GreenKeys!

SUSTAINABILITY ACTION PLAN

MONROE COUNTY, FLORIDA

Dear Monroe County Residents:

I am pleased to present this **GreenKeys! Sustainability Action Plan,** which identifies the County's vulnerabilities to sea level rise and climate change—and provides a comprehensive 5-year roadmap on how best to proactively deal with these issues that likely will worsen in the future.

Sustainability has become a major focus in our County, which consists of a chain of low-elevation islands that scientists have called the country's "Ground Zero" for experiencing the effects of sea level rise and climate change. This plan builds on the County's early efforts. It identifies and prioritizes the County's vulnerabilities in our infrastructure, buildings, roads and habitats. Just as important, it also develops strategies and actionable solutions to best prepare for and adapt to the projected changes now and in the years to come.

The **GreenKeys! Sustainability Action Plan** includes a suite of 165 recommendations to make Monroe County more sustainable and ultimately more resilient to climate change and sea level rise. The Plan also includes a very specific Projects Plan to assist the County in how to wisely invest County resources to implement these recommendations over the next five years.

Climate change and sea level rise impacts will be felt differently, at varying degrees, throughout Monroe County. The time is now to begin to understand where the biggest impacts will be—and when—so that we can best position ourselves to proactively deal with these impacts before they become problematic and likely more expensive.

I look forward to working with you as we implement the **GreenKeys! Sustainability Action Plan** projects and recommendations in the coming years. It is important that we maintain our unique quality of life so future generations can enjoy all that Monroe County and the fabulous Florida Keys have to offer.

Sincerely,

Roman Gastesi
County Administrator, Monroe County

CONTENTS

CONTENTS

1. EXECUTIVE Summary

Boca Chica Key, FL
PHOTO SOURCE: Rhonda Haag

MONROE COUNTY is proud to present our first big step toward identifying our vulnerability to climate change and sea level rise. We have identified some of the best adaptation strategies to mitigate and adapt to those risks. As an island community with most of our land at or near sea level, the County must continue the momentum generated by this **GreenKeys! Sustainability Action Plan** ("GreenKeys!") in our future planning efforts to give us the best possible chance of remaining ahead of the curve of sea level rise and prepared to respond to future climate changes.

GreenKeys! provides the results of the County's sea level rise vulnerability assessment, initial sea level rise modeling efforts, greenhouse gas ("GHG") emissions inventory update, sustainability evaluation, and a summary of public outreach activities. It provides 165 recommendations and a 5-Year Work Plan designed to place the County on a highly proactive path towards increased sustainability

"One of Florida's greatest climate change threats is sea level rise, of great concern to Monroe County since we have over 1,700 islands that stretch 120 miles from Key Largo to Key West."

Key Largo Flooding
PHOTO SOURCE: GreenKeys! Project Team

through mitigation and overall resilience to climate change and sea level rise. The County and its residents will be better prepared to handle the effects of climate change when well made plans are written and implemented.

One of Florida's greatest climate change threats is sea level rise, of great concern to Monroe County since we have over 1,700 islands that stretch 120 miles from Key Largo to Key West. This project is Monroe County's initial plan to address climate change and sea level rise to ultimately find ways to **mitigate** impacts to residents, infrastructure (including streets and buildings) and the environmental habitat and **adapt** accordingly.

Monroe County, like many Florida counties, stands at a crossroads faced with uncertainty over what the actual impacts of climate change and sea level rise will be and how soon they will be felt. The County is currently ranked third highest in the country in terms of areas to be impacted by tidal flooding, with nearly 36% of our population expected to be displaced if the forecasted high of two (2) feet of sea level rise is received by 2060. By 2100, 54.8% of our population will be affected with the forecasted high of 2.7 feet of sea level rise and 83.1% affected with 5.4 feet of sea level rise. The County's low lying land elevation and many islands contributes most to our vulnerability.

Sea level rise will impact County residents in the coming years through increased nuisance flooding, fluctuations in storm severity, and the resulting changes in our ecosystem and species populations. Climate change will also affect our average temperature and precipitation rates. Human health impacts will also be felt. By implementing proactive planning and making informed decisions, we can minimize these impacts to ensure our environmental and economic viability remain healthy well into the future, and residents and visitors alike will continue to enjoy the fabulous Florida Keys.

GreenKeys! Purpose, Structure, and Contents

GreenKeys! provides a well-chosen path for moving Monroe County into the future. Guidance is provided for current and future decision makers such as the Board of County Commissioners, County employees, and County residents and business owners. Through this planning process, we integrate decision making across multiple County disciplines to incorporate sea level rise adaptation, mitigation, and response into our policies and procedures.

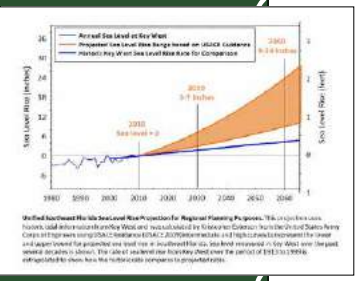
GreenKeys! contains six (6) main **Focus Areas** aligned with County priorities for future planning and project implementation:

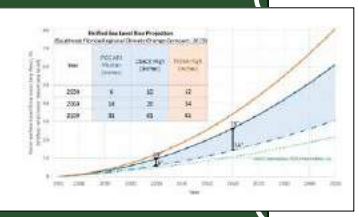
- Government Operations
- Climate & Energy
- Natural Systems
- Built Environment
- Health & Safety
- Education, Arts & Community; Economy & Jobs; Equity & Empowerment (combined)

Each Focus Area includes goals and recommendations with key implementation timeframes, funding sources, and associated implementation options.

GreenKeys! Results Summary

The results of our vulnerability analysis for habitat, facilities, roads, utilities, water, and wastewater infrastructure; sea level rise modeling to identify risks to homes and businesses; 2012 GHG emissions inventory update; and overall sustainability assessment are summarized below. We used the 2011 SE FL Compact's recommended sea level rise projections for the analyses provided in GreenKeys!.





The Compact recently updated its projections to adjust the projection baseline from 2010 to 1992, extend the projection timeline from 2060 out to 2100, and include processes that affect the local rate of sea level rise. The net result of this recent update is one (1) additional inch of sea level rise by 2030 beyond the 3-7 inches and three (3) additional inches by 2060 beyond the 9-24 inches, which is due to the additional years included in the forecast.

Vulnerability Analysis

Roads

We utilized the Florida Department of Transportation's Sketch Planning Tool to evaluate our road vulnerability County-wide. This analysis shows both the impacts to roadways during nuisance floods in King Tide events and as a result of daily tidal inundation flooding. The total impacted roadway miles are shown to the right.

County Buildings

All but two (2) of our thirty-five (35) buildings evaluated show potential exposure to regular tidal flooding by the year 2060 (not considering storm surge) due to sea level rise and future access issues. Many others show potential exposure to larger Hurricane Wilma-type events amplified by sea level rise, as follows:

- Bayshore Manor Assisted-living Facility, Key West;
- Freeman Substation, Cudjoe Key;
- Marathon Substation, Marathon;
- Roth Building, Tavernier;
- Radio Transmission Shop and Offices, Plantation Key;
- Clarence Higgs Beach Structures, Key West; and
- East Martello Tower Museum, Key West.

> "As sea level rises, we see an increased conversion of upland and freshwater-dependent land covers into tidal wetlands and open water over time. Many of our upland habitats show dramatic decreases in cover as sea level rise increases."

Roads	Nuisance Flooding		Daily Tidal Flooding	
	2030	2060	2030	2060
US Highway 1	2.3-3.2 miles	4.0-14.3 miles	0.1-0.4 miles	0.7-4.0 miles
All Roads	143.6-188 miles	217.6-449.9 miles	14.8-23.5 miles	54.7-217.6 miles

Habitat Type	2030 Low	2030 High	2060 Low	2060 High
Habitat Change (% Change)				
Inland Fresh Marsh	-53%	-76%	-66%	-93%
Brackish Marsh	-12%	-42%	-24%	-96%
Mangrove	+4%	-3%	-6%	-47%
Salt Marsh	-18%	-25%	-26%	-86%
Inundation (% Possibly Lost)				
Freshwater Wetlands	-27.8%	-42.2%	-42.7%	-6.6%
Hammock	-5.4%	-9.3%	-11.3%	-14.1%
Pineland Forests	-1.8%	-3.5%	-4.8%	-22.6%

Habitat

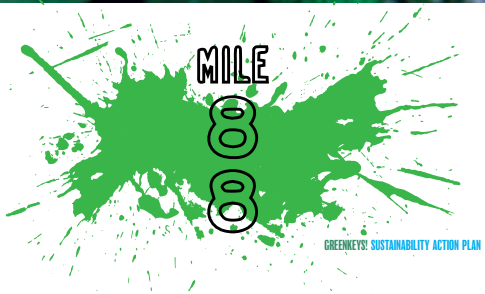
We used the Sea Level Affecting Marshes Model ("SLAMM") to evaluate the impacts of sea level rise on our natural habitats. As sea level rises, we see an increased conversion of upland and freshwater-dependent land covers into tidal wetlands and open water over time. Many of our upland habitats show dramatic decreases in cover as sea level rise increases, as shown by the percentages in the table at left.

Infrastructure

None of our wastewater treatment plant structures show risk of regular tidal flooding by 2030, and no risk of regular tidal flooding at 2060 under a low sea level rise scenario. There is however the potential foreground level flooding to some of the structures, including KW Resort Utilities, Key Haven (to be decommissioned), Bay Point, Duck Key, Cudjoe, Layton, and North Key Largo [in 2060 under a high sea level rise scenario].

Potential saltwater corrosion of water supply infrastructure from increased tidal exposure is another risk that may be of increasing concern to the Florida Keys Aqueduct Authority ("FKAA") and County over the next decades. Long-term monitoring and updated hydrologic modeling indicates that a wedge of saltwater intrusion has penetrated into the Biscayne Aquifer along the Card Sound Road Canal toward the FKAA wellfield, requiring both near- and long-term mitigation measures to avoid loss of our wellfield.

Finally, all of our assessed electrical utility infrastructure has ground elevations that are higher than the predicted tidal flood risk at 2060 under the high sea level rise scenario. This means that even under the worst case sea level rise scenario modeled, our utility infrastructure will not be impacted.



Hurricane Wilma Flooding
PHOTO SOURCE: GreenKeys! Project Team

Sea Level Rise Modeling for Properties

The Coastal Adaptation to Sea Level Rise Tool ("COAST") model mimics floods from storms and sea level rise on homes and businesses. COAST shows us the cost of **not** adapting to sea level rise and the costs and benefits of implementing various adaptation actions. We used this tool to evaluate sea level rise adaptation strategies for two (2) of our communities: Key Largo and Stock Island. The County evaluated three (3) adaptation actions for Key Largo, including: 1) elevating and floodproofing buildings, 2) building an offshore barrier, and 3) a voluntary buyout.

In Key Largo, elevating and floodproofing buildings (not already elevated or floodproofed) proved to be the most beneficial adaptation action saving the residents and County up to $12-13 in damages for every $1 spent. If we implement this strategy, residents could avoid between $871 Million (low cost scenario) and $992 Million (high cost scenario) in damages to homes and other structures from sea level rise.

For Stock Island, we evaluated elevating and floodproofing buildings (not already elevated or floodproofed) as a strategy to combat sea level rise. Again, if this adaptation strategy is implemented, residents could avoid between $169.1 Million (low cost scenario) and $149.6 Million (high cost scenario) in damages to homes and other structures from sea level rise. Therefore, we should encourage elevating and floodproofing those structures not already protected as the most cost-effective strategy for those structures.

2012 Greenhouse (GHG) Emissions Inventory Update

As part of this project, we updated the County's GHG Emissions Inventory. This new data suggests significant reductions in both government operations and on the community scale, as shown in the graphic to the right.

With these reductions, we surpassed the 20% emissions reduction target by 2020 (as compared to the 2005 baseline) that we set in our 2011 Energy Efficiency and Conservation Strategy. It is important to note that there were significant reductions on the community scale due to a one-time transition from municipal solid waste being entirely landfilled to the majority being incinerated in a waste-to-energy facility. Such significant reductions will be more difficult to demonstrate in future updates.

Sustainability Evaluation

To fully understand how sustainable we are as a County, we used the Sustainability Tools for Assessing and Rating Communities ("STAR") to determine our baseline sustainability score. STAR provides local leaders with a framework for assessing their community's sustainability, setting targets for moving forward, and measuring progress along the way.

We completed our STAR evaluation in June 2015, becoming certified as a 3-STAR Community. With this 3-STAR designation, we earn national recognition as a sustainable community in Florida. As the third County in Florida to become STAR certified, we also position ourselves as a state-wide leader in sustainability.

Shaw Drive Flooding
Monroe County, FL
PHOTO SOURCE: Stephanie Russo

Linkage to Other Plans

GreenKeys! includes a total of 165 recommendations to make the County and its residents more resilient and sustainable. Sixty-six (66) of these further initiatives recommended in the Monroe County Climate Action Plan ("MCAP") and sixty-seven (67) further the Southeast Florida Regional Climate Change Compact's ("Compact") Regional Climate Action Plan ("RCAP") recommendations. To effectively implement these recommendations, we developed a 5-Year Work Plan with specific projects to be accomplished over the next five (5) years, containing 181 projects.

Summary of GreenKeys! Recommendations In the Focus Areas

Climate change and sea level rise will affect each of the six (6) Focus Areas addressed in GreenKeys!. To address these affects, the Team identified important goals for the County within each of the Focus Areas and developed a comprehensive set of recommendations under each identified goal to ultimately help the County transition into a more sustainable and more resilient community. There are a total of 165 recommendations provided within GreenKeys!. Each of the recommendations in this document are prioritized as either short-, medium- or long-term with regard to the recommended timeline for implementation. A brief summary of the goals

(and in some instances specific recommendations to achieve those goals) are provided for each of the Focus Areas as follows:

Government Operations. Our government buildings and facilities will become increasingly vulnerable as sea levels continue to rise in the Florida Keys. We have several goals to address this vulnerability, with fifty-seven (57) specific recommendations to help us accomplish these goals, examples of which include:

- Conducting detailed site level assessments of the most vulnerable County facilities;
- Creating improved LIDAR elevation data County-wide;
- Performing energy audits on County facilities to develop retrofit priorities;
- Creating a list of incentives to encourage construction of energy efficient and water conserving structures;
- Continued GHG inventory updates and reductions;
- Increasing rates of waste diversion and recycling;
- Improving employee sustainability practices.

Climate & Energy. To help offset climate change and sea level rise impacts, we must make changes in energy consumption, technology and daily operations. Nineteen (19) specific recommendations are made to help us accomplish these mitigation goals, which include:

- Creating a database of nuisance flood events;
- Ensuring that nuisance flood data informs future road decisions;
- Developing a ranking process to identify the most vulnerable neighborhoods first;

Murray Nelson Government Center, Key Largo, FL

PHOTO SOURCE: GreenKeys! Project Team

- Continuing sea level rise vulnerability discussions;
- Creating a list of energy and water efficiency incentives within the Rate of Growth Ordinance ("ROGO");
- Adopting a plan to improve the resource efficiency of community businesses.

Natural Systems. Our marine and terrestrial habitats are among the most vulnerable in the U.S. to climate change. Long-term climate change and sea level rise will inundate our upland ecosystems. We will see large-scale changes in the composition and productivity of our marine ecosystems as the ocean continues to acidify and warm. Sea level rise will impact our intertidal mangrove wetland diversity, causing changes in sedimentation patterns and the need for human engineering interventions. To mitigate these effects, we identified several goals and twenty-four (24) recommendations to help accomplish these goals, which include:

- Continued cooperation with federal, state and private partners in support of coral reef restoration;
- Completing a County-wide tree inventory;
- Identifying and mapping natural inundation buffers;
- Maintaining natural habitat corridors;
- Identifying and protecting "core areas" with the best chance of persisting and adapting to sea level rise;
- Incentivizing protection of natural resources on sites;
- Promoting living shorelines and mangrove restoration;
- Continuing invasive exotic species management throughout the County.

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, including:

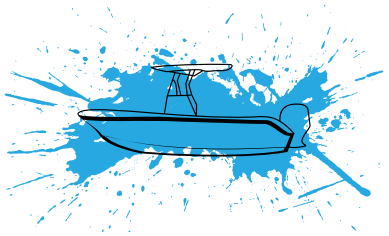
- Maintaining and strengthening setback policies;
- Imposing use restrictions in areas most vulnerable to flooding;
- Adopting an "environmentally-challenging locations" ordinance;
- Incentivizing resiliency construction standards;
- Establishing adaptation action areas;
- Increasing mileage of bicycle 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.

Health & Safety. We expect that climate change and sea level rise will impact emergency response and evacuation routes and times and the health of County residents. To ease these affects, we identified several goals – including twenty (20) specific recommendations to help us accomplish these goals – examples of which include:

- Incorporating future sea level rise impacts into emergency management plans;
- Supporting school district participation in Florida's Farm to School program;
- Encouraging the sale of local catch by charter captains;
- Including active living or active transportation in the Comprehensive Plan;
- Creating guidelines to encourage the incorporation of active building design in new buildings;
- Adopting a health-in-all policies statement;
- Encouraging workplace wellness programs;
- Identifying resources for disposal of toxic materials;
- Developing informational resources on how to properly dispose of unused medicine.

Economy & Jobs; Equity & Empowerment; Education, Arts & Community. As the County and our residents becomes more sustainable, we will see several important **benefits** including increased economic opportunities for sustainably-focused businesses and an overall shift toward a "greener" economy. As tourism and coastal recreation patterns change with the climate and sea level, so to must our economy. To facilitate this adaptation, we identified several goals and twenty (20) specific recommendations to help us accomplish these goals, examples of which include:

- Developing an "arts, culture and innovation" policy or plan;
- Building on the County's success in its commitment to public art to create opportunities on major streets;
- Encouraging sustainable practices in the County's Art in Public Places Program;
- Encouraging diverse community involvement in County government;
- Adopting policies or regulations to increase market demand for green buildings and materials;
- Developing and maintaining a Sustainability Handbook for business owners;
- Encouraging sustainable business practices; and
- Creating or supporting promotional campaigns to bank locally, buy locally, or buy from small independent businesses.



GreenKeys! 5-Year Work Plan

To facilitate the implementation of all 165 recommendations in GreenKeys!, we developed a 5-Year Work Plan & Budget. The projects in the 5-Year Work Plan are prioritized for County implementation over the next five (5) years.

The Work Plan includes recommended capital projects, policy and code revisions (Comprehensive Plan and land development regulations), education and outreach initiatives, operational and programmatic considerations, and some budget estimates that we can implement to become more sustainable and resilient to climate change and sea level rise. Financial and staff resources are critical to the successful implementation of these recommendations and projects over the next five (5) years.

Electric Vehicle Charging Stations, Marathon Airport

PHOTO SOURCE: GreenKeys! Project Team

Community Outreach

PHOTO SOURCE: GreenKeys! Project Team

Outreach, Education and Next Steps

Going forward, we will continue to educate residents, business owners and our employees to ensure continued progress toward sustainability and community resilience. As we evolve and adapt to the changing climate and rising seas, we will continue highlighting these GreenKeys! results through future outreach activities. This will help to ensure that our residents and business owners remain informed about changing conditions and engaged in the process of adapting to predicted impacts.

We also plan to use pilot projects to demonstrate and study the effectiveness of particular recommendations in GreenKeys!. For example, we may conduct a pilot project on the feasibility of flood-proofing or elevating structures to help us further prioritize future adaptation strategies within the County. Similarly, we may conduct a pilot project to assess stormwater and tidewater impacts on particularly vulnerable County roads.

This GreenKeys! project is only our first big step toward understanding our unique vulnerabilities and determining the best ways to adapt and mitigate impacts. We are committed to continuing on this path to ensure that we, as a community, can move forward and evolve with the changing conditions. By focusing on strategic planning, wise investment and adaptations now, we can make proactive changes to maximize our preparedness and overall resilience while the impacts of climate change and sea level rise are still minimal. Efforts to be proactive rather than reactive in the face of these changes will exponentially benefit the County and its residents by minimizing the resources necessary to prepare, preserving our unique quality of life long into the future.

Monroe County, FL

PHOTO SOURCE: GreenKeys! Project Team

Islamorada Nuisance Flooding

PHOTO SOURCE: Ariana Lawson

LIST OF ABBREVIATIONS AND ACRONYMS

ACSC	Area of Critical State Concern
APA	American Planning Association
BOCC	Monroe County Board of County Commissioners
CCAC	Monroe County Climate Change Advisory Committee
CEQ	Council on Environmental Quality
COAST	Coastal Adaptation to Sea Level Rise Tool
Compact	Southeast Florida Regional Climate Change Compact
Corps	U.S. Army Corps of Engineers
CRS	Community Rating System
EPA	Environmental Protection Agency
FDEM	Florida Division of Emergency Management
FDEO	Florida Department of Economic Opportunity
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FKAA	Florida Keys Aqueduct Authority
FKEC	Florida Keys Electric Cooperative
FKNMS	Florida Keys National Marine Sanctuary
FWS	United States Fish & Wildlife Service
FY	Fiscal Year
GHG	Greenhouse Gas
GIS	Geographic Information Systems
KES	Keys Energy Services
LIDAR	Light Detection and Ranging
MHHW	Mean Higher High Water
MCAP	Monroe County Climate Action Plan
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
OFW	Outstanding Florida Waters
RCAP	Southeast Florida Regional Climate Change Compact Regional Climate Action Plan
ROGO	Rate of Growth Ordinance
SLAMM	Sea Level Affecting Marshes Model
STAR	Sustainability Tools for Assessing and Rating Communities
SFWMD	South Florida Water Management District
USGS	United States Geological Survey

2. INTRODUCTION & Background

Map of the Florida Keys

PHOTO SOURCE: blackopsfishing.com

This Monroe County **GreenKeys! Sustainability Action Plan** ("GreenKeys!") is the culmination of a nearly 18-month planning process and includes strategies, policies, and tools the County can use to create and implement sustainable initiatives, reduce greenhouse gas ("GHG") emissions, increase energy and water conservation practices, and strengthen the overall resilience of Monroe County ("County") to climate change and sea level rise. GreenKeys! is intended to serve as a blueprint for the County's sustainability initiatives and provide a way for the County to measure performance and progress on these initiatives over time.

Geography

The County occupies the southernmost tip of the state of Florida and is the southernmost county in the continental United States ("U.S."). The County is comprised of a mainland region as well as

the Florida Keys archipelago ("Keys"). The mainland portion of the County primarily consists of Everglades National Park ("Park") and Big Cypress National Preserve ("Big Cypress"). The mainland and the Keys are separated by Biscayne Bay, Barnes Sound, Blackwater Sound, and Florida Bay. The Keys are a collection of 1,700 islands that lie north of the Straits of Florida and south of the Park and Big Cypress, stretching approximately 220 miles. The Keys actually divide the Gulf of Mexico from Atlantic Ocean. Most people who travel from the mainland portion of the County to the southern-most island in the Keys (Key West) travel by way of the Overseas Highway (also known as U.S. Highway 1), the only roadway in and out of the Keys.

Today, more than 99 percent of the County's population lives in the Keys, although the islands make up only 13 percent of the County's land mass. The island chain is a special place, like none other in the U.S., with the world's third largest living coral reef off its shoreline. The County is so environmentally diverse and historically important that it's worthy of seventeen (17) national and state parks, including the famed John Pennekamp State Park and Looe Key National Marine Sanctuary. Both places are world renowned snorkeling and scuba diving destinations.

The Early Years

The Florida Keys were discovered in 1513 by Spanish Explorer Juan Ponce de Leon in his search for the "Fountain of Youth." Over the next three (3) centuries, Spain and Great Britain claimed Florida as a territory. In 1821, Spain ceded Florida to the U.S. in accordance with the Adams-Onis Treaty. The following year, a small naval depot was created in

Overseas Highway, Key Largo (pre-1996)

PHOTO SOURCE: https://www.floridamemory.com/items/show/244348

Key West to help rid the area of pirates that were terrorizing the sea trade route.

In 1823, Monroe County was established as the sixth county in the Florida territory, named for fifth President of the U.S., James Monroe, who served from 1817 to 1825. Key West became the County seat in 1828, when the population was less than 600 people and the main industries were salvaging shipwrecks on the coral reef and fishing. In 1845, Florida was granted statehood. The Florida Keys were forever changed with Henry Flagler's project to build a railroad from Miami to Key West at the turn of the 20th century. The first train rolled into Key West in 1912. The railway was subsequently destroyed in the Category 5 Labor Day Hurricane of 1935, but rebuilt by the federal government as an automobile highway which ultimately helped the County's tourism industry evolve into the major industry it is currently.

Geographic Vulnerability

The Florida Keys are on the front lines of climate change and sea level rise impacts and especially vulnerable to extreme weather events and rising seas because of their low-lying elevations. In fact, the highest elevation in the Keys rises only eighteen (18) feet above sea level at a single location in Windley Key [Solaris Hill in Key West is also 18'.]. Below is a list of average elevations for the three (3) sections of the Florida Keys and the City of Key West:

- Upper Keys – Ocean Reef to Tavernier Creek: Average elevation 4.8';
- Middle Keys – Plantation Key to Knights Key (City of Marathon): Average elevation 4.29';
- Lower Keys – Ohio Key to Stock Island: Average elevation 3.17'; and
- City of Key West: Average elevation 4.7'.[1]

Monroe County, because of its unique low-lying areas, resulting vulnerabilities to sea level rise and its international presence as a premier tourist destination, has an opportunity to demonstrate leadership on this issue by implementing the critical policies, practices and investments that will eventually help mitigate the impacts of climate change. While GHG emissions produced within the Monroe County region constitute only a small percentage of national and global quantities, if sea level rise is not curtailed by immediate reductions in GHGs on a global scale, the Keys may eventually become dramatically different. However, the County can do more than prepare itself for a sustainable future, it can also do its part to help reduce the causes of climate change and sea level rise.

The Science Behind the Rising Seas

It is recognized that the burning of fossil fuels and deforestation are primary causes of increase in GHGs in the Earth's atmosphere. There is consensus among climatology scientists that this is driving increases in climate change. Post-industrial human activity has occurred at the same time as accelerated changes in climate change patterns. The consequences are dramatic and are illustrated by increases in the melting of Arctic sea ice which during some months almost entirely covers the Arctic, an expansion of the tropical zone climate and the rate of sea level rise caused by melting glaciers, the heating (thermal expansion) of the oceans and melting ice sheets in Greenland and Antarctica. In the last 100 years, there has been an average 9-inch sea level rise here in South Florida, as evidenced by data collected by the National Oceanic and Atmospheric Administration ("NOAA") at the Key West Tide Gauge.

Numerous estimates of future sea levels have been made on both global and regional scales with input from a white paper on sea level rise projections developed by the Sea Level Rise Technical Ad Hoc Working Group of the Southeast Florida Regional Climate Change Compact ("Compact") entitled

Thompson Road, Key Largo

PHOTO SOURCE: GreenKeys! Project Team

A Unified Sea Level Rise Projection for Southeast Florida.[2] The projection was an integration of similar analyses recently conducted by the U.S. Army Corps of Engineers ("Corps"), the South Florida Water Management District ("SFWMD"), Miami-Dade Climate Change Task Force Science and Technology Committee, Broward County Climate Change Task Force Science and Technical Subcommittee and numerous other universities. The projection was updated in 2015 to adjust the projection baseline from year 2010 to 1992 (consistent with guidance provided by the Corps and NOAA), extend the projection timeline from 2060 to 2100, and include the processes that affect the local rate of sea level rise.[3]

Moving Forward

Planning decisions for future public and private projects and adaptation efforts must recognize the need to address sea level rise. The current local and regional sea level rise projections do not account for future increases in ice-sheet melting. Therefore, we should consider current estimates to be conservative and optimistic. Planning decisions should take into consideration medium to high sea level rise predictions.

The long-term costs of having to implement adaptation measures intended to help cope with climate change impacts due to inaction and the subsequent negative consequences to the economy, social structure and environment make it necessary to implement mitigation actions now to avoid or minimize long-term adaptation costs. We have a chance now to prevent the worst impacts of climate change. If we act effectively, we should be able to limit both the magnitude of climate change and the severity of its impacts. The two (2) major approaches to addressing the potential negative aspects

of climate change are mitigation and adaptation. Mitigation involves actions that will slow GHG emissions to reduce the amount and speed of climate change. Adaptation involves actions to reduce the impacts of climate change on existing society and the environment. Both mitigation and adaptation strategies are discussed within this document.

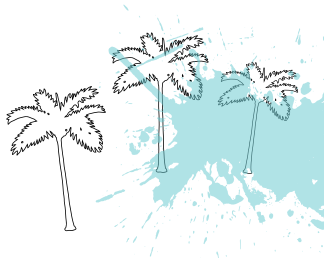
The County is joining an increasing number of local governments committed to addressing climate change at the local level. The County recognizes the risk that climate change poses to its constituents, and is acting now to reduce the GHG emissions, or "carbon footprint," of both its government operations and the community at-large through the innovative recommendations in its previous Monroe County Climate Action Plan ("MCAP")[4] and this new GreenKeys!. Ultimately, local action is needed to reduce Monroe County's contribution toward the problem of climate change and adapt to its current and future effects. Both the MCAP and GreenKeys! take advantage of common sense approaches and policies that the local government is uniquely positioned to implement – actions that can reduce energy use and waste, create local jobs, improve air quality, preserve the local landscape and history, and in many other ways benefit Monroe County for years to come.

Longstanding Public Involvement

Public involvement and intergovernmental coordination efforts play a significant role in forming policy and long-range visioning within the County. The County has numerous committees and boards, whose volunteer efforts and actions help shape and influence the County's policies, infrastructure and design decisions and social programs. The County's Advisory Boards, Councils and Committees are provided to the right; see also Appendix A for a table showing the date of creation and stated purpose of each of the County's Advisory Boards, Councils and Committees.

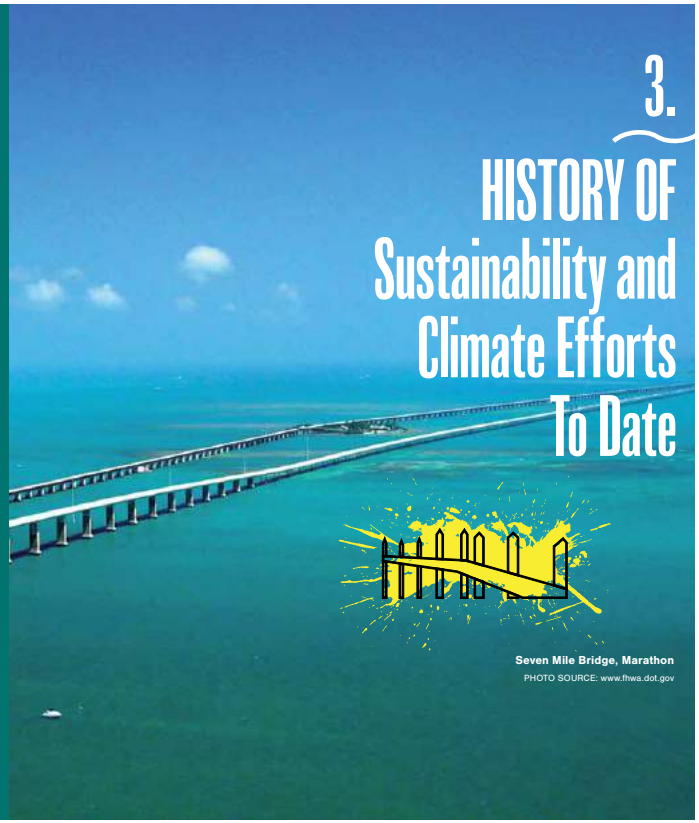
GreenKeys! furthers efforts already conducted by the County with regard to sustainability and environmental stewardship. It provides steps to move Monroe County towards resiliency and reduced emissions by exploring alternative policies and practices. It creates a platform for public outreach and public policy development to effectively communicate the steps from risk to resiliency with the general public, voters, elected officials and decision makers in the County.

The specific recommendations in GreenKeys! were developed through a collaborative process involving subject matter experts and stakeholders from public and private sectors, universities and not-for-profit organizations. These stakeholders brought specific subject area knowledge as well as information on successful initiatives already underway locally or in other communities. Many of the recommendations build upon best practices throughout our region. Others delve into new areas which call for the integration of climate change and sustainability into planning and decision making processes in ways that few local governments have yet implemented.



