
CHAPTER 3

Affected Environment

This chapter describes the existing environmental conditions in those areas with potential to be affected by the Proposed Action. **Section 3.2** describes the General Study Area (GSA) delineated for purposes of identifying potential environmental impacts. **Section 3.3** lists those environmental resource categories unlikely to be affected by the Proposed Action. Lastly, **Section 3.4** describes the baseline conditions of the natural and human environment with potential to be impacted by the Proposed Action.

3.1 General Study Area

The GSA was delineated following a combination of physical and political geographic boundaries adhering to the general area in which aviation activities related to the proposed project could reasonably be anticipated to affect the surrounding environs. This area was determined using procedure flyability lines, flight corridors, and other indicators of potential overflights. The following sub-sections describe the setting and location where the Proposed Action could potentially have an impact. This GSA will be used as the area of potential impact for each of the impact categories in the report below with the lone exception being the historic resources analysis, which is discussed in detail in **Section 3.4.5**.

3.1.1 Setting and Location

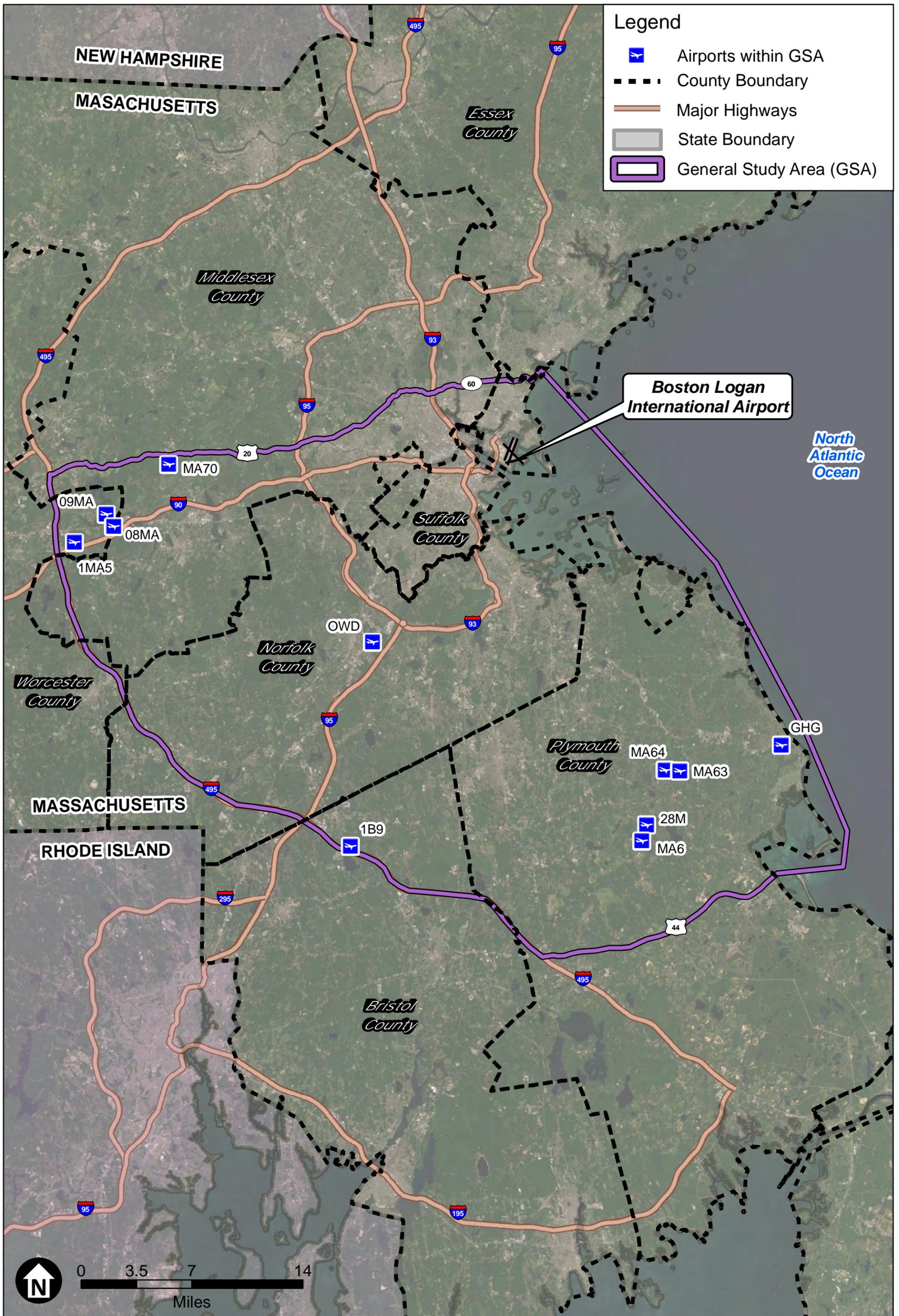
The GSA, as depicted on **Figure 3-1**, encompasses an area of 1,173 square miles in Massachusetts. The GSA includes all or parts of Middlesex, Norfolk, Plymouth, and Suffolk counties and also includes the entirety of the City of Boston. The GSA has a population of 2,419,614 and includes 27,080 Census blocks (based on 2010 U.S. Census demographic data).

An analysis studying the Proposed Action and the historical flight paths of aircraft that were expected to be using the Proposed Action was performed. Using the results of the study, the GSA was constructed to encompass the geographic area where an aircraft flight path could be affected as a result of the Proposed Action up to 10,000 feet above ground level (AGL) in line with FAA Order 1050.1F.⁹ The Airport is located in the northeastern corner of the GSA on the eastern edge of downtown Boston and bordered to the east by the Atlantic Ocean. The GSA extends to the south and west of the Airport since the Proposed Action will occur in the airspace above these areas. There are nine other airports in the GSA all of which are more than 12 miles away from the Airport and are shown in **Figure 3-1**:

- Cranland Airport (28M)

⁹ FAA Order 1050.1F, B-1.3, Affected Environment, https://www.faa.gov/documentLibrary/media/Order/FAA_Order_1050_1F.pdf,

- Mansfield Municipal Airport (1B9)
- Marshfield Municipal Airport – George Harlow Field (GHG)
- Monponsett Pond Seaplane Base (MA6)
- Norwood Memorial Airport (OWD)
- Pheasant Field Airport (MA64) – private use
- Sherman-Private Airport (MA63) – private use
- Sudbury Airport (MA70) – private use
- Unnamed Southborough Airfield (1MA5) – private use



SOURCE: Esri; Prepared by Jacobsen Daniels, 2020

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Figure 3-1
Airports in the General Study Area

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3.1.2 Boston Logan International Airport

The Airport is the primary air service facility serving the Boston Metropolitan Area and as shown on **Figure 3-1** is located just one-mile due east of downtown Boston. The Airport serves as a domestic carrier hub while also serving multiple international destinations in North America, South America, Europe, Asia, and Africa. Massport owns and operates the Airport, as well as two additional airports in eastern and central Massachusetts. In 2019, there were 343,778 domestic flights, 54,476 total international flights, and 28,922 general aviation flights totaling 427,176 operations.¹⁰ The Airport operates six runways with two pairs of parallel runways. Runways 4L/22R and 4R/22L are oriented in a northeast/southwest direction and are 7,864 feet and 10,006 feet long respectively. The other parallel runway pair, Runways 15L/33R and 15R/33L, are oriented to the northwest/southeast and are 2,557 and 10,083 feet long respectively. Runway 14/32 is oriented to the northwest/southeast on the southern edge of the airfield and is 5,000 feet long. Runway 9/27, oriented in an east/west direction, is located on the east side of the airfield crossing Runway 15R/33L and is 7,001 feet long.

