

## Workshop Two: Understanding and Gathering Coastal Data

Using Scenario Planning to Map High Risk  
Flood Areas and Consider Other Coastal  
Resources

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# BACKGROUND

# Scenario-Based Planning Framework

	Climate Futures		
Management Options	Lucky	Expected	Perfect Storm
Current Conditions	Scenario 1A	Scenario 1B	Scenario 1C
Full Build-Out (Currently Allowed)	Scenario 2A	Scenario 2B	Scenario 2C
BMP Build-Out (Spatial BMPs)	Scenario 3A	Scenario 3B	Scenario 3C

- Scenario-based planning helps navigate uncertainty by plotting different, but reasonable future narratives against each other (e.g., climate futures and growth management options).
- Assumptions are made using available information in order to craft these narratives.
  - For example, to consider future Lake Michigan standing water levels we used observed low, “average”, and high water elevations over the past 100 years.
- Analyses completed from this framework can provide useful information to coastal communities, such as potential structures at risk of flooding under each combination of climate futures and management options (i.e., under each “scenario”)

# Future Climate Conditions

- Possible climate futures (*not predictions*)
- Varying:
  - Storminess
  - Great Lakes still water levels
- Derived by:
  - FEMA FIRMs (existing & proposed – Coastal Flood Study)
  - Observed Lake Michigan water levels (gauge data)
  - Available Digital Elevation Models (DEMs)
- “Planning storm” ~ 50 year storm

# Growth Management Options

- Possible build-out futures (*not predictions*)
- Use current structures & infrastructure as a base
- Varying:
  - Zoning regulations & other growth policies
  - Allowable development in or near high risk flood areas
- Derived by:
  - Community master plan, zoning ordinance, and any other ordinances (e.g., stormwater management ordinance)
  - Spatial avoidance best management practices
  - CommunityViz software

# National Flood Insurance Program

- Flood insurance in the United States is administered at the national level
- To accomplish this, Congress established the National Flood Insurance Program (NFIP) in 1968 to provide relief to flood victims, internalize risk of insurance, and deter imprudent development
- There are a variety of ways for communities to participate in the NFIP, depending on what FEMA data is available to a community. In general, however, if a community participates in the NFIP it must require new development within the floodplain to be elevated above the base flood elevation. Communities must also restrict development in the floodway, unless it can demonstrate that development would not result in any increase in flood levels within the community during a 1% storm
- Community participation in the NFIP requires that homeowners in floodplains purchase subsidized flood insurance when they apply for a federally backed mortgage
- In order to administer the NFIP, FEMA creates and maintains Flood Insurance Rates Maps

**Source:** Title 44 – Emergency Management and Assistance; Chapter I – Federal Emergency Management Agency, Department of Homeland Security; Part 60: Criteria for Land Management and Use; Subpart A: Requirements for Flood Plain Management Regulations. FEMA. [https://www.fema.gov/media-library-data/20130726-1622-20490-7844/section60\\_3.pdf](https://www.fema.gov/media-library-data/20130726-1622-20490-7844/section60_3.pdf).

# FEMA Flood Zones

- FEMA maps flood hazard areas by type of flood hazard and level of flood risk. These hazard areas are identified to communities via Flood Insurance Rate Maps (FIRMs).
- The 1-percent annual chance flood is also referred to as the base flood or 100-year flood. There are a variety of zones that FEMA uses (e.g., A, AO, AE, and VE), based on type of flood hazard, to show the 1-percent annual chance flood on FIRMs. Taken together, these identified areas are often thought of as the “flood zone,” but only indicate a portion of a community’s flood risk.
- The 0.2-percent annual chance flood, or 500-year flood, is also shown on FIRMs via identified Zone X (shaded) areas.
- One can find and download community FIRMs at the FEMA Flood Map Service Center webpage (<https://msc.fema.gov/portal#>)
- **Note:** FEMA is currently releasing draft FIRMs from their recent Coastal Flood Study, which seeks to identify areas vulnerable to high velocity waves (VE Zones)

# Coastal Resiliency Training Workshop



Mapping	VE Zone	AE Zone	AH Zone	AO Zone	A Zone	Shaded Zone X
Current Effective	VE 14	AE 12	AH 12	AO	A	0.2%
New Coastal SFHAs	VE 14	AE 12	AH 12	AO	A	0.2%

Transects 1

0 1,000 2,000 4,000 Feet

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Swis, Korea, Swis (Taiwan), Mapbox, NGIS, © OpenStreetMap contributors, and the GIS User Community  
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FEMA Region V  
 Ottawa County, MI  
 Coastal Flood Hazard Study  
 Draft Workmaps  
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 May 2017



