



Massachusetts Office of  
Coastal Zone Management

# Martha's Vineyard Hospital Access Resilience Project –

October 1, 2024



MARTHA'S VINEYARD  
**HOSPITAL**

One Hospital Rd, PO Box 1477, Oak Bluffs, MA 02557



FUSS & O'NEILL



# Climate Resilience Priorities recap

*Martha's Vineyard Commission compiled the following priority climate impacts for Oak Bluffs based on Municipal Vulnerability Program and other studies:*

- 1) Flooding and storm damage to Eastville Ave., East Chop Dr., East Chop Bluff, County Rd., Seaview Ave., and Beach Rd., Lagoon Pond Bridge, Farm Pond culvert and buildings in the flood zone;*
- 2) Limited access to Martha's Vineyard Hospital and Windemere Nursing Home; and*
- 3) Flooding and storm damage to the Harbor.*



# About the Project

The [goal of this project](#) is very focused - to make transportation access to the hospital more resilient for EMS during current and future flooding associated with sea level rise and storm surge.

- Provide an understanding of the current and projected flood risk along the key transportation routes used by EMS to access the hospital;
- Gain an understanding of critical care service needs,
- Conduct alternative route analysis; feasibility of road raising; and analysis of nature-based solutions to reduce risk; and
- Design conceptual level roadway adaptation alternatives for prioritized (4) segments.

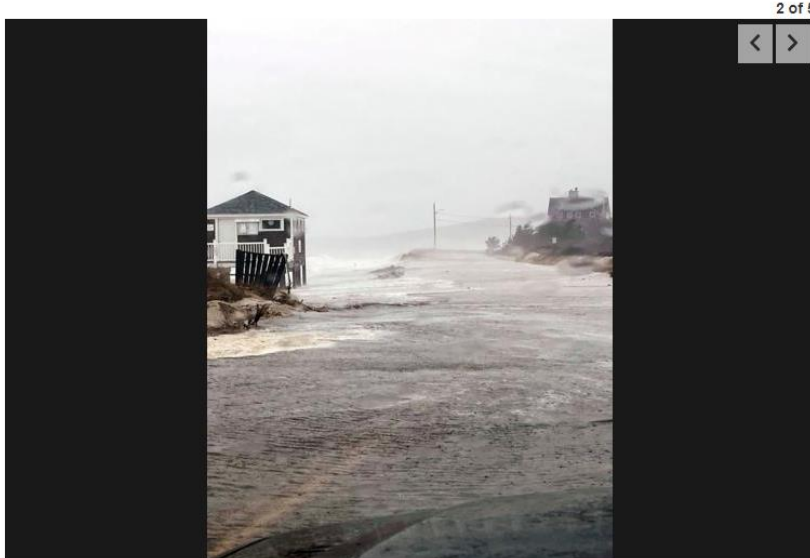


# Climate Impacts on Roadways?

## Powerful Storm Caused Power Outages, Floods On Monday

By NOELLE ANNONEN Dec 22, 2023 0

Home / Falmouth / Falmouth News



Storm waters flow over Surf Drive.  
COURTESY FALMOUTH POLICE DEPARTMENT

## Hot weather this week increases chances for pavement buckling

By staff - July 20, 2016



July 20, 2016

- ❑ Storm-related flooding—exacerbated by rising sea levels—can close low-lying roads either temporarily or long-term if roadbed or pavement is undermined
- ❑ Repeated saltwater exposure can undermine or reduce service life of the road
- ❑ Flooding from increasingly frequent heavy downpours can disrupt traffic, damage culverts, and reduce the service life of stormwater infrastructure
- ❑ High temperatures can cause softening pavement, buckling, and accelerate the deterioration of pavement
- ❑ Increased maintenance costs
- ❑ Increased disruption, access to services
- ❑ Economic impacts

# Roadway Climate Vulnerability for EMS

## Access to MV Hospital

(Sea level rise (future high tide), Storm surge)



Lake Ave on 12/23/2022 (Credit: Rich Saltzberg)



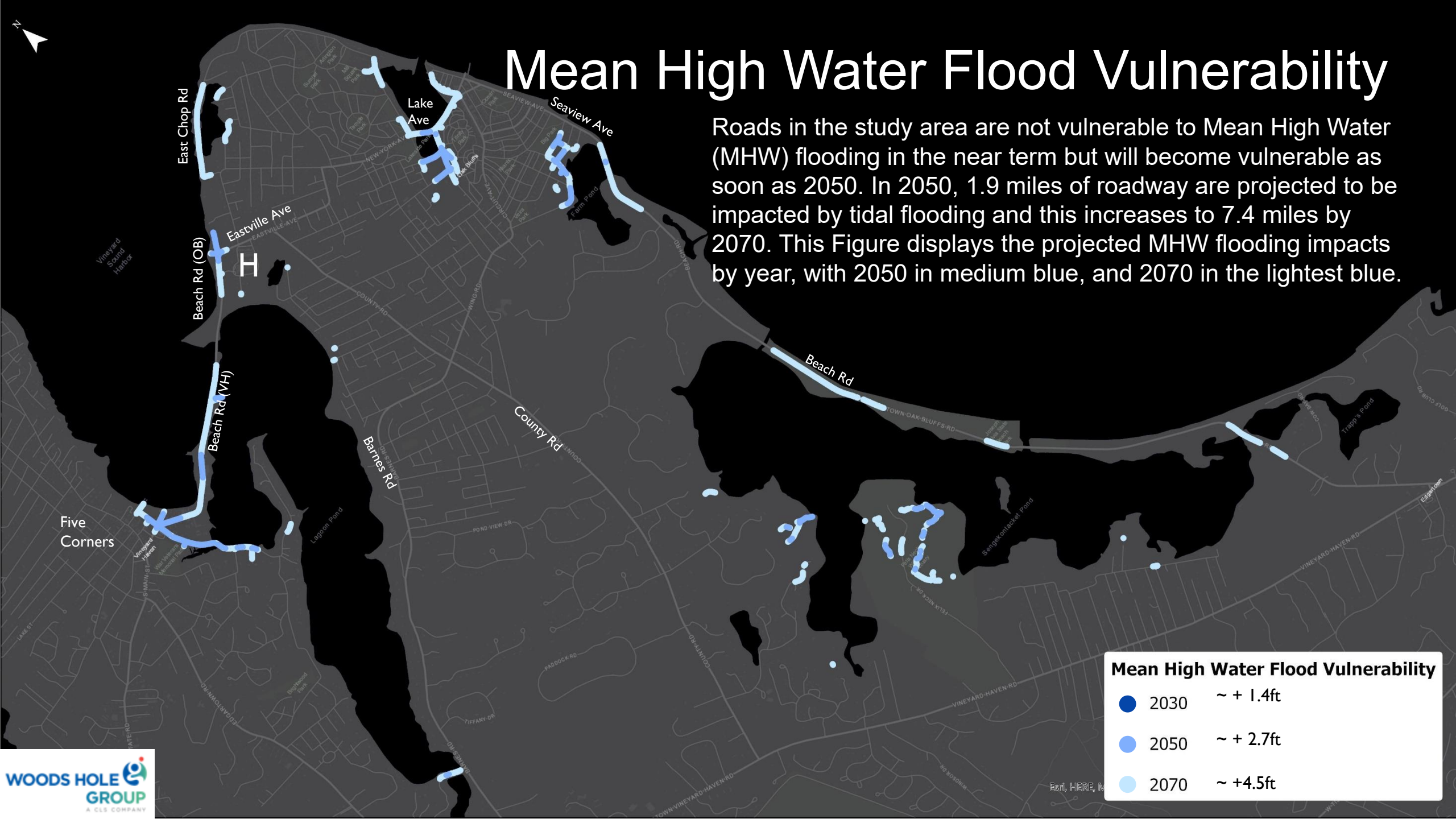
Beach Road and Eastville Ave on 12/05/2020



