US Army Corps
of Engineers®
New England
District

Charles River Natural Valley Storage Area

Eastern Massachusetts

Draft Master Plan

March 2017

BUILDING STRONG ®

Executive Summary

This Master Plan covers approximately 3,229 acres of federally owned land and 4,865 acres of federally-held easements in the upper and middle Charles River Watershed. The Master Plan prescribes an overall land and water management plan, resource objectives, and associated design and management concepts which provide the best possible combination of responses to regional needs, resource capabilities and suitabilities, and expressed public interests and desires consistent with the project's authorized flood control purposes. The Master Plan covers all project resources, including but not limited to fish and wildlife, vegetation, cultural, aesthetic, interpretive, recreational, commercial and outgranted lands, easements and water.

Inputs to the planning process were surveys and management plans for natural, wetland and cultural resources, and an analysis of recreational use, capacity and projected needs for project lands. Natural and man-made resources were located, identified and analyzed, including wetlands, exemplary natural communities, and cultural resources that require management efforts for their protection. These were integrated into a series of project wide objectives to protect and enhance project resources and promote and develop, as appropriate, those resources for public use, education, and access.

Recreational opportunities were identified through an analysis of regional needs, and the public participation process. The planning process identified opportunities to manage multiple resources, to enhance and protect important natural and cultural resources. Enhancing and preserving the resources by careful management of user conflicts were also identified.

This Master Plan provides guidance for future management of the project. The natural resources of the project will continue to be managed to provide the best combination of responses to regional and ecosystem needs, project resources and capabilities. During the implementation phase period of the Master Plan, the New England District will continue to be responsible for the administration and management of the project.

All specific proposals for recreational or other development at the project must comply with this Master Plan, the Charles River Basin flood risk reduction requirements, and the National Environmental Policy Act (NEPA) and federal requirements.

1.1 Project Authorization

The Charles River Natural Valley Storage Area, a unit in the flood risk reduction plan for the Charles River Watershed, helps protect communities along the lower Charles River in Massachusetts. Authorization of the project is contained in the Water Resources Development Act of 1974 (Public Law 93-251). The project was authorized as a multi-purpose project for flood control, recreation and natural resources management.

Acquisition of project lands began in May 1977 and was completed in September 1983 at a cost of $8,300,000.

1.2 Project Purpose

Flood problems in the Charles River Watershed are minimized by the existence of numerous large wetlands which provide significant natural storm water storage. The natural storage capacity of these wetlands is aided by incidental manmade structures such as culverts and bridge openings which restrict runoff. Preservation of these key wetland areas in the upper and middle parts of the watershed will allow for their continued ability to retain and slow flood waters and thus reduce the flood crests in the more developed areas of the lower watershed.

Through 30 September 2016, the project has prevented approximately $11,932,000 in flood damages[1].

1.3 Purpose and Scope of the Master Plan

This master plan for management of natural resources and outdoor recreation has been prepared in accordance with the objectives and policies governing planning, development and management of these resources at Corps of Engineers water resources projects. These objectives and policies are outlined in ER 1130-2-540, "Environmental Stewardship Operation and Maintenance Policies"; ER 1130-2-550, "Recreation Operations and Maintenance Policies"; EP 1130-2-550, "Recreation Operations and Maintenance Guidance and Procedures"; ER 1165-2-400, "Recreational Planning, Development, and Management Policies"; and other related or referenced regulations and policies.

ER 1130-2-540 established the following program objectives for management of a project's natural resources.

[1] Does not take into account for inflation

- **Manage natural resources on Corps of Engineers administered land and water in accordance with ecosystem management principles to insure their continued availability.**

- **Provide a safe and healthful environment for project visitors.**

Utilizing this general guidance, ER 1130-2-550 and EP 1130-2-550 provide the specific policy for preparation of project master plans. Each master plan must cover all resources, including, but not limited to, fish and wildlife, vegetation, cultural, aesthetic, interpretive, recreational, mineral, and commercial and out granted lands, easements, and water. Based on EP 1130-2-550, the primary goals of the Charles River NVS Master Plan are to prepare a concept document that prescribes an overall land and water management plan, and establishes resource objectives, and associated design and management concepts, which:

- **Provide the best combination of responses to regional needs, resource capabilities and suit abilities, and expressed public desires consistent with authorized project purposes.**

- **Contribute towards providing a high degree of recreational diversity within the region.**

- **Emphasize the particular qualities, characteristics and potentials of the project.**

- **Exhibit consistency and compatibility with national objectives and other state and regional goals and programs.**

ER 1130-2-550 further defines these goals as they relate to recreation management and established the following program objectives:

- **Provide a quality outdoor recreation experience which includes an accessible, safe and healthful environment for a diverse population.**

- **Increase the level of self-sufficiency for the Corps recreation program.**

- **Provide outdoor recreation opportunities on Corps of Engineers administered land and water on a sustained basis.**

- **Optimize the use of leveraged resources to maintain and provide quality public experiences at Corps water resources projects.**

1.4 Planning Process

An interdisciplinary study team consisting of staff from the U.S. Army Corps of Engineers, New England District (Engineering/Planning Division and Operations Division) developed the majority of information contained in the master plan. The team included personnel with expertise in the following disciplines:

- **Planning and engineering**
- **Environmental resources**
- **Archaeological and cultural resources**
- **Forestry**

Major inputs to the planning process included natural, cultural, and recreational resource inventories and analysis, projections of future needs, and public desires for use of project lands. This information was integrated into project-wide and compartmental objectives and goals to provide the best use of the 3,229 acres of federally owned land in the Charles River Natural Valley Storage Area.

Public input was obtained through public notices, coordination with state, regional and local officials, and two public meetings held in Millis, Massachusetts to present preliminary study results and receive input, and public review of the draft Master Plan.

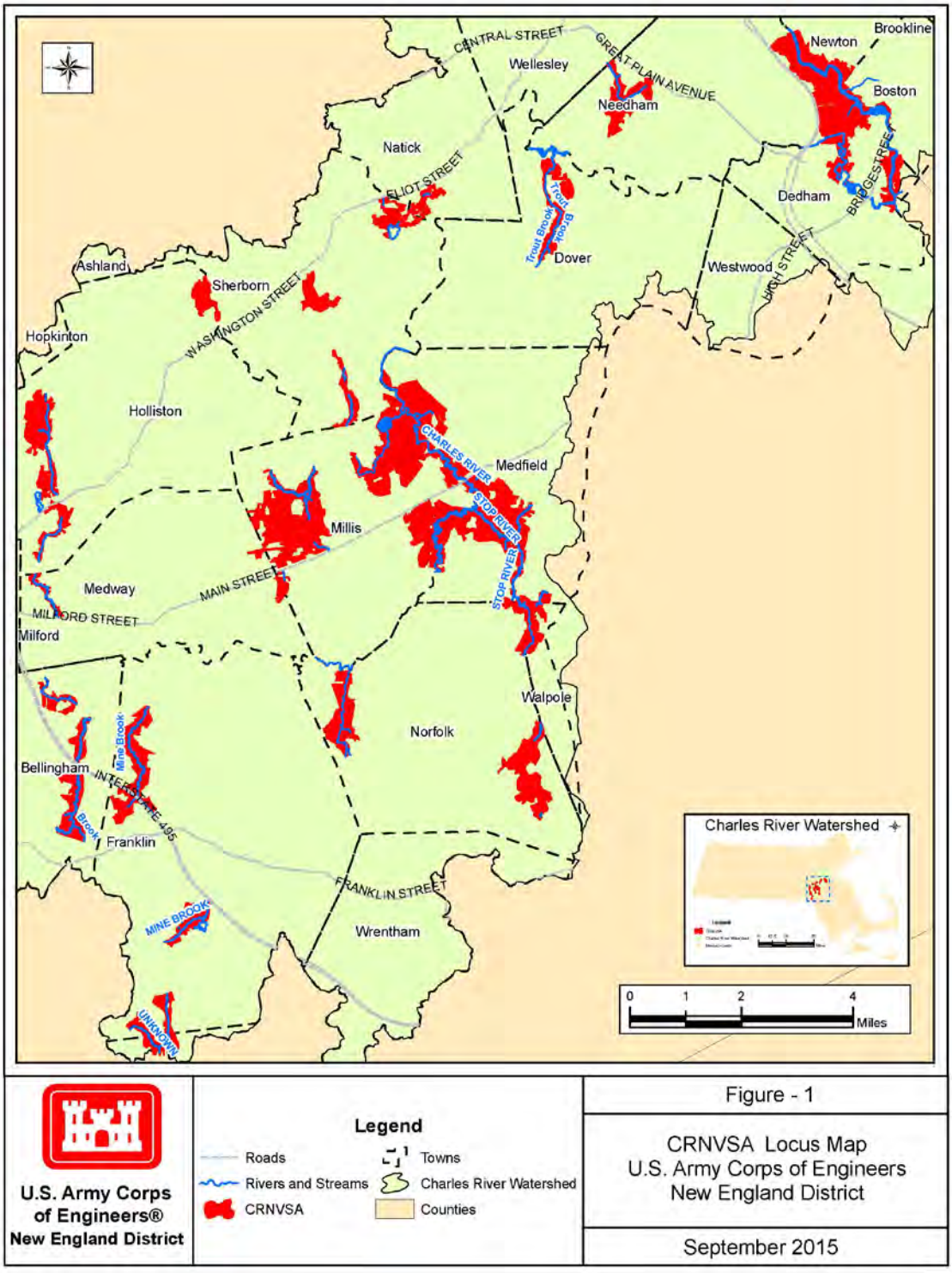
The Master Plan is a policy document that serves as an overall management guide for the project while specific management actions are included in the Operational Management Plan (OMP). For consistency with the Master Plan, the existing OMP, dated 1995, will be revised to describe, in detail, how the objectives and concepts of the Master Plan will be achieved.

The existing Master Plan was prepared in June 1984. It proposed the basic, initial development of public access, parking and minimum facilities to enable the public to enjoy the recreation experience. Over the past 15 years, detailed natural resource and cultural resource inventories have been conducted and a great deal more information about the resources at the project has become available. Updating the Master Plan will provide direction for project development and use and be a vital tool for the responsible stewardship of project resources for the benefit of present and future generations.

The Master Plan is a flexible planning document that will be reevaluated to be kept current. It will be reviewed on a periodic basis, and will be revised as required. The District Engineer will approve supplements and revisions to the Master Plan.

1.5 Watershed and Project Description

The Charles River Natural Valley Storage Area is comprised of 17 separate areas of natural wetland in the middle and upper portions of the Charles River Watershed. The areas are located in 16 towns in Norfolk, Middlesex, and Suffolk Counties, Massachusetts.
(Refer to attached FIGURE 1 – *LOCUS MAP* and section 1.7 Pertinent Information.)


CENTRAL STREET
GREAT PLAIN AVENUE
Brookline
Newton
Boston
Wellesley
Needham
Natick
ELIOT STREET
Trout Brook
Dover
Dedham
BRIDGE STREET
Ashland
Sherborn
WASHINGTON STREET
Westwood
HIGH STREET
Hopkinton
Holliston
CHARLES RIVER
Medfield
STOP RIVER
Millis
MAIN STREET
Medway
MILFORD STREET
Milford
Walpole
Norfolk
Bellingham
Mine Brook
INTERSTATE 495
Franklin
FRANKLIN STREET
MINE BROOK
Wrentham
UNKNOWN
Charles River Watershed
0 1 2 4
Miles
U.S. Army Corps of Engineers®
New England District
Legend
Roads
Rivers and Streams
CRNVSA
Towns
Charles River Watershed
Counties
Figure - 1
CRNVSA Locus Map
U.S. Army Corps of Engineers
New England District
September 2015

The position of the wetlands in the watershed is crucial to their flood reduction function. In conjunction with other characteristics of the watershed – moderate topography, large areas of highly permeable soil, and low river gradient – the floodwater storage capability of the numerous wetlands on the Charles River and its tributaries significantly slows runoff. Peak flows in the lower watershed occur approximately four days after the end of a heavy rainfall. After a major flood, it may take three to four weeks for the river to return to normal flows. In the August 1955 flood, approximately 50,000 acre-feet of water was stored in the wetlands and ponds, slowly releasing into the Charles River, several weeks after the peak discharge of the flood occurred. This is equivalent to five inches of runoff from the drainage area of 184 square miles at the Dover river gage.

The swamps, marshes, and wet meadows along the Charles River and its tributaries total 20,000 acres, approximately 10 percent of the 307 square mile watershed. An area of 100 acres was determined to be the minimum for practical Federal purchase and administration. The critical areas are either located adjacent to the Charles River or on one of the larger tributaries. Not all areas containing over 100 acres were acquired, where adjacent primary storage areas provided adequate control.

Parcels owned in fee by the Corps provide the legal basis for federal management of recreation and natural resources. Acquired restrictive easements only prohibit the construction of habitable structures or modifications that may alter the drainage characteristics of the property or otherwise have a negative impact of the project's purpose for flood water retention. The property otherwise remains private, with public access prohibited except by permission of the land owner.

1.6 Prior Project Design Memoranda

The following design memoranda, prepared by the New England Division, Corps of Engineers, provided basic data concerning the project.

Memorandum No.	Title	Date
1	Hydrology	May 1976
2	General Design	July 1976
3	Real Estate – Phase 1	Oct 1976
3A	Real Estate – Phase 2	May 1978

3B	Real Estate – Phase 3	July 1978
3C	Real Estate – Phase 4	June 1979
4	Master Plan for Recreation Development	June 1984

Other reports that were reviewed and evaluated as part of this recreational master planning effort include the following:

1. **"Natural Valley Storage Project Management Guidelines Committee; Policies and Recommendations for the Management of Natural Valley Storage Project Properties", dated February 1978.**

2. **"Final Environmental Statement, Charles River Study", dated July 1976.**

3. **"Operational Management Plan, Charles River NVS", dated May 1995.**

In addition, the following reports provided information on recreation, archaeological, and natural resources in the project area.

- **"Massachusetts Statewide Comprehensive Outdoor Recreation Plan 2012", Massachusetts Executive Office of Energy and Environmental Affairs**

- **"Intensive (Locational) Archaeological Survey of Charles River Natural Valley Storage Area", prepared by Richard Grubb & Associates, under contract to the New England District, Corps of Engineers, 2011.**

1.7 Pertinent Information

The following table is a breakdown of project acreage by NVS area:

Area	Cities/Towns	County	Fee Acres	Easement Acres	Total Acreage (combined)	Map Figure
B	Boston, Dedham, Needham, Newton	Suffolk, Norfolk, Middlesex	132.18	1033.88	1166.06	Figure 4
C	Dover	Norfolk	92.81	170.37	263.18	Figure 5
D	Needham	Norfolk	44.91	212.72	257.63	Figure 6
E	Natick, Sherborn	Middlesex	0	203.68	203.68	Figure 7
F	Sherborn	Middlesex	68.48	55.19	123.67	Figure 8
G	Medfield, Millis, Norfolk, Sherborn,	Middlesex, Norfolk	1152.65	1507.17	2659.82	Figure 9
H	Medway, Millis	Norfolk	341.88	531.18	873.06	Figure 10
I	Sherborn	Middlesex	12.27	86.45	98.72	Figure 11
J	Holliston, Sherborn	Middlesex	95.41	15.02	110.43	Figure 12
K	Norfolk, Walpole	Norfolk	8.44	355.77	364.21	Figure 13
L	Norfolk	Norfolk	185.52	114.1	299.62	Figure 14
M	Bellingham, Franklin	Norfolk	338.58	49.89	388.47	Figure 15
N	Franklin	Norfolk	78.96	57.07	136.03	Figure 16
O	Franklin, Wrentham	Norfolk	70.29	158.25	228.54	Figure 17
P	Holliston, Medway	Middlesex, Norfolk	266.58	242.75	509.33	Figure 18
R	Bellingham	Norfolk	30.34	49.41	79.75	Figure 19
S	Bellingham	Norfolk	310.59	22.78	333.37	Figure 20
		Total Acreage:	**3229.89**	**4865.68**	**8095.57**	

2. PROJECT SETTING AND FACTORS INFLUENCING RESOURCE MANAGEMENT & DEVELOPMENT

2.1 Description of Natural Valley Storage Area Pools

The Charles River Natural Valley Storage Area contains no permanent water storage areas. The protected wetlands naturally flood during periods of high water, and slowly release those waters downstream. The majority of the time each area consists of various size marshlands and riparian lowlands. Some areas are bisected by open flowing water, such as the Charles River itself or a tributary stream. For more specific descriptions of each area, please see chapter 5.

2.2 Hydrology

The Charles River watershed has a drainage area of 307 square miles which includes a highly developed portion of metropolitan Boston and many growing suburban areas. The Charles River is an 80 mi (129 km) long river that flows in an overall northeasterly direction in eastern Massachusetts. From its source in Hopkinton, the river travels through 23 cities and towns until reaching the Atlantic Ocean at Boston. The Charles River has a 350 foot elevation loss over its 80 mile course. It meanders through extensive swamplands and many heavily built-up areas before reaching the Charles River Basin, a former tidal reach, which extends from the Watertown Dam to the New Charles River Lock and Dam.

The Charles River NVS Project is located in the area known as the Upper Charles River Watershed, which is defined as the area of the watershed that is upstream of the Moody Street Dam in Waltham. The total drainage of this area is 250.6 square miles and is relatively flat, containing numerous swamps that produce a hydrologically sluggish character. Most of this area is suburban in character and is experiencing high pressure for development due to its easy access from major highways such as Interstates 90, 95 and 495.

A unique feature of the upper Charles River watershed is the Mother Brook Diversion structure, which diverts one third of the Charles River's flow at river mile 26.5 in Dedham to the Neponset River via Mother Brook. The purposes of this diversion are for industrial use and date back to an agreement made in 1831. The flows are regulated by the Commonwealth of Massachusetts by a bascule gate dam located on the east side of the Charles River in NVS area B.

2.3 Water Quality

The Commonwealth of Massachusetts has established water quality classifications for the Charles River. Standards applicable to the Charles River Natural Valley Storage Area waters are:

Class A – Waters designated as a public water supplies in accordance with the state general laws. Water quality is uniformly excellent.

Class B – Waters suitable for bathing and recreational purposes including water contact sports. Water is acceptable for public water supply with appropriate treatment. Suitable for agricultural, certain industrial cooling and processing uses excellent fish and wildlife habitat and excellent aesthetic value.

The uppermost section of the Charles River, from its source to the Dilla Street Dam in Milford, is classified as Class A and is part of the public water supply for the town of Milford.

The remainder of the Charles River from Milford to Boston is classified as a Class B waterway.

In addition, Mine Brook and Miscoe Brook in the towns of Franklin and Wrentham, which flow through NVS Areas M, N and O, have been classified by the Commonwealth as Class B waterways.

2.4 Project Access

While the watershed is crossed by many major state and local highways, access to most of the project lands is limited due to lack of official parking and lack of direct road frontage of some areas. Official parking areas are located sometimes on adjacent conservation lands that have foot trail or canoe/kayak access to project lands. For access information at specific NVS areas, please see Chapter 5.

2.5 Climate

The Charles River Watershed has a typically humid continental type of climate. It is generally hot and humid in the summers and the winter months are long with substantial snowfall. The watershed lies in the path of the prevailing winds and cyclonic storms that move across the country from the west or southwest producing frequent weather changes. The area is also exposed to coastal storms, locally known as "Nor'easters" that travel up the Atlantic seaboard, some of which are of tropical origin and of hurricane intensity. Tropical hurricanes occur less frequently, but have important potential for flood-producing precipitation, particularly from August through October.

