

# Proactive Strategies to Deal with Sea Level Rise

River to Sea TPO Annual Retreat

Daytona Beach, FL

Presented by  
Kari Hewitt

March 3, 2017

# Risky Business

- Risk management
- Planning now for long-term infrastructure investments
- Proactive vs reactive
- Incorporate decision-making into budget and planning cycles



If we continue on our current path, between \$48.2 billion and \$68.7 billion worth of existing coastal property in the Southeast will likely be below sea level by 2050.

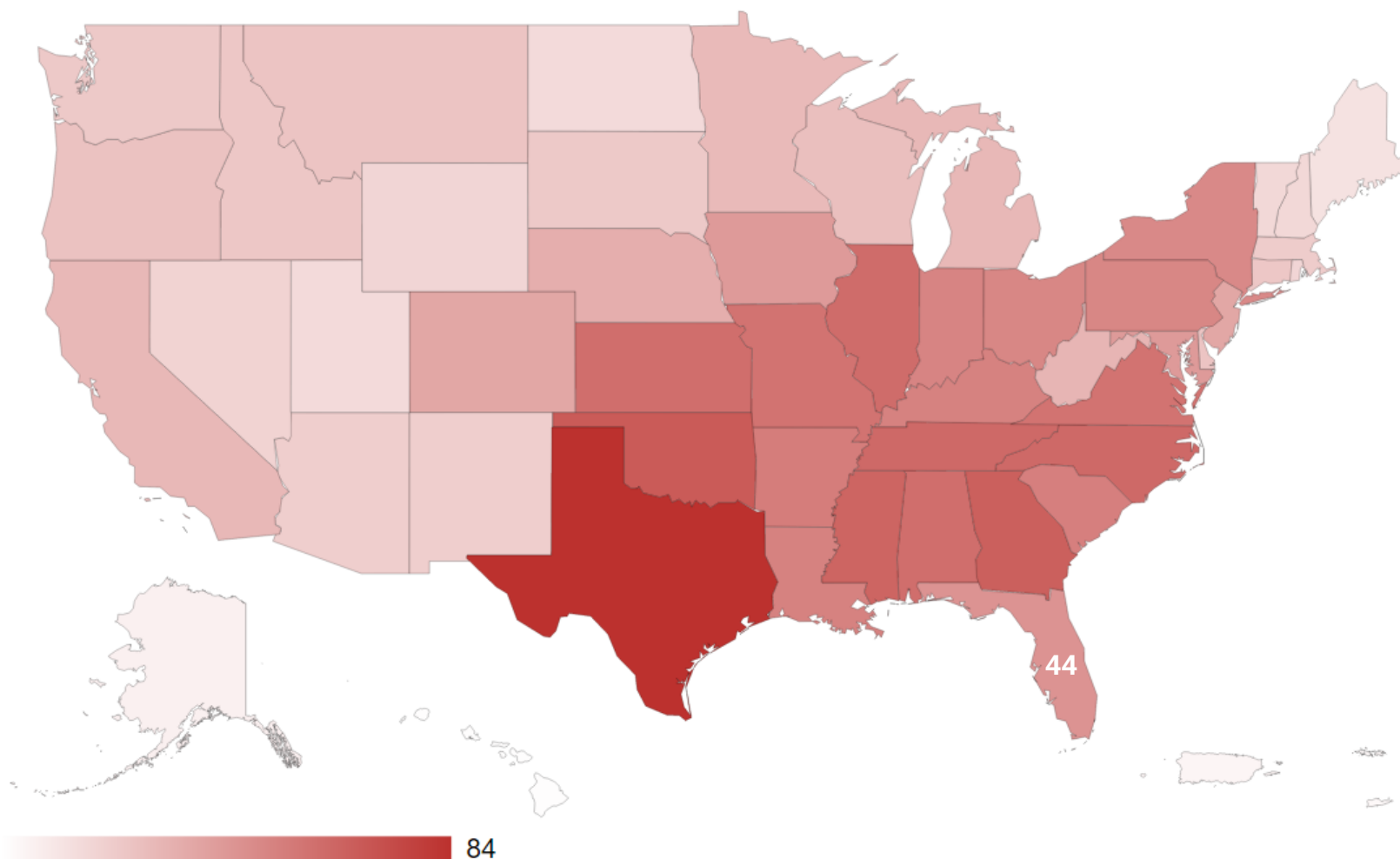


**RISKY BUSINESS**

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riskybusiness.org | @climaterisk

