Metro Mayors Climate-Smart Region

Model Criteria
October 24, 2017

Goal	Goal Weights	Criteria	Criteria Weights	Methodology	Data (Description, Date, Resolution)	Data Source
Connect	16.7%					
		Improve Bike Network - Bike to Work Priorities	14.0%	This model identifies key corridors that connect people to employment. Using Network Analyst Closest Facility tool, we identified the most direct routes with potential for active transportation from employment centers (areas with high density of businesses) to the existing bike network. All routes were buffered by 200ft to identify general corridors and assigned moderate priority (3). Additional priority was given to routes identified by MAPC as having medium Local Access Score 4) and high Local Access Score (5). The Local Access Score is calculated using travel demand software that uses input data on population and destinations to estimate the number of trips households are likely to make in a given day, the likely destinations of those trips, and the most direct routes connecting households to their destinations.	ESRI Business Analyst Existing Bike Network MAPC Bicycle and Pedestrin Infrastructure Local Access	ESRI Business Analyst MAPC MAPC MAPC
		Improve Bike Network - Proposed Bike Path Priorities	14.0%	This model identifies key proposed bike corridors that connect people to employment and assigns priority based on the Local Access Score. The Local Access Score is calculated using travel demand software that uses input data on population and destinations to estimate the number of trips households are likely to make in a given day, the likely destinations of those trips, and the most direct routes connecting households to their destinations. All routes were buffered by 200ft to identify general corridors and priority ranking based on a natural breaks classification.	Existing Bike Network MAPC Bicycle and Pedestrin Infrastructure Local Access	MAPC
		Improve Pedestrain Network: Sidewalk Improvement Priorities	14.0%	This model identifies key pedestrian corridors that have no sidewalks or sidewalk only on one side of the street and assigns priority based on the Local Access Score. The Local Access Score is calculated using travel demand software that uses input data on population and destinations to estimate the number of trips households are likely to make in a given day, the likely destinations of those trips, and the most direct routes connecting households to their destinations. All routes were buffered by 200ft to identify general corridors and priority ranking based on a natural breaks classification.	Local Access	MAPC
		Access to Public Schools	7.5%	This model identifies key corridors that connect middle and high school students from nearest bus stops as well as areas within a 10-minute walk of existing schools. Using the Network Analyst Closest facility tool, we identified the 5 most direct routes from existing middle and high schools to the nearest bus stops. All routes were buffered by 200ft to identify general corridors students might use to get from public transit to their school and assigned very high priority (5). A 10-minute walk from every school was then derived to identify opportunities for transportation improvement for younger students walking and biking to school and assigned high priority value (4).	Public Schools	Massachusetts Department of Elementary and Secondary Education (DESE)
		Gaps in Park Access	7.5%	Connecting neighborhood residents to parks and open space for walking, jogging, and bicycling is a key goal for promoting active and healthy lifestyles. The Trust for Public Land's ParkServe® index is based on the percentage of the population living within a ten-minute (half-mile) walk of a public park. The half-mile is calculated along the public road network and uninterrupted by physical barriers such as highways, train tracks, rivers, and fences. TPL's mapping technology identifies which neighborhoods and demographics are underserved by parks and how many people are able to reach a park within a 10-minute walk. Areas within the metro Mayor's region not within a 10-minute walk were assign a very high priority (5).	Parks	TPL

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		Gaps in Greenway Network	7.5%	There are currently over 159 miles of designated Greenway and Water trails in the Metero Mayors region. Nationally, Massachusetts is considered a bike-friendly area, and the region is dedicated to further improving the bicycle network. This model prioritizes potential corridors that could connect gaps in the existing regional greeway bike network. Using Network Analyst Closest facility tool, we identified the most direct routes that would connect gaps in the existing bike network. All routes were buffered by 200ft to identify general corridors and assigned at least a moderate priority (3). Corridors with more overlap were assigned additional priority high (4) and very high (5) using natural breaks classification. Additional priority was given to routes identified by MAPC as having medium Local Access Score 4) and high Local Access Score (5). The Local Access Score is calculated using travel demand software that uses input data on population and destinations to estimate the number of trips households are likely to make in a given day, the likely destinations of those trips, and the most direct routes connecting households to their destinations.	Land Line, MAPC Bicycle and Pedestrian Infrastructure Database	MAPC