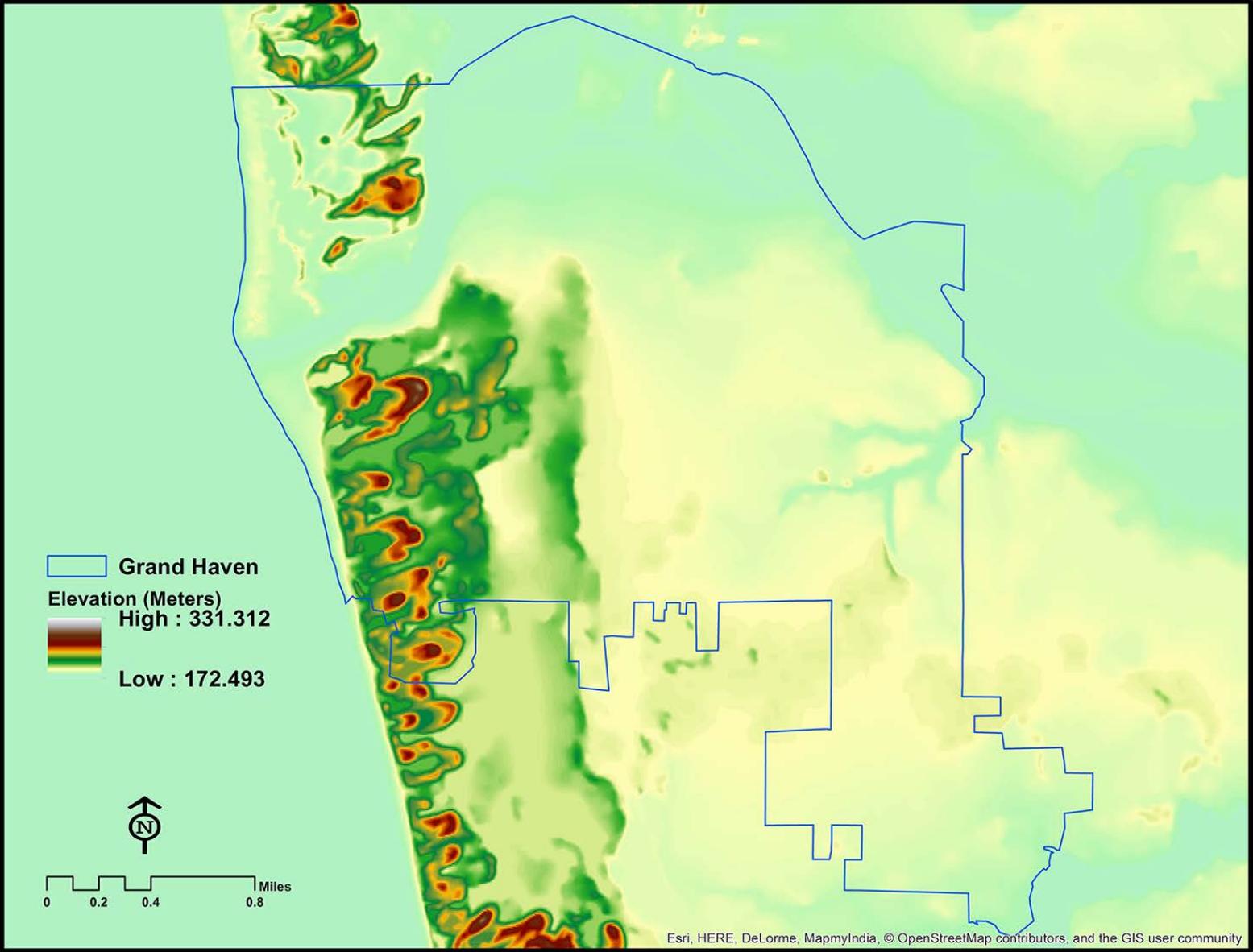
# FEMA Flood Zones

	FEMA Definition/Description
Zone A	Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. No Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.
Zone AE	Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.
Zone AH	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.
Zone AO	<p>Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.</p> <p>Some Zone AO have been designated in areas with high flood velocities such as alluvial fans and washes. Communities are encouraged to adopt more restrictive requirements for these areas.</p>
Zone VE	Areas subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. Base Flood Elevations (BFEs) derived are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Source: National Flood Insurance Program Policy Index. FEMA. <https://www.fema.gov/national-flood-insurance-program-policy-index#>.

# Digital Elevation Models (DEMs)

- Digital Elevation Models are digital representations of elevation data that can be entered into various computer programs, including ArcGIS.
- The United States Geological Survey (USGS) is a prominent organization that produces DEMs
- DEMs have been, and continue to be, acquired in a variety of ways. These various methods produce variously precise DEMs
- Light Detection and Ranging (LiDAR) is one of the higher quality methods used to collect and produce DEMs currently. It can be cost-prohibitive, however, and as a result there are many locations in both Michigan and nationally that have not yet been mapped using LiDAR technology.
- One can find and download DEMs at the USGS National Map Viewer webpage  
(<https://viewer.nationalmap.gov/basic/?basemap=b1&category=ned,neds rc&title=3DEP%20View>)



# ArcGIS

- ArcGIS is a computer program that enables users to visualize data linked to specific locations. These data are called geospatial data. Often, geospatial data is best conveyed (or visualized) through maps.
- ArcGIS also enables users to perform various analyses. For example, one can use the program to analyze how many structures sit within FEMA's 100-year floodplain, and where exactly these structures are located.
- One can learn more about ArcGIS at its about page (<http://www.esri.com/arcgis/about-arcgis/>)

