

HURRICANE BRIEFING JOURNAL:

Using GIS for Deliberate Planning and Response

May 26, 2016



FEMA

Chad Council

Regional Geospatial Coordinator

Response Division, FEMA Region I

chad.council@fema.dhs.gov



Desiree L. Kocis, GISP

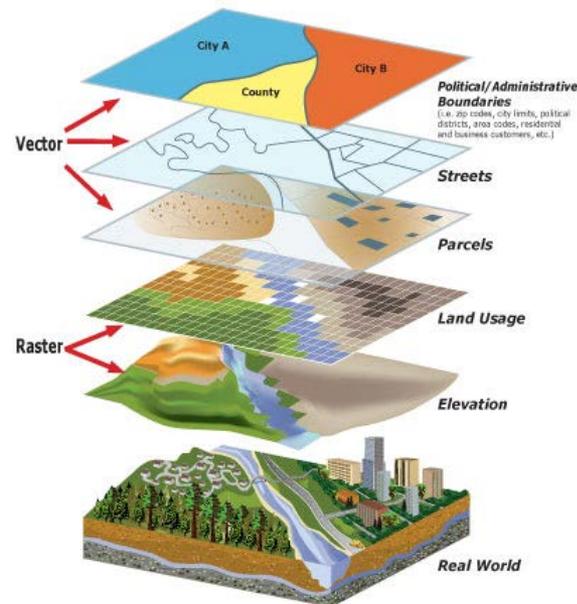
GIS Coordinator

Massachusetts Emergency Management Agency

desiree.kocis@state.ma.us

GIS

Geographic Information Systems



- Captures, stores, displays and overlays spatial data into a digital mapping platform

Geo-Enabled Planning

GIS facilitates: (1) SMARTER PLANNING, (2) BETTER RESPONSE, and (3) FASTER RECOVERY by providing:

- **Visualization** of assets, vulnerable populations and environments, estimated impact areas and potentially affected infrastructure
 - *for optimal plan development and response personnel preparedness*
- **Scenario Analysis** based on historic data and storm path potentials
 - *for better prediction on impacts, movement of resources and affected populations*
- **Situational Awareness** through online mapping
 - *for quick sharing of common operating pictures cross-agency*

Geo-Enabled Planning

Dynamic Web Mapping through ArcGIS Online:

- *Emergency management agencies are moving away from reliance on static paper maps!*

- Users can interact with web maps, triggering planning factors that may not have been otherwise considered
- Cross-Facility or Agency access to and sharing of data and maps

- **Example:**



Details

FEMA Region 1: Hurricane Information

Maps, data, and links related to hurricanes for Region 1.

owned by ccouncil_FEMA on May 11, 2015



**** Enabled quick access to regional hurricane data**

fema.maps.arcgis.com

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FEMA GeoPlatform

Providing geospatial data and analytics in support of emergency



Hurricanes and Typhoons



Flooding



Earthquakes

FEMA USNG Viewer

FEMA's GeoPlatform Journal on work being done in response to the April, 2016 **Houston** and
FEMA's GeoPlatform Journal on work being done in response to the March, 2016 **Texas and
Flooding**

FEMA is a partner of the FGDC's National Geospatial Platform Visit: www.geoplatform.gov

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Hurricanes and Typhoons

The public facing group of FEMA created and managed data relating to hurricanes and typhoons. This grouping of data is curated by the Mapping and Analysis Center of FEMA.

Search maps

Sort by **Date** Title Type Ratings Avg. Rating Comments Views



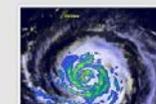
Hurricane of 1938 Scenario
Web Mapping Application by ccsundl_FEMA, Last Modified May 12, 2016.
Scenario Planning Factors for Hurricane Response Annex
(1,052 views)



FEMA's Hazus Average Annualized Loss Viewer
Web Map by ccsundl_FEMA, Last Modified Feb 9, 2016.
FEMA's Hazus Average Annualized Loss Viewer - Click on Counties to access Hazus
Loss Estimation data
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Geoframework Journal (Hurricane)
Web Mapping Application by ems.davis_FEMA, Last Modified Oct 1, 2015.
The map journal that houses web maps and content relevant to current events.
(753 views)



FEMA's Typhoon Soudeior Disaster Briefing Journal
Web Mapping Application by FEMA_MAC, Last Modified Sep 15, 2015.
Map Journal for Typhoon Soudeior
(206 views)



FEMA's Hurricane Danny Disaster Briefing Journal
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FEMA's Disaster Briefing Journal for Hurricane Danny
(172 views)



FEMA's Hurricane Ignacio Disaster Briefing Journal
Web Mapping Application by FEMA_MAC, Last Modified Sep 15, 2015.
Map Journal for Hurricane Ignacio
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Thumbnail image provided by NASA's Hurricanes and Tropical Cyclones Image Gallery. This GOES-13 satellite image is of Hurricane Irene just 28 minutes before the storm made landfall in New York City. The image shows Irene's huge cloud cover blanketing New England, New York and over Toronto, Canada. Shadows in Irene's clouds indicate the bands of thunderstorms that surrounded the storm.



FEMA



Hurricane of 1938 Scenario

Scenario Journal

This journal presents the FEMA GeoFramework web map collection for hurricanes and hurricane-like events. This journal is presenting the information and analysis of the 1938 scenario for the 2016 revision of the FEMA Region 1 Hurricane Response Annex.

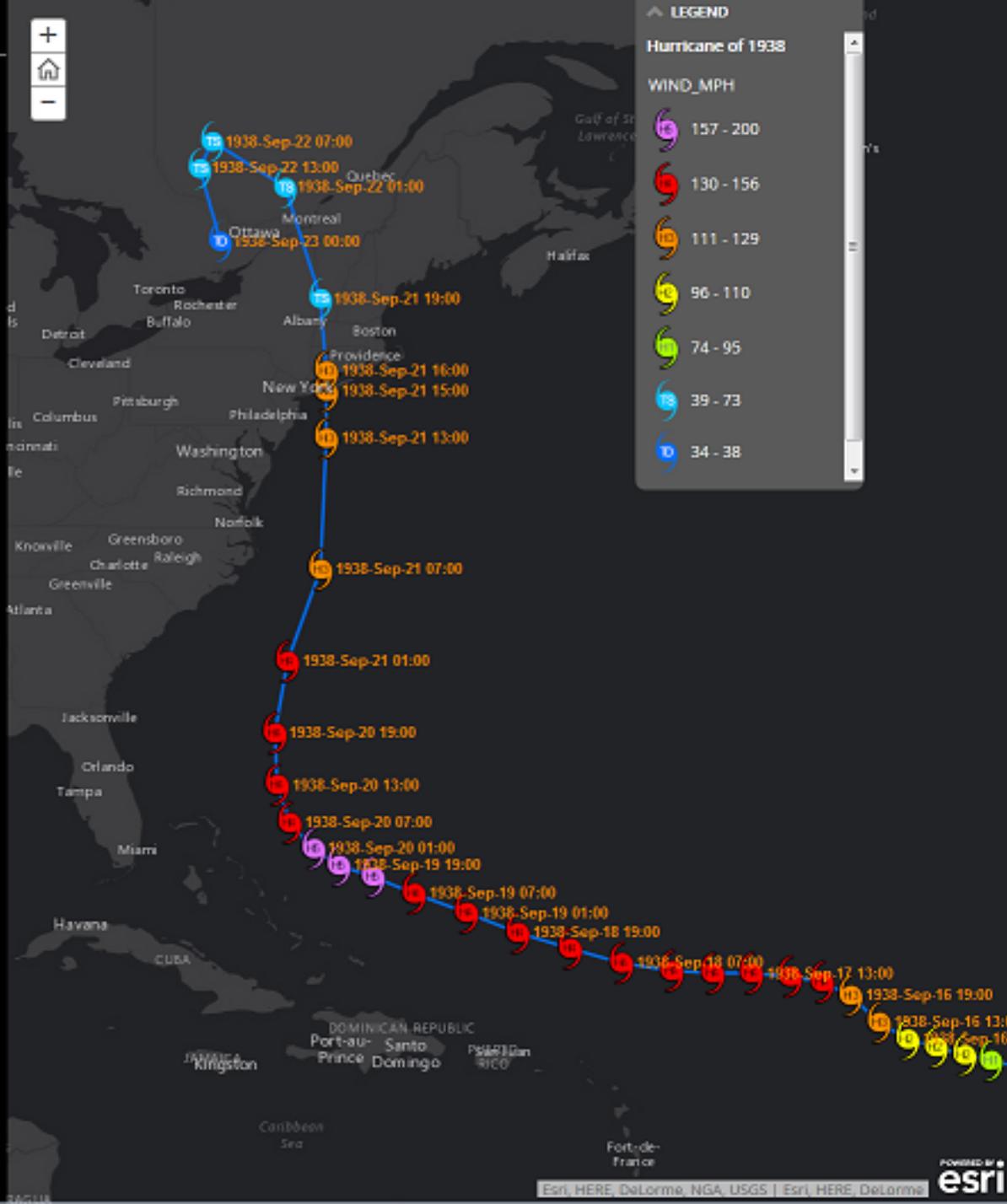
1. Hazard Overview

Hazard Overview. This broad overview details the scenario hurricane's historic path. The fast moving Unnamed Storm of 1938 traveled from Florida to New England in just 18 hours. From landfall in Connecticut as a Category 3 storm, to departure from Vermont as a Tropical storm was a short 3 hours.

