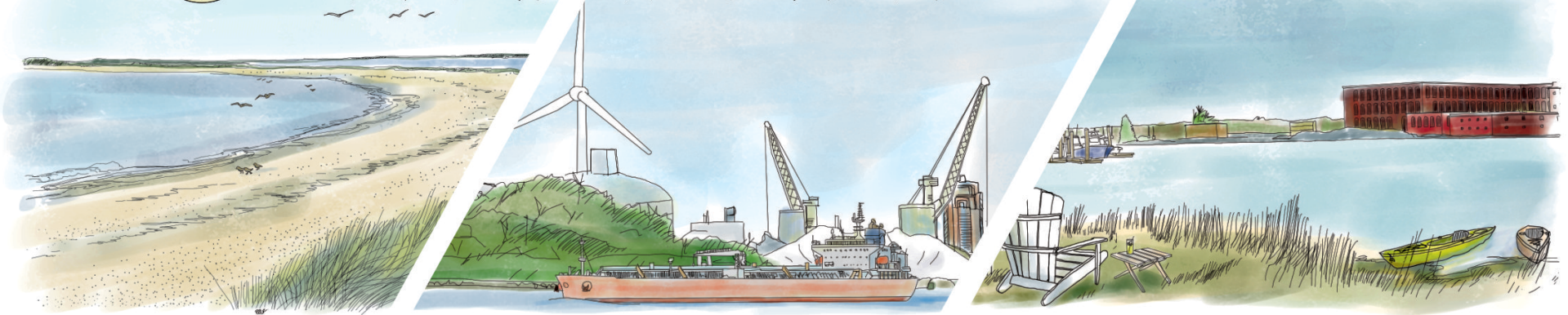




COASTAL INSTITUTE CLIMATE RESPONSE DEMONSTRATION SITES



TRANSPORTATION WORKSHOP

Mixed Use Demonstration Site: Barrington & Warren, RI

Thursday, October 16, 2019 (Warren)

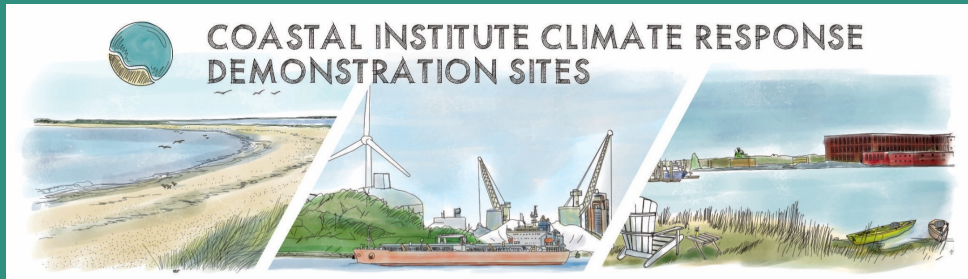
Thursday, October 23, 2019 (Barrington)

THE
UNIVERSITY
OF RHODE ISLAND

*Advance Knowledge
Synthesize Information
Solutions for Sustainable Ecosystems and Municipalities*

<https://ci.uri.edu>





A Forum for Evaluating Adaptation Practices

- Explore adaptation strategies to address sea-level, storm surge, and flooding
- Broad collaboration with partners
- Synthesize and fill information gaps
- Outreach and education



Source: [http://www.weather.gov/okx/Hurricane Sandy](http://www.weather.gov/okx/Hurricane%20Sandy)

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Synthesize Information
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Climate Response Demonstration Sites

-- representing RI coastal settings and land use types --

Natural Areas Napatree Point



- undeveloped
- ecological values
- recreational values

Mixed-Use Areas Barrington & Warren



- town centers
- historic heritage
- mixed land use
- natural areas, open space

Urban Areas Port of Providence



- industrial/commercial
- economic significance
- urban parks

Purpose of the Workshop Series

-- Identify strategies that will promote long-term adaptive capacity of coastal communities and enhance ecosystem sustainability.

- ***Sea Level Rise, Storms, and Coastal Resilience Tools***

May 2017 (Barrington) February 2018 (Warren)

- ***Land Use Strategies, Oct 2018***

Buyout Work Sessions, Nov 2018 and Feb 2019

- ***Transportation Strategies***

May 16, 2019 (Warren) May 23, 2019 (Barrington)

- ***University of Pennsylvania, School of Design, Fall 2018***

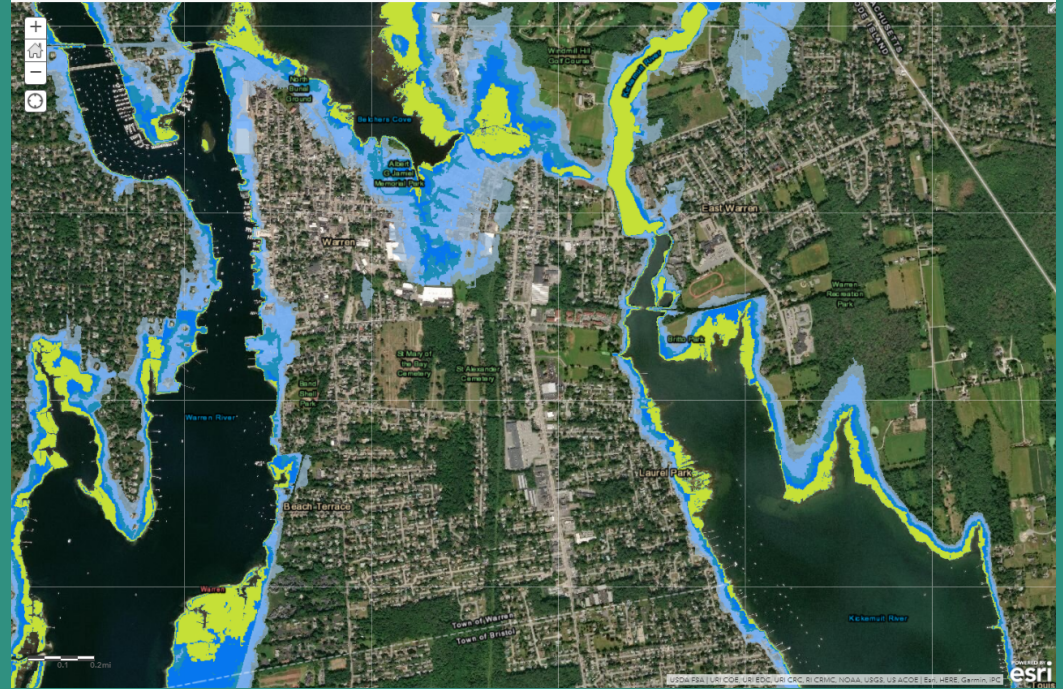
“A Future With Water: Sea-Level Rise in RI”



Source: mycoast.org/ri

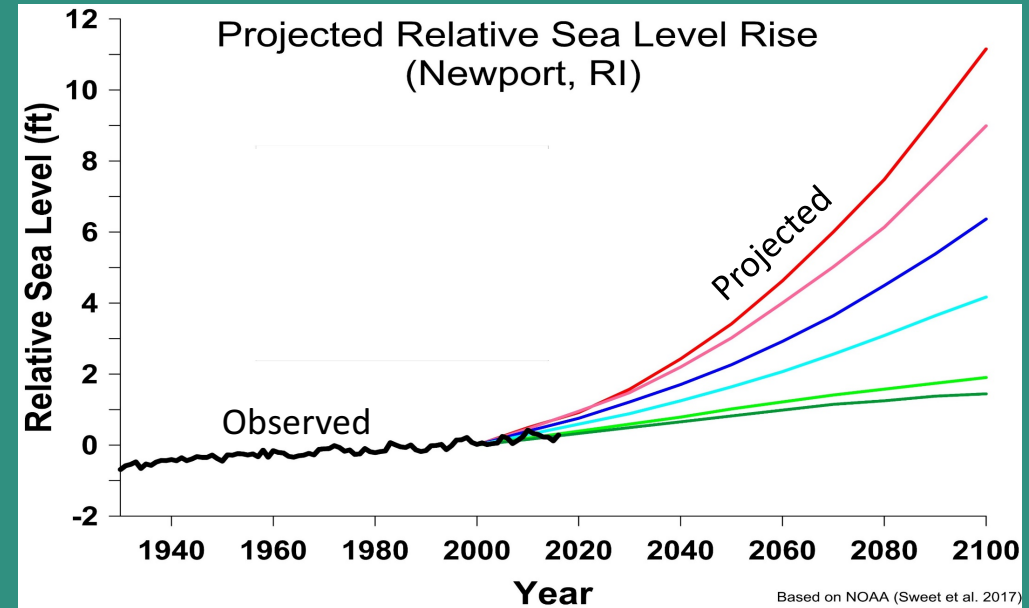
Transportation Workshop Goals

- Analyze the transportation network for vulnerability to sea level rise or storm surge in Warren and Barrington
- Use maps, data and local expertise to explore existing and new planning strategies necessary for adapting the transportation network to changing conditions



Expected Outcomes

- Contribute to a comprehensive consensus-based report to include each town's assets that are most vulnerable;



- Develop a list of adaptation, policy and restoration practices that could be considered, and suggestions on implementation strategies.
- Identify information needs and formulate questions on key concerns

