

4 Affected Environment, Environmental Consequences, and Mitigation

4.20 Public Health

4.20.1 Introduction

This section assesses the potential short-term (construction) and long-term (operational) effects of the No Build Alternative and Build Alternative on public health conditions within the Study Area. This section also outlines mitigation measures that will be implemented to avoid or minimize the potential for significant adverse effects to public health during construction or operation of the Build Alternative, as necessary.

Public health conditions are defined in this assessment as chronic diseases, disabilities, and social determinants of health, including a lack of reliable transportation options¹ and social isolation.²

[Section 4.20.2](#) provides demographic data on vulnerable populations within the Study Area who are particularly susceptible to adverse health impacts from environmental exposures, including children and the elderly.

Conclusions regarding public health are based on the analyses presented in other relevant sections of this Draft Environmental Impact Statement including:

- **Section 4.2, Transportation, Traffic, and Safety**
- **Section 4.3, Pedestrian and Bicycle Facilities**
- **Section 4.10, Water Quality and Stormwater**
- **Section 4.13, Air Quality**
- **Section 4.14, Noise and Vibration**
- **Section 4.18, Solid and Hazardous Waste Material Management**

4.20.1.1 Regulatory Context

The [National Environmental Policy Act](#) requires federal agencies to consider the environmental effects of their actions, which includes potential impacts on public health.³ The [Massachusetts Environmental](#)

¹ Defined as a lack of reliable transportation in the past 12 months among adults.

² Defined as feeling socially isolated among adults.

³ 42 United States Code (USC) 4321 et seq. <https://www.epa.gov/laws-regulations/summary-national-environmental-policy-act>

[Policy Act](#) establishes standards and limitations to protect public health and the environment for state agency actions, including permitting, financial assistance or land disposition.⁴

Many resource-specific regulations are enforced at the federal and state levels to protect public health:

- [Clean Air Act](#)⁵
- [Clean Water Act](#)⁶
- [Resource Conservation and Recovery Act of 1976](#) (RCRA)⁷
- [U.S. Comprehensive Environmental Response, Compensation, and Liability Act of 1980](#) (CERCLA)⁸
- [Massachusetts Contingency Plan](#)⁹
- [Massachusetts Wetlands Protection Act](#)¹⁰

It is important to consider these laws and their related resource effects on public health conditions during transportation project planning and development.

4.20.1.2 Study Area and Methodology

The Study Area for this public health assessment encompasses three census tracts within the town of Bourne, Barnstable County, Massachusetts: Census Tracts 137, 138, and 139 ([Figure 4.20-1](#)). This Study Area was defined to evaluate the potential direct and indirect effects of the Build Alternative on public health conditions. “Direct effects” are caused by the action and occur at the same time and place, whereas “indirect effects” are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable.

⁴ Massachusetts General Law (MGL) Chapter 30, Sections 61 through 62H. <https://malegislature.gov/Laws/GeneralLaws/PartI/TitleIII/Chapter30/Section61>

⁵ 42 USC Section 7401 et seq. https://19january2021snapshot.epa.gov/laws-regulations/summary-clean-air-act_.html

⁶ 33 USC Section 1251 et seq. <https://www.epa.gov/laws-regulations/summary-clean-water-act>