		Gaps in Public Transit	7.5%	Access to reliable and affordable public transportation is essential to enhancing quality of life as well as reducing greenhouse gas emissions for a city's population. This model prioritizes areas where city residents are more than a 10-minute walk from available public transportation as well as areas where there is a need for additional public transportation. Areas more than a 10-minute walk from public transportation stop were assigned a very high priority value (5). Areas within a 10-minute walk of the proposed greenlin extension were assigned a high value (4). Areas within a 10-minute walk of low frequency transit were assigned a moderate priority (3).	Public Transit Locations	MBTA
		Improve Pedestrian Safety	14.0%	Improving pedestrian and bicycle safety is key objective of Massachusetts' complete street policy. This model identifies areas where risk of collision is highest based on past collision locations. Hot spots of pedestrian collisions within the neighborhood of 1/8 mile from 2011 to 2013 were derived using a kernel density where added value was given to accidents that resulted in fatalities and serious injury. Priority value assigned using a natural breaks classification.	Collisions, 2011-2013	Mass Department of Transportation
		Improve Cyclist safety	14.0%	Improving pedestrian and bicycle safety is key objective of Massachusetts' complete street policy. This model identifies areas where risk of collision is highest based on past collision locations. Hot spots of bicycle collisions within the neighborhood of 1/8 mile from 2011 to 2013 were derived using a kernel density where added value was given to accidents that resulted in fatalities and serious injury. Priority value assigned using a natural breaks classification.	Collisions, 2011-2013	Mass Department of Transportation

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Cool	16.7%	Landsat Urban Heat Islands	75.0%	This model identifies urban heat islands within the Metro Mayors planning area with elevated daytime land surface temperature (LST) averaging at least 1.25 degrees Fahrenheit above the mean daily temperature during late June/early July. The model results were derived from Landsat satellite data, which provides a 30m downscaled average land surface temperature every 16 days. Historical records show the warmest months in Boston are July and August. The model used a scene from July 7, 2015, the only cloud free LandSat scene from the year.	Landsat Land Surface Temperature was derived by MAPC staff using the LandSat TRS tools toolbox. Detailed information on tools and methodology can be found in: Walawender J., Hajto M., Iwaniuk P., 2012, A new ArcGIS toolset for automated mapping of land surface temperature with the use of LANDSAT satellite data. Proc. IEEE International Geoscience and Remote Sensing Symposium (IGARSS), 22-27 July 2012, Munich, Germany, 4371-4374, doi: 10.1109/IGARSS.2012.6350405	USGS Earth Explorer Walawender J., Hajto M., Iwaniuk P., 2012
		MODIS Nighttime Urban Heat Islands	25.0%	This model identifies urban heat islands within the Metro Mayors planning area with elevated nighttime land surface temperature (LST) averaging at least 1.25 degrees Fahrenheit above the mean daily temperature during July and August of 2015. The model results were derived from MODIS/Aqua MYDA2 satellite data, which provides a 1km (0.6 mi) gridded average land surface temperature over 8 day periods derived using a plit-window algorithm. Historical temperature records show that the warmest months in Boston are July and August. Nine consecutive 8-day MODIS LST averages were compiled to create a 2-month average over the period of June 26 - September 5 2015. This broad time span helps to alleviate issues relating to short-term temperature fluctuations and absence of satellite data in specific areas due to cloud cover or other issues.	MODIS Land Surface Temperature	MODIS

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Absorb	16.7%					
		Current Flood Zones	12.5%	This model assigns coastal flooding risk priorities based on 2015 Flood Advisory Zones developed by FEMA. The Flood Advisory Zones take into consideration a combination storm surge, wave setup, and overland wave action. Zone A designates areas subject to coastal flood effects based on the 1% annual chance flood elevation (100-yr flood event). Zone X designates areas subject to coastal flood effects associated with 0.2% annual chance flood event (500-yr flood event). Zone A was assigned very high priority (5). Zone X was assigned high priority (4). The Advisory Flood Zones are intended to serve as the best available data for understanding coastal flood hazard risk and the elevations that communities should build to in order to protect themselves from future coastal flood events.	2015 FEMA DFIRM Flood Zones	FEMA, MassGIS
		Estimated Runoff Potential	12.5%	According to the Massachusetts Climate Change Adaptation Report, the frequency of extreme precipitation events is expected to increase in the future. This model estimates runoff volume for a 1" storm event using the NRCS TR-55 Curve Number methodology, which considers soil and land use characteristics. A one-inch design storm was chosen to represent runoff priorities for water quality and where first flush issues might be addressed. Runoff levels were scored based on projected runoff using a natural breaks slice as follows: Greater than or equal to 1" = Very High Priority (5) 0.75"- 1" = High Priority (4) 0.5" -0.75" = Moderate Priority (3) Less than 0.5" = not scored	SSURGO Soil Hydrologic Groups 2005 LANDUSE Purdue Runoff Curve Number Table	NRCS, ESRI Image Service MassGIS Purdue University
