



# Cape Cod Bridges Program

## Bourne, Massachusetts

### Appendix 4.9 Wetlands and Floodplains Technical Report

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## Acronyms and Abbreviations

| Acronym/Abbreviation | Definition                                           |
|----------------------|------------------------------------------------------|
| ACEC                 | Area of Critical Environmental Concern               |
| ANRAD                | Abbreviated Notice of Resource Area Delineation      |
| BLSF                 | Bordering Land Subject to Flooding                   |
| BVW                  | Bordering Vegetated Wetland                          |
| CMR                  | Code of Massachusetts Regulations                    |
| CWA                  | U.S. Clean Water Act                                 |
| <a href="#">DEIS</a> | <a href="#">Draft Environmental Impact Statement</a> |
| FEMA                 | Federal Emergency Management Agency                  |

| Acronym/Abbreviation | Definition                                                          |
|----------------------|---------------------------------------------------------------------|
| FHWA                 | Federal Highway Administration                                      |
| Fish Run             | Anadromous/Catadromous Fish Run                                     |
| HTL                  | High Tide Line                                                      |
| ILFP                 | In-Lieu Fee Program                                                 |
| If                   | linear feet                                                         |
| LSCSF                | Land Subject to Coastal Storm Flowage                               |
| LSTA                 | Land Subject to Tidal Action                                        |
| LUO                  | Land Under the Ocean                                                |
| LUW                  | Land Under Water Bodies and Waterways                               |
| MassDEP              | Massachusetts Department of Environmental Protection                |
| MassDOT              | Massachusetts Department of Transportation                          |
| MA WPA               | Massachusetts Wetlands Protection Act                               |
| MHW                  | Mean High Water                                                     |
| MRER/EA              | Major Rehabilitation Evaluation Report and Environmental Assessment |
| NAVD88               | North American Vertical Datum of 1988                               |
| NEPA                 | National Environmental Policy Act                                   |
| ORAD                 | Order of Resource Area Delineation                                  |
| PRM                  | permittee-responsible mitigation                                    |
| Program              | Cape Cod Bridges Program                                            |
| RIS                  | Rocky Intertidal Shores                                             |
| RPW                  | Relatively Permanent Water                                          |
| sf                   | square feet                                                         |
| SOP                  | Compensatory Mitigation Standard Operating Procedures               |
| SUP                  | shared-use path                                                     |
| USACE                | U.S. Army Corps of Engineers                                        |
| USC                  | United States Code                                                  |
| VW                   | vegetated wetland                                                   |
| WOTUS                | Waters of the United States                                         |

# 1 Introduction

This technical report was prepared in support of the Final Environmental Impact Statement for the Cape Cod Bridges Program (Program) in accordance with the following federal and state statutes, regulations, and guidance:

- National Environmental Policy Act (NEPA) of 1969, as amended, 42 United States Code (USC) 4321 et seq.
- *Efficient Environmental Reviews for Project Decisionmaking and One Federal Decision*, 23 USC 139.
- Federal Highway Administration's (FHWA) regulations implementing NEPA, *Environmental Impact and Related Procedures* (23 Code of Federal Regulations [CFR] 771), and corresponding guidance, Technical Advisory (T 6640.8A): *Guidance for Preparing and Processing Environmental and Section 4(f) Documents* (October 30, 1987).
- Location and Hydraulic Design of Encroachments on Flood Plains, 23 CFR 650
- Executive Order 13112, Invasive Species, [amended by Executive Order 13751](#)

## 2 Summary of Findings

This technical report explains in detail the assessment of estimated construction-term impacts on wetland and floodplain resources resulting from implementation of the Build Alternative for the Program. Construction term impacts, both temporary and permanent, are considered those that represent quantifiable alterations to state and federal resource areas. All references to temporary and permanent impacts referenced herein are related to the construction term. Once the highway approaches and bridges are constructed, operation-term impacts would be limited to the maintenance of project components, and no impacts to resources areas are anticipated. Inland and coastal wetland resources would be temporarily and permanently impacted. Temporary and permanent impacts to state and federal inland resource areas associated with the interchange approaches would be restored in-kind, and compensation provided for permanent impacts. For temporary impacts to state and federal coastal resource areas in Cape Cod Canal, the contractor would restore shoreline riprap and canal side slopes to pre-existing conditions. Waterward of the restored shoreline riprap and outside the riprap pier protection boundary, the impacted resource areas would be allowed to restore naturally. Compensation for net permanent impacts to federal and state coastal resource areas would be coordinated with the U.S. Army Corps of Engineers (USACE) and Massachusetts Department of Environmental Protection (MassDEP).

## 3 Proposed Action and Alternatives

### 3.1 Purpose and Need

In partnership with FHWA and the New England District of USACE, the Massachusetts Department of Transportation (MassDOT) proposes advancing the Program in the town of Bourne, Barnstable County, Massachusetts.

The purpose of the Program is to improve cross-canal mobility and accessibility between Cape Cod and mainland Massachusetts for all road users and to address the increasing maintenance needs and functional obsolescence of the aging Bourne and Sagamore Bridges (also known as the Cape Cod Canal highway bridges), which the United States owns and USACE operates and maintains as part of the Cape Cod Canal Federal Navigation Project. The needs for the Program are as follows:

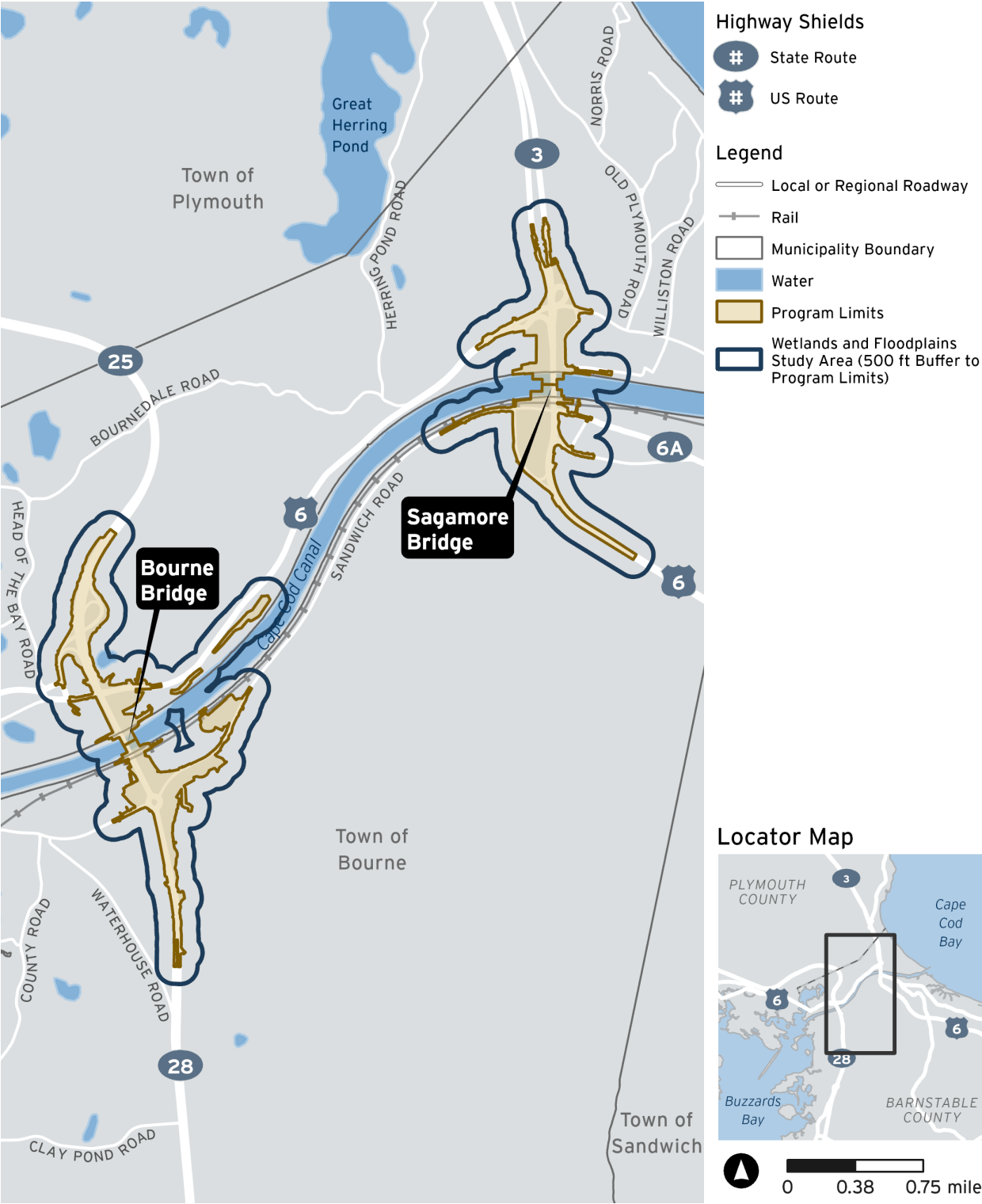
- Address the deteriorating structural condition and escalating maintenance demands of the Bourne and Sagamore Bridges.
- Address the substandard design elements of the Bourne and Sagamore Bridges, the immediate mainline approaches, and their adjacent interchanges and intersections.
- Improve vehicular traffic operations.
- Improve accommodations for pedestrians and bicyclists.

**Figure 3-1** shows two distinct project limits for the Program.

### 3.2 Study Area

The Project Study Area for the wetlands and floodplain analysis includes the Project Limits where physical work would occur within a construction zone as well as a 500-foot buffer from the construction zone. The 500-foot buffer represents areas beyond the physical work zone that may contain natural resources and associated buffer zones that could potentially be indirectly impacted during construction. Since the Draft Environmental Impact Statement (DEIS), refinements in the Program Limits and additional field studies 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.

Figure 3-1. Program Limits



Source: [Massachusetts Department of Transportation, 2026](#)

### 3.3 Build Alternative

The Program's Build Alternative would incorporate USACE's Major Rehabilitation Evaluation Report and Environmental Assessment's (MRER/EA) preferred alternative of replacing both highway bridges with new bridges, each with four through-travel lanes and two auxiliary lanes (in-kind bridge replacement that would be updated to comply with federal and state highway and design safety standards). The Program proposes to replace the Bourne and Sagamore Bridges with parallel, twin tied-arch bridge structures that would be supported on delta frames with an approximate 700-foot mainline span length. At both the Bourne Bridge and Sagamore Bridge crossings, the replacement mainline alignment locations would be offline and inboard of the existing bridges on the side of the canal between the bridges. At both canal crossings, the Program would reconfigure the highway interchange approach networks north and south of Cape Cod Canal to align with the replacement bridges. The replacement bridges and their interchange approaches would accommodate shared-use pedestrian and bicycle paths that would connect to the local roadway network on both sides of Cape Cod Canal in the town of Bourne.

**Table 3-1** presents a description of the Program elements/design parameters of the recommended Build Alternative: Replacement Highway Bridges Built to Modern Design Standards.

**Table 3-1. Cape Cod Bridges Program Preferred Alternative**

| Program Element/<br>Program Design<br>Parameter                | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Highway Bridges                                                | <u>Replacement of both highway bridges with new bridges with</u> four through-traffic lanes and two auxiliary lanes (in-kind bridge replacement <u>updated to comply</u> with federal and state highway and design safety standards).                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <u>Highway</u> Bridge Cross-<br>Section and Shared-Use<br>Path | Each replacement <u>highway</u> bridge <u>span</u> would provide <u>two</u> 12-foot-wide through- <u>travel</u> lanes ( <u>one</u> in each direction), <u>one</u> 12-foot-wide entrance/exit (auxiliary) lane, a <u>6</u> -foot-wide <u>median</u> shoulder, and a <u>12</u> -foot-wide <u>exterior</u> shoulder.<br><br>Each crossing location would include one bidirectional pedestrian and bicycle <u>shared-use path</u> , separated from vehicular traffic by the shoulder and barrier. The usable width of the <u>shared-use path</u> would be 14 feet wide on the bridge main span, 20-foot-wide on the interchange approaches, and 12 feet wide on the connecting roadways. |
| Bridge <u>Vertical and</u><br><u>Horizontal</u> Clearances     | The replacement bridges would maintain the existing vertical clearance of 135 feet above mean high water and account for <u>3.3</u> feet of fluctuations in relative sea level, <u>thereby providing a</u> vertical clearance of <u>138.3</u> feet above mean high water.<br><br>The replacement bridges would provide a minimum 500 feet of horizontal channel width to be consistent with <u>the authorized navigational channel width and</u> existing conditions.                                                                                                                                                                                                                |

| Program Element/<br>Program Design<br>Parameter  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main Span Length and<br>Bridge Pier Location     | The replacement bridges would have a main span length of <a href="#">720</a> feet, which would locate the bridge piers at the waterline adjacent to the service road (shoreline piers) into the riprap slope but above the low tide line.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Bridge Deck<br>Configuration                     | Each bridge ( <a href="#">Sagamore and Bourne</a> ) would have two separate decks (twin structures).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Mainline Alignment                               | The mainline alignment locations at both <a href="#">bridges</a> would be offline inboard. <a href="#">Both</a> spans of <a href="#">the</a> replacement <a href="#">highway</a> bridges would be outside the footprint of the existing bridge, <a href="#">7</a> feet apart and parallel to each other ( <a href="#">offline</a> ) and on the side of <a href="#">Cape Cod Canal</a> between the existing <a href="#">bridges (inboard)</a> . <a href="#">The replacement</a> main spans <a href="#">at the Sagamore crossing</a> would be west of the existing Sagamore Bridge toward Buzzards Bay. <a href="#">The replacement</a> main spans <a href="#">at the Bourne crossing</a> would be east of the existing Bourne Bridge toward Cape Cod Bay. |
| Bridge Type                                      | The replacement bridges would be <a href="#">steel</a> twin <a href="#">network</a> tied-arch bridges, with delta frames supporting <a href="#">a 720</a> -foot mainline span.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <a href="#">Interchange Approach<br/>Network</a> | <p><a href="#">Interchange approach improvements at each bridge would be as follows:</a></p> <ul style="list-style-type: none"> <li><a href="#">Sagamore Bridge Crossing: Direct connection to State Road in the Sagamore North quadrant and Westbound On-Ramp Under U.S. Route 6 with Sandwich Road Extension in the Sagamore South quadrant</a></li> <li><a href="#">Bourne Bridge Crossing: Directional Interchange in the Bourne North quadrant and a Diamond Interchange in the Bourne South quadrant</a></li> </ul>                                                                                                                                                                                                                                |

| Program Element/<br>Program Design<br>Parameter             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interchange Approach<br>Network: Sagamore<br>North Quadrant | <p>The selected interchange approach option for the Sagamore North quadrant is: <u>Direct Connection to State Road (Option SN-8A)</u>.</p> <p><u>Option SN-8A</u> would provide a single exit point from a relocated U.S. Route 6/State Route 3. <u>It would remove the Sagamore Bridge northbound off-ramp connection to Scenic Highway/Meetinghouse Lane eastbound, and instead it would connect to State Road, north of Scenic Highway/Meetinghouse Lane.</u> The remaining ramp connections would remain similar to existing conditions <u>with geometric adjustments to meet the new mainline location. A double roundabout would replace the signalized intersection of Scenic Highway/Meetinghouse Lane/State Road/Canal Street. Signalized intersections along Scenic Highway would be modified for new lane configurations.</u> The intersection of State Road at State Route 3 northbound <u>on-ramp</u> would <u>be modified to accommodate the addition of the new State Route 3 northbound off-ramp with installation of a traffic signal.</u></p> <p><u>Option SN-8A would provide a shared-use path on the U.S. Route 6 eastbound main span that would provide connections to the south side of Scenic Highway, Canal Street, and Canal Service Road. This option would provide shared-use paths along the southern side of Scenic Highway and Meetinghouse Lane, as well as along the eastern side of State Road to Homestead Avenue and Canal Street to Bourne Park and Ride.</u></p> |

| Program Element/<br>Program Design<br>Parameter             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interchange Approach<br>Network: Sagamore<br>South Quadrant | <p>The selected interchange approach option for the Sagamore South quadrant is: Westbound On-Ramp Under U.S. Route 6 with Sandwich Road Extension (Option SS-3.1A).</p> <p>Option SS-3.1A would include Cranberry Highway Extension and would relocate the westbound on-ramp so it would share the same entrance point as the eastbound on-ramp off Mid-Cape Connector.</p> <p>Modifications to lane arrangements at the intersections of Mid-Cape Connector with Sandwich Road and Cranberry Highway Extension would accommodate the revised traffic patterns resulting from the extension of Cranberry Highway and the relocation of access to U.S. Route 6 (Scenic Highway) eastbound, including modifications to the existing traffic signals. There would be a connection from Cranberry Highway to Sandwich Road east of the new mainline bridge (Sandwich Road Connector).</p> <p>A roundabout would be provided at the intersection of the U.S. Route 6 westbound off-ramp with Cranberry Highway. An additional roundabout would be provided along Cranberry Highway, providing access to Market Basket (Factory Outlet Road). There would be an access driveway to the former Christmas Tree Shops area.</p> <p>Option SS-3.1A would include a shared-use path on the U.S. Route 6 eastbound main span that would provide connections to Factory Outlet Road, Sandwich Road, and Canal Service Road. Pedestrian and bicycle improvements would also be included on Cranberry Highway. This option would add a new connection through Cranberry Highway Extension to Mid-Cape Connector.</p> |

| Program Element/<br>Program Design<br>Parameter           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interchange Approach<br>Network: Bourne North<br>Quadrant | <p>The selected interchange approach option for the Bourne North quadrant crossing is: <u>Directional Interchange (BN-14.4b)</u>.</p> <p><u>Option BN-14.4b would provide</u> a combination of direct-connection ramps between State Route 25 and U.S. Route 6 (Scenic Highway). The ramp connecting State Route 25 eastbound to Scenic Highway would be a <u>flyover ramp passing over Nightingale Road</u> and merging with the on-ramp from Belmont Circle before meeting up with State Route 25 mainline. The ramp connecting Scenic Highway eastbound to State Route 25 eastbound would be a <u>flyover ramp passing over Scenic Highway</u>, allowing vehicles to bypass Belmont Circle and eliminating the need for an additional traffic signal. This ramp would use one of the travel lanes on Scenic Highway and be a free-flowing movement to reduce congestion.</p> <p>The existing interchange ramp over the State Route 25 bridge would be relocated to <u>widen the bridge and allow for this new southbound to eastbound ramp movement</u>. The existing southbound off-ramp would be revised to be an <u>option lane</u>, improving the geometry and decision sight distance for drivers. The intersection control at Scenic Highway/Nightingale Road/Andy Oliva Drive would be provided by a <u>single-lane roundabout</u>.</p> <p>The new flyover ramp over Scenic Highway would provide a <u>shared-use path and grade-separated crossing for pedestrians and bicyclists</u>. The Scenic Highway Lane configuration would be reduced from four lanes to three lanes, which would provide additional space for multimodal accommodations. It would provide one continuous 12-foot-wide shared-use path along the south side of Scenic Highway connecting to Belmont Circle and a 6-foot-wide sidewalk along the north side of Scenic Highway.</p> |
| Interchange Approach<br>Network: Bourne South<br>Quadrant | <p>The selected interchange approach option for the Bourne South quadrant is: <u>Diamond Interchange (BS-2)</u>.</p> <p><u>Option BS-2 would</u> eliminate Bourne Rotary and replace it with a grade-separated diamond interchange, which would allow through movements on State Route 28 to bypass intersections with <u>the non-mainline</u> roadways. The two intersections within the diamond interchange would <u>be a single-lane dogbone roundabout</u>). Changes to the Trowbridge Road and Sandwich Road underpass <u>in this option would consist of a roundabout at a relocated Upper Cape Cod Regional Technical High School driveway entrance</u>.</p> <p>Option BS-2's shared-use path improvements would include providing connections to Trowbridge Road, Sandwich Road, Canal Service Road, and Bourne Recreation Area.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### 3.4 No Build Alternative

The Sagamore and Bourne bridges, as components of the Cape Cod Canal Federal Navigation Project, are federal assets that are managed by USACE’s New England District. The Commonwealth of Massachusetts owns the connecting major highway corridors at the bridges, which consist of the Route 3/Route 6 corridor at Sagamore Bridge and the Route 25/Route 28 corridor at Bourne Bridge.

In the No Build Alternative, the Sagamore and Bourne Bridges would retain their current configuration of four 10-foot-wide travel lanes (two in each direction) with one 6-foot sidewalk and a 2-foot safety curb. USACE would continue to [operate and maintain](#) the Sagamore and Bourne Bridges and would implement a maintenance and repair program as needed to maintain bridge operations and public safety. MassDOT would continue to own, operate, and maintain the state highway interchange approach networks at the two bridges.

The No Build Alternative would include recently completed and proposed Commonwealth of Massachusetts-sponsored and local transportation improvements projects in and near the Program as indicated in the Federal Fiscal Year [2026-2030](#) Transportation Improvement Program for the Cape Cod Metropolitan Planning Organization.<sup>1</sup> [Table 3-2](#) identifies the Transportation Improvement Program projects within and near the Program to be incorporated in the No Build Alternative.

**Table 3-2. Transportation Improvement Program Projects, 2026-2030 in the No Build Alternative**

| Project Number | Year | Transportation Project                             | Project Description                                                                                         | Status <sup>[2]</sup>     |
|----------------|------|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------|
| 606900         | 2020 | Belmont Circle Traffic and Multimodal Improvements | Traffic and multimodal improvements at Belmont Circle at U.S. Route 6 and State Route 25 and State Route 28 | Completed                 |
| 608422         | 2022 | Trail Improvements – Sandwich                      | Shared-use path on Service Road (State Route 130 to Chase Road)                                             | <a href="#">Completed</a> |

<sup>1</sup> [The Transportation Improvement Program for the Cape Cod Metropolitan Planning Organization was endorsed on May 19, 2025, and amended on November 17, 2025.](#)

<sup>2</sup> [Status as of October 2025](#)

| Project Number         | Year | Transportation Project                  | Project Description                                                                                                                                                                                                                                                                                                                                                                       | Status <sup>[2]</sup>     |
|------------------------|------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 610542                 | 2023 | Bourne Rotary Improvements              | <ul style="list-style-type: none"> <li>• Restriping Bourne Rotary to two lanes and adding a channelized right-turn lane from State Route 28 northbound to Sandwich Road eastbound</li> <li>• Adding signs at Bourne Rotary</li> <li>• Installing flashing beacons at the Bourne Rotary approaches</li> </ul>                                                                              | <a href="#">Completed</a> |
| 613195                 | 2024 | Bridge Systematic Maintenance           | Bridge deck replacement of the Quaker Meetinghouse Road Bridge over U.S. Route 6/Mid-Cape Highway as part of an overall bridge preservation strategy                                                                                                                                                                                                                                      | <a href="#">Underway</a>  |
| 609262                 | 2025 | Bourne Rail Trail, Phase 1              | First phase of four planned phases of the Bourne Rail Trail connection to the Shining Sea Bikeway to the south in Falmouth and to the Cape Cod Canal path (Canal Service Road) in the town of Bourne; Phase 1 is approximately one-half mile long within the existing right-of-way of the Old Colony Railroad (Woods Hole branch line) from the Canal Service Road to Monument Neck Road. | Programmed                |
| 610673                 | —    | Bourne Rail Trail, Phase 2              | Phase 2 of four planned phases of the Bourne Rail Trail connection to Shining Sea Bikeway to the south in Falmouth and to the Cape Cod Canal path (Canal Service Road) in the town of Bourne; Phase 2 is approximately 2 miles long from Monument Neck Road to Monk's Park/Valley Bars Road.                                                                                              | Not Programmed            |
| <a href="#">613864</a> | —    | Bourne Rail Trail, Phase 3 and Phase 4A | Phase 3 and Phase 4A of four planned phases of the Bourne Rail Trail connection to Shining Sea Bikeway to the south in Falmouth                                                                                                                                                                                                                                                           | Not Programmed            |

| Project Number | Year                 | Transportation Project                                        | Project Description                                                                                                                                                                                                                                                                                                                              | Status <sup>[2]</sup>          |
|----------------|----------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 607394/611998  | —                    | Bourne Rail Trail, Phase 4B                                   | Phase 4B of four planned phases of the Bourne Rail Trail connection to the Shining Sea Bikeway to the south in Falmouth and to the Cape Cod Canal path (Canal Service Road) in the town of Bourne; Phase 4B is approximately 1 mile long, extending the Shining Sea Bikeway from its current terminus in North Falmouth into the town of Bourne. | Not Programmed                 |
| 606082         | 2025                 | U.S. Route 6 Scenic Highway Median Installation               | <ul style="list-style-type: none"> <li>• Resurfacing</li> <li>• Safety improvements, including a raised center median and expanded shoulders to separate eastbound and westbound travel lanes</li> <li>• Drainage improvements</li> <li>• Traffic signal improvements at two intersections</li> <li>• Shared-use path</li> </ul>                 | <a href="#">Underway</a>       |
| 612053         | 2025                 | Bourne/Sandwich, Resurfacing and Related Work on U.S. Route 6 | Improvements to pavement serviceability, condition, and roadway safety on U.S. Route 6 from Sagamore Bridge to the Sandwich town line (8.55 miles)                                                                                                                                                                                               | <a href="#">Programmed</a>     |
| 613200         | —                    | Chase Road over U.S. Route 6 Bridge                           | Bridge deck replacement of Chase Road over U.S. Route 6 (Mid-Cape Highway) bridge structure in the town of Sandwich                                                                                                                                                                                                                              | <a href="#">Not Programmed</a> |
| 612063         | <a href="#">2030</a> | State Route 28 Resurfacing and Related Work                   | Improvements to pavement serviceability, condition, and roadway safety on MacArthur Boulevard (State Route 28) from Bourne Rotary to Otis Rotary                                                                                                                                                                                                 | <a href="#">Programmed</a>     |
| 613199         | —                    | U.S. Route 6 over State Route 130 Bridge                      | Bridge deck replacement of U.S. Route 6 (Mid-Cape Highway) bridge structure over State Route 130 in the town of Sandwich                                                                                                                                                                                                                         | <a href="#">Not Programmed</a> |

| Project Number | Year | Transportation Project                                 | Project Description                                                                | Status <sup>[2]</sup> |
|----------------|------|--------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------|
| 613271         | —    | Shared-use path, State Route 130 to Canal Service Road | Shared-use path from State Route 130 to Canal Service Road in the town of Sandwich | Not Programmed        |

Source: [Cape Cod Transportation Improvement Program for FFY 2026-2030](#)

— No date available.

Note: **Table 3-2** includes only those projects in the Federal Fiscal Year (FFY) 2026-2030 Transportation Improvement Program (TIP) within the Study Areas that are part of the No Build Alternative.

The No Build Alternative represents the “Fix as Fails” Base Condition of USACE’s MRER/EA. In the No Build Alternative, USACE would implement an ongoing program of continued inspections and maintenance, and repair of both existing bridges as needed to maintain safety. No major rehabilitation efforts involving extensive repairs and replacement of major bridge components would occur. Structural components would be repaired, and critical elements would be replaced only when inspections indicate unsatisfactory reliability ratings. The MRER/EA indicates that both the Sagamore and Bourne Bridges are in deteriorated condition and well beyond the state in which actions and funding from USACE’s operations and maintenance program could correct the deficiencies and restore and sustain reliability. USACE has indicated that as the bridges continue to age, routine maintenance and minor component replacement would result in an unacceptable structural condition. As a result, it is likely that lower vehicle weights, traffic volume restrictions, and speed limits would be required and posted to maintain continued bridge safety.

The No Build Alternative would not meet any of the Program’s identified needs:

- It would not address the deteriorating structural condition and escalating maintenance demands of the existing bridges.
- It would not address the substandard design elements of the bridges, the immediate mainline approaches, and their adjacent interchanges and intersections.
- It would not improve vehicular traffic operations.
- It would not improve accommodations for pedestrians and bicyclists.

Per NEPA requirements, the No Build Alternative is included in the NEPA document as the base condition against which the Build Alternative is compared and evaluated.