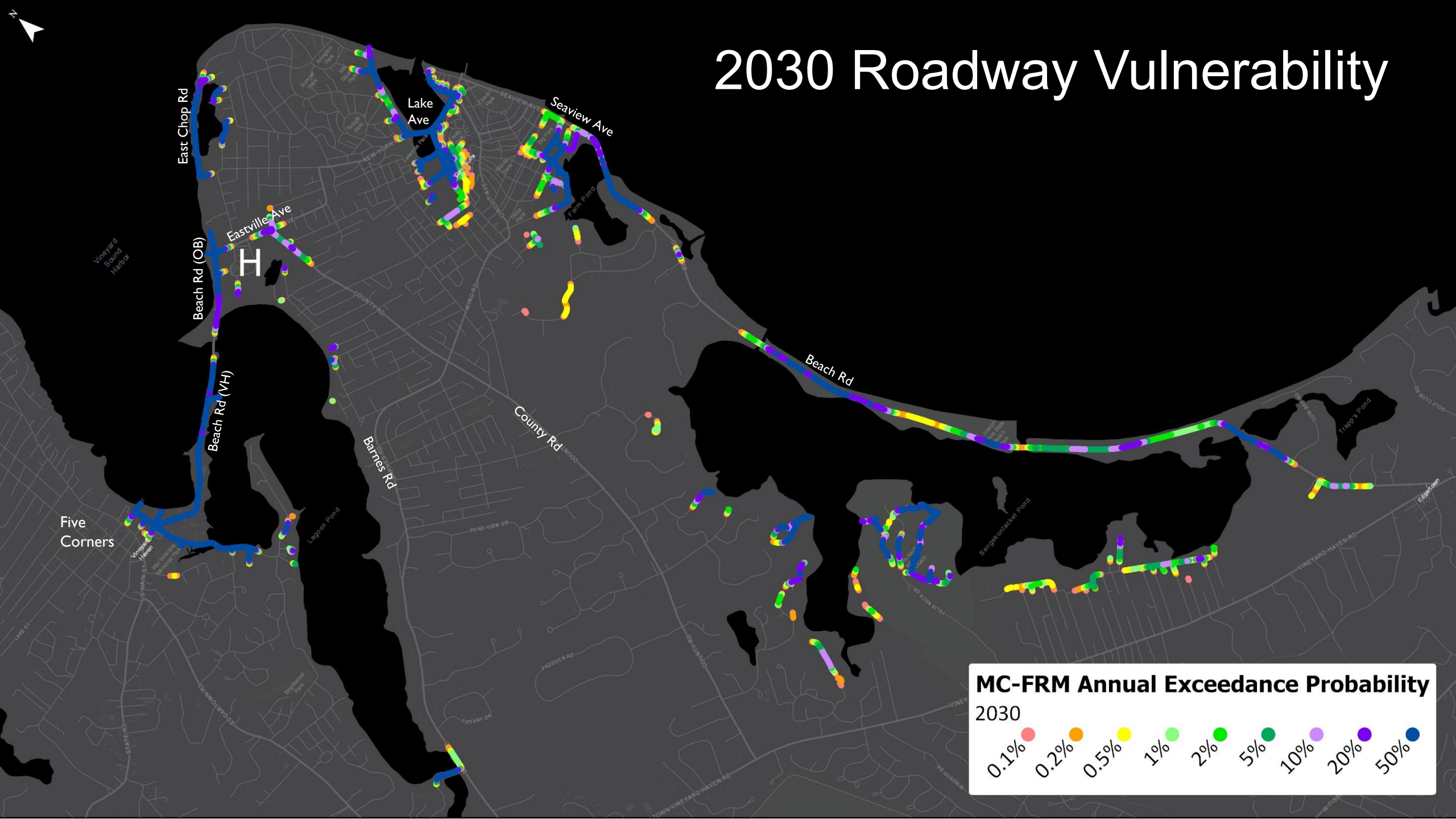
Eastville Ave Looking Towards Beach Rd  
on 1/4/2018 (Credit: Liz Durkee)

# Mean High Water Flood Vulnerability

Roads in the study area are not vulnerable to Mean High Water (MHW) flooding in the near term but will become vulnerable as soon as 2050. In 2050, 1.9 miles of roadway are projected to be impacted by tidal flooding and this increases to 7.4 miles by 2070. This Figure displays the projected MHW flooding impacts by year, with 2050 in medium blue, and 2070 in the lightest blue.

