



# Town of North Beach Compound Flood Action Plan

TOWN RESIDENTS INPUT MEETING

OCTOBER 20, 2022



*The Jewel of the Chesapeake Bay*  
**North Beach, Maryland**

# Introduction to BayLand

- Environmental Engineering Firm
- Specializing in Projects at the Land-Water Interface
  - Stream & Ecological Restoration
  - Stormwater Management & Sustainable Site Development
  - Marine, Dredging & Shoreline
- Project Team
  - Megan Barniea, PE – Senior Project Manager
  - Anna Johnson, PE, CC-P – Coastal Engineer
  - Sepehr Baharlou, PE – QA/QC

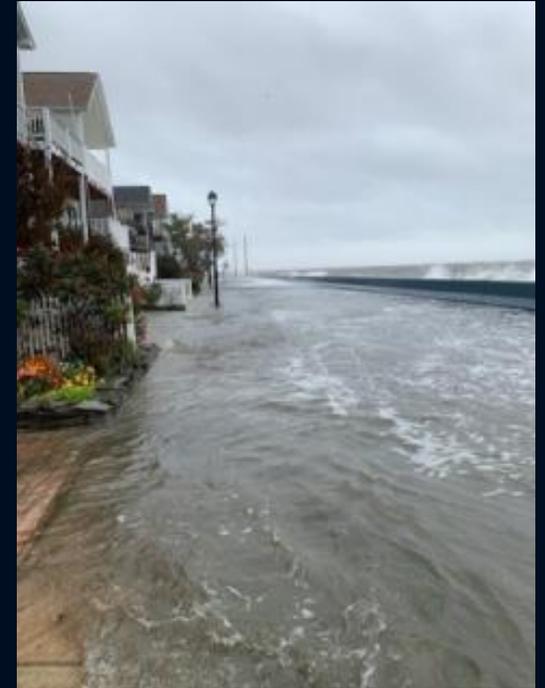


# Agenda

- Introduction
- Field Investigations
- Existing Conditions
- Flooding Analysis
  - Coastal Flooding Analysis
  - Stormwater Flooding Analysis
- Initial Priority Areas
- Next Steps

# Introduction

- Town experiences heavier and more frequent compound (stormwater & coastal) flooding
- Town created Stormwater and Flood Mitigation Advisory Committee (Flood Committee)
- Compound Flood Action Plan
  - Phase 1 – Flood and Sea Level Rise Action Plan Framework: Complete
  - Phase 2 – Compound Flood Action Plan
    - 2030, 2050, and 2100 Flood Mapping: Complete
    - Request for Proposal for consultants to develop CFAP
      - ◆ Identify and characterize both stormwater & coastal flooding problems
      - ◆ Assess the vulnerability of important assets to the flooding hazards
      - ◆ Identify solutions to mitigate flooding with an implementation plan
      - ◆ Identify funding sources to pay for solutions
      - ◆ Prepare conceptual designs for mitigation in priority areas
    - BayLand competitively selected in April 2022



# Information Gathering

- Locate and map storm drain infrastructure and identify signs of deterioration
- Photo document drainage characteristics, erosion and flow patterns
- Identify locations suitable for stormwater Best Management Practices (BMPs) to provide flood relief



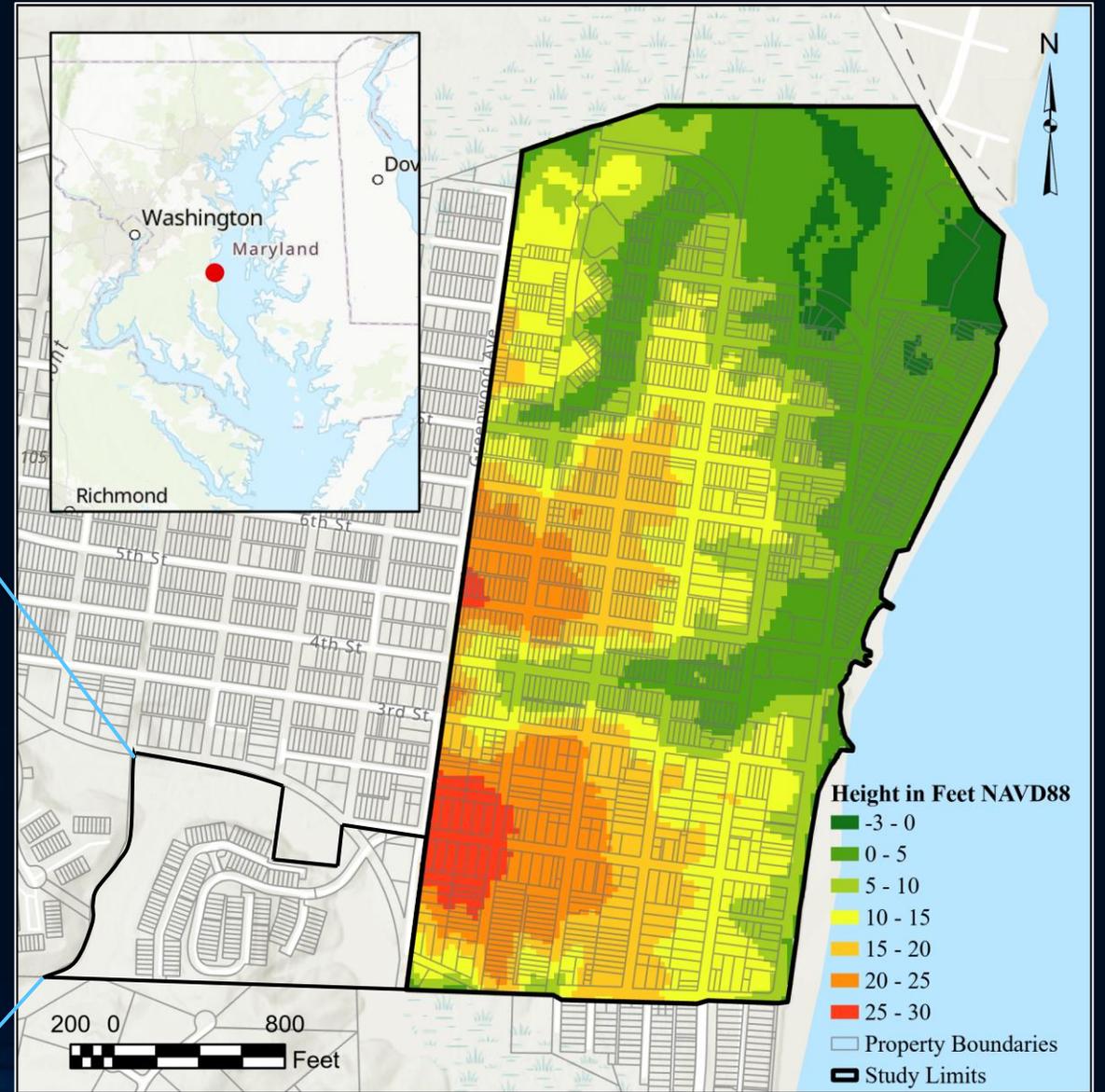
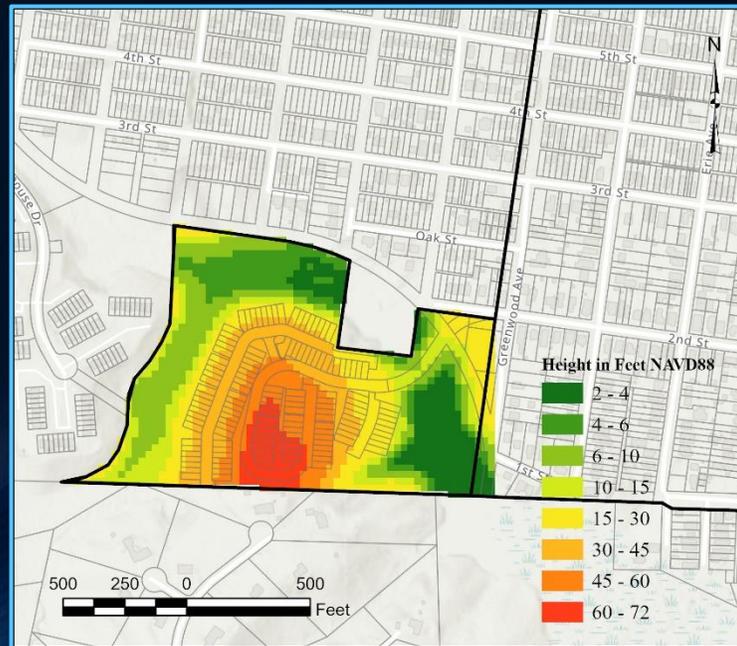
# Information Gathering

