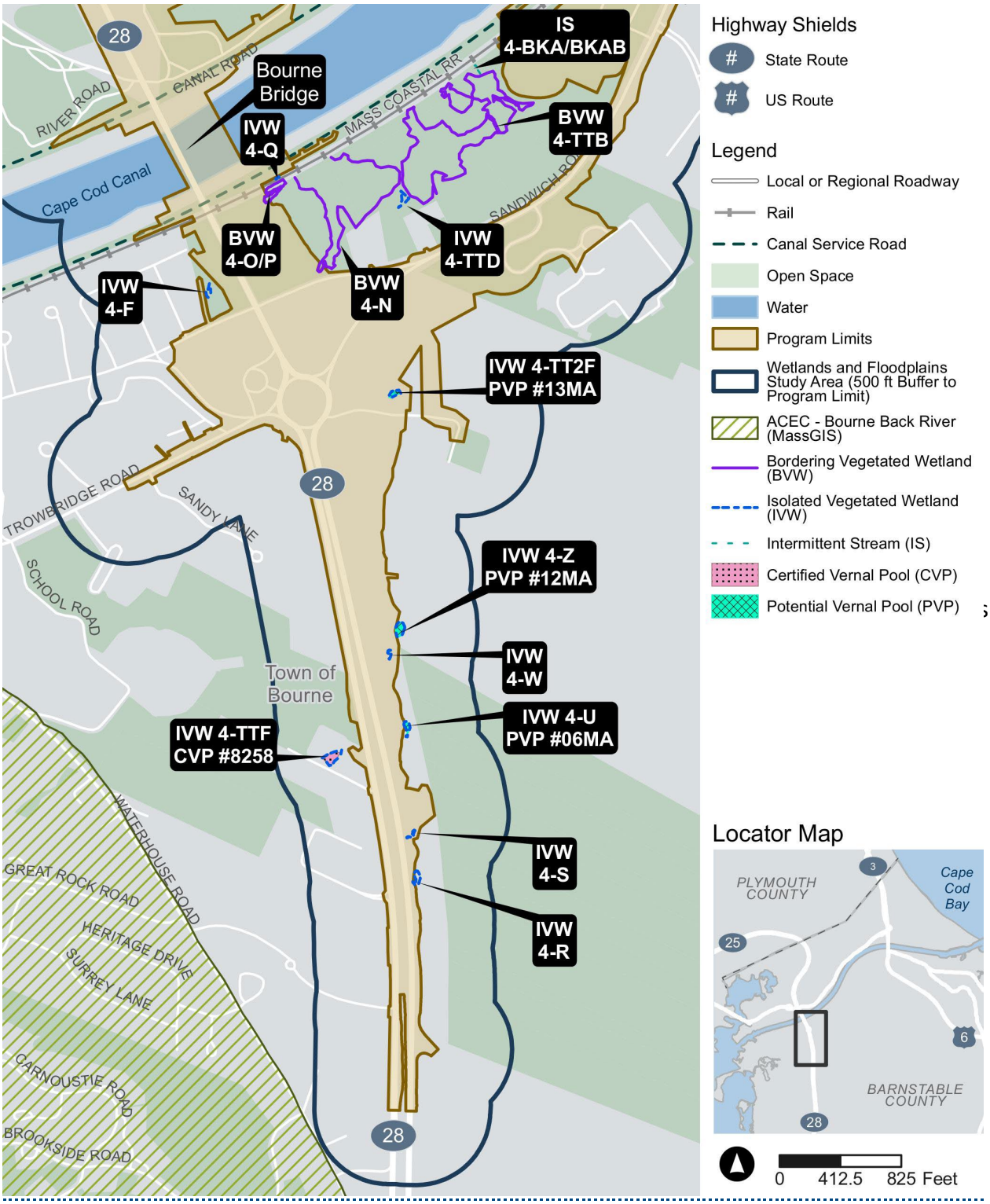
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-10. Areas of Critical Environmental Concern (Sagamore North Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2025

Figure 4.9-11. Areas of Critical Environmental Concern (Bourne South Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2025

4.9.3 No Build Alternative

For the No Build Alternative, Sagamore and Bourne Bridges would not be replaced. USACE would continue to conduct maintenance activities at both bridges. These activities would not result in permanent impacts to state or federal resource areas. Effects would be similar to those that occurred during prior maintenance activities for which USACE analyzed pursuant to the National Environmental Policy Act.

4.9.4 Build Alternative

4.9.4.1 Construction-Term Impacts

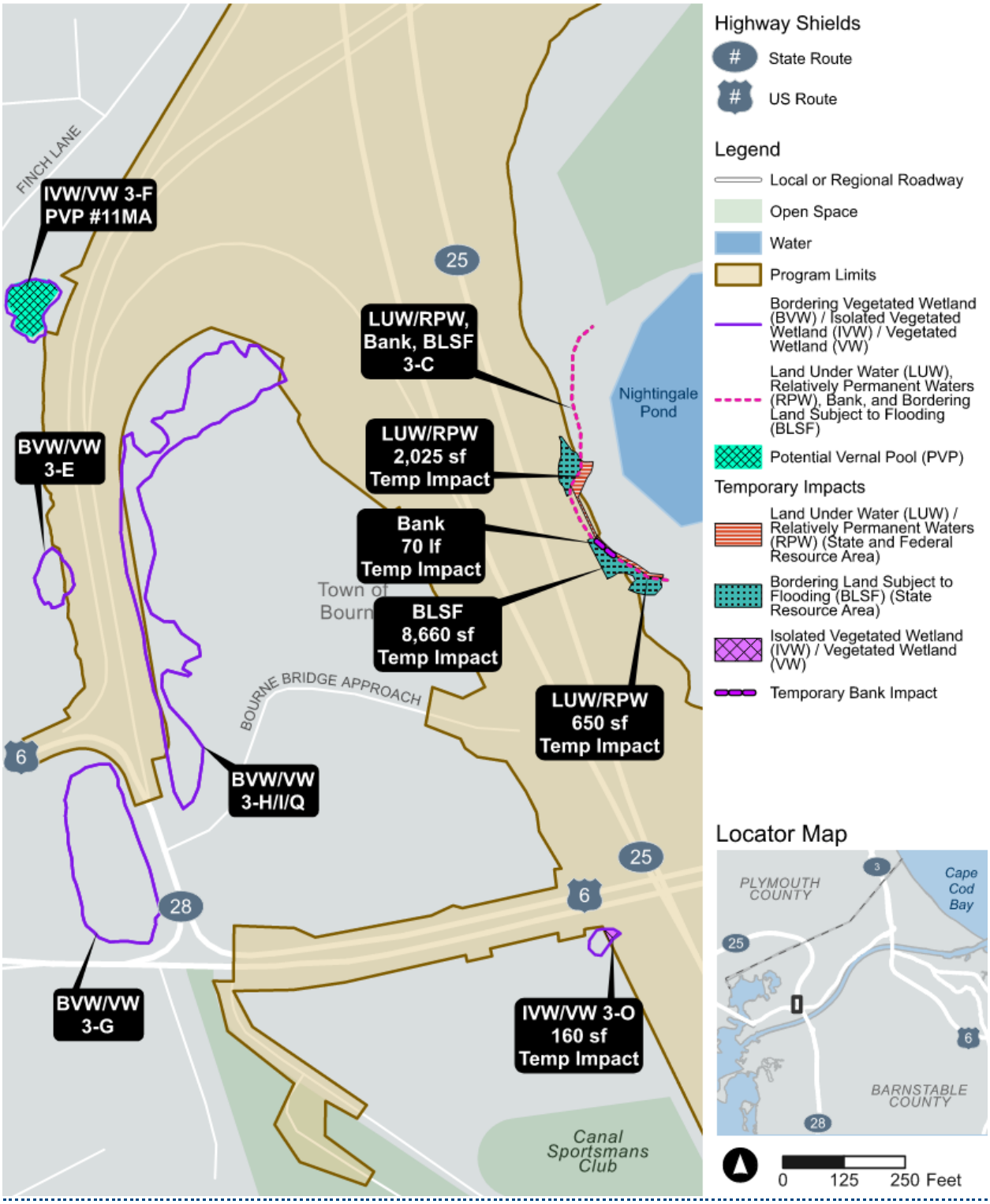
The Build Alternative would result in temporary and permanent impacts to both state and federal resources and in both inland and coastal areas. Temporary construction-term alterations would include filling, excavating, and installing structures. Permanent alterations would result from Build Alternative components, including the new bridge piers, riprap pier protection, retaining walls, parkland improvements, and highway ramps. Dredging would also be required to facilitate marine vessel access to temporary construction structures.

Impacts to State and Federal Inland Wetland Resource Areas

The Bourne North quadrant interchange approach would include roadway widening, additional lanes and/or accommodations for a shared-use path that would affect state and federal wetlands. In each location, retaining walls would be constructed to minimize the extent of fill in jurisdictional resources. The temporary alteration would allow for an 11.5-foot-wide work zone to construct the retaining walls. After construction, the same work zone would be narrowed to a 10-foot-wide grass surface, access path for maintenance purposes during operations. The 10-foot-wide access path would be considered a permanent impact. Unavoidable impacts to wetlands are mapped in **Figure 4.9-12** and **Figure 4.9-13** and described in **Table 4.9-10**; permanent impacts to wetlands would be compensated (refer to **Section 4.9.5**).

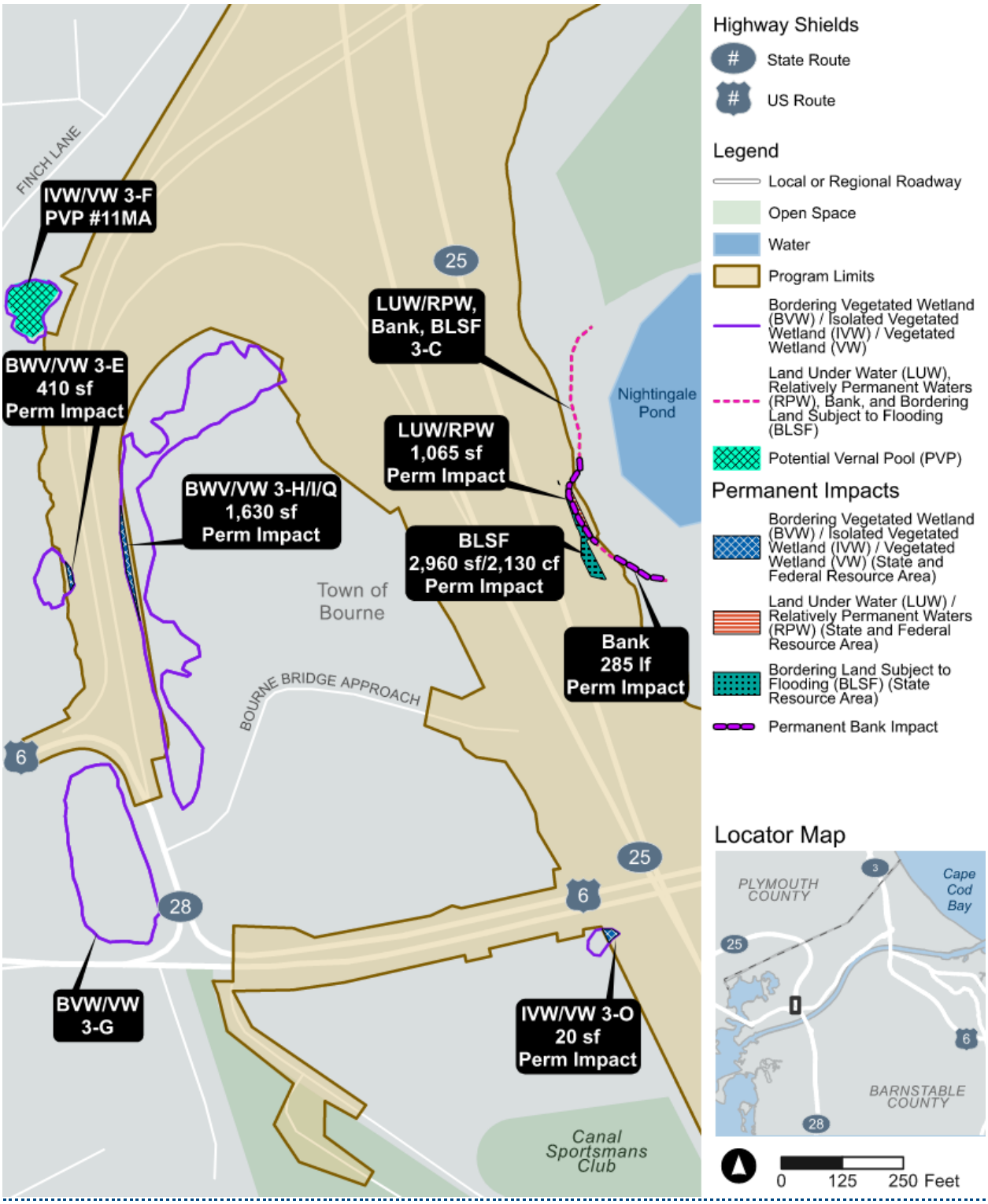
Construction of the Sagamore North quadrant and the Sagamore South quadrant interchange approaches would not result in impacts to jurisdictional wetlands. Inland resource area impacts would occur in the Bourne North and Bourne South quadrant interchange approaches, as described in **Table 4.9-10**. In the Bourne South quadrant interchange approach, the Program would impact federal jurisdictional VWs 3-O, 4-TT2F, 4-W, 4-S, and VW 4-R; these resources are not state-jurisdictional under MA WPA. Temporary and permanent impacts to inland resource areas are shown on **Figure 4.9-12 through Figure 4.9-14**.