ADVISORY BOARDS, COUNCILS, AND COMMITTEES

- Affordable Housing Advisory Committee
- Art in Public Places Committee
- Climate Change Advisory Committee
- Community Development Block Grant Citizens Advisory Task Force
- Construction Board of Adjustments & Appeals
- Contractor Examination Board
- Criminal Justice Mental Health & Substance Abuse Policy Council
- Development Review Committee
- Duck Key Security District Advisory Board
- Environmental Impact Community Oversight Committee
- Florida Keys Council for People with Disabilities
- Historic Preservation Commission
- Human Services Advisory Board
- KWIA Ad Hoc Committee on Noise
- Land Authority Advisory Committee
- Library Advisory Board
- Marine & Port Advisory Committee
- Older Americans Advisory Board
- Parks & Recreation Advisory Board
- Planning Commission
- RESTORE Act Advisory Committee
- Shared Asset Forfeiture Fund Advisory Board
- Substance Abuse Policy Advisory Board
- Tourist Development Council
- Upper Keys Health Care Taxing District Advisory Board



Seven Mile Bridge, Marathon
PHOTO SOURCE: www.fhwa.dot.gov

3. HISTORY OF Sustainability and Climate Efforts To Date

A. Early Efforts

In 2007, Monroe County began pursing sustainability and climate change mitigation initiatives. The County's initial pursuit began with the Board of County Commissioners ("BOCC") endorsing the U.S. Mayors Agreement on Climate Change (Resolution 235-2007)[5] to reduce pollution associated with global warming. This endorsement also provided the County with membership in the ICLEI Local Governments for Sustainability network and participation in the Cities for Climate Protection Campaign.

Monroe County, FL
PHOTO SOURCE: GreenKeys! Project Team

In 2008, by Resolution 177-2008, the County's BOCC established the Green Building Code Task Force to recommend sustainable and "green" standards for new building codes. The following year, the task force was renamed the Green Initiative Task Force ("GITF") (Resolution 121-2009). The GITF created the Sustainable Vision Statement which became the basis for energy efficiency components of the County's Comprehensive Plan Update transmitted in 2015 and many other policies. Also in 2009, the Monroe County Employee Green Team was created to develop a Climate Action Plan for the County's government operations.

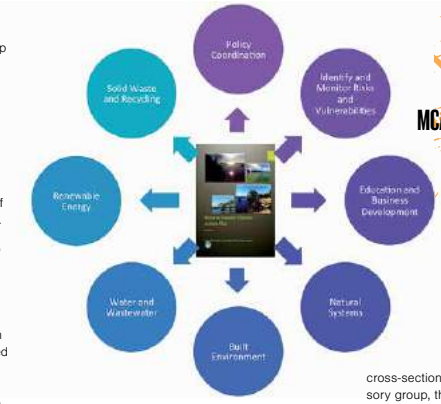
As the consequences of climate change began to affect more communities across the country, the County also proactively increased efforts to develop its own sustainability and climate change planning initiative, with 2010 becoming a milestone year for the County. First, the County officially joined the Compact (Resolution 022-2010), which includes Palm Beach, Broward, Miami-Dade, and Monroe Counties. An initial mission of the Compact was to develop the Southeast Florida Regional Climate Change Action Plan ("RCAP"). The County has continually dedicated necessary expertise and staff resources in furtherance of the Compact's mission.

In addition to working with the Compact to develop the four-county RCAP, Monroe County separately adopted the Green Team's GHG Targets for the County's government operations (Resolution 067-2010)[x]. The targets were anticipated to reduce GHG emissions to 20% by 2020 as measured from a 2005 baseline inventory. The County also adopted the Florida Green Building Coalition's Commercial Building Standard (Resolution 147-2010)[y], applicable to all County buildings in addition to the Florida Building Code as the standard to be used for construction of all public buildings.

B. The Climate Change Advisory Committee and Climate Action Plan

In 2011, the County's BOCC established the Monroe County Climate Change Advisory Committee ("CCAC"). The CCAC was an expansion of the GITF in an effort to include representatives and perspectives from an external broader cross-section of the County. As an external advisory group, the CCAC has been responsible for providing community input on County-related climate initiatives, recommending climate change adaptation and mitigation strategies to the BOCC and developing the County's MCAP. Following two (2) years of work, the CCAC, working collaboratively with County staff, finalized the MCAP. The MCAP includes a total of 72 action items (or recommendations) spanning eight (8) focus areas.

The MCAP's conceptual goals are to ensure the County moves towards resiliency and reduces emissions by exploring alternative policies and practices. It creates a platform for public outreach and public policy development to effectively communicate the steps from risk to resiliency with the general public, voters, elected officials and decision makers



MCAP with Focus Areas

Monroe County, FL
PHOTO SOURCE:
GreenKeys! Project Team

TOP 6 MCAP RECOMMENDATIONS

Action P-2.1: Revise Monroe County's Comprehensive Plan to address strategic planning related to climate change mitigation and adaptation needs.

Action P-1.1: Develop an implementation strategy for the Monroe County Community Climate Action Plan.

Action P-2.3: Create policies for future development to incorporate sea level rise inundation vulnerabilities for the life expectancy of the infrastructure.

Action M-2.2: Use improved inundation mapping to identify the sections of roadways, critical structures and natural areas that will be affected by sea level rise projections.

Action P-1.3: Provide advocacy and leadership for adoption of climate change policies and legislation with local, state, and federal entities.

Action P-2.4: Incorporate "Adaptation Action Area" designation into local comprehensive plans and regional planning documents to identify those areas deemed most vulnerable to sea level rise and other climate change impacts.

Monroe County, FL
PHOTO SOURCE: GreenKeys!
Project Team

in Monroe County. The overall objective is to integrate climate adaptation and mitigation into existing systems and to develop a plan that can be implemented through existing local organizations. It provides the common integrated framework for a stronger and more resilient Monroe County community today, and into the sustainable future.

More than simply setting conceptual goals, however, the MCAP calls for specific actions to reduce GHG emissions while anticipating and adapting to local impacts of a changing climate. The recommendations presented in the MCAP attempt to accomplish those broad goals while also serving to protect Monroe County's unique quality of life and economy, guide future investments, and foster livable, sustainable and resilient communities.

4.

POLICY & REGULATORY Overview on Sustainability and Climate Planning

Executive Order 13693
www.whitehouse.gov

The Federal government has been implementing policies in the planning arena to address the potential impacts from climate change for several years. For example, Executive Order 13514 signed in 2009[9] created the Interagency Climate Change Adaptation Task Force ("Task Force"). This Task Force identified eight (8) Guiding Principles that governments, communities and private sector organizations should consider when designing and implementing sustainability measures and climate change adaptation policies. The Council on Environmental Quality ("CEQ") has taken the policies a bit further and incorporated them into the planning requirements for federal agencies. The eight (8) climate change planning principles are:

1) Adaptation of an integrated sustainability approach into the core policies, planning and practices of the agencies;

2) Prioritizing planning approaches for the most vulnerable people, places and infrastructure;

3) Using best available science when implementing adaptation protocols even though there will always be risk of uncertainty;

4) Building strong partnerships by coordinating among geographical scales and levels of government based on the varying and unique risks of the locality and region;

5) Applying standard risk management tools that most governments already have in place to aid in critical decisions for potential consequences of inaction as well as options for risk reduction;

6) Maximizing mutual benefits by coordinating with and supporting other climate or environmental initiatives such as disaster preparedness, resource management, and cost-effective technologies to reduce GHGs;

7) Applying ecosystem based approaches by integrating biodiversity and ecosystem services into adaptation strategies; and

8) Continuously evaluating performance by measuring goals and metrics to evaluate whether adaptive measures are achieving goals.[9]

Executive Order 13693,[10] signed March 15th of 2015, takes the planning concepts a step further by enumerating twelve (12) specific sustainability goals for Federal agencies. The Order also encourages parallel changes "across the federal supply chain." Some of these new goals include:

- setting building efficiency targets for renewable or alternative energy use;
- reducing energy intensity in Federal buildings by certain percentages; and
- establishing alternative energy acquisition in government procurement policies.

While these more specific goals are not met with regulatory compliance consequences, the goals are a step towards establishing identifiable sustainability metrics.

On January 30, 2015, the President signed Executive Order 13690,[11] "Establishing a Federal Flood Risk Management Standard 'FFRMS' and

SOURCE: www.usgbcsf.org

SOURCE: http://floridagreenbuilding.org/

a Process for Further Soliciting and Considering Stakeholder Input", which amended Executive Order 11988, Floodplain Management, issued in 1977. The standard targets federal investments that are implemented through Hazard Mitigation Assistance Grants, the Public Assistance Program, and any other Federal Emergency Management Agency ("FEMA") grants when they fund construction activities in or affecting a floodplain.

These actions include: (1) acquiring, managing, and disposing of Federal lands, and facilities; (2) providing federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

This applies to all new construction and substantially improved structures (e.g., reconstruction, rehabilitation, addition, and any other improvement) the cost of which equals or exceeds 50 percent of the value of the structure. The FFRMS builds upon this Executive Order and is to be incorporated into existing Federal department and agency processes used to implement it.

The State of Florida has also implemented several policies during the past decade to address GHG mitigation and climate change generally. In 2006, the Legislature passed the Florida Energy Act[12] which created the Florida Energy Commission ("FEC"), renewable energy grants and a solar rebate program. In 2007, then Governor Charlie Crist signed a series of executive orders aimed at reducing GHG emissions and establishing an Action Team on Energy and Climate Change.[13]

Other legislation was also passed in 2007[14] directing the Florida Building Commission to create a model green building ordinance. Similarly, in 2008 legislation was passed directing local governments to include GHG reduction strategies into the Local Government Comprehensive Plans.[15] That same year, new legislation required municipal governments and state agencies to construct new buildings to a recognized green third party rating system standard, such as the U.S. Green Building Council's Leadership in Energy & Environmental Design ("LEED") or those created by the Florida Green Building Coalition.[16] Additionally, legislation also passed in 2008 requiring the Florida Building Code to become significantly more energy efficient as compared to the requirements of the 2007 Code.

In 2011, Chapter 163 of the Florida Statutes was revised to include the concept of "adaptation action areas" ("AAAs").[17] Adaptation action areas are a permissive option for local governments to address sea level rise adaptation as part of the Coastal Management Element in their Comprehensive Plans. Adaptation action areas or "adaptation areas" are defined as:

"...a designation in the coastal management element of a local government's comprehensive plan which identifies one or more areas that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels for the purposes of prioritizing funding for infrastructure needs and adaptation planning."[18]

Most recently, legislation was passed in 2015 amending Section 163.3178, Florida Statutes,[19] further expanding the requirements for redevelopment components of the Coastal Management Element of a Comprehensive Plan. Effective July 1st 2015, the Coastal Management Element of all Comprehensive Plans must include development and redevelopment principles, strategies, and engineering solutions that reduce the flood risk in coastal areas which results from high-tide events, storm surge, flash floods, stormwater runoff, and the related impacts of sea level rise. This is significant in that, for the first time, it requires local governments to consider the impacts of sea level rise in long-range planning efforts.

5.

GREENHOUSE GAS Inventory Update

"As of 2012, the County now has a more complete and comprehensive set of data from which to benchmark its energy reduction efforts. As such, it is recommended that this more complete baseline data be used moving forward for forecasting energy and emissions and for setting additional reduction targets."

For government buildings & operations, emissions dropped 31% from 11,854 metric tons of carbon dioxide equivalent ("CO_2e") in 2005 to 8,224 metric tons of CO_2e in 2012 (equivalent to emissions from electricity use in 499 homes).

The County completed GHG Inventories in 2005, 2008 and 2010.[20] Each subsequent inventory updated GHG emissions data, but also energy account information to improve the detail of reporting to reflect existing conditions. As part of ongoing efforts to be a leader in energy efficiency and sustainability, Monroe County has again in this planning process updated its GHG emissions inventory, comparing the County's 2012 results to an original 2005 baseline. This inventory measures total energy consumption and GHG emissions in two (2) categories: government operations and the community at large. Measuring emissions is an important component of managing the County's contributions to climate change and identifying the greatest opportunities to reduce those impacts while simultaneously pursuing more efficient and economic use of energy. This 2012 GHG Emissions Inventory serves as a significant milestone in documenting the County's progress toward sustainability and in determining next steps for targeting opportunities for continuous improvement.

In recent years, the County has worked closely with its local utilities to maintain a more complete and accurate set of electricity data. The County has also started utilizing the Facility Dude *UtilityTrac* system, which further supports maintenance of a comprehensive set of energy data. As of 2012, the County now has a more complete and comprehensive set of data from which to benchmark its energy reduction efforts. As such, it is recommended that this more complete baseline data be used moving forward for forecasting energy and emissions and for setting additional reduction targets. This new baseline is valuable for enabling a more precise analysis of Monroe County's energy usage and GHG emissions, ensuring consistency in data tracking and billing, and identifying additional opportunities for further reductions.

Results of the 2012 GHG Emissions Inventory Update are as follows:

Government Operations

Since 2005, the County has demonstrated significant progress in reducing GHG emissions in all sectors of County operations. This reduction means the County has already exceeded the reduction

targets established in its Energy Efficiency and Conservation Strategy of 2011 to reduce GHG by 20% by 2020 as compared to the 2005 baseline.

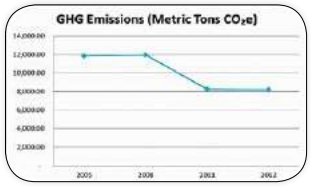
Moving forward, this inventory update shows that buildings and facilities produce nearly 65% of the County's GHG emissions, which illustrates that targeting government buildings for efficiency upgrades will be an important opportunity for improvement. Monroe County can claim success in its energy efficiency efforts to date, and should target other facilities that use large amounts of energy, like the Gato Building, Marathon Government Center and Annex, and the airport terminals, for future energy efficiency improvements. Transportation, at 20% of emissions, provides the next greatest area of potential improvement.

Community Scale

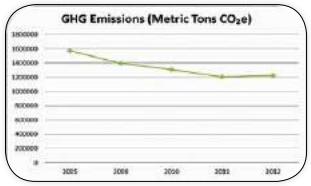
At the community scale, emissions decreased by 22%, from 1,572,770 metric tons of CO_2e in 2005 to 1,224,278 of CO_2e in 2012. Community emissions decreased in all sectors, and have surpassed the 20% reduction target. Note that this reduction includes a one-time transition from municipal solid waste being entirely landfilled to the majority being incinerated in a waste-to-energy facility, which provides significant and ongoing GHG reductions. While this reduction should be celebrated and is a reflection of effective waste management and climate action planning, it needs to be remembered when setting future targets that it will be challenging to identify additional climate actions able to reduce emissions at a similar magnitude across all sectors.

A large contributor of emissions to the community scale is also electricity usage, which presents a significant opportunity for implementation of building energy efficiency programs and a shift to renewable sources of electricity. Of note is the electricity usage of the commercial sector, which dropped significantly between 2008 and 2010, but has been climbing back toward pre-recession levels since 2010. Thus, energy efficiency efforts aimed toward the commercial sector may be especially effective in keeping emission levels down. Similarly, the large contribution of the transportation sector to community emissions shows the potential for community-scale reductions if efforts are made to reduce vehicle miles travelled within Monroe County and to shift to alternative fuels.

The supporting documentation for the GHG Inventory Update is provided in Appendix B.



GHG Emissions from Monroe County Government Operations



GHG Emissions from Monroe County Community Activities

Nuisance Flooding, Bat Tower, Monroe County

PHOTO SOURCE: Will Thompson

6. OVERVIEW OF Other Data for Development of GreenKeys!

As part of GreenKeys!, sea level rise modeling was conducted to determine the vulnerability of County infrastructure and habitat to both nuisance flooding and sea level rise at select intervals. This section discusses the modeling approach in more detail, the data identified for use in the modeling runs, and the data identifying gaps and adjustments made to combat missing or insufficient data.

A. Modeling Approach

A key component of GreenKeys! was to perform a vulnerability assessment for sea level rise scenarios in the years 2030 and 2060. This vulnerability assessment included a comprehensive evaluation of ground elevation relative to current and future tidewater heights for roads, public buildings and other critical building infrastructure including emergency response, law enforcement, wastewater facilities, water supply, schools and electrical utility infrastructure. In addition, assessments of habitat change vulnerability were performed using both tidewater inundation and the Sea Level Affecting Marshes Model ("SLAMM").

PHOTO SOURCE:
http://www.southeastfloridaclimatecompact.org

The Compact currently projects a minimum 2030 sea level rise planning scenario of three (3) inches and a maximum of seven (7) inches for all communities within Monroe, Miami-Dade, Broward, and Palm Beach counties.[21] The minimum is nine (9) inches, while the maximum is 24 inches. However, the base planning year, or the assumed zero elevation point, for sea level rise under all previous Compact scenarios was 2010 for this modeling analysis. The Compact recently updated its projections to adjust the projection baseline from 2010 to 1992, extend the projection timeline from 2060 to 2100 and include processes that affect the local rate of sea level rise. The net result of that slight shift is one (1) additional inch of sea level rise by 2030 and three (3) additional inches by 2060, which is due to the additional years included in the forecast.

The first step in developing the sea level rise vulnerability assessment was compilation of existing geo-spatial and tabular datasets. For a full description of those datasets, please see the Monroe County, FL: GIS Vulnerability Assessment for Sea Level Rise Planning report in Appendix C.

B. Data Utilized for Modeling

i.) Infrastructure

For GreenKeys!, the Team developed a building footprint layer depicting critical infrastructure within the County. A building footprint layer is a geographic information systems ("GIS") polygon file that specifically outlines the land area occupied by buildings. Early in this project, the Team learned that Monroe County, like many communities in Florida, currently lacks a GIS building footprint layer. Due to this dataset limitation, a previous sea level rise assessment for Monroe County, as conducted

Building footprint digitization of the Murray E. Nelson Government Center

PHOTO SOURCE: Monroe County, FL GIS Vulnerability Assessment for Sea Level Rise Planning

by the Compact (2012), utilized parcel-scale geographies to conduct analyses of future flood risk. As noted in the previous study, parcel-scale analyses of flood vulnerability have an important disadvantage in that they do not necessarily reflect the actual risk to structures located within the parcel. This is because property parcels can contain large percentages of area that are naturally more low-lying than the ground on which a structure is located, and in many cases structures are constructed on ground that has been significantly elevated above natural grade through the deposit of fill.

Development of a building footprint layer, which can be manually drawn from high quality aerial photographs or in some cases through more automated methods that provide indication of the land area occupied by buildings, is a common methodology used to improve the geographic precision of flood vulnerability assessments within the built environment. For this project, the Team developed a building footprints layer that includes the visible outlines of structures that various sources have listed as public and critical infrastructure located within Monroe County. This critical infrastructure includes schools, law enforcement, fire stations, other government buildings, electric and water utilities, hospitals, and disaster response staging areas. A total of 1,316 structures in Monroe County, including 386 on parcels that the Monroe County Property Appraiser dataset identified as owned by Monroe County, were digitized into building footprints through this procedure.

For a full description of the infrastructure dataset, please see the Monroe County, FL: GIS Vulnerability Assessment for Sea Level Rise Planning report in Appendix C.

ii.) Roads

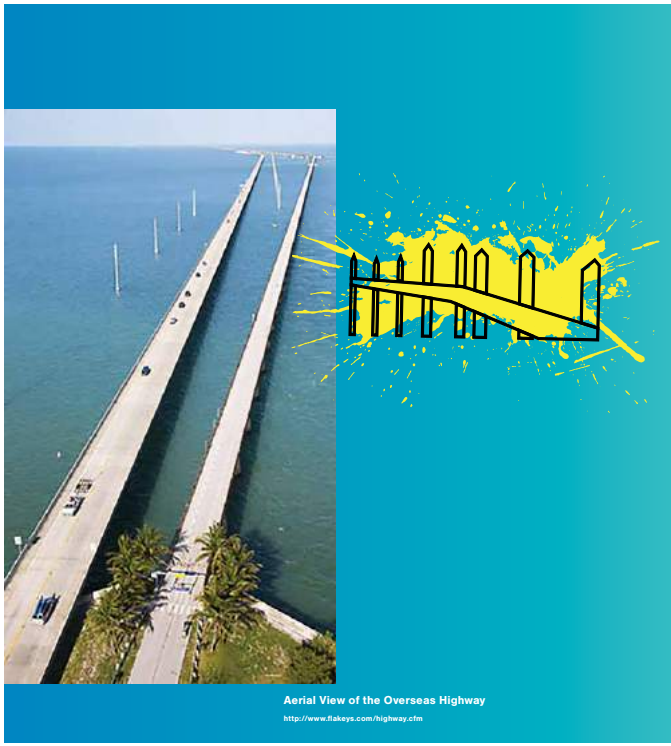
Through funding provided by the Florida Department of Transportation ("FDOT"), the University of Florida GeoPlan Center has recently developed and publicly released a series of GIS files that provide preliminary assessments of sea level rise inundation vulnerability for roads and other transportation systems, known as the "Sketch Planning Tool."

The Sketch Planning Tool is based upon a 5-meter horizontal resolution Light Detection and Ranging ("LIDAR") Digital Elevation Model ("DEM") and is designed for landscape-level vulnerability assessments of road infrastructure. The Sketch Planning Tool can be used for general planning purposes but not for site-level scale or for individual road segments. Instead, the results from the Sketch Planning Tool provide a preliminary, but objective, assessment of potential vulnerabilities, which must then be further corroborated through site-specific information (e.g., existing reports of nuisance flooding, or site surveys that indicate road grade surfaces below elevation thresholds associated with future flood risks).

For this project, the Team modified the original Sketch Planning Tool datasets in two (2) ways:

1) Incorporation of additional road segments contained with the Monroe County Property Appraiser's GIS archive, but not originally contained within the Sketch Planning Tool dataset. This provides for a more complete assessment of local roads not included within the Sketch Planning Tool.

2) Assessment of 2030 and 2060 flood vulnerability at possible nuisance flood thresholds (i.e., 1.08 above mean higher high water – "MHHW") in addition to inundation-level flooding for both the low and high sea level rise scenarios. This accounts for the fact that the onset of multiple



Aerial View of the Overseas Highway

http://www.flakeys.com/highway.cfm

nuisance flooding events a year will cause significant road maintenance and access issues well before the severe loss of services associated with inundation-level (i.e., daily) flooding.

For a full description of the roads dataset, please see the Monroe County, FL: GIS Vulnerability Assessment for Sea Level Rise Planning report in Appendix C.

iii.) Habitat

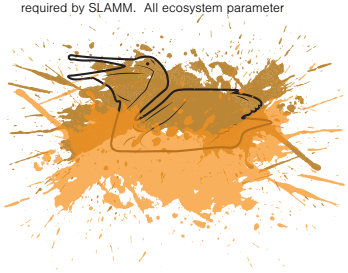
The Team conducted a detailed habitat impacts analysis utilizing SLAMM, an advanced land cover and ecosystem change tool, for the Keys portion of Monroe County. The utility of SLAMM is that, unlike other flood vulnerability assessment methods, it integrates long-term hydrologic functions and ecosystem parameters to give projections about future changes to all habitat types, including saltwater marshes, mangroves, and other coastal wetlands already subjected to regular tidal flooding. Under different sea level rise scenarios and ecosystem conditions, such coastal wetlands will in some cases be expected to expand as upland areas become subject to tidal flooding that promotes wetland colonization. In other cases, coastal wetlands may be expected to decline and transition to open water or non-vegetated mud-flats due to the inability of wetland plants to adapt to rising tides and/or coastal erosion pressures. The high value of SLAMM as a tool for making such complex assessments is well-recognized by many coastal researchers, state and federal agencies.

This analysis builds upon a previous iteration of SLAMM runs performed by the Florida Fish and Wildlife Conservation Commission ("FWC"). The previous FWC analysis utilized a previous version

PHOTO SOURCE: https://www.flickr.com/photos/dbullens/556906174/

of SLAMM (Version 6.01) and sea level rise curves developed by the 2001 Intergovernmental Panel on Climate Change ("IPCC"). The Team's analysis updates this prior FWC work by using a later version of SLAMM (Version 6.2) and revised sea level rise curves that conform precisely to the lower and upper bounds of the Compact using a 2010 baseline.

Runs of SLAMM Version 6.2 require geospatial inputs for land cover, elevation, and slope, as well as a series of ecosystem input parameters that include direction of offshore wind, historic trend of sea level rise, great diurnal tide range, elevation of the boundary where saltwater wetlands end, and estimated values of erosion and accretion for freshwater and saltwater wetlands. The FWC provided the Team with a land cover file based originally upon the Florida Cooperative Land Cover Map (2010), which an expert panel assembled by FWC had crosswalked into land cover categories required by SLAMM. All ecosystem parameter



inputs for SLAMM analyses were also provided to the Team by the FWC. Elevation and slope parameters were derived from the same LIDAR based DEM used for all other project analyses. Consistent with the original FWC analyses and the resolution of the land cover map provided by FWC, all SLAMM runs for this project were performed at a 10m raster cell size.

For a full description of the habitat dataset, please see the Monroe County, FL: GIS Vulnerability Assessment for Sea Level Rise Planning report in Appendix C.

iv.) Buildings and Homes

The Coastal Adaptation to Sea level rise Tool ("COAST") modeling software was utilized to mimic floods from storms and sea level rise on community assets, including homes and businesses within Key Largo in Monroe County. An additional set of analyses were performed in Stock Island. Modeling was performed to determine potential impacts on these assets from storm surge and sea level rise in 2030 and 2060, based on Compact high and low sea level rise scenario projections. The software was also used to calculate the cumulative damages to homes and businesses over time, considering both nuisance flooding and Wilma-sized storm events, to help Monroe County better understand the cost of not adapting, as well as the costs and benefits of implementing various adaptation strategies.

For a full discussion of the COAST modeling, see the GreenKeys!: Analysis of Damages from Storm Surge and Sea Level Rise for the Geographic Regions of Key Largo and Stock Island, Monroe County using the Coastal Adaptation to Sea Level Rise Tool Report in Appendix D.

Park Drive Flooding

PHOTO SOURCE: John Glista

C. Data "Gaps" and How They are Addressed

Some analyses could have benefited from improved data sources at a much greater cost, but in order to develop general vulnerability recommendations, the Team worked to utilize existing datasets as beneficially as possible. A few key areas where the Team had to address missing or insufficient data (data gaps) included:

Vulnerability Assessment Data. Monroe County initially lacked a GIS building footprint layer. Elevation certificates were located for a total of thirty-five (35) structures owned by the County. Additional elevation certificates for these structures would be helpful in future analyses.

Roads. The Sketch Planning Tool used for the project does not model effects of sea level rise on bridges. The Team replicated the FDOT method to develop a new road segment inundation surface corresponding to low (3 inch) and high (7 inch) sea level rise projection for 2030 as defined by the Compact. GIS data supplied by Monroe County provided point locations to identify bridges, but did not contain the footprint information necessary for more detailed analysis of raw LIDAR returns associated with bridge elevations.

Water Supply. The Florida Keys Aqueduct Authority ("FKAA") provided a full set of data showing the locations of water supply lines, pumps, and other distribution infrastructure. Above ground and below ground (invert) elevations were not available for water supply infrastructure. GIS data can be used to develop general vulnerability assessments that overlay geographic inundation risk at the years 2030 and 2060 with the locations of FKAA infrastructure. However, current data were not sufficient to conduct comprehensive damage assessments for water supply infrastructure from saltwater corrosion or other sea level rise stressors.

Despite this challenge, site vulnerability to sea level rise flooding for above ground water infrastructure was modeled for 2030 and 2060. Visualizations and assessments of possible saltwater intrusion risks to FKAA well fields at Compact sea level rise projections for 2030 (3-7 inches) and 2060 (9-24 inches) were assessed using the U.S. Geological Survey ("USGS") scenarios and updated saltwater intrusion data that correspond closest to the low and high values.

Wastewater. The FKAA provided a point dataset of wastewater treatment facilities. However, no data was provided for lift station locations, sewer pipes, or other-owned treatment facilities. With the exception of wastewater treatment plants, data were not sufficient to conduct comprehensive damage assessments for complete wastewater infrastructure due to sea level rise stressors, but existing data supported a vulnerability assessment of wastewater treatment facilities.

Stormwater. In Florida, the water management districts and local governments now impose a minimum level of stormwater treatment for all new developments, and the standards that apply to the Florida Keys are the most stringent in the State.[22] The criteria are intended to protect surface waters according to their use classification. Much of the development in the Florida Keys occurred prior to the existence of these criteria. Similar to other parts of the State at the time, stormwater was considered a nuisance since it resulted in flooding. Therefore, if stormwater control systems were employed at all, they were typically designed to efficiently convey water off land surfaces as quickly as possible. These old systems are considered to be a cause of water pollution and, therefore, policies now in place seek to retrofit them whenever possible.

Construction of Cudjoe Advanced Water Reclamation Facility

PHOTO SOURCE: http://cudjoewastewater.com/photo-library

Prior to the 1990's, given the location and configuration of the Keys and the unlimited outfall capacity of the surrounding water bodies, relatively little consideration was given to stormwater runoff. There is concern that this history of unregulated stormwater runoff contributes to a portion of the nearshore water nutrient and sediment loading. Subsequent regulatory developments have increased focus on stormwater management practices related to water quality and quantity. Designation of the Keys as an Area of Critical State Concern ("ACSC") in 1974 and designation of the surrounding waters as Outstanding Florida Waters ("OFW") in 1985 required that a county-wide comprehensive water quality monitoring program be established. In 2001, the County's Stormwater Management Master Plan was created, and a portion of its recommendations have been implemented, though implementation is not yet complete. Therefore, data regarding stormwater structures and features generally does not exist within the County except at the individual project or permit levels.

Improving COAST Modeling Data. Several limitations were identified for the COAST modeling results due to missing or insufficient data. First, values for individual buildings were sometimes not available, as County assessing records combine the values of all buildings on a particular lot into one (1) number. Second, total loss of building value and land value for the lot was assumed to occur when daily tidal waters (without any surge) reached the imaginary point centered in the parcel polygon (parcel "centroid"). Third, only structural damage to buildings was included, based upon Corps Depth Damage Functions for still water or static flooding. Fourth, damage to building contents or damage from wind or wave action was not included, meaning that damage figures are conservative in quantifying true loss. Structural Building Value was the only asset analyzed. Finally, COAST did not estimate damages to other assets such as roads, storm drainage systems, sewers, sewage treatment and pumping facilities, or other utilities when looking at cumulative damages or return on investment from implementing adaptation strategies.

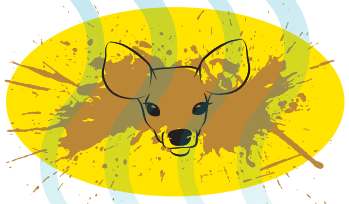
D. Recommendations for Additional Data Development in the Future

There are several instances where additional data should to be developed in the future to support and reinforce future planning efforts.

Building Footprints. The building footprints datasets developed for GreenKeys! provide detailed guidance as to where public structures and critical infrastructure may be at risk of future flooding from sea level rise. It is highly recommended that future flood vulnerability assessments in Monroe County build upon the work in GreenKeys! and continue efforts to develop a more complete digital record of Elevation Certificates for public facilities. Use, integration, and improvement of this Elevation Certificate record will promote higher confidence

Monroe County Staff

PHOTO SOURCE: Rhonda Haag



in flood risk assessments, thereby providing a basis for development of a building by building prioritization for flood retrofit and/or rebuilding as conditions warrant.

Because tidal flooding from sea level rise is a hazard that develops progressively, issues such as unacceptable loss of access and the eventual vulnerability of an individual structure due to tidal flooding will be preceded by many minor, but visible, nuisance flooding events. For this reason, the Team recommends the development and implementation of a geographic database for Monroe County employees (and interested residents) to document the time and location of nuisance flood events that affect parking lots, access roads, and landscapes of public facilities. Coupled with the building footprint layer and associated vulnerability assessment, such a geographically explicit and temporally documented nuisance flood record will provide a strong basis for implementation of targeted and justified public investments to mitigate tidal flooding vulnerabilities.

Habitat. Summary results for the 2030 and 2060 SLAMM land cover analyses in Monroe County are provided in Appendix C. Although SLAMM is an advanced ecosystem and land cover change model, the Team notes that caution is warranted in terms of how the results of SLAMM should be interpreted within the Florida Keys. In particular, further calibration of the model with historic land cover change and field observations is warranted to provide guidance for further updates and revisions of the modeling input parameters. The current results do, however, provide a potential basis for discussing and comparing the magnitude of potential ecosystem change from sea level rise in the Florida Keys.

E. Peer Review

A Peer Review process was conducted on GreenKeys!'s technical methodologies in conjunction with the County's planning process. Specific comments were received by the following individuals to assist in refinement of the vulnerability analysis:

1. Jayanatha Obeysekara, PhD, PE, DWRE, Chief Modeler, Hydrologic & Environmental Systems Modeling, SFWMD;
2. Jennifer Jurado, PhD, Director, Environmental Protection and Growth Management Department, Environmental Planning and Community Resilience Division, Broward County; and
3. Nicholas G. Aumen, PhD, Regional Science Advisor, USGS.

The Team also received comments and periodic feedback from Jerry Lorenz, PhD, State Research Director, Audubon of Florida and reviewed related work completed by Billy D. Causey, PhD, Regional Director, Southeast Atlantic, Gulf of Mexico and Caribbean Region, NOAA Office of National Marine Sanctuaries. Other Monroe County staff also provided comments at numerous points throughout the planning process, and in particular, to the technical foundation to support the planning process.

