



# Sea Level Rise in Hampton Roads: Risk and Response

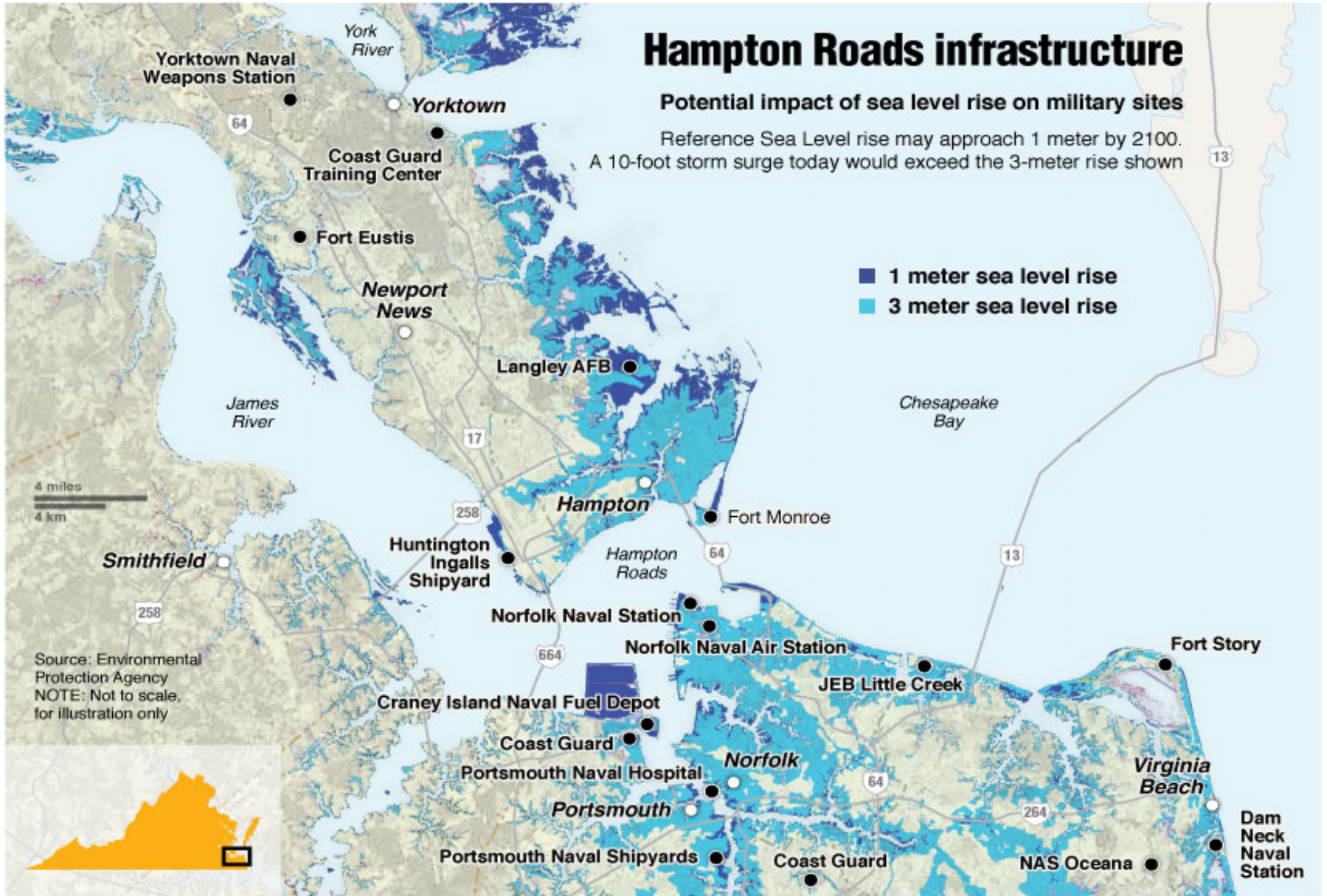
**Michelle Covi, PhD**

Assistant Professor of Practice  
Ocean, Earth and Atmospheric Sciences  
Virginia Sea Grant Extension





- ❖ What we are observing?
- ❖ What is the risk?
- ❖ Community Adaptation Response
- ❖ Regional Collaboration



National Security and the Accelerating Risks of Climate Change, CNA Military Advisory Board May 2014

# Hampton Roads is experiencing sea level rise



Home

The New York Times Magazine

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## When Rising Seas Transform Risk Into Certainty

Along parts of the East Coast, the entire system of insuring coastal property is beginning to break down.

