



Low-lying Roads: Sandwich

Project funded by the
Economic Development
Administration

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Woods Hole Group: Joe Famely

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

- Project Overview
- Vulnerability and Risk Assessment
- Results of Low-Lying Roads Screening
- Town Resiliency Initiatives
- Discussion
- 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

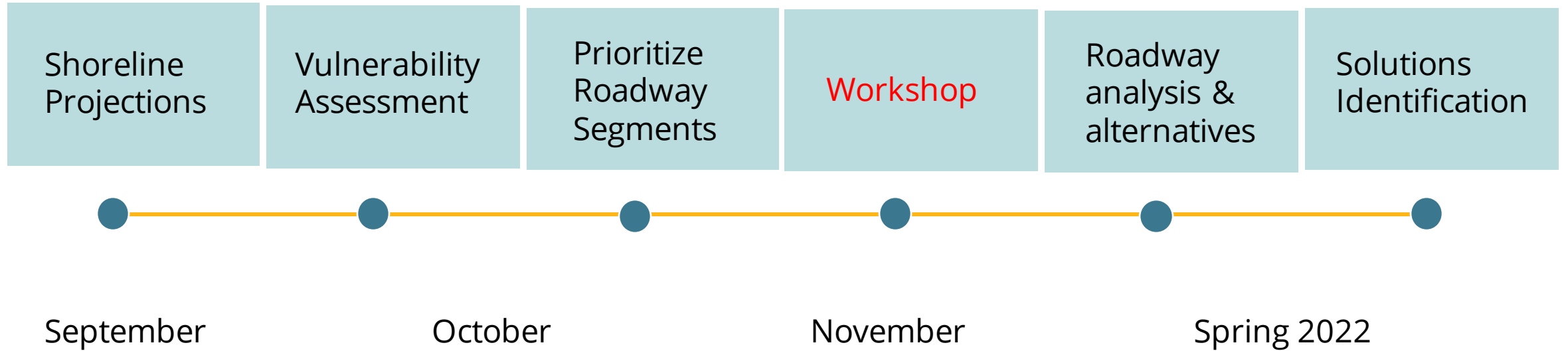


Adaptation Strategies



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

PROJECT TIMELINE



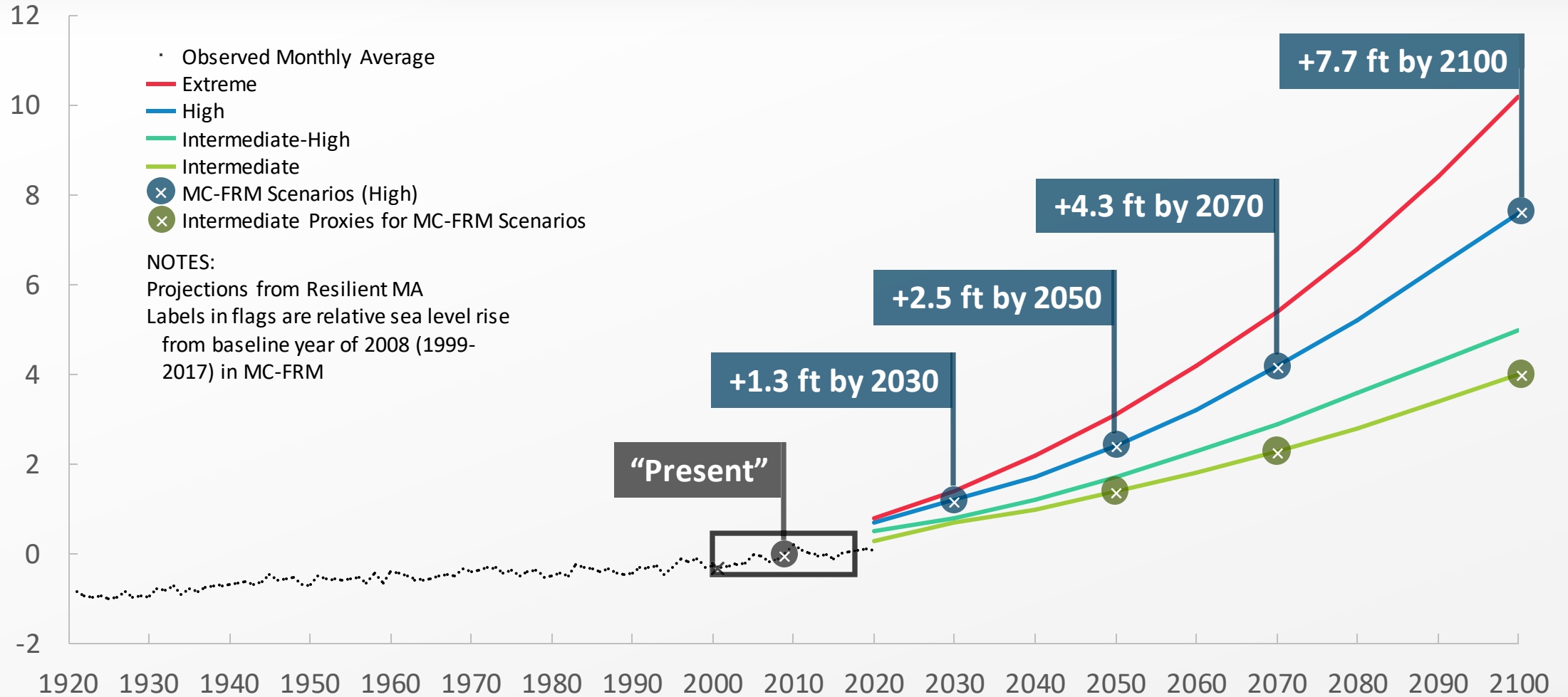
Questions?

- 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

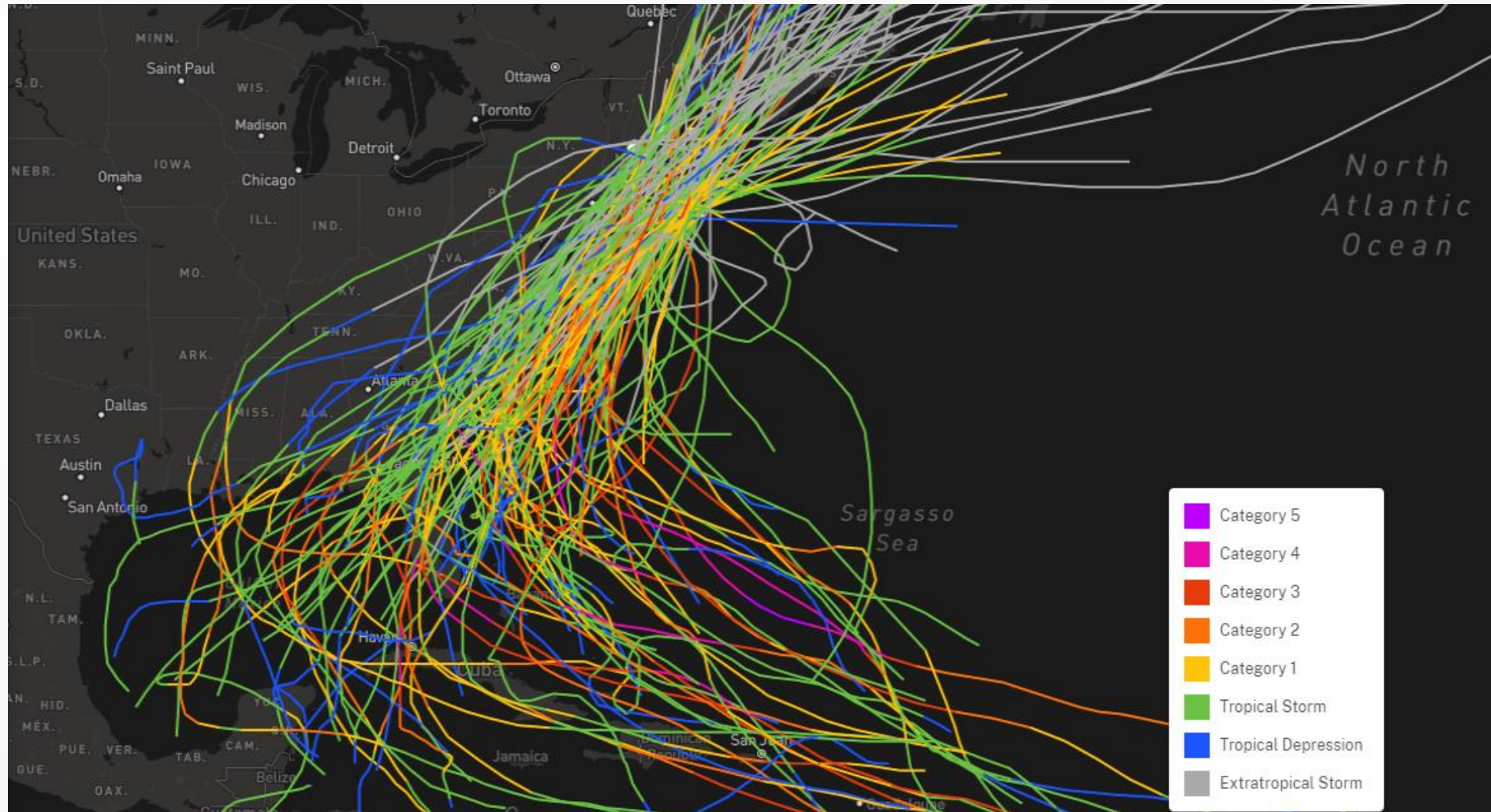
MA EOEEA Probabilistic Sea Level Rise Projections

