



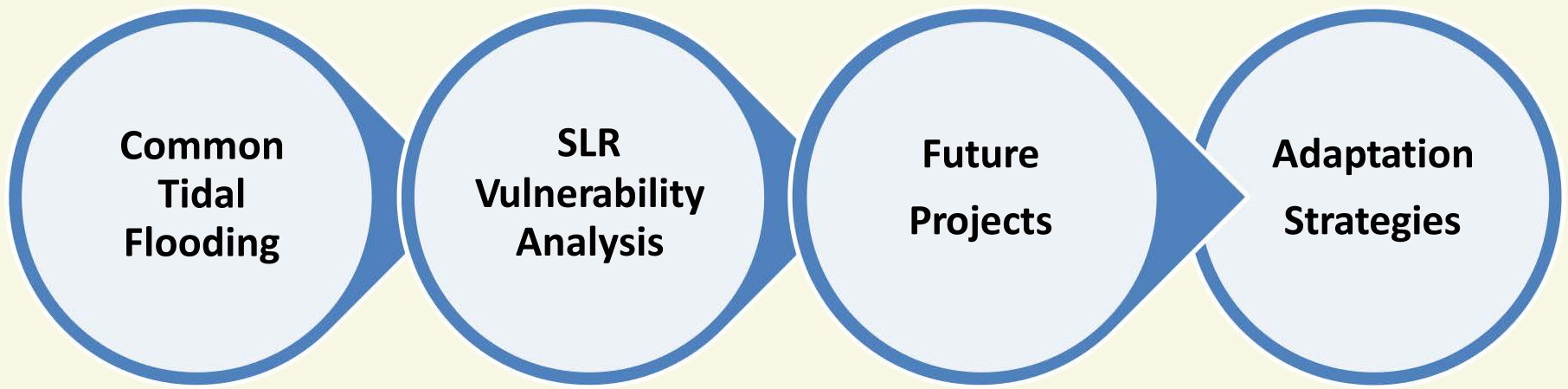
EST. 1565

ST AUGUSTINE™

CELEBRATING 450 YEARS

Florida Coastal Management Program Annual Meeting, May 16, 2017

Outline



Climate Change is a Thing

If All the Ice Melted

IF ALL THE ICE MELTED

Explore the world's new coastlines
if sea level rises 216 feet.

The maps here show the world as it is now, with only one difference: All the ice on land has melted and drained into the sea, raising it 216 feet and creating new shorelines for our continents and inland seas.

There are more than five million cubic miles of ice on Earth, and some scientists say it would take more than 5,000 years to melt it all. If we continue adding carbon to the atmosphere, we'll very likely create an ice-free planet, with an average temperature of perhaps 80 degrees Fahrenheit instead of the current 58.

CLICK FOR
INTERACTIVE
MAP

Source: waitbutwhy.com, [How Tesla Will Change Your Life](#)



Common Tidal Flooding in St. Augustine



Photos taken in October 2014 during a Nor'easter



Common Tidal Flooding in St. Augustine



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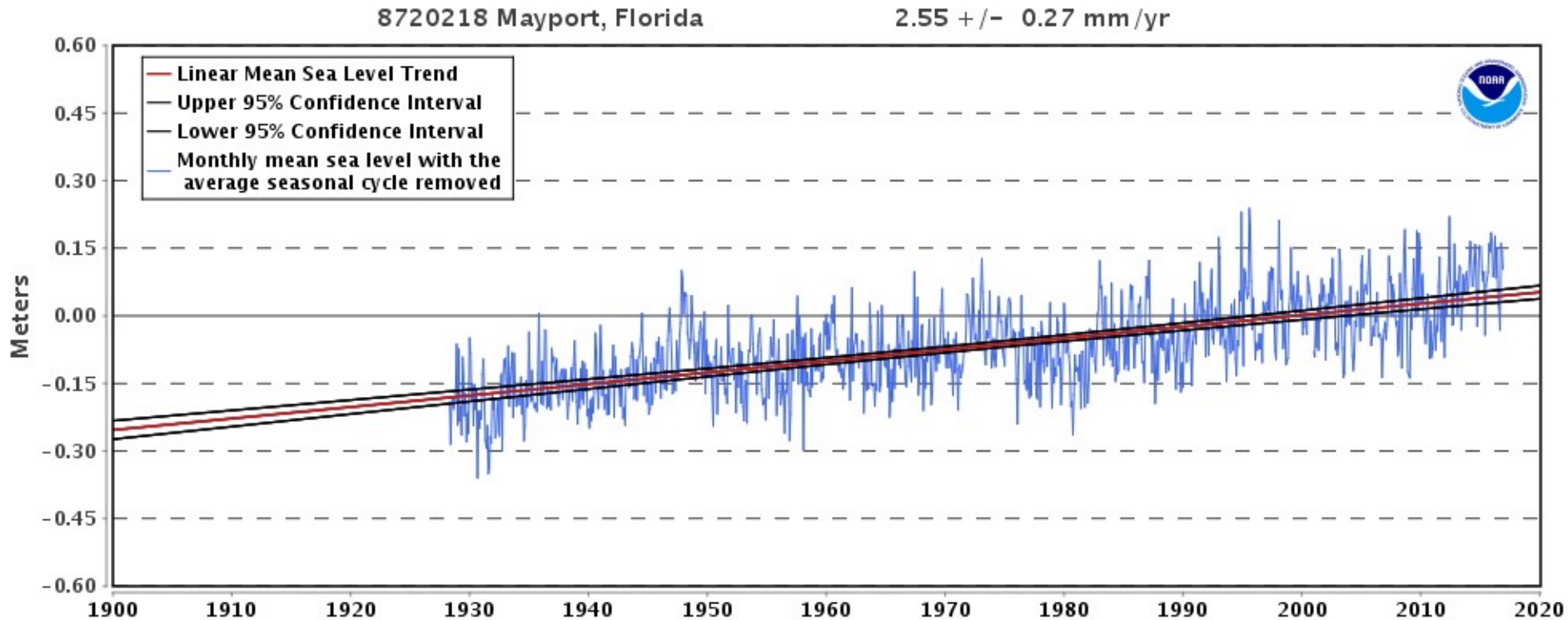
Common Tidal Flooding in St. Augustine



