

SECTION 4

**ENVIRONMENTAL
INVENTORY &
ANALYSIS**

SECTION 4.1

GEOLOGY, SOILS, AND TOPOGRAPHY**INTRODUCTION**

Boston is situated in topographic lowland, referred to as the Boston Basin. This lowland is surrounded by a ring of hills that circle it from the Middlesex Fells to the north, inland to the Belmont Hills and Newton Highlands to the west, and around to the Blue Hills to the south. Boston's geology is attributed to several different geologic processes. The geology of Boston can be described by its bedrock, structural, and surficial features including glacial, fluvial, and wind deposited sediments. The soils of Boston reflect these geological factors, as well as influences due to vegetation and humans.

GEOLOGICAL HISTORY

A distinctive grain of bedrock runs northeast through Boston and follows the Appalachian tectonic plate. This grain is most obvious in the course of the Neponset River, in the angle of the bedrock Harbor Islands, and in the angle of cliffs of the Middlesex escarpment north of the city. This ancient fault system is active and Boston is subject to earthquake shocks.

The existence of ancient volcanoes is evidenced in the granite outcrops to the north and west of the city. This rock was important to native people for tools, and was later quarried for local structures such as the Bunker Hill Monument and Quincy Market.

Much of Boston is located in a large lowland basin, which is underlain with blue clay and slate. Quarries in South Boston provided material for building foundations, roofing and gravestones for the early development of the city. Local clays were used to make pottery and bricks.

A conglomerate rock commonly known as Puddingstone is unique to the area, and gives Roxbury and Stony Brook their names. It can be found in Franklin Park and other parks throughout the city, that were likely created around rock

formations that were difficult to remove or quarry. However, it was used as a building material in Roxbury, Brookline and throughout Boston, and also as a material for Victorian Gothic churches.

The Great Ice Age (Pleistocene Epoch) began to end around 10,000 BP as the glaciers and ice sheets that had covered North America for 1.8 million years retreated. As the glaciers melted, they changed the course of rivers like the Mystic, and created large bogs. Shallow kettle lakes formed throughout greater Boston, which later became important locations for natural ecology, prehistoric settlement, colonial country estates, ice harvesting, recreational areas and reservoirs for Boston's water supply.

The glacial retreat also formed the drumlin hills that shaped the landscape of Boston. Beacon Hill, Bunker Hill, and some of the Boston Harbor Islands remain as examples, though many of the gravel hills were removed during the filling of the wetlands.

Much of the glacial plain was flooded by sea level rise as the ice melted, so the level, well-drained soil in Boston is limited. Early development was limited to these areas.

SURFICIAL GEOLOGY

The surficial geology of the Boston Basin is the dominant factor of the landscape. The surficial geology of Boston includes glacial drift, glacial outwash, riverine deposits, and marine clays, as well as loess, which is fine silt deposited by wind (see MAP 6: SURFICIAL GEOLOGY AND SOILS).

Glacial landforms dominate the local topography. These landforms resulted from periods of extensive glaciation approximately 10,000 to 50,000 years ago. Repeated advances of thick glacial ice resulted in deformation of the earth's crust. Valleys that existed 50,000 years ago were scoured, deepened, and widened by the ice. Glacial till—unconsolidated, non-stratified glacial drift—was deposited in depths of up to 150 feet.

This till was commonly deposited as smooth, oval shaped hills known as drumlins. The Boston Basin has more than 100 of these drumlin features including the Harbor Islands, Breeds Hill, and Bunker Hill. A major factor in the Boston Harbor Islands' designation by the National Park Service as a National Recreation Area is that it is the only drumlin field in North America to intersect a coastline.

Deglaciation of the basin had a profound effect on the current landscape. As glacial ice began to melt, the run-off deposited sands, gravel, and silts that had been trapped in the glacial ice. Changing sea levels, freshwater streams, wind, and erosion then modified these glacial deposits, thereby forming varied, sorted layers throughout the basin.

The prominent deposits on Boston's current topography include sand, gravel, till, bedrock, and silt and clay deposited by both fresh and estuarine water. Sand and gravel deposits run north/south through Boston. These deposits represent glacial outwash that was deposited as glacial ice melted. These deposits are found in abundance in Allston, Hyde Park, Jamaica Plain, North Dorchester, Roslindale, the South End, and West Roxbury. These deposits are well suited for development, as they are relatively stable and flat. Sand and gravel deposits typically, however, have a high water table, which may cause basements to be more susceptible to flooding. A high water table and the speed at which fluids move through sand and gravel can increase a surface release's capability to pollute groundwater.

Till and bedrock are found throughout the city and are characteristic of areas which contain drumlin hills. Neighborhoods that are dominated by till and bedrock deposits include Brighton, Central Boston, Dorchester, Mattapan, Roslindale, Roxbury, and West Roxbury. Till and bedrock are considered to be extremely stable materials for development, although they also present constraints. Bedrock presents difficulties in excavation while till is commonly found as a drumlin hill, possibly causing topographic restraints for development.

Floodplain alluvium consists of fine-grained material such as fine sands and silts that are found adjacent to, and deposited by, rivers and tidal marshes. These deposits underlie the Back Bay, Fenway/Kenmore, and South Boston. These deposits are now covered by artificial fill that was laid down in the late 18th and 19th centuries to allow development of these lands. The obvious development constraints associated with this material include instability and a high water table. The material does, however, possess a low permeability, thus trapping pollutants and resulting in a slow migration which can be contained should a release of pollutants occur.

The soils of the Boston Basin are derived from natural glacial processes and artificial processes attributed to the extensive filling of lands by humans. The three largest generalized soil units in Boston are Udorthents-Urban Land, Canton-Charlton-Hollis, and Newport-Urban Land units. These units are typically deep deposits found on land with a topographic range from nearly level to moderately steep.

The surficial geology of the Boston Basin is the dominant factor of the landscape. Structurally, several features distinguish the Boston Basin. These include plunges, folds, anticlines, synclines, and faults. These structural features are found throughout the many rock units in the Boston Basin. Geologists use these features to date rock units relative to each other.

BEDROCK GEOLOGY

The principal bedrock in the Boston Basin include the Cambridge Argillite, Roxbury Conglomerate, Mattapan Volcanic Complex, and the Dedham Granite (see MAP 7: BEDROCK GEOLOGY).

Dedham Granite is most likely the oldest rock unit found in Boston. This unit, which is found below the southern portions of Hyde Park and West Roxbury, is a Precambrian age rock that indicates an age well in excess of 600 million years.

Mattapan Volcanic Complex is one of the oldest rock units found in Boston. These volcanic rocks are primarily granite. This unit lies under the southern portion of Mattapan and large portions of Hyde Park.

Cambridge Argillite is classified as a shale or mudstone. This fine-grained sedimentary unit was most likely deposited in deep oceanic waters millions of years ago when the area was below sea level. This unit currently lies well below Allston, Back Bay, Central Boston, Charlestown, East Boston, South Boston, and the South End.

Roxbury Conglomerate is known as Puddingstone. This unit consists of pebbles and cobbles within a matrix of varying rock types. The range of size of the cobbles suggests that a river or stream deposited this unit. The Roxbury Conglomerate underlies much of Boston including Brighton, Fenway/Longwood, Jamaica Plain, Mission Hill, Dorchester, Roxbury, and the northern portions of Mattapan, Roslindale, and West Roxbury.

While ancient soils and bedrock still very much shape Boston's landscape, colonization and subsequent urbanization has rapidly and fundamentally changed the landscape here and beyond. Sea walls and river dredging change the coastal flow of sediment, exporting and importing soil to and from other lands for development alters soils profiles and land cover, building an underground infrastructure that carve a complex second city underfoot that changes drainage patterns- all these and more are changing the nature of soil and hydrography throughout the city.

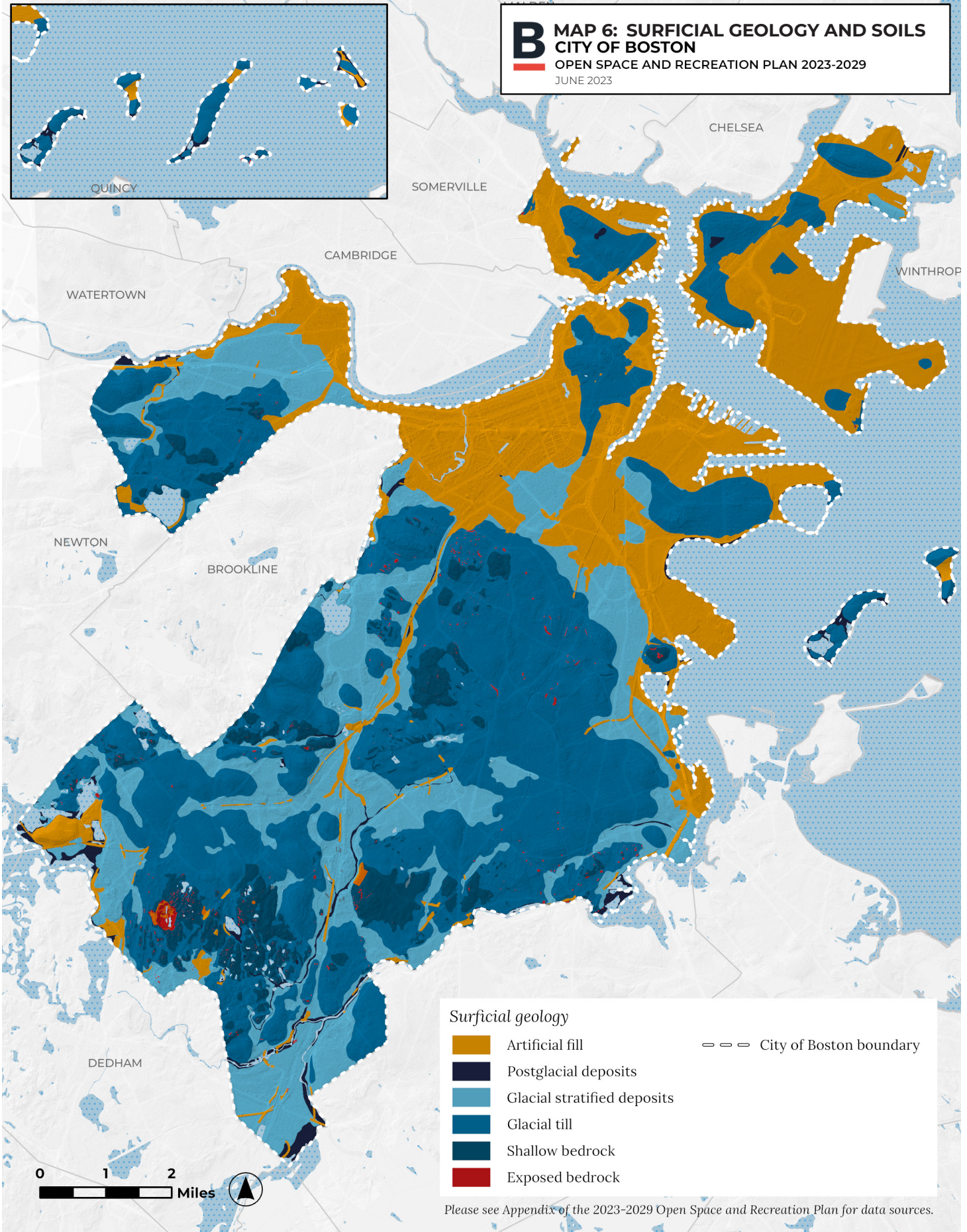
TOPOGRAPHY

Overall, the terrain of Boston is gently rolling, with heights ranging from near sea level along the coast to 370 feet above sea level at the highest point, Bellevue Hill in West Roxbury, within the Department of Conservation and Recreation's (DCR) Bellevue Hill Reservation. But ten to twelve thousand years ago, glaciers shaped the landscape that subsequently Native Americans inhabited and Europeans colonized. These massive sheets of ice moved across the land, totally displacing all flora and fauna in the area. The ice sheets' great weight caused the coastal lands to sink below the surface of the ocean.

After the glaciers retreated, the most prominent landscape features were the drumlins, hills made up of glacial till. They tend to have an oval shape, with the "points" of the oval aligned in the direction of the glacial retreat. (Many of the harbor islands are such drumlins.)

Glacial ice was so massive that it could cause land to bulge or depress. As the glacial ice receded, so did its heavy weight. Since then, land has been going through a process of glacial isostatic adjustment where land that was depressed is rising (rebound) and areas that bulged are sinking (subsidence). Cities like Boston and London, are experiencing subsidence. The impact of subsidence is significant enough to be included in sea level rise modeling for Boston.

B MAP 6: SURFICIAL GEOLOGY AND SOILS
 CITY OF BOSTON
 OPEN SPACE AND RECREATION PLAN 2023-2029
 JUNE 2023



SECTION 4.2:

LANDSCAPE CHARACTER**HISTORY OF THE LANDSCAPE**

Boston's landscape is rich in history. It has been changing since the city's founding in 1630. These changes have left traces on the landscape of the city. The growth of the city's landmass has been the most significant evidence of the change of this landscape. The history of land making in Boston is discussed in Section 3.