MC-FRM NORTH (DeConto & Kopp, 2017)

Relative Mean Sea Level (feet NAVD88)



Tropical / Extra-tropical Storms



NOAA National Ocean Service

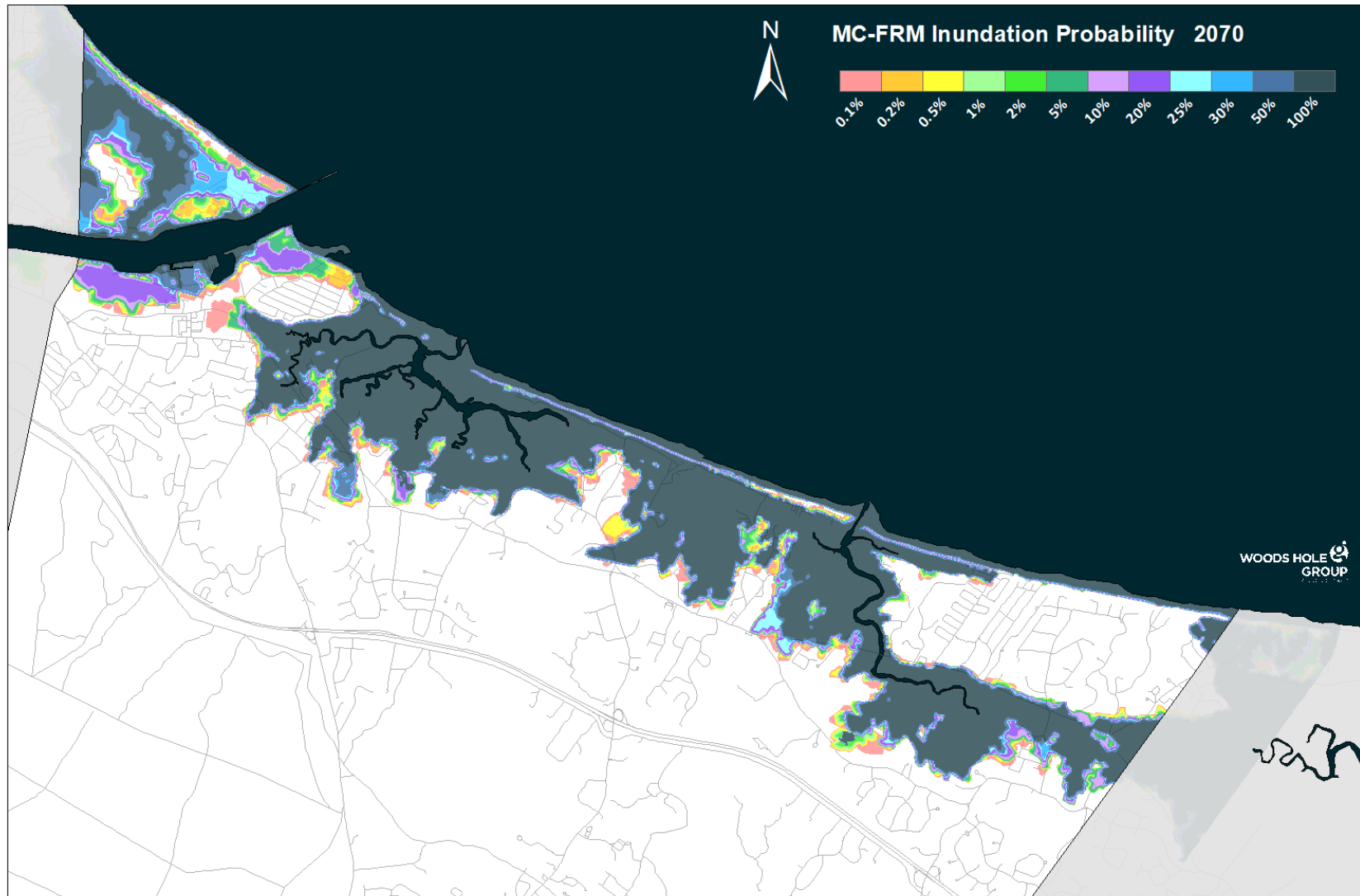
Massachusetts Coast Flood Risk Model (MC-FRM)



MC-FRM Resolution - Sandwich



MC-FRM Coastal Flood Exceedance Probability – Sandwich



Massachusetts Coast Flood Risk Model

SUMMARY

Hydrodynamically modeled projections

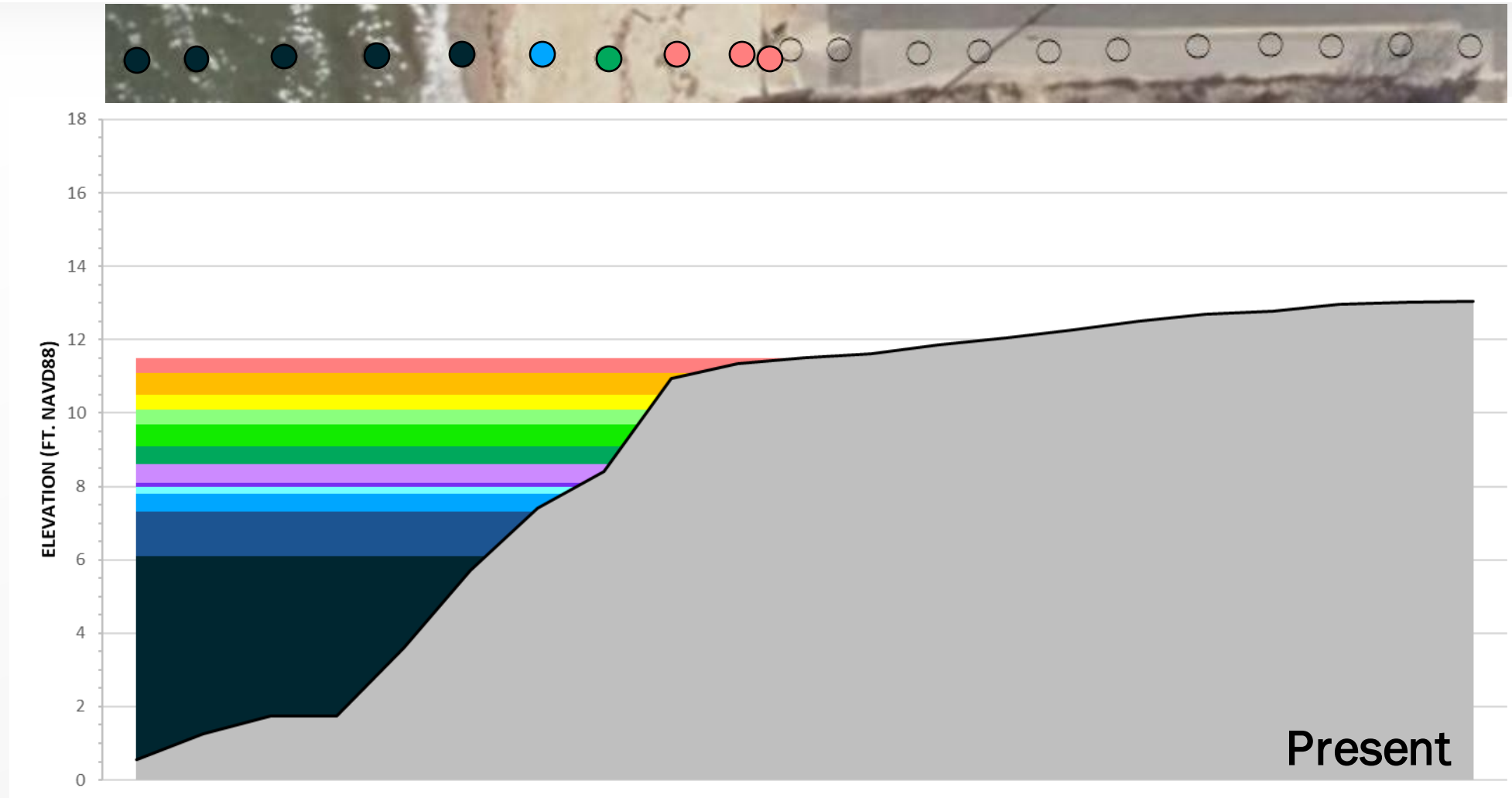
Sea level rise and storm surge – combined

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

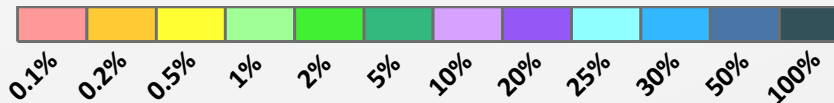
QUESTIONS?