Photos taken in October 2014 during a Nor'easter



Local Data



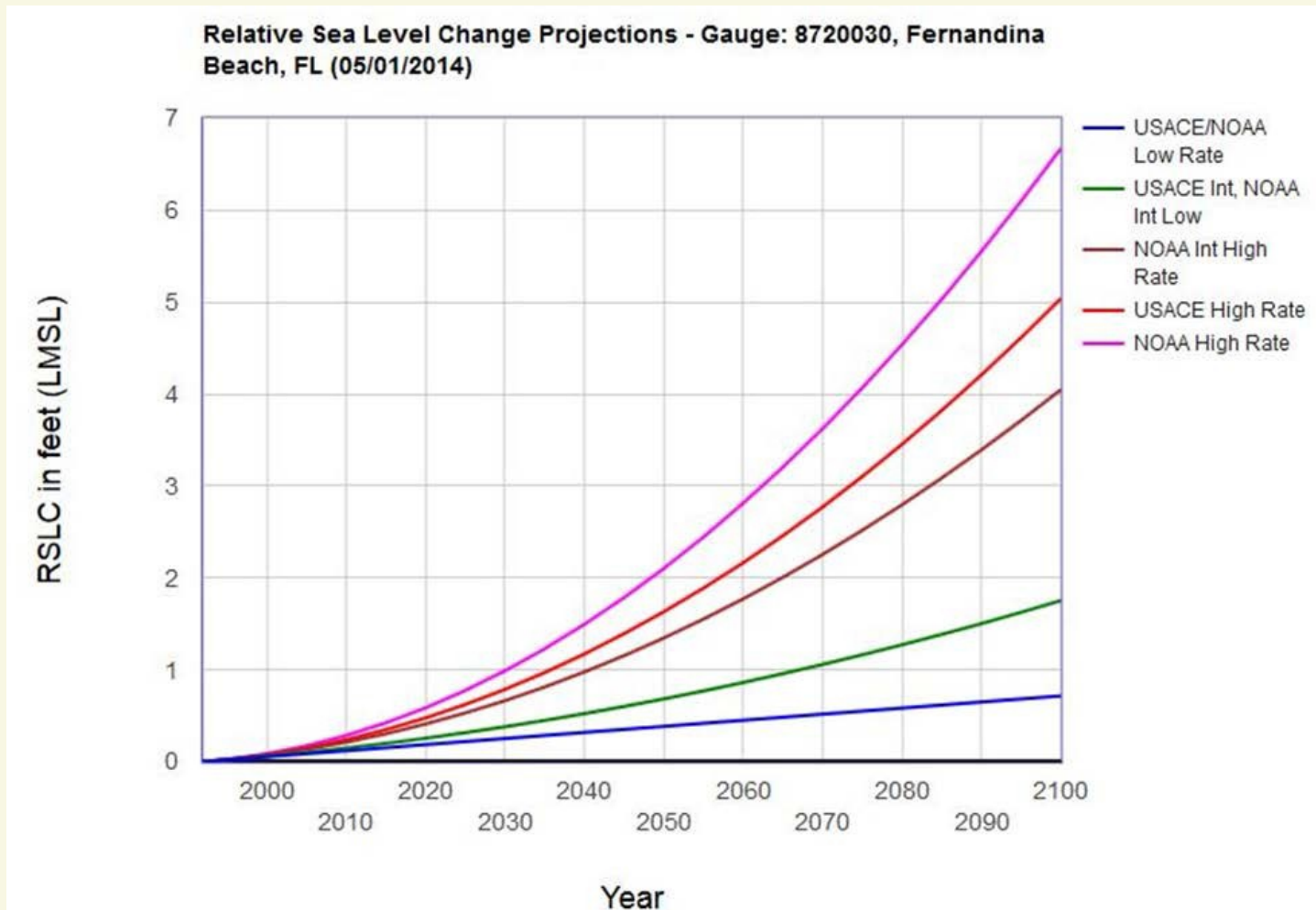
The mean sea level trend is 2.55 millimeters/year with a 95% confidence interval of +/- 0.27 mm/yr based on monthly mean sea level data from **1928 to 2015** which is equivalent to a change of **0.84 feet in 100 years.**



Source: NOAA



Local SLR Projections



Source: University of Florida, Adapting to Rising Tides



FDEO Coastal Vulnerability Assessment

Used three flood hazard types for assessment (NAVD88):

- Mean Higher High Water (MHHW) @ 2-ft
- Nuisance Flooding @ 3.75-ft
- 1% Flood @ 6-10-ft