## 1980-2016 Billion-Dollar Weather and Climate Disasters By State (CPI-Adjusted)



*Please note that the map reflects a summation of billion-dollar events for each state affected (i.e., it does not mean that each state shown suffered at least \$1 billion in losses for each event).*

[Save/Print](#)





Highways

20-50  
years



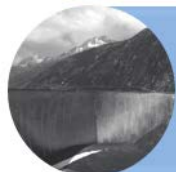
Bridges

30-75 years



Pipelines

50-100 years



Dams

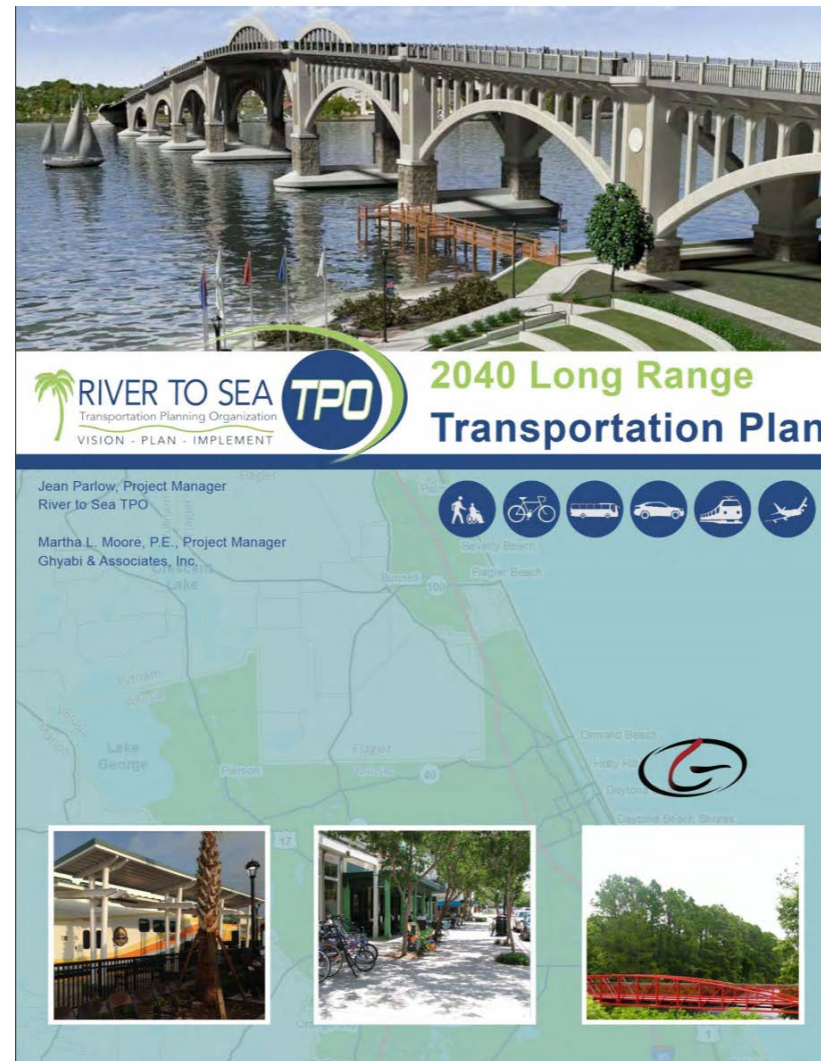
50-100 years

#### 9.4. Transportation Efficiency and System Safety Planning

This Long Range Transportation Plan also reflects the River to Sea TPO's commitment to preserving and enhancing the existing transportation infrastructure by allocating funds to improve traffic operations and safety and to utilize new technology to improve the efficiency of our existing system. This plan sets aside roughly \$41 million between 2019 and 2040 for projects that improve safety and efficiency.