## 4 Methods for Effect Evaluations

### 4.1 Regulatory Context for Wetland and Floodplain Resources

The Project Study Area, including the Bourne and Sagamore interchange approaches and Cape Cod Canal, contains wetland and floodplain resources subject to jurisdiction under the following acts and order:

#### Federal

- Federal Water Pollution Control Act of 1972 (33 USC 1251-1376), as amended by U.S. Clean Water Act (1977) and U.S. Water Quality Act (1987), Section 401 and Section 404
- Clean Water Act (CWA), Section 402, National Pollutant Discharge Elimination System (NPDES) for Stormwater Discharges and Construction General Permit (CGP)
- Rivers and Harbors Act of 1899 (33 USC 403), Section 10
- [Coastal Zone Management \(CZM\) Federal Consistency Review pursuant to the CZM Act \(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 \(CFR\) 650 Subpart A](#)
- Executive Order 13112 Invasive Species, [amended by Executive Order 13751](#)

#### State

- [Massachusetts 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 \(Massachusetts General Laws c. 21, §§ 26–53\) and regulations \(314 CMR 9.00\), Water Quality Certification](#)

USACE New England District issues a Department of the Army permit pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the CWA. The federal CWA regulates the discharge of dredge or fill materials into Waters of the United [States](#) (WOTUS) which include, but are not limited to, navigable waters and tidal wetlands, and which also include many non-tidal wetlands and other waterbodies. WOTUS are subject to federal jurisdiction under the CWA, of which Section 404 requires authorization from USACE for the discharge of dredged or fill material into WOTUS, including wetlands. Navigable WOTUS are also subject to federal jurisdiction under Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403). Any work in or over, or outside the limits of the navigable WOTUS that would affect the navigable water requires authorization from USACE.

Excavating for pier installation and dredging for riprap pier protection, vessel access, and trestle pile installation 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.<sup>3</sup>

In Massachusetts, the MassDEP administers Section 401 of the CWA through the Massachusetts Surface Water Quality Standards (314 CMR 4.00) and 401 Water Quality Certification regulations (314 CMR 9.00) to ensure compliance with state water quality standards for any activity impacting WOTUS within Massachusetts.

At the state level, coastal and inland wetlands are subject to protection under the MA WPA and its regulations (310 CMR 10.00), which is administered by municipal conservation commissions. Freshwater resources subject to protection include Bank, Bordering Vegetated Wetlands, Land under Water Bodies and Waterways, Land Subject to Flooding, and Riverfront Area. Coastal Resources subject to protection include Coastal Banks; Salt Marshes; Coastal Beaches; Coastal Dunes; Barrier Beaches; Land Under the Ocean (LUO); Land Subject to Tidal Action (LSTA); Rocky Intertidal Shores (RIS); Land Containing Shellfish; Banks of or Land under the Ocean, Ponds, Streams, Rivers, Lakes, or Creeks that Underlie an Anadromous/Catadromous Fish Run (Fish Run); and Land Subject To Coastal Storm Flowage (LSCSF).

The floodplain is defined as any land area susceptible to being inundated by floodwaters from any source. The Federal Emergency Management Agency (FEMA) identifies the 100-year floodplain as the boundary of the flood that has a 1% chance of being equaled or exceeded in any given year (also known as the base flood). FEMA identifies the 500-year floodplain as the boundary of flood that has a 0.2% chance of being equaled or exceeded in any given year. The 100-year floodplain is considered LSCSF (coastal) and Bordering Land Subject to Flooding (BLSF) (inland) under MA WPA.

In Massachusetts, an Area of Critical Environmental Concern (ACEC) designation is a formal state designation of a significant ecological area. A designated ACEC receives special recognition because of the quality, uniqueness, and significance of its natural and cultural resources. ACEC regulations (301 CMR 12.00) require agencies under the Executive Office of Energy and Environmental Affairs review projects subject to their jurisdiction to avoid and minimize adverse effects to ACEC resources.

Vernal Pools are areas typically filled with water in the autumn or winter due to rainfall and rising groundwater and remain ponded through the spring and into summer. Vernal pools provide habitat for amphibians, such as wood frogs, salamanders, and fairy shrimp. They are regulated under the MA WPA and Section 401 of the CWA if they are located within a state and/or federal jurisdictional resource area.

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<sup>3</sup> 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](https://www.dco.uscg.mil/Portals/9/USCG-USACE_Bridge_MOU_19Jan2023.pdf)

## 4.2 Methodology

Wetlands, WOTUS, floodplains, vernal pools, and ACECs within the Study Area 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](#))
- FEMA Flood Insurance Rate Maps (FIRM)
- Coastal Zone Management Mapping
- USACE Major Rehabilitation Evaluation Environmental Assessment

Wetlands in the Project Study Area were delineated June 12 through September 18, 2020, February 10, 2021, [July 29, 2025](#), and [January 13, 2026](#). Vernal pool surveys were conducted within the Project Study Area between May 13 and May 15, 2020, and [May 12 and 13, 2025](#). An Abbreviated Notice of Resource Area Delineation (ANRAD; HNTB 2021) was submitted to the Bourne Conservation Commission on December 6, 2021, and revised information was submitted on April 22, 2022 (HNTB 2022) (Appendix A). The Bourne Conservation Commission issued an Order of Resource Area Delineation (ORAD) on May 6, 2022, which was valid until May 6, 2025. The Permit Extension Act signed by Governor Healey on November 20, 2024, extends the permit for a 2-year period until May 6, 2027. Since the time of the delineation and issuance of the ORAD, further field investigations were performed in October and November 2024 to delineate and document the resource areas associated with the Cape Cod Canal, and a review of the stormwater pipe network connections was conducted. The field investigations resulted in the delineation of the resource areas within the Cape Cod Canal, and review of the pipe network connections resulted in updates to several inland state resource area qualifications. Prior to May 6, 2027, a request for an Amended ORAD and 3-year extension will be filed with the Bourne Conservation Commission to include the Cape Cod Canal, reflect the recent field investigations, and extend the ORAD (if necessary). The resource areas described herein reflect the updated delineation effort.

## 5 Affected Environment

### 5.1 State Inland Resource Areas

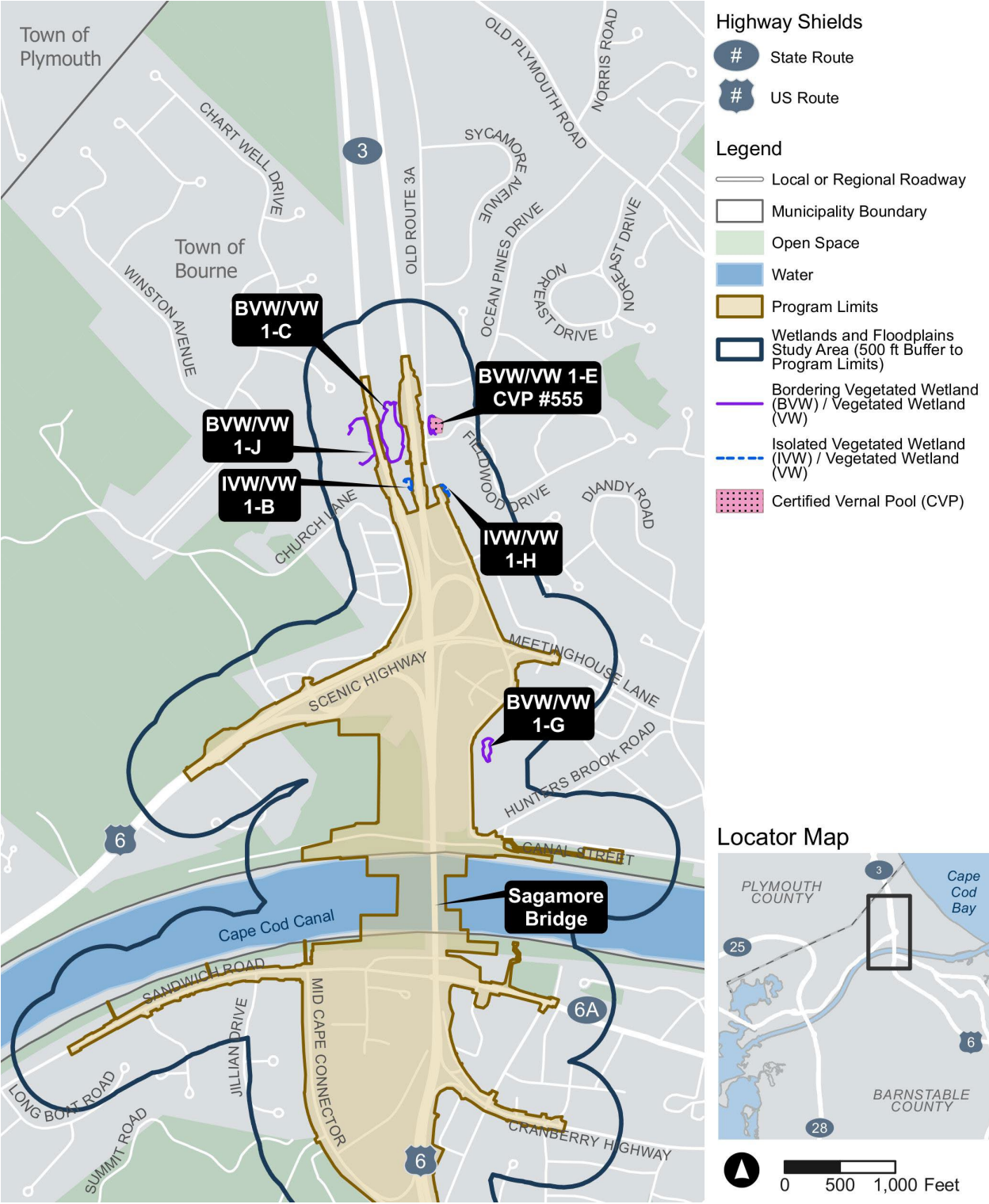
State inland jurisdictional resource areas were identified and approved in the ORAD. The resource areas were further qualified by additional investigations. There were a number of areas identified in the field, but many of them did not qualify under the MA WPA as jurisdictional areas due to their size and/or because they are human-made stormwater management features constructed in uplands. The ANRAD also included WOTUS. The state and federal resource areas were also confirmed based on field investigations, pipe network, and surface connections to Cape Cod Canal. Those discussed herein include only those with the potential to be affected.

In the Study Area, the following inland resource areas were identified in the Sagamore North, Bourne North, and South interchange approaches: BLSF, bordering vegetated wetland (BVW), land under water bodies and waterways (LUW), [and Bank](#). In addition, there are 100-foot buffer zones from the edges of both bank and BVW resources. 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 5-3](#)). Field surveys also determined one wetland which was previously considered state-jurisdictional BVW to be a state non-jurisdictional IVW (Wetland 4-TTF). State resources identified as IVWs are non-jurisdictional under the MA WPA; whereas state resources identified as BVWs are jurisdictional under the MA WPA. Jurisdictional resources identified in the Program Limits are defined in [Table 5-1](#) and depicted in [Figure 5-1 through Figure 5-3](#). No inland wetland resource areas were identified in the Sagamore South interchange approach area. Due to Program refinements, ILSF 4-B which was identified in the DEIS is no longer within the Program Limits.

**Table 5-1. Definitions of State Inland Wetland Resources**

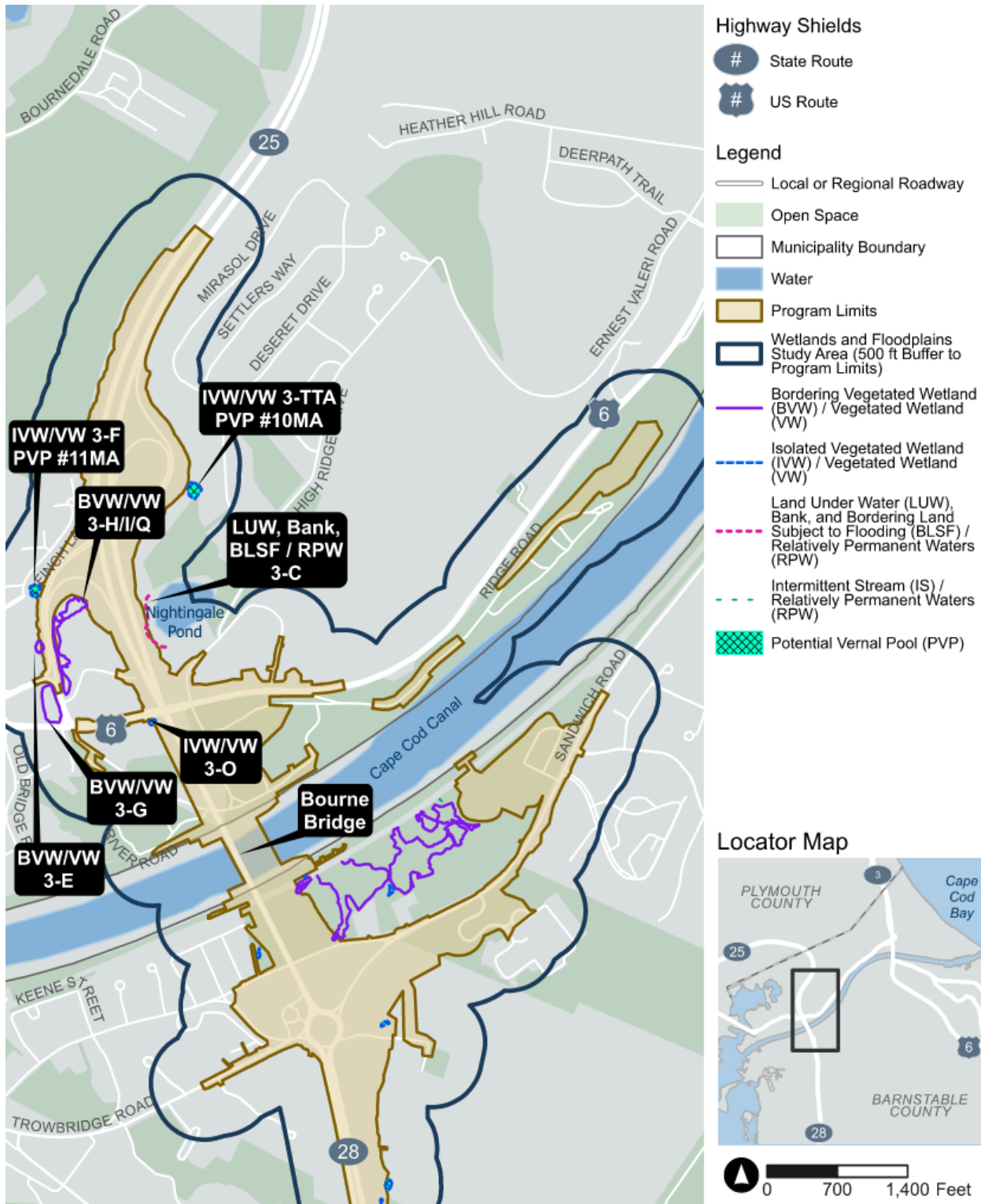
| Resource                                    | Definition                                                                                                                                                                                                                                                                  |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bank                                        | The portion of the land surface which 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 BVW occurs, it extends from said wetland.                          |
| Bordering Vegetated Wetland (BVW)           | Freshwater wetlands which 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.                                                                                                                                                                                                 |

**Figure 5-1. State and Federal Inland Wetland Resource Areas (Sagamore North Quadrant Interchange Approach)**



Source: [Massachusetts Department of Transportation, 2026](#)

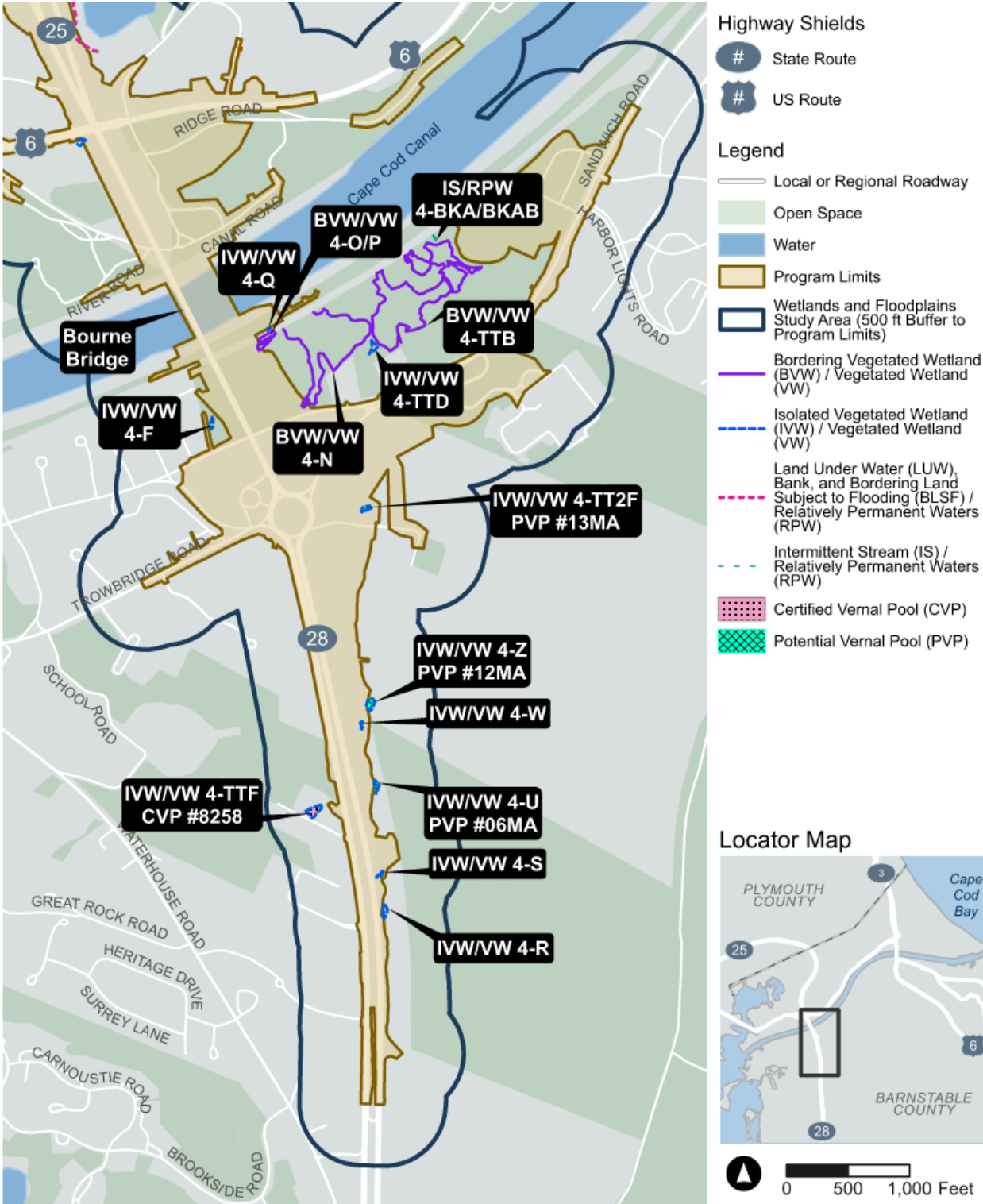
Figure 5-2. State and Federal Inland Wetlands (Bourne North Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2026

Note: Vernal Pool certification criteria not met.

Figure 5-3. State and Federal Inland Wetlands (Bourne South Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2026

Note: Vernal Pool certification criteria not met.

Of those wetland areas identified, three, all of which are located within the Bourne North quadrant interchange approach, would be impacted. **Table 5-2** lists these three wetland areas.

**Table 5-2. State Inland Wetlands (Bourne North Quadrant Interchange Approach)**

| Figure No.        | Wetland ID <sup>[1]</sup> | State Resource Area Type                                                              | Location                                                                                                                                                                                                             | Description                                                                                                                                                                                                             |
|-------------------|---------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Figure 5-2</b> | 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 ( <i>Frangula alnus</i> ), red maple ( <i>Acer rubrum</i> ), and sensitive fern ( <i>Onoclea sensibilis</i> ).                                         |
| <b>Figure 5-2</b> | 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 ( <i>Viburnum dentatum</i> ), red maple, gray birch ( <i>Betula populifolia</i> ), steeplebush ( <i>Spiraea tomentosa</i> ), and small cranberry ( <i>Vaccinium oxycoccos</i> ). |
| <b>Figure 5-2</b> | Series 3-C                | BVW<br>Land Under Water (LUW)<br>Bank<br>Bordering<br>Land Subject to Flooding (BLSF) | Nightingale Pond; east of State Route 25 northbound                                                                                                                                                                  | Dominant vegetation on edge of pond includes black gum ( <i>Nyssa sylvatica</i> ), sweet pepperbush ( <i>Clethra alnifolia</i> ), and highbush blueberry ( <i>Vaccinium corymbosum</i> ).                               |

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

**Table 5-3. Updated State Inland Resource Areas**

| Figure ID         | Quadrant              | Flag Series/Vernal Pool ID | State Resource Type                                        |
|-------------------|-----------------------|----------------------------|------------------------------------------------------------|
| <b>Figure 5-1</b> | <u>Sagamore North</u> | <u>1-G</u>                 | <u>Bordering Vegetated Wetland (BVW)</u>                   |
| <b>Figure 5-1</b> | <u>Sagamore North</u> | <u>1-B</u>                 | <u>Non-jurisdictional Isolated Vegetated Wetland (IVW)</u> |
| <b>Figure 5-1</b> | <u>Sagamore North</u> | <u>1-H</u>                 | <u>Non-jurisdictional IVW</u>                              |

| <b>Figure ID</b>           | <b>Quadrant</b>              | <b>Flag Series/Vernal Pool ID</b>                       | <b>State Resource Type</b>             |
|----------------------------|------------------------------|---------------------------------------------------------|----------------------------------------|
| <a href="#">Figure 5-2</a> | <a href="#">Bourne North</a> | <a href="#">3-TTA/Potential Vernal Pool (PVP) 10MA</a>  | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-2</a> | <a href="#">Bourne North</a> | <a href="#">3-F/PVP 11MA</a>                            | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-2</a> | <a href="#">Bourne North</a> | <a href="#">3-O</a>                                     | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-N expansion</a>                           | <a href="#">BVW</a>                    |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-Q</a>                                     | <a href="#">IVW</a>                    |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-O/P</a>                                   | <a href="#">BVW</a>                    |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-TTB</a>                                   | <a href="#">BVW</a>                    |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-TTD</a>                                   | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">BKA and BKAB</a>                            | <a href="#">Intermittent stream</a>    |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-TT2F/PVP 13MA</a>                         | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-F</a>                                     | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-Z/PVP 12MA</a>                            | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-W</a>                                     | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-U/PVP 06MA</a>                            | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-S</a>                                     | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-R</a>                                     | <a href="#">Non-jurisdictional IVW</a> |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South</a> | <a href="#">4-TTF/Certified Vernal Pool (CVP) #8258</a> | <a href="#">Non-jurisdictional IVW</a> |

Associated with wetland flag Series 3-C, the FEMA Flood Insurance Rate Study and Map, revised effective date of July 6, 2021, shows a Zone A flood zone (i.e., 1% annual chance flood hazard or BLSF) with no Base Flood Elevation associated with Nightingale Pond. Considering there is no FEMA Base Flood Elevation, the MA WPA regulations require a hydrologic analysis to determine the elevation of BLSF in accordance with 310 CMR 10.57(2)(a)3. The elevation of BLSF was calculated using a design storm of 7.5 inches of precipitation in 24 hours as set forth in the National Oceanic and Atmospheric Administration's (NOAA) 14 Precipitation-Frequency Atlas of the United States. The model calculates the peak elevations within the flooded area representing the elevation of BLSF or the 1% annual chance flood hazard. The analysis determined the BLSF elevation to be 14.5 feet North American Vertical Datum of 1988 (NAVD88). The model also calculates the 10% annual chance flood hazard area using a design storm of 5 inches of precipitation in 24 hours. The analysis determined the 10% annual chance flood elevation to be 9.3 feet NAVD88.

### 5.1.1 Vernal Pools

Vernal pools are confined basin depressions, which, in most years, hold water for a minimum of two continuous months during the spring and/or summer, are free of adult fish populations, and provide specialized and critical breeding habitat for frogs, salamanders, and invertebrates. Although vernal pools are not an area subject to protection under the MA WPA they are designated as an Outstanding Resource Water pursuant to the Massachusetts Surface Water Quality Standards and subject to regulation under Section 401 of the CWA through the Water Quality Certification regulations (314 CMR 9.00).

Vernal pools in the Study Area are described in two reports (Stantec 2020, 2026). Eight vernal pools were identified in the wetlands and floodplains Study Areas (refer to [Figure 5-1](#), [Figure 5-2](#), [Figure 5-3](#), and [Table 5-4](#)).

Table 5-4. Summary of Spring 2020 and 2025 Vernal Pool Surveys

| Figure No.                 | Survey Area/Wetland ID <sup>[1]</sup>            | Vernal Pool ID <sup>[2]</sup> | Vernal Pool ID <sup>[3]</sup> | Comments                                            |
|----------------------------|--------------------------------------------------|-------------------------------|-------------------------------|-----------------------------------------------------|
| <a href="#">Figure 5-1</a> | Sagamore North Quadrant/BVW 1-E                  | 05DN                          | Certified #555                | Within 100 feet of proposed work                    |
| <a href="#">Figure 5-2</a> | Bourne North Quadrant/BVW 3-F                    | 11MA                          | None                          | Does not meet biological criteria for certification |
| <a href="#">Figure 5-2</a> | <a href="#">Bourne North Quadrant/IVW 3-TTA</a>  | <a href="#">10MA</a>          | <a href="#">Potential</a>     | <a href="#">Within 10 feet of proposed work</a>     |
| <a href="#">Figure 5-3</a> | Bourne South Quadrant/IVW 4W                     | 05MA                          | None                          | Does not meet biological criteria for certification |
| <a href="#">Figure 5-3</a> | Bourne South Quadrant/IVW <a href="#">4-TTF</a>  | 07MA                          | Certified #8258               | Within <a href="#">70</a> feet of proposed work     |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South Quadrant/IVW 4-TT2F</a> | <a href="#">13MA</a>          | <a href="#">Potential</a>     | <a href="#">Within proposed limit of work</a>       |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South Quadrant/IVW 4-Z</a>    | <a href="#">12MA</a>          | <a href="#">Potential</a>     | <a href="#">Within 30 feet of proposed work</a>     |
| <a href="#">Figure 5-3</a> | <a href="#">Bourne South Quadrant/IVW 4-U</a>    | <a href="#">06MA</a>          | <a href="#">Potential</a>     | <a href="#">Within 1 foot of proposed work</a>      |

BVW = Bordering Vegetated Wetlands, ILSF = Isolated Land Subject to Flooding

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

<sup>[2]</sup> As identified in Stantec (2020, 2026).

<sup>[3]</sup> As identified by the Massachusetts Department of Fish and Wildlife Natural Heritage and Endangered Species Program.

