



Market to Metacom

Warren, Rhode Island

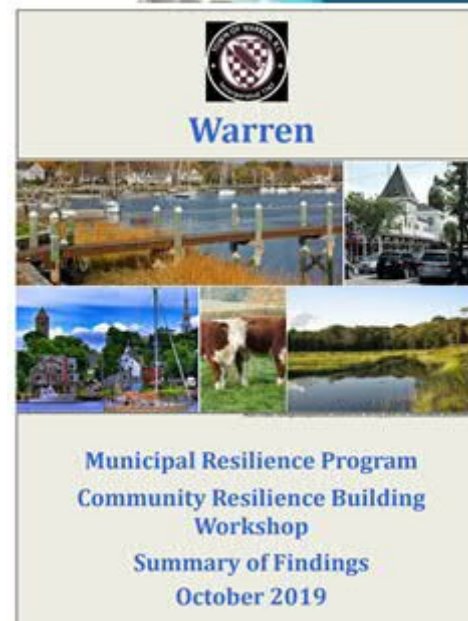
Climate Resilience and Economic Development Plan



December 16, 2021

Market to Metacom Project - Background

- Why is Warren doing this project at this time?
 - Climate change is bringing
 - *rising sea levels*
 - *stronger storms*
 - *more intense precipitation events*
 - Warren has done forecasting and planning for Town-wide impacts
 - *Municipal Resilience Plan*
 - *Hazard Mitigation Planning*
 - *URI and UPenn Projects*



Market to Metacom Project - Background

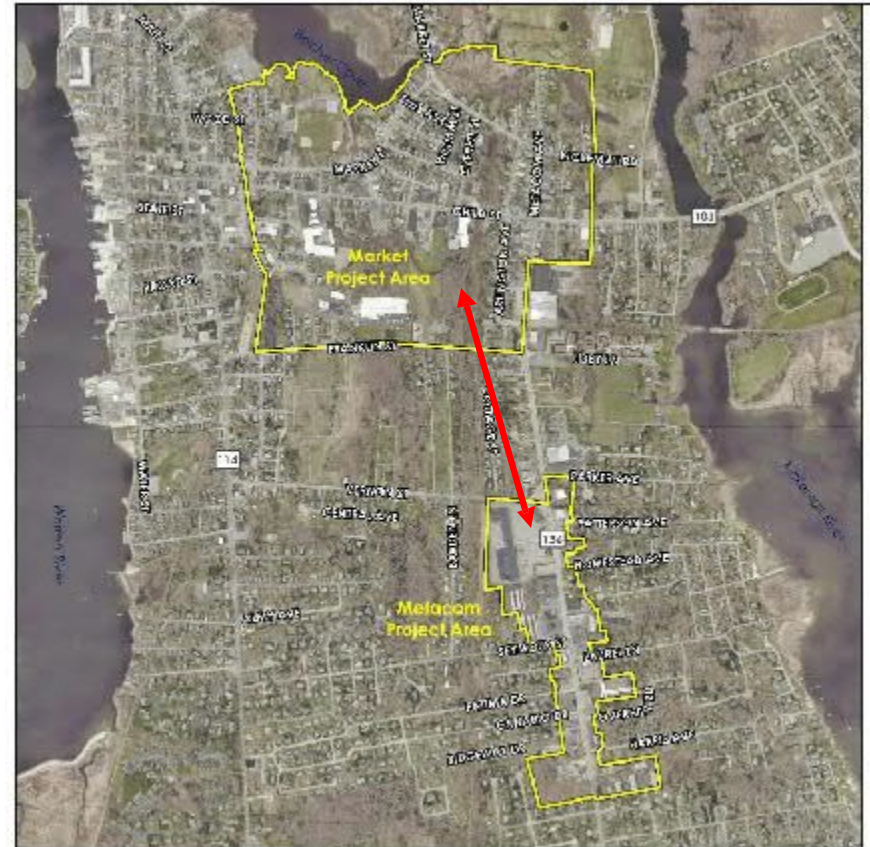
- Warren is one of the lowest lying towns in RI, and the Market Street area is one of the lowest lying areas of Warren.
- At the same time, Metacom Avenue is one of the Town's highest areas and is underutilized and has potential for redevelopment.



Market to Metacom Project - Background

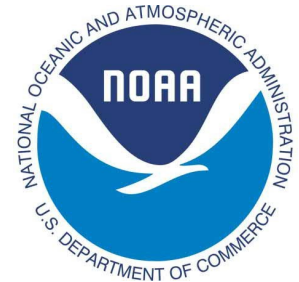
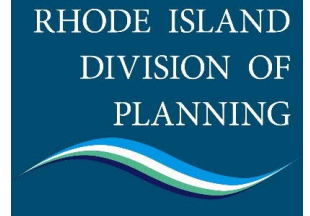
Grant from Southeast New England Program (SNEP) of Restore America's Estuaries

Explore concept of linking the future of adaptation in Market Street area with redevelopment in Metacom Avenue corridor.



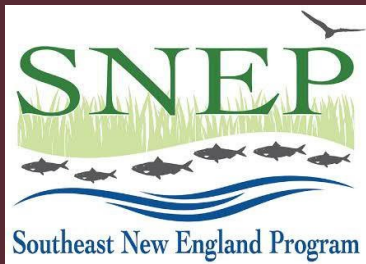
Methodology and Data

- Property/tax data – Town of Warren
- GIS data – Warren/State of RI
- Climate forecast: NOAA
- Sea level rise and storm data: StormTools
- Disaster impact estimates: FEMA and FloodFactor
- Road/bridge data – RIDOT/Statewide Planning/national





Existing Conditions: Market Street Project Area



Warren Birdseye View - 1877



a. Warren Block
b. Hotel Block
c. Green Block
d. General Store
e. Stone Block

VIEW OF
WARREN, R.I.
1877.

f. St. Mark's Church
g. St. Mark's School
h. St. Mark's Rectory
i. St. Mark's Cemetery
j. St. Mark's Chapel
k. St. Mark's Hall
l. St. Mark's Tower

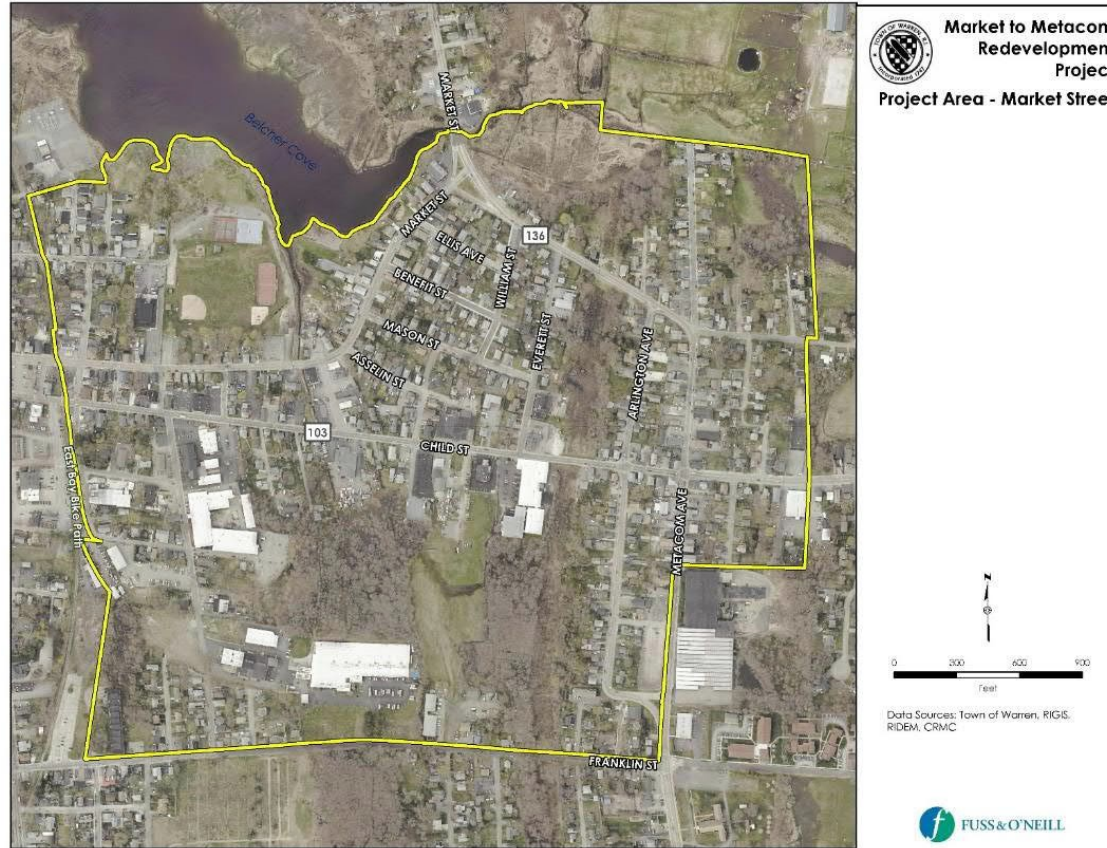
1939 Aerial – Market/Child Streets



Market Street - Project Area

Area contains approximately:

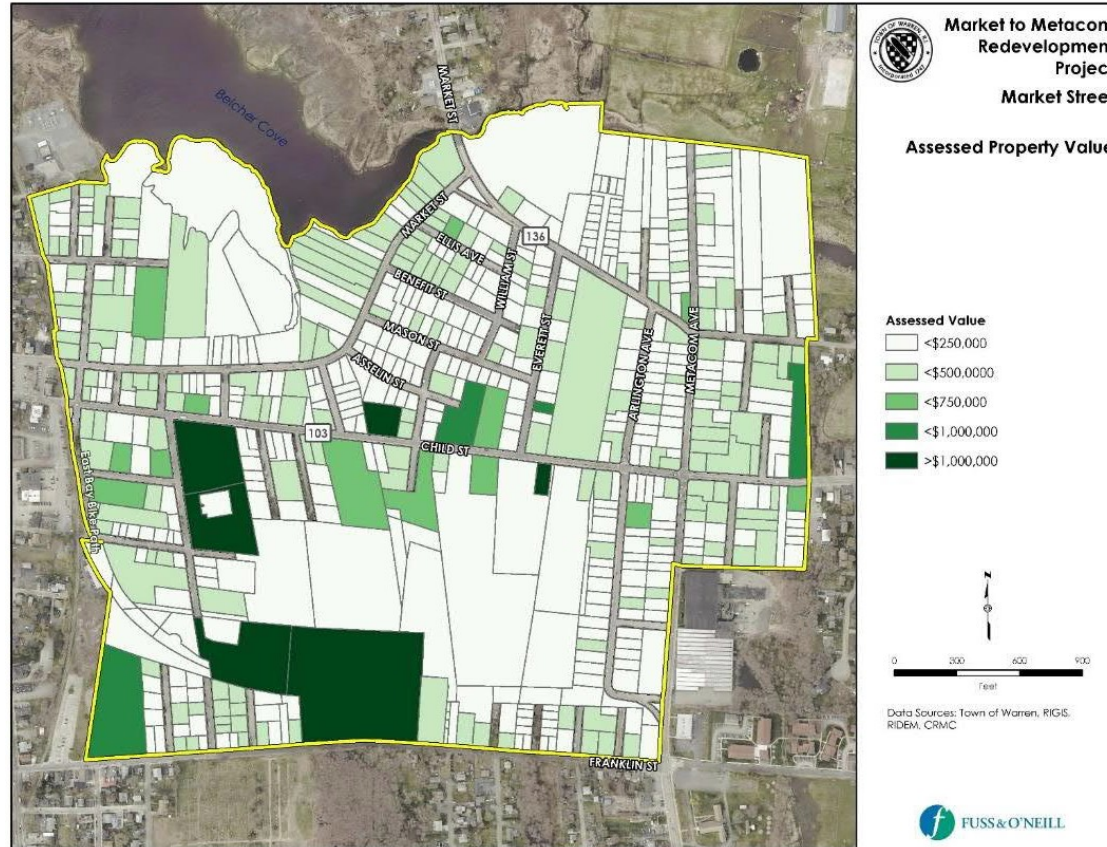
- 184 acres
- 400 buildings
- 700 housing units
- 30 businesses