Cape Cod Low Lying Roads Vulnerability Assessment Methods



COASTAL FLOOD EXCEEDANCE PROBABILITY

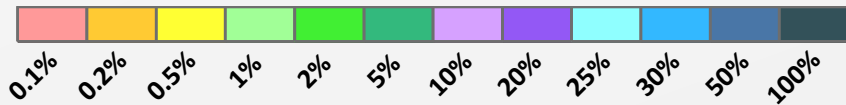


Cape Cod Low Lying Roads Vulnerability Assessment Methods



2030

COASTAL FLOOD EXCEEDANCE PROBABILITY

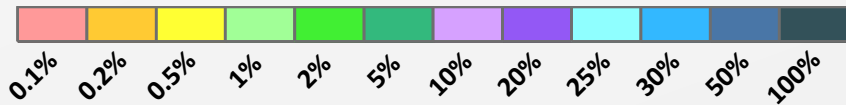


Cape Cod Low Lying Roads Vulnerability Assessment Methods



2050

COASTAL FLOOD EXCEEDANCE PROBABILITY

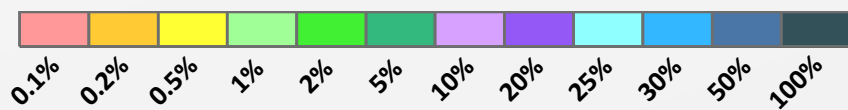


Cape Cod Low Lying Roads Vulnerability Assessment Methods

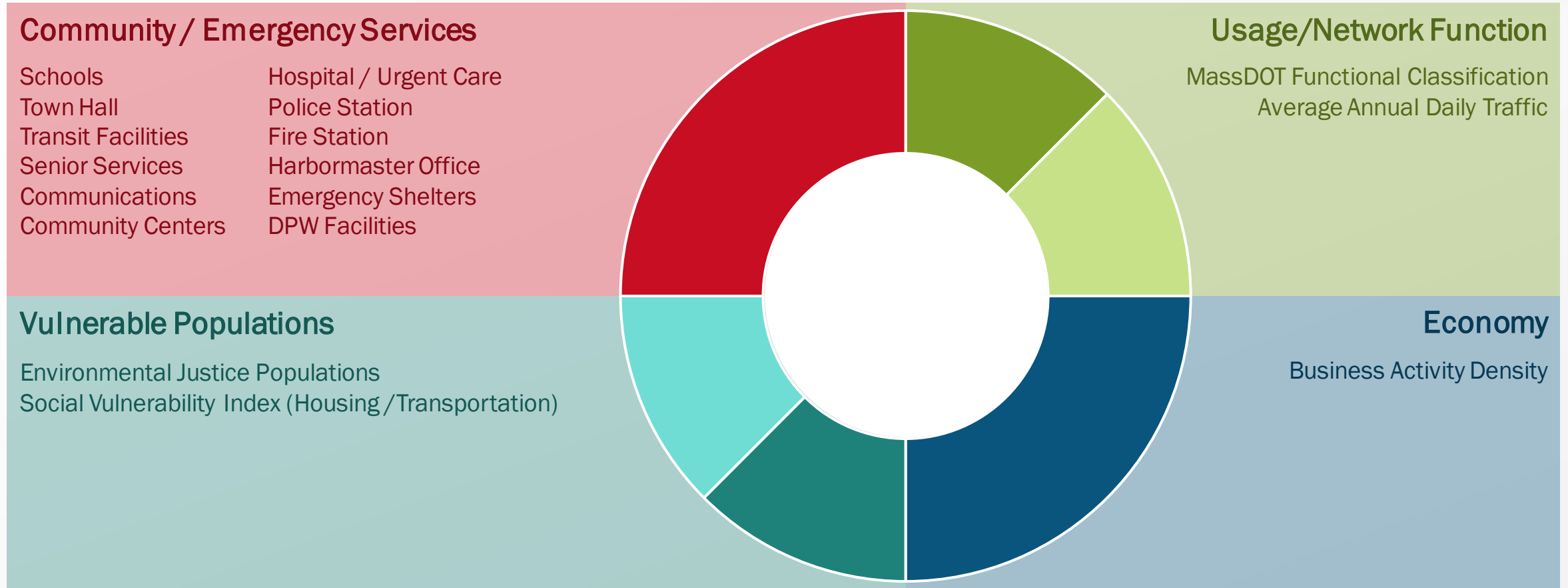


2070

COASTAL FLOOD EXCEEDANCE PROBABILITY

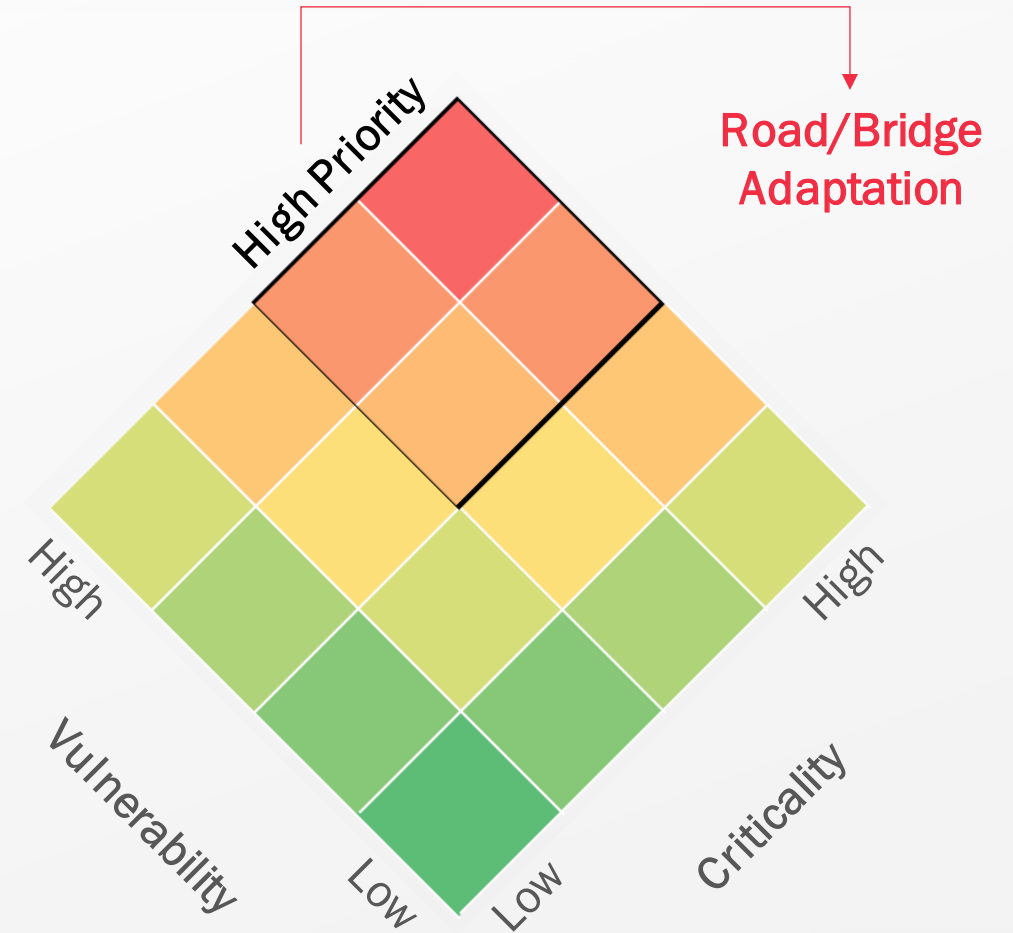


Cape Cod Low Lying Roads Criticality Scoring Framework

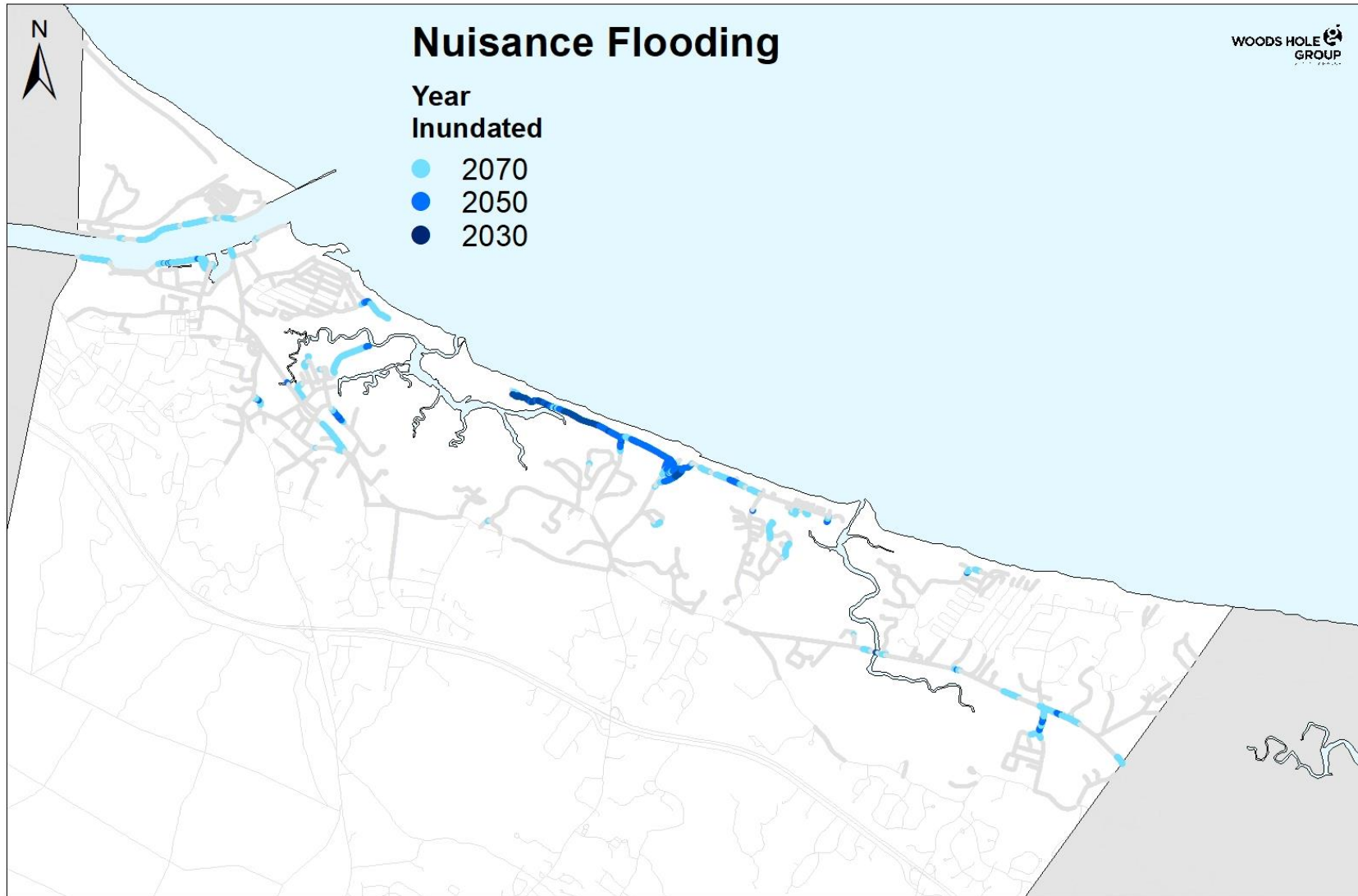


Cape Cod Low Lying Roads Risk Assessment Approach

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 (Sandwich)