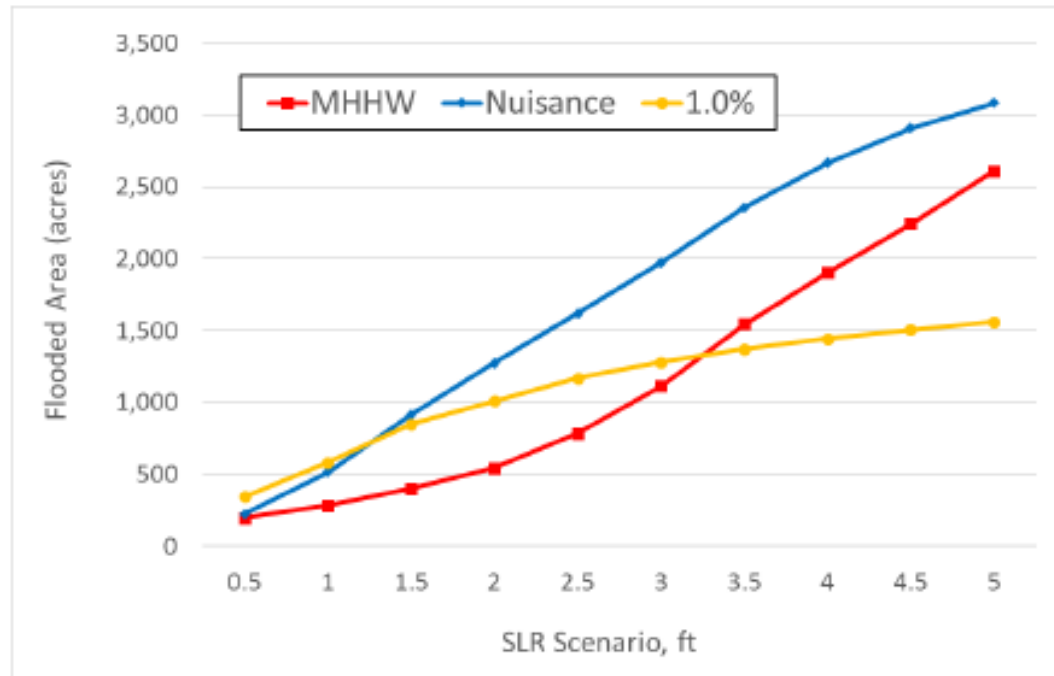


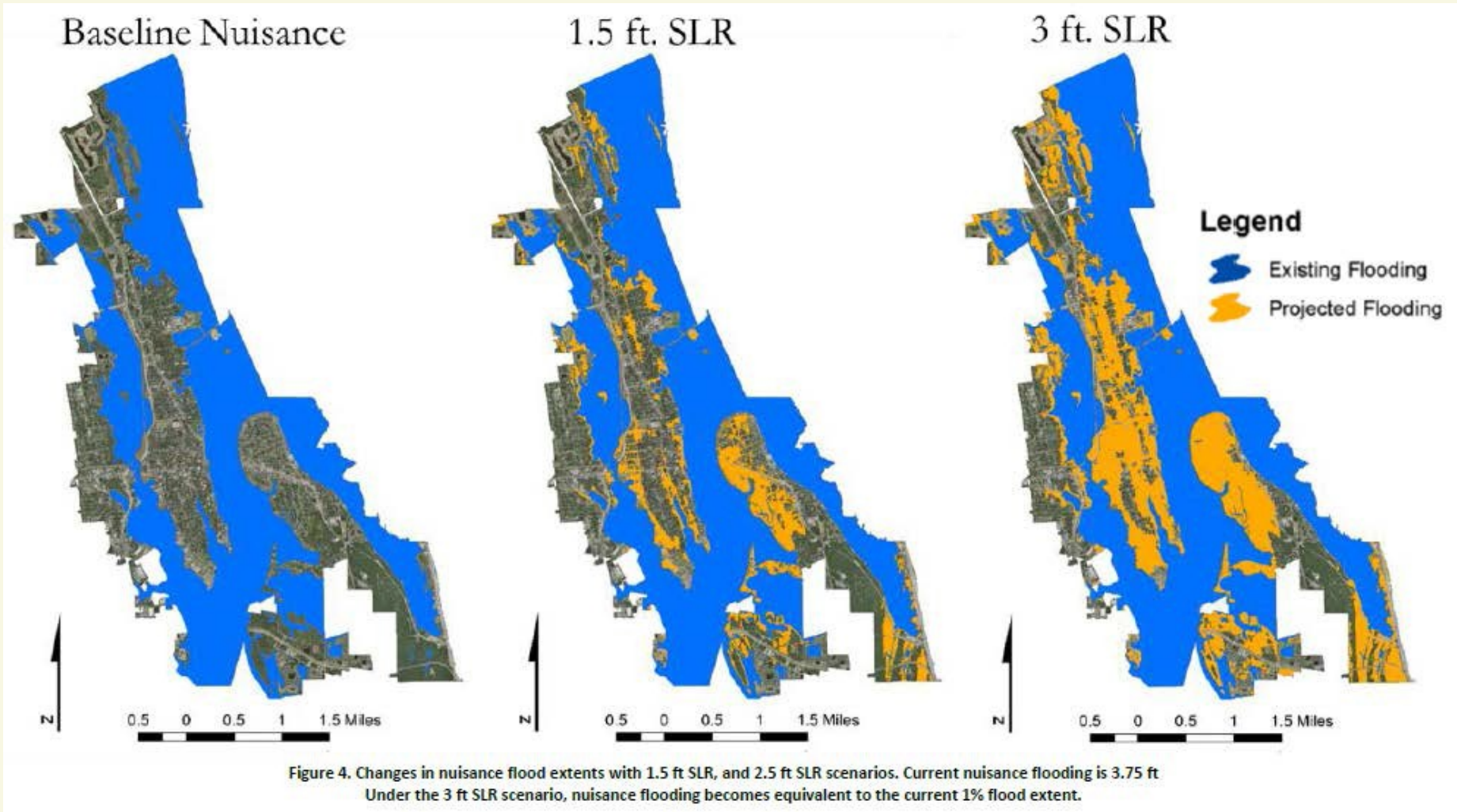
Figure 2. Changes in flooded area by flood type. Note rapid growth of nuisance flood areas, which is shared by MHHW after 2 ft of SLR. The 1% annual chance floodplain experiences slow growth after 1.5 ft of SLR.



How much more flooding is expected? Tipping points?



FDEO Coastal Vulnerability Assessment



What are the major pathways for future flooding?



FDEO Coastal Vulnerability Assessment



Legend




-  Nuisance flooding, baseline (3.75 ft)
-  Nuisance flooding, +1.5 ft SLR
-  Nuisance flooding, +3 ft SLR



Figure 16. Map depicting flood extents within St. Augustine Historic Districts.

What are the major pathways for future flooding?



FDEO Coastal Vulnerability Assessment

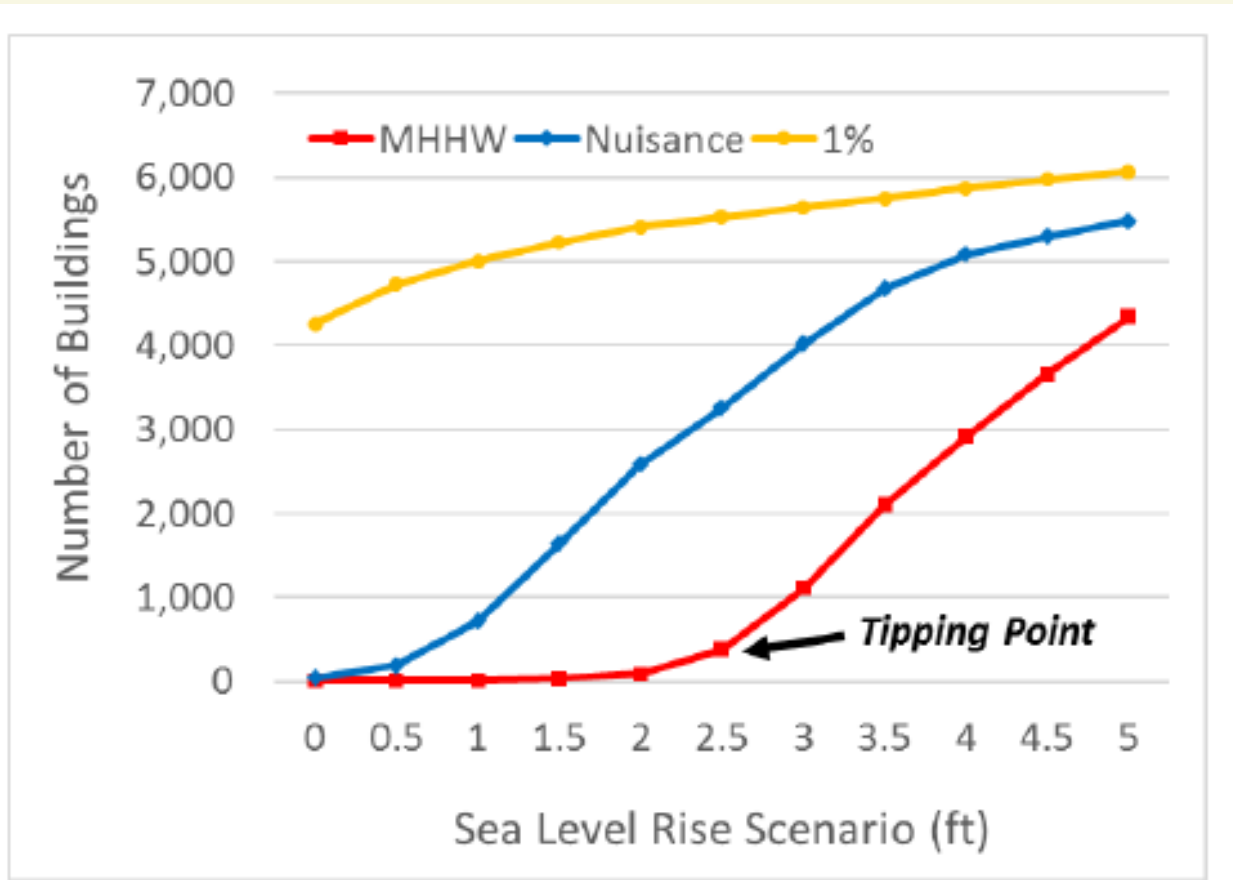


Figure 14. Number of buildings (commercial, residential and municipal) affected by MHHW, nuisance, and the 1% flood level in each SLR scenario.

