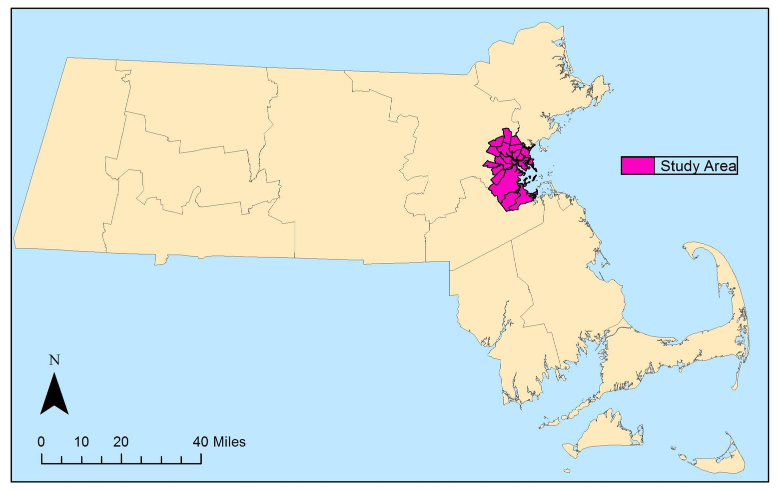
RISING SEAS, RISING COSTS: PUBLIC HOUSING & FLOODING

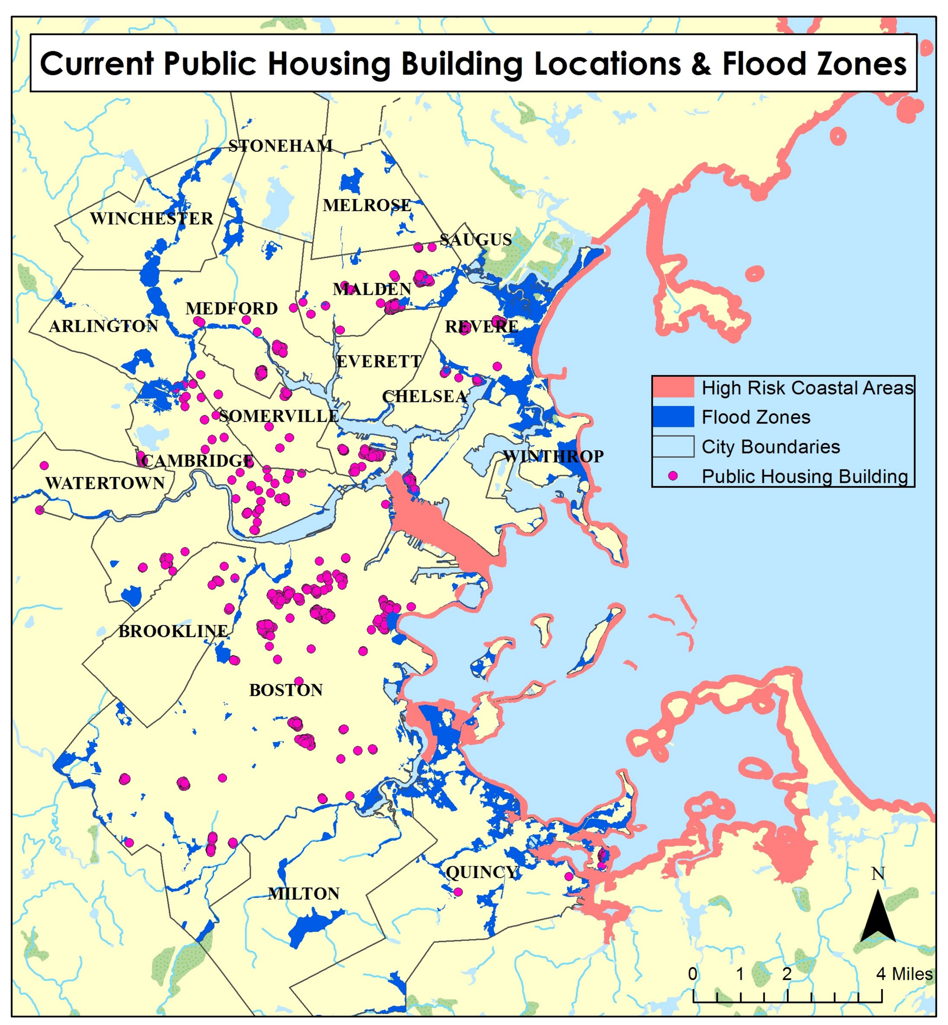
INTRODUCTION

Climate change is a costly burden to overcome as increased sea level rise intensifies storms, flooding, and damage. Massachusetts devotes millions of dollars to combat climate change through projects, like rebuilding infrastructure and nourishing beaches. According to Massachusetts' 2013 State Hazard Mitigation Plan, **there is "a total risk exposure of greater than $57 billion for state-owned and leased buildings in the Massachusetts coastal resource area"** (Commonwealth 2013, 202). Because 25 million people in the United States reside on land vulnerable to sea level rise (Ap, 2015), climate change will likely displace many of these residents in the coming years. It is unfortunate for climate change to uproot anyone from their homes, but displacement will be an especially devastating challenge for individuals at a socioeconomic disadvantage.



I aimed to use GIS to explore the connection of sea level rise and public housing in the Greater Boston Area. Not only would flooding cost the federal, state, or municipal governments that own public housing properties, but flooding and extreme weather events would also burden the low income residents. Using GIS, I **sought to answer the questions**: Where is public housing located in Greater Boston? How do the areas vulnerable to flooding relate to public housing properties? Where should public housing be located to avoid the impact of sea level rise and its consequential flooding?