Road Miles 2030

0.6/364.1

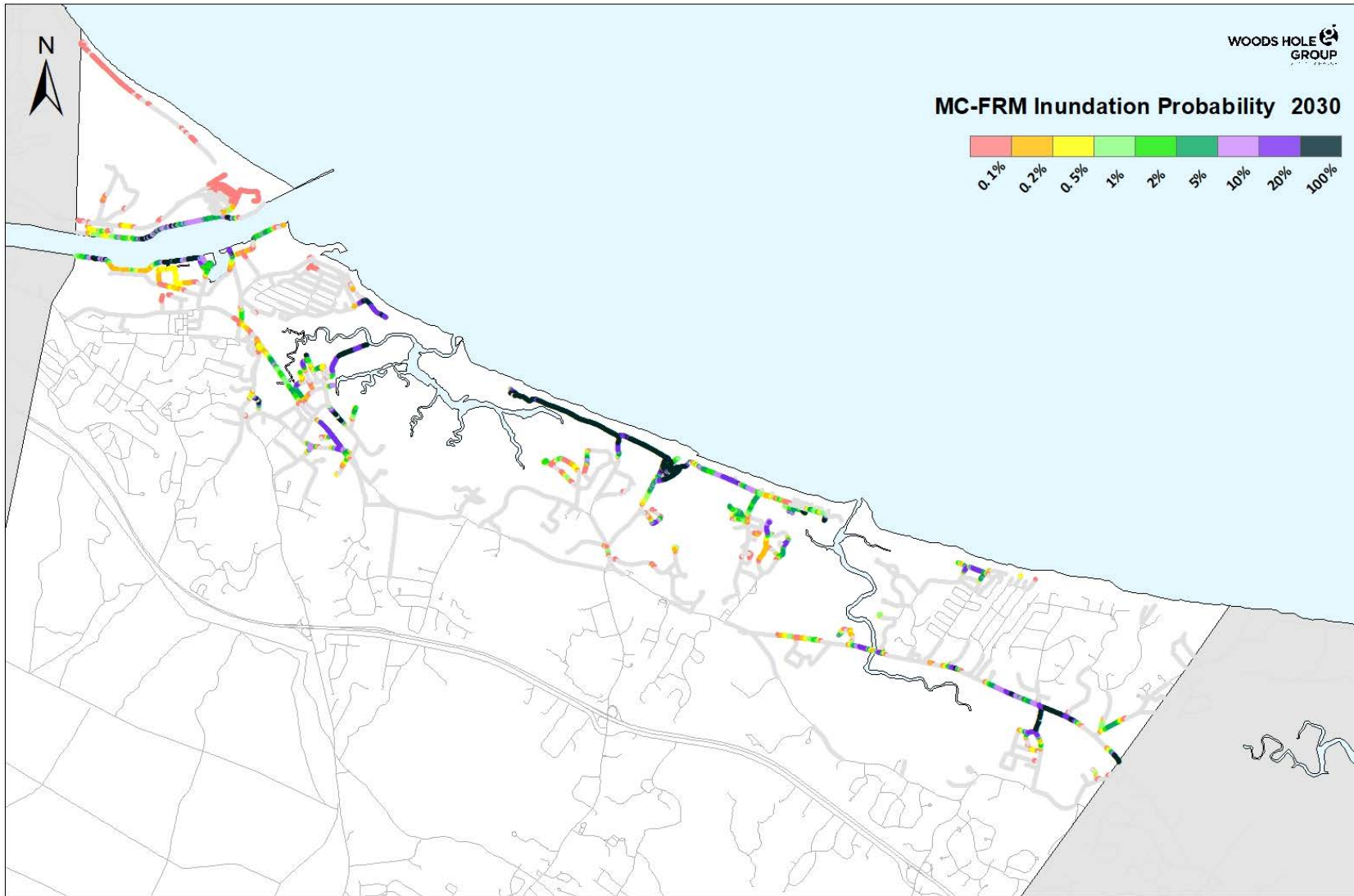
Road Miles 2050

2.1/364.1

Road Miles 2070

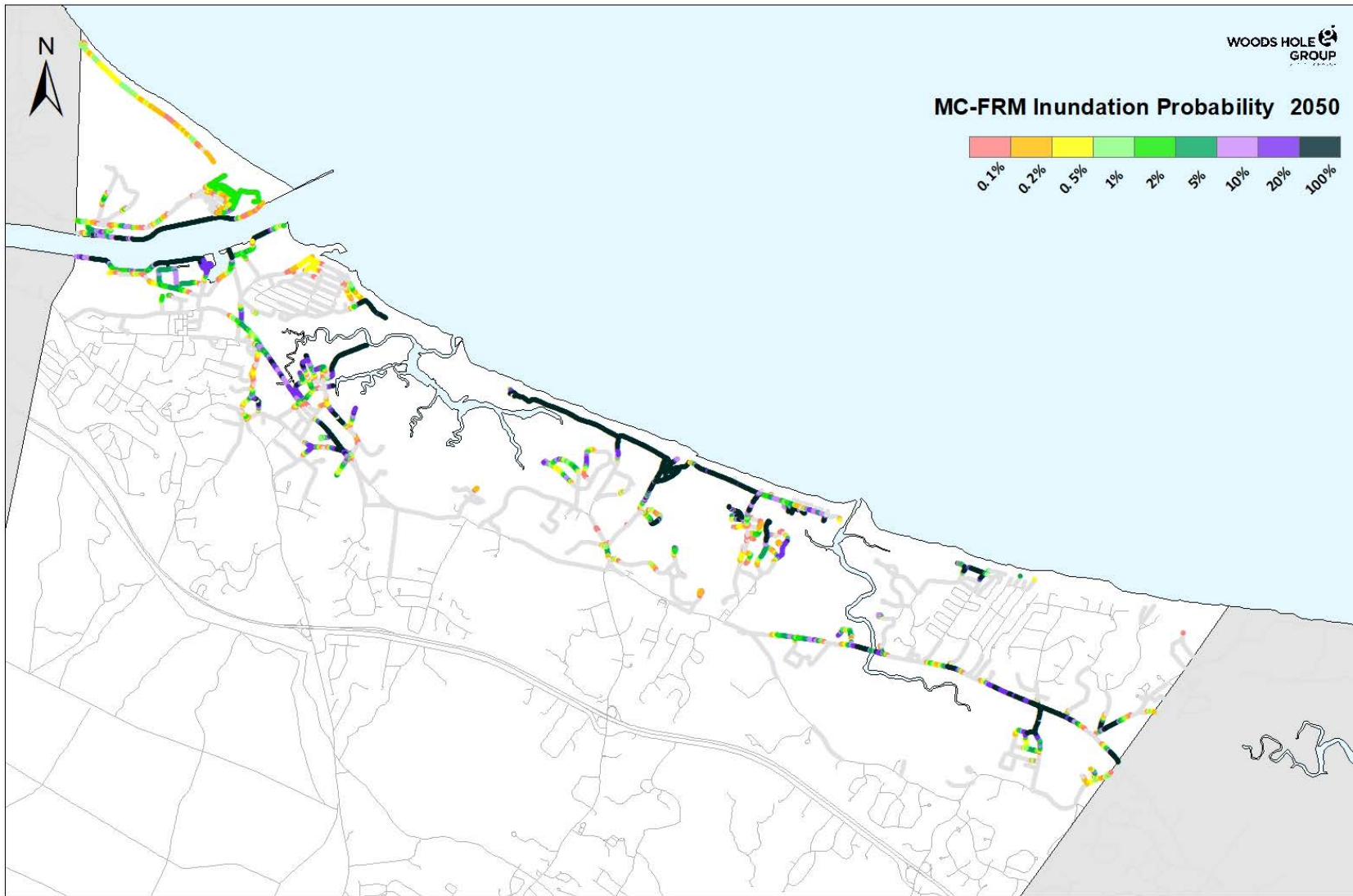
6.2/364.1

Low Lying Roads 2030 Inundation Probability (Sandwich)