SEA LEVEL RISE IN RHODE ISLAND

LIVING WITH WATER



LOCAL ANALYSIS
DEMONSTRATION SITES

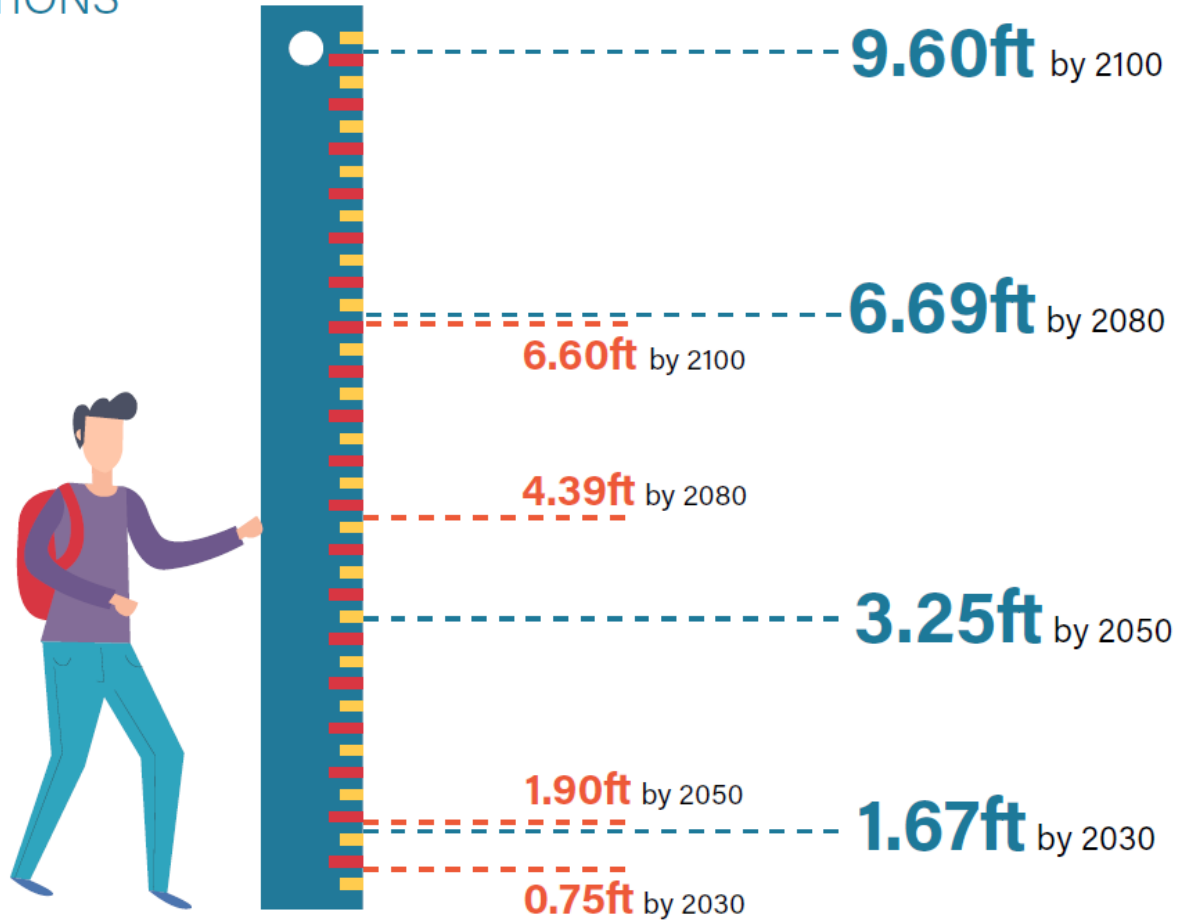


COASTAL INSTITUTE CLIMATE RESPONSE
DEMONSTRATION SITES



KEY CONCEPTS

SLR PREDICTIONS



2012 Projection

2017 Projection

LOCAL ANALYSIS



COMMUNITY



ECONOMY



HOUSING



INFRASTRUCTURE



HABITAT

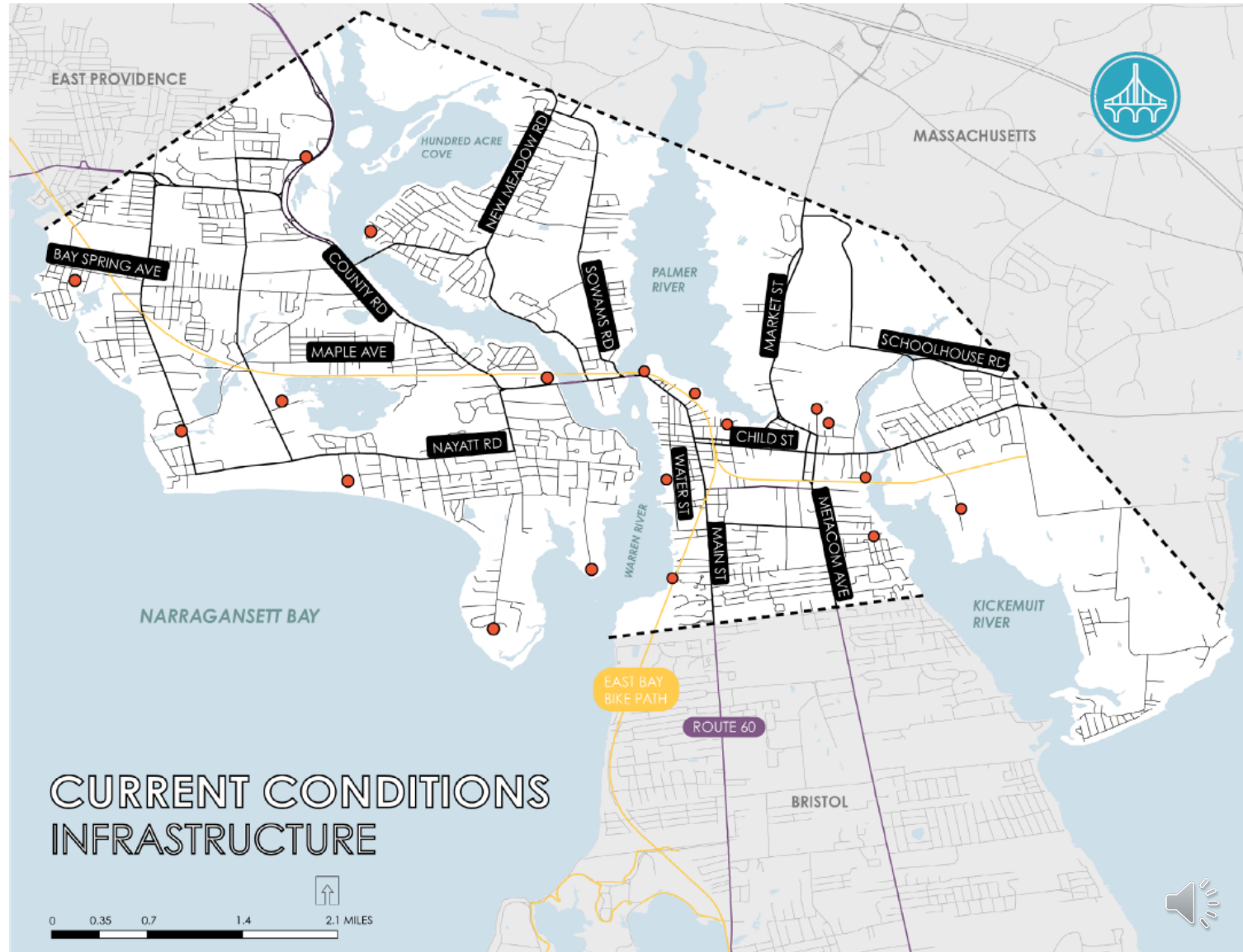


LOCAL ANALYSIS INFRASTRUCTURE

ROADS INUNDATED
0

PUMPS LOST
0

INFRASTRUCTURE
LOST
0



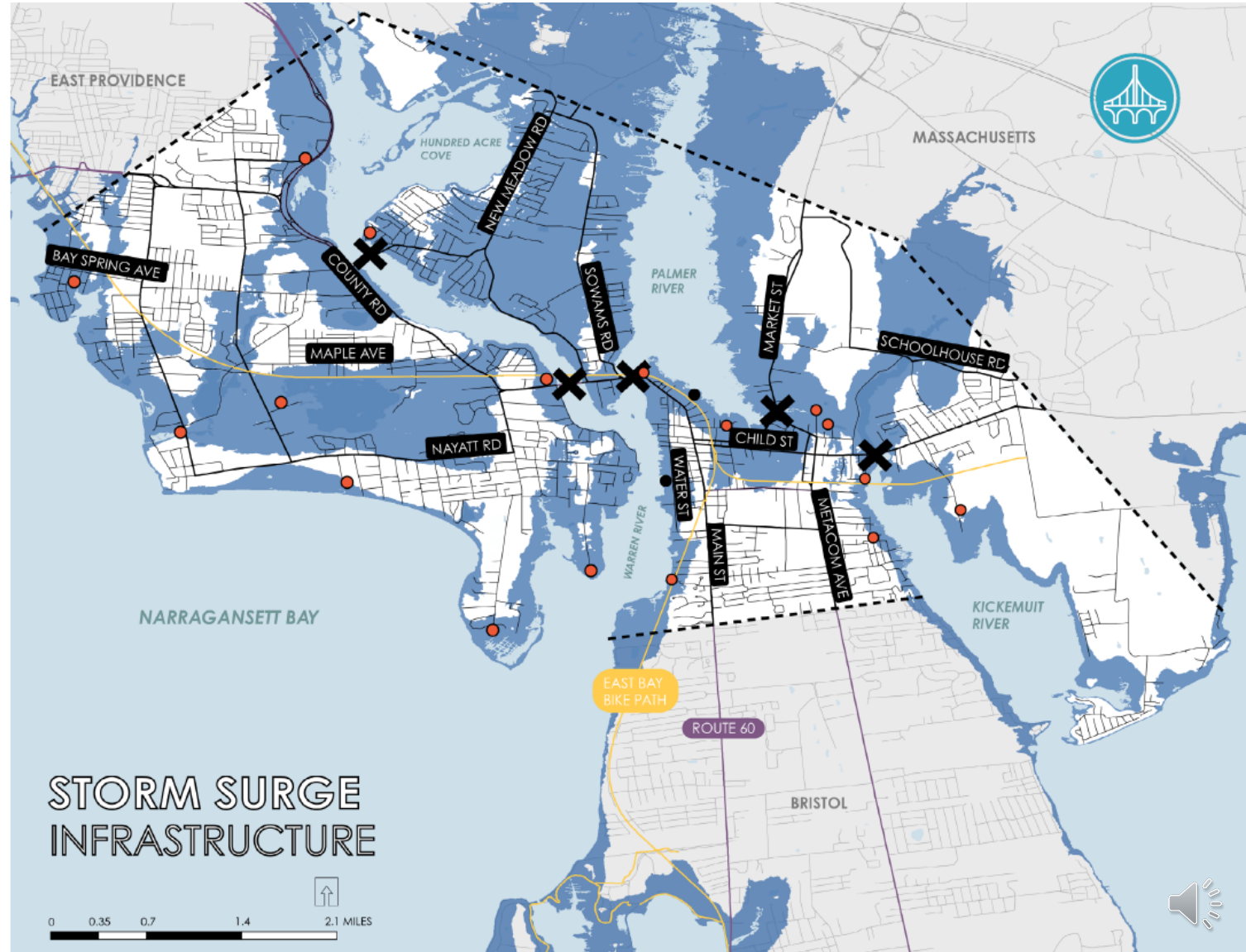
LOCAL ANALYSIS
INFRASTRUCTURE

ROADS INUNDATED
ALL STATE ROADS
ALL EVACUATION
ROUTES

PUMPS AT RISK