The average annual temperature of the basin is approximately 60 degrees Fahrenheit. Average monthly temperatures in the watershed vary greatly depending on time of year, with freezing temperature generally experienced from late October to late April. The mean annual precipitation in the Charles River watershed is approximately 44 inches. On the average, the

precipitation is evenly distributed throughout the year, but there is considerable variation in the minimum and maximum precipitation occurring in the individual months. The average snowfall in the watershed is between 45 - 55 inches.

2.6 Topography

The Charles River Watershed is part of the same physiographic province known as the Appalachian Highlands, and ancient range of igneous and metamorphic rock forming the mountains and hills of much of the northeastern United States. In recent geological time, this rugged landscape was blanketed by glaciers which covered all of New England. The southward movement of the ice sheet and subsequent melting left the area with a layer of glacial debris called till, a mixture of gravel, sand, silt and clay.

The result of this glacial activity is a landscape of gently rolling hills and wide valleys. Hills in the upper watershed range from 200' to 500' above sea level. In the middle and lower basin, the glacial till is generally deeper, particularly in the pre-glacial valleys where the quiet waters of glacial lakes produced wide, flat plains and terraces of well sorted sand gravel. These plains give the Charles River an importantly flat profile through much of its length and cause extensive meandering of the river channel.

The total fall of the river in its 85 mile length, from source to mouth, is 354 feet, yet nearly 200 feet of this fall occurs in the first 19 miles between Echo Lake and the Medway Dam. In the next 40 miles the river drops only 75 feet. Throughout its length, the major drop in river profile elevation occurs abruptly at falls or dams. This variable profile gives the river the contrasting characteristics of sometimes being a meandering channel in the midst of vast, wet meadow, and then flowing through narrow channels of exposed bedrock.

2.7 Geology and Soils

The results of glaciation can be seen today in the Charles River watershed. Effects of glaciation such as till deposits have a very important ecological impact on the development of vegetation along the Charles River. Till landing on clay type soils held water allowing for more plants to grow i.e. wetlands, swamps and marshes. Whereas, till that fell on sandy soils was often washed away from the hilltops and filled in the ravines and valleys leading to upland forest and drier lowland areas.

Drumlins resulted from the ice age in New England. Large glaciers often rode or slid along large clay deposits shaping or smoothing the land mass forming these large rounded, rolling hills. Drumlins very seldom exceed 200 feet in height and do not have a solid bedrock core.

An analysis of the soils of fee owned tracts on the Charles River NVS Project was conducted in 2008, using data from the Natural Resources Conservation Service. The primary soil types found on the project are:

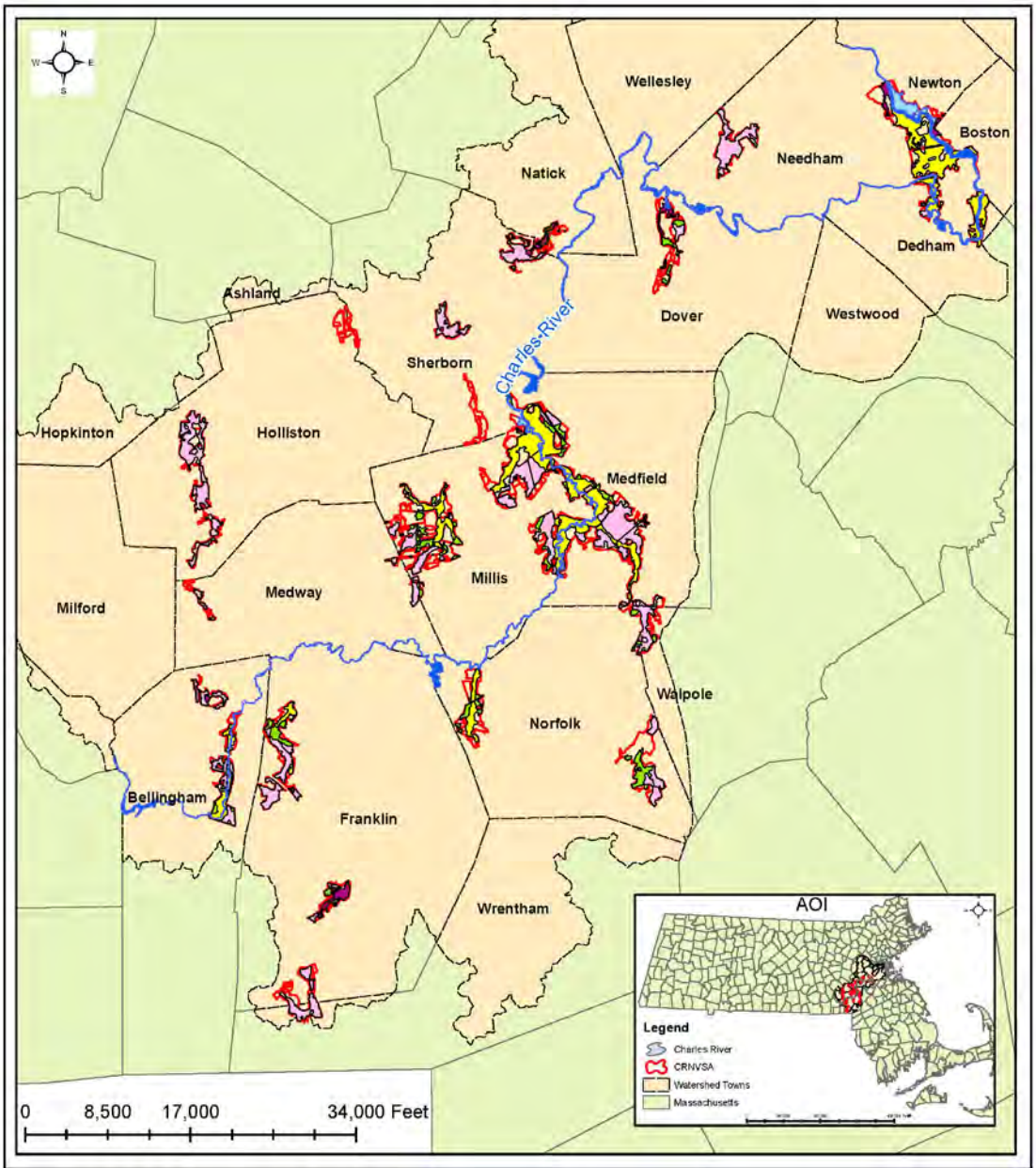
Freetown-Swansea-Saco: Very deep, nearly level, very poorly drained soils formed in highly decomposed organic material and silty alluvium; on the flood plains of the Charles River.

Hinckley-Merrimac-Urban Land: Very deep, nearly level to steep, somewhat excessively to excessively drained soils formed in sandy and loamy glacial outwash overlying stratified sand and gravel; in major stream valleys.

Canton-Charlton-Hollis: Very deep to shallow, gently sloping to steep, somewhat excessively drained to well drained, loamy soils formed in glacial till and in ice-contact, stratified drift; on upland, low hills.

Woodbridge-Paxton-Mantauk: Very deep, nearly level to steep, moderately well drained to well drained soils formed in friable, loamy glacial till overlying a firm substratum; on upland, oval hills.

The general characteristics of the major soil types are shown on attached map. (FIGURE 2 – *SOIL CLASSIFICATION*.)



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Legend

- Charles River
- Freetown Muck, ponded
- Saco Mucky Silt Loam
- Scarboro & Birdsall Soils
- Freetown Muck
- Saco Silt Loam
- CRNVSA
- Watershed Towns

Figure - 2

CRNVSA Master Plan
Soil Classification Map
Uxbridge, MA
U.S. Army Corps of Engineers
New England District

September 2015

3. RESOURCE OBJECTIVES

3.1 General

The purpose of this section is to establish resource objectives for the Charles River Natural Valley Storage Area. Resource objectives are developed to guide future design, development and management of the resource base, natural and man-made, to obtain the greatest possible benefit through meeting the needs of the public and protecting and enhancing environmental quality and ensuring sustained use.

These objectives are consistent with authorized project purposes, applicable Federal laws and directives, regional needs, resource capabilities and expressed public desires.

The overall mission is to provide high quality and responsive management of the project's natural resources, while maintaining efficient and effective flood control operations to fulfill the project's authorized flood control purpose.

3.2 Natural Resource Objectives

Continue to enforce easement language and protect project lands from encroachment, trespass and any alteration of natural state of the property.

Continue to work with local municipalities on management of nuisance species (e.g. beavers) when they present a problem for abutting landowners.

Provide for the management of all natural resources associated with the project to include the protection and preservation of rare, threatened and endangered species, the protection of water quality, and the implementation of programs to manage invasive, non-native species.

Maintain the health and biodiversity of the forest ecosystem. Provide a range of species, age classes, and structural diversity intended to enhance and maintain the biological diversity of species, communities, and ecosystems.

Manage for species well-adapted to site conditions as they are more resistant to insects and diseases.

Enhance and protect fish and wildlife habitat for indigenous species through the use of various woodland, wetlands, and open land management activities.

Care will be taken to maintain the structural components of the forest (live trees, snags, woody debris, shrubs, and ground cover) that are needed by wildlife.

Protect and conserve wetlands, rare plant and animal habitats such as vernal pools.

Wetlands are highly productive sites for a variety of ecological functions, as well as for the enhancement of water quality.
Conservation management practices will be followed on lands that contain Priority Habitat or Estimated Habitat as determined by the Massachusetts Natural Heritage and Endangered Species Program.

Promote the public's use of the project for both consumptive (hunting) and non-consumptive (bird-watching) uses.

3.3 Cultural Resource Objectives

Protect known and documented prehistoric and historical archaeological sites.

Monitor the project area for evidence of unauthorized excavation or collection of cultural resources and damage to sites. Known sites will be maintained and preserved as important project resources.

Archaeological site and sensitivity maps available at the project office will be examined and if necessary the Corps archaeologist will be consulted, prior to any development or disturbance on Corps property.

Support interpretive programs for historic and archaeological resources, where appropriate and in accordance with federal laws and directives.

3.4 Recreation Resource Objectives

Identify and evaluate the development of potential recreation sites to afford the public a diversity of recreational opportunities and/or enhance public use of project lands with input from the local community.

Support the state fish and pheasant stocking programs and use of the project for these activities.

Identify and develop trails through project lands to meet regional and local needs for formally designated recreational trails, and provide the public with opportunities to view unique natural areas.

Maintain the existing visitor assistance program including interpretation to enhance the public's understanding and appreciation of the role of the Corps of Engineers in development and administration of the project.

Continue to work with local partners to maintain the existing recreational resources on the project's fee and easement lands.

4. LAND ALLOCATION AND CLASSIFICATION

4.1 Land Allocation

All project lands were acquired for the purpose of project operations for flood damage reduction. While it does have many environmental and recreational benefits, the primary purpose for the Corps protection of these wetland areas is to retain their natural capability to reduce flooding on the lower sections of the Charles River.

4.2 Land Classification

All project fee owned lands are classified as Multiple Resource Management Lands. Though there are no developed recreation areas or formal trails, all lands are opened to passive public use, including walking, hunting (in accordance with state and local laws and restrictions), fishing, and paddling.

One small area, less than ¼ acre on Area J in Holliston, is a restricted area around the town's water supply wellhead.

4.3 Project Easement Lands

The project lands held in easement by the Corps make up more than half of the project area. As these easements were acquired for the purposes of protecting the natural hydrologic characteristics of the property for flood reduction, they are all classified as Flowage Easement. This restricts the underlying property owner from filling, altering drainage, or constructing any structure without Corps review and consent. It also gives Corps personnel the right to enter onto the easement and post signs marking the easement as deemed necessary.

5. RESOURCE PLANS

Natural Resources

5.1 Wildlife and Aquatic Resources

The wetlands and adjacent areas owned in fee or under protective easement offer a diverse range of natural habitats that are increasingly important for wildlife in the region. Preserving the area in its natural state for flood storage purposes also preserves and protects the natural habitat and its biodiversity.

Wildlife game species in the project include grey squirrel (Sciurus carolinensis), cottontail (Sylvilagus floridinus mallurus), woodcock (Philohela minor), ruffed grouse (Bonasa umbellus) and white-tailed deer (Odocoileus virginiana). Other wildlife species may include muskrat (Ondatra zibethicus), mink (Neovison vison), skunk (Mephitis mephitis), otter (Lontra Canadensis), Gray fox (Urocyon cinereoargenteus), Red Fox (Vulpes vulpes), beaver (Castor Canadensis) and raccoon (Procyon lotor). The Massachusetts Division of Fisheries and Wildlife stock approximately 250-300 pheasants (Phasianus colchicus) within the project every year during the season between the middle of October to the end of November.

The marshes, wet meadows, ponds and streams in the project are particularly valuable for waterfowl habitat. Black ducks (Anas rubripes) and wood ducks (Aix sponsa) are the dominant species, but mallards (Anas platyrhynchos), blue-winged teal (Anas discors), great blue heron (Ardea herodias) and Canada goose (Branta Canadensis) are also found. The area is situated on the Atlantic Flyway, a major migratory route along the east coast. The project provides nesting and feeding sites for waterfowl and other migratory birds.

Largemouth bass (Micropterous salmoides), yellow perch (Perca flavescens), bullhead (Ictalurus nebulosa), pickerel (Esox niger), sunfish (Lepomis auritus) and white suckers (Catastomus commersoni) are the primary warm water fish species found in the Charles River and its tributaries.

Few of the streams in the watershed are capable of supporting natural populations of cold-water fish. Only Trout Brook in Dover, which flows through NVS Area C, is a cold water fishery.

Stocking along the tributaries of the Charles River is the responsibility of the Massachusetts Division of Fisheries and Wildlife. Project areas stocked in spring fishing season with eastern brook, brown, and rainbow trout are as follows:

Area C (Trout Brook, Dover)
Area G (Charles River, Millis/Medfield)
Area L (Mill River, Norfolk)
Area N (Dix Brook, Franklin)
Area O (Miscoe Brook, Franklin)
Area P (Hopping Brook, Medway)
Area R (Stall Brook, Bellingham)

5.2 Vegetation

The vegetative resources of the Charles River Natural Storage Area can be generalized by summarizing the four plant communities that dominate throughout areas B, C, D, F, I, J, K, L, P and R. The four dominate plant communities are red maple swamp, deep emergent marsh, white pine-white oak forest and shrub swamp.

A few, of these plant communities were found in each area. The most common plant community, red maple swamp, has a tree canopy dominated by red maple and a thick understory that is commonly dominated by skunk cabbage, false hellebore, cinnamon fern, and sensitive fern. The environment ranges from wet to very wet. Deep emergent marshes are continually inundated by seasonal flooding, and contain a variety of tussock-growing grasses. White pine- white oak forests are composed of white pine and swamp white oak/white oak throughout the tree canopy. Cinnamon fern and Canadian mayflower are scattered throughout the understory, along with pine and oak saplings. Shrub swamps can be dominated by one species, but usually are composed of a mixture of shrub species, including highbush blueberry, maleberry, smooth alder, and buttonbush. Soils are temporarily or seasonally flooded and tend to be mucky. These descriptions illustrate the common vegetative resources of the Charles River Natural Storage Area.

5.3 Threatened and Endangered Species

Area G has the highest number of endangered or threatened species, and is the only surveyed area where threatened or endangered plant species are present. Hemlock parsley was identified, which is of special concern according to the Massachusetts Endangered Species Act (MESA). In addition, Long's bulrush was identified and is threatened, according to MESA. Two invertebrates were found, the Eastern pondmussel and triangle floater, both of special concern. The blue spotted salamander, a vertebrate, was identified in areas G, D, and F. Although the spotted turtle has been de-listed from the protected species list in Massachusetts, the spotted turtle is still protected on Massachusetts conservation land.

5.4 Invasive Species

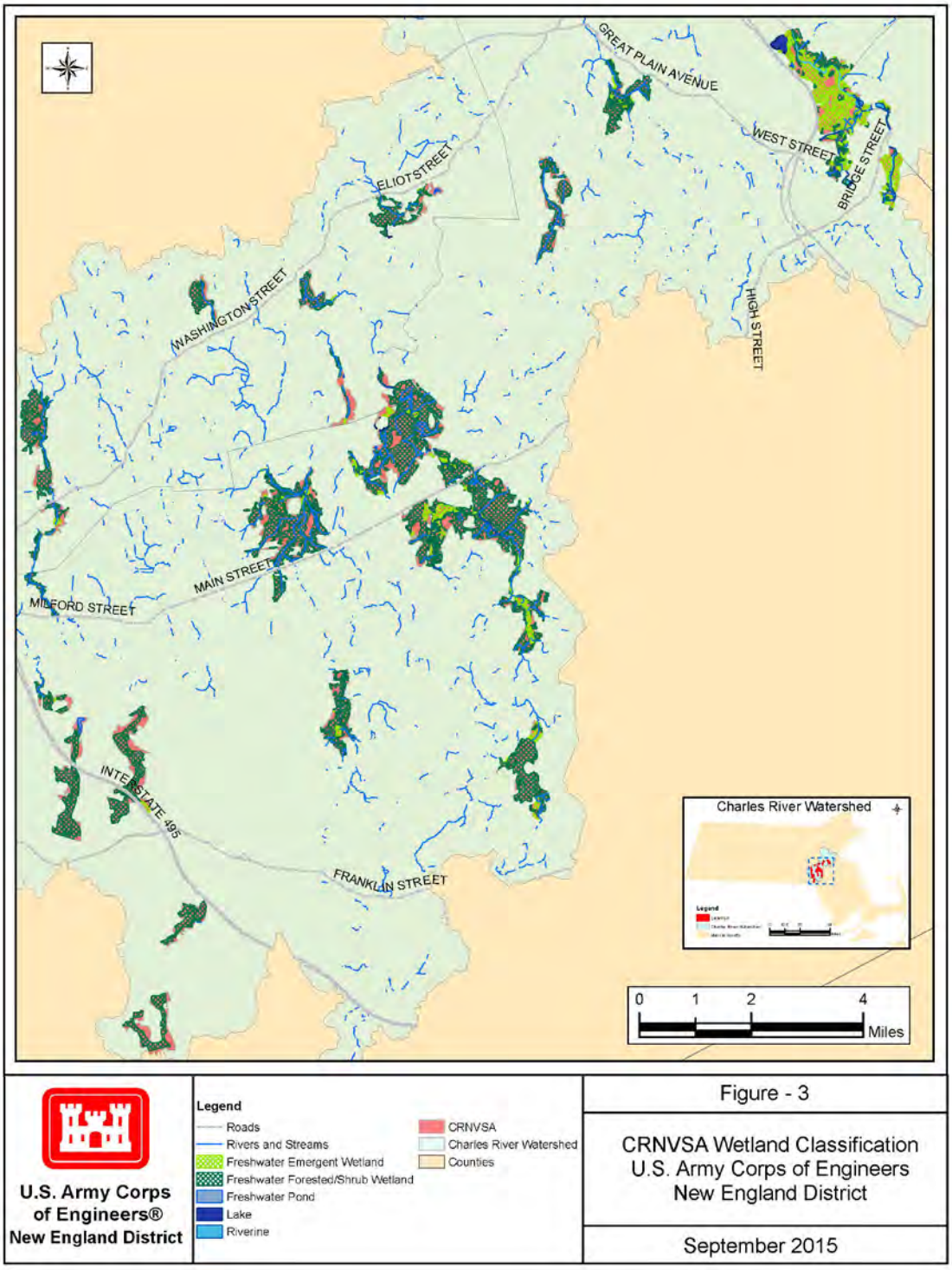
Invasive plant species were found in ten areas: B, C, D, F, I, J, K, L, P, and R. Although the plant surveys were not done in every area of the Charles River Natural Storage Area, invasive plant species were found in all areas surveyed, therefore a generalization can be made that invasive plants are found in all areas. The following are the invasive plant species identified in surveyed areas: purple loosestrife (Lythrum salicaria), phragmites (Phragmites australis), glossy buckthorn (Rhamnus frangula), burning bush (Euonymus alatus), knotweed (genus Polygonum), multiflora rose (Rosa multiflora), oriental bittersweet (Celastrus orbiculatus), autumn olive (Elaeagnus umbellate), black swallowwart (Cynanchum louiseae), garlic mustard (Alliaria petiolata), and Japanese barberry (Berberis thunbergii). Invasive species were typically in disturbed areas. An area was described as disturbed if there were dumping sites, abandoned gravel parking lots, mowed areas, cleared areas, construction sites, or any other disturbance where natives cannot thrive.