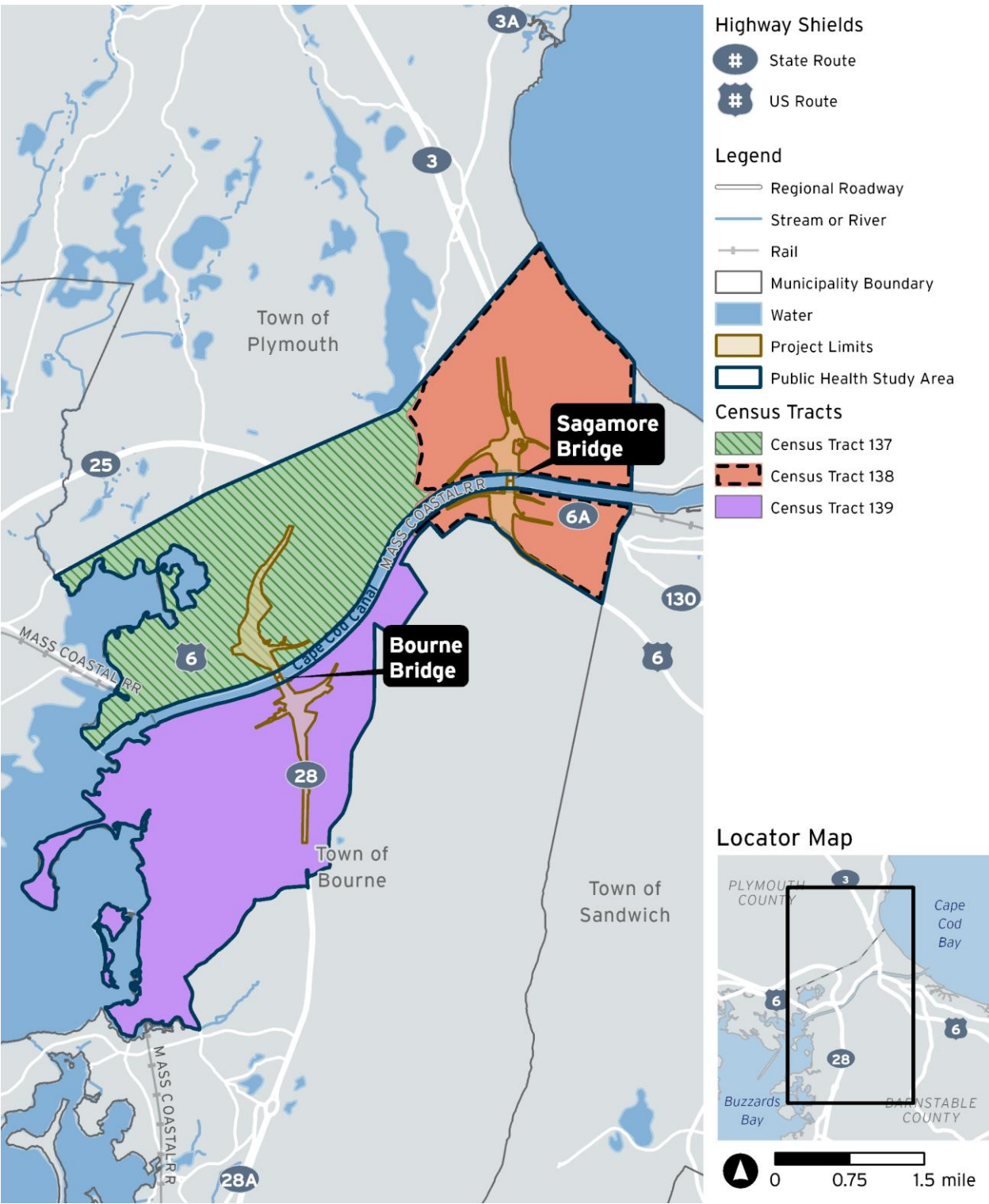
⁷ 42 USC Section 6901 et seq. <https://www.epa.gov/laws-regulations/summary-resource-conservation-and-recovery-act>

⁸ 42 USC Section 9601 et seq. <https://www.epa.gov/laws-regulations/summary-comprehensive-environmental-response-compensation-and-liability-act>

⁹ 310 Code of Massachusetts Regulations. 40.0000. <https://www.mass.gov/regulations/310-CMR-400000-massachusetts-contingency-plan>

¹⁰ MGL Chapter 131, Section 40. <https://www.mass.gov/info-details/protecting-wetlands-in-massachusetts>

Figure 4.20-1. Public Health Study Area



Source: Massachusetts Department of Transportation, 2024

This assessment provides demographic data on elderly populations (age 65 and older) and childhood populations (under age 18) relative to each census tract within the Study Area. Data on existing elderly and childhood populations at the census tract level within the Study Area was derived from the U.S. Decennial Census (2020).¹¹ Elderly populations are more susceptible to environmental health risks due to age-related decline in bodily functions and higher incidence of pre-existing chronic health conditions compared to younger populations. Childhood populations are also more susceptible to environmental health risks due to developing bodily defense systems and more opportunities for exposure such as playing outdoors.