ALL

INFRASTRUCTURE AT
RISK

PUBLIC RESERVOIR
ALL BRIDGES
DAMS
WASTEWATER PLANT



LOCAL ANALYSIS INFRASTRUCTURE

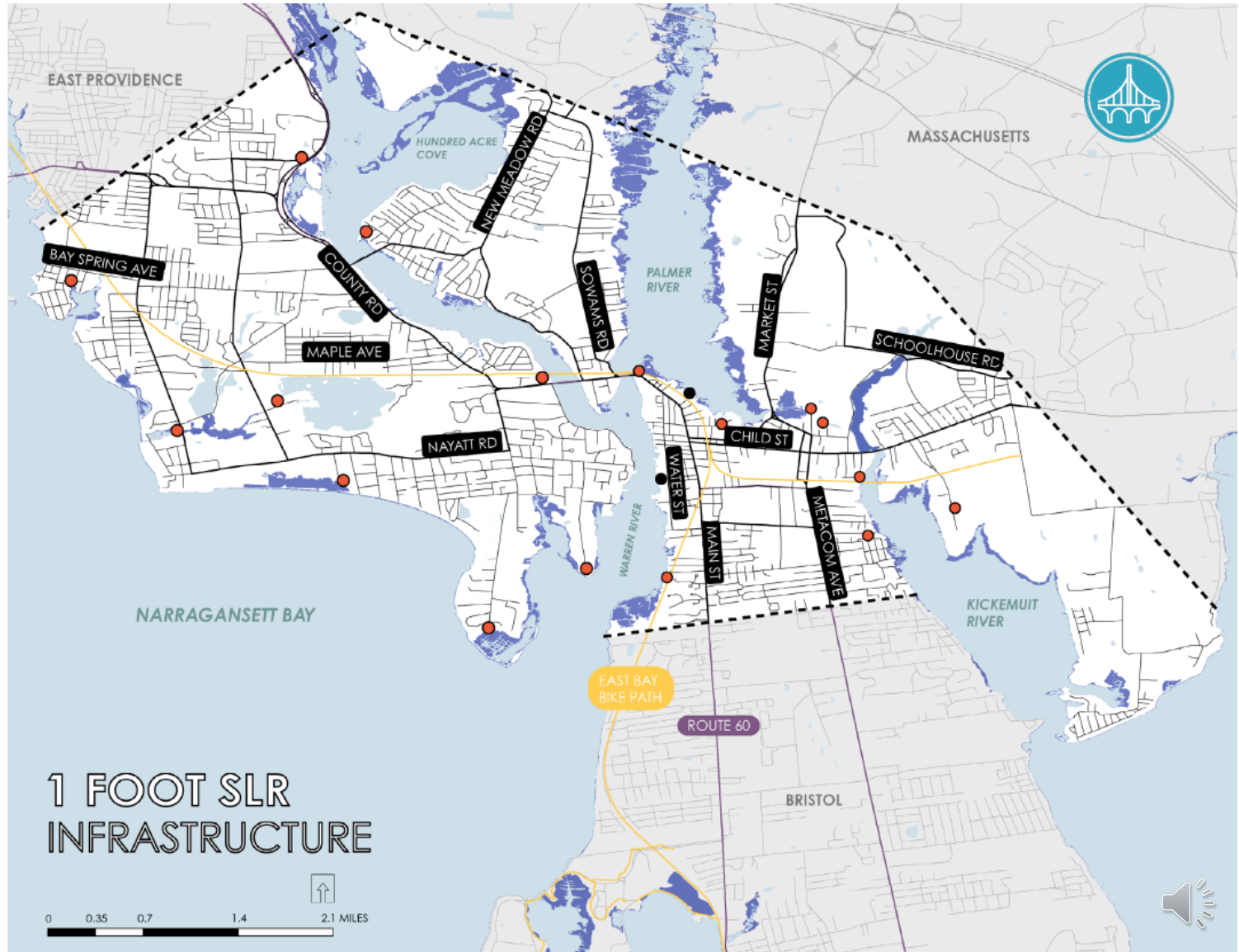
ROADS INUNDATED
0

PUMPS LOST
3

INFRASTRUCTURE
LOST

PUBLIC RESERVOIR

1 FOOT SLR
INFRASTRUCTURE



LOCAL ANALYSIS INFRASTRUCTURE

ROADS INUNDATED

MARKET ST
WATER ST
COUNTY RD
MAIN ST

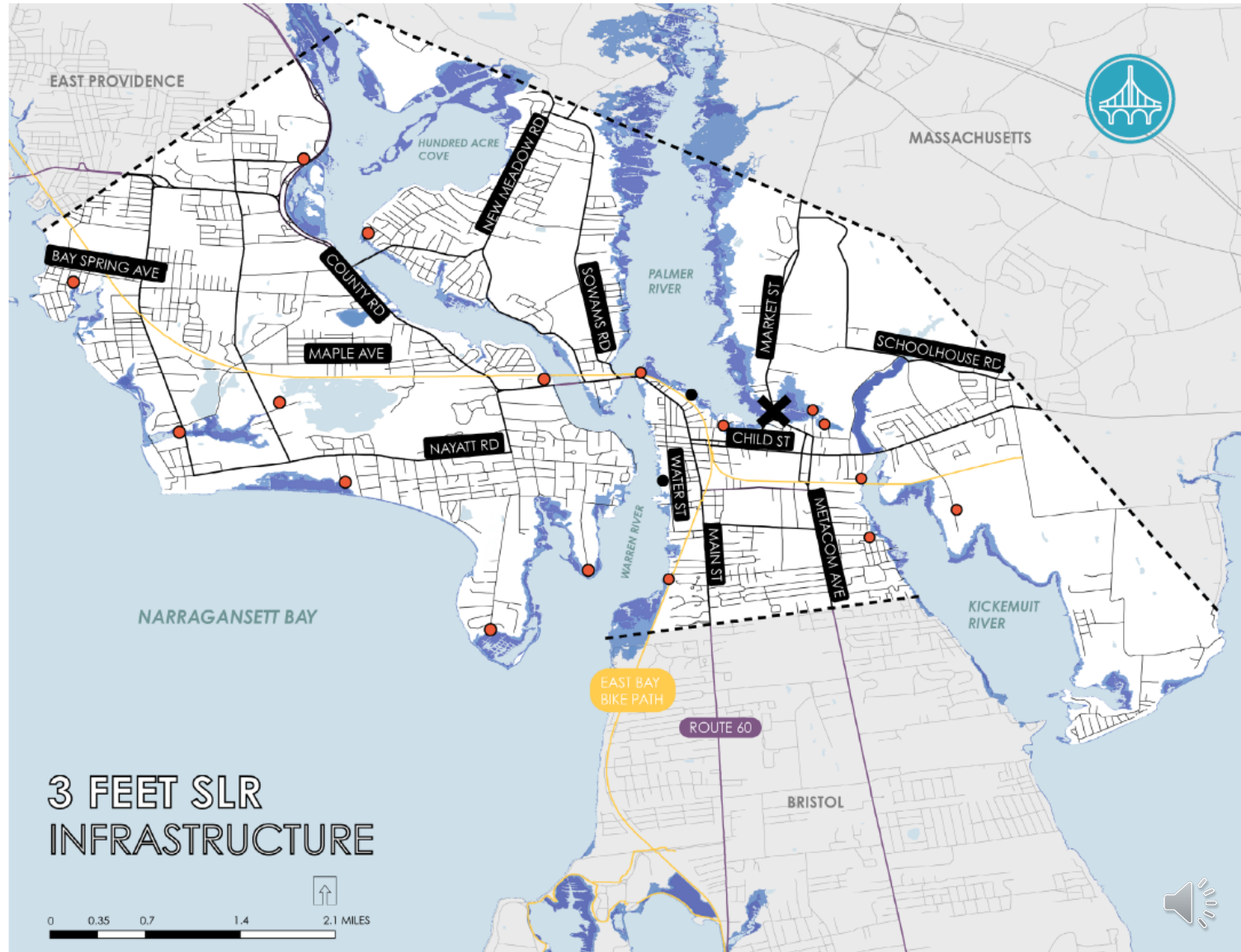
PUMPS LOST

8

INFRASTRUCTURE
LOST

PUBLIC RESERVOIR

3 FEET SLR
INFRASTRUCTURE



LOCAL ANALYSIS INFRASTRUCTURE

ROADS INUNDATED

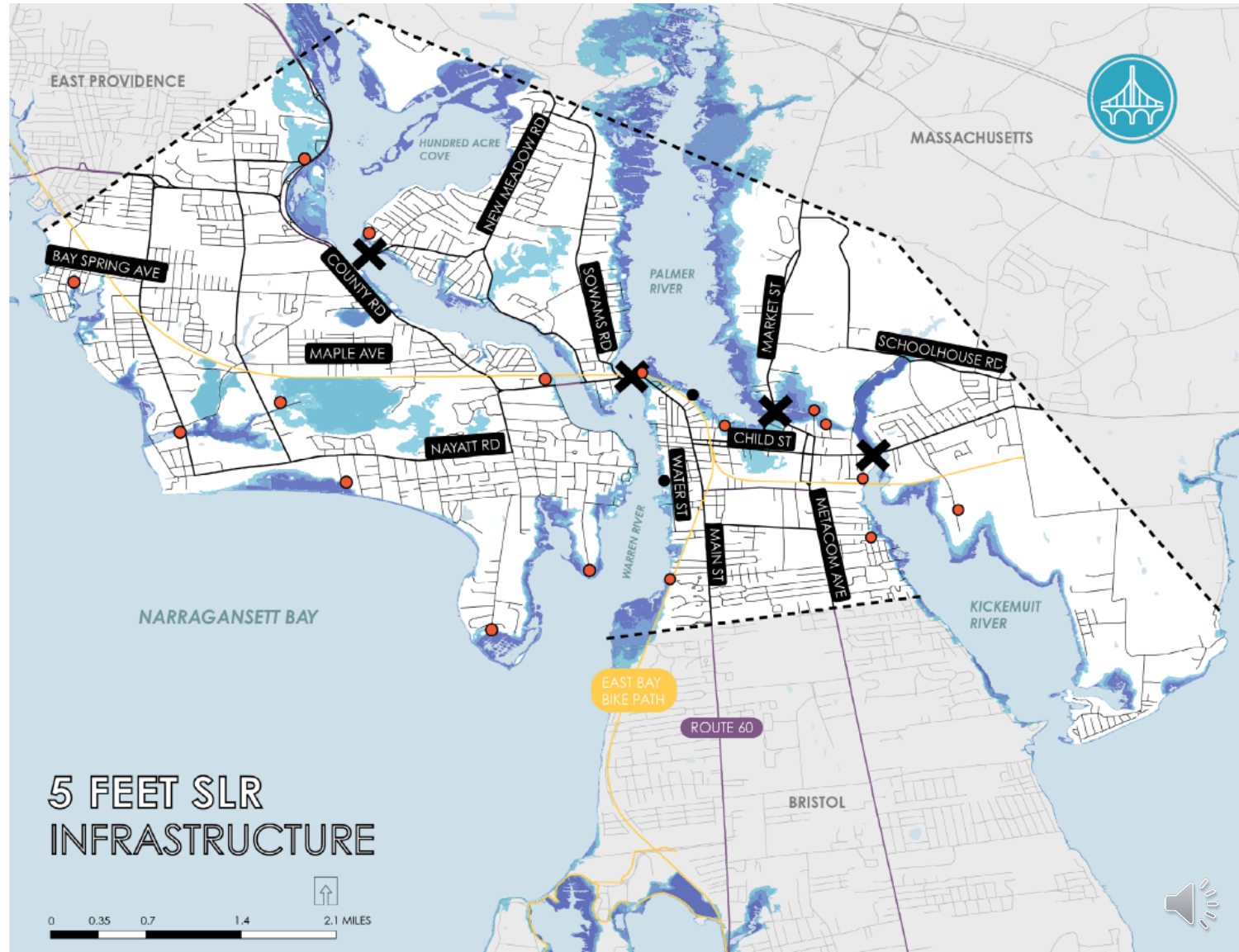
MARKET ST
WATER ST
COUNTY RD
MAIN ST
CHILD ST