## 5.2 State Coastal Resource Areas

State coastal resource areas that were identified within the Sagamore and Bourne Bridge Study Areas include LUO, Coastal Bank, RIS, LSTA, LUO Underlying a Fish Run, Land Containing Shellfish, and LSCSF. These resources are defined in [Table 5-5](#) and their locations are depicted in [Figure 5-4 through Figure 5-7](#) and described in [Table 5-7](#). These state coastal resources are associated with the Cape Cod Canal, which connects Cape Cod Bay to Buzzards Bay. [Relevant to coastal resources, the refined Study Area within all four quadrants was expanded to include the proposed Section 4\(f\) mitigation.](#)

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

Water elevations within the Cape Cod Canal were obtained from the USACE Environmental Assessment and Finding of No Significant Impact for Major Rehabilitation Evaluation Report (USACE 2022). Elevations in the USACE report were based on mean sea level datum and converted to NAVD88 to establish the state jurisdictional limits. Water elevations pertinent to state jurisdictional limits are presented in [Table 5-6](#). Variations in the values presented in [Table 5-6](#) 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 5-5. Definitions of State Coastal Resource Areas

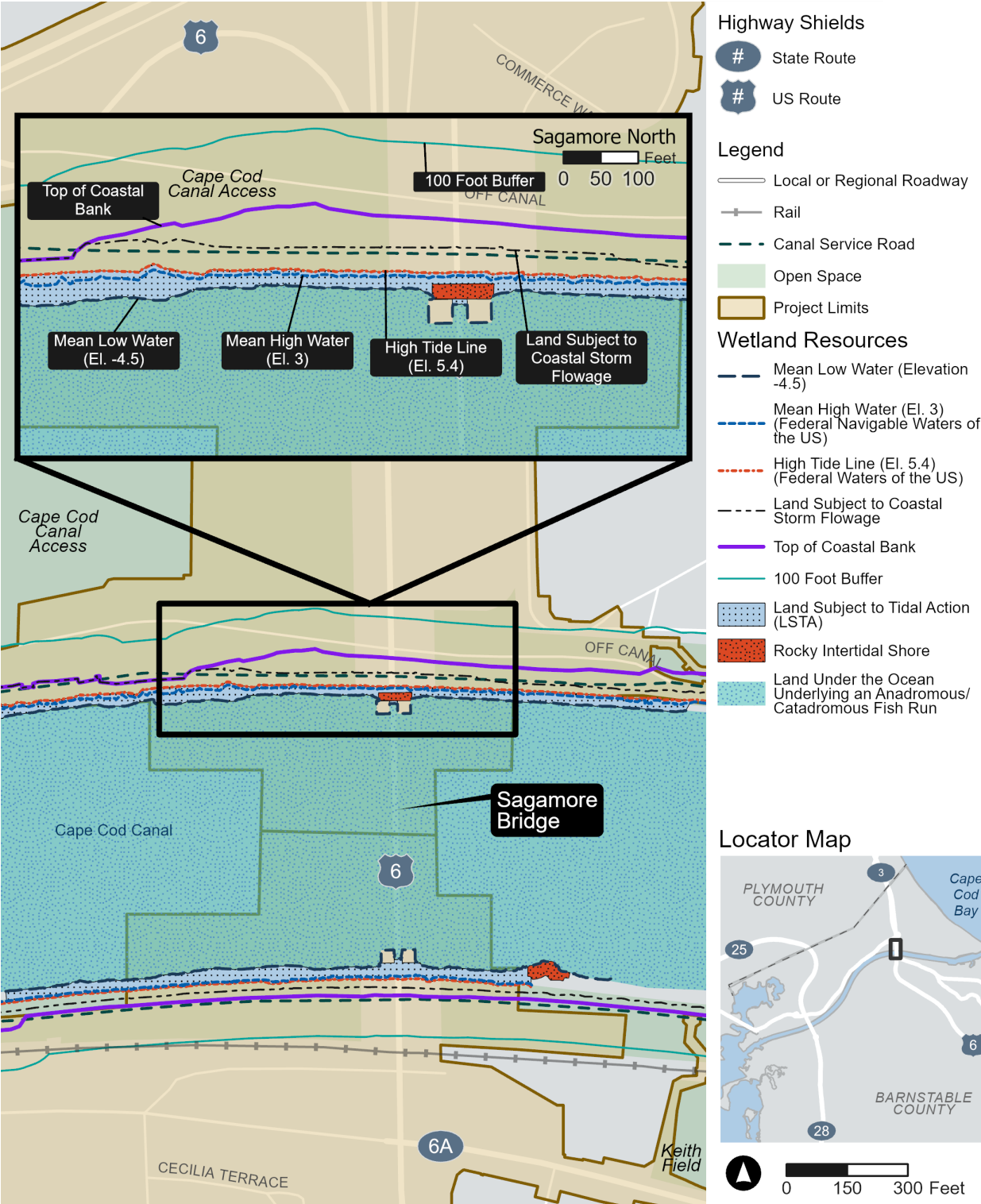
| Resource                                           | Definition                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                                       | 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 Shore (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. |

| Resource                                      | Definition                                                                                                                                    |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 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. |

**Table 5-6. Cape Cod Canal Water Elevations in Feet (Based on NAVD88)**

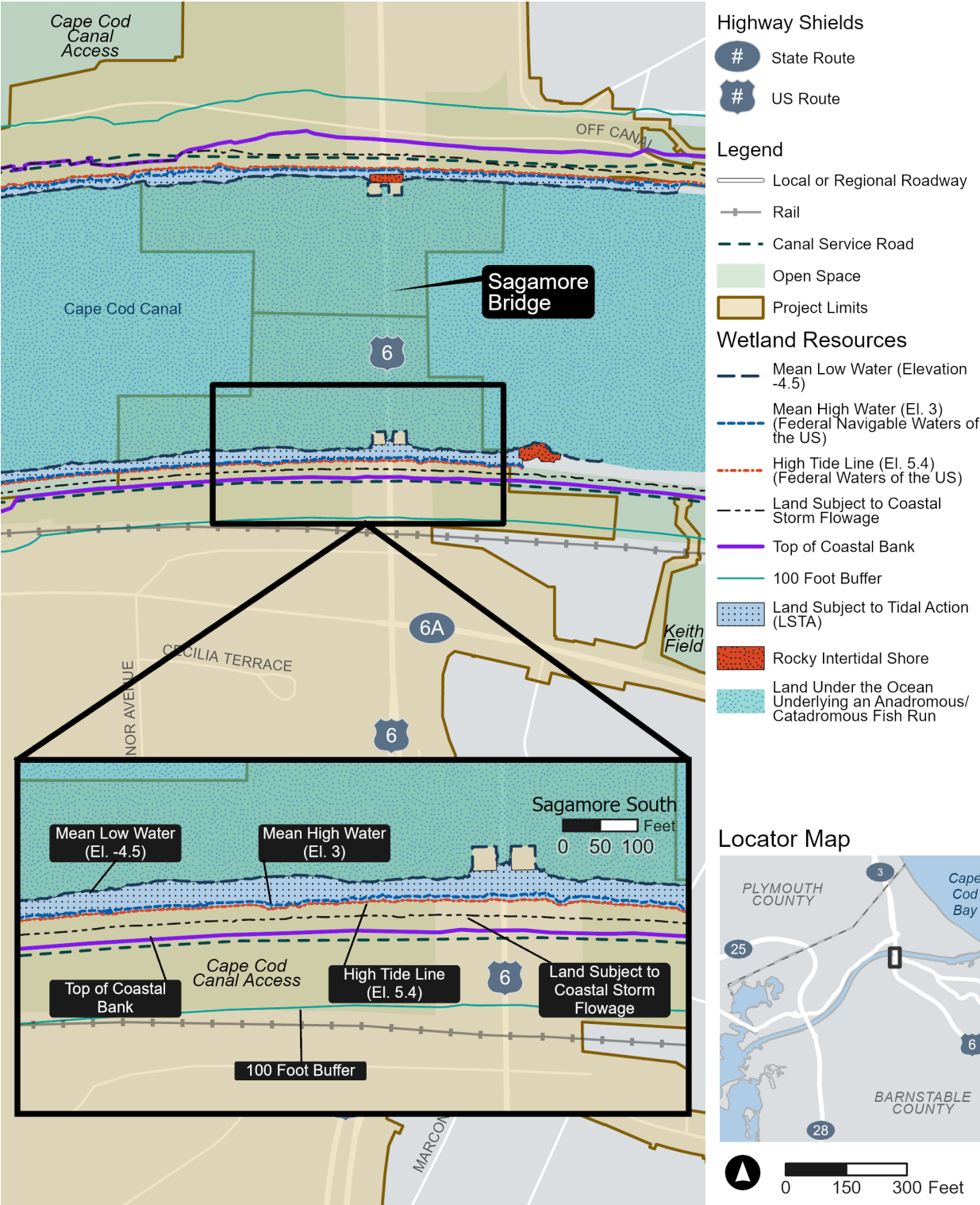
| Location        | High Tide Line | Mean High Water | Mean Low Water |
|-----------------|----------------|-----------------|----------------|
| Sagamore Bridge | 5.4            | 3.0             | -4.5           |
| Bourne Bridge   | 2.9            | 1.5             | -3.0           |

Figure 5-4. State and Federal Coastal Resource Areas (Sagamore North Quadrant)



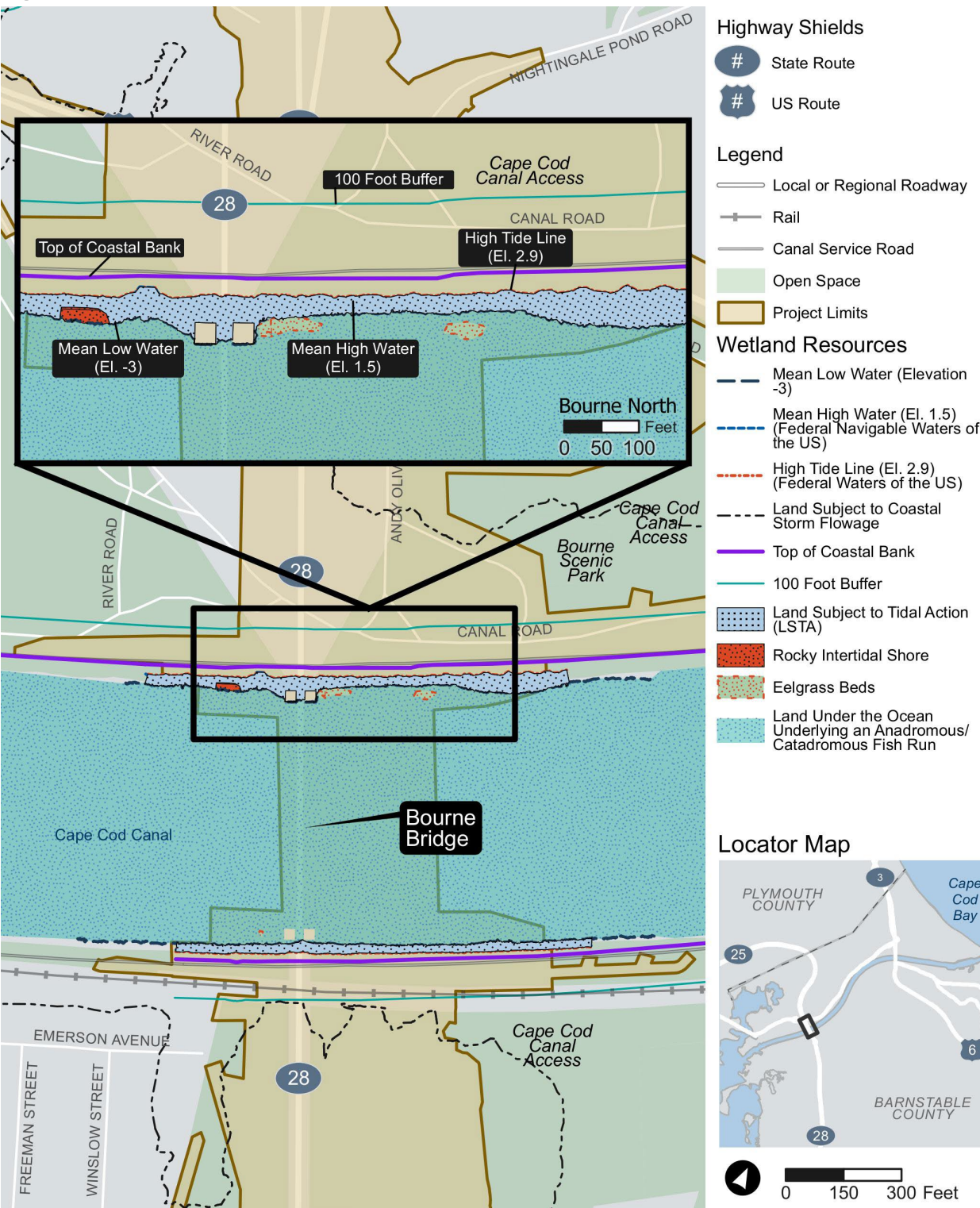
Source: Massachusetts Department of Transportation, 2026

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



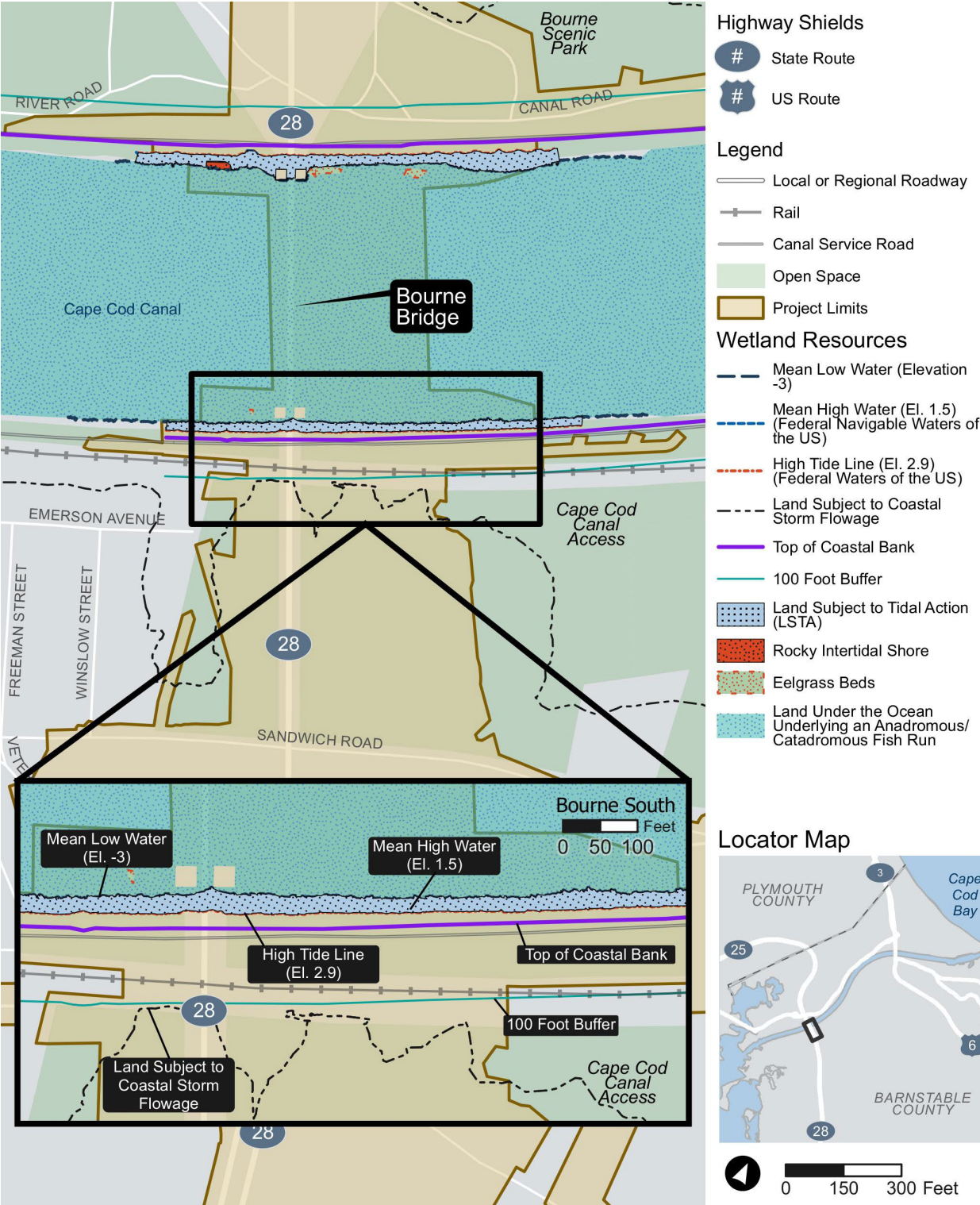
Source: Massachusetts Department of Transportation, 2026

Figure 5-6. State and Federal Coastal Resource Areas (Bourne North Quadrant)



Source: Massachusetts Department of Transportation, 2026

Figure 5-7. State and Federal Coastal Resource Areas (Bourne South Quadrant)



Source: Massachusetts Department of Transportation, 2026

Table 5-7. State Coastal Resource Areas

| Resource Area Type                                                             | Location                                                                                                                                                                                | How Determined                                                                                                                            |
|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Land Under Ocean (LUO)                                                         | Within Cape Cod Canal                                                                                                                                                                   | Below Mean Low Water elevation based on U.S. Army Corps of Engineers (2022)                                                               |
| 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 Shore (RIS)                                                   | 1,652 square feet at Sagamore North Approach and 1,167 square feet at Bourne North 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)                           |
| LUO Underlying an Anadromous/Catadromous Fish Run                              | Along north and south shorelines of entire length of Cape Cod Canal                                                                                                                     | As mapped by the Massachusetts Department of Fish and Game Division of Marine Fisheries                                                   |
| Land Containing Shellfish                                                      | Within Cape Cod Canal                                                                                                                                                                   | As mapped by the Massachusetts Department of Fish and Game Division of Marine Fisheries <a href="#">and supplemented by visual survey</a> |
| Land Subject to Coastal Storm Flowage (LSCSF) or 1% annual chance flood hazard | Elevation 14 feet North American Vertical Datum of 1988 (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                          |

Canal resource areas are depicted in [Exhibit 5-1 through Exhibit 5-8](#).

The Cape Cod Canal Project Study Area was 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 5-1. Banks of Cape Cod Canal Adjacent to Sagamore North Quadrant Bridge Piers, Looking East**



Source: Massachusetts Department of Transportation, 2024

**Exhibit 5-2. Banks of Cape Cod Canal Adjacent to Sagamore North Quadrant Bridge Piers, Looking South**



Source: Massachusetts Department of Transportation, 2024

**Exhibit 5-3. Banks of Cape Cod Canal Adjacent to Sagamore South Quadrant Bridge Piers, Looking East**



Source: Massachusetts Department of Transportation, 2024

**Exhibit 5-4. Banks of Cape Cod Canal Adjacent to Sagamore South Quadrant Bridge Piers, Looking East-Northeast**



Source: Massachusetts Department of Transportation, 2024

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



Source: Massachusetts Department of Transportation, 2024

**Exhibit 5-6. Banks of Cape Cod Canal Adjacent to Bourne North Quadrant Bridge Piers, Looking South**



Source: Massachusetts Department of Transportation, 2024

**Exhibit 5-7. Banks of Cape Cod Canal Adjacent to Bourne South Quadrant Bridge Piers, Looking East**



Source: Massachusetts Department of Transportation, 2024

**Exhibit 5-8. Banks of Cape Cod Canal Adjacent to Bourne South Quadrant Bridge Piers, Looking East (closeup view)**



Source: Massachusetts Department of Transportation, 2024

## 5.3 Waters of the United States

The Program is currently proceeding under the presumption that aquatic resources that meet the CWA definition of wetlands and any Relatively Permanent Water (RPW) with a High Tide Line (HTL), Mean High Water (MHW) mark, or Ordinary High Water (OHW) mark are subject to USACE jurisdiction pursuant to the 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. Excavation to install piers and pier protection riprap and dredging for vessel access are not subject to CWA 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.

### 5.3.1 Inland WOTUS

Inland WOTUS were identified in the Sagamore North quadrant, Bourne North quadrant, and Bourne South quadrant interchange approaches. **Figure 5-1** through **Figure 5-3** depict these wetland resources. No inland WOTUS were identified within the Sagamore South quadrant interchange approach.

Since the DEIS, field surveys identified 18 additional federal inland Vegetated Wetlands (VW), listed in **Table 5-8** 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 inland VWs may be less than those disclosed in this FEIS if not all inland VWs are determined by USACE to be federally jurisdictional. Final calculations for impacts to inland VWs will be described in federal wetlands permit applications.

**Table 5-8. Updated Federal Inland Resource Areas**

| <b>Figure ID</b>  | <b>Quadrant</b> | <b>Flag Series/<br/>Vernal Pool ID</b> | <b>Federal Resource Type</b> |
|-------------------|-----------------|----------------------------------------|------------------------------|
| <b>Figure 5-1</b> | Sagamore North  | 1-G                                    | Vegetated Wetland (VW)       |
| <b>Figure 5-1</b> | Sagamore North  | 1-B                                    | VW                           |
| <b>Figure 5-1</b> | Sagamore North  | 1-H                                    | VW                           |
| <b>Figure 5-2</b> | Bourne North    | 3-TTA/Potential Vernal Pool (PVP) 10MA | VW                           |
| <b>Figure 5-2</b> | Bourne North    | 3-F/PVP 11MA                           | VW                           |
| <b>Figure 5-2</b> | Bourne North    | 3-O                                    | VW                           |
| <b>Figure 5-3</b> | Bourne South    | 4-N expansion                          | VW                           |
| <b>Figure 5-3</b> | Bourne South    | 4-Q                                    | VW                           |
| <b>Figure 5-3</b> | Bourne South    | 4-O/P                                  | VW                           |
| <b>Figure 5-3</b> | Bourne South    | 4-TTB                                  | VW                           |

| Figure ID  | Quadrant     | Flag Series/<br>Vernal Pool ID             | Federal Resource Type       |
|------------|--------------|--------------------------------------------|-----------------------------|
| Figure 5-3 | Bourne South | 4-TTD                                      | VW                          |
| Figure 5-3 | Bourne South | BKA and BKAB                               | Waters of the United States |
| Figure 5-3 | Bourne South | 4-TT2F/PVP 13MA                            | VW                          |
| Figure 5-3 | Bourne South | 4-F                                        | VW                          |
| Figure 5-3 | Bourne South | 4-Z/PVP 12MA                               | VW                          |
| Figure 5-3 | Bourne South | 4-W                                        | VW                          |
| Figure 5-3 | Bourne South | 4-U/PVP 06MA                               | VW                          |
| Figure 5-3 | Bourne South | 4-S                                        | VW                          |
| Figure 5-3 | Bourne South | 4-R                                        | VW                          |
| Figure 5-3 | Bourne South | 4-TTF/Certified Vernal Pool<br>(CVP) #8258 | VW                          |

Of those wetland resources identified, eight, all of which are within the Bourne North quadrant and Bourne South interchange approaches (Figure 5-2 and Figure 5-3), would be impacted. Table 5-9 identifies these eight WOTUS.

Table 5-9. Federal Inland Wetland Resource Areas (Bourne Interchange Approaches)

| Figure No. | Wetland ID <sup>[1]</sup> | Resource Area Type | Location                                                                                                                                                                                                             | Description                                                                                     |
|------------|---------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Figure 5-2 | 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 5-2 | 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, steplebush, and small cranberry  |

| Figure No.        | Wetland ID <sup>[1]</sup> | Resource Area Type                               | Location                                                                                   | Description                                                                                                                                                                                   |
|-------------------|---------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Figure 5-2</b> | 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                                                                                              |
| <b>Figure 5-2</b> | Series 3-O                | Vegetated Wetland                                | Southwest corner intersection of U.S. Route 6 and State Route 28                           | Dominant vegetation includes broadleaf cattail ( <i>Typha latifolia</i> )                                                                                                                     |
| <b>Figure 5-3</b> | Series 4-TT2F             | Vegetated Wetland                                | East of Bourne Rotary                                                                      | Dominant vegetation includes Canada rush ( <i>Juncus canadensis</i> ), soft rush ( <i>Juncus effusus</i> ), woolgrass ( <i>Scirpus cyperinus</i> ), and shallow sedge ( <i>Carex lurida</i> ) |
| <b>Figure 5-3</b> | 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 ( <i>Glyceria canadensis</i> ), leather leaf ( <i>Chamaedaphne calyculata</i> ), and alder buckthorn                                     |
| <b>Figure 5-3</b> | Series 4-S                | Vegetated Wetland                                | Adjacent to State Route 28 northbound                                                      | Dominant vegetation includes red maple, alder buckthorn, and American pennywort ( <i>Hydrocotyle americana</i> )                                                                              |
| <b>Figure 5-3</b> | Series 4-R                | Vegetated Wetland                                | Adjacent to State Route 28 northbound                                                      | Dominant vegetation includes red maple, American elm ( <i>Ulmus americana</i> ), and arrowwood                                                                                                |

Note: Only those wetlands are listed where impacts are proposed.

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

### 5.3.2 Coastal (Tidal) Waters of the United States

Coastal WOTUS are those waters that are subject to the ebb and flow of the tide. Cape Cod Canal is a tidal Navigable WOTUS. Coastal WOTUS identified within the Wetlands and Floodplains Study Areas at both bridge locations are depicted in [Figure 5-4 through Figure 5-7](#). Water elevations pertinent to federal jurisdictional limits are presented in [Table 5-6](#) and were obtained from the USACE MRER/EA (USACE 2022). The Bourne Bridge North quadrant includes two eelgrass beds totaling 2,345 square feet that are located east of the existing piers. The Bourne Bridge South quadrant includes one 100 square foot eelgrass bed that is located west of the existing piers along with isolated eelgrass sprigs further west. The Sagamore Bridge Study Area does not include areas vegetated with eelgrass.

## 5.4 Floodplains

FEMA FIRM panels (25001C0316K, 25001C0318K, [25001C0313K](#), [25001C0314K](#), 25001C0501J, and 25001C0502J), identify the 1% annual chance flood hazard (i.e., 100-year floodplain) boundary within the Study Areas. The limits of the FEMA-delineated floodplain within the Study Areas are illustrated in [Figure 5-8](#) and [Figure 5-9](#).

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

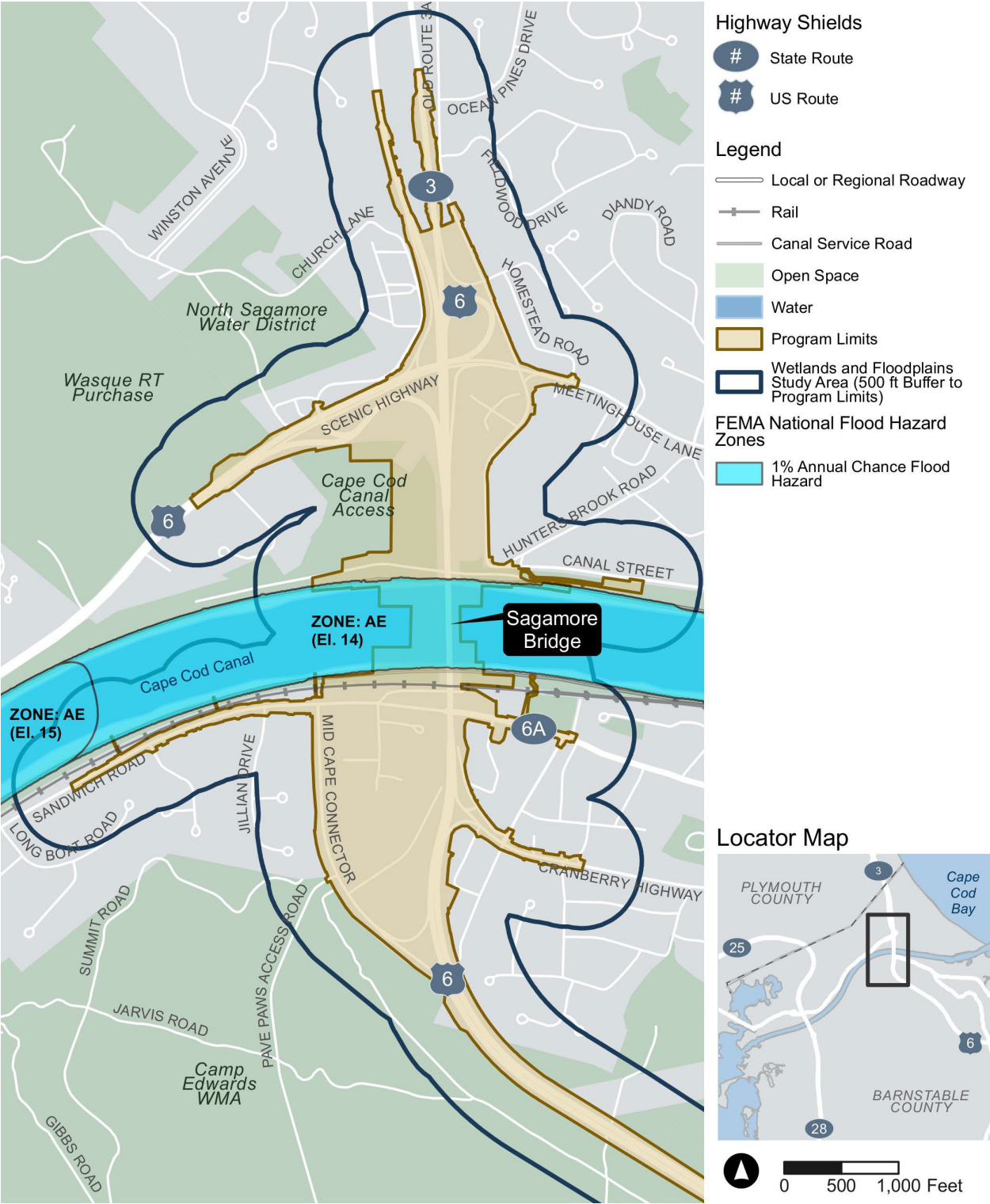
At the Bourne Bridge North Interchange Approach, Zone AE extends beyond the banks of Cape Cod Canal into Belmont Circle. At the Bourne Bridge South Interchange Approach, the flood zone extends into the adjacent properties on either side of the bridge. At the Sagamore North Interchange Approach, Zone AE is located along the landward edge of the existing pedestrian path, and at Sagamore South 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 elevation of BLSF was calculated using a design storm of 7.5 inches of precipitation in 24 hours as set forth in NOAA's 14 Precipitation-Frequency Atlas of the United States. The analysis determined the Base Flood Elevation to be 14.5 feet NAVD88.