# CommunityViz

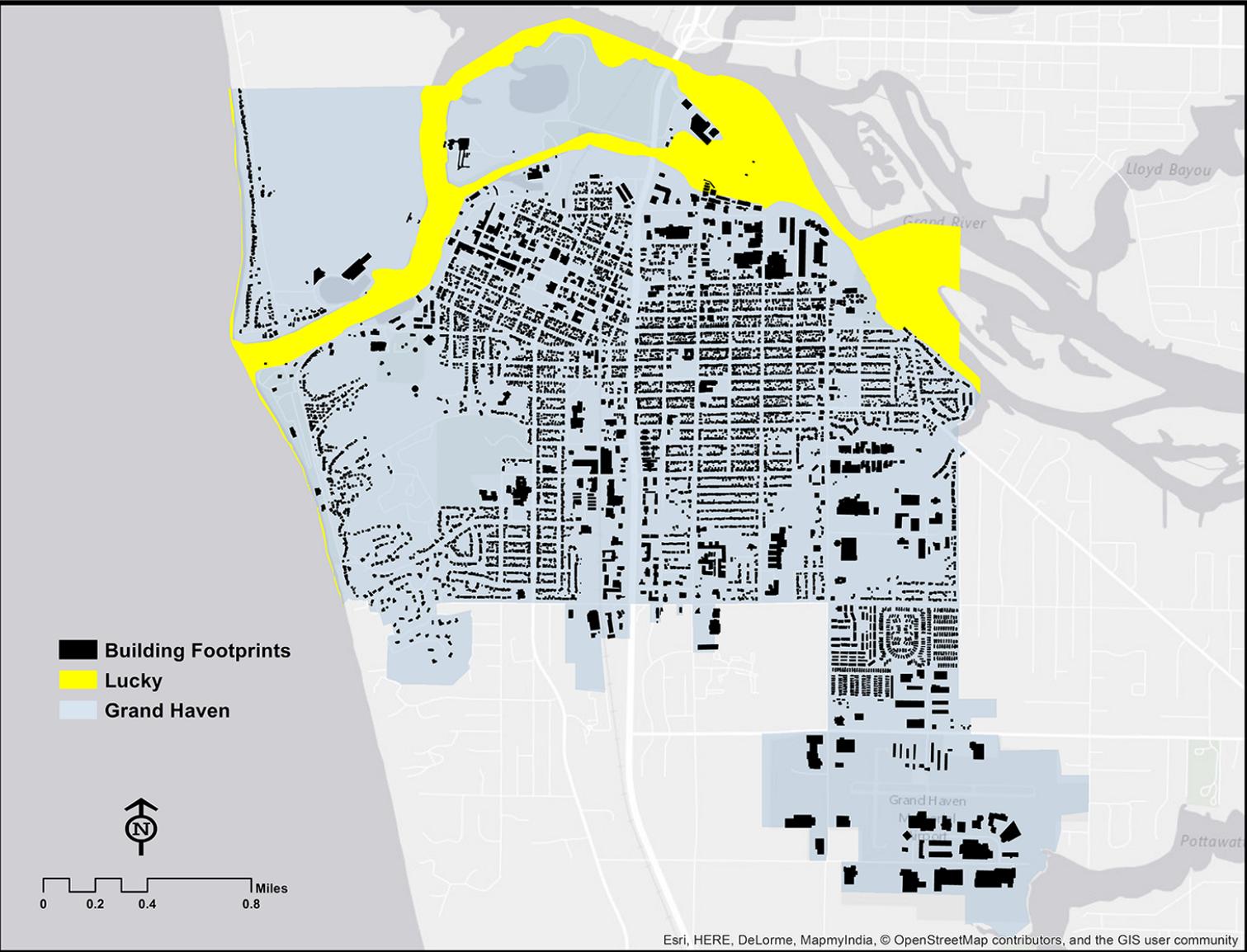
- CommunityViz is a proprietary ArcGIS extension that allows users to “analyze and understand land-use alternatives and impacts”.
- For example, one can use CommunityViz to visualize potential, future build-outs (e.g., what full build-out might look like under current zoning conditions and what a build-out might look like if BMPs were adopted to limit imprudent development)
- The tools that helps complete this analysis is called the “Build-Out Wizard”
- One can learn more about CommunityViz at its home page (<http://communityviz.city-explained.com/communityviz/index.html>)

# CLIMATE FUTURES

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# Future Climate Conditions (Forecasts)

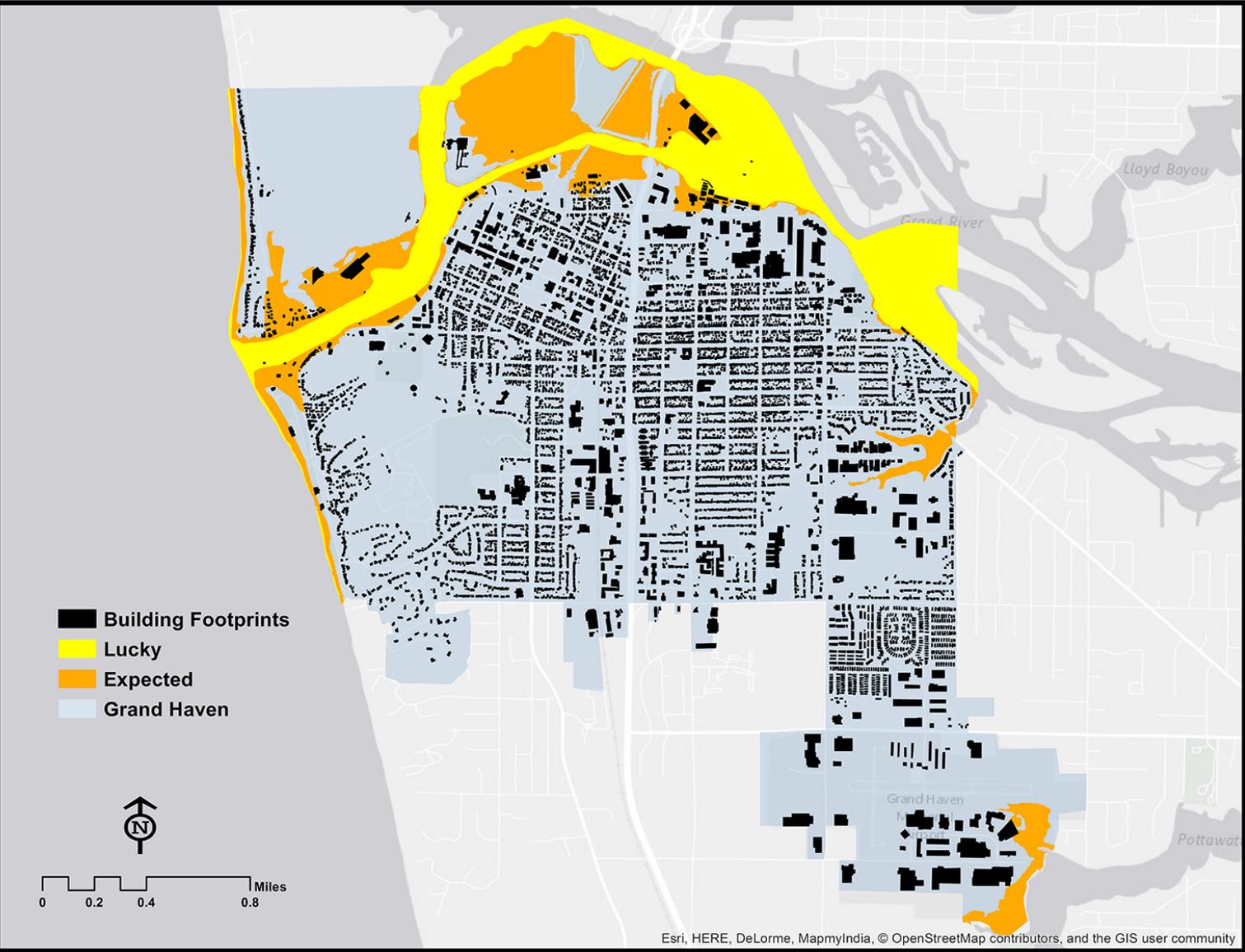
- Lucky:
  - All-time low lake water levels, no wave action (i.e., no VE)
  - Current FIRM floodway + Proposed 2% coastal base flood elevations (“coastal floodway”)
  - Planning (~50-year) storm = current 2% storm
- Expected:
  - Long-term mean lake water levels
  - Current FIRM base flood elevations (“coastal floodplain”) + elevation-derived VE
  - Planning (~50-year) storm = current 1% storm + VE (more stormy)
- Perfect Storm:
  - All-time high lake water levels
  - Current mapped .2% flood area (Shaded-x) + elevation-derived VE
  - Planning (~50-year) storm = current 0.2% storm + VE (super stormy)