PUMPS LOST

13

INFRASTRUCTURE
LOST

PUBLIC RESERVOIR
ALL BRIDGES



LOCAL ANALYSIS INFRASTRUCTURE

ROADS INUNDATED

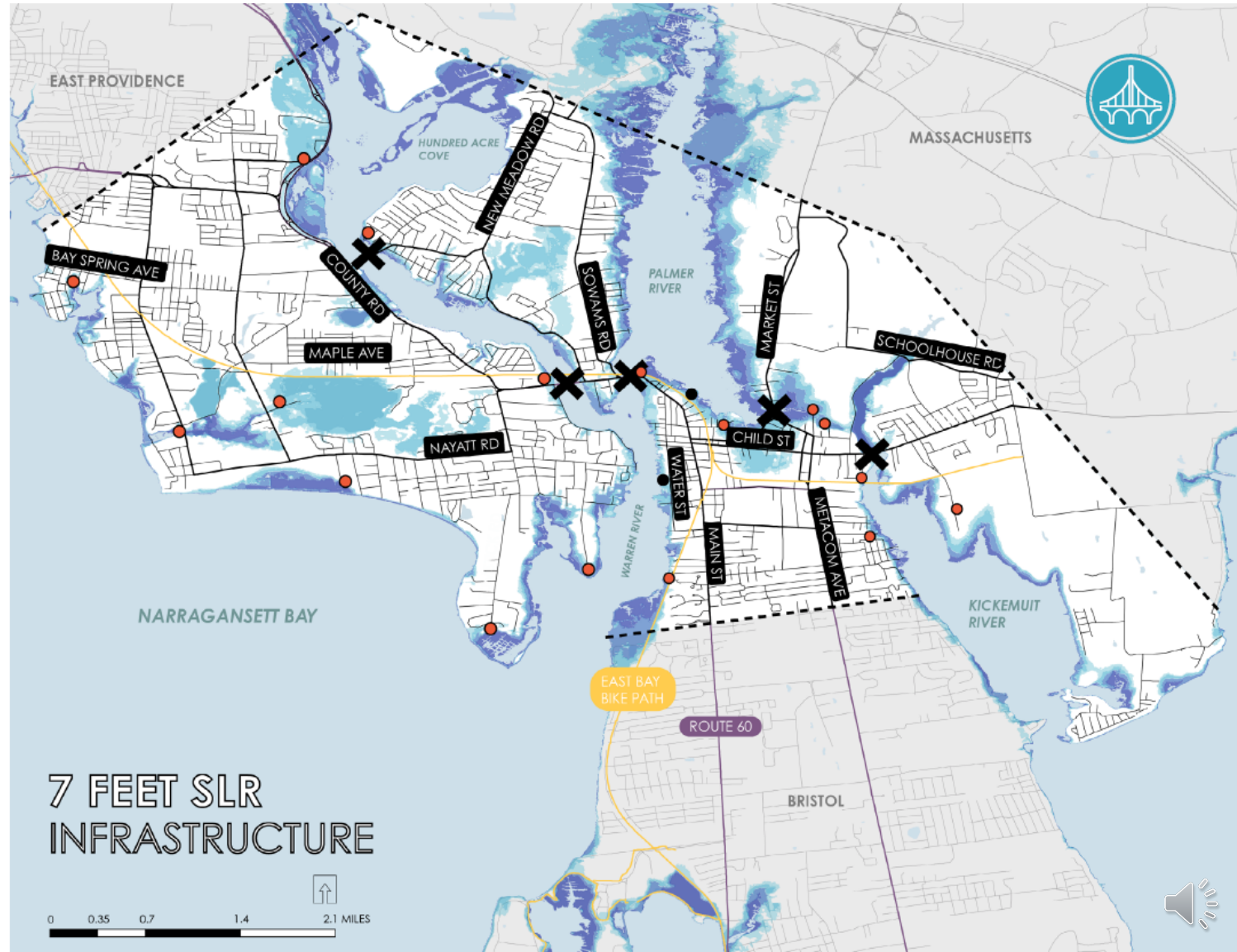
MARKET ST
WATER ST
COUNTY RD
MAIN ST
CHILD ST

