



# Market to Metacom

Warren, Rhode Island

Climate Resilience and Economic Development Plan



December 7, 2021



## Adaptation and Economic Development in Warren, RI

3



# Providence Sunday Journal

## HIGHER GROUND

Warren's neighborhood plans to relocate a flood-prone neighborhood suffers a "moth-eaten" reversal from rising seas.



This land lies between the high tide and the low tide, and is the site of the Warren neighborhood relocation project.

By John R. Sullivan

WARREN — When the Warren neighborhood relocation project was first announced, it was hailed as a major step in the city's effort to protect its coastal areas from rising seas. But now, after a year of planning and a \$10 million study, the city has decided to relocate the neighborhood to a different site, one that is not as vulnerable to flooding.

The city's decision to relocate the neighborhood to a different site is a result of a study conducted by the city's coastal planning department. The study found that the original site was not as secure as the city had hoped for, and that the new site would be a better choice for the neighborhood.

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## Contractor leaves couple in limbo

A contractor paid for a house but left the couple in a financial bind.

By John R. Sullivan

WARREN — A contractor who paid for a house but left the couple in a financial bind is the subject of a lawsuit filed in court. The couple, who had been living in the house for several years, were left in a financial bind when the contractor refused to pay for the house.

The couple, who had been living in the house for several years, were left in a financial bind when the contractor refused to pay for the house. The lawsuit was filed in court, and the couple is seeking damages for the loss of their home.

## SUNDAY+

Warren's neighborhood plans to relocate a flood-prone neighborhood suffers a "moth-eaten" reversal from rising seas.

The city's decision to relocate the neighborhood to a different site is a result of a study conducted by the city's coastal planning department. The study found that the original site was not as secure as the city had hoped for, and that the new site would be a better choice for the neighborhood.



J.C. Jackson has Sam Darnold seeing ghosts again in Pats win

# The Providence Journal

## AIMING HIGH

Warren neighborhood plagued by flooding faces choice: Relocate or be washed away



This land lies between the high tide and the low tide, and is the site of the Warren neighborhood relocation project.

WARREN — (AP) — The city of Warren is planning to relocate a flood-prone neighborhood to a different site, one that is not as vulnerable to flooding. The city's decision to relocate the neighborhood to a different site is a result of a study conducted by the city's coastal planning department. The study found that the original site was not as secure as the city had hoped for, and that the new site would be a better choice for the neighborhood.

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## ll for your serv

Warren's neighborhood plans to relocate a flood-prone neighborhood suffers a "moth-eaten" reversal from rising seas.

## Weather

High 80° Low 50°  
Breezy, Partly Cloudy, 10-15

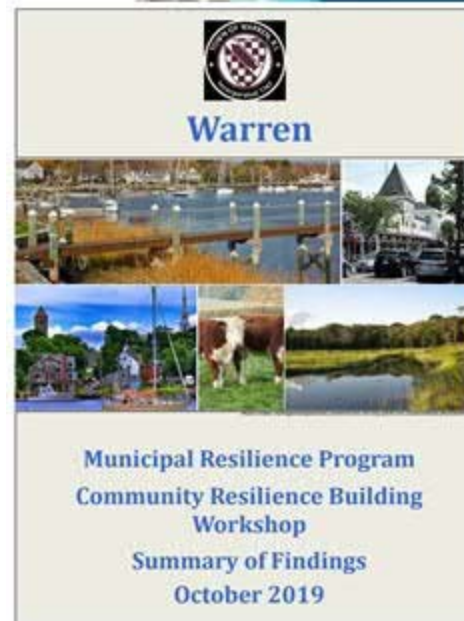
## Weather

High 80° Low 50°  
Breezy, Partly Cloudy, 10-15



# 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

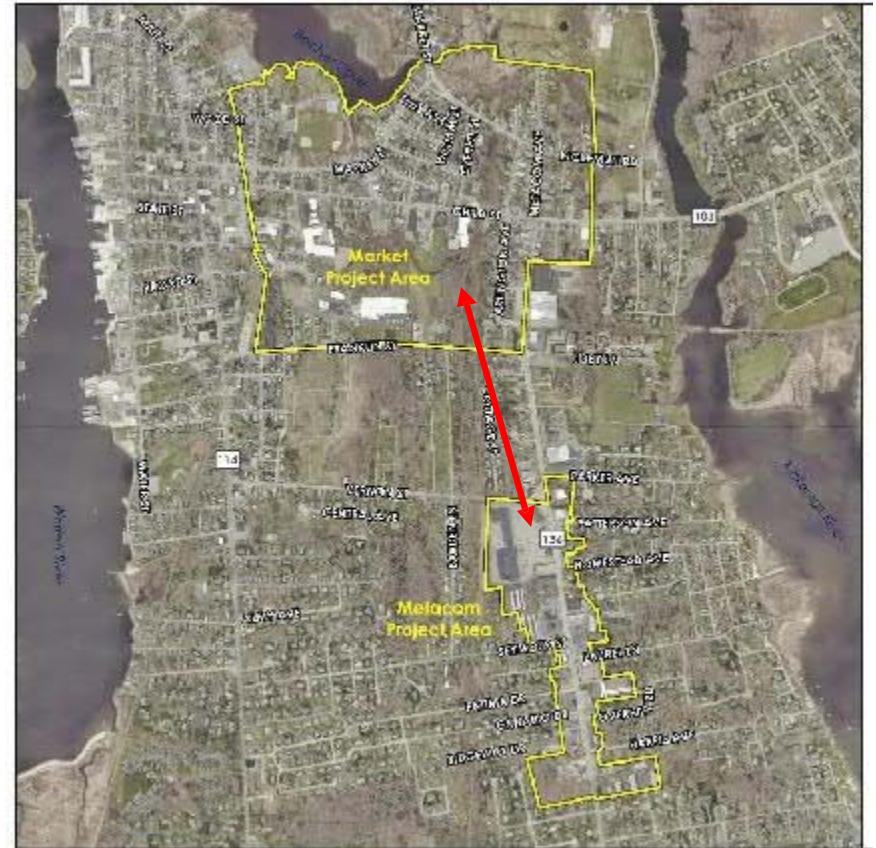
- Warren is one of the lowest lying towns in RI, and the Market Street area is one of the lowest lying areas of Warren.
- At the same time, Metacom Avenue is one of the Town's highest areas and is underutilized and has potential for redevelopment.



## Market to Metacom Project - Background

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

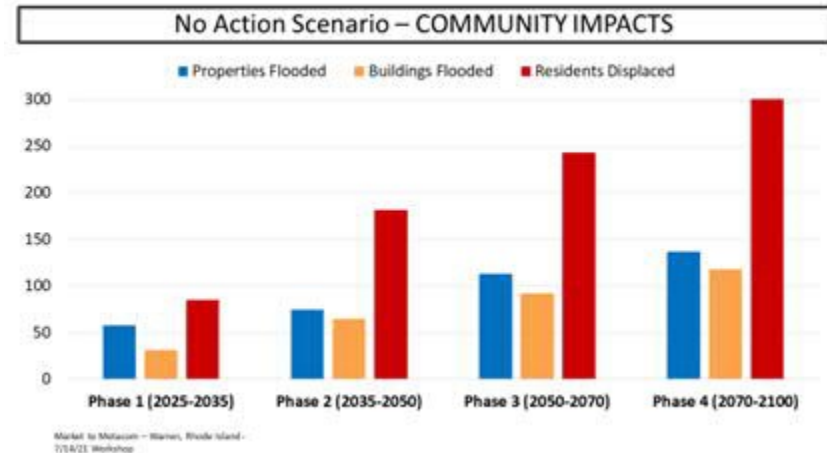
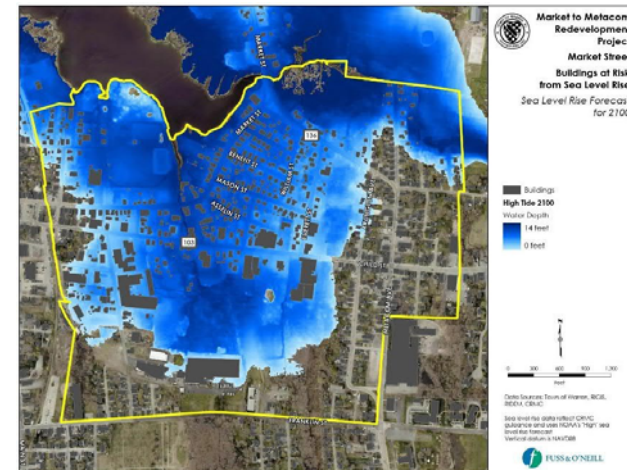
Explore concept of linking the future of adaptation in Market Street area with redevelopment in Metacom Avenue corridor.





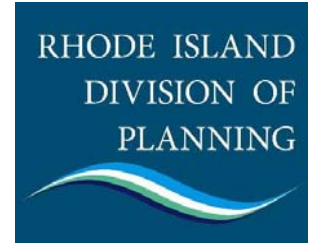
## Methodology and Data

- Concept level planning – order of magnitude
  - Measurement of forecasted impacts
  - Quantification of impacts (pessimistic)
  - Draft scenarios
- Draft scenarios – there will be hybrids and changes
- This is dynamic planning process – input and evolution are encouraged!



## 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



1. Warren Block (in 1877) 2. Warren Block (in 1877) 3. Warren Block (in 1877) 4. Warren Block (in 1877) 5. Warren Block (in 1877) 6. Warren Block (in 1877) 7. Warren Block (in 1877) 8. Warren Block (in 1877) 9. Warren Block (in 1877) 10. Warren Block (in 1877)

VIEW OF  
**WARREN, R.I.**  
1877.

11. Warren Block (in 1877) 12. Warren Block (in 1877) 13. Warren Block (in 1877) 14. Warren Block (in 1877) 15. Warren Block (in 1877) 16. Warren Block (in 1877) 17. Warren Block (in 1877) 18. Warren Block (in 1877) 19. Warren Block (in 1877) 20. Warren Block (in 1877)



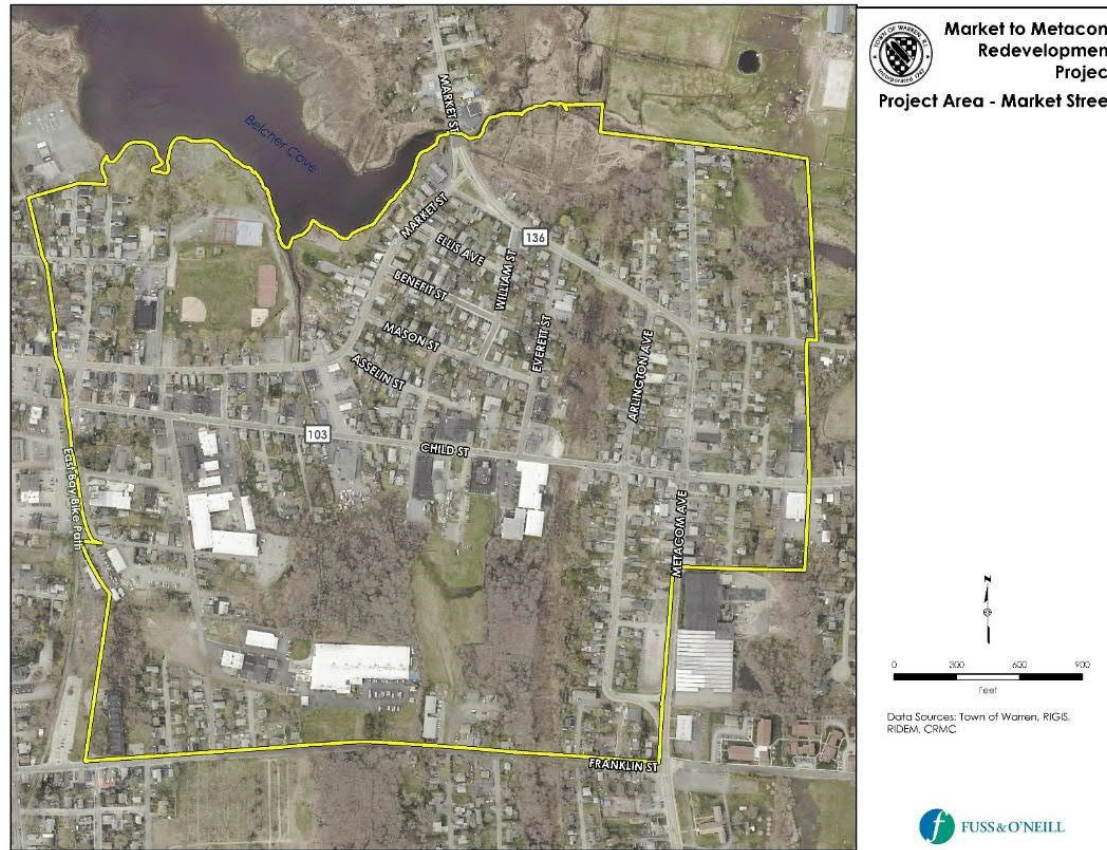
## 1939 Aerial – Market/Child Streets



# Market Street - Project Area

Area contains approximately:

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

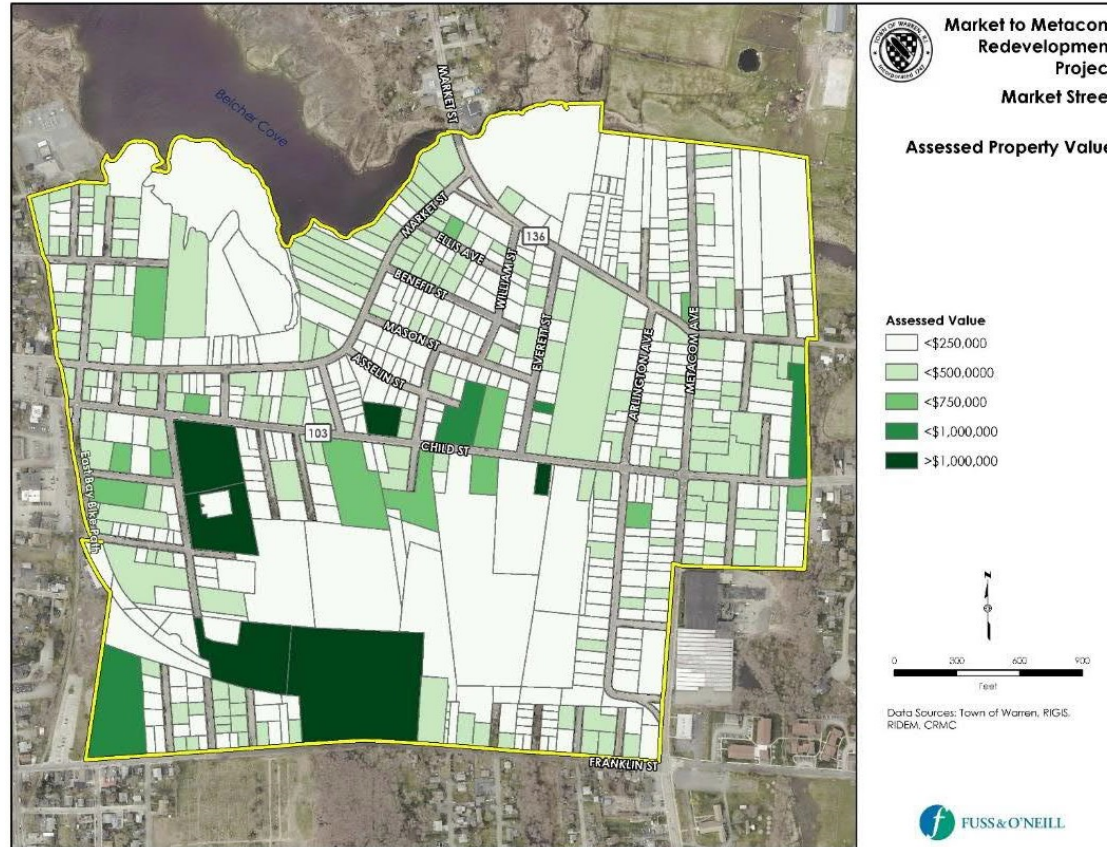




# Market Street – Assessed Property Values

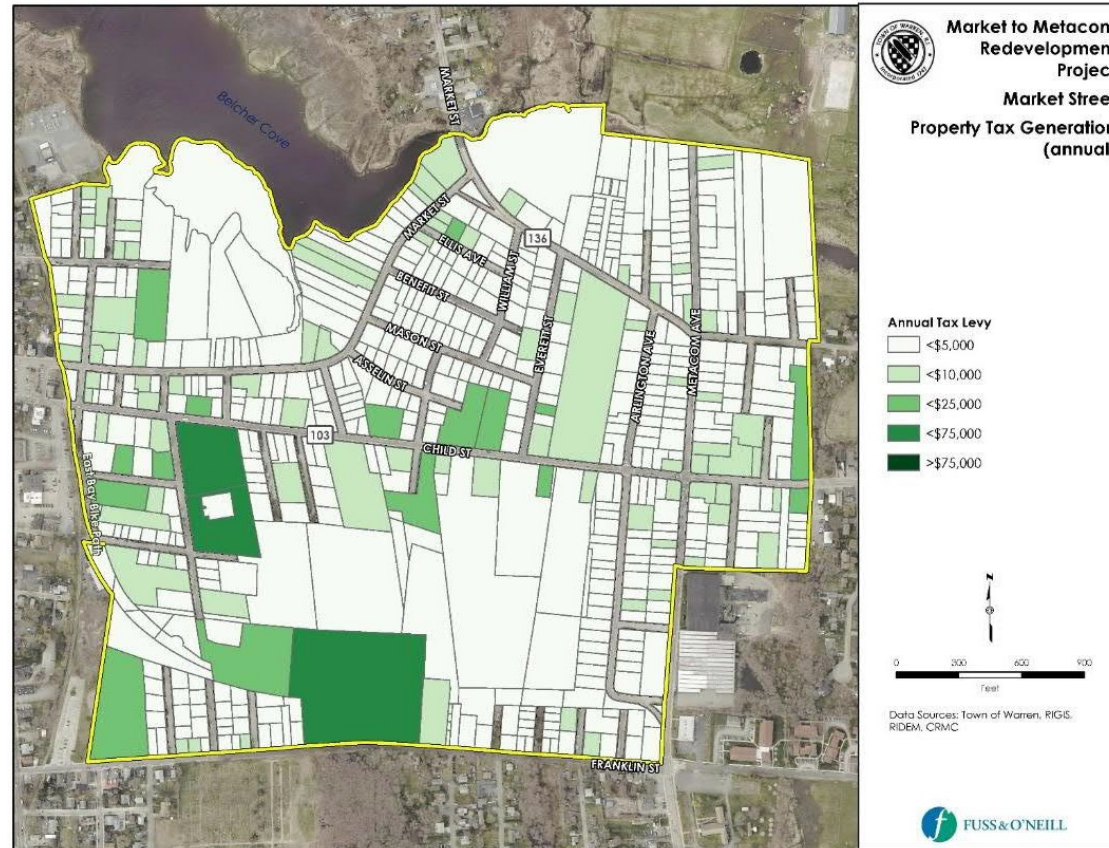
Total Assessed Value:  
\$138 million

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



# Market Street – Property Tax Generation (annual)

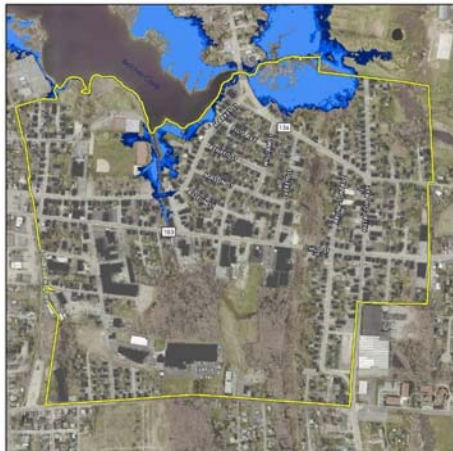
Total Annual Taxes to  
Town of Warren:  
\$2,401,000





