



FLOODING
VULNERABILITY
IN BOSTON

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PLG577: Intro to GIS

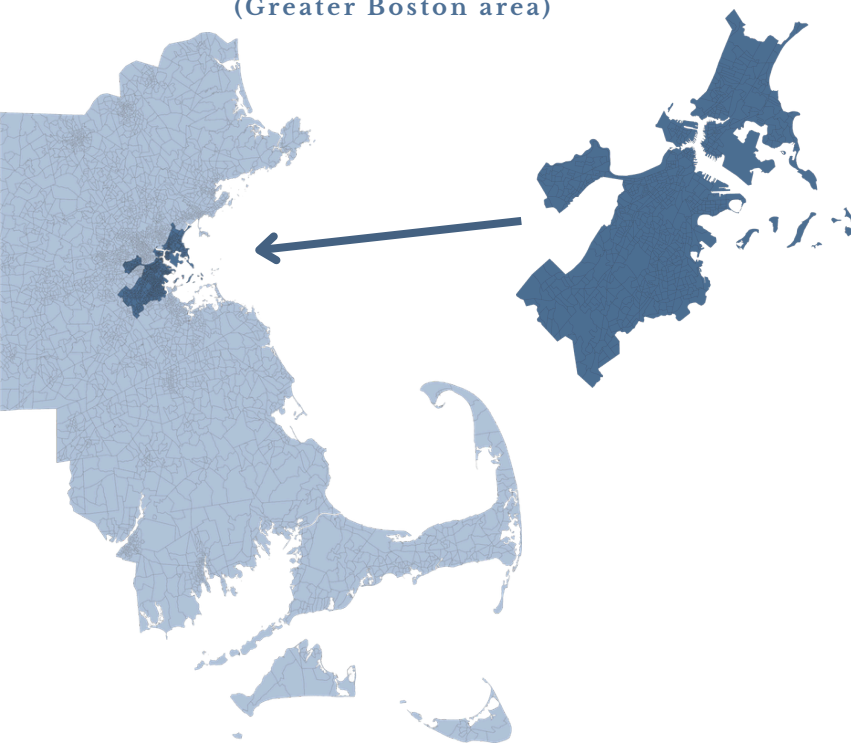
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INTRODUCTION

Which census block groups in Suffolk County, Massachusetts are most vulnerable to effects from coastal flooding?

Suffolk County, Massachusetts
(Greater Boston area)



Boston, Massachusetts is located on the Northeastern coast of the United States. Due to its proximity to the coast and northern geographic location, Boston is frequently a victim to extreme weather. In particular, Boston is highly susceptible to extreme rain storms, and in turn, coastal flooding. The City of Boston, particularly neighborhoods in Suffolk County, has taken precaution to assist neighborhoods that are especially vulnerable to flooding and flood damage.