PUMPS LOST

15

INFRASTRUCTURE
LOST

PUBLIC RESERVOIR
ALL BRIDGES
DAMS
WASTEWATER PLANT



STRATEGIES



REINFORCE

RESILIENCY
THROUGH
FORTIFICATION



RETREAT

WITHDRAWAL
AND
RELOCATION



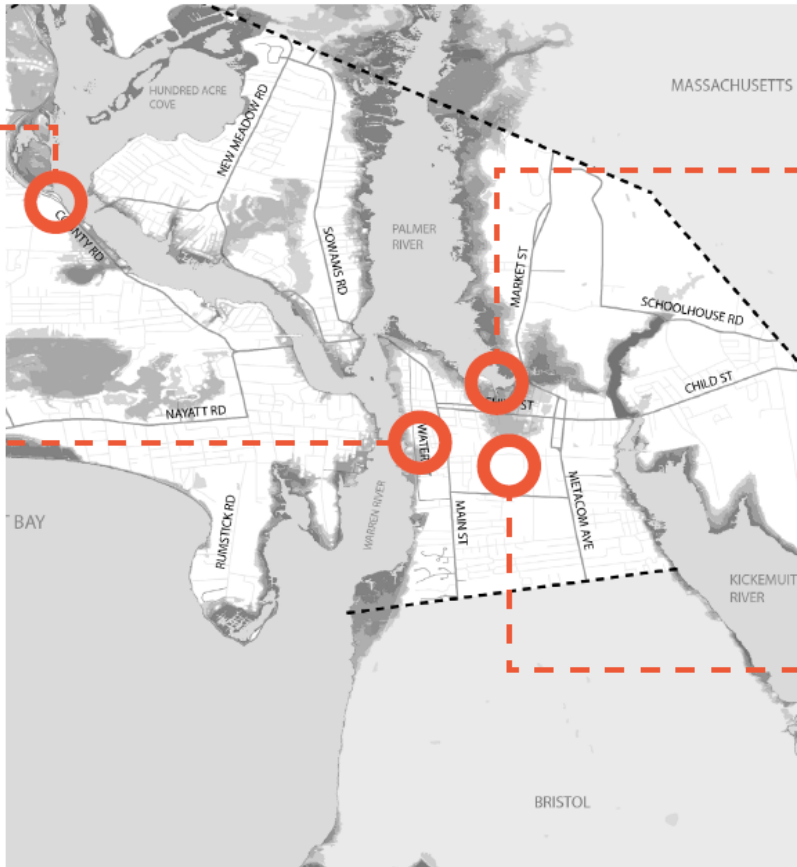
RESTORE

REMEDICATION
AND
PRESERVATION

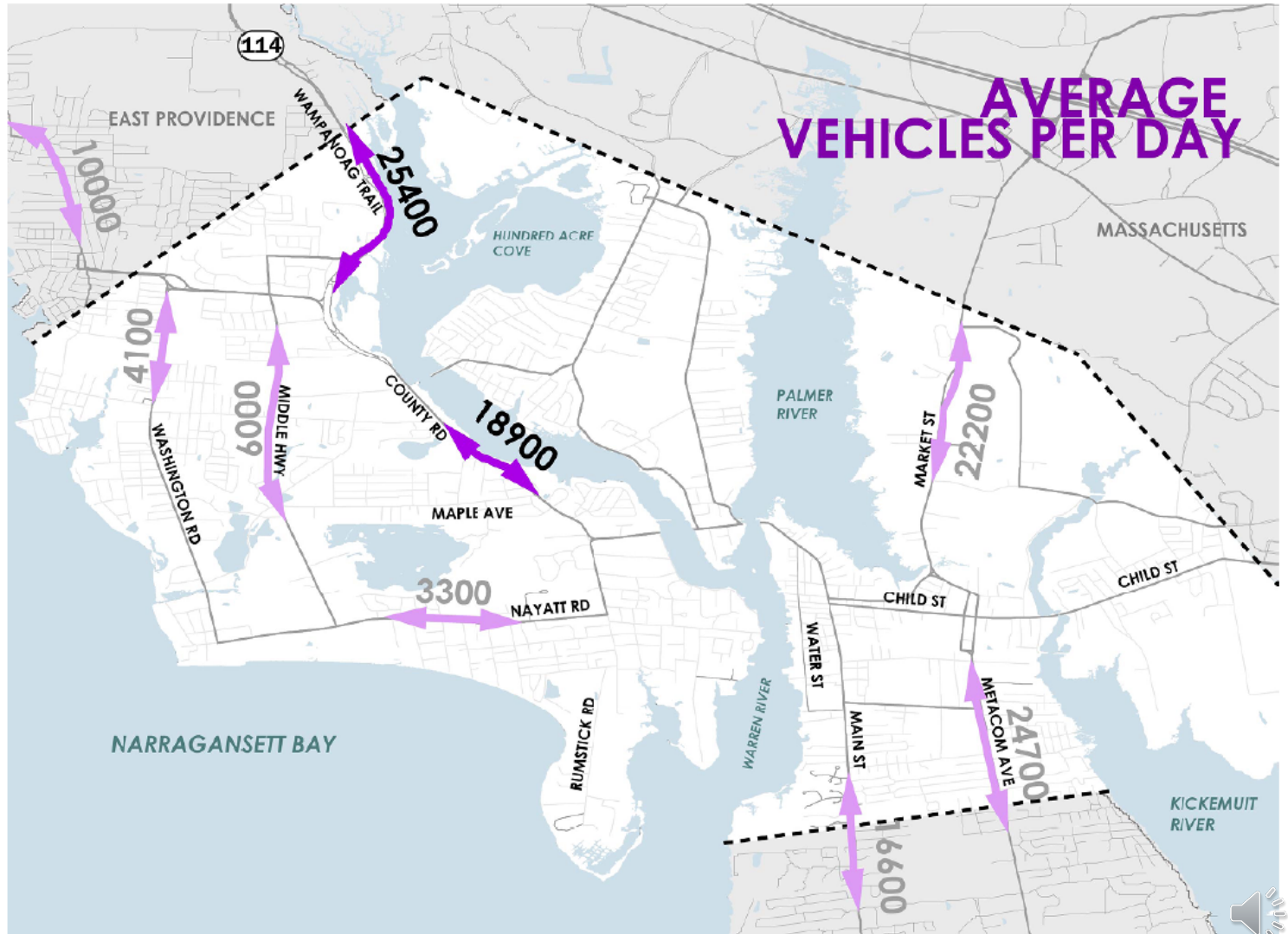


MOVING FORWARD

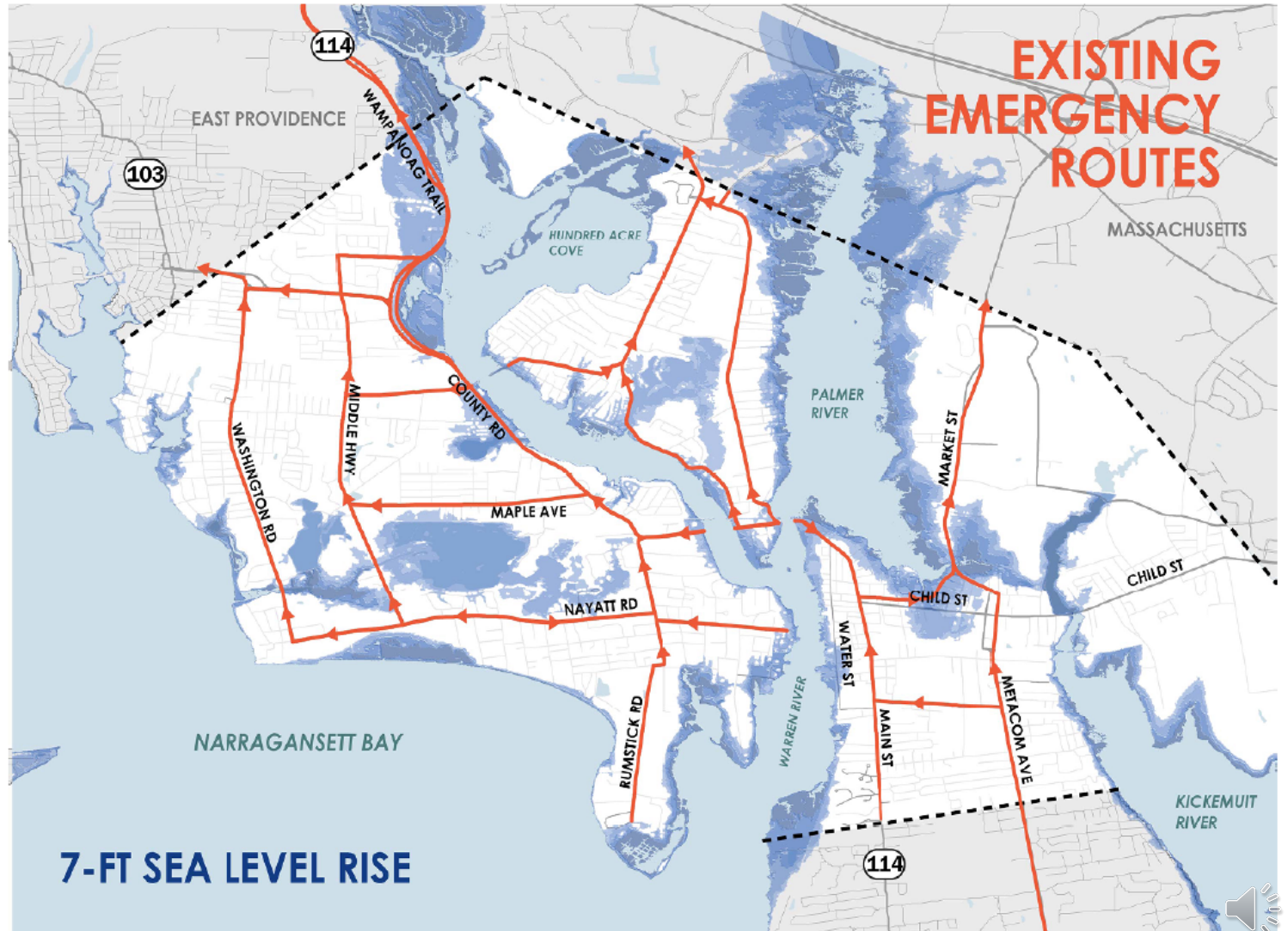
IDENTIFYING CRITICAL SITES



CRITICAL INFRASTRUCTURE TRAFFIC COUNTS



**CRITICAL
INFRASTRUCTURE
7 FEET OF SLR**

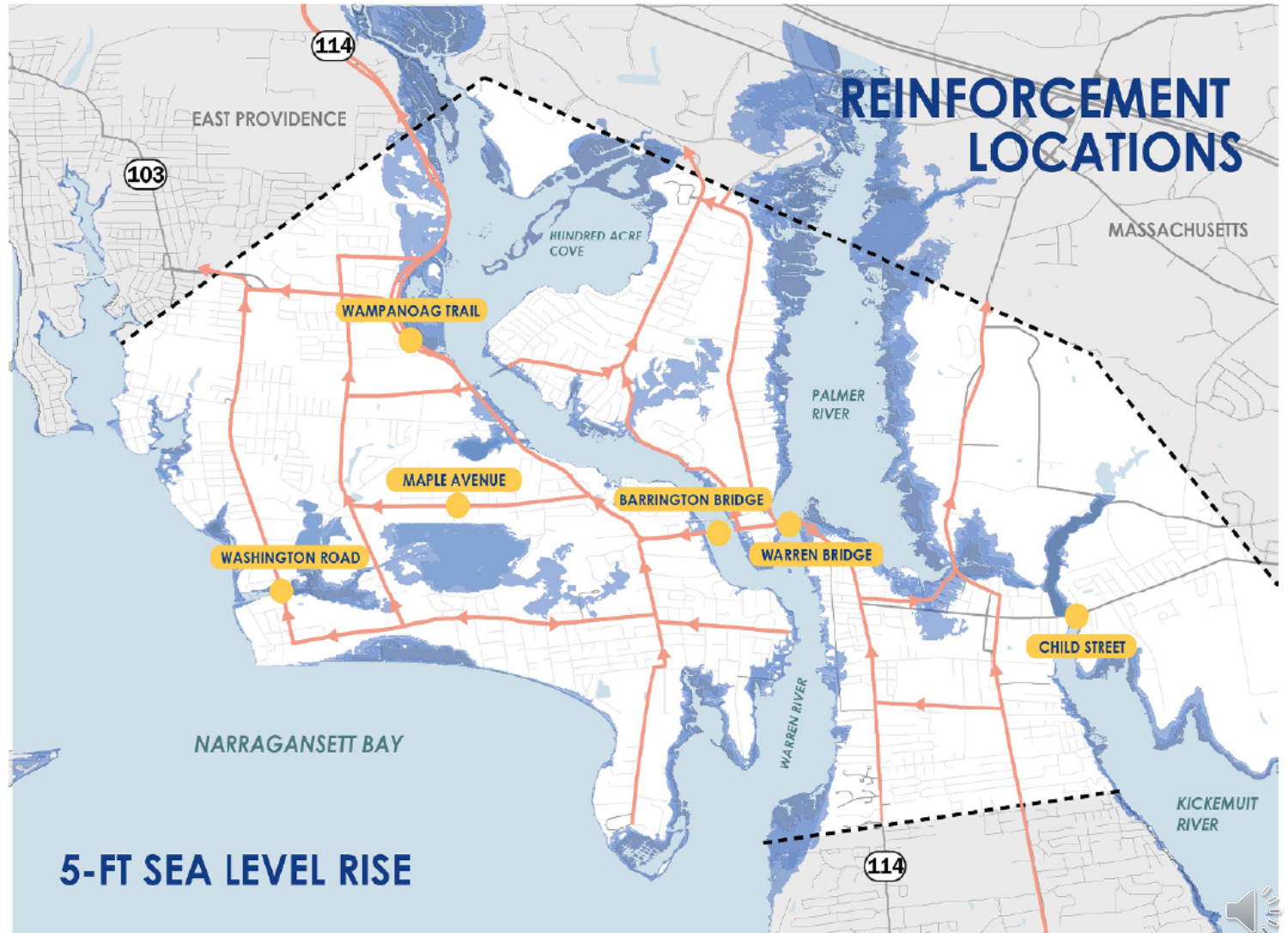


CRITICAL INFRASTRUCTURE ALTERNATIVES



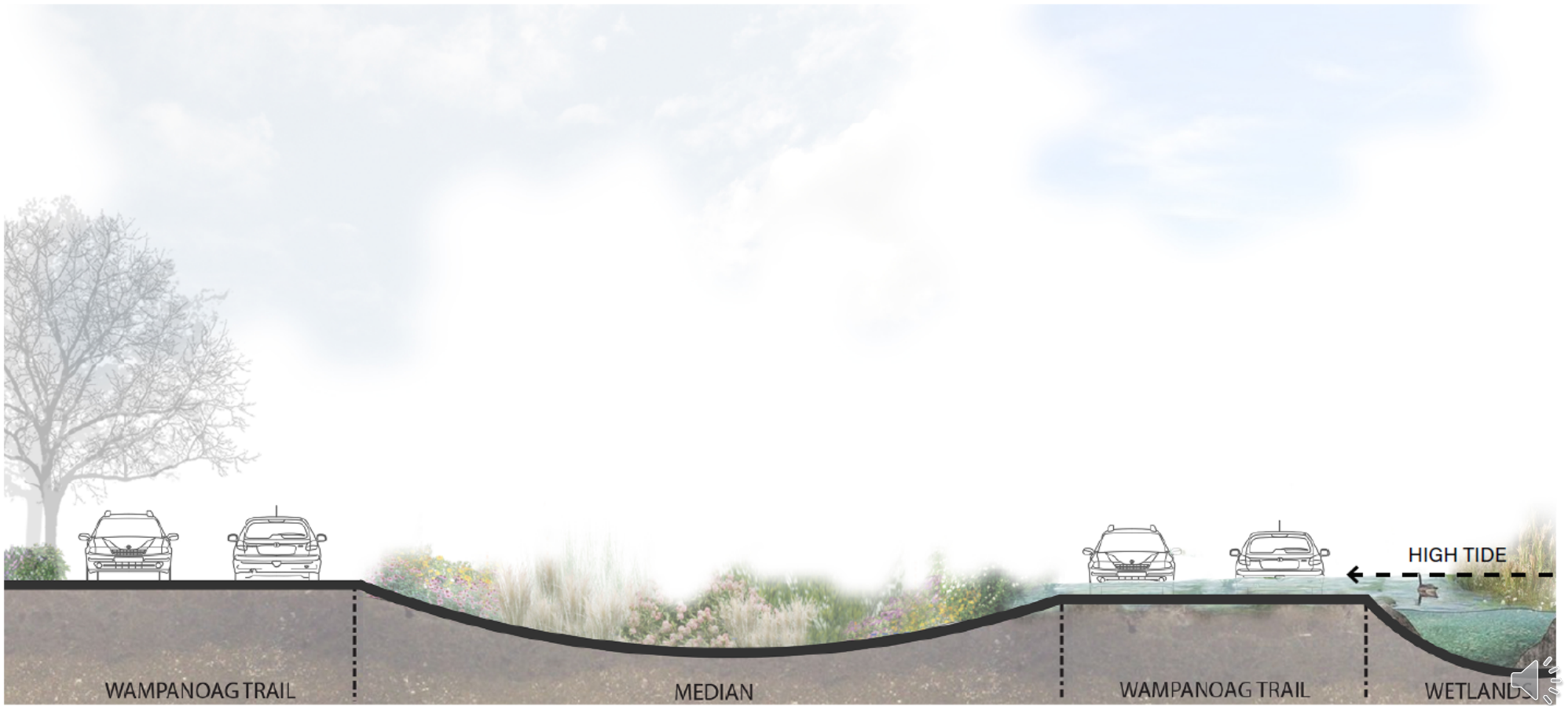
REINFORCE

RESILIENCY
THROUGH
FORTIFICATION

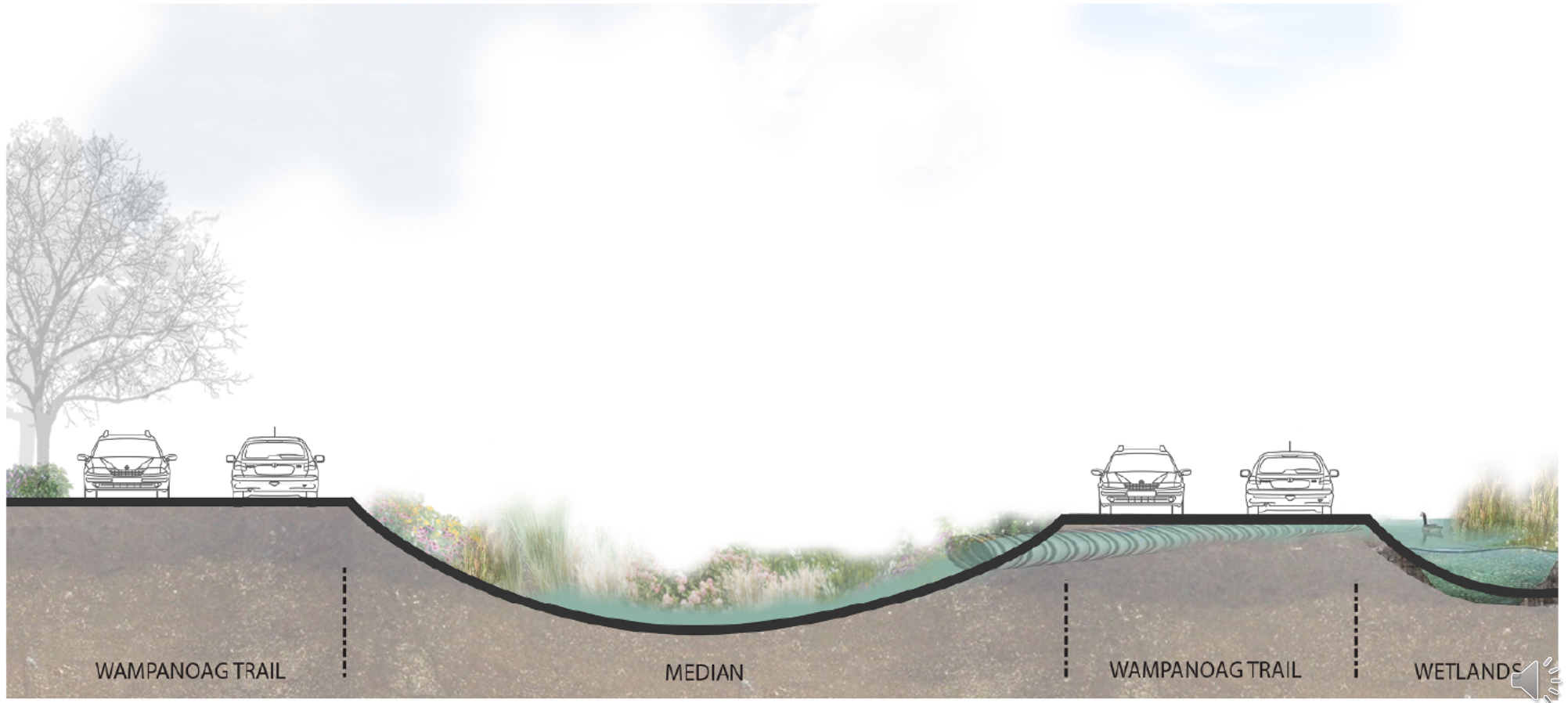


WAMPANOAG TRAIL

EXISTING CONDITIONS



WAMPANOAG TRAIL PROPOSED INTERVENTION

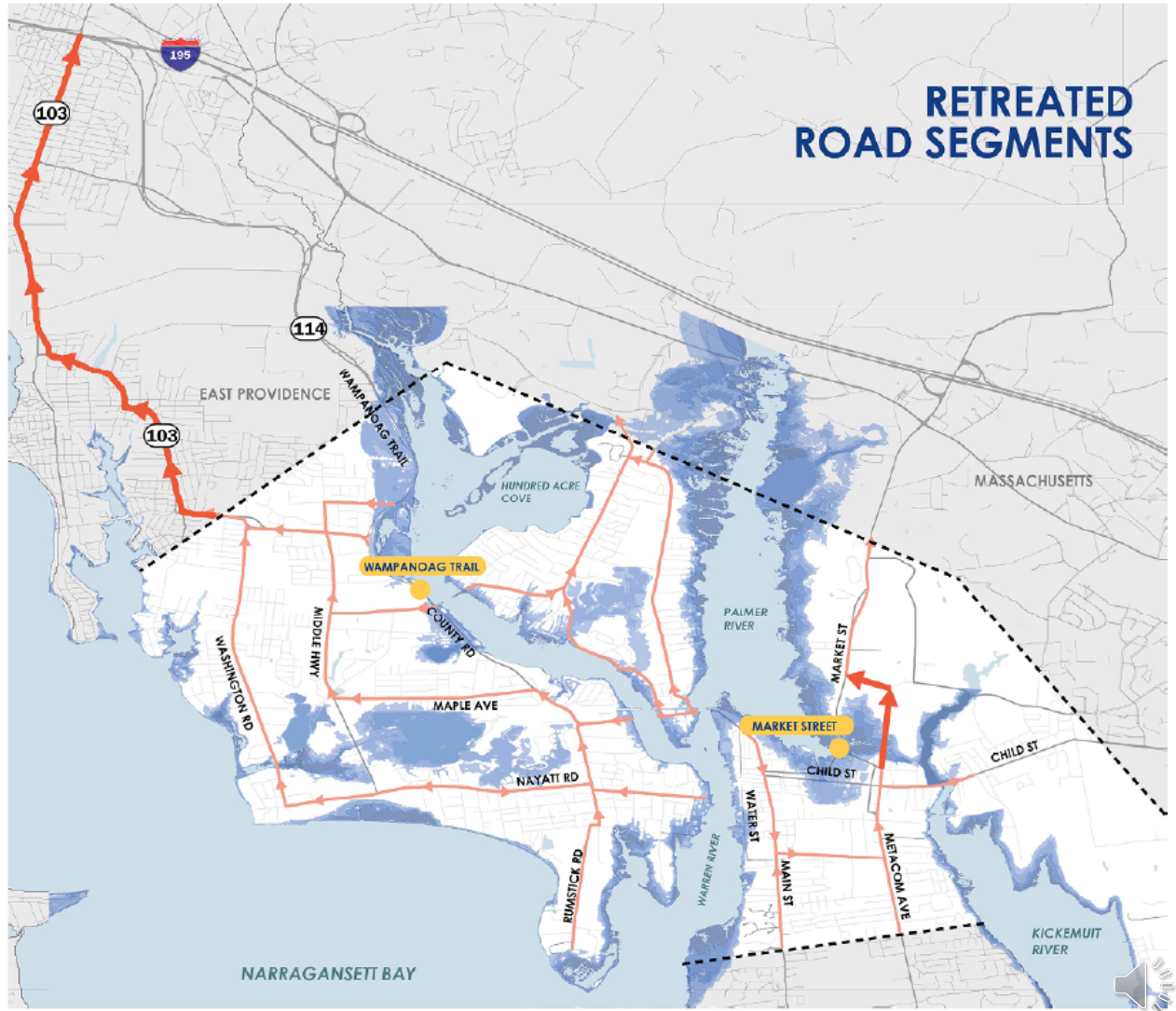


CRITICAL
INFRASTRUCTURE
PROPOSED
EMERGENCY ROUTES



RETREAT

WITHDRAWAL
AND
RELOCATION



CRITICAL INFRASTRUCTURE BOARDWALK