CURRENT ASSESSMENT

The current assessment of the landscape is also described in Section 3 and Section 7.

Boston has become a highly urbanized area. High- and low-density residential developments dominates the landscape throughout the neighborhoods of Boston. Despite this historical spread of development, the municipal and the metropolitan park systems preserve much of the original landscape character.

Water is a prominent part of the landscape character of Boston. With extensive miles of coastline and riverfront, Boston is blessed with aquatic resources, coastal and estuarine wetlands, and scenic vistas. Within city limits are many of the Boston Harbor Islands that now make up the Boston Harbor Islands National Recreation Area. Much of this area is considered a "noteworthy landscape," by the Department of Conservation and Recreation's statewide Landscape Inventory.

Boston's open lands are a mixture of uplands and wetlands. Most of the upland areas consist of forest, with the remainder in fields and meadows. These upland areas are generally either publicly-owned parklands and cemeteries or privately-owned cemeteries. The larger, expansive wetland areas are primarily under public ownership. Boston is a highly mature, developed community.

Developable land that is as yet undeveloped is extremely limited. The protection of the natural resources and open areas of Boston's landscape is as vital a function now as it was in the 19th and 20th centuries.

SECTION 4.3:

WATER RESOURCES**INTRODUCTION**

The settlement of the Shawmut Peninsula took place due to the area's outstanding water resources. Mainland Boston is bordered by water to the north, south, and east. These water resources include an ocean harbor, rivers, streams, ponds, and wetlands.

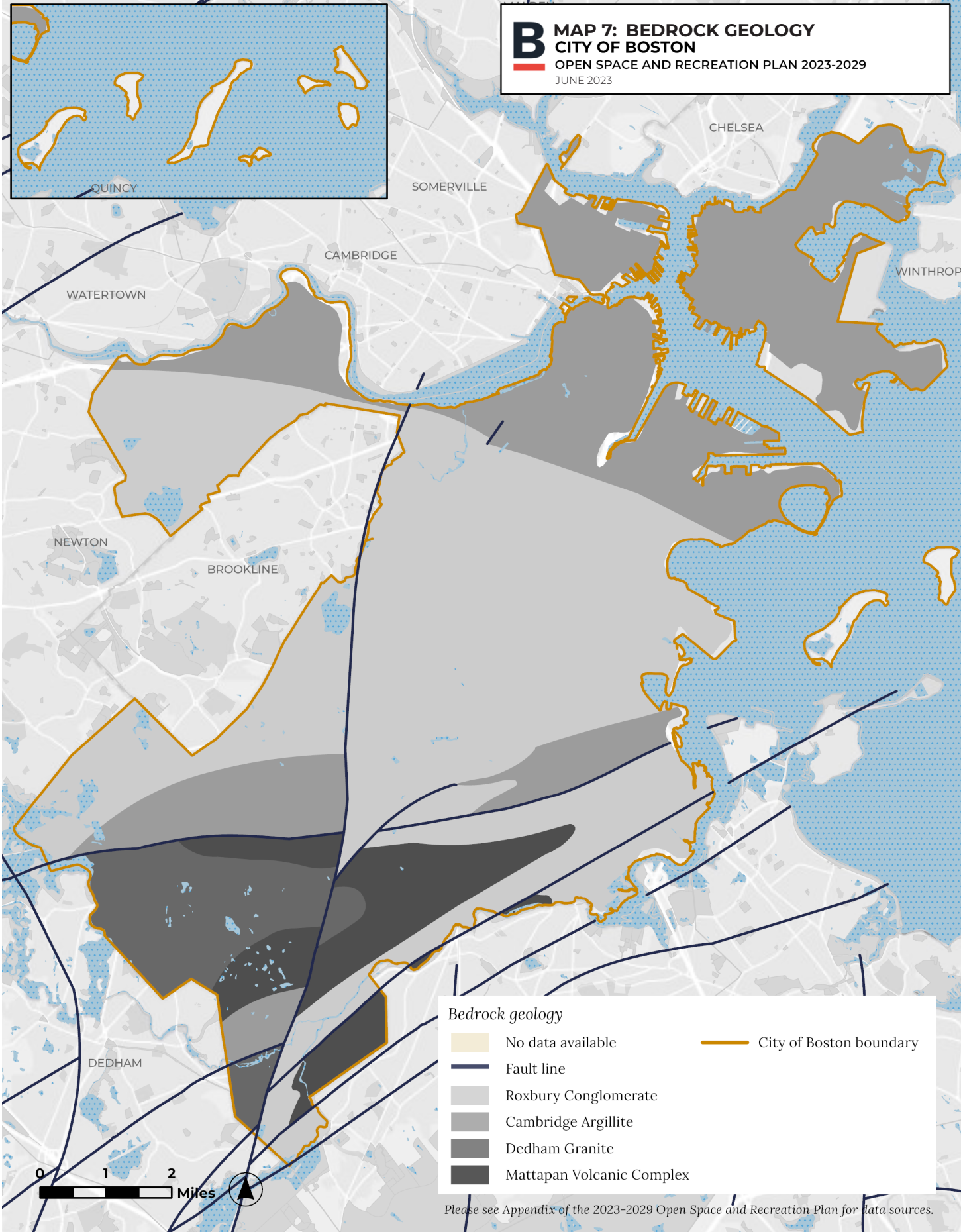
BOSTON HARBOR

To the east, ten miles of the city's shoreline lies on Boston Harbor. The Harbor consists of several unique areas which border Boston, more specifically, its Charlestown, Central Boston, East Boston, South Boston, and Dorchester neighborhoods. Sections of the Harbor include the Inner Harbor, the Outer Harbor, and Dorchester Bay.

The Inner Harbor is bounded by Charlestown, East Boston, Central Boston, and South Boston. The Inner Harbor stretches from the confluence of the Mystic and Chelsea Rivers to the Fort Independence and Fort Winthrop sections of South and East Boston, respectively. The Inner Harbor is used for recreational fishing and boating, and maritime/industrial uses. Freighters and ferries are common in its shipping channels and designated deep port areas. The Inner Harbor includes three channels: the Little Mystic, Fort Point, and the Reserved Channel. These channels are large capacity docking points that can provide protection during rough seas.

The Outer Harbor includes dozens of islands, many of which were once used as military forts, hospitals and industrial plants but have generally reverted to a more natural state. The City owns four islands: Long Island, Moon Island, Rainsford Island, and a large portion of Spectacle Island. The islands are partly submerged drumlin hills formed through glacial action. Rounded hills, open fields, forests, and historical sites characterize these islands. Beaches are found on Spectacle Island, Long

B MAP 7: BEDROCK GEOLOGY
 CITY OF BOSTON
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Island, Lovell’s Island, Thompson Island, and Gallops Island. The water of the Outer Harbor is typically used for swimming, boating, fishing, and navigation by commercial ships.

Constitution Beach Bay (aka Orient Heights Bay) is located on the eastern coast of East Boston between Logan Airport and Orient Heights. Swimming and fishing are common activities there. The bay includes 275 acres in Belle Isle Marsh, which is part of the designated Rumney Marshes Area of Critical Environmental Concern (ACEC).

These marshes are important biological resources and are host to numerous species of waterfowl, wading shore birds, migrant songbirds, invertebrates, and fish. Constitution Beach is a small beach area on tidal flats located in the northern section of the bay. Marshes to the west and the Belle Isle Marsh to the east border the beach.

Dorchester Bay stretches from Castle Island at Pleasure Bay in South Boston to the mouth of the Neponset River at Commercial Point in southern Dorchester. Dorchester Bay is used primarily for boating, fishing, and swimming. Swimmers gain access to the water at several locations along the bay in both South Boston and Dorchester. Access points include the beaches of Pleasure Bay, L and M Street Beaches, and Carson Beach in South Boston, and Savin Hill and Malibu Beaches in Dorchester.

WATERSHEDS

BOSTON HARBOR WATERSHED

Boston is located within the Boston Harbor Watershed which encompasses about 293 square miles of land, including all or part of 45 municipalities. This watershed includes the Mystic River Watershed to the north, the Charles River Watershed to the north and west, and the Neponset, Fore, Back, and Weir river watersheds to the south.

The Boston Harbor watershed has metropolitan beaches such as Constitution Beach, Pleasure Bay, Carson Beach, Savin Hill Beach, and Tenean

Beach. It also contains the Boston Harbor Islands National Recreation Area in the Outer Harbor. These islands contain trails, paths, campsites, beaches, and vistas that attract many visitors.

A publicly accessible, privately-owned HarborWalk is being developed on waterfront properties through the Coastal Zone Management program and the Chapter 91 regulations, as well as Boston Planning and Development Agency (BPDA) policy.

Boston is contained within the Mystic River Watershed, the Charles River Watershed, and the Neponset River Watershed. These watersheds are described below.

CHARLES RIVER WATERSHED

The Charles River is 80 miles long and flows through 23 towns and cities southwest of Boston, beginning at Echo Lake in Hopkinton and ending in Boston Harbor. The river forms part of the southwest boundary of Boston, and also follows the north boundary of the city. The watershed comprises 308 square miles and includes 35 towns and cities.

The Charles River watershed has heavily used park systems such as the Charles River Reservation and the Emerald Necklace, as well as Stony Brook Reservation, Cutler Park, and Millennium Park.

NEPONSET RIVER WATERSHED

The Neponset River Watershed includes about 130 square miles of land southwest of Boston. The river starts in Foxboro near Gillette Stadium and runs for 30 miles, through 14 cities and towns. It forms the southern boundary of the Boston and ends in Dorchester Bay/Boston Harbor, near the landmark gas tank along I-93.

MYSTIC RIVER WATERSHED

The Mystic River Watershed covers 76 square miles and includes 21 municipalities. It begins north of Boston in Reading, then flows into the Upper Mystic Lake in Winchester, to Lower Mystic Lake, through Arlington, Somerville, Medford, Everett, Chelsea, Charlestown, East Boston and into Boston Harbor.

RIVERS

The City of Boston is traversed by five rivers: the Charles River, the Muddy River, the Neponset River, the Chelsea River, and the Mystic River.

CHARLES RIVER

The Charles River comprises eight miles of shoreline within the city including the Charles River Reservation and the parkways of Soldiers Field Road and Storrow Drive. The portion of the Charles between the Charles River Dam and Boston University Bridge is referred to as the Charles River Basin. This section of the river, which once inundated the Back Bay, is a wide and deep impoundment of freshwater used extensively for rowing and sailing.

NEPONSET RIVER

The Neponset River flows east along seven miles of natural, meandering banks to the south of Boston through Hyde Park and along Mattapan and South Dorchester. This section of the River is bordered by the Neponset River Reservation, which includes a large tidal wetland in South Dorchester. The lower four miles of the river from Dorchester Bay to the Lower Mills Dam in southern Dorchester are tidal and frequently used for bird watching, picnicking, canoeing, and fishing.

MUDDY RIVER

The Muddy River originates at Jamaica Pond and flows north 3.5 miles before joining the Charles River. It flows through four distinct parklands designed by Frederic Law Olmsted: Olmsted Park from Ward's Pond to Leverett Pond, the Riverway from Leverett Pond to Park Drive and Brookline Avenue, the Back Bay Fens from Park Drive and Brookline Avenue to the Boylston Street Bridge, and Charlesgate from the Boylston Street Bridge to the Charles River.

The river's watershed drains 8.6 square miles of land, only 25% of which are in Boston. From Jamaica Pond to Leverett Pond, the 2% gradient is steep—an average of a two-foot drop in elevation every 100 feet downstream. This section flows through Olmsted Park, including Ward's Pond, Willow Pond, and several small waterfalls.

The lower section of the river flows from Leverett Pond to the Charles River with a gradient of less than 0.01%, causing the river to be essentially flat with little current. From Leverett Pond, the Muddy meanders through the Riverway before reaching the Brookline Avenue gates at Park Drive. When these gates are opened during times of flood, a portion of the river's flow is directed through the Muddy River Conduit under Brookline Avenue and is emptied directly into the Charles River. During periods of normal flow, river water travels one and one-half miles through the Back Bay Fens to the Charles River.

CHELSEA CREEK

Chelsea Creek (aka Chelsea River) is 2.6 miles long. It runs along Revere, Chelsea and East Boston and feeds part of the Belle Isle Marsh Reservation. The creek starts as Mill Creek in Revere, and flows east for a half mile, then turns south where it becomes Chelsea Creek. It widens as it runs between Chelsea and East Boston, then turns southwest and runs into the Mystic River shortly before it empties into Boston Harbor.

MYSTIC RIVER

There are approximately two miles of Mystic River frontage on Charlestown's north shore, and most of this is dominated by industrial marine transportation enterprises. The Mystic meets the Chelsea River under the Tobin Bridge to form the northern part of the Inner Harbor.

BROOKS AND STREAMS

STONY BROOK

Stony Brook once traversed Boston for approximately seven miles. Most of the stream has been culvertized to accommodate development and stormwater conveyance. Currently, the only portion remaining above ground is at its origin in the Stony Brook Reservation in West Roxbury. The conduit carries mostly brook flow in dry weather and combined sewer overflows and stormwater flows in wet weather.