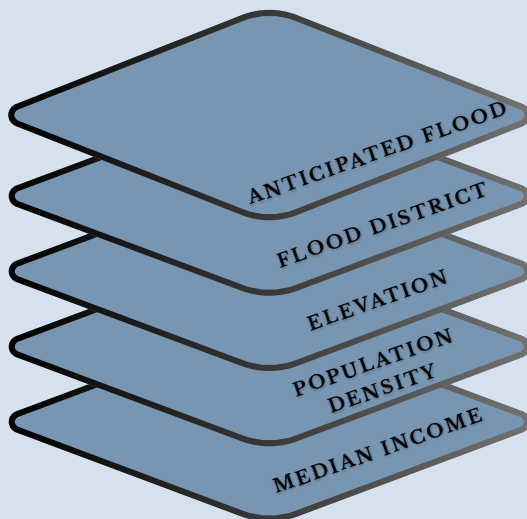
ACCORDING TO THE CENSUS

791,891

2024 POPULATION ESTIMATE

363,641

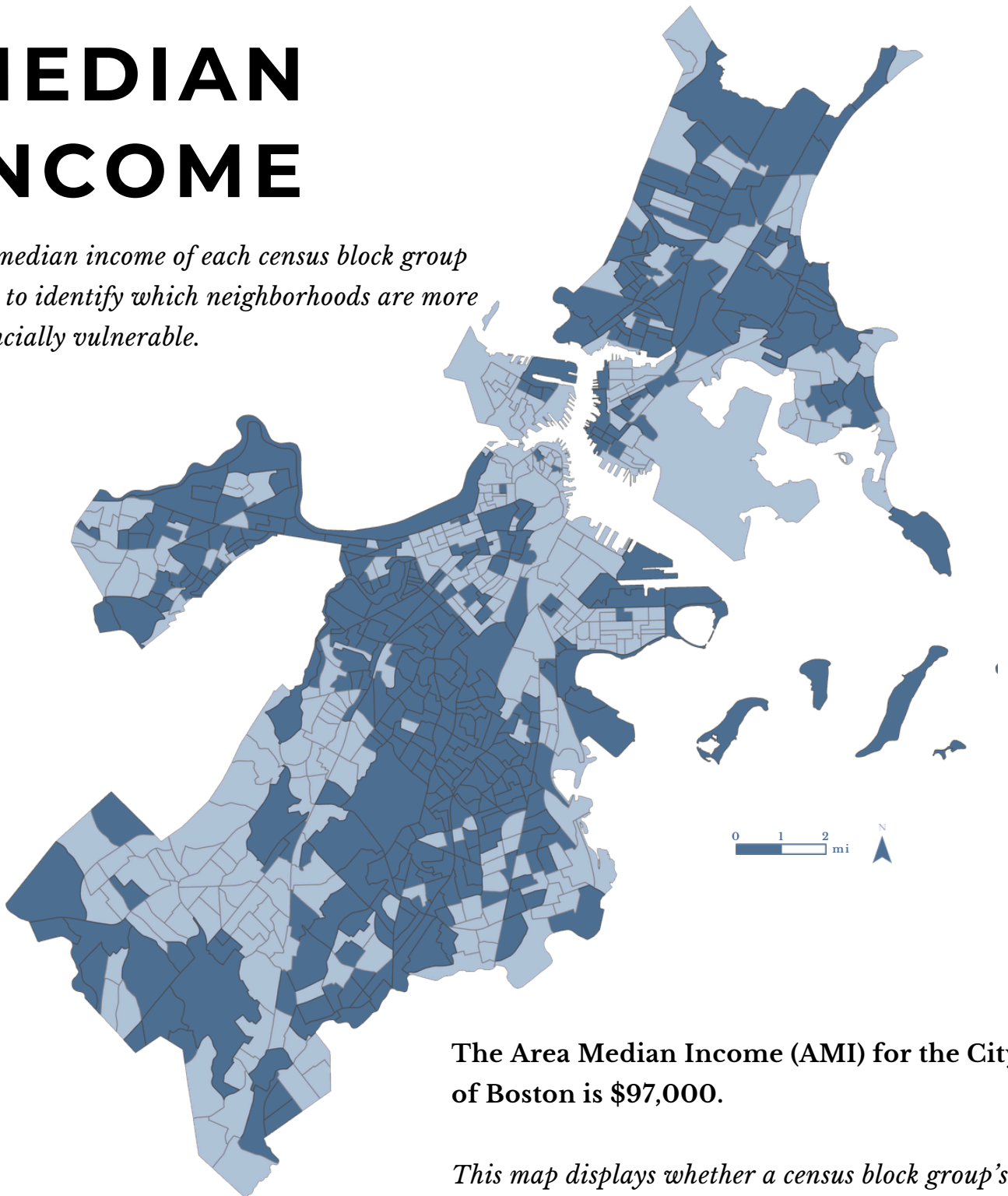
TOTAL HOUSING UNITS



The purpose of this report is to identify which census block groups in Suffolk County, Massachusetts (Boston) are most vulnerable to the effects of coastal flooding. This report will analyze and determine vulnerability scores for all 680 block groups. This is determined by selecting five criteria that is layered (as shown to the left) that helps determine potential vulnerability. Whether or not a block group meets each criteria is scored, then totaled up to determine its “suitability score” or quantitative potential vulnerability.

MEDIAN INCOME

The median income of each census block group helps to identify which neighborhoods are more financially vulnerable.



The Area Median Income (AMI) for the City of Boston is \$97,000.