Market Street – Assessed Property Values

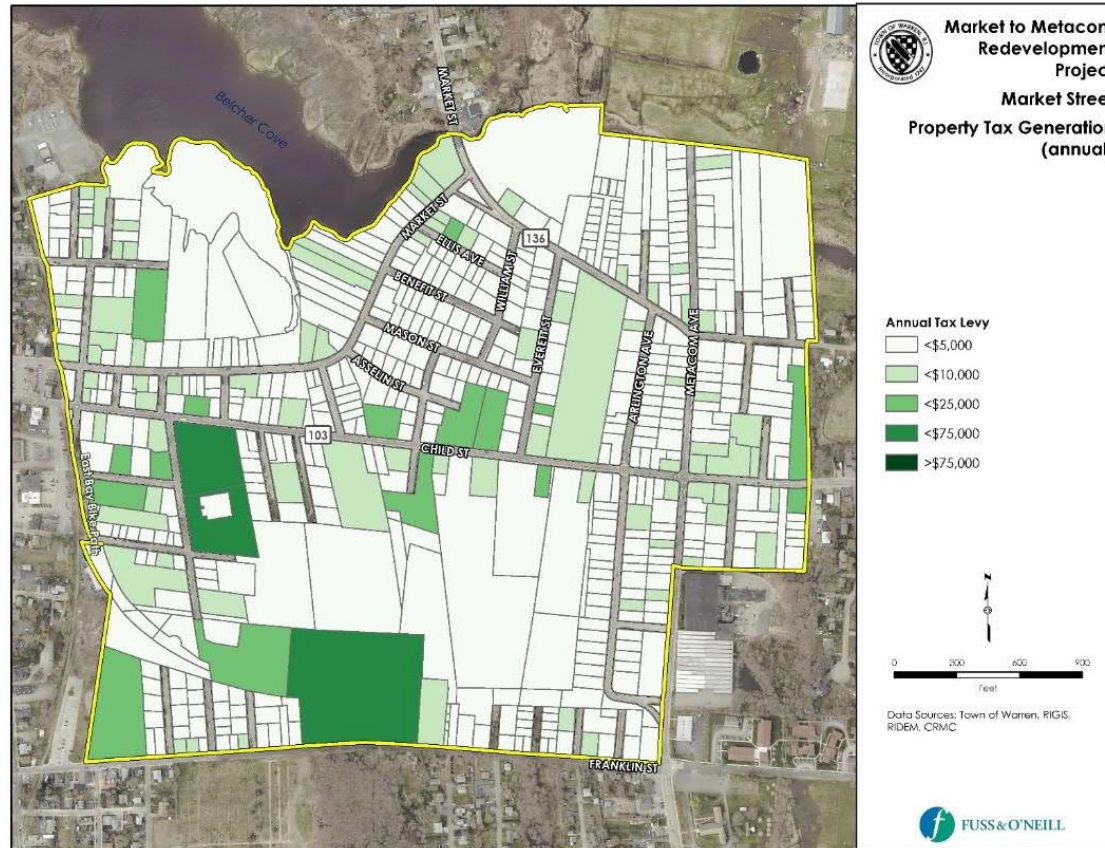
Total Assessed Value:
\$138 million

- 586 parcels
- Average parcel value: \$236,000



Market Street – Property Tax Generation (annual)

Total Annual Taxes to
Town of Warren:
\$2,401,000



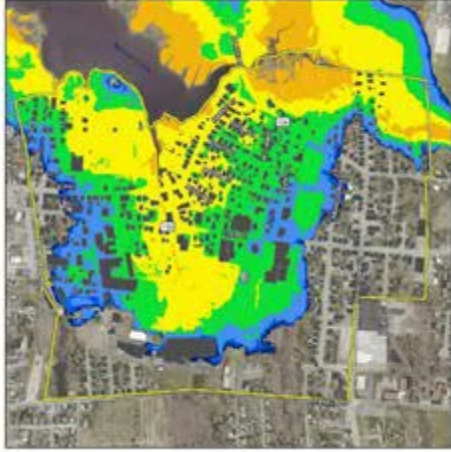
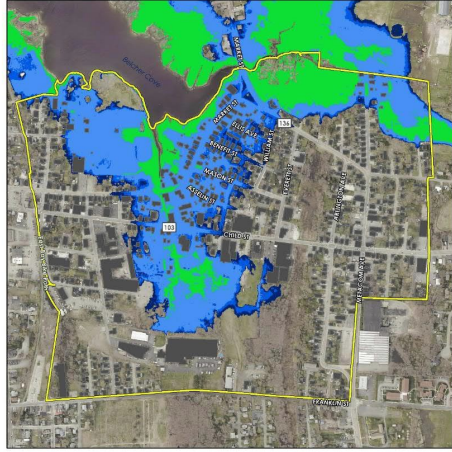
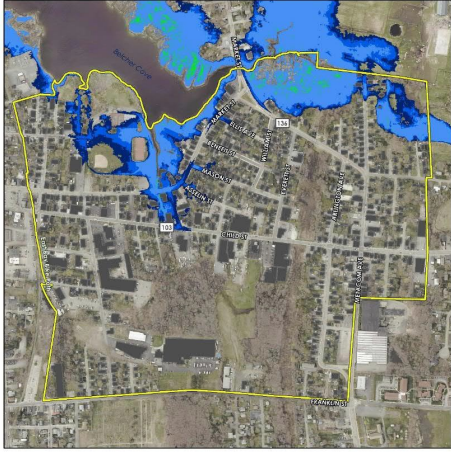
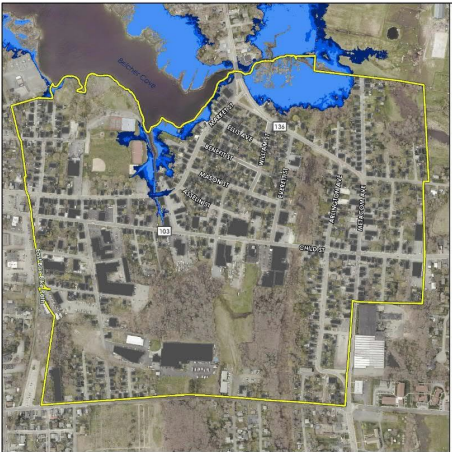
Market Street – High Tide Projections 2035-2100

2035

2050

2070

2100



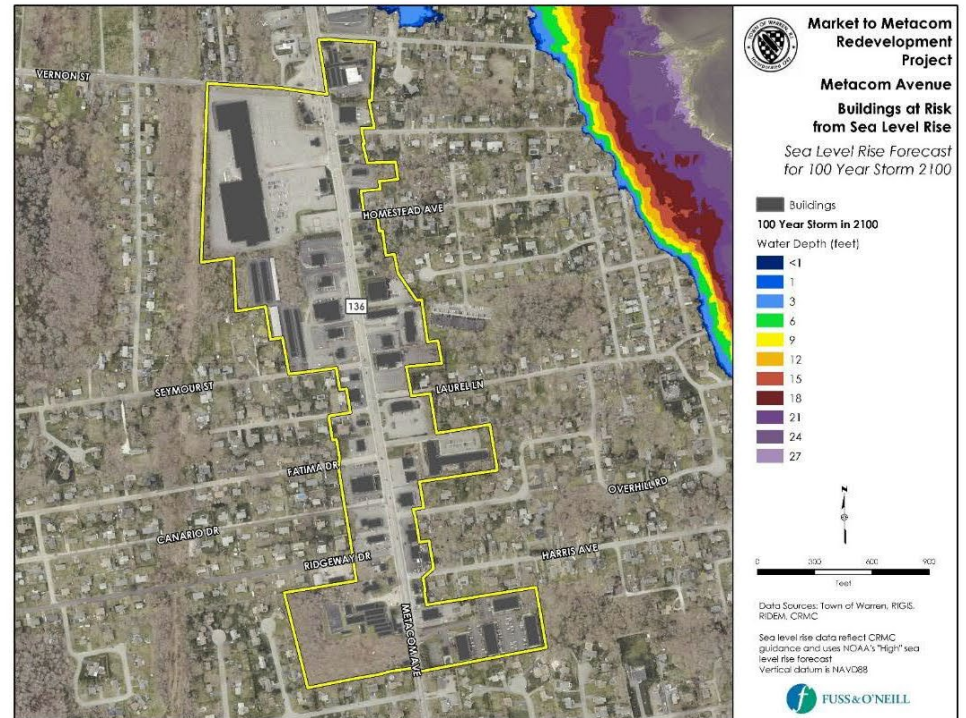
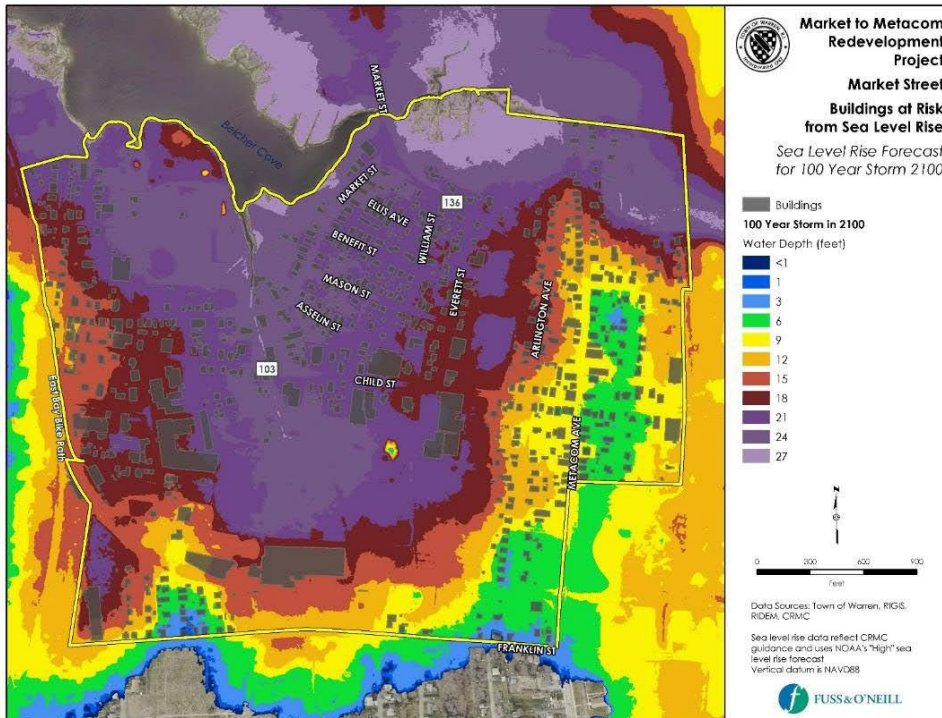