To understand baseline conditions for relevant public health conditions in the Study Area, MassDOT considered the prevalence of the following chronic illnesses related to air quality and exposure to hazardous materials:

- Cancer (non-Melanoma)
- Asthma
- Coronary heart disease
- Chronic obstructive pulmonary disease
- Stroke
- High blood pressure

MassDOT derived public health data from the Massachusetts Population Health Information Tool¹² and the U.S. Centers for Disease Control and Prevention PLACES Behavioral Risk Factor Surveillance System (2021 and 2022).¹³

MassDOT assessed the prevalence of disabilities and accessibility barriers that could be exacerbated by construction noise, vibrations, travel access impediments, and a lack of safe and connected networks for pedestrians and bicyclists. MassDOT also evaluated the percentage of populations with a hearing disability, mobility disability, and those experiencing food insecurity, social isolation, and unreliable access to transportation. MassDOT derived this data from the American Community Survey 5-Year Estimates (2018-2022).¹⁴

¹¹ U.S. Census Bureau. 2020. [Decennial Census of Population and Housing](https://www.mass.gov/info-details/community-health-data). <https://www.mass.gov/info-details/community-health-data>

¹² Mass.gov. [Population Health Information Tool: Community Health Data](https://www.mass.gov/info-details/community-health-data). <https://www.mass.gov/info-details/community-health-data>.

¹³ CDC PLACES: Local Data for Better Health. Released August 2024, Downloaded December 2024. Model data derived from Behavioral Risk Factor Surveillance System (BRFSS) 2022 data, Census Bureau 2020 population data, and American Community Survey 2018–2022 estimates.

¹⁴ American Community Survey. 2018-2022. [American Community Survey 5-Year Estimates](https://www.census.gov/data/developers/data-sets/acs-5year.2022.html#list-tab-1806015614). <https://www.census.gov/data/developers/data-sets/acs-5year.2022.html#list-tab-1806015614>

4.20.2 Affected Environment

This section presents an overview of existing vulnerable public health population demographics and public health conditions relative to chronic diseases and other health-related measures within the Study Area. [Table 4.20-1](#), [Table 4.20-2](#), and [Table 4.20-3](#) compare the relative demographic percentages and prevalence of public health conditions within the Study Area census tracts to the town of Bourne, Barnstable County (which includes all 15 towns of Cape Cod), and the state of Massachusetts (hereon referred to as reference geographies).

[Table 4.20-1](#) illustrates that the percentage of population aged 65 and over was higher for all Study Area census tracts, compared to the population under the age of 18. This data also indicates that there are higher percentages of populations aged 65 and older at the census tract, town, and county levels compared to the state. According to the Cape Cod Commission, from 1970 to 2020 the percentage of Cape Cod's population age 65 and older has increased by approximately 15.3%, while the percentage of the population under 18 has declined by approximately 17%.¹⁵ Between 2000 and 2017, Cape Cod (which encompasses the three Study Area census tracts within Barnstable County) experienced a notable change in age cohorts with a 12.2% decline in total population aged 25–34, a 45.4% decline in total population aged 35–44, and a 17% decline in total population aged 45–54.¹⁶

[Table 4.20-2](#) illustrates that the Study Area census tracts have a higher prevalence of cancer compared to the statewide prevalence, but a generally lower prevalence compared to the town and county prevalences. Asthma prevalence is comparable across all geographies. Coronary heart disease prevalence is higher at the census tract, town, and county levels compared to the state. Chronic obstructive pulmonary disease and stroke prevalence is highest for Census Tract 139 compared to all reference geographies, while Census Tracts 137 and 138 are comparable to the state prevalence. All three census tracts have a lower prevalence of high blood pressure compared to the state prevalence, and Census Tracts 137 and 138 are lower than the town and county prevalences.