RESTORE

REMEDICATION
AND
PRESERVATION



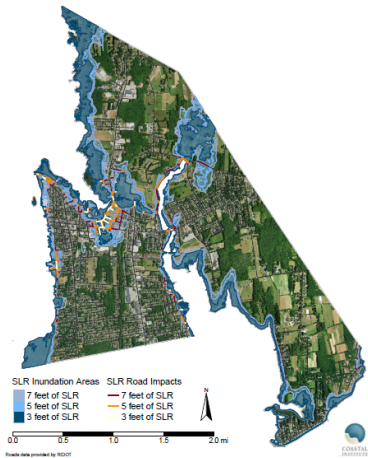


THANK YOU

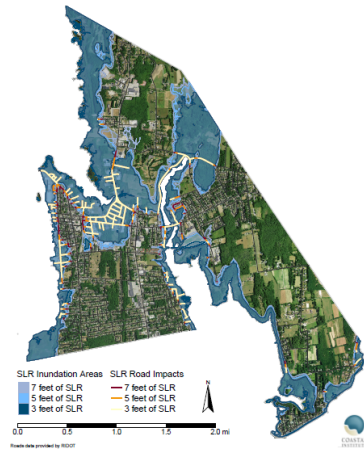


Warren's Transportation Concerns - Bob Rulli, Warren Town Planner

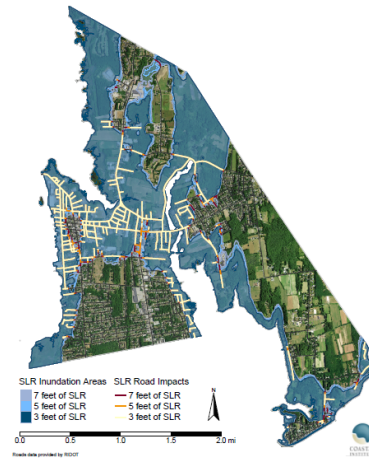
Mapping - Transportation Exposure



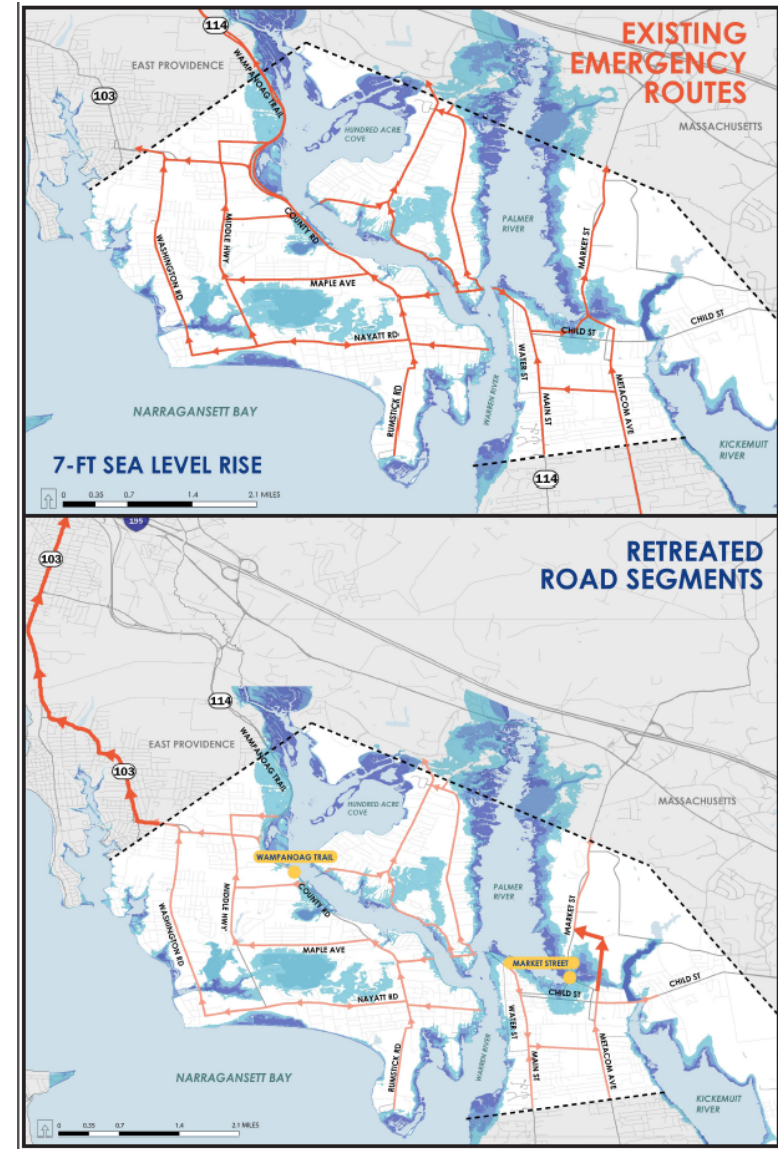
Mean Higher High Water
+ Sea Level Rise



Nuisance Storm
(10% Annual Chance)
+ Sea Level Rise



Hurricane
(1% Annual Chance)
+ Sea Level Rise





Sea Level Rise

In 2014, Executive Order 14-01 was enacted and called for the establishment of the Rhode Island Executive Climate Change Coordinating Council (EC4). The EC4 was created due to the recognition of the "strong evidence and scientific consensus that manmade greenhouse gases are causing an overall rise in global temperatures that is predicted to have profound effects on global climate, weather patterns and ocean conditions...