## 5.5 Areas of Critical Environmental Concern

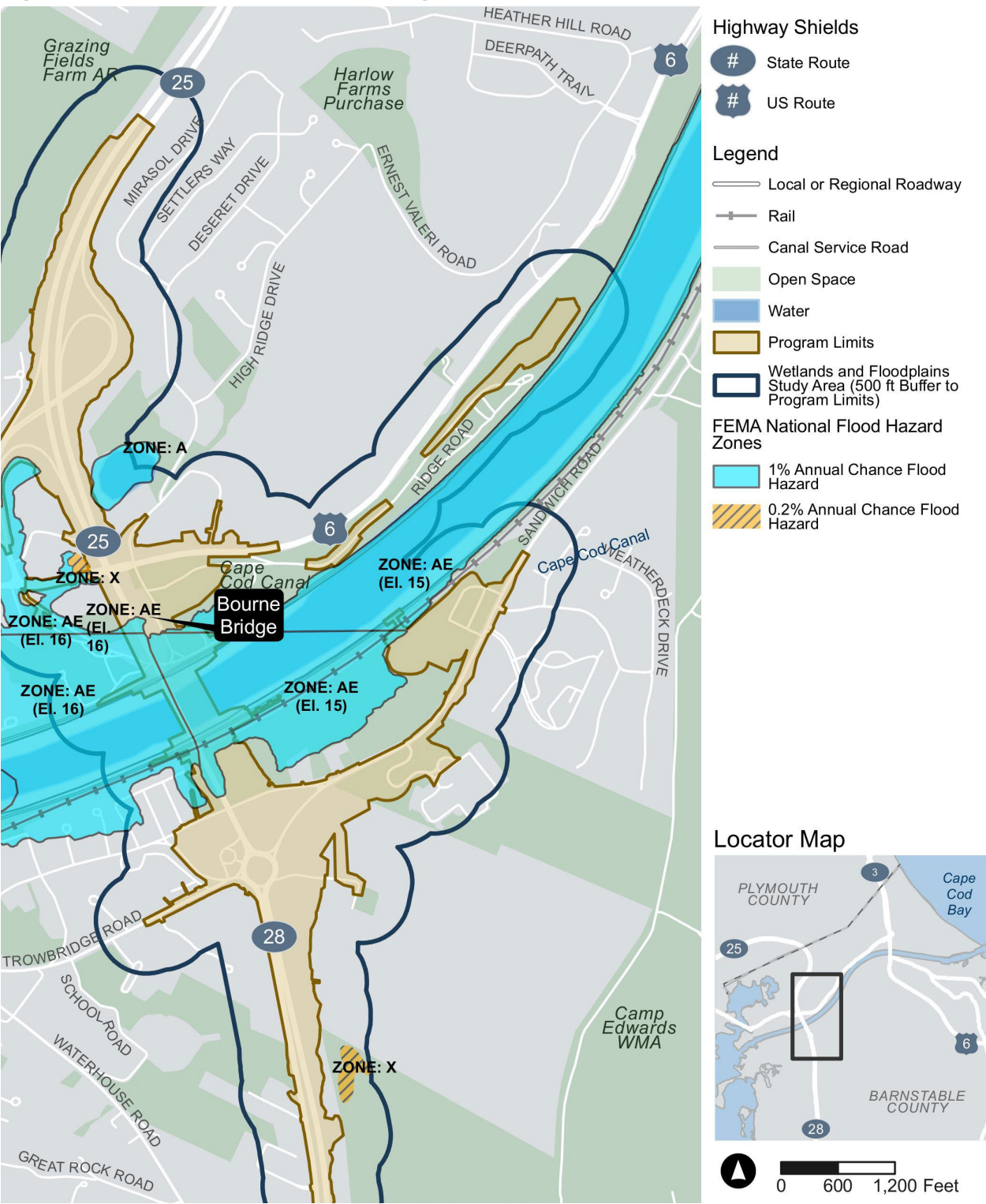
The Herring River Watershed is a mapped Area of Critical Environmental Concern (ACEC) that occurs within the Sagamore North Interchange Approach ([Figure 5-10](#)). The ACEC is mapped on the west side of State Route 3 and includes BVW series 1-J. At the southern end of the Bourne South Interchange Approach, the Project Limits overlap with the Bourne Back River ACEC ([Figure 5-11](#)). The wetlands within the ACEC are considered Outstanding Resource Waters, which are regulated under CWA Section 401.

Figure 5-8. Floodplains (Sagamore Bridge)



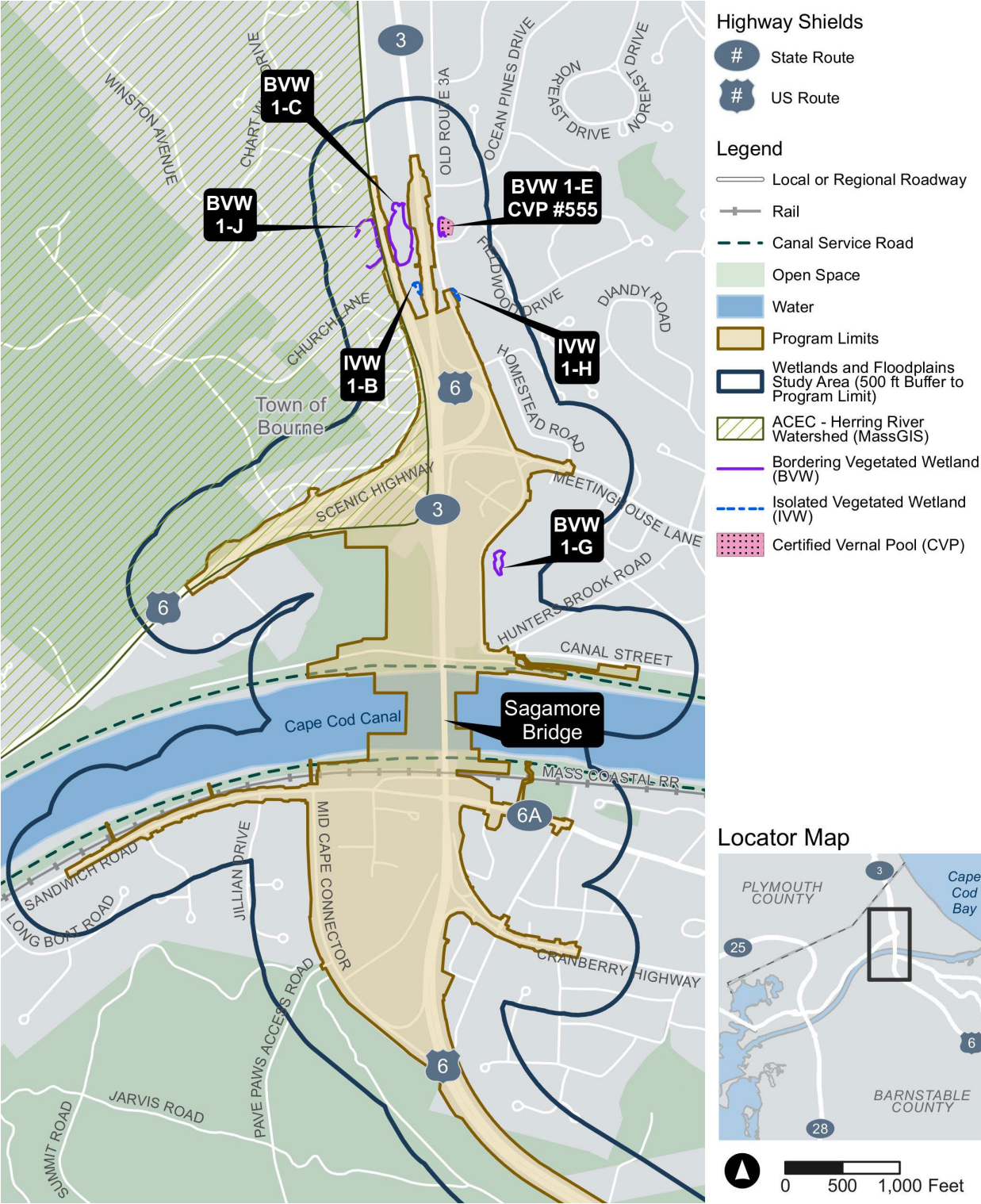
Source: Massachusetts Department of Transportation, 2026

Figure 5-9. Floodplains (Bourne Bridge)



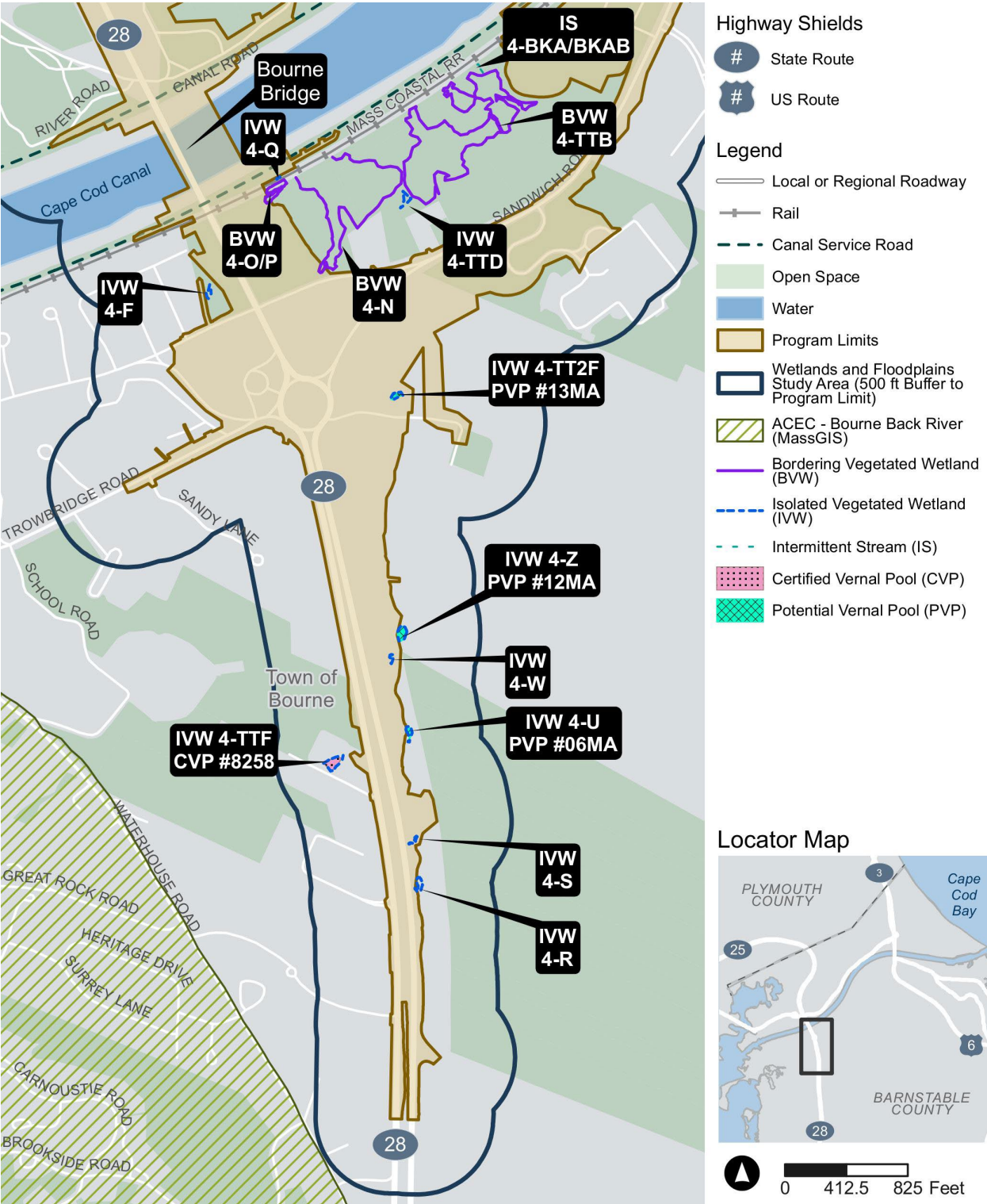
Source: Massachusetts Department of Transportation, 2026

Figure 5-10. Areas of Critical Environmental Concern (Sagamore North Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2026

**Figure 5-11. Areas of Critical Environmental Concern (Bourne South Quadrant Interchange Approach)**



Source: Massachusetts Department of Transportation, 2026

## 6 No Build Alternative

For the No Build Alternative, the 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 wetland resource areas. Effects would be similar to those that occurred during prior maintenance activities for which USACE analyzed pursuant to NEPA. [In addition, the No Build Alternative does not have the advanced stormwater treatment options, so the current ongoing effects to state and federal wetland resource areas would continue.](#)

## 7 Build Alternative

### 7.1 Construction-Term Impact Assessment

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 project components, including new bridge piers, riprap pier protection, and retaining walls. Dredging would also be required to provide marine vessels access to support construction activities during low tide cycles.

Organized by the location of the construction activities, the following subsections discuss resource area impacts, design considerations to avoid impacts, measures to avoid and minimize impacts, and mitigation for unavoidable impacts. The Sagamore and Bourne interchange approaches would also occupy the 100-foot buffer zone to state wetlands. The occupation of the buffer zone would include temporary construction work zones, permanent highway ramps, shared-use paths (SUP), landscaping, [additional work associated with parkland improvements,](#) and mitigation areas.

#### 7.1.1 Potential Impacts to State and Federal Inland Wetland Resource Areas

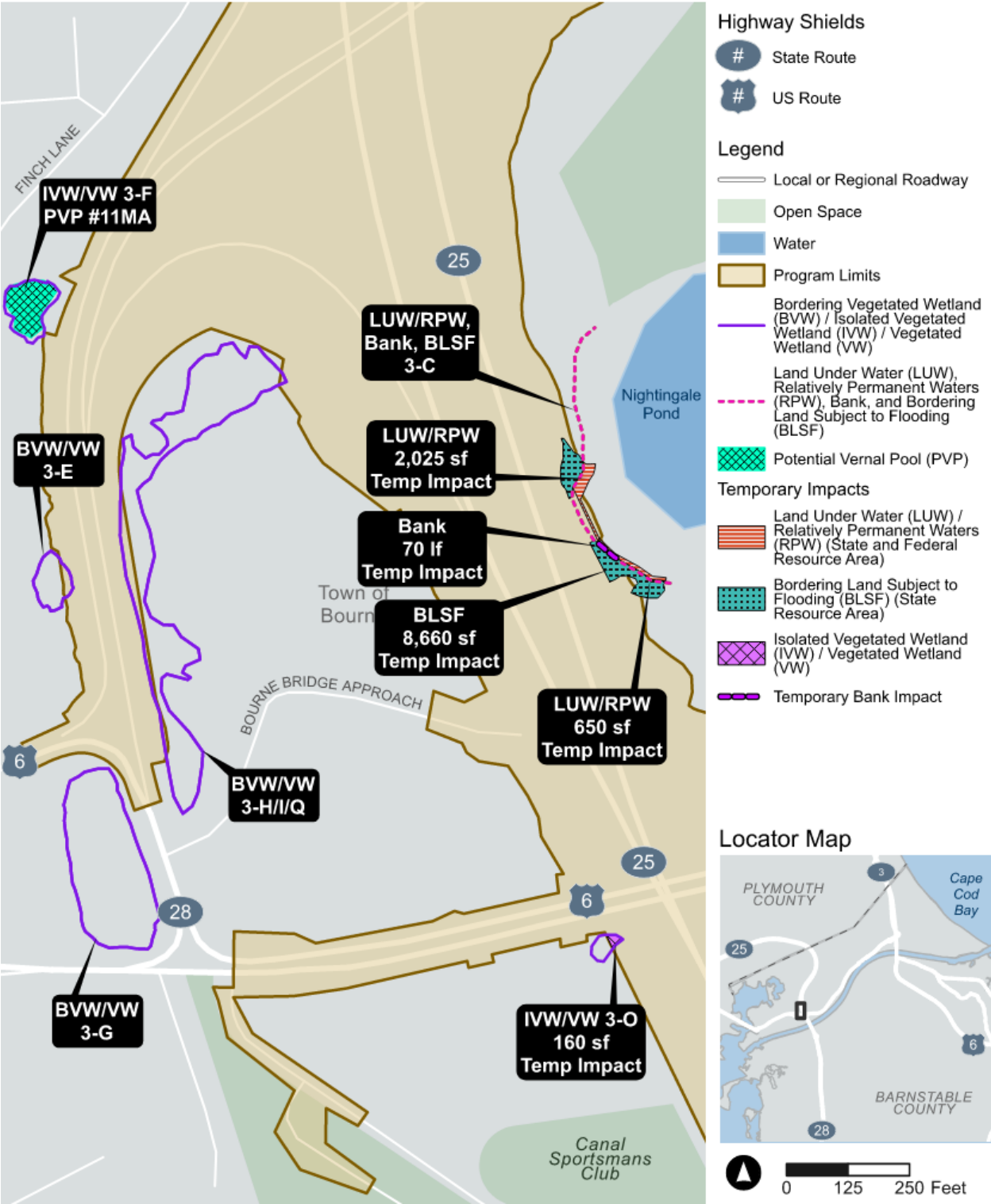
[Figure 5-1 through Figure 5-3 show the current Program Limits and identified inland wetland resources in the three quadrant interchange approaches.](#)

The Bourne North Interchange Approach would include roadway widening, additional lanes, and/or accommodations for an SUP in three locations 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 at Nightingale Pond would allow for an 11.5-foot-wide work zone to construct a retaining wall. For post-construction, this 11.5-foot-wide work zone would be narrowed to a 10-foot-wide grass surface access path for future maintenance purposes during operations. The 10-foot-wide path would be considered a permanent impact. Unavoidable impacts to wetlands are presented in [Figure 7-1](#) and [Figure 7-2](#) and described in [Table 7-1](#).

Construction [of](#) the Sagamore North quadrant and Sagamore South quadrant interchange approaches would not result in impacts to [jurisdictional](#) inland resources. [Inland resource area impacts would](#)

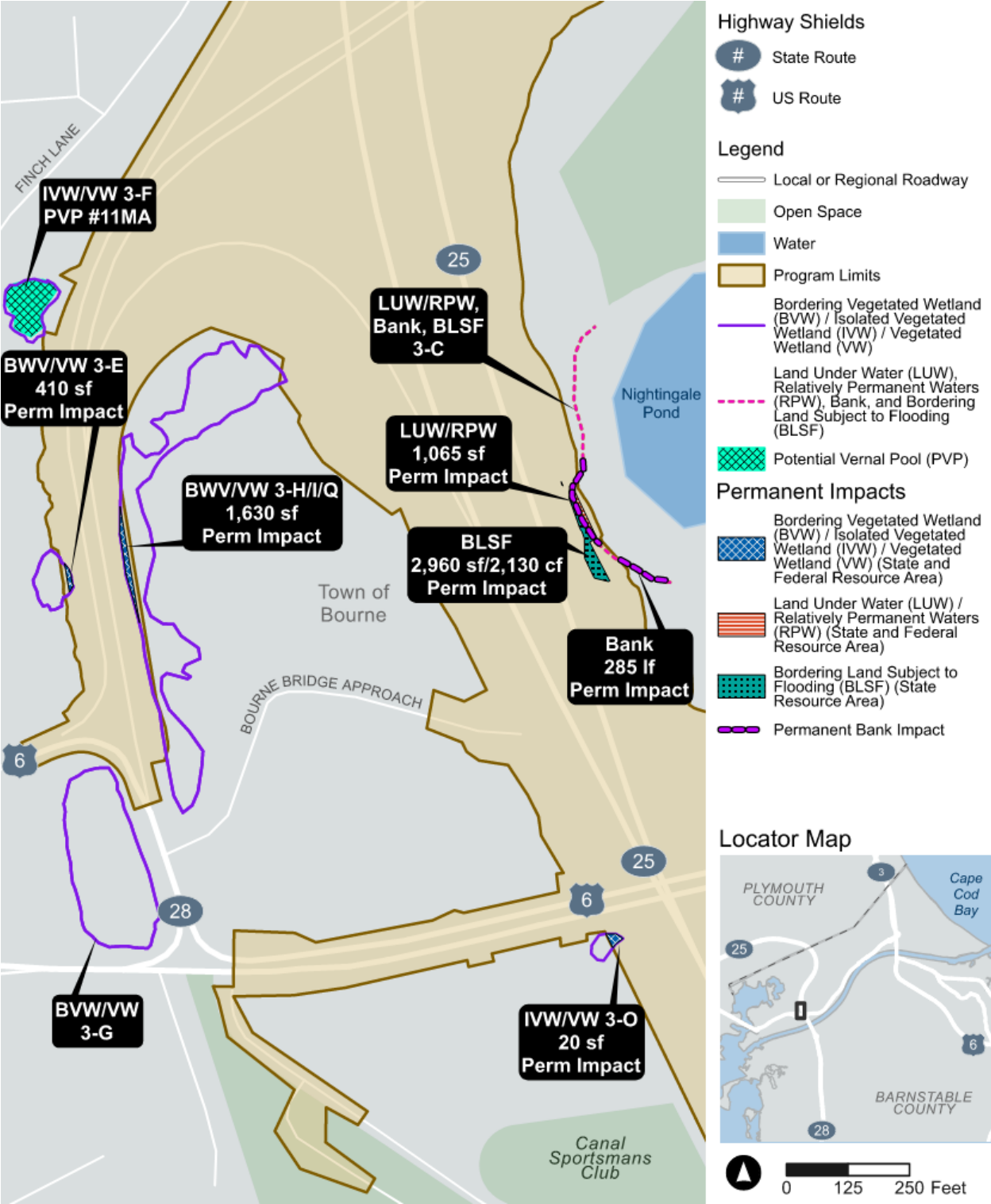
occur in the Bourne North quadrant and Bourne South quadrant interchange approaches as described in **Table 7-1**. In the Bourne South quadrant interchange approach, the Program will impact federal jurisdictional VWs 3-O, 4-TT2F, 4-W, 4-S, and VW 4-R; these resources are not state-jurisdictional under the MA WPA. Temporary and permanent impacts to inland resource areas are shown in **Figure 7-1 through Figure 7-3**.

Figure 7-1. Potential Temporary Impacts to State and Federal Inland Wetland Resource Areas (Bourne North Quadrant Interchange Approach)



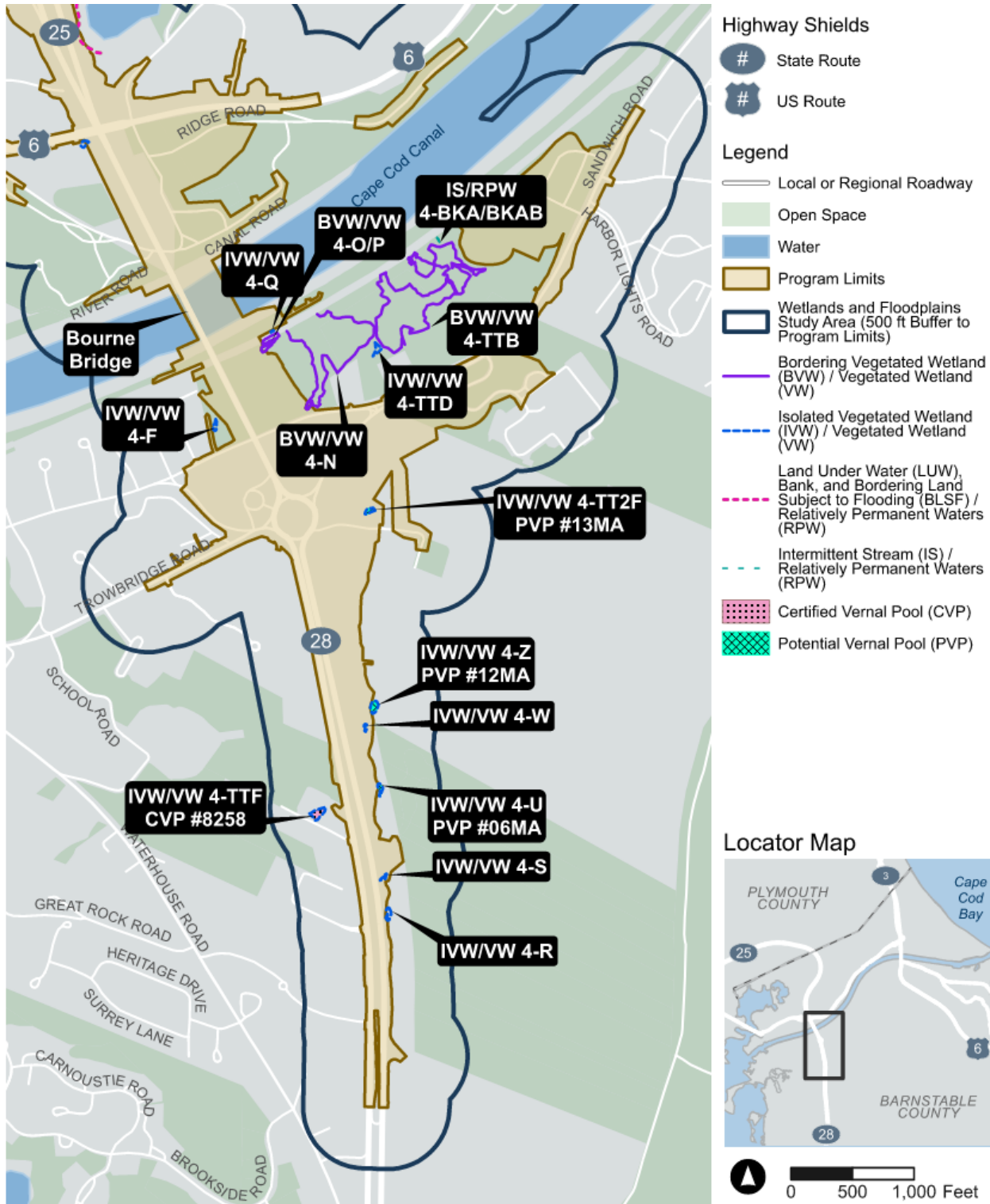
Source: Massachusetts Department of Transportation, 2026

Figure 7-2. Potential Permanent Impacts to State and Federal Inland Wetland Resource Areas (Bourne North Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2026

Figure 7-3. Potential Permanent Impacts to State and Federal Inland Wetland Resource Areas (Bourne South Quadrant Interchange Approach)



Source: Massachusetts Department of Transportation, 2026

**Table 7-1. Potential Impacts State and Federal Inland Wetland Resource Areas**

| <b>Resource<sup>[1]</sup></b>                                                           | <b>Temporary Impacts</b>      | <b>Permanent Impacts</b>              | <b>Reason for Impact</b>                                                                                                 |
|-----------------------------------------------------------------------------------------|-------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Bordering Vegetated Wetland (BVW) 3-E<br><i>VW 3-E<sup>[2]</sup></i>                    | —                             | 410 square feet (<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<br><i>VW 3-H/I/Q<sup>[2]</sup></i>                                          | —                             | 1,630 square feet (0.03 acre)         | Fill for widening State Route 25 east- and west-bound on-ramps from U.S. Route 6/State Route 28 and accommodate SUP      |
| Land Under Water (LUW) 3-C<br><i>Relatively Permanent Water (RPW) 3-C<sup>[2]</sup></i> | 2,675 square feet (0.06 acre) | 1,065 square feet (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                | 285 linear 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    |
| Bordering Land Subject to Flooding (BLSF) 3-C                                           | 8,660 square feet             | 2,960 square feet<br>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    |
| <u><i>Vegetated Wetland/VW 3-O<sup>[2]</sup></i></u>                                    | <u>160 sf</u>                 | <u>20 sf</u>                          | <u>Outfall replacement and riprap apron addition</u>                                                                     |
| <u><i>VW 4-TT2F<sup>[2]</sup></i></u>                                                   | <u>0 sf</u>                   | <u>2,400 sf</u>                       | <u>Highway ramp construction</u>                                                                                         |
| <u><i>VW 4-W<sup>[2]</sup></i></u>                                                      | <u>0 sf</u>                   | <u>900 sf</u>                         | <u>Highway widening or grading</u>                                                                                       |
| <u><i>VW 4-S<sup>[2]</sup></i></u>                                                      | <u>0 sf</u>                   | <u>900 sf</u>                         | <u>Highway widening or grading</u>                                                                                       |
| <u><i>VW 4-R<sup>[2]</sup></i></u>                                                      | <u>0 sf</u>                   | <u>90 sf</u>                          | <u>Highway widening or grading</u>                                                                                       |

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

<sup>[2]</sup> Identified as Waters of the United States.

**Table 7-2** lists information on 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 interchange approaches. In addition, part of this work would occur proximate to two vernal pools, one in the Bourne South quadrant (Vernal Pool #8258) and one in the Sagamore North quadrant (Vernal Pool #555) interchange approaches. Work is proposed within 75 feet of Vernal Pool #555, but the work would be separated by a roadway. Vernal Pool #8258 is located along the driveway of a car wash, north of Angelo Drive. Approximately 1,150 square feet of the existing driveway within 100 feet of the vernal pool would be repaved.