- Locate and map shoreline features
- Identify locations suitable for coastal flood mitigation measures to provide flood relief
- Survey critical elevations of drainage and roadway infrastructure, and shoreline elements



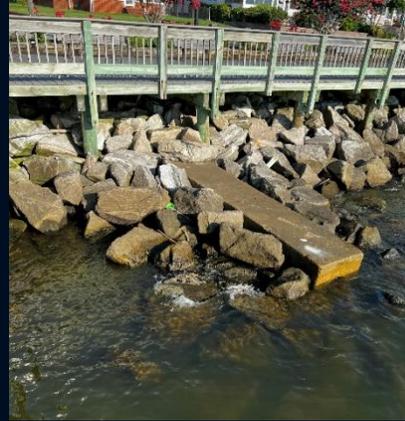
# Town of North Beach Existing Conditions – Topography

- Topography from LiDAR data
- Utilized for development of hydrologic model and supplement critical elevation survey



# Town of North Beach Existing Conditions – Drainage System

- Storm drain infrastructure
  - Large and developed drainage areas
  - Aging and undersized elements
- Approximately 15 mapped tidal outfalls
  - Outfalls below mean low water
  - Enables perpetual backwatering
  - Promotes sedimentation
- Drainage system is overwhelmed!



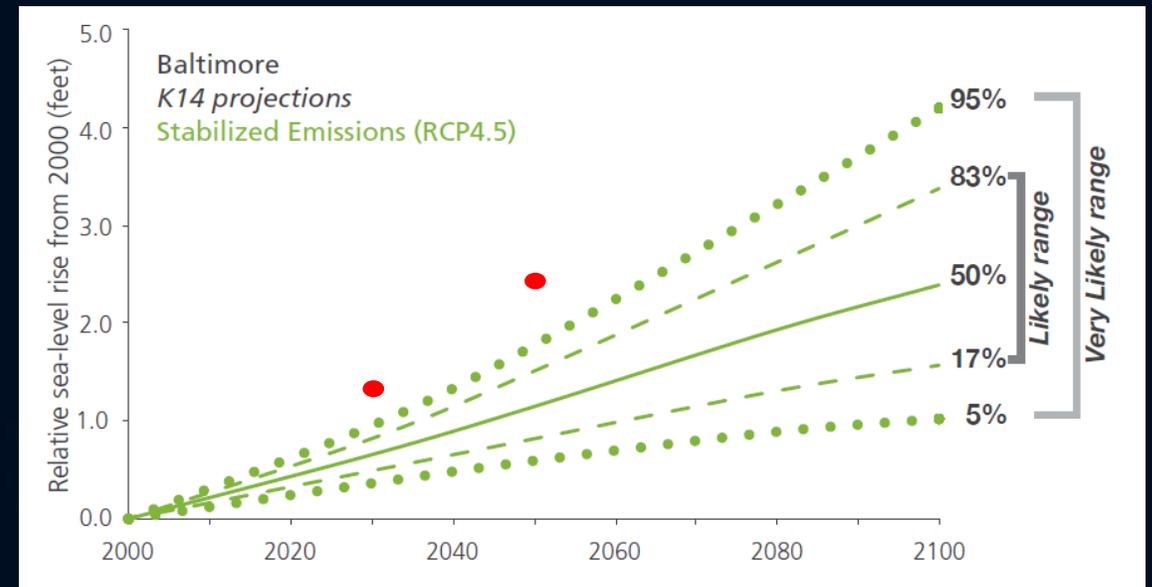
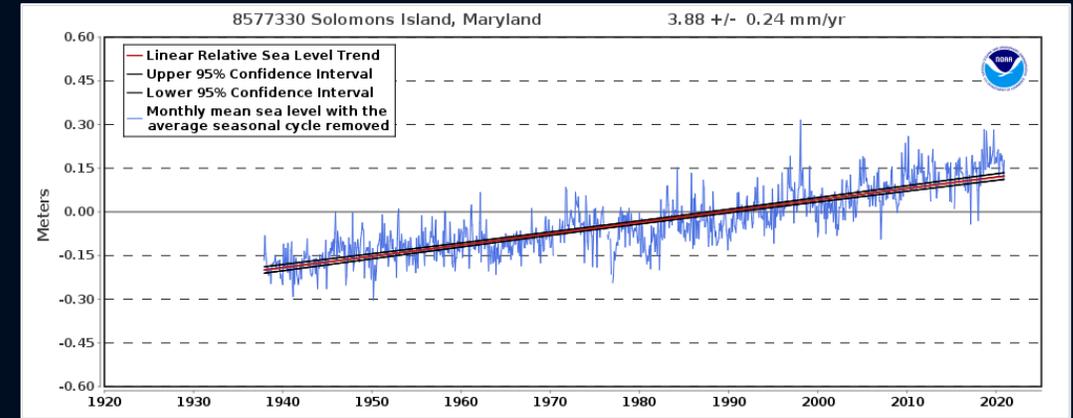
Existing Storm Drain Infrastructure Map

