Cape Cod Bridges Program

Bourne, Massachusetts

Appendix 4.10
Water Quality and Stormwater Technical Report

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
ACEC	Area of Critical Environmental Concern
BMP	best management practices
CGP	Construction General Permit
CMR	Code of Massachusetts Regulations
CWA	Clean Water Act
EPA	U.S. Environmental Protection Agency
IWPA	Interim Wellhead Protection Area
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
MS4	Municipal Separate Storm Sewer System
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
Program	Cape Cod Bridges Program
SCM	Stormwater Control Measure
SUP	shared-use path
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
WOTUS	Waters of the United States
WQS	Water Quality Standards

1 Introduction

This Water Quality and Stormwater Technical Report has been prepared in support of the Draft 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).

2 Summary of Findings

The Study Area for the water quality and stormwater assessment includes the Project Limits for the Build Alternative, as well as the areas of land that contribute flow (defined as a watershed) to Cape Cod Canal. Refer to **Figure 3-1 through Figure 3-4** for identification of the Study Area boundaries for this assessment. The contributing stormwater catchment area is the same for existing and proposed conditions. The illustrated watershed boundaries denote the geographical line determined by the highest elevations around a waterbody. The Build Alternative is within three major watersheds: South Coastal, Cape Cod, and Buzzards Bay. Refer to **Section 5** for more details about the existing environmental resource areas within the Study Area. The Build Alternative also lies within the Cape Cod Sole Source Aquifer and the Plymouth/Carver Sole Source Aquifer.[1] Refer to **Section 5** for more details about the sole source aquifer designation, which ensures protection of drinking water sources that supply at least 50% of drinking water consumed within the area of the aquifer.

The predominant land use within the Study Area is transportation (including highway and rail infrastructure), followed by forest, open space, commercial, residential, and industrial. Stormwater runoff[2] from the Study Area flows to Cape Cod Canal, with a portion captured by catch basins or similar structures and conveyed through underground pipes that discharge along the bank of the canal. The

[1] An aquifer (i.e., a water-bearing stratum of permeable rock, sand, or gravel) that supplies at least 50% of the drinking water consumed in the area overlying the aquifer. U.S. Environmental Protection Agency guidelines also require that these areas have no alternative drinking water source(s) that could physically, legally, and economically supply water to all who depend on the aquifer for drinking water.

[2] Water produced during precipitation (or snowmelt) events when the quantity exceeds the surface storage and infiltration capacity of the land surface.

rest is captured and conveyed via pipe network[3] to low-lying areas and existing stormwater basins where it recharges to the groundwater.[4]

The Build Alternative has the potential to affect water quality by changing the land cover and the hydrology of the site. Increased impervious surface without associated stormwater treatment could lead to increased surface runoff, higher peak flows during storm events, higher pollutant loads, and reduced groundwater recharge.[5]

The Build Alternative would comply with Massachusetts Stormwater Management Standards through incorporation of post-construction stormwater control measures (SCM),[6] and implementation of a Long-Term Pollution Prevention Plan and an Operations and Maintenance Plan. Refer to **Section 8** for details regarding compliance with the Stormwater Management Standards.

The Build Alternative has the potential to contribute to water quality impacts during construction due to soil and sediment disturbance from grading and excavation activities. To address these potential construction-period impacts associated with the Build Alternative, Massachusetts Department of Transportation (MassDOT) and its contractors will be required to comply with the National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP), which includes the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP) detailing strategies and best management practices (BMP) to prevent stormwater pollution during construction.

For the No Build Alternative, which includes maintenance of existing facilities as well as near-term improvements scheduled for implementation in the Transportation Improvement Program, stormwater runoff would mostly continue to flow, untreated, into existing drainage facilities and receiving waterbodies. Increased traffic volumes for the No Build Alternative could result in additional pollutants being deposited on the roadways, thereby increasing the potential for adverse effects to water quality.

With the implementation of post-construction SCMs in accordance with the Massachusetts Stormwater Management Standards and adherence to the SWPPP in accordance with U.S. Environmental Protection Agency (EPA) NPDES CGP, the Build Alternative would protect and enhance the quality of stormwater runoff discharged to receiving watersheds and the two designated sole source aquifers within the Study Area.

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[3] Infrastructure designed to drain excess stormwater runoff from impervious surfaces such as paved streets and sidewalks, consisting of underground pipes and structures.

[4] Water beneath the surface of the ground, consisting largely of surface water that has seeped down.

[5] The seepage of water into soil.

[6] Physical, structural, and/or managerial measures that reduce the downstream quality and quantity impacts of stormwater.

3 Proposed Action and Alternatives

3.1 Purpose and Need

In partnership with the FHWA and the New England District of the U.S. Army Corps of Engineers (USACE), MassDOT proposes advancing the Program in the town of Bourne, Barnstable County, Massachusetts.

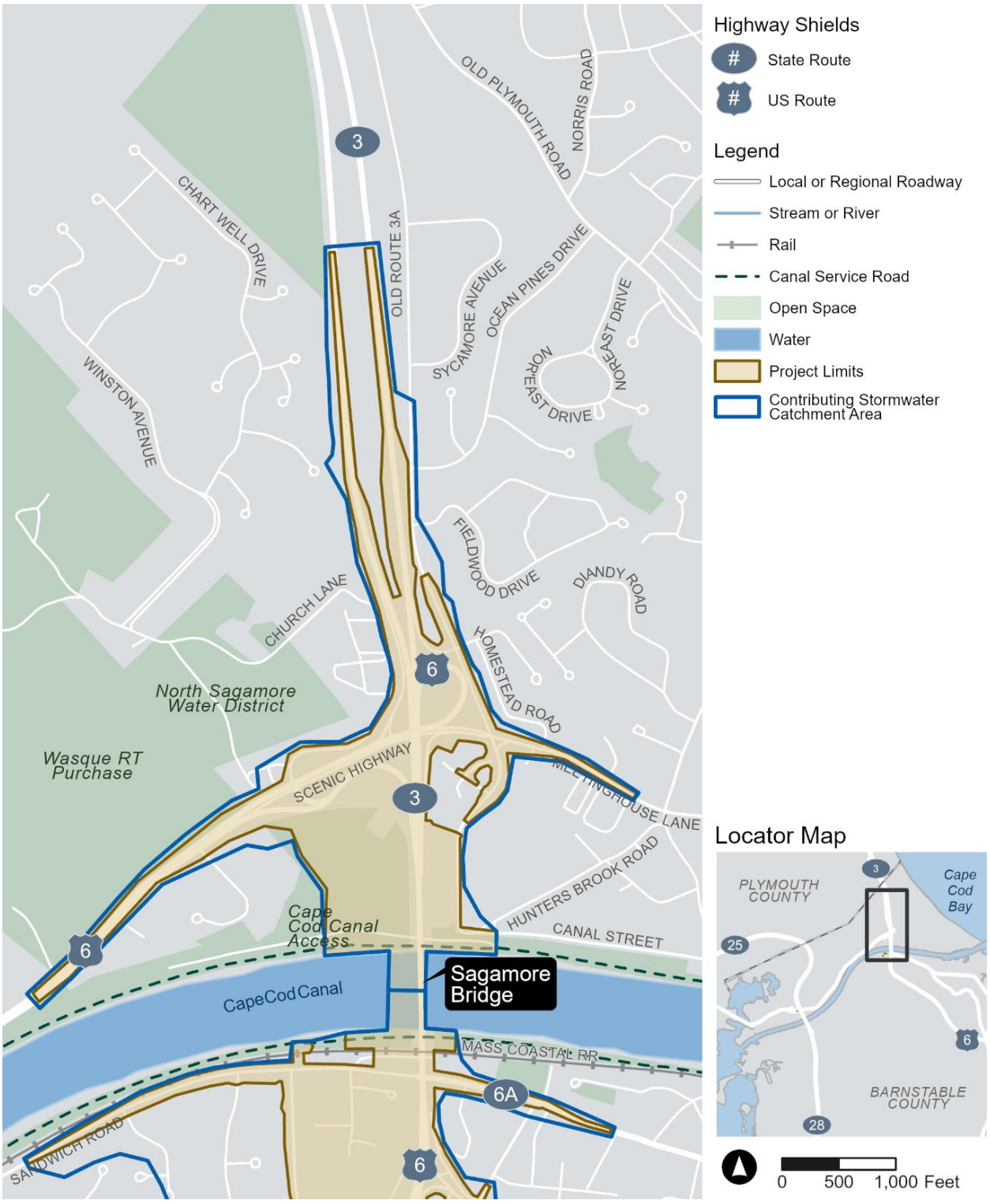
The purpose of the Program is to improve cross-canal mobility and accessibility between Cape Cod and mainland Massachusetts for all road users and to address the increasing maintenance needs and functional obsolescence of the aging Bourne and Sagamore Bridges (also known as the Cape Cod Canal highway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

3.2 Study Area

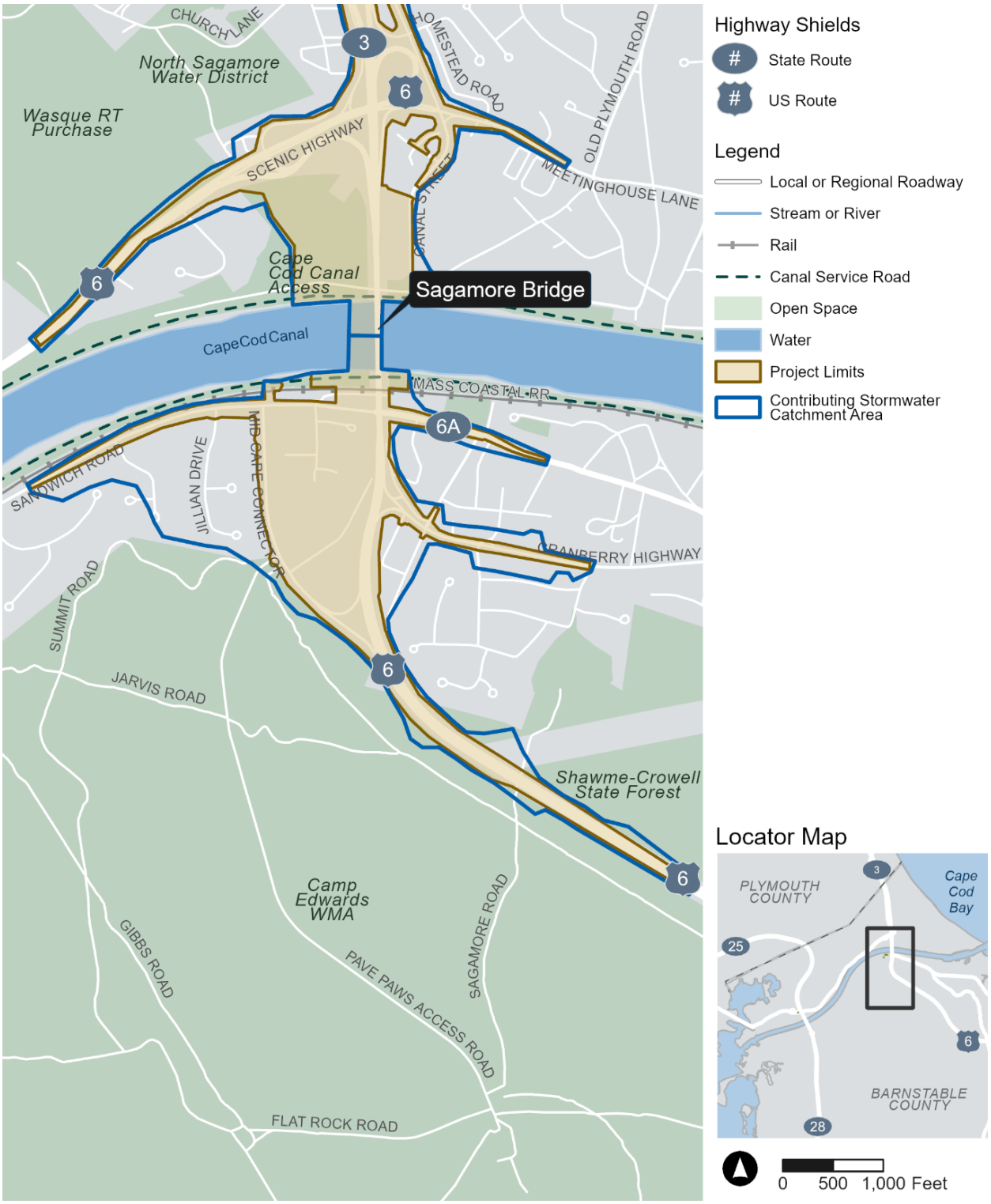
The Study Area for the water quality and stormwater assessment includes the Project Limits. The Study Area for the water quality and stormwater assessment also include the areas of land that contribute flow to the Project Limits and ultimately the Cape Cod Canal. **Figure 3-1 through Figure 3-4** identify the watershed boundaries within each Study Area quadrant: Sagamore North, Sagamore South, Bourne North, and Bourne South. The contributing stormwater catchment area is the same for existing and proposed conditions. They were delineated using a combination of topographic survey and record plans that define the existing closed drainage system. The contributing stormwater catchment area depicts the Study Area that was delineated and included in the site-specific hydrologic model for comparison of existing and proposed conditions. Areas outside of the Project Limits that will not change due to the proposed construction were not included in the hydrologic study.