This map displays whether a census block group’s median income falls below, meets, or exceeds the city AMI. This map also helps to illustrate any disproportionality in clusters of either low income or high income. Vulnerability criteria is met when the median income is less than or equal to city average, identifying a “lower-income” block group.

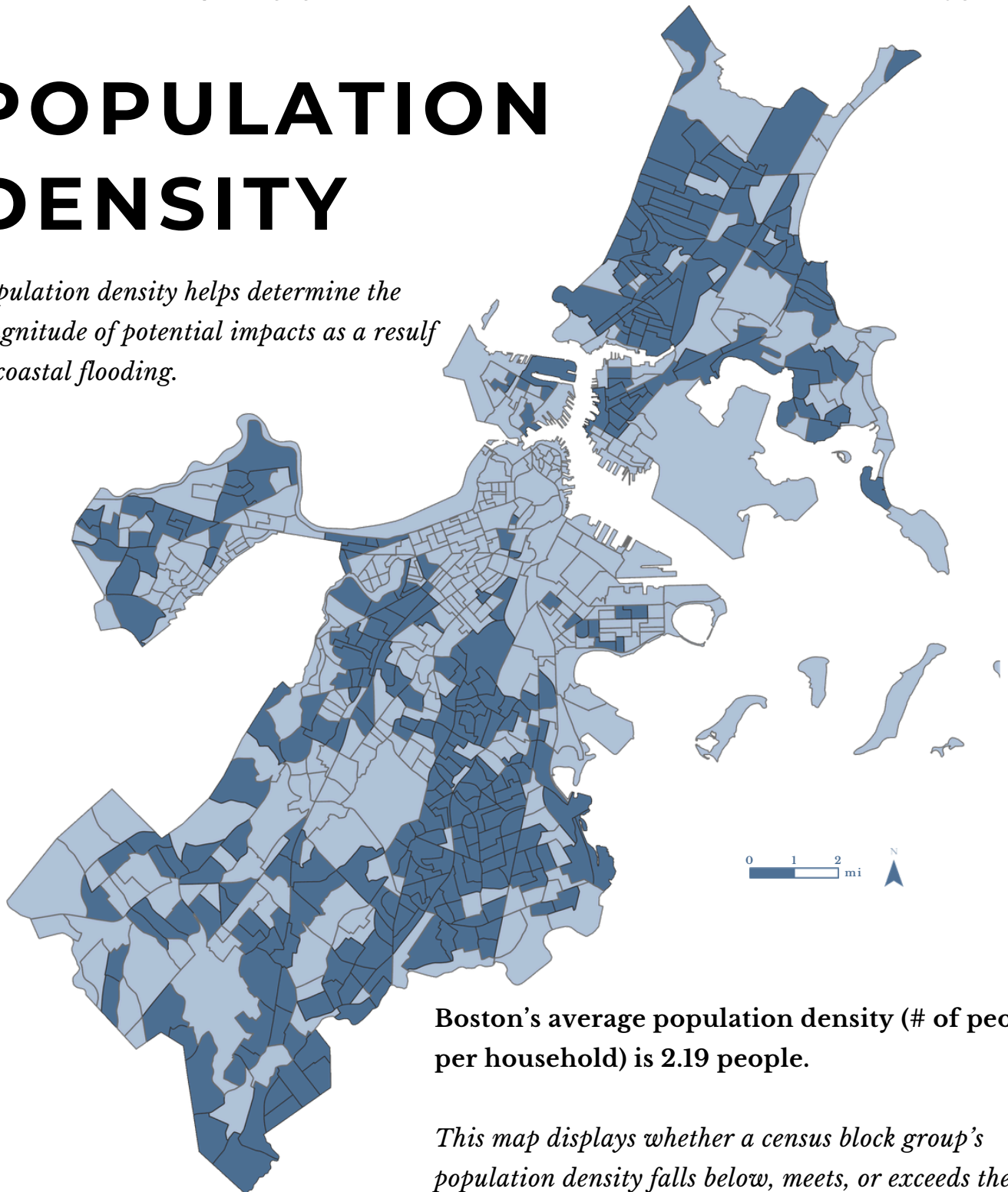
BLOCK GROUP MEDIAN INCOME

LESS THAN/AT CITY AVERAGE

MORE THAN CITY AVERAGE

POPULATION DENSITY

Population density helps determine the magnitude of potential impacts as a result of coastal flooding.