CANTERBURY BROOK

Canterbury Brook is a tributary of Stony Brook. It is a partially culvertized and partially exposed body of water that is fed by Scarborough Pond in Franklin Park, and storm drains from Mattapan and Roslindale. The brook flows southwest through sections of the former Boston State Hospital, along the edge of the Boston Nature Center, through part of the Canterbury I Urban Wild on the edge of the Greenleaf Composting operation, through part of St. Michael's Cemetery, and then briefly along the northern side of American Legion Highway south of Walk Hill Street. The brook disappears and reappears at various points along its route, dropping underground south of Walk Hill Street and ultimately merging with the Stony Brook Conduit.

MOTHER BROOK

Mother Brook was the first canal constructed in the New World. Originating at a diversion dam on the Charles River in Dedham, it flows east through Hyde Park where it joins the Neponset River. The first three-quarter mile section of Mother Brook, located in Dedham, is an artificial canal excavated to connect the Charles River to a branch of the Neponset River formerly known as East Brook. Mother Brook diverts one-third of the flow of the Charles River.

BUSSEY BROOK

Bussey Brook flows through portions of West Roxbury, Roslindale, and Jamaica Plain before discharging underground into the Stony Brook Conduit near the Forest Hills MBTA station. Like other streams in Boston, it has been almost completely buried, though remnant above-ground sections can be found in Allandale Woods and the Arnold Arboretum. Though seriously degraded by culverting and urban run-off, these remaining sections of Bussey Brook represent an important aquatic resource in Boston.

SAWMILL BROOK

Sawmill Brook traverses the perimeter of both Millennium Park (the former Gardner Street landfill) and the DCR Brook Farm Reservation in

West Roxbury. Though channelized in sections and diverted by construction of the landfill, it is an important tributary to the Charles River. Small, wooded sections of Sawmill Brook occurring within the Brook Farm Reservation are critical habitat to a number of wildlife species, including a state-listed rare amphibian (see Wildlife section).

DANA BROOK

Dana Brook was formerly the main drainage channel in West Brighton. It now lays completely underground from Chandler Pond to the Charles River, a distance of approximately one and one-half miles. Segments of Dana Brook still exist upstream of Chandler Pond, on the Newton Commonwealth Golf Course within Newton. This is the main inlet for Chandler Pond.

PONDS

Boston contains several ponds and a reservoir. These bodies of water vary in nature and origin from glacial ponds to river ponds to artificial ponds and reservoirs. Glacial ponds, called kettle ponds" were formed by glacial processes involving melting water and large blocks of ice deposited upon Boston's landscape, forming ponds. Kettle ponds are common in the Boston Basin. One example is Jamaica Pond, at approximately 80 acres the largest natural pond in Boston.

Turtle Pond is located within the Stony Brook Reservation in Hyde Park and is another natural pond of great significance. It is a popular fishing spot and, despite the presence of the adjacent Turtle Pond Parkway, is relatively undisturbed and has generally good water quality. In addition, several small, unnamed ponds within the Stony Brook Reservation provide critical habitat to a number of important wildlife species. Other small woodland ponds occur in Allandale Woods.

Boston also contains many artificial ponds, and ponds that are part of river systems. One of the most notable artificial ponds is the Public Garden Lagoon. This pond was created in 1838 during the construction of the Public Garden.

Mill Pond in Hyde Park is an artificial pond that was created through an impoundment of Mother Brook. Chandler Pond, located in Brighton, was originally excavated for the purpose of producing ice. It is the last of more than 20 ponds once found in Brighton. Scarborough Pond in Franklin Park was dug out in the 1890s during the park's construction.

The DCR Chestnut Hill Reservoir, located in Brighton, is an artificial impoundment of water that once served as Boston's only water supply. The Reservoir was discontinued as a source of drinking water following completion of the Quabbin Reservoir in Western Massachusetts. The largest body of water located within Boston, the Reservoir is now used for scenic recreation purposes.

Among Boston's ponds that are part of river systems are Cow Island Pond which is a still water section of the Charles River in West Roxbury. The DCR-owned Havey Beach borders this pond. Ward's, Willow and Leverett Ponds are part of the Muddy River system located in Olmsted Park in Jamaica Plain.

WETLANDS

Wetlands serve a vital function for Boston. They assist in flood control, treat stormwater run-off, and provide food and shelter to fish, birds, amphibians, and other important animals. However, in the last 100 years, 6,000 acres of coastal wetlands and approximately 50% of Boston's inland wetlands have been destroyed.

In December 2019, the City of Boston enacted an Ordinance Protecting Local Wetlands and Promoting Climate Change Adaptation in the City of Boston. The Local Wetlands Ordinance gives the City greater authority to protect its wetlands, which are crucial to controlling flooding and protecting Boston's neighborhoods and green space. The ordinance directs the Boston Conservation Commission to consider future climate impacts and environmental justice.

The largest single wetland in Boston, at 275 acres, is the Belle Isle Marsh in East Boston. Other substantial wetlands are found in the Neponset River Reservation in South Dorchester, the Stony Brook Reservation in Hyde Park, and the Brook Farm Reservation in West Roxbury.

Smaller yet still significant forested wetlands are found near the Leatherbee/Hancock Woods in West Roxbury, at Sherrin Woods in Hyde Park, and at Allandale Woods in Roslindale/West Roxbury. Wetlands associated with rivers and streams include those along the banks of the Muddy River, Mother Brook, the Charles River, and Saw Mill Brook (see Section 4.4 for further description of wetland resources).

AQUIFER RECHARGE AREAS

Aquifers are areas beneath the surface of the earth that contain water, whether composed of permeable rock or unconsolidated materials such as gravel, sand, silt or clay. If they are uncontaminated and of sufficient yield, aquifers serve as a source of drinking water for people throughout the world, as well as here in Massachusetts.

In Boston, high and medium yield aquifers are found in two limited locations. Both types are found in West Roxbury along the Charles River, where open spaces uses, such as Cutler Park, Millennium Park, the Rivermoor Urban Wild, Havey Beach, the West Roxbury High School athletic fields and marsh, and cemeteries dominate the landscape. Some residential, commercial, and industrial uses are also located in this area.

The second area is associated with the Fowl Meadows Area of Critical Environmental Concern (ACEC) in Hyde Park, at the southernmost tip of the city. Most of this medium yield aquifer is within the Fowl Meadows ACEC. Some of this aquifer lies within parklands held by DCR. Other portions are overlain by a residential area. One large portion is overlain by a warehouse complex.

The city of Boston is dependent on the DCR-MWRA regional system of water supply, which is based on surface water reservoirs located at great distances from Boston. Therefore, aquifer recharge area protection is not a critical issue for drinking water supply for this community. However, should the City desire at some point in the future to extract groundwater for non-drinking water supply purposes, development over these recharge areas may become an issue worth some consideration. The fact that much of these high and medium yield aquifers found within Boston's city limits are located in areas with some form of protection from development will help future generations, should the need ever arise.

FLOOD HAZARD AREAS

Areas with a greater chance of severe flooding are known as flood hazard areas. For purposes of federal and State law and policy, they are known to be areas where there is a 1% annual chance of flooding (aka the "100-year floodplain" or "FEMA Zone A"), or a 1% annual chance of flooding and an additional hazard associated with storm waves for coastal areas (aka "100-year floodplain" or "FEMA Zone V"). See MAP 8: FEMA FLOOD ZONES for the most recent FEMA maps (2015) available at the time of this plan's writing.

The citywide map titled "FEMA Flood Zones" shows the location of both FEMA Zones A and V. These areas tend to be associated with major freshwater or coastal surface water bodies, such as Boston Harbor, Dorchester Bay, the Charles River, the Neponset River, and the Muddy River. The Flood Zones map also shows open space in the city, and these areas often overlap. Major exceptions tend to be found along coastal areas, such as the downtown, East Boston, Charlestown, South Boston, and Dorchester waterfronts. Flood hazard areas not within designated open spaces are found in some smaller inland areas in East Boston, West Roxbury, Hyde Park, and the Kenmore sub-neighborhood.

Many of the flood hazard areas are found within protected open spaces, ensuring that development in these areas, if any, will be limited. In those flood hazard areas not within open spaces, protected or not, such sites are typically highly developed. Whatever redevelopment takes place in such areas will be the subject of the State Wetland Protection Act and other laws affecting development in flood hazard areas. Flood hazard mapping is periodically revised to reflect changing flood risk factors such as sea level rise. Such a map revision is currently underway at the time of this writing.

The Chapter 91 regulations mandate public access and use along the water's edge and can help reduce flood impacts along flood hazard areas that may be valuable resources.

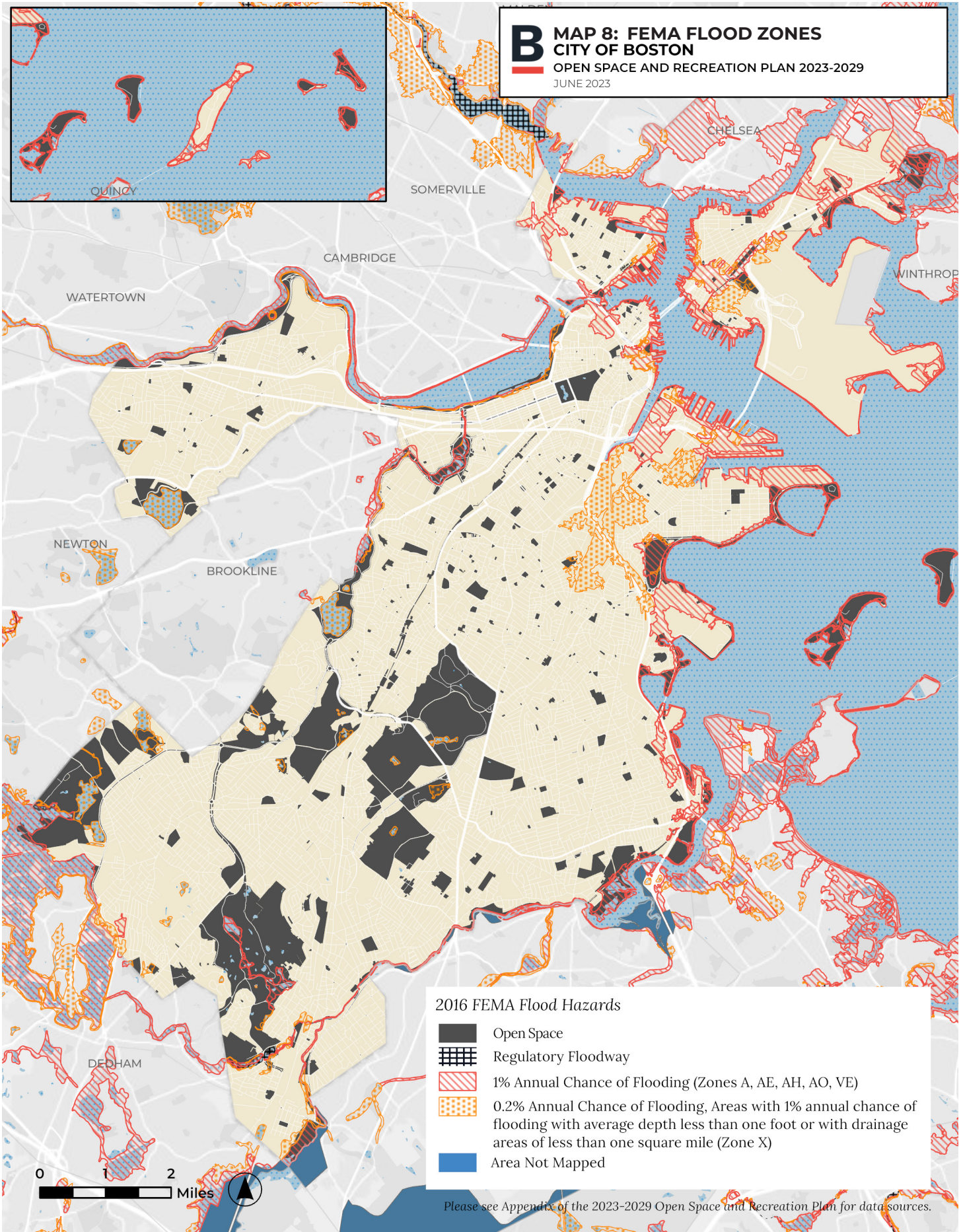
Boston Planning and Development Agency (BPDA), has developed municipal harbor plans that cover such areas as the downtown, Fort Point Channel, East Boston, and South Boston waterfronts in accordance with Chapter 91 and Coastal Zone Management policies. These plans and associated policies work with applicable regulatory review processes to ensure that development in coastal areas does not harm the environment, and is resilient in the face of coastal flooding.

The BPDA also seeks to extend the HarborWalk along the coastal shoreline of Boston (except in working waterfront areas including Logan Airport and Designated Port Areas). BPDA is assisted by the City's Conservation Commission which encourages public access along the water as part of its approvals, and by non-profit groups such as the Boston Harbor Now and Save the Harbor/Save the Bay.