The Peer Review feedback and how that feedback was addressed is included in Appendix E.

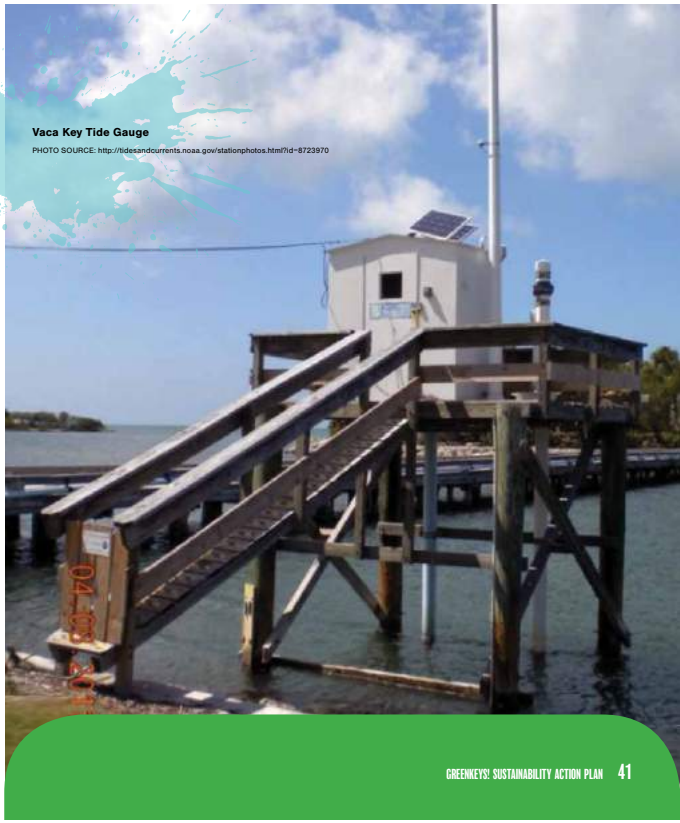
F. Vulnerability Assessment Results for Habitat and Facilities

Habitat. Generally, results of the SLAMM modeling revealed that a higher rate of sea level rise is associated with an increased conversion of upland and freshwater dependent land covers into tidal wetlands and open water habitats over time. However, an idiosyncratic result is that undeveloped dry land ecosystems show an increase in area by 2030 under the low sea level rise scenario (i.e. three inches total sea level rise), while developed dry land ecosystems show a decrease in area. A likely explanation for this discrepancy is that LIDAR elevations tend to be biased upward with areas of high coastal vegetation cover.

Mangrove ecosystems showed a highly divergent response under the two (2) sea level rise scenarios:

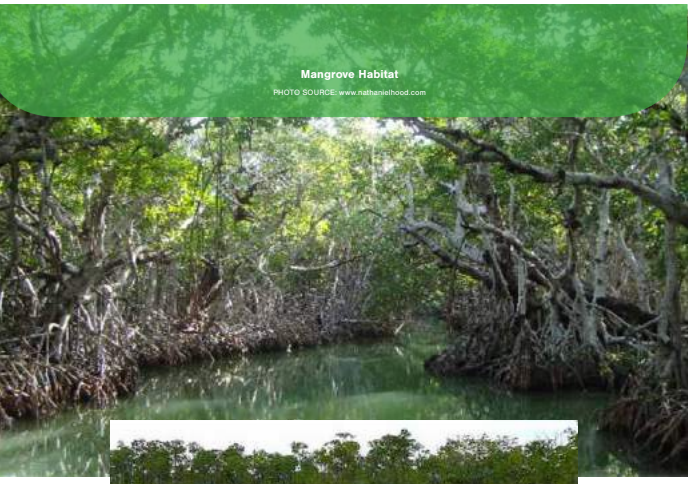
- Under low sea level rise scenario, mangrove area shows a slight increase (4%) by 2030, with a progressive decrease (-6%) occurring by 2060; and
- Under the high sea level rise scenario, these mangroves shows a slight (3%) decline in area by 2030, followed by a very significant decline (47%) in area by 2060.

These results are consistent with research suggesting that mangrove ecosystems have some capacity



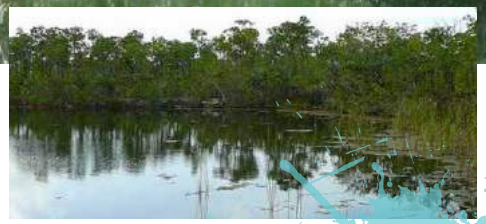
Vaca Key Tide Gauge

PHOTO SOURCE: http://tidesandcurrents.noaa.gov/stationphotos.html?id=8723970



Mangrove Habitat

PHOTO SOURCE: www.nathanielhood.com



Freshwater Wetlands, Big Pine Key

PHOTO SOURCE: www.thearmchairexplorer.com

for collecting sediments and "keeping up" with low levels of sea level rise, as well as colonizing into upland areas that become more regularly inundated by tidal influx. However, existing research also suggests that high rates of sea level rise can overwhelm the adaptive and colonization capacity of mangroves, resulting in major die-backs and significant reduction in areal coverage.

Another SLAMM result that warrants discussion is the significant decline (53 - 76% by 2030; 66 - 93% by 2060 scenarios) in inland freshwater marshes. Such freshwater marshes, while covering a very small land area in the Florida Keys, are known as highly important habitat and drinking water sources for critically endangered species, including the Key deer and Lower Keys marsh rabbit.

Freshwater wetlands showed high vulnerability by 2030 at even a low sea level rise scenario (27.8% possibly lost) and large-scale disappearance (89% likely lost) under a high sea level rise scenario. Pineland forests show moderately higher resilience than tropical hammock forests across all the sea level rise scenarios, although the high sea level rise scenario indicates possible to likely loss for over 40% of total upland forest area in the Florida Keys by 2060.

Buildings. Notably, all but two (2) County buildings out of thirty-five (35) show significant potential exposure of finished first floors of structures to regular tidal flooding (i.e., not considering storm surge) due to sea level rise. Most facilities that show potential future access issues due to low adjacent grade elevation are located within the Pigeon Key historic district. Aside from the Pigeon Key historic district, two (2) Monroe County structures show potential future exposure of finished floor to regular tidal flooding under the considered sea level rise scenarios: 1) the Monroe County Animal Shelter's kennel facility in Key West and 2) the West Martello Tower in Key West. The Monroe County Animal Shelter shows potential exposure to nuisance tidal flooding by 2060 under the high sea level rise scenario. Notably, the adjacent Animal Shelter office building also shows 2060 access concerns from nuisance flooding under a high sea level rise scenario. The historic West Martello Tower shows potential exposure of first floor to nuisance flooding by 2060 under the high sea level rise scenario. [Note that there is a new animal shelter facility being constructed down the street from the existing facility which will be elevated and therefore more flood resilient.]

Three (3) total structures located within the Key West International Airport ("KWIA") complex show potential access concerns due to future sea level rise. Two (2) buildings, both located at 3491 S. Roosevelt Boulevard, show adjacent grade elevations that indicate vulnerability to nuisance flooding by 2060 under a low sea level rise scenario, or complete inundation by 2060 under a high sea level rise scenario. The KWIA terminal, also located at 3491 S. Roosevelt Boulevard, shows potential exposure to nuisance flooding access concerns by 2060 under a high rate of sea level rise.

Several Monroe County structures show potential exposure to an extreme flood event similar to Hurricane Wilma as amplified by up to two (2) feet of sea level rise (i.e., 2060 high sea level rise scenario). Of most immediate concern due to the social vulnerability of facility residents is the Bayshore Manor assisted-living retirement home in Key West. Also of high to moderate concern are two (2) Monroe County Sheriff's Office struc-

Stock Island Fire Station

PHOTO SOURCE: Greenkeys! Project Team

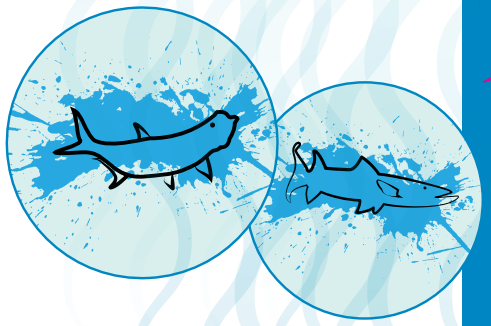
tures; the Freeman substation on Cudjoe Key with likely priority for flood mitigation and emergency preparedness and the Marathon substation which could potentially be vulnerable to an extreme event storm surge by 2060 under a high sea level rise scenario. Of moderate future concern are the Roth Building and two (2) nearby structures (Radio Transmission Shop and County Offices) that are owned by Monroe County on Plantation Key in the Village of Islamorada. Other structures that show risk of current or future flooding from a Wilma-sized event are two (2) recreation structures at Clarence Higgs Beach, including a vendor and public restroom structure, and the historic East Martello Tower Museum in Key West.

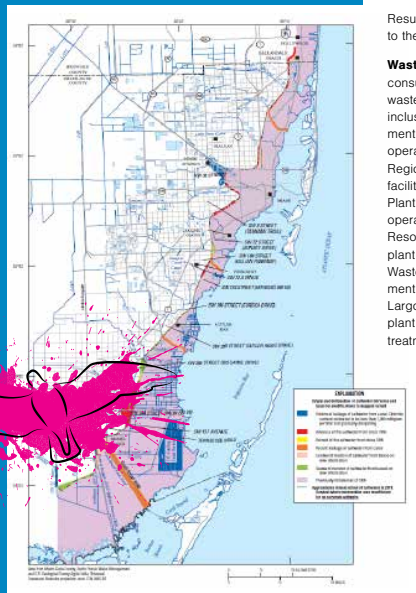
Facilities. Results of the flood vulnerability analysis for County-owned facilities are categorized as either:

- Likely Inundation – shows a high risk of complete loss under the given sea level rise scenario unless significant adaptation actions are taken;
- Possible Inundation – may have a high risk of future flooding with the possibility of complete loss under the given sea level rise scenario;
- Likely Nuisance – shows a very high risk of exposure to annual nuisance flooding events under the given sea level rise scenario;
- Possible Nuisance – may have a risk of exposure to annual nuisance flooding events under the given sea level rise scenario;
- Possible Extreme – some concern that the given infrastructure could be exposed to flooding during an extreme event; or
- Likely Extreme – shows very high risk of exposure to flooding from a Wilma-sized event under the given sea level rise category.

TABLE 1. Results of the Vulnerability Analysis for County-owned Facilities

Impact Category	Low Scenario 2030 (3" SLR)	High Scenario 2030 (7" SLR)	Low Scenario 2060 (9" SLR)	High Scenario 2060 (24" SLR)
Likely Inundation	None	None	None	None
Possible Inundation	None	1 Facility	None	29 Facilities
Likely Nuisance	3 Facilities	7 Facilities	None	34 Facilities
Possible Nuisance	11 Facilities	17 Facilities	27 Facilities	44 Facilities
Possible Extreme	None	None	None	None
Likely Extreme	None	None	None	None





Saltwater Intrusion in Southern Miami-Dade County

PHOTO SOURCE: http://pubs.usgs.gov/sir/2014/5025/downloads/sir2014-5025_figure17large.pdf.

Results of this analysis are provided in Table 1 to the left.

Wastewater Treatment Infrastructure. Through consultations with County staff, a total of nine (9) wastewater treatment plants were identified for inclusion in this sea level rise vulnerability assessment. Four (4) of these facilities are currently operated by the FKAA: Key Haven, Big Coppitt Regional, Bay Point, and Duck Key. A fifth FKAA facility, the Cudjoe Regional Wastewater Treatment Plant, was recently constructed and is currently operational. Other facilities in the analysis the K W Resort Utilities Corporation's wastewater treatment plant located on South Stock Island; the Key Largo Wastewater Treatment District's wastewater treatment plant located in Key Largo; and the North Key Largo Utility Corporation's wastewater treatment plant located in Ocean Reef. Additional wastewater treatment facilities operated by the municipalities of Key West, Key Colony Beach, Marathon, and Islamorada were not included in this vulnerability assessment.

Results of the assessment suggest that none of the wastewater treatment plant structures show risk for regular tidal flooding by 2030, and no risk to regular tidal flooding at 2060 under a low sea level rise scenario. Results for the 2060 high sea level rise scenario do indicate potential ground level flooding to some structures, including K W Resort Utilities, Key Haven, Bay Point, Duck Key, Cudjoe, Layton, and North Key Largo.

Additionally, visual assessment of each facility's overlay map does suggest that structures and surrounding parcels associated with the Key Haven and Bay Point facilities may experience widespread tidal flood risk under the 2060 high sea level rise scenario. According to County and FKAA staff, and FKAA, the Key Haven facility is scheduled for decommissioning soon after the Cudjoe Regional Wastewater Treatment Plant enters into service, mitigating any long-term sea level rise concerns associated with this facility. The relatively low elevation of the Bay Point Wastewater Treatment Plant suggests that large-scale infrastructure maintenance and upgrade decisions for this facility should include potential stressors from future sea level rise as a priority design criterion.

Water Supply and Water Distribution. In cooperation with this sea level rise vulnerability assessment for Monroe County and in accordance with FKAA's (2011) ongoing goal to assess "impact thresholds for sea level rise and needed infrastructure," FKAA officials provided the Team with a series of point locations for various types of water supply distribution infrastructure within Monroe County. These files included water storage tanks, system valves, control valves, and cathodic rectifiers associated with the water distribution network, as well as a series of test stations and sampling stations maintained by FKAA. Values for MHHW-based LIDAR elevation were extracted for all points associated with this infrastructure. These elevation values were then used to assign a future flood vulnerability score for each individual infrastructure point. Cumulative results of this assessment are provided in Table 2 at far right.

Importantly, this vulnerability assessment is based solely upon the extracted ground elevation associated with each point, and therefore does not account for any additional above-ground elevation of components that may be especially vulnerable to saltwater flooding. While ground-level exposure to tidal flooding generally provides some increased risk of materials corrosion and periodic loss of maintenance access, interpretation of specific long-term risks and vulnerability thresholds will require additional site-level information (i.e., above ground elevations, presence and condition of saltwater flood-proofing materials, and overall saltwater resistance of components). To support the ongoing climate adaptation planning efforts at FKAA, field and maintenance technicians can utilize the extracted MHHW elevations as an important objective criterion for enhanced monitoring of saltwater corrosion of individual infrastructure pieces. As appropriate, such monitoring can identify needs for retrofit maintenance and/or prioritization for replacing infrastructure to avoid or resist future seawater exposure.

Electric Utility Infrastructure. As part of this sea level rise vulnerability assessment, point geography information was obtained for seven (7) electric utility sites deemed as critical infrastructure:

- Keys Energy Services ("KES") South Stock Island generating plant;
- KES South Stock Island substation;
- KES Big Coppitt facility;
- Florida Keys Electric Cooperative Association ("FKEC") Marathon substation;
- FKEC James T. Ellis facility;
- FKEC Rock Harbor station; and
- FKEC Tavernier Operations Center.

Infrastructure footprint layers were digitized for each of these facilities, resulting in a total of thirty-four (34) separate footprint polygons. Ground level elevations within these footprints were calculated using the Zonal Statistics methodology described above for public buildings and wastewater treatment plants. Results of these analyses indicate no risk ground elevations for all assessed electrical utility infrastructure are higher than the threshold associated with regular (non-storm) tidal flood risk at 2060 under the high sea level rise scenario. Additional site-level evaluations would be necessary to determine above-ground elevations of sensitive components and associated extreme event flood risk for each individual facility.

Roads. Results of the Sketch Tool analysis of road vulnerability show impacts to Monroe County roadways both during nuisance floods in King Tide events and as a result of daily inundation flooding.


Big Coppitt Substation
PHOTO SOURCE: www.tzaworld.com

Because U.S. Highway 1 is the sole road and emergency evacuation route for the Florida Keys, even low-level nuisance flooding is problematic for public safety, health and welfare. Decreased traffic flow, increased accident risk and higher long-term maintenance costs are all concerns with nuisance flooding. These concerns are magnified exponentially with daily tidal flooding, and will likely lead to issues with evacuation times and increased costs for road replacement and eventual elevation. Roadway miles impacted by nuisance flooding and daily inundation flooding within Monroe County are provided in Tables 3 and 4 to the right.

Tolerance for nuisance road flooding impacts is based on numerous variables, but primarily on the amount of traffic served by the road being impacted. For less-travelled neighborhood roads, onset of shallow nuisance road flooding that occurs several times each year may or may not necessarily impose

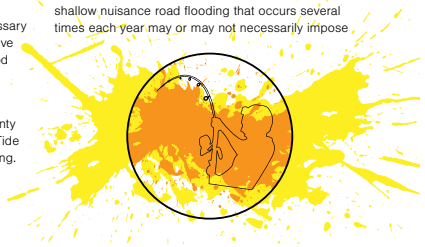


TABLE 2. Summary of MHHW-based Future Tidal Flooding Risk to Point Locations of FKAA Infrastructure

Infrastructure Type (Total Number)	2030 Flood Threshold: Low Sea Level Rise (3" of SLR)				2030 Flood Threshold: High Sea Level Rise (7" of SLR)				2060 Flood Threshold: Low Sea Level Rise (9" of SLR)				2060 Flood Threshold: High Sea Level Rise (24" of SLR)			
	Likely Inundation	Possible Inundation	Likely Nuisance	Possible Nuisance	Likely Inundation	Possible Inundation	Likely Nuisance	Possible Nuisance	Likely Inundation	Possible Inundation	Likely Nuisance	Possible Nuisance	Likely Inundation	Possible Inundation	Likely Nuisance	Possible Nuisance
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	N/A	N/A	N/A	1	N/A	2	7	1
Cathodic Rectifiers (55)	N/A	N/A	N/A	N/A	N/A	N/A	2	2	N/A	N/A	2	2	2	3	7	1
Control Valves (1,230)	N/A	88	118	109	56	56	271	143	75	56	299	150	264	183	602	165
System Valves (5,888)	N/A	87	175	436	39	121	414	580	60	151	562	630	695	795	2,173	863
Sampling Stations (184)	N/A	6	9	7	6	3	24	13	6	4	27	13	17	19	50	23
Test Stations (170)	N/A	2	5	4	1	3	7	2	2	4	9	2	9	6	19	11

TABLE 3. Summary of Road Miles Vulnerable to Nuisance Flooding During King Tide Events*

	Original Road Miles	2030 Low (3" of SLR)	2030 High (7" of SLR)	2060 Low (9" of SLR)	2060 High (24" of SLR)
US Highway 1	112.5 mi.	2.3 mi.	3.2 mi.	4.0 mi.	14.3 mi.
All Roads	830.0 mi.	143.6 mi.	188.0 mi.	217.6 mi.	449.9 mi.

*King Tide describes the elevation of tides that are higher than 99% of the high tides that occur each year at the Vaca Key tide gauge.
– 2030 Low Scenario (3" SLR): height of a King Tide is calculated at 1.5' above current MHHW, referenced to 1992 National Tidal Datum Epoch.
– 2030 High Scenario (7" SLR): height of a King Tide is calculated at 1.91' above current MHHW.
– 2060 Low Scenario (9" SLR): height of a King Tide is calculated at 2.0' above current MHHW.
– 2060 High Scenario (24" SLR): height of a King Tide is calculated at 3.33' above current MHHW.

TABLE 4. Summary of Road Miles Vulnerable to Inundation Flooding (Daily Tidal Floods)*

	Original Road Miles	2030 Low (3" of SLR)	2030 High (7" of SLR)	2060 Low (9" of SLR)	2060 High (24" of SLR)
US Highway 1	112.5 mi.	0.1 mi.	0.4 mi.	0.7 mi.	4.0 mi.
All Roads	830.0 mi.	14.8 mi.	23.5 mi.	54.5 mi.	217.6 mi.

*Daily tidal flooding occurs when a road segment is at an elevation lower than a future MHHW mark as affected by sea level rise.
– 2030 Low Scenario (3" SLR): future MHHW is calculated at 0.42' above current MHHW, referenced to the 1992 National Tidal Datum Epoch.
– 2030 High Scenario (7" SLR): future MHHW is calculated at 0.83' above current MHHW.
– 2060 Low Scenario (9" SLR): future MHHW is calculated at 0.92' above current MHHW.
– 2060 High Scenario (24" SLR): future MHHW tide is calculated at 2.25' above current MHHW.

Valencia Flooding

PHOTO SOURCE: John Glista

severe traffic constraints, although access to individual homes may be temporarily restricted. Even infrequent nuisance tidal flooding conditions on U.S. Highway 1 pose additional concerns for public safety, health, and welfare, while also impacting the local economy through the temporary loss of the primary transportation route. Such consequences justify near-term and preventive action to mitigate existing or potential flood risks on impacted transportation routes.

Full vulnerability assessment results for roads are provided in the Monroe County, FL: GIS Vulnerability Assessment for Sea Level Rise Planning report included in Appendix C.

C. COAST

The COAST modeling software mimics flood effects from storm events and sea level rise on community assets, including homes and businesses. The model also performs a vulnerability assessment by calculating cumulative damage to communities over time, from both storm events and sea level rise. This allows communities to better understand the cost of not adapting to or otherwise mitigating the impacts of storms and sea level rise. Finally, the COAST model calculates damage reductions (essentially the costs and benefits) of implementing various adaptation actions to mitigate storm impacts and sea level rise.

Calculations are determined by adding sea level rise and storm surge to the nearest known MHHW height, which is a starting or "bottom point" for any analysis of how high the water may rise in the future. For the Middle Keys, this value is available at the NOAA Vaca Key Tide Gauge Marathon.

Several model inputs are used in the COAST model, including:

- LIDAR imagery of Key Largo and surrounding area which was converted to proper vertical units which consisted of a five (5) meter by five (5) meter grid with single elevation value in feet for each square;
- Property values for land and buildings provided by the Monroe County Tax Collector's Office;
- Tide data, including the value of the high tide level for Key Largo, from the Vaca Key tide station;
- Four (4) sea level rise scenario estimates obtained from the Unified Sea Level Rise Projection for Southeast Florida prepared by the Compact; and
- Depth-damage function tables created by the Corps based on damage measurements from years of studying floods and associated insurance claims.

Using the above data, the COAST model was used to perform a vulnerability assessment of homes and commercial building structures and to model adaptation action scenarios within Monroe County in Key Largo and Stock Island. Through a separate contract, the Team also performed a vulnerability assessment in the Village of Islamorada. Sea level rise assumptions were based upon the Unified Sea Level Rise Projection for Southeast Florida, including 2030 (3-7") and 2060 (9-24") inches. Surge values from various sized storms were obtained from the most recent FEMA Flood Insurance Study. The three (3) adaptation actions modeled included: 1) elevating and floodproofing buildings, 2) building offshore barriers close to the coast, and 3) purchasing properties vulnerable to sea level rise through a voluntary buyout program over a phased timeframe.

The Team conducted three (3) Key Largo community workshops in October, November and December 2014. During these workshops, participants voted on modeling parameters and assumptions for "no-action" and the three (3) adaptation action scenarios. Voting occurred during Workshops #2 and #3 and focused on certain model parameters as well as whether or not actions should be further evaluated. The modeling results and community engagement process enabled the Team to provide residents with a context for beginning more difficult conversations and decision-making processes regarding their vulnerabilities.

Vulnerability Assessment Results. The vulnerability assessment was conducted to evaluate the financial benefits of implementing various adaptation strategies in Monroe County. This evaluation produced avoided damage estimates and benefit-cost ratios for each of the adaptation strategies evaluated.

All benefit-cost ratios for the various adaptation strategies were presented to County residents, and keypad polling technology was used to evaluate community opinion. After reviewing model results and participating in the group discussions, residents voted that elevating and floodproofing buildings was their most preferred action. Residents also supported the County pursuing sources of funding to help private property owners implement this strategy.

Elevating and floodproofing buildings showed the best benefit-cost ratio and the greatest avoided damage estimates, even under the worst case sea

Google Earth image of potential flooding damages from a Hurricane Wilma-sized flood (linear tide gauge trend) in 2060 for a section of Key Largo, Monroe County, FL.

Coral parcels indicate those flooded from storm surge, with the height of the coral extrusions representing relative damage amounts in dollars. Parcels in green indicate those permanently inundated from sea level rise.

level rise scenario. For elevating and floodproofing structures, the ratio was 5.48-13.10 and the avoided damages by the year 2060 ranged from $836.3 Million to $992.9 Million under the high sea level rise scenario (9-24"). For an offshore barrier, avoided damages by the year 2060 only ranged between $6.8 Million and $12.0 Million under a high sea level rise scenario (9-24") because a barrier does not protect against sea level rise it only diminishes wave action from storm events for properties in the FEMA V-Zones located behind the barriers. For voluntary buyouts, the avoided damages by the year 2060 ranged from $1.71 Million to $79.7 Million under a high sea level rise scenario (9-24").

For Stock Island, the Team evaluated elevating buildings as the most appropriate adaptation strategy. For the purposes of the modeling, all buildings on Stock Island not currently elevated were assumed to be elevated to the 100 Year Flood height plus three (3) feet. Modeling was based on the assumption that there would be 100% participation from building owners with buildings not currently elevated. For elevating and floodproofing structures, the ratios ranged from 5.42-14.25 and the avoided damages by the year 2060 ranged from $149.6 Million (high sea level rise) to $193.8 Million (linear tide gauge trend sea level rise). Elevating buildings is modeled as a cost-effective adaptation regardless of costs (high vs. low) or sea level rise scenario (high vs. low). Note though that although this adaptation reduced cumulative damages from storm surge over time, it does not completely protect against sea level rise because supporting infrastructure is still impacted.

A copy of the complete GreenKeys!: Analysis of Damages from Storm Surge and Sea Level Rise for the Geographic Regions of Key Largo and Stock Island, Monroe County using the Coastal Adaptation to Sea Level Rise Tool Report is included in Appendix D.

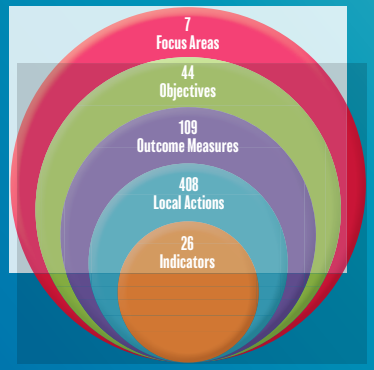
Key Largo, Flooding three (3) feet

PHOTO SOURCE: Stephanie Russo

Stock Island, FL Flooding

PHOTO SOURCE: Alison Higgins

7. USE OF SUSTAINABILITY Tools for Assessing & Rating Communities ("STAR")



Given the County's commitment to sustainability principles in its MCAP, Comprehensive Plan and other policies and procedures, the Team used the third party rating system of STAR as part of this planning process.[23] GreenKeys! incorporates the results of the STAR assessment performed for the County as part of the overall GreenKeys! project.

A. Overview of the System

STAR is the first national third-party certification program that recognizes sustainable communities for their efforts. STAR is both a framework and a certification program. Originally released in October 2012, STAR is intended to provide communities with a method for identifying, validating, and supporting the implementation of best practices that improve sustainable community conditions.

STAR provides local leaders with a framework for assessing their community's sustainability, setting targets for moving forward, and measuring progress along the way. STAR consists of seven (7) main goal areas broken down to assist local governments and their communities in more effectively strategizing and defining their sustainability planning

TABLE 5. STAR Community Rating System Goal Area Matrix[24]

BUILT ENVIRONMENT	CLIMATE & ENERGY	ECONOMY & JOBS	EDUCATION, ARTS & COMMUNITY	EQUITY & EMPOWERMENT	HEALTH & SAFETY	NATURAL SYSTEMS
Ambient Light & Noise	Climate Adaptation	Business Retention & Development	Arts & Culture	Civic Engagement	Active Living	Green Infrastructure
Community Water Systems	Greenhouse Gas Mitigation	Green Market Development	Community Cohesion	Civil & Human Rights	Community Health & Health Systems	Invasive Species
Compact & Complete Communities	Greening the Energy Supply	Local Economy	Educational Opportunity & Attainment	Environmental Justice	Emergency Prevention & Response	Natural Resource Protection
Housing Affordability	Industrial Sector Resource Efficiency	Quality Jobs & Living Wages	Historic Preservation	Equitable Services & Access	Food Access & Nutrition	Outdoor Air Quality
Infill & Redevelopment	Resource Efficient Buildings	Targeted Industry Development	Social & Cultural Diversity	Human Services	Indoor Air Quality	Water in the Environment
Public Spaces	Resource Efficient Public Infrastructure	Workforce Readiness		Poverty & Alleviation	Natural & Human Hazards	Working Lands
Transportation Choices	Waste Minimization				Safe Communities	

efforts. STAR's goal areas and objectives are provided above in Table 5.

Conducting a preliminary assessment in the rating system results in a preliminary rating score, ranging from 0 to the maximum 720 points achievable under STAR. Reporting STAR Communities, like Monroe County, undergo a more substantive assessment involving the compilation and electronic reporting of data. This data collection and submission results in formal STAR certification with review of submitted data by STAR technical staff.

B. Monroe County's Reporting STAR Community Assessment

Beginning in October 2014, Monroe County conducted an assessment of current policies, practices and services initiated and implemented by the County using the STAR framework. This assessment was conducted in order to pursue formal certification from STAR at the conclusion of all data collection and reporting activities. Over the course of nine (9) months, research was conducted to identify Monroe County initiatives in each of the seven (7) STAR goal areas. An eighth bonus goal area (Innovation & Process) was also evaluated to determine if Monroe County could score additional points for innovative efforts being undertaken by the County. Note that in instances where the County was affiliated with, supportive of or otherwise involved in programs, services and planning initiatives conducted by other entities at a regional scale, the County was credited for that participation. This is consistent with the STAR guidance and ensures that initiatives outside of the County's formal jurisdiction are credited to the County when participation is active.

All of the identified initiatives were entered into the STAR Crosswalk Excel spreadsheet and subsequently the online reporting tool. All data entered

Monroe County, FL

PHOTO SOURCE: GreenKeys! Project Team

Nuisance Flooding

PHOTO SOURCE: Greenkeys! Project Team

Once certified, an official STAR score lasts three (3) years. There are four (4) certification rating levels under STAR:

- 5-STAR Community (achieving 600-720 points)
- 4-STAR Community (achieving 400-599 points)
- 3-STAR Community (achieving 200-399 points)
- Reporting STAR Community (achieving <200 points)

into the online reporting tool was used in the formal STAR certification process discussed in the following section. The STAR Crosswalk Excel spreadsheet illustrating the results of Monroe County's assessment is provided in Appendix F.

C. Certification & Scoring

On April 2, 2015, all data collection and entry for Monroe County was completed and submitted for formal STAR certification. Preliminary verification of the submitted data was provided by STAR staff on May 28, 2015, identifying several actions and outcomes requiring clarification and/or additional data submission. After revising the STAR submission and providing all additionally requested information, final certification was requested. Monroe County was certified as a **3-STAR Community** on June 24, 2015, receiving a final score of 261.3. The County's certified STAR score is broken down in Table 6 to the right.

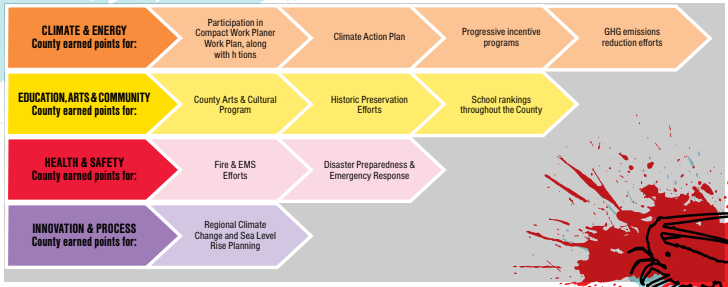
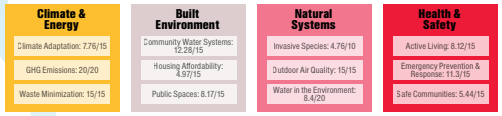
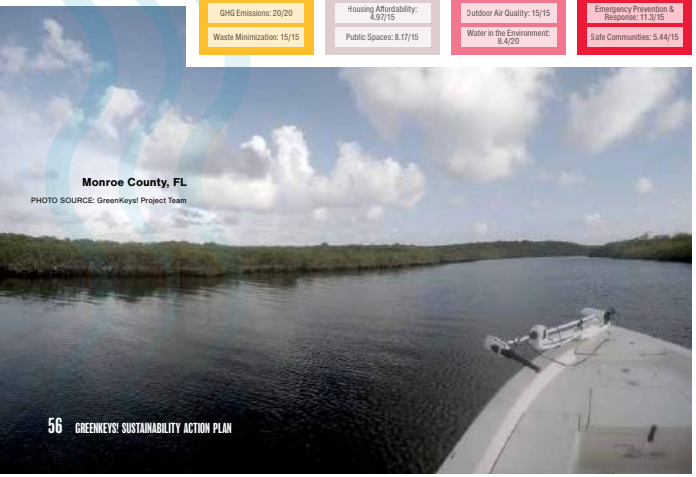


TABLE 6. STAR Assessment Points Breakdown

Goal Area	Points Scored	Points Available	% of Total Points Earned
Built Environment	33.2	100	33.2%
Climate & Energy	52.6	100	52.6%
Economy & Jobs	36.3	100	36.3%
Education, Arts & Community	31.5	70	45.0%
Equity & Empowerment	20.0	100	20.0%
Health & Safety	42.9	100	42.9%
Natural Systems	39.9	100	39.9%
Innovation & Process Credits	5.0	50	10.0%
FINAL SCORE	**261.3**	**720**	**36.2%**

The point breakdowns for the four (4) goal areas of greatest interest to the County (Climate & Energy, Built Environment, Natural Systems, and Health & Safety) are depicted in the graphic below. These areas translate into the highest priority areas in GreenKeys!. The three (3) highest scoring subgoals within each goal area are also highlighted.





