

# Low-lying Roads: Dennis

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Project funded by the  
Economic Development  
Administration

Cape Cod Commission: Heather McElroy, Martha Hevenor, Michele White, Liz Kellam, Colleen Medeiros, and Tara Lewis  
Woods Hole Group: Joe Famely

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# Purpose and Objectives of Workshop

- **Review flood projections and impacts on roadways for the town under future scenarios**
- **Discuss vulnerable low-lying roads or other transportation infrastructure**
- **Prepare the town to address priority road segments for design and permitting**

# Agenda

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- Project Overview
- Vulnerability and Risk Assessment
- Results of Low-Lying Roads Screening
- Breakout Groups
- Next Steps





# Low Lying Roads Project



# 10 TOWNS

EDA and MVP  
funding thru 2023

Vulnerability assessment of low-lying roads and transportation infrastructure

Municipal prioritization

Potential design solutions

## NEXT STEPS: PUBLIC MEETINGS

Prioritize most critical road segments for development of alternative solutions for sea level rise and storm surge adaptation

FALL - DECEMBER

**6 public workshops**

LATE WINTER - SPRING

**4 public workshops**

FALL

Yarmouth, Orleans,  
Eastham, Wellfleet,  
Sandwich, Dennis

WINTER

Barnstable, Bourne,  
Brewster, Truro

SPRING

HAZARD  
Storms, SLR  
& Flooding



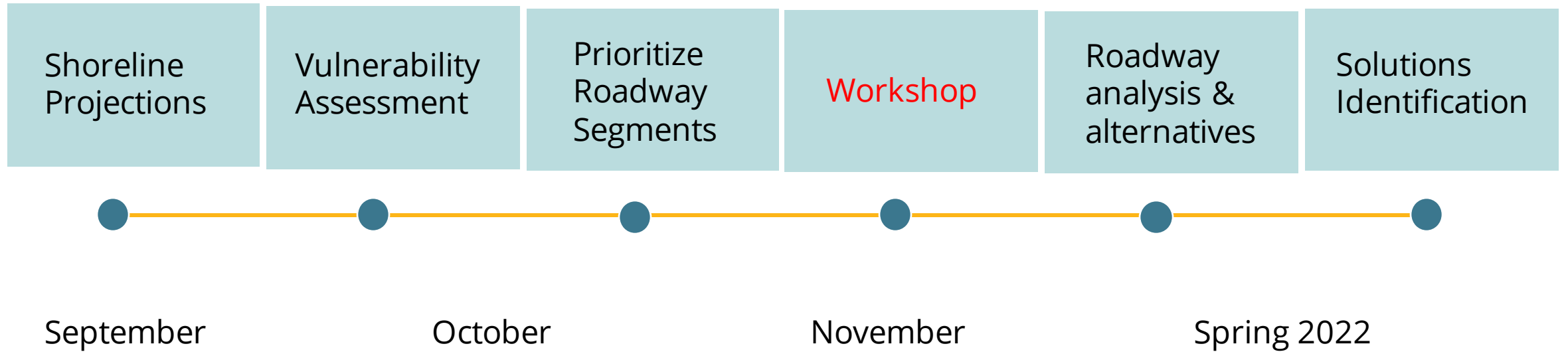


# Adaptation Strategies



- | Green Infrastructure, or Nature-based Solutions
- | Gray Infrastructure, or Traditional Engineering Structures
- | Other approaches – Managed Retreat, Abandonment

# PROJECT TIMELINE



# Questions?

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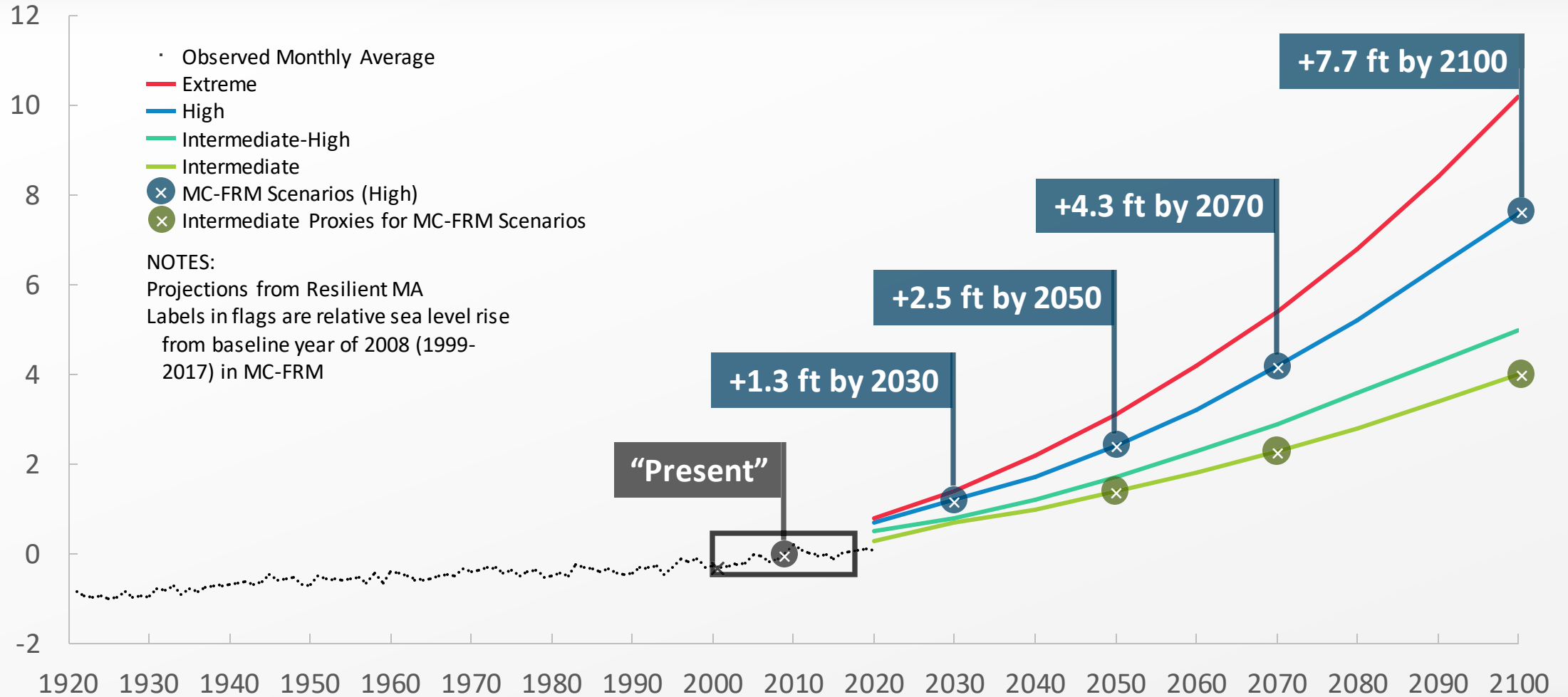
- Workshop Purpose or Objectives
- Low Lying Roads project
  - Key components
    - Vulnerability Assessment - Identify Potential Sites
    - Public Outreach and Engagement
    - Roadway Feasibility and Alternative Solutions
    - Solutions Identification
  - Timeline



# MA EOEEA Probabilistic Sea Level Rise Projections

MC-FRM NORTH (DeConto & Kopp, 2017)

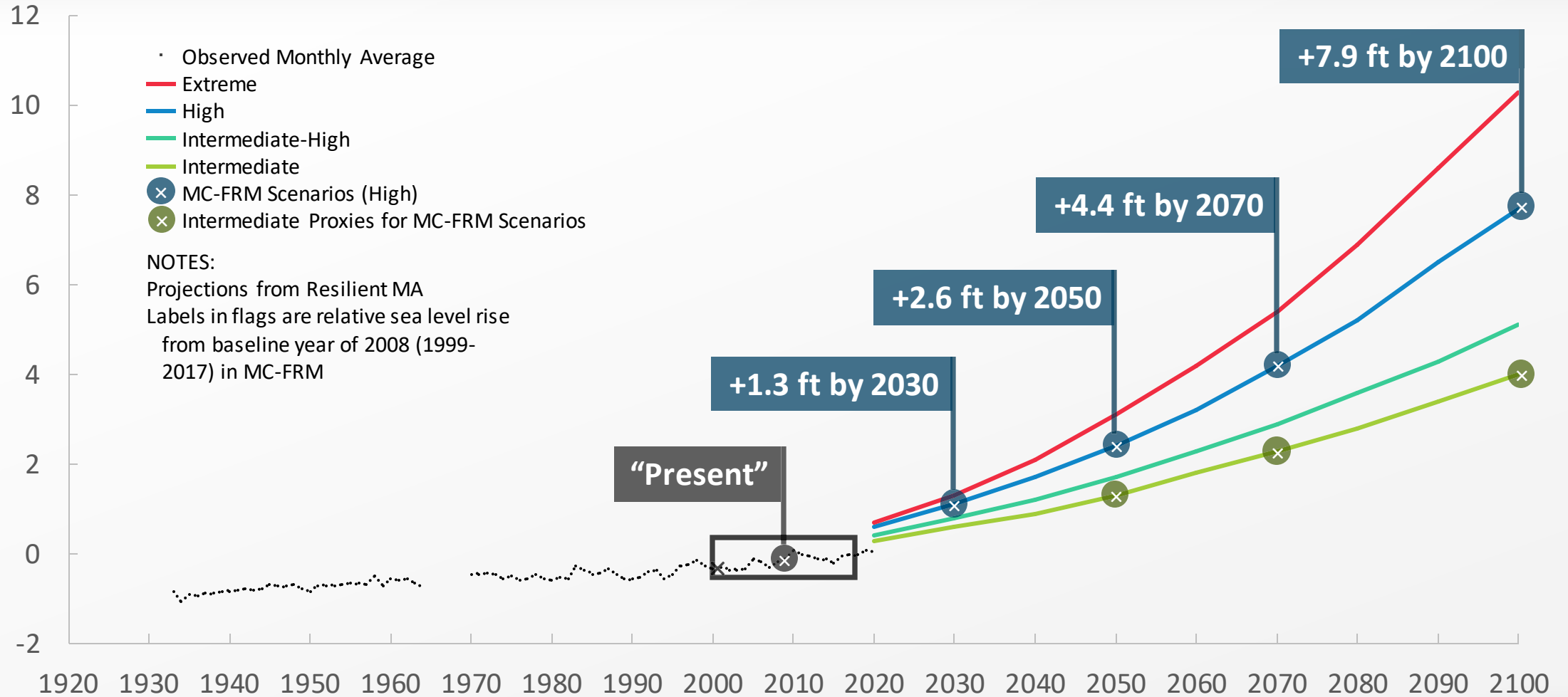
Relative Mean Sea Level (feet NAVD88)