10/8/21@10:30 AM

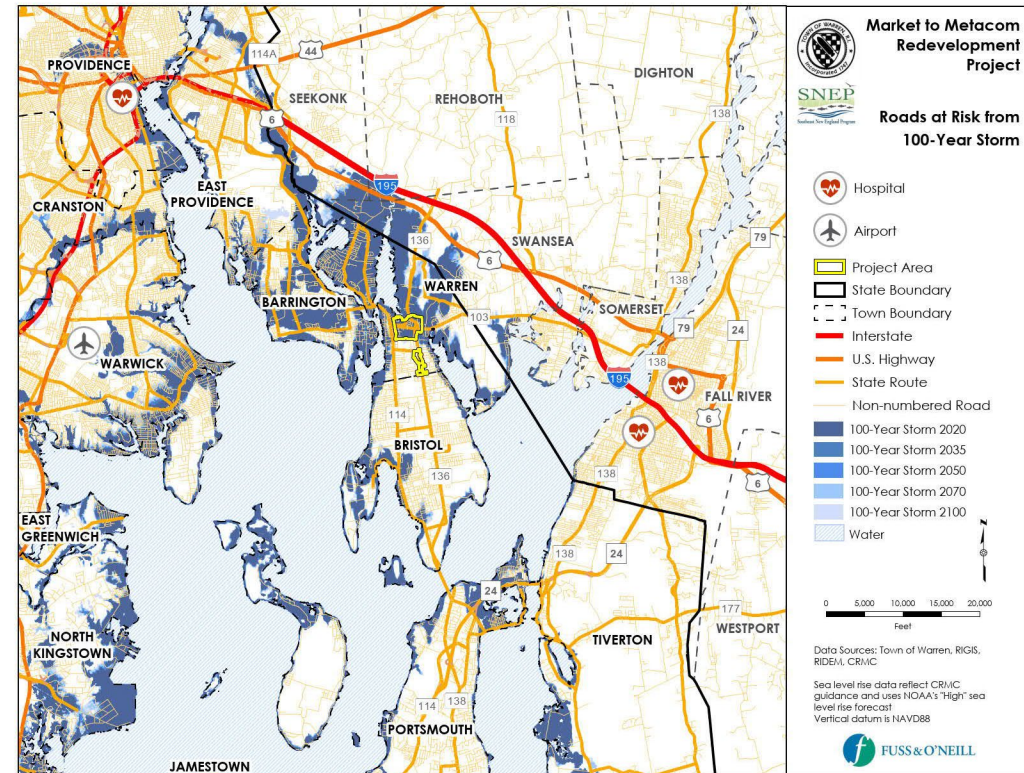
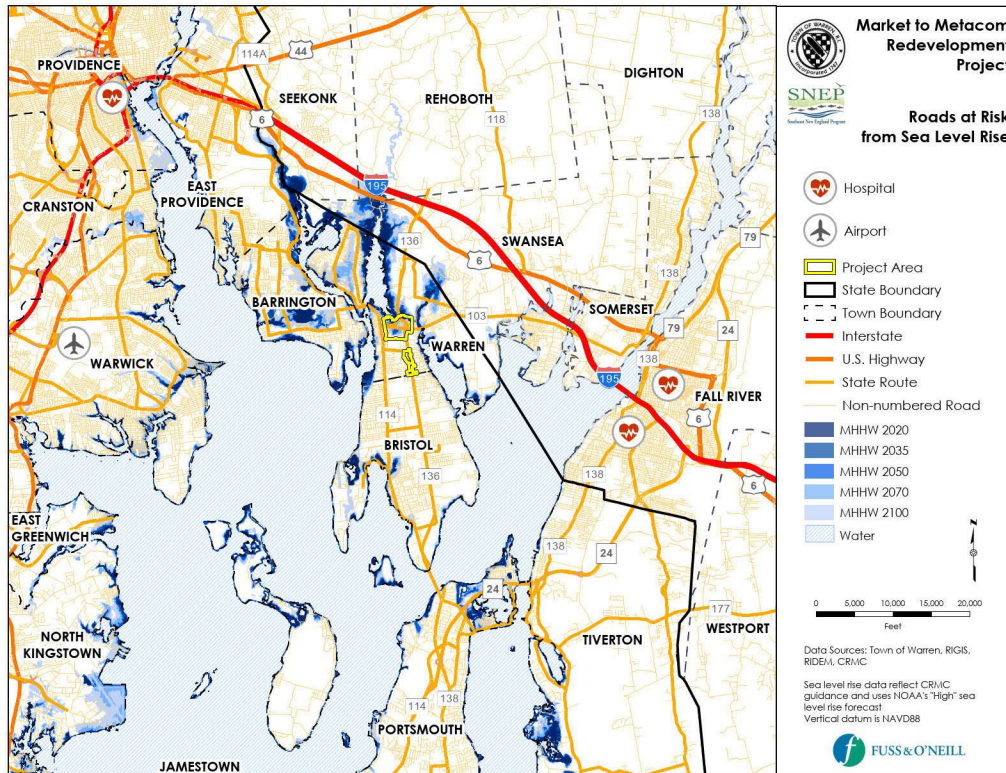
Photos from RI – Sea Grant

Belchers Cove/Market Street

Sea Level Rise Projection + 100-Year Coastal Storm in 2100



Impacts to Transportation Assets



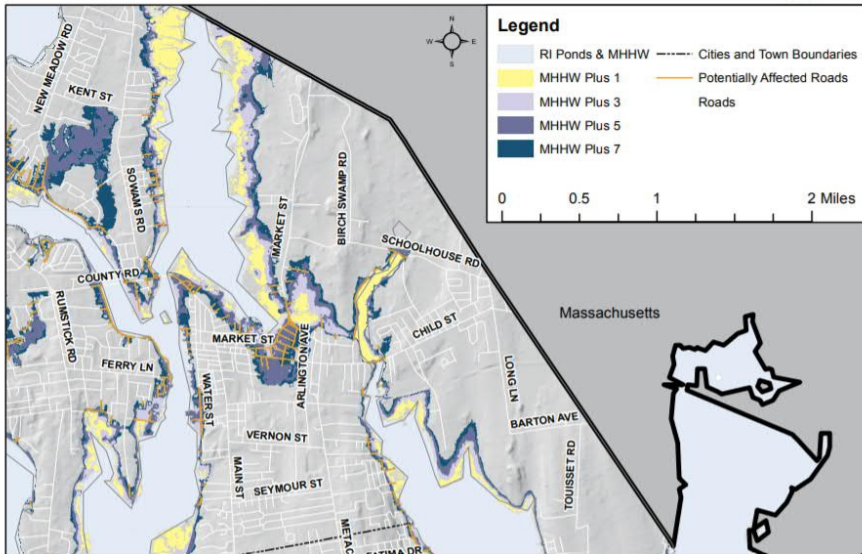
Impacts to Transportation Assets

Warren, RI

RHODE ISLAND
STATEWIDE
PLANNING
PROGRAM



Warren Roads Exposed to Sea Level Rise

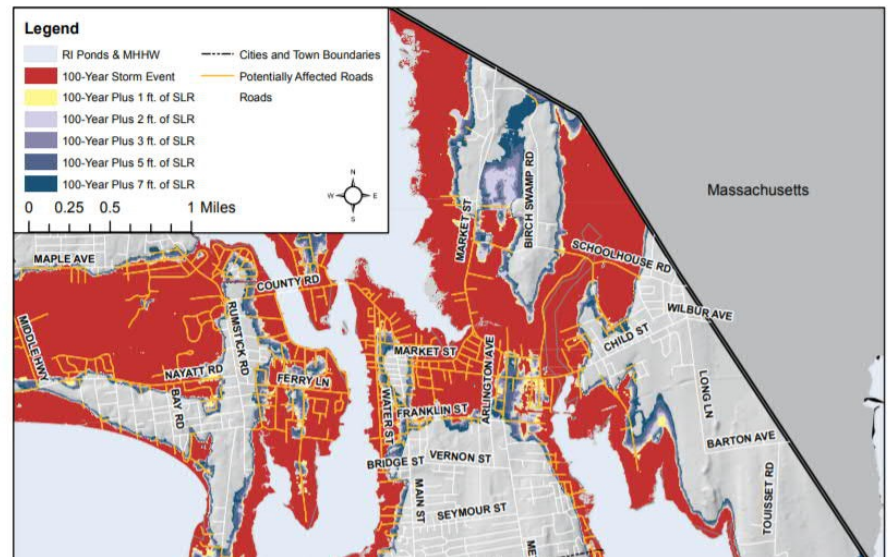


Warren, RI

RHODE ISLAND
STATEWIDE
PLANNING
PROGRAM

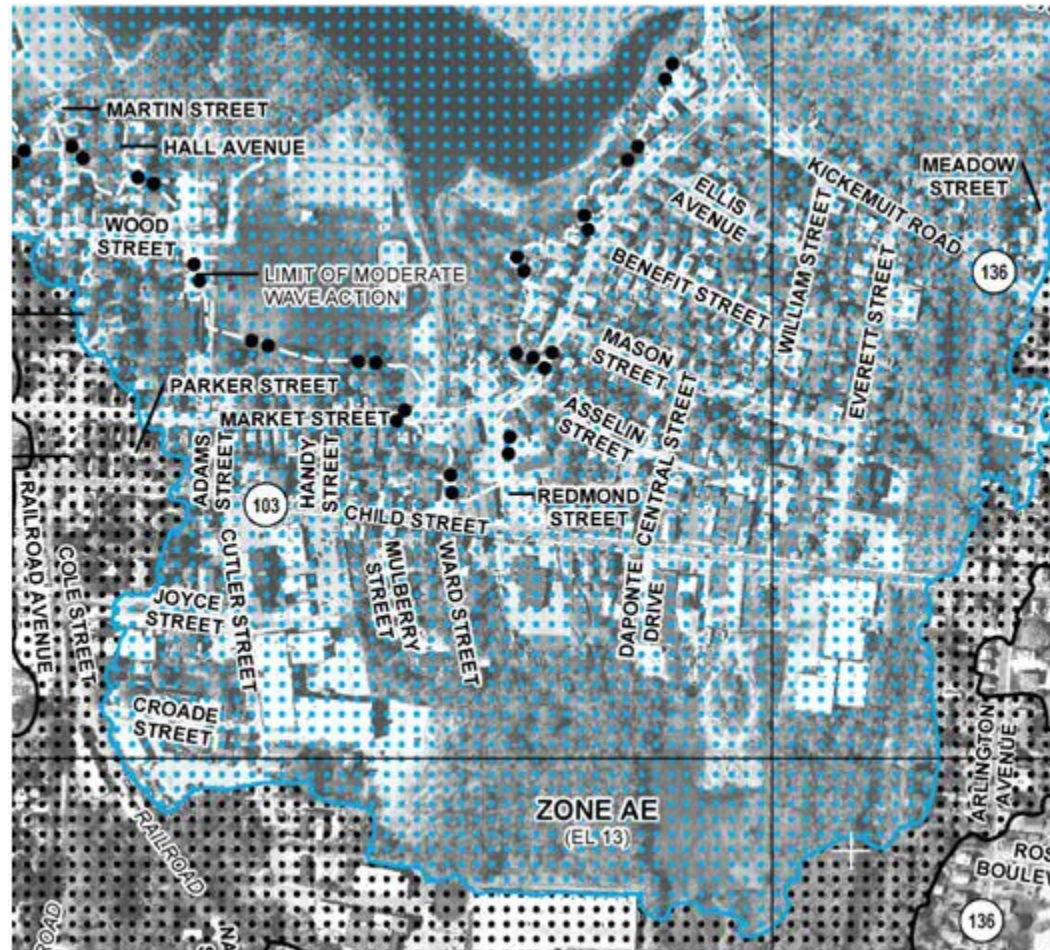


Warren Roads Exposed to 100-Year Storm Surge Events



Federal Flood Insurance Program

- FEMA Flood Insurance Rate Map (FIRM) revised July 2014
- Market Street project area is in the AE Zone with base flood elevation of 13 feet above mean high water level.