How will building vulnerability to flooding change?



FDEO Coastal Vulnerability Assessment

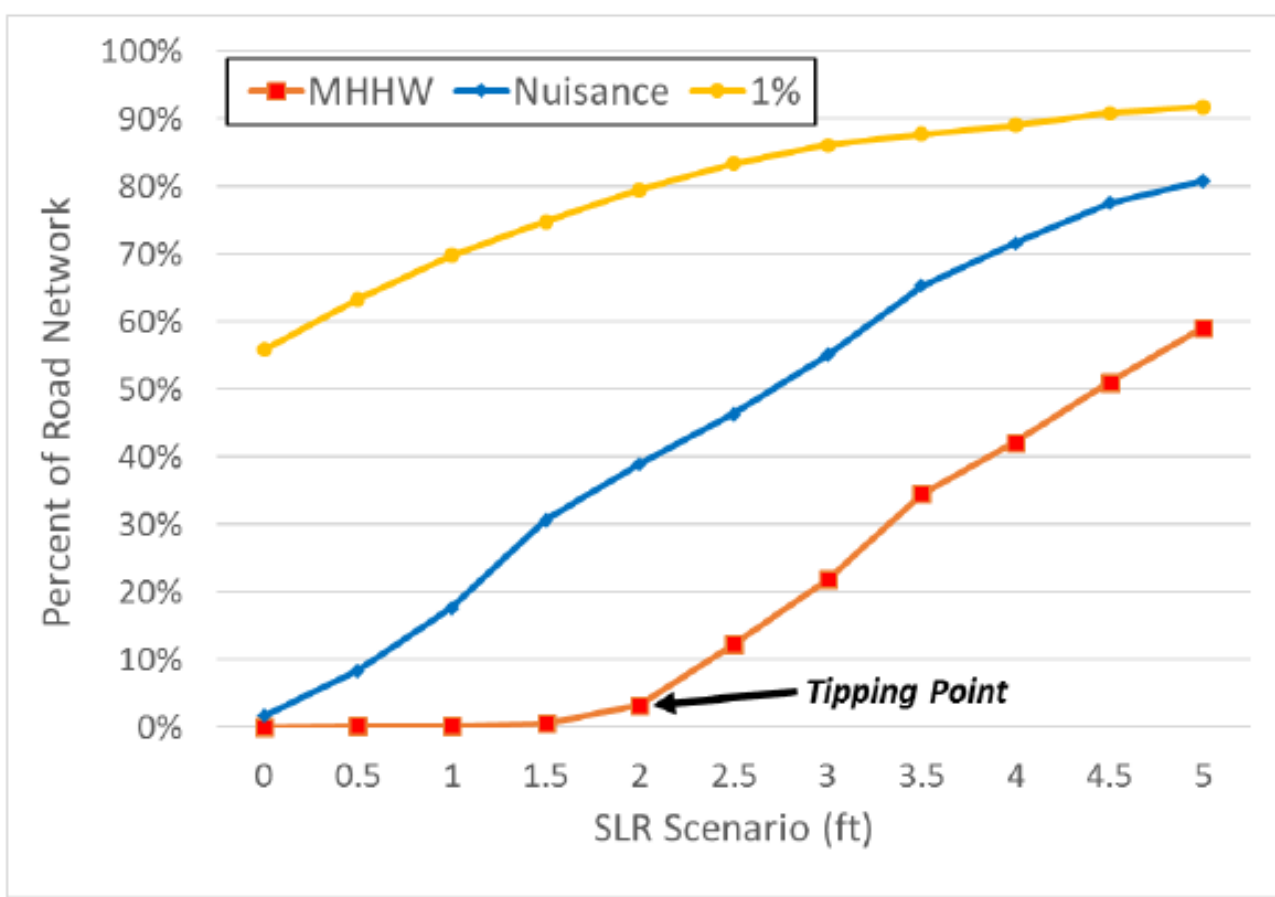


Figure 9. Percent of road network affected by MHHW, nuisance, and the 1% flood level for each SLR increment.

How will road vulnerability to flooding change?



FDEO Coastal Vulnerability Assessment

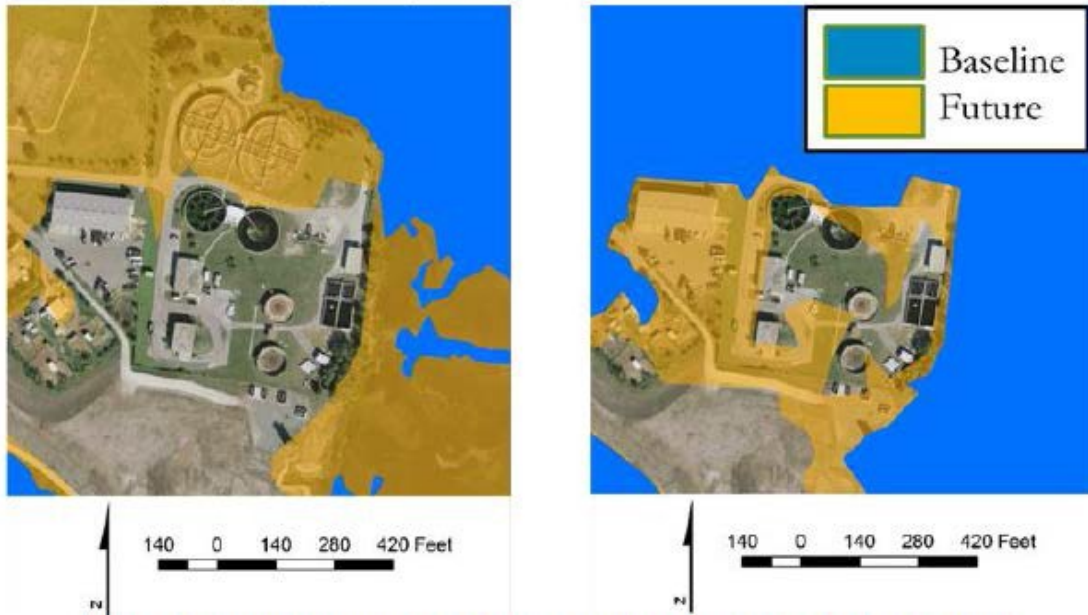


Figure 18. Wastewater treatment plant structure exposure tipping points to MHHW + 5 ft SLR (left) and to the 1% Event + 1.0 ft SLR (right).