# Town of North Beach Existing Conditions – Shoreline Features



# Sea Level Rise Mapping

- Two Components of SLR
  - Global SLR – thermal expansion, ice melt
  - Relative SLR – land subsidence, tectonic plate movement
- Historic Sea Level Rise at Solomon’s Island Station (NOAA) between 1940 and 2020 – 0.15 inch/year
- Stillwater Flood Analysis and Mapping:
  - Completed by the Eastern Shore Regional GIS Cooperative (ESRGC)
  - Utilized SLR projections for Maryland
  - 1% Annual Chance Flood Elevation – FEMA
  - Utilized DNR Guidance on SLR projection implementation for developed area



SLR for the Town of North Beach Design	
Year	SLR Meets or Exceeds:
2030	1.3 ft
2050	2.4 ft
2100	7.0 ft

Stillwater with/ SLR Flooding Estimator:

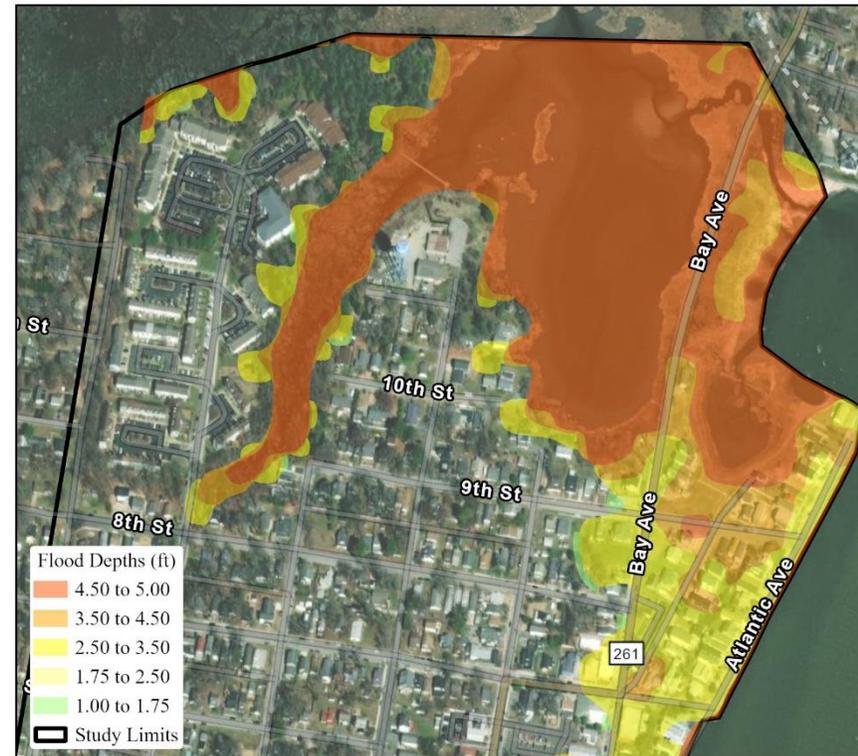
<https://coast.noaa.gov/slr/#/layer/slr/2/-8518838.868615543/4679985.120984405/15/satellite/105/0.8/2050/interHigh/midAccretion>