Market Street: Two Alternative Scenarios

- Market Street:
 - No Action
 - Phased Relocation and Restoration





Market Street: No Action Scenario



No Action Scenario - ASSUMPTIONS

- Town of Warren takes no actions to prepare for climate change impacts
- State agencies and utilities take no action to prepare for climate change impacts
- Sea level rise per NOAA forecasts:
 - 1' rise by 2035
 - 3' rise by 2050
 - 6' rise by 2070
- Increase (in frequency and severity) to historical averages of precipitation and storm events
 - Hurricanes
 - Nor'easters
 - Seasonal precipitation



No Action Scenario – FLOODING OVERVIEW



**Market to Metacom
Redevelopment
Project**

**Areas at Risk
from Sea Level Rise**

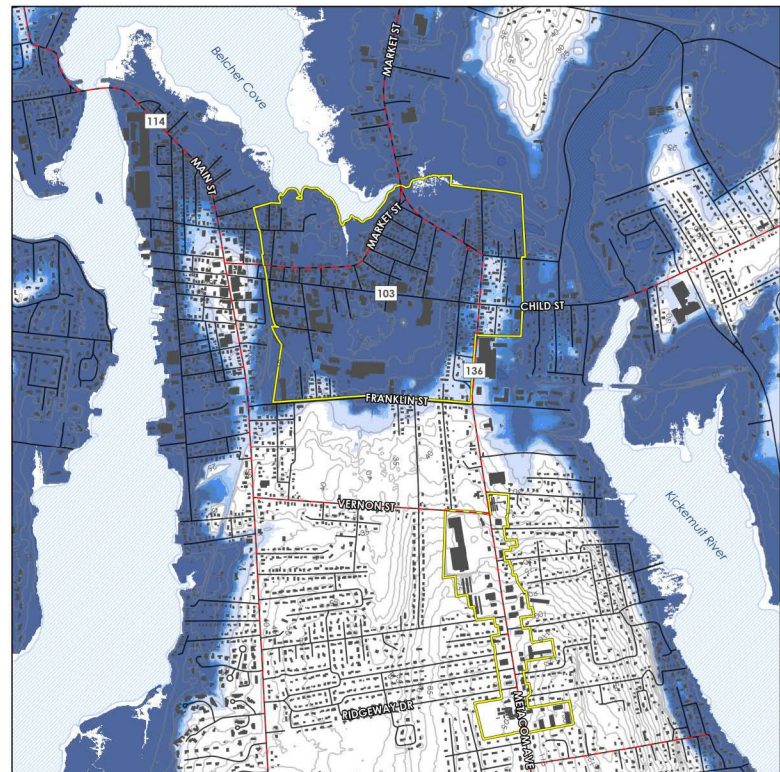
SNEP
Sustainable Neighborhood Equitable Progress

- Project Area
- Buildings
- Roads
- Evacuation Route
- 5 Foot Contours
- MHHW 2020
- MHHW 2035
- MHHW 2050
- MHHW 2070
- MHHW 2100
- Water

0 500 1,000 1,500 2,000
Feet

Data Sources: Town of Warren, RIGIS, RIDEM, CRMC
Sea level rise data reflect CRMC guidance and uses NOAA's "High" sea level rise forecast
Vertical datum is NAVD88

FUSS & O'NEILL



**Market to Metacom
Redevelopment
Project**

**Areas at Risk
from 100-Year Storm**

SNEP
Sustainable Neighborhood Equitable Progress

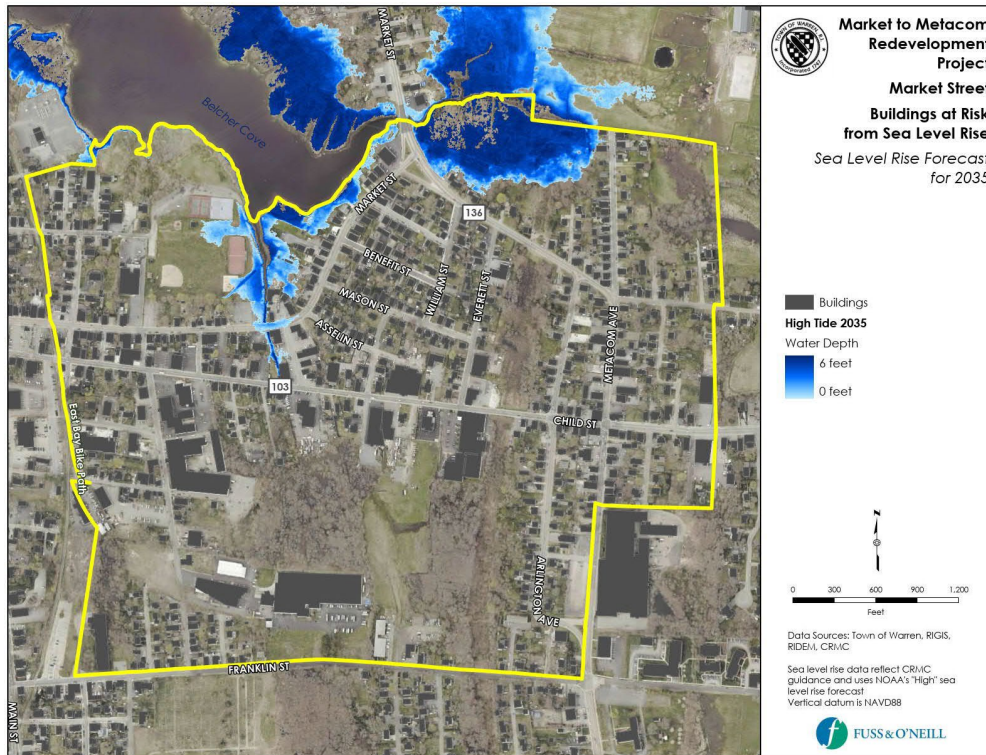
- Project Area
- Buildings
- Roads
- Evacuation Route
- 5 Foot Contours
- 100-Year Storm 2020
- 100-Year Storm 2035
- 100-Year Storm 2050
- 100-Year Storm 2070
- 100-Year Storm 2100
- Water

0 500 1,000 1,500 2,000
Feet

Data Sources: Town of Warren, RIGIS, RIDEM, CRMC
Sea level rise data reflect CRMC guidance and uses NOAA's "High" sea level rise forecast
Vertical datum is NAVD88

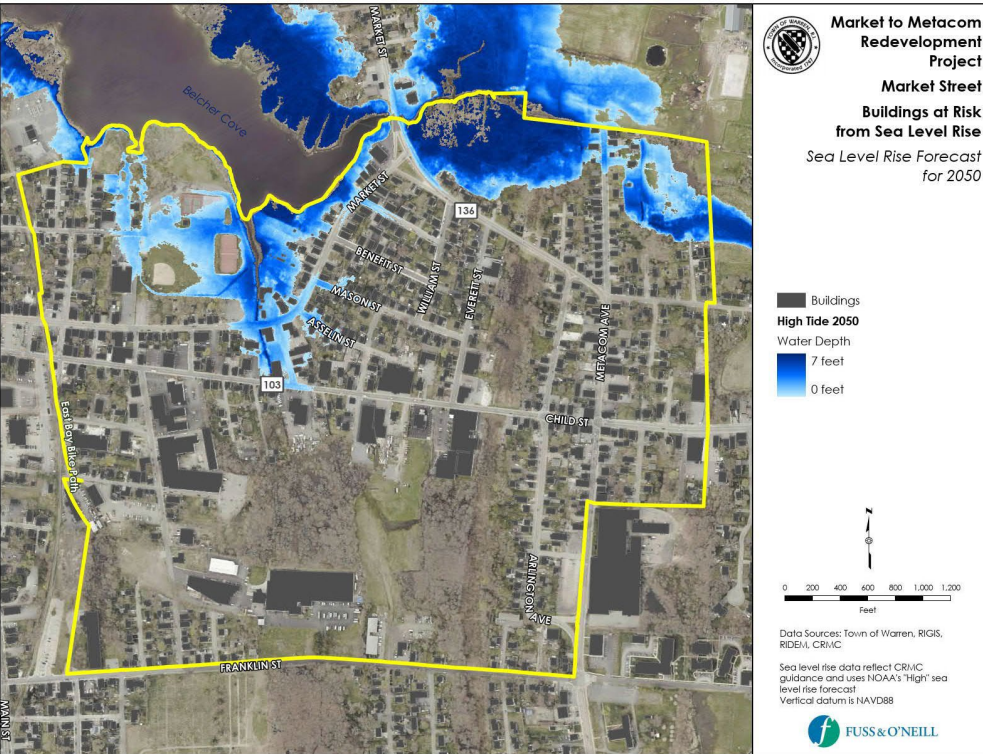
FUSS & O'NEILL

No Action Scenario – 2035



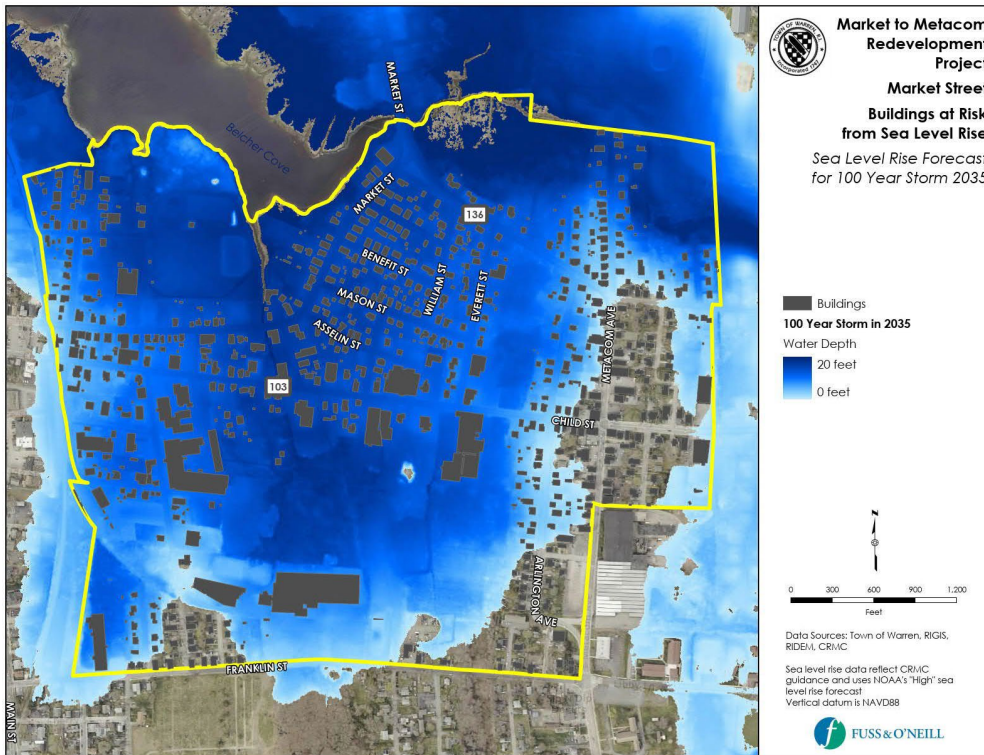
Properties Flooded	58
Buildings Flooded	31
Housing Units Lost	57
Residents Displaced	86
Lost Annual Tax Revenue	\$200,000
Building Loss Cost	\$8,100,000

No Action Scenario – 2050



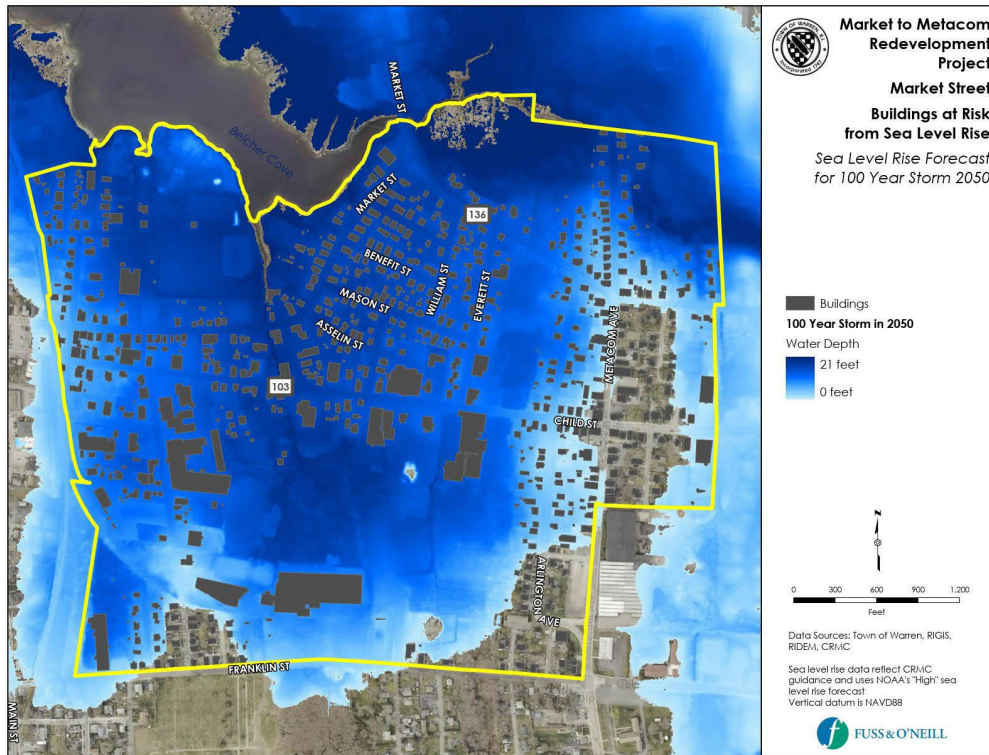
Properties Flooded	75
Buildings Flooded	65
Housing Units Lost	121
Residents Displaced	182
Lost Annual Tax Revenue	\$300,000
Building Loss Cost	\$16,600,000