Table 11. Vulnerability of St. Augustine Wastewater Treatment Plant to each flood type and SLR scenario.

		MHHW	Nuisance	1%
SLR Flood Elevation in Feet	0	None	None	Some
	0.5			Major
	1.0			Total
	1.5			
	2.0		Some	Some
	2.5			
	3.0	Major		
	3.5			
	4.0			
	4.5	Total	Total encroachment	
5.0				

	No flood impact
	Impact to some structures (<=3)
	Impact to the majority of structures
	Total encroachment

How will sea level rise impact water and wastewater facilities?



FDEO Coastal Vulnerability Assessment

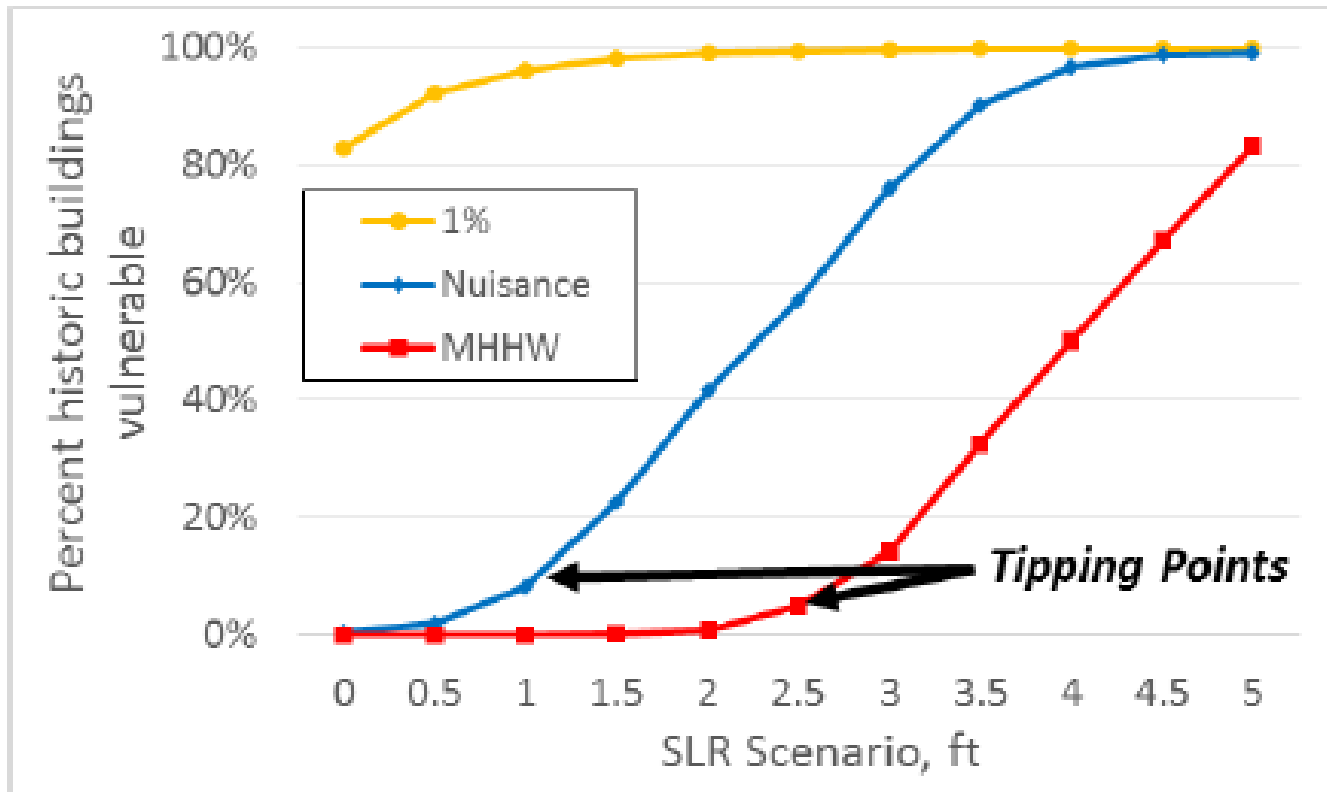
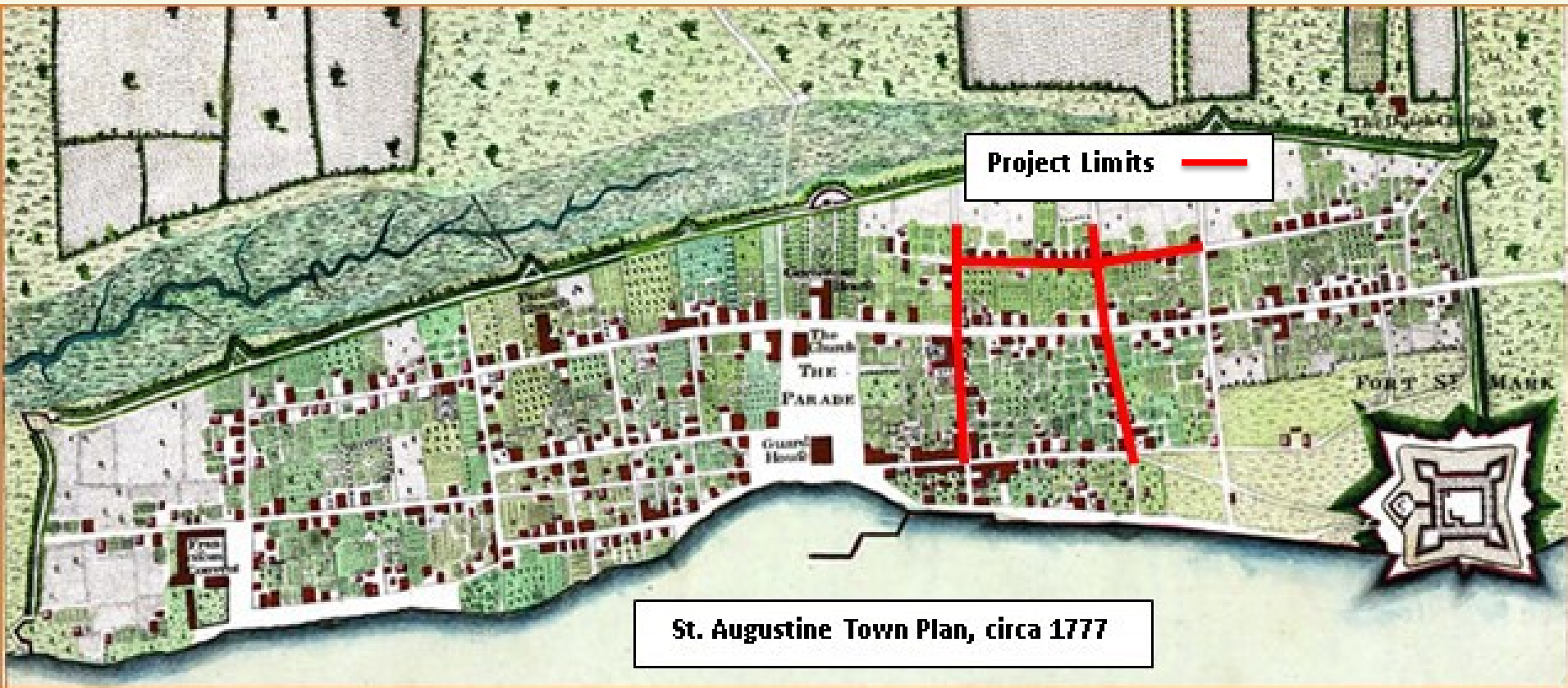