### Lucky:

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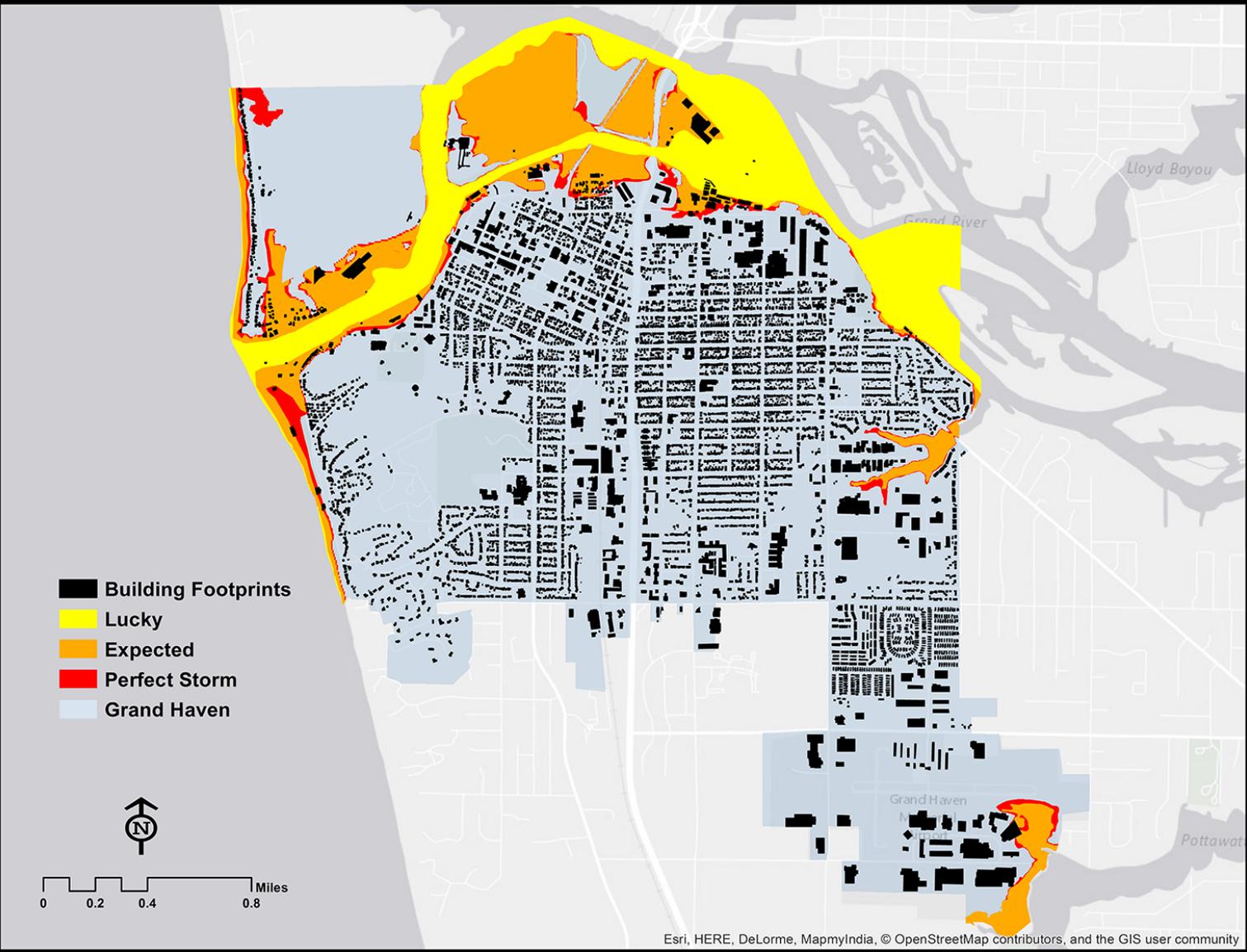
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### Perfect Storm:

- All-time high lake water levels
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# Information from Mapped Climate Futures

	Acres*	Parcel†	Structures
Lucky	404 (10%)	473 (8%)	17 (<1%)
Expected	850 (21%)	791 (14%)	142 (2%)
Perfect Storm	907 (22%)	926 (16%)	189 (3%)
<b>Grand Haven Total</b>	<b>4045</b>	<b>5656</b>	<b>6729</b>

\* Note: Inclusive of water features

† Note: Does not mean that entire parcel is impacted, just indicates that a portion of the parcel is impacted

# OTHER COASTAL RESOURCES

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# State Designated Critical Dune Areas

- The State of Michigan has identified a number of dune systems throughout the state as “Critical Dune Areas” (CDAs)
- There about 225,000 acres of dunes in Michigan, and approximately 74,000 acres are designated as CDAs. These areas include land that is both publicly and privately owned
- The original reason Michigan designated some dunes as CDAs was to regulate the sand mining industry
- As dunes became popular sites for recreation and residential development, CDA designation served the purpose of regulating other potentially harmful developments within these dune systems
- In 2012, an amendment to the Sand Dunes Protection and Management Act changed the statute’s purpose for regulation, and in short calls for a balance between environmental benefits and “the benefits of economic development”

**Source:** *Critical Dunes Area Program*. MDEQ. [http://www.michigan.gov/deq/0,4561,7-135-3311\\_4114-9832--,00.html](http://www.michigan.gov/deq/0,4561,7-135-3311_4114-9832--,00.html).