Monroe County, FL

PHOTO SOURCE: GreenKeys! Project Team

D. How Monroe County's Score Compares to Other Certified STAR Communities

Fifty (50) communities across the U.S. have completed the STAR evaluation process with another fifty-seven (57) currently undertaking it. The results of those that have been certified are depicted to the right.

In Florida:

- Three (3) other communities have been certified (Broward County achieved a 4-STAR rating and Palm Bay and Lee County each achieved a 3-STAR rating;
- Five (5) communities are "reporting," meaning that they are in the certification process presently (Sarasota County, City of West Palm Beach, City of St. Petersburg, City of Marathon and the City of Pinecrest);
- Four (4) communities are "participating" meaning they have joined as a member and completed the Crosswalk (this includes the Village of Islamorada, Bonita Springs, Coral Gables and the City of Hollywood), but not the verification/ certification process;
- Monroe County is the most recently completed certification; and
- Thirteen (13) total communities in Florida are involved in STAR.

In addition to national and Florida comparisons, the table to the right demonstrates similarities of communities with similar populations.

E. Future Use of STAR and Key Areas for Improvement

Given the comprehensive nature of STAR across all seven (7) goal areas that span from economic development to social values, there are many

TABLE 7. National and Statewide STAR Community Comparison

Community	Population	Score	Date of Certification
Albany, NY	97,000	215.2	6/1/2014
Woodbridge Township, NJ	99,585	219.5	2/2/2015
Palm Bay, FL	106,714	222.6	5/11/2015
Reading, PA	87,893	234.1	5/4/2015
Fayetteville, AR	75,000	271.9	8/10/2014

uses for this information beyond just this planning process. It can be used as a roadmap, as a planning tool, as a way to organize/guide public engagement processes, to aid in decision-making and as a measuring stick to determine whether investments are achieving outcomes. Communities have used STAR for strategic planning purposes as well as comprehensive planning purposes.

Monroe County has chosen to evaluate all seven (7) STAR goal areas for the prioritization of future efforts. Specific focus will be placed on four (4) of these in this planning process, including Climate & Energy, Built Environment, Natural Systems and Health & Safety (which are also Focus Areas for GreenKeys!)." Given the nature and overlap of the remaining Equity & Empowerment, Economy & Jobs, and Education, Arts & Community goal areas, GreenKeys! consolidates these into one (1) Focus Area. In addition to the STAR goal areas, the Team also added a sixth Government Operations Focus Area for evaluation and prioritization in GreenKeys!. After completion of the STAR assessment, County staff and the Team prioritized the remaining local actions and outcome level measures that seemed most applicable and practical to the County and in the greatest alignment with future County goals for increasing overall sustainability. Only those local actions and outcome level measures most applicable to Monroe County were prioritized and are depicted below as recommendations in this planning process.

These recommendations reflect local actions and/or outcome level measures within the STAR framework that have yet to be implemented by the County. Since GreenKeys! focuses on sustainability, sea level rise vulnerability and climate issues, this

Nuisance Flooding in Key Largo, FL

PHOTO SOURCE: Rhonda Haag

Nuisance Flooding in Key Largo, FL

PHOTO SOURCE: GreenKeys! Project Team

includes the concept of "resiliency." Resiliency is well integrated into STAR because, at its core, resilience means that a community has the resources and infrastructure in place to sustain its environment, economy, and people, regardless of shifting conditions or unforeseen events.

F. Integration with Plan Performance Tracking

Within the STAR framework, each of the forty-four (44) Objectives contains two (2) types of evaluation measures:

- **Community Level Outcomes:** more quantitative, measurable, condition-level indicators that show community progress on a STAR Community Rating System Objective. Examples: reductions in energy use or increased transportation access.

- **Local Actions:** more qualitative action government takes to move toward the Community Level Outcomes — the range of decisions, investments, programs, plans, and codes that a local community puts in place. Actions focus on deliverables that move towards Outcomes, and can be done by both the local government and other community groups and partners. Examples: land development regulations, ordinances, plans, assessments, and education and outreach activities.

Because of the qualitative nature of STAR and the multi-disciplinary input into its development, STAR has served as a sound basis for developing recommendations in this planning process. The STAR framework provides a robust metric of outcomes and actions that local governments can use to evaluate current and previous planning initiatives. It can also be used to track performance for the planning process. Outcome level measures provide quantitative measures for determining the effectiveness of initiative implementation. Additionally, the suite of local actions within the STAR framework provides ideas local governments can use in implementing new initiatives to achieve desired outcome level measures.

In addition to guiding recommendations in GreenKeys!, the STAR framework can also be used in future planning and update processes. There is significant overlap between the goal areas within the STAR framework and recommended Comprehensive Plan principles created by the American Planning Association ("APA") as part of its Sustaining Places initiative.[25] APA's recommended Comprehensive Plan principles include: 1) Livable Built Environment, 2) Harmony with Nature, 3) Resilient Economy, 4) Interwoven Equity, 5) Healthy Community, and 6) Responsible Regionalism. STAR's objectives follow these principles.

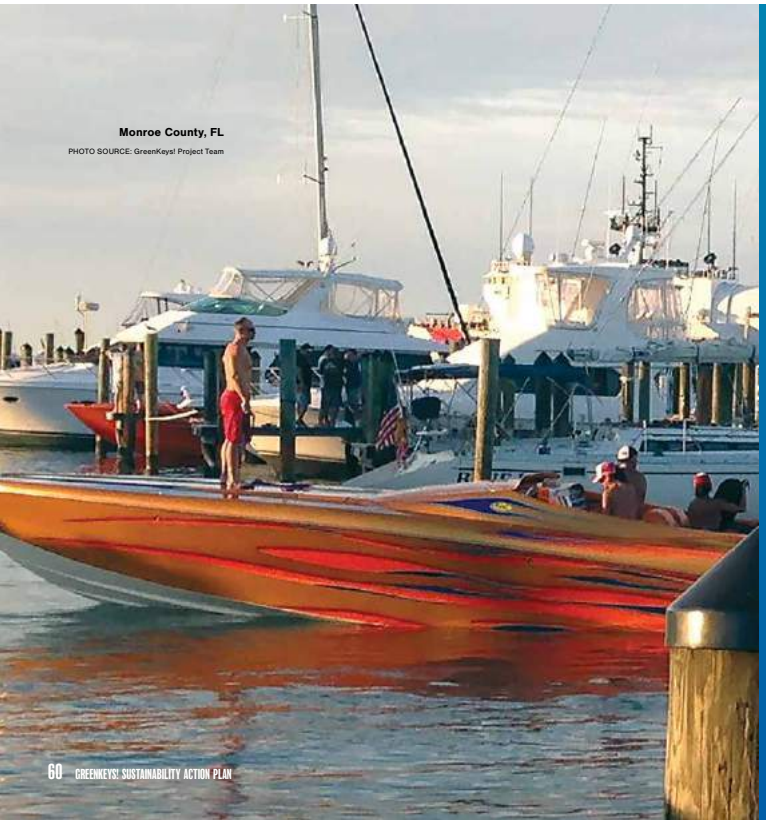
BALTIMORE, MARYLAND STAR CASE STUDY ON INTEGRATION

The City of Baltimore ("City") faces a wide range of natural hazards like flooding, coastal storms and extreme heat. In 2013, the City prepared a Disaster Preparedness Project and Plan ("DP3"), combining hazard mitigation and climate adaptation into a single plan. Their DP3 included an innovative flood vulnerability assessment showing the estimated flooding, sea level rise and coastal storm influence of climate change, coastal hazards assessment showing how urban forests, parks and green space provide a storm buffer and heat vulnerability assessment identifying urban heat islands and hot spots.

The City is currently in the implementation phase, taking actions to strengthen their resilience based on the results of the DP3. High priority actions include:

- New floodplain regulations more stringent than FEMA;
- Growing Green Initiative which uses vacant lots for stormwater management and coastal buffering;
- Installation of 200 Urban Heat Island Sensors in hot spot communities where over thirty (30) tree plantings have been conducted;
- Integration of resilience considerations into the City's Capital Improvements Process;
- Citizen and business education about emergency preparedness and the impacts of climate change; and
- Development of a tree database that considers climate change impacts and identifies which tree species are best to plant in specific areas to help mitigate the impacts.

The City's climate adaptation efforts and current implementation strategy helped contribute to the 5-STAR rating obtained by the City of Baltimore in April 2015 (one of only three 5-STAR Communities in the U.S.).



Monroe County, FL

PHOTO SOURCE: GreenKeys! Project Team

8. GREENKEYS! Focus Area Recommendations & Priorities

The six (6) main Focus Areas of GreenKeys! are:

Using the results of the STAR assessment, County staff and the Team prioritized remaining local actions and outcome level efforts that are most applicable or practical to the County and in greatest alignment with future County goals for increasing sustainability. Only those local actions and outcomes most applicable to the County were prioritized and are therefore depicted below.

These recommendations reflect local actions and/or outcome level efforts within the STAR framework that have yet to be implemented by the County as well as specific recommendations stemming from the data collection and modeling efforts and implementation described in Section 6. Where appropriate, the recommendations also reflect linkages with the County's previous MCAP.

Monroe County Government Operations
BY THE NUMBERS

80
county buildings

161
employees

311
miles of roads

21
parks and beaches

25
bridges

7
public boat ramps

757
county vehicles

A. Government Operations Focus Area

Government Operations

Government Operations include actions that Monroe County can take to increase the sustainability and resiliency of County operations, from energy and water conservation techniques to green product purchasing and resource reduction efforts. It includes actions and initiatives specifically targeted at renovating and upgrading existing County facilities and infrastructure, as well as policies and procedures guiding future County efforts.

Government Operations also includes efforts to evaluate and plan for climate change and sea level rise, which will impact both County infrastructure and decision-making processes into the future. Note that Chapter 255 of the Florida Statutes requires that newly constructed and renovated public buildings be designed and constructed to be energy and water efficient in accordance with a sustainable building rating or national model green building code.[26]

Sustainable government operations are those that reflect efficient and resilient operations. These include operations that are cost-effective and typically have a longer useful life. Not only is improving the sustainability of government operations important to the County economically, it is equally important for the County to lead by example and demonstrate the benefits of sustainability improvements to both residents and Florida Keys visitors.

Monroe County, FL
PHOTO SOURCE: GreenKeys! Project Team

NEW STOCK ISLAND FIRE STATION
Achieves First Ever Green Building Coalition Silver Level Certification

Fire Station #8 on Stock Island was awarded the Florida Green Commercial Building designation by the Florida Green Building Coalition ("FGBC") after successfully meeting the Green Commercial Building Certification program sustainability standards.

The project achieved 168 points, earning Silver level certification and making it the highest scoring Statewide FGBC certified commercial project to date. It is designed to be 42% more energy efficient than required by the Florida Building Code and will rely upon renewable energy through green power purchase agreements for 75% of its power needs.

To conserve water, the toilets, faucets, and showerheads are low-flow rated. The site also used all Florida Friendly plants and a rainwater cistern collection system to deliver 100% of the irrigation needs for the landscaping, thus negating the use of valuable potable water.

To protect building occupants, all paints, stains, adhesives, and sealants used were rated low Volatile Organic Compound ("VOC"), cabinets and insulation were free of harmful urea formaldehyde, and healthy flooring was used in 80% of the building. Sixty-one percent of the materials used contained recycled content, and many can be recycled at the end of their useful life.

Stock Island Fire Station #8
Left, Fire Station crew
Above left, LED lighting in the front office
PHOTO SOURCE: GreenKeys! Project Team

This Government Operations assessment included:

- Digitization of 1,316 structures in Monroe County, including 386 County-owned
- Elevation Certificate records for 35 County-owned structures
- 9 wastewater treatment plants
- Digitization of 34 parcels containing electrical utility infrastructure
- Analyzed critical water supply infrastructure, including storage tanks, system valves, control valves, cathodic detectors
- Evaluation of 942.5 miles of roads to determine flood risk to nuisance flooding and sea level rise

Nuisance Flooding, Key Largo, FL
PHOTO SOURCE: Stephanie Russo

As part of the GreenKeys! planning process, the Team evaluated the most critical County infrastructure to determine the most appropriate recommendations for resiliency.

Results of the vulnerability assessments conducted as part of this project revealed impacts of varying degrees to much of the County's infrastructure at either 2030 or 2060 depending on the sea level rise scenario modeled (See complete assessment results in Section 6(f) of this report. Given these impacts, the time is now for the County to begin planning for and addressing identified vulnerabilities in the County's operations. This includes not only efforts to address specific facilities and infrastructure, but also efforts to reduce the County's carbon footprint and help offset and minimize anticipated climate change impacts.

Within this Focus Area, several overall goals were identified to help the County address vulnerabilities identified as part of this GreenKeys! planning process and become more sustainable in its operations over the long-term. The identified goals include those listed at top right. Specific recommendations the County can implement to meet these goals are provided in Table 9.

TABLE KEY

Short Term Recommendations in Light Blue
Medium Term Recommendations in Light Yellow
Long Term Recommendations in Light Pink

TABLE 8. Government Operations Goals

1. Develop better data and monitoring to increase the resilience of County infrastructure to sea level rise
2. Develop specific adaptation strategies and increase resilience for County facilities with risk to sea level rise
3. Increase energy efficiency in County operations
4. Reduce GHG emissions and expand alternative energy usage County-wide
5. Expand efforts to reduce GHG impacts from County fleets
6. Strengthen water conservation efforts in County operations
7. Continue planning for and implementing solid waste reduction efforts in County operations
8. Increase efforts to promote sustainability in County operations

TABLE 9. Government Operations Recommendations

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
Goal 1: Incorporate sustainability into ongoing education and arts programs in the County			
GO 1.1 Develop site level assessments that characterize resistance of above ground structures and associated electrical components to damage from extreme event flooding.			
GO 1.2 Develop and maintain recording protocols and, as necessary, engineering assessments to assess resilience of below-grade pipes and pump to increased saltwater incursion associated with sea level rise.		M-3.1	
GO 1.3 Analyze available infrastructure and sustainability rating systems (e.g. Envision, Infrastructure Voluntary Evaluation Sustainability Tool ("INVEST") or other design-related systems that consider sustainability and resiliency factors to optimize planning for infrastructure, transportation, facilities and assets.			
GO 1.4 Develop more accurate elevation data (LIDAR) County-wide.		M-2.1	WS-11
GO 1.5 Update vulnerability assessments on Monroe County buildings based upon GreenKeys! modeling data and updated LIDAR data.			
GO 1.6 Develop a public education campaign to inform residents about energy and water efficiency and future flood risk and potential for environmental change.		E-1.1, E-1.2	

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

TABLE 9. Government Operations Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
GO 1.7 Support Fair Insurance Rates in Monroe ("FIRM") in building partnerships with engineering companies willing to provide discounted elevation certificates to promote better elevation data.			
GO 1.8 Create a database of all elevation data for County and utility facilities and assets.			
GO 1.9 Create detailed site investigations to better resolve the extreme event flood risks of all critical infrastructure within defined special flood hazard areas, with near-term prioritization of such investigations recommended for all critical infrastructure with LIDAR elevation estimates below 6.89' above MHHW.			
GO 1.10 Enhance monitoring of County buildings and create a database for flood risk to detect potential access and structural issues associated with increased tidal flooding exposure.		M-3.1	
GO 1.11 Coordinate with utilities to complete large-scale digitization of Elevation Certificates that contain specific information about the siting and elevation of equipment to develop comprehensive information about the scale of the risk, and to inform development of appropriate policy options for preventing and mitigating future risks.		M-2.1, M-2.2	WS-11
GO 1.12 Begin implementing results from studies and analyses conducted in earlier years.			
Goal 2: Develop specific adaptation strategies and increase resilience for County facilities with risk to sea level rise			
GO 2.1 Address sea level rise and climate change resilience in annual County budgeting process.			
GO 2.2 Change Sustainability Director position title to Resiliency Director.			
GO 2.3 Update annual legislative package to include sustainability and sea level rise practices.			
GO 2.4 For the West Martello Tower, which shows potential exposure to first floor nuisance flooding by 2060, consultation with historic preservation specialists in Monroe County and FEMA guidelines for retrofit of historic structures..			
GO 2.5 For the Monroe County Animal Shelter in Key West, which shows access concerns and first floor flooding under the 2060 scenario, consider potential relocation to a more elevated site as part of any future plans to renovate the Animal Shelter facilities..			
GO 2.6 Perform further analysis with improved elevation data for the Bayshore Manor assisted living retirement home.			
GO 2.7 Work with the Florida Keys Aqueduct Authority to ensure that siting and design of any new wastewater facilities include resilience to future sea level rise as a primary engineering consideration.		W-2.1	
GO 2.8 Require that significant maintenance, upgrade, or expansion of any existing wastewater facilities, including Bay Point Wastewater Treatment Plant, consider stressors from sea level rise within the life-cycle design framework.		W-2.1	
GO 2.9 Conduct site-specific analyses of particularly vulnerable wastewater infrastructure that include survey quality elevation data of sensitive components and engineering assessments of potential floodwaters to determine the present and future vulnerability to extreme flood events.			
GO 2.10 For the Marathon electric substation, which shows vulnerability to an extreme storm surge by 2060 under a high sea level rise scenario, coordinate with Florida Keys Electric Cooperative Association to determine true risk exposure and alternatives to reduce that risk.			

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

TABLE 9. Government Operations Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
GO 2.11 For the Roth Building (50 High Point Road), Radio Transmission Shop (88770 U.S. Highway 1) and County Offices (MM 88.5, U.S. Highway 1), which show potential risk to an extreme flooding event by 2060, take into account both the rate of sea level rise over the next two decades and the overall lifecycle of the buildings in making flood adaptation decisions to reduce risk.			
GO 2.12 For Clarence Higgs Beach, which shows risk of current or future flooding from a Wilma-sized event, incorporate appropriate hazard mitigation design features into any retrofits or upgrade projects.			
GO 2.13 For East Martello Tower, which shows risk of current or future flooding from a Wilma-sized event, consider flood adaptation measures (more mid to long-term because of fort construction and historic nature).			
GO 2.14 For the Monroe County Sheriff's Office Freeman substation structure on Cudjoe Key, which shows moderate risk concern, develop adaptation strategies as a likely priority for flood mitigation and emergency preparedness.			
Goal 3: Increase energy efficiency in County operations			
GO 3.1 Establish criteria and specifications that require energy efficiency in all new public construction, facility improvements, renovations or additions. These should go into bid and contract documents with designers, contractors, and engineers. These should include requirements for high efficiency HVAC equipment, efficient lighting, EnergyStar or similarly certified appliances, thermal resistance values (R-value and U-value) for insulation and windows, motor efficiency, controls and settings, and others.			
GO 3.2 Develop energy saving policies for County facilities and hire, assign or contract for a County-wide Energy Manager.			
GO 3.3 Track utility data through FacilityDude program to target and further reduce energy inefficiencies.			
GO 3.4 Start implementing an employee training program on energy efficiency, water conservation and sustainable office practices.	CE-5(7)	E-2.1, E-2.2	
GO 3.5 Promote energy usage reductions in County facilities. Provide education and outreach; create competitive programs to achieve energy reductions; and publish or post County utility bills for the public to view.			
GO 3.6 Increase lighting efficiency and promote retrofits for efficiency on County maintained and controlled roads.			SP-1, SP-2, EF-5
GO 3.7 Conduct next phase of energy auditing on County facilities and link upgrades to capital asset improvements. Install low-flow water conserving fixtures and energy saving features throughout County facilities.	CE-5(10) BE-2(8)	E-2.3, B-3.1	
Goal 4: Reduce GHG emissions and expand alternative energy usage County-wide.			
GO 4.1 Use baseline GHG emissions data moving forward for forecasting energy emissions reductions and for setting additional municipal and community reduction targets.			
GO 4.2 Establish an interim GHG target for 2030, consistent with the timeframe of the County's latest Comprehensive Plan, for a 40% reduction by 2030 as compared to the 2012 baseline.			SP-2

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

TABLE 9. Government Operations Recommendations Continued

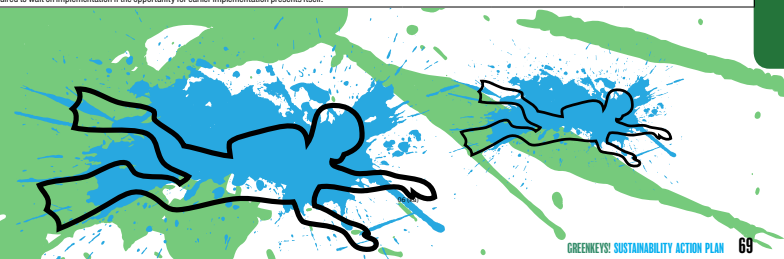
Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
GO 4.3 Adopt a target for energy use from renewable sources for County buildings and facilities such as 10% by 2025 and explore financing alternatives such as leasing. Conduct feasibility studies for alternative energy at County facilities. Partner with electric utilities for creative ways to deploy more solar. To monitor progress, develop a baseline for current renewable energy use.			SP-2
GO 4.4 Implement policies and programs to enhance electric vehicle infrastructure and make the Florida Keys "EV Ready." This could include providing electric vehicle charging stations at community parking lots and/or working with vehicle manufacturers to install publicly accessible electric vehicle charging stations.	CE-2(8)	B-4.3, B-4.4	SP-2, EF-7
GO 4.5 Engage public works and infrastructure managers in voluntary GHG reporting. This could include making materials available online to assist managers in this reporting or creation of a one page fact sheet for inclusion in the Monroe County Personnel Policies and Procedures Manual (November 18, 2014).	CE-6(5)		
GO 4.6 Inventory GHG emissions for County and Community-wide sectors every three (3) years beginning in 2016.			
GO 4.7 Upgrade to solar lighting at County parks and beaches consistent with GO 4.3. Expand the use of solar panels in County parking lots to further reduce energy use in County operations.	CE-5(10)	E-2.3	EF-5
GO 4.8 Create a green business challenge for local businesses and recognize resource reduction.	EJ-2(9)	S-1.4, E-2.3	
Goal 5: Expand efforts to reduce GHG impacts from County fleet			
GO 5.1 Complete a "right size/right type" fleet analysis.		B-4.3	SP-19
GO 5.2 Advocate for incorporation of EVs on the state-approved list.		B-4.3	SP-19, EF-1 BE-2(8)
Goal 6: Strengthen water conservation efforts in County operations			
GO 6.1 Install low-flow water conserving fixtures throughout County facilities. Water-conserving fixtures may include faucet aerators, low-flow showerheads, waterless urinals, low-flush or dual-flush toilets, and irrigation equipment.	BE-2(8)	W-1.3	
GO 6.2 Develop and implement educational materials and a program for employees to ensure water efficiency in operations and maintenance of fleet and facilities. Partner with the FKAA to target reductions in the largest water use applications.		E-2.1, E-2.2	
GO 6.3 Partner with the Florida Keys Aqueduct Authority to promote water conservation through rebate and public education programs.			
Goal 7: Continue planning for and implementing solid waste reduction efforts in County operations			
GO 7.1 Improve County waste management policy with tangible goals and baseline to track accomplishments. Track County recycling rates separately from other recycling programs and establish goal for increases. Adopt policy that the County will also achieve a 75% diversion rate of its own solid waste stream. Implement incentives or enforce regulations to ensure progress towards the 75% community waste reduction target.	CE-7(5)	S-1.1, S-1.2	SP-2
GO 7.2 Create a policy and goal to increase material salvage for County-owned full and partial building demolitions.		S-1.2	SP-2

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

TABLE 9. Government Operations Recommendations Continued

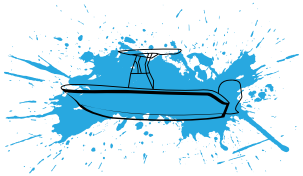
Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
Goal 8: Increase efforts to promote sustainability in County operations			
GO 8.1 Provide annual progress reports on the implementation of the GreenKeys! Sustainability Action Plan			
GO 8.2 Develop a policy and implement best practices to reduce pesticide and herbicide use in County operations.			SP-2
GO 8.3 Improve employee sustainability practices: •Conduct an internal employee survey to determine most effective and underutilized sustainability practices and modify policies to increase sustainable practices •Create a "top ten list" of energy, water and waste management efficient practices for County employees and include in the Monroe County Personnel Policies and Procedures document. •Create a monthly email blast to employees on successes and case studies for sustainable practices.			
GO 8.4 Create and continually publish an internal and external Sustainability Newsletter for distribution.			
GO 8.5 Adopt a policy to facilitate and encourage web/telephone conferencing at meetings in lieu of in-person attendance where possible.			
GO 8.6 Create an Environmentally Preferable Purchasing ("EPP") program. Develop procurement specifications for materials reuse, reduced packaging, materials with recycled content, and other waste management strategies.	EJ-2(7)	S-3.2	
GO 8.7 Investigate re-certification of STAR.			
GO 8.8 Modify procurement policies in Monroe County's Environmentally Preferable Purchasing program as necessary to further incentivize vendors whose buildings, equipment, products, and services meet achievable sustainability targets.			
GO 8.9 Update or modify the goals and recommendations in the GreenKeys! Sustainability Action Plan every 3-5 years.			

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.



Monroe County Hybrid Vehicle

PHOTO SOURCE: Greenkeys! Project Team



Several recommended actions not yet implemented in this Government Operations Focus Area align with and expand upon existing MCAP recommendations. For example, short term energy efficiency upgrades and audits, as well as targeted efficiency improvements at specific County facilities satisfy the MCAP recommendation B-3.1 of increasing energy efficiency and promoting green construction practices. Similarly, expansion of the County's renewable energy fleet corresponds with MCAP recommendation B-4.3 to promote infrastructure and encourage the use of alternative fuels and alternative fuel vehicles. New requirements to include sea level rise resilience in the siting, design, maintenance and upgrade of wastewater treatment facilities corresponds with MCAP recommendation W-2.1 which encourages the protection of these plants. Increased digitization of elevation certificates also corresponds with MCAP recommendation M-2.2 which calls for the identification of critical structures to be affected by increased inundation from sea level rise, as well as recommendation M-2.1 to improve inundation mapping and modeling.

The Implementation Matrix in Appendix G provides a timeline and method for implementing each recommendation, as well as potential funding sources available to offset the costs associated with each (where available).

Monroe County Climate & Energy BY THE NUMBERS

GHG
GHG reduction targets set

SLR
Planning for sea level rise using Compact high and low scenarios for 2030 and 2060

4
electric vehicle charging stations

2
solar arrays (FKEC)1

2
solar projects (KES)

1
wind demonstration project (KES)

B. Climate & Energy Focus Area

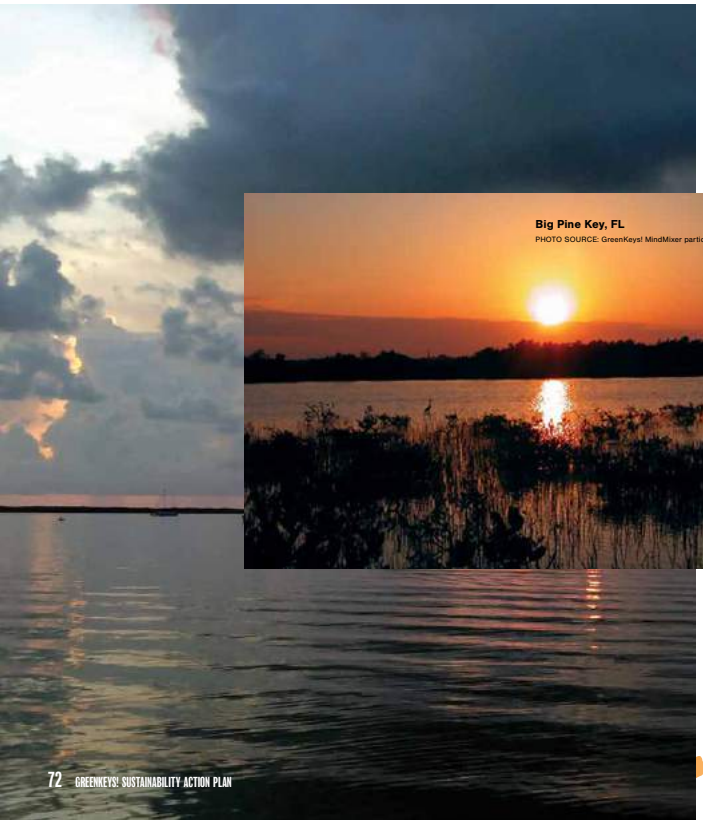
Climate & Energy

Monroe County has been committed to addressing energy and climate issues at the local level since the early 2000s. Beginning in 2005, the County started monitoring GHG emissions with the goal of reducing emissions from County operations and the community in the future. In its comprehensive MCAP, the County established a reduction target of 20% by 2020 as measured from a 2005 baseline inventory. Since establishing this target, the County has implemented several initiatives, including development of sustainable and green standards for new building codes and adoption of the Florida Green Building Coalition's Commercial Building Standard applicable to all County buildings in addition to the Florida Building Code as the standard to be used for construction of all public buildings. In June 2016, the County increased its GHG reduction goal to 40% reduction by 2030 as measured from a 2012 baseline.

The County has also taken substantial steps toward planning for climate change and sea level rise, steps that include joining the Compact in 2010 and conducting the GreenKeys! sea level rise modeling and vulnerability assessments discussed in GreenKeys!. In addition, the County has continued its commitment to increased resiliency in its long-range planning efforts by including a stand-alone Energy & Climate Element in the Comprehensive Plan update.

Also, within this Focus Area, several goals were identified to help the County continue on its path to increasing energy efficiency and independence from fossil fuels while mitigating climate change and sea level rise impacts. These goals are aimed at helping the County promote sustainability and ensuring that there is a clear path that the County's residents and business owners can take to work toward established GHG and waste reduction targets. The identified goals within this Focus Area are presented on the following page.

Given the objectives of this Focus Area and the goals identified for the County, the recommendations on the next page have been prioritized and are recommended for implementation in the County. These recommendations aim to continue the County's commitment to reducing climate change impacts and increasing resource efficiency to create a more sustainable, more resilient community.



Big Pine Key, FL
PHOTO SOURCE: GreenKeys! MindMixer participant Kim G.