		Soil Permeability	12.5%	Sea level rise combined with expected increase in large precipitation events could potentially inundate numerous municipal collection systems within the Metro Mayors region, and it is important to take measures to reduce stress on river and coastal infrastructure such as dams, levees, and seawalls (Massachusetts Climate Change Adaptation Report, 2011). One strategy to address stormwater flows is to promote stormwater infiltration into the ground at the site of origin to take pressure of a central system. This model prioritizes areas where soils have a high infiltration capacity using the SSURGO Hydrologic Soil Group classification. Soils characterized with a hydrologic soil group of A (soils having a high infiltration rate when thoroughly wet) were assigned a very high (5) priority; soils characterized with a hydrologic soil group of B (soils having a moderate infiltration rate when thoroughly wet) were assigned a moderate priority (3); all other soils were assigned a low priority (1).	SSURGO Soil Hydrologic Groups	NRCS, ESRI Image Service
		Slope	12.5%	Slope is a key consideration when choosing potential sites for green infrastructure for stormwater management. Steep slopes are typically avoided for many types of collection systems. This model prioritizes area with low to moderate slope as follows: 0 = Very High Priority (5) 0 - 2 = High Priority (4) 2 - 5 = Moderate Priority (3) Greater than 5 = not scored	This raster layer represents surface elevation for Massachusetts. It was created from the digital terrain models that were produced as part of the 1:5,000 Black and White Digital Orthophoto imagery project. Cellsize is 5 meters by 5 meters.	MassGIS

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		Existing Wetlands	12.5%	Wetlands are critical natural infrastructure for mitigating and minimizing flood damage. Wetlands store precipitation and surface water and then slowly release the water into associated surface water resources, ground water, and the atmosphere. Conservation of these areas will support the persistence of numerous species (common and rare) within Massachusetts. This model assigns very high priority(5) to areas within 200ft of all existing wetlands as well as upland habitats adjacent to existing coastal wetlands that might provide function of a wetland under future climate scenarios.	Priority Natural Communities - includes natural communities with limited distribution - regionally or globally - and the best examples documented of more common types such as oldgrowth tracts of widespread forest types. There are 782 examples of 94 different types of priority and exemplary Natural Community types included in BioMap2. Natural communities are defined as interacting assemblages of plant and animal species that share a common environment and occur together repeatedly on the landscape. Aquatic Cores - identifies core habitat for fish Species of Conservation Concern and other aquatic Species of Conservation Concern. In addition to various rivers and streams, a 30 meter band around each river segment is mapped, as well as wetlands that are wholly or partially contained within the band. The resulting Aquatic Cores are designed to protect 10 MESA-listed fish, 17 non-listed fish, as well as 145 MESA-listed species with all or a portion of their life cycle in aquatic habitats. Wetland Cores - identifies the most intact wetlands within less developed landscapes-those generally with intact upland buffers, little fragmentation, and minimally disturbed by other stressors associated with roads and development. These wetlands, selected across a diversity of ecological settings, are most likely to support critical wetland functions (i.e., natural hydrologic conditions, diverse plant and animal habitats, etc.) and are most likely to maintain these functions into the future.	NHESP/TNC BioMap2, MassGIS
		Coastal Adaptation Areas	12.5%	Wetlands are critical natural infrastructure for mitigating and minimizing flood damage, and identifying areas with high potential to support inland migration of salt marsh and other coastal habitats over the coming century due to sea level rise. This model assigns very high priority(5) to areas within 200ft of all coastal adaptation areas that might provide the function of a wetland under future climate scenarios.	The BioMap2 team examined the landward side of salt marshes to determine where these habitats might move to as sea levels rise. Undeveloped lands adjacent to and up to one and a half meters above existing salt marshes were identified, and included as Critical Natural Landscapes with high potential to support inland migration of salt marsh and other coastal habitats over the coming century	NHESP/TNC BioMap2, MassGIS
		Sinks	12.5%	A sink is a depression in the landscape that can trap water. This model identifies sinks in the landscape where water is expected to be trapped. Sinks were identified using the Digital Elevation Model (DEM) from MassGIS. The DEM was filled using the FILL tool from the ARCGIS hydrology data set. The new elevation model was subtracted from the original. Areas with negative elevation were identified as sinks and priority value was assigned using a natural breaks classification.	This raster layer represents surface elevation for Massachusetts. It was created from the digital terrain models that were produced as part of the 1:5,000 Black and White Digital Orthophoto imagery project. Cellsize is 5 meters by 5 meters.	MassGIS