Figure 15. Percentage of buildings within Historic Districts affected by MHHW, nuisance, and the 1% flood level in each SLR scenario.

How will Historic District vulnerability to flooding change?



St. Augustine Town Plan Historic District *at Risk*



Located within the St. Augustine Town Plan Historic District, a National Historic Landmark generally bounded on the north by Castillo de San Marcos, on the south by St. Francis Barracks, on the west by Cordova Street and on the east by the Matanzas River.



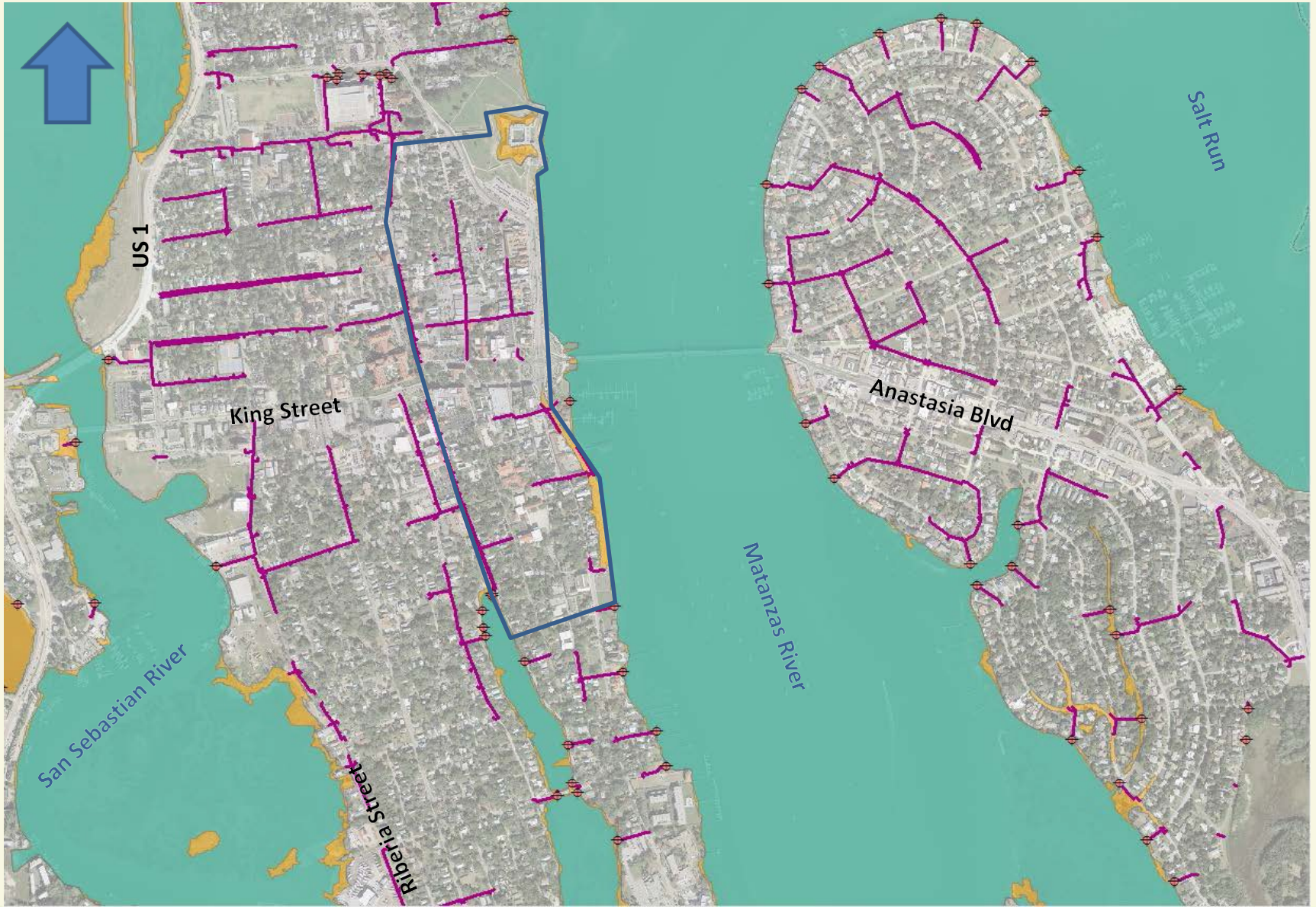
31 buildings contribute to the National Historic Registry