Figure 4.9-12. Potential Temporary Impacts to State and Federal Inland Wetland Resource Areas (Bourne North Quadrant Interchange Approach)



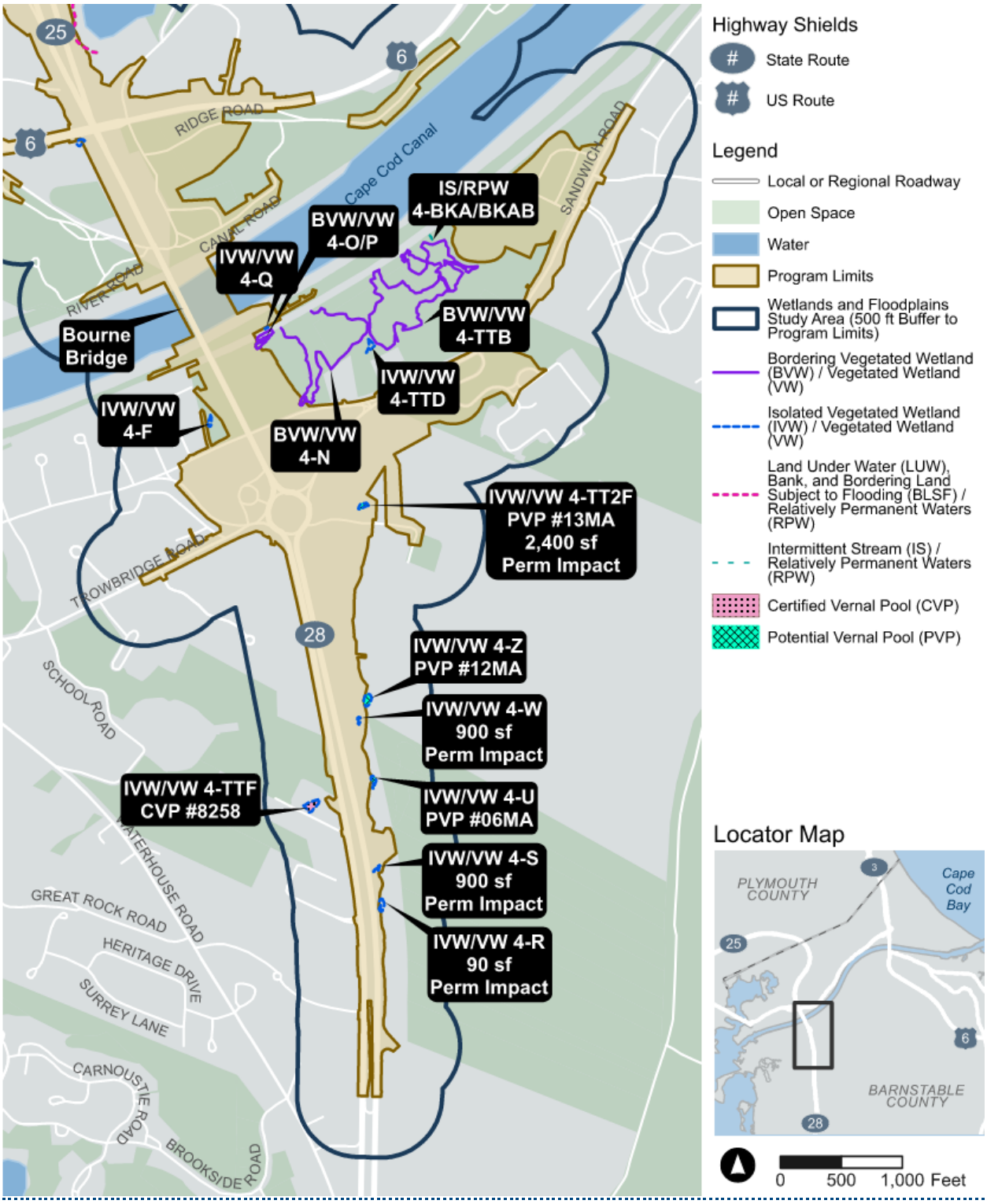
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-13. Potential Permanent Impacts to State and Federal Inland Wetland Resource Areas (Bourne North Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2025

Figure 4.9-14. Potential Permanent Impacts to State and Federal Inland Wetland Resource Areas (Bourne South Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2025

Table 4.9-10. Potential Impacts to State and Federal Inland Wetland Resource Areas

Resource[1]	Temporary Impacts	Permanent Impacts	Reason for Impact
BVW 3-E *VW 3-E*[2]	—	410 square feet (sf) (<0.01 acre)	Fill for widening State Route 25 east- and westbound off-ramps to U.S. Route 6/State Route 28 and add second travel lane
BVW 3-H/I/Q *VW 3-H/I/Q*[2]	—	1,630 sf (0.03 acre)	Fill for widening State Route 25 east- and westbound on-ramps from U.S. Route 6/State Route 28 and accommodate shared-use path
LUW 3-C *RPW 3-C*[2]	2,675 sf (0.06 acre)	1,065 sf (0.02 acre)	Fill for new westbound on-ramp to State Route 25 from U.S. Route 6 and add auxiliary lane on State Route 25 westbound
Bank 3-C	70 linear feet (lf)	285 lf	Fill for new westbound on-ramp to State Route 25 from U.S. Route 6 and add auxiliary lane on State Route 25 westbound
BLSF 3-C	8,660 sf	2,960 sf (2,130 cubic feet)	Fill for new westbound on-ramp to State Route 25 from U.S. Route 6 and add auxiliary lane on State Route 25 westbound
VW 3-O[2]	160 sf	20 sf	Outfall replacement and riprap apron addition
VW 4-TT2F[2]	0 sf	2,400 sf	Highway ramp construction
VW 4-W[2]	0 sf	900 sf	Highway widening or grading
VW 4-S[2]	0 sf	900 sf	Highway widening or grading
VW 4-R[2]	0 sf	90 sf	Highway widening or grading

BLSF = Bordering Land Subject to Flooding, BVW = Bordering Vegetated Wetland, RPW = Relatively Permanent Water, VW = Vegetated Wetland

[1] As identified in the ANRAD[10] and additional field investigations.

[2] Identified as Waters of the United States.

Table 4.9-11 lists potential impacts to vernal pools and provides their relationships to proposed Program work, which would occur proximate to five vernal pools: one in the Sagamore North quadrant, one in the Bourne North quadrant, and three in the Bourne South quadrant. No vernal pools were identified in the Sagamore South quadrant; therefore, no vernal pool impacts would occur in that area. In addition, Program work would directly impact one vernal pool in the Bourne South quadrant

[10] HNTB Corporation. December 2021 and April 2022. Abbreviated Notice of Resource Area Delineation (ANRAD), MassDOT Cape Cod Canal Area Transportation Improvements Program, Project No. 608020, Bourne, Massachusetts.

interchange approach (**Table 4.9-11**). Refer to **Appendix 4.9, Wetlands and Floodplains Technical Report, Section 7.1.1**, for details on work proximate to vernal pools.

Table 4.9-11. Proposed Work Proximate to Vernal Pools

Survey Area/ Wetland ID[1]	Vernal Pool ID[2]	Vernal Pool ID[3]	Work Within 100 Feet of Resource	Comment
Sagamore North quadrant/Bordering Vegetated Wetland (BVW)/Vegetated Wetland (VW) 1-E	05DN	Certified #555	Roadway widening for extension of acceleration lane within 75 feet of Vernal Pool	Work to occur along State Route 3 northbound and separated by State Road; no direct impact
Bourne North quadrant/Isolated Vegetated Wetland (IVW)/VW 3-TTA	10MA	Potential	Realigned ramp and grading within 10 feet	No direct impact
Bourne South quadrant/IVW/VW 4-TTF	07MA	Certified #8258	Work limited to repaving 1,150 square feet of existing driveway within 70 feet	No direct impact
Bourne South quadrant/IVW/VW 4-TT2F	13MA	Potential	Filled to accommodate at-grade off-ramp from State Route 28 to Sandwich Road Connector at Bourne Rotary	2,400 square feet of impact to IVW/VW 4-TT2F
Bourne South quadrant/IVW/VW 4-Z	12MA	Potential	State Route 28 widening and grading within 30 feet	No direct impact
Bourne South quadrant/IVW/VW 4-U	06MA	Potential	State Route 28 widening and grading within 1 foot	No direct impact

[1] As identified in the ANRAD[11] and additional field investigations.

[2] As identified in Stantec (2020,[12] 2025[13])

[3] As identified by Massachusetts Department of Fish and Wildlife Natural Heritage and Endangered Species Program.[14]

[11] HNTB Corporation. December 2021 and April 2022. Abbreviated Notice of Resource Area Delineation (ANRAD), MassDOT Cape Cod Canal Area Transportation Improvements Program, Project No. 608020, Bourne, Massachusetts.

[12] Stantec Consulting Services Inc. 2020. Bourne and Sagamore Bridge Improvement Projects – Rare, Threatened, and Endangered Species Habitat Assessment, MassDOT Project # 14-33419, Barnstable County, Massachusetts. Stantec Consulting Services Inc., Boston, Massachusetts. December.

[13] Stantec Consulting Services Inc. 2025. Draft Cape Cod Bridges Program 2025 Vernal Pool Survey Report, Bourne, Massachusetts. Stantec Consulting Services Inc. January 8, 2026.

[14] Massachusetts Division of Fisheries and Wildlife. 2009. Guidelines for the Certification of Vernal Pool Habitat (updated 2020). Massachusetts Division of Fisheries and Wildlife. Westborough, Massachusetts. March.

Impacts to State and Federal Coastal Resource Areas

Replacing Sagamore and Bourne Bridges would remove eight piers from below mean high water and construct eight new piers in Cape Cod Canal. Each bridge would be supported by four new piers to accommodate both the north- and southbound decks over Cape Cod Canal. Each pier would be partially located within the riprap banks of the canal shoreline and partially below mean high water and high tide line.

Temporary structures would include barge docks, cofferdams surrounding the work areas for pier removal and installation, bulkheads to create level work area platforms on two sides of each pier cofferdam, pile-supported work trestles to facilitate work from above the water surface, and bollards and pile-supported dolphins to accommodate work barges. The existing riprap along the shoreline would be temporarily removed to accommodate the sheet pile installations. Excavation would occur to remove the existing piers to a minimum of 2 feet below the mudline and to install the new piers. Dredging would also be required to facilitate marine vessel access to the temporary work structures. Temporary impacts are represented on two sets of figures due to the overlap of the trestles and other structures. **Figure 4.9-15 through Figure 4.9-22** show the temporary impacts to state and federal coastal resource areas.

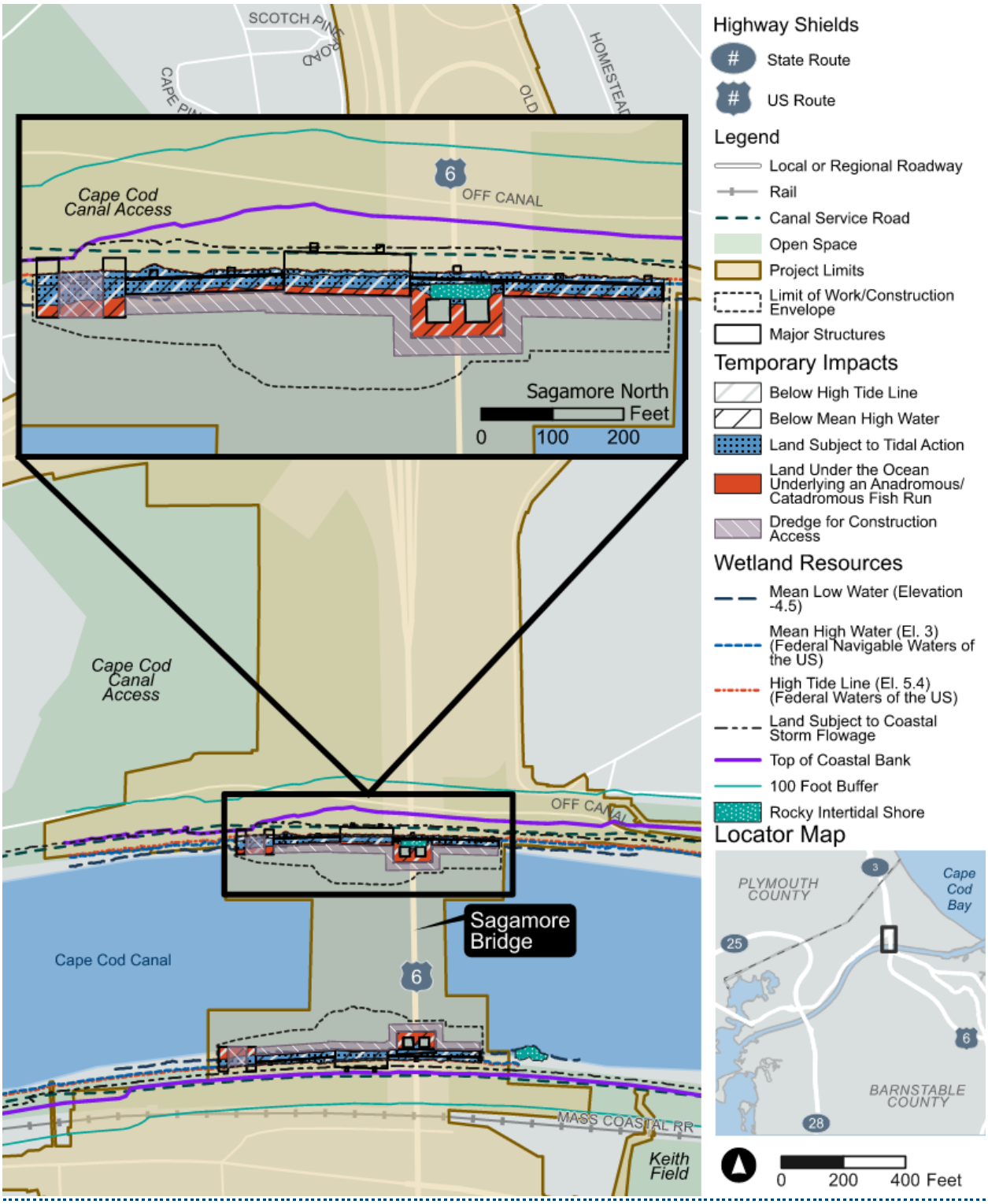
MassDOT has coordinated the design of the bridge pier protection system with USACE. The Build Alternative includes riprap to surround the new bridge piers, which would increase the permanent impact to state-regulated LUO, Land Subject to Coastal Storm Flowage (LSCSF), RIS, and Land Containing Shellfish and federally regulated RPW. The riprap pier protection is required to prevent potential bridge pier collisions by marine vessels. Dredging would be required to facilitate construction access to the work zone and installation of temporary structures, the new bridge piers, and riprap pier protection.

The Program includes activities in all four quadrant interchange approaches associated with road and parkland improvements north and south of Cape Cod Canal. This work would occur within the 100-foot buffer to Coastal Bank, an MA WPA resource. This same work would not impact federally regulated wetlands.

Permanent structures would include the new bridge piers and their foundations and riprap pier protection. The eelgrass beds within the Bourne North quadrant would be permanently impacted by the proposed riprap pier protection. **Figure 4.9-23 through Figure 4.9-29** show the permanent impacts to state and federal coastal resource areas.

