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Characteristics of Neighborhoods Vulnerable to Flooding in Boston



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Intro to GIS

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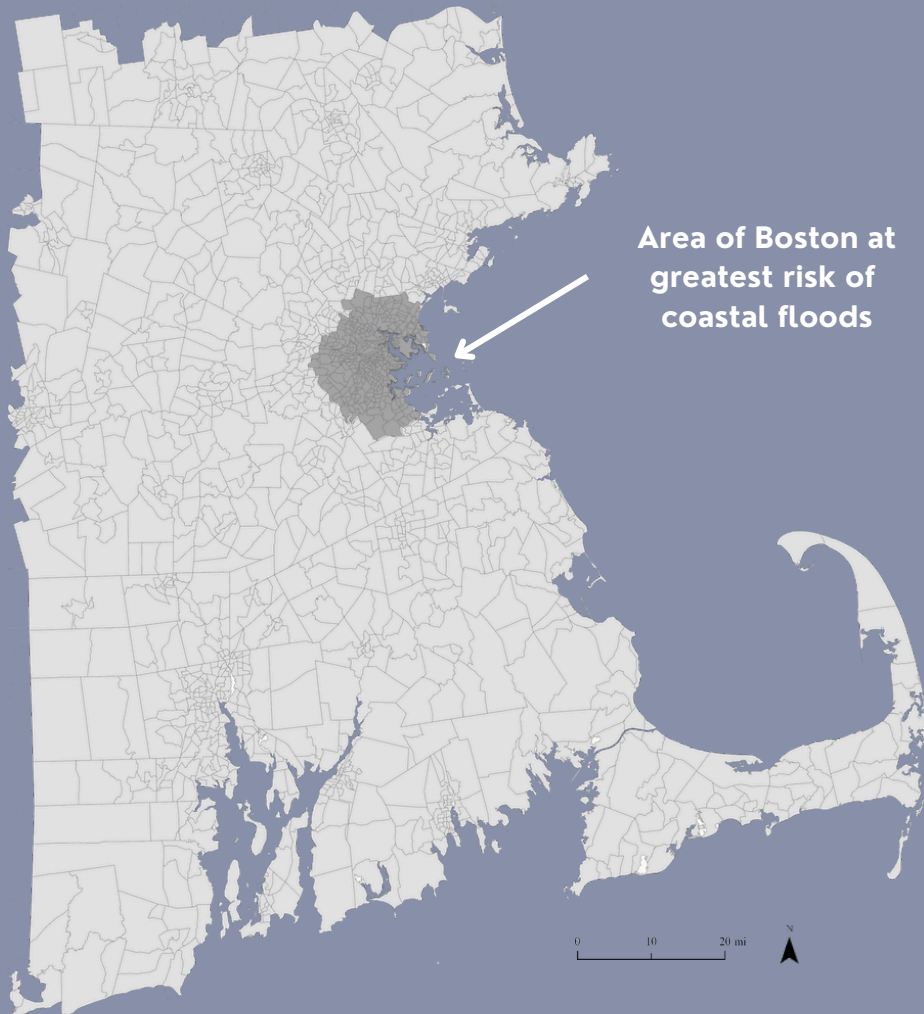


Introduction

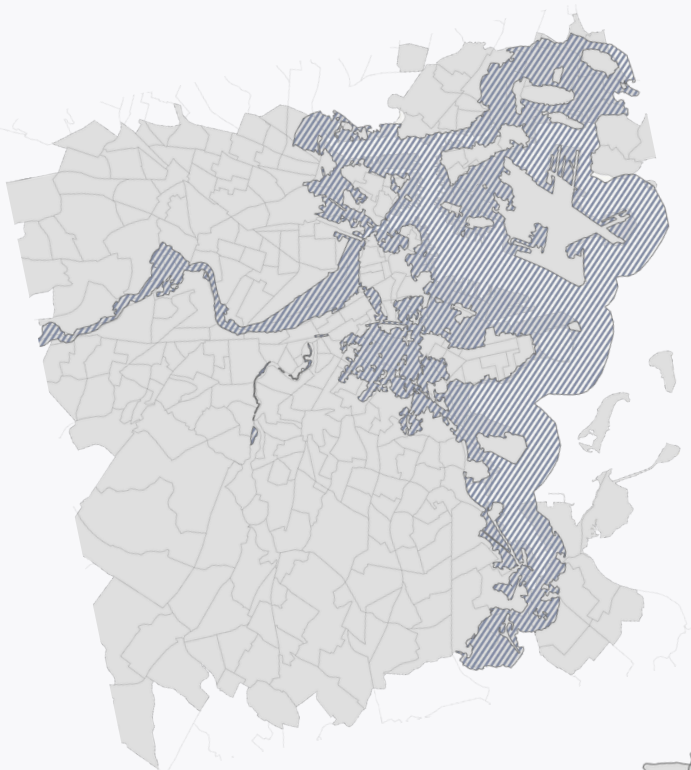
Located in the heart of New England, the Northeastern coastal city of Boston often experiences the impacts of extreme weather, specifically, severe rainstorms. Because of Boston's proximity to the Atlantic ocean, the city is at an increased risk for the negative effects of coastal flooding. In response to this, the City of Boston created an overlay district that identifies neighborhoods that are at a greater risk of flooding, compared to the rest of the city.