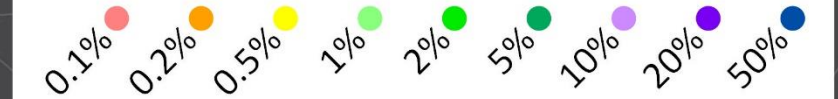


# 2030 Roadway Vulnerability



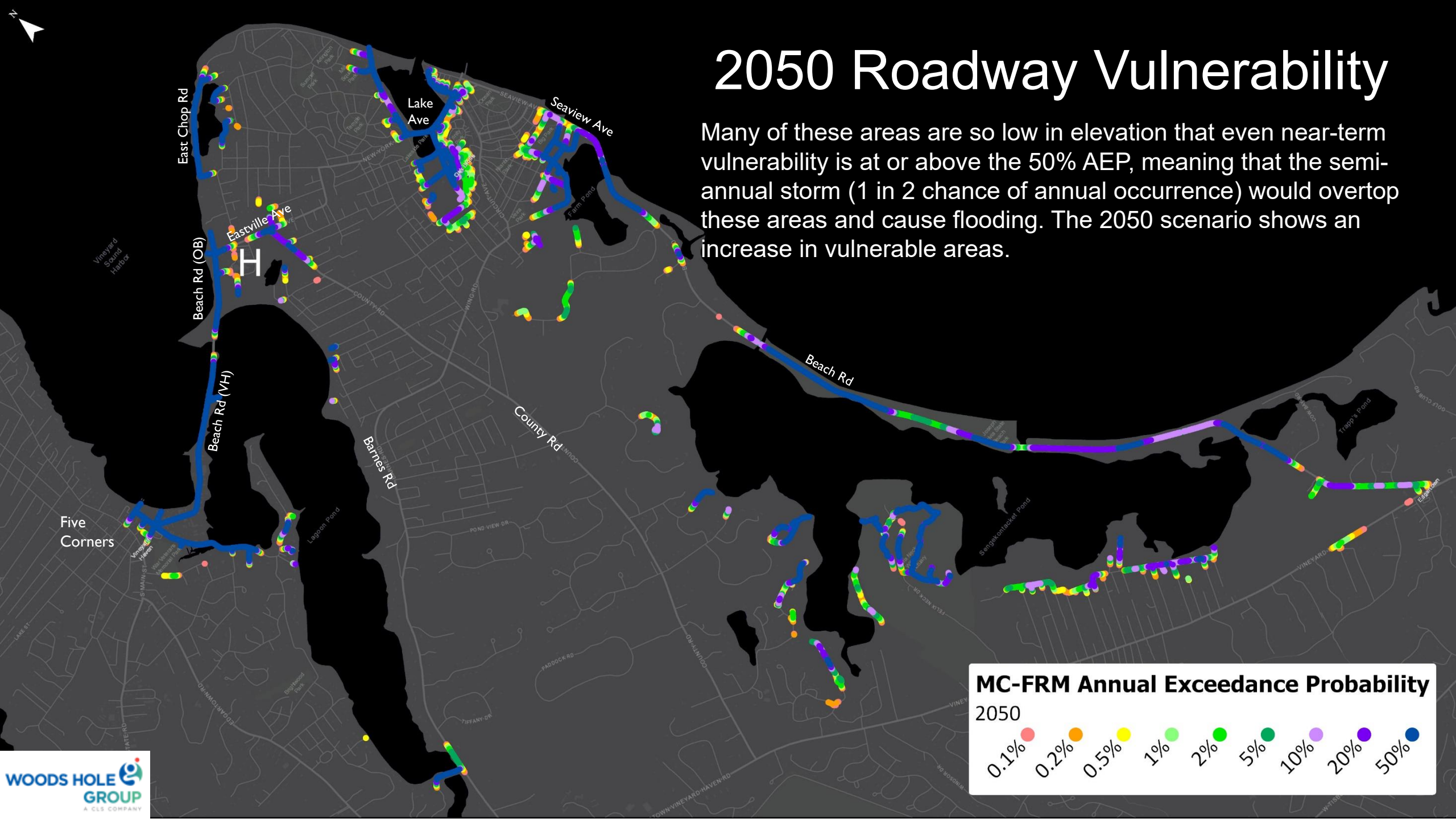
## MC-FRM Annual Exceedance Probability

2030



# 2050 Roadway Vulnerability

Many of these areas are so low in elevation that even near-term vulnerability is at or above the 50% AEP, meaning that the semi-annual storm (1 in 2 chance of annual occurrence) would overtop these areas and cause flooding. The 2050 scenario shows an increase in vulnerable areas.





# 2030 Ambulance Flood Restrictions

The 2030 50% AEP restricts ambulance travel at:


- Five Corners and approaches to the Vineyard Haven – Oak Bluffs Bridge
- Beach Road at the hospital entrance
- East Chop Drive at Crystal Lake
- Lake Avenue and areas behind Oak Bluffs Harbor
- Seaview Avenue at Farm Pond
- small segments of Beach Road along Sengekontacket Pond

The 2030 1% AEP expands flooding in these areas and also restricts ambulance travel along:


- Barnes Road at the head of Lagoon Pond
- The intersection of County Road and Eastville Avenue above Brush Pond