There are *Resilient Boston Harbor Vision* and *Coastal Resilience Solutions* studies for each of Boston's waterfront neighborhoods directly affected by sea level rise and flooding: Central Boston, Charlestown, Dorchester, East Boston, and South Boston.

For more information see Section 7: Analysis of Needs or visit: www.boston.gov/departments/environment/preparing-climate-change

B MAP 8: FEMA FLOOD ZONES
 CITY OF BOSTON
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2016 FEMA Flood Hazards

- Open Space
- Regulatory Floodway
- 1% Annual Chance of Flooding (Zones A, AE, AH, AO, VE)
- 0.2% Annual Chance of Flooding, Areas with 1% annual chance of flooding with average depth less than one foot or with drainage areas of less than one square mile (Zone X)
- Area Not Mapped

Please see Appendix of the 2023-2029 Open Space and Recreation Plan for data sources.

SECTION 4.4:

VEGETATION**INTRODUCTION**

The natural vegetation of Boston is chiefly influenced by the city's geographic position along the Atlantic coast, the presence of landforms resulting from glaciation, and a long history of human land use and manipulation of native habitats.

UPLAND VEGETATION**FORESTED UPLANDS**

The Boston area, like most of eastern Massachusetts, lies in the Appalachian oak-hickory forest zone. This forest type occurs from southern Maine, throughout southern New England, south to Georgia at higher elevations, and west to western New York. Red, white, and black oaks, with lesser densities of pignut, shag-bark, bitternut, and mockernut hickories are species found in the plant communities that dominate the Appalachian oak-hickory forest zone. Other trees commonly found are white ash, black cherry, black birch, hophornbeam, and red maple.

Numerous species of shrubs including lowbush blueberry, maple-leafed viburnum, witchhazel, flowering dogwood, and beaked hazelnut.

In Boston, the oak-hickory forest is mixed with patches of other forest types found in adjacent northern and southern regions. Elements of the northern hardwood forest, such as sugar maple, eastern hemlock, yellow birch, and American beech can be found in Boston's forested areas, especially on north and west facing ridges. These species are generally prevalent throughout northern New England and southeast Canada.

Conversely, areas in the city with well-drained, sandy soils and southeast exposures support woodland species more typical of Cape Cod and other coastal areas, such as pitch pine, scrub oak, and sweet fern. White pine is a ubiquitous species throughout the region, frequently occurring in abandoned pastures and other open, sunny locations.

Given the long history of industrial and residential development within Boston, it is not surprising that natural forests and other native plant communities occur today in remnants and small patches. The largest forested area remaining in the city is the 466-acre Stony Brook Reservation in Hyde Park, Roslindale, and West Roxbury.

Other significant forested areas are Allandale Woods (100 acres, West Roxbury), Hancock Woods (55 acres, West Roxbury), Sherrin Street Woods (25 acres, Hyde Park), the Wilderness (100 acres, Franklin Park), Olmsted Park (50 acres, Jamaica Plain), Brook Farm (120 acres, West Roxbury), parts of the Arnold Arboretum (Jamaica Plain), and sections of several Boston Harbor Islands.

Boston's forests provide a range of recreational, scenic, and ecological benefits. They are the city's lungs, cleansing the air of carbon dioxide and producing oxygen. Summer temperatures are up to ten degrees cooler in city forests, helping to mitigate the effects of urban development and activity, and global warming. They also help control stormwater and filter pollutants from urban runoff. Healthy forest communities are essential for preventing excess sedimentation of waterways, wetlands, storm sewers, and catch basins by stabilizing erodible soils and steep slopes.

Many of Boston's forested areas are open to the public providing both formal and informal environmental education opportunities to schoolchildren, families, and adults. Recreational activities such as hiking, trail running, cross country skiing, wildlife viewing and tracking, and nature photography offer city residents and visitors the unique opportunity to experience and observe nature up close within the confines of an urban environment.

Though many of these areas are publicly owned and protected from outright development, they still suffer from a host of problems. Some, such as the Stony Brook Reservation, have been fragmented by the construction of parkways, creating more edge habitat, less interior habitat, and interrupting established wildlife corridors.

The habitat value of all forested areas is seriously degraded by the prevalence of non-native, invasive plant species. These plants were either purposely or accidentally introduced to the area and, because of their tolerant and hardy nature, have become major threats to the sustainability of native forest ecosystems. Among the most destructive non-native invasive plants in Boston forests are Norway maple, Japanese knotweed, European buckthorn, multiflora rose, Asiatic bittersweet, and Japanese barberry. In addition, people sometimes subject forested areas in Boston to direct abuse. Severe littering, illegal dumping, vandalism, and trampling by foot and vehicles are chronic problems in many urban forests.

Serious pests and diseases are reoccurring natural phenomena within the world as it is now. Their impacts range from mild illness to widespread tree death. They sometimes specialize in a specific tree species or are able to thrive with a range of species. A climate resilient forest relies on nurturing healthy ecosystems and routine, proactive actions against pest and disease.

For more information on the state of tree pests and disease and how Boston is planning for a healthier, more resilient forest, see Section 7: Analysis of Needs or the Urban Forest Plan ([boston.gov/urban-forest-plan](https://www.boston.gov/urban-forest-plan)).

NON-FORESTED UPLANDS

Non-forested uplands, primarily meadows, are a dwindling resource in Boston. Often a remnant of past agricultural use, virtually all meadows and pastures throughout the city have been subject to intense residential and commercial development. Most of those not developed have been left to grow into shrubby thickets and early successional forests dominated by non-native, invasive plant species.

Meadows and pastures provide critical habitat to many species of plants and wildlife that are rarely found in Boston and are increasingly uncommon throughout the northeast. These habitats offer great scenic value, breaking up the monotony of dense residential areas and

providing expansive views of the city, Boston Harbor, and the surrounding landscape. Boston's meadows are frequently found atop hills and other steep slopes subject to erosion problems. Viable, healthy meadow plant communities are thus important to stabilize vulnerable soil.

Significant upland meadows today can be found in the Arnold Arboretum, Franklin Park, the Boston Nature Center, Calf Pasture, the Walter Street Tract, Allandale Farm, and on several Boston Harbor Islands. Most of these sites are current or former agricultural or horticultural sites. Turf grasses and opportunistic wildflower species of Eurasian origin are dominant. Farmers during the 17th and 18th centuries deliberately or accidentally introduced these species and turf grasses.

The acreage of meadow found in Boston increased substantially in 2000 with the opening of Millennium Park, a new park on top of the former Gardner Street landfill in West Roxbury. This 100-acre park includes over 70 acres of grassland comprised of both native and Eurasian grass species.

Because of the suppression of natural wildfires and the disappearance of farming practices such as haying and grazing, meadows now require regular intentional maintenance to sustain their open, pastoral character. Mowing is the most common method of maintenance; however in many cases mowing is done too frequently to allow for the development of a diverse meadow plant community. Such areas are generally devoid of any habitat value. To maximize floristic diversity and ecological value, most meadow habitats should be mowed only once per year, at the most, in the late summer.

The Parks Department through its Urban Wilds Initiative, conducts selective, low-impact mowing regimes at several meadows throughout the city's urban wilds and other natural areas. Community groups and other volunteers have also been involved in introducing native meadow plants, such as goldenrod and aster, and controlling non-native, invasive plant species at many sites.

WETLAND VEGETATION

FRESHWATER WETLAND VEGETATION

As throughout all of Massachusetts, Boston has lost a substantial percentage of its original freshwater wetlands to development. Intense filling and subsequent construction has occurred in the extensive marshes once found along Stony Brook, Bussey Brook, and the upper Charles River. Isolated wetlands, bogs, vernal pools, and small ponds have been filled for residential development. Remaining wetlands have been affected by changes to hydrology as streams have been buried and diverted to storm sewers.

Wetlands serve a vital function for the city. They help to store, control, and cleanse stormwater run-off, a function that becomes increasingly important as additional impervious surfaces are created. They also provide essential habitat for a wide array of wildlife (see Section 4.5).

Several distinct plant communities are present in freshwater wetlands in Boston. Forest wetlands—such as red maple swamps and floodplain forests—are typified by large trees, such as red maple, willows, basswood, green ash, silver maple, and a diverse shrub layer of dogwoods, alder, winterberry holly, viburnums, and swamp azalea.

An outstanding remnant of the southern New England floodplain forest, a rare community type recognized by the Massachusetts Natural Heritage Program, occurs along the Charles River shoreline of Millennium Park in West Roxbury. Other significant forested wetlands are found in the Stony Brook Reservation, Brook Farm, Sherrin Street Woods, and Leatherbee/Hancock Woods.

Non-forested wetlands – marshes, shrub swamps, and wet meadows – are dominated by shrubs, such as buttonbush, highbush blueberry, dogwoods, and elderberry, along with an extremely diverse collection of grasses, grass-like plants, and herbs typified by cattails, water willow, pickerel weed, arrow arum, bulrushes,

and sedges. Typical marshes are found at Allandale Woods, West Roxbury High School, Brook Farm, along the West Roxbury stretch of the Charles River, and the Boston Nature Center.

COASTAL WETLAND VEGETATION

Coastal wetlands, primarily salt marshes in Boston, were once the most dominant plant community within the city. Thousands of acres occurred along the harbor shoreline and up into the estuaries of the Charles, Chelsea, Mystic, and Neponset Rivers. Over the past 350 years, these salt marshes have been lost to filling, alterations to hydrology, pollution, and other drastic changes to the shoreline. Today only about 400 acres of salt marsh remain. These are primarily found at the DCR's Belle Isle and Neponset River Reservations in East Boston and Dorchester, respectively, and at MassPort's Wood Island Marsh in East Boston.

Salt marshes comprise one of the richest and most biologically productive ecosystems on Earth. The precisely balanced cycles of tide, sedimentation, and decomposition all contribute to the production of up to ten tons per acre per year of vital nutrients, minerals, and organic material to nearby aquatic and terrestrial habitats. Healthy salt marshes support dozens of animal species. Some species (ribbed mussel, salt marsh dragonfly, fiddler crab, for example) are restricted to this habitat for the duration of their lives, while other animals (sharp-tailed sparrow, mummichogs, meadow vole) use salt marshes for breeding or feeding but can also be found in other habitats.

Overwhelmingly dominated by salt marsh cordgrass and salt meadow grass, salt marshes also protect sensitive, low-lying coastal areas from flooding and other damage resulting from strong storms. They are vital to the maintenance of clean water in Boston Harbor. Other plants adapted to withstand the unique physical conditions in and around salt marshes include marsh elder, black rush, spike grass, glasswort, and sea lavender.

WETLANDS DEGRADATION

Both coastal and freshwater wetlands are particularly susceptible to the deleterious effects of urban development because they form the interface between surface waters and groundwater and developable or developed uplands. Public ownership alone is insufficient to protect them and preserve the vital functions they provide.

All of the wetlands occurring in Boston are degraded to a certain extent. They have been at least partially filled or drained, have received either too much or too little water, have been subjected to pollutants, and have been invaded by non-native, invasive plants that have out-competed the native species. The most destructive non-native plants in Boston wetlands are giant reed (*Phragmites australis*) and purple loosestrife.

PUBLIC SHADE TREES

The Parks and Recreation Department cares for more than 38,000 street trees. These public shade trees are a vital part of Boston's urban forest, providing public access to trees and their shade, reducing temperatures by shading concrete and asphalt, and creating a beautiful and meaningful public realm. As of 2019, trees in the public right-of-way account for 18% of Boston's canopy. The urban forest includes all the trees in Boston, across public and private land, and is part of an ecosystem that plays an important role in cultural and spiritual practices, providing shade, protecting people and property from wind and weather, reducing air conditioning and heating costs for adjacent buildings, helping to filter stormwater, and generally contributing to the physical well-being of the city's residents.

STATUTORY RESPONSIBILITY AND REGULATIONS

The Parks Commissioner is by statute (Chapter 87, Massachusetts General Laws) the Tree Warden of the city. Together with the Tree Warden, the Commissioner is responsible for establishing a work plan for trees within the statutes and regulations that have already been established.

MAINTENANCE

The Maintenance Division's Urban Forestry Unit is responsible for the pruning and removal of all trees under the jurisdiction of the Parks Department. In addition they supervise specialized treatments for disease such as Dutch Elm Disease and respond to emergencies like windstorms, snowstorms, and hurricanes.

See Section 7: Analysis of Needs or the Urban Forest Plan for a more in-depth discussion of the state of the urban forest, goals, and next steps: boston.gov/urban-forest-plan

RARE SPECIES

Given the history of scholarly study in the Boston area, it is not surprising that the city's natural areas were well-traveled by knowledgeable botanists and naturalists during the 19th century and the city's flora well documented. The Massachusetts Natural Heritage and Endangered Species Program (MNHESP) lists several dozen rare plant species that are known to have occurred in Boston. Currently threatened plant species still present in Boston include pale green orchis, Long's bulrush, and Britton's violet.