## Market Street – High Tide Projections 2035-2100

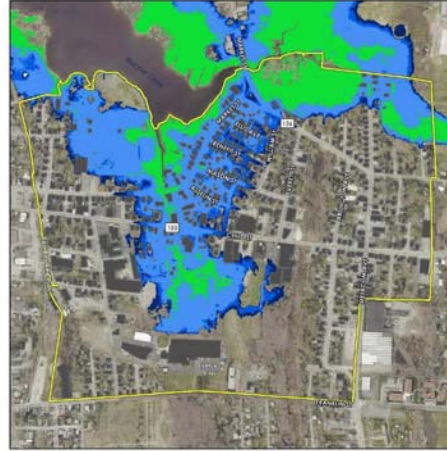
2035



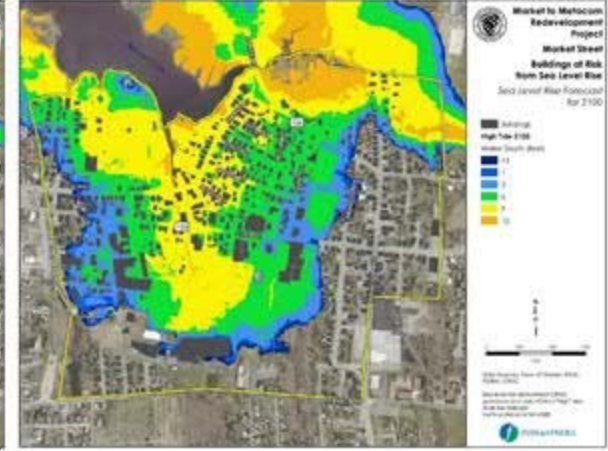
2050



2070



2100



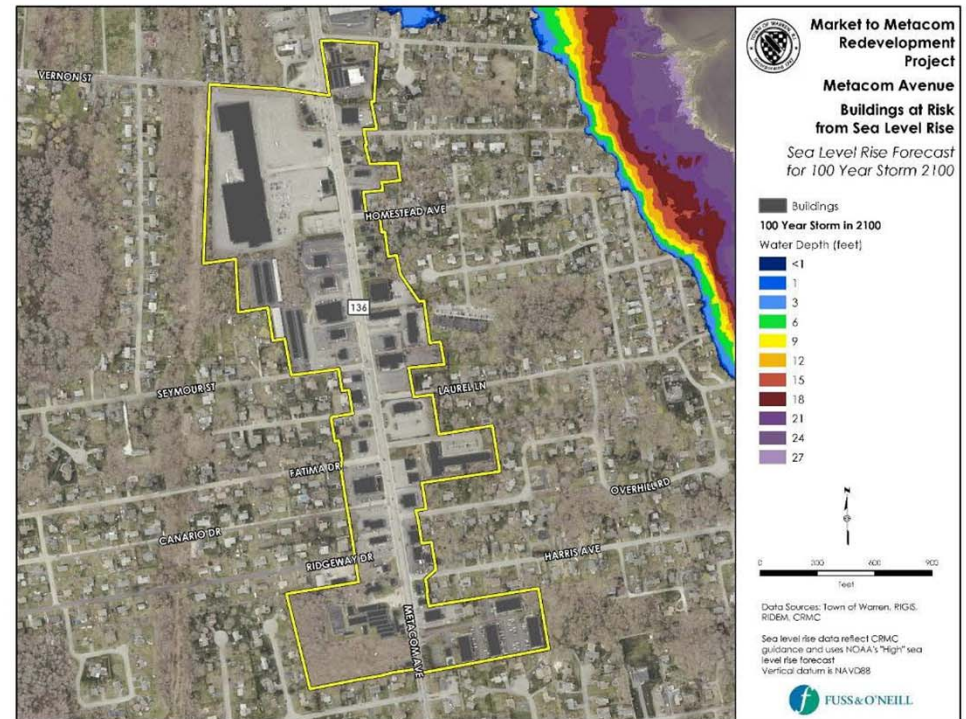
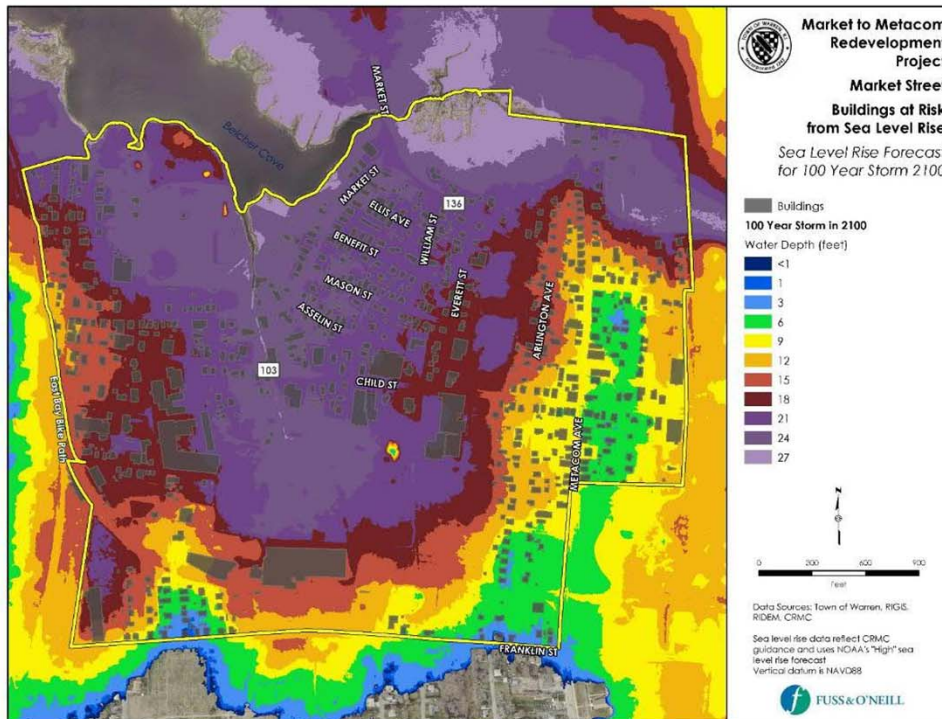




10/8/21@10:30 AM    Photos from RI – Sea Grant    Belchers Cove/Market Street

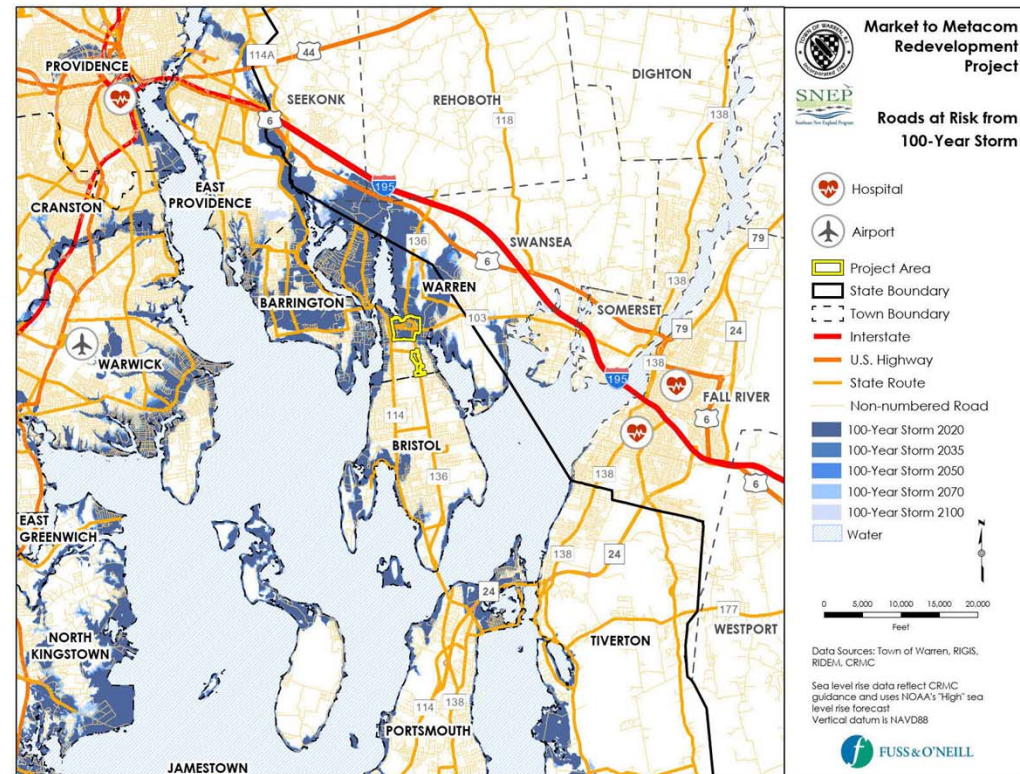
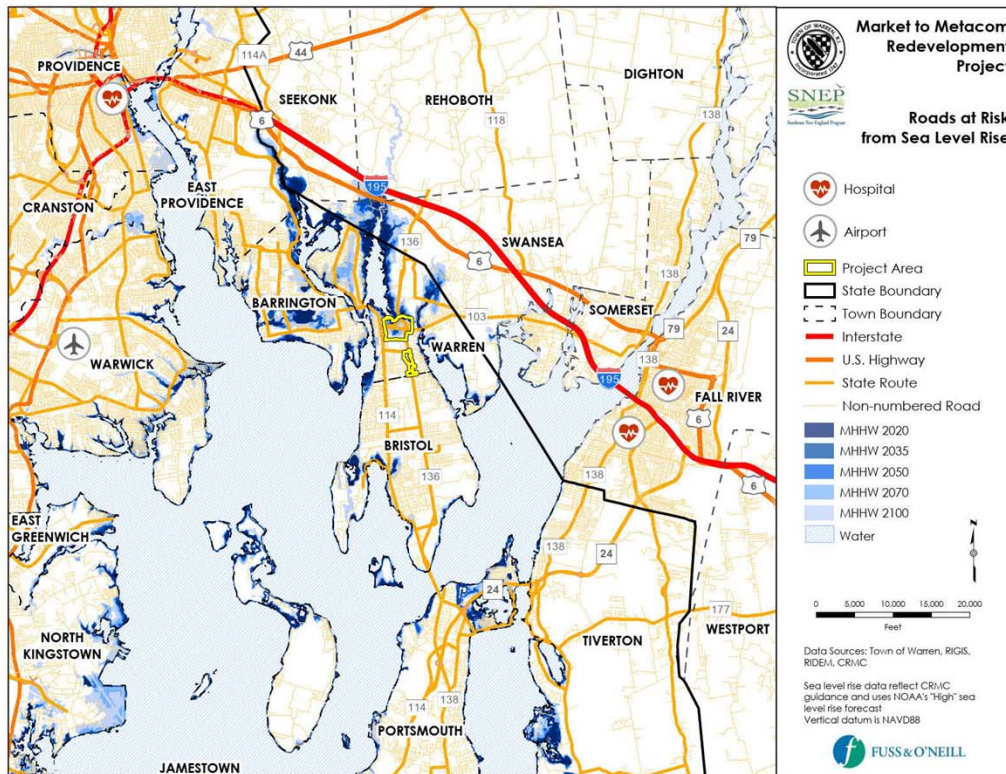


# Sea Level Rise Projection + 100-Year Coastal Storm in 2100





# Impacts to Transportation Assets



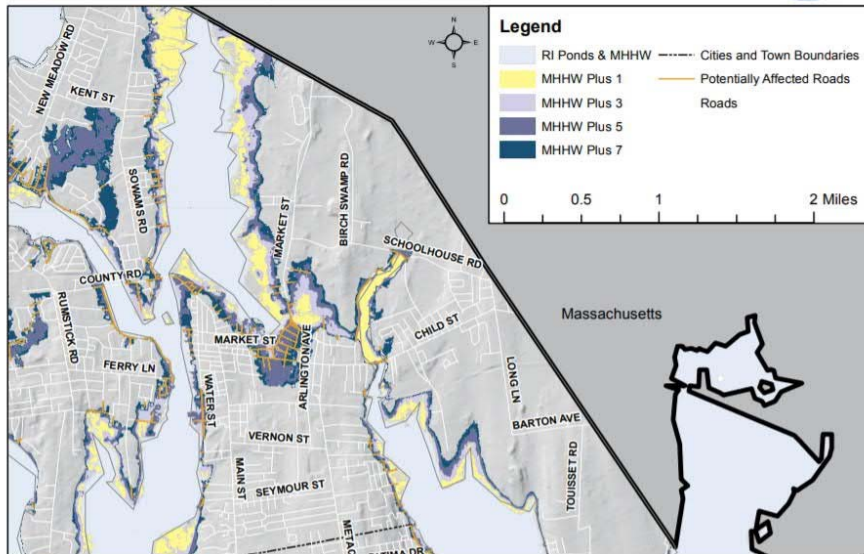


# Impacts to Transportation Assets

## Warren, RI

RHODE ISLAND  
STATEWIDE  
PLANNING  
PROGRAM

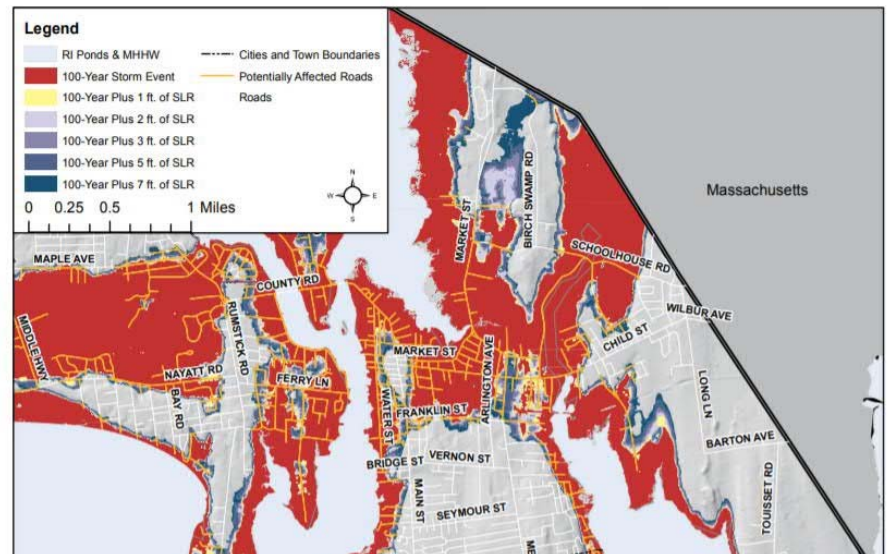
### Warren Roads Exposed to Sea Level Rise