This report will analyze the characteristics of the neighborhoods that fall within the coastal flood resilience district (pictured below). This specific district is analyzed through the lenses of income, race, and population density, in addition to the average precipitation. All data was synthesized into a singular data set in order to best address:

"What are the characteristics of neighborhoods that are vulnerable during flooding in Boston?"

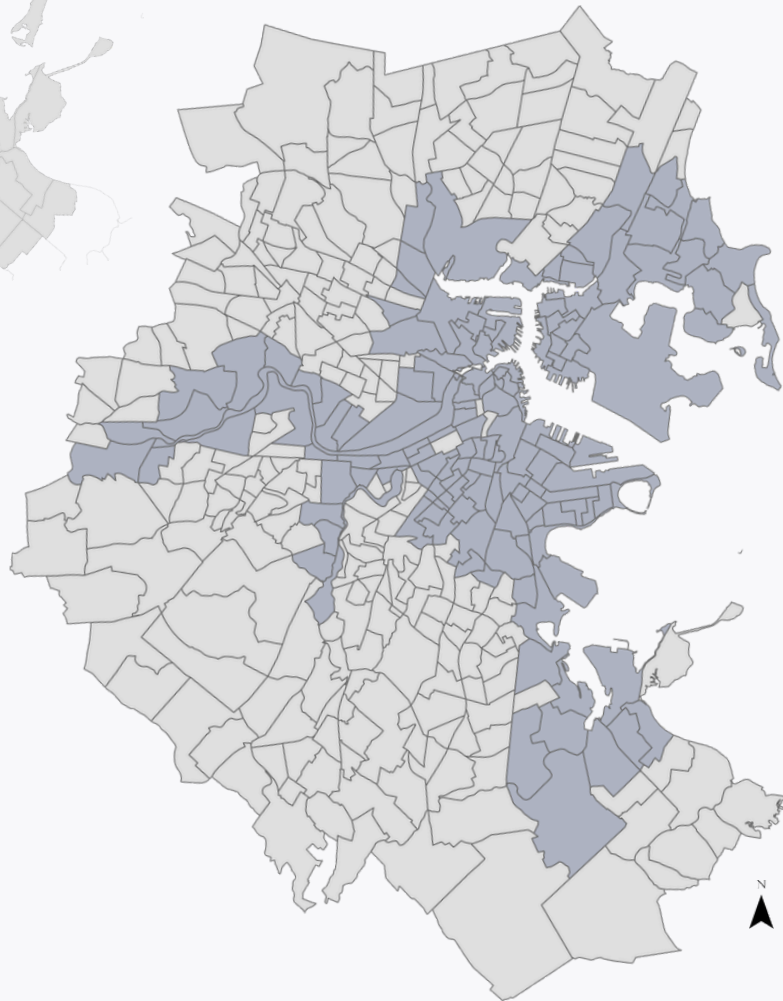


Coastal Flood Resilience District

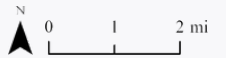


 Coastal Flood Resilience District

The Coastal Flood Resilience District was created by the Boston Planning & Development Authority as a way to identify which neighborhoods are at the greatest risk during coastal flooding. The data was imported as raster (above) then spatially joined to identify which census tract blocks intersected with the overlay district. These neighborhoods are the focus for this report, identifying their characteristics.