Boston's average population density (# of people per household) is 2.19 people.

This map displays whether a census block group's population density falls below, meets, or exceeds the city's average. This was determined by normalizing total population to number of housing units. This map also helps to illustrate any disproportionality in clusters of either low income or high income.

Vulnerability criteria is met if density is higher, when a block group's density is greater than or equal to 2.19.

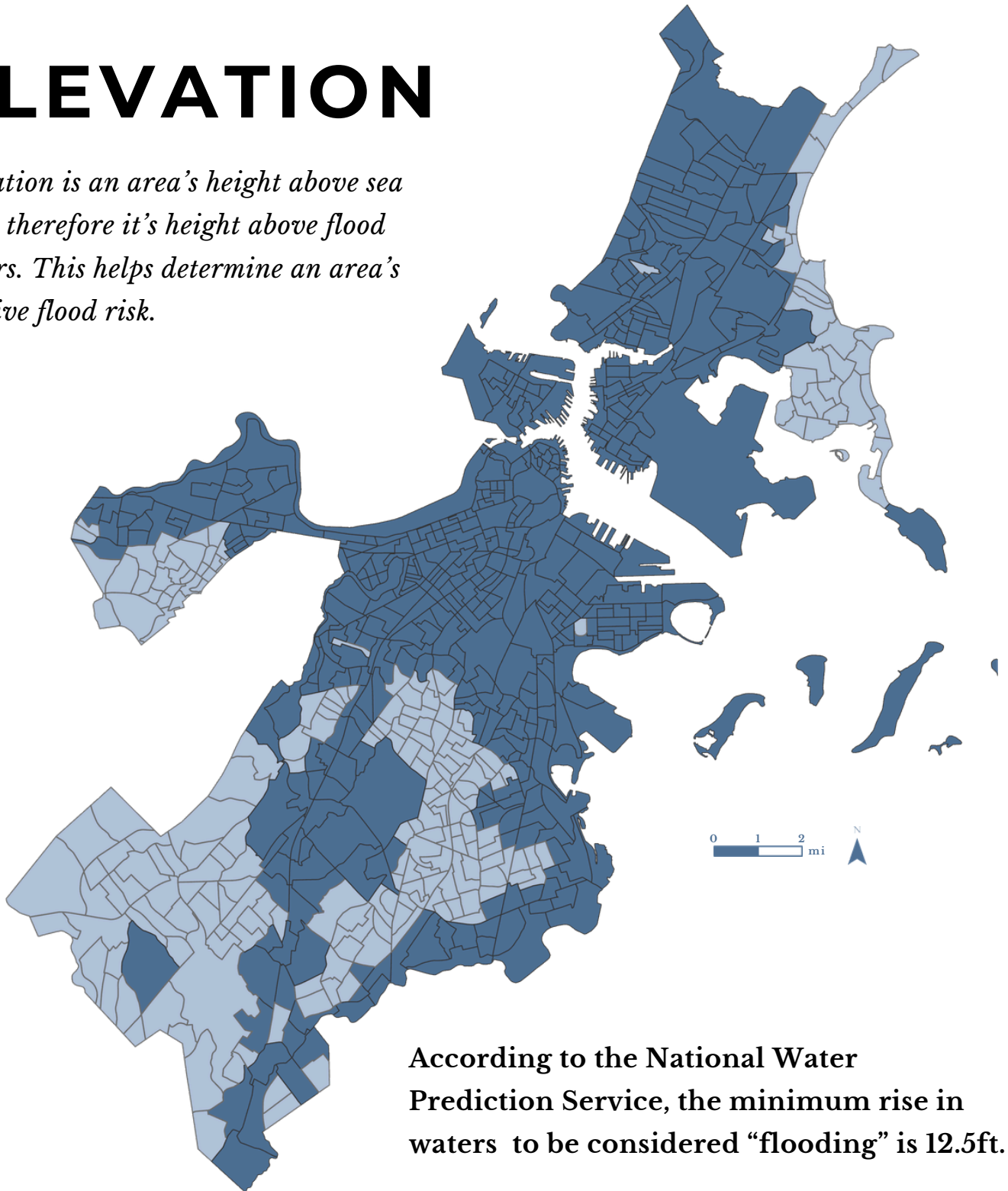
PEOPLE PER HOUSEHOLD

MEETS/EXCEEDS 2.19

FALLS BELOW 2.19

ELEVATION

Elevation is an area's height above sea level, therefore it's height above flood waters. This helps determine an area's relative flood risk.