## Warren, RI

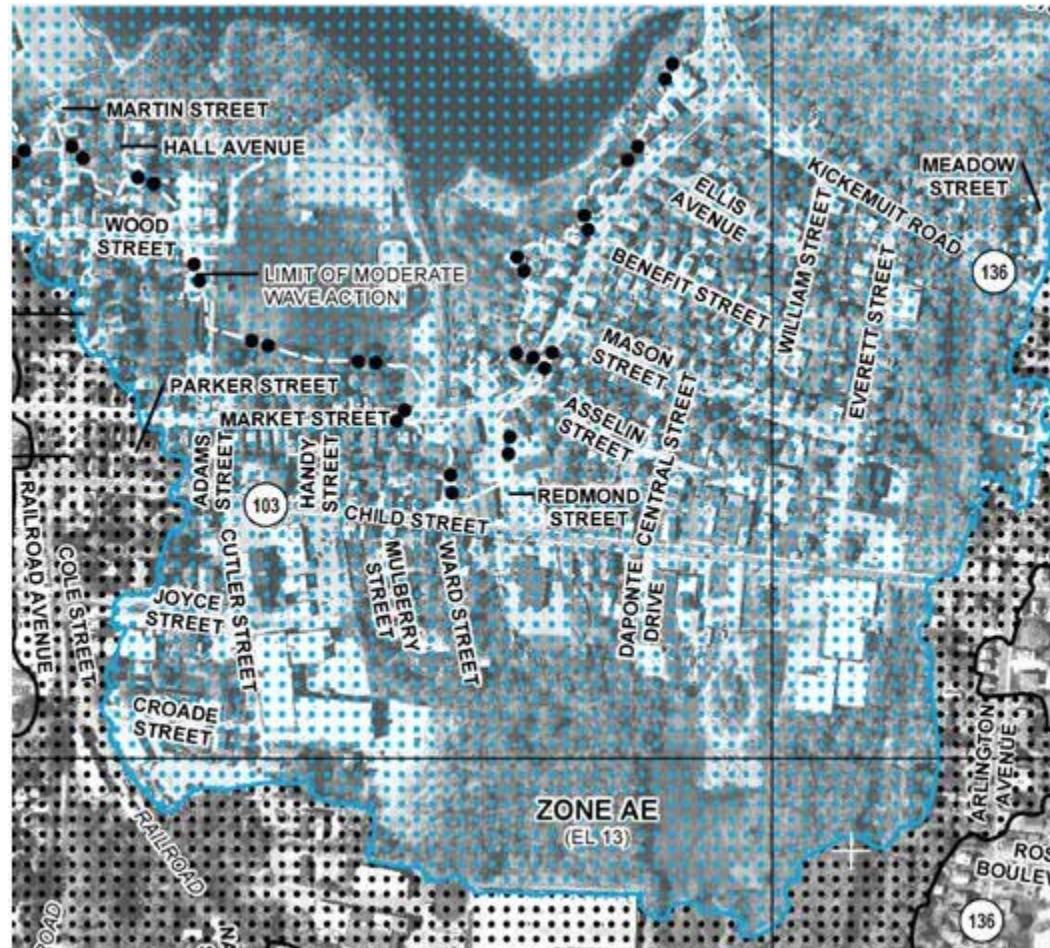
RHODE ISLAND  
STATEWIDE  
PLANNING  
PROGRAM

### 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



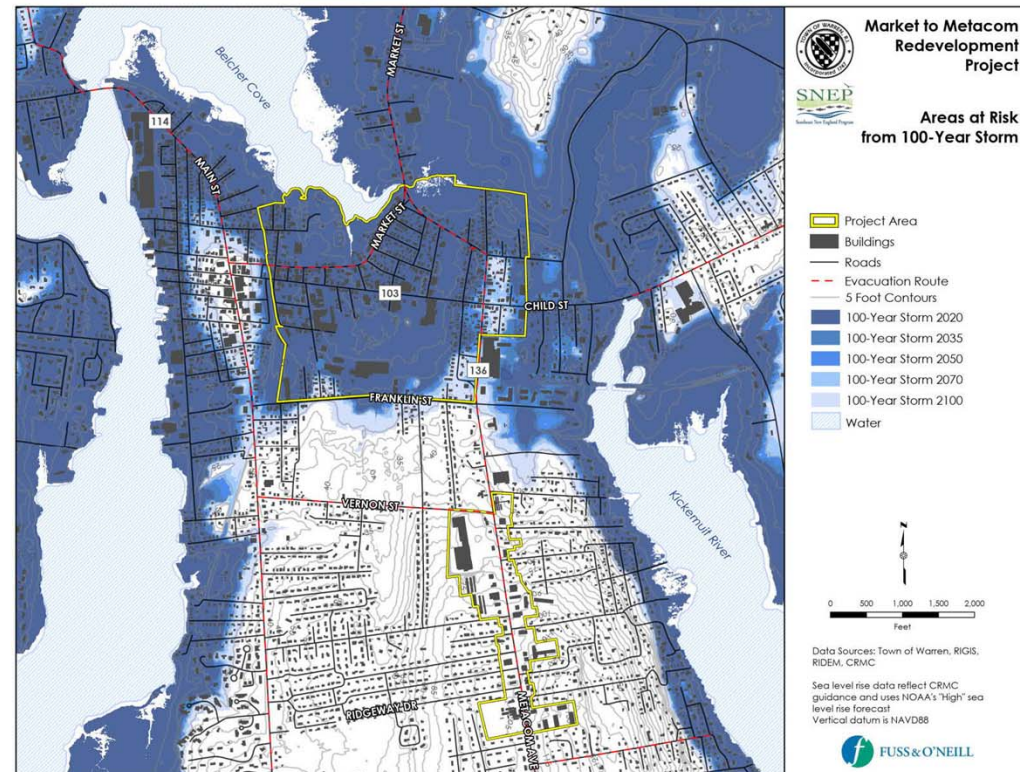
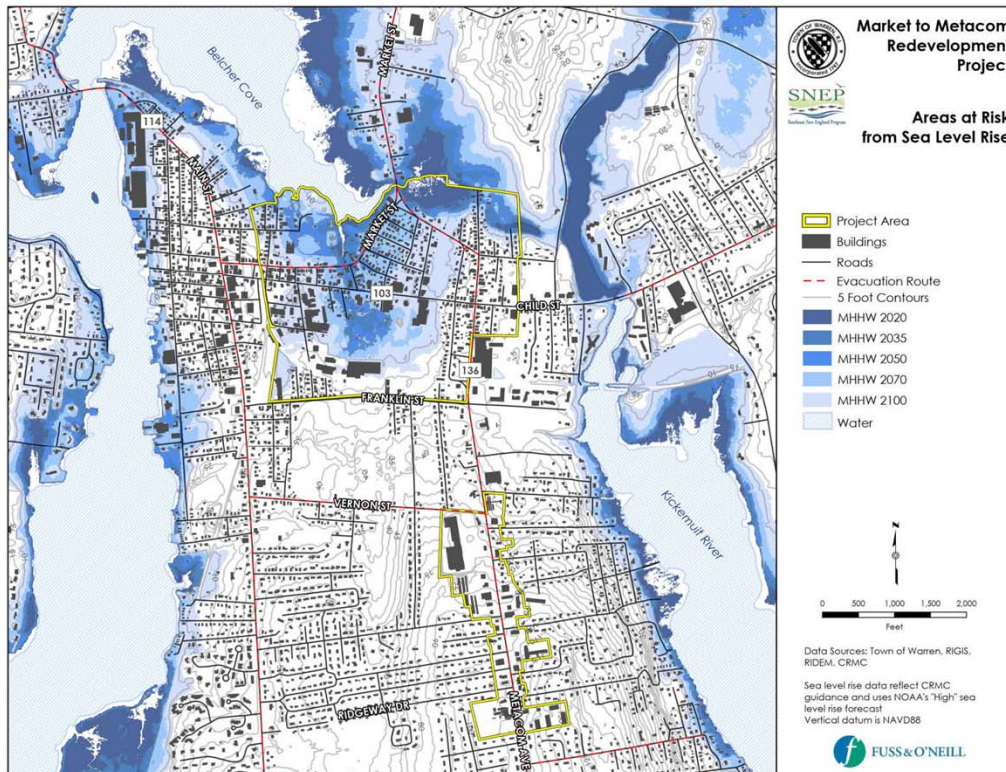