TABLE 10. Climate & Energy Goals

1. Continually develop better data to best plan for climate change and sea level rise
2. Mitigate impacts from inundation and nuisance flooding to County roads and support efforts by FDOT to mitigate impacts on FDOT-managed roads within the County
3. Increase efforts to educate residents about energy efficiency and climate resiliency
4. Develop incentives to incentivize energy efficiency, water conservation, climate resiliency and waste reduction efforts
5. Promote employee training and reporting on sustainability initiatives
6. Support efforts to diversify the energy supply within the County
7. Increase resource efficiency and reduce waste generated in the County

TABLE KEY

- Short Term Recommendations in Light Blue
- Medium Term Recommendations in Light Yellow
- Long Term Recommendations in Light Pink

TABLE 11. Climate & Energy Recommendations

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
GOAL 1: Continually develop better data to best plan for climate change and sea level rise			
CE 1.1 Develop a geographic database to document nuisance flooding events.			M-3.1
CE 1.2 Ensure that future flood vulnerability assessments in Monroe County build upon the work in the GreenKeys! project and continue efforts to develop a more complete digital record of Elevation Certificates for homes, buildings and facilities. Use, integrate, and improve the Elevation Certificate record to promote higher confidence in flood risk assessments.			M-2.2
GOAL 2: Mitigate impacts from inundation and nuisance flooding to County roads and support efforts by FDOT to mitigate impacts on FDOT-managed roads within the County			
CE 2.1 Ensure that all new nuisance flooding data informs future road decisions. These data will also need to be considered for future road decisions. This will require coordination with FDOT for impacts to State Roads (U.S. Highway 1).		M-2.2	SP-15, SP-16
CE 2.2 Pilot project to conduct a Comprehensive Feasibility Study for Enhanced Stormwater and Tidewater Criteria (prioritizing areas) for near-term areas subject to inundation risk, including nuisance flooding (in two locations).			WS-3
CE 2.3 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.		M-3.3	SP-2, SP-15, SP-16
CE 2.4 Establish mitigation as a priority in the near term including engineering interventions to keep tidal water from entering onto the road surface while maintaining stormwater drainage. Work with FDOT to develop site surveys of road bed elevation and, as appropriate, suggest engineering designs to raise portions of U.S. Highway 1 that currently show vulnerability to nuisance tidal flooding.			SP-15, SP-16
CE 2.5 Utilize the tidal flood vulnerability maps for roads as a guide for a public outreach campaign to develop a photographic record that documents the date, time, and severity of nuisance tidal flooding events.		M-2.2, M-3.1, E-1.1	

*Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
**For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

TABLE 11. Climate & Energy Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
GOAL 3: Increase efforts to educate residents about energy efficiency and climate resiliency.			
CE 3.1 Hold at least three (3) community workshops to discuss sea level rise with stakeholders.		E-1.1	SP-3, SP-4, WS-12, PO-1
CE 3.2 Build local government capacity to better understand local coastal hazard risks, and analyze the legal and policy factors that impact adaptation responses (NOAA grant). End products will include: • A participatory VCAPS assessment for Monroe County; • HAZUS damage valuations and visualizations for County; • Law and policy analysis of issues directly affecting local adaptation capabilities; • Regional analysis comparing how the state and local regulatory environment impacts resilience planning and adaptation.			SP-3, SP-4
CE 3.3 Complete Phase 2 of the NOAA grant creating digital record of Elevation Certificates for homes, buildings and facilities. Create a policy to ensure that the County uses, integrates, and improves the Elevation Certificate record to promote higher confidence in flood risk assessments.			
CE 3.4 Highlight available incentives for residents desiring to perform energy retrofits or renewable energy projects on homes or businesses.			PO-3
CE 3.5 Develop a "best practices" tool kit to educate residents on energy saving and resiliency techniques.		E-1.1	PO-3
GOAL 4: Develop incentives to incentivize energy efficiency, water conservation, climate resiliency and waste reduction efforts.			
CE 4.1 Enforce regulations (i.e. limiting development or redevelopment in particularly vulnerable areas) or offer incentives (i.e. points or permit fee reductions for elevating or floodproofing structures) to encourage residents/businesses to shift behavior to prepare for future climate change impacts.	CE-1(7)	P-1.3, B-3.1	SP-2, SP-10
CE 4.2 Create a list of incentives to encourage construction of energy and water efficient buildings, through including but not limited to linkages to the Rate of Growth Ordinance ("ROGO") or other means.	CE-5(8)	E-2.3, E-2.4, B-3.1, W-1.2, W-1.3, W-1.4	SP-1, SP-2
GOAL 5: Promote employee training and reporting on sustainability initiatives.			
CE 5.1 Develop training programs for County buildings and facilities operators on energy and water efficiency techniques and train inspectors to enforce water/energy efficiency standards in adopted building codes.	CE-5(7) CE-6(6)	E-2.1	
GOAL 6: Increase resource efficiency and reduce waste generated in the County.			
CE 6.1 Adopt a plan (e.g green business plan) designed to improve the resource efficiency of the community's businesses including manufacturing, automotive and marine repair.		CE-4(1)	
CE 6.2 Encourage specific product bans to significantly advance progress toward waste reduction goals.	CE-7(2)	S-3.1	SP-2
CE 6.3 Create or update policies for incentives reducing the generation of fats, oils, and grease and their beneficial reuse			SP-2
CE 6.4 Create financial incentives or industry-focused challenges to encourage companies to reduce the intensity of their resource consumption (e.g. Nebraska Energy Office's Dollar & Energy Savings Loan, an external revolving loan fund that provides low-interest loans of up to $750,000 for energy efficiency projects.	CE-4(8)	E-2.3, E-2.4	

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

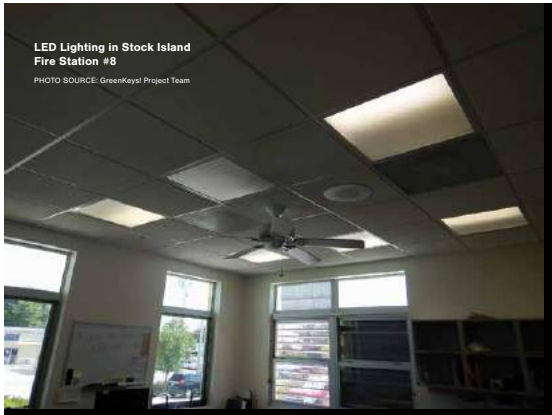
[1]Vulnerability, Consequences, and Adaptation Planning Scenarios ("VCAPS") builds on concepts of hazard management and vulnerability and uses participatory modeling techniques to organize and document dialogue and learning.
[2]HAZUS uses Geographic Information Systems ("GIS") technology to estimate physical, economic and social impacts of disasters. It graphically illustrates the limits of identified high-risk locations.

Several actions not yet implemented in this Focus Area align with, meet and expand existing MCAP recommendations. Developing a geographic database to document flooding events partially satisfies MCAP recommendation M-3.1 which calls for development of a monitoring program to evaluate and observe climate change impacts. Similarly, ensuring that future flood vulnerability assessments build on the work of GreenKeys! and using, and improving elevation certificates both help satisfy MCAP recommendation M-2.2, which calls for the use of improved inundation mapping to identify critical structures and roadway sections.

Enforcing regulations or offering incentives to encourage residents and businesses to shift behavior to prepare for future climate change impacts satisfies MCAP recommendations P-1.3 and B-3.1 which recommend climate adaptation and storm readiness policies and regulations. Programs and regulations to incentivize or require reduced energy and water consumption and train a green workforce could satisfy MCAP recommendations E-2.3 and E-2.4 which recommend enhancing the sustainability of existing businesses and enhancing the sustainable development of new business.

Adopting and enforcing incentives and regulations which encourage residents and business owners to work toward waste reduction targets corresponds with MCAP recommendations S-1.2 and S-2.2 that recommend phased in, zero waste programs and pay-as-you-throw residential waste programs. Similarly, product bans and participation in coalitions to meet waste reduction targets corresponds with MCAP recommendation S-3.1 that recommends lobbying the State of Florida to allow the local community to regulate specific items, like single-use plastic bags. Monroe County adopted Resolution 102a-2015 in April 2015 supporting the initiatives by local governments in Florida to lessen the negative impacts of single-use plastic bags on the environment. This resolution also requested expansion of state legislation to include counties, in addition to municipalities, to allow regulation or ban of these bags.

The Implementation Matrix in Appendix G provides a timeline and method for implementing each recommendation, as well as potential funding sources available to offset the costs associated with each (where available).



LED Lighting in Stock Island Fire Station #8

PHOTO SOURCE: GreenKeys! Project Team

Monroe County Natural Systems

BY THE NUMBERS

2,600

MARINE HABITAT – 2,600 square nautical miles of marine sanctuary (FKNMS)

over 234,000

MANGROVES – 234,000 acres in Monroe County

over 3 million

SEAGRASS BEDS – over 3 million acres in and adjacent to FKNMS

220 miles

CORAL REEFS – 220 miles of coral reef ecosystem

3

Marine Communities – three unique communities: mangroves, seagrass beds, reefs

5

Wetlands – five types totaling over 65,000 acres

2

Upland Vegetation – two communities: tropical hardwood hammocks and pinelands

C. Natural Systems Focus Area

Natural Systems

Natural systems within Monroe County are critical to both the current tourism economy and future resiliency of the County. Monroe County is world-renowned for its diverse marine and terrestrial habitats, which include an extensive living coral barrier reef system off the Atlantic coast, highly productive submerged seagrass and intertidal mangrove communities in Florida Bay, vast subtropical wetlands in Everglades National Park, and rare tropical upland vegetation communities found throughout the Florida Keys archipelago. These habitats are critical to a variety of endemic, endangered, threatened, and otherwise protected species, and also serve as the base of a regional ecosystem that sustains a number of commercially and recreationally important fisheries. As a result, there has been a long-term recognition that the health and sustainability of natural ecosystems is central to the economy, lifestyle, and overall heritage of the County.

The federal government controls a number of large conservation areas in or including portions of Monroe County. These include Everglades National Park, Big Cypress National Preserve, Key Deer National Wildlife Refuge, Crocodile Lake National Wildlife Refuge, Great White Heron National Wildlife Refuge, and the Key West National Wildlife Refuge. Boca Chica Naval Air Station, although it is not primarily a conservation area, provides vital habitat and habitat protection for a number of protected species. Major state-owned conservation areas in Monroe County include John Pennekamp Coral Reef State Park, Dagny Johnson Key Largo Hammock Botanical State Park, Long Key State Park, Lignumvitae Key Botanical State Park, Curry Hammock State Park, Bahia Honda State Park, and the Florida Keys Wildlife and Environmental Area which includes portions of islands from the Saddlebunch Keys to Key Largo. A number of other smaller conservation tracts held by federal, state, county, municipal, and private entities are also found throughout Monroe County. Summed together, approximately 96 percent of Monroe County's land area is set aside for conservation purposes. Jurisdiction of many protected areas also extends into nearshore marine waters on both the Florida Bay and Atlantic sides of Monroe County, and joint federal and state management of all nearshore waters in the Florida Keys is encompassed under the auspices of Florida Keys National Marine Sanctuary ("FKNMS").

Although the natural habitats of Monroe County are among the most highly protected and strictly managed in Florida, there is great concern that various aspects of climate change pose a significant long-term peril to the future health and sustainability of these ecosystems. In fact, numerous scientific studies and previous assessments have noted that Monroe County's marine and terrestrial habitats are likely among the most vulnerable in the United States to climate change impacts.[27] Perhaps the most predictable of these projected impacts is

Young Key Deer Buck on Upper Sugarloaf Key

PHOTO SOURCE: MindMixer participant Midge J.

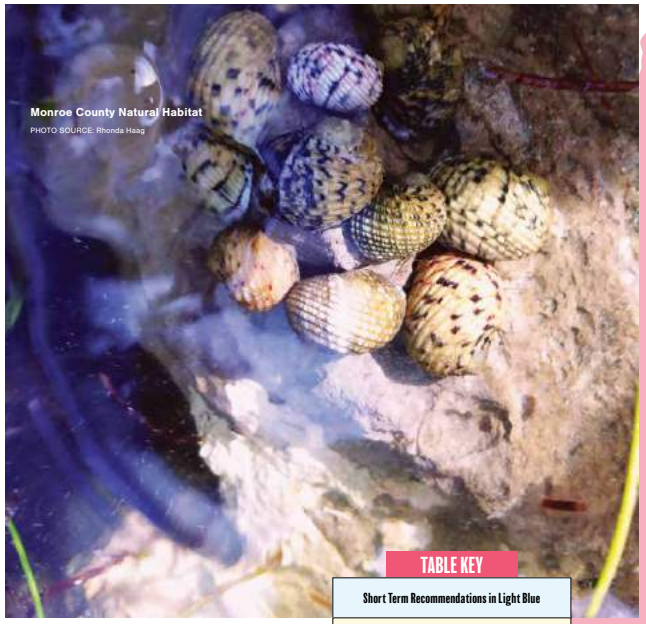
Monroe County Natural Habitat

PHOTO SOURCE: Rhonda Haag

long-term disappearance of upland ecosystems and associated species that become inundated by rising seas.[28] However, there is also significant potential for large-scale changes in the composition and productivity of marine ecosystems due to the combined stressors of ocean acidification (as associated with increased atmospheric carbon dioxide), increased ocean temperatures, and rapid sea level rise.[29] Impacts of climate change on intertidal mangrove wetland communities are perhaps among the least predictable, as such communities could potentially decline or expand depending on multiple factors that include rate of sea level rise, changes in regional sedimentation patterns, and the future extent of human engineering within the intertidal zone.[30]

Despite these risks, a recent study by NOAA in April 2015 found that coastal community resilience to storms, flooding, erosion and other threats can be strengthened when these communities are protected by natural infrastructure including marshes, reefs, and beaches. Resilience of coastal communities is also strengthened with hybrid approaches, like "living shorelines" which combine natural habitat and built infrastructure. Hybrid approaches often provide more cost-effective flood risk reduction options and alternatives for communities, especially when limited space precludes the use of natural coastal protection alone.

Within this Focus Area, several goals were identified to help the County continue on its path to conserving natural systems within its boundaries and to preserve these ecosystems and make the most beneficial use of their protective capacities to protect against sea level rise. The identified goals within this Focus Area are shown in Table 12 to the right.



Monroe County Natural Habitat

PHOTO SOURCE: Rhonda Haag

Given the objectives of this Focus Area and the goals identified for the County (above right), the following Recommendations have been prioritized and are recommended for implementation in the County. The Recommendations in this Focus Area are aimed at further protecting and conserving the valuable natural systems within Monroe County.

TABLE KEY

- Short Term Recommendations in Light Blue
- Medium Term Recommendations in Light Yellow
- Long Term Recommendations in Light Pink

TABLE 12. Natural Systems Goals

1. Continue cooperative efforts that support natural systems restoration and conservation
2. Build a better database of the most vulnerable natural systems within the County
3. Strengthen protection of natural systems within the County
4. Improve and increase incentives for residents to conserve and preserve natural systems
5. Establish a framework for evaluating adaptation strategies
6. Continue County efforts to control invasive species

TABLE 13. Natural Systems Recommendations

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
Goal 1: Continue cooperative efforts that support natural systems restoration and conservation			
NS 1.1 Continue cooperation with federal, state, and private partners in support of coral reef restoration initiatives to support the implementation of strategies that may promote long-term recovery and resilience of the Florida Keys coral barrier reef system in the face of future climate change.		N-1.1	SP-13, NS-9
NS 1.2 Continue cooperation with federal, state, and private efforts to research, implement, and improve seagrass replanting efforts.		N-1.1	NS-9
NS 1.3 Cooperate with the U.S. Fish and Wildlife Service, FWC, and conservation organizations to monitor populations of endangered species, track habitat trends, and, as necessary, implement relocation experiments under conditions of drastic habitat loss for endangered species due to sea level rise.		N-1.1	
Goal 2: Build a better database of the most vulnerable natural systems within the County			
NS 2.1 Conduct a tree inventory and establish tree canopy goals County-wide to determine opportunities for increasing canopy on public and private lands for carbon sequestration benefits.	NS-4(10)		NS-14
NS 2.2 Calibrate the Sea Level Affecting Marshes ("SLAMM") Model results with historic land cover change and field observations and coordinate with land acquisitions.			

*Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
**For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

TABLE 13. Natural Systems Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
NS 2.3 Identify and map natural inundation buffers which could also provide sea level rise adaptation benefits.			SP-13
NS 2.4 Update requirements for ecological buffers and provide guidance on how to establish or adjust these buffers to accommodate sea level rise. Buffers should be designed, where site applicable, to provide "habitat migration corridors" that allow sensitive habitats and species to migrate inland or upland as sea level rises. To accommodate sea level rise, the amount of buffer required between development and coastal habitats may need to be increased.			SP-2
Goal 3: Strengthen protection of natural systems within the County			
NS 3.1 Continue supporting the implementation of traditional coral reef management actions as strategies for supporting the maintenance of functional coral reef systems under rapid climate change. Such actions should clearly include decreasing nutrient and sediment loads, continued restoration of apex predator populations, and creation of physical reef structures that may enhance recruitment of hard coral species.		N-3.3	NS-8, NS-9
NS 3.2 Maintain and enhance programs, like canal restoration, to improve water quality nearshore and offshore to reduce environmental stressors exacerbated by sea level rise and increasing ocean temperatures.			
NS 3.3 Increase the percentage of funding invested in green infrastructure.	NS-1(7)	N-3.1, N-3.2	
NS 3.4 Maintain natural habitat corridors in low-lying areas that allow for up-gradient colonization of tidal wetlands to promote future coverage of mangroves and other tidal wetland ecosystems.			SP-13, NS-5
NS 3.5 Include marine ecosystem mitigation under accelerated sea level rise as a possible overlay component in future land buying and conservation zoning within the County.			SP-2
NS 3.6 Increase efforts to protect and maintain natural habitats, especially "core areas" with the best chances of persistence during sea level rise.			SP-13, NS-5
Goal 4: Improve and increase incentives for residents to conserve and preserve natural systems			
NS 4.1 Create or enhance programs aimed at increasing tree canopy through active planting.			NS-14
NS 4.2 Provide incentives to residents and developers to protect critical watershed protection areas.		N-1.2	SP-2, SP-13
NS 4.3 Review land development regulations to better incentivize protecting natural resources on sites.			SP-2
NS 4.4 Pursue "blue carbon" payments for conserved and restored seagrass areas through international carbon mitigation markets that may begin emerging over the next decade. Such payments could serve as a possible revenue source for adaptive management and, as necessary, assisted migration/colonization of seagrass communities under accelerated climate change scenarios.			

*Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
**For long-term recommendations, the County is not required to wait on implement^{t}tion if the opportunity for earlier implementation presents itself.

TABLE 13. Natural Systems Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
NS 4.5 Pursue future revenue opportunities from "blue carbon" payments associated with conservation and assisted migration of local mangrove habitats. This revenue source could be used for adaptive management and, as necessary, assisted migration of local mangrove habitats.			
Goal 5: Establish a framework for evaluating adaptation strategies			
NS 5.1 Identify intact corridors for future tidal wetland migration corridors as a potential criterion for future land purchase and flood mitigation initiatives within Monroe County. For example, land acquisition priorities.		N-1.2, N-3.1	
NS 5.2 Incentivize "soft options" like living shorelines and mangrove restoration as an alternative to traditional bulkheads for near-term stabilization of eroding coastal areas. Require detailed evaluation of soft options in an alternatives analysis and require the use of soft protection where feasible. Incorporate sea level rise and storm surge into the siting and design of any soft protection projects.			
NS 5.3 Specify priority areas where shoreline protection structures should be removed and continue discouraging the use of hard protection unless no other feasible alternative is available.		N-2.1	SP-13, SP-2
Goal 6 : Continue County efforts to control invasive species			
NS 6.1 Continue invasive exotic species management.			NS-6
NS 6.2 Identify areas for habitat maintenance where the removal of exotics could improve the quality of that area to serve as a natural or soft protection option. Establish maintenance schedule that factors in benefits of managing habitats as a natural defense strategy against sea level rise impacts.			
NS 6.3 Establish and enforce regulations to control the use and sale of invasive species. This would expand the County's existing regulations limiting invasive species in site restoration and landscaping.	NS-2(7)	B-1.1	

*Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
**For long-term recommendations, the County is not required to wait on implement^{t}tion if the opportunity for earlier implementation presents itself.

Boca Chica
PHOTO SOURCE: Rhonda Haag

Several actions not yet implemented in this Focus Area align with, and could satisfy, existing MCAP recommendations. Increasing the percentage of funding invested in green infrastructure satisfies MCAP recommendations N-3.1 and N-3.2 which recommend protecting, restoring and enhancing green infrastructure areas and continuing to prioritize purchasing natural lands for conservation purposes. Enforcing regulations to control the use and sale of invasive species corresponds directly with MCAP recommendation B-1.1 which recommends encouraging native flora planting and discouraging the spread of invasive species.

Creating incentives for residents and business owners to protect and restore critical watershed protection areas corresponds with MCAP recommendation N-1.2 which recommends protecting resources of concern. Similarly, continued cooperation with federal, state and private entities to research, implement and improve resilience of coral reefs and seagrass beds corresponds with MCAP recommendation N-1.1 which calls for coordination with state, regional and national strategic planning efforts to evaluate vulnerabilities in the natural environment to climate change impacts.

The Implementation Matrix in Appendix G provides a timeline and method for implementing each recommendation, as well as potential funding sources available to offset the costs associated with each (where available).

Boca Chica Habitat
PHOTO SOURCE: Rhonda Haag

Monroe County Built Environment

BY THE NUMBERS

311

PAVED ROADS – 311 miles of paved roads (unincorporated County)

1,158

NAMED STREETS 1,158 named roads

25

BRIDGES – 25 County-maintained bridges spanning 1.26 miles

73,422

BUILDINGS – 52,935 homes and 20,487 businesses in Monroe County

Aerial view of Jewfish Bridge with 18 mile stretch in the background and Key Largo in the forefront

PHOTO SOURCE: Greenkeys! MindMixer participant Kim G.

D. Built Environment Focus Area

Built Environment

Monroe County's Built Environment includes roads, public buildings, homes, and private buildings and the power supply. Note that specific County-owned facilities (buildings) are included in the Government Operations Focus Area discussed in Section 8(a) above. Monroe County's roadway network consists of the major thruway, U.S. Highway 1, and connector and local streets that provide access to abutting land uses and channel traffic towards U.S. Highway 1. Currently, there are 1,158 named streets in Monroe County totaling 311 miles of paved roadways in unincorporated Monroe County (not including FDOT-managed roadways).

Existing and planned bicycle trails for the Keys, including the Overseas Heritage Trail, account for well over 100 miles of trails. All plans by FDOT, both current and future, for U.S. Highway 1 include bike lanes. Additionally, all of the larger parks and Federal and State conservation areas have bike trails within their sites.

Two (2) utilities provide electric services in Monroe County. Florida Keys Electric Cooperative provides electric service to the Upper and Middle Keys from north Monroe County to the Seven Mile Bridge. Keys Energy Services provides electric service south of the Seven Mile Bridge to Key West. FKEC serves approximately 32,000 accounts, operates six (6) substations, two (2) office facilities, and maintains 800-miles of power lines. FKEC also maintains a 138,000 kilo-volt transmission line that brings power from the mainland. FKEC purchases 100% of its energy needs from Florida Power & Light ("FPL"). KES serves more than 28,000 customers, maintaining over 338 miles of electrical lines in the Lower Keys.

Currently, there are 52,935 houses[31] and 20,487 businesses[32] in Monroe County. The County regulates development and its rate of growth through a rate of growth ordinance ("ROGO") adopted in 1992. The County's ROGO severely restricts new residential and commercial construction to a certain number of new units annually. The number of allocations available each year is determined at the state level and based on the progress the County has made toward achieving State-set goals such as a central wastewater system being available Keys wide. The total number of available allocations is split among three (3) areas of the County: 1) the Upper Keys, 2) the Lower Keys and 3) Big Pine and No Name Key planning area. Essentially, under ROGO, applicants compete against one another within the same sub-area for building permits. Applications for affordable housing are handled differently, with affordable housing applicants competing against all applicants for affordable housing permits Keys wide (no sub-areas). Allocations are awarded quarterly in each sub-area, except for Big Pine Key and No Name Key where allocations are awarded annually. In 2006, the County revised its ROGO system by implementing a tier system to establish a method of directing growth to acceptable areas while encouraging conservation in environmentally-sensitive areas.

From a land use perspective, it will become increasingly risky to develop in extremely low-elevation land areas where tidal flooding is common and storm surge is severe as sea level rise threats increase. Existing building codes and flood insurance requirements will not eliminate this risk. As sea level rise projections are approached and surpassed, policies and land development regulations will need to be periodically updated to ensure that existing risks are accounted for. Traditional controls, like land-use zoning, are one strategy to limit development in such areas, or create stricter or incentivize "above code" requirements for redevelopment such as higher freeboard standards. Vulnerability data from this planning process can also be used to identify areas where an overlay or adaptation action area may be established. Finally, for some of the built environment, retreat to other areas or higher ground may become a strategy that is utilized over time. This could become necessary as private and public buildings and other infrastructure, including roads, become more challenging to maintain as the environment continues to change. There are many public health and safety implications that must be addressed, which may result in the abandonment of certain infrastructure or negotiated levels of service. Issues could include loss of access to a property, reduced quality of access or loss of property value due to removal of an inter-related public or private asset. In some instances, the County may need to consider adoption of a "environmentally-constrained roads" or "natural forces" ordinance to redefine level of service requirements in areas where infrastructure maintenance is no longer possible or economically feasible. See Appendix H for a model ordinance.

There are several options, or adaptation strategies, that can be implemented to respond to sea level

Duval Street, Key West

PHOTO SOURCE: Greenkeys! Project Team

Jordan v. St. Johns County CASE STUDY

This issue involved a dispute among several private property owners challenging St. Johns County over their legal responsibility to maintain Old A1A, a coastal road inundated by storms and hurricanes. In 1979, the State deeded Old A1A to the County. By 2005, the County enacted a temporary residential building moratorium for properties along the roadway segment at issue (approximately 60). In response to the County's actions, a complaint was filed in 2005 against St. Johns County claiming generally that the County had deprived these landowners of access to their land.

A total of five claims were raised involving whether the County had a duty to maintain Old A1A and whether their failure to do so constituted a legal taking under the law. The case ultimately settled whereby the County and property owners came to agreement on levels of service for the road in the future, recognizing the environmental challenges impacting the quality of the road in the future.

The County adopted an Ordinance in 2012 to specifically address natural forces' degradation and damage to public roads and streets and other improved public rights-of-way used for travel and recreation. The law is far from settled on this issue, but lessons learned to date can, and should, be used to guide future Monroe County planning decisions especially in relation to "environmentally-compromised" infrastructure.

rise and increased storm surge. Options are broken into four (4) categories, including: 1) Avoid, 2) Accommodate, 3) Protect, and 4) Retreat.

Adaptation strategies focused on **Avoidance** limit development in particularly vulnerable areas, redirecting development to less vulnerable areas. Adaptation strategies that **Protect** use hard or soft structures to protect structures and prevent flood waters from reaching community assets. Hard structures could include seawalls or bulkheads, while soft structures could include geotextiles tubes and giant fabric sandbags designed to be replaced after storms. This strategy does not protect wetlands and beaches in front of these structures which are at risk of disappearing as they are pinched out between the rising water levels and the fortifying structures behind them. Adaptation strategies that **Accommodate** modify community assets to reduce the impact of flood waters from storm surge, but do not completely protect against sea level rise. Accommodation acknowledges long-term effects and that structures will become wet, but implements short-term actions to make structures more resilient, such as elevating structures or their critical systems. Last, **Retreat** involves relocating existing structures, people and land uses away from high-risk flood areas to new locations to eliminate the flooding risk, damage and loss. This adaptation strategy allows wetlands, beaches and natural coastal habitats to migrate to higher elevations naturally. Individuals and business owners affected by future sea level rise will need to make adaptation decisions about their own homes, land and businesses. A main goal of this planning process and the recommendations in this section is to assist individuals and business owners in making the best, most informed decisions for their own particular circumstances. Individuals and business owners may choose to elevate or relocate structures further away from vulnerable areas. Alternatively, they may choose not to make any structural or relocation decisions based upon the anticipated consequences of sea level rise.

Within this Focus Area, several goals were identified to help the County prioritize its efforts. The identified goals within this Focus Area are shown in the Table 14 to the right.

Given the objectives of this Focus Area and the goals identified for the County, the Recommendations in Table 15 have been prioritized and are recommended for implementation in the County. The recommendations in this Focus Area are intended to address vulnerabilities to the current built environment, further reduce noise and light pollution County-wide, and improve alternate modes of transportation through community development patterns and livability and design characteristics.

TABLE KEY

Short Term Recommendations in Light Blue
Medium Term Recommendations in Light Yellow
Long Term Recommendations in Light Pink

TABLE 14. Built Environment Goals

1. Increase the resilience of structures and buildings within the County
2. Continue making improvements to promote alternate modes of transportation within the County
3. Strengthen regulation of noise and light pollution within the County
4. Promote urban agriculture within the County

TABLE 15. Built Environment Recommendations

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
Goal 1: Increase the resilience of structures and buildings within the County			
BE 1.1 Conduct additional study of a freeboard initiative to elevate and floodproof buildings within Monroe County.			WS-11
BE 1.2 Provide outreach on "demonstration" projects (e.g. Stock Island Fire Station and Bayshore Manor) to provide examples of benefits. Distribute information about GreenKeys! planning efforts at County events.			
BE 1.3 Ensure resiliency and energy efficiency design considerations are included in affordable housing projects.			
BE 1.4 Create a list of funding sources to finance energy-efficiency and resiliency upgrades in residences and businesses (e.g. Property Assessed Clean Energy ("PACE") or other financing strategies).			
BE 1.5 Develop criteria for Adaptation Action Areas and adoption in Comprehensive Plan.		P-2.4	SP-3, SP-4
BE 1.6 Maintain and strengthen setback policies to account for sea level rise impacts.		B-2.1	SP-2
BE 1.7 Consider imposing use restrictions on development in areas most vulnerable to flooding.		B-2.1	SP-2, SP-10

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself

TABLE 15. Built Environment Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
BE 1.8 Adopt an ordinance to address "environmentally-challenging locations" and damage to public roads, streets, highways, bridges, sidewalks, curbs and curb ramps, crosswalks, bicycle ways, hiking and walking paths and trails, underpasses, overpasses, and other improved public rights-of-way used for travel and recreation or other appropriate infrastructure.			
BE 1.9 Establish triggers for retrofit of a structure impacted by changing site conditions such as when erosion is within a certain distance of the foundation; when monthly high tides are within a certain distance of the finished floor elevation; or when a setback decreases to a certain width. Consider these concepts in development/redevelopment principles: • Address sea level rise in "non-conforming" structure policies. • Address sea level rise in redevelopment or replacement of existing structures. • Use rolling easements in property development and redevelopment strategy. • Enhance Transfer of Development Rights program parameters to account for sea level rise impacts by directing growth to land outside of potentially vulnerable areas.		B-2.1	SP-2, SP-10
BE 1.10 Incentivize available "resiliency" construction standards (e.g. Resilience STAR™, the Institute for Business and Home Safety's FORTIFIED Home™, FORTIFIED Commercial, FORTIFIED Safer Business, FORTIFIED for Safer Living®, RELi or others) to determine which will be most appropriate for County regulations.			SP-2
BE 1.11 Enhance coordination with the development and real estate communities to provide information about projected sea level rise impacts and solutions from the GreenKeys! planning process. Schedule annual briefings with the predominant industry associations to increase communication.			
BE 1.12 Develop incentive program for developers and property owners who relocate structures landward, develop in less vulnerable tiers, conserve more open space along the shoreline, and/or preserve or restore natural flood buffers.			SP-2, SP-10
Goal 2: Continue making improvements to promote alternate modes of transportation within the County			
BE 2.1 Analyze pedestrian network to improve safety and continue increasing total mileage of bicycle lanes and shared use paths, including coordination with Oversea Heritage Trail.	BE-7(7)	B-4.2	SP-27
BE 2.2 Amend the land development regulations to require one out of three following elements for new parking lots over a certain threshold in the number of spaces: (a) 50 percent of the parking lot to be shaded by tree canopy, (b) solar photovoltaic panels, (c) or the use of cooling pavements or pavement coatings with albedos greater than 40 percent if trees and solar panels are impractical due to site considerations. Incorporate sustainable parking practices and design into land development regulations such as increasing stormwater infiltration where applicable, including bike parking, reducing heat island effects, and other strategies to reduce environmental impacts.			
BE 2.3 Develop a feasibility analysis for a public bike share program in more urbanized areas.	BE-7(9)	B-4.1, B-4.2	

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

TABLE 15. Built Environment Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
BE 2.4 Establish a target to reduce per capita vehicle miles travelled. Create vibrant neighborhoods where a certain percentage of residents can easily walk or bicycle to meet all basic daily, non-work needs and have safe access to transit.			SP-26, SP-27
BE 2.5 Achieve recognition as a Bicycle Friendly Community or Walk Friendly Community.			
BE 2.6 Include transit incentives in affordable housing projects.			
BE 2.7 Develop a ride sharing program for Monroe County employees to identify potential carpool candidates.			
BE 2.8 Adopt a complete streets policy for County maintained and controlled roads. Complete Streets improvements support safe, efficient, and convenient mobility for all users (pedestrians, bicyclists, transit, motorists) regardless of age or ability.	BE-7(2)		SP-26
BE 2.9 Implement programs to improve pedestrian and bicycle safety (e.g. targeted speed and red light enforcement using radars or cameras in areas where frequent violations or collisions have occurred; targeted crosswalk right-of-way enforcement; targeted bicycle traffic law obedience enforcement; bicycle lane encroachment enforcement; or school zone enforcement).	BE-7(5)	B-4.2	SP-26
BE 2.10 Identify strategies to provide better public transportation options through improved connectivity, extended routes, expanded hours, increased reliability and more education of available services.			SP-27
Goal 3: Strengthen regulation of noise and light pollution within the County			
BE 3.1 Incorporate Dark Skies best practices into land development regulations to reduce light pollution and minimize bird strike hazards. This could include incorporation of Dark Sky Friendly Lighting into County infrastructure to further reduce light pollution within the County. Establish programs that eliminate existing sources of light pollution coming from County-owned entities.	BE-1(9)		
BE 3.2 Review code enforcement procedures to specifically track noise and light violations so that trends can be monitored to reduce these types of issues.	BE-1(6)		
Goal 4: Promote urban agriculture within the County			
BE 4.1 Analyze land development regulations and zoning requirements to determine how to allow and promote sustainable food system including local agriculture, farmers markets, community gardens, Farm-to-School programs, Dock-to-Dish programs, etc.	EAC-2(2) HS-4(2)	B-1.2	SP-17, AG-6

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself

Shaw Drive Flooding

PHOTO SOURCE: Kim Weatherly

Several actions not yet implemented in this Focus Area align with MCAP recommendations. Developing alternative transportation safety programs, increasing sidewalk miles, and supporting bike share programs correspond directly with MCAP recommendations B-4.1(3) and (4) which recommend the support of ride share programs and B-4.2 which recommends enhancement of bicycle, pedestrian, and motorcycle safety. Strengthened setback policies, use restrictions on development in areas most vulnerable to flooding and establishing retrofit triggers all correspond with MCAP recommendation B-2.1 which recommends development and implementation of adaptive planning and zoning policies, regulations and programs to ensure that appropriate land use, construction and redevelopment activities address the potential impacts of sea level rise.