		Water Quality	12.5%	Using NHD catchments, we prioritize with a 5 those that have impaired waters where all of the TMDLs have been approved and in place. A 4 is assigned to catchments that have impaired streams where some, but not all required TMDLs have been implemented. A 3 is assigned to catchments that are impaired by pollution, not caused by a pollutant.	TMDL NHD Catchment Areas	EPA National Hydrography Dataset

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Protect	16.7%					
		Current Flood Zones	20.0%	Understanding the chance of a flood occurring is key to identifying and managing flood risk. The chance of a flood occurring is typically represented by its Exceedance Probability (EP). A flood with a 1% EP has a one in a hundred chance of occurring annually. Currently, the 1% Exceedance Probability or more frequent flood event area is considered high risk; the 0.2% Exceedance Probability is considered moderate risk; and any flood area with less than the 0.2% Exceedance Probability is considered low risk. This model assigns coastal flooding risk priorities based on 2013 exceedance probabilities from the Boston Harbor Flood Risk Model (v3) as follows: - areas with greater than or equal to 1% Coastal Flood Exceedance Probability is a very high (5) priority; - areas with 0.5% - 0.2% Coastal Flood Exceedance Probability is a high (4) priority; and - areas with 0.1% Coastal Flood Exceedance Probability is moderate (3) priority	The Boston Harbor Flood Risk Model is a hydrodynamic model that includes relevant flooding processes and their interaction. The model includes the dynamic effects of tides, storm surge, land effects, winds, waves, wave setup, etc. Results also include changes in limate to assess variations in storm intensity, etc. These processes can result in significant differences in the magnitude and extent of flooding throughout a region. The model resolution ranges from five to thirty meters for both inland areas and coastal waters. These raster datasets used were derived for the Climate-Smart Cities Metro Boston project and based on work fromthe Boston Harbor Flood Risk Model (BH-FRM) for 2013, 2030, 2070/2100 sea level rise and coastal storm simulations as described in the report MassDOT-FHWA Pilot Project Report: Climate Change and Extreme Weather Vulnerability and Adaptation Options for the Central Artery/Tunnel System (Pilot Project Report). For each of these three simulations, the model output is provided as three separate raster datasets: (1) estimated coastal flood exceedance probabilities (CFEP), (2) estimated flood depths for 1% CFEP, estimated flood depths for 0.2% CFEP, and (4) estimated flood depths for 0.1% CFEP. Each dataset has been spatially interpolated and also categorized into discrete intervals to facilitate visual interpretation.	BH-FRM, Woods Hole Group, Umass-Boston, UNH
		2030 Flood Zones	20.0%	Understanding the chance of a flood occurring is key to identifying and managing flood risk. The chance of a flood occurring is typically represented by its Exceedance Probability (EP). A flood with a 1% EP has a one in a hundred chance of occurring. Currently, the 1% Exceedance Probability or more frequent flood event area is considered high risk; the 0.2% Exceedance Probability is considered moderate risk; and any flood area with less than the 0.2% Exceedance Probability is considered low risk. This model assigns coastal flooding risk priorities based on 2013 exceedance probabilities developed by the Woodshole Group as follows: - areas with greater than or equal to 1% Coastal Flood Exceedance Probability is a very high (5) priority; - areas with 0.5% - 0.2% Coastal Flood Exceedance Probability is a high (4) priority; and - areas with 0.1% Coastal Flood Exceedance Probability is moderate (3) priority	The Boston Harbor Flood Risk Model is a hydrodynamic model that includes relevant flooding processes and their interaction. The model includes the dynamic effects of tides, storm surge, land effects, winds, waves, wave setup, etc. Results also include changes in limate to assess variations in storm intensity, etc. These processes can result in significant differences in the magnitude and extent of flooding throughout a region. The model resolution ranges from five to thirty meters for both inland areas and coastal waters. These raster datasets used were derived for the Climate-Smart Cities Metro Boston project and based on work fromthe Boston Harbor Flood Risk Model (BH-FRM) for 2013, 2030, 2070/2100 sea level rise and coastal storm simulations as described in the report MassDOT-FHWA Pilot Project Report: Climate Change and Extreme Weather Vulnerability and Adaptation Options for the Central Artery/Tunnel System (Pilot Project Report).	BH-FRM, Woods Hole Group, Umass-Boston, UNH