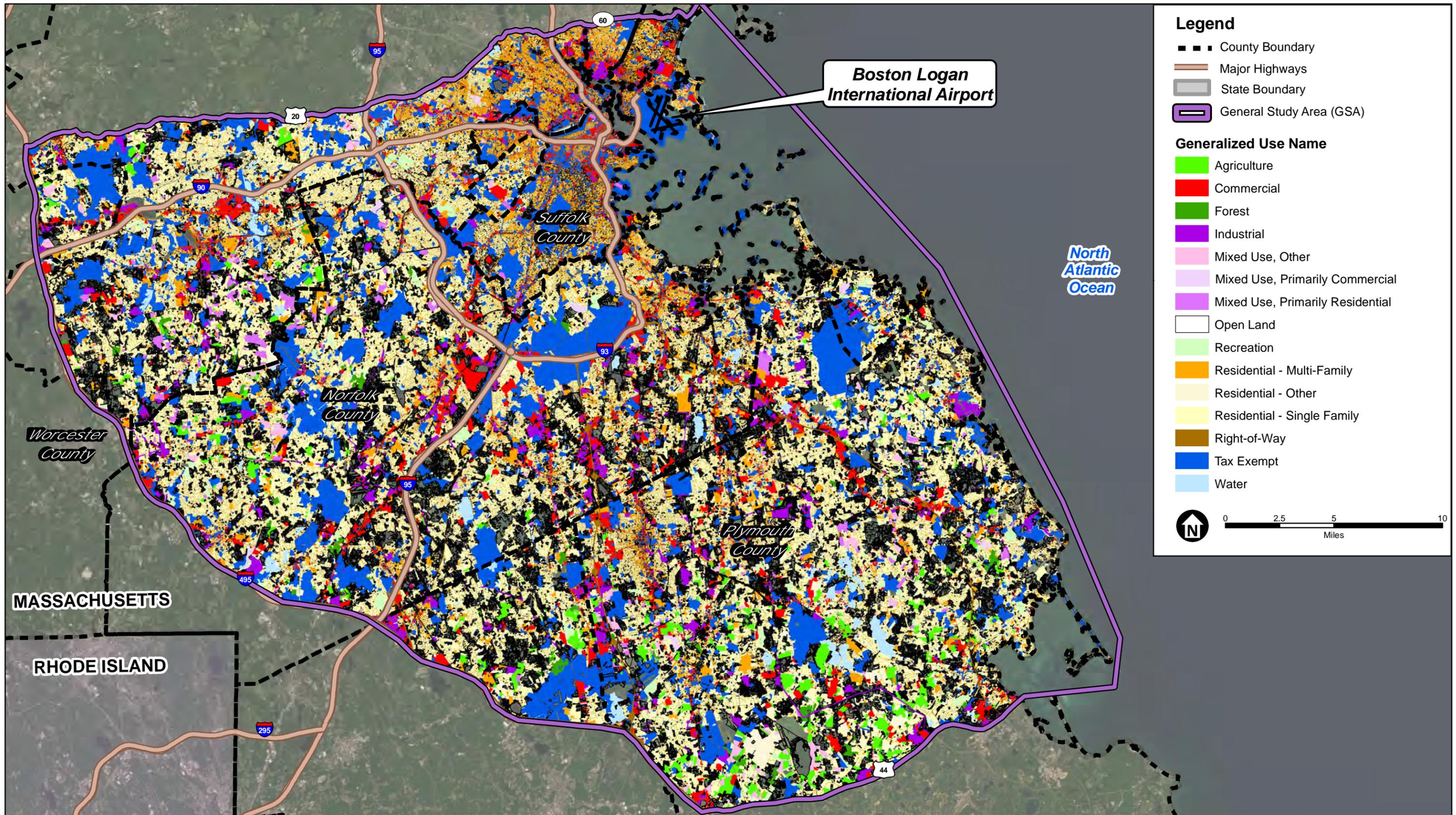
3.1.3 Existing Land Use

Figure 3-2 depicts generalized land use in the GSA. In the vicinity of the Airport and the City of Boston, land use is dominated by multi-family residential and commercial areas dotted by large, interspersed parcels of tax-exempt land. Looking at the GSA outside the City of Boston, the primary residential land use shifts from multi-family to single-family with a more diverse range of neighboring land uses including agricultural and industrial tracts.

Figure 3-3 depicts existing land uses in the Airport environment. The areas immediately surrounding the Airport are highly urbanized with a variety of land uses within a dense environment. For example, the area closest to the Runway 4L threshold includes the Paul Conley Container Terminal (operated by Massport and considered tax exempt), multiple city parks, a mix of upscale commercial businesses and the City Point and Telegraph Hill neighborhoods of South Boston consisting of dense multi-family housing. Multi-family housing dominates the area with single-family housing increasing as distance from the Airport increases. Commercial and industrial development tend to dominate waterfront areas near the Airport.

¹⁰ Boston-Logan International Airport Monthly Airport Traffic Summary – December 2019, <http://www.massport.com/media/3927/1219-avstats-airport-traffic-summary.pdf>

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SOURCE: Esri; Prepared by Jacobsen Daniels, 2020

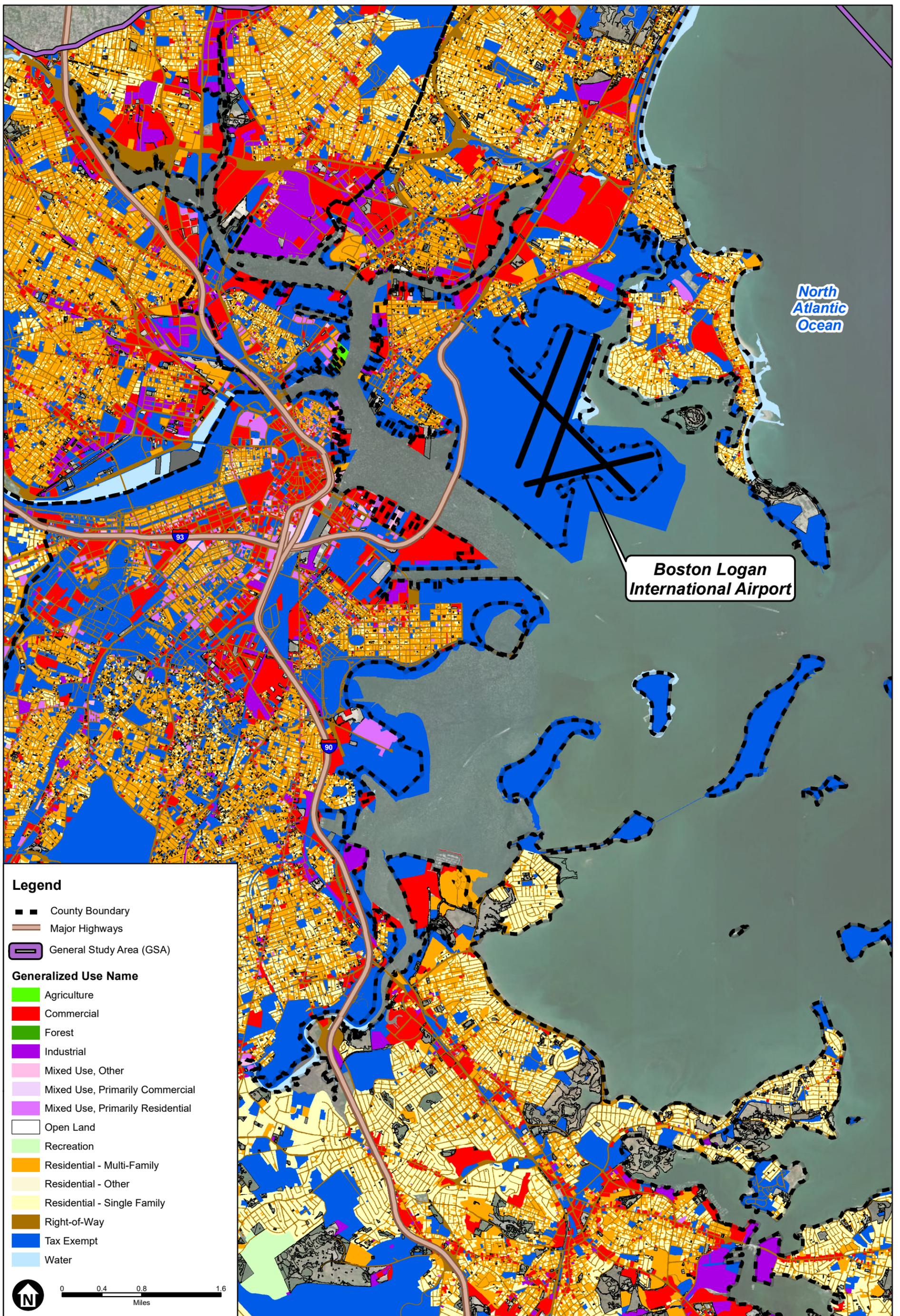
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Figure 3-2

Generalized Existing Land Use in the General Study Area

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SOURCE: Esri; Prepared by Jacobsen Daniels, 2020

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Figure 3-3
Generalized Existing Land Use in the Airport Environment

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3.2 Environmental Resources Unlikely to be Affected by the Proposed Action

Because of the nature of the Proposed Action, neither the Proposed Action nor the No Action Alternative are anticipated to affect certain environmental resource categories identified in the Desk Reference for FAA Order 1050.1F. Accordingly, no further discussion of these environmental resource categories is warranted. These environmental resource categories include:

- **Biological Resources – Fish, Plants, and Terrestrial Species Only:** the Proposed Action does not result in ground-based disturbance and is therefore not expected to have impacts on any terrestrial organisms considered as part of the Biological Resources impact category.
- **Coastal Resources:** the Proposed Action is an airspace action with no physical ground-based improvements and is thus not expected to have an impact on any coastal area or coastal ecosystem.
- **Farmlands:** the Proposed Action is an airspace action with no physical ground-based improvements and will not cause any conversion of farmlands into non-agricultural uses.
- **Hazardous Materials, Solid Waste, and Pollution Prevention:** the Proposed Action does not include construction or physical improvements and is not expected to have any impact on solid waste, hazardous waste, contaminated sites as defined by FAA Order 1050.1F, and solid waste management.
- **Historical, Architectural, Archeological, and Cultural Resources – Archeological Resources Only:** the Proposed Action is an airspace action with no physical ground-based improvements and is not expected to have any impact on any archeological sites. Historical, Architectural and Cultural resources are discussed below.
- **Natural Resources and Energy Supply:** the Proposed Action will not cause demand to exceed the availability of available or future supplies of natural resources as the increase in operations at the Airport due to the Proposed Action is just 255 additional annual aircraft arrivals.
- **Socioeconomics, Environmental Justice, and Children’s Environmental Health – Socioeconomics and Children’s Environmental Health Only:** the Proposed Action is not expected to cause any changes to a community tax base, or any disruption or relocation of any community business or houses. It should be noted that air quality impacts are being considered as part of the Air Quality impact category. The Proposed Action is not expected to disproportionately cause a health or safety risk to children. Thus, these parts of this impact category were not considered.
- **Light Emissions and Visual Effects:** the Proposed Action is an airspace action only. Airspace actions are associated with low levels of light intensity; therefore, the Proposed Action is not expected to cause any changes to visual effects in the GSA. Furthermore, the Proposed Action will affect aircraft in areas that are already overflowed by thousands of aircraft annually.
- **Water Resources (including Wetlands, Floodplains, Surface Waters, Groundwater, and Wild and Scenic Rivers):** the Proposed Action is an airspace action with no physical ground-based improvements and thus is not expected to cause any changes to water resources in the GSA.

3.3 Potentially Affected Environmental Resource Categories

This section describes current conditions in the GSA for those environmental resource categories or sub-categories that the Proposed Action has the potential to affect. These environmental resource categories or sub-categories include:

- Air Quality (Section 3.4.1)
- Climate (Section 3.4.2)
- Biological Resources – Wildlife Only (Section 3.4.3)
- Department of Transportation Act, Section 4(f) Properties (Section 3.4.4)
- Historical, Architectural, Archeological, and Cultural Resources – Historic, Architectural, and Cultural Resources Only (Section 3.4.5)
- Noise and Noise-Compatible Land Use (Section 3.4.6)
- Environmental Justice (Section 3.4.7)
- Cumulative Impacts (Section 3.4.8)

The following sub-sections discuss each of these environmental resource categories in detail.

3.3.1 Air Quality

This sub-section describes the existing air quality conditions within the GSA, as related to national air quality standards. The Clean Air Act (CAA) is a federal law designed to control national air pollution, and requires the United States Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for ambient (i.e., outdoor) concentrations of the following criteria pollutants: carbon monoxide (CO), oxides of nitrogen (NO_x), ground-level ozone (O₃), oxides of sulfur (SO_x), lead (Pb), particulate matter with a diameter of 10 microns or less (PM₁₀), and particulate matter with a diameter of 2.5 microns or less (PM_{2.5}). The General Conformity Rule ensures that the actions taken by federal agencies, such as airport construction, do not interfere with a state's plans to attain and maintain national standards for air quality. States must identify geographic areas that do not meet the NAAQS for each criteria pollutant. These areas are then identified as non-attainment areas for the applicable criteria pollutant(s). States must develop a State Implementation Plan (SIP) for non-attainment areas that includes a variety of emission control measures that the state deems necessary to produce attainment of the applicable standard(s) in the future. If a SIP already exists, it must be revised if an area becomes non-attainment for a criteria pollutant.

An area previously designated non-attainment pursuant to the CAA Amendments of 1990 and subsequently re-designated as attainment, is termed a maintenance area. A maintenance area must have a maintenance plan for 20 years following attainment to ensure the air quality standard is maintained.

The mixing height is defined by EPA based on atmospheric turbulence and directly reflects the ability of pollutants emitted above the ground to impact people on the ground. Air traffic activities taking place above the mixing height are exempt from the General Conformity Rule, and criteria pollutants emitted above this height are not considered in the air quality analysis (see Chapter 4).

In the case of Boston, the mixing height is assumed to have an annual average height of 3,000 feet AGL.

Within the GSA, criteria pollutant emission levels associated with current flight operations at the Airport are shown in **Table 3.3-1**.

**TABLE 3.3-1
FUEL BURN AND CRITERIA POLLUTANT EMISSIONS BELOW MIXING HEIGHT**

Air Quality Pollutants	Short Tons Per Year¹
CO	691.3
Volatile Organic Compounds (VOCs)	25.7
NO _x	1,696.9
SO _x	97.0
PM _{2.5}	9.8
PM ₁₀	9.8
Fuel Burn	82,819

1: A short ton is equivalent to a mass of 2,000 pounds.
Source: Prepared by RoVolus, 2020.

A summary of the attainment status of counties within the GSA for applicable NAAQS is shown in **Table 3.3-2**. Further details about these NAAQS are presented in **Sections 3.3.1.1** through **3.3.1.4**.

**TABLE 3.3-2
ATTAINMENT STATUS OF COUNTIES WITHIN THE GSA**

NAAQS	Attainment	Nonattainment	Maintenance
Ozone (1-hour, 1979) - Revoked		X	
Ozone (8-hour, 1997) - Revoked		X	
Ozone (8-hour, 2008) - Revoked	X		
Ozone (8-hour, 2015)	X		
PM ₁₀ (1987)	X		
PM _{2.5} (2012)	X		
CO (1971)			X

Source: EPA Greenbook, 2020.

3.3.1.1 Ozone

Ozone at ground level is a harmful air pollutant because of its effects on people and the environment, and it is the main ingredient in “smog.” Ozone is not emitted directly into the air but is instead created by chemical reactions between NO_x and VOC. This happens when pollutants

emitted by cars, power plants, industrial boilers, refineries, chemical plants, and other sources chemically react in the presence of sunlight.

The entire GSA is part of the Boston-Lawrence-Worcester maintenance area¹¹ for ozone and contains all or part of the Massachusetts counties of Bristol, Essex, Middlesex, Norfolk, Plymouth, Suffolk, and Worcester. These counties were all designated as moderate nonattainment areas for ozone under the 1997 8-hour NAAQS, prior to the revocation of that standard. Additionally, these counties were also designated as severe nonattainment under the 1979 1-hour NAAQS before that standard was revoked. The 1-hour and 8-hour NAAQS refer to the amount of time over which ozone levels are averaged to meet each standard. None of the counties in the GSA are designated nonattainment or maintenance areas under the 2008 or 2015 8-hour NAAQS for ozone.

3.3.1.2 Particulate Matter (PM₁₀)

Particulate matter, or PM₁₀, is the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be observed using an electron microscope. Particles less than 10 microns in diameter pose problems because they can get deep into lungs, and some may even get into the bloodstream.

None of the counties in the GSA are designated nonattainment under the 1987 PM₁₀ standard.

3.3.1.3 Fine Particulate Matter (PM_{2.5})

Fine particulate matter, or PM_{2.5}, consists of fine inhalable particles with diameters that are generally 2.5 microns and smaller. Exposure to such particles can affect human cardiovascular and respiratory systems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- Premature death in people with heart or lung disease
- Nonfatal heart attacks
- Irregular heartbeat
- Aggravated asthma
- Decreased lung function
- Increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.

People with heart or lung diseases, children, and older adults are the most likely to be affected by particle pollution exposure.

None of the counties in the GSA are designated nonattainment under the 2012 NAAQS for PM_{2.5}.

3.3.1.4 Carbon Monoxide

CO is a colorless, odorless, and poisonous gas produced by incomplete combustion of hydrocarbon fuels. Most CO emissions are from transportation sources, with the largest share

¹¹ A maintenance area is a former nonattainment area that has subsequently met or exceeded standards and has been redesignated as such by the Environmental Protection Agency (EPA).

from highway motor vehicles. CO molecules survive in the atmosphere for a period of approximately one month, eventually reacting with oxygen to form carbon dioxide (CO₂). CO levels found in ambient air may reduce the oxygen-carrying capacity of the blood. Health threats are most serious for those with angina or peripheral vascular disease. Exposure to elevated CO levels can cause impairment of visual perception, manual dexterity and learning ability as well as decreased performance of complex tasks.

Middlesex, Norfolk, and Suffolk Counties had previously been a moderate nonattainment area for the 1971 standard for CO. On April 1, 1995, air quality monitoring enabled EPA to re-designate the area as a maintenance area for the 1971 CO NAAQS.

Worcester County had previously been an unclassified nonattainment area for the 1971 standard for CO. On April 22, 2002, air quality monitoring enabled EPA to re-designate the area as a maintenance area for the 1971 CO NAAQS.

3.3.2 Climate

Greenhouse gases (GHG) are naturally occurring and man-made gases that can trap and disperse heat throughout the global atmosphere. These gases include CO₂, methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Combustion of fossil fuels is responsible for the majority of man-made GHG emissions. For airspace actions, the primary source of GHG is CO₂ emissions from aircraft fuel combustion. According to the EPA, the proportion of national CO₂ emissions attributable to the aviation sector was 3.0% in 2009 and approximately 2.5% in 2018.