By BROOKE JARVIS — APRIL 18, 2017



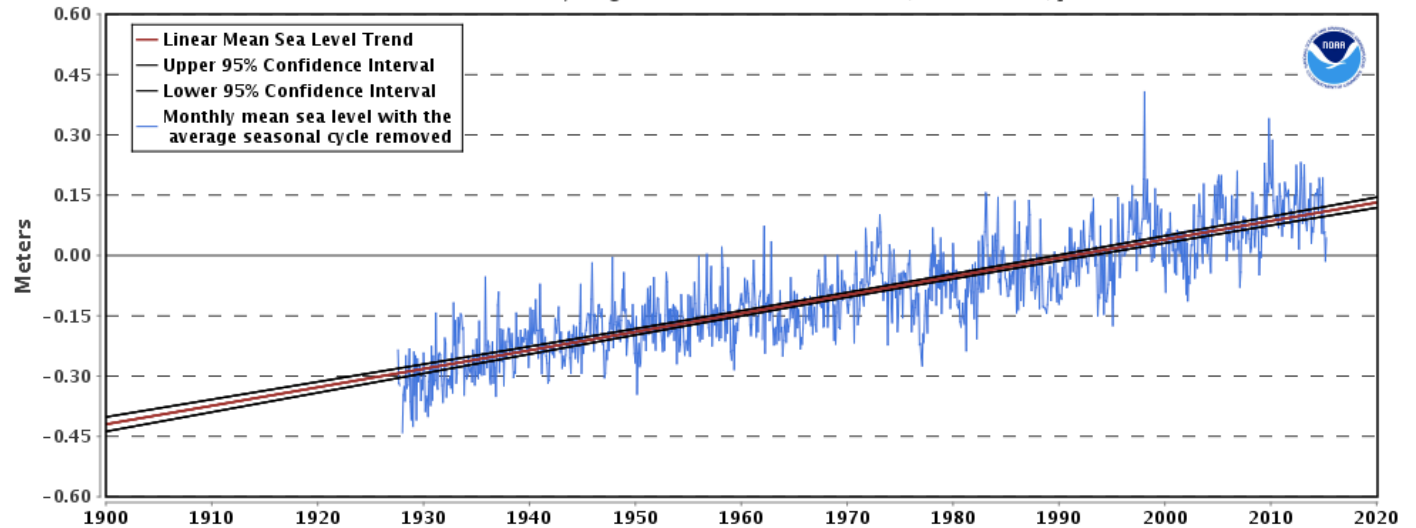
# Measuring Sea Level Rise

Sewell's Point Tide Gauge

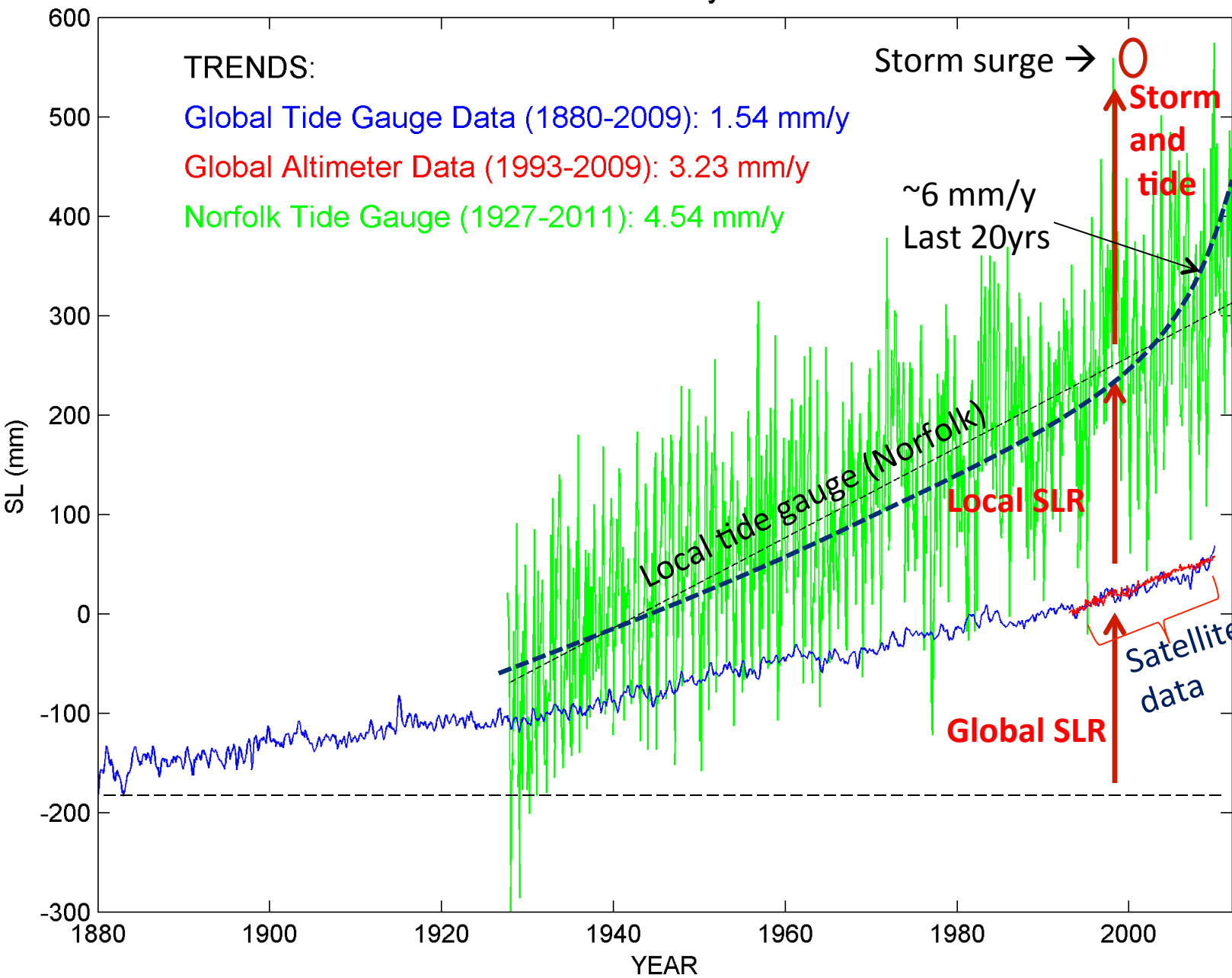


8638610 Sewells Point, Virginia

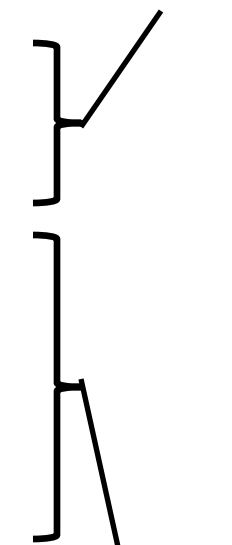
4.60 +/- 0.24 mm/yr



# Observed Monthly Sea Level



Impact from changes in ocean currents



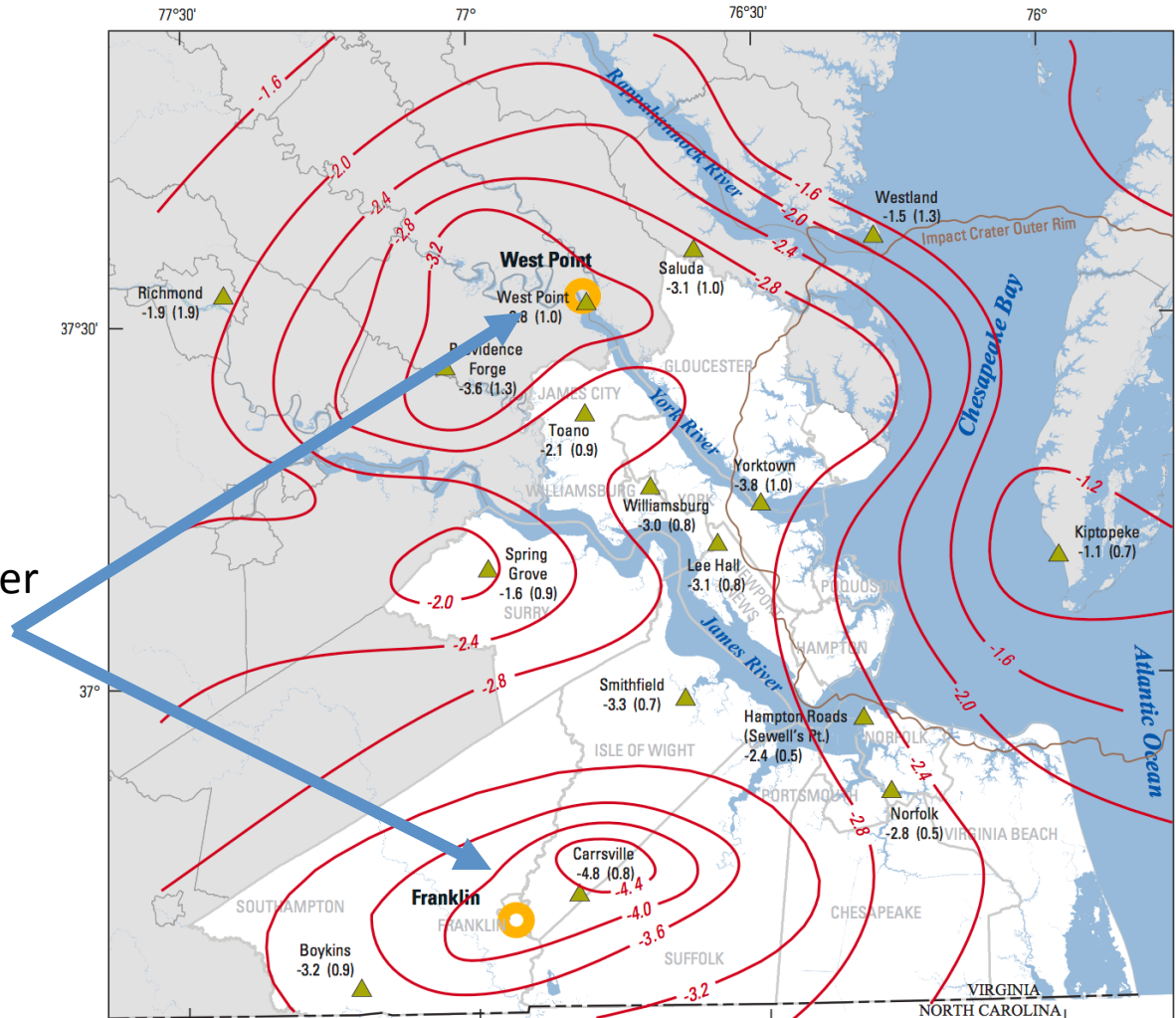
land Subsidence (we are sinking...)

# Land subsidence

about 1 ft. per century in Virginia



Groundwater pumping



Map made from U.S. Geological Survey and Virginia Department of Game and Inland Fisheries data  
 Virginia State plane projection  
 Virginia south Federal Information Processing Standard (FIPS) 4502  
 North American Datum 1983 (NAD83)