## Routing in Flood Conditions

Flooding in 2030 50% AEP Water Level

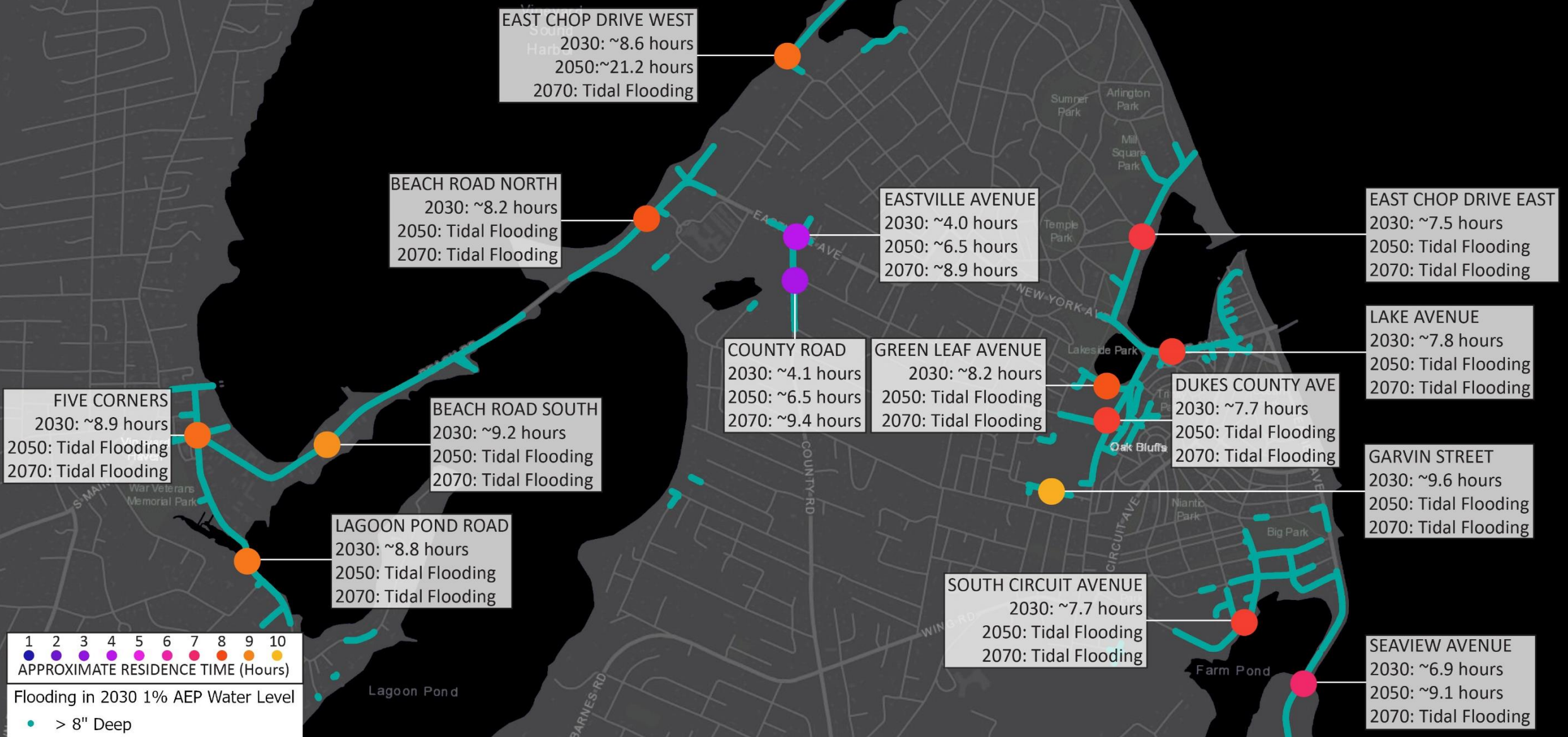
 > 8" Deep

Flooding in 2030 1% AEP Water Level

 > 8" Deep

# 2030 – 2050 – 2070 1% AEP Flood Residence Time

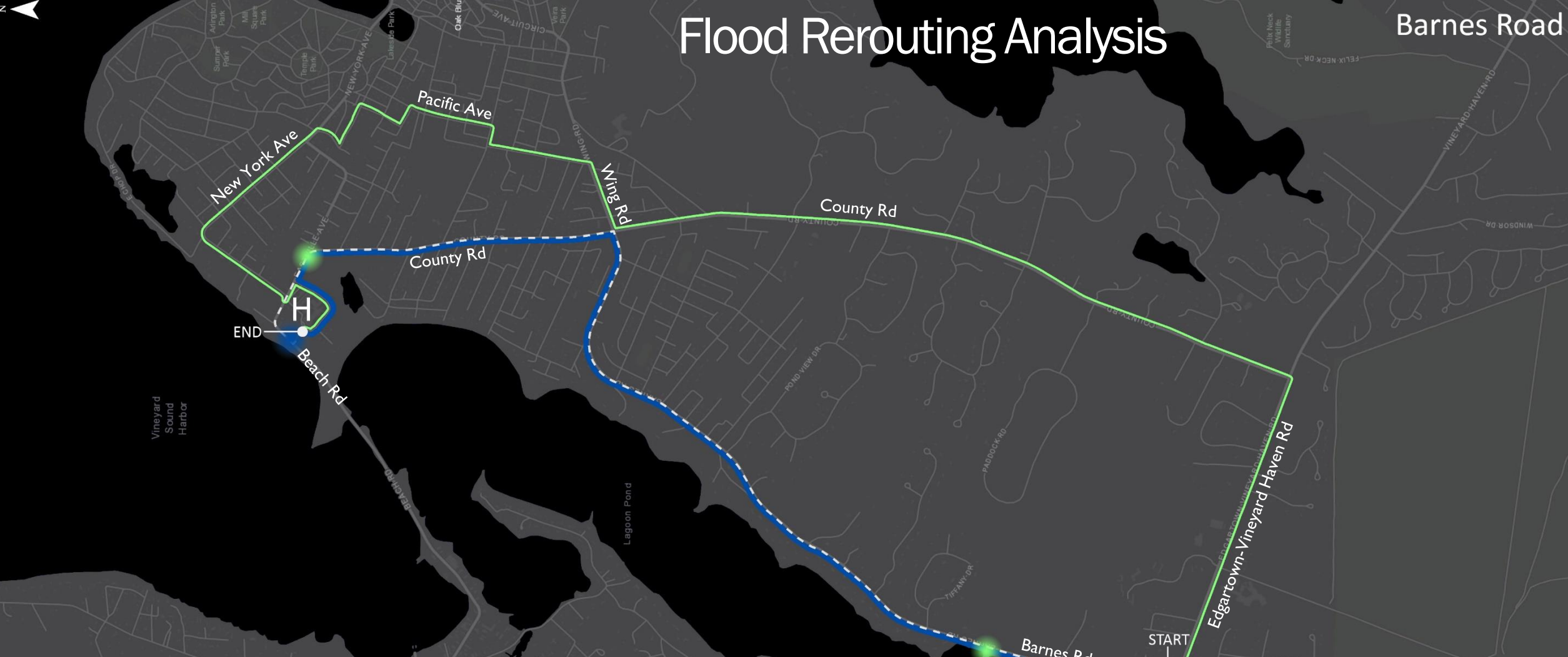
INSET MAP: Northwest study area



# Routing Analysis & Priority Segments

# Flood Rerouting Analysis

Barnes Road



TRAVEL TIME TO HOSPITAL DURING FLOODING		
Legend	Water Level	Travel Time
-----	Present Day MHW	7:14
—————	2030 50% AEP	+0:30
●	2030 50% AEP flooding causing rerouting	
—————	2030 1% AEP	+5:28
●	2030 1% AEP flooding causing rerouting	

*County Rd/Eastville Ave. impacted every major EMS route when Five Corners was flooded ~ Prioritized segments*



# Hospital Route Flood Impact Summary

Origin	Travel Time (MM:SS)			Flooded Segments Affecting Route										
	Existing Conditions	Added by 2030 50% AEP Flooding	Added by 2030 1% AEP Flooding	Five Corner‡	Beach Road (VH)‡	Beach Road (OB)	Barnes Road	East Chop Drive	Eastville Avenue	County Road	New York Ave	Lake Avenue	Dukes County Way	Seaview Avenue‡
Vineyard Haven	2:58	8:44	13:26	1%	1%	1%	1%	-	1%	1%	-	-	-	-
				50%	50%	50%	-	-	-	-	-	-	-	-
Oak Bluffs Ferry	3:57	2:57	4:31	-	-	1%	-	-	1%	1%	1%	1%	1%	-
				-	-	50%	-	-	-	-	50%	50%	50%	-
East Chop Road	2:44	2:58	3:00	-	-	1%	-	1%	1%	-	-	-	-	-
				-	-	50%	-	50%	-	-	-	-	-	-
Harthaven	7:17	0:31	2:42	-	-	1%	-	-	1%	1%	-	1%	1%	1%
				-	-	50%	-	-	-	-	-	50%	50%	50%
Barnes Road	7:14	0:30	5:28	-	-	1%	-	-	1%	1%	-	-	-	-