Figure 3-1. Contributing Stormwater Catchment Area (Sagamore North Quadrant Study Area)



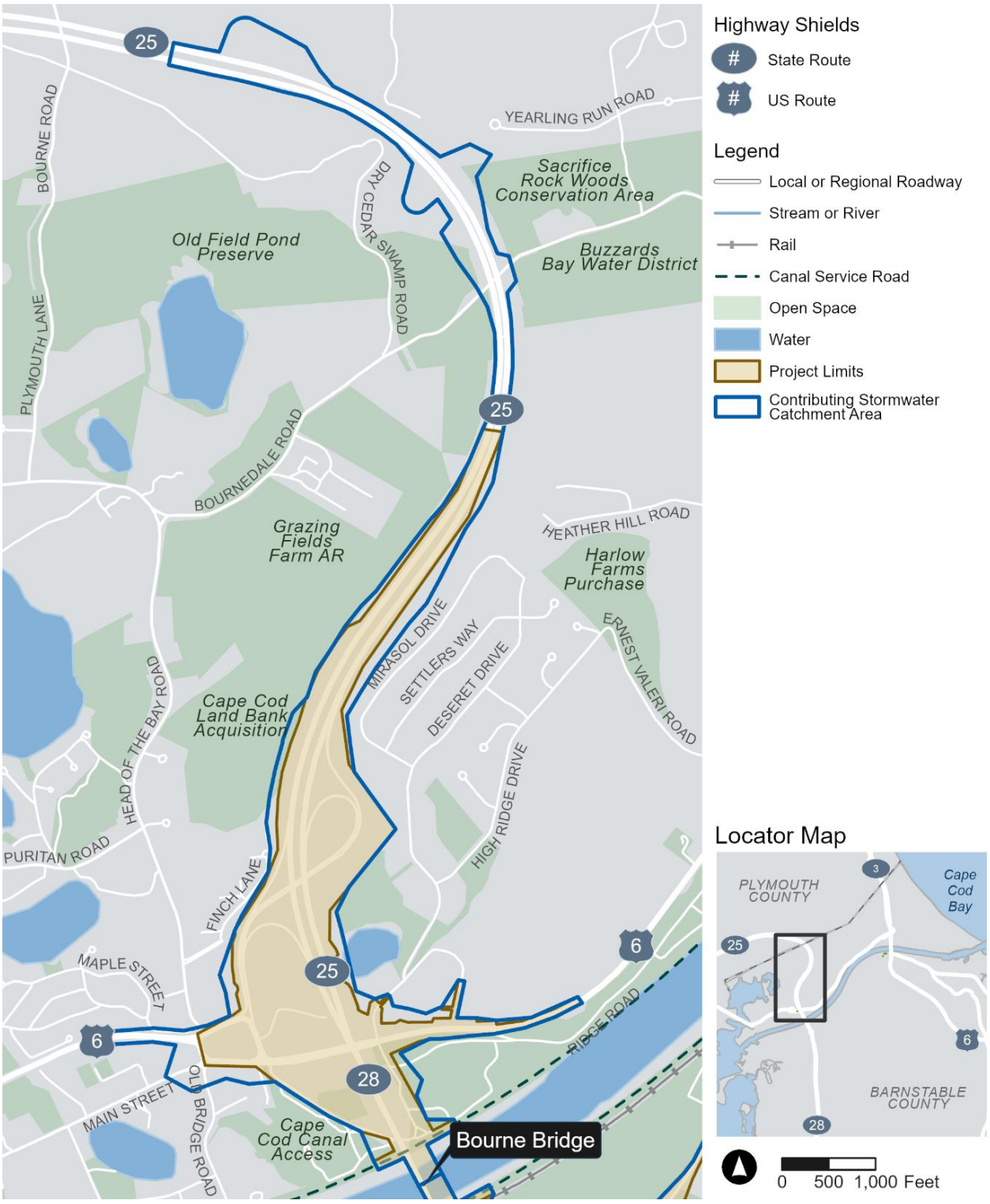
Source: Massachusetts Department of Transportation, 2024

Figure 3-2. Contributing Stormwater Catchment Area (Sagamore South Quadrant Study Area)



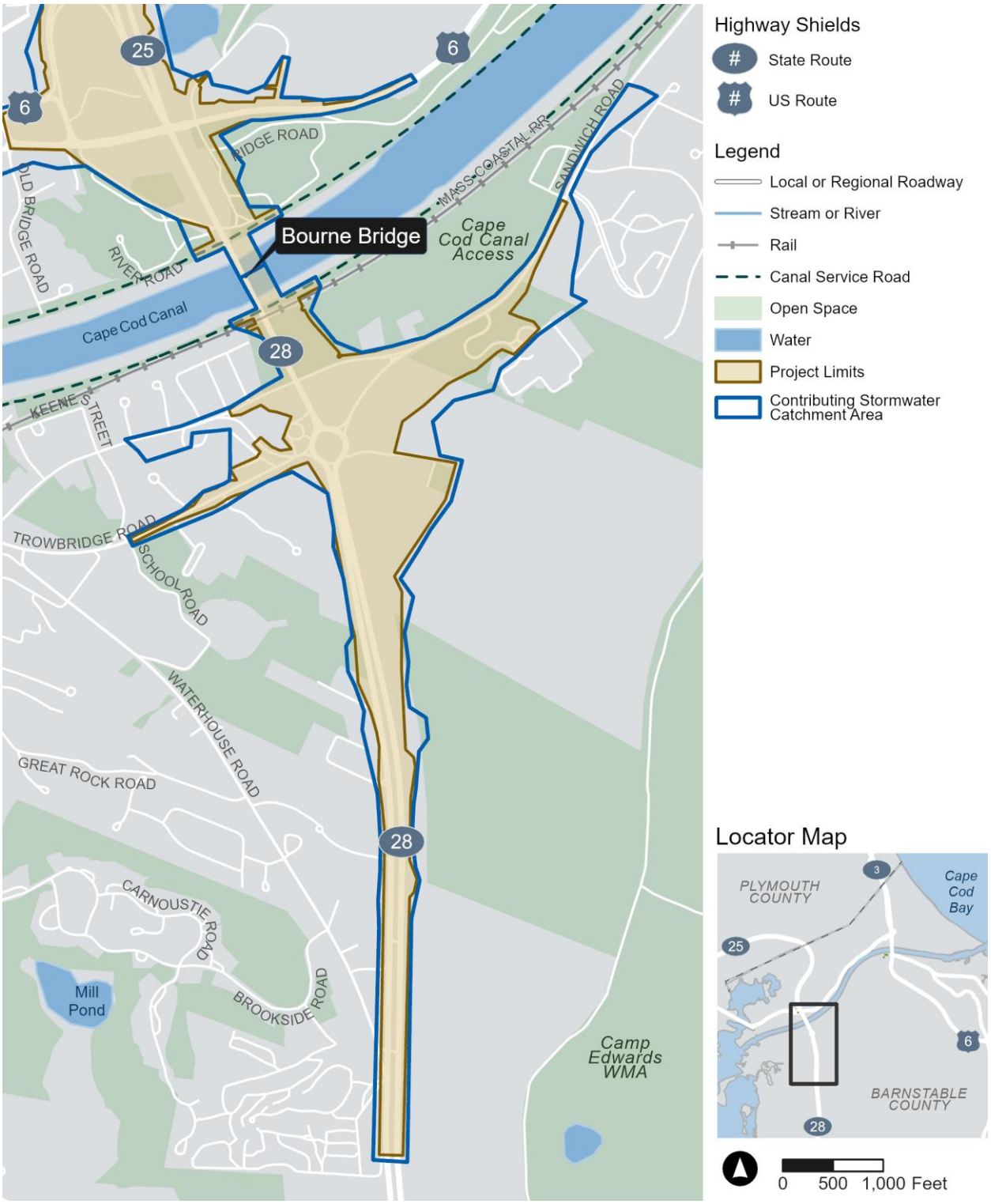
Source: Massachusetts Department of Transportation, 2024

Figure 3-3. Contributing Stormwater Catchment Area (Bourne North Quadrant Study Area)



Source: Massachusetts Department of Transportation, 2024

Figure 3-4. Contributing Stormwater Catchment Area (Bourne South Quadrant Study Area)



Source: Massachusetts Department of Transportation, 2024

3.3 Build Alternative

The Program's Build Alternative would incorporate the 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. Description of Design Parameters of the Recommended Build Alternative

Program Element/ Program Design Parameter	Description
Highway Bridges	Both the Bourne and Sagamore Bridges would be replaced with new bridges, with each comprising four through-travel lanes and two auxiliary lanes (i.e., an in-kind bridge replacement that would comply with federal and state highway and design safety standards).
Bridge Highway Cross-Section and Shared-Use Path	Each replacement bridge would provide four 12-foot-wide through-traffic lanes (two in each direction), two 12-foot-wide entrance/exit (auxiliary) lanes, a 4-foot-wide left shoulder, and a 10-foot-wide right shoulder. Right and left barriers would be offset an additional 2 feet beyond the limits of the shoulders.
	Each crossing location would include one bidirectional pedestrian and bicycle shared-use path (SUP), separated from vehicular traffic by the shoulder and barrier. The usable width of the SUP would be 14 feet wide on the bridge main span, 20 feet wide on the interchange approaches, and 12 feet wide on the connecting roadways.
Bridge Clearances	The replacement bridges would maintain the existing vertical clearance of 135 feet above mean high water and account for 3 feet of fluctuations in relative sea level, for a total vertical clearance of 138 feet above mean high water. The replacement bridges would provide a minimum 500 feet of horizontal channel width to be consistent with existing conditions.

Program Element/ Program Design Parameter	Description
Main Span Length and Bridge Pier Location	The replacement bridges would have a main span length of approximately 700 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 Configuration	Each replacement bridge would have two separate decks (twin structures).
Mainline Alignment	The mainline alignment locations at both crossings would be offline inboard: the main spans of each replacement bridge would be located outside the footprint of the existing bridge, approximately 10 feet apart and parallel to each other and on the side of the canal between the existing Bourne Bridge and Sagamore Bridge. At the Bourne crossing, both main spans would be located east of the existing Bourne Bridge toward Cape Cod Bay. At the Sagamore crossing, both main spans would be located west of the existing Sagamore Bridge toward Buzzards Bay.
Bridge Type	The replacement bridges would be twin tied-arch bridges with delta frames supporting an approximate 700-foot mainline span.
Interchange Approach Network: Sagamore North	The Sagamore North interchange approach network would follow the "Direct Connection to State Road (Option SN-8A)" configuration. This design would provide a single exit point from a relocated U.S. Route 6/State Route 3 and eliminate the existing Sagamore Bridge northbound off-ramp connection to Scenic Highway/Meetinghouse Lane eastbound. Instead, the new connection would tie into State Road, north of Scenic Highway/Meetinghouse Lane. The remaining ramp connections would remain similar to existing conditions. Intersections along Scenic Highway and Meetinghouse Lane would be modified to accommodate new lane configurations. The intersection of State Road at State Route 3 northbound would also be reconfigured to support the addition of the new northbound off-ramp. The design includes a SUP on the U.S. Route 6 eastbound main span, providing connections to the south side of Scenic Highway, Canal Street, and Canal Service Road. Additional SUPs would be constructed along the southern side of Scenic Highway and Meetinghouse Lane, as well as along the eastern side of State Road to Homestead Avenue.

Program Element/ Program Design Parameter	Description
Interchange Approach Network: Sagamore South	The Sagamore South interchange approach network would follow the "Westbound On-Ramp Under U.S. Route 6 with Sandwich Road Extension (Option SS-3.1A)" configuration. This design includes the Cranberry Highway Extension and relocates the westbound on-ramp to share the same entrance point as the eastbound on-ramp from the Mid-Cape Connector. The existing westbound ramp from Cranberry Highway to the Sagamore Bridge would be removed and replaced with a new westbound on-ramp connection from the Mid-Cape Connector. Lane arrangements at the intersections of the Mid-Cape Connector with Sandwich Road and Cranberry Highway Extension would be modified to accommodate revised traffic patterns resulting from the new Cranberry Highway Extension and changes to U.S. Route 6 access. A new connection from Cranberry Highway Extension to Sandwich Road would be provided east of the new mainline bridge structure, forming the Sandwich Road Extension. Access to Market Basket via Factory Outlet Road would be modified, and a new driveway would be added to serve the former Christmas Tree Shops property. A SUP would be constructed along the U.S. Route 6 eastbound main span, providing connections to Factory Outlet Road, Sandwich Road, and Canal Service Road. Additional bicycle and pedestrian improvements would be included along Cranberry Highway. A new connection would also be established through the Cranberry Highway Extension to the Mid-Cape Connector.
Interchange Approach Network: Bourne North	The Bourne North interchange approach would follow the "Directional Interchange (Option BN-14.4b)" configuration. This design includes a combination of direct connection ramps between State Route 25 and U.S. Route 6. The ramp connecting State Route 25 eastbound to Scenic Highway would be a direct connection, providing access to Scenic Highway eastbound only. A new flyover ramp from Scenic Highway to State Route 25 would allow vehicles to bypass Belmont Circle, improving traffic flow without the need for additional intersection control. This ramp would repurpose one of the existing travel lanes on Scenic Highway and provide a free-flowing movement to reduce congestion. To accommodate this new southbound-to-eastbound movement, the existing State Route 28 bridge over State Route 25 would be relocated and widened. The existing southbound off-ramp would be reconfigured as an option lane, improving geometry and decision sight distance for drivers. Intersection control at U.S. Route 6/Nightingale Road/Andy Oliva Drive is being evaluated, with a single-lane roundabout previously considered. MassDOT continues to assess appropriate control types through the Intersection Control Evaluation (ICE) process. The design also includes a SUP and a grade-separated crossing for pedestrians and bicyclists via the new flyover ramp over Scenic Highway. U.S. Route 6 would be reduced from four lanes to three, creating space for multimodal accommodations. A continuous 12-foot-wide SUP would be provided along the south side of U.S. Route 6, connecting to Belmont Circle, with a 6-foot-wide sidewalk along the north side.

Program Element/ Program Design Parameter	Description
Interchange Approach Network: Bourne South	The Bourne South interchange approach network would follow the "Diamond Interchange (Option BS-2)" configuration. This design would eliminate the existing Bourne Rotary and replace it with a grade-separated diamond interchange, allowing through movements on State Route 28 to bypass intersections with local roadways. Both intersections within the diamond interchange would include appropriate intersection controls to manage traffic flow and improve safety. Changes to the Trowbridge Road and Sandwich Road underpass would include a reconfigured entrance to Upper Cape Cod Regional Technical High School, relocated to improve access and circulation. The design would also provide Shared Use Path (SUP) connections to Trowbridge Road, the Cape Cod Canal Service Road, and the Bourne Recreation Area, enhancing multimodal connectivity throughout the corridor.

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 the USACE's New England District. The Commonwealth of Massachusetts owns the connecting major highway corridors at the bridges, which consist of the State Route 3/State Route 6 corridor at Sagamore Bridge and the State Route 25/State 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. The USACE would continue to own 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 2025–2029 Transportation Improvement Program for the Cape Cod Metropolitan Planning Organization.[7] **Table 3-2** identifies the Transportation Improvement Program projects within and near the Program to be incorporated in the No Build Alternative.

[7] The Transportation Improvement Program was endorsed on May 20, 2024, with subsequent amendments on November 18, 2024; December 16, 2024; February 24, 2025; and an adjustment on March 24, 2025.

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 the USACE's operations and maintenance program could correct the deficiencies and restore and sustain reliability. The 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.

Table 3-2. Transportation Improvement Program Projects, 2025-2029

Project Number	Year	Transportation Project	Project Description	Status
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)	Underway
610542	2023	Bourne Rotary Improvements	• Restriping Bourne Rotary to two lanes and adding a channelized right-turn lane from State Route 28 northbound to Sandwich Road eastbound • Adding signs at Bourne Rotary • Installing flashing beacons at the Bourne Rotary approaches	Underway
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	Programmed
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

Project Number	Year	Transportation Project	Project Description	Status
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
---	—	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
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	2025–2028	U.S. Route 6 Scenic Highway Median Installation	• Resurfacing • Safety improvements, including a raised center median and expanded shoulders to separate eastbound and westbound travel lanes • Drainage improvements • Traffic signal improvements at two intersections • Shared-use path	Programmed
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)	Programmed
613200	2026	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	Programmed
612063	2028	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	Programmed

Project Number	Year	Transportation Project	Project Description	Status
613199	2028	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	Programmed
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

Note: **Table 3-2** includes only those projects in the Study Areas that are part of the No Build Alternative. It does not include Project S13144, the replacement of the Sagamore Bridge, which was added to the Federal Fiscal Year (FFY) 2025-2029 Transportation Improvement Program (TIP) as Amendment #2, December 9, 2024.

— No date available.

The No Build Alternative represents the "Fix as Fails" Base Condition of the USACE's MRER/EA. In the No Build Alternative, the 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.