# Coastal Flooding: 2030 – Area 1

2030 - MHW



2030 + 1% Annual Chance Exceedance Stillwater Level

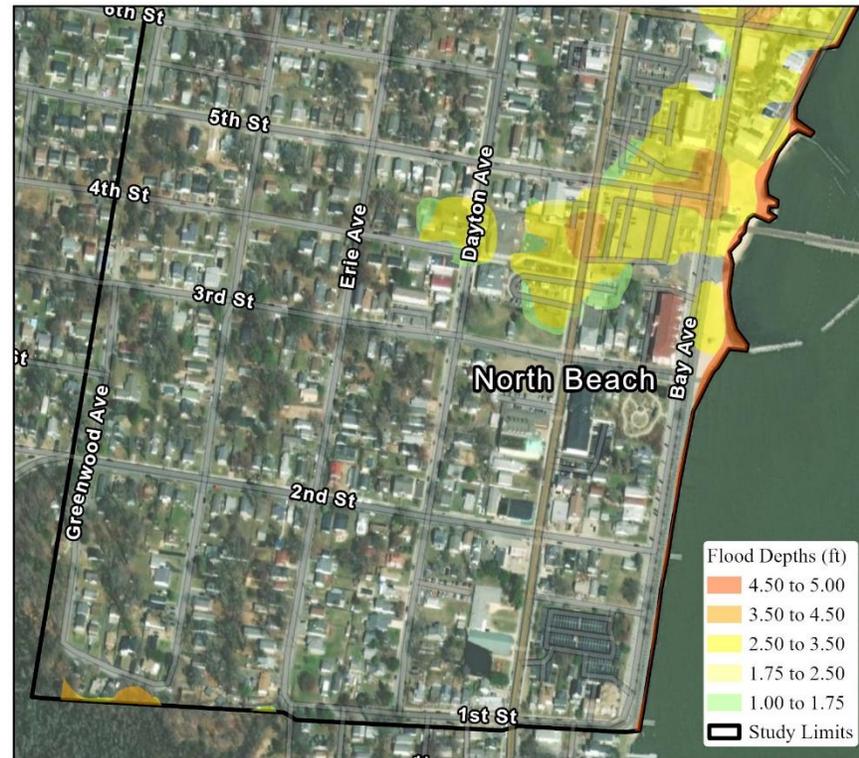


# Coastal Flooding: 2030 – Area 2

2030 - MHW

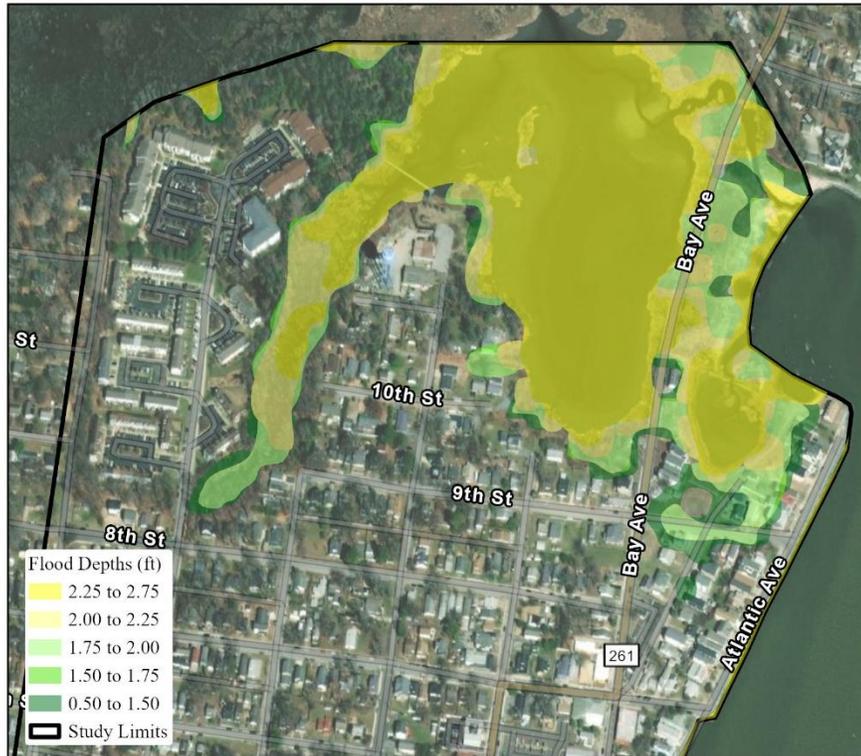


2030 + 1% Annual Chance Exceedance Stillwater Level

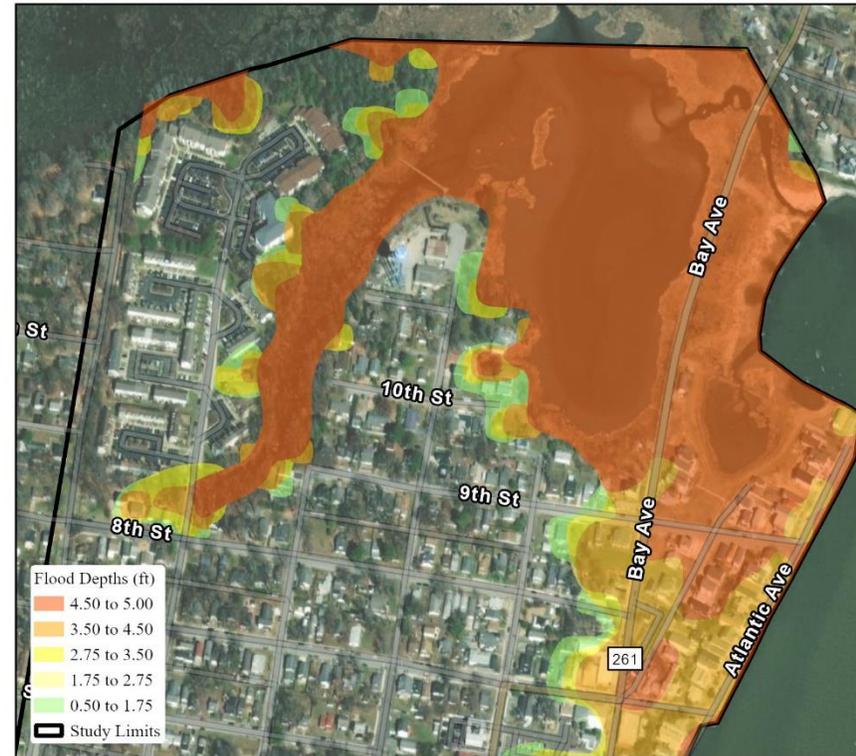


# Coastal Flooding: 2050 – Area 1

2050 - MHW



2050 + 1% Annual Chance Exceedance Stillwater Level