5.5 Wetlands

A wetlands inventory of the Charles River Natural Valley Storage Area was conducted by the Corps in 2015. The aim was to identify and characterize surface waters and wetland communities on project fee- owned and easement leased lands. The U.S. Fish and Wildlife Service National Wetlands Inventory was used to identify and evaluate wetlands on the site. Roughly 90 percent of the CRNVSA (7,260 acres) was comprised of wetlands. A summary of the wetland types occurring at the CRNVSA included:

Palustrine Freshwater Emergent Wetland - 923 acres
Palustrine Freshwater Forested/ Shrub Wetland - 5,475 acres
Freshwater Pond - 47 acres
Lake - 104 acres
Riverine - 711 acres

Wetland mapping for the project is shown on attached map. (FIGURE 3 – *WETLAND CLASSIFICATION*.)


GREAT PLAIN AVENUE
WEST STREET
BRIDGE STREET
ELIOTSTREET
WASHINGTONSTREET
HIGH STREET
MAIN STREET
MILFORD STREET
INTERSTATE 495
FRANKLIN STREET
Charles River Watershed
0 1 2 4
Miles
U.S. Army Corps of Engineers®
New England District
Legend
Roads
Rivers and Streams
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Riverine
CRNVSA
Charles River Watershed
Counties
Figure - 3
CRNVSA Wetland Classification
U.S. Army Corps of Engineers
New England District
September 2015

Cultural Resources

An intensive archaeological survey of the Charles River NVS project area was completed in October 2011 by Hardlines Design Company under contract to the Corps of Engineers, New England District. Goals of this survey were to investigate areas that had been determined by a previous reconnaissance study (completed in 2000 by the Public Archaeology Laboratory) to be of high or moderate sensitivity for archaeological resources. The following information is based upon this intensive survey.

During the field testing and survey portions of the study, a total of 44 pre-contact and eight post-contact sites were identified, as well as four sites that has evidence of both pre- and post-contact use. 36 of the pre-contact sites and five of the post-contact sites were deemed potentially significant and further recommendations for avoidance or additional study were described. In addition, many of the stratified zones of high or medium archaeological sensitivity would require further investigation. Based on the findings of this report, seven sites (two pre-contact and five post-contact) were selected for detailed site examinations, which were carried out in 2011. Following those examinations, only two of those sites were recommended as being potentially eligible for recording on the National Register of Historic Places.

Please note that archaeological site locations are confidential information that is exempt from Freedom of Information Act requirements, and cannot be divulged to the general public.

5.6 Economic/Demographics

Economics

The primary area of economic influence for the Charles River Natural Valley Storage area watershed lies almost entirely within the Boston Standard Metropolitan Statistical Area (MSA). MSAs are defined by the Office of Management and Budget. Metropolitan areas have a population of 50,000 or more and contain multiple counties that have a high degree of social and economic integration (U.S. Census Bureau). The Boston MSA includes parts of five cities and thirty towns in Middlesex, Norfolk, Suffolk, and Worcester counties. The majority of the towns are in Middlesex and Norfolk Counties, with one town in Suffolk and three towns in Worcester Counties. Massachusetts is the third most densely populated state in the country. The Boston MSA is one of the most highly populated and developed locations with the largest employment and population center in New England. The following sections present the demographic information for the primary area of economic influence.

Population

The total population for the zone of interest in 2010 census (latest available) was 1,532,013, as shown in table 1 in the appendix. Approximately 37% of the population of interest is in Middlesex County, 20% in Norfolk, 3% in Worcester County, and 40% in Suffolk County. The population makes up approximately 23% of the total population of Massachusetts. From 2010 to 2035, the population in the zone of interest is expected to increase to 1,793,883, an annual growth rate of 0.63% per year. By comparison, the population of Massachusetts is projected to increase at an annual rate of 0.45% per year. Of the 30 towns in the zone of interest, nine are expected to decrease in population as shown by the negative percentage change from 2010 to 2035.

The population distribution of the counties are similar to the distribution of the state. All counties have over 10% of their population under the age of 9; 30% under the age of 24; 55% under the age of 44 and 85% under the age of 64. Suffolk County has a younger population than the other counties and the overall state average with 55% of Suffolk's population under the age of 34 while the other counties and the state have approximately 44% of their population under the age of 34. The age distribution for the counties and the Commonwealth of Massachusetts are provided in Table 2 in the appendix.

Education

The percentage of residents with college degrees in Middlesex, Norfolk, Suffolk, and Worcester counties range from 34% to 51%. The percentage of the population that has not completed high school ranges from 8.0% to 16%. Table 3 in the appendix shows the education level of the counties containing the zone of interest.

Middlesex County and Norfolk County have lower population percentages in Some College, High School Only, and Less than High School categories than the state average, and have a higher percentage of residents with college degrees. Suffolk County similarly has a higher percentage of residents with college degrees, but also has a higher percentage of residents with education levels less than high school. Worcester County has a lower percentage of residents with college degrees than the state average, and has the same percentage of residents as the state average with less than high school experience.

Households and Income

Middlesex County has the highest number of households for the counties of interest with 581,120 households. Worcester, Suffolk, and Norfolk counties have a similar number of households ranging from approximately 260,000 to 300,000. Table 4 in the appendix shows the number of households and the average number of persons per household by county.

Worcester and Suffolk counties have median incomes below the median income of the Commonwealth of Massachusetts. Middlesex and Norfolk counties are significantly above the median income of Massachusetts. Table 5 below displays the median income values, ranging from $50,000 to $80,000.

Recreational Benefits

The Charles River Natural Valley Storage Area was authorized as a multi-purpose project for flood control, recreation and natural resources management. The Federal Water Project Recreation Act of 1965 requires full consideration be given to the opportunities that Federal multipurpose and other water projects afford for outdoor recreation and associated fish and wildlife enhancement. Engineering Regulation 1105-2-100 (22 Apr 2000), Appendix E, Section VII, contains guidance for evaluating the National Economic Development (NED) benefits of recreational activities provided by USACE water resource projects.

Benefits arising from recreation opportunities created by a project are measured in terms of willingness to pay. These benefits are generally used as a means of evaluating the NED benefits of a proposed Federal project, but can also be used to approximate the NED recreational benefits of existing projects.

Recreation Benefits are calculated using the certified tool for the Unit Day Value (UDV) Method as detailed in Corps Economic Guidance Memorandum #16-03, "Unit Day Values for Recreational, Fiscal Year 2016." The recreation experience is evaluated through a point system which rates the recreational area using five criteria. The number of points attributed to the overall visitor experience is cross-referenced to dollar values provided in the economic guidance memorandum to determine the average dollar value per day per user, or UDV. The criteria and point values for CRNVS are listed in Table 6 in the appendix.

In the case of the Charles River Natural Valley Storage Area, there are no entrance gates where the number of visitors can be recorded so a range of recreational benefits was calculated based on the visitation numbers provided in the State of Massachusetts Charles

River Basin Master Plan. Using these visitor numbers allows an assessment of recreational benefits created by lands acquired and maintained primarily for flood control.

Recreational opportunities at CRNVSA generate a total of 63 points and a UDV of $9.18 for FY16. The UDV amount is multiplied by the number of visitors to determine the value of recreational benefits. Using a range of annual visitors between 350,000 and 500,000 yields a range between $3.2 million and $4.6 million in annual recreational benefits. An economic assessment of the project would add these benefits to the $11.9 million in flood damages prevented to yield the total economic benefit of the project between $15.1 and $16.5 million.

5.7 Recreation Facilities, Activities and Needs

Table 7 in the appendix, identifies three different recreational areas that are located within 25 miles of the project. They all provide similar recreational opportunities within the region.

5.8 Real Estate Acquisition Policy

Large intact wetlands in the middle and upper Charles River watersheds over 100 acres in size were identified as having the highest potential for flood water retention. The lands acquired for the project were delineated by using elevations above mean sea level, based upon the 1955 flood level plus two feet in elevation. Lands below that area in the identified wetlands were selected for acquisition. No lots with existing developments, regardless of elevation, were acquired.

While many tracts were taken in fee simple, however, the majority of the project acreage consists of restrictive easements on non-Corps property. This was done primarily to address concerns of existing landowners or in cases where the Corps determined that acquiring fee ownership was not in the best interest of the Government. While the specific details of each easement tract's estate vary, they all have the same standard provisions. A copy of the standard easement language is included in Appendix C.

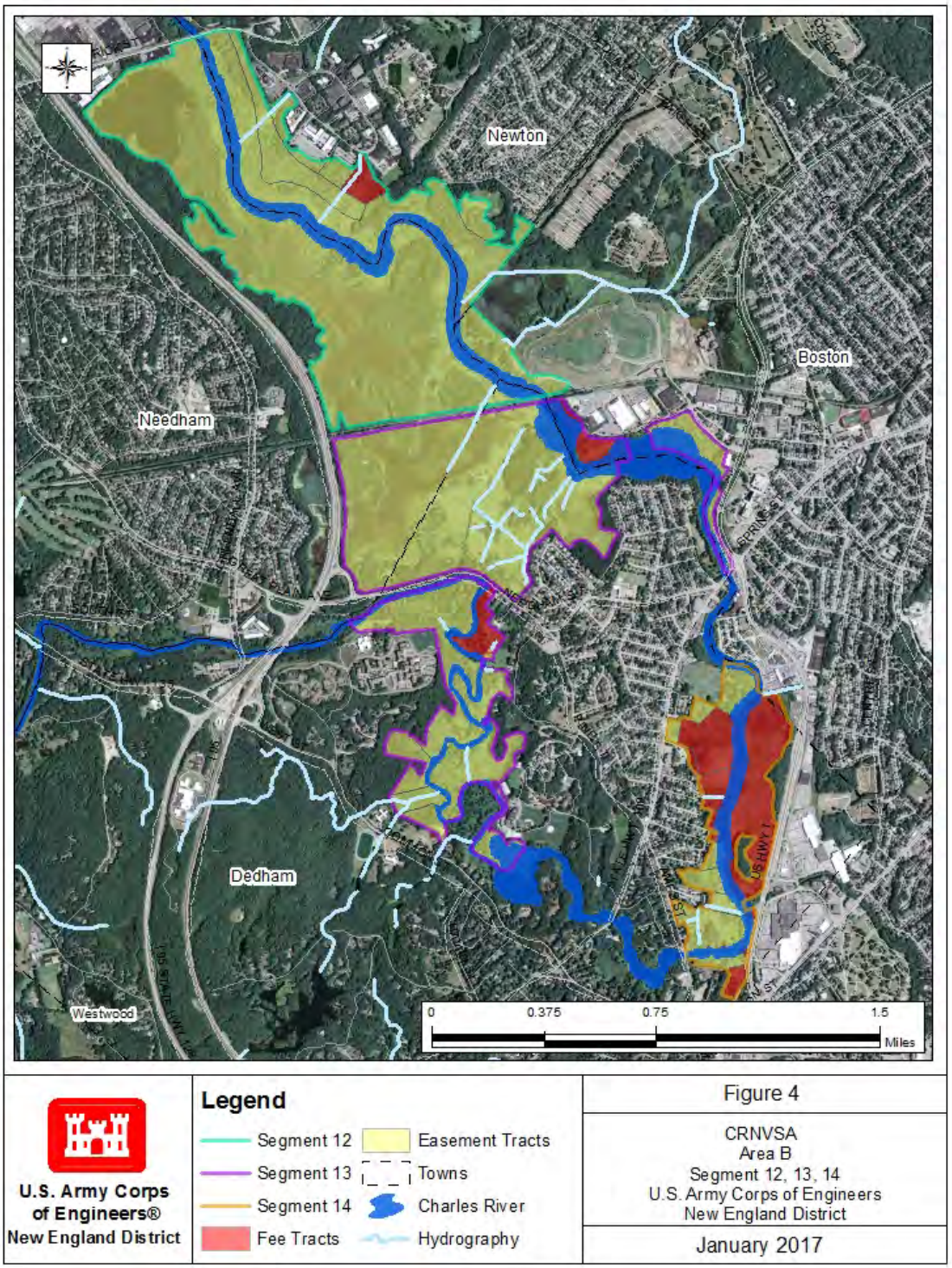
5.9 *Area B*

Area B is located in the Towns of Dedham, Needham, Newton and the City of Boston. It consists of 132.18 acres in Fee and 1033.88 acres of Easement. This area protects the large wetlands along the main stem of the Charles River upstream of the Nahanton Street Bridge, and up to elevation 95 ft MSL. The northern section of this area, north of Needham Street, is primarily flowage easement on a large state park known as Cutler Park. This park has many resources for passive recreation, including a nearly 10-mile nature trail loop known as the Great Blue Heron Trail. Parking for this trail, which is a popular place for hiking and nature viewing, can be found at lots on both Kendrick Street in Needham and Needham Street in Dedham. This trail and the access lots are maintained by the Mass. Department of Conservation and Recreation.

The river in this section is wide and flat, making it a very popular section of the river for canoeing and kayaking. Launches are located on Needham Street in Dedham, at the Dedham Recreation Complex on Common Street in Dedham, at the Mother Brook Diversion on Providence Highway in Dedham, at Millennium Park in Boston, and at Nahanton Park in Newton. All of these launch sites are maintained by the respective towns and city. In addition, a section of the river in Dedham and Boston has been named as a National Recreation Trail by the National Park Service for its excellent qualities as a paddling route. This trail is marked by interpretive signage and forms a loop, utilizing the Long Ditch (a flood control channel that dates back to the earliest settlement of the region in the late 1600s) to connect the two ends of the trail. This trail is maintained by the Town of Dedham.

Use of this area for fishing is also popular, though hunting on this area is not allowed due to the urban surroundings of the area and in consistency with the hunting prohibition on the state park owned lands.

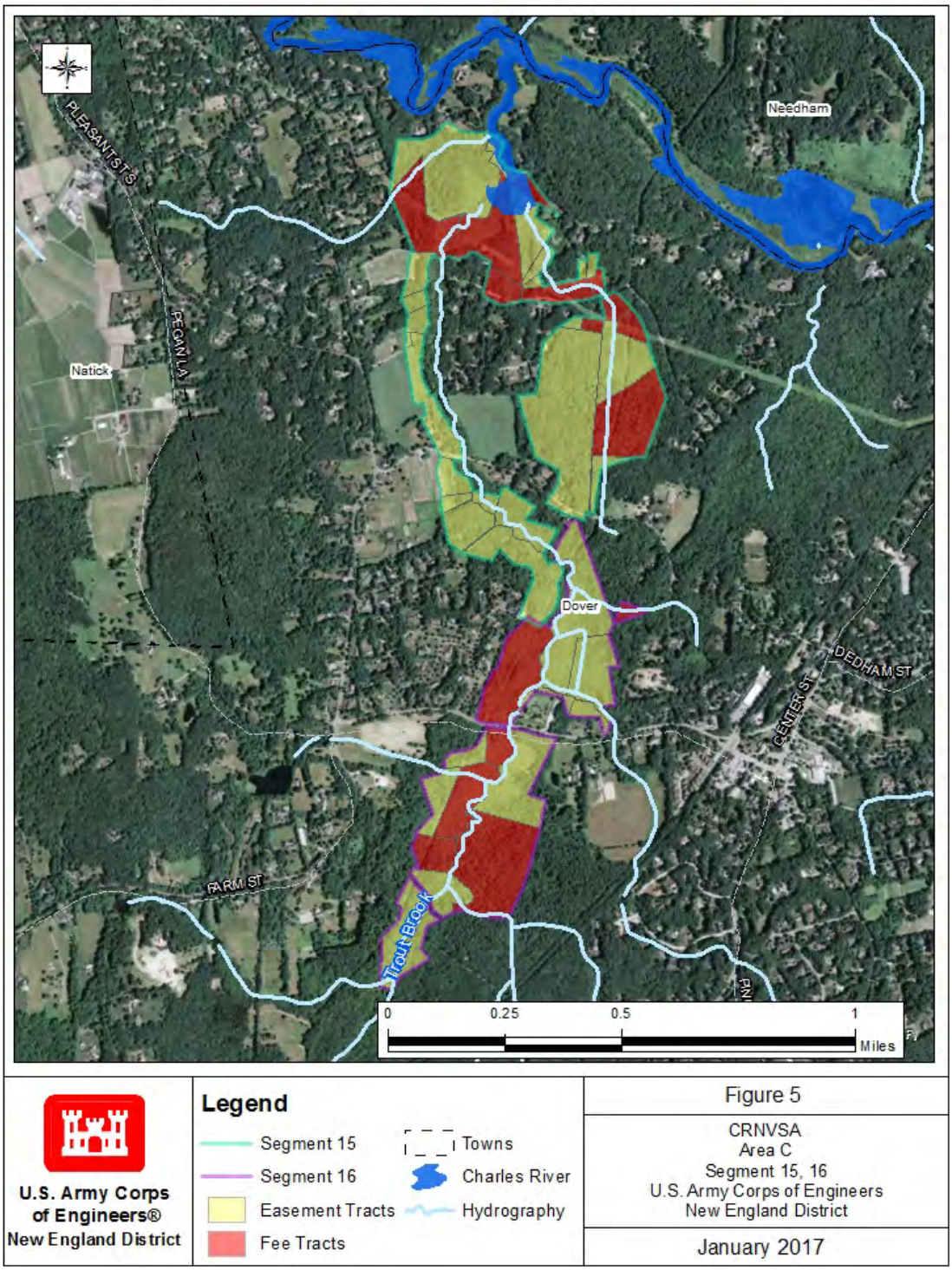
Fee owned parcels are currently managed directly by the Corps. In the future, it may be desirable to license these areas to the state Conservation and Recreation department for management as part of the larger Cutler Park.


Newton
Boston
Needham
Dedham
Westwood
0
0.375
0.75
1.5
Miles
Legend
Segment 12
Segment 13
Segment 14
Fee Tracts
Easement Tracts
Towns
Charles River
Hydrography
U.S. Army Corps of Engineers®
New England District
Figure 4
CRNVSA
Area B
Segment 12, 13, 14
U.S. Army Corps of Engineers
New England District
January 2017

5.10 *Area C*

Area C is located in the Town of Dover and consists of 92.81 acres in Fee and 170.37 acres of Easement. This area protects the wetlands along Trout Brook, a tributary of the Charles River. Of the Easement area, approximately 62 acres are owned by the town as conservation land. The Fee owned parcels are managed directly by the Corps of Engineers.