No Action Scenario – 2035 – 100 Year Storm Event



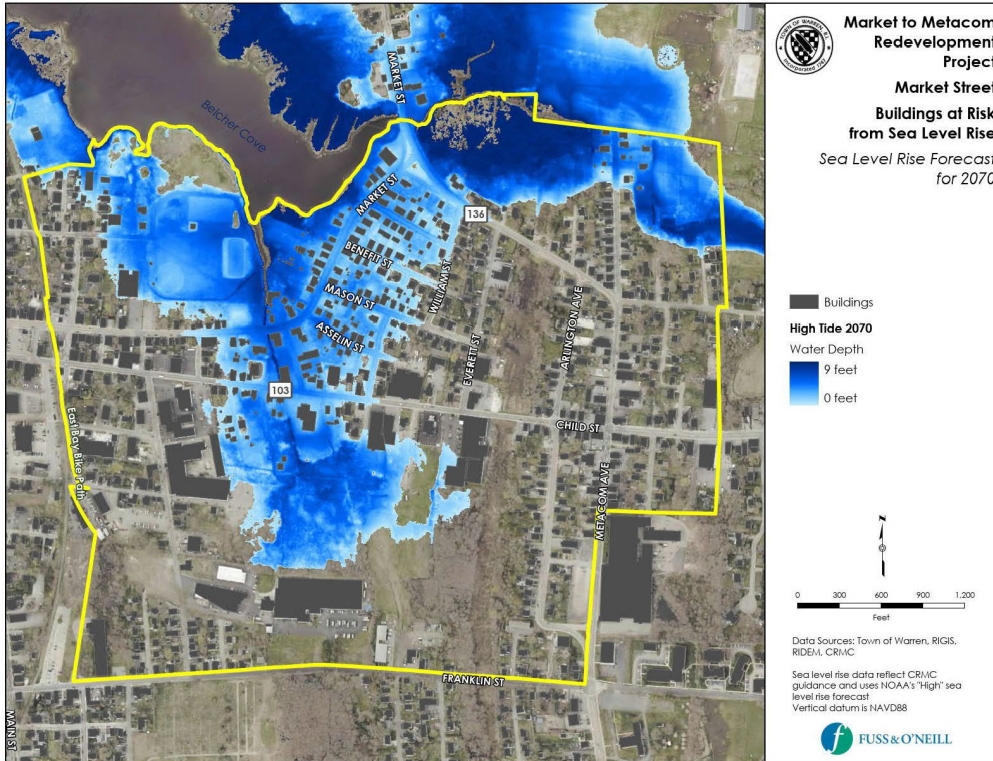
Damage	\$3,500,000
Lost Business Revenue	\$5,400,000
Total Flood Impacts	\$8,900,000

No Action Scenario – 2050 – 100 Year Storm Event



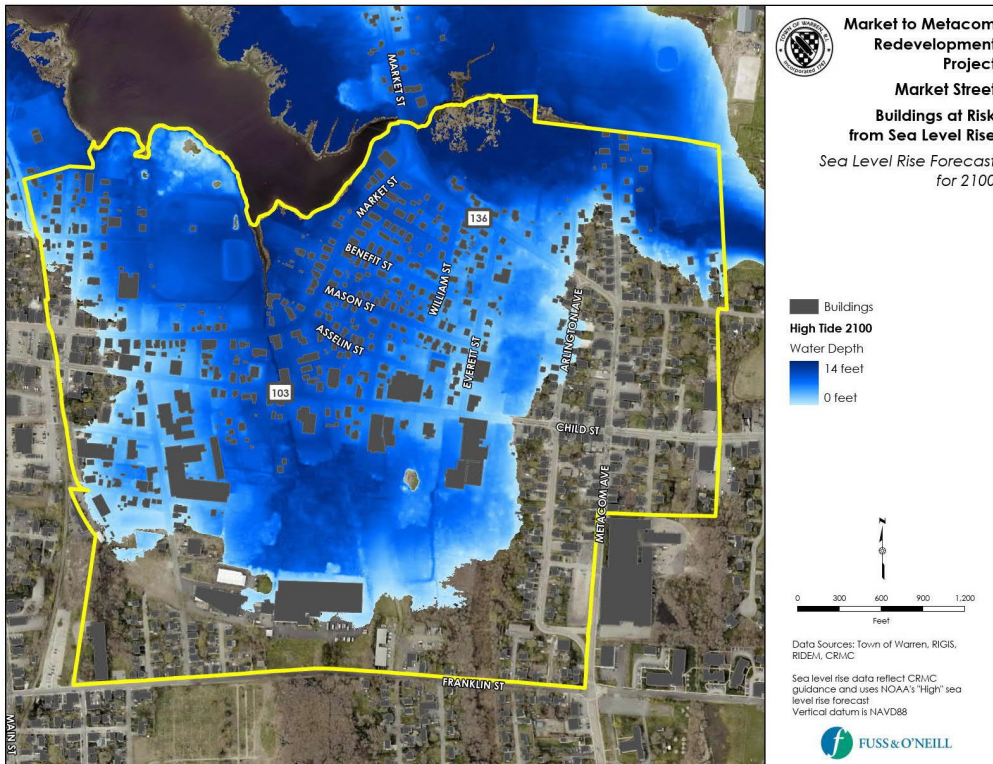
Damage	\$8,500,000
Lost Business Revenue	\$3,600,000
Total Flood Impacts	\$12,100,000

No Action Scenario – 2070



Properties Flooded	113
Buildings Flooded	92
Housing Units Lost	162
Residents Displaced	243
Lost Annual Tax Revenue	\$400,000
Building Loss Cost	\$23,000,000

No Action Scenario – 2100



Properties Flooded	137
Buildings Flooded	118
Housing Units Lost	201
Residents Displaced	302
Lost Annual Tax Revenue	\$700,000
Building Loss Cost	\$38,100,000

No Action Scenario - COSTS

- Insurance losses to property owners/insurers
- Loss of commercial buildings
- Displacement of businesses
 - Lost operational days
- Environmental pollution and clean-up costs
 - Landfill at Jamiel's Park
 - DEM-registered sites
- Municipal financial impacts
 - lost tax revenue
 - repair/replacement of infrastructure

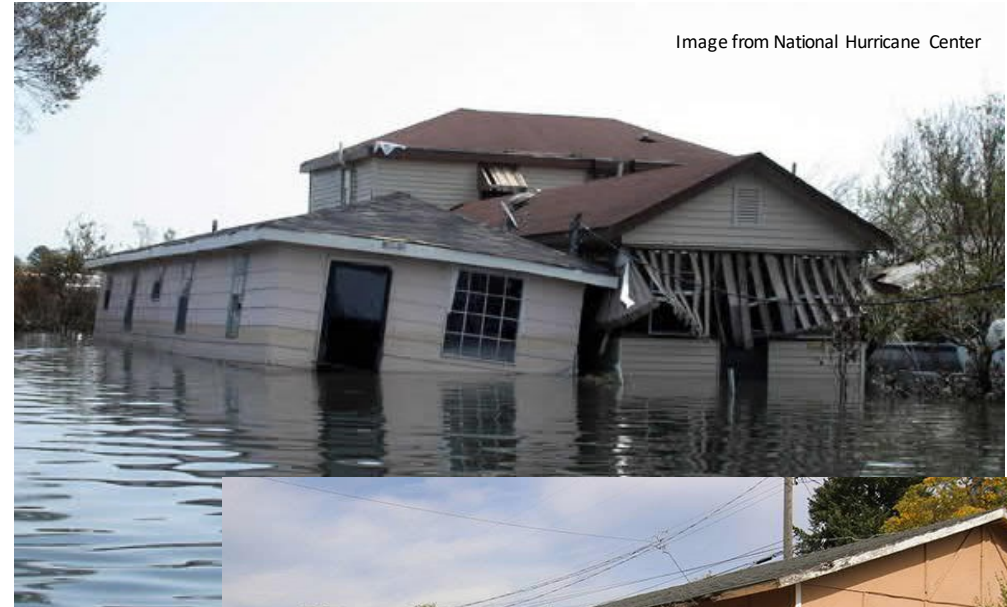


Image from National Hurricane Center



Image from Spokane Journal of Business

No Action Scenario – COMMUNITY IMPACTS

Time Period	2025-2035	2035-2050	2050-2070	2070-2100	Total by 2100
Properties Flooded	58	75	113	137	383
Buildings Flooded	31	65	92	118	306
Housing Units Lost	57	121	162	201	541
Residents Displaced	86	182	243	302	812

No Action Scenario – COSTS SUMMARY

Time Period	2025-2035	2035-2050	2050-2070	2070-2100	Total by 2100
Properties Flooded by Sea Level Rise	58	75	113	137	383
Buildings Flooded by Sea Level Rise	31	65	92	118	306
Building Loss Cost	\$8,100,000	\$16,600,000	\$23,000,000	\$38,100,000	\$85,800,000
Damage from 24” Flood Event	\$3,500,000	\$8,500,000	\$13,100,000	\$27,500,000	\$52,700,000
Lost Business Revenue from 24” Flood Event	\$5,400,000	\$3,600,000	\$22,000,000	\$95,200,000	\$126,300,000

No Action Scenario – ROADWAY IMPACTS

- Market, Child and Rte.136 are flooded during 100-year storm events
- Market Street at Redmond is flooded every day (by 2035)
- Child Street is flooded every day (by 2050)
- Rte. 136 at Belcher Cove Bridge is flooded every day (by 2050)