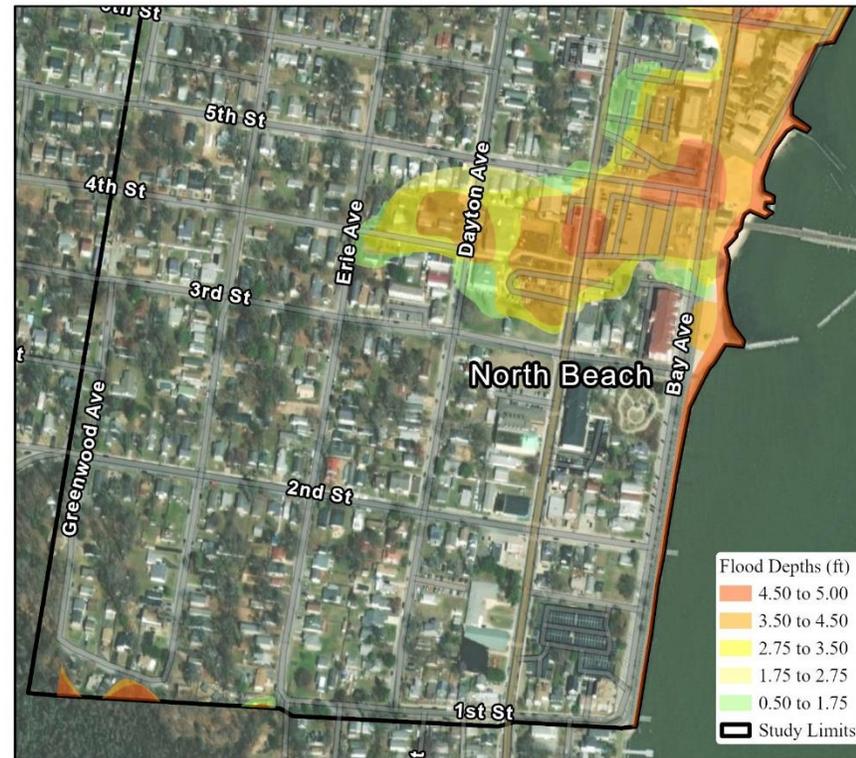


# Coastal Flooding: 2050 – Area 2

2050 - MHW

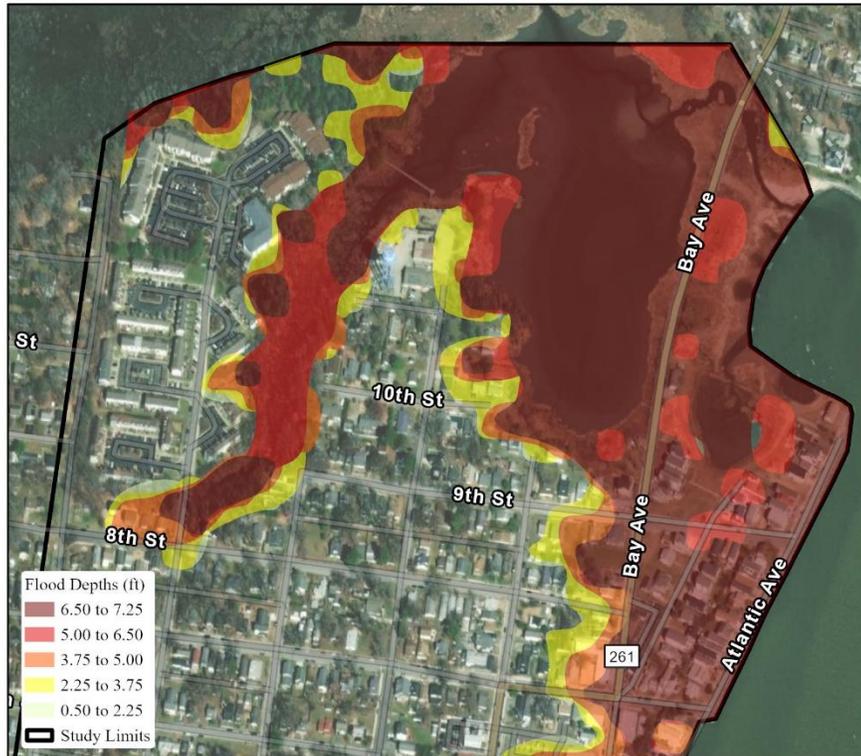


2050 + 1% Annual Chance Exceedance Stillwater Level

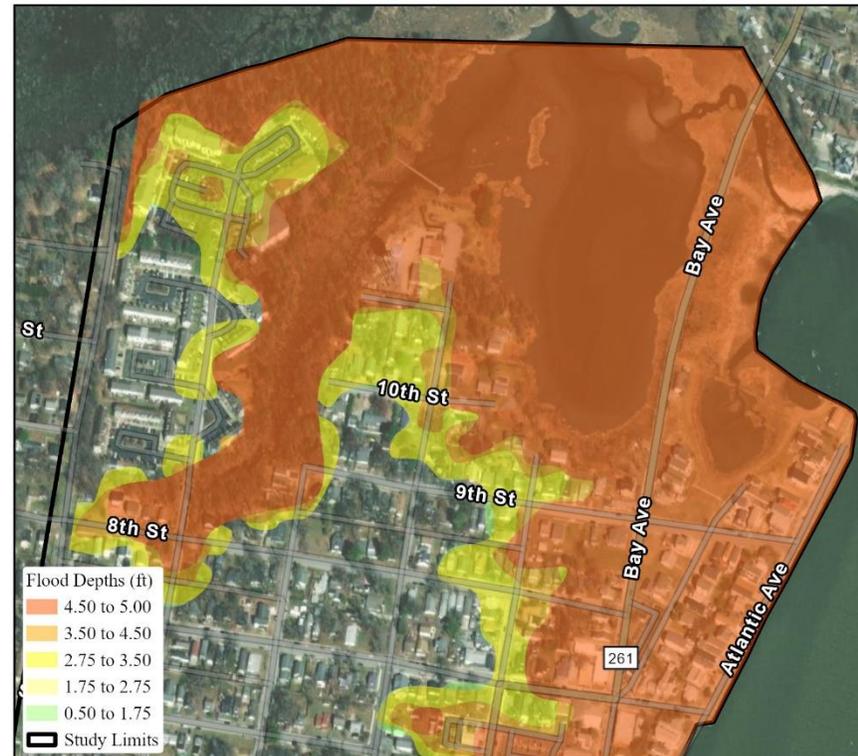


# Coastal Flooding: 2100 – Area 1

2100 - MHW



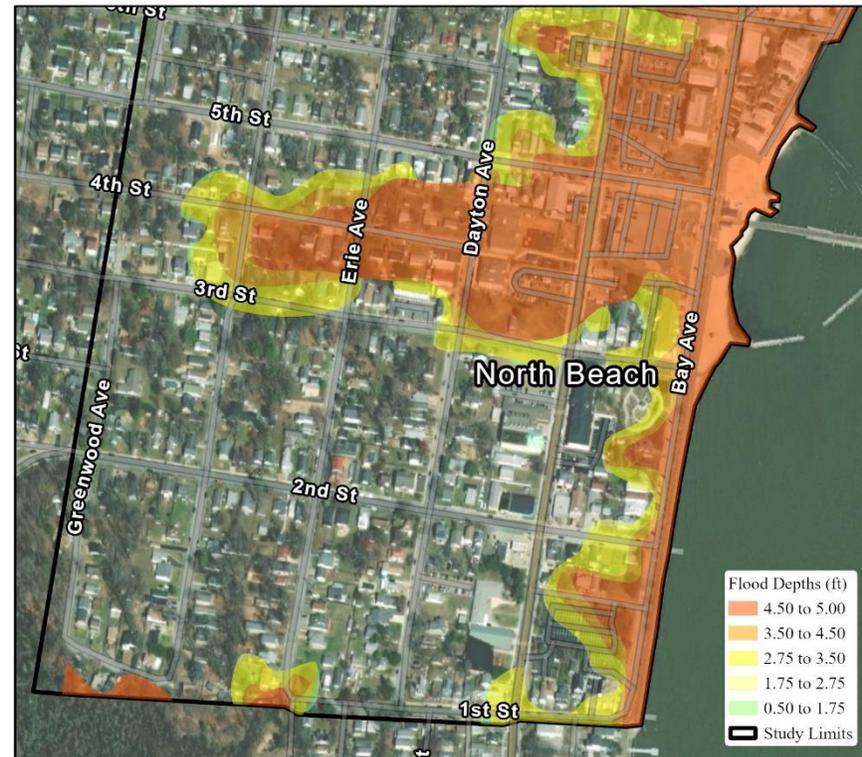
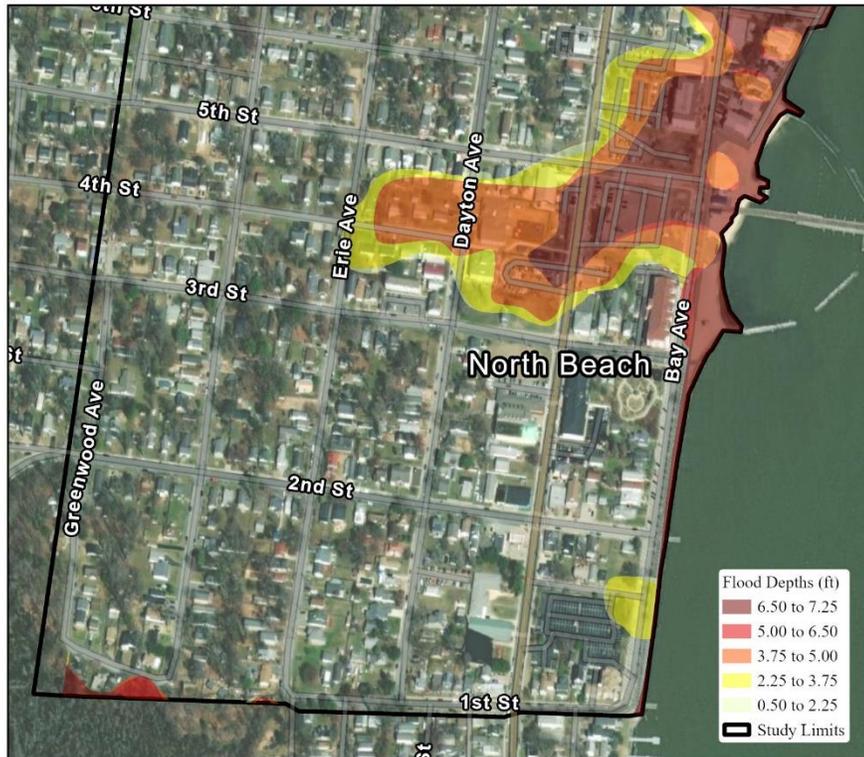
2100 + 1% Annual Chance Exceedance Stillwater Level