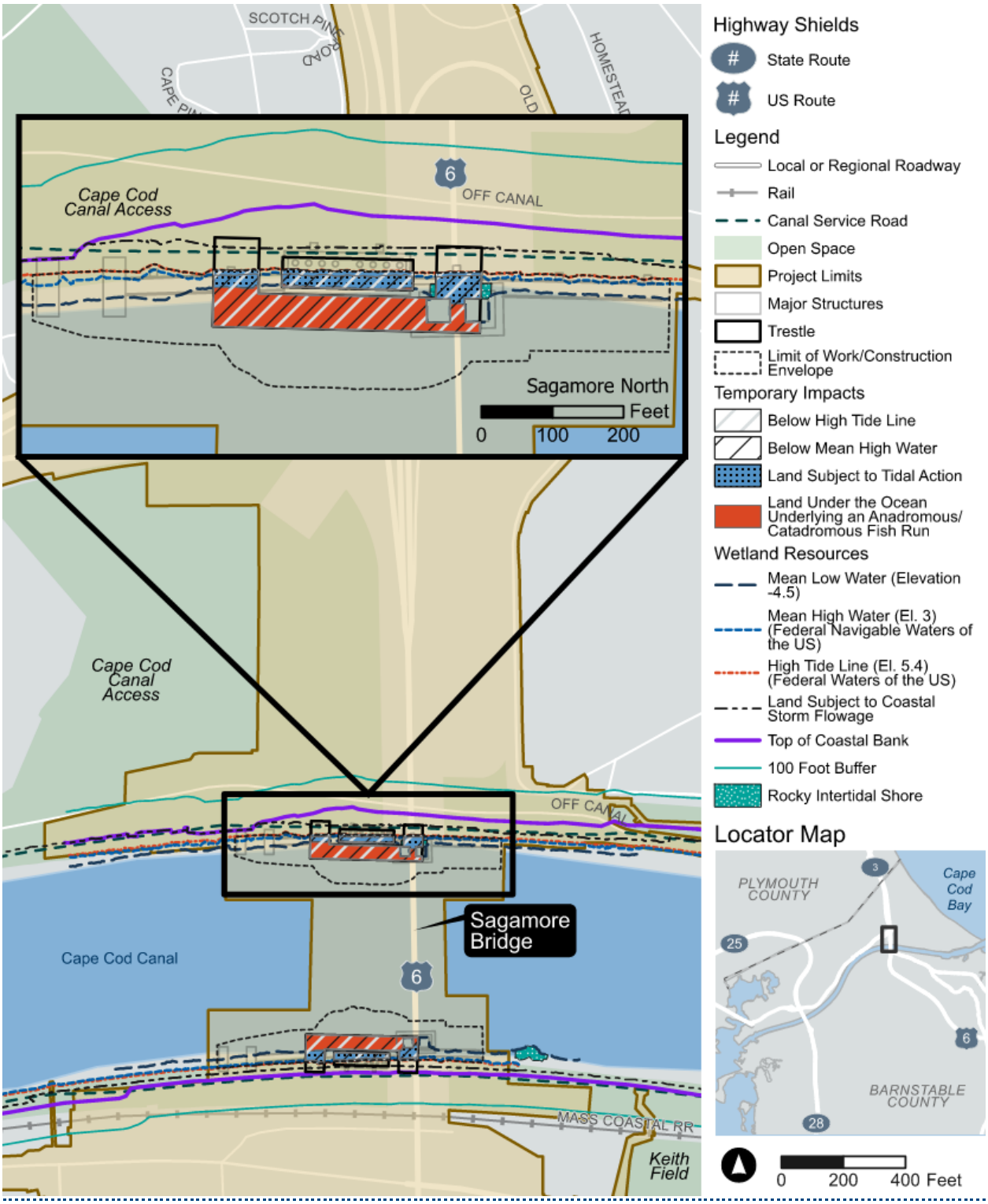
Table 4.9-12 and **Table 4.9-13** summarize the potential temporary and permanent impacts to state and federal coastal resource areas for both bridges. Refer to **Appendix 4.9, Wetlands and Floodplains Technical Report, Table 7-5 through Table 7-8,** for detailed assessments of these impacts by proposed activity for each bridge quadrant.

Figure 4.9-15. Potential Temporary Impacts to State and Federal Coastal Resource Areas (Sagamore North Quadrant)



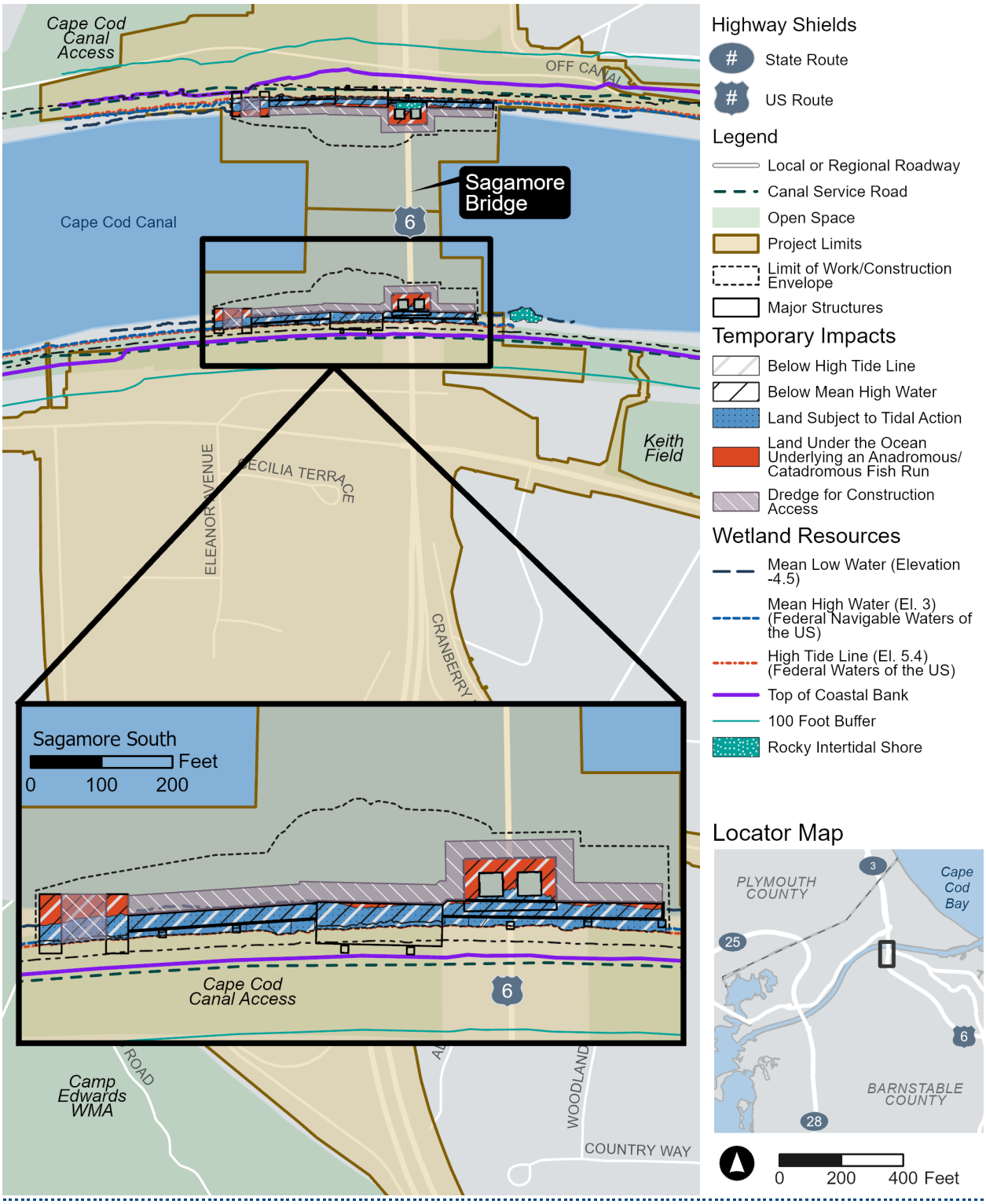
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-16. Potential Temporary Trestle Impacts to State and Federal Coastal Resource Areas (Sagamore North Quadrant)



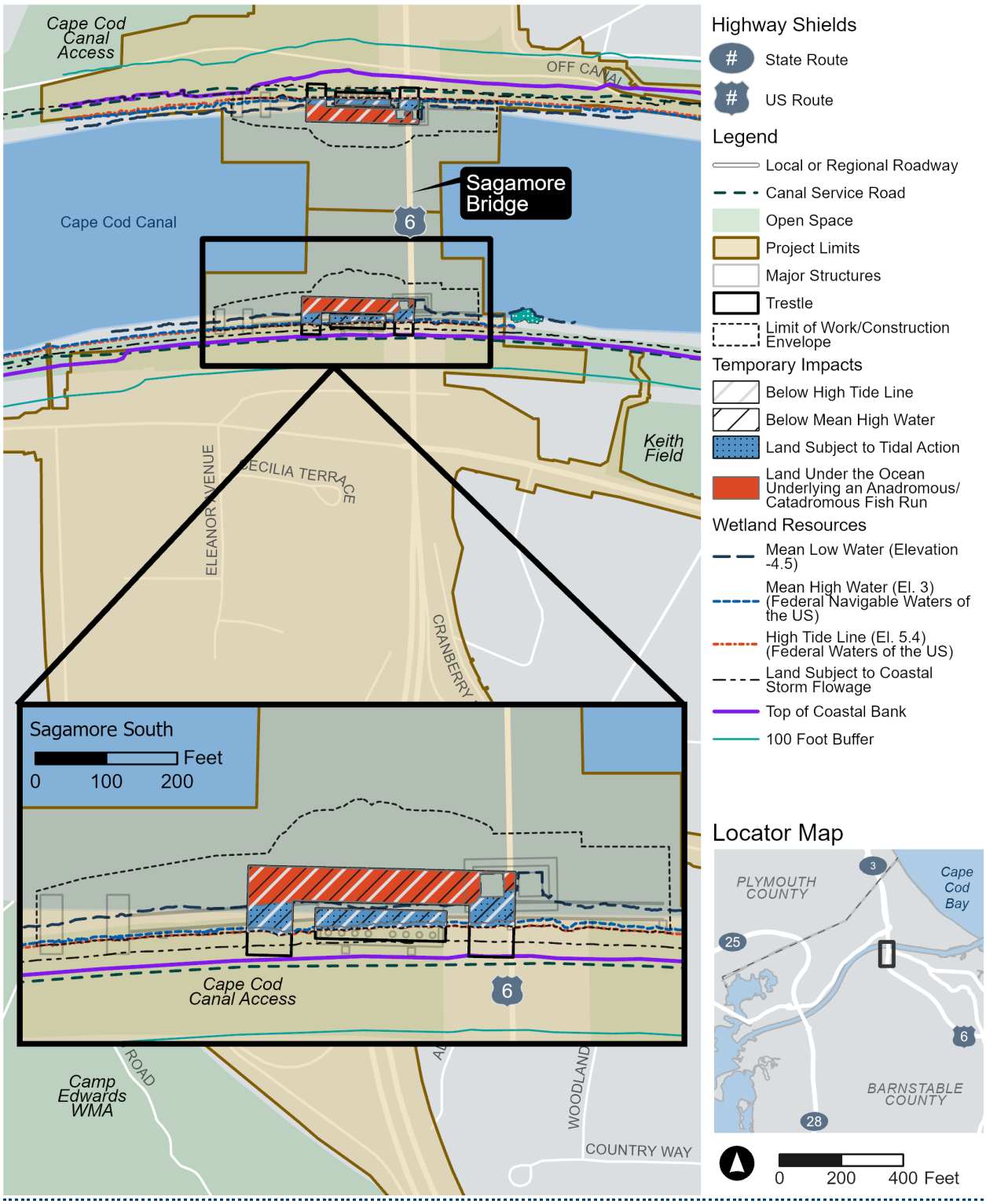
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-17. Potential Temporary Impacts to State and Federal Coastal Resource Areas (Sagamore South Quadrant)



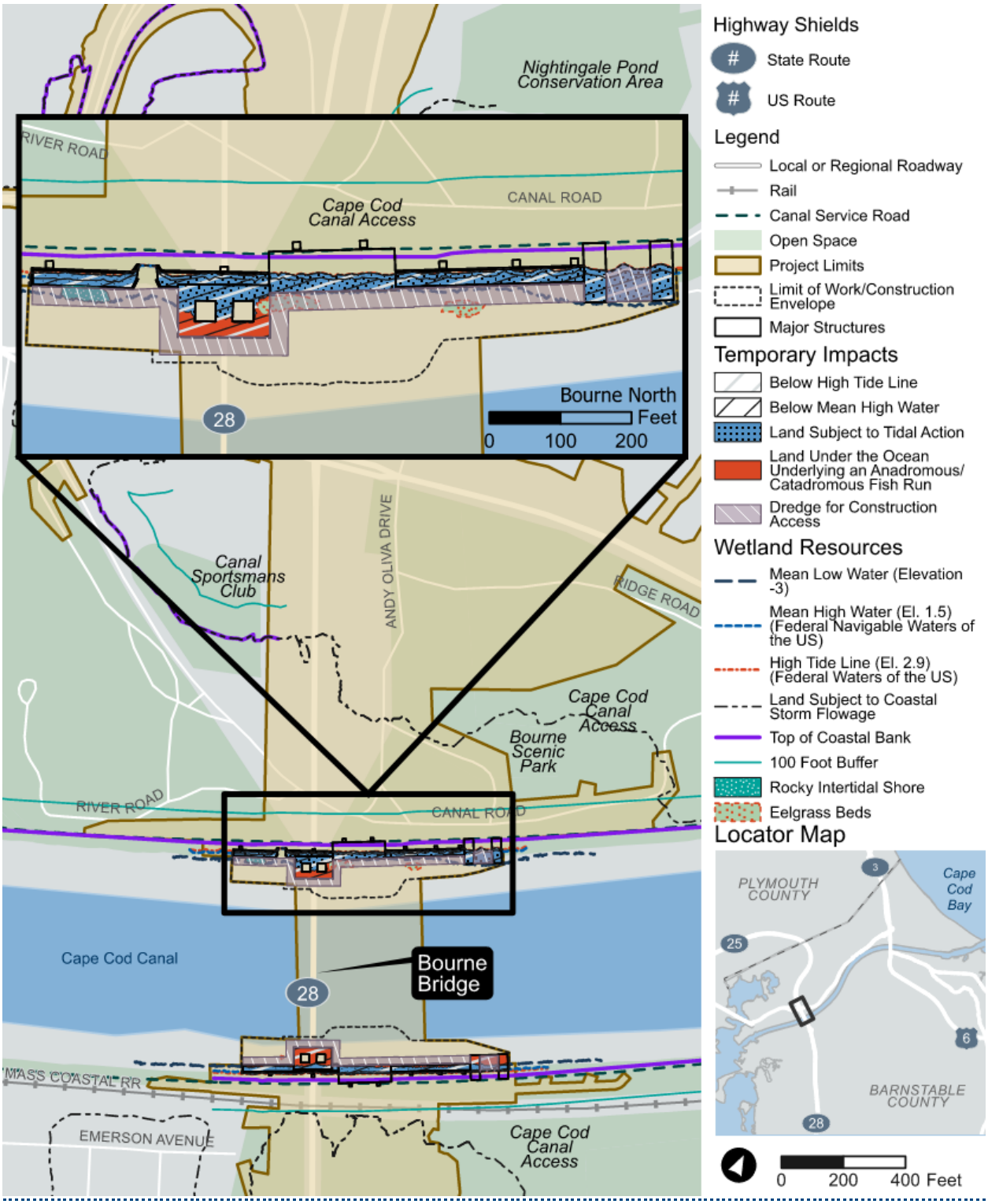
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-18. Potential Temporary Trestle Impacts to State and Federal Coastal Resource Areas (Sagamore Bridge South)