1a. Hurricane Track Speed

A notable characteristic of the Hurricane of 1938 was how quickly it moved up the coast. From Florida to Connecticut was less than 18 hours.

Click the play button on the Time Slider to animate the hurricane track and see the storm track progress in daily chunks.





Hurricane of 1938 Scenario

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2. Max Sustained Winds

Maximum Sustained Wind (MPH) as modeled by HAZUS with the 1938 scenario.

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3. Coastal Inundation

Coastal surge inundation was estimated with the Hazus hurricane model using the Hurricane of 1938 as a scenario.

For Boston, the surge inundation was estimated using a notional "Hurricane Travis" scenario.

Zoom in to take a closer look, or click on the Tabs across the top to focus on one of several areas that would likely experience major inundation.

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4. Riverine Flooding

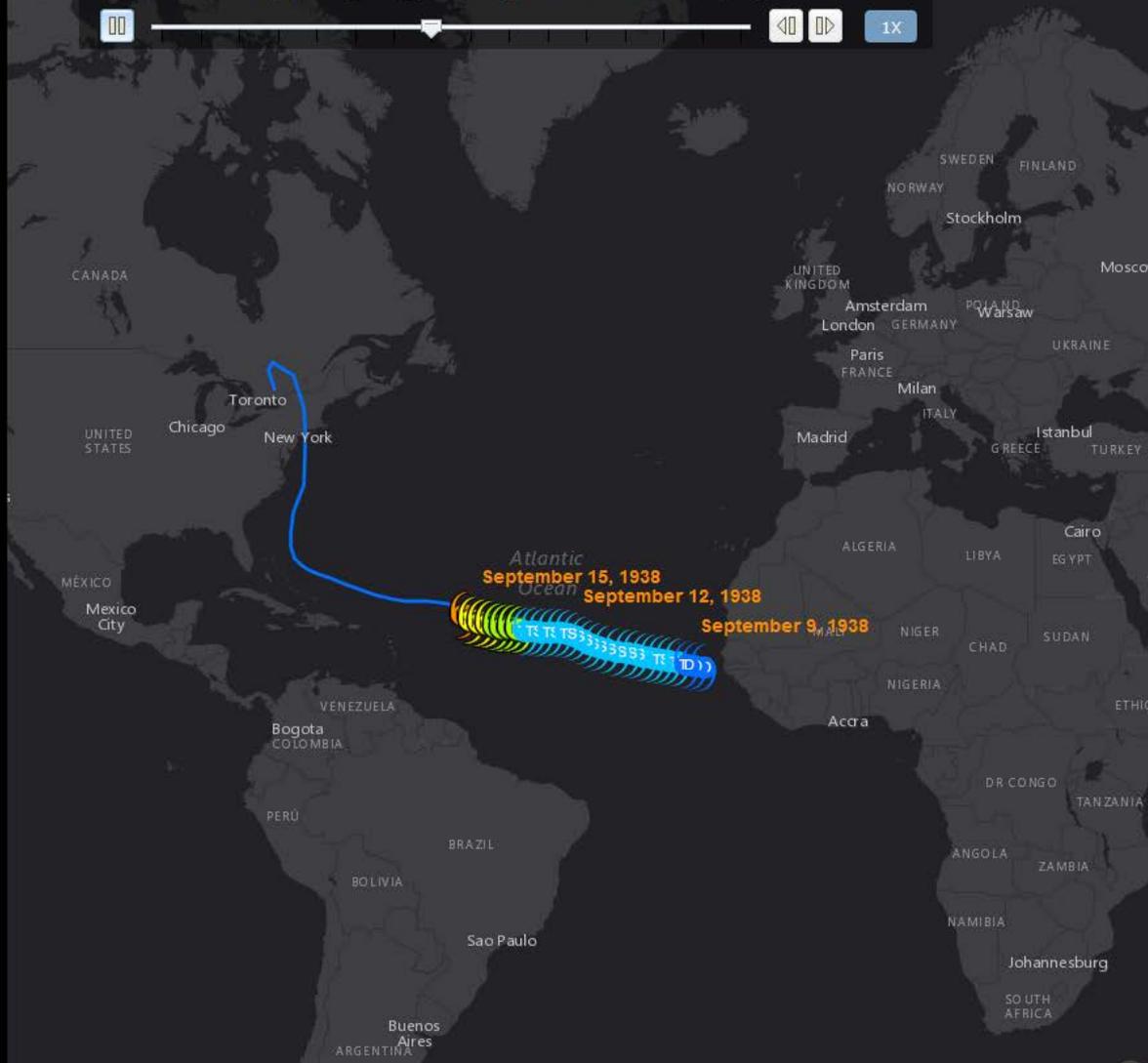
Hurricane of 1938 Time Path



September 8, 1938 to September 15, 1938
Layers: Hur_1938_Symbolized_Path - Sustained Winds (MPH)



1X



1000mi 37.908 -111.727 Degrees





Hurricane of 1938

2. Max Sustained Winds

Maximum Sustained Wind (MPH) as modeled by HAZUS with the 1938 scenario. The dark red areas indicate sustained winds of 97 MPH.

Max Sustained Winds



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3. Wind, Power and Population Density

Wind Speeds: The red, blue, and yellow color coded outlines show geographic areas based on a range of sustained wind speeds during the Hurricane of 1938. A significant portion of southern New England falls within the area outlined by the red line, indicating they endured at least 75 MPH sustained winds.

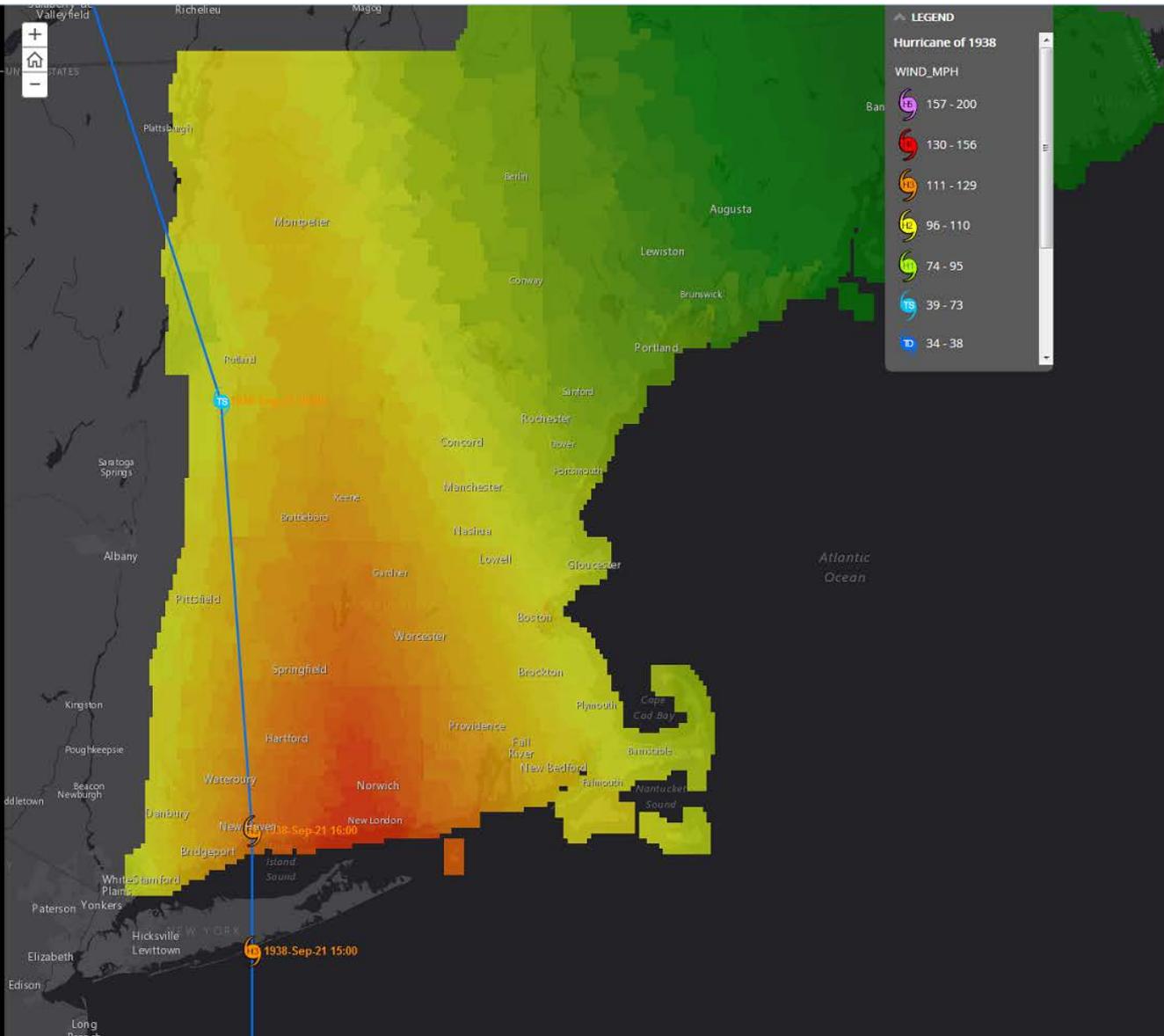
Power Outage Exposure: The selected wind categories correspond to power industry terms. For the 75 MPH + range, the expectation is a *Severe Impact to Operations* - meaning a greater chance of power outages.