		2070 Flood Zones	20.0%	Understanding the chance of a flood occurring is key to identifying and managing flood risk. The chance of a flood occurring is typically represented by its Exceedance Probability (EP). A flood with a 1% EP has a one in a hundred chance of occurring. Currently, the 1% Exceedance Probability or more frequent flood event area is considered high risk; the 0.2% Exceedance Probability is considered moderate risk; and any flood area with less than the 0.2% Exceedance Probability is considered low risk. This model assigns coastal flooding risk priorities based on 2013 exceedance probabilities developed by the Woodshole Group as follows: - areas with greater than or equal to 1% Coastal Flood Exceedance Probability is a very high (5) priority; - areas with 0.5% - 0.2% Coastal Flood Exceedance Probability is a high (4) priority; and - areas with 0.1% Coastal Flood Exceedance Probability is moderate (3) priority	The Boston Harbor Flood Risk Model is a hydrodynamic model that includes relevant flooding processes and their interaction. The model includes the dynamic effects of tides, storm surge, land effects, winds, waves, wave setup, etc. Results also include changes in limate to assess variations in storm intensity, etc. These processes can result in significant differences in the magnitude and extent of flooding throughout a region. The model resolution ranges from five to thirty meters for both inland areas and coastal waters. These raster datasets used were derived for the Climate-Smart Cities Metro Boston project and based on work fromthe Boston Harbor Flood Risk Model (BH-FRM) for 2013, 2030, 2070/2100 sea level rise and coastal storm simulations as described in the report MassDOT-FHWA Pilot Project Report: Climate Change and Extreme Weather Vulnerability and Adaptation Options for the Central Artery/Tunnel System (Pilot Project Report).	BH-FRM, Woods Hole Group, Umass-Boston, UNH

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		New Coastal Innundation Areas - 2030 100-yr Flood	10.0%	This model assigns coastal flooding risk priorities based on the difference between the estimated flood depths for 1% Coastal Flood Exceedance Probability for 2030 and the estimated flood depths for 1% Coastal Flood Exceedance Probability for 2013. Priority was given to areas where there was an increase in flood depths estimated for the 100-year flood between 2030 and 2013 and where green infrastructure interventions may play a role in minimizing impacts of increase in predicted flood depths: 0 ft - 1.5ft increase in predicted flood depth = high priority (5) 1.51 ft - 2.5ft increase in predicted flood depth = moderate to high priority (4) 2.51ft - 3.5ft increase in predicted flood depth = moderate priority (3) > 3.51ft increase in predicted flood depth = low priority (1)	The Boston Harbor Flood Risk Model is a hydrodynamic model that includes relevant flooding processes and their interaction. The model includes the dynamic effects of tides, storm surge, land effects, winds, waves, wave setup, etc. Results also include changes in limate to assess variations in storm intensity, etc. These processes can result in significant differences in the magnitude and extent of flooding throughout a region. The model resolution ranges from five to thirty meters for both inland areas and coastal waters. These raster datasets used were derived for the Climate-Smart Cities Metro Boston project and based on work fromthe Boston Harbor Flood Risk Model (BH-FRM) for 2013, 2030, 2070/2100 sea level rise and coastal storm simulations as described in the report MassDOT-FHWA Pilot Project Report: Climate Change and Extreme Weather Vulnerability and Adaptation Options for the Central Artery/Tunnel System (Pilot Project Report).	BH-FRM, Woods Hole Group, Umass-Boston, UNH
		New Coastal Innundation Areas - 2070 100-yr Flood	10.0%	This model assigns coastal flooding risk priorities based on the difference between the estimated flood depths for 1% Coastal Flood Exceedance Probability for 2070 and the estimated flood depths for 1% Coastal Flood Exceedance Probability for 2013. Priority was given to areas where there was an increase in flood depths estimated for the 500-year flood between 2070 and 2013 and where green infrastructure interventions may play a role in minimizing impacts of increase in predicted flood depths: 0 ft - 1.5ft increase in predicted flood depth = high priority (5) 1.51 ft - 2.5ft increase in predicted flood depth = moderate to high priority (4) 2.51ft - 3.5ft increase in predicted flood depth = moderate priority (3) > 3.51ft increase in predicted flood depth = low priority (1)	The Boston Harbor Flood Risk Model is a hydrodynamic model that includes relevant flooding processes and their interaction. The model includes the dynamic effects of tides, storm surge, land effects, winds, waves, wave setup, etc. Results also include changes in limate to assess variations in storm intensity, etc. These processes can result in significant differences in the magnitude and extent of flooding throughout a region. The model resolution ranges from five to thirty meters for both inland areas and coastal waters. These raster datasets used were derived for the Climate-Smart Cities Metro Boston project and based on work fromthe Boston Harbor Flood Risk Model (BH-FRM) for 2013, 2030, 2070/2100 sea level rise and coastal storm simulations as described in the report MassDOT-FHWA Pilot Project Report: Climate Change and Extreme Weather Vulnerability and Adaptation Options for the Central Artery/Tunnel System (Pilot Project Report).	BH-FRM, Woods Hole Group, Umass-Boston, UNH