There are no formal, developed recreation facilities or trails in this area. Trout Brook is stocked by the Mass Division of Fish and Wildlife every spring for fishing season, and informal parking areas can be found alongside Haven Street and Springdale Avenue where they abut the project area. Hunting is generally prohibited in this area in accordance with local by-laws. Limited deer hunting is allowed in season with a special permit issued by the town board of health.

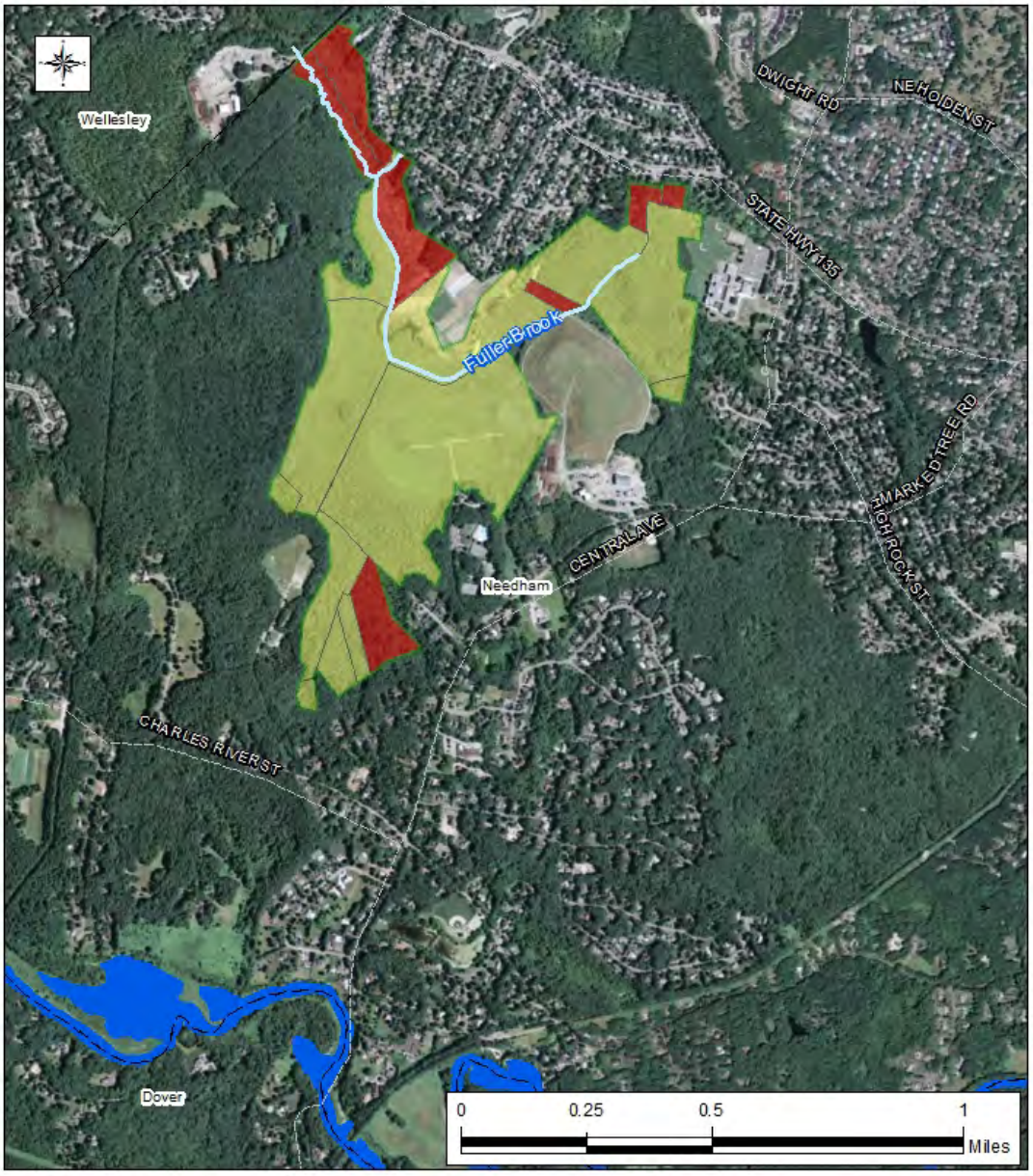

Needham
Natick
Dover
PLEASANT ST S
PEGAN LA
DEDHAM ST
CENTER ST
FARM ST
Trout Brook
0
0.25
0.5
1
Miles
U.S. Army Corps of Engineers®
New England District
Legend
Segment 15
Segment 16
Easement Tracts
Fee Tracts
Towns
Charles River
Hydrography
Figure 5
CRNVSA
Area C
Segment 15, 16
U.S. Army Corps of Engineers
New England District
January 2017

5.11 *Area D*

Area D is located in the Town of Needham and consists of 45 acres in Fee and 212 acres of Easement. The area protects wetlands along Fuller Brook, a tributary of the Charles River. Of the easement area, approximately 76 acres is conservation land owned by the town. Another 257 acres of easement is owned by TV station WHDH for the site of their transmission towers and is closed to public access.

The town of Needham maintains a short nature trail on an easement parcel known as the Eastman Conservation Area, located behind the adjacent Newman Elementary School. Located to the west of Area D, but not on project lands, is a larger town-owned conservation land known as Ridge Hill Woods, which has hiking trails.

The fee owned tracts are managed by the Corps of Engineers. They are small and scattered and do not have easy direct public access. Hunting is not permitted on this Area due to local town by-laws and the small size of Corps fee parcels.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 17
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrography

Figure 6

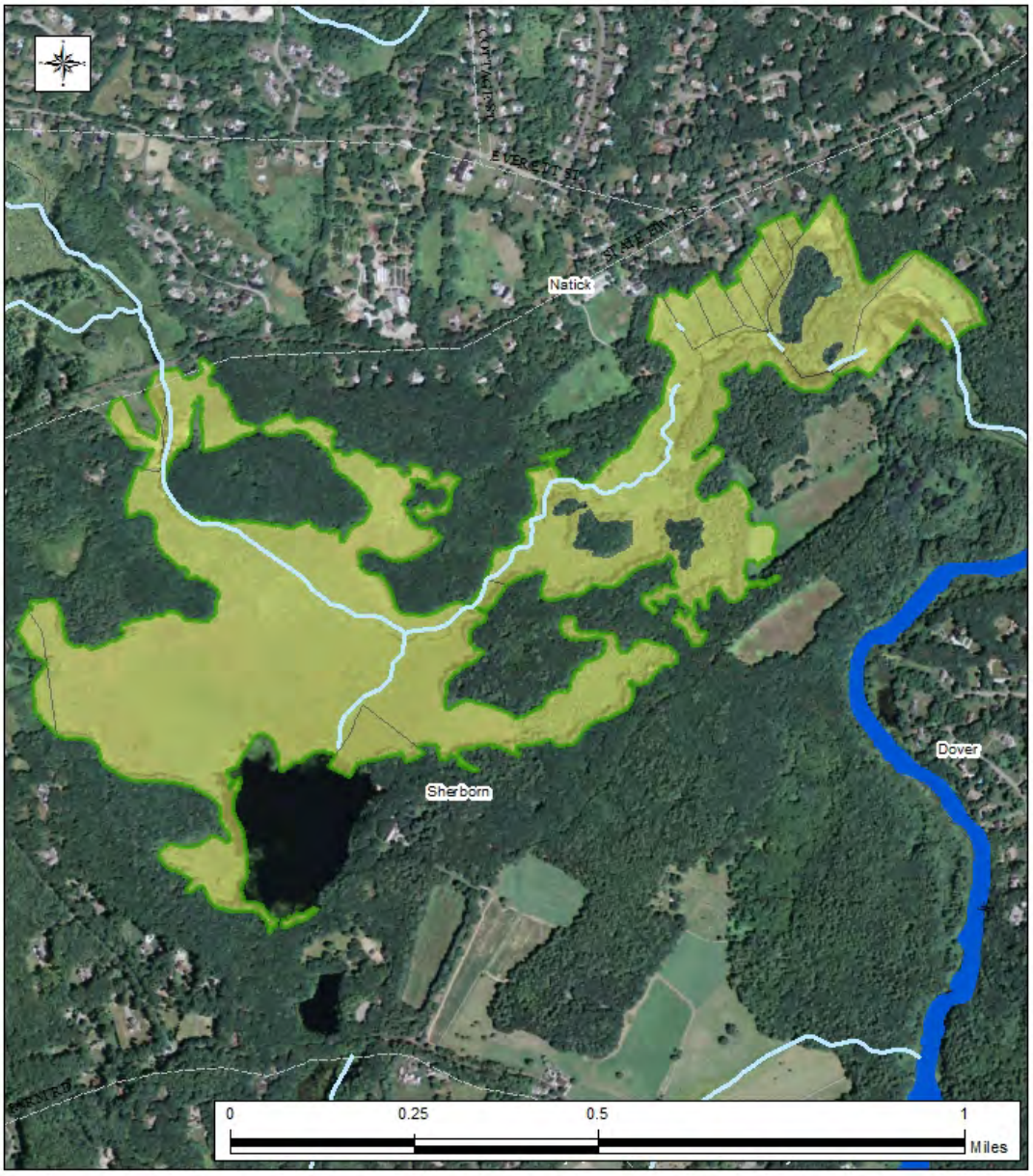
CRNVSA
Area D
Segment 17
U.S. Army Corps of Engineers
New England District

January 2017

5.12 *Area E*

Area E is located in the towns of Natick and Sherborn and consists entirely of 203.68 acres of Easement. There is no Corps Fee owned property in this area. The area protects the wetlands along Indian Brook, which flows to the Charles River. The majority of this area is owned and managed by the Massachusetts Audubon Society as part of their Broadmoor Wildlife Sanctuary. They maintain miles of nature trails that criss-cross the area and operate a nature center and visitor center.

As the Corps does not own any fee tracts, there is no direct corps management of this area.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 18
- Easement Tracts
- Towns
- Charles River
- Hydrography

Figure 7

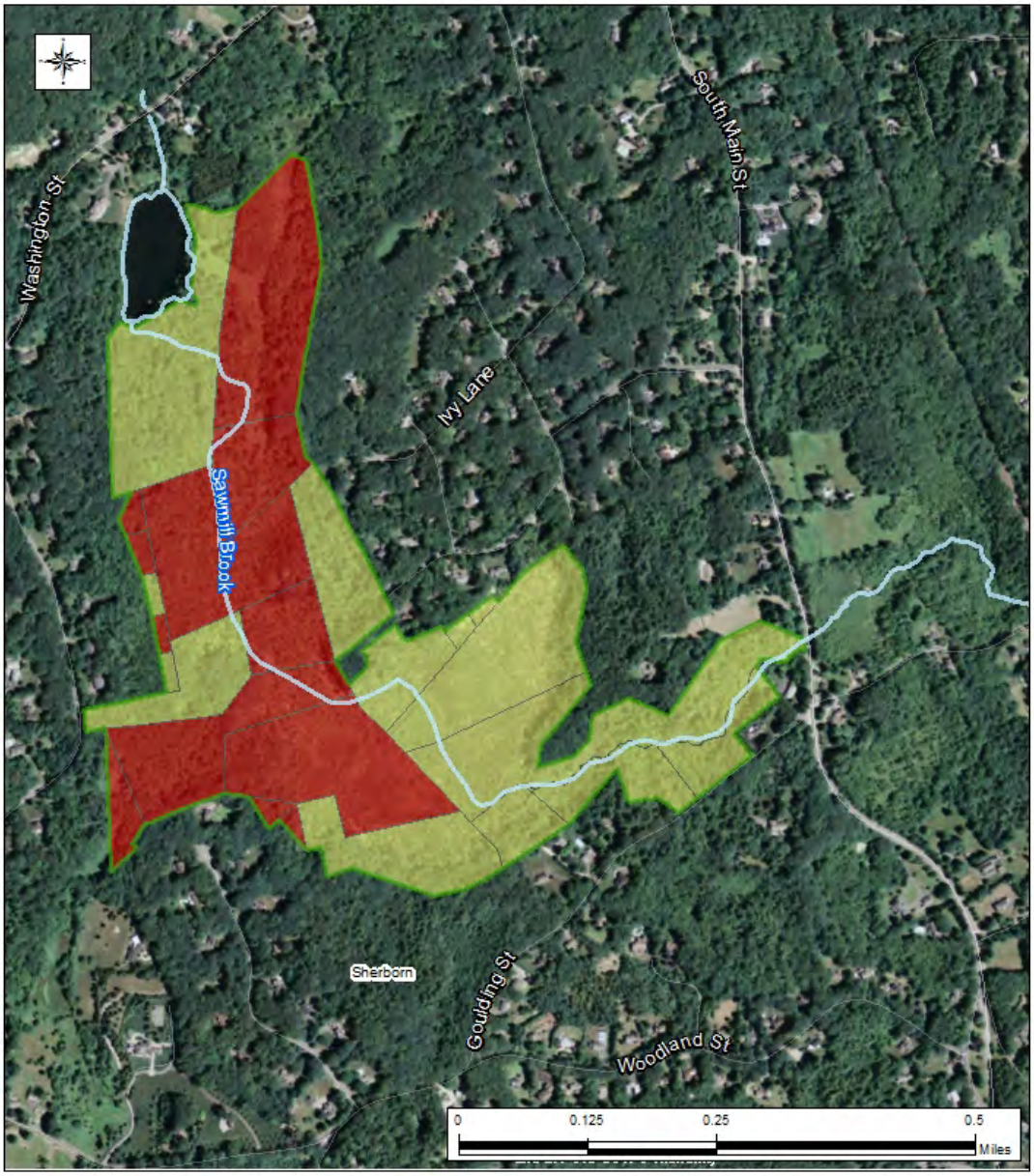
CRNVSA
Area E
Segment 18
U.S. Army Corps of Engineers
New England District

January 2017

5.13 *Area F*

Area F is located in the Town of Sherborn and consists of 68.48 acres in Fee and 55.19 acres of Easement. This area protects the wetlands at the headwaters of Sewall Brook, a tributary of the Charles River. There are no developed recreation facilities or trails on this area, and hunting is not allowed by town by-laws.

Management of the Fee owned tracts is directly by the Corps of Engineers. There is very little easy public access to the Fee owned properties, which are very wet and mostly surrounded by easement or off-project private property.



U.S. Army Corps of Engineers®
New England District

Legend

Segment 29
Easement Tracts
Fee Tracts
Hydrography

Figure 8

CRNVSA
Area F
Segment 29
U.S. Army Corps of Engineers
New England District

January 2017

5.14 *Area G*

Area G is the largest of the NVS areas, consisting of 1149 acres in Fee and 1507 in Flowage Easement. This area spread into the towns of Medfield, Millis, Norfolk, Sherborn and Walpole. It protects the large wetlands along the main stem of the Charles River, as well as wetlands along the Stop River and Bogastow Brook, which flow into the Charles.

Of the Easement tracts, approximately 900 acres are owned by other conservation groups including the state Department of Conservation and Recreation, the non-profit Trustees of Reservations, and the local towns themselves.

This section of the river is very popular for paddling trips, as it is a wide, slow section of the river with excellent fishing and wildlife viewing opportunities. Canoe and kayak launch sites are located on the Charles River and tributaries at the following locations:

Forest Street, Millis (maintained by Corps of Engineers)
Causeway Street, Medfield (maintained by Town of Medfield)
West Street, Medfield (maintained by Town of Medfield)
Route 27 bridge, Medfield (maintained by Town of Medfield)

Formerly, a launch was located on private property at the Route 109 bridge in Millis. At this time, that launch has been closed by the property owners, but may reopen in the future.

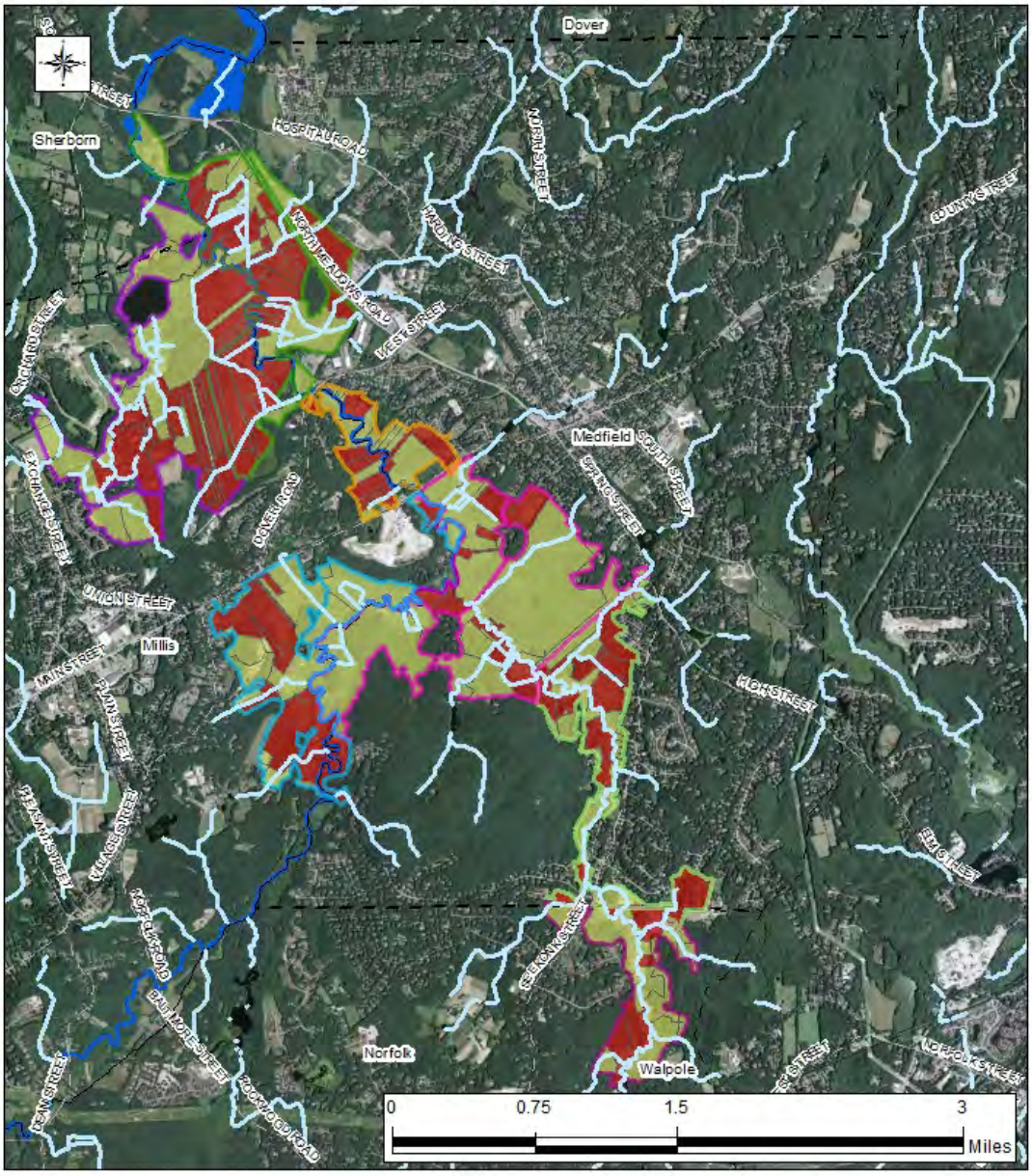
In addition to the Charles River launches, a canoe and kayak launch is available on the shores of South End Pond. Maintained by the town of Millis, it is at the end of the water department access road off of Route 115 in Millis.

