



# **Sea Level Rise in the Florida Keys** **FROM MODELING TO IMPLEMENTATION** ***CHARTING THE COURSE*** **FOR THE FUTURE**

Rhonda Haag, Monroe County,  
7<sup>th</sup> Annual Climate Summit, Key West  
December 2, 2015

# Overview of GreenKeys! Sustainability Plan Process



## GreenKeys! A Plan to Create a Sustainable Florida Keys

### Climate: Forecasting Tools & Modeling

County Assets  
Infrastructure  
Habitat



Community  
Impacts



### Sustainability: Greenhouse Gas

Government Operations  
Natural Systems  
Built Environment  
Health & Safety  
Education, Arts & Community  
Economy & Jobs  
Equity & Empowerment







# Questions Related to Sea Level Rise in the Keys

***1. What impacts to County assets, infrastructure and habitat will occur from sea level rise in 2030 (at 3" and 7") and in 2060 (9" and 24")?***

- *2014-15 Modeling addressed the projected impacts*

***2. How can Monroe County address the impacts and prepare for the future?***

- *New data and conceptual designs for 2016 and Beyond*

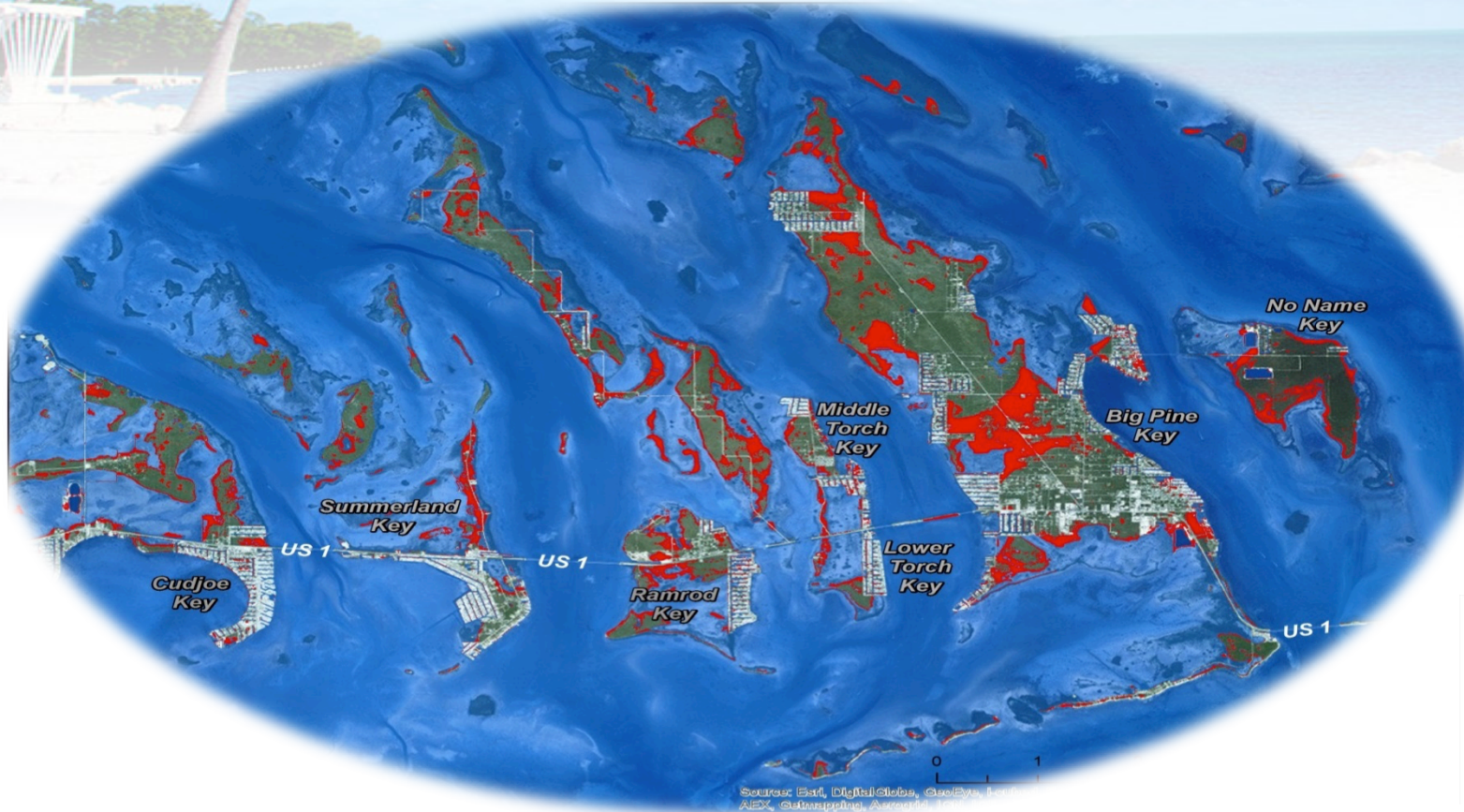


# Big Pine Key and Vicinity, Present Day

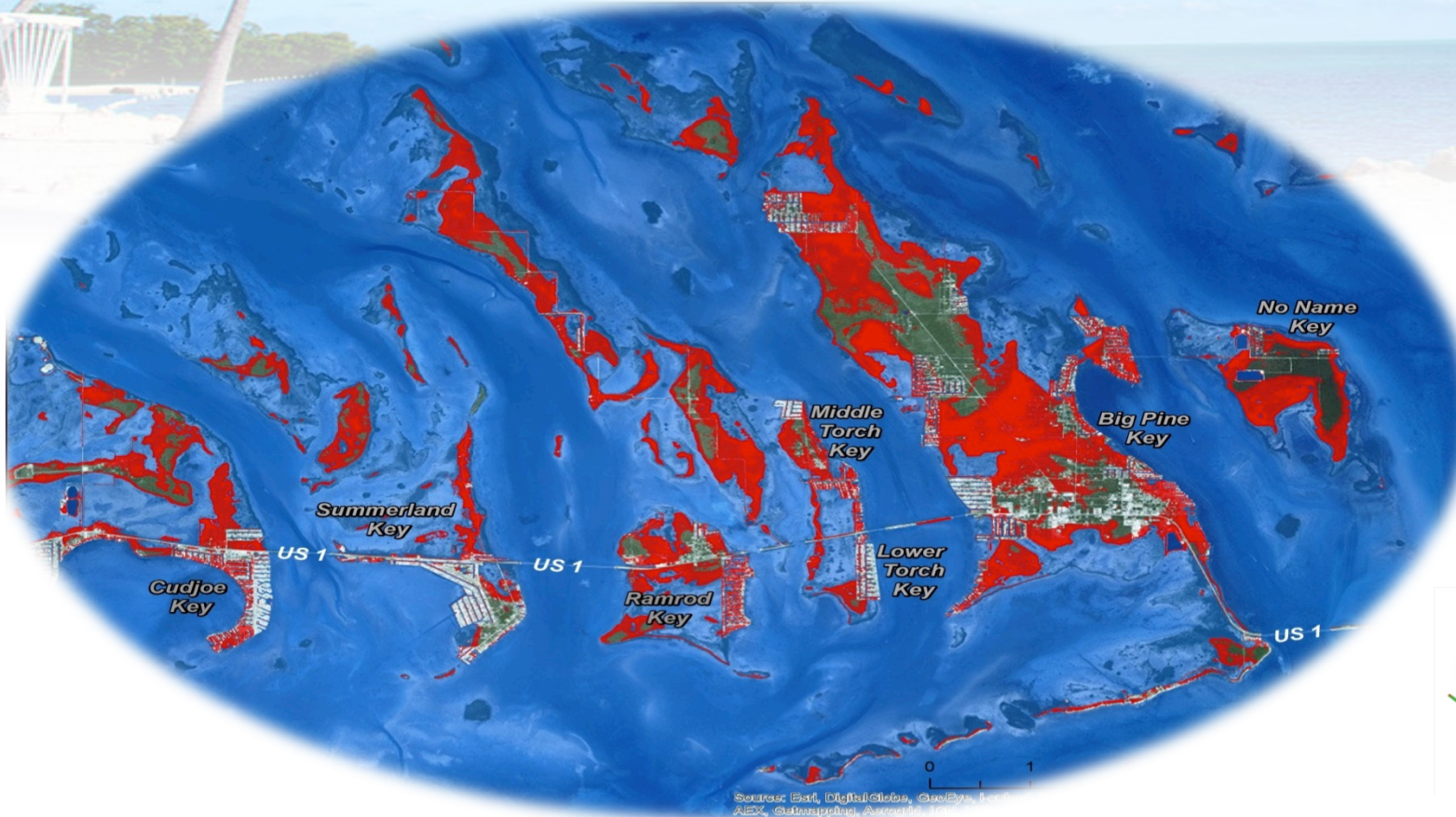




# Big Pine Key and Vicinity, 9 inches Sea Level Rise (2060, Low Scenario)



# Big Pine Key and vicinity, 24 inches Sea Level Rise (2060, High