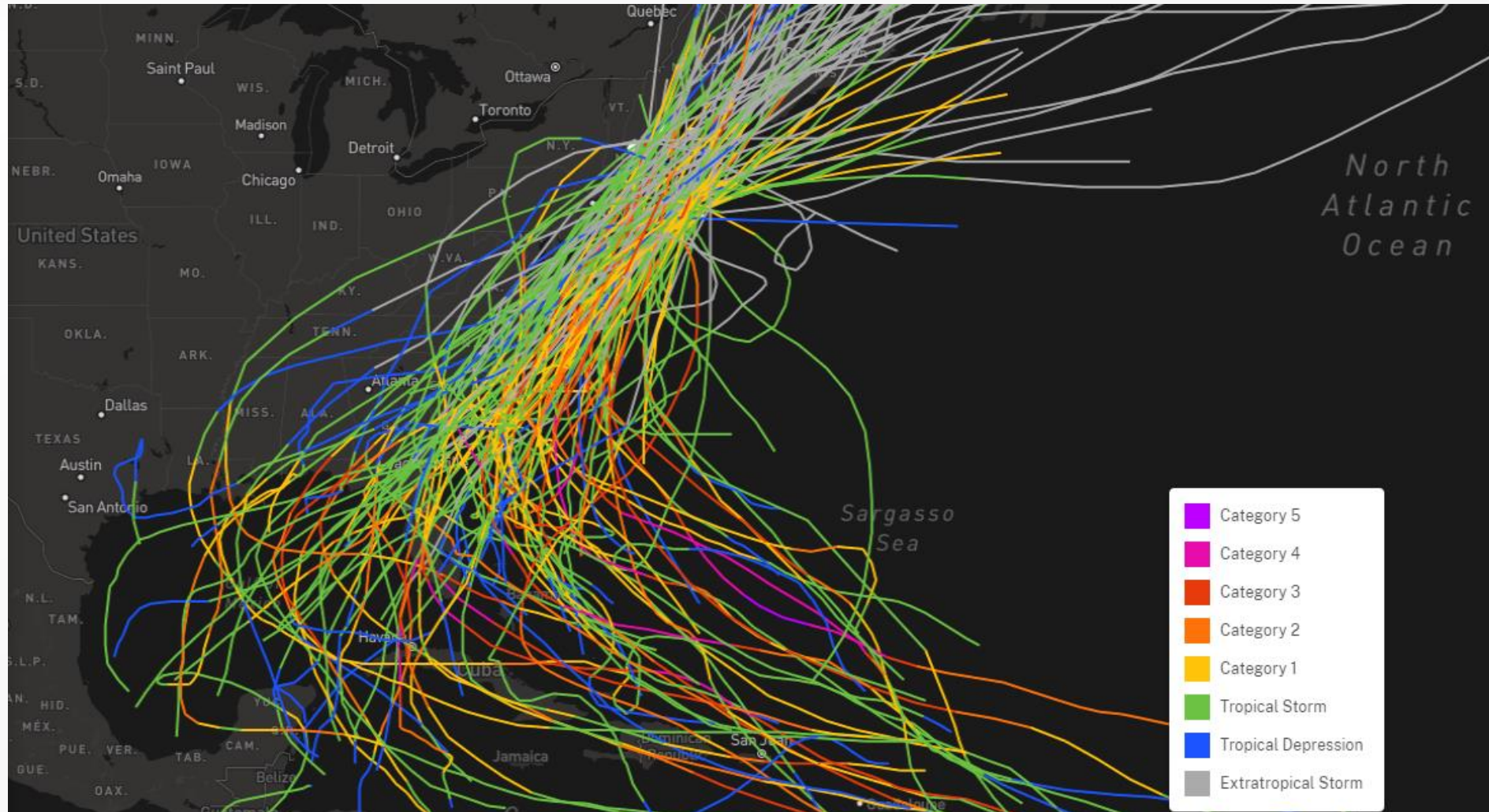
# MA EOEEA Probabilistic Sea Level Rise Projections

MC-FRM SOUTH (DeConto & Kopp, 2017)

Relative Mean Sea Level (feet NAVD88)