[Table 4.20-3](#) illustrates that Census Tract 139 has the highest percentage of populations with a mobility disability and hearing disability compared to all reference geographies. All census tracts have higher percentages of populations with a hearing disability compared to the state. Census Tract 137 has the highest percentage of populations experiencing social isolation and with unreliable transportation options compared to the town and county percentages. All three census tracts have lower percentages of populations experiencing food insecurity compared to the town and county percentages.

¹⁵ Cape Cod Commission. 2024. [2024 Cape Cod Comprehensive Economic Development Strategy](https://www.capecodcommission.org/resource-library/file?url=/dept/commission/team/Website_Resources/economicdevelopment/CEDS/2024/2024%20Cape%20Cod%20CEDS%20Text%20Version.pdf). June. https://www.capecodcommission.org/resource-library/file?url=/dept/commission/team/Website_Resources/economicdevelopment/CEDS/2024/2024%20Cape%20Cod%20CEDS%20Text%20Version.pdf

¹⁶ MassDOT. 2019. [Cape Cod Canal Transportation Study](https://www.mass.gov/doc/cover-and-intro/download). October. <https://www.mass.gov/doc/cover-and-intro/download>

Table 4.20-1. Vulnerable Public Health Populations

Geography	Percentage of Population Under 18 Years of Age	Percentage of Population 65 Years and Older
Census Tract 137 (Bourne)	11.2%	30.9%
Census Tract 138 (Bourne)	18.6%	21.0%
Census Tract 139 (Bourne)	19.9%	38.5%
Town of Bourne	21.4%	45.6%
Barnstable County	14.5%	31.6%
Massachusetts	19.6%	17.1%

Source: U.S. Census Bureau. 2022. American Community Survey Demographic and Housing Estimates. [ACS 5-Year Estimates Data Profiles, Table DP05](https://data.census.gov/tables//ACSDP5Y2022.DP05?q=DP05). <https://data.census.gov/tables//ACSDP5Y2022.DP05?q=DP05>

Table 4.20-2. Public Health Conditions – Chronic Illness

Geography	Percentage of Adult Population (18 Years and Older) with Cancer*	Percentage of Adult Population with Asthma	Percentage of Adult Population with CHD	Percentage of Adult Population with COPD	Percentage of Adult Population Ever Diagnosed with a Stroke	Percentage of Adult Population with HBP
Census Tract 137 (Bourne)	8.8%	10.8%	6.3%	5.4%	2.7%	27.7%
Census Tract 138 (Bourne)	11.1%	11.1%	7%	5.7%	3%	31.5%
Census Tract 139 (Bourne)	12.8%	11.6%	9.9%	8.3%	4.3%	36.7%
Town of Bourne	12.9%	11.1%	9.3%	7.2%	3.9%	35.7%
Barnstable County	12.5%	11%	9%	7.3%	3.8%	35%
Massachusetts	8.3%	11.3%	4.6%	5.8%	2.7%	39.3%

Source: [U.S. Centers for Disease Control and Prevention PLACES: Local Data for Better Health](https://chronicdata.cdc.gov/browse?category=500+Cities+%26+Places&sortBy=newest&utf8). Released August 2024, Downloaded December 2024. Model data derived from Behavioral Risk Factor Surveillance System 2022 data, Census Bureau 2020 population data, and American Community Survey 2018–2022 estimates. <https://chronicdata.cdc.gov/browse?category=500+Cities+%26+Places&sortBy=newest&utf8>.

* This measure excludes Melanoma.