St. Augustine



St. Augustine



0-ft SLR: NUISANCE

MHHW



St. Augustine

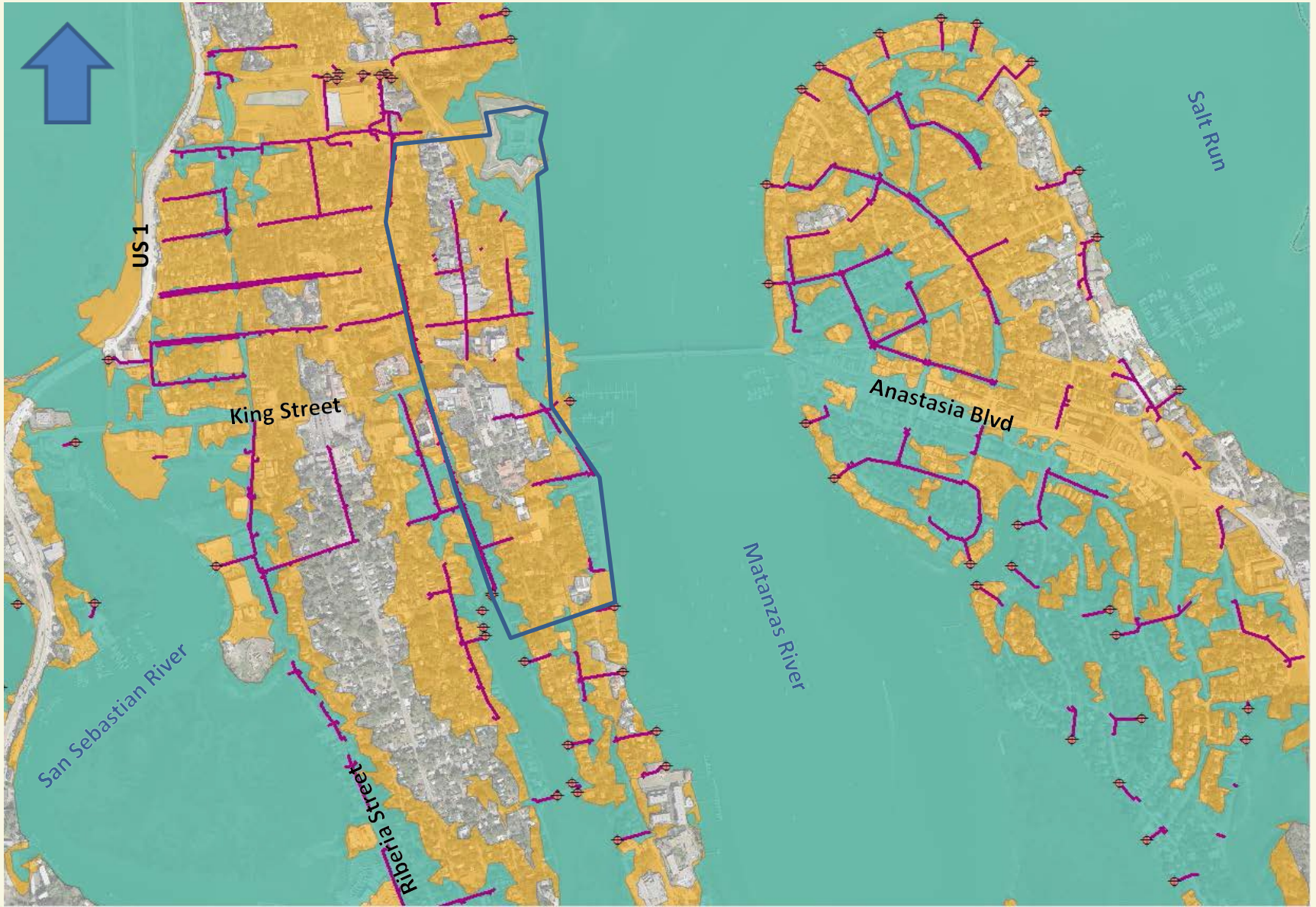


1-ft SLR: NUISANCE

MHHW



St. Augustine



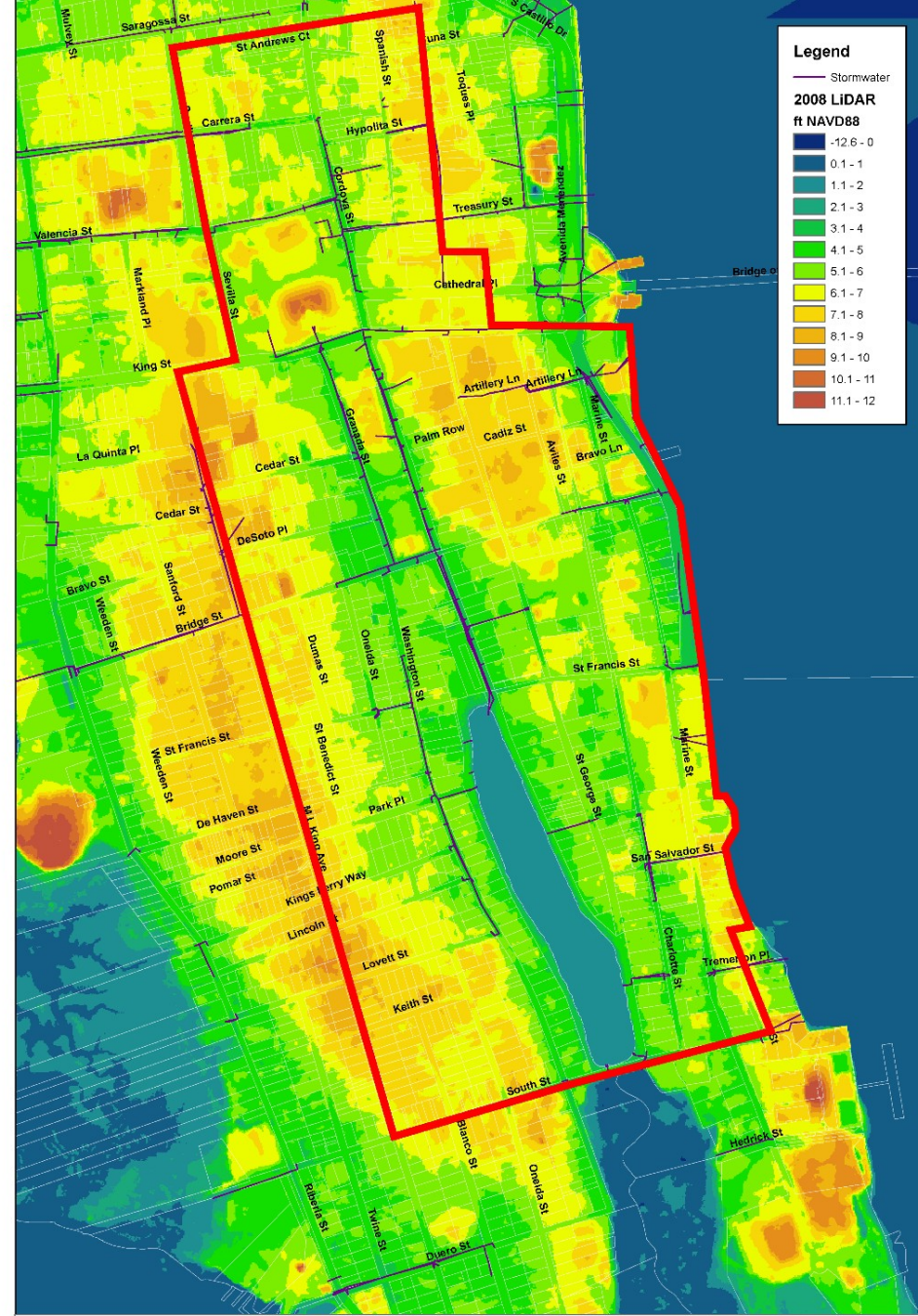
3-ft SLR: NUISANCE

MHHW

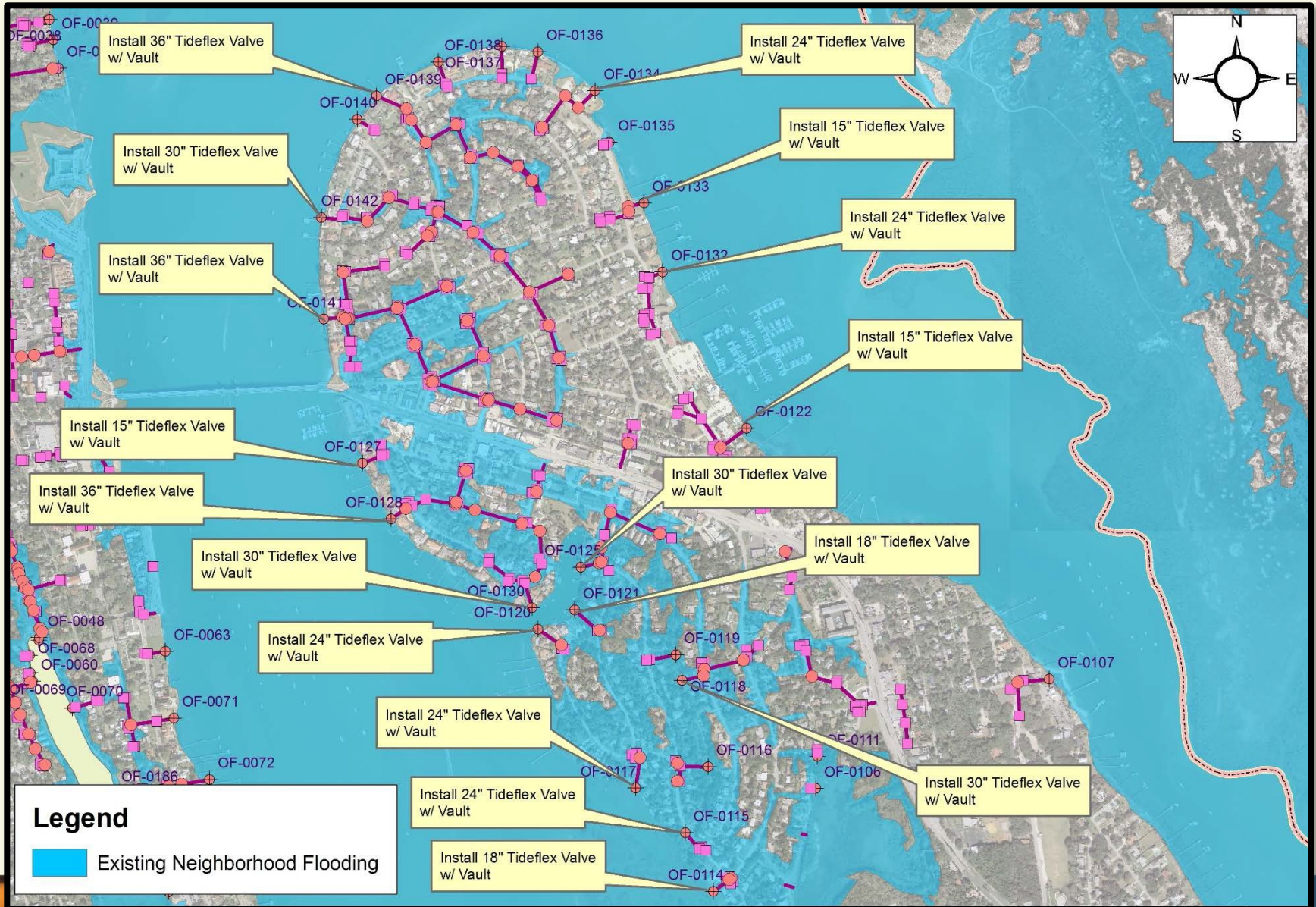


Downtown Drainage Improvement

- Basin Area > 86 Acres
- Upsize collection system
- Raise Street Profile (elevation)
- Design Pump Station
- Re-evaluate for SLR



Planned Backflow Prevention Projects



Adaptation Strategies

Social, Technical, Administrative, Political, Legal & Economic

- STAPLEE
- Define future LOS
- AAAs
- Freeboard

Potential Responses	Evaluation Criteria			Governance Criteria	
	Economic	Environmental	Social	Administrative	Legal
PLANNING TOOLS					
1. Comprehensive Plans ^o	*	*	*	*	*
REGULATORY TOOLS					
2. Zoning and Overlay Zones ^o	*	*	*	*	*
3. Floodplain Regulations ^o	*	*	*	*	*
4. Building Codes and Resilient Design	~	~	~	~	+
5. Setbacks/Buffers	~	+	~	~	~
6. Conditional Development and Exactions	~	+	+	~	~
7. Rebuilding Restrictions	~	+	~	~	~
8. Subdivisions and Cluster Development	+	+	~	~	+
9. Hard-Armoring Permits	!	!	~	~	~
10. Soft-Armoring Permits	~	~	~	~	~
11. Rolling Coastal Management / Rolling Easement Statutes	~	+	~	~	!
SPENDING TOOLS					
12. Capital Improvement Programs	~	+	~	~	~
13. Acquisitions and Buyout Programs	!	+	~	~	+
14. Conservation Easements	+	+	+	~	~
15. Rolling Conservation Easements	~	~	+	!	!
TAX AND MARKET-BASED TOOLS					