Scenario)





# Key West, Present Day



# Key West, 9 inches Sea Level Rise (2060, Low Scenario)





# Key West, 24 inches Sea Level Rise (2060, High Scenario)

Naval Air Station Sigsbee Annex

Naval Air Station Trumbo Point

Mallory Square

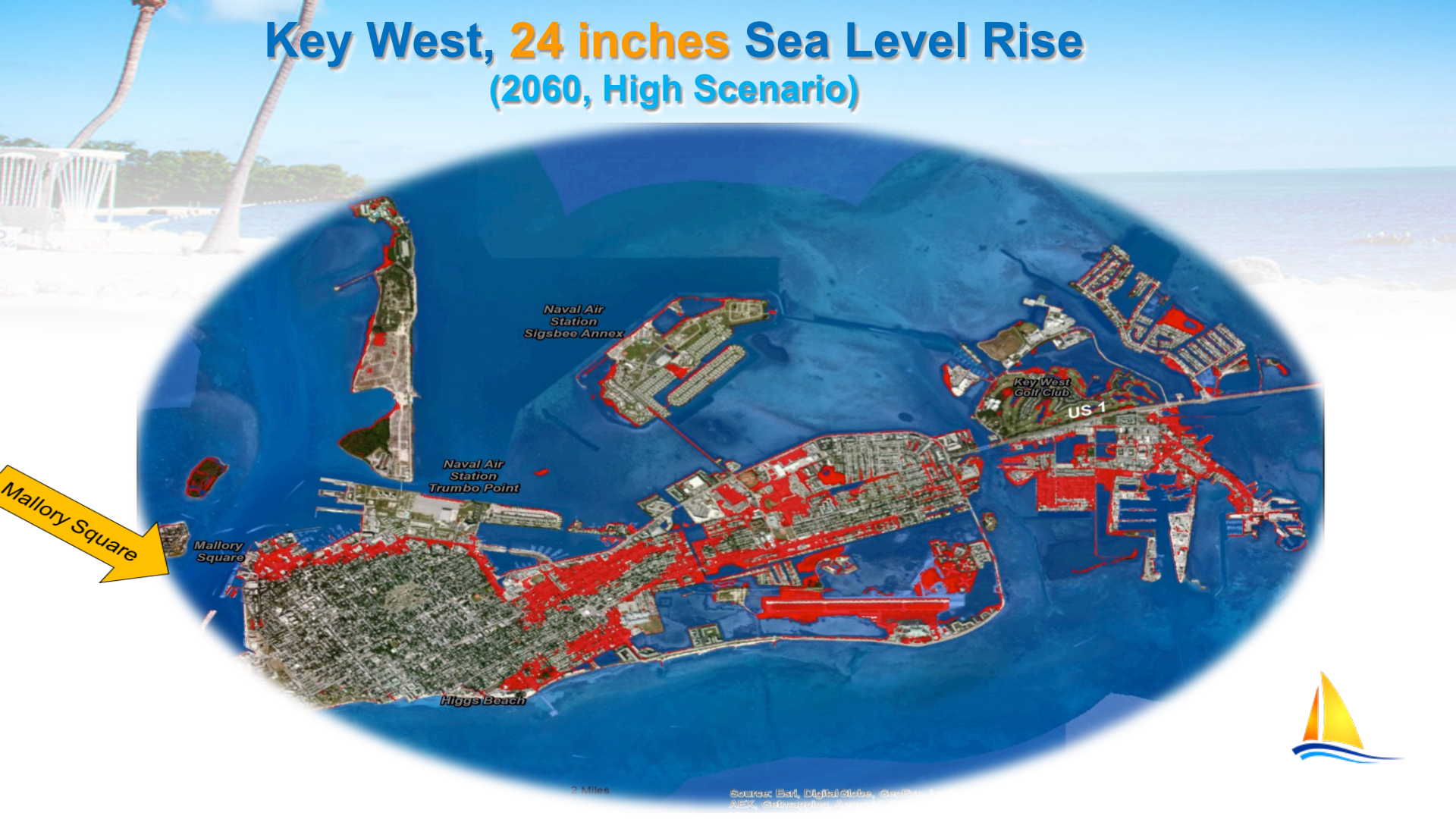
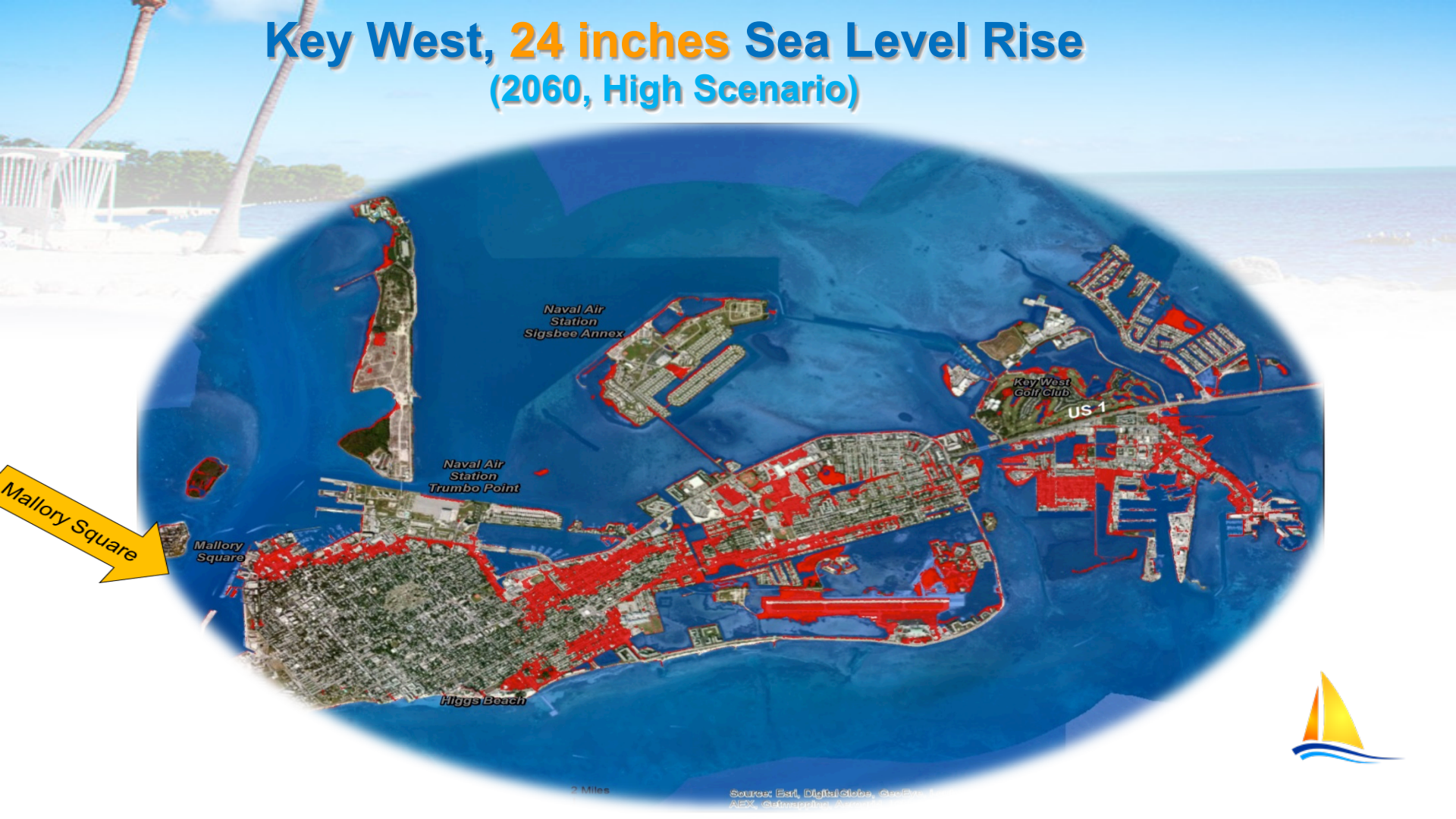
Higgs Beach

Key West Golf Club

US 1

2 Miles

Source: Esri, DigitalGlobe, GeoEye, Aerial, etc.