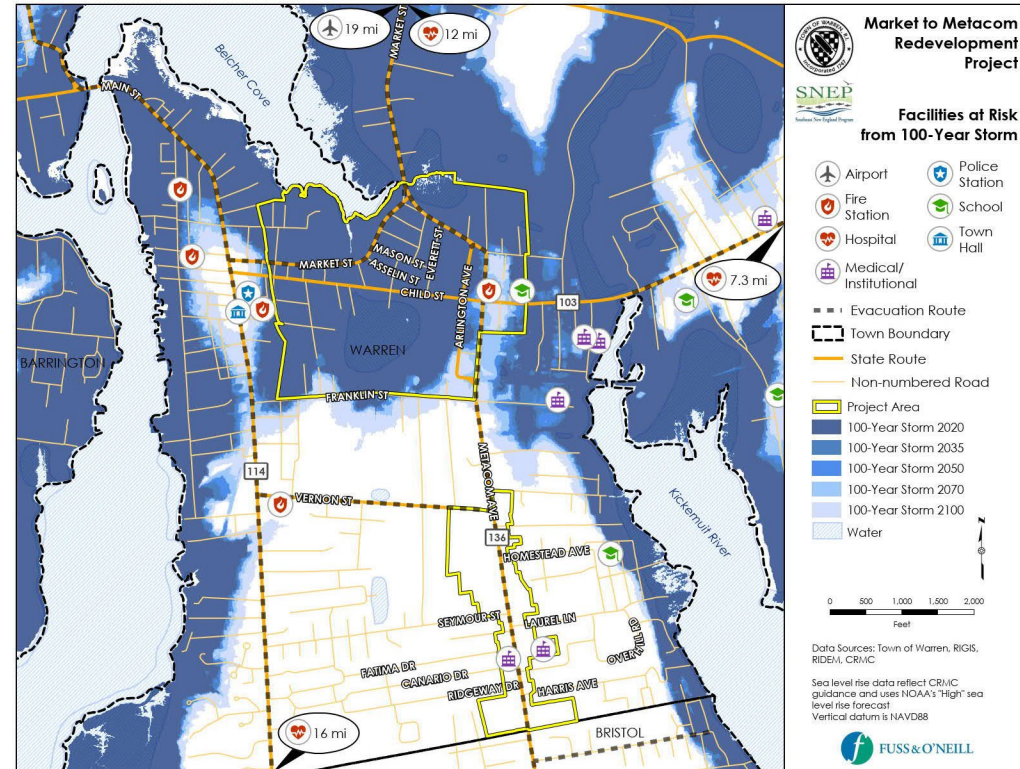
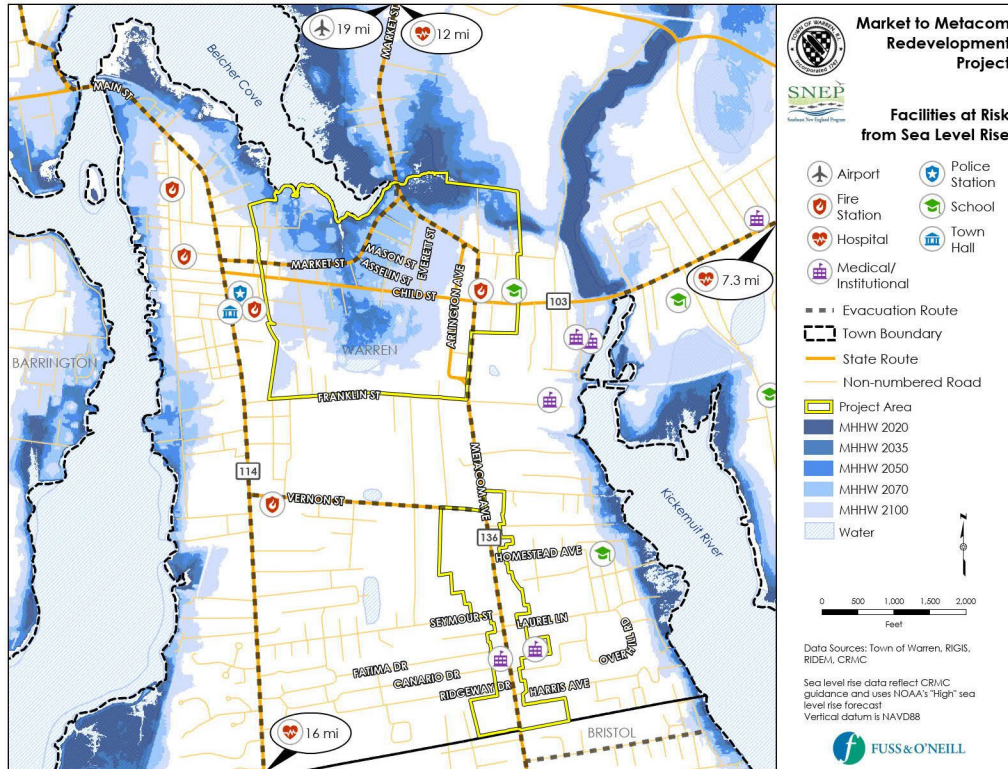


No Action Scenario – ROADWAY IMPACTS

- Impassable roads during high tides and storm events
 - Rerouting of traffic
 - Evacuation routes
- Non-functioning stormwater systems
- Accelerated roadway deterioration
- Increased repair costs
 - Annual
 - Post-event

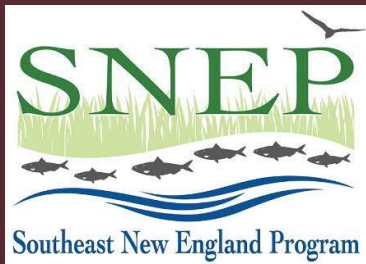


No Action Scenario – EMERGENCY SERVICES IMPACTS





RECOMMENDATION: Market Street: Phased Relocation and Restoration Scenario

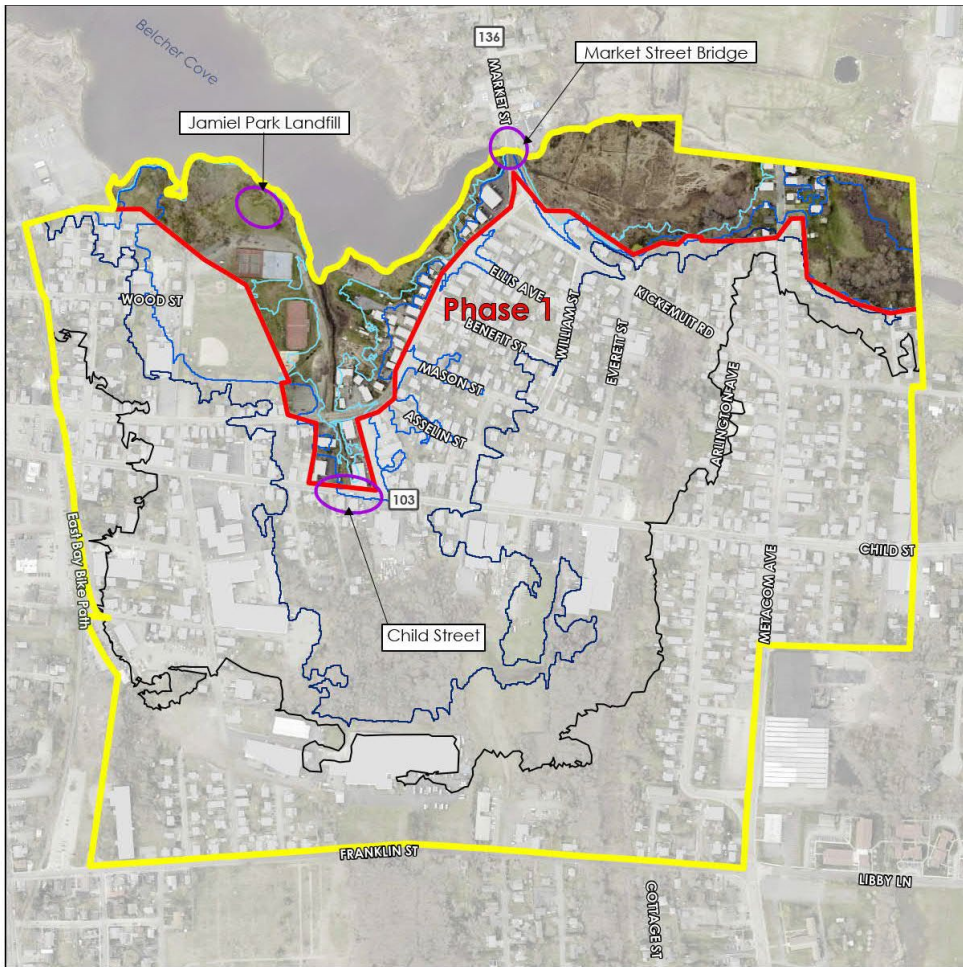


Phased Relocation and Restoration Scenario - ASSUMPTIONS

- Occurs in 4 Phases over 50-70 years
- Buy-outs of properties in danger of repetitive flooding and storm damage
- Removal of most local streets
- Removal of most utilities
- Restoration of wetlands for protective buffering and flood storage
- Adaptation of State roadways to protect transportation connections



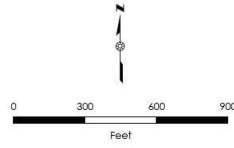
Phased Relocation and Restoration – PHASE 1 (2025-2035)



**Market to Metacom
Redevelopment
Project
Market Street**

Phase 1 (2025-2035)

- Project Area
- Predicted MHHW Extent
 - 2035
 - 2050
 - 2070
 - 2100
- Critical Infrastructure



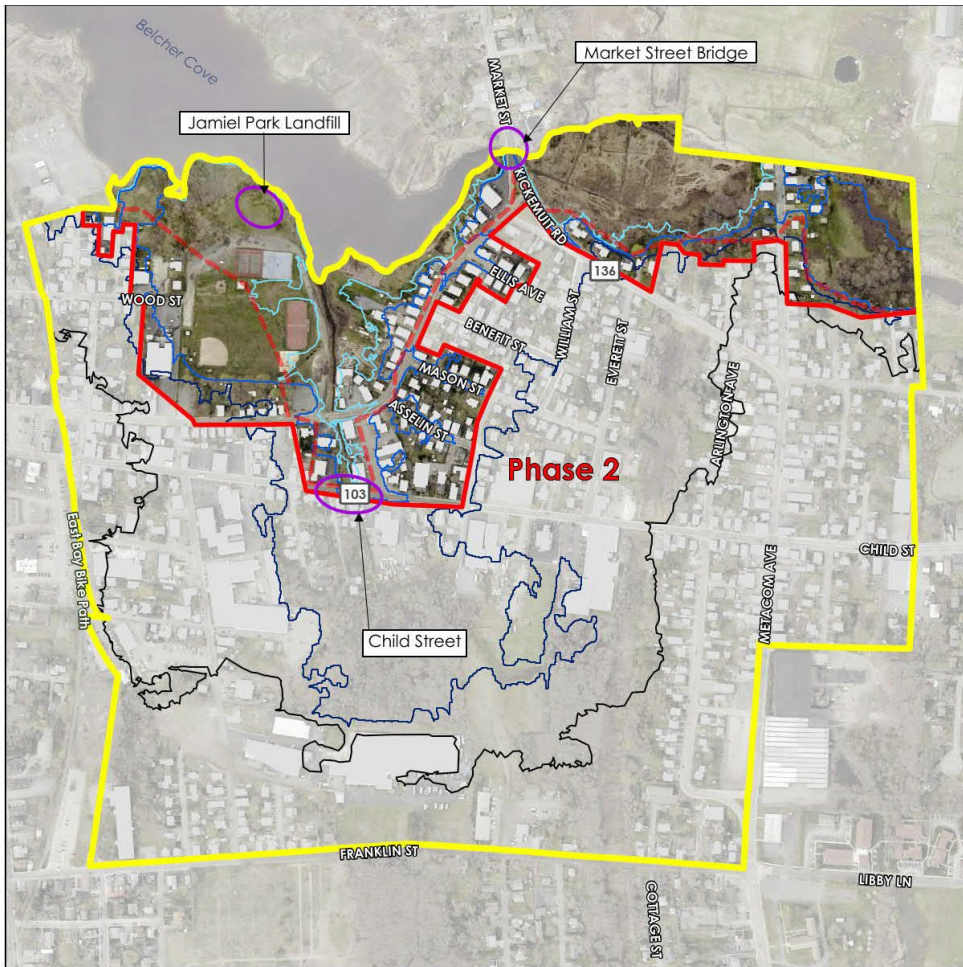
Data Sources: Town of Warren, RIGIS, RIDEM, CRMC
 Sea level rise data reflect CRMC guidance and uses NOAA's "High" sea level rise forecast
 Vertical datum is NAVD88




Properties	58
Buildings	31
Total Cost	\$14,900,000

Total cost includes property acquisition, demolition, utility removal, site clearing, and restoration.

Phased Relocation and Restoration – PHASE 2 (2035-2050)




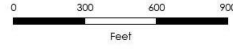

**Market to Metacom
Redevelopment
Project**
Market Street
Phase 2 (2035-2050)

- Project Area
- Prior Phases


Predicted MHHW Extent

- 2035
- 2050
- 2070
- 2100

- Critical Infrastructure

Data Sources: Town of Warren, RIGIS, RIDEM, CRMC
Sea level rise data reflect CRMC guidance and uses NOAA's "High" sea level rise forecast
Vertical datum is NAVD88




Properties	75
Buildings	65
Total Cost	\$24,600,000

Total cost includes property acquisition, demolition, utility removal, site clearing, and restoration.