The town maintained launches are all located on project flowage easement or are off project lands. The Corps maintains one launch in Millis at the upstream end of Area G. It was constructed jointly by the Corps and the Mass Public Access Board in 2004. Day to day maintenance of the launch is currently conducted by the Fin Fur and Feather Club of Millis, as part of a license agreement with the corps allowing them to use some corps Fee land for their club shooting range. Their maintenance activities at the launch are overseen directly by the Corps' project staff.

Numerous hiking trails are located on project easement lands. The Trustees of Reservations property known as Shattuck Reservation has trails, including a section of the regional Bay Circuit Trail, that cross project easement north of Causeway Street in

Medfield. They also maintain a trail to the Medfield Rhododendron Reservation, located west of Route 27 just south of the center of Medfield. The town of Medfield itself has some walking trails that cross project lands on various parcels located west of South Street and off the end of Lakeview Street. These trails are minimally maintained by the town or local volunteer groups. The state maintains a short section of the Bay Circuit Trail on a segment of the project that they own, off of Route 27 near the north end of Area G. Access to these trails is from roadside parking lots located along the numerous public streets that cross this area.

The Fee owned lands in this area are under license to the Massachusetts Department of Fish and Wildlife. They are responsible for management of the fish and wildlife resources of the fee tracts and for the resolution of all encroachment and trespass issues. Annually, the state stocks the Charles River in this area with trout, and stocks pheasant in this area for ground bird hunting. All forms of hunting are allowed, in accordance with regular state regulations. The Corps remains responsible for boundary line marking and other management issues not related to fish and wildlife.



U.S. Army Corps of Engineers®
New England District

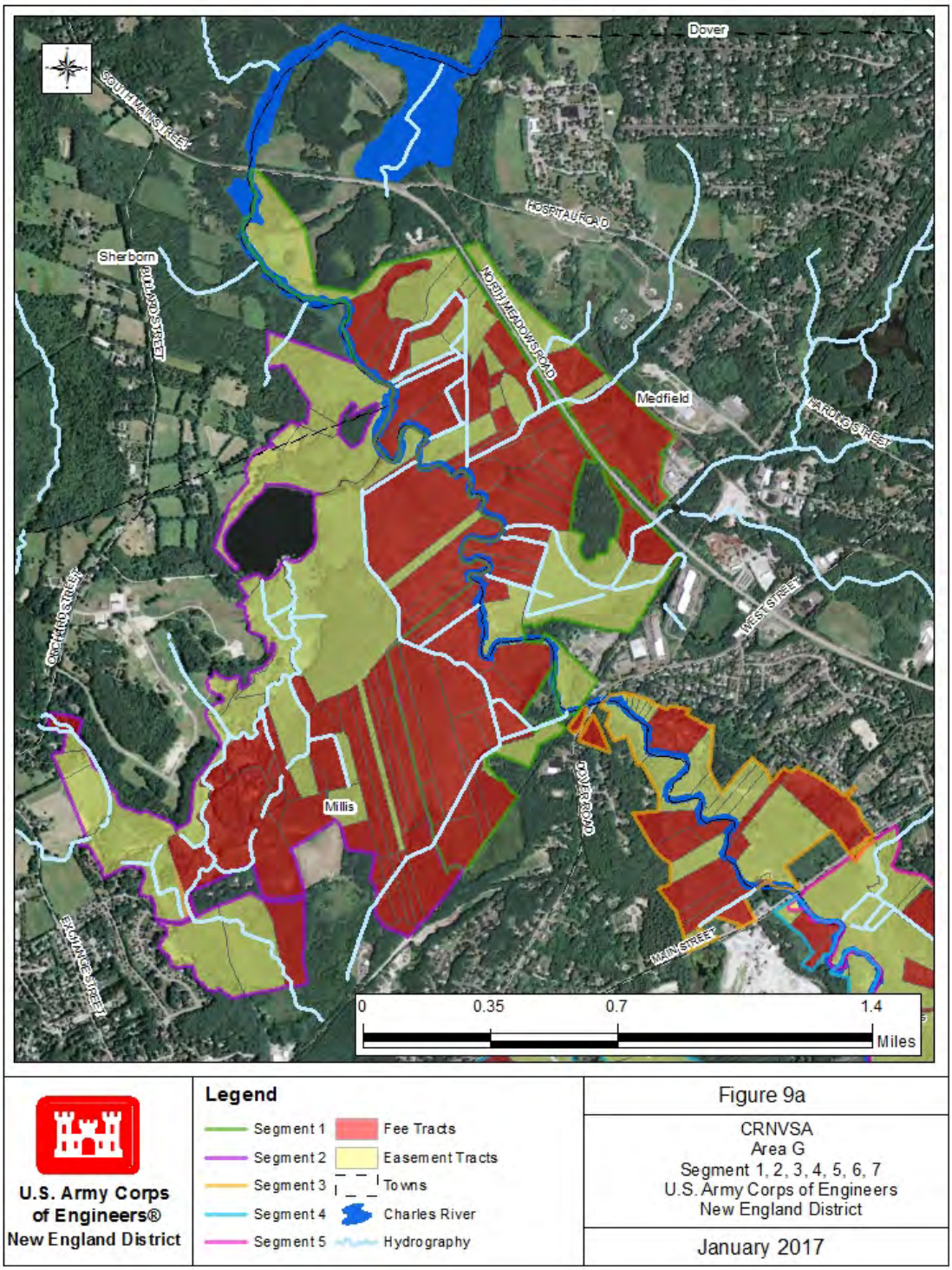
Legend

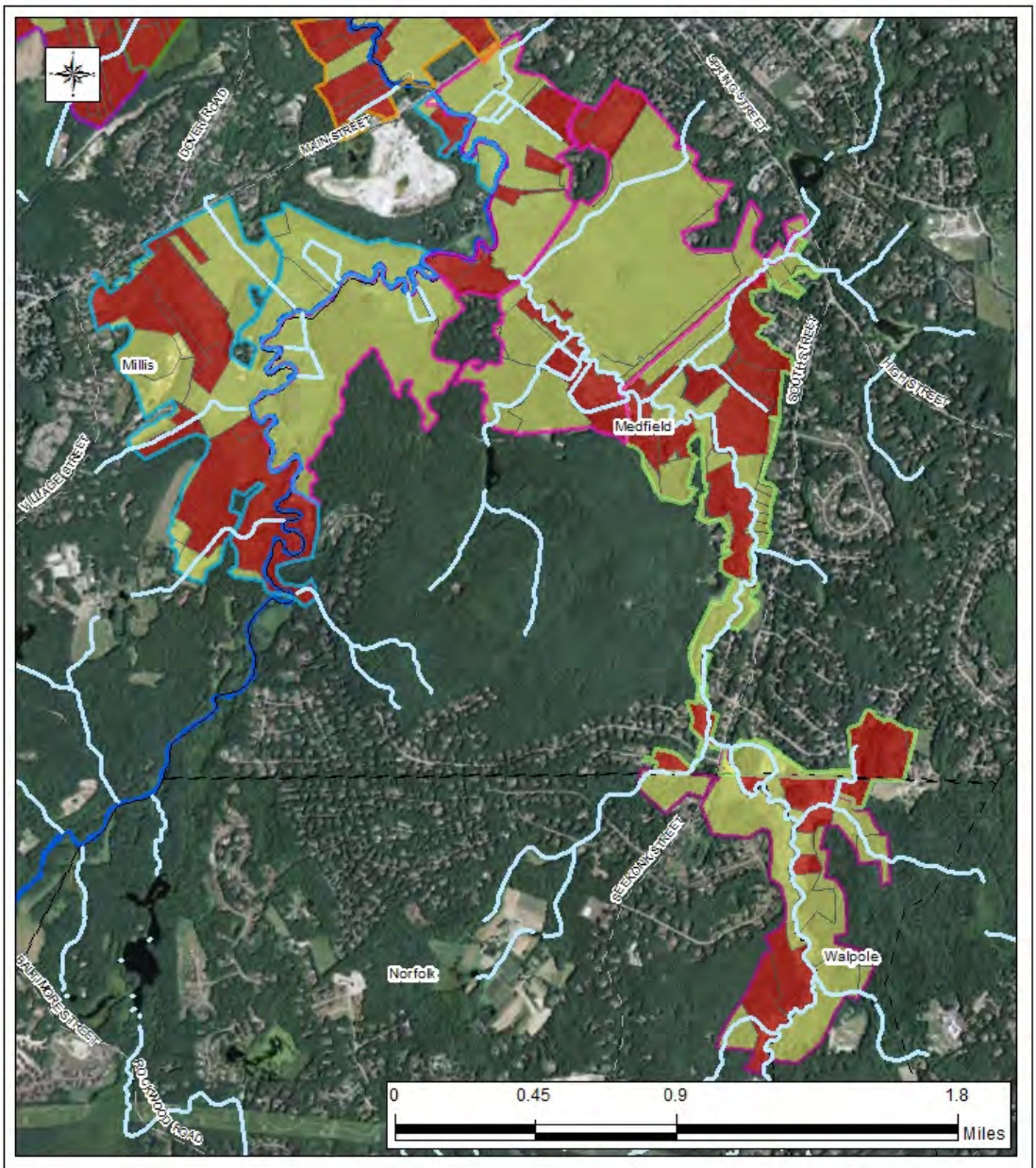
- Segment 1
- Segment 2
- Segment 3
- Segment 4
- Segment 5
- Segment 6
- Segment 7
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrography

Figure 9

CRNVSA
Area G
Segment 1, 2, 3, 4, 5, 6, 7
U.S. Army Corps of Engineers
New England District

January 2017


Dover
SOUTH MAIN STREET
HOSPITAL ROAD
Sherborn
BULLARD STREET
NORTH MEADOWS ROAD
Medfield
FARM STREET
OAK HILL STREET
WEST STREET
Millis
DOVER ROAD
SCHOOL STREET
MAIN STREET
0
0.35
0.7
1.4
Miles
U.S. Army Corps of Engineers®
New England District
Legend
Segment 1
Segment 2
Segment 3
Segment 4
Segment 5
Fee Tracts
Easement Tracts
Towns
Charles River
Hydrography
Figure 9a
CRNVSA
Area G
Segment 1, 2, 3, 4, 5, 6, 7
U.S. Army Corps of Engineers
New England District
January 2017



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 3
- Segment 4
- Segment 5
- Segment 6
- Segment 7
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrography

Figure 9b

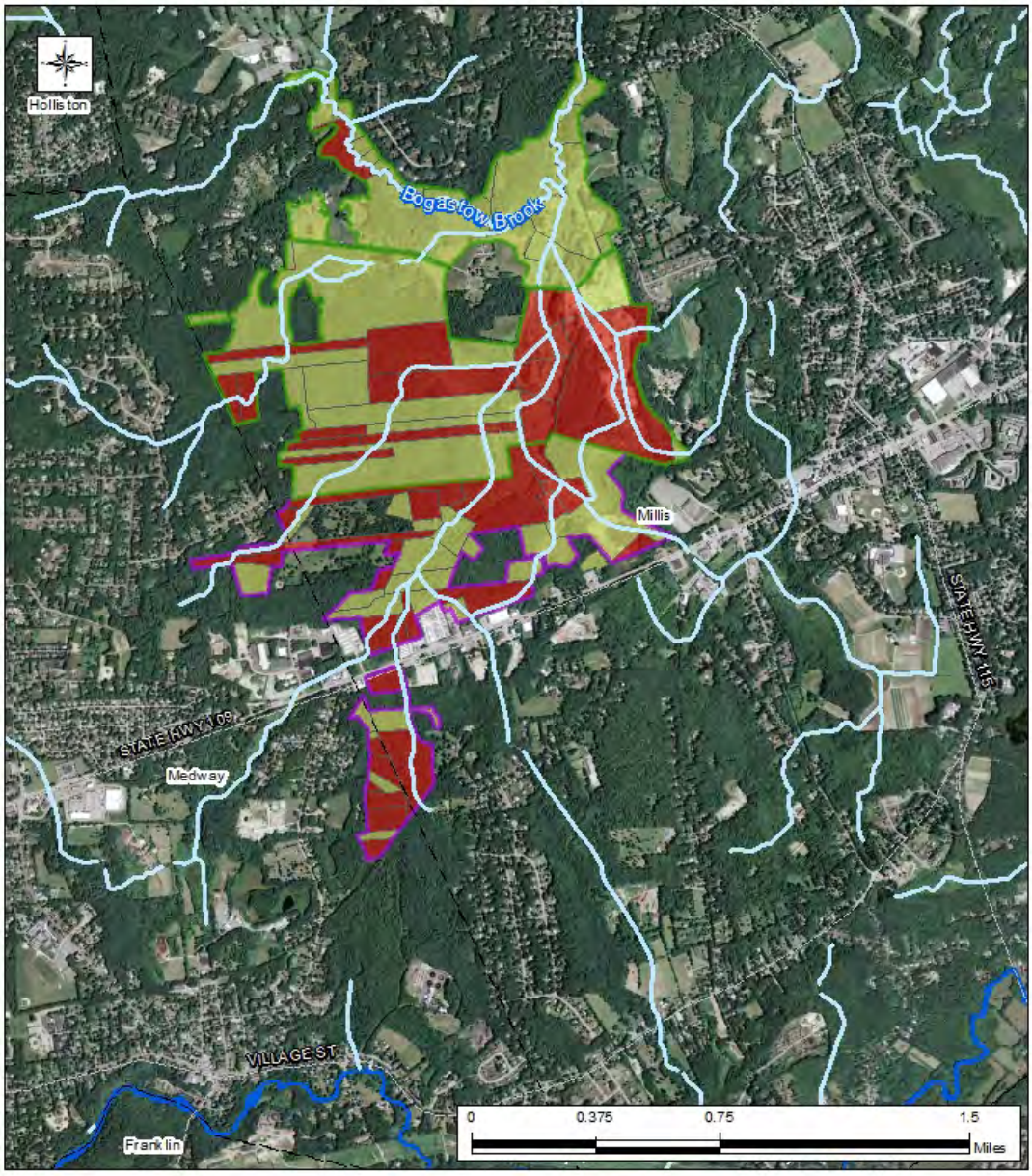
CRNVSA
Area G
Segment 1, 2, 3, 4, 5, 6, 7
U.S. Army Corps of Engineers
New England District

January 2017

5.15 *Area H*

Area H is located in the towns of Medway and Millis, consisting of 341.88 acres in Fee and 531.18 acres of Easement. This area protects a large forested wetland along Bogastow Brook that is locally known as the Great Black Swamp. There are no developed recreation facilities or trails in this area. The tracts owned in fee are scattered and oddly shaped, with no easy public access. Most of the flowage easement is on private property that is not open to public use.

The fee tracts are under license to the Massachusetts Department of Fish and Wildlife, who are responsible for management of the fish and wildlife resources of the area and for resolution of all encroachment and trespass issues. Hunting is permitted on the fee tracts, in accordance with all state regulations. The Corps remains responsible for boundary line marking and other issues not related to fish and wildlife.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 8
- Segment 9
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrography

Figure 10

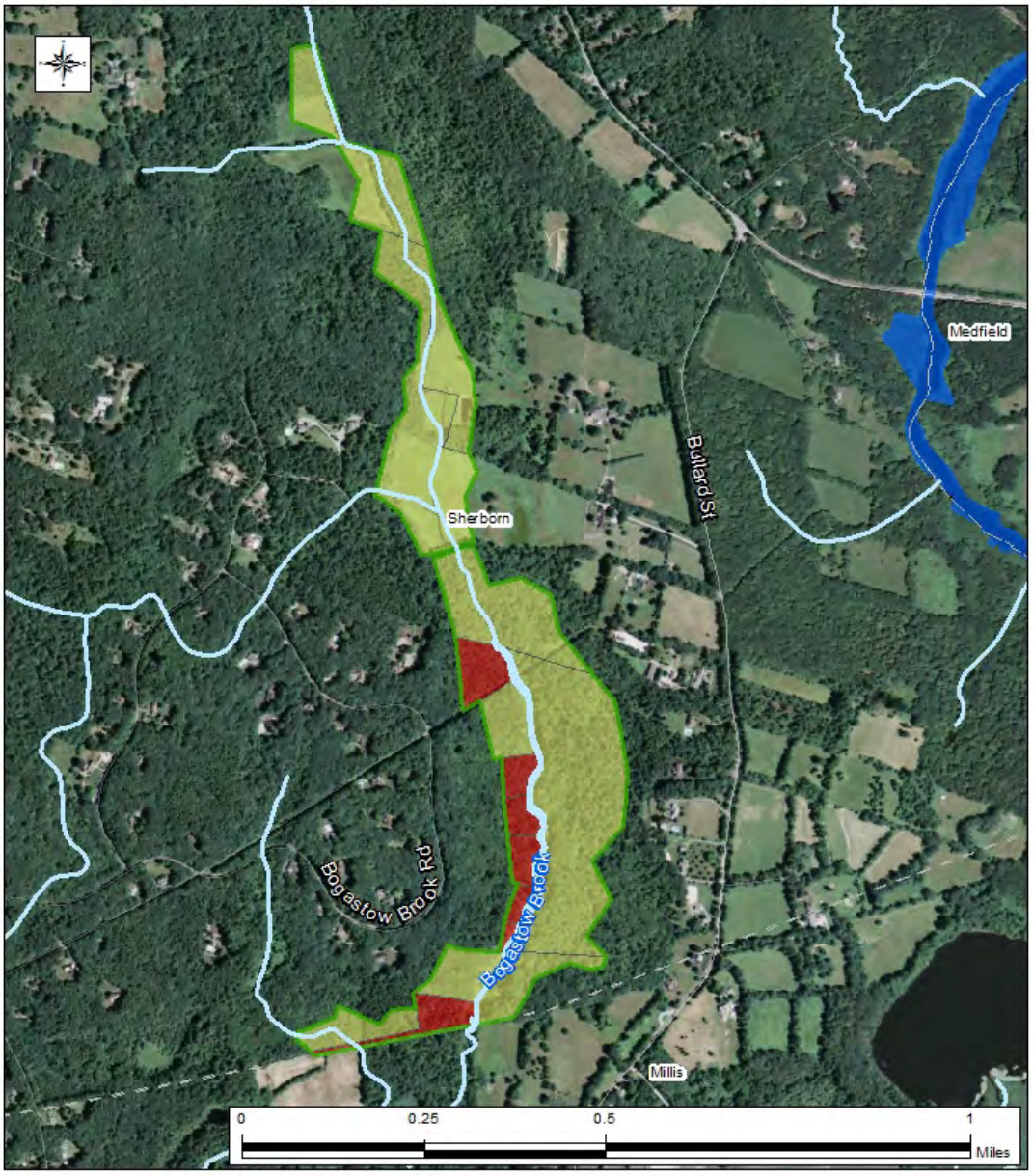
CRNVSA
Area H
Segment 9, 10
U.S. Army Corps of Engineers
New England District

January 2017

5.16 *Area I*

Area I is located in the town of Sherborn and consists of 12.27 acres of Fee and 86.45 acres in Easement. This area protects the wetlands near the headwaters of Bogastow Brook, a tributary of the Charles River. The tracts owned in fee are very small and have no direct public access. The majority of the easement is on private lands with no public access.