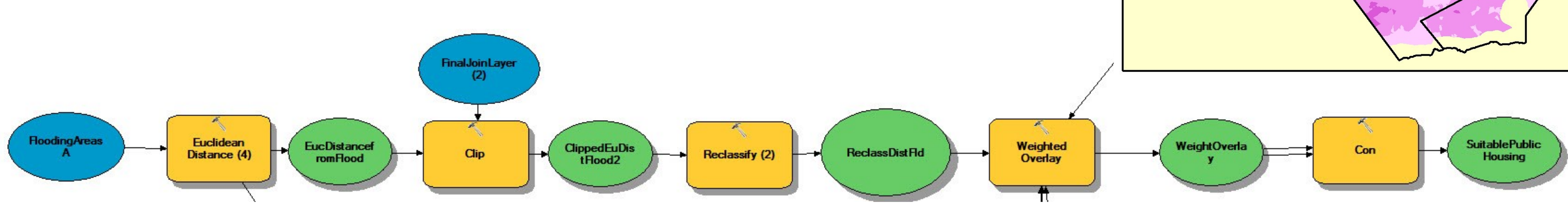
METHODOLOGY

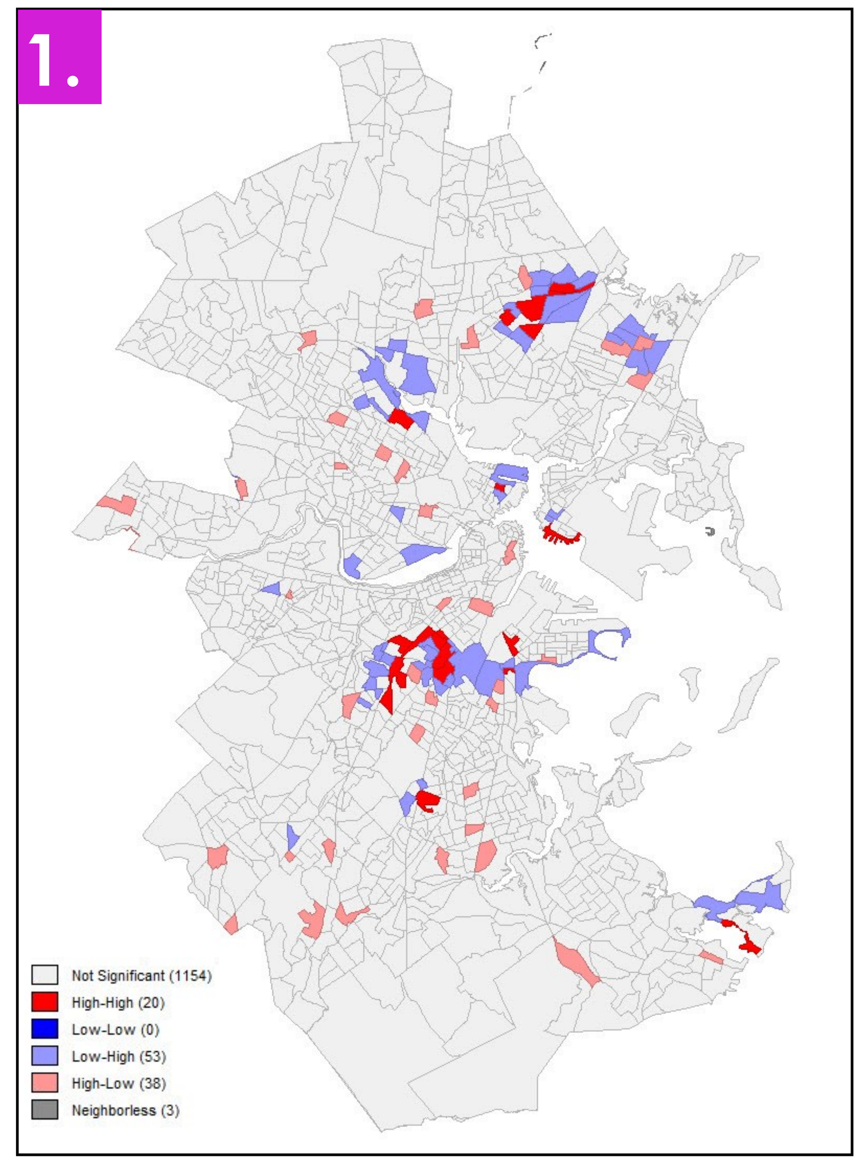


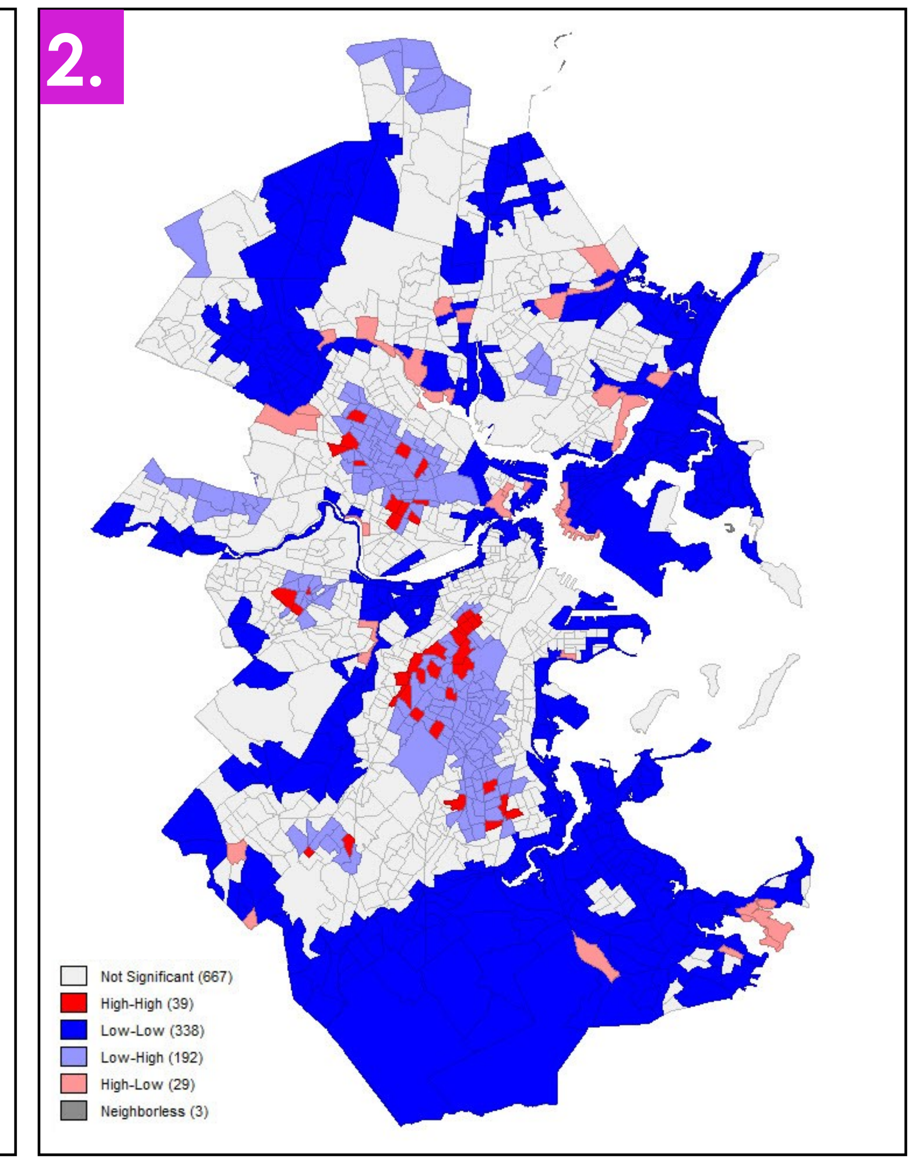
To identify locations of public housing and flood zones around Boston, I retrieved data from the U.S. Department of Housing and Urban Development (HUD) and Mass GIS. After "clipping" HUD's public housing building data to only represent the buildings within my study scope, there were a total of 867 buildings. From Mass GIS, I obtained the Federal Emergency Management Agency's National Flood Hazard Layer that identifies high risk coastal areas and locations with a 1% annual chance of flood risk. This layer was also "clipped" to represent flooding areas within the study scope. With this data, I created a basic map to present the current locations of public housing and flood zones.