[illegible]

Sources: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar, AeroGRID, IGN, USGS, AeroGRID, IGN, USGS, Terracon, Mapbox, and others.



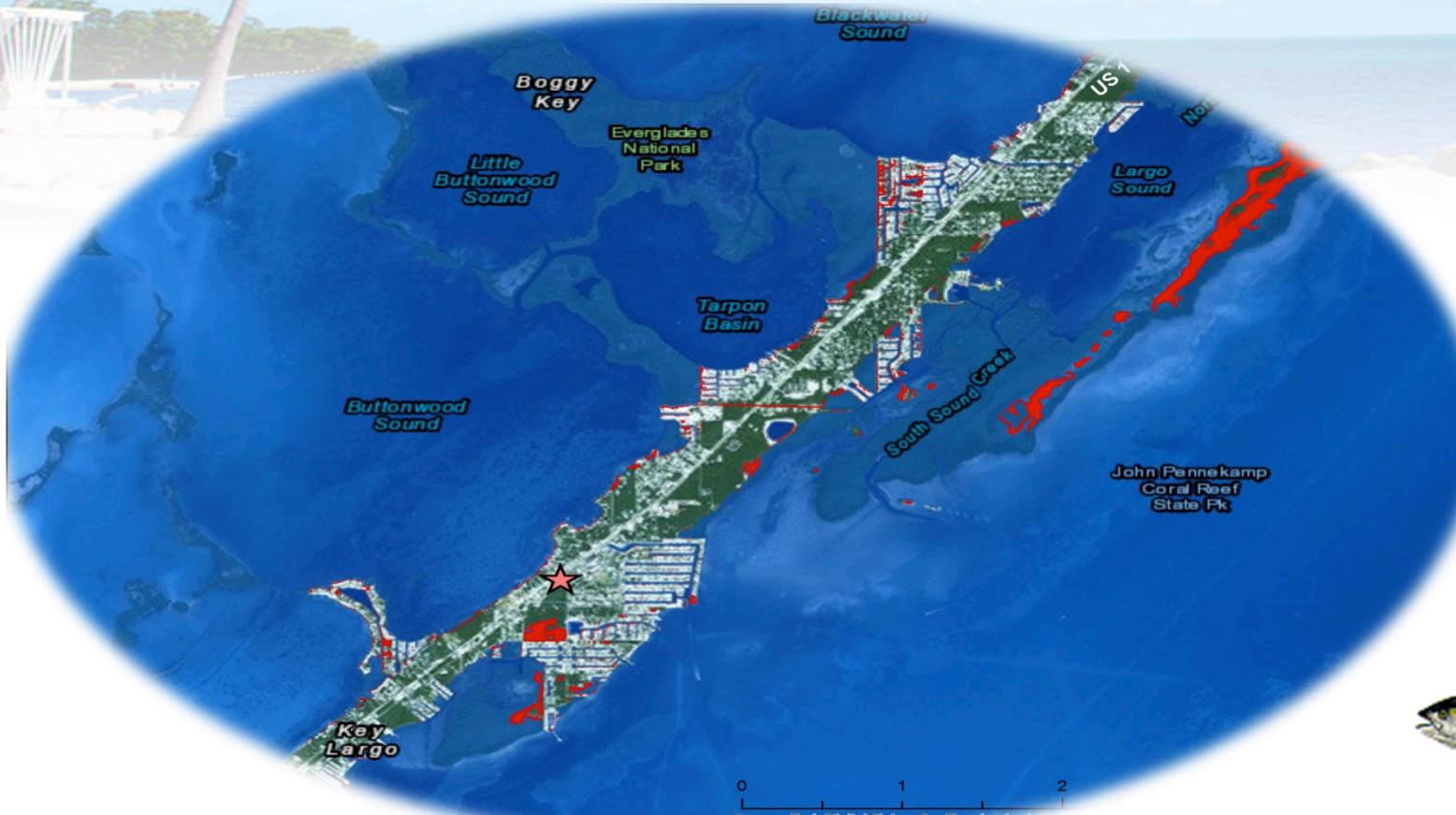
# Key Largo, 9 inches Sea Level Rise (2060, Low Scenario)