The vast majority of rare plant species habitat is long gone in Boston, but isolated occurrences may still exist in a few locations. In 2003, the New England Wildflower Society conducted botanical inventories at selected urban wilds in Boston. These inventories noted two potentially rare species that are listed by the MNHESP on their "watch" list. These species are Black Oat Grass (*Piptochaetium avenaceum*) and Violet Bush Clover (*Lespedeza violacaea*).

CULTURAL COMMUNITIES

As one of the oldest cities in the U.S., Boston has a very long tradition of agriculture and horticulture. At one time, the majority of what is now the city was farmland. Jamaica Plain, Mission Hill, Dorchester, Roxbury, and Hyde Park were all intensely farmed into the early 20th century, providing food and supplies to the burgeoning

industrial and commercial center in central Boston. Pieces of this activity still remain. Allandale Farm in West Roxbury and Brookline is the lone remaining working farm in Boston. It is planted with vegetables, fruit, hay, and cover crops that are sold at the farm's retail stand.

The Arnold Arboretum, managed by Harvard University on land owned by the Parks Department, is a world-famous facility with a collection of trees and shrubs from around the globe. The site contains several expansive, naturalistic meadows and unmanicured woodlands that provide excellent wildlife habitat and give visitors a sense of the area's pastoral history. The 25-acre Bussey Brook Meadow Urban Wild is one of the few areas within the Arboretum that is truly managed as a natural area.

SECTION 4.5:

FISH AND WILDLIFE

INTRODUCTION

Approximately half of Boston's 5,800 acres, is comprised of land that provides important habitat for a large number of plant and animal wildlife species. These areas are made up of reservations, beaches, urban wilds, portions of parklands, sections of the Boston Harbor Islands, campus areas, and privately-owned land. The diversity of these areas and the plant communities found at each, support an abundant collection of both native and non-native animal species.

FISH

The city's most diverse habitat for fish is Boston Harbor. This is probably one of the few habitats in Boston that supports a generally native wildlife population. It is also a major recreational resource for sport fishing. The commercial aspect of fishing, though integrally tied to the historic economic development of Boston, is almost completely limited to charter boats and other activity supporting sport fishermen.

The most significant fish in Boston Harbor are striped bass, winter flounder, cod, mackerel, bluefish, and monkfish. Other important species are pout, hake, dogfish, menhaden, and killifish. The clean-up of Boston Harbor has improved the habitat for all marine wildlife, though populations of several fish species are still imperiled by overfishing and degraded habitats. Good access for onshore fishing is found at Castle Island, Long Island, Harbor Point and along the Dorchester and East Boston shorelines.

Boston's shellfish beds have been officially closed for many years. Abundant populations of clams, mussels, quahogs, and to a lesser extent, oysters, are still found within Boston Harbor. However, water quality has still not improved to the level required for state officials to allow

their consumption, except for those found in certain small beds in Dorchester Bay and Constitution Beach Bay. Shellfish in those beds can be harvested with the proper license and made fit for human consumption with post-harvest cleansing at a shellfish purification facility.

Sport fishing also occurs on several of Boston's rivers and ponds such as Scarborough Pond, Chandler Pond, Turtle Pond, the Charles River, and most notably Jamaica Pond. The State stocks Jamaica Pond with hatchery-raised trout and smallmouth bass. Native species found in Boston's ponds include golden shiner, bluegills, pumpkinseed, chain pickerel, and American eel. These populations have suffered from generally poor water quality and non-native species such as carp, bass, trout, and goldfish.

The Charles River still supports seasonal migrations of some anadromous fish (species that generally live in salt water and return to freshwater for breeding), most notably Atlantic herring and American shad.

One State-listed rare species of fish occurs in Boston, the three-spined stickleback. This small, inconspicuous fish lives in a small pool in the Olmsted Park area. The species occurs commonly in marine habitats, but freshwater populations are rare in New England. The Boston population is the southernmost freshwater occurrence and the only one in Massachusetts.

BIRDS

Urban natural areas provide important, valued habitat for birds, other fauna, and wild plant species. More than 200 species of birds can be seen within Boston in one calendar year. This diversity stems from Boston's location on the Atlantic Flyway migration corridor and the diverse collection of habitats found within the city limits. Boston Harbor and its associated estuaries, salt marshes, beaches, and mud flats support numerous species of waterfowl, shorebirds, and seabirds. Forested areas and

wetlands are home to resident songbirds and dozens of species of neotropical migrants in the spring and fall. Meadows and other open areas attract raptors and owls.

Birdwatching is an increasingly popular recreational activity in urban areas as more people discover the great array of birds found even in the midst of extensive development. In the Back Bay Fens area, over 170 species of birds have been documented by local birders, all within the shadows of Fenway Park and the Hancock Tower. At the Boston Nature Center in Mattapan, naturalists have documented approximately 150 species of birds. Other important and well-documented habitat areas for birds are the Arnold Arboretum, the Belle Isle Reservation, Franklin Park, and the Stony Brook Reservation.

The Massachusetts Natural Heritage Program lists six species of rare birds that have nested in Boston: vesper sparrow, common tern, least tern, barn owl, peregrine falcon, and upland sandpiper. Currently, the upland sandpiper is listed as endangered, the grasshopper sparrow is listed as threatened, and the least tern and common tern are listed as of special concern. In addition, several state-listed rare species, such as pied-billed grebe and piping plover, have nested in towns adjacent to Boston and could just as easily nest within the city boundaries.

Wild turkeys have returned to the city after an absence of many years. Several Boston Harbor Islands host nesting colonies of egrets and herons. Given the colonial and sensitive nesting habits of these birds, these rookeries are of great regional significance.

The city also contains significant wintering habitat for several important bird species. Examples of this are the snowy owls and other birds of prey that spend most winters along the runways at Logan Airport. This phenomenon has been well documented by researchers at the Massachusetts Audubon Society with the cooperation of MassPort.

Falling partly within the limits of the City of Boston are three Important Bird Areas (IBAs). Important Bird Areas have been identified and designated in more than 130 countries in order to focus attention on the significance of protecting critical bird habitats. The Massachusetts Audubon Society has taken the lead in identifying IBAs in Massachusetts. The Massachusetts IBA program may be viewed online through the Mass Audubon website. The three IBAs falling partly in the city of Boston are Belle Isle Marsh, the Boston Harbor Islands National Recreation Area, and the Mystic River Watershed. Mass Audubon has urged that any public open space within these areas be managed in a manner compatible with the goals of the IBA program.

Several species of birds, both native and non-native, have grown in population to be considered public nuisances. The common pigeon, for example, was developed from the European rock dove and introduced into this country as a domesticated bird, but many of these birds escaped and formed feral populations. Today the pigeon is found in association with human habitations and regarded as a pest.

Other non-native bird species, such as the house sparrow, European starling, and house hinch, are also abundant in Boston and wreak havoc among populations of native birds. Humans introduced all of these species to North America. These non-native species have grown to a population size where they outcompete native species for food, nesting sites, and other resources.

Canada goose and American crow, both native species, have also experienced recent population explosions, causing a variety of problems among other native bird populations. The Canada goose population has also created a negative impact on the quality of lawns and playing fields in parks, as well as water run-off from parklands.

MAMMALS

Like the rest of eastern Massachusetts, Boston is experiencing rapid and dramatic changes to its resident wild mammal population. A combination of factors—explosive residential development in the suburbs, intentional and inadvertent creation of forested wildlife corridors, and the continued habituation of animals to human activity, among others—has caused the sighting of species traditionally associated with remote wilderness areas to be an increasingly common occurrence within the city.

White-tailed deer, rarely seen within the Route 128 beltway only 25 years ago, are now year-round residents in Boston. Deer and signs of their presence—tracks, scat, antler rubbings, and browse—are frequently seen in Franklin Park, the Arnold Arboretum, Allandale Woods, and near Millennium Park, among other locations. As the presence of deer has become more common, concern may develop over the possible impacts deer have on public and private lands and public safety. Shrubbery browsed by deer, the prevalence of Lyme disease, and the potential for deer-car collisions all contribute to the public's eventual intolerance for large populations of deer in dense residential areas.

Coyotes have also made a dramatic comeback to eastern Massachusetts, after being almost completely extirpated by a government-sponsored eradication program during the 19th century. Coyote sightings in areas of the city, such as along the Neponset River, have become more common in recent years.

Small mammals adaptable to humans and human settlements, such as raccoons, possum, striped skunk, and cottontail rabbits, abound throughout the city, in both developed and undeveloped areas. Less conspicuous mammals, such as mice, voles, shrews, and moles, though rarely seen, are also common in natural habitats.

OTHER VERTEBRATES

Reptiles and amphibians, commonly grouped as herpetiles, are imperiled animals, and their presence is used as an ecological indicator to gauge the health of an ecosystem. Common species found in Boston include green frog, bullfrog, painted turtle, red-eared slider (non-native), snapping turtle, garter snake, red-backed salamander, and two-lined salamander. Though these species are common elsewhere, their occurrence in Boston is sporadic at best, with only scattered records existing in a few neighborhoods.

The Massachusetts Natural Heritage Program lists the blue-spotted salamander as a species of special concern in Boston. In addition, two state-listed rare herpetiles occur in West Roxbury. Species that should occur in Boston but have not been recently documented include milk snake, black racer, northern-water snake, ribbon snake, American toad, and wood frog. Significant herpetile habitats are in the Stony Brook Reservation, the Brook Farm Reservation/Millennium Park area, and Allandale Woods.

INVERTEBRATES

Insects and other invertebrates are also commonly used indicators of ecosystem viability, particularly for aquatic ecosystems. Preliminary studies of benthic macroinvertebrates conducted by the Parks Department at Chandler Pond, Scarborough Pond, Wards Pond, Willow Pond, and the Muddy River have shown very low species diversity, thereby confirming the poor water quality of these water bodies.

WILDLIFE CORRIDORS

The undeveloped vegetated lands and the water bodies of the City of Boston play an important role in supporting wildlife. While in some cases, these are islands in a sea of urbanization, many of these lands and water bodies are connected so that even species with lesser mobility than birds and insects can traverse the cityscape.

Corridors associated with water bodies are the dominant corridors in the City of Boston. Much of the undeveloped harborfront serves as a wildlife corridor, and the Harbor itself and associated bays and estuaries serve as aquatic wildlife corridors. The Chelsea, Mystic, Charles, and Neponset Rivers also serve as terrestrial and aquatic wildlife corridors. Thanks to state, city, and federal agencies, these water-based corridors have protected lands that are vegetated and provide the ability for wildlife to move along them. The Charles River Reservation, the Neponset River Reservation, and the Belle Isle Marsh Reservation are among the largest of such land holdings. Smaller holdings also help, such as Millennium Park along the Charles, Constitution Beach along Winthrop Bay, and the Old Harbor Reservation along Dorchester Bay.

Then there are corridors that connect inland from these river- and harbor-based corridors. One of the most significant of these is the Emerald Necklace park system from Charlesgate at the Charles to the Back Bay Fens, the Riverway, Olmsted Park, and Jamaica Pond Park, linked by the Muddy River tributary to the Charles. There is a further land-based connection via the Arborway to the Arnold Arboretum. Then again, there is another land connection, either from the Arboretum to the nearby Allandale Woods tracts, or from Jamaica Pond Park through vegetated lands in the Jamaica Hills neighborhood and southern Brookline to Allandale Woods. From Allandale Woods, wildlife can connect via two parkways to two large vegetated areas of the city. Southward from West Roxbury Parkway, wildlife can connect to the Stony Brook Reservation & George Wright Golf Course area, and then connect to the Neponset via the Mother Brook, which is tributary to both the Charles and the Neponset. Westward from the VFW Parkway, wildlife can connect through the large group of lands in northwest West Roxbury, primarily cemeteries, but also conservation lands such as Hancock Woods and Brook Farm, and parkland such as Millennium Park, to the Charles River. The

Neponset Valley Parkway serves as a corridor from the Stony Brook Reservation southward to the Neponset River Reservation and the Blue Hills Reservation in Milton and Canton.

A more isolated wildlife corridor of lands exists in what was once termed “the Heart of the City.” This assemblage of vegetated lands exists surrounded by the neighborhoods of Jamaica Plain, Roxbury, Dorchester, Mattapan, and Roslindale. The biggest parcel is Franklin Park, but this corridor also includes the Boston Nature Center, and the following cemeteries: Forest Hills Cemetery, St. Michael’s Cemetery, Calvary Cemetery, New Calvary Cemetery, and Mount Hope Cemetery.

Railroad corridors and associated lands can also serve as wildlife corridors. With Boston as a rail hub, many rail corridors from more rural parts of the state cross into the city. The Southwest Corridor and its associated Park serves as a wildlife corridor linking the highly developed Back Bay neighborhood to both the Emerald Necklace corridor and the Heart of the City corridor. It is likely that such a rail corridor or perhaps the Charles River Reservation was the likely route for the deer sighted in May 2009 in such downtown locations as Boston Common, the Public Garden, and City Hall Plaza. (It was killed when struck by a car on the Massachusetts Turnpike near Fenway Park.)