Phased Relocation and Restoration – PHASE 3 (2050-2070)


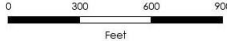



**Market to Metacomb
Redevelopment
Project**
Market Street
Phase 3 (2050-2070)


- Project Area
- Prior Phases

Predicted MHHW Extent

- 2035
- 2050
- 2070
- 2100
- Critical Infrastructure



 Feet

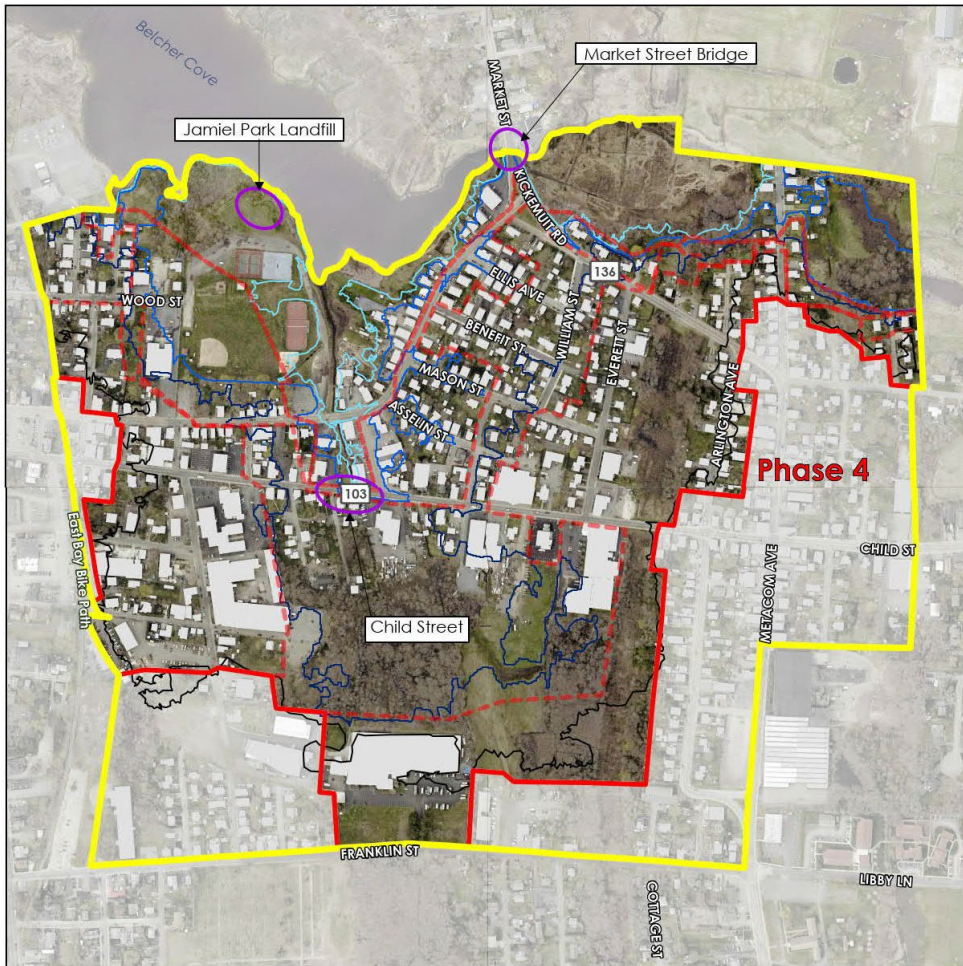
Data Sources: Town of Warren, RIGIS, RIDEM, CRMC
 Sea level rise data reflect CRMC guidance and uses NOAA's "High" sea level rise forecast
 Vertical datum is NAVD88


FUSS & O'NEILL

Properties	113
Buildings	92
Total Cost	\$36,600,000

Total cost includes property acquisition, demolition, utility removal, site clearing, and restoration.

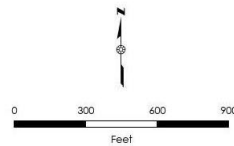
Phased Relocation and Restoration – PHASE 4 (2070-2100)



Market to Metacom Redevelopment Project Market Street

Phase 4 (2070-2100)

- █ Project Area
- - - Prior Phases
- Predicted MHHW Extent
 - 2035
 - 2050
 - 2070
 - 2100
- Critical Infrastructure



Data Sources: Town of Warren, RIGIS, RIDEM, CRMC

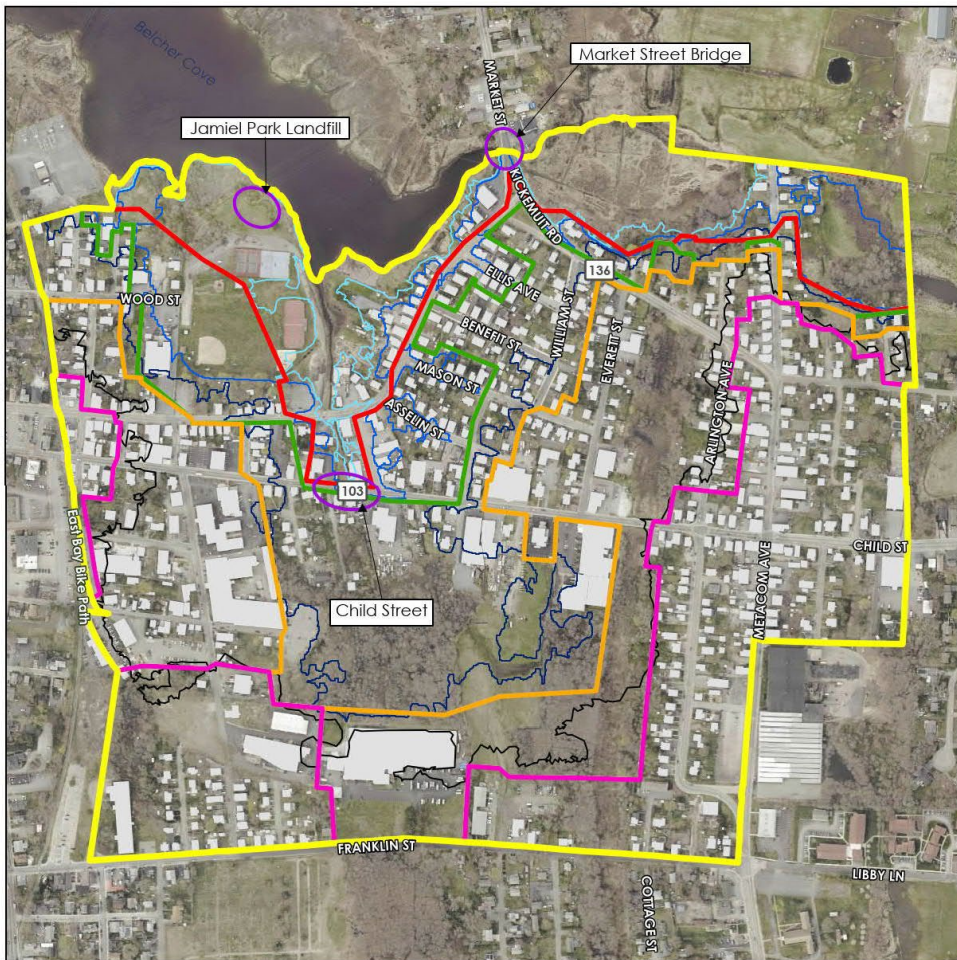
Sea level rise data reflect CRMC guidance and uses NOAA's "High" sea level rise forecast
Vertical datum is NAVD88



Properties	137
Buildings	118
Total Cost	\$62,100,000

Total cost includes property acquisition, demolition, utility removal, site clearing, and restoration.

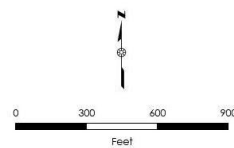
Phased Relocation and Restoration - SUMMARY



Market to Metacom Redevelopment Project Market Street

All Phases

- ▭ Project Area
- ▭ Phase 1 (2021-2035)
- ▭ Phase 2 (2035-2050)
- ▭ Phase 3 (2050-2070)
- ▭ Phase 4 (2070-2100)
- Predicted MHHW Extent
 - 2035
 - 2050
 - 2070
 - 2100
- Critical Infrastructure



Data Sources: Town of Warren, RIGIS, RIDEM, CRMC

Sea level rise data reflect CRMC guidance and uses NOAA's "High" sea level rise forecast. Vertical datum is NAVD88



Totals by 2100

Properties	383
Buildings	306
Total Cost	\$138,300,000

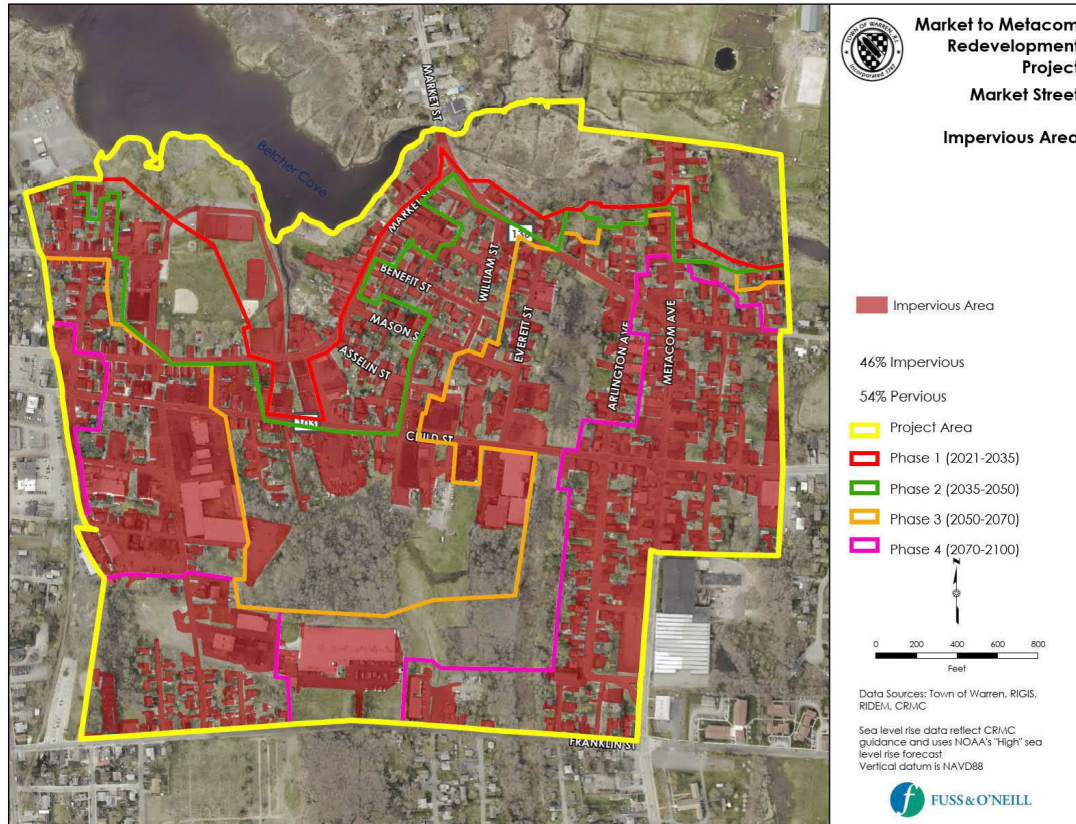
Total cost includes property acquisition, demolition, utility removal, site clearing, and restoration.