The map illustrates the coastal area around Key Largo, Florida, with various geographical features labeled. Red shading indicates the extent of land inundated by a projected 9-inch sea level rise by the year 2060. The inundation is most significant along the southern coast of Key Largo and in several smaller bays and sounds.

Labels on the map include:

- Blackwater Sound
- Boggy Key
- Everglades National Park
- Little Buttonwood Sound
- Tarpon Basin
- Buttonwood Sound
- South Sound Creek
- John Pennekamp Coral Reef State Pk
- Key Largo
- US 1

A scale bar at the bottom indicates distances from 0 to 2 miles.



Source: Esri, DigitalGlobe, GeoEye, I-cubed, etc.

# Key Largo, 24 inches Sea Level Rise (2060, High Scenario)





# Key Largo, Murray E. Nelson, 24 inches SLR



# Tidal “Nuisance” Flooding in Key Largo

## October 3, 2015



Photo Credit Stephanie Russo

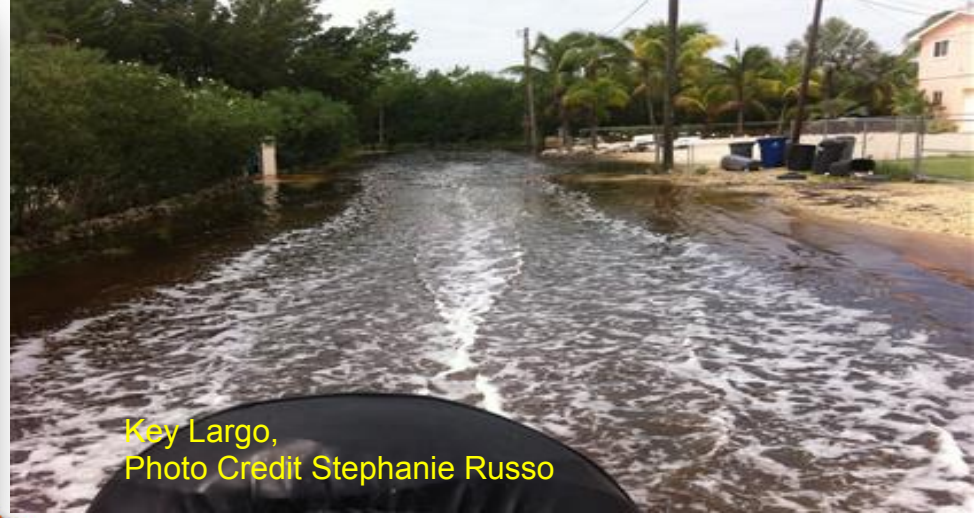


Photo Credit Stephanie Russo





# Tidal “Nuisance” Flooding Key Largo, October 2015



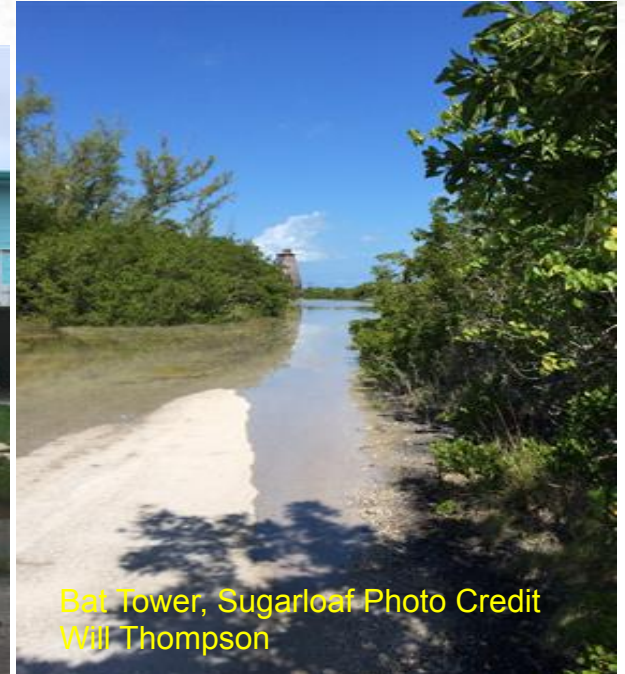
# Big Pine Key Nuisance Flooding October, 2016