ELEVATION MINIMUMS

AT OR BELOW 12.5FT

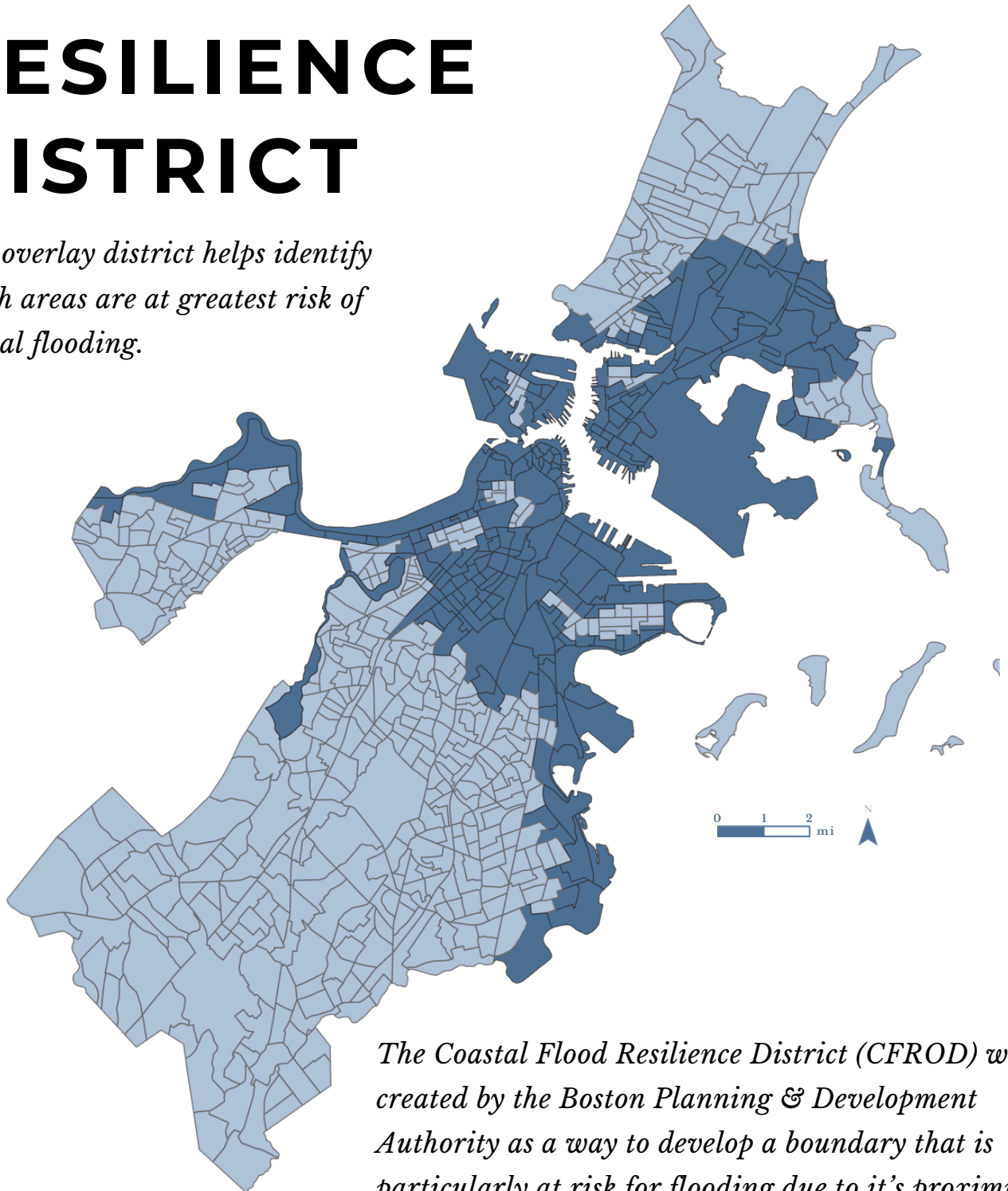
HIGHER THAN 12.5FT

According to the National Water Prediction Service, the minimum rise in waters to be considered “flooding” is 12.5ft.