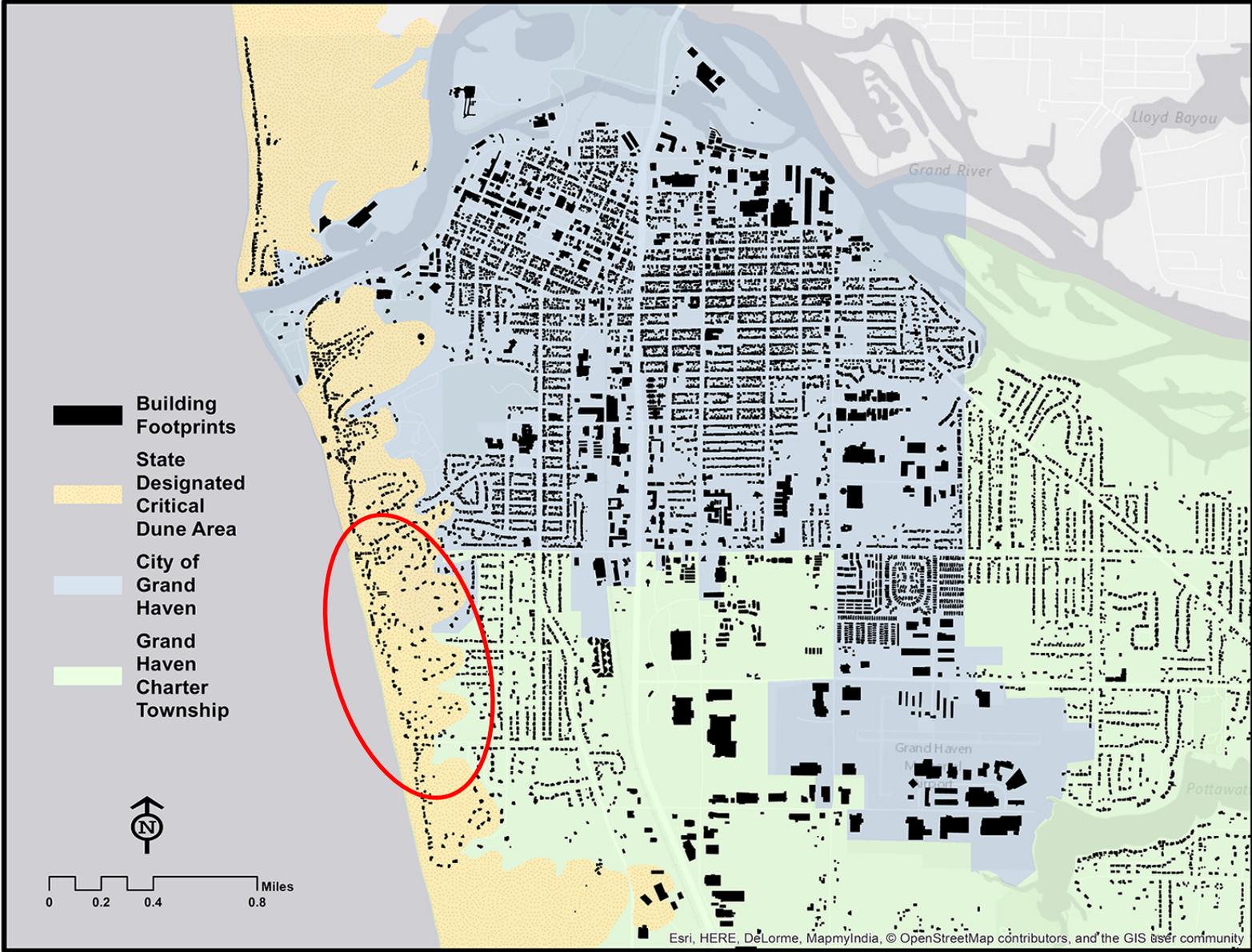
# CDA Amendment Implications

## Some 2012 Amendment Changes to Part 353, MI Sand Dunes Protection & Management Act:

- Local critical dune ordinances may not be more restrictive than state law.
- Structures proposed lakeward of the crest may be permitted, under certain conditions, Section 35304(3).
  - "Crest" means the line at which the first lakeward facing slope of a critical dune ridge breaks to a slope of less than 1-foot vertical rise in a 5-1/2-foot horizontal plane for a distance of at least 20 feet
- A driveway on steep slopes may be permitted without a special exception (variance), if the proposed driveway meets the criteria found in the revised law, Section 35311(a).

**Source:** *FAQ's 2012 Public Act 297 Amending Part 353, Sand Dunes Protection & Management.*  
MDEQ's Water Resource Division Staff. [http://www.michigan.gov/deq/0,4561,7-135-3311\\_4114-292870--,00.html](http://www.michigan.gov/deq/0,4561,7-135-3311_4114-292870--,00.html).

# Coastal Resiliency Training Workshop



# Coastal Resiliency Training Workshop



Grand Haven Charter Township's Fire and Rescue team have access such as the photo above to help access hard to reach areas. In the case of fire, however, large trucks are often needed to haul heavy equipment.



This condemned structure in Grand Haven Charter Township has been damaged by the natural movement of dune systems over time. Homes within the shorelands may be subject to erosion, sand movement, and other coastal dynamics.



Decades of development in the township's dunes have created challenges for emergency response and fire department workers to reach homes.



The Wilderness community of the township prides itself on having a strong rural character built around the dunes, yet coastal residents often do not anticipate increased response times that their remote location causes for emergency service providers.