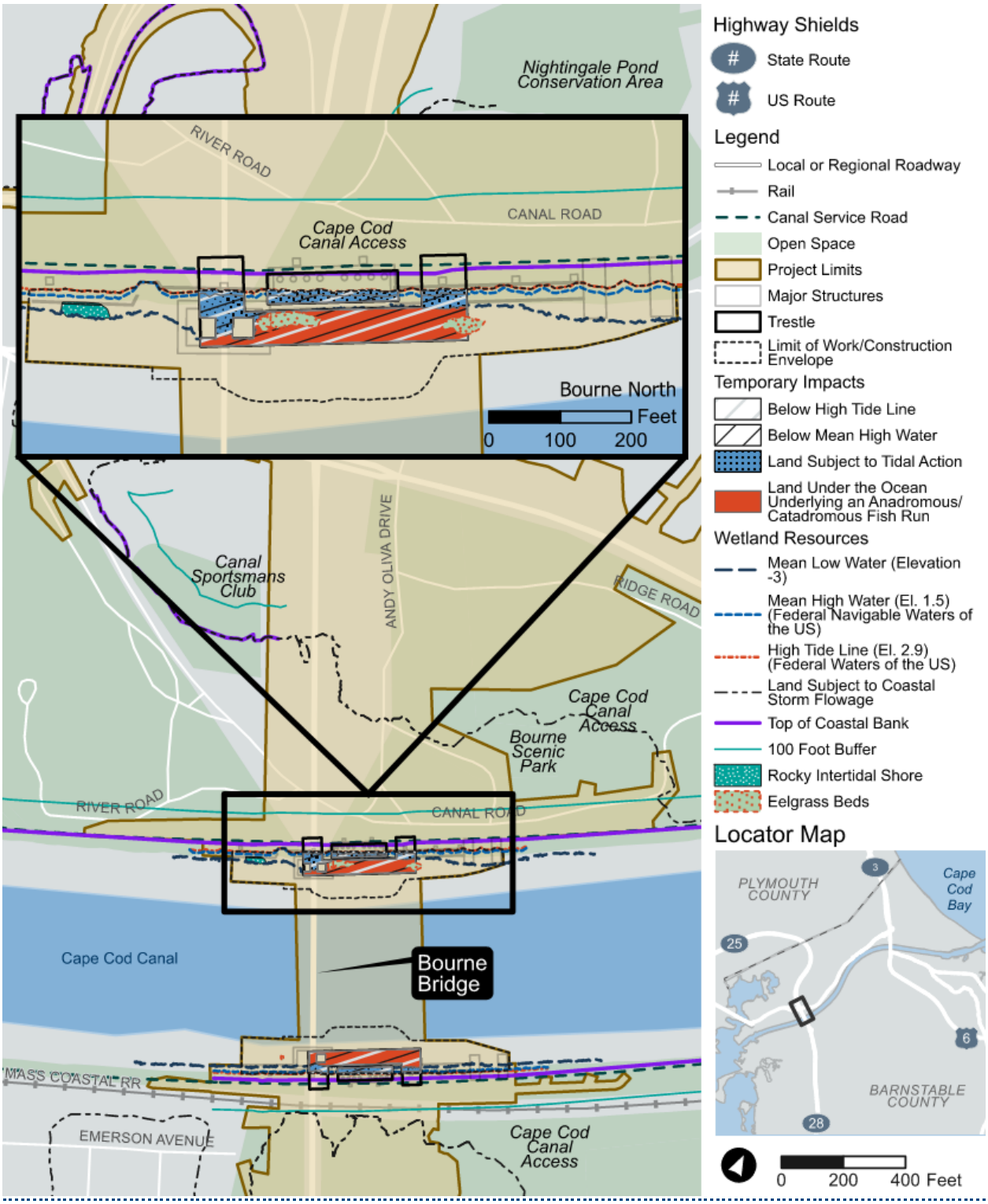
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-19. Potential Temporary Impacts to State and Federal Coastal Resource Areas (Bourne North Quadrant)



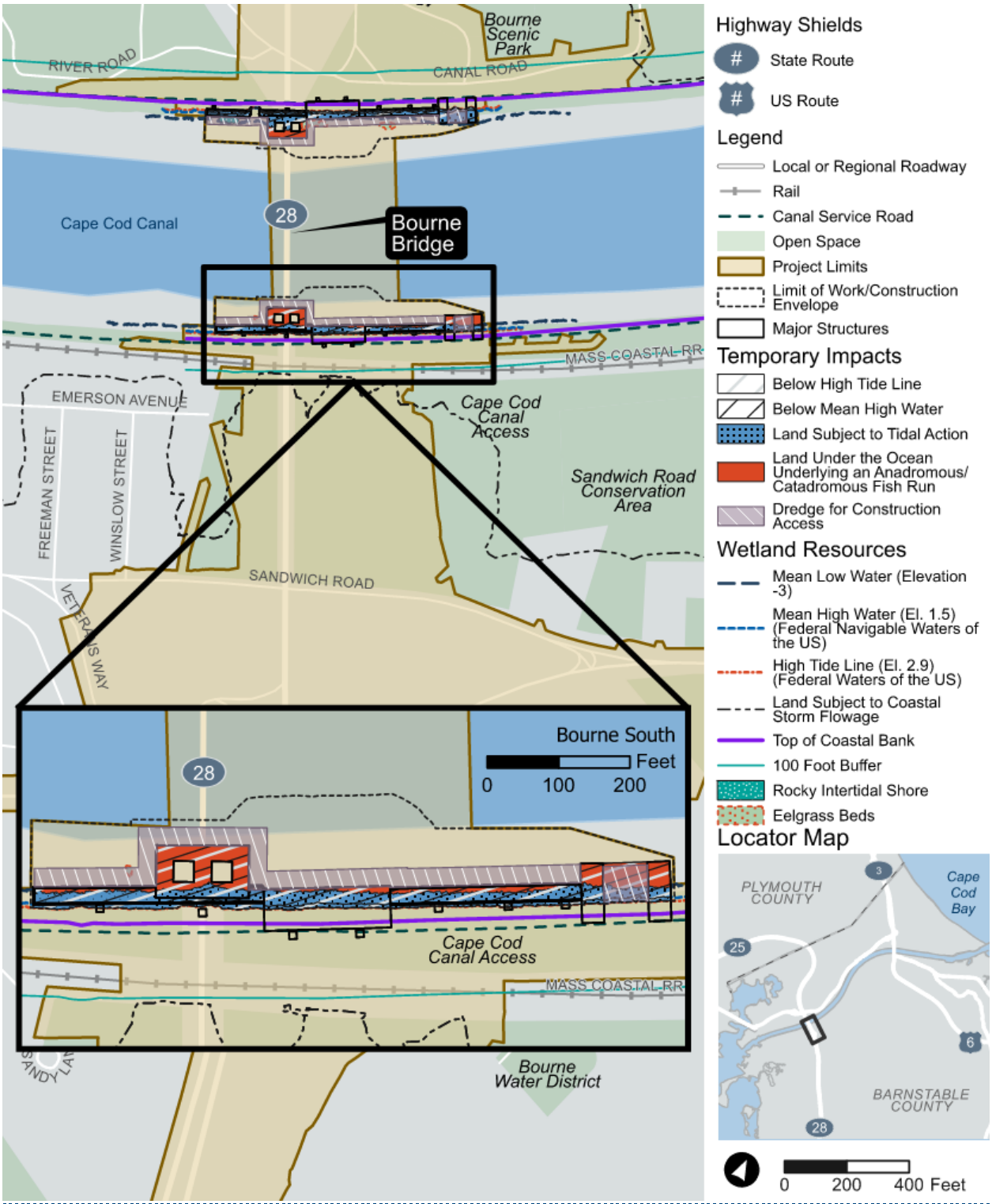
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-20. Potential Temporary Trestle Impacts to State and Federal Coastal Resource Areas (Bourne North Quadrant)



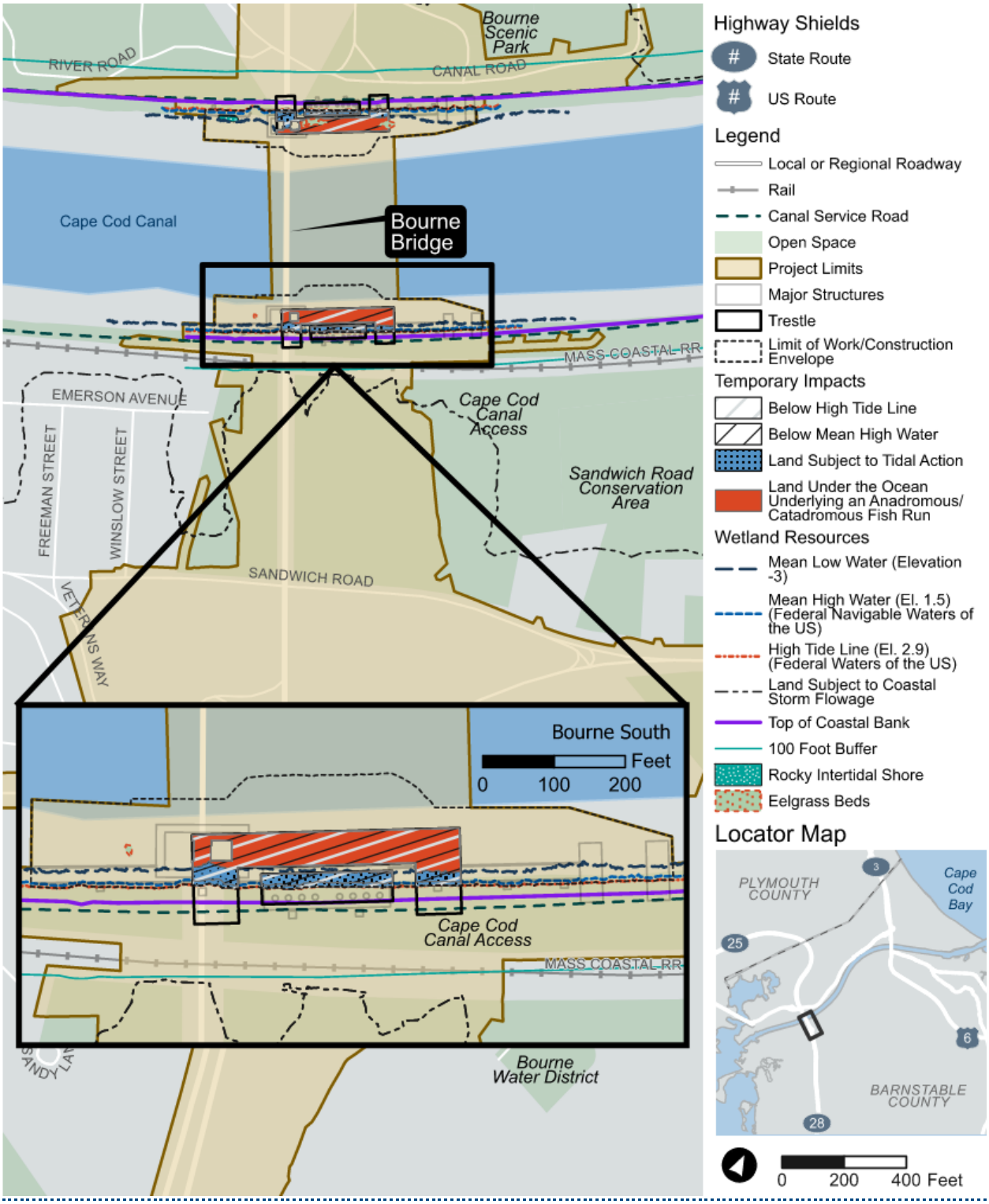
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-21. Potential Temporary Impacts to State and Federal Coastal Resource Areas (Bourne South Quadrant)



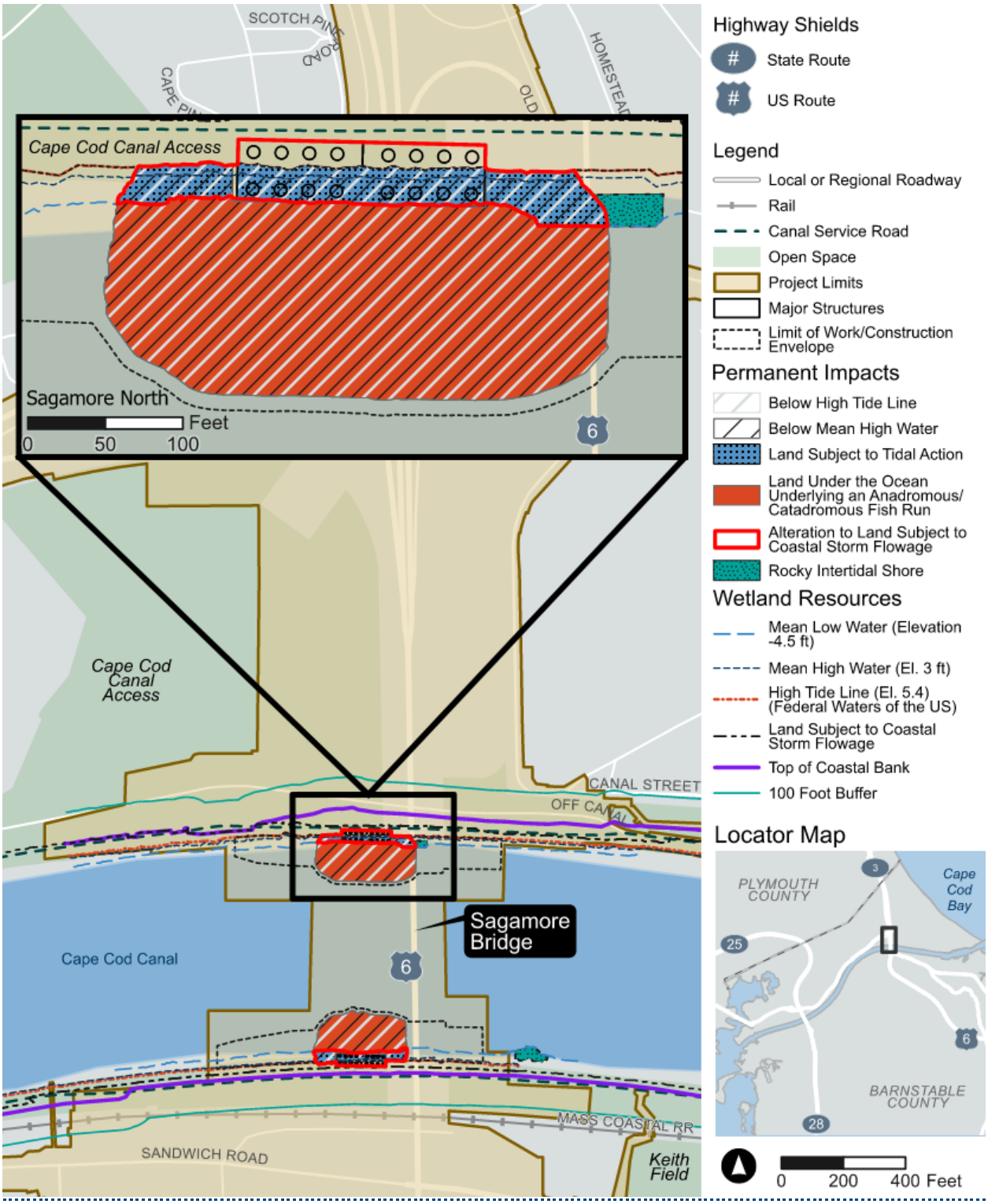
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-22. Potential Temporary Trestle Impacts to State and Federal Coastal Resource Areas (Bourne South Quadrant)