# Tropical / Extra-tropical Storms



NOAA National Ocean Service





# Massachusetts Coast Flood Risk Model (MC-FRM)



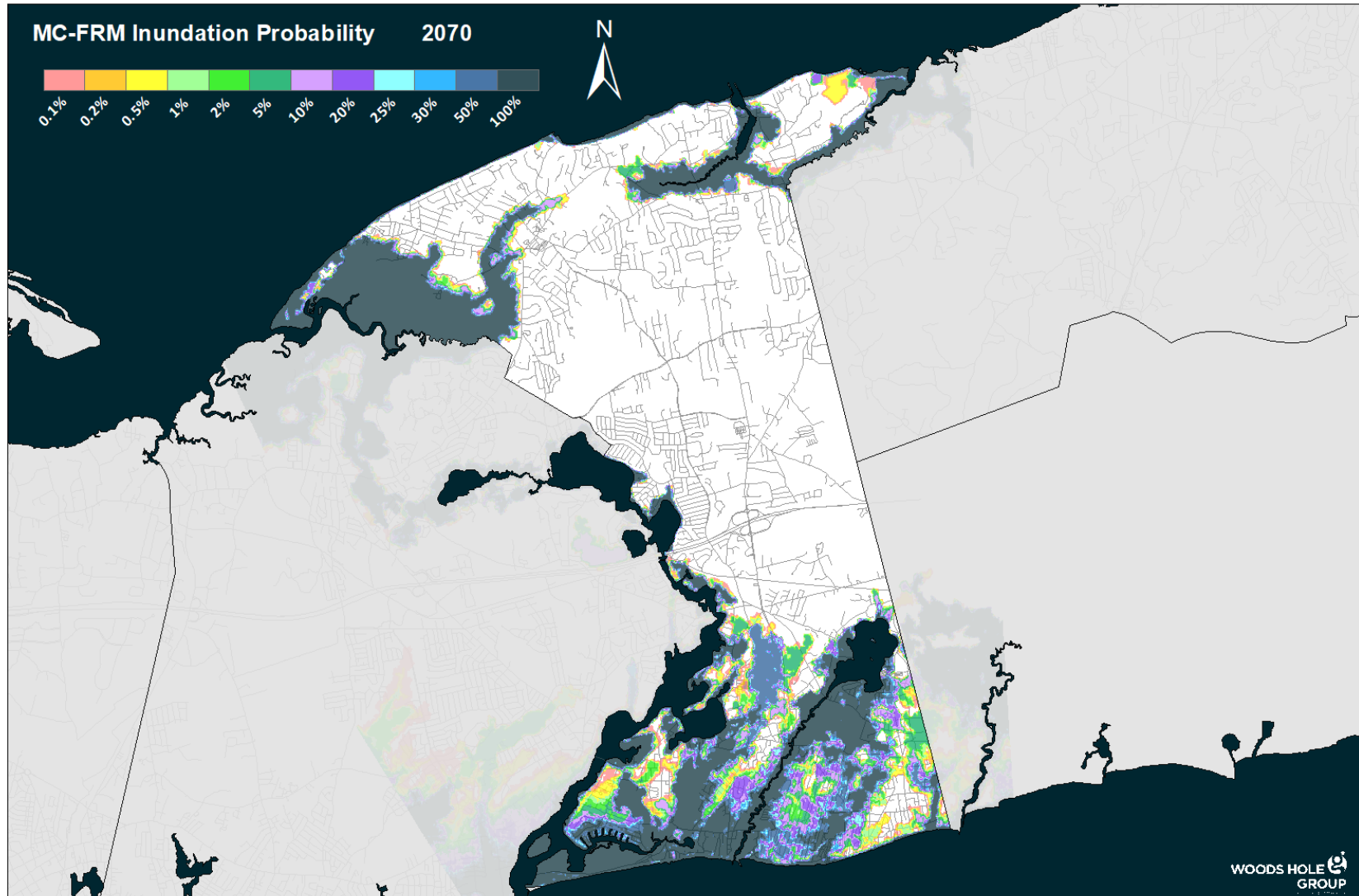


# MC-FRM Resolution - Dennis





# MC-FRM Coastal Flood Exceedance Probability – Dennis



# Massachusetts Coast Flood Risk Model

## SUMMARY

Hydrodynamically modeled projections

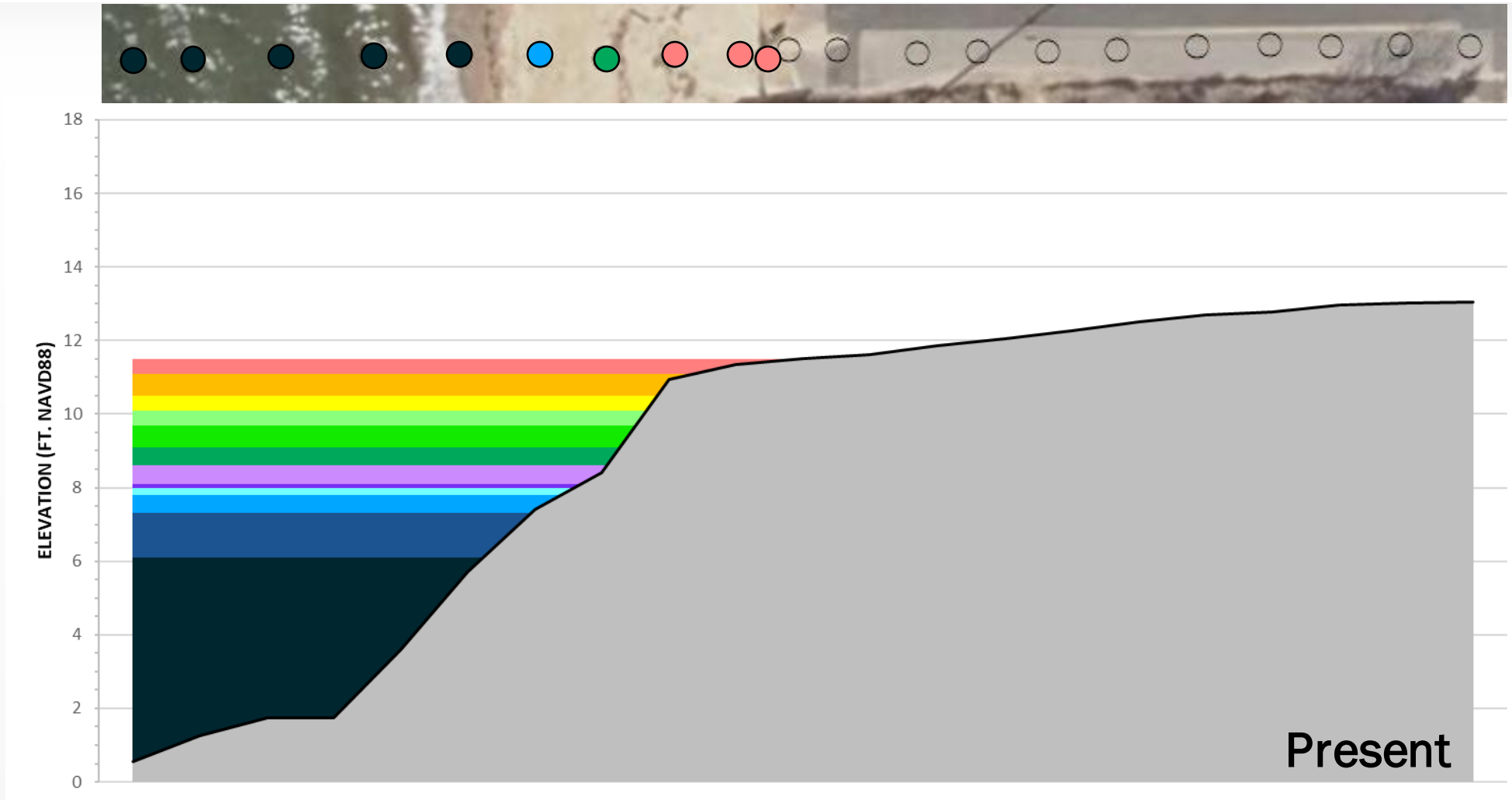
Sea level rise and storm surge – combined

Annual chance of flooding under 2030/2050/2070 climate conditions

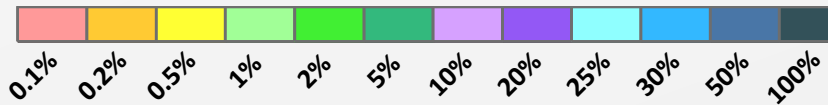
## QUESTIONS?