SECTION 4.6:

SCENIC RESOURCES AND UNIQUE AREAS

SCENIC LANDSCAPES

Boston has many scenic and significant landscapes that define the city’s character. The most extensive landscape type is the waterfront. Whether along Dorchester Bay, the Inner Harbor, Belle Isle Inlet, the Mystic, or the Chelsea, saltwater-oriented landscapes form much of the basis for Boston’s attractiveness.

Freshwater-oriented landscapes, such as the Neponset, Mother Brook, Bussey Brook, Scarborough Pond, and Chandler Pond also have great scenic charm. The two most notable scenic landscapes based on fresh water are the Charles River Reservation and the Emerald Necklace. In the midst of a densely developed urban area, these green corridors provide a visual and recreational respite. As envisioned by Frederick Law Olmsted and Charles Eliot, the views they afford, and the opportunity to stroll away from streets and through naturalized and recreational landscapes, provide relief from the hectic pace of urban life.

Some parklands developed on former landfills provide scenic landscapes themselves as well as the opportunity for viewing scenic vistas. Pope John Paul II Park along the Neponset in southern Dorchester provides views of the Neponset Estuary, including extensive estuarine wetlands. Millennium Park in West Roxbury forms a prominent hill along the banks of the Charles, a unique landform in the valley of a mature, meandering river. It provides vistas, especially to the west, that some have said are more typical of views from hilltops in rural Central Massachusetts. Of course, the exception is the view to the northeast, which shows the top of the glass Hancock Tower peeking over a wooded skyline.

GEOLOGICAL FEATURES

Geologic features are described elsewhere in this section. The one geologic feature most appropriate for discussion in this particular section is Roxbury Conglomerate, also known as Roxbury Puddingstone, the State Rock of Massachusetts. This particular bedrock unit is unique to the Boston Basin, yet quite prevalent within the Basin. Its presence as a rock outcrop is seen occasionally in parts of the city, often-times because of the expense of blasting it to provide room for development. It forms a prominent feature in some parks and natural areas/urban wilds, such as Franklin Park, Allandale Woods, Hancock Woods, and Stony Brook Reservation. Such outcrops are natural play areas for children, who love to climb them.

CULTURAL AND HISTORIC AREAS

Boston has numerous properties designated as historically significant, as well as entire districts so designated. Much of the Emerald Necklace is so designated as well as several other parks. The protection of such cultural and historical resources has become City policy and a facet of the character and strategy for redevelopment of neighborhoods, commercial areas, and parklands.

A map has been included in this plan that shows the extensive designation of districts and sites throughout the city. These designations offer some degree of protection with a review process if federal or state monies, approvals, or licenses are required. Preservation of these areas not only protects the cultural heritage of Boston, but also maintains the visual character of the city.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

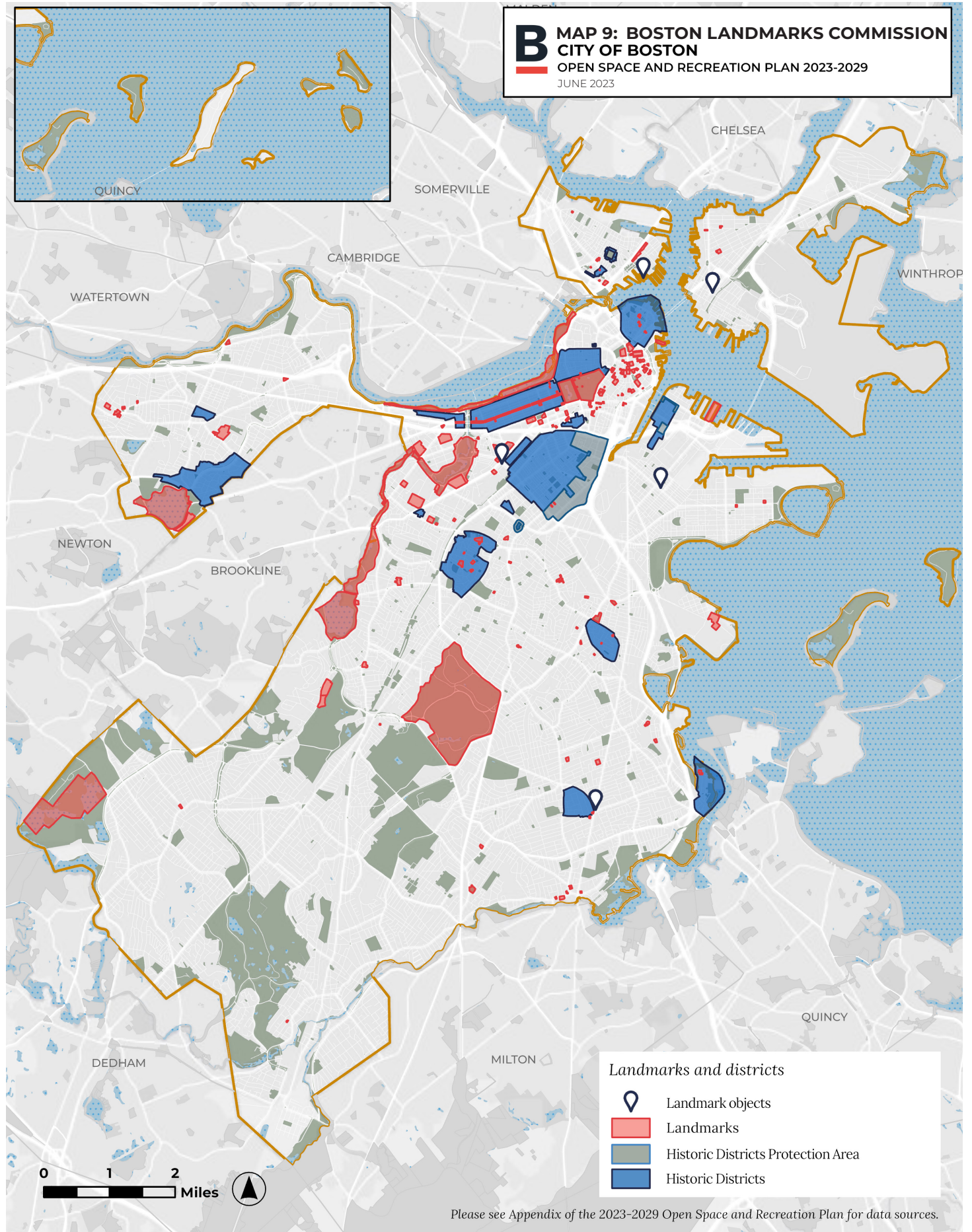
The Massachusetts Department of Conservation and Recreation (DCR) administers the Area of Environmental Concern (ACEC) program in order to identify, inventory, and ensure careful stewardship of the Commonwealth's outstanding natural resource areas. The City of Boston contains portions of three ACECs—Rumney Marshes, Neponset Estuary, and Fowl Meadow/Ponkapoag Bog (see MAP 10: CRITICAL ENVIRONMENTAL AREAS).

THE RUMNEY MARSHES

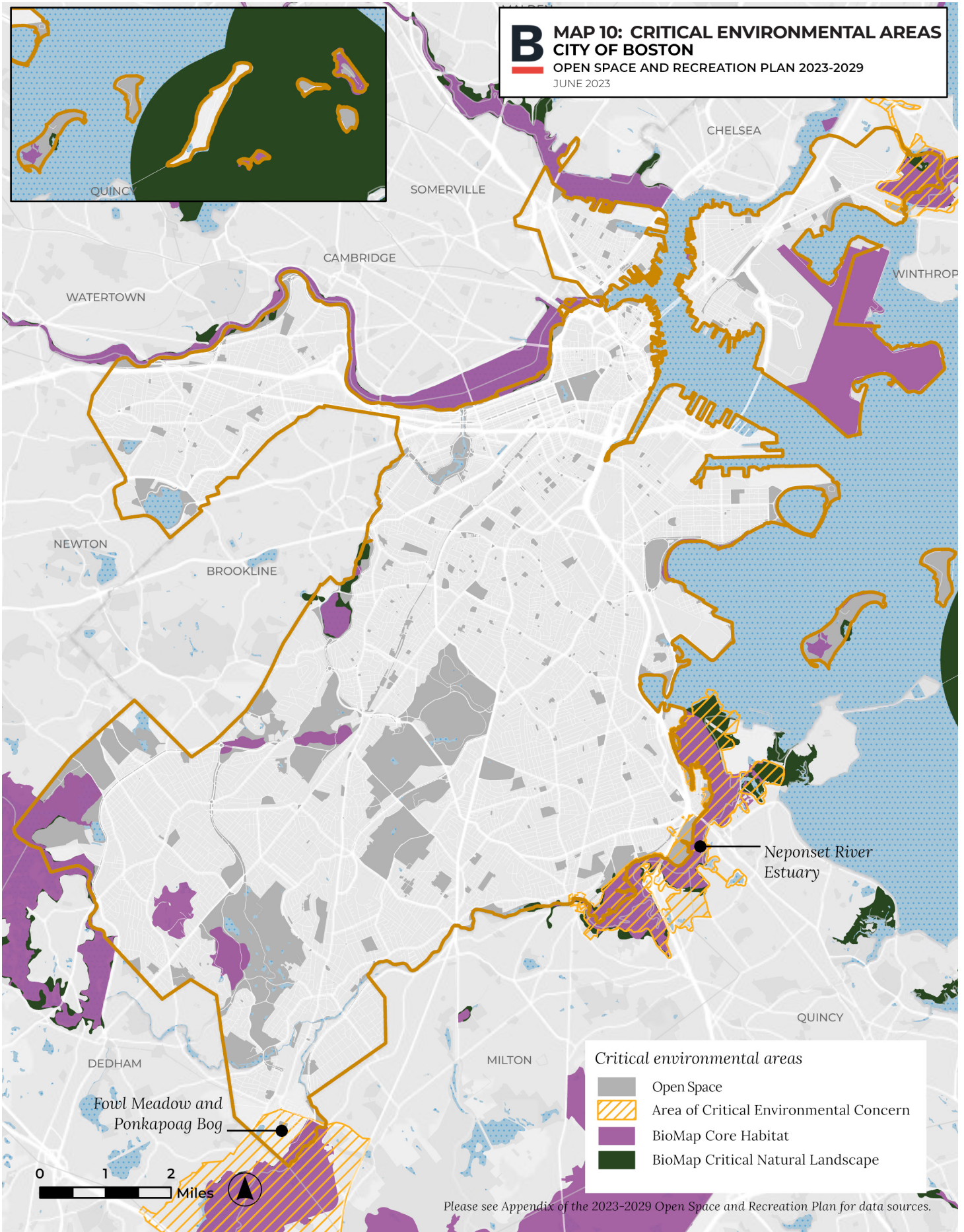
According to DCR's Office of Natural Resources, the U.S. Fish and Wildlife Service has characterized the Rumney Marsh ACEC as one of the most biologically significant estuaries in the state. The area includes approximately 1,000 acres of highly productive salt marsh, tidal flats, and shallow channels. The Belle Isle Marsh in East Boston is wholly included in the Rumney Marsh ACEC and comprises 275 acres of salt marsh, salt meadow, and tidal flats, providing critical wildlife habitat, flood storage, and water quality improvement functions. All of the Belle Isle Marsh is publicly owned by the DCR, except for small parcels owned by the Town of Winthrop and the City of Boston-owned Belle Isle Coastal Preserve, formerly known as Belle Isle Fish Company Urban Wild.

THE NEPONSET ESTUARY

The Neponset Estuary ACEC extends from the mouth of the Neponset River to the Lower Mills Dam, which separates the tidal and freshwater sections of the river. About 435 acres of the 1,260-acre ACEC are located in Boston with the remainder located in Milton and Quincy. The Neponset Estuary provides valuable habitat for anadromous fish species, including smelt and blueback herring. Most of the open space along the Boston side of the estuary is owned by the DCR, providing a variety of public open space



B MAP 10: CRITICAL ENVIRONMENTAL AREAS
CITY OF BOSTON
OPEN SPACE AND RECREATION PLAN 2023-2029
JUNE 2023



Please see Appendix of the 2023-2029 Open Space and Recreation Plan for data sources.

and recreational opportunities. The DCR's Lower Neponset River Reservation Master Plan provides a vision for the long-term development of these properties.

THE FOWL MEADOW/PONKAPOAG BOG

The Fowl Meadow/Ponkapoag Bog ACEC is also located along the Neponset River, from the Readville section of Hyde Park and through the towns of Canton, Dedham, Milton, Norwood, Randolph, Sharon, and Westwood. Large areas of the 8,350-acre ACEC are part of the DCR's Blue Hills Reservation. This ACEC protects habitat for at least 13 rare species, several aquifers and public water supplies, floodplains, and wetlands associated with the Neponset and its tributaries. In Boston, Sprague Pond and the Sprague Pond Shoreline Reserve, Boston's newest park as of January 2023, are located within this ACEC.

SECTION 4.7:

ENVIRONMENTAL CHALLENGES

INTRODUCTION

Boston's intense land use can pose threats to several different components of the environment. Recognizing and planning for these different threats is essential for the environmental protection of Boston and the region.