The Implementation Matrix in Appendix G provides a timeline and method for implementing each recommendation, as well as potential funding sources available to offset the costs associated with each (where available).

Monroe County Health & Safety

BY THE NUMBERS

76,351
POPULATION:
76,351 residents

3 million
VISITORS:
Close to 3 million annually

69
HEALTH DEPARTMENT:
69 full-time employees with 4 clinics Keys-wide

4+40
HOSPITALS & CLINICS:
4 hospitals and over 40 public and private clinics in the Florida Keys

9
FIRE RESCUE:
9 stations Keys-wide and 1 of only 31 certified firefighting training centers in Florida

11
SHERIFF STATIONS:
Sheriff's Office has 11 facilities Keys-wide and 546 employees

E. Health & Safety Focus Area

Health & Safety

Sustainable communities are those that achieve social health and resiliency. The social aspect focuses on the health of the resident population understanding that healthy communities are sustainable communities. Resiliency in this Focus area includes not only climate change resiliency, but also disaster management through emergency response and preparedness.

Monroe County's unique geography plays a major role in how goods and services, including health care and emergency services, are provided. The Florida Department of Health in Monroe County, Monroe County Social Services Department and Monroe County Department of Emergency Management all provide vital health and safety services throughout the County. The Florida Department of Health in Monroe County serves the residents of and visitors to the Florida Keys, maintaining clinics and community health service offices from Key West to Key Largo. The County's social services are offered primarily to assist disabled individuals, senior citizens, families with young children, the working poor and those individuals who are unable to be assisted with traditional support programs. Emergency Management services include both Fire and EMS throughout the County with a focus on emergency response and preparedness. Emergency response and evacuation is especially critical in Monroe County due to influxes in the tourist population during certain times of year and the presence of only one (1) main route of ingress and egress into the Florida Keys.

From a resiliency and disaster management standpoint, the County collaborates with many local municipalities for disaster management planning for both natural and man-made hazards, including hurricanes and flooding. Such planning efforts are conducted to reduce harm to humans and property by utilizing long-term preventative and collaborative approaches to avoid emergency incidents and minimize their impacts. As part of state planning efforts for natural disaster mitigation and preparedness, the County prepared and updates its Local Mitigation Strategy ("LMS"). The 2010 LMS for Monroe County and its Municipalities[35] is one of the County's critical steps to improve resiliency to natural hazards. The LMS anticipates damage and disruption that could result from a hurricane or other disaster, and then determines how best to eliminate or at least reduce the expected damage. The County's LMS was prepared in accordance with FEMA and Florida Division of Emergency Management ("FDEM") requirements. The LMS serves several purposes, including strategies for long-term resilience to natural hazards through actions that reduce exposure of people and property, and in doing so, LMS projects are eligible for certain state and federal grants. The LMS was recently updated, with final LMS approval due by December 6, 2015.

The health of Monroe County residents is fundamental to sustainability, yet it's health status is profoundly influenced by factors outside the traditional healthcare system. The social, economic,

and physical conditions in which people live affect choices regarding behaviors that ultimately affect health outcomes. The knowledge and means to access healthy food, physical activity opportunities, safe housing, education, income, and transportation options, and avoid toxic exposure all contribute to an individual's overall health. Healthy communities tend to be more sustainable communities. Active lifestyles promote sustainability by reducing the health costs borne by all, supporting the local economy through increased recreational tourism, increased property values near parks and trails, and reducing air pollution and GHG emissions through active transportation.

Climate change and sea level rise will also have impacts on the health of Monroe County residents. The Centers for Disease Control and Prevention ("CDC") and the National Environmental Health Association ("NEHA") have identified several health impacts specifically related to climate change, including: 1) heat impacts, 2) vector borne diseases, 3) extreme weather events, 4) air quality, and 5) waterborne diseases.

The impacts to human health from heat stress include exacerbated chronic conditions like respiratory and cardiovascular disease. It is estimated that during the next 5-25 years, Florida will likely see as many as 1,840 additional deaths per year due to extreme heat. The elderly and young children are most vulnerable to heat-related health risks. Additionally, as temperature rises past human comfort levels, labor productivity will decline, particularly in "high-risk" industries involving outdoor work (which is prevalent in the Keys). Because of this risk, it is important for the County to fully understand the climate risks and become a model of climate risk mitigation and resilience. Existing and new vector borne diseases may prevail in new environments as the natural barriers of inhospitable environments to the vectors of such diseases are diminished in a warming climate. The County's existing partnership with the Florida Keys Mosquito Control District, the entity charged with controlling mosquito populations in the Keys to minimize the spread of mosquito-borne diseases, could become increasingly critical as the climate warms. Stronger storms, more frequent floods, hurricanes, and tropical storms have numerous immediate to long-term physical and emotional health impacts, including injury, drowning, death from structural collapses, infectious and chronic disease, displacement, and socioeconomic disruption. Even air quality impacts may occur, causing heightened levels of allergies and respiratory disease as ground-level pollutants increase. Finally, pathogens and pollutants from runoff and flooding have the potential to enter water supplies, while increased temperatures will support pathogen growth, and concentration of these agents under drought conditions will increase the threat of waterborne disease.

Monroe County is responding and preparing for these health effects through a number of collaborative efforts with several entities, including: Building Resilience Against Climate Effects, the SE FL Climate Change Compact, Health Impact Assessment Public Health leaders, the Marshall Foundation, Early Learning Miami, Florida International University, the University of Florida's Extension Service, the South Florida Regional Planning Council and many other local partners.[54] Engaging residents in conversations about health impacts and weather is the starting point for creating improved resilience over the long term.

Within this Focus Area, several goals were identified to help the County increase the health and wellness of its population and address public health and safety issues implicated by climate change and sea level rise. The five (5) identified goals in this Focus Area are shown in Table 16 to the right.

This Focus Area recognizes that the development of healthy, safe and resilient communities requires proactive efforts to prevent disease, injury and premature death. There are many ways to accomplish this, like fortifying protective factors and reducing risk factors that undermine healthy outcomes. Given the objectives of this Focus Area and the goals identified for the County, the following Recommendations in Table 17 have been prioritized and are recommended for implementation in the County.

TABLE KEY

- Short Term Recommendations in Light Blue
- Medium Term Recommendations in Light Yellow
- Long Term Recommendations in Light Pink

TABLE 16. Health & Safety Goals

1. Ensure that sea level rise and climate change is being considered in health and safety and emergency preparedness and response planning
2. Increase efforts to consume local food, including seafood
3. Incorporate active living into County planning and capital improvement projects
4. Promote wellness and healthy living among residents throughout the County
5. Continue efforts to reduce the use and impacts of toxic chemicals throughout the County

TABLE 17. Health and Safety Recommendations

Recommendation		STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
Goal 1: Ensure that sea level rise and climate change is being considered in health and safety and emergency preparedness and response planning				
HS 1.1	Incorporate future sea level rise impacts into emergency management plans including but not limited to the Local Mitigation Strategy and its projects. Ensure that post-disaster redevelopment planning considers sea level rise risks.			
HS 1.2	Discuss emergency prevention and response, including nuisance flooding and sea level rise, with County residents at the neighborhood level.			HS 1.3
HS 1.3	Analyze health issues caused by extreme heat days and associated poor air quality, especially for populations most vulnerable to these impacts by improving the preparation for and response to heat by health, community service, public safety and emergency response staff and services.			
HS 1.4	Partner with Mosquito control agencies to develop better elevation data.			
HS 1.5	Partner with Mosquito Control agencies to identify risk areas from vector populations by managing habitat and by working with the community to reduce health risks.			
HS 1.6	Ensure that climate change and sea level rise information is available to all groups and in multiple languages.			
HS 1.7	Work with local animal services/rescue/control organizations to ensure pet safety health issues in the face of sea level rise.			

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

TABLE 17. Health and Safety Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
HS 1.8 Incorporate future sea level rise impacts into the 2020 Local Mitigation Strategy Update.			SP-2, RR-3
Goal 2: Increase efforts to consume local food, including seafood			
HS 2.1 Support school district participation in Florida's Farm to School program that connects in-state growers with local schools.			
HS 2.2 Identify appropriate spaces in County Parks and partner with School District to provide opportunities for community gardens.	HS-4(2)		
HS 2.3 Expand Community Supported Agriculture ("CSA") programs throughout the County to promote local agricultural products (e.g. Dock-to-Dish and Annie's garden).		B-1.2	
HS 2.4 Encourage the sale of locally-caught fish by charter boat captains and allow sale of locally-caught fish at the docks and/or to local restaurants.			
Goal 3: Incorporate active living into County planning and capital improvement projects			
HS 3.1 Improve infrastructure for increased physical activity and design routes that are integrated into the regional park system. Design parks to maximize space for physical activity.			
HS 3.2 Create guidelines to encourage incorporation of active building design in new buildings. Active building design is a process of consciously incorporating building design features that encourage physical activity (e.g. bicycle storage, highly visible stairways, and showers and locker rooms).	HS-1(3)	P-2.2, B-4.2	
HS 3.3 Adopt a "health in all policies" statement or policy commitment expressing the County's clear commitment to consider community health impacts of local decisions and take policy action to improve public health. This commitment can extend to land use, design, transportation, and other aspects of the built environment that impact the ability for residents to walk or bicycle to destinations.	HS-3(10) HS-2(3)		
HS 3.4 Evaluate current policies and regulations to identify appropriate places to include wellness, active living and active building design concepts.	HS-1(1)	P-2.2	
Goal 4: Promote wellness and healthy living among residents throughout the County			
HS 4.1 Encourage worksite wellness programs that provide physical activity and weight loss programs at work.			
Goal 5: Continue efforts to reduce the use and impacts of toxic chemicals throughout the County			
HS 5.1 Identify resources to provide disposal options for toxic materials, such as household hazardous waste.			
HS 5.2 Develop informational resources on how to properly dispose of unused medicine. Coordinate with health care facilities to offer and promote collection sites or services for unused medicines.			
HS 5.3 Create a healthy hazardous product initiative that includes: •Educating residents about proper use and disposal of hazardous products, and making information about more sustainable household products available. •Hosting green cleaning workshops and awareness programs.			

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

TABLE 17. Health and Safety Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
HS 5.2 Develop informational resources on how to properly dispose of unused medicine. Coordinate with health care facilities to offer and promote collection sites or services for unused medicines.			
HS 5.3 Create a healthy hazardous product initiative that includes: •Educating residents about proper use and disposal of hazardous products, and making information about more sustainable household products available. •Hosting green cleaning workshops and awareness programs.			

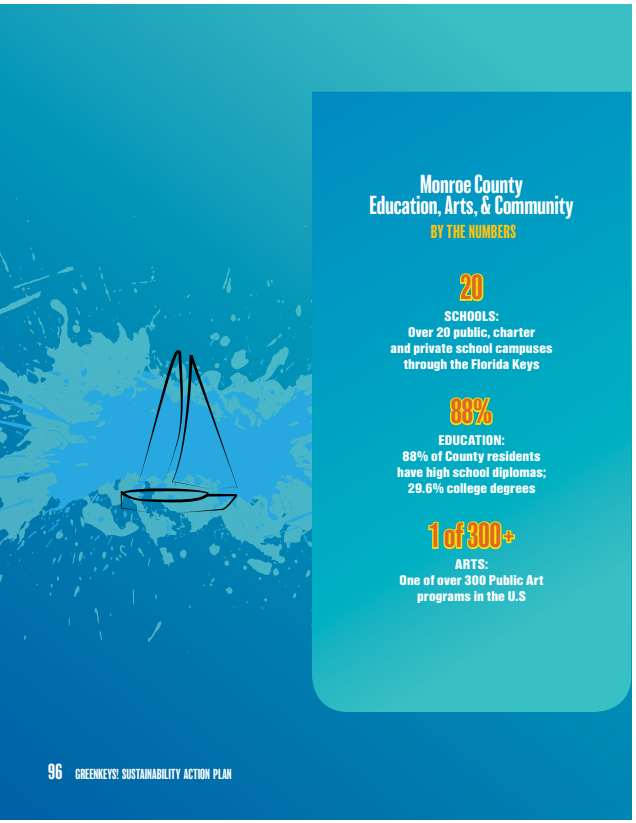
* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

Several actions not yet implemented in this goal area align with, and could satisfy, existing MCAP recommendations. These include incorporating active living/transportation in the Comprehensive Plan, encouraging active building design in new construction, and improving the walkability of the Keys through increased bicycle and pedestrian pathways which directly correspond with MCAP recommendations P-2.2 and B-4.2 which recommend advancing livable communities and enhancing bicycle/pedestrian safety and encouraging alternative modes of transportation, respectively. Additionally, the adoption of zoning or land development regulations permitting farmers markets and community gardens satisfies MCAP recommendation B-1.2 which recommends encouraging both farmers markets and community gardens within the County.

The Implementation Matrix in Appendix G provides a timeline and method for implementing each recommendation, as well as potential funding sources available to offset the costs associated with each (where available).

Yellowtail Snapper caught in Monroe County

PHOTO SOURCE: Greenkeys! Project Team



Monroe County Education, Arts, & Community

BY THE NUMBERS

20

SCHOOLS:
Over 20 public, charter and private school campuses through the Florida Keys

88%

EDUCATION:
88% of County residents have high school diplomas; 29.6% college degrees

1 of 300+

ARTS:
One of over 300 Public Art programs in the U.S

F. Education, Arts, & Community; Economy & Jobs; and Equity & Empowerment Focus Area

The Education, Arts & Community portion of this Focus Area promotes an educated, cohesive, and socially connected community. Monroe County established an Art In Public Places Committee in 2001 with the purpose of enriching culture and benefitting the citizens and visitors of the County by placing art in public places. The Committee administers the purchase and installation of artwork under a one (1) percent for art program in any new major County construction or renovation.

The Florida Keys Council of the Arts serves as staff to this committee and is the main source of information on arts and culture in the Florida Keys. Art in public places projects featuring the art of local artists have been completed at the following locations: 1) The Roth Building on Plantation Key (2003), 2) Fire Stations in North Key Largo and Tavernier (2007), 3) Freeman Justice Center in Key West and Big Pine Park Community Center (2008), 4) Murray E.

"The Art in Public Places Committee administers the purchase and installation of artwork under a 1 percent for art program in any new major County construction or renovation."

Nelson Government & Cultural Center in Key Largo, Key West International Airport and Big Pine Key Fire Station (2009), and 5) Conch Key and Stock Island Fire Stations (2014). Upcoming projects include Bernstein Park, Marathon Court House renovations, Freeman Justice Center lobby expansion and Freeman Justice Center Drug Court renovations.

The Economy & Jobs portion of this Focus Area promotes equitably shared prosperity and access to quality jobs. Tourism is the largest industry in the Florida Keys and a major factor in the Monroe County economy, contributing roughly 60 percent of the local economy and 44 percent of the local income. Additionally, the tourism industry — including hotels, guesthouses, restaurants, and attractions — accounts for nearly 55 percent of the total workforce in the County. Most workers in Monroe County are employed in one of five areas: accommodation and food service, retail trade, public administration, health care and social assistance or educational services. The County has one of the lowest unemployment rates in the State of Florida.

Many communities are discovering that energy efficient operation and the use and promotion of

Monroe County Economy & Jobs

BY THE NUMBERS

EMPLOYMENT:
Most employed in accommodation and food service, retail trade, public administration, healthcare and social assistance or educational services

$53,821
MEDIAN INCOME

$2.23 billion
TOURISM:
Contributes $2.23 billion to local economy and $870 million to local income

environmentally-responsible products can drive local economic activity in emerging and expanding green industries which also contribute to a community's overall level of sustainability. Sustainable business models minimize impacts to the environment while maximizing profit simultaneously. In the private sector, energy and water cost savings can be converted to profits or diverted to other business investments. For the public sector, these savings represent a more efficient use of taxpayer dollars and provide an opportunity to lead by example. In addition, growing and strengthening local businesses and commerce within a community contributes to the economic sustainability and resilience of that community.

The Equity & Empowerment portion of this Focus Area promotes equity, inclusion, and access to opportunity for all residents. As of 2010, the population of Monroe County was distributed as follows: 89.5% White, 5.7% African American, 0.4% Native American/Alaska Native, 1.1% Asian, 0.1% Native Hawaiian/Pacific Islander, 1.4% Other Race and 1.8% Two or More Races. Equity and empowerment are critical components of sustainability. Studies have shown that environmental degradation intensifies inequality in human development and vice versa. Environmental sustainability is most easily achieved by addressing health, education, income, and gender disparities together with the need for action on energy production and environmental protection. Fairer flows of public investment; more democratic, inclusive and accountable institutions; coordinated implementation and monitoring systems; and climate resilient strategies all contribute to achieving equitable and sustainable development.

Within this Focus Area, several goals were identified to help the County incorporate sustainability into all aspects of its economy. The identified goals within this Focus Area are depicted in Table 18 to the right. Given the objectives of this Focus Area and the goals identified for the County, the Recommendations in Table 19 have been prioritized and are recommended for implementation in the County.

TABLE KEY

Short Term Recommendations in Light Blue
Medium Term Recommendations in Light Yellow
Long Term Recommendations in Light Pink

TABLE 18. Education, Arts & Community; Economy & Jobs; and Equity Empowerment Goals

1. Incorporate sustainability into ongoing education and arts programs in the County
2. Encourage a balanced local economy that is protective of all sectors of the County's population
3. Promote sustainability in all sectors of the County's economy

TABLE 19. Education, Arts & Community; Economy & Jobs; and Equity & Empowerment Recommendations

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
Goal 1: Incorporate sustainability into ongoing education and arts programs in the County			
M 1.1 Continue to promote arts, cultural, entertainment, and historic preservation amenities to residents and local, national and international audiences. Create a County-wide "art and design week" that coordinates with existing arts events to promote local arts and culture and attract artists and innovators from art, design, architecture, fashion, and related fields.			
M 1.2 Encourage sustainable practices in Monroe County's Art in Public Places Program.			
M 1.3 Use County libraries as a platform to promote environmental and social engagement.			
M 1.4 Encourage and partner with municipalities to expand "arts districts" and events to promote them.			
M 1.5 Continue to attract and sponsor major arts, design, music and cultural events as a way of bringing tourists into the County.			
M 1.6 Build on the County's success in its commitment to public art to create opportunities along prominent streets and in public spaces. Take residents' preferences into account and use local artists where possible to build neighborhood pride as well as identity to reinforce their uniqueness, image, and branding, and attract additional visitors.			

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

TABLE 19. Education, Arts & Community; Economy & Jobs; and Equity & Empowerment Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
M 1.7 Target artists and the creative industries to bring economic and community development to neighborhoods and districts by increasing the connections between the arts and cultural sector and other sectors of the economy and providing information about locally available resources and assets.			
M 1.8 Require art, cultural, and educational organizations to establish recommended sustainability policies and practices as a condition for the receipt of public funds or services.			
M 1.9 Develop a special "Arts Pass" and/or "Event Pass" that residents and visitors can purchase for a reduced rate for certain County-wide events to supplement existing special ticket price initiatives (e.g. Historic Tourist Discounts).			
M 1.10 Develop an "arts, culture, and innovation" policy or plan clearly defining County's role based on: • A survey of the location of arts amenities throughout the County. • Ensure Plan aligns with County's economic and community development approach including the economic, environmental, and social impact of arts, design, and cultural industry in County. • Highlighting the community's existing cultural assets by increasing their presence on the street and in highly visible public forums. • Establishing priorities for public art and design projects, events, and locations for the next fifteen years. • Encouraging streetscape and public spaces that promote cultural and arts projects throughout the County.			
Goal 2: Encourage a balanced local economy that is protective of all sectors of the County's population			
M 2.1 Encourage diverse community involvement in County government. Post vacancies and announcements regarding governmental boards in public locations.	EAC-5(3)		
M 2.2 Adopt policies or regulations that increase overall market demand for green buildings and associated materials, renewable energy products or infrastructure, and recyclable products.	EJ-2(2)	S-2.5	SP-2
M 2.3 Provide outreach to increase green and resilient construction practices for retrofits and encourage sustainable business practices and new economic opportunities.		E-2.4	SP-2
M 2.4 Address impacts of climate change and sea level rise on disadvantaged social groups, values and symbolic places. Target an annual community workshop aimed at underserved and underrepresented populations on sea level rise and resilience.			PO-1

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

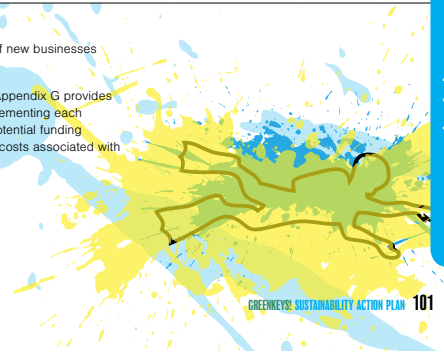
TABLE 19. Education, Arts & Community; Economy & Jobs; and Equity & Empowerment Recommendations Continued

Recommendation	STAR Identifier	Corresponding MCAP Recommendation	Corresponding RCAP Recommendation
Goal 3: Promote sustainability in all sectors of the County's economy			
M 3.1 Develop and maintain a Sustainability Handbook for business owners on the County's GreenKeys! website,		E-2.3, E-2.4	PO-3
M 3.2 Encourage sustainable business practices such as recycling and use of local and sustainably-grown products. Hold at least one annual briefing with the predominant Chambers of Commerce to discuss opportunities for enhancing sustainability-related incentives and initiatives.		E-2.3, E-2.4	
M 3.3 Create a web-based clearinghouse for best management practices, local data, tools, and tracking for the business community.		E-2.4	PO-3
M 3.4 Promote local agricultural programs (e.g. bees).			
M 3.5 Work with Florida Keys Community College to expand or create a green jobs program for new opportunities in green industries and trades such as green buildings and energy management.-	EJ-6(9)	E-2.1	
M 3.6 Create or support promotional campaigns to bank locally, buy locally, or buy from small and independent businesses/retailers.	EJ-3(4)		

* Short-term (1-3 yrs.) recommendations in light blue, medium-term (3-5 yrs.) recommendations in light yellow, and long-term (>5 yrs.) recommendations in light pink.
** For long-term recommendations, the County is not required to wait on implementation if the opportunity for earlier implementation presents itself.

Several actions not yet implemented in this Focus Area align with, and could satisfy, existing MCAP recommendations. Adopting policies or regulations that increase overall market demand for green buildings, renewable energy products and recyclable products would satisfy MCAP recommendation S 2.5 which recommends greater use of recycled building materials. Developing a Sustainability Handbook and encouraging sustainable business practices would satisfy MCAP recommendations E-2.3 and E-2.4 which recommend enhancing the sustainability of existing businesses and enhancing the sustainable development of new businesses coming into the County.

The Implementation Matrix in Appendix G provides a timeline and method for implementing each recommendation, as well as potential funding sources available to offset the costs associated with each (where available).



9. PROJECTS & Initiatives

Monroe County, FL

PHOTO SOURCE: GreenKeys! Project Team

Monroe County has already begun the process of addressing sustainability, climate change and sea level rise in its capital planning process. Projects completed by the County in recent years, as well as those proposed for the future, are provided in the following two (2) sections.

A. Projects Completed to Date

In recent years, Monroe County has completed several projects aimed at increasing overall sustainability and resilience to climate change and sea level rise. Notable infrastructure projects completed in recent years which will help increase the overall resiliency of the County are provided in Table 20.

B. Projects in the Pipeline

Of the County's proposed $416,958,562 Million budget for FY 2016, the County's multi-year (4 years) Capital Plan of $328.7 Million includes significant investment in the maintenance, repair, and improvement of the County's capital assets, public safety and physical environment. These investments are specifically targeted at wastewater-related infrastructure, roads, bridges, canals, land acquisition, parks and beaches, fire stations and fire trucks, a new jail and a new courthouse. The County's FY 2016 budget includes a Capital Budget of $115 Million that specifically includes $22 Million for wastewater-related infrastructure, $20 Million for roads and bridges, $10 Million for parks and beaches, and $8 Million for the Jefferson Browne Courthouse.

There are many types of projects where departments can collaborate on adding energy efficiency and sustainability and resiliency features into existing or near-future design or renovation plans. Some projects may also be suitable for an evaluation using one of the many infrastructure project analysis tools like Envision, Infrastructure Voluntary Evaluation Sustainability Tool ("INVEST") or other design-related systems tools that consider sustainability and resiliency factors to optimize design. The projects in Table 21 are proposed in the County's Capital Improvements Program for FY 2016-2020. Additionally, the table below provides suggestions for how the County could consider integrating various sustainability and adaptation strategies into this and future capital planning and budgeting processes.

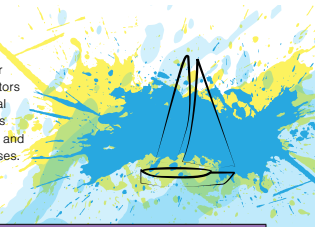


Table 20. Capital Improvement Projects Completed in Recent Years

Project Completed	Project Improvements	Total Project Cost
Stock Island Fire/EMS	Renovation and addition of the fire station facility on Stock Island. The fire station includes two (2) drive through apparatus bays and approximately 3,500 sq. ft. of office area and living quarters for the staff.	$4,573,864
Conch Key Fire Station	Renovation of the existing building and a new addition. 1,713 sq. ft. lower level garage, 1,820 sq.ft. second floor that includes an office, bath, lockers and sleeping rooms. Site Work included parking, drainage, landscaping, existing demolition and fuel tank. Garage heightened and generator relocated.	$2,300,951
Cudjoe Regional Wastewater Treatment Plant	Design and construction of the Cudjoe Regional Waste Water System. FKAA and the County have an Interlocal Agreement for this wastewater project.	$47,125, 082

Table 21. Capital Improvement Projects in the Pipeline

Project Planned	Project Improvements	Budgeted Amount	How recommendations in this Plan can influence capital project implementation
Higgs Beach Master Plan	Visitor & Nature Center, relocation of internal road and White Street enhancements, relocation of parking lots, bicycle lanes, expansion of beach area, relocation/expansion of children's playground, addition/expansion of pedestrian sidewalks, addition of maintenance buildings, addition of volleyball courts and pickle ball courts, removal tennis courts, relocation of small dog park and revision of large dog park, revision of outdoor lighting fixtures, addition of sculpture garden, pond renovation.	$1.9 Million appropriated for FY 2016, $1.0 Million proposed for FY 2017	• Ensure that energy efficient fixtures (e.g. LED bulbs, occupancy sensors) and water conserving fixture (e.g. low-flow toilets, faucet and shower fixtures) are used in maintenance, repair and construction activities. • Increase building insulation and upgrade to energy efficient windows where possible when making building repairs. • Use sustainable materials or recycled products where possible. • Ensure that sea level rise is considered for all larger-scale maintenance and renovation of facilities. • Continue using native plants and ecosystem appropriate flora in replanting efforts.

Table 21. Capital Improvement Projects in the Pipeline Continued

Project Planned	Project Improvements	Budgeted Amount	How recommendations in this Plan can influence capital project implementation
Old Seven Mile Bridge	Extensive repairs to the bridge deck, flooring and beams.	$2.7 Million proposed for FY 2016	
Big Pine Swimming Hole	Development of a passive recreational park, near MM29 on south side of US1. Improvements would be consistent with Liveable Communikeys Plan.	$100,000 proposed for FY 2017; $900,000 proposed for FY 2018	• Consider future flooding from sea level rise in design of improvements.
Freeman Justice Center Lobby Expansion	Interior expansion of approximately 800 square feet to the existing main lobby entrance, in a manner that when completed will match all existing finishes and treatments.	$4,537 appropriated for FY 2016	• Ensure that energy efficient fixtures (e.g. LED bulbs, occupancy sensors) and water conserving fixture (e.g. low-flow toilets, faucet and shower fixtures) are used in maintenance, repair and construction activities. • Increase building insulation and upgrade to energy efficient windows where possible when making building repairs. • Use sustainable materials or recycled products where possible.
Cudjoe Regional X Paving	Road paving improvements.	$3 Million appropriated for FY 2016, $3 Million proposed for FY 2017	• Consider future flooding from sea level rise in design of improvements.
Marathon Library	Construction of a new library in Marathon.	$820,000 appropriated for FY 2016, $2.2 Million proposed for FY 2017	• Ensure that energy efficient fixtures (e.g. LED bulbs, occupancy sensors) and water conserving fixture (e.g. low-flow toilets, faucet and shower fixtures) are used in maintenance, repair and construction activities. • Increase building insulation and upgrade to energy efficient windows where possible when making building repairs. • Use sustainable materials or recycled products where possible. • Ensure that sea level rise is considered for all larger-scale maintenance and renovation of facilities. • Continue using native plants and ecosystem appropriate flora in replanting efforts.

Table 21. Capital Improvement Projects in the Pipeline Continued

Project Planned	Project Improvements	Budgeted Amount	How recommendations in this Plan can influence capital project implementation
Bernstein Park	Raise level of entire field by 18" to 24", add new restrooms, develop a new baseball field, soccer field, and basketball court, add new playground equipment, add a walking track, create a storm water retention system, remove the existing dwelling, and build a community center. The park is approximately six acres in size.	$3.9 Million appropriated for FY 2016, $1.1 Million proposed for FY 2017	• Ensure that energy efficient fixtures (e.g. LED bulbs, occupancy sensors) and water conserving fixture (e.g. low-flow toilets, faucet and shower fixtures) are used in maintenance, repair and construction activities. • Increase building insulation and upgrade to energy efficient windows where possible when making building repairs. • Use sustainable materials or recycled products where possible. • Ensure that sea level rise is considered for all larger-scale maintenance and renovation of facilities. • Continue using native plants and ecosystem appropriate flora in replanting efforts.
Jefferson Browne Building	Project management and construction of the facility.	$1.0 Million appropriated for FY 2016, $5.4 Million proposed for FY 2020	• Ensure that energy efficient fixtures (e.g. LED bulbs, occupancy sensors) and water conserving fixture (e.g. low-flow toilets, faucet and shower fixtures) are used in maintenance, repair and construction activities. • Increase building insulation and upgrade to energy efficient windows where possible when making building repairs. • Use sustainable materials or recycled products where possible. • Ensure that sea level rise is considered for all larger-scale maintenance and renovation of facilities. • Continue using native plants and ecosystem appropriate flora in replanting efforts.
Gulf Seafood	Project management.	$7.0 Million appropriated for FY 2016	
Summerland Fire Station	Building a new fire station on Summerland Key or east Cudjoe.	$3.1 Million appropriated for FY 2016, $925,000 proposed for FY 2017	• Ensure that energy efficient fixtures (e.g. LED bulbs, occupancy sensors) and water conserving fixture (e.g. low-flow toilets, faucet and shower fixtures) are used in maintenance, repair and construction activities. • Increase building insulation and upgrade to energy efficient windows where possible when making building repairs. • Use sustainable materials or recycled products where possible. • Ensure that sea level rise is considered for all larger-scale maintenance and renovation of facilities. • Continue using native plants and ecosystem appropriate flora in replanting efforts. • Consider future flooding from sea level rise in design of improvements.

Table 21. Capital Improvement Projects in the Pipeline Continued

Project Planned	Project Improvements	Budgeted Amount	How recommendations in this Plan can influence capital project implementation
Training Academy-Crawl Key	Construction of a one story, 5,625 sq. ft. masonry and concrete building that will include two covered and closed garage bays, a training classroom, two offices, storage room, and two restrooms with showers, lockers, and changing areas. The building will have to be raised five feet for flood plain. A ramp and two stairs will be added on the outside for access.	$1.8 Million appropriated for FY 2016	• Ensure that energy efficient fixtures (e.g. LED bulbs, occupancy sensors) and water conserving fixture (e.g. low-flow toilets, faucet and shower fixtures) are used in maintenance, repair and construction activities. • Increase building insulation and upgrade to energy efficient windows where possible when making building repairs. • Use sustainable materials or recycled where possible. • Ensure that sea level rise is considered for all larger-scale maintenance and renovation of facilities. • Continue using native plants and ecosystem appropriate flora in replanting efforts. • Consider future flooding from sea level rise in design of improvements.
PK Jail and Courthouse	Performance of a facility condition assessment at each site. Modernize and construct a new courthouse and jail facility on Plantation Key.	$443,750 appropriated for FY 2016, $10.6 Million proposed for FY 2017, $6.2 Million proposed for FY 2018, and $400,000 proposed for FY 2019	• Ensure that sea level rise is considered for all larger-scale maintenance and renovation of facilities. • Ensure that energy efficient fixtures (e.g. LED bulbs, occupancy sensors) and water conserving fixture (e.g. low-flow toilets, faucet and shower fixtures) are used in maintenance, repair and construction activities. • Increase building insulation and upgrade to energy efficient windows where possible when making building repairs. • Use sustainable materials or recycled products where possible. • Continue using native plants and ecosystem appropriate flora in replanting efforts. • Consider future flooding from sea level rise in design of improvements.
Sugarloaf Fire Station	Construction of new Sugarloaf Fire Station.	$500,000 proposed for FY 2018 and $3 Million proposed for FY 2019	• Ensure that energy efficient fixtures (e.g. LED bulbs, occupancy sensors) and water conserving fixture (e.g. low-flow toilets, faucet and shower fixtures) are used in maintenance, repair and construction activities. • Increase building insulation and upgrade to energy efficient windows where possible when making building repairs. • Use sustainable materials or recycled products where possible. • Ensure that sea level rise is considered for all larger-scale maintenance and renovation of facilities. • Continue using native plants and ecosystem appropriate flora in replanting efforts. • Consider future flooding from sea level rise in design of improvements.