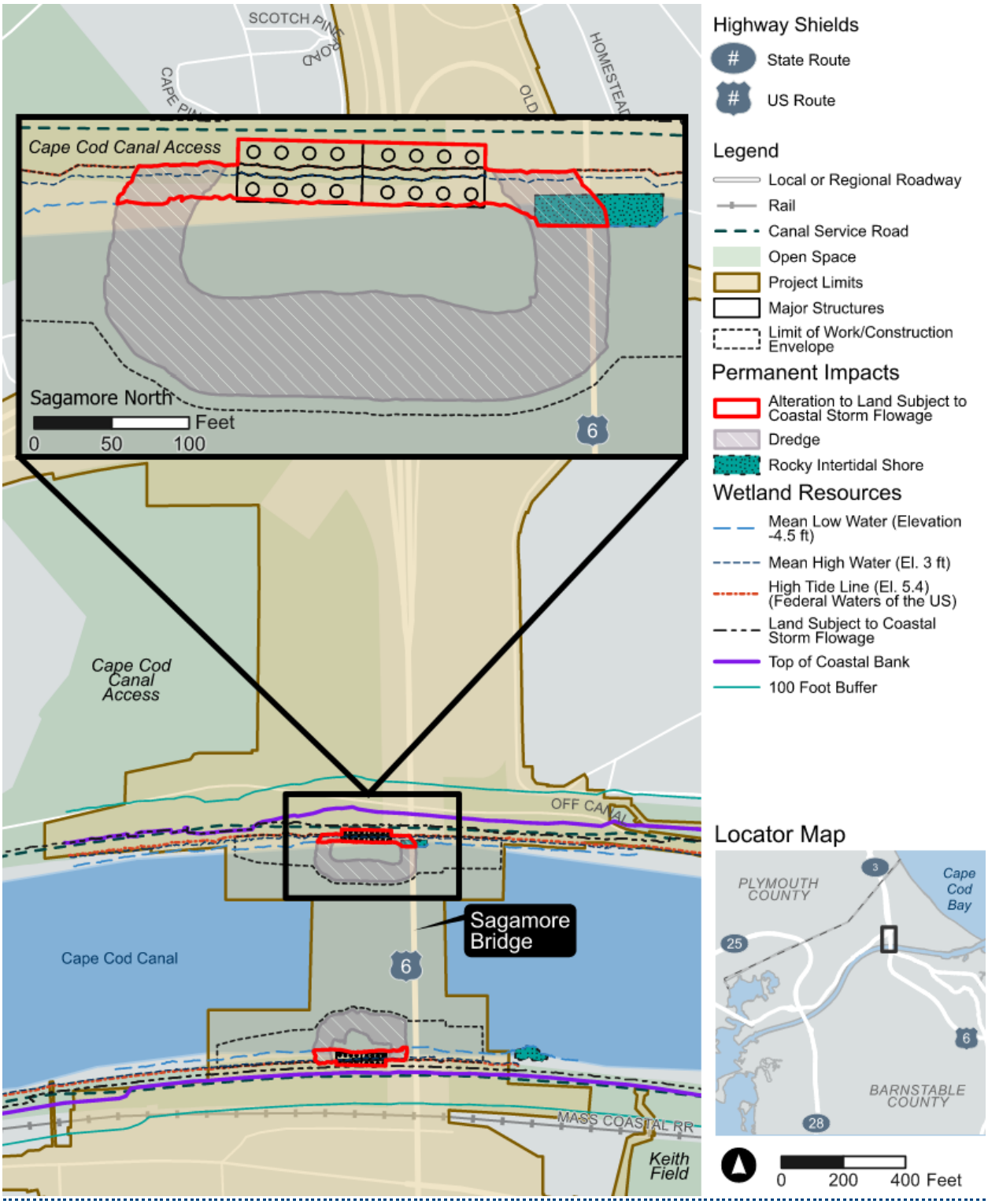
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-23. Potential Permanent Fill Impacts to State and Federal Coastal Resource Areas (Sagamore North Quadrant)



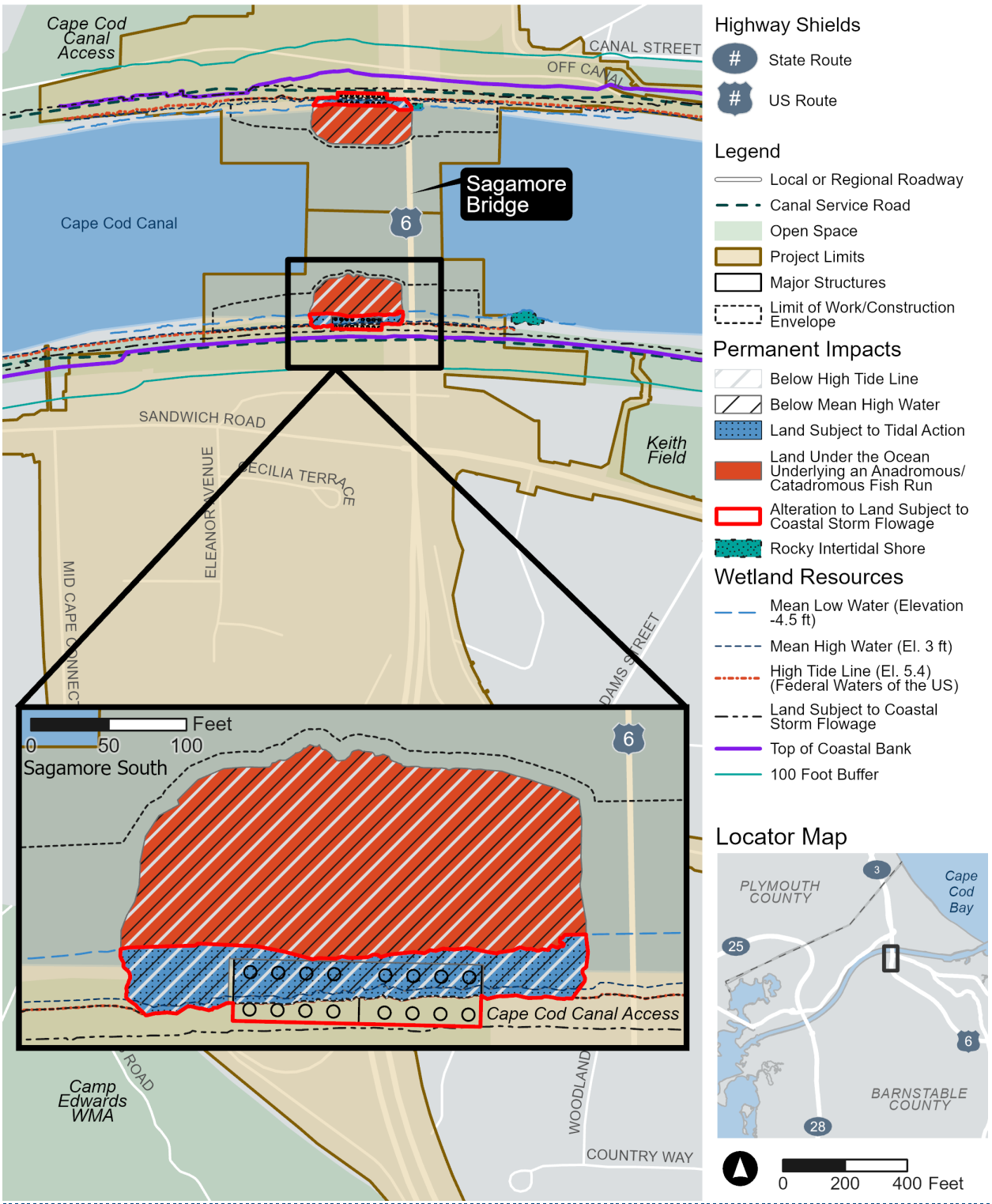
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-24. Potential Dredge Impacts to State and Federal Coastal Resource Areas (Sagamore North Quadrant)



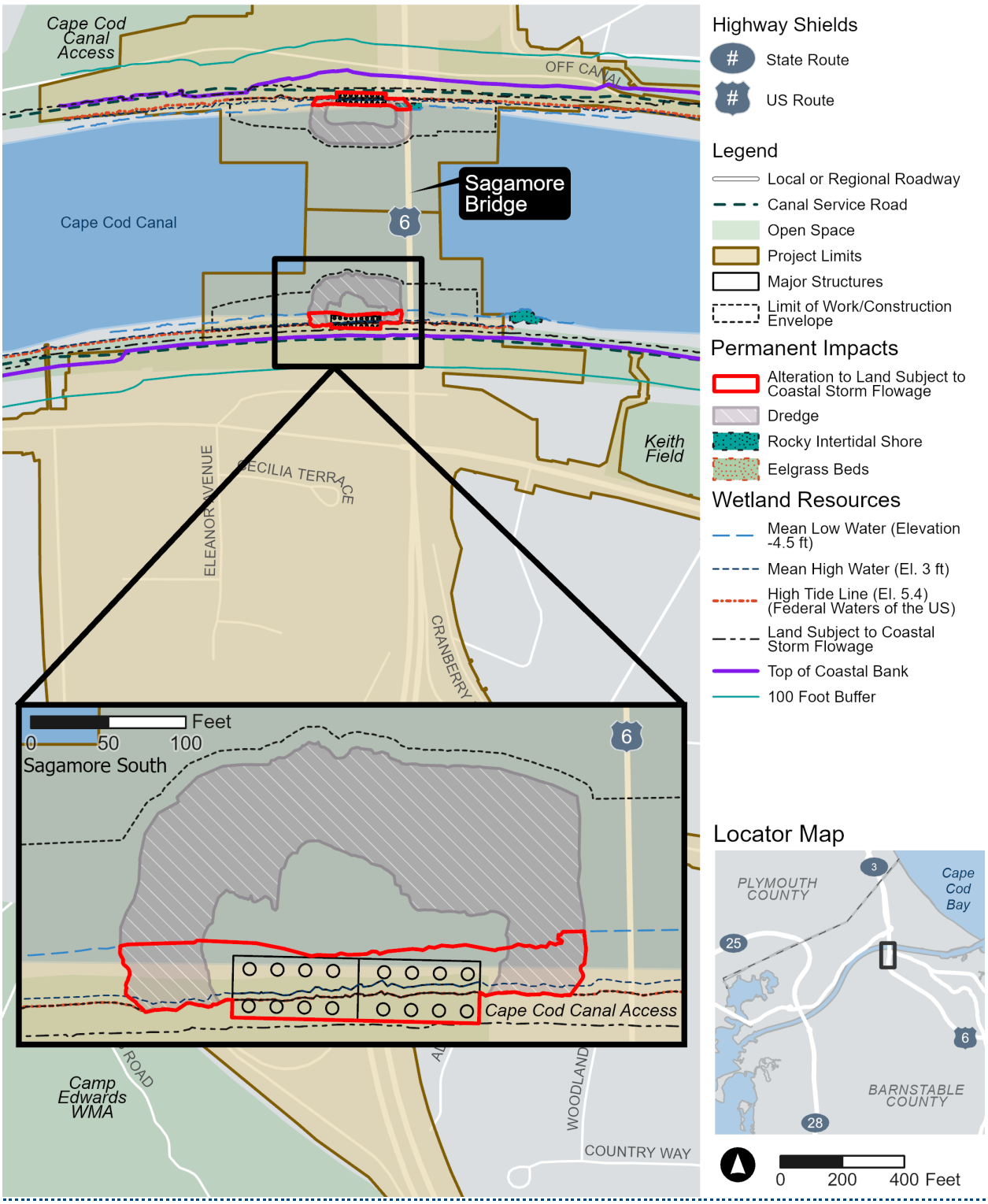
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-25. Potential Permanent Fill Impacts to State and Federal Coastal Resource Areas (Sagamore South Quadrant)