		New Coastal Innundation Areas - 2030 500-yr Flood	10.0%	This model assigns coastal flooding risk priorities based on the difference between the estimated flood depths for 0.2% Coastal Flood Exceedance Probability for 2030 and the estimated flood depths for 0.2% Coastal Flood Exceedance Probability for 2013. Priority was given to areas where there was an increase in flood depths estimated for the 500-year flood between 2030 and 2013 and where green infrastructure interventions may play a role in minimizing impacts of increase in predicted flood depths: 0 ft - 1.5ft increase in predicted flood depth = high priority (5) 1.51 ft - 2.5ft increase in predicted flood depth = moderate to high priority (4) 2.51ft - 3.5ft increase in predicted flood depth = moderate priority (3) > 3.51ft increase in predicted flood depth = low priority (1)	The Boston Harbor Flood Risk Model is a hydrodynamic model that includes relevant flooding processes and their interaction. The model includes the dynamic effects of tides, storm surge, land effects, winds, waves, wave setup, etc. Results also include changes in limate to assess variations in storm intensity, etc. These processes can result in significant differences in the magnitude and extent of flooding throughout a region. The model resolution ranges from five to thirty meters for both inland areas and coastal waters. These raster datasets used were derived for the Climate-Smart Cities Metro Boston project and based on work fromthe Boston Harbor Flood Risk Model (BH-FRM) for 2013, 2030, 2070/2100 sea level rise and coastal storm simulations as described in the report MassDOT-FHWA Pilot Project Report: Climate Change and Extreme Weather Vulnerability and Adaptation Options for the Central Artery/Tunnel System (Pilot Project Report).	BH-FRM, Woods Hole Group, Umass-Boston, UNH

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		New Coastal Innundation Areas - 2070 500-yr Flood	10.0%	This model assigns coastal flooding risk priorities based on the difference between the estimated flood depths for 0.2% Coastal Flood Exceedance Probability for 2070 and the estimated flood depths for 0.2% Coastal Flood Exceedance Probability for 2013. Priority was given to areas where there was an increase in flood depths estimated for the 500-year flood between 2070 and 2013 and where green infrastructure interventions may play a role in minimizing impacts of increase in predicted flood depths: 0 ft - 1.5ft increase in predicted flood depth = high priority (5) 1.51 ft - 2.5ft increase in predicted flood depth = moderate to high priority (4) 2.51ft - 3.5ft increase in predicted flood depth = moderate priority (3) > 3.51ft increase in predicted flood depth = low priority (1)	The Boston Harbor Flood Risk Model is a hydrodynamic model that includes relevant flooding processes and their interaction. The model includes the dynamic effects of tides, storm surge, land effects, winds, waves, wave setup, etc. Results also include changes in limate to assess variations in storm intensity, etc. These processes can result in significant differences in the magnitude and extent of flooding throughout a region. The model resolution ranges from five to thirty meters for both inland areas and coastal waters. These raster datasets used were derived for the Climate-Smart Cities Metro Boston project and based on work fromthe Boston Harbor Flood Risk Model (BH-FRM) for 2013, 2030, 2070/2100 sea level rise and coastal storm simulations as described in the report MassDOT-FHWA Pilot Project Report: Climate Change and Extreme Weather Vulnerability and Adaptation Options for the Central Artery/Tunnel System (Pilot Project Report).	BH-FRM, Woods Hole Group, Umass-Boston, UNH

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Climate Equity	16.7%					
		People of Color	12.5%	This model identifies socially vulnerable populations based on the percent of individuals within a block group who listed their racial status as a race or ethnicity other than non-Hispanic White alone. The percentage of individuals identifying with one of these racial or ethnic groups were broken into 0 to 5 priority classes using a natural breaks slice classification. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 29.4% - 46.8% High (4) = 46.9% - 72.1% Very High (5) = 72.2% - 100% Block groups with zero households and parks and natural areas were removed.	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes people of color, which is referred to as Percent Minority in the EPA dataset. Percent Minority is defined as The percent of individuals in a block group who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino. That is, all people other than non-Hispanic white-alone individuals. The word "alone" in this case indicates that the person is of a single race, not multiracial. The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	EPA (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)
		Low Income Households	12.5%	This model identifies socially vulnerable populations based on the percent of households within a block group where the household income is less than or equal to twice the federal "poverty level." The percentage of households with incomes less than or equal to twice the federal "poverty level" were broken into 0 to 5 priority classes using a natural breaks slice classification. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 15.9% to 44.5 % High (4) = 44.6% to 71.7% Very High (5) = 71.8% to 100% Block groups with zero population, parks and natural areas were removed.	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes low-income households, which is referred to as Percent Low_income in the EPA dataset. Percent Low-Income is defined as the percent of a block group's population in households where the household income is less than or equal to twice the federal "poverty level." The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	EPA (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)