CHD = coronary heart disease; COPD = chronic obstructive pulmonary disease; HBP = high blood pressure

Table 4.20-3. Public Health Conditions – Disability and Access to Resources

Geography	Percentage of Population with Mobility Disability	Percentage of Population with Hearing Disability	Percentage of Population Experiencing Food Insecurity	Percentage of Population Experiencing Social Isolation	Percentage of Population with Unreliable Transportation Options
Census Tract 137 (Bourne)	9.7%	6.8%	8.9%	35.9%	7%
Census Tract 138 (Bourne)	10.3%	6.9%	6%	30.6%	4.7%
Census Tract 139 (Bourne)	15.2%	9.8%	8.4%	29.6%	5.7%
Town of Bourne	13.6%	9.1%	9%	29.7%	6%
Barnstable County	13.3%	8.8%	9.4%	31.1%	6.1%
Massachusetts	11.1%	6.3%	Not Applicable ^[1]	Not Applicable	Not Applicable

Source: [U.S. Centers for Disease Control and Prevention PLACES: Local Data for Better Health](https://chronicdata.cdc.gov/browse?category=500+Cities+%26+Places&sortBy=newest&utf8). Released August 2024, Downloaded December 2024. Model data derived from Behavioral Risk Factor Surveillance System 2022 data, Census Bureau 2020 population data, and American Community Survey 2018–2022 estimates. <https://chronicdata.cdc.gov/browse?category=500+Cities+%26+Places&sortBy=newest&utf8>.

^[1] Geography not assessed by this data source for this specific characteristic.

4.20.3 No Build Alternative

For the No Build Alternative, Sagamore and Bourne Bridges—including their highway approach roadway networks north and south of Cape Cod Canal—would retain their current configuration, number of lanes, and alignment. As outlined in **Section 4.2.3.1, Vehicular Traffic Operations**, higher projected average annual daily traffic volumes crossing Sagamore and Bourne Bridges for the 2050 No Build Alternative are expected to increase overall network travel times by 20.1%, compared to 2019 existing conditions.

The 2050 No Build Alternative would have long-term adverse effects on public health conditions within the Study Area due to increased emergency response times and delays accessing essential healthcare services. According to the Air Quality Analysis described in **Section 4.13, Air Quality**, the No Build Alternative would result in greater vehicle miles traveled, vehicle hours traveled, vehicle trips, and traffic congestion when compared to the Build Alternative, which would have long-term adverse effects on public health conditions within the Study Area. Increased traffic congestion and longer commute times for the 2050 No Build Alternative could also have potential long-term adverse effects on overall health and quality of life for local communities within the Study Area due to elevated stress levels and anxiety. With no improvements to bicycle and pedestrian accommodations and connectivity

in the Study Area for the No Build Alternative, opportunities to encourage active transportation would be precluded.

Routine bridge and roadway maintenance activities for the No Build Alternative could involve handling and disposal of hazardous materials, such as lead-based paint and other potentially harmful substances, which would require implementation of strict procedures to prevent a risk of exposure to workers and the environment.

4.20.4 Build Alternative

4.20.4.1 Construction Effects

This section discusses the potential construction-period, health-related effects of the Build Alternative related to air quality and emissions, hazardous material and waste management, noise and vibration, and water quality and stormwater. As described in the relevant analyses of this DEIS/DEIR and summarized in the following sections, the Build Alternative, with implementation of proposed mitigation measures outlined in [Table 4.20-4](#), would not have significant adverse effects on public health conditions during construction.

Air Quality

The operation of heavy-duty diesel equipment and trucks would result in short-term elevated air quality emissions of nitrogen oxides, particulate matter, and carbon monoxide, posing potential respiratory health risks for construction workers and vulnerable populations, such as children, the elderly, and people with pre-existing health conditions. In addition, demolition, cutting, grinding, material handling (loading and unloading) and earthwork (site clearing, excavation, grading, and compaction) have the potential to generate particulate matter during construction, which can contribute to respiratory health impacts and allergic reactions.

The risks of air quality emissions to public health during construction would be temporary, and can vary depending on construction means and methods, wind patterns, and the proximity of sensitive receptors relative to the construction sites. [Table 4.20-4](#) outlines measures that MassDOT will implement to mitigate adverse public health effects related to air quality during construction.