Phased Relocation and Restoration – ENVIRONMENTAL IMPACTS

- Create natural wetland buffers
- Improve stormwater quality from removal of impervious cover and upgrades to stormwater systems
- Mitigate existing environmental pollution sources
 - Landfill at Jamiel’s Park – contain to limit impacts
 - DEM-registered sites – remove approximately 30 fuel and chemical tanks
 - Domestic heating oil tanks - remove



Phased Relocation and Restoration – Impervious Removed



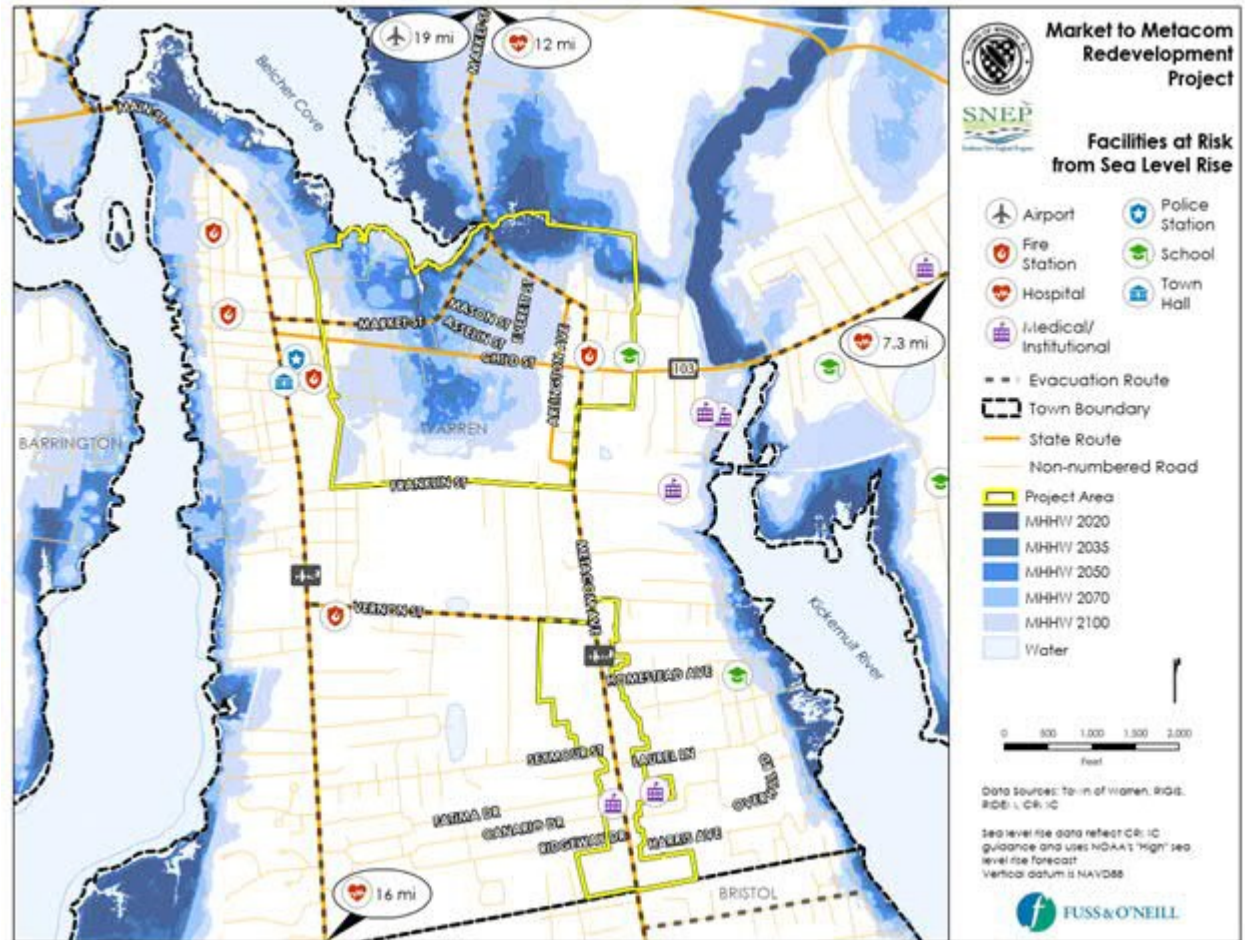
Phase	Impervious Area Removed (Acres)	Marshland Created (Acres)
1	8	34
2	10	21
3	17	42
4	29	56
Total	63	153

Phased Relocation and Restoration – Marsh Park



Adaptation of State Roadways – Regional connections

- Protect transportation connections
- Evacuation routes
- Potential to act as buffers against flooding



Phased Relocation and Restoration Scenario – AVAILABLE FUNDING

- EPA: Pre-Disaster Mitigation Grants
- FEMA: BRIC Program – Building Resilient Infrastructure and Communities
- Army Corps Of Engineers
- US Dept. of Agriculture/NRCS
- RI Infrastructure Bank
- Town of Warren TIF Funds

FEMA to open up more money for resilience projects

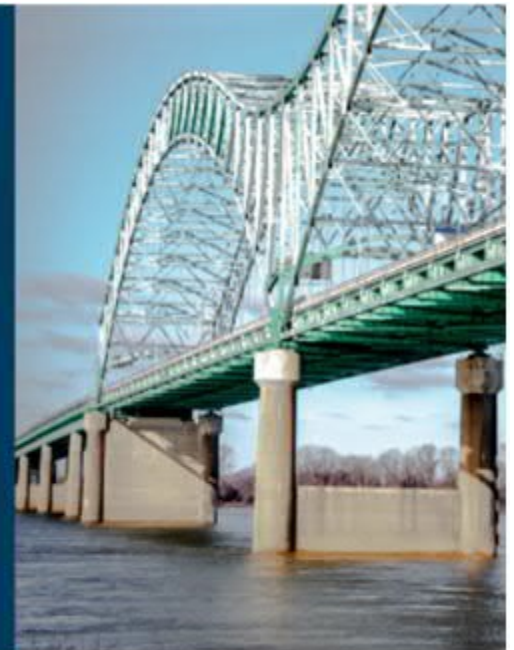
\$400 million+

Building Resilient Infrastructure and Communities (BRIC) program, expected annual funding

\$56 million

Predisaster Mitigation Program, on average from 2009-2016

* \$400M figure depends on disaster expenditures and is at the discretion of FEMA.



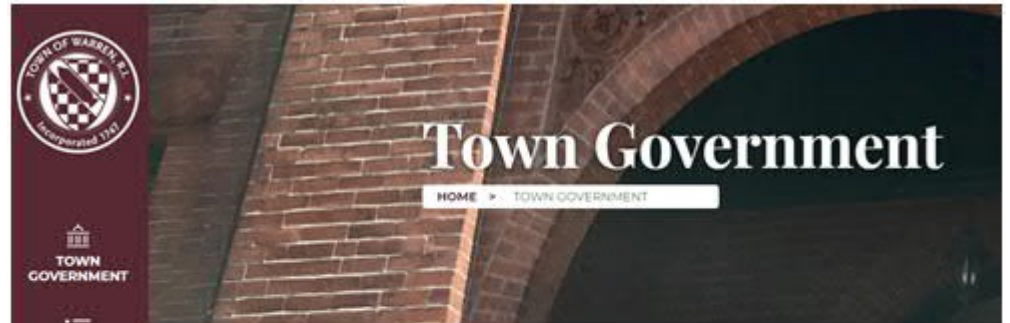
Phased Relocation and Restoration Scenario – ABILITY TO IMPLEMENT

- Federal funding for pre-disaster adaptation and mitigation
- Tax Incremental Financing (TIF) from redevelopment within Metacom Avenue corridor
- Stormwater system funding
- Relocation and restoration feasible over the long-term



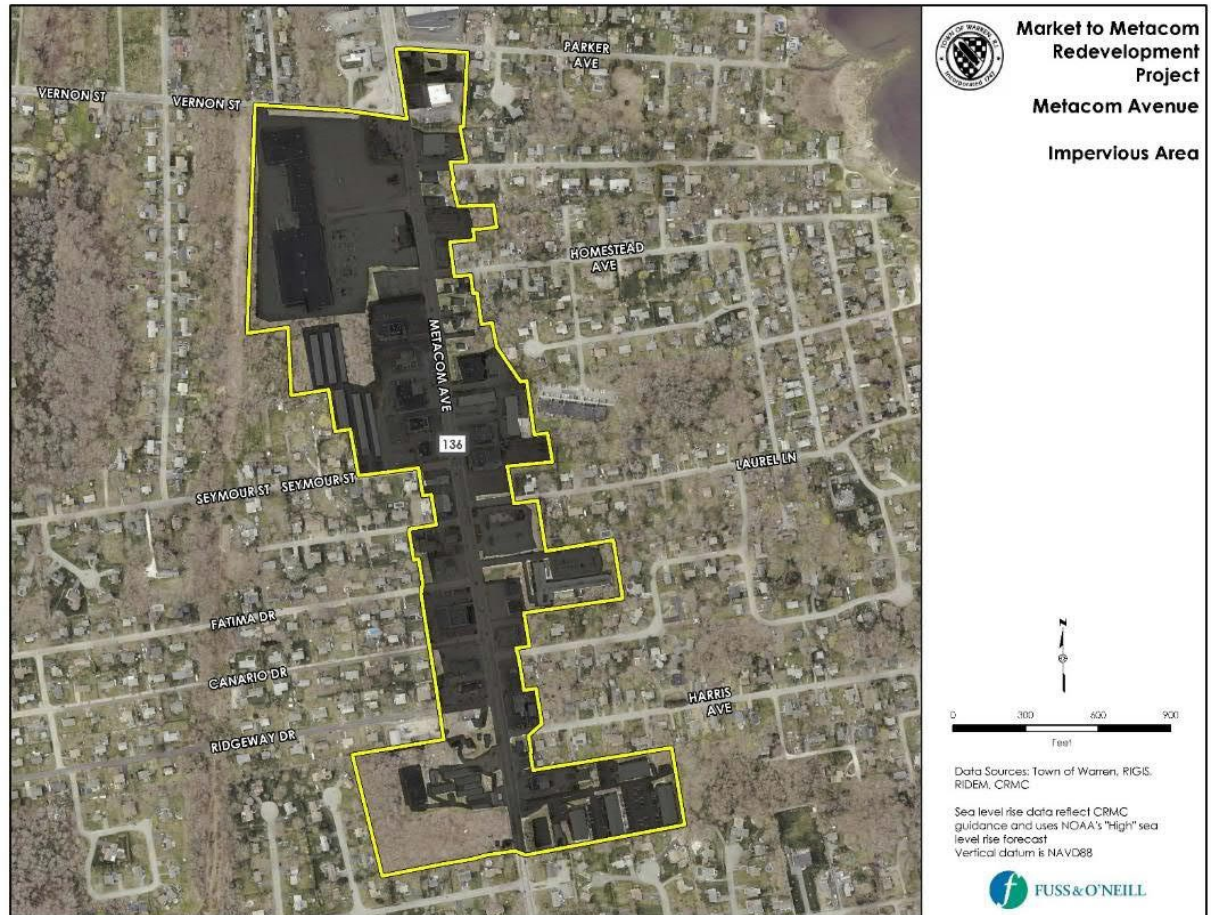
Metacom Avenue Redevelopment Scenario

- Can begin almost immediately
- Town changes framework for redevelopment by amending current zoning, adopting Form Based Code and promoting mixed use development to include Workforce Housing
- State and federal funding for infrastructure upgrades
 - Transportation
 - Stormwater management
 - Utilities



Metacom Avenue Stormwater Retrofits

- Currently 76% impervious (paved) surfaces
- Minimal on-site stormwater treatment/mitigation on any parcels



Metacom Avenue Stormwater Retrofits

- Stormwater flows to Narragansett Bay:
- Kickemuit River via streets and storm drains
- Warren River via Vernon Street



Metacom Avenue Stormwater Retrofits


- Opportunity to improve water quality impacts to Kickemuit and Warren River
 - Redevelopment of privately owned parcels
 - RI DOT improvement of State roads
 - Town-owned properties and streets



Metacom Avenue Stormwater Retrofits

- Reduce water velocity





Kate Michaud, Town Manager
kmichaud@townofwarren-ri.gov

Bob Rulli, Director
Office of Planning & Community Development
brulli@townofwarren-ri.gov

Project Website:
Project Website <https://bit.ly/M2M-Warren>



Thank you