There are approximately 12,678,050 people in the *Severe Impact to Operations* zone. This represents a major planning factor for massive power outages that could significantly affect response operations.

Population Density: (ESRI) This map shows the population density in the United States in 2012. Population density is calculated by dividing the total population count of geographic feature by the area of the feature, in square miles. The area is calculated from the geometry of the geographic feature in projected coordinates. The best use of this map is at the larger scales (tracts and block groups). The geography depicts States at greater than 50m scale, Counties at 7.5m to 50m scale, Census Tracts at 200k to 7.5m scale, and Census Block Groups at less than 200k scale. Scale Range: 1:591,657,528 down to 1:72,224. For more information on this map, including our terms of use, visit us online at http://goto.arcgisonline.com/maps/Demographics/USA_Population_Density

Facebook Twitter Share

4. Coastal Inundation



LEGEND

Hurricane of 1938

WIND_MPH

- 157 - 200
- 130 - 156
- 111 - 129
- 96 - 110
- 74 - 95
- 39 - 73
- 34 - 38



Hurricane of 1938 Scenario

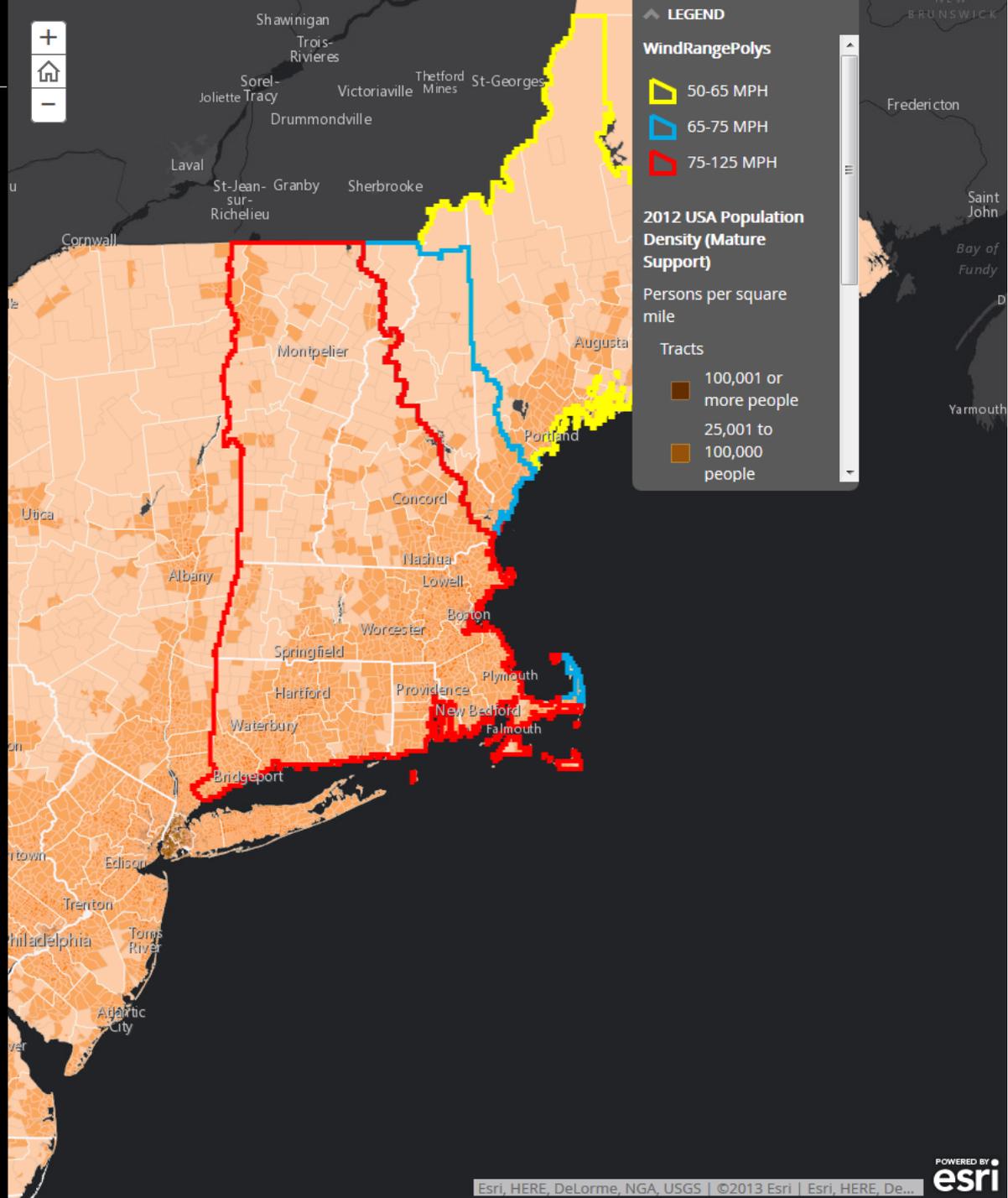
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Hurricane of 1938 Scenario

Coastal Inundation Overview

Providence, RI

New Bedford, MA

Buzzards Bay, MA



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 Facebook  Twitter  Share

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The Hazus flood model was run with this scenario and that flood extent is displayed here as well.