Management of the fee parcels is directly by the Corps of Engineers. Hunting is not allowed, in accordance with local by-laws. There are no developed recreation facilities or trails, due to lack of public access.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 30
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrography

Figure 11

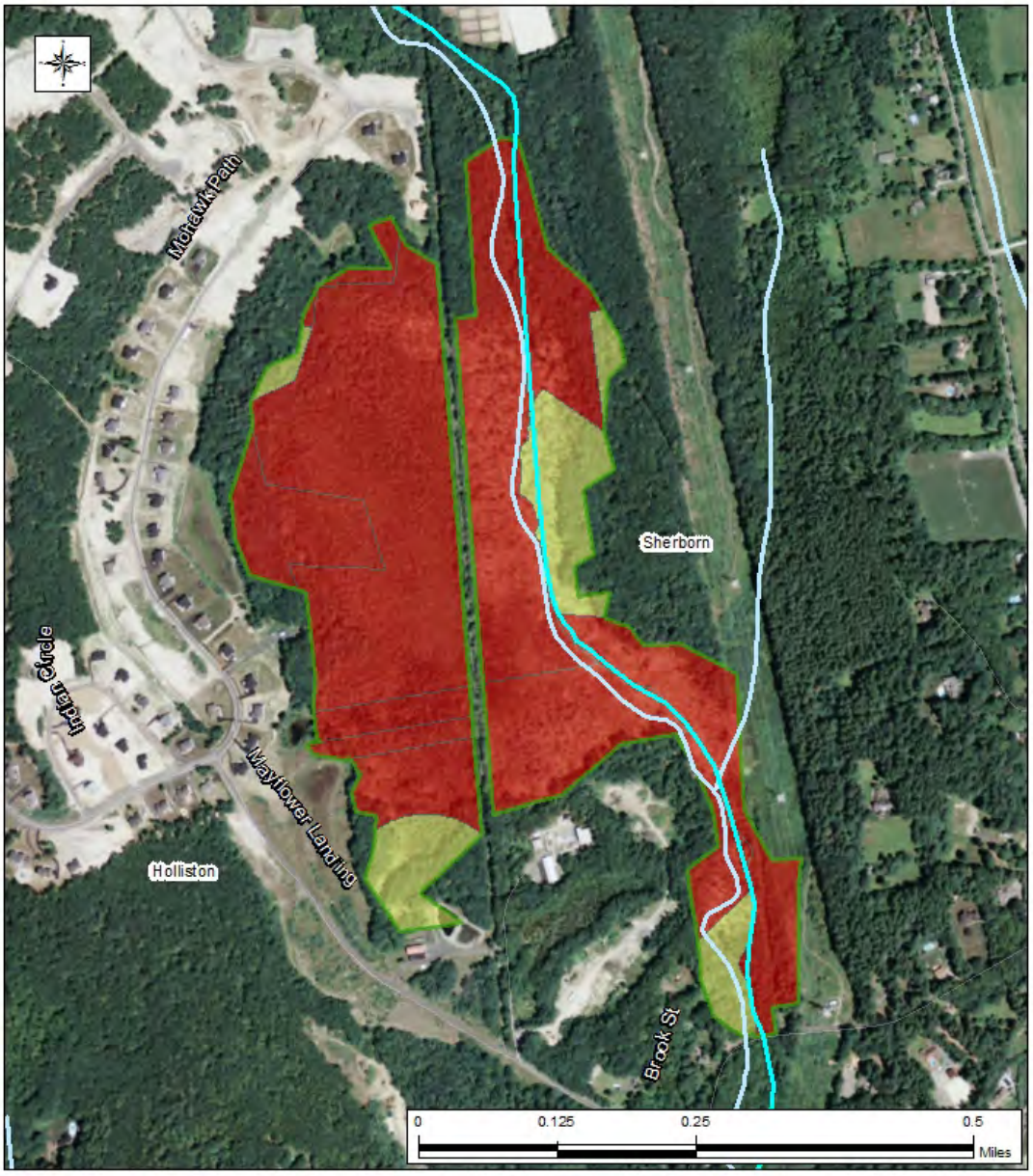
CRNVSA
Area I
Segment 30
U.S. Army Corps of Engineers
New England District

January 2017

5.17 *Area J*

Area J is located in the towns of Holliston and Sherborn, and consists of 95.41 acres in Fee and 15.02 acres of Easement. This area protects a wooded wetland along Dopping Brook, a tributary of the Charles River. There are no developed recreation facilities or trails in this area, though the abandoned railroad bed that bisects the area is planned by the town for development into a multi-use trail, part of the Upper Charles River Rail Trail. The rail bed is surrounded by, but does not cross over, any project lands.

Management of fee parcels is directly by the Corps of Engineers. One small area on the west side is designated a restricted area, and has been licensed to the town of Holliston for a public water supply well. This area is fenced off and marked. Hunting is not allowed on this section due to local by-laws and the closeness of abutting homes to the west of the area.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 31
- Fee Tracts
- Easement Tracts
- Towns
- Hydrology

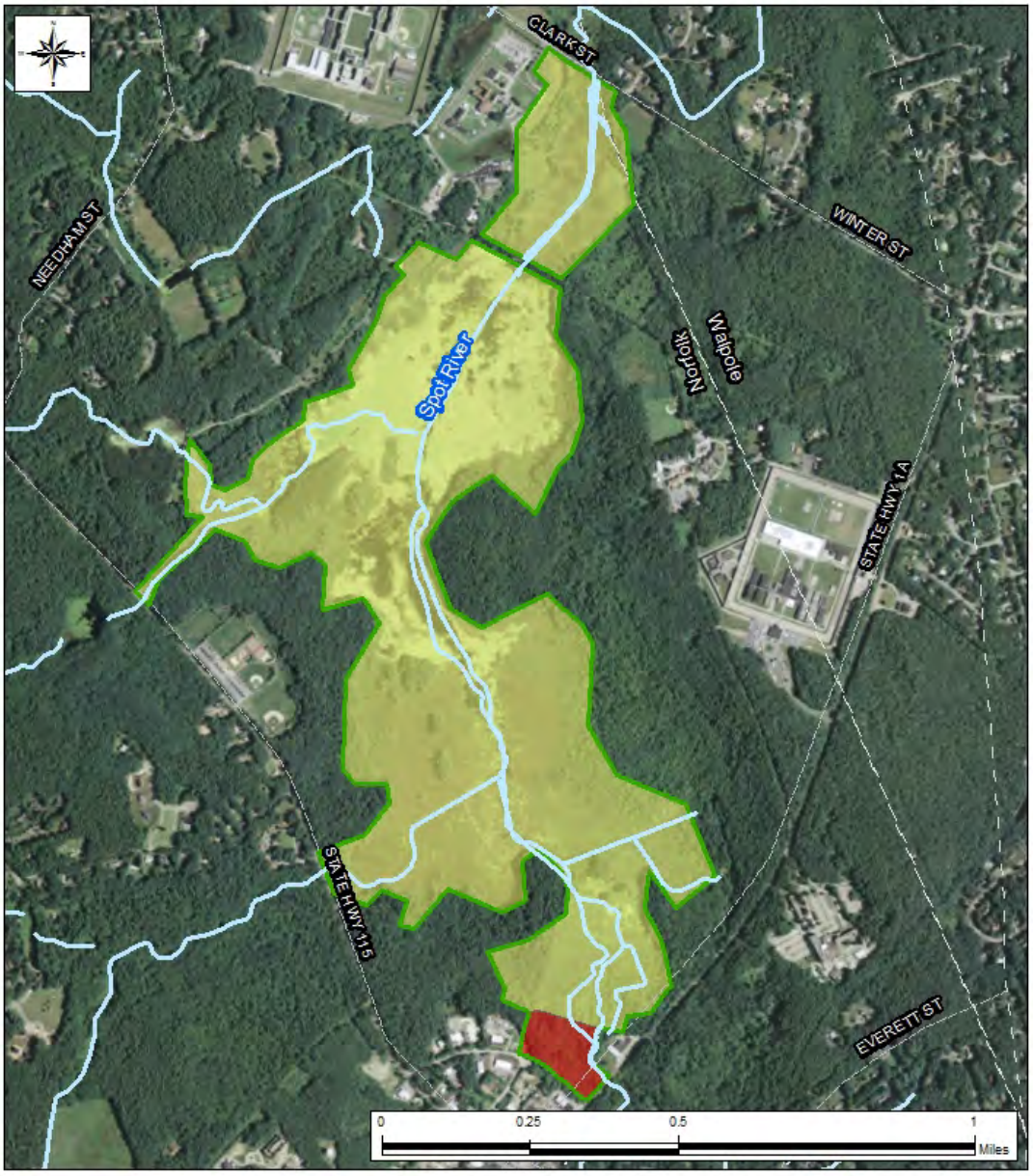
Figure 12

CRNVSA
Area J
Segment 31
U.S. Army Corps of Engineers
New England District

January 2017

5.18 *Area K*

Area K is located in the towns of Norfolk and Walpole and consists of only 8.44 acres in Fee and 355.77 acres of Easement. The small fee parcel is mostly thick wetland with limited access. The easement lands are owned by the Massachusetts Department of Corrections as part of the property surrounding the Walpole and Cedar Junction prison complex. As such public access to the easement land is restricted. Hunting is not permitted due to the close abutting developments to the fee parcel, which is managed directly by the Corps of Engineers. This area protects the large wetlands along the Stop River, a major tributary of the Charles River.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 10
- Fee Tracts
- Easement Tracts
- Towns
- Hydrography

Figure 13

CRNVSA
Area K
Segment 10
U.S. Army Corps of Engineers
New England District

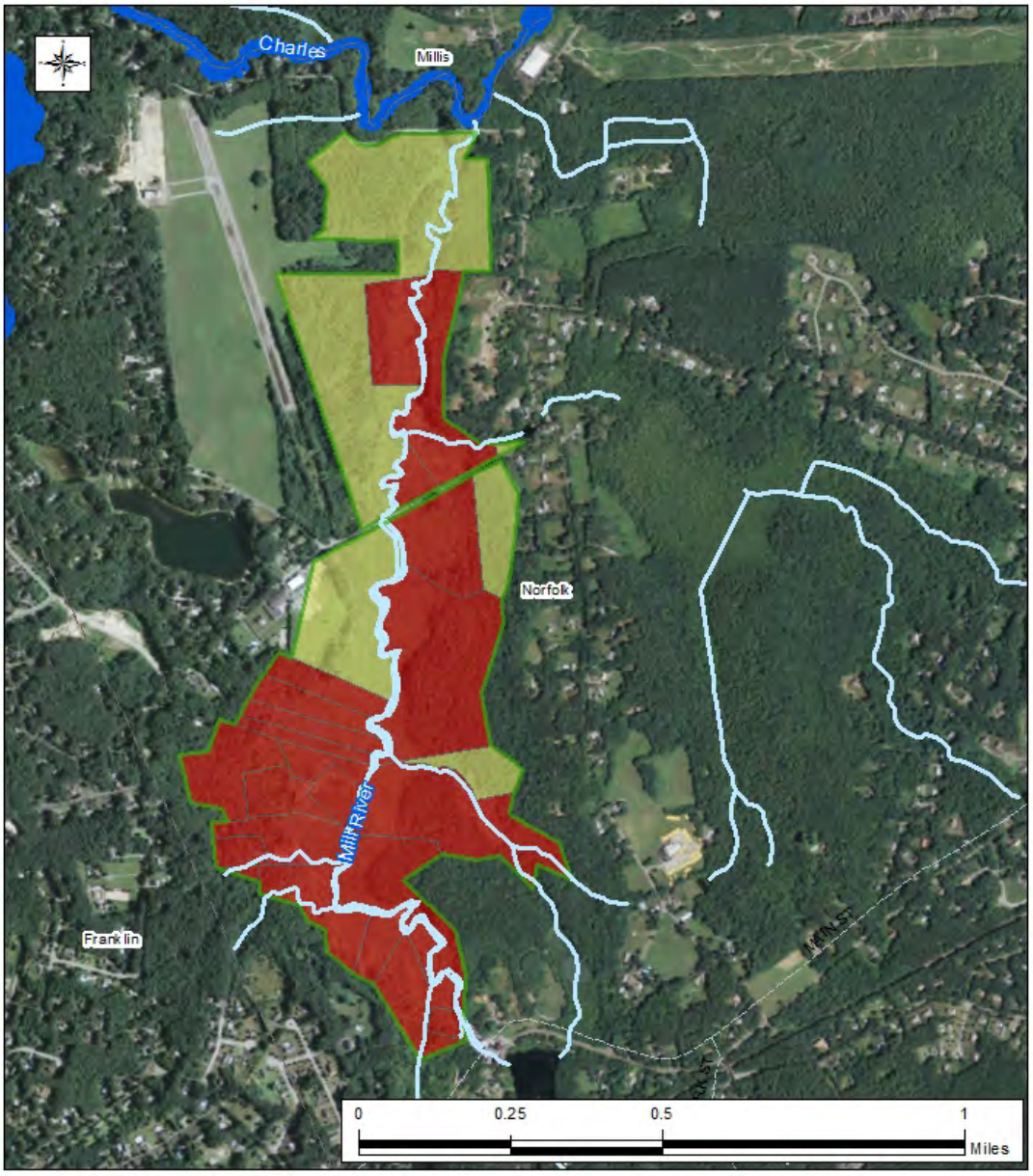
January 2017

5.19 *Area L*

Area L is located in the town of Norfolk, and consists of 185.52 acres in Fee and 114.10 acres of Easement. It protects the wetlands along the Mill River, just above its confluence with the Charles River.

The Fee area is located in one large parcel, bisected by Miller Street which provides good public access and has an informal parking area just west of the Mill River Bridge. No formal trails or recreation facilities have been developed due to the wet conditions found on most of the area. The state stocks the Mill River in this area with trout during spring season.

The fee tracts are under license to the Massachusetts Department of Fish and Wildlife, who are responsible for management of the fish and wildlife resources of the area and for resolution of all encroachment and trespass issues. Hunting is permitted on the fee tracts, in accordance with all state regulations. The Corps remains responsible for boundary line marking and other issues not related to fish and wildlife.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 11
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrology

Figure 14

CRNVSA
Area L
Segment 11
U.S. Army Corps of Engineers
New England District

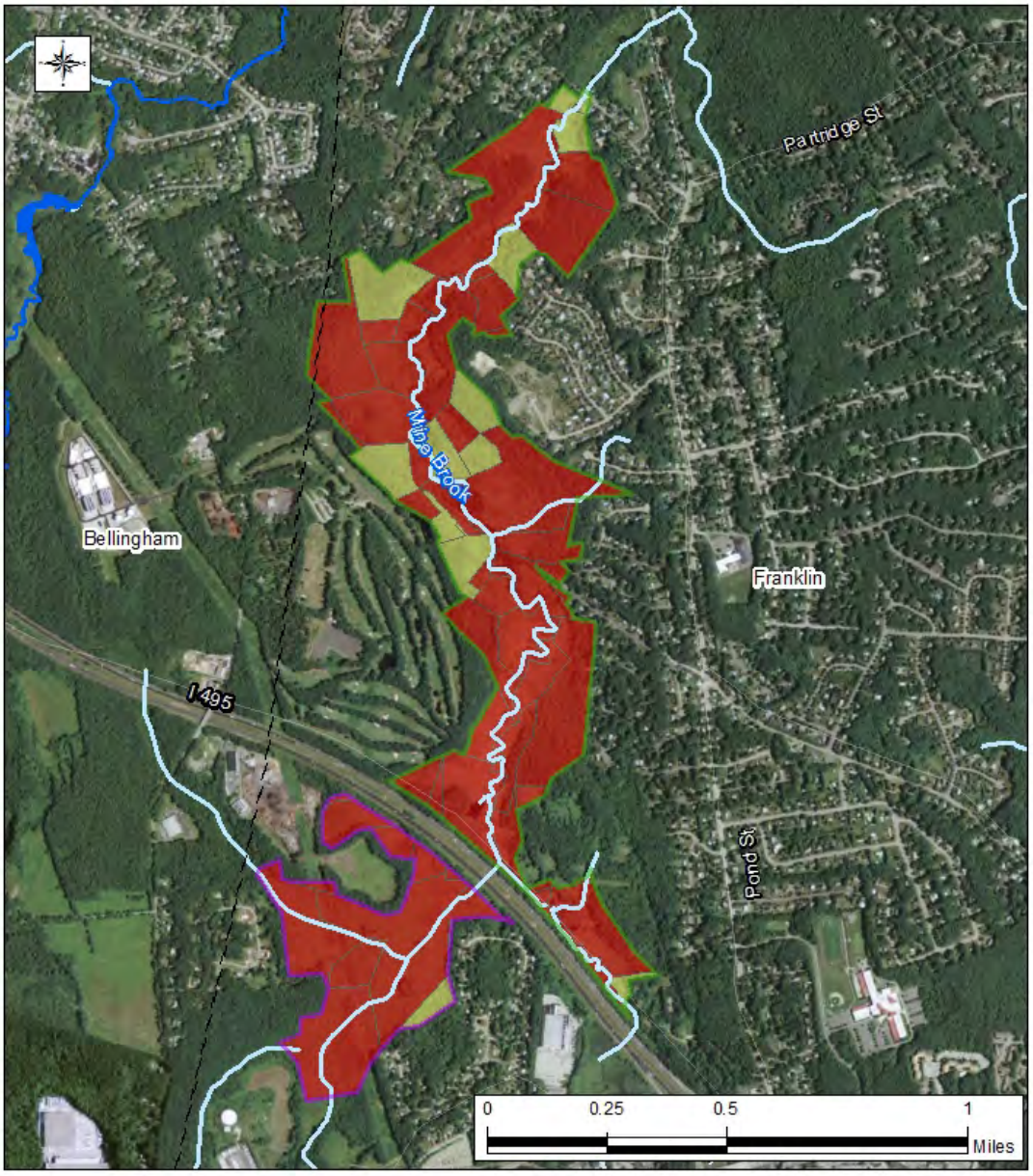
January 2017

5.20 *Area M*

Area M is located in the town of Franklin, and consists of 338.58 acres of Fee and 49.89 acres of Easement. This area protects a series of wetlands along Mine Brook.

The majority of this area is owned by the Corps in fee and has several access points. Though no formal trails or recreation facilities have been developed, there are numerous informal trails that cross some upland parts of this area. One area along the north side of Interstate 495 has numerous trails, many of which were created by illegal off-road vehicle activity entering the area from abutting town owned property. Access to this area is from Pond Street, via a gated dirt road that led to a now abandoned sewer department facility. Coordination with the town for control of this illegal vehicle use is ongoing, with the town installing barriers on their land where necessary. Public access is also available from the end of Oak Street Extension, where the abandoned road right of way enters Corps property. This access is not frequently used due to the wet nature of the property in that area.