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 Evaluation

4.1 Regulatory Framework

Stormwater management and water quality are governed by various federal and state regulatory programs. The Federal Water Pollution Act Amendments of 1972,[8] also known as the Clean Water Act (CWA), is the primary federal law governing surface water quality protection in the United States.

[8] Federal Water Pollution Control Act (Clean Water Act) of 1972 (33 U.S. Code 1251-1376) as amended by the U.S. Clean Water Act (1977) and the Water Quality Act (1987); Sections 401 and 404 of the Clean Water Act (33 U.S. Code 1251-1376). https://www.epa.gov/laws-regulations/summary-clean-water-act

Stormwater management in Massachusetts is governed by sections of the Massachusetts Wetlands Protection Act Regulations,[9] and the state's 401 Water Quality Certification Regulations.[10]

Further details on the relevant federal and state regulations and programs governing water quality and stormwater are provided in the following sections.

4.1.1 Federal Regulations and Water Quality

4.1.1.1 Federal Water Pollution Control Act (Clean Water Act) of 1972 (33 USC 1251-1376) as amended by the U.S. Clean Water Act (1977) and the Water Quality Act (1987)

The CWA establishes the basic structure for regulating discharges of pollutants into the Waters of the United States (WOTUS) and regulating quality standards for surface waters.[11] The CWA requires that industrial facilities, construction sites, and municipal separate storm sewer systems (MS4) have measures in place to prevent pollution from being discharged with stormwater into nearby waterways.[12]

Section 401 of the Clean Water Act

Under Section 401 of the CWA, a federal agency may not issue a permit or license to conduct any activity that may result in any discharge into WOTUS unless a Section 401 Water Quality Certification is issued, or certification is waived. In Massachusetts, Section 401 of the CWA is administered by Massachusetts Department of Environmental Protection (MassDEP) through 401 Water Quality Certification regulations.

Section 402 of the Clean Water Act

Section 402 of the CWA establishes the NPDES permit program, which regulates point source discharges of pollutants into WOTUS. The NPDES permit program requires operators of construction sites that disturb 1 acre or more of land, where those discharges enter WOTUS, to obtain coverage under an NPDES CGP for their stormwater discharges. The NPDES CGP requires operators of such construction sites to prepare and implement an SWPPP in accordance with the provisions of the CWA. The SWPPP requires documentation of stormwater controls, erosion and sedimentation controls, pollution prevention controls, and construction dewatering controls to be implemented during construction. In Massachusetts, the EPA issues NPDES CGPs.

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[9] Massachusetts Department of Environmental Protection. 2014. Massachusetts Wetlands Protection Act Regulations (310 Code of Massachusetts Regulations [CMR] 10.00). October. https://www.mass.gov/regulations/310-CMR-1000-wetlands-protection-act-regulations

[10] Massachusetts Department of Environmental Protection. 2014. Massachusetts 401 Water Quality Certification Regulations (314 CMR 9.00). October. https://www.mass.gov/regulations/314-CMR-9-401-water-quality-certification

[11] U.S. Environmental Protection Agency. n.d. Summary of the Clean Water Act. https://www.epa.gov/laws-regulations/summary-clean-water-act

[12] U.S. Environmental Protection Agency. n.d. Water Enforcement. https://www.epa.gov/enforcement/water-enforcement#stormwater

Section 404 of the Clean Water Act

Section 404 of the CWA requires authorization from the Secretary of the Army, acting through the USACE, for the discharge of dredged or fill material into all WOTUS, including wetlands. The term "dredged material" means material that is excavated or dredged from WOTUS. The term "fill material" means any material that has the effect of either replacing any portion of a WOTUS with dry land or changing the bottom elevation of any portion of a WOTUS.

Total Maximum Daily Loads and Section 303(d) Program

The EPA requires states to establish priority rankings for waters and develop Total Maximum Daily Loads (TMDL) for these waters under Section 303(d) of the CWA to address pollution from point and non-point source discharges. TMDLs represent a pollution budget that establishes the maximum amount of a pollutant that can occur in a waterbody and still meet Massachusetts Surface Water Quality Standards (WQS). States are required to submit lists of impaired waters to the EPA for approval. "Impaired" status means that the waterway does not meet state WQS. These are waters that are too polluted or otherwise degraded to meet WQS. Once approved under the Section 303(d) Program, the state then continues to study and test the waterway and if the quality degrades further, then eventually a TMDL is developed for a specific pollutant. A TMDL serves as a planning tool and potential starting point for restoration or protection activities with the goal of attaining or maintaining WQS.

- Section 303(d) Listed Impairments in Cape Cod Canal – According to the Massachusetts Year 2022 Integrated List of Waters by MassDEP, Cape Cod Canal, identified as MA95-14, is listed as impaired for fecal coliform.
- TMDLs in the Cape Cod Canal – There is one TMDL that applies to Cape Cod Canal within the Study Area: the Final Pathogen TMDL for the Buzzards Bay Watershed dated March 2009.

The Final Pathogen TMDL for the Buzzards Bay Watershed indicates that the source for pathogens in the Study Area is bacteria and fecal-related pollution, where the majority of the pollutant is from illicit sewer connections to storm drains, urban stormwater runoff that contains pet and/or animal waste, and illicit boat discharges. The Massachusetts WQS also set criteria for fecal coliform in Class SB marine waters, which state that the geometric mean of a representative set of fecal coliform samples shall not exceed 35 colonies per 100 milliliters and no more than 10% of the samples shall exceed 130 colonies per 100 milliliters. The MassDEP may apply these standards on a seasonal basis. The TMDL document analyzed and calculated the percentage of pathogen reductions required to meet WQS for the canal. In Cape Cod Canal, identified in the TMDL document as segment MA 95-14, the TMDL is 9.07E+09 colonies per day. The target reduction for illicit sources is 100%. The target reduction for pathogens in stormwater is two to three orders of magnitude, which is generally expected to be achieved by the implementation of SCMs.

Municipal Separate Storm Sewer System (MS4) Program

The MS4 owners operate their stormwater management systems in accordance with permits issued by the EPA and MassDEP, as authorized by the CWA, under the NPDES program where they are required

to develop and implement stormwater management programs to meet specific water quality criteria for their respective stormwater discharges. MassDOT is currently covered by the General Permit that was issued in 2003 for urbanized areas of Massachusetts. A new permit was issued in 2016, but MassDOT was not named as a regulated entity in that version of the permit. MassDOT is seeking coverage under an individual Transportation Separate Storm Sewer System (TS4) Permit for its stormwater discharges. The TS4 Permit has not been released yet, but it is expected to follow the same general requirements of the MS4 Permit. The Town of Bourne is currently covered under the 2016 MS4 Permit.

4.1.2 State Regulations and Water Quality

The Massachusetts Stormwater Management Standards are enforced through sections of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and the 401 Water Quality Certification Regulations (314 CMR 9.00). The Massachusetts Stormwater Management Standards set treatment targets for water quality and quantity and require the implementation of SCMs to meet those targets. MassDEP is revising the Massachusetts Stormwater Management Standards, but the release date is unknown.

4.1.2.1 Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00)

These regulations establish procedures for local conservation commissions and MassDEP to follow in issuing permits for work in areas protected under the Wetlands Protection Act.[13] The Massachusetts Stormwater Management Standards are incorporated into the Wetlands Protection Act at 310 CMR 10.05(6)(b)(1)(a).

4.1.2.2 Massachusetts 401 Water Quality Certification Regulations (314 CMR 9.00)

The Massachusetts 401 Water Quality Certification regulations establish procedures and criteria for administration of Section 401 of the CWA for the discharge of dredged or fill material in WOTUS within the Commonwealth of Massachusetts, which require federal licenses or permits. MassDEP administers the 401 Water Quality Certification regulations to ensure compliance with the Massachusetts Surface WQS (314 CMR 4.00).[14] The Massachusetts Stormwater Management Standards are incorporated into the Water Quality Certification Regulations at 310 CMR 9.06(6)(a).

Massachusetts Stormwater Handbook and Stormwater Standards, February 2008

The Massachusetts Stormwater Handbook was revised and updated in February 2008 in accordance with revisions to the wetlands regulations (310 CMR 10.00), and the Water Quality Regulations (314

[13] Massachusetts Department of Environmental Protection. 2014. Massachusetts Wetlands Protection Act Regulations (310 Code of Massachusetts Regulations [CMR] 10.00). October. https://www.mass.gov/regulations/310-CMR-1000-wetlands-protection-act-regulations

[14] Massachusetts Department of Environmental Protection. 2014. Massachusetts 401 Water Quality Certification Regulations (314 CMR 9.00). October. https://www.mass.gov/regulations/314-CMR-9-401-water-quality-certification

CMR 9.00) relating to stormwater.[15] The handbook presents the legal and regulatory framework, stormwater BMPs, and technical guidance for documenting compliance.

Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas; A Guide for Planners, Designers, and Municipal Officials, May 2003 (reprint)

This guide presents planning principles and BMPs for controlling erosion and sedimentation.

4.1.2.3 Massachusetts Surface Water Quality Regulations (314 CMR 4.00)

The Massachusetts Surface Water Standards classify surface waters in the state and establish minimum criteria to protect and enhance uses. The state regulations classify Cape Cod Canal as a Class SB coastal waterway with shell fishing qualifier. Class SB waters include designated uses as habitat for fish, other aquatic life, and wildlife, as well as for primary and secondary contact recreation. The WQS set criteria to sustain the listed designated uses for discharges of potential pollutants, including dissolved oxygen, pH, solids, color and turbidity, aesthetics, and nutrients.

4.2 Methodology

Surface and groundwater resource areas within the Study Area were identified and characterized by location. The existing stormwater collection and treatment system infrastructure, including outfall locations, was identified using topographic survey data and record plans. No potential connections to combined sewer overflows were found.

Potential direct and indirect effects to receiving waters were assessed for temporary (construction period) and long-term (operational) for the Build Alternative. Effects were addressed quantitively and qualitatively. Temporary and No Build Alternative effects were assessed qualitatively. The quantitative assessment for the Build Alternative includes the total alteration to impervious cover (refer to **Table 6-1**), a comparison of peak flow rates for storm events under existing and proposed conditions (refer to **Table 8-1 through Table 8-3**), the recharge compliance requirements (refer to **Table 8-4**), and the water quality requirements (refer to **Table 8-5**).

The potential temporary and operational effects of the Build Alternative to groundwater were assessed, including measures to protect the sole source aquifers. Minimization and mitigation strategies for construction and operational effects were identified. Quantitative results were provided for peak flow reduction (refer to **Table 8-1 through Table 8-3**), recharge volume (refer to **Table 8-4**), and pollutant removal achieved (refer to **Table 8-5**) by the proposed stormwater management system for the Build Alternative.

Rainfall predictions were used to design a stormwater management system that would provide adequate flood storage given future climate conditions. The Resilient MA Action Team, co-led by Massachusetts Executive Office of Energy and Environmental Affairs and Massachusetts Emergency

[15] Massachusetts Department of Environmental Protection. 2008. Massachusetts Stormwater Handbook and Stormwater Standards. February. https://www.mass.gov/guides/massachusetts-stormwater-handbook-and-stormwater-standards#-stormwater-handbook-volume-1-

Management Agency, developed a Climate Resilience Design Standards Tool to help Massachusetts agencies and municipalities integrate climate data and methodologies into the planning and design of projects with physical assets. For the Program, this design standards tool recommended accommodating the 2070, 100-year return period. The tool predicts that in the year 2070, the 100-year (or 1% probability) storm event will result in 9.8 inches of rainfall in 24 hours for the Sagamore Bridge watersheds and 9.9 inches of rainfall in 24 hours for the Bourne Bridge watersheds. These rainfall depths were used to assess the vulnerability of the stormwater management system and design sustainable infrastructure.

A qualitative comparative assessment was provided of the stormwater management system improvements for the Build Alternative to existing conditions and the No Build Alternative. The Build Alternative was evaluated for consistency with the Massachusetts Stormwater Management Standards in accordance with applicable State regulations.

4.2.1 Method of Calculation

The design flood[16] frequency for stormwater conveyance design elements was selected in accordance with MassDOT and FHWA guidelines. **Table 4-1** summarizes the design flood frequencies for the Build Alternative.

Table 4-1. Design Flood Frequency

Highway Functional Class	Cross Culverts and Open Channels	Storm Drain System and Pavement Drainage	Underpasses and Depressed Sections
Interstate	2% (50-year)	10% (10-year)	2% (50-year)
Arterial	2% (50-year)	10% (10-year)	2% (50-year)

Note: A culvert is a pipe crossing under a road, sidewalk, etc., that is open to daylight on both ends.

4.2.1.1 Hydrologic Analysis

The hydrology of the Study Area was analyzed in HydroCAD software using the Soil Conservation Service (SCS) Technical Release No. 20 (SCS unit hydrograph procedures),[17] and SCS Technical Release No. 55 (for Times of Concentration and Runoff Curve Numbers).[18] The SCMs were analyzed using the Dynamic Storage Indication Method.[19] The Type III 24-hour storm was used for stormwater runoff calculations.

[16] A design flood is a hypothetical precipitation event used for analyzing or designing a stormwater management structure that is tied to the probability of that event occurring (e.g., a 2-year storm has a 50% probability of occurring in any given year and a 100-year storm has a 1% probability of occurring in any given year).

[17] Natural Resources Conservation Service. n.d. TR-20: Project Formulation – Hydrology. https://hydrocad.net/tr-20.htm

[18] Natural Resources Conservation Service. n.d. TR-55: Uban Hydrology for Small Watersheds. https://www.hydrocad.net/tr-55.htm

[19] Natural Resources Conservation Service. n.d. Using the Dynamic Storage-Indication Method. https://hydrocad.net/dsi.htm

Table 4-2 presents the 24-hour precipitation depths that were used to evaluate various storm event probabilities. The precipitation depths were estimated using the National Oceanic and Atmospheric Administration Atlas 14 data source.[20]

Table 4-2. Precipitation Depth

Storm Event Probability	24-Hour Depth (inches)
50% (2-year)	3.4
10% (10-year)	5.0
2% (50-year)	6.7
1% (100-year)	7.5

4.2.1.2 Hydraulic Analysis

The proposed storm drainage collection system was designed for the design flood frequencies listed in **Table 4-1** using the Rational Method. Bentley® StormCAD software was used to perform the hydraulic analysis for the storm drainage system.

Table 4-3 presents the precipitation intensities that were used to evaluate the storm drain conveyance system. The precipitation intensities were estimated using the National Oceanic and Atmospheric Administration Atlas 14 data source.