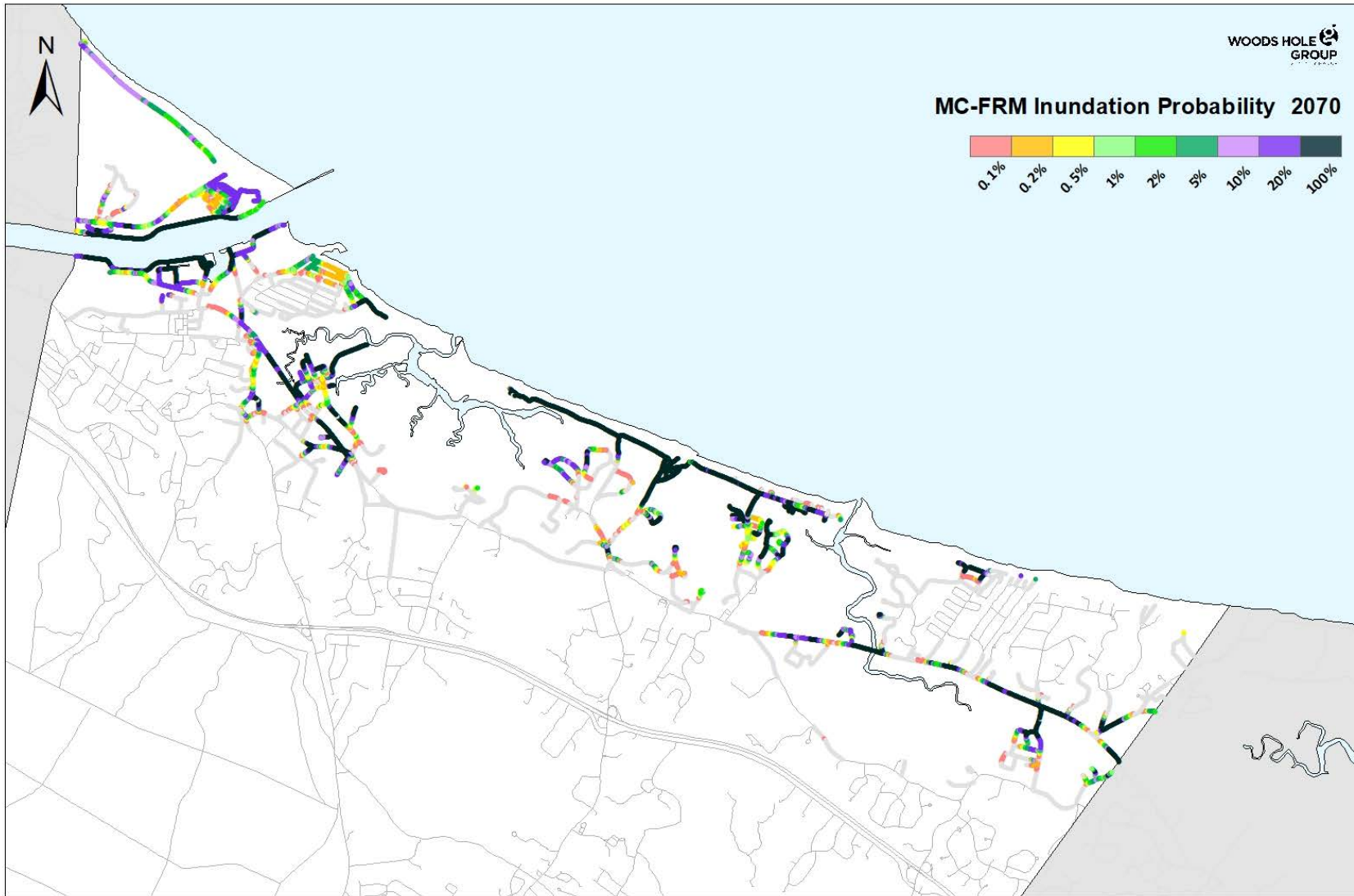
	%	Road miles
	0.1	17.6
	0.2	14.2
	0.5	12.3
	1	10.6
	2	9.2
	5	7.6
	10	6.0
	20	4.6
	100	2.9

Low Lying Roads 2050 Inundation Probability (Sandwich)



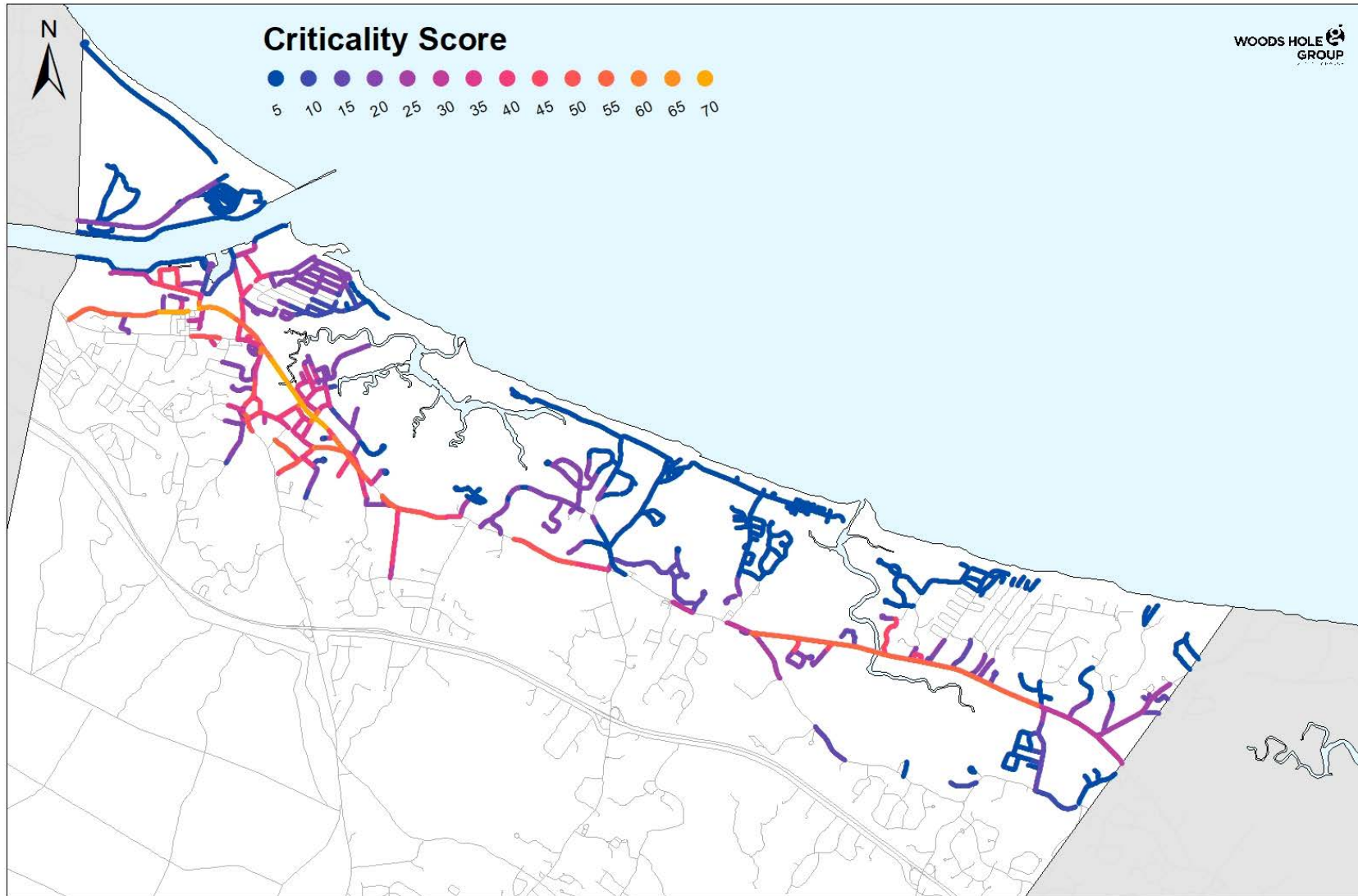
%	Road miles
0.1	24.6
0.2	22.8
0.5	20.4
1	18.1
2	16.2
5	13.2
10	11.0
20	8.9
100	7.0

Low Lying Roads 2070 Inundation Probability (Sandwich)