		Less than a HS Education	12.5%	This model identifies socially vulnerable populations based on the percent of people age 25 and older in a block group that do not have a high school diploma. Block groups with populations without a high school degree were broken into 0 to 5 priority classes using a natural breaks slice classification. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 13.1% to 21.9% High (4) = 22% to 35.3% Very High (5) = 35.4% to 68.7% Block groups with zero population, parks and natural areas were removed.	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes block groups with populations age 25 or older that have not obtained a high school diploma which is referred to as Less than high school education n the EPA dataset. Less than high school education is defined as the percent of people age 25 or older in a block group whose education is short of a high school diploma. The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	EPA (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)
		Linguistic Isolation	12.5%	This model identifies socially vulnerable populations based on the percent of people in a block group living in limited English speaking households (formerly referred to as "linguistic isolation"). A limited English speaking household is a household in which all members age 14 years and over speak a language other than English and also speak English less than "very well" (have difficulty with English). Block groups with linguistically isolated households were broken into 0 to 5 priority classes using a natural breaks slice classification. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 10.5% to 17.3 % High (4) = 17.4% to 28.4% Very High (5) = 28.5% to 100% Block groups with zero households and parks and natural areas were removed.	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes linguistically isolated households, which is referred to as Linguistic isolation in the EPA dataset. Linguistic isolation is defined as the percent of people in a block group living in linguistically isolated households. A household in which all members age 14 years and over speak a non-English language and also speak English less than "very well" (have difficulty with English) is linguistically isolated. The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	EPA (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)

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Goal	Goal Weights	Criteria	Criteria Weights	Methodology	Data (Description, Date, Resolution)	Data Source
		Population under 5	12.5%	This model identifies socially vulnerable populations based on the percent of people in a block group under the age of 5. Block groups with individuals under the age of 5 were broken into 0 to 5 priority classes using a natural breaks slice classification. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 6.0% to 8.4% High (4) = 8.5% to 12.8% Very High (5) = 12.9% to 24.6% Block groups with zero population, parks and natural areas were removed.	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes block groups with populations under the age of 5 which is referred to as Individuals under age 5 in the EPA dataset. Individuals under age 5 is defined as the percent of people in a block group under the age of 5. The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	EPA (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)
		Population over 64	12.5%	This model identifies socially vulnerable populations based on the percent of people in a block group over the age of 64. Block groups with individuals over age 64 were broken into 0 to 5 priority classes using a natural breaks slice classification. The break points for the moderate to very high priority classes were as follows: Moderate (3) = 19.7% to 29.4% High (4) = 29.5% to 64.6% Very High (5) = 64.7% to 100% Block groups with zero population, parks and natural areas were removed.	EJSCREEN uses demographic factors as very general indicators of a community's potential susceptibility to the types of environmental factors. The EJSCREEN includes block groups with populations over the age of 64 which is referred to as Individuals over age 64 in the EPA dataset. Individuals over age 64 is defined as the percent of people in a block group over the age of 64. The source of all demographic data used in EJSCREEN is the American Community Survey (ACS) five-year summary file (2008 - 2012).	EPA (http://www.epa.gov/sites/production/files/2015-05/documents/ejscreen_technical_document_20150505.pdf)
		One-person Households	12.5%	This model identifies socially vulnerable populations based on the percent of single person housholds in a block group. Persons living alone, particularly the elderly or those that are linguistically isolated, are more vulnerable to climate impacts, especially when emergency communication are needed. Block groups were broken into 0 to 5 priority classes using a natural breaks classification. The break points for the moderate to very high classes were as follows: Moderate (3) = 23.3% to 32.4% High (4) = 32.5% to 46.6% Very High (5) = 46.7% to 86.6% Block groups with zero population, parks and natural areas were removed.	American Community Survey (ACS) five-year summary file (2008 - 2012).	https://www.census.gov/programs-surveys/acs/