The Grand Haven Township Fire and Rescue Department has 7 full-time and 24 part-time staff. The average response time community-wide to emergencies is three minutes, but narrow roads in the dunes make it difficult and sometimes impossible for fire trucks to reach homes.

# Wetlands

- Michigan's wetland statute recognizes the following benefits provided by wetlands:
  - Flood and storm control by the hydrologic absorption and storage capacity of wetlands
  - Wildlife habitat by providing breeding, nesting, and feeding grounds and cover for many forms of wildlife, waterfowl, including migratory waterfowl, and rare, threatened, or endangered wildlife species
  - Protection of subsurface water resources and provision of valuable watersheds and recharging ground water supplies
  - Pollution treatment by serving as a biological and chemical oxidation basin
  - Erosion control by serving as a sedimentation area and filtering basin, absorbing silt and organic matter
  - Sources of nutrients in water food cycles and nursery grounds and sanctuaries for fish

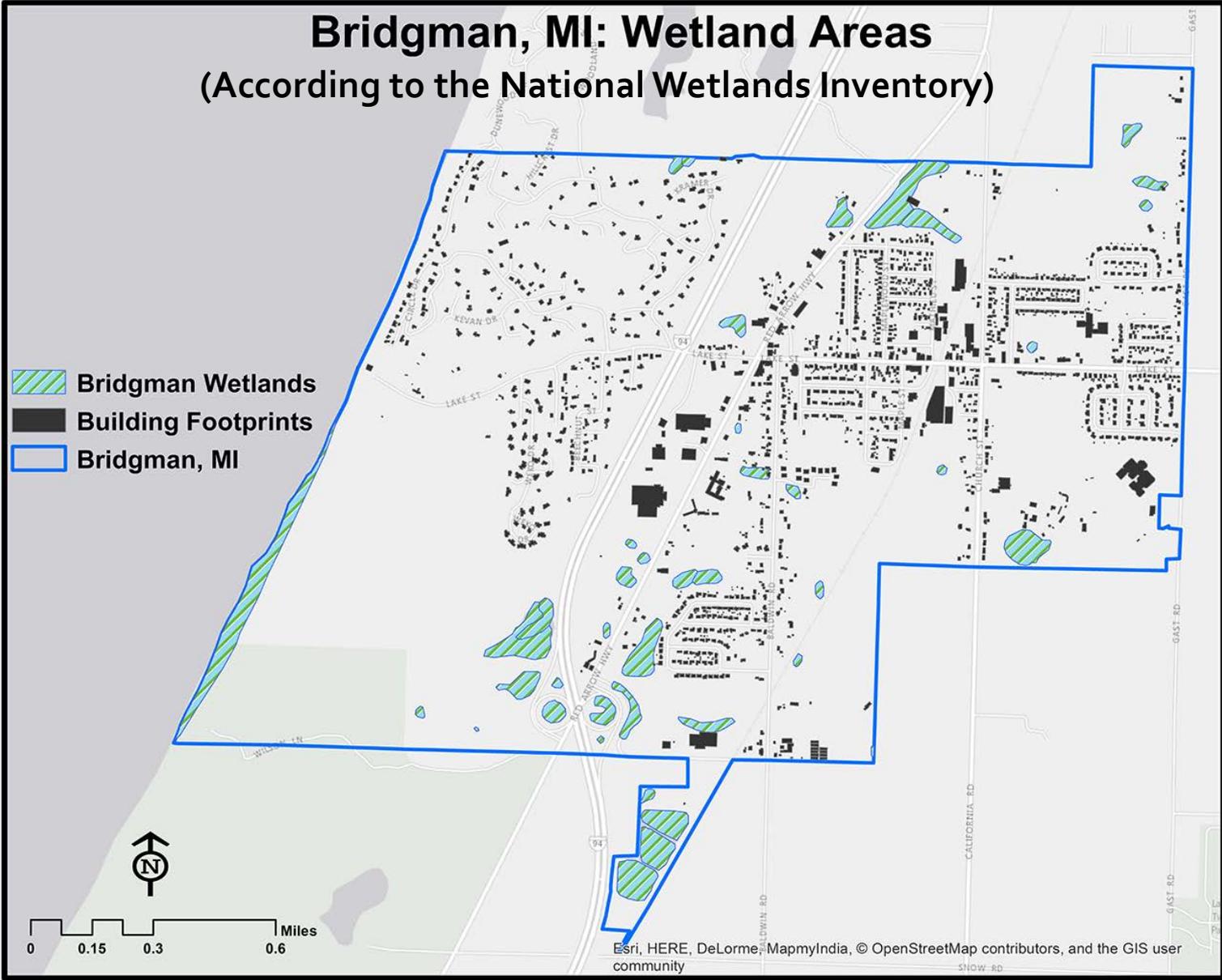
**Source:** *What are wetlands and why are they important?*. MDEQ. [http://www.michigan.gov/deq/0,4561,7-135-3313\\_3687-141296--,00.html](http://www.michigan.gov/deq/0,4561,7-135-3313_3687-141296--,00.html).