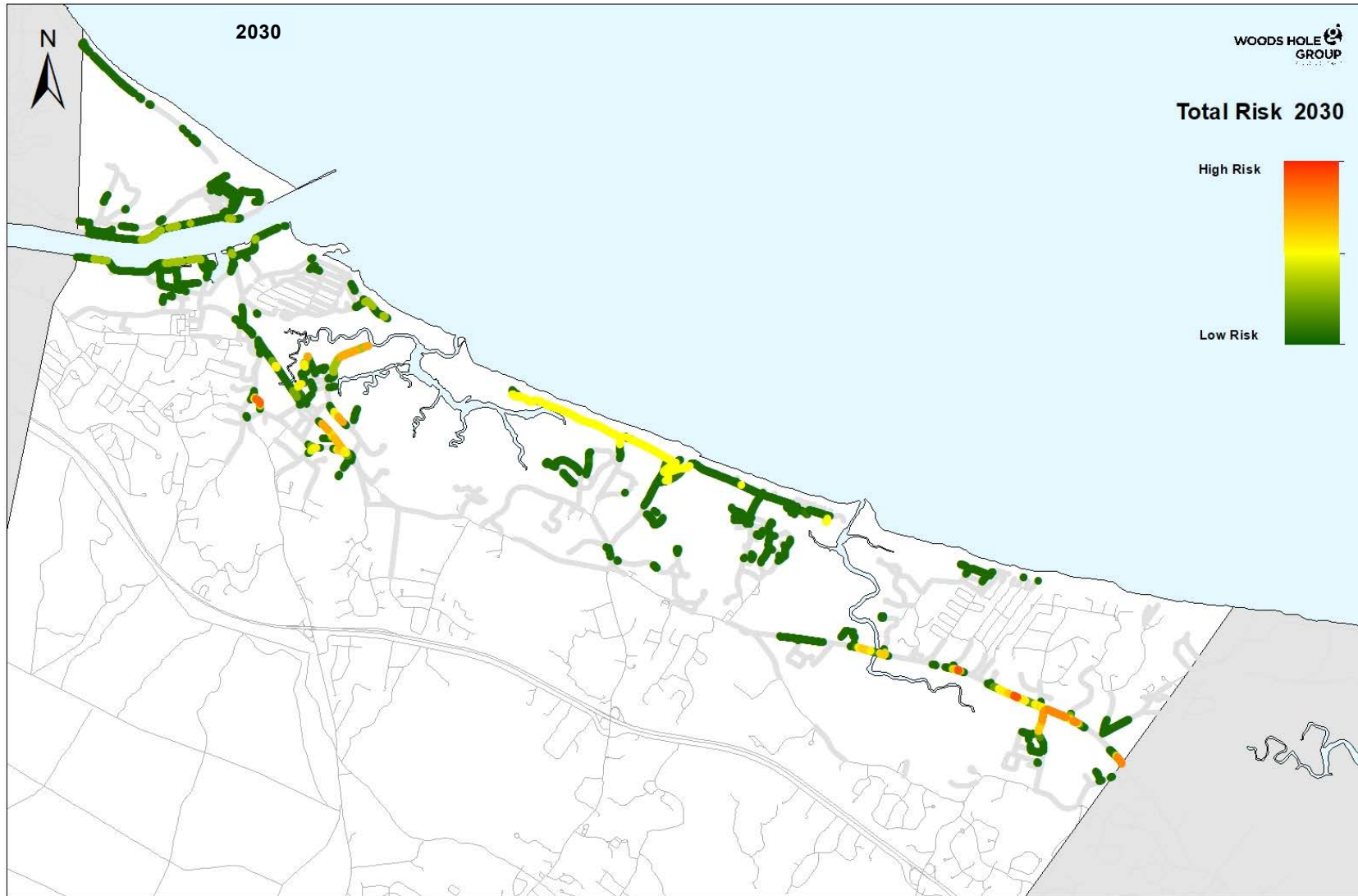


%	Road miles
0.1	31.3
0.2	28.5
0.5	26.3
1	24.7
2	23.1
5	20.8
10	18.5
20	16.1
100	11.3

Low Lying Roads Criticality Scoring (Sandwich)



Low Lying Roads 2030 Risk Results (Sandwich)



High Risk Road Segments

Route 6A (Joslin Ln)*

River St

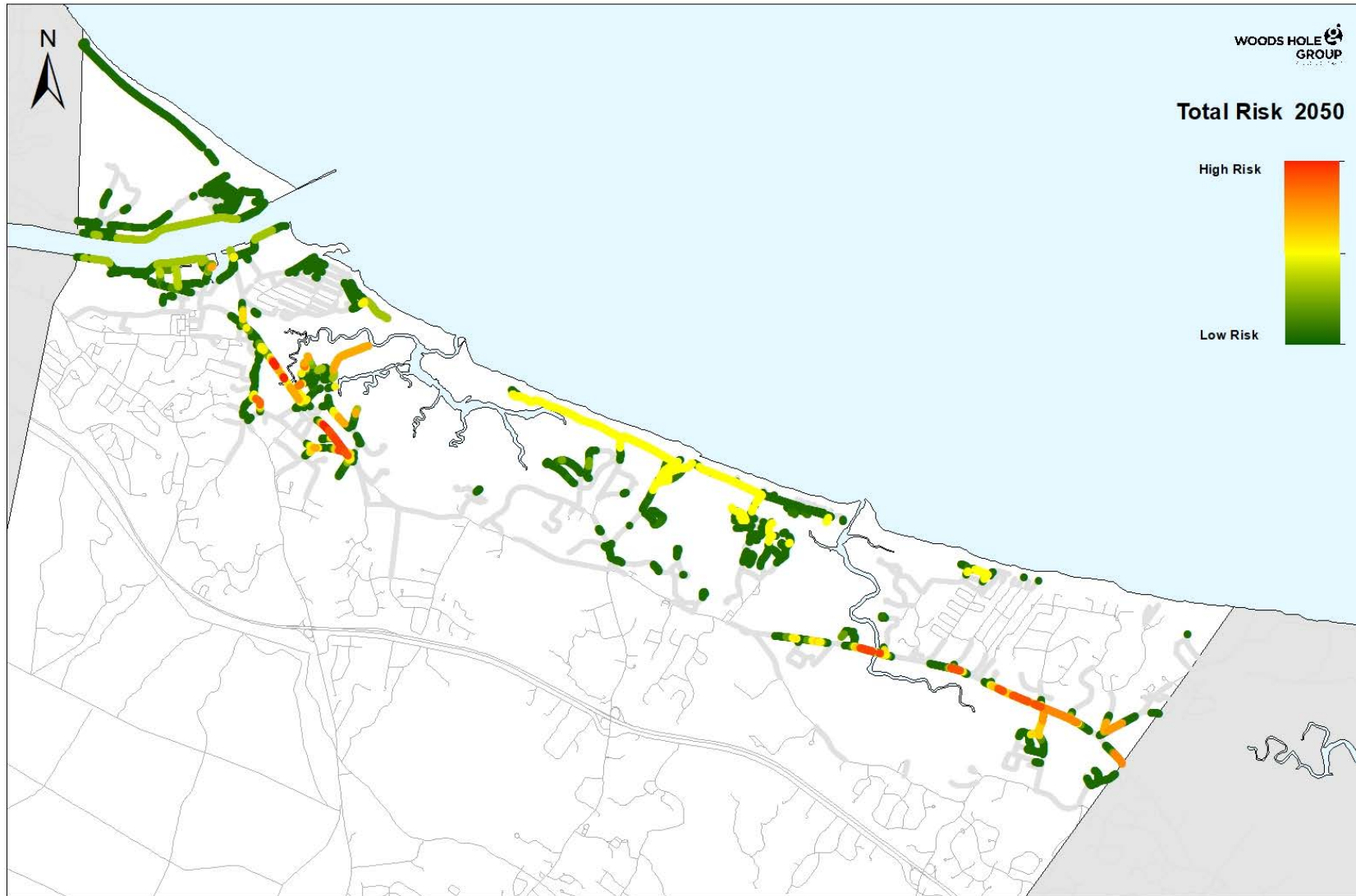
Route 6A (Howland Ln)*

Jones Ln (Scorton Creek & Route 6A)

Boardwalk Rd

Dewey Ave

Low Lying Roads 2050 Risk Results (Sandwich)



High Risk Road Segments

Route 6A (Joslin Ln)*

River St

Route 6A (Howland Ln)*

Jones Ln (Scorton Creek & Route 6A)

Boardwalk Rd

Dewey Ave

Route 6A (Old Main St intersection)*

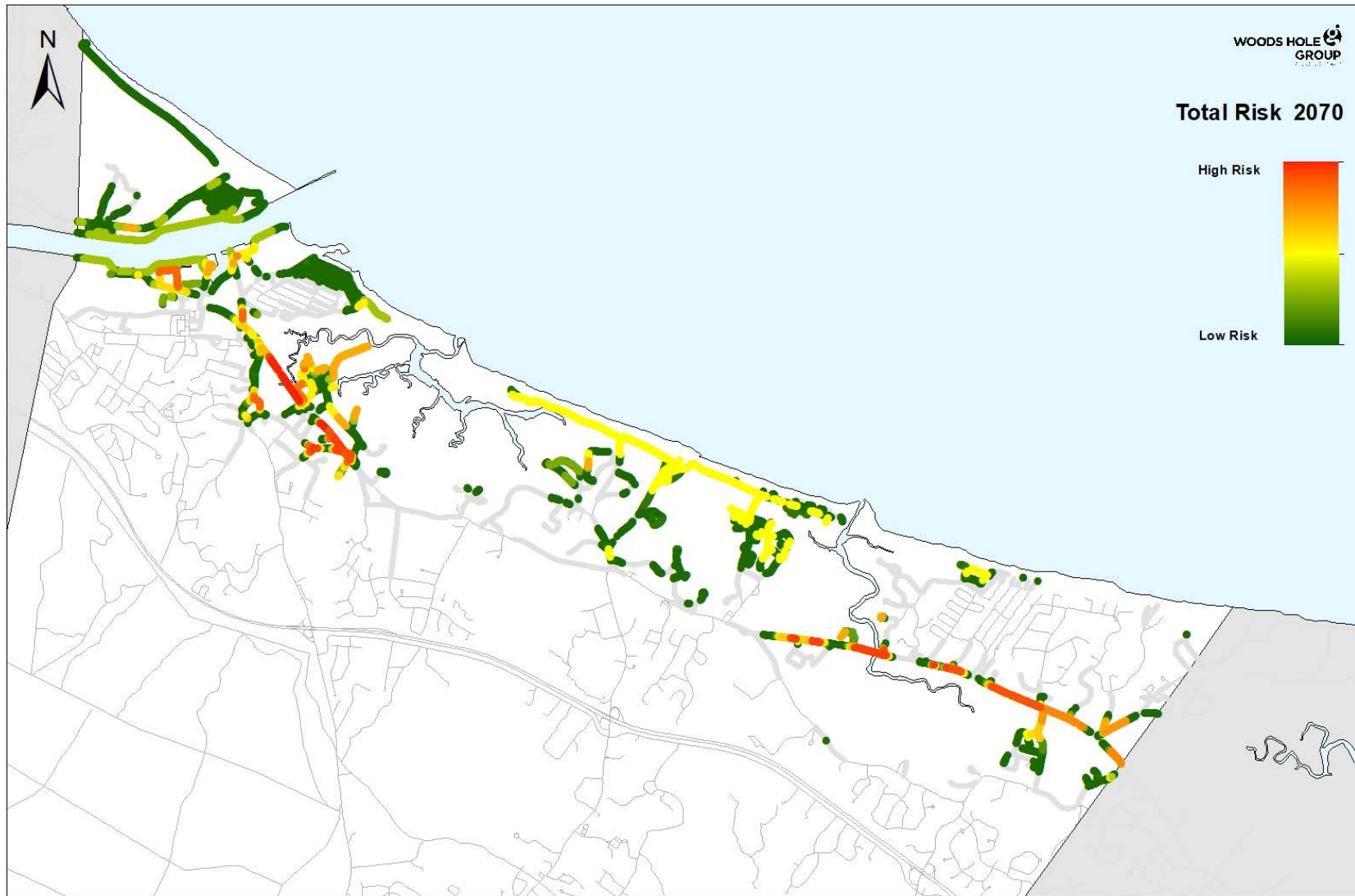
Route 6A (Scorton Creek Bridge)*

Route 6A (Mill Creek Bridge)*

Willow St and Jarves St

Sandy Neck Rd and Cranberry Trail

Low Lying Roads 2070 Risk Results (Sandwich)