# Coastal Flooding: 2100 – Area 2

2100 - MHW

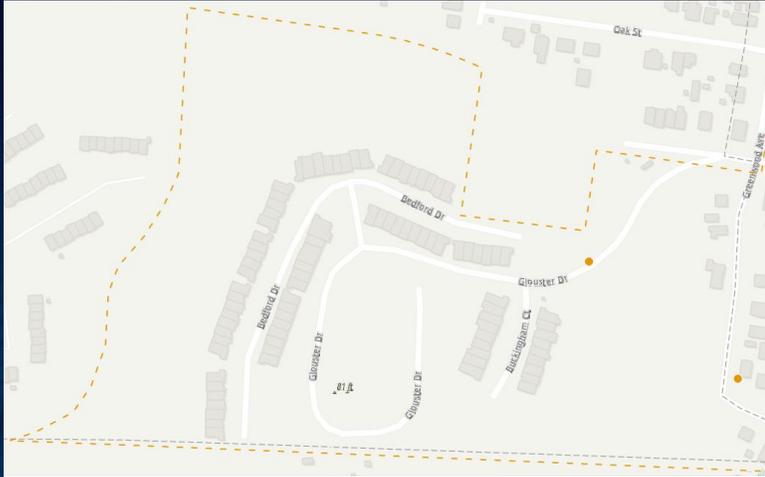
2100 + 1% Annual Chance Exceedance Stillwater Level



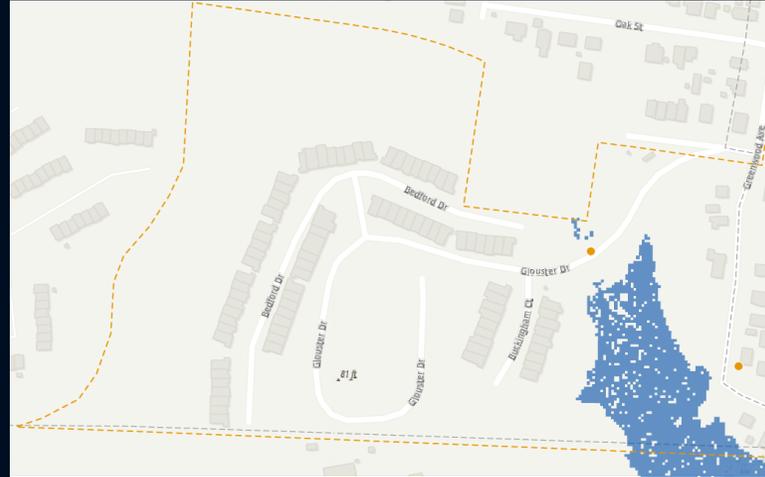
# Coastal Flooding at San Francisco by the Bay

Area 1

MSL – 2030



MSL – 2050

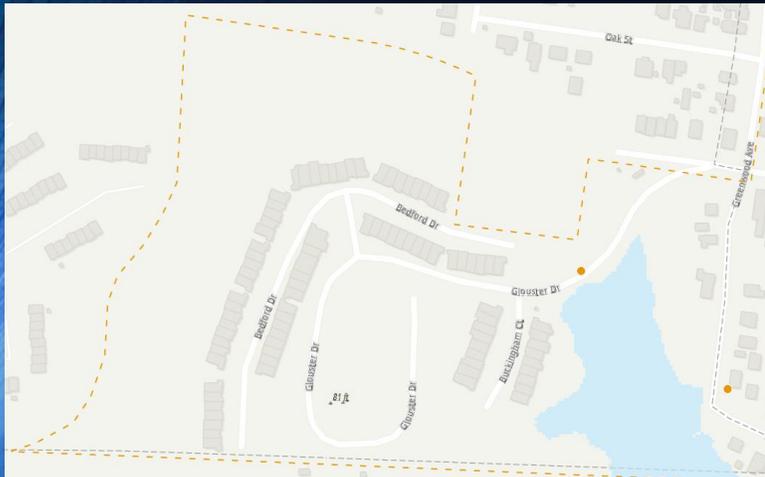


MSL – 2100



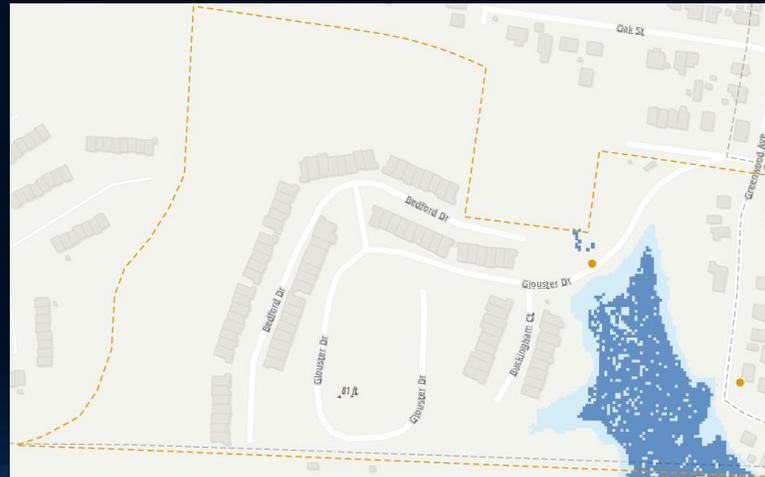
MSL 2030

+ 1% Annual Chance Storm



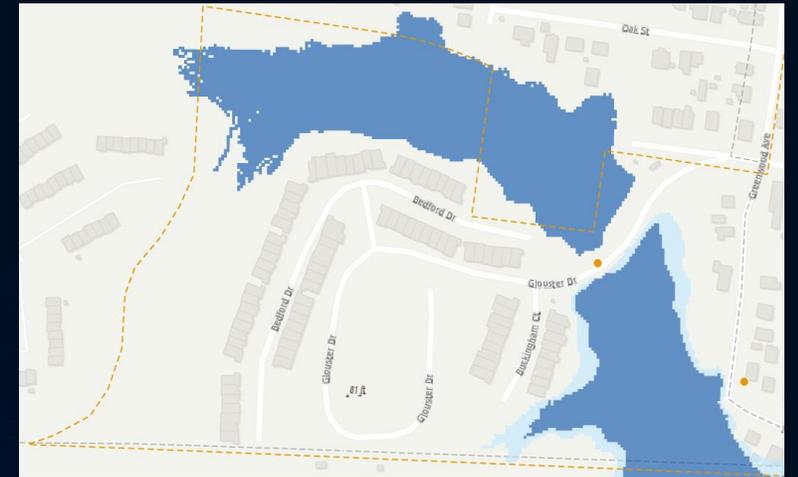
MSL 2050

+ 1% Annual Chance Storm



MSL 2100

+ 1% Annual Chance Storm



# Coastal Flooding – Overtopping Analysis

- Analyze wind speed, water levels and wave heights to determine flooding due to waves