Hazardous Material and Waste Management

The Build Alternative would involve structural demolition activities, dredging, grading, and excavation for utilities and foundations, creating the potential for exposure to contaminated soils, debris, or groundwater during construction. Contaminated materials pose serious health complications to construction workers and the public, if released into the workplace or environment during construction. [Table 4.20-4](#) outlines industry best management practices that MassDOT will implement to mitigate the release of contaminated materials during construction.

Noise and Vibration

During construction, surrounding noise-sensitive land uses would be exposed to temporarily elevated noise levels that may be a source of annoyance to the public. Construction noise would arise from construction vehicles and construction equipment performing earth work, delivering material, roadway

and bridge demolition and construction, building demolition, and vibrations from pile driving. Prolonged exposure to noise pollution can contribute to a variety of public health-related risks, including stress, elevated blood pressure, hearing loss and sleep disruption. During construction, vibration producing activities would be limited to auger drilling hoe ramming, and use of large bulldozers. To mitigate construction-period vibration effects, MassDOT would include contract specifications that require pre-construction surveys, vibration monitoring, and equipment restrictions. [Table 4.20-4](#) outlines measures that MassDOT will implement to minimize the adverse effects of construction noise and vibration on surrounding noise-sensitive land uses.

Water Quality and Stormwater

Sedimentation from earth disturbing activities and stormwater runoff generated during construction can be substantial sources of pollution for surface waters, groundwater, and drinking water supplies, if stormwater control measures controls are not in place. The Build Alternative would require a National Pollution Discharge Elimination System permit from the U.S. Environmental Protection Agency to legally discharge stormwater runoff from the construction site. National Pollution Discharge Elimination System permits limit the quantities of pollutants to be discharged and impose monitoring requirements to protect water quality and human health. [Table 4.20-4](#) outlines measures that MassDOT will implement to prevent adverse effects to water quality during construction.

4.20.4.2 Operational Effects

The Build Alternative would replace the existing Sagamore and Bourne Bridges to modern design standards with upgrades to their approach roadway networks, which would yield substantial long-term operational benefits to public health conditions in the Study Area due to:

- Improved traffic operations and reduced delays accessing healthcare and other essential services.
- Improved access for emergency vehicles (e.g., ambulances, police cars, fire trucks) crossing Cape Cod Canal.
- Accommodation of an enhanced active transportation (pedestrians and bicycle) network and improved pedestrian and bicycle safety through provision of off-road multiuse facilities on the replacement bridges with connections to new share-used paths along the local roadway network.
- Provision of Americans with Disabilities Act–accessible accommodations for pedestrians (including sidewalks, crosswalks, curb ramps, detectable warnings, and signals).
- Improved community cohesion by enhancing local connectivity from the replacement bridges to neighborhoods, transit services, jobs, schools, recreational facilities, grocery store and other community destinations.
- Improved local and regional air quality through reduced vehicular emissions.

As discussed in **Section 4.10, Water Quality and Stormwater**, the Build Alternative proposes an increase in impervious surface due to construction of the replacement bridges and reconfiguration of their approaches, which could affect water quality due to resultant runoff volume and/or pollutant

load. MassDOT will implement permanent stormwater control measures to reduce, convey, and treat stormwater runoff in accordance with applicable state regulatory requirements.

Based on the Noise and Vibration Analysis results described in **Section 4.14, Noise and Vibration**, noise-sensitive land uses in the Study Area would approach or exceed the FHWA Noise Abatement Criteria for noise-sensitive land uses as a result of the Build Alternative. To mitigate operational traffic noise effects, MassDOT conducted a noise barrier evaluation to identify the feasibility and reasonableness of installing noise barriers. MassDOT identified one location that meets MassDOT’s criteria for noise abatement, providing noise reduction benefits for 38 affected residential dwelling units. MassDOT will evaluate the feasibility of noise barriers as the design advances.