Table 7-2. Propose Work Proximate to Vernal Pools

| Survey Area/Wetland ID <sup>[1]</sup>      | Vernal Pool ID <sup>[2]</sup> | Vernal Pool ID <sup>[3]</sup> | Work Within 100 Feet of Resource                                                                               | Comment                                                                                           |
|--------------------------------------------|-------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Sagamore North/BVW/ <u>IVW</u> 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; <u>no direct impact</u> |
| <u>Bourne North quadrant/IVW/VW 3-TTA</u>  | <u>10MA</u>                   | <u>Potential</u>              | <u>Realigned ramp and grading within 10 feet</u>                                                               | <u>No direct impact</u>                                                                           |
| Bourne South/ <u>IVW/VW 4-TT2F</u>         | 07MA                          | Certified #8258               | Work limited to repaving 1,150 square feet of existing driveway <u>within 70 feet</u>                          | <u>No direct impact</u>                                                                           |
| <u>Bourne South quadrant/IVW/VW 4-TT2F</u> | <u>13MA</u>                   | <u>Potential</u>              | <u>Filled to accommodate at-grade off-ramp from State Route 28 to Sandwich Road Connector at Bourne Rotary</u> | <u>2,400 square feet of impact to IVW/VW 4-TT2F</u>                                               |
| <u>Bourne South quadrant/IVW/VW 4-Z</u>    | <u>12MA</u>                   | <u>Potential</u>              | <u>State Route 28 widening and grading within 30 feet</u>                                                      | <u>No direct impact</u>                                                                           |
| <u>Bourne South quadrant/IVW/VW 4-U</u>    | <u>06MA</u>                   | <u>Potential</u>              | <u>State Route 28 widening and grading within 1 foot</u>                                                       | <u>No direct impact</u>                                                                           |

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

<sup>[2]</sup> As identified in Stantec (2020, 2026).

<sup>[3]</sup> As identified by Massachusetts Department of Fish and Wildlife Natural Heritage and Endangered Species Program.

## 7.1.2 Impacts to State and Federal Coastal Resource Areas

Replacing the Bourne and Sagamore bridges would remove eight piers from below MHW and construct eight new piers in Cape Cod Canal. Each bridge would be supported by four new piers to accommodate both the north- and south-bound decks over the Cape Cod Canal. Each pier would be partially located within the riprap banks of the canal shoreline and partially below MHW and HTL.

Temporary structures would include barge docks, cofferdams surrounding the work areas for pier removal and installation; and 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 two 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. Potential temporary impacts to state and federal coastal resources are shown in [Figure 7-4 through Figure 7-11](#), which are represented on two sets of figures due to the overlap of the trestles and other structures.

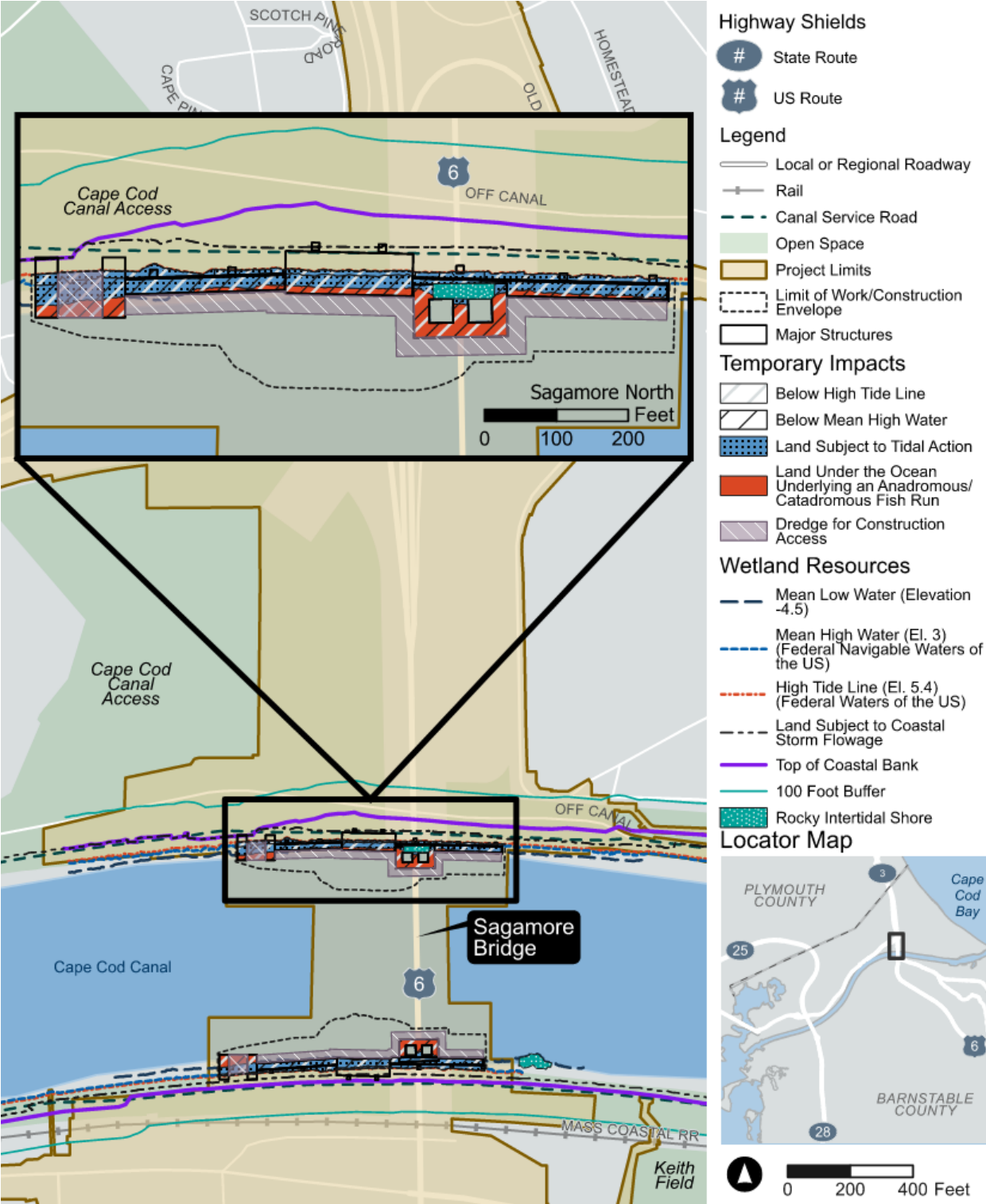
Most of the temporary occupations of water sheet below the MHW and HTL would extend to the limit of the navigational channel boundary. For temporary alterations to resource areas, the proposed bridge pier construction along the north and south sides of the canal at the Sagamore and Bourne Bridges would occupy an in-water work zone that varies between approximately 80,000 and 90,000 square feet at each set of piers. This is the area expected to be needed by the design-build contractor to stage, access, and construct the new piers and demolish the existing piers. Following construction, all temporary structures would be removed.

MassDOT has coordinated the design of the bridge pier protection system with USACE. The Build Alternative includes a riprap pier protection system to protect the new bridge piers, which would increase the permanent impact to state-regulated LUO, 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, installation of temporary structures, the new bridge piers, and riprap pier protection. The temporary work would occur within a construction envelope that remains unchanged from the DEIS filing in terms of size. The permanent alterations to the canal would increase due to the riprap pier protection. The Program work zone was refined to accommodate the riprap.

The Program includes activities in all four quadrant interchange approaches associated with road and parkland improvements north and south of 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.

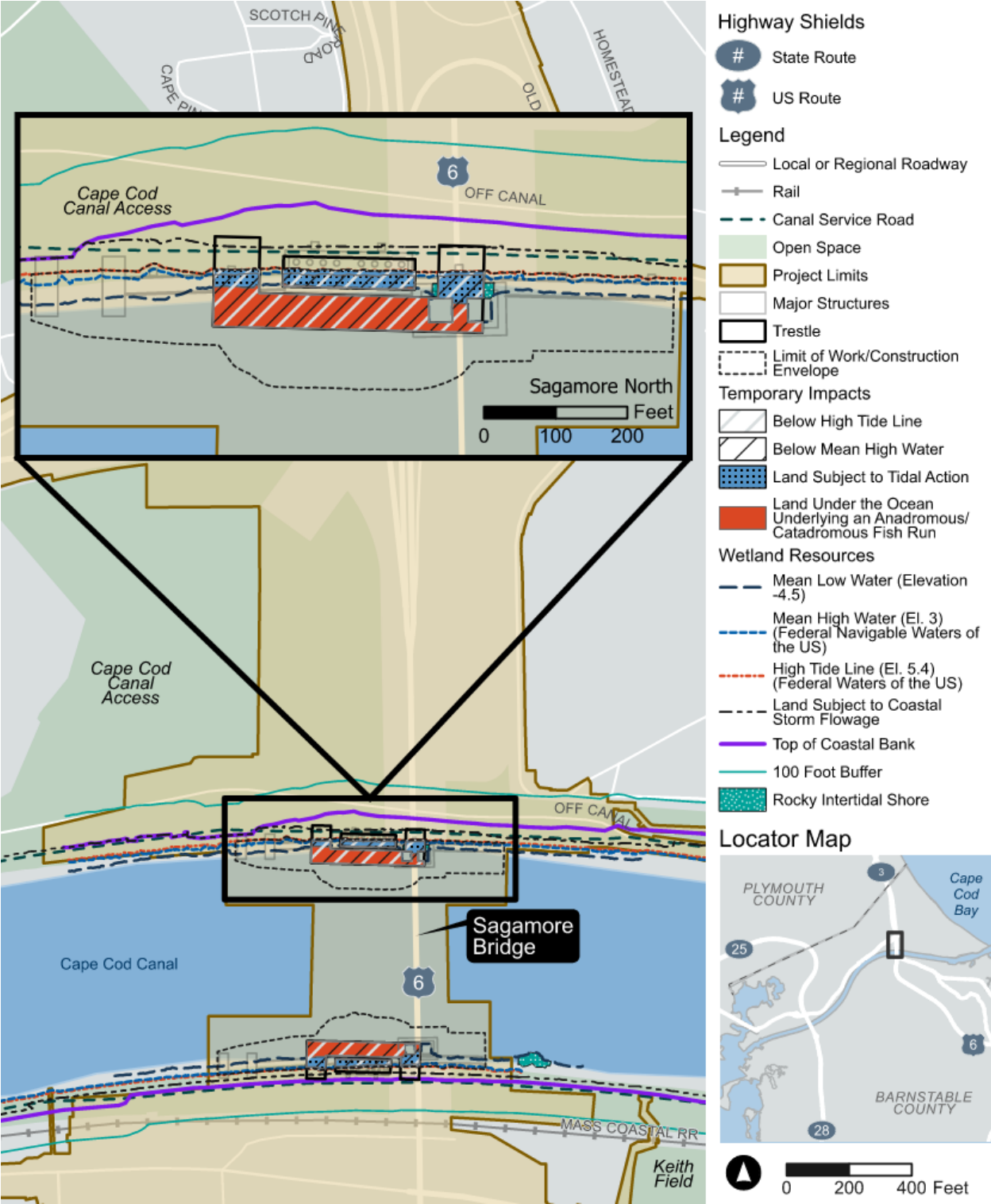
Permanent structures would include the new bridge piers and their foundations and riprap pier protection. The eelgrass beds within the Bourne North and Bourne South quadrants would be permanently impacted by the proposed riprap pier protection. Potential permanent impacts to state and federal coastal resources are shown in [Figure 7-12 through Figure 7-18](#).

Figure 7-4. Potential Temporary Impacts to State and Federal Coastal Resource Areas (Sagamore North Quadrant)



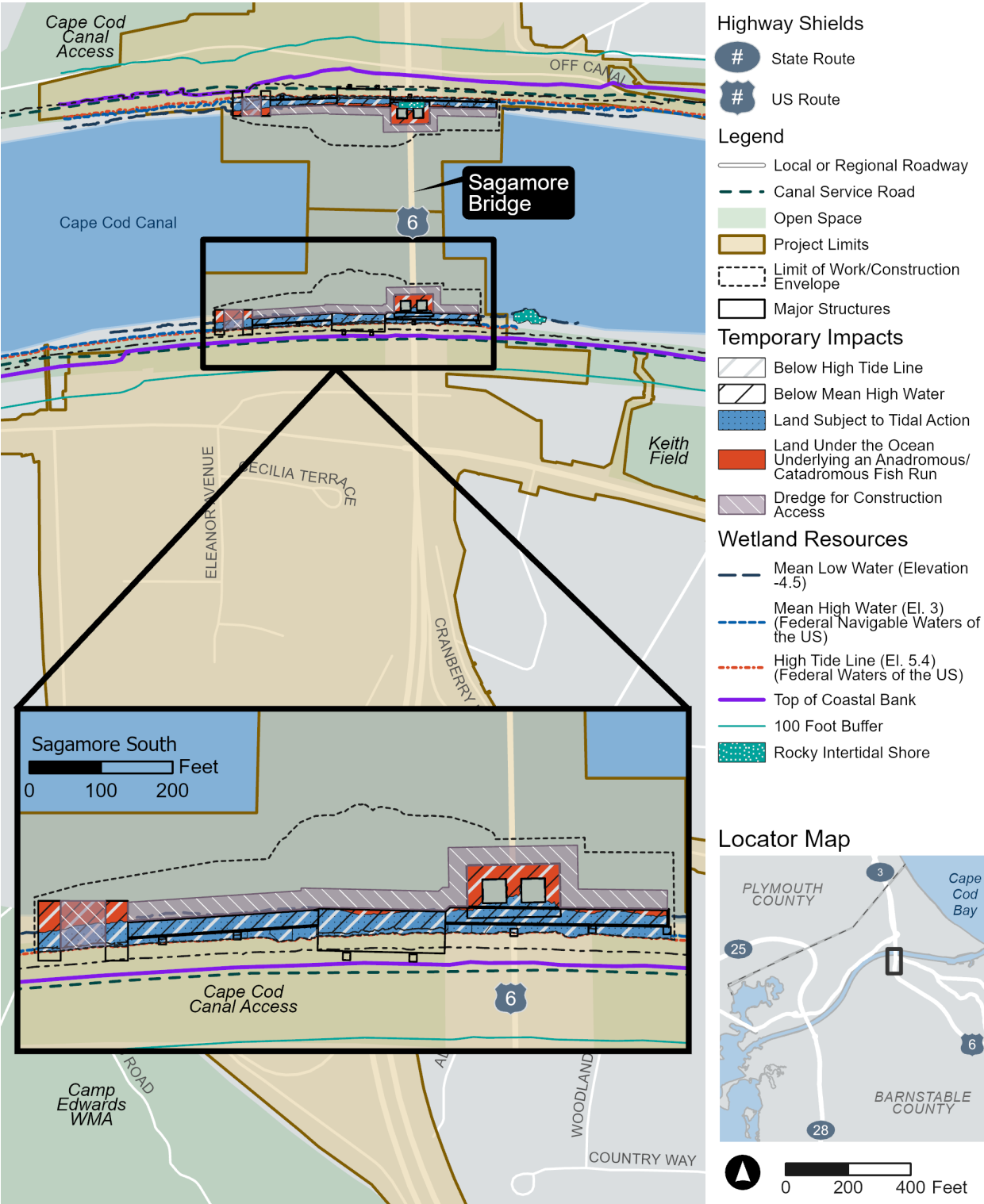
Source: Massachusetts Department of Transportation, 2026

Figure 7-5. Potential Temporary Trestle Impacts to State and Federal Coastal Resource Areas (Sagamore North Quadrant)



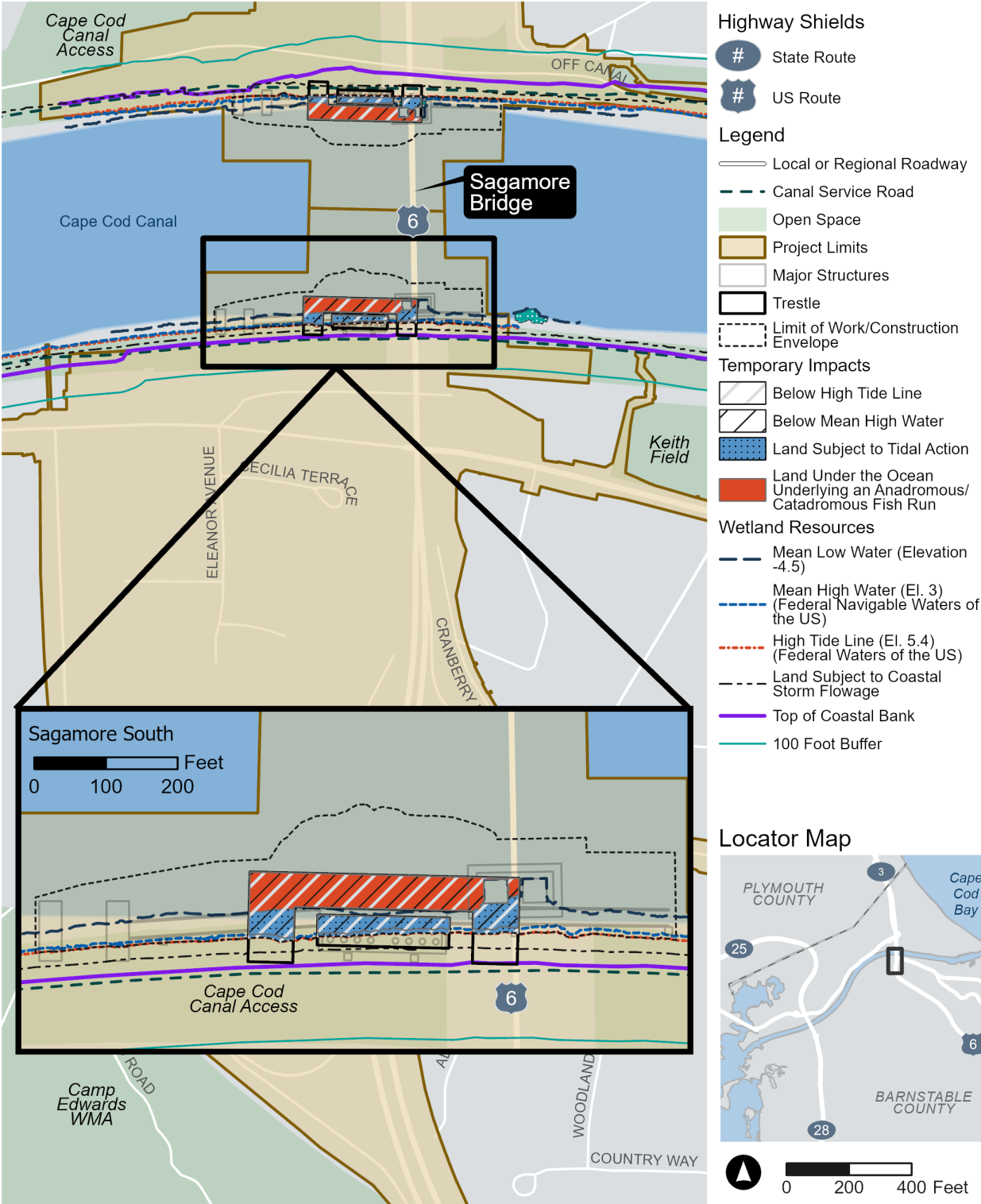
Source: Massachusetts Department of Transportation, 2026

**Figure 7-6. Potential Temporary Impacts to State and Federal Coastal Resource Areas (Sagamore South Quadrant)**



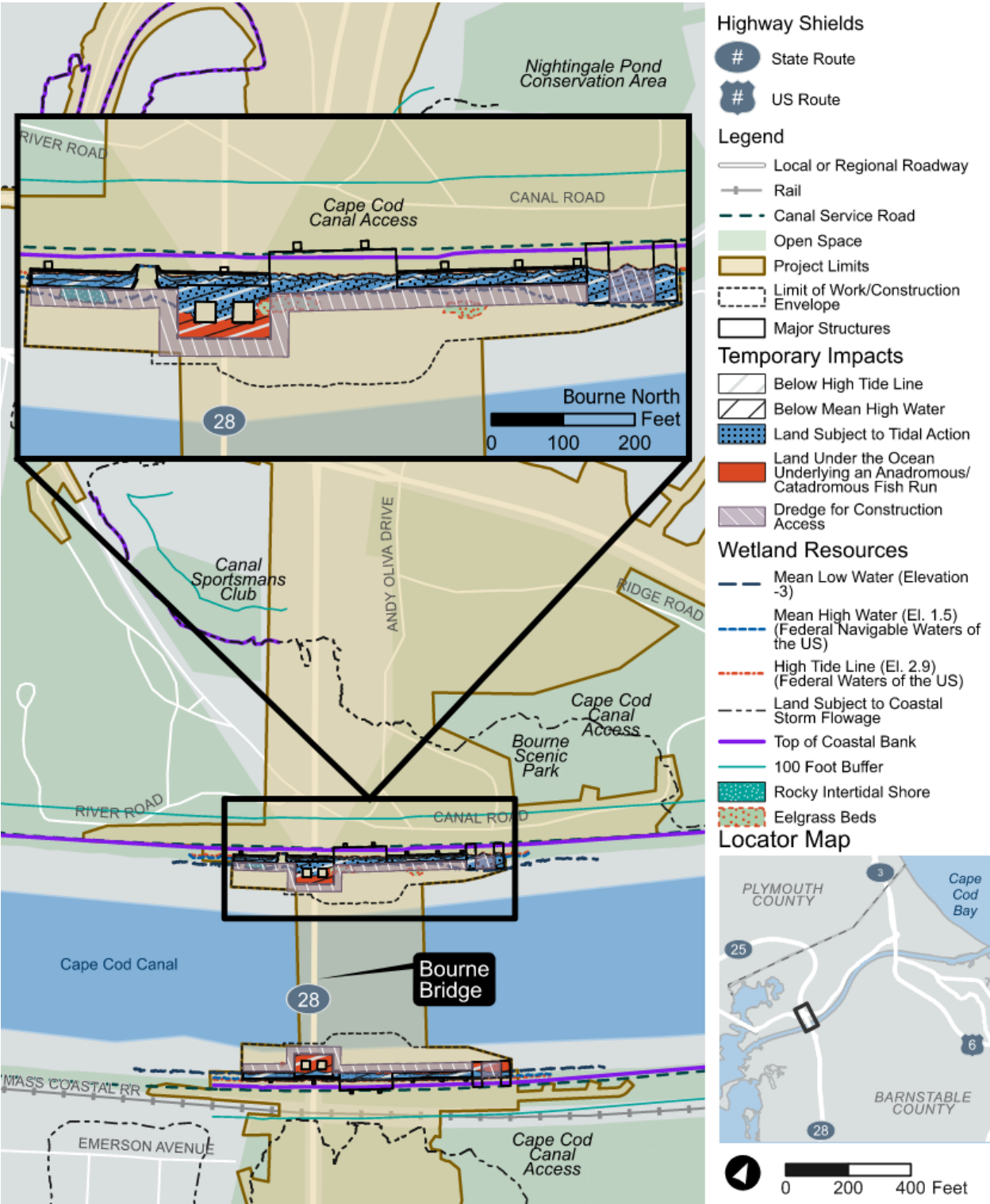
Source: Massachusetts Department of Transportation, 2026

**Figure 7-7. Potential Temporary Trestle Impacts to State and Federal Coastal Resource Areas (Sagamore South Quadrant)**



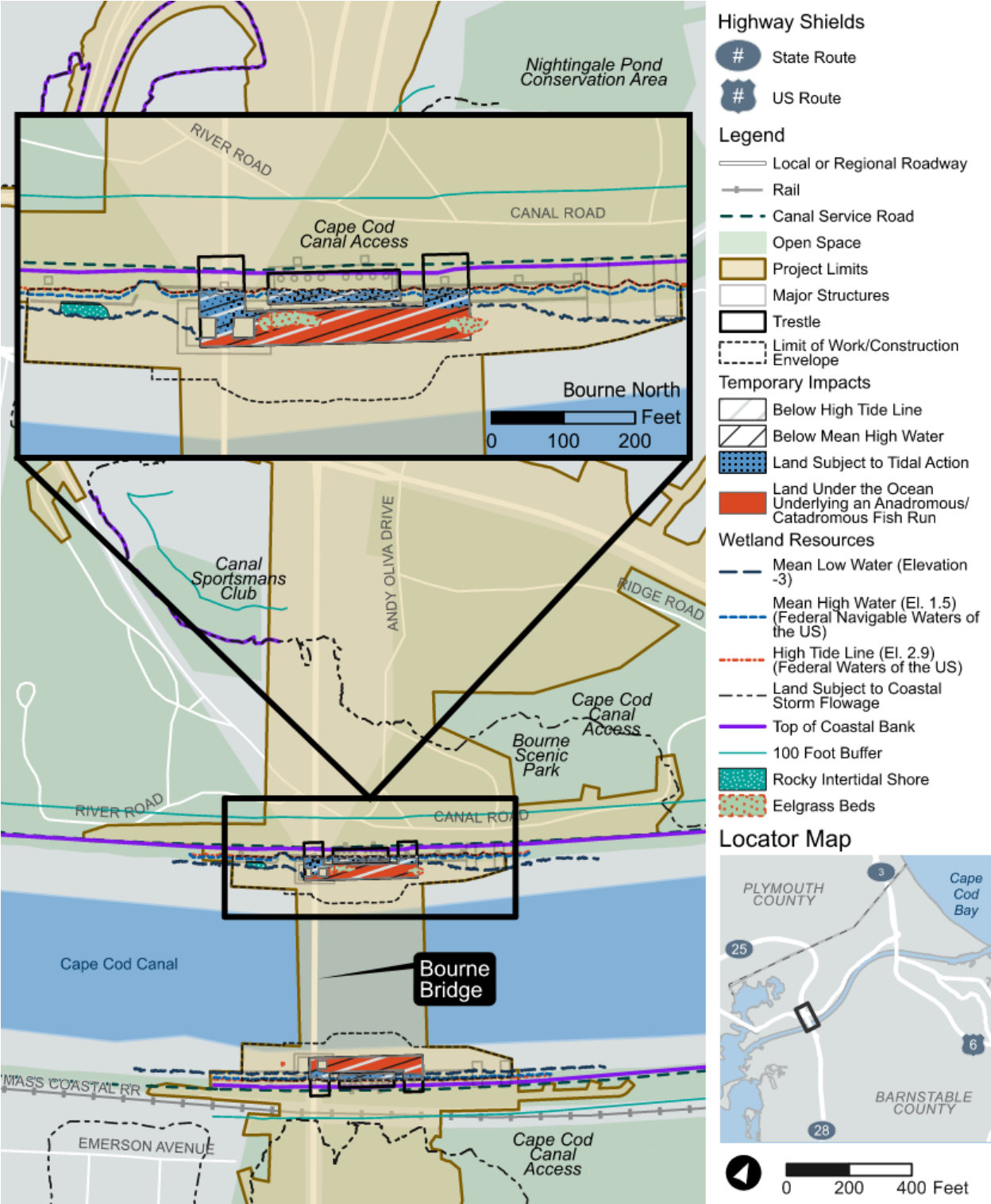
Source: Massachusetts Department of Transportation, 2026

Figure 7-8. Potential Temporary Impacts to State and Federal Coastal Resource Areas (Bourne North Quadrant)