Calculated Overtopping		
Annual Chance Storm (%)	Wind Speed (mph)	Overtopping Level
50%	40	
10%	45	
1%	52	



Table VI-5-6  
Critical Values of Average Overtopping Discharges

$q$ $m^3/s$ per $m$		$q$ litres/s per $m$			
SAFETY OF TRAFFIC		STRUCTURAL SAFETY			
VEHICLES	PEDESTRIANS	BUILDINGS	EMBANKMENT SEAWALLS	GRASS SEA-DIKES	REVETMENTS
					1000
					Damage even for paved promenade
			Damage even if fully protected		200
				Damage	100
			Damage if back slope not protected		50
			Damage if crest not protected		20
				Start of damage	10
					2
					1
					0.1
					No damage
					0.03
					0.02
					0.01
					0.004

# Stormwater Flooding Analysis

- Hydrology = the amount of flow to the system
- Hydraulics = how the stormwater flows through the system
- Model will be used to determine anticipated performance and flood reduction from proposed mitigation solutions

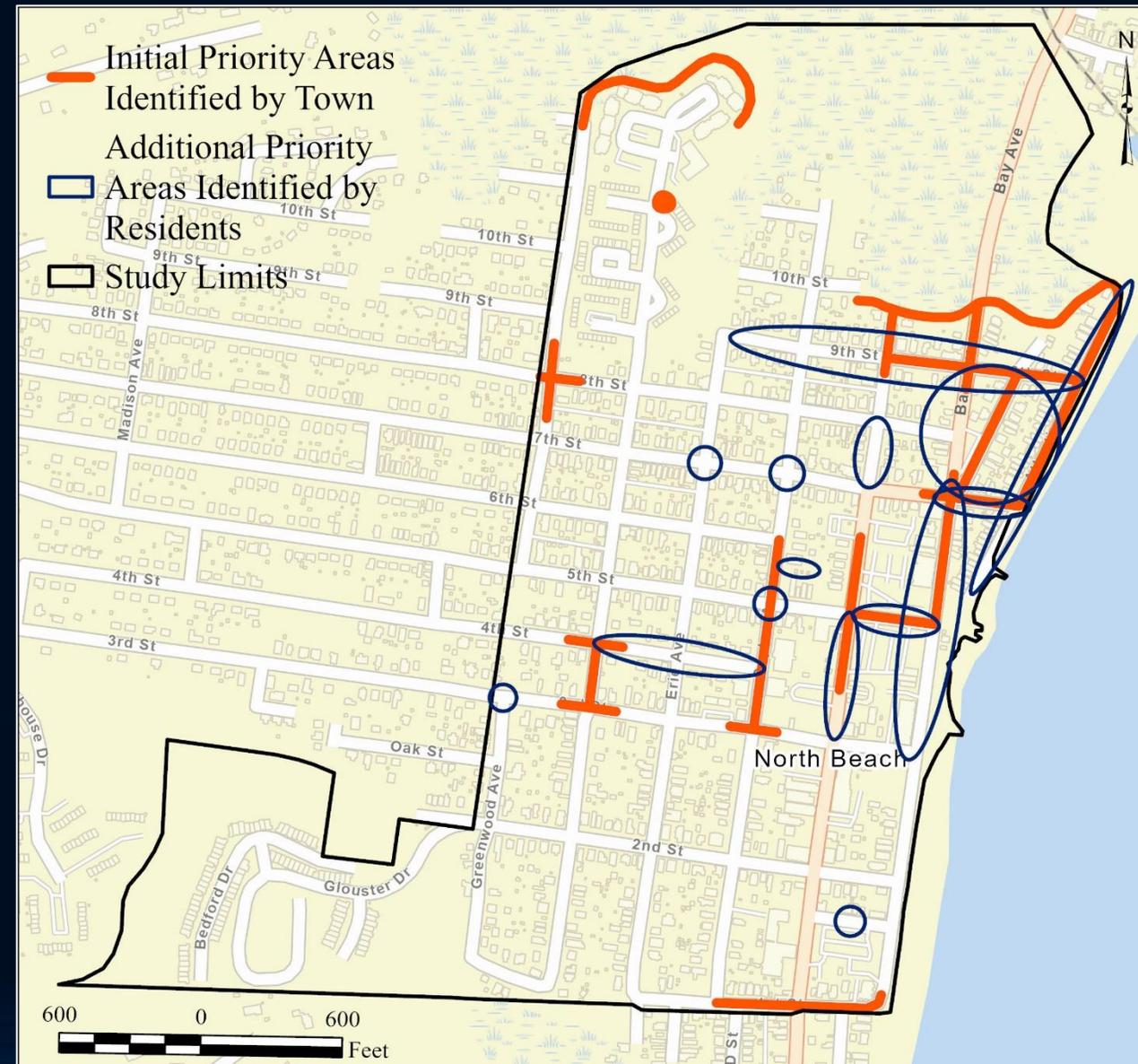


10-year storm event in 2050

# Initial Priority Areas

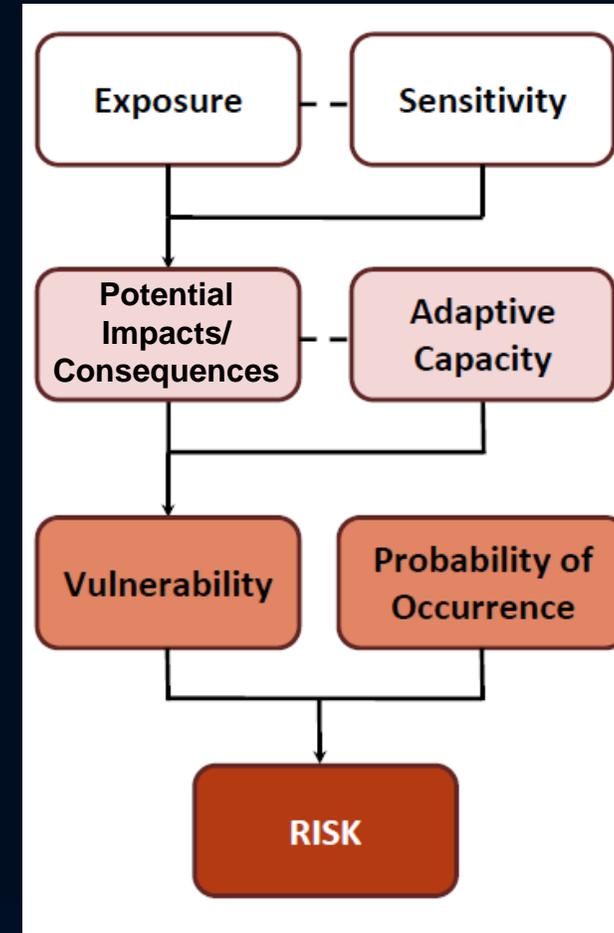
- 1<sup>st</sup> Street between Chesapeake Avenue and Bay Avenue
- Dayton Avenue between 3<sup>rd</sup> Street and 6<sup>th</sup> Street
- Frederick Avenue between 3<sup>rd</sup> Street and 4<sup>th</sup> Street
- Chesapeake Avenue between 4<sup>th</sup> Street and 6<sup>th</sup> Street
- Greenwood Avenue and 8<sup>th</sup> Street
- Bay Avenue between 5<sup>th</sup> Street and 7<sup>th</sup> Street
- 5<sup>th</sup> Street Between Chesapeake Avenue and Bay Avenue
- 7<sup>th</sup> Street between Bay Avenue and Atlantic Avenue