The 2040 LRTP also helps to create high quality transportation facilities by allocating approximately \$38 million in funding between 2019 and 2040 for Local Initiative projects. These include projects that address complete streets retrofits, roundabouts, major technology improvements, climate change adaptation aesthetics and other qualified improvements that support the goals of the plan.

The TPO supports local governments by conducting feasibility studies for projects early in the development stage to provide assistance in accessing federal and state funding programs. The studies take a planning level approach and consider the purpose and need for the project, phases that need to be funded, project issues impacting constructability and preliminary cost estimates. The TPO sets aside \$200,000 per year in SU funds to conduct feasibility studies.



## ECHOtourism



### Cultural

Want to live where you can attend performances by world-famous European symphony orchestras or visit top-quality museums with exhibitions by the finest of today's contemporary artists?

### Ecological

Ecological paradise abounds in Volusia County with an abundance of natural places to view and experience firsthand.

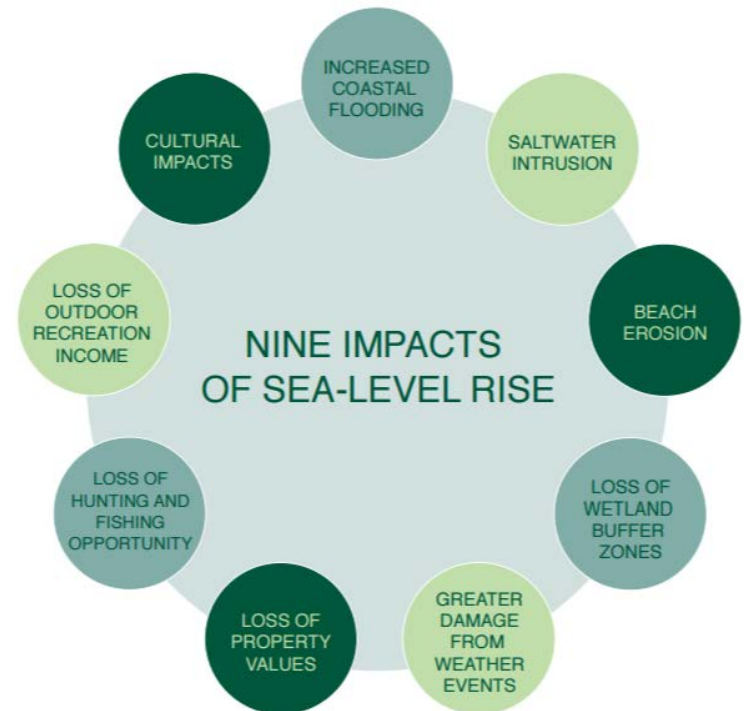
### Heritage

Owing largely to its important geographical position, Volusia County has enjoyed a rich and diverse history.

### Outdoors

Volusia County is blessed with some of the most beautiful parks in the Southeast.

*With a \$60 billion beach tourism industry, the impacts of sea-level rise have the potential to severely harm Florida's economy.*



Property appraisers say [Hurricane Matthew](#) left more than \$67 million in damages to hotels and motels in [Volusia County](#), a popular tourist area that includes Daytona Beach.



 BUY PHOTO

 HIDE CAPTION

Erosion along North A1A in Ormond by the Sea as the damage from Hurricane Matthew unfolded Saturday October 8, 2016. News-Journal/JIM TILLER

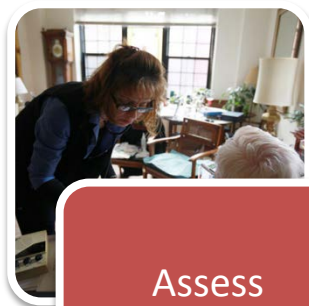
# *Planning for Resilience*

**Climate Resilience is the ability to prepare for, withstand, and recover from extreme events and environmental changes.**