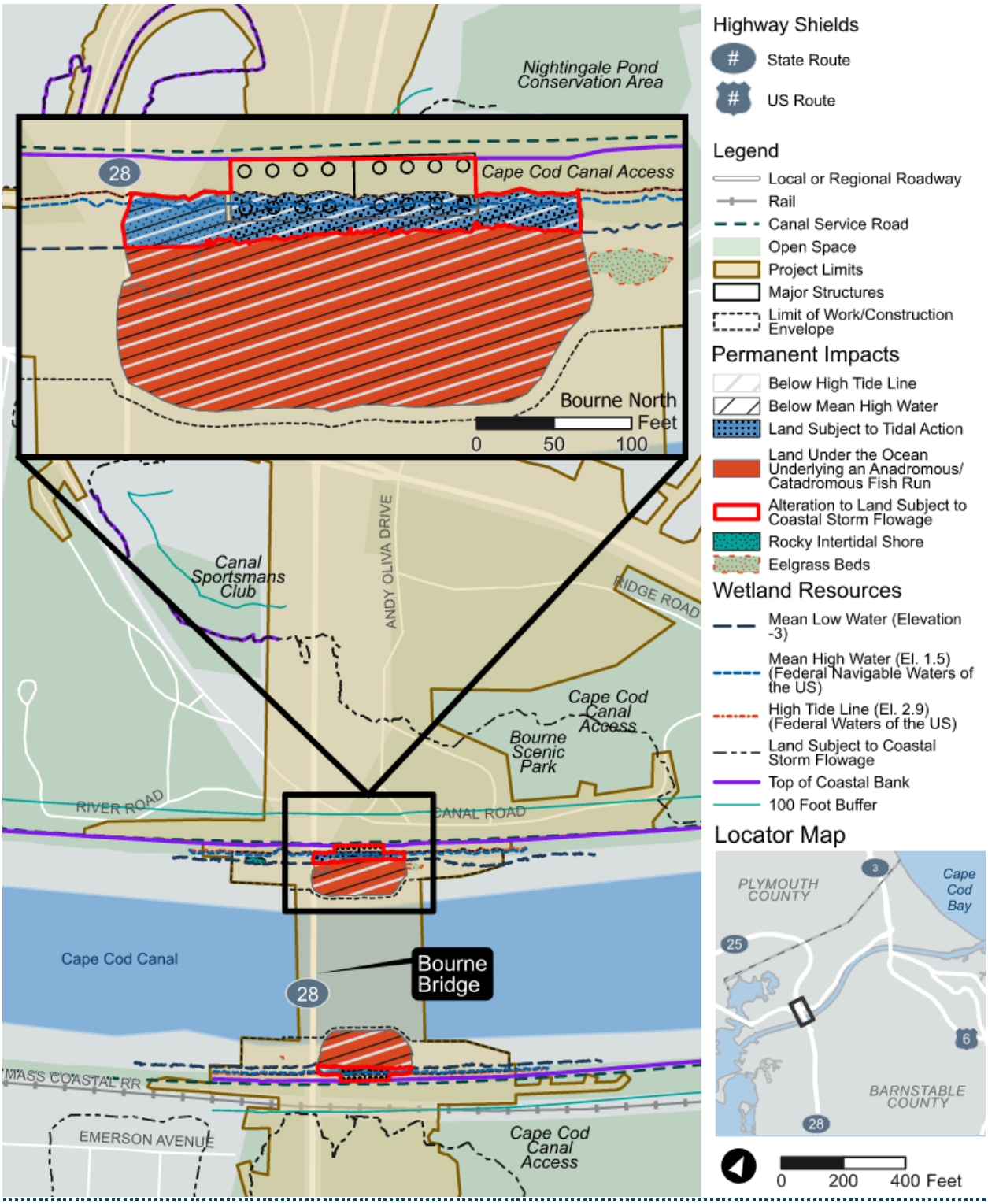
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-26. Potential Dredge Impacts to State and Federal Coastal Resource Areas (Sagamore South Quadrant)



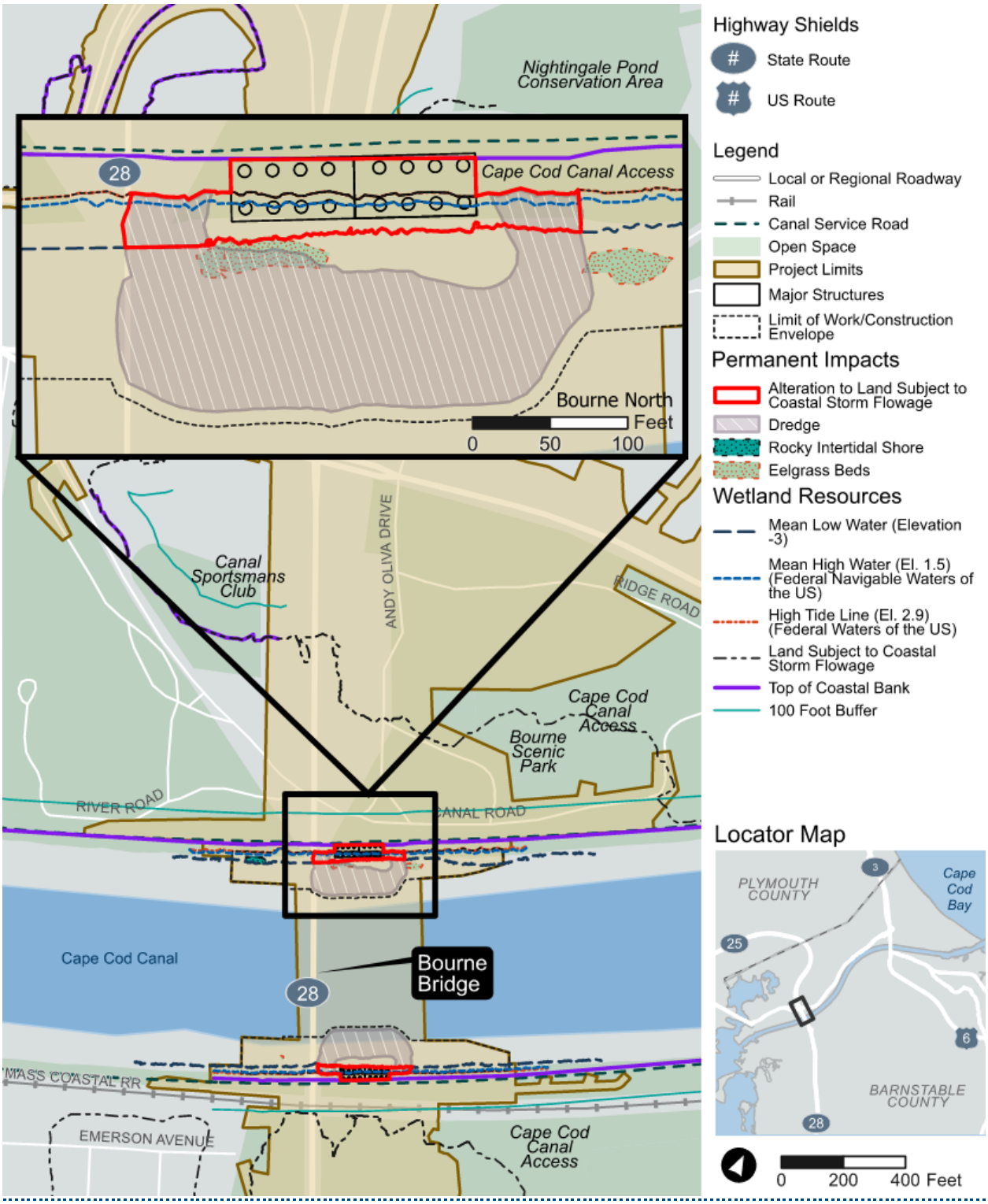
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-27. Potential Permanent Fill Impacts to State and Federal Coastal Resource Areas (Bourne North Quadrant)



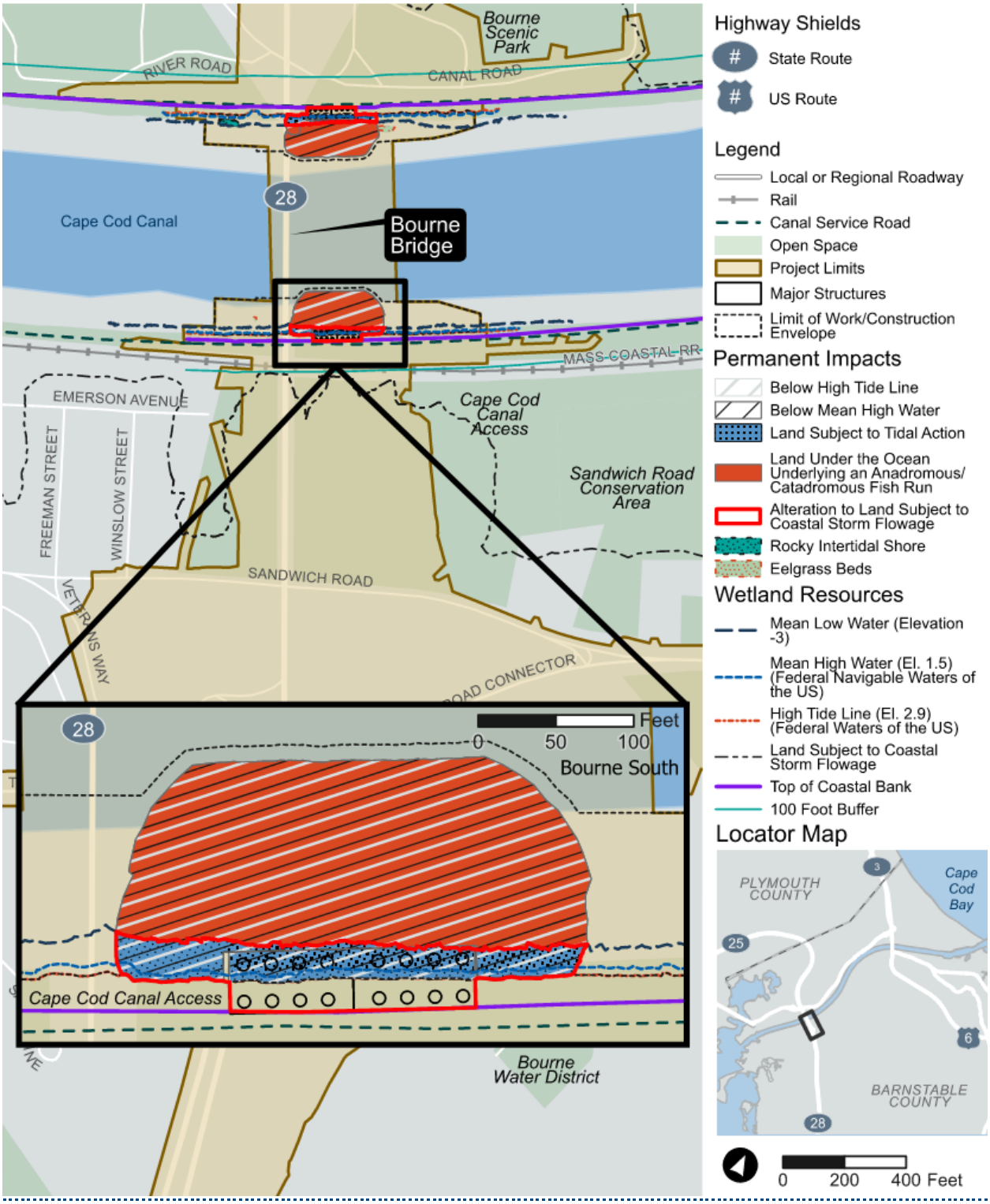
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-28. Potential Dredge Impacts to State and Federal Coastal Resource Areas (Bourne North Quadrant)



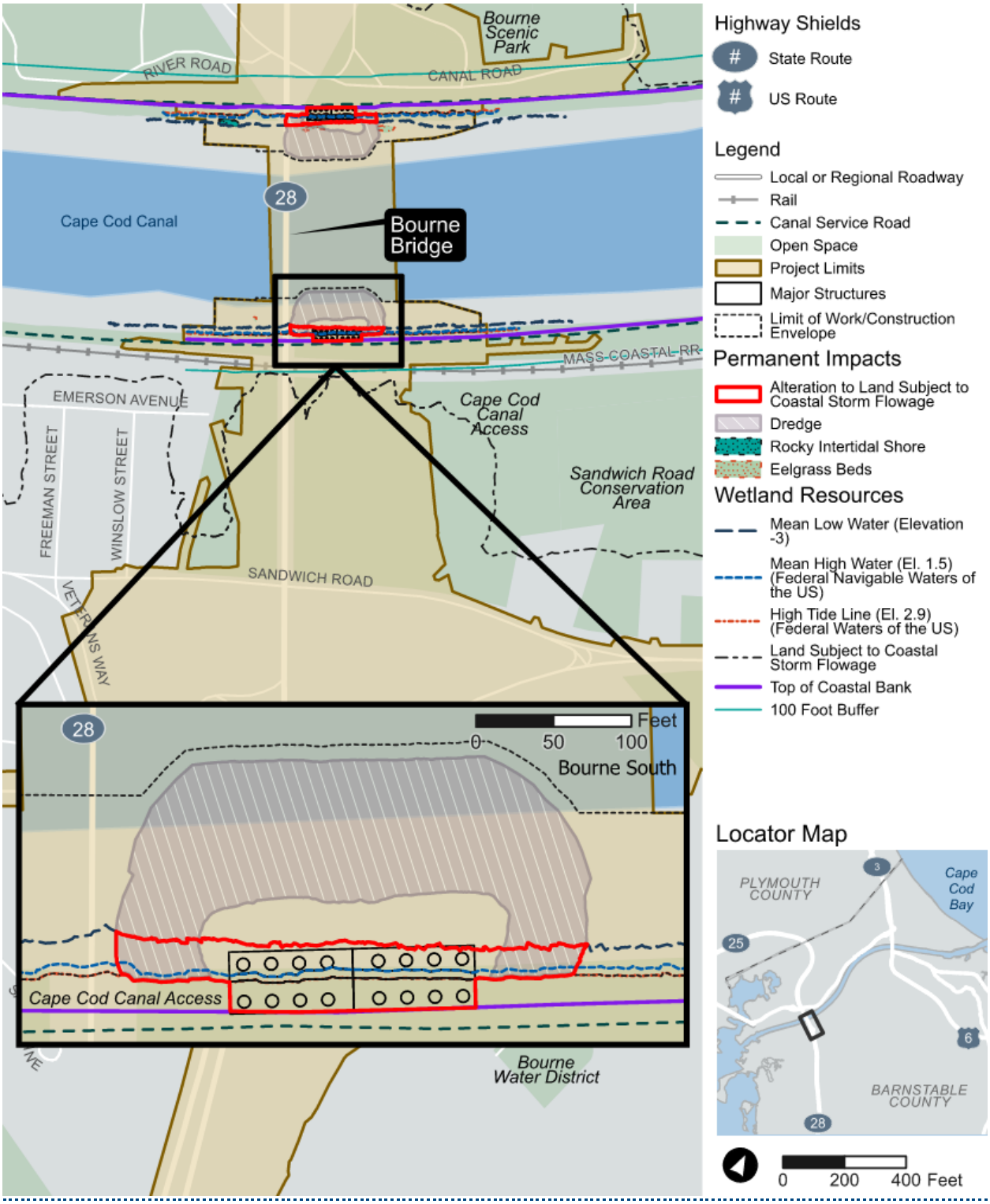
Source: Massachusetts Department of Transportation, 2025

Figure 4.9-29. Potential Permanent Fill Impacts to State and Federal Coastal Resource Areas (Bourne South Quadrant)



Source: Massachusetts Department of Transportation, 2025

Figure 4.9-30. Potential Dredge Impacts to State and Federal Coastal Resource Areas (Bourne South Quadrant)