The fee tracts are under license to the Massachusetts Department of Fish and Wildlife, who are responsible for management of the fish and wildlife resources of the area and for resolution of all encroachment and trespass issues. Hunting is permitted on the fee tracts, in accordance with all state regulations. The Corps remains responsible for boundary line marking and other issues not related to fish and wildlife.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 19
- Segment 20
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrology

Figure 15

CRNVSA
Area M
Segment 19, 20
U.S. Army Corps of Engineers
New England District

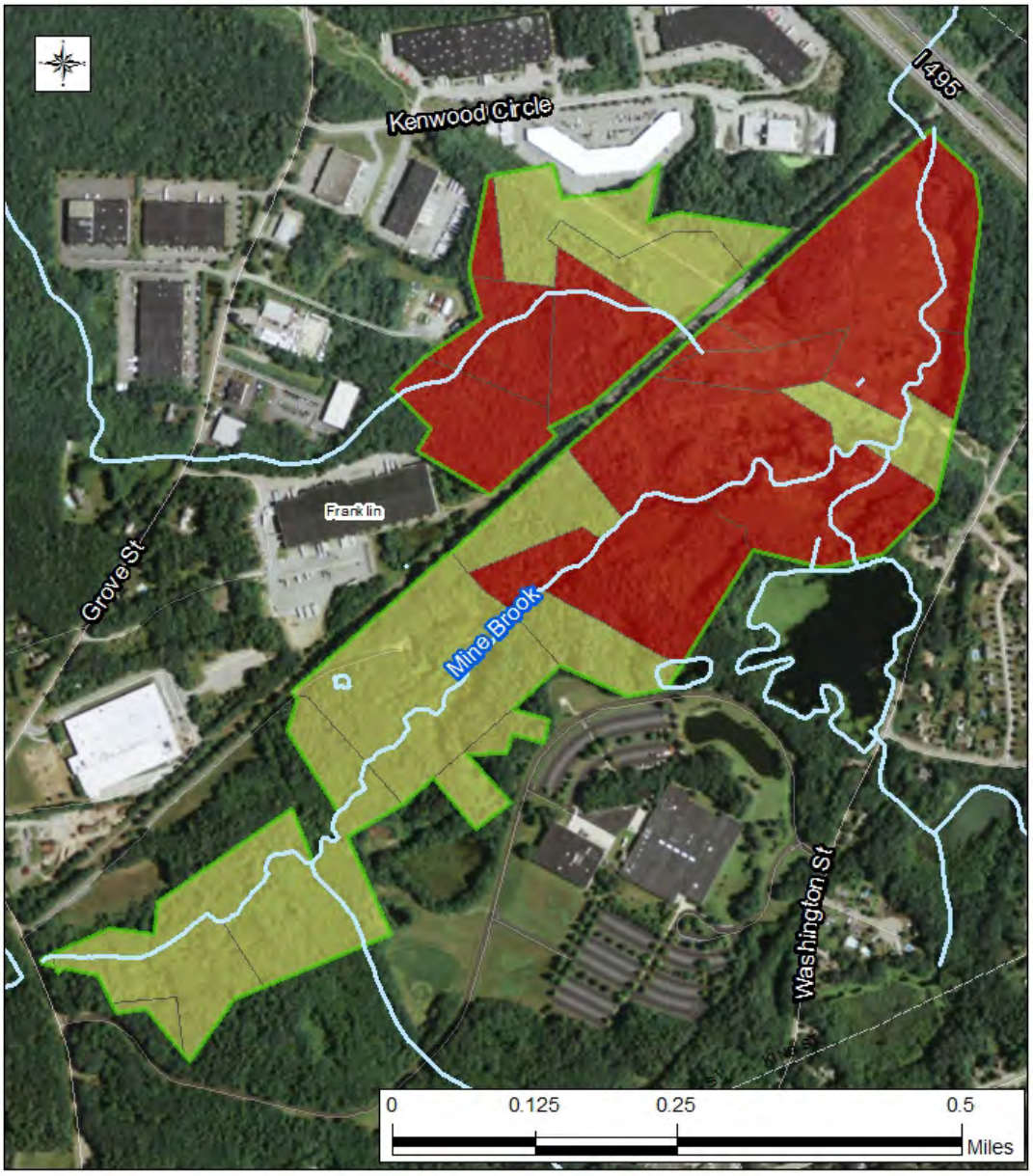
January 2017

5.21 *Area N*

Area N is located in the town of Franklin and consists of 78.96 acres of Fee and 57.07 acres in Easement. It protects a wetland area at the confluence of Mine Brook and Dix Brook.

There are no developed recreation facilities or trails in this area, which is surrounded by an industrial park and is bisected by an active freight railroad line. Public access to the fee areas is limited but can be made from Washington Street.

The fee tracts are under license to the Massachusetts Department of Fish and Wildlife, who are responsible for management of the fish and wildlife resources of the area and for resolution of all encroachment and trespass issues. Hunting is permitted on the fee tracts, in accordance with all state regulations. Dix Brook, just upstream of this area, is stocked with trout in the spring fishing season. The Corps remains responsible for boundary line marking and other issues not related to fish and wildlife.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 21
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrography

Figure 16

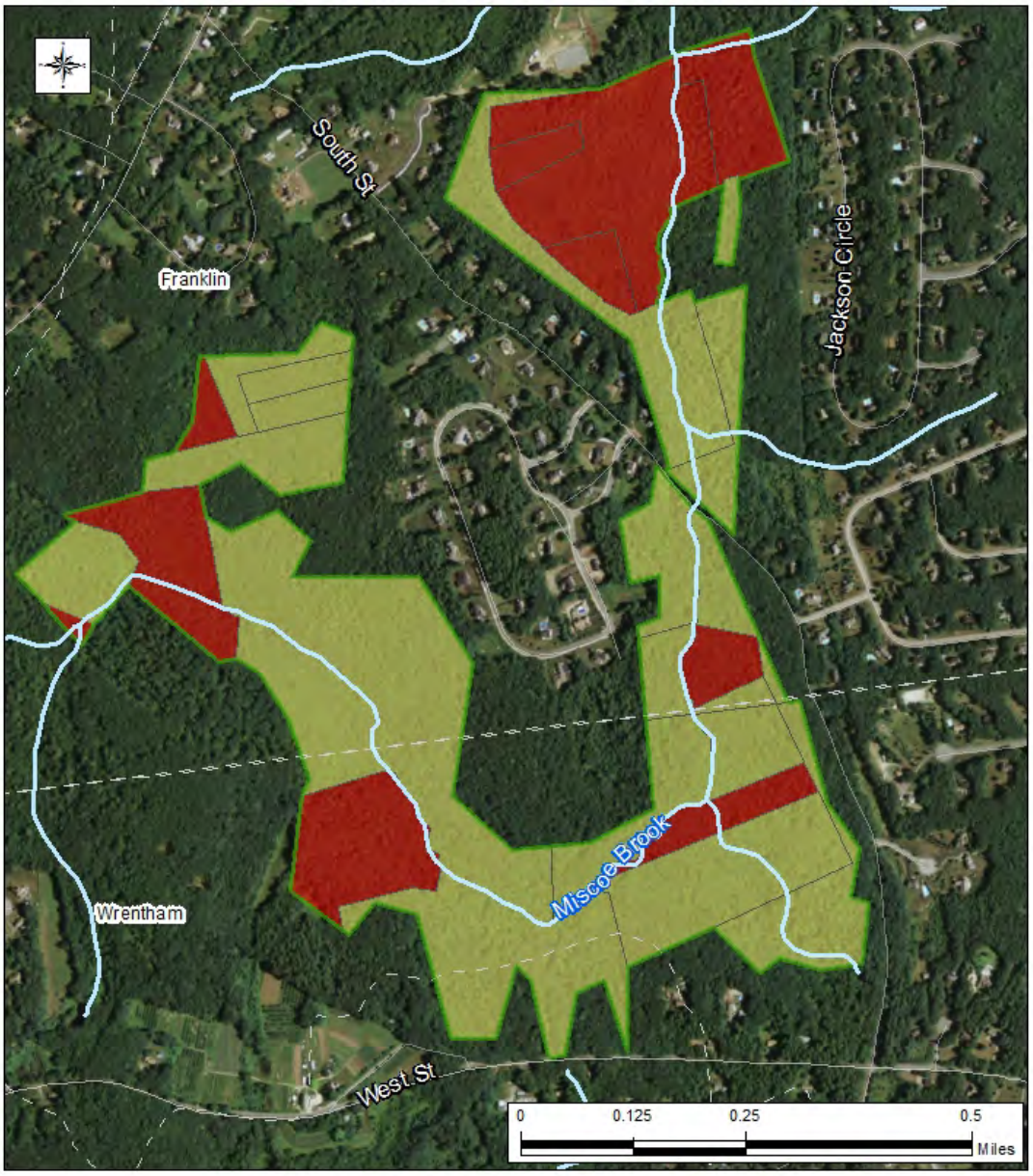
CRNVSA
Area N
Segment 21
U.S. Army Corps of Engineers
New England District

January 2017

5.22 *Area O*

Area O is located in the towns of Franklin and Wrentham, and consists of 70.29 acres of Fee and 158.25 acres in Easement, much of which is owned by the state as part of Franklin State Forest. This area protects wooded wetlands along Miscoe Brook. There are no developed trails or recreation facilities in this area. Access to the one large fee tract is through adjacent state forest lands. The remaining fee areas are small and scattered with little public access.

The fee tracts are under license to the Massachusetts Department of Fish and Wildlife, who are responsible for management of the fish and wildlife resources of the area and for resolution of all encroachment and trespass issues. Hunting is permitted on the fee tracts, in accordance with all state regulations. Miscoe Brook in this area is stocked with trout during spring fishing season. The Corps remains responsible for boundary line marking and other issues not related to fish and wildlife.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 22
- Fee Tracts
- Easement Tracts
- Towns
- Hydrology

Figure 17

CRNVSA
Area O
Segment 22
U.S. Army Corps of Engineers
New England District

January 2017

5.23 *Area P*

Area P is located in the towns of Holliston and Medway, and consists of 266.58 acres in Fee and 242.75 acres of Easement. It protects the extensive wetlands along Hopping Brook, a tributary of the Charles River.

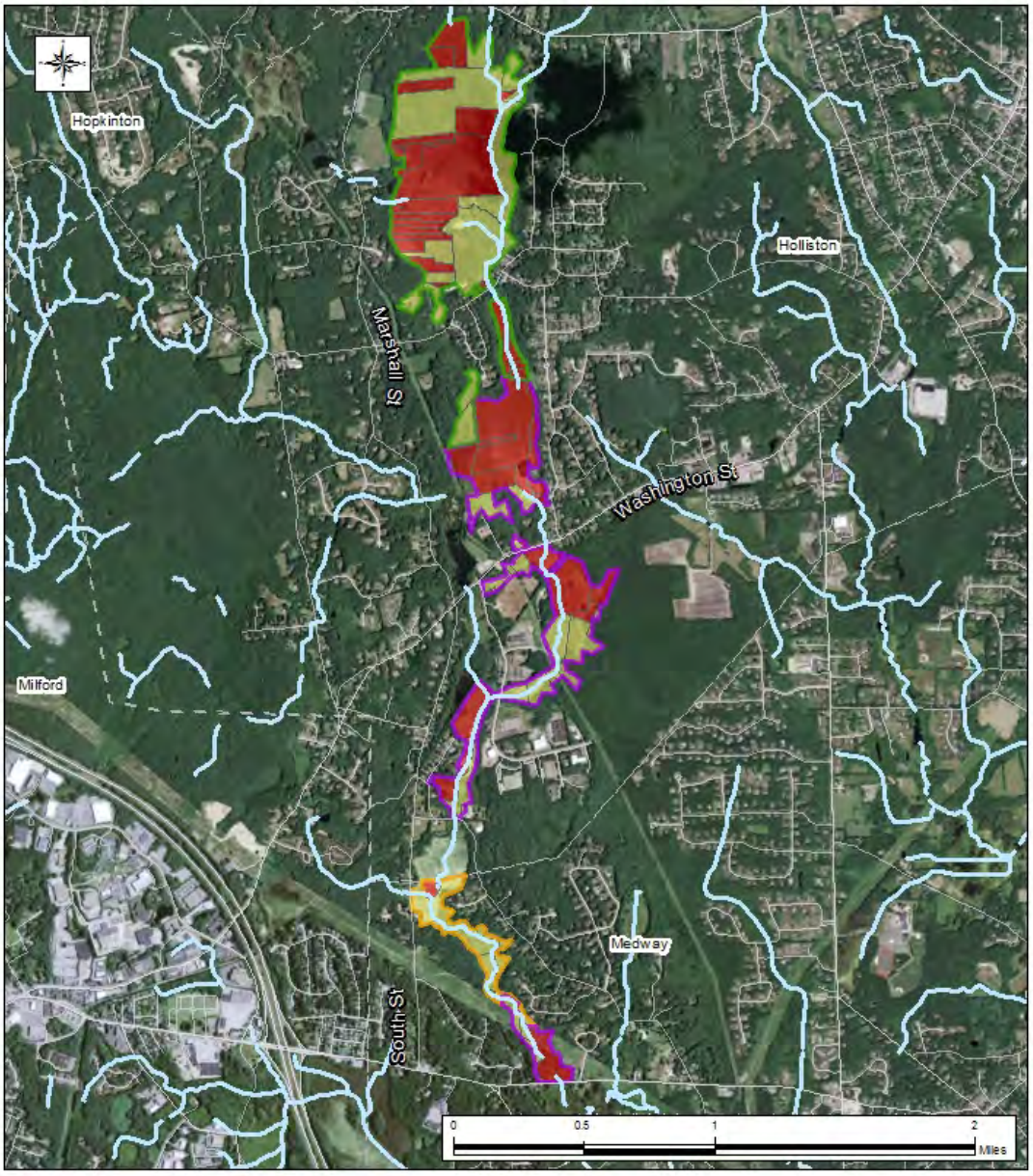
There is a developed trail system located on Fee and Easement land at the north end of the area, north of Gorwin Drive. These trails are maintained by the town of Holliston and the easement tracts are on town owned land known as the Brentwood Conservation Area. These trails start from a gated trailhead on Gorwin Drive and loop through the area, accessing now-flooded cedar swamp and eventually to an upland area home to numerous old-growth beech trees.

South of Gorwin Drive, the fee areas are very wet and surrounded by private property, offering only limited public access. The abandoned railroad bed that crosses the area south of Route 16 is planned for development of a multi-use trail, to be part of the Upper Charles Rail Trail. This trail, to be maintained by the town, will offer great views of, but will not cross onto, project lands.

Weston Pond Recreation Area, managed by the town of Holliston, a popular ice skating area, is located adjacent to project easement.

The fee tracts south of Gorwin Drive are under license to the Massachusetts Department of Fish and Wildlife, who are responsible for management of the fish and wildlife resources of the area and for resolution of all encroachment and trespass issues. Hunting is permitted on the fee tracts, in accordance with all state regulations. Hopping Brook in Medway, near the southern part of this area, is stocked with trout in spring fishing season. The Corps remains responsible for boundary line marking and other issues not related to fish and wildlife.

Fee tracts north of Gorwin Drive are currently managed directly by the Corps of Engineers and hunting is not permitted in this area in accordance with town conservation land rules. In the future, management of this area by the town under a license should be considered, to provide uniform management with the existing town conservation lands that are intermingled with Corps' fee tracts.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 23
- Segment 24
- Segment 25
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrology

Figure 18

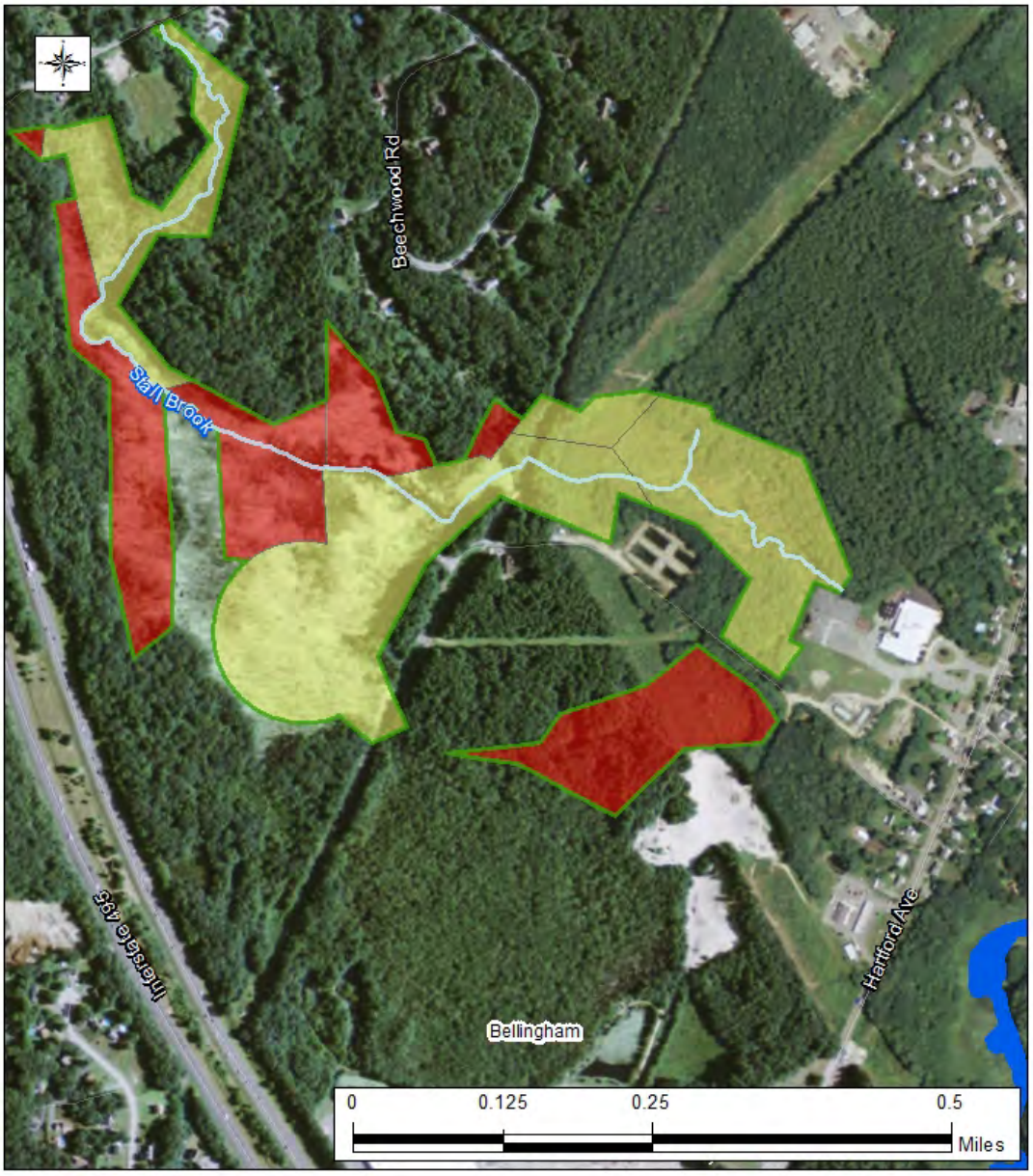
CRNVSA
Area P
Segment 23, 24, 25
U.S. Army Corps of Engineers
New England District

January 2017

5.24 *Area R*

Area R is located in the town of Bellingham and is the smallest of the NVS areas, consisting of 30.34 acres in fee and 49.41 acres in Easement. It protects a wetland along Stall Brook. The fee tracts are small and scattered with little public access, and much of the easement lands are owned by the town as part of their drinking water supply wellhead area, with restricted public use. No developed trails or recreation facilities are in this area.