CO₂ emissions for current flight operations within the GSA were calculated using the Aviation Environmental Design Tool (AEDT). **Table 3.3-3** gives the current flight operations' CO₂ emissions along with the annual and statewide emissions totals for reference. In calendar year 2019, there were 427,176 aircraft operations at the Airport. This inventory only includes emissions associated with operations below the mixing height and does not include ground-based emissions sources on Airport property.

**TABLE 3.3-3
GREENHOUSE GAS EMISSIONS**

Scale of Annual GHG Emissions	Annual Metric Tons of CO ₂ Equivalent
Nationwide GHG Emissions	5,270,700,000 ¹
Massachusetts GHG Equivalent Emissions	67,488,856 ²
Boston Logan International Airport CO ₂ Emissions	261,293 ³

¹U.S. Environmental Protection Agency Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017,
²Massachusetts Annual Greenhouse Gas Emissions Inventory: 1990-2017
³AEDT

Source: Prepared by RoVolus, 2020.

3.3.3 Endangered Species

3.3.3.1 Threatened and Endangered Species

The United States Fish and Wildlife Service (USFWS) operates the Information for Planning and Consultation (IPaC) service, which provides for the identification of federally-listed threatened and endangered species, candidate species, and designated critical habitat within geographically defined areas. **Table 3.3-4** identifies federally-listed threatened and endangered bird and bat species and the counties in the GSA in which they are known or believed to occur. One bat species, the Northern Long-eared Bat, as well as two bird species, the Piping Plover and the Red Knot, are federally-listed as Threatened. One bird species, the Roseate Tern, and one reptile species, the Plymouth Redbelly Turtle, are federally-listed as Endangered. There are no candidate species or designated critical habitats found in the GSA.

**TABLE 3.3-4
FEDERALLY-LISTED THREATENED, ENDANGERED, CANDIDATE, AND PROPOSED SPECIES**

Group	Species	Scientific Name	Status	Counties where Species is Known or Believed to Occur
Mammals	Northern Long-eared Bat	<i>Myotis septentrionalis</i>	Threatened	Bristol, Middlesex, Norfolk, Plymouth, Suffolk, and Worcester
Birds	Piping Plover	<i>Charadrius melodus</i>	Threatened	Bristol, Plymouth, and Suffolk
Birds	Red Knot	<i>Calidris canutus rufa</i>	Threatened	Bristol, Middlesex, Plymouth, Norfolk, and Suffolk
Birds	Roseate Tern	<i>Sterna dougallii</i>	Endangered	Bristol, Plymouth, and Suffolk
Reptiles	Plymouth Redbelly Turtle	<i>Pseudemys rubriventris bangsi</i>	Endangered	Bristol, Plymouth

Source: U.S. Department of Interior Fish and Wildlife Service Information, Planning, and Conservation System (IPaC), Feb. 2020.

The Massachusetts Endangered Species Act (MESA) protects 173 species of animals and 259 species of plants native to Massachusetts. The Massachusetts Division of Fisheries and Wildlife maintains a database identifying each of the 432 species and its specific status as either Endangered, Threatened, or Special Concern. A complete list of these state-listed species can be found in **Appendix D**.

3.3.3.2 Migratory Birds

The Migratory Bird Treaty Act of 1918 (MBTA) (16 U.S.C. §§ 703-712) prohibits the taking of any migratory bird and any part, nest, or egg of any such bird, without a permit issued by the USFWS. A “take” under the MBTA is defined as the action or attempt to “pursue, hunt, shoot, capture, collect, or kill.” Federally-listed migratory bird species are managed by the same agency staff responsible for compliance with Section 7 of the MESA. Non-listed migratory bird species are managed by the Migratory Bird Program of the USFWS.

The GSA occurs in a coastal area of Massachusetts with potential for migratory bird travel. Migratory bird management policy is often based on the north-south routes flown by birds to and from northern breeding grounds and southern wintering grounds. Although actual routes vary by species, migratory routes have been grouped into four “flyways” occurring over North America for

management purposes. The flyways are representative of broad areas where birds migrate and are often delineated by topographic features. The four North American flyways include the Atlantic, Central, Mississippi, and Pacific flyways. The GSA is located within the Atlantic flyway where individual migration routes tend to overfly river valleys and mountain ranges.

3.3.4 Department of Transportation Act, Section 4(f) Properties

Section 4(f) of the Department of Transportation (DOT) Act of 1966 (codified at 49 U.S.C. Section 303(c)), commonly referred to as Section 4(f), provides, in part, that:

“...[the] Secretary of Transportation may approve a transportation program or project requiring the use of any publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance or land from a historic site of national, State, or local significance, only if there is no feasible and prudent alternative to the use of such land and the program or project includes all possible planning to minimize harm resulting from the use.”¹²

The word “use” includes both direct and indirect or “constructive” impacts to Section 4(f) properties. A direct use is the physical taking of a Section 4(f) property. An indirect impact or “constructive” use does not require a physical taking of a Section 4(f) property. A constructive use would occur when a project would produce an effect, such as excessive noise, that would result in substantial impairment to a property to the degree that the activities, features, or attributes of the property that contribute to its significance or enjoyment are substantially diminished. The determination of use must consider the entire property and not simply the portion of the property being used for a Proposed Action. Privately-owned parks, recreation areas, and wildlife refuges are not subject to Section 4(f).

The FAA has established guidelines for aircraft noise and land use compatibility under 14 CFR Part 150 (Part 150). However, the applicability of Part 150 is limited when assessing noise impacts to areas where quiet and serenity are expected attributes. Accordingly, special consideration is given to parks and natural areas where a quiet setting is a generally recognized purpose and attribute. In these areas the FAA “must consult all appropriate Federal, State, and local officials having jurisdiction over the affected Section 4(f) resources when determining whether project-related noise impacts would substantially impair the resource.”

For this analysis, natural areas are areas considered to have recreational or environmental significance and include national parks, wildlife refuges, forests, wildlife management areas, or other similar places. City, county, state, and federally maintained parks and natural areas within the GSA are depicted on **Figure 3-4**.

3.3.4.1 Section 4(f) Properties in the General Study Area

Section 4(f) properties within the GSA were inventoried using geospatial data from federal, state, and local sources. The sources inventoried include multiple datasets from the MassGIS (Bureau of Geographic Information for the state of Massachusetts), Open Space data from the City of

¹² FAA Order 1050.1F, B-2 Section 4(f), 49 U.S.C. 303, p. B-9,
https://www.faa.gov/documentLibrary/media/Order/FAA_Order_1050_1F.pdf

Boston, and parks data from the City of Quincy. A total of 11,803 Section 4(f) properties were identified within the GSA with specific locations noted on **Figure 3-4**. Historic and cultural resources are addressed by both Section 4(f) and the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. § 470, as amended), and are discussed further in **Section 3.4.5**. Locations of historic and cultural resources within the GSA are depicted on **Figure 3-4**.

A comprehensive list of Section 4(f) properties located within the GSA is included in **Appendix C**.

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3.3.5 Historical, Architectural, Archeological, and Cultural Resources – Historic, Architectural, and Cultural Resources Only

Under NEPA, the FAA is responsible for analyzing the impacts of its action on historical, architectural, archeological and cultural resources as part of its broader review of the human environment. Because the National Historic Preservation Act (NHPA) is the principal statute concerning such resources, most of this analysis is conducted in coordination with the process under Section 106 of the NHPA, which requires federal agencies to consider the effects of their projects on properties listed, or eligible for listing, in the National Register of Historic Places (NRHP). Regulations related to this process are promulgated in 36 CFR Part 800, Protection of Historic Properties.

While FAA Order 1050.1F states in Exhibit 4-1 that there is no significance threshold for Historical, Architectural, Archeological, and Cultural Resources, the Order also states that a finding of adverse effect by the Proposed Action through the Section 106 process is a factor to consider.¹³ A finding of “adverse effect,” “no adverse effect” or “no historic properties affected” is made under 36 CFR part 800 in consultation with the State Historic Preservation Officer (SHPO) and other consulting parties. Section 8.3.2 of the 1050.1F Desk Reference expands on the text in Order 1050.1F to say that while an adverse effect under Section 106 is not necessarily a significant impact under NEPA, the FAA’s determination on the level of impact under NEPA may be informed by advice from the SHPO, which for the Proposed Action is the Executive Director of the Massachusetts Historical Commission (MHC).

The Proposed Action is an aircraft arrival procedure that is located entirely above the surface of the earth. Accordingly, it does not physically affect properties, alter properties in any way physically, remove properties from their historic locations, result in any neglect of a property, or result in the transfer of any property out of federal control or ownership. However, the FAA is considering, through the Section 106 process, whether changes in aircraft flight routes associated with the Proposed Action would introduce or increase aircraft routing over historic properties that could result in potential adverse effects due to the introduction of atmospheric, audible or visual elements.¹⁴ In particular, the FAA has assessed, in consultation with the SHPO and other consulting parties, whether the Proposed Action would diminish the integrity of the historic features that make the properties eligible for inclusion in the National Register.