- 9<sup>th</sup> Street between Chesapeake Avenue and Atlantic Avenue
- Annapolis Avenue between 7<sup>th</sup> Street and 9<sup>th</sup> Street
- Atlantic Avenue “peninsula”
- Burnt Oaks behind Sea Maid Court, northwest of Sea Shell Court, retention pond area
- What are your additional areas of concern?
  - Town survey result shown on map
  - Town-wide culverts and road shoulders

<https://www.northbeachmd.org/compound-flood-action-plan-information/webforms/resident-questionnaire-flood-concerns>



# Next Steps – Ranking Priority Areas

- Vulnerability Assessment of highest priority areas
  - *Exposure*
  - *Sensitivity*
  - *Consequence (Physical, Social & Economic Impact)*
  - *Adaptive*
- Use this risk level to rank top areas in prioritization table for project implementation
  - Effectiveness of addressing flooding concerns
  - Difficulty of implementation
  - Cost of Implementation
  - Impacts on the Town, residents, business, tourists, etc.



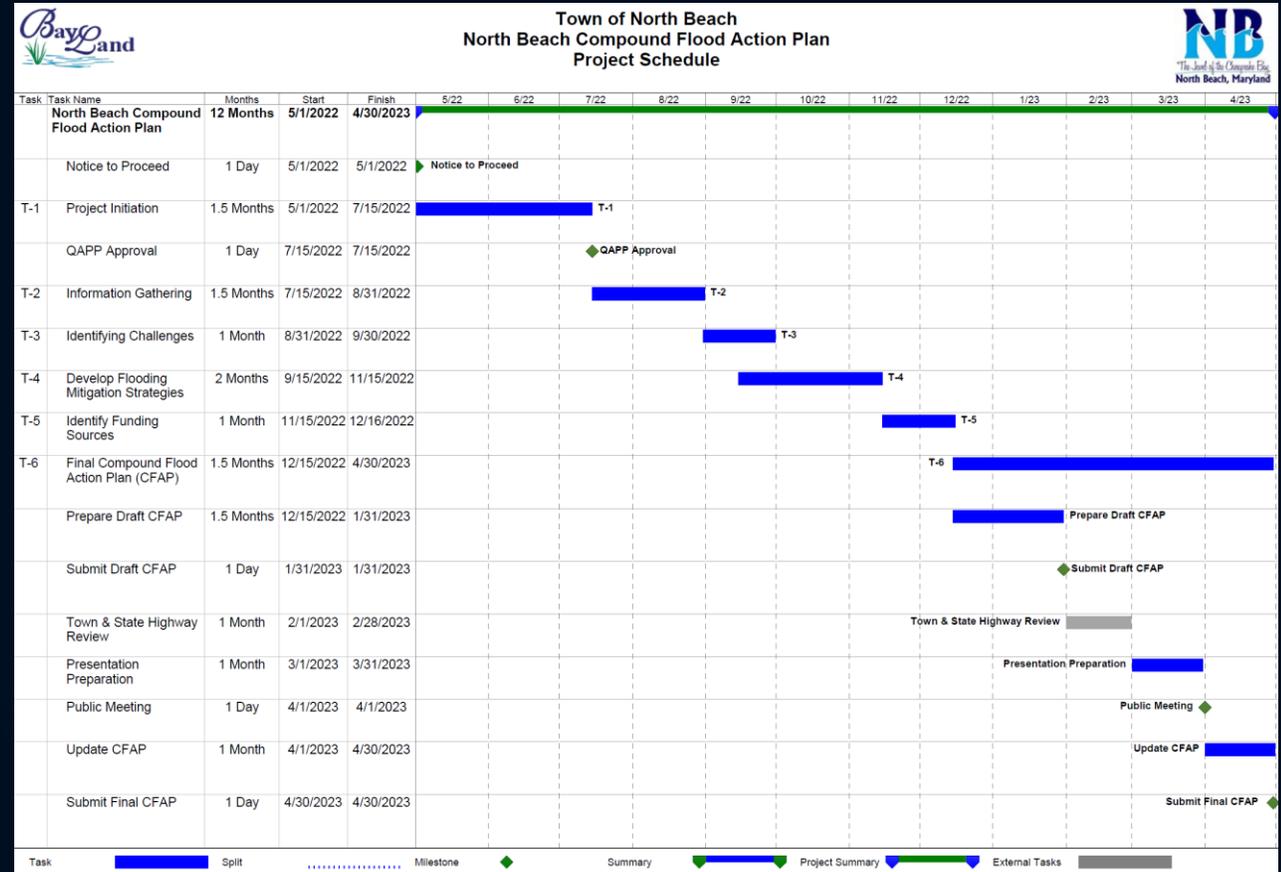
# Next Steps

- Develop flood mitigation strategies and implementation plan for high priority areas!!!
  - Nature-based/Passive Solutions
  - Structural Improvements
  - Green and Gray BMPs
  - Management Strategies
  - Relocation and Acquisition
  - Community Education and Outreach
  - Implementation Plan



# Next Steps

- Develop budget and funding scenarios
  - Implementation Plan
  - Funding Sources
- Second public meeting to present draft Compound Flood Action Plan and solicit resident's feedback
- Finalize Compound Flood Action Plan



# Question and Answer Session