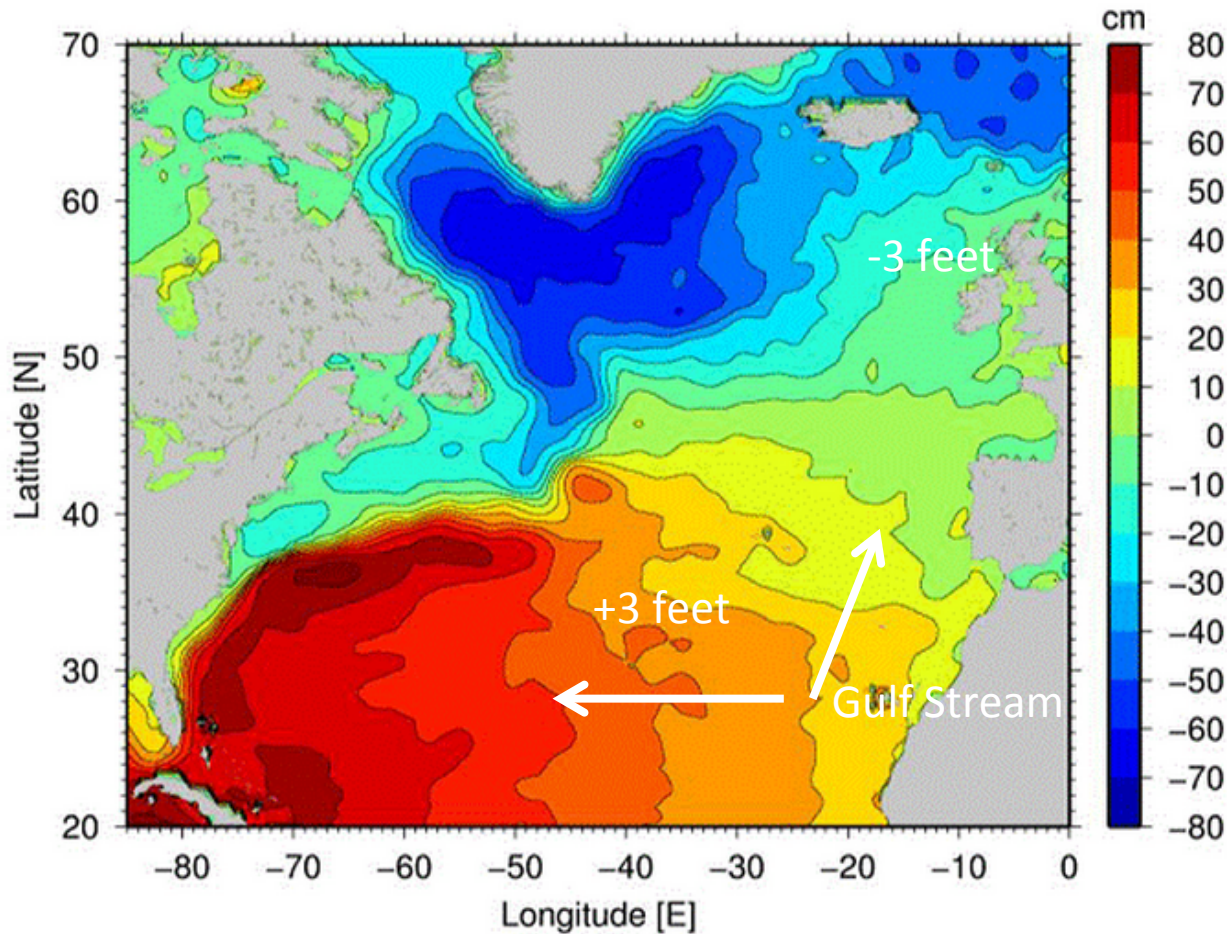
0 5 10 15 20 MILES  
 0 10 20 KILOMETERS

Geodetic leveling from Holdahl and Morrison (1974)

**EXPLANATION**

# Ocean Currents

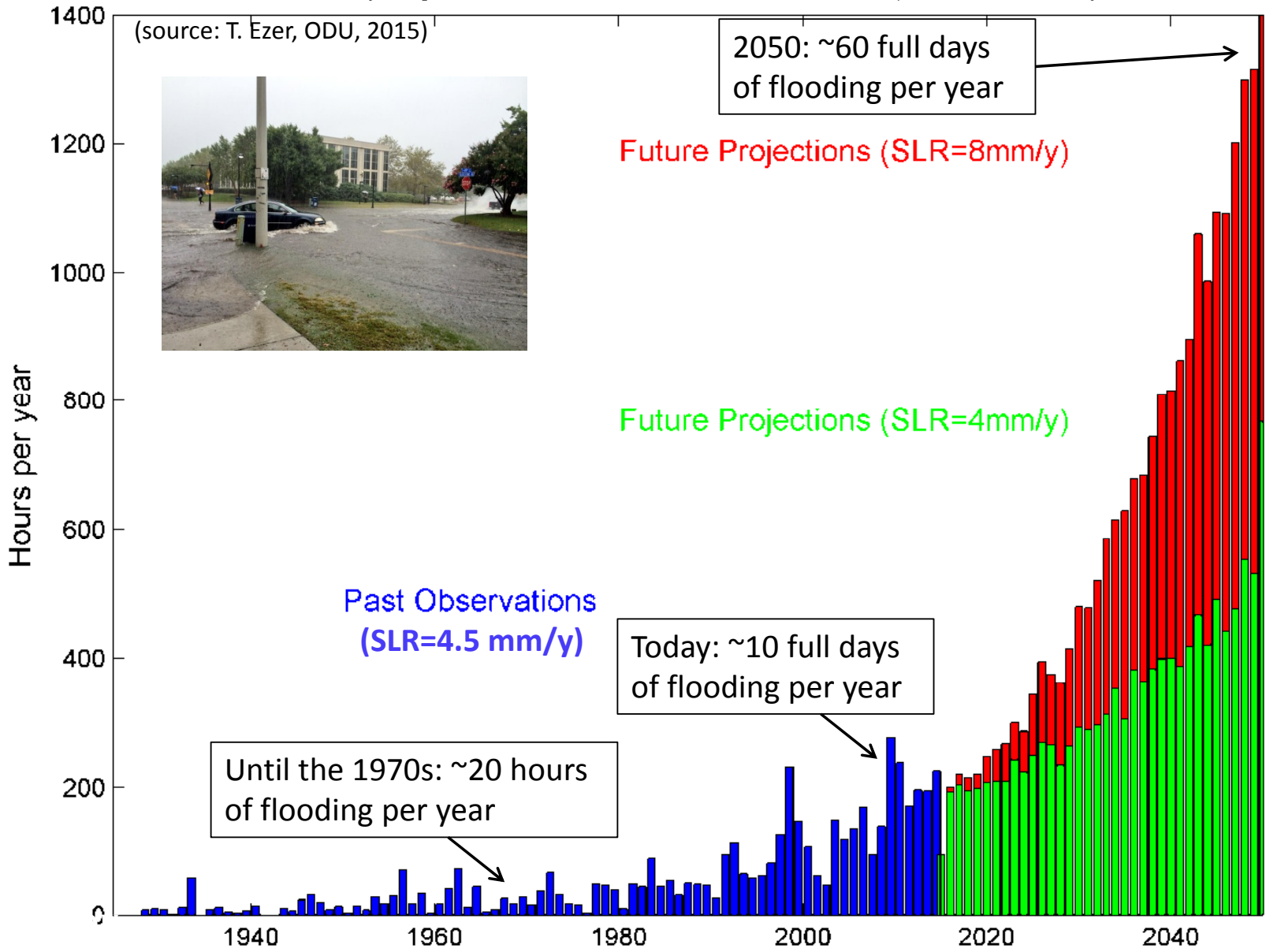
Small changes in ocean currents cause **big changes in coastal sea level**