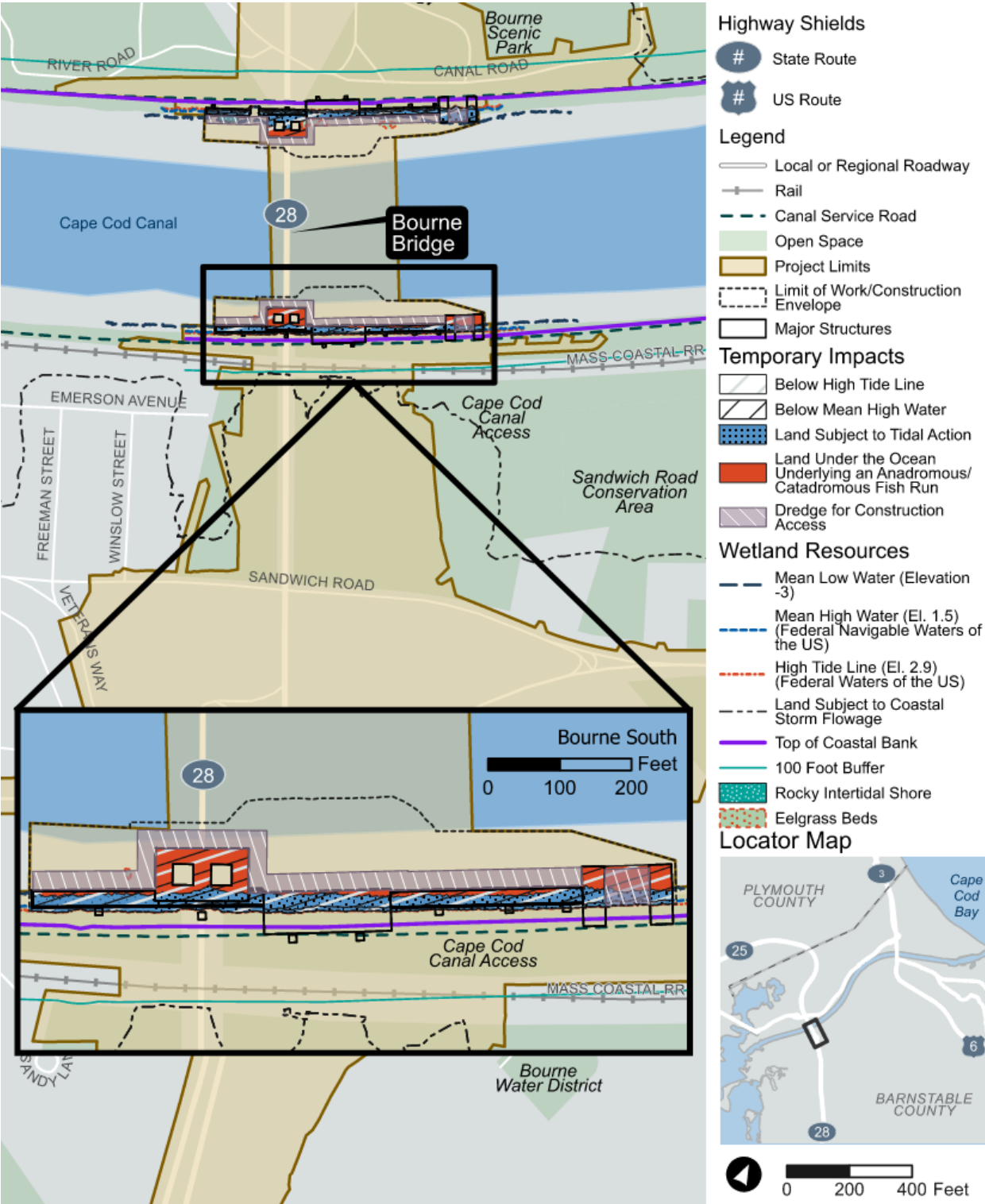
Source: Massachusetts Department of Transportation, 2026

Figure 7-9. Potential Temporary Trestle Impacts to State and Federal Coastal Resource Areas (Bourne North Quadrant)



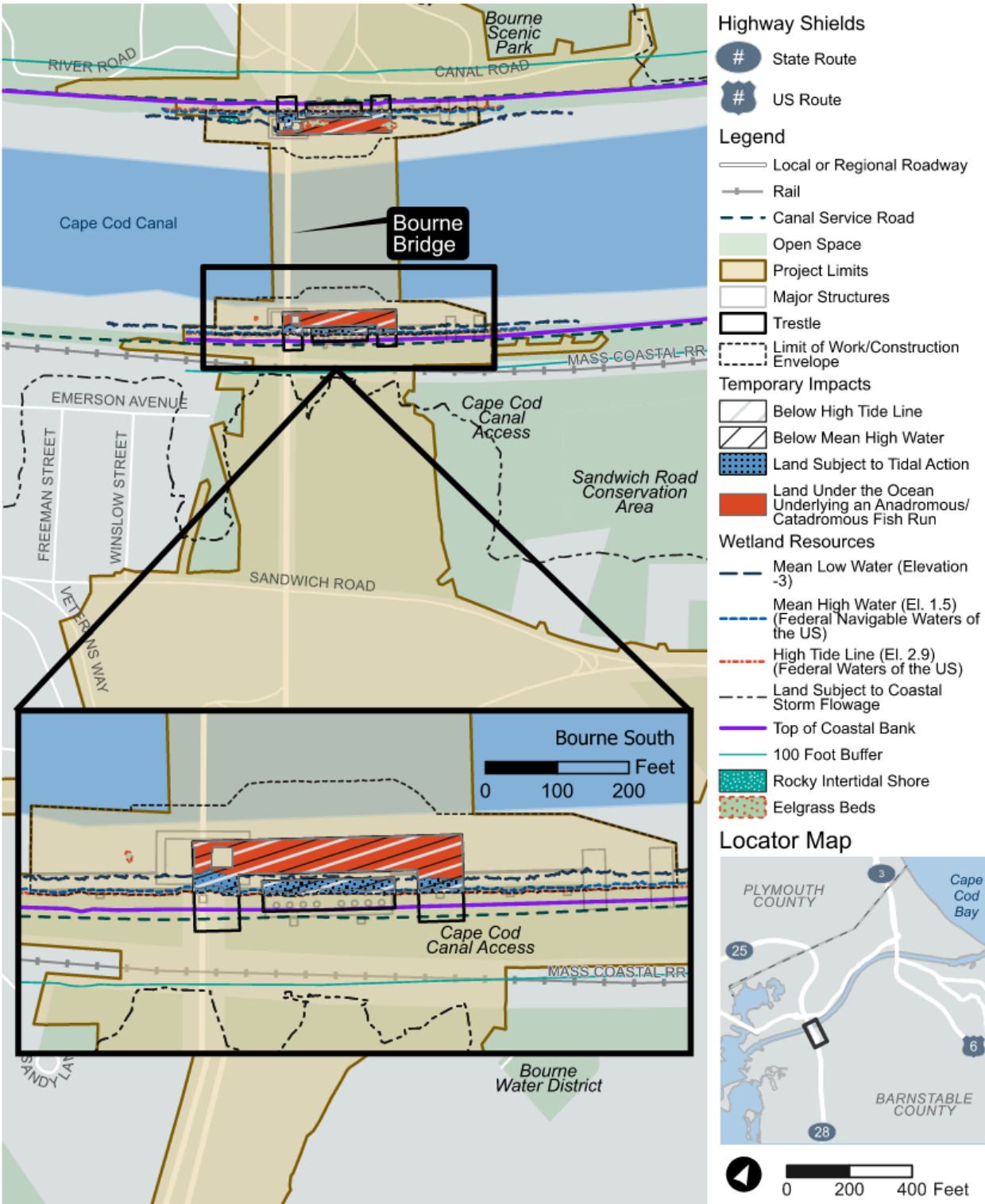
Source: Massachusetts Department of Transportation, 2026

Figure 7-10. Potential Temporary Impacts to State and Federal Coastal Resource Areas (Bourne South Quadrant)



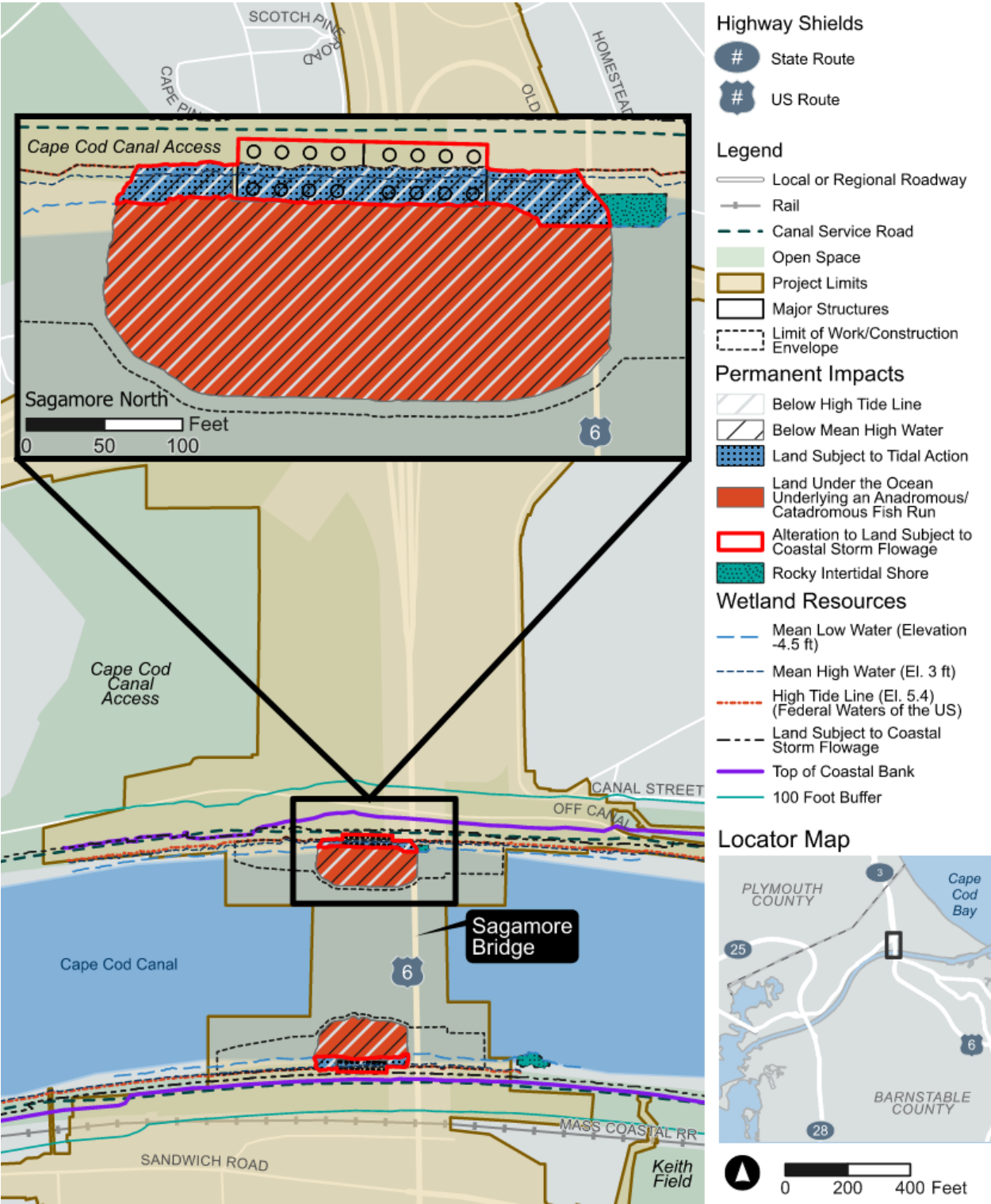
Source: Massachusetts Department of Transportation, 2026

Figure 7-11. Potential Temporary Trestle Impacts to State and Federal Coastal Resource Areas (Bourne South Quadrant)



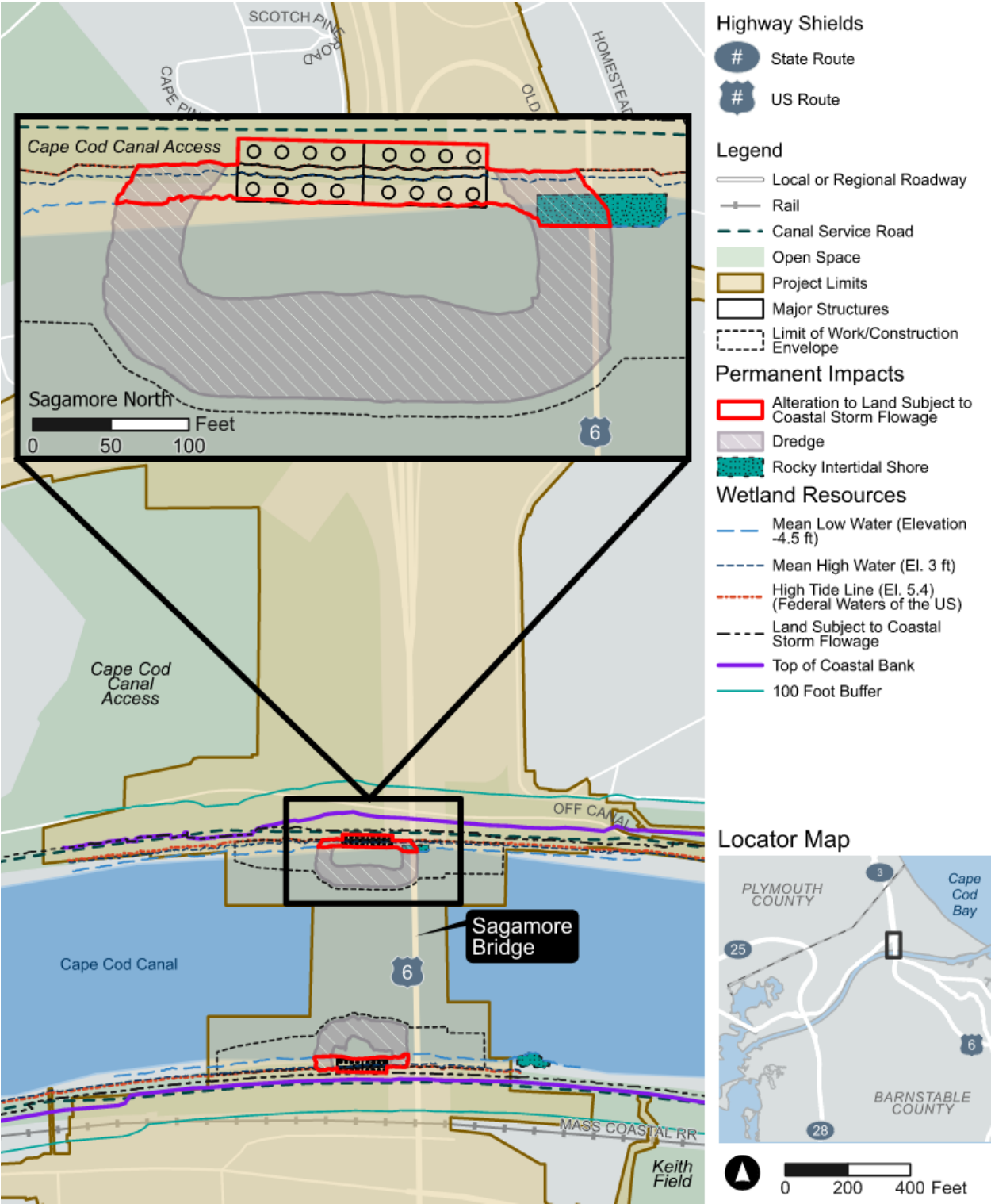
Source: Massachusetts Department of Transportation, 2026

Figure 7-12. Potential Permanent Fill Impacts to State and Federal Coastal Resource Areas (Sagamore North Quadrant)



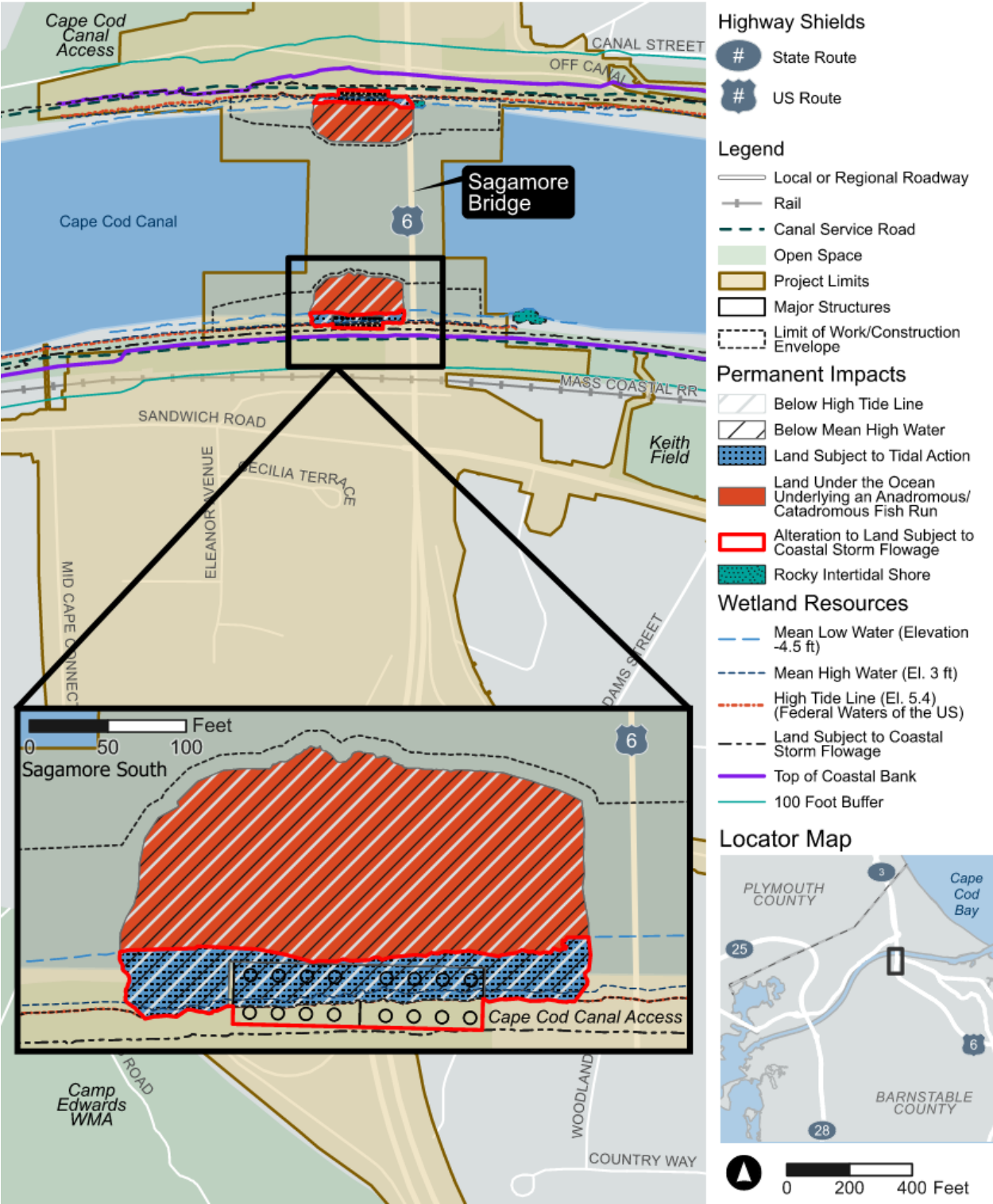
Source: Massachusetts Department of Transportation, 2026

Figure 7-13. Potential Dredge Impacts to State and Federal Coastal Resource Areas (Sagamore North Quadrant)



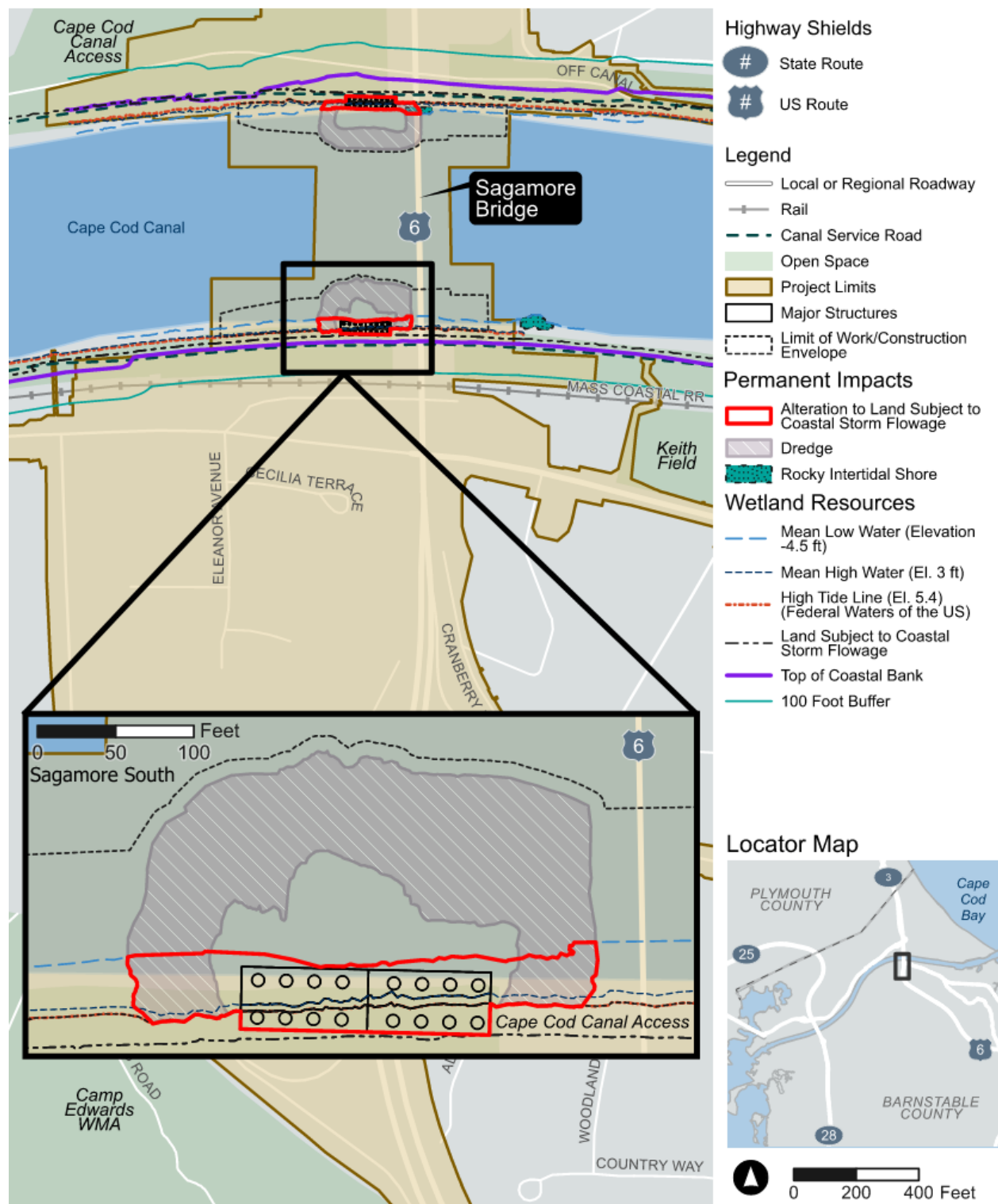
Source: Massachusetts Department of Transportation, 2026

Figure 7-14. Potential Permanent Fill Impacts to State and Federal Coastal Resource Areas (Sagamore South Quadrant)



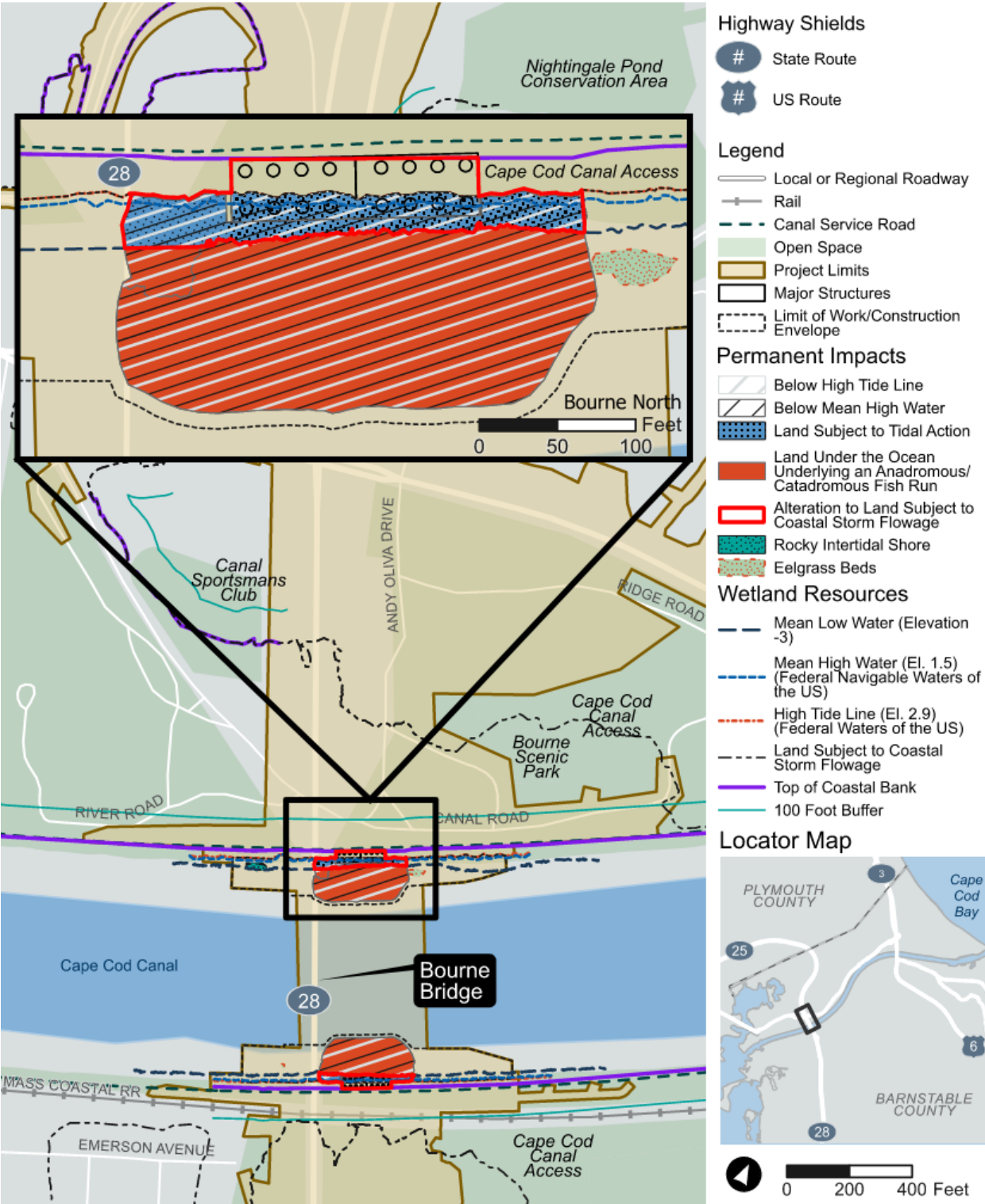
Source: Massachusetts Department of Transportation, 2026

Figure 7-15. Potential Dredge Impacts to State and Federal Coastal Resource Areas (Sagamore South Quadrant)



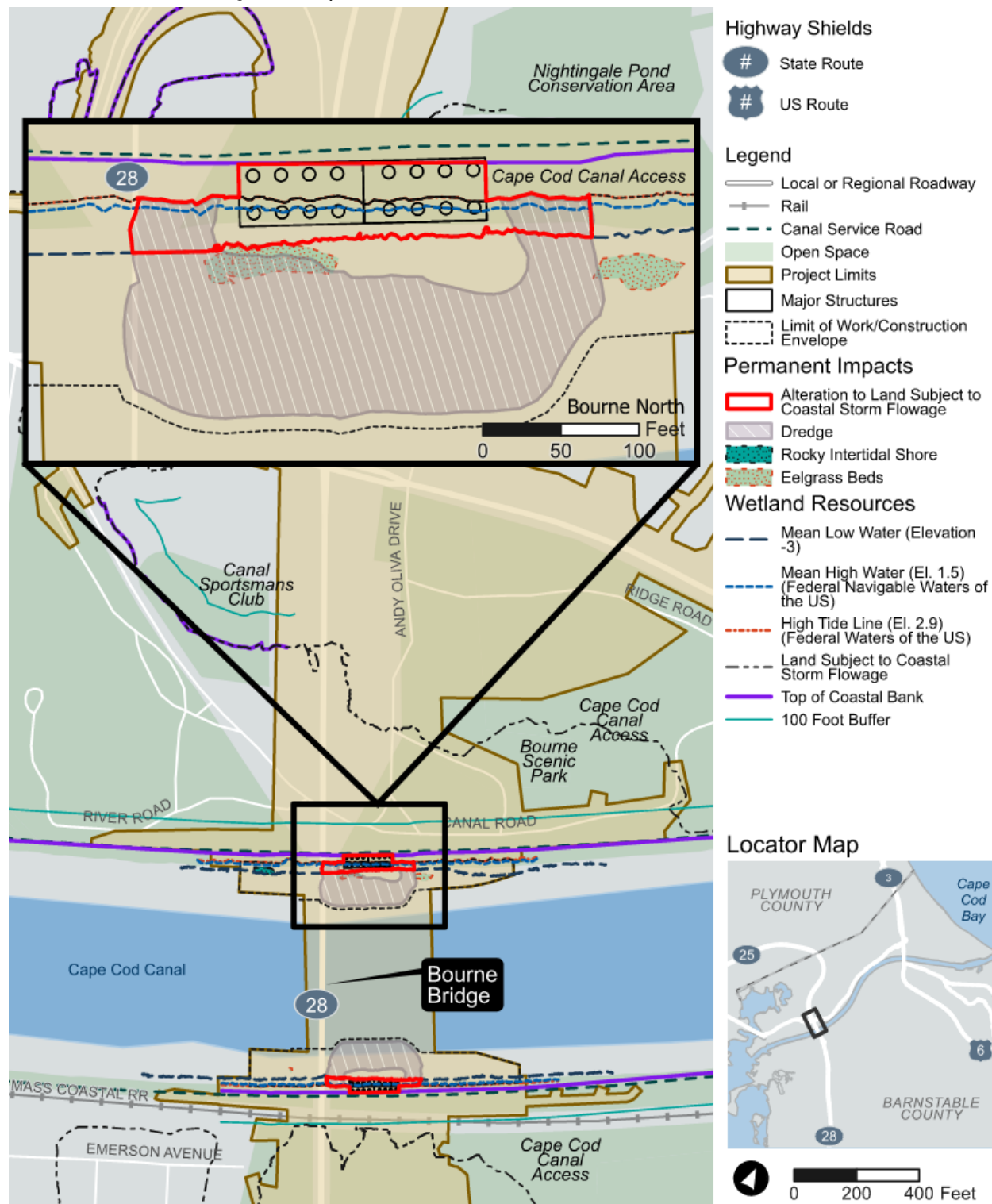
Source: Massachusetts Department of Transportation, 2026