Upon the formation of the EC4, the Division of Statewide Planning launched efforts to evaluate climate change related events in the state of Rhode Island.

Work product timeline:

- 2014: The Division completed the Vulnerability of Transportation Assets to Sea Level Rise, a study which takes a statewide view to zero in on transportation infrastructure exposed to multiple sea level rise scenarios.
- 2016: In 2016, the Division completed two additional sea level rise projects. The first, Vulnerability of Municipal Transportation Assets to Sea Level Rise and Storm Surge indicates local infrastructure and transportation assets impacted at various sea level rise scenarios, and also factors in storm surge.
- 2016: The second project completed in 2016 was the Socioeconomics of Sea Level Rise project.

While much of the work and analyses previously performed on sea level rise focuses on infrastructure, the Socioeconomics of Sea Level Rise project is unique as people are the forefront of the analysis. The project aims to identify the number and demographic and socioeconomic makeup of the people located within multiple sea level rise inundation scenarios.

The Division continuously aims to address current and long-term challenges in an effort to assist Rhode Island communities. Sea level rise is a challenge that is culminating, relevant, and a topic which the Division would like to work on as a partner with communities.

Vulnerability of Statewide Transportation Assets to Sea Level Rise

The first sea level rise project completed by the Division of Statewide Planning was [Technical Paper 164: Vulnerability of Transportation Assets to Sea Level Rise](#), which was completed in 2014.

Quick Links

[Sea Level Rise Home](#)

[Statewide Transportation Assets](#)

[Municipal Transportation Assets](#)

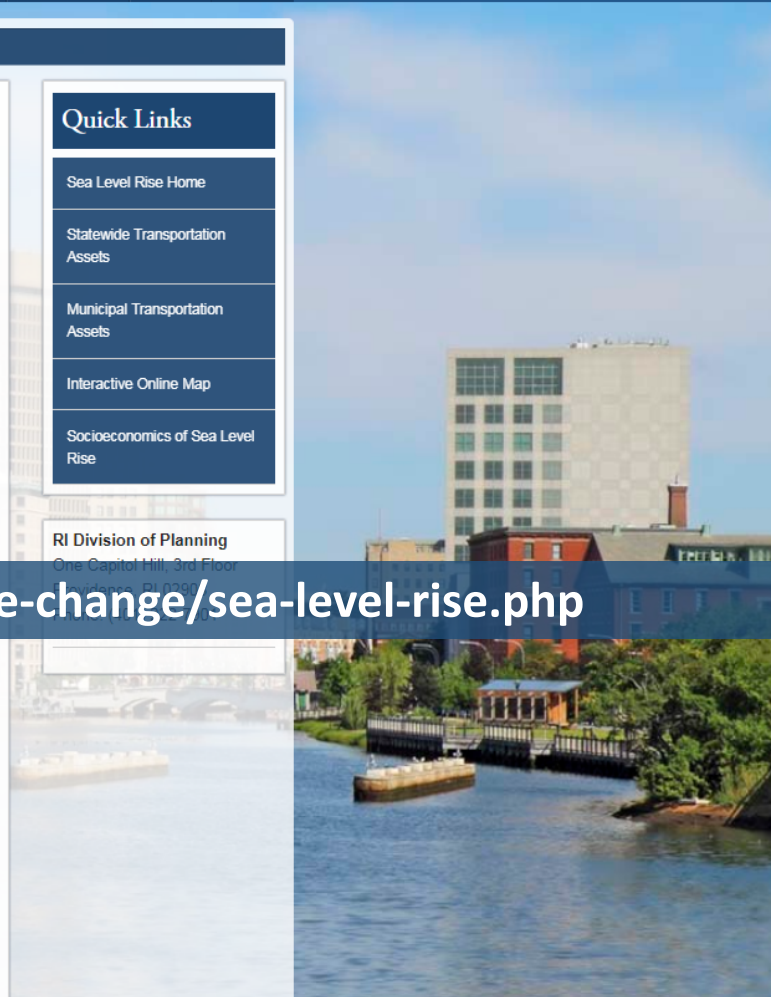
[Interactive Online Map](#)

[Socioeconomics of Sea Level Rise](#)

RI Division of Planning

One Capitol Hill, 3rd Floor
Providence, RI 02903

<http://www.planning.ri.gov/planning-areas/climate-change/sea-level-rise.php>



Vulnerability of Transportation Assets to Sea Level Rise

Technical Paper 164
January 2015

Rhode Island Statewide Planning Program
Division of Planning
Department of Administration
One Capitol Hill
Providence, RI 02908
www.planning.ri.gov

**Top 10
ROAD
SEGMENTS
most
vulnerable to
1-ft, 3-ft & 5-ft
Sea Level Rise**

Top 10 Road Segments Under State Jurisdiction Most Vulnerable to Sea Level Rise

Rank	Road Name	Municipality	Feet of SLR When Road First Floods	Functional Classification	Hurricane Evacuation Route	Linear Feet Flooded at:			Vulnerability Index Score
						1ft SLR	3ft SLR	5ft SLR	
1	County Rd (103)	Barrington	1	Principal Art.	Yes	31	248	2,888	8.8
2	Child St	Warren	1	Principal Art.	Yes	32	302	1,198	8.5
2	Main St	Warren	1	Principal Art.	Yes	25	318	883	8.5
3	Highland Rd	Tiverton	1	Major Collector	Yes	150	834	953	7.9
4	Massasoit Ave	Barrington	1	Minor Art.	Yes	15	59	630	7.5
5	Wampanoag Trl (114)	Barrington	3	Principal Art., Local	Yes	0	141	6,368	7.3
6	Poppasquash Rd	Bristol	1	Minor Collector	No	59	3,156	4,381	6.9
6	Hope St	Bristol	3	Principal Art.	Yes	0	583	2,021	6.9
7	Phillips St	N. Kingstown	3	Principal Art.	Yes	0	209	583	6.8
8	Market St	Warren	3	Principal Art., Minor Art.	Yes	0	1,129	2,164	6.7

**Top 10
RIPTA Routes
most
vulnerable to
1-ft, 3-ft & 5-ft
Sea Level Rise**

Top 10 RIPTA Routes Most Vulnerable to Sea Level Rise									
Rank	#	Name	Weekly Ridership (people)	Weekly Frequency (trips)	SLR Scenario When Route First Impacted	Stops Flooded at 3 ft SLR	Stops Flooded at 5 ft SLR	Feet Flooded at 5 ft SLR	Vulnerability Index Score
1	60	Providence/Newport	332,983	551	1	5	33	15,918	10.0
2	66	URI/Galilee	192,375	278	3	1	6	7,561	5.6
3	14	West Bay	85,518	190	3	2	9	8,660	5.2
4	33	Riverside	158,398	404	3	0	4	1,485	4.5
5	64	Newport/URI	41,475	118	3	0	7	6,430	3.9
5	65	Wakefield Express	28,935	55	3	1	4	5,605	3.9
7	3	Warwick Ave	148,719	399	3	0	0	1,195	3.8
8	67	Bellevue Mansion/Salve Regina	54,220	514	5	0	1	2,576	3.7
9	1	Eddy St	197,685	516	5	0	0	801	3.6
10	32	East Providence/Wampanoag	24,958	189	3	0	4	1485	3.0
10	34	East Providence	55,565	209	3	0	4	1,485	3.0

**Top 10
RIPTA Stops
most
vulnerable to
1-ft, 3-ft & 5-ft
Sea Level Rise**

Top 10 RIPTA Stops Most Vulnerable to Sea Level Rise						
<u>Rank</u>	<u>Name</u>	<u>Ridership - Weekly</u>	<u>SLR Scenario When Route First Impacted</u>	<u># Lines Served</u>	<u>Avg # Passengers Getting on On+Off</u>	<u>Vulnerability Index Score</u>
1	Gateway Center	Newport	5	5	1,060	6.8
2	W Marlborough Ns Thames	Newport	5	3	150	5.6
3	S Water At James	Providence	5	4	11	5.3
3	S Water Fs Crawford	Providence	5	4	31	5.3
5	Hope Fs Washington	Bristol	3	1	15	5.1
6	Sand Hill Cove Opp Roger Wheeler Beach	Narragansett	3	2	1	4.5
7	Barrington Park N Ride (White Church)	Barrington	5	1	84	4.4
7	Barrington Park N Ride (White Church)	Barrington	5	1	77	4.4
8	Great Island Rd at Ferry Terminal	Narragansett	5	2	33	4.1
8	S Water Opp Power	Providence	5	4	5	4.1
8	S Water Between Packet & Planet	Providence	5	4	6	4.1

**Top 10
Bridges
most
vulnerable to
1-ft, 3-ft & 5-ft
Sea Level Rise**

Top 10 Bridges Under State Jurisdiction Most Vulnerable to Sea Level Rise									
<u>Bridge Name</u>	<u>Town</u>	<u>Facility</u>	<u>Feature Intersected</u>	<u>Year Built</u>	<u>AADT</u>	<u>Inches of Freeboard</u> ⁷	<u>Currently over MHHW?</u>	<u>Access Problem</u>	<u>Vulnerability Index Score</u>
Barrington	Barrington	RI 114/103 CNTY RD	Barrington River	2009	26,000	74	Y	problem	9.6
Warren	Barrington	RI 114/103 CNTY RD	Warren River	1914	19,900	98	Y	problem	9
C.L. Hussey Memorial	North Kingstown	US 1A BSTN NCK RD	Wickford Cove	1925	9,100	48	Y	problem	8.85
Wickford	North Kingstown	US 1A Bstn Nck Rd	Academy Cove	1951	9,100	61	Y	problem	8.85
New Harbor Road	New Shoreham	Ocean Av	Trimms Pond	1925	7,000	70	Y	problem	8.85
New Shoreham	New Shoreham	Beach Av	Harbor Pond	1997	7,000	73	Y	problem	8.85
Barrington Parkway	East Providence	Veterans Mem Pkwy	Watchemoket Cove	1973	12,700	80	Y	problem	8.25
Bridgetown	Narragansett	Bridgetown Rd	Pettaquamscutt River	1934	9,800	86	Y	problem	8.25
Central	Barrington	Massasoit Av	Barrington River	1940	8,800	99	Y	problem	8.25
Silver Creek	Bristol	RI 114 Hope St	Tidal Inlet	1922	18,200	20	N	problem	8