# Cape Cod Low Lying Roads Vulnerability Assessment Methods



COASTAL FLOOD EXCEEDANCE PROBABILITY



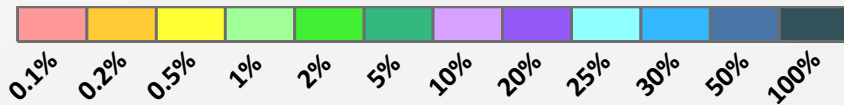


# Cape Cod Low Lying Roads Vulnerability Assessment Methods



2030

COASTAL FLOOD EXCEEDANCE PROBABILITY

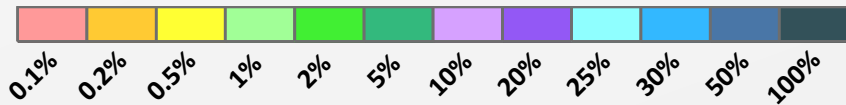


# Cape Cod Low Lying Roads Vulnerability Assessment Methods

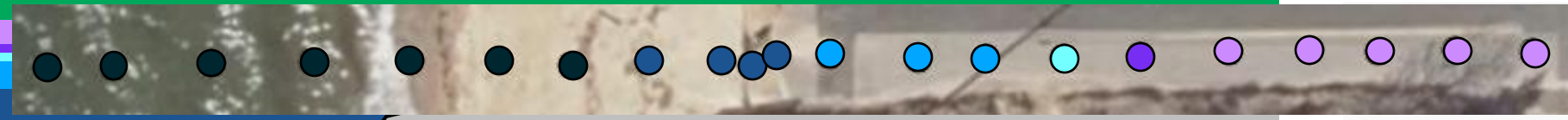


2050

COASTAL FLOOD EXCEEDANCE PROBABILITY

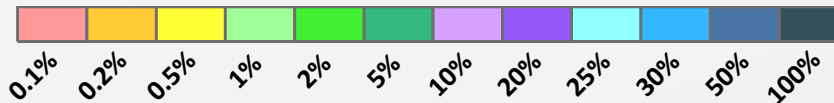


# Cape Cod Low Lying Roads Vulnerability Assessment Methods



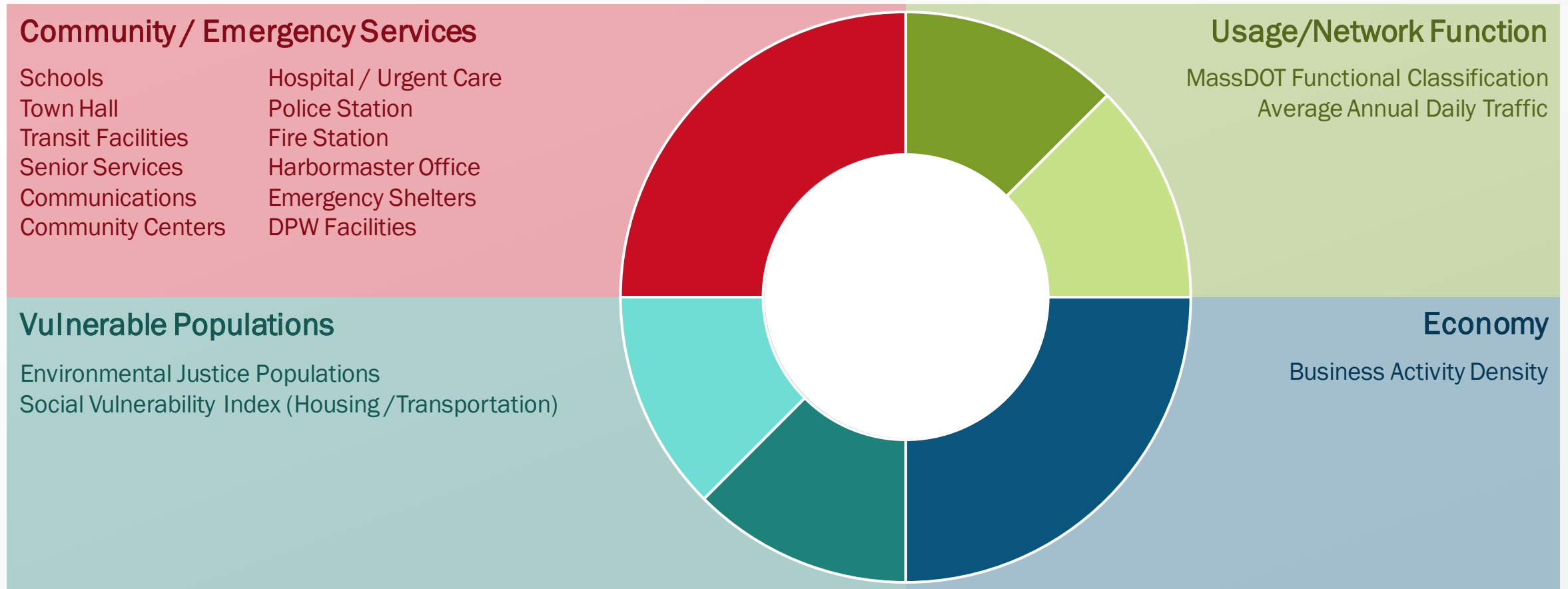
2070

COASTAL FLOOD EXCEEDANCE PROBABILITY



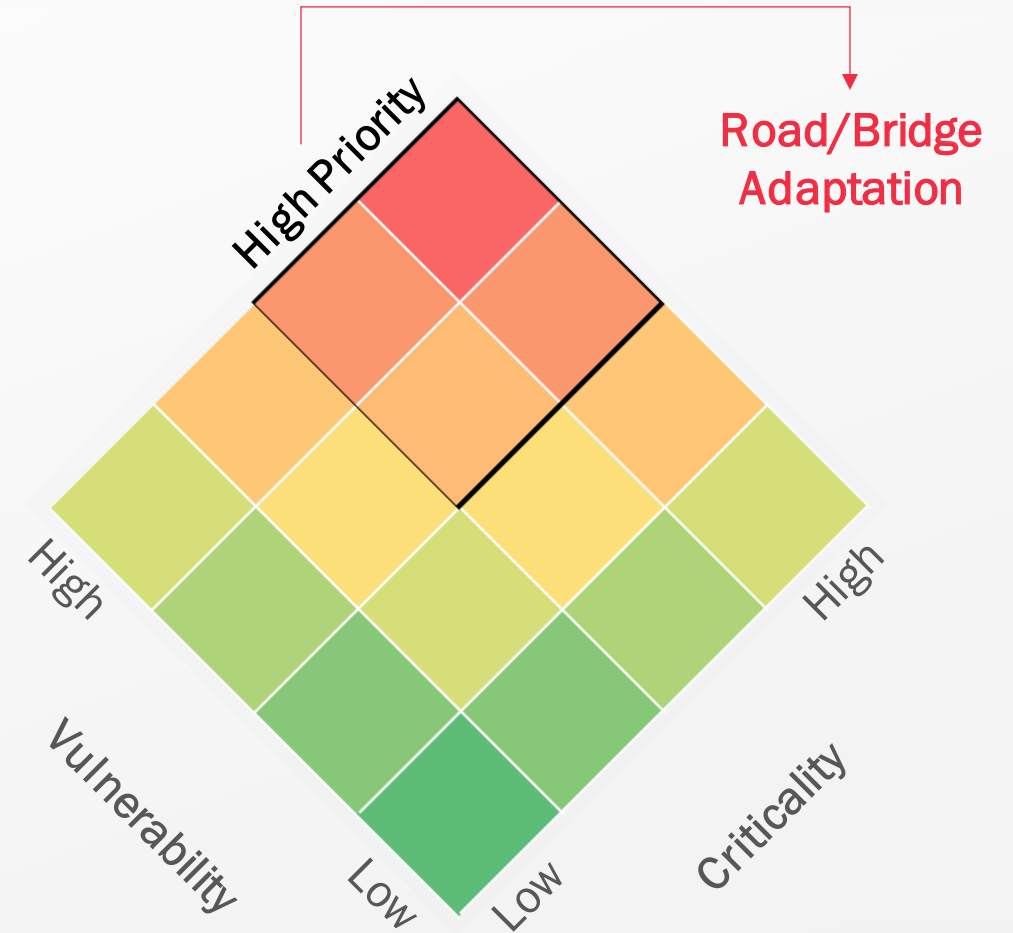


# Cape Cod Low Lying Roads Criticality Scoring Framework

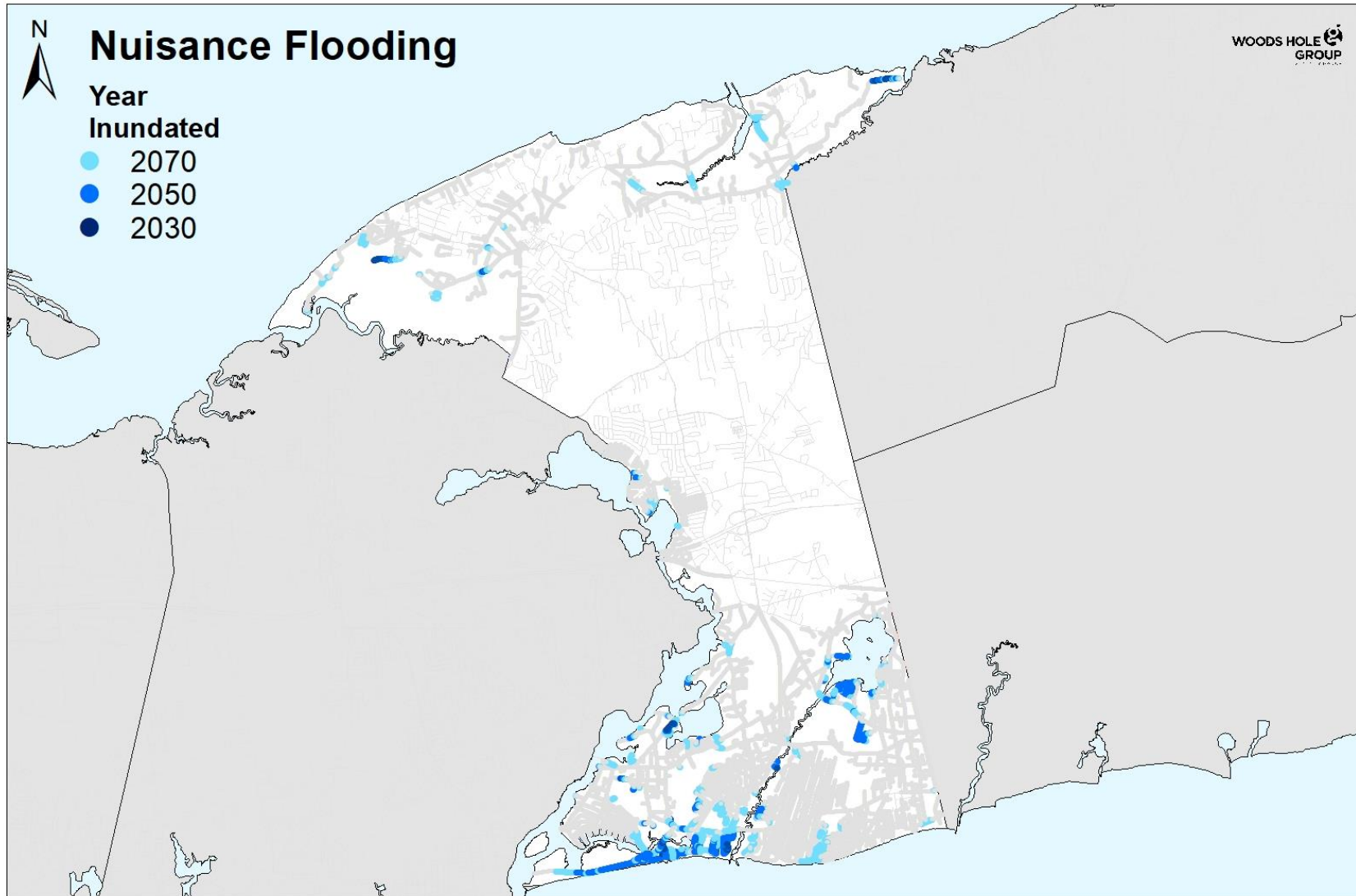


# Cape Cod Low Lying Roads Risk Assessment Approach

1. Extract roadway/bridge critical elevations (CEs)
  - › From LiDAR at 20m interval along surface
2. Compile 2030/2050/2070 MC-FRM water surface elevations (WSEs)
  - › 0.1%, 0.2%, 0.5%, 1%, 2%, 5%, 10%, 20%, 100%
3. Compare CEs to WSEs to determine vulnerability
  - › Highest probability WSE exceeding CE
4. Score road segment criticality
  - › Usage/Network Function
  - › Economy
  - › Vulnerable Populations
  - › Community and Emergency Services
5.  $\text{Probability} * \text{Criticality} = \text{Risk}$
6. Prioritize high-risk road segments for community consideration