Figure 7-16. Potential Permanent Fill Impacts to State and Federal Coastal Resource Areas (Bourne North Quadrant)



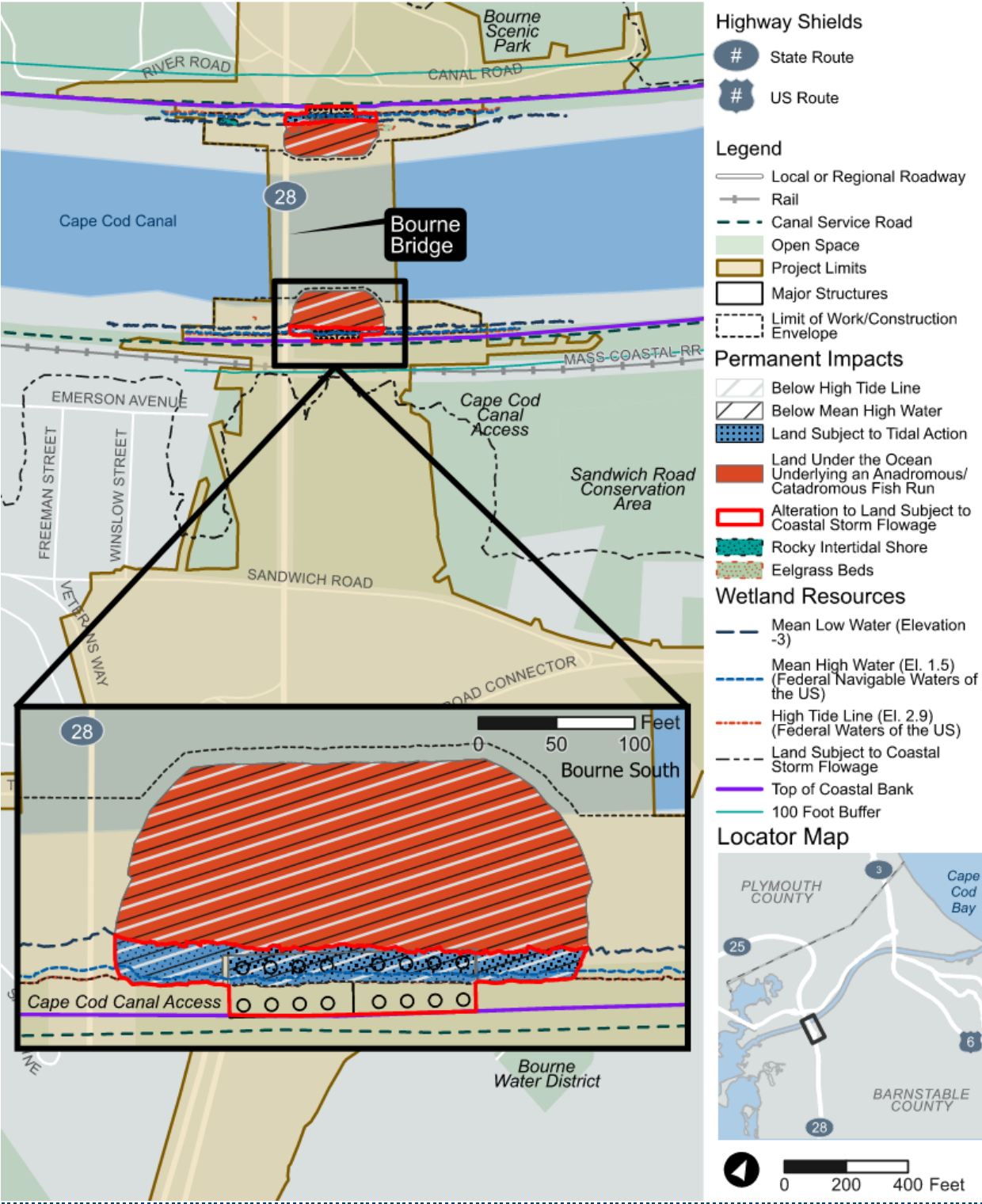
Source: Massachusetts Department of Transportation, 2026

Figure 7-17. Potential Dredge Impacts to State and Federal Coastal Resource Areas (Bourne North Quadrant)



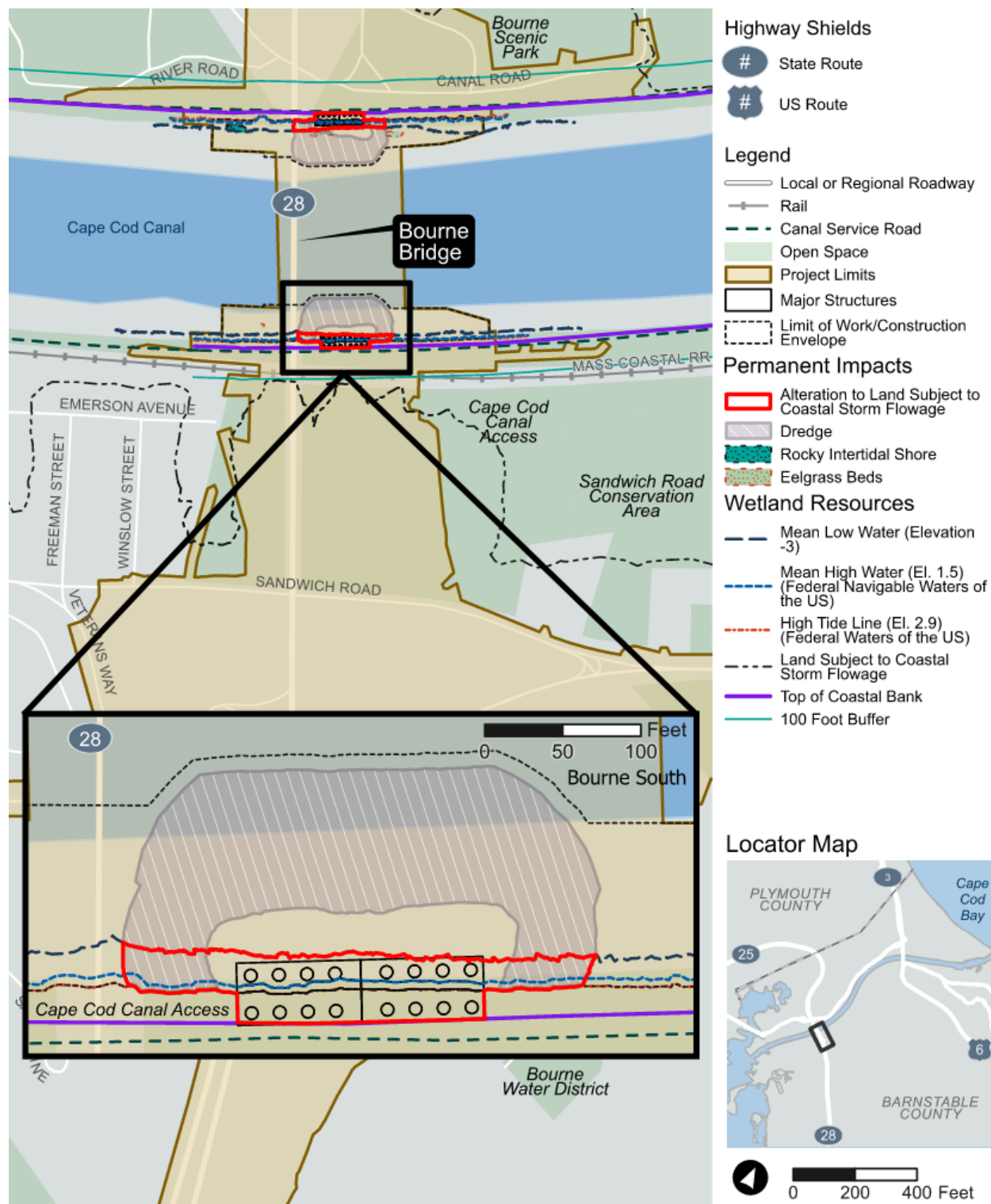
Source: Massachusetts Department of Transportation, 2026

Figure 7-18. Potential Permanent Fill Impacts to State and Federal Coastal Resource Areas (Bourne South Quadrant)



Source: Massachusetts Department of Transportation, 2026

Figure 7-19. Potential Permanent Dredge to State and Federal Coastal Resource Areas (Bourne South Quadrant)



Source: Massachusetts Department of Transportation, 2026

**Table 7-3** and **Table 7-4** summarize the proposed temporary and permanent impacts to state and federal coastal resources for the Sagamore and Bourne bridges. **Table 7-5 through Table 7-8** provide detailed assessments of these impacts by proposed activity for each bridge quadrant.

Note: The following is provided in support of the information presented in **Table 7-3 through Table 7-8**:

- Quantities are provided below HTL as an estimate based on the current level of design. Permit applications will include dredge quantities below MHW based on regulatory requirements.
- LSCSF impacts are calculated for permanent impacts or losses only. Because the two resources overlap, LSTA impacts are included in the LSCSF impacts.
- The temporary and permanent impacts to resource areas presented herein are preliminary and subject to change as the design advances.
- The Build Alternative would result in impacts to Land Containing Shellfish and LUO Underlying a Fish Run, both of which are regulated under the Massachusetts Wetlands Protection Act and its implementing regulations. Impacts to Land Containing Shellfish are based on field observations. Impacts to LUO Underlying a Fish Run are based on the impacts to LUO.

**Table 7-3. Potential Impacts to State and Federal Coastal Resource Areas (Sagamore Bridge)**

| Resource Area |                                            | Temporary Impacts                                                         | Permanent Impacts                     | Reason for Impact <sup>[1]</sup>                                                                                                                                                                                                                                                                                     |
|---------------|--------------------------------------------|---------------------------------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Federal       | <u>Waters of the United States (WOTUS)</u> | <u>129,000 square feet (sf) (3.0 acres)/ 37,200 cubic yards (cy) fill</u> | 87,500 sf (2.0 acres)/ 36,200 cy fill | <ul style="list-style-type: none"> <li>• Temporary: cofferdams, <u>containment cells</u>, <u>sheetpile/bulkheads</u>, <u>work trestle piles</u>, docks, dolphins, <u>riprap for pile-supported structures</u>, and <u>excavation/dredge</u></li> <li>• Permanent: bridge piers and riprap pier protection</li> </ul> |
|               | WOTUS – (Excavation/ Dredge)               | <u>85,700 sf (2.0 acres)/81,200 cy</u>                                    | <u>0 sf (0 acres)/0 cy</u>            | <ul style="list-style-type: none"> <li>• <u>Temporary</u>: cofferdams, <u>containment cells</u>, and dredge for navigation access to temporary structures and riprap <u>and</u> structure removal, <u>and installation of piers and riprap pier protection</u></li> </ul>                                            |

| Resource Area |                                                                                  | Temporary Impacts                   | Permanent Impacts | Reason for Impact <sup>[1]</sup>                                                                                                                                                                                                                                                                                                              |
|---------------|----------------------------------------------------------------------------------|-------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| State         | Land Under the Ocean (LUO) and LUO Underlying an Anadromous/Catadromous Fish Run | 39,500 sf                           | 73,000 sf         | <ul style="list-style-type: none"> <li>Temporary: cofferdams, <a href="#">containment cells</a>, <a href="#">sheetpile/bulkheads</a>, work trestle piles, docks, dolphins, <a href="#">riprap for pile-supported structures</a>, and excavation/dredge</li> <li>Permanent: <a href="#">bridge</a> piers and riprap pier protection</li> </ul> |
|               | Coastal Bank                                                                     | 1,700 linear feet                   | 0 linear feet     | <ul style="list-style-type: none"> <li>Temporary: cofferdams, <a href="#">containment cells</a>, <a href="#">sheetpile/bulkheads</a>, work trestle piles/<a href="#">riprap</a>, bollards, and docks</li> </ul>                                                                                                                               |
|               | Rocky Intertidal Shore                                                           | 800 sf                              | 900 sf            | <ul style="list-style-type: none"> <li>Temporary: <a href="#">dredging within containment cell for pier demolition and vessel access</a></li> <li>Permanent: riprap pier protection <a href="#">and restoration</a></li> </ul>                                                                                                                |
|               | Land Subject to Tidal Action                                                     | <a href="#">Included with LSCSF</a> |                   |                                                                                                                                                                                                                                                                                                                                               |
|               | Land Subject to Coastal Storm Flowage                                            | 34,500 sf                           | 26,600 sf         | <ul style="list-style-type: none"> <li>Temporary: cofferdams, <a href="#">sheetpile/bulkheads</a>, work trestle piles/<a href="#">riprap</a>, bollards, and docks</li> <li>Permanent: <a href="#">bridge</a> piers and riprap pier protection</li> </ul>                                                                                      |
|               | Land Containing Shellfish                                                        | 7,000 sf                            | 2,400 sf          | <ul style="list-style-type: none"> <li>Temporary: <a href="#">cofferdams, work trestle piles/riprap, bollards, and docks</a></li> <li>Permanent: <a href="#">piers and riprap pier protection</a></li> </ul>                                                                                                                                  |

<sup>[1]</sup> 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 7-4. Potential Impacts to State and Federal Coastal Resource Areas (Bourne Bridge)

| Resource Area |                                                                                                                     | Temporary Impacts                                                                  | Permanent Impacts                                     | Reason for Impact <sup>[1]</sup>                                                                                                                                                                                                                                                                                                                               |
|---------------|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Federal       | Waters of the United States (WOTUS)                                                                                 | <a href="#">134,000 square feet (sf) (3.1 acres)/ 37,400 cubic yards (cy) fill</a> | <a href="#">78,800 sf (1.8 acres)/ 31,000 cy fill</a> | <ul style="list-style-type: none"><li>• Temporary: cofferdams, <a href="#">containment cells</a>, <a href="#">sheetpile/bulkheads</a>, <a href="#">work trestle piles</a>, docks, dolphins, <a href="#">riprap for pile-supported structures</a>, and <a href="#">excavation/dredge</a></li><li>• Permanent: bridge piers and riprap pier protection</li></ul> |
|               | WOTUS – (Excavation/ Dredge)                                                                                        | <a href="#">98,700 sf (2.3 acres)/ 85,700 cy</a>                                   | <a href="#">0 sf (0 acres)/ 0 cy</a>                  | <ul style="list-style-type: none"><li>• <a href="#">Temporary</a>: cofferdams, <a href="#">containment cells</a>, dredge for navigation access to temporary structures, riprap and structure removal, <a href="#">and installation of piers and riprap pier protection</a></li></ul>                                                                           |
|               | Eelgrass                                                                                                            | <a href="#">0 sf</a>                                                               | <a href="#">2,545 sf</a>                              | <ul style="list-style-type: none"><li>• <a href="#">Permanent</a>: <a href="#">dredging and riprap pier protection</a></li></ul>                                                                                                                                                                                                                               |
| State         | Land Under the Ocean ( <a href="#">LUO</a> ) and <a href="#">LUO Underlying an Anadromous/ Catadromous Fish Run</a> | <a href="#">35,100 sf</a>                                                          | <a href="#">63,200 sf</a>                             | <ul style="list-style-type: none"><li>• Temporary: cofferdams, <a href="#">containment cells</a>, <a href="#">sheetpile/bulkheads</a>, work trestle piles, docks, dolphins, <a href="#">riprap for pile-supported structures</a> and excavation/dredge</li><li>• Permanent: <a href="#">bridge</a> piers and riprap pier protection</li></ul>                  |
|               | Coastal Bank                                                                                                        | 1,760 linear feet                                                                  | 0 linear feet                                         | <ul style="list-style-type: none"><li>• Temporary: cofferdams, <a href="#">containment cells</a>, <a href="#">sheetpile/bulkheads</a>, work trestle piles/riprap, bollards, and docks</li></ul>                                                                                                                                                                |
|               | Rocky Intertidal Shore                                                                                              | <a href="#">1,200 sf</a>                                                           | <a href="#">0 sf</a>                                  | <ul style="list-style-type: none"><li>• Temporary: <a href="#">sheetpile/bulkheads</a> and excavation/dredge</li></ul>                                                                                                                                                                                                                                         |
|               | Land Subject to Tidal Action                                                                                        | <a href="#">Included with Land Subject to Coastal Storm Flowage (LSCSF)</a>        |                                                       |                                                                                                                                                                                                                                                                                                                                                                |
|               | LSCSF                                                                                                               | <a href="#">50,200 sf</a>                                                          | <a href="#">25.6 acres<sup>[2]</sup></a>              | <ul style="list-style-type: none"><li>• Temporary: cofferdams, work trestle piles, bollards, and docks</li><li>• Permanent: piers and riprap pier protection</li></ul>                                                                                                                                                                                         |
|               | <a href="#">Land Containing Shellfish</a>                                                                           | <a href="#">726 sf</a>                                                             | <a href="#">539 sf</a>                                | <ul style="list-style-type: none"><li>• <a href="#">Temporary</a>: cofferdams, <a href="#">work trestle piles/riprap</a>, <a href="#">bollards</a>, and <a href="#">docks</a></li><li>• <a href="#">Permanent</a>: <a href="#">piers and riprap pier protection</a></li></ul>                                                                                  |

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

<sup>[2]</sup> 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 or 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 further development of preliminary design.

**Table 7-5. Detailed Potential Impacts to State and Federal Coastal Resource Areas (Sagamore North Quadrant)**

| Resource Area |                                                                                   | Temporary Impacts                                                | Permanent Impacts                   | Reason for Impact                                                                                                                                                                                                                                                           |
|---------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Federal       | Waters of the United States (WOTUS)                                               | 62,200 square feet (sf) (1.4 acres)/18,500 cubic yards (cy) fill | 45,100 sf (1.0 acre)/19,800 cy fill | <ul style="list-style-type: none"><li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures, and excavation/dredge</li><li>Permanent: bridge piers and riprap pier protection</li></ul>  |
|               | WOTUS – (Excavation/ Dredge)                                                      | 42,500 sf (1.0 acre)/41,900 cy                                   | 0 sf (0 acres)/0 cy                 | <ul style="list-style-type: none"><li>Temporary: cofferdams, containment cells, and dredge for navigation access to temporary structures and riprap and structure removal, and installation of piers and riprap pier protection</li></ul>                                   |
| State         | Land Under the Ocean (LUO) and LUO Underlying an Anadromous/ Catadromous Fish Run | 17,500 sf                                                        | 38,500 sf                           | <ul style="list-style-type: none"><li>Temporary: cofferdams, containment cells, sheetpile/ bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures, and excavation/dredge</li><li>Permanent: bridge piers and riprap pier protection</li></ul> |
|               | Coastal Bank                                                                      | 850 linear feet                                                  | 0 linear feet                       | <ul style="list-style-type: none"><li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles/riprap, bollards, and docks</li></ul>                                                                                                               |

| Resource Area |                                       | Temporary Impacts   | Permanent Impacts | Reason for Impact                                                                                                                                                                                        |
|---------------|---------------------------------------|---------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | Rocky Intertidal Shore                | 800 sf              | 900 sf            | <ul style="list-style-type: none"> <li>Temporary: dredging within containment cell for pier demolition and vessel access</li> <li>Permanent: riprap pier protection and restoration</li> </ul>           |
|               | Land Subject to Tidal Action          | Included with LSCSF |                   |                                                                                                                                                                                                          |
|               | Land Subject to Coastal Storm Flowage | 16,600 sf           | 13,500 sf         | <ul style="list-style-type: none"> <li>Temporary: cofferdams, sheetpile/bulkheads, work trestle piles/riprap, bollards, and docks</li> <li>Permanent: bridge piers and riprap pier protection</li> </ul> |
|               | Land Containing Shellfish             | 4,400 sf            | 1,200 sf          | <ul style="list-style-type: none"> <li>Temporary: cofferdams, work trestle piles/riprap, bollards, and docks</li> <li>Permanent: piers and riprap pier protection</li> </ul>                             |

Table 7-6. Detailed Potential Impacts to State and Federal Coastal Resources (Sagamore South Quadrant)

| Resource Area |                                     | Temporary Impacts                                                    | Permanent Impacts                       | Reason for Impact <sup>[1]</sup>                                                                                                                                                                                                                                              |
|---------------|-------------------------------------|----------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Federal       | Waters of the United States (WOTUS) | 66,800 square feet (sf) (1.5 acres)/<br>18,700 cubic yards (cy) fill | 42,400 sf (1.0 acre)/<br>16,400 cy fill | <ul style="list-style-type: none"> <li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures, and excavation/dredge</li> <li>Permanent: bridge piers and riprap pier protection</li> </ul> |
|               | WOTUS – (Excavation/ Dredge)        | 43,200 sf (1.0 acre)/<br>39,300 cy                                   | 0 sf (0 acres)/0 cy                     | <ul style="list-style-type: none"> <li>Temporary: cofferdams, containment cells, and dredge for navigation access to temporary structures and riprap and structure removal, and installation of piers and riprap pier protection</li> </ul>                                   |

| Resource Area |                                                                                  | Temporary Impacts   | Permanent Impacts | Reason for Impact <sup>[1]</sup>                                                                                                                                                                                                                                              |
|---------------|----------------------------------------------------------------------------------|---------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| State         | Land Under the Ocean (LUO) and LUO Underlying an Anadromous/Catadromous Fish Run | 22,000 sf           | 34,500 sf         | <ul style="list-style-type: none"> <li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures, and excavation/dredge</li> <li>Permanent: bridge piers and riprap pier protection</li> </ul> |
|               | Coastal Bank                                                                     | 850 linear feet     | 0 linear feet     | <ul style="list-style-type: none"> <li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles/riprap, bollards, and docks</li> </ul>                                                                                                               |
|               | Rocky Intertidal Shore                                                           | 0 sf                | 0 sf              | N/A                                                                                                                                                                                                                                                                           |
|               | Land Subject to Tidal Action                                                     | Included with LSCSF |                   |                                                                                                                                                                                                                                                                               |
|               | Land Subject to Coastal Storm Flowage                                            | 17,900 sf           | 13,100 sf         | <ul style="list-style-type: none"> <li>Temporary: cofferdams, sheetpile/bulkheads, work trestle piles/riprap, bollards, and docks</li> <li>Permanent: bridge piers and riprap pier protection</li> </ul>                                                                      |
|               | Land Containing Shellfish                                                        | 2,600 sf            | 1,200 sf          | <ul style="list-style-type: none"> <li>Temporary: cofferdams, work trestle piles/riprap, bollards, and docks</li> <li>Permanent: piers and riprap pier protection</li> </ul>                                                                                                  |

Table 7-7. Detailed Potential Impacts to State and Federal Coastal Resources (Bourne North Quadrant)

| Resource Area |                                                                                  | Temporary Impacts                                                | Permanent Impacts                    | Reason for Impact                                                                                                                                                                                                                                                          |
|---------------|----------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Federal       | Waters of the United States (WOTUS)                                              | 64,700 square feet (sf) (1.5 acres)/18,700 cubic yards (cy) fill | 39,300 sf (0.9 acres)/15,500 cy fill | <ul style="list-style-type: none"><li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures, and excavation/dredge</li><li>Permanent: bridge piers and riprap pier protection</li></ul> |
|               | WOTUS - dredge                                                                   | 48,400 sf (1.1 acres)/42,400 cy                                  | 0 sf (0 acres)/0 cy                  | <ul style="list-style-type: none"><li>Temporary: cofferdams, containment cells, dredge for navigation access to temporary structures, riprap and structure removal, and installation of piers and riprap pier protection</li></ul>                                         |
|               | Eelgrass                                                                         | 0 sf                                                             | 2,445 sf                             | <ul style="list-style-type: none"><li>Permanent: dredging and riprap pier protection</li></ul>                                                                                                                                                                             |
| State         | Land Under the Ocean (LUO) and LUO Underlying an Anadromous/Catadromous Fish Run | 11,600 sf                                                        | 31,200 sf                            | <ul style="list-style-type: none"><li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures and excavation/dredge</li><li>Permanent: bridge piers and riprap pier protection</li></ul>  |
|               | Coastal Bank                                                                     | 900 linear feet                                                  | 0 linear feet                        | <ul style="list-style-type: none"><li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles/riprap, bollards, and docks</li></ul>                                                                                                              |
|               | Rocky Intertidal Shore                                                           | 1,200 sf                                                         | 0 sf                                 | <ul style="list-style-type: none"><li>Temporary: sheetpile/bulkheads and excavation/dredge</li></ul>                                                                                                                                                                       |
|               | Land Subject to Tidal Action                                                     | Included in LSCSF impact                                         |                                      |                                                                                                                                                                                                                                                                            |
|               | Land Subject to Coastal Storm Flowage                                            | 30,200 sf                                                        | 17 acres                             | <ul style="list-style-type: none"><li>Temporary: cofferdams, work trestle piles, bollards, and docks</li><li>Permanent: piers and riprap pier protection, and work in approaches (ramps, abutments, parkland improvements)</li></ul>                                       |

| Resource Area |                           | Temporary Impacts | Permanent Impacts | Reason for Impact                                                                                                                                                            |
|---------------|---------------------------|-------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | Land Containing Shellfish | 333 sf            | 283 sf            | <ul style="list-style-type: none"> <li>Temporary: cofferdams, work trestle piles/riprap, bollards, and docks</li> <li>Permanent: piers and riprap pier protection</li> </ul> |

Table 7-8. Detailed Potential Impacts to State and Federal Coastal Resources (Bourne South Quadrant)

| Resource Area |                                                                                  | Temporary Impacts                                                    | Permanent Impacts                        | Reason for Impact <sup>[1]</sup>                                                                                                                                                                                                                                              |
|---------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Federal       | Waters of the United States (WOTUS)                                              | 69,300 square feet (sf) (1.6 acres)/<br>18,700 cubic yards (cy) fill | 39,300 sf (0.9 acres)/<br>15,500 cy fill | <ul style="list-style-type: none"> <li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures, and excavation/dredge</li> <li>Permanent: bridge piers and riprap pier protection</li> </ul> |
|               | WOTUS - dredge                                                                   | 50,300 sf (1.2 acres)/<br>43,300 cy                                  | 0 sf (0 acres)/<br>0 cy                  | <ul style="list-style-type: none"> <li>Temporary: cofferdams, containment cells, dredge for navigation access to temporary structures, riprap and structure removal, and installation of piers and riprap pier protection</li> </ul>                                          |
|               | Eelgrass                                                                         | 0 sf                                                                 | 100 sf                                   | <ul style="list-style-type: none"> <li>Permanent: dredging and riprap pier protection</li> </ul>                                                                                                                                                                              |
| State         | Land Under the Ocean (LUO) and LUO Underlying an Anadromous/Catadromous Fish Run | 23,500 sf                                                            | 32,000 sf                                | <ul style="list-style-type: none"> <li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles, docks, dolphins, riprap for pile-supported structures and excavation/dredge</li> <li>Permanent: bridge piers and riprap pier protection</li> </ul>  |
|               | Coastal Bank                                                                     | 860 linear feet                                                      | 0 linear feet                            | <ul style="list-style-type: none"> <li>Temporary: cofferdams, containment cells, sheetpile/bulkheads, work trestle piles/riprap, bollards, and docks</li> </ul>                                                                                                               |
|               | Rocky Intertidal Shore                                                           | 0 sf                                                                 | 0 sf                                     | N/A                                                                                                                                                                                                                                                                           |
|               | Land Subject to Tidal Action                                                     | Included in LSCSF impact                                             |                                          |                                                                                                                                                                                                                                                                               |

| Resource Area |                                       | Temporary Impacts | Permanent Impacts | Reason for Impact <sup>[1]</sup>                                                                                                                                                                                                            |
|---------------|---------------------------------------|-------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | Land Subject to Coastal Storm Flowage | 20,000 sf         | 8 acres           | <ul style="list-style-type: none"> <li>• Temporary: cofferdams, work trestle piles, bollards, and docks</li> <li>• Permanent: piers and riprap pier protection, and work in approaches (ramps, abutments, parkland improvements)</li> </ul> |
|               | Land Containing Shellfish             | 393 sf            | 256 sf            | <ul style="list-style-type: none"> <li>• Temporary: cofferdams, work trestle piles/riprap, bollards, and docks</li> <li>• Permanent: piers and riprap pier protection</li> </ul>                                                            |

### 7.1.3 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 or coastal resources that would result in changes to the functions and values in terms of the overall wetland hydrology, or fragmentation. The project impacts would not result in isolated fragments of wetlands or waterways. Potential indirect effects include the unintended introduction of invasive plant species.