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OVERVIEW MAP





Hurricane of 1938 Scenario

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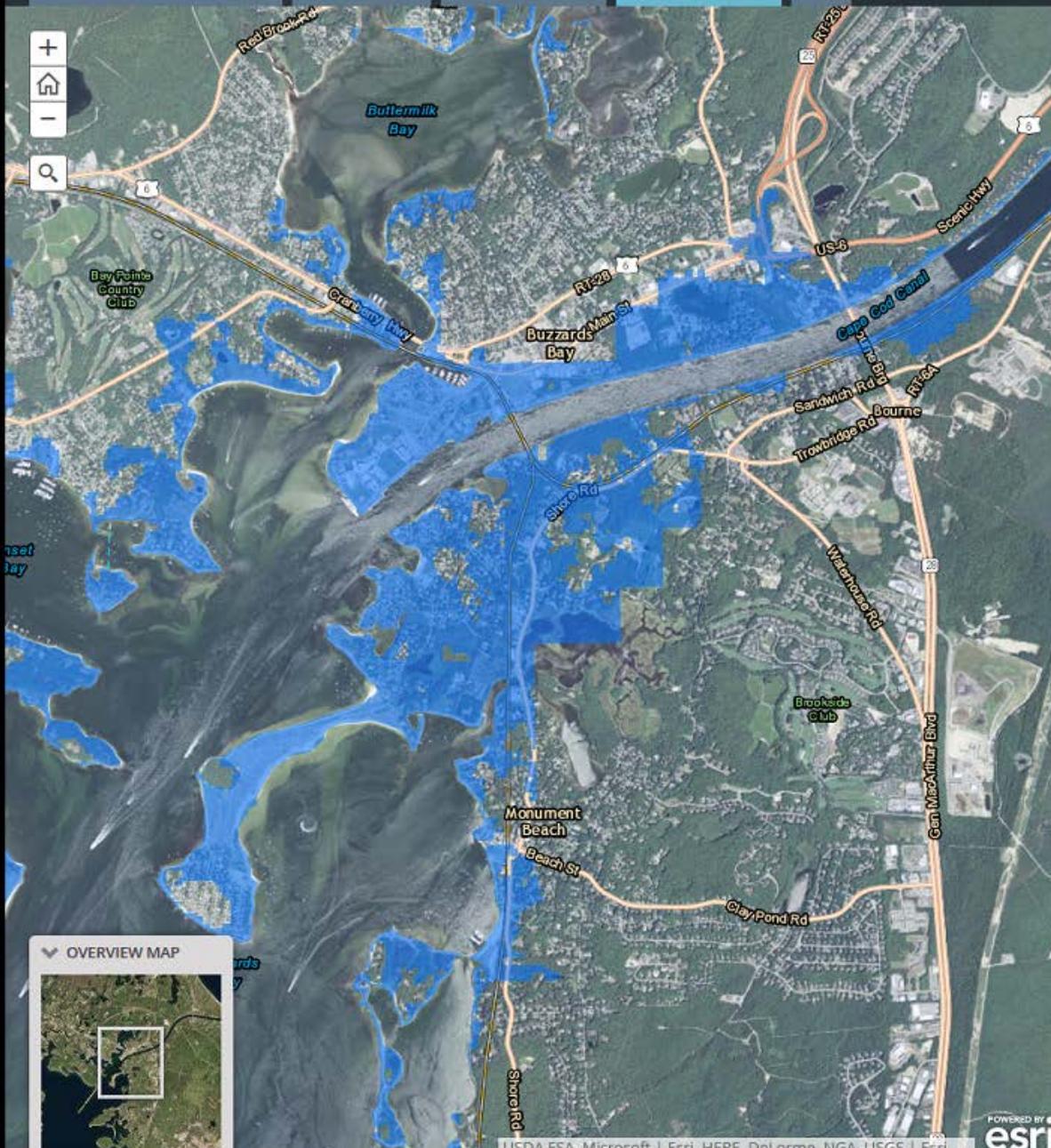
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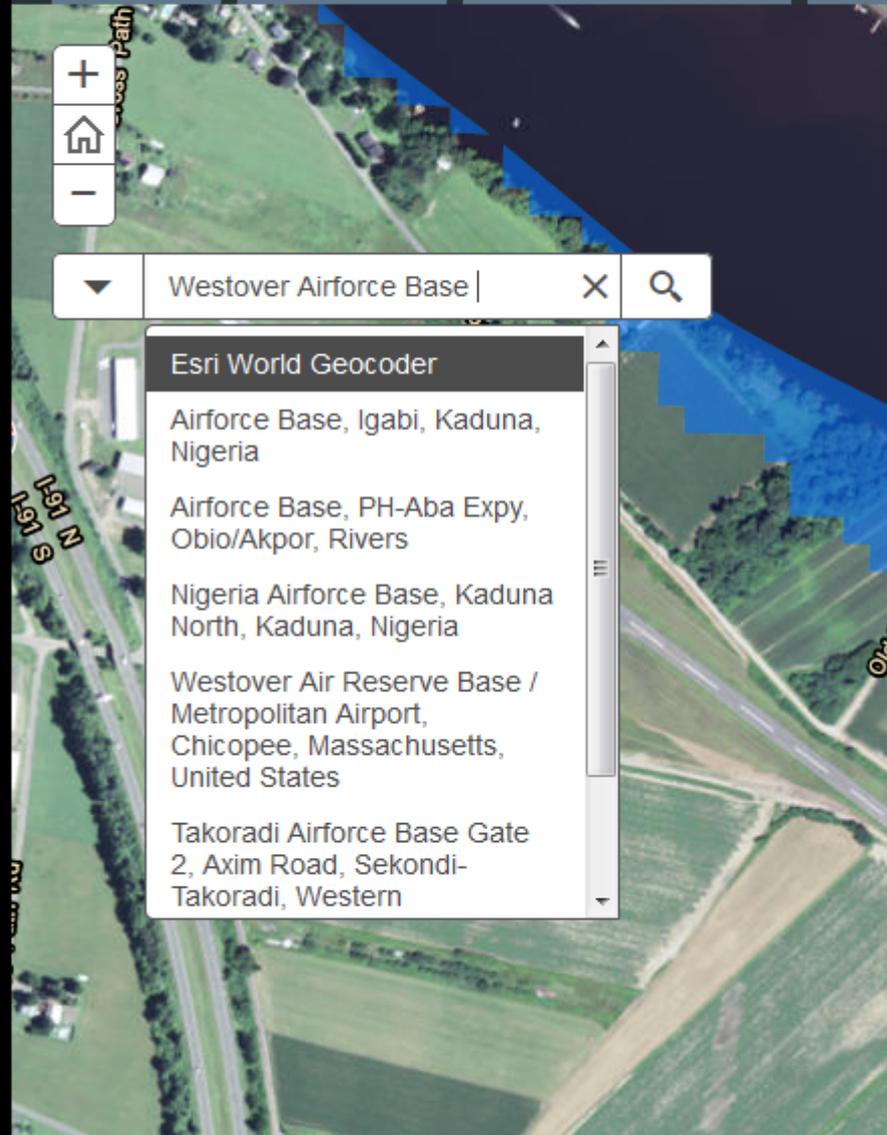
Riverine Flooding

Overview

Hartford, CT

Springfield, MA (area)

Springfield, MA





Hurricane of 1938 Scenario

Overview

Hartford, CT

Springfield, MA (area)

Springfield, MA (detail)

Northampton, MA

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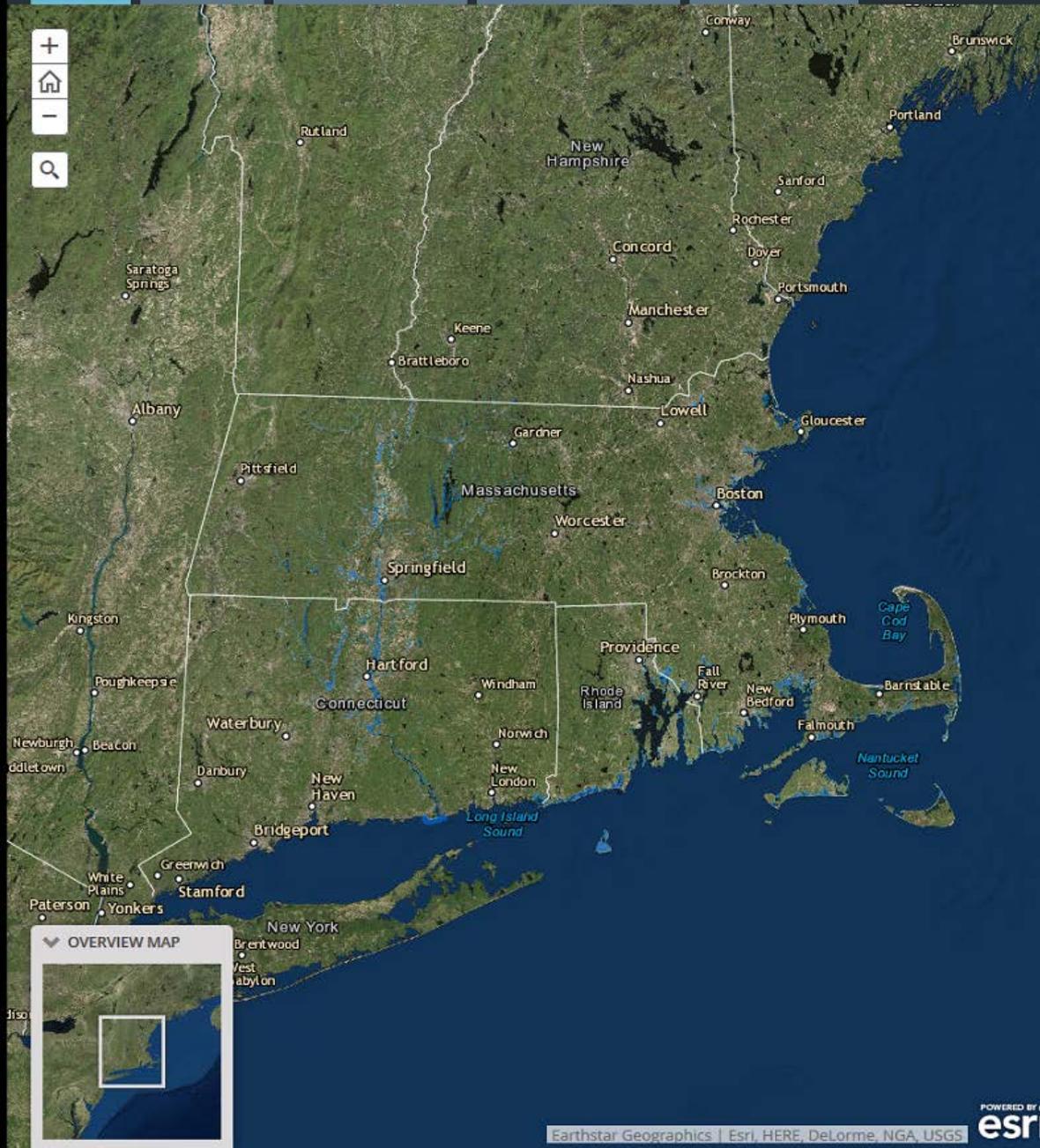
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Hurricane of 1938 Scenario