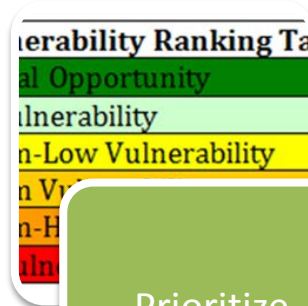


# Process

Stakeholder Engagement



Assess  
Vulnerabilities  
and Impacts



Prioritize  
Vulnerabilities



Develop  
Strategies

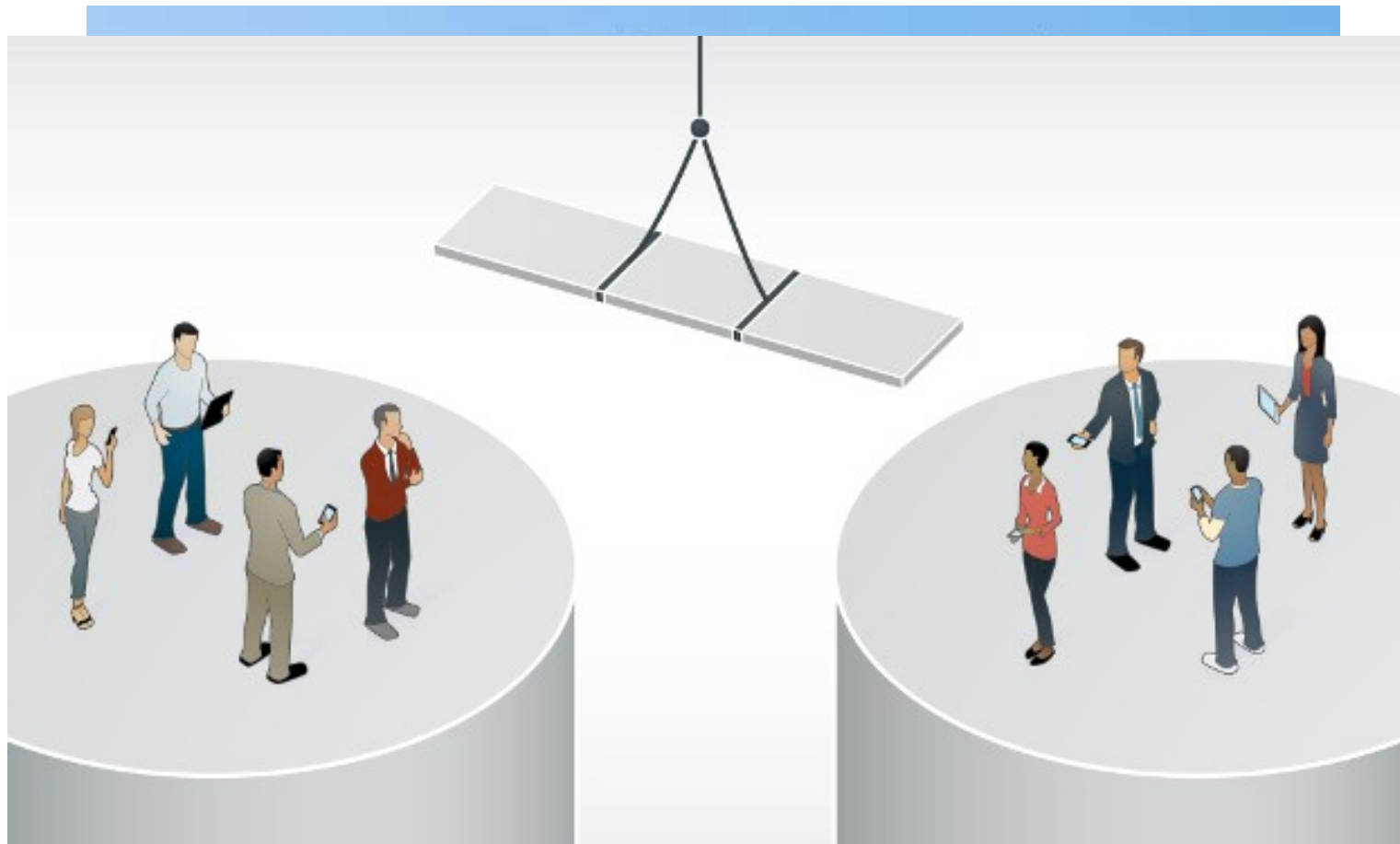


Implement



Monitor and  
Reassess





# Bring together key stakeholders

- Planning staff
- Stormwater Mgmt
- Water/Wastewater Mgmt
- Emergency Mgmt
- Public Health
- Public Works
- Utilities
- Transportation agencies
- Community Groups
- Business representatives



# Assessing Vulnerabilities

What do we mean by vulnerability?