3.3.5.1 Historic, Architectural, and Cultural Resources in the General Study Area

The NHPA defines historic properties as:

“...any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register, including artifacts, records, and material remains relating to the district, site, building, structure, or object and located within such properties.”¹⁵

¹³ FAA Order 1050.1F, Exhibit 4-1, p. 4-8. https://www.faa.gov/documentLibrary/media/Order/FAA_Order_1050_1F.pdf

¹⁴ 36 CFR 800.5(a)(2)(v), <https://www.achp.gov/sites/default/files/regulations/2017-02/regs-rev04.pdf>

¹⁵ 54 U.S.C. § 300308, <https://www.govinfo.gov/content/pkg/USCODE-2016-title54/pdf/USCODE-2016-title54-subtitleIII-divnsA-app-chap3003-sec300308.pdf>

Figure 3-5 depicts the location of historic and cultural resources identified in the GSA. The NRHP, the Massachusetts Historical Commission, and the Boston Landmarks Commission's data sources were used to gather a comprehensive directory of all potential historic and cultural resources within the GSA. A total of 70,142 listed properties were identified in the GSA. **Figure 3-5** shows the location of historic and cultural resources identified in the GSA. A comprehensive list of the historic properties identified within the GSA is included in **Appendix G**. In addition to the review and inventory of properties listed in the NRHP, BLC and MHC databases, the FAA consulted previously prepared environmental documents from the Boston metropolitan area.

3.3.6 Noise and Noise-Compatible Land Use

This section includes a brief overview of aircraft noise, the noise analysis methodology used for this EA, and a discussion of the existing aircraft noise exposure levels in the GSA.

3.3.6.1 Noise Modeling Methodology

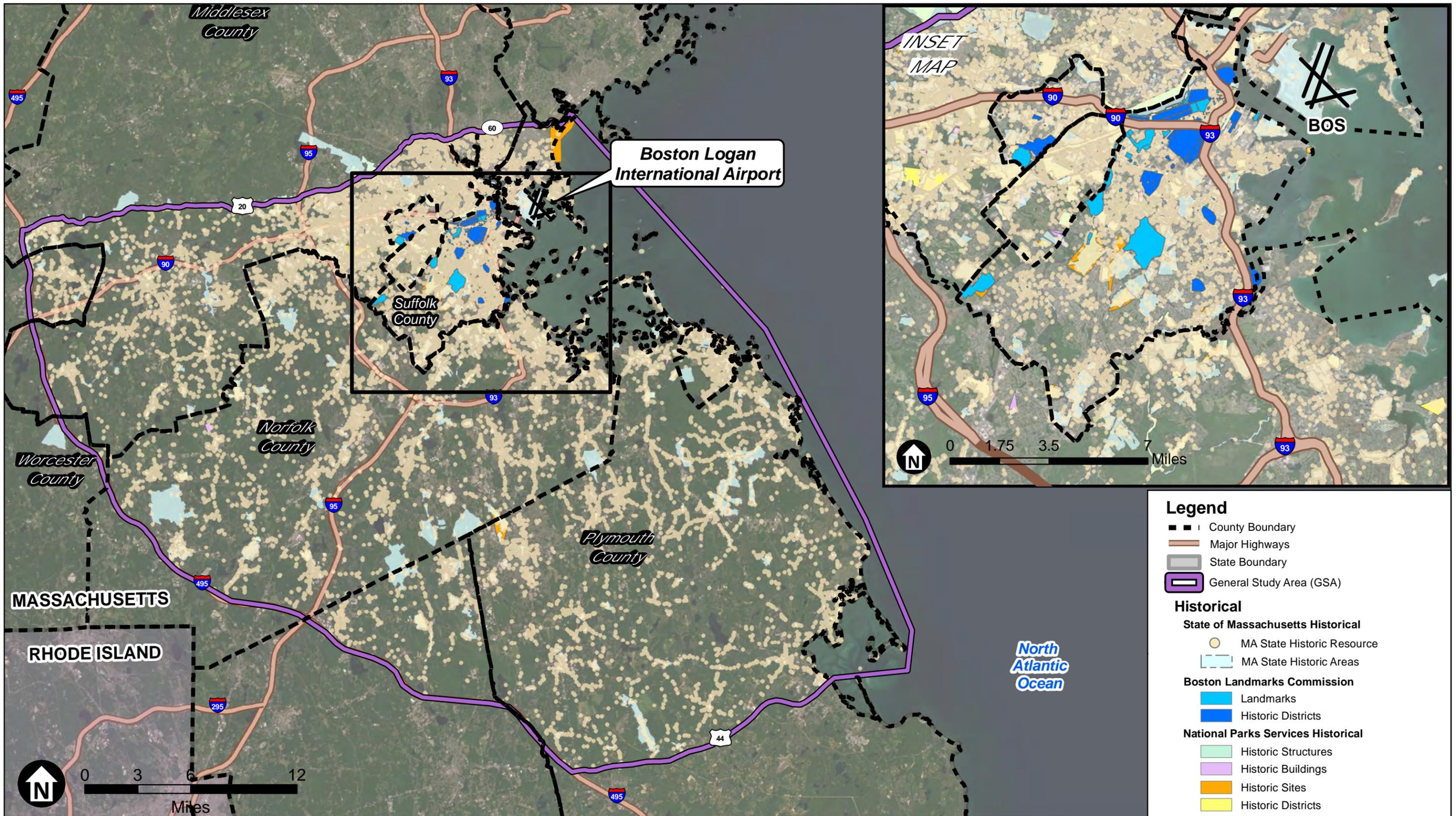
The FAA has developed specific guidance and requirements for the assessment of aircraft noise to comply with NEPA. This guidance, specified in FAA Order 1050.1F, requires that aircraft noise be analyzed in terms of the day-night average sound level (DNL) metric. DNL values are calculated for the average annual daily operations for the year of interest. The noise analysis evaluated all aircraft arriving and departing the Airport for the entire GSA. Noise modeling was based on fixed-wing and helicopter flight operations recorded by radar occurring in the baseline timeframe (November 1, 2018 through October 31, 2019).

Fleet information from the radar data was used to determine the number of operations and the types of aircraft to be modeled. Assumptions regarding fleet mix and operational considerations were verified by the Boston Consolidated TRACON (A90).

Noise Metric

Sound is energy transferred through the air that is detected by the ears as small changes in air pressure. The decibel (dB) is the unit used to measure the intensity of sound, and is measured on a logarithmic scale. It is important to understand this logarithmic nature as it is counterintuitive to our regular understanding of numbers; for example, a sound of 40 dB combined with a second sound of 40 dB will only produce a combined sound of 43 dB. Another way of putting this is that a 10 decibel increase or decrease in sound will be heard as a doubling or halving of a sound's loudness respectively. In order to assist in the understanding of certain levels, a figure of comparative indoor and outdoor noise levels are shown in **Figure 3-6**. Noise is defined as sound that is unwanted. Perception of aircraft noise by people on the ground depends on a variety of factors, including background (environmental) noise, relative proximity to aircraft operations, aircraft type, aircraft operational mode (arrival, departure, or overflight), ambient weather and terrain.

Noise being emitted from sources that are in motion (such as aircraft) will change over time relative to the person hearing the noise. While it can be useful to measure the maximum sound level of a single noise event, that does not account for the duration of the event. To account for differences in duration and loudness of noise, various noise metrics can be used to evaluate noise exposure and potential noise impacts.