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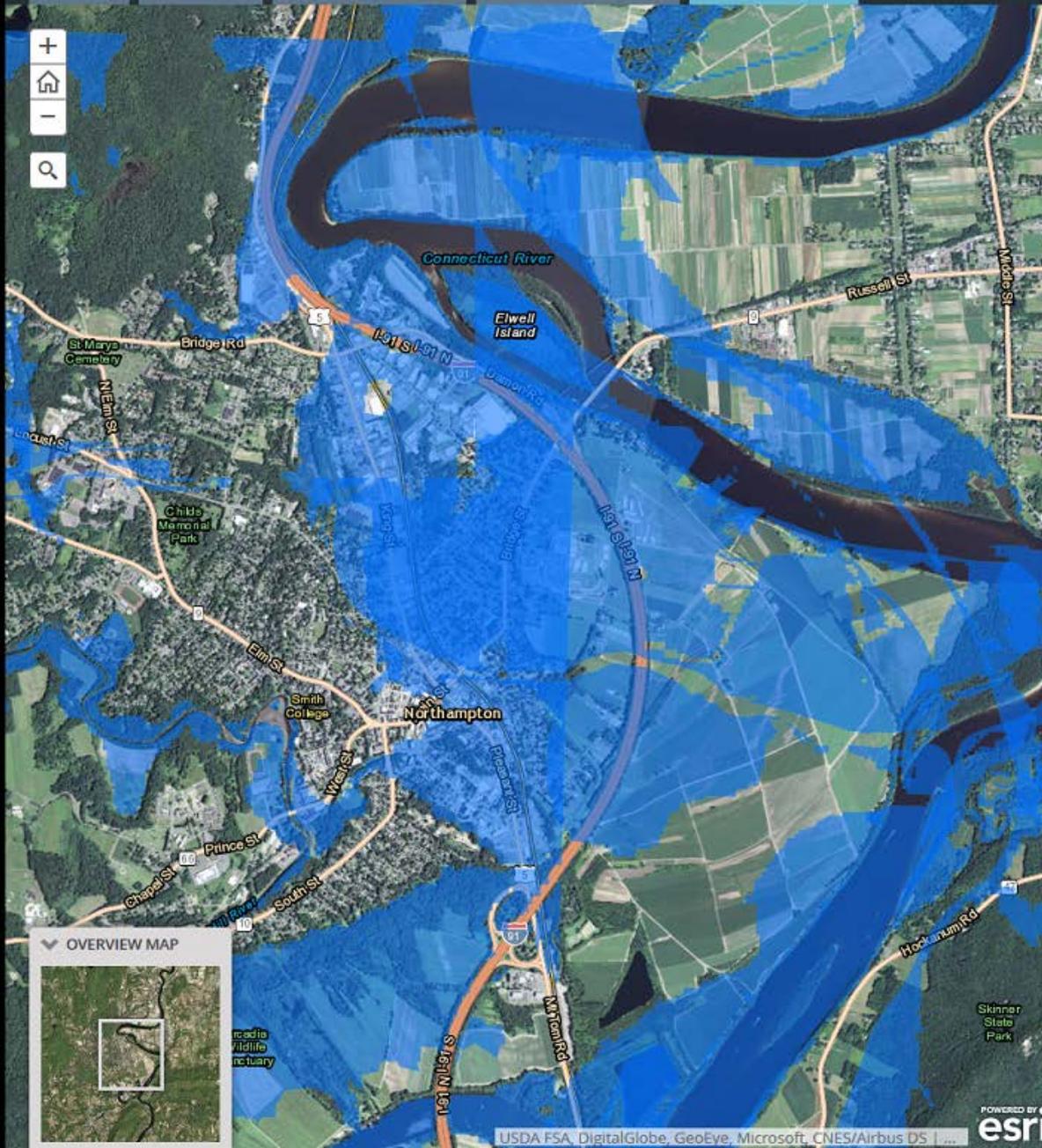
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5. Scenario Inundation vs Planning Inundation

The tool to the right provides a way to compare the inundation modeled from the 1938 scenario and the maximum inundation modeled by US Army Corps of Engineers, used by state EMAs for planning purposes.

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7. Social Vulnerability

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Social Vulnerability: SoVI® 2006-10 marks a change in the formulation of the SoVI® metric from earlier versions. New directions in the theory and practice of vulnerability science emphasize the constraints of family structure, language barriers, vehicle availability, medical disabilities, and healthcare access in the preparation for and response to disasters, thus necessitating the inclusion of such factors in SoVI®. Extensive testing of earlier conceptualizations of SoVI®, in addition to the introduction of the U.S. Census Bureau's five-year American Community Survey (ACS) estimates, warrants changes to the SoVI® recipe, resulting in a more robust metric. These changes, pioneered with the ACS-based SoVI® 2005-09 carry over to SoVI® 2006-10, which combines the best data available from both the 2010 U.S. Decennial Census and five-year estimates from the 2006-2010 ACS. For more on the Social Vulnerability Index (SoVI®) visit our official site at: <http://www.sovius.org>. To see metadata or see component summaries to understand what is driving SoVI® for each coastal state go to: http://webra.cas.sc.edu/hvri/feature/data/SoVI_Data.aspx.

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8. Courses of Action

This section describes broad courses of action to consider for hurricane response.

Massachusetts Inundation Zones vs. Scenario Modeled Inundation

Buzzards Bay Evacuation and Scenario Inundation

- 1
- 2
- 3
- 4

Overview

This map is showing two layers that you can compare side by side:

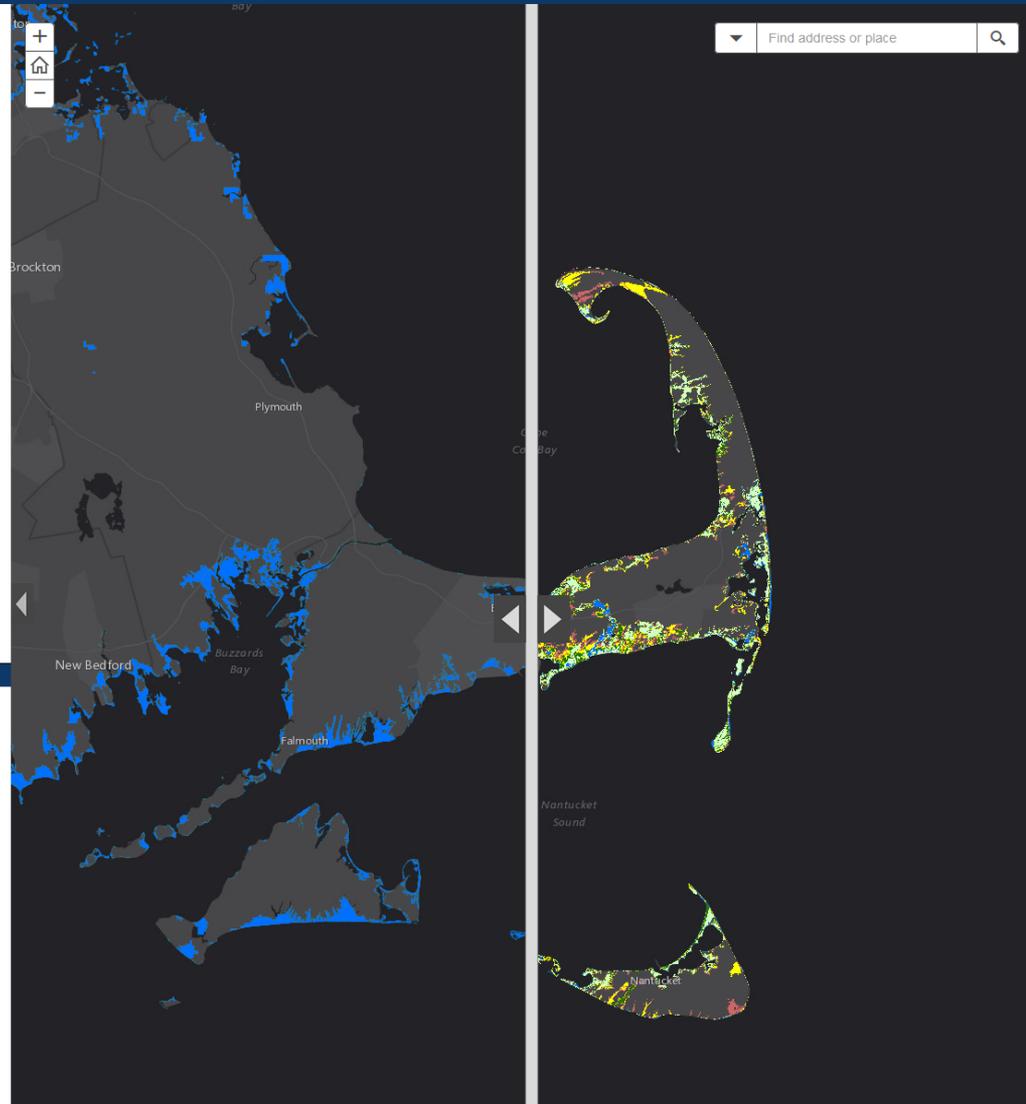
- The inundation that was modeled by Hazus for the Hurricane of 1938 scenario
- The Hurricane Inundation Zones used by Massachusetts Emergency Management

Click and drag the vertical bar left or right to "swipe" between the two layers.