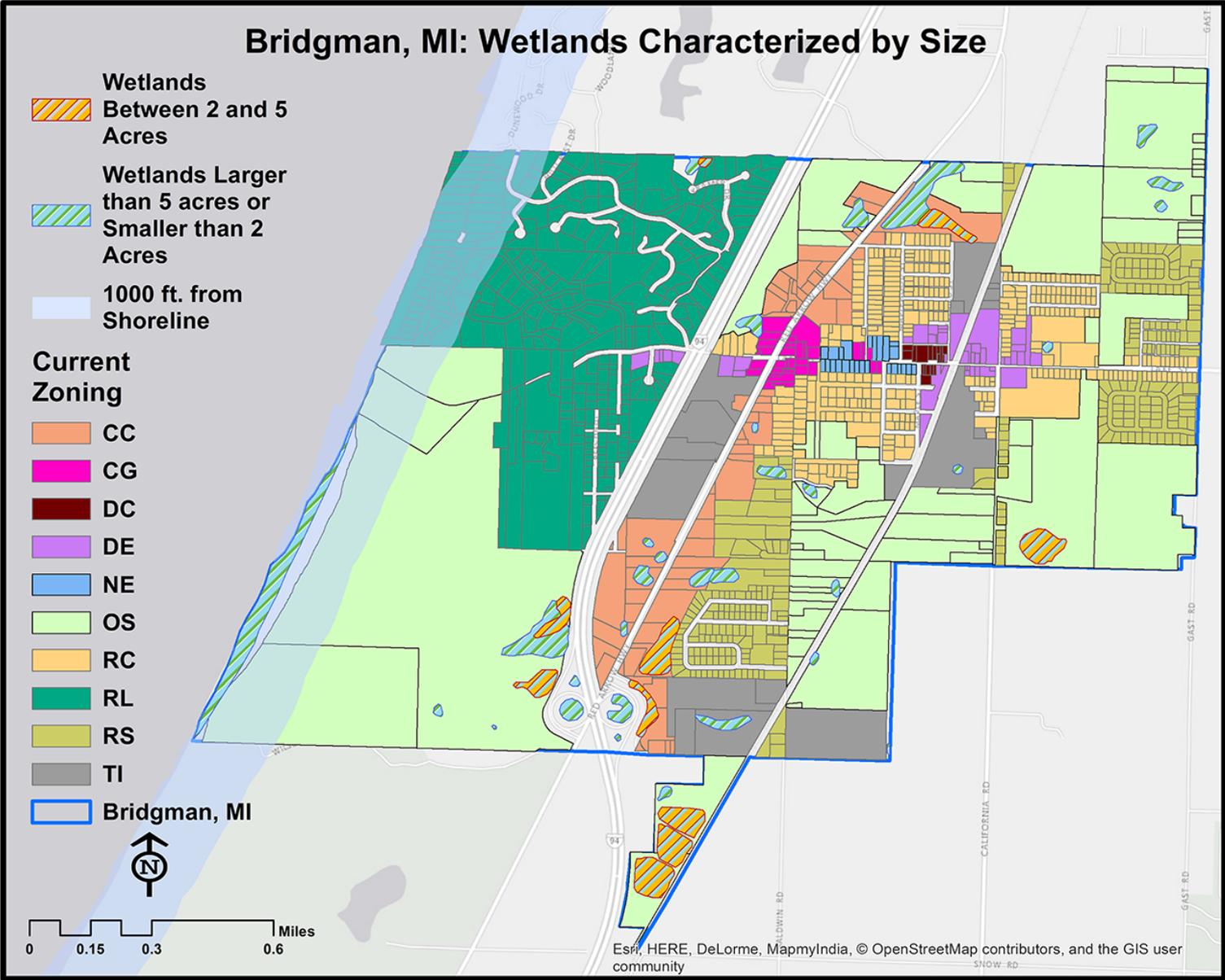
# Wetlands

- The State of Michigan regulates wetlands if they are any of the following:
  - Connected to one of the Great Lakes or Lake St. Clair
  - Located within 1,000 feet of one of the Great Lakes or Lake St. Clair.
  - Connected to an inland lake, pond, river, or stream
  - Located within 500 feet of an inland lake, pond, river or stream
  - Not connected to one of the Great Lakes or Lake St. Clair, or an inland lake, pond, stream, or river, but are more than 5 acres in size
  - Not connected to one of the Great Lakes or Lake St. Clair, or an inland lake, pond, stream, or river, and less than 5 acres in size, but the DEQ has determined that these wetlands are essential to the preservation of the state's natural resources and has notified the property owner
- A local unit of government can regulate wetlands by an ordinance in addition to state regulations, but must meet certain criteria
- A local unit of government can also regulate wetlands less than 5 acres, but larger than 2 acres, without having to prove ecological value

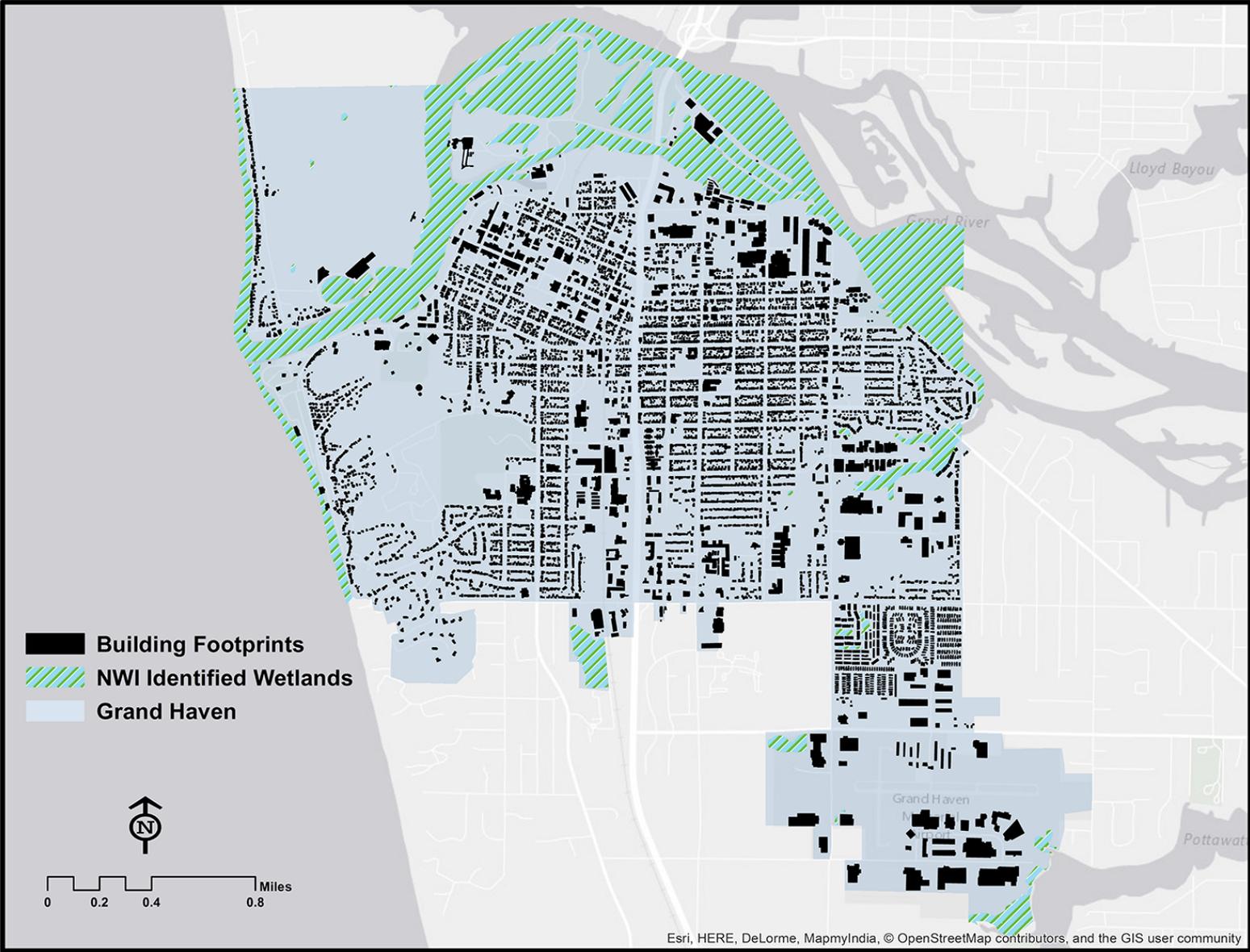
**Source:** *Wetlands Protection: Protecting Michigan's Wetlands*. MDEQ.