## No Action Scenario - ASSUMPTIONS

- 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

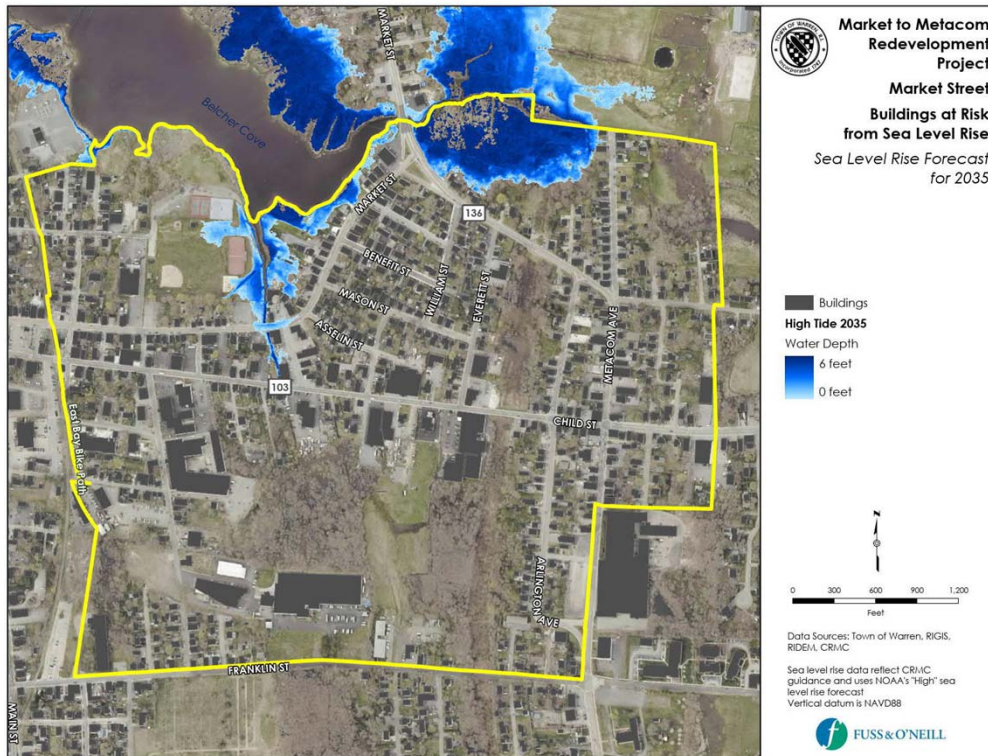


# No Action Scenario – FLOODING OVERVIEW



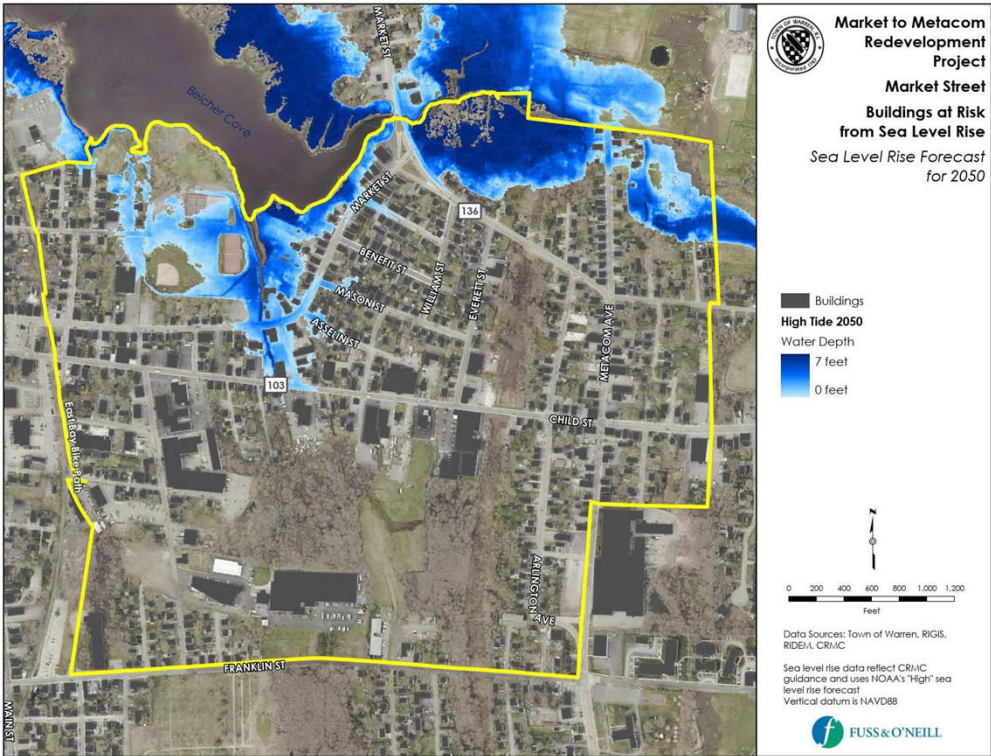


## No Action Scenario – 2035



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

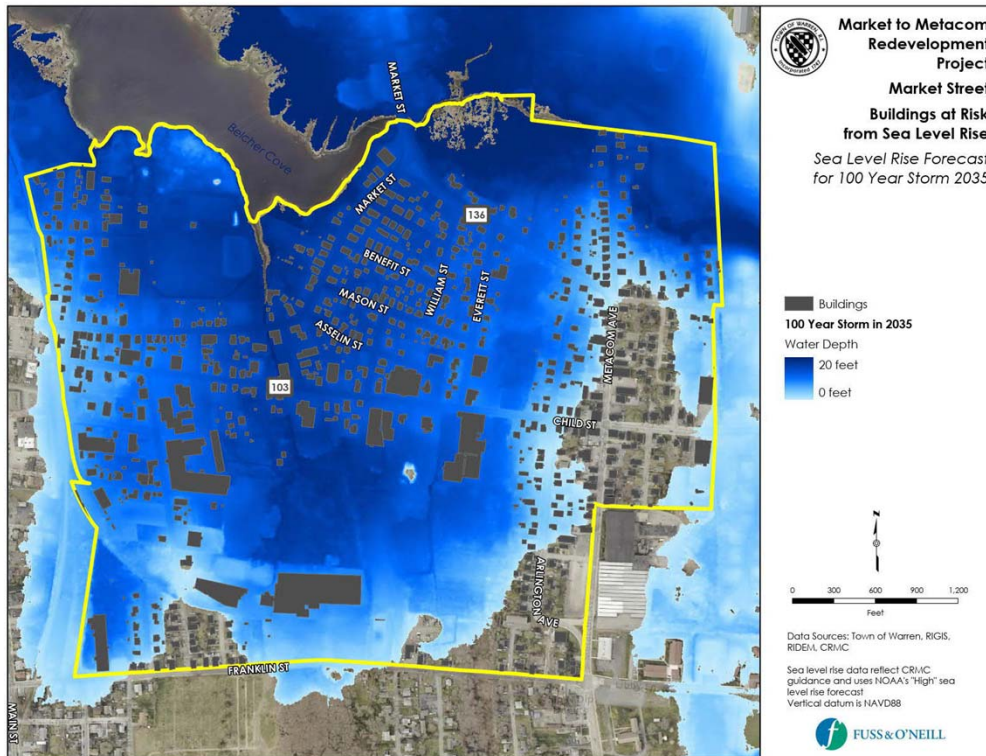
# No Action Scenario – 2050



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

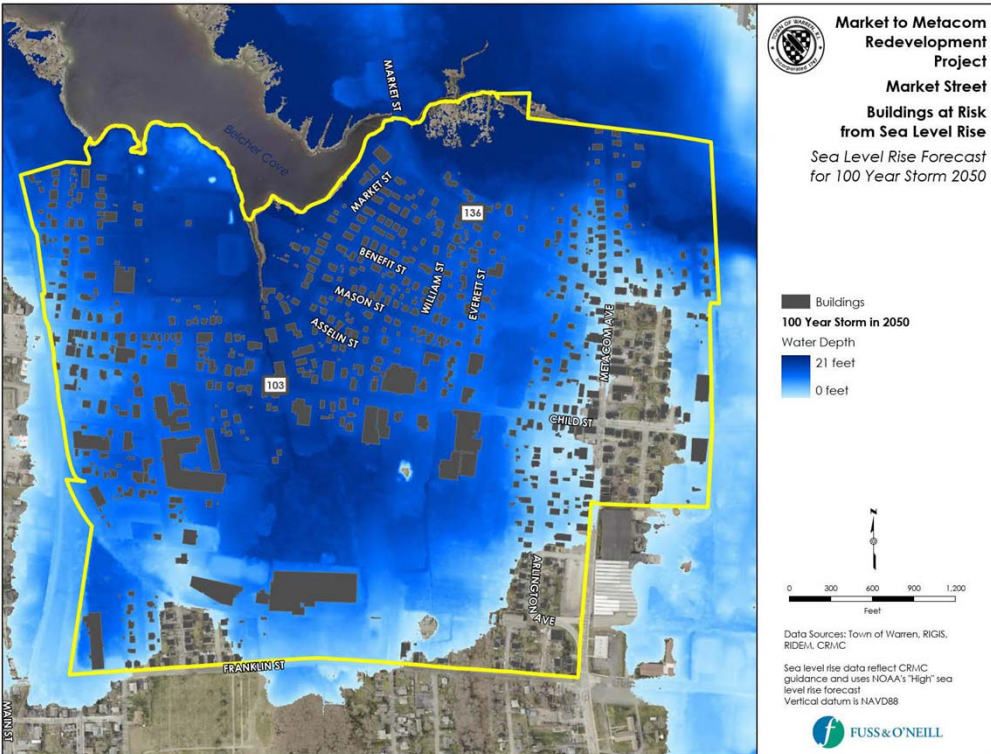


## No Action Scenario – 2035 – 100 Year Storm Event



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

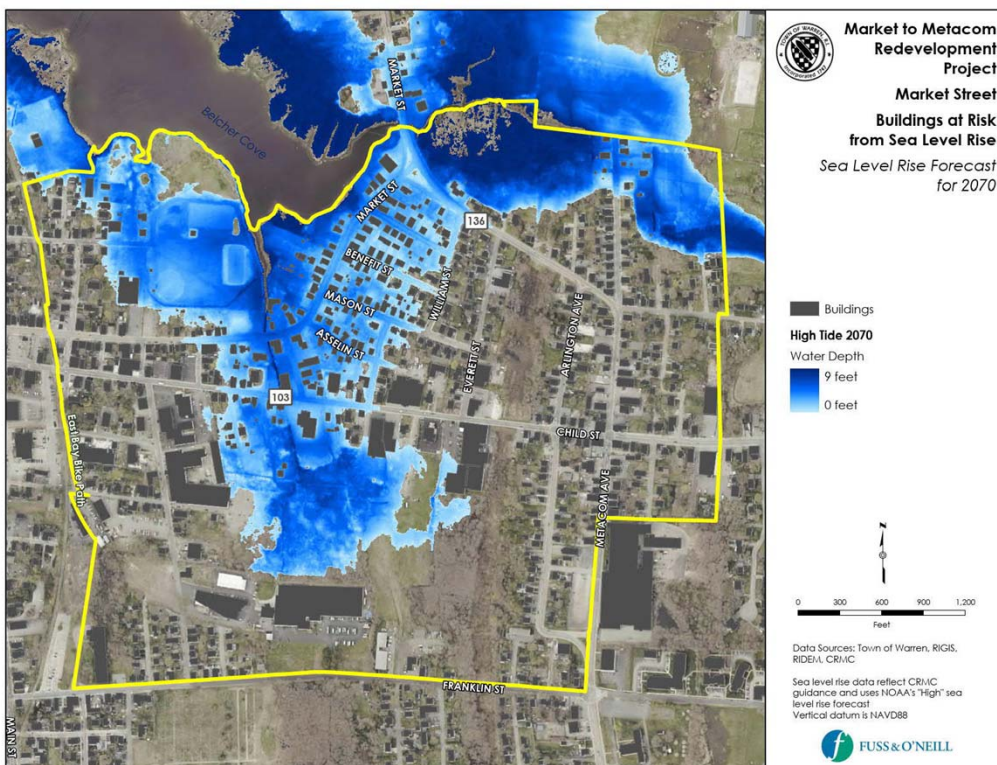
## No Action Scenario – 2050 – 100 Year Storm Event



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

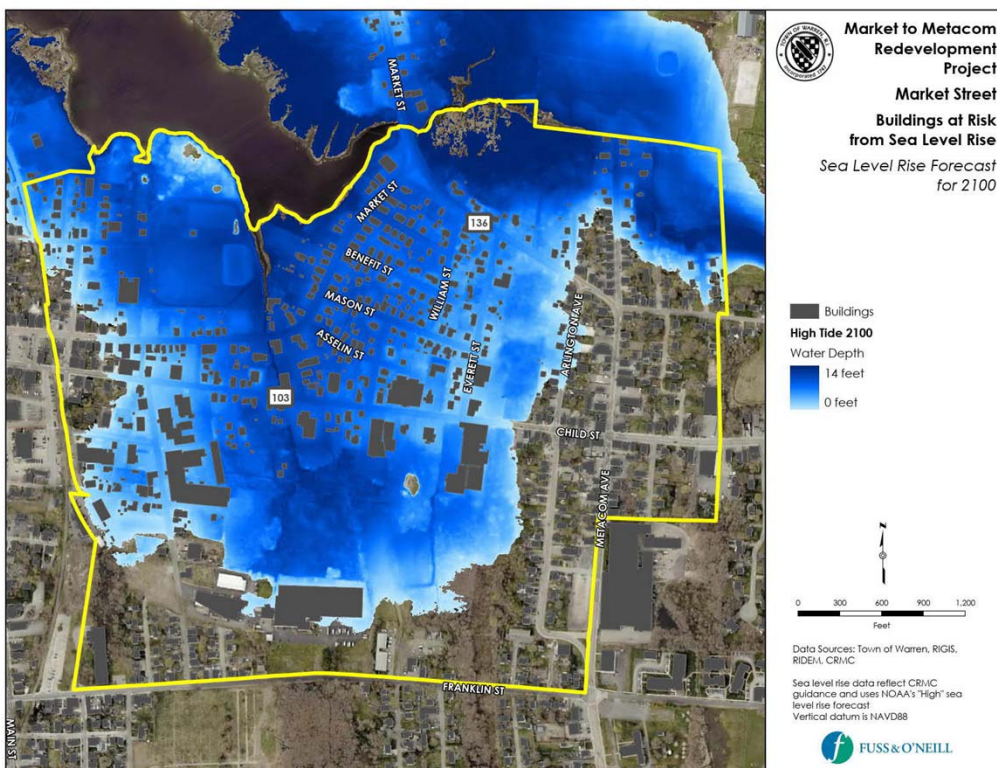


## No Action Scenario – 2070



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
<b>Lost Annual Tax Revenue</b>	<b>\$700,000</b>
<b>Building Loss Cost</b>	<b>\$38,100,000</b>



## 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

<b>Time Period</b>	<b>2025-2035</b>	<b>2035-2050</b>	<b>2050-2070</b>	<b>2070-2100</b>	<b>Total by 2100</b>
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)