Table 4-3. Precipitation Intensity

Duration (minutes)	10-Year Intensity (inches per hour)	50-Year Intensity (inches per hour)
5	6.9	9.7
10	4.9	6.9
15	3.8	5.4
30	2.8	3.9
60	1.8	2.5

[20] National Oceanic and Atmospheric Administration, National Weather Service. n.d. Hydrometeorological Design Studies Center: NOAA Atlas 14 Point Precipitation Frequency Estimates. https://hdsc.nws.noaa.gov/pfds/pfds_map_cont.html

5 Affected Environment

5.1 Drinking Water Supplies

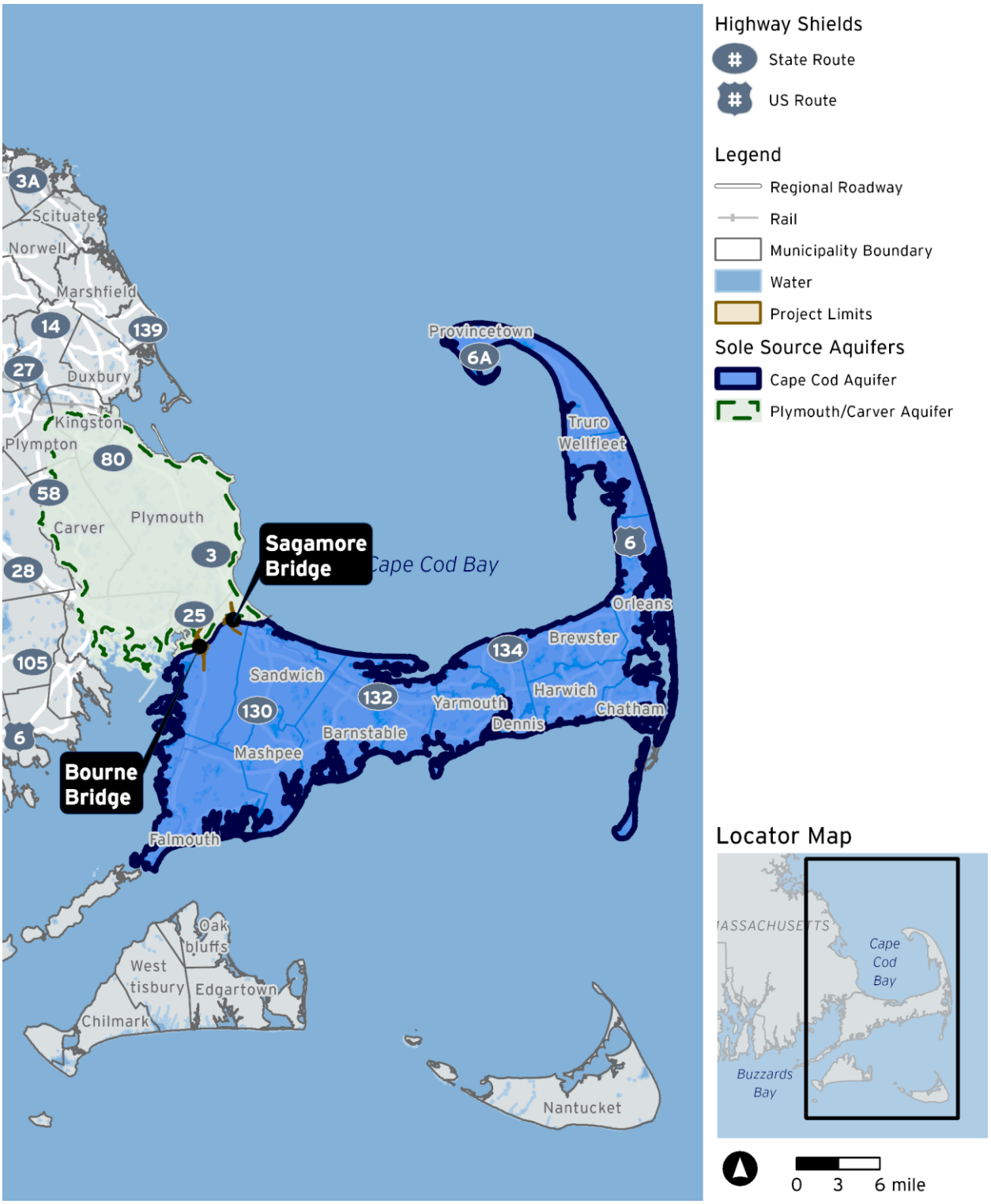
The Study Area lies within two sole source aquifers, as designated by the EPA. The Cape Cod Sole Source Aquifer encompasses the entire Study Area south of Cape Cod Canal. The Plymouth/Carver Sole Source Aquifer encompasses the entire Study Area north of Cape Cod Canal. The designation ensures that no commitment for federal financial assistance may be provided for any project that the EPA determines may contaminate the aquifer through its recharge area to create a significant hazard to public health.[21] The EPA defines a sole source aquifer as one which supplies at least 50% of the drinking water consumed in the area overlying the aquifer. EPA guidelines also require that these areas have no alternative drinking water sources(s) that could physically, legally, and economically supply water to all who depend on the aquifer for drinking water.[22] **Figure 5-1** illustrates the extent of the two sole source aquifers within the Study Area.

Groundwater within these watersheds generally flows towards Cape Cod Canal, except for the portion of the Bourne North quadrant located north of Nightingale Pond, which flows towards Buttermilk Bay. As discussed in **Section 4.18, Solid and Hazardous Waste Material Management**, there are release sites within the Program Limits documented by MassDEP. All release sites are closed, having achieved a level of no significant risk under 310 CMR 40.000, the Massachusetts Contingency Plan. The releases are predominantly petroleum in nature, generally small in magnitude, and limited in extent based upon the tendency for petroleum to naturally attenuate over time and over relatively short distances (i.e., several hundreds of feet). Individually, each release would not contribute significantly to adverse groundwater quality within the sole source aquifers. The available groundwater quality data is specific to the individual releases but are not expected to include contaminants unrelated to each specific site. The available data is also spread out over time, in some cases by decades, making any comparison among data sets misleading or not representative of current conditions. Release sites are required to meet applicable risk standards to achieve regulatory closure. Based upon the sole source aquifers, applicable groundwater cleanup standards are the drinking water standards. However, some portions of these aquifers have been designated as non-potential drinking water source areas. Impacted soil and groundwater in these areas would not have to meet the most stringent drinking water clean-up standards. Also, disposal sites with residual groundwater impacts may have contaminant levels that are higher than drinking water standards in these areas.

[21] U.S. Environmental Protection Agency, Region 1. 2008. Sole Source Aquifer Program. https://www3.epa.gov/region1/eco/drinkwater/pc_solesource_aquifer.html

[22] U.S. Environmental Protection Agency, Region 1. 2008. Sole Source Aquifer Program. https://www3.epa.gov/region1/eco/drinkwater/pc_solesource_aquifer.html

Figure 5-1. Sole Source Aquifers



Source: Massachusetts Department of Transportation, 2024

5.2 Study Area Watersheds

The Study Area also lies within three major watersheds: South Coastal, Cape Cod, and Buzzards Bay. Stormwater runoff within the Study Area flows to Cape Cod Canal with a portion captured by catch basins or similar structures and conveyed through underground pipes that discharge along the bank of the canal. Stormwater runoff within the Study Area is also captured and conveyed via pipe network to low-lying areas and existing stormwater basins where it recharges to the groundwater, which is part of the Cape Cod and Plymouth/Carver Sole Source Aquifers. **Figure 5-2** illustrates the three major watersheds within the Study Area.

All developed land covers convey natural and human-made materials, including sediment, nutrients, metals, salts, organic chemicals, litter, and bacteria that are either deposited on surfaces by wind, air pollution fallout, and rain or generated by land-use activities. Roadways and other impervious urban areas can convey naturally deposited materials, materials of their construction, and materials that are tracked on or deposited by vehicular traffic, as well as other sources. Roadways and parking lots may also receive de-icing chemicals and/or winter maintenance sands applied to maintain safe operating conditions. The U.S. Geological Survey, in cooperation with MassDOT, has characterized, quantified, and interpreted the quality of runoff from highways and bridges in Massachusetts.[23]

New or more current stormwater management systems typically have in-line treatment devices or practices to reduce the pollutants in the stormwater prior to discharge to wetlands or waterways. Most of the existing pipe networks discharging to Cape Cod Canal in the Study Area were constructed before MassDEP issued the Stormwater Policy in 1996 that established Stormwater Management Standards and provide a minimal level of treatment of pollutants prior to discharge. The exception is the Sagamore North quadrant, which was reconstructed in the early 2000s during MassDOT's Sagamore Rotary Grade Separation Project and includes stormwater treatment basins. Stormwater runoff from the Sagamore and Bourne Bridges discharges directly to the water and land below the bridge deck through openings called scuppers, which are connected to downspouts. **Exhibit 5-1** illustrates downspouts originating from the Sagamore Bridge deck and ending at the bottom of the bridge truss where water falls to the ground.

MassDOT conducts snow and ice management that is consistent with the practices outlined in the MassDOT Snow and Ice Control Program Environmental Status and Planning Report, formerly known as the Snow and Ice Control Generic Environmental Impact Report.

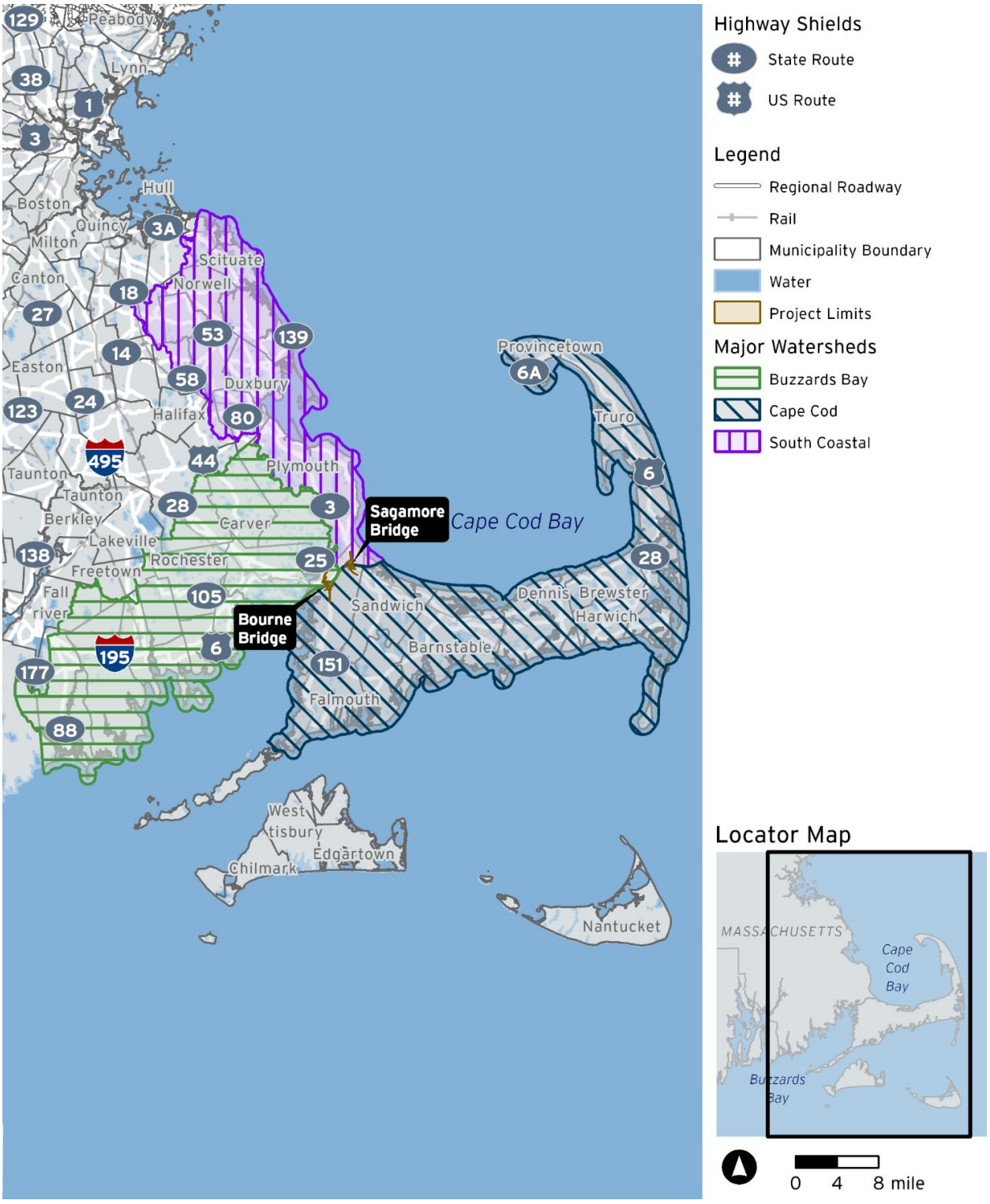
Cape Cod is a Reduced Salt Zone due to its sandy soils and sole source aquifer. The standard 240 pound per lane-mile sodium chloride roadway treatment is replaced with 120 pounds sodium chloride mixed with 120 pounds sand in Reduced Salt Zones. MassDOT collects the sand from roadways and stormwater basins after the winter season.

[23] U.S. Geological Survey Scientific Investigations Report 2009–5269. https://doi.org/10.3133/sir20095269, U.S. Geological Survey Scientific Investigations Report 2018–5033, https://doi.org/10.3133/sir20185033.

MassDOT updates the snow and ice control program report annually and revamps it every five years. The report details BMPs employed by MassDOT's snow and ice program to limit the environmental repercussions from its winter roadway maintenance to the extent possible. MassDOT also works with individual well owners to alleviate concerns related to salinity and participates in discussions with water authorities that have an interest in the snow and ice management practices. All proposed infiltration basins for the Program would be located outside of the Zone II areas, which contribute to wellhead protection areas via groundwater flow.