				-	-	50%	-	-	-	-	-	-	-	-
Edgartown-West Tisbury Road	11:00	0:30	5:06	-	-	1%	1%	-	1%	1%	-	-	-	-
				-	-	50%	-	-	-	-	-	-	-	-
County Road (North at Wing Rd)	2:54	0:30	4:06	-	-	1%	-	-	1%	1%	-	-	-	-
				-	-	50%	-	-	-	-	-	-	-	-
County Road (South at E-VH Rd)	6:54	0:30	3:54	-	-	1%	-	-	1%	1%	-	-	-	-
				-	-	50%	-	-	-	-	-	-	-	-
Edgartown (Upper Main St)	13:54	0:30	3:54	-	-	1%	-	-	1%	1%	-	-	-	-
				-	-	50%	-	-	-	-	-	-	-	-
Linton Avenue	1:56	0:30	1:46	-	-	1%	-	-	1%	1%	-	-	-	-
				-	-	50%	-	-	-	-	-	-	-	-

‡ Segment included in other resiliency projects

# Alternatives Assessment (Feasibility Analysis)

# Incorporating Nature-based Solutions

Beach/dune enhancement could reduce wave runup and flooding to Beach Rd...likely subject to erosion along structured shoreline, need to consider potential impacts to eelgrass (beach) and private property (dune) as well as flanking from Brush Pond

Wave attenuation could reduce wave runup to Beach Rd...need to model effectiveness and consider impacts to eelgrass as well as flanking from Brush Pond

Potential to integrate small landscape berms to prevent minor flooding and intercept wave runup...limited by tie-in elevations

Potential long term marsh migration zone (with culvert installation)

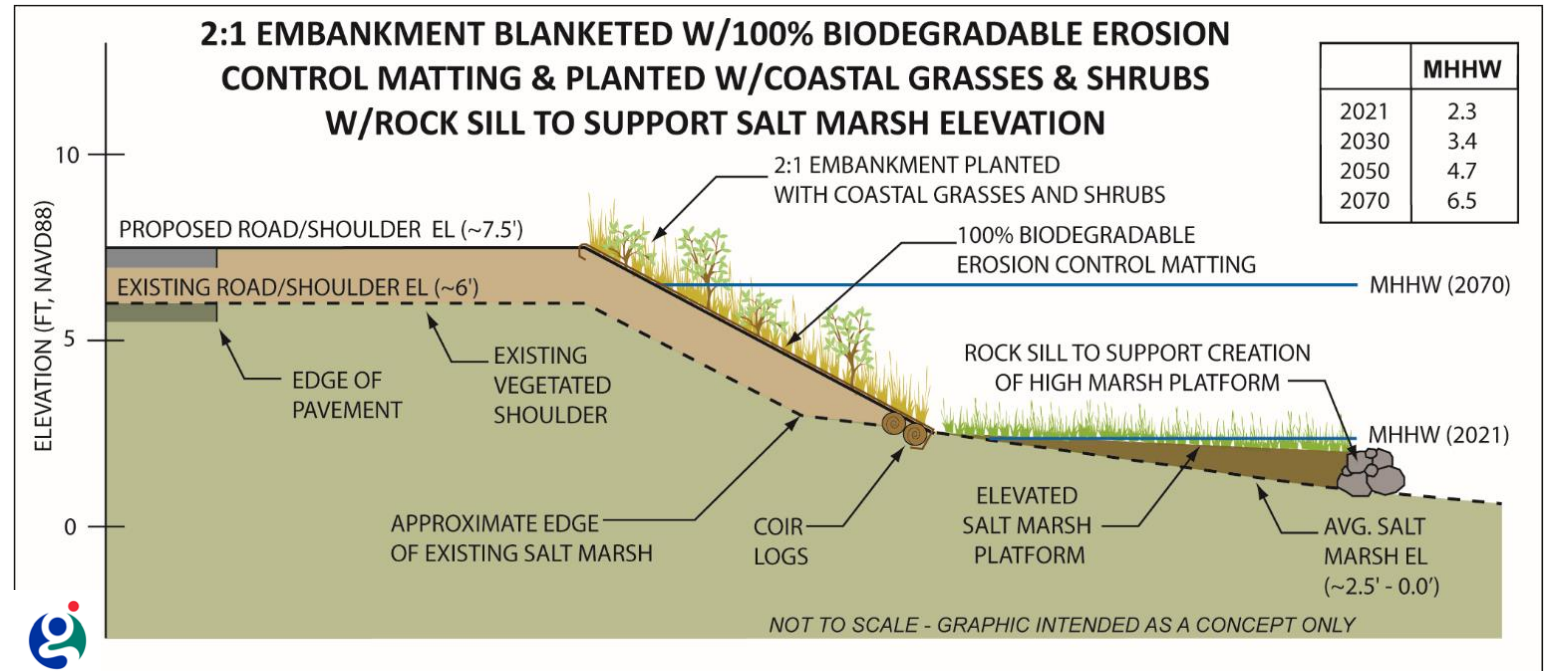
Potential to integrate small landscape berms to prevent minor flooding and intercept wave runup...limited by tie-in elevations and flanking from Vineyard Sound