Source: Massachusetts Department of Transportation, 2025

Table 4.9-12. Potential Impacts to State and Federal Coastal Resource Areas (Sagamore Bridge)

Resource Area		Temporary Impacts	Permanent Impacts	Reason for Impact[1]
Federal	Waters of the United States (WOTUS)	129,000 square feet (sf) (3.0 acres [ac])/37,200 cubic yards fill	87,500 sf (2.0 ac)/36,200 cubic yards fill	• Temporary: cofferdams, containment cells, sheetpile/bulkhead, work trestle piles, docks, dolphins, riprap for pile-supported structures, and excavation/dredge • Permanent: bridge piers and riprap pier protection
	WOTUS – (Excavation/ Dredge)	85,700 sf (2.0 ac) 81,200 cubic yards	0 sf (0 acres)/ 0 cubic yards	• Temporary: cofferdams, containment cells, and dredge for navigation access to temporary structures and riprap/structure removal, and installation of new piers and riprap pier protection
State	Land Under the Ocean (LUO) and LUO Underlying Anadromous/ Catadromous Fish Run	39,500 sf	73,000 sf	• Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures, and excavation/dredge • Permanent: bridge piers and riprap pier protection
	Coastal Bank	1,700 linear feet (lf)	0 lf	• Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles/riprap, bollards, and docks
	Rocky Intertidal Shores (RIS)	800 sf	900 sf	• Temporary: dredging within containment cell for pier demolition and vessel access • Permanent: riprap pier protection and restoration
	Land Subject to Tidal Action (LSTA)	Included with LSCSF impact		
	Land Subject to Coastal Storm Flowage (LSCSF)	34,500 sf	26,600 sf	• Temporary: cofferdams, work trestle piles/riprap, bollards, and docks • Permanent: bridge piers and riprap pier protection

Resource Area		Temporary Impacts	Permanent Impacts	Reason for Impact[1]
	Land Containing Shellfish	7,000 sf	2,400 sf	• Temporary: cofferdams, work trestle piles/riprap, bollards, and docks • Permanent: piers and riprap pier protection

[1] Excavation to install piers and dredging for riprap pier protection, vessel access, and piles are not subject to Section 404 permitting. It is anticipated these activities will be authorized under a Section 9 Bridge Permit from the U.S. Coast Guard.

Table 4.9-13. Potential Impacts to State and Federal Coastal Resource Areas (Bourne Bridge)

Resource Area		Temporary Impacts	Permanent Impacts	Reason for Impact [1]
Federal	Waters of the United States (WOTUS)	134,000 square feet (sf) (3.1 acres [ac])/37,400 cubic yards fill	78,800 sf (1.8 ac)/ 31,000 cubic yards fill	• Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures, and excavation/dredge • Permanent: bridge piers and riprap pier protection
	WOTUS - (Excavation/ Dredge)	98,700 sf (2.3 ac)/85,700 cubic yards	0 sf (0 acres)/ 0 cubic yards	• Temporary: cofferdams, containment cells, dredge for navigation access to temporary structures, riprap and structure removal, and installation of piers and riprap protection
	Eelgrass	0 sf	2,545 sf	• Permanent: dredging and riprap pier protection

Resource Area		Temporary Impacts	Permanent Impacts	Reason for Impact [1]
State	Land Under the Ocean (LUO) and LUO Underlying Anadromous/Catadromous Fish Run	35,100 sf	63,200 sf	• Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures, and excavation/dredge • Permanent: bridge piers and riprap pier protection
	Coastal Bank	1,760 linear feet (lf)	0 lf	• Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles/riprap, bollards, and docks
	Rocky Intertidal Shores (RIS)	1,200 sf	0 sf	• Temporary: sheetpile/bulkheads and excavation/dredge
	Land Subject to Tidal Action (LSTA)	Included in LSCSF impact		
	Land Subject to Coastal Storm Flowage (LSCSF)	50,200 sf	25.6 acres[2]	• Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, bollards, riprap for pile-supported structures, and excavation/dredge • Permanent: bridge piers, riprap pier protection, and work in approaches (ramps, abutments, and parkland improvements)
	Land Containing Shellfish	726 sf	539 sf	• Temporary: cofferdams, work trestle piles/riprap, bollards, and docks • Permanent: piers and riprap pier protection

[1] Excavation to install piers, dredging for riprap pier protection, and dredging for vessel access and piles are not subject to Section 404 permitting. It is anticipated these activities will be authorized under a Section 9 Bridge Permit from the U.S. Coast Guard.

[2] Impacts to Land Subject to Coastal Storm Flowage (LSCSF) in the Draft Environmental Impact Statement represented those in Cape Cod Canal. LSCSF extends into the Bourne North and South interchange approaches where work includes highway ramps, bridge abutments, and improvements to Bourne Scenic Park and Bourne Recreation Area. For purposes of this Final Environmental Impact Statement, an impact estimate is provided for occupation of LSCSF from the work in the interchange approaches as well as in the canal (i.e., piers and pier protection [26,700 sf/0.6 acres] plus work in approaches [25 acres] equals 25.6 acres). The Notice of Intent application to the Bourne Conservation Commission will include the final impact number based on design advancement.

Floodplains

The construction of the westbound ramp from U.S. Route 6 to State Route 25 and auxiliary lane on State Route 25 would result in potential temporary impacts (9,760 square feet) and permanent impacts (2,960 square feet; 5,160 cubic feet) to the floodplains associated with Nightingale Pond (3-C). Both Sagamore and Bourne Bridges would result in 55,750 square feet of permanent impacts to the floodplain associated with the piers and riprap placement for pier protection in Cape Cod Canal.

Portions of the Section 4(f) mitigations in the Bourne North and Bourne South quadrants would also occur within the floodplain. In the Bourne North quadrant, MassDOT would construct several new facilities for east- and west-side improvements to the Bourne Scenic Park and Campground extension, which would occur in the floodplain. New utilities are also proposed in conjunction with the park and campground improvements within the floodplain. In the Bourne South quadrant, activities associated with relocating part of Bourne Recreation Area and a SUP connection would also occur in the floodplain.

Additionally, within the Bourne North quadrant, the Program would remove two existing bridge abutments and construct two new abutments and new highway ramps. This work would occur in the approach to the new Bourne Bridge on the north side of the canal in the vicinity of Bourne Scenic Park and would result in coastal floodplain impacts.

The floodplains affected by the Program are tidally dominated coastal floodplains associated with the Cape Cod Canal, where base flood elevations (BFEs) are governed by coastal storm surge conditions. The Program has been designed to avoid increases in BFEs or changes to mapped floodplain boundaries. As a result, the Program would comply with applicable National Flood Insurance Program (NFIP) requirements for coastal high hazard areas under 44 CFR 60.3(e). In accordance with 23 CFR 650.111(f), MassDOT has coordinated with the Massachusetts Department of Conservation and Recreation (DCR), the state floodplain management agency, to confirm that the Program is consistent with applicable watershed and floodplain management programs. Documentation of this coordination is located in **Appendix 4.9, Wetlands and Floodplains Technical Report, Attachment 3**.

Areas of Critical Environmental Concern

Within the Sagamore North quadrant approach interchange, Series 1-J BVW is mapped within the Herring River Watershed ACEC. There are no permanent or temporary impacts proposed within Wetland 1-J.

Within the Bourne South quadrant approach interchange area, the Bourne Back River ACEC is mapped on the west side of the State Route 28 southbound travel lane and extends 15 feet east into the median. The Project Limit is approximately 1,200 feet north of the ACEC limit within State Route 28

southbound. Therefore, no temporary or permanent impacts are proposed within the Bourne Back River ACEC.

4.9.4.2 Indirect Effects

Indirect effects are those effects which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include related effects on air and water and other natural systems, including ecosystems. There are no indirect effects to inland wetlands or coastal resource areas that would result in changes to the functions and values in terms of the overall wetland hydrology, or fragmentation. The Build Alternative impacts would not result in isolated fragments of wetlands or waterways. Potential indirect effects include the unintended introduction of invasive plant species.

4.9.4.3 Operation-Term Impact Assessment

Once the highway approaches and bridges are constructed, operation-term impacts would be limited to the maintenance of Build Alternative components including the stormwater management system. The stormwater management system would be maintained in accordance with the Build Alternative-specific Operations and Maintenance Plan, which would include good housekeeping and pollution prevention measures to minimize sediment from reaching receiving waters during operations. Refer to **Section 4.10, Water Quality and Stormwater** for additional details pertaining to water quality and stormwater management.

4.9.4.4 Summary

Construction of the Bourne Bridge would result in temporary and permanent impacts to inland wetland resources. Construction of both bridges would result in temporary and permanent impacts to coastal wetland resources. Indirect impacts resulting from construction may include the unintended introduction of invasive plant species. Operation-term impacts would be limited to the maintenance of project components including the stormwater management system.

Temporary impacts to inland wetland resources would be limited to wetlands 3-C and 3-O, while permanent impacts would occur to wetland resources 3-C, 3-E, 3-H/I/Q, and 3-O, which are all located in the Bourne North quadrant, and wetland resources 4-TT2F, 4-W, 4-S, and 4-R, which are all located in the Bourne South quadrant.

The primary functions of wetland 3-C, an approximately seven-acre waterbody, are fish and wildlife habitat. The total temporary and permanent impacts represent approximately 1 percent of the resource area and occur along its outer fringe. The temporary impacts would be restored in place, and permanent impacts would be compensated through creation of an additional waterbody, approximately 2.4 times larger than the impact area, adjacent to the impact area (refer to **Section 4.9.5**).

The primary functions of wetlands 3-E and 3-H/I/Q are groundwater recharge/discharge and wildlife habitat. These vegetated wetlands occur on opposite sides of a road from each other but are connected by a culvert. The total permanent impacts to these wetlands represent approximately

3.6 percent of these resource areas and occur along the outer fringe of these resources. The permanent impacts will be compensated through creation of additional vegetated wetland, approximately 1.5 times larger than the impacts, adjacent to wetland 3-H/I/Q (refer to **Section 4.9.5**).

Wetlands 3-O, 4-TT2F, 4-W, 4-S, and 4-R are all isolated. These wetlands could provide nominal function for sediment/toxicant retention due to their close proximity to the roadway. Wetlands 4-TT2F, 4-W, 4-S, and 4-R may function as wildlife habitat and provide value for threatened and endangered species habitat due to their location within mapped polygons of Priority and Estimated Habitats. These resources would not qualify as jurisdictional under MA WPA. MassDOT has filed a Jurisdictional Determination request with USACE to verify the federal regulatory status of these five inland wetlands within the Program Limits.

Because temporary impacts will be restored and additional wetland resources in excess of the permanent impacts will be created, the loss of wetland resources is considered short-term. Refer to **Appendix 4.9, Wetlands and Floodplains Technical Report.**

A Biological Assessment has been prepared for the Program's effects on marine species which may utilize the wetland resource areas that would be impacted by the Program. This assessment concluded that all effects of the Program, when added to baseline conditions and accounting for the proposed conservation and mitigation measures discussed in **Section 4.11, Threatened, Endangered, and Protected Species and Habitats**, are too small to be meaningfully measured or detected and, therefore, are considered insignificant or are extremely unlikely to occur.

MassDOT submitted a final Essential Fish Habitat Assessment and Wildlife Coordination Act Consultation Worksheet on March 6, 2025, incorporating the National Oceanic and Atmospheric Administration National Marine Fisheries Service's (NOAA Fisheries) Essential Fish Habitat Conservation Recommendations and proposing an approach to compensatory mitigation of affected submerged aquatic vegetation. On March 12, 2025, MassDOT provided written concurrence with NOAA Fisheries' recommendation and committed to measures to avoid, minimize, and mitigate impacts to Essential Fish Habitat, consistent with NOAA Fisheries' recommendations. Refer to **Section 4.11, Threatened, Endangered, and Protected Species and Habitats** for more information.

4.9.5 Compensation

4.9.5.1 Requirements and Guidance

State Resources

For any impacts that are unable to be avoided or minimized, MA WPA regulations contain performance standards for each resource area, intended to ensure protection of their functions and values. The performance standards require that projects first seek to avoid and minimize impacts to wetland resource areas, and where impacts are unavoidable, ensure no adverse effects on the interests protected by the WPA such as flood control, water quality, and wildlife habitat. Refer to **Appendix 4.9, Wetlands and Floodplains Technical Report, Attachment 2** for a discussion of the Program's conformance with performance standards of MA WPA regulations.

Federal Resources

After practicable measures have been taken to avoid and minimize impacts to WOTUS, Section 404(b)(1) of the federal CWA requires compensation for unavoidable, permanent impacts to WOTUS. Compensation for permanent impacts would be provided through Permittee-responsible mitigation in the form of vegetated wetland creation within the Wetlands and Floodplains Study Areas along with participation in the Massachusetts Department of Fish and Wildlife's In-Lieu Fee Program. Refer to **Appendix 4.9, Wetlands and Floodplains Technical Report, Section 9** to review how the Build Alternative would conform to the performance standards of CWA for impacts associated with dredge and fill.