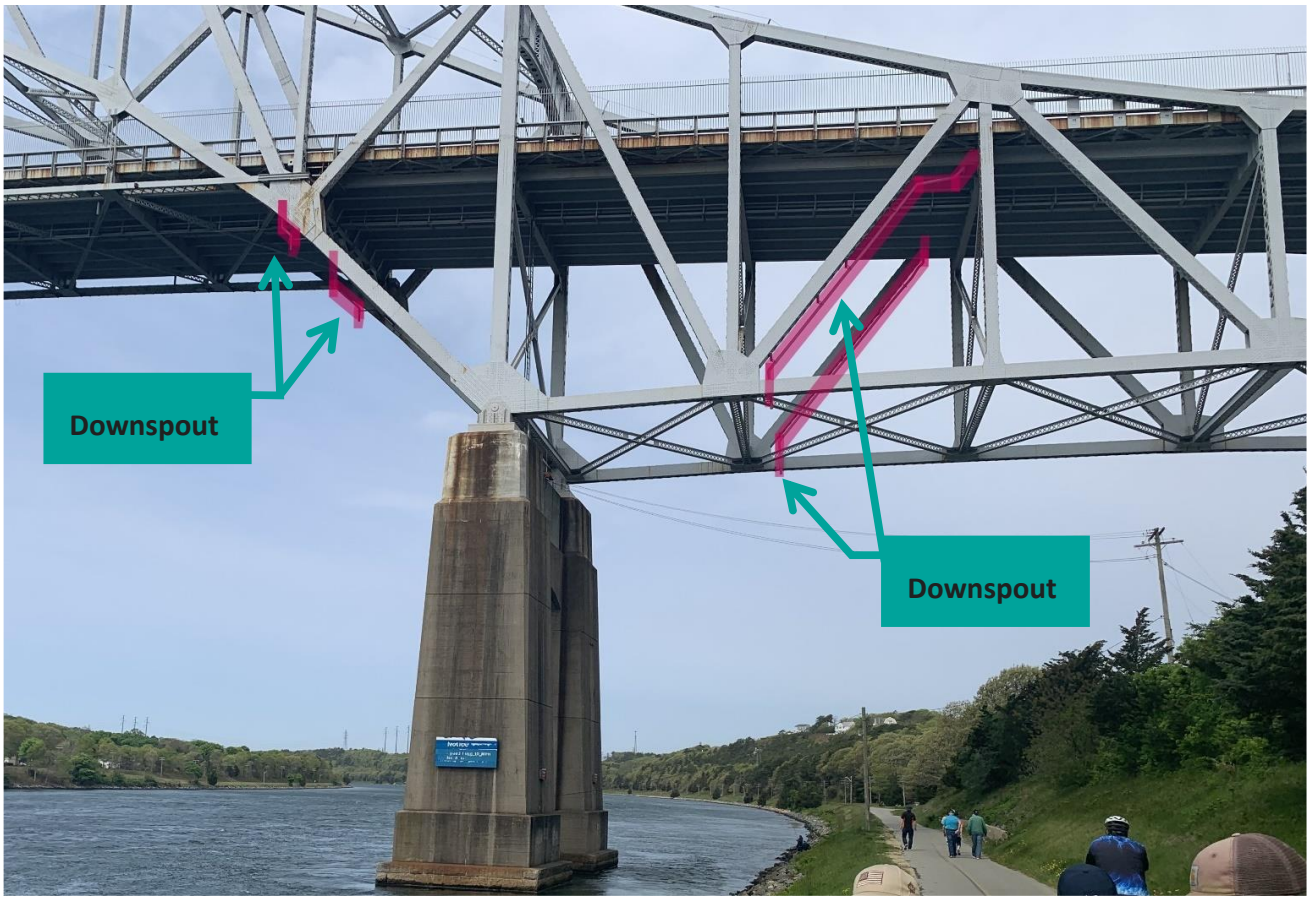
The following sections describe existing conditions within each Study Area quadrant: Sagamore North, Sagamore South, Bourne North, and Bourne South.

Figure 5-2. Major Watersheds Relevant to Study Area



Source: Massachusetts Department of Transportation, 2024

Exhibit 5-1. Downspouts (Sagamore Bridge)



Source: Massachusetts Department of Transportation, 2023

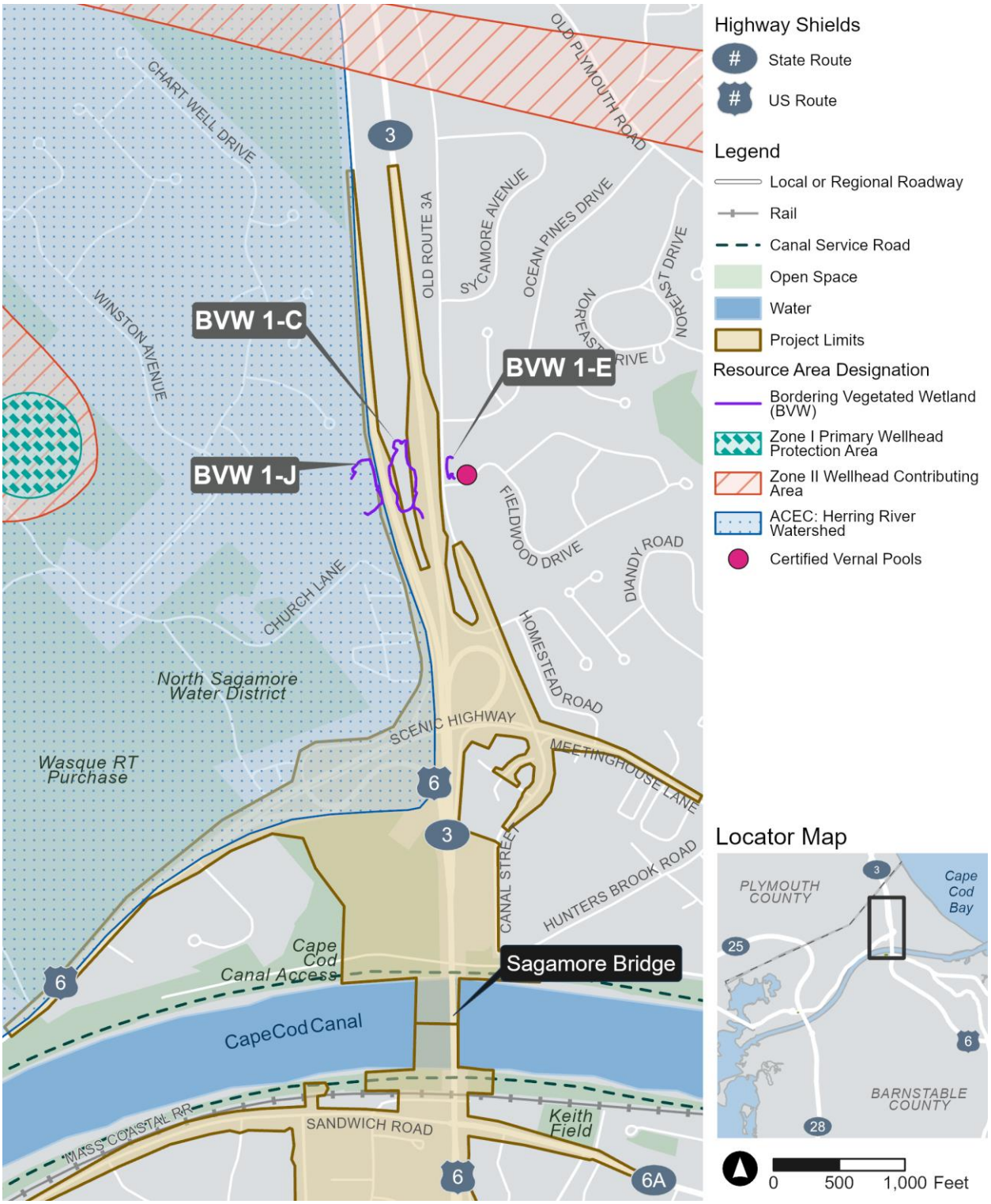
5.3 Sagamore North Quadrant

The Sagamore North quadrant is the portion of the Study Area north of Sagamore Bridge. The Sagamore North quadrant lies within drainage subbasin 21089 of the South Coastal major watershed. The area drains via surface runoff and pipe conveyance to Cape Cod Canal. Stormwater runoff also recharges to groundwater within the Plymouth/Carver Sole Source Aquifer. Portions of the Sagamore North quadrant drain to inland wetlands 1-C, 1-E, and 1-J (**Figure 5-3**). Wetland series 1-E contains a certified vernal pool. Wetland series 1-J is mapped within the Herring River Watershed Area of Critical Environmental Concern (ACEC).[24] Vernal pools and ACECs are critical environmental resource areas that provide ecological benefit.

The existing stormwater management system for the Sagamore North quadrant includes catch basin inlets that capture roadway runoff and convey it via underground pipes to stormwater treatment basins. **Figure 5-4** illustrates the locations of the existing SCMs within the Study Area. **Exhibit 5-2** and **Exhibit 5-3** illustrate two of the existing stormwater treatment basins. The existing stormwater basins include a micropool (an area that retains stormwater) as well as overflow areas that allow ponded water to infiltrate after treatment. Most runoff from this Study Area discharges to groundwater after treatment. There is also an existing 24-inch pipe that runs down Canal Street and discharges to Cape Cod Canal; this pipe conveys runoff from portions of State Route 3 located south of Scenic Highway and a portion of the Sagamore Park and Ride Lot (Commerce Way, Bourne).

[24] An Area of Critical Environmental Concern (ACEC) is a place in Massachusetts that receives special recognition because of the quality, uniqueness, and significance of its natural and cultural resources. Such an area is identified and nominated at the community level and is reviewed and designated by the state's Secretary of Energy and Environmental Affairs. The Department of Conservation and Recreation administers the ACEC Program on behalf of the Secretary.
Source: Massachusetts Department of Conservation & Recreation. n.d. ACEC Program Overview. https://www.mass.gov/info-details/acec-program-overview

Figure 5-3. Resource Area Designations (Sagamore North Quadrant)



Source: Massachusetts Department of Transportation, 2024

Figure 5-4. Existing Storm Control Measures (Sagamore North Quadrant)

Source: Massachusetts Department of Transportation, 2024

Exhibit 5-2. Stormwater Basin at Canal Street and Commerce Way (Sagamore North Quadrant)

Source: Massachusetts Department of Transportation, 2023

Exhibit 5-3. Stormwater Basin at State Route 3 North Off-Ramp to U.S. Route 6 West (Sagamore North Quadrant)

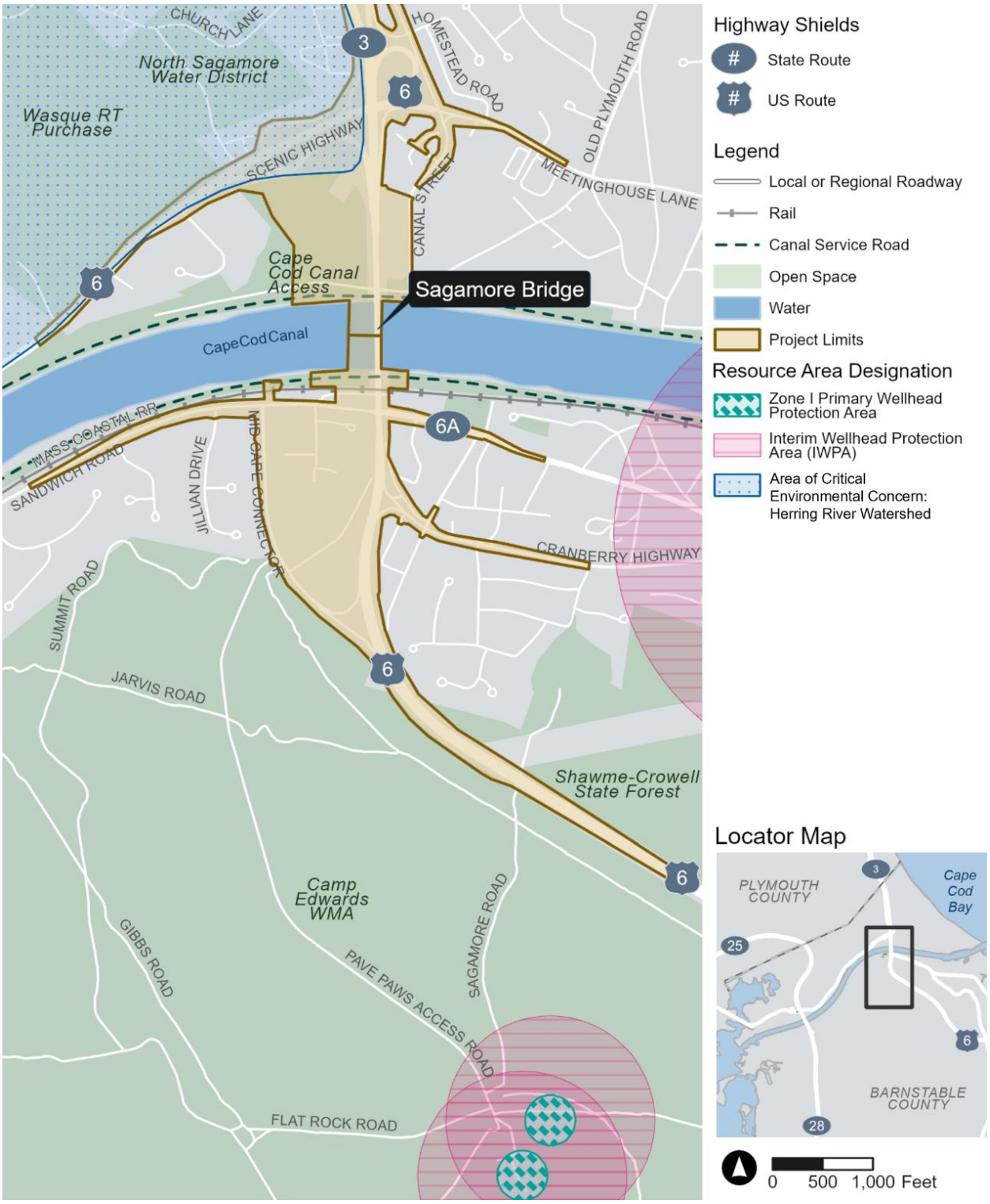
Source: Massachusetts Department of Transportation, 2023

5.4 Sagamore South Quadrant

The Sagamore South quadrant is the portion of the Study Area south of the Sagamore Bridge. The Sagamore South quadrant lies within drainage subbasin 22001 of the Cape Cod major watershed. The area drains via surface runoff and pipe conveyance to Cape Cod Canal. Stormwater runoff also recharges to groundwater within the Cape Cod Sole Source Aquifer. There are no inland wetland resource areas within the Sagamore South quadrant. **Figure 5-5** illustrates the MassDEP Wellhead Protection Areas relative to the Project Limits. Zone I refers to the primary protection area around a well, which must be controlled by the water supplier. Zone II is an area that contributes to the well water supply under severe pumping and recharge conditions. The Interim Wellhead Protection Area (IWPA) serves the same purpose as Zone II but is applied to public supply wells that lack a MassDEP approved Zone II boundary.

The existing stormwater management system for the Sagamore South quadrant includes catch basin inlets that capture roadway runoff and convey it via underground pipes to ditches, low-lying areas, and outfalls at the canal. There are two main pipe outfalls at Cape Cod Canal for this Study Area. The first is a 36-inch pipe outfall opposite Mid-Cape Connector that discharges stormwater runoff from Mid-Cape Connector and Sandwich Road. The second is a 36-inch pipe outfall approximately 50 feet east of Sagamore Bridge that discharges stormwater runoff from U.S. Route 6 and Cranberry Highway. Roadway runoff from U.S. Route 6 south of Mid-Cape Connector on- and off-ramps discharges to low-lying areas where it infiltrates to groundwater.

Figure 5-5. Resource Area Designations (Sagamore South Quadrant)



Source: Massachusetts Department of Transportation, 2024

5.5 Bourne North Quadrant

The Bourne North quadrant is the portion of the Study Area north of Bourne Bridge. The Bourne North quadrant lies within the drainage subbasin 24001 of the Buzzards Bay major watershed. The area drains via surface runoff and pipe conveyance to Cape Cod Canal. Stormwater runoff recharges to groundwater within the Plymouth/Carver Sole Source Aquifer. Portions of the Bourne North quadrant drain to inland wetlands 3-C (Nightingale Pond), 3-E, and 3-H/I/Q, as illustrated in **Figure 5-6**. There are two Wellhead Protection Areas within the Bourne North quadrant: an IWPA for Sandy's Restaurant and a Zone II wellhead protection area for Buzzards Bay Water District. As stated in 310 CMR 22.02, a Zone II is:

> "That area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield, with no recharge from precipitation). It is bounded by the groundwater divides which result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, Zone IIs shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock, or a recharge boundary)."[25]

In the absence of an approved Zone II, MassDEP has adopted the IWPA as the primary, protected recharge area for public water supply[26] groundwater sources.[27]

The existing stormwater management system for the Bourne North quadrant includes catch basin inlets that capture roadway runoff and convey it via underground pipes to ditches, low-lying areas, and an outfall at the canal. Within the groundwater Wellhead Protection Areas north of the State Route 25 ramps, all stormwater runoff is collected and conveyed to Cape Cod Canal via twin 43-inch by 68-inch elliptical pipes. Refer to **Exhibit 5-4** and **Exhibit 5-5**.