16. Tax and Other Development Incentives	~	+	+	~	~
17. Transferable Development Credits	+	+	+	!	+
18. Real Estate Disclosures	~	~	~	~	~

Advantageous (+)

The tool maximizes benefits and is feasible.

Neutral (-)

The tool may present some disadvantages or some feasibility problems.

Disadvantageous (!)

The tool may be difficult to implement because of costs or infeasibility.

“St. Augustine’s historic districts are vulnerable, immovable and irreplaceable. In the background of these STAPLEE features is a basic, existential conundrum: can St. Augustine adapt while continuing to embody those features that are fundamental to its current character?”



Adaptation Strategies – Action Measures

- FEMA – FIRM Map
- Low Impact Development
- Targeted Stormwater Management Upgrades
- Engage FDOT
- Cost/Benefit on road and bridge segments
- Modify HP Comprehensive Plan
- WWTP/Sewer Charette



Adaptation Strategies – Moving Forward

- Educate the Public

“Many residents do not know what’s coming.”

- Seek Regional, State & Federal Partnerships
- Learn from Others





Acknowledgements

Chris Zambito, Krista Rand & Brian Batten – Dewberry

DEO

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City Staff

Reference

Adapting to Rising Tides, UF

Coastal Vulnerability Assessment:
City of St. Augustine, Florida
June 24, 2016

Adaptation Plan for St. Augustine, Florida
May 2017

Martha Graham, P.E.
and Reuben C. Franklin Jr., P.E.
Public Works Department
City of St. Augustine

THANK YOU!