This map displays whether the minimum elevation for each census block group is at or beneath 12.5 ft, indicating a higher likelihood of flooding. Vulnerability criteria is met if a block group's minimum elevation is at or below 12.5ft.

COASTAL FLOOD RESILIENCE DISTRICT

This overlay district helps identify which areas are at greatest risk of coastal flooding.



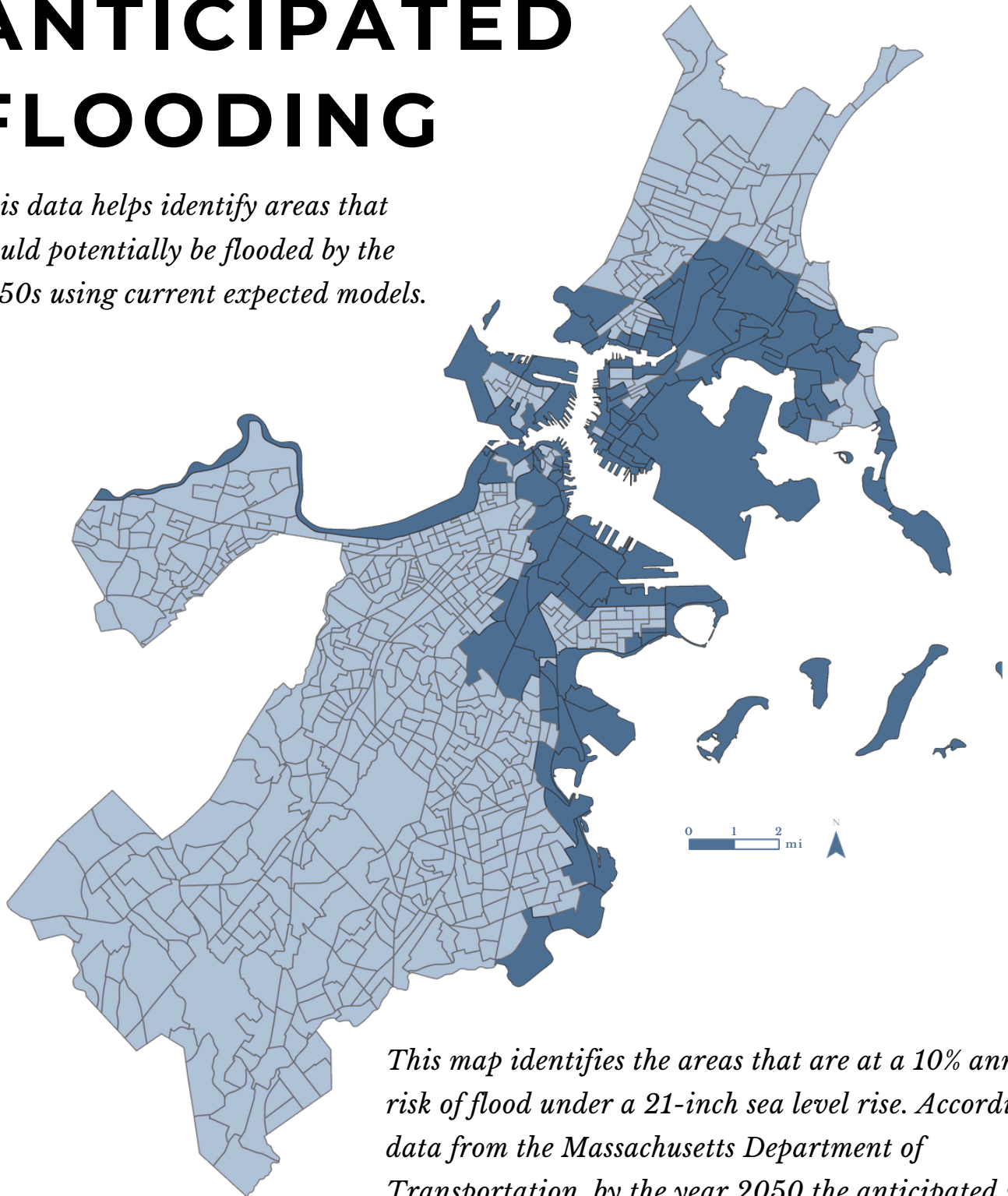
WITHIN CFROD

OUTSIDE OF CFROD

The Coastal Flood Resilience District (CFROD) was created by the Boston Planning & Development Authority as a way to develop a boundary that is particularly at risk for flooding due to its proximity to the coast. This map illustrates which census block groups intersect with the overlay district. Vulnerability criteria is met when a block group falls within the CFROD.

ANTICIPATED FLOODING

This data helps identify areas that would potentially be flooded by the 2050s using current expected models.