The bookmarks above will refocus the map on key areas of interest.

Legend

Modeled Hurricane of 1938 Inundation	MEMA Inundation Zones
Buzzards Bay	Inundation Zones
■	■ 1
	■ 2
	■ 3
	■ 4



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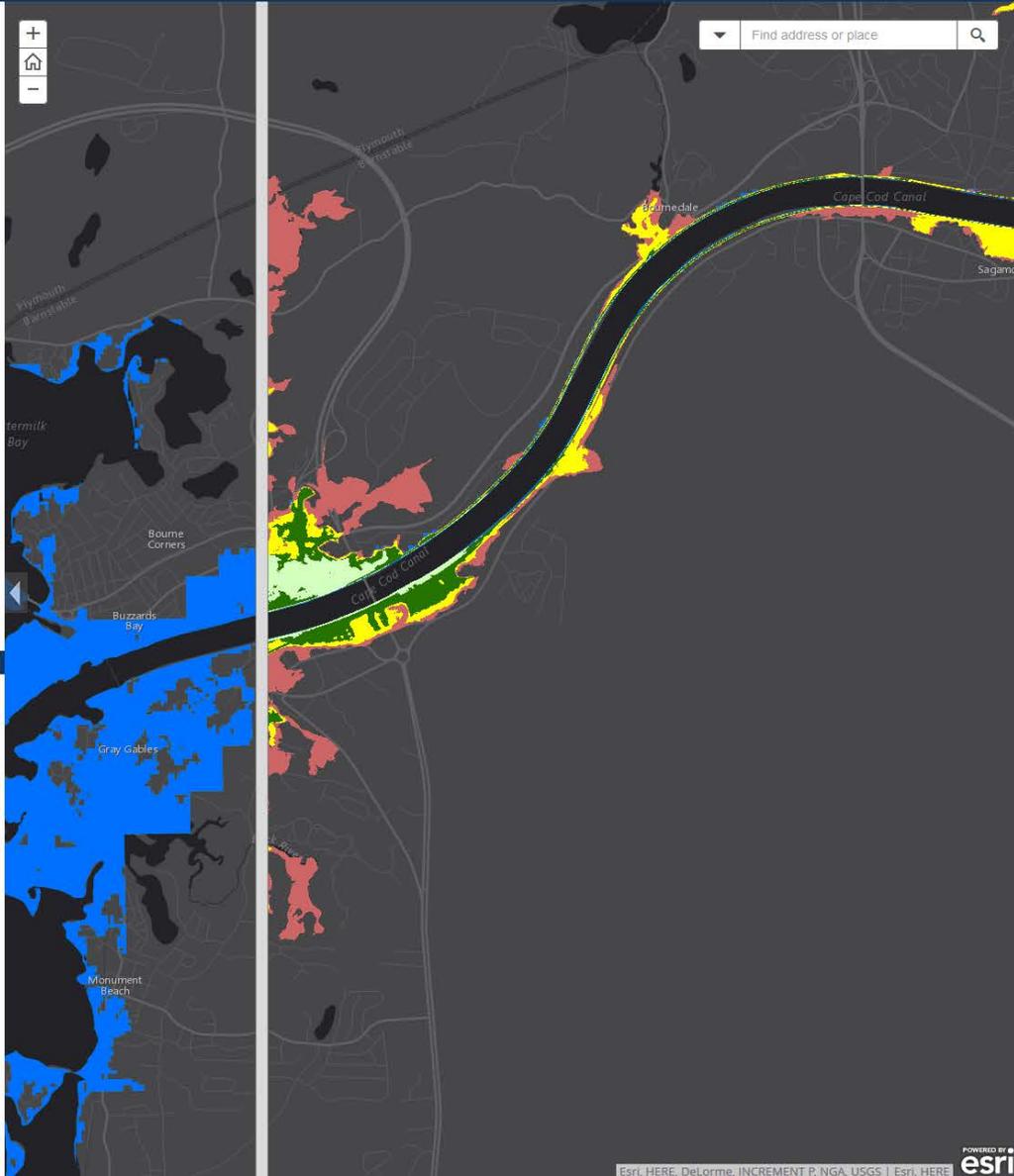
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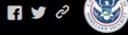
Cape Cod Canal

This area shows the Cape Cod Canal and the Bourne Bridge. As you can see by swiping between the two layers, the inundation from the Hurricane of 1938 scenario is completely contained by the MEMA Inundation Zones number 1 and 2.



Legend

Modeled Hurricane of 1938 Inundation	MEMA Inundation Zones
Buzzards Bay	Inundation Zones
■	■ 1
	■ 2
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Hurricane of 1938 Scenario

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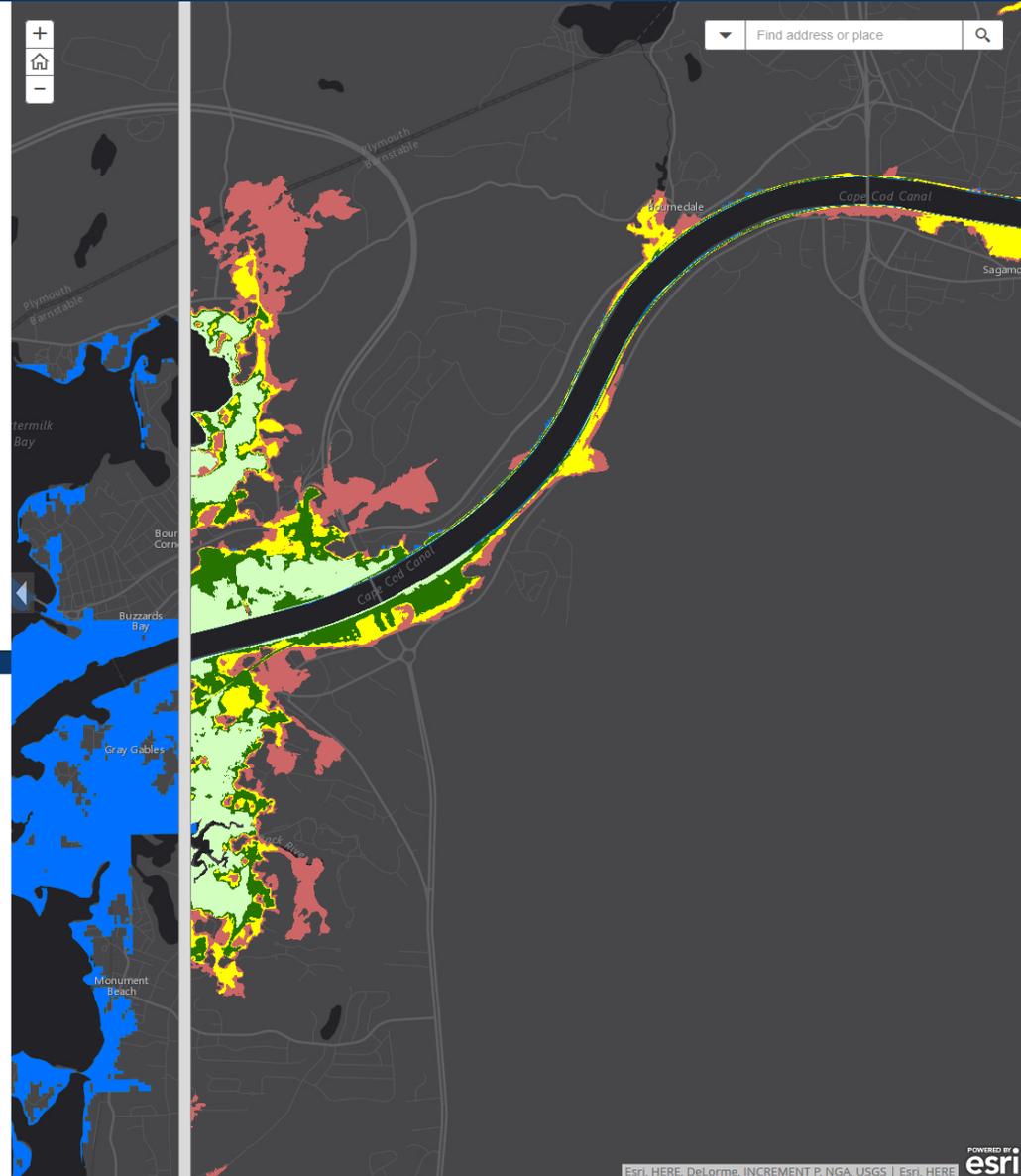
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Hurricane of 1938 Scenario

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For each course of action, use the time slider across the bottom to see what actions are taken as the storm crosses each decision point. Details of these actions and decisions are described to the right of the map.