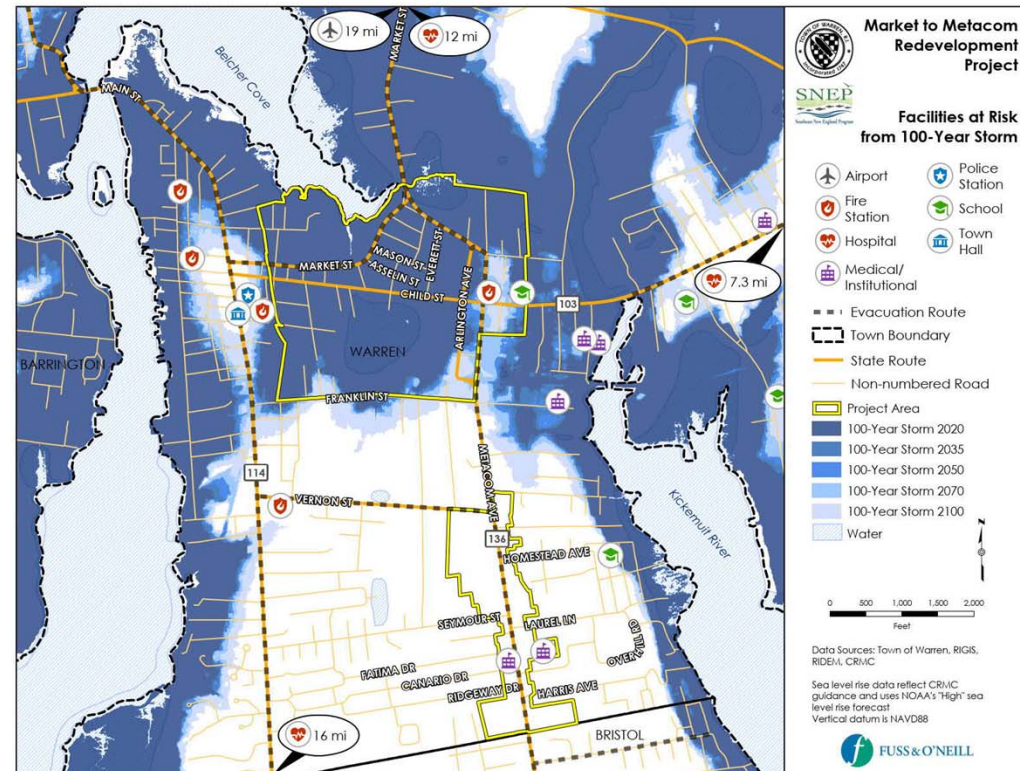
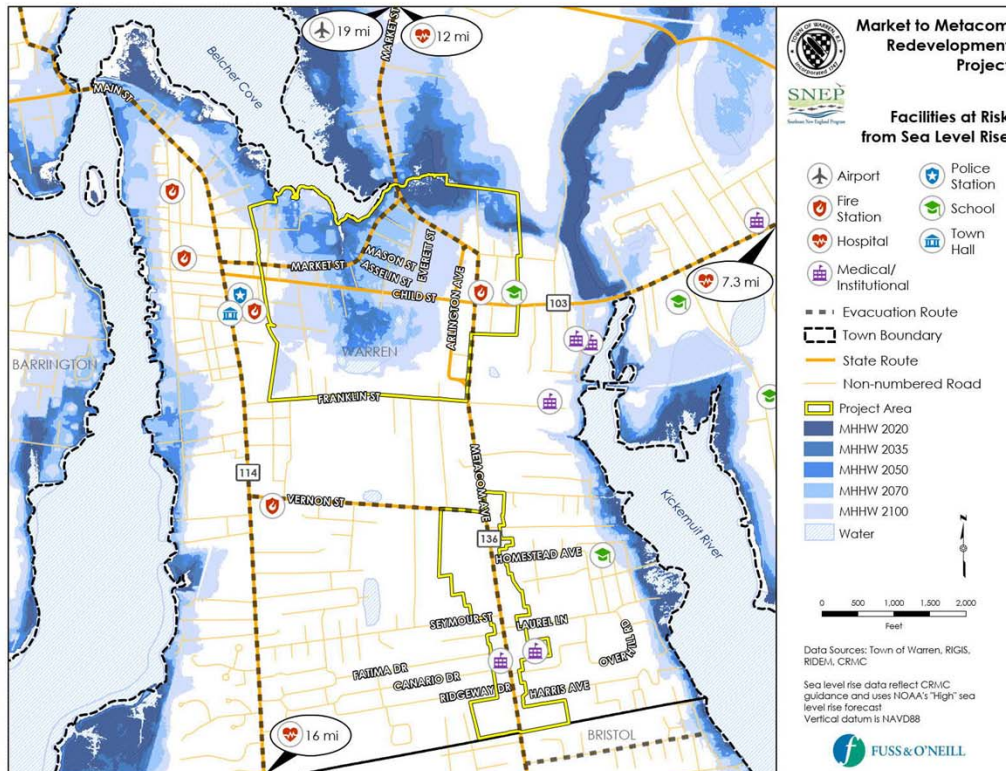


## No Action Scenario – ROADWAY IMPACTS

- 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



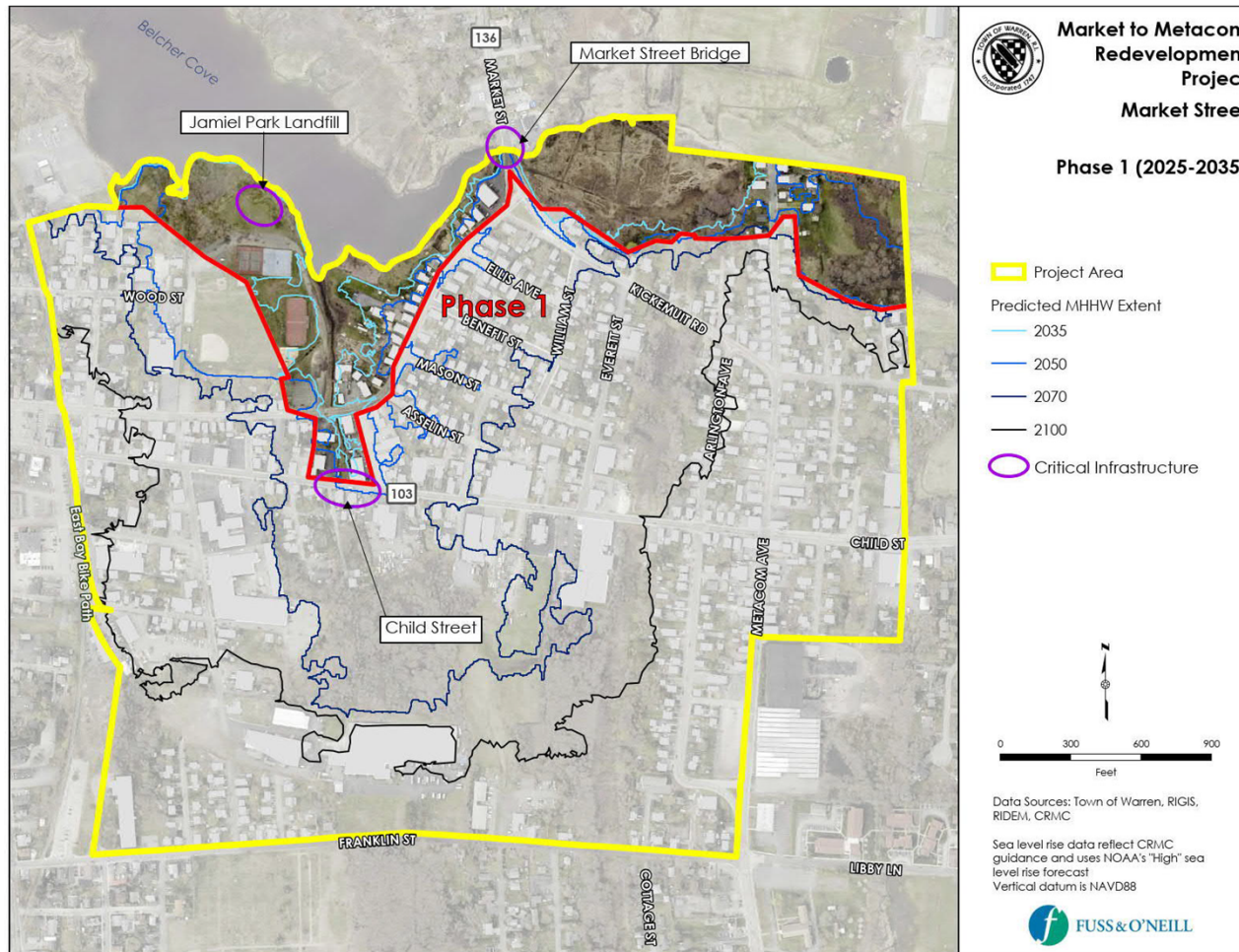
## Phased Relocation and Restoration Scenario - ASSUMPTIONS

- 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





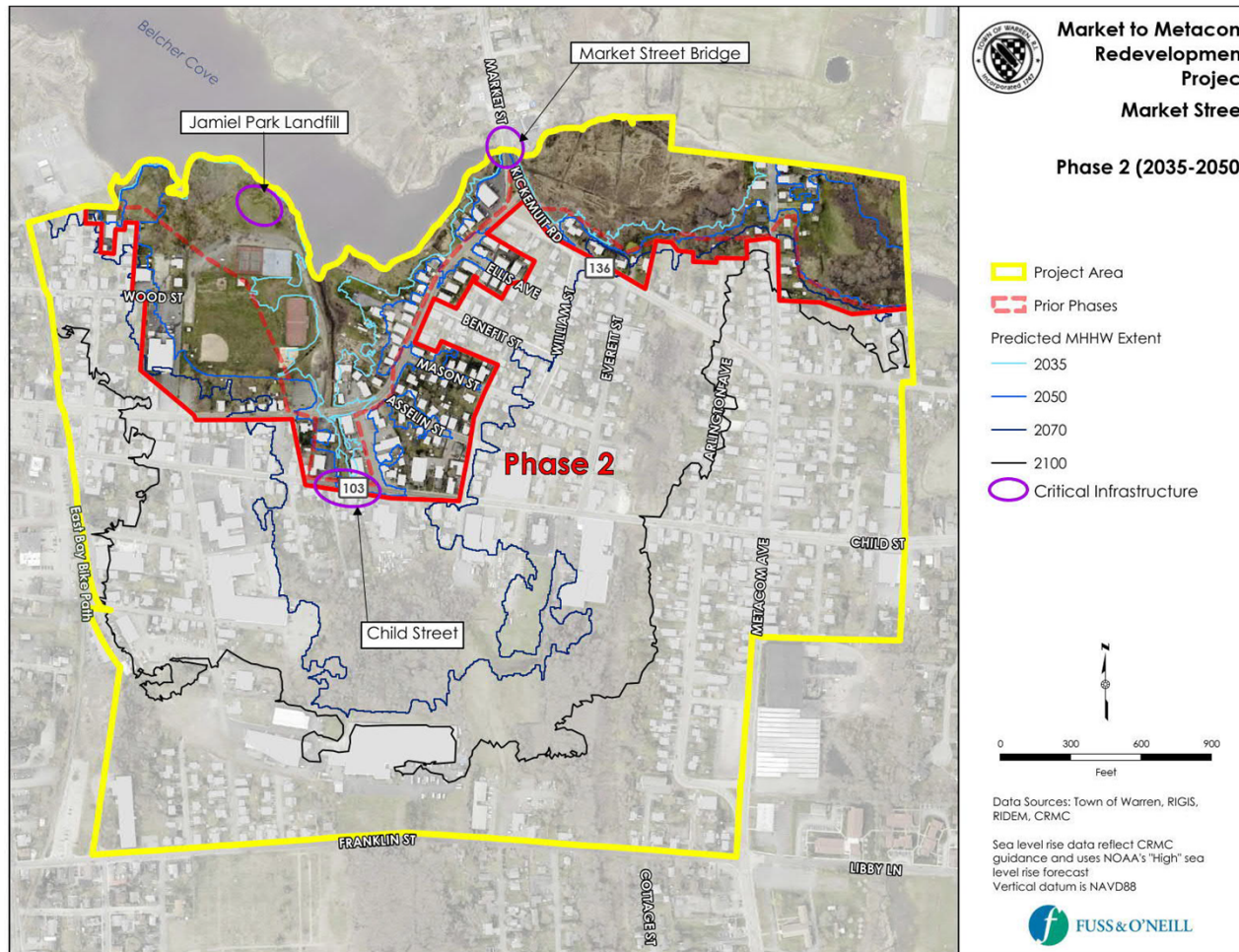
# Phased Relocation and Restoration – PHASE 1 (2025-2035)