- Exposure
- Sensitivity
- Adaptive Capacity
- Criticality and Prioritization



**Requires stakeholder engagement!**

# Example Impacts and Vulnerabilities

## Impacts

- Heat
- Drought
- Air Quality
- Changes in Precipitation
- Storm Intensity
- Sea Level Rise
- Flooding
- Biodiversity loss
- Vector-borne Diseases

## Vulnerable Sectors

- Social
  - Public health
  - Cultural resources
- Ecological
  - Water/coastal resources
  - Forests
  - Other habitats
- Infrastructure
  - Transportation
  - Water/Wastewater
  - Stormwater
  - Energy/Communications
  - Agriculture and food systems
  - Emergency Response Networks





# Prioritizing Vulnerabilities for Action

- Magnitude of Impact
- Timing of Impact
- Persistence and Reversibility of Impact
- Likelihood of Impact
- Potential for Adaptation Actions
- Criticality of systems/assets

Vulnerability Ranking Table
Potential Opportunity
Low Vulnerability
Medium-Low Vulnerability
Medium Vulnerability
Medium-High Vulnerability
High Vulnerability

		Sensitivity: Low → High				
		S0	S1	S2	S3	S4
<b>Adaptive Capacity:</b> Low ↓ High	AC0					
	AC1					
	AC2					
	AC3					
	AC4					

**Table 1: Water infrastructure vulnerability and risk from heat**

(V5 – Most Vulnerable, V0 – Least Vulnerable; R4 – Highest Risk, R1 – Lowest Risk)

Critical Assets		Heat - 2030		Heat - 2070	
Type	Name	Scenario: 4-day >90 F heatwave		Scenario: 5-day >90 F heatwave with 3 days > 100 F	
		Vulnerability	Risk	Vulnerability	Risk
Surface Water Bodies	Charles River	V2		V2	
	Alewife Brook	V2		V2	
Dams	New Charles River Dam	V1		V1	
	Amelia Earhart Dam	not assessed		not assessed	
Drinking Water System	Fresh Pond Reservoir	V0		V0	
	Walter J. Sullivan Water Purification Facility	V0		V0	
Stormwater Pump Stations	New Street Pump Station	V2		V2	
	Cambridge St Underpass pump station	V3		V3	
Combined Sewer/Sanitary Pump Stations	Sewer pump station: Prison Point	V3		V3	
	Sewer pump station: Cottage Farm	V2		V2	
Separated Stormwater Catchment Areas	CAM 400 (Alewife)	no interaction		no interaction	
	D46 (Alewife)	no interaction		no interaction	

**Table 2a: Water infrastructure vulnerability and risk from inland flooding by 2030s**  
(V5 – Most Vulnerable, V0 – Least Vulnerable; R4 – Highest Risk, R1 – Lowest Risk)

Critical Assets		Flooding - 2030			
Type	Name	10 yr 24-hr (5.6 in.)		100 yr 24-hr (10.2 in.)	
		Vulnerability	Risk	Vulnerability	Risk
Surface Water Bodies	Charles River	V1		V1	
	Alewife Brook	V1		V3	
Dams	New Charles River Dam	V1		V1	
	Amelia Earhart Dam	V1		V2	
Drinking Water System	Fresh Pond Reservoir	V0		V4	R3
	Walter J. Sullivan Water Purification Facility	V0		V1	
Stormwater Pump Stations	New Street Pump Station	V5	R3	V5	R2
	Cambridge St Underpass pump station	V2		V2	
Combined Sewer/Sanitary Pump Stations	Sewer pump station: Prison Point	V2		V2	
	Sewer pump station: Cottage Farm	V2		V3	
Separated Stormwater Catchment Areas and Associated Conveyance Systems	CAM 400 (Alewife)	V3		V5	R3
	D46 (Alewife)	V5	R2	V5	R2
	CAM 004 (Alewife)	V3		V5	R3
	May Street Golf Course (Alewife)	V3		V5	R1
	Sparks St (Charles)	V3		V3	
	Harvard Sq (Charles)	V3		V3	
	Area 13 (Charles)	V3		V4	R2
	Coperthaite (Charles)	V3		V4	R2
	Dewolfe (Charles)	V2		V3	
	Western Flagg (Charles)	V2		V4	R3
	Cambridgeport (Charles)	V3		V4	R2
	North Point (Charles)	V3		V3	