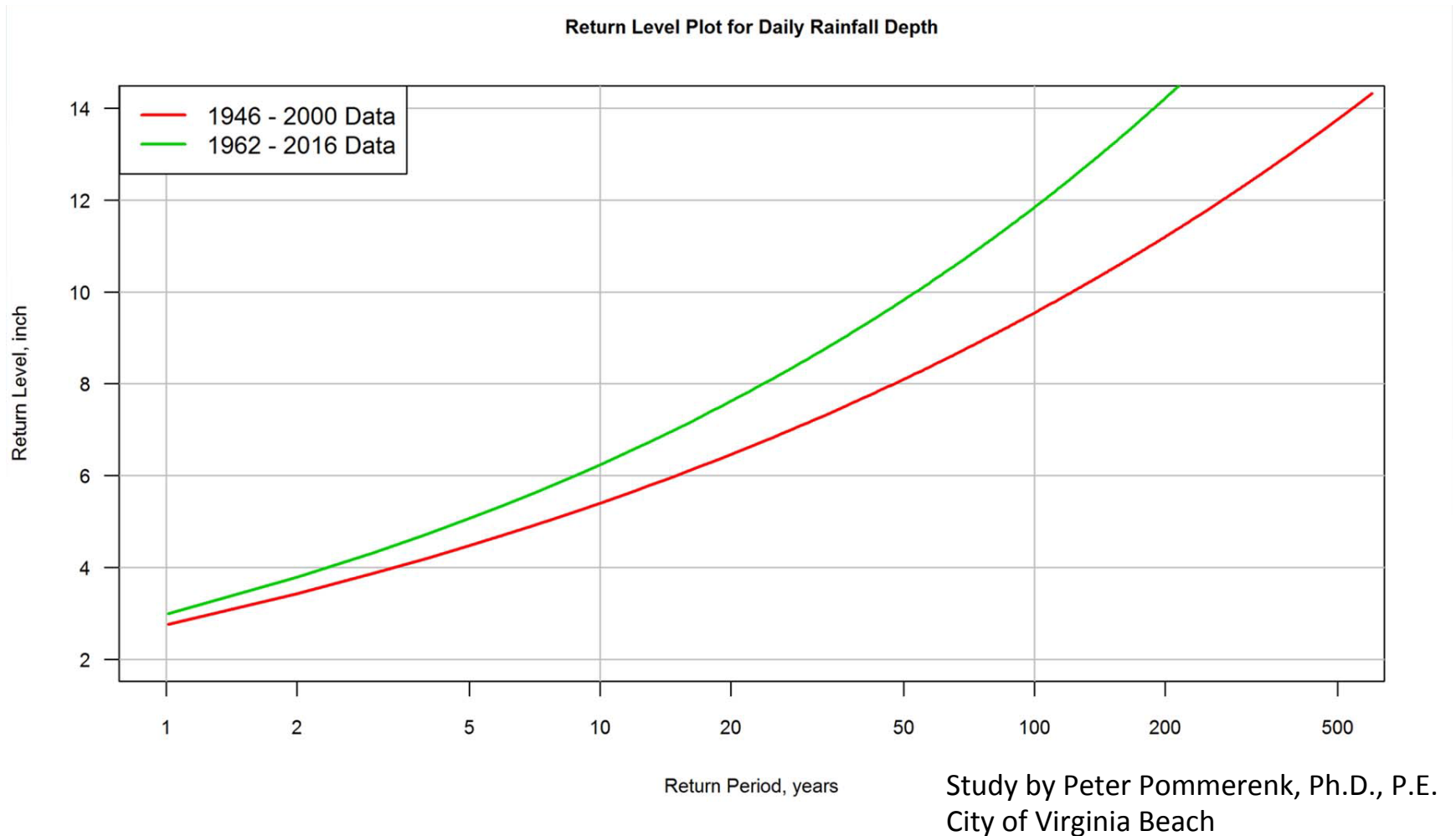


# Hours per year of nuisance floods in Norfolk (MHHW+0.3m)

(source: T. Ezer, ODU, 2015)



# Changing Rainfall Patterns





# What is at risk?

- Increased threat from severe storms
- Difficulty living in the coastal zone
  - Transportation
  - Property Insurance
  - Economic stability
- Land inundation and shoreline erosion
- Loss of wetlands
- Ecological changes





# Regional Resilience Efforts

## Hampton Roads Sea Level Rise/ Flooding Adaptation Forum

- 2012- now
- Municipal staff, academics, stakeholders to share latest science and policy
- Informal setting to discuss science and best practices, network, collaborate