# Low Lying Roads Nuisance (MHW) Flooding (Dennis)



Road Miles 2030

0.7/278.4

Road Miles 2050

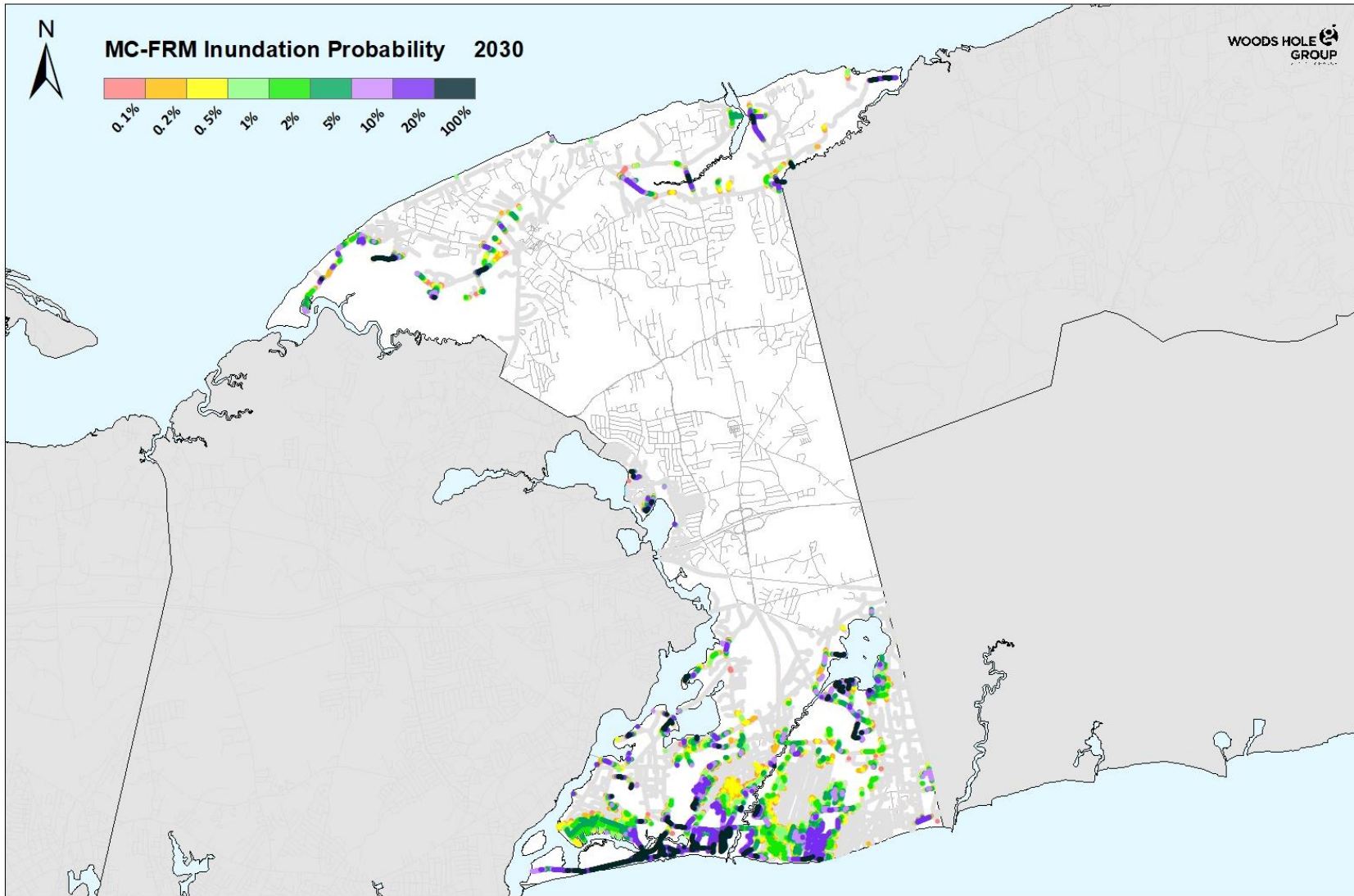
5.7/278.4

Road Miles 2070

14.3/278.4

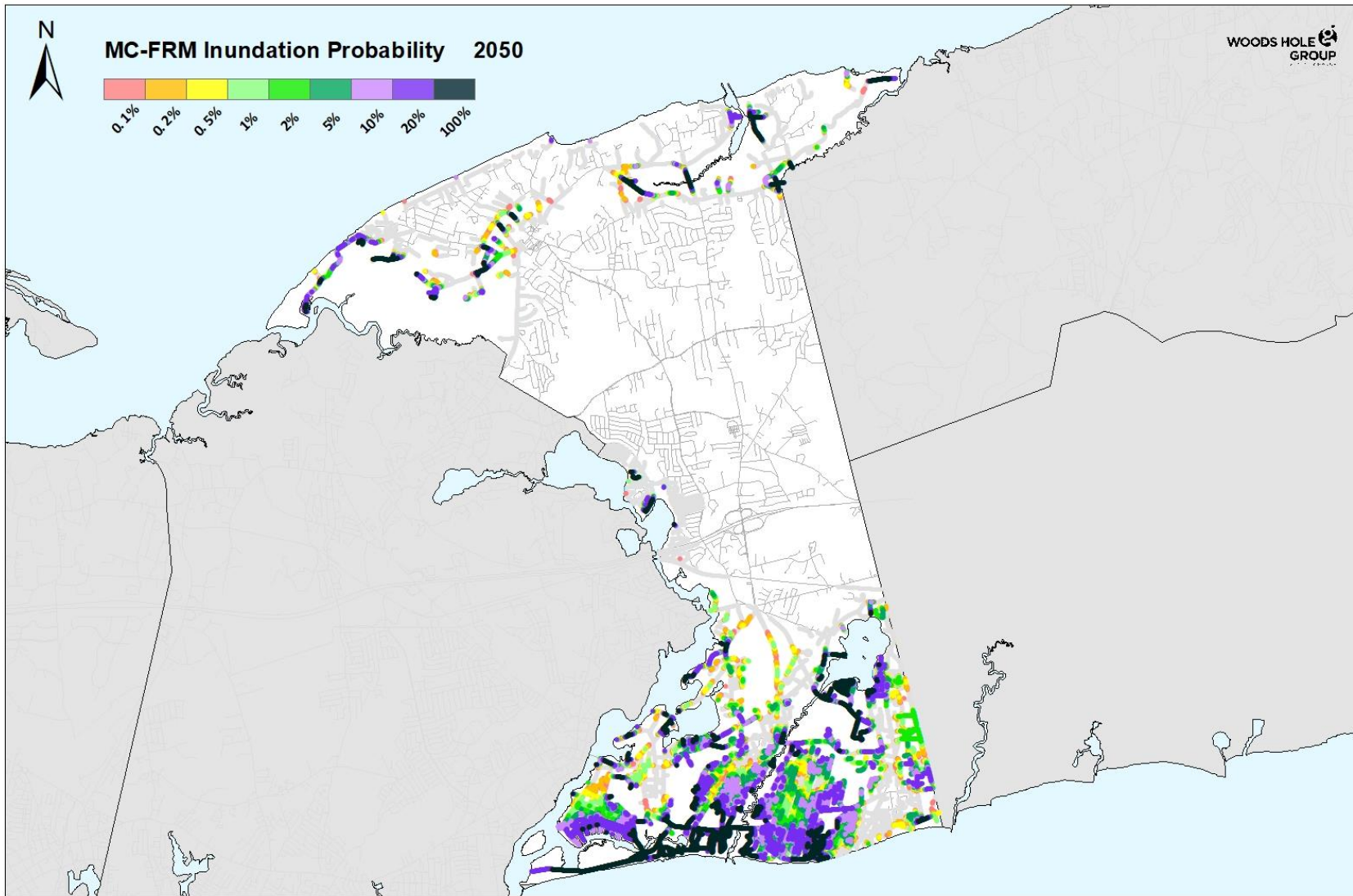


# Low Lying Roads 2030 Inundation Probability (Dennis)



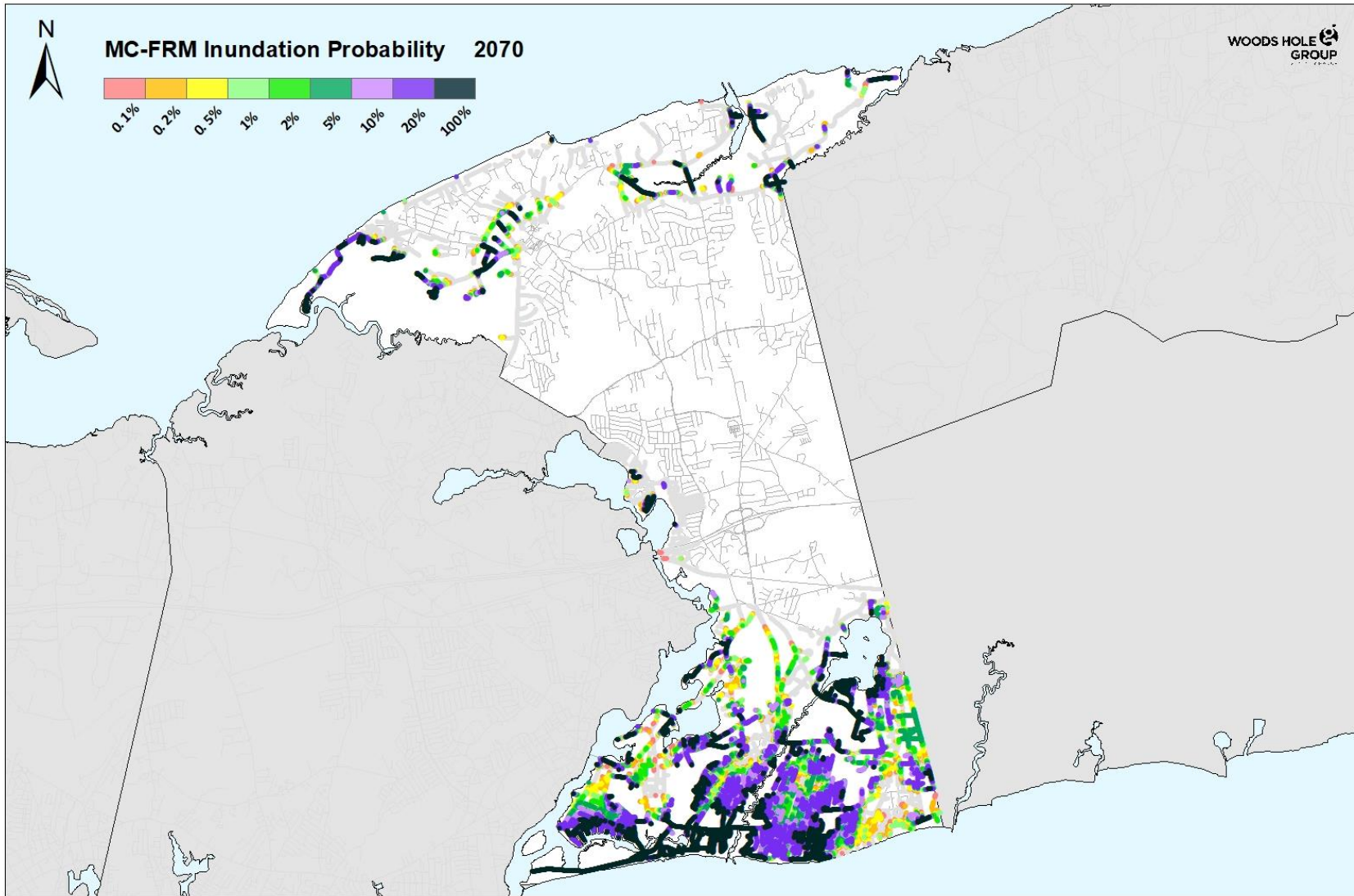
%	Road miles
0.1	48.4
0.2	46.7
0.5	42.2
1	36.7
2	31.7
5	24.4
10	18.0
20	12.9
100	5.0