### 7.1.4 Floodplains

Construction of the westbound ramp from U.S. Route 6 to State Route 25 and auxiliary lane on State Route 25 would result in temporary impacts (8,660 sf) and permanent impacts (2,960 sf; 2,130 cubic feet) to the floodplains associated with Nightingale Pond (3-C). Both Sagamore and Bourne Bridges would result in 55,750 sf of permanent impacts to the floodplain associated with the new bridge piers and riprap placement for pier protection in Cape Cod Canal.

Portions of the proposed Section 4(f) mitigation in the Bourne North and Bourne South quadrants would occur in the floodplain (Figure 5-9). 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; these activities would occur in the floodplain. New utilities are also proposed in conjunction with the Bourne Scenic Park and campground improvements within the floodplain. In the Bourne South quadrant, activities associated with relocating part of the 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 **Attachment 3**.

### 7.1.5 Areas of Critical Environmental Concern

Within the Sagamore North 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. At its closest location, the existing pavement edge along State Route 3 southbound is approximately 28 feet from the edge of the wetland, separated by a forested 2:1 slope. The roadway would be widened at this location, and the edge of the new roadway would be approximately 18 feet from the wetland. Although pavement widening of approximately 10 feet would occur within the ACEC, it would be located within the existing roadway shoulder of MassDOT's right-of-way. The widening and introduction of pavement within this area is a continuation of the use of an existing transportation corridor, and it would not result in impacts to the wetlands, the sole source aquifer, or threatened and endangered species. Therefore, it is not expected to adversely affect protected resources associated with the ACEC. Construction-term impacts may occur; however, the implementation of erosion prevention and sediment controls will minimize impacts to the resource area.

Within the Bourne South Approach Interchange Area, the Bourne Back River ACEC is mapped on the west side of the State Route 28 southbound travel lane and extending 15 feet east into the median. The Project Work 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.

## 7.2 Operation-Term Impact Assessment

Once the highway approaches and bridges are constructed, operation-term impacts would be limited to the maintenance of project components including the stormwater management system. The stormwater management system would be maintained in accordance with the project specific Operations and Maintenance Plan, details of which are presented in **Section 4.10, Water Quality and Stormwater** of the Final Environmental Impact Statement.

## 7.3 Summary

Construction of the Bourne Bridge would result in temporary and permanent impacts to inland wetland resources. Temporary impacts to inland wetland resources would be limited to wetland 3-C and 3-O, while permanent impacts would occur to wetland resources 3-C, 3-E, 3-H/I/Q, 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.

Wetlands 3-O, 4-TT2F, 4-W, 4-S, and 4-R are all isolated. These resources would not qualify as jurisdictional under MA WPA. As stated previously, MassDOT has filed a Jurisdictional Determination request with USACE to verify the federal regulatory status of these five inland wetlands within the Program Limits.

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.

## 8 Mitigation Measures

### 8.1 Requirements And Guidance

#### 8.1.1 State Resources

For any impacts that are unable to be avoided or minimized, the 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 [MA](#) WPA, such as flood control, water quality, and wildlife habitat. Refer to **Attachment 2 Build Alternative: Conformance with Performance Standards of the Massachusetts Wetlands Protection Act** for a discussion of the Program's conformance with performance standards of the MA WPA regulations.

#### 8.1.2 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. USACE New England District has Compensatory Mitigation Standard Operating Procedures (SOP, dated April 26, 2024), which provide guidance for developing mitigation plans for, among other resources, vegetated wetlands, RPW, and submerged aquatic vegetation. According to the SOP, the use of mitigation banks and/or In-Lieu Fee Program (ILFP) mitigation is preferred over permittee-responsible mitigation (PRM) unless the permittee demonstrates PRM is more ecologically appropriate.

There are no USACE-approved wetland mitigation banks in Massachusetts. However, the Massachusetts Department of Fish and Game (DFG) has a USACE-approved ILFP. Because PRM compensation would be required for impacts to state wetland resources, as discussed in [Section 8.2](#) compensation for permanent impacts would be provided through PRM in the form of vegetated wetland and RPW creation within the project area along with participation in DFG's ILFP.

## 8.2 Compensation for Impacts to Inland Wetlands

Proposed compensation for permanent impacts to inland resources is summarized in **Table 8-1**. Inland resources impacted include state-regulated BVW, Bank, LUW, and BLSF and federally regulated VW and RPW. Details for the compensatory wetlands would be included in the final compensatory mitigation plan to be prepared in conjunction with the permit applications to federal and state agencies, which the design-build contractor, on behalf of MassDOT, would be responsible for updating to account for final impacts to habitat types (e.g., forested, emergent), permit conditions, and design changes, as applicable.

Success of the proposed PRM compensation areas would be documented through completion of annual monitoring reports developed in accordance with the USACE SOP and MassDEP Guidelines.

**Table 8-1. Proposed Compensation for Permanent Impacts to Inland Resources**

| Wetland Series ID <sup>[1]</sup> | State Resource                                                       |                                 | Federal Resource              |                             | Impact to Compensation (Creation) Ratio |
|----------------------------------|----------------------------------------------------------------------|---------------------------------|-------------------------------|-----------------------------|-----------------------------------------|
|                                  | Impact Type and Extent                                               | Compensation                    | Impact Type and Extent        | Compensation <sup>[2]</sup> |                                         |
| 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                     | N/A                           | N/A                         | 1:1.1                                   |
|                                  | Land Under Water (LUW) 1,065 sf                                      | LUW: 2,590 sf                   | RPW 2,590 sf                  | N/A                         | 1:2.4                                   |
|                                  | Bordering Land Subject to Flooding (BLSF) 2,130 cubic feet /2,960 sf | BLSF 3,210 sf /5,430 cubic feet | N/A                           | N/A                         | 1:2.5                                   |

<sup>[1]</sup> As identified in the ANRAD (HNTB 2021, 2022) and additional field investigations.

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

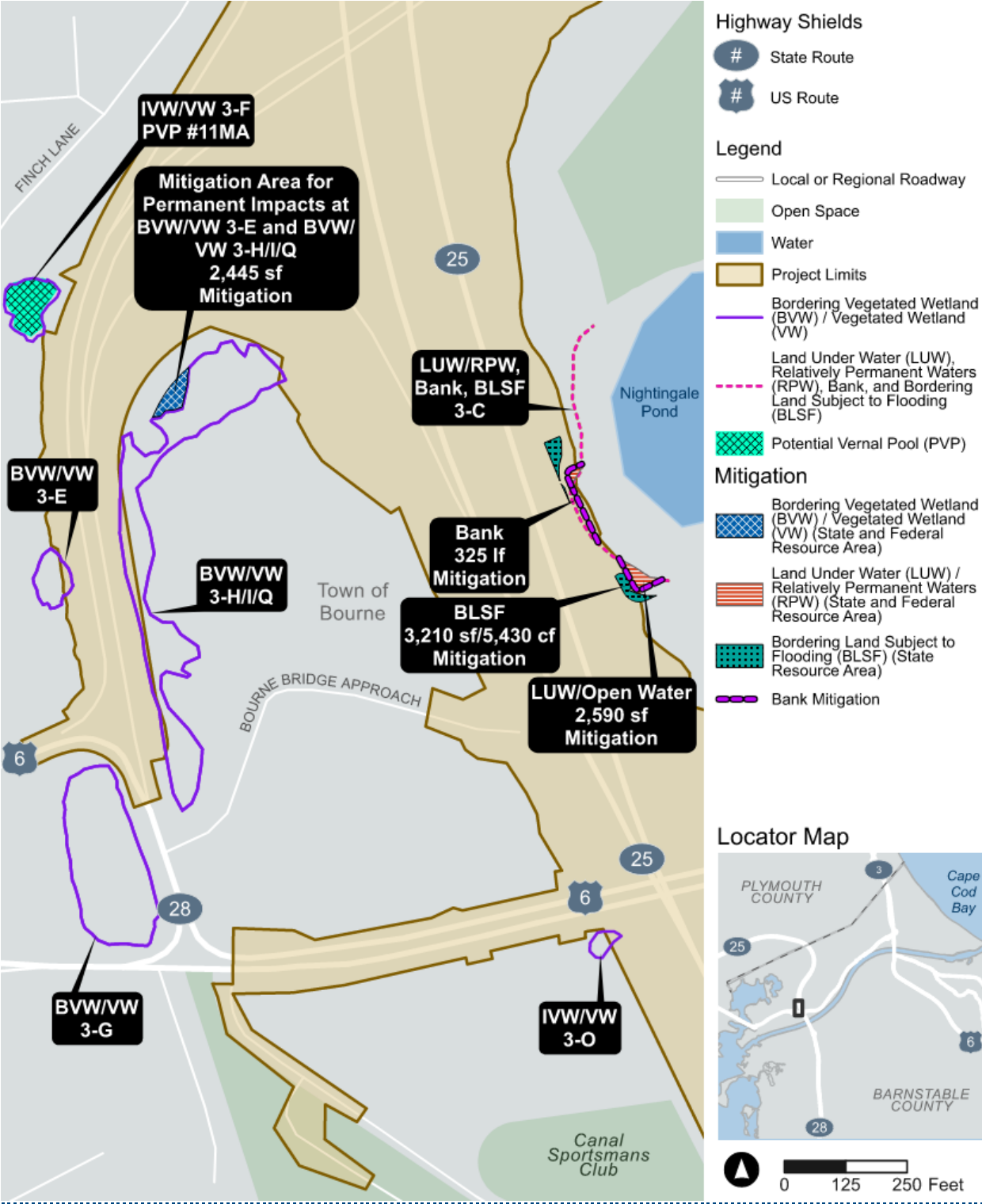
Permanent impacts to vegetated wetlands would be compensated through the creation of vegetated wetlands adjacent to Series 3-H/I/Q. Locating the proposed compensation site adjacent to Series 3-H/I/Q would allow the functions impacted by the permanent alterations to be compensated appropriately. For BVW, the 1:1.5 ratio of impact to compensation is proposed, which exceeds the performance standards (310 CMR 10.55(4)(b)(1)) of 1:1. The USACE SOP includes a recommended

impact to compensation ratio of 1:4 for permanent impacts to forested wetlands, which would be met through both wetland creation and purchasing credits from the DFG ILFP. The general location of the wetland creation area is depicted on **Figure 8-1**.

Permanent impacts to state resource areas of Bank and LUW and federal RPW at Nightingale Pond would be compensated through the creation of Bank along the limit of the permanent impact area and expansion of Nightingale Pond to the north and south of the proposed permanent impact area. The compensation area would be graded to approximate that of the permanent impact area. The surface layer of the subaqueous soils within the impact area would be removed prior to filling and used as the surface layer in the compensation area. The general location of the Bank, LUW, and RPW compensation is depicted on **Figure 8-1**.

As noted previously, MassDOT has filed a Jurisdictional Determination request with USACE to verify the federal regulatory status of five inland wetlands within the 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.

Figure 8-1. Potential On-Site Compensation for State and Federal Inland Wetland Resource Areas



Source: Massachusetts Department of Transportation, 2026

Impacts to BLSF would be mitigated by providing compensatory flood storage on a foot-by-foot basis at each elevation. **Table 8-2** demonstrates the excavation required to compensate for the corresponding fill at each elevation.

**Table 8-2. Compensatory Flood Storage Analysis for Nightingale Pond**

| <b>Elevation<br/>(feet)</b> | <b>Incremental Volume of Fill (cubic feet)<br/>(between each elevation)</b> | <b>Incremental Volume of Excavation<br/>(cubic feet) (between each elevation)</b> |
|-----------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| 6                           |                                                                             |                                                                                   |
|                             | 170                                                                         | 260                                                                               |
| 7                           |                                                                             |                                                                                   |
|                             | 240                                                                         | 250                                                                               |
| 8                           |                                                                             |                                                                                   |
|                             | 40                                                                          | 290                                                                               |
| 9                           |                                                                             |                                                                                   |
|                             | 20                                                                          | 360                                                                               |
| 10                          |                                                                             |                                                                                   |
|                             | 40                                                                          | 480                                                                               |
| 11                          |                                                                             |                                                                                   |
|                             | 80                                                                          | 690                                                                               |
| 12                          |                                                                             |                                                                                   |
|                             | 240                                                                         | 730                                                                               |
| 13                          |                                                                             |                                                                                   |
|                             | 630                                                                         | 1,240                                                                             |
| 14                          |                                                                             |                                                                                   |
|                             | 670                                                                         | 1,130                                                                             |
| 14.5                        |                                                                             |                                                                                   |
|                             |                                                                             |                                                                                   |
| <b>Total Volume</b>         | <b>2,130</b>                                                                | <b>5,430</b>                                                                      |
| <b>Total Area</b>           | <b>2,960</b>                                                                | <b>3,210</b>                                                                      |

Temporary impacts to Bank and LUW would result from the construction of the compensation area at Nightingale Pond. Prior to disturbance, the temporary impact areas would be photographed to document existing ground conditions and surveyed to confirm pre-construction elevations or baseline conditions. Vegetation within the impact area would be re-established through the application of a wetland seed mix and/or plant plugs and trees and shrubs as applicable, which are native to southeast

Massachusetts and Cape Cod. Soil within the restoration area would be similar to preconstruction soils (e.g., depth of surface layer, organic matter content, texture).

### 8.3 Compensation for Impacts to Coastal Resources

MassDOT continues to work with the issuing authorities, including MassDEP, USACE, and NOAA National Marine Fisheries Service (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 federal and state agencies. MassDOT is also coordinating mitigation for impacts to shellfish with the applicable regulatory agencies. The agreed upon shellfish mitigation will be included in the respective permit applications.

The placement of the riprap pier protection would result in additional impacts to state-regulated LUO, LUO Underlying a Fish Run, LSCSF, RIS, Land Containing Shellfish, and federally regulated WOTUS. There are no mitigation provisions or requirements for these state-regulated resources areas. Following the replacement bridge construction and existing bridge demolition, the temporary work structures would be removed.

To the maximum extent possible, the contractor would restore shoreline riprap and canal side slopes to pre-existing conditions. Additionally, the contractor 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.

The removal of the existing bridge piers will result in the restoration of approximately 4,600 sf of Navigable WOTUS and LUO. Compensation for net impacts to federal and state resource areas will be coordinated with USACE and MassDEP.

### 8.4 Mitigation for Construction-Term Impacts

Construction effects or impacts to wetland resources from construction-related pollutants, stormwater runoff, and dewatering activities may impact resource areas. The potential impacts would be minimized through the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP), required pursuant to the U.S. Environmental Protection Agency's National Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities. The SWPPP would include best management practices to prevent erosion, minimize sediment transport, and other associated construction-term potential pollution sources. Construction-term impacts are associated with all Program activities for inland and coastal resource areas within the Study Areas.

For conformance with Executive Order 13112 (Invasive Species), the contract will include specifications for the management and disposal of soil and plant material and the prevention of the spread of invasive species via equipment.

## 9 Regulatory Compliance

The Program will require federal and state permits for temporary and permanent impacts to inland and coastal resource areas. The following addresses regulatory compliance with respect to state and federal requirements:

### 9.1 Massachusetts Wetlands Protection Act Order of Conditions

The MA WPA regulations (310 CMR 10.00) include performance standards to be met when state-regulated resource areas are altered. For the project, this includes temporary and permanent alterations to Bank, LUW, BVW, BLSF, LUO, rocky intertidal shore, Coastal Bank, LSTA, and LSCSF. How the proposed Project would meet these performance standards is explained in **Attachment 2, Build Alternative: Conformance with Performance Standards of the Massachusetts Wetlands Protection Act**.

### 9.2 Water Quality Certification (Clean Water Act Section 401)

The Massachusetts Water Quality regulations (314 CMR 9.00) include performance standards to be met for dredging and the discharge of dredged or fill material. A Major Dredge Project Certification for more than 5,000 cubic yards will be required. In addition, because the project would result in the loss of more than 5,000 sf of LUW for the discharge of dredged or fill material, a Major Project Certification for Fill/Excavation will be required. The following information demonstrates conformance with the criteria outlined in 314 CMR 9.06 Criteria for the Evaluation of Applications for the Discharge of Dredged or Fill Material and 314 CMR 9.07 Criteria for the Evaluation of Applications for Dredging and Dredged Material Management.

#### 9.2.1 Conformance with 9.06: Criteria for the Evaluation of Applications for Discharge of Dredged or Fill Material

- *Standard 9.06 (1)*

No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.

- *Response*

An alternatives analysis of this water-dependent project selected a Build Alternative considering a range of both in-water and terrestrial interests, including navigational clearances, structural integrity of the bridge, the location of the existing Canal service road, and construction impacts. Additionally, alternatives were reviewed in relation to their performance at meeting screening criteria related to operations, connectivity, geometrics safety, constructability, multi-modal connections, utility impacts, environmental impacts (including avoidance of wetland resources), and right-of-way impacts.

- *Standard 9.06 (2)*

No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which will avoid and minimize potential adverse impacts to the bordering or isolated vegetated wetlands, land under water or ocean, or the intertidal zone. However, no such project may be permitted which will have any adverse effect on specified habitat sites of Rare Species.

- *Response*

The Program has been designed in accordance with CWA 404(b)(1) guidelines, to avoid and minimize impacts as practicable and to provide mitigation for the unavoidable impacts.

The Project Limits include areas mapped as Estimated Habitat of Rare Wildlife [and Priority Habitat of Rare Species](#) by the Massachusetts Wildlife's Natural Heritage and Endangered Species Program (NHESP). [However, these habitats only occur in the upland and not inland or coastal wetlands.](#)

- *Standard 9.06 (3)*

Except as otherwise provided in 314 CMR 9.06(3), no discharge of dredged or fill material shall be permitted to Outstanding Resource Waters. The discharge of dredged or fill material to an Outstanding Resource Water in association with an activity listed in 314 CMR 9.06(3)(a) Effective 10/through (k) may be permitted without requiring the applicant to obtain a variance in accordance with 314 CMR 9.08 provided that the Department determines that the discharge of dredged or fill material may be permitted in accordance with 314 CMR 9.06(1), (2), (4), (5), and (7), and is not identified in 314 CMR 9.06(4) as a discharge of dredged or fill material that requires a variance.

- *Response*

The Program does not involve a discharge of dredged or fill material to Outstanding Resource Waters.

- *Standard 9.06 (4)*

The discharge of dredged or fill material into wetlands or waters of the Commonwealth within 400 feet of the high water mark of a Class A surface water (exclusive of tributaries) requires a variance issued by the Department pursuant to 314 CMR 9.08 unless the discharge of dredged or fill material is associated with an activity conducted by a public water system under 310 CMR 22.00: Drinking Water or by a public agency or authority for the maintenance or repair of existing public roads or railways. The discharge of dredged or fill material to a vernal pool certified by the Division of Fisheries and Wildlife requires a variance pursuant to 314 CMR 9.08.

- *Response*

The Program does not involve the discharge of dredged or fill material into wetlands or waters of the Commonwealth within 400 feet of the high water mark of a Class A surface water. The

Program does not involve the discharge of dredged or fill material to a vernal pool certified by the Division of Fisheries and Wildlife.

- *Standard 9.06 (5)*

No discharge of dredged or fill material is permitted for the impoundment or detention of stormwater for purposes of controlling sedimentation or other pollutant attenuation. Discharge of dredged or fill material may be permitted to manage stormwater for flood control purposes only where there is no practicable alternative and provided that best management practices are implemented to prevent sedimentation or other pollution. No discharge of dredged or fill material is permitted for the impoundment or detention of stormwater in Outstanding Resource Waters for any purpose.

- *Response*

The Program does not involve the discharge of dredged or fill material for the impoundment or detention of stormwater for purposes of controlling sedimentation or other pollutant attenuation (refer to **Section 4.10, Water Quality and Stormwater**).

The Program does not involve a discharge of dredged or fill material to Outstanding Resource Waters.

- *Standard 9.06 (6)(a)*

Except as otherwise provided in 314 CMR 9.06, stormwater discharges shall be provided with best management practices to attenuate pollutants and to provide a setback from the receiving water or wetlands in accordance with the Stormwater Management Standards as further defined and specified in the Massachusetts Stormwater Handbook.

- *Response*

The project has been designed in accordance with the Stormwater Management Standards as further defined and specified in the Massachusetts Stormwater Handbook (refer to **Section 4.10, Water Quality and Stormwater**).

## 9.2.2 Conformance with 9.07: Criteria for the Evaluation of Applications for Dredging and Dredged Material Management

- **Standard 9.07 (1)(a)**

No dredging shall be permitted unless appropriate and practicable steps have been taken which would first avoid, and if avoidance is not possible, then minimize, or if neither avoidance or minimization are possible, then mitigate, potential adverse impacts to land under water or ocean, intertidal zone, and special aquatic sites. No dredging shall be permitted if there is a practicable alternative that would have less impact on the aquatic ecosystem. However, no such dredging may be permitted, which would have any adverse effect on specified habitat sites of Rare Species unless the work is subject to a Conservation and Management Permit or Determination of No Take issued by the Division of Fisheries and Wildlife.

– **Response**

The Program has been designed in accordance with CWA 404(b)(1) guidelines [and MA WPA](#) to avoid and minimize impacts as practicable and to provide mitigation for the unavoidable impacts (refer to **Attachment 2, Build Alternative: Conformance with Performance Standards of the Massachusetts Wetlands Protection Act**).

The Project Limits include areas mapped as Estimated Habitat of Rare Wildlife and Priority Habitat of Rare Species by the NHESP. [However, these habitats only occur in the upland and not inland or coastal wetland resource areas. These habitats would not be affected by dredged material excavation and disposal.](#)

An alternatives analysis of this water dependent project selected a Build Alternative considering a range of both in-water and terrestrial interests, including navigational clearances, structural integrity of the bridges, the location of the existing Canal service road, and construction impacts. Additionally, alternatives were reviewed in relation to their performance at meeting screening criteria related to operations, connectivity, geometrics safety, constructability, multi-modal connections, utility impacts, environmental impacts (including avoidance of wetland resources), and right-of-way impacts.

The Program does not involve a discharge of dredged or fill material to Outstanding Resource Waters.

• **Standard 9.07 (2)**

Sampling and Analysis Requirements. The applicant shall submit the results of all relevant sampling with the application unless an alternative schedule is specifically authorized by the Department in writing.

– **Response**

The Project will comply with all sampling requirements.

• **Standard 9.07 (3)**

Dredging Performance Standards. Dredging shall be planned and conducted to minimize short-term, long-term, [and cumulative](#) impacts on the aquatic ecosystem and to provide protection to human health.

– **Response**

The project will plan and conduct dredging to minimize short-term, long-term, [and cumulative](#) impacts on the aquatic ecosystem and to provide protection to human health. [Dredging methods, equipment selection, and operational controls will be chosen to minimize resuspension of silt, clay, oil/grease, and other fine particulates.](#)

[Due to the swift currents of Cape Cod Canal, the use of turbidity curtains would be infeasible for containing turbidity impacts within the water column near the work area. Additionally, the canal is a dynamic, high-energy environment exposed to regular dredging by USACE for canal maintenance, wave action, storms, and vessel activity. Natural and anthropogenic sources of turbidity occur](#)

regularly, indicating a range (low to high) of turbidity within the canal. Natural sources of turbidity include runoff, storm events, tidal currents, erosion, and plankton blooms. Anthropogenic sources of turbidity include urban runoff, agricultural runoff, vessel traffic, wastewater discharges, and in-water construction (including dredging). The naturally high currents in the canal prevent the accumulation of fine sediments that would cause increased concentration of and longer lasting turbidity plumes. Additionally, NOAA Fisheries has determined that turbidity plumes resulting from dredging are generally expected to last for less than 24 hours and would likely result in only minor alterations to normal movements in strong swimming fishes. Other studies have shown that anticipated total suspended solids levels for mechanical (e.g., clamshell) dredging (up to 445 milligrams per liter) are below the levels expected to have adverse effects on fishes (typically up to 1,000 milligrams per liter) (NOAA Fisheries 2025). Therefore, the turbidity producing activities associated with project construction are unlikely to cause adverse effects on aquatic life and other existing and designated uses of waters of the Commonwealth.

### 9.3 Section 404 of the Clean Water Act

The Build Alternative would require a Section 404 permit for the placement of fill material in WOTUS. These impacts are evaluated under Section 404 (b)(1) Guidelines, the intent of which is to avoid unnecessary filling of waters and wetlands. Section 404 (b)(1) Guidelines (40 CFR § 230) which state:

- Except as provided under section 404(b)(2) of the CWA, no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences, the intent of which is to avoid unnecessary filling of waters and wetlands (40 CFR § 230.10(a)). An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. If it is otherwise a practicable alternative, an area not presently owned by the applicant which could reasonably be obtained, utilized, expanded, or managed in order to fulfill the basic purpose of the proposed activity may be considered (40 CFR § 230.10(a)(2)). Where the activity associated with a discharge which is proposed for a special aquatic site (as defined in subpart E) does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., is not “water dependent”), practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise. In addition, where a discharge is proposed for a special aquatic site, all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise (40 CFR § 230.10(a)(3)).
- Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem (40 CFR § 230.10(d)).

### 9.3.1 Alternatives

An alternatives analysis of this water dependent project selected a Build Alternative considering a range of both in-water and terrestrial interests, including navigational clearances, structural integrity of the bridge, the location of the existing Canal service road, and construction impacts. Additionally, alternatives were reviewed in relation to their performance at meeting screening criteria related to operations, connectivity, geometrics safety, constructability, multi-modal connections, utility impacts, environmental impacts (including avoidance of wetland resources), and right-of way impacts. For further discussion regarding the Alternatives Analysis, refer to **Chapter 3, Proposed Action and Alternatives**.

### 9.3.2 Minimization

The Program has been designed to minimize adverse impacts as appropriate and practicable (refer to **Attachment 2, Build Alternative: Conformance with Performance Standards of the Massachusetts Wetlands Protection Act**).

## 9.4 23 CFR 650 Subpart A (Floodplain)

23 CFR Part 650 Subpart A – Location and Hydraulic Design of Encroachments on Flood Plains 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. Conformance with applicable requirements of Subpart A is described [in Table 4.9-15 of Section 4.9, Wetlands and Floodplains](#).

## 10 References

- HNTB Corporation (HNTB). 2021. Abbreviated Notice of Resource Area Delineation (ANRAD), MassDOT Cape Cod Canal Area Transportation Improvements Program, Project No. 608020, Bourne, Massachusetts. HNTB Corporation, Boston, Massachusetts. December.
- HNTB. 2022. Abbreviated Notice of Resource Area Delineation (ANRAD), MassDOT Cape Cod Canal Area Transportation Improvements Program, Project No. 608020, Bourne, Massachusetts. HNTB Corporation, Boston, Massachusetts. April.
- Massachusetts Division of Fisheries and Wildlife (MassWildlife). 2009. Guidelines for the Certification of Vernal Pool Habitat (updated 2020). Massachusetts Division of Fisheries and Wildlife. Westborough, Massachusetts. March.
- [National Oceanic and Atmospheric Administration National Marine Fisheries Service \(NOAA Fisheries\). 2025. Section 7 Effects Analysis: Turbidity in the Greater Atlantic Region. September 11. Available from: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effects-analysis-turbidity-greater-atlantic-region. Accessed February 16, 2026.](https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effects-analysis-turbidity-greater-atlantic-region)
- Stantec Consulting Services Inc. (Stantec). 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.
- [Stantec. 2026. Draft Cape Cod Bridges Program 2025 Vernal Pool Survey Report, Bourne, Massachusetts. Stantec Consulting Services Inc. January 8.](#)
- 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.

## 11 Attachments

Attachment 1. Abbreviated Notice of Resource Area Delineation

Attachment 2. Build Alternative: Conformance with Performance Standards of the Massachusetts Wetlands Protection Act

Attachment 3. Floodplains Coordination