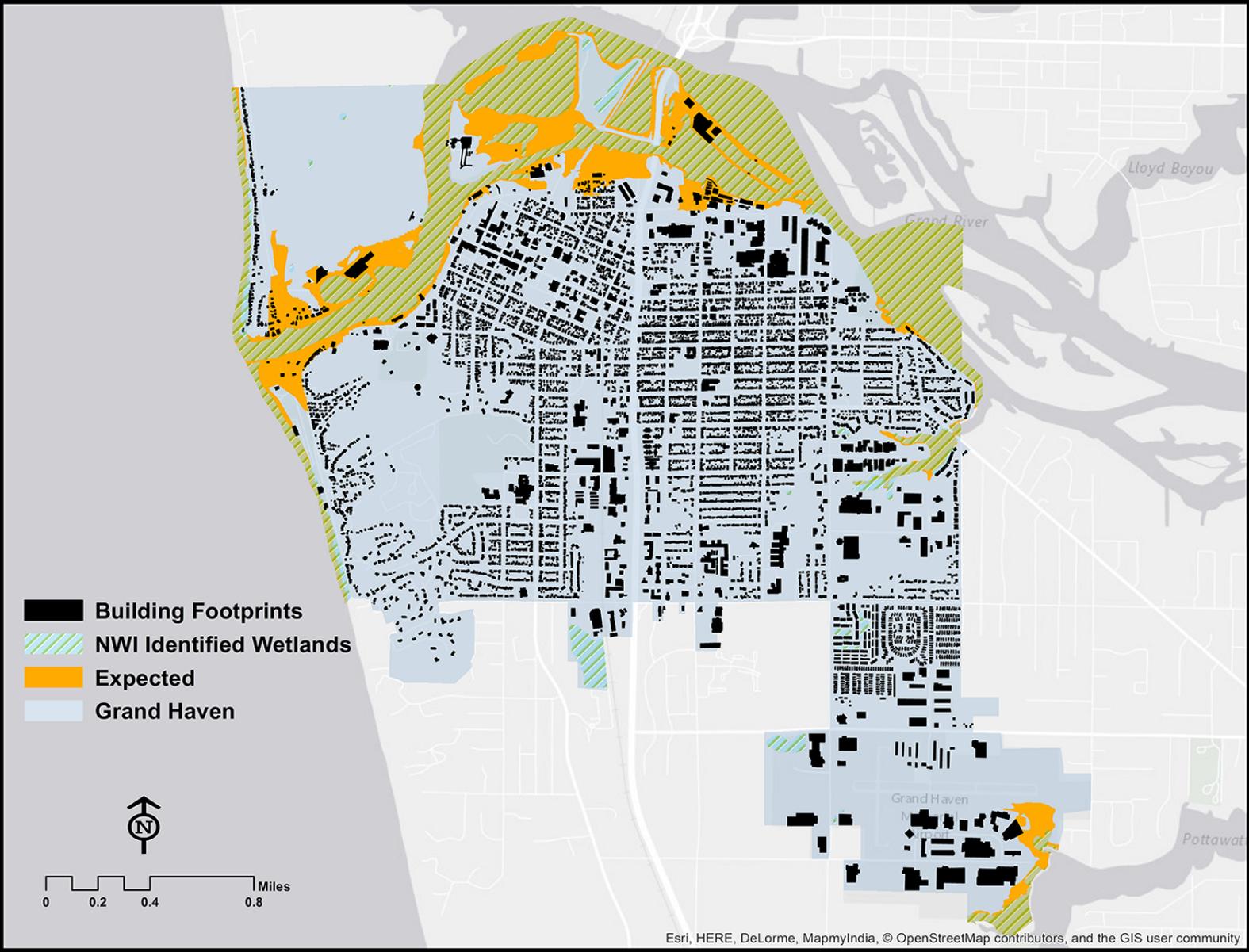
[http://www.michigan.gov/deq/0,4561,7-135-3313\\_3687---,00.html](http://www.michigan.gov/deq/0,4561,7-135-3313_3687---,00.html).





# Coastal Resiliency Training Workshop





# VULNERABILITY ASSESSMENT

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# Next Workshop Topics

**At the 3<sup>rd</sup> Workshop, we will continue this conversation and cover the following topics:**

- Mapping build-out futures
- Analyzing land use, fiscal, and environmental impacts
- Assessing resilient coastal management options

QUESTIONS?

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