**City of Cambridge, MA**

Weather & Climate Change	Aircraft Operations	Airfield Operations	Utility Systems (fuel, water, energy, etc.)	Employees & Human Resources
More days over 95°F	increased cooling demands at gates; reduced airplane performance,  we need to look at other airports in locations with climates similar to projected climate for MSP	surface damages- pavement buckling and depressions weathering of GSE, including tires <i>Increased rubber buildup on runways resulting in increased rubber removal and subsequent polishing of surfaces which will require abrasive</i>	increased cooling demand (cost, strain on systems - increased maintenance) unpreparedness for regional brownout? <i>Increased need for irrigation.</i>	heat-related illness (respiratory, heat stroke) reduced productivity, increased loss of work days, potential for employee altercations, accumulative trauma, higher costs to maintain employee health; increase redundancy or depth of staffing resources
<b>Sensitivity</b>	S1	S1	S1	S3
<b>Adaptive Capacity</b>	AC2	AC2	AC1	AC1
<b>Vulnerability Ranking</b>				
Increased days per year with over 1" rainfall	reduced visibility; travel delays, increased cancellations, reduced capacity, potential aircraft damage	operational disruptions from flooding, potential overwhelm of stormwater management system/NPDES permit violation, potential development of ice, <i>creation of ponding areas in turf resulting in increased numbers of ducks, geese and wading birds. Potential for more events with wet snow/ice during winter.</i>	location of backup generators, utility manholes filled with water may affect electrical/plumbing, electrical systems below grade-flooding impacts	safety; ability to travel to work; psychological impacts (stress); standing water hazards
<b>Sensitivity</b>	S1	S2	S2	S1
<b>Adaptive Capacity</b>	AC2	AC2	AC2	AC2
<b>Vulnerability Ranking</b>				

# Develop Strategies

- Incorporate into planning (comprehensive, hazard mitigation, LRTP)
- Policies and permitting
- Infrastructure improvements – hardening, redundancy
- Protect natural buffers
- Education/Outreach

Develop strategies based on:

- Criticality/Vulnerability
- Timescale and planning/budget cycles
- Best practices
- Opportunities to leverage resources
- Win-win strategies (mitigation and adaptation)