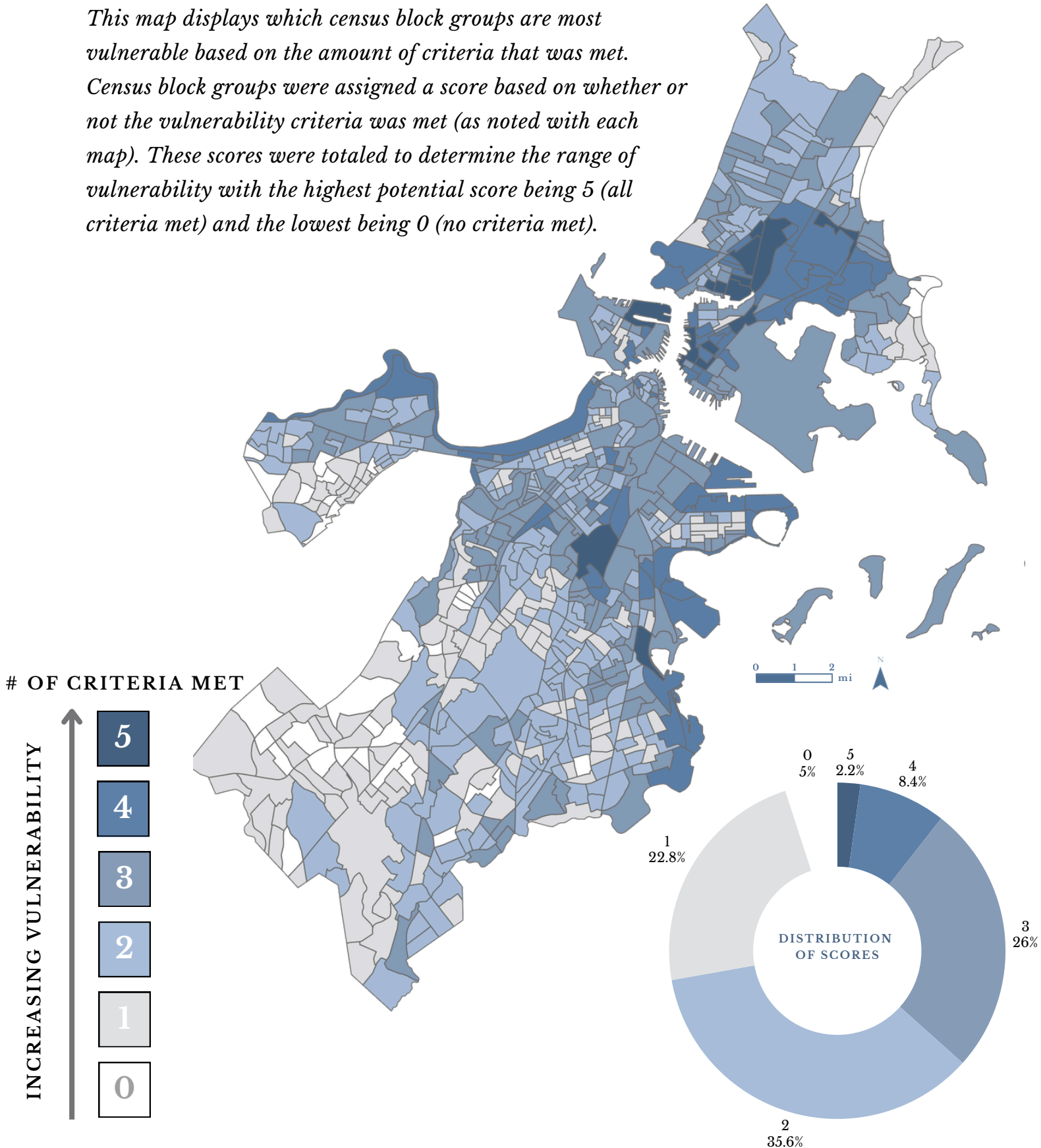
FLOOD ANTICIPATED

FLOOD NOT ANTICIPATED

This map identifies the areas that are at a 10% annual risk of flood under a 21-inch sea level rise. According to data from the Massachusetts Department of Transportation, by the year 2050 the anticipated sea level rise is 21". This map highlights which areas have the highest likelihood of coastal flood in this scenario. Vulnerability criteria is met if the census block group falls within the anticipated flood area.

SUITABILITY SCORES

This map displays which census block groups are most vulnerable based on the amount of criteria that was met. Census block groups were assigned a score based on whether or not the vulnerability criteria was met (as noted with each map). These scores were totaled to determine the range of vulnerability with the highest potential score being 5 (all criteria met) and the lowest being 0 (no criteria met).



METADATA

Map 1 - Median Income

Who: 2024 American Community Survey: 5-year data

What: Median Household Income in the Past 12 Months (in 2024 Inflation-Adjusted Dollars)

Where: Households, Census Tracts (By State/County), United States

Why: Determines the median income per household within a specific census tract block, for the entire United States.

When: 5 year period, 2020-2024, specifically estimates for 2024.

Map 2 - Population Density (Housing)

Who: 2024 American Community Survey: 5-year data

What: Total Housing Units

Where: Census Tracts (By State/County), United States

Why: Identifies the total number of housing units in each census tract block, for the entire United States.

When: 5 year period, 2020-2024, specifically estimates for 2024.

Map 2 - Population Density (Population)

Who: 2024 American Community Survey: 5-year data