Dune enhancement could reduce volume/duration of flooding via Brush Pond...need to model effectiveness and consider impacts to pond flushing as well as flanking over Beach Rd

Potential to integrate small landscape berms to prevent minor flooding and intercept wave runup...limited by tie-in elevations

# Critical Considerations for Roadway Adaptation

- ❑ Climate Resilience, Design Standard and Relative Risk Reduction
- ❑ Slope Achievable (2:1 horizontal to vertical)
  - ❑ Available Right of Way
  - ❑ Required Lane Width
  - ❑ Private Property Impacts
  - ❑ Natural Resource Boundaries
- ❑ Drainage
- ❑ Natural Resource Impacts &
- ❑ Permitting Requirements
- ❑ Adaptable to Future Conditions
- ❑ Jurisdiction (MassDOT vs. Town-owned roadways)
- ❑ Cost/ Benefit
- ❑ Alternatives





# Climate Risk Reduction– Phased Approach for County/Eastville

	2030	2050	2070
0.1%	11.6	14.3	16.3
0.2%	10.9	13.5	15.5
0.5%	10	12.4	14.4
1%	9.3	11.6	13.5
2%	8.7	10.8	12.7
5%	7.8	9.7	11.6
10%	7	8.8	10.7
20%	6.2	7.9	9.7
50%	5	6.4	8.3



**Phase 1** – Raise elevation to 7.9 feet providing a level of protection up to and including:

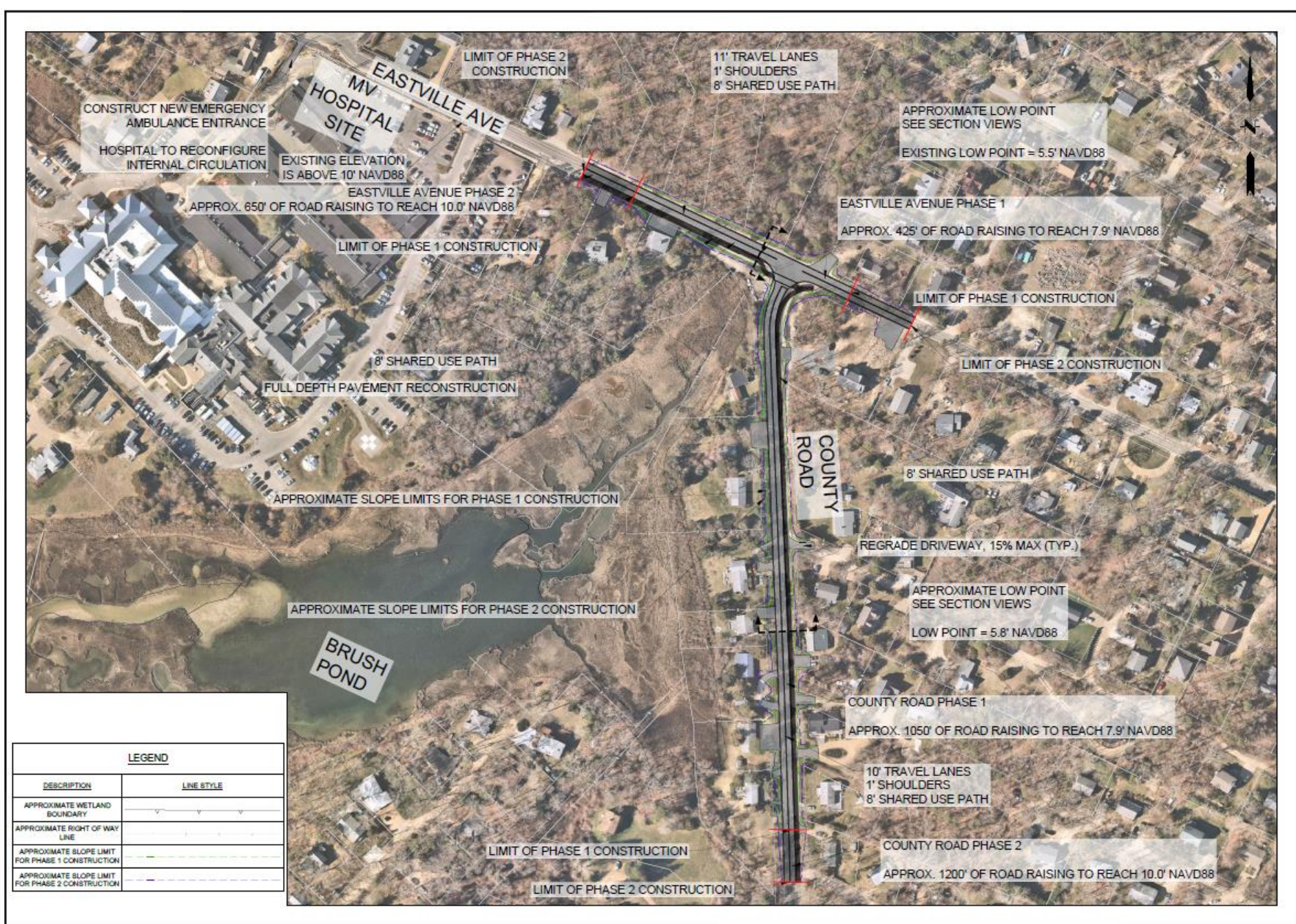
- 2030 5% AEP
- 2050 20% AEP (as indicated by dark gray fill and solid red outline).