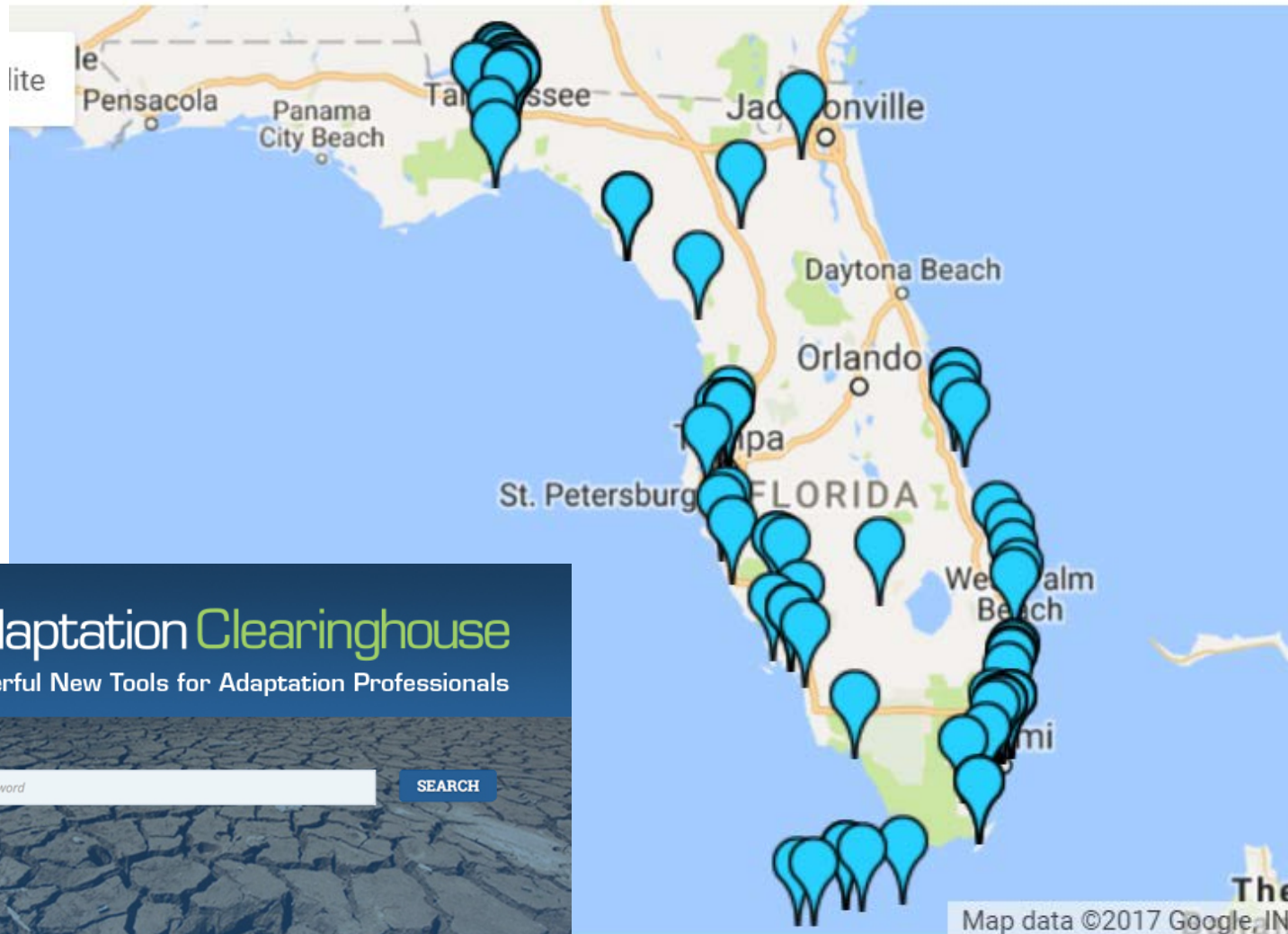
## **BUILT ENVIRONMENT.**

Over the long-term, we will increasingly need to focus planning activities on adapting to sea level rise impacts through available adaptation strategies, which include: avoidance, accommodation and protection. To guide this planning, we developed twenty-five (25) specific recommendations to help us adapt, which include:

- Maintaining and strengthening setback policies;
- Imposing use restrictions in areas most vulnerable to flooding;
- Adopting an "environmentally-challenging locations" ordinance;
- Incentivizing resiliency construction standards;
- Establishing adaptation action areas;
- Increasing mileage of bicycle lanes/shared use paths;
- Identifying strategies to provide better public transportation options;
- Adopting a Complete Streets policy;
- Incorporating Dark Skies practices into land development regulations;
- Adopting zoning and development regulations that allow farmers markets, community gardens and urban agriculture.



# Current state of planning



 **Adaptation Clearinghouse**  
Powerful New Tools for Adaptation Professionals

Enter a keyword

**SEARCH**

# Resources

## US Climate Resilience Toolkit

- <https://toolkit.climate.gov/>

## Climate Adaptation Knowledge Exchange

- <http://www.cakex.org/>

## Georgetown Climate Center

- <http://www.georgetownclimate.org/>

## NOAA Climate Office

- <http://www.noaa.gov/climate>

## Compact of Mayors

- <https://www.compactofmayors.org/>

## 100 Resilient Cities

- <http://www.100resilientcities.org/#/-/>

## ICLEI USA ADAPT Tool

- <http://www.icleiusa.org/tools/adapt>

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