# Low Lying Roads 2050 Inundation Probability (Dennis)



%	Road miles
0.1	86.9
0.2	83.4
0.5	77.0
1	70.6
2	63.2
5	54.0
10	43.0
20	32.1
100	15.0

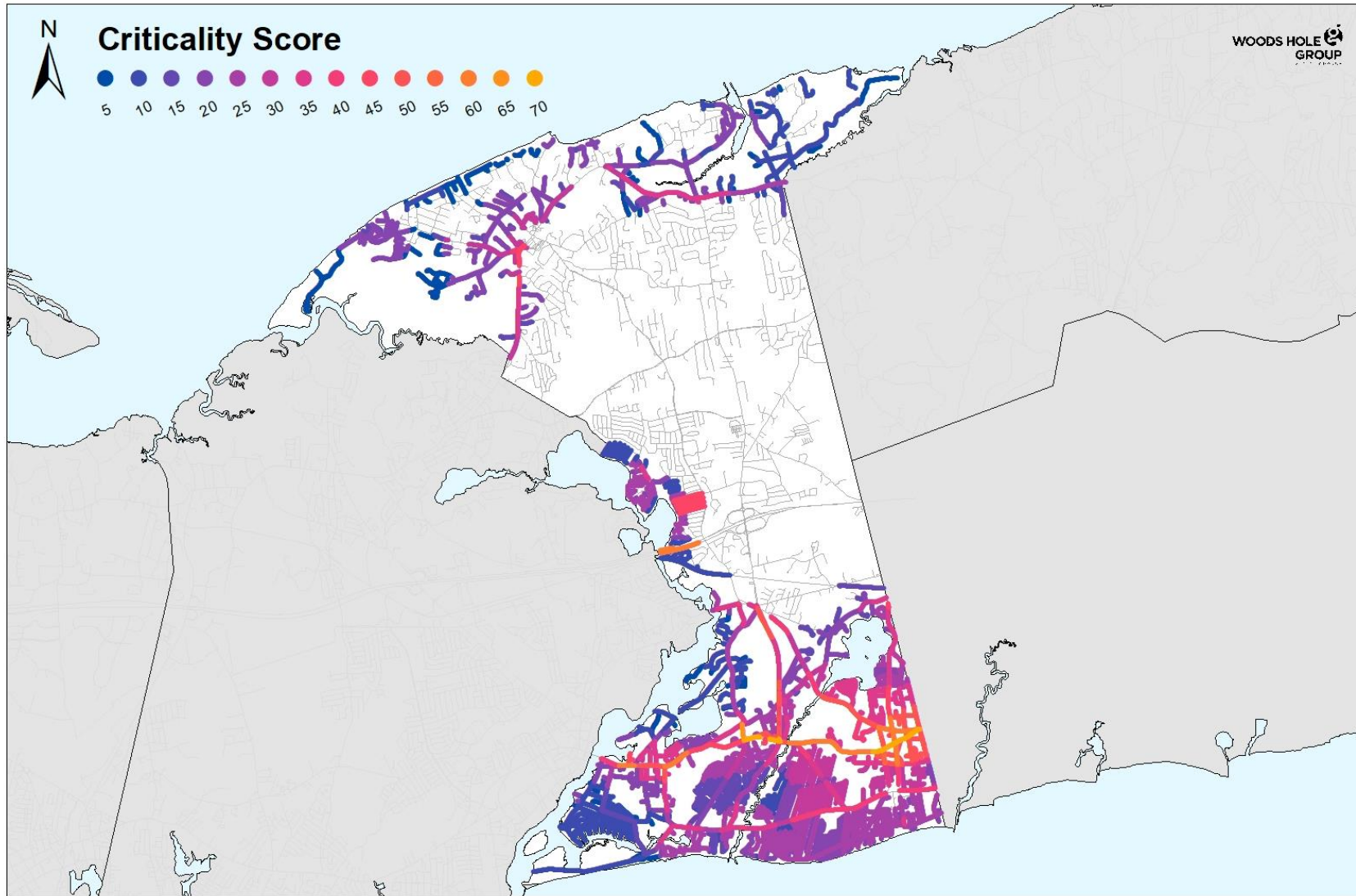
# Low Lying Roads 2070 Inundation Probability (Dennis)



%	Road miles
0.1	99.2
0.2	95.9
0.5	89.4
1	82.9
2	76.4
5	64.6
10	57.3
20	46.9
100	25.0

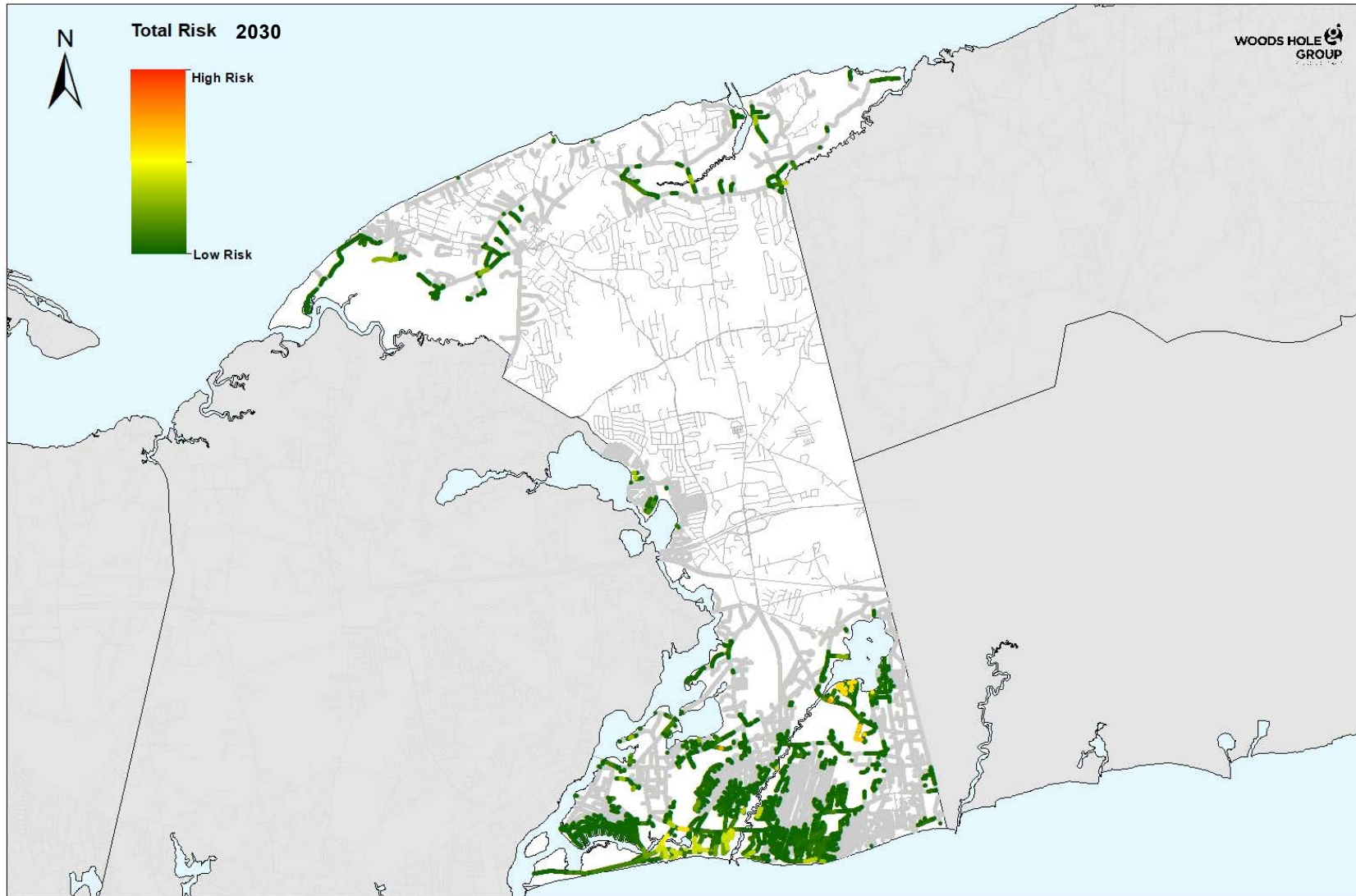


# Low Lying Roads Criticality Scoring (Dennis)





# Low Lying Roads 2030 Risk Results (Dennis)



## High Risk Road Segments

Route 28 (Weir Creek)\*

Indian Trail

Lower County Rd (Weir Creek)