What: Total Population, Race

Where: Census Tracts (By State/County), United States

Why: Identifies the total population of every census tract block, and identifies the race of each individual, for the entire United States.

When: 5 year period, 2020-2024, specifically estimates for 2024.

Map 3 - Elevation

Who: National Map Viewer, United States Geological Survey

What: GEOTiff. Digital Elevation Model (DEM) ⅓ Arc Second resolution

Where: Boston, Massachusetts and surrounding areas

Why: Identifies the elevation levels (highs, lows, medians, etc.) for a specific, designated area

When: Created January 17th, 2023. Last updated January 18th, 2023.

Map 4 - Coastal Flood Resilience District

Who: Boston Planning & Development Agency

What: Feature layer. Coastal Flood Resilience Zoning Overlay District (CFR), part of Boston Zoning Code Article 25A.

Where: Boston, Massachusetts and surrounding areas

Why: It identifies the parts of the city that are at greater risk for flood during major storms.

When: Created November 16, 2021. Last updated May 20, 2024.

Map 5 - Anticipated Flooding

Who: Boston Maps, Boston Planning & Development Agency

What: Feature layer. 21Inch Sea Level Rise, 10% Annual Flood chance.

Where: Boston, Massachusetts and surrounding areas

Why: It identifies areas of the city that have a 10% annual risk of flood under a 21inch sea level rise.

When: Created September 22nd, 2017. Last updated July 8th, 2020.

Supplemental Statistics & Data

United States Census Bureau. (2025). *Quick Facts: Suffolk County, Massachusetts*.

<https://www.census.gov/quickfacts/fact/table/suffolkcountymassachusetts#>

National Water Prediction Service. (2026). *Boston Harbor at Boston (IN MLLW)*.

<https://water.noaa.gov/gauges/bhbm3>