C. Recommendations for 5 Year Work Plan of Future Projects/Initiatives, Projected Benefits, and Costs

Table 22 contains several of the projects included in the 5-Year Work Plan of future projects and initiatives to be implemented by the County. These projects are derived from the sea level rise modeling, vulnerability analysis and GHG emissions inventory update conducted as part of GreenKeys!. Specific projects, which constitute 64 of the total 165 recommendations in GreenKeys!, are divided into three (3) sections: 1) Facilities projects, 2) Adaptation projects and 3) Other projects. The complete 5-Year Work Plan, which includes the projects listed in the tables below (as well as additional policy recommendations), is provided in Appendix I.

i) Facilities Projects

Since 2005, Monroe County has made significant progress in reducing GHG emissions but it remains important for the County to continue implementing energy and GHG reduction strategies into the future. This will help the County meet future, more stringent, GHG reduction targets while also increasing the energy and water efficiency of County-owned facilities. All of these efforts contribute to increasing the overall sustainability of the County.

Equally, or more importantly, increasing the energy efficiency and water conservation capabilities of County facilities translates to significant cost savings for the County. Monroe County has an established track record of saving money through efficiency upgrades. For example, in 2012 the County implemented a number of energy conservation measures in several County buildings, including the Freeman Justice Center, Lester Building, Historic Courthouse, Jefferson Browne Building, and Chiller Plant. Not only did these measures reduce energy usage at these facilities by 23 percent, they also resulted in over $70,000 in annual energy cost savings for the County.

The following facilities projects are recommended to ensure that the County continues making progress on increasing efficiency and reducing the carbon footprint of County facilities.

These projects, along with other policy recommendations, are also provided in the 5-Year Work Plan in Appendix I.

Table 22. Facilities Project Recommendations

Facilities Project Recommendations	Timeframe	Energy/GHG Reductions (Y/N)	Adaptation/ Resilience Benefits (Y/N)
Provide annual progress reports on the implementation of the GreenKeys! Sustainability Action Plan.	Year 1 and Ongoing	Y	Y
Create an internal and external Sustainability Newsletter for distribution.	Year 1 and Ongoing	Y	Y
Track utility data through FacilityDude program to target and further reduce energy inefficiencies.	Year 1	Y	N
Conduct next phase of energy auditing on County facilities and link upgrades to capital asset improvements. Install low-flow water conserving fixtures and energy saving features throughout County facilities.	Year 1	Y	Y
Develop energy saving policies for County facilities and hire, assign or contract for a County-wide Energy Manager.	Year 1	Y	Y
Expand County's use of renewable energy through the installation of electric vehicle charging stations and solar lighting. To monitor progress, develop a baseline for current renewable energy use.	Year 1	Y	Y

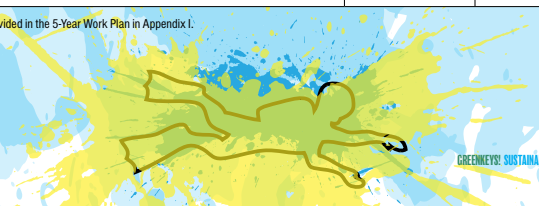
Table 22. Facilities Project Recommendations Continued

Facilities Project Recommendations	Timeframe	Energy/GHG Reductions (Y/N)	Adaptation/ Resilience Benefits (Y/N)
Use baseline GHG emissions data moving forward for forecasting emissions reductions and for setting additional municipal and community reduction targets.	Year 1	Y	Y
Establish an interim GHG emissions reduction target for 2030, consistent with timeframe of County's latest Comprehensive Plan, for a 40% reduction by 2030 as compared to the 2012 baseline.	Year 1	Y	Y
Create a web-based clearinghouse for best management practices, local data, tools, and tracking for the business community.	Year 1	Y	N
Create an Environmentally Preferable Purchasing ("EPP") program. Develop procurement specifications for materials reuse, reduced packaging, materials with recycled content, and other waste management strategies.	Year 1	Y	Y
Create a list of funding sources to finance energy-efficiency and resiliency upgrades in residences and businesses (e.g. Property Assessed Clean Energy ("PACE") or other financing strategies).	Year 1	Y	N
Develop a public education campaign to inform residents about energy and water efficiency and future flood risk and potential environmental change.	Year 1	Y	Y
Adopt a target for energy use from renewable sources for County buildings and facilities such as 10% by 2025 and explore financing alternatives such as leasing.	Year 2	Y	Y
Promote energy usage reductions in County facilities. Provide education and outreach; create competitive programs to achieve energy reductions; and publish or post County utility bills for the public to view.	Year 2	Y	Y
Increase lighting efficiency and promote retrofits for efficiency on County maintained and controlled roads.	Year 2	Y	Y
Engage public works and infrastructure managers in voluntary GHG reporting. This could include making materials available online to assist managers in this reporting or creation of a one page fact sheet for inclusion in the Monroe County Personnel Policies and Procedures Manual (dated November 18, 2014).	Year 2	Y	Y
Implement policies and programs to enhance electric vehicle infrastructure and make the Florida Keys "EV Ready." This could include providing electric vehicle charging stations at community parking lots and/or working with vehicle manufacturers to install publicly accessible electric vehicle charging stations.	Year 2	Y	Y

Table 22. Facilities Project Recommendations Continued

Facilities Project Recommendations	Timeframe	Energy/GHG Reductions (Y/N)	Adaptation/ Resilience Benefits (Y/N)
Conduct feasibility studies for alternative energy at County facilities. Partner with electric utilities for creative ways to deploy more solar.	Year 2	Y	Y
Start implementing an employee training program on energy efficiency, water conservation and sustainable office practices.	Year 2	Y	Y
Complete a "right size/right type" fleet analysis.	Year 2	Y	Y
Conduct a tree inventory and establish tree canopy goals County-wide to determine opportunities for increasing canopy on public and private lands for carbon sequestration benefits.	Year 2	Y	Y
Improve County waste management policy with tangible goals and baseline to track accomplishments. Track County recycling rates separately from other recycling programs and establish goal for increases. Adopt policy that the County will also achieve a 75% diversion rate of its own solid waste stream. Implement incentives or enforce regulations to ensure progress towards the 75% community waste reduction target.	Year 2	Y	N
Create a policy and goal to increase material salvage for County-owned full and partial building demolitions.	Year 2	Y	N
Improve employee sustainability practices: • Conduct an internal employee survey to determine most effective and underutilized sustainability practices and modify policies to increase sustainable practices. • Create a "top ten list" of energy, water and waste management efficient practices for County employees and include in the Monroe County Personnel Policies and Procedures document. • Create a monthly email blast to employees on successes and case studies for sustainable practices.	Year 2	Y	N
Inventory GHG emissions for County and Community-wide sectors every three (3) years.	Year 3	Y	Y
Improve infrastructure for increased physical activity and design routes that are integrated into the regional park system. Design or redesign parks to maximize space for physical activity.	Year 3	N	N

These projects, along with other policy recommendations, are also provided in the 5-Year Work Plan in Appendix I.



ii) Adaptation Projects

Over the past several years, the County has increased its focus on identifying the risks of climate change and sea level rise on its infrastructure and the community as a whole. The results of this GreenKeys! planning project provide the County with recommendations for adaptation projects based on identified vulnerabilities within the County. The adaptation projects in Table 23 below focus not only on individual structural improvements, but also include projects designed to ensure that natural habitats provide their maximum benefit against anticipated climatic changes and rising seas. These projects, along with other policy recommendations, are also provided in the 5-Year Work Plan in Appendix I.

Table 23. Adaptation Project Recommendations

Adaptation Project Recommendations	Timeframe	Energy/GHG Reductions (Y/N)	Adaptation/ Resilience Benefits (Y/N)
Hold three (3) community workshops to discuss sea level rise with stakeholders.	Year 1 and Ongoing	N	Y
Develop more accurate elevation data (LIDAR) County-wide.	Year 1	N	Y
Develop a geographic database to document nuisance flooding events.	Year 1	N	Y
Pilot project to conduct a Comprehensive Feasibility Study for Enhanced Stormwater and Tidewater Criteria (prioritizing areas) for near-term areas subject to inundation risk, including nuisance flooding (in two locations).	Year 1	N	Y
Perform further analysis with improved elevation data for the Bayshore Manor assisted living retirement home.	Year 1	N	Y
Build local government capacity to better understand local coastal hazard risks, and analyze the legal and policy factors that impact adaptation responses. (NOAA grant) End products will include: • A participatory VCAPS* assessment for Monroe County; • HAZUS* damage valuations and visualizations for County; • Law and policy analysis of issues directly affecting local adaptation capabilities; • Regional analysis comparing how state and local regulatory environment impacts resilience planning and adaptation.	Year 1	N	Y
Develop site level assessments that characterize resistance of above ground structures and associated electrical components to damage from extreme event flooding. (Coordination)	Year 1	N	Y
Conduct a County-wide roads analysis to identify near-term roads subject to inundation risk, including nuisance flooding. This will include researching where related green infrastructure would be appropriate. Increase the percentage of funding invested in green infrastructure.	Year 2	N	Y
Update vulnerability assessments on Monroe County buildings based upon GreenKeys! modeling data and updated LIDAR data.	Year 2	N	Y
Conduct additional study of a freeboard initiative to elevate and floodproof buildings within Monroe County.	Year 2	N	Y
Analyze available infrastructure energy and sustainability rating systems (e.g. Envision, Infrastructure Voluntary Evaluation Sustainability Tool ("INVEST") or other design-related systems that consider sustainability and resiliency factors) to optimize planning for infrastructure, transportation, facilities and assets.	Year 2	Y	Y

Table 23. Adaptation Project Recommendations Continued

Adaptation Project Recommendations	Timeframe	Energy/GHG Reductions (Y/N)	Adaptation/ Resilience Benefits (Y/N)
Develop adaptation alternatives for most vulnerable County facilities and infrastructure to be impacted the earliest (based on low and high 2030 sea level rise scenario).	Year 2	N	Y
Complete Phase 2 of the NOAA grant creating digital record of Elevation Certificates for homes, buildings and facilities. Create a policy to ensure that the County uses, integrates, and improves the Elevation Certificate record to promote higher confidence in flood risk assessments.	Year 2	N	Y
Identify intact corridors for future tidal wetland migration corridors as a potential criterion for future land purchase and flood mitigation initiatives within Monroe County. For example, land acquisition priorities.	Year 2	N	Y
Provide outreach on "demonstration" projects (e.g. Stock Island Fire Station and Bayshore Manor) to provide examples of benefits. Distribute information about GreenKeys! planning efforts at County events.	Year 2	Y	Y
Discuss emergency prevention and response, including nuisance flooding and sea level rise, with County residents at the neighborhood level.	Year 2	N	Y
Identify areas for habitat maintenance where the removal of exotics could improve the quality of that area to serve as a natural or soft protection option. Establish maintenance schedule that factors in benefits of managing habitats as a natural defense strategy against sea level rise impacts.	Year 3 and Ongoing	N	Y
Conduct an analysis of where maintaining living shorelines would be beneficial. Identify and map natural inundation buffers which could also provide sea level rise adaptation benefits.	Year 3	N	Y
Create a database of all elevation data for County and utility facilities and assets.	Year 3	N	Y
Calibrate the Sea Level Affecting Marshes Model ("SLAMM") results with historic land cover change and field observations and coordinate with land acquisition.	Year 3	N	Y
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.	Year 3	N	Y
Work with local animal services/rescue/control organizations to ensure pet safety health issues in the face of sea level rise.	Year 3	N	N
Develop adaptation alternatives for vulnerable County facilities based on low and high 2060 sea level rise scenario.	Year 4	N	Y
Enhance coordination with the development and real estate communities to provide information about projected sea level rise impacts and solutions from the GreenKeys! planning process. Schedule annual briefings with the predominant industry associations to increase communication.	Year 4	N	Y
Ensure that climate change and sea level rise information is available to all groups and in multiple languages.	Year 4	N	Y

Table 23. Adaptation Project Recommendations Continued

Adaptation Project Recommendations	Timeframe	Energy/GHG Reductions (Y/N)	Adaptation/ Resilience Benefits (Y/N)
Analyze available "resiliency" construction standards (e.g. Resilience STAR™, the Institute for Business and Home Safety's FORTIFIED Home™, FORTIFIED Commercial, FORTIFIED Safer Business, FORTIFIED for Safer Living®, RELi or others) to determine which will be most appropriate for County regulations.	Year 4	N	Y
Address impacts of climate change and sea level rise on disadvantaged social groups, values and symbolic places. Target an annual community workshop aimed at underserved and underrepresented populations on sea level rise and resilience.	Year 4	N	Y
Utilize the tidal flood vulnerability maps for roads as a guide for a public outreach campaign to develop a photographic record that documents date, time and severity of nuisance tidal flooding events.	Year 5	N	Y
[3] Vulnerability, Consequences, and Adaptation Planning Scenarios ("VCAPS") builds on concepts of hazard management and vulnerability and uses participatory modeling techniques to organize and document dialogue and learning. [4] HAZUS uses Geographic Information Systems ("GIS") technology to estimate physical, economic and social impacts of disasters. It graphically illustrates the limits of identified high-risk locations.			

These projects, along with other policy recommendations, are also provided in the 5-Year Work Plan in Appendix I.

iii) Other Projects

Several other projects are recommended which do not specifically relate to County facilities or adaptation. These projects are recommended to further the County's commitment to improved sustainability, GHG emissions reduction through renewable energy deployment and expanded use of alternative modes of transportation, green infrastructure and tree canopy conservation, and invasive species control efforts.

Table 24. Other Project Recommendations

Other Project Recommendations	Timeframe	Energy/GHG Reductions (Y/N)	Adaptation/ Resilience Benefits (Y/N)
Maintain and enhance programs, like canal restoration, to improve water quality nearshore and offshore to reduce environmental stressors exacerbated by sea level rise and increasing ocean temperatures.	Year 1 and Ongoing	N	Y
Continue canal restoration, sea level rise, and land acquisition programs.	Year 1 and Ongoing	N	Y
Develop a Sustainability Handbook for business owners on the County's GreenKeys! website.	Year 1	Y	Y
Develop a feasibility analysis for a public bike share program in more urbanized areas.	Year 2	Y	N
Adopt a plan (e.g. green business plan) designed to improve the resource efficiency of the community's businesses including manufacturing, automotive and marine repair.	Year 2	Y	N
Encourage specific product bans to significantly advance progress toward waste reduction goals.	Year 2	Y	N

Table 24. Other Project Recommendations Continued

Other Project Recommendations	Timeframe	Energy/GHG Reductions (Y/N)	Adaptation/ Resilience Benefits (Y/N)
Expand Community Supported Agriculture ("CSA") programs throughout the County to promote local agricultural products (e.g. Dock-to-Dish and Annie's garden).	Year 2	Y	N
Promote local agricultural programs (e.g. bees).	Year 2	N	N
Investigate re-certification of STAR.	Year 3	Y	Y
Enhance public information campaign on waste reduction targets and available recycling programs. This should include creating or updating policies and incentives reducing the generation of fats, oils, and grease and their beneficial reuse.	Year 3	Y	N
Create or support promotional campaigns to bank locally, buy locally, or buy from small and independent businesses/retailers	Year 3	Y	N
Create a green business challenge for local businesses and recognize resource reduction.	Year 3	Y	N
Achieve recognition as a Bicycle Friendly Community or Walk Friendly Community.	Year 4	Y	N
Develop a ride sharing program for Monroe County employees to identify potential carpool candidates.	Year 4	Y	N
Establish a target to reduce per capita vehicle miles travelled. Create vibrant neighborhoods where a certain percentage of residents can easily walk or bicycle to meet all basic daily, non-work needs and have safe access to transit.	Year 4	Y	N
Encourage the sale of locally-caught fish by charter boat captains and allow sale of locally-caught fish at docks or to restaurants.	Year 4	Y	N
Implement programs to improve pedestrian and bicycle safety (e.g. targeted speed and red light enforcement using radars or cameras in areas where frequent violations or collisions have occurred; targeted crosswalk right-of-way enforcement; targeted bicycle traffic law obedience enforcement; bicycle lane encroachment enforcement; or school zone enforcement).	Year 4	Y	N
Research the feasibility of pursuing "blue carbon" payments for conserved and restored seagrass areas and pursuing future revenue opportunities from "blue carbon" payments associated with conservation and assisted migration of mangrove habitats.	Year 5	Y	N
Identify strategies to provide better public transportation options through improved connectivity, extended routes, expanded hours, increased reliability and more education of available services.	Year 5	Y	N
Create a healthy hazardous product initiative that includes: • Educating residents about proper use and disposal of hazardous products, and making information about more sustainable household products available. • Hosting green cleaning workshops and awareness programs.	Year 5	N	N
Begin implementing results from studies and analyses conducted in earlier years.	Year 5	Y	Y

These projects, along with other policy recommendations, are also provided in the 5-Year Work Plan in Appendix I.

10. PUBLIC Involvement

Monroe County GreenKeys! Community Workshop

PHOTO SOURCE: Greenkeys! Project Team

Green Keys! MindMixer Page Screenshot

PHOTO SOURCE: GreenKeys! MindMixer Site

Public involvement was a critical component of the development of GreenKeys!. Several methods were employed to involve the residents in the planning process, including electronic forums supporting GreenKeys! discussion, emails, public workshops, public outreach at community events and to individual organizations and a public survey.

A. GreenKeys! MindMixer

As part of the GreenKeys! development, the County maintained an online MindMixer site to facilitate public engagement in the GreenKeys! project. MindMixer is an online engagement platform that the Team used as an outreach and engagement tool for GreenKeys!. Because feedback from the community is critical to the success of GreenKeys!, creating and maintaining this online platform was an important tool for facilitating community engagement.

The GreenKeys! MindMixer site was launched in July 2014 and remained active until May 31, 2015 (visible online until June 30, 2015). Note that Monroe County IT staff also produced a video that was used as an overview to sustainability.

Overall, the GreenKeys! MindMixer site generated a total of 551 interactions, 89 comments, and 51 shares. This platform provided a forum for community members to keep informed about the GreenKeys! project and have their voices heard on issues of importance to them. For the County, this platform provided an invaluable means of obtaining feedback directly from community members on where County efforts should be focused and in what order of priority.

During the eleven (11) months the site was active, 72 registered participants engaged in 34 topic discussions posted to the site. These topics were posted to solicit feedback from County residents on the most important efforts the County can take regarding sustainability. Topics and polling questions were also posed to the group to get community feedback on how to prioritize various efforts. Topics posed to the community are shown at the right.

Community feedback provided in response to each of the polling questions was used to prioritize the importance of the recommendations in GreenKeys!. For example, many of the polling questions asked MindMixer participants to prioritize various actions within a given topic. That community prioritization was then used to shape specific recommendations in GreenKeys! to ensure that resident concerns and resident priorities are reflected in the recommendations being made (where possible). In some instances, community feedback was also used to guide the recommended timeline for implementation, particularly for climate change and sea level rise adaptation recommendations.

The final MindMixer report with all community feedback is provided in Appendix J.

POLLING QUESTIONS TO PRIORITIZE COUNTY EFFORTS COVERED A WIDE RANGE OF TOPICS, INCLUDING:

- How to make the Keys economically viable;
- Making buildings and homes more sustainable and resilient to climate change and sea level rise;
- How to make schools and community leaders work together to create a more sustainable County;
- Determining what sea level rise adaptation strategies are best suited for the Keys;
- How to best prevent the spread of invasive plants and animals in the County;
- Ways to increase ride-share and carpooling in the County;
- Best methods for reducing litter in the Keys;
- Reducing problematic wildlife encounters in the Keys;
- How to bolster local-sourced food networks and local food consumption;
- Most prominently used methods of water conservation by County residents;
- Prioritizing Monroe County's most important transportation enhancements;
- What residents are most concerned about regarding development and redevelopment in the County;
- How to incentive increased use of public transit;
- Identification of the biggest challenges to the County's current transportation system;
- Barriers to improving energy efficiency in residential and commercial buildings;
- Best strategies for protecting natural systems in the Keys;
- Understanding community concerns about health and safety in the Keys; and
- Most important aspects of sustainability and climate change/sea level rise that the County should be considering.

B. Public Workshops

As part of GreenKeys!, several public workshops and other education and outreach activities were conducted. These workshops and events were held to better understand the unique perspectives of Monroe County residents and solicit community engagement in the planning process.

Table 25 below illustrates the workshops and events used to engage the community in this sustainability and sea level rise planning process.

In addition to engaging the community about GreenKeys!, a database of potentially interested County residents and business owners was created. Using Constant Contact, electronic invitations (email), save the date cards and flyers were distributed to the contact list created for the County in advance of each community workshop.

These electronic communications served a dual purpose, increasing attendance at subsequent workshops and ensuring that local residents and business owners remained engaged throughout the GreenKeys! planning process. Thirty-one (31) informational emails were sent over the course of the GreenKeys! project.

Table 25. List of Public Workshops and Events Attended for GreenKeys!

Date of Workshop / Event	Workshop / Event	Workshop / Event Description
September 3, 2014	Monroe County BOCC Workshop on Sea Level Rise, Key Largo	Presentation on sea level rise made to the Monroe County Board of County Commissioners. This presentation was made on initial modeling results from projected sea level rise impacts in 2030 and 2060. The Team showed results from its analysis on impacts to County buildings, electrical supply, water supply, wastewater, roads and habitat. This included impacts to actual facilities, but also projections in increased nuisance flooding. In addition to the impacts to facilities, the Team discussed the basis of the planning process including shifts in policies, regulations, laws and the availability of grant funding to plan and implement projects to mitigate impacts. The Team fielded questions and outlined the next steps to develop GreenKeys!.
October 2, 2014	6th Annual Southeast Florida Climate Leadership Summit Presentation, Miami Beach	Presentation on Monroe County GreenKeys! sea level rise modeling and planning project.
October 9, 2014	GreenKeys! Community Workshop #1	The first community workshop was focused on the risks of sea level rise and the types of economic and flooding impacts that could affect Key Largo homes and businesses in the future. The Team presented the modeling process to address impacts to homes and businesses and provided an actual example of how modeling was used to mitigate rising water levels in another community. This showed how the flooding impacts of sea level rise with varying rates of severity can be managed. The workshop included a panel of local community leaders to discuss impacts and potential solutions to sea level rise on roads and other critical areas in Key Largo. Panelists at this first workshop included: • Mayor Sylvia Murphy, Monroe County; • Stephanie Scuderi, Centennial Bank, Senior Vice President; • Dr. Jerry Lorenz, Ph.D., Audubon Florida, State Research Director; and • Richard Barreto, Tavernier Community Association, President. During the meeting, there was a spirited discussion about the biggest concerns and Key Largo's unique characteristics that need to be considered when planning for sea level rise. Participants were eager to understand the appropriateness of the data being proposed for use in the overall COAST modeling process.

Table 25. List of Public Workshops and Events Attended for GreenKeys! Continued

Date of Workshop / Event	Workshop / Event	Workshop / Event Description
November 5, 2014	GreenKeys! Community Workshop #2	The second workshop focused on how to best prepare for sea level rise in the Key Largo. Results of the sea level rise vulnerability assessment were presented showing anticipated impacts to homes and businesses. These results included predicted costs of building damage. Discussion focused on possible adaptation strategies, such as raising building elevations or relocating facilities entirely. Participation was critical to ensure that the diverse perspectives of community members were adequately considered when choosing the most appropriate adaptation strategies. During the meeting, participants discussed three (3) primary adaptation strategies, including: 1) elevating and floodproofing properties not already elevated or floodproofed; 2) constructing breakwaters at two "at risk" locations and 3) Voluntary property acquisitions where high tide would be at the center of the property either by 2030 or 2045.
November 8, 2014	Community Day at Florida Keys Community College	Conducted public education and outreach about the GreenKeys! projects during Community Day. Passed out GreenKeys! flyers, promoted upcoming public workshops and attempted to further engage residents in the sea level rise planning project.
December 9, 2014	GreenKeys! Community Workshop #3	The third workshop addressed the pros and cons of each of the adaptation strategies identified during the previous workshop. Implementing the right adaptation strategies should ultimately result in less damage over time. Discussions focused on how well each of the identified adaptation strategies is predicted to protect Key Largo in the future. Cost-benefit analyses were used throughout the entire evaluation process. Participation was again critical to ensuring that community perspectives were adequately considered when selecting the most appropriate adaptation strategies for this community.
March 12, 2015	Bahia Honda State Park Earth Day Celebration	Conducted public education and outreach about the GreenKeys! projects during the Bahia Honda State Park Earth Day Celebration. Passed out GreenKeys! flyers, promoted upcoming public workshops and attempted to further engage residents in the sea level rise planning project.
October 6, 2015	Stock Island Sea Level Rise Community Workshop	Workshop presented to inform Lower Keys residents about the sea level rise modeling Monroe County completed and how rising seas could affect roads, bridges, homes, businesses and habitat in Stock Island by the years 2030 and 2060.
October 7, 2015	Middle Keys Sea Level Rise Community Workshop	Workshops presented to inform Middle Keys residents about the sea level rise modeling Monroe County completed and how rising seas could affect roads, bridges, homes, businesses and habitat in the Middle Keys by the years 2030 and 2060.

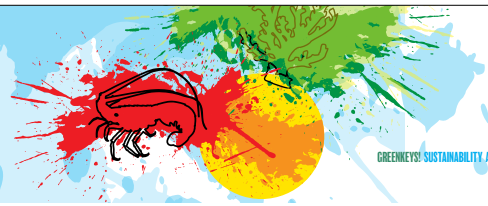


Table 25. List of Public Workshops and Events Attended for GreenKeys! Continued

Date of Workshop / Event	Workshop / Event	Workshop / Event Description
October 14, 2015	Upper Keys Community Workshop on GreenKeys!	Workshops held to provide Upper Keys residents and business owners with an overview of the recommendations provided in the draft GreenKeys! and solicit community feedback on those recommendations.
October 19, 2015	Lower Keys Community Workshop on GreenKeys!	Workshops held to provide Lower Keys residents and business owners with an overview of the recommendations provided in the draft GreenKeys! and solicit community feedback on those recommendations.
October 22, 2015	Middle Keys Community Workshop on GreenKeys!	Workshops held to provide Middle Keys residents and business owners with an overview of the recommendations provided in the draft GreenKeys! and solicit community feedback on those recommendations.

C. GreenKeys! Public Survey

To assist with the prioritization of goal area recommendations and further engage Monroe County residents and business owners, the Team used a "Survey Monkey" online survey tool to poll thirty-one (31) questions for distribution within the community. Questions drafted for the survey included strategies for ranking by asking residents and business owners to prioritize and rank several of the STAR recommendations, as well as for open responses to provide their thoughts and feedback on the County's sustainability efforts to date. This survey was distributed to the Constant Contact database (392 individuals on the Monroe County Climate List, 38 County staff on the Monroe County Employees list and entire Monroe County Climate Change Advisory Committee), as well as to Chambers of Commerce throughout the County for distribution to their membership.

The survey was left open from approximately April 20, 2015 to June 22, 2015 (62 days), during which time 161 responses were received.

Results of the survey are provided in the graphic on the top right of the next page.

Copies of the survey and responses are included in Appendix K.

D. Individual Outreach to Organizations and Agencies

In addition to the public outreach efforts discussed above, individual outreach efforts were made to Monroe County organizations and agencies. This outreach was conducted to educate these local organizations and agencies on GreenKeys! and solicit their support for the project.

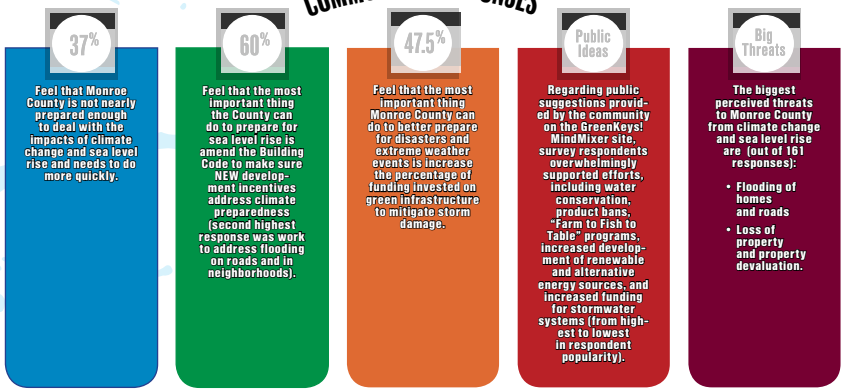


Table 26. Individual Outreach Conducted for GreenKeys!

Date of Event	Organization	Outreach Description
November 3, 2014	Sea Level Rise Presentation to South Florida Regional Planning Council	Presentation provided to the South Florida Regional Planning Council on sea level rise and climate change.
December 10, 2014	Key Largo Chamber of Commerce	Presentation provided to the Key Largo Chamber of Commerce on sea level rise and climate change.
January 14, 2015	South Florida Water Management District	Presentation provided to the South Florida Water Management District governing board on sea level rise and climate change.
January 28, 2015	Republican Club, Key Largo	Presentation provided to the Republican Club on sea level rise and climate change.
January 30, 2015	Last Stand, Key West	Presentation provided at the Last Stand Annual Meeting on climate change.
March 12, 2015	Florida Keys National Marine Sanctuary, Marathon	Presentation to the Florida Keys National Marine Sanctuary Steering Committee on sea level rise.
May 7, 2015	Gulf Coast Symposium	Presentation at the Gulf Coast Symposium on sea level rise.

11. IMPLEMENTATION Strategy

> “These recommendations can be implemented in several ways, including: integration with the capital planning process; securing newer partnered funding sources; integration with the County’s Code of Ordinances and Land Development Regulations; integration with flood mitigation policies, and other mechanisms.”

Though the County has already put in place several policies and programs to improve sustainability and help the County mitigate climate change and sea level rise impacts, the recommendations provided in GreenKeys! exceed the scale of existing efforts. Implementation of the recommendations in GreenKeys! is critical to ensuring that real improvements are made. The recommendations provided within this document can be implemented in several ways, including: integration with the capital planning process; securing newer partnered funding sources; integration with the County’s Code of Ordinances and Land Development Regulations and integration with flood mitigation policies; and other mechanisms. The Implementation Matrix provided in Appendix G illustrates specific methods of implementation for each individual recommendation per Focus Area, as does the narrative below.

A. Integration with Capital Planning Process

i) Monroe County

One strategy for implementing some of the recommendations outlined in GreenKeys! includes identification of annual public infrastructure expenditures within the Monroe County Fiscal Year 2016 Proposed Annual Operating & Capital Budget (“Budget”) to identify which investments could be adapted to increase sustainability efforts associated with rising sea levels (budget partially included in Appendix L).

For Fiscal Year (“FY”) 2016, the County has allocated $115,204,597 for capital improvement projects related to public facilities and infrastructure. Monroe County’s capital improvements are developed in concert with the Monroe County Year 2010 Comprehensive Plan which was recently updated (out to 2030). The County designs its capital improvements in a report entitled Capital Projects Plan. Capital projects are those projects that the County initiates to maintain existing infrastructure and accommodate future growth within the County. Capital projects include construction and rehabilitation of public buildings, major street improvements, parks and recreation projects, canal restoration projects, and maintenance and acquisition of fleet vehicles.

The Capital Projects Plan is a multiyear (4 year) plan that identifies each proposed capital project to be undertaken, the year in which it will be started, and the proposed method of financing the expenditures. The Capital Projects Plan is designed to guide Monroe County’s capital planning process in order to promote financial stability and limit the need for dramatic tax increases or diversions of resources from other programs to make unanticipated capital expenditures. Major capital outlays, such as the acquisition or construction of capital facilities and other capital assets are funded from many funding sources, including Road & Bridge Fund, Impact Fees Fund (Roadways, Parks & Recreation, Libraries, Solid Waste, Police Facilities, Fires & EMS), and the One Cent Infrastructure Sales Tax.