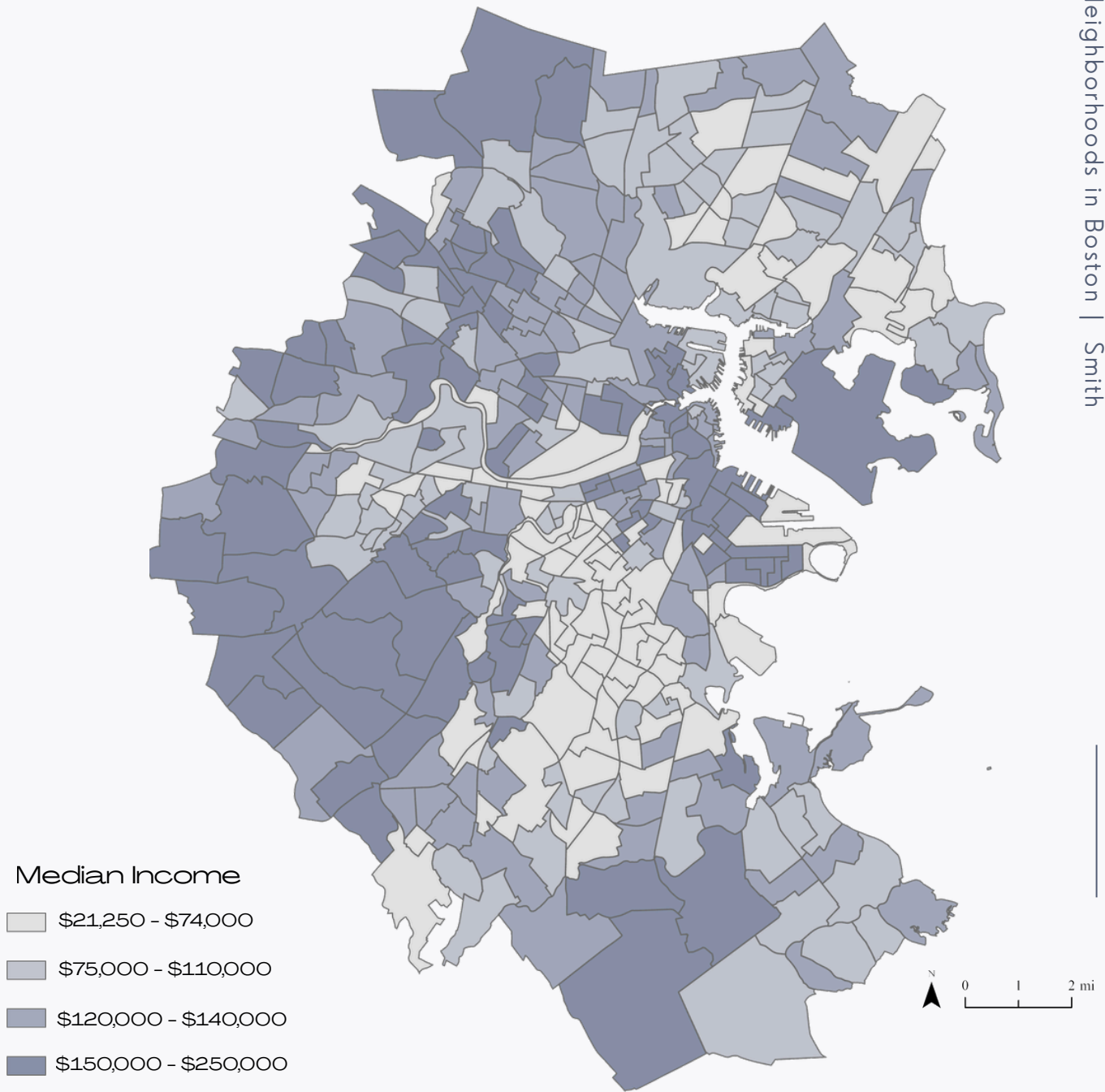


 Intersecting Neighborhoods



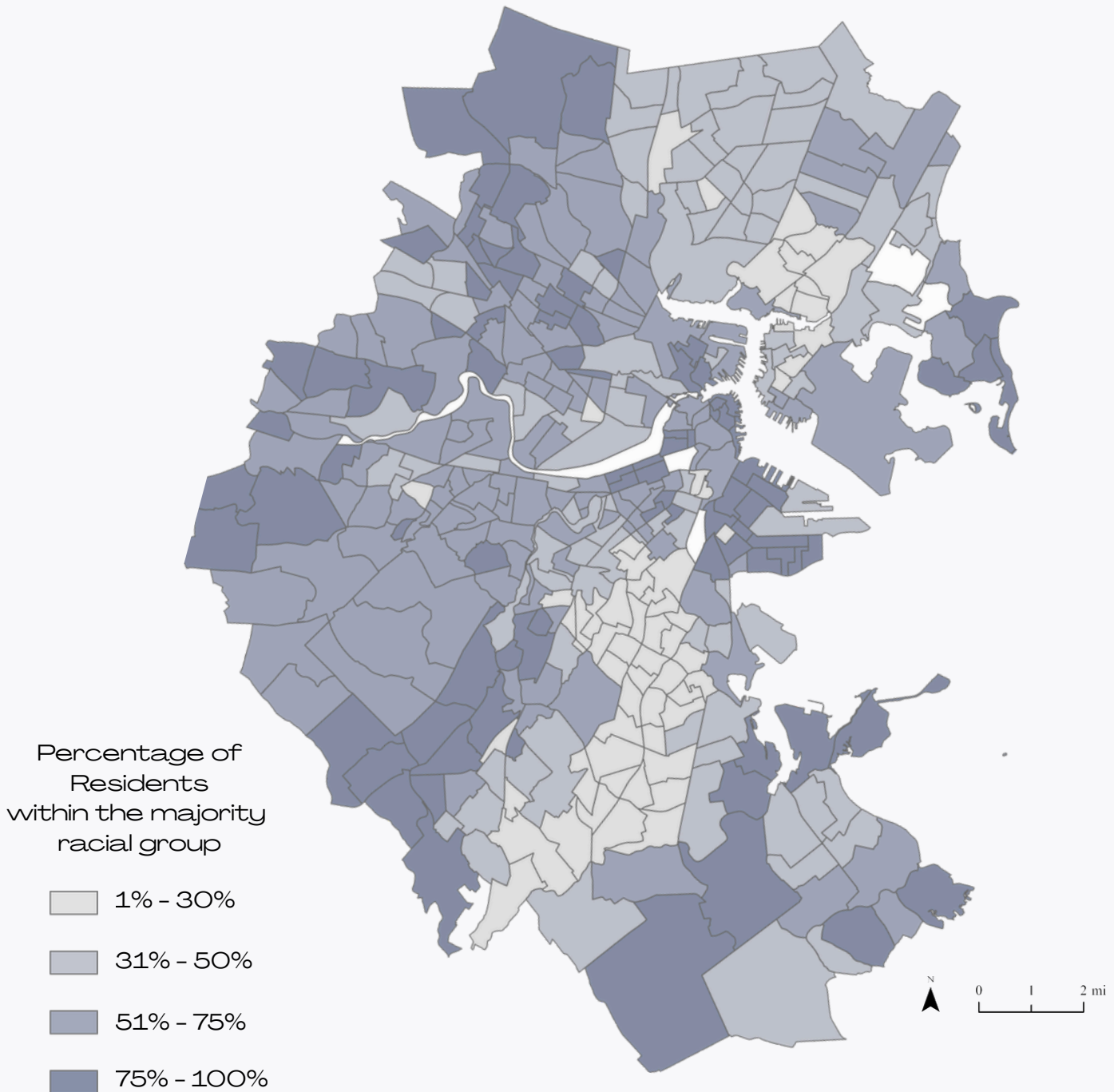
This district contains neighborhoods primarily along the coast. Bostonians would benefit from this data, especially those living in these neighborhoods, as they can identify that they are at an increased risk of flooding compared to the rest of the city.