For example, most reflective of an environment's health is its water quality. Threats to water quality include hazardous waste sites, landfills, and sewer discharges. However, water itself poses a threat to the landscape. Flooding, erosion, and sedimentation threaten the constructed and natural landscapes of Boston.

The preservation and expansion of Boston's green spaces contribute to both climate mitigation and adaptation. Green spaces keep the city cooler in summer, thereby reducing the urban heat-island effect (black pavement and other urban structures absorb more solar energy than grass and trees). This reduces the amount of electricity (and associated greenhouse gasses) needed for air conditioning and reduces the risks of more frequent heat waves posed by climate change. Greenery also increases the amount of groundwater recharge, thereby lowering flood risks.

DEVELOPMENT

Areas of current or anticipated development activity include former or active industrial areas in Allston-Brighton, Hyde Park, Dorchester, South Boston, Charlestown and East Boston. New development, if thoughtfully planned, can bring open space benefits to a neighborhood through the creation of new parkland and connections to existing parks through greenways and complete streets. Permanent dedication of land to public parks is essential in these converting neighborhoods because most evolving industrial areas do not have adequate existing open space to support new residential or commercial development. Similarly, as neighborhoods with limited parkland

take on greater development density, existing parks can become overburdened and not able to meet community needs. The provision of open space, particularly for active recreation, is an essential element in neighborhood planning.

Boston is also seeing conversion of institutional land for new uses. University and school campuses as well as religious properties are sites of many larger scale redevelopment projects throughout the city. The conversion of some of these sites can result in tree canopy loss, an increase in impervious areas, and other environmental impacts.

Current considerations related to the impact of development of the open space system include protection of significant viewsheds with parks like Jamaica Pond or Schoolmaster and Scarboro Hills in Franklin Park. Park use and character is also impacted by the introduction of new or expanded shadows from tall buildings.

Protection of access to sunlight for park users and park vegetation is essential.

URBAN FOREST

Now and over the coming decades, Boston is facing significant challenges including climate change, a rising cost of living, and development pressures that come with a growing population. All of these place pressure on the urban forest which includes all the trees in Boston, growing across public and private land. The Urban Forest Plan produced a series of findings, the following of which highlight the environmental challenges the city's canopy faces:

- Tree canopy is not equitably distributed across Boston.
- The majority of tree canopy is on private land.
- The urban forest is vulnerable to threats from climate change, development, disease/pests, lack of care, limited space, and growing conditions.
- Trees must be treated as critical city infrastructure.
- Room and quality growing space for trees is limited in Boston.

Section 7: Analysis of Needs under the heading “Protecting and Expanding the Urban Forest” describes the goals and actions designed to respond to these key findings.

For more information on how Boston is planning for a healthier, more resilient forest, see Section 7: Analysis of Needs or the Urban Forest Plan project page (boston.gov/urban-forest-plan).

HAZARDOUS WASTE SITES

As of January 2023, there were 5,718 reported releases in the City of Boston, both active or inactive (usually resolved) (MassDEP n.d.). A hazardous waste site is an area in which a hazardous substance has been released into the ground. The most common hazardous waste released is petroleum-based. Therefore, the most common hazardous waste site is one that has a land use associated with motor vehicles. This may be a gas station, service garage, or junkyard. Leaking underground tanks are responsible for a substantial amount of contaminated sites. These tanks commonly hold fuel oil for homes and businesses, or gasoline for service stations. Other typical locations of hazardous waste include dry cleaners and industrial land uses which use various chemicals in manufacturing or processing.

Once released into the ground, pollutants may migrate towards ground and surface water resources. If the contaminated soil is exposed to the air (not covered by concrete or asphalt) the pollutant may vaporize causing unusual odors and harmful vapors. Physical contact with contaminated soil may cause skin irritation. Remediation or cleansing of contaminated soils is necessary because of these threats.

The Massachusetts Department of Environmental Protection (MassDEP) is responsible for enforcing laws that require remediation of contaminated sites (primarily MGL Chapter 21E). The hazardous waste sites in Boston are either considered to be of highest priority for

clean up, and therefore require MassDEP permitting, or where classification is unconfirmed or not yet determined, so that many of these sites may not be seriously contaminated, making remediation a financially feasible possibility for reuse.

LANDFILLS

Boston does not currently have an active landfill, but does have several areas that have operated as landfills, dumps, or waste transfer stations. Former landfills include the Spectacle Island and Gardner Street landfills. Both facilities have undergone a capping that has resulted in the safe containment of waste and the creation of open space.

The Gardner Street landfill site is located on the banks of the Charles River in West Roxbury. The landfill's operation began in the 1930s and closed in 1980 but not capped. Contaminated surface runoff and groundwater flow posed a threat to the water quality of the nearby Charles River and its associated wetlands and groundwater resources. Excess material from the Central Artery Project was used to cap the landfill in 1997, which created the 105-acre Millennium Park which was dedicated in 2000. This park features several athletic fields, passive recreation areas, a canoe/kayak launch on the Charles River, six miles of paths, grasslands, and nature study areas.

The Spectacle Island landfill was located on Spectacle Island in the Boston Harbor. It operated until the 1950s. In an uncapped state, the dump presented a threat to water quality in the Boston Harbor. Excess material from the Central Artery Project was used to cap the landfill, which created 105 acres of primarily passive parkland. The park was opened to the public in 2006 with the completion of a visitor's center, walking paths, and a swimming beach. The Parks Department and the Massachusetts Department of Conservation and Recreation jointly manage this park.

The Hallet Street and Neponset Avenue Landfills are also capped and used as open space. DCR closed and capped the landfills, and created the Pope John Paul II Park which opened in 2000 as part of the Lower Neponset River Reservation. This park includes active and passive features as well as improvements for access to the water.

The other closed landfills in Boston are at Columbia Point in Dorchester along Dorchester Bay where UMass Boston and housing uses are found, and the Barry Quarry in Hyde Park, which is also known as the Oak Lawn Driving Range.

EROSION SEDIMENTATION

Channelized streams and ocean walls have historically controlled erosion along the city's waterways. Pavement or structures cover a large percentage of Boston's surface area, served by an extensive stormwater drain system. This minimizes most land erosion, yet also contributes to localized erosion problems both by increasing surface run-off volume and speed, and by concentrating flows at specific discharge points. Erosion also occurs in areas that are undeveloped and not served by storm drains.

Urbanization is associated with impervious surfaces that speed the delivery of water to the river channel and result in larger and quicker peak flows. These increased peak flows transport large sediment loads that are dumped upon reaching low energy environments (i.e., slower moving waters contained in broader, shallower channels).

In association with chronic erosion and uncontrolled run-off in Boston's open spaces, deposition of sediments has posed a threat to areas such as the Back Bay Fens and Muddy River system. The Muddy River is an area of intensive sedimentation within Boston (and Brookline). The Muddy River receives a large volume of inorganic sediment from storm runoff caused by the intense urbanization within the river's drainage basin. Large deposits of sediments are concentrated along the Riverway and Back Bay Fens sections of the Muddy River.

Construction of the Charles River Dam in 1910 prevented tidal flow into the Muddy therefore decreasing salinity and preventing flushing of river sediment. This river sediment has remained along the Muddy River's banks, creating point bars that contribute to the proliferation of the non-native, invasive Phragmites—a tall freshwater grass with robust, hollow stems and dense, tasseling flower heads that can be seen flourishing, up to 20 feet tall, along the banks of the Muddy River. Phragmites contributes to sedimentation of the river by trapping sediment, which then encourages further Phragmites growth. While the Phragmites trap sediment, pollutants chemically bound to the sediment seriously degrade water quality in the river. Pollutants found in sediment include trace metals, inorganic nutrients, and organic compounds.

FLOODING

Boston is served by an extensive stormwater drainage system of dams, berms, and seawalls that have been designed to prevent flooding. However, changing weather patterns, coupled with aging infrastructure, are straining the system. Annual precipitation is expected to increase by 5%–8% by 2050, and 7% to 14% by 2100 according to the 2011 *Massachusetts Climate Adaptation Report*. In addition, the National Oceanic and Atmospheric Administration anticipates sea levels in Boston to rise by up to 2.2 feet by 2050 and up to 6.86 feet by 2100 (EOEEA 2011).

Major storms between 2010–2013 caused substantial flooding in both coastal and inland neighborhoods. During a storm in March 2010, the City of Boston broke the record of 11 inches of rain previously set in 1953. Storm surge reached 6.5 feet. Major flooding was experienced. The MBTA's Green Line D branch was hindered by a sinkhole that washed out a track.

From December 2010 through February 2011, the City of Boston saw a series of winter storms that led to a record snowfall of over 70 inches, more

than 45 inches above the average. Heavy snow, combined with rain led to numerous collapsed roofs, downed trees and utility lines and flooding problems throughout the City.

In October 2012, Hurricane Sandy brought high winds and coastal flooding to Boston. Sustained wind speeds of 41 mph and gusts to 62 mph were reported at Logan Airport. Seas were 20–25 feet just off the coast with a storm surge generally about 2.5 feet to 4.5 feet. Luckily, storm surge peaked at 4.57 feet in between high tide cycles, and as a result only moderate coastal flooding occurred within Boston. If the peak surge had hit five hours earlier at high tide, the city would have experienced severe flooding.

In February 2013, a blizzard known as Winter Storm Nemo, produced moderate to major coastal flooding, most notably during the time of the high tide Saturday morning. The 5th largest snow accumulation ever recorded of 24.9 inches occurred at Logan.

The City of Boston anticipates working with the Commonwealth of Massachusetts on planning for climate adaptation for the parks along the coast in light of the predicted increased flooding and sea level rise in the foreseeable future. City parks such as Condor Street Beach, the East Boston Greenway, Umana School Park, LoPresti Park, Porzio Park, Charlestown Naval Shipyard Park, Ryan Playground, Barry Playground, Little Mystic Access Area, Menino Park, Langone Park, Puopolo Park, Christopher Columbus Park, Long Wharf, Children's Wharf Park, L Street Beach, and McConnell Park will be affected by more frequent and intensive salt water inundation.

State parks along the coast in Boston are numerous and large in size. City and State parklands are often located side-by-side so an integrated system of adaptation is possible. Areas under the control of National Park Service, MassPort, and private owners of the publicly accessible HarborWalk will also be affected by coastal flooding and its aftereffects, and could share common adaptation policies and practices.

Flooding in the Fenway/Longwood area is caused by the Muddy River system. High water levels in the Muddy River can occur as a result of intense surface runoff from storm events, high water levels in the Charles River, and the nearly level gradient of the Muddy River in the Fenway area. These high water levels impede discharge from the Stony Brook Conduit, which carries stormwater, brookflows, and combined sewage from West Roxbury, Hyde Park, Roslindale, Jamaica Plain, and Roxbury.

SEWAGE DISCHARGE

Millions of gallons of effluent (treated sewage) are released into Massachusetts Bay each day. Sewage from Boston and outlying communities is treated by the MWRA at the Deer Island Sewage Treatment Plant. The volume discharged is roughly equivalent to the combined flow of the Charles, Mystic, and Neponset Rivers. The Deer Island treatment facility now also treats sewage that is pumped under the Harbor from the former Nut Island treatment plant in Quincy.

The Deer Island treatment plant is the second largest in the nation. It uses two phases of treatment, primary and secondary. Primary treatment separates the sewage by allowing sludge (primarily human waste) to settle from the water. Secondary treatment uses microorganisms to consume the remaining human waste and toxic chemicals. The effluent is then disinfected with chlorine and is 90% free of human waste and 70% free of toxic chemicals. It is released from the facility via a 9.5-mile, 24-foot diameter deep rock tunnel. At its end, the tunnel diffuses the effluent into Massachusetts Bay where ocean currents mix and further dilute the effluent. This largely minimizes the impact of treated wastewater on Boston Harbor.

The most prominent point source pollution in Boston is discharge from combined sewer overflow systems (CSOs). Combined sewer overflow systems collect both sewage and surface water runoff from rainfall and snowmelt. During wet weather conditions, surface runoff causes sewer

lines to overload. To prevent this overload from backing up into streets or basements, designated overflow discharge points are located along Boston Harbor and the Charles and Muddy Rivers.

Due to the various sources of CSO discharges, many pollutants may be present. These pollutants include fecal coliform bacteria, suspended solids, nutrients, metals, and floatable material. Discharges containing such pollutants create potential health impacts near areas such as swimming beaches and shellfish beds.

WATER QUALITY

The following reporting on water quality is derived from the Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle (MassDEP 2021).

CHELSEA RIVER (CHELSEA CREEK)

Public access

The first direct public access to the Chelsea River from East Boston was developed when the City's Parks and Recreation Department and the Urban Wilds Initiative, constructed a hazardous waste remediation and urban open space reuse project at the Condor Street Beach urban wild. The public now has access to view the river and the industrial activity and traffic. A portion of the site is now a restored coastal wetland.