High Risk Road Segments

Route 6A (Joslin Ln)*

River St

Route 6A (Howland Ln)*

Jones Ln (Scorton Creek & Route 6A)

Boardwalk Rd

Dewey Ave

Route 6A (Old Main St intersection)*

Route 6A (Scorton Creek Bridge)*

Route 6A (Mill Creek Bridge)*

Willow St and Jarves St

Sandy Neck Rd and Cranberry Trail

Beale Ave and Main St

Town Neck Rd

Scusset Beach Rd

Ploughed Neck Rd

Spring Hill Rd

Foster Rd (Old Harbor Creek)

Wood Ave

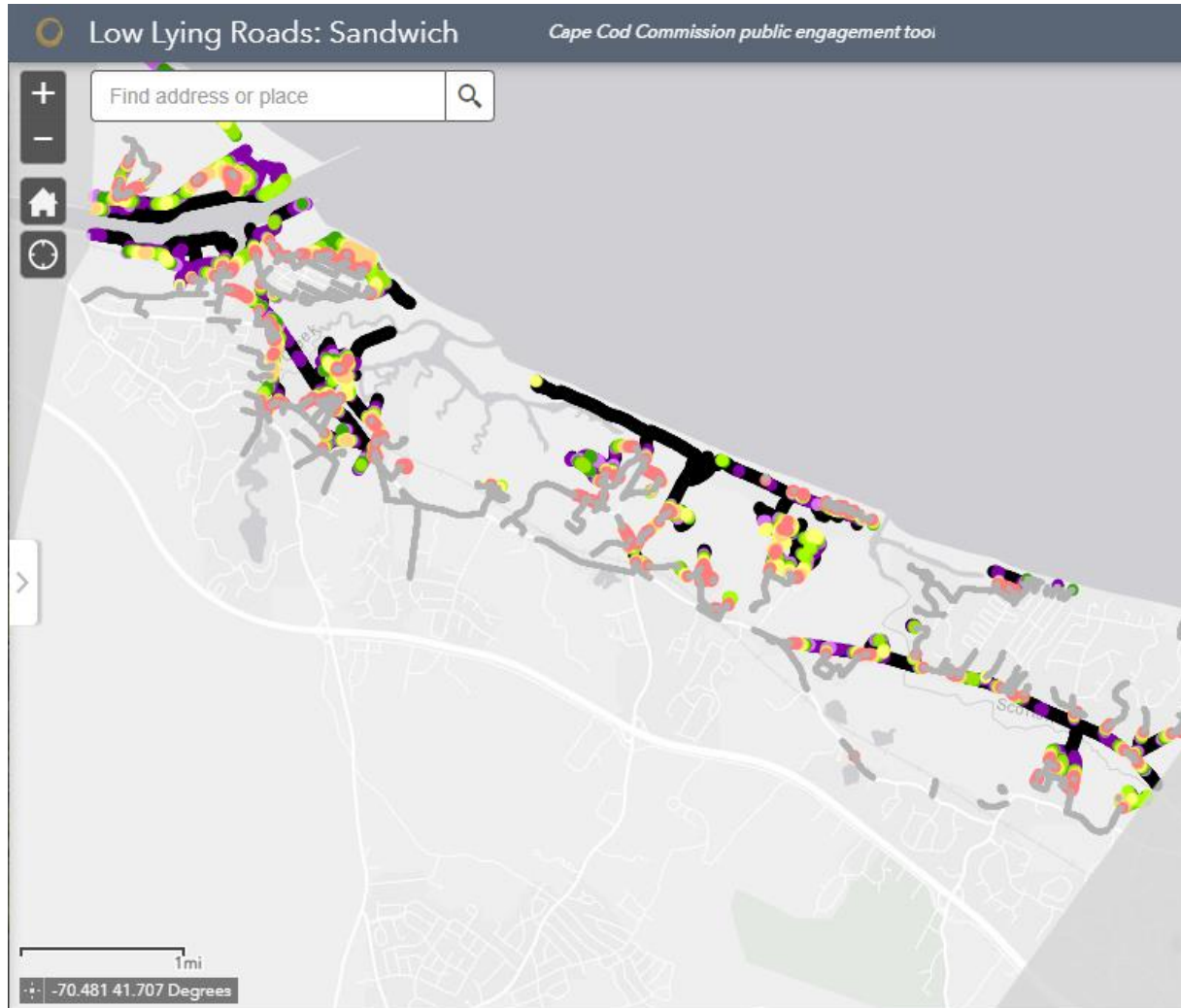
Summary of High Priority Road Segments (Sandwich)

	Name	Length (ft)	Description	Segment Storm Probability (%)			Nuisance Length (ft)		
				2030	2050	2070	2030	2050	2070
A	*Route 6A (Joslin Ln)	520	Segment of 6A at Joslin Ln	0.2-100	2-100	100	40	220	
B	River St	520	Between Main St and Tupper Rd	1-100	10-100	100	100	440	
C	*Route 6A (Howland Ln)	580	Segment of 6A at Howland Ln and Barnstable line	0.2-100	2-100	100		320	
D	Jones Ln (Scorton Creek & Route 6A)	4600	Segment over Scorton Creek to neighborhood	0.2-100	2-100	20-100	560	3120	
E	Boardwalk Rd	1640	Access to Sandwich Boardwalk parking lot	2-100	20-100	100	120	1600	
F	Dewey Ave	780	Between Liberty St and Georges Rock Rd	0.2-100	2-100	100	420	600	
G	*Route 6A (Old Main St intersection)	2480	6A at Main St, Clayton St, Old Main	0.2-100	5-100	100		1400	
H	*Route 6A (Scorton Creek Bridge)	1020	6A over Scorton creek Bridge	0.2-20	2-100	100		400	
I	*Route 6A (Mill Creek Bridge)	1700	6A over Mill Creek Bridge	0.5-10	5-100	20-100			
J	Willow St and Jarves St	1240	Access to neighborhood and Boardwalk	0.1-20	2-100	20-100		600	
K	Sandy Neck Rd and Cranberry Trail	1300	Access to Sandy Neck Beach	0.1-10	2-100	20-100			
L	Beale Ave and Main St	520	Intersection of Beale Ave and Main St	0.5-10	10-20	100		20	
M	Town Neck Rd	460	Access to Town Neck Beach from 6A	0.1-0.5	2-20	20-100			
N	Scusset Beach Rd	680	Access to Scusset Beach	0.2-0.5	2-10	100			
O	Ploughed Neck Rd	1000	Access to N Shore Blvd and Scorton Creek inlet	0.1-5	1-100	100			
P	Spring Hill Rd	260	Access to neighborhood and Spring Hill Beach	0.2-2	2-5	100			
Q	Foster Rd (Old Harbor Creek)	580	Access to Salt Marsh Rd and Beach	5-100	20-100	100	340	460	
R	Wood Ave	400	Access to Town Neck Beach parking lot	1-100	10-100	20-100	100	280	

* = MassDOT or other State roadway

LOW LYING ROADS

Group Discussion



**DISCUSSION
ORIENTATION**

Town Initiatives

COASTAL RESILIENCE PROGRAM

Coastal Resilience Story Map

The online hub for information related to climate change planning in the Town of Sandwich. You can visit it at: https://bit.ly/TownofSandwich_CoastalResilienceProgram

CoastSnap

A fixed platform beach monitoring system at Town Neck Beach that creates a controlled orientation for any smart phone device to get a true measure of the changing landscape. Photos are collected into a database and can then be analyzed to measure the changing beach width and shoreline, and the beach response to local ocean conditions.