Median Income



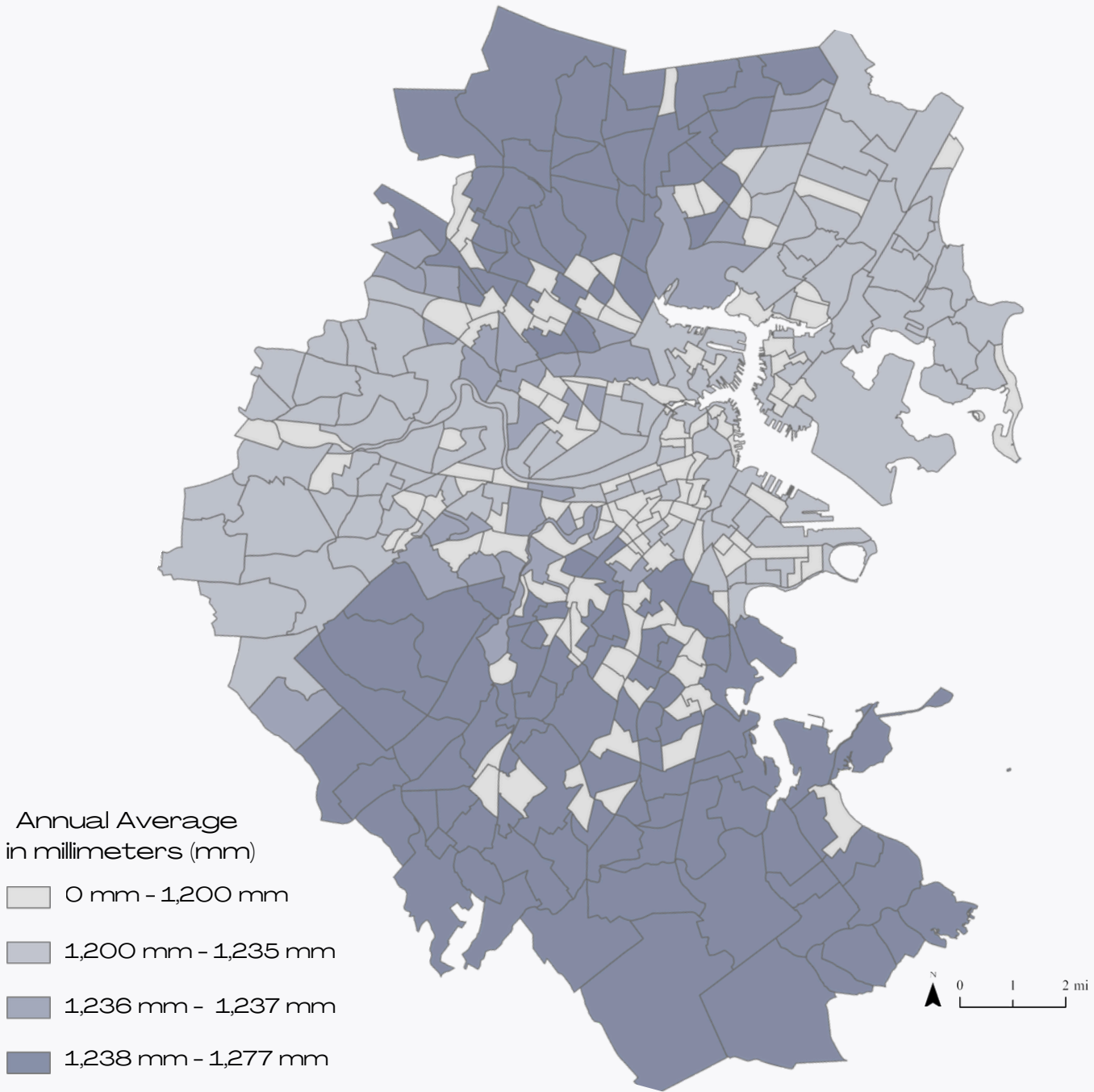
In order to identify the socioeconomic background of these coastal neighborhoods, median income per household must be studied. This map illustrates the wide variety of income levels, and how neighborhoods tend to cluster (ex. higher income neighborhoods in one area). There is an exception, in the middle of the map, where there is a wide range in household income levels within a small area. This data is useful to help identify the household income levels within vulnerable neighborhoods, potentially identifying any disproportionate impact to a specific income level.