SOURCE: Esri; Prepared by Jacobsen Daniels, 2020

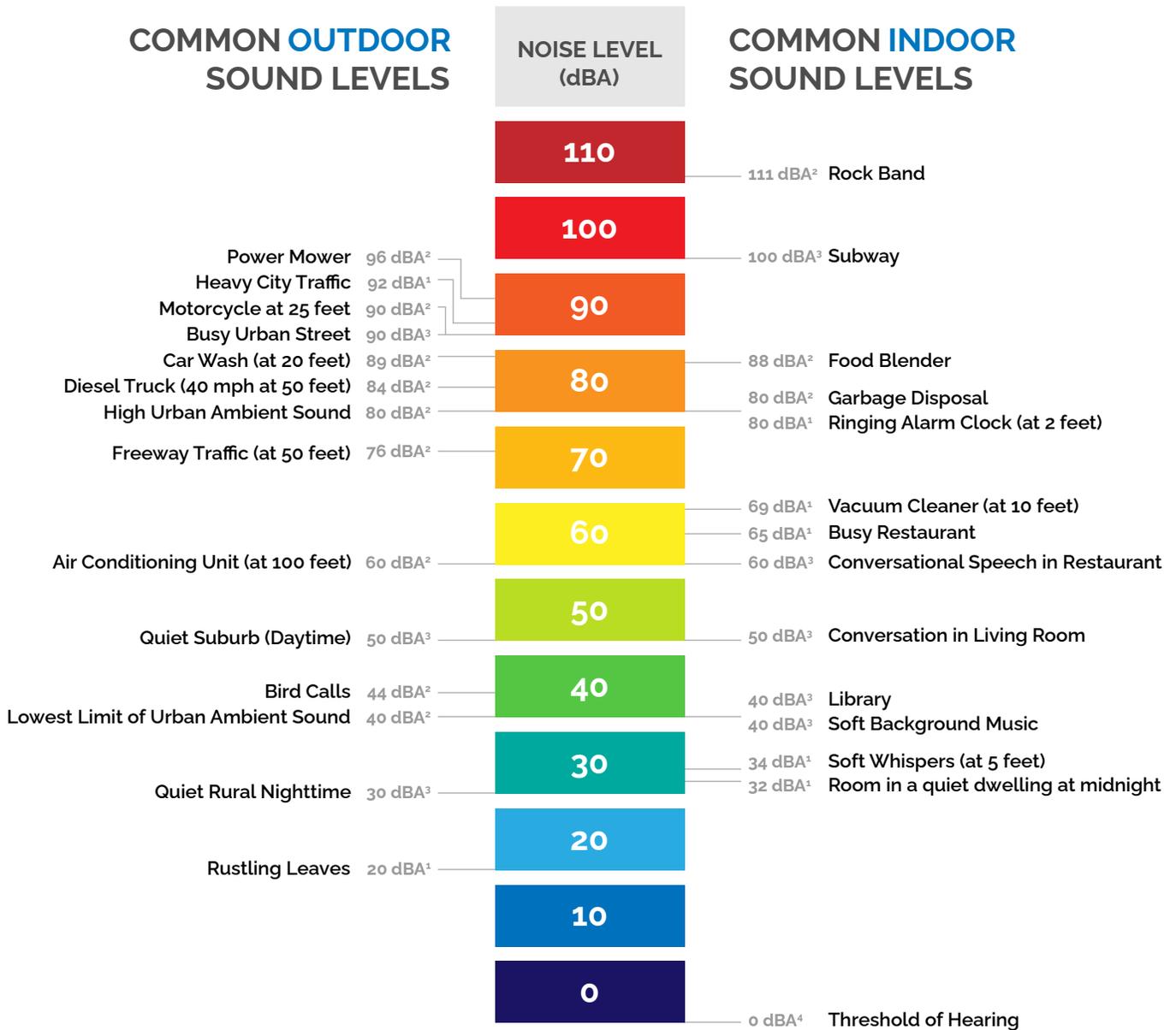
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Figure 3-5
Historic Resources in the General Study Area

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Comparative Noise Levels (dBA)



1 Aviation Noise Effects, FAA, AEE, March, 1985 (FAA-EE-85-2), Table 1.1
 2 Federal Agency Review of Selected Airport Noise Analysis Issues (Federal Interagency Committee on Noise), August 1992, Table B.1
 3 Children's health and the environment, A Global Perspective, World Health Organization, 2005, Table 15.1
 4 OSHA Technical Manual, TED 01-00-015, Section III (Health Hazards), Chapter 5 (Noise, Updated 8/15/2013)

SOURCE: ESA, 2021

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The DNL metric is the sound level from aircraft operations for a 24-hour period, which includes all of the time-varying aircraft sound energy within the period. DNL accounts for the noise levels of all individual aircraft events, the number of times those events occur, and the period of day/night in which they occur. Since people are more sensitive to noise events at night, DNL includes a 10- dB additional weight for night-time noise events (those that occur between 10:00:00 p.m. and 6:59:59 a.m.). Ambient (without aircraft) sound levels during nighttime are typically about 10 dB lower than during daytime hours.¹⁶ FAA guidelines, established under 14 CFR Part 150, identify land uses that are generally considered compatible or incompatible with various DNL values.

As DNL values scale logarithmically, a 10 dB increase in DNL equates to a sound that is perceived as twice as loud. For example, a noise exposure increase from DNL 50 dB to DNL 60 dB is perceived as twice as loud by observers, while an increase from DNL 50 dB to DNL 70 dB would be perceived as four times as loud.

DNL is the metric prescribed in FAA Order 1050.1F and has been found to be the best measure of significant noise impact on the quality of the human environment. The DNL metric is based on a substantial body of scientific data on the reaction of people to noise. Federal interagency committees such as the Federal Interagency Committee on Urban Noise (FICUN) and the Federal Interagency Committee on Noise (FICON) which include the EPA, FAA, Department of Defense (DOD), Department of Housing and Urban Development (HUD), and Veterans Administration (VA), found DNL to be the best noise metric for representing aircraft noise resulting from approaches and application in land use planning.

Noise Model

AEDT is the FAA's approved model for assessing noise and emissions at civilian airports. AEDT has been used for environmental review of air traffic noise and emissions impacts since 2012 and is also used for 14 CFR Part 150 studies as well as NEPA EAs and EISs. For these types of analysis, AEDT is used to estimate the long-term average changes in environmental impacts.

Detailed information on aircraft operations at the Airport was input into AEDT, including specific fleet mix information such as aircraft type, arrival and departure times, trip distance, runway use, flight track location/usage, and weather conditions (e.g., temperature and humidity). Noise exposure from aircraft operations was calculated at the 27,080 Census blocks throughout the GSA. The locations consist of population centroids, representing the centers of 2010 Census blocks. Census blocks are the smallest geographic unit for which the U.S. Census Bureau tabulates 100% sample data. Census blocks are generally bounded by streets, legal boundaries, and other features. For this analysis, the Census block counts represent the maximum potential population within the Census block that could be exposed to the modeled DNL values, including family and non-family households, but excluding those residing in group quarters (often representing transient or temporary residential arrangements). The actual number of people impacted can be smaller than the total population represented by a single Census block because

¹⁶FAA Order 1050.1F Appendix B, https://www.faa.gov/documentLibrary/media/Order/FAA_Order_1050_1F.pdf

noise levels will vary throughout the Census block. More details on the specific inputs and assumptions used for modeling aircraft noise are included in **Appendix B**.

3.3.6.2 Operational Inputs

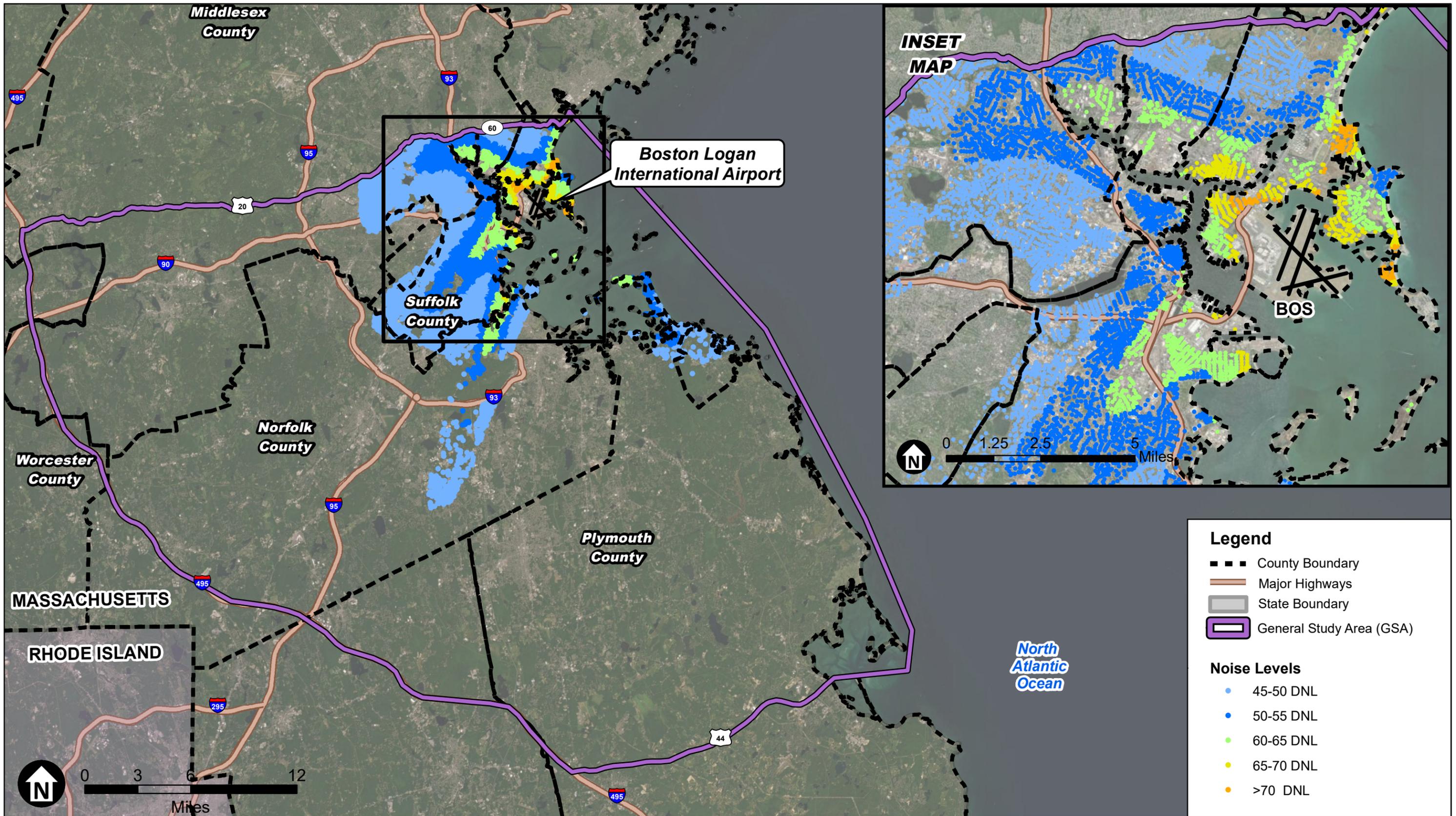
Operational inputs (aircraft flows and operations) were developed by processing radar traffic data for the baseline timeframe into backbones representing distinct traffic flows. These backbones were then loaded with traffic event data, which includes information such as the number of operations on an average annual day, the type and frequency of aircraft operations, runway locations and use, and the time of day of operations (daytime or nighttime). The operations derived from radar data were uniformly scaled to be equivalent to the total reported operation count of 432,328 operations for this period from the FAA's Operations and Performance Data (OpsNet), the official source of FAA air traffic operations and delay data. This resulted in an average annual day count of approximately 1,184 operations at the Airport that were reflected in the noise model.