Properties	58
Buildings	31
<b>Total Cost</b>	<b>\$14,900,000</b>

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

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

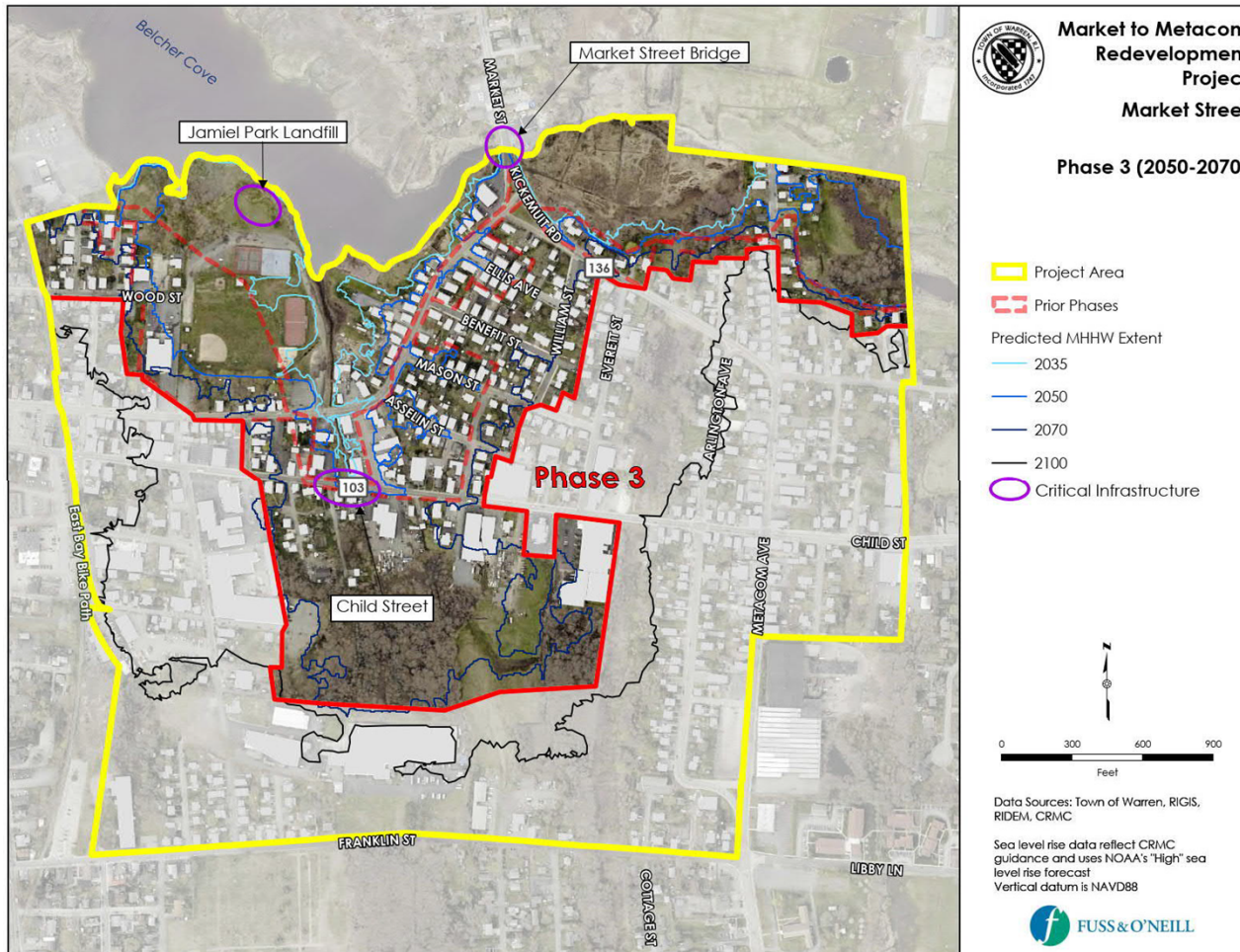


Properties	75
Buildings	65
<b>Total Cost</b>	<b>\$24,600,000</b>

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



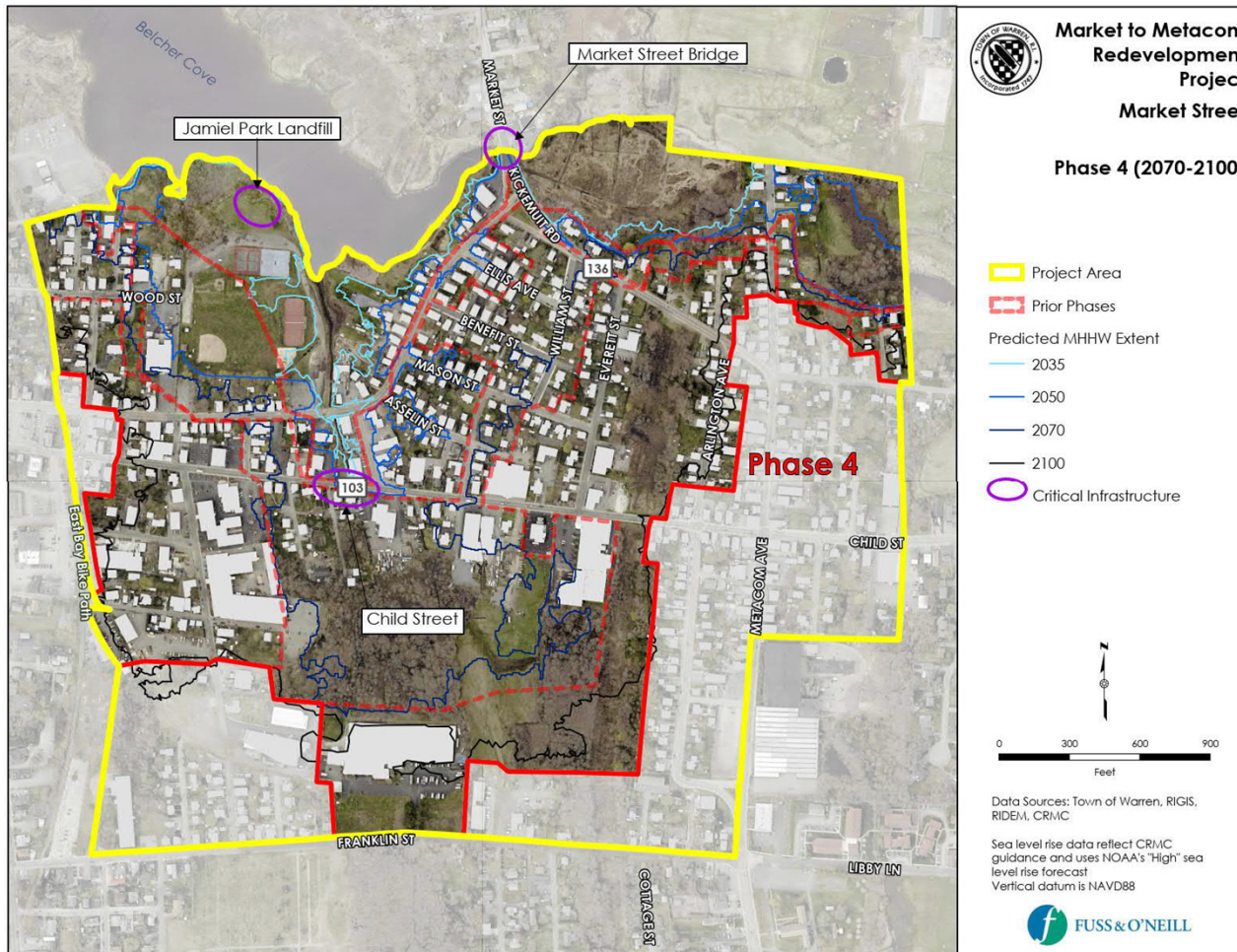
# Phased Relocation and Restoration – PHASE 3 (2050-2070)