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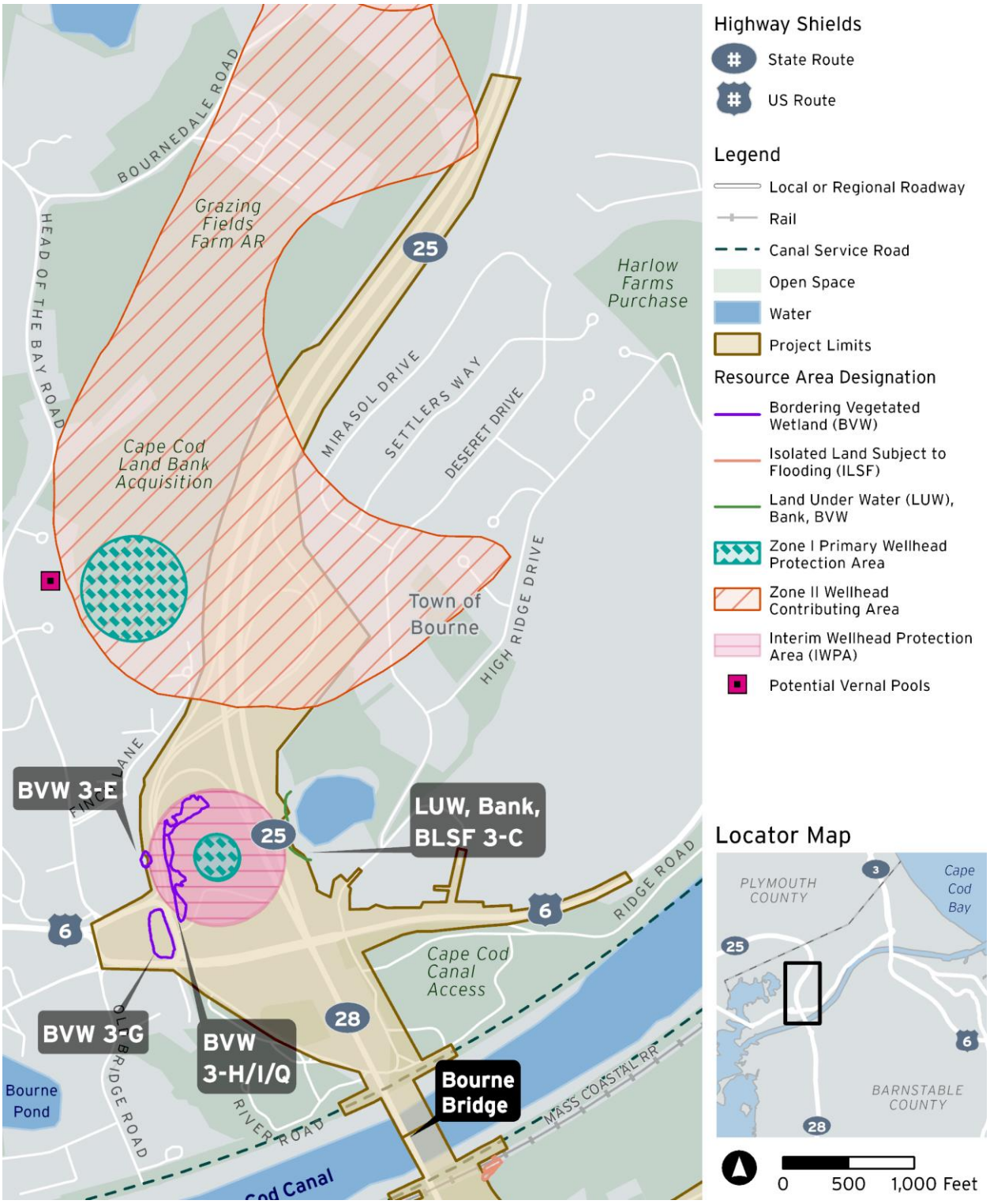
[25] Executive Office of Technology Services and Security. 2024. MassGIS Data: MassDEP Wellhear Protection Areas (Zone II, Zone I, IWPA). April. https://www.mass.gov/info-details/massgis-data-massdep-wellhead-protection-areas-zone-ii-zone-i-iwpa

[26] A system for the provision to the public of water for human consumption, through pipes or other constructed conveyances, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days of the year.
Source: 310 CMR 22.02, https://www.mass.gov/info-details/determining-if-a-water-system-is-public-or-private

[27] Executive Office of Technology Services and Security. 2024. MassGIS Data: MassDEP Wellhear Protection Areas (Zone II, Zone I, IWPA). April. https://www.mass.gov/info-details/massgis-data-massdep-wellhead-protection-areas-zone-ii-zone-i-iwpa

Figure 5-6. Resource Area Designations (Bourne North Quadrant)



Source: Massachusetts Department of Transportation, 2024

Exhibit 5-4. Pipe Outfall Location at Cape Cod Canal (Bourne North Quadrant)

Source: Massachusetts Department of Transportation, 2023

Exhibit 5-5. Twin 43-inch by 68-inch Elliptical Pipe Outfalls (Bourne North Quadrant)

Source: Massachusetts Department of Transportation, 2023

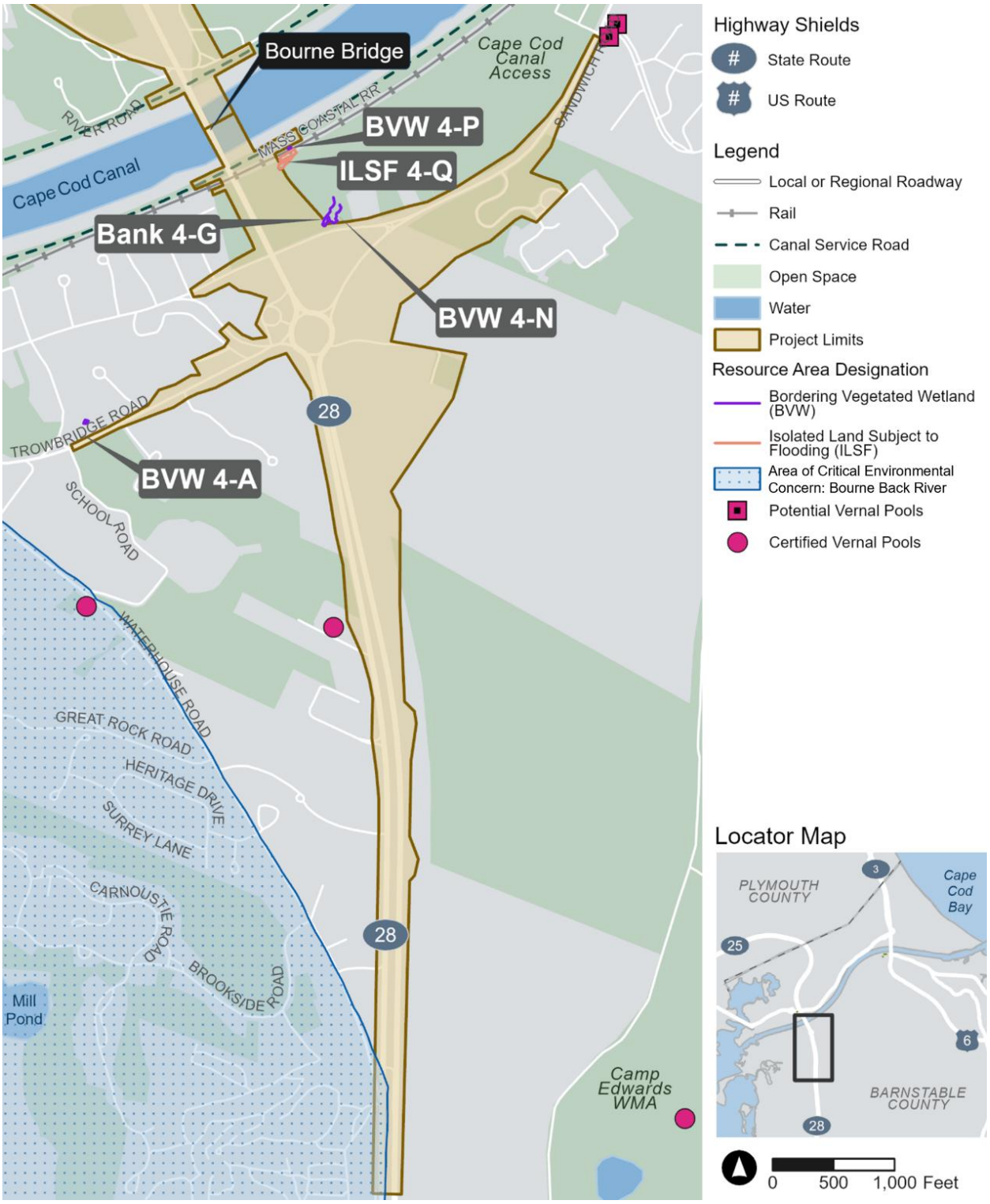
There is an impervious shoulder, which consists of hot mix asphalt buried approximately 4 feet deep, in all pervious medians and shoulders within the wellhead protection area that prevents stormwater from infiltrating to groundwater. Snow melt or runoff from large storms that is not captured by the catch basin inlets in the roadway is collected in a subdrain system and conveyed to Cape Cod Canal via the twin 43-inch by 68-inch elliptical pipes. Roadway runoff from the southern portion of State Route 25 and Main Street discharges to low-lying areas where it infiltrates to groundwater.

5.6 Bourne South Quadrant

The Bourne South quadrant is the portion of the Study Area south of Bourne Bridge. The Bourne South quadrant lies within the drainage subbasin 22141 of the Cape Cod major watershed. The area drains via surface runoff and pipe conveyance to Cape Cod Canal. Stormwater runoff recharges to groundwater within the Cape Cod Sole Source Aquifer. Portions of the Bourne South quadrant drain to inland wetland 4-N. **Figure 5-7** illustrates the ACEC and vernal pools relative to the Project Limits.

The existing stormwater management system for the Bourne South quadrant includes catch basin inlets that capture roadway runoff and convey it via underground pipes to ditches, low-lying areas, and an outfall at the canal. There is a 24-inch pipe outfall approximately 150 feet west of Bourne Bridge that discharges stormwater runoff from the Bourne Rotary and Sandwich Road (refer to **Exhibit 5-6**). Roadway runoff from State Route 28 south of the rotary discharges to low-lying areas where it infiltrates to groundwater.

Figure 5-7. Resource Area Designations (Bourne South Quadrant)



Source: Massachusetts Department of Transportation, 2024

Exhibit 5-6. 24-Inch Pipe Outfall at Cape Cod Canal (Bourne South Quadrant)

Source: Massachusetts Department of Transportation, 2023

6 Environmental Consequences

6.1 No Build Alternative

The No Build Alternative includes maintenance of existing facilities as well as recently completed and near-term projects included in the Cape Cod region's Federal Fiscal Year 2025–2029 Transportation Improvement Program. For the No Build Alternative, most of the existing impervious surface area along roadways in the Study Area would remain untreated, which has the potential for long-term adverse effects to surface water and groundwater quality within the Study Area. The projected increase in traffic volumes for the future 2050 No Build Alternative could increase the amount of pollutants deposited on roadways, leading to higher potential pollutant load in stormwater runoff.

6.2 Build Alternative

6.2.1 Construction Impacts

Sedimentation from earth-disturbing activities and stormwater runoff generated during construction can be substantial sources of pollution to surface waters, groundwater, and drinking water supplies, if SCMs are not in place. The Build Alternative would disturb greater than 1 acre of land and discharge to a WOTUS (Cape Cod Canal) and, therefore, would require the preparation and implementation of an SWPPP in accordance with the EPA's 2022 NPDES General Permit for Discharges from Construction Activities. The CGP authorizes discharge from construction activities and imposes monitoring requirements to protect water quality.

The SWPPP will include a detailed description, with timelines, of all controls, applicable BMPs, and mitigation measures that will be implemented at the construction sites for each construction phase identified as major soil disturbing activities. Refer to **Section 7.1** for a listing of the BMPs and control measures that will be implemented and enforced as part of the SWPPP to prevent pollutants from entering stormwater runoff during construction.

6.2.2 Operational Impacts

As illustrated in **Table 6-1**, the Build Alternative would result in an increase of approximately 51 acres of new impervious surface area compared to existing conditions.

The Build Alternative has the potential to affect water quality by changing the land cover and ultimately the hydrology of the site. Increased impervious surface without associated stormwater treatment could lead to increased surface runoff, higher peak flows during storm events, higher pollutant loads, and reduced groundwater recharge.

Under the Build Alternative, new collection and conveyance systems would be constructed for the proposed bridges and approach roadway systems. Stormwater detention and recharge, and improved water quality, would be provided through installation of low-impact SCMs, as discussed in **Section 7.2**. The proposed SCMs for the Build Alternative would improve the treatment and quality of the runoff

that is eventually discharged to Cape Cod Canal and the Plymouth/Carver and Cape Cod Sole Source Aquifers.

The stormwater management system for the Build Alternative will be designed to comply with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations and the 401 Water Quality Certification Regulations, which are discussed in **Section 8**.

Table 6-1. Build Alternative: Impervious Area

Study Area Quadrant	Existing Impervious Area (acres)	Proposed Impervious Area (acres)	Impervious Area Increase (acres)	Impervious Area Increase	Treated Impervious Area (acres)
Sagamore North	23.9	34.1	10.2	43%	27.4
Sagamore South	19.0	34.1	15.1	79%	28.2
Bourne North	23.3	36.7	13.4	58%	29.0
Bourne South	20.7	32.9	12.2	59%	32.1
Total	**86.9**	**137.8**	**50.9**	—	116.7

7 Mitigation Measures

This section describes mitigation measures that will be implemented to avoid or minimize the potential construction and operational effects of the Build Alternative relative to stormwater runoff and water quality.

7.1 Construction Impacts

Mitigation measures that will be implemented to avoid or minimize the potential for adverse impacts to groundwater, surface water, and stormwater runoff during construction will be specified in the SWPPP. The minimum practices that will be included in the SWPPP, will include, but will not be limited to, the following:

- Installation of sediment controls along the top of the bank of Cape Cod Canal and inland wetland resource areas, such as silt fence and/or compost filter tubes
- Stabilized construction exits to prevent sediment tracking from the work area onto public ways
- Site-specific construction phasing plans to minimize the extent of the disturbance at any one time
- Soil stockpile protection, including temporary erosion measures and perimeter controls
- Dust suppression, including watering
- Good housekeeping pollution prevention measures, including secondary containment
- Maintenance requirements

- Temporary and permanent stabilization requirements
- Recordkeeping/inspection requirements

A copy of the SWPPP will be provided to the Bourne Conservation Commission in conjunction with the requirements of Stormwater Management Standard 8. The SWPPP will be implemented by the contractor. A kick-off meeting will be held by the stormwater team, including the SWPPP preparer and the contractor, to review the SWPPP and conditions required by the CGP.