Big Pine Key. Photo Credit: Greg Corning



Big Pine Key. Photo Credit: Greg Corning

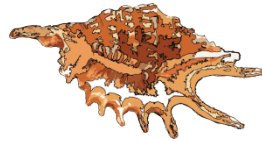
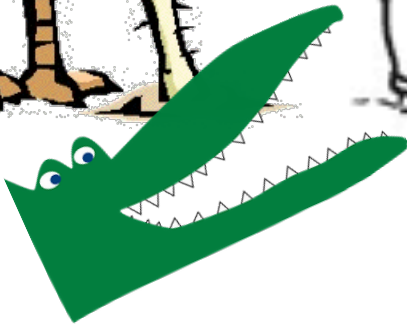


Bat Tower, Sugarloaf Photo Credit  
Will Thompson





# COMMUNICATION - COURAGEOUS



# What Does Proactive Planning Look Like?

## Stock Island Fire Station





# What could this mean for Properties?



*Elevating  
properties*

# Cost- Benefit Ratios

1. For every **\$1** spent today to elevate and flood proof buildings, **\$14.25**, **\$12.43** or **\$11.00** is saved in avoided damages from storm surge and high sea level rise by 2060 (depending on participation).
2. Elevating and flood proofing buildings is modeled as a **cost-effective** adaptation regardless of costs (high vs. low) or sea level rise scenario (high, low or historic trend).





# ACCOMPLISHMENTS FOR 2015

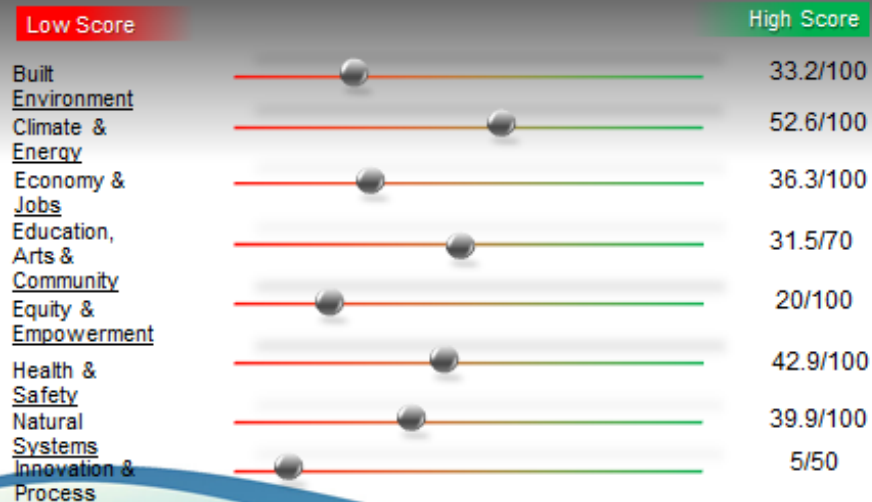


1. Finalized new **Energy and Climate Element of Comp Plan** (pending final adoption)
2. Completed **vulnerability modeling for sea level rise** for 2030 and 2060 impacts:
  - a) Infrastructure (roads, electric, water and wastewater)
  - b) Habitat
3. **GreenKeys Climate and Sustainability Plan**
  - a) Final workshop (January 2016)
  - b) Conducted numerous workshops, events and outreach activities
  - c) Conducted survey to generate ideas for Plan recommendations and priorities (161 responses)
  - d) Online community engagement site was open for 11 months, people discussed sustainability issues, shared photographs and generated plan ideas
4. **NOAA Grant Won and NFIP/CRS Prep**



# Sustainability Tools for Assessing and Rating Communities

Total Score: **261.3** = 3-STAR Community – 200-399 points  
Recognized for sustainability leadership





## Sustainability Action Plan

[GreenKeys! Sustainability Action Plan](#) – This document is the entire draft GreenKeys! Sustainability Action Plan including results of the vulnerability assessments, sea level rise modeling and sustainability evaluation, along with specific recommendations to increase the County's overall sustainability and resilience to climate change and sea level rise.