# Regional Resilience Efforts

- 2014-2016
- Whole of Government
- Whole of Community
- Legal, Infrastructure, Citizen Engagement, Public Health Working Groups
- Private infrastructure, Science, Economic Impacts Committees

Hampton Roads Sea Level Rise  
Preparedness and Resilience  
Intergovernmental Planning  
Pilot Project



# Regional Resilience Efforts

- Regional Coastal Resilience Committee
- Regional Coastal Resilience Working Group
- Technical Assistance
- Joint Land Use Studies



# Norfolk's Resilience Approach

PIONEERED BY THE  
ROCKEFELLER FOUNDATION

100 RESILIENT CITIES

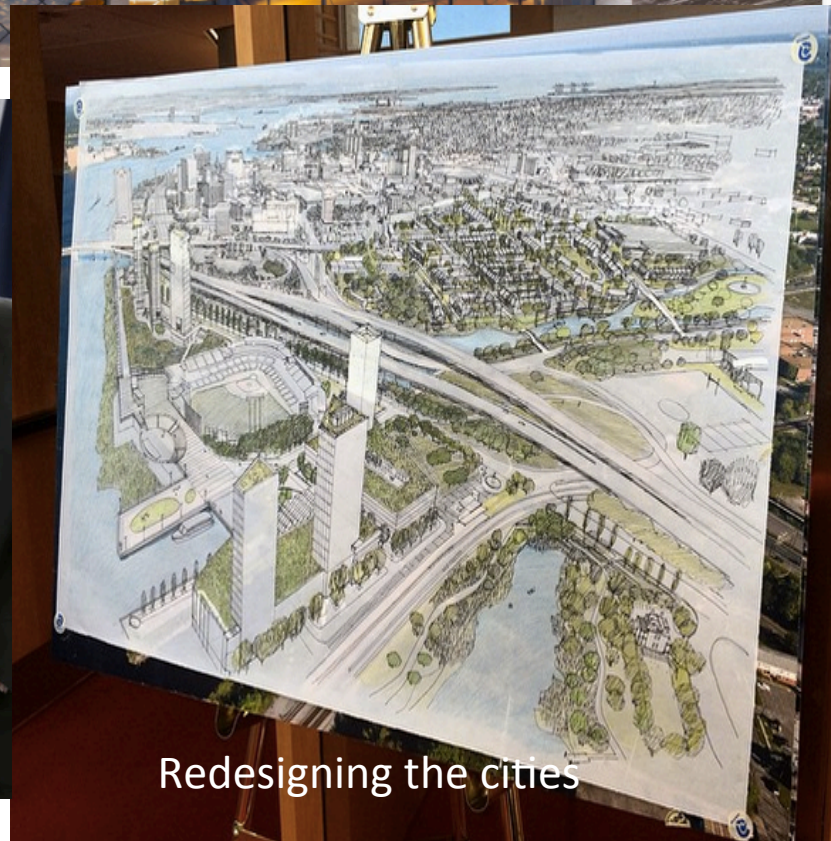


- Design the coastal community of the future
- Create economic opportunity
- Connect communities and strengthen neighborhoods

NORFOLK RESILIENT CITY



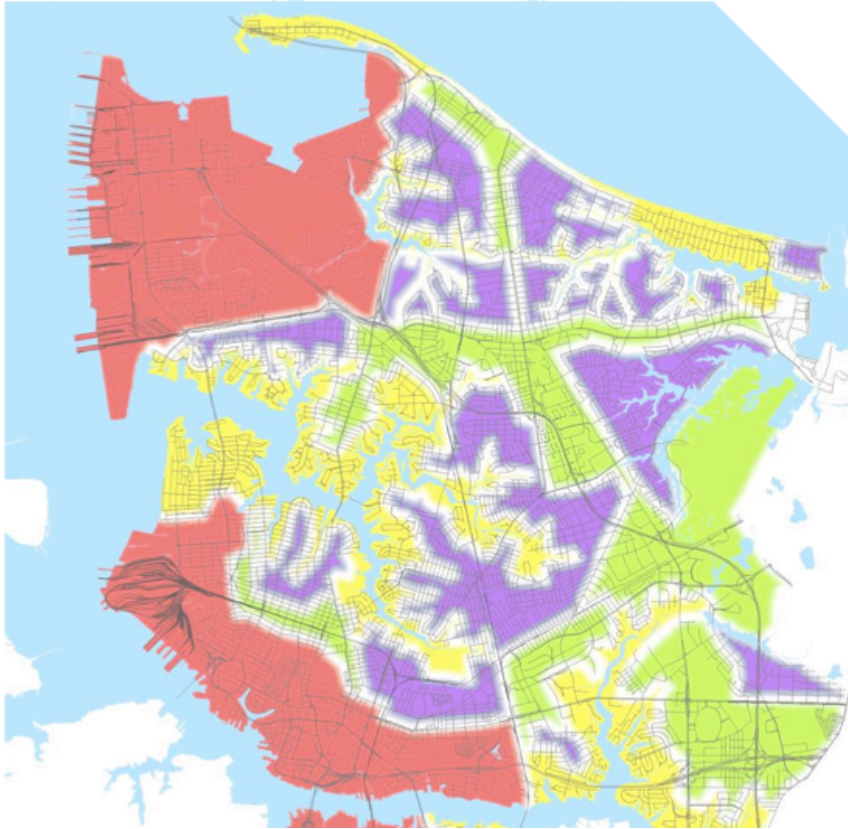
# Norfolk's Resilience Approach



Redesigning the cities



# Norfolk's Resilience Approach



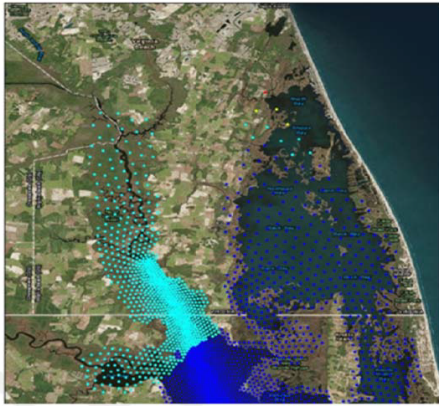
- “Red” – “economic engines”
- “Yellow” – “adaptation areas”
- “Green” – “new urban centers”
- “Purple” – “neighborhoods of the future”