Properties	113
Buildings	92
<b>Total Cost</b>	<b>\$36,600,000</b>

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

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

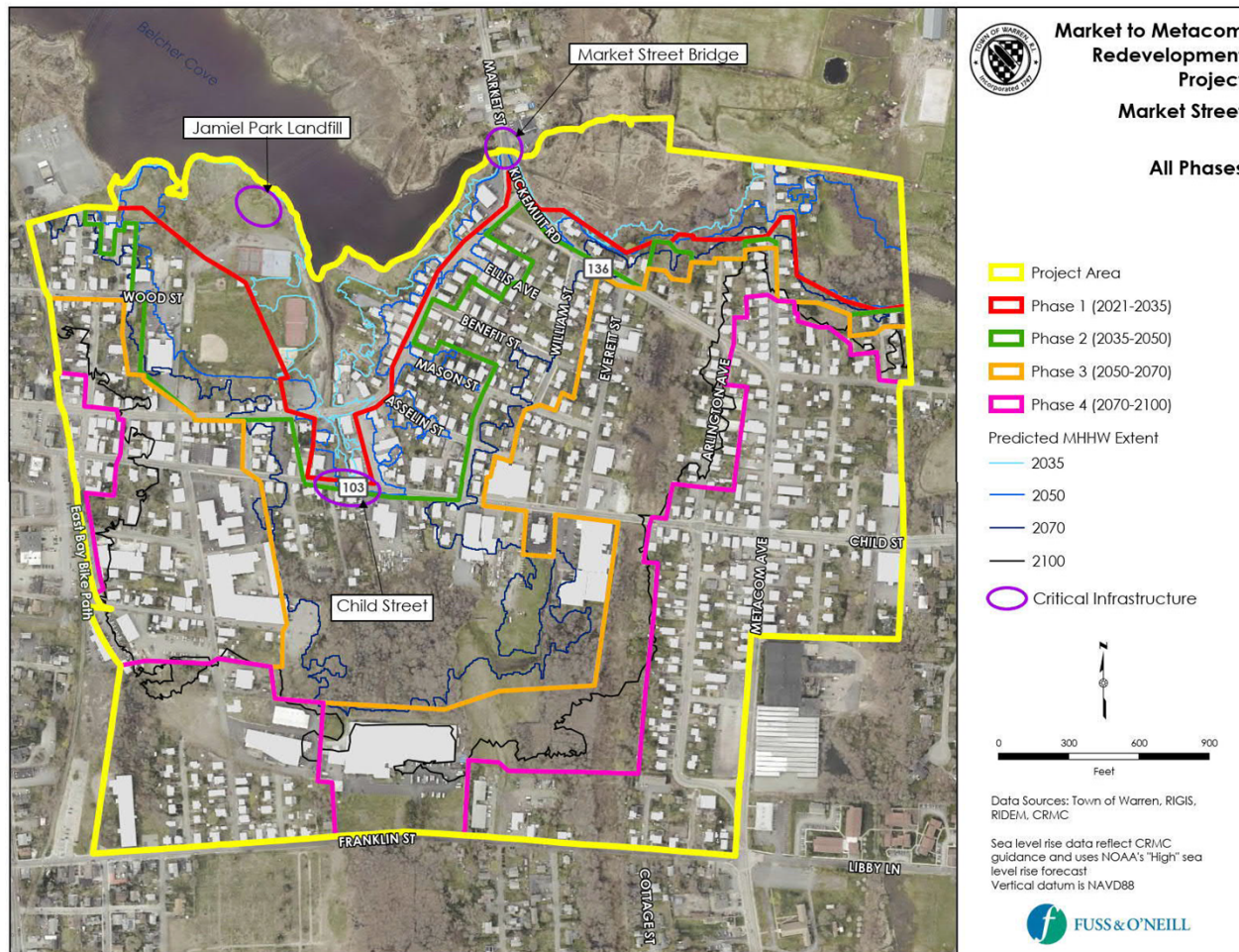


Properties	137
Buildings	118
<b>Total Cost</b>	<b>\$62,100,000</b>

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



# Phased Relocation and Restoration - SUMMARY



## Totals by 2100

Properties	383
Buildings	306
<b>Total Cost</b>	<b>\$138,300,000</b>

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

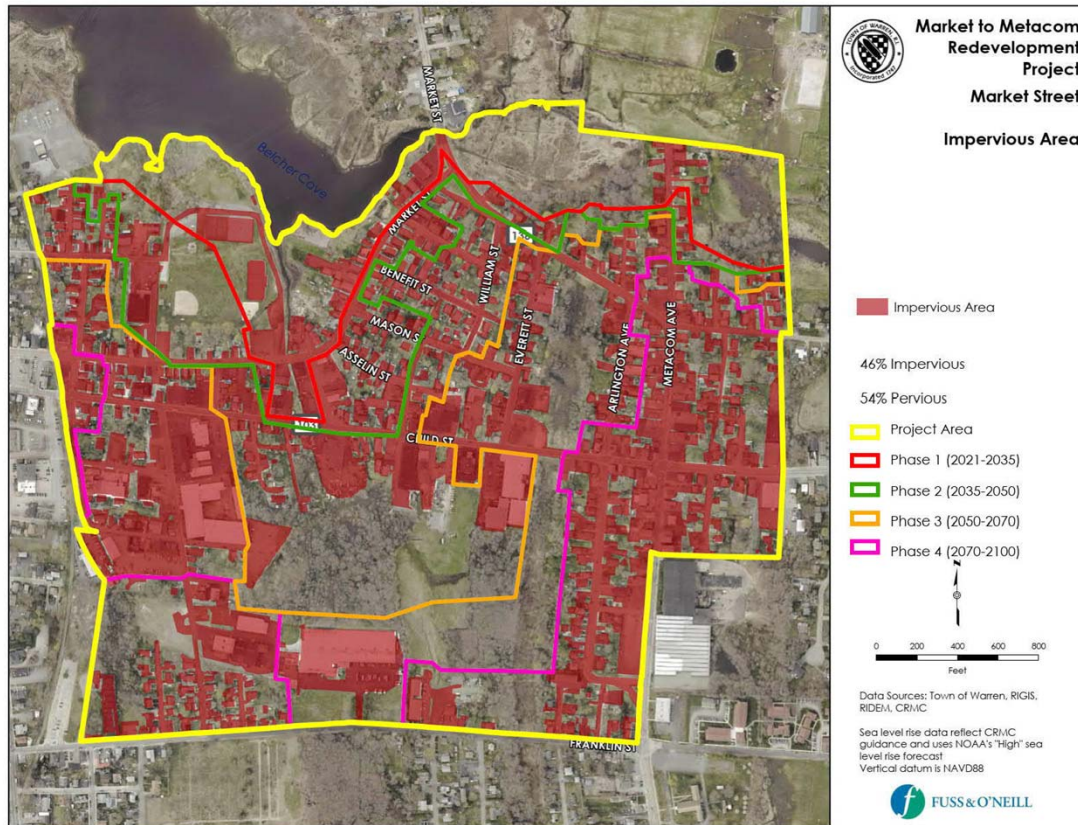
## Phased Relocation and Restoration – ENVIRONMENTAL IMPACTS

- 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
<b>Total</b>	<b>63</b>	<b>153</b>

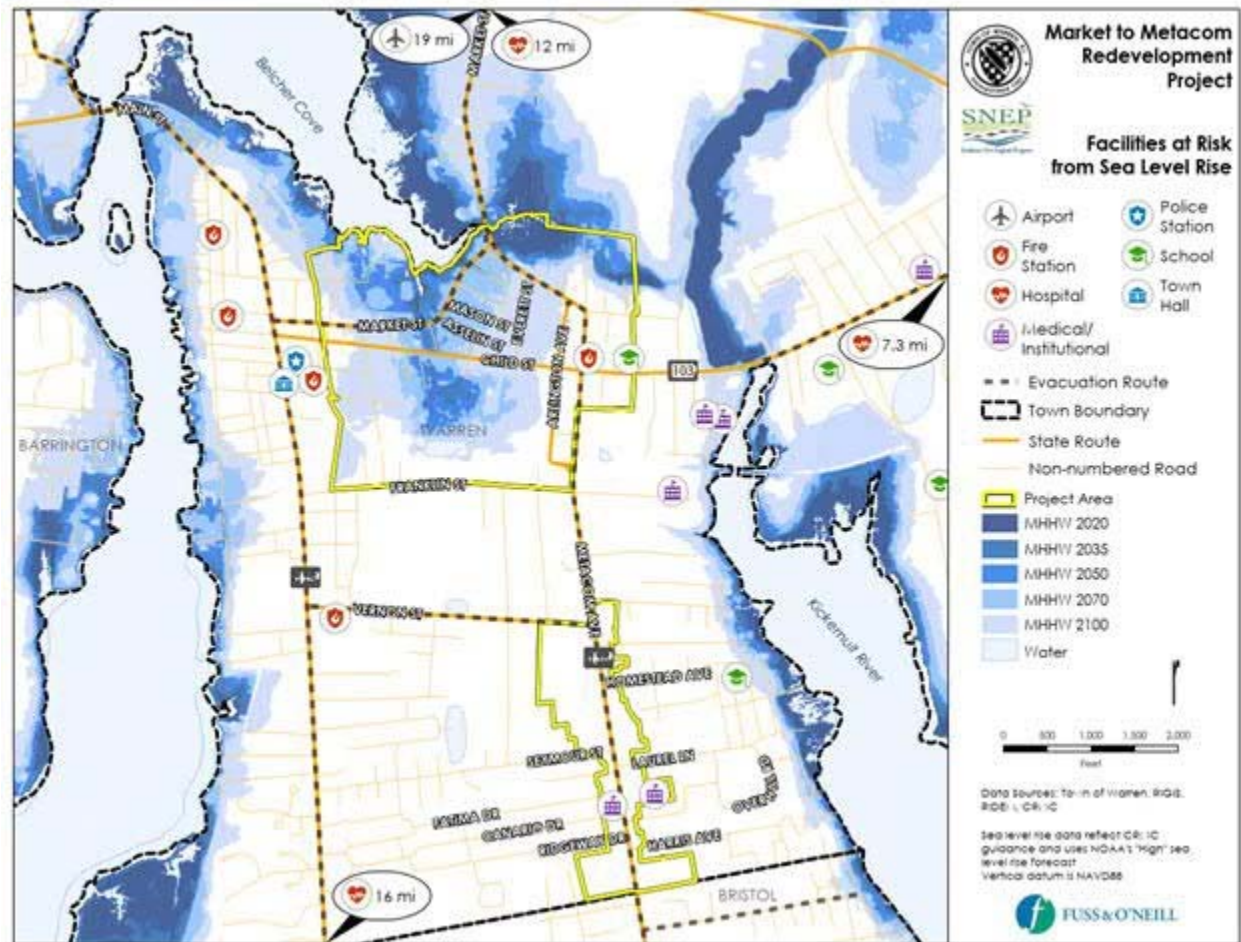
# Phased Relocation and Restoration – Marsh Park





## 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





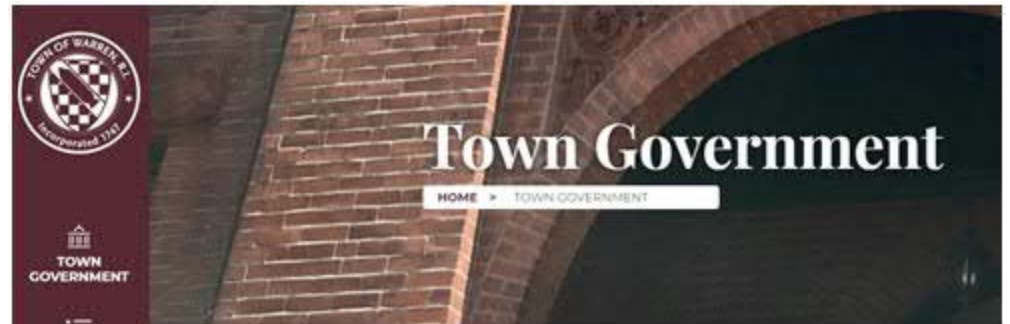
## Phased Relocation and Restoration Scenario – ABILITY TO IMPLEMENT

- 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

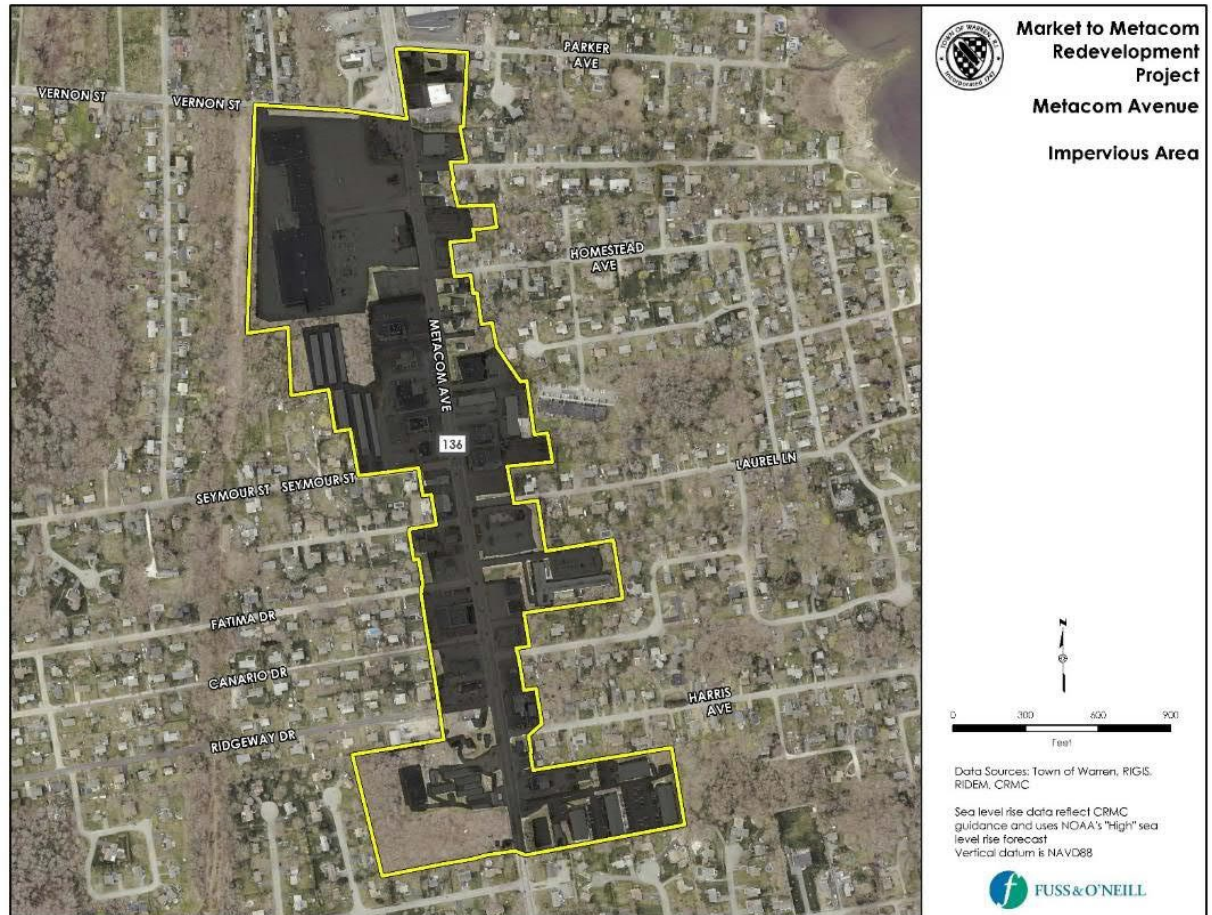
- Can begin almost immediately
- Town changes framework for redevelopment by amending current zoning, adopting Form Based Code and promoting mixed use development to include Workforce Housing
- State and federal funding for infrastructure upgrades
  - Transportation
  - Stormwater management
  - Utilities





# 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





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Fuss & O'Neill  
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Project Website:  
Project Website <https://bit.ly/M2M-Warren>



Thank you