**Phase 2** – Raise elevation to 10.0 feet providing a level of protection up to and including:

- 2030 0.5% AEP,
- 2050 5% AEP
- 2070 20% AEP (as indicated by light gray fill and dashed red outline).

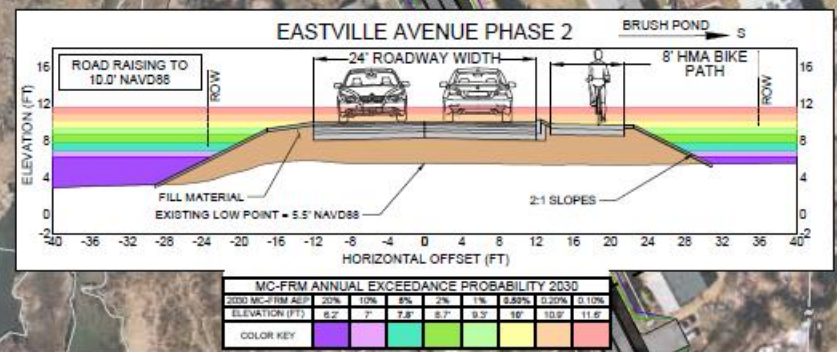
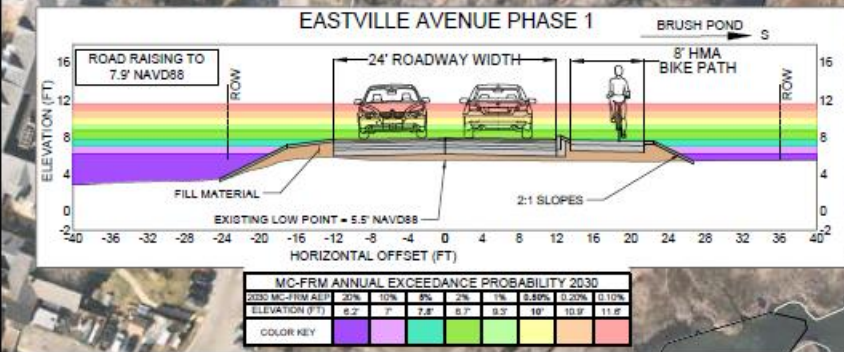
*If aligned with roadway lifespan and climate conditions, the transition from Phase I to Phase II could preserve the 5% AEP level of protection for Eastville Ave and County Rd, originally established in Phase I for 2030 conditions, into the 2050-time horizon (as indicated by the transition from solid red line to dashed red line).*

# Phased Road Raising – County Rd/Eastville Ave



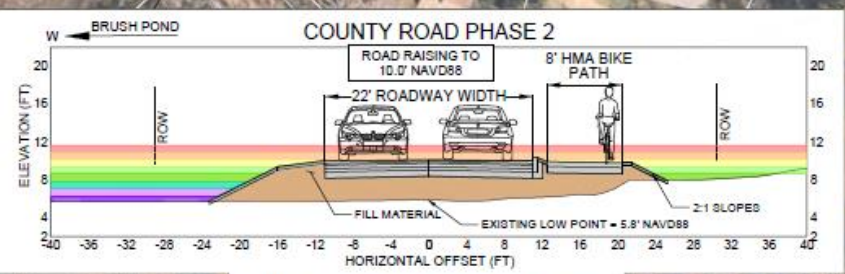
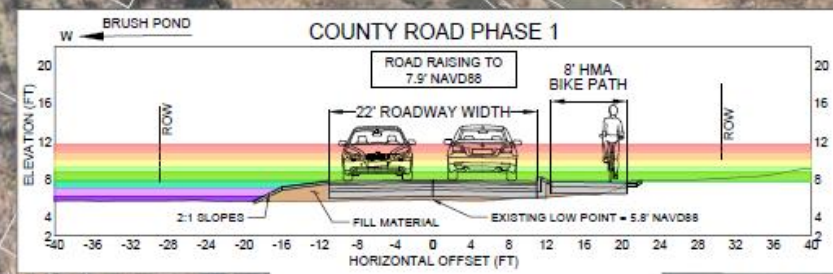


LEGEND	
DESCRIPTION	LINE STYLE
APPROXIMATE WETLAND BOUNDARY	
APPROXIMATE RIGHT OF WAY LINE	
APPROXIMATE SLOPE LIMIT FOR PHASE 1 CONSTRUCTION	
APPROXIMATE SLOPE LIMIT FOR PHASE 2 CONSTRUCTION	