		Disability	12.5%	This model identifies socially vulnerable populations based on the percent of population in a block group with disabilities. People with disabilities are more vulnerable in disaster, emergency and conflict situations, all of which are expected to increase in frequency with climate change. Block groups were broken into 0 to 5 priority classes using a natural breaks classification. The break points for the moderate to very high classes were as follows: Moderate (3) = 23.3% to 32.4% High (4) = 32.5% to 46.6% Very High (5) = 46.7% to 86.6% Block groups with zero population, parks and natural areas were removed.	American Community Survey (ACS) five-year summary file (2008 - 2012).	https://www.census.gov/programs-surveys/acs/

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Goal	Goal Weights	Criteria	Criteria Weights	Methodology	Data (Description, Date, Resolution)	Data Source
Critical Infrastructure	16.7%					
		Density of Essential Emergency Services	24.0%	This model assigns critical infrastructure risk based upon density of locations of essential service facilities. Essential Services facilities include acute care hospitals, private ambulatory services, emergency shelters, EMS stations, fire stations, and police stations. Kernel Density of essential service facilities was derived using 1/4 mile (equivalent to 5 minute walk) circular radius. The resulting density raster was broken into priority classes using slice tool and a natural breaks classification using scale of 0 to 5.	acute care hospitals private ambulatory services emergency shelters EMS stations fire stations police stations	MassGIS ESRI Business Analyst MassGIS
		Density of Key Transportation Infrastructure	14.0%	This model assigns critical infrastructure risk based upon density of locations of key transportation infrastructure. Key transportation infrastructure includes evacuation routes, ports, and bridges, Kernel Density of key transportation infrastructure including ports and the entrance and exits of bridges was derived using 1/4 mile (equivalent to 5 minute walk) circular radius. The resulting density raster was broken into priority classes using slice tool and a natural breaks classification using scale of 0 to 5. A Kernel Density of evacuation routes was derived using 1/8 mile search radius. The resulting line density raster was broken into priority classes using slice tool and a natural breaks classification using scale of 0 to 5. The point and line priority rasters were combined using equal weights.	Commuter Rail Water Taxis Transit Stops Highway On/off Ramps Ramps and Tunnels Evacuation Routes Bike Lanes Buildings at Logan High Frequency Bus Stops	MAPC MassDOT MBTA MassGIS
		Density of Other Emergency Facilities	24.0%	This model assigns critical infrastructure risk based upon density of locations of other emergency facilities. Other emergency facilities include community centers and other schools Kernel Density of high potential loss facilities was derived using 1/4 mile (equivalent to 5 minute walk) circular radius. The resulting density raster was broken into priority classes using slice tool and a natural breaks classification using scale of 0 to 5.	Schools Community Centers	DESE MassGIS
		Density of Cultural and Institutional Facilities	10.0%	This model assigns critical infrastructure risk based upon density of locations of cultural and institutional facilities. Cultural and institutional facilities include courthouses, colleges, libraries, historical sites, city and town halls, and museums. Kernel Density of institutional facilities was derived using 1/4 mile (equivalent to 5 minute walk) circular radius. The resulting density raster was broken into priority classes using slice tool and a natural breaks classification using scale of 0 to 5.	Libraries Museums City and Town Halls Historic Buildings Colleges and Universities Courthouses	MassGIS Massachusetts Historic Commission
		Density of High Potential Loss Facilities	14.0%	This model assigns critical infrastructure risk based upon density of locations of high potential loss facilities. High potential loss facilities include Dams and Cahpter 21E sites. Kernel Density of high potential loss facilities was derived using 1/4 mile (equivalent to 5 minute walk) circular radius. Line Density of high potential loss facilities was derived using 1/8 mile radius. Density layers were combined and the resulting combined density raster was broken into priority classes using slice tool and a natural breaks classification using scale of 0 to 5.	Dams Chapter 21E AUL sites	Mass Office of Dam Safety, MassGIS Mass DEP

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Goal	Goal Weights	Criteria	Criteria Weights	Methodology	Data (Description, Date, Resolution)	Data Source
		Density of Dependent Population Facilities	14.0%	This model assigns critical infrastructure risk based upon density of locations of dependent population facilities. Dependent Population facilities include community housing facilities, homeless shelters, animal shelters and boarding facilities, long-term care facilities, nursing homes, daycare facilities, and prisons Kernel Density of high potential loss facilities was derived using 1/4 mile (equivalent to 5 minute walk) circular radius. The resulting density raster was broken into priority classes using slice tool and a natural breaks classification using scale of 0 to 5.	Community Housing Prisons Long-term Care Facilities Homeless Shelters Childcare and Group Home Facilities Animal Shelters and Boarding Facilities	MassGIS