After joining all of this data to the cities' block groups along with information regarding race and median rent, I was able to use the "Near" tool to determine the distance of block groups to sites of flooding and calculate how many public housing buildings are in these block groups. To further understand the relationship of median rent, race, and public housing with proximity to flood zones, I utilized GeoDa to run a regression and produce two more maps that indicate clustering.

Lastly, I determined which areas were suitable for public housing by factoring in distance from high risk coastal areas and flood zones along with high elevation and desirable characteristics, like closeness to schools, MBTA rapid transit, and MBTA bus stops. These variables were reclassified on a scale of 1 (low suitability) to 10 (high suitability) and uniquely weighted: 20% Distance to Flood Zones, 25% Distance to High Risk Coastal Areas, 10% Proximity to Schools, 15% Proximity to MBTA rapid transit, 10% Proximity to MBTA bus stops, and 20% High Elevation. I created the suitability map using the same processes for each of these variables. Please see a portion of the model I produced for the variable flood zones or "FloodingAreasA" below:



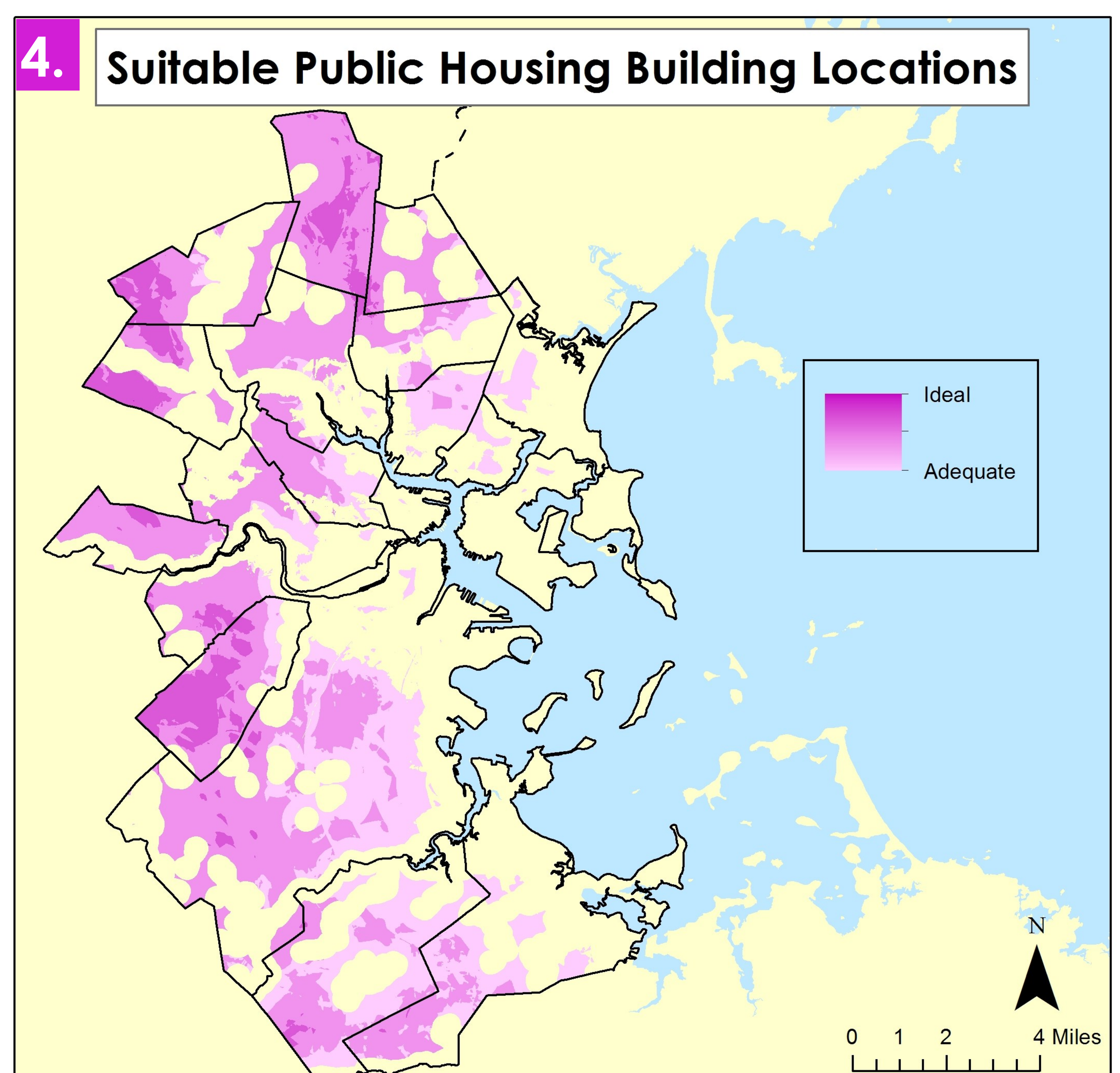




3.

VARIABLE	COEFFICIENT	STANDARD ERROR	T STATISTIC	PROBABILITY
CONSTANT	300.7232	45.6771	6.5837	0.0000
BLACK POPULATION	.5380	0.0574	9.3698	0.0000
MEDIAN RENT	.0849	0.0217	3.9036	0.0001
PUBLIC HOUSING	-9.0662	3.4834	-2.6027	0.0094

OBSERVATIONS	1268
R-SQUARED	.1322



RESULTS & DISCUSSION

1. The first map produced in GeoDa indicates clustering of public housing buildings. The dark red block groups represent high number of public housing buildings surrounded by block groups that also have a high number of public housing buildings, while the light red represents block groups with a high number of public housing buildings surrounded by block groups that have a low number of public housing buildings. The light blue block groups signify low numbers of public housing buildings surrounded by block groups with a high number of public housing.

2. The second map produced in GeoDa indicates clustering of public housing and proximity to flood risk areas. I am specifically interested in the light pink areas in East Boston, Quincy, Chelsea, and Medford as these block groups signify a high number of public housing buildings and a low distance from flood risk zones.