4.9.5.2 Mitigation for Impacts to State and Federal Inland Wetland Resource Areas

Compensation for Permanent Impacts

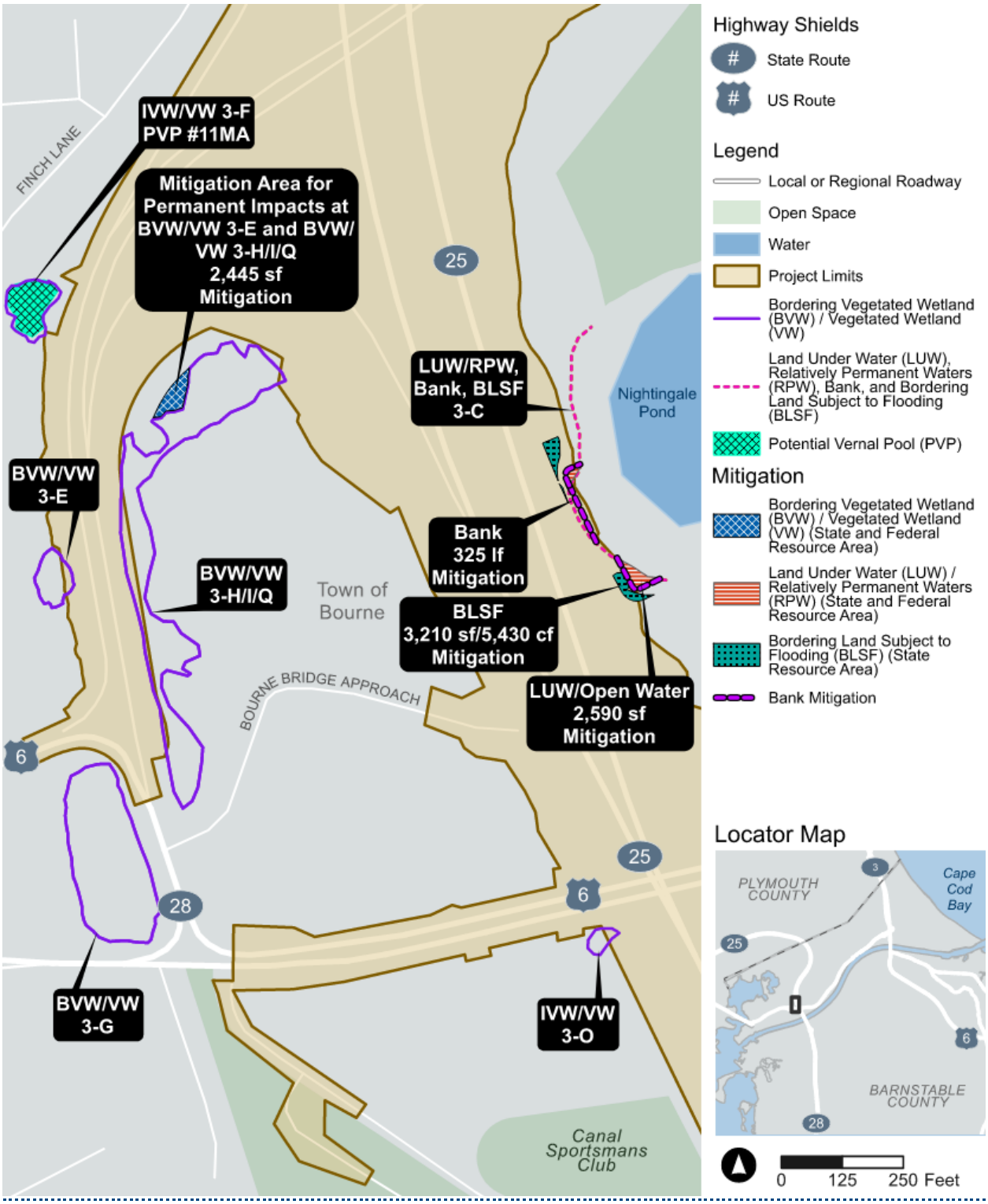
Figure 4.9-31 illustrates and **Table 4.9-14** summarizes the proposed on-site compensation for permanent impacts to inland resources. Refer to **Appendix 4.9, Wetlands and Floodplains Technical Report, Section 8.2,** for details on the Build Alternative's mitigation program.

As noted previously, MassDOT has filed a Jurisdictional Determination request with USACE to verify the federal regulatory status of inland and coastal wetlands within the Bourne Bridge Program Limits. Once the jurisdictional status of these wetlands is confirmed, MassDOT will determine if mitigation is required for permanent impacts in coordination with USACE through the Section 404 permitting process.

Compensation for Temporary Impacts

Upon completion of construction, temporary impacts to wetland resources associated with Nightingale Pond and IVW/VW 3-O will be compensated through in-kind restoration.

Figure 4.9-31. Potential On-site Compensation for State and Federal Inland Wetlands



Source: Massachusetts Department of Transportation, 2025

Table 4.9-14. Potential On-site Compensation for Permanent Impacts to Inland Wetlands

Wetland Series ID[1]	State Resource		Federal Resource		Impact to Compensation (Creation) Ratio
	Impact Type and Extent	Compensation	Impact Type and Extent	Compensation[2]	
3-E	Bordering Vegetated Wetland (BVW) 410 square feet (sf)	BVW 615 sf	Vegetated Wetland (VW) 410 sf	VW/615 sf	1:1.5
3-H/I/Q	BVW 1,630 sf	BVW 2,445 sf	VW 1,630 sf	VW/2,445 sf	1:1.5
3-C (Nightingale Pond)	Bank 285 linear feet (lf)	Bank 325 lf	Not applicable (N/A)	N/A	1:1.1
	Land Under Water (LUW) 1,065 sf	LUW: 2,590 sf	Relatively Permanent Water (RPW) 2,590 sf	N/A	1:2.4
	Bordering Land Subject to Flooding (BLSF) 2,130 cubic feet (cf)/2,960 sf	BLSF 3,210 sf/ 5,430 cf	N/A	N/A	1:2.5

[1] As identified in the ANRAD[15] and additional field investigations.

[2] In addition to creation of vegetated wetland, credits would be purchased through the Massachusetts Department of Fish and Wildlife In-Lieu Fee Program.

4.9.5.3 Compensation for Impacts to State and Federal Coastal Resource Areas

The placement of the riprap pier protection would result in additional impacts to state-regulated LUO/LUO Underlying an Anadromous/Catadromous Fish Run, LSCSF, Rocky Intertidal Shores, and Land Containing Shellfish and federally regulated WOTUS. There are no provisions/requirements for mitigation for the state-regulated resources areas.

Compensation for Permanent Impacts

The removal of the existing bridge piers would result in the restoration of approximately 4,600 square feet of Navigable WOTUS and Land Under Ocean. Compensation for net impacts to federal and state resource areas will be coordinated with USACE and the Massachusetts Department of Environmental Protection (MassDEP).

MassDOT continues to work with the issuing authorities, including MassDEP, USACE, and NOAA Fisheries, to determine a viable mitigation strategy for eelgrass mitigation. The agreed upon eelgrass mitigation will be included in the respective permit applications to the federal and state agencies.

[15] HNTB Corporation. December 2021 and April 2022. Abbreviated Notice of Resource Area Delineation (ANRAD), MassDOT Cape Cod Canal Area Transportation Improvements Program, Project No. 608020, Bourne, Massachusetts.

Refer to **Section 4.11, Threatened, Endangered, and Protected Species and Habitat**s, for an update on the Program's eelgrass mitigation strategy.

Compensation for Temporary Impacts

Temporary impacts to state and federal coastal resource areas will be compensated through in-kind restoration and natural reestablishment. Following the new bridge construction and existing bridge demolition, the temporary work structures would be removed. To the maximum extent possible, the Design-Build contractor (Design Builder) would restore shoreline riprap and canal side slopes to pre-existing conditions. Additionally, the Design Builder would install the pier protection system at the bridge sites. Waterward of the restored shoreline riprap and outside the riprap pier protection boundary, the impacted resource areas would be allowed to restore naturally.

4.9.5.4 Construction-Term Mitigation Measures

Construction-related pollutants, stormwater runoff, and dewatering activities may affect wetland resource areas. The potential impacts would be avoided and minimized through the development and implementation of a Stormwater Pollution Prevention Plan, required pursuant to the U.S. Environmental Protection Agency's National Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities.

For conformance with Executive Order 13112 as amended by EO 13751, the contract would include specifications for the management and disposal of soil and plant material and prevention of the spread of invasive species via equipment.

4.9.6 Regulatory Compliance

MassDOT has designed the Program to comply with applicable state and federal requirements related to impacts to wetlands and floodplains. **Attachment 2, Build Alternative: Conformance with Performance Standards of the Massachusetts Wetlands Protection Act,** describes the Program's compliance with performance standards of the MA WPA for temporary and permanent alterations to state-regulated resource areas.

Appendix 4.9, Wetlands and Floodplains Technical Report, Section 9, describes how the Build Alternative would conform to the performance standards of the Federal CWA for impacts associated with dredge and fill, including the performance standards of the Massachusetts Water Quality regulations (314 CMR 9.00) which implement the CWA.

Table 4.9-15 addresses the Program's conformance with the applicable requirements of 23 CFR Part 650 Subpart A – Location and Hydraulic Design of Encroachments on Flood Plains, which prescribes FHWA policies and procedures for the location and hydraulic design of highway encroachments on flood plains, including direct Federal highway projects administered by FHWA.

Table 4.9-15. 23 CFR Part 650 Subpart A Conformance

Performance Standard	Conformance
Sec. 650.111 Location Hydraulic Studies	
a) National Flood Insurance Program (NFIP) maps or information developed by the highway agency, if NFIP maps are not available, shall be used to determine whether a highway location alternative will include an encroachment.	The Federal Emergency Management Agency (FEMA) National Flood Hazard Layer (NFHL) Viewer[16] was used to identify the base flood elevation (BFE) limits (map panels 25001C0316K, 25001C0318K, 25001C0313K, 25001C0314K, 25001C0501J, and 25001C0502J). A floodplain encroachment will occur at both the Sagamore and Bourne Bridge project areas.
b) Location studies shall include evaluation and discussion of the practicability of alternatives to any longitudinal encroachments.	The Cape Cod Bridges Program (Program) does not include a longitudinal encroachment as the proposed bridges would cross the floodplain perpendicular to the direction of flow, not parallel. Since there is no longitudinal encroachment, an alternatives analysis is not required.
c) Location studies shall include discussion of the following items, commensurate with the significance of the risk or environmental impact, for all alternatives containing encroachments and for those actions which would support based floodplain development: (1) The risks associated with implementation of the action, (2) The impacts on natural and beneficial flood-plain values, (3) The support of probable incompatible flood-plain development, (4) The measures to minimize flood-plain impacts associated with the action, and (5) The measures to restore and preserve the natural and beneficial flood-plain values impacted by the action.	The Program would result in a floodplain encroachment at both the Sagamore and Bourne Bridge crossings. The extent of overland coastal surge for the Build Alternative for Sagamore Bridge would be the same as the No Build Alternative because there would be no proposed changes to grading within the flood extents. The extent of overland coastal surge for Bourne Bridge for the Build Alternative would be the same as the No Build Alternative, with the exception of the Bourne North quadrant, where the proposed grade changes near Belmont Circle would accommodate the higher bridge deck elevation spanning Cape Cod Canal to maintain navigational clearance and connect to existing grades. These grade changes would slightly reduce the extent of coastal inundation at the edge of the floodplain but would not affect the flood pathways compared to the No Build Alternative.
d) Location studies shall include evaluation and discussion of the practicability of alternatives to any significant encroachments or any support of incompatible flood-plain development	The Program will not result in a significant encroachment and does not support incompatible floodplain development.

[16] FEMA's National Flood Hazard Layer (NFHL) Viewer. https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd

Performance Standard	Conformance
e) The studies required by Sec. 650.111 (c) and (d) shall be summarized in environmental review documents prepared pursuant to 23 CFR Part 771	The Program's Final Environmental Impact Statement provides a summary.
f) Local, State, and Federal water resources and flood-plain management agencies should be consulted to determine if the proposed highway action is consistent with existing watershed and flood-plain management programs and to obtain current information on development and proposed actions in the affected watersheds	MassDOT has coordinated with the Massachusetts Department of Conservation and Recreation (DCR), the state floodplain management agency, and the Town of Bourne, the local floodplain administrator, to confirm that the Program is consistent with applicable watershed and floodplain management programs. Documentation of this coordination is provided in **Appendix 4.9, Wetlands and Floodplains Technical Report, Attachment 3**. Based on the current design, the Program is not anticipated to result in increases to base flood elevations (BFEs) or changes to mapped floodplain boundaries. Final determinations regarding potential effects to BFEs and floodplain limits will be made during final design and in coordination with DCR and the local floodplain administrator. If the project results in an increase in BFEs or floodplain boundaries of 1.0 foot or greater, or a more stringent threshold established by DCR or the local floodplain administrator, MassDOT will obtain a Conditional Letter of Map Revision (CLOMR) and/or a Letter of Map Revision (LOMR) from the Federal Emergency Management Agency, as appropriate.
Sec. 650.113 Only Practicable Alternative Finding	
a) A proposed action which includes a significant encroachment shall not be approved unless the FHWA finds that the proposed significant encroachment is the only practicable alternative. This finding shall be included in the final environmental document (final environmental impact statement or finding of no significant impact) and shall be supported by the following information: (1) The reasons why the proposed action must be located in the flood plain, (2) The alternatives considered and why they were not practicable, and	The floodplain encroachment associated with the Build Alternative does not meet the definition of "significant." The Build Alternative would facilitate emergency egress of high traffic volumes from Cape Cod in the event of a hurricane or other potential hazards by replacing Bourne Rotary with a grade-separated diamond interchange and constructing a new flyover ramp connection from Scenic Highway to State Route 25 westbound. Construction of two separate deck structures for the replacement bridges for the Build Alternative would provide additional service redundancy in case of an emergency evacuation or a compromising event that would affect a single bridge

Performance Standard	Conformance
(3) A statement indicating whether the action conforms to applicable State or local flood-plain protection standards.	structure. Cross-canal pedestrian and bicycle lanes would also improve hurricane evacuation ability for all road users. While flooding of Belmont Circle has at least a 1% annual likelihood of flooding (or a 1-in-4 chance of flooding over 30 years), the Build Alternative would increase the adaptive capacity of the network to reduce vulnerability to coastal inundation. While the Build Alternative would reduce the impact of flooded roadways and evacuation routes, the new traffic patterns will be reviewed and the Cape Cod Emergency Traffic Plan will be updated as necessary to reflect construction and proposed configurations and flows, as well as remaining flood risk at Belmont Circle. This may include signage and public notices when storms are forecast, as appropriate. The siting and elevations (bottom, overflow, and top) of stormwater infiltration basins proposed for water quality and stormwater mitigation described in **Section 4.10, Water Quality and Stormwater**, will seek to reduce the risk of inundation through piped infrastructure and from coastal overland flows. Backflow preventers are included at select stormwater control measure infiltration basins to ensure they function as designed during coastal storm surge events under the Build Alternative. To reduce the risk of backflow into basins during coastal storm surge events, backflow preventers would be included at the seven stormwater control measure infiltration basins where a surge event of +19.3 feet North American Vertical Datum of 1988 (Category 2 Hurricane peak surge elevation +3 feet) would exceed the lowest basin outlet elevation. The proposed design for the outlet control structure at these seven basins includes an in-line check valve in the outlet pipe at the outlet control structure to prevent backflow. The design incorporates modern resilience standards by elevating the new bridge structures to account for projected fluctuations in sea level and conducting appropriate scour analyses to inform foundation design and protect against flood- and erosion-related impacts. The replacement bridges and associated roadway improvements were designed to avoid sensitive coastal and estuarine resources where possible. The relocation of the bridge piers from the in-water portion of the

Performance Standard	Conformance
	canal to a more landward position along the bank would minimize in-water impacts. Engineering controls, such as cofferdams and containment cells, would be implemented to isolate construction activity, limit turbidity, and prevent sediment or debris from entering the canal. Contractors will be required to adhere to time of year restrictions for in-water related work that has the potential to generate silt and increase turbidity, ensuring such activities only occur during periods that minimize impacts on sensitive aquatic species and habitats. No Coastal Barrier Resource Units or areas regulated under the Coastal Barrier Resources Act would be affected.