The fee tracts are under license to the Massachusetts Department of Fish and Wildlife, who are responsible for management of the fish and wildlife resources of the area and for resolution of all encroachment and trespass issues. Hunting is permitted on the fee tracts, in accordance with all state regulations. Stall Brook, near this area, is stocked with trout during spring fishing season. The Corps remains responsible for boundary line marking and other issues not related to fish and wildlife.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 26
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrography

Figure 19

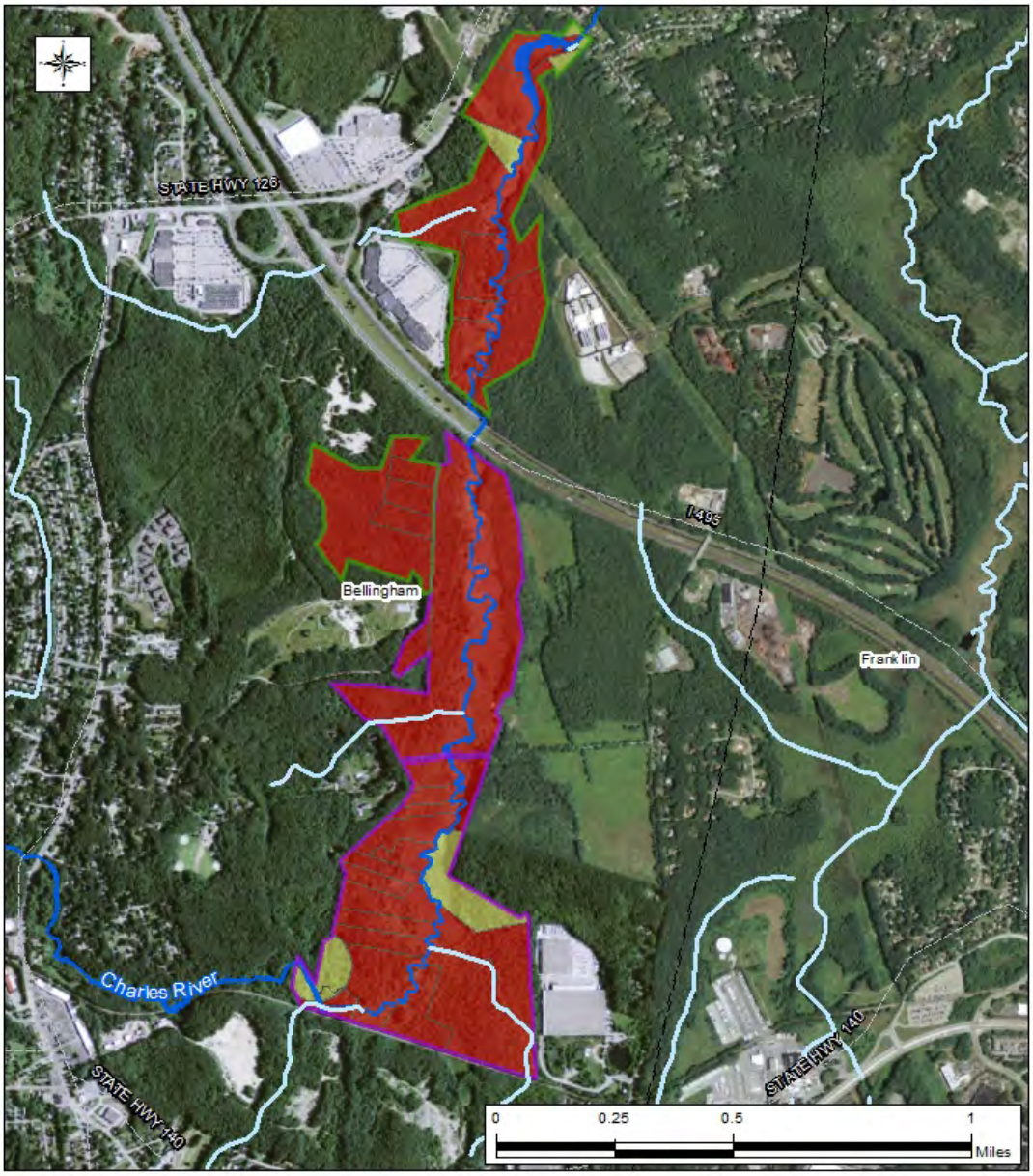
CRNVSA
Area R
Segment 26
U.S. Army Corps of Engineers
New England District

January 2017

5.25 *Area S*

Area S is located in the town of Bellingham and consists of 310.59 acres of Fee and 22.78 acres in Easement. This area protects the wetlands along the main stem of the Charles River, upstream of the North Bellingham Dam. The fee owned tracts form one large block, bisected by Interstate 495 and High Street. The surrounding land is mostly private property, or restricted water department well property, granting little public access to most areas. Some public access to the southern sections is available off High Street, where there is informal parking on the road shoulder.

The fee tracts are under license to the Massachusetts Department of Fish and Wildlife, who are responsible for management of the fish and wildlife resources of the area and for resolution of all encroachment and trespass issues. Hunting is permitted on the fee tracts, in accordance with all state regulations. The Corps remains responsible for boundary line marking and other issues not related to fish and wildlife.



U.S. Army Corps of Engineers®
New England District

Legend

- Segment 27
- Segment 28
- Fee Tracts
- Easement Tracts
- Towns
- Charles River
- Hydrology

Figure 20

CRNVSA
Area S
Segment 27, 28
U.S. Army Corps of Engineers
New England District

January 2017

6. SPECIAL TOPICS / ISSUES/ CONSIDERATIONS

6.1 Partnerships with other agencies

The Corps works closely with the Massachusetts Department of Fish and Wildlife, who has a license to manage the fee owned properties on many of the project areas. Under this license, the state is responsible for managing the fish and wildlife resources of the project, including all hunting, fishing, and trapping activities, as well as habitat management. They are also primarily responsible for the resolution of trespass and encroachment issues. This license has been in place, in various forms, since 1979 and is reviewed and renewed every 5 years.

The Corps has also partnered with the Massachusetts Public Access Board for the improvements to the Forest Street canoe launch site in Millis, which were completed in 2005. Another partnership, with the Fin Fur and Feather Club, provides for the day to day maintenance of the launch area. This is through a real estate license, where the club's work on the launch is in lieu of cash payment for the license to use some acreage on Area G abutting their private land for a hunting range. This agreement is also reviewed and renewed every 5 years.

7. AGENCY AND PUBLIC COORDINATION

Coordination with elected officials, other agencies, and the public was conducted as part of the planning process. This insured that the Master Plan provided the best response to local and regional needs, project resource capabilities, suitabilities and expressed public desires. Public coordination was initiated with the issuance of a Public Notice and a News Release on March 22, 2017 and letters to local town leaders on March 22, 2017. These documents announced the initiation of the study and solicited input.

8. SUMMARY OF RECOMMENDATIONS

It is recommended that the Charles River Natural Valley Storage Area Master Plan be approved as a guide to the orderly use and development of natural and man-made resources at the project. Approval of this master plan would rescind Design Memorandum No. 4; Master Plan for Recreation Resources Development, dated June 1984.

This master plan provides guidance for future development at Charles River Natural Valley Storage Area. The natural and man-made resources at the project will continue to be managed by the New England District to provide the best combination of responses to regional and ecosystem needs, project resource capabilities, and public desires consistent with the project's authorized flood control purpose.

Natural and man-made resources have been identified and analyzed. This included wetlands, exemplary natural communities and cultural resources which require specific management efforts for their protection. Recreational opportunities were identified through an analysis of regional needs and expressed public desires.

Through land use classification, the master plan has designated areas for project operations, recreation, environmental protection, and multiple resource management. All specific proposals for recreational or other development at the project must comply with this master plan, the Thames River Basin flood risk reduction requirements, and the National Environmental Policy Act and other Federal requirements.

9. BIBLIOGRAPHY / REFERENCES

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http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml#none

Renski et al. (2015)
UMass Donahue Institute Vintage 2015 Population Projections, March 2015

State of Massachusetts Charles River Basin Master Plan (2017 Commonwealth of Massachusetts)
http://www.mass.gov/eea/agencies/dcr/conservation/planning-and-resource-protection/charles-river-basin-master-plan.html

United States Census Bureau (January 2016)
https://www.census.gov/did/www/saipe/data/statecounty/data/2010.html

United States Census Bureau (January 2016)
http://quickfacts.census.gov/qfd/states/25000.html

United States Department of Agriculture Economic Research Service (January 2016)
http://www.ers.usda.gov/data-products/county-level-data-sets/education.aspx

APPENDIX/TABLES

Table 1 ***Population Estimates and Projections by Town***

COUNTY	TOWN	YEAR 2010	2015	2020	2025	2030	2035	% CHANGE 2010-2035
Middlesex								
	Arlington	42,844	45,049	46,482	47,625	48,849	49,988	17%
	Ashland	16,593	18,313	19,408	20,549	21,669	22,768	37%
	Belmont	24,729	26,162	27,342	28,305	29,276	30,345	23%
	Cambridge	105,162	107,855	110,644	113,718	116,422	118,853	13%
	Holliston	13,547	13,675	13,283	12,937	12,524	12,026	-11%
	Hopkinton	14,925	15,644	15,870	16,526	17,512	18,530	24%
	Lexington	31,394	32,738	33,595	34,293	35,423	36,943	18%
	Lincoln	6,362	9,390	9,786	10,033	10,253	10,400	63%
	Natick	33,006	34,638	34,823	35,020	35,171	35,325	7%
	Newton	85,146	88,215	91,144	92,790	92,541	92,298	8%
	Sherborn	4,119	4,115	3,985	3,876	3,814	3,724	-10%
	Somerville	75,754	76,224	75,534	74,221	72,502	70,729	-7%
	Waltham	60,632	63,376	66,354	69,608	72,228	73,660	21%
	Watertown	31,915	32,792	33,362	33,904	34,181	34,010	7%
	Wayland	12,994	13,032	12,658	12,447	12,326	12,213	-6%
	Weston	11,261	11,213	10,811	10,192	9,770	9,705	-14%
Norfolk								
	Bellingham	16,332	17,537	18,128	18,652	18,959	19,179	17%
	Brookline	58,732	61,826	65,347	69,645	73,413	75,636	29%
	Dedham	24,729	26,707	28,537	30,183	31,578	32,596	32%
	Dover	5,589	5,664	5,671	5,642	5,628	5,554	-1%
	Foxborough	16,865	17,810	18,059	18,417	18,717	18,870	12%
	Franklin	31,635	33,151	33,490	34,203	35,024	35,775	13%
	Medfield	12,024	11,688	10,954	10,515	10,304	10,150	-16%
	Medway	12,752	13,153	13,146	13,312	13,502	13,526	6%
	Millis	7,891	8,075	7,924	7,780	7,566	7,239	-8%
	Needham	28,886	29,628	29,610	28,974	28,539	28,674	-1%
	Norfolk	11,227	11,984	12,398	12,905	13,298	13,456	20%
	Walpole	24,070	25,512	25,993	26,594	27,218	27,776	15%
	Wellesley	27,982	28,844	29,647	29,323	28,340	28,420	2%
	Westwood	14,618	14,865	14,488	14,276	14,377	14,655	0%
	Wrentham	10,955	11,359	11,378	11,505	11,677	11,775	7%
Suffolk								
	Boston	617,594	651,624	688,212	724,166	752,196	772,503	25%
Worcester								
	Hopedale	5,911	6,144	6,168	6,242	6,317	6,338	7%
	Mendon	5,839	6,295	6,527	6,794	7,063	7,277	25%
	Milford	27,999	30,061	30,896	31,781	32,434	32,967	18%
	TOTAL	1,532,013	1,604,358	1,661,654	1,716,953	1,760,611	1,793,883	17%

Source: UMass Donahue Institute Vintage 2015 Population Projections, March 2015

Table 2 *Estimated Population Distribution 2010-2014*

	Estimated % of Population 2010-2014				
	Middlesex County	Norfolk County	Suffolk County	Worcester County	Massachusetts
Under 5 years	5.60%	5.50%	5.60%	5.70%	5.50%
5 to 9 years	5.70%	6.20%	4.60%	6.00%	5.70%
10 to 14 years	5.80%	6.50%	4.40%	6.70%	6.00%
15 to 19 years	6.60%	6.60%	7.30%	7.30%	7.00%
20 to 24 years	6.70%	5.80%	11.60%	6.80%	7.30%
25 to 34 years	15.00%	12.20%	21.60%	12.00%	13.40%
35 to 44 years	13.60%	13.20%	12.80%	13.30%	12.90%
45 to 54 years	15.10%	15.90%	11.70%	16.10%	15.10%
55 to 59 years	6.70%	7.20%	5.20%	7.20%	6.90%
60 to 64 years	5.60%	5.90%	4.60%	5.60%	5.90%
65 to 74 years	7.10%	7.70%	5.80%	7.10%	7.60%
75 to 84 years	4.30%	4.80%	3.30%	4.00%	4.50%
85 yrs and over	2.10%	2.50%	1.60%	2.20%	2.30%
SUM	100%	100%	100%	100%	100%

Source: http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml#none

Table 3 *Level of Education by County and Massachusetts*

	2009-2013			
	College Degree	Some College	High School Only	Less than High School
Middlesex	50.7%	19.8%	21.6%	7.9%
Norfolk	49.2%	22.8%	21.7%	6.3%
Suffolk	40.4%	19.3%	24.3%	16.1%
Worcester	33.8%	27.0%	28.5%	10.6%
Massachusetts	39.4%	24.2%	25.8%	10.6%

Source: http://www.ers.usda.gov/data-products/county-level-data-sets/education.aspx

Table 4 *Households by County of Interest and Massachusetts*

	2009-2013				
County	Middlesex	Norfolk	Suffolk	Worcester	Massachusetts
Households	581,120	257,451	288,240	299,663	2,530,147
Persons per Household	2.52	2.56	2.39	2.59	2.51

Source: http://quickfacts.census.gov/qfd/states/25000.html

Table 5 *Median Income of Selected counties and Massachusetts*

	Median Income	Percent Above or Below State Average
Middlesex County	$ 75,364	+21%
Norfolk County	$ 79,899	+29%
Suffolk County	$ 49,584	-2-%
Worcester County	$ 61,079	-2%
Massachusetts	$ 62,133	

Source: https://www.census.gov/did/www/saipe/data/statecounty/data/2010.html

Table 6 *Recreation Benefits based on Unit Day Value*

UDV CRITERIA	POINT RANGE	Project POINTS
Recreation Experience	0 - 30	23
Availability of Opportunity	0 - 18	10
Carrying Capacity	0 - 14	11
Accessibility	0 - 18	9
Environmental Aesthetic	0 - 20	10
Total Points		63
$ Value/User/Day		$9.18

TABLE 7 ***Regional Recreation Facilities within 25 mile radius of the Charles River Natural Valley Storage Area.***

Area	Boating	Camping	Fishing	Hiking	Hunting	Picnicking	Ski-touring	Snowmobilin	Swimming
STATE									
Charles River Reservation	**X**		**X**	**X**		**X**			**X**
Hopkinton State Park	**X**		**X**	**X**	**X**	**X**	**X**		**X**
Ashland State Park	**X**		**X**	**X**		**X**			**X**

APPENDIX A

Application of Public Laws

The following laws and regulations provide for the development and management of Federal projects:

1. Historic Sites, Buildings and Antiquities Act of 1935 (16 U.S.C. 461-467). Known as the Historic Sites Act, this Act declared it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provides for designation, acquisition, administration and protection of such sites. (Additionally, National Historic Landmarks are designated under authority of this Act.)

2. Public Law 78-534 (The Flood Control Act of 1944), as amended by the Flood Control Acts of 1946, 1954, 1960 and 1962, authorizes the Corps of Engineers to construct, operate and maintain public park and recreation facilities at water resource development projects, and to permit local interests to construct, operate and maintain such facilities.

3. Public Law 85-624 (The Fish and Wildlife Coordination Act) requires that the Corps of Engineers and any agency impounding, diverting, or controlling water, consult with the United States Department of the Interior, Fish and Wildlife Service. The Department of the Interior would evaluate proposed water resources development measures, and determine potential impacts to wildlife resources and measures needed to prevent such impacts.

4. Public Law 86-717 (Forest Cover Act, 6 September 1960) provides a statutory mandate for multiple use forest management, or other vegetative cover management, on project lands and waters.

5. Public Law-72 (The Federal Water Project Recreation Act of 1965), accompanied by House Committee Report No. 254, requires that the Corps of Engineers and other Federal agencies give full consideration to fish and wildlife enhancement. It also provides for non-Federal participation in land acquisition, and in the development and management of recreational facilities and fish and wildlife resources.

6. Public Law-190 (The National Environmental Policy Act of 1969), directs the Corps of Engineers and other Federal agencies to prepare environmental impact statements or assessments that describe the environmental effects of proposed projects and measures necessary to minimize any adverse effects.

7. Public Law 91-604 (The Clean Air Act, as amended), specifies that any Federal activity, which may result in discharge of air pollutants, comply with Federal, state, interstate, and local requirements concerning control and abatement of air pollution.

8. Public Law 03-205 (The Endangered Species Act of 1973, as amended) requires Federal agencies to utilize their authorities to carry out programs for conservation of endangered and threatened species protected by the Act.

9. Executive Order 11990 (Protection of Wetlands, 24 May 1977) requires that all Federal agencies take action to minimize destruction, loss or degradation of wetlands. It stipulates that Federal agencies must avoid providing assistance for new construction located in wetlands unless no practicable alternatives exist, and the proposed action includes measures to minimize harm to wetlands.

10. Public Law 95-217 (Clean Water Act of 1977, as amended). Section 404 imposes requirements with respect to dredge and fill activities in waterways of the United States, including wetlands. Any fill activities in wetlands must comply with Section 404(b) (1), Guidelines for the Specification of Disposal Sites for Dredge or Fill Material. These guidelines allow fill activities for only the least environmentally damaging practicable alternative.

11. Public Law 96-95 (Archaeological Resources Protection Act of 1979 - RPA). This statute provides protection for archaeological resources by requiring any interested parties to apply for a permit from the controlling Federal agency to excavate, or remove any archaeological resource located on public or Indian lands. The Act also provides for civil and criminal penalties for individuals disturbing or looting sites (including military personnel that allow such actions).

12. National Register of Historic Places, Nominations by States and Federal Agencies (36 CFR 60). These regulations govern the process whereby State and Federal agencies nominate specific resources under their control to the National Register of Historic Places. This is the country's basic inventory of historic resources and it is maintained by the Secretary of the Interior. This inventory includes buildings, structures, objects, sites, districts, and archaeological resources that may be significant at the national, state or local level.

13. Advisory Council on Historic Preservation, Protection of Historic Properties (36 CFR 800). These are the implementing regulations which govern the Section 106 review process established by the National Historic Preservation Act of 1966, as amended for Federal agencies. These regulations implement procedures for assessing the effects of federally approved, assisted, or funded undertakings on properties which are, or may be eligible for listing on the National Register of Historic Places.

APPENDIX B

U.S. Army Corps of Engineers Guidance
The Master Plan has been prepared in accordance with guidance contained in the following U.S. Army Corps of Engineers regulations, pamphlets, and manual:

ER 1130-2-500 Project Operations, Partners and Support, Work Management Policies

ER 1130-2-540 Environmental Stewardship, Operations and Maintenance Policies

ER 1130-2-550 Recreation, Operations and Maintenance Policies

ER 1165-2-400 Recreation Planning, Development and Management Policies

EP 1130-2-500 Project Operations, Partners and Support, Work Management Guidance and Procedures

EP 1130-2-540 Environmental Stewardship, Operations and Maintenance Guidance and Procedures

EP 1130-2-550 Recreation, Operations and Maintenance Guidance and Procedures

EM 1110-1-400 Recreation Planning and Design Criteria

APPENDIX C