**Top 10
Bike
Infrastructure
Segments
most
vulnerable to
1-ft, 3-ft & 5-ft
Sea Level Rise**

Top 10 Bike Infrastructure Segments Most Vulnerable to Sea Level Rise								
Rank	Road Name and/or Bike Network Name	Segment Type	Town	SLR Scenario When First Impacted	Linear Feet Flooded at:			Vulnerability Index Score
					1ft SLR	3ft SLR	5ft SLR	
1	East Bay Bike Path	Path	East Providence	1	222	2,144	5,336	8
2	East Bay Bike Path	Path	Bristol	1	74	1,975	2,916	7.4
3	Crompton Ave Landfill Bikeway Segment	Path	East Greenwich	1	18	376	761	6.2
4	East Bay Bike Path	Path	Warren	1	12	32	2,889	6
5	East Bay Bike Path	Path	Barrington	1	25	69	496	5.4
6	Point Ave - Warwick-East Greenwich Bicycle Network	Local Bike Route	Warwick	3	0	626	3,017	5.2
6	Sand Hill Cove Road	Statewide Route	Narragansett	3	0	1,079	3,936	5.2
6	Shawomet Ave - Warwick-East Greenwich Bicycle Network	Local Bike Route	Warwick	3	0	957	2,350	5.2
6	Calf Pasture Point Bike Path (Old Sanford Rd)	Path	North Kingstown	3	0	72.9	1,638	5.2
9	Eagle St - Northwest Trail-Woonasquatucket River Bikeway	Local Bike Route	Providence	1	3	79	377	4.6
9	Galilee Connector Road	Statewide Route	Narragansett	3	0	738	1,137	4.6
9	Warren Bike Path	Path	Warren	1	12	37	98	4.6
9	Boston Neck Road	Statewide Route	North Kingstown	1	20	35	120	4.6

**Top 10
Park & Ride Facilities
most vulnerable to 1-ft, 3-ft & 5-ft
Sea Level Rise**

Park and Ride Facilities Affected by Sea Level Rise			
Municipality	Type	Feet of SLR	Location
Newport	RIPTA Park and Ride	5	Gateway Center At 60 Bus Berth
Barrington	RIPTA Park and Ride	5	Barrington Park N Ride (White Church)

Details | Basemap

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Legend

RoadSegments, Top 10 Most Vulnerable to SLR

■ Road Segments, Top 10 Most Vulnerable to SLR

Bridges, Top 10 Most Vulnerable to SLR

● Bridges, Top 10 Most Vulnerable to SLR

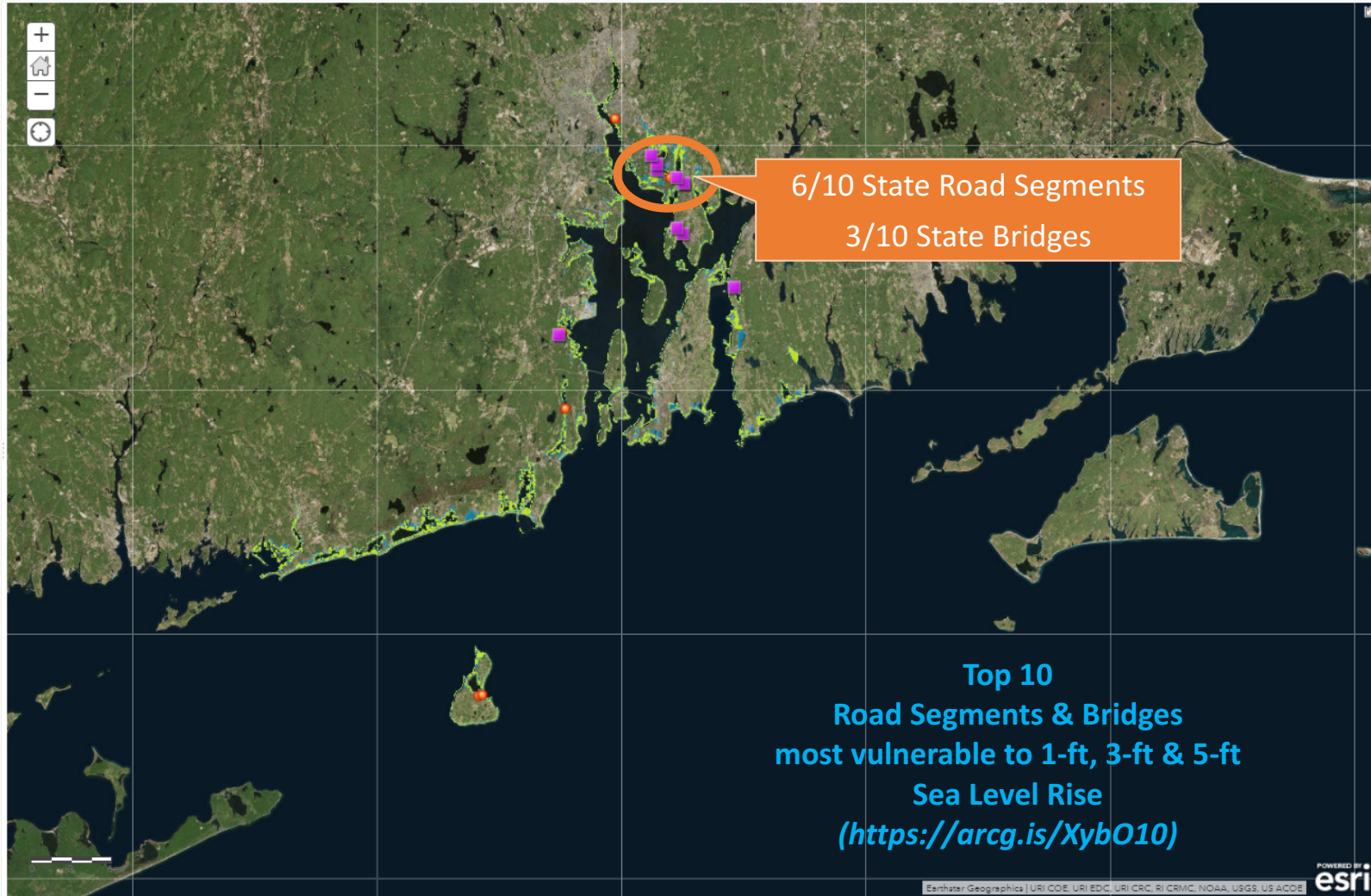
1-ft Sea Level Rise (High Tide) (flooding in feet)



3-ft Sea Level Rise (High Tide) (flooding in feet)



5-ft Sea Level Rise (High Tide) (flooding in feet)



Details Basemap

Share Print Measure Find address or place

About Content Legend

Legend

RoadSegments, Top 10 Most Vulnerable to SLR

Road Segments, Top 10 Most Vulnerable to SLR

Bridges, Top 10 Most Vulnerable to SLR

Bridges, Top 10 Most Vulnerable to SLR

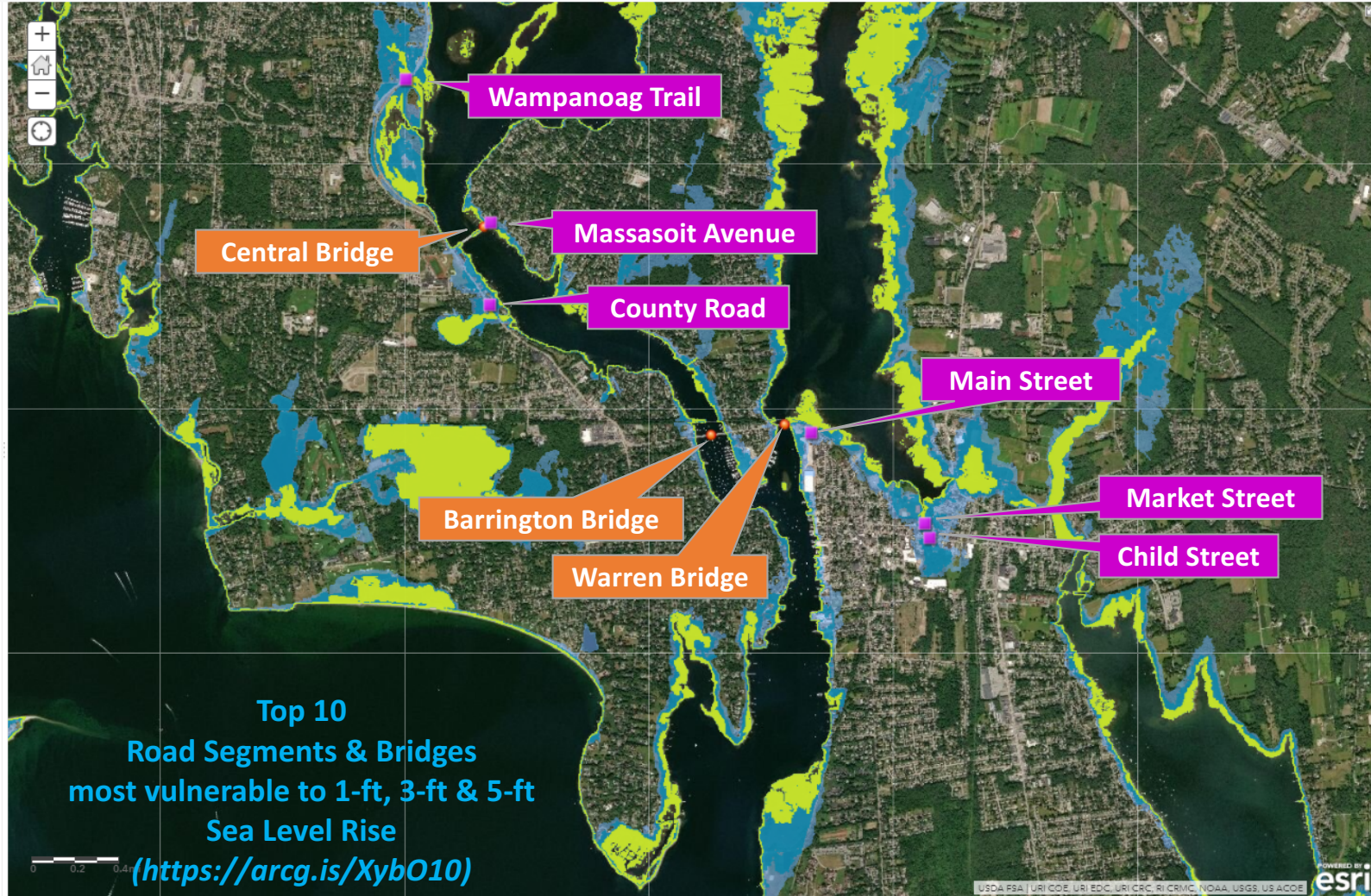
1-ft Sea Level Rise (High Tide) (flooding in feet)



3-ft Sea Level Rise (High Tide) (flooding in feet)



5-ft Sea Level Rise (High Tide) (flooding in feet)



BREAKOUT GROUPS

- 1. Rank the top 3 transportation areas of concern in the town.**
- 2. What are the local and regional consequences of a flooded transportation network in town?**
- 3. What are the alternatives for adaptation to future flooding and what are the challenges to implementing these alternatives?**