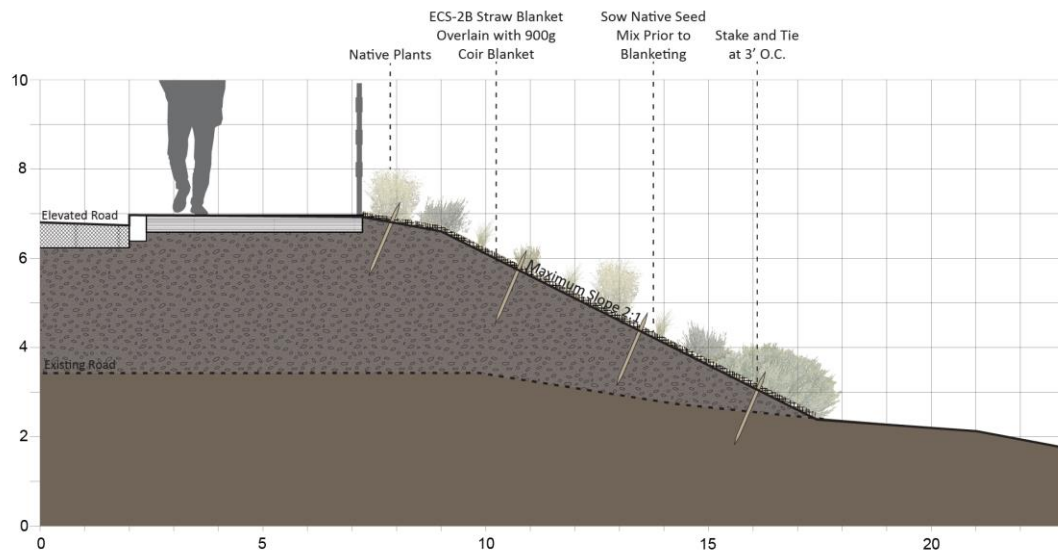
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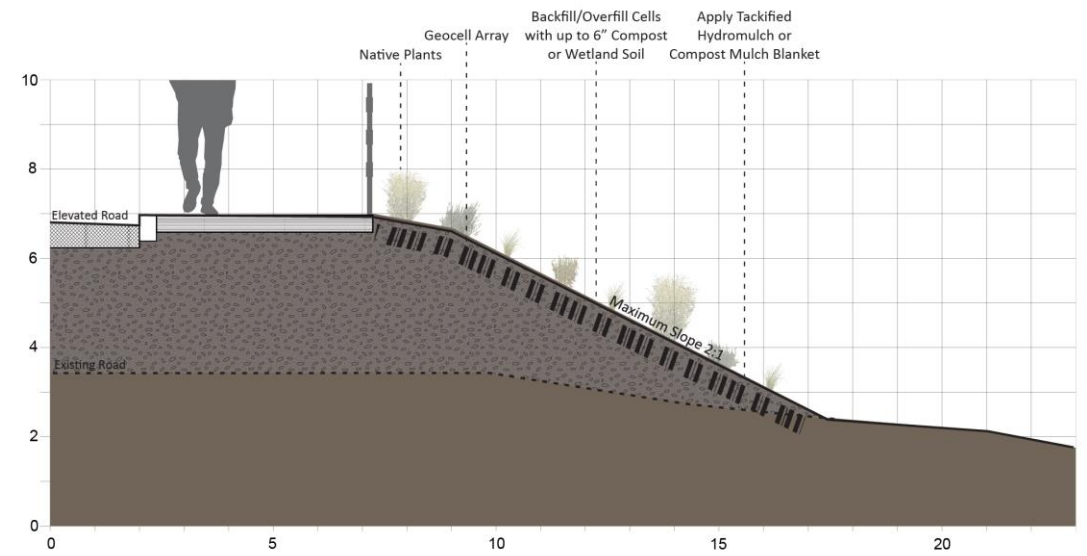
MC-FRM ANNUAL EXCEEDANCE PROBABILITY 2030							
2030 MC-FRM AEP	20%	10%	5%	2%	1%	0.50%	0.20%
ELEVATION (FT)	5.2	7.7	7.2	8.7	9.3	10	10.9
COLOR KEY							

MC-FRM ANNUAL EXCEEDANCE PROBABILITY 2030							
2030 MC-FRM AEP	20%	10%	5%	2%	1%	0.50%	0.20%
ELEVATION (FT)	5.2	7.7	7.2	8.7	9.3	10	10.9
COLOR KEY							

# Nature-Based Side Slope Blanketed and Planted, Planted Geocells



SIDE SLOPE TREATMENT  
Blanketed and Planted



SIDE SLOPE TREATMENT  
Planted Geocells

# Our Project Team



**Dean Audet, PE**  
Senior Vice President, Fuss & O'Neill  
Technical Advisor  
30+ Years of Experience

- Flood Resilience
- Stormwater Management
- Nature-based Solutions



**Brittany Hoffnagle**  
Climate Resilience, Woods Hole Group  
Route Analysis  
8+ Years of Experience

- Climate Resilience Planning
- GIS
- Route Analysis



**Eileen Gunn, AICP**  
Associate, Fuss & O'Neill  
Project Manager  
30+ Years of Experience

- Climate Resilience PM
- Transportation Planning
- Grant Management



**Connor Agro, PE**  
Transportation Engineer  
Conceptual Design  
5+ Years of Experience

- Roadway Design
- Complete Streets
- Safety Analysis



**Adam Finkle, BS, MS**  
Coastal Scientist, Woods Hole Group  
Nature-based Solutions  
10+ Years of Experience

- Ecological Restoration
- Bioengineering
- Coastal Resiliency



**Pat Tierney, PE**  
Transportation Engineer  
Conceptual Design  
10+ Years of Experience

- Roadway Design
- Climate Resilience
- Safety Analysis

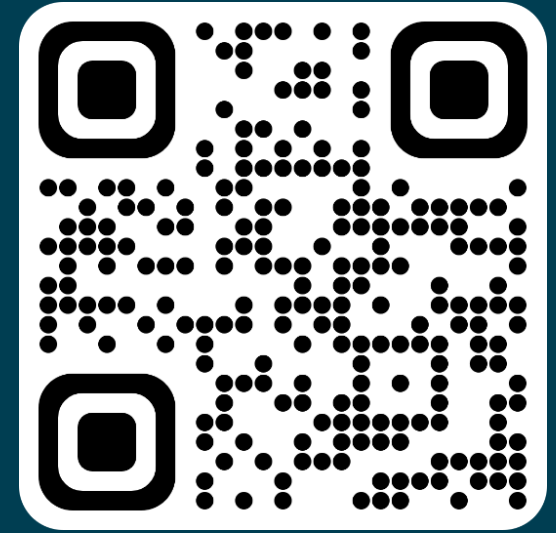


**Joseph Famely, MEM**  
Senior Environmental Scientist, Woods Hole Group  
Vulnerability, Resilience  
20 Years of Experience

- Sustainability Planning
- Risk Management
- MVP Trainer

# Project Website

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<https://tinyurl.com/MVHospitalResilience>