As discussed in the vulnerability analysis completed as part of this project, several County-owned and maintained facilities appear to be vulnerable to sea level rise under the modeled scenarios. While not necessary for incorporation into the capital planning or budgeting process in the near term cycles, it is important to consider that the projected impacts of 2030 vulnerability are only fifteen (15) years out. To put this in perspective, the tidal flooding model predicts stormwater impacts and potential nuisance

Crawl Key Training Academy Capital Project

PHOTO SOURCE: Monroe County Emergency Management

flooding for between 2.3 miles (low sea level rise scenario) and 3.2 miles (high sea level rise scenario) along U.S. Highway1 by 2030.

The following are points on guidance provided for implementing new capital budget items.

Specific Facility Improvements

Some of the new capital budget items recommended include:

1) For the Monroe County Animal Shelter in Key West, which shows access concerns and first floor flooding under the 2060 scenario, consider potential relocation to a more elevated site as part of any future plans to renovate the Animal Shelter facilities (Recommendation GO 2.5).

2) For the Marathon electric substation, which shows vulnerability to an extreme storm surge by 2060 under a high sea level rise scenario, coordinate with Florida Keys Electric Cooperative to determine true risk exposure and alternatives to reduce that risk (Recommendation GO 2.10).

3) For the Roth Building (50 High Point Road), Radio Transmission Shop (88770 U.S. Highway 1) and County Offices (MM 88.5, U.S. Highway 1), which show potential risk to an extreme flooding event by 2060, take into account both the rate of sea level rise over the next two decades and the overall lifecycle of the buildings in making flood adaptation decisions to reduce risk (Recommendation GO 2.11).

4) For Clarence Higgs Beach, which shows risk of current or future flooding from a Wilma-sized event, incorporate appropriate hazard mitigation design features into any retrofits or upgrade projects (Recommendation GO 2.12).

5) For East Martello Tower, which shows risk of current or future flooding from a Wilma-sized event, consider flood adaptation measures (more mid to long-term because of fort construction and historic nature) (Recommendation GO 2.13).

6) For the Monroe County Sheriff's Office Freeman substation structure on Cudjoe Key, which shows moderate risk concern, develop adaptation strategies as a likely priority for flood mitigation and emergency preparedness (Recommendation GO 2.14).

Funding for these budget items can potentially be obtained from several sources, including: FEMA's Pre-Disaster Mitigation Grant Program; FEMA's Hazard Mitigation Grant Program (after disaster only) and FEMA's Flood Mitigation Assistance Program. See Section 11(d) and the Implementation Matrix in Appendix G for additional information on funding specific recommendations in GreenKeys!.

Assessments and Investigations

Site-level assessments and investigations are also recommended to ensure that the County makes capital planning decisions based on facility-specific information, including:

1) Develop site level assessments that characterize resistance of above ground structures and associated electrical components to damage from extreme event flooding (Recommendation GO 1.1).

2) Create detailed site investigations to better resolve the extreme event flood risks of all critical infrastructure within defined special flood hazard areas (Recommendation GO 1.9).

3) Enhance monitoring of County buildings and create a database for flood risk to detect potential access and structural issues associated with increased tidal flooding exposure (Recommendation GO 1.10).

4) Conduct site-specific analyses of particularly vulnerable wastewater infrastructure that include survey quality elevation data of sensitive components and engineering assessments of potential floodwaters to determine the present and future vulnerability to extreme flood events (Recommendation GO 2.9).

5) Develop and maintain recording protocols and, as necessary, engineering assessments to assess resilience of below-grade pipes and pump infrastructure to increased saltwater incursion associated with sea level rise (coordination with FKAA) (Recommendation GO 1.2).

In 2014, the Environmental Protection Agency ("EPA") released a guidance document for auditing site-level flood resilience of wastewater infrastructure.[55] Following this guide, the Team specifically recommends that Monroe County's Floodplain Coordinators be supplied with site-level assessments that characterize resistance of above-ground structures and associated electrical components to damages from extreme event flooding consistent with EPA audit guidance.

From a long-term planning perspective, it is critical to note that flood hazards from a high sea-level rise scenario would be expected to alter current patterns of resident population settlement and the magnitude of visitor travel within the Florida Keys.[56] Future siting and capacity decisions for the County's wastewater treatment facilities under a high sea level rise scenario therefore should not only account for the flood risks at the site of wastewater treatment facilities themselves, but also associated changes in the resident population and economic activity of wastewater service areas.

Clarence Higgs Memorial Beach

PHOTO SOURCE: Monroe County Proposed FY2016 Budget

Cudjoe Wastewater Treatment Plant

PHOTO SOURCE: Monroe County Proposed FY2016 Budget

There may also be the need for the development of recording protocols and/or engineering assessments to further address resilience of other infrastructure associated with the most vulnerable facilities. Funding for these budget items can potentially be obtained from several sources, including: FEMA's Pre-Disaster Mitigation Grant Program; FEMA's Hazard Mitigation Grant Program (after disaster only) and FEMA's Flood Mitigation Assistance Program. See Section 11(d) and the Implementation Matrix in Appendix G for additional information on funding specific recommendations in GreenKeys!.

ii) Other Capital Planning Efforts

Besides maintaining focus on adaptation expenditures through capital planning efforts, Monroe County should not lose sight of other assets within the County's geographic boundaries vulnerable to climate change and sea level rise but outside the regulatory and proprietary jurisdiction of the County. For example, the FDOT manages several key public roadways within Monroe County, most significantly U.S. Highway 1. U.S. Highway 1 is the sole road transport and emergency evacuation route in the Keys portion of Monroe County.

For low level or nuisance flooding, such concerns include decreased traffic flow due to flooding of traffic lanes, increased risk of traffic accidents due to the hazard of tidal flooding conditions, and the likelihood of higher long-term maintenance costs due to saltwater overwash and saturation that may together accelerate degradation of the road bed.[57]

As sea levels rise, what is now seen as nuisance flooding from tidal fluctuations will become more extensive causing longer lasting transportation disruptions and damage. In cases of major storm events, emergency situations and evacuations, the longer lasting tidal flooding could cause flood blockage of low-lying sections of U.S. Highway 1 and would therefore be highly problematic for public health, safety, and welfare for the County's residents and visitors.

As discussed in Section 8(d) above, the loss of use of roadways has the potential to create similar disputes as was litigated in St. Johns County in early 2005. The difference in the St. Johns County case and U.S. Highway 1 is that the level of service provided by U.S. Highway 1 serving the entire County is much more intense than a small portion of A1A serving only several residents.

The FDOT plans its maintenance responsibilities in five year advance efforts through its State Transportation Five-Year Work Program ("Transportation Program").[38] The Transportation Program implements FDOT's mission, goals and objectives of the broader and long range Florida Transportation Plan.[39] The Transportation Program is the tentative list of projects that will be funded and carried out in District 6, which includes Miami-Dade and Monroe counties, during the next five (5) years.

It is developed through extensive coordination with local governments, Metropolitan Planning Organizations ("MPOs"), regional planning groups and the public through a series of public hearings. For Monroe County projects, FDOT submits the final draft of the Program to the MPO and Monroe County BOCC following the public hearings. This provides the BOCC with another opportunity to have input on the Program to ensure consistency with GreenKeys! initiatives. The FDOT then submits the tentative work program to the governor's office and Legislature, as well as the Florida Transportation Commission and the FDEO. After review and approval of the Program and appropriations by the Governor's office and the Legislature, the Program is formally adopted by the FDOT.

Monroe County projects listed in the Tentative Transportation Program Fiscal Years 2016/2017 through 2020/2021 are provided in graphic at the bottom of the page.[40]

The Florida Transportation Plan ("Transportation Plan") establishes long range goals to provide a policy framework for the expenditure of federal and state transportation funds in the state of Florida. Every five (5) years, the FDOT takes the lead in updating the plan to respond to new trends and challenges to meet the future mobility needs of Florida's residents, visitors and businesses. The Transportation Plan is currently in the process of being updated. Given the importance of U.S. Highway 1 on the economy, but also on the health, safety and welfare of the County's residents and visitors, the County should collaborate with FDOT in its planning processes to ensure consistency with the County's implementation efforts to adapt, reduce and mitigate the effects of climate change and sea level rise.

Repair/Rehabilitation	Resurfacing	Landscaping	Bike Path/Trail	Other
• U.S. Highway 1 over Channel 2 (2017) • U.S. Highway 1 over Channel 5 (2019, 2020) • Tea Table Channel Bridge (2016) • Seven Mile Bridge over Moser Channel (2016) • U.S. Highway 1 over Niles Channel Bridge (2017) • Card Sound Rd. Bridge (2017) • Garrison Bight Bridge at Palm Ave. and North Roosevelt Blvd (2017)	• U.S. Highway 1 MM 38.647 – 39.993 (2018) • U.S. Highway 1 MM 19.794 – 20.664 (2018, 2019) • U.S. Highway 1 MM 77.5 – 81.42 (2017) • U.S. Highway 1 MM 48.70 – 49.03 (2017) • U.S. Highway 1 Seven Mile Bridge to south end of Knight Key Boulevard (2017) • U.S. Highway 1 MM 23.121 – 25.396 (2017)	• U.S. Highway 1 MM 20.42 – 23.48 (2019) • U.S. Highway 1 MM 15.46 – 20.14 (2019) • U.S. Highway 1 MM 23.69 – 25.40 (2017) • U.S. Highway 1 MM 77.47 – 81.44 (2019) • U.S. Highway 1 MM 28.75 – 32.98 (2017)	• Overseas Heritage Trail & Scenic Highway Vista at various locations (2017) • Overseas Heritage Trail & Scenic Highway MM 54.5 – 60 (2018) • City of Marathon Aviation Boulevard Bicycle Path Improvements Phase I (2019) • City of Marathon Aviation Boulevard Bicycle Path Improvements Phase II 2021	• County-wide Drainage Improvements (2017-2020) • County Traffic Operations Improvements (2017, 2019) • Old 7-Mile Bridge Water Taxi/ Ferry Service (2017-2019) • Old 7 Mile Bridge from Knights Key to Pigeon Key (2017-2018) • Snake Creek Bridge Painting (2019) • U.S. Highway MM 50 – 54.6 traffic signals (2017)

B. Integration with Comprehensive Plan & Code Recommendations

In addition to the implementation of GreenKeys! recommendations through Capital Project expenditures, these recommendations can also be implemented by incorporating recommendations into Policies in the Comprehensive Plan and Code.

The Implementation Matrix, attached as Appendix G, outlines the methodology to integrate many of the 165 recommendations of GreenKeys! within its existing long-term and short-term policy structures where appropriate. The Implementation Matrix provides specific policy and Code sections recommended for revision or update based on the recommendations made in GreenKeys!.

Recommended Comprehensive Plan updates and amendments can be implemented over future amendment cycles to ensure that the next iteration of the Comprehensive Plan continues to integrate sea level rise and future flood risk. Additionally, future updates to the County's Comprehensive Plan should continue the process of more fully integrating sea level rise and resiliency. It should be noted that Section 4 discusses new requirements for including future flood strategies into Coastal Management Elements of Comprehensive Plans. This integration can be accomplished through several options:

- Creating core values around the general safety of citizens and the community with a need to plan for future threats;
- Including sea level rise and natural hazards data in the background information, making sure to specifically call out impacts already experienced by the County, as well as the future flood threats;
- Encouraging the use of best practices development and redevelopment principles, strategies and engineering solutions that will result in the removal of coastal real property from flood zone designations by FEMA;
- Identifying site development techniques and best practices that may reduce losses due to flooding; and
- Being consistent with, or more stringent than, the flood-resistant construction requirements in the Florida Building Code and floodplain management regulations set forth in 40 C.F.R. Part 60.

Similarly, Code additions and amendments should be adopted in accordance with the timeline provided in the Implementation Matrix. Comprehensive Plan and Code revisions can likely be implemented with existing staff resources or additional outside resources if needed.

C. Integration with Community Rating System

Implementing the recommendations of GreenKeys! will help the County meet several self-initiated goals, including becoming a more resilient community.

Meeting the various criteria for good standing within the Community Rating System ("CRS") program compliments many of the recommendations provided in GreenKeys!, including managing development in areas that are vulnerable to flooding and preserving areas of the natural floodplain.

Monroe County is currently in the process of making application to the CRS. After the County obtains its first formal rating, it will be required to

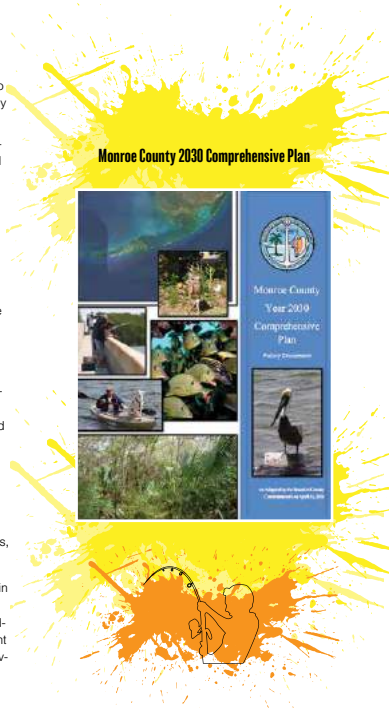


PHOTO SOURCE: www.ci.east-paloalto.ca.us

undergo recertification to verify that it is continuing to perform the activities that are being credited by the CRS. During each recertification process, the County will have the opportunity to continue to improve its Class rating by undertaking new mitigation and floodplain management activities that earn even more points.

Communities can get additional points in the CRS program by undertaking various activities not already credited. FEMA will also review activities not listed in the Coordinator's Manual for credit based upon how well those activities increase public safety, reduce property damage, avoid economic disruption and loss, and protect the environment. A community can work with FEMA upfront on any of these additional activities to assure they will translate into scored points and result in actual improvement in the rating process.[41]

The 2013 Coordinator's Manual ("Manual") includes new provisions related to credit for sea level rise and future flood risk planning. This recognizes that the future of how floodplains will look and be managed is an important consideration in planning. Factors listed affecting future flood risk are included in the Manual, such as increased impervious surfaces in developing watersheds, beach nourishment projects, new fill in floodways, rising sea levels, and changes in natural functions of floodplains. While Flood Insurance Rate Maps ("FIRM") do not consider these future impacts on the regulatory side, CRS incentivizes their consideration for credits in the following ways:

- Credit is provided under Section 322.c for communities that provide information about areas (not mapped on the FIRM) that are predicted to be susceptible to flooding in the future *because of climate change or sea level rise;*

Table 110-1. CRS classes, credit points, and premium discounts.

CRS Class	Credit Points (CT)	Premium Reduction	
		In SFHA	Outside SFHA
1	4,500+	45%	10%
2	4,000–4,499	40%	10%
3	3,500–3,999	35%	10%
4	3,000–3,499	30%	10%
5	2,500–2,999	25%	10%
6	2,000–2,499	20%	10%
7	1,500–1,999	15%	5%
8	1,000–1,499	10%	5%
9	500–999	5%	5%
10	0–499	0	0

SFHA: *Zones A, AE, A1–A30, V, V1–V30, AO, and AH*

Outside the SFHA: *Zones X, B, C, X99, AR, and D*

Preferred Risk Policies are not eligible for CRS premium discounts because they already have premiums lower than other policies. Preferred Risk Policies are available only in B, C, and X Zones for properties that are shown to have a minimal risk of flood damage.

Some minus-rated policies may not be eligible for CRS premium discounts.

Premium discounts are subject to change.

CRS Classes, FEMA NFIP Coordinator's Manual

- To become a Class 4 or better community, a community must (among other criteria) demonstrate that it has programs that *minimize increases in future flooding;*

- To achieve CRS Class 1, a community must receive credit for using regulatory flood elevations in the V and coastal A Zones that reflect future conditions, *including sea level rise*;

- Credit is provided under Section 342.d when prospective buyers of a property are advised of the potential for flooding **due to climate changes and/or sea level rise;**

- Credit is provided under Section 412.d when the community's regulatory map is based on future-conditions hydrology, *including sea level rise;*

- Credit is provided under Section 452.a if a community's stormwater program regulates runoff from **future development**;

- Credit is provided under Section 452.b for a community whose watershed master plan manages *future peak flows* so that they do not exceed present values; and

- Credit is provided under Section 512.a, Steps 4 and 5, for flood hazard assessment and problem analysis that address areas likely to flood and flood problems that are likely to get worse in the future, including (1) changes in floodplain development and demographics, (2) development in the watershed, and (3) *climate change or sea level rise.*

It should be noted that credit for some of the above CRS activities requires higher standards, such as adopting County-specific maps and regulating more stringently than currently required by FEMA. One way to enhance the County's rating in the future would be to apply for the above listed credits related to future flood risk analysis. Further analysis shows that upwards of 518 points could be available through addressing sea level rise in the CRS process."[42] Again, these additional 518 points would require higher regulatory standards adopted by the County and enforced by the community, but could be attainable.

Only eighteen (18) out of 235 communities in Florida have achieved a Class Rating of 5 and no communities in Florida as of May 2014 had achieved a Class Rating of 4. Given that these future flood risk criteria are relatively new in the CRS evaluation process, FEMA should be consulted to determine examples of where these points have been awarded and what data was used to achieve them.

D. Funding Opportunities

GreenKeys! has identified the likely impacts from sea level rise on various parts of County infrastructure and facilities. The extent of these potential impacts, however, assume no action will be taken to minimize or mitigate the risks from rising seas. As the County continues actions to reduce or mitigate impacts, the Monroe County economy and quality of life can continue to thrive. The fundamental issues for the County, or any government responsible for strengthening resiliency of its infrastructure, are the anticipated costs and how those costs can be funded. Construction costs for meeting resiliency goals are by far the most significant costs for a government. Looking at the price tags for infrastructure improvements, i.e., construction costs, has to be weighed against the probable costs of future property damage and disruptions to the economy. The science is beginning to establish the link between consistently rising seas and the likelihood of increasing severity of flooding from storm surges. Monroe County should therefore weigh these types of potential cost comparisons.

Flooding at the Intersection of Crane Street and Adams Drive

PHOTO SOURCE: John Glista

To address the funding needs the County will encounter, the GreenKeys! Team identified several new funding sources outside of the County's Capital Project budgets for the recommendations provided herein. New funding sources include:

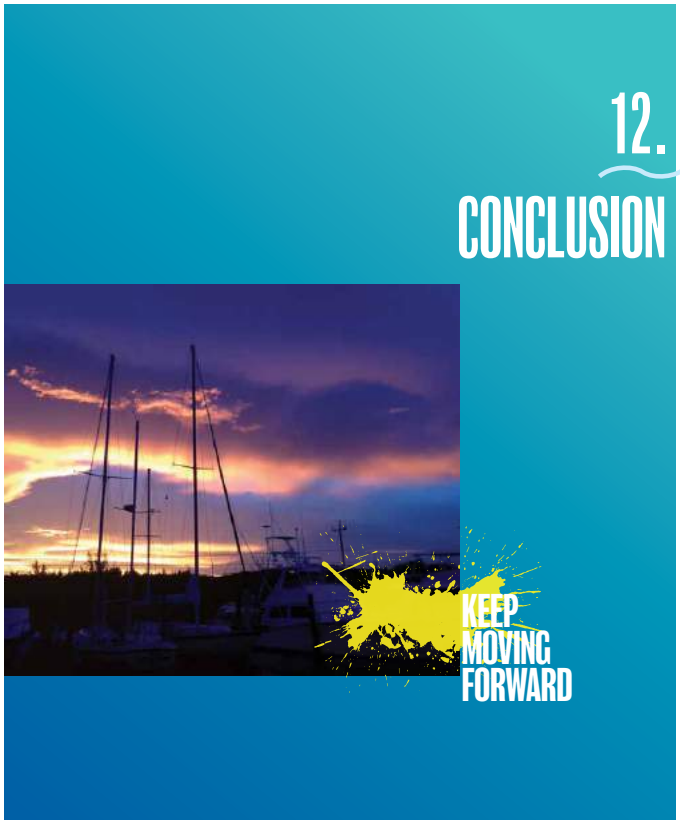
- pre-disaster mitigation planning funds;
- impact fees;
- special revenue funds;
- landscape mitigation fees;
- stormwater utility enterprise funds;
- special assessments; and
- grants.

Each potential funding source is described in greater detail in Appendix M. The Implementation Matrix in Appendix G also provides a list of specific funding sources applicable to the individual recommendations in GreenKeys!.

E. Monitoring, Reporting, and Updates

To ensure that the GreenKeys! planning project is successful, implementation progress should be monitored annually to assess efforts and evaluate recommendations yet to be implemented. Monitoring and progress updates should occur before, or in conjunction with, the Capital Planning process. This will provide County staff with an opportunity to determine current implementation priorities and resource allocation, present updates on efforts initiated during the previous year, and report on the progress of larger scale recommendations for tracking purposes.

Another helpful technique is the development of trigger points to ensure that recommendations are implemented appropriately, especially for medium- and long-term recommendations. Essentially, trigger points are monitoring thresholds used to avoid environmental or socioeconomic tipping points, points where the impacts become so severe that they are irreversible. Trigger points can be used to justify and initiate proactive policy changes at the initial onset of a problem or in some instances avoid consequences entirely. This is especially important since many of the adaptation actions recommended in GreenKeys! are designed to address problems associated with the projected rapid sea level rise, not the current slower rate of change. Since sea level rise is expected to accelerate in the future, establishing trigger points for adaptation actions allows the County to balance policies that will preserve the status quo for as long as possible, while making a forward commitment to protect future populations.



This GreenKeys! planning project is a significant first step for Monroe County toward taking a proactive approach to not only becoming more sustainable, but also to identifying the risks of climate change and sea level rise and the best adaptation strategies that we can use to mitigate those risks. This planning project has also started an important dialogue with our residents and business owners, staff and decision-makers about important topics with the potential to bring significant changes to County operations in the coming years.

To continue the momentum generated by this planning project, Monroe County (along with the Village of Islamorada) will also be part of the NOAA grant entitled *Advancing Understanding of Risk: Increasing Accuracy of Hazard Damage Assessment Tools by Improving Base Data and Analyzing Opportunities.*

This grant project will be implemented in 2016-2018 to improve the resilience of four (4) coastal communities across four (4) states in the Southeast, including Florida, Georgia, South Carolina and North Carolina. For each community, stakeholder input will be collected to determine local resilience priorities. In addition, digital data will be built to improve local planning capacity related to the priorities identified. Legal and policy research will also be conducted to improve the implementation of adaptation measures identified by the communities. Finally, pre- and post-project knowledge assessments will be conducted to evaluate the success of this method in communicating hazard vulnerability and resilience information on a regional scale. This grant project will specifically include public workshops, integration of project findings into local planning and policy development initiatives (including the CRS) and collaboration in developing legal research publications that broadly communicate lessons learned in the project to a regional audience. Most importantly, this project will build better base data for the County and create more accurate hazard damage assessments, and improve knowledge of local vulnerabilities and resilience.

To further expand the County's base dataset, we are also moving forward with the collection of improved LIDAR county-wide. As is highlighted in this report, the County and our residents will significantly benefit from using improved LIDAR data in future planning and project design activities, particularly those involving roads and capital improvements.

We remain committed to continuing to modify County operations to increase overall sustainability and resilience to climate change and sea level rise. This GreenKeys! effort is just a first step in the process of identifying both vulnerabilities and areas where improvements can be made.

Monroe County is an extraordinary place that will face unique challenges as the climate changes and sea level rises. By implementing the recommendations in this plan and continuing to be proactive, we will be in the best possible position to adapt and efficiently respond to changing conditions.

We are hopeful that this GreenKeys! effort will provide a solid foundation upon which the County can build. As we continue to strengthen our commitment to sustainability and resilience, we look forward to making changes today that will safeguard the future of our residents for generations.

Monroe County, FL
PHOTO SOURCE: GreenKeys! Project Team

Endnotes

[1]A Unified Sea Level Rise Projection for Southeast Florida, available at http://southeastfloridaclimatecompact.org/pdf/Sea%20Level%20Rise.pdf

[2]A Unified Sea Level Rise Projection for Southeast Florida, available at http://southeastfloridaclimatecompact.org/pdf/Sea%20Level%20Rise.pdf

[3]2015 Unified Sea Level Rise Projection for Southeast Florida is, available at: http://www.southeastfloridaclimatecompact.org/wpcontent/uploads/2015/10/2015-Compact-Unified-Sea-Level-Rise-Projection.pdf

[4]Monroe County Climate Change Advisory Committee, Monroe County Climate Action Plan (2103), available at: http://www.monroecountyfl.gov/DocumentCenter/View/6596

[5]Monroe County Resolution 235-2007, available at: http://www.monroecounty-fl.gov/DocumentCenter/View/5008

[6]Monroe County Resolution 067-2010, available at: http://www.monroecounty-fl.gov/DocumentCenter/View/5007

[7]Monroe County Resolution 147-2010, available at: http://www.monroecounty-fl.gov/DocumentCenter/View/5006

[8]Executive Order 13514 was revoked with publication of the new Executive Order "Planning for Federal Sustainability in the Next Decade" which outlines forward-looking goals for federal agencies in the areas of energy, climate change, water use, vehicle fleets, construction and acquisition. Available at: https://www.fedcenter.gov/programs/eo13514/

[9]Council on Environmental Quality, Federal Agency Climate Change Adaptation Planning: Implementing Climate Change Adaptation Planning in Accordance with Executive Order 13515 (March 4, 2011); available at: https://www.whitehouse.gov/sites/default/files/microsites/ceq/adaptation_support_document_3_3.pdf

[10]Executive Order 13693, Planning for Federal Sustainability in the Next Decade (March 19, 2015), available at: https://www.fedcenter.gov/programs/eo13693/

[11]Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input (January 30, 2015), available at: https://www.federalregister.gov/articles/2015/02/04/2015-02379/establishing-a-federal-flood-risk-management-standard-and-a-process-for-further-soliciting-and

[12]§ 377.804, Fla. Stat. (2006).

[13]See 2006 Fla. Laws ch. 230 (S.B. 888); Exec. Order No. 07-126, Leadership by Example: Immediate Actions to Reduce Greenhouse Gas Emissions from Florida State Government (July 13, 2007'); Exec. Order No. 07-127, Immediate Actions to Reduce Greenhouse Gas Emissions within Florida (July 13, 2007); Exec. Order No. 07-128, Florida Governor's Action Team on Energy and Climate Change (July 13, 2007).

[14]Florida House Bill No. 7123 (2007), available at: http://www.myfloridahouse.gov/Sections/Bills/billsdetail.aspx?BillId=36885

[15]Florida House Bill No. 697 (2008), available at: http://www.myfloridahouse.gov/Sections/Bills/billsdetail.aspx?BillId=38094

[16]HB 7135 (2008) amended § 255.2575(2), Fla. Stat (2007).

[17]2011 Fla. Laws ch. 2011-34, Senate Bill No. 1204 (2011).

[18]§ 163.3164, Fla. Stat. (2011).

[19]2015 Fla. Laws ch. 2015-69, Senate Bill No. 1094 (2015).

[20]Cameron Cole, Monroe County, Florida Community-Wide CY 2010 Greenhouse Gas Emissions Inventory Report Version 1.0 (July 26, 2012), available at: http://www.monroecounty-fl.gov/DocumentCenter/View/5009

[21]Southeast Florida Regional Climate Change Compact, A Unified Sea Level Projection for Southeast Florida (April 2011), available at: http://www.southeastfloridaclimatecompact.org/

[22]Monroe County Comprehensive Plan Update Evaluation and Appraisal Report (2012), available at: http://www.minutes-monroeclerk. com/WebLink8/DocView.aspx?id=220511&page=286&dbid=0

[23]Sustainability Tools for Assessing and Rating Communities website, available at: https://reporting.starcommunities.org/

[24]Technical Guide to the STAR Community Rating System – Version 1.1 (2014).

[25]American Planning Association, Comprehensive Plan Standards for Sustaining Places, available at: https://www.planning.org/sustainingplaces/compplanstandards/

[26]§ 339.135, Fla. Stat. (2013).

[27]Scavia, D., J.C. Field, D.F. Boesch, R.W. Buddemeir, V. Burkett, D.R. Cayan, et al. 2002. Climate change impacts on coastal and marine ecosystems. Estuaries 25:149-164.

[28]Ross, M.S., J.J. O'Brien, R.G. Ford, K. Zhang, and A. Morkill. 2008. Disturbance and the rising tide: The challenge of biodiversity management on low-island ecosystems. Frontier in Ecology and the Environment 7:471-478.

[29]Duarte, C.M. 2002. The future of seagrass meadows. Environmental Conservation 2:192-206.

[30]Krauss, K.W., K.L. McKee, C.E. Lovelock, D.R. Cahoon, N. Saintilan, R. Reef, and L. Chen. 2014. How mangrove forests adjust to rising sea level. New Phytologist 202:19-34.

[31]United States Census Bureau, Monroe County Quick Facts, available at: http://quickfacts.census.gov/qfd/states/12/12087.html

[32]Obtained from Monroe County Tax Collector Business Tax Report website available at: https://www.monroe.county-taxes.com/public/reports/business_tax

[33]The 2015 LMS Update was prepared to comply with Florida Division of Emergency Management requirements (Florida Administrative Code Chapter 27P-22); provisions of the federal Hazard Mitigation and Pre-Disaster Mitigation Programs (44 CFR Parts 201 and 206); and the Flood Mitigation Assistance Program (44 CFR 78.6).

[34]Boguszewski, V.G., Monroe County Adaptation Guide for the Health Care Community (2015).

[35]U.S. Environmental Protection Agency, Flood Resilience: A Basic Guide for Water and Wastewater Utilities (September 2014), available at: http://water.epa.gov/infrastructure/watersecurity/emerplan/upload/epa817b14006.pdf

[36]Mozumder, P. E. Flugman, and T. Randhir. 2011. Adaptation behavior in the face of global climate change: Survey responses from experts and decision-makers serving the Florida Keys. Ocean and Coastal Management 54:37-44.

[37]Titus, J. 2002. Does sea level rise matter to transportation along the Atlantic Coast? In The Potential Impacts of Climate Change on Transportation, Summary and Discussion Papers, pp. 135-150. Washington: Brookings Institute.

[38]§ 339.135, Fla. Stat. (2015).

[39]§ 339.155, Fla. Stat. (2015).

[40]Florida Department of Transportation District 6, FDOT Tentative Work Program for Fiscal Year 2016/17 thru 2020/21, available at: http://www.fdotmiamidade.com/userfiles/files/WPBooklet2015-Monroe.pdf

[41]Federal Emergency Management Agency, National Flood Insurance Program Community Rating System: A Local Official's Guide to Saving Lives, Preventing Property Damage Reducing the Cost of Flood Insurance, available at: http://www.fema.gov/media-library-data/20130726-1708-25045-7720/99032_nfip_small_brochure.pdf (last viewed August 9, 2015)

[42]Thomas Ruppert, References to Climate Change and Sea-Level Rise in the 2013 NFIP CRS Coordinator's Manual (March 2015), available at: https://www.flseagrant.org/wp-content/uploads/SLR-and-CC-in-CRS-program_FINAL_3.3.15.pdf Examples include: Section 412.d. Higher study standards (160 pt. max.): To receive this credit for coastal studies, the community must use an estimate of the sea level rise anticipated by the year 2100 or later. The study used to determine the sea level rise must have been developed by FEMA, the Corps, the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, or through a regional study that produced higher base flood elevations.

Additionally, under Section 512.a, Step 4—Assess the Hazard (5 pt. max) and 452.b., Step 5—Assess the Problem (15 pt. max if SLR integrated into Step 4 and meet Step 5(b)(3)-(5) (p. 510-16). A sea level rise vulnerability assessment could be a basis for seeking this credit. FEMA should be consulted ahead of time to determiner any required parameters for that sea level rise vulnerability assessments when seeking credit.

13.
APPENDICES

Appendix A.

Monroe County Advisory Boards, Councils, and Committees

Appendix B.

Greenhouse Gas Inventory Update Documentation

Appendix C.

Monroe County, FL: GIS Vulnerability Assessment for Sea Level Rise Planning

Appendix D.

GreenKeys!: Analysis of Damages from Storm Surge and Sea Level Rise for the Geographic Regions of Key Largo and Stock Island, Monroe County using the Coastal Adaptation to Sea Level Rise Tool

Appendix E.

Peer Review Feedback

Appendix F.

STAR Supporting Documentation

Appendix G.

Implementation Matrix

Appendix H.

Model Ordinance

Appendix I.

5-Year Work Plan

Appendix J.

MindMixer Report

Appendix K.

Monroe County Survey and Responses

Appendix L.

Monroe County Fiscal Year 2016 Adopted Annual Operating & Capital Budget (partial)

Appendix M.

Potential Funding Sources

GREENKEYS!

A PLAN TO CREATE A SUSTAINABLE FLORIDA KEYS

ERIN L. DEADY, P.A.

STETSON UNIVERSITY

Sea Grant Georgia

Sea Grant Florida

The Nature Conservancy
Protecting nature. Preserving life.

Catalysis

vhb