Town Initiatives

JONES LANE CULVERT IMPROVEMENT

Project Goal:

Restore the full tidal range that would naturally occur upstream of the structure and improve the resiliency of the culvert and roadway under future sea level rise and storm surge conditions

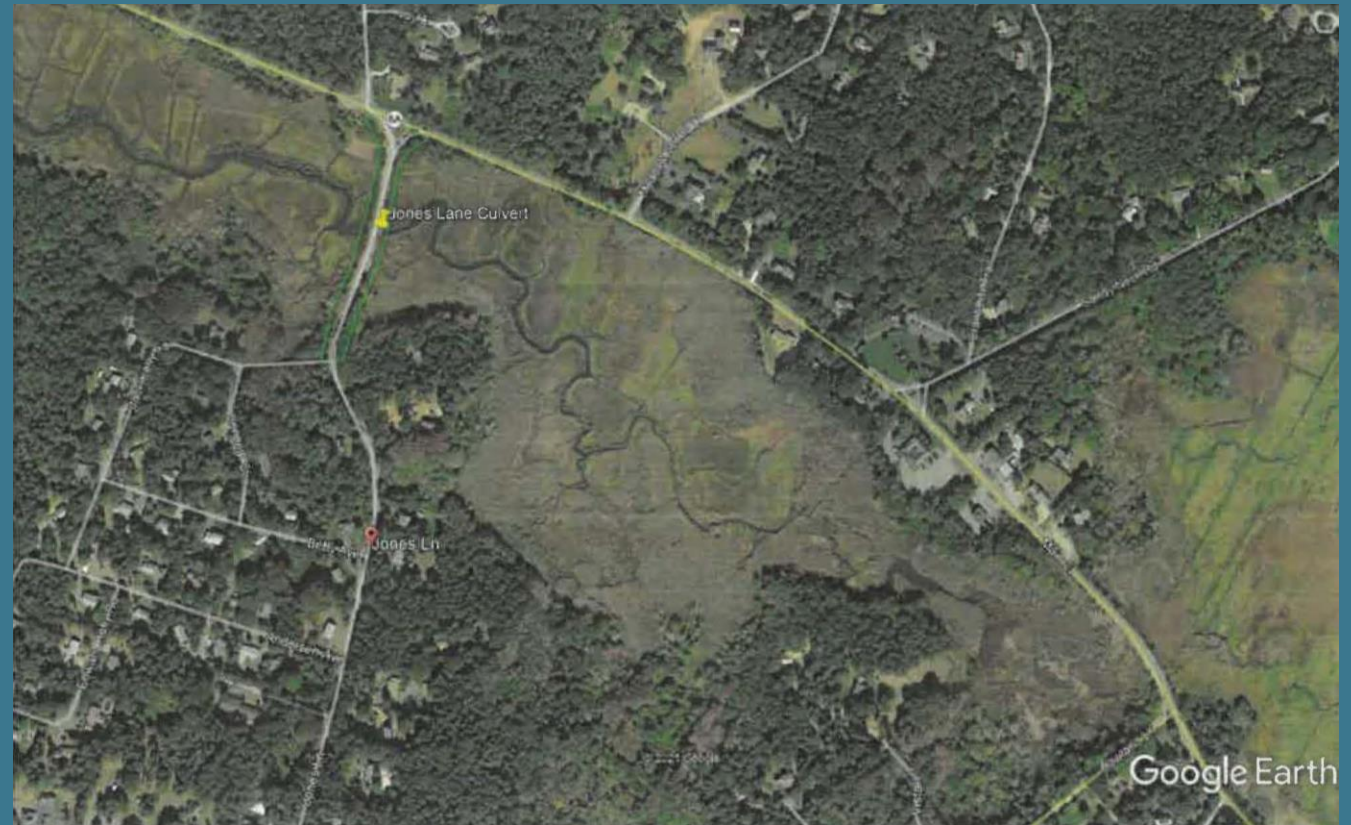
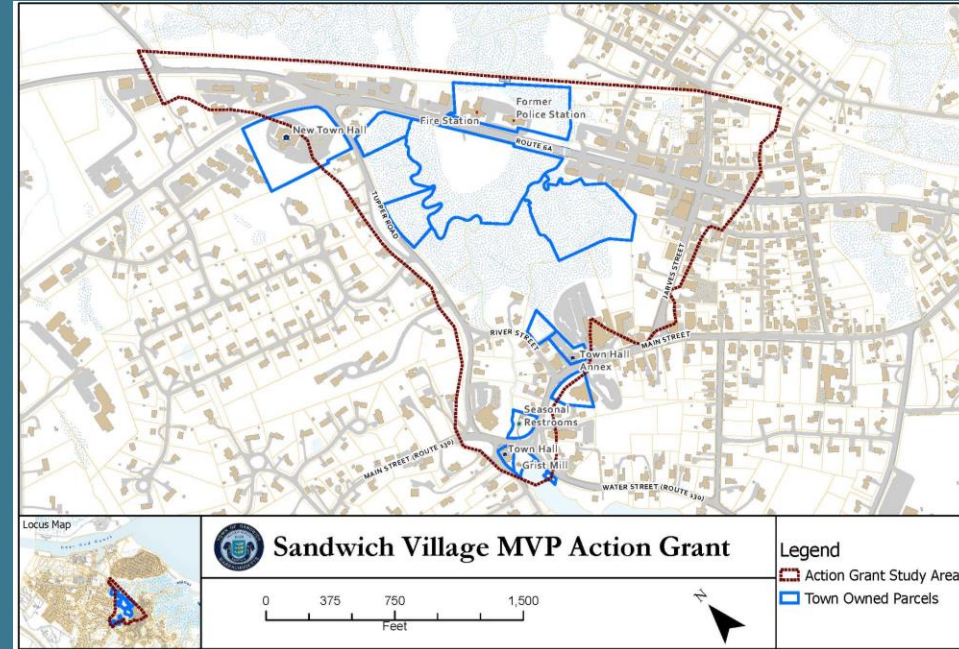


Figure 1. Jones Lane and Scorton Creek with culvert location shown and extent of wetland survey outlined in yellow.

Town Initiatives

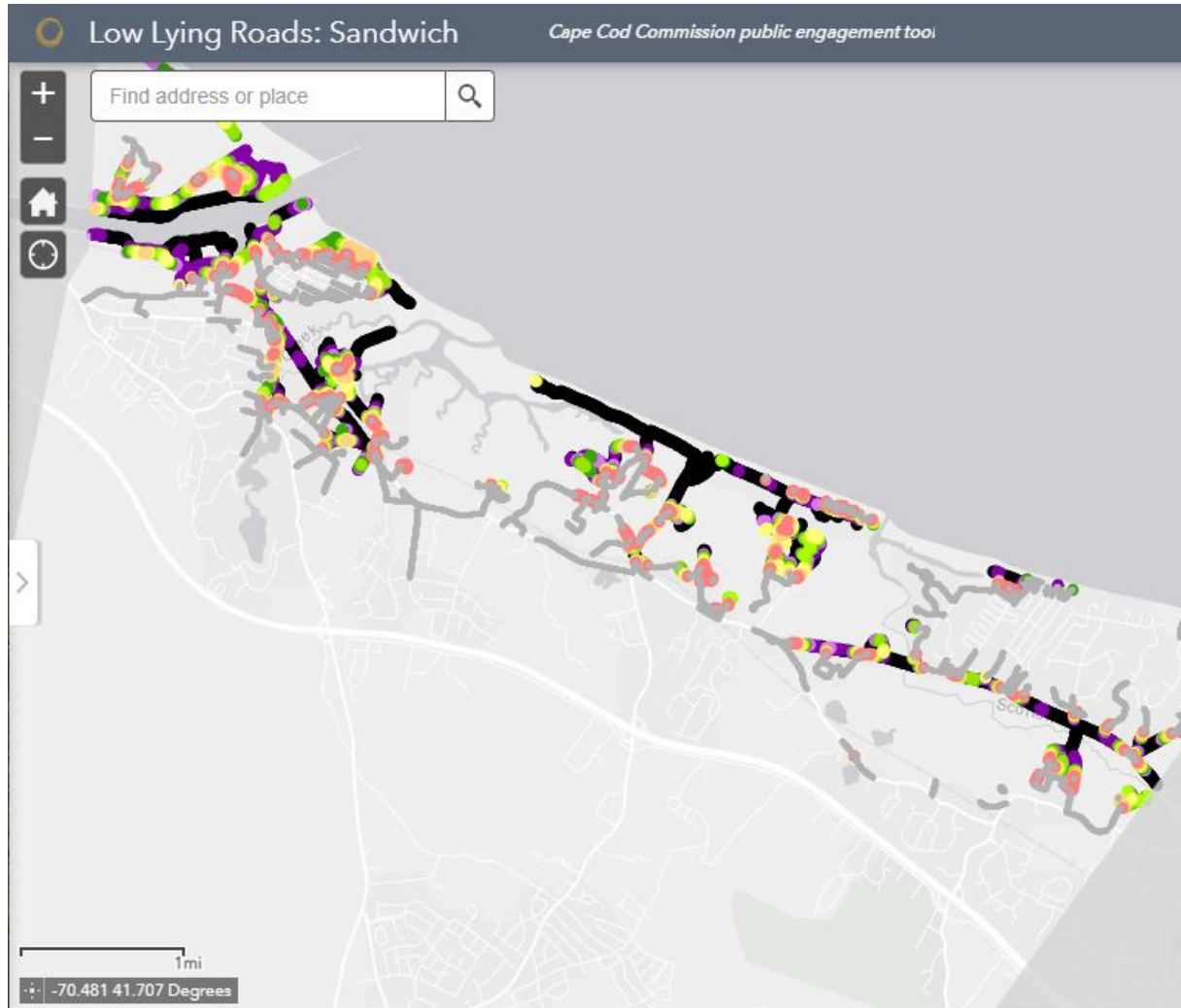
SANDWICH VILLAGE MVP ACTION GRANT

In 2018, the Town of Sandwich was awarded a Planning Grant from the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) to implement the Municipal Vulnerability Preparedness (MVP) Program's Community Resilience Building (CRB) framework. The MVP program was designed to help communities reduce vulnerability to climate-related hazards and build community resilience.



The CRB workshop resulted in a list of implementable actions and certified the Town of Sandwich as an MVP community.

As a certified MVP community, the Town of Sandwich was eligible to apply for MVP Action Grants to implement prioritized actions from the workshop.



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?

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NEXT STEPS

- 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!