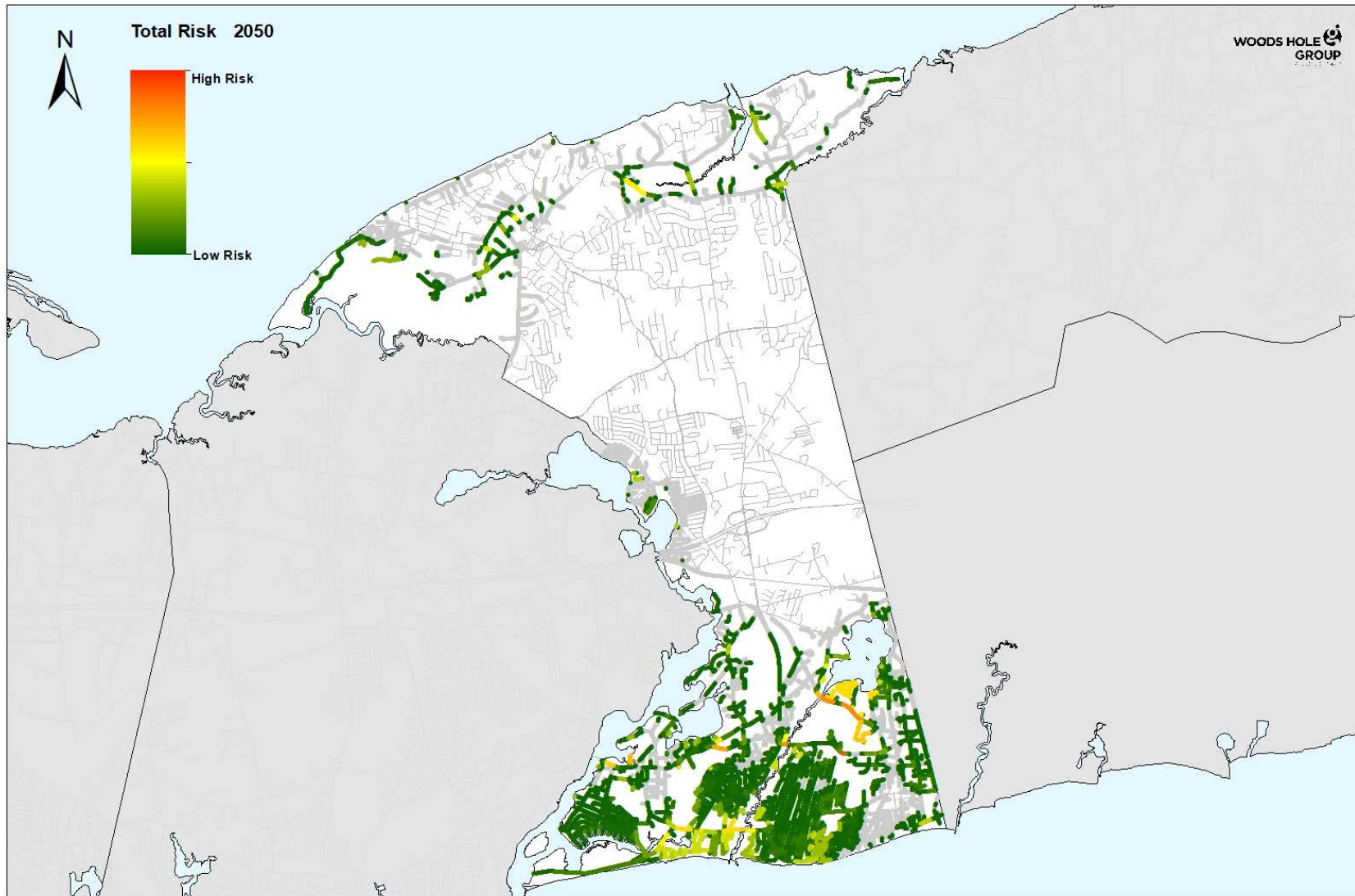
Lighthouse Rd

Uncle Stephens Rd

Trotting Park Rd

Route 6A (Quivett Creek)\*

# Low Lying Roads 2050 Risk Results (Dennis)



## High Risk Road Segments

Route 28 (Weir Creek)\*

Indian Trail

Lower County Rd (Weir Creek)

Lighthouse Rd

Uncle Stephens Rd

Trotting Park Rd

Route 6A (Quivett Creek)\*

Old Wharf Rd

Upper County Rd

Lower County Rd (Swan Pond River)

Route 28 (Swan Pond River)\*

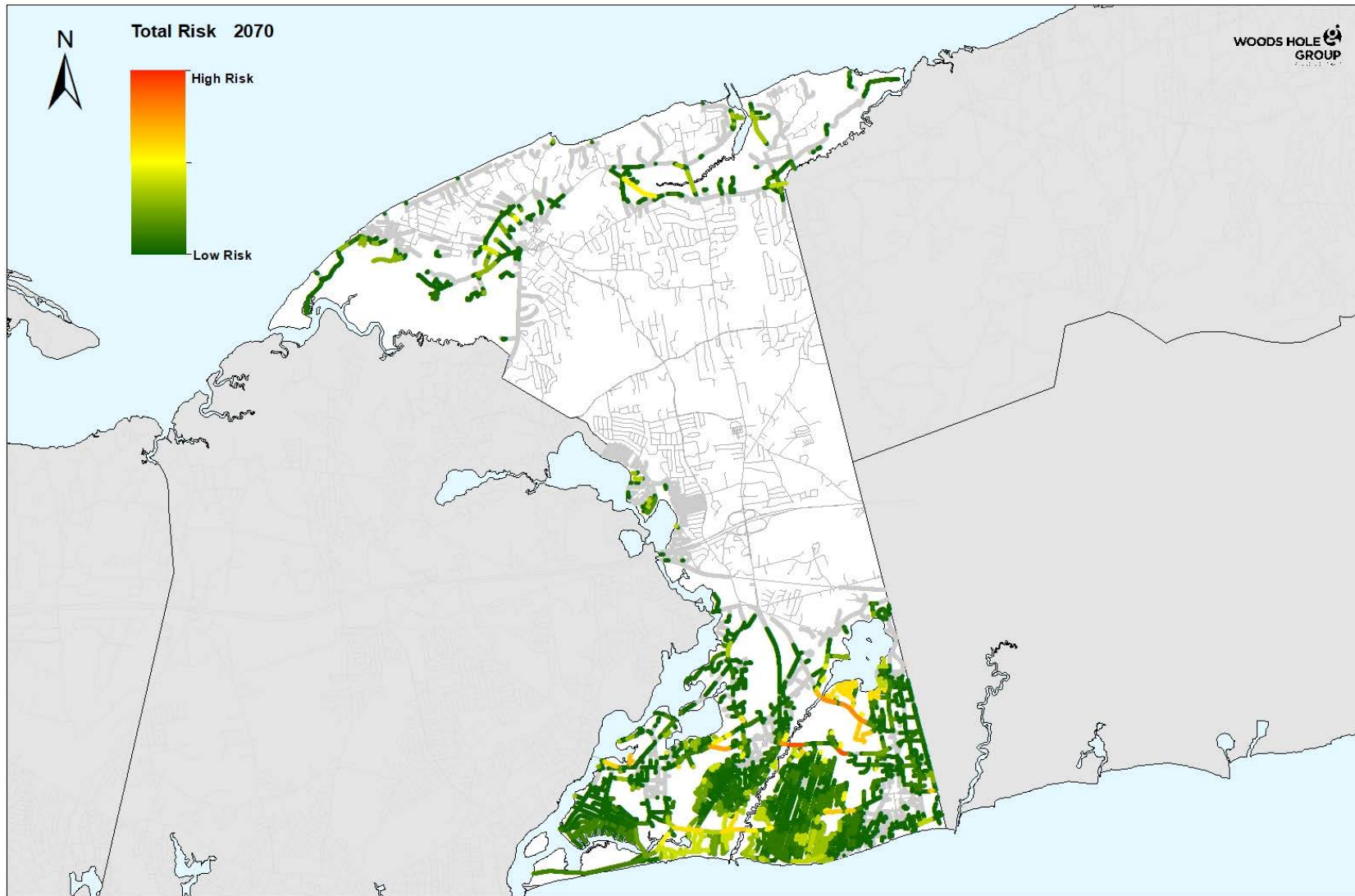
Route 28 (West of Center St)\*

Cold Storage Rd and Salt Works Rd

Bridge St

New Boston Rd

# Low Lying Roads 2070 Risk Results (Dennis)



## High Risk Road Segments

Route 28 (Weir Creek)\*

Indian Trail

Lower County Rd (Weir Creek)

Lighthouse Rd

Uncle Stephens Rd

Trotting Park Rd

Route 6A (Quivett Creek)\*

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Old Wharf Rd

Upper County Rd

Lower County Rd (Swan Pond River)