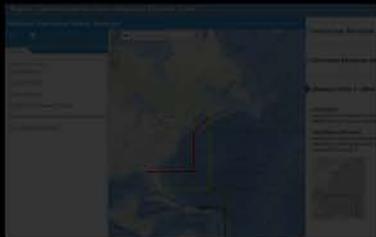
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9. Operational Decision Guides

By integrating the planning process and GIS, the Region 1 Operational Hurricane Decision Guide was created. The guide has two formats:

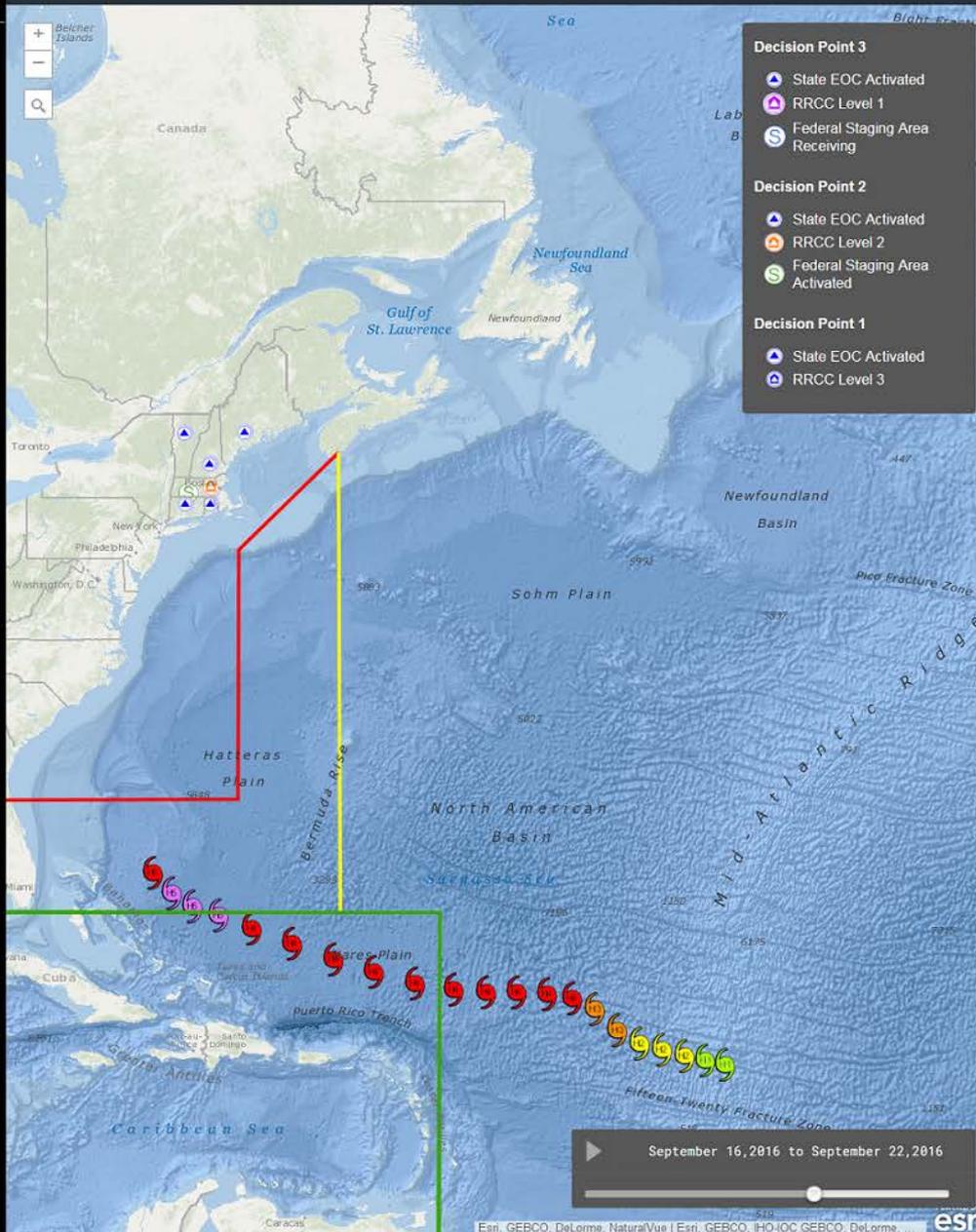
1. The Region 1 Hurricane Response Decision Guide: Shown to the right, this tool provides the user with a view of the geographic decision points and considerations for each decision point. To illustrate how this is used, each decision point presents the Hurricane of 1938 path as it enters into the decision point area.

2. Region 1 Operational Hurricane Response Decision Guide: Available at [this link](#), this product uses the same format as the Decision Guide but also allows the user to incorporate the forecast data from the National Hurricane Center to visualize the predicted path of storms relative to the decision points.



These two tools represent operational decision support needs that are being satisfied by virtue of the deliberate planning process.

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1 Current Course of Action

Decision Point 1 or H-96

- Activate RRCC to Level 3
- Issue Warning Order
- Decide whether to accelerate Resource Phasing Plan

Decision Point 2 or H-72 Hours

- Activate RRCC to Level 2
- Issue Alert Order
- Execute Phase 1b Checklist
- Execute Phase 1b Resource Phasing Plan
- Decide whether to accelerate Resource Phasing Plan
- Decide whether to adjust Resource Package (for Cat. 1/TS, II, or III)

Decision Point 3 or H-48 Hours

- Activate RRCC to Level 1
- Appropriate Liaison officers and IMATs are in place
- Execute Phase 1c checklist
- Execute Phase 1c Resource Phasing Plan
- Decide whether to accelerate Resource Phasing Plan
- Decide whether to adjust Resource Package (for Cat. 1/TS, II, or III)

Hurricane of 1938 Scenario

SoVI® metric from earlier versions. New directions in the theory and practice of vulnerability science emphasize the constraints of family structure, language barriers, vehicle availability, medical disabilities, and healthcare access in the preparation for and response to disasters, thus necessitating the inclusion of such factors in SoVI®. Extensive testing of earlier conceptualizations of SoVI®, in addition to the introduction of the U.S. Census Bureau's five-year American Community Survey (ACS) estimates, warrants changes to the SoVI® recipe, resulting in a more robust metric. These changes, pioneered with the ACS-based SoVI® 2005-09 carry over to SoVI® 2006-10, which combines the best data available from both the 2010 U.S. Decennial Census and five-year estimates from the 2006-2010 ACS. For more on the Social Vulnerability Index (SoVI®) visit our official site at: <http://www.sovius.org>. To see metadata or see component summaries to understand what is driving SoVI® for each coastal state go to: http://webra.cas.sc.edu/hvr/feature/data/SoVI_Data.asp.

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8. Courses of Action

This section describes broad courses of action to consider for hurricane response planning. Each course of action is described and visualized in terms of the geography and timing of the incoming hurricane and response operations.

The timing of the hurricane path has been modified to allow for more continuous visualization and does not represent the timing of the Hurricane of 1938.

For each course of action, use the time slider across the bottom to see what actions are taken as the storm crosses each decision point. Details of these actions and decisions are described to the right of the map.