3. This table represents the regression report that was generated after selecting Distance to flood zones (in meters) as the dependent variable. The low probability values indicate that there are significant relationships between the variables "Black population," "Median Rent," and number of "Public Housing Buildings" with Distance. As distance away from flood zones increases by 1 meter, the number of public housing buildings decreases by 9.06618. This means that locations that are further away from flooding areas and, thus, safer from the consequences of climate change, have less public housing. The "Black population" and "Median Rent" variables are directly related to the distance from flooding zones. The standard error represents how much the coefficient may fluctuate, while the T statistic represents the coefficient divided by the standard error. The low R squared value suggests that this model may not be completely suitable for this data.

4. This map indicates adequate to ideal locations for public housing buildings based on distance from high risk flood areas and flood zones, high elevation, and close proximity to schools, MBTA rapid transit stops, and MBTA bus stops. The dark pink areas in Brookline, Stoneham, Winchester, and Arlington represent the most suitable sites for public housing. In these locations, residents will be at minimal risk to flooding. Although these are the most suitable sites for public housing, HUD's data signifies that there are few to none public housing buildings currently in these cities. Overall, as climate change and sea level rise become increasingly risky threats, it is valuable to consider what and who exists in the most vulnerable locations and what sites are safer for people and infrastructure.

REFERENCES

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- Tufts M Drive
- U.S. Department of Housing and Urban Development

Cartographer: Mary Elise Calnan

Date: May 10, 2016

Projection: Lambert_Conformal_Conic

Coordinate System: NAD_1983_StatePlane_Massachusetts_Mainland_FIPS_2001

Course: GIS 102/ Advanced GIS

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