Route 28 (Swan Pond River)\*

Route 28 (West of Center St)\*

Cold Storage Rd and Salt Works Rd

Bridge St

New Boston Rd

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Doctor Bottero Rd

Shad Hole / Lower County Rd

Route 28 (Bass River)\*

# Summary of High Priority Road Segments (Dennis)

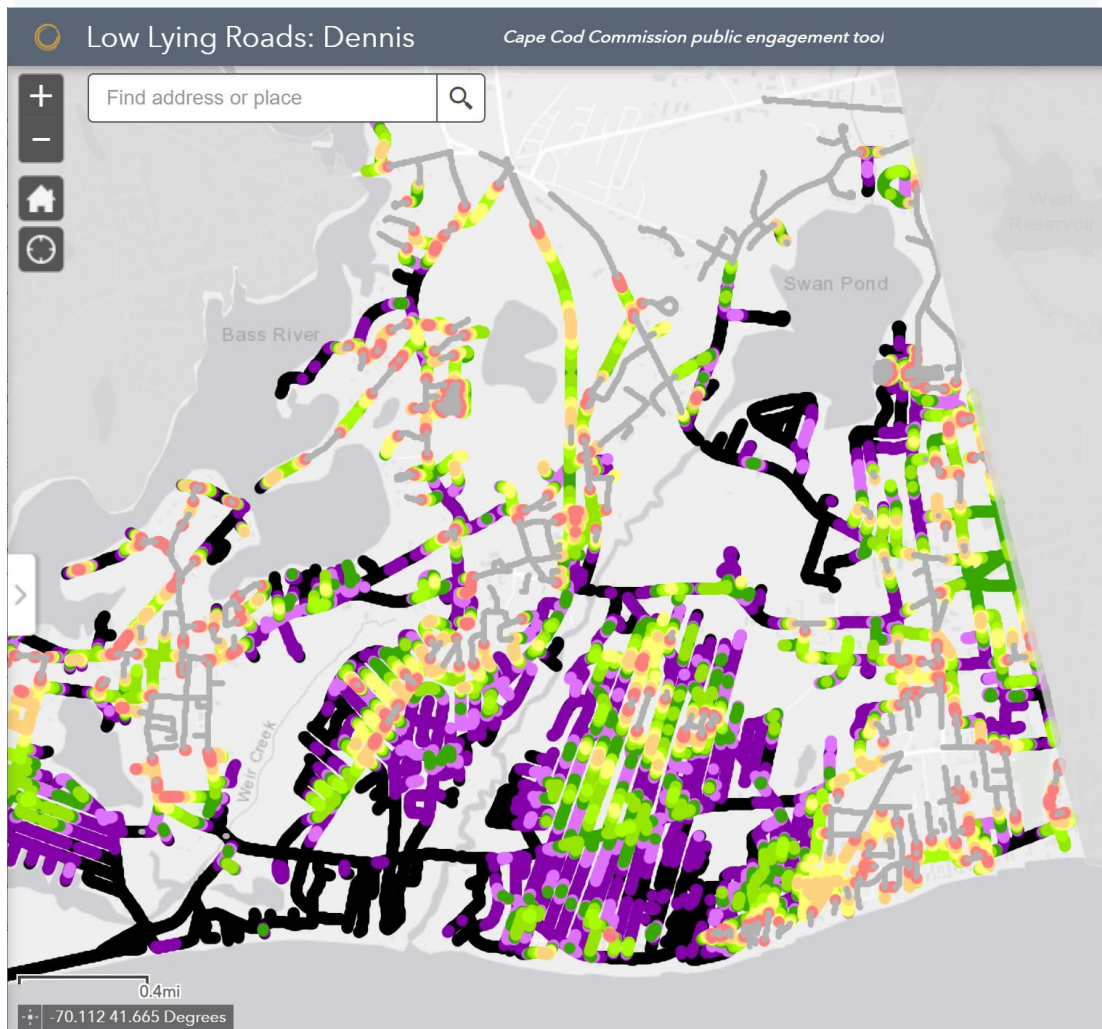
	Name	Length (ft)	Description	Segment Storm Probability (%)			Nuisance Length (ft)		
				2030	2050	2070	2030	2050	2070
A	*Route 28 (Weir Creek)	1220	Main St at Weir Creek & Old Main St	0.5-100	10-100	20-100			280
B	Indian Trail	1500	Residential area off Upper County Rd	100	100	100		1400	1500
C	Lower County Rd (Weir Creek)	1240	Near Uncle Stephens Pond and Weir Creek	10-100	20-100	100		260	940
D	Lighthouse Rd	1460	At Uncle Stephens Pond	2-100	20-100	100	200	780	1420
E	Uncle Stephens Rd	920	Some segments may be private	20-100	20-100	100		360	820
F	Trotting Park Rd	1260	South of Lower County Rd	10-100	20-100	100		620	1040
G	*Route 6A (Quivett Creek)	960	Route 6A at Quivett Creek	0.2-100	2-100	20-100	40	40	540
H	Old Wharf Rd	1700	Adjacent to Nantucket Sound shoreline	1-100	10-100	20-100			1100
I	Upper County Rd	3020	Including bridge at Swan Pond	0.1-100	2-100	5-100		400	1700
J	Lower County Rd (Swan Pond River)	1060	Including bridge at Swan Pond River	2-20	20-100	100			260
K	*Route 28 (Swan Pond River)	1100	Main St and bridge at Swan Pond River	0.5-5	10-100	100			
L	*Route 28 (West of Center St)	780	Main St West of Center St	0.2-100	5-100	20-100			
M	Cold Storage Rd and Salt Works Rd	2680	East side of Sesuit Harbor	0.1-100	2-100	20-100		20	1980
N	Bridge St	1180	Including bridge at Sesuit Creek	0.2-100	2-100	20-100			640
O	New Boston Rd	1520	Residential area at Chase Garden Creek	0.2-100	2-100	20-100	80	260	740
P	Doctor Bottero Rd	1100	Access to Chapin Memorial Beach	0.1-10	1-20	5-100			
Q	Shad Hole and Lower County Rd	2220	Intersection of Shad Hole and Lower County Rd	1-20	5-20	20-100			
R	*Route 28 (Bass River)	920	Main St at Bass river	0-20	2-100	20-100			420

\* = MassDOT roadway



## LOW LYING ROADS

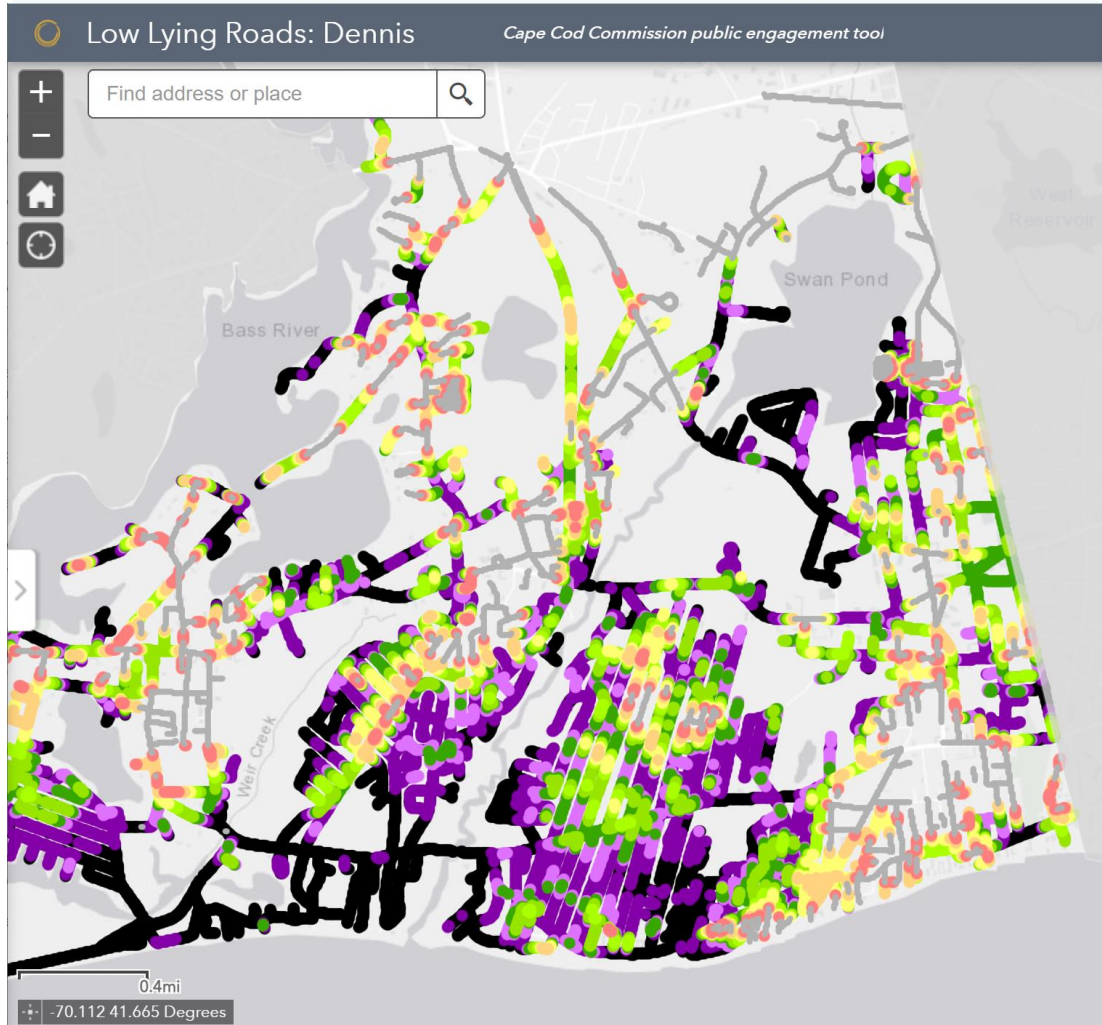
# Group Discussion



**DISCUSSION  
ORIENTATION**

## LOW LYING ROADS

# Group Discussion



## DISCUSSION QUESTIONS

1. Are there roads that we missed?
2. How would you prioritize these roads – what local knowledge or concerns can you bring to the discussion?
3. What are the high-priority road segments?

# Summary of High Priority Road Segments (Dennis)

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\* = MassDOT roadway



# NEXT STEPS

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- Town staff to select 2 road segments
- Feasibility analysis
- 3 solutions + costs per segment
- Solutions available to view on Low Lying Road webpage late spring 2022: <https://www.capecodcommission.org/our-work/low-lying-roads-project/>

**THANK YOU!**

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