7.2 Operational Impacts

The Build Alternative would implement SCMs, such as rain gardens and infiltration basins, to meet the required targets for peak-rate attenuation, recharge, and water quality treatment, including total suspended solids (TSS), nitrogen, phosphorus, metals, and pathogens removal in accordance with the Massachusetts Stormwater Management Standards.

The feasibility and applicability of SCMs to treat stormwater runoff, especially for the purpose of infiltration and recharge, is dependent on the suitability of soils, including permeability and depth to groundwater and the limiting layer (clay/bedrock). Record soils and groundwater information from the U.S. Department of Agriculture National Resources Conservation Services and U.S. Geological Survey along with pilot borings strategically spaced throughout the Study Area have informed the preliminary layout and design of the proposed stormwater management system. During the 25% design and permitting phase, detailed subsurface analysis will be performed to determine the feasibility of implementing SCMs with infiltration capabilities. The results will identify maximum water table fluctuations, hydraulic conductivities and site-specific geologic information that will be used to evaluate long-term hydrogeologic effects. The following sections describe SCMs that will be implemented and maintained for the Build Alternative to protect and improve the quality of stormwater runoff post-construction.

7.2.1 Bioretention Area/Rain Garden

Bioretention areas/rain gardens will be implemented adjacent to proposed sidewalks and paths for treatment of pavement runoff, where feasible. This design allows decentralized treatment of runoff close to the source, which is preferred over concentrated end of the line treatment. Bioretention is considered a Low Impact Development technique and allows for aesthetic appeal with the appropriate plantings, which will be integrated into the streetscape. Plants selected for use in bioretention areas and rain gardens will be native and salt-tolerant species, to the extent feasible. **Exhibit 7-1** illustrates a typical rain garden planter between a sidewalk and a roadway.

Exhibit 7-1. Typical Rain Garden

Source: Massachusetts Department of Transportation, 2024

7.2.2 Infiltration Basin

Infiltration basins will be implemented to treat stormwater runoff from the replacement bridges and their approach roadway networks. The bottom of the basins will be at least 2 feet above seasonal, high groundwater and bedrock as required under MassDEP's Stormwater Management Standards. The elevation of seasonal, high groundwater will be confirmed prior to final design to determine the viability of infiltration basin locations. Each basin will be designed to hold the required recharge volume, allowing stormwater to filter through the subsurface, which removes pollutants, prior to reaching groundwater. Runoff from larger storm events will discharge through an outlet control structure, enter a collector pipe, and eventually discharge either to Cape Cod Canal via pipe outfall or to the groundwater via infiltration through the soils. Linear infiltration will be used as a retrofit technique to transform existing conveyance swales and ditches into stormwater treatment practices. Linear infiltration will also be used when physical constraints preclude the use of infiltration basins. Infiltration is considered a goal of many Low Impact Development techniques. **Exhibit 7-2** illustrates a typical infiltration basin with sediment forebay.

Exhibit 7-2. Typical Infiltration Basin with Sediment Forebay

Source: Massachusetts Department of Transportation, 2013

7.2.3 Sediment Forebay

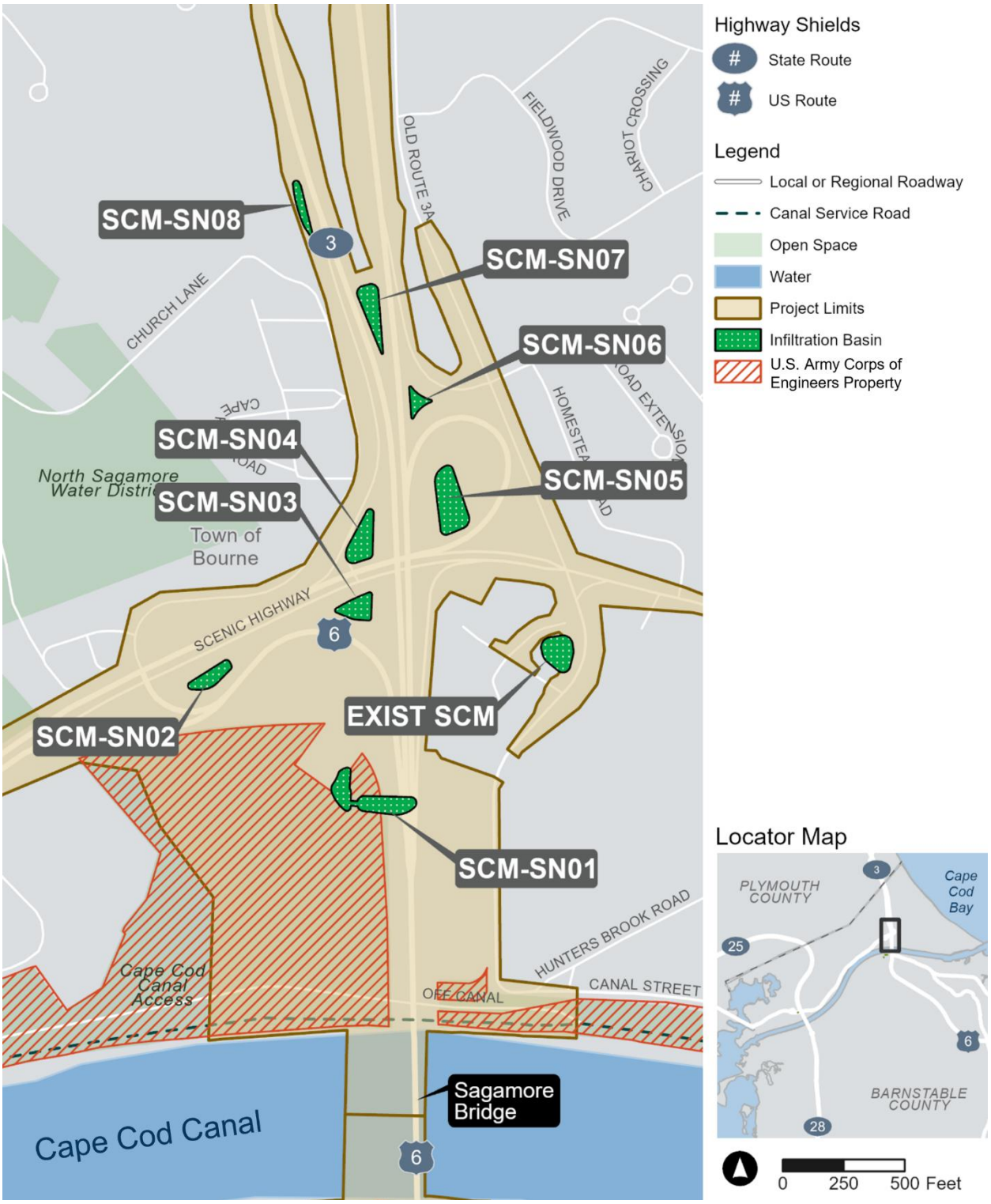
Sediment forebays are considered part of the infiltration basin and rain garden. They provide a storage area at the point where the discharge pipe enters, for solids and sediment to settle out, providing pretreatment prior to entering the main part of the SCM. The forebays will be sized to treat an equivalent of 0.1 inch of runoff from the contributing impervious area, consistent with MassDEP sizing guidelines. In addition to TSS removal, the forebays will also provide velocity dissipation where higher flows will be dissipated to minimize erosion.

7.2.4 Deep Sump Catch Basin

Deep sump catch basins will be implemented on all roadways within the proposed limits of construction. Bicycle-friendly catch basin grates will be installed on those sections of roadway where cycling is allowed. Deep sump catch basins contribute towards water quality treatment. The treatment train consisting of deep sump catch basin to sediment forebay reduces TSS by 44%, which is required prior to infiltration for soils with rapid infiltration rates (>2.4 inches/hour) and discharges to critical areas.

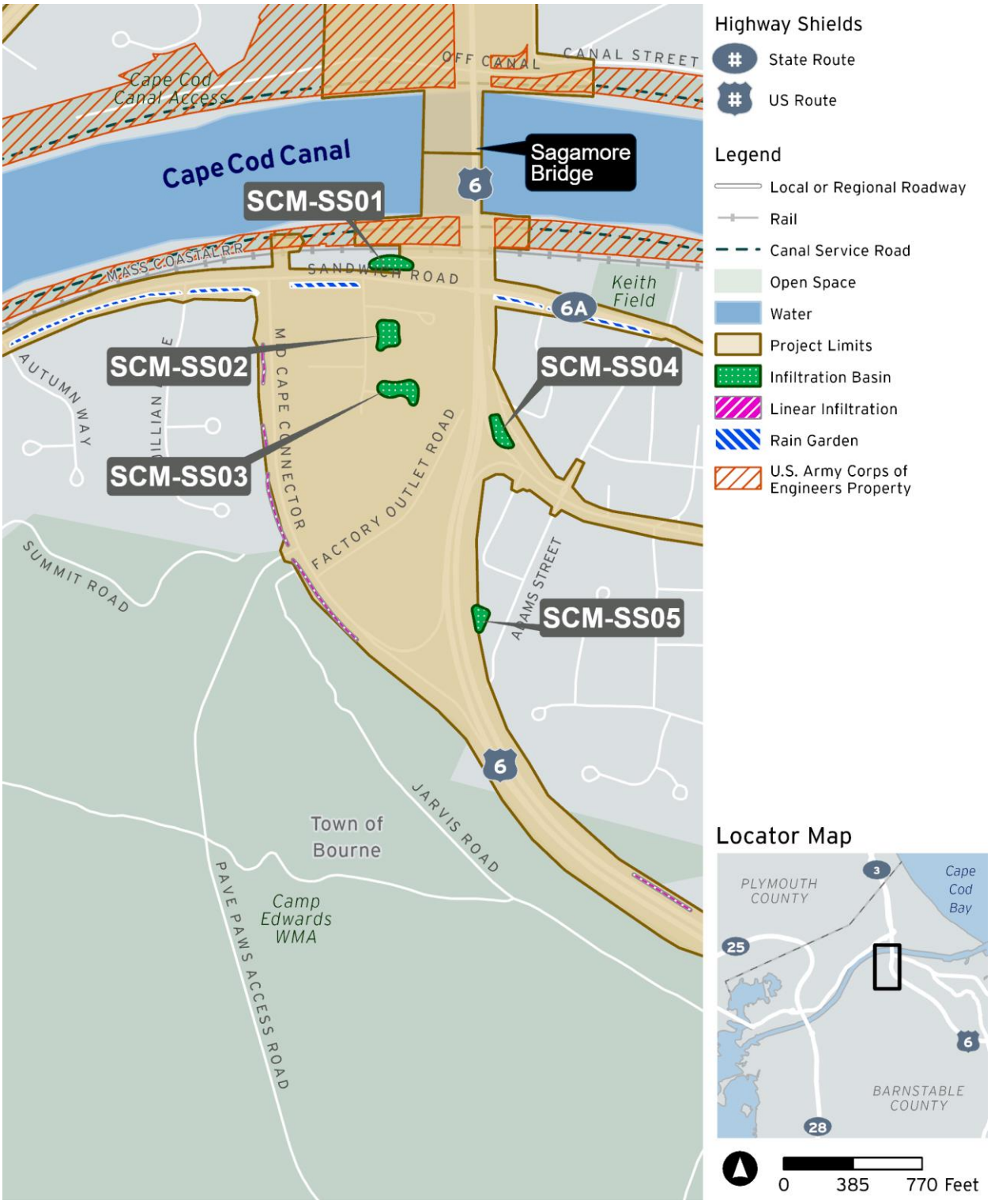
Figure 7-1 through Figure 7-4 present potential SCM types and locations within the Study Area.

Figure 7-1. Potential Stormwater Control Measures (Sagamore North Quadrant)



Source: Massachusetts Department of Transportation, 2024

Figure 7-2. Potential Stormwater Control Measures (Sagamore South Quadrant)

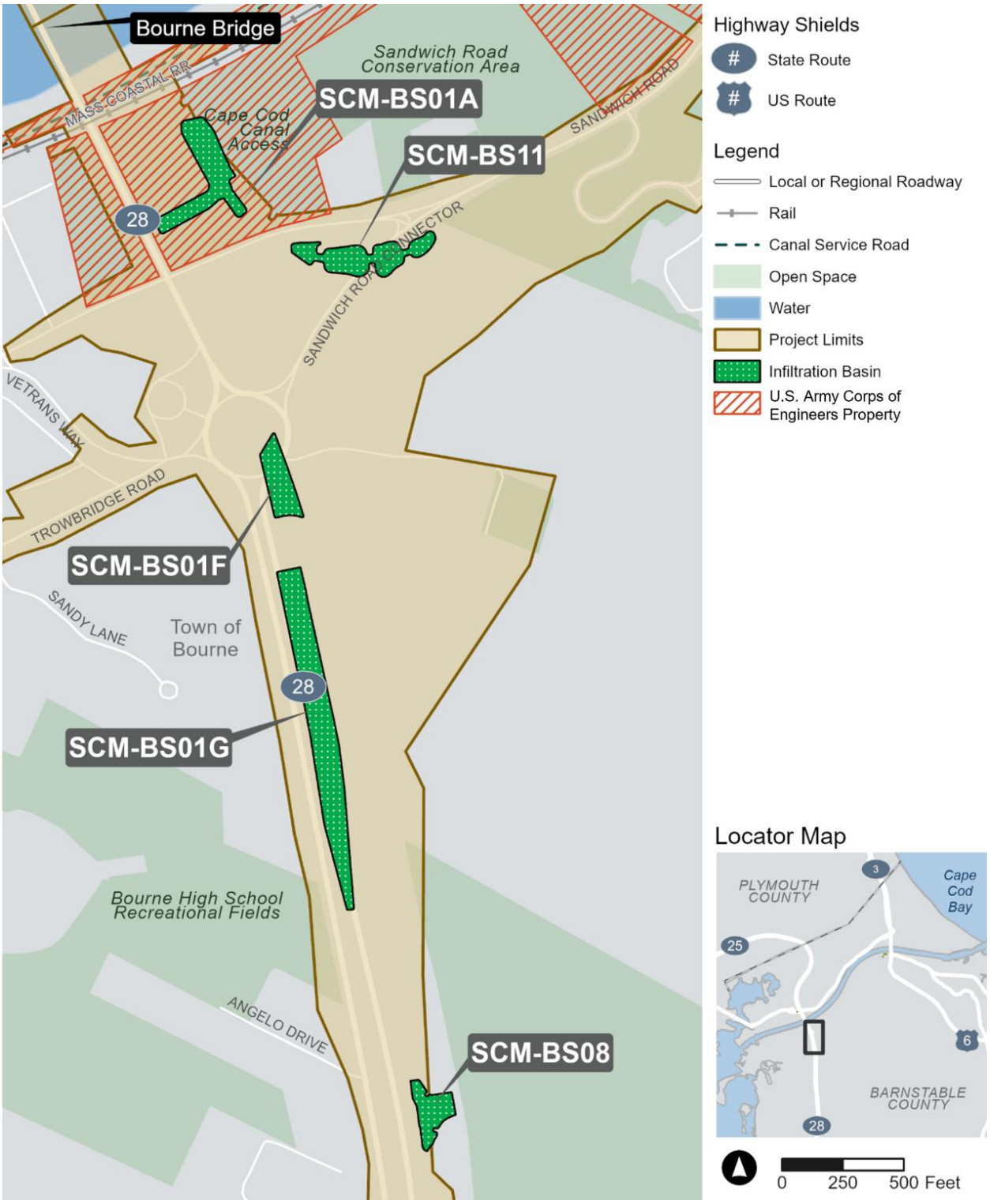


Source: Massachusetts Department of Transportation, 2024

Figure 7-3. Potential Stormwater Control Measures (Bourne North Quadrant)

Source: Massachusetts Department of Transportation, 2024

Figure 7-4. Potential Stormwater Control Measures (Bourne South Quadrant)



Source: Massachusetts Department of Transportation, 2024

8 Regulatory Compliance

The proposed stormwater management system for the Build Alternative will be designed to comply with the Massachusetts Stormwater Management Standards, as enforced through the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and the 401 Water Quality Certification Regulations (314 CMR 9.00). The following sections discuss how the Build Alternative would be designed, operated, and maintained in compliance with each of the 10 Massachusetts Stormwater Management Standards.