As discussed in **Section 4.18, Solid and Hazardous Waste Material Management**, there would be no long-term impacts related to hazardous materials for the Build Alternative. Overall, the Build Alternative would reduce the likelihood of exposure to or potential contamination from hazardous materials and waste through demolition of the aging Sagamore and Bourne Bridges, which contain lead-based paint. The replacement bridges for the Build Alternative would be designed with modern corrosion protection systems to prevent rust and deterioration of their structural steel components.

4.20.5 Mitigation

Table 4.20-4 outlines mitigation measures that will be implemented to avoid or minimize the construction-period effects of the Build Alternative relative to air quality, hazardous material and waste management, noise and vibration, and water quality. With implementation of these outlined mitigation measures, the Build Alternative would not result in significant adverse effects to public health during construction.

Table 4.20-4. Construction-Phase Mitigation Measures

Impact Category	Mitigation Measures
Air Quality	• Install on-site anti-idling signage at various loading and drop-off locations. • Use low-emitting diesel-fueled equipment or retrofitting of heavy-duty diesel-fueled construction equipment to meet applicable emission standards. • Apply dust suppression wetting agents during excavation, grading, and other soil disturbing activities. MassDOT would implement Air Monitoring Plans to provide protections for construction workers and surrounding communities from potential airborne releases. • Limit work or activities that may generate substantial airborne dust emissions to less windy days. • Apply secure containment measures for active on-site stockpiles and during transportation of dust-producing materials on public roadways. • Implement a Traffic Management Plan with designated truck routes.

Impact Category	Mitigation Measures
Hazardous Material and Waste Management	• Use a Massachusetts Department of Environmental Protection Licensed Site Professional (LSP) to oversee work within areas of known or suspected contamination. • Develop a Soil and Groundwater Management Plan and implement by a Contractor to outline procedures for the field screening, classification, and proper handling of excavated soil and groundwater generated during excavation activities. • Develop an Environmental Health and Safety Plan and implement by the Contractor to identify potential hazards associated with planned field activities and outline necessary measures to protect the health and safety of employees, the public, and the environment during construction. • Develop Asbestos and Lead Paint Abatement Work Plans and implement by the Contractor to outline procedures for the proper management of asbestos and lead-based materials during construction. • Require that persons performing the functions of Lead and Asbestos workers, supervisors, or contractors during construction have valid licensing and training certifications in accordance with applicable federal and state regulations.
Noise and Vibration	• Develop a Noise Control Plan and implement by the Contractor to identify noise sources, monitor noise levels, and outline noise reduction strategies. • Perform equipment maintenance regularly to minimize noise generation. • Use mufflers and other noise-dampening attachments, where feasible. • Use temporary noise barriers or enclosures, particularly near residences. • Use vibratory pile driving methods instead of traditional impact pile driving. • Schedule noise intensive activities (e.g., pile driving, steel cutting, jackhammering) during daytime hours. • Establish procedures for filing local community noise complaints. • Address construction noise concerns from local residents and work to find solutions.
Water Quality	• Develop a Stormwater Pollution Prevention Plan and implement by the Contractor in conformance with National Pollution Discharge Elimination System requirements to identify potential sources of stormwater pollution from the construction sites and outline control measures to reduce pollutants in stormwater discharges. • Install erosion and sediment control practices prior to the start of earth-disturbing activities. • Maintain and inspect on-site erosion and sedimentation control practices regularly

As discussed in [Section 4.20.4.2](#), replacing the aging Sagamore and Bourne Bridges and configuring their approach roadway networks for the Build Alternative would provide substantial operational benefits in terms of traffic safety and operations, active transportation safety and mobility, and reduced likelihood of exposure to hazardous materials. In addition, new permanent stormwater control measures would be implemented for the Build Alternative in accordance with applicable regulatory requirements to protect and enhance the quality of runoff before it reaches surface waters and drinking water supplies. Furthermore, the noise control plan would minimize nuisance noise conditions and reduce operational noise effects on public health in the Study Area. These benefits of the Build Alternative would contribute to improved public health outcomes within the Study Area over the long term.