**NORFOLK**  
VISION2100

PLANNING FOR THE FUTURE  
NEW SURVEY

# Virginia Beach's Approach

 Dewberry



## Southern Watershed Storm Surge Elevation Review

City of Virginia Beach, Virginia  
CIP 7-030, PWCN-15-0014, Work Order 8  
Date: May 13, 2016



Stormwater improvements



## Rainfall Correlated Tailwater Elevations for the Lynnhaven Watershed, Draft Report

City of Virginia Beach, Virginia  
CIP 7-030, PWCN-15-0014, Work Order 2

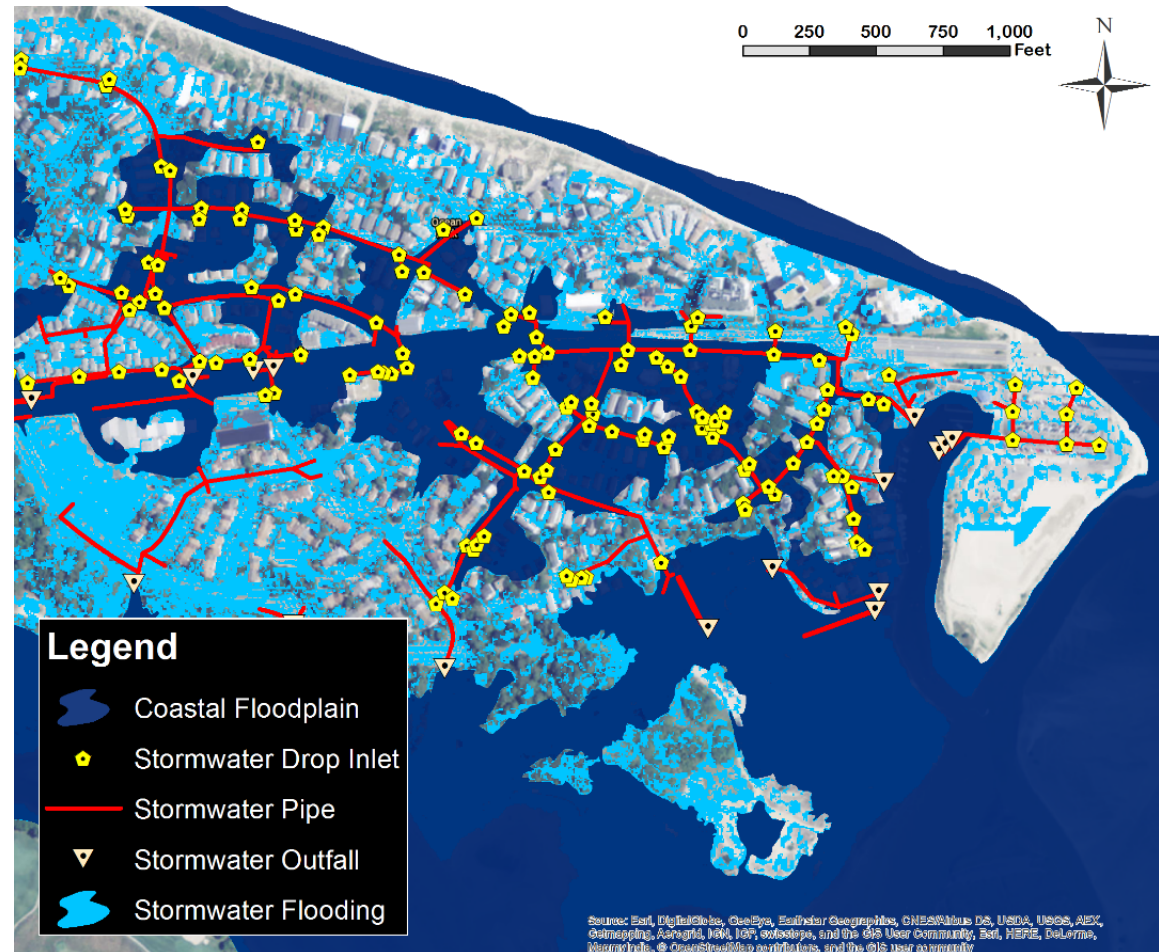
November 16, 2015

Submitted to: City of Virginia Beach  
Department of Public Works



# Water Infrastructure

- Coastal Flooding
- Stormwater Conveyance
- Combined Flooding



# Adaptation Strategies

- What strategies are needed to address the risk portfolio?
  - What policy has to be created or changed?
  - How can land use be managed?
  - Where do structural solutions make sense?
  - What's the return on investment?
  - What strategies work best?
  - When should implementation occur?