8.1 Standard 1 – No New Untreated Discharges

No new outfalls are proposed for the Build Alternative. Existing outfalls will be reused, and treatment will be provided for stormwater runoff prior to discharge, as demonstrated under Standard 4. Scour protection measures (such as stone aprons) and bank stabilization (such as plantings) will be implemented to prevent erosion of wetland resource areas when the proposed velocity exceeds the permissible velocity.

8.2 Standard 2 – Peak Rate Control

SCMs will be designed to reduce post-development peak discharge rates[28] to less than or equal to pre-development peak discharge rates for the 2-year, 10-year, and 100-year, 24-hour design events. This standard may be waived for discharges to land subject to coastal storm flowage as defined by 310 CMR 10.04, "land subject to any inundation caused by coastal storms up to and including that caused by the 100-year storm, surge of record or storm of record, whichever is greater", which includes Cape Cod Canal. The standard applies to intermediate discharge points to inland resource areas or within buffer zones. **Table 8-1 through Table 8-3** list existing and proposed peak-rate discharges at Cape Cod Canal for each Study Area. Detailed analysis will be performed during the 25% design and permitting phase to ensure compliance with this standard at intermediate discharge points.

[28] Discharge rate is the volumetric flow rate used to measure how much stormwater runoff leaves a given site. The discharge rate depends upon the roughness of the surface, the location of the impervious area in relation to the point of analysis, the slope of the ground surface, and the total distance that the runoff must travel to the point of analysis.

Table 8-1. Build Alternative: 2-Year Storm Peak Rate Comparison

Study Area Quadrant	Existing Peak Discharge Rate (cubic feet per second)	Proposed Peak Discharge Rate (cubic feet per second)	Difference Peak Discharge Rate (cubic feet per second)
Sagamore North	26.9	16.7	-10.2
Sagamore South	25.7	17.2	-8.5
Bourne North	58.0	42.5	-15.5
Bourne South	20.2	12.8	-7.4

Table 8-2. Build Alternative: 10-Year Storm Peak Rate Comparison

Study Area Quadrant	Existing Peak Discharge Rate (cubic feet per second)	Proposed Peak Discharge Rate (cubic feet per second)	Difference Peak Discharge Rate (cubic feet per second)
Sagamore North	55.8	42.9	-12.9
Sagamore South	86.3	73.4	-12.9
Bourne North	167.1	151.0	-16.1
Bourne South	78.8	72.7	-6.1

Table 8-3. Build Alternative: 100-Year Storm Peak Rate Comparison

Study Area Quadrant	Existing Peak Discharge Rate (cubic feet per second)	Proposed Peak Discharge Rate (cubic feet per second)	Difference Peak Discharge Rate (cubic feet per second)
Sagamore North	106.9	102.2	-4.7
Sagamore South	237.8	196.0	-41.8
Bourne North	395.4	395.2	-0.2
Bourne South	234.4	185.5	-48.9

8.3 Standard 3 – Recharge

The use of environmentally sensitive site design and LID technique features will be maximized to the extent practicable. At least 65% of impervious cover for the Build Alternative will be directed to infiltration SCMs or the required recharge volume will be increased using the capture area adjustment calculation. The additional pretreatment requirements for soils with rapid infiltration rates and discharges to critical areas will be met. All infiltration SCMs will be located outside of Zone I, Zone II, and IWPAs. The required recharge volume equals 0.6-inch runoff times total impervious area. **Table 8-4** presents the required and proposed recharge volumes for the Build Alternative.

Table 8-4. Build Alternative: Recharge Compliance

Study Area Quadrant	Required Recharge Volume for Redevelopment (cubic feet)	Required Recharge Volume for New Development (cubic feet)	Combined Required Recharge Volume (cubic feet)	Impervious Area Directed to Infiltration Stormwater Control Measures (percentage)	Proposed Recharge Volume (cubic feet)
Sagamore North	52,100	22,200	74,300	>100%	154,500
Sagamore South	41,400	32,800	74,200	>100%	160,500
Bourne North	50,700	29,000	79,700	>100%	196,500
Bourne South	45,200	26,500	71,700	>100%	262,600

8.4 Standard 4 – Water Quality

SCMs will be designed to meet additional treatment requirements (1-inch water quality volume) for soils with rapid infiltration rates and discharges to critical areas. SCMs will provide 80% TSS reduction from total impervious area within the Study Area, as feasible. The removal will be quantified using the EPA pollutant removal curves.[29] MassDOT will develop a Long-Term Pollution Prevention Plan and submit it to the Bourne Conservation Commission for review during the permitting process. The use of environmentally sensitive site design and LID techniques will be prioritized. The target reduction for pathogens in stormwater is two to three orders of magnitude, which is generally expected to be achieved by the implementation of SCMs. **Table 8-5** presents the required and proposed water quality volumes and TSS removal for the Build Alternative.

[29] U.S. Environmental Protection Agency. 2010 (revised). Stormwater Best Management Practices (BMP) Performance Analysis. March. https://www3.epa.gov/region1/npdes/stormwater/tools/BMP-Performance-Analysis-Report.pdf

Table 8-5. Build Alternative: Water Quality Compliance

Study Area Quadrant	Required Water Quality Volume for Redevelopment (cubic feet)	Required Water Quality Volume for New Development (cubic feet)	Combined Required Water Quality Volume (cubic feet)	Proposed Water Quality Volume (cubic feet)	Total Suspended Solids Removal (percentage)
Sagamore North	86,800	37,100	123,900	154,500	88%
Sagamore South	69,000	54,600	123,600	160,500	86%
Bourne North	84,500	48,300	132,800	196,500	84%
Bourne South	75,300	44,200	119,500	262,600	100%

8.5 Standard 5 – Land Uses with Higher Potential Pollutant Loads

This standard is not applicable because roadways and bridges are not considered land uses with higher potential pollutant loads.

8.6 Standard 6 – Critical Areas

The Study Area includes the following critical areas:

- Zone I, Zone II, and IWPAs (Buzzards Bay Water District and Sandy's Restaurant)
- Class SB coastal waterway with shell fishing qualifier and bordering vegetated wetlands[30] (Cape Cod Canal)
- Certified vernal pools
- Herring River Watershed ACEC

SCMs will be designed to avoid new discharges to all Wellhead Protection Areas and meet additional treatment and pretreatment requirements for discharges to Cape Cod Canal and bordering wetlands and discharges to certified vernal pools. The Build Alternative would relocate existing discharges to provide buffer and treatment, when feasible. The Build Alternative would implement treatment measures that minimize standing water and promote infiltration to address pathogen reduction to shellfish areas.

The Long-Term Pollution Prevention Plan will include spill containment measures and procedures. Response procedures will be implemented at all SCMs within the Program for any significant release of hazardous materials, such as fuels, oils, or chemical materials, which have the potential of discharging to the Cape Cod Sole Source Aquifer or the Plymouth/Carver Sole Source Aquifer.

[30] 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.

Reportable quantities will be reported immediately to the applicable federal, state, and local agencies as required by law. Reportable quantities of chemicals, fuels, or oils are established under the CWA and enforced through MassDEP. The MassDEP Emergency Response Program will be immediately notified by telephone at (888) 304-1133, in accordance with the required procedures for the report of a release.

MassDOT works with first responders and/or public water supply owners to determine the best approach to protect water supplies and provide training and materials to carry out action plans. In the case of a spill, applicable containment and clean-up procedures will be performed immediately. These procedures are implemented in accordance with the Unified Response Manual at the local level by first responders, which includes the Town of Bourne's local public safety departments (e.g., fire, police, public works, board of health). MassDOT will be on-site to aid with traffic control and provide clean-up supplies, as necessary. Spill material collected during the response will be promptly removed and disposed of in accordance with Federal, State, and local requirements. If necessary, a licensed emergency response contractor will assist in the cleanup of releases, depending on the amount of the release and the ability of the responsible party to perform the required response.

8.7 Standard 7 – Redevelopment

Redevelopment, which equals the amount of existing impervious area, will be treated to the maximum extent practicable. Reconfiguration of the four interchanges on both approaches of the Sagamore and Bourne Bridges would result in ample open space that would be used in part for stormwater treatment. The maximum extent practicable for the Build Alternative would result in full compliance with all Massachusetts Stormwater Management Standards for total impervious area, including both new development and redevelopment areas.

8.8 Standard 8 – Erosion and Sediment Control

Erosion and sediment control plans, details, and pay items will be included in the contract documents. The Build Alternative would require coverage under the EPA 2022 NPDES CGP. MassDOT contract specifications will require the contractor to prepare and implement a SWPPP that will include BMPs to control pollutants, sediment from erosion, stormwater runoff, and other construction-related impacts. A single plan that satisfies the SWPPP requirements of the CGP and the construction period erosion, sedimentation, and pollution prevention plan (CP4) requirements of Standard 8 will be submitted for approval to the Bourne Conservation Commission and MassDEP and implemented prior to starting land disturbing construction activities.

8.9 Standard 9 – Operation and Maintenance Plan

MassDOT will prepare a post-construction Operations and Maintenance Plan, which will be included in the Stormwater Management Report to be filed in accordance with permitting requirements under the Massachusetts Wetlands Protection Act. MassDOT uses a performance-based inspection and maintenance program for SCMs and catch basins. For SCMs, MassDOT's overall approach is to inspect SCMs, and based on the results of the inspections, perform maintenance to preserve functionality. For

catch basins, MassDOT's overall approach is to perform maintenance at an interval that maintains the functionality of the catch basin (e.g., sump is less than 50% full of sediment). Catch basin inspections, including documentation of sediment accumulation, and maintenance will occur simultaneously.

MassDOT's operations and maintenance program is data driven. Inspections and maintenance are recorded by personnel using hand-held tablets in the field to document sediment accumulation, maintenance action performed, and follow-up actions needed. Data are recorded in MassDOT's asset management system, which is accessible in the field (mobile) or the office (desktop).

Table 8-6 summarizes data that is generally collected for each asset type. For all assets, the inspector and inspection date are recorded. Photo documentation of structure condition is taken and attached to the inspection record.

Table 8-6. Data Collection

Inspection Form	Applicable Stormwater Assets	Information Collected
Inlets	• Catch basins • Outlet control structures	• Sediment accumulation • Trash/Debris accumulation • Signs of contamination • Frame and grate condition • Overall structure condition
Stormwater Control Measures (SCM)	• Infiltration SCMs • Bioretention SCMs	• SCM accessibility • Presence of standing water • Level of erosion • Sediment accumulation • Trash/Debris accumulation • Vegetation condition • Overall SCM condition
Storm Discharge Points	• Outlets to SCMs	• Presence of flow • Signs of contaminated flow • Sediment accumulation • Level of erosion • Pipe condition • Scour protection condition • Overall structure condition

Maintenance actions will not occur at any set frequency but rather will be based on condition and impact to functionality. **Table 8-7** lists potential maintenance activities to be performed on the stormwater system.

Based on the results of the inspection, repairs will be made in accordance with MassDOT standard practices. Maintenance will be prioritized given the urgency of the required maintenance and availability of staff, contracts, etc. Maintenance may require contracting if existing contracts are unavailable to perform the work. More intensive remedial activities may require permitting and/or an engineering solution.

Table 8-7. Potential Maintenance Activities

Stormwater Feature	Potential Maintenance Actions
Surface Stormwater Control Measures (SCM)	• Remove and properly dispose of accumulated material (e.g., sediment, trash, leaf litter, debris). • Mow vegetated areas and remove and dispose of grass clippings. • Regrade areas that show signs of unwanted ponding and channelization. • Stabilize or reconstruct eroded areas and reseed. • Replace stones/soil and/or replant vegetation. • Remove woody growth. • Treat invasive plants according to the Massachusetts Department of Transportation (MassDOT) Landscape Design Section. • Infiltration and bioretention Stormwater Control Measures (SCM) only: – Address issues of standing water. – Drain and reconstruct SCM. • If rehabilitation is not possible, then retrofit to be a wet SCM while considering safety implications.
Underground SCMs	• Remove and properly dispose of trash, sediment, debris, and root intrusions. • Clean out sumps at an interval to maintain functionality (less than 50% full of sediment). • Jet and repair pipes. • Rehabilitate filtering and infiltration materials (e.g., geotextile fabric, crushed stone). • Stabilize and replace deteriorated structures. • Perform evaluations (e.g., test pits) to evaluate subsurface conditions.

Stormwater Feature	Potential Maintenance Actions
Inlets and Outlets to SCMs	• Clear inlet and remove and properly dispose of sediment, trash, leaf litter, debris, and vegetation. • Regrade areas that show signs of ponding and channelization. • Repair or replace structural components. • Repair damaged or eroded areas. • Provide or rehabilitate erosion control at the outlet. • Regrade and replace the channel materials. • Remove woody growth. • Stabilize or reconstruct eroded areas. • Treat invasive plants according to the MassDOT Vegetation Management Plan.

8.10 Standard 10 – Illicit Discharge Detection and Elimination

An illicit discharge compliance statement will be included with the Stormwater Management Report that will be filed in accordance with permitting requirements under the Massachusetts Wetlands Protection Act. The drainage plans will be reviewed for interconnections to the stormwater management system. Interconnections identified during this process will be coordinated with the District Permits Engineer to determine status of authorization. Should any illicit discharges be identified during construction, they will be reported to the Resident Engineer or MassDOT District 5 Environmental Engineer and MassDOT Stormwater Management Unit to determine the source and potential for resolution through MassDOT's Illicit Discharge Detection and Elimination program.