Water quality challenges

CSO discharge, industrial activities, salt storage on banks, dredging and nutrient overload. Per the Clean Water Act 2018/2020 Reporting Cycle report, "The Aquatic Life Use of the Chelsea River MA71-06 AU remains Not Supporting due to un-ionized ammonia, petroleum hydrocarbons, and contaminants in aquatic wildlife as measured in sediment screening values (Cause Unknown). However, based on the extensive MWRA data set, Dissolved Oxygen is being delisted (see Removal Comment for full rationale). An Alert for DO supersaturation is being added."

MYSTIC RIVER

Public access

The only public access to the Mystic River in Charlestown is from Ryan Playground, where the Parks Department provides a shoreline boardwalk, and at the Schraffts Center, which has a boardwalk installed as a result of the state-mandated Chapter 91 and the BPDA-mandated HarborWalk requirements.

Water quality challenges

Metals, other inorganics, priority organics, unionized ammonia, organic enrichment/low DO, pathogens, oil and grease, taste, odor, and color. During summer months, the river is on “Alert Status” due to organic enrichment and low DO that can impact aquatic life. During wet weather, elevated pathogen counts can impact primary and secondary contact recreation. Per the Clean Water Act 2018/2020 Reporting Cycle report, “The Aquatic Life Use of Mystic River MA71-03 is assessed as Not Supporting. Indicators of enrichment (>10% of surface chlorophyll a samples >10 µg/L and DO saturation >125% multiple times per year) warrant adding an impairment for “Nutrient/Eutrophication Biological Indicators.” Problems with low DO at the bottom persist, so that impairment is being retained. Without additional data, the prior impairments for Un-ionized Ammonia, Cause Unknown, and Petroleum Hydrocarbons are also being retained.”

INNER HARBOR

Consists of the Chelsea Creek and Mystic River confluence, the Upper Inner Harbor, Fort Point Channel, the Lower Inner Harbor, and the Reserved Channel.

Public access

There are many points of public access to the Inner Harbor thanks to public parks and the Harborwalk system based on the state Public Waterfront Act (Chapter 91). A continuous public access system along the waterfront here is not yet realized, in part thanks to areas that require no public access, such as at Logan Airport or the Coast Guard station, or due to marine industrial uses.

Water quality challenges

While water quality has improved, the Clean Water Act 2018/2020 Reporting Cycle report states that, “[t]he Aquatic Life Use of Boston Inner Harbor (MA70-02) will continue to be assessed as Not Supporting[.]” thanks to dissolved oxygen (DO) impairment and the impact of water and sediment quality in Fort Point Channel.

PLEASURE BAY

Part of the Olmsted-designed waterfront recreation area on the South Boston shoreline. It is mostly enclosed, with flow restricted to two channels between Castle and Head Islands.

Public access

A beach stretches for two-thirds of its shoreline, and a pedestrian causeway links Castle and Head Islands for the remainder of the length.

Water quality challenges

Data was not “available to assess the Aquatic Life Use for Pleasure Bay, so it is Not Assessed[.]” per the Clean Water Act 2018/2020 Reporting Cycle report.

DORCHESTER BAY

Dorchester Bay stretches from the mouth of the Neponset River, Boston/Quincy to the line between Head Island and the north side of Thompson Island, and the line between the south point of Thompson Island, Boston and Chapel Rocks, Quincy.

Public access

Mix of industrial, commercial, residential, and recreational uses. Major points of public access include Malibu Beach, UMass Harborwalk, Old Harbor Beach, and the beaches in South Boston.

Water quality challenges

The Clean Water Act 2018/2020 Reporting Cycle report states that, “[t]he Aquatic Life Use of Dorchester Bay (MA70-03) is assessed as Fully Supporting due to the generally good water quality The alert for degraded sediment quality is being carried forward due to lack of recent data and in acknowledgment of the relatively low macroinvertebrate species in the bay.”

OUTER HARBOR AND HARBOR ISLANDS:**Public access**

From the Inner Harbor and surrounding bays, there are access points for ferries or boat launches to reach the Harbor Islands. Except for Thompson Island and Long Island, the other islands are publicly accessible.

Water quality challenges

Typically meets water quality standards for its SB:SFR (shellfishing restricted) classification. This qualifies these waters for primary and secondary contact recreation, as well as aquatic life. However, per the Clean Water Act 2018/2020 Reporting Cycle report, “[t]he Alert Status associated with fin erosion, bent fin ray and flounder liver disease at Deer Island Flats will be carried forward due to a lack of recent data.”

WINTHROP BAY/ORIENT HEIGHTS BAY

Between East Boston and Winthrop

Public access

The major means of public access here are the Belle Isle Marsh Reservation and Constitution Beach. Much of the shoreline does not allow for access thanks to Logan Airport.

Water quality challenges

Winthrop Bay/Orient Heights Bay as the SB:SFR water quality standard classification. The Clean Water Act 2018/2020 Reporting Cycle report states, “Aquatic Life Use for Winthrop Bay is assessed as Fully Supporting based on the generally good water quality conditions documented by MWRA between 2009 and 2018.” Belle Isle Inlet, which feeds into Orient Heights Bay, is a Class SA: Outstanding Resource Water, Shellfishing Open estuary. Per the Clean Water Act 2018/2020 Reporting Cycle report, “[w]ith no data available for this reporting cycle, the Aquatic Life Use of Belle Isle Inlet...remains Not Assessed.”

NEPONSET RIVER**Public access**

There are numerous places to access the Neponset River and the Mother Brook in their Boston stretches, thanks to public parklands, both city and state. Some major ones include Victory Road Park, Tenean Beach, Port Norfolk Park, and Pope John Paul II Park in Dorchester, Ryan Playground in Mattapan, and Reservation Road Park, Martini Playground, the Neponset River Reservation at the Neponset Valley Parkway, and Mill Pond Reservation in Hyde Park.

Water quality challenges

Per the Clean Water Act 2018/2020 Reporting Cycle report, the Neponset River upstream of the Baker Chocolate Dam is freshwater Class B: Wet Weather Flow, and Not Supporting of Aquatic Life Use, partly due to low DO and to metals and PCBs in the sediment. Downstream of the Baker Chocolate Dam, the Neponset is an SB: Shellfishing Restricted estuary, supporting of Aquatic Life Use, but with an Alert due to the PCBs found upstream in the freshwater portion of the river. Mother Brook is a Class B tributary to the Neponset; Per the Clean Water Act 2018/2020 Reporting Cycle report, “the Aquatic Life Use of Mother Brook will continue to be assessed as “Not Supporting” based on existing impairments for Dewatering, Dissolved Oxygen, and Total phosphorus.” Sprague Pond is considered a Class B freshwater lake; per the Clean Water Act 2018/2020 Reporting Cycle report, “With no available data for this reporting cycle, the Aquatic Life Use for Sprague Pond is Not Assessed.”

CHARLES RIVER

Traces a considerable amount of the northern edge of Boston and a portion of the southwestern edge of the city in West Roxbury. There are also three ponds within the watershed that provide public access: Chandler Pond, Jamaica Pond, and Scarboro Pond.

Public access

Much of the banks along this stretch are protected parklands and wetlands, while some land uses along these banks are industrial, commercial, and residential.

Water quality challenges

The Charles River segment in West Roxbury is considered a Class B: Wet Weather Flow freshwater river where per the Clean Water Act 2018/2020 Reporting Cycle report, “Aquatic Life Use of Charles River MA72-06 should remain Not Supporting due to multiple prior enrichment related impairments. An Alert is being added due to a potential infestation of curly-leaf pondweed (*Potamogeton crispus*).” The Charles River segment east of the Watertown line is considered a Class B: Wet Weather Flow (CSO) freshwater river, due to the New Charles River Dam impeding the normal flow of salt water into this segment. Per the Clean Water Act 2018/2020 Reporting Cycle report, “Aquatic Life Use of Charles River MA72-06 should remain Not Supporting due to...prior impairments.” Chandler Pond, in Brighton, is a Class B freshwater lake where per the Clean Water Act 2018/2020 Reporting Cycle report, “Aquatic Life Use...is assessed as Not Supporting due to prior impairments for enrichment related causes.” Jamaica Pond, in Jamaica Plain, is a Class B freshwater lake where per the Clean Water Act 2018/2020 Reporting Cycle report, “...Aquatic Life Use remains assessed as Not Supporting”, due to continued DO and total phosphorus impairment and “...an infestation of the non-native Eurasian water milfoil (*Myriophyllum spicatum*).” Scarboro Pond, in Franklin Park, is a Class B freshwater lake that, per the Clean

Water Act 2018/2020 Reporting Cycle report, “Aquatic Life Use...will continue to be assessed as Not Supporting due to the presence of this non-native [aquatic macrophyte] species *Nymphoides peltata* [(water fringe)].”

MUDDY RIVER

A tributary to the Charles that forms the “backbone” for three of the Olmsted-designed Emerald Necklace parks—Olmsted Park, the Riverway, and the Back Bay Fens.

Public access

Nearly all of its banks are parkland.

Water quality

The river drains a highly urbanized watershed. Transportation corridors cross the river, such as State Route 9, the Massachusetts Turnpike, and commuter rail tracks. Per the Clean Water Act 2018/2020 Reporting Cycle report, “[t]he Muddy River is a Class B (CSO): Wet Weather Flow river in a pond or reservoir condition thanks to the New Charles River Dam. Aquatic Life Use for the Muddy River...will continue to be assessed as Not Supporting with all former impairments being carried forward. An Alert is being added due to a potential infestation of curly-leaf pondweed at the mouth of the river.”

CLIMATE CHANGE: MITIGATION AND ADAPTATION

Boston is already experiencing the effects of increasing storm intensity, rising seas, heavier downpours, and hotter summers. These effects are projected to grow over the coming decades. The City of Boston continues to study climate change and develop strategies to equitably protect residents from climate impacts that we are experiencing and that we are projecting in the future (Environment Department 2022). The following excerpts from the *Climate Ready Boston program*, *Heat Resilience Solutions for Boston report (Heat Plan)*, and the *Natural*

Hazard Mitigation Plan update (NHMP) help provide a broad overview of some key changes:

- *Climate Ready Boston*: By 2070, Boston anticipates approximately 40 inches of sea-level rise across the city, which includes 36 inches of sea-level rise and 4 inches of land subsidence, which is the gradual sinking of land. Sea-level rise in Boston is likely to be greater than the global average, because Boston's land mass is subsiding, or sinking, at about six inches per century, and changing ocean currents and other features are affecting the distribution of ocean water.
 - MAP 11: SEA LEVEL RISE shows that the areas of Boston that are vulnerable to climate change and sea level rise include parts of Charlestown, East Boston, South Boston, the South End, Fenway, Downtown, and along the Charles, Muddy and Neponset Rivers.
- *NHMP*: Between 2000 and 2020, 20 flood events, specific to Boston or reported as a county-wide event, were recorded in the NOAA Storm Events Database (NOAA 2020a) with an additional nine flash flood events.... With this projected increase in rainfall, waterbodies in and around the City will be increasingly likely to overtop their banks and cause localized flooding. As the frequency and severity of rain events continues to increase, it will become more difficult for the system to convey collected stormwater without associated flooding...Green infrastructure or low impact development improvements can help reduce demand on the existing stormwater system by increasing infiltration on-site...According to NOAA's Storm Event Database there were 32 occurrences of coastal flooding in Suffolk County between 2000 to 2020. These events did not result in any injuries or deaths but did produce \$3.63 million in damages (NOAA 2020a).
- *Heat Plan*: Between 2010 and 2020, Boston experienced more hot days than any decade in the previous 50 years. This trend is projected to continue. If emission trends continue as they are, it's predicted that there will be up to 25 to 42 days above 90°F, including up to 1 to 6 days above 100°F by the 2050s.¹

There may be more time between precipitation events, producing more severe periods of drought. Snow or rain, when it does fall, will likely fall in more concentrated bursts. According to a recently published report, *Climate Change Impacts on Groundwater in MAPC Communities*, changes in the timing and intensity of precipitation will also affect groundwater elevations which are projected to rise in New England through 2030 and then begin to decline due to decreased snowpack and increased evapotranspiration in vegetated areas. Rising sea levels along the coast introduce the possibility of saltwater intrusion and higher groundwater levels (MAPC 2022).

Groundwater in New England is generally held in soils and supplies water to plants, household wells, and surface waters. In fact, rivers receive a considerable amount of their volume from groundwater. When groundwater levels are high enough, they can rise up through the soil and be seen as ponding.

The impacts of changing groundwater dynamics in Boston are varied and require closer inspection to understand how Boston's wildlife and natural areas, buildings, underground and above ground infrastructure, and even drinking water supplies from the Quabbin Reservoir will be affected.

To learn more about projected changes in groundwater levels, visit: www.umb.edu/editor_uploads/images/centers_institutes/urban_harbors_institute/GBRAG_GW_report.pdf

¹ These ranges present 17-83% confidence interval projections for RCP 8.5.

B MAP 11: SEA LEVEL RISE
CITY OF BOSTON
OPEN SPACE AND RECREATION PLAN 2023-2029
JUNE 2023