# Portsmouth Comprehensive Planning

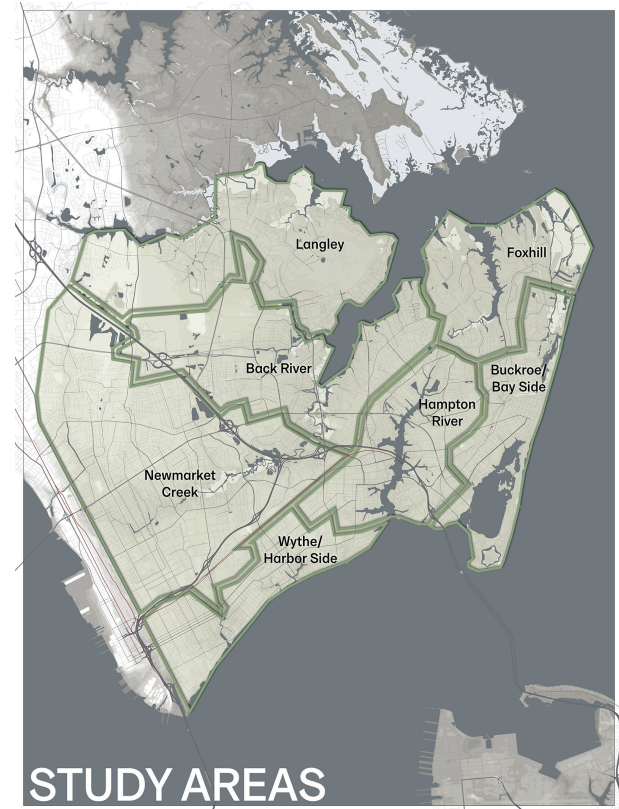
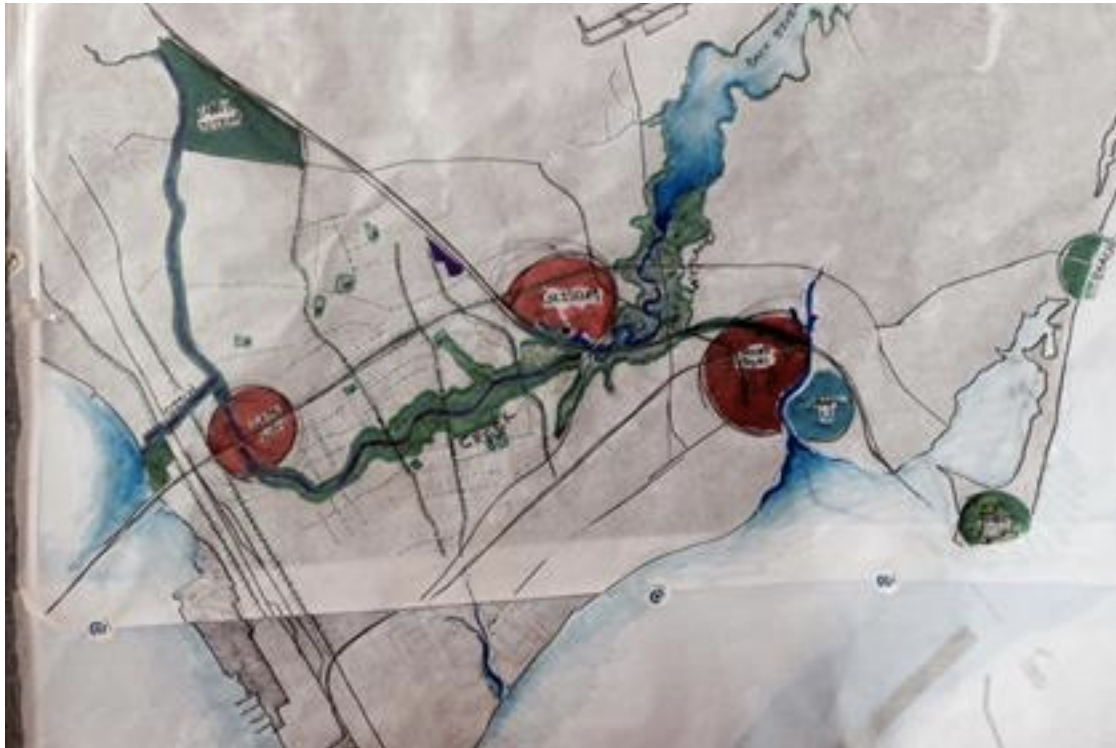


**DESTINATION 2025**  
*Setting A Bold New Course*

City of Portsmouth, Virginia  
Comprehensive Plan  
2005

# Hampton Urban Water Plan

- Life at Sea Level /Waggoner and Ball
- City- wide and neighborhood plans





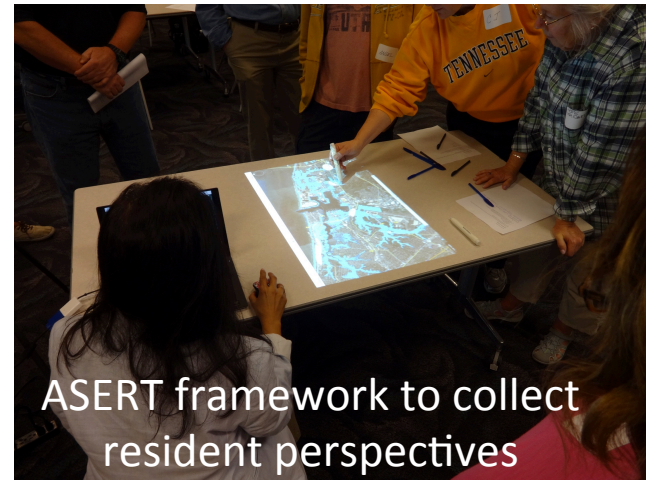
# Collaboration



Hampton Roads Sea Level Rise/  
Flooding Adaptation Forum



ULI Resilient Region Reality  
Check



ASERT framework to collect  
resident perspectives

# Thank you