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9. Operational Decision Guides

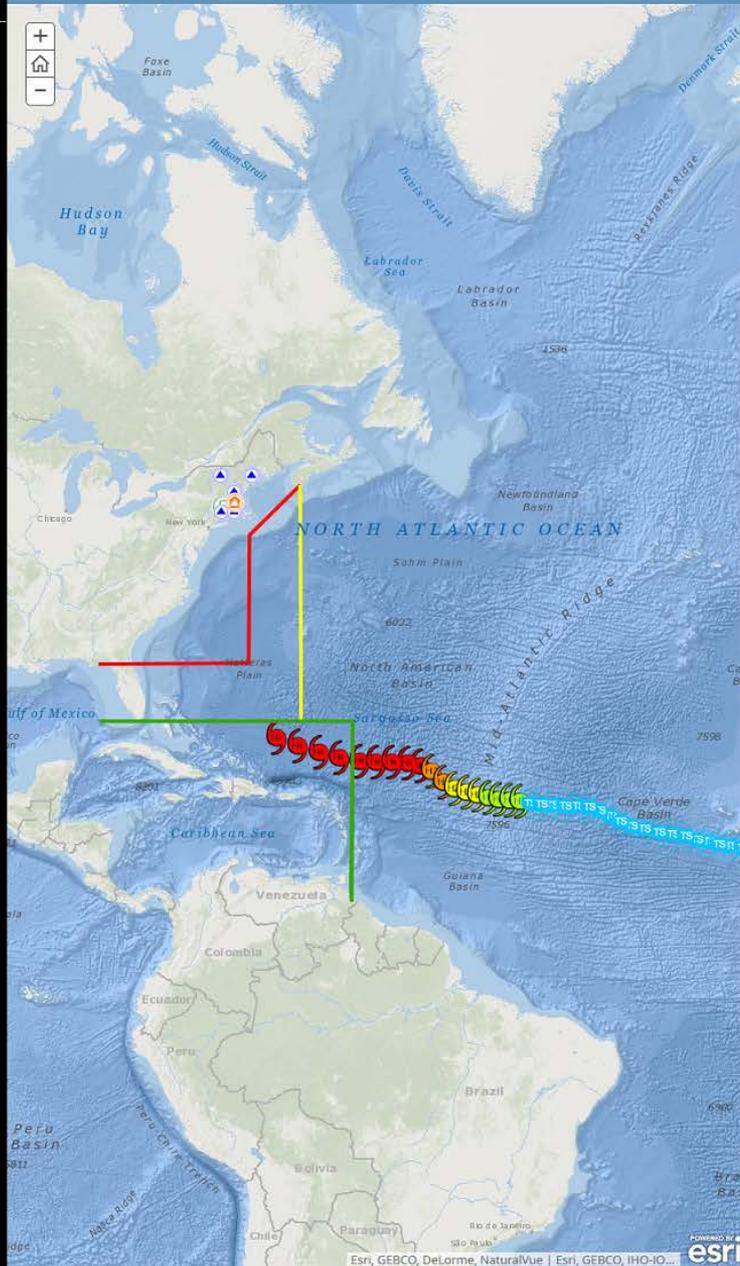
By integrating the planning process and GIS, the Region 1 Operational Hurricane Decision Guide was created. The guide has two formats:

1. The Region I Hurricane Response Decision Guide: Shown to the right, this tool provides the user with a view of the geographic decision points and considerations for each decision point. To illustrate how this is used, each decision point presents the Hurricane of 1938 path as it enters into the decision point area.
2. Region I Operational Hurricane Response Decision Guide: Available at this link, this product uses the same format as the Decision Guide but also allows the user to incorporate the forecast data from the National Hurricane Center to visualize the predicted path of storms relative to the decision points.



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Decision Guide Briefing Scenario

Hurricane Response Decision Guide

Decision Point 1 - Alert

Conditions:
Hurricane/TS in Caribbean or Gulf
AND 96 hours or more to forecasted impacts

Key Federal Decisions:
Accelerate or delay response actions
Determine Level of Response (low, medium, high)
Activate RRCC to Level 3

- State EOC Activated
- RRCC Level 3

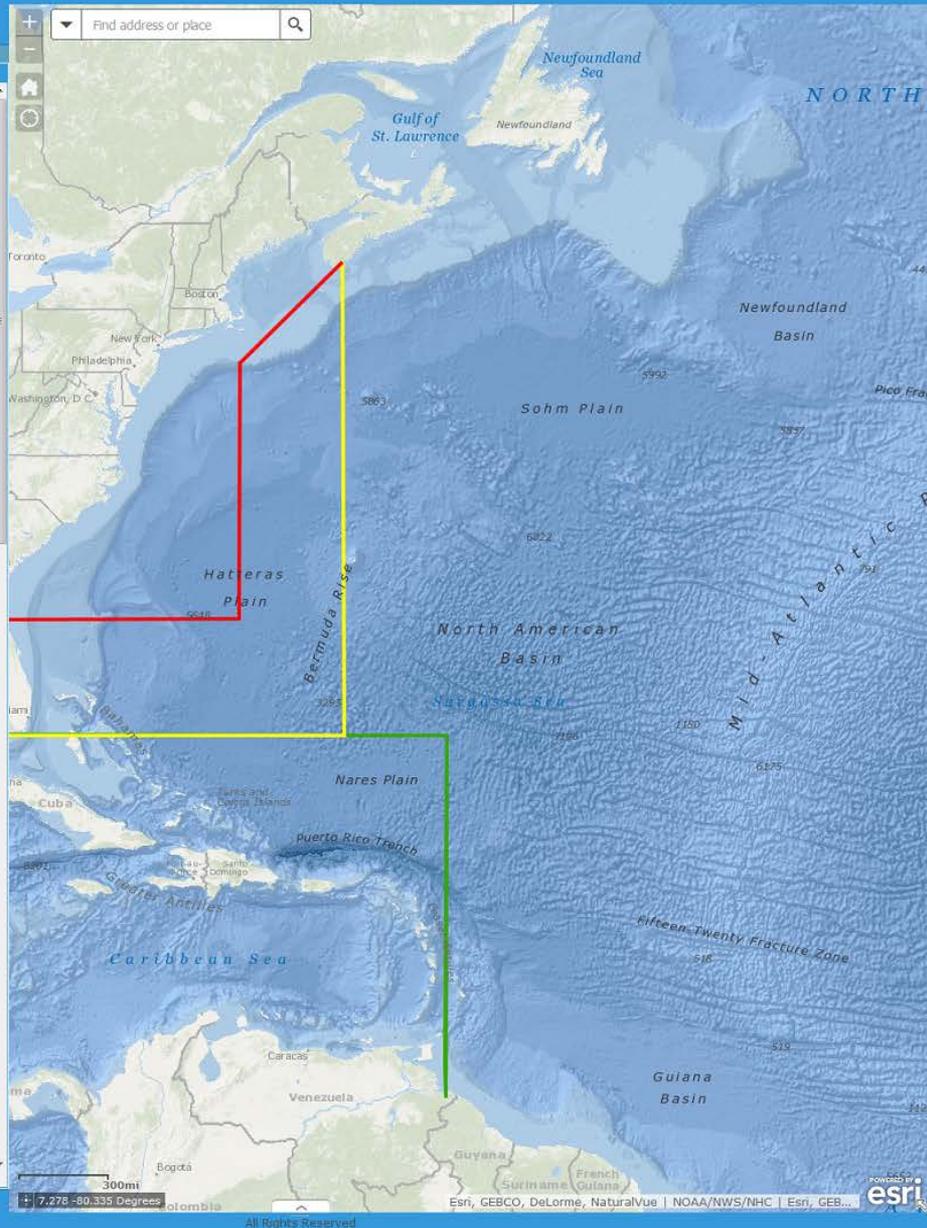
Decision Point 2 - Activate

Decision Point 3 - Deploy

National Hurricane Center Forecast

<http://www.nhc.noaa.gov/cydonies/>

- Layer List
- Operational Layers
 - DecisionPoint 3
 - Decision Point 2
 - Decision Point 1
 - NWS Atlantic Hurricane Forecast
 - 2 Day Probability Outlook
 - 2 Day Probability Outlook Area
 - 5 Day Probability Outlook
 - 5 Day Probability Outlook Area
 - AT1 Forecast Points
 - AT1 Forecast Track
 - AT1 Forecast Cone
 - AT1 Watch-Warning
 - AT1 Past Points
 - AT1 Past Track
 - AT1 Best Cumulative Wind Swath
 - AT1 Best Wind Radii
 - AT1 Surface Wind Field
 - AT1 Forecast Wind Radii
 - AT1 Surge
 - AT2 Forecast Points
 - AT2 Forecast Track
 - AT2 Forecast Cone
 - AT2 Watch Warning
 - AT2 Past Points
 - AT2 Past Track
 - AT2 Best Cumulative Wind Swath
 - AT2 Best Wind Radii
 - AT2 Surface Wind Field
 - AT2 Forecast Wind Radii



How to Use This Guide

Hurricane Response Decision Guide

Decision Point 1 - Alert

Conditions:
Hurricane/TS in Caribbean or Gulf
AND 96 hours or more to forecasted impacts

Key Federal Decisions:
Accelerate or delay response actions
Determine Level of Response (low, medium, high)
Activate RRCC to Level 3



Decision Point 2 - Activate

Decision Point 3 - Deploy



FEMA