Racial Diversity



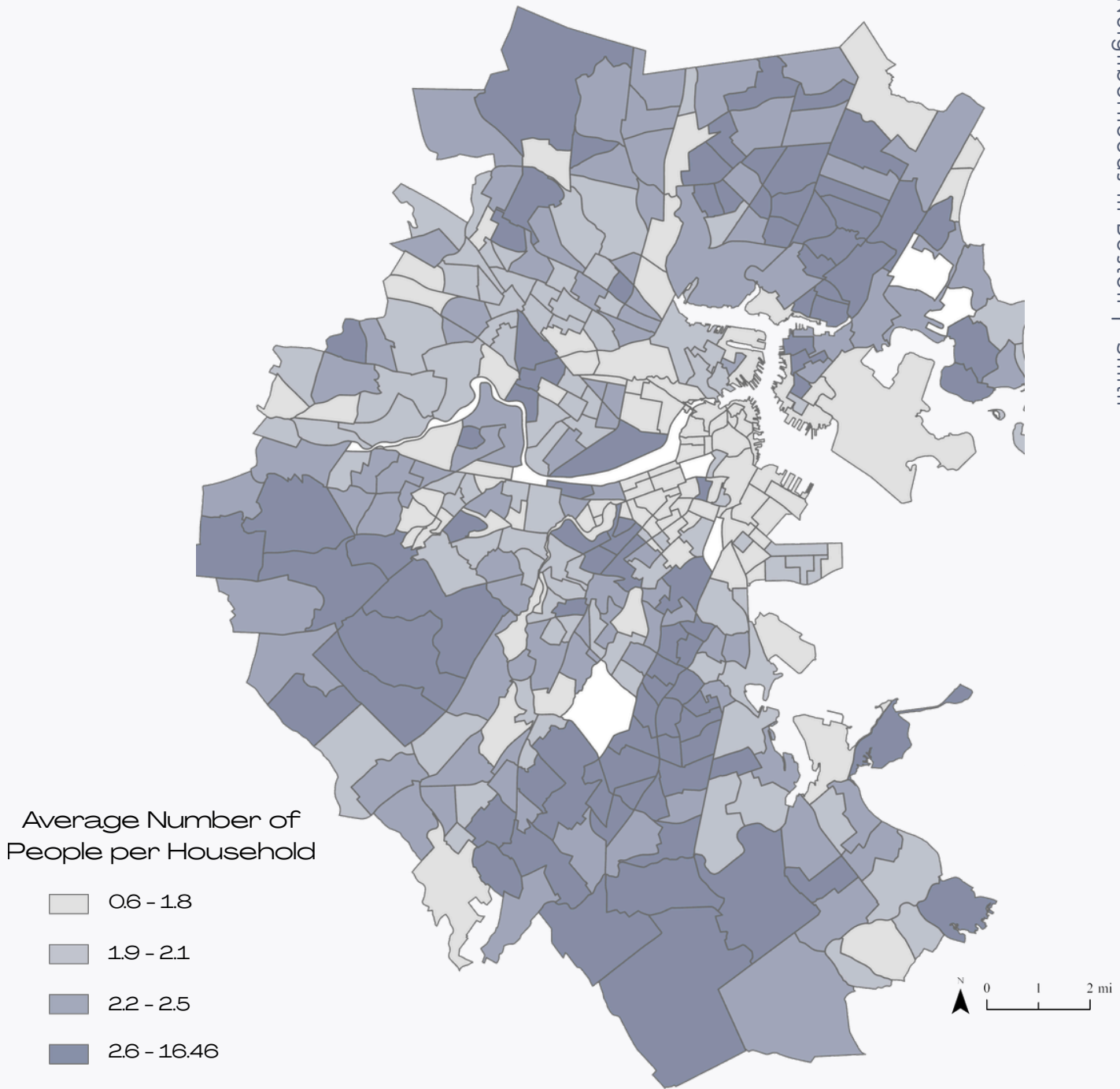
Similar to the Median Income map (Pg. 3), the Racial Diversity map was designed to determine the racial demographics of these neighborhoods. Racial data was retrieved from the Census, which contained the total population, and the count of each individual's race within that census tract block. The total population was normalized with the number of residents who identified with the majority racial group (white), determining the percentage of residents who are not a racial minority. This map helps identify whether racial minorities within a specific neighborhood are disproportionately affected by coastal flooding.

Average Precipitation



One of the most major contributors to risk of flood is rainfall or precipitation. This map uses the PRISM's Digital Elevation Model (DEM) data to identify the area's 30-year average precipitation. The data was displayed as a raster, but using zonal statistics, was joined with census tract blocks to identify the varying precipitation amounts in each neighborhood. The precipitation data was displayed with units in millimeters, which when converted into inches, ranges from 47in to 50in annually. *It is important to note that there are some neighborhoods with "null" precipitation values, which is displayed with the lightest shade of grey.

Population Density



When determining the characteristics of vulnerable neighborhoods, population density is an important attribute to consider, as it helps identify the breadth of potential impacts from coastal flooding. It also helps identify if higher density neighborhoods are disproportionately impacted in flooding. To create this map, housing unit data was retrieved from the census and normalized with population count from the race data. This produced the average number of household members within a census tract block.

Metadata

Map 1 - 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 2 - 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 3 - Racial Diversity

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 4 - Average Precipitation

Who: PRISM Group, Oregon State University

What: Digital Elevation Model (DEM). 30-year Normal Precipitation, Annual Temporal Period, 800m spatial resolution.

Where: Continuous (continental 48) United States.

Why: It identifies the parts of the city that are at greater risk for home damage due to lower groundwater levels

When: 30-year period, 1991-2020.

Map 5 - 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 5 - 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.