This baseline noise analysis is the foundation upon which the noise modeling for the Proposed Action was developed. **Appendix B**, *Noise Modeling Technical Report* provides additional details regarding noise model input data.

3.3.6.3 Existing Aircraft Noise Exposure at Population Centroids

Figure 3-7 shows the existing (2019) noise exposure levels at population centroids between DNL 45 dB and 75 dB. As would be expected, the areas closer to the Airport are exposed to the highest DNL values. Noise exposure levels are not calculated for Census blocks that did not include any residential population.

As shown in **Table 3.3-5**, approximately 52% of people residing within the GSA are exposed to aircraft noise levels associated with the Airport of less than DNL 45 dB. Noise levels between DNL 45 dB and 60 dB include approximately 45% of the GSA population. 22,969 people experience aircraft noise levels between DNL 60 dB and 65 dB, and 6,935 people experience aircraft noise levels of DNL 65 dB or higher.



SOURCE: Esri; Prepared by Jacobsen Daniels, 2020

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Figure 3-7
Proposed Alternative Noise Exposure
No Action

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**TABLE 3.3-5
GSA POPULATION EXPOSED TO AIRCRAFT NOISE ASSOCIATED WITH BOSTON
LOGAN INTERNATIONAL AIRPORT – EXISTING (2019) CONDITIONS**

DNL Range (dB)	Population	Percentage of Total
Less than 45	546,258	51.78%
45 to less than 50	256,639	24.33%
50 to less than 55	168,470	15.97%
55 to less than 60	53,711	5.09%
60 to less than 65	22,969	2.18%
65 to less than 70	6,767	0.64%
70 to less than 75	168	0.02%
Greater than or equal to 75	0	0.00%
Total	1,054,982	100%

Notes: Population values in this table represent only the population in the GSA exposed to noise associated with the Airport, not the total GSA population. Percentage totals may not equal 100% due to rounding.

Sources: U.S. Census 2010 (population centroid data), April 2020; prepared by RoVolus, 2020.

3.3.7 Socioeconomics, Environmental Justice, and Children’s Environmental Health – Environmental Justice Only

This section is limited to a discussion of Environmental Justice (EJ) as it pertains to potential aircraft noise impacts from the Airport in the GSA. The EPA defines EJ as the “fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.”¹⁷ An EJ analysis considers the potential of the Proposed Action Alternative to cause disproportionate and adverse effects on low-income or minority populations. If adverse effects are determined, applicable mitigations will be explored in order to avoid or minimize disproportionate impacts.

3.3.7.1 Definition of Impact Category

Executive Order 12898, “Federal Actions to Address EJ in Minority and Low-Income Populations,” the accompanying Presidential Memorandum, and DOT Order 5610.2B, “*Department of Transportation Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*,” provide guidance for the Federal government, including the FAA, regarding EJ compliance. The FAA must provide (1) meaningful public involvement by minority and low-income populations and (2) analysis, including demographic analysis, which identifies and addresses potential impacts on those populations that may be disproportionately high and adverse. The Presidential Memorandum encourages the consideration of EJ impacts in EAs, especially to determine whether the Federal Action may cause a disproportionately high and adverse impact. For this EA, the FAA defined Census block groups of EJ concern as those in which either the concentration of minority population and/or the concentration of low-income population are higher than their respective averages of the GSA.

3.3.7.2 Existing Conditions

The socioeconomic and racial characteristics of the population within the GSA are based on data from the 2010 U.S. Census and 2015 American Community Survey (ACS 5-year dataset) - the most recent available - to identify minority populations and low-income populations in the GSA. DOT Order 5610.2(a) defines “low-income” as “a person whose median household income is at or below the Department of Health and Human Services (HHS) poverty guidelines.” The order defines “minority” as one of the following categories:

- Black – a person having origins in any of the black racial groups of Africa
- Hispanic or Latino – a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race
- Asian American – a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent

¹⁷ Technical Guidance for Assessing Environmental Justice in Regulatory Analysis, United States Environmental Protection Agency, page 1, https://www.epa.gov/sites/production/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf

- American Indian and Alaskan Native – a person having origins in any of the original people of North America, South America (including Central America), and who maintains cultural identification through tribal affiliation or community recognition
- Native Hawaiian and Other Pacific Islander – persons having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands

The EJ module of AEDT was utilized to perform analysis of the GSA at the U.S. Census block group level, defining Census block groups for minority and low-income population as follows:

- A *disproportionate minority population Census Block Group* is a group having a minority population percentage greater than the average minority population percentage in the GSA. Based on the 2010 data, the average percentage of minority population residing in the GSA was 33.4 percent. Therefore, every Census block group with a percentage of minority population greater than 33.4 percent was identified as a Census block group of EJ concern.
- A *disproportionate low-income population Census Block Group* is a group having a low-income population percentage greater than the average low-income population percentage in the GSA. Based on the 2010 Poverty Guidelines identified by the HHS, the poverty threshold for a household of three persons was set at \$18,310 for the 48 contiguous states, and therefore is applicable to the GSA. For the purposes of identifying low-income population census tracts, the HHS threshold of \$18,310 was used. Based on 2010 data, the average percentage of low-income population residing in the GSA was 12.3 percent. Therefore, every Census block group with a percentage of low-income population greater than 12.3 percent is identified as a Census block group of EJ concern.

Table 3.3-6 presents the breakdown of minority and low-income population for the purposes of this EJ analysis.

Figure 3-8 depicts the areas of EJ concern located within the GSA, derived from Census block groups. In examining **Figure 3-7**, it is important to note that population distribution is not necessarily uniform across a Census block group. For that reason, the actual number of minority or low-income persons impacted can be more or less than the total population represented by a single Census block group because impacts may vary throughout the Census block group. In addition, because EJ includes the entirety of Census block groups intersecting the GSA, the total population reported as part of EJ will not equal the total block-derived population located inside the GSA. The GSA contains a large number of Census block groups that exceed EJ thresholds on all sides of the airport. However, these EJ Census block groups are particularly concentrated to the south and west of the airport, which are the primary areas of change due to the Proposed Action.

**TABLE 3.3-6
STATISTICS ON LOW-INCOME AND MINORITY POPULATIONS WITHIN THE GSA**

Demographic	Population	Percentage of Total
Total Population	2,611,261	100.0%
Minority Population^a		
Total Minority Population^b	1,017,313	39.0%
Hispanic or Latino (may be of any race)	275,868	10.6%
Black or African American	367,151	14.1%
American Indian and Alaska Native	17,024	0.7%
Asian	244,558	9.4%
Native Hawaiian and Pacific Islander	4,229	0.2%
Other or Two or More Races	108,483	4.2%
Low-Income Population		
Population Below Poverty Threshold of \$18,310	297,443	11.4%
Census Block Groups		
Total Census Block Groups Intersecting GSA	1,984	100.0%
Census Block Groups Containing Disproportionate Minority Populations ^c	779	39.1%
Census Block Groups Containing Disproportionate Low-Income Populations ^d	699	35.2%
Census Block Groups Containing Disproportionate Minority and Low-Income Populations ^e	496	25.0%

Notes:

^a Names as they appear in the U.S. 2010 Census data

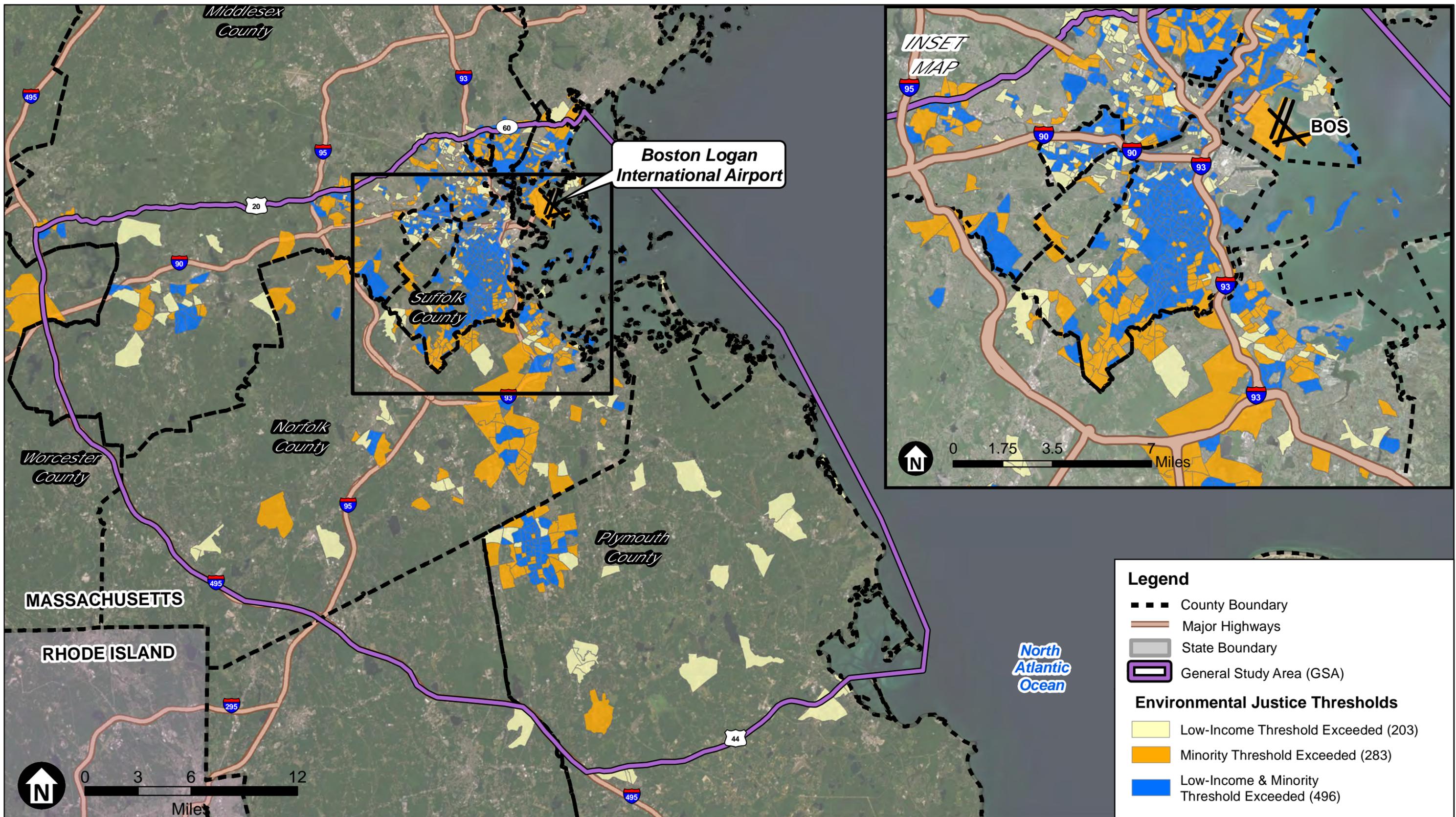
^b Includes all persons who qualify in one or more of the minority categories

^c For EJ purposes, a disproportionate minority Census Block Group is defined as one that has a percentage of minority population greater than 33.4 percent (the minority population percentage of the GSA)

^d For EJ purposes, a disproportionate low-income Census Block Group is defined as one that has a percentage of low-income population greater than 12.3 percent (the low-income population percentage of the GSA)

^e A disproportionate minority and low-income Census Block Group is defined as a census block group in which both the percentage of minority population or the percentage of low-income population is higher than their respective percentages within the GSA.

Sources: Population Data Source: U.S. Census 2010 (population centroid data) accessed April 2020; prepared by RoVolus, 2020.



SOURCE: Esri; Prepared by Jacobsen Daniels, 2020

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Figure 3-8
Environmental Justice Census Block Groups Intersecting the General Study Area

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3.3.8 Cumulative Impacts

Cumulative impacts refer to the impacts resulting from the effects of implementation of the Proposed Action with other actions in the GSA that when combined have the potential to affect the environment. The White House Council on Environmental Quality (CEQ) regulations define a cumulative impact as

“an impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.”¹⁸

The CEQ regulations also state that cumulative impacts can result from individually minor, but collectively significant actions that take place over a period of time.

“For cumulative effects analysis to help the decision-maker and inform interested parties, it must be limited through scoping to effects that can be evaluated meaningfully. The boundaries for evaluating cumulative effects should be expanded to the point at which the resource is no longer affected significantly or the effects are no longer of interest to affected parties.”¹⁹

The Proposed Action is only expected to change the arrival path for a subset of air traffic at the Airport and has no effect on any activities once the aircraft has touched down. This Proposed Action Alternative and the changes related to this Proposed Action Alternative will be considered against past, present, and reasonably foreseeable future actions with direct or indirect effects on the human environment.

Reasonably foreseeable future actions are considered projects included in planning documents that are expected to proceed (e.g., funding has been allocated) and are described with adequate detail to inform decision-makers and the public. While there is not a specific time frame defined as “reasonably foreseeable”, actions that occur many years in the future are typically speculative and their details are ill-defined for inclusion in analyzing their cumulative impacts.

Because the Proposed Action concerns an arrival path, aviation-related projects associated with airports within the GSA were emphasized when assessing cumulative impacts--these projects would be more likely to generate impacts similar to the Proposed Action. In addition to projects at the Airport, additional projects have been identified at other airports in the GSA—all these projects are listed in **Table 3.3-7**.

Non-aviation projects and plans within the GSA were also identified for consideration in the assessment of cumulative impacts. Regional and local plans for jurisdictions and agencies in the GSA were reviewed to identify projects which could contribute to cumulative impacts. While these plans have been identified from across the GSA, the environmental consequences from the considered impact categories in this EA will be tabulated and reviewed relative to these projects

¹⁸ 40 CFR §1508.7, 1978 (as amended in 1986 and 2005).

¹⁹ Considering Cumulative Effects Under the National Environmental Policy Act, Council on Environmental Quality, p. 8, <https://ceq.doe.gov/docs/ceq-publications/ccenepa/sec1.pdf>

to ascertain if any of plans meet the definition of cumulative impacts with respect to the Proposed Action. Given that the project is entirely within the airspace around the Airport, the potential for cumulative impact for non-aviation projects and plans will be judged relative to any significant or reportable impacts from the considered impact categories. There are over 100 non-aviation projects that have recently occurred or are expected to occur in the reasonably foreseeable future within the GSA and given the large list, these projects are listed in **Appendix C**.

**TABLE 3.3-7
ANTICIPATED PROJECTS AT AIRPORTS WITHIN THE GSA**

Airport Name	Identification Code	Ongoing/Anticipated Projects
Boston Logan International Airport	BOS	Framingham Logan Express Expansion Project
Boston Logan International Airport	BOS	Airport Parking Project
Boston Logan International Airport	BOS	Terminal C Canopy, Connector and Roadway Project
Boston Logan International Airport	BOS	Terminal E Modernization Project
Boston Logan International Airport	BOS	Airport Renovations and Improvements at Terminals B & C/E
Boston Logan International Airport	BOS	Rehabilitation of Runway 9-27 and Taxiway D
Boston Logan International Airport	BOS	Rehabilitation of Runway 4L-22R and Electrical Vault
Boston Logan International Airport	BOS	Airport Noise Study (BLANS)
Cranland Airport	28M	No Anticipated Changes
Mansfield Municipal Airport	1B9	Reconstruct Main Apron and East Ramp
Mansfield Municipal Airport	1B9	Reconstruct Runway 14-32
Mansfield Municipal Airport	1B9	Reconstruct Quadrant Four Apron
Mansfield Municipal Airport	1B9	Reconstruct Taxiway "C" and "D"
Marshfield Municipal Airport-George Harlow Field	GHG	No Anticipated Changes
Monponsett Pond Seaplane Base	MA6	No Anticipated Changes
Norwood Memorial Airport	OWD	No Anticipated Changes
Pheasant Field Airport (private)	MA64	No Anticipated Changes
Sherman-Private Airport (private)	MA63	No Anticipated Changes
Sudbury Airport (private)	MA70	No Anticipated Changes
Unnamed Southborough Airfield	1MA5	No Anticipated Changes

Source: Massachusetts Port Authority, 2020. Mansfield Municipal Airport, Airport Master Plan Update.