- [Discuss this item online](#), or [Email a comment here](#)

[Executive Summary](#) – This executive summary provides a high-level overview of the GreenKeys! Sustainability Action Plan, including the vulnerability assessment results and recommendations.

- [Discuss this item online](#)

[Recommendations](#) – This section provides a detailed list of recommendations broken down by Focus Area in a stand-alone document.

- [Discuss this item online](#), or [Email a comment here](#)

[Implementation Matrix](#) – This matrix provides the method and timeline for implementing each of the 162 GreenKeys! Sustainability Action Plan recommendations, as well as potential funding sources and costs where applicable.

- [Discuss this item online](#), or [Email a comment here](#)

[GreenKeys! Sustainability Action Plan Appendices](#) – The appendices include supporting documentation referenced in the GreenKeys! Sustainability Action Plan, including:

# Implementation: Translating Recommendations to Actions/Projects

CE: 2.3: Conduct a Comprehensive Feasibility Study for Enhanced Stormwater / Tidewater Criteria on roads for near term areas subject to inundation risk including nuisance flooding.

			MCAP Overlap
		the time and	M-3.1
		ers! project and facilities. Use, ents.	M-2.2
CE 1.3	Continu	providing data to educate residents about opportunities to plan and costs of inaction.	
<b>Goal 2: Mitigate inundation and nuisance flooding to County roads and support efforts by FDOT to mitigate impacts on FI within the C</b>			
CE 2.1	new nuisance flooding data informs future road decisions, starting now. These data will also need to be ed for future road decisions. This will require coordination with FDOT for impacts to State Roads (U.S. Highway		M-2.2
CE 2	Create better elevation data County-wide to improve decision-making and inform future decisions, develop improved LiDAR County-wide.		M-2.1
CE 2.3	Conduct a Comprehensive Feasibility Study for Enhanced Stormwater Criteria (prioritizing areas) for near-term areas subject to inundation risk, including nuisance flooding.		
CE 2.4	Develop a ranking process to identify the most vulnerable neighborhoods first. Develop criteria to establish levels of service each road gets subjected to based upon a tolerable level of nuisance flooding (saltwater-based flooding on a road for some amount of time).		M-3.3

**Implementation:** Decide on flood risk standard, budget funds, develop solicitation and secure engineering firm to develop County-wide Plan.



# Decision Making Paradigm Shift



## Land and Infrastructure-

Species, Habitat considerations  
Adaptation and Mitigation for infrastructure

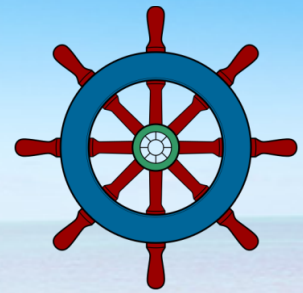
## Policy Implementation

Departmental Collaboration,  
Comp Plan, Code, Legal Issues

## Project Planning-

Addressing Priority Vulnerabilities,  
Budget Implications (New Cost Considerations),  
Also Departmental Collaboration

# Monroe County Charting the Course for 2016



1. **Shift from identifying vulnerabilities to solving them**
  - a) Two demonstration sites to be selected for tidal flooding conceptual design projects
2. **Improving data sets** through better elevation data and vulnerability analysis through the NOAA grant:
3. **Policy Decisions:** Board of County Commission workshop January, 2016
  - a) Presentation of **Sustainability Action Plan** and recommendations
  - b) **Policy impacts** of sea level rise
    - I. **How to incorporate SLR into capital infrastructure improvements**
    - II. **Land acquisition** needs and priorities
    - III. **How to retool Code and Comp Plan** (development standards)
  - c) **Implementation**
    - I. **Timelines/phases**
    - II. **Funding Strategies**



# THE PROJECT TEAM

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Jason Evans, PhD, Stetson University



Chris Bergh, The Nature Conservancy



VHB/Miller Sellen



Catalysis Adaptation Partners



Quest Ecology



EcoSmart





# Thank you!

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